D. BUNN

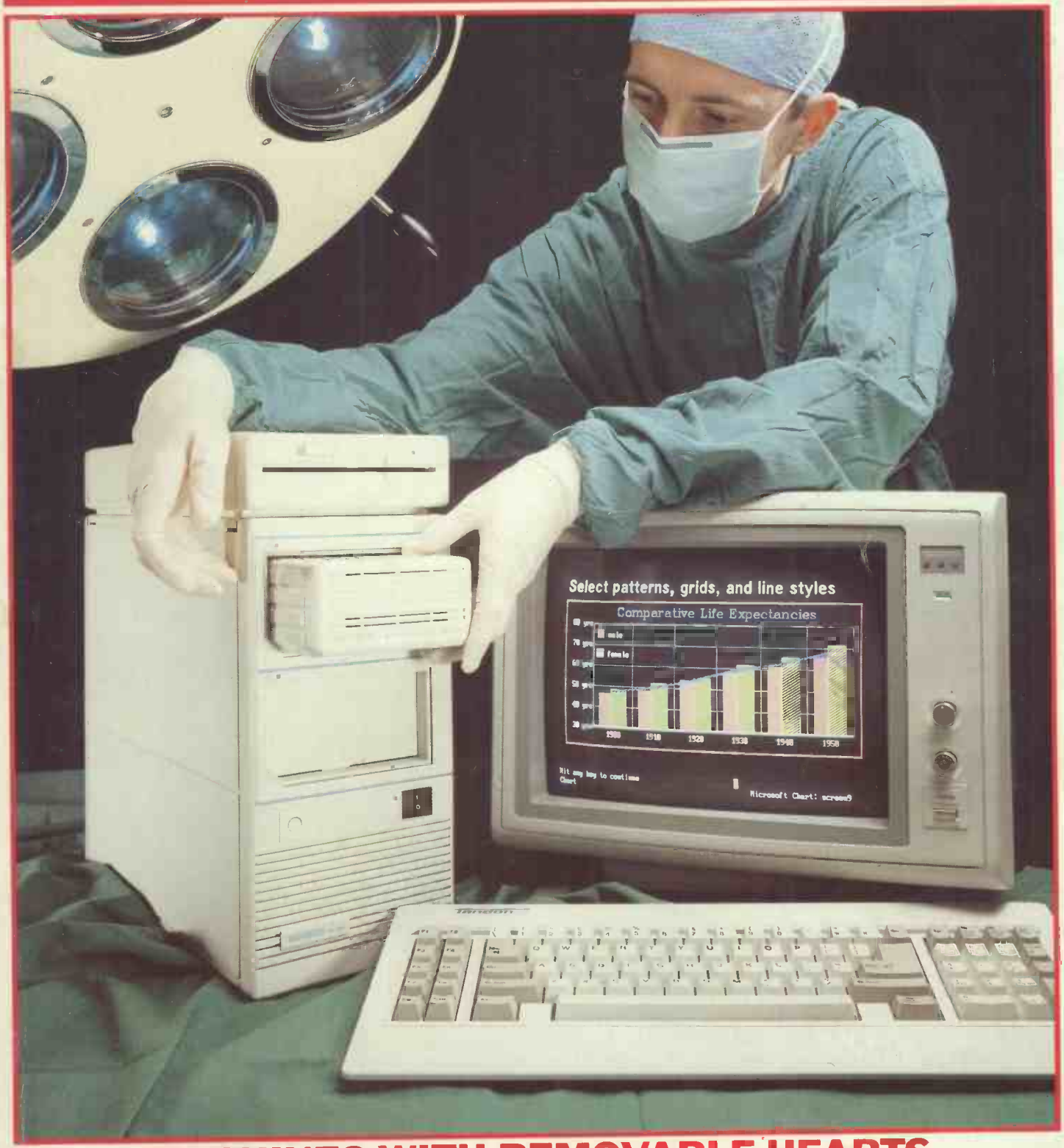
Personal Computer World

U$2 95/SFr8.0/Ir£1 76/BFr127
Lire4,500/DKr31.00

June 1987 £1.20

IBM Model 30 exclusive review

BRITAIN'S BIGGEST MICROCOMPUTER MAGAZINE



MACHINES WITH REMOVABLE HEARTS

Benchtest of the Tandon PAC286

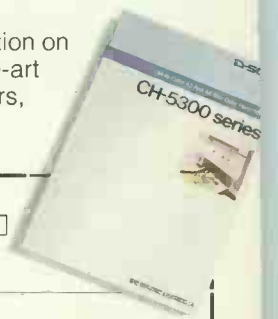
dazzling!

D-SCAN
COMPUTER GRAPHICS
SEIKO INSTRUMENTS & ELECTRONICS LTD.

The D-SCAN CH-5300 series of multi-colour hardcopiers are quite simply unique – a generation ahead of the competition and packed with dazzling features...

A3·A4 Multi-colour Hardcopiers.

For more information on these state-of-the-art colour hardcopiers, contact Ambitron today.



Performance. Images made up of as many as 4,912 colours appear in as little as 50 seconds, and can be taken from virtually any video source.

Resolution. With 8 dots/mm (2048 x 2944 dots) for the A3 size and 6 dots/mm (1188 x 1280 dots) for the A4 size, the CH-5300 series excels at ultra-fine detail.

Price. CH-5300 units are cheaper to buy than you think and copies (on plain paper or clear polyester film) come out extremely competitively.

Please send details on D-SCAN equipment.
Colour hardcopiers ☐ terminals ☐ digitisers ☐ plotters ☐

Name _____

Position _____

Company _____

Address _____

_____

Telephone _____

For European enquiries contact D-SCAN at Seiko Instruments GmbH, Lyoner Strasse 44-48 (Arabella-Center), D-6000 Frankfurt Main. Tel: 69-6666971

Ambitron Computer peripherals to give you the edge

Ambitron Limited, 13 The Paddock, Hambridge Road, Newbury, Berkshire, RG15 5TQ. Telephone (0635) 36555. Telex 846239 AMBIT

THE C LANGUAGE

New is High C, the first 386 compiler for DOS. Hi-Tech is mid price with very fast compilation.Turbo C will be with us by the time you read this.

C COMPILERS

Alcor C	Z80 + CP/M-80	£ 85
Aztec C Personal 1.06D	CP/M-80	£125
Aztec Commercial 1.06D	CP/M-80	£215
BDS C 1.60	Z80 + CP/M-80	£ 70
Eco-C v3.22	Z80 + CP/M-80	£ 50
Hi-Tech C	Z80 + CP/M-80	£CALL
Mix C	Z80 + CP/M-80	£ 45
Toolworks C/80 v3.2	CP/M-80	£ 45
Advantage C++	MS-DOS	£440
Aztec Apprentice	MS-DOS	£ 40
Aztec Prime	MS-DOS	£ 75
Aztec C86 Developer	MS-DOS	£190
Aztec C86 Commercial	MS-DOS	£310
CI C86 Plus	MS-DOS	£340
De Smet C88 Starter	MS-DOS	£ 85
De Smet C88 Programmer	MS-DOS	£125
De Smet C88 Enhanced	MS-DOS	£165
De Smet C88 Prof.	MS-DOS	£200
ECO-C88 V3.22	MS-DOS	£ 50
HIGH C (Metaware)	MS-DOS	£360
HIGH C 386	MS-DOS	£595
Hi-Tech C	MS-DOS	£CALL
Lattice C v3.00	MS-DOS	£235
Mark Williams MWC86	MS-DOS	£385
Mark Williams LETS C	MS-DOS	£ 60
Microsoft C v4.0	MS-DOS	£235
MIX C	MS-DOS	£ 45
Turbo C	PC-DOS	£ 80
Toolworks C v3.2	MS-DOS	£ 45
Wizard C v3.0	MS-DOS	£300
Zorland C	PC-DOS	£ 29
Zorland C Power Pack	PC-DOS	£ 59
Aztec C86 Developer	CP/M-86	£250
Aztec C86 Personal	CP/M-86	£150
CI Optimizing C86	CP/M-86	£270
De Smet C Starter	CP/M-86	£ 85
De Smet C Programmer	CP/M-86	£125
De Smet C Enhanced	CP/M-86	£165
Hi-Tech C	CP/M-86	£CALL
Lattice C v1.04	CP/M-86	£260
Aztec C65 V1.05	Apple DOS	£195
Aztec C65 V3.20	Apple PRO-DOS	£250
Aztec C65 Prime	Apple DOS	£ 75
Aztec C68 Commercial	MACINTOSH	£310
Aztec C68 Developer	MACINTOSH	£190
Hi-Tech C	ATARI	£CALL
Lattice C	ATARI	£ 80
Mark Williams C	ATARI	£140

C CROSS COMPILERS

We supply Aztec, Lattice, IAR and Hi-Tech Cross Compilers hosted on MS-DOS and targeted on Z80, 8085, 6502,6801, 68HC11, 6301, 8051 and 68000. Please call for information or advice.

C INTERPRETERS

C-terp	PC-DOS	£180
Interactive C	PC-DOS	£195
Introducing C	PC-DOS	£105
Living C	PC-DOS	£ 70
Instant-C v2.0	MS-DOS	£390
RUN/C	MS-DOS	£ 60
RUN/C Professional	MS-DOS	£120
Living C Apricot	MS-DOS	£ 70
Instant-C v1.27	CP/M-86	£390

ASSEMBLERS

Phar Lap 386-
the first 386 assembler on DOS

2500AD 8086 Asm.	MS-DOS	£ 80
Dig.Res. RASM-86	MS-DOS	£180
MS Macro-86 v4.0	MS-DOS	£ 90
Phoenix PASM-86	MS-DOS	£130
Phar Lap 386	MS-DOS	£415
2500AD 8086 Asm.	CP/M-86	£ 80
Dig.Res. RASM-86	CP/M-86	£180
2500AD Z80 ASM	CP/M-80	£ 80
Dig.Res. RMAC	CP/M-80	£180
Microsoft Macro-80	CP/M-80	£ 60
SLR Z80ASM	CP/M-80	£ 45
SLR Z80ASM-PLUS	CP/M-80	£175
SLR MAC	CP/M-80	£ 45
SLR MAC-PLUS	CP/M-80	£175
SLR 180 (Hitachi)	CP/M-80	£ 45
SLR 180-PLUS (Hitachi)	CP/M-80	£175

Not all assemblers are supplied with a linker. Check before ordering.

CROSS ASSEMBLERS

We supply cross-assemblers by Avocet, 2500AD, and IAR Systems for more than thirty target processors to run on MS-DOS, CP/M-86 and CP/M-80. This totals more than 200 products and we do not have space to list them all here. We hold some stock but you should allow 10-14 days for delivery. Please call for information or advice.

PRICES AND DELIVERY

Prices do not include VAT or other local taxes but do include delivery in UK and Europe. Please check prices at time of order, ads are prepared some weeks before publication.

For other products in our range please ask us to send you a complete price list.

BASIC LANGUAGE

New TURBO BASIC now provides competition for Quickbasic.

BASIC INTERPRETERS

BBC Basic	PC-DOS	£ 95
BetterBASIC v2.1	PC-DOS	£150
Professional BASIC	PC-DOS	£ 70
TrueBasic	PC-DOS	£115
Microsoft MS-BASIC	MS-DOS	£210
MEGABASIC v5.2	MS-DOS	£235
Dig.Res. CBASIC	CP/M-86	£290
MEGABASIC	CP/M-86	£235
MEGABASIC	MP/M-86	£365
BBC BASIC	Z80+CP/M-80	£ 95
Dig.Res. CBASIC	CP/M-80	£130
Microsoft MBASIC	CP/M-80	£ 60
MEGABASIC	CP/M-80	£195

BASIC COMPILERS

Microsoft QuickBASIC	PC-DOS	£. 60
Softaid MTBASIC	PC-DOS	£ 60
Turbo Basic	PC-DOS	£ 75
ZBASIC	MS-DOS	£ 75
Alcor Multi-Basic	MS-DOS	£ 85
Microsoft MS-BASIC	MS-DOS	£235
Dig.Res. CBASIC	MS-DOS	£390
Dig.Res. CBASIC	CP/M-86	£390
Dig.Res. CBASIC	CP/M-80	£435
ZBASIC	Z80+CP/M-80	£ 75
Softaid MTBASIC	Z80+CP/M-80	£ 60
Alcor Multi-Basic	Z80+CP/M-80	£ 85

DISK COPYING SERVICE

We can copy files to and from 400 disk formats including CP/M, CP/M-86, MS-DOS, PC-DOS, ISIS, APPLE, SIRIUS, BBC, TORCH, APRICOT, HP150, TRSDOS, DEC RT- 11, IBM BEF, ATARI520, AMSTRAD.

£10.00 + disk + VAT

with discounts on small quantities and disks are normally despatched within 24hrs of receipt.

For more information call us.

PROGRAM EDITORS

Spoilt for choice
with so many good things here

BRIEF v1.32	PC-DOS	£155
EC Editor v2.1	PC-DOS	£ 40
Epsilon v3.1	PC-DOS	£140
Lattice CVUE	PC-DOS	£ 95
FirsTime for Pascal	PC-DOS	£190
FirsTime for Turbo-P	PC-DOS	£ 60
Pmate PC v4	PC-DOS	£120
RED v6.6	PC-DOS	£ 65
XTC (with Pascal source)	PC-DOS	£ 65
Vedit-Plus	PC-DOS	£120
FAST-C (debug.util) L	PC-DOS	£195
CSE (with C source)	MS-DOS	£ 75
MIX Editor	MS-DOS	£ 35
Pmate 86 v4.00	MS-DOS	£120
Vedit-Plus	MS-DOS	£120
Vedit-Plus	CP/M-86	£120
CSE (With C source)	CP/M-80	£ 75
MIX Editor	Z80 + CP/M-80	£ 35
Nevada Edit	CP/M-80	£ 35
Vedit-Plus v2.33	CP/M-80	£120

For more information please call us.

PASCAL LIBRARIES

TURBO PASCAL LIBRARIES

Blaise Power Tools Plus	PC-DOS	£ 75
Blaise Turbo Asynch	PC-DOS	£ 75
Mathpak 87	MS-DOS	£ 80
Multi-Halo	PC-DOS	£185
Paragon Supertools	PC-DOS	£ 55
RM Graph Nimbus +	MS-DOS	£ 49
Report Builder	MS-DOS	£ 70
Science & Eng.Tools	MS-DOS	£ 60
System Builder	MS-DOS	£ 85
T-Debug Plus	PC-DOS	£ 40
Turbo Database CP/M &	MS-DOS	£ 49
Turbo Editor Toolbox	PC-DOS	£ 49
Turbo Extender	PC-DOS	£ 65
Turbo Gameworks	PC-DOS	£ 53
Turbo Graphix Toolbox	PC-DOS	£ 49
Turbo Lader	MS-DOS	£ 75
Turbo Link	PC-DOS	£ 65
Turbopower Utilities	PC-DOS	£ 65
Turbo Professional	PC-DOS	£ 45
Turbo Screen CP/M,MS,	PC-DOS	£ 65
Turbo Tutor CP/M &	MS-DOS	£ 29
TurboWINDOWS	PC-DOS	£ 50

GENERAL PASCAL LIBRARIES

We have a wide range of other Pascal Libraries. Please call.

ADA COMPILERS

At Last- good Adas at good prices! New products include AdaVantage, Artek Ada and Ada/Ed-C.

Ada/Ed-C	MS-DOS	£ 80
AdaVantage	PC-DOS	£ 125
Artek Ada v1.25	MS-DOS	£ 350
JANUS/Ada C-Pack	MS-DOS	£ 90
JANUS/Ada ED-Pack	MS-DOS	£ 285
JANUS/Ada D-Pack	MS-DOS	£ 825
JANUS/Ada S-Pack	MS-DOS	£2890
Augusta (with source)	CP/M-80	£ 75
JANUS/Ada C-Pack	CP/M-80	£ 80
JANUS/Ada D-Pack	CP/M-80	£ 260
Supersoft Ada	CP/M-80	£ 250

GREY MATTER

4 Prigg Meadow, Ashburton, Devon TQ13 7DF
TEL. (0364) 53499

GREY MATTER

4 Prigg Meadow, Ashburton, Devon TQ13 7DF
TEL. (0364) 53499

GREY MATTER

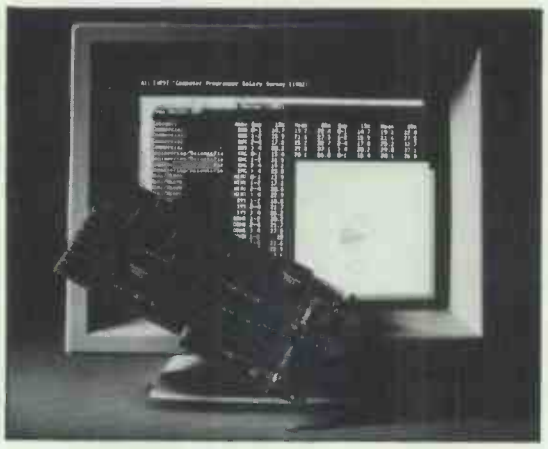
4 Prigg Meadow, Ashburton, Devon TQ13 7DF
TEL. (0364) 53499

CONTENTS

Vol 10 No 6 June 1987

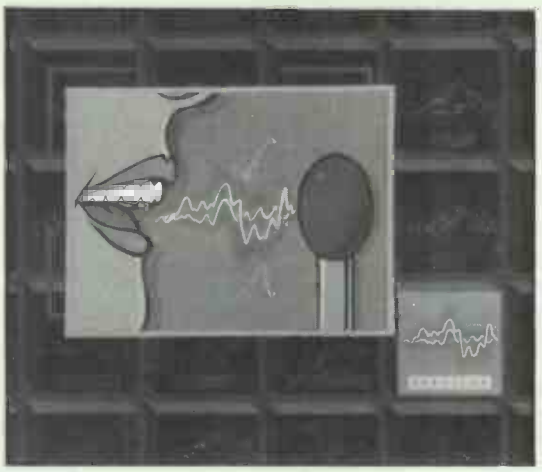
Cover photography by Chris Bell
Cover story begins on page 96

BENCHTESTS & REVIEWS



Founder Angelo Zgorelec Editor Derek Cohen Deputy Editor Nick Walker Production Editor Ginny Conran Deputy Production Editor Lauraine Danker Staff Writers Owen Linderholm, Robert Schifreen Editorial Secretary Debbie Wallace Consultant Editors David Tebbutt, Dick Pountain Art Director Martyn J Rowbotham Art Assistant Soo Abram Publishing Director Mike Agate Group Advertisement Manager Jan Pitt Advertisement Manager Moira Thomson Assistant Advertisement Manager Gary Lucas Sales Executives Julie Carter, Janett Harrison, Anne-Marie Halton, Tim Conniff, Stephen Babb, Sally McLester Advertisement Assistant Val Young Production Manager Cecile Passmore

FEATURES



REGULARS

PCW Subscription Enquiries Stuart Cruickshank Subscription Rates UK £15, Overseas £33 Subscription and back issues address: 32-34 Broadwick Street, London W1A 2HG, tel: (01) 439 4242 Advertising address 32-34 Broadwick Street, London W1A 2HG, tel: (01) 927 9016 Editorial address 32-34 Broadwick Street, London W1A 2HG, tel: (01) 439 4242. All departments Telex: 23918 VNUG — No material may be reproduced in whole or in part without written consent from the copyright holders © VNU Business Publications bv 1987. Typeset by Phase Communications, Pioneer House, 44/48 Clerkenwell Road, London EC1. Printed by Chase Web Offset, St Austell, Cornwall. Distributed by Comag Ltd, Tavistock Road, West Drayton, Middlesex, tel: (0895) 444055

I.S.C. Offer the UK's Best Service on computer software

COME TO THE EXPERTS — I.S.C. ARE THE LARGEST INDEPENDENT PEGASUS DEALER IN THE U.K.

PEGASUS ACCOUNTING

(All Pegasus includes FREE 2 year support)

PEGASUS SINGLE USER £160
Multi Company, Eight Module Integration

PEGASUS SENIOR £295
Multi Company, Currency, Consolidations

PEGASUS MULTI USER £345
Multi Company, Currency, Workstation, MSDOS

INFORMATION MANAGER £160
Reads Data directly from Pegasus Files

ELITE SENIOR DATABASE £345
Reads + Writes Pegasus Data Files

WORK INVOICING £295
Integrated with Pegasus Single User for Complex Invoicing and Repeat Billing

SUPPORT CONTRACT £50
Prices per Module over 2 Years
Free to ISC Customers
(Multi User 100 pounds per module)

Data Transfer, Upgrades, Bespoke, Training + Installation Services Available.

STATIONERY

Prices are per 500, total order minimum 1000

2 PART STATEMENTS	£26
3 PART STATEMENTS	£27
2 PART INVOICES	£29
3 PART INVOICES	£31
4 PART INVOICES	£43
PAYSLIPS	£21
REMITTANCE ADVICE	£32
BANK GIRO	£19
P14/P60	£34
P35	£34
STATEMENT ENVELOPES	£22
PAYSLIP ENVELOPES	£21

Please Call for Sample Sets.
Free Delivery Mainland U.K.

I.S.C. OFFER A FULL TECHNICAL ADVICE, SUPPORT AND INSTALLATION SERVICE + CUSTOMISED SINGLE AND MULTI USER SYSTEMS

SMART INTEGRATED SOFTWARE

SMART SYSTEM V3.0 ..... £395
Includes Database, Spreadsheet + WP

DATABASE MANAGER £275

SPREADSHEET £275

WORDPROCESSOR £195

SPELLCHECKER £95

SMART LAN MULTIUSER £1395
For Networking, Three User Access

SMART SYSTEM USER ACCESS £450
For Unlimited User Access

TRAINING

I.S.C. offer training at your premises, on a wide range of Software and Hardware Products.

WORDSTAR PROFESSIONAL
LOTUS 1-2-3
SMART INTEGRATED SOFTWARE
PEGASUS ACCOUNTS
NETWORKING PRODUCTS
DBASE 2/3/+

* * * Many Other Single and Multi User Products

MULTIUSER

TANDON PCA30 30MB 80286 PROCESSOR 1MB RAM
2 IBM STYLE TERMINALS
5 MODULES OF MULTI-USER PEGASUS ACCOUNTING
2 DAYS INSTALLATION AND TRAINING
2 YEARS HOT LINE SUPPORT £5995

(EQUIVALENT TO 33% DISCOUNT)

(THE ABOVE IS ONLY AN EXAMPLE, OTHER COMPUTERS OR SOFTWARE AVAILABLE

I.S.C.

XEN IN STOCK

AMSTRAD PC MAIN DEALER

* Guarantee the UK's lowest prices on computer systems

COMPUTERS

All Computers include Mono Screen, MS DOS and KB

TANDON PCX10 /256K/10MB/360K	£795
TANDON PCX20 /256K/20MB/360K	£955
TANDON PCA20 /512K/20MB/1.2MB/SP/HERC	£1495
TANDON PCA30 /512K/30MB/1.2MB/SP/HERC	£1750
TANDON PCA40 /512K/40MB/1.2MB/SP/HERC	£1845
TANDON PCA70/512k/70Mb/1.2Mb/SP/HERC	£2245
AMSTRAD PC1512/512K/TWIN DRIVE/MONO	£595
AMSTRAD PC1512/512K/TWIN DRIVE/COLOUR	£750
AMSTRAD PC1512/512K/20MB/360K/MONO	£935
AMSTRAD PC1512/512K/20MB/360K COLOUR	£1095
12 MONTHS ON SITE MTCE INCLUDED	
APRICOT XEN X120/512K/20MB 1.2MB	£1950
APRICOT XEN XD20/1MB/20MB/1.2MB	£2095
APRICOT XEN XD45/1MB/45MB/1.2MB	£2695
APRICOT XEN 386 1MB/30MB/1.2MB	£2695
APRICOT XEN 386 2MB/45MB/1.2MB	£3445
IBM XTSDD/640K/TWIN 360K	£1395
IBM XTSFD/640K/20MB/360K	£1595
IBM XT286/640K/20MB/1.2MB	£2260
IBM ATX/512K/30MB/1.2MB	£2999
AST M20/640K/20MB/1.2MB/10MHZ/EGA COLOUR	£2195
AST M40/640K/40MB/1.2MB/10MHZ/EGA COLOUR	£2495
AST M70/640K/70MB/1.2MB/10MHZ/EGA COLOUR	2695
COMPAQ D286M2/512K/30MB/1.2MB	£3095
COMPAQ D286M3/640K/70MB/1.2MB	£4595
COMPAQ D386	POA
OLIVETTI	POA
ZENITH	POA
KAYPRO	POA

COLOUR SYSTEMS ADD THE FOLLOWING:-

APRICOT 195 . . . TANDON 215 . . .
OLIVETTI 250 . . . AMSTRAD 150 . . .
IBM 220 . . . COMPAQ 220 . . . ZENITH 215 . . .

DEMONSTRATION AND SECOND USER MACHINES AVAILABLE

COMPANY SERVICES INCLUDE:

LEASING, LEASE RENTAL + HIRE PURCHASE
CUSTOMISED DATABASE SYSTEMS,
MAINTENANCE CONTRACTS,
INSTALLATION CONTRACTS,
NETWORK SYSTEMS, MULTI-USER SYSTEMS

TRADE AND EXPORT ENQUIRIES WELCOME

All products carry 12 months guarantee and

HOTLINE

PHONE SUPPORT

PRINTERS

EPSON LX800 120CPS/20NLQ/80COL	£205
EPSON EX800 300CPS/50NLQ/80COL	£395
EPSON FX800 200CPS/50NLQ/80COL	£305
EPSON LQ800 180CPS/60NLQ/80COL	£430
EPSON EX1000 300CPS/50NLQ/132COL	£515
EPSON FX1000 200CPS/50NLQ/132COL	£395
EPSON LQ1000 180CPS/50NLQ/132COL	£575
EPSON LQ2500 270CPS/90NLQ/132COL	£815
FUJITSU 2100 220CPS-55NLQ/80 COL	£295
FUJITSU 2200 220CPS/55NLQ/132COL	£395
CANON A55 180CPS/45NLQ/132COL	£375
CANON LBP8A1 LASER 8 PAGE PER MIN	£1495
CANON LBP8A2 LASER 8 PAGE PER MIN/GRAPHICS	£2295
CANON LBP SERIES 2 8 PAGE PER MIN/GRAPHICS	£1895
HP LASERJET 8 PAGE PER MIN	£1695
HP LASERJET+ 8 PAGE PER MIN	£2295
HP SERIES 2 8 PAGE PER MIN	£1995
JUKI 6100 15CPS/DAISYWHEEL	£275
JUKI 6200 30CPS/DAISYWHEEL	£425
JUKI 6300 35CPS/DAISYWHEEL	£645

SOFTWARE

PEGASUS SINGLE USER	£160
(2 YEARS SUPPORT)	
PEGASUS SENIOR	£POA
(2 YEARS SUPPORT)	
PEGASUS MULTI USER	£POA
(2 YEARS SUPPORT)	
DELTA 4 PROFESSIONAL	£335
DBASE2	£245
DBASE3+	£355
WORDSTAR PROFESSIONAL	£209
WORDSTAR 2000	£259
MICROSOFT WORD	£270
LOTUS 1-2-3.V1	£179
LOTUS 1-2-3.V2	£269
LOTUS SYMPHONY	£359
SMART INTEGRATED SYSTEM	£395
OPEN ACCESS	£335
LOGISITIX	£255
SAGE BOOKEEPER	£80
SAGE ACCOUNTANT	£120
SAGE ACCOUNTANT+	£150
VENTURA	£645
ABILITY	£90

SPECIALS

APRICOT 256K RAM	£99
APRICOT 512K RAM	£119
IBM 256K RAM	£119
IBM 384K RAM	£139
SONY 3.5 INCH D/S DISKS	£32
20MG UPGRADE FOR IBM	£395
E.G.A. CARD + MONITOR	£695
HERC/CGA/EGA	

*** PROVIDE A CURRENTLY ADVERTISED LOWER PRICE WITHIN 7 DAYS AND DIFFERENCE WILL BE REFUNDED**

I.S.C. LIMITED

Prices Exclude only VAT and Delivery

Access

GRAPHIC HOUSE
88 WAVENEY ROAD
ST IVES
CAMBRIDGESHIRE
PE17 4FW

TEL: 0480 300530
(16 lines)
TELEX: 329115 ISC LTD

SCOTTISH OFFICE:
I.S.C. SCOTLAND
19 CARDEN PLACE
ABERDEEN
AB1 1UQ

TEL: 0224 639944
(3 lines)

Advantage

The Independent Computer User Group

(PCW'1) 33 Malyns Close, Chinnor, Oxfordshire OX9 4EW.
Tel: 0844 52075

VISA

AUTHORISED PC-SIG DEALER

Access

ORDERING – Prices include VAT and UK postage. VISA and ACCESS accepted by post or telephone. Send a stamped, addressed envelope for our latest catalogue.

PLEASE STATE WHICH COMPUTER YOU ARE USING

NEW

PC Owners send just £2 for our new catalogue on a disc, which includes SAMPLE games and utilities

PCW & CPC SOFTWARE

EACH DISC £6.95 (Advantage Members £4.95)
Overseas add £1 per disc.

The six discs below contain Public Domain software plus Advantage user notes.

COMPLEAT UTILITIES – Selective file copy erase, hide, rename and print, Sector Editor, Z80 Assembler/Disassembler, Z80 Debugger, Erased File Find and Recovery (CP/M 2.2), Sorted Directory, File Scanner, Splitter, String Finder, Bad Sector Eliminator, Typewriter Emulator.

GAMES COMPENDIUM – Chess, Colossal Cave Adventure, Othello, Mastermind, Awari, Life, Golf, Polish Pong, Maze, Biorhythms, Word Search Puzzle Maker, Calendar Generator, Noughts & Crosses, Banner Printers.

APPLICATIONS – Inventory/Database, Library Utilities, Word Count, Alphabetic Sort, Simple Spelling Checker, Easy to edit Starter Dictionary, Disc Catalogger, File Squeeze/Unsqueeze (saves up to 40% disc space), Password Protection.

COMMUNICATIONS – UK Modem7, MEX, Kermit, BINARY-HEX Converter and other utilities.

AMUSEMENTS & DIVERSIONS – 25 games and 8 utilities written in unprotected MALLARD BASIC, including Star Trek, Merchant, Hangman, Nim, Baseball, American Football, Calculator, Home Budget and Label Printer

SMALL C COMPILER – produces machine code programs and includes 25k of documentation

PC SOFTWARE

EACH DISC: £9.95 (Advantage Members £7.95)
Overseas please add £1 per disc

We have an extensive library of over 700 PC-SIG public domain and user-supported discs. Here are some of the favourites

PC-WRITE – Multi-function Word Processor 60k file size. 100 page on-disc manual
PC-FILE III – Fully user – definable Database 32,767 records. 100 page on-disc manual
PC-CALC – Spreadsheet similar to 123 (64 column x 256 row). 30 page on-disc manual
PC-TUTOR – Course in computers and DOS
CASH-TRAC – Household budget organiser
PRO-COMM – Comprehensive Communications
PC DESKTEAM – more features than Desk Mate
ULTRA UTILITIES – Powerful Disc Doctor with disc mapper, unerase, sector editor
BEST UTILITIES – Selective delete and copy, print spooler, file, Browse, super TYPE
BEST GAMES –Two classics: Space Invaders & Packman, plus Life, Bugs, Castle (adventure)
ASSORTED GAMES – Pinball, Catch The Baby, Frogger, Multi-maze, War Game
ARCADE GAMES – 3-Deman, Donkey Kong, Golf, Fortune, Breakout, Pango, Pittail, Pyramid
PC-CHESS – Full feature, on-screen board
OTHELLO – Reversi game with graphics
COLOSSAL CAVE ADVENTURE
STAR TREK –Large graphics version
TRIVIA QUIZ – A two disc set £15.95
MONOPOLY – The board game on computer
CAVE QUEST – Dungeons & Dragons game
Q-BERT – fast square-jumping arcade game
HANGMAN – Well presented graphics version
FUNNELS & BUCKETS – A fun learning maths game for over 7's

MIX C COMPILER

- Full Kernighan-Ritchie implementation
- Fast Linker to build an executable program from separately compiled files
- Supports all data types, floats, bit fields, doubles, structures and unions
- Unix C compatible
- Extensive library of 175 functions
- Optimisation tools for speed and space
- 450 page manual describing compiler operation, C programming and tutorial
- UK technical support from Advantage

"Outstanding value for money" – CWA 2/87
Available for CP/M+ and MSDOS. Second drive or RAM disc is recommended for CPC owners.
£36.95 Overseas please add £5

MIX C TRACE

A powerful aid to fast program debugging with four-window monitoring and animated trace which highlights each statement as it executes. Single step and continuous functions with dynamic monitoring of source, output, variables, symbols and memory. Unlimited breakpoints. Comprehensive manual. MS DOS only.
£36.95 Overseas please add £3

MIX SPLIT SCREEN EDITOR

£29.95 Overseas add £3

MIX ASSEMBLER UTILITY

£10.95 Overseas please add £1

*Buy any 2 MIX packages – deduct 10%
any 3 – deduct 15% all 4 – deduct 20%
Advantage members may also deduct £2 per item

BORLAND TURBO PASCAL

The fastest Pascal compiler with programing environment, editor, error detection, window procedures, sound, colour and graphics.
"Runs like magic" – PC Magazine
Amstrad CP/M Version: £63.95
Overseas add £3
PC MSDOS Version £76.95
(Members deduct £2)

NEVADA & UTAH COBOL

Features runtime error messages, random access and sequential files and integration of assembly language using DR MAC.
CP/M or MSDOS **£36.95 (Mem! £34.95)**

NEVADA & UTAH FORTRAN

Random I/O file, assembly language support, function library + real time error reports. MSDOS or CP/M "Outstanding Value" – CWA 11/86
£36.95 (Members £34.95)
Overseas add £3

FULL SCREEN TEXT EDITOR

Suitable for generating compiler source code – CP/M and MSDOS versions available.
£10.95 (Members £8.95)
Overseas add £1

INDEPENDENT USER GROUP

Choose either Group-8 (CPC & PCW) or Group-16 (PC1512) for monthly newsletter user support and software discounts.
Annual membership: £10.95 (UK)
£13.95 (Europe)
£16.95 (Rest of World)

MicroProcessor Eng Ltd
133 Hill Lane
Southampton SO1 5AF

0703 631441

mpe

FORTHS

For IBM PC and Compatibles

Modular Forth	£475.00
Source Code	£5,000.00
Workforth	£55.00
Workforth Extensions:	
Viewtrace	£35.00
Floating Pt	£35.00
Windows & Graphics	£45.00
Doc Tool Pack	£45.00
Workforth & all ext.	£145.00

For Atari ST & Macintosh

Gem Forth Metacomco	£65.00

For Vax, RSX-11 etc

Uniforth	£175.00
MPE-Forth/OS9 68k	£375.00
MasterForth by MM	£125.00
Extensions: flt Pt	£45.00
HIRES graphics	£45.00
MVP-Forth for C. Amiga	£150.00

Forthright

CROSS COMPILERS

for CPM 80, MS-DOS, PC-DOS, CPM 68k, FLEX, OS9

(needs workforth as host)	£250.00
Targets: PDP-11 6502, 6511Q, 8080/5, Z80, 8086/88, Z8, 1802 8070, 6809, 6800/01/03/6303, 68000, 9900x	£175.00
8031/51 Bryte Forth	£350.00
Forth-83 Targets:	
Z80, 8086, 680XO 32-bit	£225.00

For RT-11, RSX-11 & VMS-11:
Uniforth — Prices on application.

HARDWARE for PC Programmers:

Gal Programmer (MPE)	£450.00
Pal Programmer	£350.00
EPROM Programmer	£145.00
Stack EPROM Programmer	£795.00

Forth Engines:

Novix 5MIP Board	£852.00
MVP Microcoded	£1225.00

Kaypro PC Clones:

286i (AT Clone with 20Mb)	£2200.00
K200 (LCD & Batteries)	£1132.00
Amstrad PC Clones	£549 to £1069.00

WERRINGTON COMPUTERS LTD

BRINGS YOU THE MOST COMPETITIVE PRICES YET

Software

Pegasus Single user per module	£160
Pegasus Multi user per module	£355
Pegasus Senior per module	£300
Delta Professional	£345
DBase 3+	£355
Word Star Professional	£225
Word Star 2000	£279
Sage Bookkeeping	£95
Sage Accountant	£135
Sage Accountant +	£165
Lotus 1-2-3	£299
Lotus Symphony	£415
Psion X Change	£325
Smart Series	£450

Printers

Epson FX800	£310
Epson FX1000	£410
Epson LQ800	£445
Epson LQ1000	£585
Epson EX800	£415
Epson EX1000	£525
Canon A50	£295
Canon A55	£375
Juki 6100	£295
Juki 6200	£425
Fujitsu 2100	£315
Fujitsu DX2200	£415
Canon A1 Laser	£1895
Canon A2 Laser	£2750
HP Laser	£1995
HP Laser Jet	£2675

Computers

Apricot Xen HD + Monitor	£2325
Apricot Xen Xi20 + Monitor	£1799
Apricot Xeni XD 20Mb	£2195
Apricot Xeni XD 45Mb	£2795

NEW

Apricot Xen 386 30Mb + Monitor £2895

IBM Compatibles

Tandon PCX 10 System	£975
Tandon PCX 20 System	£1125
Tandon PCA 20 System	£1495
Tandon PCA 30 System	£1875
Tandon PCA 40 System	£2245
Kaypro 286i 20Mb	£1650

Consumables

Apricot 256k Ram Board	£105
Apricot 512k Ram Board	£125
Box of 5¼" XT Disks	£20
Box of 5¼" AT Disks	£35
Box of Sony 3½" Double Sided Disks	£35

PRICES EXCLUSIVE OF VAT AND DELIVERY AND SUBJECT TO AVAILABILITY

TRADE + EXPORT WELCOME

PLEASE CALL IMMEDIATELY FOR FURTHER DETAILS

0733 322488

WERRINGTON COMPUTERS LTD 44 WOODHALL RISE, WERRINGTON, PETERBOROUGH

ATT peripherals CORPORATION

SPECIALISTS IN EXPORT

PRINTERS

EPSON LX 86	£195 NEC P5 £799
EPSON FX 105+	£37 NEC P6 £425
EPSON EX 1000	£515
EPSON LQ 1000	£575
EPSON LQ 2500	£765
BROTHER HR20	£355
BROTHER HR25 XL	£532
BROTHER M1509	£385
BROTHER M1409	£299
BROTHER TWINWRITER	£975

MODEMS

HAYES SMART MODEM	£360
DOWTY QUATRO	£612
DOWTY MINIMO + 2	£209
DACOM DSL 2123	£172
MIRACLE WS2000	£105
PC COMMS QUATROCARD	POA
RACAL MILGO	POA
THORN DATATECH	POA

MONITORS + ADD-ON BOARDS

NEC MULTISYNC	£544
SONY 10" COLOUR	£495
TAXAN EGA	£418
INTEL INBOARD 386	£1260
ORCHID JET 386	£740
AST PREMIUM/RAMPAGE	POA
HERCULES MONO	£199
HERCULES COLOUR	£105

DRIVES + TAPE BACK UP

SEAGATE 20Mb ST225 Inc WD Cont	£372
SEAGATE 30 Mb ST238 + Cont	£504
SEAGATE 40Mb ST251	POA
RODINE	POA
EVEREX INT 20 Mb T/S	£665
EVEREX INT 60 Mb T/S	£890
EVEREX EXT 20 Mb T/S	£746
EVEREX EXT 60Mb T/S	£970

MOUSE DEVICES + SOFTWARE

MS MOUSE	£142
PC MOUSE	£130
LOGIMOUSE	£76
SUMMA MOUSE	89
MS WORD	£249
DB3+	POA
LOTUS 123	POA
SUPERCALC	POA
MULTIMATE ADV	POA
SMART	POA

ACCESSORIES

DRAMS 664K	£1.50
DRAMS 256K	£5.00
DRAMS 128K	£9.00
MATHSCO-PRO 80287 – 6MHz	£175
MATHSCO-PRO 8087 – 5MHz	£105
MATHSCO-PRO 8087 – 8MHz	£140
SPECIAL OFFERS	
PARALLEL PRINTER CABLES	£12.50
EP TONER CART	£74.95

RING NOW: 01-739 4596

ATT peripherals Corporation Ltd

AMERICAN EXPRESS BARCLAYCARD VISA

(T1) INDUSTRIAL UNITS STANWAY STREET LONDON N1 6RY

TEL: 01-739 4596 Telex 895 1182 GECOMS G *CALLERS BY APPOINTMENT ONLY*

ATT Corporation Ltd
PRICE GUARANTEE

PROVIDE A WRITTEN LOWER QUOTATION FROM AN AUTHORISED DEALER WITHIN 7 DAYS OF PURCHASE AND THE DIFFERENCE WILL BE REFUNDED!

CALLERS BY APPOINTMENT ONLY "PRICES SUBJECT TO FLUCTUATION. VAT NOT INCLUDED"

SPECIALISTS IN EXPORT

APPLE

MACINTOSH SE 2×800	£1940
MACINTOSH SE 1×800/20MB	£2500
Keyboard for the above	£75
MACINTOSH PLUS	£1570
MAC 512-800	£1480
IMAGEWRITER II	£365
IMAGEWRITER 15"	£405
MAC DRIVE 800K	£310
HARD DISK 20Mb	£850
APPLE LASERWRITER	£3750
LASERWRITER PLUS	£4400

APRICOT

★ SPECIAL ★	£1575
XEN XI/512k/10Mb/1.2Mb	£1975
XEN XI/512k/20Mb/1.2Mb	£2300
XEN I/1Mb RAM/20Mb/1.2Mb	£3050
XEN XD/1Mb RAM/40Mb/1.2Mb	£2350
XEN 80386/1Mb RAM/30Mb/1.2Mb	£3150
XEN 80386/2Mb RAM/45Mb/1.2Mb	£280
P/WHITE MONITOR	£140
GREEN MONITOR	£160
MONO CARD	£299
EGA CARD	

LASER PRINTERS

★ SPECIAL PRICES ★	£4500
T.I. OMNILASER MODEL 2015	£1499
CANON AI LASER PRINTER	£2400
CANON AII LASER PLUS	£1750
CANON LBP 8/2 Pand S parts	£1599
HP LASER JET	£1975
HP LASER JET II	£2100
HP LASER PLUS	

DESKTOP PUBLICATIONS

PROFESSIONAL SYSTEM

Macintosh Plus
Hard Disk 20Mb
LaserWriter
Two Apple Talk Connectors
MacDraw
MacPaint
Microsoft Word
Aldus PageMaker
10 Sony D/S Disks

★ £7000 ★

KYPRO — see our other ad on p82

DESKTOP PUBLICATIONS

THE BUSINESS SYSTEM

Macintosh Plus
External 800k Disk Drive
LaserWriter
Two Apple Talk Connectors
MacDraw/MacPaint
Microsoft Word
Aldus PageMaker
10 Sony D/S Disks

★ £6450 ★

FINANCE

LEASE RENTAL
CASH
LEASE PURCHASE
HIRE PURCHASE
INSTANT CREDIT (Subject to Status)

products carry a 12 months Full Guarantee with HOTLINE Phone Support

RING NOW: 01-729 7033

ATT Corporation Ltd

(TI) INDUSTRIAL UNITS STANWAY STREET LONDON N1 6RY
TEL: 01-729 7033 Telex: 895 1182 GECOMS G

RSC Ltd

(0923) 43301
(24 hours)
(0923) 41921

ALL PRICES INCLUDE VAT & POSTAGE
Export, Government & Educational Orders Welcome
All enquiries & payments to
RSC Ltd, 75 Queens Road, Watford WD1 2QN
Telex: 265871 MON REF G. REF CJJ128
Tel: (0923) 43301-41921
Callers Welcome
All prices subject to change without notice — all goods subject to availability.

ALL PRICES INCLUDE VAT — INSURANCE & CARRIAGE

AMSTRAD PC 1512

All Prices include VAT & carriage

PC1512 SINGLE DRIVE MONO	£489.00
PC1512 DOUBLE DRIVE MONO	£615.00
PC1512 SINGLE DRIVE COLOUR	£669.00
PC1512 DOUBLE DRIVE COLOUR	£799.00
PC1512 20MB HARD DISK MONO	£989.00
PC1512 20MB HARD DISK COLOUR	£1175.00

AMSTRAD PCW8256/8512

All prices Include VAT & carriage
(All PCWs come with 5 free disks)

PCW8256 (SINGLE DRIVE)	£430.00
PCW 8512 (TWIN DRIVE)	£545.00

Complete range of software and add-ons for PCW at competitive prices — phone or send for list.

RSC'S OWN COMBINATION

PC1512 SINGLE DRIVE MONO WITH 32MB SCRIBE CARD	£899.00
PC1512 SINGLE DRIVE COLOUR WITH 32MB SCRIBE CARD	£1099.00
PC1512 DOUBLE DRIVE MONO WITH 32MB SCRIBE CARD	£1029.00
PC1512 DOUBLE DRIVE COLOUR WITH 32MB SCRIBE CARD	£1219.00

ADD-ONS

TANDON 20Mb HARD DISK. An upgrade kit consisting of — Controllercard — software — cables — installation brackets — Instruction manuals £499.00

TANDON 10MB HARD DISK	£399.00
NEC 32MB HARD DISK (with complete kit)	£599.00

HARD CARDS

TANDON 10MB HARD CARD	£365.00
TANDON 20MB HARD CARD	£465.00

SCRIBECARD 30

Breakthrough: new-tech performance at old-tech prices.
32MB Disc Card — a fast card low power consumption comes formatted.

CHIPS

128k UPGRADE PC TO 640k	£22.50
MATHS CO-PROCESSOR 8087-2	£169.00
NEC V30-REPLACEMENT FOR THE 8086	£32.50

TAPE STREAMERS

CIPHER 1525-CT 20MB — 20MB STORED IN 20mins £475.00 — SELF POWERED

Back-up tapes	£32.50

PC & COMPATIBLE SOFTWARE

INTEGRATED PACKAGES	
ABLE-ONE	£84.50
FIRST CHOICE	£149.95
ABILITY	£84.50
ABILITY PLUS	£159.00
OPEN ACCESS	£134.50
PSION-FOUR	£67.50
LOGISTIX	£84.50
INTERPRETED 7	£84.50
PC WORDPROCESSORS	
WORDSTAR 1512	£54.50
SAGE PC WRITE	£97.50
NEW WORD II	£94.50
TASWORD PC	£22.00
TASPRINT PC	£22.00
GEM WRITER	£84.50
WORD PERFECT JUNIOR	£84.50
WORD PERFECT PERSONAL	£179.00
VOLKSWRITER DELUXE	£39.99
VOLKSWRITER 3	£189.00
WORD JUNIOR	£64.50
FIRST PLUS	£69.00
G BASE	£84.50

DISKS

TDK® *It's a guarantee in itself*

5.25" DISKS	PRICE PER BOX 1-4	PRICE PER Box 5 or more
MID [48tpi] Single sided/double density	£12.00	£11.50
M2D [48tpi] Double sided/double density	£14.00	£13.50
MIDD [96tpi] Single sided	£14.50	£14.00
M2DD [96tpi] Double sided	£15.00	£14.50
M2HD [1.6Mb] High density	£28.00	£26.00
3½" DISKS		
MF — 1DD Single Sided	£25.00	£23.50
MF — 2DD Double sided	£28.00	£26.50

RSC'S OWN BRAND

5¼" disks (free case) double sided/d density	£10.00	£9.50
3½" disks (free case) double sided/d density	£17.50	£17.00

PC DATABASES

SAGE RETRIEVE	£94.50
COMPSOFT DELTA 4.3	£79.00
CAXTON CARDBOX	£44.50
CAXTON CARDBOX PLUS	£299.00
CAXTON CONDOR 1 JUNIOR	£79.50
CAMSOFT CAMBASE	£37.50
TAS +	£69.00
TAS DEVELOPER	£199.00
VP INFO	£84.50
D BASE II (1512 VERSION)	£94.50
PC PROMISE	£57.50
SUPERBASE PERSONAL	£84.50
PC PROMISE (FULL VERSION)	£169.00

PC SPREADSHEETS

AMSOFT SUPERCALC 3	£54.50
CAXTON SCRATCHPAD +	£47.50
SAGE PC PLANNER	£97.50
CRACKER 3	£64.50
MULTIPLAN JNR	£57.50
VP PLANNER	£84.50
MULTIPLAN (MICROSOFT)	£150.00
WORDS & FIGURES	£85.00
KUMA K SPREAD II	£69.95
SAGE DESKTOP	£67.50

PC ACCOUNTS

All prices include VAT & carriage

SAGE BOOKKEEPER	£97.50
SAGE ACCOUNTANT	£145.00
SAGE ACCOUNTANT PLUS	£195.00
SAGE PAYROLL	£97.50
SAGE FIN CONTROLLER	£295.00

GRAPHICS & DESKTOP PUBLISHING

GRAPH PAD 3	£179.95
GEM DRAW	£82.50
GEM GRAPH	£82.50
DELTA GRAPH (COMSOFT)	£59.95
LIGHT PEN (ELECTRIC STUDIO)	£18.50
ART STUDIO	£47.50
FLEET STREET EDITOR	£135.00
PRINT SHOP	£34.50
PRINTSHOP GRAPHICS LIBRARY	£17.50
FONTOSY	£69.00
FONTOSY ADD-ON FONTS	£42.50

GENERAL & UTILITIES

GEM DRAW BUS LIBRARY	£34.95
GEM PROG TOOLKIT	£159.95
GEM FONTS & DRIVERS PACK	£34.95
PROTEXT	£94.50
FLYING START	£59.95
TURBO PASCAL	£67.50
TURBO TUTOR	£28.50
TURBO EDITOR TOOLBOX	£47.50
TURBO GRAPHIX TOOLBOX	£47.50
TURBO PROLOG	£67.50
TURBO BASIC	£67.50
TURBO LIGHTNING	£67.50
TURBO WORD WIZARD	£47.50
BORLAND REFLEX	£87.50
AMSOFT REFLEX	£52.50
SIDEKICK (BORLAND)	£67.50
TRAVELLING SIDEKICK	£67.50
QUICK BASIC COMPUTER (MICROSOFT)	£79.50
LEAMING DOS (MICROSOFT)	£29.95
MS-DOS USER GUIDE (MICROSOFT)	£57.50
MS-DOS PROG REF (MICROSOFT)	£57.50
ZORLAND C	£29.95
ZORLAND DEVELOPERS UPGRADE	£19.95
LINKER PACKAGE	£19.95
COMPLETE INTEL PACK	£59.95
PASCAL C, COBOL, BASIC, FORTRAN (MICROSOFT)	PLEASE RING

COMMUNICATIONS

AMSTRAD PC CARD MODEM (AUTO)	£9.00
LINNET V21/V23 (AUTO)	£149.00
MIRACLE WS 4000 V21/V23	£179.00
SAGE CHIT-CHAT PACK (WITH PACE MODEM)	£209.00
SAGE CHIT-CHAT SOFTWARE	£99.00

DOT MATRIX PRINTERS

All prices include VAT & carriage

AMSTRAD DMP 3000	£179.00
AMSTRAD DMP 4000 (WIDE CARRIAGE)	£365.00
PANASONIC KX-P1080A (80 COL)	£169.00
PANASONIC KX-P1081 (80 COL, IBM)	£179.00
PANASONIC P1592 (136 COL)	£395.00
EPSON LX86 (80 COL) 100CPS	£223.00
EPSON LQ800 (80 COL) 180CPS	£579.00
EPSON LQ1000 (132 COL) 180CPS	£699.00
EPSON EX800 (80 COL) 300CPS	£449.00
EPSON EX100 (136 COL) 3200CPS	£549.00
EPSON FX800 (80 COL)	£350.00
EPSON FX1000 (132 COL)	£450.00
EPSON LQ2500 (136 COL) 200CPS	£845.00
CANON PW1080A (80 COL) 160CPS	£269.00
CANON A55 (156 COL) 180CPS	£459.00
CANON A60 (80 COL) 300CPS	£459.00
CANON A65 (136 COL) 200CPS	£565.00
MP165 (80 COL) 165CPS	£199.00
MP200 (80 COL) 200CPS	£299.00
MP201 (132 COL) 200CPS	£350.00
MP135 (80 COL) 135CPS	£169.00
MP480 (80 COL) 480CPS	£369

DAISYWHEEL PRINTERS

JUKI 6100 20CPS	£295.00
PANASONIC KX P3131 0 17CPS	£287.50
MP26 26CPS	£259.00
MP40 40CPS	£379.00

COLOUR PRINTERS & PLOTTERS

JUKI 5520 (4 COLOUR)	£389.00
EPSON EX-SERIES COLOUR UPGRADE	£62.00
ROLAND PX7980A (A3)	£735.00
EPSON GQ3500 LAZERPRINTER	£POA
HP 7440A COL PLOTTER	£995.00

PRINTER ACCESSORIES

PC PRINTER CABLE	£16.50
EPSON LX86 TRACTOR FEEDER	£23.00
EPSON LX86 SHEETFEEDER	£63.00
EPSON LQ800 T/FEED	£45.00
EPSON LQ8000 T/FEED	£57.00
LQ 800 SHEETFEEDEER	£155.00
LQ1000 SHEETFEEDER	£185.00
JUKI 6100 T/FEED	£149.00
JUKI 6100 SHEETFEEDER	£269.00

RIBBONS — PAPER — PRINTER STANDS — DUST COVERS ETC. PLEASE PHONE.

DISKETTE STORAGE

Removable lid supplied with index labels, dividers, lock and two keys. Anti-static.

RSC 50	£11.50
RSC 100	£14.95

K.D. PRINTER STAND

TPS-25: K.D. printer stand for 80 column printers. Paper feeds from underneath and the dial adjustable paper feed plate guides the paper onto the collection rack for neat stacking Sturdy steel and plastic construction with space saving design.

80 Col Stand	£34.95
132 Col Stand	£42.50

TATUNG AT-COMPATIBLE

Voted best buy — April Which Computer
TC57000E/8/85 — 20MB HDD **£1899 inc VAT**
14" Dual freq Mono Monitor and Hercules Card **£259 inc VAT**

COMPUMART

WATFORD (0923) 55633

IBM

	Mono	Colour
PC XT (SDD):(640k RAM 2 × 360k Disk)	£1100.00	£1290.00
PC XT (SFD):(640k RAM 360k +20Mb Disk)	£1400.00	£1600.00
PC XT (286):(640k RAM 1.2Mb + 20Mb Disk)	£2000.00	£2200.00
PC AT X:(512k RAM 1.2Mb + 30Mb Disk)	£2975.00	£3170.00

All prices include Keyboard, Monitor & DOS

8087 Chip £195.00 80287 Chip £295.00 AT 360k Disk £145.00

TOSHIBA

Lap Top Computers

T1100:(256k RAM, 3½" 720k Disk, 80C88 Co-pro, DOS 2.1)	£1122.00
T1100 Plus (640k RAM, 2×3½" 720k Disks, DOS 3.2, and A/C Adapter-Charger & Carrying Case:	£1450.00
T3100:(640k RAM, 3½" Disk + 10Mb H/Disk, 8MHz 80286 Co-pro, Clock Cal)	£2772.00

olivetti

Desktops

	Mono	Colour
M24:(640k RAM 360k + 20Mb Disk)	£1683.00	£1897.00
M24SP:(640k RAM 360k + 20Mb Disk)	£1826.00	£2040.00
M28:(512k RAM 1.2Mb + 20Mb Disk Bs. Con)	£2266.00	£2493.00
M28:(512k RAM 1.2Mb + 40Mb Disk Bs. Con)	£2730.00	£2958.00

All prices include Keyboard, Monitor & DOS

COMPAQ

Portables

Portable I:(256k RAM 2 × 360k Disks)	£1397.00
Portable I Plus:(360k Disk + 10Mb H/Disk	£1817.00
Portable II Model 2:(256k RAM 2 × 360k Disk)	£1680.00
Portable II Model 4:(640k RAM 360k Disk + 20Mb H/Disk)	£2275.00
Portable 286 Model 3:(640k RAM 1.2Mb + 20Mb H/Disk + 10Mb Tape)	£3147.00

All prices include DOS

Deskpros

Deskpro Model 2:(256k RAM 2 × 360k Disks)	£1307.00
Deskpro Model 3:(640k RAM 360k + 20Mb Disk)	£1797.00

New 12MHz MODELS 50% FASTER

Deskpro 286 20:(640k RAM 1.2Mb + 20Mb Disk)	£2367.00
Deskpro 286 40:(640k RAM 1.2Mb + 40Mb Disk)	£2718.00
Deskpro 286 70T:(640k RAM 1.2Mb + 70Mb Disk + 40Mb Tape Backup)	£4245.00
Deskpro 386 40:(1Mb RAM 1.2Mb + 40Mb Disk)	£4706.00
Deskpro 386 70:(1MB RAM 1.2Mb + 70Mb Disk +	£5186.00

All prices include Keyboard, Dual-Mode Monitor & DOS

COMPAQ PORTABLE III

640k, 286 Processor, 1.2Mb Floppy, 20Mb H/Disk:	**£2914.00**
640k, 286 Processor, 1.2Mb Floppy, 40Mb H/Disk:	**£3234.00**

All prices include DOS

PRINTERS

Dot Matrix	Epson FX800:(240cps, 35cps NLQ, 80col)	£444.00
	Epson FX1000:(240cps, 35cps NLQ, 132col)	£453.00
	Epson LQ1000:(180cps, 60cps NLQ, 132col)	£681.00
	NEC P660:(180cps, 72cps NLQ, 80col)	£410.00
	NEC P760:(180cps, 72cps NLQ, 136col)	£490.00
	NEC P565XL:(264cps, 88cps LQ, 136col)	£885.00
	Toshiba P351	£856.00
Letter Quality	NEC Spinwriter 8850:(55cps)	£899.00
	IBM Quietwriter Model 1	£858.00
	IBM Quietwriter Model 2	£1075.00
	HP Laserjet (8ppm)	£1496.00
	HP Laserjet Plus (8ppm + graphics)	£2200.00
Plotters	HP 7440A:(A4) £776.00	
	HP 7475A:(A3) £1366.00	

All prices include cable

SOFTWARE

Multimate Advantage	£346.00	Dbase III Plus	£399.00
Wordstar Professional	£290.00	Smart	£486.00
Displaywrite III	£322.00	Symphony	£355.00
Lotus 1-2-3	£247.00	Paradox	£430.00
SuperCalc IV	£230.00	Microsoft Mouse	£140.00

Other Printers, Multifunction Cards & Software available.

EX-RENTAL EQUIPMENT

Please telephone Steven on (0923) 53933 ext 2550 for information and prices on current stock.

SPECIAL OFFERS

Taxan mono monitor 12"	£135.00	Paradise AutoSwitch EGA	£279.00	AST Rampage 512k for AT	£428.00
Princeton mono monitor 12"	£161.00	Hercules Mono Plus graphic card	£199.00	QUAD EGA (short)	£229.00
Princeton colour monitor 12"	£352.00	Mountain Hardcard 20Mb	£620.00	DC 600A Tape	£26.00
Princeton EGA monitor 12"	£395.00	AST SixPac 384k	£418.00	DC 1000A Tape	£14.00

Please ring for an immediate response and the latest prices

Prices exclude VAT & Delivery

ALL MAJOR CREDIT CARDS ACCEPTED

All prices are subject to C.W.O.

ADVICE LINE

0 7357-4466 for PRINTERS GALORE!

LOW, LOW PRICES but with FULL BACK-UP SERVICE

Call our Engineers for advice on printer selection.

OKI MICROLINE PRINTER SPECIALISTS

Superb range of dual mode printers, speeds of 100 cps NLQ and 400 cps draft. Competitive performance and features with unique Print Menu giving user friendly operation. PC Compatibility. Call for engineering advice.

Competitive prices to match any competition.

DEALER ENQUIRIES WELCOME.

CALL FOR PRINT SAMPLES

MICROLINE OFFICIAL APPOINTED DISTRIBUTOR

BROTHER PRINTERS

As Brother Master Dealers we recommend these Daisywheel Printers for office or home use. Sheet feeders available for simple word-processing application.

EPSON PRINTERS

All models of Epson Matrix printers at reasonable prices. We are always pleased to help with selection of the most suitable model to suit your application and budget.

JUKI PRINTERS

Excellent value for money printer range – see our Discount panel for the best prices around. Speeds from 20 to 60 cps.

FREE 1 YR ON SITE MAINTENANCE

OKI LASERLINE 6

NOW LASER JET PLUS COMPATIBLE AT £1895 + VAT

An ultra quiet compact H.P. compatible laser printer. Low noise, long life and a wide range of emulations. Large capacity input and output stackers. Face down output stacking. High reliability. TRADE ENQUIRIES WELCOME

OTHER LEADING PRINTERS

Ring for a DEMO now!

● CENTRONICS ● NEC
● STAR ● TOSHIBA

DEALER ENQUIRIES WELCOME.

LASER PRINTERS

PERFECT FOR LOW COST DESK TOP PUBLISHING

Many models are available, H.P. Canon, Centronics, OKI etc. We can advise on the Laser for your particular requirements.

Fleet Street Editor Software £130.00

ACOUSTIC HOODS

High quality wood or metal.

AMSTRAD

Appointed Dealer

AMSTRAD 1512	Sgle Disc Mono	£449
AMSTRAD 1512	Dual Disc Mono	£559
AMSTRAD 1512	Sgle Disc Col.	£619
AMSTRAD 1512	Dual Disc Col.	£729
AMSTRAD 8256	Sgle Disc + Ptr	£399
AMSTRAD 8512	Dual Disc + Ptr	£499

10m, 20m etc.

SOFTWARE

WORDSTAR 1512	£59
SUPERCALC 3	£59
VOLKSWRITER deluxe	£39
WORDS & FIGURES	£99
SAGE SOFTWARE	£POA

Amstrad printer cable £12.00

THIS MONTH'S DISCOUNT OFFERS

EPSON PRINTERS

LX86	£210
FX800	£335
FX1000	£429
LQ800	£450
LQ1000	£595
EX800	£395
EX1000	£525
LQ2500	£799

JUKI PRINTERS

6100	£259
6200	£435
6300	£675
6500	£999

CABLES

IBM parallel £12
B8C £10

DAISYWHEEL SPECIALS

½ PRICE DAISYWHEEL SPECIAL OFFER — DYNEER DW20 20cps RRP £569 — NOW ONLY £249

Dyneer DW-40 40cps	£749
Dyneer 20 Tractor Feed	£115
Quendata Tractor Feed	£75

LASER PRINTERS

Canon Laser LBP-8A1	£1895
Canon Laser LBP-8A2	£2995
Canon Toner Cartridge	£86
Canon Font Cartridge from	£179
Centronics Line Printer 8	£1995
H.P. Laser	£POA

OTHER PRINTERS & PLOTTERS

Canon PW1080A 160 cps	£255
Roland DXY880A A3 Plotter	£750
Star NL – 10	£245
Epson FX 105 +	£350
Centronics GLP & Tractor	£145
Hitachi 672 Plotter A3 Size	£495
OTC 700 700cps	£1995

ALL PRICES EXCLUDE VAT & CARRIAGE. Prices subject to change without notice.

TELEPHONE ORDERS taken 9-5.30 Mon to Fri. & 9-12.00 Sats. Delivery Charge of £9 + VAT on all printers and computers.

COMPLETE RANGE OF PRINTER BUFFERS, INTERFACES, CABLES AND RIBBONS AVAILABLE. PLEASE CALL FOR ADVICE 07357 4466.

MICRO GENERAL

Specialists in MICRO and PRINTER technology

(Dept PCW6) Unit 25, Horseshoe Park, Pangbourne, Reading, RG8 7JW

OPTIMUM TECHNOLOGY

MORE THAN JUST LOWER PRICES

LISTED BELOW IS JUST A SELECTION FROM OUR WIDE RANGE OF PRODUCTS — AVAILABLE IN A WIDE RANGE OF FORMATS — PLEASE CONTACT US WITH YOUR REQUIREMENTS

OPTIMUM

WORD PROCESSORS

Lotus Manuscript NEW!	£269
Multimate Advantage	£249
Volkswriter Deluxe	£39
Word 3.1 - Microsoft	£245
Wordcraft V3	£345
Word Perfect 4.2	£249
Word Perfect Library	£124
Wordstar Prof. V4 (NEW!)	£210
Wordstar 2000 PLUS Rel 2	£269

DATABASES

Cardbox Plus	£245
dBase-III Plus V1.1 (unprot.)	£335
Clipper (new version)	£389
Geniffer-III	£249
Paradox V1.1i	£379
Q & A V2 (inc. spell. chk.)	£165
Rbase-5000	£245
Rbase SYSTEM-V	£445
Reflex V1.1 - the Database	£77
Rapid File (Ashton Tate)	£269

SPREADSHEETS

Javelin	£359
Logistix - new low price!	£95
Lotus 123 V2.01	£229
Other Lotus Products →→→	
MATHPLAN-3	£295
Multiplan V3 (NEW!)	£139
Supercalc-4	£225

INTEGRATED PACKAGES

Migent ABILITY V1.2E	£79
ABILITY PLUS (NEW!)	£154
PFS: First Choice inc. Spell Chk	£119
Framework-2	£325
Smart-3.1	£369
Smart Spell Checker	£89
Symphony V1.2	£329
Psion Xchange	£235
Psion PC-Four	£65

LOTUS PRODUCTS

LOTUS MANUSCRIPT	**£269**
LOTUS METRO (NEW!)	**£65**
LOTUS 123 V2.01	**£229**
HAL	£109
Report Writer	£75
Quickcode-for-123 (F&G)	£79
SYMPHONY V1.2	**£329**
Spelling Checker	£89
Text Outliner	£89
1-2-3/Symphony GRAPHICS	
Freelance Plus	£295
Graphwriter Combination	£375

GRAPHICS/CAD

Autosketch	£75
GEM Draw Plus — NEW!	£163
GEM Graph	£145
Harvard Pres. Graphics	£275
Harvard Prof. Publisher	£575
The Newsroom	£49
LOTUS Graphics — see above	
ProDesign-2 V2.5	£238

dBASE PRODUCTS

dBase-III Plus V1.1 (unprot)	£335
Clipper Compiler (new vers.)	£389
Geniffer-III App. Gen. V1.01	£249
Quicksilver Compiler	£369

BORLAND

EUREKA: The Solver	£65
Reflex V1.1	£69
Reflex Workshop	£59
Sidekick (unprotected)	£59
Travelling Sidekick	£59
Sidekick & T/Sidekick	£79
Superkey	£59
Turbo Basic NEW!	£65
Turbo C NEW!	£84
Turbo Prolog V1.1	£54
Prolog Toolbox	£67
TURBO PASCAL V3 (inc 8087)	£57
Turbo Database Toolbox	£44
Turbo Editor Toolbox	£42
Turbo Gameworks	£42
Turbo Graphix Toolbox	£39
Turbo Numerical Toolbox	£67
Turbo Tutor V2	£28
Turbo Holiday Jumbo Pk	£175
Turbo Lightning	£59
Word Wizard	£42

COMMUNICATIONS

Our Free communications consultancy means that you can simply telephone or write for free datapaks and/or advice on modems and software.

Modems: All modems are Auto-Dial/Auto-Answer and BABT approved. Baud rates are V21=300/300 V23=1200/75 V22=1200/1200 V22bis=2400/2400.

We also supply modems from Dowty/Racal/Tandata/Steebek/Dacom/PC at best prices.

IBM PC Modem Cables	£15
Modem Cables for other computers	£23
MIRACLE TECHNOLOGY	
WS SERIES — EXTERNAL	
WS4000 V21/V23 (Economy)	£149
WS3000 V21/V23 Professional Series	£259
WS3000 V22 (& V21/V23)	£395
WS3000 V22BIS (& V22/V21/V23)	£545
Datatalk with WS Modems	£80
KEYCARD-3000 SERIES — INTERNAL · NEW! (includes Protect-3000 security option and Datatalk)	
Keycard V21/23	£289
Keycard V22 (& V21/23)	£449
Keycard V22bis (& V22/V21/V23)	£589
PACE SERIES-4/LINNET — EXTERNAL	
Pace Linnet V21/23 (Economy)	£139
Series-4 2123S (V21/V23)	£229
Series-4 1200S (V22/V21/V23)	£359
Series-4 2400S (V22bis/V22/V21/V23)	£449
HAYES 1200 V22	£395
HAYES 1200B V22 Internal	£375
HAYES 2400 V22bis	£595
MICROTELEX (inc software)	£895
ORATOR — Modem & Speech	£778
Comms Software:	
Carbon Copy (each)	£137
Crosstalk XVI	£99
Datatalk V3.27	£133
Sage Chit-Chat V2.2	£85
Smartcom-2 V2.2	£135
Vicom with GEM Desktop	£139

SAGE

All Sage products available at best pricing

Financial Controller	£225
Bookkeeper	£84
Accountant	£118
Accountant Plus	£159
Payroll	£82
Retrieve	£82
Chit-Chat	£85

HARDWARE

Hercules Graphics Cards	CALL
Logimouse C7+ (PC or AT)	£94
MS Mouse V6 (Bus)	£135
MS Mouse V6 (Serial)	£135
SummaMouse (Opto)	£95
EGA Wonder Card (NEW!)	£295

UTILITIES/MISC

'Above-Disk' NEW!	£79
Gem Collection	£89
Hard Disc Optimiser	£39
Intelligent Backup V1.5	£79
MS C Compiler V4	£249
MS Flight Simulator V2.13	£39
MS Macro-Assembler V4	£115
MS Quickbasic Compiler V2	£69
MS WINDOWS V1.03	£69
Norton Utilities V4 NEW!	£69
Norton Advanced Utils NEW!	£99
Norton Commander	£55
Norton Editor	£87
Sideways V3.1	£43
SQZ! Lotus Compressor V1.53	£55
WordPerfect Library	£124
Xtree V2	£47

JUNE'S OPTIMUM CHOICE

- **FREE 'OPTIMUM SPREAD' GAME WITH EACH ORDER**
  disc is 5¼" IBM format — while stocks last
- **MS WINDOWS V1.03 — £69!**
  includes calendar, calculator, graphics interface, cardfile, clock, control panel, MS-Dos Executive, notepad, reversi game, terminal, Windows Write, Windows Paint, clipboard, spooler, Ram-Drive etc, etc.
- **QUICKSILVER dBASE-III PLUS COMPILER**
  — a full feature compiler offering many advantages including freedom from license fees, improved execution speeds, windowing capability, LAN support, and much more... — ask for datapak!
- **SAGE ACCOUNTING SYSTEMS**
  — cost effective, ideal for the small and medium sized business, yet easy to use — ask for datapak!
- **LOTUS METRO — £65**
  — a must for the lotus user! — includes Editor, Clipboard Appointment Book, Phone Book, Calculator, Macros, Timers etc etc. — Ask for Datapak!
- **FREE SHORTFORM CATALOGUE — FREE DATAPAKS!**
  simply phone/write with your requirements

YES!

PLEASE RUSH ME

☐ The following good(s):

_____

_____

_____

☐ A FREE Datapak on:

_____

_____

_____

☐ A FREE shortform Catalogue.

I enclose £ .....
(I have added carriage, then VAT)

CARRIAGE: Most software/hardware items add £5 + vat.
dBASE/SMART/MODEMS/EXPRESS DELIVERY add £10 + vat.
EXPORT: Please phone/write with details or estimate the amount and we will refund any extra.

Name _____

Address _____

_____

_____

_____

Phone No. _____

OPTIMUM TECHNOLOGY LTD

9 Marlborough Avenue, Edgware, Middx. HA8 8UH

Sales Desk: 01-958 9652

Telex: 265871 MONREF G quoting Ref 72:MAG10834 Telecom Gold: 72:MAG10834

PLEASE ADD CARRIAGE, THEN VAT TO ALL PRICES

The above is a sample of the goods we supply — please ask for latest shortform catalogue.
We welcome official Govt./Educational/Local Authority and Export orders.
Pro-Forma invoices available on request. Ask for further quantity discounts. Software prices are for the IBM PC — please enquire for other formats. Prices/specifications subject to change without notice. Please phone to arrange demonstrations or to collect goods.

SCOOP PURCHASE

Portability you can afford

Almost certainly your last chance to buy a GENUINE, Brand New

IBM PORTABLE COMPUTER

(You can't get more compatible) – Just look what you get:

★ IBM Portable Computer ★ Twin 360kb Disk Drives ★ 256kb Memory ★ Parallel Printer Port
★ R.G.B. Output ★ Smart IBM Carry Case ★ DOS 3.0 ★ Full Manuals ★ 12 Months Warranty

PLUS ***ABSOLUTELY FREE***

A Racal 2123 internal modem worth over £350 – Send Telex's, E-Mail or dial into your favourite bulletin-board, by simply connecting in to the nearest telephone point.

All this for an ***AMAZING*** **£850**

Great value for computing and communications on the move – upgrade your portable to 640kb for only £79

AND THE BARGAINS GO ON...

The ideal companion to your portable – the highly successful **EPSON LX80** Dot Matrix Printer. The LX80 offers excellent NLQ, with a variety of fonts, all selectable from the font panel. It is unlikely you will be able to buy a Genuine EPSON at such a Crazy price again.

In true S.C.S. style **ABSOLUTELY FREE** we are including the LX80 tractor feed worth £25.00.

The EPSON LX 80 costs only **£149** with 12 months warranty.

IBM style parallel cables are available for £12.50.

If you are going dotty trying to select a printer just look at our matrix

	Width	N.L.Q.	Speed	Serial	Parallel	Graphics Compatibility
Epson LX80	80	✓	100		✓	Epson
Star Delta 10	80		160	✓	✓	Epson
Shinwa	132		130		✓	IBM
OKi M/L 83A	132		120		✓	Epson
Star Radix 10	80	✓	200	✓	✓	Epson
Star Radix 10i	80	✓	200	✓	✓	IBM
Fujitsu DC 1200	132	✓	180		✓	IBM/Epson

S.C.S. Ltd. specialise in the sales of surplus computer products. This month's end of line specials are:

Apricot F1, 512kb, Mouse & Gem S/W	**£335**
Gridcase III Compatible Lap Top, 512kb, Plasma Screen	**£900**
Epson LX80 with Tractor Feed	**£149**
Star Delta 10	**£175**
Shinwa Professional Printer	**£180**
OKi Microline 83A	**£185**
Star Radix 10	**£210**
Star Radix 10i (IBM Graphics Compatible	**£230**
Fujitsu DC1200	**£290**

To order:

Phone 07357-5455

There is a great Deal going on at...

Surplus Computer Sales Ltd.

20A Horseshoe Park, Pangbourne, Berks. RG8 7JW

Telephone: Pangbourne (07357) 5455

ALL PRICES EXCLUDE VAT AND DELIVERY

COMPUTER PRECISION

TOSHIBA LAPTOP COMPUTERS

T3100/20: 80286 8MHz, 640K RAM 20MB Hard Disk, 720K Floppy Plasma Display, Ser/Par, 15lbs

T3100: 80826 8MHz, 640K RAM 10MB Hard Disk, 720K Floppy Plasma Display, Ser/Par, 15lbs

T1100 PLUS: 8086 8MHz, 640K RAM 2 x 720K Floppy, Supertwist LCD Ser/Par, 8 Hour Battery 10 lbs

OPTIONS: Internal Modem, Keypad 2MB Memory Board, Expansion Box External 5.25" Disk Drive

Please Call For Latest Toshiba Prices

NEC COMPUTER SYSTEMS

MULTISPEED: NEC V30 9.54MHz ..... POA
640K RAM, 2 x 720K Floppy Supertwist Display, Ser/Par 6-hour Battery, 11lbs

APC IV40: 80286 8MHz, 40MB HD . **£2,495**
1.2MB Floppy, 640K RAM, Ser/Par MultiSync Monitor & EGA Adaptor Enhanced Keyboard, MS Dos

APC IV20: 80286, 8MHz, 20MB HD . **£2,250**
1.2MB Floppy, 640K RAM, Ser/Par MultiSync Monitor & EGA Adaptor Enhanced Keyboard, MS Dos

TANDON COMPUTER SYSTEMS

PCA70: 70MB HD, 1.2MB Floppy .. **£2,275**
512K RAM, 14" Mono Monitor
Ser/Par, MS Dos, GW-Basic

PCA40: 40MB HD, 1.2M8 Floppy .. **£1,895**
512K RAM, 14" Mono Monitor
Ser/Par, MS Dos, GW-Basic

PCA30: 30MB HD, 1.2M8 Floppy .. **£1,750**
512K RAM, 14" Mono Monitor
Ser/Par, MS Dos, GW-Basic

PCA20: 20MB HD, 1.2MB Floppy .. **£1,495**
512K RAM, 14" Mono Monitor
Ser/Par, MS Dos, GW-Basic

ENHANCED GRAPHICS

NEC MultiSync Monitor EGA, PGA	£550
Princeton HX12e EGA Monitor	£395
Taxan EGA Monitor	£425
Taxan MultiScan Monitor EGA, PGA ..	£595
AST 3G Plus EGA Card	£245
Orchid EGA Card	£225
VEGA Deluxe Auto EGA	£279
ATI EGA Wonder Card	£249
TVM EGA Monitor & Adaptor	£499

MOUSE DEVICES

Microsoft Mouse v6	£135
Mouse Systems PC Mouse	£135
LogiMouse C7	£79
SummaMouse	£89

MATHS CO-PROCESSORS

8087 5MHz	£125
8087 8MHz	£155
80287 6MHz	£175
80287 8MHz	£225
80287 10MHz	£295

MEMORY BOARDS

AST Rampage XT 2MB	£395
AST Rampage AT 2MB	£595
AST 6 Pack Plus 384K	£249
AST Six Pack Premium 1MB	£395
Intel Above Board XT 2MB	£495
Intel Above Board AT 2MB	£625

TAPE STREAMERS

Alloy APT40 Internal	£475
Archive 60MB External	£595
Everex Stream 20 Internal	£675
Everex Stream 60 Internal	£975

DOT MATRIX PRINTERS

Epson LQ2500 270cps, 90nlq	£730
Epson LQ1000 180cps, 60nlq	£585
Epson LQ800 180cps, 60nlq	£435
Epson EX1000 250cps, 50nlq	£525
Epson EX800 250cps, 50nlq	£390
Epson FX1000 200cps, 40nlq	£385
Epson FX800 200cps, 40nlq	£305
Epson LX800 150cps, 25nlq	£199

DAISY WHEEL PRINTERS

NEC Spinwiter Elf	£310
Brother HR20	£340
Brother HR40	£750

LASER PRINTERS

HP LaserJet II, 8ppm	£1,995
HP LaserJet, 8ppm	£1,495
Epson GQ-3500 6ppm	£1,450
Oki Laserline 6, 6ppm	£1,500
Citizen Overture 110, 10ppm	£1,595
AST Turbo Laser 8ppm 1.5MB Ram .	£3,295

COMMUNICATIONS

WS4000 V21, 23 AA AD	£145
WS4000 V21, 22, 23 AA AD	£339
WS3000 V21, 22, 23 AA AD	£399
WS3000 V21, 22, 23, 22BIS AA AD ..	£520
Keycard 3000 V21, 23	£290
Keycard 3000 V21, 22, 23	£465
Keycard 3000 V21, 22, 23, 22BIS	£595
Linnet V21, 23 AA AD	£129
Pace V21, 22, 23 AA AD	£320
Pace V21, 22, 23 22BIS AA AD	£399
Quattro V21, 22, 23 22BIS	£635
Orator	£715
Procomm 20 Telex on a Card	£695

SOFTWARE

dBase 3 Plus vl.1	£350
Framework II	£335
FreeLance Plus	£285
Lotus 1-2-3 r2.01	£250
MS Flight Simulator	£45
MS Multiplan 3	£125
MS Windows	£60
MS Word 3.1	£260
Norton Utilities v4	£59
Advanced Norton Utilities	£99
SuperCalc 4	£225
Ventura Publisher	£635
VP Info	£65
VP Planner	£65
Word Perfect 4.2	£260
Wordstar Professional v4	£235

BORLAND SOFTWARE

Turbo C	£69
Turbo Basic	£55
Turbo Pascal 8087/BCD	£49
Turbo Tutor	£25
Turbo Database Toolbox	£35
Turbo Editor Toolbox	£35
Turbo Graphics Toolbox	£35
Turbo Gameswork	£35
Turbo JUMBO Pack	£165
Turbo Numeric Methods Toolbox	£55
Turbo PROLOG	£49
Turbo Prolog Toolbox	£55
Eureka the Solver	£55
Reflex	£70
Reflex Workshop	£49
SuperKey	£49
SideKick (unprotected)	£49
Travelling Sidekick	£49
Turbo Lightning	£49
Lightning Word wizard	£40

Toshiba 3½" format available.

Official orders are accepted from GOVERNMENT & EDUCATIONAL AUTHORITIES & PLCs
Prices exclude VAT. EXPORT enquiries welcome

AUTHORISED TOSHIBA NEC Tandon DEALER

Comprehensive service includes: Consultancy, Demonstrations & Hotline support

01-226 3043 VISA

TELEX 299091 BRIDGE ATTN COMPRE
271 UPPER STREET, ISLINGTON, LONDON N1 2UQ

FORTRANSOFT LTD

PROFESSIONAL SOFTWARE FOR THE IBM PC/XT/AT AND COMPATIBLES, eg. OLIVETTI, COMPAQ, AMSTRAD, APRICOT . . .

BASIC is fine for short programs and when speed and portability are not important. Besides, you can draw pretty pictures on the screen with BASIC. However, if you are writing large programs and wish to protect all the hours (in some cases years) you spent in writing your software then **Fortran** comes into its own. Whilst most languages are 'here today — gone tomorrow', **Fortran** designed in the late fifties, still remain the dominant language for scientific and general purpose programming today. This means that programs you write today will work tomorrow on future generation of machines with little or no change.

Fortransoft now brings you an affordable ANSI 77 Fortran Compiler. And you can still draw pretty pictures on the screen because the GRAPHKIT library comes with the compiler and is included in the price.

FS-Fortran 77 is now at level 3.14d and current users may obtain a copy of the compiler for £2 all incl.

FS-Fortran 77 with CGA graphics routines **£29.95**
FS-Fortran 77 with CGA and Hercules mono graphics routines **£39.95**

FS-Graphkit is a comprehensive suite of graphics and sound routines, including routines for drawing lines, circles, ellipses, painting, read/write to port . . . and is available with standard Colour Graphics Adapter (CGA) support, or CGA and Hercules mono graphics support.

CGA colour graphics for Microsoft Fortran Compiler £19.95
CGA colour graphics for Ryan Mc Farland/IBM Professional Fortran £24.95
CGA colour graphics for **Zorland C** £14.95
CGA and Hercules mono for Microsoft Fortran Compiler £29.95
CGA and Hercules mono for Ryan Mc Farland/IBM Professional Fortran £34.95
CGA and Hercules mono for **Zorland C** £19.95

FS-Sortmerge is a suite of Fortran-callable routines for sorting/merging an unlimited number of records on multiple keys. Any combination of alphabetic and numberic keys may be specified.

FS-Sortmerge for **FS-Fortran 77** Compiler £19.95
FS-Sortmerge for Microsoft Fortran Compiler £19.95
FS-Sortmerge for Ryan Mc Farland/IBM Professional Fortran £24.95

FS-Smutil — A sort/merge utility program which may be used on its own without requiring any other software £9.95

Fortransoft acknowledges all trademarks and registered names in this advert. Please indicate Compiler and Computer type when ordering. All prices include packing, postage and VAT, but please add £3 for air delivery. All software comes on 5.25" 360k diskette. COD's and purchase orders are NOT accepted. Send cheque with order to: (or write for further details)

FORTRANSOFT LTD
60 HARNESS WAY, ST. ALBANS HERTS AL4 9HB.
(Tel: (0727) 32409)

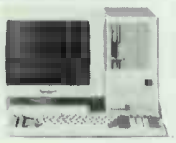
Slough Computers

COMMODORE AMIGA A500 & A2000

Come and see the superb Commodore Amiga 2000 starting at only £1095 including one year's on site service
Limited quantities of the new A500 Now available from only £499

Tandon

PCA20 512K. 6/8MHz. 80286. MSDOS 3.2
1.2Mb FLOPPY. 20MB WINCHESTER
£1995
AT NO EXTRA COST WE WILL SUPPLY THE ABOVE SYSTEM WITH EGA CARD AND MONITOR **SAVING £750**
NEW 70MB PCA 70 NOW AVAILABLE FROM **£2495**



The new target range and other models available

NEW BRITISH AT — THE SBC MISTRAL

Based on a state of the art 6 layer VLSI motherboard designed in the UK and built by British Aerospace. A range of soft selectable clock speeds and wait states to give incredible speed. Serial and parallel ports, clock, 6 free slots, 1Mb RAM, 1.2Mb floppy, 30Mb Winchester. Not a cheap import. This quality product will be available within weeks at prices starting at only £1799. Including 1 years on-site service.

PC/AT EGA UPGRADE BARGAIN

14" Enhanced colour monitor with multiple choice colour switch for high resolution text EGA/CGA/HGC Graphics crad, all to suit PC's, AT's and compatibles at previously unheard of price of only **£399**

EPSON SPECIALS FOR MAY

FX800 **£309** | EX800 **£369** | LX86 **£199**
FX1000 **£389** | EX1000 **£459** | LQ800 **£419.**

245 HIGH STREET, SLOUGH, BERKS SL1 1BN Tel: SLOUGH (07053) 21594/32753
VAT & CARRIAGE MUST BE ADDED TO ALL PRICES. TELEPHONE/MAIL ORDERS WELCOMED
ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

BACKUP

EASILY SECURELY & FAST

kBAK 4.0 £120

NEW RELEASES

- ★ Interactive Menu with specific help at every point
- ★ Array of Menu example items ready for use
- ★ Log of all transactions made from the Menu
- ★ New interface to tried and tested working routines

RETAINED from earlier releases:

- ★ The unique high-speed compression — fewer disks
- ★ The many ways for selection — smaller backup volume
- ★ Optional high-speed encryption — kBAK only
- ★ The ultimate standard of reliability

CLIP 4.0L £59

Move or modify any menu item in seconds. Make new entries with a highly visual representation as you do so. Add custom notes when your procedures are defined, and check their execution in the log. Result — backup is always done and the most efficient path is the easiest.

Keele Codes have five years specialist experience in backup — we had a product for the PC before the PC had hard disks. Manufacturing licencees include Philips, British Telecom, Ashton-Tate and others who demand the best. Back up your hard disk in a coffee-break with the safest and best-tested product on the market.

ORDER NOW

CLIP 4.0L has fewer features than kBAK but includes all the above basic functions.

Available from stock for PC/XT/AT and compatibles PC DOS/MS DOS or CDOS

KEELE CODES LTD
University of Keele, Keele, Staffordshire, UK Tel: (0782) 629221 Telex: 36113

All prices excl. VAT, post free in UK

LOWEST PRICES IN UK?

MICROS

Sinclair Spectrum 128K + 2 (Software)	£139
Sinclair Spectrum 128K	£117
Sinclair Spectrum Plus	£87
Sinclair QL	£126
Commodore 64C Compendium	£174
Commodore 128 Compendium	£247
Commodore 128D	£435
Amstrad CPC 6128 G Monitor	£260
Amstrad CPC 6128 C Monitor	£347
Amstrad PCW 8256	POA
Amstrad PCW 8512	POA
Amstrad PC 1512 SD Mono	£449
Amstrad PC 1512 SD Colour	£619
Amstrad PC 1512 DD Mono	£559
Amstrad PC 1512 DD Colour	£729
Amstrad PC 1512 HD20 Mono	£899
Amstrad PC 1512 HD20 Colour	£1069
Atari 520 STM	£215
Atari 520 STFM — Drive + Mouse	£330
Atari 520 STFM — as above + Monitor	£413
Atari 1040 STF with mono monitor	£579

PRINTERS

Epson LX 86 - The Best Seller	£199
Star NL10 - The Best Seller	£205
Citizen 120-D-A Hot Seller	£156
Panasonic 1081 - The Hot Seller	£150
MP 165 - Cheap & Good Quality	£170
Amstrad DMP 2000 NLQ	£135
Amstrad DMP 3000 NLQ	£140
Amstrad DMP 4000 NLQ	£305
Citizen 180D — For Commodore	£161
Commodore MPS 1000	£221
Brother M 1190, 120 cps, 80c	£175
Brother M1409, 180 cps, 110c	£295
Brother HR20, 20 cps D-Wheel	£335
Brother HR25 XL	£529
Brother M1509 136 col 180cps	£375
Brother M1709 136 col 240cps	£535
Canon PW1080 BNLQ 160cps 80c	£239
Juki 6100 20cps 110 CD-Wheel	£245
Juki 5510 NLQ 180cps 80c	£235

PHOTOCOPIERS & FAX

Canon FC3	£450
Canon FC5	£650
Canon PC14	£760
Canon Fax 220	£2268
Sharp Fax FO-200	£1615

PSION

Psion II CM	£82
Psion II XP	£115
8K Datapak	£11
16K Datapak	£17
32K Datapak	£30
64K Datapak	£69
128K Datapak	£147
Formatter	£39

CASIO

Scientific	
FX82A	£8
FX100	£11
FX451	£17
FX570	£14
FX580	£22
FX3600P	£15
FX3800P	£17
FX8000G	£78
FX7000G	£43
FX4000P	£26

Pocket Computers

PB110	£26
FX5200P	£35
FX720P	£47
PB410	£35
FX730P	£69
FX750P	£78
PB700	£103

TYPEWRITERS &

Canon	
Typestar 7	£175
Typestar 6 II	£148
Typestar 5 II	£129
Canon 5200	£159
Canon 5300S	£315
Typestyles	£22
Ribbons 1 bx	£10
Ram 4k, 8k, 16k	POA

DISK DRIVES & MONITORS

Commodore 1541C	£164
Commodore 1571	£233
Amstrad 3" DD1 or FD1	POA
Commodore Green Monitor	£70
Commodore 128 Colour Monitors	£282

Texbase	£30
Numbase	£43
Finance Pack	£26
Maths Pack	£26
PC Four	£60
RS232 Link	£41
Linkup Adapt	£11
Mains Adapt	£11

Data Bank

SF3000BX	£56
BC 300	£56
PF 7000	£34
PF 3200	£37

ACCESSORIES

RP8	£14
RP16	£29
RC2	£21
OR4	£26
RC4	£31
OR40	£33
OR8	£60
FA3	£20
FP-12-S	£44

GENERAL

Calculators	POA
Watches	POA
Keyboards	POA

CALCULATORS

Casio	
CW25	£199
CW11	£100
DR110S	£69
DR120S	£79
HR100	£30
HR16	£29
Watch DB510	£28
Watch DBC60	£29

Complete range of Casio, Commodore & Amstrad add ons at discount prices. Prices/ Goods subject to availability and change without notice. ALL PRICES EXCLUDE VAT. P&P £5 (within UK). Export Enquiries welcome. TELEX: 268312 WESCOM G ATTN KKS.

K.K. STATIONERS

187 Edgware Road	126 Edgware Road	172 Queensway
Marble Arch	Marble Arch	Queensway
London W2 1ET	London W2 2AZ	London W2 4QT
Tel: 01-723 1436	Tel: 01-402 4592	Tel: 01-229 3247

Slough Computers

AMSTRAD PC1512

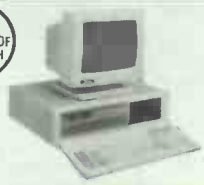
FLOPPY AND HARD DISK SYSTEMS FROM **£449**
RANGE OF BUDGET PRICED SOFTWARE IN STOCK

BONDWELL PC PORTABLES

MODEL 8 LAPTOP **£799**
512K 3½" DRIVE. LCD
MODEL 18 PORTABLE **£699**
640K, 2 × 5¼" DRIVES. CRT
ALL WITH DOS/BASIC 2.11

FREE!
1 YEARS ON-SITE SERVICE

FOR ALL YOU ADDICTS OF THE HIGH SPEC



PC USER "THIS IS THE ONE I'D BUY"

THE OPUS PC II RANGE

1024K. 2 DRIVES + RAM DISK.
HERCULES COMPATIBLE GRAPHICS.
4.77-8MHz TURBO V20
AT STYLE KEYBOARD.
TILT & SWIVEL MONITOR **£679**

SYSTEMS FROM £499-20MB £969
EGA SYSTEMS FROM ONLY £799
VARIOUS OPTIONS AVAILABLE INCLUDING 1.2MB & 3½" FLOPPIES AND 8087

Card Mounted Winchesters ONLY

Very low power consumption
Ultra fast disk access
Ideal for use with Amstrad 1512 etc.

10Mb £299
30Mb £359

245 HIGH STREET, SLOUGH, BERKS SL1 1BN Tel: SLOUGH (0753) 21594/32753
VAT & CARRIAGE MUST BE ADDED TO ALL PRICES. TELEPHONE/MAIL ORDERS WELCOMED
ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

EVEN BETTER PRICES
FROM
COMPUSTAND LTD.

Olivetti M24
20Mb Hard Disk
360 Kb Floppy Drive
640 Kb RAM
Monochrome Display
Keyboard
MS-DOS £1545
As above with 30 Mb hard disk £1675

Olivetti M24 SP £1731
(Colour supplement on all above £210)

Olivetti M19 £1092
(Colour supplement £119)
Olivetti M15 portable £935
Super prices on all Olivetti configurations Inc M28

Tandon

PCA 20	£1435
PCX 20	£1095

AMSTRAD

Dual Drive, Mono	£539
20 Mb Hard disk, Colour	£1045

Hard Disks

20 Mb Dysan Hard card	£395
30Mb Miniscribe Hard card	£395
20 Mb Seagate Kit	£325

Lasers

HP Laserjet II	£1225

Software

Multimate 3·3	£195
Multimate Advantage	£245
DBase III+	£323
Symphony	£321
Lotus 123	£221
Smart V.3	£355
Framework II	£299
Wordstar	£145
Wordstar Prof	£195
Wordstar 2000/2	£210
Wordstar 2000+	£256
MS-Word	£239
MS-Chart	£146
MS-Project 2	£207
Multiplan II	£108
SuperProject Plus	£245
Supercalc 4	£189
Lotus HAL	£82
Lotus Manuscript	£238

ALL LATEST VERSION

Full range of Dot Matrix, Daisy Wheel and Laser printers – Call for best prices.
Prices for Add on Boards, Hard Disks, Modems and other software available on request.

CALL US NOW ON CHICHESTER (0243) 771786.

COMPUSTAND LTD. **Quarry Lane, Chichester, West Sussex, PO19 2NY**

All prices include full 12 months warranty but are exclusive of VAT and delivery.

Evesham Micros

ALL PRICES INCLUDE VAT & DELIVERY

AMSTRAD 1512

Full range of hardware, software, peripherals and sundries in stock. We would be pleased to quote you for your requirements.

Hard disk systems at special prices

- **Mono 20 meg £999.00 inc. VAT**
- **Colour 20 meg £1199.00 inc. VAT**

SPECIAL OFFER

Buy a 1512 and a printer from us and we will give you Tasword PC (word processing program) and 25 blank disks absolutely free of charge (or equivalent value off software of your choice).

Evesham 30MEG 1512s

If you want a hard disk model we can provide some interesting alternatives !

Twin floppy with 30meg hard card	
Mono	**£1069.00**
Colour	**£1265.00**
Single floppy with 30meg hard disk	
Mono	**£915.00**
Colour	**£1110.00**

All prices VAT inclusive!

HARD DISK

30meg for 20 price

CARD

Microscribe 30meg hard card, simple to fit, low power consumption, the ideal way to give your 1512 the luxury of hard disk.

- ★ **Simple fitting in expansion slot**
- ★ **Very low power consumption**
- ★ **Absolute highest quality**
- ★ **Use as drive C with twin floppys.**
- ★ **30meg for less than 20meg price**

ONLY **£429.00**

Why settle for 20? You can't have too much!

INTERNAL

30meg internal system for less than 20meg price! Ideal for single drive owners.

ONLY **£399.00**

20 meg available at same price!

PRINTERS

PRICES INCLUDE CABLE

THE STAR PRINTERS FOR BUSINESS

NL-10

***WHICH* MAGAZINE BEST BUY**

- **Automatic single sheet handling**
- **Tractor feed built in**
- **"Front Panel" mode selection**
- **Double and Quad height characters**
- **120 cps draft and 30 cps NLQ**

In a group test with other popular printers such as Epson, Citizen and OKI *What Micro* magazine described the NL10 as **"the Rolls Royce of this group"**

Only **£249.00**

Automatic cut sheet feeder available as an option for **£63.25**

THE STAR PRINTERS FOR BUSINESS

NX-15

- **Elite and proportional NLQ**
- **4K buffer**
- **Combined IBM/Epson interface**

Wide carriage version of the NL10, similar features and same high quality with 134 column capability.

Only **£349.00**

Automatic cut sheet feeder available as an option for **£159.00**

THE STAR PRINTERS FOR BUSINESS

NR-15

Another fabulous new model from Star the masters of quality. This 15" carriage model is packed with the latest printer technology.

- **240 cps draft mode**
- **Auto single sheet feed**
- **Front panel control**
- **60 cps in N.L.Q.II**
- **Epson & IBM emulation**

If you want a top notch printer at a sensible price then look no further

Only **£499.00**

Automatic cut sheet feeder available as an option for **£159.00**

Panasonic KXP1081

Fantastic quality and value. A truly reliable printer at a price that is very tempting.

- **Friction and tractor feed**
- **120 cps draft and 24 cps NLQ**
- **Epson/IBM compatible**
- **Wide range of print styles**

You could pay a lot more than this for a lot less printer

Only **£189.00**

DON'T FORGET ALL PRINTER PRICES **INCLUDE** VAT, CARRIAGE AND CABLE

MANY OTHER MODELS STOCKED AT COMPETITIVE PRICES, e.g.:

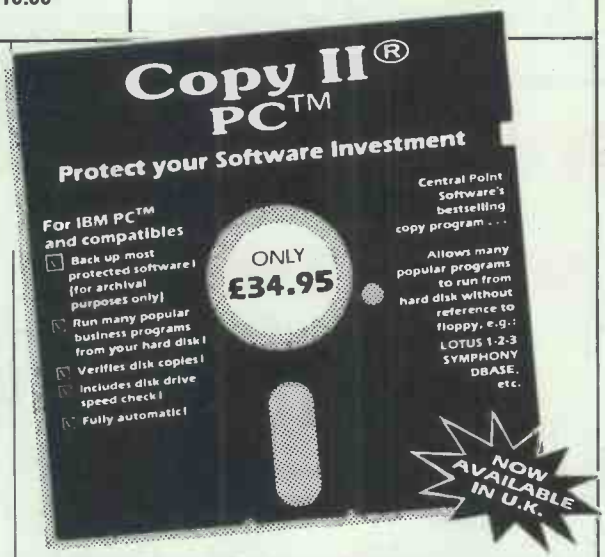
AMSTRAD DMP3000	**£189.00**
AMSTRAD DMP4000	**£389.00**
MICRO P MP165	**£219.00**
MICRO P MP200	**£299.00**
JUKI 6100	**£289.00**

PC TOOLS!

V2.0

Combine the most popular features of the Norton Utilities with a powerful DOS interface, make them resident like Sidekick and you've got **PC TOOLS!** Completely re-written and expanded. **Version 2 is faster and more powerful than ever.** Runs on nearly all IBM compatibles. Requires 256K; in resident mode, occupies only 64K of the computer's memory.

ONLY **£34.95**



GOLD MEDAL WINNER! OVER 100,000 COPIES SOLD

DISCS + BOXES

	ONLY
25 bulk packed DS/DD disks with w/p tabs and labels	**£13.95**
25 disks as above with 50 capacity lockable box	**£22.95**
25 disks as above with 100 capacity lockable box	**£24.95**
50 capacity lockable box	**£10.95**
100 capacity lockable box	**£13.95**

MEMORY UPGRADE

This kit with **ultra detailed fitting instructions** will allow you to expand the memory of your 1512 to 640K. That extra memory is really useful when using GEM and it really is straight forward to fit.

ONLY **£25.00**

ORDERING INFORMATION

ALL PRICES INCLUDE VAT AND FREE DELIVERY WITHIN U.K. (Despatch within 24 hours whenever possible)

HOW TO ORDER

By Post — Send cheque, P.O., or ACCESS/VISA details to our Evesham address

By Phone — Call our Evesham branch and quote your ACCESS/VISA details

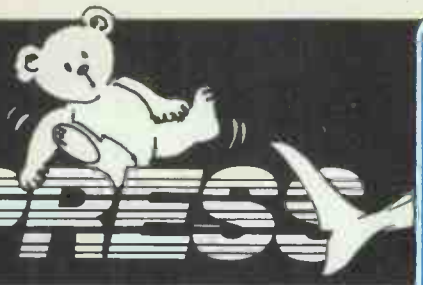
EVESHAM MICROS, 63 BRIDGE ST, EVESHAM, WORCS. WR11 4SF. TEL: 0386 41989

CALLERS WELCOME

Also at: 1756 Pershore Road, Cotteridge, Birmingham B30 3BH. Tel: 021 458 4564

All items subject to availability. E.&O.E. Orders from Government and Educational departments welcome. Goods shipped anywhere within Europe at advertised price

COMPUTER EXPRESS



DOT MATRIX PRINTERS

Epson LX86 - The Best Seller in the World!	£195
Star NL10 - The Number Two Seller-Best Spec	£210
Star NX15 - The New Wide-body NL10!	£291
Star NR15 - Replaces the SR15-A Great Mover	£224
Panasonic 1081 100cps & 80 col - Brand New!	£249
Panasonic 1091 - Byte Magazine Says It's No 1	£228
Epson FX105+ - The Ford Transit of Printers!	£375
Epson LQ800 - Letter Quality-24 Pin Printhead	£428
Epson LQ1000 - Letter Quality-24 Pins-132 Col	£571
Epson LQ2500 - This one is really good!	£725
Epson SQ2500 - Ink your jet with this one!	£999
Epson FX800 - Brand New! 240cps! Wow!	£324
Epson FX1000 - Brand New! Replaces FX105	£415
Epson EX800 300cps & 80 column-Super Fast!	£385
Epson EX1000 300cps & 136 column-Super Fast!	£517
Star NB15 - The big, up-market Star 24-pin	£699
Star NB2415 - Same as above, just a bit slower	£599
Juki 5510 - A Best Seller	£265
Seikosha MP1300AI - 300cpsI (EX800 clone)	£302
Seikosha MP5300AI - 132col Version of MP1300	£439
MP 165 - Cheap Fast And Good Quality 180cps	£170
MP 200 - 200cps! 132 column!	£260
MP 201 - 132 column 200cps	£295
NEC P6 - Good Buy	£395
NEC P7 - One of the Best Sellers Ever - 24 pin	£449
Oki Microline 182 - The Number 2 Brand	£205
Oki Microline 192 - Perennial Favourite	£299
Oki Microline 193 - Worth A Look	£369
Oki Microline 293 - Worth A Long Look	£608
Citizen MSP-15 160cps & 80 column	£329

DAISY WHEEL PRINTERS

Star Power Type 18cps - The Current Cheap One	£189
Juki 6100 - 20cps - Very Popular	£269
Juki 6200 - 30cps - Still Popular	£437
Juki 6300 - 40cps - Very Up-Market	£692
Juki 6500 - 60cps - Heavy Duty and Very Fast	£966
NEC 8800 - Thimble Printer, 55cps	£850
Qume Sprint 11/90 - 90cps Daisywheel Printer	£1200

COLOUR PRINTERS

Okimate 20 Thermal Printer	£159
Juki 5520 - The Market Leader - Fast!	£335
Epson EX-Series Colour Option	£55
NEC P565XL - Heavy-Duty Office Favorite!	£780
Epson LQ2500 Colour Option/Makes LQ2500 Colour	£55
Seikosha MP1300 Colour Kit/Makes MP1300 Colour	£87

PLOTTERS, DIGITIZERS & LASERS

New Oki Laserline 6 - 6 pages per minute	£1599
HP LaserJet Plus - The Leader	£2299
HP LaserJet II - Newer, Better, Cheaper!	£2099
Cherry A3 Digitizer	£475
Roland 880A Plotter - Best Value A3 Plotter	£649

CABLES AND THINGS

IBM-Compatible Centronics Parallel Cable (Round)	£11.90
BBC Centronics Parallel Cable (Ribbon)	£7.90
Serial Cables Made to Order	£20.00
Two-Way Printer T-Switch	£40.00
Fan-Fold White Paper, 11in long, 1000 sheets	£6.99
80 Col Printer Stands	£21.00
132 Column Printer Stands	£28.00
SpaceBase Adjustable Floor-Standing Printer Stand	£83.50
DiskStore (Stores 50 5.25in diskettes)	£10.00

AMSTRAD PC

Amstrad 1512 Single Floppy/Mono Monitor	£436
Amstrad 1512 Double Floppy/Mono Monitor	£543
Amstrad 1512 Single Floppy/Colour Monitor	£601
Amstrad 1512 Double Floppy/Colour Monitor	£693
Amstrad 1512 20mb Hard Disk/Mono Monitor	£873
Amstrad 1512 20mb Hard Disk/Colour Monitor	£1037
Amstrad 1512 SD Mono with 20mb Upgrade	£786
Amstrad 1512 SD Colour with 20mb Upgrade	£951
Upgrade any 1512 to 640k (including labour)	£35
Amstrad PCW 8256	£374
Amstrad PCW 8512	£470

EPSON PC's

Epson Taxi PC, 256k RAM, Single Floppy	£466.00
Epson Taxi PC, 256k RAM, Double Floppy	£539.00
Epson Taxi PC, 256k RAM, 20mb Hard Disk	£870.00
Epson Taxi PC 256k RAM Upgrade	£99.00
Epson PC+ 640k RAM, Single Floppy, Video Card	£899.00
Epson PC+ 640k RAM, Double Floppy, Video Card	£1005.00
Epson PC+ 640k RAM, 20mb Hard Disk, Video Card	£1199.00
Epson AX-20 AT 640k RAM, 1.2mb Floppy, 20mb HD	£1799.00
Epson AX-40 AT 640k RAM, 1.2mb Floppy, 40mb HD	£2249.00

All Epson PC's, PC+'s and AT's require monitors and all PC's require Monitor Adaptor Cards.

OLIVETTI PC's

Olivetti M24 Single Floppy Base Unit/640k	£999
Olivetti M24 Double Floppy Base Unit/640k	£1148
Olivetti M24SP 20mb/single floppy Base Unit/640k	£1618
Olivetti M24 or M28 Monochrome Monitor	£169
Olivetti M24 82 or 102-key Extended Keyboard	£120
Olivetti M24 or M28 MS-DOS/GW-Basic Pack	£51
Olivetti M28 Keyboard	£140
Olivetti M24 or M28 Colour Monitor	£400
Olivetti M28 AT Compatible - 20mb Hard Disk	£1884
Olivetti M28 20mb Hard Disk with 20mb Tape Back-up	£2368
Olivetti M28 40mb Hard Disk, 640k RAM	£2392
Olivetti M28 40mb Hard Disk with 20mb Tape Back-up	£2877
Special Offers:	
Olivetti M24 with 640k, 7-slot Bus Converter Monitor, MS-DOS/GW-Basic, Keyboard, 20mb Hard Disk	£1569
M24SP Complete System (Monitor/Keyboard/DOS)	£1899

COMPAQ

Compaq Portable II Model 2	£1947
Compaq Portable II Model 4	£2772
Compaq Portable III Model 1 12MHz/640K/1 1.2MB FD	£2437
Compaq Portable III Model 2 640K/20MB HD	£2963
Compaq Portable III Model 3 640K/40MB HD	£3297
Compaq Deskpro 286 Model 20 640K/1 FD/20MB H.D.	£2161
Compaq Deskpro 286 Model 40 640K/1 FD/40MB H.D.	£2536
Compaq Deskpro 386 Model 40 1024K/40MD HD/Tape Bk	£4050
Compaq Deskpro 386 Model 70 1024K/70MB HD/Tape Bk	£4499
Compaq Deskpro 386 Model 130 1024K/130MB HD/Tape	£5622

All Compaq Deskpro computers require Monitors, Monitor Adaptor Boards and MS-DOS.

MACDOUGALL PC's

MacDougall 286 AT 640k 10mz/20mb HD/mono monitor	£999

MONITORS

Dyneer 12in 12MHI Mono Monitor & Tilt/Swivel Stand	£100
Taxon K16SV860 16in Ultra High EGA Colour Monitor	£699
Taxon K12SV3 Supervision III Colour Monitor	£359
Eizo ER8030M 14in High Resolution Colour Monitor	£319
Eizo ER8042S 14in Ultra-High Res EGA Colour Monitor	£465
ADI 14in Mono Monitor with Tilt/Swivel Stand	£120

TOSHIBA

Toshiba T3100 Lap Top	£2675
Toshiba T3100 Carrier Bag	£40
Toshiba T2100 Lap Top	£1800
Toshiba External 5.25 Disc Drive	£335

ATARI

Atari 520STM 512k RAM, TV Modulator, no disk drive	£215
Atari 520STFM 512k RAM, disk drive, mouse	£318
Atari 1040STF with Mono Monitor, 1mb RAM, disk drive	£564
Atari 1040STF with Atari SC1224 Colour Monitor	£775
Atari SF314 1mb Floppy Disk Drive	£155
Atari SF354 512k Floppy Disk Drive	£115
Atari SH204 20mb Hard Disk Drive	£557
Cumana CS354 1mb Floppy Disk Drive	£128
Cumana CS358 double 1mb Disk drive Unit	£204
Atari SM125 High Resolution Monochrome Monitor	£115
Atari SC1224 Colour Monitor	£307

ATARI TOP 21 SOFTWARE

Rainbird Starglider	£19
Computer Concepts Fast Basic	£77
Flight Simulator II	£37
Arena Sports Simulation	£23
Modula-2 Development System	£69
Modula-2 ST Toolbox	£42
Prospero Pro Fortran 77	£106
VIP Professional (Lotus Clone)	£139
Metacomco Lattice C Compiler	£71
Metacomco Macro Assembler	£36
Metacomco Pascal Compiler	£64
Migraph Inc Easy Draw	£107
Rainbird Soft The Pawn	£18
Microdeal Time Bandit	£21
Chipsoft ST Accounts	£107
Cashlink Accounts	£242
Mark Williams C Compiler	£128
Atari Fastcom	£37
World Games Simulation	£29
Megamax C Compiler	£113
Sage Software	call
All Other Atari Software	15% discount

DISKETTES

Computer Express 5.25in DS/DD 48tpi disks	£1.00 each
Computer Express 5.25in DS/DD 96tpi disks	£1.40 each
Computer Express 5.25in DS/DD 96tpi Hi-Density	£1.85 each
TDK 3.5in DS/DD diskettes	£2.99 each
Computer Express Branded 3.5in DS/DD diskettes	£1.99 each
Un-branded Sony 3.5in SS/DD diskettes	£1.50 each

COMMUNICATIONS

Miracle WS4000 V21-V23 Modem	£135
Miracle WS3000 V22 Professional Modem	£420
Unity Internal V12-V23 Modem	£199
Sage Chitchat Comms Pack (Modem/Software/Cable)	£210
Crosstalk IV Comms Software	£110
Sage Chitchat Comms Software	£85
One-To-One Electronic Mail Subscription	£20
RS232 serial modem cable	£15

HARD DISKS, ADD-ON BOARDS, CHIPS

Dysan/Western Digital 10mb File Card	£300
Miniscribe 30mb Hard Disk Card	£400
64k dRAM chips (nine to make 64k)	£1.15 each
256k dRAM chips (nine to make 256k) 150 N.S.	£3.00 each
8087 5mz Maths Co-Processor	£125
8087 8mz Maths Co-Processor	£149
80287 Maths Co-Processor	£199
AST SixPack Plus 64k memory Multifunction Card	£197
Qubie SixShooter Multifunction Card 64k memory	£150
Intel Aboveboard with 0k installed	£325
Plus Hardcard 10mb	£350
Plus Hardcard 20mb	£595
Seagate 20mb Hard Disk with WD Controller & Cables	£350
Hercules Colour Card	£100
Everex Mini Magic Ram Expansion Card (0K)	£69
Hercules Graphics/Graphics Plus Card	£189
Clone Hercules Card	£85
Mouse Systems Mouse with Pop-Up Menus & PC Paint	£125
Microsoft Bus Mouse - Don't forget the cat!	£135
Eizo Auto-Switch EGA Card	£275
Paradise Auto-Switch EGA Card	£250

IBM-COMPATIBLE SOFTWARE TOP 23

WordStar 2000 release 2	£231
WordStar Version 4 - New Features in Old Dress	£199
WordStar Professional Version 4	£249
Dbase III Plus - Best Selling Professional Database	£335
Framework II VER 1.1	£313
Lotus 1-2-3 ver 2.1 Top Selling Package In The World	£229
Supercalc ver 4 - The Celebrated Lotus-Beater!	£197
Smart System - The Best Intergrated Package	£365
Word Perfect ver 4.2 - The Number 1 WP Package	£249
Microsoft Word ver 3 - Number 2 WP Package	£270
Multimate ver 3.31	£207
Executive Systems X-Tree (Super Friendly HD Organizer)	£34
Pegasus Accounts (per Module)	£199
Psion Chess - You too can become like Gary Kasperov	£25
Quaid Software Copywrite (Back up Protected Software)	£39
Lotus Symphony ver 1.1	£333
Microsoft Flight Simulator - Don't crash	£39
Funk Software Sideways	£40
Borland Turbo Lightening	£55
Microsoft Windows	£59
Lotus Manuscript - Latest Blockbuster WP Package!	£290
PFS: First Choice	£110
Grafox Logistix	£80

ALTERNATIVE LOW-COST IBM/ AMSTRAD COMPATIBLE SOFTWARE

VP Planner by Paperback Software - Best Seller!	£75
VP Info (dBASE II Clone)	£75
Borland Sidekick - The Original Co-Resident Process!	£49
Gem Collection	£99
Sage Bookeeper	£85
Sage Retrieve Database	£85
Sage PC Planner Spreadsheet (Lotus Clone)	£85
Sage Desk-Set	£59
Sage PC-Write Word Processor	£85
Sage Accountant	£127
Sage Accountant Plus - Top Selling Cheap Accounts	£160
Sage Payroll	£85
Sage Financial Controller - Just reduced from 995!	£250
Personal Word Perfect	£149
Word Perfect Junior	£80
Microsoft Word Junior	£62
WordStar 1512	£62
Multiplan Junior	£62
Supercalc 3	£62
Amstrad Reflex	£62
Migent Ability - Top Integrated Package	£85
Words & Figures - Lotus 123 v1 Clone with WP	£85

SPECIAL OFFERS

Epson PC+ 20mb with Eizo 8042S EGA Monitor & Card	£1599
Amstrad PC1512 Double Floppy/Colour Monitor	£666
Star PowerType Daisywheel Printer 18cps	£175
Migent Ability	£65
Miniscribe 30mb Hard Disk on a Card	£350
Olivetti 48tpi Demodisks - See a dem, use a disk	£15 box

Above offers subject to payment with order and valid only while current stocks last. First come first served. Only one of each item per customer and you must mention this ad.

All prices exclude VAT and delivery. Prices are correct at the time of going to press although they are subject to change without notification. Official purchase orders welcome. Full back up and support. Open Monday to Friday 9am-6pm. Open Saturday 10am-4pm.

"YEP - THE BEARS ATE THEM!"

FOR FULL PRICE LIST PLEASE CALL
TELEPHONE ORDERS WELCOME

0727-72790

SINGLE AND MULTI-USER MICRO-COMPUTER AND SOFTWARE SALES AND SUPPORT

99 PARK STREET LANE • BRICKET WOOD • HERTFORDSHIRE • AL2 2JA • ST ALBANS (0727) 72790

Telex: 8950511 ONE ONE G (Quote Ref: 15412001)

OSIRIS
MICRO BROKERS

01-891 6433

3-5 York Street, Twickenham, Middlesex TW1 3JZ

All orders subject to carriage + VAT at 15%

SOFTWARE TOP 20:

LOTUS 1-2-3	£235
WORDSTAR 2000	£220
WORDSTAR 2000 PLUS	£265
DBASE 111 +	£340
SUPERCALC 4	£195
SMART 3	£375
SYMPHONY	£335
MULTIMATE	£199
MULTIMATE ADVANTAGE	£265
MS WORD	£245
DISPLAYWRITE 3	£305
PEGASUS SINGLE USER	£160
PEGASUS SENIOR	£295
PEGASUS MULTI-USER	£345
DELTA PROFESSIONAL	£345
MULTIPLAN V.2	£125
FRAMEWORK V.2	£325
WORDCRAFT	£315
OPEN ACCESS I	£295
JAVELIN	£380
OPEN ACCESS II	£395

PRINTERS

BROTHER 1109, 120 cps, 80 col	£175
BROTHER 1409, 180 cps, 110 col	£295
BROTHER 1509, 180 cps, 132 col	£375
NEC P6, 180 cps, 80 col	£410
NEC P7, 180 cps, 132 col	£495
NEC P5X, 220 cps, 132 col	£799
BROTHER HR20 daisywheel	£335
BROTHER HR25XL daisywheel	£550
BROTHER HR25 daisywheel	£725

SPECIAL OFFERS

FREE PRINTER and CHOICE OF SOFTWARE!*

TANDON PCA20 with 512k RAM, 20Mb HD, 1.2Mb Floppy, Mono Screen, Keyboard, DOS 3.1. Includes FREE EPSON FX800 (220cps) and ANY SOFTWARE PACKAGE WITH RSP UP TO £400.

*As Specified **£1999**

FREE INTEGRATED SOFTWARE with all **AMSTRAD 20MB SYSTEMS.**
(Database, Spread-sheet, WP, Graphics
£POA

MULTIFUNCTION CARD
640K P/F Ports
Clock/Calendar
for XT Compatibles
£149

SYSTEMS * *

COMPAQ Portable Plus, 10Mb, 256k	£1750
COMPAQ Portable 2 M3, 10Mb, 640k	£2475
COMPAQ Deskpro M2, 256k, 2 floppies	£1495
COMPAQ Deskpro 286 M40, 512k, 40Mb	£2695
COMPAQ Deskpro 386 M40, 512k, 40Mb	£4450
OLIVETTI M24, 640k, 20Mb	£1499
OLIVETTI M24SP, 640k, 20Mb, (10MHz)	£1799
OLIVETTI M28, 512k, 40Mb, 1.2Mb	£2699
APRICOT XEN Xi, 10Mb, 512k, 1.2Mb	£1550
APRICOT XEN Xi, 20Mb , 512k, 1.2Mb	£1950
APRICOT XEN I, 1Mb, 20Mb, (10MHz)	£2295
TOSHIBA 3100 Laptop, 10Mb, 640k	£2695
ALL TANDON/AMSTRAD Systems	£POA

* * All systems include keyboard, monitor & DOS

MEMORY

AST Rampage (XT), 2Mb	£395
AST Ramvantage (AT), 2Mb	£495
AST Rampage (AT), 2Mb	£595
Everex Minimagic 128k (AT)	£110

ENHANCED GRAPHICS

Paradise Switchable EGA Adaptor	£210
Everex EGA + Card, 256k, Parallel Port	£245
Taxan EGA Compatible Colour Monitor	£399

HARD DISKS/BACKUP

20Mb HD with Controller Card & Software	£350
20Mb Business Card	£395
20Mb Hard Card for Amstrad —occupies 1 slot	£450
Irwin 20Mb Int Tape Streamer	£495
Irwin 45Mb Int Tape Streamer	£625
Irwin 40Mb Ext Tape Streamer	£725

IGNORE THE REST – WE ARE THE VERY BEST

PICCADILLY micros

olivetti M28
40 Mb Hard Disk
8MHz Clock Speed
512 RAM MSDOS
Olivetti Monitor
Olivetti Keyboard £2695.00

olivetti M28
20Mb Hard Disk
8MHz Clock Speed
512K RAM MSDOS
Olivetti Monitor
Olivetti Keyboard £2195.00

olivetti M24 SP
10MHz Clock Speed
20Mb Hard Disk
640K RAM MSDOS
Olivetti Monitor
Olivetti Keyboard £1825.00

olivetti M24
20Mb Hard Disk
Olivetti Monitor
Olivetti Keyboard
640K RAM MSDOS £1570.00

PC1512SD — Mono Monitor	£449.00
PC1512DD — Mono Monitor	£559.00
PC1512SD — Colour Monitor	£619.00
PC1512DD — Colour Monitor	£729.00
PC1512HD 10Mb — Mono Monitor	£799.00
PC1512HD 20Mb — Mono Monitor	£899.00

WE SUPPLY EVERYONE FROM LEADING UK COMPANIES, GOVERNMENT DEPARTMENTS, EDUCATIONAL ESTABLISHMENTS, LOCAL AUTHORITIES, THE COMPUTER TRADE TO SMALL BUSINESSES AND THE PRIVATE INDIVIDUAL – ANYWHERE IN THE WORLD!

CALL US NOW – IN YOUR AREA!

EDINBURGH	031 556 9903
NEWCASTLE	091 276 6887
MANCHESTER	061 228 7965
NOTTINGHAM	0602 583461
BIRMINGHAM	021 643 5072
LONDON	01 481 3929
BRISTOL	0272 273665

olivetti M24
Twin Floppy Disk Drive
Olivetti Monitor
Olivetti Keyboard
640K RAM MSDOS £1395.00

AMSTRAD
Complete systems
Discount for quantity

Free UK Delivery on all Amstrad PC orders

olivetti M19
Twin Floppy Disk Drive
Olivetti Monitor
Olivetti Keyboard
256K RAM MSDOS £845.00

Tandon Complete Systems

PCX 256K 10Mb, Screen Keyboard, MSDOS	£999.00
PCX 256K 20Mb, Screen, Keyboard, MSDOS	£1175.00
PCA 20 512K 20Mb, Screen, Keyboard, MSDOS	£1645.00
PCA 30 512K 30Mb, Screen, Keyboard, MSDOS	£1925.00

TOSHIBA 3100 Portable
80286 Processor, 8MHz, 640K RAM, 10Mb Hard Disk, 720K Floppy Serial/ Parallel Port, Weight 15lbs £2695.00

TOSHIBA 2100 Portable
8086 Processor, 7MHz, 640K, RAM, 10Mb Hard Disk, 720K Floppy Serial/ Parallel Port, Weight 13lbs £2195.00

PC1512HD 10Mb — Colour Monitor	£969.00
PC1512HD 20Mb — Colour Monitor	£1069.00
PCW8256 Word Processor	£339.00
PCW8512 Word Processor	£425.00

PRINTERS

Epson FX800 160CPS & NLQ	£339.00
Epson FX105 160CPS & NLQ	£420.00
Epson LQ800 180CPS & NLQ	£475.00
Epson LQ1000 180CPS & NLQ	£625.00
Epson SQ2000 Ink Jet Printer	£1295.00
Olivetti DM280 160CPS & NLQ	£335.00
Olivetti DM290 160CPS & NLQ	£375.00
Olivetti DM286 220CPS & NLQ	£480.00
Olivetti DM296 220CPS & NLQ	£600.00
Olivetti DY200 25CPS Daisywheel	£345.00
Olivetti DY300 30CPS Daisywheel	£548.00
Olivetti DY800 80CPS Daisywheel	£1050.00
NEC Pinwriter P6	£395.00
NEC Pinwriter P7	£460.00
Canon LBP-8A1 Laser Printer	£1995.00
Canon LBP-8A2 Laser Printer 1.25Mb RAM	£2995.00
OKI Laserline 6 Laser Printer	£1625.00
Amstrad DMP3000 110CPS & NLQ	£150.00

SOFTWARE

DBase III Plus	£349.00
Framework II	£330.00
GEM Collection	£75.00
Lotus 123	£249.00
MS Word 3	£249.00
Multimate Advantage	£275.00
Multiplan II	£125.00
Olitext	£125.00
Psion Exchange	£250.00
SMART Software	£395.00
Symphony	£349.00
Wordstar 2000	£236.00
Sidekick for Amstrad	£25.00
Relfex for Amstrad	£55.00
Superkey for Amstrad	£25.00
All Microsoft Packages	Large Discounts
All Lotus Packages	Large Discounts
All Multisoft Accounting Packages	Large Discounts

PICCADILLY micros

Piccadilly Micros, Warwick Chambers, 14 Corporation Street, Birmingham B2 4RN. Telephone: 021 643 5072. Telex: 334264

★ 12 months warranty ★ 7 day money back guarantee ★ Next day del. available
★ On site maintenance contracts available ★ Finance plans available

-W1- WEST ONE BUSINESS SYSTEMS

NEW IBM Personal System 2
Available now
Telephone for Demonstration

Model 30/002 with Dual 3-5 720k Floppy drives, 640k Memory Enhanced keyboard, serial and parallel parts **£1095**

Model 30/021 with 20mb hard disk, one 720k 3-5 floppy drive 640k memory. Enhanced keyboard, serial and parallel parts. **£1445**

Model 50 10mhz, 80286 desk top system with 20mb hard disk one 1-44mb 3-5 floppy, 640k memory. Enhanced keyboard, serial and parallel parts **£2395**

Monitary for the above systems

Mono-display — 12" screen size, black and white, 64 shades of grey, 640 × 480 resolution **£169**

Colour-display — 12" screen size 256 colours available from 262,144 possible, 640 × 480 resolution **£445**
14" screen size, 256 colours available from 262,144 possible, 640 480 resolution **£495**

Limited Offer!

Save 25-30% on existing IBM systems!

Comple IBM Personal Computer Systems including Monchrome Monitor, Adaptor card, Enchanced Keyboard and 640k memory.

IBM XT SDD with two 360k floppy disk drives **£995**

IBM XT SFD with one 20mb hard disk and one 360 floppy Drive **£1395**

IBM XT 286 80286 processor with 20mb hard disk and one 1-2mb floppy drive **£1995**

IBM ATX Fast 80286 processor with 30mb hard disk and one 1-2mb floppy drive (512k RAM) **£2995**

Complete range of IBM peripherals available including monitors
Memory upgrades and printers.
Authorised IBM DEALER

TRAINING AND INSTALLATION

Full onsite training and installation is available on all products. Ask us for a quotation! We also supply and install a range of Multi user and Network products including Xenix and Novell. Telephone for further details on 01-636 7142 or 01 323 2840.

The Akhter P.C. — IBM Compatible System

All systems with keyboards compatible Adaptercard, Turbo Main Board 477/8mhz, Serial/pawalal part, Games part, 150 watt P.S.U. and 8 expansion slots.

P.C. 1000 Single 360 floppy drive, 256 RAM £499
P.C. 1500 Dual 360k floppy, 256k RAM £598
P.C. 2000 Single 360k, 20mb hard disk, 512k RAM £859
P.C. 2500 Dual 360k, 20mb hard disk 512k RAM £958
PC 3000 Dual 720k-3.5" disk drives 512k RAM £615
PC 3500 Single 720k-3.5" disk, 20mb hard disk 512k £869

MONITORS

7513 Phillips Monochrome Monitor-IBM 8533 Phillips Med. Res 600 × 200 resolution (G.Grt, Mono, T.T.L) £246

CM8873 Phillips E.G.A. Multi Scan, 850-285 max resolution £572

1404 Mitsubishi Med Res colour 600 × 200 resolution £240

NEC Multi Synch 800 × 560 max resolution £585

Disk Drives

20mb hard disk drives and controller card £349
40mb hard disk drive and controller card £749
360k 5-25 floppy disk drive £95
1-2mb 5-25 floppy disk drive £129
720k 3-5 floppy disk drive £119
Monochrome Adaptor £89
Colour adapter £89
E.G.A Card £195

Please call for more information on other products

PRINTERS

Superb range of high Quality Star and IBM Printer

Star N.L.10 – 9pin, 120cps draft – 30 cps N.L.Q. 80 col ... £226
Star NX 15 – 9pin as above but 132 col £295
Star NR15 – 9pin, 240 cps draft – 60cps N.L.Q. 132col ... £479
Star NB 24-10 24pin, 216cps draft –72cps L.Q. 80col £486
Star NB 24-15 24 pin as above but 132 col £616
IBM Proprinter 9pin, 160cps draft-40cps. N.L.Q. 80col £266
IBM Proprinter XL 9pin as above but 132 col £395
IBM Quiet write Model 2 ..... £695
IBM Quiet writer Model 3
Canon Laser printer – 8 page per minute £1795

Full range of
Epson printers available –
Telephone for details

Sanyo Special Offer

Sanyo Special Offer

Sanyo 550 with Dual 800k Drives, Monitor, Wordstar and Calc Star including a **Daisywheel** Printer all for **£599**

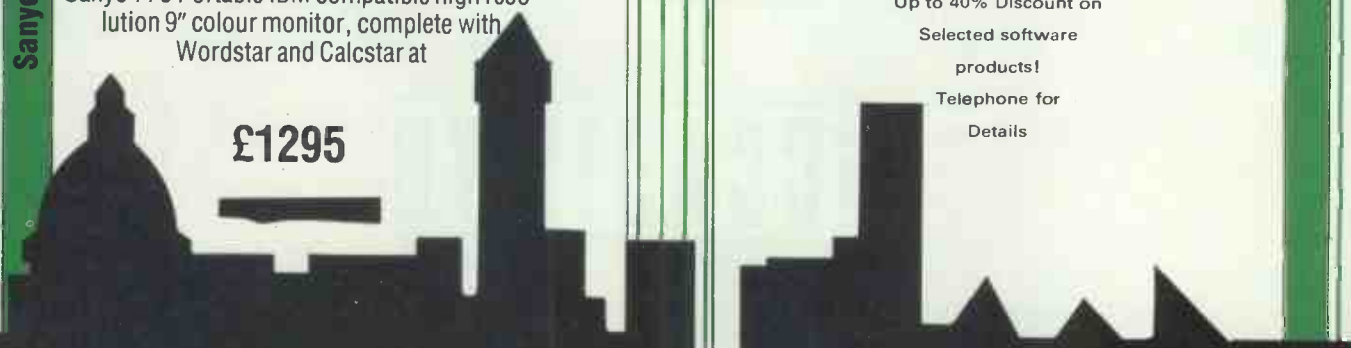
Sanyo 775 Portable IBM compatible high resolution 9" colour monitor, complete with Wordstar and Calcstar at

£1295

Limited stock! Clearance Prices!

Spewg IT and spewg HT — 80mb, 40mb, 20mb systems. Olivetti M24 and M15 — complete systems. Apricot Xen — Dual Floppy Systems

Up to 40% Discount on
Selected software
products!
Telephone for
Details



37 STORE ST. OFF TOTTENHAM COURT RD, LONDON WC1
01-636 7142 or 01-323 2840 (4 lines)

All prices exclude VAT. Visa and Access accepted. Prices exclusive of postage and packing. Price subject to change without notice. All goods subject to availability.

APPROVED FOR

SOFTWARE

by

PEGASUS
Single-User, Senior, Multi-User
WORDCRAFT
Lotus
Symphony
dBASE II & III PLUS

HARDWARE

by

IBM
Personal Computers
COMPAQ®
VICTOR®
TOSHIBA

PRINTERS

by

EPSON
brother
OKI
Canon
Laserjet
IBM
Quietwriter

NETWORKING

by

NOVELL
PROTEON

SERVICES

Installation
Training
Maintenance
Hotline Support
After-Sales Service

Da Vinci Computers LIMITED

01-202 2272/3/4
112 Brent Street Hendon NW4 2DT
Telex 265871 (MONREF G) Refer to 81:MMD 102
Telecom Gold: 81: MMD 102 FAX NO. 01 202 4982

We Want Your Seal Of Approval.

FOR THE EXECUTIVE ON THE MOVE

TOSHIBA

TOP PERFORMANCE AND COMPACT DESIGN

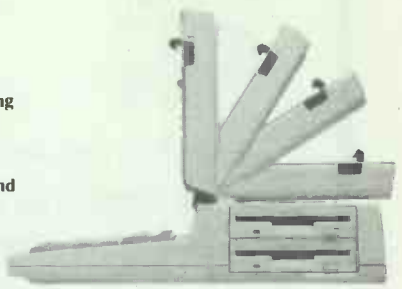
TOSHIBA IBM COMPATIBLE PORTABLE COMPUTERS AT GULTRONICS

T1100 PLUS

The portable that thinks it's a desktop PC!

T1100 PLUS specification.

Operating system	• MS-DOS 3.2
Processor	• 80C86 running at 7.16 MHz or 4.77 MHz
Memory	• 640K
Disk drives	• Two 3.5" 720KB offering 1.4MB total storage
Display	• Supertwist technology • 80 characters × 25 lines • 9.1 × 4.7 inches • 640 × 200 pixels • Position adjustable a full 90°
Keyboard	• 81 keys, full size
Standard interfaces	• RGB colour monitor • Monochrome composite monitor • IBM compatible parallel printer/ 5.25 disk drive • RS-232C serial communications • I/O bus for Expansion Box
Dimensions	• 12.1" wide, 2.6" high, 12" deep
Weight	• Less than 10lbs
Power	• Built in rechargeable NiCad batteries
Included accessories	• 240VAC adaptor for recharging and mains power operation • MS-DOS manual • Owner's manual • Carrycase with grap handle and shoulder strap
Options	• Internal V21, V22, V23 Hayes compatible modem (BABT approved) • External 5.25" floppy disk drive • Universal Floppy Link to desktop PC disk drive • Car cigarette lighter power adaptor/charger • Expansion Box with five IBM compatible slots • Bi-Synchronous Communications Adaptor



T3100 (ALSO AVAILABLE NOW T3100 20Mb)

Features

• Enormous processing power – this is the main feature of the T3100.

• The basic version of the T3100 comes with 640 KB of main memory which can be expanded to 2.6 MB.

• The T3100 also has a built-in 3½" drive with 720 KB storage capacity for exchanging data and programs with other computers.

• The hard disk – a standard feature of the T3100 – provides even greater storage capacity than the diskettes.

• The enormous storage capacity, the hard disk offers two other important advantages: considerably faster access to stored data, which means much faster response time for the computer, and greater data security.

GULTRONICS

COMPUTER CENTRE

200/204 TOTTENHAM COURT ROAD, LONDON W1P 9LA TEL: 01-323 2838/323 4612 TELEX: 295358
OPPOSITE GOODGE ST. TUBE STATION

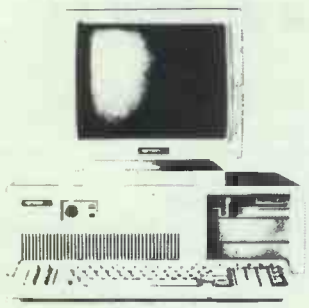
London's main stockists for Amstrad, Atari, Commodore, Epson, Brother, Citizen, Star, Sinclair. Also extensive range of software, Modems and peripherals.

All offers also available at: 43 Church Street, Croydon, Surrey. Tel: 01-681 3344

CONSULT GULTRONICS BEFORE COMMITTING.

SIERRA Computer Consultants Ltd.

TANDON, OLIVETTI, JUKI, PEGASUS, SAGE



SPECIAL OFFERS
PCX 10 640k
Juki D/W Printer
Word Processing
All for £1795

PCA 20 640k
Epson Printer
EGA/ECD
All for £2495

PCA 40 IMB
Epson FX105
EGA/ECD
4 User Systems
All for £4795

SPECIAL OFFERS
M24 20mb 640k
Lotus 123
All for £2715

M24SP 20mb 640k
Full A/Cs Package
All for £2745

M20 20mb 640k
Colour System
Laserjet Printer
All for £4895

MISC. SPECIAL OFFERS

Hardware

AMSTRAD 1512 Twin Floppy	POA
AMSTRAD 1512 hd 20 Colour	POA
Twin Serial Boards	£50
EGA/ECD (screen & board)	£595
Epson FX800 Printer	£376
Epson FX1000 Printer	£481
Epson EX1000 Printer	£652
Juki 6200 D/W Printer	£525
MEMTEC INT. Tape Streamer	£595

Software Packages

Lotus 123	£269
Symphony	£362
Smart System V3	£398
Dbase III Plus	£372
SAGE A/Cs Plus	£175
SAGE Bookkeeper	£85
SAGE Payroll	£85

The above are just a sample of the products available. Please Telephone for Specific Quotation. **Telephone: 0705-504874.**

SIERRA COMPUTER CONSULTANTS LTD. The Sanderson Centre, Lees Lane, Gosport, Hants.

Almo Computer Systems

New Number
More Lines
0730 68877

PRICE REDUCTIONS ON MOST PRINTERS AND SOFTWARE

TOSHIBA 24 Pin Head

P321	(216/72cps)	£415
P341E	(216/72cps)	£489
P351	(288/100cps)	£736
P351C	(288/100cps) Col	£988

EPSON Dot Matrix

LX86	(120/16cps)	£193
LX800	(150/25cps)	£call
FX800	(240/40cps)	£307
FX1000	(240/40cps)	£393
LQ800	(180/60cps)	£447
LQ1000	(180/60cps)	£597
LQ2500	(270/90cps)	£747
SQ2000	(176/105cps)	£1219
SQ2500	(270/90cps) P/S	£962
EX800	(300/50cps)	£397
EX1000	(300/50cps)	£533

MICRO P Dot Matrix Printers

MP165	(165/35cps) P	£172
MP200	(200/40cps) P	£247
MP201	(200/40cps) P	£266

OTC

OTC 700	(700cps)	£1377

BROTHER D/wheel Printers

HR20	(20cps)P/S	£354
HR25XL	(25cps)P/S	£553
HR40	(40cps) P/S*	£791
	*T/feed,S/Feed standard	
TwinWriter Daisy/D.Mat		£1030

BROTHER Dot Martrix

2024L	(160/96cps) P/S	£632
M1409	(180cps)	£306
M1509	(180/45cps) P/S	£394
M1709	(240/50)P/S	£473

OKI Microline Dot Matrix

84	(200cps)P	£645
84	(200cps)S	£725
84XS	(200/50cps)	£1036
182	(120/60cps)P/I	£210
182HS	(H/Speed Ser)	£235
192	(160cps)P/I	£289
192	(160cps)S	£331
193	(160cps)P/I	£373
193	(160cps)S	£416
292	(200/100cps)Col	£461
293	(200/100cps)Col	£615
294	(400/100cps)Col	£843

CANON Dot Matrix Printers

PW1080A+	(160/27cps)	£233
A55	(180/34cps)	£384
A60	(200/100cps)	£397
A65	(200/100cps)	£468

LASER PRINTERS

Canon LBP-8A1 (8pm)P/S	£1512
Canon LBP-8A2 (8pm-Gr)	£2706
Canon SERIES II LASER A1	£1653
HP Laserjet	£1486
HP Laserjet Plus (P&S)	£2162
HP Laserjet 500	£3452
HP SERIES II LASER	£1963
Epson GQ3500 Laser	£1310

JUKI Daisywheel Printers

6100	(20cps)P	£267
6200	(30cps)P	£403
6300	(40cps)P/S/IBM	£647
6500	(60cps)P	£870

CALL FOR PRICES ON
OTHER PRINTERS
MSDOS SOFTWARE
MACINTOSH SOFTWARE

P=parallel,S=serial,I=IBM,col=colour

Access/Barclaycard/Visa/Applecard accepted. All prices are exclusive of VAT. Telephone for prices for other printers and accessories. Prices correct at time of going to press. Cables from £15 extra. Carriage Printers £7, Laserprinters £20.
Terms cash with order - Mail order only

SOFTWARE SPECIALS

IBM

Lotus 123	£249
Symphony	£354
Wordperfect	£268
Wordstar	£174
Dbase II	£242
Dbase III+	£368
Supercalc 4	£252
Ventura Publisher	£675

MACINTOSH

Word 3	£207
Works	£172
Excel	£207
Omnis 3	£312
PageMaker	£335

SYSTEMATICS ACCOUNTING
Sales - Purchase ledgers
General Ledger & Fin Planning
Stock Control - Invoicing
Job Costing - Administrator
Cheque Writer
£95 Per Module
Plus Delivery & VAT

Phone (0730) 68877 16a College Street, Petersfield, Hampshire. GU31 4AD

COMLEX

*COMPUTERS-PRINTERS-MONITORS-
DRIVES-SOFTWARE

MULTISOFT ACCOUNTS
Single User £199 per module
Support and Multi User Software available
MITSUBISHI ACCOUNTS
Single user £275 per module

Special Bromcom 4 user system inc. Sage Financial controller (multi-user) £4199
Amstrad 1512 Mono (20Mb Seagates) 640k Memory £784
Amstrad Colour 1512 (20Mb Seagate) 640k Memory £925
Amstrad 128k memory upgrade £29

COMPUTERS

Amstrad PCW 8256	£379
Amstrad PCW 8512	£479
BBC Master	£399
BBC Master Compac	£347
BBC Master Compac + Green screen	£434
BBC Master Compac + Colour Monitor	£544

ATARI

520STM	£205
520STFM	£305
520STM + mono monitor	£390
520STFM + Philips colour	
520STFM + Philips colour Hi-res	£556
1040STF + mono	£556
1040STF + Philips colour	
1040STF + Philips colour Hi-Res	£722

COMMODORE

Amiga 500	POA
Amiga 500 modulator	£25
Amigia I	£949
Amiga II	£1049
Amiga 2000 1Mb	POA
Amiga Bridge +5¼	POA
PC Double Disk Drive	£799
PC One Disk Drive 20Mb	£1099
AT 20Mb 1.2 Disk Drive 20Mb	£1775

EPSON PC

PC Twin D/D mono mon.256	£799
PC Single D/D 20Mb mono mon.256	£1199
Colour monitor add	£325

VICTOR

Victor machines	POA

OLIVETTI

M24 1 D/D	£949
M24 2 D/D	£1025
M24 20Mb (Olivetti)	£1350
M24 20Mb (Seagate)	£1250
M24 30Mb (Seagate)	£1450
M24 SP	£1499
M28 20Mb H/D	£1999
M28 20Mb + T/S	£2499
M28 40Mb	£2549
M28 40 Mb + T/S	£2999

All machines come with Keyboard Monitor and MS-DDS. M24's 640k colour monitor £250 extra.

SPERRY

HT 100	£1050
HT 200	£1150
HT 250	£1340
HT 300	£1775
HT 400	£1425
HT 450	£1715
HT 500	£2100
HT Standard keyboard	£85
HT Professional keyboard	£149
Parallel Printer port (required for HT 250, 300, 450 & 500)	£59
Micro IT 1.2DD 20Mb Standard or AT keyboard 512k and green monitor	£2250
Full IT 1.2DD 44Mb, Standard or AT keyboard 512k and green monitor	£2730

AMSTRAD PC

1DD Mono	£423
2DD Mono	£522
1DD Colour	£567
2DD Colour	£666
20Mb Mono	£833
20Mb Colour	£977
20MB upgrade for Amstrad PC (fitted if required)	£345

BONDWELL PC

B8 Portable	£679
B18 Portable	£599
B34 2DD 640k	£499
B36 20Mb 640k	£849
B38/2 2DD 640k	£699
B38/3 20Mb 640k	£999
BW39	POA
Colour Monitor add	£199

SBC

SBC 40	£525
SBC 55	£699
SBC 55 20Mb	£899
SBC At 30Mb 1.2DD green screen 6,8,2 Mhz	£1499
SBC At 30Mb 1.2DD colour 6.8 + 12 Mhz	£1675
SBC At 30Mb 1.2DD ega colour 6.8 + 12 Mhz	£1849

Free 12 months a sight maintenance with all Bandwells + SBC measures

TANDON

PCX	£849
PCX 10	£925
PCX 20	£1049
PCA 20	£1399
PCA 30	£1780
PCA 40	£2099
Colour Upgrade	£260
Tandon Target 20Mb	£13.99
Tandon Target 30Mb	£11.50
Tandon Target 40Mb	£20.75
Ega colour upgrade	£475.00

APRICOT

XEN XI 10	£1575
XEN XI 20	£1975
XEN HD	£2199
XEN I	£2399
Colour Upgrade	£195
Medium res col mon	£275 extra
High res col mon	£685 extra
Enhanced col monitor	£589
Professional keyboard	£63 extra

MULTI USER SYSTEMS

Comart Quad 20Mb	£4250
Comart Quad 40Mb	£4999
Northstar Dimension 30Mb	£3680
Northstar Terminals	£799
M28 running Xenix (as other AT's)	POA
Apricot Multi User Newtwork or Xenix	POA
20Mb Hard Disk Upgrades from	£325

HARD DISKS

Seagate 20Mb 65ms	£299
Seagate 30Mb 65ms	£429
Seagate 20Mb 40ms	£579
Seagate 30Mb 40ms	£679
Seagate 40Mb 40ms	£689
Miniscribe 20Mb	£299
Miniscribe 30Mb	£375
Miniscribe 30Mb hardcard	£349

All drives include controller + leads.

MONITORS

Philips 7502 (green)	£69
Philips 7522 (amber)	£75
Philips (paper white)	£79
Philips cm 8501 RGB standard res	£199
Philips cm 8533 medium res	£235
Microvitec 1431	£179
Microvitec 1451	£225
Microvitec 1441	£375

DOTMATRIX PRINTERS

Amstrad DMP 3000	£149
Amstrad DMP 4000	£299
Brother M1409	£289
Brother M1509	£365
Brother M1709	£499
Brother 2024L	£625
Brother 4018	£1149
Canon 1080A	£215
Canon A55	£349
Citizen 120D	£149
Citizen MSP 10E	£249
Citizen MSP 15E	£319
Citizen MSP 20E	£239
Citizen MSP 25E	£299
Epson LX86	£187
Epson FX800	£299
Epson FX1000	£375
Epson EX800	£389
Epson EX1000	£499
Epson LQ800	£425
Epson LQ1000	£589
Epson LQ2500	£695
Epson SQ2500	£949
Micro P MC165	£165
Micro P MP200	£239
Micro P MP201	£289
NEC Pinwriter P6	£379
NEC Pinwriter P7	£549
NEC Pinwriter P5	£739
OKI ML182	£199
OKI ML192	£279
OKI ML193	£365
OKI ML292	£439
OKI ML293	£589
OKI ML294	£799
Olivetti DM1000	£205
Olivetti DM250	£329
Olivetti DM290	£389
Olivetti DM600	£919
Panasonic 1080	£175
Panasonic 1091	£235
Panasonic 1092	£310
Panasonic 1592	£399
Panasonic 1595	£525
Panasonic 3131	£259
Panasonic 3151	£425
Star NL10	£203
Star SD15	£269
Star SR10	£269
Star NX15	£319
Star SR15	£338
Star NB15	£639

Phone for prices on Diablo, Newbury Data, Qume and Ricoh.

DAISYWHEEL PRINTERS

Brother HR20 22cps	£329
Brother HR25 XL 25cps	£519
Brother HR35 35cps	£695
Micro Peripheral MP26 (new) 26cps	£259
Micro Peripheral MP40 (new) 40cps	£379
Olivetti DY450	£789
Olivetti DY800	£1049
Panasonic 3031	£259
Panasonic 3151	£425
Juki 6000 12cps	£145
Juki 6100 20cps	£225
Juki 6200 30cps	£399
Juki 6300 40cps	£629
Juki 6500 60cps	£899

LASER PRINTERS

AST Turbo	£3299
BDS 630	£1649
Canon LBP 8A1	£1499
Canon LBP 8AII	£2650
Centronics PP8	£1699
HP Laser Jets PA4	£1799
HP Laser Jets HPA4 (with fonts)	£2599
Kyocera F1010	£2600
Mannesman Tally M910	£2500
Olivetti PC401	£2450
OKI Laser Line	£1450
Qume Laser 10	£2225
Ricoh Laser 10	£3125

CAD CAM PLOTTERS

Epson H180 4 pen A4	£309
HP 7440 8 pen A4	£975
HP 747SA 6 pen A3	£1445
Roland DXY 880 A3	£649
Roland DXY 980 A3	£935
Roland DPX 200 A2	£3199
Hitachi 672 4 pen A4	£435
Taxan KPL 710	£635

Phone for details on larger Plotters A0 AT, Hewlett Packard, Calcomp, Benson.

DIGITISERS

Cherry Tablet A3	£450
TDS LC12 11 × 11	POA
TDS LC20 20 × 20	POA
TDS IIR48 48 × 36	POA
Calcomp Digitisers	POA
Maths Co-processors 8087	£98
80287	POA

MODEMS

Pace Nightingale	£79
Pace Series 421235	£219
Pace Series 4 12005	£349
Pace Series 4 24005	£439
Miracle WS2000	£85
Miracle WS3000 2123	£229
Miracle WS3000 22	£379
Miracle WS3000 221315	£509
Miracle WS4000	£119

Phone for prices on Thom, Dacan, Racal and Steebek.

SAGE SOFTWARE

Bookkeeper	£72.50
Accountant	£112.00
Accountant +	£145.00
Payroll	£72.50
Retrieve	£72.50
Chitchat	£72.50
PC Planner	£72.50
Desk set	£50.00
PC write	£72.50
Financial controller	£218.00
Financial controller multi user	£729

WORD PROCESSING

Wordstar Proff	£198
Wordstar 2000	£229
Wordstar 2000 +	£269
Word Perfect	£249
Wordcraft	£299
Multimate Advantage	£299

SPREADSHEETS

Multiplan II	£129
Supercalc	£229
VP Planner	£62

DATA BASES

Data case	£459
D. Base 3+	£359
Delta Professional	£329
VP-info	£62

CAD-CAM

Dax Cad	£1650
Auto Cad	£1999

GOVERNMENT AND EDUCATIONAL ORDERS WELCOME, EXPORT ENQUIRIES WELCOME
STANDARD DELIVERY £5 AND NEXT DAY
£9.50 — ADD 15% TO ORDER TOTAL

**Comlex House, 28 Bradgate Road,
Hinckley LE10 1LA
(0455) 635583
Manchester 061-976 3763**

Goto Computers

10 Old Crown, Windsor Road, Slough, Berks SL1 2DL

Sales Hotlines: Slough (0753) 34191
Slough (0753) 824767

100 MILE FREE DELIVERY

(Over 100 miles and under £100 add £5)

COMPUTERS

	£
Amstrad PC1512HD-20Mb Col+10 DSDD	1069
Amstrad PC1512SD-Mono +10 DSDD disks	449
Epson PC AX 20Mb 640k 10Mhz ex Mon	1800
Epson PC AX 40Mb 640k 10Mhz ex Mon	2350
Epson PC AX Mono Display/Adaptor	245
Olivetti 83 or 102 key Keyboard	120
Olivetti Color Monitor	399
Olivetti M24 640k 20Mb 1FD	1335
Olivetti M24SP 640k 20Mb 1FD 10 Mhz	1495
Olivetti MSDOS/GW Basic	52
Olivetti Mono Monitor	165
Opus PC11 EGA 640x 360 16cl 20Mb	1350
Opus PC11 System 3 Turbo 2FD Mono	660
Opus PC11 System 4 20Mb Mono mon	969
Tandon EGA Monitor and Adaptor	440
Tandon PCA20 640k 20Mb 1FD Colour	1775
Tandon PCA20 640k 20Mb 1FD Mono	1475
Tandon PCA30 640k 30Mb 1FD Mono	1699
Tandon PCA40 640k 40Mb 1FD Mono	1865
Tandon PCX20 640k Par/Ser Mono mon	925
Tandon Target 20 1Mb 20Mb 1FD Mono	1995

MONITORS

	£
Hercules Color Card 320 x 240 4 cols	159
NEC JC 1401P3A Multisync EGA PGA	550
Philips 8833 600 dots 285 lines NEW	265
Philips 8873 Multisync 14" EGA/PG	435
Princeton HX12E EGA	375
Taxan 560 EGA/MGA/CGA Switch Card	210
Taxan 760 EGA 14" EGA 15/22 Khz	415
Taxan 770 Multiscan 14" EGA 15/34Khz	575
Taxan 860 16" EGA 0.39 dot	675
Taxan KX 1212/13 Green and Amber	118
Taxan Supervision IV 16" NEW	750
Taxan Supervision IVmRGB + KIF3800	£400
Thompson 4470D 14" EGA Dual Scan	£400

SOFTWARE

	£
Ability Integrated Software v 1.2e	70
Autocad 2.6 Basic	285
Borland SuperKey/Light/Pro/SK each	60
Borland Reflex The Analyst V 1.1	70
Borland Turbo Holiday Jumbo Pack	160
Clipper dBase III Compiler NEW	365
Compsoft DELTA 4 Professional	325
Dbase III + V1.1 Unprotected	330
Expert Xi Plus The Expert System	1250
First Choice PFS Integrated New	130
Flying Start Instant Info Process	69
Fontasy 28 fonts 95 patterns Ver 2	70
Framework II V 1.1	315
Graphwriter Combination	270
Harvard Presentation Graphics	230
Harvard Professional Publisher	575
Lotus 123 Rel 2.01	230
Lotus HAL	105
Lotus Manuscript Word Processor	295
Lotus Measure (Scientific) NEW	345
Lotus Metro NEW	65
Lotus Symphony 1.2	330
Microsoft Flight Simulator V 2.13	42
Microsoft QuickBasic ve 2.1 NEW	75
Multimate Advantage 3.60	265
Norton Advanced Utils NEW	99
Norton Utilities Ver 4 NEW	54
Open Access II V2 NEW	365
Paradox Rel 1.1 Relational DBase	365
Q&A File Report Writer VER 2 NEW	205
SAGE Accountant Plus	145
SAGE Financial Controller NEW	245
SAGE Payroll V 7 NEW	75
Smart System 3.1 LAN Ready V3.10	375
Statgraphics Ver 2.1 NEW	440
SuperProject Plus UK Vers	315
Supercalc IV NEW UK Ver	200
Ventura Desk Top Publishing	625
Wordperfect 4.2 NEW	250
XTREE File & Directory Manvt V 2.0	44

PLOTTERS DIGITISERS LASER

	£
Canon LBP-8A2 MkII More fonts et	2675
Cherry A3 Digitiser Mk II NEW	465
Citizen Overture 110 10ppm NEW	1625
Hewlett-Packard 7475A A3 6 Pen Plt	1325
Hewlett-Packard LaserJet Plus PS	2150
Hewlett-Packard LaserJet Series 2	2675
Hewlett-Packard ScanJet Imagiser	1625
Hitachi 672 4 Pen A4 Serial/Par	430
Kyocera F-1010 Laser A4 62 fonts	2575
OKI Laserline 6 6ppm	1600
Roland DXX 2000 A2 8 pen	3125
Roland DXY 880A A3 8 pen	635
Roland DXY 885 A3 + Autosketch NEW	995
Roland DXY 980A A3 8 pen	905
Roland DXY 990 A3 + Autosketch NEW	1050
Summasketch Graphics Tablet	335
Taxan 716 A3 10 Pen	875

DOT MATRIX PRINTERS

	£
Brother 1509 NLQ/Tractor 136cl	365
Brother 1709 50/240cps 136 cl NEW	455
Brother 2024L NLQ/190cps	630
Brother M4018 100NLQ/480cps 18 pin	1475
Canon A55 34NLQ/180cps 156 cols	365
Canon A60 34WPQ/100NLQ/200cps 80 cols	400
Canon A65 34WPQ/100NLQ/200cps 132c	475
Citizen 120D 25NLQ/120cps 80 col	162
Citizen HQP-45 66NLQ/200cps 136c	540
Epson EX 800 50NLQ/300cps 80 col	390
Epson EX1000 50NLQ/300cps 136 col	510
Epson FX1000 40NLQ/200 132 col NEW	391
Epson FX800 40NLQ/200 80 col NEW	315
Epson LQ 1000 80LQ/160cps 156c24pi	575
Epson LQ 800 60LQ/160cps 80c 24 pin	438
Epson LQ 2500 90LQ/270cps 24pin	715
Fujitsu DX2100 55NLQ/220cps 80cl	285
Fujitsu DX2200 55NLQ/220cps 136c	385
Juki 7200 24 wire flatbed AMF NEW	Call
Mannesman Tally MT 85 180cps 80	295
Mannesman Tally MT 86 180cps 136	365
NEC Pinwriter P5XL 88NLQ/264 136c	715
NEC Pinwriter P6 72/216 24p 80co	380
NEC Pinwriter P7 72/216 24p 136c	448
Olivetti DM280 NLQ/160cps	310
Panasonic KX P 1081 NLQ/120cps NEW	159
Panasonic KX-1592 38NLQ/180 136c	355
Star NL10 30NLQ/120 80cl + I/Face	220
Star NX15 30NLQ/120cps 136l+I/face	290
Taxan 815 NLQ/180cps IBM set NEW	269

DAISYWHEEL PRINTERS

	£
Brother HR25XL 25cps Dual 132 Col	520
Brother HR40 FT 30 sheet Sheetfeed	710
Brother Twinwriter 40cps/160 matrix	995
Citizen Premier 35cps Fric-Frac	450
Juki 6100 18cps	270
Juki 6200 30cps 132 col	380
Panasonic KX-P3131 22cps 80 col 32kb	249
Panasonic KX-P3151 22cps 132 col	375

ADD-ONS & UPGRADES

	£
80287 6Mhz Maths Processor AT	165
8087 8Mhz M24/1512/Compaq Deskpr	140
8087 Maths Processor XT 5Mhz	105
Cypher 1525 CT 25Mb Streamer + PS	520
Dysan (WD) File Card 10Mb	280
Dysan (WD) File Card 20Mb	395
Fujitsu Copyboard A4 Presentations	1915
Hercules Color Graphics Card	100
Hercules Graphics Card Plus	170
Ideal Hardware 30Mb Hard Card	405
Inforem M/Function 384k Cl/Ca PS	135
Intel Above Board/AT 512k onboard	395
Intel Inboard 386/AT to 16Mb 1Mb	2045
Kodak Datashow PC to Overhead Proj	1075
Microsoft Mouse Bus or Ser + Paint etc	135
MiniScribe 30Mg HardCard only 9.5w	390
MiniScribe 38.4Mb H/Ht HD+WD+Kit	385
NEC 20Mg half HT + WD + Cont + Kit	345
NEC 256k DRAMS chips(9) 150ns	25
Orchid 286 EGA Turbo	480
Orchid Jet 386 16Mhz	765
Orchid Tiny Turbo 80286 with cable	375
PVC Moulded PC 2 Metre Cable	16
Switch Box 2 Printers to 1 computer	50
Sysgen 60Mb Tape Streamer	850
Tandon 20Mb Business Card	390
V20-5Mhz Speeds up PC/XT up to 35%	20

COMMUNICATIONS

	£
Crosstalk IV Software New	96
Datatalk Software V3.27	130
Hayes 2400 V22bis	590
Hayes Smartmodem 1200 V22	365
Hayes Smartmodem 1200B Internal	355
Miracle WS3000 V21 V22 V23 Auto	380
Miracle WS3000 V21 V23 Auto	235
Miracle WS3000 V22bis 2400/2400	520
Miracle WS4000	135
PACE Series 4 Modem V21/V23	215
SAGE Chit Chat Software	82
SAGE Comms pack Modem + Chit Chat	225

NOVELL NETWORK SYSTEMS

	£
Advanced Netware 286/Ethernet kc	3900
Advanced Netware 286/G-Net	2770
Netware Server 286A-30Mb kc	6660

ORDERS TAKEN FROM UK GOVERNMENT BODIES — EDUCATIONAL ESTABLISHMENTS — COMPANIES
EXPORT ORDERS UNDERTAKEN TO BE SEPARATE ITEMS
LEASING AND H.P. ARRANGEMENTS.
PRICES SUBJECT TO CHANGE WITHOUT NOTICE
OPEN 9.00AM TO 5.30PM MON THRU FRIDAY AND 9.30AM TO 12.30PM SATURDAY
WE MOVE SERVICE NOT BOXES
Please add VAT to all prices

VISA Access AMERICAN EXPRESS

FOR ALL IBM PC COMPATIBLES INCLUDING THE AMSTRAD PC1512 HD

TAS™ Database and Application Developer

Ready Made Applications

Two application suites are available from MEGATECH. TAS Modifiable Accounting and TAS Advanced Accounting. These were developed using the £199 TAS Plus Developer and this package is included in the price. But besides the database you also get the source code (that's the original database code the accounting systems were written in) and all other information and tools, including an excellent tutorial and reference manual. This allows you or your supplier to add modules or make changes to existing modules that will become your 100% accounting solution.

Modifiable Accounting £499

This includes the £199 TAS Plus Developer's version and consists of:

Nominal Ledger

3 years totals by month. Budgeting by month. Multiple departments/profit centres. Full VAT analysis for up to 10 rates of VAT. Post to previous periods and reclose. Financial statement writer. Up to 5 bank accounts. Detailed history files.

Purchase Ledger

Easy to enter invoices. Recall last nominal distribution. Pay invoices automatically or by hand. On-line account enquiry. Full supplier history and ageing reports. Real time updates.

Sales Ledger

Invoicing and sales analysis. Easy adjustments of current ledger entries. Statements, aged debt reports, bad debt letters, daybooks etc. define individual customer history.

Advanced Accounting £799

In addition to Modifiable Accounting you get three more modules:

Stock Control

Wholesale distribution-type. Regular and non-stock items. Average and last cost. Multiple selling prices. Easy stock adjustments. Month and year to date sales and costs. Post to individual nominal accounts. Full reporting.

Purchase Order Processing

Provides for regular and non-stock items. Automatic last cost check. Easy adjustments. Allows for part delivery, over/under shipments.

Sales Order Processing

No limit sales order entry with invoicing and backorders. Full salesman support. Unique price matrix "remembers" specials per individual customer. Picking slips. Easy adjustments and much much more.

System Requirements

TAS Plus runs on any IBM PC, XT, or AT compatible machine (including the AMSTRAD PC1512) with at least 384KB RAM and two floppy discs or a hard disc. A version for Concurrent CP/M with a different specification is also available. Ask MEGATECH for more information.

TAS Plus Database and Application Developer

The TAS Plus database and application developer is an invaluable tool for anyone requiring quick access to information. It allows you to enter, store, display, report and manipulate data, quickly, and easily and is suitable for both programmers and beginners.

Fast and Easy to learn

An excellent tutorial and reference manual teaches you step-by-step how to create your own applications using the TAS facilities. You start by "painting" the screen the way you want it and then the TAS Plus program generator writes the program for you. Producing reports is just as easy. When you have created your application, the database browser and report generator allow you to retrieve the information quickly and print it to screen, disc or printer. You will learn how to use the automated source code editor to add commands to your programs in order to produce professional menu-driven applications supporting multiple files, reports and screens that include pop-up menus and windows. Finally, when it comes down to the speed of developing and, more importantly, running your applications (because that's what you do every day) you will find that the compiled code makes TAS quicker than any other database.

Suitable for Most Applications

Use it for mailing lists and mailmerge applications, client records, stock systems, membership records, subscription accounting, and virtually any other application where you want to enter, store, display, report and manipulate data, quickly and efficiently. Our integrated financial accounting system is written in TAS (available with the TAS source code included) which proves conclusively that almost any database application can be produced with TAS.

At £99 TAS Plus is Complete

It consists of a Screen Painter, Program Generator, Database Browser, Report Generator, Command Language, Source Code Editor and Compiler. TAS Plus opens up to 16 files simultaneously where each file may have up to 16 key fields (through which you may locate a record) which are automatically kept in sorted order. Each file may have up to 65,000 records and each record may have an unlimited number of fields with up to 10,000 characters per record. TAS Plus supports excellent array handling, string manipulation and full arithmetic and bracketed expressions as well as time and (European) date arithmetic. Read and write non-TAS (ASCII) files and automatically convert to and from dBase 3 files. Use all IBM compatible colours and business graphics. User definable printer control characters, full function key access and control and more.

TAS Plus Developer £199

This is for those that need even more power and flexibility. Open 32 files, each with up to 32 keys. Save up to 17 million records per file. It includes extra commands and allows you to develop programs using an ASCII text editor. Study the developer source code of the browser, screen painter, program and report generator and the 120K command editor all of which were developed in TAS!

What the Press Says

"Combination of good, basic menu driven facilities with powerful programming tools make it excellent value for money, especially for novices wanting to learn, and developers wanting economical runtimes systems". (Personal Computer World)

"On a value for money basis, this must be one of the most attractive databases on the market". (Accountancy Magazine)

"TAS manages to pack plenty of power into its small price. It performed well in our tests and you can quickly write dense and efficient code for custom applications". (PC Magazine)

"There is no doubting that TAS is a very capable product—it handles serious-sized applications and does so with speed." (What Micro Magazine)

TAS Multi-User Version £349

The multi-user developer's version of TAS will work with IBM PC Network, Novell Advanced Netware, Torus Netware, 3-Com Netware, Transnet, D-Link, Multilink Advanced, MS-Net (Apricot Xen-I) and all other MS-DOS 3.1 NETBIOS compatible networks.

30-Day Money Back Guarantee

The package you receive contains a sealed an unsealed set of floppy disks. The unsealed set is fully operational but can only save a limited number of records. This allows you to use the complete working system at your leisure. If you find that TAS does not perform in accordance with our claims and provided that the sealed set remains unopened and all goods are returned to us (in a good condition) within 30 days of purchase, we will refund your purchase price less handling and a 10% re-stocking charge.

Order Your Copy Today

NOT COPY PROTECTED

TAS™ PCW/6/87

Please send me the following items:

More information:

TAS Plus @ £99:

TAS Plus Developer @ £199:

TAS Plus Modifiable Accounts @ £499:

TAS Plus Advanced Accounting @ £799:

Add handling & shipping @ £6:

Add 15% VAT

I enclose a total of:

Payment

Cheque Access Visa

Card Number:

Card Expiry Date:

Card Name:

Card Address:

Postcode:

Daytime Tel. No.:

Signature:

A VAT Invoice will be included in the parcel. Enclose a company letterhead if Invoice name and address need to be different from card name and address

MEGATECH CORPORATION

111-113 Wandsworth High Street
London SW18 4HY
Telephone: 01-874 6511. Telex: 21768

XT-Compatible 20 Megabytes 4.77/8 MHz

£795

- The PC88 Turbo
- Legal BIOS
- NEC V20 Super Processor
- Switchable 4.77/8 MHz Clock
- 640K RAM
- 20MB Half Height Hard Disk
- 360K half Height Floppy
- Parallel Printer + RS 232 Serial ports
- Monographic/Printer card
- 130W Power Supply
- Professional Keyboard
- "Hi-Res 12"" Green Monitor
- MS-DOS 3.2
- Full Set of Manuals
- 8 Expansion Slots
- 12 Months Warranty
- Clock/Calendar with Battery Back-up

AT-Compatible 20 Megabytes 6/8/10 MHz

£1295

0 or 1 Wait States

- The PC-286 Turbo
- Legal Bios
- Switchable 6/8/10 MHz
- 640K RAM
- 20 MB Half Height Hard Disk
- 1.2 MB Half Height Floppy
- Parallel Printer + Two RS232 Serial Ports
- Clock/Calendar with Battery Back-up
- Monographic/Printer card
- 200W Power Supply
- Professional Keyboard
- "Hi Res 14"" Green Monitor
- MS-DOS 3.2
- Full Set of Manuals
- 8 Expansion Slots
- 12 Months Warranty

OPTIONS

- 30 MB Hard Disk Drive Upgrade
- 40 MB Hard Disk Drive Upgrade £365
- 14" Colour Monitor Upgrade £175
- 14" Hi Res Colour Monitor and EGA Card Upgrage £395
- EGA Card £165

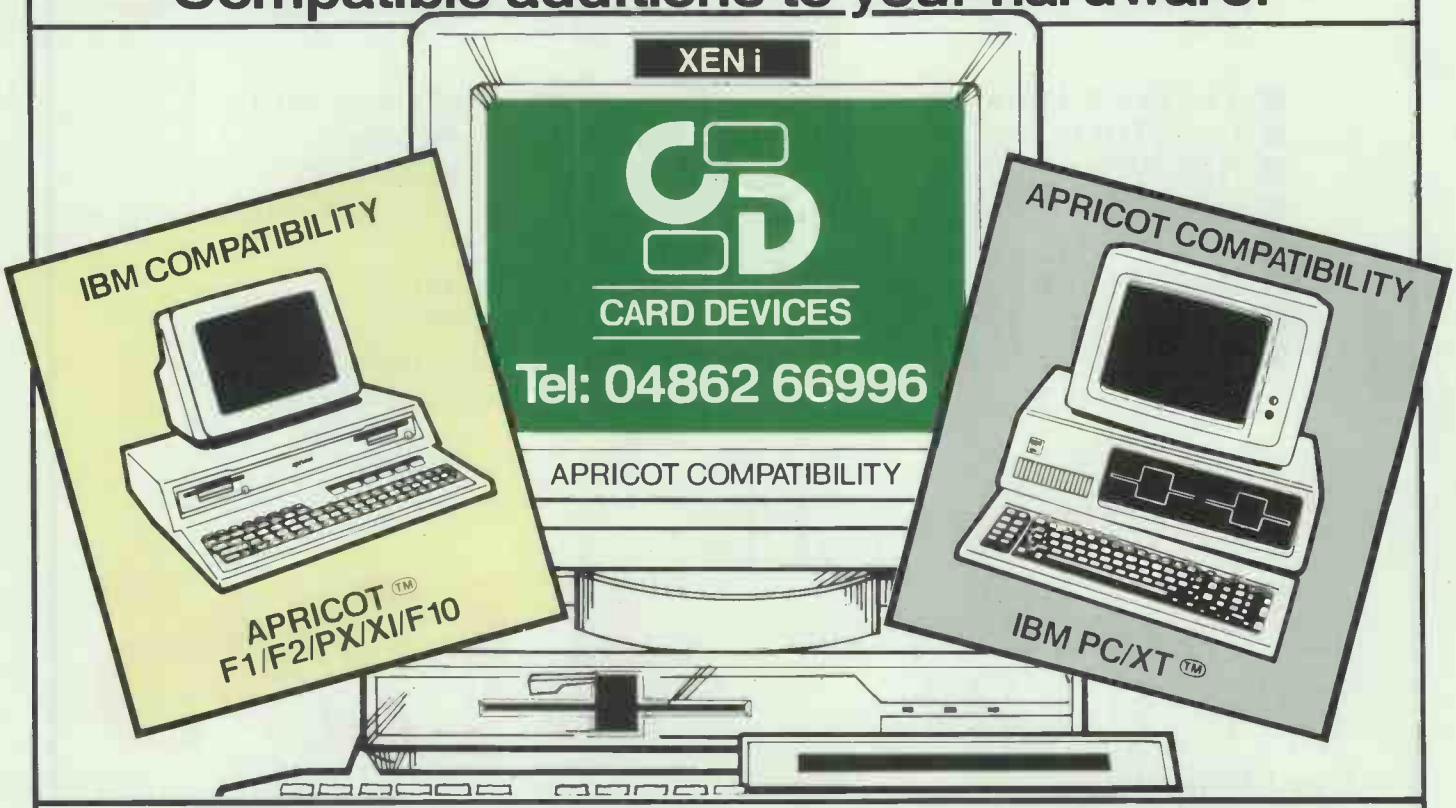
ELONEX (UK) Ltd.

Please feel free to visit our showroom for demonstration

RAYS HOUSE, NORTH CIRCULAR ROAD, STONEBRIDGE PARK, LONDON NW10 7XR TELEPHONE: 01-965 3225

Mix n' match

Compatible additions to your hardware.



Card Devices Ltd., market leaders in compatibility have the easy solution to all your compatibility problems.

Our very flexible software team enables us to offer file compatibility between the most commonly used P.C.'s listed as follows:-

£395 **XF400A** allows IBM PC compatibility with the APRICOT PC range, enabling you to read and write Data Files on either machine.

£395 **XF400S** allows IBM PC compatibility with the SIRIUS/VICTOR 9000 range, enabling you to read and write data files on either machine.

£295 **XF400X** allows IBM PC compatibility with the XEN 3½" PC enabling you to read and write data files on either.

£295 **XF700i** allows APRICOT PC compatibility with the IBM PC, XT, AT, and CLONES (please state when ordering) enabling you to read and write data files.

£350 **XF700S** allows APRICOT PC compatibility with the SIRIUS/VICTOR 9000 range.

£350 **XF700X** allows APRICOT/XEN PC compatibility with the XENi 5¼" PC, enabling you to read and write data files

£295 XF700A gives second drive (720k) on F1 range of computers including portable.

XM512 RAM CARD excellent value for your APRICOT PC/F1/Portable etc. 512k single card, no wait states. For Apricot PC range **£120**. Daughter Board RAM – For XEN & XENi range **£175**

THE EIGHT INCH SOLUTION FOR ALL THOSE DIFFICULT FORMATS THAT YOU WANT TO READ ON YOUR IBM PC, XT, AT & CLONES from formats such as S32, IBM 3740/3741, 4100, PDP11 and many others.

Designed and produced only by Card Devices Ltd. Please write or ring for further information. All Drive Subsystems supplied complete with drive, case, PSU, (where necessary) connecting cables, and software.
All products supplied with one year's warranty. Prices are exclusive of V.A.T. and carriage.

CARD DEVICES

Card Devices Ltd, Padmores Yard, St. Johns, Woking, Surrey GU21 1SE. Tel: 04862 66996/65634.

MICRO MEDIA Computer Supplies

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

0707 52698 or 0707 50913

Printer Ribbons

Mixed types for quantity breaks

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

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

Computer Labels

Continuous fanfold, sprocket fed

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

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

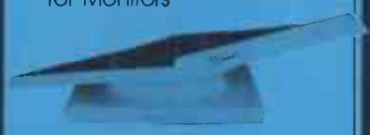
Computer paper

Plain fanfold, micro perfed edges except*

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

Swivel Bases

for Monitors



Pan tilt revolves around 360°
12.5° tiltable up and down
adjustable by front mechanism.
12" Monitors **£12.00**
14" Monitors **£15.00**

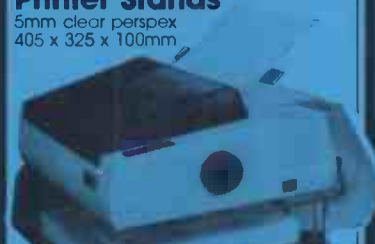
Adjustable Copy Holders

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

£20.90

Printer Stands

5mm clear perspex
405 x 325 x 100mm



80 column printers £19.90
132 column printers £24.90

The Space Saver

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

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

Micro Media Brand Universal 5¼" Discs

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

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

Unbranded 5¼" Discs

Certified lifetime warranty
hub rings, envelopes, labels
Prices per 10 Discs

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

Unbranded 3½" Discs

Lifetime Guarantee/label sets

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

3M 5¼" Lifetime Guarantee

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

3M 3½" Lifetime Guarantee

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

Verbatim Datalife 5¼"

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

3" Maxell Discs CF2/CF2D

Reversible
or DS 34.70 33.00 29.50

3M Data Cartridges

For tape streamers

3M Code	Storage Capacity MB	1+	5+	10+
DC 1000	10-20	17.80	15.70	14.80
DC 300XL	4.3	21.50	20.00	19.10
DC 300XLP	45	26.00	25.00	23.90
DC 600A	60	27.00	25.50	24.30

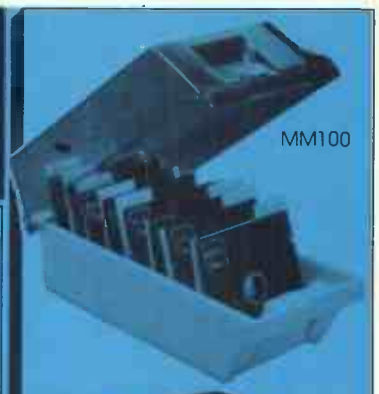
Head Cleaners

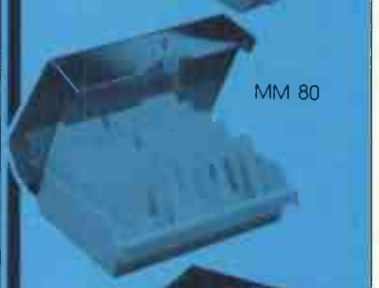
Discs with 15ml cleaning solution

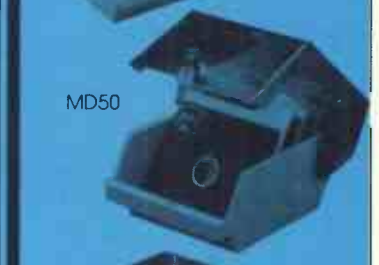
5¼" Head Cleaner 4.00
3½" Head Cleaner 5.00

Printout Binders

Adjustable hardback ring binder for 11x9½ to 12x9½ cont paper 40mm paper capacity
BLUE RED or BLACK £4.90 each
Set of 5 indexes £2.30







Disc Boxes

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

All MM/MD boxes anti-static with lock

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

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

ALL PRICES INCLUSIVE OF POSTAGE & PACKING

Please add VAT at 15%

24-Hour Credit Card Orders

0707 52698

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

PLUS 5

COOL CUSTOMER!

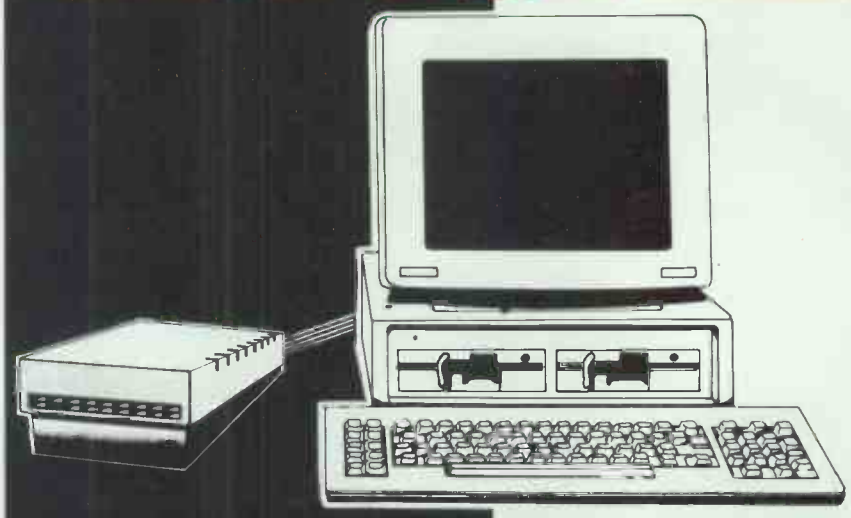
The AHD range: 10 to 40Mb External hard disc for the Amstrad PC1512.

Plus 5 are pleased to announce our professional hard disc solution for the Amstrad PC. THE AHD RANGE features half height hard disc drives in a compact external cabinet - NO OVERHEATING!

The AHD is simple to install with power supplied from the Amstrad PC and interfacing via a half size controller card fitted in one of the PC expansion slots. IDEAL FOR USE WITH TWIN FLOPPY PC'S.

AHD gives on-line storage equal to 40-160 floppy disks with fast access at a price you can afford.

Also available is a 20Mb PLUSNET version AHD. PLUSNET allows up to seven MS-DOS or PC-DOS computers shared access of the hard disc and permits transfer of software from one PC to another. PLUSNET requires no additional memory, fileserver or multi-user software.



AHD10	10Mb hard disc	£349
AHD20	20Mb hard disc	£399
AHD30	30Mb hard disc	£549
AHD40	40Mb hard disc	£739
AHDP20	20Mb PlusNet hard disc	£549
HA/1	PlusNet host adaptor (for 2nd and subsequent PC's)	£350

PLUS-FD

PCW to PC1512 COMPATIBILITY!

Our unique PLUS-FD add on 3" floppy drive for the AMSTRAD PC1512 makes data transfer between the PCW and PC1512 (or any IBM and compatible) as simple as inserting a floppy diskette!

IMAGINE - Your valuable locoscript files may be transferred to your PC without re-input at the keyboard. THIS PRODUCT IS A MUST FOR ANYONE UPGRADING FROM THE AMSTRAD PCW! PLUS-FD only £150

PLUS 5 Products are covered by 12 months parts and labour warranty. ON-SITE MAINTENANCE available. Prices subject to VAT.

Available from:

PLUS 5 ENGINEERING LIMITED

Crowborough Hill, Crowborough, Sussex TN6 2EG. Tel: (08926) 63211
Telex 95538 PLUS G

Access VISA Mail and Telephone Orders welcome.

CONTACT

Communications
Software for IBM PCs and compatibles

You will have heard of Contact but may not be aware of just how powerful and easy to use it is. So here are a few of its features in more detail:

Automatic Sequences

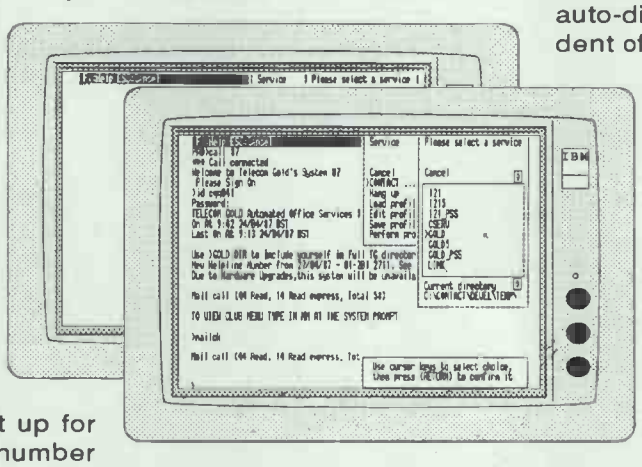
With Contact we provide powerful Automatic Sequences to enable your computer to automatically login to Telecom Gold (or One to One, Link7500 etc.) collect your mail and logoff. It will then print the mail out properly paginated at any time of the day or night you choose! Of course you can easily write your own sequences too.

VT100 and Viewdata

Contact offers both a high quality VT100 emulation and a full screen Viewdata display. For those with Amstrad PC1512s or IBM PCs with an EGA card the display is in full colour. The VT100 emulation is extensive. With VT100 you can move away from scrolling screens - giving much faster screen update. Most importantly files can be captured to disk with all the escape sequences removed - so you get a text file that really can be edited by your word processor or fed into your database.

Programmable Function Keys

The menus can be pulled down with a mouse or by pressing function keys. In addition you can program each of the 10 function keys with a sequence of commands. For example you could set F5 to contain "Mail Scan Unread" or for Prestel F5 could contain *72195# to take you straight into "Datasearch".Not only can each function key contain up to 80 characters but all 10 can be automatically set up for each of the unlimited number of different services you may want to contact.



Voyager modem? - fine!

Naturally Contact supports virtually all of the usual auto-dial modems but, being independent of any modem manufacturer, we also support some of the less common types; such as the Voyager.

Contact costs £79.95 and is available in two versions: one for the IBM PC and compatibles and the other for the Amstrad PC1512. To place your order or request more information please complete the coupon below and return it to:

X-ON Software Ltd.,
65 Victoria Road,
London N22 4XA.
Telephone 01 881 3659

☐ Please send me Contact for IBM PC or compatibles
☐ Please send me Contact for Amstrad PC 1512
☐ Please send me more information about Contact

I wish to pay by cheque / postal order / Access
Please debit my Access account with the amount of £79.95 - My Access number is

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Signature _____

PC WEEK1

Name (as on Access card) _____

Address _____

_____

_____

_____

Telephone ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

IBM PC SOFTWARE FOR BUSINESSMEN

When it all gets too much, when there's a lapse between board meetings and client presentations, wouldn't you like a chance to.... ESCAPE. Now you can without leaving your office. Entertainment and excitement is at your fingertips to a degree unparalleled on other systems.

DESTROYER
The time is 1400 hours – somewhere in the Pacific. Now you find yourself at the helm of the deadly Fletcher Class Destroyer commanding the greatest concentration of firepower ever put in a lightweight fighter. Can you master the wars of the sea?

£24.99

LEADERBOARD
Time to fit in a quick game of golf? Anything's possible with a computer and with Leaderboard you'll get all the pleasure, aggravation and stimulation of true golf simulation.
"The sports simulation of the year – if not the decade".

£24.99

SUB BATTLE SIMULATOR
Dive... Dive.... Dive...
Test dive any one of 6 different US Navy submarines or German Kriegs marine U boats and patrol the Pacific or Atlantic Ocean in the maelstrom of conflict between 1913 and 1945.

£24.99

STRIP POKER
Definitely something different!! Settle down for a sizzling game of Strip Poker with 2 gorgeous opponents, Suzi and Melissa. The more chips you win the more they take off. When you think about it you can't lose.

£19.99

DAMBUSTERS
This is the stuff heroes are made of, this is, your chance to play a part in one of the most legendary missions of World War II. Draw up your nerve, courage and skill as you relive the excitement, tension and drama of this historic operation.

£19.99

PSI5 TRADING CO.
If you're ripe for a challenge and feel comfortable in the role of space freighter Captain, your ship just came in as you take command of a space ship of the future on one of the all-time great adventures of the 35th Century.

£19.99

WORLD GAMES
Wing your way round the globe and beat the pants off the foreign competition in eight international events, each one authentic to its country of origin.

£24.99

BRUCE LEE
The legend lives on...
Experience the power and the glory of Bruce Lee, one of the greatest exponents of the martial arts.

£19.99

INFILTRATOR
Imagine yourself 'The Infiltrator' – ace helicopter pilot, super soldier, all round 'devil may care' good guy. Your mission... To save the world (at least!!) as it stands on the brink of complete destruction.

£24.99

U.S. GOLD® All American Software

Even Businessmen like a bit of fun

U.S. Gold Ltd.,
Units 2/3 Holford Way,
Holford,
Birmingham B6 7AX.
Tel: 021 356 3388.

A Minstrel 4 eight-user package – £15,465 complete INCLUDING LASER PRINTER

We've built a proven reputation as leading Specialists in multi-user networking. Each Minstrel computer provides performance and flexibility for 2 to 16 users operating their own individual processors.

- *From 2 to 4080 Simultaneous users (up to 16 per machine)*
- *From 0 to 4080 printers (up to 16 per machine)*
- *Up to 147,900,000,000 characters of on-line storage (580Mb per machine)*
- *Network in up to 254 IBM PCs of any description.*

Currently, we're offering an eight user Minstrel system with integral tape back up, a laser printer and a Minstrel office automation Softpack. All for £15,465 excluding VAT. 145Mb formatted capacity Winchester Disk Drive is £3,725 extra. Each additional 2 users are £2190 complete.

Additional high performance software for accounting, point of sale, hospital administration, databases and many other applications are also available.

For further information simply call us or send the coupon below.

HM Systems plc

HM Systems plc,
220 The Vale, London NW11 8HZ.
Telephone: 01-209 0911.
Telex: 266828-HMS G

Please send me full details on Minstrel multi-processor systems.

Name_____

Title_____

Company_____

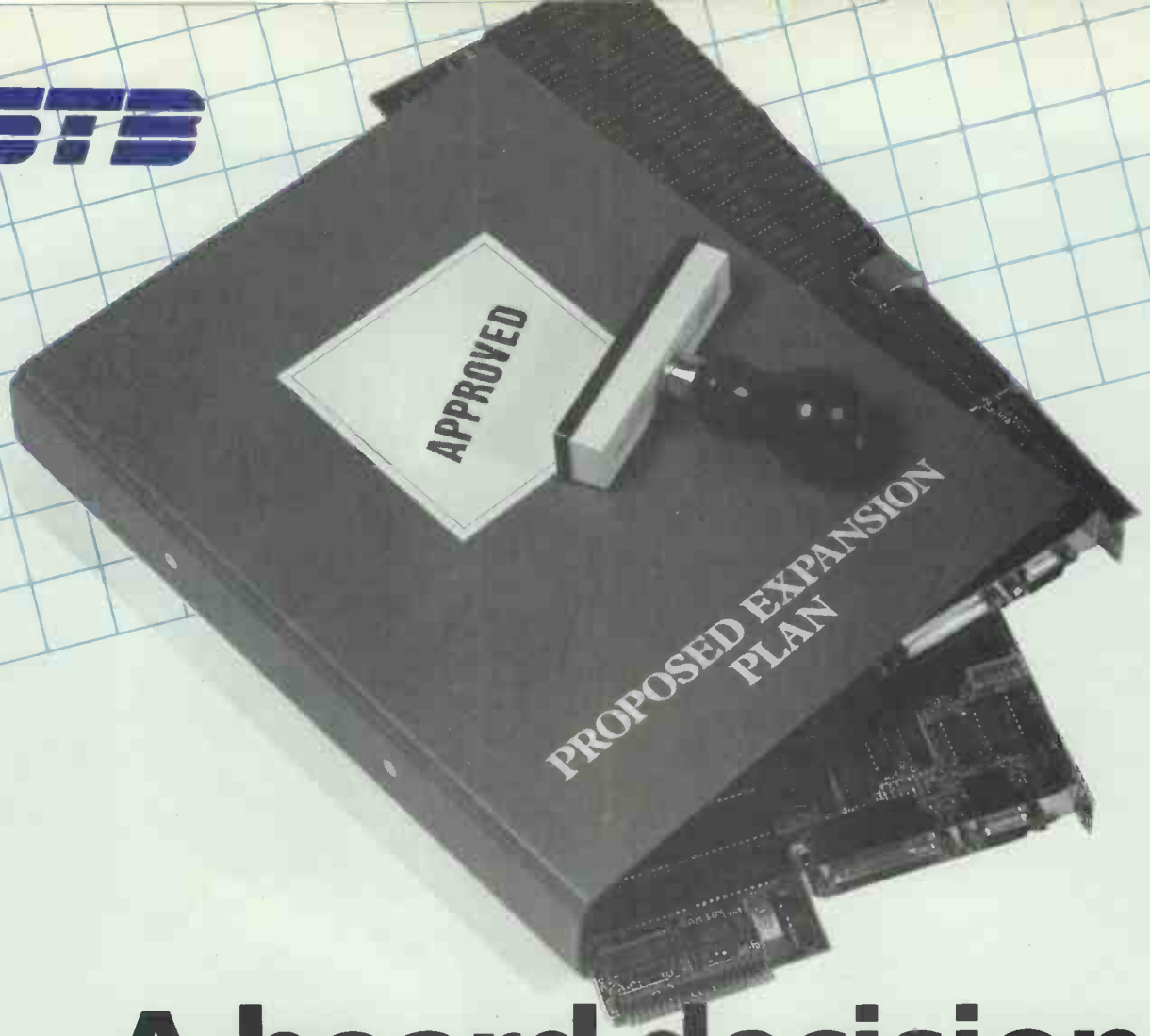
Address_____

_____

Phone_____

NEW MINSTREL 4E.P. OUT NEXT MONTH .. FASTER AND BETTER!

STB



A board decision

The performance and reliability of STB enhancement products has been proven by large OEM's both in the USA and the United Kingdom since the company was founded in 1981.

The STB memory and multifunction products available today are able to meet the majority of user needs in the enhancement market place.

STANDARD MEMORY REQUIREMENTS are met by using:-

STB C-RAM 384
A CMOS memory card providing 384K memory expansion for the IBM convertible PC. Taking total memory of 640K using one expansion board.

STB Memory Companion
Providing up to 2 MByte of memory meeting the LIMS specification for use with the Lotus, Ashton-Tate, and Auto Cad software packages requiring paged memory devices.

STB Grand Byte
For use with the IBM AT and compatibles, providing up to 2.5 MBytes of expansion memory with split memory addressing and use of either 64K and 256K DRAMS on the same board.

STB Rio Plus II
For the 256K PC and XT upgrade to 640K and providing serial and parallel I/O plus clock calendar and game ports if required.

STB Rio Grande
When you have an IBM AT or compatible requiring memory and I/O upgrade, the RIO GRANDE provides up to 1.5 MByte of memory expansion plus serial and parallel I/O with an optional games port and second serial port.

STB SER/PAR
Adaptor provides you with the basic Serial/Parallel output required when you already have the memory you require.

If you cannot see your exact requirement for memory or I/O here, call Technitron X-Data and discuss your problem. You may be surprised at how quickly your problem can be resolved.

Technitron X-Data supports the STB range of products with advice, problem solving and liaison for special applications.

Make a sound board decision, phone Technitron X-Data and buy STB products from your nearest Dealer.

Technitron
X-DATA

A member of the Technitron group

TECHNITRON X-DATA Ltd. 750/751 Deal Avenue Slough Trading Estate Slough Berks SL1 4SH Tel: Slough (0753) 31292 Tlx: 847728

UNITED KINGDOM ■ DENMARK ■ FRANCE ■ HOLLAND ■ ITALY ■ NORWAY ■ SWEDEN ■ WEST GERMANY

A Viglen PC.

FROM £449 +VAT

What IBM Compatibility is really about

IBM compatibility means different things to different people. But to us it means that our range of PCs must take known IBM PC, XT and AT software.

So what's the difference (apart from the price) between Viglen and our somewhat larger brother?

Quite simply that in all cases Viglen offer higher memory capacities for our basic systems than those offered by IBM (sorry, big brother).

Viglen produce the full range of IBM Compatibles, from the PC through to XT and our top of the range 8 MHz AT286 compatible.

All Viglen Compatibles are *hardware switchable* from the super fast turbo speed of 8 MHz down to standard IBM processing speed. This feature ensures full compatibility with software, network hardware and display adaptors.

You can choose high resolution monochrome, colour CGA, EGA or PGA systems, single or dual disc drives or up to 40 megabyte Winchester. Our VPCXT and VPCAT come with 1 megabyte RAM expansion *as standard*.

Viglen VPC and VPCXT systems are supplied with a word processor, spreadsheet, and database enabling you to use our machines immediately without incurring high software costs.

All Viglen PCs can be supplied with MS DOS 3.2.
MS windows are standard on our IBM AT compatible, the VPC AT.

When you consider that we've been in the PC market virtually since it began and that all of our machines have a four layer PCB and assembled and serviced in the UK, you'll know what IBM compatible is really about.

It's about specifying Viglen PCs instead of a big name machine (with matching price) or a little known machine (with little use for your business). Each PC comes with a full 12 month warranty with an optional two-year on-site maintenance contract (8HR callout).

Simply call John Hegarty or our PC Sales Desk on 01-843 9903 for the address of your nearest Viglen Primary Contact. Special education discounts.

Viglen

The Perfect Partners

Unit 7, Trumpers Way,
Hanwell, London W7 2AQ.
Sales Hotline 01-843 9903
Telex: 919 304 VIGLEN G
Fax: 01-574 5126

SURPLUS COMPUTER STOCKS

MORGAN COMPUTER CO. DISPOSAL OF SURPLUS INVENTORY, LIQUIDATED STOCK, DEMO & USED COMPUTER MERCHANDISE

APRICOT

Apricot 9 inch mono mon	£35
Apricot Pertmaster	£95
Apricot 128k expansion card	£55
Apricot internal modem	£95
Apricot Portable 256k	£395
ACT F10 daisywheel printer	£350
Micro Modeller	£100
File Transfer	£45
Calcmaster	£65

HEWLETT PACKARD

*HP 7550A A3 plotter	£2500
HP 150 inc 15mb hard disk	£1250
HP 150 model II inc d/drive	£1500
HP 7470A Plotter RS232 HP-1B	£695
HP 7475A Plotter RS232 HP-1B	£995
*HP Tilt unit 92240A	£20
HP 125 terminal & kbd	£250
HP 86a cpu	£450
HP 150 mkII touch screen opt	£95
HP TMS prop I font cartridge	£50
HP 110 Lapheld inc Lotus 123	£595
HP monitor 829134	£95
HP 85 Surveying Pac	£45
Acoustic hood 26764A	£100
HP83 Computer (demo)	£150
HP 7225 Plotter HP-IB	£225
HP 82905B RS232 printer	£250
HP 2674A thermal printer	£95
HP Think Jet HP-IB HP-IL	£195
CP/M system for HP80 series	£100
Graphics Presentation Pac HP87	£55
Visicalc Plus	£45
*HP-IB cable, 1 metre	£25
Linear Programming Pac	£25
*Memo Maker HP150	£45
*Multiplan HP150	£100
*Wordstar HP150	£100
*Mailmerge HP150	£75

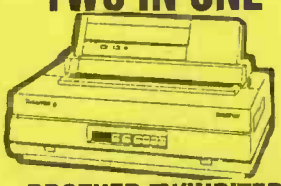
PRINTERS

Honeywell L34 CQ	£300
NEC P7	£350
Juki 6100 daisywheel	£150
Juki 5520 colour dot matrix	£195
Fujitsu DMPG 9 IBM compat	£150
Siemens ink jet PT88	£125
Brother HR1	£99
Brother HR5	£65
*Ricoh RP1200N daisywheel	£195
*Brother M1109 RS232 & para.	£175
Ricoh RP1300 parallel d/whl	£250
Ricoh RP1600 parallel d/whl	£495
Microline 193 parallel 132 col	£195
Dyneer DW20 daisywheel para	£195
Qume 11/40 plus demo	£395
Qume 11/55 demo	£550
*Silver Reed EXP400 D/W RS232	£150
*Silver Reed EXP500 D/WRS232	£175
*Silver Reed CF-120 EXP500	£120
*S/Reed T/F EXP500 & EXP400	£85
*Ziyad s/feeder for Qume	£50
*NEC Pinwriter P2 18 pin	£225
C Itoh M1550 latest model	£195
Triumph Adler 7020 RS232	£150
Ricoh 1600Q d/whl	£550
Brother Sheet Feeder	£125
Brother HR15 parallel d/whl	£175
*Serial 8056	£45
*NEC 3550 Qume interface	£350
IDS Prism 132 dot matrix	£195
Dec LQP02 slight demo	£500
Honeywell L32i IBM compatible	£175

PHILIPS

*P2012 64k 2 x 640k drives	£425
*P2010 64k 2 x 160k drives	£325
*10 mb upgrade inc controller	£495
Fitting extra	£35
*256k 16 bit/ MS-DOS upgrade	£110
Fittlng extra	£25
*Technical Reference Manual	£35
*CP/M Reference Manual	£35
*Carrying case	£25
Printer cable	£15
*Cardbox database	£45
*Sorcim Supercalc spreadsheet	£75
*Dataman database	£65
1 year 24hrs on-site contract	£169
Ditto for P2010	£125
CP plus CP/M front end	£25
Plannercalc spreadsheet	£35

TWO IN ONE



BROTHER TWINRITER

Unique double printer, dual printhead, daisywheel speed 40cps 160cps dot matrix (DEMO) **£495**

MED RES!

MICROVITEC CUB D1456

Medium resolution colour monitor (apprx 650 x 580) for IBM compats, (SLIGHT DEMO) **£125**

FLEA MARKET

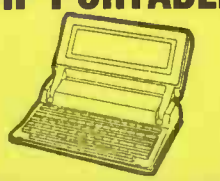
PARTS ONLY, NO WARRANTY GIVEN

Major parts Sanyo 555	£45
Compaq mono monitors	£45
ACT Sirius complete	£295
Linokey 2 inc disk drive	£450
Assorted computer boards	£5
Decwriter II	£95
IBM 5¼ inch 360k floppies	£30
No-name 132 col printer fast	£75
Osborne I brown case	£95
*NEC 64k Dram chips each	£1
110v 1000W transformer	£10
*OKI IBM Plug'n Play	£25
Portascribe O/H projector	£125
Tandy Model III 16k	£45
*DRE ICL 2348 hard disk	£995
War surplus 5¼ foppies 10s	£6
Bit 24 for BBC	£15
*Scotch DC300 A data cart	£10
110v Nec Spinwriter	£250
*Omega cassette recorder	£15
Diabolo typewriter/printer	£95
Xerox/Remington typewriter	£50
Apple disk drives uncased	£35
Ricoh 1600	£99
*IBM DOS 1.1	£10

EPSON

P 80 printer demo	£75
CX 21 Acoustic coupler	£65
Tractor feed for SQ 2000	£35
*PX8 inc software	£395
*TF-20 dual floppy	£250
*TF-15 dual disk drive	£295
Sheetfeeder 7334 for LQ-1000	£95
Sheetfeeder 8344 for LQ-1500	£125
P40 thermal printer demo	£45
LQ 1500 demo	£395
PX-8 (very slight demo)	£325
*PX Ramdisk 128k	£125
*RS232 interface LQ-1500	£35
SQ 2000 demo	£795
RX-100 + demo	£200
HX-20 inc microcassette demo	£195
MX/FX 80 serial adaptors	£20

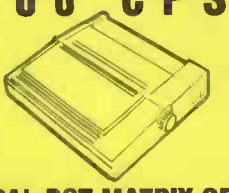
HP PORTABLE



HEWLETT PACKARD HP 110

Laptop c/w Lotus 123, inc MS-DOS 384k Rom & 278k Ram, AC adpt. (DEMO) **£595**

100 CPS!



COPAL DOT MATRIX OFFER

Direct from the liquidator, 100cps, 80 col, friction or tractor, full documentation,(NEW) **£99**

MISC

Compaq 286 Deskpro 30mb	£1895
Apple Europlus CPU	£195
*Keytronic kbd for IBM PC	£75
Superbrain inc software	£250
ARC AT compat	£995
Apple IIe	£325
Kaypro 2000 EXP box	£250
Televideo 1605 pc compatible	£595
Televideo 1605H ditto inc 10mb	£795
Atari 130 XE	£95
PR1 acoustic coupler	£25
Compaq Plus inc 256k 10mb	£1100
Compaq Portable 256k	£895
Apple Macintosh 128k	£595
*Buzzbox modem inc PSU	£45
*Dacom Auto answer modem	£65
Tandon PCA 20 mono AT comp	£1500
Polaroid Palette demo	£750
Fat Mac 512k demo	£795
Compaq Deskpro 10mb	£995
Kaypro 2000 inc software	£695
ACT Sirius inc mon & kbd	£495
*Steebek-Dowty SB1212 V22	£250
*Apple Profile 5mb	£350
Apple II/III disk drives	£95
Kimtron terminal	£250

IBM HARDWARE

IBM PC 64k, inc monitor & kbd	£550
IBM PC 512k complete	£695
IBM XT 640k 10mb complete	£995
IBM PC 256k 10mb complete	£795
IBM ATX 512k 20mb colour	£2500
IBM AT co-processor	£95
IBM SDLC card	£50
IBM AT serial cables	£35
IBM Async Comms card	£50
IBM base colour display	£150
PC Express card	£150
*Orchard PC turbo 186	£295
*AST Colourgraphplus	£50
AST Rampage AT	£200
*AST Sixpak inc 64k Sidekick	£150
IBM Convertible as new	£1295
*Quadboard 384k card etc	£125
Dyneer colour monitor	£195
Mountain 30mb internal drive	£450
IRMA board	£495
*Microsoft Pascal compiler	£195
IBM Quietwriter 1	£450
*Intelligence Res PC Express	£150
Tecmar AT multifunction card	£150
Ideadisk 10mb & 5mb backup	£500
*5250 card, cable, program	£395
*IBM uncased 5¼ floppies	£65

IBM SOFTWARE

Displaywrite 3	£200
DOS 3.1 tech ref man	£20
AT/X HMS	£50
*IBM Pascal	£75
*Calc-it 3D Spreadsheet	£95
*Show-it graphs package	£45
*Ask-it compliments Keep-it	£25
*Sort-it ditto	£25
QED	£95
PFS Graph	£20
PFS File	£20
PFS Report	£20
*Micropro Datastar	£65
*Micropro Wordstar 2000	£195
*Keep-it database	£95
*dBase II Multi user	£350
*dBase III plus	£295
*Edit-it simple text editor	£35
*Peachtree Dec Manager	£45
*Easy Junior A/C package	£150
*Word Plus PC inc BOSS spell	£75
*Calcmaster	£75
*Fox & Geller Quickcode	£75
*Superterm 400	£95
*Superterm VT100	£95
Word Perfect vers 3.00	£225
*Visicalc IV	£65
*Visiword	£35
*Visi Desktop/plot	£20
dUtil	£45
Quickcode	£65
*Easywriter II	£85
*Multiplan	£65
*Omnifile	£95
Lotus 123	£150
*Multimate word processor	£95
*Graphwriter	£250
Executive Writer VP software	£35
Number Works VP software	£35
Framework integrated s/ware	£195
Cadplan	£550
Hardware man Portable	£50
DG Blast	£100
GTO IBM XT	£35

Part exchanges accepted.

** indicates brand new goods*

Morgan Computer Co.

ACCESS AND VISA ACCEPTED
PRICES SUBJECT TO 15% VAT
MAIL ORDER (CARRIAGE EXTRA)

179 TOTTENHAM COURT ROAD, LONDON W1. 01-636 1138

OPEN MONDAY TO SATURDAY
PRICES SUBJECT TO CHANGE
GOODS SUBJ. TO AVAILABILITY

CHROMASONIC
Computer Centres

Authorised Dealer

Stress Rating Survey

	Tick below Yes	No
1. Do you manage information ?		
2. Do you need to have the facts at your fingertips ?		
3. Do people hang on your every word ?		
4. Do numbers figure in your work ?		
5. Does most of your work end up in print ?		
6. Do you wish to use a letter quality printer with your Macintosh ?		
7. Do You wish to use IBM created files on your Macintosh to alter them ?		
8. Do you long for ease of use ?		
9. Do you wish to share the Macintosh Laserprinter using your IBM ?		
10. Do you wish to share data between the Macintosh and IBM ?		

Tick any box and then phone CHROMASONIC for immediate stress relief with the ;-

Macintosh Business Solution

01 444 3563 Muswell Hill Centre **or** **263 9493/5** Archway Centre

or post this coupon to get our immediate attention.

To CHROMASONIC *Computer Centres*
238 Muswell Hill Broadway, London, N10 3SH

Please supply solutions on item numbers

Company Name

Position

Address

A star is born
MODULA-2
From Pecan

Looking for a compiler? Stop here!! Pecan's new Modula-2 boasts an array of features to make it the envy of its competitors:

• Portable Program Code. • Native Code Generation • Fast Compilation, Compact Code Files • Separate Compilation of Modules • Extended Precision and BCD Arithmetic • Event-Driven Multitasking and Process Synchronisation • Integratability with UCSD Pascal, FORTRAN-77, BASIC and Assembler • IEEE 64-Bit Floating Point Format with full 8087 support • Supports up to 16MB of Addressable Memory for Code Space • On-Line Documentation.

THE PECAN POWER SYSTEM •

The force is with you! The formidable Pecan Power System is available at only £99.95 exc. VAT and includes:-

• Advanced Systems Editor • Native Code Generator • Graphics • Filer • 8087+BCD Support • Choice of Compilers – MODULA-2, PASCAL, FORTRAN-77, BASIC.

VERSATILITY PORTABILITY •

With Pecan products there is no need to limit yourself to one make of hardware. Versatility is the keyword and a system can be developed across a range of equipment with unrivalled ease. The program code can easily be transferred to other computers. The Power System is available on PC DOS, MS-DOS, Amiga, Atari ST, Amstrad 1512, Comart, Commodore 64 & 128, Macintosh, Tandy, Apple II (including new Apple II GS), DEC Rainbow, Stride and most popular 8/16/32 bit systems – also available for VAX Unix, and DEC PDP II.

• Special pricing for educational establishments, dealers and distributors – ask for details.

REVIEWS •

"... Recommended based on its superior development environment... Its compiling speed, and its relative polish."
PC Magazine

"... an excellent product in virtually every respect."
Info World

SEND YOUR ORDER THROUGH TO PECAN NOW
Enquire for our free comprehensive brochure and modestly priced listing of add-on utilities.
Pecan products are not copy protected

PECAN®
The UCSD Pascal Company

PECAN SOFTWARE EUROPE, MGM HOUSE,
OAKFIELD GROVE, CLIFTON, BRISTOL BS8 2BN
FAX NO. 0272 744875
TELEPHONE 0272-733633

VISA

FREE SOFTWARE?

SPECIAL SELECTIONS FROM THE PUBLIC DOMAIN (0344) 86 3020

Well, almost free. We don't charge for the public domain and user supported software but there is a small service charge from £6 per disk to cover promotion costs, selection, testing, copying, etc. We have disks for MS-DOS and CP/M. Mail and telephone order only.

Out of the thousands of programmes we have collected, we bring you a SELECTION OF THE BEST that have been carefully tested and documented. They'll run on a wide variety of computers that will accept 5¼" disks.

MS-DOS programmes are intended for the IBM-PC and close compatibles. Documentation is included on the disks, where required.

MS-DOS

Disk No. GAMES

M1: SPECIAL COLLECTION. A graphic, intelligent adventure, a space trek and a surprise called Bouncing Baby.

M3: ORIGINAL ADVENTURE. The original classic in C, with source.

M4: SELECTED BASIC GAMES. More than 20 games, including Blackjack, Catch88, Eliza, Meteor, and Pacman.

M5: SUPER COMPILED GAMES (1) Eight very good arcade games, including Pango, Gold, Pyramid, 3-Demon, etc.

M6: CHESS. Several extensive versions of this well-written game. Has graphics.

M8: SELECTED FAMILY FUN GAMES. 2 Flight Simulators, Music Generator, excellent Pacgirl, Space Wars, etc.

M11: MONOPOLY. Several excellent computer versions of this popular board game.

M13: DUNGEONS & DRAGONS. Cave Quest – a very good adventure game. If you like monsters and magic this is for you.

M17: PINBALL GAMES. Contains three fascinating games of varying degrees of difficulty. Engrossing.

M1022: SUPER COMPILED GAMES (3). Arcade type games. Includes Kong, Striker, Spavevade, Life2 and Frog.

M1023: GREAT BASIC GAMES. Over a dozen, including Wizard, Xwing, Combot, Mars, Racecar, CIA. Requires Basic.

M1037: POOLS AND LOTTO. Choose your numbers and the game does the rest.

M1038: TAROT AND I CHING. A choice Aussie contribution. Reads your "cards" or "throws" coins or yarrow sticks.

M1039: JOKES AND INSULTS. Harmless practical jokes on computer users. Also surprises with insults on screen.

M1040: YACHT RACE SIMULATION. Interactive, extensive and fascinating. Based on America's Cup match racing.

UTILITIES

M26: UTILITIES FOR PERSONAL MANAGEMENT. Similar to Sidekick, with calculator, notepad/editor, phone index, alarm clock, calendar, printer controls, etc.

M27+: UNPROTECTION METHODS. Hints and programmes that help you to back-up a variety of copy-protected programmes. 3 disk set for £24.

M32: DISK DOCTOR COLLECTION. Excellent debugging and file repair programmes. Includes Jaz, Easy-Zap, Diskit, etc.

M33: HARD DISK UTILITIES. Special set of dozens of highly useful utilities for greater efficiency.

M34: MULTI-TASKING SHELLS. Two excellent DOS Shells which allow you to operate and execute from a menu-system – Dosamatic and Still River Shell. Interrupt tasks and switch to other programmes.

M35: CP/M EMULATION. Run CP/M software on your PC. Well-documented and source coding is provided.

M2030: SYSTEM SNOOPER. Has device drivers, utility tutorials, marks bad blocks, diagnostics, redirects output, etc.

M2031: STRATFORD UTILITIES. Has demon for backing-up some difficult programmes, replaces joystick commands with cursor control and more.

M2032: NANOVISION UTILITIES. Converts text files to com files for self-display; memory-resident page; visual file deletion. More.

M2033: SELECTED MENU SYSTEM. Menus are created with word processor. 10 options per menu; sub-menus, etc. Makes usage friendlier.

M2034: MULTIPLE FILE CATALOGUER. Catalogues for word processing, databases, games, etc. Searches, sorts, prints reports and directories.

M2035: MORE HARD DISK UTILITIES. A super collection for optimising disk usage. well worth having.

M2036: PC SPEED-UP. Inexpensive way of getting more out of your hardware. Diagrams need Epson-compatible printer.

M2037: MANAGING MEMORY-RESIDENT UTILITIES. Organise and control memory better.

WORD PROCESSING

M42: TYPING TUTOR. Improve your keyboard work. Menu-driven, easy to use.

M43: MULTI-FONT WRITER. On-screen scientific notation. Greek letters, gothic, bold, italics, etc. Recommended.

M48: OUTLINER FOR WORD PROCESSING Considered by many to be the best outliner/ideas processor available.

M49: FORM LETTERS. Examples of the most commonly-used business letters – dozens of them.

M3014: SIDEWRITER. Generates printed output sideways to fit wide reports on to a page.

M3019: PROGRAMMERS EDITOR for source code editing in structured languages. can be memory-resident. Built-in doc.

GRAPHICS

M61: GRAPHICS. Some of the best programmes, including picture-graphics set of commercial standard.

M62: SLIDE PRESENTATION. Prepare transparencies for overhead slides.

M66: EXTENDED FONT CHARACTERS – A utility for Epson-compatible printers that will print all of the printable characters of MS-DOS character set.

M67+: COMPUTER-AIDED DESIGN. Powerful control over drawing, graphics, printing, and slide show. Two-disk set £18. Requires colour monitor.

LANGUAGES

M85: PASCAL. A popular language for general programming. Good choice for learning to programme.

M94+: ARTIFICIAL INTELLIGENCE. These 2 disks contain TWO expert system shells – Esie and Expert. £18. They help you gather information and make a recommendation.

M95+: BASIC LANGUAGE. Interpreter with manual. 2 disks. £18.

COMMUNICATIONS

M101: TWO MAJOR COMMUNICATIONS programmes – Qmodem and Kermit. Lots of bells and whistles.

M6010: PROCOMM. Many featured programme for contacting bulletin boards.

M6012: UK BULLETIN BOARDS. A comprehensive listing of bulletin boards in UK. M107 is an Australian listing.

BUSINESS/CALCULATION

M121: GENERAL LEDGER ACCOUNTING. A small-business recording system. Highly regarded. Excellent reports.

M124: STOCK MARKET ANALYSIS. Special aids to help you "think and grow rich". For managing and evaluating portfolios and prospects.

M125: GOAL/TIME MANAGEMENT. For goal-directed organisation. Arranges information, prompts action.

M126: STATISTICAL ANALYSIS. Many programmes in Basic for analysis – Chi, Regression, Fisher, Binomial, Variance, Histogram, Polsson, Correlation, etc.

M127: SPREADSHEET. Easily used, comprehensive programme.

M128+: INTEGRATED PACKAGE. Three disks. Includes integrated word processor/spreadsheet/database/graphics. £24.

M129: 1-2-3 UTILITIES. Highly regarded collection of utilities that enhance the operations of Lotus 1-2-3.

M132+: 1-2-3 WORKSHEETS. Comprehensive special set of worksheets, aids and utilities. £54 for 8 disks. (Does not include M129.)

M136: PROJECT MANAGEMENT. Will handle 1000 tasks and does critical path analysis, cash flow, bar charts, cost reports, etc.

M137: STOCK CHARTING SYSTEM. Records highs, lows, volumes, prices, etc. In Basic.

M7029: INTEGRATED ACCOUNTING. General Ledger, Cash Book, Debtors, Payroll, etc – all on one disk.

M7030: CALCULATERS' COLLECTION. Calculations for various occasions – programming, school, finance, many digits, etc.

M7031: PERSONAL FINANCE MANAGER. Manages cheque and credit card a/cs, savings, purchases, withdrawals, interest, budgets.

DATABASE MANAGEMENT

M142+: DBASEII/III APLLICATIONS. Extensive group including: cheque payments, mail management, inventory ctl, budgeting, accounting, depreciation, general ledger, graphics, etc. 5 disk set £36.

M143+: FAMILY TREE/GENEALOGY. Recording, tracing, grouping, printing family tree. In Basic. 2 disks with documentat. £18.

M147: DBASEIII SCREEN CODE GENERATOR. Greatly reduces the amount of programming you need to do. Generates coding to include in your own programme.

M150+: DATA BASE MANAGER. Suits sales/stocks/mailing/personnel/payroll. Calculates, prints invoices etc. 2 disks £18. Has full documentation.

M151: MAILING LIST MANAGER. You can add, edit, sort, and print mailing labels for all members or selected groups.

M152+: RBASE LOOKALIKE. Operates as standalone system in menu and command modes or will drive application programmes. 3 disks. £24. Requires hard disk.

M8012: LABEL PRINTING. Collection that allows you to print labels for all sorts of uses, as well as control mailing lists.

M8013: FREE FILE. Menu-driven, easy to use relational data base that allows 100 fields and up to 2 billion records.

M8015: RETAIL INVENTORY. Menu-driven, very fast system for keeping inventories up to date.

M8017: PRODUCTION DATABASE. Keeps track of suppliers, materials requirements, product costs, etc.

EDUCATION

M201: BASIC TUTORIAL. How to programme in Basic. Onscreen demonstration and explanation.

M203: MATHS TUTOR. A Basic programme that suits primary classes. Has six grades of arithmetic training.

M204: PC-TUTOR. Learn more about the operation of your computer, the important commands, etc.

M9007: SECONDARY MATHEMATICS. Collection of Basic programmes that provide instruction in key areas.

M9015: FOREIGN LANGUAGES TUTORIAL Has instruction for French, German, Italian, Spanish and Hebrew.

M9016: LOTUS 1-2-3 TUTORIAL. Advanced techniques when developing spreadsheet skills.

M9017: DOS TIPS AND HINTS. Collection of advice on printing, screen, keyboard, colour, batching, booting, AT keyboard, etc.

GENERAL

M9501: DIETER'S FRIEND. Nutritional analysis programme compares your intake.

M9502: SPORTING ADMINISTRATION. Helps run events, match opponents, report results.

M9503+: BIBLICAL QUOTES. 14,800 cross-references to 7956 verses of new testament for talks, sermons, essays. £18.

SHAREWARE REQUIRED FOR INTERNATIONAL DISTRIBUTION

We have extensive marketing and distribution facilities locally and overseas and require quality software for international distribution. Adequate documentation should be on the disk. Please forward submissions to our Chief Executive at the address below.

CP/M

Call or write for free catalogue.

PUBLIC DOMAIN NEWSLETTER

For news, reviews, views and how to use public domain and user-supported software subscribe to our bi-monthly newsletter and keep informed on the free programmes that help your computer to serve you. Only £12 per annum. (VAT not applic.)

ORDERS:

The first disk costs £10, the second £8 and each disk thereafter is £6. The price of sets is specified in adv. Add £2 post/pack and 15% VAT to total. Orders outside U.K. post/pack £3 (no VAT).
ORDERS MUST BE PREPAID.

PAYMENT BY MAIL TO:
SELTEC COMPUTER PRODUCTS LTD,
"Farley Hall", Wokingham Road, Bracknell,
Berkshire RG12 5EU

TELEPHONE ORDERS: (0344) 86 3020
(0344) 56 029
Pay by Mastercard or Visa.

We cannot guarantee the suitability of public domain/user-supported software for users' needs or equipment.

PC PROGRAMMES FOR ONLY £2!

From the thousands of programmes we have collected from public domain and user-supported software we bring you a special selection of the best utilities available – special purpose programmes that you may choose in any combination that you wish.

Choose any number for only £2 each (service charge), with a minimum of six programmes, and we transfer them on to one (or more) of our disks for you.

We include source coding where possible. The programmes are documented, where required. Disks are formatted for MS-DOS 2. or greater. 360 k. Programmes are intended for the IBM-PC or close compatibles.

EFFICIENCY WITH FILES AND COMMANDS

U1. DIRECTORY CONTROL. Returns you to a previous directory whose name it saves.

U2. RAMDISK. Very good ramdisk creator – like a memory-resident disk drive.

U3. WINDOW TOOLS. Mini Sidekick with memory-resident editor, timer, ASCII reference.

U4. FAST DISK. Speeds up activity and processing of many programmes.

U5. FILE MANAGER. Excellent general purpose file manager that copies, deletes, views, etc. Many features.

U6. DIRECTORY LISTER. Creates directory lists for comments. Saves to disk.

U7. DIRECTORY PATHS. Lets programmes write to other directories.

U8. KEYBOARD DEFINER. Redefines keyboard to suit own needs.

U9. SPACE. Shows the amount of free space on disk in thermometer style.

U10. SUPERIOR DIRECTORY Shows disk directory with file attributes which are active. Also sorts by name, date, size, extension. Accurate for hard disk.

U11. BACKED UP. Indicates which hard disk files have not been backed-up.

U12. NEW FILES. Lists files that you created today.

U13. SPEEDKEY. Increase speed of cursor.

FILE PRINTING/EDITING

U101. PRINTER SWAP. Swaps line printer assignments for easier printing.

U102. WORDSTAR CONVERTER. Superior converter of wordstar to ASCII and reverse from document file.

U103. DISK COVER DIRECTORY. Prints directory in size suitable for pasting on disk jacket.

U104. COMMAND EDITOR. Very good editor of operating system commands.

U105. BANNER. Prints wide banners on your printer.

U106. LISTER. Prints documentation, adding page numbers.

U107. PRINT CONTROLLER. Gives extensive control of printer settings – bold, italics, compressed, etc. Epson compatible.

U108. NOT PRINT. Redirects computer output to the screen.

U109. DARKEN. Overstrikes a text file to obtain darker print.

U110. MERGE. Merge sorted files into one sorted file.

U111. TEXT FORMATTER. Processes text files for printing with special features imbedded in output – bold, italics, etc.

U112. SEARCH/REPLACE. Search for and replace characters.

U113. CUT & PASTE. Allows movement of parts of documents between files.

U113. NOTEPAD. Ready at hand notepad. Memory resident.

U114. TEXT INDEX. Indexing for text files. Mark words for listing.

U115. WORDSTAR INDEX. Indexing system for Wordstar.

U116. UNDERLINE STRIPPER. Strip underline from Wordstar files.

U117. KEYBOARD DEFINER. Keyboard redefiner for Wordstar.

U118. WORDSTAR COLOUR. Adds colour to Wordstar.

U119. WORDSTAR NUMBERS. Add and remove numbers to paragraphs in Wordstar files.

U120. WORDSTAR CHARACTERS. Character look-up programme.

U121. EXECUTABLE PATCHES. Standalone Wordstar patches.

U122. WORDSTAR GREEK. Obtain Greek characters in Wordstar documents.

U123. PROGRAMME EDITOR. Editor for programmers, with multiple windows.

U124. TEXT EDITOR. Editor with major commands, without frills.

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

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

U127. SQUEEZE LIST. Lists squeezed library files.

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

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

FILE LOCATING

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

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

U204. CHARACTER SEARCH Searches disk for character or string.

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

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

FILE READING/DISPLAY

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

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

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

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

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

U306. BROWSE. Examine files with 4 way scrolling.

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

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

U309. KEYBOARD BUFFER. Keyboard buffer of 160 characters.

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

EQUIPMENT HANDLING

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

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

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

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

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

FILE MOVING

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

U502. REDIRECTS output to a disk file.

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

U504. SECTOR RETURN. Recovers deleted first sectors.

U505. SELECTIVE COPYING. Copy programme using menu system.

U506. SELECTIVE DELETION. Programme delete using menu system.

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

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

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

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

FILE ORGANISATION AND CHECKING.

U601. ARCHIVER. Superior file compressor and library creator.

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

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

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

U605. SECRET FILES. Make, go to, or remove a secret directory.

U606. SQUEEZE/UNSQUEEZE. Compresses files to save space. Also uncompresses.

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

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

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

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

SPECIAL FEATURES

U701. CALENDAR. Display of any month or year.

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

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

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

U705. ALARM. Sets time for alarm to sound.

U706. NEW TIME. Sets system time and clock.

U707. DOS HELP. Assistance with dos commands displayed on screen.

U708. GET TIME. Simplifies getting time and date.

U709. CLOCK. Shows time on screen while you work.

U710. CALCULATOR. Memory-resident for convenient access.

FILE ALTERATION/RECOVERY/ REPAIR

U801. FILE RECOVERY. Retrieves a programme you have just erased.

U802. DEBUG TIPS. Tips on using debugging programme effectively.

U803. DISK PATCHER. Reads and patches disk contents. Altering files, repairing corruptions, allowing unerase and creating files from memory.

U804. LOCK/UNLOCK. Protects files from unauthorised access with simple encrypting technique.

ORDERS:

The service charge for each programme is £2. There is a minimum charge of £12 (six programmes) plus £2 for postage and packaging. Add 15% VAT to total. ORDERS MUST BE PREPAID.

PAYMENT BY MAIL TO:
SELTEC COMPUTER PRODUCTS LTD
Farley Hall, Wokingham Rd, Bracknell, Berkshire RG12 5EU. U.K.

TELEPHONE ORDERS:
Pay by Mastercard or Visa.
(0344) 86 3020, (0344) 56029.

We cannot guarantee the suitability of programmes for users needs or equipment.

CIRCLE NUMBERS BELOW AND SEND TO US WITH PAYMENT AND YOUR NAME AND ADDRESS. OR TELEPHONE US WITH THE PARTICULARS. SEE ABOVE.

1 2 3 4 5 6 7 8 9
10 11 12 13 101 102 103 104 105
106 107 108 109 110 111 112 113 114
115 116 117 118 119 120 121 122 123
124 125 126 127 128 129 201 202 203
204 205 206 301 302 303 304 305 306
307 308 309 310 401 402 403 404 405
501 502 503 504 505 506 507 508 509
510 601 602 603 604 605 606 607 608
609 610 701 702 703 704 705 706 707
708 709 710 801 802 803 804

Get your system networking with LANLink for only

£495 +VAT +P&P

Think before you spend four times this amount on a hardware network. Our **LANLink** starter kit with a server, a satellite and 50ft of cable, is **ONLY £495** plus VAT, and £9.50 post & packing, total: £578.75.

UNIQUE
NO RISK 30-DAY MONEY BACK
GUARANTEE
(subject to the terms and conditions of this offer)

- PC, XT, AT or clone compatible
- total DOS compatibility
- be free of hardware obsolescence
- upgrade easily and cheaply
- install it yourself *in 10 minutes*
- use any wiring (incl. phone lines)
- no limits to network size
- ring, star or tree configurations
- does not tie up a server
- worldwide support – no maintenance
- supports fibre optic comms up to 3km between nodes
- built-in error check, correction and comms
- built-in print spooling, disk cacheing etc
- benchmarked or better performance
- server can run 16 tasks simultaneously (multitasking)

BUY IT, TRY IT... OVER 100,000 ALREADY SOLD WORLDWIDE

PAYMENT BY:
Access, Barclaycard, American Express, cheque, postal order or cash with order.

LANLINK
PC MAGAZINE
TECHNICAL EXCELLENCE
AWARD WINNER

PHONE FOR YOUR SPECIAL STARTER KIT NOW:

01-248 8895

or ask your local dealer

ICCT Ltd. Worcester House, Vintners Place, Upper Thames Street, London EC4
Tel: 01-248 8895. Telex: 934161 ICCT UK G.

ZORLAND

VERSION 2

FOR IBM PC/AMSTRAD 1512

NEW! LATTICE/UNIX/ANSI Compatible! Now Zorland C is even more compatible! It is probably the most up-to-date ANSI standard C compiler on the market today! Why waste hours waiting for programs to compile! ZORLAND C is 3 TIMES FASTER! Even major companies like IBM, XEROX and FUJITSU use ZORLAND C!

NEW! Integrated Compiler/Editor Environment! Our new environment is truly amazing! Gives TOTAL control! It's a wonderful way to program in C! Compile in memory! Edit FIVE files at once! Keyboard Macros! "123" style menus! On-Line Help! Compiling C programs has never been so easy!

NEW! Massive 350 Page Manual! The tutorial takes you step-by-step into the World of C! Start with the "idiots" guide and then (hopefully!) — move on! Build-up to the more advanced features! Lots of examples! Over 210 functions explained! Write your own libraries!

NEW! ZORLAND BTREE/ISAM DATABASE package. Get your business application off to a flying start! Includes FULL SOURCE CODE and an example indexed Name & Address application showing how easy it is! Supplied complete and ready-to-go with our great 70 page manual!

Only £29.95 + vat!

NEW! ZORLAND WINDOWS gives your program that professional look — just like "Framework" and "123"! Fast Exploding and Zooming windows with automatic saving and buffering in memory. "Pop-Up" and "123" style menus — comes with fantastic demo progs and 50 page manual! FULL SOURCE CODE!

Only £29.95 + vat!

NEW! ZORLAND OPTIMIZER! will "fine-tune" your progs during compilation by running a THIRD pass to OPTIMIZE your code using state-of-the-art "Global Optimizing" techniques found only on mainframe C compilers! Now you can squeeze that last ounce of speed out of your code! Does NOT replace assembly code! — Does NOT replace good programming!

Only £29.95 + vat!

★ ZCNEWS MAGAZINE! Now ZC Users have their own monthly magazine containing articles on a whole range of topics for ZC enthusiasts! You can submit an article for publication with the opportunity of winning a £250 prize for "Article of the Month". Each issue contains at least 30 pages full of interesting articles for C programmers!

★ ZC USER GROUP! FREE! Subscription to ZCNEWS gives you free membership! Here to help you get technical support and quality control that you need! Telephone hotline provided for members who need to talk through any problems.
ZCNEWS/ZC USER GROUP £15.75 p.a.

Highly Recommended Books!

C Primer Plus — £19.95
This 500 page book from USA is highly recommended for those new to C! It takes you through the basics in an easy to follow, easy to read, enjoyable style. It has many example programs that utilize sound, graphics and disk files.

Advanced C Primer — £19.95
This 500 page book starts were most other books stop! It gets right down to the nitty gritty of File I/O, PC Memory, BIOS & DOS calls, Graphics displays and integrating your Assembly Language routines into your progs.

Here's your chance to save over £300! Buy ZORLAND C at £29.95! Learn how to use our industry standard C compiler! The same as LATTICE and MICROSOFT! ZORLAND C applications are even being ported up to VAX mainframes! ZORLAND C is three times faster than the Giants! One tenth the price! No wonder most U.K. universities and polytechnics are now switching to ZORLAND C!

Save £300!

TECHNICAL SPECIFICATIONS — POWER PACK — A complete FULL K&R specification C compiler with ALL the UNIX V extentions and ANSI enhancements! Supports & emulates 8087/80287 maths co-processor, assembly language interface, Compact,Small,Data & Large models, includes FULL SOURCE CODE to the library, over 210 functions! Including trigs, fast screen access, disk sector read/write, dos/bios calls, interupts, etc. 64 bit precision. MS-LINK compatible linker and librarian are included together with many UNIX programming utilities like MAKE and TOUCH. Powerrrrrfullll!

Yes, Send me ZORLAND C now!

- ☐ **ZORLAND C** £34.44 inc. vat. C compiler with integrated editor and big 350 page manual!
- ☐ **DEVELOPER'S UPGRADE** £22.94 inc. vat. Allows you to compile progs larger than 64k (P,D,L models) and includes FULL LIBRARY SOURCE CODE!
- ☐ **LINKER/LIBRARIAN** £22.94 inc. vat. MS-DOS compatible LINK.EXE prog and Librarian for creating your own function libraries. 30%-200% faster than MS-DOS LINK! (Needed for PC1512)
- ☐ **ZORLAND C POWER PACK!** £68.94 inc.vat. SAVE £10! Buy all three for only £59.95! This is the full ZORLAND C compiler with the DEVELOPERS UPGRADE and LINKER/LIBRARIAN!
- ☐ **ZCNEWS/ZC USER GROUP** £15.75 inc. 12 issues of ZCNEWS direct to your door, plus ZC USER GROUP membership.
- ☐ **C PRIMER PLUS** £19.95 500 pages for beginners!
- ☐ **ADVANCED C PRIMER** £19.95 500 pages for advanced users!
- ☐ **BTREE/ISAM DATABASE** £34.44 inc.vat.
- ☐ **ZC WINDOWS LIBRARY** £34.44 inc.vat.
- ☐ **OPTIMIZER KIT!** £34.44 inc.vat.

Name

Address

PCM

For Overseas AirMail orders please add £5.00.

TO: ZORLAND LTD, 65-66 WOODROW, LONDON SE18 5DH
Tel:01-854 1194 (4 lines) Fax:01-317 1284

VISA

TECHNOMATIC

17 Burnley Road, London NW10 1ED Tel: 01-208 1177
305 Edgware Road, London W2 Tel: 01-723 0233

INTERGRATED PACKAGES

Smart ver 3.10	£375(a)
Framework II Ver 1.1	£320(a)
Symphony Ver 1.2	£339(a)
Open Access II Ver 2.0	£375(a)
Open Access Ver 1.03	£235(a)
Lotus 1.2.3	£239(a)

WORD PROCESSORS

Wordstar Professional Ver 4.0 new	£269(a)
Wordstar 2000 plus Rel 2	£269(a)
Wordstar	£165(a)
Microsoft Word Ver 3.10	£269(a)
Microsoft Word Junior	£64(b)
Multimate Advantage	£269(a)
Word Perfect Ver 4.2	£259(a)
Word Perfect Personal	£165(a)
Word Perfect Junior	£82(b)

DATABASE

dBase III Plus Ver 1.1 unpr.	£335(a)
Quicksilver - Compiler dBase III	£375(a)
Clipper - Compiler dBase III	£375(a)
Genifer - App. Gen.dBase III	£199(a)
Paradox Ver 1.1i	£379(a)
Delta 4 Professional	£399(a)

SPREADSHEET

Supercalc 4	£225(b)
Farsight	£99(b)
Javeline	£359(a)

LOTUS SERIES

Manuscript	£329(b)
Hal	£109(b)
Report Writer	£95(c)
Measure	£345(b)
Freelance Plus	£329(b)
Quickcode	£79(c)
Spot Light	£52(c)
Metro	£65(c)

UNIX SYSTEM

UNIX V Version 2.0 by Microport for PC-AT and compatibles	
Runtime System	£169(b)
Software Development 'C', Fortran	£170(b)
Text Preparation	£170 (b)
Complete Package	£475(a)
All packages supported by full documentation	

BUSINESS SOFTWARE

ACCOUNTING SOFTWARE

Sage Book Keeper	£85(b)
Sage Accountant	£125(b)
Sage Account Plus	£160(b)
Sage Financial Controller	£269(b)
Sage Payroll	£85(b)

PROFESSIONAL CAD

Autosketch	£79(d)
AutoCad Basic Ver 2.5	£300(a)
AutoCad ADE1,2&3 Ver 2.5	£2500(a)
Tracker ball for AutoCad	£109(b)
Inside AutoCad	£24(c)
Pro-Design II Ver 2.5	£245(b)

DESKTOP PUBLISHING

Ventura Publisher	£749(a)
Pagemaker	£595 (a)
Fleet Street Editor	£199(b)
GEM Collection	£89(b)
Lotus Manuscript	£329(b)

BORLAND SOFTWARE

Reflex Ver 1.1	£75(b)
Reflex Workshop	£65(b)
Turbo Basic	£65(b)
Turbo C	£65(b)
Turbo Pascal BCD/8087	£59(b)
Turbo Tutor	£25(b)
Turbo Prolog	£54(b)
Turbo Prolog Toolbox	£65(b)
Turbo Lightning	£59(b)
Lightning Word Wizard	£39(b)
Turbo Editor Toolbox	£39(b)
Turbo Graphix Toolbox	£39(b)
Turbo Database Toolbox	£45(b)
Turbo Numerical Toolbox	£65(b)
Eureka The Solver	£65(b)
Sidekick	£59(b)
Traveling Sidekick	£59(b)
Superkey	£59(b)
Turbo Gameworks	£45(b)
Turbo Holiday Jumbo Pack	£159(a)

PROJECT MANAGEMENT

Super Project Plus	£325(a)
PertMaster	£475(a)
PertMaster & PertPlotter	£525(a)
MS Project	£245(a)

LANGUAGES & O.S.

MicroSoft Basic Interpreter	£245(b)
MicroSoft QuickBasic	£75(b)
MicroSoft Pascal Compiler	£209(b)
MicroSoft C Compiler	£260(a)
MicroSoft Cobol Compiler	£399(a)
MicroSoft Macro Assembler	£125(b)
Digital Research C Compiler	£249(b)
Digital Research Fortran 77	£249(a)
Digital Research Level II Cobol	£470(a)
Digital Research Assm. & Tools	£169(b)
Zorland C	£29(d)
Zorland C - Power Pack	£59(c)
MS DOS 3.2 & GW Basic	£65(b)
GW Basic	£39(c)
PC DOS 3.2	£55(b)
Learning DOS	£24(c)

COMMUNICATIONS

Datatalk (inc. Prestel) V3.27	£129(d)
Crosstalk XVI	£95(d)
Sage ChitChat Ver V2.2	£85(d)

BUDGET SOFTWARE

Ability Ver 1.2E	£69(c)
Psion PC-Four	£65(c)
VP Planner	£65(c)
VP Info	£65(c)
WordStar 1512	£59(b)
dBase II 1512	£95(b)
Delta 4 1512	£85(b)
Supercalc IV 1512	£59(b)
Turbo Pascal 1512	£49(c)
Sidekick 1512	£29(c)

UTILITIES

Norton Utilities Ver 4.0	£55(c)
MicroSoft Windows Ver 1.03	£72(c)
Copy II PC	£40(c)
Fastback	£165(c)
Xtree Ver 2.0	£49(c)

PRINTER UTILITIES

Sign Designer	£42(d)
Widespread	£39(d)
Typewriter	£39(d)
Keyboard Master Tutor	£39(d)

MISCELLANEOUS

MS Flight Simulator	£45(c)
Psion Chess	£22(c)
Share Master - Inv Analyst	£129(c)

SICON

SICON AT	£1,375 (a)
SICON PC	£455 (a)
SICON XT	£755 (a)
SEAGATE 20 Mbyte 1/2 ht drive with controller card	£289(a)
DYSAN 20 Mbyte Card (can be installed in Amstrad PC)	£429(a)
Miniscribe 30 Mbyte file card (can be installed in Amstrad)	£475(a)

Larger capacity hard drives available.

AMSTRAD PCs

PC1512

SDMM (Single Drive Mono Monitor)	£449 (a)
DDMM (Dual Drive Mono Monitor)	£559 (a)
SDCM (Single Drive Col. Monitor)	£619 (a)
DDCM (Dual Drive Col. Monitor)	£729 (a)
HD20-M (Hard Disc 20Mb, Mono)	£899 (a)
HD20-C (Hard Disc 20Mb, Col.)	£1069 (a)

CO Processors

8087-5MHz	£120 (c)	8087-8MHz	£160 (b)
8087-10MHz	£240 (b)	80287-6MHz	£160 (b)
80287-8MHz	£280 (b)	80287-10MHz	£299 (b)
V-20 5MHz	£10 (b)	V-30 5MHz	£10 (b)
V-20 8MHz	£12 (b)	V-30 8MHz	£12 (b)

INTERFACE CARDS

for IBM PC/XT & Compatibles

Auto Switch 560 Card
The 560 card recognises EGA, CGA, Monographics adaptor and Hercules Software. It automatically switches modes to suit the application software. 256K Video memory, flicker free scrolling in all modes, dip switches on external edge to configure for a particular monitor — £249 (b)

EGA Board
* Multimode card including all the capabilities of IBM, EGA, Hercules mono card, IBM colour and mono card. — £199 (b)

Monochrome Graphics Card
Fully compatible Hercules graphics card. Includes parallel printer port. — £79 (b)

Colour Graphics Card
* 320 × 200 colour graphics mode.
* 640 × 200 Hi-Res mono graphics mode. — £72 (b)

Multi-function Card
* 384K RAM
* Parallel/Serial/Games Ports.
* Battery backed Clock/Calendar.
* RAM disk & print spooler compatible. — £149 (b)

Multi I/O Card
* Parallel/Serial Ports
* Battery backed calendar/clock. — £79 (b)

RAM Card 384K
(Expandable to 512K). — £89 (b)

RS232 Serial Card
Short slot card with option for 2nd port — £35(c)
Extra for 2nd port — £16

Parallel Interface Port
Short slot card, Epson/Centronics compatible — £19(c)

MS Mouse specify bus/serial version — £135 (b)
Logimouse (Serial) — £95 (b)

PC Compatible Witty Mouse
Plugs into serial port, adaptor for parallel conn. to k/bd. MS software compatible. — £79 (b)

NETWORK ADAPTORS

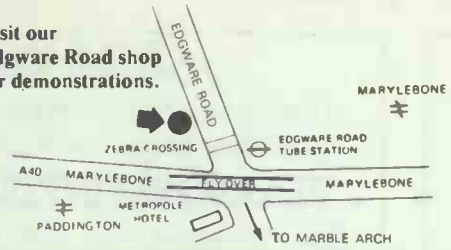
Economical interlink between IBM PC, XT, AT and compatible including Amstrad PC1512.

TRANSNET Starter Pack
Links two stations with adaptors, cabling, NETBIOS and easy to use menu driven software. — £429 (a)
Transnet Pack for additional station. — £229 (b)

Ask for full details

MAIL ORDER
& RETAIL
17 Burnley Road
London NW10 1ED
Telex 922800
WEST END BRANCH
305 Edgware Road
London W2

Visit our Edgware Road shop for demonstrations.



For fast delivery telephone your order on 01-208 1177 using VISA/Acess Card

Orders welcome from government depts & educational establishments

All prices ex VAT.
No VAT on exports
Phone 01-450 9803 for export enquiries
Please add carriage
(a) £8.00 (Datapost)
(b) £2.50 (c) £1.50
(d) £1.00

PRINTERS

DOT MATRIX PRINTERS:

EPSON PRINTERS:

LX86	**£195 (a)**		
FX800	**£319 (a)**	**FX 1000**	**£449 (a)**
EX800	**£399 (a)**	**EX1000**	**£579 (a)**
LQ800	**£439 (a)**	**LQ1000**	**£579 (a)**

Taxan KP815 £269 (a)

Taxan KP915 £379 (a)

National Panasonic KX P1081 £169 (a)

Star NL 10 with IBM Interface £239 (a)

Amstrad DMP3000 Printer £159 (a)

DAISY WHEEL PRINTERS

Juki 6100 £249 (a)

Brother HR20
(Parallel & Serial Interface) £329 (a)

National Panasonic KX P3132
with 32K buffer £249 (a)

Integrex Inkjet Colour Printer £549 (a)

IBM EGA/CGA dump
64 colour screen dump for Integrex. £45 (b)

PLOTTERS

Hitachi 672 A3 4 colour
High speed, high precision plotter
Serial & Parallel Interface. £454 (a)

We can also offer Roland & Watanabe plotters at competitive prices

IBM Type Parallel Printer Lead (2m) £12 (d)

ADD-ON CARDS

A new exciting range of add-on cards from Computer Peripherals has just arrived in stock. These high quality cards carry a two year parts and labour warranty. Please send for our catalogue for full details. The range includes:

OverAchiever up to 3Mb RAM for PC & AT
Racer 286 for PC/XT. 80286 CPU at 8MHz
Little Dicktor. Voice input with 500 word vocabulary and many others.

PRINTER SHARERS & BUFFERS

PB Buffer

Internal buffer suitable for most EPSON printers. Easy to instal. Instructions supplied.

PB128 128K Parallel Buffer. £99 (b)

Printer Sharers:

(All lines are switched).	Parallel	Serial
2 computers to one printer	£45 (c)	£45(c)
3 computers to one printer	£69 (c)	£65 (c)
4 computers to one printer	£85 (c)	£75 (c)
2 computers to 1 or 2 printers.	£69 (c)	£69 (c)

Cable sets for all popular computers available.

External Serial/Parallel or Parallel/Serial converter £37.50(c)

IBM Parallel Printer Lead. £12 (d)

A wide range of printer interfaces, sheetfeeders, tractor units, acoustic hoods, ribbons available from stock.

MIRACLE MODEMS

KEYCARD Internal modem for IBM PC/XT/AT & compatibles supplied complete with Dak Security Device & Datatalk comms software.

KeyCard 3000 V21/V23	**£345(a)**
KeyCard 3000 V22	**£545(a)**
KeyCard 3000 V22 bis	**£699(a)**

Please ask for full spec sheets

WS2000 V21/23	**£95 (b)**
WS4000 V21/23	**£155(b)**
WS3000 V21/23	**£289 (b)**
WS3000 V22	**£489 (b)**
WS3000 V22 bis	**£639 (b)**
DATATALK Comms Package	**£70 (c)***

Price applicable when bought with the modem.

Enquire about Miracle Plug in modem for PC's and compatibles

3M DISCS & CARTRIDGES

Industry standard high quality discs with reinforcing hub rings and GUARANTEED error free performance for life. In pack of 10.

5.25" 745 48TPI DSDD for IBM pc	**£11.50 (d)**
5.25" 747 96TPI DSDD	**£15.00 (d)**
5.25" HD 1.6Mb Discs for AT	**£28 (d)**
3.5" 96TPI DSDD Disc	**£23 (d)**

Back up cartridges for tape streamers.

DC1000	**£12.00 each (d)**
DC3000 XL	**£16.50 each (d)**
DC600A	**£18.50 each (d)**

Bulk Discs
High quality unlabelled discs with hub reinforcing rings and guaranteed error free performance for life. Supplied in pack of 50 discs in a lockable disc box.
48TPI DSDD £42 (d)

Floppiclene Drive Head cleaning kit supplied with 20 disposable cleaning discs. Disposable discs ensure there is no recontamination of heads by repeated use of the same cleaning disc.

5.25" Floppiclene Kit	**£12.50 (d)**
3.5" Floppiclene Kit	**£14.50 (d)**

MONITORS

MONOCHROME 12"

Composite Video (for use with CGA)

Philips 7502 Green + Swivel Stand	**£75(a)**
Philips 7522 Amber + Swivel Stand	**£79(a)**
Taxan KX117 Green	**£79(a)**
Taxan KX119 Amber	**£85(a)**
Monochrome 12" TTL Input (for use with monochrome adaptor).	
Philips 7513 + Swivel Stand	**£99(a)**
Taxan KX1212G Green.	**£120 (a)**

COLOUR MONITORS (CGA)

Mitsubishi XC1404 14"	**£229 (a)**
Taxan Super Vision 620 12"	**£279 (a)**
Taxan Super Vision 625 12"	**£319 (a)**
Taxan Super Vision IV 12"	**£479 (a)**

COLOUR MONITORS (EGA)

Mitsubishi XC1440 14"	**£475 (a)**
Taxan Super Vision 760 14"	**£499 (a)**
Taxan MultiScan 770	**£659 (a)**
Taxan Supervision IV 12"	**£479 (a)**

BOOKS (NO VAT £2 p&p)

80286 Prog Ref Manual	**£14.75**
8086 Book	**£23.95**
8087 Appl & Prog for PC	**£19.10**
Prog the 8086/8088	**£16.95**
RS232 Solutions	**£17.95**
RS232 Made Easy	**£19.95**
Solutions in C	**£17.95**
C at a Glance	**£7.95**
Advanced C Tech & Appl	**£19.95**
Understanding Unix	**£18.45**
A User Guide to Unix	**£19.95**
MS/PC DOS Prompt	**£10.95**
Using PC DOS	**£19.95**
How to write an IBM PC Program	**£6.95**
123 for Business	**£16.95**
ABC of Lotus 123	**£17.45**
Using 123	**£18.45**
123 Tips Tricks & Traps	**£18.45**
Mastering 123	**£24.95**
Introduction to Wordstar	**£17.95**
Wordstar Made Easy	**£16.95**
Wordstar Handbook	**£11.95**
Wordstar Prompt	**£5.95**
Practical Wordstar Uses	**£18.95**
Inside AutoCad	**£24.00**
Understanding dBase II	**£22.95**
dBase III for 1st Time User	**£19.95**
Mastering the dBase III	**£22.95**
Adv Tech in dBase III	**£22.95**
Understanding dBase III +	**£22.95**
dBase III Handbook	**£18.45**
Multimate Complete Guide	**£16.95**
Multiplan Made Easy	**£18.95**
Introduction to Turbo Pascal	**£14.95**

We can only show a small range of the products stocked by Technomatic in this advertisement. If you would like further information, please indicate your interest by ticking the appropriate box and we will send you a brochure.

☐ Sicon ☐ Software ☐ Modems
☐ Printers ☐ Monitors ☐ BBC Systems

NAME _____
ADDRESS _____
_____ POST CODE _____

Return to Technomatic Ltd 17 Burnley Road, London NW10 1ED PCW 6/87

FREE OVERNIGHT DELIVERY!*

01-455 9823

COMPUTERS/CALCULATORS/PLOTTERS

LASER PRINTERS
CANON LBP8 ..... £1835.00
BDS (CANON COMPATIBLE) £2197.00
QUME LASER TEN £2285.00
NEC L08 ..... £2399.00
HP LASER PLUS ..... £POA
HP LASER JET £1750.00
HP THINK JET £435.00
RICOH LP4081-RI (WITH HP LASER + EMULATION £2999.00
AST TURBO-LASER £3550.00
OKI LASERLINE £1750.00
OLIVETTI M24 ..... £POA
EPSON PC 256K + 2 x 360K/D £650.00
EPSON PC 256K + 360K/D + 20MB H/D £999.00
EPSON PC + 640K + 2 x 360K/D ..... £POA
HP 41 CV COMPUTER £139.00
HP 41 CX COMPUTER £199.00

HP 18C (BUSINESS CAL) £160.00
HP 28C (SCI PRO CAL) £200.00
HP7440 (A4 2 PEN PLOTTER) £860.00
HP745A (A3 6PEN PLOTTER) £1499.00
HP7550 (8 PEN A4/A3) £3220.00
HP7580B (A1) £7500.00
ROLAND 980 (A3/8 PEN) £1075.00
TAXAN 710 (A3/6 PEN) £895.00
SHARP PC 1500A £147.00
PC1600 (16K) £199.50
EPSON PC AX WITH 20MB H/D £2350
AMSTRAD 8512 PC/1512 (MONO/COLOUR/DISK 10/20 MB/HD ..... FROM £449.00
AMSTRAD SOFTWARE, SAGE ETC IN STOCK.
IBM 8 COMPATIBLE EXPANSION PRODUCTS AST/PERSYST/EVEREX/ TECMAR/GENOA/OMEGA/ QUADRAM/ORCHID/PARADISE

MONITORS/PRINTERS

MICROLINE 102 (120 CPS) £193.50
MICROLINE 192 (160 CPS) £307.50
MICROLINE 84T/F (200 CPS) £620.00
OKI 294 (400 CPS) £700.00
OKI COMPLETE RANGE IN STOCK UKI IN STOCK
NEC P7 ..... £465.00
NEC P5 ..... £750.00
NEC COMPLETE RANGE IN STOCK DISK DRIVES/TAPE STREAMER POA
QUME 12/20 ..... £410.00
QUME 12/45 SPRINT (S/P) £599.00
QUME 1190 (90 CPS) £1355.00
QUME COMPLETE RANGE IN STOCK
STAR NB15 (136COL/300CPS) £760.00
MODEMS
(DACOM/MASTER/EPSON/ NIGHTINGALE/INTERLEKT/ STEEBEK/ANSWERCALL ETC FROM £73.50
MANNESMANN TALLY (FULL RANGE)
MT290 (IBM/EPSON COM) £600.00
MT90 (INKJET 220/110 CPS) £395.00
MT85 (80 COL IBM £264.00

TAXAN — PRINTERS AND PLOTTER RANGE HELD
EPSON COMPLETE RANGE IN STOCK
LX86 (120CPS) £210.00
LQ1000 67K BUFFER (180CPS) £643.00
LQ800 (60 180CPS) £470.00
LQ2500 ..... £787.00
EX8000 ..... £439.00
EX1000 ..... £559.00
SQ2500 (NEW) ..... £POA
BROTHER HR20 ..... £333.00
HR25 (3K BUFFER 25CPS) £549.00
H35 (35CPS) £720.00
2024L (190CP/NLQ) £690.00
1709 (240CPS) £456.00
(BUFFERS/IN-LINE 1256K/512MG) AUTO-SWITCHS/BI-DIRECTIONAL CONVERTERS
MONITOR/TERMINALS
ZENITH ..... FROM £425.00
TELEVIDEO ..... FROM £280.00
WYSE ..... FROM £360.00
QUME ..... FROM £360.00
HAZELTINE/SPRIT ..... FROM £425.00
TAXAN/PHILIPS/ZENITH ..... FROM £65.00
NEC MULTISYNC COLOUR

CAN YOU FIND A LOWER PRICE
PHONE US FOR BEST DEAL

SOFTWARE

IBM COMPAQ/OLIVETTI/AMSTRAD
LOTUS 1-2-3 ..... £222.00
SYMPHONY £339.00
GRAPHWRITER COMBO PAK £339.00
CHARTMASTER £295.00
MAP MASTER £285.00
PSF PROF WRITE £169.00
PFS PROF FILE £229.00
PFS PROF PLAN £250.00
FREELASE + ... £350.00
FRAME WORK II £313.00
D/BASE III PLUS £335.00
D/BASE CLIPPER £399.00
JAVELIN £345.00
R BASE 5000 ..... £220.00
EASY FILLER £199.00
TRAINING LOTUS 1-2-3 ..... £65.00
LOGISTIX £95.00
HERCULES GRAPHIC CARD PLUS £195.00
FORMATTING AVAILABLE
HARVARD PRESENTATION GRAPHICS £250.00
MS WINDOWS £75.00
COBOL COMPILER £495.00
PASCAL COMPILER £190.00
FORTRAN COMPILER £220.00
VOLKSWRITER 3 ..... £169.00
MICRO SOFT MOUSE/ WINDOWS £199.00
MICROSOFT WORD 3.1 ..... £310.00
LOTUS HAL £115.00
FUNK SIDEWAYS 3.1 ..... £68.00
HARVARD TOTAL 2 ..... £399.00
R BASE SYSTEM 5 ..... £499.00
(SELECTION OF EXTENSIVE RANGE)
OPEN ACCESS II £575.00
OPEN ACCESS £265.00

SMART SYSTEM £399.00
SMART SPREAD SHEET £299.00
SMART WORD PROC £220.00
DATA MANAGER £299.00
MICROSOFT PROJECT £275.00
SUPERCALC 4 ..... £238.00
TURBO CAD £330.00
WORD STAR 2000 ..... £215.00
WORD STAR PROF 4.0 ..... £267.00
MULTIMATE £247.00
QUICKCODE III £179.00
SAGE CHIT-CHAT ..... FROM £76.00
SAGE ACCOUNTS ..... FROM £85.00
CROSSTALK £120.00
GEM PAINT/WRITE £125.00
BORLAND TURBO RANGE ..... FROM £22.00
JENNIFER £275.00
SAMNA PLUS £498.00
MULTIMATE ADVANTAGE £295.00
ORMIS 3D/BASE £295.00
LATTICE C COMPILER £245.00
REFLEX £57.00
VP INFO £62.00
LOTUS MANUSCRIPT £269.00
VENTURA DESKTOP PUBL £769.00
VOLKSWRITER III £187.00
WORD III £243.00
WORDCRAFT £309.00
WORD PERFECT £249.00
WORD PERFECT LIBRARY £124.00
WORDSTAR £144.00
WORDSTAR 2000 ..... £229.00
WORDSTAR 200 + ... £269.00
WORDSTAR PROFESSIONAL £193.00
MULTIPLAN £109.00
SAGE PC PLANNER £71.00
VP PLANNER £61.00

GOODS FULLY GUARANTEED. PRICES EXCL VAT (P&P EXTRA ON GOODS UNDER £300)
Company and Government orders accepted by telephone
Barclaycard/Access/Visa accepted by phone

Tel: 01-455 9823
MOUNTAINDENE
22 Cowper Street, London EC2

J. & M. Computers

Eight Acres, Maldon Road, Wickham Bishops, Witham, Essex. Tel: Maldon (0621) 892701

REASONABLE OFFERS CONSIDERED

Alloy PC back-up store, 17Mb tape streamer + 40Mb (formatted) hard drive + interface card, cables and software included.
Compatible to IBM AT and XT and close compatibles **£600**

ITT EXTRA PC's 256K (EXPANDABLE)
Single floppy or turn floppy drive also 10Mb hard drive with single floppy available. Green screen + keyboard included. Prices from **£500 to £650**

PRINTERS

Centronics Print Station 351/DOT Matrix Used **£250**
Centronics 700-701/Dot Matrix (new & used) **£250**
Qume 57/45/Daisywheel (new & used) **£250**

MONITORS/WORD PROCESSORS

ITT Scribe 3214/Screen + Keyboard (new) **£50**
ITT DSV 621/Screen + Keyboard/Full edit RS232 **£195**
Qume QVT 103/Screen + Keyboard/Full Edit RS232 **£195**
Lee Data Colour Screen plus Keyboard, phone for details.

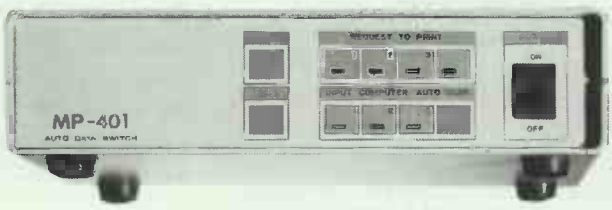
OFFERS

ITT 3342/Swift
ITT 3341/Swallow
ITT 9420/Controller
Rodime RO203 or RO204E/Hard drives/Good price
Maxtor XT 10.65/65Mb Hard drives/Good price
Many floppy drives available.
Various keyboard available.

Much more in stock than advertised
Equipment bought and scrapp purchased. All equipment add VAT & P&P

For any enquiries contact (0621) 892701

4 WAY AUTO PRINTER SHARER FOR ONLY £99



SPEC: MP401 4 way Auto-switch with 25 wayD type parallel I/O suitable for IBM & Compatible machines.

OTHER PRODUCTS AVAILABLE:

MECHANICAL

2 WAY 25D TYPE	39.95	2 WAY CENTRONICS	£49.95
3 WAY 25D TYPE	£46.95	3 WAY CENTRONICS	£67.95
4 WAY 25D TYPE	£55.00	4 WAY CENTRONICS	£77.95
2 WAY X OVER 25D	£55.79	2 WAY X OVER 36C	£81.95

AUTO-SWITCH

MP401 4 WAY	£99
MP801 8 WAY	£153.95

BUFFERS

PB64 64K RAM	£122.95
PB256 256K RAM	£195.00

LINE CONVERTERS
SERIAL TO PARALLEL **£69.00**
PARALLEL TO SERIAL **£69.00**

TO ORDER PLEASE SEND CHEQUES BUT ADD VAT & £3 P&P
DEALER AND EXPORT ENQUIRIES WELCOME

BRIGDEN TECHNOLOGY

0322 331984

UNIT24 ERITH BUSINESS CENTRE
ERITH HIGH ST, ERITH, KENT DA8 1QY

LONDON'S LARGEST DISPLAY OF PRINTERS MONITORS COMPUTERS AND PERIPHERALS

HI VOLTAGE

The London AMIGA Centre

OPEN MONDAY-SATURDAY 9 AM-6 PM

OPEN MONDAY-SATURDAY 9 AM-6 PM

NEW AMIGA A500 IN STOCK NOW!

'The Ultimate Home Computer' 512K machine with built-in 3½" 880K double sided drive. Runs original Amiga software

PRICES FROM £499 + VAT
INCLUDING FREE SOFTWARE

AMIGA A1000 IN STOCK NOW!

Based around the Motorola 68000 CPU, with multi-tasking as standard along with a palette of 4096 colours.

PRICES FROM £599 + VAT
INCLUDING ON SITE MAINTENANCE

ALEGRA ½ MEG
A1000 RAM PACK CAN BE UPGRADED TO 2 MEGS
NOW ONLY £299 + VAT

NEW AMIGA A2000 IN STOCK NOW!

'The Only Desktop Computer You Will Ever Need' capable of running 2 x 3½" disc drives, 1 x 5¼" drive and a hardcard with IBM Emulation simultaneously.

PRICES FROM £1095 + VAT
INCLUDING FREE SOFTWARE + ON SITE MAINTENANCE

Organize Database £99.95 inc VAT
Dbase III compatible high power database

Scribble V2.0 Wordprocessor £99.95 inc VAT
Now includes mailmerge and spellchecker

Analyze II Spreadsheet with Graphics £149.95 inc VAT
New version now much faster with integrated graphics

Deluxe Paint II Now In stock

PUBLISHER "Move over Mac"
Desk top publishing for the Amiga integrates with deluxe paint, scribble wordprocessor etc. Can produce copy in both colour and black and white
Desktop Publishing Software
£199.95 inc VAT

PHONE FOR NEW UPDATED AMIGA CATALOGUE AND PRICE LIST

Largest range of floppy disks and printer ribbons available in London over the counter.
London's largest range of games and software. Thousands of titles in stock.
PHONE FOR NEW CATALOGUE

Mail Order + Export Hot Line Phone 01-686 6362

Delivery by Securicor (4 day) please add £5.75 per item.
Delivery by Securicor 24 hour please add £9.95 per item.

Send off or order by 'phone quoting your Access, Visa No. 'Phone 01-686 6362. Immediate despatch on receipt of order or cheque clearance. Or Telex your order on: 946240 Attn 19001335.

EXPORT
Contact our specialist export department on 01-686 6362

EXPORT CUSTOMERS SUPPLIED TAX FREE.

ALSO A VAST RANGE OF DISK DRIVES, JOYSTICKS, DISK BOXES, INTERFACES, SHEETFEEDERS, ETC.

HI VOLTAGE 53-59 High Street, Croydon, Surrey CR0 1QD. Tel: 01-681 3022

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

HI-YO

London's Largest

LONDON'S LARGEST SPECIALIST AMSTRAD DEALER

Alternative PC clones — in stock now.

COMMODORE 10 MHz AT	ZENITH	TANDY
20 Meg Mono **£1995** + VAT	Prices from **£699** + VAT	Prices from **£399** + VAT
40 Meg EGA **£2495** + VAT	20 meg Hard disc models From **£999** + VAT	10 meg Hard disc models **£849** + VAT
includes 1 year Free on site service	EGA available	EGA available

LOW COST PC SOFTWARE

Over 100 Titles in Stock

Word Processors, Spreadsheets, Databases, Graphics, CAD/CAM, Accounts, Languages, Desk Top Publishing, Utilities, Integrated Packages.

PORTABLE PC COMPATIBLES

Zenith Z-171
512K RAM 2 x 5¼" 360K disks
25 line LCD display
£1099 + VAT

Zenith Z-181
640K RAM 2 x 3½" 720K disks · 25 line Supertwist Screen
£1695 + VAT

AMSTRAD HARD DISK MODELS NOW IN STOCK

10 Megabyte **£799** + VAT
20 Megabyte **£899** + VAT
30 Megabyte **£959** + VAT

PCW 8256/8512

USED MODELS — GUARANTEED FROM
£299 + VAT (£343.85 inc VAT)

DAISY WHEEL PRINTER PACKAGE FOR PCW8256/8512

£199.96 + VAT (£229.95 inc VAT)

Use LOCOSCRIPT with a DAISY WHEEL

New LSPRINT enables you to print your Locoscript text files on a daisywheel printer.
£29.95 inc VAT

PART EXCHANGE YOUR PCW 8256 or PCW 8512 FOR THE NEW AMSTRAD PC — PHONE FOR PRICES

HARD DISKS ON A CARD

Including formating and configuring
10 Megabyte **£349** + VAT
21 Megabyte **£429** + VAT
30 Megabyte **£499** + VAT

Low cost Networking

From **£279** per PC + VAT

CHRISTIE TAPE STREAMERS FOR HARD DISK BACK UP

10 MEG **£399.00** + VAT
20 MEG **£499.00** + VAT

8087-2 8 MHz Maths Co-processor

Including test software
£159 + VAT **£182.85** inc VAT

NEW PC HARDWARE AND LOW COST SOFTWARE CATALOGUE JUST PRINTED — PHONE FOR YOUR FREE COPY

640K MEMORY UPGRADE

Add an extra 128K of RAM
£39 + VAT **£44.85** inc VAT

RECOMMENDED PRINTERS FOR THE AMSTRAD PC

Choose from over 50 models

New Amstrad DMP4000
132 col 200cps 50cps NLQ **£399.95** inc VAT

Star NL10
IBM compatible NLQ dot matrix **£259.95** inc VAT

Citizen 120D
IBM compatible NLQ dot matrix **£199.95** inc VAT

Epson LX86 **£229.95** inc VAT

OPUS PC's

We carry all models of this popular range of PC clones.
Prices from **£499** + VAT

10 meg Hard disc models. Prices from **£829** + VAT

20 meg Hard disc models. Prices from **£995** + VAT

Extra for EGA. Now only **£399** + VAT

ATARI

520ST	£199.95
520STM	£249.95
520STFM	£389.95
520STFM + mono monitor	£489.95
1 x Meg Disk Drive	£199.95
2 x 1 Meg Disk Drive	£239.95
20 Meg Hard Disk	£689.95
High Res. Mono Monitor	£139.95
Med. Res. Colour Monitor	£389.95
1040 STF inc 1 Meg. Drive	£589.95
1040 STF inc Mono Monitor	£689.95
1040 STF inc Std. Colour Monitor	£979.95

SPECIAL PACKAGE OFFER

- 520 STM Computer & Mouse
- SF 354 Disk Drive • SM 125 Mono Monitor • 1st Word Software Package

Normal Price £559.85 inc VAT
Hi-Voltage Package Price **£439.95** inc VAT

LATEST SOFTWARE IN STOCK

LTAGE
Computer Shop

OVER 40 PRINTERS ON DISPLAY. MOST ON DEMONSTRATION

DOT MATRIX PRINTERS

Amstrad DMP2000 NLQ	£159.95
Amstrad DMP3000 NLQ IBM	£194.95
Amstrad DMP4000 NLQ 132 col 200cps	£399.95
Canon PW1080A NLQ	£289.95
Citizen 120D NLQ IBM	£199.95
Epson LX86 NLQ (120cps)	£229.95
Epson FX800 NLQ 200cps.	£399.95
Epson FX1000 NLQ 132 col 200cps	£515.95
Epson EX800 NLQ 300cps	£519.95
Epson EX1000 NLQ 132 col 300cps	£699.95
Epson LQ800 NLQ	£585.95
Epson LQ1000 NLQ 132 col 300cps	£799.95
Epson LQ2500	£979.95
Oki-Mate 20 Colour + software	£199.95
Micro P. 165 NLQ	£229.95
Micro P. 201 NLQ 132 col 200cps	£399.95
Star NL10 NLQ inc I/F	£259.95
Star NX15 NLQ 132 col	£379.95
Star NR15 NLQ 132 col 240cps	£559.95
Star NB 24-10 NLQ 80 col 24 pin 216cps	£549.95
Star NB24-15 NLQ 132 Col. 24 Pin 216 cps	£699.95
Star NB15 NLQ 132 Col. 24 Pin 300 cps	£879.95

DAISYWHEEL PRINTERS

Dyneer DW12	£139.95
Juki 6100	£329.95
Juki 2200 Typewriter Serial	£249.95
Silver Reed EXP500 16cps	£229.95
Silver Reed EXP550 19cps serial	£279.95

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

Let our experts match your computer to the printer of your choice. Printers — All models parallel-centronics interface Serial RS232C available at same or slightly higher prices.

LASER PRINTERS

Prices from only **£1395** + VAT

THE UK'S LARGEST RANGE OF LASER PRINTERS ON DEMONSTRATION

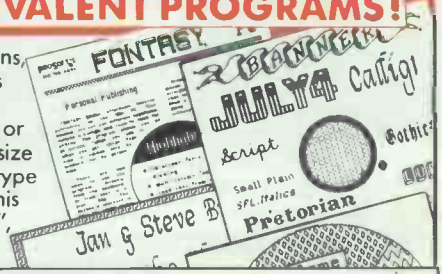
Are you confused by the variety of lasers available? No problem! Visit our showroom and compare before you buy. Off the shelf delivery on most models.

Plus full ranges from Canon and Hewlett Packard

ENTER THE WORLD OF DESK-TOP PUBLISHING ON YOUR P.C. WITH FONTASY FOR ONLY £79.95 inc VAT

HALF THE PRICE AND DOUBLE THE POWER OF EQUIVALENT PROGRAMS!

FONTASY brings affordable desktop publishing to the IBM-PC and PC compatibles. Your presentations, flyers, signs, newsletters, overhead foils, announcements, menus, layouts, invitations, logos and banners can use different typefaces, include drawings, and reserve room for photos. **FONTASY** gives you a "what-you-see-is-what-you-get" picture, as you type and draw on the graphics screen of your IBM-PC or PC compatible. You can create a page at a time, see a mini-picture of it, print it, and save it to disk. Page size is limited only by memory, not by screen size. You can draw from the keyboard or with a mouse. You can type directly onto the screen in whatever fonts you select, or tell FONTASY to read the text from a disk file. This new release of FONTASY comes with over 28 fonts in a variety of sizes and 60 pieces of small "clip art", and lets you change their sizes right on the screen.



FONTASY PROGRAM inc 28 fonts, 95 fill patterns 60 pieces of clip art. 250 page manual ..... **£79.95** inc VAT & P&P

DEALER ENQUIRIES WELCOME

ALSO AVAILABLE

Publishing font disk No. 1 (33 fonts)	£49.95 inc VAT & P&P
Display font disk No. 2 (36 fonts)	£49.95 inc VAT & P&P
Decorative font disk No. 3 (30 fonts)	£49.95 inc VAT & P&P

EXPORT CUSTOMERS SUPPLIED TAX FREE — ASK FOR EXPORT LIST

Official orders welcomed from PLC's government and education establishments

ALL PRICES INCLUDE VAT
(except where stated)

OPEN MONDAY-SATURDAY 9AM-6PM

Largest range of floppy disks and printer ribbons available in London over the counter.

London's largest range of games and software. Thousands of titles in stock.

Mail Order + Export Hot Line Phone 01-686 6362

Delivery by Securicor (4 day) please add £5.75 per item.
Delivery by Securicor 24 hour please add £9.95 per item.

Send off or order by 'phone quoting your Access, Visa No. 'Phone 01-686 6362. Immediate despatch on receipt of order or cheque clearance. Or Telex your order on: 946240 Attn 19001335. **EXPORT CUSTOMERS SUPPLIED TAX FREE.**

HI-VOLTAGE

53-59 High Street, Croydon, Surrey CR0 1QD. Tel: 01-681 3022

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

Get the best for less at Ness

ARABIC VERSIONS AVAILABLE
EXPORT ORDERS WELCOME

THE NEW PC 386 FROM £2995

THE NESS SUPER XT TURBO 20MB £795

- NEC V20 Super processor
- switchable 4.77/8 mHz clock
- 20MB hard disk
- 1 x 360K floppy drive

THE NESS SUPER AT TURBO 20MB £1395

- a true 10 mHz computer
- switchable 6/8/10 mHz
- 20MB hard disk
- 1.2MB half height floppy

THE NESS SUPER PC-386T £2995

- Intel 80386 processor
- up to 2MB RAM on mother board
- fast 16 mHz clock
- 1.2K floppy drive
- full AT compatibility

FEATURESFEATURESFEATURES!

- 100% industry compatible
- high performance
- quality build
- top-grade components
- fully supported by NESS technicians
- stand-alones or systems
- installation and after-sales engineering
- wide range of upgrades available
- many peripherals in stock
- comprehensive software
- satisfaction or money back in 14 days

★ 30MB, 40MB, 80MB AND MORE UPGRADES AVAILABLE

ALL NESS COMPUTERS COME WITH THE FOLLOWING AS STANDARD:

- professional keyboard
- parallel and RS232 serial ports
- clock/calendar with battery back-up
- monographic and printer cards
- high-resolution 12" monitor
- full set of manuals
- 8 x expansion slots
- 12 month guarantee

AT COMPATIBLE FROM £995

ADDITIONAL OVERSEAS AGENTS REQUIRED

NESS FOR QUALITY

NESS INDUSTRIES LIMITED
38-40 Upper Clapton Road, London E5 8BQ
Telex: 261840 NESS G Fax: 01-806 2743
PHONE: 01-806 1072/8904

HI·SPEC

- High speed 8 MGHZ processor
- 640K RAM
- 360K Floppy drive
- 20M hard drive
- Full feature-enhanced keyboard
- Latest style case
- Re-set button
- LED indicators
- Graphics display adaptor
- Printer port
- Hires TTL monitor

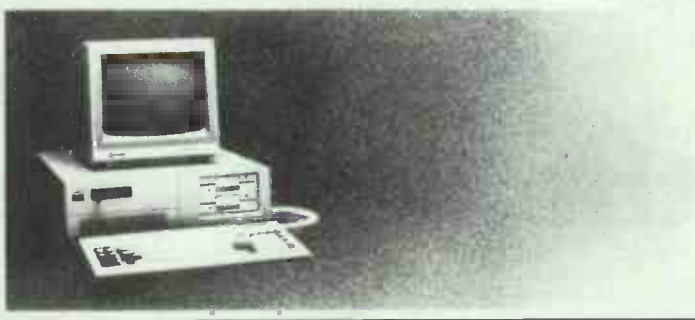
20 MBXT COMPLETE SYSTEM £795

- Multi-speed 80286 processor 6/8/10 MHZ
- 1 MG RAM
- 1.2M Floppy drive
- Graphics adaptor
- Printer port
- Full feature-enhanced keyboard

286 AT COMPATIBLE £999

- PC/MS DOS, Xenix, Unix, compatible
- 14.5 MHZ processor 0 wait states
- Norton rating 18.7
- 32 BIT RAM

32-BIT 80386 PC £2995



HI·SPEC SYSTEMS TO BUILD ON

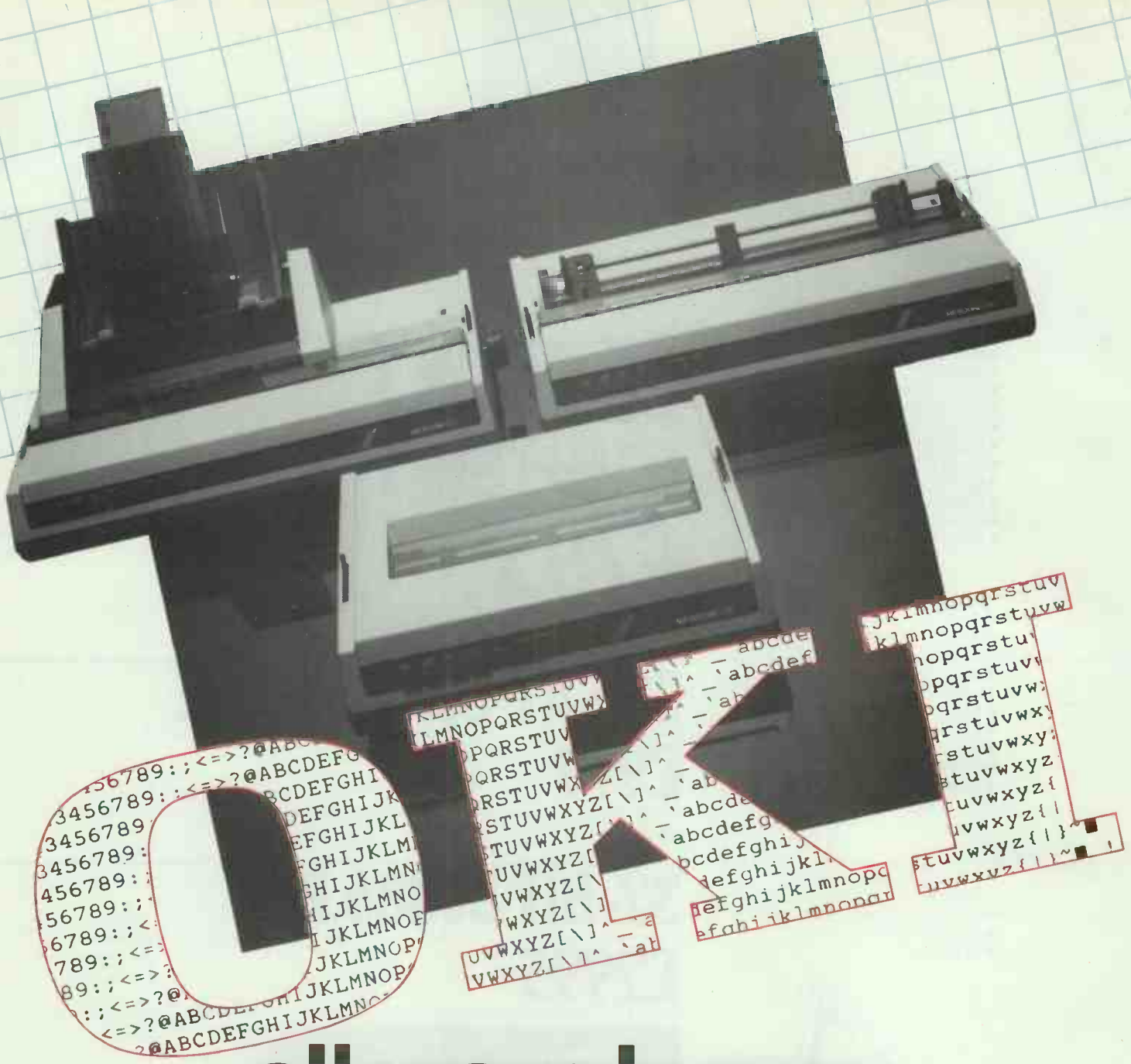
All system are guaranteed PC DOS compatible

13 month warranty. All Hi-Spec systems are designed and manufactured in the UK and include manuals. All systems are Securicor delivered, bench tested and ready to run.

System options include:
- Drives up to 170 MB
- CD ROM drives
- Networking
- Colour/enhanced colour
- CAD

For orders and enquiries or to discuss custom specified systems, contact:

Hi-Spec Systems Limited
Brettenham House South,
5 Lancaster Place
London WC2E 7EN
TEL 01-379 5562
FAX 222 7471
TLX 931770 WIBUG



all ways leaves the right impression

The OKI Microline 200 Series represents a major step forward in quality dot matrix printers, both in price and performance.

No matter what your printing requirements the Microline 200 Series with their two different advanced 18 pin head designs, means there will be a printer from the series ideal for your application.

The Microline 292 and 293 can print up to 200 characters per second but the staggered 18 pin head designs also means a remarkable 100 character per second single pass correspondence quality mode. Coupled with this, all the features that you would expect from a printer with a pedigree that comes from OKI, means satisfaction is guaranteed.

The Microline 294 is the workhorse of the 200 Series. Two parallel rows of needles allow print speeds of 400 characters per second to be achieved, but intelligent firmware does not allow any individual component to push to its limits. What does this mean to you? Higher reliability and better quality printing. Even with the speed of the 294 there is still the standard 100 character per second near letter quality mode.

High resolution graphics are of course a standard feature on all the 200 Series, as are double height characters, italics, sub script, super script and underline. All of the printing characteristics of the 200 Series are user accessible from an easy to use menu select mode.

System integration of the Microline 200 Series is further enhanced by the use of user installable personality modules, an extensive range of which are available as standard.

Full advantage can be taken of the 200 series' excellent print quality by use of such features as the semi automatic sheet feed and on the 292 and 293 the optional cut sheet feeder.

All these advanced features from the OKI Microline 200 Series and there is more: TEXT AND GRAPHICS MAY BE PRINTED IN HIGH DEFINITION COLOUR SIMPLY BY CHANGING THE RIBBON.

Superb print quality, high speed printing, enhanced printing characteristics and total flexibility.

The Microline 200 Series – the complete printing solution.

Technitron

X-DATA

A member of the Technitron group

TECHNITRON X-DATA Ltd. 750/751 Deal Avenue Slough Trading Estate Slough Berks SL1 4SH Tel: Slough (0753) 31292 Tlx: 847728

UNITED KINGDOM ■ DENMARK ■ FRANCE ■ HOLLAND ■ ITALY ■ NORWAY ■ SWEDEN ■ WEST GERMANY

At last . . . all the leading software fully described in one manual

FREE £10 VOUCHER in every manual against your first purchase!

Isn't this what you have always wanted?

The Software Handbook is a brand new publication listing all the top selling software packages from utilities to integrated packages including leading names such as; Lotus 123, DBASE III, Symphony, Wordstar, Smart, Sidekick, Supercalc 4 and many more . . .

If you've ever wondered what all these software packages actually do, now you can find out. Written in straightforward, easily understood text, the SOFTWARE HANDBOOK is clearly laid out to make identification easy. Over 70 different software packages are described in detail, listing all the features and functions of each.

Once you receive your manual we will keep you up to date with the latest software by issuing new pages as information becomes available – including regular special offers.

All the software is available 'off the shelf' at guaranteed INFOSOFT low prices.

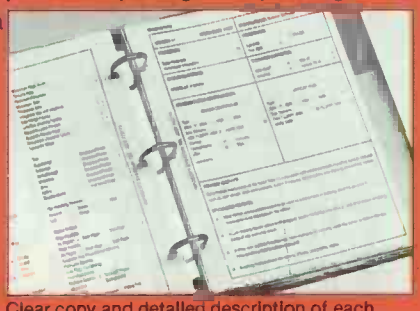
If you have an IBM/IBM compatible, AMSTRAD or APRICOT then you must not be without the SOFTWARE HANDBOOK.

To order your copy, telephone or write to Infosoft, enclosing **£19.95** plus £2.00 postage and packing.

Access and Visa card accepted.

Infosoft Systems Ltd

17 Queen Street, Droitwich, Worcs, WR9 8LA.
Tel: 0905 772773. Telex: 335540.



Clear copy and detailed description of each package helps you exactly fit the software to your needs.

THE ULTIMATE BACK-UP

The Odyssey XR4 Tape Back-Up

The Odyssey XR4 is the first tape back-up system to optimise hardware, software, performance and price. The system architecture is designed as a new standard in performance, ease of use, reliability and low cost of ownership.

- High Capacity (up to 44 MB formatted capacity using DC 2000)
- Simple to Use (Menu driven and command line)
- High Speed Performance (250/500 K Bits per second XT/AT)
- Ceramic head with advanced mechanical design
- Intelligent, XT/AT interchangeable
- Internal and External models for economy

Internal XR4 £595 External XR4 £695 Driver Board £95 (for external)

(Prices do not include VAT and carriage)

DIGITAN

Tel: 0342 24631 Telex: 957418

Unit M, Charlwoods Business Centre, Charlwoods Road, East Grinstead, West Sussex RH19 2HH

Distributed by Iliad International, a division of Odyssey International (USA) Inc.

"Developed by Colorado Memory Systems."

AN INTEGRATED ACCOUNTS PACKAGE
592 UK USERS

GENUINELY EASY TO USE

AN INTEGRATED ACCOUNTS PACKAGE
592 UK USERS

★
IMPACCT

UNIQUE CHALLENGE - FOR A LIMITED TIME ONLY

HOW TO EARN £199, WIN OR LOSE

BY LEGALLY BINDING GUARANTEE

Use Impacct Integrated Accounts in your business, and we will REFUND TWICE THE PURCHASE PRICE, unless the software PAYS FOR ITSELF TWICE OVER.

SALES LEDGER
Printed Invoices and Statements. Six-month aged debtors. 3 Discounts. VAT.

NOMINAL LEDGER
Trial Balance. Profit and Loss Report. Budgeting facilities. Balance Sheet.

PURCHASE LEDGER
Stock Receipts. Six-month aged creditors report. Overheads and Credit Notes.

SALES ORDERS
Printed Order Acknowledgements and Despatch Notes. Stock Allocation.

STOCK CONTROL
Re-Order Level Report. FIFO Valuation. Up to 10 shops or warehouses.

PURCHASE ORDERS
Printed Orders to Suppliers. Suggested Purchase Orders. Overdue Orders.

Major (multi-million pound) companies in the UK have used Impacct for over six years. They say that the system has paid for itself many times over by: BETTER CREDIT CONTROL, FASTER CUSTOMER SERVICE, LOWER PAPERWORK OVERHEADS, CLEARER MANAGEMENT INFORMATION, and REDUCED STOCK HOLDINGS.

The system is now available for the IBM PC, XT and AT, the AMSTRAD PC1512, and all compatibles. (With 256K RAM, and hard disk or 2 floppies.)

Complete system with 304 page manual is £199.95 (incl VAT).
(The Impacct software originally sold for £22,000 on minicomputers!)
Multi-user upgrade (up to 1024 users/VDUs) POA.
Single Ledgers or Stock Control available for £49.95.

For more details of software and guarantee, please contact Candy Moyce at:

FORESHORE SOFTWARE LTD
Stone Pier Yard, Shore Road
Warsash, Southampton SO3 6FR

DEALERS WELCOME Tel: (04895) 4992 *DEALERS WELCOME*

NTS PC

FREE!
PC-Write
PC-CALC
PC-FILE III
with every PC

THE RANGE:—

NTS 10: 1 x 360K, 640K RAM, NEC V20 AT Keyboard, PC Software **£399**

NTS 100: 2 x 360K, 640K RAM, NEC V20, AT Keyboard, Monitor, PC Software **£599**

NTS 120XT: 1 x 360K, 640K RAM, NEC V20, NTS Mouse, Monitor, 20Mb Hard disc, PC Software **£899**

NTS 286TM: 80286-8, 1 x 1.2FDD, Monitor, 20Mb Hard disc, Mouse, MS Windows, PC Software 12MHZ Clock, magnificent performance — Norton SI 14.7, ideal for use with CAD/CAM **£1599**

NTS 386TM: 80386 — 16MHZ System as above **£2995**

NTS—The very best in technology. Our new range of IBM* Compatible PC, XT, and AT computers represent unparalleled value for money and each system comes with free software. The PC and XT models come with PC-write, a powerful wordprocessor, PC-calc-a powerful spreadsheet, PC-File III, a simple database and an Arcade games compendium. The ATM models come with Microsoft's* software and a mouse as a powerful front end system for the professional user. NTS's huge range of accessories ensures that the user has every possible upgrade path in the future. Nationwide on-site maintenance can be arranged from as little as £45* a year and all our products come with 12 months warranty. If you want quality, compatibility, performance and sheer value for money, choose NTS. Mail order welcome, generous discounts to dealers and Education.

*Prices correct at time of going to press and exclude VAT.
Microsoft Windows is the Registered Trade Mark of Microsoft Corp.

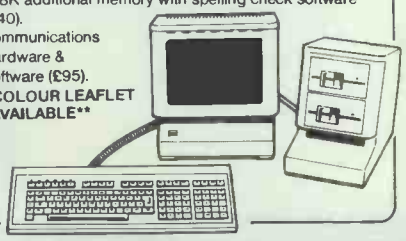
Northern Technology Systems Ltd.
9-14 Maritime Street,
Edinburgh EH6 6SB. Tel: 031-554 4388.
Telex: 728298 EBC Ltd. FAX: 031-554 2581

SURPLUS COMPUTER HARDWARE

ITT SCRIBE III WORD PROCESSING SYSTEM.
Professional system originally selling at around £6000 without printer. Now offered with **software included** & a variety of different options available. This system is available from us **ALL BRAND NEW** at the cost of current budget systems, but with **office-quality** performance & features.
SOFTWARE INCLUDED:
*DATABASE — allows information storage & retrieval by user-selectable criteria.
*EDITING — including easy reformatting, global search & replace, save & move, cursor control etc.
*AUTOMATIC LETTERWRITING — with merge, glossary file for much used phrases etc.
*MATHS FUNCTIONS — screen maths allows addition of rows, columns & complete tables.
*PROGRAMMABLE COMMANDS — allows format changes, accessing record block files, prompts etc.
*HELP FILES — quicker to use than the comprehensive manual supplied.
*BASIC COMPILER.

HARDWARE INCLUDED:
*SCREEN/WORKSTATION — dual processor (16 bit TI 9995 & Z80H) with 128K memory, 12" green screen 25 x 80 character display with slow scrolling, QUME printer interface.
*KEYBOARD — low-profile keyboard additionally has 43 clearly marked dedicated function keys.
*DISC DRIVES — dual SHUGART 5¼" DSDD drives each 430K capacity formatted. **£295.00**

OPTIONS:
*10mbyte MiniScribe WINCHESTER disc drive (£195).
*NEC Model 3500 35cps daisy wheel printer (£295).
*NEC Model 7700 55cps daisy wheel printer (£395).
*128K additional memory with spelling check software (£40).
*Communications hardware & software (£95).
COLOUR LEAFLET AVAILABLE

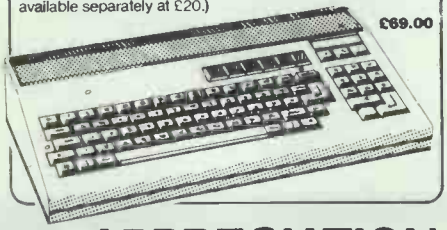


HITACHI Model 305S/SX 3" disc drives.
With SHUGART compatible interface (34 way edge connector) and suitable for **BBC** with DFS. **AMSTRAD 664/6128, TATUNG EINSTEIN** & many others. Will usually replace 5 ¼" drives directly. 250K (double density unformatted) per side reversible; 40 track; standard power connector for 12V & 5V; overall power consumption typically 3.7W. Supplied **BRAND NEW** with connector pin-out details etc. but uncased without PSU. Data **cables** are available for AMSTRAD & BBC (£7.50) and an **installation pack** including data & power cables with instructions is available for the TATUNG EINSTEIN (£12.00)

£29.95

MATMOS PC. Available without disc drives only. 64KB Z80A based keyboard sized machine with RGB, composite video outputs & UHF modulator. Serial, parallel, cassette & peripheral bus interfaces are provided, together with a ROM port. MICROSOFT BASIC is in ROM. Office quality machine originally sold at £350 by its big-name manufacturer. **BRAND NEW**
*Over 1500 already sold by us **£49.00**

MATMOS TERMINAL (Ver.2). MATMOS PC as above but with additional plug-in terminal emulation ROM. Features include *SET UP MENU *RS232 with handshake* all BAUD RATES to 9600* access to MICROSOFT BASIC which is still available to the user. **Cursor addressing and character attributes are VT-52 compatible.** (ROM is available separately at £20.) **£69.00**



TOSHIBA Model T300 system (semi-compatible with IBM PC). With 6mHz 8088 processor, 256KB RAM, single half-height 5¼" floppy disc drive (640KB), high resolution green display, serial & parallel interfaces. Included are **MS-DOS** Ver 2, **MICROSOFT T-BASIC**, good manuals & comprehensive diagnostic disc. Available options include a colour monitor and memory extension. **BRAND NEW** **£295.00**
AS ABOVE but with dual floppy disc drives. **£350.00**
TOSHIBA Model T100 CP/M system. With 64KB RAM, dual 500K 5¼" floppy disc drives, serial & parallel interfaces & **MICROSOFT BASIC** in ROM. BRAND NEW **£199.00**

DEC PDP 11/73 system. With 500KB RAM, twin **AMPEX** 20MB WINCHESTER disc drives, single **TANDON** 8" floppy disc drive (**DILOG** controllers), DLV-11 serial interface & DZV-11 4 line asynch. multiplexor. All DEC system, except for disc drives/controllers, in DEC cabinet. **£4500.00**

DEC PDP 11/23 system. With 256KB RAM, single **FUJITSU** 20MB WINCHESTER disc drive, single **TANDON** 8" floppy disc drive, **DLV-11J**, & **XENIX** operating system with all original manuals. **£1800.00**

CANON Model A-1300 twin 5¼" disc drives. Cased BRAND NEW half height drives, DSDD, 80 track, 640 KB per drive, SHUGART compatible interface. Without PSU, per pair **£99.50**

FUJITSU 5¼" WINCHESTER disc drives. 5MB capacity with ST506 interface. BRAND NEW **£75.00**

Please note:
**VAT & CARRIAGE must be added to all items. Carriage is £3.00 + VAT for 3" disc drives, and £10.00 + VAT for most other items.*
**SAE please, for further details of any item and complete stock list with details of many other items including test equipment, terminals, plotters etc. etc.*

MATMOS Ltd., 1 Church Street, Cuckfield, W. Sussex RH17 5JZ. (0444) 414484/454377
COMPUTER APPRECIATION, 111 Northgate, Canterbury, Kent CT1 1BH. (0227) 470512. TELEX 966134 COMPAP

matmos & COMPUTER APPRECIATION

The new era is upon us.....

Watch this space in next months issue, for details of our "special" pachages.

In the meantime ...

123, Symphony[v1], Wordstar 2000 and 50 blank disks, for only £499

To first 75 ONLY

DIAMOND SOFTWARE

162 EARLS COURT ROAD
KENSINGTON
LONDON SW5 9QQ

TEL: 01-370 6846

THOUGHTS & CROSSES

(COMPUTERS) LTD.

33 MARKET STREET, HECKMONDWIKE, WEST YORKS

COMPUTERS

Amstrad PCW 8512	£573
Amstrad PCW 8256	£458
Amstrad CPC464 (Colour Monitor) + £100 FREE software	£299
Amstrad CPC6128 (Co. & disk drive	£399
Amstrad PC1512 (Single Drive, Mono Monitor)	£516
Amstrad PC1512 (Twin Drive, Mono Monitor)	£711
Amstrad PC1512 (Single Drive, Colour Monitor)	£710
Amstrad PC1512 (Twin Drive, Colour Monitor)	£838
Amstrad PC1512 Hard Disk 20Mb Mono	£1033
Amstrad PC1512 Hard Disk 20Mb Colour	£1229
Atari 520STFM	£380
Atari 1040STF with 1Mb Drive & Mono Monitor	£680
BBC Master Series	£499
BBC Master Compact with green screen monitor	£539
BBC Master Compact with medium res colour monitor	£688
Sinclair QL	£129
Atari 1040STF with 1Mb Disk Drive & Philips 8533 Colour Monitor	£870
BBC Master Compact + TV Modulator	£458
Sinclair Spectrum Plus 2	£149

PRINTERS

Canon PW1080A	£285
Canon A55 (14 1/2 Carriage)	£425
Citizen 120D NLQ	£195
Citizen MSP10E	£295
Citizen MSP 25E (14 1/2 Carriage)	£525
Mannesman MT85 NLQ	£345
Epson LX86	£275
Citizen MSP15 (14 1/2 Carriage)	£325
Panasonic KXP1080 1081	£185
Amstrad DMP 3000	£195
Amstrad DMP 2000	£195

DAISY PRINTERS

Juki 6100	£320
Juki 6200	£549

PRINTER ACCESSORIES

Epson LX80/86 Tractor Unit	£25
Epson LX80/86 Sheet Feeder	£65
Juki 6100/6200 Tractor Feeder	£159
Juki 6100/6200 Sheet Feeder	£220

EXTERNAL CENTRONICS TYPE

Commodore 64 — Citizen 1200	£49
Kempston interface-E Rom based for Spectrum	£39.95
QL Centronics interface	£20
Tripler 20/64 for C8 VIC20/64	£50

PRINTER RIBBONS

Amstrad PCW8256	£5.50
Brother EP44	£2.30
Brother HR5	£2.99
Brother M1009/Centronics GLP	£3.80
Canon/Kaga Taxan	£5
CBM MPS801	£6.50
Citizen 120D	£5
DMP 2000/3000	£5
Epson LX80	£4.50
Epson MX/FM/RX80	£4
Juki 6100 Single strike	£2
Juki 6100 Multistrike	£5
Mannesman Tally MT80/MT80 Plus	£6
OKI Microline 80	£2.30
Qume Multistrike	£4.30
Seikosha GP80	£4.50
Seikosha GP100	£4.50
Shinwa CP80/CPA80/SP80	£6
Star NL 10	£8

10 or more ribbons deducted 10%
Others available, please ask.
Also PRINT WHEELS available please ask.

LASER PRINTERS

OMS K8 Laser Printer	£1840

LEADS

Amstrad Centronics Printer Lead	£10
Apricot Centronics Lead	£15
Atari 520ST printer	£15
BBC Centronics Printer Lead	£10
BBC Microvitec RGB	£5.95
BBC Serial RS232 Printer Lead	£10
Commodore Serial Lead	£5.95
Dragon Centronics Printer Lead	£10
Einstein Centronics Printer Lead	£10
IBM Printer Lead (Cable)	£15
Memotech Centronics Printer Lead	£10
MSX Centronics Printer	£15
Opus Discovery Centronics Lead	£15
Oric Centronics Printer Lead	£10
QL to RS232 Lead	£14.95
Waladrive to Centronics Lead	£15
ZX Interface 1 to RS232 'D'	£14.95
RS232 'D' to RS232 'D'	£20

MONITORS

Microvitec 1431 MS (Standard res)	£215
Microvitec 1451 MS (Medium res)	£290
Microvitec 1451 DQ Sinclair QL	£275
Philips 7502 anti-glare screen monitor (20MHz)	£82
Philips 7522 anti-glare amber screen monitor	£95
Philips 7542 anti-glare paper white monitor (20MHz)	£95
Philips 8533 RGB/TTL/Audio Med Res	£290

DISK DRIVES

Amstrad PCW 512k Upgrade + 720k Second Drive	£189
Atari SF354 5Mb Drive	£140
Atari SF314 1Mb Drive	£190
Cumana (Atari) 1Mb Drive	£159
QL 720K Drive + Interface	£199
QL Twin 720K Drive + Interface	£299
Commodore 1571	£269
Amstrad DD-1 (Drive + Interface)	£159
Amstrad FD-1 (Second Drive)	£99
Cumana CSX 400	£135
Commodore 1541C	£195
Cumana CD800S	319

DISKETTES

5-¼ SS DD 48+pi	10 for £9
5-¼ DS DD 48+pi	10 for £9
5-¼ DS DD 96+pi	10 for £9
3" CF2	10 for £30
3-½ Single Sided	10 for £16
3-½ Double Sided	10 for £22

PVC COVERS

Amstrad Colour Monitor	£4.80
Amstrad CPC464	£3.99
Amstrad CPC6128	£3.99
Amstrad Green Monitor	£4.80
Amstrad PCW Cover Set	£10
Amstrad PC1512 Cover Set	£10
Panasonic KXP1080	£4.80
DMP 3000 Printer	£4.80
BBC Computer	£3.99
BBC Master	£4.60
Brother M1009	£4.30
Canon PW1080A/Kaga Taxan	£4.80
CBM 16/20/64	£2.99
CBM 128	£3.99
Citizen 120 D	£4.80
Juki 6100	£5.60
Microvitec 14"	£4.80
Philips 7502/7522 etc	£4.30
Saga Emperor Keyboard	£4.50
Spectrum + 2	£3.99
Sinclair QL	£3.99
ZX Spectrum	£1.99
ZX Spectrum Plus	£2.99

PSION ORGANISER PRODUCTS

Organiser 11 CM (8KRam/32KRom)	£139
Organiser 11 XP (16KRam/32Krom)	£139
16K Ram Upgrade	£19
32K Ram Upgrade	£34
64K Ram Upgrade	£79

ATARI ST SOFTWARE

Little Computer People	Activision	£22.50
Paintworks	Activision	£36
D.B. Calc	Atari	145
Haba spell	Haba	£35.95
Haba Merge	Haba	£35.95
Haba View	Haba	£67.95
Haba Writer	Haba Writer II	£67.50
Davpac St	Hisoft	£44.95
Pascal St	Hisoft	£53.95
ANIMATOR	Miocrodeal	£29.95
Leaderboard	US Gold	£22.50
Winter Games	US Gold	£22.50
Music Studio	Activision	£26.95
Sundog	Frozen Legacy	£26.95
Higgo C	Haba	£67.55
Deadline	Infocom	£21.00
Hitchhikers Guide	Infocom	£28.00
Planetfall	Infocom	£21.00
Seastalker	Infocom	£21.00
Sorcerer	Infocom	£21.70
Spellbreaker	Infocom	£25.20
Starcross	Infocom	£21.70
Suspended	Infocom	£21.70
Wishbringer	Infocom	£26.10
Zork 1	Infocom	£21.00
Alternative Reality	Datasoft	£22.50
Typing Tutor	Academy	£31.45
Championship Wrestling	US Gold	£22.50
Tee Up	Anco	£13.50
K Spread 2	Kuma	£72.00
Terrestrial Encounter	Solar	£13.50
Forever Voyaging	Infocom	£21.70
Flight Simulator II	Subiogc	£45.00
Chess	Psion	£22.50
Wanderer	Pyramid	£22.50
Jewels of Darkness	Rainbird	£18.00
Silicon Dreams	Rainbird	£18.00
Accountant	Sage	£152.00
Accountant Plus	Sage	£206.00
Speller Bee	Sage	£45.00
Back Pack	Comp Concepts	£45.00
Stand Alone	Comp Concepts	£13.50
Colourspace	Llamasoft	£17.95
Assembler	Metacompco	£45.00
Lattice C	Metacompco	£90.00
Pascal	Metacompco	£81.00
Cards	Microdeal	£17.95
Desk Help	Microdeal	£26.95
Direct File Transfer	Microdeal	£26.95
Dos-Shell	Microdeal	£26.95
intro to St Logo	Microdeal	£17.95
Major Motor	Microdeal	£22.50
Mi-Term	Microdeal	£26.95
Mudpies	Microdeal	£17.95
Utilities	Microdeal	£35.95
Brataccas	Psygnosis	£31.50
The Pawn	Rainbird	£22.50
Trimbase	Talent	£81.05
Rouge	Epyx	£22.50
Silent Service	Microprose	£22.50
Trinity	Infocom	£31.50
Temple of Apshai Trilogy	Infocom	£22.50
Minstrel	Kuma	£27.95
Mercenary	Novagen	£22.50
Shanghai	Activision	£22.50
Clock	Robtrek	£45.00
Cambridge Lisp	Metacomco	£135.00
BCPL	Metacomco	£81.00
Make	Metacomco	£45.00
Basketball	Activision	£22.50
Tass Times	Activision	£22.50
Printmaster	Anolasoft	£26.95
Degas Elite	Batteries inc.	£72.00
Personal Money Manager	Microdeal	£26.95
Back up (Hard Disk)	Microdeal	£22.50
Mindshadow	Activision	£22.50
Fantastic 4	Adventure	£17.95
Spiderman	Adventure	£17.95
Strip Poker	Anco	£17.95
Disk Doctor	Antic	£26.95
Flash	Antic	£36.95
Bridge 4.0	Artwork	£26.95
D Base II	Ashton	£107.00
Thunder	Batteries	£35.95
Micro C Shell	Beckermeyer	£44.95
Micro C Tools	Beckermeyer	£22.50
Cashlink A/C	Cashlink	£295.00
Fast Basic	Comp Concepts	£81.00
Int. Karate	Eidersoft	£22.50
Protector	Eidersoft	£17.95
Space Station	Eidersoft	£22.50
Moonmist	Infocom	£35.95
Witness	Infocom	£26.95
Pro Fortran 77	Prospero	£135.00
Pro Pascal	Prospero	£135.00
Book Keeper	Sage	£102.50
Homework (Maths)	Spinnaker	£44.95
Homework (Words)	Spinnaker	£44.95
Ram Disk + Spool	Talent	£22.50
Leaderboard (Tom)	US Gold	£8.95
VIP Professional	VIP	£175.00
Mean 18 Golf	Accolade	£40.45
CAD 3D	Antic	£45.00
ST Accounts	Chipsoft	£155.00
Saved ST	HiSoft	£23.40
Enchanter	Infocom	£26.95
Hollywood Hijinks	Infocom	£26.95
Ballyhoo	Infocom	£26.95
Leather God	Infocom	£26.95
Ninja Mission	Mastertronics	£8.99
Art Director	Mirrorsoft	£45.00
Fleet Street Editor	Mirrorsoft	£103.00
Strike Force Harrier	Mirrorsoft	£22.50
Starglider	Rainbird	£22.50
Trimbase	Talent	£81.05
10th Frame	US Gold	£22.50
Super Cycle	US Gold	£22.50
Super Huey	US Gold	£18.00
World Games	US Gold	£22.50
VIP Professional (GEM)	US Gold	£205.00

PC 1512/IBM SOFTWARE ACCOUNTING SOFTWARE

Payroll	Camsoft	£45.00
Integrated Accounts	Compact	£179.00
Sales Ledger	Compact	£80.95
Sales Invoicing	Compact	£80.95
Purchase Ledger	Compact	£80.95
Nominal Ledger	Compact	£80.95
Payroll	Compact	£89.95
Daybook	Compact	£62.95
Integrated Accounts	Map	£135.00
Sales Ledger & Invoicing	Map	£45.00
Nominal Ledger	Map	£45.00
Purchase Ledger	Map	£45.00
Stock Control	Map	£45.00
Payroll	Map	£45.00
Mapspec (SSP System)	Map	£45.00
Sales Order Entry	Map	£53.00
Purchase Order Entry	Map	£53.00
Job Costing	Map	£89.00
Book Keeper	Sage	£102.45
Accountant	Sage	£154.20
Accountant Plus	Sage	£205.95
Payroll	Sage	£102.50
DAC Easy Accounting	DAC	£88.00
DAC Easy Make	DAC	£52.00
DAC Easy Tutor	DAC	£31.00
Bookworker	Compsoft	£179.00
Financial Manager	Camsoft	£135
Sales & Marketing	Map	£90
Magic	Map	£90
Financial Controller	Sage	£269

BUSINESS PRODUCTIVITY

Homebase	Amber	£62.95
Reflex	Amsoft	£62.95
Sidekick PC1512	Amsoft	£26.95
Brainstorm	Caxton	£44.95
Timekeeper	Caxton	£44.95
Dominoe	Compsoft	£89.95
One Up	Moneywise	£89.95
Desk:set	Sage	£71.40
Library	SSI	£152.10
Able One	Conceptdata	£179.00
Open Access One	SPI	£135.00

COMMUNICATIONS

Chitchat	Sage	£102.50
Able One	Conceptdata	£90.00

DATABASES

Cambase	Camsoft	£44.95
Cardbox	Caxton	£53.99
Condor 1 Junior	Caxton	£89.99
Nucleus	Compact	£89.99
Delta 4.3	Compsoft	£89.95
Retrieve	Sage	£105.00
SSI Data	SSI	£202.50
TAS Plus	TAS	£71.42
TAS Plus Dev	TAS	£205.95
TAS Plus Dev Multi User	TAS	£309.45
G Base	SPI	£90.00
DAC-Base	DAC	£90

ENTERTAINMENT SOFTWARE

Chessmaster 2000	Electronic Arts	£26.95
Grand Slam Bridge	Electronic Arts	£17.95
Decision in the Desert	Microprose	£22.50
Super Sunday (American Fiball)	Nexus	£20.65
Fortune Teller	Status Software	£13.50
ICON Quest for the Ring	Status Software	£13.50
Alter Ego	Activisoq	£22.95
Borrowed Time	Activision	£17.95
Mind Shadow	Activision	£17.95
Music Studio	Activision	£22.50
Shanghai	Activision	£17.95
Tass Times	Activision	£17.95
Alex Higgins Snooker	Amsoft	£17.95
Cyrus II Chess	Amsoft	£17.95
Mean 18 Golf	Amsoft	£17.95
Music Construction	Amsoft	£17.95
Pinball Construction	Amsoft	£17.95
Pitstop II	Amsoft	£17.95
Seven Cities of Gold	Amsoft	£17.95
Summer Games II	Amsoft	£17.95
Winter Games	Amsoft	£17.95
Lode Runner	Broderund	£28.00
Sargon 3	Hayden	£39.00
Mind Prober	Human Edge	£31.00
Ballyhoo	Infocom	£26.00
Deadline	Infocom	£21.00
Enchanter	Infocom	£21.00
Hitchikers Guide	Infocom	£26.00
Moonmist	Infocom	£26.95
Plantefall	Infocom	£21.00
Seastalker	Infocom	£21.00
Sorceror	Infocom	£21.00
Zork 1	Infocom	£21.00
Zork 2	Infocom	£21.00
Crusade in Europe	Microprose	£22.50
Archon	Anolasoft	£18.00
Leather Godess	Infocom	£32.00
Backgammon	Microdeal	£18.00
Calixto Island	Microdeal	£18.00
Sea Search	Microdeal	£18.00
F15 Strike Eagle	Microprose	£19.95
Hellcat Ace	Microprose	£17.95
Silent Service	Microprose	£22.50
Solo Flight 2	Microprose	£17.95
Spitfire Ace	Microprose	£17.95
Flight Simulator	Microsoft	£45.00
Scenery Disks 1-6	Microsoft	£83.00
Jewels of Darkness	Rainbird	£17.95
Jet	Subiogic	£45.00
Bruce Lee	US Gold	£17.95
Dambusters	US Gold	£17.90
Strip Poker	US Gold	£17.95
Ultima III	US Gold	£18.00
Exodus	Origin	£18.00
Starglider	Rainbird	£18.00
Silicon Dreams	Rainbird	£18.00

SPREADSHEETS

Supercalc 3	Amsoft	£62.95
Scratchpad Plus	Caxton	£53.99
PC Planner	Sage	£102.50
Logistic	Grafox	£102.50
K Spread 2	Kuma	£72.00
Silk	CSD	Call

WORD PROCESSORS

Mindreader Executive	Advance	£44.95
Wordstar 1512	Amsoft	£62.95
PC Write	Sage	£102.50
Wordperfect junior	SSI	£89.00
Wordperfect Personal	SSI	£179.00
Wordperfect	Wordperfect Corp	£439.00

MISCELLANEOUS

Touch N Go	Caxton	£22.50
Delta Graph	Compsoft	£62.95
Fleet St Editor	Mirrorsoft	£135.00
Complete Introduction	Reeltime	£26.95
Information System	Portex	£102.50
PC Four	Psion	£72.00

GEM SOFTWARE

Gem Diary	Digital Research	£35.95
Gem Draw	Digital Research	£89.95
Gem Draw Business Library	Digital Research	£35.95
Gem Font Editor	Digital Research	£89.95
Gem Fonts & Drivers	Digital Research	£35.95
Gem Graph	Digital Research	£89.95
Gem Programmers Toolkit	Digital Research	£162.00
Gem Word Chart	Digital Research	£89.95
Gem Write	Digital Research	£89.95

UTILITY SOFTWARE

The Knife — 86	Hisoft	£26.95
Turbo Pascal Graphic Toolbox	Borland	£45.00
Turbo Pascal	Borland	£72.00
Turbo Lightening	Borland	£72.00
Turbo Prolog	Borland	£72.00
Turbo Gameworks	Borland	£45.00
Turbo Basic	Borland	Call
Quick Basic	Borland	Call

WE ALSO STOCK SOFTWARE FOR

Spectrum	500 titles
Commodore 64	400 titles
Amstrad 464	200 titles
Amstrad 6128	200 titles
Amstrad PCW8256/8512	100 titles
Electron	100 titles
BBC	200 titles
QL	80 titles

EXPORT ORDERS WELCOME
ASK OR SEND FOR PRICE LIST

Access

BARCLAYCARD VISA

Tel: (0924) 409753 for Access, Visa, Mastercard

We welcome enquiries from Government,
Local Authorities & Education
Special BFPO Rates

Tel: (0924) 402337 for General Enquiries.
TELEX 556577 CROSSG
Shop open 9-5pm Mon-Sat; Mail Order 9-8pm Mon-Fri.

ALL PRICES INCLUDE VAT AND CARRIAGE

PCW SHOW FOCUS

The 10th Personal Computer World Show

23-27 SEPTEMBER 1987
OLYMPIA LONDON

Sponsored by Personal Computer World and PC Week

The PCW Show is approaching fast and this year it promises to be even bigger and better than ever before. We preview some of the highlights at this year's action-packed event, which include the annual British Microcomputing Awards.

Autumn prizes

Two key industry events will coincide this year, as the British Microcomputing Awards ceremony moves from June to September to join the PCW Show. Awards will be presented to the winners, who in the past have included Apricot, Miracle Technology, Data General, Acornsoft and Amstrad, at a special dinner to be held during the Show.

The British Microcomputing Awards represents the industry's highest recognition of achievement and covers all aspects of it, with ten main categories of award. These include: business micro of the year, low-cost micro, business software, utility software, communications, peripherals, portables, game and educational product of the year. There will also be a special prize to be presented at the discretion of the judges.

Entrants are selected by public nomination and the final choice made by a panel of eight judges drawn from all sectors of the computer industry to include Derek Cohen, the editor of *PCW*. As in past years, prizewinners will receive a specially commissioned plaque. Readers of *PCW* and *PC Dealer* are invited to nominate companies and products to enter any of the categories. For more details see the BMA ad on page 261 of this issue.

Making notes in the village

The Atari Village will be well-orchestrated this year, with a complete sound studio on the Syndromic Music stand.

Specialising in MIDI (Musical Instruments Digital Interface) applications, Syndromic Music will also be launching one of the first low-cost interactive arcade games for the Atari ST that uses the MIDI port, as well as programs published under its own Soundbits software label.

Music at the touch of a button from Hybrid Arts

Based in Muswell Hill, North London, Syndromics is the UK distributor for Hybrid Arts in the US. The MIDImaze game to be released at the Show was developed by Hybrid Arts and caters for up to 15 STs linked together by one MIDI cable. Each can interact with the others and players can gang up on each other in the full-colour 'happy-face'-type game.

'It's really a foolish use of MIDI because, although it will have offset music, the really remarkable thing about the game is its level of interactivity,' commented Vince Hill, managing partner of Syndromic.

He stresses that the company will be catering for professional musicians as well as amateurs and games enthusiasts, and will have a special 'pro-area' within the studio for quiet demos. Visitors will be able to see a wide range of ST products from entry-level MIDI synthesisers or keyboards, for simply storing programs on the Ataris, up to professional recording products with tape control synching to SMPTE (Society of Motion Picture and TV Engineers) time code standards.

The Soundbits label covers visual, screen editing applications for the general consumer with a low-cost synthesiser. Three programs have been released so far; two for the Yamaha range, and one for Roland synthesisers.

'Atari has brought computers to the musician, said Hill. 'It's been a long-term process because the musician thinks that computers will inhibit or destroy his creativity.

'We have to show that what we sell will enhance his creativity, and the ST is the best machine so far. It makes good sounds and the software that's around is so good compared with what there has been for the IBM and 8-bit micros.'

Hands up for hands-on!

Anyone wanting hands-on experience and impartial advice about business software will be able to get it on a one-to-one basis at the Budget Software Village in Olympia 2.

This year the Federation of Microsystems Centres plans to set up four booths, each with a different application running on a standalone PC linked to an overhead projector.

Visitors will be able to experiment with various packages in each booth and receive instruction from a consultant, or watch the efforts of others relayed on monitors outside.

'We expect to have between 6-10 consultants on hand to give general advice and information on a selection of hardware and software,' promised Fred Hawker, chairman of the Federation, who also manages the Newcastle centre.

'They will take people on a one-to-one basis through standard word-processing, spreadsheet and database applications.' The Federation is under contract to the Department of Trade and Industry to act as a commercially impartial consulting, training and information body. It has 21 centres around the country, which are open to anyone wishing to see different computer systems or software in action, or attend training courses.

Between April 1986 and January 1987, the Federation carried out 1000 consultancy projects, offered 2500 training places and serviced 10,000 visitors and telephone enquiries nationwide.

Thai party for two

One lucky visitor will leave this year's PCW Show with the holiday of a lifetime to look forward to. He or she will have won a 16-day Siam Holiday for two in Thailand, donated jointly by Keith Prowse Journeys and Thai Airways International.

Worth a total of £2500, the prize includes 13 nights' accommodation at top-class hotels and a sightseeing tour in each of three locations. Four nights are spent in Bangkok, two in the northern trekking centre of Chiang Mai, and seven on the paradise island of Phuket.

Anyone can enter the draw: all visitors have to do is leave their names at the competition stand on Level 2 in the Business Hall. One name will be drawn every hour, and will go forward to enter the final draw on Sunday.

All entrants will receive a £25 voucher redeemable against a Keith Prowse Journeys holiday.

INFORMATION

To book your PCW Show space contact Richard Hodgson on (01) 486 1951 or (01) 487 5831, or write to: Computer Upgrade, PCW Show, 11 Manchester Square, London W1M 5AB. END

GRAPHTEC. THE NEW A3 RANGE OF PLOTTERS — PROGRAMMED FOR VALUE

There are ten plotters in the Graphtec A3 range... costing from as little as £895.

The features and benefits are outstanding and offer an exceptional value which belies the price.

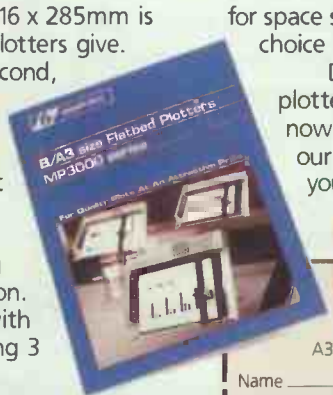
For example, an image area of 416 x 285mm is much closer to a true A3 than other plotters give.

With pen speeds of 40cms per second, you get quicker plots — and a resolution of 0.025mm gives you a better quality plot. And to help you make really attractive plots, there is not only an eight pen facility, but a wide variety of pen types available, from basic fibre tips to specialised ceramic tips and draughting pens. There's even a pencil plotting option.

Graphtec plotters can interface with practically any host computer and having 3 switch-selectable command languages, including HP-GL, are compatible with most software packages.

A large 24K capacity buffer frees your pc for other duties. And there's more... LCD status report... tilt stand for space saving... a number of pen protection devices... choice of paper holds...

Discover just how much more Graphtec plotters can give you — including value. Phone us now or use the Freepost coupon. We'll send you our colour brochure, a price list and the name of your nearest appointed Graphtec stockist.



Phone 0270 625115

OR POST FREE (No stamp needed).

Please send me information on:

A3 Plotters ☐ Large Format Plotters ☐ Range of Digitisers ☐

Name _____

Position _____

Company _____

Address _____

_____

County _____ Post Code _____

Tel: _____

Type of Business _____ PCW 1

Post to: Environmental Equipments (Northern) Ltd, Freepost, Nantwich, CW5 6BR

Environmental Equipments (Northern) Ltd,
Environ House, Welshman's Lane,
off Welsh Row, Nantwich, Cheshire CW5 6AB.

SOLE UK DISTRIBUTORS

GRAPHTEC

PUTTING · THE · FUTURE · INTO · YOUR · HANDS

PEARTREE COMPUTERS LTD

Peartree House, No 1 Blackstone Road, Stukeley Meadows Industrial Estate, Huntingdon, Cambs PE18 6EF. Telephone (0480) 50595

OPUS PC II

SYSTEM 1

- Fully compatible 16-bit micro
- CPU allowing 4.77/8MHz turbo processing
- Highly compatible U.S. registered BIOS
- 360K floppy disk drive
- High quality AT-style U.K. specification keyboard
- Hercules-compatible high resolution graphics card
- Monochrome monitor with tilt and swivel base
- 256K of RAM
- 8 expansion slots
- Battery-backed clock/calendar
- Joystick interface
- Approved 150 watt power supply

IBH001 **£499.00**

SYSTEM 2

- Standard system features plus:
- RAM expanded on the motherboard to 1024K
- 384 RAM disk implemented
- RAM disk software
- Serial card

IBH001 **£599.00**

SYSTEM 3

- Standard System 2 plus:
- Second 360K floppy disk drive

IBH003 **£699.00**

PLEASE USE OUR CODES WHEN ORDERING

All prices are exclusive of VAT.

SYSTEM 4

- Standard system features plus
- 20 Megabyte Winchester drive
- Winchester controller card
- RAM expanded on motherboard to 1024K
- 384K RAM disk implemented
- RAM disk software
- Serial card

IBH004 **£995.00**

COLOUR AND EGA OPTIONS

- Opus colour option add £200
- Opus EGA option add £500

MICROSOFT DOS 3.2

- 100% IBM-compatible DOS for use with Peartree PCs
- Supplied with GW-BASIC V3.2

IBH069 **£50.00**

*We are also registered **Amstrad** and **Commodore Amiga** dealers.*

Phone us for all your upgrade requirements. We can build a system to suit your unique specifications.

Maintenance contracts also available.

*Telephone **0480 50595** for further details and prices.*

PUTTING · THE · FUTURE · INTO · YOUR · HANDS

WORD PROCESSING

IBS002 **WORDSTAR 3.40** £199.95
- Industry standard word-processor
- Document or ASCII text editing
- On-line help facility

IBS0041 **WORDSTAR PROF REL.4** £379.00
- Latest release of Wordstar Professional
- 87,000 word speling checker
- 220,000 word thesaurus

IBS004 **NEWWORD 2** £99.00
- Compatibility with Wordstar
- Built-in mailmerge and spelling checker

IBS005 **MICROSOFT WORD 3.1** £329.95
- Outline document processar
- Built-in spelling checker and thesaurus
- Best suppart for laser printers and EGA displays

IBS009 **WORDSTAR 1512** £60.83
- Amstrad PC1512 only
- Built-in mailmerge
- Compatibility with 'standard' Wordstar

IBS006 **MICROSOFT WORD JUNIOR** £60.83
- Basic compatibility with Word 3.1
- Full mouse suppart
- Mailmerge facility built-in

SPREADSHEETS

IBS012 **SUPERCALC 4** £259.95
- Extended graphing facilities
- New financial features
- Fully data compatible with versions 2 and 3

IBS013 **LOTUS 1-2-3- RELEASE 2** £319.95
- Industry standard spreadsheet
- Full graphing facilities

IBS011 **SUPERCALC 3.1** £60.83
- Amstrad PC1512 only
- Full graphing facilities

IBS017 **MICROSOFT MULTIPLAN JUNIOR** £60.83
- Fast calculations and screen update
- 63 by 255 matrix

DATABASES

IBS022 **DBASE III+** £449.95
- Industry standard database system
- Powerful extended command language with pull-down menus

IBS021 **DBASE II** £299.95
- Industry standard database system
- Command language

IBS024 **PARADOX** £459.95
- Very powerful relational database
- Full support for LANs

IBS020 **DELTA 4** (budget version) £69.95
- Up to 80,000 records per file
- Both standard and user-designed screen layouts

IBS019 **CARDBOX** £52.13
- Famous electronic card index system
- Excellent for mailing lists

INTEGRATED SOFTWARE

IBS026 **SMART SYSTEM** £449.95
- Integrated suite containing database, word processor, spreadsheet, time manager and communications modules
- Latest network-reody version 3.1 now available

IBS015 **FRAMEWORK II** £399.95
- Integrated suite containing database, spreadsheet, graphics, communications, text outliner, and 'Fred' programming language
- Supports full data exchange with Lotus 1-2-3, Wordstar, dBase II and III+, and many more

IBS027 **PC FOUR** £67.95
- Integrated suite incorporating word processor, database, spreadsheet, graphics package and including a full tutorial
- Allows swapping of datafiles between modules

IBS028 **ABILITY** £89.95
- Low-cost fully-integrated system with word-processor, spreadsheet, database, communications and business graphics
- Supports imports from Lotus 1-2-3

COMMUNICATIONS

IBS029 **DATATALK** £129.95
- Full-featured viewdata and ascii terminal communications software
- Support for many modems
- Menu driven for ease of use
- XModem and own file transfer protocols

IBS030 **CROSSTALK XVI** £99.95
- Industry standard ascii communications software
- Allows capture of data direct to a memory buffer
- LAN version available

IBS031 **CHIT-CHAT** £89.95
- Low-cast viewdata and ascii communications software
- Menu driven with built-in telephone directary

UTLITIES

IBS032 **SIDEKICK** (not copy protected) £49.95
- World-famous memory-resident desktop system
- Incorporates notepad, telephone directory, calculator, calendar and ascii table
- Full support of colour and hard disks

IBS033 **NORTON UTILITIES** £59.95
- Allows recavery of deleted data from disks
- Other utilities include disk editar and file management
- Excellent manual

IBS034 **TURBO LIGHTNING** £56.95
- Memory-resident spelling checker & thesaurus
- Configurable for many applications including Wordstar
- Pull-down menus far ease of use

IBS035 **MICROSOFT WINDOWS** £66.95
- Screen management and front-end system
- Allows multi-tasking
- Supports colour with EGA monitors
- Fully Microsoft Mouse compatible

IBS037 **COPY II PC** £39.95
- Makes back-up copies of most copy protected programs
- Comes with other utilities including Nokey and NoGuard

IBS038 **FASTBACK** £129.95
- Very fast hard disk back-up program
- Uses own disk format ta store 400k per floppy disk

IBS039 **SIDEWAYS** £37.95
- Turns text on its side when printing
- Useful for printing wide spreadsheets
- Recommended by Lotus for use with 1-2-3

IBS040 **DISK OPTIMIZER** £34.95
- Re-arranges your hard disk far the fastest access time
- Includes other utilities such as file examiner

GAMES

IBS062	**FLIGHT SIMULATOR**	£39.95
IBS063	**LODE RUNNER**	£24.95
IBS064	**PSION CHESS**	£39.95
IBS065	**THE JET**	£34.95
IBS066	**HITCH-HIKER'S GUIDE TO THE GALAXY**	£24.95

LANGUAGES

IBS041 **MICROSOFT C** £299.95
- Full standard 'C' compiler
- Produces very fast and compact code
- Complete with Symbolic debugger

IBS042 **MICROSOFT MACRO ASSEMBLER** £99.95
- Fast and powerful full-featured macro assembler
- Symbolic debugger now included
- Supports 8088/8086/80186/80286 instruction sets plus 8087/80287 math co-processors

IBS043 **MICROSOFT FORTRAN** £229.95
- Subset of ANSI standard Fortran 77
- Optimising compiler for better use of available memory
- Same data format as other Microsoft languages

IBS044 **MICROSOFT COBOL** £499.95
- Full ANSI standard implementation
- Modular programs possible
- Includes compiler, macro assembler, linker and librarian

IBS045 **TURBO PASCAL** £59.95
- World-famous implementation of Pascal
- Integrated editor/compiler with run-time error detector
- Now supplied with 8087 and BCD support as standard
- Huge range of toolboxes and support products available

IBS046 **ZORLAND C** £29.95
- Full Kernighan and Richie implementation
- Produces optimized code in standard Intel formot

HARDWARE

MONO15 **NEC MULTISYNC** £599.95
- Ultra-high resolution 14 inch colour monitor
- Compatible with IBM's CGA, EGA and PGA standards
- Superb sharp and steady picture

IBP002 **VEGA 7 EGA CARD** £299.95
- Full-featured EGA display card with 'Autaswitch' system
- Extended screen sizes when used with NEC Multisync
- Small size allows fitment in a short slot

IBP003 **PARADISE AUTOSWITCH EGA CARD** £299.95
- Compatible with EGA, CGA, Hercules and Plantronics standards
- 'Autaswitch' automatic standard selection
- Fits in a short slot

IBP004 **AST SIX-PACK-PREMIUM** £359.95
- Supports up to 2Mb of Lotus/Intel/Microsoft standard EMS RAM
- Supplied with 512k RAM, serial and parallel ports, and clock
- Complete with software and a full manuol

IBP005 **AST PREMIUM-PAK** £299.95
- Piggy-back board for fitment on AST's Six-Pack-Premium
- Supplied with 1Mb of RAM

IBP006 **SIX-PACK-PREMIUM RAM UPGRADE** £44.95
- Upgrades your AST Six-Pack-Premium from 512k RAM to 1Mb
- Supplied with comprehensive instructions

IBP007 **MICROSOFT MOUSE** £149.95
- Both card and serial port versions available
- Adds ease of use to your PC
- Excellent for use with many applications

We accept Barclaycard/Visa/Access/ Mastercard/postal orders or cheques. We accept government and educational orders. Dealer enquiries welcome.

You may purchase any of the items listed, by cheque made payable to **PEARTREE COMPUTERS LTD.**

All you have to do is to list your requirements on a sheet of paper, post it to us quoting ref, and we will despatch your goods within 24 hours, whenever possible.

Please add the following amounts for postage and packing:

Items below **£10.00**	add **£1.50**
Items below **£50.00**	add **£2.50**
Items below **£100.00**	add **£3.50**
Items over **£100.00**	add **£9.00**

Independent courier for items over £100.00

All prices exclude VAT.

Access/Barclaycard holders—call us on our new special line: **(0480) 50595**

Prices are correct at time of going to press. Peartree Computers reserves the right to change prices without prior notice.

PLEASE USE OUR CODES WHEN ORDERING

SHARPEST VISION
SHARPEST PRICE £399

THE NEW OPUS EGA MONITOR AND CARD

The new enhanced graphics monitor system from Opus is proud to display something none of its rivals can emulate — a price tag of only £399+VAT. It's enough to turn even the most colourful computer display green with envy.

Opus offers you Britain's most affordable enhanced graphics upgrade — a 14" super high resolution EGA colour monitor and versatile IBM/Hercules-compatible enhanced graphics display board with 256K of display memory for under £400. Together they make a stunning combination and stunning graphics.

The Opus display card will emulate IBM's EGA, CGA and MDA boards as well as the Hercules Monochrome Graphics Adaptor. So if you need 16 colours from a palette of 64 for computer-aided design and business graphics, or pin-sharp colour and monochrome text for wordprocessing and desktop publishing, it's all available. The Opus monitor offers maximum 640×350 resolution for rock-steady graphics and, like our EGA display board, it's covered by a full 12-month warranty.

So for the sharpest vision at the sharpest price call Opus today on **0737 65080**

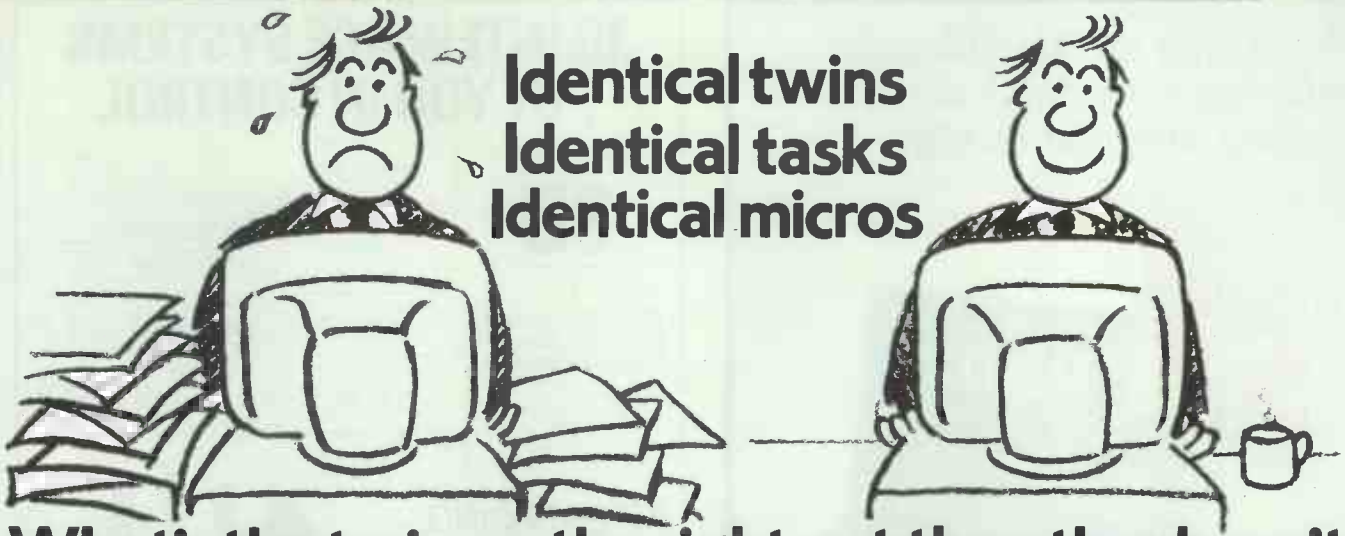
We offer special education and government discounts and welcome dealer and export enquiries.

Opus Supplies Ltd, 53 Ormside Way, Holmethorpe Industrial Estate, Redhill, SURREY RH1 2LW.

Opus

IBM is trademark of International Business Machines Corporation.

Hercules is a trademark of Hercules Computer Technology



Identical twins
Identical tasks
Identical micros

What's the twin on the right got the other hasn't?

He's got the **Recall** full text retrieval system. It's a revolutionary new software package for micros.

It means the twin on the right has instant access to information, regardless of its size, shape or content.

While the one on the left has to scroll through endless text files and hunt through endless piles of paper for the same information. He could be there until Christmas!

At which time his twin should display some goodwill and tell him about the **Recall** range.

Up to 32,000 documents (contracts, press releases, reports, letters etc) can be stored anyway you like and minutely examined for the information you want. Just describe it in plain English and hey presto it's there.

You can then display it, print it, or write it to disk, in whole or in part. Within seconds you can complete a task that could take you months.

What's more the price makes **Recall** a real gift. Just £195 + VAT.

For more complex tasks, there's **Recall Plus**. It offers you a host of additional features, including synonym and phrase searching, and a user-definable thesaurus.

The **Recall** range will run on all IBM XT/AT/Compatible micros and the ACT Apricot/Xen. Multi-user versions are available for any DOS based network.

Contact Steve Robinson on Bristol 268893 for the full **Recall** story.

Recall

FULL TEXT RETRIEVAL SYSTEM

Insoft Ltd, 35 King Street, Bristol BS1 4DZ. Tel (0272) 268893.

When your Computer needs PROTECTION

try the POWERBANKS

POWQUIP POWERBANK — AN UNINTERRUPTIBLE POWER SUPPLY

PROVIDING THE COMPLETE ANSWER TO ALL OF YOUR PROBLEMS

PROTECT YOUR COMPUTER HARDWARE & SOFTWARE
SAVE YOUR TIME & COSTS

For further information — contact us at:

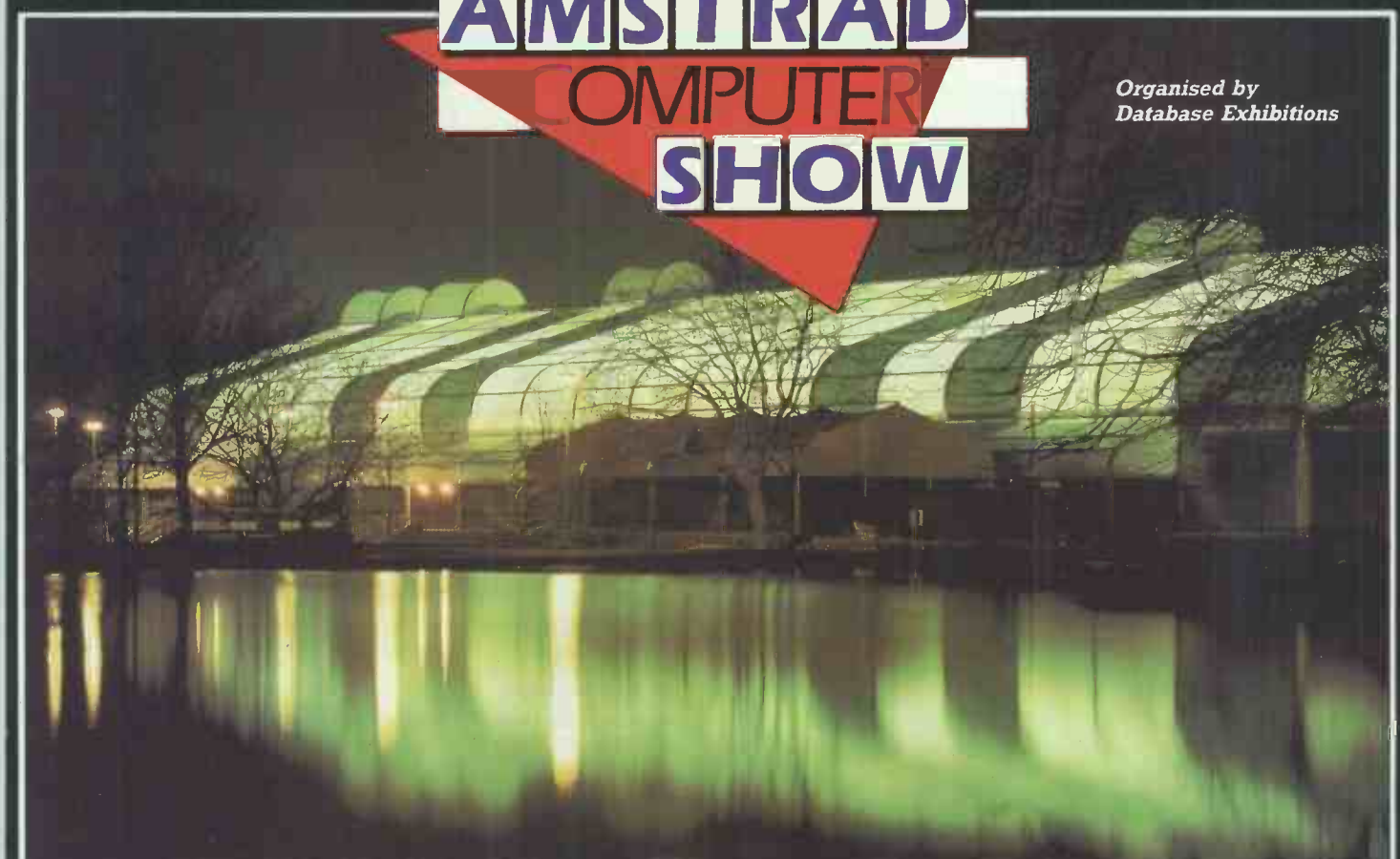
POWER EQUIPMENT LIMITED

Kingsbury Works, Kingsbury Road, London NW9 8UU
Tel: 01-205 0033 Telex: 8952887 POWQIP G

The 7th official

AMSTRAD COMPUTER SHOW

Organised by Database Exhibitions



Friday July 10 10am-6pm
Saturday July 11 10am-6pm
Sunday July 12 10am-4pm

Alexandra Pavilion
London N22

The BIGGEST Amstrad event ever!

If you've an Amstrad computer – or thinking of getting one – you just HAVE to visit this mega event in the computing world.

The move to Alexandra Pavilion – one of London's largest and most prestigious venues – means there is 50% more space – with many more stands and many more exhibitors than ever before. It's the fastest growing computer show of them all!

FREE THEATRE PRESENTATIONS

To meet the exceptional demand, we've DOUBLED the number of seats in the Amstrad Theatre. In continual sessions every day of the show, Britain's top experts will be there to answer your questions – and help you make the correct choice from the multitude of new products you'll see on display at the show.

HOW TO GET THERE

It's so easy to get to the show – by car, rail, underground or bus. Alexandra Palace has its own British Rail station, whisking visitors to and from King's Cross in just nine minutes. And there's a free bus service shuttling between station and show every 10 minutes.

If you're travelling by road the show is only 15 minutes away from Junction 25 on the M25 – and all car parking is free.

This advance ticket saves £1 a head – and cuts the queues

Advance ticket order

Please supply:

- ☐ Adult tickets at £2 (save £1) ..... £
- ☐ Under-16s tickets at £1 (save £1) ..... £

Total £ _____

- ☐ Cheque enclosed made payable to Database Publications Ltd.
- ☐ Please debit my credit card account:

Access/Visa

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Admission at door:
£3 (adults), £2 (under 16s)

AMSTRAD COMPUTER SHOW

Alexandra Pavilion
Alexandra Palace, Alexandra Park
Wood Green, London

July 10-12, 1987

Post to: ***Amstrad Show Tickets, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.***

Name .....

Address .....

.....

..... Signed .....

PHONE ORDERS: Ring Show Hotline: 061-480 0171
PRESTEL ORDERS: KEY *89, THEN 614568383
MICROLINK ORDERS: MAILBOX 72:MAG001
Please quote credit card number and full address + Ref. PCW 6

(Computer Peripherals Division)
TLX 449148

0789 765295 North/Midlands or 0380 870867 South

COMPUTERS ALL IN STOCK

Make	Model	Specification	Mono	Colour
TATUNG	7000-1	6/8MHz 640RAM/1.2Mb/20Mb	1586	1741
TATUNG	7000-2	6/10MHz 640RAM/1.2Mb/20Mb	1697	1852
TATUNG	7000-3	6/8MHz 640RAM/1.2Mb/30Mb	1950	2105
TATUNG	7000-4	6/10MHz 640RAM/1.2Mb/30Mb	2057	2212
TATUNG	7000-5	6/10MHz 640RAM/1.2Mb/40Mb	2157	2327
		COMPLETE TANDON RANGE		POA
APRICOT	XENXi20	8MHz 512RAM/1.2Mb/20Mb	1854	2503
APRICOT	XENiXD20	10MHz 1Mb/1.2Mb/20Mb	2025	2730
APRICOT	XENiXD45	10MHz 2Mb/1.2Mb/45Mb	2594	3299
		SPECIALS F2 520 F10 695 X110 1295		
ZENITH	Z-181	Portable 640RAM/2×720K	1350	–
ZENITH	159	8MHz 768RAM/360/20Mb	1900	2156

*All systems include Monitor, Keyboard, MS-DOS.
Call for best prices on OLIVETTI, COMPAQ, IBM, AMSTRAD 1512.

ENHANCEMENTS

Hercules Mono+	191	Orchid PC Net	312
Hercules Colour	103	IBM Par Cable(P)	18
Hercules Compatible Card	75	WS4000 + Multicom	198
C.G.A. Card	81	Sage V21/V23AA.AD + Chit Chat S/W	285
Vega E:G.A.	256	20Mb H.D.D.	469
Taxan E.G.A.+14" Monitor	665	30Mb H.D.D.	662
AST Sixpak 64	230	40Mb H.D.D.	795
Microsoft Mouse	127	14" COLOUR MONITORS	
PC Mouse + Software	127	Tatung 1322 C.G.A.	294
Orchid Tiny Turbo 286	399	Tatung 1380+E.G.A. Card	639
Orchid Turbo E.G.A.	585	Tatung 1376 P.G.A.	504
Orchid Jet 386	750	Tatung 1380 E.G.A.	429
80287 8MHz	250		
256 DRAMS(9) £4 each		64 DRAMS (8) £1.68 each	

PRINTERS

EPSON LX86 120cps/16/80Col	194	BROTHER Twinwriter 160cps/40	995
EPSON FX800 160cps/32/80clm	306	OKI182 120cps/20/80(P)	190
EPSON FX1000 160cps/32/132clm	391	OKI 182 120cps/20/80(S)	235
EPSON LQ800 180cps/32/80clm	435	OKI 192 160cps/40/80(P)	285
EPSON LQ1000 200cps/60/132clm	575	OKI 192 160cps/40/80/(S)	325
EPSON EX800 250cps/50/80clm	395	OKI 193 160cps/40/136(P)	375
EPSON EX1000 250cps/50/132clm	530	OKI 193 160cps/40/136(S)	400
EPSON LQ2500 200cps/90/132clm	735	OKI 292 200cps/100/80(SP)	435
BROTHER 1409 180cps/45/80clm	294	OKI 293 200cps/100/136(SP)	575
BROTHER 1509 180cps/45/132clm	378	OKI 294 400cps/100/136(SP)	750

LASER PRINTERS

CANON A1	1775	KYOCERA	2720
CANON A2	2700	QUME 10	2255
QMS K8	1900	TALLY 910	2685
OKI Laserline	1563	CENTRONICS PP8	1600
GENICOM 5010	1750		

SOFTWARE

Lotus 1-2-3 v.2	250	Javelin	350
Symphony	375	Harvard Pres.Graphics	223
Supercalc IV	235	First Choice	115
Multimate Adv	299	Sage Accountant	125
Smart	410	Sage Accountant +	165
Wordstar 2000	250	Sage Payroll	90
Wordperfect	298	Wordstar 1512	60
Framework 2	355	Reflex	99
Delta 4	335	Sidekick	55
Cardbox +	256	Gem Collection	99
D Base III +	350	Gem Draw 1512	90
Wordcraft	325	Gem Graph 1512	90
Pertmaster	575	*Other software prices on request	

TERMINALS

WYSE 50	380	ESPRIT 6515	459
WYSE 50+	420	ESPRIT 6310	430
WYSE 60	420	ESPRIT 6110+	307
WYSE 85	390	OPUS II	410
WYSE 99GT	685	AMPEX 220	390

Please call our Systems Division for a TOTAL Computer Package

R.D.S. LTD
Pendennis House, Keevil
Trowbridge, Wilts BA14 6NA
All prices exclude VAT/Delivery

THE COMPLETE CENTRE FOR THE AMAZING PSION ORGANISER II, THE PC IN YOUR POCKET!!

PSION Organiser II brings Effortless and Professional Data Collection and Retrival within reach of the smallest business.

The Basic Organiser II provides you with a sophisticated Diary, Calculator, Alarm Facility, simple Data Base and an advanced Programming Language.

EIDERSOFT is pleased to announce a range of powerful, hardware and software applications to help you get the best out of your Organiser II.

TEXTBASE is a sophisticated user-defined data base for the Psion Organiser II.

— features —

- ★ Powerful Search and Select Facilities.
- ★ Label Printing.
- ★ File Maintenance.
- ★ Import and Export from IBM, APRICOT, ATARI, QL and most PC's.
  Automatic import and export into Psion Xchange™.

*Requires RS232 lead.

NUMBASE STATSPACK has been especially designed for numeric data collection and processing.

— features —

- ★ Up to 255 undefined fields.
- ★ Analysis and selection on any no. of fields.
- ★ Mean, standard deviation and frequency distribution on any field.
- ★ Graphic print outs.
- ★ Import and export from IBM, APRICOT, ATARI, QL and most PC's.
- ★ Direct import into Xchange™ business graphics and spread sheet.

Full range of Statistical test and tables.

PRICE LIST All prices include 15% VAT.

Psion Organiser II; Model CM	£99.50
Psion Organiser II; Model XP	£139.50
16K Datapak	£19.95
32K Datapak	£34.95
64K Datapak	£79.95
Text Base	£34.95
Num Base	£49.95
Finance Pack	£29.95
Maths Pack	£29.95
Concise Oxford Spelling Checker	£29.95
RS232 Link	£47.95
Link—Up adaptors (specify type)	£12.95
Mains Adaptor	£12.95
Barcode Reader	£172.50

EIDERSOFT SYSTEMS & SOFTWARE

up front in communications

Eldersoft, The Office, Hall Farm, North Ockendon, Upminster, Essex RM14 3QH.

OFFICIAL ORGANISER CENTRE

Organiser and Xchange are the Trademarks of Psion Ltd.

SALES HOTLINE — 0708 856468

How to make sure your Printer doesn't slow your PC down.

Without a Megabuffer your Printer can slow down the rate your PC outputs to the rate your Printer prints. Turning a 5 minute print file into half-an-hour. Which means that the PC can be out of action for long periods. Merely outputting. With a Megabuffer the PC outputs at its top speed into the Megabuffer memory, the PC is then released for further work, and the Printer prints at its own rate from the Megabuffer memory.

- Allows you to use your PC more
- Can emulate special plotter handshake protocols
- Compatible with most computers, printers and plotters: IBM & compatibles, AMSTRAD, HP, ACT, SHARP, EPSON, CALCOMP and many more • Can cut PC output time to one sixth or less.
- Software-independent
- Data Buffer and interface converter
- Pause, 'reprint page' and multiple copy facilities

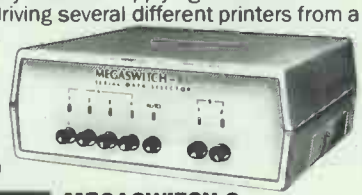
Full range of memory sizes for every application: 64K **£160**, 128K **£216**, 256K **£278**, 512K **£388**, 1MB **£556**.

Flexible Interfacing that keeps them all talking

Eliminate miles of spaghetti and all those 'T' and 'X' switches with a simple Megaswitch which allows your PC to instantly connect to a selection of printers and plotters.

MEGASWITCH AS — Serial Data Selector

- Single unit multiplexer and demultiplexer • 2K data buffer
- RS-232 and RS-422 versions • Can operate as RS-232/RS-422 converter • Diagnostic output • Megabuffer compatible
- Multiplexer — Ideal for printer sharing. 4 inputs and 2 outputs. Can automatically select any channel supplying data
- Demultiplexer — Ideal for driving several different printers from a PC. 2 inputs and 4 outputs Software and manual selection. Downloadable code translation tables. Hardware and XON/XOFF handshakes (RS-232) **£189**



INPUT UP TO 5 PCs

MEGASWITCH S — RS232 Serial Selector

- Connects any of 5 inputs to either of 2 outputs
- Universally compatible — works with all baud rates and handshake arrangements
- LED indication of data flow
- Use it with a Megabuffer for additional time saving **£99**

OUTPUT UP TO 2 PRINTERS PLOTTERS

MEGASWITCH AP — Parallel Data Selector

- Connects any of 4 inputs to either/both of 2 outputs
- Can automatically switch to any channel supplying data
- Ideal for laser printer sharing
- Universally compatible — works with all standard centronics computer and printer interfaces
- Use it with a Megabuffer for additional time saving **£169**

RINGDALE PERIPHERALS

11 Decoy Road, Worthing,
West Sussex BN14 8ND
Telephone (0903) 213131
Telex 265871 REF: JBC2021

UK delivery **£3**/UNIT, cables from **£15**. VAT extra Dealer and Export Enquiries welcome

STOP PRESS

DISKS Wholesale

★ **Major Branded Disks**
SKC, TDK, SONY, MAXELL, BASF, 3M, NASHUA etc.

★ Factory fresh in Boxes of 10 Disks

Minimum order 5 Boxes per type

Price per Box (depending on Brand)

5¼"	DS/DD 48 tpi	**£6.50-£8.50**
	DS/HD 1.6Mb for 'AT'	**£14.50-£16.00**
3½"	SS/DD 135 tpi	**£10.50-£12.50**
	DS/DD 135 tpi	**£14.00-£16.00**

Please enquire for Brands availability/prices

Official Govt/Educational, Local authorities & Company orders welcome.

Export enquiries/orders welcome
Telex: 923729 ROLAND G (attn: Startex)
FAX: 01-446 1963 **FAX**

Terms: CWO. Prices exclusive of VAT. **Free P & P UK.** Overseas Customers please enquire for exact Post Parcel/Air Freight charges for your Country.

Personal Callers by appointment. Tel: 01-446 6786

STARTEX

ROWLANDSON HOUSE
289-293 BALLARDS LANE
LONDON N12 8NP
Telephone: 01-446 6786

Go for The Computer That Goes MICROWAY

M-3355
PC/AT COMPUTER
6/8/10/12 MHz Switchable

- CPU: 80286 W/80287 Socket
- RAM: 1MB on Board
- ROM: 16KB expandable 32K
- ONE 1.2MB Floppy Disk Driver
- Detached Keyboard W/Cursor Pad
- FDD/HDD Disk Controller
- Monochrome Graphics W/Printer Card
- Serial/Parallel Card.
- Power: 200W (Overload and Short Protection)
- Flip-Up Case (Optional Slide-in)
- Built-in Clock Calendar W/Battery Back-up
- With Key-Lock and Power + HDD Light Indicator
- Fully IBM PC/AT Compatible
- Available keyboard in English, French, German, Swedish, Spanish....etc.

Portable XT/AT

W/Built-in Monochrome Monitor (B/W, Amber, Green, Optional) Keyboard of English or German optional.

Also on offer are all kinds of add-on cards.

MICROWAY ENTERPRISES CO., LTD.

MAILING ADDRESS:
P.O. BOX 32-30 TAIPEI, TAIWAN, R.O.C.
TEL: (02)7110637, 7218530, 7714809
TLX: 23125 MICROWAY FAX: 886-2-781-4212

NEW BABY AT TURBO COMPATIBLES FOR UNDER £1000

Now only £975

NEW LOW PRICES

full working system, no hidden extras

COMPUTER SYSTEM:

* 80286/8 Mother Board
* 6/10 MHz switchable
* 640k RAM, expandable to 3Mb
* Phoenix bios,
* 8 Expansion slots
* Hercules compatible graphics card
* Parallel port, 4 serial ports (3 opt)
* 200W power supply
* Keyboard
* Geared for multi user application

AT-1	Computer System, 1.2Mb floppy, mono monitor	£975
AT-2	Computer system, 1.2Mb floppy, colour RGB Monitor (colour/green/amber switchable).	£1175
AT-3	Computer System, 20Mb Hard disk, 1.2Mb floppy, Mono Monitor	£1395
AT-4	Computer system, 20Mb Hard disk, 1.2Mb floppy, colour RGB Monitor, (colour/green/amber switchable).	£1595
AT-EGA	Computer system, 20Mb Hard disk, 1.2Mb floppy, EGA graphics card, EGA Monitor (colour/green/amber switchable).	£1795

XT compatible range available CALL for PRICES

7 DAYS TRIAL PERIOD OR MONEY BACK

Upgrade Kits ☆ Special Offer ☆

		Fitted
20 Mb Hard disk + controller for XT	£339	£375
30Mb Hard disk + controller for XT	£465	£499
Hercules compatible graphics card + mono monitor (amber) with swivel base	£169	£199
EGA Card (emulates EGA/CGA/Hercules) + EGA monitor (Packard Bell)	£575	£620
40Mb Internal tape streamer	£595	£695

add on cards

● TURBO XT motherboard 4.77/8Mhz, OK RAM	£199.00
● Disk I/O card	£79.00
● H/Res mono/graphic printer adaptor (Hercules compatible)	£75.00
● Hi/Res colour/graphic printer adaptor	£75.00
● Floppy disk controller with cables	£42.50
● RS232C card	£27.50
● Modem card Hays compatible (BT approved)	£299.00
● 12 bit AD/DA card	£87.50
● Keyboard AT compatible XT/AT switchable	£80.00
● Switching power supply for XT, 150W	£75.00
● Switching power supply for AT, 200W	£139.00
● FDD/HDD controller for AT	£210.00
● XT hard disk controller	£95.00
● 1.2Mb floppy controller	£79.00
● EGA graphics card (emulates EGA/CGA Hercules)	£199.00
● Serial parallel card	£75.00
● Serial card (support 4 ports)	£95.00
● AT enhanced keyboard	£110.00

accessories

● 360k floppy disk drive for AT	£89.00
● 360k floppy disk drive for XT	£69.00
● 1.2Mb DS/DD floppy disk drive for AT	£149.00
● Genius mouse (MS Systems compatible)	£75.00
● Joystick	£17.50
● 20Mb hard disk drive	£250.00
● 40Mb hard disk drive (40ms)	£650.00
● Data switch: 2 way parallel	£49.00
● Data switch: 4 way parallel	£59.00
● Star NB24-15 24 pin dot matrix printer 216cps, 72cps (LQ)	£675.00
● Citizen 120D dot matrix printer 120cps, 25cps (NLQ) 80 col	£199.00
● Star SR-15 dot matrix printer 200cps 50cps (NLQ) 136 col	£449.00
● Citizen HQP 45 24 pin dot matrix printer 200cps 60 LQ	£695.00

CALL for complete add on cards and accessories prices

ALL PRICES EXCLUDE VAT

Dealers and educational ENQUIRIES WELCOME

AJP Business Computers Ltd.
South Bank Technopark,
90 London Road, London SE1 6LN.
Tel: 01-922 8849
Telex: 946240 CWEASY G Ref: 19015840.

MICRO-RENT

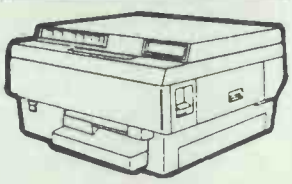
MICRO-RENT DO MORE!

MAC-PLUS

TANDON

H-P LASERJET

£58 PER WEEK*



IBM PC AT

*Prices quoted are based on 3-month rental, excluding VAT.

Micro-Rent do more than offer you the best rental deals on microcomputers. They rent printers, hard-disk systems, monitors - even some software!

Micro-Rent - the complete rental service - saves you time and money, and solves your problems fast.

Buying? Ex-rental machines often available at reduced prices.

AND NOW - FAX MACHINE RENTAL FROM £40 PER WEEK!
Ring for details

01-700 4848

MICRO-RENT

St. Marks Studios, Chillingworth Road, London, N7

APPLE · APRICOT · IBM PC & XT · OLIVETTI MACINTOSH · TANDON · SIRIUS · COMPAQ LASER PRINTERS · DESK-TOP PUBLISHING

NEWSPRINT

Careless whispers in and around the Atari camp suggest that the company's next generation of micros will be based on the Inmos Transputer chip. Guy Kewney's news reveals all this, and much more.

Transputer for Atari?

One product that won't have been openly discussed at last month's Atari Show in London is the next Atari design.

The next generation, I'm now convinced, will not be based on bigger and better Motorola 68000 chips, but on the revolutionary Inmos Transputer chip.

Several things conspire to suggest this.

First, a mole inside the company's Sunnyvale headquarters warned me to look for signs of these developments. I found them when I visited the company in March.

Second, when challenged for an official response to the evidence I discovered, senior executives in the US made the tactical blunder, if they wanted to keep it secret, of saying it was a secret and they couldn't talk about it.

That makes it sound much closer than my mole had suggested.

I checked with another mole; and it turns out that Atari seriously hopes to have a working product on the market, at under £2000, some time next year.

The Transputer in question would be the new floating-point one, the T800 — of which I wrote recently that it could outperform the 68020 plus floating-point unit by a factor of nearly four.

The problem that Atari has not yet tackled, however, is that of operating software.

An operating system for the Transputer is something for more serious discussion than there is space for here. For the moment, however, I can say that Tim King, the man who wrote AmigaDos for Commodore, is rapidly gathering support for a project to produce a standard, multi-tasking, parallel operating environment for Transputer users.

And he has certainly been seeing people at Atari.

Tim King has a Transputer project of his own waiting in the wings, in the form of the Perihelion project being planned in Cambridge by computer industry pioneer Jack Lang.

His theory — and you can't really argue with it — is that the time is now, if we want to get a standard operating system for the chip. Leave it another year, and there will be a lot of half-baked things done by individual companies, all doing half the job and all incompatible.

His problem: money.

Perihelion plans to produce a £1000 Transputer-based workstation to rival the Sun workstation — an enormous machine running Unix. The Sun machines have just had a price cut of over 30 per cent, but even so, Perihelion (if it can be financed) would be able to come in well underneath.

Money for King's project would come from Atari, which has well over $150m of spare cash, having just raised $75m on the American stock market. That is, it would if King wasn't also under contract to Commodore to maintain AmigaDos. Atari doesn't trust Commodore.

Watch this space, because Atari's plans are currently fluid enough that each month changes them somewhat. But the project is very much under way, and as soon as Inmos is shipping T800s at reasonable prices, the company will look to have prototypes at exhibitions.

That could be as soon as Spring next year. It will almost certainly be ready for unveiling at next year's PCW Show.

Camera not included: but for £99, you can buy something to put pictures into your CP/M Amstrad PCW.

It takes the PCW screen to a video tape, but more important, it takes pictures off video (tape or camera) and puts them into the computer's memory. You can have 16-shade snapshots of still pix, or two (or four) shade pix of moving camera images.

The image recorded here is of Joy Sharp, of Rombo, printed out on a standard PCW printer. Good enough? Then contact Rombo on (0506) 39046 in West Lothian, Scotland.

From strange truth comes strange fiction

Douglas Adams in profile

The publicity for the new Douglas Adams game, Bureaucracy (from Infocom) is getting hauntingly like the game itself.

The game is based on (legend has it) a true episode in the life of Adams, author of the *Hitch-Hiker's Guide to the Galaxy*. He moved house, and his credit card was accordingly cancelled by the bank . . . or so it says on the publicity handout.

The true story is that he obtained a mortgage from the bank, which then sent its next two statements to his old address. He wrote, pointing out that the bank, of all people, should know the address of the property it had mortgaged. The bank wrote back, humbly apologising — and guess which address they sent the letter to?

The object of the game is to get the bank to acknowledge a change of address form.

I saw copies in March in New York, and was irritated to receive a press release from Activision — on 15 April — saying that it would be out in March. 'Why do we not get a review copy with the release? Why the delay?'

Answer: 'There is no delay.'

'But I saw it in New York last month.'

'Well, it's not ready yet — we're just going into manufacturing in the UK. It will be ready, let me see (rustle, rustle) . . . um, today!'

'Can I have a copy?'

'We hope to have it out on the streets on Friday.'

'Friday, then?'

'Ah, but that's a holiday.'

'So there *will* be some delay.'

'No, no, but we do tend to slip a little.'

The really interesting point about Bureaucracy is that Douglas Adams didn't write it.

Infocom, in best bureaucratic traditions, appointed a team of 20-odd writers to work with him. By the time the team was assembled, however, Adams had spent too many weeks in Boston and was back in London.

The team thereupon messed up his ideas so badly that they ended up having to hire Michael Bywater, computer expert at *Punch*, to redo the whole thing.

I rang Adams to get his opinion, but naturally his phone was engaged. However, he had warned me (a year ago) that there was a starring role in the game for an automatic garage door which only opens when Flight 124 from San Francisco flies over, and behind which is a letter for you.

I asked Bywater how you solved that problem.

'I'm sorry. It's out. It had to go,' he said.

This promises to be a difficult adventure . . .

The disk is dead — long live silicon and memory

Some people have interpreted this month's enthusiastic review of the Tandon PAC (Benchtest, page 96) as an indication that I think disks are here to stay.

Wrong. The disk is dead, and the only question is: when do we bury it?

Disks in the next decade will be made of silicon. For once, I don't have to offer my own unsupported rantings as evidence of this. I can quote the *California Technology Stock Letter.*

'The key to understanding the future cross-over between the costs of semiconductor memory and disk memory is this: dynamic RAM chips always come down to $2 per chip.'

The most advanced purveyor of silicon, you will possibly be surprised to hear, is IBM. IBM has already announced that it is building memory chips with four million bits per chip. And it has started testing designs for a 16-million bit chip.

'Unless the strengthening yen messes up the relationship,' continues the analyst, 'the megabit DRAM should cost $2 some time in 1989.'

That will make chip memory cost under $20 per megabyte. Disks are around that level now, and will get cheaper. But the race is on, and the *Stock Letter* analyst has produced figures which seem to indicate the memory chip will win.

A chart reproduced in the *Stockletter* shows costs expected for bigger 14in disks and 8in disks, but not for the cheaper 3½in disks that are now about. Even so, silicon and disks meet at roughly the same cost per megabyte, in around 1994 or 1995.

At that point, why would you use disks? The only possible reason is that they don't need to be kept supplied with power to retain data.

They rattle. They whine. They crash. And compared with memory, they are *unbelievably slow.*

Most disks work at 80 millisecond access time. Fast ones can get down to single-figure milliseconds. Most memory works in speeds of tens of nanoseconds.

The key to the future of the RAM chip is its power consumption.

When IBM is producing RAM chips holding 16Mbits each, eight of them will hold 16Mbytes. 100 Mbytes of storage will require 48 chips, which will draw too much power to be happy for more than a day or so connected to a set of Sony Walkman batteries.

But when IBM gets down to the 64Mbit chip, a couple of years later, we are talking about keeping 16 chips supplied with current. Really, not a problem. And IBM researchers are currently working on the 256Mbit chip. Sixteen of those would give half a gigabyte.

The disk is dead.

It looks like a Macintosh: it's a BBC Micro. You can use a mouse or a tracker ball to move your pen around the screen and produce things just like Mac Paint.

There's a whole wad of products announced by WCS in this family, products like Quill Draw with Quill Mouse, or with the Marconi Tracker Ball, at just under £100, right down to a set of software utilities at £14.37 or 'The Mountain Adventure' at the same price.

What I find hard to take is the claim by WCS that this is the first of several 'fully integrated desktop publishing applications' for the Beeb. It's very clever, yes, but desktop publishing it ain't.

Details on (0946) 820755.

Bristol Micro Traders — more than meets the eye

Some 120 people, many of them *PCW* readers, have been caught in the collapse of Bristol Micro Traders, a company which sold computers by mail order, took money in advance, and didn't send the goods.

PCW publisher, VNU, was less than amused by the excuse put forward by proprietor Heather Dixon, for the collapse of her company.

Speaking at a creditors' meeting, Dixon blamed 'high costs of advertising' — together with the inevitable grumble about high discounting — for the collapse.

VNU Publications would like this to be true — BMT owes us £35,000 for advertising. It seems more likely that the truth is more in line with the alternative theory — inadequate accounting records.

It appears that some 122 people sent money and received no hardware from the company, which imported Taiwanese clones.

The total accepted from customers — *PCW* readers — amounted to £67,255.

Trade paper *MicroScope* quoted the liquidator as saying that Dixon faced a possible adverse report, under the new Directors' Disqualification Act, for handling of the company.

BMT has now been taken over by Alex Heal of PC Compatible. Heal could be said to owe *PCW* a couple of favours after a dispute over a competition last year. On that occasion he promised £1000 to the winner of a design competition. At the end, he suggested that the entries had been so few and so bad, that he would only supply the prize in hardware from his firm.

So, suggestions that he might be prepared to offer a special 'introductory' price to BMT customers who have been left without hardware, are not to be taken too seriously. Most people, having been bitten, are unlikely to want to give more money to the same outfit, anyway.

Intriguingly, one part of the company hasn't arrived at Heal's premises. That part is the Transputer card business. The Transputer, an amazingly powerful parallel RISC (reduced instruction set computer) chip, is supplied by BMT on a plug-in card, which is the subject of some controversy in Bristol computing circles.

This card, and the business of selling it, was disposed of before BMT went down. It was sold for the princely sum of £100 to Systems West.

The liquidator is investigating further. ▶

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

We're one of the biggest software companies in the world—and we got that way by making "Quality, Speed, Power, & Price" essential characteristics of every Borland software program. Look for Borland software—then look no further.

Turbo Prolog™

Our new Turbo Prolog has drawn rave reviews—which we think are well deserved—because Turbo Prolog brings 5th-generation language and super-computer power to your IBM PC and compatibles. Turbo Prolog is a high-speed compiler for the artificial intelligence language, Prolog, which is probably one of the most powerful programming languages ever conceived. We made a worldwide impact with Turbo Pascal, and you can expect the same results and revolution from Turbo Prolog, the natural language of Artificial Intelligence. Minimum memory: 384K.

Reflex® and Reflex Workshop™

No matter what business you're in, if you use Lotus 1-2-3® or dBASE® you *need* Reflex and the new Reflex Workshop to give you all the tools and views to see what your numbers mean. The new Reflex 1.1 with expanded memory support allows you to manage huge databases of up to 8 megabytes of RAM, 32,000 records, and 250 fields per record with "Reflex Lightning Speed." The Reflex Workshop gives you a wide range of analytical tools written for specific applications like Finance/Accounting, Administration, Sales and Marketing, and Production and Operations. You can use the tools "as is" or modify them to suit your business needs. Minimum memory: 384K.

SuperKey®
Turns 1000 Keystrokes Into 1!

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

SideKick®
Instant Desktop Management!

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

Traveling SideKick®

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

Turbo Lightning®
Solves All Your Spelling Problems!

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

Lightning Word Wizard™
Technical Reference Manual For Turbo Lightning!

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

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

Turbo Database Toolbox®

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

Turbo Editor Toolbox®

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

Turbo GameWorks®

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

Turbo Tutor® 2.0

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

Turbo Graphix Toolbox®

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

Why more than half a million people are using Turbo Pascal

Because at up to 4,000 lines of code per minute, Turbo Pascal® is faster than any other Pascal compiler. And because Turbo Pascal is backed by a complete range of "toolboxes" that give you most of the programming tools you'll ever need.

The Worldwide Programming Standard

"For the IBM PC, the benchmark Pascal compiler is undoubtedly Borland International's Turbo Pascal," says Gary Ray of PC Week. We and more than 500,000 other people around the world think Mr. Ray got that right.

Since launch, Turbo Pascal has become the *de facto* worldwide standard in high-speed Pascal compilers.

> "Turbo Pascal has got to be the best value in languages on the market today.
> *Jerry Pournelle, BYTE Magazine*
>
> Turbo Pascal turned what was an academic's hobby-horse about the untidiness of BASIC into a fully fledged industry and culture.
> *Practical Computing*"

Described by Jeff Duntemann of *PC Magazine* as the "*Language deal of the century,*" Turbo Pascal is the high-performance development tool sought by professional programmers.

Even if you have never programmed in a high-level language before, Turbo Pascal helps you get started with an easy-to-use, structured programming environment.

Free 8087 Support and BCD Reals

Now Turbo Pascal is an even better deal because it includes two of the most popular options—8087 math co-processor support for intensive calculations and Binary Coded Decimals (BCD) to eliminate rounding-off errors for business applications.

Turbo Pascal also includes a full screen, WordStar®-like editor. The compiler instantly locates errors, automatically activates the editor and shows you the location of the error in the source code. This provides an integrated programming environment that will improve the productivity of newcomers and experts alike.

A Whole Family of Tools

Success breeds success, so the Turbo Pascal family is never static. It is continuously expanding, with new products like Turbo Editor Toolbox and Turbo GameWorks.

The secret of software success is not merely low price, but top quality allied with complete documentation, like our 400-page reference manual.

All of which are some of the reasons why Turbo Pascal is clearly the leader, and the recipient of awards like *PC Week*'s "Product of the Year" and *PC Magazine*'s "Award for Technical Excellence."

An Offer You Can't Refuse

Turbo Pascal is now an even better deal than ever because you can get a lot more for a lot less. The compiler, a completely integrated programming environment, and BCD reals and 8087 support are now available for only £69.95!

Better yet, save almost £65.00 when you choose the Turbo Jumbo Pack. Six different Turbo Pascal products (Turbo Pascal 3.0, Turbo Tutor 2.0, Turbo Editor Toolbox, Turbo Graphix Toolbox, Turbo GameWorks and Turbo Database Toolbox) for only £245.00! Hurry! Place your order today. Minimum memory: 128K

YES! I want the best!

Copies	Product	Price	Totals
	Turbo Pascal w/8087 & BCD	£ 69.95	£
	Turbo Pascal for CP/M-80	49.95	£
	Turbo Prolog	69.95	£
	Turbo Basic	69.95	£
	Reflex : The Database Manager	*129.95	£
	Reflex Workshop	*69.95	£
	Reflex & Reflex Workshop	**129.95	£
	Turbo Database Toolbox	49.95	£
	Turbo Graphix Toolbox	49.95	£
	Turbo Tutor 2.0	39.95	£
	Turbo Editor Toolbox	49.95	£
	Turbo GameWorks	49.95	£
	Turbo Lightning	69.95	£
	Lightning Word Wizard	49.95	£
	Turbo Lightning & Lightning Word Wizard	99.95	£
	SideKick	69.95	£
	Travelling SideKick	69.95	£
	SideKick & Travelling SideKick	125.00	£
	Superkey International Version	69.95	£
	Turbo Jumbo Pack	245.00	£
	†Eureka: The Solver	69.95	£
	Outside UK add £10 shipping per copy		£
	Add 15% VAT		£
	Amount enclosed		£

Prices include shipping to all UK cities
Carefully describe your computer system : E6
Mine is : _____ 8 bit _____ 16 bit
I use _____ PC-DOS _____ CP/M 80
_____ MS-DOS _____ CP/M 86
My computer's name and model is

The disc size I use is ☐ 5¼" ☐ 3½" ☐ 3"
Payment : Access Visa Money order Cheque
Credit card expiration date _____
Card No. |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|

Signature
Name : _____
Shipping Address : _____
_____
_____
Postal Code : _____
Telephone : _____

CODs and purchase orders WILL NOT BE accepted by Borland. Outside UK make payment by credit card or International Postal Money Order.
*New UK version (check shipping date)
**Time limited promotional offer, now shipping
† New product now shipping

NOT COPY PROTECTED
60 DAY MONEY-BACK GUARANTEE
If within 60 days of purchase you find that this product does not perform in accordance with our claims call our customer service department and we will gladly arrange a refund.
All prices are suggested list prices and are subject to change without notice.

BORLAND INTERNATIONAL

Dept E6
One Great Cumberland Place
London W1H 7AL
(01) 258-3797

Vive la différence

Borland products include Turbo Basic; Eureka: The Solver; Turbo Pascal Numerical Methods Toolbox, Turbo Prolog, Turbo Pascal; Turbo Pascal for the Mac, Turbo Tutor; Turbo Editor Toolbox, Turbo Database Toolbox; Turbo Graphix Toolbox; Turbo GameWorks, Turbo Lightning; Lightning Word Wizard, Reflex: The Analyst; Reflex for the Mac; Reflex Workshop; SideKick, SideKick for The Mac, Traveling SideKick; and SuperKey — all of which are trademarks or registered trademarks of Borland International, Inc. or Borland/Analytica, Inc. Traveling SideKick is not in any way associated with Traveling Software, Inc. of Seattle, Washington.

Lotus 1-2-3 is a registered trademark of Lotus Development Corp. dBASE is a registered trademark of Ashton-Tate. Microsoft Word and MS-DOS are registered trademarks of Microsoft Corp. MultiMate is a trademark of Multimate International Corp. Random House is a registered trademark of Random House, Inc. CP/M is a registered trademark of Digital Research, Inc. IBM is a registered trademark of International Business Machines Corp. WordStar is a registered trademark of MicroPro International Corp.

BE-1002

In CAD, one name stands out

DAXCAD leads the new generation of CAD systems. Setting new standards for ease of use, the unique DAXCAD interface enables the many sophisticated features of the system to be quickly exploited.

DAXCAD is a comprehensive design tool, with costed bills of material and parts listings being produced automatically straight from the drawing, and the DAXCAD Parametric Module can be used by any designer or draughtsman to improve productivity dramatically.

DAXCAD fully supports PC networks such as NOVELL, TORUS and ETHERNET, to give all users easy access to symbol, component and parts libraries on micros and supermicros from the IBM PC to the Apollo Domain.

DAXCAD also interfaces with desktop publishing software for fast and accurate production of technical manuals.

DAXCAD is backed by on-site support and training nationwide. To find out more about what DAXCAD can do for you, please contact Gerry Gorevan, Marketing Director at the address below:

DAX CAD

Practical Technology Ltd
Clutha House
120 Cornwall Street South
Kinning Park
Glasgow G41 1AD
Telephone 041-427 5371

Simple by design

Speed is the essence

A 16-bit version of the Zilog Z80 is not, whatever Zilog says, 'the most talked-about product of the decade'. But it could be the product which keeps CP/M alive into the 1990s.

The chip comes in two main versions, both of which will run 8-bit Z80 code; but neither actually fits into the same socket as the old 8-bit Z80. So, designers who want to pay today's $27 price per chip will have to design new boards.

The list of buzz-words produced by the company's publicists is strangely reminiscent of those in IBM's latest PS/2 announcements.

'The new Z280 provides system designers with three performance features required for highest throughput — on-chip cache, on-chip memory management, and support for burst memory.'

Burst memory means that you don't have to do direct-memory transfers one byte at a time, but can take over the system bus and send a whole block (of finite size) at a time. It speeds up a system by several factors.

On-chip cache is fast because memory speed is the single greatest limiting factor in processor speed. Cache is fast because it stores things in the order which you are most likely to want them, based on how recently you last used them. (Strangely, when I organise my desk like this, it is described as 'a mess' . . .)

Other claims are: 'Any program written for the Z80 will operate without modification on the Z280.' Well, only if you do input and output the way Zilog said you should: this chip includes a UART — universal asynchronous receiver/transmitter. Software which talks to other peripheral chips will require rewriting. These days, a lot of Z80 software talks to special-purpose logic arrays. But the task will be relatively simple.

By this time next year, systems using this chip will run at least twice as fast as today's Z80 systems — the Amstrad range of 8-bit machines could all, theoretically, be upgraded like this. Software written to use the go-faster features could go much quicker still.

Following vaguely along in Sir Clive Sinclair's footsteps, Plus 5 Engineering has produced this alternative to the floppy disk. It's a memory card, holding anything from 32k to 256k, and keeping the data alive with a rechargeable battery built in.

You might be wondering where our official final Benchtest figures are for the new Sinclair-built marvel, the Cambridge Computer Z88.

At press time, machine production was delayed (mid April). The software wasn't ready, no, but that wasn't the reason, according to Sir Clive. The reason was that the trade war between the US and Japan had led to a reduction in memory chip shipments, and he couldn't get them.

Some people have smiled at that. Don't — you'll be hearing that excuse increasingly if the trade dispute isn't sorted out soon.

Banking on the Model 30

Inevitably, there was someone stupid enough to announce, on the same day that IBM announced its new System 2 machines, that it was going to spend £8m buying them.

Some people will do anything for publicity, and in this case, it's Lloyds Bank.

Rule One of personal computing ('never be a guinea pig') having thus been broken, the situation was ripe for the announcement that the machine Lloyds was buying was not really a PS/2, but the strange Model 30.

With the new OS/2 operating system, you will never be able to run multiple copies of today's PC-DOS programs simultaneously — but then that's not different from today. And already, there are products on PS/2 range machines which can cope with this — Concurrent 386 and Desqview are two. They really can run Lotus Symphony, Crosstalk and Space Invaders on the same screen.

But the Model 30 won't run OS/2 because it isn't a 'protected mode' machine. And it isn't even a PC clone: software developers, even those quoted publicly as supporting the launch, have been very negative about this machine's compatibility problems.

The key to the Model 30 is that it is the machine which IBM has picked to run its desktop publishing system.

In the US, but not in the UK, IBM has announced an $9000-odd package including laser printer, plug-in 68000 card, Pagemaker and Microsoft Windows, as its rival to the Apple Macintosh and LaserWriter.

Now, this is curious. Firstly, Windows on the real PS/2 machines, which are based on the 80286 and 80386 chips, will be a different Windows. It will be Windows 2, or the 'presentation manager' of OS/2, whenever that arrives. And it will be quite fast.

Windows (today's version) is quite possibly all that Microsoft claims for it, but it is also slow. No-one who has seen it running on an ordinary 8086 machine has said they would like to work with such a system.

IBM obviously would want to have its desktop system available on a faster machine. Why not announce it on a Model 50?

My answer: because Windows (OS/2 version) will be quite different from today's version, and IBM doesn't want to support today's version *and* the new version on PS/2.

Raising BT's tone

The truth is out — BT engineers will tell lies rather than admit that they don't know how the telephone system works, or if they do, they don't know how to fix it.

And the lies they tell are always along the lines that it's the customer's equipment which must be wrong.

All this came to light when my local exchange was converted to the spanking new all-digital System X. One of the facilities available on this system is dual-tone multi-frequency tone dialling (or DTMF). This allows you to dial faster, and to use the * and # characters for special system facilities like call redirection.

Of course, you need a tone-dialling phone for this; or a modem, most of which are already equipped to tone dial.

The local telephone sales office insisted that, as the exchange has been changed over, my line already supported tone dialling. 'There must be something

FAMOUS HIGH ST NAME: £3/4 MILLION CLEARANCE

COMPAQ

TAPE STREAMER

Compaq internal tape streamer, 10mb, easily fitted, for Deskpro. Takes DC 1000 cassette **£150**

*HP150 Wordstar	£100
*HP150 Mailmerge	£75
IBM colour monitor	£195
*HP150 128k ram upgrade	£100
*HP150 256k ram upgrade	£135
*IBM Brainstorm	£25
*Microsoft Word for Macintosh	£195
*Micropro Planstar	£35
*ABC programme generater	£75
Brother HR25 RS232 & Cent	£195
*HP150 Pertmaster	£95
Brother HR15 XL	£150
Delta 4	£195

IBM PRINTER

IBM QUIETWRITER

IBM Quietwriter model 1 produces better than daisywheel printout fraction of noise **£450**

IBM 512k PC

EX SHOWROOM MODELS

Min spec 2 X 360k floppy, Dyneer mono mon, 512k, IBM kbd, DOS, basic & manuals. **£695**

MAC SOFT

JaZZ

MACINTOSH JAZZ PACKAGE

Software from Lotus, inc word processing, spreadsheet, database, comms, (NEW) **£150**

PLOTTER

HP 7550A PLOTTER

Hewlett-Packard 8 pen A3 plotter. RS232 and HB-IB i/f, (DEMO, manuals) **£2000**

ASHTON TATE

ASHTON·TATE

FRAMEWORK II

IBM integrated package inc word processing, spreadsheet, comms, database, (NEW) **£250**

Apple 20mb hard disk demo	£995
*HP150 internal printer	£95
*IBM Displaywrite II	£75
*IBM Displaywrite III upgrade	£75
HP 40mb internal hard disk	£500
V22 Quattro modem	£295
Assorted acoustic hoods	£125
*IBM Writing assistant	£35
*IBM Filing assistant	£35
Dataproducts DP55	£495
Wordstar 2000 IBM	£95
10md hardcard for IBM	£195
Brother Twinriter	£495

WP PACKAGE

IBM DISPLAYWRITER II

Industry std. WP software – used in many office enviro-ments worldwide (NEW) **£75**

BULK STORAGE

TALLGRASS 20mb+ 20mb

external 20mb hard disk plus 20mb tape backup includes interface card & software **£550**

5mb HARD DISK

FLOPPY DISK PRICE

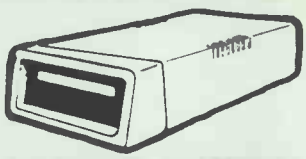
5mb full height internal hard disk for IBM, BBC. Controller extra. (NEW) **£95**

APPLE MAC

EX-DEMONSTRATION AREA

Apple Macintosh models from 128k to Mac plus, inc software & manuals, (DEMO) from **£595**

IBM BACKUP



ALLOY TAPE STREAMER

17.5mb external tape streamer. includes interface card, software, tape cartridge **£295**

COMPAQ

COMPAQ PORTABLE

IBM compatible, minImum spec 512k, twin floppies, printer card, diags, manuals, (DEMO) **£750**

HP 150

HEWLETT PACKARD 150

Complete system inc terminal, dual floppies, keyboard and manuals, (DEMO) from **£695**

TOP QUALITY

DYNEER DAISYWHEEL 36

Takes 15 inch paper, 36 cps, tractor feed and sheetfeeder as optional extra, (DEMO) **£250**

COMPAQ

COMPAQ PORTABLE II

IBM compat, 512k, 2x360k, 80286 processor, 9" text & graphics mon (DEMO) **£1200**

*IBM 15mtr Network cable	£18
HP150 Programmers tool kit	£95
Apricot Easy Junior V2.2	£95
*dBase III C tools	£125
HP150 Lotus 123	£150
*CDC internal 30mb drive	£495
Lotus Symphony version 1	£125
DOS 3.2 tec ref manual	£25
Mountain 20mb hard card	£395
HP 110 external drive	£250
Apricot Xi 10mb	£995
IBM Proprinter XL	£250
Brother HR 35 serial	£295

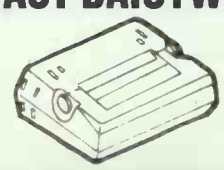
KIMTRON

TCL

3 USER SYSTEM

Uses your AT or compat. Includes card, 2 Kimtron terminals, software + installation. **£995**

FAST DAISYWHL



LATE MODEL RICOH 1600

60 cps office quality daisywheel printer. Double daisy-wheel 100+ ctrs, (DEMO) **£350**

PORTABLE 286

COMPAQ PORTABLE 286

IBM compatible, 640k, 1 X 1.2mb floppy, 20mb hard disk printer card, (DEMO) **£1750**

MODEM

PC COMMUNICATIONS

Missing Link internal modem for IBM. Ideal electronic mail, Prestel etc. Auto-dial. **£195**

HP LASERJET

HP PART NUMBER 2686

Hewlett Packard laserjet printer, RS232 inc cartridge & A4 tray, mans, (DEMO) **£1150**

*IBM Network adaptor	£350
Ricoh 1300 parallel printer	£250
Epson SQ-2000 sheetfeeder	£125
Apple Macintosh 800k drive	£250
*Gem Collection software	£45
Brother 2420L dot matrix	£395
V21 acoustic coupler	£25
Ricoh 1300 tractor feed	£35
IBM Wheelprinter	£495
Qume Letterpro 20 RS232	£225
Crosstalk for IBM	£75
IBM pro graphics monitor	£1000
IBM pro graphics adaptor	£300

Part exchanges accepted.

Morgan Computer Co.

** Indicates brand new goods*

ACCESS AND VISA ACCEPTED
PRICES SUBJECT TO 15% VAT
MAIL ORDER (CARRIAGE EXTRA)

179 TOTTENHAM COURT ROAD, LONDON W1. 01-636 1138

OPEN MONDAY TO SATURDAY
PRICES SUBJECT TO CHANGE
GOODS SUBJ. TO AVAILABILITY

wrong with your equipment,' came what I now understand to be the standard-issue BT response.

My protests that I had a number of different types of equipment, none of which worked, elicited the reply that there were two sorts of tone dialling — ordinary DTMF and MF4 — and they must all use the wrong sort. I was not convinced.

The crunch came when the telephone engineer came round to test the line. His equipment didn't work either. 'I guess we can't get away with it this time,' he admitted. 'There must be something wrong at the exchange.'

They myth of the different types of multi-frequency dialling was blown apart very vocally by a senior BT official who admitted that MF4 vs DTMF was 'a load of bol***ks'.

So this is what you do.

If you want multi-frequency dialling on your phone line, and it is one of the exchanges listed at the start of this story, phone the operator and ask for telephone sales for your area. Tell them your number and say: 'I wish to have tone dialling on this number.'

If they give you problems, ask them again politely. Then ask for the supervisor, and keep on up the hierarchy until you find someone who knows what you're talking about. But don't try it on any but the few exchanges which have the facility.

Derek Cohen

Coming down to earth

Amstrad is very busy these days, issuing writs of libel against people who quoted a computer industry paper which suggested that the PC1512 was possibly unsafe because it had no earth wire.

The reason the writs were issued is simple — Alan Sugar and his staff believe these libels are damaging sales.

The proof of the pudding would be if sales were dropping.

Getting actual figures out of the trade is virtually impossible, but there is some evidence that UK sales, at least, are slower than Amstrad expected. Overseas sales, by contrast, are apparently doing surprisingly well.

Most UK distributors report steady sales — but not huge ones. They tell me to disregard rumours that sellers of Commodore products have been offered 'hundreds' of Amstrad PCs at cost price, as 'inevitable, and not an indication of anything significant'. But I do have some reports of such offers being made.

Amstrad anticipated a sales drop at this time, which is why its big advertising campaign has been running. But the drop in the UK, at least, seems to be bigger than anticipated.

I have my own explanations for the drop, if Alan Sugar is still interested in a word I say. I seriously doubt, however, that fears about electrical safety are part of the deal. I think the warranty (no warranty), the screen (no EGA) and Amstrad's own attitude (paranoid) are some of the problems.

First, the warranty scheme is losing friends. Amstrad doesn't provide a warranty on the machine to dealers. If faults aren't found inside a week, Amstrad says they developed after delivery. Dealers — even respectable ones — are now trying to fob this off on customers. This is illegal: as a consumer, your rights are defined under the Sale of Goods Act.

An interesting question for Amstrad: are faulty machines reaching such numbers that dealers need to do this?

Second, corporate buyers — as I predicted in my report to Alan Sugar last summer — aren't happy about a machine that can't have its video upgraded to higher resolution. They may not actually know what they would do with higher resolution, but equally, they don't want to paint themselves into a corner. Corporate sales, I believe, are disappointing. The amount of publicity for desktop publishing, currently, is part of this.

Finally, Amstrad is buried in a fort built out of its own paranoia. You cannot get through to the company because everyone there is under threat of the sack if they speak to the Press. Which is (ironically) how the 'unsafe power supply' story was started.

The story came out of Southampton University, where Peter Malson was trying to carry out his duties of ensuring electrical safety. He couldn't find an earth wire, and so phoned Amstrad.

'I am afraid,' wrote the University vice-chancellor to Amstrad when the case came to court, 'that though he was transferred from one extension to another, he was given no firm information. He wrote to the Trading Standards Office, and also to the Customer Services Department at Amstrad. No written reply was received, but he was phoned and told he could either flash test the PC or fix a three-core mains lead — but that would invalidate the warranty. The member of staff concerned declined to put this statement in writing, but offered the information that the PC was being submitted for BEAB testing.' (Invalidate the warranty? What warranty?)

Many journalists know the feeling — ringing Amstrad, getting a runaround, writing a story, and being accused of hostility to the company as a result.

In this case, the result was a story in *Computer Weekly* and *PC Business World*, saying that staff at Southampton University had been worried about the safety of the system. The fact that the PC had, in fact, passed the University flash test, wasn't reported at the time.

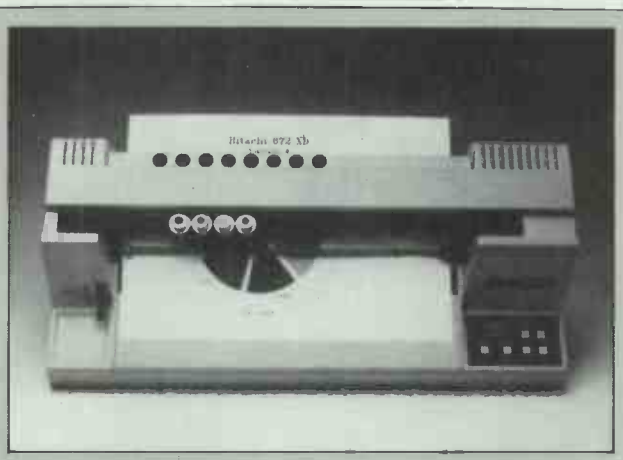
Naturally, rival firms are keeping this one alive.

The British standard involved, BS415 Class II, is pretty lax, and says only that no live mains cable can be closer than three millimeters from a chassis (where the Amstrad allows fifteen millimetres) unless the chassis is earthed. The idea is to guard against sparks jumping the gap. The possibility that a pin, staple, screw, wire or piece of coffee-wet fluff might bridge the gap, isn't considered.

The possibility — remote — does exist that such an object could get into the Amstrad monitor, where the power supply is. At a guess, 400 of those would merely destroy the monitor for every one which managed to connect the exposed mains fuse to the chassis.

So — I'm not taking my Amstrad apart to cover the fuse. On the other hand, a safety standard is a safety standard — and most of the live mains parts in the Amstrad monitor *are* protected from that kind of accident. So why not the fuse? Take it up with the BSI.

But just think: if someone at Amstrad had actually had the power to give a straight answer to the man from Southampton, the whole fuss over BS415 Class II would probably have arisen in a hairdressing journal over some Taiwanese hairdryer. ▶



It's a new plotter from Hitachi, capable of doing A3-size documents. What's new about it? The software, the interfacing and, above all, the price.

At £595, the model 672-XD is 'around one third the price of equivalent A3 plotters such as the HP7475A,' says Hitachi Europe from its office in Hammersmith.

It works with 'nearly every CAD program' — including Autocad, Robocom's software and IBM's Graphic Assistant, plus a whole heap of things from Lotus 1–2–3 to Logistix. And new 'handshaking' abilities make it compatible, Hitachi says, 'with virtually every micro or PC on the market.'

The plotter will be marketed by the surprisingly named UK firm of Nissei Sangyo, on (01) 567 3655.

Courting disaster

A legal dispute in the US over two communications programs — Crosstalk XVI and Mirror, a 'lookalike' — has just ended in a tantalising half-victory for each side.

Lotus, however, the publisher of Lotus 1–2–3, doesn't see it like that.

If you or I were Lotus, suing people who we felt had copied the 'look and feel' of our program, we would be very disappointed to hear that a judge had said, very specifically, that 'look and feel' was not a suitable subject for copyright.

The judge in the Mirror vs Crosstalk case said last month in Atlanta that Crosstalk had copyright on the 'arrangement and design of the status screen' — the two are shown together here — used by Mirror.

But Crosstalk did not have a case against Softklone for Mirror itself, because, said the judge, he was not granting Crosstalk copyright 'over the ideas of a command-driven program, or the use of particular command terms or symbols.'

So I expected to find a disappointed Lotus when I contacted the company.

Not at all, they said. Well, *eventually* they said not at all. The people in the UK said they didn't know anything about it. They referred me to a US publicity chief. He promised to call back. Meanwhile, Lindsey Kiang, general counsel (head of legal staff) who had been delighted to speak to me six months ago when Broderbund won a look-and-feel action against Unison, suddenly was unavailable for comment.

I was finally granted an interview with an official who pronounced himself entitled to speak on Lotus' behalf, who referred me to the company's lawyers in New York. 'I understand that he has been advising journalists privately, but I don't know what he's been saying,' I was assured.

Now, the two cases seem to me to be very similar. VP Planner, published by my old friend Adam Osborne, takes the idea of a spreadsheet and improves on it by adding more database. Mirror takes the idea of a comms program and improves on it by letting it run in background mode. Both are 'keystroke compatible' with the originals, in the same way that many programs are 'keystroke compatible' with WordStar.

I wondered whether Lotus was disappointed with the outcome? It appears not.

'As I see it, there are two scenarios possible, and either way we win.'

He then explained, and I quickly got lost. It seems he argued like this: since Paperback Software's VP Planner doesn't actually use the same design and arrangement of the status screen, and since Lotus has been refused copyright on that same screen, Lotus would be bound to win . . .

What! Why? Because the judge would tell the copyright office to provide copyright on it, or else would say that copyright on the program covered the screen anyway.

'But VP Planner doesn't use the status screen,' I said. 'Well, then we come to the commands of the program.'

'But the judge said that those weren't copyright.'

'Well, then, we still have to come down to the question of the actual code.'

There has never been any suggestion that the author of VP Planner copied a single byte of Lotus 1–2–3 code. If the suggestion were made, it would be a joke, because VP Planner resembles Lotus about as much as Mirror resembles Crosstalk. It has a three-dimensional database built into it, something more on the lines of dBaseII with an extra dimension. It does some things faster than 1–2–3, others slower, and has one or two minor bugs of its own while omitting one or two minor bugs in Lotus 1–2–3.

I put this point to the official. 'Well, we still haven't examined the code. That comes later.' Later? It's already two years since VP Planner was launched!

And he proceeded to read me a sermon. It had to do with the need to protect innovation, and the need for legal acknowledgement of intellectual property rights.

Innovation? What innovation are we getting out of Lotus? What has it done since inventing 1–2–3?

VP Planner is an innovation. I'd say Lotus is trying to suppress it.

I tested this theory. I asked Adam Osborne: 'If, when you were launching VP Planner, Lotus had arrived and said: "Hm, that's a nice program. Very like ours though, isn't it? How about paying us a royalty of $50 per copy?" — what would you have said?'

'I'd have jumped at it,' he said. 'No question. I'd have been wrong, legally, but it would have avoided so much hassle.'

And the precedent would have been set.

It didn't even occur to Lotus people to try. The reason, whatever they say today, is simple: they weren't interested in

Typical of several new, low-cost and simple local networks, is this one from Altek, which is supplying it under the name Tiara.

This is a starter kit for linking three PC-compatible machines. They can use any version of DOS 2 or 3, and even use different versions on the same network.

The real reason for showing it, however, is to frighten the over-bold with a long hard look at that cable.

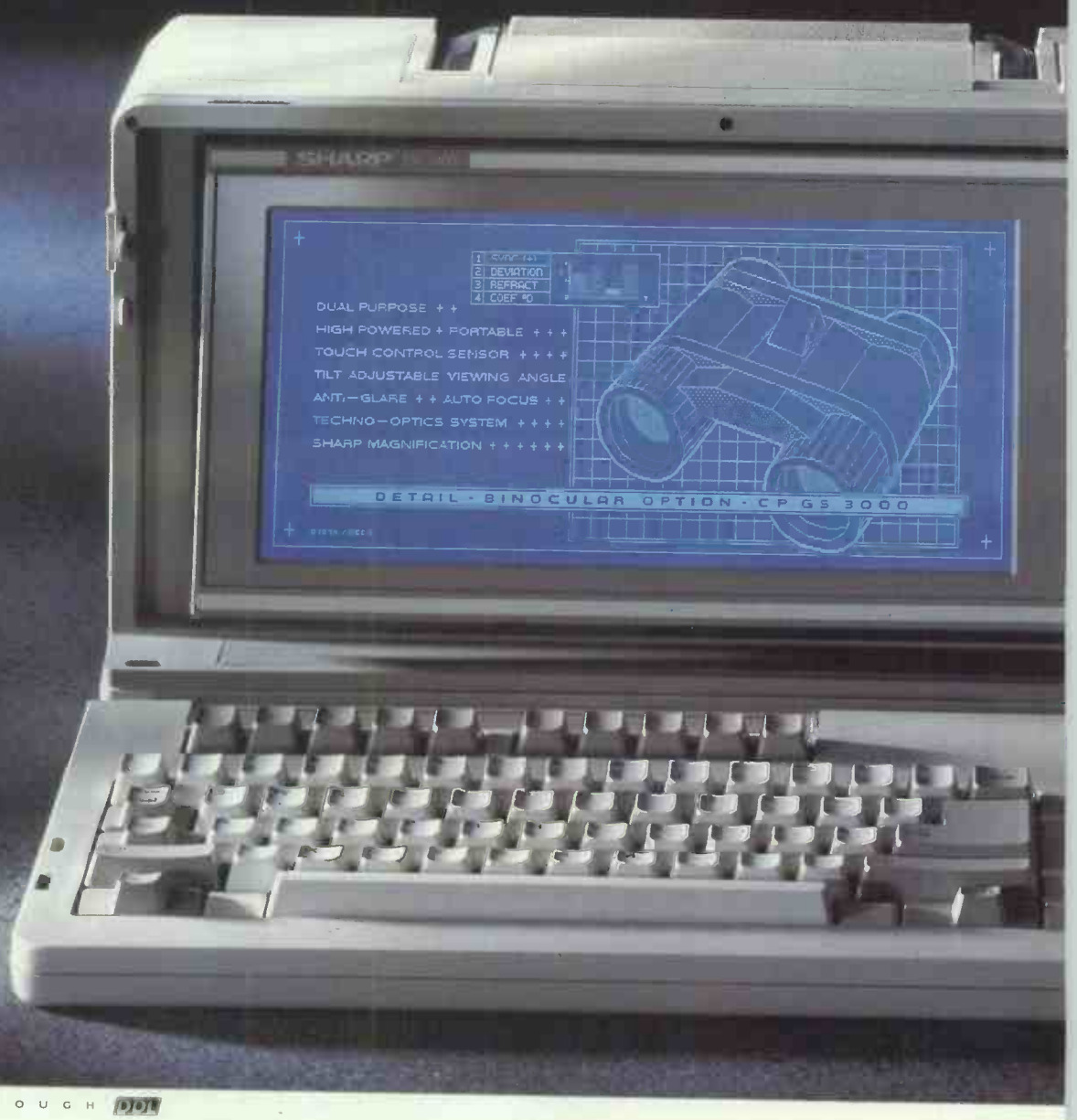
The software may be simple and foolproof, the network fast and easy to operate — but can you punch enough holes in the office walls to get that cable connected to all the machines?

That's why networks still haven't really caught on. Details on (0734) 791579

```
CROSSTALK - XVI Status Screen                          Off line

NAme   Personal Computer World                 LOaded  C:STD.XTK
NUmber 439-4242                                CApture Off

Communications parameters                      Filter settings
SPeed 1200   PArity None   DUplex  Full        DEbug   Off   LFauto  Off
DAta  8      STop   1      EMulate None        TAbex   Off   BLankex Off
POrt  1                    MOde    Call        INfilter On   OUtfiltr On

Key settings                                   SEnd control settings
ATten  Esc                 COmmand ETX (^C)    CWait   None
SWitch Home                BReak   End         LWait   None

Available command files

 1) BIX          2) BIXDIREC     3) CSERV        4) GOLD         5) GOLDIREC
 6) GOLDPSS      7) MUDIREC      8) MUDXT        9) NEWUSER     10) OFFICE
11) SETUP       12) SOURCE      13) STCDIREC    14) STD         15) VNU

Command?
```

```
MIRROR Status Screen                                   Off-line

NAme   Personal Computer World                 LOaded  None
NUmber 01 439 4242                             CApture Off

Communications parameters                      Filter settings
SPeed 1200   PArity None   DUplex  Full        DEbug   Off   LFauto  Off
DAta  8      STop   1      EMulate None        TAbex   Off   BLankex Off
POrt  1                    MOde    Call        INfilter On   OUtfiltr On

Key settings                                   SEnd control settings
ATten  Esc                 COmmand ETX (^C)    CWait   None
SWitch Home                BReak   End         LWait   None

Available command files

 1) BIX          2) CSERV        3) GOLDIREC     4) PCD4         5) SETUP
 6) VID_MONO

Command?
```

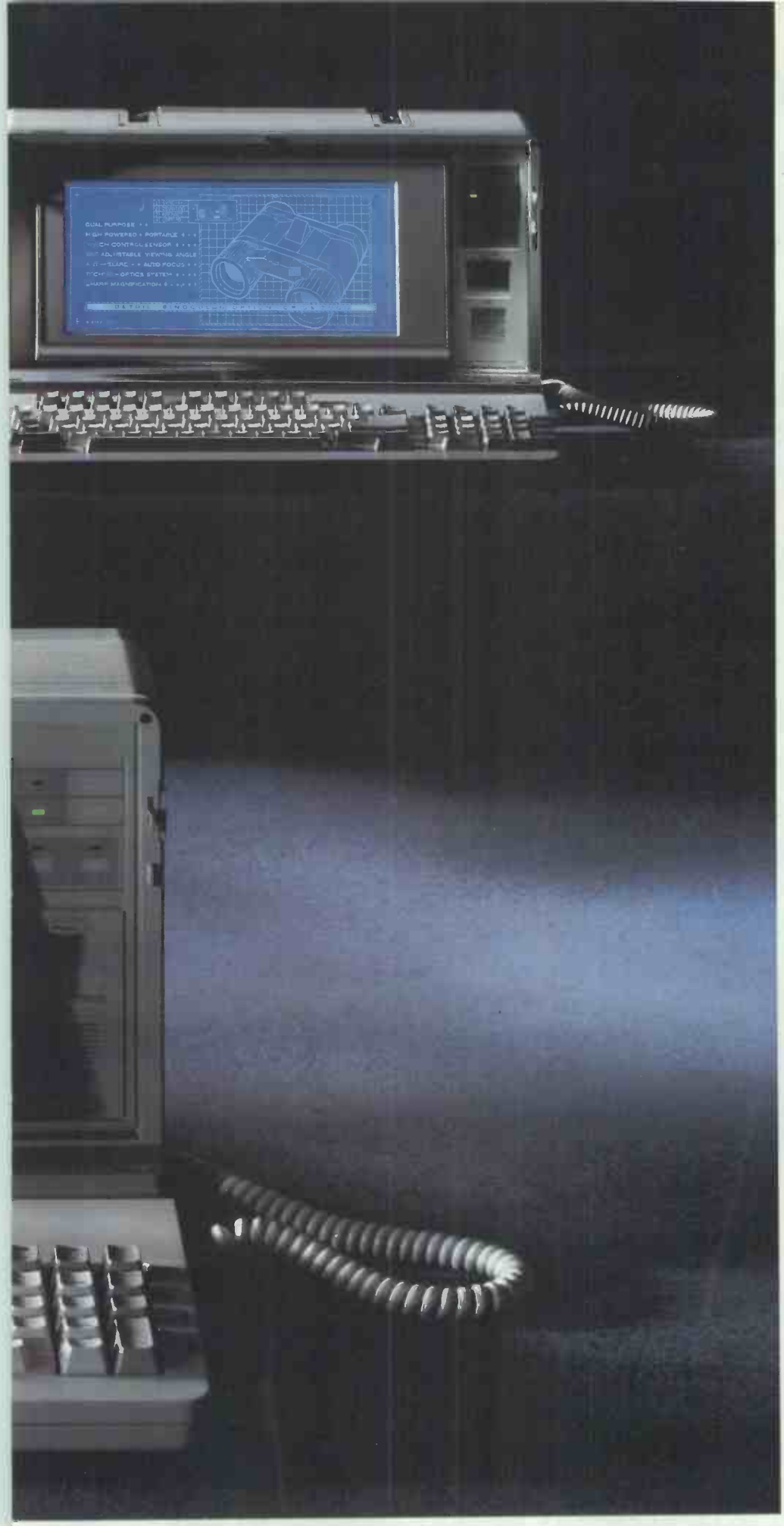
TWICE AS SHARP



DISTRIBUTED THROUGH DOT

SHARP

COMPUTERS



A NEW AGE OF PORTABLE COMPUTERS, WITH ADVANCED DISPLAY TECHNOLOGY.

Note: THE 7100 AND 7000A PERSONAL COMPUTERS.

TWO IN THE RANGE OF COMPACT TRANSPORTABLES, WITH THE SOPHISTICATION OF DESK-TOP COMPUTERS. IBM COMPATIBLE. HIGH CONTRAST SUPER TWIST L.C.D. ELECTRO LUMINESCENT BACKLIGHTING. FOR ENHANCED IMAGE QUALITY. PC 7100 DESIGNED WITH BUILT-IN 20MB HARD DISK DRIVE AND 5¼" FLOPPY. HIGH SPEED OPERATION. LARGE SCALE APPLICATION. BROAD SYSTEM EXPANDABILITY. MULTI-FEATURED FLEXIBILITY. THE BEST OF BOTH WORLDS. CLEAR AND SHARP _____

All enquiries to; MR. A. FALL. NATIONAL SALES MANAGER. SHARP BUSINESS EQUIPMENT DIVISION. SHARP HOUSE. THORP ROAD. NEWTON HEATH. MANCHESTER M10 9BE.

Name _____

Company _____

Address _____

_____

Postcode _____ *Tel:* _____

PC4

FOR PEOPLE WHO MEAN BUSINESS

KAYPRO®

AUTHORISED **KEY DEALER**

ATT

CORPORATION LTD

KAYPRO®

GIVING BUSINESS OUR FULL SUPPORT

RING NOW: 01-729 7033

ATT Corporation Ltd

(TI) INDUSTRIAL UNITS STANWAY STREET LONDON N1 6RY

TEL: 01-729 7033

Telex: 895 1182 GECOMS G

Fax: 01 318 1439

licensing their idea, but in suppressing competition. They wanted to charge exorbitant rates for 1–2–3, and competition threatens to force those prices down.

Now, I'm all in favour of copyright and patent protection (what writer wouldn't be?). It works well in the micro business. And the law should be clear, and it isn't.

In the semiconductor business, Fairchild invented the integrated circuit and lived for years off the patents. Intel and Texas Instruments invented the micro and the single-chip micro, and paid each other and Fairchild.

But no-one ever suggested that, as the inventor of the integrated circuit, Fairchild was entitled to obtain injunctions against anyone who wanted to use the technology.

The Lotus Corporation seems to see it like that. It is remarkable. It daily gets more and more like British Telecom, with an excuse for everything and a total inability to understand why the rest of us get irritated with it.

The question has to be asked: what is it all *for*? We can see this monstrous elephant of a company crashing around, trampling on fences, destroying saplings and making loud trumpetings, but what's in it for the rest of us?

According to Lotus, it's all to provide the resources for research and development of new products. Such as?

Take Manuscript, the latest gem from the company. It's a very fancy word processor, and on specification alone, it looked like the answer to a prayer — handling fonts, columns, graphics, foreign script, outlines, and so on.

But the reality is such a disappointment! My colleague Robert Schifreen described it as 'something written by a committee,' and that sums it up. It's greedy for memory, ruling out RAM-resident programs. It's clumsy onscreen, either using blocks (why?) or hopelessly slow.

Its help screen has 36 different subject headings, and to select one, you have to hold the cursor down and scroll through because it can't work out that if you type 'V' you must mean 'Virtual Memory' — something basic to Lotus 1–2–3 technology.

It doesn't understand what a mouse is — in 1987, for goodness' sake! There isn't even a reference to 'mouse' in the index.

There are menus, some of which require you to hit 'Enter' and others which require you to type 'Ins', the insert key. No doubt there's a reason, but it beats me, and I always get it wrong. I can't delete a line, and I can't even set up a macro command to let me do so.

It costs a fortune, but it comes with the manual unbound; you have to insert separators and load the thing into three ring binders. ('We'll have a new edition out in due course, Guy.')

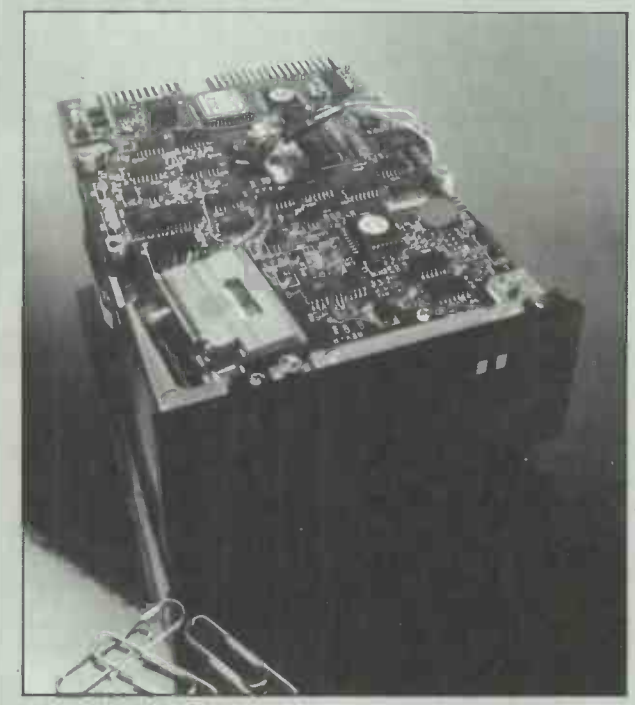
The design concept is excellent. And if Manuscript had been released by a one-man band in a hurry, for £99, you'd expect something like this. For the price Lotus is asking — £450 — however, you expect a finished product — polished, slick, and with bells and whistles. And Lotus should be equipped to provide it.

But all the 'innovation' I can see from Lotus has come from companies it has bought up. Otherwise, it is starting to look like bureaucracy gone mad, including Manuscript.

Lotus should examine its soul hard, and ask exactly where it is trying to go.

At the moment, the company is trying to create a software world where the equivalent of *West Side Story* would be impossible for Leonard Bernstein to write because it has the 'look and 'feel of Shakespeare's *Romeo and Juliet*. The music, the creativity and the artistry — all would count for nothing.

Is this what Lotus wants for our micro world?



C Itoh kindly supplied this picture of a 3½in Winchester disk drive — one holding 45Mbytes. It's a new design, with an average access time of 45 milliseconds; and to get that, it spins at 60 revolutions per second.

You may well find it, before long, in Apple Macintosh designs. The company provides it with the option of an imbedded SCSI controller.

Details on (01) 946 4960.

Mirror: the changes

After the lawsuit, Mirror had to be withdrawn. Mirror II was promised for a week later, with a new 'status screen' and several important upgrades.

Unfortunately, I still can't use it as my only comms program, despite improvements to the Kermit file transfer, because the silly people still haven't implemented sliding-window Kermit.

A sliding window is not an onscreen animation. It refers to the fact that Kermit, like Xmodem, does error-checking in blocks. The problem arises when you transmit a file down phone lines from one machine to another.

At the end of each block of a couple of hundred bytes (it's variable) the receiving machine sends an acknowledgement to the transmitter. It does this by sending a checksum, which should match that of the transmitting micro. If not, the block is re-transmitted.

On a comms link to the US, there is a significant delay between the time the block ends and the time when the next block starts, because the machines have to wait for acknowledgement.

Procomm, a 'shareware' program supplied by DataStorm Technologies in the US, can take half an hour to download a file that takes Mirror two hours to receive, because it doesn't wait for the acknowledgement.

Sliding-window technology saves the blocks in memory, and doesn't have to wait for the clerical process of acknowledgement of blocks. When the response does come, several seconds later, it only gets excited if a block turned out to be bad, and requests that block — which was sent several seconds ago.

This uses memory, and Mirror, being RAM-resident, doesn't want to waste memory. Mirror has to be RAM-resident because it operates in the background, running constantly, even while you use other programs. This is its unique strength.

It would be so nice to be able to let Mirror get on with downloading a program, or an article, or whatever file it might be, while I carried on with typing, sorting disks, or spreading sheets — but not at the price of spending two hours online to a remote system instead of 30 minutes.

So, I use Procomm.

One day, both Mirror and Procomm will do Prestel, too, but today they don't.

So I need a third comms program — ChitChat, for choice — to do that.

It's a mess, isn't it?

Correction

The phone number published for PC-SIG distributor ISD in the May issue of *PCW* (Newsprint, page 75) was incorrect. ISD is on (021) 378 2229.

REPORT FROM THE WEST COAST FAIRE SAN FRANCISCO, 26-29 MARCH 1987

Tales from the Faire

A week before IBM dropped its bombs, the West Coast Faire was held in San Francisco. All the hype in the world couldn't rescue the world's oldest computer show from this blunder — no-one did anything.

The Faire is an old favourite with UK micro freaks — *PCW* even put on an organised expedition for readers one year — and last year, it looked like it was on its way back.

It used to be *the* place for Silicon Valley types to meet, have parties, discuss ideas, do deals, and chat up the Press.

Last year was the first time it was organised by Interface, after several years in which some misguided souls tried to make it a business show with no games, no start-up whizzkids and no loonies. This year, I really expected the revival to be under way.

I think next year I'll give it one last chance, just in case it was the IBM eclipse that spoiled this one.

But spoiled it was.

The most interesting whizzkids were simple crooks — setting up booths which sold cheap clones at unrepeatable offers, or spurious software, or junk, all to disappear at the end of the show and vanish into the mist when customers started wondering why it wasn't working.

That said, I did come back with one or two goodies, as follows.

AI on Lotus!

Lotus believes programmers should produce add-ons to 1–2–3, not rival spreadsheets. Lotus should *love* Robert Benson, who has used 1–2–3 as his programming language for an expert system.

Benson doesn't believe that his If/Then package is going to dominate artificial-intelligence markets, but he does think he will sell some, at $70 a copy.

'There's been a lot of stuff written about expert systems, AI and rule-based and knowledge-based software,' he said from a tiny corner of a small booth he was sharing with other entrepreneurs.

'And corporate businessmen are wondering what it's all about — and this gives them a chance to find out.'

A toolkit of five templates 'de-mystifies' AI, by teaching such concepts as backwards chaining, forward chaining, knowledge representation, demons and fifteen other ideas.

'At the end of it, the typical Lotus user will have some idea of what kind of expert system might be helpful to deal with whatever problem they have,' said Benson.

I think it sounds really interesting, and if only I could get Lotus 1–2–3 version 2 properly installed, I'd even test it myself.

Details, for anyone with version 2, are available from If/Then Solutions, 1 Mallorca Way, Suite 301, San Francisco; Ca 94123. Tel: (415) 346 5886.

Tracking salesmen

The newest idea at the Faire was Tracker, a program to help salesmen.

Actually, anyone who ever uses a phone will find it useful — in theory at least, since I haven't tested it yet.

It's a database-style product, but set up for typical use by someone keeping in touch with a large number of sales contacts, friends, prospects, clients, or whatever.

Not only does it find names, addresses and phone numbers in a nice, structured way, but it allows you to link the database through to a diary so that you can ask it simple questions such as: 'When should I expect Mr Fitzgibbon to call again?' and 'What did she say the last time she called?' and 'What did I promise to have ready by Tuesday?'

It also types address labels, sorts in a variety of ways, types out a 'today's list of things to do' and is RAM-resident, so can be constantly ready to pop up, whatever else the computer is doing.

The company which produces Tracker is Australian — Adaptive Electronics is at 418 St Kilda Road, Melbourne, Victoria, Australia 3004. The phone number I have is (+61 3) 267 7574.

I could have done without the Dirty Digger hats the staff all wore to the show, though . . .

Turbo Pascal link

My favourite idea at the show was a programmers' utility (currently under test in the UK) to let Turbo Pascal writers link to assembly language. It was called Turbo ASM and was priced at $99.95.

It allows the loading of assembler in three ways: included .COM files; separately assembled .COM files loaded on the system heap (taking no Turbo code space); or as your own interrupt routines called from Pascal, also taking no code space.

As an add-on product, PM Tools supplies a library of routines that can be included. The company has promised to send this on to *PCW*, and we'll let you have a report if we like it, later this year.

In the meantime, details on (415) 366 2062.

New Modula — 2

Doing his best not to look like the son of someone famous, Alex Pournelle showed his new version of Modula-2 for MS-DOS computers.

This is the 'large-memory version' of that programming language, and the company which produces it is called Workman and Associates.

The company launched the product as 'based on the third edition of Niklaus Wirth's book, *Programming in Modula-2*, where other compilers conform only to the second, older edition.'

The language is an enhancement of Pascal by the inventor of Pascal, and should gain in popularity.

The price of the new version is $80. Details on (818) 791 7979.

Vital statistics

A magazine for artificial-intelligence users of micros has been launched.

After Adam Osborne's candid admission (in connection with his own VP Expert) that 'expert systems on micros are just database', you might think there wasn't much future in the mag — and you'd be hopelessly wrong, I think.

Interest in the subject at the Faire was enormous. The first edition of *PC AI* runs to 70 pages, and features a buyers' guide to AI products costing less than $100 — a long list.

To encourage potential readers, the publisher listed some statistics. Selected from a page full of these:

Number of add-ons for Turbo Prolog — 2. Number of users — 100,000 plus. Estimated number of people employed in commercialisation of AI — 16,000. Number of people who attended Texas Instruments' first satellite AI symposium — 30,000.

And:

Number of people who jump out of an airplane daily — 5000.

The magazine, whimsey apart, sells for $4.95 in the US, $28 per year, plus $25 airmail costs. Details from Knowledge Technology, 3310 West Bell Road, Suite 119, Phoenix, Arizona 85023. Tel: (602) 439 3253.

A new Magic Sac, legal or not

Apple insists it's illegal, but Data Pacific has now announced a new revision of its Magic Sac which, in conjunction with genuine Apple Macintosh ROMs, lets you run Macintosh software on an Atari ST.

The new version, revision 4.0, allows you to use 800k drives, and also allows you to use printers that aren't Apple Imagewriters — for example, Epson or Epson compatibles.

The Sac is a plug-in cartridge, from Data Pacific on (303) 733 8158. Address is 609 E Speer Blvd, Denver, Colorado 80203. END

W. H. Smith now have a range of computer software, plus an extensive selection of computer stationery.

WHS Continuous A4 paper – 500 sheets (letter quality) £6.95.

WHS Pack of 10 x 5¼" universal disks £14.95.

WHS Flip & file 3/3½" 10 disk box £6.95.

WHS Flip & file 5¼" 10 disk box £4.95.

Business Packages

Writer's Choice (Word Processing) £34.99.

Planner's Choice (Spreadsheet) £34.99.

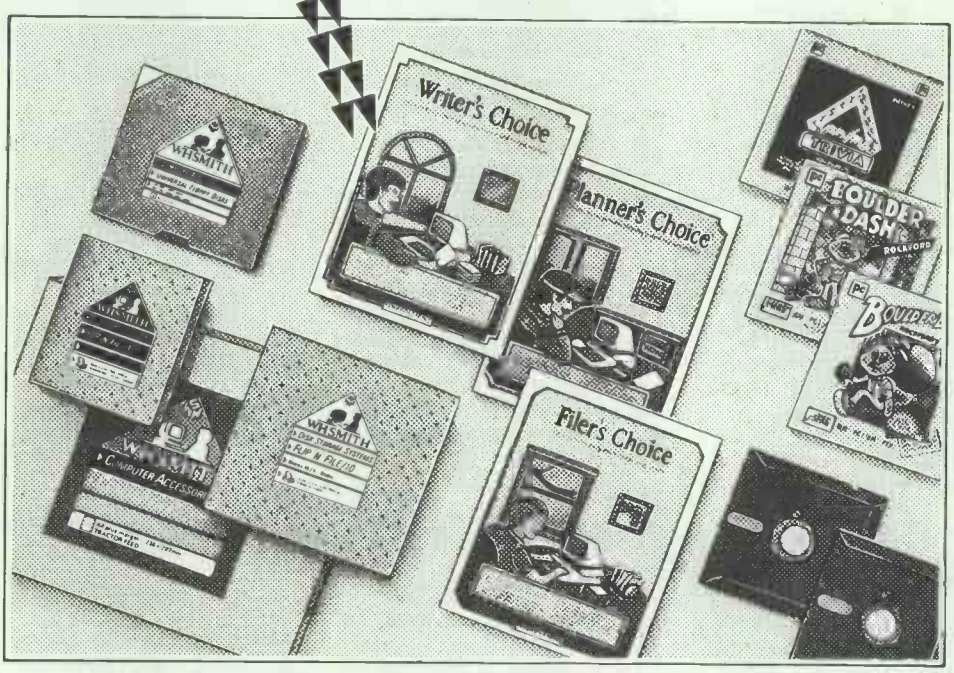
Filer's Choice (Database) £34.99.

PC Games

AM/FM Trivia £9.95.

Boulderdash £9.95.

Boulderdash 2 £9.95.



WHSMITH WHSMITH

Subject to availability Prices correct at time of going to press

THE WEST COAST CONNECTION

The initial introduction of Microsoft's Windows didn't exactly set the world on fire, but now the PC-clone manufacturers are falling over themselves to learn to write under Windows. Tim Barjarin's news from America tells you all about it.

Capitalising on innovation is the way to go

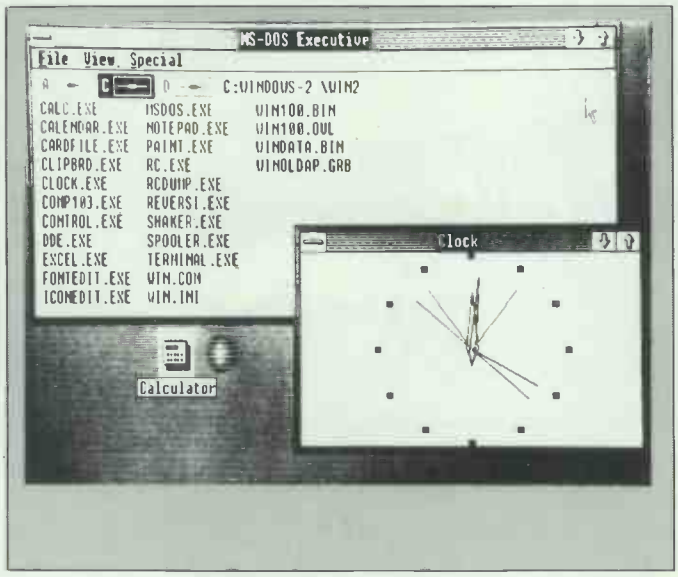
When Microsoft introduced its graphical user interface, known as Windows, most PC users were very sceptical about its future; such users were not mouse-orientated, and on top of this, the PC itself was not considered a graphics-based machine. Once Microsoft actually introduced Windows, it was another two years before the company delivered the product. And, during 1986, only a few applications written under Windows even came to market.

But, with IBM endorsing a superset of Windows — known as the Presentation Graphics Manager, which resides as a part of the operating system, known as OS/2 — the entire PC software world is now scrambling to learn how to write under Windows.

Ironically, this 'windowing' technology goes back to Xerox and its Palo Alto Research Center (PARC). Developed in the late 60s and early 70s, it was a brilliant piece of code that Xerox could never really figure out what to do with. Xerox has a reputation for great technology, but seems to lack the ability to capitalise on it (see the Tandon PAC review).

Another example of this comes from the folks at Adobe Systems. Dr John Warnock was at Xerox PARC and helped develop Interpress, the Xerox page description language (PDL). He became frustrated with Xero's stalling, left and started Adobe, and went on to make his own version of this PDL, Postcript, a market standard.

When Steve Jobs went through the Xerox PARC labs and saw this windowing technology demonstrated, he said: 'I want that.' He then offered great sums of money to Xerox PARC personnel who knew how to write such code, and they developed, under his guidance, the Macintosh interface that we know today. The major problem with getting this concept accepted at that time was that it was on a Mac.



In response to user demand, Microsoft has allowed the different windows to be overlapped

When the Mac was introduced, it was considered more of a toy than a serious computing machine. But as the Mac gained in popularity, because of the friendly graphics interface, it soon became a serious computing standard.

When Bill Gates, chairman of Microsoft, saw this technology, he realised that it made the computer easy to use and so he set out to develop a windowing system for the PC, and he has maintained his visionary role of the future of operating systems.

Although Microsoft looks like the only company who wins big — and has been referred to recently as 'a software monopoly' — the company is giving the PC world a platform on which to write and create exciting applications. It has the potential to give the PC world the same platform that the Mac has given us: one of an easy-to-use, graphically-orientated user interface. By early 1988, we will have Excel for the PC, under Windows. This is considered the product that could knock Lotus 1-2-3 off the charts. Later in the year we will have most of the PC drawing programs under Windows and will see some Quickdraw-like utilities available for the PC. In fact, many of the brilliant programs on the Mac, like Omnis 3, Write Now, More and Guide, will soon work exactly as they do on a Mac, but on your PC.

As you can imagine, the people at Apple Computer must be very concerned. Although they can't claim original rights to this windowing concept, they did, after all, popularise it. Even if the PC is not as good a graphics machine as the Mac, it could still have a serious impact on Apple's corporate push.

Although most of the new products under Windows will not hit the market until late next year, the move to a windowing environment as standard on the IBM PC is now a certainty.

Where there's a will, there's a way

On the day after the IBM product announcements, employees from Chips and Technologies queued up outside various IBM dealerships and were the first to buy any new IBM Personal System/2s they could get their hands on. By noon, insiders say, they had them apart and were going over them with a fine toothcomb. Board and chip makers everywhere were doing the same thing.

Chips and Technologies is likely to be the first out with a VGA-compatible card.

However, because IBM has developed its VGA to be compatible with existing standards, if you already have an AT, you can actually buy an IBM VGA card for your own machine.

Major players like AST and Quadram are both diligently working on ways to replicate IBM's boards, and will do their best to provide the same type of functionality as soon as possible. How soon will these clone cards appear?

The race is on to beat IBM at its own game. Again the legal issues of getting past IBM's patents could slow this down, but the motto of these clone-card makers that continues to drive them forward is: 'Where there's a will, there's a way.'

If you play your smart cards right

Credit cards? No — smart cards with potential

While browsing at the recent Hanover Computer Faire, I came across a technology that I believe has an interesting future. Both Toshiba and Mitsubishi showed new versions of their IC cards, better known as smart cards.

The Toshiba card can now take up to 128k of data and is being used to download everything from a person's medical and drug history to an individual's credit record. Although these are more like credit cards than RAM cards, their impact on personal data storage is almost limitless. Toshiba tells me that it is working on data readers that will be under $100 and could work directly with a PC as well as with a small calculator device.

The Mitsubishi card is a bit thicker, and is actually a static RAM card. It holds a small NiCad energy cell, as well as 32 data strips that plug into a data reader. The card I saw had 512k of memory onboard, and by the end of the year, Mitsubishi will use the other side to add another 512k of memory.

The company already has a drive for this that links directly to an IBM PC. In Japan, it is used as a game cartridge for the JX home computers, as well as a font cartridge for laser printers.

But, the Mitsubishi card has interesting potential when you link it up with the laptop computer concept. Alan Kay, ex Palo Alto Research scientist and now an Apple Fellow, has long had a dream about putting a computer into a device the size of a book. Known as the Dynabook, Kay believes that one day we will have the technology available to make such a 'notebook-size' computer; and the Mitsubishi card could well be the storage medium for this type of computer. Mitsubishi is already working on a drive that would be very small, and would fit easily into this kind of computer.

We already have the chip technology — through LSI techniques — to put all the brains on a card with a very small footprint. What is holding up the development of a book-like PC is the display technology. But with major advances in low-power, high-resolution screens, we would see some significant breakthroughs in this area very soon.

I have seen flat-panel technology that you can actually roll up, but to date it is being developed more for military applications rather than consumer-type projects. But, by 1990, the merging of these various technologies could give us Alan Kay's dream machine.

Crossing the Channel to prosperity

One of the most controversial parts of the new IBM product announcement was the Micro Channel Architecture (MCA) bus. This new bus architecture allows for true multi-tasking, multi-processing features on the new hardware, but because of the need to maintain compatibility with the DOS from the past, the new OS/2 will work with any 80286 or 80386 machine, regardless of maker. This ironic move makes the clone/compatible makers very happy.

Although it will probably take at least a year for anyone to clone the new bus, you can be sure that someone *will*. And when that happens, you can bet that IBM, fresh from filing over 100 patents covering every aspect imaginable on these new PCs, will challenge these clones in the courts immediately.

The IBM Personal System 2 (reviewed last month)

But the immediate question is — does the clone maker really need the MCA bus in order to survive? The new bus has serious ramifications for the Fortune 1000 market where mainframe connectivity is important, so companies like Compaq will want to find a way to give their machines these same features. But if you are a manufacturer whose machines are used more for personal productivity, then the new bus is overkill, except for the serious power user who wants the latest bells and whistles.

Since IBM's own Extended Edition version of OS/2 will work with 80286 and 80386 clones, albeit without the advantage of the IBM-specific technology, you can be sure that the clone makers who persevere, will continue to prosper.

IBM's commitment to OS/2, and its continued dependence on Microsoft, make it a pretty sure bet that, at least for the next five years, IBM will make sure its hardware works directly with this new operating system.

The sky's the limit for videotext

When videotext systems were developed in the late 1970s, it was assumed that they would eventually be the hottest thing for the home and business market. In the UK these facilities have been implemented on viewdata services like Prestel and off-air teletext services like Oracle and Ceefax. In the US major companies like IBM, Sears, Knight-Ridder, and so on, jumped on this bandwagon and tried to get the market to accept this new technology; but to date it has been a real flop. IBM just recently backed out of the Sears/IBM videotext project, and Knight-Ridder has all but abandoned its service.

One of the reasons for videotext's slow start has been the lack of inexpensive ways to deliver such data and the high 'online' charges. Another area of concern has been keeping the interactive nature of the system, for which telephone lines are the best medium. But for a long time, it has been held that TV cable systems would be the most efficient way to actually deliver the data in the most cost-effective manner.

With a new system called PC Express, a computer user with a TV cable system can link up directly with the major wire services and financial databases. You can also use the system to get the latest weather, sports and business stories, as well as information on your favourite soap opera, a review of the hottest play on Broadway, or even a review of a book on the *New York Times* bestseller list.

You do not get the interactive features like Email, or online conferences, but you do get instant database information whenever you want it. You could stay online for 24 hours, every day of the month, all for an initial set-up fee of $79.

The low cost is due to the utilisation of cable lines and direct links to various satellite delivery systems. I have used it for about a month, and have become an 'informaniac'.

Still in its infancy, PC Express is only available for the IBM PC and Apple II world, but a Macintosh version is in the pipeline and an Atari ST version may well be ready in early 1988. END

Double

When we first brought out our top selling PC16-X, at a starting price of £449, the competition weren't exactly smiling.

And while their grey hairs were being pulled out, just to match the price, we were finding further ways in both quality and performance to ensure our computers were totally unbeatable.

We're certain we've found that balance—our customers keep telling us so, and they keep coming back for more. From small businesses to multi-nationals, from Universities to Government bodies, the PC16-X has proved itself to be a most reliable and versatile workhorse. Now there's real trouble, in fact double trouble, with the launch of the new Digitask AT compatible, the AXIOM 286-10. Both compact and powerful, good looking and good value for money, we know we're on to another winner.

One look at the top features and you won't need any persuasion. Is there a catch? Well, no—but there are a number of things you *won't* get when you buy a Digitask PC—cheap plastic, poor expansion capacity, unreliable drives, fuzzy monitor, limited compatibility and a fifteen year waiting list—we'd better not go on!

We don't intend to be a nuisance to our competitors, in fact we offer them our deepest sympathy, but if by putting a smile on your face, we put a frown on theirs, we've only one choice—and a possible side-line in hair restorers!

DIGITASK **Tel. (0342) 24631**
Telex: 957418

Digitask Business Systems Ltd, Unit M,
Charlwoods Business Centre, Charlwoods R
East Grinstead W. Sussex RH19 2HH

Trouble!

DIGITASK PC16-X

• 8088-2 co-processor operating at 4.77 MHz • Soft/hard switchable to 8 MHz Turbo (provision for 8087-2 co-processor) • Full 512 KB on-board memory as standard • Single floppy (brand name) drive • 8 IBM® compatible expansion slots (7 on portable) • 150 watt power supply • 1 x parallel port, 1 x serial port (2nd serial opt.) 1 x clock, 1 x games port, 1 x light pen interface • Reset button, enabling cold boot without switching off • Strong, durable case • Easy access flip-top lid (slide on portable) • 84 key, AT® style keyboard • Colour display adaptor • Composite green/amber monitor (internal 9" TTL on portable) • Excellent software compatibility • Free Application/Utilities Software • One year parts and labour warranty (on-site maintenance available)

STARTER SYSTEM *(Specifications as above)*	**£499**
FULL FEATURE SYSTEM *Dual 360KB Floppy Drive 640K Ram,* *High Resolution TTL Monitor, Mono-Graphics Adaptor*	**£695**
BUSINESS PRO SYSTEM *20MB Hard Drive, Single 360KB Floppy Drive*	**£975**
BUSINESS PRO PLUS SYSTEM *20MB Hard Drive, 1 x 1.2MB + 1 x 360KB Floppy Drive*	**£1159**
MICROSOFT MS-DOS® *3.20 with GW Basic Interpreter (latest version)*	**£65**

DIGITASK AXIOM 286-10

• 80286-10 co-processor (6/10 MHz switchable) • Zero or one wait-state selectable • 16 level interrupt, 7 channel DMA • 3 programmable timers • 16-Megabyte addressable mode • Reduced chip count (due to custom chips set) • Optional 80287 co-processor • Phoenix BIOS • Full Megabyte on-board memory supplied • Combined floppy/hard drive controller • 1.2 MB floppy drive • 6 x 16 bit IBM® compatible expansion slots (5 usable on portable) • 2 x 8 bit expansion slots • 200 watt power supply (180 watt on portable) switchable 110/220V • 2 x parallel ports, 1 x serial port (2nd serial opt.) • On-board CMOS real time clock with ni-cad battery back-up • Hardware reset from front panel • Keyboard lock on front panel • Modern, attractive case • Easy access flip-top lid (slide on portable) • Small Footprint • 84 key, AT® style keyboard • Mono/graphics adaptor • High resolution TTL monitor (internal 9" on portable) • One year parts and labour warranty (on-site maintenance available)

AXIOM SILVER *(Specifications as above)*	**£1253**
AXIOM GOLD 20 *1 x 20MB Hard Drive*	**£1399**
AXIOM GOLD 40 *2 x 20MB Hard Drive* *Other configurations–please call*	**£1649**
MICROSOFT MS-DOS® *3.20 with GW Basic Interpreter (latest version)*	**£65**

THE DIGITASK PORTABLE RANGE

• PC16-X STARTER SYSTEM PORTABLE	£699
• PC16-X FULL FEATURE PORTABLE	£779
• PC16-X BUSINESS PRO PORTABLE	£1069
• PC16-X BUSINESS PRO PLUS PORTABLE	£1239
• AXIOM SILVER PORTABLE	£1353
• AXIOM GOLD 20 PORTABLE	£1499
• AXIOM GOLD 40 PORTABLE	£1749

Specifications as desktop systems
All prices do not include carriage & VAT (Please call)

LETTERS

This is the chance to air your views — send your letters or contact us on Telecom Gold 83: VNU200. The address to write to is: Letters, Personal Computer World, 32-34 Broadwick St, London W1A 2HG. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

No cover-up

The front cover of April's *PCW* was one of the most successful ever. It would be an education for many of us to learn how it was produced, from idea to CAD to print. Presumably it was *not* created on a Mac II, but could it have been?
Patrick Doorly, ICARUS, London SW12

Wouldn't it be wonderful if PC or Mac-based software could produce such a cover. Though very close to the actual Mac II screen — which in itself is a marvellous piece of computer graphics — the cover is in fact an airbrush drawing.

Constructive criticism

I have read *PCW* monthly since number one, and I should like to think that my comments echo what is said by other 'grown-up hackers'. I like what is happening to *PCW* at the moment; I do not have time to read *Byte* regularly but it seems to me that *PCW* is now aiming for the same market and trying to offer something to both the home and business user. The book reviews have improved immensely now that they are being handled by a panel, and complement the 'Subset' and 'Program File' sections.

I have only three criticisms, which are intended to be constructive:
(i) Could we *please* have brief biographical details of the authors of articles, in line with the majority of quality technical magazines. If somebody is a staff writer, please could we have an introduction when he joins you. A good example is 'The Authors' section in *Scientific American*. A lot of people seem to get very hot under the collar in the 'Letters' pages because they do not appreciate that Guy Kewney is a journalist (albeit one with an excellent grip of the technicalities) rather than an engineer.
(ii) Brief example listings in articles get mangled because of your three-column format: for example, March '87, p134, middle column. I am not a graphic designer and hesitate to comment on your house style, but couldn't you use these three columns for your editorial pages and two for articles?
(iii) I am occasionally visited by reps (sometimes called Field Sales Editors) from Addison Wesley, Prentice Hall *et al* who have a constant stream of new books in the computing field. Granted that a fairly high proportion of these are thoroughly esoteric and well beyond the majority of readers (beyond me, at least — I am still trying to work out what Denotational Semantics are), could you not find a postgraduate student somewhere who could review one or two a month for the benefit of those readers with an academic bent and wish to know what is coming out in the field of Computer Science rather than using programming and application packages?

Keep up the good work.
Mark Morgan Lloyd, Just Mark Software, Leicester

Yes, yes, yes. And thanks for the feedback.

Cash refund

I recently bought an evaluation copy of Cash Trader from IT Marketing of Brixham to run on my Sanyo MBC555. Before ordering it, I checked with the company that the package would indeed run on my machine and that it was available on single-sided DOS disks.

Imagine my surprise, then, to receive the package on double-sided disks and with a manual which states that the package will only run on the Sanyo if it is fitted with an expensive add-on video card.

Telephone conversations with IT Marketing have produced conflicting replies about whether or not the package should work on my machine.

In the end I returned the £19.95 evaluation package, but IT Marketing seems reluctant to refund my money, saying that its ads do not state that money is refundable.

Surely I am legally entitled to return anything I buy through mail order that is unsatisfactory.
MN Goodchild, Plymouth, Devon

If you order goods by mail order, then you have certain rights as a consumer, including the right to a refund for unsatisfactory products. Additionally, using a credit card for your purchases gives you extra protection. So keep on complaining, and contact Barclaycard also. We've passed your full letter on to our ad department as well.

A real gem

In reply to Guy Kewney's article 'RAMming home the point' I can let you know how to get around the problem of using a RAM disk with GEM on the PC1512.

Solution one (rather crude) is to delete the line in the GEM.BAT file which calls NVRPAT2. This is the progam which reduces the RAMdrive value to zero in the NVR (non-volatile RAM).

Second solution (more sophisticated) is to alter your CONFIG.SYS file to state whatever RAMdrive parameters you want, rather than calling on the ones set in NVR. This means altering the line which says:
"DRIVER=\MSDOS\
RAMDRIVE.SYS NVR"
to read
"DRIVER=\MSDOS\
RAMDRIVE.SYS 64 128 32"
where 64 means allocate 64k to the RAMdrive, 128 represents the sector size (bytes) and 32 represents the maximum number of root directory entries allowed. Of course, you can alter these figures (within limits) to suit your own circumstances. If you wish to use an extended memory board (LIM standard) you can allocate RAMdrive space in extended memory by adding the parameter /A to the above string.

Obviously you lose the flexibility that the NVR method gives but it does allow you to operate GEM with a RAMdrive. Incidentally, if you take too much memory for this you will find that not all of the memory-resident utilities will be loaded with GEM (clock, calculator, print-spooler, camera). Be aware that it may also limit your use of PAINT workspace.

Another little hint regarding the Amstrad:

Many people will be trying to get to grips with Locomotive Basic2 on the new Amstrad PC.

While it is undoubtedly a very comprehensive implementation of the language I have, until recently, considered it to have one problem — it is a long and painful process to load GEM, Basic2 and your own program — then run it. Fine the first couple of times but the whole process becomes a trifle boring after a while — and a definte inhibitor to its use.

There is a simpler and very much quicker way — and it is not documented anywhere, as far as I can tell. When calling GEM, add a

LETTERS

Continuing the controversy over AI/expert systems misunderstanding

I know it's sticking one's head in the lion's mouth to criticise reviewers, but I think Owen Linderholm has perhaps exceeded the bounds of common decency in his expert system mauling (April, *PCW*). I suppose Crystal will be seven times more aggrieved (*pro rata* on cost, you understand), in which case I would be careful to avoid dark alleys for a while if I were you.

I rather doubt if we or PSI will be interested in cooperating with *PCW* by presentation of pre-release products if we find words like *appalling* used wantonly about a photocopy of the galley proofs.

The only saving grace that I can detect in the entire article is that Owen uses NewWord3, and thus cannot be quite as hopeless a case as the rest of the article would imply. However, I seem to recall a review of NW3 by the said Mr Linderholm that failed, at the time, to convey any enthusiasm for that product either, and only conclude that he may repent in this case too.

Bill Poel, NewStar Software, Brentwood, Essex

Your recent review of Intelligent Environments' product Crystal demonstrates what is, in fact, a widespread misunderstanding of what expert system shells are. The naive perception is that they are brain replacements. The actuality is that they are programmer tools for generating rule-based systems. Crystal uses a deductive approach, where rules are entered explicitly. Other products use an inductive approach, where rules are abstracted from data.

As programming tools, expert system shells are used by application developers and the test of success is the ability to generate practical applications. Contrary to the review's statements, Intelligent Environments can show many examples of applications developed using Crystal. In fact, the largest known PC expert system was developed by Coopers & Lybrand for the DHSS using Crystal. This application interfaces to Lotus Symphony files using one of the interfaces available from Intelligent Environments. (Again, contrary to the statements made in the review, dBase, ASCII file and Interactive Video interfaces are available for Crystal as well as the Lotus interface.) The ALVEY Club for the insurance business (ARIES) selected Crystal to deliver its fire risk assessment system. Thomas Cook has implemented a system which advises customers on how to connect to a network travel information service, using data from a Lotus worksheet. Intelligent Applications in Scotland has created a system which enables real-time monitoring of diesel engines. Many other examples can be quoted but I think these prove the point.

It should be said that the misrepresentation of expert system shells in general is partly the fault of hyping by some vendors and the press. However, recently more serious and considered articles on the subject have appeared in your sister publications. I hope that by working with you, future reviews and articles will be better judged and more informative to your readers.

Dr Laurence Shafe, managing director, Intelligence Environments Ltd, Richmond, Surrey

Your April issue with purported reviews on Crystal and VP-Expert recently crossed my desk. For your information, I am sending you a real review of VP-Expert authored by an acknowledged authority in the field, Mr Paul Harmon. Mr Owen Linderholm's comments say nothing about Crystal or VP-Expert but they speak volumes for his inability to use either product. Mr Linderholm's comments are so full of inaccuracies and downright errors that I am sending you Mr Harmon's review rather than taking equal time to pull Mr Linderholm's comments apart step by step.

My question to the editors of *PCW* is this: Why do you print the opinions of an individual who clearly knows nothing about the subject he is covering?

Adam Osborne, Paperback Software, Berkely, California

Owen Linderholm replies: *My review of Crystal and VP-Expert was written from the point of view of expert systems as a part of artificial intelligence. I felt that this was a reasonable approach since this is what most users feel about expert systems. Almost all the articles written about expert systems in the press discuss mainframe-based systems. If users' expectations of expert systems are based on these, then it is fair to say that the performance of micro-based expert systems is very poor.*

The review differentiates very clearly between describing the functions and capabilities of the programs and any criticism levelled at calling the programs expert system shells. As to the criticisms of factual information in the review, I did not say that the programs were incapable of performing a useful function. Nor did I say that Crystal did not have interfaces to other programs available, merely that they were not supplied with the program. VP-Expert's documentation was indeed in an unfinished state and I apologise for misleading anyone. The word 'appalling' was meant to apply to the content of the manual, not its presentation.

Adam Osborne's letter, while criticising my review, doesn't get specific enough for me to reply. The copy of the review he sent was from Expert Systems Strategies, *a newsletter published in the US. The review describes VP-Expert as 'a simple rather than a structured rule tool'. The reviewer also makes it clear that he regards VP-Expert as a beginner's expert system tool. One point should be noted, however; the reviewer makes no bones about the fact that he runs a business involved in training people in using Expert Systems, so he is hardly likely to want to put people off.*

Remembering that the differences in 'intelligence' between Crystal and VP-Expert are not very great, I think the last word belongs to Adam Osborne himself. At a product announcement in Holland recently he agreed that describing such packages as expert systems was 'a con'. I suppose he might not have said this had he realised he was talking to a PCW *journalist.*

couple of extra parameters to the command, thus:

GEM BASIC2 program

where 'program' denotes the Basic2 program name (with or without .BAS extension). If 'program' is not in the default subdirectory (which will be \ GEMBOOT) then the full pathname should be given, according to the normal rules. So, to run the program DEMO.BAS located in the BASIC2 subdirectory, the command would be:

GEM BASIC2 \
BASIC2 \ DEMO

The specified program will be loaded (with GEM) and run automatically. Control/C stops it as normal and you can edit and save, as you wish. The QUIT option from the files menu (or typed in the dialogue window) does not return you to GEM DESKTOP, as this has not been loaded. It will drop you straight out to DOS again.

This also works for any GEM application — Paint, Doodle, and so on.

Chris Churchouse, Kings Worthy, Winchester

Online takes its final bow

It was with mixed feelings that I read the letter I received recently informing me that PCW Online would be closing down.

One the one hand, I had already decided that it was a bit of a white elephant; an unnecessary drain on my bank account. But then again, I thought, what a shame that something so potentially useful has to die before it has even reached anything like maturity.

In my work at Kingston College, I make frequent use of electronic mail and, since it is such a boon, I do my best to encourage at least a passing familiarity with it in my students. PCW Online, however, was always sadly lacking in so many respects.

At home, for example, keen to justify the purchase of a modem to my girlfriend, I used PCW to demonstrate: 'Look,' I said, 'You want a

LETTERS

lapheld, don't you?'

'Yes, but I want to read about two or three before I choose one,' she replied.

'Fine,' said I, the gleam of victory already in my eyes, 'we can use Online to see what's available these days.' I logged on and selected the appropriate menu and then downloaded the reviews of laphelds. She was duly impressed at the speed but not the quantity. Fortunately she didn't notice that the meagre three reviews I obtained for her could have been read in the previous issue of PCW.

As the log-on message said, there was a staff shortage. I would have thought that hiring someone would be the answer to that one, but then, being a lecturer, I understand woefully little of the real world of work. In fact, I'm so naive in these matters that I think that when most of the information needed on the system — reports and reviews, for instance — is already electronically recorded anyway and you have an optical reader for that which is not, supporting the network to a standard that would encourage a high level of take-up, thus financing the operation, would be a relatively minor task.

Oh well, with silly notions like 'if you provide a useful service people will pay for it' perhaps I'd better get back to teaching my next class how to make sensible use of the available information technology.

John Seaman, lecturer, Kingston College, Kingston-upon-Thames

The cost of hiring extra staff would have been reflected in even higher Online charges, and we already felt the service was too expensive to run. This applied to both PCW *and TTNS — the operators of the system.*

Setting matters straight

I write with reference to my letter in the April issue of *PCW*, 'If you want it doing properly'.

Since the letter was written, software companies have been announcing that their programs will be sold through Dixons shops. Furthermore, I now understand that Dixons has invested large amounts recently in staff training.

It is obvious, therefore, that Dixons *is* supporting its customers and that the letter now contains some inaccuracies and unjust criticism.

Jon A Slack, proprietor, ACD Computer Services, Nottingham

Heat and dust

Further to your request for more imaginative uses of Red Boxes-type infra-red detectors, the following proposal is from an environmental group monitoring abnormal release of smoke and dust from Monkton Coke works.

Each observing site is equipped with conventional and Polaroid cameras to record the emissions on film. By having a number of observation sites, it should be possible to pinpoint the exact source of the heat.

The detector is pointed at the Coke works and screened against casual infra-red emissions such as passing birds and cars. The detector is adjusted until it only registers abnormal releases of hot smoke, which are particularly good emitters of infra-red radiation.

The detector is wired up through a device such as Red Boxes to sound an alarm which will summon the camera operator when an emission is detected. The operator can note the time and sign and date the Polaroid picture to provide evidence, the Polaroid tallying with conventional photographs which can be processed later.

DTC Porthouse, Hebburn, Tyne & Wear

Totally organised

I would like to say a word or two in favour of the Psion Organiser II. What little I have seen in print about the Organiser has not been particularly favourable, and I feel this is quite unjust!

In my opinion the Organiser is quite remarkable: it is very well-constructed and is endowed with an extremely robust menu-driven operating system. On the organisation side it has made my alarm clock, calculator, diary and address book all totally redundant.

There is much to praise on the programmable side also; OPL, the resident programming language, is an excellent version of BBC-type Basic with additional features usually found in languages like C or Pascal. Although the Organiser is not orientated toward the assembly language programmer, it's not really too difficult to construct and use machine code subroutines.

I would recommend the Organiser to anyone; it's a pleasure to use. If anyone would like to correspond on this subject I will be happy to reply.

Lawrence Blanchard, PO Box 181, Bethnal Green SD0, London E2 9AA

Contributions to Program File for the Organiser II would be gratefully received.

Compliments all round

I must congratulate you — as I am sure many people have — on your exceptional publication. On the cover it is clearly printed that you are 'Britain's Biggest Microcomputer Magazine'; *PCW* is also Britain's Biggest *and Best* Microcomputer Magazine — well, as far as I am concerned.

There are four parts of your publication that are especially appealing to myself. These are: 'Benchtests', which are brilliant — other publications which I will leave nameless give information on the basic features of a given computer system whereas you take the trouble of testing the system in great detail; 'Screentest', testing software and putting it through its paces; 'Computers in Action', showing how computers are put to practical use in job environments; and 'Programming', giving hints and tips suitable for the professional or the beginner.

To myself and my fellow students, your publication is in a class of its own.

Bobby Dhaliwal, London W2

Right or wrong?

We would agree almost entirely with Robert Schifreen's review of PC Write (February *PCW*) if the text were in a large bracket prefixed by *NOT*.

We represent entirely different views. I would perhaps be classed as a computer person. As a two-finger typist I use PC Write for writing formal documents. I've also used it for program editing.

My secretary does not consider herself a computer person but made friends with PC Write in an hour or so, and as a skilled typist has used it for an extraordinary range of output since. We have looked at other WP packages over the last few years but we have not seen sufficient advantages to woo us away from PC Write.

JD Underwood, product manager, Magnetic Tape, AMPEX, Reading

Craving for a Cray

Alongside my Reader Survey I thought I would amplify a couple of points.

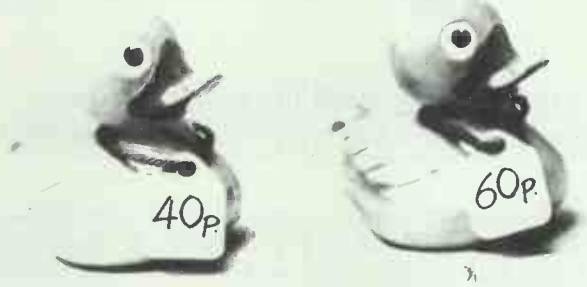
I'd really like to see a series of articles on supercomputers, especially the Cray II. I know they are not really business machines, but I'm sure that many readers would like to buy one. And it would be interesting to see what's at the very pinnacle of computing and how far micros have to go to catch up.

I think your covers are usually brilliant, though a bit similar in their execution. But then, maybe in ten years' time we'll see animated covers.

John Trippick, Motherwell, Lanarkshire

As the Cray II seems, on a preliminary glance, to be the computer the majority of our readers would like to own, we are already investigating a special offer of one at half price for each reader. END

30MB for the price of 20MB!



Spot The Difference

If you were looking to buy a rubber duck, which would you choose?
Offered two items, identical in all but price you would naturally choose the cheaper.
Unfortunately, Kudos doesn't sell rubber ducks. We do however stock a large range of top quality peripherals and IBM AT compatibles at prices which will make choosing easy.
Take for example the Kudos HarDisk 20. It's a complete 20MB hard disk system that suits most PC's (including the Amstrad) and its only £299 (ex VAT). Until now Amstrad owners have had to pay as much as £650 for a 20MB hard disk system.
And following the same low pricing policy we can also supply RAM cards, graphics cards, multifunction cards and tape streamers - all for less than you'd expect.
Simply put, our prices are the lowest you'll find anywhere, but we don't expect you to take our word for it. We want you to look around, compare prices and see for yourself.
To order the Kudos HarDisk 20 or to find out more about our product range complete the coupon below or ring 01-200-6511.
Sorry we can't help with the rubber ducks.

The Kudos HarDisk 20
A complete 20MB hard disk upgrade for your Amstrad PC or IBM compatible

for only £299 (ex VAT)

A 20 megabyte hard disk drive has the storage capacity of 50 floppy disks and is 10-12 times faster than a floppy disk drive. It enables you to store a whole programme/data library inside your micro. Floppy disks need only be used for back-up storage. In essence, a hard disk drive can transform the way you work with your micro.

The Kudos HarDisk 20 includes: Seagate ST225 20MB hard disk drive, WD controller card, fully documented manual, connecting cable, utility disk and, of course our 12 month no-quibble guarantee. For Amstrad PC1512 owners a mounting bracket and modified front bezel are included in the package at no extra cost.

The Kudos HarDisk 20 is easy to install. However, your dealer can fit the upgrade for you. Alternatively you can call in at our distribution centre and we'll install it in your micro for £19.50 (ex VAT).

If you're a government department, education authority or PLC, just send us an official order and your goods will be despatched on the same day.

If you're a dealer and would like a Dealer Datafile call Grant Bosher on 01-200-6511

To: Kudos Systems Ltd, 72 Capitol Way, Edgware Road, London,NW9 OEW Please rush me:

____(Qty)Kudos HarDisk 20 at £299 + VAT + CARRIAGE = £357.65 I enclose a cheque for £ _____

My computer is _____ (please state make and model)

Please send me your latest information pack ☐

Name _____

Company _____

Address _____

Postcode _____ Telephone _____

KUDOS Systems LIMITED

Kudos Systems Ltd
72 Capitol Way
Edgware Road
LONDON
NW9 OEW

Tel: 01-200 6511
TLX: 8813241
Fax: 01-205 3911

Personal Callers Welcome - Call in and save on delivery charges.

All tradenames and product names are the property of their respective manufacturers/owners.

Are we quackers?

Last month we ran the advertisement opposite and it certainly generated a lot of orders. Many people asked if we could supply 30MB hard disk drives.

The answer is yes.

We are now able to offer exactly the same package but with the massive storage capacity of 30MB (The equivalent of over 80 floppy disks), *at the same price!* — **£299 (ex. VAT).**

The Kudos HarDisk 30 includes: Seagate ST238 30MB hard disk drive (65-85ms access time), Western Digital half-size controller card, manual, connecting cables, utility disk and, of course, our 12 month no-quibble guarantee. For Amstrad PC1512 owners a mounting bracket and modified front bezel are included in the package at no extra cost.

To order the Kudos HarDisk 30 (ex stock) or to find out more about our product range, complete the coupon below or ring 01-200 6511.

To: Kudos Systems Ltd, Capitol House, Capitol Way, Edgware Road, London NW9 0EQ

Floppy disks don't fit the bill — please rush me:

_____(Qty) Kudos HarDisk 30 at £299 + VAT + Carriage = £357.65

I enclose a cheque for £_____ or debit my VISA card number _____

My computer is _____ (please state make and model)

Please send me your latest information pack ☐

Name _____

Company _____

Address _____

Postcode _____ Tel _____

KUDOS Systems LIMITED

If you're a government department, education authority or PLC, just send us an official order and your goods will be despatched on the same day. If you're a dealer and would like a Dealer Datafile call Gary Munz on 01-200 6511.

Kudos Systems Ltd
Capitol House
Capital Way
Edgware Road
London NW9 0EQ
Tel: 01-200 6511
Tlx: 8813241
Fax: 01-205 3911

Personal Callers Welcome – Call in and save on delivery charges.

All tradenames and product names are the property of their respective manufacturers/owners.

BANKS' STATEMENT

Money talks

Designing for the disabled is usually done with idealistic motives. Martin Banks thinks a little commercial thinking might be more useful.

Yates is one of the best. He's only young, it's true, but he is already experienced. He is also extremely cuddly in a rogueish sort of way. Perhaps it's something to do with the way in which he lies under the lunch table, rubbing his head against my shin.

He's certainly very good natured. After all, he didn't seem to mind a bit when I first sat down at the table. Yates, you see, was already under it and I managed to walk over just about all of him. But did he complain? Not a bit of it: he just poked his head up beside me on the chair and gave my hand a monumental licking.

You guessed: Yates is a dog. To be more specific, he is Julia Scholfield's guide dog, and she had invited me to lunch. Julia will already be known to many *PCW* readers, for her work in developing products for the disabled is well-known.

It is also a tough business to be in, which, indirectly, was the reason I went to see her. There are several idealistic bits of me which feel that the great euphemistic 'we' should be doing much more for the disabled than we are. These bits also suggest to me that the intro to the *Six million dollar man* is getting ever more true. We do have the technology, and it does sadden me at times to see the use to which it is, and isn't, being put.

Yet — and it is a biggish 'yet' — there is actually some danger in thinking this way, for it can lead to problems and pitfalls, especially for the thinker. The greatest danger is that people get involved in 'helping' the disabled for the wrong motives. Because, as Julia put it, 'all do-gooding must be good.' Wrong.

It is far too easy to let one's initial bouts of slushy sentimentality turn into disillusionment and self-righteousness, just because these disabled people are so ungrateful as not to use the wonderful product, idea or gizmo which we have kindly invented for them.

I wonder just how many bent and bruised egos have wandered off, never again to attempt to make a product for the disabled. Julia, I suspect, knows a goodly number of them. It is sad that such people can be put off so easily, for there is much that needs to be done, and *can* be done, to help the disabled. It would be arrogant of me to set out here the products or services I feel we could provide for them, as I certainly don't have the intellect to conceive of all the ideas.

What is important is that these products, whether from industrial operations or from individual inventors, actually are developed. I have whittered on before in these pages about a fundamental view which I hold dear: I don't think we are making the best use of computers. The uses we do have are far too orientated towards the immediate gratification of the Great God Mammon (blessings and peace be upon his [it's bound to be a man] tax havens).

I sometimes go weak at the knees with idealism, thinking that all we have to do is apply the technology we have and the lives of our disabled will come right.

The short answer is that this is true. The technology does exist, or if it doesn't, it damn well soon will. Even one of the toughest problems — creating a speech system that is quick and easy to use, intelligible, and small enough to fit into a pocket — is certainly solvable, if not this week. It is also desperately needed. Many sober, intelligent, speech-impaired people are assumed to be hopeless drunks because of their difficulty.

The long answer, however, is that it is not true, and for a number of reasons. One of the main problems, as already stated, is the attitudes of the able-bodied. Another is a subsidiary effect, through which even the most devout Mammon worshippers forget their religious training. It is very easy for the able-bodied to fall into the trap of 'knowing best'. But we don't and can't conceive of it. Walking around with your eyes closed for a while is not the same thing as being blind, yet people assume it is and make judgements accordingly. Do-gooding social awareness can get very battered if a disabled recipient of a new gizmo says 'nice try but no thanks'. 'Damn it,' we think, 'they should be grateful for our efforts. How do they know it is wrong?'

They know, of course, because fate (or whatever you believe in) has made them experts. 'If you're training to be an artist,' Julia said, 'you expect to have to learn, to be told by an expert when you are going wrong.' Us able-bodied people just ain't very good at being told that. When it comes to developing ideas for the disabled, our social conscience is misguiding us.

And that is where the fundamental teachings of Mammon actually have a part to play, a part that social conscience makes us disregard. Yes, there is much that we can do for the disabled and many products to make. But there is nothing fundamentally immoral in making a bit of money from them, making them a commercial proposition.

'It is not a business to be emotional about,' Julia said, though it is a hard fact for the able-bodied to accept readily. 'It has to be treated in a cold, hard, commercial way.' But, given acceptance of that simple rule, there is then much product development which can be tackled.

However, if you go into it you never expect to end up rich. I suppose it is fortunate for humanity in general that making products for the disabled is not a red-hot commercial market.

Yet some sound, commercially-orientated thinking, coupled to some occasionally brutal advice from the experts, can create new products and services that are both right for the disabled, and economically sensible. Here the personal computer has been, and will continue to be, such valuable raw material. People like you, who understand the beasts, are best placed to make that raw material into useful tools. With a bit of sense, and hardly any sentimentality, you can even make money at it. **END**

Illustration by Kate Charlesworth

Tandon PAC286

Chuck Peddle, 'father' of the industry and inventor of the 6502 and the Commodore Pet, has re-emerged as the brains behind the PAC286, an industry-standard portable AT clone with a difference. Guy Kewney carried it home to test its abilities.

Photography by Chris Bell

Six months ago, Chuck Peddle told the world that 'IBM has made innovation impossible.' This month, Chuck Peddle's company, Tandon, has produced the PAC286, ostensibly an IBM AT clone. But this is an industry-standard machine with one difference: you can take the hard disks out and plug them into another machine as easily as taking out a floppy disk. That, he admits, is an innovation — or rather, in his own words, 'a revolutionary concept in personal computing.'

Chuck Peddle is known to many as the 'father of the personal computer'. Some people say this is because he invented the 6502, the chip which powered so many Apple II, Commodore Pet/Vic/64/128, Atari and Acorn computers. Others, including Peddle himself, believe that it was because he invented the Pet, the 'first self-contained microsystem'. He also invented the Sirius, with perfectly ordinary diskettes that stored over 1Mbyte; a trick which IBM, three years later, had to use special high-density media to achieve.

In a nutshell, Peddle could no more live without innovating than he could speak without breathing. It's just that these days he thinks it's unfashionable, so he tries to hide it.

The PAC286 is only an IBM clone in the sense that it will run most of today's IBM software. Scratch the surface, however, and you find that there is a lot more to this machine than the innovatory replaceable hard disks. This particular innovation, however, isn't entirely Peddle's doing. It comes from Xerox, a company justly famous for its brilliant and large-scale innovations.

What we know as the Tandon Personal Advanced Computer 286 started out as a contract done by Peddle and Tandon for Xerox, under the codename Pegasus. It began 18 months ago, and the idea was not simply to have replaceable disks, but to produce a whole new method of distributing software.

For most of us, the 'soul' of a machine is its hard disk. Try moving over to another machine, and you will find you can't use it. The problem is that there are different things on the hard disk. Instead of A>, my machine says: 'You're logged onto drive a: in directory/OUTLINES.' On the next machine, there is a 256k RAM disk called Drive D: which is set up when you switch on. Hit the cursor-up key on the next box you meet, and the previous command you typed will appear. Programs which appear not to be on the disk will run because of the strange PATH command used. The letter 'X' is a complex command on my machine, and does an equally complex but totally different thing on his. Mine has WordStar version 4 as its editor, but yours will run PC Write if you type ED. Hers runs under GEM, but has the keys customised.

The mechanism which pulls the Data Pacs into the system is innovative but could give cause for concern

All this is defined by the directories on the hard disk, the paths, the keyboard defaults, and other things loaded at start-up from the hard disk. The Xerox man who saw this came up with the idea that if everyone had removeable, ruggedised disks, they could, by taking those disks into the shops where software is sold, buy their programs for direct installation. Pegasus was to have been the basis of a whole new software distribution industry.

In order for this to work, Peddle was encouraged to keep the design rights so that he could license it to other manufacturers. Everyone must have a machine like this, they insisted. It was designed, prototyped, tested, re-tested, re-designed, re-tested, and finally appeared in the marketing department. 'What are we supposed to do with *this*?' queried the outraged marketing people. 'It'll take *years* before it becomes viable as a method of software distribution.'

The skills of the people at Xerox cannot be doubted. They gave the world the Palo Alto Research Centre, from which we have derived expert systems, Smalltalk, windows, icons and mice, networks, and several other wonderful goodies. But none of these came from Xerox, because Xerox's marketing men killed them all off between production and customer. Other people, like Apple, coined it instead.

They've done it again. Peddle had the rights to sell the idea, and he's doing it. He calls it a portable computer because you can take your Data Pac out of one machine and plug it into another (at home, perhaps) and instantly transform that into your machine.

Hardware

There are several points of real interest in this machine. Obvious points are the disks and their controllers, but there is more fascination in the memory control system. This applies not just to the way main chip memory is addressed by the computer chip, but in the way direct memory access works. Of equal interest is the disk cacheing system, which significantly improves the disk performance.

What marks the PAC286 out as special are the two fist-sized holes in the front. They look roughly like two blank spaces where hard disk drives would fit in a standard machine, and that's roughly what they are. Tandon calls them Data Racs.

This machine can be operated flat or vertically. It looks better vertical, when the writing on the hard disks is readable. Horizontally, it looks much more like a standard AT.

The surprise is the floppy disk. This is detachable, and sits on top of the box when it stands vertical. It looks a little like a silly hat. It can either be a 360k drive or a high-density drive, or even a 3½in drive. I didn't get to test the 3½in drive.

At the back are five standard chrome slot covers for expansion circuits. One of these has to be filled with the video display driver of your choice unless you are happy to go with the standard Hercules-compatible video provided on an add-in card. Another has to hold the special controller card for the Data Pacs. Also at the back are sockets for a printer and a modem.

Inside, the system looks very strange. One of the designers, Bill Seiler, described it as 'rather like those pictures of human anatomy — everything is packed in very tight, and there's no space for anything else.' The problem is that the system is quite a lot smaller than the average AT, but has a lot more in it.

The CPU is a standard Intel 80286 running at what is now 'a mundane 8MHz, and there is a socket for an optional 80287 maths co-processor. Apart from the five expansion slots, the machine is unrecognisable as a PC. There's an enormous metal plate, used for radio frequency shielding, under which the power supply and the disk cartridge loading machines lurk.

Just accessible between the slot ends and the cartridge box is an area where a piggy-back memory board with 1Mbyte of RAM can be attached. Use megabit RAM chips, and it adds 4Mbytes to the 1Mbyte already onboard.

There is a detachable plastic strip, through which the interface to the floppy disk can be fitted. Another detachable strip to one side, next to the expansion slots, reveals a Sinclair Spectrum-style expansion slot. Because the box is so small, the designers decided that it would be a good idea to allow users an easy expansion route. To use this, you have to have the machine lie flat and attach an expansion unit. Exactly how the expansion unit will be attached, I can't tell you, because Tandon didn't have any to show me.

If you think you might need to use this expansion slot, check that it works before buying a machine. To my mind it looks too like the Spectrum expansion slot which caused so many problems for users when it became detached. Admittedly, the PAC286 and its expansion box are hardly likely to flap around on a desk the way the tiny Spectrum did — but I'll still be happier when I see it work.

The diskette controller is on the central circuit board. It will drive a high-density 1.2Mbyte floppy, a standard 360k floppy, or a 3½in drive. This may sound standard, but it isn't. To illustrate the point, you can persuade the system that the 5¼in disk (360k capacity) is really a 3½in drive. It then formats the disk for 720k, under DOS 3.2!

As on the already available Target (Targa, in the US) range from Tandon, this system includes a fiddle to emulate the Lotus-Intel-Microsoft (LIM) memory extension standard. Normally, memory on a PC stops at 640k. The 8086 and 8088 can only handle 1Mbyte, and Microsoft took 360k of that for system functions under MS-DOS. The 80286 can, theoretically, control 16Mbytes because it has 24 address lines. However, most AT designs use the chip in its 8086 mode, and have to go through LIM to expand — very laboriously — beyond 640k.

In the PAC286, therefore, we have the ludicrous situation of seeing the designers resorting to special chips — the Mapper — to perform functions that the 286 chip could do itself, if the operating system used it in protected mode.

The Mapper takes six bits of the 286 address bus — lines A14 to A19 — and uses them to select one of 64 registers. The six address lines are translated into ten output address lines, giving the system its full 16Mbytes again. More to the point, the system now has access to a full megabyte, not just 640k. Exactly how this will work when Microsoft produces MS OS/2, is one of those questions which we'll just have to wait for an answer to.

In the meantime, however, the advantage is very clear: you don't have to buy expensive LIM memory cards. Any old memory board will do, as long as it can start from addresses above 1Mbyte. Lotus version 2 will use it straight away.

You can take the Data Pac apart with a screwdriver and examine the very clever contents (though this is not a suggestion that anybody *should*). The two plastic ends unscrew and drop off. They reveal a 'nutshell' design, with two plastic covers that drop away revealing a tiny circuit board and the Winchester disk drive itself.

The drive behaves as if it had a voice-coil actuator for the heads. In fact, it has a stepper motor. A voice-coil is very simple: it is operated by electromagnets in much the same way that a loudspeaker works. More voltage, and the heads move further in; less, and they move out.

The usual advantage of this is speed. The penalty is that you have to have a highly sensitive feedback system to keep the heads in position on a track. The standard method is to have a track written on one special disk surface, the 'servo' surface, and have one head follow this track constantly as the disk spins. All the other heads follow that, of course, because they are on the same arm. The penalty for this approach is cost: you need an extra platter and the electronics is expensive.

In the Pac, however, there is a stepper motor. Pulse width modulation electronics allow this to be moved into positions between stepper motor 'steps', making the operation faster and more precise (say the designers). Servo information is 'embedded' in the actual data platters. However, as the Benchmarks indicate clearly, this does slow down absolute times for track and sector access.

Tandon mitigates this effect with disk cacheing, which the company claims reduces average access (effectively) from over 80 milliseconds to around 40 milliseconds. Even 80 milliseconds is acceptably fast, however,

Small shock absorbers are housed in the corners inside the Data Pac; these emphasise the overall ruggedness of the system

and there are commercial drives on the market with access times many times slower.

The capacity of these drives is 30Mbytes, but Tandon estimates that it can take this design to 120Mbytes before the company has to invent more complex technology, just by adding platters and playing standard high-density tricks.

With any innovation there are new problems, as bad habits which didn't matter before suddenly turn out to be crippling. Firstly, as I discovered within half an hour of sitting down in front of the machine, Peddle is wrong when he says about the Data Pac: 'That is your computer.'

Do you have a mouse attached to one machine? Plug that machine's Data Pac into another, without the mouse, and the software won't work properly. And if one mouse is a plug-in card and the other attaches to a serial port, you will probably find your comms software will get confused. (Well, comms software always gets confused, anyway. Just changing serial cards is enough, usually.)

How much memory do you have, then? 256k? A system set up to use 512k will keep crashing on it. A system set up to use 2Mbytes will destroy it on start-up, by trying to create a 1.5Mbyte RAM disk. Oddly, a system set up to use the Lotus/Intel/Microsoft (LIM) extended memory system will work on the PAC286 (more of which later).

And what about the type of graphics display? Some software can be quickly adjusted to display its output on a Hercules card. Some software needs tedious patching before it can be persuaded to switch over to EGA standard. And some software — for example, the GEM graphics environment manager — simply has to be installed again from the start.

And if you're unlucky enough to want to run a complex GEM-based program like Ventura desktop publisher, that means the installation of both Ventura and GEM again — because Ventura tends to want its own (older) version of GEM to run without trouble.

That's one problem — the nature of the hardware. There is another, to do with exchangeable disks, which hard-disk users tend to forget. On a floppy-disk system, users quickly grow accustomed to being careful about how they install new software. It must have all the programs and overlay files on drive A:, and the data files on drive b:.

Hard-disk users arrogantly install all their software on drive C:, knowing that there's plenty of room for program and data. Then they set up little batch files which feed the processor with a batch of the many commands needed to run the software. Typically, all these batch files refer to drive C:, too.

Inside the PAC286: the two battery-like objects in the centre are the stepper motors, one for each disk drive

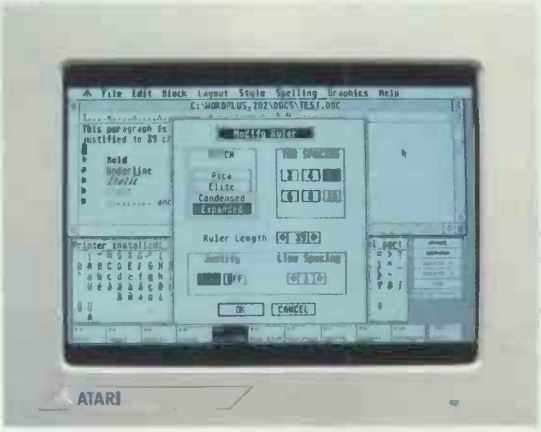
A standard selection of ports is present. The detachable floppy disk sits on top of the system box when it is vertical and looks like a silly hat

But on the PAC286, there's no guarantee that you will have your hard disk as drive C:. I tried the experiment of taking the Pac out and plugging it into drive D: — and suddenly, all the PATH commands and all the batch files and all the install routines were invalid. WordStar couldn't find its overlays, WordFinder couldn't find its thesaurus, and batch files run themselves over and over again because the only file with that name they can find is their own.

With this system, you have two hard disk drives for the cost of one, which means that you don't need a tape back-up system. A second Data Pac will accept everything from the first, in a matter of five minutes. And unlike tape the back-up can be used directly, without having to unload the back-up onto a fresh disk first. The system switches its motors off when you eject the disk — the software handles this in much the same way as an Apple Macintosh does. At this point, little wedges force themselves between the heads, holding them firmly away from the recording surfaces. The result is an astoundingly rugged head.

The disks are guaranteed against 300 gravities — a drop onto carpet of about three feet. In fact the heads will stand up to more, but two other parts will not. Firstly, the rivets which

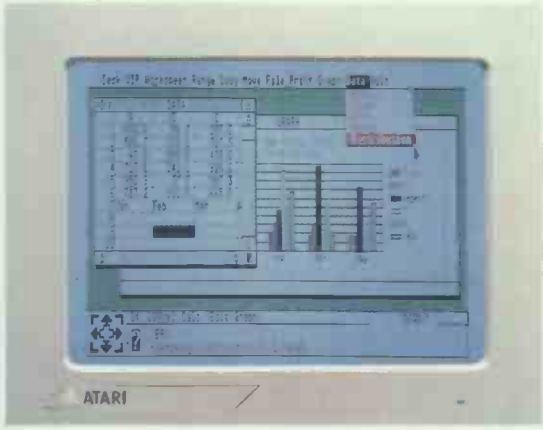
Taxmen, bank managers and accountants are easy to defeat.



1st Word Plus – G.S.T. Professional word processor featuring U.K. spellings and integration of graphics including 1st Mail for full control of form letters etc.

Superbase Personal – Precision Software. All the features of GEM combined with full relational database power. Easy to set up, flexible, plus unique picture index facility.

Fleet Street Publisher – Mirrorsoft. The complete desk-top publishing package. Gives you page make-up combining text and graphics for sophisticated, professional looking documents.



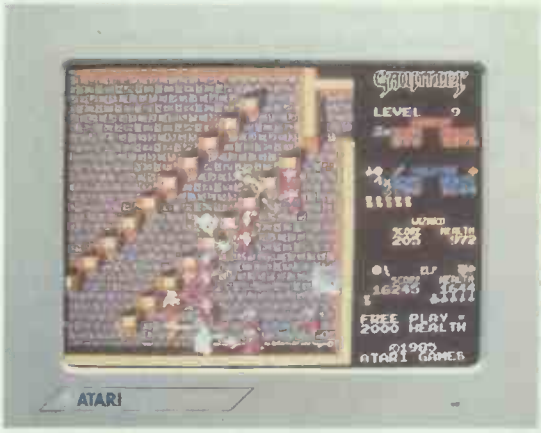
VIP GEM – Silica Distribution. VIP Professional is an integrated spreadsheet, database, and graphics package. GEM environment plus Lotus 1-2-3 compatibility.

Neochrome – Atari. A powerful, sophisticated painting program for unsurpassed graphics. Work boldly on full screen canvas or in minute detail using Neochrome's magnifier.

Fastcom – Atari. A professional communications software package giving access to most major databases worldwide. (Integrated ASCII/Viewdata package).

*Screenshots are

These other fiends may be a bit trickier.



Gauntlet – U.S. Gold. Enter a world of monsters, mazes, mystery and combat in the ultimate role-playing fantasy game.

Tai Pan – Ocean. Voyage to 19th Century Hong Kong for action and excitement with pirates, smuggling and mutiny.

Metrocross – U.S. Gold.* It takes lightning reflexes to get past the potholes, obstacles and forbidden zones to reach the other side. And that's just the beginning!

Arkanoid – Imagine.* The latest smash-hit coin-op game! Are your reactions quick enough to handle 33 different play screens?

Mixing business with pleasure is no problem with an Atari 520 ST. Not when you've got over 1,000 software titles to choose from.

You'll find all the latest games and a huge range of business titles from the top business software houses. And the range is growing all the time.

You won't be short of power, either. The Atari 520 ST is twice as powerful as most business micros.

So you'll be able to create spectacular colour graphics. Even animate them to make your own films. If you're musically minded, you can compose and play a full symphony.

Or, for those who'd rather write programs than music, the 520 ST supports over thirty programming languages.

In fact, whatever you're looking for in a computer, you'll find it in the Atari 520 ST.

ATARI 520 ST
WORKS HARD · PLAYS HARD

ginal Arcade game. If you require any further information concerning software featured please write to: PO Box 555, Atari House, Railway Terrace, Slough, Berks SL2 5BZ.

hold the air-tight compartment together begin to stretch, and the system begins to rattle. That's a sign (should you have to be so rough with a Pac) that you should back it up and send it away for service.

But more alarmingly, the bearings begin to go. It seems that the tiny, spherical, steel balls in the bearings are hard enough to dent the spindle, with the shock of severe battering. The initial effect is noise, either from the dented spindle or perhaps from the ball-bearings themselves being forced out of shape. After really severe abuse, friction inside the bearings gets to the point where the noise becomes a painful screech — and the motors are simply unable to rotate the disk platters fast enough, or for long enough, for the disk to operate.

Peddle's designers are taking this seriously and are looking into rivet and bearing design, but frankly, I doubt that anyone will systematically submit a disk Pac to even a fraction of the kind of abuse that I did under test. I expect these Pacs to have a long life under normal use.

The mechanism which pulls the Data Pacs into the system and plugs them in is the only really new technology that can be seen. Looking inside the Rac slot was worrying at first. There were the 'hooks' designed to pull the Pac in. At the back were wires. What would happen if you had a child who fed its hand, or bits of wire, in?

Nothing, Tandon assures me. All visible parts are ultra-low power stuff, mainly power to the electric motors which operate the pull-in mechanism. They are very weak, and highly geared to give them the necessary leverage to operate. 'The only problem might arise if a child fed a paper clip in — but the same child might feed the same paper clip into any microsystem, through the diskette drive or the air holes. And all that would do would be to damage some chips — the main power supply is totally isolated.'

The Rac mechanism is about as easy to describe, verbally, as a spiral staircase. A cam at the rear operates a piston-like flat arm which reaches out towards the front of the machine. As the 'claws' move towards you they drop into slots, which takes them out of the way. As they move back again, the slots force them against the small recesses on the Pac, and they take hold. You can push the piston in, manually, against a ratchet. A Pac, inserted, won't go all the way in until the motors have responded and pushed the piston out again.

A crucial part of the design — how external Data Pacs interface to standard AT machines — was under major revision at the time of writing. There's no reason to suppose it won't work, but it will not bring all the advantages (and disadvantages) of the radical PAC286 architecture to other users. On the other hand, it should be easily adaptable to the new IBM range, and even to the Macintosh (though not with program compatibility). Peddle is hoping that third-party designers will take over this work.

System software

MS-DOS 3.2 — well, nearly. At the time of test, back in early April, DOS 3.1 was the only bug-free version of MS-DOS available; and the version of 3.2 which was being tested included several disk formatting fiddles. By delivery time — around now — Tandon was convinced that DOS 3.2 would be available. At press time there was no information about DOS 3.3, as supplied with IBM's new machines.

Somewhat to my annoyance, this system comes free with Microsoft Windows — and without a mouse. I have no objection to getting Windows free on an 80286-based machine, because the extra speed of the chip is enough to compensate for the amazing overhead. But I do want a mouse. Mice on an AT are hard to fit, vary enormously in standards, and take a bit of software setting up. Microsoft's own mouse disobeys all the Windows rules, and talks to hardware direct. Ho hum, and no marks, Tandon.

Several AT clones improve somewhat on the IBM idea of keeping the system configuration recorded in battery-backed RAM. This one has a SETUP program which checks to see if the system is the same as the last time you used the machine; and if it finds new hardware, offers you the chance to adjust the configuration.

Stupidly, this SETUP program is in the hardware, not on the Pac. This will have to change so that software can customise itself to the disk, not the system, or the whole point of the exchangeable Pacs is lost.

Applications software

With Windows, you get Windows Write and Window Paint. If you happen not to like these, you are no worse off than if you had none, and you can go buy what you really want. But both programs are fully functional, and will give the buyer a chance to use the system while deciding on software.

Benchmarks

Intmath	(approx) 2.0 secs
Realmath	2.0 secs
Triglog	15.0 secs
Textscrn	47.0 secs
Grafscrn	12.0 secs
Store	5.0 secs

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

Prices

Prices have been quoted for these systems but until they are actually available, they should be taken with salt — and not necessarily just a pinch.

However, Tandon does aim to compete on price as well as specification. Data Pacs should sell for around £300; and the ad-Pac for machines which don't accept them, around £250. It is hoped that a PAC286 with two Data Pacs will retail for less than £3000.

Conclusion

The idea of a two-pound hard disk which you can throw into your briefcase and carry home is a real breakthrough, and will transform the way I use IBM family machines — if it catches on. If Xerox ever gets off its behind and launches its version of the machine, the chances of success will improve enormously. And if corporate buyers test the system as an alternative to tape back-up, it could succeed even if the PAC286 does not.

If Tandon can stick to its original ideas about price, it should sell a lot of systems. END

Technical specifications

Processor:	Intel 80286, 8MHz
RAM:	1Mbyte expandable to 5Mbytes onboard
ROM:	32k
Mass storage:	One 360k/1.2Mbyte floppy; two removable 30Mbyte Pac hard disks
Display:	Choice of MDA/Hercules monochrome, or CGA and EGA colour at extra cost
Expansion:	Five PC/AT-type expansion slots
Operating system:	MS-DOS 3.2
Bundled software:	None

To help you defeat the taxman

and destroy the aliens,

we've massacred the price.

For a limited period, the Atari 520 STM is even more of a knockout than usual.

We're offering it for just £449.95 (inc. VAT) complete with SF354 disk drive, SM125 mono monitor,* a mouse worth £24.95 and 1st Word, worth £49.95.

So as well as saving you from the enemy, the 520 STM will also save you £184.

You'd better hurry though, because it won't be long before our stocks are wiped out.

ATARI 520 STM
WORKS HARD · PLAYS HARD

*Offer includes mono monitor. The 520STM plugs into a standard colour T.V.

IBM Model 30

The Model 30 is something of a 'black sheep' in the new IBM family, lacking the capability to run the advanced OS/2 operating system. But, as the successor to the IBM PC, do its abilities justify its high price tag? Derek Cohen and Nick Walker find out.

Photography by Dennis Bunn

When IBM announced the Personal System range earlier this year, most of the attention went to those machines that were capable of running a new advanced operating system called OS/2. One machine, the Model 30, was somewhat overlooked as it will never be capable of running OS/2. However, the Model 30 is a significant product for IBM, being a direct successor to the original IBM PC and a new challenge to a market now almost entirely dominated by clone manufacturers. In this light we gave the Model 30 the full Benchtest it deserves.

Hardware

Like the rest of the machines in the range, the Model 30 is the usual IBM office grey. The system box is now made out of plastic, rather than the traditional metal case of the old IBM PC, although three of the sides have integral metal shielding plates behind them.

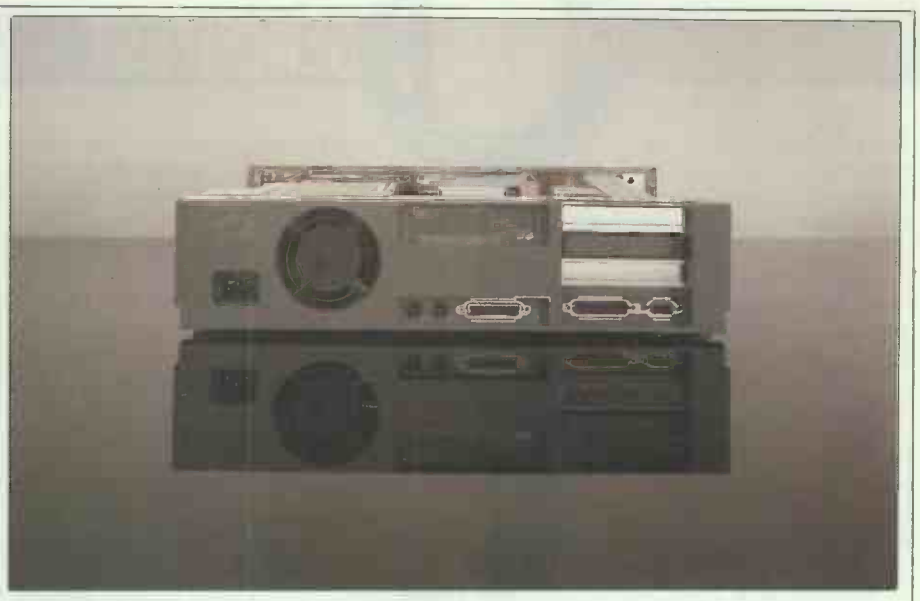
In terms of volume, the Model 30 is about half the size of the IBM PC; most of this is accounted for in the reduced height of the system unit. Although the footprint is only slightly less than the old IBM PC, the reduction in height and improved styling make it much more appealing to have on your desk. The Model 30 keeps the Personal Systems' style, with a wedge protruding from the front which houses disk drives and power switch.

The back of the system box contains all the ports, leaving the side practically bare except for a small keyboard and case lock on the right-hand side. The entire left-hand side is given up to ventilation.

The Model 30 is lighter than its predecessor but is still noticeably heavier and sturdier than, say, an Amstrad PC, probably due to the shielding required to meet the most stringent radio interference laws known to IBM.

Setting up the Model 30 proved to be no problem and took less than ten minutes. Most of the ports are designed so that the lead can only fit in one way, although there is a slight danger of putting the keyboard into the mouse port. The review machine was a Model 30-020, which means that it contained a 20Mbyte hard disk. Once set up the disk and fan were very quiet, producing a barely noticeable hum.

The two ports that should be standard, are (serial and parallel printer port), but with everything else IBM has once again gone its own way. From left to right the ports are: three-pin power, video output, keyboard mini-DIN, mouse mini-DIN, 25-pin serial port, and bi-directional parallel port. The power supply is a worldwide auto-sensing unit, which means that it can be plugged into any country's AC mains supply. By using a previously unused line on the parallel port, data can be sent from and to the Model 30. IBM intends to produce a cable and software for file transfer from older machines using this port.



Apart from the non-standard keyboard and mouse ports, the rear of the Model 30 holds few surprises. The horizontal expansion slots are initially covered by grey plastic plates. The fan is almost silent

Surface-mount technology features largely on the 'Planar' or motherboard. The detachable expansion bus also houses the CMOS RAM back-up battery. The Inmos chip (bottom left) holds the colour look-up table

With the Model 30, IBM has at last switched to an 8086 processor (16-bit internal word, 16-bit external address) from the 8088 processor (16-bit internal word, 8-bit external address) used in the PC. This processor runs at 8MHz with no wait states. Like the Amstrad PC there is no option to switch it down to a slower 4.77MHz PC-compatible speed, so just a small proportion of software will be unusable due to timing problems (mostly arcade games). An optional 8087 maths co-processor can be installed to speed up certain calculations.

The Model 30's RAM totals 640k installed on two removable banks of 256k SIPs (single in-line package) and 128k on the motherboard. When 1Mbit chips become generally available it will be possible to expand each bank to 1Mbyte, giving a total of 2128k of RAM internally. The 64k of ROM contains a very slightly modified form of the IBM PC's ROM BIOS, now called the CBIOS (compatible BIOS) to differentiate it from the ABIOS (advanced BIOS) used in the Models 50, 60 and 80 running OS/2. This ROM also contains the power-up diagnostics, and cassette Basic unchanged from original 1981 form.

There are four custom IBM gate arrays on the PCB, containing the functions that were previously contained within expansion cards. The exact functions of these are: floppy disk controller, hard disk controller, MCGA video chip; and a processor support chip which handles proces-

sor I/O, bus control, keyboard and all the ports. There is also an Inmos-labelled chip which acts as a huge colour look-up table, producing the analogue colour corresponding to the setting of an internal 6-bit register. This gives 262,144 colours to choose from.

Four very peculiar screws, a cross between a star-head and a normal screw, hold the lid down. Attempting to remove these with either a flat-bladed or a Phillips screwdriver will result in damage to the screws, eventually making it impossible to get inside the unit. IBM claims that all that is needed is a standard screwdriver of the right width, and the star shape will guide it into the right position; we're not convinced.

Once inside, the quality of the PCB is excellent: surface-mounted technology is used throughout, and there are no cludges except for one small patch wire. The layout is excellent and uses a high level of integration — a significant advance for IBM, especially to those familiar with the old PC's technology. The processor and two ROM chips are socketed, allowing for easy updates and enhancements. One omission we were particularly pleased to see was the lack of DIP switches and jumpers; all such functions are now contained within the CMOS RAM as is usual on AT compatibles.

One non-standard 16-bit expansion slot on the PCB supplies a vertically mounted board which carries three standard IBM PC expansion slots. Expansion cards lie horizontally, which means that the system box can be lower: however, this does cause some problems. Firstly, the vertically mounted board has a plastic strut bracing it against the power supply in order to give it some rigidity. Unfortunately this is far too fragile, and we could easily envisage both the strut and the board breaking. Secondly, there is a CMOS battery mounted on the board which will get in the way of certain heftier cards, such as modems or hard-disk cards. The CMOS battery provides power to the clock and system configuration information when the machine is not in use.

The Model 30 is available with either two 3½in floppy drives, or one floppy and one 3½in 20Mbyte hard disk. Both disks are mounted in a removable disk cradle so upgrading should be easy. Clearly-labelled cables are provided from the motherboard for both floppies and the hard disk, and the nature of the sockets makes it impossible to connect these the wrong way round. The hard disk is quiet and not particularly fast (access time is 80ms). No technical data was available for the floppy, but in use it seemed quite slow.

The monitor supplied with the Model 30 was the model 8512, a 12in colour unit working, like all of the PS-range monitors, at a fixed scan rate of 70MHz. This is fed with an MCGA (multi-colour graphics array) signal through a very peculiar socket. MCGA is compatible with CGA (colour graphics adaptor) but not EGA as on the Models 50, 60 and 80.

Before you cringe at the thought of those giant, coarse pixels characteristic of CGA, things are nowhere near that bad. In text mode each character is now made up of 8 by 16 pixels with far nicer, more readable text. All the graphics modes of CGA have been maintained and two new ones have been added: 320 × 200 pixels in 256 colours and 480 × 640 pixels in two colours.

In all graphics modes it is now possible to select a palette of colours from a total of 262,144 supplied courtesy of the Inmos graphics chip. In addition the character font is now held in software so that alternative fonts can be created. However, the most impressive feature is the machine's ability to detect a graphics card in the expansion slot and use that instead of the onboard graphics. As Amstrad owners will appreciate, this is no small achievement.

The monitor itself is a definite improvement on previous IBM screens, with better clarity and brightness. Although stylish, all the new monitors are very deep due to the longer tube needed to maintain a 70MHz scan rate. IBM also offers a 'paper-white' monochrome monitor which simulates colours in shades of grey, and a 14in colour monitor.

The keyboard is the standard ATE keyboard introduced in early 1986. We've always liked the feel of IBM keyboards — they are sturdy, well-built and give a reassuring click when the key has registered rather than when it has reached the end of its travel. The biggest disappointment is that IBM has reverted to putting the backslash key between 'Shift' and 'Z', which annoys touch-typists.

We tested a number of expansion cards including a Quattro card modem and a Phoenix 80286 expansion card; both worked fine, as did the serial Torrington optical mouse. An AST EGA card took over from the on board graphics with no fuss and ran EGA software on an EGA monitor while the Model 30's own monitor sat patiently and did nothing — just a blinking cursor to show it was still alive.

System software

The launch of the IBM Models 50 through to 80 saw a parting of the ways between 8088/8086 PCs and those using 80286 and later processors. As I have mentioned already, machines with the minimum of an 80286 CPU will be able to run a new operating system, OS/2, which is promised for some time next year. This will provide true multi-tasking and access to much larger amounts of memory. In the meantime, users will have to stick with the 3.x series of operating systems.

Launched at the same time as the Model 30 was DOS 3.3, which is almost identical to DOS 3.2 in both its MS-DOS and PC-DOS incarnations. DOS 3.3 does not solve any of the problems of limited memory access and single-tasking of its predecessors. Users are still limited to 640k RAM and having only PRINT as a possible background task. However, it does have a few new features, in addition to which Microsoft is claiming that some of the existing functions of DOS 3.2 have been speeded up or otherwise enhanced.

Using a new internal CALL command, it is now possible to properly 'nest' batch files. At present, a batch file called from another never returns program control to its parent. Also, it is now possible to test for environmental variables from within batch files, allowing for greater creativity in conditional execution.

For those who use programs which access overlays, the PATH command has been supplemented with an APPEND command. This allows a program to find its overlays and other supporting files if they are not in the current directory.

FASTOPEN is a resident utility which occupies a mere 2.7k, providing a small amount of disk cacheing which allows often-accessed files to be opened more quickly. Unless otherwise specified, FASTOPEN will leave the 'handles' of the last 34 open files in memory; a parameter allows the user to specify the number of files from 10 to 999. This facility will be particularly useful to those people using a PS as the file server on a LAN.

The Model 30 does not need DOS 3.3 and, indeed, ran quite happily under DOS 3.2. It was interesting to note, however, that MS-DOS versions of 3.2 (as opposed to PC-DOS versions) produced a screen message to the effect that it was 'illegal' to use MS-DOS version 3 unless it was PC-DOS. The DOS still worked corectly, however. Our legal experts are investigating the exact status of this illegality.

Applications software

No software house worth its reputation will risk its products not working on a machine from IBM. We therefore rejected the usual tests of Lotus 1-2-3, Microsoft's Flight Simulator, and so on, in favour of more badly behaved programs — often from the public domain — which address hardware directly. The following 'ill-behaved' games all ran without a hitch: Bricks, Stargate, Digger and Zaxxon.

PC-Write ran perfectly except that, using its RECORD mode to test the scan codes of keys, we discovered that certain key combinations were missing. Control-\ and Control-Numeric* both failed to register with the program. These keys are recognised by the same progrInter-Orient ATs using standard AT keyboards. However, the unusual Control-Shift -<letter> and Alt-shift -<letter> combinations used to produce box-drawing characters all performed well, as did the Alt-space combination to hide formatting characters.

PC-Outline also ran in both foreground and resident modes. However, it too fell foul of the keyboard's lack of a Ctrl-\ code which is usually used to invoke it in resident mode. When the 'invoke' key was reinstalled to another combination, the program popped up and closed down quite happily.

Turbo Pascal worked perfectly in both text and graphics modes, and the comms program Procomm ran very smoothly with the 'exploding' windows zooming in and out noticeably faster. Disk directory manager Xtree and Borland's SideKick also ran their course without a hitch, with the former seeming not to find anything at all strange in working on a 3½in disk. Peter Norton's SI speed index rated the Model 30 at 1.9.

Perhaps the most surprising program that did work was 130color, a Basic routine which drives the 6845 graphics chip of a CGA expansion card directly. On a CGA monitor it produces 130 different colours ranging from shades of greys and pinks through to bright reds and greens. Considering the new architecture of the Model 30's graphics, without a 6845 this was one program we were certain would fail and it didn't, attesting to the very accurate 6845 emulation being used.

Benchmarks

intmath	2.6 secs
realmath	3.4secs
triglog	25.4secs
textscrn	36.3secs
grafscrn	14.2secs
store	(floppy) 13.6secs
	(hard) 8.1secs

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

Technical specifications

Processor:	8086 running at 8MHz
ROM:	64k
RAM:	640k expandable to 212k onboard
Mass storage:	720k 3½in floppy, 20Mbyte 3½in hard disk
Display:	IBM 8513 12in colour display, 70MHz scan rate
Keyboard:	102-key full stroke
Size:	4ins × 16ins × 15.6ins
I/O:	Bi-directional parallel port, 25-pin serial port, mouse and keyboard port, video output
Weight:	28lbs
DOS:	PC-DOS 3.3

In perspective

The Model 30 doesn't 'feel' like a part of the new IBM PC (sorry, PS/2) range. It stands apart from the other machines launched on 2 April in that it will *not* run OS/2, and it *will* accept existing add-in cards.

In the US, where schools have much more money than in the UK, the machine is being targetted into education — a fact which led some people to speculate that it would not be launched in the UK at all.

The most obvious comparisons for the Model 30 are not even with IBM's own PCs and XTs, which have for a long time seemed like dinosaurs rudely outstaying their welcome. The Model 30 is neater, has better graphics, and is faster than all of these machines and their 8088-based clones from Taiwan and other points around the globe. Rather, we have to look to two other 8086-based machines — the Amstrad 1512, and the still-popular Olivetti M24. Both these manufacturers decided to use the full 8086 CPU rather than the lame 8088; and to add their own brand of graphics, each of which bears some similarity to the new IBM MCGA standard. Alan Sugar's PC offers colours and bundled GEM to add to the good value his machines already are. Olivetti has always had a better graphics standard than IBM, and its M24 has sold exceedingly well. Its price is now within £15 of the Model 30.

Yet, one wonders why anyone would buy an 8088/8086 machine at all these days. AT compatibles are cheap, and practically all of them will be able to run OS/2 whenever it arrives. It cannot be long before a graphics-card manufacturer produces a clone of the MCGA and 3½in disk drives are in plentiful supply. For the price of a Model 30 you could buy yourself a 20Mbyte small-footprint AT and have a foot in the door to the next generation of operating systems.

Documentation

No documentation was supplied with the Model 30 but it will be shipped with a *Guide to operations*. A small PC-DOS manual is included with the operating system which most owners will purchase with the system. At no extra cost IBM has bundled a diagnostic disk, and a 'getting started' disk which contains the most delightful and informative introduction to personal computers we have seen.

From an introduction which shows the user the inside and outside of the machine, the tutorial moves on to teach the novice how to look after disks and what to do if something goes wrong. At any point it is possible to skip out of a sequence and look words up in an alphabetical index.

Prices

No — IBM hasn't dropped the policy of pricing the keyboard, monitor and DOS at additional cost. The Model 30-002 two-floppy system unit costs £1106, and the Model 30-020 20Mbyte hard disk unit costs £1558. Additionally you can choose from the following 'options': keyboard, £189; monochrome monitor, £201; 12in colour monitor, £505; 14in colour monitor, £583; PC-DOS 3.3, £70; and a mouse at £69.

Conclusion

If nothing else, the arrival of the Model 30 in the UK reinforces the notion that there are people to whom those three, small letters — IBM — still count for something. Undoubtedly many of these are users of IBM minis and mainframes for whom buying a few hundred Model 30s is mere petty cash.

You won't be disappointed with the Model 30 — it's pretty compatible, fairly fast, and will produce amazing graphics if anyone bothers to write the applications software to use them. The box is well-designed and the inside construction is a dream of modern manufacturing techniques. But it's an expensive momento of an eclipsing generation of PCs. END

The First Choice

MICROCOMPUTER SYSTEMS • PERIPHERALS • SOFTWARE • MAINTENANCE • TRAINING

OLIVETTI M24

Superior performance and excellent display from Europe's no. 1 PC compatible. 640K RAM; 20MB compatible hard disk; serial/parallel; 7 slot bus; Keyboard; Mono display; MS DOS.

£1295

Upgrade to Olivetti colour display: £220

NEED EXTRA SUPPORT?

£29.95

Software Support Contract

Mayfair Micros are now able to offer a premium level of support to users who are inexperienced or unfamiliar with the MS DOS operating system and the major application packages.

For just £29.95 you can take out a 12 months software support contract to cover your PC, MS DOS operating system and applications program.

Your contract gives you unlimited access to the Interflex on-line telephone support service and stops you wasting valuable time.

PHONE NOW FOR DETAILS

MICROCOMPUTER SYSTEMS

EPSON	£
PC PLUS 640k 20MB MONO	1399
PC AX 640k 20MB MONO	1999
PC AX 640k 40MB MONO	2499
PC AX 640k 60MB MONO	2999
PC AX 640k 80MB MONO	3499
EGA COLOUR OPTION EXTRA	450
OLIVETTI	
M19 256k TWIN 360k DRIVES	845
M24 640k SINGLE 360k DRIVE	1035
M24 640k 20MB HARD DISK	1295
M24 640k 40MB HARD DISK	1695
M24 SP (10MHZ) 640k 20MB	1570
M28 512k 20MB HARD DISK	POA
M28 512k 40MB HARD DISK	POA
COLOUR MONITOR EXTRA	220
SPERRY	
MICRO IT 512K 20MB	2345
PC/IT 512K 40MB (+80287)	2995
EGA COLOUR OPTION EXTRA	450
TANDON	
PCX 10 256K 10MB	999
PCX 20 256K 20MB	1175
PCA 20 512K 20MB	1645
PCA 30 512K 30MB	1925
EGA COLOUR OPTION EXTRA	450

HARD DISKS/TAPE BACKUP

20MB HARD DISK UPGRADE	395
40MB HARD DISK UPGRADE	795
IRWIN 20MB INTL TAPE UNIT	450
IRWIN 40MB INTL TAPE UNIT	545
WANGTEK 60MB INTL TAPE UNIT	695
CHRISTIE 20MB EXTL STREAMER	795

PRINTERS

EPSON	
LX86 120CPS + NLQ	205
FX 800 200 CPS + 40CPS NLQ	325
FX 1000 AS ABOVE 130COL	399
LQ 800 180CPS + 60CPS LQ	445
LQ 1000 AS ABOVE 130COL	595
LQ 2500 270CPS + 90CPS LQ	795
EX 1000 250CPS + 50CPS NLQ	525
NEC	
PINWRITER P6 180CPS + NLQ	395
PINWRITER P7 AS ABOVE 130COL	475
OLIVETTI	
DY 300 30CPS DAISYWHEEL	495
DY 450 45CPS DAISYWHEEL	725
DY 800 80CPS DAISYWHEEL	875
DM 290 160CPS + 35CPS NLQ	350
DM 296 220CPS + 90CPS NLQ	525
DM 600 200CPS + 70CPS LQ	725
LASERS	
EPSON GQ 3500	POA
CANON LBP 8 II	1695
HP LASERJET	1495
HP LASERJET SERIES II	1995

(HP Lasers incl 12 month on-site warranty)

SOFTWARE

CROSSTALK XVI	95
CLIPPER (DBASE 3 COMPILER)	425
DBASE 3 PLUS	345
PFS: FIRST CHOICE	149
GEM COLLECTION	80
LOTUS 123	245
LOTUS SYMPHONY	340
MIGENT ABILITY	99
MULTIMATE ADVANTAGE	275
SMART SYSTEM	450
WORD 3	275
WORDPERFECT	245
WORDSTAR 2000/2	260

All prices exclude VAT and delivery

MAYFAIR MICROS

01-871 2555
Telex 936066

Blenheim House, Podmore Road, London SW18 1AJ.

WARM EGO

A laser printer for the cost of a daisy wheel?

Imagine the superb results and versatility that a laser printer offers—but at the economical price of a daisywheel printer system*.

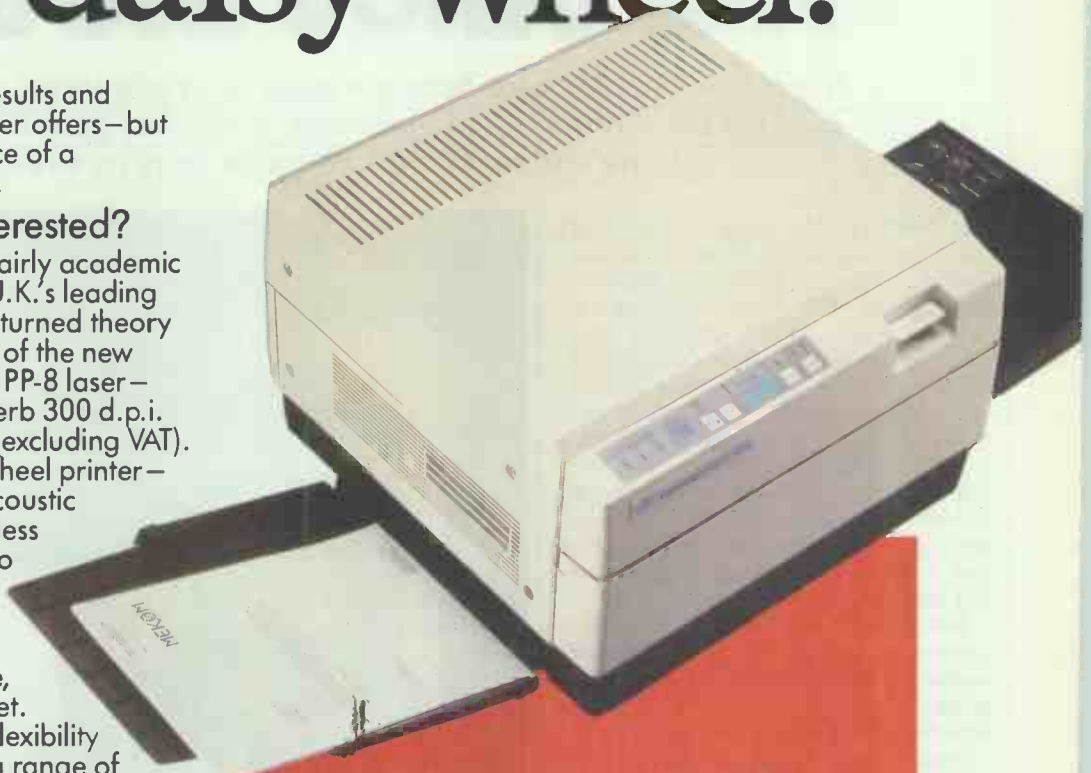
Wouldn't you be interested?

Until now it's been a fairly academic exercise, but Mekom, the U.K.'s leading laser specialists, have turned theory into reality with the launch of the new low-priced Centronics PP-8 laser—8 pages per minute of superb 300 d.p.i. quality for just £1595 (excluding VAT). Compare that to a daisy-wheel printer—but don't forget the acoustic hood and sheet feeder, unless you want your office to grind to a halt—and you'll see why the PP-8 has one of the lowest costs per copy, at 1.7 pence, of any printer on the market.

Add to that the extra flexibility that a laser can provide—a range of resident and optional plug-in fonts for different type-styles; upgradeable memory for graphics applications; superb paper handling—the list is endless.

So before you decide on your next printer consider the PP-8 from Mekom.

We're not called the Leaders in Lasers for nothing!



Centronics PP-8
ONLY £1595†
(excluding VAT)

Only Mekom could do it!

MEKOM
Computer Products Limited

Head Office and Midlands Region,
Enfield Hall, Enfield Road, Edgbaston,
Birmingham B15 1QA Telephone: 021-454 2288

Northern Region
850 Birchwood Boulevard, Birchwood, Warrington,
Cheshire WA3 9QZ Telephone: 0925-821776

Southern Region
Giltspur House, 6 Giltspur Street, London EC1A 9DE
Telephone: 01-248 1711

LEADERS IN LASERS

Please complete and return to: Mekom Computer Products Ltd
Enfield Hall, Enfield Road, Edgbaston, Birmingham B15 1QA.

Please send me details of the low-priced Centronics PP-8 ☐
Please call me to arrange a free, no strings attached demonstration of the PP-8 ☐
Please send me details of other Mekom products and services ☐

Name: _____
Position: _____
Company: _____
Address: _____
_____
_____ Telephone: _____
Printer currently used: _____

† Centronics PP-8 base model with 256K RAM. Model illustrated shows optional plug-in font card. (Retail Price £100 each).
*Typical Daisywheel system including Daisywheel Printer, Acoustic Hood and Sheet Feeder.

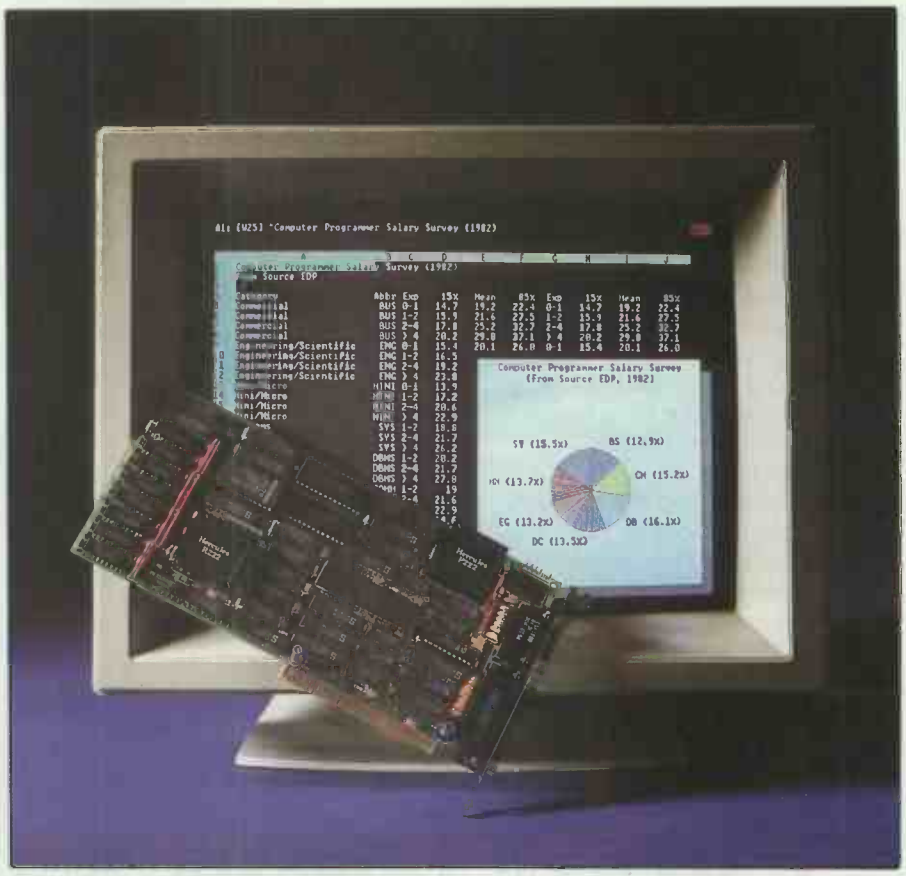
Hercules InColor

The InColor GB222 card from Hercules is an enhanced colour graphics card for the IBM family of machines, which lets you design your own colours and fonts. Dick Pountain tests its strengths.

The IBM PC has graphics adaptors the way dogs have fleas. The recent launch of the Personal System/2 (Benchtest, *PCW* May) introduces no less than the fourth graphics standard in so many years (CGA, EGA, PGA and now VGA, to get acronymic). You might think, therefore, that this is probably not a good time for a third party to launch a graphics card which is not merely an Enhanced Graphics Adaptor (EGA) clone, but sets a new proprietary standard. If the company responsible were any but Hercules, you'd be right.

Hercules was possibly the first company to get rich by offering cures for the deficiencies of the original PC. It produced the Hercules Graphics Card which permitted hi-res monochrome graphics to be performed on the previously text-only IBM monochrome monitor (the monitor most business users buy). So successful was this card — largely thanks to demand from the millions of Lotus 1-2-3 users — that it became one of the graphics standards, and it is a foolish software house indeed which omits the card from its installation menu.

Last year Hercules introduced an upgraded Hercules Graphics Card Plus, which featured an innovatory system of soft typefonts called Ramfont and permitted appropriately written software to display multiple fonts onscreen. Now Hercules has gone the whole way. The InColor GB222 Card, the subject of this review, is an enhanced colour graphics card which includes the Ramfont capability. As expected it is more capable than the IBM EGA card, but less expectedly it turns out to be more easily exploitable by existing software than the EGA is.



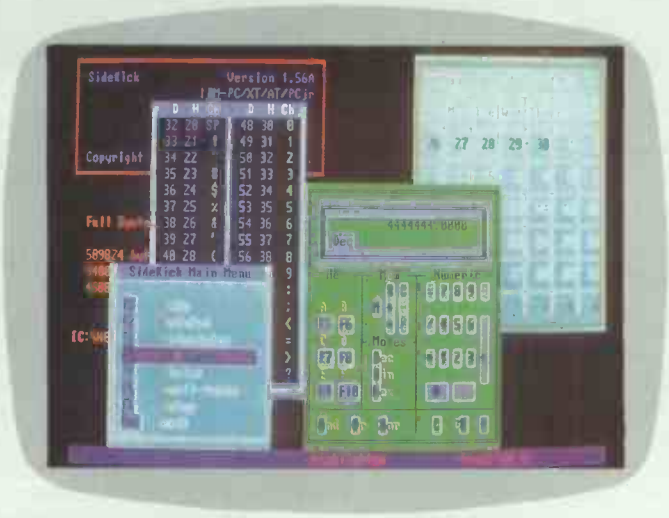
Hardware

The InColor Card is a half-length board which occupies a single slot in a PC, XT or AT. It requires an EGA standard colour monitor (22KHz horizontal and 60Hz vertical scan rates) and will not work with lower resolution CGA monitors; I used an NEC MultiSynch multi-standard monitor on an IBM PC. Like previous Hercules cards, it is not happy co-existing with other colour cards, so if you have a CGA or EGA it would have to be removed. Clones such as the Amstrad PC1512 which have a CGA equivalent on the motherboard may not be able to use InColor. As a bonus, InColor throws in a parallel printer port, configured as logical device LPT1; again this may clash with a previously present port, but in this case the answer is to reconfigure the latter as LPT2.

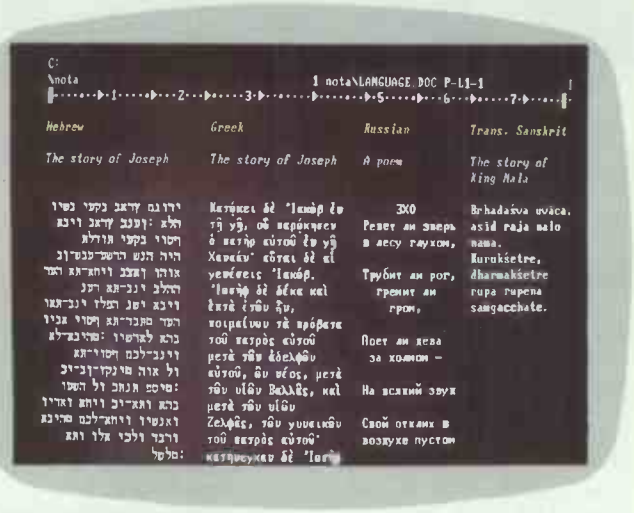
The basic video specification of the board is that it produces a display of 720 × 348 pixels (rather better horizontal resolution than the EGA) in 16 colours chosen from a palette of 64. In text mode this permits a character matrix of either 9 × 14 pixels which is sufficiently large to support different fonts, or 8 × 14 pixels with 90 characters per row. In high-res graphics mode it can plot 720 × 384 pixels in a full 16 colours; unlike IBM adaptors it does not employ different modes which trade off colours against resolution.

The card contains 256k of display memory organised as four bit-planes of 64k each. Each bit-plane represents one of the colours red, green, blue and grey (or intensity); the displayed picture is the result of superimposing these four planes. The display memory can be partitioned in three different ways according to mode:

- In Text mode only the lowest 4k of



By using the Palette program, even ordinary programs like SideKick can be coloured to be as lurid or as tasteful as you wish



OUP's Nota Bene makes use of the multiple fonts to represent a number of different alphabets — producing graphics with text-mode speed

memory is used, the rest being wasted; characters are supplied by a hardware character generator which is compatible with the IBM character set. This mode guarantees that all existing text-only programs will run properly.

● In Ramfont modes, the lowest 16k of memory (in each plane) is used as a text display buffer and memory above this is used to store font data. There are two Ramfont modes. In 4k mode only a single font of 256k characters can be loaded, and this then becomes the standard character set you see on the screen. In 48k mode all the rest of display memory can be used for fonts, up to 3072 characters' worth. This will enable word-processing and desktop publishing software to display up to 12 different typefaces on the screen simultaneously. However, in this case each character must be addressed by a 12-bit code rather than the usual 8-bit ASCII code; this means that only specially written software can access it. 4k Ramfont mode, on the other hand, is compatible with all existing software, as it uses standard ASCII codes. You load a font from disk, using the supplied program RAMFONT-.COM, and all your software then appears in that font.

● In Graphics mode all of the memory is used for two pages of hi-res graphics. These can be displayed alternately, in the technique called double buffering, so that one page is being updated while the other is displayed, allowing a smooth transition between pictures.

InColor does not contain a graphics co-processor, nor any hardware assistance for raster block moves (a so-called 'blitter') such as is found in the Amiga. However, it is a good deal smarter than the totally passive IBM EGA: it could most accurately be described as an 'active display controller'. The main engine is the venerable 6845 Display Controller chip as used on the IBM CGA card. Hercules has added two custom ICs which extend the capabilities of this chip considerably, and combine with the bit-plane organised memory to give excellent performance.

Unlike the older IBM graphics adaptors, the InColor card does not store colour attributes in display memory. Each bit-plane is a simple bit-map, with one bit per pixel, as on a black and white display like the Macintosh's. One immediate advantage of this is that it provides compatibility with the older monochrome Hercules cards — one InColor bit-plane is equivalent to a monochrome screen. Another advantage is that pixels can be manipulated independently of their colour; colour is imposed by the contents of registers on the card, and can be changed virtually instantaneously.

The custom ICs extend the 6845 instructions by adding a number of 8-bit logical operations on byte values. Pixels are handled eight at a time (eight adjacent pixels are called a 'raster'), and the four bytes (one per colour plane) that represent the raster are handled in parallel by copying them into a 32-bit register on the card called the 'Source Latch'. From this latch, an 8-bit mask is produced which is sent to the CPU and allows it to set any pixel to any colour. This mask is called the BBM (Background Bit Mask) and it tells the CPU which pixels in a raster have (or alternatively don't have) a specified colour. The Source Latch can also be used to protect a specified pixel from modification. Unlike a true co-processor, InColor does not take the load of graphics manipulation away from the CPU completely; instead it makes the load less taxing.

The colour registers require 6-bit values specifying one of 64 colours. The four bits which represent a pixel are, therefore, used to index a table of sixteen 6-bit registers called the Palette, and copy the found value to a colour register. The Palette can be changed by the user with supplied software utilities, or under control of specially written applications programs so that a different 16 colours become available.

In use

The InColor Card produces a very high-quality display, noticeably crisper than that of the IBM EGA thanks to the greater horizontal resolution. Unlike the EGA, it can be used to alter the colours of applications programs originally written for the IBM CGA or even the monochrome adaptor.

The Palette is controlled by two supplied programs called SETCOLOR and PALETTE. Both are interactive programs which display a colour chart and allow you to step through the colours by pressing the space bar. A set of colour choices can also be saved as a file and then recalled by, say, SETCOLOR <filename>, perhaps from a batch file.

SETCOLOR is the simpler of the two programs to use, as it only alters five colours — the foreground and background colours, highlighted colour, 'underlined' colour and cursor colour. These correspond to the screen attributes used by monochrome software and such software will appear in colour if it is reasonably well-behaved (that is, it doesn't bypass the operating system).

PALETTE allows all sixteen colours to be altered. These map onto the colours 0 to 15 used by the IBM CGA, so well-behaved programs written for colour will use them correctly. 'Well-behaved' in this context is a fairly loose affair, as I found that SideKick, SuperKey, PC-Write, Pro-Comm, Lotus 1-2-3 and other distinctly non-kosher programs worked fine. Of course, the five monochrome 'colours' are included among the 16,

so PALETTE subsumes SETCOLOR.

The colours available are superb, ranging through subtle tints to full intensity, though the steps between tints are more noticeable than on an analogue system like the Amiga. Since all good IBM programs allow you to install the colours they employ, you ultimately get more control than you do by dragging the sliders in the Amiga Preferences screen. I was able for the first time to find a colour scheme that I'm completely happy with for word processing, namely black on a 'parchment' beige tint. The only fly in the ointment is that InColor does not allow you to set a border colour as the CGA did, and so a reversed screen is surrounded by an ugly black band; however, since the EGA doesn't support a border either, I can't be too harsh.

Fonts are loaded by the utility RAMFONT, and 25 examples of 4k fonts are supplied on the disk. These range from the attractive (sanserif) to the bizarre (fake handwritten script and medieval runes). The PC-DOS prompt in runes looks pretty weird. As on all computers I've seen, including the Macintosh, the italic font looks dreadfully jaggy. A minor problem with the fonts is that the tone characters (code 176, 177, 178) do not join up to form a uniform tint; the box-drawing characters (codes 179 upwards) are properly expanded to nine pixels and do join up.

A full Greek alphabet is one of the fonts, and other foreign-languages fonts such as Cyrillic and Hebrew are on the way. No programs I tried objected to using these fonts, though some home-brewed programs which mess with that part of memory corrupted the fonts, producing odd-looking results. It is not possible to load 48k fonts from the keyboard; this has to be done by actual applications and there aren't many on the market yet.

A very sophisticated font editor called FONTMAN is supplied, which goes far beyond simple fancy-font programs and is aimed at developers writing applications for 48k Ramfont mode. As well as the usual grid editor for characters, it permits copying ranges of characters from one font to another; searching for bit patterns throughout a font; the symbolic naming of fonts or ranges of characters; and logical combinations of characters using AND, OR and NOT. It's also very quick compared to similar programs I've used.

For programmers who need to get to grips with InColor's new architecture, a software simulator called LEARN222 is supplied, along with its source code in Turbo Pascal. This is an interactive program which displays the contents of the InColor registers down the side of the screen. You can enter graphics instructions directly and observe their screen effect in the central window. A Display List of these instructions may be written as an ASCII file and then loaded and executed in single-step fashion. I found it to be an invaluable learning aid.

What about performance? The InColor card provides slick, flicker- and snow-free scrolling that will be a relief to oppressed CGA users. Hercules claims that InColor also dramatically increases the scrolling rate of many programs. I ran the *PCW* scrolling Benchmark TextScrn in BasicA, Turbo Pascal and LMI PC-Forth, and the results were confusing. Both Basic and Turbo showed a mere 10 per cent increase in speed, but PC-Forth showed an increase of more than 100 per cent (from 66 down to 26 seconds).

Drivers

Not all programs run in pure text mode, and those which need graphics modes will not run immediately on the InColor card. Hercules has, therefore, supplied some screen drivers for popular applications such as AutoCAD, Lotus 1–2–3, Symphony and Manuscript, Microsoft Word and Windows, and Ashton-Tate's Framework II and Javelin. These drivers vary considerably in the extra features they provide. There are four alternative drivers for Lotus 1–2–3 (which you put into 1–2–3's normal Driver Library); all provide graphs in 16 colours, while some give more characters onscreen (90 × 25 or 90 × 38) or the facility to have graphs in a pop-up window on the spreadsheet screen.

Compatibility

I found that the InColour card provided remarkably good compatibility with old monochrome and CGA software, especially considering its very different architecture. Not every program ran straight away, but only minor tweaks were needed.

One factor that may intrude is memory organisation. As described above, InColor uses three different memory maps according to mode. Most applications switch it to the correct mode automatically; a few, such as Lotus 1–2–3 version 1A, don't. The solution is to set the mode explicitly using the supplied HGC utility: HGC DIAG sets text mode; HGC HALF sets one page of graphics; and HGC FULL sets both pages. For Lotus 1A you use HGC FULL (perhaps in a batch file). HGC alone resets the card, which is important as an IBM warm boot doesn't.

The other factor which may give problems is that InColor occupies IBM memory space starting at $B000:0000, rather than $B800:0000 as the CGA does. In other words, it looks like a monochrome adaptor to programs. Some programs, like SideKick, will lock up when first booted; the solution is to go into their Install program and tell them you're using a monochrome display. It seems paradoxical, but it works and you get all the colours.

Conclusion

I was impressed by InColor's performance in a way that I never was by IBM's EGA. It's important, however, to be clear in your mind about what it can and can't do for you.

InColor is not a supercharged graphics co-processor card. If you're into CAD/CAM then you'd be better buying one of the new TI 34010 cards (for example, Cambridge Computer Graphics' Xcellerator) and a 1024 × 1024 analogue monitor.

InColor is not an instant solution for desktop publishing. The Ramfont capability is confined to the screen and does not translate onto paper without the usual fancy and expensive software and a laser printer. However, it will make desktop-publishing software for the PC more attractive to look at, and more similar in feel to that on the Macintosh.

InColor is aimed at everyday PC users, and provides a quality of display which is the equal of the best in the business. More importantly, it can do this for most existing software, thus preserving your investment in time and money. In this respect it's more flexible and usable than IBM's own EGA card. IBM's new VGA standard offers much higher performance, but whether it will retro-fit to existing PCs is not yet clear.

As to the question of future software support, Hercules is the leading independent graphics vendor for IBM, and all the major houses are likely to support InColor and Ramfont.

At £399 plus VAT the InColor card is not exactly cheap, and a suitable monitor will cost another £500 or so. Nevertheless, if I were buying an AT clone, it would be my choice of display system.

The InColor GB222 card is available from First Software on (0256) 463344. END

1ST WORD PLUS

by GST
The new standard

FOOTNOTES
FOR STUDENTS AND AUTHORS

- Automatic numbering and re-numbering
- Automatic same page formatting
- Separate footnote ruler

MAIL MERGE
TOTAL MAIL-SHOT CONTROL

- 1ST Mail included as standard
- Full function interactive system
- Accepts data from most popular database programs
- Multi-column output

SPELL CHECKER
ERROR-FREE DOCUMENTS

- 40,000 word UK dictionary
- Foreign dictionaries available on request
- Spell check either whole document or as you type
- Dictionary browser with suggested corrections

MULTIPLE RULERS
FOR PROFESSIONAL DOCUMENTS

- Embedded rulers for total control of margins, tabs and pitch
- Simple add, delete and read ruler with flexible reformat control

GRAPHICS
FOR EXCITING DOCUMENTS

- Use snapshot to import pictures from any GEM application
- Special utility available for DEGAS®
- Move images with ease, even overlay text and graphics

1st Word PLUS all of this...

ATARI ST

AND MORE...
A TOTAL SOLUTION

- Full document statistics including word count. RAM available etc.
- Formatting with flush right hand margin
- Background printing
- Improved printer installation
- Semi-automatic soft hyphenation
- Greater re-format control

GST produced 1st Word for the ST to great acclaim. Since then users' enthusiasm has created an ST standard for word processing. However there were functions missing and you told us. Not resting on our laurels we listened, thought and then listened to you some more. Then with all of your help we developed 1st Word Plus, compatible with 1st Word yet with all this much more.

1st Word Plus
£79.95
inc. VAT

AVAILABLE NOW
YES REALLY
from all good ST dealers
– buy it today.

Electric SOFTWARE

Cromwell Business Centre, New Road, St. Ives, Cambs. PE17 4BG. Telephone (0480) 66433

Colour by numbers

Impressive presentation in the highly competitive business world is half the battle. Robert Schifreen examines colour printer technology in general and laser printers in particular, to provide a pointer to the perfect printer within everyone's reach.

The majority of modern micros have a colour display. When it comes to getting information down on paper, though, colour printers are few and far between. Word-processed text would look much better if headings and highlights could be in a different colour, for example. And painting programs like Degas Elite are all very well, except that once you've created the masterpiece, you can sit and admire it on the screen but you can't print it.

Although few micro users have them, there are actually a number of colour printers around. As the technology develops, manufacturers are divided in their opinions as to what is the best way to transfer a colour image from screen to paper.

This article examines ways in which you can dress up your printouts. It explains how laser printers work, and looks at the various technologies used by manufacturers in their quest to produce the ultimate, but affordable, colour printer.

How colour printing works

Getting a computer to print in black and white is not amazingly difficult. Computers work in binary, which corresponds to electrical ons and offs. The basis of a printer interface is that you send data down on a wire to the print head, and where there's a 1, the pin fires to produce a black dot on the page. Where there's a 0, the pin doesn't fire, so you effectively get a white dot.

Colour printing is much more involved. For a start there are thousands of possible colours in the spectrum, which would make for a very wide ribbon. Luckily, each colour can be made by mixing various amounts of yellow, magenta (purple) and cyan (light blue). These three colours are often referred to as the process colours, as they are also used in the commercial printing industry.

Early colour printers, like the Epson dot matrix JX-80, had a four-layer ribbon. There were yellow, magenta and cyan stripes, and a black one for good measure. (You can make black by mixing the other three colours, but it's faster — and darker — not to.)

The four-colour ribbon was installed just like a manual typewriter ribbon, with the coloured stripes stacked on top of each other. If you sent the printer an ESCape code that told it to change to cyan printing, a small motor would raise the level of the ribbon so that the pins struck the cyan stripe and not the black one.

For green print, the machine would print once in yellow and then overprint in cyan. Because the inks used in the ribbon were slightly transparent, the colours would show through on the paper and you would get a reasonable green. The JX-80 could print in seven different colours, using this method.

Printing with needle-based print heads is known as impact printing. There are a couple of problems associated with this method. In black and white printing, the problems are mainly noise and speed. Because the pins are moving in and out against the ribbon at up to 1500 times a second, there's a loud, high-pitched noise when printing.

With colour printing, another problem occurs. Although different parts of the multi-coloured ribbon are used to make different colours, it is the same print head that does all the work. After a fairly short time, the pins on the head manage to carry tiny amounts of the coloured inks onto parts of the ribbon that they are not supposed to be on. As the ribbon becomes more and more grubby, the paper results become dull. At this point the ribbon can be changed, though cleaning the pins is a difficult and dangerous task. The danger is the fact that breaking a pin will cost you around £150 for a new head.

The speed problems tend to multiply with colour printing, too. Some colours take three overprints, as they contain quantities of yellow, magenta and cyan. In NLQ this makes six passes, which is rather a long time to wait for a single line of text.

Manufacturers generally agree that the future lies in non-impact printing. As the name implies, non-impact printing means that nothing is actually banged against the paper to form each dot of colour. Although most printer manufacturers are agreed that non-impact printing is the way to go, each has its own idea of what technology to use. There are a number of non-impact printing methods around at the moment, each with its own plus and minus points.

Laser printers

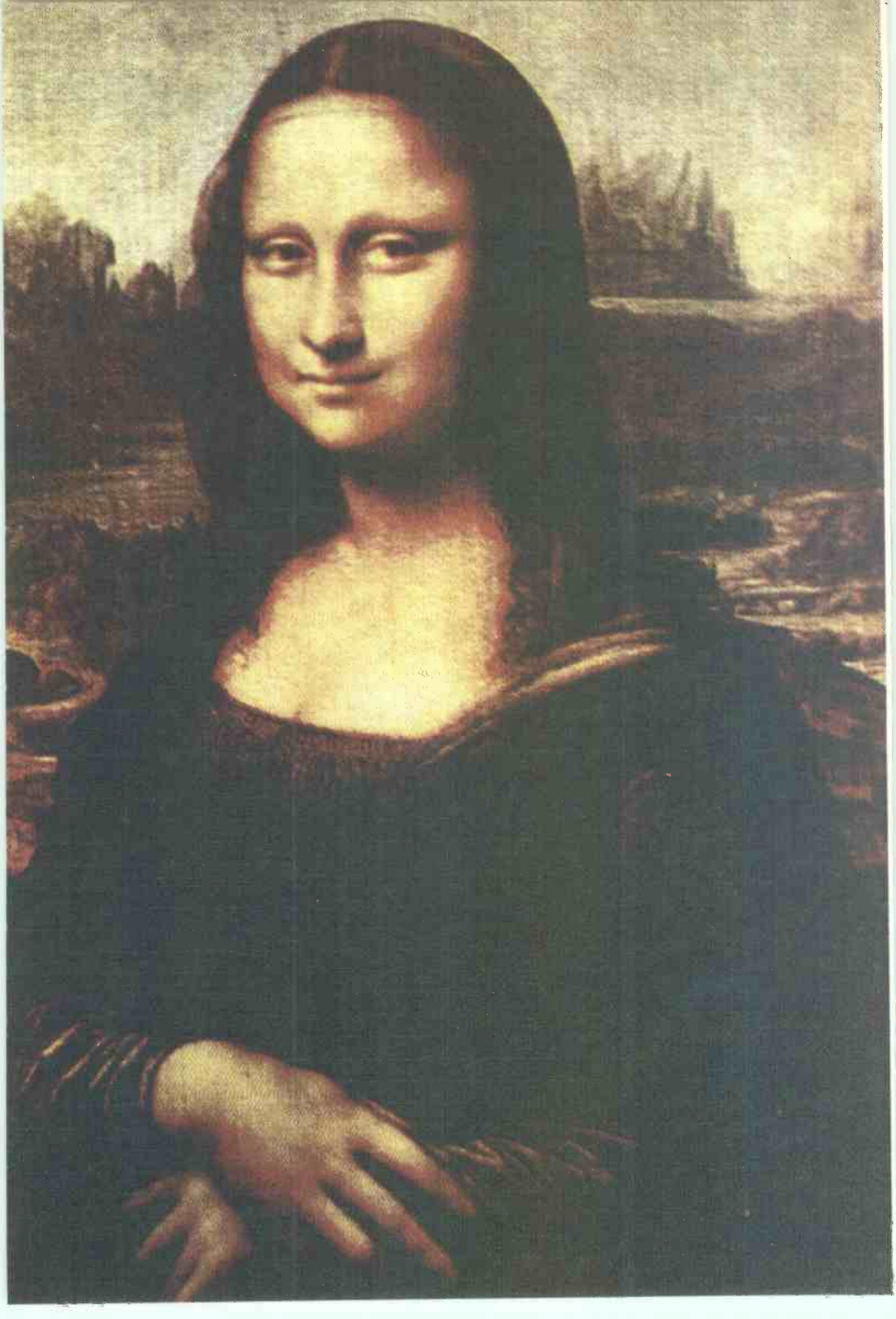
Most well-known among the non-impact printers is the laser printer. These belong to a family of printers known as page printers, as they make up a whole page in their memory before transferring it all to a single sheet of A4 or A3 paper. The resolution of most of today's laser printers is quoted as 300 dots per inch, or dpi; so, a solid black square an inch across consists of 90,000 dots.

In text mode, laser printers make up characters from stored patterns, just like dot matrix printers, so a laser printer doesn't need much memory to print a page of text. If you want to print graphics, though, there must be enough RAM in the printer for it to store the whole page of graphics before printing, which is why your average laser printer has around 1Mbyte of memory.

At the moment laser printers can't print in colour. There are a number of reasons for this, which I'll explain shortly. First, though, an explanation of how black and white lasers work.

When the computer is ready to send a page of output to the laser printer, it sends it down a normal Centronics or serial interface. The im-

A digitised Mona Lisa from the Mitsubishi G650 thermal transfer printer. This was done using a yellow/magenta/cyan ribbon — black is made by overprinting all three. The original image was scanned into a PC using a digitising camera



age is stored in the printer's RAM by the machine's processor. With the image stored in the printer, the computer's job has finished and it can continue with what it was doing before. The printer is left to get on with transferring the contents of its memory to the paper.

At the heart of a laser printer is an aluminium drum, as wide as the paper and usually around two to five inches in diameter. It's coated with a special substance that is very sensitive to electrical charge. That is, if you charge up part of the surface, that area of the coating will accept the charge and stay like that until you discharge it.

The coating on the drum doesn't last forever. Normally, the drum has to be replaced after every 7000 to 10,000 prints, at a cost of around £100. Some toner cartridges contain replacement drums, too.

As you would imagine, there really is a laser in a laser printer. It's very low-powered, though, and is totally encased so you never see it. Even if you could, you'd have to get within a couple of inches of the beam before it would do you any damage.

The laser is fixed in position and never moves. It is pointed at the centre of the surface of the drum. Between the laser source and the drum is a hexagonal (six-sided) mirror, standing upright; this is constantly rotating. Now, if the laser is suddenly switched on for a tiny fraction of a second, it will strike the drum. However, the beam will be defected by the rotating mirror, which means that the actual position along the drum that is struck by the laser depends on where the mirror happens to be at the time.

The mirror is hexagonal because, as one complete side of the mirror passes in front of the laser, the beam is deflected from one side of the drum to the other. Then, as the next side of the mirror comes round, the beam returns immediately to the left-hand side, to start the next scan line.

By carefully monitoring the position of the mirror and timing the laser precisely, the printer can direct a flash of laser light anywhere across the drum. And by rotating the drum as well, any point on the drum's sur-

An untouched photocopy, as produced by Canon's full-colour photocopier. For £36,000, you too might be tempted to make your own bus passes and banknotes. The original is separated into its yellow, magenta and cyan constituents. Then, each colour is laid down in turn on the paper, before heat and pressure are used to fuse the toner into the paper and make the image permanent.

face can be accessed. This is the method used to transfer the stored image onto the drum. Wherever the printer wants a dot, a pulse of laser light is used to charge a tiny point on the drum.

The image is built up on the drum in rows, just like a TV picture. So, after one whole revolution of the drum, it contains a page of output in the form of lots of charged particles. As the charged drum rotates, it passes above a trough of toner. This is the same substance that you fill photocopiers with — indeed, the photocopier is the parent of the laser printer.

The toner consists of minute particles of a black substance which are also sensitive to charge. As the drum passes over the toner, particles of toner jump across and stick, like iron filings to a magnet, to the charged areas of the drum. At this point, the toner on the drum resembles the page of text.

With the toner sticking to the drum, the drum is passed very close to a sheet of paper that has been taken from the printer's tray. The paper can't be allowed to actually touch the drum, as the surface is very delicate and paper would scratch it. The sheet of paper is connected to earth. The toner, innocently obeying the laws of physics, transfers itself from the drum to the paper, producing the image.

Now, the paper is passed through a heating unit to fuse the toner into the paper, and to produce an image that won't rub off on your hands.

Meanwhile, there's no guarantee that every bit of toner that was on the drum has actually made it to the paper. Indeed, only around 70 per cent gets through. It's essential to clean off this residue or subsequent images will be dirty, so a micro-fine blade cleans any remaining toner from the drum. Finally, any remaining charge is taken from the drum and the process repeats. The waste toner is normally not re-used.

Although the sheet of paper is considered too abrasive to be allowed to touch the drum, the blade is specially engineered to do the job.

Most laser printers work to a resolution of 300 dots per inch, and build up the image line by line in memory. For detailed graphics work, you would think that it would be possible for the laser to be moved in two dimensions instead of one, and draw a very fine image directly onto the drum. Although this is possible, it's too slow to be practical — mainly because the drum would have to do so many revolutions. Speed would typically be decreased by a factor of 20 or more if this method were used.

Colour lasers

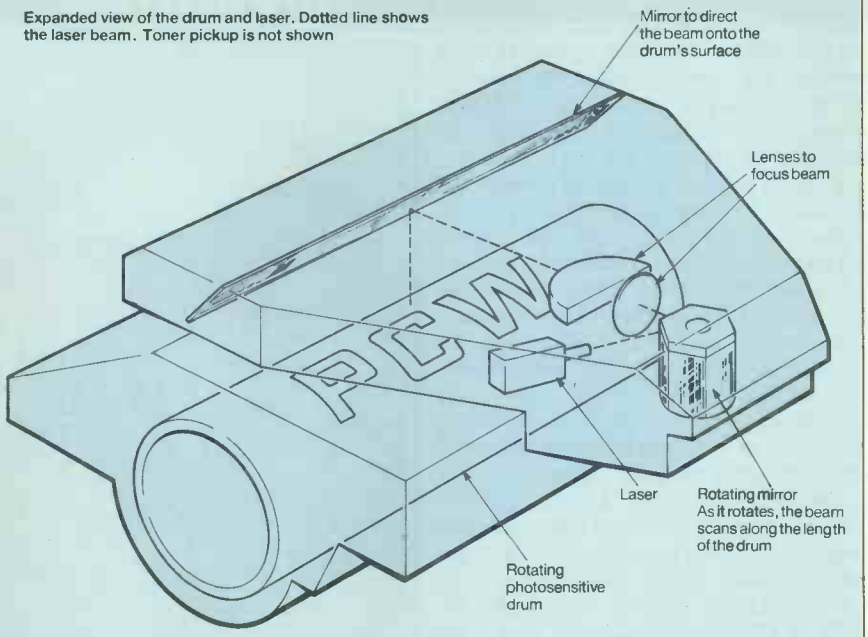
When you understand how a black and white laser printer works, you begin to appreciate the difficulties involved in making it produce full-colour copies. Like impact printers, you'd need three separate phases — yellow, magenta and cyan. First, you'd have to print only the yellow part of the image: that is, any part that contains yellow (like green, for example). This would be done by using a yellow filter, and putting a yellow image on the paper. Next, you'd have to make sure the drum was completely cleaned of yellow toner and add the magenta. Finally, in the same way, would come the cyan.

Building a machine to do all this becomes rather expensive, as you'd have to scan the image to isolate the three separate colours and work out the mixes exactly to get the right results. Also, with all that toner around, the paper tends to get rather thick and, by the time you come to heat up the cyan part, the process melts the existing yellow and magenta and you end up with a mess. Having three separate drums is a possible solution, but would be far too expensive.

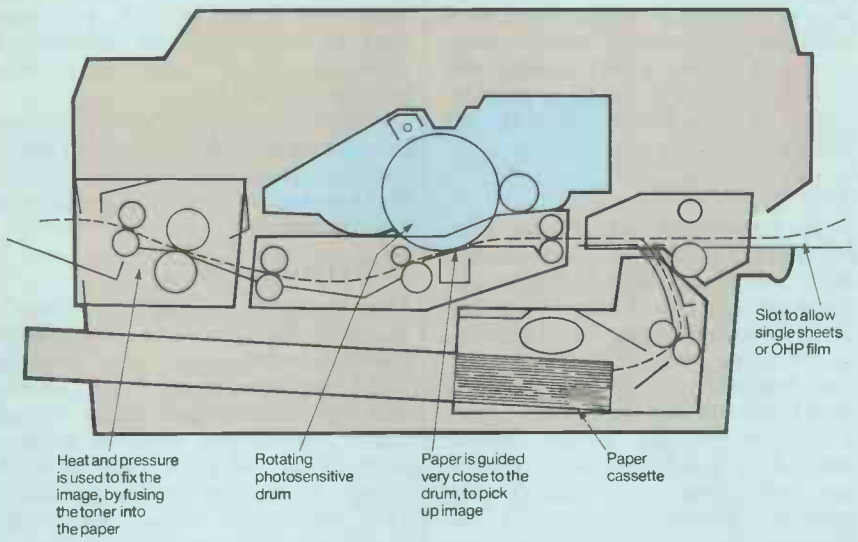
Another method way is to charge the drum to varying degrees and then pass it over three separate troughs of toner. According to the level of the charge, the correct coloured toner would be picked up. Although this method has been considered by manufacturers, no-one has actually implemented it in a production model yet.

Although there aren't any colour laser printers yet, Canon and Rank Xerox do produce colour photocopiers. These work by making three passes. First, the yellow toner is put

Expanded view of the drum and laser. Dotted line shows the laser beam. Toner pickup is not shown



Side view of a laser printer showing the complete paper path



on the paper; then the magenta, and finally the cyan. Then, the whole thing is fixed in a heating compartment. A full-colour A4 copy takes 12 seconds to produce on the Canon.

In each pass, the dots of colour are arranged in varying densities to produce dark and light shades. These arrangements are known as dither patterns. The more dots of yellow per square millimetre, for example, the darker the shade obtained. By controlling the densities accurately, thousands of colours can be obtained. For example, differing amounts of cyan and yellow will produce different shades of green.

The heart of Canon's colour photocopier is identical to a laser printer engine, so it's possible that Canon will produce a full-colour laser printer in the near future. The copier retails at £36,000, though, so don't expect real colour lasers to be cheap. The price is high because of all the work involved in mixing the required colours to imitate the original.

Printing costs aren't cheap, either. The drum is much larger than in a normal laser printer, and replacement costs almost £1000. Taking this into account puts the cost of producing an A4 colour copy at 24p. A3 copies are twice that.

Colour toners

Despite the lack of colour laser printers, there are two relatively cheap ways to jazz up plain black output from machines like Apple's Laserwriter or Hewlett-Packard's LaserJet. The cheapest method is to buy coloured toners to use in the machine instead of the normal black stuff. Canon can supply brown toner; while Xerox makes yellow, magenta, cyan, red, green, blue and brown varieties in addition to normal black. Not every photocopier, and few laser printers, can take these coloured toners as they are chemically different and will not be picked up properly.

Another way to liven up black output, that will work for every photocopier and laser printer, is to use a machine made by Omnicrom. The system involves specially-coated coloured sheets. When heated, the coloured coating comes off the sheet and attaches itself firmly to any black toner from a laser printer or photocopier, while leaving any white paper clean. The sheets come in 60 colours, including gold and silver, and cost around 12-20 pence a time in A4 size, and twice that for A3. The heated roller is £995, which is extortionately expensive but essential for decent results. You do get £350 worth of colour sheets included, though.

Omnicrom's results are impressive. A page from a Laserwriter, transformed to glossy gold print, looks impressive on the front of a document. It's fiddly, though, and takes time to wrap the black printouts in coloured sheets and pass them through the roller.

The Howtek printer squirts droplets of plastic ink onto paper. The resolution is not as high as a laser printer, but the colours are sharp

When the coating has been transferred to the toner, you're left with a negative image on the coated sheet that can be used as a foil for an overhead projector.

Starting cheap

The cheapest real colour printer is the Okimate 20 which uses thermal transfer technology. The machine looks similar to a dot matrix printer, with a roll of paper going through the machine and passing under a print head. The print head is of the 24-pin variety (see the March issue of *PCW* for details), though Oki prefers to call them 'thermal points'. The ribbon is a plastic film, coated with a coloured wax-like material.

To make a dot on the page, the pins on the head are not fired onto the paper. Instead they are heated for a fraction of a second, which melts the waxy ribbon and leaves a mark on the paper. The whole head is in contact with the paper all the time, but wax is only transferred when the temperature of one or more 'thermal points' is high enough to melt it. The exact temperatures involved, as well as the length of time the pin needs to remain hot, is not something that manufacturers like to divulge.

The Oki's ribbon is arranged in a segmented way. The single-pass ribbon contains alternating 6in-or-so segments of yellow, magenta and cyan. Therefore, the ribbon starts off yellow and, as it advances, changes colour. Between each colour is a small, black mark that the print head reads, so it knows exactly which colour ribbon is showing at any time. By waiting until the desired colour comes round, and overprinting two or three times, any colour that can be produced on a micro's screen can be transferred to paper. There's no black segment on the ribbon — it is made from a mixture of the three colours.

Although the printer is not the fastest around (it's only £173), you may have to write a driver for your particular micro or software package. A segmented colour ribbon will last for up to a dozen screendumps and costs £6.14. There's also a plain black ribbon for £5.58.

For draft printing, there's no need for a ribbon at all. Because the machine uses a thermal print head, it's possible to buy thermal paper which turns black when it comes into contact with the heated needles. This paper is £4.85 for a 30-metre roll. (All prices are plus VAT.)

More thermal transfer

Because of the design of the Oki ribbon, it can take five minutes to print a page. Each line has to be printed separately, in the same way as a black and white dot matrix printer. Special paper has to be used, as ordinary paper may not conduct heat away from the head fast enough, causing the head to burn out.

One way to make thermal transfer printing faster is to keep the segmented ribbon but make it a line wide, instead of just the height of a single line of type. This means that a complete page of each colour is laid down as one segment passes the print head. Therefore, with three col-

YOU ASKED FOR IT - ISIS-200 XT TURBO

You asked for quality, high spec, great display, fast maintenance, wide compatibility and looks to enhance your office environment.

ISIS-200 specifications are:

IBM-XT* compatible
4.77mhz/8mhz switchable
NEC V20 processor
512k RAM expandable to 640k on-board
Hercules-compatible mono graphics
Centronics Port
Asynchronous Comms port (RS232)
Battery-backed Clock/Calendar Card
84 or 101 key keyboard
12 inch amber screen monitor on tilt and swivel stand
1 or 2 360k branded Japanese drives
20mb NEC hard disk drive (optional)

Quality components cost a little more, but you save it on the warranty and reduced down-time. Each unit includes a free 12 month on-site maintenance agreement with Datafax Ltd of Basingstoke*, renewable on expiry. Datafax gave us a great price after they had inspected the machine.

Price includes delivery and 12 months repair service at your premises within 24 hours. Available ex-stock.

PRICES:	ISIS-200 with Single 360k floppy drive	**£549.00**
(Ex VAT)	ISIS-200 with Dual 360k floppy drives	**£619.00**
	ISIS-200 with Single floppy and 20mb Hard disk	**£919.00**
	Microsoft MS-DOS v.3.20. and GW Basic	**£ 50.00**

Payment by Access, Visa or Cash with Order. 14 day credit to PLCs, Government and companies listed in Dun & Bradstreet's "Britain's Top 20000."

Access VISA

Call or write: ELR INTERNATIONAL LTD, ISIS House, 2 Walnut Tree Park, Guildford, Surrey GU1 4TR.
Tel: (5 lines) 0483 505605 Telex: 859428 ELRINT Fax: 0483 33503

*On-site warranty available Midlands and South England only at present. *IBM and XT are registered trade marks of International Business Machines Inc.

oured segments required to produce a full-colour image, it's possible to produce an A4 page in under half a minute.

Two machines which work like this are the D-Scan and Mitsubishi machines. D-Scan is actually a subsidiary of Seiko, as is Epson, though I'm assured that the machine won't be appearing with Epson's name on it. The Mitsubishi G500 and G650 are the printers which produce near-perfect copies of the Mona Lisa and generate instant crowds at shows.

In order to make everything work as fast as possible, the idea of a moving print head was ruled out. Instead, a non-moving print head is used, that is as wide as the printer itself. In the case of the A3 Mitsubishi printer, the print head has 3392 elements, each one pixel wide. To print one complete row of pixels across the sheet of paper, selected points on the head are heated as the paper goes past, and melt the wax onto the paper. It takes around 10 seconds to produce a whole page in each colour, and there are three colours to a page (yellow, magenta and cyan).

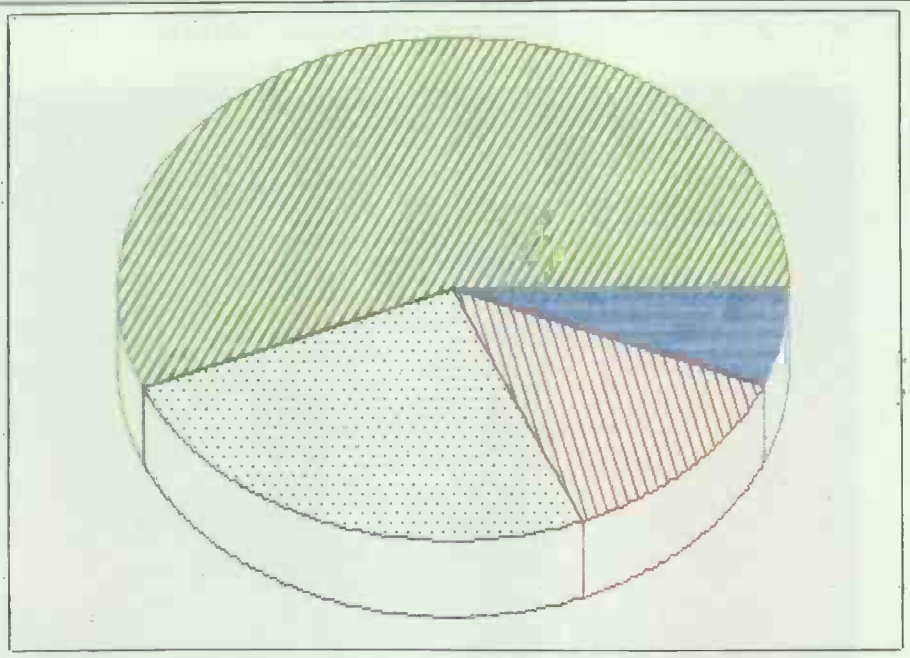
With each element of the print head so close to its neighbour, the timing and temperatures have to be carefully controlled. If an element stays too hot for too long, heat will be conducted to other elements and produce speckles on the paper.

The Mitsubishi printers have a resolution of 300 × 300 dots per inch. They cost £4100 for the A4 model, and £6470 for A3. They come with a Centronics or RS232 interface, and drivers for IBMs are available. Negotiations are under way with a number of software houses to include drivers in their packages. An A4 copy takes 60 seconds and costs around 27p to make, and just about any colour can be mixed.

The D-Scan models are around twice the price of Mitsubishi's. They are not designed for general printing jobs, but more as add-ons for CAD workstations. No interface as such is required, as the device connects to the monitor port on the PC. You simply make up a Y-junction cable, so that whatever goes to your monitor also goes into the back of the D-Scan. Then, whenever anything interesting appears on the screen, you press the PRINT button on the printer and, 20 seconds later, out pops a colour printout of what was on the screen.

With a normal CGA or EGA monitor, you can't really take advantage of the printer. It will work better with the Professional Graphics Adaptor, or an add-on board like the Metheus.

The only limitation to the system is that you have to freeze the screen display for around 20 seconds, to give the printer enough time to copy the image into its memory ready for printing. The printer actually makes four passes, though the first is just to line up the paper and no actual printing takes place. The whole four-pass process takes two minutes. You end up with a glossy A3 or A4 print, with very sharp colours. The wax seems to stick to the paper fairly firmly and survives bending and folding.



Epson's JX-80 was a dot matrix printer with a four-colour ribbon. ESCape codes would raise or lower the print head to the required colour

Ink-jets

If Sinclair's £60 spark-jet printer went part of the way to putting people off non-impact printers, ink-jets completed the job. Ink-jet printers work by squirting a fine stream of ink onto paper. The paper is not special, but does need to be treated so that ink won't spread across (making the dots bigger) or down into the paper (making them lighter).

There are two methods used to get ink from the nozzle to the paper. The older method is known as the continuous method. Here, drops of ink are permanently being squirted from the nozzle. If a drop of ink is required at a certain position on the paper, electric fields are generated to deflect the ink to the place where it is needed. If no electric field is generated, the ink just falls into a receptacle and is then recycled.

The other printing technique is called drop-on-demand. Here, a droplet of ink is projected only when it is required.

Early problems with ink-jet printers lay with the ink, which had a habit of solidifying in the nozzles. If an ink-jet printer was turned off over the weekend and left in a warm office, the print head would resemble a fountain pen that had been left on a radiator overnight.

Now, ink-jet printers are gaining in popularity. New inks have been developed which don't congeal so easily, and redesigned print heads have water squirted through them at regular intervals when not printing to flush out any debris and keep things flowing.

Tektronix, Canon and Integrex all produce colour ink-jet printers. The Tektronix 4692 costs around the £7000 mark. It prints on sheets of A4 paper, and has a resolution of 154 × 200 dots per inch, from a palette of 216 colours. The model 4695 costs £1700, and produces 100 colours in 120 × 116 resolution.

The machines have Centronics interfaces as standard, though Tektronix also provides black boxes which let you connect an RGB input to the machine and it will send the correct data to the Centronics port.

Unlike the thermal transfer printers with their three-colour segmented ribbons, Tektronix's machine has four reservoirs of ink. As well as yellow, magenta and cyan, there's also a black cartridge. Although this means that you have to buy four pots of ink instead of three, it's faster to get black directly than mixing it. You also get a much darker colour.

The sheet of paper taken from a cassette is stuck onto a drum that is large enough in diameter to take the whole sheet without overlaps. There's a carriage which contains the four nozzles, and the whole carriage moves across the drum, taking one step each revolution and building up the image.

A PCW without Protext is like a car with one gear.

Cars are useful. You sit down, drive away and — eventually — arrive at your destination. But some people comfortably speed along, while others don't.

The PCW is useful, too. You sit down, type away and — hopefully — produce a neat, accurate document. But some people crawl along using inferior software — while others use Protext.

Protext releases the power of your PCW. It is faster, easier and more flexible than any of its rivals.

And because Protext has been designed exclusively for the PCW, you don't need optional extras.

When it comes to text handling, Protext streaks ahead of the rest. Word search and replace is four or five times faster than rival packages can manage.

Naturally, you get full mail-merge facilities to produce top-quality personalised letters — with details read, reformatted and printed from separate files. And Protext works with any printer.

No stopping to check for spelling, either. Protext's integrated spell-checker scans your text files to produce consistently accurate, professional documents. It comes with an extensive dictionary — to which you can add thousands of your own words.

When you've seen how Protext moves, we know you'll never use anything else.

Arnor's Protext costs an economical £79.95. So if you have the words, we have the way...

Call 01-684 8009 — 24 hr service

VISA Access

"Accept no substitutes — this is the word processor for the PCW."

POPULAR COMPUTING WEEKLY

ARNOR

Releasing your Amstrad's potential...

Arnor Limited, *118 Whitehorse Road, Croydon CR0 2JF*

After the whole image has been printed, the drum spins for a few more seconds to allow the ink to dry properly. If you're printing onto overhead projector film the drum spins even longer, as plastic film isn't the best absorber of water-based inks.

The Integrex ColourJet 132 also has four coloured nozzles. Each is a hair-thin glass tube surrounded by a piezo-electric element. When an electric voltage is applied to the piezo element, the glass tube contracts slightly and capillary action forces a miniscule droplet of ink to be squirted out. This method of getting ink out of a tube is known as drop-on-demand printing.

The unique feature of the Integrex machine is its viewdata mode. In addition to understanding normal Epson ESCape codes, the viewdata capability means that you can send Prestel frames (BBC mode 7) directly.

Solid sticks of colour

There's one thing worse than changing a messy bottle of ink in a black and white ink-jet printer, and that's changing four bottles in a colour one. If that's your main objection to ink-jets, then Howtek may have the solution. Its colour printer works with any plain paper, has a resolution of 240 × 240 dots per inch and doesn't use any liquid inks. Instead, it takes four sticks of solid ink which you plug into a hole and forget about. The holes and sticks are even different shapes, so you can't put the wrong ones in the wrong holes.

The plastic sticks are solid ink, developed by Howtek itself. The print head contains 32 nozzles. Twenty of these are connected to the black ink, while the yellow, magenta and cyan sticks each get four. This arrangement means that a black page can be printed in half a minute, and a full colour one in four minutes. And all without changing sticks.

To produce an ink that can be squirted through holes, the tips of the crayons are melted to form a runny plastic ink. Droplets 5/1000ths of an inch across are squirted onto the paper and immediately solidify, making the printout *feel* embossed.

Howtek's paper handling, also, is nothing if not novel. A sheet is taken from a cassette and is wrapped round a drum. The tube stands vertically in the printer, like a chimney, and stays still while the print head rotates around it, moving from the bottom to the top of the sheet as it spins.

'The Mac II looks set to do for colour desktop publishing what the original Macintosh did for today's laser printers. At that point, desktop publishing will have truly arrived.'

The Pixelmaster printer, as it's called, currently costs $3000. It will produce a 240 × 240 dots-per-inch graphics page in four minutes which, although not as high a resolution as some other models, produces the brightest colours I've seen. This is because the plastic ink solidifies as soon as it touches the paper, and none evaporates or is absorbed. There's also HPGL and PCL emulation built in.

Electrostatic

The heart of a laser printer is a drum that is charged. This attracts toner, and the paper then picks up the toner from the drum. This method of charging is known as indirect, because the charge doesn't go straight to the paper but goes via the drum.

Electrostatic printing is known as direct charging. Instead of applying the charge to a drum, the drum is dispensed with and yet another type of special print head applies charge to the paper directly.

The disadvantage of this system is that special paper must be used, coated with a charge-retaining material. But the absence of a drum lowers the running costs considerably. An A4 sheet costs around 4p to print electrostatically, and nearly twice that on a laser if you take drum costs into account.

Electrostatic colour printers are now appearing, and Versatec's range will print anything from an A4 sheet to a piece of paper 72 inches wide by 500 metres long, and still get the three colours to line up on top of each other exactly. This is done by reading little black marks that have to be on the paper.

The print head in an electrostatic printer looks similar to the one on a page-at-a-time thermal transfer printer like the Mitsubishi G500. It's made up of as many separate elements as there are pixels across the page. The print head doesn't move, but is always in contact with the paper.

Instead of an element getting hot, a charge is applied to it and is picked up by an electrode that is placed behind the paper. When that has been done, a particular pixel on the paper is charged and ready to accept toner. The charged sheet of paper is passed over a liquid toner which consists of tiny graphite particles suspended in a special liquid. The graphite particles stick to the charged areas of the paper, and react with a chemical in the paper that fixes them permanently in place so they won't rub off. No heating process is necessary. Surplus liquid is washed away by a vacuum process.

The toner particles themselves are semi-transparent, allowing the yellow, magenta and cyan layers to partially show through each other. This is one of the ways in which different colours are made. The other way is by making tiny mosaic patterns of different colours, which look like a colour TV set if you look closely.

Conclusion

Colour monitors, though widely available and a little more expensive than mono ones, have not totally obliterated the market for black and white monitors. Whether a market really exists for a cheap, full-colour printer to hook onto the back of the home micro, we have yet to see.

There's no doubt, though, that in a year or two, the choices available will multiply many times. Real full-colour laser printers will arrive, and new technologies that are currently locked away in R&D departments will see the light of day.

The Mac II looks set to do for colour desktop publishing what the original Macintosh did for today's laser printers. With a Mac II and a decent colour printer, a micro user will soon be able to produce glossy colour brochures — and even printing plates — instantly and cheaply. At that point, desktop publishing will have truly arrived. END

Contacts

Canon (UK) Ltd	(01) 773 3173
D-Scan — UK Distributor: Ambitron	(0635) 36555
Howtek Inc (USA)	(0101) 603 882 5200
Integrex Ltd	(0283) 215432
Mitsubishi Electric (UK) Ltd	(0923) 770000
Oki — UK Distributor: XData	(0753) 72331
OmniCrom Systems Ltd	(0204) 392050
Main dealer: Apple Centre, Chiswick	(01) 994 7424
Rank Xerox	(0895) 51133
Tektronix	(0506) 32766
Versatec	(0635) 517200

FOR AS LITTLE AS £159 YOU CAN BE THE HOME SECRETARY.

There's more to home computers than fun and games.

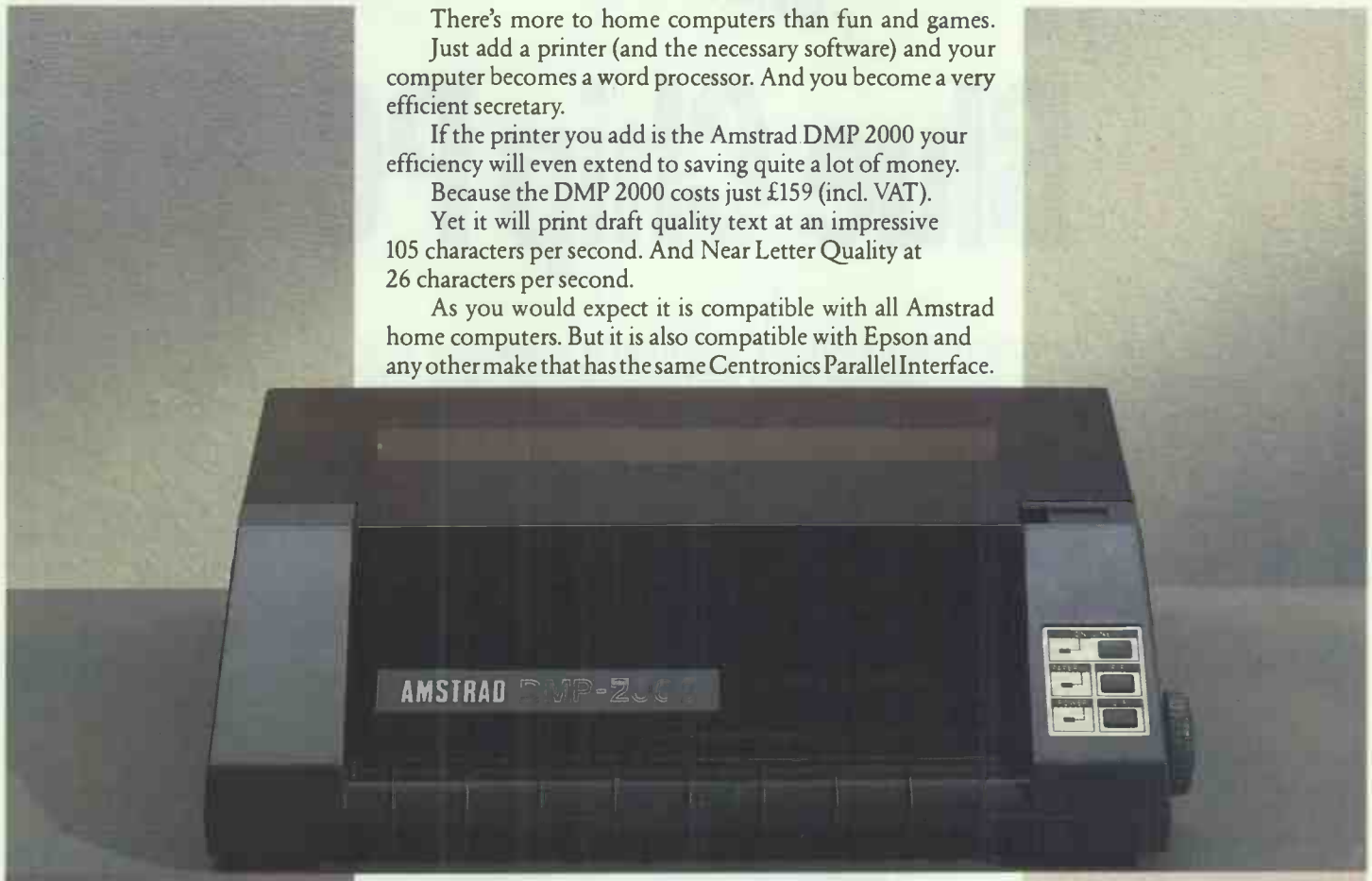
Just add a printer (and the necessary software) and your computer becomes a word processor. And you become a very efficient secretary.

If the printer you add is the Amstrad DMP 2000 your efficiency will even extend to saving quite a lot of money.

Because the DMP 2000 costs just £159 (incl. VAT).

Yet it will print draft quality text at an impressive 105 characters per second. And Near Letter Quality at 26 characters per second.

As you would expect it is compatible with all Amstrad home computers. But it is also compatible with Epson and any other make that has the same Centronics Parallel Interface.



If you've already graduated to a PC there's the Amstrad DMP 3000 printer.

It's compatible with all the Amstrad PC 1512's as well as Epson and all other IBM compatible PC's. It costs just £169 (plus VAT).

Both printers have easy front loading and both will take ordinary A4 paper. One of them is bound to be right for your particular home office.

Please send me further information on the DMP 2000 ☐ and DMP 3000 ☐ PCW6/87

Name_____

Company_____ Telephone_____

Address_____

Amstrad plc., PO Box 462, Brentwood, Essex CM14 4EF. Telephone: (0277) 262326.

AMSTRAD PRINTERS

Amstrad plc., PO Box 462, Brentwood, Essex CM14 4EF. Telephone: (0277) 230222.

Blue Chip PC

The flourishing South Korean electronics industry is responsible for the production of leading Atari and Amstrad machines, but its own PC clones have something to say, too. Peter Jackson looks at Hyundai's Blue Chip PC, and asks whether it can escape the 'just another clone' tag.

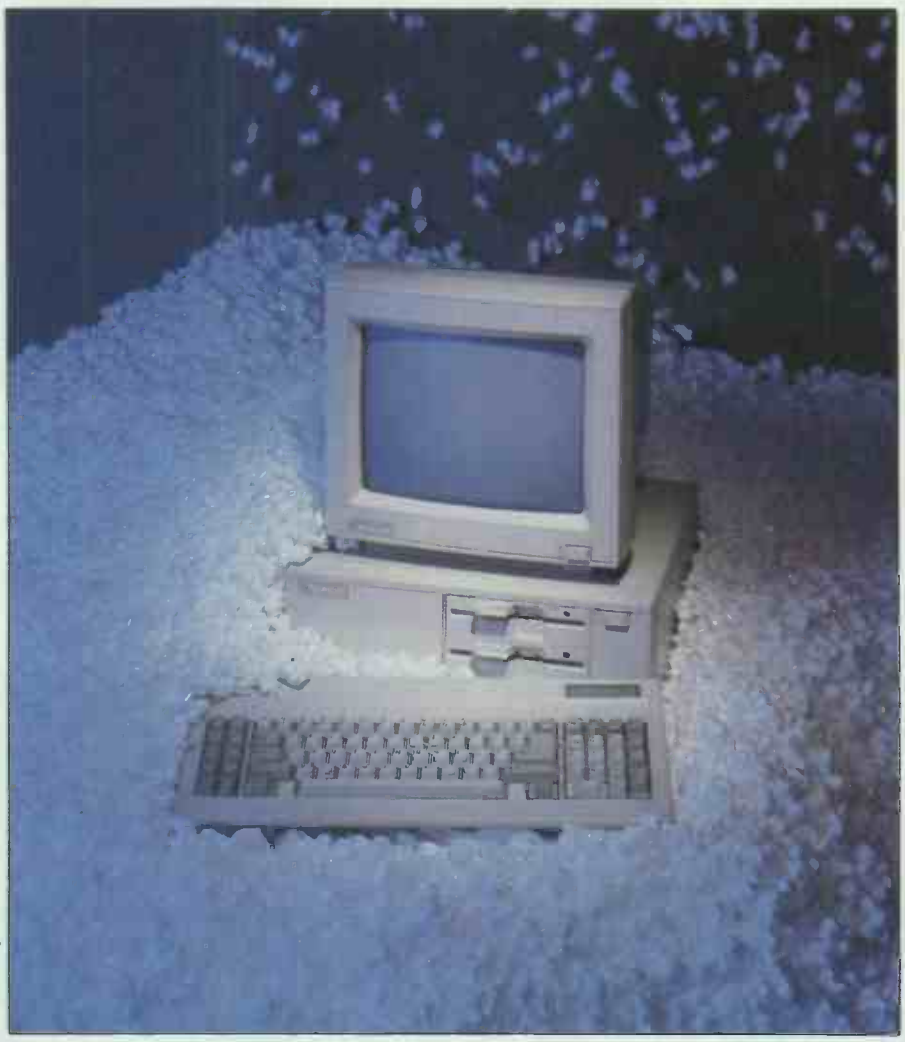
When Amstrad delivered its first PC 1512s to Texan distributor Vidco, it looked as though the Union Jack would be bravely flying against the Stars and Stripes of existing big-selling PC clones such as Leading Edge's Model D and the Blue Chip PC.

But closer inspection reveals that they could have saved shipping costs and battled it out at a pre-Olympic bout in Seoul. All three machines are actually built by the flourishing but unsung South Korean electronics industry, which also makes the Amstrad PCW range and Atari's entire set of STs, as well as Atari's just-launched PC.

The Koreans can build cheaply, but it seems they can build reliably too. Despite their origins, the Leading Edge and Blue Chip PCs have already made their mark in the US market thanks mainly to their prices, but thanks also to the fact that they are built by substantial multi-national industrial conglomerates. While there is little but guesswork to recommend buyers to the equally cheap Taiwanese cottage-industry clones from makers like Glorious Union Information or Show Magazine Electronics — which really do exist — the vaguely familiar Daewoo and Hyundai labels behind the Leading Edge and Blue Chip logos inspire rather more confidence.

For example, it is reassuring to spot the same Hyundai name on a PC motherboard as on the tailgate of a four-wheel drive Land Rover clone, or a Chevrolet-compatible saloon; the image of ruggedness and engineering expertise seems to rub off on the computers.

But whatever the psychology, there is no doubt that the Korean clones offer some of the best value on the US market today. And as the £600 Blue Chip PC starts to arrive in the UK, it is worth finding out how Hyundai can do it for the money and whether it really can take on Amstrad on its home ground.



Hyundai's Blue Chip PC is higher in overall quality than most PC clones

Hardware

The Blue Chip PC does not look like the typical Far East clone, which tends to follow the IBM format slavishly enough to look identical in a poor light. The first impression of the Hyundai machine is that it looks very like its Leading Edge competitor from Daewoo, or like small-footprint PCs and ATs such as the Epson PC+, the Ericsson PC, the Sperry micro/IT, and even the Hewlett-Packard Vectra.

Although it is the same depth as

the classic old IBM PC design so that it can accept full-length expansion cards, the Blue Chip is actually much narrower — around two-thirds the width of a standard PC. This has been done by cutting down the mass storage options to just two half-height floppy or hard disk drives, while other clone makers have kept the PC's two full-height drive slots and provided the necessary power and controller connections for four drives to be installed in the case.

The two drive slots in the Blue Chip are positioned one above the other towards the centre of the front panel, leaving room to one side for the mains power switch and red power-on indication LED. The machine's basic configuration includes just one drive, but most users will want either a second floppy or a hard disk. Blue Chip has a second 360k floppy drive and 10 and 20Mbyte Winchesters available as options.

If the front panel is almost featureless, the same goes for the rest of the system unit. The left-hand side has just one break for the typical DIN-style PC keyboard socket; the right-hand side is blank; and the back holds just two power sockets for the mains input and the standard monochrome monitor, a reset button, and the covering panels for the six expansion slots. Even the fan housing is restrained, with a louvred panel rather than a mesh screen.

Opening the case by removing four obvious big screws and one rather subtly-placed small one reveals the usual PC hardware components in a somewhat unusual configuration.

The motherboard at the bottom of the case is remarkably conventional. There are no custom gate arrays, and no custom sets like the Chips and Technologies products that reduce most of a PC's hardware to two components. Instead there is the old pattern of several large chips such as the 4.77MHz 8088 processor itself and the 8255 input/output controller, surrounded by dozens of simple TTL chips doing the logical and electrical housekeeping for their big brothers. This design method has largely been abandoned by the Taiwanese makers, since more chips make the boards more expensive to produce and increase the quality control problems by providing more ways for the board to fail. To produce the Blue Chip at such a low price, Hyundai must be using high production levels and high-volume chip purchasing to give it economies of scale. Either that, or the company is making a loss on every machine sold.

The motherboard follows the usual clone course of including things as standard rather than on plug-in boards, and has the floppy disk controller, one RS232 serial port, and one parallel port built-in along with the usual 8087 socket. The standard 512k RAM is made up from two rows of nine 256k RAM chips rather than the currently fashionable single-in-line memory modules (SIMMs), with IBM-style parity checking, but there is no way to expand RAM to the 640k MS-DOS maximum on the motherboard. Blue Chip can supply an expansion board with the required extra 128k on it along with a real-time clock/calendar, an extra serial port and a games controller interface.

There are just six expansion slots, fewer than many clones, although the inclusion of the floppy controller on the motherboard means that just one slot is filled — by the display controller board — in the floppy-based version. The hard disk version needs an extra disk controller board, taking up a second full slot. However, one advantage is that all the slots are full-length, since the positioning of the floppy drives leaves more room for expansion despite the narrowness of the case design.

The standard display board provided with the machine is a Hyundai monochrome graphics adaptor, with Hercules-compatible bit-mapped graphics and IBM-compatible text using a 14 x 9 dot matrix for each character. Naturally, other colour graphics adaptor (CGA) or enhanced graphics adaptor (EGA) boards and monitors can also be used.

The most interesting features inside the Blue Chip, however, have nothing to do with the electronics but more with the industrial design. Apart from the motherboard, which fills more than two-thirds of the base, the machine is divided firmly into two parts by an aluminium spine. On one side are the expansion boards, while on the other are the floppy drives and the smaller-than-

All the usual PC hardware components are present in a somewhat unusual configuration, although the motherboard itself is conventional

Unlike most PC clones, the Blue Chip only has six expansion slots

usual 130W power supply. This spine does not appear to serve any electrical purpose such as interference shielding — apart, of course, from being a handy mounting for the PC's standard speaker — but is there solely to strengthen the case, support the disk drives, and make the whole structure as rigid as possible.

In fact, rigidity is one of the Blue Chip's advantages. Besides the spine, which helps support the top of the case when the monitor is resting on it as well as preventing the front and back of the chassis from twisting, the floppy disk surround is bolted to a specially formed metal fitting riveted to the machine's base. This fitting also secures the power supply, besides the bolts that fix the supply to the back of the case, making the whole chassis a remarkably strong and rugged structure.

This whole approach to construction seems to have something in common with Hyundai's other major activity: car building. The PC, like today's cars, is built as a set of 'crush-proof cells' and 'crumple zones' that support each other.

The one thing the Blue Chip does *not* look is cheap. It is strong, neat and well-finished by comparison with some of the other clones on the market, and once again it is hard to see how it can be sold at such a low price.

The same goes for the standard monitor that comes with the system, also built by Hyundai and matching the system unit in styling and colour. It is another strong and solidly engineered box, perhaps explaining the need for the strengthening spine inside the system unit it rests on, with the on/off switch and brightness and contrast controls on the front panel where they are needed, rather than at the back as they are on monitors from most other clone manufacturers.

On the review machine the monitor was the 110V model sold in the US, which posed a problem; the system unit power supply has a set of jumpers to switch it between 110V and 220V mains input, but the auxiliary monitor power socket on the back panel only puts out the mains supply that goes in. In the end, this was solved by switching the power supply to 110V operation and using a transformer to step down the UK mains supply going into the system. Blue Chip — or rather, Hyundai — will solve it more simply by supplying a 220V monitor for European use.

The final component of the system is the keyboard, which is not built in Korea but in the keyboard capital of the Far East, Taiwan. Like the many others on the market this BTC-built unit is a competent copy of the IBM PC/AT keyboard, but without the distinctive clicky feel of the genuine article. The layout, besides the key-lock indicator lights and the big Enter and left shift keys introduced with the AT and dropped again with the new 'enhanced' keyboard, is US-style with the '@' symbol above the number '2' rather than the double-quote symbol.

This keyboard is heavier than many of the other cheap clone keyboards, with a steel base rather than plastic to give the board some solidity and stop it sliding around on the desktop. Apart from that the keys themselves have a rather light and plastic feel overall, something like the Amstrad PC 1512 keyboard (actually made in Korea). However, the keyboard is at least the same odd pinky-beige colour of the rest of the system.

The AT-lookalike keyboard has a steel rather than a plastic base, and is also heavier than most clones; this reinforces the machine's 'solid' look

Software

The review machine came with a Blue Chip-labelled copy of MS-DOS 3.2, the latest version generally available, as well as GW-Basic 3.2 and a disk full of advanced diagnostic programs for the machine. The manual supplied states that MS-DOS is not included with the machine and must be purchased separately, but it now appears that Blue Chip is bundling the operating system with the system for the same $649 price.

As so often these days, there is little point in describing the ins and outs of MS-DOS, even when the version number changes. This operating system, now six years old, has graduated from version 1.0 to version 3.2 via versions 1.1, 2.0, 2.1, 2.11, 3.0 and 3.1, with a few other version numbers used by OEMs. The only real basic change was made between version 1.1 and version 2.0, when hierarchical directories and other Xenix-compatible features were added; and development since then has only been to include networking support and the new 1.2Mbyte and 3½in floppy drives introduced with the PC/AT and the PC Convertible.

However, there is extra interest in the Blue Chip PC's MS-DOS since the machine's BIOS — the Basic Input/Output System software in ROM that makes a PC IBM-compatible — bears a copyright message from Falcon Technology. As *PCW* was heading for press, there was a dispute brewing between Microsoft and Falcon over alleged unauthorised copies of MS-DOS being sold under the Falcon name. Falcon and UK distributors like InterOrient Computers had been combating these allegations as strongly as they could, while Microsoft was actually seizing copies of the Falcon DOS wherever it could find them.

To be fair to Blue Chip, the MS-DOS and GW-Basic supplied with the machine bear all the hallmarks of perfectly legitimate Microsoft-licensed versions, and there is nothing in the Falcon/Microsoft dispute to affect the BIOS.

The disk-based diagnostics test the major processor board components, main RAM and video RAM, the keyboard interface and connections, the printer interface, the video display controller, the serial port, and the optional 8087 and hard disk drive if installed. These are included to

Canon technology has set the industry standard for laser beam printers throughout the world and the introduction of the compact new LBP-8 Mark II heralds a new generation of technical excellence and sophistication. Lighter and smaller it might be, but its performance is enough to make most of its established rivals look decidedly flat-footed. Even though they charge more for the pleasure. And the LBP-8 Mark II is aptly named, because so many of its features have been advanced twofold. Just look at the repertoire: **Twice The Paper Capacity** The LBP-8 Mark II paper cassette has a capacity of 200 sheets. So you waste less time re-loading. It can handle varying weights from 60 to 135 gsm, plus envelopes, and there are face-up and face-down modes for easy collating. **Twice The Fonts** The LBP-8 Mark II can mix 12 different fonts and 64 shading patterns on a single page. It has 8 resident fonts. But, if you want to be more creative, there is an expanding library of slot-in cartridges which will soon give you access to more than 100 type styles and point sizes. **Twice The Memory** The LBP-8 Mark II has a built-in memory of 512K for better graphics and font downloading. For full page graphics the memory is expandable to 1.5 MB. **Twice The Emulations** The LBP-8 Mark II has the ability to emulate just about any of the most popular printer brands currently in service. And that means it can use the software they use. **Twice The Life** The LBP-8 Mark II will go on running for 300,000 pages before it needs a major overhaul. And its unique maintenance-free toner cartridge will print 4,000 pages before it has to be replaced. A simple 30-sec job.

Canon
LASER BEAM PRINTER MARK II

POST TODAY

To: Canon (UK) Ltd., Text & Data Products, Canon House, Manor Road, Wallington, Surrey SM6 0AJ. Telephone: 01-773 3173.
Please beam me more information about the Canon LBP-8 Mark II

Name_____
Company_____
Position_____
Type of Business_____
Address_____

Postcode_____ Tel_____ PCW6

back up the power-on self-test (POST) routines, which themselves check memory and helpfully list the various installed options like disk drives and graphics boards while testing them, and are similar to IBM's advanced diagnostics routines.

Aside from the diagnostics, this is very much a plain vanilla MS-DOS and GW-Basic bundle. The only addition is a set of programs to set the optional real-time clock and get MS-DOS to read it; hardly revolutionary, but then, that is the last thing a cheap PC clone wants to be.

In use

The most striking thing about using the Blue Chip PC is the noise. It has a remarkably loud fan, much louder than the standard PC and even louder than the rattletrap Taiwanese PC resident at the review site. The floppy drives, as though in compensation, are quiet and fast.

The monitor does a good job of displaying IBM monochrome text and Hercules graphics, but with an annoying type of long-persistence green phosphor that will be familiar to anyone who remembers the original pre-IBM-compatible Apricot PCs. This meant that, for example, the sign-on logo of Lotus 1-2-3 was clearly visible on the screen even after the program had finished loading and the first spreadsheet display was in view.

There were few other annoying features, apart from the slightly worrying prominence of the hardware reset button on the back panel. Push the machine back against a wall too hard, or move a monitor or printer cable suddenly, and there could easily be the equivalent of a Ctrl-Alt-Del.

The Blue Chip is compact, looks neat on a desk without dominating it, and is still — despite my previous gripes — higher in overall quality than most cheap PC clones.

Compatibility

As we expect these days, there were no software problems at all. Lotus 1-2-3, dBaseIII Plus, Infocom's Cornerstone, Word Perfect, Ability from Migent, SideKick, SoftKlone's Mirror communications package, and everything else found lying around worked fine either in 80 x 25 text or Hercules text and graphics modes.

It would be very surprising indeed if, at this late stage in the game, a PC clone failed to run any software apart from the most obscure; but it still needs to be tried. The performance is another matter. On all the standard Benchtest programs the Blue Chip matched the 4.77MHz IBM PC speeds byte for byte, which is fine as far as it goes but disappointing given the ready availability of switch-selectable pin-compatible 4.77 and 8MHz 8088-2 processors, or even the slightly-faster NEC V20s, as engine-room enhancements.

On the hardware side there was more to complain about. One feature of the Hyundai motherboard design is that the RAM chips are mounted in enormous blue plastic sockets that raise them around half an inch from the board surface. And it turns out that these high-rise sockets are just in the right place to interfere with the insertion of the bulkier type of full-length expansion board. A Mountain hard disk card, for example, would not fit properly and could only be used perched precariously in its bus slot rather than firmly screwed down. (It is worth reporting, however, that the drive did work perfectly and first time, despite looking as though it would fall out of the machine at a breath.)

The problem lies in the height of the board; if it is intended to go right down to the motherboard level, which can be checked visually by seeing if the bus connector sticks out below the card or is on a level with it, then there is a good chance that installation in a Blue Chip PC will be tricky if not impossible. There is no way to generalise about this, and it will largely be a suck-it-and-see exercise.

However, Hyundai has done one service by positioning the 8088 processor right at the edge of the board as far away from the disk drives as possible. This means that installing accelerator boards — or NEC V20s — that require the removal of the 8088 is much easier, without the processor being half-hidden under a disk drive and a maze of power supply cables.

The other hardware problem involved the installation of the AutoCAD design package, which uses a ridiculous 'dongle' copy protection scheme requiring a lumpy piece of hardware to be inserted into the machine's serial port. The Blue Chip PC's RS232 port is recessed into the back panel, which is no problem with normal cables but which makes it impossible to plug the dongle into its proper place. Hence AutoCAD did not get a run on the machine.

It would, of course, have been possible to pull one of the serial ports from the other PC at the review site, plug it into the Blue Chip expansion bus, reconfigure the machine so that the new port was the COM1: that AutoCAD requires, find the adaptor that turns the 9-pin serial connector on the serial expansion board into a 25-pin one, and then try the software out. On the other hand, that would also have meant retrieving the dongle from the street, where it had been flung in frustration, and AutoCAD does not deserve any encouragement anyway.

These caveats apart, there were no operational problems with any of the available cards to hand, as long as they fitted over the odd RAM towers.

Price

The price for the Blue Chip PC comprising single floppy, operating system and monitor is £599 (excl VAT).

Conclusion

If the phrase 'cheap clone' is taken to mean anything that looks and acts as though it was built down to a budget — take the Amstrad PC 1512 as the prime example, although there are plenty of others — then the Blue Chip PC is not a cheap clone despite its price. Swap labels and turn down the spotlights slightly, and many observers would mistake it for an Ericsson PC, costing twice as much.

Internally the machine is built to high standards both electronically and physically, and all the components of the system are pleasantly rugged. If Hyundai could only get the Noise Abatement Society onto the fan and cut the RAM banks down to size, it would be a pleasure to use and as compatible as they come.

Blue Chip can be contacted in the US on (602) 961 1485. END

In perspective

The sub-£500 clone market is getting more and more crowded by the day, and Hyundai is trying to muscle in with a machine that is better built and presented — but just as cheap — as the competition. Comparing it feature for feature with the Amstrad PC 1512 would bring the Amstrad out on top thanks to its bundled software and mouse. But compare it feature by feature with regard to solidity, quality feel and expandability, and the Blue Chip PC wins hands down.

However, the Blue Chip will doubtless be tarred with the 'cheap clone' brush, and the known names will win out unless the buyers actually sit down and work with various machines rather than buy on price. If they did that, and felt the hefty solidity of the Blue Chip, they might very well decide to rely on it.

GET THE MOST FROM YOUR AMSTRAD PC 1512

GET PC PROMISE – THE DATABASE MANAGER

PC Promise gives you instant power to create forms and store, sort and retrieve information to suit your own business needs.

A POWERFUL RELATIONAL DATABASE MANAGER

This simply means that you can store information in a number of separate files and relate the files for the purposes of reporting and updating. For example, if you were looking at your invoice, you could display information from your Customer and Product Files and update your Customer Balance and Product Stock.

This is a considerable advantage over a flat file database (such as REFLEX or CARDBOX) where you are limited to one file at a time.

> "Best buy in databases
> *Which Computer, August 1986*
>
> **A range of features far beyond what businesses usually get for such a price**
> *PC World, May 1986*
>
> **Unusually easy to use in relation to its power – excellent value for money**
> *PC User, April 1986*
>
> **PC Promise . . . its low-cost, minimal system requirements and two-way file transfer capabilities make it ideal**
> *PC magazine, February 1986*"

CIRCLE NO: ON REPLY CARD (149) FAST FACTS ☎ 01-200 0200

EASE OF USE AND FLEXIBILITY

PC Promise is so easy to use – you simply lay out your own forms on the screen as you would on a piece of paper.

Within seconds you can be storing information and retrieving it.

And unique to PC Promise is its flexibility. When you want to change the layout of your form, such as adding and deleting information, all changes are made on the screen, without having to worry about the information in your file.

SOME OF THE MANY TASKS THAT PC PROMISE WILL HANDLE

- Labels
- Standard letters
- Invoicing
- Job costing
- Personnel records
- Mailing lists
- Order processing
- Customer files
- Insurance records
- Sales ledger
- Library records
- Membership files
- Solicitors records
- Car sales
- Patient records
- Inventories

ALL THE FEATURES YOU NEED FOR THE AMSTRAD

- No programming language required
- Will run on one floppy disk
- Variable length fields (no wasted disk space)
- 250 fields per record
- 32,000 records per file
- 1,800 characters per field
- File security by password
- Data can be interchanged with other databases, wordprocessors and spreadsheets (including REFLEX)
- You can define your own menus and help screens
- Screens can be redefined as windows (so you can view several screens at once)
- Provides full colour support.

STILL NOT SURE?

Try out a demonstration diskette of PC Promise. Please send a cheque for £5.00 with the completed coupon, or call us on 01-942 2538.

Also runs on Tandy, Zenith, Olivetti, Sperry, Toshiba, Tandon and all IBM PC Compatibles.

PC Promise for the Amstrad PC1512 is £69.95 (inc. VAT)

Available through local dealers or from P & P Micro Distributors, Lightning Distribution Ltd, Softsel, CSD Ltd, Gem Distribution and Vanguard Leisure.

DUNCAN DDB DATA BASES

Duncan Databases Limited,
9 Chestnut Grove, New Malden,
Surrey, KT3 3JJ, England.
Telephone: 01-942 2538.

Access VISA

To Duncan Databases Ltd., 9 Chestnut Grove, New Malden, Surrey, KT3 3JJ, England.
Please send me a PC Promise demo diskette

Name _____

Address _____

_____

_____

Telephone _____

I enclose cheque value £ _____ WC/4/87

Working to rule

Expert systems depend on their database of rules. Jack Weber shows how a spreadsheet such as Excel can be used to store this core of data.

Expert systems have been one of the most talked-about applications of computing in the past few years. Their origin in artificial intelligence, their retinue of knowledge engineers and their promise of the dawning fifth generation have given expert systems a glamour that is somewhat belied by the few real applications that exist, many in resolutely unglamorous areas like air conditioning maintenance. Nonetheless, these knowledge-based systems have brought many important and valuable computing techniques into use; one of which is a process called rule induction.

The core of any expert system is its database of rules. These codify the knowledge contained in the system in the form of multiple IF ... THEN ... statements. Deriving these rules is the most time-consuming part of creating an expert system. Rule induction automates the process by using the computer to extract general conclusions from a list of specific examples. For instance, I may not know the difference between butterflies and moths but, given a large enough number of correctly identified specimens, I should be able to discover that both have four wings but that only the butterflies have clubbed antennae. Rule induction would establish this fact and create a rule along the lines of 'If antenna shape is clubbed then specimen is butterfly.' Since wing number does not help in the identification, it would be automatically excluded.

Like any attempt to argue from the particular to the general, rule induction is fraught with dangers. Most importantly, its usefulness is very dependent on the selection of examples. But used intelligently, rule induction can have many applications, and not just for creating expert systems. For example, it can be usefully employed in business to analyse pricing policy in a particular market or used to check the validity of one's assumptions about a subject.

Various techniques have been developed for rule induction; the program described here is based on a method called the CLS (Concept Learning System) algorithm. One form of CLS, known as ID3 (Interactive Dichotomiser 3), has been the basis for several successful commercial programs such as Expert-Ease. Although not quite as sophisticated as the commercial packages, this program is perfectly usable for serious applications and the result is presented in a form that should be fairly easy to adapt to many expert system shells.

	A	B	C	D	E	F
1	Attributes	RAM	HD SPEED	DISPLAY	CPU	PRICE
2	Values that	512	fast	EGA	8	1400
3	may be used	640	slow	Hercules	10	1700
4	(up to ten)	1000	*N/A	MDA	*N/A	2000
5	:	*N/A	*N/A	*N/A	*N/A	*N/A
6	:	*N/A	*N/A	*N/A	*N/A	*N/A
7	:	*N/A	*N/A	*N/A	*N/A	*N/A
8	:	*N/A	*N/A	*N/A	*N/A	*N/A
9	:	*N/A	*N/A	*N/A	*N/A	*N/A
10	:	*N/A	*N/A	*N/A	*N/A	*N/A
11	:	*N/A	*N/A	*N/A	*N/A	*N/A
12	No. of values					
13	Examples	512	slow	Hercules	8	1700
14	:	1000	slow	Hercules	8	1700
15	:	512	slow	EGA	8	2000
16	:	512	slow	Hercules	10	1400
17	:	1000	slow	Hercules	10	1700
18	:	512	slow	EGA	10	2000
19	:	640	fast	EGA	8	2000
20	:	1000	fast	EGA	8	2000
21	:	512	slow	MDA	8	1700
22	:	1000	slow	MDA	8	1700
23	:	512	fast	MDA	8	2000
24	:	512	slow	EGA	8	2000
25	:	1000	fast	MDA	8	2000
26	:	1000	slow	EGA	10	2000

Data set for IBM AT compatibles

Choice of language

When approaching a programming task, it is natural to think of the language one knows best. Certainly there is no reason why common languages like Basic or Pascal should not be used for a rule induction program, but would they be the best choice? Professional knowledge-base programs are often written in Lisp or Prolog, which are well-suited to the task but are not widely used outside the academic community. The nature of rule induction suggests another alternative.

I shall be dealing with a database of examples, and many of the operations required are the typical database ones like sorting, deleting, comparing and extracting data according to certain criteria. Normal mathematical and control functions are also needed, plus the ability to employ physical layout to make the rule's meaning clearer. The obvious choice seemed to be a programmable spreadsheet.

All too often, spreadsheets are treated as if they were only fit for accountancy and financial forecasting. Even the simplest spreadsheet is a limited form of language, while the more sophisticated ones are powerful and versatile programming languages in their own right. Their control structures tend to be limited, but they do offer many advanced functions that would take a great deal of

coding in other languages.

The program (which is given in 'Program File') is written for Microsoft Excel (only available on the Apple Macintosh) but it should be possible to transfer the approach to other macro-programmable spreadsheets and databases. The underlying algorithm could, of course, be implemented in any language on any machine.

The rule induction algorithm

First, a few terms need to be defined. For the subject in hand we select a number of *attributes* (for example, size) which can take on a pre-defined range of *values* (for example, small, medium, large). We also select an *outcome* with its own range of values — our aim is to find out how *examples* with different combinations of attribute values allow us to predict the outcome.

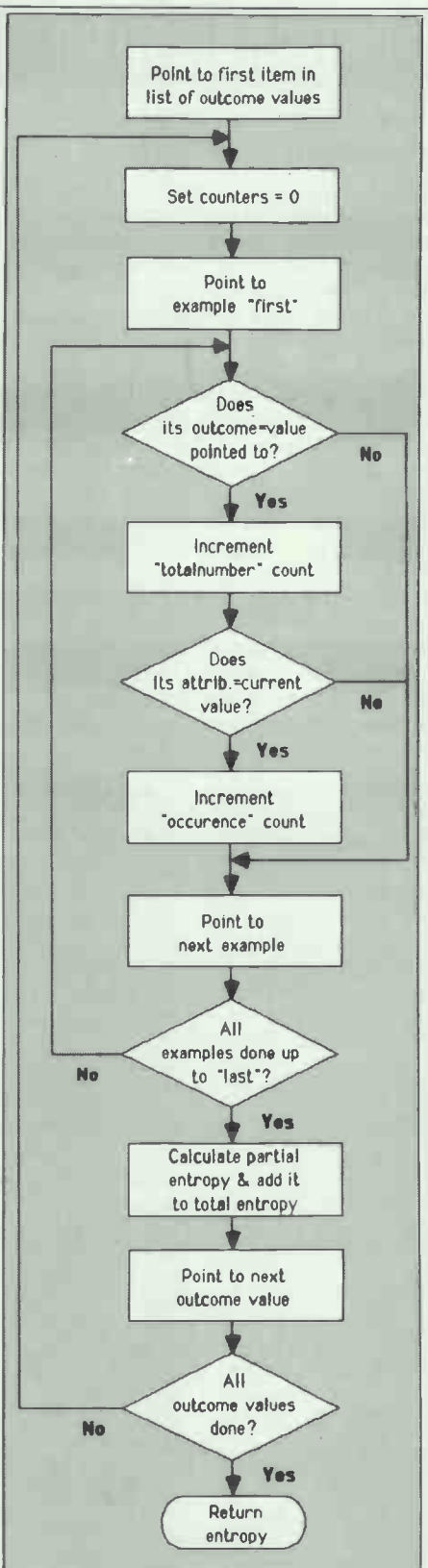
The table opposite shows how different values combine in reality. From these specific examples, the program must induce a general rule which will tell us what outcome to expect for any combination of attribute values. The table shows some features of various makes of low-end IBM AT compatibles. The chosen outcome is price (±£150) and we want to see how the price is determined by display type, CPU speed (MHz), hard-disk speed and RAM size (k).

It is important to appreciate that we will not be creating any new information. Everything that we can hope to obtain is already in the list of examples; all that we are trying to achieve is brevity. For instance, it is evident from the example table that all the models containing an EGA display fall into the £2000 bracket regardless of which other features are present. Rule induction could reduce all these examples to one line: 'If display = EGA then price = 2000'. MDA and Hercules displays, on the other hand, need to be further sub-divided according to other attributes, so they will lead to a more complex branching in the rule.

However, display type may not be the best attribute to begin with; perhaps starting with hard-disk speed would lead to a simpler rule. It is often not obvious what to do, and creating the most efficient rule requires that we should select very carefully the order in which we take the attributes and their values.

This sorting and ordering of attributes and values is the main task of the rule induction algorithm. It is achieved by the repeated use of a mathematical concept borrowed from communication theory — entropy.

Entropy originally arose in the study of thermodynamics but it has since been applied to many other areas. It is a difficult notion to capture without the use of mathematics, but a worthwhile and often-used analogy is to think of it as a measure of disorder or randomness. Suppose that you are sending data down a telephone line. If the circuit were perfect, you could predict that what is received will be exactly the same as the message sent. In practice, interference and degradation of the signal will result in some of the information being corrupted. The result is, therefore, somewhat unpredictable but not totally random; entropy provides a way of measuring this uncertainty.



Flowchart for function macro 'Entropies': calculates entropy of a given attribute value using examples 'first' to 'last'

In the context of rule induction, we are also interested in a form of prediction. Going back to the computer example, the presence of an EGA display turns out to be a perfect predictor of price (that is, it has zero entropy) but what about the Hercules card? Three out of four examples have the same price, which suggests that there is some predictive value but that it is not perfect. Entropy allows us to quantify and compare these predictive powers precisely. Just as individual values have an entropy, so do complete attribute columns. Is display type a better predictor than RAM size? Using entropy we can decide.

Calculating entropy

One simple formula is central to the whole program — it calculates the entropy associated with a particular attribute value. Entropy is a logarithmic function, and it is usual in communications and information theory to use logs to base 2. Like most other programming languages, Excel does not offer base 2 logs as a built-in function but they can be easily calculated using:

$\log_2(N)=\log_{10}(N)/\log_{10}(2)$.

The other element of the calculation is probability; in particular, the likelihood of getting a specific outcome value, given a certain attribute value. In the case of the Hercules display, out of four examples, we get 1400 once, 1700 three times and 2000 not at all; so the probabilities of these outcomes are 0.25, 0.75 and 0 respectively. For each outcome value we must multiply the probability by its logarithm, then sum up all the results like this:

$$\text{Entropy(Hercules)} = -(0.25 \times \log_2(0.25) + 0.75 \times \log_2(0.75) + 0 \times \log_2(0))$$

The minus sign is needed because logs of fractions come out negative and it makes more sense to have a positive answer. Note also that log(0) is an undefined number, but that whenever it crops up it is always multiplied by zero and so can be ignored.

Having obtained all the attribute value entropies, we can compare complete attribute columns by calculating an overall entropy for each. A simple sum of its value entropies would not do because the most common values should contribute more than the rare ones. It would be much better to multiply each value entropy by the probability of finding that value. Out of 14 examples, six have EGA, four Hercules and four MDA.

The corresponding entropies are 0, 0.8113 and 1, so the overall entropy of the Display attribute is:

Entropy(Display) = 0 x (6/14) + 0.8113(4/14) + 1 x (4/14)

Doing the same for all the attributes, the results come out to: RAM (1.1180), Hard Disk Speed (0.9721), Display (0.5175), CPU Speed (1.1221); so Display is the one to start with.

It is important to note that entropies are not absolute, fixed quantities — in fact they are extremely fluid, being based only on the particular set of examples. Add or delete a single example and the entropy could change substantially — the assertion that swans are white has zero entropy in Europe but a much higher entropy if Australian examples are included. Similarly, as the program works its way through, it will take different subsets of examples and the entropy that appears for any attribute value is likely to be quite different each time.

Program structure

The first step is to sort the attribute columns into the optimum order. The most efficient rule will begin with the attribute that gives most information about the outcome (has lowest entropy) and work through to the least informative. Then, working column by column across the table, examples must be classified into blocks which correspond to the branches of a decision tree. In the first column, this is simply a matter of sorting the examples so that all those with the same value are together and the values are in ascending order of entropy.

We begin with a table of examples — each column is an attribute, each row is an example showing an actual combination of values for those attributes. The program condenses this information into the most efficient form. Fortunately, a spreadsheet is ideal for displaying and manipulating tabular data. A program's operations will be done within the example table, sorting and deleting entries until what is left — the rule — is as efficient a description of the original table as possible.

Suppose that the first attribute has three values; after sorting, they will form three blocks of examples (branches of the tree). The second attribute column is then tackled as if it were three separate sets of examples. Within each of these three blocks, the values of the second attribute are sorted to create a second level of sub-blocks. If the second attribute has two values, there will now be up to six (3*2) blocks. This sub-division continues until all the attributes have been done. In any column there may be one or more values which give a constant outcome — like the block formed by the EGA display type. Such values have zero entropy and do not need to be

	A	B	C	D	E	F	G	H	I	J	K
1	Attributes	Attr. 1	Attr. 2	Attr. 3	Attr. 4	Outcome					
2	Permitted	#N/A	#N/A	#N/A	#N/A	#N/A					
3	values	#N/A	#N/A	#N/A	#N/A	#N/A					
4	(up to ten)	#N/A	#N/A	#N/A	#N/A	#N/A					
5		#N/A	#N/A	#N/A	#N/A	#N/A					
6		#N/A	#N/A	#N/A	#N/A	#N/A					
7		#N/A	#N/A	#N/A	#N/A	#N/A					
8		#N/A	#N/A	#N/A	#N/A	#N/A					
9		#N/A	#N/A	#N/A	#N/A	#N/A					
10		#N/A	#N/A	#N/A	#N/A	#N/A					
11		#N/A	#N/A	#N/A	#N/A	#N/A					
12	No of vals.								Sort keys		Ranking
13	Examples	#N/A	#N/A	#N/A	#N/A	#N/A					
14	(up to 20)	#N/A	#N/A	#N/A	#N/A	#N/A					
15		#N/A	#N/A	#N/A	#N/A	#N/A					
16		#N/A	#N/A	#N/A	#N/A	#N/A					
17		#N/A	#N/A	#N/A	#N/A	#N/A					
18		#N/A	#N/A	#N/A	#N/A	#N/A					
19		#N/A	#N/A	#N/A	#N/A	#N/A					
20		#N/A	#N/A	#N/A	#N/A	#N/A					
21		#N/A	#N/A	#N/A	#N/A	#N/A					
22		#N/A	#N/A	#N/A	#N/A	#N/A					
23		#N/A	#N/A	#N/A	#N/A	#N/A					
24		#N/A	#N/A	#N/A	#N/A	#N/A					
25		#N/A	#N/A	#N/A	#N/A	#N/A					
26		#N/A	#N/A	#N/A	#N/A	#N/A					
27		#N/A	#N/A	#N/A	#N/A	#N/A					
28		#N/A	#N/A	#N/A	#N/A	#N/A					
29		#N/A	#N/A	#N/A	#N/A	#N/A					
30		#N/A	#N/A	#N/A	#N/A	#N/A					
31		#N/A	#N/A	#N/A	#N/A	#N/A					
32		#N/A	#N/A	#N/A	#N/A	#N/A					
33	No of egs										
34	Entropy										
35	table										
36											
37											
38											
39											
40											
41											
42											
43											
44											

The empty worksheet template

considered any further because subsequent attributes can have no effect. That branch of the tree is now fully resolved and, within that block, all columns to the right will be cleared.

If our choice of attributes was appropriate, all the examples will have reached zero entropy by the final column. Any remaining non-zero blocks represent conflicting data which may need additional attributes to resolve them or may simply contain inappropriate examples. For instance, the sample table contains only machines with 20Mbyte hard disks. Clearly it would be foolish to include a model with a 30Mbyte disk as it is not a fair comparison (though, of course, hard-disk capacity could have been chosen as one of the attributes). The program allows the user to remove all conflicting data or leave it in, in which case the output of a branch will appear as a list of the different outcome values that it leads to.

The example data is now very nearly in its final form but further tidying up may still be necessary. In particular, duplicate lines may now be present since examples which originally differed only in their values of an attribute that was found redundant will now, after pruning, be identical. The program will remove any such duplicates and re-sort the table so as to sink empty lines to the bottom. Finally, within each block, columns of identical values will appear. All except the first entry are cleared to create a neat, uncluttered layout, and the now much reduced example table is copied into a separate area of the worksheet laid out to present the induced rule (see 'The completed rule' table).

To achieve all this, the program must sort by columns and by rows; this is done by providing additional tables around three sides of the example area. Above it is a table listing all the possible values of each attribute and of the outcome. Below it lies a table in which the entropies corresponding to each attribute value are stored — these two tables match each other so that the third value in the second column has its entropy in the third position of the second column down below. At the very bottom lie the overall entropies of each attribute which provide a key for sorting the columns.

To the right of the examples lies a table of sort keys in which entropy values corresponding to each example are entered and used to sort the rows within each block. A column at the far right holds a final sort key based on a ranking associated with each block of the first attribute. This is used to deal with situations in which a value with low entropy nevertheless requires more attributes to resolve it than another that began with higher entropy but was then quickly resolved by a subsequent attribute. By selecting complete columns and rows across all the tables, it is easy to keep associated entries lined up throughout all of these sort and deletion operations.

If: / **then:**

DISPLAY=	HD SPEED=	RAM=	CPU=	PRICE=
EGA				2000
MDA	fast			2000
	slow			1700
Hercules	slow	1000		1700
		512	8	1700
			10	1400

The completed rule

	A
1	**Rule Induction**
2	
3	© Jack Weber January 1987
4	
5	**Program**
6	count the number of allowed values for each attribute
7	=SELECT(!$B$12:$F$12)
8	=FORMULA.FILL("=MacrosICountup(R[-10]C,R[-1]C)")
9	count the number of attributes
10	=SET.VALUE(A13,1)
11	=SET.NAME("attributes",0)
12	=SET.NAME("attributes",attributes+SIGN(INDEX(!$B$12:$E$12,A13)))
13	=A13+1
14	=IF(A13<5,GOTO(A12))
15	count the number of examples
16	=SELECT(!$B$33:$F$33)
17	=FORMULA.FILL("=MacrosICountup(R[-20]C,R[-1]C)")
18	work out the entropy of each attribute value
19	=SELECT(!$B$34:$E$43)
20	=FORMULA.FILL("=MacrosIEntropies(RC,1,20)")
21	work out the overall entropy of each attribute
22	=SELECT(!$B$44:$E$44)
23	=FORMULA.FILL("=MacrosISumentropies(RC)")
24	sort all the attribute columns in order of increasing entropy
25	=SELECT(!$B$1:$E$44,!$B$44)
26	=SORT(2,"R",1)
27	Now that attribute columns are sorted into a classification hierarchy,
28	sort examples according to their entropies within each column.
29	Begin by creating a sort key based on the first attribute.
30	=SELECT(!$G$13:$G$32)

An example of the Excel rule induction program. The full listing is in Program File, page 191

Using the program

Excel offers worksheets, which are conventional spreadsheets, and macro sheets which contain the program (command macro) and any specially created functions (function macros) that can then be put into worksheet cells or called by the command macro.

The first thing to do is to prepare and save a template for the example tables on the worksheet. Note that two of the tables in the box opposite have been initialised to the error value #NA to differentiate blank cells, which would be treated as containing the number zero, from cells that may have zero as an actual value. The template has been designed to accommodate 20 examples with up to four attributes, any of which may have up to ten values (numbers, text or Booleans). It is perfectly possible to set up much larger tables but the relevant cell references will have to be changed in the program.

Next, the main program and the special functions need to be put onto a macro sheet called 'Macros'. It is good programming practice to use labels for all cell references; I have deliberately not done so because the program contains many loops, often nested, and instructions like =GOTO(loop5) are harder to follow in a long program than =GOTO(A57). Similarly, loop counters have been put into cells rather than named as this makes debugging easier if one examines cell values during execution.

One consequence of this approach is that the program must be entered exactly as it is, at the very least allowing blank lines where text comments now exist. When complete, unwanted comments or spaces can be removed and Excel will automatically adjust all cell references. Labels in bold type mark the start of individual macros and must be defined (using the Define Name command) so that the macros can be called. 'Program' is a command macro; all the rest are function macros that return a value.

To use the program, make the worksheet window active, enter the lists of permitted values and the actual examples in the areas initialised to #NA, and run the Program macro from the menu bar. As the program runs you will see values being filled in and examples being sorted and pruned. The final rule will emerge in about five to ten minutes.

Limitations

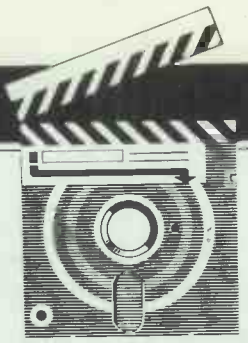
It cannot be stressed too strongly that rule induction takes the adage 'garbage in — garbage out' to new heights. It is not a substitute for thought. Given well-chosen examples CLS/ID3 creates excellent rules, but it is particularly susceptible to conflicting examples. This lays the responsibility on the user to supply good data — the examples being entered must be ones that can reasonably be expected to be comparable. As many examples as possible should be entered. If conflicts do appear, consider why they are there — unfair comparisons, poor choice of attributes or simply because this is the one exception that proves the rule.

Further reading

Machine Learning by R Forsyth (*Artificial Intelligence: principles and applications* by M Yazdani — Chapman and Hall 1986)

Finding Rules in Data by B and W Thompson (*Byte* — November 1986)

END



SCREENTEST

Deluxe Paint II

Much has been made of so-called computer art packages, and their usefulness — or not, as the case may be — to artists. Stephen Applebaum tests out Deluxe Paint II for the Amiga, which is one package that lives up to its name.

The visual representation of objects using computers has become so commonplace, particularly in the television advertising business, that few of us take more than a moment's notice of such fantastical images as a multi-coloured line of Smarties scudding over a football pitch; even further from our thoughts is the technology that allowed the designers to paint and animate those wonderully complex images.

Though many artists have not yet realised it, the computer has given birth to a new and important medium of expression that could lead them along creative paths hitherto unimagined. Until a short while ago, not one micro was available that had the specifications necessary to stimulate the kind of functions artists require. Now there are two: the Atari ST and the Commodore Amiga.

Commodore recognised its machine's potential as a graphics workstation right from the word go. And to make sure that everyone else did, invited the now sadly deceased Andy Warhol along to demonstrate the Amiga in his own inimitable way at its glitzy launch in New York.

But you would not have to be an Andy Warhol to draw and paint with the Amiga. We can all open up the computer's graphics treasure chest for ourselves with Electronic Arts' recently released Deluxe Paint II, an enhanced version of Deluxe Paint.

Of course, Deluxe Paint II can't make you into an artist; what it can do, though, is give you the tools to create and manipulate images quickly and 'easily'. Images which a lot of artists would probably not see as the 'be all and end all', but rather as a means to an end: the prototypes for works produced in other mediums.

But, no doubt, there will be those artists who use the computer as an art form in its own right. David Hockney, for instance, voiced his enthusiasm for the medium after being given an opportunity to work on a Xerox machine.

Toolbox design

Deluxe Paint II's display looks very similar to that of Art Director and Degas Elite, two painting packages for the ST reviewed in the February issue of *PCW*.

On top of all the usual design tools, however, Deluxe Paint II has a host of facilities which allow you to manipulate your paintings in whatever way you please. A particularly interesting feature is the ability to rotate an image of almost any size about all three x, y, and z axes.

But more of that later. First we must look at the fundamental design tools stored in the 'toolbox', the backbone of the package.

Deluxe Paint II's toolbox is displayed as a narrow, vertical strip, running down the right-hand side of the work area. At its top is a compartment containing ten built-in brushes, designed to produce different strokes.

Any one of these brushes can be modified by selecting it with the right mouse button, and then moving it diagonally across the work space until it reaches the required size. Since the built-in brushes can all be used in conjunction with Deluxe Paint II's airbrush and line-drawing tools, this ability to make your own modifications increases the package's overall flexibility.

There are four line-drawing tools in the toolbox, two of which are for drawing dotted and continuous lines freehand. The former is ideal for sketching, as no matter how fast you move the mouse, the brush always keeps up with your actions; the latter is much more sensitive to movement, and is therefore suited to more detailed work.

The other two line-drawing tools are for creating straight lines and curves.

Straight lines are drawn by clicking the points on the screen where you would like the line to start and finish. Curves, too, begin life in this way, but differ in the sense that the line drawn between the two fixed points can then be dragged to form a curve, using the cursor as a kind of hook.

Four shape tools are available for drawing filled or unfilled circles, rectangles, ellipses and polygons. Clicking the right mouse button on any of these produces a requester box with controls to change the type of fill used to colour a figure. You could, for instance, select a colour range encompassing many gradations of the same hue or a pattern.

Below the shape tools there is an icon that resembles four photograph brackets. This is the brush selector, a powerful tool that lets you create your own brush out of any part of a picture; and there is no limit — other than the size of the display itself — to how big you make it.

Brushes are made by dragging a window around the section of a picture you would like to paint with. Holding down the left button during this process copies the windowed section, while holding down the right one actually cuts it from the page, revealing the background colour.

This second characteristic makes Deluxe Paint II's brush-making facility ideal for rearranging the layout of

Areas of the screen can be modified in several ways. One of these involves stretching corners and edges of an area as if it were a rubber sheet

An example of perspective painting. The Tutankhamun picture has been reflected, pasted and stretched into a perspective area

compositions, as you can pick up any piece of a page and move it to another location, without having to erase and redraw the particular portion elsewhere.

Brushes made using the method described above are generally rectalinear — that is, either square or rectangular in shape. It is possible to create a brush of virtually any shape, however, simply by double clicking on the brush selector icon. This switches off the window system, and allows you to 'fence' round a section of the page as if you were drawing a polygon. In this way, you can create a non-symmetrical brush.

If you want your custom brush to be round, you can cut around a circle drawn on the background colour using the window method and still have a brush with rounded edges, because Deluxe Paint II treats the background colour as a transparent sheet. Utilising this feature, you can make intricately shaped brushes with holes that allow a painting to show through as the brush is passed over the top.

Moving down the toolbox, a 'Grid' option allows you to overlay an invisible grid on the entire work area, making it rather like a large sheet of graph paper. Although the grid is invisible, it makes its presence known by restricting the movement of your drawing tools to specific, evenly spaced points.

Like a lot of the toolbox functions, Grid can be modified to suit your requirements. A 'gridding requester' contains options to adjust the space between points along the x and y axes. If you are working in three dimensions, a third option is included to cover the z axis.

Obviously there is not much call for a grid when you are doing freehand work, but it is indispensable when designing a repetitive pattern — something frequently done in the textile industry.

Other tools in the toolbox include 'Symmetry', which lets you draw up to 40 mirror images about a single point simultaneously; 'Undo'; 'Clear Screen'; 'Magnify'; and 'Zoom'.

Activating Magnify splits the screen into two halves, displaying both the magnified section of your painting and how it looks normally. Clicking on the toolbox Zoom icon increases the magnification still further, enabling you to enlarge pixels up to 400 times their original size.

Located at the base of the toolbox is the palette, from where you select your colours when painting. Depending on which mode you are working in and how much memory your Amiga has, the palette can contain up to 32 different colours; and you are not confined to the paints in Deluxe Paint II's default palette. If there are specific colours that you would like to use, but which are not available, you can mix them yourself from an amazing repertory of 4096 shades, using another of the package's requester boxes.

On top of the palette is a small square containing a circle. This is the colour indicator and it is used to show the current background and foreground colours. Clicking on this with the right mouse button displays a kind of 'mixing desk' for colour called a 'colour palette requester'.

Every colour, as you are no doubt aware, consists of a red, a green and a blue component which means that all you have to do to create a new one is to alter the amount of each component relative to the other two.

Enclosed in the colour palette requester are slide controls for changing the intensity levels of a colour's prime components on a scale of 0 to 15. White, for example, is made by mixing the three components at maximum intensity (15), while black is mixed by lowering all three to 0.

Next to the slide controls there is a smaller version of the current palette. You can select any colour from here and then change it, simply by fiddling with its levels of red, green and blue until you have the right colour. A small box above the palette contains the currently selected colour, and shows any changes you make with the aforementioned controls. An alternative way of mixing colour is to change its hue, saturation and value. As before, these are manipulated via slide controls.

Hue, saturation and value refer to a colour's position in the visible spectrum, its strength or purity, and its black level or how much light it would reflect. If you were to mix white using this method, you would set both the levels of hue and saturation at 6, and the value to 15, since it contains no black.

A useful function of the colour palette requester is that you can create colour spreads composed of subtly different shades of the same hue or evenly spaced gradations between different hues. All you do to set-up a colour spread is tell Deluxe Paint II the colours you want at its extremities. The program then calculates the new shades on the basis of the properties of the first and last colours and the number of steps between them in the palette.

Deluxe Paint II's colour spread facility is useful for producing different shades of the same colour. In much the same way, it is possible to produce colour ranges made up of tones that run into each other.

The colour palette requester allows you to define four colour ranges, all of which can then be used as a fill or paint. They can also be cycled through to produce simple anima-

Please send me the fine print on your fine LX-86 printer.
Name _____ Position _____
Company/Address _____

_____ Telephone _____
To: Epson (UK) Limited, Freepost, Birmingham B37 5BR.
(Alternatively, call up Prestel *280# or ring 0800 289622 free of charge.) EPSON LPW2

nt £450 on a PC,

You shouldn't be too surprised at the print quality of this text. (After all, if you've already spotted the name on the machine below, you wouldn't expect anything less.)

What will surprise you, however, is the price of the Epson LX-86. Its recommended retail price is a mere £275 (excluding VAT), which makes it the perfect printing partner for your budget PC.

No other printer at this price can match its performance. In fact, the LX-86 boasts a host of features that would put many more expensive machines to shame.

It can produce an enormous range of typestyles in both correspondence - quality mode (like this) and in draft, justifying, centring and underlining text if necessary. It can even draw pies, graphs and charts.

Furthermore, changing between the fonts on the LX-86 is extremely simple. All you have to do is press a button on the front of the machine.

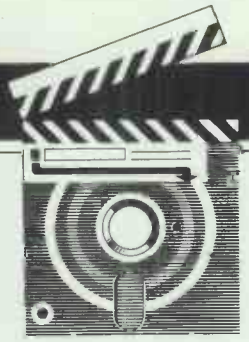
In draft mode, the LX-86 nips along at a brisk 120 characters per second, while in letter-quality mode, it can manage a respectable 16 c.p.s..

And to save even more time, a 1K buffer (or memory) is fitted as standard. This frees your computer for other tasks more quickly.

An IBM character set also comes as standard, while a variety of paper feed options are available to make the printer still more flexible.

Of course, the LX-86 is just as reliable as Epsons have always been. The print head will strike the paper at least 100 million times before it even thinks of giving out.

Yet there's even more to tell about the LX-86 than this. For further details on this cut-price printer, cut the coupon.



SCREENTEST

tion, using a colour cycle command found in several of the menus.

Pull-down menus

So far I have only described the toolbox. There are, however, many more elements to Deluxe Paint II, all of which are dispersed throughout six pull-down menus called 'Picture', 'Brush', 'Mode', 'Effects', 'Font', and 'Prefs' (preferences).

Not immediately visible, the menu headings have to be 'uncovered' by pointing to the top of the screen and clicking on the right mouse button.

Stored away in the Picture menu are utilities for saving and loading pictures to and from disk, as well as outputting them to a printer. I'll refer to the Picture menu in more detail below, as many of its utilities cannot be understood until you are familiar with the facilities offered by the other menus.

Brushes play an important role in Deluxe Paint II, as we have already seen. Not only are they used to paint with but also to move and copy parts of a picture: a role which is greatly extended by the contents of the Brush menu. Custom brushes, made with the brush selector tool, can be saved and loaded in exactly the same way as pictures, via the Brush menu. Saved along with a brush is the palette active at the time, plus colour cycling information and any colour ranges that were defined.

In this way, it is possible to build-up large libraries of brushes culled from pieces of past work. To get you started, Electronic Arts has included an art disk in the Deluxe Paint II package, full of predefined brushes of all shapes and sizes.

Brushes can be manipulated in a variety of different ways, producing some quite stunning effects. For example, on the art disk, there are — along with the brushes — a number of brilliantly drawn screens. One of these in particular, a depiction of the famous Tutankhamun death mask, lends itself very well to being resized and flipped.

A number of rotations are available in the Brush menu, allowing you to turn a brush, and hence any portion of a painting, through any angle, ranging from fixed steps of 90° to anything between 1° and 360°.

Apart from changing a brush's orientation, you can also distort it. 'Shear', for instance, fixes the top of a brush, leaving the rest of it free to be dragged either left or right. When applied to text, no matter what its size, Shear has the effect of italicising it. This is useful for the design of letter headings or bill posters.

Having sheared your brush, you could then bend it. Deluxe Paint II's 'Bend' function operates in both the horizontal and the vertical planes, producing some extraordinary results. By bending a brush vertically, it can be made to look as though it is stuck on the outside of a tin can.

Whereas the Brush menu items alter a brush's physical appearance, the contents of the Mode menu are concerned with cosmetic changes.

'Matte', the first option in the Mode menu, displays a custom brush in its original form. 'Colour', on the other hand, washes a brush in the current foreground colour, turning a multi-coloured brush into a solid one. Using these two commands together, it is easy to create, say, a drop shadow behind an image, thus producing the illusion of depth.

Several of the Mode menu functions have no effect on the brush *per se*, but use it to make changes to the current painting. 'Smear' is one such command.

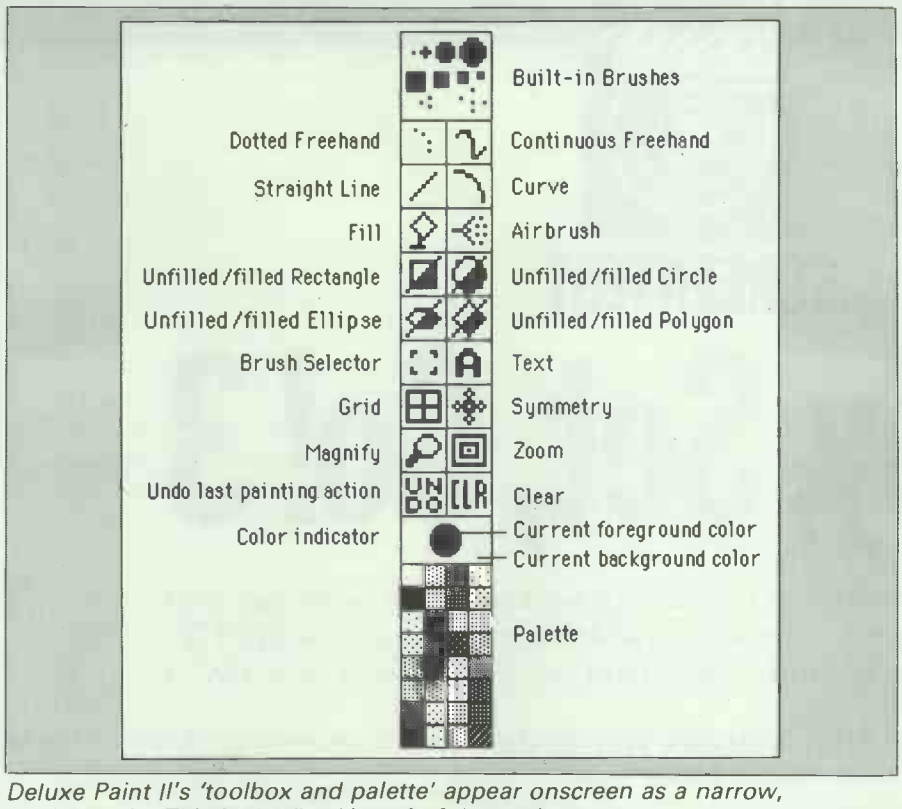
Moving a brush over a picture in Smear mode causes colours to run into each other, but although the colours become smeared, they do not mix and form a new hue. To make them do that, you must use the brush in 'Blend' mode. This time, when two colours meet, they combine to form a third shade.

One of the most useful painting functions in the Mode menu is 'Shade'. Using this, you can create some intricate shading effects that would otherwise be very difficult to achieve, not to mention time-consuming. When painting in Shade mode, the brush only operates on colours that are in a currently selected cycle range. Pressing the left mouse button while over one of these colours paints it with the next higher shade in the cycle range, while pressing the right button paints it with the next lower shade.

When airbrush artists paint, they often use stencils or friskets to recreate often-used patterns, and to protect parts of the picture painted in a different colour. Deluxe Paint II's 'Effect' menu contains a 'Stencil' submenu with options that allow you to make your own stencils and save them onto disk for future use. Stencils, in Deluxe Paint II, *lock* certain selected colours or areas of a picture, making it impossible for the user to

Any area of a picture can be zoomed in on at varying levels of magnification. Fine touching-up can be done more easily on the enlarged section

You can use any part of a picture as a paintbrush and distort it in several ways. The paintbrush can be used to paint with



Deluxe Paint II's 'toolbox and palette' appear onscreen as a narrow, vertical strip. This is the 'backbone' of the package

paint on them.

Activating a function called 'Make' calls up a 'stencil requester'. In this is contained a version of the current palette. Clicking on any of the colours in the requester box, or on the work area, or the onscreen palette, forms an invisible mask which overlays those areas painted in the colours selected and prevents them from being painted on. This means that you can spray over a painting with the airbrush to your heart's content; the only bits which actually receive the paint being those left unselected in the stencil requester.

Placing a stencil over a painting enables you to paint in front or even behind locked areas of colour. It also means you do not have to worry about being accurate with the airbrush, as there is no way that paint will be sprayed on the protected areas.

A command called 'Fix', located in a sub-menu called 'Background', also found in the Effects menu, works in a similar way to stencil. But instead of protecting a specific area, Fix locks the current picture, leaving it unaffected by anything drawn on top of it, or even the Undo and Clear Screen commands.

Three dimensions

Unlike the majority of art packages on the market, Deluxe Paint II allows you to manipulate objects in three-dimensional space, thus making it possible to give a painting a feeling of depth or perspective. Working in three dimensions can be confusing at first. Not only have you the x (horizontal) and y (vertical) planes to think about, but also a third which runs perpendicular to the screen, the so-called z plane.

Deluxe Paint II's 'Perspective' functions work on custom brushes only. To begin the process, you first have to set the perspective centre. This is a mark that can be placed anywhere on the screen, and is used to represent the viewer's eye level.

Having set the perspective centre, you then put the brush into 'Perspective' mode using a command called 'Do'. This replaces the current brush with a four-cell matrix, which can be moved anywhere on the screen. At this point, the brush (matrix) shares the same axes as the screen: that is to say, its x axis is also the screen's x axis, and so on. Moving the mouse from left to right, therefore, moves the brush horizontally along the x axis; whereas pushing it forward moves the brush up the y axis.

In Perspective mode, the top three rows of keys on the Amiga's numeric keypad provide the controls for rotating the brush about the x, y and z axes respectively. This is where things can become confusing.

Holding the SHIFT key together with keypad 8, rotates the bush 90° about the x axis so that all you can then see of the brush is a line, since you are looking at it end on. After a brush has been rotated, its axes become relative to its orientation rather than the screen.

Following the rotation of the brush in the example above, for instance, the brush's y axis now lies perpendicular to the screen while its z axis lies along the screen's vertical plane. Moving the mouse forward still moves the brush along the y axis, though instead of rising up the screen it goes into it, its size *apparently* decreasing as it gets further away.

Using the keypad, it is possible to rotate a brush through any angle about one or all of the three planes. Furthermore, a brush can be made to move up and down the z axis by pressing the '" and ';' keys. That said, it is possible to *fix* one of the three axes so that the brush can be, say, moved up and down the z axis and along the y axis using the mouse.

Deluxe Paint II's 'Fonts' menu lets you load a library of fonts included on the Deluxe Paint disk. Once in memory these can be enlarged to different point sizes, italicised, put into bold or underlined. If interlace or hi-res is used with a standard Amiga monitor, the screen flickers constantly. The only remedy is to invest in a high-persistence monitor.

As mentioned above, the Picture menu contains utilities to save pictures onto disk. An extensive list of print options also lets you produce hardcopy versions of your paintings which can be printed in colour, shades of grey or black and white.

Other functions allow you to specify the size of the left and right margins, and alter the aspect ratio of the picture. This last feature is particularly handy, as it means your paintings should not come out with that 'squashed' look.

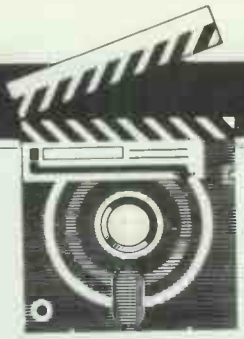
Selecting 'page size' from the picture menu reveals a requester with controls for setting the size of the onscreen page. There are three preset sizes included in the requester, though you can input your own measurements. The maximum page size possible is 1008 × 1024, but this means that you are limited to a palette of only two colours.

Deluxe Paint II can work in four screen modes, all of which can be accessed from the Picture menu. They include: lo-res (320 × 200 with 32 colours available); med-res (640 × 200) with 16 colours available); and interlace and hi-res (640 × 400 with 16 colours if memory expansion has been fitted).

Conclusion

Deluxe Paint II is one of the most comprehensive painting programs on the market. One thing that is missing, though, is a keyboard overlay. Since virtually all of the package's functions can be accessed via the keyboard, I would have thought that this would have been an obvious inclusion. But that aside, Deluxe Paint II is little less than an artist's dream come true.

Deluxe Paint II costs £129 (incl VAT) from Silica Shop on (01) 301 1111. END



SCREENTEST

Ready, Set, Go! 3

The race to produce desktop publishing packages has been fast and furious, but one worthy competitor which got off to a slow start is making up for lost time. John Donaldson tests out Ready, Set, Go! 3.

When Apple Computers invented the concept of 'desktop publishing', the product it chose to spearhead its drive was Aldus' Pagemaker: this package brought the power of dedicated publishing systems onto the desks of Mac owners. Around the same time another desktop publishing package was launched called Ready, Set, Go!. Unfortunately, Pagemaker was much better than Ready, Set, Go!, so people didn't take much notice of it.

Now the package has been almost entirely re-written and has re-emerged as Ready, Set, Go! 3 (from now on RSG3). It boasts all the latest features such as hyphenation and kerning, and looks set to knock Pagemaker right off its perch.

In use

Ready, Set, Go! 3 is supplied on two 400k Mac disks. The first contains the usual Mac system files including the laser printer drivers; while the second contains the RSG3 program file and the dictionary for the spelling checker. None of the files are copy-protected, so it's easy to copy the program onto hard disks or to make back-ups onto 800k Mac Plus drives.

The program is started in usual Mac style by double-clicking the RSG3 icon. When the program has loaded, the screen divides into a number of sections with the main window displaying the page layout of the current publication; it *is* possible, however, to have more than one publication loaded at any one time with each publication displayed in its own window. The only limit on the number of publications which may be loaded is the amount of free memory in your machine.

The page can be viewed in a number of different scales ranging from 'double size' through 'full size' down to 'size to fit', which displays the whole page in miniature within the window. One restriction is that RSG3 only allows you to lay out one page at a time, so it isn't possible to lay out a spread in the same way as Pagemaker 2. Using the 'Facing Pages' command from the 'Special' pull-down menu, you can see how a spread will look — but you can't change it.

The finished page shows how text can be made to 'run around' a picture block. The text in the headline is Times Roman 36-point which has been 'closed up' by one point to make it compact (original reduced by 34%)

To the left of the publication window there are two toolboxes. The top box contains icons which allow you to manipulate graphics and text and draw lines, ovals and boxes, while the bottom box allows you to choose from a range of line-styles and widths.

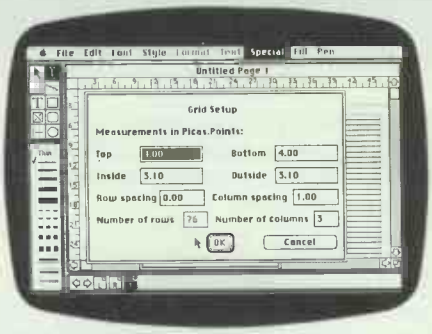
Running along the bottom of the screen are icons representing the pages of the publication. The first two of these are left and right-hand 'Master Pages'. Anything placed in these two pages can be duplicated onto all subsequent left or right-hand pages.

If your publication has more than twenty pages, then the left and right arrow icons can be used to scroll through the pages until you find the one you want. It is also possible to use the 'Go to page' command from the Special pull-down menu to go directly to any page.

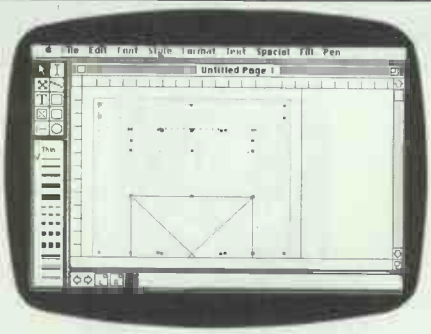
One of the main features which sets RSG3 apart from programs such as Pagemaker is the way that it keeps the design of the page totally separate from the words and pictures which are eventually placed in the design. With Pagemaker, you place text and graphics as you go along until you end up with a completed page. Although this makes the page layout easy to visualise, it does make it very difficult and time-consuming to repeat the same basic design on a number of different pages. To achieve a finished page using RSG3, you first have to create a design and then place your text and graphics.

Design

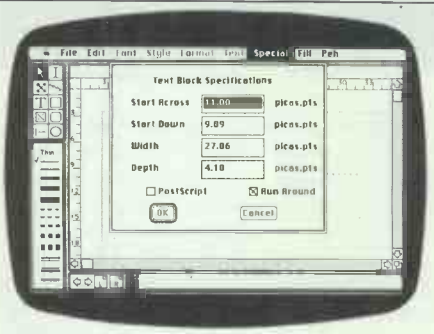
The first thing to do when you want to design a page using RSG3 is to set the page size; it's all too easy to forget to do this because RSG3 makes no attempt to remind you that it should be done. This is exacerbated by the fact that the program invariably defaults to something other than the A4 paper size which is the most common in the UK. Page-



'Grid Setup' can be used to design grids to your own specification, in this case 76 lines over three columns



Before you can place the text, you must design the page using text and picture blocks



All objects on the page have an associated specifications sheet, which is very useful for positioning objects

maker, on the other hand, forces you to set the page size before it allows you to do a layout.

Another shortcoming of RSG3 is that it only supports the standard Mac paper sizes. There is no provision for A3, for example, or for the custom paper sizes allowed by other page-layout packages. Round 1 to Pagemaker.

It is also a good idea at this stage to set the unit of measurement in which you want to work. RSG3 supports inches, centimetres, picas and points. I found that inches was the most useful setting because RSG3 allows you to position objects to the nearest thousandth of an inch. If you use centimetres, for example, you can only work to the nearest millimetre which isn't as accurate.

The second stage of page design is to decide on a grid. The idea of using a grid as a basis for the design of a page goes back to 1946 when a system called Modular was patented by the infamous French architect LeCorbusier (yes, the same man who gave the world the idea of the tower block). The idea of using a grid is to provide a framework on which to base your page design. Apart from anything else, it makes it easy to get everything on the page to line up correctly.

The size of the grid can be defined by selecting 'Design Grids' from the Special pull-down menu. This allows you to choose from predefined grids ranging from one row by one column up to eight by eight. If this is not to your liking, you can select 'Grid Setup'. This allows you to define your own grid including the number of rows and columns and the size of the gaps in between as well as the top, bottom, left and right margins.

After you have designed the grid, every object you place on the page will automatically snap to the nearest grid point. If necessary this 'snap to grid' feature can be turned off from the Special menu.

As soon as all the preliminaries have been completed, you are ready to design a page; design is achieved by placing objects on the page. All the available objects are represented by icons in the toolbox in the top left-hand corner of the screen, the majority of which will either be text blocks or picture blocks. As their name implies, these contain text or graphics respectively.

To design a page, you decide where you want the text to be and place text blocks on the page in the appropriate places using the Mac mouse. Text blocks are represented on the screen by white rectangles, and they can be moved, expanded and compressed using the standard Mac techniques of grabbing a section of the rectangle and pulling it into the required shape.

When you have created the text blocks for a publication, you link them together using the linker tool from the toolbox. Linked blocks need not be next to each other; they can be anywhere, in any order, within the publication.

When text is read into a linked text block, it automatically flows from one linked box to the next along the chain. This is different from Pagemaker where you have to manually flow text down each column in turn. The main problem with linked blocks in RSG3 is that the links are not shown on the screen, so if you have a number of different chained stories within one publication, it can be difficult to remember which block is linked to which.

Next, you decide where you want to position the graphics and place picture blocks in the appropriate places. Picture blocks are represented by a rectangle with a large cross drawn along its diagonals. Finally, using the remaining tools from the toolbox, you can draw on any lines, boxes or circles needed to complete the design. Boxes and ovals can be filled with any of the standard Mac patterns, allowing you to generate a number of patterns and greyscales within a publication.

One of the most useful features of RSG3 is that every object placed on the page has an associated specifications sheet which can be called up by selecting 'Specifications' from the Special pull-down menu.

The specification sheet displays the position of each object on the page along with its exact size. This means that you no longer have to rely on your eye when drawing on the screen. If you want a text block which is 1.3454ins wide by 4.5639ins deep, you just type the numbers into the specification sheet and the system will re-draw the box to that size.

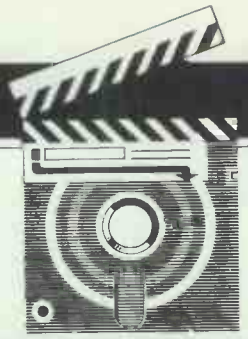
The specification sheet also allows you to select the attributes of objects, one of the most useful of which is 'Run Around'. You can specify that if any text comes into contact with a runaround object, the text will be laid out so that it avoids the object. Say, for example, you had a page with three columns of text and you wanted a picture to be positioned in the centre of the page so that it took up the whole of the central column and half of the outside columns.

If you positioned the picture block in this way, the text would automatically make way for the picture block and run around its edges. This is very useful, and means that you can play around with the position of pictures with the text automatically reflowing each time you move the picture.

The only gripe with the runaround facility is that it can only run around oblongs. If your picture is circular or an irregular shape, then the text will flow in a straight line. Not much use. Having said that, Pagemaker can't handle runaround at all, and the only package which can run around irregular shapes is Hayden's Xpress which costs twice as much as RSG3.

One of the interesting attributes which can be assigned to a text block is 'Postscript'. This allows you to embed a Postscript program within a text block. When the page is sent to the printer, instead of printing the text it runs the program and displays the result within the text block (if you get your coordinates right). This is a very powerful feature and means that experienced Postscript programmers can produce quite professional results.

One of the advantages of keeping the design of the page separate from the text and graphics is that once you have designed one page, you can then copy it to all the other



SCREENTEST

pages of your publication simply by selecting 'Insert Pages' from the Special pull-down menu. It also means that you can store a number of different standard publication layouts on disk and then just call back the appropriate layout and insert the text and graphics. However, if you do this you have to be very careful with filenames when you save the publication, otherwise RSG3 will overwrite the master layout.

Text

When you have completed your design, you can start to insert the text and graphics to create the finished page. Text can be entered in two ways: either it can be imported from popular Mac word processors; or it can be typed directly into the text blocks in the layout.

RSG3 can import word-processor files from either Macwrite or Microsoft Word; it can also read ASCII files. Text mode is entered by selecting the editor icon from the toolbox and then selecting the text block on which you want to work. To import text you select 'Get Text' from the 'File' pull-down menu. A list of available files is then displayed and you select the one you want.

The program then proceeds to run the text into the text block. If the file is longer than the text block, the text will run on into any linked blocks. If there is more text left at the end of the last block, then the program puts a mark after the last block to show that there is more text to come.

Text imported from the word-processor files keeps all the attributes it was created with, with the exception of tabs and indents which have to be set up separately within RSG3. As text is run into the text blocks, words are automatically hyphenated as necessary. This automatic hyphenation is one of RSG3's claims to fame because Pagemaker 1.2 doesn't have this feature. Although it worked well, I found that RSG3's hyphenation program tended to get carried away with itself and ended up 'showing off' by hyphenating far more words than necessary. A page with too much hyphenation can look worse than one with no hyphenation at all.

Instead of using a proper hyphenation dictionary, RSG3 comes with a special algorithm which it uses to decide where and when to hyphenate a word. The problem is that the English language is illogical, so applying such a set of rules often produces the wrong result. To get around this, RSG3 comes with a user-definable exception dictionary where you can list the words you don't want hyphenated. This can be tedious to maintain.

As soon as the text has been entered — either by importing it or by typing it yourself — RSG3 provides a number of powerful functions for manipulating the words, such as 'Find and replace' and a 'Spelling Checker'. The program also allows 'Glossaries' where frequently used sections of text can be assigned to a key and then recalled with a single keystroke. Up to nine different tabs can be set, along with the indent and whether the tab is flush left, flush right, centred or justified. Text can be edited using the traditional Mac interface using the T-beam cursor, and highlighting text to be worked on using the mouse. The font, point size and style of the text can be selected from the 'Font' and 'Style' pull-down menus. Point size can be specified in one-point increments.

As you would expect of a full-page layout package, RSG3 also contains some sophisticated text manipulation facilities: for example, line spacing can be set to automatic or specified in one-point increments. I would have been happier if spacing could have been specified in fractions of a point because often you don't need a whole point of leading. A magazine, for example, might be set in nine on nine and a half-point.

One of RSG3's other claims to fame is its ability to do 'kerning'. This is the method of reducing the spacing between certain pairs of letters to improve the look of the type. For example, the combination 'AV' looks better when the letters are closed up. Each typeface comes with a kerning table containing the letter pairs which can be kerned. Selected text can be kerned in RSG3 by selecting 'Kern' from the 'Format' menu.

In addition to automatic kerning, RSG3 also allows you to alter the letter-spacing of the selected text manually. This is done by holding down the Command key and pressing the left or right arrow keys on the keyboard. Hitting the right arrow will increase letter-spacing by one point while the left arrow decreases letterspace by one point. This can be very useful for making headlines fit or for creating interesting typographical effects.

As well as being able to alter the horizontal position of letters, RSG3 also allows you to move letters vertically above or below the baseline. This is achieved by holding down the Command key and pressing the up or down arrows. Again, all movements are in units of one point.

Graphics

To place a graphic on the layout, you have to select the cropping tool from the toolbox. Using the cropping tool you can select the picture block where you want to place the graphic. Once the picture block has been selected, it is marked out with a series of horizontal squiggly lines.

RSG3 can read graphics files from MacPaint and FullPaint as well as from MacDraw and MacDraft as long as the files are stored in PICT format. As usual, if you are using a laser printer it is better to stay away from MacPaint-type bit images because you lose a great deal of quality. Graphic files are read into RSG3 by selecting 'Get Picture' from the 'File' menu and then selecting the file you want.

When the program has retrieved the picture, it is displayed in the picture block. If the graphic is larger than the block, then the picture block acts as a window onto the graphic. You can use the mouse to move the graphic around under the window until the correct portion of the picture is displayed. Unlike Pagemaker, RSG3 doesn't allow you to scale a graphic using the mouse. The only way to scale a graphic is to call up the Specifications box for the picture block. This allows you to specify percentage vertical and horizontal scaling which can then be applied to the graphic. A word of warning, though: working out the percentages in your head can be tricky — it's much easier with a mouse.

Documentation

The documentation supplied with RSG3 consists of a 64-page 'magazine' which was prepared using the program. The first section contains a quick getting started feature while subsequent sections cover the program's features in greater depth.

My first impressions of the manual were not good. I like a manual to look like a manual, not a copy of *The Beano*. However, after a month of use it has grown on me. My only gripe now is that according to the manual it is possible to create white type on a black background, but for the life of me I can't work out how.

sion

Conclusion

I am very impressed with RSG3: it is both easy to use and powerful. When it was first launched, it set out to beat Pagemaker. For my money this version is also more useful than the brand new version 2.

Ready, Set, Go! 3 costs £395 (excl VAT) and is available from Letraset on (01) 928 7551. END

Quite simply, it leaves other word processors lost for words.

WordPerfect 4.1 includes many features not found in other word processors.

Newspaper style columns can be displayed on screen, 100,000 word phonetic dictionary, word-count, background printing and automatic reformatting increase efficiency.

Line drawing and rulers, sorting search and 5-function maths are invaluable assets.

The colour-coded template makes using WordPerfect simpler than you would believe. Most features are available with a single keystroke. This makes learning easier than ever before and using it a real pleasure.

What you see on the screen is what will actually print. This makes good, professional layouts simple.

Documents are treated as a whole and not a series of pages. Reformatting and repagination after editing are automatic and very rapid.

However fast you type, you will never be too fast for WordPerfect.

To find out more, write to the address opposite.

And see how WordPerfect delivers today what others are still searching for.

SENTINEL
SOFTWARE

Sentinel, Wellington House,
New Zealand Avenue,
Walton-on-Thames, Surrey, KT12 1PY.
Telephone: (0932) 231164.

WordPerfect | **MathPlan** | **SSI Database**

SCRABBLE® letter tiles by permission of J. W. Spear & Sons PLC.

Loud and clear

The problem of speech synthesis has been tackled and successfully overcome by computer scientists, but voice recognition is a more complex issue altogether. Nick Hampshire traces the progress so far.

To the computer scientist, the challenge of creating a computer system capable of conversing with its human users in a natural spoken language is enormous.

Indeed, natural language speech recognition is one of the main areas of research in the so-called Fifth Generation computer projects initiated by the Japanese Government and more recently by the British Alvey project, the EEC Esprit project and the US Star Wars program.

At present there is no general-purpose, speech-based interface between humans and computers. Nonetheless, a great deal is already known about how to build computer systems which recognise and in a sense 'understand' a limited number of spoken commands. Voice output is far more advanced than recognition and has already found its way into consumer products, from talking motorcars to talking microwave ovens. The technology of voice output is reasonably difficult, but the technology of voice recognition is several orders greater in complexity and shares more with the area of artificial intelligence than traditional computing.

To understand why progress has been so apparently slow, it is necessary to understand just how complex a problem speech recognition is.

What is speech?

Speech conveys information, and the primary task of computer speech processing is the transmission and reception of that information. Superficially speech recognition might seem quite a simple problem. Speech is, after all, just a complex sound wave which can be captured by a microphone, and converted into digital data. This data could then be analysed to see if the waveform matched any known word, or it could be reconverted to analogue form and output through a speaker to give a synthesised voice output.

However, speech is not as simple as it might seem, for it can simultaneously convey up to three kinds of information (assuming you understand the language), the most important of which is linguistic information. This is the kind of information we generally regard as the meaning of an utterance.

However, at the same time an utterance also provides socio-linguistic information — it tells us something about the speaker's socio-economic group and geographical origin — what we usually refer to as 'accent'.

The final form of information provided by an utterance gives the listener personal information about the speaker — their sex, age, voice quality, emotional state, and so on. It is this information which enables us to recognise people by their voices.

Linguistic information is basically the same as written information except there is no spelling to distinguish between the words or phrases which sound the same.

Consider the following sentence:

to be or not to be

In written form this sentence has just one meaning. But if we disregard the constraints of correct grammar for the moment, in spoken form it could have any one of 576 different permutations of meaning. The word 'to' could be one of 'to', 'too', 'two', or the number 2. Similarly, 'be' could be one of 'be', 'bee' or the letter 'B', and so on.

All these factors add considerably to the complexity of computer-speech recognition. They are also the reasons why computer-generated speech can be very unsatisfactory. Despite the fact that speech can now be synthesised with very acceptable quality, all it conveys is linguistic information. Without emphasis and intonation, it lacks the true quality of human speech which requires all three different types of information.

Building blocks

In nearly all spoken words, the source of power is the lungs pushing air across the vocal chords which are located at the top of the windpipe in the throat. The air passing over the vocal chords causes them to vibrate, as in a musical instrument. This vibration is amplified and modulated by the vocal tract, the tube formed by the windpipe and the cavity of the mouth, throat and nose. By opening and closing various parts of the vocal tract, a process known as articulation, the sound output is changed.

There are basically six types of articulation:

stop — sound stopped by closing the mouth, as in the beginning of 'my' or 'nigh'

fricative — a turbulent airflow as in the first part of 'fie' or 'thigh' or 'shy'

approximant — when one articulation comes close to another, as in the consonants in 'we' or 'you'

trill — vibration of tongue, uvula and lips as in the 'r' in 'rye' or 'ire'

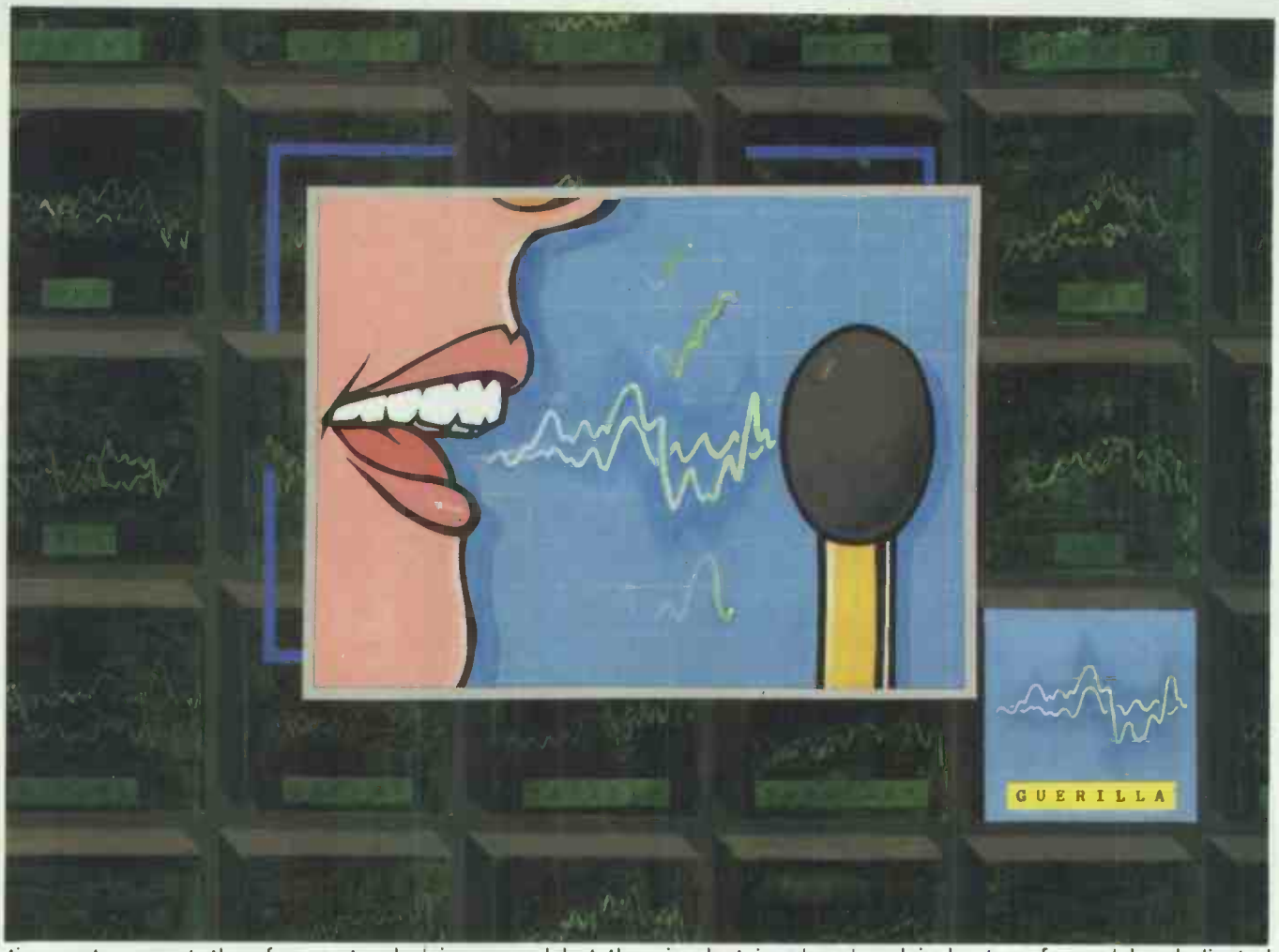
lap — when one articulation touches another as in the middle of 'letter' or 'Betty'

lateral — an incomplete closure on either side of the airstream as at the beginning of 'lull'

The articulations are used to create a set of basic speech sounds known as phonemes. Phonemes are the speech equivalent of the letters of the alphabet used to construct written words. They form a special phonetic alphabet. Phonemes are the basis of many commercial speech synthesisers and voice synthesis programs available for some popular computers since they offer an ideal way of building up the sound of a word without having to store all the data necessary to contain the entire waveform of a single word.

These speech-building blocks are also very valuable in speech recognition. Just as there are rules of spelling for written words, so there are phonetic rules. The recognition and analysis of phonemes, and a knowledge of how they come together, is employed in some of the most sophisticated modern speech-recognition systems.

The information contained in speech is very variable — no two people have exactly the save voice, and even the voice of a single individual varies considerably depending on his or her state of health or emotion. In addition, many spoken words are sufficiently ambiguous that they are impossible to recognise out of context. A practical speech recogni-



tion system must, therefore, not only be able to extract the broad underlying patterns within speech in order to recognise words, but must also be able to understand the context in which the words are spoken.

The reason why engineers have been able to develop recognition systems without the benefit of computer-based artificial intelligence is simply that we can successfully recognise speech in single words and short utterances using pattern-recognition techniques which do not rely on any 'understanding' of what is being said and which do not try to ease their load by predicting which words will come next.

Turning noises into numbers

Sampling speech via a microphone produces a complex electrical waveform. This usually has a repeating pattern and is built up from a number of different frequency signals, each produced by a different part of the vocal tract. These different frequencies vary between 200 and 4000 cycles per second and when produced simultaneously produce a complex waveform.

An analysis of the component frequencies of the speech waveform is the basis of most voice-recognition systems currently available. There are several different ways of analysing sound but the simplest involves taking regular samples of the sound and digitising using an analogue to digital converter. A computer can then be used to analyse the digital information into its component frequencies. This mathematical method is known as Fourier analysis.

The problem with using Fourier analysis is that it is very computationally-intensive and, therefore, too slow for real-time voice-recognition systems. However, the speed of computation can be speeded up by the use of dedicated electronics which decompose the incoming waveform. The earliest of these circuits used a bank of filters, each tuned to allow through only one part of the frequency range of the human voice. By using 14 filters, for example, the voice can be divided into 14 different component frequencies, each with a bandwidth of 250Hz. The information produced can be used to construct a spectrogram of the particular spoken word.

The disadvantage of the Fourier analysis approach is that any background noise will be included within the spectral analysis and, therefore, produce spurious data. One way of overcoming this problem is to use a technique known as Linear Predictive Coding or LPC. LPC is a mathematical process which produces forecasts based on previous events. However, it too is computationally-intensive and is best performed by dedicated hardware. The hardware comprises a filter bank known as an adaptive lattice filter. The output of each filter is dependent on the previous samples and spurious noise will be rejected by the filter system.

By the use of feedback within the LPC filter system, an actual sample is subtracted from its predicted value — the result is a prediction error. The LPC hardware thus separates the components of a signal into those which it can predict and those which it cannot. The LPC can predict speech data because, although speech signals have a complex waveform, they tend to be periodically repetitive and, therefore, predictable. Most external noise, on the other hand, tends to be random. In this way the filter can separate a wanted tone from an unwanted tone such as traffic noise.

The interesting feature of an LPC circuit is that it can act in reverse as a speech synthesiser by applying data obtained during analysis back to the filter bank. This models the articulation of the vocal tract and can generate very high-quality speech output.

Both Fourier analysis and LPC circuits have, over the last two years, been produced as integrated circuits by semiconductor manufacturers for use in simple voice-input systems. Nonetheless, the effectiveness of a speech-recognition system depends

Illustration by David Fathers

on how well the software can interpret the 'clean' data supplied to it by the Fourier and LPC circuits.

Simplifying the data

In order to recognise a given utterance, the software must have a method of matching the data with that of words it has been trained to recognise. The simplest and most common method of doing this is to organise the regularly sampled data as a two-dimensional matrix, with time along one axis and the frequency analysis along the other. This matrix is then compared with reference matrices or templates. The comparison is done using a 'least distance' method which entails computing the sum of the squares of the difference between corresponding elements in the two matrices. The best match will have the smallest distance.

The data may consist of speech samples taken perhaps fifty times a second with each sample consisting of between eight and twelve values corresponding to the frequency bands of the speech waveform. These measurements are collectively known as a 'phone unit'.

The problem with simple matrix-matching techniques is that the duration of a given word varies from utterance to utterance. People do not always speak at the same speed; and even if they did, there is no guarantee that the speech system would start its sampling at exactly the same moment each time.

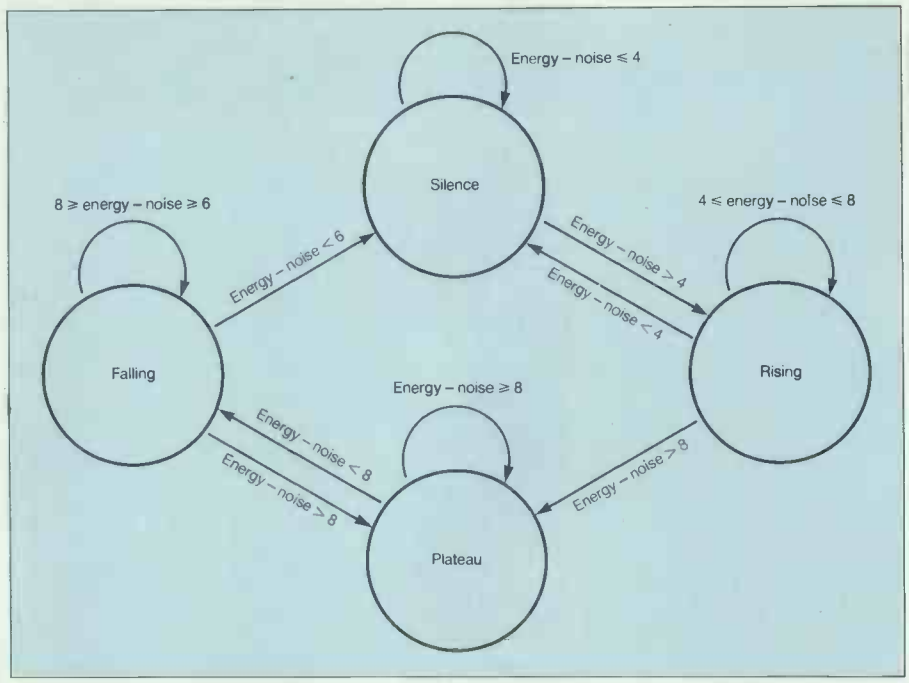


Diagram showing finite state for endpoint detection

Most simple commercial speech-recognition systems, such as those employed in some toys and computer games, make very little attempt to overcome the problems of timing. They rely, instead, on the user re-

Dynamic Time Warping

Because speaking rates vary between different utterances of the same word, a dynamic time-warping algorithm is often used to eliminate local timing differences within the word.

After normalisation and scaling, the input data and reference templates are in the form of 12 time frames each with nine coefficients corresponding to one frequency band. In the DTW algorithm a graph is created and the path followed by the line on that graph is used to determine the distance between the two samples.

The first procedure is to place the reference template against the X axis of the graph and the unknown utterance template against the Y axis. Each point along the axis corresponds in fact with a set of coefficient values.

The dynamic time-warping algorithm is used to find the optimal path between coordinates 1,1 and the top right-hand corner, such that the total distance D is minimised.

There are a number of constraints applied to the possible path of the graph to speed up the process and ensure that excessive expansion or compression of the time axis does not occur.

To make it easier to implement the DTW algorithm, the path of the line matching the two templates must start at point 1,1 and end at point 12,12. This 'endpoint' constraint may be different in continuous speech, but will serve for this isolated utterance example.

Additionally, in order to prevent too much time distortion, a local constraint is applied which says that the slope of the graph at any one point can take one of only three values: ½, 1 or 2. These slopes are assigned weighting factors W of 2, 1 and 1 determined by how far in the X direction they move.

The combination of these two constraints means that any path must lie within a narrow parallelogram.

The combination of these two constraints means that any path must lie within a narrow parallelogram.

The DTW algorithm is concerned with finding, among all the template matches, the one with the shortest global distance between points 1,1 and point 12,12, irrespective of the shape of that path. To add to the compexity, the global distance is not a simple measurement but is the sum of weighted local distances between each point.

An example will better illustrate the method.

Two templates each contain six frames of fine coefficient values. The starting point for the calculation is the first endpoint constraint which is coordinate 1,1. The local 'distance' d(1,1) at that point is the sum of the differences between each pair of coefficients.

In the example

d(1,1) = (13−18)+(25−(−10))+
(−7−(−9))+(−2−8)+(23−23) = 52

Local constraints mean that the next point on the path can only be (2,3), (2,2) or (3,2).

First the local distance at each of these points is calculated by pairing coefficients from the fames that intersect at each of the three points.

The values produced are:

d(2,3)=87
d(2,2)=72
d(3,2)=66

The total distance D at each of these points is the sum of the distance between the templates at point (1,1) plus the distance at each of the three points multiplied by the weighting factor W of the slope needed to get there. Thus:

D(2,3) = D(1,1) + W*d(2,3)
=52 + 1*87 =139
D(2,2) = D(1,1) + W*d(2,2)
=52 +1*72 = 124
D(3,2) = D(1,1) +W*d(3,2)
=52 + 2*66 =184

The smallest of these three values then becomes the new starting point along the optimal path. In this case (2,2) would be the next point.

This process is repeated to find the remaining points on the graph, summing weighted values of d(x,y) to give a final global distance D.

This process is performed for each reference template and the one which produces the smallest global distance is deemed to be the best match.

peating an utterance until some form of feedback shows that the utterance has been recognised. By a very careful choice of vocabulary, to ensure the maximum phonemic difference between all words, such systems can successfully recognise about 75 per cent of isolated words spoken. But such repetition of words is clearly impractical for any serious continuous speech recognition system and in these cases an alternative to simple matrix matching is used. This is called Dynamic Programming.

The immediate problem encountered in filling a speech data array is that of determining the beginning and end of the utterance. Most of the time the input circuitry will be sampling non-speech data which is present in the pauses between utterances. This will consist of an assortment of background noises which could include distant speech. This data needs to be rejected and the process of finding the start and end of an utterance is known as 'endpoint detection'.

This process involves identifying four different phases of an utterance. These are termed 'Silence', 'Rising', 'Plateau' and 'Falling'. The beginning of an utterance is defined as that sample of speech where there is a transition from Silence to Rising. The end of an utterance is where there is a transition from Falling to Silence. The utterance will, therefore, consist of all the data samples between and including the two endpoint transitions.

The transition between states is based upon the energy level of the input signal, on the assumption that background noise will always have less energy and thus be quieter than the spoken input. Endpoint detection can be thought of as a finite state machine which moves between the states according to certain rules.

Endpoint detection is further refined by the addition of four criteria.

1 Any single data sample can cause only one state transition. The exception is the data which causes the transition from Plateau to Falling. This data can also be used to test for a Falling to Silence transition. If such a transition is made, then that sample is the endpoint.

2 After the transition from Falling to Silence, there must be at least ten continuous samples of Silence data for the endpoint to be detected. If there are less than ten, then it is assumed that the silence is simply a slight pause within a word rather than an inter-word space. In such cases the system is reset to the Plateau state and the Silence data samples are discarded. Endpoint detection continues from the first non-Silence sample found.

3 Any utterance must contain at least four data samples. If there are fewer, the input is considered to be background noise and is discarded.

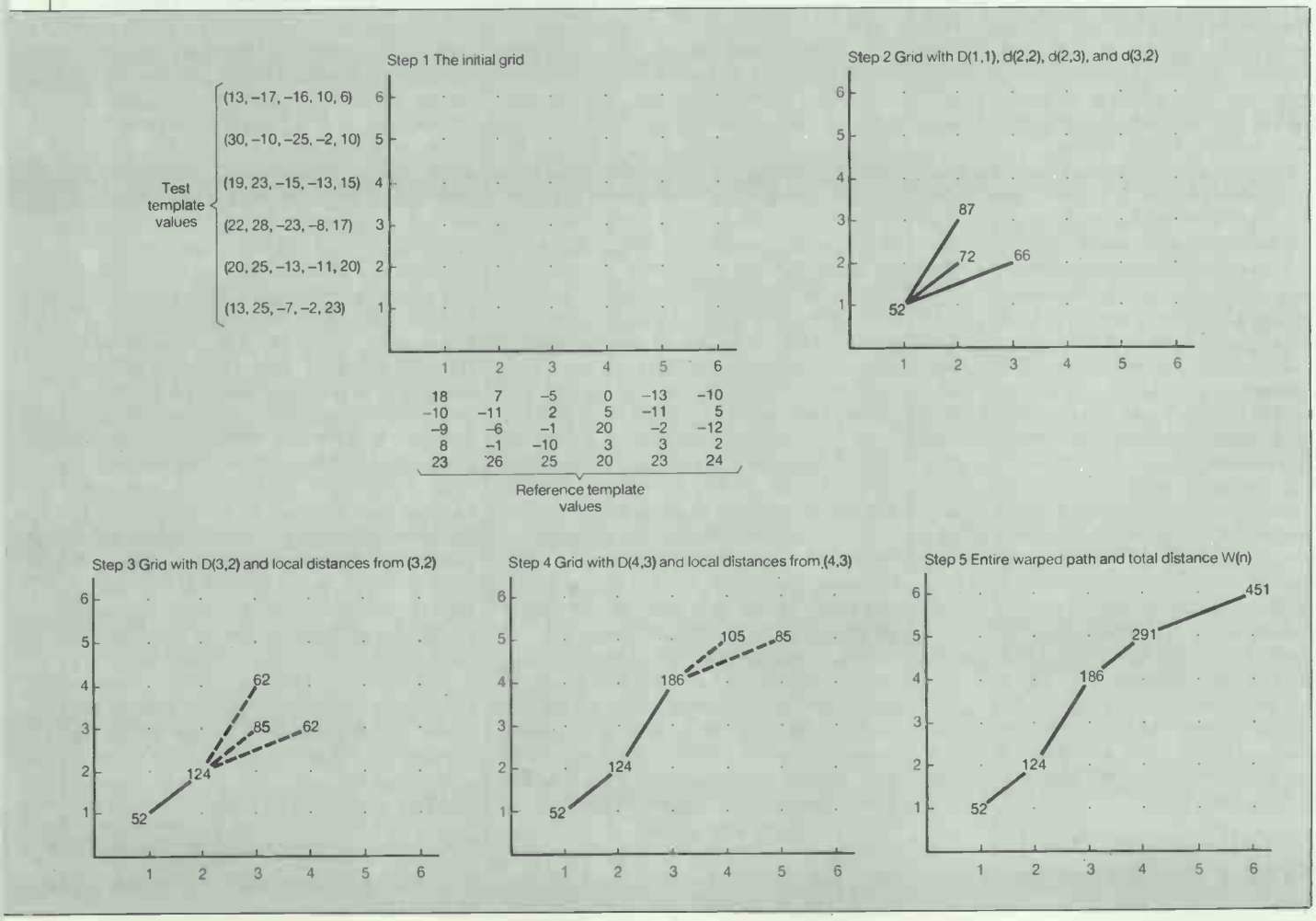
4 The maximum energy level in any utterance must be at least 15 decibels greater than the average background noise energy level. If it is less the utterance is discarded.

Data will only pass through the finite state machine if all of these criteria have been met.

Having used endpoint detection to input all the data samples which comprise an utterance, the data is passed through the finite state machine a second time to eliminate all samples whose energy levels fall outside a proscribed dynamic range — here taken to be 42 decibels. This is done by replacing the average noise energy level in the machine with a new lower level set at 42 decibels below the highest energy level of the utterance. By removing all samples with an energy level less than 42 decibels below the peak all data for the template will lie within a 42 decibel dynamic range.

A problem of timing

The data emerging from the endpoint detection process could consist of anything between four and two hundred time samples. Even different utterances of the same word will contain different numbers of samples since no-one ever speaks at exactly the same speed. To overcome this variability it is necessary to standardise the number of data samples in



all utterances. By doing this the algorithm which matches a spoken word to a template will be able to work with the same number of data elements in each case.

If the input data has a larger number of data elements than is standard, a routine averages out adjacent elements. Alternatively, if the sample has too few, it will replicate adjacent samples to expand the number of elements.

At this stage we have a standard number of data elements, each of which lies within a 42 decibel range. However, it is also necessary to compensate for variations in the volume with which the speaker said the word. The scaling process modifies the amplitude of the samples so that the peak amplitude is always 30 decibels. This is done arithmetically, and any samples whose amplitude falls below zero are set to zero. The standard number of data elements, which now all have an amplitude in the range 0 to 30 decibels, are further scaled to fit in a range −40 to +40 decibels.

The data array which emerges from these processes forms the final speech template. This array might typically consist of twelve samples or time frames, which each containing nine parameters or coefficients corresponding to a different waveband.

However, before the system can recognise any speech it has to be trained. Training consists of constructing reference templates which are stored in memory and used during the recognition phase.

A reference template could be created from just one set of input data, but higher recognition scores can be obtained by averaging together two or more templates made from different utterances of the same word. Increasing the number of training passes does not necessarily give a continued improvement in recognition success. A point is eventually reached when too many templates have been averaged together and the coefficients start to converge and lose their meaning.

Improvements in recognition success can be achieved by using multiple templates of the same word generated during different training passes. Such a group of passes is known as a cluster, and the more clusters used the higher the recognition score. However, this will be achieved at the expense of a considerable increase in memory and processor time and a reduction in the number of different words in the template library.

Template matching

The heart of a voice-recognition system is the template matching routine. The normalised data from the utterance is compared with the reference set of templates, each of which is connected with a known word. This superficially simply problem is complicated by the fact that the data contained in the input template will vary slightly for every utterance of the same word.

Not only might the frequency 'shape' of a word be different, but even the same word normalised into the same time frame might have the various syllables spread differently within that time. A speaker might speak quickly at the start of a word on one occasion and slowly the next, yet the whole word might be uttered in the same time.

The variability of fuzziness of the data makes it impractical to use conventional pattern-matching techniques. A conventional algorithm such as 'the sum of the squares of the difference' can be effectively used when reference template words have been selected to be as different as each other, but will fail to reliably identify utterances which are phonemically very similar.

Much of the research into speech recognition has been directed towards finding pattern-matching techniques which can cope with the variability of input data, and one of the most successful of these is known as Dynamic Time warping.

In implementing the DTW algorithm (see the explanatory box) optimisation of run time is very important. In a practical application, the grid size would typically be 12×12, which means that each template would consist of 12 time frames. Even so, finding the optimal path and the minimum distance for each comparison of utterance and reference template will require a considerable number of calculations. A vocabulary of just 100 words would require 100 calculations in order to find the closest matching word for each utterance. To work in real time and, therefore, match words as quickly as they are spoken, run-time optimisation of what must be assembly code routines is essential.

For larger vocabularies, it becomes necessary to use more powerful processors, and to look towards second-guessing what the next word might be to reduce the search time.

It is at this point that speech recognition moves into the field of artificial intelligence. By attempting to understand what is being said, it is possible to direct searches into subsets of the known vocabulary. This would add considerable speed to the recognition of each utterance.

The use of Dynamic Time Warping has been the basis of most of the advances in speech recognition over the past few years. The power of this algorithm is not just confined to the elimination of time distortions within the input data. It is also capable of identifying words within continuous speech — a situation where it is impossible to accurately identify the beginning and end of individual words.

Using the DTW algorithm, detection of word boundaries is unnecessary. By simply lengthening the matrix to accommodate an entire sentence, the DTW algorithm can be used to spot individual words within the sentence. By moving a reference matrix for the target word along the sentence matrix, it is possible to look for a significant drop in difference value which signifies the occurrence of the target word.

Despite these many techniques, the computational overhead demanded by real-time voice-recognition is immense. It is estimated that a vocabulary of 5000 words would be needed to cover 95 per cent of the words used in everyday speech.

Current micro-based processors seem capable of handling only around 500 words at a time. Machines handling larger vocabularies have used specialised parallel-processing circuitry — an ideal application for the Inmos Transputer.

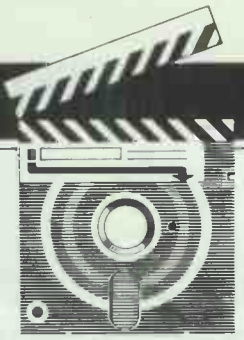
What's available now?

The range of sub-£600 commercially-available, voice-recognition devices generally work with vocabularies of up to about 500 words. These are all single-speaker, isolated utterance devices which have, in the main, found their use in hands-off computer applications where the user can interact with the computer via phone or radio link. Such applications range from credit card verification and stocktaking to military command systems.

The more advanced large vocabulary continuous speech devices are largely research projects and not yet commercially available. IBM has developed a 5000-word, voice-input system based on its digital signal processor chips and an IBM AT as a host controller. IBM claims that the system can be trained to recognise a speaker after just 20 minutes and that it will then recognise 98 per cent of the words spoken. IBM is currently trying to expand this device's vocabulary to 20,000 words and to move its accuracy closer to 100 per cent.

The other product capable of handling large vocabularies is the Kurtzweil Voicewriter. This is able to handle 10,000 word vocabularies and should come onto the market during 1987 at a price of $10,000.

Nick Hampshire would like to thank General Instruments, manufacturer of the SP1000 voice input chip, for its assistance in writing and researching this article. END



SCREENTEST

Norton Utilities

To many IBM PC users, the Norton Utilities are indispensable. Robert Schifreen looks at the advanced version of this computing 'life-saver', to see if perfection has been improved upon.

To a generation of serious users of the IBM PC, Peter Norton is a hero. His *Programmer's Guide To The IBM PC* is still the best single source of technical information on the machines, and his utility programs have long been a life-saver for those who like to DEL now and think later.

For the uninitiated, the Norton Utilities are a collection of programs for the serious user of an IBM PC or compatible. They are not applications programs, like word processors or databases, but utilities for making better use of your machine or for helping you recover from mistakes. The most well-known part of the package is the set of programs which let you recover a file or directory that has accidentally been deleted from a disk.

Two new versions of the Norton Utilities are now available: Version 4.0 is an updated and enhanced version of 3.1; the Advanced Edition contains everything from Version 4.0, as well as two new programs and a couple of upgrades to the existing ones. The product I'm reviewing here is the Advanced Edition (see the panel on page 152 for full details of the differences between this and Version 4.0).

The complete package consists of two disks which contain 24 programs. There's also a 175-page paperback manual, a reference card and, in the Advanced Edition, a booklet explaining the technicalities of disk storage on the PC.

The disks are not copy-protected, so to install them on a hard disk you have to make a directory called NORTON and copy everything into it.

The job that the Utilities are famous for is recovering files that are accidentally deleted. If you go out and buy this product because you have just done that, it's essential that you use the programs from the floppy disk, as copying them to the hard disk (or, indeed, writing anything at all to it) will probably make recovery of that file impossible. It's good to see that the manual mentions this early on.

Getting started

Included for the first time is a program called the Integrator. This presents you with a list of all the utility programs down one side of the screen, and, as you select one with the cursor, the other side of the screen shows details of what the program does and how you use it. Pressing Return starts the selected program, and you are returned to the Integrator screen afterwards.

Considering that you can start a program from the Integrator and then return to the Integrator main menu afterwards, I'd love to be able to alter the Integrator program and put my own programs on its menus. Perhaps this facility will appear in version 5.0.

It's impossible to fully describe 24 programs here, so I'll just concentrate on what I consider to be the most important, useful or interesting. The others are described in the panel on page 153.

DT — Disk Test

Like DOS's CHKDSK program, DT tests the integrity of a disk and allows you to repair damage. The types of test performed by the two programs are different, though. CHKDSK performs a simpler task — it checks through a disk's File Allocation Table and directory to make sure that the data on the disk is where the directory thinks it should be.

DT, on the other hand, looks for physical errors on a hard or floppy disk. It will search only the part of the disk in use by files, or the reverse (parts containing erased files, the system and directory areas), or both.

If a disk is known to be damaged and you want to be able to take as much information as possible from it before throwing it away or reformatting, DT will allow you to mark an individual cluster as good or bad. When DOS formats a disk, any clusters which give errors are marked as bad and will be ignored by DOS in future. If a cluster subsequently becomes bad, the disk will keep giving errors; being able to mark as bad clusters which DOS thinks are usable will result in the loss of a small part of a file, but allow the rest of a disk to be read.

DT also lets you salvage parts of bad clusters and move them to error-free areas of a disk.

I found DT to be more thorough than CHKDSK at finding errors. DT managed to pick up half a dozen physical errors on a disk, while CHKDSK regarded it as perfect. Armed with the numbers of the dubious clusters (as reported by DT), I could mask them out and get DOS to read what was left of the disk.

FI — File Info

The problem with MS-DOS's DIRectory command is that it doesn't make best use of space on the screen. The filename, size, time and date take up 40 characters. Most users have 80-column monitors, though, so the other side of the screen is wasted. FI allows you to add a comment to a file, and that comment will be displayed in the empty space.

Unfortunately, the DIR command still works as normal. If you want to see the comments you have to type

FI instead. Also, FI puts filenames in lower case, which is hard to get used to if you are accustomed to seeing them in capitals.

In order to store the comments, FI creates a file called FILEINFO.FI in every directory which has commented files. On a floppy disk, you may possibly run into problems if disk space is tight and you want to add a comment. The way round this is frequent use of the PACK command, to compress the data file and remove comments for files that have been deleted. This is not normally done automatically, so you should do it often. Another reason for doing it is, if you rename a file to one that existed some time ago, the renamed file will inherit a comment if the erased file had one.

Because FI is not a built-in command like DIR, you have to make sure that MS-DOS's PATH command is set to point to the NORTON directory or wherever you put FI.EXE.

Comments can be up to 65 characters long, though only the first 40 are displayed. To see the full version, you have to use a different form of the FI command which shows only a file's name and does not give its size, date or time.

Wildcards can be used to add comments to groups of files.

A serious omission to FI is the ability to search a disk or directory for a specified comment. You can list out comments, but not search for one in particular and be told which file/directory it appears in. It would be useful, for example, to be able to search for comments such as 'this file not needed' or 'must be backed up daily'.

FR — Format Recover

Normally, when you format a hard disk, MS-DOS doesn't overwrite what was on it. It just deletes the directory (a special file that tells MS-DOS where files are) and File Allocation Table (which tells MS-DOS where individual parts of a file are, if it has to split them up to use disk space efficiently).

In theory, if you saved the directory and FAT somewhere safe and then formatted the hard disk, replacing the FAT and directory would totally restore the hard disk. In effect, it would reverse the format operation. This is what FR does. You have to tell it to save the information, and you have to tell it quite often, because any changes you make after saving the FAT and directory won't be reflected in the restored version. The manual recommends you put the FR/SAVE command in your AUTOEXEC.BAT file, and the Norton office suggests that you put it at the top of your most-used batch files, too.

The information is saved in the data area of the hard disk (this only works on a hard disk), just like a file. Then, if you accidentally format the hard disk, typing FR (assuming you still have FR.EXE on a floppy) will undo most of the damage. I say most, because my experiments resulted in the loss of a sub-directory that contained 69k of data. I don't know where it went, but it was enough to convince me that FR, though useful, is not foolproof. I think I'll stick to using a lower-case volume name and not storing the FORMAT program on the hard disk.

Incidentally, other Unformat programs like Mace and S&S's don't need to make a copy of the FAT or directory at all. They just go through the ruins of the data, work out where the files must have started and ended, and create a FAT and directory from scratch.

And, more incidentally, some versions of MS-DOS do actually overwrite all the data area of a hard disk during formatting, and not just the FAT and directory, so it's well worth backing up everything to floppies and testing your system first if you plan to use FR seriously.

NU — the Norton Utility

If the Quick Unerase program (see the panel) fails to find all of your missing file, it's time to dig out the main NU program. This is a very comprehensive piece of software that lets you examine just about every area on a hard and floppy disk, and change any of the information on it. You can, for example, unerase a file by pointing to DOS's amended directory entry and recreating the details in a couple of keystrokes.

If the file is fragmented (split up, for efficiency, by MS-DOS to fit into small areas of free space on a disk), NU will make a guess at finding what it thinks is the correct file, in the correct order. The guesses are usually spot-on, though you can drive the system manually when it becomes confused and steer it back on course.

You can edit any file on a disk, which is useful if you want to change a program's built-in settings without resorting to MS-DOS's DEBUG program. Just about the only thing you can't do is look at, and edit, the directory, FAT and partition table — at least, you can't on Version 4.0. The NU program included with the Advanced Edition even allows you to do that.

Unless you know what you're doing, though, a tool like this can be dangerous. The partition table, for example, tells MS-DOS whether a hard disk will boot or not, and which operating system is on it. Change this, and you'll have problems.

If you don't want all the technicalities but just want to be able to restore deleted files, then the manual contains a useful tutorial that guides you through using NU and shows you how to recover a file that is difficult to restore because it was fragmented.

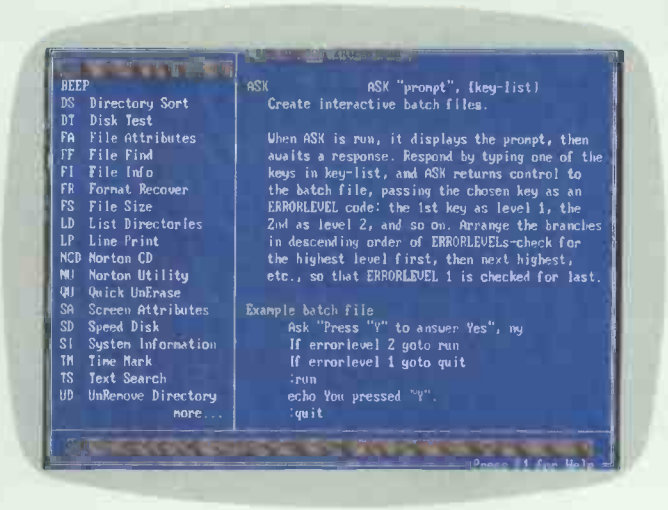
UD — Unremove Directory

If you delete a file and then delete the sub-directory where it was located, you can't restore the file because the directory doesn't exist. First, you have to restore the directory that contains the list of deleted files; then you can reconstruct the deleted file from the remnants of its directory entry.

UD lets you reverse the action of MS-DOS's RD or RMDIR command and restore the directory. Not only is the directory restored, but UD searches the disk for deleted files that were once in the now-restored directory. The files aren't automatically unerased, but if you haven't saved much to disk since erasing them, it's fairly easy to retrieve with QU.

Prices

Norton Utilities Version 4.0 costs £74.95. The Advanced Edition is £117. Both prices exclude VAT, and



Included with this version for the first time is the Integrator. This is a separate program that gives a screen of information on each of the utilities, and lets you select and start one from a menu. When execution is complete, you automatically return to the Integrator and not to DOS

Other utilities included with the Advanced Edition

ASK: Used in batch files to ask the user a question and take action according to the reply. Coupled with MS-DOS 3.3's ability to call batch files as subroutines from within other batch files, ASK will make it easy to set up a menu-driven MS-DOS environment for new PC users.

BEEP: Sounds the speaker for a given duration and frequency. A set of notes can be stored in a file.

DS: Sorts a directory by filename, extension, size, date and/or time. Will sort in ascending or descending order. Full-screen mode allows individual files to be placed anywhere in the directory listing, so that frequently-used ones will always appear at the top.

FA: Displays, sets or clears one or more of a file's attributes. This is similar to MS-DOS's ATTRIB command, though versions of DOS prior to 3.30 will not allow all attributes to be set.

FF: File Find. Searches all the directories on a disk for a specified file. Similar to the widely used WHEREIS program.

FS: File Size. Lists the files in a directory (and, optionally, all its sub-directories) and shows their size in bytes. Also shows amount of disk space used and unused, and the percentage of 'slack' space — disk space wasted through putting small files into large clusters.

LD: Lists all directories on a disk and, optionally, the size of each one. It's useful to redirect the directory list to a file and use a word processor to add a comment to each line. You can then produce a batch file that does the same thing to every directory on a disk.

LP: Line Print. Prints a file to the printer, with optional line numbers and time and date header. Page size and column width are configurable. Will optionally strip the top bit from all characters, so WordStar documents can be handled.

NCD: Norton Change Directory. An improved version of DOS's CD command that is intelligent enough to let you change to a unique directory without forcing you to type the full pathname.

QU: Quick Unerase. If you accidentally delete a short file that spans only a couple of clusters, it's possible to recover it almost instantly by typing QU followed by the filename.

SA: Screen Attributes. Sets the foreground, background and border colours to be used by DOS. There are pros and cons to this program. Annoyingly, it uses the ANSI.SYS driver so it won't work unless ANSI.SYS is loaded. What's helpful is the choice of English-like parameters, for example:

SA BRIGHT WHITE ON BLUE

SD: Speed Disk. Optimises a hard or floppy disk by rearranging all the clusters that make up files so that they are contiguous — that is, not split up into fragments.

Such a program is only really of use on a hard disk and, in theory, should speed up access times if the disk is nearly full. Unfortunately, the program managed to lose two batch files when I tried it, and I immediately lost confidence.

SI: An enhanced version of the System Info command, producing the Norton Index for a machine, much used by reviewers to indicate how much faster than the original IBM XT a clone runs. The new version gives separate ratings for disk and processor times, as well as an overall rating.

TM: A stopwatch, accurate to a second (actually four stopwatches that can be examined, stopped and started independently. Useful for timing how long you spend online to Telecom Gold).

TS: Text Search. Searches a directory, group of files or entire disk, to find any files that contain a specified string. Will optionally search only areas of a disk containing erased files, so you can then unerase that file with the NU program.

VL: Similar to DOS's LABEL command, that lets you put a volume label on a disk. Norton's version allows you to put lower-case letters in the label, while DOS does not. Before formatting a hard disk under DOS you have to type the volume label, and the volume label on the disk must be in upper case. Using Norton to put a lower-case label on a hard disk makes it harder to inadvertently format a hard disk.

WIPEDISK: This program is deemed powerful, so it has a real filename and not just two letters. It removes any traces of a file from a disk, preventing it from being unerased, even by the Norton Utilities.

WIPEFILE: A less drastic version of WIPEDISK.

Note: Format Recover and Speed Disk are not included with version 4.0. Also, the main NU program in version 4.0 does not allow direct editing of the directory, FAT and partition table of a disk.

dealers should stock both items. Existing users should be able to upgrade to Version 4.0 or the Advanced Edition but no prices were fixed at the time of writing.

Conclusion

It's a fact of life that insurance, although a life-saver, is never cheap. Norton's Utilities earned their name as insurance against deleting files from a hard disk and — make no mistake — that is what they still are. While it may be useful to have an easier way of changing directories or finding a file or its size, there are plenty of programs around that will do this for you; just ask your local user group. And the average user would be well-advised not to explore the innards of hard disk just for fun.

When it comes to undeleting files, Norton has a reputation and it's this which keeps people buying the software. If you use a hard disk for programming or any other serious use, having something like Norton around is good insurance. You'll hardly ever need it but, when you do, you'll thank yourself. For this purpose, I found the programs worked well (though I don't trust Format Recover) and the manual makes a good job of guiding you through the process. Version 4.0 is a worthwhile investment to keep for emergencies, though I see no reason at all for buying the Advanced Edition — Speed Disk (see the panel) is far from reliable and Format Recover isn't worth the risk.

If you already have an older version of Norton, it's worth upgrading only if you have a specific task in mind and your current version won't do it.

As a general protection against accidents, neither Version 4.0 nor the Advanced Edition are significantly better than Version 3. They may be slightly easier to use, and the menus rearranged, but that's no reason for upgrading. END

WARNING

After my experience with Speed Disk and the loss of two files, I took the particular program home to investigate further. It lost the entire contents of my 20Mbyte disk and, although I subsequently performed a low-level format, all is still not well. If you intend to use Speed Disk, back up your disk at least once before you do anything.

Unless you watch it,

This new video will make sure you choose one of the most popular multi-user accounting packages of the future, instead of one of the most popular packages of the past.

your new accounting package may turn out to be obsolete.

If you're about to change your accounting software, we recommend seeing our video first.

Because accounting software itself has just made an important change for the better.

With *Chameleon*. The most advanced and adaptable multi-user accounting software package yet devised.

Why you'll be seeing a lot more of Chameleon from now on

While even the most costly accounting packages expect you to work like a machine, *Chameleon* allows you to work like a thinking, responsive company. One where business changes by the minute, not the decade.

Instead of ploughing step-by-step through numerous menus, with *Chameleon* you can skip instantly from one accounting module to the next.

Or rapidly refer back to one ledger while you're working on another. Improving efficiency and productivity every moment of the working day.

Working in a constantly changing environment

You can change descriptions instantly. Easily reformat reports. Create your own menus. Control workstation security and priority.

Or work in different currencies, or allow European colleagues to work in their own language, as you work in your language. And much, much more as you'll discover, when you see *Chameleon* in action on our video.

Don't change your software until you see how software's changed

Chameleon is the first accounting software that can adapt to the way you want to work now, an hour from now, and years from now.

And it's been developed by Tetra Business Systems. The company that's already created one industry standard business accounting product, Tetraplan.

To find out about *Chameleon*, use the reader reply service or phone 0494-450291. Or use the FREEPOST coupon.

You'll also receive our free *Chameleon* Information Pack. Unless you find out the facts now, your new accounting package may turn out to be an old one.

Post today to find out how accounting software's changing with *Chameleon*

☐ **Yes** Please let me have a CHAMELEON VHS VIDEO AND FREE INFORMATION PACK. I understand there's no commitment.
My current computer and model No. Is.

☐ I don't have a computer

BLOCK CAPITALS PLEASE

Name .....

Position .....

Company .....

Address .....

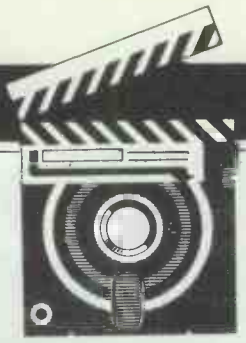
.....

Postcode ..... Tel .....

POST TO:
Tetra Business Systems Limited,
FREEPOST,
14-16 Temple End, High Wycombe,
Bucks, HP13 5BR.

NO STAMP NEEDED PCW 3

Chameleon
ACCOUNTING FOR CHANGE



SCREENTEST

First Word Plus

First Word Plus from GST is a standard word-processing package that has one significant advantage — it is enhanced by the user-friendliness of GEM. Roger Howorth gets to know it.

Most ST owners will be familiar with First Word, the excellent if slightly rudimentary word processor which is often bundled with the ST system. The best features of First Word are not really linked to naked word processing power as much as to the use of GEM as a host operating system. GEM provides a level of user-friendliness that just doesn't exist on the majority of computer systems.

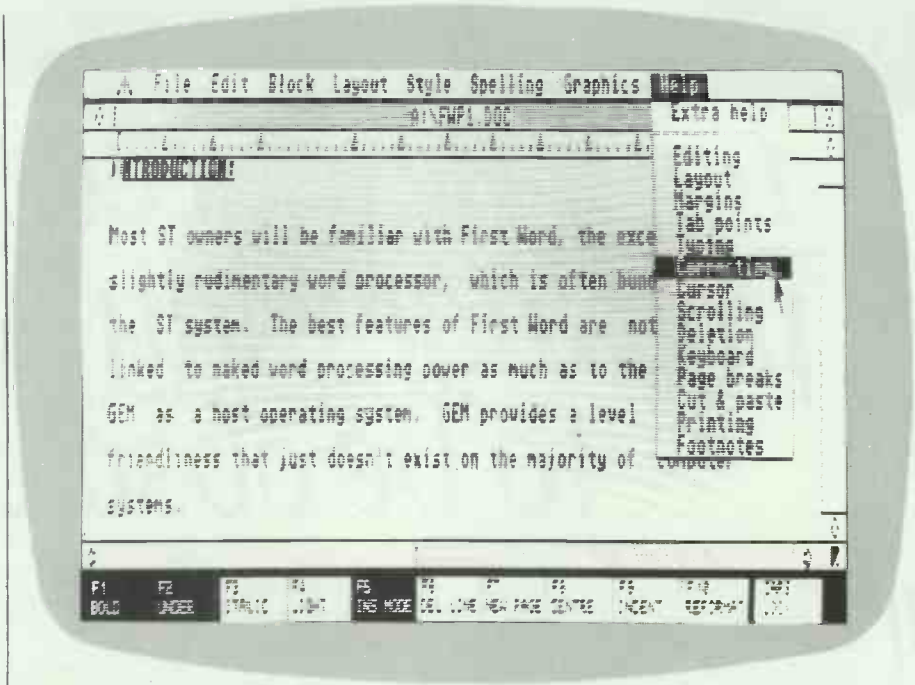
Despite the availability and quality of First Word, and the debatable size of the WP market in relation to the ST user base, the software industry is keen to produce alternatives. First Word Plus, from GST, is the latest of such packages and has now also been made available as a GEM product for the Amstrad PC or any IBM clone running GEM.

Features

In terms of basic word-processing tools, First Word Plus comes with a fairly standard load. But, like its little brother, it is enhanced by GEM, so that operation of the program is far simpler than more typical WPs. To define a block, for example, one has only to place the mouse cursor at the start, click and hold down the mouse button, and drag the cursor to the end of the block.

Where functions aren't so easily 'moused', menus step in to remove the necessity for 'control X'-type commands, so that even traditionally tedious commands such as Find and Replace can be instigated by simply filling in a form.

On the other hand, functions more common on other hardware have until now not been seen on the ST. First Word Plus is unique in providing the Atari with a word processor that has a memory-resident, 40,000-word spelling checker and a graphics mode. The Amstrad version, however, has insufficient memory to do this and hence keeps the spell-checking dictionary on disk, making it considerably slower in operation.



First Word Plus uses the full facilities of GEM. This screenshot shows the editing screen with the Help menu activated. The most common functions are repeated at the bottom of the screen

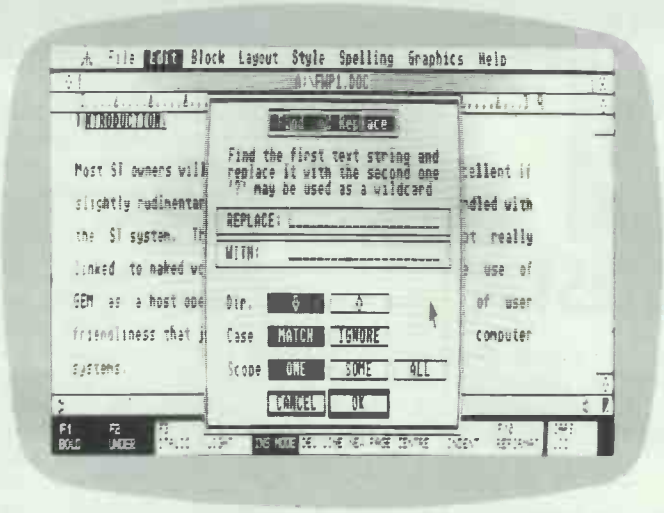
WYSIWYG

It would be very difficult for a GEM programmer to produce a word processor that didn't provide a reasonable level of 'What-You-See-Is-What-You-Get' — italics or bold text are as easy to display on a GEM system as normal text. First Word Plus naturally takes advantage of this so that if you *select* italics, you *see* italics onscreen. Other styles available are bold, light, underlined, sub- and superscripts, which may all be freely intermixed. This system effectively allows the characters to be their own control codes, so the more common ones such as ^G are completely absent from the screen display.

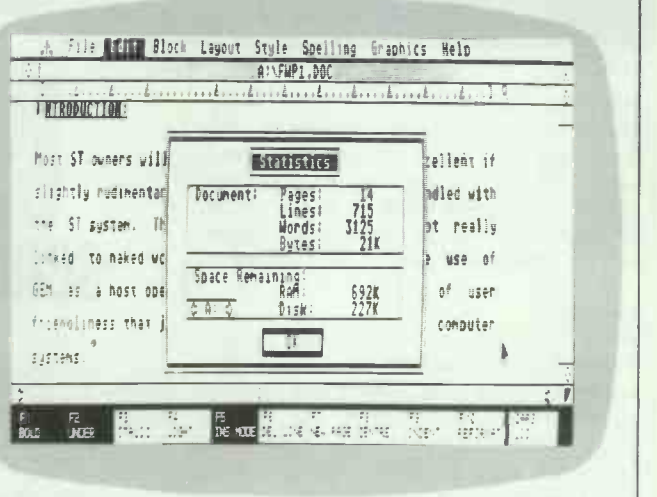
To this point, First Word Plus could claim to provide a WYSIWYG environment. However, it is possible to take this kind of thing further, and provide page previewing and proportional spacing onscreen. Unfortunately, First Word Plus doesn't.

Menus

If you're familiar with menus you'll experience no difficulty with First Word Plus, but if not it's tough



The standard word-processing functions are mostly contained in pull-down menus. Most functions, such as 'Find & Replace' shown here, operate from dialogue boxes with mouse-selected 'Push' and 'Radio' buttons



A useful statistics window lists the number of pages, lines, words and bytes in a document. The Disk Space facility is useful when the document exceeds the remaining space on the disk

cookies as there's no duplication of menu commands on the keyboard. This is rather slack, as GEM itself provides such facilities quite simply.

Help

First Word Plus is nothing if not user-friendly, and one offshoot of this is a basic lack of rules — you can quite happily edit and spell-check a document while viewing a graph that you have imported. If you do get stuck, though, onscreen help is only a menu away. The level of help is not sufficient to bypass the manual, but it does provide brief reminders of the uses and implications of the various functions.

Data saving and retrieval

Disk handling is fairly comprehensive. All file-naming and selection is performed via the GEM item selector, which cures the problem of mistyping or even forgetting lengthy pathnames. Documents may either be loaded into their own window or read into an already open window, thus allowing an unlimited number of files to be merged.

Automatic back-ups are kept by a system of re-naming old files with a .BAK extension when updating documents. Files may be deleted, but there is no facility to format a new disk within the program or even to create new sub-directories.

For ST owners First Word Plus will almost certainly be purchased as a replacement for First Word, so you'll be pleased to know that file compatibility has been retained.

Additionally, it's worth noting that First Word files exported from the ST to the Amstrad PC are also compatible. First Word Plus can load and save files in ASCII format but can't cope with DOC files from other programs such as Boffin and HabaWriter. There is no facility for the loading of anything but straight ASCII files on the Amstrad version.

Windows

Each document is allocated a screen window, of which you may have up to four open at one time; these may all be re-positioned and re-sized at will. Each window is independent of the others, so one may be used to edit a document incorporating graphics while another may be a standard ASCII file. However, text is easily copied from one to another by use of the common block manipulation functions.

'For ST owners First Word Plus will almost certainly be purchased as a replacement for First Word, so you'll be pleased to know that file compatibility has been retained. Additionally, it's worth noting that . . . files exported from the ST to the Amstrad PC are also compatible.'

The text cursor may be moved around the screen either by using the arrow keys on the keyboard or by pointing and clicking with the mouse. Similarly, margins and tabs are set simply by clicking the mouse over the ruler displayed along the top of each window. Four bookmarks are also supported to help with longer hops from page to page.

Rulers

First Word Plus provides four standard rulers that are always available for insertion within your documents, and these may be altered and saved to disk for future use. The ruler defines how the document is to appear onscreen, and tab stops, margins, line-spacing and right-hand justify toggles are all accessed from the ruler menu.

As well as providing the usual text tabs, decimal tabs are available which allow numbers to be aligned by their decimal point and provide right-hand justification of vertical stacks of text.

In this control-code-free environment, the ruler is also used to tell your dot matrix printer which of the four common fonts to use — enlarged, condensed, pica or elite — but unlike text styles such as italics, these fonts are not shown onscreen (so even First Word is not 100 per cent WYSIWYG).

Multiple rulers are allowed within documents, so some paragraphs may be formatted for 'enlarged' printing, others for 'condensed', and so on. It is possible to save to disk default document formats which specify ruler and page layout settings, headers, footers, and so on, for different types of file, DOCument, MEMo and LETter.

Blocks

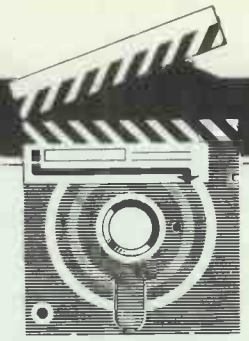
Blocks of text are easily defined by the mouse and stored into the paste buffer, from where they may either be moved or copied around the current window, saved to disk, pasted into another window or, indeed, deleted from the source document.

Find & Replace

Although this function is simple to use, it is limited to a string of 21 characters and to one window. Cases can either be matched or ignored, but text styles are unsupported and the reformatting of affected paragraphs is not automatic.

Hyphenation

This function, when enabled, will suggest certain long words be hyphenated rather than having over-padded lines during document refor-



SCREENTEST

matting. The breaks are fairly intelligent, and like padding spaces the hyphens are 'soft', being used and removed as necessary. A statistics command keeps track of the amount of RAM used and remaining, space left on disk, word count, and so on.

Headers

Page headers and footers can be defined for the whole document but must fit onto one line. Each line is divided into three parts: the first is left justified, the second centred, and the third right justified, but this text can't be spell-checked.

To complement this rather limited facility, footnotes may be added throughout the document which are automatically numbered and protected by First Word Plus, and can be spell-checked in the normal way.

Graphics

By far the most unusual feature of First Word Plus is the graphics mode, which provides a facility to import picture files from disk. These files are created by a desktop accessory called 'Snapshot' which is supplied with First Word Plus, and it is this, plus your other graphics software, that does the real work.

Having loaded a picture into a document, it's easy to move it around simply by positioning the mouse cursor over it and dragging it to wherever you like. Snapshot only provides the ability to save a picture in a form acceptable to First Word Plus, and as there is no graphics editor within First Word Plus, a graphics program is essential before any useful pictures can be incorporated into your documents.

I really think that GST has been rather mean with the graphics facility. As it stands the picture must be exactly the right size, shape, colour (or not!) and orientation on the page; you can't draw a border around it or load a picture drawn in a different screen resolution.

There are limitations within Snapshot. Because it's a desktop accessory it can only run from within GEM-based programs which use the menu bar system, but only a few of the spreadsheet and art programs available for the ST do this. Furthermore, to save a picture using Snapshot involves dragging a box around the image with the mouse, so consequently your pictures can never be larger than the ST's screen.

But GST has perhaps realised that this is a rather poor situation and has provided a partial solution. An extra utility program which comes with the ST version converts files between Snapshot and Degas format, allowing for a touching-up facility on most pictures once loaded into Degas. All this demands a lot of planning, which in turn robs the program of some of its versatility and user-friendliness.

'By far the most unusual feature of First Word Plus is the graphics mode, which provides a facility to import picture files from disk. These files are created by a desktop accessory called "Snapshot" . . . but there are limitations within Snapshot.'

Spell-checker

The relative abundance of RAM on the ST means that the spelling-checker's dictionary can be loaded into memory, but on the Amstrad it remains on disk. Rough calculations suggest that it's ten times faster than the Amstrad at spell-checking. Supplementary dictionaries may be created and used alongside the main dictionary, although only one supplementary can be loaded at a time and it can't be swapped without first dumping the entire dictionary from memory and reloading with the new combination.

Adding words is done to a supplementary dictionary initially. Having altered the dictionary, the program will remind you to save it before you are allowed to quit. Once out of First Word you may then merge your supplementary dictionary with the main one, using a separate program supplied with the First Word Plus disks. This process is predictably slow, taking up to three minutes to merge a handful of words.

Removing words from the main dictionary is rather more complicated. Firstly, the offending word is added to a supplementary list and this is saved to disk. Next, the list must be edited with First Word Plus to insert a minus sign immediately before the word. Finally, this dictionary has to be merged with the main one in the normal manner. This is a tolerable system considering how infrequently this task is performed, but it certainly does not run true with the program's otherwise very user-friendly front end.

In order to reduce loading time and not tie up precious memory on the 520k machines, First Word Plus doesn't load the dictionary unless instructed. But, once in, the dictionary is constantly available for normal document correction or as a lexicon from which you may look up any word. User interrogation is limited to straight alphabetical searching with no wildcard facilities, so it won't be of any use to crossword buffs.

Checking a document can be performed in one of two ways: as a retrospective function starting from the current cursor position and searching until an error is found; or as a concurrent task that checks each word as you type it, beeping when you type an unrecognised word. That is all the spell-checker does. When an error has been spotted you are returned complete control of the program; and whether you choose to browse through the dictionary to try and find the correct spelling or, indeed, add a new word to the dictionary is up to you. This makes the checker quite spontaneous to use.

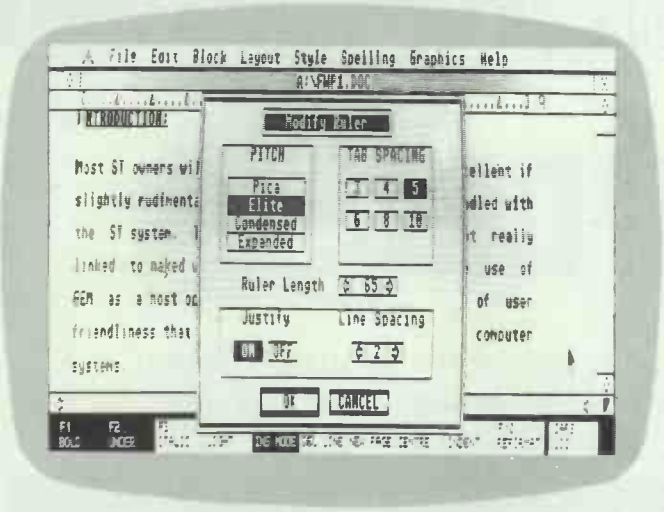
The 'browser' is your interface to the program's dictionary. When called up it displays a list of the ten words that are closest alphabetically to the erroneous word. There is also a facility to list up to ten suggested spellings; these suggestions are quite good, as during testing the correct spelling was found on nearly every occasion. Phonetically similar words are never suggested, so if the word is incomplete rather than misspelt, for example, the browser will leave you up the reek without a pad (*sic*).

The quality of the checking algorithm was OK but not startling. While it detected any word that wasn't in its dictionary, it was unable to cope with some variations on the words that were. All letters were treated as lower case, therefore it wouldn't spot 'thIS' as a mistake and plurals had also to be entered into the dictionary.

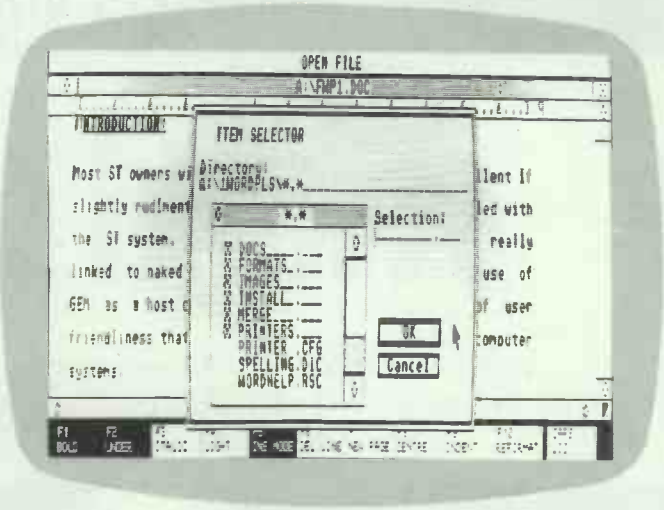
Apostrophes are used as word terminators, so while dealing with 'boy's' is fairly straightforward, 'didn't' is read as 'didn' and produces an error. More seriously, the checker couldn't handle its own soft hyphens, which until this bug is corrected makes the auto-hyphenation system rather useless.

Icons

Although First Word Plus is very much a GEM-based product, GST



The ruler bars of First Word Plus have more configurable facilities than the majority of professional PC word processors; particularly nice is the selection of pitch from Pica, Elite, Condensed and Expanded



The item selector screens will be a boon to hard-disk users, and allow you to select a file from any directory. A wildcard search facility helps you to find the required file quickly

realises that there are times when a mouse just isn't the best way of doing something. The company has duplicated some of the more common, typing-related functions from the pop-down menus onto the ten function keys, *à la* First Word. These include typestyle changes from normal to bold or underlined, and so on, line delete and centring, indenting, paragraph reformat, page breaks and overwrite toggles.

The function keys and the Caps Lock key are also represented as onscreen icons, which serve as reminders of each key's function and the current state of each function — this being shown in reverse video if active. These icons can also be used in their own right with the mouse to toggle their respective functions.

There is also a very useful printer icon which displays all characters that the installed printer can use, and provides a means of entering into your documents those characters which are printable but not found on the keyboard. From here you can toggle between the serial and parallel interface and change printer drivers.

Printing

This was the area where I expected problems, but my fears were unfounded. GST has succeeded in producing a fast, trouble-free routine that can handle text styles and font changes, and intermix bit-mapped graphics. All this is performed as a semi-background task which is only temporarily interrupted when using menus or alert boxes.

GST has supplied drivers for many common printers including daisy-wheel, and 9 and 24-pin matrix printers; and, as I mentioned earlier, has largely succeeded in eradicating control codes from your text.

Unfortunately, GST does seem to have overlooked proportional spacing for matrix printers, and has yet to provide a system whereby a file can be printed out with line spacing that is different from the spacing used in the file itself.

Mail-merge

Bundled with First Word Plus is GST's First Mail program which has been available separately for quite some time. This version has modified printer support to allow for any graphics or ruler changes that you may wish to include in your mail-shots.

Merging is efficient and comprehensive, allowing data from one or more data files as well as the keyboard to be merged with up to twenty nested documents. The finished document is automatically reformatted before being sent either directly to the printer or to disk for later use.

It is disappointing, however, that mail-merging has to be performed by a separate program. Obviously, a lot could be gained in terms of usability if this task could be included within the program.

Documentation & support

The manual comes as a loose-leaf, ring-bound book of some 230 pages, which is well-indexed and written with plenty of work-you-through examples and screenshots. It is generally thorough, but unfortunately it is lacking in the real nitty-gritty detail that is required to produce a printer driver for proportional spacing, for example.

The software is unprotected, which makes installation onto hard disk easy, although no software is supplied to do this. Users are promised free technical support in response to written enquiries, or phone back-up if they are prepared to pay an extra £20 per year and join GST's priority support and update scheme which is known as 'First Aid'.

Conclusion

GST has created a dichotomy for itself that it has yet to resolve. If the company doesn't include useful and unusual features such as graphics and spell-checking then its product will not stand out from the rest. Conversely, if it implements such ideas to the full, First Word Plus will no longer fit onto a single-sided disk or within a 520k machine.

This must be my biggest disappointment. I assume that because of GST's insistence on everything fitting into a 520k ST or Amstrad, while all the features are adequately implemented, none break new ground and all leave room for improvement. The market is still wide open for someone to produce a WP/desktop-publishing package that takes advantage of the 1040ST's memory — perhaps we may yet see a First Word Plus Plus?

As it is, this program is attractive to existing ST owners because they will be familiar with both the quality and problems of First Word; First Word Plus retains compatibility with its little brother and certainly cures its faults. Improved operating speed and its list of goodies can only make this program an obvious choice to the First Word user on the upgrade path, but it is unlikely to sway people into the ST market from elsewhere. Very little separates the Amstrad version from the ST's.

For Amstrad users there is practically no alternative word processor that will run under GEM. There are better, more powerful, word processors, but they all run in the relatively unfriendly environment of MS-DOS.

First Word Plus costs £79.95 and is available from Electric Distribution on (0954) 61258. END

A kind of magic

Are you settled in your ways, prepared to opt for the tried and trusted methods of improving your programs? Mike James tempts you into devious means with a look at various 'magic algorithms'.

Illustration by Mark Hackett

The obvious way of doing something often produces simple, compact and clear programs, but just occasionally there is a devious trick which gives rise to a method that is lightning fast compared to the more obvious 'old plodder'. By 'devious trick' I don't mean tinkering with the mechanics of coding a method in a particular language, but some less-than-obvious ways of going about things.

For example, if you were working something out that involved multiplying two lists of numbers together, and I suggested that it would be a lot quicker to do all the odd pairs, then all the even pairs and then combine them to give the result, you would probably think this perverse and unlikely to work! However, this is the basis of one magic algorithm — the Fast Fourier Transform or FFT — and its use has cut computing time in some branches of engineering and technology from hours to milliseconds! There are a few other examples of such magic algorithms to be found in more down-to-earth applications such as sorting and searching data, and basic calculations such as finding powers.

The most interesting thing is that before these methods were discovered, no-one even guessed that a better way might exist — how many more magic algorithms are there just waiting to be discovered? In this article I'll take a look at what makes such methods fast and how this might be applied to other, more general, programming problems.

The essence of the magic

If you are faced with a problem that involves performing a task on N data items, then it is clearly important to try to find a method for which the time taken to complete the task increases as slowly as possible as N increases. It is simple-minded to assume that there is one single, best algorithm in the sense of fastest algorithm because there is often no algorithm that is the fastest for all values of N. For example, some sorting methods are efficient for small values of N but hopelessly inefficient for large values of N.

The basis of a lot of the magically fast methods is dividing the problem down into smaller and, hopefully, simpler parts. If a task is being performed on N data items, then there is a chance that it can be performed quicker by dividing the N items into two equal-sized groups of N/2 items and performing the task separately on each half. That is, given N items:

Total Task
N items

try to decompose the total task into two separate parts:

Task A	Task B
N/2 items	N/2 items

and derive the final result by combining the result from tasks A and B.

At this point it is difficult to see how it is that the amount of work involved can possibly be reduced by

Binary search

Binary search is perhaps the best known of all the fast methods. Indeed, it is so well-known and loved that it is often not counted as an improved method but as *the* method. If you are searching a list of items for a particular target item, then the simplest algorithm is the linear search — that is, start at the top of the list and compare each item to the target. It is not difficult to see that linear search takes, on average, N/2 operations to find an item and N operations to discover that an item is not in the list. Thus, linear search is an algorithm that takes time proportional to O(N).

If the list of items is sorted into order, a better method of searching — binary search — can be employed. This works by repeatedly dividing in two the range that the target is thought to be in. If the items are stored in the array A with the smallest in A(1) and the largest in A(N), then at the beginning of the search we assume that the target will be in the range L to U with L=1 and U=N — that is, the entire array.

The first stage in the division process is to decide if the target, stored in T, is in the lower or upper half of the array. If M is in the middle of the range, we can decide which sub-range the target must be in by the following tests:

IF A(M) <T THEN target is in upper range — that is, M+1 to U

IF A(M) >T THEN target is in lower range — that is, M−1 to L

Of course there is also the possibility that A(M)=T, and in this case we have found the target and the process terminates. That is:

IF A(M)=T THEN target found

This division process continues until either the target is found or L>U, in which case the interval has been shrunk to nothing and the target is not in the array. This sketch of the method is sufficient to write a Basic subroutine to perform a binary search:

```
1000    L=1:U=N
1010    REM DIVISION LOOP
1020    IF L>U THEN I=0:RETURN:          REM EMPTY RANGE EXIT LOOP
1030     M=CINT((L+U)/2):                REM COMPUTE MIDDLE OF RANGE
1040     IF A(M)<T THEN L=M+1:           REM TARGET IN UPPER HALF
1050     IF A(M)>T THEN U=M-1:           REM TARGET IN LOWER HALF
1060    IF A(M)=T THEN I=M:RETURN:       REM TARGET FOUND EXIT LOOP
1070    GOTO 1010
```

When this subroutine terminates, I contains either the position of the target in the array or 0 to indicate that it hasn't been found.

Binary seach is a clear application of the repeated division principle. Each division produces a pair of subtasks: that is, find the target in half the number of items, but one of the sub-tasks is trivial because we can decide that the target is not in its half of the array. In this case, each division takes the same amount of time and doesn't depend on the number of items in the list. As each division takes a constant time and the number of divisions is $\log_2 N$, the entire process takes $O(\log_2 N)$. This represents a considerable saving in time for large lists.

For example, a linear search of 1000 items takes 500 comparisons to find the target and 1000 to report that it isn't present. A binary search of the same set of items takes roughly 10 divisions either to find, or not find, the target.

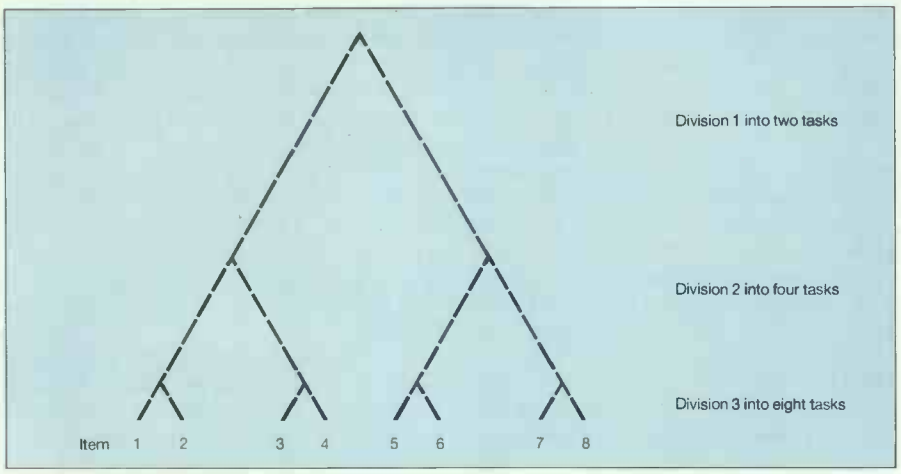
Of course, for a binary search the items have to be in order and the additional time it takes to sort them has been taken into account, but often the list has to be sorted for other reasons. Even if this isn't the case, it doesn't need many look-ups to make binary search plus sort more efficient than linear search.

From the point of view of our general repeated division method, binary search is an example of an improvement on an O(N) method — linear search — that can be implemented as $\log_2 N$ divisions which each take a time that doesn't depend upon N. Binary search is a very powerful and general algorithm that can crop up in many unexpected places.

For example, if you are looking for a serious bug in a program that completely crashes the system, the quickest way to track it down with minimum effort is to place print statements that divide the program into ranges in the manner of a binary search. That is, for the first run place the print statement in the middle of the program. If you see its output, the bug must be in the second half; if not, the bug is in the first half. Simply repeat the operation until the bug is pinned down into a small enough range for you to spot it. At most this will take $\log_2 N$ runs and print statements, where N is the number of lines in the program.

this division. Surely task A and task B together must take at least as long as the total task, and what about the extra time required to perform the division and recombination? Surprising though it seems, such a division does, in practice, usually provide an increase in speed because the dominating factor is how many items the task is working on. If you assume that a speed gain is indeed produced by such a division — what would you do to increase it even further? The answer is that you would repeat the process by dividing each of the two sub-tasks into two sub-sub-tasks, and so on, until each section of the problem consisted of a single element and the task performed on it would usually turn out to be trivial.

If there are N items, how many times can this division process be repeated? The answer to this is (perhaps not surprisingly for those mathematically minded) $\log_2 N$. Of course, it is only possible to carry out this division exactly if N is a power of two, and this accounts for the restriction of many of the fast methods to values of N that are a power of two. For example, if N=8 then the division process can be applied exactly three times. It is sometimes useful to draw a diagram of the division process as a binary tree.



The division process of N=8 as a binary tree

In the case of N=8, see the example shown above.

In general the decomposition tree for N items has $\log_2 N$ levels, and this visualisation gives us a way of exploring the way that an increase in speed might be gained. If each division process takes time T, then the total time taken is $T\log_2 N$ and this is often smaller than the time taken for the straightforward approach.

If you still think that all this is unlikely, then to a certain extent I have to agree with you. But it is surprising how often in practice a division process can be found which not only gives the same result as the original process, but is an order faster! The trouble with all this is that at the moment it seems very abstract and gives us no clue as to what a real division process might consist of.

In the accompanying panels a number of practical fast methods are described for a variety of processes. In these cases it is all too easy to lose sight of the theory as outlined here and become bogged down in the practical details of implementation. As you read the explanations

Fast power

This example is a lot less well-known than binary search, and is a little more difficult to understand because it uses some binary arithmetic. The problem that we are trying to solve is to work out X^N. The straightforward way of working this out is to use a loop to multiply X by itself N times. That is:

```
P=1
FOR I=1 TO N
  P=P*X
NEXT I
```

and this clearly takes a time proportional to O(N). There is a very simple method of computing powers that works in time proportional to $O(\log_2 N)$. Before reading on you might like to try to find it for yourself.

The principle of the fast power method is based on the observation that certain powers of X are very easy to calculate. For example, X^2 is just X*X, X^4 is X^2*X^2, X^8 is X^4*X^4, and so on. In other words, you can work out an X raised to a power of 2 by repeatedly squaring the previous result. If there were some way of breaking a general power of N down into a combination of powers of 2, then we would have a faster algorithm. In fact, any number can be represented as a sum of powers of 2; this is nothing more than its binary representation. For example, 7 is $1*2^2+1*2^1+1*2^0$ and its binary representation is 111; 5 is $1*2^2+0*2^1+1*2^0$ and its binary representation is 101; and so on. In the same way, N can be decomposed into a sum of powers of 2. This may not seem to be of much help in computing X^N but as X(a+b)=Xa*Xb, XN can be calculated as a product of X raised to the powers of 2 that occur in the binary representation of N.

If this seems a little abstract then consider X^7 which is equal to $X^4*X^2*X^1$ (4+2+1=7) or X^5 which is equal to X^4*X^1 (4+1=5). Notice that the only thing that makes this decomposition of X^N easier to compute is the simplicity of computing X raised to a power of 2. The final program is:

```
1000 P=1
1010 R=X
1020 REM START OF POWER LOOP
1030 IF N<=0 THEN RETURN:          REM EXIT LOOP
1040  IF (N AND 1)=1 THEN P=P*R:REM INCLUDE R IF LAST BIT IS SET
1050  R=R*R:                       REM COMPUTE X TO POWER OF 2
1060  N=INT(N/2):                  REM REDUCE N BY FACTOR OF 2
1070 GOTO 1020
```

The only difficult points in the above program are the use of the AND in line 1050 to test if the right-hand bit of N is 1 or not; and the integer division by 2 in line 1060 which is equivalent to shifting all the bits in N one place to the right and discarding the right-hand bit.

The fast power algorithm works in time proportional to $O(\log_2 N)$. It is a subtle example of the division method described above in that what is being divided is a number, N, into its binary representation. That is, N is made up of so many lots of 1, so many lots of 2, so many lots of 4, so many lots of 8, and so on ... and this corresponds to repeatedly dividing N by 2 until it is less than or equal to 1 (compare this to dividing the range in a binary search). Each division takes a constant amount of time and there are $\log_2 N$ such divisions, so the entire algorithm is $O(\log_2 N)$. If you want to compute $X^{10,000}$, the simple method will take 10,000 loops but the fast algorithm will take only 14 loops!

Although the fast power method is interesting, it is only useful when a log function isn't available — for example, when writing in assembler — because it is usually just as fast to use N*LOG(X) or X^N to compute powers.

and examine the programs, try to keep in mind the general principles described above.

Let's now take a look at the mathematics behind the operation of this kind of algorithm. Although it is not necessary to understand the mathematics in order to use the algorithms, taking the trouble to work your way through the explanation will help. If you want to modify or use similar algorithms, it is essential to understand the mathematics — one small change can make a vast difference to the algorithms' execution time.

Mathematics

To characterise completely the speed of an algorithm, it helps to draw a graph of how the time to complete to task increases with the number of items, N. This is, to a certain extent, overkill, in that how the time taken increases with N can be characterised by stating that the graph is roughly linear, quadratic, cubic, and so on. In the jargon this is equivalent to saying that the algorithm takes time proportional to O(N), $O(N^2)$, $O(N^3)$, and so on (the 'O' is pronounced 'Order'). If algorithm A is O(N) and algorithm B is $O(N^2)$, then there is certain to be a value of N above which A is increasingly faster than B. In this sense we would prefer O(N) algorithms to $O(N^2)$ algorithms and $O(N^2)$ algorithms to $O(N^3)$ algorithms, and so on.

Another way of looking at this is to ask how much the time taken increases if N is doubled:

N doubles:	O(N)	$O(N^2)$	$O(N^3)$
Increases time by:	2	4	8

Using this table, it isn't difficult to see that an O(N) algorithm remains practical long after you have grown old waiting for an $O(N^3)$ algorithm to finish. You might think that this is an exaggeration: an $O(N^3)$ algorithm that takes one second to process 100 items seems inefficient, but not ridiculously so when compared with an O(N) algorithm that takes .001 seconds. However, for 1,000,000 items the O(N) algorithm would take something like 10 seconds, but the $O(N^3)$ algorithm would take 32,000 years!

Quicksort

Quicksort, invented in 1962 by CAR Hoare, is still the fastest sorting method that we know. And as it takes time proportional to $O(N\log_2 N)$, we know that it must be within a constant of being optimum. Simple sorting methods such as selection sort, insertion sort, and so on, take time proportional to $O(N^2)$ or worse, so quicksort is a great improvement when N is large. For small numbers of items, simple sorting methods may actually be faster than the more complicated quicksort, but as N increases it doesn't take long for quicksort to live up to its name.

The fundamental operation of quicksort is a division of the array into a right-hand part that contains items greater than a given value A, and a left-hand part that contains items less than this value. (The value of A is arbitrary, but for an efficient method it is desirable that it divides the array into roughly two equal-sized portions.) That is, after the first partition the array is:

< A	A	<	> A

This partitioning operation can be performed using two pointers — I and J, say. Firstly, a scan to the right is performed using I to find an element bigger than A, then a scan to the left is performed using J to find an element smaller than A. These two elements are clearly in the wrong portions of the array, so they have to be swapped. That is:

```
   REM SCAN RIGHT
   I=1
x  IF X(I)<A THEN I=I+1:GOTO x
   REM SCAN LEFT
   J=N
y  IF X (J)>A THEN J=J-1:GOTO y
   REM SWAP X (I) AND X(J)
```

After the first swap, the left and right scans continue from where they left off and elements are swapped until the two pointers meet somewhere in the middle of the array. At this stage the partition is complete, and all the elements to the left of the meeting place are less than A and all the elements to the right of the meeting place are greater than A.

A partitioning of this type doesn't result in a sorted array, but the array is more ordered in that during subsequent sorting, no elements will have to be moved between the two halves. This, of course, means that the two halves can be sorted independently of one another, and we have succeeded in splitting the task of sorting N items into two tasks of sorting N/2 items.

The next stage should be obvious in that further applications of the partitioning method would reduce the task even more. Repeatedly partitioning the array finally results in partitions of single elements which need no additional work to sort: that is, the array can be completely sorted by use of nothing but the partitioning method.

You should recognise in this all the features of the general partitioning method described earlier. As each partition takes roughly O(N) operations and on average $\log_2 N$ partitions will be needed, the entire quicksort procedure will take $O(N\log_2 N)$.

The subroutine given below performs a quicksort on the array X. It is essentially based on the methods described above but with some practical modifications to make the process more efficient. In particular, to minimise storage overheads, the smallest of the two portions of the array produced by a partition is selected for further partitioning. If you are not convinced that such an elaborate subroutine could be faster than a simple selection or insertion sort, it is worth examining the following table:

	256 items	512 items
Insertion sort	366	1444
Selection sort	509	1956
Bubble sort	1026	4054
Quicksort	60	146

(The times are in milliseconds for Pascal versions running on a CDC 6400 computer — taken from N Wirth, *Algorithms+Data Structures=Programs.*)

```
1000 REM QUICKSORT
1010 M=12:                              REM DEPTH OF STACK
1020 S=1:                               REM STACK POINTER
1030 DIM STACK(M,2):                    REM ***MOVE TO MAIN PROGRAM***
1040 STACK(1,1)=1:STACK(1,2)=N:         REM INITIALISE STACK
1050 REM LOOP POP STACK
1060  L=STACK(S,1):R=STACK(S,2):S=S-1
1070  REM DO DIVISION OF L TO R
1080  I=L:J=R:A=X(INT((L+R)/2))
1090  REM SWAP X(I), X(J) LOOP
1100   REM SCAN RIGHT LOOP
1110    IF X(I)<A THEN I=I+1:GOTO 1110
1120   REM SCAN LEFT LOOP
1130    IF X(J)>A THEN J=J-1:GOTO 1130
1140   IF I>J THEN GOTO 1190:           REM EXIT SWAP LOOP
1150   W=X(I):X(I)=X(J):X(J)=W:         REM SWAP VALUES AT I AND J
1160   I=I+1:J=J-1:                     REM SET POINTERS FOR NEXT SCAN
1170   IF I>J THEN GOTO 1190:           REM EXIT SWAP LOOP
1180  GOTO 1090
1190  REM STACK SMALLEST PARTITION
1200  IF J-L<R-I AND I<R THEN S=S+1:STACK(S,1)=I:STACK(S,2)=R
1210  IF J-L>=R-I AND L<J THEN S=S+1:STACK(S,1)=L:STACK(S,2)=J
1220  REM SORT REMAINING PARTITION
1230  IF J-L<R-I THEN R=J ELSE L=I
1240  IF L>=R THEN GOTO 1260:          REM EXIT DIVISION LOOP
1250 GOTO 1070
1260 IF S=0 THEN GOTO 1280:            REM EXIT LOOP STACK EMPTY
1270 GOTO 1050
1280 RETURN
```

The fast median finder

The fast median finder was invented in 1970, and it's a strange blend of binary search and quicksort. The median of a set of numbers is the value that 'lies in the middle': that is, half of the values are smaller or equal to it and the other half are larger or equal to it.

Another definition of the median is that it is the middle value after sorting the set into order. For example, the median of:

4 2 10 3 7 18 60

can be found by first sorting the set into order:

V

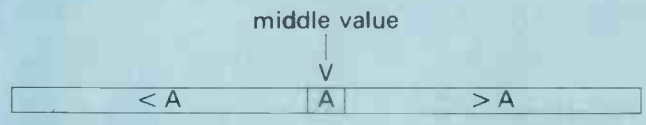
2 3 4 7 10 18 60

and picking the middle value — that is, the median is 7. In statistics, the median is often used in place of the mean to indicate the value that a set of numbers is centred on.

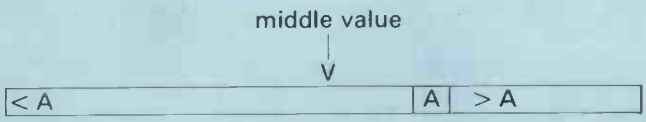
The most common way of finding the median is to proceed as above and sort the numbers into order before finding the middle value. If the best sorting method is used, this takes $O(N\log_2 N)$, but there is a much faster method that will find the median in time proportional to O(N) based on the partitioning operation introduced as part of quicksort.

If you perform the partitioning operation used in quicksort on an array using a value A, then the result splits the array into two portions: one smaller than or equal to A; and one bigger than or equal to A.

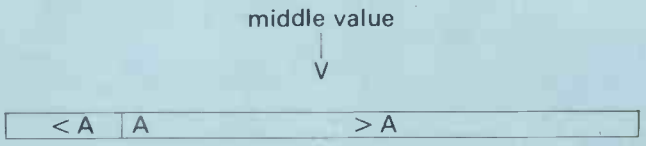
If this division is into two equal parts, then A is the median of the set of values:



However, as A was chosen at random, this equal split is unlikely to be obtained. If the left-hand portion of the split is larger, the value A is too big to be the median which must lie in the left-hand portion:



If, on the other hand, the right-hand portion is larger, the value of A is too small to be the median which must lie in the right-hand portion:



At this stage you should be able to see that the partitioning operation either finds the median, or pins it down to lying in one of the two portions of the array. This is remarkably similar to the division of the range that a target is assumed to lie in during a binary search.

The next stage is to repeatedly apply the partioning operation to the portion of the array that the median is located in until it is found. This on average takes 2N operations, so the entire process is O(N) which is a considerable improvement over $O(N\log_2 N)$.

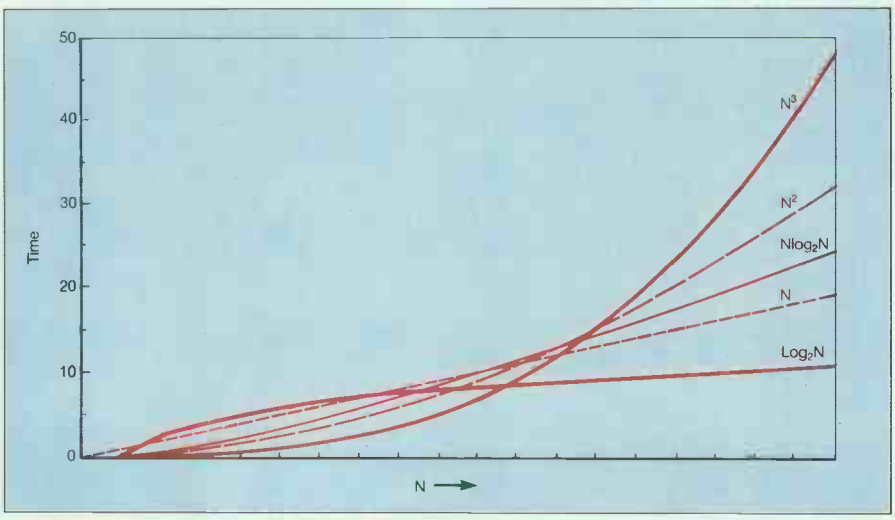
The following program finds the median of the values stored in the array X using the method described above. The median returned is A(K).

```
1000 L=1:R=N:REM SET INITIAL RANGE
1010 K=CINT(N/2) :REM K=POSITION OF MEDIAN I.E. MIDDLE OF ARRAY
1020 REM PARTITION UNTIL L>R
1030 IF L>R THEN GOTO 1200
1040 A=X(K):                          REM SET VALUE OF A
1050 I=L:J=R:                         REM SET SCAN POINTERS
1060  REM DO DIVISION OF L TO R
1070  REM SWAP X(I), X(J) LOOP
1080   REM SCAN RIGHT LOOP
1090    IF X(I)<A THEN I=I+1:GOTO 1090
1100   REM SCAN LEFT LOOP
1110    IF X(J)>A THEN J=J-1:GOTO 1110
1120   IF I>J THEN GOTO 1170:         REM EXIT SWAP LOOP
1130   W=X(I):X(I)=X(J):X(J)=W:       REM SWAP VALUES AT I AND J
1140   I=I+1:J=J-1:                   REM SET POINTERS FOR NEXT SCAN
1150   IF I>J THEN GOTO 1170:         REM EXIT SWAP LOOP
1160  GOTO 1070
1170  IF J<K THEN L=I:               REM SET POINTERS TO LARGEST
1180  IF K<I THEN R=J:               REM PARTITION
1190 GOTO 1020
1200 RETURN
```

Algorithms which take time proportional to $O(N^c)$, where c is a constant, are called 'polynomial time algorithms'. But there are algorithms that perform worse than polynomial time algorithms.

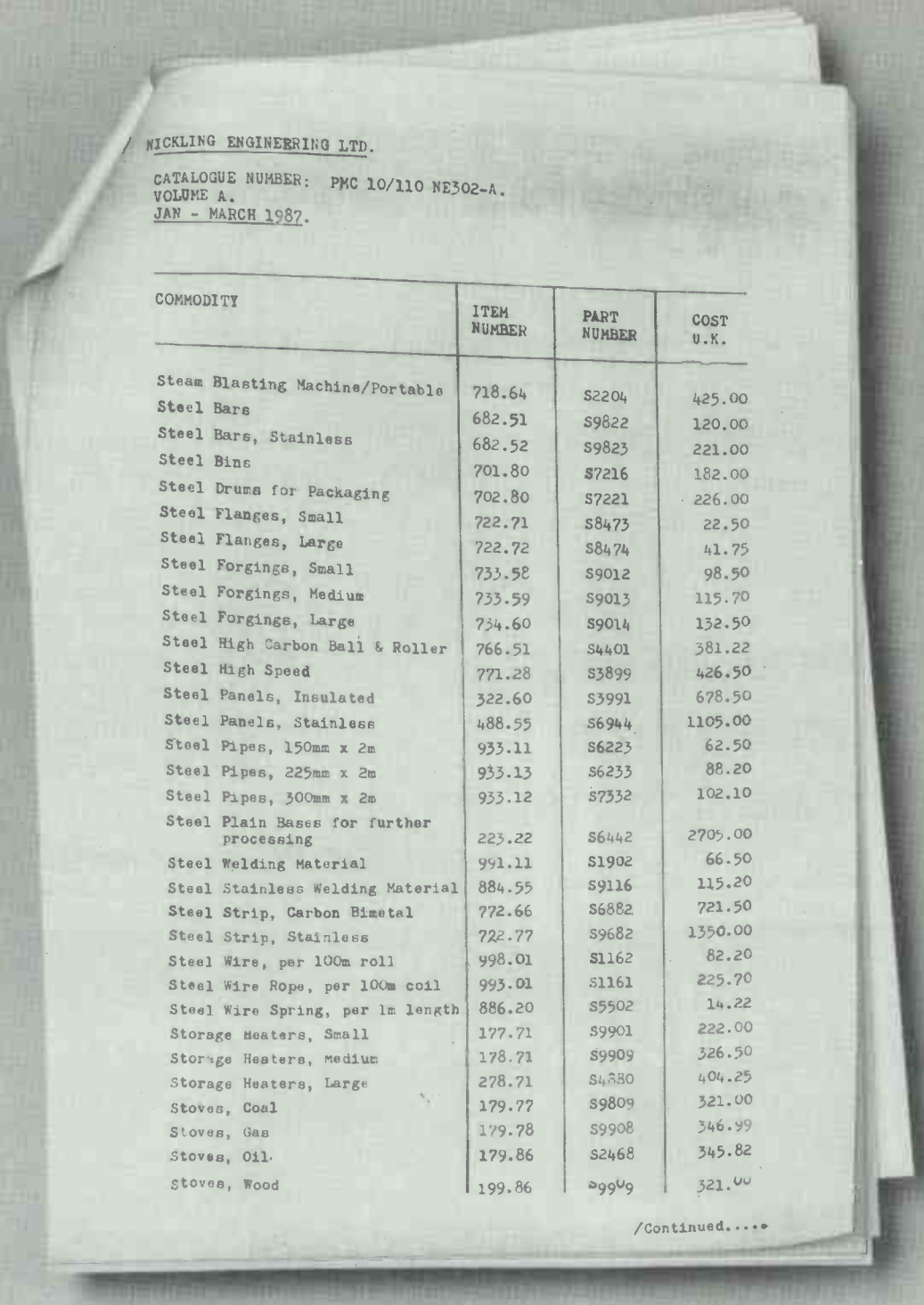
For example, an exponential time algorithm $O(e^N)$ performs worse than any polynomial time algorithm. In other words, $O(e^N)$ is another order of badness! Most of the magic algorithms described in this article take time proportional to either $O(N\log_2 N)$ or $O(\log_2 N)$. An $O(N\log_2 N)$ algorithm is worse than O(N) but better than $O(N^2)$, and an $O(\log_2 N)$ is particularly prized because it is even better than O(N). If N is doubled, the time taken by an $O(\log_2 N)$ algorithm only increases by one unit of time whereas an O(N) algorithm doubles the time it takes.

If you are not familiar with the $\log_2$ (that is, log to the base 2) function, it is worth saying that $\log_2 N$ is simply the power of 2 that equals N. In other words, if $a=\log_2 N$ then $N=2a$. For example, $\log_2 8=3$ because $2^3=8$, and $\log_2 2.828=1.5$ because $2^{1.5}=2.828$ (not so easy to verify by simple arithmetic due to the fractional power).



Graph to show time in relation to number of items

The reason why $\log_2$ is involved in the performance of all of the fast methods is no accident and, indeed, it is a clear indication of the division principle that they all embody. This is because asking how many times N can be divided by 2 before reaching 1 is equivalent to asking how many 2s have to be multiplied together to make N — that is, what power of 2 equals N, and this is simply $\log_2 N$. END



NICKLING ENGINEERING LTD.

CATALOGUE NUMBER: PMC 10/110 NE302-A.
VOLUME A.
JAN - MARCH 1987.

COMMODITY	ITEM NUMBER	PART NUMBER	COST U.K.
Steam Blasting Machine/Portable	718.64	S2204	425.00
Steel Bars	682.51	S9822	120.00
Steel Bars, Stainless	682.52	S9823	221.00
Steel Bins	701.80	S7216	182.00
Steel Drums for Packaging	702.80	S7221	226.00
Steel Flanges, Small	722.71	S8473	22.50
Steel Flanges, Large	722.72	S8474	41.75
Steel Forgings, Small	733.58	S9012	98.50
Steel Forgings, Medium	733.59	S9013	115.70
Steel Forgings, Large	734.60	S9014	132.50
Steel High Carbon Ball & Roller	766.51	S4401	381.22
Steel High Speed	771.28	S3899	426.50
Steel Panels, Insulated	322.60	S3991	678.50
Steel Panels, Stainless	488.55	S6944	1105.00
Steel Pipes, 150mm x 2m	933.11	S6223	62.50
Steel Pipes, 225mm x 2m	933.13	S6233	88.20
Steel Pipes, 300mm x 2m	933.12	S7332	102.10
Steel Plain Bases for further processing	223.22	S6442	2705.00
Steel Welding Material	991.11	S1902	66.50
Steel Stainless Welding Material	884.55	S9116	115.20
Steel Strip, Carbon Bimetal	772.66	S6882	721.50
Steel Strip, Stainless	722.77	S9682	1350.00
Steel Wire, per 100m roll	998.01	S1162	82.20
Steel Wire Rope, per 100m coil	993.01	S1161	225.70
Steel Wire Spring, per 1m length	886.20	S5502	14.22
Storage Heaters, Small	177.71	S9901	222.00
Storage Heaters, Medium	178.71	S9909	326.50
Storage Heaters, Large	278.71	S4880	404.25
Stoves, Coal	179.77	S9809	321.00
Stoves, Gas	179.78	S9908	346.99
Stoves, Oil	179.86	S2468	345.82
Stoves, Wood	199.86	S9909	321.00

/Continued....

Which company would

These two spare parts catalogues have just landed on the desk of your most important customer.

One is yours...the other is from a competitor.

One is the same old difficult-to-read typewritten list your customer's been getting for the past 25 years.

No wonder he always picks up the other catalogue first.

As you can see, it's professionally designed and typeset to make it easier to read.

And much easier to find what you're looking for.

It must have cost a fortune and taken ages to produce.

Or did it?

Actually, the whole 32 page book was whisked out very cheap in under a day. That's because one of you was smart enough to invest in Letraset's revolutionary new 'Ready, Set, Go! 3' Graph Design Software program and an Apple Macintosh™ system.

Letraset Ready, Set, Go! 3 and the Apple Macintosh is the perfect combination of art and science that allows any company t up-grade its professional image through the desktop publishing it produces.

With no graphic design experience at all, you can produce anything from a single page document to a complete catalogue magazine faster, easier and more economically than ever before.

PRIMARY

ENGINEERING LTD

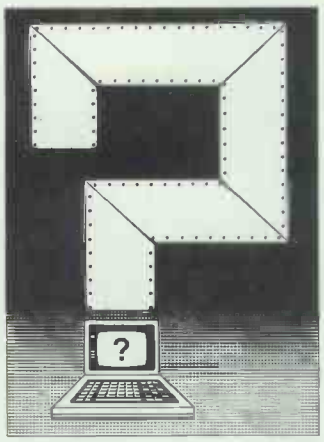
CATALOGUE NUMBER: PMC 10/110 NE302-A
VOLUME A
JAN - MARCH 1987

COMMODITY	ITEM NUMBER	PART NUMBER	COST U.K.
Steam Blasting Machine/Portable	718.64	S2204	425.00
Steel Bars	682.51	S9822	120.00
Steel Bars, Stainless	682.52	S9823	221.00
Steel Bins	701.80	S7216	182.00
Steel Drums for Packaging	702.80	S7221	226.00
Steel Flanges, Small	722.71	S8473	22.50
Steel Flanges, Large	722.72	S8474	41.75
Steel Forgings, Small	733.58	S9012	98.50
Steel Forgings, Medium	733.59	S9013	115.70
Steel Forgings, Large	734.60	S9014	132.50
Steel High Carbon Ball & Roller	766.51	S4401	381.22
Steel High Speed	771.28	S3899	426.50
Steel Panels, Insulated	322.60	S3991	678.50
Steel Panels, Stainless	488.55	S6944	1105.00
Steel Pipes, 150mm x 2m	933.11	S6223	62.50
Steel Pipes, 225mm x 2m	933.13	S6233	88.20
Steel Pipes, 300mm x 2m	933.12	S7332	102.10
Steel Plain Bases for further processing	223.22	S6442	2705.00
Steel Welding Material	991.11	S1902	66.50
Steel Stainless Welding Material	884.55	S9116	115.20
Steel Strip, Carbon Bimetal	772.66	S6882	721.50
Steel Strip, Stainless	722.77	S9682	1350.00
Steel Wire, per 100m roll	998.01	S1162	82.20
Steel Wire Rope, per 100m coil	993.01	S1161	225.70
Steel Wire Spring, per 1m length	886.20	S5502	14.22
Storage Heaters, Small	177.71	S9901	222.00
Storage Heaters, Medium	178.71	S9909	326.50
Storage Heaters, Large	278.71	S4880	404.25
Stoves, Coal	179.77	S9809	321.00
Stoves, Gas	179.78	S9908	346.99
Stoves, Oil	179.86	S2468	345.82
Stoves, Wood	199.86	S9909	321.00

PAGE 21

COMPUTER ANSWERS

Our technical expert takes his toolkit to your problems. The address to write to is: Computer Answers, PCW, 32-34 Broadwick Street, London W1A 2HG.



Computer Answers is PCW's help column. We offer advice about all kinds of specific hardware and software problems through the pages of the magazine. We also welcome further information in response to published queries.

Patching is the key

I use an IBM PC mostly for word processing, and I use several languages including French, Swedish and Portuguese. I have only the standard English keyboard, which makes typing foreign characters very cumbersome — I have to type in the full ASCII code while holding down the Alt key.

Is it possible to reassign some of my lesser-used keys to give me direct access to certain foreign characters?
Sven Norrby, Delft, The Netherlands

If you have an English keyboard on your PC, I assume you use KEYBUK — the resident program that configures PC-DOS to work with a UK keyboard.

KEYBUK works by intercepting all the characters you type, and substituting them for others, before they reach any applications program. So, if you press the hash key within WordStar, for example, KEYBUK will trap that key and replace it with the code for a pound sign, without WordStar knowing what has happened.

KEYBUK knows which characters are replaced by what, by having a look-up table. To reassign single keys in a way that should work with any software, you simply need to alter the look-up table which KEYBUK uses.

If you use a file editor like DEBUG or Norton Utilities to examine KEYBUK.COM, you will see a list of keys which comprise the entire character set that the keyboard can produce. The order that the keys take in the table is the order they take on the keyboard, so by changing the contents of this table or the order of the entries, you can redefine keys.

You will probably find two or more key tables in KEYBUK.COM, as separate ones are used with Shift, Alt, Ctrl, and so on.

To effect the patches, make a copy of KEYBUK.COM and call it, say, NEWKBUK.COM. Then, use DEBUG or Norton to patch your NEWKBUK.COM file. You will probably have to experiment with your patches until they work exactly as you want. When they do, put a NEWKBUK command in your AUTOEXEC.BAT file and the redefined keys will be active each time you start the PC.

Full instructions on using DEBUG are in your DOS manual, though you'll find it easier with something like the Norton Utilities.

Before you attempt all this, contact your local IBM office and ask if they can supply ready-patched KEYBUKs for particular languages. (Incidentally, KEYBUK — or its patched equivalent — can be temporarily turned off and back on again by Ctrl-Alt-F1 and Ctrl-Alt-F2 respectively.)

Alternatively, try a resident-key macro program like Superkey which will substitute codes for keys you type.

Printer problem

I have an Atari 800XL which I use with a 1050 disk drive, a 1027 letter-quality printer and the Atariwriter. When printing lengthy documents, the printer occasionally locks up for no apparent reason. I've tried hitting 'Break' followed by 'P' to restart the print, but this just results in the printing beginning at the start of the document again.

Why does this happen and how can I overcome it?
DS Hammonds, London N21

This problem has baffled many an 8-bit Atari owner. It is caused by a peculiar bug in Atariwriter which only occurs when the machine is connected to both the 1027 printer and the 1050 disk drive. The solution, however, is — *wait.* After approximately 4½ minutes, the printer will start up again just as mysteriously as it stopped. This is annoying and time-wasting, but at least you won't have to restart from the beginning.

Deleting directories

I have a problem with deleting two sub-directories on the hard disk of my Amstrad PC. The two directories in question are empty of files, yet trying to remove them gives an 'Invalid path or directory not empty' message every time.

I have deleted directories many times, so I am sure that I am using the correct commands. I have used CHKDSK to make sure that the directories in question don't contain any hidden files. They don't.

I can't see how the error message can be correct.
Stephen Kirk, Perth, Scotland

It sounds as if you have a problem with your File Allocation Table, or FAT; this is the area on a disk that contains the information about where each file is stored. Storage on a hard disk is divided into chunks that are, typically, 2k in size. To store a 15k file takes eight of these chunks, called clusters. Sometimes, all eight clusters may be one after the other on the disk. But this is not always the case — the clusters may be spread over the entire disk. The File Allocation Table tells MS-DOS which clusters contain which files, so it can keep track of how the disk space is used.

If your machine crashes while a file is open, or if a fault occurs, there is a chance that, although a file has been added or deleted on a hard disk, the FAT has not yet been updated. This sounds like what has happened to your hard disk: although there don't appear to be any files in your directory, it is possible that the FAT has become corrupted and MS-DOS thinks that part of a file is still in that particular directory.

When you use BACKUP to back up a hard disk onto floppies, any FAT errors don't find their way on to the back-up floppies, though one or more files may be corrupted or missing. You should, therefore:

- Back up everything from your hard disk onto floppy disks.
- Reformat the hard disk, to clear the FAT and start afresh.
- Copy the floppies back onto the hard disk. Everything will now be correct.

If your particular BACKUP program gets upset about FAT errors and won't back up the disk, use COPY or XCOPY instead.

As well as informing you about hidden files, CHKDSK also tells you if there are any corrupted FAT entries. If there are, you will see a message about lost clusters when you run CHKDSK. If this message appears, it confirms my diagnosis.

Directing errors

I recently bought a copy of MASM 4.0, and it is very much improved in terms of speed. Unfortunately, Microsoft has done something so transcendentally dumb and crippling that I can't believe it. The error messages are now sent to the STDERR device, handle 3, instead of to STDOUT. Under MS-DOS this output goes to the display.

I'm very much used to redirecting MASM output to

a file called ERRORS: you can do what you please with it then. Now, I can only redirect it to the printer with this batch sequence:

CTTY PRN
MASM, and so on
CTTY CON

This won't work to a file. The only other way I know to redirect STDERR is in the running program, by closing the handle and opening it to another device. But I can't find where they are opening the STDERR handle, to change it.
John DeHaven, Wat Pleng, Thailand

This problem crops up because Microsoft re-wrote MASM completely between version 3.0 and 4.0. The old version was in machine code, while the new one was written in C. Microsoft's C compiler appears to have done a fine job on the low-level code, but apparently it doesn't have code to re-direct STDERR in its library. You couldn't find the code that opens STDERR because it's already open when the program starts to run — MASM doesn't open it explicitly.

As Microsoft sees it, the problem is that the 'shell' you are using — the command-line interpreter — is not clever enough to redirect STDERR. The company suggests you write a program in assembler, C, or any other language that lets you execute another program with an INT 21 instruction. Close STDERR and re-open it as required, before calling up MASM. STDERR will revert to the display when your control program — in effect, a 'shell' — stops.

This seems a rather roundabout solution, but it may have to suffice until the gurus at Microsoft find it sufficiently annoying to want to fix it — or release the shell *they're* using!

SideKick hiccough

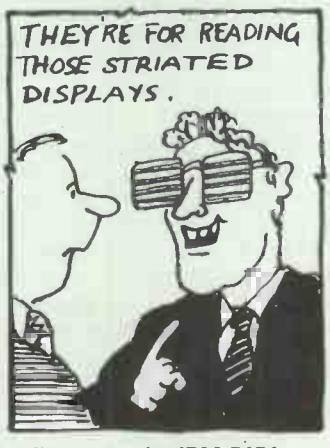
I recently purchased a Miracle Technology WS4000 modem. This performs faultlessly when connected to an Olivetti M24 using Datasoft Datalk communications software. However, the SideKick phone dialler, using pulse dialling, causes the system to 'hang' after a number has been dialled. The voice link is established and pressing SPACE switches the modem offline, but SideKick refuses to accept any input.

Can you help?
D Berger, Freiburg, West Germany

SideKick is an American product, and it has taken a while for its programmers to get the hang of the European telephone system; Version 1.56 cures the problem you mention. There's still one annoying snag — when you hang up the phone the software won't automatically disconnect the line for you. This is not too much of a problem, as the WS4000 detects this and 'drops' the line automatically when its 'timeout' period expires. This normally happens after 30 seconds, but the software allows you to change this.

Monitoring screens

I have just purchased a Tandy 1000. Although I generally like the machine, I'm very disappointed with the quality of the monochrome display — the letters appear striated. I've tried various monochrome monitors, but they all give the same striped look. Is there a monitor I can use that will give solid letters onscreen?



I've seen the IBM 5151 monochrome monitor hooked to an IBM PC, and it looks wonderful. Unfortunately, the monitor connector on the PC is not the same as on the Tandy 1000. Do you know if I could make some sort of adaptor to hook the 5151 to the 1000; and, having done that, will I get the same sharp letters I have seen on the PC?
Stephen Davies, Perth

The striped look you describe is typical of display systems which emulate the IBM PC colour display adaptor. It comes from the 200-line, vertical-resolution limit imposed by the TV-compatible scan rates, combined with the non-interlaced mode to avoid jitter. This is a characteristic users have learned to live with.

The high-quality display you see on the IBM 5151 monitor is the result of using faster horizontal sweep and slower vertical sweep to give 350 or so lines of vertical resolution, combined with wider video bandwidth (frequency response) to provide 720-line horizontal resolution. The display board also has a different character-generator ROM to take advantage of the higher resolution.

If you try to use the 5151 monitor with your Tandy 1000 graphics display driver, you not only won't get an improved display, you will also probably burn out the monitor's power supply due to the incompatible sweep rates.

It might be possible to use a display driver like the monochrome display adaptor and then use the IBM 5151 or an equivalent monitor if you can find one that fits. The problem is that the Tandy's expansion slots are shorter than IBM's, so the IBM board won't fit. Larger Tandy dealers stock a list of expansion cards that do fit; this list includes alternative monochrome display adaptor cards.

Getting the boot

I have an Atari ST and I want to auto-boot a GEM application. Unfortunately GEM is initialised *after* the auto-folder, and this won't work. I have attempted to use the boot sector on the disk, but so far I haven't even been able to boot a TOS program this way. I have both versions of *Internals*, but obviously I've missed something.
Daniel Demaret, Angered, Sweden

It is possible to auto-boot GEM applications, but only by using tricks to fool the ST. There are two possibilities. The first is to run a TOS application, which installs GEM and then runs a GEM application. To do this, you will need to know how to initialise GEM while retaining control from your program.

The second way is to write your program as a desk accessory. It is possible to make desk accessories auto-run, but I'm not sure if this can be done with GEM-based desk accessories.

There is a 3k program floating around on American bulletin board systems called Autogem that does precisely what you want — it boots GEM applications from within the AUTO folder. It is definitely available on the XANTH bulletin board on (0101) 206 682 8039, although it will be expensive to download it.

Disk waste on the AT

I have just purchased a cheap AT clone for use in my office. One of the main reasons why I chose this particular machine was because it comes with a 40Mbyte hard disk.

However, I have now discovered that MS-DOS and PC-DOS can't work with more than 32Mbytes, and that I am wasting 20 per cent of my hard disk because I can't format or access it. Is there any way I can reclaim the missing 8Mbytes?
Anthony O'Connor, Hammersmith, London

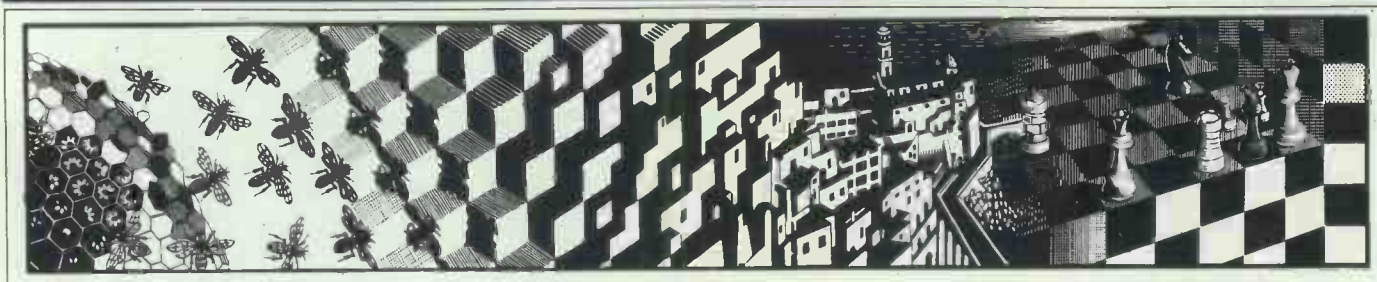
All current versions of MS-DOS and PC-DOS (up to and including 3.20) can only access 32Mbytes on a single hard disk. You can have more than one 20Mbyte drive — DOS will happily access all of them — but 32 Mbytes is the limit for a single drive.

To use all of your 40Mbyte drive's space, you have to partition it into two separate 20Mbyte drives. You will then have a 20Mbyte drive C and a drive D of the same size. To set this up, you need a special program to format and partition the hard disk, and an MS-DOS device driver to access the second 20Mbyte half.

Some manufacturers (Zenith and Mitsubishi among them) bundle this software with their machines; the programs are called XCOPY and XDISK. Perhaps they will sell you a copy of their MS-DOS system disk, on which you'll find these programs.

Our technical staff can only reply to queries through the pages of the magazine. Please don't send an sae expecting an individual reply. END

SCREENPLAY



Stephen Applebaum, not content with striking it lucky at the bowling alley and saving thrones from unscrupulous usurpers, launches himself into the mini-screen version of The Fourth Protocol — and all because he's reviewing the best of this month's games.

Going out in style

Title: Sinbad and the throne of the Falcon
Computer: Amiga; Atari ST
Supplier: Mindscape
Format: Disk
Price: £39.95 (Amiga); £29.95 (ST)

Sinbad and the throne of the Falcon is the fourth — and sadly last — title in Master Designer Software's glittering Cinemaware series; a project that began with Defender of the Crown and then looked doomed to failure with the launch of the dreadful Reagan-pandering SDI. But, as The King of Chicago, reviewed in last month's Screenplay, showed, SDI was — thank goodness — just a momentary aberration.

If the Cinemaware project started on a high note, then it finishes on an even higher one: Sinbad and the throne of the Falcon is by far the better of the four games. Not even Defender of the Crown can escape the shadow cast by this one.

The game's scenario centres around the ailing Caliph of Damaron who, days before announcing his successor, is magically transformed into a falcon. Rulerless, Damaron falls into a state of confusion.

In the mountains and meads beyond the city walls, Black Prince Camaral, the disinherited son of the Caliph, orders his armies to attack the palace and make the throne his. But it isn't only Camaral who sees the Caliph's misfortunes as his victory. In a small village near Damaron, Libitina (whom the Caliph divorced, saying she was a witch) prepares her son, Jamoul, for Royal office.

Back in Damaron, Princess Sylphani and Prince Harun, the man thought to have been the Caliph's choice of successor, await the arrival of Sinbad, their only hope against the evil threatening Damaron from all quarters.

Your role in all of this is, of course, that of the heroic Captain Sinbad. With the aid of your 'willing' crew and those whom you can press into service, you must sail the world in search of the spell that will release the Caliph from his affliction and bring peace to Damaron once again. Until that time, you must also command the Caliph's armies against the forces of Black Prince Camaral.

Sinbad and the throne of the Falcon is played by alternating between three control screens, each one of which provides information on different aspects of the adventure.

The Time screen displays an instrument rather like an hour glass, indicating the time you have left to find a cure for the Caliph. Should you fail to beat the rush of sand, the Caliph will be doomed to live out the rest of his days as a falcon.

Of the three control screens, the most ingenious is one featuring a topographical map of the mythical world where the adventure takes place. Pressing the left-hand mouse button when this screen is selected produces a large magnifying glass which you can guide over the map to reveal the names of seas, towns and islands. You must know these, as the only way of moving around the world is by selecting the name of your destination from a pull-down menu called 'Move To'; the contents of which change, depending on your current location.

The final screen is called 'The City'; and features a close-up view of Damaron and its environs. Again the scene shows only the geographical features of the land, though in this case names are not important. What is, is the meshwork of hexagons drawn over the background.

Each hexagon on The City map represents a space into which you can move an army. Your armies — or rather, those loyal to the Caliph — are shown in red, while Camaral's are black.

When you point to an army with the mouse cursor, a status line along the top of the screen informs you of its size and mobility. Weak armies, severly depleted through battle, can be moved into one of six special hexagons designated as supply centres. Any army, whether it be one of yours or the Prince's, reaching a supply centre, is almost immediately reinforced back to full strength.

Throughout the game, help can be gleaned from the Princess Sylphani, a shaman, a genie, Prince Harun, a gypsy named Iris, and even the seductress, Libitina.

When you meet a character with whom you can converse, the display changes to show a small, animated representation of that person. In each case, speech bubbles filled with

questions puff from their mouths, and you have to answer by selecting the most appropriate reply from a list stored in a pull-down menu. Most of these contacts are fairly uneventful, though the one with Libitina is rather interesting, to say the least.

Many of the islands on which you land are inhabited either by Camaral's armies or a ferocious creature such as a black panther or a lion. An encounter with one of these invariably means having to let your sword do the talking.

Sword fights are brilliantly 'staged', with the antagonists represented as large, animated figures which cut and thrust with deadly precision. Fights such as these are waged until one of the characters's strength falls to zero, as represented by a bar along the top of the screen. During a fight, hits with the sword result in a spurt of blood and groaning issuing from the victim, if it is a human. Panthers and lions roar with menacing realism, while a skeleton, who appears every now and then, rattles.

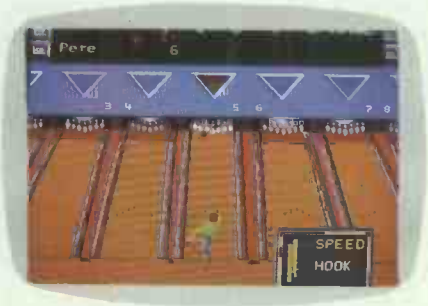
As if swordfights weren't enough, storms often blow up unexpectedly at sea, and you find yourself having to guide your ship around gigantic pillars of rock while boiling seas toss you from side to side.

Each scene in Sinbad and the throne of the Falcon is superbly depicted with some quite stunning artwork. One of the most beautiful scenes is of your ship at dusk, its sails billowing in the breeze. Add to sights like this the atmospheric soundtrack that changes with your location, and you have a game to challenge anything on the market at the moment.

If this really is the last Cinemaware game, Master Designer Software could not have chosen a program with more lasting impact to finish off its incredible series.

Strike it lucky

Title: 10th Frame
Computer: Atari ST
Supplier: US Gold
Format: Disk
Price: £19.95



American software house Access has earned itself a reputation for producing high-quality sports simulations. One of its most successful titles, a golf game called Leaderboard, is a fine example of the genre and one of the best in its field. And now 10th Frame, a 'pro bowling simulator' and the company's latest foray into the sporting milieu, looks set to become not only a massive success but also a classic of its kind.

Whereas Leaderboard is a highly stylised representation of golf, 10th Frame is very much a straightforward simulation of ten-pin bowling. In fact, Access' programmers have gone out of their way to make the game as realistic as possible, even as far as digitising the sounds from a real bowling alley.

A game of 10th Frame can be contested by up to eight individual players in Open mode, or two teams of four in League mode. In both modes, players can select their skill levels from Kids, Amateur and Professional.

Kids is not meant insultingly but to indicate that the first level really is designed for children in the age range four-eight years. This is a nice facility and means that there is no reason for children to get bored while Mum and Dad focus their attention on the computer.

Some people will no doubt be upset by the omission of a facility which allows you to play against the computer, though the variations included go some way to offset this oversight.

During play, the display features a three-dimensional view of what you would see if you were standing on a balcony directly behind the lane where the game is being played: in the foreground stands the bowler, while the skittles, or pins, are arranged in the form of a triangle near the top of the screen. Above everything else, in a rectangular box located along the top of the display, is the current player's scorecard.

Thankfully, the computer takes care of all the scoring. But for all those diehards who like to keep their own scores, Access has included a brief resumé of the rules in the game's playing instructions (which is lucky, as the method of scoring in ten-pin bowling is odd, probably due to its American provenance).

The actual mechanics of bowling in 10th Frame are very simple and the technique will be familiar to everyone who has played Leaderboard.

When setting up a shot in 10th Frame, you must position both the bowler and his mark. The mark is a small yellow square that can be moved from left to right across the lane and denotes the direction the ball will roll in when the bowler releases it from his grip. Where you position the bowler depends on the amount of 'hook' you intend to apply to the ball.

The method used for bowling is rather like that employed in Leaderboard Golf and, similarly, consists of three phases, all of which are monitored on a speed/hook meter in the bottom right-hand corner of the display. The speed/hook meter consists of two vertical bars side by side, each with a small graduated section at one of its extremities. Speed is indicated on the left-hand bar, while the amount of hook applied to the ball is shown on the right one.

To start the bowler off on his run-up, you first press and hold down the left-hand mouse button. As he runs forward, a yellow indicator rises up the speed bar. When it reaches the small, graduated section near the top, you release the button, thus setting the ball's maximum speed. You must release the mouse button at just the right point along the graduated section, otherwise the ball will be released at too high or too low a speed, incurring a direction error.

Releasing the mouse button causes a yellow indicator to run down the hook bar. This time, you must press the mouse button when the indicator reaches the graduated section or so-called hook zone. Timing is all important here, as giving the ball too great a hook will send it careering off into the left-hand gulley.

As the ball trundles off down the lane, it does so to the sound of a real ball recorded at a bowling alley. Having finally been hit, the pins fly off in all directions. Some spin, some teeter, while others hurtle off into the trough at the very end of the lane.

After all the players in a game have finished their current round of frames (two bowls), a large score sheet 'drops' from the top of the display to reveal the scores of each player. This may be output to a printer at the end of a game, if you wish.

There is very little that can be faulted in 10th Frame, except that it becomes a little too easy when you get the hang of aiming the ball and using the speed/hook indicator. Although I don't think it will lose its appeal for groups of players, it can become rather monotonous if you are playing on your own. That said, there is no ten-pin bowling simulation to better it at present.

The game of the film of the book

Title: The Fourth Protocol
Computer: Amstrad PCW; IBM; Apple
Supplier: Ariolasoft
Format: Disk
Price: £15.95 (PCW); £19.95 (IBM & Apple)

In the ephemeral world of computer games where fashions change almost daily, it is rare for a software house to re-release a product two years after its initial launch. Rarer still is the possibility of such a product doing better, saleswise, than it did first time around.

Ariolasoft, however, has thrown all caution to the wind and unpragmatically launched two new conversions of The Fourth Protocol, an interesting and slightly whimsical adventure based on Frederick Forsyth's novel of the same name.

Although, on the surface, Ariolasoft appears to be playing a costly game of Russian Roulette, it has in fact made a smart move. The book *The Fourth Protocol* has recently been made into what film publicists love to call a 'major motion picture'.

The book, and hence the game, takes its title from one of four 'secret' protocols listed in the Nuclear Non-Proliferation Treaty signed by the UK, the USA and the USSR on 1 July 1968. The fourth protocol, we are told, 'forbade any signatory country to introduce on to another's territory a nuclear device in assembled or unassembled form by covert means for detonation'.

In Forsyth's story, a Soviet undercover agent breaks the fourth protocol by smuggling a small nuclear device into Britain, where he intends to detonate it. The KGB, for whom the agent is working (surprise, surprise) has codenamed the operation Plan Aurora.

John Preston, newly appointed head of the CI(A), is the character you play in Ariolasoft's computerised rendering of this rather wild *Boy's Own* tale. As Preston, you must blow the Russian agent's cover and prevent him breaching the fourth protocol, so bringing Plan Aurora to an unsuccessful and abrupt halt.

The Fourth Protocol is composed of three games: The NATO Documents, The Bomb and The SAS Assault. Although they are not interconnected as such, each game can only be entered by means of a special password or code uncovered in the previous section.

When the first game begins, the Ministry of Defence (MOD) receives an envelope containing top-secret NATO documents from an anonymous source. How the documents came to fall into the hands of someone outside of NATO is unclear. What is evident, is that there is a leak in Britain's security network. As head of the CI(A), it is your job to uncover the mole, the identity of the organisation to whom the documents are being leaked, and why.

The NATO Documents is an adventure, albeit a rather unorthodox one. Instead of using pure text or the now popular combination of text and graphics, it uses icon-driven graphics; making the PCW, with its green-screen monitor, an ideal machine for this particular program.

Everything in The NATO Documents is accessed via the Cencom menu screen. Here are located a variety of information-gathering and storage devices, represented by individual icons. Each one of these is vital, not only to the case in hand but also the day-to-day running of the CI(A). Just because some fanatical Ruskie is wandering around with a nuclear bomb in his napsack, it does not mean you can slack on more mundane things — life still goes on within the organisation.

Along the bottom of the Cencom menu are three icons depicting computer terminals. From left to right, these represent terminals where sitreps (situation reports), reports and memos arrive. Messages received at any one of the three terminals can be enlarged for reading by pointing to the appropriate icon with a cursor shaped like a hand.

Sitreps arrive in the first terminal from 'Watchers', shadowy figures whose job is to spy on suspects. Sitreps contain information about a suspect's whereabouts, actions, meetings, and so on.

Reports arrive in the second terminal, and generally contain information from members within the CI(A) or one of its associated organisations. Memos are much the same.

When you access one of the aforementioned terminals, you can not only read the current message but also file it away in the Cencom filing system. Messages thus saved are held in the computer's memory until you decide to delete them.

On the left-hand side of the screen is a telephone icon. Just like the real thing, this allows you to call other characters within the organisation as well as receive calls from them.

Above the telephone is a filing cabinet where all your files are stored. When this icon is selected, a small sub-menu appears giving you the options to list all the names of the files currently available, read a specific one, or delete any that are out of date.

The NATO Documents takes place over a period of 40 days or 1 hour 20 minutes real time. During this time you will collect specially coded clues which can be deciphered using a series of decoding pads, supplied with the program. One such code word is your key to the next game. Since the decoding pads play such a vital role, I suggest that you make photocopies — it's virtually impossible to play the game without them.

The Bomb, the second of the three games, takes you out of the office environment in search of the infernal machine itself. Again it is icon-driven, though this time the icons provide more conventional adventure-type functions such as look, examine, pick up, put down, move and communicate.

There are a great number of locations in The Bomb, many of which are reached by taking a taxi or a ride on the London Underground. Unlike the first game where you are in the same place throughout, this game has you continually on the move from location to location, so it's well worth taking time to map your movements.

In the heart-stopping finale, The SAS Assault, you lead a crack SAS squad into a building where the device is being guarded by seven Soviet zealots. When they are out of the way, you can then move in and diffuse the bomb.

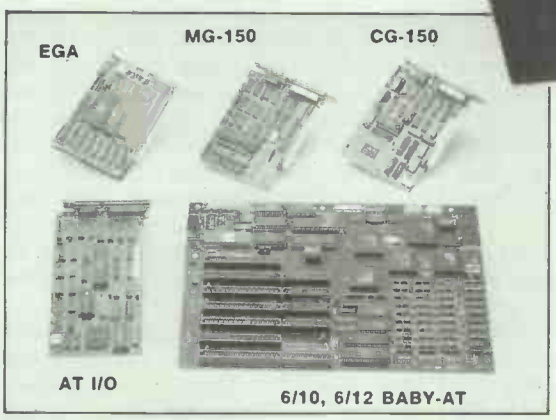
Having reviewed The Fourth Protocol when it first appeared two years ago, I was surprised to see it surface again. However, it shows little signs of age, and is still one of the most ambitious twists on the conventional adventure. END

"REAL BABY-PC/AT, PC/XT COMPUTER"

PERIPHERALS:

* 640K MOTHERBOARD, 4.77/8/10 MHZ XT TURBO MOTHERBOARD
* 6/10, 6/12 MHZ BABY-AT, BABY-AT MOTHERBOARD, 1 MEG
* ADD-ON CARDS: FOR PC/XT, PC/AT:
  - MONO/GRA/PRINTER CARD (SHORT)
  - EGA CARD WITH PRINTER PORT
  - MULTI I/O CARD (SHORT)
  - COLOR/GRA/PRINTER CARD (SHORT)
  - HARD DISK CONTROL CARD (SHORT)
  - FLOPPY CONTROL CARD
  - EPROM WRITER CARD
  - FLOPPY/HARD DISK CONTROL CARD CARD FOR XT/AT
  - FLOPPY CONTROL CARD FOR 360K/1.2MEG FLOPPY
  - ALL OTHER ADD-ON CARDS.
  - POWER SUPPLIES AND KEYBOARDS ARE ALSO AVAILABLE.

NEW



*** We supply complete system, with OEM style, and SKD form**

* CASE DIMENSION: 155(H) x 400(D) x 355(W) MM, FLIP-TOP
* 6/10, 6/12 MHZ, 512K RAM EXPENDABLE TO 1 MEG
* KB-5160 PC/XT/AT AUTO-SWITCHEABLE
* 360K, 1.2MB FLOPPY, 5¼" OR 3½" HARD DISK
* 200W POWER SUPPLY
* FLOPPY/HARD DISK CONTROL CARD
* MONO/GRAPH/PRINTER CARD
* MS-DOS 3.1 OR 3.2, GWBASIC. * SERIAL/PARALLEL CARD

FOR DETAIL, PLEASE CONTACT:

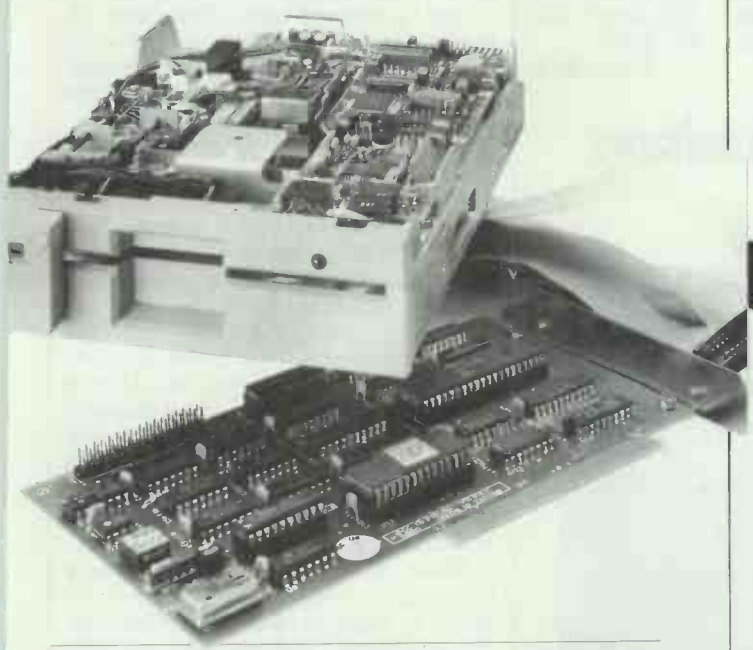
MICROMARK CO., LTD.

Manufacturer & Exporter

P.O.BOX: 30-415 Taipei, Taiwan, R.O.C. TELEX: 29721 MIMARK

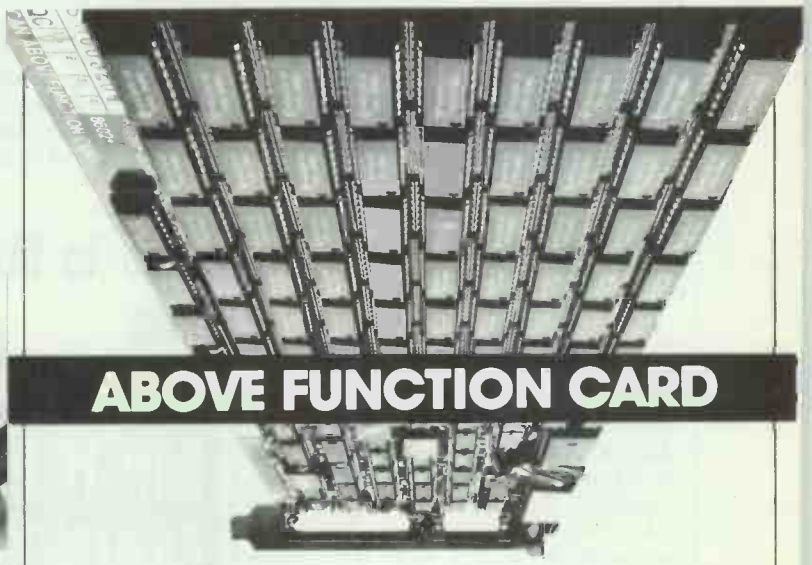
TEL: 886-2-3926489, 886-2-3926298 FAX: 886-2-3949737

The Great Communicator



• Allows free interchange between XT® and AT® computers • Dual drive controller and Brand Name 80TR, 1.2MB formatted drive • Achieves more than 3-times capacity of normal 360KB floppy drive • Controller handles (intelligently with on-board ROM) combinations of 1.2MB and 360KB floppies • FAST data transfer (500K Bits/sec) in 1.2MB format. Excellent for Winchester backup • 1.2MB drive reads/writes and formats 360KB using normal DOS 3 · X commands • No messy DOS patch software necessary! • Standard DIGITASK ONE YEAR parts and labour warranty

DIGITASK £179 *(excluding carriage & VAT)*



ABOVE FUNCTION CARD

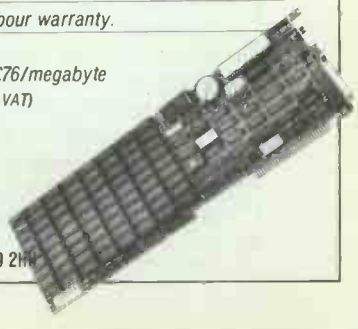
• Up to 2MB expansion memory (2048KB) • First 384KB may be configured as conventional memory • LIM, LOTUS®, INTEL®, MICROSOFT®, (EMM) specification • Async Comms adaptor (configurable as COM1 or COM2 or disable) • Parallel Printer Port (configurable as LPT1 or LPT2 and Hercules® compatible) • Real time clock/calendar with battery backup • Games adaptor • Utility software includes expanded memory manager, clock, ramdisk and printspooler • Includes cables • Fully compatible with IBM® PC/XT/AT computers. • Standard DIGITASK ONE YEAR parts and labour warranty.

£179 *(Unpopulated) Ram at £76/megabyte*
(Prices exclude carriage and VAT)

DIGITASK

Tel. 0342 24631 Telex 957418

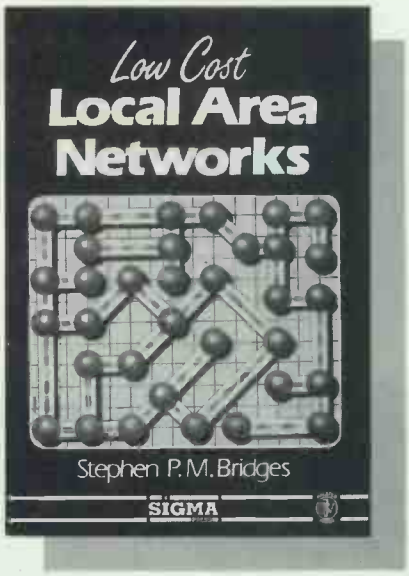
Unit M, Charlwoods Business Centre,
Charlwoods Rd, East Grinstead West Sussex RH19 2H



BIBLIOFILE

From the computer bookshelf this month we have chosen the realm of communications, plus some general books for easy reading. Our reviewers guide you through the jargon of LANs, BBSs, et al.

Low Cost Local Area Networks



Author: Stephen PM Bridges
Publisher: Sigma Press
Price: £10.95

'A LAN is a system of interconnection for computers and associated devices which allows interchange of information within a limited geographical area.' There you are, that's all a Local Area Network (LAN) is, in a nutshell.

A mountain of literature has been produced over the past few years concerning LANs. Initially, all seemed relatively clear, when Ethernet and Cambridge Ring ruled the roost, but then came WANs, VANs . . . , and strange terms such as 'topology' (which always conjures up to me images of turning my tea cup into the mint with a hole), 'empty slot', 'buffer insertion', 'token passing', and so on. Once again, users who initially understood the concept, application and reason may have become lost in the jargon and ambiguity.

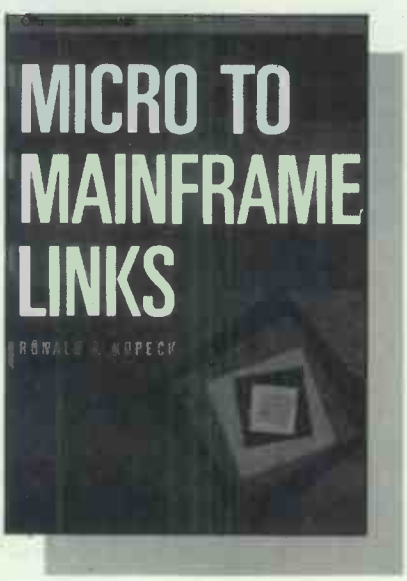
Stephen Bridges could have gone some way to lifting this veil of confusion had his book been laid out differently: it is almost back to front. The technical section comes first, plunging the reader into transmisson mediums and modes, and access and signalling methods; while the second section deals with the practical side — that is, what do you want from a LAN? If this book is aimed at the engineer, then Section Two isn't really relevant; if it is aimed at a user manager — that is, a novice to LANs — then I'm sure that they would never have completed Section 1.

On the other hand, the sections independently are quite concise, and when the author is dealing with practical questions such as 'Can it easily be connected to your equipment?', then you feel that he is really on your side. Also, if you are slightly technically-minded and know your broadband from your baseband, then you'll be OK in Section 1.

In conclusion, study the 'Contents' pages first and read the chapters in *your* defined order; all the terms used are ultimately explained but you do have to search for them.

Lorna Kyle

Micro to Mainframe Links



Author: Ronald F Kopeck
Publisher: Osborne McGraw-Hill
Price: £18.95

What would you do if you were told that you were solely responsible for connecting your company's stand-alone personal computer(s) to the mainframe 300 miles away? Go out and buy a long piece of string and two tins? Feign earache for six months? Leave? Well, the first thing you should do is grab hold of a copy of *Micro to Mainframe Links* and read it; it will drive away your (possible) doom and despondency and replace it with knowledge and enthusiasm.

It is at long last appreciated that users want access to systems and files that previously only heavy-rimmed bespectacled, baggy corduroyed-trousered programmers, or your organised and secretive MI5 team, could access and write applications for.

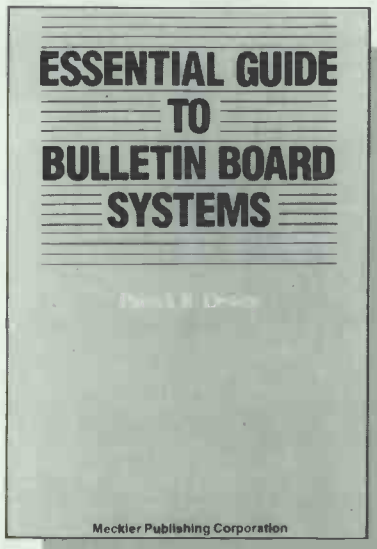
Ronald F Kopeck presents an honest and open approach to all the intricate problems and decisions of linking and/or networking personal computers into host mainframes. Modems and multiplexers, hardware cards, software-only link products, LANs, file servers, data PBXs, integrated voice/data PBXs, and so on, are all brought out into the light and discussed in layman's terms. This book is *not* aimed at the powerful, experienced software engineer but geared towards *'anyone who is trying to get perspective on the whole issue of linking personal computers into hosts.'* Having said that, it is not a woolly 'we-won't-discuss-that-here' type of book either, as the author's scope ranges from 'The Evolution of End-User Environments' to 'Evaluating Prototype Link Results' and 'Establishing a Pilot'.

Micro to Mainframe Links is very informative and can be read from cover to cover or dipped into for specific chapters. Summaries are provided at the end of every chapter for easy consolidation of facts. My only criticism is that the appendices of 'Link Vendors' and 'LAN Vendors' did not contain any UK suppliers.

Having read this book I now feel that I can look my IRMA board straight in the eye with a smug smile hovering about my lips.

Lorna Kyle

Essential Guide to Bulletin Board Systems



Author: Patrick R Dewey
Publisher: Meckler Publishing Company
Price: $24.95

Patrick R Dewey certainly loves his BBSs. His admiration and zeal for them bounce out of every page. He *is* well-qualified in the field, however, having set up the first library electronic bulletin board system at the Chicago Public Library.

BBSs themselves arose from the fact that people love to talk and communicate with each other (apart from on the London Underground that is). You talk and you listen, you give and you receive. Translated to the BBS individual, you dial-in and you wait, you upload and you download. And you can become seriously hooked, an electronic chatterbox in fact.

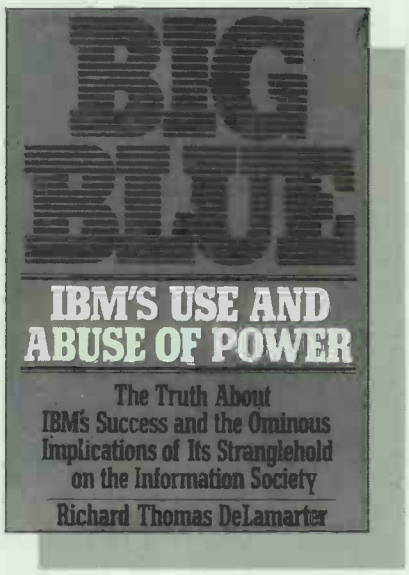
Almost anyone with a microcomputer can set up a BBS. Put simply, a BBS is just '*an interactive, online, electronic database system, usually operated on a microcomputer.*' Users may include any or all of the following: electronic mail, software exchange, conferencing, bulletins, games, and networking. Specialised BBSs have been set up for medical research, business purposes, religious groups, library information — the list is endless.

The author presents a very straightforward book with no punches pulled. When discussing the fact that both hardware and software are required, he claims that what you end up with is '*largely a function of personal choice, need and pocket book.*' No one particular supplier is favoured and very comprehensive lists of (US) available modems, terminal programs and BBS software packages are given.

This book will be of great benefit to the would-be BBS user as well as a source of information for the more experienced one. Do bear in mind, though, that this is an American book; and they do tend to be more fanatical over there.

Lorna Kyle

Big Blue — IBM's use and abuse of power



Author: Richard Thomas DeLamarter
Publisher: Macmillan
Price: £14.95

The old saying 'No-one ever lost their job buying from IBM' epitomises in many people's minds IBM's powerful and respected image in the computer market-place. The title of this book, therefore, comes as something of an unnerving revelation that all is not what it seems.

The author, Richard DeLamarter, has left no stone unturned in his efforts to reveal the true story behind IBM. Having spent some eight years working as a senior economist for the US Justice Department on the antitrust case 'US vs IBM' before IBM was given a clean bill of health in 1982, and a further four years researching the material for this book, Mr DeLamarter is out to destroy IBM's all-caring, altruistic image, which he feels (and perhaps rightly) is attributable to the antitrust suspicion that the company has engendered over the past 50 years, *forcing* it to lay down a 'Business Conduct Policy' for its employees.

He presents a damning indictment (backed up by voluminous detail) of a ruthless company's unrelenting pursuit of 'market share', and how it has used and manipulated its power to gain control.

Divided into four self-contained parts comprising several hundred pages, Big Blue documents the history of IBM, its rise to power and eradication of the competition, its discriminatory pricing strategy and monopolisation of the market, and the ominous implications for the future of IBM's vice-like grip on the computer industry: '*IBM's expanding monopoly over information technology is fast giving it the power to enter and ultimately dominate the many service industries of the future . . .*'

It's chilling, but gripping, stuff, and it's clear that DeLamarter has done his homework as he reels off facts, figures and percentages (tables and appendices abound) to corroborate his story. Without doubt Big Blue is an insightful book, while at the same time a totally absorbing read in its own right.

Joanna Murchison

Towards a Magical Technology

Author: Tom Graves
Publisher: Gateway Books
Price: £2.95

Have you reached the stage where you're so into computing that the joy has worn off? Have you reached the point where the ruthless logic of the machine has started to permeate your non-computing activities? Has the 'scientific' view of the world replaced the 'human' view of your early life? *Towards a Magical Technology* attempts to heal the unnecessary divide between science and nature, between technology and magic.

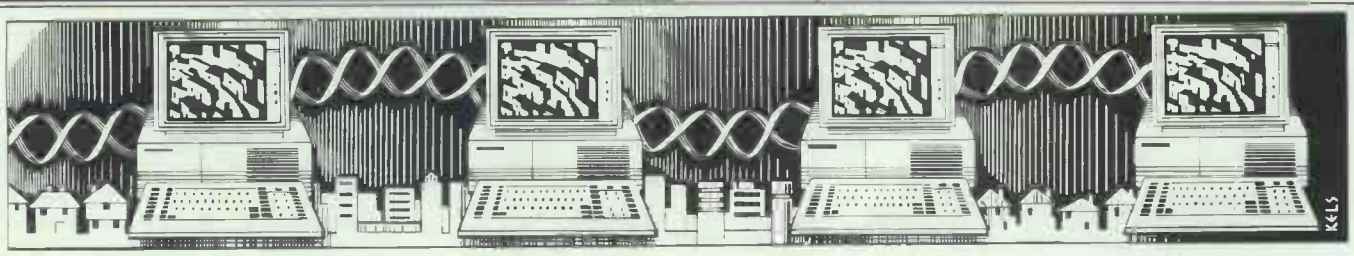
Tom Graves is a computer wizard. He also happens to be a dab hand at dowsing. From this basis, he explains that there's more to life than meets the eye. He highlights the paradoxes inherent in our widespread acceptance of things such as scientific, religious and medical dogma. His idea is not so much to knock as to get the reader to think for himself, to risk moving to a fresh viewpoint.

Towards a Magical Technology is both small — 85 pages — and strange. It is one man's quirky ramble across a number of contentious subjects. Since the author has one foot planted firmly in computer technology and the other in the 'supernatural', he is well-qualified to describe the journey.

This isn't a major work but it is an honest explanation by an honest man of his unusual view of the world. Those with open minds may glean much from it; the people who need it most are those with closed minds. But, because they are unreceptive to challenging ideas, they're never likely to read it.

David Tebbutt

END



Go by the board

Downloading software is an obvious use for a bulletin board. Peter Tootill looks at what's available.

Having got yourself a modem and communications/terminal software you may be wondering what you can do with them. One answer is to hunt around the bulletin board systems (BBSs) looking for software to 'download'. Downloading is transferring a file from the BBS to your computer — with good terminal software at your end, it is very easy.

A wide variety of public domain (PD) and shareware software is available on BBSs — utilities such as DOS-edit, workhorse programs such as Procomm, PC-Write and PC-Outline, and, of course, games. The software covers a variety of machines but the emphasis is on IBM and CP/M systems. Much of it is excellent, some less good, and a very small proportion downright dangerous (see Trojan horses below).

Many of the programs are taken from the large libraries of public domain software collected by user groups such as the British CP/M user group (which now has its own BBS on (0753) 868 196). PC-Blue is an American software library whose disks feature on BBSs — as did PC-SIG disks until recently. User groups of other machines maintain software libraries and can often be tracked down on BBSs.

You can also, if you download programs yourself, avoid dealing with organisations who 'sell' disks full of PD and shareware programs such as ISD and Seltec. The latter charges over £16 (with VAT and P&P) for a disk of PD or shareware programs. You can download a lot of files for £16, even at peak long distance rates (see the 'Ready Reckoner' table).

Where to look

Finding a program for a specific purpose can be a problem because there is such a wide choice. The British CP/M User Group (or rather CPMSDOSUGUK as it now is called since it expanded to include MS-DOS machines) has nearly 2000 disks of CP/M and MS-DOS software! There is a lot of overlap in them, but even so there's enough to keep anyone busy for quite a while.

Of course not all of this is available on BBSs — there aren't many systems around with 500Mbytes of online disk storage! In fact, the programs that find their way into BBS download areas tend to be the more useful ones, so a bit of sifting has been done for you. BBS operators (sysops) all have their own interests and if you can track down one who shares yours, that can obviously help. Some BBSs specialise in one particular machine — MacTel is a BBS for the Macintosh, for example. Where we are given this information, we try to include it in the numbers list in End Zone.

How to download a file

Downloading a program is relatively straightforward. However, you do need terminal software to do it. Most, if not all, commercial and public domain terminal programs available today will work.

The commonest way of downloading is to use the Xmodem protocols. This isn't the name of a book, but a set of protocols (or rules) for transferring files between computers. It corrects errors caused by line noise (see Mailbox in April's *PCW* for more information about file transfer protocols) and allows programs to be transferred, as well as simple text files.

When you have found something you wish to download from a BBS (and I suggest that you pick a short, simple file for your first attempt) the procedure is simple. First, you tell the BBS which file you want to download (the actual commands vary). Then you tell your software that you want to receive a file and what the file is to be called — you don't have to use the same name as the BBS. The transfer should proceed automatically. Most programs display the block count on the screen. You may get the occasional bad block, but if this happens the Xmodem system makes sure that the block is sent again. If you get too many errors, the transfer will be aborted. This could be due to a very bad phone line, but this is unusual in my experience.

If you have problems with downloading, ask for help from other callers by leaving a message in the public messages area of the BBS. Describe your problem, and the computer and software set-up you are using. You will find that someone can give you some tips as to what may be going wrong. (A public message is better than a private message to the sysop who may not have any direct knowledge of your computer. Also, a public question means that someone else can see and answer — which cuts down on his or her workload.) Getting help with your problems is another good reason for using BBSs. A lot of people call them and there is usually someone who can help with a problem.

Worms and Trojan horses

I can't write a piece on PD software without mentioning worms and Trojan horses. The definitions have become blurred, but originally a Trojan horse program was one designed to give unauthorised access to a system that it had been run on. One example is a program that looked like a useful utility and could be uploaded to a BBS. However, after the sysop had run it, it would allow someone 'in the know' to

call up and download the user files — complete with passwords and other confidential information. This could result in the hacker finding out about privileged users (for example, remote sysops) who had access to non-public areas and even to DOS. All that person had to do then was call back as one of those users and he could wreak havoc.

Worms are programs that do nasty things such as reformatting your hard disk when you run them — again usually under the guise of doing something useful such as reorganising the directory. Why anyone should want to spend time writing a program of this type is beyond me but it has happened. Fortunately both types of program seem to be rare in this country — so far. A list of Trojan horse programs and pirated programs that have had copyright notices deleted (and are passed off as public domain) is available on some BBSs — I got a copy from Bullet AT, (0792) 297 845.

What does it cost?

In most cases downloading from a BBS costs no more than the phone call. However, some systems do charge a subscription — normally those set up specifically to provide software. The Ready Reckoner will help you to work out the cost of using a BBS and downloading programs. It needn't be expensive, especially if you are within local call distance of a BBS. You could save a bit more by using Mercury and I hope to cover that network in a future column. The download costs assume Xmodem protocols and are based on real, not theoretical, transfer times. If you are running at 300 bits/sec, multiply by four (or buy a faster modem!). Divide by two for 2400 bits/sec. Bear in mind that programs for 16-bit machines such as the IBM PC tend to be big.

When I first started downloading from BBSs with my old Tandy Model 1, a 30k program was a big one. Now you will find programs of 200k and more. Downloading one of these at 300 bits/sec would take well over two hours!

A couple of warnings about downloading files are in order. Firstly, some sysops take exception to people who call their systems simply to download software — they complain about the 'pigs at the trough' syndrome. People who do it are even called 'troughies'. Personally I don't mind what people do on my system, but I can understand those who think that callers should contribute as well as take. Be sensitive to the sysops' wishes: after all, they are providing the system for you to call — probably out of the goodness of their hearts! Subscriber systems such as the PD-SIG boards do not, of course, object.

The second point is that you have to be prepared to get 90 per cent of the way through downloading a big file and have the process abort for some reason. It doesn't happen very often — but it's very frustrating!

News items

Big Softy

To help track down the elusive PD/shareware program that you need, Brian Williams (sysop of Compulink North) has written Big Softy, which could be called an intelligent catalogue of PD and user-supported software. Big Softy, which runs on MS-DOS systems, will search its database by name, category or description and list matching programs for you. Having found the programs you want, it also allows you to order the disk(s) by printing an order form on your printer — with all the details (even your name and address) included. Big Softy is available for downloading from a number of BBSs. You can also get it by post for £5 from AnyTime Software, 3 Gainsborough Close, Liverpool L12 9LB. Disks ordered via Big Softy cost only £2.50 each.

Modems

A number of new modems have been launched recently and the price of faster (V.22 and V.22bis) modems is falling:

Dacom has launched two internal card modems for the PC. The Unity (V.21 and V.23) at £299 (£344 inc VAT) and the Unity Gold which has V.22 as well, at £399 (£459 inc VAT). They are both Hayes compatible and come bundled with Datatalk software for the IBM PC and clones.

Trintas' Phasor 2221 has been approved by BABT. It is unusual in that it is V.21 and V.22 only — no V.23. Trintas thinks that V.23 is obsolete and will soon die out. This may be true, especially for users of commercial systems, and even Prestel will be available at V.22 soon. However, a lot of V.21/23 BBSs are around and it could be a while before they include V.22. The Phasor is Hayes-compatible with autospeed detect. It is very compact and sturdy-looking and seems good value at £295 (£339 inc VAT).

Pace has introduced the Linnet, a V.21/23 Hayes-compatible with a buffered interface to allow IBM PCs to use V.23 without special software. It costs £139 (£160 inc VAT). The new prices for the Series Four are £399 (£459 inc VAT) for the V.22 version, £499 (£574 inc VAT) for the V.22bis model. The basic V.21/23 model is unchanged at £265 (£305 inc VAT). Also from Pace is an internal V.21/23 modem for the BBC Master series at £119 (£137 inc VAT). This integrates with the computer, providing several '*' commands for dialling, configuration, and so on. It can be used with terminal software or with a cartridge version of Commstar.

Amstrad has moved into the comms field with an internal card modem for the PC1512. Providing V.21 and V.23 it is designed and made by Pace (and I would guess is based on the Linnet). It comes bundled with Datatalk, a communications package with viewdata and ASCII terminal emulation modes, as well as Kermit and Xmodem file transfer protocols. The modem costs £150 (£173 inc VAT) which is the normal price of Datatalk alone!

Miracle Technology has introduced several versions of the WS3000 in recent months. These include a V.22-only version and an internal card version for IBM PCs. The latter is called the Keycard 3000. Like the WS3000 it has several configurations from V.21/23 up to V.22bis. Prices start at £345 (£397 inc VAT) and include bundled software (no details of that at present).

You can contact Peter Tootill electronically on:
Telecom Gold 83:VNU202,
Prestel 219991119,
or CompuServe 72746,3202.

END

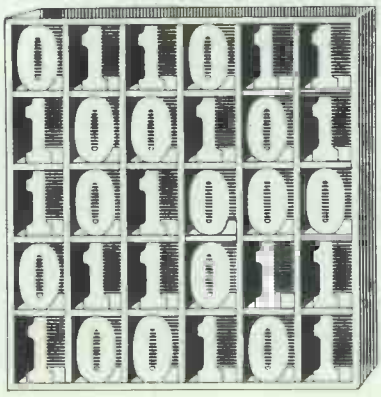
Ready Reckoner

Telephone call charge Ready Reckoner (c) Peter Tootill 1987. (All costs in £stg.)

Rate	Secs/unit	Call duration (mins) 1	5	10	20	60	App download cost @1200 bps[1] 10	50	100	200
L Cheap	360.00	0.05	0.05	0.10	0.20	0.56	0.05	0.10	0.20	0.35
L Std	90.00	0.05	0.20	0.35	0.71	2.07	0.10	0.35	0.71	1.37
L Peak	60.00	0.10	0.30	0.56	1.06	3.09	0.15	0.56	1.06	2.07
A Cheap	100.00	0.05	0.20	0.35	0.66	1.87	0.10	0.35	0.66	1.27
A Std	34.30	0.10	0.46	0.91	1.77	5.31	0.20	0.91	1.77	3.54
A Peak	25.70	0.15	0.61	1.21	2.38	7.13	0.25	1.21	2.38	4.76
B1 Cheap	60.00	0.10	0.30	0.56	1.06	3.09	0.15	0.56	1.06	2.07
B1 Std	30.00	0.15	0.56	1.06	2.07	6.12	0.25	1.06	2.07	4.10
B1 Peak	22.50	0.15	0.71	1.37	2.73	8.15	0.30	1.37	2.73	5.41
B Cheap	45.00	0.10	0.35	0.71	1.37	4.10	0.15	0.71	1.37	2.73
B Std	24.00	0.15	0.66	1.32	2.58	7.64	0.30	1.32	2.58	5.11
B Peak	18.00	0.20	0.86	1.72	3.39	10.17	0.35	1.72	3.39	6.78
Eirecheap	12.00	0.30	1.32	2.58	5.11	15.23	0.56	2.58	5.11	10.17
Eire Std	8.00	0.40	1.92	3.85	7.64	22.82	0.81	3.85	7.64	15.23
Eire Peak	8.00	0.40	1.92	3.85	7.64	22.82	0.81	3.85	7.64	15.23
US cheap	5.25	0.61	2.93	5.82	11.59	34.71	1.16	5.82	11.59	23.17
US Std	4.50	0.71	3.39	6.78	13.51	40.53	1.37	6.78	13.51	27.02
US Peak	4.10	0.76	3.74	7.44	14.83	44.48	1.52	7.44	14.83	29.65

1. Download costs are for file of given size using Xmodem protocols and are approximate only
Costs include VAT and file sizes are in kbytes

SUBSET



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to SubSet, PCW, 32-34 Broadwick Street, London W1A 2HG.

DATASHEET 1

```
;INPUTA          Input a string of limited length, composed only of
;                valid printable ASCII characters.
;INPUTR          Input a string of limited length, composed only of
;                characters within a given range.
;
;STRUCTURAL CONCEPTS
;PROGRAM         bufferindex = 0.
;                UNTIL character = carriage-return
;                [
;                  INPUT character.
;                  IF character = deletecharacter
;                  [
;                    IF bufferindex > 0
;                    [
;                      bufferindex = bufferindex - 1.
;                      OUTPUT character.
;                    ]
;                    ;
;                    IF character = carriage-return
;                    [
;                      (bufferindex) = character.
;                      bufferindex = bufferindex + 1.
;                      OUTPUT character.
;                    ;
;                      IF character >= minimumcharacter
;                      AND character =< maximumcharacter
;                      AND bufferindex < maximumbufferindex
;                      [
;                        (bufferindex) = character.
;                        bufferindex = bufferindex + 1.
;                        OUTPUT character.
;                      ]
;                    ]
;                  ]
;                ]
;
;SYSTEM REQUIREMENTS
;PROCESSOR       6502
;HARDWARE        Buffer RAM.
;                Keyboard & screen used by CHRIN & CHROUT.
;SOFTWARE        "CHRIN" - get character from keyboard in A.
;                "CHROUT" - print character in A to screen.
;                (Neither routine may change registers.)
;
;PROGRAM DETAILS
;INPUT           INPUTA only:
;                  M0 = minimum acceptable value.
;                  M1 = maximum acceptable value + 1.
;                INPUTA & INPUTR:
;                  A = maximum string length
;                       (0 to 255 excluding carriage-return character).
;                  Y = buffer address hi-byte.
;                  X = buffer address lo-byte.
;OUTPUT          Input string in buffer.
;                A = length of string (excluding carriage-return).
;STATE CHANGES   Flags changed. X & Y unchanged.
;                M2, M3 & M4 changed.
;                M0 & M1 may be changed by INPUTA.
;I/O ERRORS      None.
;OPTIMISATION    Requires maximum character value to be set at
;                maximum + 1 for easier test of CMP carry status.
;INTERRUPT EFFECT May be interrupted.
;                May be re-entered if page zero use is preserved.
;LOCATION NEEDS  Not specific. Relocatable. PROMable.
;PROGRAM BYTES   64
;STACK BYTES     INPUTA: 3 + CHRIN & CHROUT stack use.
;                INPUTR: 2 + CHRIN & CHROUT stack use.
;CLOCK CYCLES    Not given.
;
;...Define page zero storage.
;
MINCH   =   M0          ;Contains minimum acceptable value.
MAXCH   =   M1          ;Contains maximum acceptable value.
MAXLEN  =   M2          ;Holds maximum number of bytes (1 - 255).
BUFFER  =   M3          ;(& M4) Holds buffer address.
;
;...Entry point if range is printable ASCII ($20 to $7E).
;
INPUTA  PHA             ;Save maximum length.           48
        LDA  #32        ;Store ASCII SPACE as           A9 20
        STA  MINCH      ;minimum acceptable value.      85 M0
        LDA  #127       ;Store ASCII DEL as             A9 7F
        STA  MAXCH      ;maximum accpetable value + 1.  85 M1
        PLA             ;Restore maximum length.        68
;
;...Entry point if range is in MINCH & MAXCH at entry.
;
```

String input

Datasheet 1, from Jonathan Temple of Nottingham, is a useful routine to limit string input. The maximum input length is 255 characters, terminated by a carriage return. All input is written to an indexed buffer and also echoed to screen.

The routine has two entry points. INPUTA accepts any printable ASCII character, $20 to $7E. INPUTR allows you to set the page zero locations M0 and M1 as lower and upper limits to the range of codes accepted. For example, to alternate between decimal numeric input and text, you would first call INPUTR with M0=48 ('0') and M1=58 (':') and then call INPUTA, ignoring M0 and M1 which are changed to the full ASCII range automatically.

The routine allows you to use the delete key to delete the last character input but not to use cursor keys for more sophisticated editing.

DATASHEET 1 (CONTINUED)

```
INPUTR  STA  MAXLEN      ;Store input maximum length.     85 M2
        STX  BUFFER      ;Store buffer 1st byte address   86 M3
        STY  BUFFER+1    ;for indexed indirect addressing. 84 M4
        LDY  #0          ;Set Y as 1st byte buffer index. A0 00
;
NEXTCHAR JSR CHRIN       ;Input in A from keyboard.       20 lo hi
;
        CMP  #127        ;Check first for delete keypress C9 7F
        BNE  NOTDEL      ;and skip if not.                D0 08
;
        CPY  #0          ;If no character to delete       C0 00
        BEQ  NEXTCHAR    ;then ignore and get next.       F0 F5
;
        DEY              ;Else adjust Y to delete from    88
        CLC              ;buffer, then go PRNTCHAR to     18
        BCC  PRNTCHAR    ;delete from screen display.     90 13
;
NOTDEL  CMP  #13         ;Check carriage-return, missing  C9 0D
        BEQ  STORCHAR    ;out range test if so.           F0 0C
;
        CMP  MINCH       ;If less than minimum value then C5 M0
        BCC  NEXTCHAR    ;ignore and get next.            90 E9
;
        CMP  MAXCH       ;If equal to or greater than max C5 M1
        BCS  NEXTCHAR    ;value then ignore and get next. B0 E5
;
        CPY  MAXLEN      ;If index already at maximum     C4 M2
        BEQ  NEXTCHAR    ;length then ignore and get next. F0 E1
;
STORCHAR STA (BUFFER),Y  ;Write input char to buffer and  91 M3
        INY              ;index next free position.       C8
;
PRNTCHAR JSR CHROUT      ;Echo input char to screen.      20 lo hi
        CMP  #13         ;If char not carriage-return     C9 0D
        BNE  NEXTCHAR    ;then go get next.               D0 D7
;
        DEY              ;Index stored CR, transfer to A  88
        TYA              ;as string length (excluding CR). 98
        LDY  BUFFER+1    ;Restore buffer address hi-byte  A4 M4
        RTS              ;to Y and exit, string got.      60
;
```

Character rotation

Datasheets 2 and 3 are improvements by Edmund Ramm of Kaltenkirchen in the Federal Republic of Germany to CHROT68K (*PCW*, September 1986).

CHROTMEM and CHROTREG both rotate a matrix of eight contiguous bytes, assumed to contain the bit patterns for any display character, by 90° anticlockwise. This is useful in many graphics applications and possibly for dumping screen displays to a matrix printer.

CHROTMEM uses a method practically identical to that

DATASHEET 2

```
;
;CHROTMEM        Rotate an 8-bit by 8-bit character matrix, stored as
;                eight contiguous bytes, by 90° anticlockwise, using
;                memory and register workspace.
;-------------------------------------------------------------------
;STRUCTURAL CONCEPTS
;PROGRAM         FOR destinationbyte = 7 to 0
;                {
;                  FOR sourcebyte = 0 to 7
;                  {
;                    SHIFT LEFT (sourcebyte).
;                    ROTATE LEFT (destinationbyte).
;                  }
;                }
;-------------------------------------------------------------------
;SYSTEM REQUIREMENTS
;PROCESSOR       68000-series.
;HARDWARE        8-bytes matrix RAM.
;SOFTWARE        None.
;-------------------------------------------------------------------
;PROGRAM DETAILS
;INPUT           A0 addresses 8-byte source matrix lowest address
;OUTPUT          Matrix rotated 90° anticlockwise.
;STATE CHANGES   CCR changed. All other registers unchanged.
;I/O ERRORS      None known.
;OPTIMISATION    None.
;INTERRUPT EFFECT May not be interrupted without error if interrupt uses
;                User Stack Pointer (A7).
;                May not be re-entered without error.
;LOCATION NEEDS  Not specific. Relocatable. PROMable.
;PROGRAM BYTES   50
;STACK BYTES     (A7): 36.
;CLOCK CYCLES    2356 (68000 timing).
;-------------------------------------------------------------------
;
CHROTMEM MOVEM.L  D0-D2/A1,-(SP) ;Save registers used.          48E7 E040
         LINK     A6,#-16        ;Get 16 bytes stack w'space.  4E56 FFF0
;
         MOVE.L   (A0)+,D0       ;Get source bytes 0-3 in D0   2018
         MOVE.L   (A0)+,D1       ;and source bytes 4-7 in D1.  2218
         MOVEP.L  D0,0(SP)       ;Store 8 bytes to hi order    01CF 0000
         MOVEP.L  D1,8(SP)       ;bytes of 8 words above SP.   03CF 0008
         MOVE.L   SP,A1          ;Save workspace address.      224F
         MOVEQ    #7,D0          ;Set 8 result byte count.     7007
;
DESTLOOP MOVEQ    #7,D2          ;Set 8 source byte count.     7407
;
SRCELOOP LSL.W    (SP)+          ;Next highest bit, through X  E3DF
         ROXL.B   #1,D1          ;into reg-byte lowest bit.    E311
         DBF      D2,SRCELOOP    ;Repeat for all bit position  51CA FFFA
         MOVE.L   A1,SP          ;Reset SP to w'space start.   2E49
         MOVE.B   D1,-(A0)       ;Store result byte of 8 same  1101
         DBF      D0,DESTLOOP    ;place source bits.           51C8 FFF0
;
         UNLK     A6             ;Clear w'space from stack.    4E5E
         MOVEM.L  (SP)+,D0-D2/A1 ;Restore registers and        4CDF 0207
         RTS                     ;exit, character rotated.     4E75
;-------------------------------------------------------------------
```

DATASHEET 3

```
;
;CHROTREG        Rotate an 8-bit by 8-bit character matrix, stored as
;                eight contiguous bytes, by 90° anticlockwise, using
;                register workspace only.
;-------------------------------------------------------------------
;STRUCTURAL CONCEPTS
;PROGRAM         FOR destinationbyte = 7 to 0
;                {
;                  FOR sourcebyte = 0 to 7
;                  {
;                    SHIFT LEFT (sourcebyte).
;                    ROTATE LEFT (destinationbyte).
;                  }
;                }
;-------------------------------------------------------------------
;SYSTEM REQUIREMENTS
;PROCESSOR       68000-series.
;HARDWARE        8-bytes matrix RAM.
;SOFTWARE        None.
;-------------------------------------------------------------------
;PROGRAM DETAILS
;INPUT           A0 addresses 8-byte source matrix lowest address
;OUTPUT          Matrix rotated 90° anticlockwise.
;STATE CHANGES   CCR changed. All other registers unchanged.
;I/O ERRORS      None known.
;OPTIMISATION    The sequence of shifts/rotates and swaps in DESTLOOP
;                is repeated to save the 240 clock cycle overheads of
;                setting up a half-matrix loop.
;INTERRUPT EFFECT May be interrupted and re-entered.
;LOCATION NEEDS  Not specific. Relocatable. PROMable.
;PROGRAM BYTES   88
;STACK BYTES     (A7): 24.
;CLOCK CYCLES    1684 (68000 timing).
;-------------------------------------------------------------------
;
CHROTREG MOVEM.L  D0-D5,-(SP)    ;Save registers used.        48E7 FC00
         MOVEQ    #1,D4          ;Count for twice FILLREGS.   7801
;
FILLREGS MOVE.B   (A0)+,D0       ;D0 = rows 0 and 4           1018
         MOVE.B   (A0)+,D1       ;D1 = rows 1 and 5           1218
         MOVE.B   (A0)+,D2       ;D2 = rows 2 and 6           1418
         MOVE.B   (A0)+,D3       ;D3 = rows 3 and 7           1618
         SWAP     D0             ;Swap words to get 1st       4840
         SWAP     D1             ;half of matrix in lo-word   4841
         SWAP     D2             ;and 2nd (lower) half of     4842
         SWAP     D3             ;matrix in hi-word.          4843
         DBF      D4,FILLREGS    ;                            51CC FFEE
;
         MOVEQ    #7,D4          ;Count for 8 columns.        7807
;
DESTLOOP LSL.B    #1,D0          ;Move next highest bit from  E308
         ROXL.B   #1,D5          ;each row in turn via X into E315
         LSL.B    #1,D1          ;intermediate register store E309
         ROXL.B   #1,D5          ;going down from top to      E315
         LSL.B    #1,D2          ;bottom rows of matrix,      E30A
         ROXL.B   #1,D5          ;bits going into             E315
         LSL.B    #1,D3          ;left to right position in   E308
         ROXL.B   #1,D5          ;destination.                E315
```

used by CHROT68K but employs faster instructions to cut the execution time down from 2536 clock cycles to 2356 and the length from 74 to 50 bytes. The LINK instruction saves the contents of A6 on stack, copies the Stack Pointer to A6 and then moves the SP to a lower address giving 16 bytes of stack workspace. UNLK copies A6 to the SP, clearing the workspace from stack, and then restores the original contents of A6.

At 88 bytes, CHROTREG is over 75 per cent longer than CHROTMEM but executes in only 1684 clock cycles — about 40 per cent faster. Ten bytes could be saved inside CHROTREG's DESTLOOP by making two passes over the code which processes one half of the matrix, as is done in the FILLREGS section. This would require use of another data register as an extra loop counter and use four more bytes of stack. The loop mechanism would consume 240 extra clock cycles.

16-bit rotations can be peformed by rotating each quarter (8 by 8-bit) and then rotating the four quarters.

Linkage

It seems that Mr JA Cook of Wolverhampton echoed the feelings of many when he wrote in March of the problems he had experienced with the L80 linker.

Other readers have written expressing similar dissatisfaction with L80 and offering their solutions.

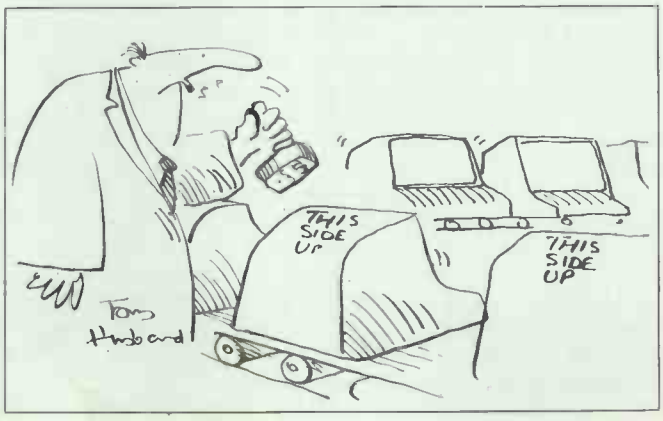
SR Wilson of Penistone, who cannot understand why Microsoft should supply such a poor product alongside such a good product as M80, gave up the struggle and bought a linker from Phoenix Software Associates. Plink-II apparently has its own built-in macro language to allow conditional includes. It will accept several object code formats and link to any address, building the output file on disk.

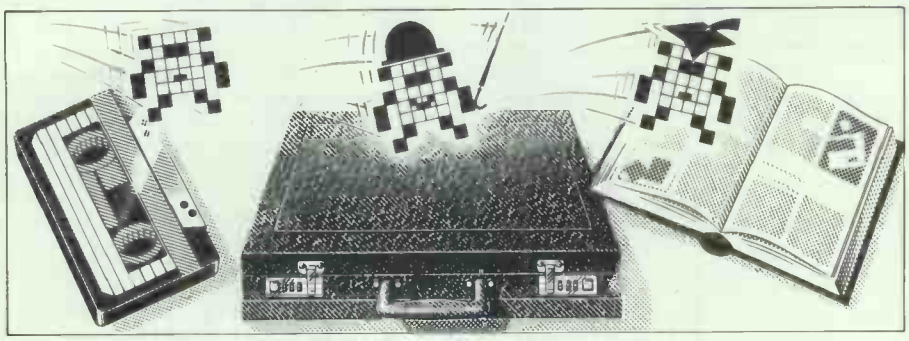
Richard Russell of Gravesend writes that LINKMT, the linker supplied with Pascal MT+, is better and uses the same relocatable file format. But LINKMT is expensive and still has some shortcomings, so Richard wrote his own linker, LINK-COM, which he has donated to the UK CP/M Users' Group.

Richard's LINK is limited in that it does not support libraries or overlays. However, it does overcome the problems mentioned by Mr Cook and is virtually free. LINK is only 3k long compared with the 11k of L80. END

DATASHEET 3 (CONTINUED)

```
;
         SWAP     D0             ;Having got bits from top    4840
         SWAP     D1             ;half of matrix, swap        4841
         SWAP     D2             ;registers to make bottom    4842
         SWAP     D3             ;half available.             4843
;
         LSL.B    #1,D0          ;Continue with 2nd half of   E308
         ROXL.B   #1,D5          ;matrix, current column,     E315
         LSL.B    #1,D1          ;until all 8 bits of current E309
         ROXL.B   #1,D5          ;column (one from each       E315
         LSL.B    #1,D2          ;byte = row) are in result   E30A
         ROXL.B   #1,D5          ;byte = row.                 E315
         LSL.B    #1,D3          ;                            E30B
         ROXL.B   #1,D5          ;                            E315
;
         SWAP     D0             ;Swap registers back to      4840
         SWAP     D1             ;regain availability of      4841
         SWAP     D2             ;top half of matrix for      4842
         SWAP     D3             ;next iteration.             4843
;
         MOVE.B   D5,-(A0)       ;Store rotated col as row.   1105
         DBF      D4,DESTLOOP    ;Repeat for all 8 columns.   51CC FFCC
;
         MOVEM.L  (SP)+,D0-D5    ;Restore registers and       4CDF 003F
         RTS                     ;exit, character rotated.    4E75
;-------------------------------------------------------------------
```





Games

Scientific/mathematic

Business

Toolkit/utilities

Educational/Computer Aided Learning

The missing link

Significant advantages in speed of searching can be gained from this month's programming technique; and Owen Linderholm selects the best of readers' programs.

This month's programming technique comes courtesy of a reader, David Weatherall, in response to the first technique on linked lists (PCW, April). It describes a method of implementing and accessing a binary tree storage structure. Although this technique requires careful programming and thought, it has significant advantages in speed of searching.

There is a particular form of linking that can make quicker extraction possible, while still retaining the other benefits of linked lists. This method is called the binary tree, or B-tree.

An example of a B-tree is shown in the box alongside. The order of entry of the data items already in the tree is shown at the top, with their resulting positions in the tree. Below that are examples of the states of the various pointers involved.

Each data item sits at a node in the tree, and has three pointers associated with it. They point to the parent item and the two daughter items. The first item to be entered is placed at the root node, which is at the top of the tree diagram. Thereafter, each item entered is placed at the end of a new branch according to the following rules:

Compare the input data item with the data item in the B-tree. If the in-

PCW is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer. Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number.

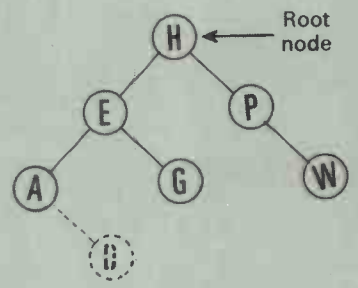
Check through the previous Program Files to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in). All programs should be fully debugged and your own original, unpublished work. We prefer to receive programs with a maximum 80-column width printed in emphasised typeface. If possible, please include printed sample output.

We will try to return submissions if they are accompanied by a stamped, addressed envelope of the appropriate size, but please keep a copy of everything. Programs are paid for at the rate of £50 per page of published listing, plus a £50 bonus for the Program of the Month.

Send your contributions to Owen Linderholm, Program File, *PCW*, 32-34 Broadwick Street, London W1A 2HG.

Data items entered in this order:

H E G P A W (D)



Arrays before addition of D

	Data items D$(N)	Left chain BT%(0,N)	Right chain BT%(1,N)	Upwards chain BT%(2,N)
1	H	2	4	0
2	E	5	3	1
3	G	0	0	2
4	P	0	6	1
5	A	0	0	2
6	W	0	0	4
7				

Arrays after addition of D

	Data items D$(N)	Left chain BT%(0,N)	Right chain BT%(1,N)	Upwards chain BT%(2,N)
1	H	2	4	0
2	E	5	3	1
3	G	0	0	2
4	P	0	6	1
5	A	0	7	2
6	W	0	0	4
7	D	0	0	5

put item is earlier in sequence than the B-tree item being examined, follow the branch to the left; otherwise follow the other branch. Keep doing this comparison with all the B-tree items encountered until you end up trying to go down a branch that doesn't exist. Then hang the input data item on a new branch there.

An example will make the method clearer. Suppose the next data item to be put into the tree is D. On comparing it with the root node item, H, it is clear that D comes before H, so we go down the left-hand chain to E. D also comes before E, so again we take the left-hand branch and arrive at A. As D comes later than A, we should take the right-hand branch. In this case there is no right-hand branch, so we make one and put the new data item, D, at the end of it.

The second table shows how the various pointers appear after the addition of D.

It is a simple matter to extract the desired item again. All that is needed is to use the same rules to journey through the tree, and end the search once the desired item has been reached.

The example program shown demonstrates the various functions in Microsoft Basic. The main program is in lines 10–240, the subroutine for putting data into the B-tree is in lines 60000–60210, and the extraction subroutine is in lines 60500–60570.

Speed

How quickly can data be extracted from a B-tree? Suppose we have a balanced B-tree containing 32,000 data items. The first decision eliminates 16,000 items from the search immediately, the next rejects 8000, and so on. Only 16 data items need to be examined in order to extract the desired one. You can see that this method is very useful for large files, as doubling the file size to 64,000 items would only increase the number of items to examine by one.

However, the data must be entered in unsorted order. If the data were entered in sorted order, all we would have would be a linked list, and retrieval would be much slower.

It might be thought that randomly entered data would result in slow retrieval times when compared with a balanced tree where each node had exactly two data items hanging from it. In fact, the randomly entered tree is only about 38 per cent slower than the perfectly balanced tree in searching — which, in most cases, is not enough to warrant trying to improve it.

This is all very well, but we still haven't extracted the items of data in sorted order.

Sorting

The logic behind this is more complex than straightforward data entry and retrieval. The algorithm itself appears in lines 60700–60820 of the example program, and the following is a description of how it works.

Take a look at the B-tree diagram. The early items in sorted sequence are always to the left of the later ones, and the first item is the leftmost one. So, as a general rule for extracting items in sorted order, we should keep going to the left as much as possible and only go to the next piece of the tree when all the nodes in the current part of the tree have been accessed.

To start, place yourself at the root node.

● **Step 1** Go down the tree, taking the left-pointing branch at each node until you can't go any further. Use that one and make a note that you have used it.

● **Step 2** The current node is on the path towards the next one in the sorted sequence, so go to the daughter node on the right (if it exists). Do not use it, but return to Step 1.

● **Step 3** If there is no daughter node to the right, go back up the tree, looking for the first unused node. Once found, use it, make a note to that effect and go to Step 2.

Of course, there will be a stage when all the nodes have been retrieved and returning up the tree will eventually bring you to the root node, which itself will have been used. When that condition has been detected, the sorted list is finished.

Summary

Normally, sorting is needed because data is held on the disk (or in memory) in the order it has been entered, and it needs to be output in sorted order. All that is needed to avoid the sorting stage is a small routine to add chain information to data records at entry time. Thereafter the data items are available in the order of entry, sorted order, or individually by key, without any further work.

Try it — you may never need to do a sort again!

```
10 PRINT "BINARY TREE DEMONSTRATION PROGRAM":PRINT:PRINT
20 PRINT "This program generates random strings"
30 PRINT "and puts the unique ones into a binary tree."
40 PRINT:PRINT "Then they are listed in sorted order, and"
50 PRINT "finally you may extract any of them by request."
60 PRINT:INPUT "How many items would you like";N
70 IF N<1 THEN END
80 GOSUB 60900:NX%=1:REM dimension arrays

90 REM now to generate random strings
100 REM and put them into the btree
110 FOR I=1 TO N:X$=""
120 FOR J=1 TO 6:X$=X$+CHR$(65+INT(RND(4)*26)):NEXT J
130 GOSUB 60000:PRINT X$,"Item number";I:NEXT I

140 PRINT:PRINT "The B-tree is now filled."
150 PRINT "Press the <RETURN> key to list it in sorted order."
160 WHILE INKEY$<>CHR$(13):WEND
170 AP%=1
180 GOSUB 60700:IF ET=0 THEN PRINT D$(AP%),"Item number";AP%:GOTO 180

190 PRINT:PRINT:PRINT"All items now output."
200 PRINT:PRINT"You may now extract any item."
210 PRINT"Just enter the string you desire."
220 INPUT"Your string";X$:IF X$="" THEN END
230 GOSUB 60500:IF ET=1 THEN PRINT"No such item.":GOTO 220
240 PRINT D$(AP%),"Item number";AP%:GOTO 220
60000 REM put data in btree array d$(n)
60010 REM bt% array holds btree pointers
60020 REM bt%(0,n) is left chain pointer
60030 REM bt%(1,n) is right chain pointer
60040 REM bt%(2,n) is chain pointer to mother node (upwards)
60050 REM lr% is left/right indicator (0=left, 1=right)
60060 REM ap% is array pointer for moving through btree
60070 REM nx% is pointer to next vacant spot in array
60080 REM x$ is input data to be put into btree
60090 REM first search btree for end of chain
60100 LR%=0:AP%=1
60110 IF X$<D$(AP%) THEN LR%=0 ELSE LR%=1
60120 IF BT%(LR%,AP%)<>0 THEN AP%=BT%(LR%,AP%):GOTO 60110
60130 REM end of chain has been reached.
60140 REM now to add input data (x$) to btree
60150 REM first adjust pointer to point to new item
60160 BT%(LR%,AP%)=NX%
60170 REM now add new item complete with pointers
60180 D$(NX%)=X$
60190 BT%(2,NX%)=AP%:REM upwards pointer
60200 BT%(0,NX%)=0:BT%(1,NX%)=0:NX%=NX%+1
60210 RETURN
60500 REM extract specified item from btree
60510 REM search key is x$
60520 REM success shows et=0, failure shows et=1
60530 AP%=1:ET=0
60540 IF X$=D$(AP%) THEN RETURN
60550 IF X$<D$(AP%) THEN LR%=0 ELSE LR%=1
60560 IF BT%(LR%,AP%)<>0 THEN AP%=BT%(LR%,AP%):GOTO 60540
60570 ET=1:RETURN
60700 REM output items from btree array in sorted order
60710 REM start with ap%=1 before calling subroutine
60720 REM return with et=0 and pointer to d$() in ap%
60730 REM if et=1 then end of list has been reached
60740 REM got%() is array for noting items used
60750 ET=0:IF GOT%(AP%)<>0 THEN GOTO 60780
60760 IF BT%(0,AP%)<>0 THEN AP%=BT%(0,AP%):GOTO 60760
60770 IF GOT%(AP%)<>1 THEN GOT%(AP%)=1:RETURN
60780 IF BT%(1,AP%)<>0 THEN AP%=BT%(1,AP%):GOTO 60760
60790 IF AP%=1 AND GOT%(1)=1 THEN ET=1:RETURN
60800 AP%=BT%(2,AP%):REM go up to mother node
60810 IF GOT%(AP%)=1 THEN GOTO 60790
60820 GOT%(AP%)=1:RETURN
60900 REM dimension  btree arrays ready for work
60910 REM if listing in sorted order not required,
60920 REM there is no need for got%(n)
60930 DIM D$(N):DIM BT%(2,N):DIM GOT%(N)
60940 RETURN
```

This month's programs

The Program of the Month is Solitaire by Cliff Hatch and Phil Willcox. It illustrates some intelligent games programming techniques and is presented superbly. If anyone wants to know how I would like to receive programs — *this* is how! Versions of the program are given for the BBC Micro and the QL.

Other programs this month include a program for the IBM/compatibles to provide a link from Basic to MS-DOS; a program for the Amstrad CPC series to automatically switch off the screen if the computer is unused for a certain amount of time; a program for the Amstrad PCW range to provide an address database and mailmerge facility for Locoscript; and a listing in Microsoft's Excel macro language to accompany Jack Weber's article on rule induction on page 130 of this issue.

Program of the Month
BBC/QL Solitaire

by Cliff Hatch and Phil Willcox

This program plays the board game Solitaire. It is designed to give an insight into the 'mechanics' of game-playing programs, particularly the use of recursion and strategy. It is written in Basic, in BBC and QL versions. Both versions are first presented using a recursive brute force method to solve the game; strategy is added later so that its effect on performance can be seen. The BBC and QL micros enhance the demonstration of the techniques used, by the use of colour graphics.

The program was inspired by two past features in *PCW* — 'The missing link' by Mike James, November 1986, and 'A game of skill' by David Levy, September 1986.

The game of Solitaire

Solitaire is a one-player game. The board has 33 holes into which 32 pins are inserted. The object of the game is to move the pins, which can take each other in a similar way to draughts, and to end up with one pin in the centre of the board. Pins can move vertically and horizontally — not diagonally. The rules are simple, but Solitaire is a difficult game because there are millions of combinations of moves to choose from.

Why recursion?

Fig 1 shows that the game can be visualised as a 'tree of board positions'. I have simplified the example by choosing the starting position, 'A', with only four pins on the board. The tree was constructed by considering all possible moves from 'A'. One particular set of moves leads to 'J', which is the solution. You could solve the game of Solitaire from any starting position by drawing a tree like this and then looking along the ends of the branches for the solution. By working back up the tree you could easily deduce the moves which led to the solution. If the number of pins on the board at the start is large (as in Fig 1) then it becomes an impossible task to do this on paper, but the principle remains the same. If you visualise the game as a tree, then you can solve it by searching the tree!

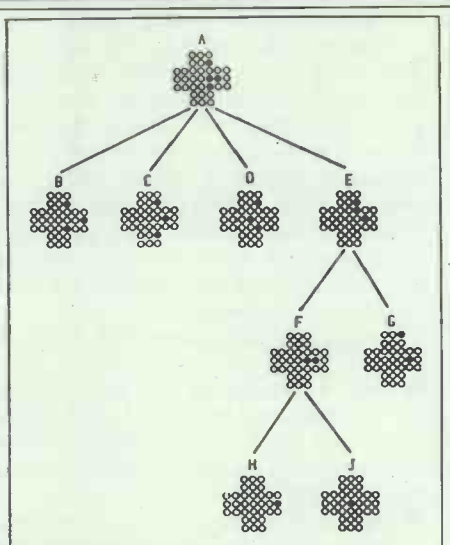


Fig 1 Simplified game tree

Tree searching is a naturally recursive activity. In 'The missing link', Mike James explained the reason for this with reference to binary trees. The concept applies equally well to game trees.

Computer representation

In the Basic programs I represent the Solitaire board by a two-dimensional integer array, a%(,), with subscripts matching the coordinates shown in Fig 2. Each element of the array holds a '1' to indicate that a pin is present, a '0' to indicate no pin present, or a '9' to indicate out of bounds. In the BBC version a stack of Solitaire boards is created by using the three-dimensional a%(,,) instead of a%(,). The directions of movement — north, east, south and west — are represented by the integers 1, 2, 3 and 4.

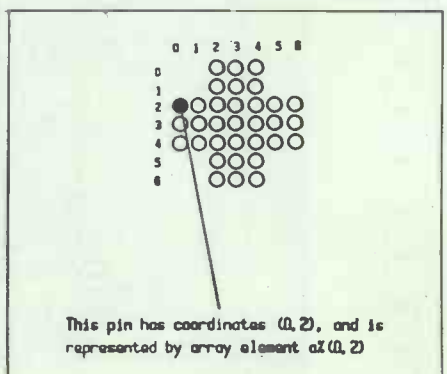


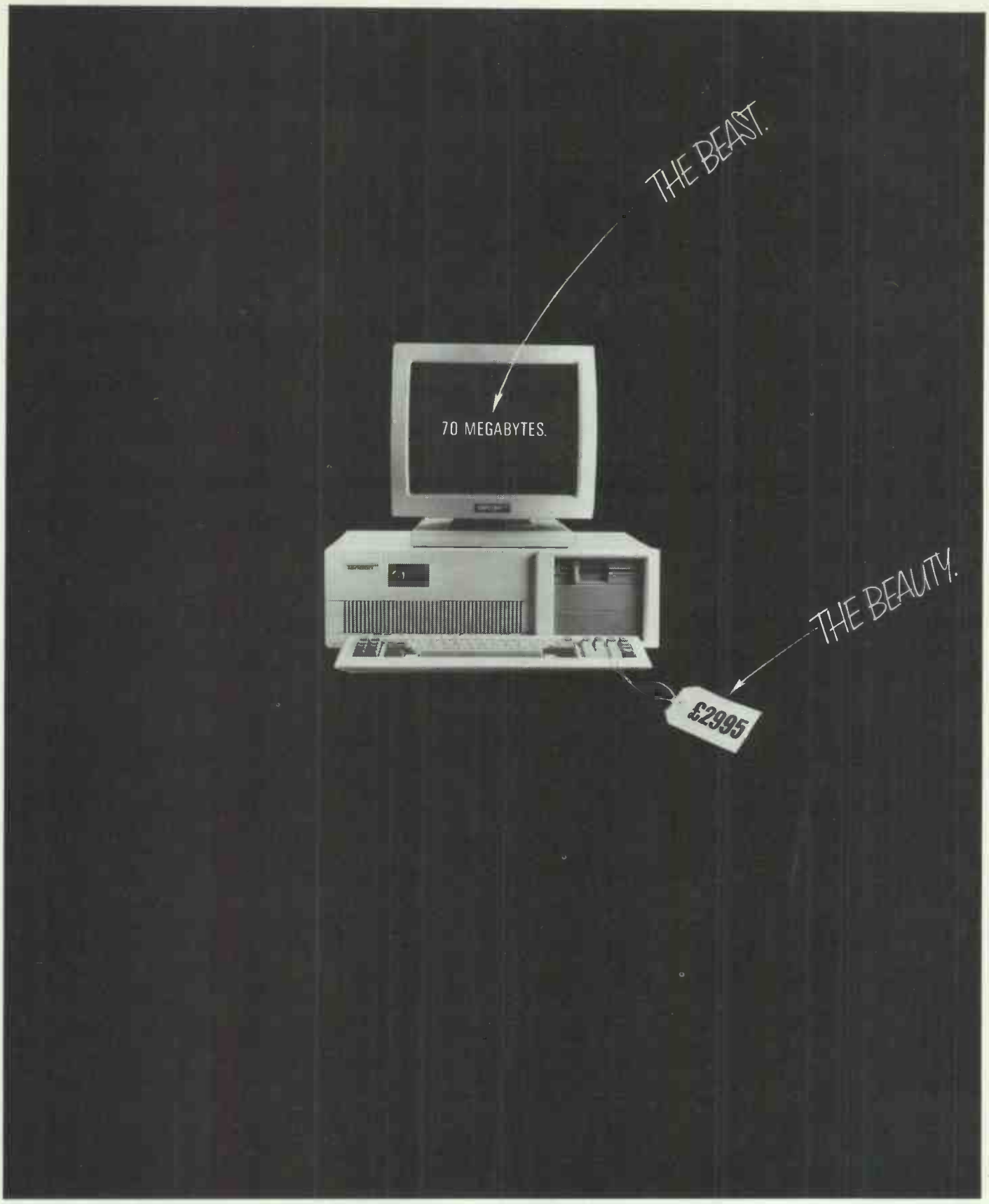
Fig 2 Coordinate system

We also need a notation for printing out the solution. Suppose that the eleventh move involves moving the pin at coordinates 0,3 eastwards; we would print this '11:0,3>E'. For readability, the directions 1, 2, 3 and 4, used inside the program, are translated to N, S, E and W for printing out the solution. So, for example, the program would print the solution to position 'A' in Fig 1 as '3:5,3>W 2:4,1>S 1:4,4>N'. The moves are printed in reverse order for reasons which will become clear later.

The programs

The BBC and QL versions of the program are shown in Listings 1 and 2; all the variables used are described after the listings. Before delving into the Basic code, it is useful to consider the underlying structure. 'Solit' is the recursive procedure which forms the heart of the program: its job is to identify and execute legal moves. It considers one hole and one direction of movement at a time, so it has to be called many times to check for legal moves over the whole board. Each time a legal move is found, Solit executes it — generating a new board position — then calls itself to check for legal moves in the new position, and so on. It looks out for the solution as it goes. On each call Solit needs to know the current state of the board, and which move to consider.

In Basic the parameters 'state', 'move', and so on, are comprised of more than one variable. Loop statements like 'for all move' generate the parameter 'move' for each call of Solit. Loops like this translate to three nested loops in Basic (QL lines 110 to 160 and 390 to 460; BBC lines 290 to 360 and 730 to 880). Since the board is represented by a 7x7 array and there are four directions of movement, Solit is called 7x7x4=196 times to cover the whole board. It checks the legality of each move in QL lines 195 to 290, BBC lines 420 to 540. If the move is illegal then it returns without taking any action; otherwise it executes the move, resulting in the generation of a new board state (QL lines 345 to 355, BBC lines 640 to 660), then it calls itself to examine all possible moves in the new board state (QL lines 385 to 460, BBC lines 730 to 880). When the solution is found, Solit sets the globe flag sol% (QL line 380, BBC line 710).



Buying a computer with monstrous power usually means paying a monstrous price.

Unless you buy the Tandon PCA70, in which case the massive capacity of 70 megabytes will cost a diminutive £2,995.

But the PCA70 isn't just big and fast.

With Hercules compatible graphics and serial/parallel ports both included in the price, it's got flexibility as well.

To find out more fill in the coupon.

It could prove the start of a beautiful relationship.

Please send me more information on the PCA70 and Tandon's other high quality, low price computers. Tandon (UK) Ltd., Freepost, Redditch, B97 4BR. Tel: (0527) 46800.

Name_____

Job Title_____

Company/Address_____

_____

Postcode_____ Tel._____

Nature of Business_____

No. of Employees_____

No. of installed PCs_____

Tandon

It then unwinds, printing out the moves which led to the solution as it goes.

The unwinding process naturally prints the moves in reverse order because Solit returns from the solution back to the starting position. If the program is given a starting position for which there is no solution, it searches the entire tree before printing conclusively 'no solution exists'.

When the solution has been found and printed out, the program stops. It does not continue to search the rest of the tree for possible alternative solutions.

The game's starting position is defined in data statements (QL lines 470 to 510, BBC lines 900 to 980). The first two numbers are the maximum x and y coordinates (that is, the size of the board). These are followed by the layout of the pins (1 for a pin, 0 for no pin, and 9 for an out of bounds hole); the last two numbers are the coordinates of the 'win' hole, where the last pin has to end up. By altering these data statements you can set up any starting position you like, and you can even experiment with different sized and shaped boards (bear in mind that the graphics routines will not cope with oversized boards).

The BBC and QL programs both contain procedures 'graphinit' and 'boardplot' for displaying the search graphically.

The BBC and QL versions are different in a number of respects. The unusual aspects of both versions are described below.

QL quirks

- In calls of the procedure Solit (lines 125 and 405), enclosing the actual parameters dep% and np% in brackets causes the procedure to work on its own local copies of these variables. Their values in previous calls are not disturbed and are accessible when the procedure returns. This treatment of parameters is described in the *QL User Guide*, 'Concepts', page 23. Unfortunately the same principle doesn't apply to arrays, so we arrange to copy the array a%(,) into the local array ac%(,) prior to each recursive call (lines 310 to 330). This ensures that the contents of a%(,) remain undisturbed by subsequent calls.
- SuperBasic does not allow integer variables to be used as FOR loop counters, or in SELect ON statements. The real variables xx, yy, and rdir are used in contexts where integer variables would have been preferred.

BBC quirks

This program is coded to follow the QL version as closely as possible and as such is not optimised. Some differences are forced by machine and language differences:

- The level to which FOR NEXT loops can be nested is limited to ten in BBC Basic — hence the untidy looking GOTO loops in lines 730 to 880.
- Since the passing of arrays to procedures as parameters is not implemented in BBC Basic, it is not possible to pass board positions to Solit using the two-dimensional array a%(,). To get round this problem an extra dimension is added to the array, making it a%(,,). This allows it to hold a stack of board positions with the third dimension representing the 'height' of the stack. The local parameter dep% (depth of call) is used as a pointer to determine which level of the stack to access. On each recursive call Solit works at the appropriate level of the stack, so board positions established by previous calls remain undisturbed.

Running the programs

The BBC and QL versions of the program in Listings 1 and 2 are self-contained. Type in the appropriate version and run it. When it runs, the program initialises four windows on the screen. The top two display the starting position and the position currently being searched; the middle window displays a static 'Solitaire' banner; the bottom window displays messages indicating how many positions have been examined, how many pins are currently remaining, and the depth of recursive calls — it also displays the solution when it is found. You might like to try running the program with different starting positions by modifying the data statements (BBC lines 910 to 970, QL lines 475 to 505).

To get an initial feel for the way the program works it is best to stick to simple problems, with five pins, say. The easiest way to invent solvable problems is to get hold of a Solitaire set and play a few moves backwards from the solution. Watch the program play and see if you can recognise the order in which it examines the moves — the order is specified by the three nested loops (QL lines 390 to 460, BBC lines 730 to 880). If it arrives at a state where it can find no further moves, it backtracks through previous board positions until it finds one. The QL version contains a BEEP statement in the Solit procedure to give an impression of the number of recursive calls taking place — delete line 190 if you prefer peace and quiet. The program solves problems with five pins in minutes. If you try some starting positions with six, seven and eight pins, and so on, you will prob-

ably find that the time increases dramatically.

Recursion and brute force

Try setting up the full starting position. Run the program and watch it play for a while. At first things seem to go quite well. The program quickly succeeds in removing most of the pins from the board — but then, a serious flaw in its style of play emerges. It spends an enormous amount of time examining positions which cannot possibly lead to the solution, usually because one or more pins have become stranded at the edge of the board. Positions like these are obviously hopeless to the human eye, but the machine blindly continues to explore them. You might begin to suspect that it would take months, perhaps years, to solve the game.

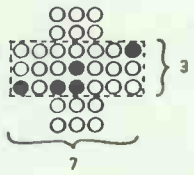
The problem is that the tree is too large to search by brute force. It contains millions of board positions. It would help if we could somehow cut the tree down to a more manageable size — which brings us to strategy.

● Recursion and strategy

One way of speeding up the search would be to cut some branches off the tree — preferably without cutting off the solution(s). A possible strategy would be to check every board position during the search and judge whether or not it might lead to the solution. If, for example, the position contains a pin stranded at the edge of the board, then it obviously won't lead to the solution — in which case there is no need to search any deeper from that position. That particular branch can be cut off.

Additions to the BBC and QL programs to demonstrate this strategy are shown in Listings 3 and 4. Type the appropriate version on top of Listing 1 or 2. The resulting program uses a function called 'treesaw' to judge whether or not the current position is worth searching. It returns a '0' if it is not worth searching and a '1' if it is. Treesaw is called after every move (BBC line 713, QL line 381). If the current position is not worth searching, then olit cuts off the branch by simply executing a RETURN (BBC line 716, QL line 382). No further recursive calls are made from that position.

Treesaw uses a simple scoring function. All board positions score either 0 or 1. The function works by measuring how dispersed the pins are — Fig 3 shows an example. An imaginary rectangle is drawn on the board, enclosing all the pins. The lengths of the sides of the rectangle are then added together and the result is compared with a predetermined limit. If it is greater than the limit, the pins are considered to be too dispersed to lead to a solution: the word 'reject' is printed in the text window and treesaw returns a 0 (BBC lines 2150 to 2180, QL lines 1140 to 1165).




```
Sum of Sides = 3 + 7 = 10
Number of pins = 5
limit%(5) = 9

In this case the Sum of the Sides is greater
than the limit set for 5 pins - so treesaw
would cut the branch at this point.  The possible
moves remaining would not be explored.
```

Fig 3 Treesaw algorithm

The limit on the size of the rectangle is related to the number of pins on the board — more pins can reasonably occupy more space. It is obtained from the array limit%() with the subscript denoting the number of pins on the board. Only positions containing from 2 to 12 pins are examined; all those with more than 12 pins are assumed to be worth searching further.

The values in limit%() are loaded from a data statement (BBC line 2190, QL line 1180). These values were obtained by experimentation, working backwards from the solution and observing the size of the rectangles generated. We have no theoretical argument to support their correctness — they just seem to fit. If they are not correct, treesaw might make inaccurate judgements and cut off branches which contain the solution. We have acknowledged this possibility by changing BBC line 370 and QL line 165 to print 'NO SOLUTION FOUND' instead of 'NO SOLUTION EXISTS'.

The treesaw function demonstrates how strategy can be applied 'on top of' the recursive search. It significantly improves the performance of the program. Despite the fact that the scoring function is based on one simple rule, it generally manages to cut down the size of the search by more than 50 per cent.

This completes the development of the BBC and QL programs. The programs are deliberately simple in order to provide an effective demonstration of the techniques used. Also, the simplicity of the treesaw function makes it a useful starting point for experimenting with different strategies.

PROGRAM FILE

Conclusion

The program shows how a recursive tree search can be used to solve the board game Solitaire, and how performance can be improved by the addition of strategy. The program is designed to give a simple demonstration of game-playing techniques, and to provide a starting point for experimenting with new ideas. The QL and BBC micros enhance the demonstration through the use of our graphics.

The concepts of recursion and strategy also apply to two-player games like draughts and chess, although these are much more complex and challenging. Their implementation requires faster computation and more intricate strategy than is appropriate for Solitaire.

My thanks to David Levy and Mike James for stimulating my interest in this area.

Listing 1

```
  10 REM BBC solitaire
  20 REM phil willcox, nov 86
  30 REM adapted from QL program by Cliff Hatch
  40 REM ****************************************
  50 MODE7:DIM dir$(4):dir$(1)="N":dir$(2)="E":dir$(3)="S":dir$(4)="W"
  60 PROCgraphinit
  70 REM read the initial board configuration and count the pins
  80 READ dx%,dy%
  90 DIM a%(dx%,dy%,50)
 100 np%=0
 110 FOR y%=0 TO dy%
 120   FOR x%=0 TO dx%
 130     READ a%(x%,y%,0)
 140     IF a%(x%,y%,0)=1 THEN np%=np%+1
 150     NEXT
 160   NEXT
 170 READ wx%,wy%
 180 REM
 190 sol%=0:m%=0:dep%=0:pr%=0:vpos%=0
 200 lx%=9-INT(dx%/2):IF lx%(5 THEN lx%=5
 210 rx%=lx%+dx%+2:IF rx%)17 THEN rx%=17
 220 ty%=6-INT(dy%/2):IF ty%(2 THEN ty%=2
 230 by%=ty%+dy%+2:IF by%)10 THEN by%=10
 240 PROCboardplot(lx%,by%,rx%,ty%)
 250 lx%=lx%+19:IF lx%(22 THEN lx%=22
 260 rx%=lx%+dx%+2:IF rx%)34 THEN rx%=34
 270 PROCboardplot(lx%,by%,rx%,ty%)
 280 REM solve
 290 FOR y%=0 TO dy%
 300   FOR x%=0 TO dx%
 310     FOR dir%=1 TO 4
 320       PROCsolit(x%,y%,dir%,dep%,np%)
 330       IF sol%=1 THEN PRINT" ";dep%+1;":";x%;",";y%;"]";dir$(dir%);:dir%=4:
x%=dx%:y%=dy%
 340       NEXT
 350     NEXT
 360   NEXT
 370 IF sol%=0 THEN PRINT"NO SOLUTION EXISTS"
 380 END
 390 REM
 400 DEF PROCsolit(x%,y%,dir%,dep%,np%)
 410 LOCAL xx%,yy%,dirc%
 420 REM check there is a pin at x%,y% to move
 430 IF a%(x%,y%,dep%)()1 THEN ENDPROC
 440 REM check it is possible to move pin in specified direction
 450 IF dir%=1 THEN destx%=x%:desty%=y%-2:skipx%=x%:skipy%=y%-1
 460 IF dir%=2 THEN destx%=x%+2:desty%=y%:skipx%=x%+1:skipy%=y%
 470 IF dir%=3 THEN destx%=x%:desty%=y%+2:skipx%=x%:skipy%=y%+1
 480 IF dir%=4 THEN destx%=x%-2:desty%=y%:skipx%=x%-1:skipy%=y%
 490 REM check for destination off board
 500 IF destx%(0 OR desty%(0 OR destx%)dx% OR desty%)dy% THEN ENDPROC
 510 REM check for destination occupied or illegal
 520 IF a%(destx%,desty%,dep%)=1 OR a%(destx%,desty%,dep%)=9 THEN ENDPROC
 530 REM check there is a pin to jump over
 540 IF a%(skipx%,skipy%,dep%)()1 THEN ENDPROC
 550 REM ok - legal move found
 560 REM copy current state of play into next level of array
 570 FOR yy%=0 TO dy%
 580   FOR xx%=0 TO dx%
 590     a%(xx%,yy%,dep%+1)=a%(xx%,yy%,dep%)
 600     NEXT
 610   NEXT
 620 dep%=dep%+1
 630 REM
 640 REM make the move
 650 m%=m%+1
 660 a%(x%,y%,dep%)=0:a%(skipx%,skipy%,dep%)=0:a%(destx%,desty%,dep%)=1:np%=np%
-1
 670 PROCboardplot(lx%,by%,rx%,ty%)
 680 vpos%=vpos%+1:IF vpos%)9 THEN vpos%=9
 690 PRINTTAB(0,vpos%)"states ";m%;", pins ";np%", depth ";dep%
 700 REM check if this is a solution
 710 IF np%=1 AND a%(wx%,wy%,dep%)=1 THEN sol%=1:PRINT"SOLUTION FOUND:":ENDPROC
 720 REM explore all possible remaining moves until solution found
 730 yy%=-1:xx%=-1:dirc%=0
 740 yy%=yy%+1
 750   xx%=xx%+1
 760     dirc%=dirc%+1
 770       PROCsolit(xx%,yy%,dirc%,dep%,np%)
 780       IF sol%=0 GOTO 840
 790       IF dep%(9 THEN PRINT" ";
 800       PRINT;dep%+1;":";xx%;",";yy%;"]";dir$(dirc%);
 810       pr%=pr%+1
 820       IF pr%=4 THEN PRINT:pr%=0:ELSE PRINT" ";
 830       dirc%=4:xx%=dx%:yy%=dy%
 840     IF dirc%(4 GOTO 760
 850     dirc%=0
 860   IF xx%(dx% GOTO 750
 870   xx%=-1
 880 IF yy%(dy% GOTO 740
 890 ENDPROC
 900 DATA 6,6
 910 DATA 9,9,0,1,0,9,9
 920 DATA 9,9,0,1,0,9,9
 930 DATA 0,0,1,0,0,0,0
 940 DATA 0,1,1,0,0,1,0
 950 DATA 0,1,1,1,0,1,0
 960 DATA 9,9,0,1,0,9,9
```

PROGRAM FILE

```
  970 DATA 9,9,0,0,0,9,9
  980 DATA 3,3
  990 REM
 1000 DEF PROCgraphinit
 1010 REM set up "solving" and "current" boards
 1020 PRINTTAB(0,1);CHR$133;CHR$157;CHR$132"    SOLVING:     ";CHR$156;CHR$131;CHR
$157;CHR$132;"CURRENT STATE:  ";CHR$156
 1030 FOR vx%=2 TO 10
 1040   PRINTTAB(0,vx%);;CHR$133;CHR$157;CHR$129
 1050   PRINTTAB(18,vx%);CHR$156;CHR$131;CHR$157;CHR$129
 1060   PRINTTAB(38,vx%);CHR$156
 1070   NEXT
 1080 REM set up "solitaire" banner
 1090 FOR vx%=12 TO 13
 1100   PRINTTAB(7,vx%);CHR$141;CHR$129;CHR$157;CHR$135:"S O L I T A I R E  ";CHR
$156
 1110   NEXT
 1120 ENDPROC
 1130 REM
 1140 DEF PROCboardplot(lx%,by%,rx%,ty%)
 1150 LOCAL x%,y%
 1160 VDU28,lx%,by%,rx%,ty%
 1170 CLS
 1180 FOR vx%=0 TO dy%
 1190   FOR x%=0 TO dx%
 1200     IF a%(x%,y%,dep%)=0 THEN PRINT;"o";:ELSE IF a%(x%,y%,dep%)=1 THEN PRIN
T"e";:ELSE PRINT" ";
 1210     NEXT
 1220   PRINT
 1230   NEXT
 1240 VDU28,0,24,39,15
 1250 ENDPROC
```

Listing 2

```
  5 REMark ************************
 10 REMark QL solitaire
 15 REMark cliff hatch, nov 86
 20 REMark ************************
 25 CLEAR:CLS:DIM dir$(4):dir$(1)="N":dir$(2)="E":dir$(3)="S":dir$(4)="W"
 30 graphinit
 35 REMark read the initial board configuration and count the pins
 40 READ dx%,dy%
 45 DIM a%(dx%,dy%)
 50 np%=0
 55 FOR yy=0 TO dy%
 60   FOR xx=0 TO dx%
 65     READ a%(xx,yy)
 70     IF a%(xx,yy)=1 THEN np%=np%+1
 75   END FOR xx
 80 END FOR yy
 85 READ wx%,wy%
 90 REMark
 95 boardplot a%,2:boardplot a%,3
100 REMark solve
105 sol%=0:m%=0:dep%=1:pr%=0
110 FOR yy=0 TO dy%
115   FOR xx=0 TO dx%
120     FOR rdir=1 TO 4
125       solit a%,INT(xx),INT(yy),INT(rdir),(dep%),(np%)
130       IF sol%=1 THEN
135         PRINT " ";dep%;":";xx;",";yy;")";dir$(rdir);
140         EXIT yy
145       END IF
150     END FOR rdir
155   END FOR xx
160 END FOR yy
165 IF sol%=0 THEN PRINT "NO SOLUTION EXISTS"
170 STOP
175 REMark *****************************************
180 DEFine PROCedure solit (a%,x%,y%,dir%,dep%,np%)
185   LOCal ac%(dx%,dy%),xx,yy,rdir,depc%
190   BEEP 250,500
195   REMark check there is a pin at x%,y% to move
200   IF a%(x%,y%)<>1 THEN RETurn
205   REMark check it is possible to move pin in specified direction
210   rdir=dir%
215   SELect ON rdir
220     ON rdir=1
225       destx%=x%:desty%=y%-2:skipx%=x%:skipy%=y%-1
230     ON rdir=2
235       destx%=x%+2:desty%=y%:skipx%=x%+1:skipy%=y%
240     ON rdir=3
245       destx%=x%:desty%=y%+2:skipx%=x%:skipy%=y%+1
250     ON rdir=4
255       destx%=x%-2:desty%=y%:skipx%=x%-1:skipy%=y%
260   END SELect
265   REMark check for destination off board
270   IF destx%<0 OR desty%<0 OR destx%>dx% OR desty%>dy% THEN RETurn
275   REMark check for destination occupied or illegal
280   IF a%(destx%,desty%)=1 OR a%(destx%,desty%)=9 THEN RETurn
285   REMark check there is a pin to jump over
290   IF a%(skipx%,skipy%)<>1 THEN RETurn
295   REMark ok - legal move found
300   REMark copy the current state of play into local variables
305   BEEP 100,0
310   FOR yy=0 TO dy%
315     FOR xx=0 TO dx%
320       ac%(xx,yy)=a%(xx,yy)
325     END FOR xx
330   END FOR yy
335   depc%=dep%+1
340   REMark
345   REMark make the move
350   ac%(x%,y%)=0:ac%(skipx%,skipy%)=0:ac%(destx%,desty%)=1:np%=np%-1
355   m%=m%+1
360   CLS #3:AT #3,0,2:PRINT #3,"CURRENT STATE:"
365   boardplot ac%,3
370   PRINT "states ";m%;", pins ";np%;", depth ";dep%
375   REMark check if this is a solution
380   IF np%=1 AND ac%(wx%,wy%)=1 THEN sol%=1:PRINT "SOLUTION FOUND:":RETurn
385   REMark explore all possible remaining moves until solution found
390   FOR yy=0 TO dy%
395     FOR xx=0 TO dx%
400       FOR rdir=1 TO 4
405         solit ac%,INT(xx),INT(yy),INT(rdir),(depc%),(np%)
410         IF sol%=1 THEN
415           IF depc%<10 THEN PRINT " ";
420           PRINT depc%;":";xx;",";yy;")";dir$(rdir);
425           pr%=pr%+1
430           IF pr%=4 THEN PRINT:pr%=0:ELSE PRINT " ";
435           BEEP 100,depc%
440           EXIT yy
```

PROGRAM FILE

```
445         END IF
450       END FOR rdir
455     END FOR xx
460   END FOR yy
465 END DEFine solit
470 DATA 6,6
475 DATA 9,9,0,1,0,9,9
480 DATA 9,9,0,1,0,9,9
485 DATA 0,0,1,0,0,0,0
490 DATA 0,1,1,0,0,1,0
495 DATA 0,1,1,1,0,1,0
500 DATA 9,9,0,1,0,9,9
505 DATA 9,9,0,0,0,9,9
510 DATA 3,3
515 REMark ******************************************
520 DEFine PROCedure graphinit
525   REMark clear all windows to black
530   MODE 8:PAPER #0,0:CLS #0:PAPER #1,0:CLS #1:PAPER #2,0:CLS #2
535   REMark set up the "solving" window
540   WINDOW #2,215,100,40,9
545   PAPER #2,6:BORDER #2,2,7:INK #2,2:CLS #2:STRIP #2,7
550   AT #2,0,5:PRINT #2,"SOLVING:"
555   REMark set up the "current state" window
560   OPEN #3,scr_215x100a256x9
565   PAPER #3,6:BORDER #3,2,7:INK #3,2:CLS #3:STRIP #3,7
570   AT #3,0,2:PRINT #3,"CURRENT STATE:"
575   REMark set up "solitaire" banner
580   WINDOW #0,431,25,40,110
585   PAPER #0,1:BORDER #0,2,7:INK #0,7:CLS #0
590   CSIZE #0,3,1:AT #0,0,9:PRINT #0,"Solitaire";:CSIZE #0,0,0:CURSOR #0,0,0
595   REMark set up "text" window
600   WINDOW #1,431,120,40,136
605   PAPER #1,2:BORDER #1,2,7:INK #1,7:CLS #1
610 END DEFine graphinit
615 REMark ******************************************
620 DEFine PROCedure boardplot (a%,chano%)
625   LOCal xx,yy,startx%,starty%,pitch%,rad%
630   startx%=40:starty%=85:pitch%=13:rad%=5
635   FOR yy=0 TO dy%
640     FOR xx=0 TO dx%
645       IF a%(xx,yy)=0 THEN FILL #chano%,0:ELSE FILL #chano%,1
650       IF a%(xx,yy)<>9 THEN CIRCLE #chano%,startx%+xx*pitch%,starty%-yy*
pitch%,rad%
655     NEXT xx
660   NEXT yy
665 END DEFine boardplot
```

Listing 3 BBC treesaw procedure

```
 175 DIM limit%(12):FOR j%=2 TO 12:READ limit%(j%):NEXT
 370 IF sol%=0 THEN PRINT"NO SOLUTION FOUND"
 713 con%=FNtreesaw(np%,dep%)
 716 IF con%=0 THEN ENDPROC
2000 DEF FNtreesaw(np%,dep%)
2010 REM return 0 if current state looks bad
2020 REM otherwise return 1
2030 maxnp%=12:minx%=dx%:maxx%=0:miny%=dy%:maxy%=0:gflag%=1
2040 IF np%)maxnp% THEN =gflag%
2050 IF np%=1 THEN =0
2060 FOR ys%=0 TO dy%
2070   FOR xs%=0 TO dx%
2080     IF a%(xs%,ys%,dep%)<>1 GOTO 2130
2090     IF xs%<minx% THEN minx%=xs%
2100     IF xs%)maxx% THEN maxx%=xs%
2110     IF ys%<miny% THEN miny%=ys%
2120     IF ys%)maxy% THEN maxy%=ys%
2130     NEXT
2140   NEXT
2150 IF (maxx%-minx%+1)+(maxy%-miny%+1))limit%(np%) THEN gflag%=0
2160 IF gflag%=0 THEN vpos%=vpos%+1:IF vpos%)9 THEN vpos%=9
2170 IF gflag%=0 THEN PRINT"reject"
2180 =gflag%
2190 DATA 3,5,7,9,10,11,12,12,13,13,14
```

Listing 4 QL treesaw function

```
86 DIM limit%(12):FOR j=2 TO 12:READ limit%(j):END FOR j
165 IF sol%=0 THEN PRINT "NO SOLUTION FOUND"
381   con%=treesaw(np%,ac%)
382   IF con%=0 THEN RETurn
900 REMark ******************************************
1000 DEFine FuNction treesaw(np%,a%)
1010   REMark return 0 if current state of play looks bad
1020   REMark otherwise return 1
1025   maxnp%=12:minx%=dx%:maxx%=0:miny%=dy%:maxy%=0:gflag%=1
1030   IF np%)maxnp% THEN RETurn gflag%
1035   IF np%=1 THEN RETurn 0
1040   FOR ys=0 TO dy%
1050     FOR xs=0 TO dx%
1060       IF a%(xs,ys)=1 THEN
1070         IF xs<minx% THEN minx%=xs
1080         IF xs)maxx% THEN maxx%=xs
1090         IF ys<miny% THEN miny%=ys
1100         IF ys)maxy% THEN maxy%=ys
1110       END IF
1120     END FOR xs
1130   END FOR ys
1140   IF (maxx%-minx%+1)+(maxy%-miny%+1))limit%(np%) THEN gflag%=0
1160   IF gflag%=0 THEN PRINT "reject":BEEP 5000,250
1165   RETurn gflag%
1170 END DEFine treesaw
1180 DATA 3,5,7,9,10,11,12,12,13,13,14
```

Basic variables

QL	BBC	DESCRIPTON
dir$()	dir$()	String array holding directions: N,E,S,W
dx%	dx%	Maximum x coordinate on board
dy%	dy%	Maximum y coordinate on board
a%(,),ac%(,)	a%(,,)	Array containing board position(s)
np%	np%	Number of pins
x%,xx,xs	x%,xx%,xs%	X coordinate
y%,yy,ys	y%,yy%,ys%	Y coordinate
wx%	wx%	X coordinate of win hole

PROGRAM FILE

```
wy%             wy%             Y coordinate of win hole
sol%            sol%            Solution flag (=0 solution not found)
                                                (=1 solution found)
dep%,depc%      dep%            Depth of recursive calls
pr%             pr%             Counter for printing moves 4 per line
                vpos%           Print tabulator, text window
                lx%             Window position for board plotting (left)
                rx%             Window position for board plotting (right)
                ty%             Window position for board plotting (top)
                by%             Window position for board plotting (bottom)
dir%,rdir       dir%,dirc%      Direction of movement: 1,2,3,4
destx%          destx%          X coordinate of destination hole
desty%          desty%          Y coordinate of destination hole
skipx%          skipx%          X coordinate of skip hole
skipy%          skipy%          Y coordinate of skip hole
m%              m%              Number of states/positions found
con%            con%            Flag holding value returned by treesaw
chano%                          Channel number for board plotting
startx%                         X coordinate to start board plotting
starty%                         Y coordinate to start board plotting
pitch%                          Distance between holes - for plotting
rad%                            Radius of holes - for plotting
maxnp%          maxnp%          Maximum number of pins considered by treesaw
minx%           minx%           Minimum x coord - for calculating sum of sides
maxx%           maxx%           Maximum x coord - for calculating sum of sides
miny%           miny%           Minumum y coord - for calculating sum of sides
maxy%           maxy%           Maximum y coord - for calculating sum of sides
gflag%          gflag%          Flag returned by treesaw (=0 cut branch)
                                                (=1 don't cut branch)
limit%()        limit%()        Array of limits on dispersal of pins


Parameters used to describe structure, relate to the following BASIC variables:

"state"     is comprised of - OL: a%(,), np%          BBC: a%(,,dep%), np%
"move"      is comprised of - OL: dep%, xx, yy, rdir  BBC: dep%, x%, y%, dir%
"new_state" is comprised of - OL: ac%(,), np%         BBC: a%(,,dep%), np%
"new_move"  is comprised of - OL: depc%, xx, yy, rdir BBC: dep%, xx%, yy%, dirc%
```

MS-DOS/Basic DOSLINK

by LM Brann

The MS-DOS operating system provides a software interface between user-developed software and the machine's hardware — that is, disk storage, keyboard, display and peripheral devices. This software interface consists of a series of software routines to perform specific functions: for example, read keyboard, read/write disk, and so on. The DOS defines a standard software interface to these routines but has code specific to the hardware that the DOS is implemented upon. This ensures that user software will run on various hardware configurations without modification.

While operating within the Basic environment, direct access to DOS is not provided: the programmer is limited to the functions and facilities provided by the Basic language. Basic provides good access for the use of data files but has limitations that restrict its use for disk utility and management programs.

DOSLINK was developed to overcome this limitation: it is a short Basic subroutine that provides a link between Basic and the MS-DOS function calls. It allows the Basic programmer with little or no knowledge of assembly language to invoke various MS-DOS function calls to create utility and management programs that are not otherwise possible with Basic alone. Via DOSLINK, Basic can be used to access the disk directory, disk label, file attributes, time and date as well as direct sector access — all essential for the creation of disk library and management utilities.

MS-DOS can be viewed as a series of subroutines, each with a dedicated function. On entry certain variables are set up to define how the function is to perform; on exit the routine places the result of its function into variables. Normally the access to MS-DOS is at assembly language level and the necessary variables are passed using the CPU registers.

Recommended access to MS-DOS is via a special method of calling known as a software interrupt. The 8088/86-type CPU provides for a number of these, with its INT XX instruction where XX defines which software interrupt to execute. Whenever the CPU finds an INT instruction in its program, it transfers program control to the address specified in a special memory location called an interrupt vector.

Each of the INT instructions has its own associated vector. Those INTs used to interface to MS-DOS have a vector address to the MS-DOS function allocated to that interrupt. The operation of the software interrupt functions as a GOSUB in Basic: that is, when the end of the routine is reached, MS-DOS returns program control back to the calling program immediately after the software interrupt that invoked it. The use of this calling technique allows the detail of MS-DOS to be changed at any time without altering the way each function is invoked. This allows updates and correction of bugs to MS-DOS

without the need to change the user programs.

To establish a working link between Basic and MS-DOS requires that Basic sets up the required entry data into the CPU registers, executes the appropriate software interrupt for the function required, and then reads back the resulting data from the CPU registers. DOSLINK achieves this by the use of a short machine code routine and the facilities of the Basic CALL statement.

The Basic CALL statement provides the facility to execute machine code programs from within Basic. It also allows the passing of pointers to the location of certain defined Basic variables on the CPU stack, thereby allowing the machine code routine to read and write data to and from Basic variables. Machine code programs can be stored in various ways for use by Basic. DOSLINK uses the area of memory allocated to an integer array.

DOSLINK allocates a group of Basic variables for the interface within the machine code program. To invoke any of the MS-DOS function calls or any software interrupt, the Basic programmer is required to set up the entry data in the correct Basic variables, make the Basic CALL to the DOSLINK machine code routine, and read the Basic variables on return. The following text defines those variables used by DOSLINK, and their application (note — all variables passed are integer type):

RAX — passed to and from CPU reg AX
RBX — passed to and from CPU reg BX
RCX — passed to and from CPU reg CX
RDX — passed to and from CPU reg DX
RDI — passed to and from CPU reg DI
RSI — passed to and from CPU reg SI

RFG — receives a copy of CPU flag register on return
RES — receives a copy of CPU segment register ES on return

FUN — defines which software interrupt to execute

(On entry to the machine code routine, Basic sets all segement registers to point at Basic's data segment.)

Passing data to and from DOSLINK

As detailed above, Basic variables can be passed to a machine code program by the CALL statement of Basic. Prior to invoking the CALL to the machine code, the CALL statement places pointers to the variables to be passed to that routine onto the CPU stack. These pointers indicate where the actual data for the passed variables is stored in Basic's data segment. The machine code routine can, therefore, access the data in each of the passed variables by these pointers.

The DOSLINK machine code expects to find pointers to Basic integer variables. Basic integer variables can be in the range −32768 to +32767, the actual value being stored in two bytes in 2's complement format. DOSLINK passes data from integer variables of this format to the CPU registers and back again. To set up the register values, it is recommended that the hexadecimal format is used — for example, &H1234. The following Basic statements can be used to convert between positive Basic floating point variables and integer variables for passing to and from DOSLINK:

To convert a positive decimal value in the range 0 to 65535 to an integer variable suitable for passing to DOSLINK:

```
RAX=XAX+(XAX>32767)*2^16
```

where RAX=integer variable to pass to DOSLINK
XAX=floating point variable (between 0 and 65535)

To convert an integer variable loaded by DOSLINK to a positive decimal value:

```
XAX=RAX+(RAX<0)*2^16
```

where XAX=floating point variable (between 0 and 65535)
RAX=integer variable loaded by DOSLINK

The 8088/86 CPU has 16-bit registers which can be accessed as two 8-bit registers. Register AX is a 16-bit register which can be accessed as two 8-bit registers called AH and AL, where AH is the 8 high bits of AX and AL is the 8 low bits. Registers BX, CX and DX all conform to this convention. DOSLINK passes all CPU register data in 16-bit format as above. To determine the value to be passed to DOSLINK in terms of the high and low registers, use the following format:

```
XAX=XAH*256+XAL
```

where XAX is the 16-bit value passed to CPU reg AX by DOSLINK
XAH is the 8 bits for CPU reg AH
XAL is the 8 bits for CPU reg AL

Allocation of work areas for use by DOSLINK

For certain functions, MS-DOS requires work areas in memory through which it can transfer data to and from the calling routine: this is

particularly so when using disk access functions. For an effective DOS to Basic link it is necessary to allocate those work areas in the Basic data segment, in the area normally used by Basic to store its variables. The most practical option is to allocate Basic string space as the work area; this then allows Basic to readily access the work area using the string operators. When Basic allocates a string variable, it stores that variable in the Basic data segment in the same way as a numeric variable, except that in place of the numeric value it stores a string descriptor. The actual data for the string is stored in a separate area. The string descriptor records the length of the data and points to its location in the data segment. Basic allows a maximum string length of 255 characters and is the preferred method of allocating work areas up to 255 bytes; however, for work areas of more than 255 continuous bytes, it is necessary to use string arrays. When the string space has been allocated, its memory location will need to be communicated to DOS via the various DOS function calls and DOSLINK.

Basic provides a function called VARPTR to allow the location of any of its variables to be found. The following example finds the location of WA$ in the Basic data segment and loads RDX ready to make a call to DOSLINK, a typical set-up prior to an MS-DOS call:

```
X=VARPTR(WA$):X = PEEK(X+1)
  +PEEK(X+2)*256:RDX = X+
  (X>32767)*2^16
```

It is recommended that this statement be executed just prior to the DOSLINK call and must be executed after any redefinition of WA$ by Basic.

The following Basic statements show examples of work space allocation using both single strings and string arrays.

Allocation of a 128-byte work area in a single string:

```
WA$=SPACE$(128)
```

Allocation of an ASCIIZ string for transfer to DOS:

```
WA$="Filenam.xyz"+CHR$(0)
```

Allocation of a 1024-byte work area:

```
DIM WA$(63):FOR 1=63 to 0 STEP
  -1:WA$(1)=SPACE$(16):NEXT
```

The use of string arrays warrants special consideration and handling due to the way Basic allocates string space. When Basic allocates a new string or changes the contents of an existing one, it then finds the first free space in the string storage area and uses this, and sets the string descriptor accordingly.

Basic works from the top of available memory down in the allocation of string space. For this reason it is necessary to define the last element of the string array first to ensure that the array elements are stored from low memory to high memory, which is the convention that DOS will use for its work areas. It should be noted that when Basic allocates a string array, it is only the variable containing the string descriptor that will be stored in contiguous memory locations in the array table: the location of the actual string data can be stored in any part of Basic's string space. It is therefore essential, when defining a Basic string array for use as a work area, that the string data for each element be defined in turn and that no other string definition occurs between element definition. Consideration should also be given to the use of such a work area. If any single element of the array is redefined, then the data for that element will be allocated somewhere outside of the contiguous block of memory allocated as the work area. If Basic requires to write data into the work area, it is recommended that the POKE statement is used. The location of any element in the string array can be found with the following:

```
X=VARPTR(WA$(10)):X = PEEK(X
  +1)+PEEK(X+2)*256
```

Care should also be taken with regard to the Basic's 'garbage collection' routines. As each string is redefined, the new contents are stored in the next free space of Basic's string space; the old data for the string remaining where it was. Eventually all of the available memory becomes full of string data, some of which is no longer valid. To enable Basic to continue working it performs an operation to 'clean up' the string space and remove all of the old string data, moving the valid strings to new destinations in memory.

Provided no further variable definition takes place after using VARPTR to find a string and prior to the information returned by VARPTR being used, no problems should occur. However, use the Basic function FRE(A$) to force a 'clean-up' of string space prior to accessing any string data with VARPTR.

```
1000 ' ************************************************************
1010 ' *                                                          *
1020 ' *        DOS-LINK - A BASIC UTILITY SUBROUTINE             *
1030 ' *        ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~               *
1040 ' *                                                          *
1050 ' *        VERSION 02.00 01/10/86  (C) L.M.BRANN             *
1060 ' *                                                          *
1070 ' * PASSES DATA FROM BASIC VARIABLES TO THE CPU REGISTERS     *
1080 ' * EXECUTES THE SOFTWARE INTERRUPT DEFINED IN 'FUN'         *
1090 ' * RETURNS CPU REGISTER VALUES BACK TO BASIC VARIABLES      *
1100 ' *                                                          *
```

PROGRAM FILE

```
1110 ' # VALUES P.:SSED ON ENTRY                                   #
1120 ' #                          RAX TO CPU REG AX                #
1130 ' #                          RBX TO CPU REG BX                #
1140 ' #                          RCX TO CPU REG CX                #
1150 ' #                          RDX TO CPU REG DX                #
1160 ' #                          RDI TO CPU REG DI                #
1170 ' #                          RSI TO CPU REG SI                #
1180 ' #                                                           #
1190 ' # VALUES PASSED ON EXIT                                     #
1200 ' #                          CPU REG AX TO RAX                #
1210 ' #                          CPU REG BX TO RBX                #
1220 ' #                          CPU REG CX TO RCX                #
1230 ' #                          CPU REG DX TO RDX                #
1240 ' #                          CPU REG DI TO RDI                #
1250 ' #                          CPU REG SI TO RSI                #
1260 ' #                          CPU REG ES TO RES                #
1270 ' #                          CPU REG FG TO RFG (FLAGS)        #
1280 ' #                                                           #
1290 ' # DOS-LINK ESTABLISHED BY CALL TO A SHORT MACHINE CODE      #
1300 ' # PROGRAM. THIS IS LOADED INTO INTEGER ARRAY A() PRIOR      #
1310 ' # TO MAKING A CALL TO THE DOSLINK SUBROUTINE.               #
1320 ' #                                                           #
1330 ' #############################################################
1340 '
1350 ' #############################################################
1360 ' #                                                           #
1370 ' #   DEFINE DOSLINK VARIABLES AND LOAD MACHINE CODE TO A()   #
1380 ' #   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~   #
1390 ' #                                                           #
1400 ' # Execute this prior to the DOSLINK call,                   #
1410 ' #                                                           #
1420 ' #############################################################
1430 '
1440 ' Load machine code program to array A()
1450 '
1460 DEFINT A,D,F,R
1470 RAX=&H0:RBX=&H0:RCX=&H0:RDX=&H0:RDI=&H0:RSI=&H0:RES=0:RFG=1:FUN=&05:DLINK=0

1480 DIM A(54):RESTORE 2080:FOR I=0 TO 54:READ A(I):NEXT:RETURN
1490 '
1500 ' #############################################################
1510 ' #                                                           #
1520 ' # DOSLINK DATA CONVERSIONS .......                          #
1530 ' # ~~~~~~~~~~~~~~~~~~~~~~~~                                  #
1540 ' #~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~#
1550 ' #                                                           #
1560 ' # To convert floating point variable to integer format      #
1570 ' #                                                           #
1580 ' #   RAX=XAX+(XAX>32767)*2^16                                #
1590 ' #                                                           #
1600 ' #   Where XAX = Floating Point Variable                     #.
1610 ' #         RAX = Integer Variable to pass to DLINK           #
1620 ' #                                                           #
1630 ' #~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~#
1640 ' #                                                           #
1650 ' # To convert DLINK integer variable format to floating point #
1660 ' #                                                           #
1670 ' #   XAX=RAX+(RAX<0)*2^16                                    #
1680 ' #                                                           #
1690 ' #   Where XAX = Floating Point Variable                     #
1700 ' #     RAX = Interger Variable to pass to DLINK              #
1710 ' #                                                           #
1720 ' #~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~#
1730 ' #                                                           #
1740 ' # To find String variable contents and set a pointer to its #
1750 ' # location in the BASIC Data Segment.                       #
1760 ' #                                                           #
1770 ' #  SADDR=VARTR(ST$):SADDR=PEEK(SADDR+1)+PEEK(X+2)*256       #
1780 ' #                                                           #
1790 ' #  Where ST$ is string variable                             #
1800 ' #        SADDR is a floating point variable                 #
1810 ' #                                                           #
1820 ' #############################################################
1830 '
1840 ' #############################################################
1850 ' #                                                           #
1860 ' #     DOSLINK SUBROUTINE (LINK TO DOS)                      #
1870 ' #     ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~                      #
1880 ' #                                                           #
1890 ' # Assembly language loaded to interger array a()            #
1900 ' #                                                           #
1910 ' # ENSURE AL:L VARIABLES PASSED ARE DEFINED PRIOR TO ENTRY   #
1920 ' # ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~   #
1930 ' #                                                           #
1940 ' # On entry RAX, RBX etc holds register entry values         #
1950 ' #          FUN holds the DOS INT for the required function  #
1960 ' #                                                           #
1970 ' #############################################################
1980 '
1990 DLINK=VARPTR(A(0)):CALL DLINK(DLINK,FUN,RAX,RBX,RCX,RDX,RSI,RDI,RES,RFG)
2000 RETURN
2010 '
2020 ' #############################################################
2030 ' #                                                           #
2040 ' #     MACHINE CODE DATA FOR DOSLINK - LOAD TO ARRAY A()     #
2050 ' #                                                           #
2060 ' #############################################################
2070 '
2080 DATA &H8B55,&H06EC,&H5E8B,&H8B0C,&H8B37,&H0A5E,&H3F8B,&H5E8B,&H8B18,&H0507
2090 DATA &H003B,&HC88B,&H5E8B,&H8B16,&H8B07,&H8BD9,&H8B07,&H0E5E,&H178B,&H5E8B
2100 DATA &H8B10,&H8B0F,&H145E,&H078B,&H8B50,&H125E,&H078B,&HD88B,&H5558,&H05CD
2110 DATA &H535D,&H5E8B,&H890C,&H8B37,&H0A5E,&H3F89,&H5E8B,&H890E,&H8B17,&H105E
2120 DATA &H0F89,&H5E8B,&H8914,&H8B07,&H125E,&H8958,&H8B07,&H065E,&H589C,&H0789
2130 DATA &H5E8B,&H8C08,&H0707,&HCA5D,&H0014
2140 '
2150 '~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
2160 '
```

PROGRAM FILE

Excel Macro Rule Inference

by Jack Weber

This is the program which accompanies Jack Weber's article, 'Working to rule', on rule induction from within a spreadsheet using its macro language (page 130, this issue).

	A	B
1	**Rule Induction**	
2		
3	© Jack Weber January 1987	
4		
5	**Program**	
6	count the number of allowed values for each attribute	
7	=SELECT(!$B$12:$F$12)	select cells to take counts
8	=FORMULA.FILL("=Macros!Countup(R[-10]C:R[-1]C)")	call function to count the 10 rows above
9	count the number of attributes	
10	=SET.VALUE(A13,1)	set loop to do columns: 1 - 4
11	=SET.NAME("attributes",0)	initialise counter
12	=SET.NAME("attributes",attributes+SIGN(INDEX(!$B$12:$E$12,A13)))	increment count if values present
13	=A13+1	increment column loop
14	=IF(A13<5,GOTO(A12))	do next column
15	count the number of examples	
16	=SELECT(!$B$33:$F$33)	select cells to take counts
17	=FORMULA.FILL("=Macros!Countup(R[-20]C:R[-1]C)")	call function to count the 20 rows above
18	work out the entropy of each attribute value	
19	=SELECT(!$B$34:$E$43)	select cells to take entropy table
20	=FORMULA.FILL("=Macros!Entropies(RC,1,20)")	call function to find entropy of each value
21	work out the overall entropy of each attribute	
22	=SELECT(!$B$44:$E$44)	select cells to take attribute entropies
23	=FORMULA.FILL("=Macros!Sumentropies(RC)")	call function to find entropy of each column
24	sort all the attribute columns in order of increasing entropy	
25	=SELECT(!$B$1:$E$44,!$B$44)	select value, example & entropy tables
26	=SORT(2,"R",1)	sort attributes by entropies in bottom row
27	Now that attribute columns are sorted into a classification hierarchy,	
28	sort examples according to their entropies within each column.	
29	Begin by creating a sort key based on the first attribute.	
30	=SELECT(!$G$13:$G$32)	select first sort key column
31	=FORMULA.FILL("=Macros!Classify(RC)")	call function to get corresponding entropies
32	=SELECT(!$B$13:$G$32)	select whole example table and key
33	=SORT(1,"C[5]",1,"C",1)	sort by: 1-key, 2-1st attribute values
34	Initialise remaining sort keys to zero.	
35	=SELECT(!$H$13:$K$32)	select remaining sort keys
36	=FORMULA.FILL("=Macros!Keyfill(RC)")	call function to fill with 0 (*NA if empty)
37	To create sort keys, look at entropy in previous key column - branches of the	
38	decision tree appear as blocks of one entropy value. Find first and last items	
39	in block. If its entropy=0 no more work is required, else classify and sort	
40	that block according to values of current attribute.	
41	=SET.VALUE(A61,2)	set loop to do columns: 2 - no. of attributes
42	=SET.NAME("start",1)	initialise "start" of block to 1
43	=SET.NAME("blockentropy",INDEX(!$G$13:$J$32,start,A61-1))	init. "blockentropy" to entropy in last colum
44	=SET.VALUE(A46,start)	set loop to do rows:"start" - no. of egs.
45	=IF(INDEX(!$G$13:$J$32,A46,A61-1)<>blockentropy,GOTO(A48))	end of block reached? If so, exit loop
46	=A46+1	increment example loop
47	=IF(A46<=!$B$33,GOTO(A45))	do next example
48	=SET.NAME("finish",A46-1)	set end of current block
49	=IF(INDEX(!$G$13:$J$32,start,A61-1)=0,GOTO(A57))	if entropy=0 skip to next block
50	=IF(ISNA(INDEX(!$G$13:$J$32,start,A61-1)),GOTO(A57))	skip blank rows
51	=SELECT(!INDEX(!$B$34:$E$43,0,A61))	select current column in entropy table
52	=FORMULA.FILL("=Macros!Entropies(RC,Macros!start,Macros!finish)")	call function to calculate block entropies
53	=SELECT(INDEX(!$G$13:$J$32,start,A61):INDEX(!$G$13:$J$32,finish,A61))	select block in current key column
54	=FORMULA.FILL("=Macros!Classify(RC)")	call function to get corresponding entropies
55	=SELECT(INDEX(!$B$13:$J$32,start,0):INDEX(!$B$13:$J$32,finish,0))	select block across examples & keys
56	=SORT(1,INDEX(!$G$13:$J$32,0,A61),1,INDEX(!$B$13:$E$32,0,A61),1)	sort by: 1-key, 2-attribute
57	=IF(A46>=!$B$33,GOTO(A61))	last eg. reached? If so, go to next column
58	=SET.NAME("start",finish+1)	set "start" for next block
59	=SET.NAME("blockentropy",INDEX(!$G$13:$J$32,start,A61-1))	set "blockentropy" for next block
60	=GOTO(A44)	go back to example loop
61	=A61+1	increment column loop
62	=IF(A61<attributes+1,GOTO(A42))	do next attribute column
63	All attributes are now classified but some branches of tree still may not be	
64	resolved if conflicting data was present. Check if non-zero entropies remain.	
65	If so, offer user choice to remove them or incorporate them into rule.	
66	=SUM(INDEX(!$G$13:$J$13,attributes):INDEX(!$G$13:$J$32,!$B$33,attributes))	sum of entropies in final attribute key
67	=IF(A66=0,GOTO(A82))	no conflict if sum=0, so skip next section
68	=ALERT("Remove conflicting data?",1)	conflicts present so offer to remove them
69	=IF(A68=FALSE(),GOTO(A82))	leave conflicts, so skip next section
70	Remove conflicting data from example table.	
71	=SET.VALUE(A75,1)	set loop to do example rows: 1 - no. of egs.
72	=IF(INDEX(!$G$13:$J$32,A75,attributes)=0,GOTO(A75))	final entropy=0? If so, skip to next example
73	=SELECT(INDEX(!$B$13:$K$32,A75,0))	select whole example row
74	=FORMULA.FILL("=NA()")	replace with *NA to allow sorting out
75	=A75+1	
76	=IF(A75<=!$B$33,GOTO(A72))	do next example row
77	=SELECT(!$B$33:$F$33)	recount number of examples
78	=FORMULA.FILL("=IF(SIGN(R[-21]C)=1,Macros!Countup(R[-20]C:R[-1]C),0)")	and enter new counts under example table
79	=SELECT(!$B$13:$K$32)	select all examples and keys
80	=SORT(1,"C[5]",1,"C[6]",1,"C[7]",1)	sort by keys to shift down deleted lines
81	Final attributes may not be contributing. Count number of significant attributes.	
82	=SET.VALUE(A84,1)	set loop to do attribute columns: 1 - 4
83	=SUM(INDEX(!$G$13:$J$13,A84):INDEX(!$G$13:$J$32,!$B$33,A84))	add up entropies in that column
84	=A84+1	increment column loop
85	=IF(A83=0,GOTO(A87))	1st all zero col. was reached, so exit loop
86	=IF(A84<5,GOTO(A83))	do next column
87	=SET.NAME("attributes",A84-1)	set new value of "attributes"
88	Rearrange sort order of first attribute according to number of steps needed	
89	to resolve the branch fully. For each block, a ranking key is set up showing	
90	average number of extra attributes needed to resolve it.	
91	=SET.NAME("start",1)	initialise "start" of block to 1
92	=SET.NAME("blockvalue",INDEX(!$B$13:$B$32,start))	init. "blockvalue" to 1st value of 1st attrib.
93	=SET.VALUE(A95,start)	set loop to do examples:"start" - no. of egs.
94	=IF(INDEX(!$B$13:$B$32,A95)<>blockvalue,GOTO(A97))	end of block reached? If so, exit loop
95	=A95+1	increment example loop

PROGRAM FILE

	A	B
96	=IF(A95<=!$B$33,GOTO(A94))	do next example row
97	=SET.NAME("finish",A95-1)	set end of current block
98	=SET.NAME("counter",0)	init. counter for no. of later non-zero steps
99	=SET.VALUE(A104,start)	set loop to do eg. rows:"start" - "finish"
100	=SET.VALUE(A102,1)	set loop to do attribute columns: 1 - 4
101	=IF(INDEX(!$G$13:$J$32,A104,A102)>0,SET.NAME("counter",counter+1))	if entropy>0, increment "counter"
102	=A102+1	increment column loop
103	=IF(A102<5,GOTO(A101))	do next attribute column
104	=A104+1	increment example loop
105	=IF(A104<=finish,GOTO(A100))	do next example row
106	=counter/(1+finish-start)	average no. of steps for all egs. in block
107	=SELECT(INDEX(!$K$13:$K$32,start):INDEX(!$K$13:$K$32,finish))	select block in ranking column
108	=FORMULA("=MacrosRanking()")	call function to enter average
109	=FILL.DOWN()	copy value to other lines in the block
110	=IF(A95>!$B$33,GOTO(A114))	last example reached? if so, go to sort
111	=SET.NAME("start",finish+1)	set "start" for next block
112	=SET.NAME("blockvalue",INDEX(!$B$13:$B$32,start))	set "blockvalue" for next block
113	=GOTO(A94)	go back to example loop
114	=SELECT(!$B$13:$K$32)	select example & key tables
115	=SORT(1,"C11",1,"C2",1)	sort according to ranking
116	For each example, eliminate attributes which are not significant - ie, all	
117	those with zero entropy, beyond the first one.	
118	=SET.VALUE(A126,1)	set loop to do example rows: 1 - no. of egs.
119	=SET.VALUE(A121,4)	set loop to do attrib. columns: 4 - 2
120	=IF(INDEX(!$G$13:$J$32,A126,A121-1)>0,GOTO(A123))	if entropy in previous col.>0, exit col. loop
121	=A121-1	decrement column loop
122	=IF(A121>1,GOTO(A120))	do next column back
123	=IF(A121=4,GOTO(A126))	if only last column was 0, skip to next eg.
124	=SELECT(INDEX(!$B$13:$E$32,A126,A121+1):INDEX(!$B$13:$E$32,A126,4))	select all except first column with 0
125	=CLEAR(3)	clear them
126	=A126+1	increment example loop
127	=IF(A126<=!$B$33,GOTO(A119))	do next example row
128	With some attributes removed, there may be examples left which are now	
129	identical. Remove these duplicates.	
130	For each example, compare all subsequent examples, delete if matching.	
131	=SET.VALUE(A145,1)	set loop to do example rows: 1 - no. of egs.
132	=IF(ISNA(INDEX(!$B$13:$B$32,A145)),GOTO(A146))	skip missing examples
133	=SET.VALUE(A144,A145+1)	set loop to compare subsequent examples
134	=SET.NAME("counter",0)	initialise matching value "counter" to zero
135	=SET.VALUE(A139,1)	set loop to do attribute columns: 1 - 5
136	=INDEX(!$B$13:$F$32,A144,A139)	point to value at reference example
137	=INDEX(!$B$13:$F$32,A146,A139)	point to value at comparison example
138	=IF(A136=A137,SET.NAME("counter",counter+1))	if examples match, increment "counter"
139	=A139+1	increment column loop
140	=IF(A139<6,GOTO(A136))	do next attribute column
141	=IF(counter<5,GOTO(A144))	no match if count<5, so do next comparison
142	=SELECT(INDEX(!$B$13:$K$32,A144,0))	select matching example & keys
143	=FORMULA.FILL("=NA()")	replace with #NA to allow sorting out
144	=A144+1	increment comparison example loop
145	=IF(A144<=!$B$33,GOTO(A134))	do next comparison
146	=A146+1	increment reference example loop
147	=IF(A146<!$B$33,GOTO(A132))	do next reference example
148	=SELECT(!$B$13:$K$32)	select all examples & keys
149	=SORT(1,"C11",1,"C2",1)	sort out deleted lines
150	=SELECT(!$B$33:$F$33)	recount number of examples
151	=FORMULA.FILL("=IF(SIGN(R[-21]C)=1,MacrosCountup(R[-20]C:R[-1]C),0)")	and enter new counts under example table
152	For each branch of the tree (block of example table), remove duplication of	
153	values so that only first entry is left.	
154	=SET.NAME("start",1)	initialise "start" of block to 1
155	=SET.NAME("blockvalue",INDEX(!$B$13:$B$32,start))	init. "blockvalue" to 1st value of 1st attrib.
156	=SET.VALUE(A158,start)	set loop to do examples:"start" - no. of egs.
157	=IF(INDEX(!$B$13:$B$32,A158)<>blockvalue,GOTO(A160))	end of block reached? if so, exit loop
158	=A158+1	increment example loop
159	=IF(A158<=!$B$33,GOTO(A157))	do next example row
160	=SET.NAME("finish",A158-1)	set end of current block
161	=SELECT(INDEX(!$B$13:$E$32,start,0):INDEX(!$B$13:$E$32,finish,0))	select block in example table
162	=IF(start=finish,GOTO(A174))	if block only one line, skip to next block
163	=SET.VALUE(A172,1)	set loop to do attribute columns: 1 - 4
164	=SET.VALUE(A170,finish)	set loop to do eg. rows:"finish" - "start"+1
165	=INDEX(!$B$13:$E$32,A170,A172)	point to value in current row & column
166	=INDEX(!$B$13:$E$32,A170-1,A172)	point to cell in row above
167	=IF(A165<>A166,GOTO(A170))	if equal delete lower, else skip on
168	=SELECT(INDEX(!$B$13:$E$32,A170,A172))	select lower cell ...
169	=CLEAR(3)	clear it
170	=A170-1	decrement example loop
171	=IF(A170>start,GOTO(A165))	do next example row back
172	=A172+1	increment column loop
173	=IF(A172<5,GOTO(A164))	do next attribute column
174	=IF(A158>20,GOTO(A179))	last eg. reached? if so, go to next section
175	=SET.NAME("start",finish+1)	set "start" for next block
176	=SET.NAME("blockvalue",INDEX(!$B$13:$B$32,start))	set "blockvalue" for next block
177	=GOTO(A156)	go back to example loop
178	Provide headings for the completed rule.	
179	=SELECT(!$B$50)	select empty cell
180	=STYLE(TRUE,FALSE)	set style to Bold
181	=FORMULA("If:")	enter text "If:"
182	=SELECT(!$F$50)	select cell four columns along
183	=STYLE(TRUE,FALSE)	set style to Bold
184	=FORMULA("then:")	enter text "then:"
185	=SET.VALUE(A191,1)	set loop to do attrib. names:1 - "attributes"
186	=INDEX(!$B$1:$E$1,A191)	point to name at top of value table
187	=SET.NAME("heading",A186&"=")	set "heading" to that name with "=" at end
188	=SELECT(INDEX(!$B$51:$E$51,A191))	select corresponding column in rule area
189	=STYLE(TRUE,FALSE)	set style to Bold
190	=FORMULA(Macrosheading)	call function to enter "heading"
191	=A191+1	increment column loop
192	=IF(A191<=attributes,GOTO(A186))	do next attribute column
193	=SET.NAME("heading",!$F$1&"=")	set "heading" to outcome name with "="
194	=SELECT(!$F$51)	select corresponding column in rule area
195	=STYLE(TRUE,FALSE)	set style to Bold
196	=FORMULA(Macrosheading)	call function to enter "heading"
197	Transfer remaining example table entries to give text of rule.	
198	=SELECT(INDEX(!$B$13:$F$32,1,0):INDEX(!$B$13:$F$32,!$B$33,0))	select remaining examples
199	=COPY()	copy them
200	=SELECT(OFFSET(SELECTION(),39,0))	select equal sized area below rule headings
201	=PASTE()	paste rule in
202	=BORDER(TRUE,FALSE,FALSE,FALSE,FALSE)	draw border around rule
203	=RETURN()	
204		
205	End of main program.	
206	Function macros follow.	

PROGRAM FILE

	A	B
207	**Countup**	
208	Counts number of items in the column range specified.	
209	=ARGUMENT("range",8)	argument is a range of cells in one column
210	=ROWS(range)	number of rows in range
211	=SET.NAME("counter",0)	initialise "counter" to zero
212	=SET.VALUE(A215,1)	set loop to do rows: 1 - length of range
213	=IF(ISNA(INDEX(range,A215)),GOTO(A215))	skip empty cells
214	=SET.NAME("counter",counter+1)	increment count
215	=A215+1	increment loop
216	=IF(A215<=A210,GOTO(A213))	do next row
217	=RETURN(counter)	return value of count
218	**Entropies**	
219	Calculates entropies for each attribute value between "first" and "last".	
220	=ARGUMENT("cell",8)	1st argument is reference to calling cell
221	=ARGUMENT("first",1)	2nd argument - begin with this example
222	=ARGUMENT("last",1)	3rd argument - finish with this example
223	=SET.NAME("entropy",0)	initialise variable for summing entropy
224	=IF(OFFSET(cell,12-ROW(cell),0)=0,RETURN(NA()))	skip empty columns
225	=OFFSET(cell,-32,0)	point to attribute value
226	=IF(ISNA(A225),RETURN(NA()))	skip blank attribute values
227	=SET.VALUE(A244,1)	set loop to do outcome values: 1 - 10
228	=INDEX(!$F$2:$F$11,A244)	point to reference outcome value
229	=IF(ISNA(A228),GOTO(A244))	skip blank outcome values
230	=SET.NAME("occurence",0)	init. counter for matching outcomes to 0
231	=SET.NAME("totalnumber",0)	init. counter for matching attr. values to 0
232	=SET.VALUE(A238,first)	set loop to do example rows:"first" - "last"
233	=INDEX(!$B$13:$E$32,A238,COLUMN(cell)-1)	point to example attribute value
234	=IF(ISNA(A233),GOTO(A238))	skip blank examples
235	=INDEX(!$F$13:$F$32,A238)	point to example outcome
236	=IF(A233=A225,SET.NAME("totalnumber",totalnumber+1),GOTO(A238))	if attrib. matches, increment "totalnumber"
237	=IF(A235=A228,SET.NAME("occurence",occurence+1))	if outcome matches, increment "occurence"
238	=A238+1	increment example loop
239	=IF(A238<=last,GOTO(A233))	do next example
240	=occurence/totalnumber	probability
241	=(A240)*LOG10(A240)/LOG10(2)	sub-entropy
242	=IF(ISERROR(A241),SET.VALUE(A241,0))	fix (/0)error caused by probability=0
243	=SET.NAME("entropy",entropy-A241)	add to total entropy for this value
244	=A244+1	increment outcome loop
245	=IF(A244<11,GOTO(A228))	do next value of outcome
246	=RETURN(entropy)	return value of entropy
247	**Sameatropies**	
248	Combines entropies for each value of an attribute to give an overall entropy	
249	that can be used to sort attributes into classification order.	
250	=ARGUMENT("cell",8)	reference to calling cell
251	=SET.NAME("columnentropy",0)	set entropy accumulator to zero
252	=IF(OFFSET(cell,-32,0)=0,RETURN(NA()))	if no attribute present, return #NA
253	=SET.VALUE(A264,1)	set loop to do attribute values: 1 - 10
254	=INDEX(!$B$2:$E$11,A264,COLUMN(cell)-1)	point to attribute value
255	=IF(ISNA(A254),GOTO(A264))	skip blank values
256	=SET.VALUE(A260,1)	set loop to do examples: 1 - no. of egs.
257	=SET.NAME("counter",0)	initialise "counter" to zero
258	=INDEX(!$B$13:$E$32,A260,COLUMN(cell)-1)	point to example
259	=IF(A258=A254,SET.NAME("counter",counter+1))	if example matches value, increment count
260	=A260+1	increment example loop
261	=IF(A260<=!$B$33,GOTO(A256))	do next example
262	=(counter/OFFSET(cell,-11,0)*OFFSET(cell,A264-11,0))	sub-entropy
263	=SET.NAME("columnentropy",columnentropy+A262)	add to columnentropy
264	=A264+1	increment attribute value
265	=IF(A264<=INDEX(!$B$12:$E$12,COLUMN(cell)-1),GOTO(A254))	do next attribute value
266	=RETURN(columnentropy)	return columnentropy
267	**Classify**	
268	Creates sort keys by returning entropy corresponding to current attribute value.	
269	=ARGUMENT("cell",8)	reference to calling cell
270	=OFFSET(cell,0,-5)	point to example
271	=MATCH(A270,INDEX(!$B$2:$E$11,0,COLUMN(cell)-6),0)	index of corresponding value
272	=INDEX(!$B$34:$E$43,A271,COLUMN(cell)-6)	gives its entropy
273	=RETURN(A272)	return the entropy
274	**Keyfill**	
275	Fills remaining sort keys by returning zero if example present, #NA if not.	
276	=ARGUMENT("cell",8)	reference to calling cell
277	=IF(ROW(cell)<!$B$33+13,RETURN(0),RETURN(NA()))	if eg. present, return 0, if not return #NA
278	**Ranking**	
279	Creates key by returning ranking average if example present, #NA if not.	
280	=IF(ISNA(blockvalue),RETURN(NA()),RETURN(A106))	if eg. present, return rank else return #NA

Amstrad CPC Screen Saver

by Dave Instone Brewer

This is a very useful utility to preserve the life of your monitor. The program should extend the useful lifespan of your computer by turning off the screen when you aren't using it but without clearing the memory. One press of the keyboard and you are back at the same point in the program where you left off.

All the time your screen is in use it is ageing, and if you constantly have the same image on it for hours on end, a 'ghost' of that image is burned into the screen. Your computer also ages every time you turn off and on again, because temperature changes are one of the few things which can damage integrated circuits. So, you shorten the lifetime of your computer by leaving it on and turning it off.

This short machine code routine solves the dilemma in the same way that some expensive business machines do, by turning off the screen when you are not using the computer. It allows you to leave the computer on and it automatically turns the screen off after about a minute if you haven't used the keyboard during that time. When you do want to go back to the program, pressing any key will restore the screen and restart the program

PROGRAM FILE

where it stopped.

This routine can lie in the background of most utilities and games, without you or the program being aware that it is there (until you stop using the computer, of course).

Type in the Basic loader and run it. If you have typed in the DATA lines correctly it will automatically save the program CLS-WAIT.BIN, and call the start address to switch on the delayed screen-off function. If you now wait for about a minute without touching the keyboard, your screen will go blank. Pressing any key will restore it.

To load this function into the computer in future, all you need do is LOAD "CLS-WAIT.BIN" and CALL &9900. If you want to stop the screen-off function you can CALL &9917, and then to restart it later, CALL &9900. The amount of delay can be varied by POKEing a new value into &9910 (for the first delay) and &9913 (for subsequent delays).

Don't discard the Basic loader because you can use this to relocate the machine code to a new address which may be more suited to the program you want it to run with. You can change it to any address divisible by &100 (such as &A600 or &BF00) without recourse to a disassembler/assembler. You just need to change the value of 'm' in line 30 to the first two numbers of the new address in hex (such as &A6 or &BF for the above examples), and substitute every occurrence of '99' in the DATA lines with these numbers (that is, 'A6' or 'BF' not '&AF' or '&BF').

A good address to choose to hide the routine in is &BF00. The area from &BF00 to about &BF80 is not used by any commercial program that I know of, and is even preserved when you restart the computer with CTRL-SHIFT-ESC. This is actually the bottom end of area reserved for the stack, which starts at &C000 and moves downwards as far as is needed, but it very rarely moves down further than &BF70.

The program works by setting up an interrupt routine which periodically checks to see that the computer is still being used. If it isn't, then it turns the screen off and waits for a keypress.

To find out if the computer is still being used, the routine looks to see if the contents of the keyboard buffer have changed. Rather than check the whole buffer, it looks at the contents of the second byte of the final buffer entry, the buffer free space and the input pointer. These are held at &B53B-3D in the CPC464 and at &B685-87 in the CPC 664/6128. If they are different from the last time they were checked, the new values are noted and the interrupt ends. If the values have not changed, the screen is turned off until the next keypress.

The screen is switched off by changing the values in the registers of the chip which controls the cathode ray tube (the 6845). Register 6 determines how many lines are displayed (usually 25) so changing this to zero effectively turns the screen off. Unfortunately the design of the screen memory means that some of the very top row of pixels are still displayed. To get rid of these the screen is moved up, by means of Register 7, until the top row is off the edge of the visible area of the tube. Restoring the default values of these registers restores the screen.

When you have installed this program in the background of your favourite games and utilities, remember to tell your family. If someone comes to do the hoovering and doesn't notice the faint glow from the dead screen or the red LED on the keyboard, they may unplug the computer in order to plug in the vacuum cleaner!

```
10 'CLS-WAIT
20 '(C) D.Ironton Brewer, 1987
30 m=&99
40 MEMORY (m*&100)-1:lin=200
50 FOR x=m*&100 TO (m*&100)+58 STEP 8
60 READ l$:sum=0
70 FOR n=0 TO 7
80 a$=MID$(l$,1+n*2,2):a=VAL("&"+a$)
90 POKE x+n,a:sum=sum+a
100 NEXT n
110 IF sum<>VAL("&"+RIGHT$(l$,3)) THEN PRINT"Data error in line";lin:END
120 lin=lin+10
130 NEXT x
140 PRINT"Is this a CPC464? (Y/N) "
150 r$=UPPER$(INKEY$):IF r$="" THEN 150
160 IF r$="Y" THEN add=(m*&100)+&21:POKE add,&3B:POKE add+1,&B5
170 PRINT"Saving CLS-WAIT.BIN"
180 SAVE"!CLS-WAIT",B,m*&100,&67
```

PROGRAM FILE

```
190 CALL a*&100
200 DATA 21659906B1111D9926D
210 DATA CDEFBC215F991100 3A2
220 DATA 03010006C3E9BC21293
230 DATA 5F99C3ECBC215C99479
240 DATA 1185B606031ABE2024D
250 DATA 2C132310FB2BE51B295
260 DATA D5110023CD4099D1380
270 DATA E11ABE28FC11191E325
280 DATA 0107BCED4906BD4A307
290 DATA ED490106BCED4906335
300 DATA BD4BED49C91A7713 3AB
310 DATA 2310FAC99C000000292
```

Amstrad PCW Mailout

by Nick Phillips

The task that Locoscript cannot handle, but which most people would like it to, is that of printing personalised letters by merging a letter file with a list of names and addresses. Mailout overcomes this deficiency. It is an easy-to-use database for storing names and addresses, and it will merge these with an ASCII letter file produced using Locoscript (or another word processor); it will also print the names and addresses onto address labels.

In addition, Mailout is an excellent model database which is easy to modify for a wide variety of tasks by anyone familiar with Basic (guidelines for this are given later). It is clearly and concisely written, and is a useful vehicle for learning to use keyed files (which are not explained at all clearly in the Amstrad manual).

Using Mailout

No instructions are included in the program because it is so simple to use and the menus are largely self-explanatory.

● **Creating a new file**

When this option is selected, the program automatically creates two files, FILENAME.FIL and FILENAME.IND; the first for the address list itself, and the second for the index. *Always keep up-to-date copies of both files.*

Each record has nine fields, to hold the name, address and telephone number. Each record is indexed by name, the index entry (or 'key') being of the form NAME FORENAME; hence the records are displayed in alphabetical order by name.

● **Editing a file**

The left and right cursor keys can be used to scan backwards and forwards through the file. In addition, records can be selected by name (press 'N' and enter the name to be searched for); if a matching record is not found, then the next one in the file will be given.

Press 'A' to add records to the file. The program will stay in the Add New Records mode until you attempt to save a record in which both name and forename are blank.

When editing an individual record, the keyboard (especially the character, cursor, Delete and Return keys) behave as one would expect them to.

● **Deleting records**

Press 'D' to mark a record as deleted: it will not be erased and will still be displayed, but it will not be printed out. To recover it, press 'U' (for undelete).

To erase a record completely from the file, edit it, delete the name and forename, then try to save it again. (Records cannot be saved, and will be erased, if both name and forename are blank.)

● **Printing mailing lists**

Address labels: the printer is automatically set for continuous stationery, and assumes the labels to be spaced at intervals of 1½in (this is a standard size).

Letters: the letters should be written using Locoscript, then saved as 'Page Image' ASCII files (f7=Modes in the Disk Management mode). The Page Image option means that spaces, return codes and line-feed codes are automatically inserted into the ASCII file to mimic the layout of the original document. The following layout is recommended:

Left-hand margin 0
Right-hand margin 64 (for A4 paper, printing 10cpi)
Header zone 0

When printing letters the program asks for the date, which is inserted at the top of the letter.

PROGRAM FILE

How Mailout works

Mailout uses Mallard Basic's keyed file (Jetsam) facility to produce mailing lists which are listed in alphabetical order and in which records can be selected by name.

Each record is 196 characters long (plus two characters which are used by Jetsam); these are edited as 10 fields (field$(1) to field$(10) — 1–9 hold the name, address, telephone number and greeting; and 10 marks whether or not the record is 'deleted').

Each record has a key stored in the index, which is of the form UPPER$(field/(1)+" "+field$(2)).

When keyed files are edited, the computer automatically updates the index file to keep pace with the data file. However, the changes are not saved to disk immediately; and the two files are only finally brought up to date, and made consistent with each other, when the keyed file is closed using a specific CLOSE command. If the files are left open or are closed incorrectly, then they become unreadable. To avoid this situation the Stop key is disabled in Mailout. The program also incorporates an error-trapping routine which will close the files correctly if an error halts the program.

Modifying Mailout

Mailout is carefully written in structured Basic, so that it is easy both to understand and to modify for other, more specialised tasks.

As an aid to modifying the program for other uses, the most important lines that are likely to have to be changed are listed in Fig 1.

Size of record, number of fields	Print positions of items onscreen	Layout of printed list
530	510	2410–3620
590	520	Especially:
600	1000	2670–2910
970	1260	3260
990	1360	3360–3620
1530	1920	
1550	1980	
2110	2220	
2160	3150	
2210	3830	
3210	3860	
4000	4210	
4050	4240	
4090		

Fig 1 Line numbers likely to need changing

```
1 REM WHEN TYPING IN MAILOUT, ALWAYS SAVE THE PROGRAM BEFORE RUNNING IT!
10 REM  *** MAILOUT ***
20 REM Copyright N.R. Phillips
30 REM Mallard BASIC for the Amstrad PCW 8256/8512
40 :
50 REM to protect files, program must not halt with files open
60 ON ERROR GOTO 4280: REM error trapping routine
70 OPTION RUN: REM disables STOP key
80 :
90 GOSUB 3900: REM initialization
100 PRINT nocursor$: REM disable cursor
110 WHILE NOT answer=3
120   exit%=no%
130   GOSUB 220: REM print menu
140   match$="123": prompt$="*** Choose option 1-3 ***": GOSUB 3640
150   IF answer=3 THEN GOTO 180
160   ON answer GOSUB 340,340: REM create or open mailing list file
170   IF NOT exit% THEN GOSUB 630: REM edit or print mailing list
180 WEND
190 PRINT cursor$: REM enable cursor
200 END
210 :
220 REM  *** PRINT MENU ***
230 PRINT cls$
240 RESTORE 240
250 DATA "Copyright 1986 N.R. Phillips"
260 DATA "(1) CREATE a new mailing list"
270 DATA "(2) EDIT or PRINT an existing mailing list"
280 DATA "(3) EXIT from program"
290 DATA "NB/. To EXIT from program, first return to this MENU",""
300 title$="********** MAILOUT mailing-list program **********"
310 GOSUB 3750: REM print instructions
320 RETURN
330 :
340 REM  *** CREATE AND/OR OPEN MAILING LIST FILE ***
350 GOSUB 390: IF exit% THEN GOTO 370: REM get filenames (file, index)
360 GOSUB 500: IF exit% THEN GOTO 370: REM create/open keyed files
370 RETURN
380 :
390 REM  *** get filenames for file & index ***
400 RESTORE 400
410 DATA "","(Just press RETURN to exit to menu)","","",""
420 IF answer=1 THEN title$="CREATE NEW MAILING LIST" ELSE title$="EDIT OR PRINT
 EXISTING MAILING LIST"
430 GOSUB 3750: REM print instructions
440 message$="Enter FILENAME for mailing list....": GOSUB 3820: file$=UPPER$(get
$): REM input get$
```

PROGRAM FILE

```
450 IF file$="" THEN exit%=yes%: GOTO 480
460 index$=LEFT$(file$,8)+".IND"
470 file$=LEFT$(file$,8)+".FIL"
480 RETURN
490 :
500 REM  *** create/open files ***
510 PRINT FNcentre$("Filenames... "+file$+", "+index$)
520 PRINT: PRINT FNcentre$("Please wait....")
530 IF answer=1 THEN CREATE 1,file$,index$,2,198 ELSE OPEN "K",1,file$,index$,2
540 IF exit% THEN GOTO 560
550 GOSUB 580: REM define record layouts
560 RETURN
570 :
580 REM  *** define record layouts ***
590 FIELD 1, 15 AS field$(1), 15 AS field$(2), 25 AS field$(3), 25 AS field$(4),
 25 AS field$(5), 25 AS field$(6), 25 AS field$(7),
25 AS field$(8), 15 AS field$(9), 1 AS field$(10)
600 FIELD 1, 196 AS delete$
610 RETURN
620 :
630 REM  *** EDIT OR PRINT MAILING LIST ***
640 PRINT cls$: GOSUB 790: GOSUB 900: REM draw menu & set up first record
650 WHILE NOT exit%
660   GOSUB 2060: REM print current record
670   IF empty% THEN GOSUB 740: GOTO 710: REM restricted menu when file empty
680   prompt$="*** Choose (A)(C)(E)(N)(D)(U)(M)(P) or cursor key ***"
690   match$="ACEN"+CHR$(1)+CHR$(6)+"DUMP": GOSUB 3640: REM get key
700   ON answer GOSUB 1040,1040,1040,1720,2010,2010,2140,2140,2380,2410
710 WEND
720 CLOSE 1: RETURN
730 :
740 REM  *** restricted menu when file empty ***
750 prompt$="*** Choose (A) or (M) ***": match$="AM": GOSUB 3640: REM get key
760 ON answer GOSUB 1040,2380
770 RETURN
780 :
790 REM  *** draw menu ***
800 RESTORE 800
810 DATA "ADD record ++ COPY record ++ EDIT record"
820 DATA "select record by NAME"
830 DATA "++ use cursor keys to scan backwards or forwards ++"
840 DATA "DELETE record ++ UNDELETE record"
850 DATA "return to MENU ++ PRINT mailing list"
860 title$="EDIT MAILING LIST: "+file$
870 GOSUB 3750: REM print instructions
880 RETURN
890 :
900 REM  *** set up first record ***
910 GOSUB 950: REM draw skeleton card
920 GOSUB 1890: REM read first record
930 RETURN
940 :
950 REM  *** draw skeleton record ***
960 RESTORE 960
970 DATA "NAME","Forename","Address","","","","","Phone no","Greeting"
980 PRINT FNscreen$(18,27,line$) FNscreen$(29,27,line$)
990 FOR n=1 TO 9
1000   READ label$: PRINT FNscreen$(19+n,35-LEN(label$),label$+":")
1010 NEXT
1020 RETURN
1030 :
1040 REM  *** add/copy/edit record ***
1050 GOSUB 1110: REM print edit instructions
1060 ON answer GOSUB 1240,1340,1340: REM add, copy, edit
1070 exit%=no%: copy%=no%
1080 GOSUB 790: REM draw menu
1090 RETURN
1100 :
1110 REM  *** print edit instructions ***
1120 RESTORE 1120
1130 DATA "Edit record using:-"
1140 DATA "Normal character keys ++ Cursor keys ++ Return key ++ Delete keys"
1150 DATA "Press EXIT to save record"
1160 DATA ""
1170 DATA "If both NAME and Forename are blank, record will be erased"
1180 IF answer$="A" THEN title$="ADD NEW RECORDS TO: "+file$
1190 IF answer$="E" THEN title$="EDIT DISPLAYED RECORD"
1200 IF answer$="C" THEN copy%=yes%: title$="COPY DISPLAYED RECORD"
1210 GOSUB 3750: REM print instructions
1220 RETURN
1230 :
1240 REM  *** add records ***
1250 add%=yes%
1260 PRINT FNscreen$(17,0,clear$)
1270 WHILE NOT exit%
1280   GOSUB 2060: REM print current record
1290   GOSUB 1340: REM edit record
1300 WEND
1310 add%=no%
1320 RETURN
1330 :
1340 REM  *** edit record ***
1350 IF add% THEN prompt$="and program will quit 'ADD NEW RECORDS' mode" ELSE pr
ompt$=""
1360 PRINT FNscreen$(14,0,FNcentre$(prompt$))
1370 line%=1: letter%=1: key$=INKEY$
1380 PRINT cursor$: GOSUB 1430: PRINT nocursor$: REM use keys to edit record
1390 GOSUB 2250: REM write record to file
1400 IF exit% THEN GOSUB 1890: REM read first record in file
1410 RETURN
1420 :
1430 REM use keys to edit record
1440 edit$=CHR$(30)+CHR$(13)+CHR$(31)+CHR$(6)+CHR$(1)+CHR$(7)+CHR$(127)
1450 WHILE NOT key$=esc$
1460 PRINT FNline$ FNcursor$;: REM print field & cursor
1470 GOSUB 3700: REM read inkey$
1480 IF ASC(key$)>31 AND ASC(key$)<127 THEN GOSUB 1620: GOTO 1500: REM enter let
ter into field
1490 ON INSTR(edit$,key$) GOSUB 1530,1530,1550,1570,1590,1670,1670
1500 WEND: RETURN
1510 :
1520 REM  *** cursor keys and RETURN key ***
1530 letter%=1: line%=line%+1: IF line%>9 THEN line%=1
1540 RETURN
1550 letter%=1: line%=line%-1: IF line%<1 THEN line%=9
1560 RETURN
1570 IF letter%(length%(line%) THEN letter%=letter%+1
1580 RETURN
1590 IF letter%>1 THEN letter%=letter%-1: RETURN
```

PROGRAM FILE

```
1600 RETURN
1610 :
1620 REM  *** enter letter into field ***
1630 LSET field$(line%)=LEFT$(field$(line%),letter%-1)+key$+MID$(field$(line%),l
etter%)
1640 letter%=letter%+1: IF letter%>length%(line%) THEN letter%=length%(line%)
1650 RETURN
1660 :
1670 REM  *** delete keys ***
1680 IF key$=CHR$(7) THEN LSET field$(line%)=LEFT$(field$(line%),letter%-1)+MID$
(field$(line%),letter%+1)
1690 IF key$=CHR$(127) AND letter%>1 THEN LSET field$(line%)=LEFT$(field$(line%)
,letter%-2)+MID$(field$(line%),letter%): letter%=let
ter%-1
1700 RETURN
1710 :
1720 REM  *** select record by name ***
1730 message$="Enter NAME to search for....": GOSUB 3820: record$=get$: REM inpu
t get$
1740 IF record$="" THEN GOTO 1780
1750 record$=UPPER$(LEFT$(record$,30))
1760 result=SEEKKEY(1,0,0,record$)
1770 IF result=103 THEN GOSUB 1800: REM record is off end of index - move to end
 of file
1780 RETURN
1790 :
1800 REM  *** move to end of file ***
1810 result=SEEKREC(1,0,0,old.key$,old.record%): REM restore original record
1820 WHILE result<102
1830   old.key$=FETCHKEY$(1): old.record%=FETCHREC(1)
1840   result=SEEKNEXT(1,0): REM move through file
1850 WEND
1860 result=SEEKREC(1,0,0,old.key$,old.record%): REM restore last record in file
1870 RETURN
1880 :
1890 REM  *** read first record in file ***
1900 empty%=no%
1910 result=SEEKRANK(1,0,0)
1920 IF result=0 THEN PRINT FNscreen$(17,0,clear$) ELSE GOSUB 1950: REM file emp
ty
1930 RETURN
1940 :
1950 REM  *** file empty ***
1960 empty%=yes%
1970 message$=inversevideo$+SPACE$(7)+"**** FILE EMPTY ****"+SPACE$(8)+truevideo
$
1980 PRINT bell$ FNscreen$(17,27,message$)
1990 RETURN
2000 :
2010 REM  *** read next/previous record ***
2020 IF key$=CHR$(6) THEN result=SEEKNEXT(1,0) ELSE result=SEEKPREV(1,0)
2030 IF result)102 THEN result=SEEKREC(1,0,0,old.key$,old.record%): REM end/begi
nning of file
2040 RETURN
2050 :
2060 REM  *** print current record ***
2070 IF add% OR empty% THEN LSET delete$="": GOTO 2100: REM blank record
2080 GET 1
2090 old.record%=FETCHREC(1): old.key$=FETCHKEY$(1)
2100 GOSUB 2200: REM print deleted message
2110 FOR line%=1 TO 9: PRINT FNline$: NEXT
2120 RETURN
2130 :
2140 REM  *** delete/undelete ***
2150 GET 1
2160 LSET field$(10)=answer$
2170 GOSUB 2200: GOSUB 2250: REM print deleted message and write record to file
2180 RETURN
2190 :
2200 REM  *** print deleted message ***
2210 IF field$(10)="D" THEN message$=inversevideo$+SPACE$(5)+"**** DELETED RECOR
D ****"+SPACE$(6)+truevideo$ ELSE message$=clear$
2220 PRINT FNscreen$(19,27,message$)
2230 RETURN
2240 :
2250 REM  *** write record to file ***
2260 IF NOT add% AND NOT copy% THEN result=DELKEY(1,0,0,old.key$,old.record%): R
EM delete old record
2270 new.key$=UPPER$(field$(1)): GOSUB 2330
2280 new.key$=new.key$+" "+UPPER$(field$(2)): GOSUB 2330
2290 IF new.key$="" THEN exit%=yes%: GOTO 2310: REM do not add blank records
2300 result=ADDREC(1,2,0,new.key$)
2310 RETURN
2320 :
2330 REM  *** remove superfluous spaces from key ***
2340 WHILE RIGHT$(new.key$,1)=" "
2350   new.key$=LEFT$(new.key$,LEN(new.key$)-1)
2360 WEND: RETURN
2370 :
2380 REM  *** return to menu ***
2390 exit%=yes%: RETURN
2400 :
2410 REM  *** PRINT MAILING LIST ***
2420 GOSUB 2490: IF exit% THEN GOTO 2450: REM choose labels,letters or list
2430 GOSUB 2920: IF exit% THEN GOTO 2450: REM select record to start printing fr
om
2440 GOSUB 3110: REM print list
2450 exit%=no%
2460 GOSUB 790: GOSUB 900: REM print menu & set up first record
2470 RETURN
2480 :
2490 REM  *** choose labels, letters, list ***
2500 PRINT cls$
2510 RESTORE 2510
2520 DATA "Do you want to print :-"
2530 DATA "(1) ADDRESS LABELS"
2540 DATA "(2) LETTERS"
2550 DATA "(3) REFERENCE LIST"
2560 DATA "EXIT"
2570 title$="PRINTING MAILING LIST: "+file$
2580 GOSUB 3750: REM print instructions
2590 prompt$="*** Choose 1,2,3 or EXIT ***": match$="123"+esc$: GOSUB 3640: REM
get key
2600 print%=answer
2610 IF print%=4 THEN exit%=yes%: GOTO 2650
2620 IF print%=1 THEN choice$="LABELS": GOSUB 2670: REM set printer for labels
2630 IF print%=2 THEN choice$="LETTERS": GOSUB 2730: REM get letter details
2640 IF print%=3 THEN choice$="REFERENCE LIST"
2650 RETURN
```

PROGRAM FILE

```
2660 :
2670 REM  *** set printer for labels ***
2680 LPRINT esc$;"C";: REM continuous paper
2690 LPRINT esc$;"C";CHR$(9);: REM page length 9, gap length 0
2700 LPRINT esc$;"9": REM paper end detection
2710 RETURN
2720 :
2730 REM  *** get letter details ***
2740 RESTORE 2740
2750 DATA "","(Just press RETURN to exit)","","",""
2760 GOSUB 3750: REM instructions
2770 message$="Enter FILENAME of letter....": GOSUB 3820: letter$=get$: REM inpu
t get$
2780 IF letter$="" THEN exit%=yes%: GOTO 2830
2790 OPEN "I",2,letter$: IF exit% THEN GOTO 2830
2800 GOSUB 2850: REM read letter file
2810 message$="Enter DATE to be printed at head of letter....": GOSUB 3820: date
$=get$: REM input get$
2820 IF date$="" THEN exit%=yes%: GOTO 2830
2830 RETURN
2840 :
2850 REM  *** read letter file ***
2860 text%=0
2870 WHILE NOT EOF(2)
2880   text%=text%+1: LINE INPUT £2, text$(text%)
2890 WEND: CLOSE 2
2900 RETURN
2910 :
2920 REM  *** select record to start printing from ***
2930 match$="NY"+ret$: prompt$="Do you want to start printing from the first rec
ord in the list (Y/N) ?": GOSUB 3640
2940 PRINT cls$: GOSUB 900: REM set up first record
2950 IF answer=3 THEN exit%=yes%
2960 ON answer GOTO 2980,3090,3090
2970 :
2980 RESTORE 2980
2990 DATA "","Select record from which to start printing :-"
3000 DATA "N=select record by NAME, or cursor keys to scan through file"
3010 DATA "P=start PRINTING from current record : EXIT to exit",""
3020 GOSUB 3750: REM print instructions
3030 WHILE answer<4
3040   GOSUB 2060: REM print current record
3050   prompt$="*** Press P to start printing ***": match$="N"+CHR$(1)+CHR$(6)+"
P"+esc$: GOSUB 3640
3060   ON answer GOSUB 1720,2010,2010
3070 WEND
3080 IF answer=5 THEN exit%=yes%
3090 RETURN
3100 :
3110 REM  *** print mailing list ***
3120 RESTORE 3120
3130 DATA "","Press EXIT to quit printing","","",""
3140 GOSUB 3750: REM print instructions
3150 PRINT FNscreen$(14,0,clear$)
3160 :
3170 i$=INKEY$
3180 WHILE NOT i$=esc$
3190   i$=INKEY$: IF i$=esc$ THEN GOTO 3250
3200   GOSUB 2060: REM print current record
3210   IF field$(10)="D" THEN GOTO 3240: REM ignore deleted record
3220   FOR n=1 TO 2: GOSUB 3290: NEXT: REM remove superfluous spaces from names
3230   ON print% GOSUB 3360,3450,3550: REM print label, letter, reference list
3240   result=SEEKNEXT(1,0): IF result>101 THEN i$=esc$: GOTO 3250: REM end of f
ile
3250 WEND
3260 IF choice$="LABELS" THEN LPRINT esc$;"@": REM reset printer to default stat
e
3270 RETURN
3280 :
3290 REM  *** remove superfluous spaces from names ***
3300 name$(n)=field$(n)
3310 WHILE RIGHT$(name$(n),1)=" "
3320   name$(n)=LEFT$(name$(n),LEN(name$(n))-1)
3330 WEND
3340 RETURN
3350 :
3360 REM  *** print label/address ***
3370 LPRINT name$(2) " " name$(1)
3380 blank%=4
3390 FOR n=3 TO 7
3400   LPRINT field$(n): IF field$(n)=STRING$(25," ") THEN blank%=blank%-1
3410 NEXT
3420 IF print%=1 THEN LPRINT: LPRINT: LPRINT: REM wind to next label
3430 RETURN
3440 :
3450 REM  *** print letter ***
3460 LPRINT "PERSONAL COMPUTER WORLD, 32-34 BROADWICK STREET, LONDON  W1A 2HG"
3470 LPRINT: LPRINT date$: LPRINT
3480 GOSUB 3360: REM print address
3490 FOR n=1 TO blank%: LPRINT: NEXT
3500 greeting$=field$(9): IF greeting$=SPACE$(15) THEN greeting$=name$(2)+" "+na
me$(1)
3510 LPRINT "Dear " greeting$: LPRINT
3520 FOR n=1 TO text%: LPRINT text$(n): NEXT
3530 RETURN
3540 :
3550 REM  *** print reference list ***
3560 LPRINT UPPER$(name$(1)) ", " name$(2) TAB(27) field$(8);
3570 item%=0: FOR n=3 TO 7
3580   IF item%=0 AND field$(n)<>SPACE$(25) THEN LPRINT
3590   IF NOT field$(n)=SPACE$(25) THEN LPRINT field$(n) " ";: item%=item%+1: IF
 item%=3 THEN LPRINT
3600 NEXT: LPRINT: IF NOT item%=3 THEN LPRINT
3610 RETURN
3620 :
3630 REM  *** GENERAL SUB-ROUTINES ***
3640 REM  *** get key ***
3650 PRINT FNscreen$(14,0,FNcentre$(prompt$))
3660 GOSUB 3700: answer$=UPPER$(key$): REM read inkey$
3670 answer=INSTR(match$,answer$): IF answer=0 THEN GOTO 3660
3680 RETURN
3690 :
3700 REM  *** read inkey$ ***
3710 key$=INKEY$
3720 WHILE key$="": key$=INKEY$: WEND
3730 RETURN
3740 :
3750 REM  *** print instructions ***
3760 PRINT home$ FNcentre$(title$): PRINT
```

PROGRAM FILE

```
3770 FOR n=1 TO 5
3780   READ instruction$: PRINT FNcentre$(instruction$): PRINT
3790 NEXT
3800 RETURN
3810 :
3820 REM  *** input get$ ***
3830 PRINT FNscreen$(14,0,FNcentre$(message$))
3840 PRINT: PRINT SPACE$(35);cursor$;: REM position cursor & enable
3850 INPUT get$
3860 PRINT FNscreen$(14,0,"");nocursor$: REM disable cursor
3870 FOR n=1 TO 3: PRINT clear$;: NEXT: REM erase prompt
3880 RETURN
3890 :
3900 REM  *** INITIALIZATION ***
3910 REM  *** set up variables ***
3920 yes%=-1: no%=0
3930 esc$=CHR$(27): home$=esc$+"H": cls$=esc$+"E"+home$: PRINT cls$
3940 ret$=CHR$(13): bell$=CHR$(7): line$=STRING$(35,"_"): clear$=SPACE$(90)
3950 cursor$=esc$+"e": nocursor$=eec$+"f"
3960 truevideo$=esc$+"q": inversevideo$=esc$+"p"
3970 :
3980 REM  *** dimension arrays ***
3990 REM 10 fields per record: length%(10) holds max lengths of fields
4000 DIM field$(10): DIM length%(10)
4010 DIM text$(80): REM holds letter text, where applicable
4020 :
4030 REM  *** set length of fields within each record ***
4040 RESTORE 4040
4050 DATA 15,15,25,25,25,25,25,25,15,1
4060 FOR n=1 TO 10:  READ length: length%(n)=length: NEXT
4070 :
4080 REM set memory buffer to 198 (=number of characters per record +2)
4090 MEMORY,,,198
4100 REM reserve 6 buffers (198 characters each) for use by Jetsam
4110 BUFFERS 6
4120 :
4130 REM  *** user-defined functions ***
4140 REM define screen$ (=PRINT AT) function ***
4150 DEF FNscreen$(row%,col%,message$)=esc$+"Y"+CHR$(32+row%)+CHR$(32+col%)+mess
age$
4160 :
4170 REM define centre$(=CENTRE PRINTING) function ***
4180 DEF FNcentre$(message$)=SPACE$(44-INT(LEN(message$)/2))+message$+SPACE$(90-
LEN(message$)-(44-INT(LEN(message$)/2)))
4190 :
4200 REM define line function for printing lines (=fields) in record ***
4210 DEF FNline$=FNscreen$(19+line%,37,field$(line%) )
4220 :
4230 REM define cursor function - for printing cursor within field ***
4240 DEF FNcursor$=FNscreen$(19+line%,36+letter%, "" )
4250 :
4260 RETURN
4270 :
4280 REM  *** ERROR TRAPPING SUBROUTINE ***
4290 PRINT inversevideo$
4300 IF ERL<>530 AND ERL<>2300 AND ERL<>2790 THEN GOTO 4490
4310 GOSUB 4360: IF NOT err%=ERR THEN GOTO 4490: REM read error message
4320 prompt$=bell$+error$+" - Press SPACE BAR to continue": match$=" ": GOSUB 36
40
4330 PRINT truevideo$
4340 exit%=yes%: RESUME NEXT
4350 :
4360 REM *** read error message ***
4370 RESTORE 4370
4380 DATA 53,"File not found"
4390 DATA 58,"Already a file of that name on disc"
4400 DATA 61,"Disc full"
4410 DATA 64,"Not a valid filename"
4420 DATA 113,"Not one of my mailing lists"
4430 DATA 115,"Files damaged - use latest back-up copy"
4440 FOR n=1 TO 6
4450   READ err%,error$: IF err%=ERR THEN n=7
4460 NEXT
4470 RETURN
4480 :
4490 REM *** unpredicted error ***
4500 PRINT FNscreen$(14,0,FNcentre$("The error is in line"+STR$(ERL)+", despite
what the computer says!"))
4510 PRINT truevideo$ cursor$
4520 CLOSE 1,2: ERROR ERR
4530 END
```

IBM Turbo Pascal Moving Pictures

by Adam Borowiecki

This program shows how to create animation on a CGA screen using Turbo Pascal. The program is based around two external procedures for saving and loading fragments of the screen display rapidly. These can be reloaded fast enough to enable a frame-based form of animation.

The two assembler programs should be typed into an editor and saved as ASCII files; you will need a copy of MASM or some other assembler. Instructions for assembling these files into .COM files are given at the end of each listing. For other assemblers, use the standard procedures given in the instructions for your assembler. Alternatively, it should be possible to convert both of these into procedures within Turbo Pascal using the INLINE command.

When this has been done, you should enter the main Turbo Pascal program as normal, compile it to a .COM file and run it. The program as given is very sketchy but does work, and should be considered as the basis for further experimentation.

PROGRAM FILE

```
program moving_pictures;
{
                Moving  Pictures  Programm
                  ( on IBM XT with CGA )
                    by A. Borowiecki
                      January 1987

              ( Using TURBO Pascal v.3.01A
            and Microsoft MACRO Assembler v.3.00 )

}
type
  frame_typ     = array [1..40,1..120] of byte;
  film          = ^picture;
  picture       = record
                    frame : frame_typ;
                    next  : film;
                  end;
var
 f_picture, l_picture,
 n_picture                : film;
 film_top                 : ^integer;
 k,j                      : integer;
 ch                       : char;

 procedure IT(se, ofs, xt, yt, xb, yb : integer); external 'inst.com';
   {see inst.asm}
 procedure ST(se, ofs, xt, yt, xb, yb : integer); external 'savet.com';
   {see savet.asm}
 procedure Windmill(radius:integer;phi:real);
 var
   xa,ya, xb,yb       : integer;
   x,y                : real;       {point coordinates}
   procedure Line;
   begin
      x  := radius*sqr(sin(pi/40 * (j mod 80)))*cos(pi/40 * (j mod 80));
      y  := radius*sqr(cos(pi/40 * (j mod 80)))*sin(pi/40 * (j mod 80));
                                                 {computing}
      xb := xa;
      yb := ya;
      xa := 320-round(2*(sin(phi)*x+cos(phi)*y)); { moving,x-scaling  }
      ya := 100-round(-cos(phi)*x+sin(phi)*y);    { and revolving     }
      draw(xa,ya,xb,yb,1);                       { drawing }
   end; {Line}
 begin
    xa := 360;
    ya := 170;
    for j := 0 to 80 do Line;
 end; {Windmill}

 procedure PictureCreation;
 begin
   Windmill(60,(pi/30)*k);
 end; {PictureCreation}

     procedure Filming;
     begin
      for k:=0 to 14
          do begin
              HiRes;
              writeln('Filming, picture ',k);
              PictureCreation;
              new(n_picture);
              with n_picture^ do
                   ST(seg(frame),ofs(frame),40,120,20,40);
              if f_picture = nil then f_picture := n_picture
                                 else l_picture^.next:=n_picture;
              l_picture := n_picture;
              l_picture^.next := nil
             end;
      l_picture^.next := f_picture;
     end; {Filming}

     procedure Screen;
     begin
       HiRes;
       draw(159,161,481,161,1);
       draw(481,39 ,481,161,1);
       draw(159,39 ,481,39 ,1);
       draw(159,39 ,159,161,1);
       gotoXY(1,4);
       writeln('                      Projection');
       gotoXY(1,22);
       writeln('                      Program Moving Pictures.');
       write('                       (press 1,2,3,4,5,6 or <ESC>)');
     end; {Screen}

     procedure Projection;
        procedure Delaying;
        begin
         if keypressed then read(kbd,ch);
         case ch of
              '1' : delay(10);     '2' : delay(30);
              '3' : delay(50);     '4' : delay(75);
              '5' : delay(100);    '6' : delay(150);
             end
        end;{Delaying}
     begin
      k:=0;
      ch:=' ';
      n_picture := f_picture;
      repeat     { projection }
           Delaying;
           with n_picture^ do
                IT(seg(frame),ofs(frame),40,120,20,40);
           n_picture := n_picture^.next;
      until ch=^[;
     end; {Projection}

begin

       f_picture := nil;
       Mark(film_top);
         Filming;
         Screen;
         Projection;
       Release(film_top);
       TextMode
     end.

  ;
  ; procedure IT(se, ofs, xt, yt, x_byte, y_bit : integer);
  ; {insert the array into screen memory}
  ; parameters :   se          -  [bp+14] {Segment of the Array}
```

PROGRAM FILE

```
;                ofs        -  [bp+12] {Offset of the Array}
;                xt         -  [bp+10] {X-Size of the Array}
;                yt         -  [bp+8 ] {Y-Size of the Array}
;                x_byte     -  [bp+6 ] {X-byte Screen Address}
;                y_bit      -  [bp+4 ] {Y-bit Screen Address}
;.............................
code    segment
        assume cs:code
mtab    proc    near
;.............................
        push    bp
        mov     bp,sp
        push    ax
        push    cx
        push    es
        push    di
        push    si
        push    ds
;.............................
        mov     ax,0B800h       ; Top of Screen Memory
        mov     es,ax
        mov     ax,[bp+14]      ; Segment of Array
        mov     ds,ax
        mov     si,[bp+12]      ; Offset of Array
;.................................
        mov     ax,[bp+4]       ; Compute the First Screen Byte :
        xor     di,di           ;
        test    ax,1            ; if (y and 1) > 0 then di := 2000h
        jz      11              ;                  else di := 0
        mov     di,2000h
11:     and     ax,0feh         ; di := di + (ax and FEh) * 40
        mov     cl,3
        shl     ax,cl
        add     di,ax
        shl     ax,1
        shl     ax,1
        add     di,ax
        add     di,[bp+6]       ; di := di + x_byte
;.................................
        cld
        mov      cx , [bp+8]
loop1:  push     cx
        push     di
        mov      cx , [bp+10]
        rep      movsb          ; Insert the Line of Screens Fragments
        pop      di
        pop      cx
;.................................
        cmp      di,2000h       ; Compute the Next Line Address
        jge      do
        add      di,2000h

        jmp      exd
do:     sub      di,2000h
        add      di,80
exd:    loop     loop1
;.................................
        pop     ds
        pop     si
        pop     di
        pop     es
        pop     cx
        pop     ax
        pop     bp
        ret     12
;.................................
mtab    endp
code    ends
        end
;
; WARNING : Now exit to PC-DOS and type:
; MASM <Enter> INST <Enter> <Enter>
; LNK  <Enter> INST <Enter> <Enter> <Enter>
; EXE2BIN INST.EXE INST.COM
; (Ignore minor errors from MASM and LINK
;
; procedure  ST(se, ofs, xt, yt, x_byte, y_bit : integer);
; [Save the Screen Fragment into Array)
; parameters :     se       -  [bp+14] {Segment of the Array)
;                  ofs      -  [bp+12] {Offset of the Array)
;                  xt       -  [bp+10] {X-size of the Array)
;                  yt       -  [bp+8 ] {Y-size of the Array)
;                  x_byte   -  [bp+6 ] {X-byte Screen Address}
;                  y_bit    -  [bp+4 ] {Y-bit Screen Address)
;
;.............................
code    segment
        assume cs:code
mtab    proc      near
;.............................
        push      bp
        mov       bp,sp
        push      ax
        push      cx
        push      es
        push      di
        push      si
        push      ds
;.............................
        mov       ax,0B800h       ; Top of the Screen Memory
        mov       ds,ax
        mov       ax,[bp+14]      ; Segment of Array
        mov       es,ax
        mov       di,[bp+12]      ; Offset of Array
;.................................
        mov       ax,[bp+4]       ;  Compute the First Savet Byte :
        xor       si,si           ;
        test      ax,1            ; if (y and 1) > 0 then si := 2000h
        jz        11              ;                  else si := 0
        mov       si,2000h
11:     and       ax,0feh         ; si := si + (ax and FEh) * 40
        mov       cl,3
        shl       ax,cl
        add       si,ax
        shl       ax,1
        shl       ax,1
        add       si,ax
        add       si,[bp+6]       ; si := si + x_byte
;.................................
        cld
        mov       cx , [bp+8]
loop1:  push      cx
        push      si
```

PROGRAM FILE

```
        mov     cx , [bp+10]
        rep     movsb           ; Save the Screen Line
        pop     si
        pop     cx
;.....................................
        cmp     si,2000h        ; Compute the Next Line Address
        jge     do
        add     si,2000h
        jmp     exd
do:     sub     si,2000h
        add     si,80
exd:    loop    loop1
;.....................................
        pop     ds
        pop     si
        pop     di
        pop     es
        pop     cx
        pop     ax
        pop     bp
        ret     12
;.....................................
mtab    endp
code    ends
        end
;
; WARNING : Now exit to PC-DOS and type:
; MASM <Enter> SAVET <Enter> <Enter> <Enter>
; LNK  <Enter> SAVET <Enter> <Enter> <Enter>
; EXE2BIN SAVET.EXE SAVET.COM
; [Ignore minor errors from MASM and LINK
```

Lynx DOS Access

by Colin Clayman

This utility describes how blocks of Lynx DOS disks may be directly read and written from within any program, Basic or machine code, by calling a very useful routine in the DOS itself which has not been previously made public.

I guessed that there must be often-called routines in the DOS that would read/write a particular block to/from a given buffer. On this basis I have located a single routine in DOS that appears to handle all block-level access to the disk; certainly reading and writing. While I am sure of its address, I may not have discovered all its possible input values or returned values; however, there is sufficient information to read and write blocks.

In order to call this DOS routine easily from Basic, I have also provided a machine code interface routine that can be used in any Basic or machine code program.

This information will be of use to those who want to access disks at a block level by program, rather than interactively as provided by the disk editor (DISKED).

Block-level disk I/O routine

Routine call

This DOS routine is located at address &5975 in the data RAM and, accordingly, is normally hidden by the ROM. Therefore, it cannot be called directly from Basic and must be called from machine code. For compatibility with possibly different issues of DOS, it is also vectored from a standard address — &FFF2 in the visible RAM — and it is this address that should be called in preference to &5975.

Any machine code calling up this DOS block-level disk routine should, besides handling its parameters, do the following in sequence:

— switch out ROM,
— CALL &FFF2,
— switch in ROM again,
— return.

Function code

Immediately after the call instruction, there must be a single byte between 1 and 9 to determine which disk function should be carried out by the routine. These functions are as shown in the box below.

Code	Function
1	Reads bytes 8-15 of block 0, containing disk size/type, to a buffer
2 & 3	Read a block to a buffer
4 & 5	Write a block from a buffer
6	? Usually inactive
7	Initialises most of disk to &E5 except blocks 0 and 1, but does not leave it properly formatted
8	Moves head to the last sector of a given track
9	Obeys BOOT code from somewhere in blocks 0 and 1

PROGRAM FILE

While there seems to be duplication of the Read/Write functions, the odd-numbered code of each runs considerably slower than its even counterpart, and, therefore, presumably carries out validation on the transfer. Experience shows that these odd codes are safer.

Parameters
Depending on the function, the routine may require some parameters to be set up in the Z80 registers BC and DE prior to its call, as shown in the box below.

Code	BC	DE
1	C= drive no. (0 to 3)	Address of 8-byte buffer
2	Address of 5-byte area	Address of 256-byte buffer
3	consisting of drive no.	
4	followed by 4-byte block	
5	no. (stored byte-reversed)	
6	—	—
7	B= drive	&86, &A6, &C6, and so on, in steps of &20
8	B= drive, C= track	0
9	C= drive	—

'—' means not required. Where a parameter is required, it should not be given an invalid value: it may either do nothing or crash the Lynx.

Result code
The routine sets register A as a result code on exit, as follows:

Result	Meaning
0	OK
&80-&EF	Disk failure (see DOS manual)
&F0-&FF	Parameter error

Block-level interface
The machine code routine below, designed to easily fit in with Basic, can be used to interface to the DOS routine from any Basic or machine code program.

```
3E 10       DOSIO   LD A, &10
01 7F FF            LD BC, &FF7F
ED 79               OUT A, (C)      :Switch out ROM
C5                  PUSH BC
EB                  EX HL, DE       :Second para. from HL
01 00 00            LD BC, &0000    : First para
CD F2 FF            CALL &FFF2      : DOS I/O routine
00                  DEFB 0          : Function
6F                  LD L,A          : Reply to HL
7F                  XOR A
67                  LD H,A
C1                  POP BC
ED 79               OUT A, (C)      : Switch in ROM
C9                  RET             : Exit
```

This interface routine can be put in a Basic code line or anywhere in RAM; in the following, 'dosio' represents its address — for example, LCTN (10). It should be called with HL containing the second parameter (the one for DE) if any; having first DPOKEd dosio+10 with the first parameter (the one for BC) and POKEd dosio+15 with the function code. It will reply with the result code in HL.

For reading or writing blocks the routine can be used from Basic, or the machine code equivalent, by initially setting up the 5-byte parameter:

```
20 CODE 00 00 00 00 00
30 LET C=LCTN (20)
40 DPOKE dosio+10, C
```

and then, whenever a disk read or write is required of block n on drive 0 to/from the 256-byte buffer starting at b, doing the following:

```
POKE dosio+15, function
DPOKE C+1, n
CALL dosio, b
IF HL THEN PRINT "Disk Failure"
   #HL
```

PROGRAM FILE

Roman Number Conversion Tip

by Mads Dam-Larsen

Decimal numbers to roman numerals
If D is a decimal number, then GOSUB 100 will cause R$ to hold the roman numberal. For example: If N is 1987, then R$ will be MCMLXXXVII.

```
100 REM DECIMAL TO ROMAN
101  R$="":Z=7:RESTORE 106
102  V=INT(2↑INT((Z-1)/2)*5↑INT(Z/2))
103  A=INT(D/V):B$=MID$("IVXLCDM",Z,1)
104  FOR X=1 TO A:R$=R$+B$:NEXT X
105  D=D-A*V:Z=Z-1:IF Z THEN 102
106  DATA CCCC,M,XXXX,L,IIII,V
107  FOR N=1 TO 3:READ A$,B$:Q=INSTR(R$,A$)
108  IF Q THEN R$=LEFT$(R$,Q)+B$+MID$(R$,Q+1)
109  NEXT N
110 RETURN
```

Roman numerals to decimal numbers
If R$ is a roman numeral, then GOSUB 200 will cause D to hold the decimal number. For example: if R$ is MCMLVII, then D will be 1957.

```
200 REM ROMAN TO DECIMAL
201  T(1)=1:T(2)=5:T(3)=10:T(4)=50:T(5)=100:T(6)=500:T(7)=1000
202  D=0:L=LEN(R$)
203  FOR N=1 TO L
204     X=N:C=FNV(X)
205     IF C > FNV(X+1) THEN 208
206     IF C < FNV(X+1) THEN C=-C:GOTO 208
207     X=X+1:IF X < L THEN 205
208     D=D+C
209  NEXT N
210 RETURN
211 DEF FNV(X)=T(INSTR("IVXLCDM",MID$(R$,X,1)))
```

The routines above have been written in NewBrain Basic, but only standard statements have been used. Conversion to other machines shouldn't be difficult.

Tandy 100 Escape Sequence Tip

by Colm Buckley

The Tandy 100 portable computer has some escape sequences that perform various operations onscreen. Unfortunately these are not documented in the manual, but help is at hand! To use one of these codes send an ESC code by PRINT CHR$(27); first. So, to send ESC A, use PRINT CHR$(27);"A".

Code	Parameters	Function
ESC A	None	Moves text print position up a line
ESC B	None	Moves text print position down a line
ESC C	None	Moves text print position right a space
ESC D	None	Moves text print position left a space
ESC E	None	Clears screen
ESC H	None	Moves text print position to top left of screen
ESC J	None	Clears screen from text position to end of screen
ESC K	None	Clears screen from text position to end of line
ESC L	None	Scrolls down current line and all below it
ESC M	None	Scrolls up current line and all below it
ESC P	None	Turns on cursor
ESC Q	None	Turns off cursor
ESC T	None	Sets up seven-line scrolling window (LABEL line doesn't scroll)
ESC U	None	Reverts to eight-line scrolling
ESC V	None	Prevents screen scrolling
ESC W	None	Restarts scrolling
ESC Y	Two	Positions text cursor to (P2,P1) so to move cursor to 5,5 use the following: PRINT CHR$(27);"Y";CHR$(37);CHR$(37); note that the top left corner is (32,32)
ESC l	None	Deletes current line
ESC p	None	Inverts text colours (white on black)
ESC q	None	Normal text colours

· CHEQUE · AMEX · VISA · ACCESS ·

Thanks for the Memory

For the BBC (B, B+, Master)

OVERLAY BASIC ·

Transparent, easy to use. Lets your BBC BASIC programs call procedures from disk, use them, then forget them until next needed. Programs now needing 64K RAM may only need 5K RAM. Runtime module allows other BBC users to run the programs from disk without the chip.

£29.95 inc. VAT + p&p

Available only from:

Elsevier – BIOSOFT

68 Hills Road · Cambridge CB2 1LA
Telephone (0223) 68622 · Telex 81623

· CHEQUE · AMEX · VISA · ACCESS ·

SPECIAL OFFER

5¼" British Made Disks

	Track	10+	50+
SS/SD	40	0.45	0.40
SS/DD	80	0.59	0.52
DS/DD	40	0.69	0.62
DS/QD	80	0.79	0.72

Prices include envelopes, WP Tabs and First Class delivery within UK.

3½" Disks

		10+	50+
SS	1.35 TPI	1.95	1.50
DS	1.35 TPI	2.50	2.00

Plastic Library Cases
(to hold 10 disks) £1.20
5¼" Head Cleaning Disks £4.60

Prices include VAT & free UK delivery
Lifetime guarantee – 2 for 1 replacement or money back if not satisfied.
Send cheque/P.O. to:

LONGWORTH LTD,
31 BRIDGE STREET,
NEWPORT, GWENT NP9 4BH
Tel: 0633-52538

WANTED FOR CASH!!

ALL TYPES OF COMPUTER EQUIPMENT

ATARI, AMSTRAD, IBM PC, BBC, COM 64 etc.
BULK QUANTITIES ACCEPTED.

WE BUY, SELL AND PART EXCHANGE NEW AND USED

FULL MAIL ORDER SERVICE WITH GUARANTEE
Educational discounts available

CHIPS

(DATA DIRECT LTD)
53 RUGBY ROAD, WORTHING, SUSSEX
Tel: :0903) 40509 24 hours

How To Save Money

Don't spend it. But you've got to live.
So you've got to spend money on food, clothes, fuel and so on.
So how do you save?
You use the tools at your disposal: your computer, your intelligence, your skill.
You use the Home Finance Program designed to help you save money.
The **HFP.**
It runs on Amstrad PCWs and the CPC6128.
It's fast, easy-to-use, and comes with a comprehensive manual.
It will even have your name on it.

Send the name of your household and cheque/PO for £24.95 to

Datavise (PCW)
20 Drumnaquoile Road, Castlewellan, Co Down BT31 9NT
or sae for further details

UK & EXPORT

Amstrad PC1512:
All models now available including hard disc versions. 12 months warranty.

Sinclair QL:
Ask for details of our extensive range of QL hardware and software. We also have our own high quality software including: QL Pascal; Forth; Assembler; Monitor; Typing-Tutor; Task Swopper; Boot 128k; 1 to 1 Dump and Microdrive Toolkits — **Dealer Enquiries Welcome.**

COMPWARE

Overseas customers: Please ask for our export terms

Compware, 57 Repton Drive, Haslington, Crewe CW1 1SA.
Tel: Crewe (0270) 582301
Telex: 265871 MONREF G (Quote MAG70076)

SANYO OFFER

MBC 555 IDEAL FOR WORDPROCESSING & TELEX TERMINAL
2 x 160K DRIVES, 128K RAM, FREE SOFTWARE INCLUDED:– WORDSTAR, CALCSTAR, MAILMERGE, DATASTAR, REPORT STAR, s BASIC, DOS 2.11. WILL DRIVE MOST STANDARD DOT MATRIX & DAISYWHEEL PRINTERS.

SPECIAL OFFER PRICE

MBC555 CPU, KEYBOARD & S/WARE
PHILLIPS MONITOR ADD £75
QUALITY DOT MATRIX, NLQ, 120 CPS PRINTER ADD £149

£199 +VAT

ALSO AVAILABLE AT UNBEATABLE PRICES

TOSHIBA T3100 10 MB	**£2,550**
SHARP PC700 Fully compatible portable 2 x 360K Drives	**£795**
TANDON PCX20 Call for other models	**£1,125**
SEAGATE 20/30MB Includes controller and cables	**£320/£425**

SAVE POUNDS !!!

AVAILABLE EX-DEMO/USED IBM PC XT, AT OLIVETTI (MOST MODELS) APRICOT PC XI XEN's.
LOTS OF PRINTERS BOTH DOT MATRIX AND DAISYWHEEL

PRIMA BROKERS

Telephone (0602) 810884
810974
Telex 342533 TINTIM G
VAT Reg. No: 416 3665 52

44A ALBERT ROAD WEST BRIDGEFORD NOTTINGHAM NG2 5GS

FREE SOFTWARE

(including spreadsheet word processor database & utilities worth more than £40)
plus
FREE DELIVERY
(anywhere in UK)
with every OPUS PC II Turbo purchased from us

Fully compatible 16-bit micro, NEC V20 CPU allowing 4,77/8 MHz turbo processing, legal BIOS, 256K RAM (expandable to 1024K with 384K RAM disk,) 360K floppy disk drive, 8 expansion slots, parallel port, high quality keyboard, battery-backed clock-calendar, joystick interface and keyboard lock. Built to strict American FCC standards with FCC approved computer case for low RF emission (improved security), 150 watt UL approved power supply, Hercules-compatible hi-res graphics card, hi-res 720 x 348 pixels monitor with tilt and swivel base. We supply the PC II with a comprehensive user manual.

From £499 + VAT

Expanded versions of the PC II include 1024K RAM and serial card. Twin floppy drive, 20 Mbyte hard disk, colour graphics and EGA versions are available.
We also suppy the PC1512 with extra software, other micros, printers and installation of all hardware and software products supplied. Call us for a quotation anytime.

R H COMPUTER CONSULTANTS
Abbey House, 28-29 Railway Approach
Worthing, West Sussex BN11 1UR
Tel: Worthing 090 321 3551

IT REALLY IS MAGIC!

AMSTRAD · Tandon · THORN EMI Datatech · TOSHIBA · EPSON · ATARI · CITIZEN · Opus. · NEC · Canon · VICTOR

Thinking of buying a Computer, Accessories, Printers or Software?
Why not save up to 40%
Contact Rocketfield, PCW1, 86 Birch Hall Lane, Manchester 13.
Tel. 061-224 4032

WE GUARANTEE THE LOWEST PRICES

Don't forget to ask for your 'Magic' Order form

ROCKETFIELD®
computer systems

READ & PRINT BAR-CODES USING ANY COMPUTER

Complete identification system including microprocessor controlled scanner hardware plus software to print barcodes on Epson (or similar) dot matrix printer. Most industrial & commercial codes can be read. Packages available for virtually any computer. Our systems are in regular use by many private & public sector organisations worldwide.
Prices start from £250. More information on request.

ALTEK INSTRUMENTS
Enterprise House
44-46 Terrace Road
Walton-on-Thames, Surrey
KT12 2SD
Tel: (0932) 244110
Telex: 295800 CWAOL

ONLY £119.95

dBASE™ III USERS

RRELAX WITH R&R

From Concentric Data Systems, Inc.

Relate and Report. Then Rest and Relax. With R&R, the Relational Report Writer.

Prepare reports faster, easier, and without programming – monthly sales, most active accounts, purchase orders, multi-page invoices, ...

R&R is full-featured and flexible. It handles the tedious and time-consuming tasks of report creation and modification. It lets you concentrate on making reports show exactly what you want to show, in exactly the way you want to show it. Fields and free-form text are placed where they are to be printed. New fields are computed, such as lineitem amounts and invoice totals. Fields are formatted with $-signs, for example, and with print attributes such as **bolding**, to make the invoice look better. Finally, a query is defined to select the invoices to print.

Use 1-2-3®-like commands and menus.

After the master file is selected, R&R shows an empty screen area to "write" on. Text simply is typed and fields are inserted where wanted; 1-2-3- like commands do the rest. R&R isn't particular about the order of doing things. File relations can be set as needed, or all at once. Fields can be formatted when inserted, or later. Any part of the report can be changed at any time.

Set and edit file relations.

File relations are set one at a time through a series of commands aided by prompts. The narrative near the bottom of the screen shows the highlighted relationships in plain-English.
Up to nine relations may be set among up to ten files, through dBASE indexes. One-to-one, or "lookup", relations find a single record in the related file for each value of the linking field; for example, the company name for a specific customer number. One-to-many, or "scanning", relations find as many records in the related file as have the same value of the linking field; for example, all of the lineitems with the same order number.
Relations may be nested in up to nine levels, with a "scanning" relation and any number of "lookup" relations at each level.

Insert fields from pull-down menus.

Using the Field insert command, fields from the pull-down menu are inserted at the current cursor location. The pull-down menu graphically shows file and field relationships.

Move fields and text freely around the report.

Individual fields, segments of text, or entire lines can be highlighted and then moved elsewhere with the cursor movement keys.

Sort and independently group records.

R&R makes complete and efficient use of dBASE indexes for file processing and record ordering. When the resulting record order is not as wanted, R&R can sort records on up to eight levels, using any fields including those calculated by R&R itself.

Create new calculated fields.

New (calculated) fields are created by typing expressions containing field names, functions, operators, and other expressions, or by selecting them from pull-down menus. More than 60 functions are available for character, date, mathematical, and special test calculations.

Get HELP whenever it's needed.

Pressing the HELP key gives an instant reference for whatever is being done. Each screen has cross-references to the pages in the User's Guide, and to other HELP screens.

Format fields and text for finished layout.

Text is shown just as it will be printed. Fields are shown by pictures that indicate field type, format, and width.
Calculated numeric fields are shown as #'s. The highlighted field is formatted as currency, and will print with leading $-sign and imbedded commas. **Bolded** items will print in **bold**, *italics*, underlined, or some **combination** of print attributes specified item-by-item or by line.

Select records using plain-English query.

Queries are built in plain-English by selecting fields, comparison operators, and logical connectors from pull-down menus. Any level of complexity can be attained with AND/OR connectors and full nesting of parentheses.

Control output with print options.

Numerous print options give complete control over such things as page margins. All settings are clearly shown on status screens.
You can use R&R with or without dBASE. You can also print R&R reports from your own custom dBASE applications by using the R&R runtime program, RRUNTIME.

Runtime program included at no extra charge.
Don't wait. Try R&R. Order now!

*Works with CLIPPER - R&R CLIPPER Module Available For £159.95

Order NOW BY ☎ **07357-5244** VISA Access

Or write to: 1st FIRST SOFTWARE LTD

First Software Ltd, 20B Horseshoe Park, Pangbourne, Berks RG8 7SW

Name _____

Address _____

Access / Visa No. _____

TRANSACTION FILE

Your chance to buy, sell or swap equipment.

● CIFER 64k LUGGABLE MODEL 1882. Twin 800k d/ drives, CPM2.2, MBasic, serial and parallel ports, spare disks, case, manuals, books, etc. Offers. Dover 205964.

● OSBORNE. With usual software, plus Epson LX80 with tractor and sheet feeder, plus monitor screen. Fairly new Epson, therefore asking £495. Also have another Osborne plus Bytewriter. Robertson. Ansaphone 262-3395.

● SINCLAIR QL. In mint condition. With Psion packages. Also Miracle. WS200 modem. Sold separately or together to first serious offer. Tel: (01)997 2161.

● ATARI 520ST. Mono monitor, SSDD disk drive, +500k internal RAM upgrade, Metacomco PASCAL, RAMdisk + lots more software, AMSTRAD DMP2000 NLQ printer, £800 complete. Tel 0327 76694 weekdays after 6pm.

● EPSON PX-8. Plus CX-21 acoustic coupler, 120k RAMdisk; Wordstar, Calc, Intext BASIC in ROM; printer cable, all manuals included. High-quality portable comms package. £500. (0803) 865852 days.

● ATARI 520ST. GEM in ROM. Two ½ meg disk drives, hi-res mono monitor with stand. Macro assembler plus usual software included. £400. (0803) 865852 days.

● APPLE II EUROPLUS. Twin disk drives, monitor Videx 80 column card, Microline printer, All v.g.c. £600. Troon, Ayrshire, Scotland. Tel: 0292 311204. Eves.

● ATARI ST PUBLIC DOMAIN S/W. Graphics Demos, wp's, languages and lots more. SAE to: B. Wilson, 107 Bollington Rd, Macclesfield, SK10 5EL.

● COMMODORE 4032 COMPUTER. 4040 dual floppy, 4022 printer. All with cables, leads, manuals and covers. Many books and lots of disks. £500. Tel: Horsham (0403) 65146.

● APRICOT PORTABLE SOFTWARE WANTED. 256k 1D/D. I have Supercalc, Superwriter. I need a database or any other software. Tony, Southend 0702 76976.

● BBC-B PLUS CUMANA DRIVE. Epson RX80 F/T printer, ATPL sidewise board, Worldwise, Toolkit, graphics, Pascal-T and other ROMS, leads, manuals, software, etc. £475 o.n.o. Or will split. Tel: 042 879 3725 (Godalming Surrey) For quick sale.

● WANTED! WANTED! WANTED! WANTED! Amstrad 8512 in Yorkshire. Tel Leeds 551865. Can collect.

● APPLE II EUROPLUS. 2 disk drives, monitor, Pascal, Basic compiler, Micromodeller, statistical analysis, Grappler card, communications cards, loads of disks. £450 o.n.o. Epson MX-100 printer. 136 col. £300 o.n.o. 0252 722113.

● COMMODORE 64 DISK SOFTWARE: Oxford Pascal, £20. Commodore macro assembler development system with programmer's reference guide. £20. Commodore LOGO, £10. Super type typing tutor, £10. Tel. Bristol (0272) 392615 Eves.

● WANTED. Apricot MSD10 for portable. Good condition, reasonable price. Contact Davies, P.O. Box 4418 Hodeidah Y.A.R.

● PSION ORGANISER II. RS232 interface. Transfers files to IBM etcetera, £35. Casio PB1000 pocket computer. Touch screen, RTC, Basic, Assembler, technical manuals, £100. Macproject, original packing. £35. Tel Jon 0990 58004.

● AMIGA DEVELOPERS SYSTEM: 512k RAM, two 3,5" drives, high res colour monitor, developers documentation, software (including Lattice 'C' compilers), newsletters. List price, £1465 for hardware alone. Bargain at £1100 o.n.o. Tel: (01) 731 2194.

● BBC B. Twin DD 80/40T drives, Acorn Z80 second processor, RGB monitor, RAM/ROM board, 32k video RAM, auto dial modem, joy sticks, lots of software and manuals, mouse. £450. Eves 0206 395994, day 0473 224564.

● COLOUR MONITOR. Dyneer 14 CHI high resolution plus IBM compatible video card. Gives 600 x 400 line text + fine resolution CGA graphics. £425. Tel (01) 363 1122 Thurley.

● IBM PC/AMSTRAD PC1512 TELEX CONVERSION. Includes proper telex number with own answer back. £230. PC1512 S/D mono. £448. New Greatbatch 086 733 348. Oxon.

● Printer. dot-mat, Parallel, Centronic, Horizon, N.L.Q. V.G.C. £155 o.n.o. Tel. Brighton 410715.

● NEWBRAIN A. With manuals, some software, leads, £50. Monitor, green screen, Sanyo D, hi resolution. Both excellent condition. Will separate. Tel: (051) 523 1536. Treat yourself to a new brain!

● APRICOT PORTABLE. 256k RAM, MS/DOS, 720k drive. LCD display. Manuals, software. 9-months warranty £199. Three months old. Mani. 21 Tennyson Road, Hounslow, East Middlesex, London. Tel: office (01) 846 8462, home (01) 572 4013.

● TANDY MOD 4. With 360k drive and 5MB hard disk. £495. 028 373 3574.

● OFFERS INVITED: Tandy TRS 80. Model 1, level 2. Tel 0531 821040.

● WANTED: TRS 80 5MB hard disk. Model III or IV. Must be in working order. If you have either hard disk or TRS 80 III or IV call me on, day (01) 735 5309 or Eves (01) 650 2359.

● CITIZEN MSP-10. Very slim (2½ inches high) 9 × 9 (with true descenders) NLQ dot matrix printer. Tractor and platern paper feed. Epson IBM graphics modes. £125 (£349 new) Tel: (026477) 2070 M3 - A303.

● EPSON LQ1500. With tractor feed and font board. £550. Diablo 630 KSR with keyboard and tractor. £650. Sprinter interface converter, £100. All domestic use only. 0296 88122 day, 641666 Eves.

● COMMODORE 715 (256k). 8250 LP dual drive (2MB), 1361 printer (136 column, 150 cps, heavy duty). Complete system including Superscript. Little used and perfect. £900. Lionel Tun (01) 928 3065.

● BIG BOARD II. Full implementation CP/M plus & 2.2, 256k RAM, 16Mb Winchester, 5/8 inch floppies, plus keyboard, monitor, built-in real-time clock, Eprom programmer. Lots of software. £450 o.n.o. Twyford (0734) 340736.

● CROMEMCO Z2DS100 SYSTEM. Twin 5¼ floppy's, with CIT80 terminal. No manuals or software.£100. Tel (0442) 45282 Eves.

● BBC B OS1.2 BASIC II. DFS 40/80 400k drive, joystick, toolkit plus, white knight, revs, advanced user & disk guides, books, magazines and disks. Worth £700. £350 o.n.o. Tel: (01) 684 4188 after 7.00pm.

● COMPAQ MAINTENANCE/SERVICE MANUALS. With test cables. Boxed sets covering all portable and desk-pro models (retail price £300) selling for £85. Chance of a lifetime never used. 0753 841155 (W. London).

● WANTED: Software for Logic analysis: Decision table processing. Boolean Algebra source code reformat and restructure Goto elimination modelling of program contents. Any helpful advice much appreciated. Frank (01) 833 1740 Eves.

● BUSINESS BBC SYSTEMS. Torch twin 400k Z80 processor. Perfect software. Torch IBM graduate twin disk processor. Xchange software. Tabs sales purchase ledgers. Green monitor. £850 o.n.o. Tel: (01) 398 8623.

● TANDY 102 PORTABLE. With battery powered floppy drive, nullmodem for online connection. August 1986. Almost unused, £350. Tribute Hazelgrove Farm, Brook, Godalming, Surrey, GU8 5LB. 042879 2249 Fax: 042879 4802.

● WANTED: Software for Apricot PC on single sided disks. All programs considered. K R Dodd, 57 Evelyn Drive, Hatch End, Pinner, Middlesex, HA5 4RL.

● SAGE FINANCIAL CONTROLLER FOR I.B.M. Used but original and complete, £475. Sirius computers from £495: Tel Malcolm (0532) 860795.

● GENEALOGICAL DATABASE — AMSTRAD PC/PCW/CPC. 1000 subjects per file (10 marriages, 19 children). Compehensive searches. Birth brief/descent charts. Line trace. £35. Details 061-439-4841 or write: 38 South Parade, Bramhall, Stockport.

● BBC B AND TORCH GRADUATE. Run BBC and IBM software. 256k (expandable), 2×360k drives. MSDOS, Psion Xchange included. Little used £600. Bracknell 0344.483769 (Eves).

● CANON AS 100 REQUIRES WORDSTAR COMMAND DISTRIBUTION DISK. For Canonbrain CF/M-86TM operating system stop other users. Please contact Macadam, 150 High Street, Edinburgh, EH1 1QS. Tel 031-225-5252.

● 3½" DISKS. Quality Dysan DSDD. Only £20, box of ten. Including post. Howard Bingham-White, 0604 716109.

● MACINTOSH 128k. Single 400k disk drive. Multiplan, Macwrite, Macpaint. Carry case, numeric keypad, Imagewriter II. All manuals and packaging, offers around £1500. Tel: (0222) 625510. Cardiff.

● ATARI-ST PUBLIC DOMAIN DISKS. Massive library of over 100 disks. Send 18p stamp for free ST-club newsletter and P.D. catalogue. Mr Glover, Mangrove House, Balls Park, Hertford, SG13 8AK.

● APRICOT XEN HD 1Mb hard disk 10Mb 3½" floppy disk 720k, paper-white 800 × 400 resolution monitor, XEN keyboard + microscreen, MS-WINDOWS. Software includes Write, Paint, and others. All as new, £2500 o.n.o. Tel (01) 940 4257.

● WANTED: Software TRS 80 model IV. CP/M, Montezuma profile. etc Might buy machine. Moore (01) 959 4458.

● AST MONOGRAPH PLUS CARD. New, unused, boxed, C/W software includes calendar clock, serial port, parallel port, compatible PCXT/Lotus 1-2-3, £195. Rediffusion 14in COMP/TTL/RGB colour monitor. (BBC, etc.) £125. Tel: 0903-883986.

● SIRIUS 128k. 2×1.2MB disk drives, monitor, keyboard. Some software, £500 incl VAT. Tel: 05097-2521 Eves.

● OLIVETTI M24. 10MB+ 360/720k floppy, 640k RAM, bus converter, colour monitor, No 2 keyboard. Plus public domain software. £2000 incl vat. Serviced from new, under maintenance contract. Tel 05097-2521.

● MICROVITEC CLUB STANDARD RESOLUTION COLOUR MONITOR. Model 1431MS (with T.T.L. input for BBC micros). Excellent condition. £120 o.n.o. Tel: Steve on Morecambe (0524) 423478.

● PRINTER. TEK Starwriter, heavy duty daisy wheel, parallel interface, complete with spare printwheels and ribbons. Excellent condition. £195 o.n.o. Martin Hughes Tel. Sheffield (0742) 366428 (may be answering machine).

● DAISYSTEP 2000 DAISYWHEEL PRINTER. Perfect condition, with rustcover and alternative wheel. £150 o.n.o. Paul, Alfreton (0773) 835249.

● APRICOT PORTABLE. As new, very little used. Complete with diary, sketch, voice recognition, G.W. Basic, Activity tutor, Superplanner, Supercalc, Superwriter. Ten unused disks. £400 ovno. Brentwood (0277) 212175.

● BBC B. Dual D.S. 40/80T drives. RGB monitor, ATPL ROMboard, lots of software, Wordwiset, Forth, etc. 32k sideways RAM, Epson printer, leads, modem, recorder, joysticks, books, magazines, £499. Whitehaven (0946) 820436.

● BONDWELL BW8. IBM compatible lap-top, with back-lit LCD screen, internal 3½" disk drive, external 5¼" drive, three months old. Cost £1200, accept £875. Tel: (01) 584 5816.

● TO ALL YOU UNSERIOUS BBC USERS !!!!. I would like to swap demos, games and programs with you. Please write to me: Tor Houghton, Fjellveien 4, 1362, Billingstad, Norway.

● SIRIUS 2×1.2Mb DRIVES. 256k RAM, high resolution monitor, plus lots of software and manuals, £795. Mannesmann Tally printer plus cables, £195. Tel: (0908) 605585) Eves.

● BROTHER HR15 DAISYWHEEL PRINTER. For professional looking correspondence. Suit small business. Centronics or serial interface. Perfect condition. Cost £372, price £150. Or offers. (01) 800 0717.

● TRS-80 BOOKS WANTED: "Machine Language Disk I/O and Other Mysteries" and "Microsoft Basic Decoded": Steve Ridd, 34 Farrington Road, Wolverhampton, WV4 6QH.

● TRANSTEC/RADE 64k CPM COMPUTER. Twin 5¼" disk drives, 800k total. Serial and parallel printer ports. Software supplied, Wordstar, Basic, Bascom, Lync. Full technical manuals. Price £350. Tel. (0274) 613369.

● NEC500 SPRINWRITER LETTER QUALITY PRINTER. Fast 55cps. Working order

TRANSACTION FILE

but needs service. Cost over £1000. Equipment surplus to requirement. Bargain £200 o.n.o. Tel (01) 868 9548/(01(866 2258.

● WANTED: BYTE Back. Issues '84, '85, and '86. Willing to pay £15 for each year, £50 all. (01) 431 0633.

● EPSON PX-8 LAPTOP. Complete with PF-10 portable 360k 3½" drive and 120k RAM. Wordstar, Cardbox, Calc, Basic, all cables. A complete system. £450 the lot. Tel Mark 0279 37484.

● APPLE MACINTOSH 512/ 400k, £950. 512k logic board, £150. Apple Europlus, £150. Language card, £35. Europlus mother board, £60. Clock card, £35. Tel. 052524 243.

● BRAND NEW NEC SPINWRITER DAISY-WHEEL LQP. 23cps, full 15" platen, bi-directional tractor, serial interface, cable and manuals, £340. Seagate 5¼" full height hard disk, £125. Ampthill (0525) 404572 (Bedfordshire).

● ASHTON TATE dBASE II PLUS SOFTWARE PACKAGE O.R.O. £350. Tel day 0359 41841.

● SUPERBRAIN QD. 2× 360k drives, MBasic, Wordstar, Mailmerge, DMS. All with manuals, £110 o.n.o. Tel Burgess Hill 0444 644398 after 6pm.

● BBC B. Twin 80 track disks, Z80 second processor, Microvitec monitor, ROM board, Viglen case, mouse, joysticks CPM and BBC software. Manuals. Complete system, offers. Could deliver. 0484 606513.

● SHARP MZ80A. Twin disk drive, P6 printer, manuals, all leads, word processing, purchase ledger software. Excellent condition. £250. Tel (01) 458 4110.

● ATARI 1040ST. With high-res mono screen. and VIP professional (full version). Practically unused. £900 retail price, £650. May sell separately £550 Atari, £125 VIP prof. Tel. (01) 935 2549 day.

● POCKET WORDSTAR (AMSTRAD) SEALED, £25. Gamemaker (twin cassette) for CBM 64/128, £5. CBM 610 128k plus LP 8250 dual D/drive (2MB) no screen/ software, £250. CBM 64 plus CN2 cassette, £70. 08012 2770 (Northants).

● ERICSSON STEP-ONE. 256k RAM, 2×720k d/drives. MS DOS 2.11, Pascal, CPM 86, aviterm. Long persistence green screen, £250. CBM 610, 128k RAM, LP 8250 2Mb drive. No screen, no software. £250. Tel 08012 2770 (Northants).

● APPLE IIc. With manuals, TV modulator, cables, joy stick, and about 40 disks of games and software. £275.00. (01) 998 7088.

● LEARN C FOR £350. Brilliant tutorial book, QL computer, book, 3.5" drive, colour monitor and award winning Metacomo C. I enjoyed it. Tel David Jewson, Norwich (0603) 31858.

● BBC B. Double sided double density 80 track drive. ADFS, DDFS, Watford ROM/RAM (32k) board. Plus GXR, ISO Pascal, Forth 83, ADE Assembler ROMS. £400 o.n.o. Barrie (0473) 645368 9-5pm.

● FOR SALE: Sirius with 10 Mbyte hard disk, £850. Sirius with 2 × 660k floppy disks, £450. Includes manuals. Also Apricot F range mouse, £40, and Apricot F1 manual, £25. Tel: Chris (01) 394 1766.

● AMSTRAD SOFTWARE AND BOOKS. Pascal MT+, £20. ProPascal, £25. CPM+ handbook, £10. The Amstrad CPM+, £5. Also 6128 serial interface, £20. All above boxed as new. Tel Dunbar 63332 after 6.

● MACINTOSH 512k, 800k disk drive. 9 months old, as new, £1000. Tel: (01) 226 1985.

● SUPERBRAIN. Working order. Basic Wstar. Plus possible purchase of accounts package. Any reasonable, sensible offer considered. tel 0342 316459.

● TRS-80 MODEL III. 84k, twin disk drives, RS232 and Centronic ports, manuals, printer cable, Visicalc, DOSplus and comms software. Some extra disks thrown in, 115 V.AC, anti-glare panel, £225. Tel: (0539) 26909.

● BBC MODEL B. Watford DFS Twin 80 track 800k disk drives, ATPL ROM board, 16k sideways RAM, Watford NLQ designer ROM. Books, Micro & Acorn User from issue 1, £400.00. A.G. Kiernan, Chamberlain Hall, Bassett, Southampton.

● ATARI SYSTEM: 600XL computer, 64k memory expansion, tape unit, disk drive, £160. Various games, mainly tape, £80. Tel Jeremy (01) 876 1441 Eves. Would prefer to sell all but offers taken!

● HEWLETT PACKARD 9826 COMPUTER. With RS.232 card, manuals, various disks including: Basic 2.0, utilities 1 and 2. Needs power board. Reasonable offers to BOB 025485 2685. Nr. Preston.

● ACORN ELECTRON. With Plus 3 Disk drive, Plus 1, monitor, Joystick, trackball, tape recorder, 20 disks. Lots of software on disk and tape. £500. (0933) 58122 Eves only.

● PET 3032+ 4040 DISK. CMB C64 + 1541 disk + 1525 printer. Lots of software. SAE for list. 14 Hillview Road, W-S-M Avon. BS23 3HS. Tel 0934 412178.

● FOR SALE: XT compatible, 640k RAM. 20MB hard disk, 10MB tape streamer, 360k floppy, business software, hardly used, £890 ono. Tel Hussain, Day 572 3411 eves 890-2702.

● APPLE MACINTOSH PLUS. 11 months old, (upgrading), perfect condition, games, siwtcher, RAMdisk, fonts, other software included. £1450. Tel: Cambridge 0223-328408.

● AMSTRAD Pub stocktaking program. Only £50. Tel (061) 428 5796.

● AMSTRAD CPC464. Colour monitor, diskdrive, speech synthesizer, graphics, lightpen, software copier, joystick, over 150 software titles on disk and tape. Price negotiable. Best offer. Tel: (01) 674 7210 between 6-8pm.

● OLIVETTI M20 COMPUTER. With DW195100 printers and manuals included. Perfect working order, £500 each. Will sell separately. Tel 0494 26426. Vivien. Daytime.

● NEWBRAIN AD + 64k EXPANSION. With CPM, disk controller, disk drive, Hitachi 8" monitor, Star dot matrix printer, power supplies, leads, technical manuals, books, disks, paper. £400 o.n.o. Tel: 0372 56519 delivery possible.

● COMMODORE 4023 PRINTER. New, boxed, (kept as spare but never used). £150 only. Also a couple of IEEE cables, £15. Superscript II (for 700/8250/ 8050) £40. Please contact: Lionel Tun (01) 928 3065.

● NORTHSTAR HORIZON. 64k, 2 × 5¼" floppy disk drives, high quality Volker-Craig monochrome (green) monitor. Northstar, DOS/ Basic, manuals, plus 20 disks. £200 o.n.o. Tel: (01) 348 5741.

● SIRIUS SOFTWARE CLEAROUT. Send s.a.e. for list. Sharps, PC-1211 pocket computers and CE-122 printer. No reasonable offer refused. Keith 27 Moor Allerton Drive, Leeds, LS17 6RY (0532) 66443.

● AS NEW. Microvitec 1451DQ3 medium resolution, colour, monitor. (For Sinclair QL). Complete with eleven months guarantee. £150. Preston (0772) 455281.

● LOGI-TEC COMPATIBLE MOUSE FOR SALE. Three available, brand new with all adaptors, IBM PC/XT/AT compatible. Connects Com 1 & keyboard. Only £40. Send address and tel no. to A. Willerton, 15 Jordan Way, Stone, Staffordshire.

● LATEST WORDSTAR PROFESSIONAL RELEASE 4.0. UK non-copy protected, £200. (List £399 +VAT). Unused, sealed. NEWWORD.3, £120. (List £299). GEM-WRITE, sealed, £45. Various games £15 ea. Thomas Malinowski, (01) 429-7440. 41 Beck Rd, London, E.8. 4RE.

● SHARP MZ80A. With tapes, manuals, books, word P, broken eject key. £75.00. Epson MX82F/T printer, with Sharp interface, £25. Will split. Tel (01) 478 6668 Eves.

● APPLE II+. Two drives, BMC monitor, MX80 printer, 96k memory, 80 col. screen, Z80 card, RS232 interface, business and games software, (Zork I, II & III, Wizadry I, II & III, Visicalc, TLO, Pascal 2.2, ect). Only £500 o.n.o. 0948 2676.

● APPLE III. 256k RAM, monitor III, built-ind isk drive. Basic, Pascal, Visicalc, business graphics, comms, Apple II+ emulation. £250. Additional disk drive, £75. Tel: Itchen Abbas (096 278) 619 Eves.

● SHARP MZ80B 64k RAM, built-in screen, cassette. Printer, disk cards, £150. Commodore 710, 128k RAM, screen, detachable keyboard. Basic 4, RS232, IEEE 488, parallel, user, cartridge ports. £125. Tel 096 278 Hants. 619.

● SINCLAIR QL. Plus Sanyo green monitor, Centronics interface, 30 microdrive cartridges and RAM disk software. Boxed plus manuals, £225. Will split. Tel: 051 931 4284

TRANSACTION FILE ADVERTISEMENT FORM

All Transaction File ads must be submitted by readers on this form or a photocopy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £5. Make cheques or POs payable to *Personal Computer World*. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to help you by printing your ad very clearly. Send your completed form to: Transaction File, *PCW*, 32-34 Broadwick Street, London W1A 2HG.

Please find enclosed my cheque/PO for £5 for the following Transaction File ad.

As from the July issue of *PCW*, all Transaction File ads will be divided into categories. Please tick the appropriate category for your ad from those listed here:

Acorn ☐ Amstrad ☐ Apricot ☐ Atari ☐ Commodore ☐ CP/M ☐ IBM & Compatibles ☐ Miscellaneous ☐ Monitors ☐ Peripherals ☐ Portables ☐ Printers & Plotters ☐ Sinclair ☐ Software ☐ Sharp ☐ Tandy ☐ Wanted ☐

TRANSACTION FILE

(Liverpool) Eves.
● HEWLETT PACKARD HP41CV. Programmable multi function calculator, mint, boxed, three manuals, continuous memory, high quality keyboard, Alpha numeric display, (retail £170) only £95.00. Tel Ruislip 635588.
● BBC B. Econet, Basic 2, OS1.2, DFS and NFS chips. DNFS. £290. ATPL ROM board plus 16k, battery, switch, £39. View 2.1, £22.00. Communicatur, £22.00. CCGraph, £13. Printmaster, £13. Oxford Pascal, £33. 0273 475499.
● APPLE IIE NETWORK SYSTEM. 2 C.P.U's plus 10MEG SYMBFile, SYMBNet cards, imagewriter, serial card, 80 col cards, Applewriter software. Two years old, cost over £6000. Offers! Tel (01) 637 4834.
● AS NEW. IBM/PC. Hard disk, 360k floppy, 640k RAM, mono monitor. New IBM colour printer, IBM spreadsheet, wordprocessor, IBM Basic, DOS 3.2. All original IBM. Bargain at £1,495. Tel: Jutta on (01) 402 0523/388 1620.
● APPLE MACINTOSH 512. External 400k drive, write and print, public domain software, £1200. Tel 061 998 4715.
● BBC Model-B. Opus Challenger, 256k RAM, disk and 800k 40/80 track drive. Sanyo Hi-Res mono monitor, voltmace joystick, 10 disks, some software, manuals. £490 o.n.o. David (01) 940 5550 Eves.
● APPLE IIe CAD SYSTEM. Robo 1500E 128k monitor, two disk drives. Bitstick, Epson, FX100 printer, A3 plotter. Appléworks and other software. Approximately 1 year old. offers region £1,000. Tel (01) 833 1183.
● ATARI 1040ST COLOUR SYSTEM. With £550 of software and documentation. A bargain at £899 o.n.o. Will deliver. Tel: 0280 813467.
● BBC 'B'. DFS, high res monitor, disk drive, tape recorder, joystick, dustcover. Hours of tape games. Was £900. Accept £400 o.n.o. For quick sale. Tel (01) 764 7402 ask for Martin.
● TELETYPE PRINTER MODEL 3321 3WF. Mounted on detachable stand. Includes paper tape punch and reader. Runs from RS232 serial interface via internal current loop. £35 o.n.o. Tel: 041 772 5286.
● TANDY 1000 EX COLOUR SYSTEM. With deskmate software. Only five months old, 256k RAM, 360k built-in DDFD; 128k DMA speed-up expansion board; total cost new; £775. Bargain @ £650. Tel (0222) 707147.
● PHILIPS P2012C PORTABLE. CPM 2.2, MSDOS 2.11 computer. Twin 800k floppies, 512k RAM, manuals, wordstar, calcstar, Basic, Dataplot, BasicA, WP etc. Will read/write IBM and other formats. Two serial ports. £500 o.n.o. (01) 659 6175 Eves.
● APRICOT PORTABLE 256k. 720k disk, with case, voice, etc. Superplanner, Supercalc, Superwriter, MSBasic. Perfect condition, only £175. 08277 3350 or call 57 Ainsdale Close, Aldermans Green, Coventry. Andy.
● COMPLETE COMPRUPRO 10MHz 680000 system. Including VDU. 256k RAM, 2.4 MB floppies, interfacer 4 and system support. Supports CPM68k, C. Forth, assembler. Sell below half price for £1700. Tel (0291) 424686.
● IBM PC, mono, twin floppy disk. All manuals and boxes. Epson matrix printer. All in mint condition. £850. Tel: (0843) 603478.
● QL 384k. Microvitec colour monitor, twin 3½" disk drives, mouse. Turbo compiler, editor, ICE ROM, choice, Metacomco assembler, EYE-Q, etc. QL books, magazines. £350 o.n.o. Tel: John Whiting 0206 564042.
● APPLE 2E 64k. Single disk. Green Kaga monitor. Epson RX-80F/T. 80 col card, Cirtech printer card. Apple works, Apple writer. Hardly used. 061 439 6939 after 6 pm. £750.
● APPLE II+ COMPATIBLE. 64k, twin disks, Z80, 80col, 16k parallel printer, Eprom programmer, serial, talk, PAL cards. Over £3000 worth of software, manuals, etc. £450.00 o.n.o. Tel (0222) 864614.
● TRS80MODEL II. Expansion interface, monitor, disk drive. Lots of books, 80 micros, disks and cassettes. Printer. Tel Lawrence (01) 656 3964 Eves. Priced low to clear. Will split.
● IRWIN 20Mb EXTERNAL TAPE STREAMER. For IBM-XT, +5 tapes, software, interface card, cables. As new. £550 o.n.o. Tel: Taunton (0823) 71422.
● IBM COMPATIBLE COMPUTER. 640k RAM, 20Mb disk, 1×360k F/D, amber monitor, AT-style keyboard, Hercules compatible graphics, 6/8 MHz switchable, 3 printer ports. Hardly used, under warranty. £750 o.n.o. Tel: (0823) 71422.
● SHARP MZ-80A, MZ80k and MZ-700 software. Business, games and languages. Basic, Pascal, Assembler. Disassembler. On tape and disk. Also Centronics and RS232 for MZ-80A. Write: N.D. Ainge, 1 Percy Road, London, N12 8BY.

END

LEISURE LINES

Brainteasers courtesy of JJ Clessa

Prize puzzle

A simple optimisation problem this month. Starting at any square in the first column of the grid shown, proceed to the next column, and so on, until you reach the right-hand edge of the grid. Add up the values in each square that you have entered. The prize will be awarded to the entrant whose total score is the highest. All moves must be in an East, North East, or South East direction — that is only 12 squares may be traversed.

Answers on postcards please, or backs of envelopes only, to reach PCW, Leisure Lines June 1987, 32-34 Broadwick Street, London W1A 2HG, no later than 30 June 1987.

29	35	35	22	30	33	39	25	23	38	22	23
32	22	40	30	33	33	29	38	31	25	36	27
35	25	30	35	31	24	37	39	22	22	30	29
38	27	28	22	38	26	36	29	34	40	39	33
24	40	26	30	24	36	38	38	32	22	40	23
27	29	40	23	31	29	30	23	28	37	36	26
21	36	29	40	23	38	24	23	40	36	21	32
35	37	37	22	36	39	33	28	38	37	37	31
35	34	22	27	33	29	40	28	33	26	28	40
32	23	31	32	23	39	21	25	35	34	29	31
30	35	34	34	33	37	23	35	36	35	31	25
21	34	35	23	33	33	38	32	31	24	35	34

March prize puzzle winner

This month's puzzle in logic was obviously more difficult than usual; even though several different answers were possible, only 36 entries were received. Although logic puzzles are not usually well-supported, several readers have specifically asked for them, so we do try to include them from time to time.

The winning entry came all the way from Warsaw in Poland. The winner's name was Withold Bielecki. Congratulations — your prize is on its way. Mr Bielecki's winning solution was:

	A	B	C	D	E	F	G
Shorthand	46	36	30	56	47	32	42
Typing	29	40	47	22	32	48	39
Total	75	76	77	78	79	80	81

Quickie

Can you find a single word anagram of CHESTY?

No prizes for this one.

END

MICROCHESS

A national team of chess computers was in action recently, with a match between England Computers and England Juniors. Kevin O'Connell observed the action.

The world's first ever chess match featuring a national team of chess computers was played earlier this year in Bath. England Computers played England Juniors over six boards in a two-leg match sponsored by Mindscape. This was a chess 'first' which will probably surpass in importance the first game of chess played between Earth and Space (a couple of cosmonauts in a Soviet spacecraft) more than a decade ago.

The final score of 6½-5½ in favour of the computers has left the humans thirsting for revenge. It did not seem probable that the final scoreline would be so close after the computers won the first round by 5-1, conceding just two draws to their human opponents. However, the star-studded junior line-up showed great resilience and fought back wonderfully well in the second round.

As chairman of the World Chess Federation's Computer Chess Committee, it was my pleasure to organise this match, which was sponsored by Mindscape Inc, a US desktop publishing, personal productivity and educational software publisher from Chicago. Mindscape's involvement with an English event is explained by the facts that they had recently published Laptop Chess, one of the computer team; and that the company president was born just a few miles from Bath.

On top board the reigning World Microcomputer Champion, Mephisto Dallas, programmed by Richard Lang, scored a win and a loss against James Akehurst, the Lloyds Bank National Junior Squad Under-14 Champion.

On second board, Cyrus 68K, programmed by Mark Taylor of Intelligent Chess Software, beat one and lost to the other of the joint British Under-15 Champions . . . Jonathan Rogers and Graeme Buckley respectively.

On third board, Advance, programmed by Dave Wilson, won one and lost one to Simon Pain, a top Manchester junior.

On board four, Natasha Regan, the Lloyds Bank National Girls Under-16 Champion, struck a blow for women's chess by defeating, by a draw and a win, Colossus 4, programmed by Martin Bryant.

On fifth board, Chess Champion Mark V, the computer reserve (playing in place of Don Beal's BCP) drew both games against Julie Harwar, an England girls international. This was a very creditable performance by the veteran computer (1981 Microcomputer World Champion and another product of Intelligent Chess Software's programmers).

On board six, Mindscape's Laptop Chess, again programmed by Intelligent Chess Software, won both games against Jack Rudd, the reigning England Junior Squad Under-7 Champion and a possible future star of the calibre of Nigel Short.

Aside from the computers, which were delighted with the conditions (no spikes) and the result, no doubt the girls are happy because they also made a plus score while the boys lost 3-5. The humans are now anxious for revenge, so I expect that a return match will soon be in the offing. The computers are ready . . . anytime that they can be plugged in!

The game which follows was played on board three in the second round. It shows the human taking advantage of a demonstrable weakness of the program . . . it does not give enough weight to king safety.

White: Simon Pain. Black: Advance. Opening: French Defence.

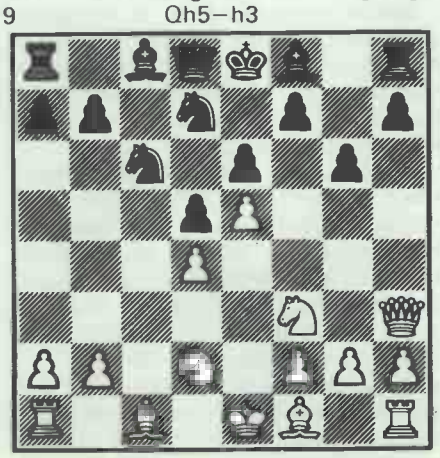
1	e2–e4	e7–e6
2	d2–d4	d7–d5
3	Nb1–d2	Ng8–f6
4	e4–e5	

A real hiccough occurred here. Advance consulted its opening book, found that it was supposed to be playing e6–e5, correctly ascertained that the move was illegal (it was a typographical error), exited its book and was on its own from here.

4	. . .	Nf6–d7
5	Qd1–h5?	

Advance would normally have played 5 f2–f4, the move in its book. The text is weak.

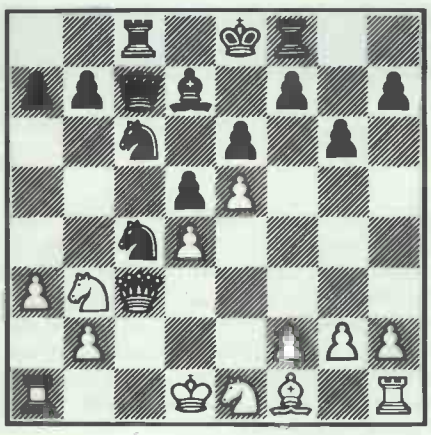
5	. . .	c7–c5
6	c2–c3	c5×d4
7	c3×d4	Nb8–c6
8	Ng1–f3	g7–g6
9	Qh5–h3	



9	. . .	Nc6–b4

The threatened knight fork on c2 forces White to give up castling rights.

10	Kel–d1	Qd8–c7
11	Nf3–e1	Nd7–b6
12	Nd2–b3	Bc8–d7
13	a2–a3	Nb4–c6
14	Bc1–h6	Nb6–c4
15	Bh6×f8	Rh8×f8
16	Qhc–c3	Ra8–c8



17	Bf1×c4	

Apparently winning a pawn, but . . .

17	. . .	d5×c4
18	Qc3×c4	Qc7–b6

This ensures that Black regains the pawn. The immediate threat is 19 . . . Nc6×e5, discovering an attack on the white queen from the rook on c8.

19	Qc4–d3	Nc6×e5!
20	d4×e5	Bd7–a4

Not only regaining the piece, but also threatening to win the queen with Rc8–d8.

21	Qd3–e3	Ba4×b3+
22	Kd1–d2	Qb6–a5+
23	Kd2–e2	Bb3–c4+
24	Ke2–f3	f7–f5
25	e5×f6?	

Advance played this on positional grounds, by its own reckoning. The *en passant* capture eliminates White's attacked e-pawn and creates an isolated black e-pawn. That much is true, but it is more than outweighed by the opening up of the position which enables Black to continue his king hunt.

25	. . .	Rf8×f6+
26	Kf3–g3	Qa5–c7+
27	Kg3–h3	

If 27 f2–f4, 27 . . . g6–g5 is deadly.

27	. . .	e6–e5
28	Qe3×a7?	

Another mistake. 28 Ra1–d1, keeping the queen centrally placed to help defend the king, would have

END ZONE

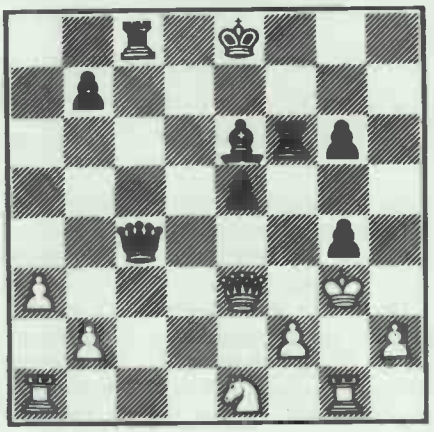
MICROCHESS

been better.

28	...	Bc4–e6+
29	g2–g4	Qc7–c4
30	Rh1–g1	h7–h5
31	Qa7–e3	

The queen comes back, but Black has had two free moves to increase his attack.

31	...	h5×g4+
32	Kh3–g3	
32	...	Qc4–f4+
33	Qe3×f4	e5×f4+
34	Kg3–h4	



This hastens the end, but 34 Kg3–g2 also loses to 34 . . . Be6–d5+ 35 f2–f3 (or 35 Kg2–f1 f4–f3 36 Rg1–h1 Bd5–c4+ 37 Kf1–g1 Bc4–e2 and White is completely tied up) 35 . . . g4×f3+ 36 Kg2–f2 (on 36 Ne1×f3, Rc8–c2+ wins everything) 36 . . . Rf6–b6 (this is important because it opens up the seventh rank) 37 b2–b4 Rb6–e6 and Black wins: for example, 38 Rg1–g5 Re6–e2+ 39 Kf2–f1 Bd5–c4 40 Ne1×f3 Re2–a2+.

34	...	Ke8–f7
35	Kh4–g5	Rc8–h8
36	0–1	

White cannot avoid being mated by Rh8–h5. END

NUMBERS COUNT

Mike Mudge sets two different problems this month and asks readers to let him know which they prefer.

This month's 'Numbers Count' displays two totally different types of problem in empirical number theory. Readers are, as usual, invited to submit attempts at solution to either (or both) of the problems posed; but are also invited to indicate which subject area they prefer, hopefully with some logical reasoning.

Problem I:

The Left Factorial Function

Recall that factorial n, where n is a positive integer, is defined by: n! = 1.2.3.4.5.6. . . . n thus 6! = 720, 10! = 3628800.

Further, 0! = 1 by definition.

Following D Kurepa we write the left factorial function thus:

!n = 0! + 1! + 2! + 3! + . .+(n−1)!

thus: !6=0! + 1! + 2! + 3! + 4! + 5!

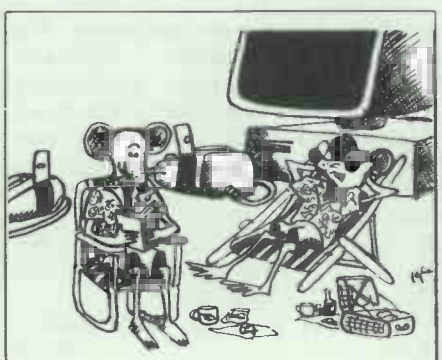
hence: !6=154 and !11 = 4037914

Is !n ever divisible by n (without remainder) if n is greater than 2? The conjecture is that the highest common factor of !n and n! is 2.

Further following SS Wagstaff we write:

$B_n = !(n+1) - 1$

$B_n = 1! + 2! + 3! + \ldots + n!$



'I just love Bank Holidays, don't you, Squeaky?'

and observe that 3 is a factor of B_n if n is greater than 1, that 9 is a factor of B_n if n is greater than 4 and that 99 is a factor of B_n if n is greater than 9. How does this generalise?

Problem II:

On a Congruence of Mok-Kong Shen

Recall that two integers a and b are said to be congruent modulo a third integer c if and only if a − b is divisible (without remainder) by c; we write $a \equiv b$ (modulo c), for example $98 \equiv 46$ (modulo 13) because 98 − 46 = 52 = 4.13.

A Rotkiewicz (1984) asked for all solutions of the congruence: $2^{n-2} \equiv 1$ (modulo n). Five solutions are known in the interval 3, 10^6). The smallest is 20737 and the largest is 540857. What are the others?

Mok-Kong Shen (1986) has shown that there are infinitely many positive integers k such that the congruence $2^{n-k} \equiv 1$ (modulo n) has infinitely many solutions for n; however, it remains an open question whether there are infinitely many solutions for n for *all* positive integers k.

While realising that a computer can never find an infinite number of solutions to any problem, how would the solutions to Shen's congruence be efficiently calculated within a given interval for n?

Readers are encouraged to send their thoughts, together with complete or partial attempts at the solutions to either of the above problems, to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Staffordshire WV4 5NF, tel: (0902) 892141, to arrive by 1 September 1987.

It would be appreciated if such submissions contained a brief summary of results obtained in a form suitable for publication in *PCW*. These submissions will be judged using subjective criteria, and a prize will be awarded by *PCW* to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

Review: December '86

Readers wishing to pursue the connection between The Fermat Quotient and Fermat's Last Theorem are referred to *13 Lectures on Fermat's Last Theorem* by Paulo Ribenboim (Springer-Verlag 1979) while those interested in the computations of Brillhart, Tonascia and Weinberger mentioned in *PCW* (December 1986 page 250/51) should consult *Computers in Number Theory* edited by AOL Atkin and BJ Birch (Academic Press 1971, pages 213/222).

This month's prizewinner is Ray Davies of 33 Windrush Crescent, Barrow-in-Furness, Cumbria LA14 3UJ. Ray used Basic on his BBC and concentrated entirely on the algorithm for solving $a^{p-1} \equiv 1$ (mod p^2) for p prime and different values of a. p is restricted to being less than 2^{15} to avoid integer overflow and the submission contained, in addition to listings and output a significant amount of theoretical background.

Mike Mudge welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or particular, for future Numbers Count articles; all letters will be answered in due course.

Isolated readers can be put into contact with others sharing the same interests. However, greater efficiency regarding published problems should result from contacting the prizewinner directly. END

USER GROUPS

Rupert Steele presents this month's club news, and welcomes advice on, and contributions to, the new Directory of User Groups

The User Groups column has changed to a new format. The news from around the clubs will stay, although I shall be incorporating slightly more detailed features on specific groups as well as the more general news. The main new item is the Directory of User Groups (which will be published next month) and which is intended to allow you to look up a user group which may be able to help you solve a problem. The directory has been compiled from advertisements and recent correspondence, and while I have taken good care in compiling it, I obviously can't guarantee the quality of service from all the groups listed, or that every entry will be fully up to date. Over the next few months, the directory will be extended and periodically re-checked with the groups themselves, but I would be grateful to hear from readers whether or not they like the format, and whether they have any additions or amendments.

User group news

Martin Houston has written to me about the C Users' Group (UK), often known as CUG (UK). The group aims to be of interest to professional C users and those who have home machines capable of running C compilers, and was founded some twelve months ago through *PCW*. The group has a software library which contains a collection of useful utilities, games and other knick-knacks in the form of 'C' source code. This software should, therefore, be portable across a wide range of machines. The library material is distributed on standard PC-DOS format disks, reflecting the large number of PC-style machine users in the group. Other members have Sinclair QLs, a few Amstrads, and Unix/Xenix systems. Martin hopes to operate a dial-in service with the library on his Xen Xenix system so that members may peruse the library over the phone and download what they want.

'And how long have you thought that someone has been watching you?'

The *CUG (UK) Newsletter* serves as the usual forum for hints and tips, as well as reviews. The C language is so flexible that there are several dozen possible solutions to a problem: so, it's very important for programmers to refresh themselves occasionally by having to grasp someone else's programming style. Indeed, to the experienced eye, the style of a C program is almost as distinctive as the handwriting of its author, as the scope for varying syntax and layout is so great. There are also reviews of C-orientated products such as compilers, and some shorter programs selected from the library.

The subscription is £10 per annum for individuals, or £50 a year for corporate members. More details are available from Martin Houston, 36 Whetstone Close, Farquhar Road, Edgbaston, Birmingham B15 2QN.

Peter GQ Brooks has also written, about his International TI User Group — closely related to the West Midlands & Oxon TI User Group. The group began life in early 1984, following the demise of the original TI group, TIHOME. It has been growing ever since, and recently took on its new name. The group is reputed to comprise some 200,000 owners of the TI99/4a in the UK alone, and possibly four million worldwide. There is now a considerable range of software and hardware, both commercial and public domain, available for the machine. Two upgrades for the TI99/4a are expected this year: a new 9995-based computer on a card to sit in the peripheral expansion box and supplied with Pascal as standard, capable of running 95 per cent of existing 99/4a software; and a PC clone on a card, also designed to sit in the PCB. Languages available include Pascal, TI Forth, Small C, Pilot, 9900 assembly code and GPL — the graphic programming language. So, you have plenty of alternatives to Basic-in-ROM.

The group caters largely for the user who has an expanded 99/4a, although there is some material directed to the user with just the bare console. There is a monthly newsletter, *International TI-LINES*, which aims to keep members informed of the developments, and reference articles are published for the solder jockey and novice owner alike.

The group aims to cater for every interest, recognising, however, that this is easier said than done! The subscription year begins in June, but new subscribers are welcome at any time. The policy is to provide all new subscribers with the issues in the current volume that have been published to date. This practice, adopted by many newsletter clubs, reduces administrative costs by avoiding staggered renewals. All advertisements in *TI-LINES*, whether private or commercial, are free of charge, to ensure the widest possible range of contacts available to the members.

The current subscription is £11 a year for UK residents, and £12 for overseas (surface mail). New subscribers are offered a free copy of *Mastering the TI-99* by Peter, who has 500 copies available and would quite like to give some away through this scheme, so as to allow free passage through his living room! For more information about ITUG and the West Midlands/Oxon TI User Group, consult the directory or contact Peter directly at 96 Banbury Road, Oxford OX2 6JT.

And finally, news from a couple of local clubs: I am pleased to announce the formation of a new local club for the Plymouth area, specialising in the Atari ST machines. It is called the South West ST User Club and will meet at the Computer Centre in the General Teaching Block of Plymouth Polytechnic on the second Tuesday of each month. If you are interested, contact the secretary, Karl Fuller, 289 Fort Austin Avenue, Crownhill, Plymouth, Devon PL6 5ST; or you can call him on (0752) 773482.

Philip Ramage has written from the Croydon Apple User Group. One particularly interesting point in Philip's newsletter was that one of his members had an application which would part justify the use of an Apple Mac for drawings/design (with a laserprinter). The member is looking for two or three others who might take shares in the machine. Anyone interested in that, or in the club itself, should contact Philip at 515 Limpfield Road, Warlingham, Croydon CR3 9LE or call him on (08832) 6715.

If you would like your user group or club to have a mention in this column, or you wish to be considered for the Directory of User and Support Groups, please write to Rupert Steele, 12 Philbeach Gardens, London SW5 9DY. END

END ZONE

UK BULLETIN BOARDS

An up-to-date list of UK bulletin boards, compiled by Peter Tootill.

(0001) 764 942 Infomatique, Dublin
MF:10pm-6pm ; WE:10pm-6pm,3/1275
Amiga based
(0001) 854 522 Dublin Fido
24 hrs. 3-24
(0001) 885 634 DUBBS, Dublin
MF:8pm-8am ; WE:24hrs. 3-24
First BBS in Eire. Amiga based
(0001) 903 341 IACCBBS, Eire
24 hrs, 300bd.
Irish ACC. Runs on Commodore 64
(01) 200 3439 Airtel TBBS, London
24 hrs, 3/1275. Has a pilots area.
(01) 200 7577 Hendon Fido, London
24 hrs. 3/1275. Also (01) 220 8281
Opus system (FIDO clone)
(01) 207 2989 Dark Crystal Fido, London
24 hours, 3-12
(01) 248 5747 Prestel, London
24 hours, 300 bd.
No graphics on this number.
(01) 346 7150 Marctel, London
24hrs,3/1275
FBBS system.
(01) 348 9400 TBBS London
24hrs, 3-12
(01) 399 2136 MG-Net, London
Only open Sun 5pm-10pm. 300
(01) 429 3047 OSI Lives!, London
24 hrs RING BACK. 300.
(01) 450 9764 Techno Line, London
24hrs. 1275v. Commercial
(01) 452 1500 Techno-line 2, London
Evenings 24hrs 1275v Commercial
(01) 455 6607 NNBBS London
24hrs 3/1275
(01) 542 3772 WBBS Wimbledon, London
Sat 7pm-Mon 8am 3/1275
(01) 542 4977 TBBS Rovoreed, London
24hrs 3-24
(01) 543 7020 Dataflex Fido, S.London
24hrs 3/1275
(01) 573 8822 Taecom, London
MF:7pm-8am. All day Sun. 300
Interak micro section.
(01) 580 1690 Poly Fido, London
24hrs. 3-12
(01) 624 5338 Twighlight Phone,London
24hrs. 300. Fido.
(01) 638 2034 CyberZone, London
24hrs. 300.
(01) 648 0018 MBBS Mitcham, London
24hrs. 3/1275
(01) 659 6992 Link Fido, London
24hrs. 3-12
(01) 735 6153 Brixton ITeC, London
24hrs. 1275
(01) 863 0198 London Underground
24hrs. 3-12. Opus system.
Amiga, Atari ST , IBM sigs
(01) 883 5290 NBBS London
24 hrs. 3/1275
(01) 886 2813 Crystal Tower, London
24hrs. 3-24. Apple, IBM and more.
(01) 888 8894 Gnome at home, London
24hrs. 1275v
Home of the Micrognome
(01) 927 5820 Owltel, London
24hrs. 1275v
(01) 941 4285 Metrotel, London
24hrs. 1275v
(01) 960 4742 ITCU Exchange & Mart
24hrs 1275v ITeCs central system
(01) 968 7402 Communitel, London
24hrs. 1275v
(01) 985 3322 Hackney BBS, London
24hrs. 1275v
(01) 986 4360 Health data, London
24hrs. 1275v
(0204) 43082 Bolton BBS
MF:8pm-8am ; WE: 24hrs. 8am-8pm
RING BACK. 3-24.
(0206) 862 354 Pete's Place, Colchester
24hrs. 3/1275. Opus system.
(021) 430 3761 CBABBS, Birmingham
24hrs. Not Thurs. 300
Atari based. Mail to Canada
(021) 444 1484 TUG II, Birmingham
24hrs. 3/1275
Amstrad, Tandy, online Adventure
(021) 476 9881 Infocom BBS, Birmingham
24hrs. 3/1275
On-Line games, adult stories, BBC
(0222) 464 725 Cardiff ITeC
24hrs. 1275v
(0223) 243 642 Acorn BBS, Cambridge
24hrs. 1275v
(0224) 641 585 ABERDEEN ITEC
24hrs. 1275v
(0224) 781 919 Aberdeen Commodore
24hrs. 300
Commodore 64 based
(0247) 455 162 SBBS II (Irish Man).
MF:9pm-11pm RING BACK
WE:11pm-9am RING BACK
3/1275
(0247) 467 863 Deep Thought Fido, Bangor
24hrs. 3-24
PC-DOS, CP/M, BBC,Tech.help sigs
(0258) 54 494 TBBS Blandford, Dorset
24hrs. 300
Blandford Computers
(0268) 22 177 BITEC, Basildon ITeC
24hrs. 1275v
Also on (0268) 25122
(0272) 421 196 Octopus, Bristol
MF:6pm-6.30am ; WE:24hrs. 3/1275
(0274) 480 452 OBBS Bradford
24hrs. 3/1275. Colour for BBC users
(0277) 228 867 NBBS Essex, Brentwood
24hrs. 3/1275
Subscribers only
(0295) 720 812 Bloxam Board
10pm-1am every day. 300
(0367) 81 507 Trinity 2, Faringdon Ox
24hrs. 3/1275
Sponsored by Courier Consultancy
(0376) 518 818 ARCNET, Colchester
24hrs. 300
(0384) 635 336 West Midlands, Stourport
6pm-8am every day. 300
TBBS system
(0392) 53 116 CBBS South West, Exeter
24hrs. 3/1275
(0394) 276 306 BABBS, Felixstow
24hrs. 3-12
(0395) 272 611 Trinity 1, Exmouth
24hrs. 3-12
(0401) 50 745 MBBS Leconfield
24hrs. 3/1275
(041) 956 6537 People's Palace, Glasgow
6pm-8am every day. 3/1275 Colour
(0443) 733 343 MGBBS Mid Glamorgan, Ferndale
6pm-1am every day. 300
Used to be on 0443 755298
(0463) 231 339 Betelgeuse 5, Inverness
24hrs. 3/1275
(0482) 465 150 Hamnet, Hull
MF:6pm-8am ; WE:24 hrs. 3/1275
Radio Hams' area
(0482) 859 169 Forum-80, Hull
MF:7pm-11pm ; WE:1pm-11pm 3/1275
Midnight - 8am on Bell 103 tones.
(0483) 573 337 Compulink CIX, Guildford
24hrs. 3-24. Multi-user. CoSy system.
Also on 0483 573338
(04862) 25 174 PBBS 'Adult' BBS, Mitcham
24hrs. 3/1275
(0492) 49 194 Cymrutel, Colwyn Bay
24hrs. 1275
(0506) 38 526 Livingstone BBS
24hrs. 300
(051) 220 3761 Fido Compulink North, Liverpool
24hrs. 3/1275
(051) 428 8924 Liverpool Mailbox, Liverpool
24hrs. 3-24
Britain's first 24 hr system
(0524) 60 399 CNOL, Lancaster
24hrs. 300
Clinical Notes OnLine - BBS for medics
(0532) 600 749 L.E.M.S Fido, Leeds
10pm-8am every day. 3/1275
(0534) 39 389 Jersey Fido
24hrs. 3/1275
(0592) 860 313 JMBBS Amstrad BBS, Fife
9.30pm-8am every day. 300
Sponsored by John Menzies
(0602) 811 950 MacTel Green Box, Nottingham
24hrs. 3-24
For Macintosh users
(0602) 817 696 MacTel HQ, Nottingham
24hrs. 3-12
For Macintosh Users
(0604) 20 441 Norview, Northants
24hrs. 1275v
(061) 427 1596 OBBS Manchester
24hrs. 3/1275
(061) 494 6938 Fido TeePee link, Manchester
24hrs. 3-24
(061) 773 7739 Fido Manchester
24hrs 3/1275
Mektronic Electronic design cons
(0625) 33 703 Telemac 15, Macclesfield
24hrs. 3/1275
(0628) 824 852 C.A.T.S. Fido, Maidenhead
24hrs. 3/1275 V22/bis shortly.
(0642) 481 643 System 2000 Comp Club, Redcar
7pm-7am every day. 300
(0642) 784 819 Fido Teeside, Cleveland
24hrs. 3/1275
(0698) 884 804 SABBS, Larkhall
24hrs. 300
Atari based system
(0702) 54 6373 C.View Rochford
24hrs 1275v
(0705) 524 805 Gosport Apricot BBS
24hrs. 300
(0705) 736 025 BBS09, Portsmouth
Weds:7pm-7am ; WE:24hrs 300
OS9, Sci-Fi sections
(0707) 52 242 RSGB, London
24hrs. 1275v
(0734) 484 847 Trinity 3, Reading
24hrs. 3/1275 TBBS system
(0742) 350 319 MacTel Sheffield
24hrs. 3-24 For Macintosh Users
(0762) 333 872 PBBS1 Portadown, N.Ireland
10pm-1am RING BACK every day. 300
(0766) 4154 Prometheus (Opus), Porthmadog
24hrs 3-24. ANSI colour graphics
(0767) 50 511 Fido Gamlingay, Sandy, Beds
24hrs. 3-24

UK BULLETIN BOARDS

(0782) 265 078 Stoke ITeC
24hrs. 1275v
(0792) 203 953 FBBS Swansea
24hrs. 300
(0792) 297 845 Bulletin AT Fido,
MF:6pm-9pm WE:24hrs 3-12
(0832) 73 003 Intel-Ace, Oundle
Swansea
MF:6pm-8am WE:24hrs 1275v
(0865) 882 872 Banat Board, Oxford
24hrs. 3-24
Opus - colour graphics for ANSI
(0874) 711 147 Communitree
24hrs 300
(0883) 844 164 LABBS
24hrs. 3/1275
The Prisoner - 2 lines
(08926) 61 149 PD-Sig Fido 1,
Crowborough
24hrs 3/1275
PD software interest group
(0895) 420 164 CBBS, London NW
24hrs 300
(0895) 52 685 London West Tech
24hrs. 3/1275 TBBS system
(0903) 212 552 Lasermail Fido
24hrs. 3/12
Subscribers only.
(0905) 52 536 Access Fido, Worcester
24hrs 3-24
Midi section
(0908) 668 398 Key Board, M.Keynes
MF:8pm-8am exc.Tue and Thurs.
WE:12h
Spectrum Micron BBS
(091) 477 3339 Log On the Tyne Fido
10pm-7am every day. 3/1275
(0923) 676 644 SBBS - Watford
MF:9pm-11pm ; WE:11pm-6am 3/1275
(0924) 442598 Kirklees ITeC, Batley
24hrs 1275v
Information Technology Centre
(0925) 411 265 OSI Health Line,
Warrington
24hrs 3-24
(0934) 29 570 Avon Fido, Weston S/Mare
24hrs 3/1275
(0936) 77 025 NBBS Cheshire
24hrs 3/1275
(0942) 609 611 Pyramid, Leigh, Lancs
24hrs 300

Note to sysops

If you want your BBS to appear in the list please send all the above details to Peter Tootill either by post or on Telecom Gold to 83:VNU202. Include a voice telephone number for verification purposes (this will not be published.) Any additions or updates will be gratefully received. END

Key to baud rates, etc
---

300 = 300 (V.21)
1275 = 1200/75 (V.23)
h = half duplex
v = viewdata graphics
12 = 1200/1200 (V.22)
24 = 2400/2400 (V.22bis)
3-12 = V.21,V.23,V.22
3-24 = V.21,V.23,V.22,V.22bis
MF = Monday-Friday times
WE = weekend times

DIARY DATA

A look ahead at computer shows throughout 1987. Readers are advised to check details before setting out on their journey.

COMPUTER NORTH G-Mex Complex, Manchester — Cahners Exhibitions (061) 832 4242	**27-29 May 1987**
COMMODORE COMPUTER SHOW Novotel, London — Database Exhibitions (061) 456 8835	**12-14 June 1987**
NETWORKS '87 Wembley Conference Centre, Middx — Online International (01) 868 4466	**16-18 June 1987**
SOFTWARE TOOLS '87 Wembley Conference Centre, Middx — Online International (01) 868 4466	**23-25 June 1987**
ELECTRONIC PUBLISHING AND PRINT SHOW '87 Wembley Conference Centre, Middx — Online International (01) 868 4466	**30 June-2 July 1987**
PC USER SHOW Olympia, London — EMAP International Exhibitions (01) 608 1161	**30 June-2 July 1987**
AMSTRAD COMPUTER SHOW Alexandra Palace, London — Database Exhibitions (061) 456 8383	**3-5 July 1987**
COMPUTERS IN MANUFACTURING SHOW (CIM) Olympia, London — Independent Exhibitions Ltd (01) 891 3426	**2-5 June 1987**
IBM SYSTEM USER SHOW Olympia 2, London — EMAP International Exhibitions (01) 608 1161	**2-4 September 1987**
PCW SHOW Olympia, London — Montbuild (01) 486 1951	**23-27 September 1987**
COMPUTER GRAPHICS '87 Wembley Conference Centre, London — Online Conferences Ltd (01) 868 4466	**13-15 October 1987**
AMSTRAD COMPUTER SHOW G-Mex, Manchester — Database Exhibitions (061) 456 8383	**23-25 October 1987**
DEC USER SHOW Barbican, London — EMAP International Exhibitions (01) 608 1161	**6-8 October 1987**
ELECTRON & BBC MICRO USER SHOW New Horticultural Hall, London — Database Exhibitions (061) 456 8383	**13-15 November 1987**
COMPEC Olympia, London — Cahners Exhibitions (01) 891 5051	**17-20 November 1987**
THE WHICH COMPUTER? SHOW NEC, Birmingham — Cahners Exhibitions (01) 891 5051	**19-22 January 1988** END

COMPUTER SUPPLIES
BEST QUALITY AT BEST PRICES

PAPER		PER BOX	1 BOX	5 PLUS
11 x 9.5	60 GSM PLN/MUS	2000	£11.90	£ 9.83
11 x 9.5	60 GSM MICRO P	2000	£12.40	£10.66
11 x 9.5	70 GSM MICRO P	2000	£13.90	£11.92
TRUE A4	90 GSM MICRO P	1500	£17.90	£16.10
11 x 14.5	60 GSM PLN/MUS	2000	£17.00	£12.65

11 x 9.5 CONQUEROR HI WHITE WOVE 100GSM		1 BOX
	500	£19.95
5 x 11 85GSM CONTINUOUS ENVELOPES	500	£14.95

MANY OTHER SHAPES AND WEIGHTS AVAILABLE

CONTINUOUS CHEQUES AND LETTER HEAD

LABELS

3.5 x 1 7/16	1000	£4.10
4 x 1 7/16	1000	£4.40
3.5 x 1 15/16	1000	£5.50

PARROT DISKS

5¼	10 PER BOX		
SS/DD	DS/DD	DS/QD	DS/HD
£12.40	£15.20	£19.50	£25.50

MORE QUANTITY MORE DISCOUNT

ALL PRICES INCLUDE DELIVERY ENG & WALES

PLEASE ADD VAT

RING FOR FULL PRICE LIST AND SAMPLES

VISA ****TRY US FOR SIZE****

PHONE CLP on 0258 89 400

BOX 18, BLANDFORD, DORSET, DT11 7YE

PSION PC FOUR

WORD PROCESSING — PC-QUILL

- Easy on-screen editing: fast search and replace. Display reflects print-out with complete range of type emphasis.
- Full text and page formatting facilities. Automatic page numbering. Headers and footers.
- Disk-based files permit massive documents.
- Mail merge – from file keyboard.

Plus many, many more invaluable features.

DATABASE — PC-ARCHIVE

- Up to 64k records per file, 255 fields per record, 255 characters per field. Any number of files up to the system capacity can be used at a time.
- Direct commands or powerful structured database language.
- Fast access. Fields redefinable at any time. Flexible file ordering, using up to four different fields.
- Format designer for screen and printed page.

SPREADSHEET — PC-ABACUS

- 999 rows, 255 columns, with efficient memory usage.
- Columns, rows and cells identified by textual content.
- Full format control.
- Split windows for examing different areas.
- Full range of functions and conversions with string handling and condition-testing facilities.

GRAPHICS — PC-EASEL

- Interactive entry and design. Choice of high resolution 3D bars, line graphs, pi-charts.
- Built in or user definable text and design elements.
- Vertical and horizontal annotation. Automatic insertion of keys and labels, and scaling of axes.
- Operates under MS-DOS or GEM and supports IBM colour graphics adaptor and Hercules graphics card.

INTEGRATED SOFTWARE

FOR THE AMSTRAD 1512 & PC COMPATIBLES

ALL FOR £69.00 + VAT

VISA TRANSFORM LTD.

24 West Oak, Beckenham, Kent BR3 2EZ 01-658 6350

MIGHTY MICRO

Mighty Micro Manchester Ltd, Sherwood Centre
268 Wilmslow Road, Fallowfield, Manchester M14 6WL
Telephone 061-224 8117 (3 lines)

Tandon · FERRANTI Personal computers · KAYPRO · SPERRY · THE STAR PRINTERS FOR BUSINESS · CITIZEN · brother · JUKI technology true to type · EPSON

BUSINESS–COMPUTERS

Amstrad PC1512	Master Dealer
Amstrad PCW Range	Call
Atari 520STFM	£347.00
Atari 1040ST/F	£522.00
Commodore Amiga	Special Price
Ferranti PC1860 (NEW)	£895.00
Ferranti PC1860XT/20Mb	£1195.00
Ferranti PC2860AT/20Mb	1995.00
Ferranti PC2860AT/40Mb	£2900.00
Epson PC/FD	£745.00
Epson PC/HD 20Mb	£1439.00
Kaypro PC/768K, + Monitor	£1030.00
Kaypro PC/20Mb	£1430.00
Kaypro 286iAT/20Mb/Mono	£1750.00
Kaypro 286iAT/20Mb/Colour	£1960.00
Kaypro P2000 Lapheld	£950.00
Kaypro P2000 LargeScreen	£1150.00
Sharp PC7000	£900.00
Sperry PC/HT100	Call
Sperry PC/IT 44Mb hard	£2549.00
Tandon PCX/Mono	£985.00
Tandon PCX10/Mono	£1067.00
Tandon PCX20/Mono	£1223.00
Tandon PCA20/Mono	£1645.00
35Lcomputers	Call

HOME COMPUTERS

Amstrad 464/6128	Call
BBC Compact	Special Price
BBC Master 128	£400.00

HARD DISK WINCHESTERS

SEAGATE 10MG + CARD	£337.00
SEAGATE 20MB + CARD	£357.00
DYSAN 10MB HARD CARD	£339.00
OSIC 20MB HARD CARD	£415.00
OSIC 30MB HARD CARD	£435.00
OSIC 40MB TAPE STREAMER	£440.00

ALL EXCLUDE VAT

PRINTERS

Amstrad DMP2000	£139.86
Brother M-1409	£340.00
Brother M-1509	£421.75
Brother M-1709	£520.60
Brother HR15	£347.00
Brother HR25XLD	£651.00
Epson LX86	£226.05
Epson LQ800	£475.00
Epson LQ1000	£635.00
Epson LQ2500	£836.00
Epson FX800	£344.00
Epson FX1000	£440.00
Star NL10	£243.45
Star NX15	£325.78
Star NB24/15	£721.00
Citizen MSP-20	£286.00
Citizen MSP-15E	£339.00
Citizen MQP-45	£695.00
Citizen 35 PREM	£595.00
Juki 6000	£173.86
Juki 6100	£286.91
Silver Reed EXP400	£173.86
Amstrad DMP4000	£325.00
Panasonic 1081	£173.91

ALL EXCLUDE VAT

LASER PRINTERS

Scanners + plotters	Call
Cannon LBP-8A1	£2185.00
Cannon LBP-8A2	£3235.00
QMS PS800 A4 + Postscript	£3780.00
QMS P8 A4	£1945.00
OKI Laserline	£1720.00
Centronics Page Pub	£1950.00

ALL EXCLUDE VAT

AMSTRAD 1512 PC/MS-DOS SOFTWARE

WORD PROCESSING

Word Star 1512	£60.82
1ST Word Plus	£69.52
Word Perfect Jr	£86.91
Volkswriter Deluxe	£39.12
Vuwriter 1512	£49.56
Word Star 3.3	£211.25
Word Star Prof 3.3	£273.75
Word Star 2000 (Rel 2)	£306.25
Word Star 2000 Plus	£368.75

DATABASE

Reflex 1512	£60.82
VP Info	£86.08
Card Box	£52.13
PC Promise	£60.82
Tas Plus	£63.47
Dbase 2 1512	£103.47
Dbase 2 (IBM)	£297.60
Dbase 3 Plus	£418.75

INTEGRATED SYSTEMS

Ability	£98.26
First Choice	£149.00
PC-Four (PSION)	£69.95
Smart System	Call
Framework 2	£406.25
Symphony	£490.00

FINANCIAL PLANNING

Supercalc 3.10 1512	£60.82
VP-Planner	£86.08
Supercalc 4	£250.00
Javelin	£410.00
Multiplan	£150.00

MODEMS AND COMMS

WS4000 V21/V23 AA/AD	£149.95
WS4000 V21/V23/V22 AA/AD	£399.95
WS3000 V21/V23 AA/AD	£295.00
LINNETT V21/V23 AA/AD	£135.00
UNITY INTERNAL 2123 AA-AD	£215.00
AMSTRAD INTERNAL V21/V23	£150.00

ALL EXCLUDE VAT

ADDON CARDS

EGA CARD	£223.75
CGA CARD	£63.00
MBA CARD	£85.00
MULTIFUNCTION CARD	£140.00

WHAT ELSE

Floppy disks/Floppy disk boxes/Books/Rams/ and Roms/Joysticks Cables/Listing paper and Labels/Mouse for most Computers/Ribbons/ Calculators/and of course software for all our range of computers.

NEW PRODUCT LINE

PSION ORGANISER
SPECIALIST CALCULATOR
NEC MULTISYNC MONITORS
OPUS COMPUTERS

ALL PRODUCTS EXCLUDE VAT

MONITORS

Philips 8501 Colour	£156.48
Philips 8533 Colour	£273.85
Philips BM7502 Green	£78.25
Eizo ER3010WL B/W	£109.52
Zenith 1230 Green	£82.56
Zenith 1220 Amber	£91.26

PERSONAL EXPORT SPECIALISTS

Export to over 60 countries in 1986
Please add 15% VAT to all prices
Delivery: Free to UK mainland for orders over £100

MANCHESTER

Easy Access from the M56, M6, M62, M63, M602

MIGHTY MICRO BULLETIN BOARD

Ring 061 224 8117
Ring for prices/orders/leave messages Upload/Download free DDM software Any modem with 300/300 1200/75 and TTY software Online from 7pm to 8am Mon-Sat/All day Sunday

PRINTER PRICE

How about this for the printer price sensation of the year – a top quality Qume daisywheel printer, sophisticated dual-bin sheet feeder and an interface for your IBM PC or compatible – all for a staggering £599 + VAT.

Opus offer you a ready-to-run, letter-quality printer system at an astonishing low price.

- **QUME SPRINT DAISYWHEEL PRINTER**
  37 characters per second and a quality finish you won't find from a dot matrix.
- **DUAL-BIN SHEET FEEDER**
  Electronically-controlled with automatic paper-feed system and LED console display.
- **PRINTER INTERFACE**
  RS232C Serial interface for use with the IBM PC or compatibles.

All this for under £600! Unfortunately we only have limited stocks of this 3-in-1 printer system available, hence the low, low price. To avoid disappointment call Opus now on **0737-65080.** We can guarantee 72-hour delivery anywhere in mainland Britain and we welcome dealer, education and government discount enquiries.

An amazing £599 + VAT while stocks last

CRASH

0737-65080.

Opus Supplies Ltd,
53 Ormside Way,
Holmethorpe Industrial Estate,
Redhill, SURREY RH1 2LW.

Opus.

PC/AT COMPATIBLES

BREAKING THE PRICE BARRIER!!!!!!!
MANUFACTURED IN THE UNITED KINGDOM
USING HIGHEST QUALITY JAPANESE PRODUCTS

PC/XT £380
PC/XT, 20MB, MONITOR TTL £780

★ 8088/V20 ★ 640k
★ "NEC" FLOPPY DRIVE ★ "SERIAL/PARALLEL" PRINTER PORT
★ HERCULES GRAPHICS DISPLAY ADAPTOR ★ KEYBOARD NUMS + CAPS LOCK ★ 8 SLOTS ★ FLAT SCREEN MONITOR

3X FASTER

AT/TURBO £949 WITH 20MB MONITOR £1280

★ DYNAMIC SPEED CONTROL ★
★ 80286 6/8/12 MHZ ★ 512K RAM EXPANDABLE TO 1M
★ LEGAL BIOS ★ FLOPPY DRIVE 1.2M
★ PRINTER PORT ★ GRAPHICS DISPLAY ADAPTOR ★ AT STYLE KEYBOARD WITH SEPARATE CURSOR PAD

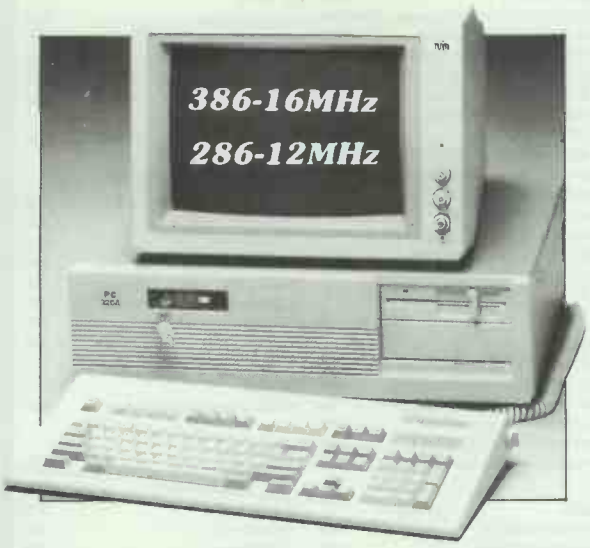
★ NEW 386 TURBO £2900 ★

MONITOR, 20MB HARD DISK, 640K RAM, 1.2MB FLOPPY KEYBOARD, DOS 3.2
ALL SYSTEMS ARE TOTALLY COMPATIBLE
HI REST TTL MONITOR £69 20MB HARD DISK £299
BILINGUAL SYSTEMS EXPORT ORDERS WELCOME
12 MONTHS WARRANTY AND SUPPORT INCLUDED PRICES EXCLUDING VAT
FOR ORDERS AND ENQUIRIES PLEASE CONTACT

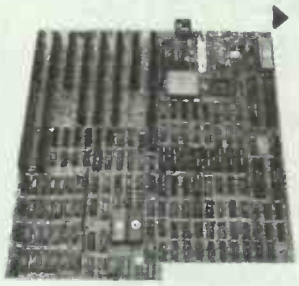
C.A.S. COMPUTER POINT LTD
TEL 01-708 3775/01-708 2734
TLX 8952387 ANSWER G

OUR PRICES ADD MORE SELLING POWER TO YOUR COMPUTERS

COME WITH US,
YOU WILL ALWAYS BE THE LEADER.



P&C SHITEN ENTERPRISE CO., LTD.
RM 7, 8 FL., NO. 100 ROOSEVELT RD., SEC. 3,
TAIPEI, TAIWAN, R.O.C.
P.O. BOX 30-291 TAIPEI TAIWAN
TLX: 19206 PC SHITEN
TEL: (02) 395-1400 FAX: 886-2-3512073



M-80386-A
- Hardware & Software are completely compatible with current 80286 based systems.
- Mother Board Size is same like Full-Size AT Mother Board.
- CPU runs at a super-fast 16MHz.
- Processor can dynamically sized to handle 32-Bit or 16-Bit data bus operations.
- 512K byte Ram on board.
- 16MB expandable
- The 80386 virtual mode will allow copies of different operating systems.
- 16 MHz 80386, 8 MHz AT Bus.

MACROTEK MINITURBO AT:
- CPU 80286-10
- 6, 10 or 12 MHz Selectable Speed
- 8-1/2"×12" Multi Layer Board Identical PC/XT Dimension Can Fit Into AT or XT Case
- 7 I/O Expansion Slots
- One Mega Byte Memory Size
- Optional 80287 Match Co-Processor
- Zero Wait State

MACROTEK MP-401 ENHANCED TURBO XT
- CPU 8088-2
- 4.77 MHz or 10 MHz Selectable Speed
- 2 Layer Board Demension
- 8 Expansion Slots
- 640KB RAM Expandable

Auto Scan Printer Buffer
- 256K/512K RAM on Board.
- Input: 1-3 Sets Computer
- Output: One Printer
- Operation: Auto Scan

MACROTEK International Corp.
2 Fl., No. 12 Alley 13, Lane 245, Sec. 4, Pa Te Rd., Taipei, Taiwan, R.O.C. Telex: 27183 MACROTEK
Tel: 886-2-7655064 • 886-2-7652496 • 886-2-7665204

INTRODUCING THE NEW GPR•2000 DAISYWHEEL PRINTER

LOOK!

AMAZING VALUE!

The ideal letter quality printer for reports and general correspondence. Manufactured in Japan. Complements all modern PC's

★ 18cps printing speed ★ Variable line spacing
★ 10, 12 & 15 pitch ★ 96 char daisywheel
★ Interface – parallel standard ★ RS232 option
★ Qume compatible ★ Paper-max 13" wide
★ Front panel controls ★ Low noise 58dBA
★ Bi-directional logic seeking print system
★ Supports Wordstar commands ★ Tractors & S/Feeder option

THE VERY LATEST DESIGN WITH UP TO THE MINUTE STYLING

THE PRICE OF SIMILAR MODELS

ONLY **£199** +VAT + P&P

Plus **FREE**

★ 10 & 12 pitch daisywheels
★ Spare ribbon cassette ★ Dust cover
★ Detailed user manual & mains lead
★ Interface cable to your computer
★ £10 voucher for VOLKSWRITER de Luxe word processor

NO QUIBBLE – FULL MONEY REFUND IF NOT DELIGHTED

Internationally available ribbons and daisywheels guarantee low running costs.

The GPR – 2000 accepts Qume fabric or film ribbon cassettes

Wide choice of Qume compatible daisywheels

DATAPLUS
DATAPLUS (Sales) Ltd.
PO Box 122, CHELTENHAM, GL51 8QL

TELEPHONE ORDERS **0242 573573** 24 HR

DATAPLUS (Sales) Ltd.
PO Box 122, CHELTENHAM, GL51 8QL

Please supply _____ GPR 2000 Daisywheel printers at £228.85 each incl. VAT. plus £8.50 courier delivery and insurance.

☐ cheque ☐ Access ☐ Visa

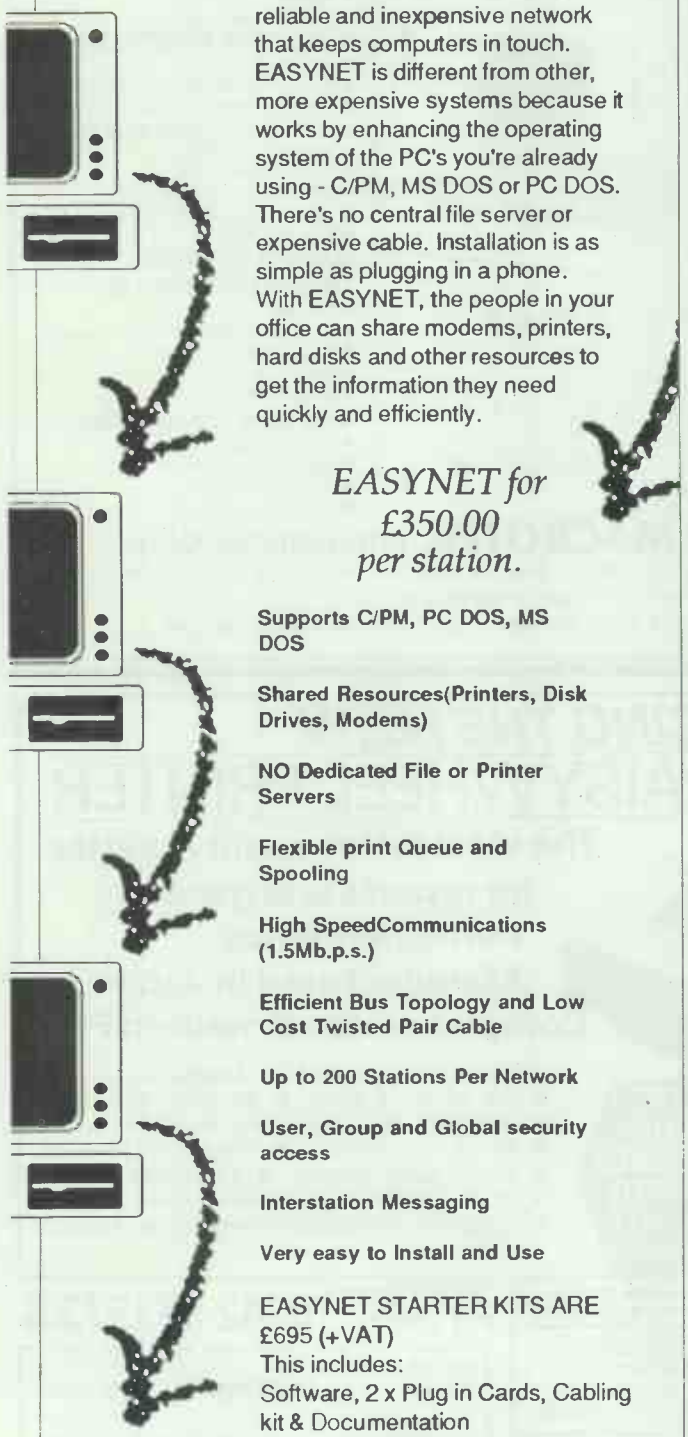
Expiry date _____
Name _____
Address _____
_____ Post Code _____
Daytime Tel No. _____

Reg in England 2080289

NETWORKS ARE A NIGHTMARE

Networking is complicated, expensive and difficult to understand and implement!

This has been the traditional view but now there's EASYNET, the reliable and inexpensive network that keeps computers in touch. EASYNET is different from other, more expensive systems because it works by enhancing the operating system of the PC's you're already using - C/PM, MS DOS or PC DOS. There's no central file server or expensive cable. Installation is as simple as plugging in a phone. With EASYNET, the people in your office can share modems, printers, hard disks and other resources to get the information they need quickly and efficiently.



EASYNET for £350.00 per station.

Supports C/PM, PC DOS, MS DOS

Shared Resources(Printers, Disk Drives, Modems)

NO Dedicated File or Printer Servers

Flexible print Queue and Spooling

High SpeedCommunications (1.5Mb.p.s.)

Efficient Bus Topology and Low Cost Twisted Pair Cable

Up to 200 Stations Per Network

User, Group and Global security access

Interstation Messaging

Very easy to Install and Use

EASYNET STARTER KITS ARE £695 (+VAT)
This includes:
Software, 2 x Plug in Cards, Cabling kit & Documentation

EASYNET

The Low Cost, High performance LAN Solution

Send for further information to:

LOGOTRON

Dales Brewery, Gwydir Street, Cambridge CB1 2LJ. (0223) 323656

BONDWELL MASTER DEALER
OFFICIAL DEALERS ★ AMIGA ★ AMSTRAD ★ ATARI

COMPUTERS	
Commodore AMIGA 2000 1Mb RAM & Colour Mon	1395.00
Commodore AMIGA 1000 512Kb RAM & Colour Mon	899.00
Commodore AMIGA 500 512Kb RAM + Integ Disk Drive	477.39
Commodore SIDECAR PC	599.00
Amstrad PC1512 Series + On-Site Maintenance	From 449.00
Amstrad PCW8256 Word Processor System	369.00
Atari 1040STF with 1Mb drive, Mouse & Mono Mon	559.00
Atari 1040STFM with 1Mb drive, Mouse & Colour Mon	799.00
Atari 520STFM with Mouse, 0.5Mb drive & TV O/P	319.00
Atari 520STFM with Hi Res Mono Monitor	399.00
Atari 520STM (Mouse £21.70)	209.00
Bondwell 8 Lapheld 512k RAM 720k Drive Recharge Batt	699.00
Bondwell 18 Transportable 640k RAM Dual 5.25" Drives	749.00
Bondwell 38-2 Ptoressional PC 4.77/8MHz	749.00
Bondwell 38-3 with 20Mb Winchester	1149.00
Commodore 128D inc. built-in 1571 disk drive + Mon	489.00
Commodore 1218D inc. built-in 1571 disk drive	439.00
Psion Drganiser CM Hand Held Diary/Clock/Alarm/Cmptr	79.00
Psion Drganiser XP 16Kb expandable to 128Kb RAM	109.00
PRINTERS	
Citizen 120D Dot Matrix 120cps & NLQ Fric/Trac	173.04
Citizen 120D for Commodore 64/128	181.74
Commodore MPS1000 Dot Matrix 100cps & NLQ Fric/Trac	219.00
Dkimate 20 Ribbon Transfer Colour Printer	159.00
Star NL10 (various interfaces) 120cps & NLQ	220.00
Star Powertype Daisywheel 18cps Parallel & RS232	189.00
MONITORS	
Atari High Res Mono Monitor	119.00
Atari Med Res Colour Monitor	319.00
Commodore 1901 Col 14"	263.00
Philips 8533 14" Col RGB/Comp Med Res	236.00
Philips BM7502 Green 12" Comp Video + Sound	72.00
DISK DRIVES	
Atari 0.5Mb Disk Drive	119.00
Atari 1Mb Disk Drive	159.00
Atari 20Mb Hard Disk	559.00
Cumana CSA354 1Mb disk Drive for Atari ST	123.00
Cumana CDA3582 x 1Mb Dual Drive for Atari ST	209.00
Commodore 1571 Disk Drive for C128	207.83
Commodore 1541C Disk Drive for C64/128	159.00
ACCESSORIES	
Centronics Interf for C64/128 8K Buffer & Graphics	51.30
Centronics Interf for C64/128	26.04
The Final Cartridge II for C64	30.43
IEEE Interface for C64/128	69.95
RS232C Interface for C64/128 with disk software	49.95
Surge Protector 13amp Plug (Also adapter—£13)	10.39
Smart Printer Buffer 256Kb	99.95
Smart Printer Switch	89.95
SOFTWARE	
Available at low prices for above computers	Phone
DISKS (Box 10)	
5.25" SS/DD Xidex Precision	7.74
5.25" DS/DD Xidex Precision	8.69
3.5" SS/DD Branded	17.39
3.5" DS/DD Branded	20.87
3" DS (CF2) Amstrad	29.00

Please add 15% VAT to above prices
CARRIAGE £8, EXPRESS DELIVERY £12, Software & Small Items FREE.

Delta Pi Software Ltd

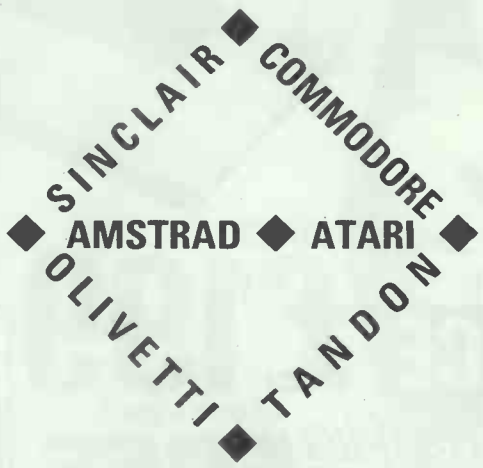
8 Ruswarp Lane, WHITBY, N. Yorks. YO2 1ND.
Tel: 0947 600065 (9am-7pm)

EXPORT SPECIALISTS

Have you been let down by failed deliveries and worthless promises of shipment???

We **GUARANTEE DELIVERY !!!**

We export all the leading names in business and home computing.



Fully Tested IBM Compatibles from £370.00

Contact us NOW for the very best prices.

OMEGA PC LTD, 97 Kingsley Road, Hounslow, Middlesex, TW3 4AH.

FAX: 01-577 0967
TLX: 295267 GURPAL G

In a Class on its own

This little lot ask more of their IBM-compatibles in a day than most users demand in a year. But then this is London's Polytechnic of the South Bank, one of Britain's leading institutes of science and technology.

Here wordprocessing and data storage, financial management and computer-aided design, networking and terminal emulation are all in a day's work.

So you can be sure that when the Polytechnic chose the PC II Turbo from Opus—almost 200 of them in fact—it was only after a great deal of study.

Even with a starting price of £499 the PC II Turbo faced some cheaper competitors but, when it came to speed, compatibility and expandibility, it proved to be in a class of its own. Now it's in every class from electronic engineering to administrative studies and from computer services to humanities and social sciences.

With its NEC V20 processor the PC II Turbo is up to three times as fast as the IBM PC/XT and its switchable from 4.77 to 8 MHz Turbo processing at the flick of a keyboard. You can choose high resolution monochrome, colour or EGA systems, single or dual disc drives, 1 Megabyte RAM expansion or 20 Megabyte Winchester. And if you think our options could teach the competition a lesson or two, you'll find the PC II Turbo's standard features a real education.

- *NEC V20 Super Processor*
- *360K Floppy Disk Drive*
- *Hercules-compatible Graphics Card*
- *High Resolution Monochrome Monitor*
- *Quality AT-Style keyboard*
- *Highly Compatible BIOS*
- *256K of RAM Expandable to 1 Mb creating 384K RAM disk*
- *8 Expansion Slots*
- *Keyboard Security Lock*
- *Parallel Printer and Joystick Interfaces*
- *Real Time Clock/Calendar with Battery Back-Up*
- *150 Watt UL-Approved Power Supply*
- *Comprehensive User Manual*
- *12-Month Guarantee.*
- *Now available with new maths co-processor option.*

Should you need more than our 12-month free warranty, we'll even offer you a low-cost on-site maintenance option.

Like South Bank Polytechnic we're sure you'll take a close look at the competition, their options and availability. When you have, call Opus on **0737 65080** and hear about our guaranteed 72-hour delivery. We offer special education and government discounts and welcome dealer and export enquiries. Price quoted exclusive of VAT and carriage.

PC II TURBO

Opus Supplies Ltd,
55 Ormside Way,
Holmethorpe Industrial Estate,
Redhill, SURREY RH1 2LW.

Opus.

IBM is a trademark of International Business Machines Corporation.

Looking for AT/XT at the most competitive prices in the UK market? The Alphatronics **XT** and AT, manufactured in Taiwan, have sold in thousands throughout the world under various brands. The XT already has 2000 successful corporate sales under its belt in the UK. Phone with your preferred spec for a quote.

XT ALPHATRONICS ALPHATRONICS AT

640k Turbo
20Mb

ALPHA add on cards combine Japanese excellence in quality assurance with the competitiveness of Taiwanese pricing:
PC/XT expansion: Colour graphic/printer card £79 ★★ Hercules Monographic/printer card £79 ★★ I/O plus card (printer/1 optional /2 serial/game/clock) £69 ★★ 384KB multifunction (RS232/printer/clock/game) £89 ★★ 384KB memory expansion £79 ★★ Serial port £29.
PC/AT expansion: Enhanced Graphic Adaptor £160 ★★ 3.5Mb memory expansion card (start address selectable, uses 256DRAM) £95 ★★ 2.5Mb multifunction card (parallel/serial all fully assignable LPT1/2 COM1/2/3/4 start address selectable) £99.
POWER
150 WXT power supply £79; 225W AT power supply £145

Enquiries to:

(North/Midlands): Alphatronics, Wolverley House, Digbeth, Birmingham B5 6JB. 021 643 9866

(South/London): GUARDIAN DATA SYSTEMS Ltd, Guardian House, Borough Road, GODALMING GU7 2AE. 04868 25585/8

DISKS

TDK. *It's a guarantee in itself.*

5.25" DISKS	PRICE PER BOX 1-9	PRICE PER BOX 10-49
MID [48tpi] Single sided/double density	£12.00	£11.50
M2D [48 tpi] Double sided/double density	£14.00	£13.50
MIDD [96 tpi] Single sided	£14.50	£14.00
M2DD [96 tpi] Double sided	£15.00	£14.50
M2HD [1.6 Mb] High density	£28.00	£26.00
3½" DISKS		
MF — 1DD Single sided	£25.00	£23.50
MF — 2DD Double sided	£28.00	£26.50

>>>>>>> SPEEDY RETURN <<<<<<<

ALL PRICES INCLUDE VAT & POSTAGE

ALL ENQUIRIES & PAYMENTS TO BE MADE TO
R.S.C. LTD., 75 QUEENS ROAD
WATFORD WD1 2QN Tel: (0923) 43301
(0923) 41921

VISA

TELEX: 265871 MONREFG REF CJJ128

PEG Associates

THE PEGASUS SPECIALISTS
SINGLE & MULTI-USER

MAIL ORDER — From £145 + VAT per Module
HELPLINE — Telephone Support
TRAINING COURSES — Nationwide
SYSTEM SET—UP & INSTALLATION
ESTABLISHMENT OF NOMINAL CODES
SUPPORTING SPREADSHEETS
SPECIAL PROGRAMS DESIGNED & WRITTEN
ACCOUNTING SYSTEMS CONSULTANCY

Special services for Silicon Office, Delta, Supercalc, Multiplan, Visicalc, Lotus 1-2-3, Wordcraft.

APPROVED PEGASUS XENIX & DEVELOPMENT CENTRE

WE PROVIDE END USER & DEALER SUPPORT.

For Further Details call Rugby (0788) 73855
or write:—
PEG ASSOCIATES, FREEPOST, VICTORIA HOUSE,
50 ALBERT STREET, RUGBY CV21 2BR

DISCOUNT DISKS FROM RUNNYMEDE (0784 39844)

PLUS 5% ADDITIONAL DISCOUNT FOR CHEQUE WITH ORDER
NEW * VERBATIM HARD CARD 30MB £699
SUPERIOR QUALITY UNBRANDED DISKS!
ALL 100% ERROR FREE – PRODUCED BY LEADING MANUFACTURERS. FULL LIFETIME NO QUIBBLE GUARANTEE

5¼" Price Per Disk

	10's	25-99	100-249	250+
SSDD 48TPI	0.75	0.51	0.46	0.41
DSDD 48TPI	0.77	0.53	0.48	0.43
SSQD 96TPI	0.82	0.62	0.55	0.48
DSQD 96TPI	0.84	0.64	0.57	0.50

SUPPLIED WITH HUB RINGS, LABELS, WRITE PROTECT TABS AND SLEEVES. 10's ARE SUPPLIED IN PLASTIC LIBRARY CASES

3½" Price Per Disk

	10's	25-99	100-249	250+
SONY SSDD 135TPI	1.74	1.36	1.29	1.22
SONY DSDD 135TPI	1.82	1.42	1.34	1.26

SUPPLIED WITH LABELS. 10's ARE IN PLASTIC LIBRARY CASES

AMSOFT 3" CF2 Price Per Disk

5-24	25-99	100+
2.75	2.50	2.25

BOXED DISKS
ALL SUPPLIED IN 10'S IN MANUFACTURERS PACKING.

5¼" DISKS	Price Per Box
*OPUS DSDD 48TPI	9.40
*OPUS DSQD 96TPI	12.21
*OPUS HD(IBM AT)	18.10
MAXELL DSDD 48TPI	17.25
MAXELL DSQD 96TPI	20.02
MAXELL HD(IBM AT)	30.98
FUJI DSDD 48TPI	16.36
FUJI DSQD 96TPI	18.82
PARROT DSDD 48TPI	15.00
PARROT DSQD 96TPI	17.18
3½" DISKS	
OPUS DSDD 135TPI	20.20
SONY DSDD 135TPI	36.86

PLASTIC LIBRARY CASES

Box to hold 10 5¼" disks	1.56
Box to hold 50 5¼" disks	7.78
Box to hold 10 3½" disks	1.56
Box to hold 90 3½" disks	8.70

P&P FREE (UK only)
Please add 15% V.A.T.
Government, Educational and company orders welcome

DEPT:- M.D.
RUNNYMEDE COMPUTER HARDWARE LTD
69 CLARENCE STREET, EGHAM, SURREY
TW20 9QY (0784-39844)

DON'T FORGET 5% DISCOUNT FOR CHEQUE WITH ORDER!

FARNHAM COMPUTERS

We are dealers for

AMSTRAD

Acorn

and ATARI ST

For your Computer, Software and Peripherals requirements

Call Us for Prices:

1 South Street, Farnham, Surrey
Tel: 0252 723107

BARCLAYCARD VISA Access

ATARI COMPUTERS

All ST computers come with a mouse and software except where stated. Atari 1040STF without monitor £542 (£529) £569. Atari 1040STF with b/w monitor £637 (£638) £728. New Atari 520STFM with built in disk drive (512k RAM) £363 (£360) £400. Atari 520 STFM + (1000K ram) £452 (£445) £485. Atari 520STFM with b/w monitor £458 (£470) £560. Atari 520STM without mouse £238 (£240) £279. Atari 520STM £263 (£265) £304. Atari 520STM+ (1000k ram) £352 (£348) £387. Cumana 1000k disc drives for the 520STMsingle £147 (£147) £163, dual £242 (£236) £260. Atari 500k ST disc drives £139 (£139) £155. Atari 1000k ST disc drives £183 (£182) £198. Atari ST monochrome monitor £137 (£147) £195. Atari 12" medium resolution ST colour monitor £368 (£362) £413. 20 Mb ST hard disc (Now available from stock) £636 (£613) £673. Centronics printer cable for the ST range £16 (£16) £20. We offer good discounts on most ST software for example — Hisoft DEVPAK £42 (£42) £46, Metacombo Lattice C £81 (£81) £85, Computer Concepts Fast Basic £79 (£76) £80. LDW Basic ST, new basic compiler £99 (£88) £92. VIP Professional, Lotus 1-2-3 Clone for ST £159 (£139) £143. Pro Fortran 77 £121 (£108) £112. Pro Pascal £121 (£108) £112. Atari 130XE Computer + game £95 (£99) £120. Atari 130XE + disc drive + 1027 printer + software £313 (£315) £373. Atari cassette recorder £34 (£38) £48. Atari 1020 4 colour printer £93 (£94) £114. Atari 1027 letter quality printer £118 (£124) £151. Atari 1029 dot matrix printer £118 (£124) £151. Atari 1050 disk drive with DOS 3 £118 (£124) £151.

AMSTRAD PRODUCTS

We can supply a wide range of software for the 1512, the PCW8256 and the PCW8512 — write for a quote. New Amstrad 1512 IBM Personal Computer Clones:- 1512 computer with single disc drive and b/w monitor £499 (£499) £606, dual disc b/w £619 (£614) £621, single colour £669 (£655) £762, dual colour £771 (£745) £852, 10Mb hard disk b/w £863 (£830) £970, 20Mb HD b/w £951 (£907) £1047, 10Mb HD colour £1014 (£961) £1101. 20Mb HD colour £1102 (£1038) £1178. DMP3000 printer £190 (£193) £226. FD3 £166 (£173) £204. HD10 £467 (£430) £490. HD20 £575 (£540) £600. Amstrad CPC464 computers:- colour £291 (£320) £404, green £197 (£235) £316. Amstrad 6128 colour £391 (£420) £500. Amstrad PCW8256 £440 (£464) £571. Amstrad PCW8512 £554 (£577) £684. Amstrad DMP2000 printer £166 (£171) £204. Extra disc drive for Amstrad 6128 £99 (£105) £136. Amstrad DD1 Disc Drive £155 (£156) £186. Amstrad joystick £11 (£12) £16.

CAMBIDGE COMPUTERS AND SINCLAIR PRODUCTS

Cambridge computers Z88 £297 (£271) £299. Mains adaptor £15 (£17) £22. 128k ram cartridge £65 (£57) £62. Spectrum 128K Plus Two computer without joystick and software pack £148 (£50) £180, with joystick and software pack £158 (£162) £194. Blank microdrive cartridges for the QL and the Spectrum £2.50 (£3) £4. QL floppy disc interface (See Cumana disc drive section for suitable drives) £86 (£84) £94. Spectrum floppy disc interface (See Cumana section for suitable disc drives) £76 (£76) £86. Spectrum centronics printer interface and cable £46 (£42) £47.

COMMODORE COMPUTERS

Commodore Amiga A500 Computer £533 (£524) £574. Modulator £25 (£35) £25. Amiga A500 with 1080 colour monitor £848 (£839) £946. Commodore 128D £518 (£499) £539. 1571 disc drive £276 (£269) £285. Commodore 64C computer with mouse, cassette recorder and software £239 (£242) £272. Convertor to allow the use of most ordinary mono cassette recorders with the Commodore 128 and Commodore 64 £9.78 (£9) £11. Commodore MPS1000 printer £269 (£262) £296. 1541C disk drive £194 (£192) £208.

PRINTERS

Epson LX86 without tractor £276 (£275) £309, with tractor for £300 (£298) £342. Star NL10 £235 (£234) £270. Interfaces for NL10 £37 (£35) £37. Brother M1109 £220 (£224) £265. Shinwa CTI CPA80+ £208 (£210) £247. Cannon PW1080A £303 (£298) £338. Microperipherals MP165 £219 (£223) £265. **CUMANA 3.5" AND 5.25" CASED DISK DRIVES WITH CABLE AND POWER SUPPLY.** 40/80 track switchable double sided to suit floppy disc interfaces of the Sinclair QL, Sinclair Spectrum and BBC B 3.5" drives:- single £134 (£134) £156, dual £224 (£219) £251. 5.25" drives:- single £172 (£169) £199, dual £310 (£306) £347.

SWANLEY ELECTRONICS

The Computer Export Specialists.
Dept PCW, 32 Goldsel Rd., Swanley, Kent BR8 8EZ, England

Tel: SWANLEY (0322) 64851. We give an additional discount of 2% to UK personal callers who pay cash. Official orders welcome. UK prices are shown first and include post and VAT. The second price in brackets is for export customers in Europe and includes insured airmail postage. The third price is for export customers outside Europe (Including Australia etc) and includes insured airmail postage.

RGP DISTRIBUTION

59 Exeter Street, Plymouth PL4 0AN

DEALER ENQUIRIES WELCOME

0752 225732

THE PERFECT PARTNERS

BROMCOM QC
THE BEST IDEA SINCE THE PC

4 Terminal multi user system. 20, 40 or 80Mb hard disk, 1, 2 or 4Mb RAM.
Amstrad/IBM compatible networking. Typical 4 terminal system with 1Mb RAM, 20Mb hard disk

£4,495

BABBAGE Software

Integrated Accounting Systems

Integrated Accounting Systems

- Purchase Ledger
- Nominal Ledger
- Sales Ledger
- Sales Invoicing
- Sales Order Processing
- Stock Control
- Purchase Order Processing
- Payroll
- Point Of Sale Invoicing etc

Single user MS-DOS/PC-DOS/CPM etc
£199 per module

XENIX etc
1-4 users **£299** 5 + users **£499**

DISKS

Probably the lowest priced. FUlly guaranteed disks in the UK!!!

48TPI DS/DD 10's in plastic case

1-4 boxes	**£7.95** per box
5-9 boxes	**£7.00** per box
10-24 boxes	**£6.00** per box
25-49 boxes	**£5.50** per box
50+ boxes	**£5.00** per box

Bulk Packed Loose

50 disks	**60p** each
100 disks	**55p** each
250 disks	**50p** each
500 disks	**40p** each

Call for lowest prices on higher quantities.
All other disk formats available.

PRINTERS

Polo, the rugged budget priced Epson/IBM compatible dot matrix Draft and NLQ

£179.95

SAVE UP TO 50% ON RRP

Compsoft Budget Range

Bookworker Accounts	**£140.00**
Delta 4	**£60.00**
Delta Graph	**£40.00**
Domino	**£60.00**
1 Up	**£30.00**

Trust Range

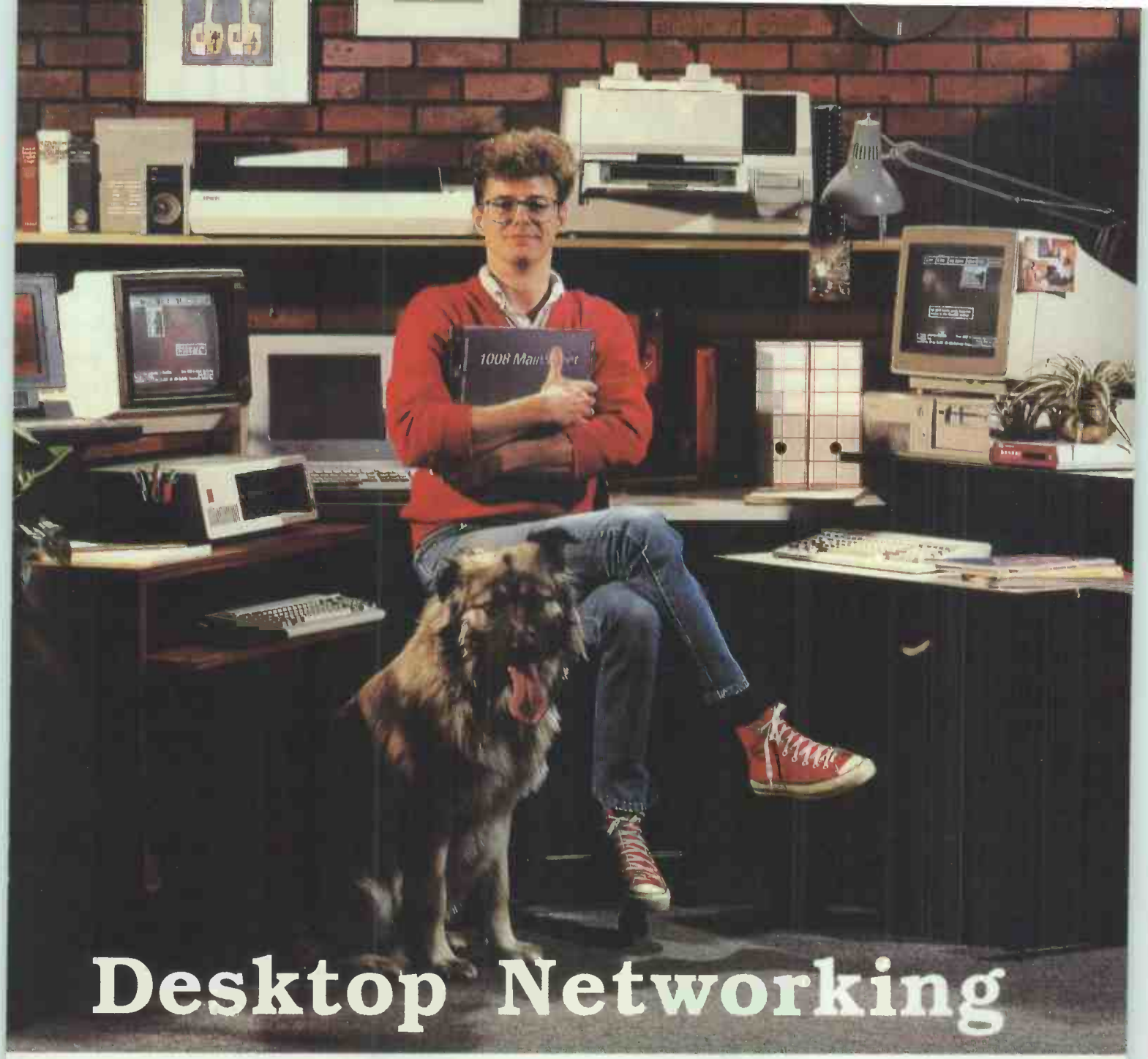
Trust Writer full function WP	**£30.00**
Trust Desktop	**£18.00**
Trust Database	**£30.00**
Trust Spelling Checker	**£15.00**

Other Products

Labels Label/Letter/List printing etc	**£49.00**
Turbocad Junior	**£69.00**
Turbocad Senior	**£225.00**

Phone now for Brochures, Fact Sheets etc.

We also have available, fully supported software at savings in excess of 80% — Bulk Sales Only.



A MainStreet™ data controller puts you back in control

Living with a computer was simple when you only had a printer. But once you added a modem and several other devices, life became more complex. You seemed to spend more time changing cables, activating switches and altering settings than you did working with your computer.

Now there is an alternative ... a MainStreet data controller from Newbridge. The controller takes care of your peripherals while you take care of business.

Available in two models for use with up to 48 connected devices, MainStreet controllers let you transform your independent computers and peripherals into an integrated desktop network which concentrates, directs and manages the flow of information from your desktop. You and your co-workers can share information, peripherals and other computing resources.

And, to make your life even easier, your desktop network is surprisingly affordable.

NEWBRIDGE

Networks for all ... big and small

•*Newbridge Networks Limited* 22 Welsh Street, Chepstow, Gwent, UK NP6 5LL Tel. 02912 6896
•*Newbridge Networks Corporation* 1051 Baxter Road, Ottawa, Ontario, K2C 3P2 (613) 726-1601
•*Newbridge Networks Inc.* 13873 Park Center Road, Suite 160, Herndon, VA 22071 (703) 834-3600 •7114 West Jefferson Ave. Suite 106, Lakewood, CO 80235 (303) 986-3600

olivetti PERSONAL COMPUTER

KIRIN PRICE GUIDE

AMSTRAD Canon CITIZEN EPSON IBM

MULTIFUNCTION BOARDS

Card with 640K on board	£142.00
256K Memory Board	£85.00
384K Memory Board	£119.00
AST Advantage 1.4Mb	£390.00
AST Rampage 1.5Mb	£490.00
PC-Express 8086, 8087 (option)	£440.00
Orchid Tiny Turbo 80286	£390.00
Maths Co-Pro 80875 MHz	£110.00
Maths Co-Pro 80287 8MHz	£225.00

COMMUNICATION BOARDS

IRMA Board	£785.00
ATACHMATE	£998.00
PCOX/Standard	£580.00
PCOX Plus	£850.00
PCOX/3720 PC	£1250.00
PCOX/Standard Remote	£425.00
PCOX/3720 PC Remote	£950.00

KEYBOARDS

Keytronics 5150 (83 Keys)	£130.00
Keytronics 5151 (99 Keys)	£195.00
EECO 8600 for AT/PC/XT (84 Keys)	£99.00

EGA CARDS

SWT SIGMA 256K	£195.00
Everex Enhancer 256K	£210.00
Paradise Auto Switch 256K	£275.00
GENOA with own B10S 256K	£245.00

OLIVETTI COMPUTERS — MAIN DEALER

Special This Month M19 512K 360K FDD Hi-Res Mono & Keyboard	£750.00
M24 2 × 360K FDD 640K MEM Hi-Res Mono & Keyboard	£1245.00
M24SP 20Mb 640K RAM 10MHz Mono & Keyboard	£1752.00
M28 20Mb 1.2Mb FDD 512K	£2470.00

LEASING — FINANCE AVAILABLE

COMPAQ

Compaq Desk-Pro Model 3	£1665.00
Compaq Desk-Pro 286 Model 40	£2705.00
Compaq Desk-Pro 386 Model 70	£4799.00

AMSTRAD COMPUTERS

PC1512SD	£449.00
PC1512DD	£559.00
PC1512HD 10Mb	£799.00
PC1512HD 20Mb	£899.00

Colour Monitor £275.00 extra

All softwares available including SAGE Soft and others.

Please ring for quote.

MONOGRAPHIC CARDS

Hercules Compatible	£89.00
Hercules Graphic Card	£149.00
GENOA Spectrum (132 Column)	£139.00

COLOUR CARDS

Paradise Short Card	£92.00
Hercules Compatible ½ Card	£65.00

HARD DISKS & CARDS

Seagate 20Mb Upgrade Kit	£298.00
NEC 20Mb Upgrade Kit	£350.00
NEC 40Mb Disk Drive	£420.00
Mini Scribe 20Mb Hard Card	£350.00
WD Filecard 20Mb	£450.00
PLUS Hardcard 20Mb	£595.00
Mini Scribe 30Mb Hard Card	£385.00
1.0 Mega Bernoulli Box 10 + 10	£1995.00
1.0 Mega Bernoulli Box 20 + 20	£2750.00
1.0 Mega 20 + 20 Plus 80Mb Disk	£3250.00
1.0 Mega 10Mb Cartridges	£52.00
1.0 Mega 20Mb Cartridges	£60.00
1.0 Mega IBM Interface Card	£125.00

TAPE BACK-UP

Maynard 20Mb Portable	£766.00
Maynard 60Mb Portable	£966.00
Maynard 20MN Internal	£575.00
Maynard 60Mb Internal	£850.00
Genoa 20Mb External (TEAC Drive)	£875.00
Genoa 60Mb External	£989.00
Genoa 20Mb Internal (TEAC Drive)	£730.00
Genoa 60Mb Internal	£790.00

Also stock, MOUNTAIN, EVEREX

TERMINALS

WYSE 30	£315.00
WYSE 50	£385.00
WYSE 60	£455.00

PRINTERS

Citizen 120D	£165.00
Citizen MSP25	£412.00
Epson LX86	£210.00
Epson FX85	£323.00
Epson FX1000	£410.00
Epson LQ800	£456.00
Juki 5510	£267.00
Juki 5520	£347.00
Juki 6100	£255.00
Juki 6200	£444.00
Canon A-50	£289.00
Canon A-55	£360.00
Star NL-10	£185.00
Star NB-15	£750.00
Panasonic P1080	£180.00
Panasonic P1092	£284.00
Panasonic P1592	£365.00

IBM

PC XT SDD	£1298.00
PC XT DDD	£1376.00
PC XT Fixed Disk Drive	£1526.00
PC AT (enhanced)	£2628.00
PC AT (expended)	£2950.00
PC Keyboard UK	£126.50
PC XTS E. Keyboard	£145.00
PC AT Keyboard UK	£157.00
Mono Monitor	£140.00
Colour Monitor	£373.00
ProPrinter	£347.00
Quietwriter/2	£1105.00

LASER PRINTERS

QMS K8 (KISS)	£1645.00
Canon LBP-8 A1	£1525.00
Canon LBP-8 A2	£2650.00
Canon A1-A2 Upgrade Board	£750.00
ACE CX-1 (Full IBM Graphics)	£2150.00
H-P Laserjet	£1550.00
H-P Laserjet Plus	£1995.00
Toner Cartridge	£64.00
TIOnmilLaser (15PPM)	£3300.00
Kyocera F1010	£2725.00
Kyocera F20-10	£3800.00

SOFTWARES

LOTUS, MICROSOFT, SAGE, MICROPRO, BORLAND, ASHTON-TATE DIGITAL RESEARCH ETC.

MODEM CARD

Special Modem for Amstrad PC1512	£129.00
Dowty Quatro Card V22 bis	£635.00
PC Com Quatro Card	£635.00
Miracle Tech WS4000	£150.00
Thorn EMI VX524	£380.00

MONITORS

ADI-DM14	£125.00
Eizo 8030 (RGB)	£320.00
Eizo 8042 (EGA)	£499.00
Tatung (EGA) 1380	£385.00
NEC Multi-Sync 14"	£485.00

KIRIN

KIRIN COMPUTING SYSTEMS LTD • UNIT 69 • ABBEY BUSINESS CENTRE • INGATE PLACE • QUEENSTOWN ROAD • LONDON SW8 3NS • TEL: 01-720 7722 • 720 5064 • TELEX: 946461

WORLDWIDE PRICE LIST

IBM Authorised Dealer Personal Computers

IBM Authorised Dealer IBM 6150 Micro Computer System

OLIVETTI PERSONAL COMPUTER

COMPAQ

EPSON

AMSTRAD

All prices excluding VAT and DELIVERY MAY A

LONDON

Worldwide House, Quicks Road,
Wimbledon, London SW19 1EX
Telex: 8955888 Fax: 01-543 7812

01 543 2211

BRIGHTON

Regent House, 2 North Road,
Brighton, Sussex BN1 1YA
Telex: 877649 Fax: 0273 671513

0273 609331

SCOTLAND

11-14 Maritime Street,
Edinburgh EH6 6SB
Telex: 728298 Fax: 031-554 2581

031 554 4361

IBM

IBM PC-XTS 640kb 2x36 kb DD	Call
IBM PC-XTS 640kb 1x3[illegible]kb DD + 20mb HD	
IBM PC-XT286 640kb 1x1.2mb DD + 20mb HD	
IBM PC-ATX 512kb 1x1.2mb DD + 30mb HD	

IBM Personal System 2 ™

SEE SPECIAL OFFERS

Olivetti 0% Finance available Call for Details *Licenced Credit Brokers*

Olivetti M15 720kb 1x720kb Laptop	999.00
Olivetti M19 256kb 2x360kb + K/B + Dos Mono/Colour	825/955.00
Olivetti M19 256kb 1x369kb 20mb HD Mono	1125.00
Olivetti M24 640kb 1x360kb	975.00
Olivetti M24 640kb 2x360kb	1065.00
Olivetti M24 640kb 1x360kb + 20mb HD	1370.00
Olivetti M24SP 640kb 1x360kb + 20mb HD	1495.00
Olivetti M28 512kb 1x1.2mb + 20mb HD	1915.00
Olivetti M28 512kb 1x1.2mb + 40mb HD	2425.00
Olivetti M28SP 1mb 1x1.2mb + 70mb HD	2915.00
Olivetti M24/M28 Mono Display Amber-Green-White	169.00
Olivetti M24/M28 Colour Display	395.00
Olivetti Keyboard Extended/IBM	120.00
Olivetti Enhanced Colour Adaptor	455.00

COMPAQ

Portable 4.77mhz 256kb 1x360kb	Call
Portable2 6/8mhz M2 256kb 2x360kb	for
Portable2 6/8mhz M4 640kb 1x360kb +20mb	the
Portable3 12mhz M1 640kb 1x1.2kb	best
Portable3 12mhz M20 640kb 1x1.2kb + 20mb	prices
Portable3 12mhz M40 640kb 1x1.2kb + 40mb	on
Deskpro M1 128kb 1x360kb	the
Deskpro M2 256kb 2x360kb	full
Deskpro M3 640kb 1x360kb + 20mb + RS232 + Clock	COMPAQ
Deskpro M4 640kb 1x360kb + 20mb + RS232 + Clock & Tape	range
Deskpro 8/12mhz 286 M1 256kb 1x1.2mb	of
Deskpro 8/12mhz 286 M20 640kb 1x1.2mb + 20mb	personal
Deskpro 8/12mhz 286 M40 640kb 1x1.2mb + 40mb	computers
Deskpro 8/12mhz 286 M40T 640kb 1x1.2mb + 40mb + Tape	
Deskpro 8/12mhz 286 M70T 640kb 1x1.2mb + 70mb + Tape	We
Deskpro 16mhz 386 M40 1mb 1x1.2mb + 40mb	have
Deskpro 16mhz 386 M70 1mb 1x1.2mb + 70mb	the
Deskpro 16mhz 386 M130 1mb 1x1.2mb +130mb	best
Deskpro 286 & 386 Colour Systems Extra	PRICES

Amstrad

	Mono/Colour
Amstrad PC 512kb 1x360kb DD + K/B	449/619.00
Amstrad PC 512kb 2x360kb DD + K/B	559/729.00
Amstrad PC 512kb 1x360kb DD + 10mb HD K/B	799/969.00
Amstrad PC 512kb 1x360kb DD + 20mb HD K/B	899/1069.00

Epson

Epson PC 256kb 2x360kb + K/B	549.00
Epson PC + 640kb 2x360 kb + K/B	1025.00
Epson PC + 640kb 1x360 kb 20mb HD + K/B	1225.00
Epson AX + 512kb 1x1.2 kb 20mb HD + K/B	1799.00
Epson AX + 512kb 1x1.2 kb 80mb HD + K/B	3175.00

IBM Compatible Monitors & Adaptors

Hercules Mono/Graphics Plus Adaptor	180.00
Hercules Colour/Graphics Adaptor	100.00
Hercules InColour/Graphics Adaptor	265.00
Orchid EGA 256kb + Printer Adp	220.00
AST 3G EGA 256kb	220.00
Interquadram Quad EGA + 256kb	280.00
Interquadram ProSync	370.00
Vega deLuxe Enhanced EGA	390.00
Tatung EGA Monitor	430.00
ADI EGA Monitor	450.00
NEC Multi Sync Monitor EGA/Colour/Mono/PGA	550.00
IRMA Card 3270 Emulation Adaptor	939.00
IRMA Graphics Card 3270 Emulation Adaptor	1525.00

IBM Compatible Memory Upgrades

384kb Multifunction XT	199.00
Intel/EMS Compat Ram Adaptor Upgrade 1.5mb XT	399.00
AST SixPac Plus 384kb Multifunction XT	275.00
AST SixPac Premium 2mb EMS Multyfunction XT	430.00
AST Advantage 1.5mb Serial + Parallel AT	425.00
AST RAMvantage 3mb AT	650.00
AST Rampage! 2mb EMS XT	350.00
AST RampageAT 2mb EMS AT	595.00
Interquadram Quad Board 640kb XT	320.00
Clock Card with Batt Back up + Ser + Parallel XT	85.00

Plotters

Epson HI 80	A4	4pen	349.00
Hitachi 672	A3	4pen	499.00
Hewlett Packard 7440	A3	4pen	750.00
Hewlett Packard 7475	A3	6pen	1360.00
Hewlett Packard 7550A	A3	8pen	2850.00
Hewlett Packard 7570A	A1	8pen	3799.00
Houston DMP56B	A0	1pen	5399.00
Roland DXY 980A Plotter	A3	8pen	930.00
Roland DXY 880A Plotter	A3	8pen	655.00
Roland DPX 2000 Plotter	A2	8pen	2575.00

Laser Printers

Canon Laser LBP-8 A1 S or P	8ppm	1675.00
Canon Laser LBP-8 A2 S or P	8ppm	2799.00
Canon Laser II S&P	8ppm	1975.00
Hewlett Packard LaserJet S	8ppm	1495.00
Hewlett Packard LaserJet Series II	8ppm	1999.00
Hewlett Packard LaserJet 500 S + P	8ppm	3465.00
Kyocera F1010	10ppm	2999.00
Kyocera F2010	10ppm	4380.00
Oki Laser Line 6	6ppm	1645.00
Qume Laser Ten	10ppm	2300.00
Qume Laser Ten + Plus	10ppm	2900.00

Maths Co-Processors

Maths Co-Pro 8087 5mhz/8mhz	120/145.00
Maths Co-Pro 80287 6mhz/8mhz	175/250.00

Mouses

Summa Graphics Mouse	110.00
Microsoft Mouse (Serial or Bus)	140.00
Logitek Mouse	99.00

IBM Compatable Turbo Upgrades

AST Flashpack 9 54mhz NEC V30	295.00
Orchid Tiny Turbo 80286 8mhz	399.00
Orchid 286e Turbo 80286 8mhz 1mb Memory	778.00
Orchid JET386 Turbo 80386	795.00

Modems & Telex

Sage Chit-Chat + Modem	275.00
Breakout Modems come with Crosstalk XV1 & Breakout	
Breakout Ext or Int V23 V21	450.00
Breakout Ext or Int V23 V22 V21	599.00
Breakout Ext or Int V23 V22 V22bis V21	799.00
Procom 20 Internal Telex Card	699.00
Dowty Microtelex	795.00

Tape Backup

Christy Reel One	675.00
Everex 20mb Internal	630.00
Everex 20mb External	725.00
Everex 60mb Internal	899.00
Everex 60mb External	925.00
Tallgrass TG40/60 External	1199.00
Identica 60mb External	799.00

Ink Jet Printers

Epson SQ2500	180/540cps	1199.00
Canon BJ-80	110/220cps	388.00
Hew. Packard Thinkjet 80col	160cps	399.00
Hew. Packard Quietjet 132col	40/192cps	553.00

Terminals

Qume QVT101	ASCII	294.00
Qume QVT101 +	ASCII	340.00
Qume QVT103	ANSI	505.00
Wyse WY-60	ASCII	510.00

Daisywheel Printers

Brother HR20D	22cps	335.00
Brother HR25XL	28cps	515.00
Brother HR40	40cps	775.00
IBM Wheelprinter	25cps	795.00
IBM Quietwriter Mod3 Graphics	80/273cps	845.00
Juki 6100	45cps	265.00
Olivetti DY300	35cps	599.00
Olivetti DY800	80cps	1175.00
Qume 11/55	55cps	1275.00

Hard Disks

10mb to 20mb Hard Disk Exchange	320.00
360kb to 10mb Hard Disk Exchange	260.00
360kb to 20mb Hard Disk Exchange	320.00
360kb to 30mb Hard Disk Exchange	340.00
Fitting on the above	*15.00*
Outright Sale on the Above	*50.00*
Bernoulli Box 20 + 20mb	2155.00
Large Capacity Hard Disks	Call

Printers Dot Matrix

Brother M1109	25/100cps	175.00
Brother M1409	45/180cps	295.00
Brother M1509	45/180cps	380.00
Brother M1709	50/240cps	445.00
Brother 4018	100/480cps	1150.00
Brother TwinWriter 5	40/160cps	970.00
Brother 2024L	96/160cps	690.00
Epson LX86	16/120cps	210.00
Epson FX800	32/200cps	322.00
Epson FX1000	32/200cps	420.00
Epson EX800 opt Colour	50/300cps	415.00
Epson EX1000 opt Colour	50/300cps	559.00
Epson LQ800	60/180cps	469.00
Epson LQ1000	60/180cps	625.00
Epson LQ2500 opt Colour	90/270cps	785.00
Honeywell 4/21	40/200cps	415.00
IBM Proprinter	40/200cps	363.00
IBM Proprinter XL	40/200cps	395.00
Proprinter X24	67/240cps	445.00
Proprinter XL24	67/240cps	590.00
NEC P5XL	88/264cps	915.00
NEC P6	77/216cps	410.00
NEC P7	77/216cps	490.00
Oki Microline 84p	50/200cps	629.00
Olivetti DM100	25/120cps	199.00
Panasonic KP 1080	20/100cps	185.00
Panasonic KP 1091	29/120cps	245.00
Panasonic KP 1092	33/180cps	320.00
Panasonic KP 1595	51/260cps	520.00

Scanners

AST Turbo Scan	1475.00
HP ScanJet inc. Adaptor	1395.00

Software

Data Base/Accounts

Cardbox Plus	244
Dataease	480
dBase II	270
dBase III plus	357
Clipper dB3 Comp	430
Delta 4 Prof	390
IBM Filing Assis	99
Multisoft A/Cs from	390
Pegasus A/Cs from	175
Sage Bookeeper	85
Sage Accountant	125
Sage Accountant +	155
Sage Fin Cont	240
Paradox	430
IBM Teamwork from	305

Desktop Publishing

Fleet Street Editor	210
Pagemaker	595
sc\LASERplus	299
Ventura	795

Graphics

Autosketch	75
Autocad 2 + EX123	2150
Autocad 2 Base	300
MS Chart	184
Domino	365
Energraphics	240
VXN Execuvision	396
Gem Draw +	125
Gem Graph	125
Gem Wordchart	89
Freelance Plus	275

Amstrad PC1512 (Budget)

Reflex	60
Wordstar 1512	60
Delta 4 1512	87
Domino 1512	87
Supercalc 3	60
Sage PC Write	84
Sage Deskset	69
Sage Retrieve (DB)	84
Sidekick	25

Word Processing

DisplayWrite 4	350
Manuscript	299
1-2-3 Report Writer	99
Symphony Text Outliner	89
Multimate Adv	395
Multymate	295
Samna III	355
Samna Plus	435
Word Perfect	270
Word 3	280
Wordcraft 3	360
Wordcraft Elite	600
Wordstar	170
Wordstar 4	205
Wordstar 2000R2	265
Wordstar 2000 +	285
Writing Assist	79

Spreadsheet

Framework II	345
Open Access	290
Smart Suite v3.1	388
Symphony	357
Javelin	380
Lotus 123	247
Lotus HAL	110
Multiplan v2.0	169
Supercalc 4	225

Utilities & Games

Crosstalk XVI	110
Flight Simulator	35
Gem Collection	94
Gem Desktop	47
Norton Util V4	65
Sidekick (NCP)	55
MS Windows	75
Top View	115
Lotus Metro	85

Network Systems Available
Please call for details

Special Offers

20mb Olivetti

M24 Base Unit
Compat 20mb Hard Disk
1 x 360kb Floppy Disk
Monitor - Keyboard
640kb Memory + Dos 3.1
Serial + Parallel Ports
Clock

Mono £1575
Colour £1795
30mb Hard Disk
Mono £1640
Colour £1860

IBM Personal System 2 ™

PS/2 Model 30-002
8086 8mhz
2 x 720kb 3.1/2"
Int. Colour Adp MCGA
Clock + 640kb Memory
Mouse Port
Serial + Parallel Ports

Mono £1299
Colour £1546

PS/2 Model 30-021
8086 8mhz
1 x 720kb 3.1/2"
1 x 20mb Hard Disk
Int. Colour Adp MCGA
Clock + 640kb Memory
Mouse Port + Lock
Serial + Parallel Ports

Mono £1674
Colour £1921

PS/2 Model 50-021
80286 10mhz
1 x 1.44kb 3.1/2"
1 x 20mb Hard Disk
Int. Colour Adp VGA
Clock + 1mb Memory
Mouse Port + Lock
Serial + Parallel Ports

Mono £2575
Colour £2950

All Prices Subject to Change E&OE.

WORLDWIDE COMPUTERS PLC

Computers by Post

LOWEST U.K. PRICES GUARANTEED

PRINTER RIBBONS

		2+	5+	12+
ACORN	AP80	£2.70	£2.20	£2.00
	AP100	£2.70	£2.20	£2.00
AMSTRAD	DMP1	£3.90	£3.30	£3.10
	DMP2000/3000	£4.40	£4.10	£4.00
	PCW8256/8512	£4.30	£4.00	£3.80
BROTHER	HR5	£3.00	£2.80	£2.60
	HR15 Corr	£2.90	£2.50	£2.30
	HR15 FAB	£3.30	£2.90	£2.60
	HR15 MS	£3.20	£2.80	£2.50
	HR15 also for HR25/HR35			
	EP44	£2.90	£2.50	£2.30
	M1009	£3.40	£2.90	£2.70
CANON	PW1080A Black	£3.10	£2.60	£2.40
	PW1080A Red or Blue	£4.50	£4.10	£3.80
	PJ1080 Ink Jet Colour. One Off			£10.90
	PJ1080 Ink Jet Black. One Off			£8.90
CBM	1515	£2.70	£2.20	£2.00
	1525	£2.70	£2.20	£2.00
	MPS801	£3.60	£3.00	£2.80
	802/1526	£3.70	£2.90	£2.70
	803	£3.40	£2.90	£2.70
	MPS1000	£2.70	£2.30	£2.10
	4022	£2.70	£2.30	£2.10
	MSC801 Colour. One Off			£18.50
	DPS1101 SS	£2.40	£1.90	£1.75
	DPS1101 MS	£2.90	£2.50	£2.30
	DPS1101 Corr	£1.80	£1.50	£1.40
CENTRONICS	GLP 1/2	£3.40	£2.90	£2.70
CITIZEN	120D	£5.00	£4.60	£4.30
DAISYSTEP	2000 MS	£3.10	£2.60	£2.40
	2000 FAB	£4.90	£4.20	£4.00
EPSON	MX/FX/RX80 Black	£2.70	£2.30	£2.10
	MX/FX/RX80 Red or Blue	£3.90	£3.20	£3.00
	100 Series	£3.70	£3.30	£3.00
	LX80/LX86	£2.70	£2.30	£2.10
	JX80 Colour. One Off			£18.50
	LQ800	£3.70	£3.30	£3.10
	LQ1000	£4.50	£3.90	£3.60
JUKI	6000/2200 MS	£4.00	£3.60	£3.40
	6000/2200 Corr	£3.10	£2.70	£2.50
	6100 MS	£2.90	£2.50	£2.30
	6100 SS	£2.40	£1.90	£1.75
	6100 Corr	£1.80	£1.50	£1.40
KAGA	KP810 Black	£3.10	£2.60	£2.40
	KP810 Red or Blue	£4.50	£4.10	£3.80
M/TALLY	MT80	£3.70	£2.90	£2.70
OKI	80/82	£1.40	£1.10	£1.00
	84	£3.90	£3.40	£3.20
	Mate 20 Colour	£7.00	£6.50	£6.20
	Mate 20 Black	£6.60	£6.20	£6.00
PANASONIC	Dot Matrix	£5.00	£4.60	£4.30
QUENDATA	DWP1120 MS	£3.10	£2.60	£2.40
	DWP1120 FAB	£4.90	£4.20	£4.00
QUENDATA	DWP1120 MS	£3.10	£2.60	£2.40
	DWP1120 FAB	£4.90	£4.20	£4.00
QUME	Sprint 7/9 MS	£2.80	£2.30	£2.10
	Sprint 7/9 FAB	£4.00	£3.70	£3.40
SEIKOSHA	GP50	£6.00	£5.50	£5.20
	GP80	£2.70	£2.20	£2.00
	GP100/250	£2.60	£2.20	£2.00
	GP500/550	£3.90	£3.30	£3.10
	GP700 Colour. One Off			£18.50
	SP1000	£6.00	£5.50	£5.20
SHINWA	CP80	£3.70	£2.90	£2.70
SMITH CORONA	Fastext 80 (Twinpack)	£11.70	£11.20	£10.90
	TPI M/S	£8.50	£7.90	£7.20
	TPI Fabric	£3.90	£3.60	£3.40
	TPI Corr	£5.00	£4.70	£4.50
	D100/200	£4.80	£4.40	£3.90
	D300	£6.00	£5.50	£5.30
STAR	DP/GEMINI/SG	£1.40	£1.10	£1.00
	SR15	£4.90	£4.50	£4.30
	NL10	£5.40	£4.70	£4.40

FLOPPY DISKS

5¼"		BOXES OF 10 DISKS 1-2	3-9	10+
JVC inc Plastic Case				
MD-1D	S/side D/dens 40TR	£9.99	£9.50	£9.25
MD-2D	D/side D/dens 40TR	£11.99	£11.50	£11.25
MD-2DD	D/side Q/dens 80TR	£15.99	£15.50	£15.25
MD-2HD	D/side H/dens 1.6MB	£26.99	£25.99	£25.49
VERBATIM – DATALIFE				
MD525	S/side D/dens 40TR	£11.60	£11.00	£10.60
MD550	D/side D/dens 40TR	£14.80	£14.00	£13.60
MD577	S/side Q/dens 80TR	£14.99	£14.75	£14.49
MD557	D/side Q/dens 80TR	£19.50	£19.00	£18.60
MD HD	D/side H/dens 1.6MB	£27.99	£26.99	£25.99
FUJI	*S/side D/dens 40TR	£10.99	£10.50	£10.25
	*D/side D/dens 40TR	£13.49	£12.99	£12.75
*Coloured Disks – red, green, blue, beige, grey £1.00 per box extra.				
	D/side D/dens 80TR	£17.99	£17.50	£17.25

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

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

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

3" DISKS

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

LASER PRINTER CONSUMABLES

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

DISK STORAGE

LOCKABLE DISK BOXES

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

PRINTER CABLES & INTERFACES

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

COMPUTER STATIONERY

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

COMPUTER LABELS

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

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

PRINTERS

Silver Reed EXP500	£159.95
Epson LX86	£199.95
Epson FX800	£319.95
Epson FX1000	£409.95
Epson EX800	£415.95
Epson LQ800	£469.95
Citizen 120D	£155.95
Amstrad DMP2000	£139.95
Amstrad DMP3000	£165.95
Amstrad DMP4000	£342.95
Panasonic KXP1080	£149.95
Oki-mate 20 Colour	£169.95
Micro P MP165	£199.95
Star NL10 inc I/F	£199.95
Star NX15	£299.95
Star NR15	£429.95
Star NB24-10	£429.95
Star NB24-15	£549.95
Juki 6100	£279.95
HP Laserjet Laser Printer	£1549.95
Canon A-1 Laser Printer	£1629.95
Oki Laserline 6	£1559.95
QMS K8	£1659.95
Citizen Overture	£1529.95

COMPUTERS

Amstrad PCW8256	£379.95
Amstrad PCW8512	£475.95
Amstrad CPC6128 Green	£239.95
Atari 520STM	£213.95
Atari 520STFM	£327.95
Atari 520STFM+mono monitor	£409.95
Atari 1040STF	£489.95
Atari 1040STF+mono monitor	£572.95
20 Meg Hard Disk	£579.95
Mono monitor	£122.95
Colour monitor	£329.95
Commodore C64	£139.95
Commodore C64C compend.	£204.95
CBM 1541C Disk Drive	£168.95
CBM Amiga 512K Syst 1	£899.95
Sinclair Spectrum 128K + 2 inc Joystick + Software	£126.95

AMSTRAD PC1512

Single Drive Mono Monitor	£435.95
Double Drive Mono Monitor	£539.95
Single Drive Colour Monitor	£599.95
Double Drive Colour Monitor	£709.95
S/D Mono + 20 Meg Hard Card	£829.95
S/D Colour + 20 Meg Hard Card	£999.95
S/D Mono + 30 Meg Hard Card	£899.95
S/D Colour + 30 Meg Hard Cord	£1069.95

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

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

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

CF2 3" Disks
Box of 10
£28.90

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

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

All prices exclude VAT

CREDIT CARD HOT-LINE

01-760 0014

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

Export Enquiries Welcome

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

I wish to order_____

My computer is_____

I enclose cheque/PO for £_____ inc VAT

or charge my Access/Visa No:

Name_____

Signature_____

Address_____

Postcode_____ Tel No:_____

P.C.W. 6/87

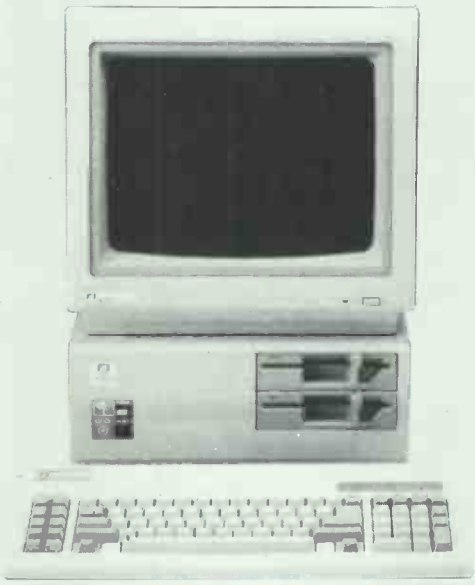
NEW

80386

£4650
Including EGA Monitor

* 80386 at 16Mhz
* 1Mb Ram Expandable 2Mb on board
* 40Mb Hard Disk Drive
* 1.2 Floppy Disk Drive
* Maths Co-processor Socket
* 8 Slots
* EGA Display Card
* 14" EGA Monitor
* Parallel Printer Port
* RS232 Communications Port
* Calendar Clock
* 200 Watt Power Supply
* Enhanced Keyboard with 101 keys
* MS-Dos 3.x

PC,XT, & AT.



AT—6,8,10Mhz

£1429
2 x 1.2Mb Drives

£1675
20Mb & 1 x 1.2Mb Drives

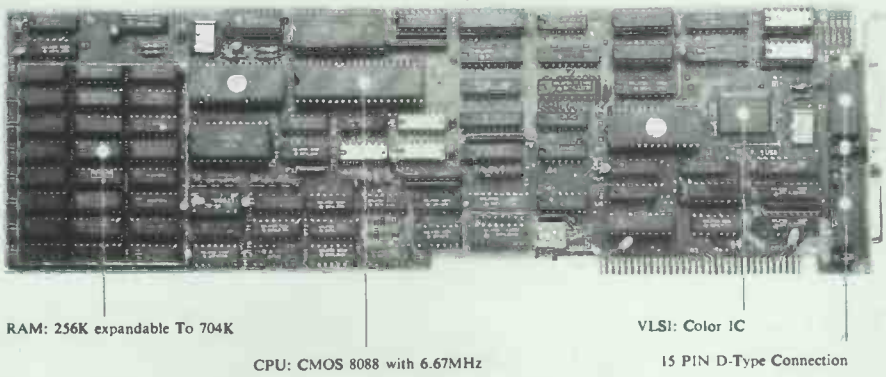
PC & XT—4.77 & 8Mhz

£625
2 x 360Kb Drives

£995
20Mb & 1 x 360Kb Drives

* PC & XT 8088-2 at 4.77 or 8Mhz
  AT 80286 at 6,8 or 10Mhz
* 640Kb Ram (Expandable to 1Mb on AT)
* Maths Co-Processor Socket
* 8 Slots
* Hercules compatible Monographic Display Card
* Parallel Printer Port
* RS232 Communications Port
* Calendar Clock
* 150 watt Power Supply PC & XT
  180 watt Power Supply AT
* 14" Tilt & Swivel Monochrome Monitor
* Turbo Switch, Activity LED's & Reset on Front Panel
* MS-Dos 3.x

OURS 88



* NEC V20 at 6.67 Mhz
* 256Kb Ram expandable to 740Kb
* Parallel Printer Port
* RS232 Communications Port
* Disk and Peripheral Sharing
* File Lock Protection
* Cabling to Maximum Length of 200ft.
* NORTON SI 2.4
* Requires MS—Dos 3.x

£616 Complete with Dual Frequency 14" Monitor, Cables & Keyboard.

The OURS88 Expansion Card is a breakthrough in PC/AT Technology, offering significant saving when compared with additional PC's or Networked Work Stations. Utilising a Single Slot to perform the Network function of a full Computer it provides convenient operation of both data and any combination of peripherals.

Barbatan Limited

All prices quoted exclude VAT

35-38 High Street, Bristol. BS1 2AW
Telephone: Bristol, (0272) 213928
Fax (0272) 213541

DEALER ENQUIRIES INVITED

DIGITASK 0342 24631

Unit M, Charlwoods Business Centre, Charlwoods Road, East Grinstead, West Sussex RH19 2HH **Telex 957418**

CALL US FOR THE BEST GENUINE PRICES IN THE UK.

DOT MATRIX PRINTERS

BROTHER M1109 80col 100cps 25NLQ F/T P&S	(220)	162
BROTHER M1409 110col 180cps 45NLQ F/T P&S	(385)	289
BROTHER M1509 136col 180cps 45NLQ F/T P&S	(495)	353
BROTHER M1709 136col 240cps 65NLQ F/T P&S (dual i/face) IBM/FX Comp Paper Parking	(595)	439
BROTHER 2024L 136col 160cps 96NLQ P 24 pin head	(795)	599
BROTHER TWINWRITER		959
CITIZEN 120D 80col 120cps 25NLQ F/T P	(245)	147
CITIZEN MSP-10 80col 160cps 40NLQ F/T P	(349)	259
CITIZEN MSP-15 136col 160cps 40NLQ F/T P	(449)	325
EPSON LX-86 80col 120cps 16NLQ F P	(275)	191
EPSON FX-800 80col 200cps 40NLQ F/T P	(430)	299
EPSON EX-800 80col 300cps 50NLQ T P	(555)	399
EPSON FX-1000 136col 200cps 40NLQ f/t P	(550)	396
EPSON LQ-800 80col 180cps 60NLQ F P 24 pin head	(625)	423
EPSON EX-1000 136col 300cps 50NLQ T P	(745)	536
EPSON LQ-1000 136col 180cps 60NLQ F P 24 p h	(835)	559
EPSON LQ-2500 136col 270cps 90NLQ T P 24 p h	(1045)	695
EPSON SQ-2500 Ink Jet	(1345)	989
MICRO-P MP 165 80col 165cps 35NLQ F/T P	(259)	189
MICRO-P MP200 80col 200cps 40NLQ F/T P	(329)	247
MICRO-P MP201 132col 200cps 40NLQ F/T P	(399)	305
NEC Pinwriter P6 80col 216cps 72NLQ F P 24 p h	(549)	377
NEC Pinwriter P7 136col 216cps 72NLQ F P 24 p h	(649)	447
NEC Pinwriter P5 136col 264cps 86NLQ F P 24 p h	(1066)	745
NEWBURYDATA. DIABLO. QUME. RICOH		CALL
OKI ML182 80col 120cps NLQ F P	(269)	189
OKI ML192 80col 160cps NLQ F P	(375)	283
OKI ML193 132col 160cps NLQ F P	(485)	367
OKI ML84 80col 200/400cps NLQ F/T P	(779)	618
OLIVETTI DM100/4 80col 120cps 25NLQ F P	(295)	188
OLIVETTI DM280/1 180col 160cps 35NLQ F/T P	(466)	288
OLIVETTI DM290/1 136col 160cps 35NLQ F/T P	(581)	363
OLIVETTI DM600 132col 200cps 70NLQ F P&S	(1179)	929
STAR NL-10 80col 120cps 30NLQ F/T P	(278)	197
STAR ND15 136col 180cps 45NLQ F/T P NEW	489	352
STAR SR-10 80col 200cps 50NLQ F/T P	(489)	319
STAR NX-15 136col 120cps 30NLQ F/T P NEW	(389)	289
STAR SR-15 136col 200cps 50NLQ F/T P	(589)	335
STAR NB 24-15 136col 216cps 72NLQ F/T P IBM/Epson Comp 24 pin head 360dpi NEW	(759)	589
STAR NB-15 136col 300cps 100NLQ F/T P IBM/Epson Comp 24 pin head 260dpi NEW	(949)	679

DAISY WHEEL PRINTERS

BROTHER HR20 117col 22cps F P&S (dual i/face)	(445)	327
BROTHER HR25XL 132col 25cps F P&S (dual i/face)	(695)	529
BROTHER HR35 132col 20cps F P	(995)	699
JUKI 6000 80col 12cps F P	(199)	165
JUKI 6100 132col 20cps F P	(399)	239
JUKI 6200 132col 30cps F P	(579)	397
JUKI 6300 132col 40cps F P	(899)	660
JUKI 6500 132col 60cps F P	(1299)	997
OLIVETTI DY450/1 132col 45cps F P Diablo compat	(1140)	799
OLIVETTI DY800/2 132col 80cps F P&S (dual i/face)	(1483)	1059

COLOUR PRINTERS

	RRP	Our Price
OLIVETTI DM 285/1 80col 160cps 35NLQ F/T P JX compat	(555)	415
OLIVETTI DM 295/1 132col 160cps 35NLQ F/T P&S (dual i/face) JX compat	(707)	526
OLIVETTI DM 590/1 132col 192cps 120NLQ F P JX/Qume/Diablo compat	(1137)	846

LASER PRINTERS

AST TURBO LASER 10 page/min 1 5MB	(4150)	3199
BDS 630/8 8 page/min IBM/Diablo compat 28KB	(2249)	1656
CANON LBP8-A1 Mk 2 8 page/min P or S 128KB	(2195)	1829
CANON LBP8-A2 8 page/min P A4 Vec G 1024KB	(3845)	2699
DATAPRODUCTS LASER PRINTER 26 p/m p/script	(4950)	14359
HP LASERJET 8 page/min 128KB	(2664)	1475
HP LASERJET PLUS 8 page/min P or S 512KB	(3658)	1970
INTEROUADRAM QUADLASER 8 page/min 1 5MB		CALL
OLIVETTI PG-101 8 page/min P & S Diablo/HP/ Epson 250KB NEW	(3140)	2499
QUME LASERTEN PLUS 10 p/m t & en g 512KB	(3499)	CALL
QUME LASERTEN 10 page/min t & g 128KB	(2880)	2249
RENTAL RESCH MODEL 30 26 page/min A3/A4 Tektronix/Diablo/HPGL/Epson/HPGL+ 2MB	(13600)	13199
RICOH LASER PRINTER 10 page/min	(3950)	3159
For details of compatibility		PLEASE CALL

COMPUTERS

DIGITASK PC16X STARTER SYSTEM XT compat. Single 360KB floppy drive	499
DIGITASK PC16X FULL FEATURE SYSTEM XT compat. Dual 360KB floppy drive	695
DIGITASK PC16X BUSINESS PRO SYSTEM XT compat. 20MB hard drive. 1 x 360KB floppy drive	975
DIGITASK PC16X BUSINESS PRO PLUS SYSTEM XT compat. 20MB hard drive. 1 x 1.2MB + 1 x 360KB floppy drive	1159
DIGITASK VT286 TURBO AT compat.	From £1253

MAINBOARDS

SUPER TURBO XT 4 77/8 MHz (up to 640K-with OK)	149
SMALL FOOTPRINT PC/AT Comp 6/8/10 MHz (OK)	499

MONO MONITORS

	RRP	Our Price
SAMSUNG SM125F 12" Amber. Med Pers. Hi Res. TTL/IBM with T&S base	(139)	95
TAXAN KX-1201 12" Green comp P31 Short Pers	(109)	85
TAXAN KX-1202 12" Green comp P39 Long Pers	(119)	89
TAXAN KX-1203 12" Amber comp PUL Long Pers	(119)	91
TAXAN KX-1212 12" Green Hi Res P39 Long Pers TTL/IBM	(149)	118
TAXAN KX-1213 12" Amber Hi Res PUL Long Pers TTL/IBM	(149)	109

COLOUR MONITORS

TAXAN SUPERVISION 620 12" Hi Res IBM/RGB	(389)	265
TAXAN SUPERVISION III 12" Ultra Res IBM/RGB	(459)	309
TAXAN SUPERVISION IVm 12" Hi Res IBM/OLI/RGB	(499)	349
TAXAN SUPERVISION IV 12" Ult Res IBM/OLI/RGB	(579)	459
THOMSON 36512VP1R 14" Med Res TTL/RGB/RGBI/PAL comp 0.48 dot	(261)	225
THOMSON 36382SIR 14" Hi Res TTL/RGB/RGBI 0.38 dot (inc cabl)	(385)	329

EGA MONITORS

NEC MULTISYNC 14" Hi Res TTL/Analog IBM/CGA/EGA/PGS 0.31 dot NEW	(649)	579
PHILIPS CM8873 MULTISYNC 14" Hi Res TTL IBM/RGB/RGBI CGA/EGA/PGA NEW	(499)	425
TAXAN SUPERVISION 660 12" Hi Res TTL/EGA	(549)	389
TAXAN SUPERVISION 760 14" Hi Res TTL/EGA	(579)	439
TAXAN SUPERVISION 860 16" Hi Res TTL/EGA	(899)	699
THOMSON 44700 14" Hi Res TTL/IBM/EGA/CGA	(495)	419
THOMSON 4270M MULTISCAN 14" Super Hi Res TTL IBM/MDA/CGA/EGA/PGA 0.31 dot NEW	(669)	559

PC/XT/AT HARDWARE

POWER SUPPLY 135/150 max Watt Switch Mode XT	89
AT Keyboard replacement (84 Key)	109
MITSUBISHI FLOPPY DRIVE 360KB Half Ht	69
MITSUBISHI FLOPPY DRIVE 1.2MB for PC/AT	125
FLOPPY DRIVE 360KB Half Ht DS/DD (Grey front) for AT	95
NCL HARD/FLOPPY CONTROLLER for PC/AT (to 16MHz)	169
KEYBOARD K-150M AT-Style for XT (84 Key)	89
CASE PC/XT Swingtop (incl hardware kit)	55

WINCHESTER DRIVES

SEAGATE ST213 10MB H.Ht (65ms access)	(470)	220
SEAGATE ST225 20MB H.Ht (65ms access)	(545)	240
SEAGATE ST238 30MB H.Ht (65ms access) Plated Media with all Contr & Cables (Xt only)	(575)	499
SEAGATE ST4026 20MB F.Ht (40ms access)	(745)	524
SEAGATE ST251 40MB H.Ht (40ms access)	(1015)	624
SEAGATE ST4038 30MB F.Ht Vcoil (40ms access)	(919)	624
SEAGATE ST4051 40MB F.Ht (40ms access)	(1060)	754
SEAGATE ST4096 80MB F.Ht (28ms access)	(1946)	999
WD/NCL XT Hard drive controller & cables		95
NCL SHORT CONTROLLER (Up to 16MHz) FDD/HDD for AT		169
AT HARD DRIVE Cable set		12
AT FLOPPY DRIVE Cable set		12

TAPE STREAMERS

ARCHIVE 3540 40MB Internal streamer (XT or AT)	(499)	389
CRISTIE THE REEL ONE 1020i 20MB Internal Strmr	(695)	559
EVEREX STREAM-20 20MB Internal Streamer	(895)	585
EVEREX STREAM-60 60MB Internal Str (XT or AT)	(1295)	815
ODYSSEY DRIVER BOARD for Extnl Strmr XT & AT	(125)	95
ODYSSEY XR4 40MB Internal Streamer XT & AT	(895)	595
ODYSSEY XR4 40MB External Streamer XT & AT	(995)	695
QIC-125 Fast prof 125MB b up Novell. 3COM comp	(1499)	1349

T-SWITCHES & BUFFERS

T-SWITCH Parallel 1-2 (or Serial 1-2)		35
INTELLICOM LONGLINK Parallel to Parallel inc 50ft cable (up to 7000ft maximum)	(149)	135
UPGRADE TECH BUFFER 64KB P-P stand alone	(140)	119
UPGRADE TECH BUFFER 256KB P-P stand alone	(256)	219
UPGRADE TECH BUFFER Half Megabyte Dual Channel full feature stand alone	(395)	335
UPGRADE TECH BUFFER One Megabyte Dual Channel full feature stand alone	(495)	419

PLOTTERS

EPSON HI-80 4 pen A4	(400)	345
HP 7440A 8 pen A4	(1160)	985
HP 7475A 6 pen A3	(1796)	1469
HP 7550A 8 pen A3	(3813)	3399
ROWLAND DXY 880A 8 pen A3	(775)	645
ROWLAND DXY 980A 8 pen A3	(1100)	924

SPECIAL OFFERS

INFOREM MULTIFUNCTION CARD 640KB Max Populated to 384KB Name brand UK product Comms 1. Comms 2 opt. parallel 1. games. clock with full Software	(195)	95
WESTERN DIGITAL FILECARD 10MB	(595)	296
VICTOR 80286 FASTCARD for PC/XT and comp. Socketed for 80287 8K cache selectable 5 or 8MHz (virtually ident'l to Mountain Racecard)	(799)	375
IBM PC-ATE 512KB Ram 1.2MB 20MB Keyboard UK	(3467)	2395
EPSON PC 256KB 1 x 360KB 20MB 12" Hi Res Dyneer Monitor Persyst display adaptor with printer port	(1459)	1139
EPSON PC As above with Taxan Supervision II & Taxan display adaptor	(1675)	1299

BRANDED PERIPHERALS

EGA & MONITOR COMBI	
TAXAN K14SV760 14" Supervision 760 monitor non glare. high contrast 21.85/15.75KHz/Paradise autoswitch EGA-MDA, CGA, Hercules & Plantronics compatible	649
PACKARD BELL EGA & Monitor EGA. CGA. MDA compat	559
PRINCETON 12" & AST 3G EGA card. MDA. CEA. Hercules compat optional printer port	575
RAM EXPANSION	
AST ADVANTAGE 0K 1S. 1P (AT only) upgradeable to 3MB	349
AST ADVANTAGE PAK 0K (up to 1.5MB)	119
AST RAMPAGE XT (2MB) Pop. to 256K	199
AST RAMPAGE AT (2MB) Pop. to 512K	449
AST RAMVANTAGE with 128K (upgra'ble to 3MB) for PCAT	349
AST SIXPACK PLUS. 64KB. 1C. 1S. 1P (upgra'ble to 384K)	197
AST SIXPACK PREMIUM 512KB. C. 1S. 1P (EMS)	309
INTEL ABOVE BOARD	CALL
INTERQUADRAM Memory expansion & I/O cards	CALL
INFOREM 256K Ramcard (256K pop) (128K for AT)	95
PERSYST PC/Short memory board (0K pop) to 384K	109
PERSYST MEGA Memory AT/XENEX up to 3MB (0K pop)	289
PERSYST STRETCH (Lotus/intel/MS) up to 2MB (0K pop)	219
EVEREX Mini Magic 60K pop) up to 576K	85
EVEREX RAM 3000 at (0K pop) up to 3 MB	219
EVEREX RAM 2500 at (0K pop) up to 2.5MB	199
EVEREX Magic Card at 1p. 1s. Ws. (0K pop) up to 2MB	259
NETWORKS	
AST-PC NET II (RSN 34 PCs more with repeaters 5Mbps)	345
3-COM	CALL
IRMA Emulators & Accessories	CALL
CHASE AT-8 8MHz 32K Ram 32K Rom 50-38400 Baud 8 port serial intell contrllr using 80186 PC/AT-ATE-ATX Xenix 5/concurr PCDOS-5 comp with drivers	1099
GO-FASTER BOARDS	
AST FLASHPAK (NEC. V30 at 9.54MHz)	289
INTERQUADRAM QUADSPRINT	329
MAYNARD SURPRISE TURBO (State PC or compatible)	189
MOUNTAIN RACECARD 80286	459
ORCHID TINY TURBO	389
ORCHID TURBO EGA	499
ORCHID PC-TURBO 186 with 256K	699
ORCHID JET 386 PC/AT upgrade up to 3 x faster! NEW	799
ORCHID TURBO PGA	949
TITAN ACCELERATOR PC 512K	729
TITAN ACCELERATOR PC 256K	659
DISPLAY ADAPTORS	
AST 3-G EGA card 256K, MDA, Herc. CGA & EGA compat	218
AST COLORGRAPHPLUS (full spectrum) 32KB. 1P	159
EVEREX THE EDGE Mono/Colour 80/132 col. Lotus/Symphony compat	319
EVEREX GRAPHIC EDGE as above with graphics	339
ORCHID EGA. (MDA, CGA & Hercules compat)	195
TAXAN KIF3810 IBM comp (640 x 400 dots) Download Characters	229
TAXAN KIF 3800 IBM CGA comp (10 x 16 text) Supervision 4/4M)	145
TAXAN KIF3650SP IBM CGA. MDA. Herc comp (short) 1P	169
TAXAN KIF 3600SP IBM CGA compat (short) 1P	119
HERCULES PLUS Card	178
HERCULES CGA	94
HERCULES Monochrome/gr Adaptor	165
OTHER	
RADCOM BAR CODE READER (inline keyboard)	449
ADDONICS SERIAL/PARALLEL CARD for AT	89
ADDONICS MULTI-ASYNC CARD for AT (4 port)	195
BROTHER 3.5" FLOPPY DRIVE for PC/XT (Integral PSU) NEW	159

GENERIC PERIPHERALS

576K Ramaster Expansion Card (0K)	89
640K Multifunction Card (0K) 1P. 1S. 1G. 1C. SW	97
8255 I/O Card	89
Async Comms Adaptor (dual port) 2S	39
Async Comms Adaptor Upgrade Kit (1-port)	12
Async Comms Adaptor 1S. 2S. optional	27
4-port Multi Async comms adaptor. 4S	119
Colour/Gr & Printer Adaptor RGB 2 comp LP	129
Colour/Graphics adaptor	79
Drive Master 1.2MB/360KB 4 floppy contr for PC/XT	CALL
Eprom Programmer/Analyser PCP-128 to 128K SW	149
Eprom Programmer/Analyser to 512K. 4-BANK. SW	259
Floppy Drive Adaptor (4 drive) 4FI	54
Floppy Drive Adaptor (2 drive) short. 2FI	32
Games Adaptor (dual port)	24
Little Dictator Voice Recognition Syst. 500 word 2/10 sec	CALL
Mono/Graphic (Hercules compat) card	87
Multi I/O & Display Adaptor 1P. 1S. 1G. 1C. 2FI. CGA. MGA. LP. SW	159
Multi I/O Adaptor 1P. 1S 1C. 1G. 2FI. SW	95
Parallel Printer Adaptor 1P	18
PS10-XT short Multifunction Adaptor 1P. 1S. 1C. SW	99

RAM CHIPS & PROCESSORS

INTEL 8087 (8087-3) 5MHz math co-proc chip (PC/XT)	97
INTEL 8087-2 8MHz math co-proc chip (TURBO PC/XT)	139
INTEL 80287-6 5MHz math co-proc (PC/AT Apricot)	167
INTEL 80287-8 8MHz math co-proc (PC/ATX Apricot)	195
INTEL 80287-10 10MHz math co-processor	200
NEC V-20 Fast processor (8088 equiv)	14.95
NEC V-30 Fast processor (8086 equiv)	14.95
SAMSUNG 4164 DRAM CHIP 150ns (set of 9)	8.50
SAMSUNG 41256 DRAM CHIP 150ns (set of 9)	22.50
SAMSUNG UPGRADE 256KB - 640KB	39.95
SAMSUNG ONE MEGABYTE CHIP SET (144 x 4164) or (36 x 41256) multiples of 1MB only	79

CLAIM YOUR FREE PRINTER DUST COVER WITH EVERY PRINTER PURCHASE

FREE PRINTER CABLE with EVERY PRINTER PURCHASE OVER £400 (Offers available while stocks last)

FREE VIDEO COPYING KIT OR BOX OF 10 DISKETTES WITH EVERY ORDER OVER £300 (Excluding printers)

HARDWARE, PERIPHERALS AND SOFTWARE FOR 1512/IBM AT LOW PRICES

GUARANTEED 24 HOURS DELIVERY OPEN 7 DAYS A WEEK

GAMES AND ADVENTURE

Cyrus II Chess	£18.95
Sargon III Chess	£47.00
Summer Games	£18.95
Winter Games	£18.95
Alex Higgins Snooker	£18.95
Mean 18 Golf	£18.95
Pitstop	£18.95
Grand Slam Bridge Master	£18.95
Silent Service	£23.95
Solo Flight II	£18.95
F15 Flight Eagle	£20.95
Gato	£28.95
Balance of Power	£28.95
Orbiter	£28.95
Silicon Dreams	£18.95
Star Glider	£18.95
Championship Golf	£23.00
Strip Poker	£19.00
Leather Goddess	£27.00

BUSINESS GRAPHICS

GRAPHSTATION — Business Presentation & analysis Graphics	£595.00
PIZAZZ — RAM Resident Print Enhancement Program	£99.00

SPECIALIST SOFTWARE

INSURMITE — Insurance office Automation	£POA

COMMUNICATION

TELETERM — EM Terminal Emulation and Communication Software	£550.00

WORD PROCESSORS

Wordstar 1512	£56.95
Sage PC Write	£99.00
Word Perfect Junior	£90.00
Tasword PC	£23.00
Volkswriter	£46.00
Gem Write	£90.00
New Word	£90.00

DATABASES

dbase III plus	£590.00
Sage Retrieve	£99.00
PC Promise	£65.00
Reflex	£57.00
VP Info	£95.00
Flying Start	£69.00

SPREADHSEETS

Supercalc 4	£350.00
Supercalc 3	£56.00
Scratchpad +	£51.00
Sage PC Planner	£92.00
Sage Desktop	£70.00

ACCOUNTING SOFTWARE

Sage Financial Controller	£298.00
Sage Accounts Plus	£198.00
Intuitive Bookkeeper	£90.00
Compact Accounts	£180.00
MAP Integrated Accounts	£140.00

DESKTOP PUBLISHING

Serox Ventura	£899.00
Fleet Street Editor	£148.00

INTEGRATED SOFTWARE

Logistix	£95.00
INTEGRATED SEVEN	£95.00
Words and Figures	£95.00
Open Access	£145.00

LANGUAGES

Turbo Pascal	£75.00
Turbo Tutor	£32.00
Turbo Prolog	£73.00
Zorland C	£31.00
Lisp MS DOS	£230.00
C compiler	£350.00

Please send me more information on

☐ I/We have placed an order for

Name

Company Position

Address

Postcode Tel No

Signature

☐ I enclose a cheque for £.... payable to Euromark International Ltd

☐ Bill my company later

MAJOR CREDIT CARDS ACCEPTED

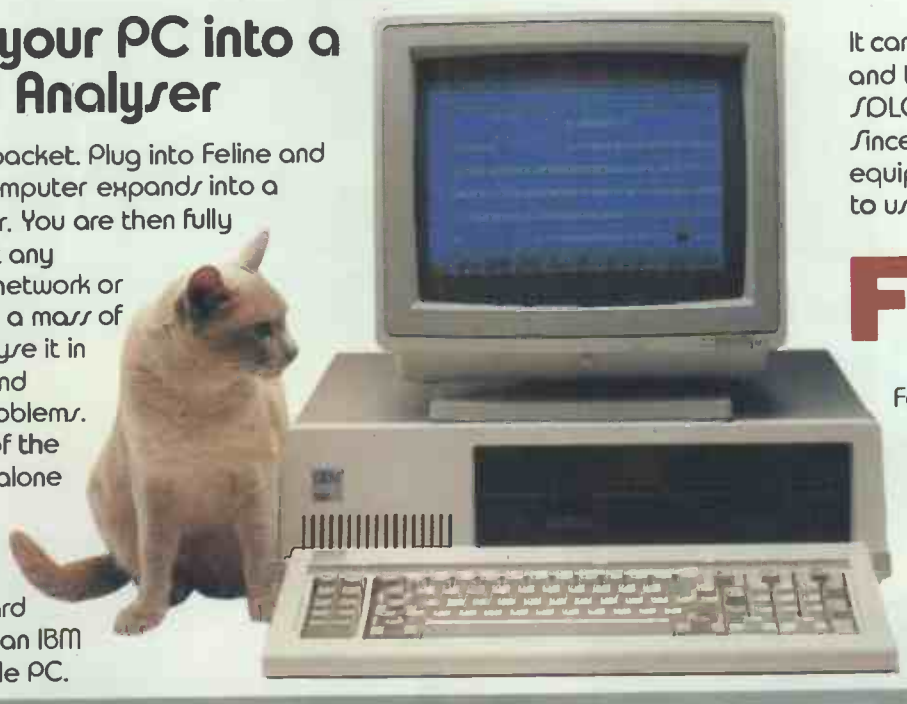
We have a wide range of computers, Peripherals and other powerful software packages. Please return the coupon opposite, **NO STAMPS NEEDED.**
Details available on request.

Euromark International Ltd
FREEPOST (HA2593)
92A High street
Edgware
Middlesex
HA8 7BR
Telephone 01 951 1147/5771/5869
Telex 295441 Busy B. Fax 01-209 1231

PURRFECT

Convert your PC into a Protocol Analyser

Save yourself a packet. Plug into Feline and your Personal Computer expands into a Protocol Analyser. You are then fully equipped to test any communications network or equipment, store a mass of information, analyse it in your own time, and diagnose any problems. All at a fraction of the cost of a stand-alone unit.
Feline is a general purpose analyser on a card which plugs into an IBM or any compatible PC.



It can be used to simulate protocols and to monitor data in Async, Sync, SDLC, HDLC and X.25 formats. Since you are working with familiar equipment, Feline is extremely easy to use.

FELINE™

For further information contact:

Sygnus Data Communications Ltd.
Turret House, Station Road,
Amersham, Bucks. HP7 0AB.
Tel No: (02403) 4757

sygnus

I want to convert my PC **PURRFECTLY.** Please send me details of Feline. PCW 06/87

Name: Position:

Company:

Address:

Tel No:

To:
Sygnus Data Communications Ltd.
Turret House, Station Road,
Amersham, Bucks. HP7 0AB.

Series Four V21, V23, V22, V22bis Data Modems

The last word in Micro-communications

Once in a while a truly exceptional product reaches the market place. When the first modem appeared for a micro computer in the seventies, it transformed the role of the micro. Now the Modem has come of age with the introduction of Series Four the range of intelligent modems from Pace.

All Series Four models include as standard V21/V23 CCITT capability, supplied with microprocessor control, automatic dialling and answering. Hayes compatibility and standard ports for RS232C, telephone, and parallel printer connection.

A 32 character LCD display and three 'touch' controls are used to relay messages about call progress to display time, date etc and to simplify programming of the modem via the Hayes commands. In addition, status LED's monitor modem operation and provide visual indication of the condition.

Multiple baud rates are supported by all Series Four models with 300/300, 1200/75 and 75/1200 rates being available for use with standard viewdata and low speed full duplex systems. For more exacting requirements the Series Four 1200S will support 1200 baud full duplex (V22), and the Series Four 2400S will provide 2400 baud full duplex (V22 bis) operation.

Some of the features of Series Four:

- Multiple baud rates (upgradeable)
- Auto dial/auto answer
- Microprocessor control
- Inbuilt date/time clock
- Automatic speed buffering
- Automatic baud rate detection
- Hayes compatibility
- Auto re-dial
- Dial tone detect
- Number store
- Call progress monitoring
- Printer port
- Unattended printing of incoming data
- 32 character LCD display
- Tone dialling
- Comprehensive 'help' command pages
- Visual line condition indication

The features offered by the new Pace Series Four modems are too numerous to detail fully here, a comprehensive fact sheet is available free on request.

PACE

PACE Micro Technology
Allerton Road, Bradford, West Yorkshire.
Tel. 0274 488211 Telex No. 51338
Prestel Mailbox No. 274 729306
Telecom Gold Mailbox No. 79: PCE 001 Int. Tel. No. +44 274 488211

sbc is the name we have chosen for the smart new range of PC- compatible products for the business computer division of Spectrum Group plc. Spectrum, and its nationwide network of Master Dealers, are justifiably proud to bring to the table a range of PC computers and peripherals, the quality and value of which is simply second to none.

From our compact twin drive sbc FD at £599, through to our top-of-the-range British developed and manufactured, 286 ATE (EGA) at £2199, we can offer you a 'stand alone' system or multi-user/ network system that's more efficient than anything in its class today. To compliment your system, choose from our range of monitors, printers, network systems and uninterruptable power supplies, which pound-for-pound beat anything on the market.

Finally we are so confident about our new product that we include **a 12 month On-Site Maintenance Contract with every sbc computer.**

sbc is the business computer division of Spectrum Group plc
Hunting Gate, Hitchin, Herts, SG4 0TJ. Tel: 0462 37171.

Sensational Value
SBC TP180-9 PRINTER

- High speed 180 cps draft/ 36 cps NLQ
- 96 Standard ASCII plus foreign characters and italic font
- Font styles switchable from front panel
- Adjustable tractor and friction feed with bi-directional paper feeding
- 7K buffer

£249.00

COMING SOON
TP180-24 : 24 PIN HEAD DOT MATRIX.... T.B.A

Uninterruptable Power Supplies at Sensational Prices - from sbc

No need to lose valuable data due to unexpected power failures, our system allows you up to 18 minutes of back-up time - a U.P.S is invaluable in today's business environment.

PWM 200 (200W)	£199.00
PWM 500 (500W)	£299.00
UPS 1000 (1KVA)	£799.00

SBC MONITORS

12" green T.T.L.	£69.95
14" green or amber including swivel & tilt	£99.95
14" medium resolution colour	£269.95
14" EGA compatible colour	£359.00

Bondwell

PC Compatible

Each week more and more major corporations, financial and civic institutions, small and medium size businesses are choosing Bondwell as their PC compatible.

The logic is simple, Bondwell boasts low cost, reliable compatibles which can be used not only as 'Stand Alone' PC's but as part of multi-user systems or networks.

FREE ON SITE MAINTENANCE

On site maintenance for PC's can be very expensive, in some cases costing hundred's of £££'s per annum. We are that confident of the quality of Bondwell PC compatible products that we now include a full 12 months Fast Call Out On Site Service Contract with every Bondwell computer FREE OF CHARGE.

BW18

- MS-DOS and PC-DOS compatibility
- 83 key keyboard
- Built-in 9" amber monitor
- 640K random-access memory
- Dual 5.25" disk drives

£699.00

Other Bondwell Product

BW34 twin floppy XT	£599
BW36 20MB XT	£999
BW38-2 enhanced twin floppy XT	£699
BW38-3 enhanced 20MB XT	£1099
BW63 full size 512KB AT	£1799
BW39 small footprint IMB AT	£1899

SBC MASTER DEALER NETWORK · SBC MASTER DEALER NETWORK

LONDON
E11 Computer Junction 475/477 High Road Harrow Green Leytonstone Tel: 01 556 2266
N3 Mayflower Business Supplies 42 Hendon Lane Finchley Tel 01 346 6300
NW2 Kay Jay Systems 135 Coles Green Road Tel 01 208 0100
NW10 Microartners Park Royal Business Center 9-17 Park Royal Road Tel 01 961 8544
N18 Amson Computing 6 Rays Road Edmonton Tel 01 803 7074
SE18 Computer Facilities 2 Kings Highway Plumstead Tel 01 854 5313
SW11 Arding & Hobbs Clapham Junction Tel 01 228 8877
W1 Micro Anwika Ltd 220A Tottenham Court Road Tel 01 636 2547
W2 Henry's Radio, 404/6 Edgeware Road Tel 01 402 6822
W5 System Supplies 3 Station Parade Ealing Common Tel 01 992 8963
WC2E Relay Data Services 33 Southampton Street Tel 01 240 9905

AVON
BATH Computer News 9 Walcot Street Tel 0225 60541
BRISTOL Barbatan Ltd 35-38 High Street Tel 0272 213928
RAILSEA P&P Systems (UK) Ltd, The Sion Crown Glass Place Tel 0272 856502

BEDFORDSHIRE
LEIGHTON BUZZARD Computa-Scene Ltd, 8 Hockliffe Street Tel 0525 3717090
LUTON Mill Computers 18 Cardiff Street Tel 0582 458806

BERKSHIRE
BRACKNELL Miller Computing Unit 10, Longshot Lane Tel 0344 411133
MAIDENHEAD Avant Garde Systems 54-70 Moorbridge Road Tel 0628 20202
READING Computercare 487 Oxford Road Tel 0734 508099
SLOUGH Slough Computers 245 High Street Tel 0753 21594

BUCKINGHAMSHIRE
CHESHAM D. L Chittenden 59-61 The Broadway Tel 0494 784441

CAMBRIDGESHIRE
PETERBOROUGH Logic Sales 6 Midgate Tel 0733 49696

CHESHIRE
ALTRINCHAM Regent Computers 14 Regent Street Tel 061 928 0333
CREWE Micromart 128 Nantwich Road Tel 0270 216014
NORTHWICH Barda Systems Support Unit 1, GSK House 71/73 Middlewich Road Tel 0606 2351
SALE Leigh Computer Systems 75 Cross Street Tel 061 905 2344
STOCKPORT D. Kipping Ltd., The System Centre Chester Street Chester Gate Tel 061 477 3880
WARRINGTON Pyramid Micros Cairo Street Tel 0925 35713
WARRINGTON Micro Aids Beech House Hob Hey Lane Culcheth Tel 0925 762613

CLEVELAND
MIDDLESBOROUGH Briers Computer Services 1 King Edwards Square Tel 0642 242017
MIDDLESBOROUGH Silicon Services, Room 308 Broadcasting House Newport Road Tel 0642 226945

CORNWALL
PENZANCE S W Microdeal 17a Market Jew Street Tel 0736 66338
ST AUSTELL A & C Computers 6 Lower Alymer Square Tel 0726 67337

CUMBRIA
BARROW IN FURNESS C A V E, 48 Cavendish Street Tel 0229 29109
KENDAL Kendal Computer Centre 68 Stramongate Tel 0539 22559
PENRITH Penrith Communications, 14 Castlegate Tel 0768 67146

DERBYSHIRE
ALFRETON Gordon Harwood, 69-71 High Street Tel 0773 836781
WOODHOUSE Bodkin Systems Ltd NCS House, Four Lane Ends, Horsley Tel 0332 883333

DEVON
TAVISTOCK Cloud 9 Software 4 Dolvin Road Tel 0822 5737

DORSET
BOURNEMOUTH Eldoncray Ltd., 137 Stewart Road Tel 0202 21505
WEYMOUTH WSL Micro Systems Ltd., 10 Queen Street Tel 0305 781178

ESSEX
BASILDON Alders Department Store Eastgate Centre Tel 0268 27858
BASILDON Godfreys, 28/30 East Walk Tel 0268 289379
CHELMSFORD Maxton Hayman, 5 Broomfield Road Tel 0245 354595

GREATER MANCHESTER
MANCHESTER Executive Reprographics & Business Consultants 2/4 Oxford Road Tel 061 228 1637
OLDHAM Professional Computer Services, 108/110 Yorkshire Street Tel 061 624 4065

HAMPSHIRE
ALTON Alton Computers, 62 High Street Tel 0420 87996
PORTSMOUTH Alders Department Store, Commercial Road Tel 0705 821221
SOUTHAMPTON Dataxend, 289 Salisbury Road, Totton Tel 0703 867204

HEREFORDSHIRE
HEREFORD Honeysett Computers, 17 Union Street Tel 0432 279404

HERTFORDSHIRE
BALDOCK Threshold Electronics Ltd., Icknield Way Tel 0462 895994
POTTERS BAR Diskprint, 10 Eastfield Parade, Forbes Avenue Tel 07076 6833
ROYSTON Shep Associates, Long Barn, North End, Meldreth Tel 0763 61686
SAWBRIDGEWORTH Sounds Great 18 Bell Street Tel 0279 725029

HUMBERSIDE
HULL M F Benman & Sons, 308 Newland Avenue Tel 0482 41976
HULL P & K Cash Systems, 135 Beverley Road Tel 0482 226396

KENT
BROMLEY Alders Department Store, High Street Tel 01 464 6533
CANTERBURY Aphros Software, 123 Wincheap Tel 0227 471115
CANTERBURY Canterbury Computers, 56/57 Palace Street Tel 0227 452101
CHATHAM Alders Department Store, 220/240 High Street Tel 0643 407377
MARGATE Aphros Software, 47 Hawley Square Tel 0843 294699
RAINHAM Microway Computer Centre, 39 High Street Tel 0634 376702
SITTINGBOURNE Secrefone Ltd., Central House, Centre Avenue Tel 0795 77639
TENTERDEN MGA Micro Systems, 140 High Street Tel 05806 4278

LANCASHIRE
BLACKPOOL Electronic Services, 176 Victoria Road West Clevelys, Tel 0253 822708
BOLTON ACE Computer Equipment, 27 Victoria Road, Horwich Tel 0204 696710
BURNLEY Burnley Computer Centre, 12 Hailstead House St James Road Tel 0282 34772
MOSSLEY New World Computers Ltd, 61 Richmond Crescent, Ashton-under-Lyme Tel 04575 4270
PRESTON 4-Mat Computing, 67 Friargate Tel 0772 561952
WIGAN Pier Computing Ltd, Suite 109, Standish Business Centre, Cross Street, Standish Tel 0257 424442

LEICESTERSHIRE
HINCKLEY Leigh Computer Systems, 28 Bradgate Road Tel 0455 612139
LEICESTER Sonal Computers, 105 Belgrave Road Tel 0533 660240
LEICESTER Dimension Computers, 27-29 High Street Tel 0533 517479
LEICESTER Cavendish CBM, 66 London Road Tel 0533 550993

LINCOLNSHIRE
OAKHAM Zebra Computer Services, Glaston Road, Uppingham Tel 0572 821234

MERSEYSIDE
LIVERPOOL Bits & Bytes Computers, 18 Central Station Ranelagh Street Tel 051 709 4036
NEWTON-LE-WILLOWS Source Computers, 4 Cross Lane Tel 09252 29049

MIDDLESEX
HARROW ASC Systems Ltd., Brent House 214 Kenton Road Tel 01 907 1867
HARROW Burocare Computer Systems, 211 Kenton Road, Kenton Harrow Tel 01 907 3636
NORTHWOOD Screens Computers, 6 Main Avenue, Moor Park Tel 09274 20664
TWICKENHAM Productive Computers Ltd., 72 Heath Road Twickenham Tel 01 891 4991
UXBRIDGE, JKL Computers, 7 Windsor Street Tel 0895 51815

NORFOLK
KINGS LYNN Computer Plus, 40 New Conduit Street Tel 0553 774550
NORWICH Viking Computer Centre, Ardney Rise, Off Catton Grove Road Tel 0603 401982
THETFORD Thetford Micros, 21 Guildhall Street Tel 0842 61645

NORTHAMPTONSHIRE
NORTHAMPTON Cloudhall Ltd, Mayleigh House, Derby Road Tel 0604 31494
NORTHAMPTON Portasoft Ltd, 2 Fullebum Court, Lumbertubs Tel 0604 407150
NORTHAMPTON Constold, 302 Wellingborough Road Tel 0604 230161

NORTHUMBERLAND
ALNWICK Alnwick Computerware, The Market Place Tel 0665 604816

NOTTINGHAMSHIRE
BULWELL Dial Computer Services, Fuel House, Cinderhill Road Bulwell Tel 0602 277004

sbc is the business computer division of Spectrum Group plc Hunting Gate, Hitchin, Herts, SG4 0TJ. Tel: 0462 37171.

Not all dealers stock every advertised item, please phone before making your journey. Prices correct at time of going to press. E. & O.E.

Bondwell

Portable Wonder ...

BW-8

"Very few machines costing even twice as much offer so many facilities in such a small and attractive package - a portable wonder." Which Computer Feb'87

- True portability, approx 4.5 Kg (10lbs)
- Low-power CMOS components
- 512KB system RAM
- Built-in 3.5" disk drive, double-density 720KB formatted capacity

£799.00

GOLDSTAR DISKS

Possibly some of the finest quality and value diskettes in the world.

SSDD 5¼"	£12.95
DSDD 5¼"	£14.95
DSQD 5¼"	£17.95
DSHD 5¼"	£29.95
SSDD 3½"	£24.95
SSDD 3½"	£28.95

All prices, per box of 10 disks

Lockable Diskette Storage Boxes

FDB40	holds 40 3½" disks	£9.99
FDB50	holds 50 5¼" disks	£10.95
FDB100	holds 100 5¼" disks	£13.95

sbc P.E.P.S.

PRINTER ENHANCEMENT PRODUCTS

PEP is a range of external add-on modules permitting a unique flexibility in the accessing and control of parallel printers from a group of PC's. The enhancements range from a simple extension (of up to 1000 ft) to a network of printers.

PEP chex - pair of modules to allow PC and printer to be separated by up to 1000 ft — **£99.95**

PEP net/S-Slave - PC transmitter to an interconnected system — **£79.95**

PEP net/M-Master - Printer receiver from an interconnected system — **£79.95**

PEP sharer - Module to accept input from 1 to 4 PC's to one printer — **£129.95**

PEP buffer - 256K programmable print buffer — **£99.95**

PEP switch - PC controlled module to switch printer output — **£89.95**

SBC MASTER DEALER NETWORK · SBC MASTER DEALER NETWORK

OXFORDSHIRE

BANBURY Alphascan, Little Boulton House, Southam Road Tel 0295 758202
BICESTER ITT Terryphone Ltd, Station Approach, London Road Tel 0869 244661
CHIPPING NORTON Cotswold Computers, 6 Middle Row Tel 0608 41232
HEADINGTON Absolute Sound & Video, 19 Old High Street Tel 0865 60990
KIDLINGTON Brookwood Computers, Brookwood House 8 Banbury Road Tel 08675 5406
WHITNEY Micro Text Computers Ltd, Fairfield House 70 New Yatt Road Tel 0993 3685

SHROPSHIRE

TELFORD Business Computer Centre, Unit 2, Paddock Mount Office, Dawley Centre, Dawley Tel 0952 501754

STAFFORDSHIRE

BURTON ON TRENT P. F. Balance & Co, 4 Horninglow Road Tel 0283 44732
STAFFORD Mitek, Ravenscroft Chambers, Mount Street Tel 0785 47707
TAMWORTH Small Business Computer Services, 1st Floor 81a Bolebridge Street Tel 0827 63549
TAMWORTH Micro-Tronics, 27a Market Street Tel 0827 51480

SUFFOLK

BURY ST. EDMUNDS Harram Computers, 11 Guildhall Street Tel 0284 705808

SURREY

CAMBERLEY Allders Department Store, High Street Tel 0276 62211
CROYDON Allders Department Store, North End Tel 01 681 2577
SUTTON Allders Department Store, High Street Tel 01 642 6000
CATERHAM Wego Computers Ltd, 22a High Street Tel 0883 49231

SUSSEX

BRIGHTON Gamer, 71 East Street Tel 0273 728681
HOVE Business Plan Ltd, 10 The Drive Tel 0273 722311
WORTHING Data Direct, T/A Chips, 53 Rugby Road Tel 0903 40509

TYNE & WEAR

SUNDERLAND Sunderland Computer Centre, 29 Crow Tree Road Tel 0783 655711

WARWICKSHIRE

LEAMINGTON SPA Words Group Services, 39a Regent Street Tel 0926 30209
NUNEATON Microcity, 1a Queens Road Tel 0203 382049
RUGBY Greenjade Computers, 35/37 Albert Street
RUGBY Rugby Micro Spares, 30 Oxford Street Tel 0788 71643

WEST MIDLANDS

BIRMINGHAM Allen James, 831 Stratford Road, Sparkhill Tel 021 778 5737
BIRMINGHAM Lee Computers, 160 Highfield Road, Hall Green Tel 021 777 9631
BIRMINGHAM Astro Computers, 3 Elmdom Road, Warston Green Tel 021 779 6771
BIRMINGHAM Mentorrum Systems Ltd, 168 Corporation Street Tel 021 236 3349
COVENTRY Micro Learn, 1 Lamb Street Tel 0203 22503
DUDLEY Telepro Ltd, Abberley House, 9 Himley Road Tel 0384 239491

WILTSHIRE

SWINDON Simcon Associates Ltd, Brunswick House 38 Dover Street, Old Town Tel 0793 619969
SWINDON Codepoint Systems Ltd, Dammas House, Dammas Lane Tel 0793 618130

WORCESTERSHIRE

MALVERN Wordscope, Coldwell House, Walwyn Road Tel 0684 40059
WORCESTER Computer Counter Ltd, Unit 95B Blackhorse Trading Estate (West) Tel 0905 58351

YORKSHIRE

BRADFORD Emicks, Fotosonic House, Rawson Square Tel 0274 309266
HALIFAX Abacus Computers, 23 Bull Green Tel 0422 45276
ROTHERAM GT Leisureworld, Unit 1, Cascade Centre Tel 0709 67391
ROTHERAM Rotheram Computer Centre, 135 Wellgate Tel 0709 69912
SCARBOROUGH Paperstat-Phoneline, 181/183 Dean Road Tel 0723 366066
SHEFFIELD Computer Eng & Support Services, Regency House 75-77 St Mary's Road Tel 0742 737303
SHEFFIELD West Riding Graphic Supplies Ltd, WRG House 49 Wellington Street Tel 0742 701981
SHEFFIELD Ferrydata Systems & Supplies, 50 Portland Avenue Aston Tel 0742 872157
SHIPLEY DAC Consultants, Unit 13, Powell Road Tel 0274 588114
WHITBY Delta PI Software, 8 Busward Lane Tel 0947 600065

WALES

CARMARTHEN Strong Computer Systems, Bryn Cottage Tel 0267 231246
HAVERFORDWEST Business Informat Systems, Swan Square Bridge Street Tel 0437 68228
MOLD Mold Micro Systems, 8 Dwyfor Avenue, Bryn-y-Baal Nr. Mold, Clwyd Tel 0352 56152
NEWPORT Gwent Computers, 92 Chepstow Road Tel 0633 841760
PRYL Lisdam Systems Ltd, Cefndy Ind. Est, Cefndy Road Tel 0745 31952/31862
WREXHAM Wrexham Computers, 24 Abbot Street Tel 0978 358832

NORTHERN IRELAND

BELFAST Chevron Computing, 43 Lockview Road Tel 0232 3181335
LISBURN MKM Electric, 25 Antrim Street Tel 08462 3184

SCOTLAND

ABERDEEN Knight TV & Computers, 108 Rosemount Place Tel 0224 630526
CUMBERNAULD Megabyte Computers, 12 Ettrick Square Town Centre Tel 0236 738398
ELGIN Mobile Micros Ltd, 1 East Back Street, Bishopmill Tel 0343 49944
PEEBLES Peebles Micro Systems, 9 Eshiels Tel 0721 21479
PERTH Vics Independant Supplies, 31-33 South Street Tel 0738 36704

CHANNEL ISLANDS

GUERNSEY Channel Isle Computer Dist, PO Box 299 St Peters Port Tel 0481 47966

There's never been a better time to become an sbc Master Dealer - contact Michael Stern or Steve Cole on 0462 37171

All prices shown are ex VAT

sbc is the business computer division of Spectrum Group plc Hunting Gate, Hitchin, Herts, SG4 0TJ. Tel: 0462 37171.

The SBC FD

Priced...to beat you know who!

Now, from your sbc Master Dealer an enhanced range of superbly styled, second generation PC XT compatible computers that are faster and considerably more reliable than their predecessors.

Just check out the features listed below then add on our Free 12 month On-Site Maintenance Contract worth £54, then we think you'll agree, **We know how too!**

Undoubtably the best value PC in Europe today

The sbc FD Twin drive 360K

£599.00

ex VAT

FREE ON SITE MAINTENANCE

On site maintenance for PC's can be very expensive, in some cases costing hundred's of £££'s per annum. We are that confident of the quality of SBC PC compatible products that we now include a full 12 months Fast Call Out On Site Service Contract with every SBC computer FREE OF CHARGE.

SBC HD20

Features	1512 DDMM £559 +VAT	SBC FD £599 +VAT	Features	1512 DDMM £559 +VAT	SBC FD £599 +VAT
Microprocessor	8086-2	NEC V-40	Basic language supplied	Loco-motive Basic-2	Industry Stnd. GW Basic 3.2
8087-2 co-processor socket	✓	✓	Expansion slots	3	4
Parallel centronics port	✓	✓	EGA graphics option	No	✓
RS232 serial port	✓	✓	CGA graphics output	No	✓
Power supply rating	30W (approx)	135W	Mono/colour changeover switch	No	✓
Power supply location	In monitor Case	In Main CPU	Dual speed processor	No	✓
Twin 360K floppy drives	✓	✓	640K RAM as standard	No	✓
Mouse and controller	✓	No	Full 12 months on-site warranty included in purchase price	No	✓
Gem and gem paint	✓	No			
MS DOS 3.2	✓	✓			

SBC HD20 Specification as the FD but with one 20MB hard disk **£999**

SBC FDC as FD but with 14" colour monitor **£799**
SBC HD20C as HD20 but with 14" colour monitor **£1199**

All prices are ex VAT.

Not all dealers stock every advertised item, please phone before making your journey. Prices correct at time of going to press. E. & O.E.

INTRODUCING
The British Designed, British Built, SBC Mistral 286 AT

Yes! designed in Cambridge, motherboard built in Bristol, casing and power supply assembly produced in Stourbridge plus final assembly in London. It's as British as we can make it, and the best. The heart of the Mistral is the superb 12" x 12" motherboard running at an incredible 12MHz built at British Aerospace (BAe's) Filton plant using the latest surface mounting technology. It has already been acclaimed as "the 286 board by which others will be judged in the future".

sbc is proud to bring you the finest quality and value AT-compatible in the world.

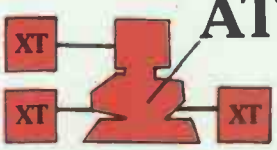
Main Features of Mistral 286 AT Series

1. PC AT-compatible
2. 80286 CPU running at 6, 8 or 12 MHz
3. 1 MB RAM on board (max. 4 MB)
4. 1.2 MB floppy drive
5. 30MB hard disk
6. Maximum display resolution 1024 x 768
7. Battery back-up real time clock
8. RS232 serial and parallel port
9. 6 expansion slots
10. 80287 maths co-processor socket
11. Motherboard built in the UK by British Aerospace.
12. 14" green or amber monitor including swivel and tilt stand
13. MS DOS 3.2 GW-BASIC 3.2
14. Full 12 months on-site warranty
15. 84 key AT keyboard

£1799.00 ex VAT

Sensational but True
The SBC System M* Multi-user/Network System

Just take a Mistral 286 AT. Add 3 sbc FD's. Network with our custom designed sbc - NET. Enter Stothers & Hardy's Brilliant multi-user accounting software (sales, purchase and nominal ledger), and what have you got?
The most incredible value, multi-user, intelligent terminal, turnkey system.



at just £4999.00

The sbc System M is flexible, expandable and innovative too. It offers multi-user facilities (up to 9 intelligent terminals from one file server) in an original and exciting format. System M avoids the traditional dependence on a central unit through the operation of "an intelligent work station environment" also designed by Stothers & Hardy. For further information and details of your nearest sbc System M Dealer, contact Roland Freestone or Steve Cole at Spectrum on 0462 37171.

*Available only from sbc System M authorised Dealers.

SBC MISTRAL 286 ATC

Featuring the 286 but with the sbc 14" medium resolution colour monitor and CGA compatible colour card.

£1999.00
inc. MS DOS 3.2, GW Basic 3.2

MISTRAL 286 ATE

Featuring the 286 but now coupled with the sbc 14" EGA colour monitor and EGA compatible colour card.

£2199.00
inc. MS DOS 3.2, GW Basic 3.2

All prices are ex VAT.

Not all dealers stock every advertised item, please phone before making your journey. Prices correct at time of going to press. E. & O.E.

DIGITASK MODEM SELECTOR

MANUFACTURER	MODEL	SPECIFICATION	DESCRIPTION	AUTO ANS	No. STORE	AUTO DIAL	ERR CORR	AUTO SENSE	BUFF I/FACE	PULSE TONE	AUTO LOG ON	RRP	OUR PRICE
ANSWERCALL	MINIMODEM	V21	Simple direct connect modem									(75)	**59**
DACOM	DSL 2123AD	V21, V23	Mainstay of Dacom range	Y	Y	HAYES		Y	Y	BOTH		(255)	**195**
DACOM	DSL 2123GT	V21, V23	Fully buffered to 9600 intelligent	Y	Y	Y	Y	Y	Y	BOTH	Y	(398)	**359**
DACOM	PC123	V21, V22, V23	Latest IBM multispeed internal	Y		HAYES	Y & EPAD	Y	Y	BOTH		499	**399**
DACOM	PC123 BIS	V21, V22, V22BIS, V23	Latest IBM high speed internal	Y		HAYES	Y & EPAD	Y	Y	BOTH		699	**549**
INTERLEKT	PORTMAN	V21, V23	Reliable no frills modem	Y					OPT			173	**139**
INTERLEKT	PROSPECT	V21, V23	Reliable no frills modem									125	**99**
MIRACLE	WS2000	V21, V23	Low cost manual modem	OPT		OPT						108	**89**
MIRACLE	WS3000 2123	V21, V23	Cost effective multispeed	Y	Y	HAYES		Y	Y	BOTH		295	**235**
MIRACLE	WS3000 22	V21, V22, V23	Cost effective multispeed	Y	Y	HAYES		Y	Y	BOTH		495	**385**
MIRACLE	WS3000 22 BIS	V21, V22, V22BIS, V23	Multispeed top of Miracle range	Y	Y	HAYES		Y	Y	BOTH		650	**519**
MIRACLE	WS4000	V21, V23(V22 OPT)	Budget "Hayes" multispeed	Y		HAYES				PULSE		170	**133**
MODULAR TECHNOLOGY	INTERMOVER 5021	V21	Low cost compact stand alone	Y								98	**79**
MODULAR TECHNOLOGY	INTERMOVER 5022	V22	Low cost compact stand alone	Y								295	**269**
PACE	NIGHTINGALE	V21, V23	Low cost manual modem									99	**77**
PACE	SERIES 4 2123S	V21, V23	Latest multispeed (Space Age)	Y	Y	HAYES		Y	Y	BOTH		265	**224**
PACE	SERIES 4 1200S	V21, V22, V23	Latest multispeed (Space Age)	Y	Y	HAYES		Y	Y	BOTH		399	**339**
PACE	SERIES 4 2400S	V21, V22, V22BIS, V23	Top pace range multispeed	Y	Y	HAYES		Y	Y	BOTH		499	**429**
MISSING LINK	BREAKOUT 2123	V21, V23 & S/W	IBM internal card & software pack	Y	Y	Y	Y		Y	BOTH	Y	525	**449**
MISSING LINK	BREAKOUT 2400	V21, V22, V22BIS, V23 & S/W	IBM internal card & software pack	Y	Y	HAYES	Y	Y	Y	BOTH	Y	945	**819**
MISSING LINK	QUATTRO CARD	V21, V22, V22BIS, V23	Multispeed IBM internal card	Y	Y	HAYES	Y	Y	Y	BOTH	Y	795	**695**
RACAL	MPS1222	V22	Stand alone professional modem	Y		OPT						625	**599**
RACAL	V12422	V21, V22, V22BIS	High spec PSTN multispeed	Y		Y	OPT	Y		AUTO		865	**819**
RACAL	MPS24	V26	Synchronous leased line & PSTN	Y								530	**509**
RACAL	CP2123	V21, V23	Stand alone	Y		Y		Y		AUTO		356	**299**
RACAL	CP2123PM & S/W	V21, V23 & SPEAKEASY	IBM internal card & software pack	Y	Y	HAYES	Y			AUTO	Y	450	**395**
RACAL	CP2123PM	V21, V23	IBM internal card	Y		HAYES				AUTO		385	**295**
RACAL	PM22	V22	IBM internal card latest Racal	Y		HAYES				AUTO		495	**395**
DOWTY	QUATTRO	V21, V22, V22BIS, V23	Multispeed modem top Dowty range	Y	Y	HAYES	Y	Y	Y	BOTH	Y	795	**POA**
DOWTY	TRIO	V21, V22, V23	Intelligent multispeed	Y	Y	HAYES	Y	Y	Y	BOTH	Y	595	**POA**
DOWTY	DUO	V21, V23	Multistream modem plus!	Y	Y	HAYES	EPAD	Y	Y	AUTO	Y	340	**POA**
DOWTY	MINIMO + 2	V21, V23	Auto/Manual direct connect	Y		HAYES			Y	P(T,OPT)	Y	245	**POA**
DOWTY	SB1212	V22	UK best selling V22 stand alone	Y		OPT	OPT			BOTH		495	**POA**
DOWTY	TRIO CARD	V21, V22, V23	Multispeed IBM internal card	Y	Y	HAYES	Y	Y	Y	BOTH	Y	595	**POA**
DOWTY	SB2426	V26 BIS	PSTN or LL synchronous modem	OPT								317	**POA**
DOWTY	SB4827	V27	High speed Sync/Async private line									795	**POA**
DOWTY	SB9629	V29	High speed Sync/Async private line									995	**POA**
TANDATA	TM512	V21, V23	Easy to use professional modem	Y	Y	HAYES	EPAD OPT	Y	Y	AUTO	Y	255	**195**
TANDATA	TM602	V21, V22, V23	Cost effective reliable multispeed	Y		Y			Y	BOTH		465	**397**
THORN	VX543	V21, V23	Thorn's best selling low cost modem	Y		Y		Y	Y	AUTO		195	**165**
THORN	VX512	V21, V22, V23	New multispeed high tech modem	Y	Y	HAYES	Y	Y	Speed buff	BOTH		399	**335**
THORN	VX524	V21, V22, V22 BIS, V23	Top of the range multispeed	Y	Y	HAYES	Y	Y	Speed buff	BOTH		499	**459**
LION SYSTEMS DEV	ORATOR	Call for details	Integrated speech & data comms centre									795	**CALL**

★ **SPECIAL OFFER–FREE Chit-Chat S/W & IBM Cable with every V22, V22BIS (RRP £119) OR only £45 with every V21, V23.** ★

(Offers available while stocks last)

Prices do not include VAT and Carriage

0342 24631

Unit M, Charlwoods Business Centre
Charlwoods Road
East Grinstead

VISA ACCESS

SAME DAY DELIVERY SERVICE AVAILABLE

Telex 957418

TECHNOLOGY SO ADVANCED ...

MEMORY
* 512Kbytes RAM (520ST-M, FM)
* 1024Kbytes RAM (1040ST-F)
* 192Kbytes ROM
* 128Kbytes external plug-in ROM option

ARCHITECTURE
* Motorola 68000 Central Processing Unit (CPU) with a clock speed of 8MHz
* 16-bit external data bus
* 32-bit internal data bus
* 24-bit address bus
* 8×32-bit data & address registers
* 7 levels of interrupts
* 56 instructions
* 14 addressing modes
* 5 data types
* DMA (Direct Memory Access)
* real time clock as standard

GRAPHICS
* full bit-mapped display
* palette of 512 colours

Using Atari Monitors (on 520 & 1040):
* 640×400 high resolution - monochrome
* 640×200 medium resolution - 4 colours
* 320×200 low resolution - 16 colours
* 80 column text display (40 col low res)

Using Domestic TV (on 520):
* 640×200 medium resolution - 4 colours
* 320×200 low resolution - 16 colours
* 40 columns × 25 line text display

SOUND AND MUSIC
* 3 programmable sound channels
* frequency programmable 30Hz - 125KHz
* programmable volume
* wave & dynamic envelope shaping
* programmable attack, decay, sustain, release
* Musical Instrument Digital Interface (MIDI)
* MIDI allows connection of synthesisers etc.

MOUSE
* high precision
* 2 button control
* free with 520ST-FM/1040ST-F
* non slip ball motion sensor
* removable ball for easy cleaning

STANDARD SOFTWARE
* GEM desktop + TOS operating system
* ST BASIC interpreter/language system

INPUT/OUTPUT
* MIDI out ..... (5 pin DIN) 31.25K baud
* MIDI in ..... (5 pin DIN) 31.25K baud
* audio out ..... 1.0V DC peak to peak, 10K ohm
* audio in ..... 1.0V DC peak to peak, 10K ohm
* RGB monitor ..... 1.0V DC, 75 ohm
* mono monitor ..... 1.0V DC, 75 ohm
* mono horizontal scan rate 35.7KHz
* mono vertical scan rate 71.2KHz
* sync ..... 5V DC (active low) 3.3K ohm
* modem/serial ..... RS232C, 50 to 19,200 baud
* floppy disk ..... 250 Kbits/s
* hard disk ..... 11.3 Mbits/s
* mouse ..... standard Atari connector
* joystick ..... standard Atari connector
* cartridge port ..... 128K capacity
* RF output (520ST-FM) ..... for TV use

OPERATING SYSTEM
* TOS with GEM environment in ROM
* hierarchical file structure with sub-directories and path names
* user interface via GEM, with self explanatory command functions
* multiple windows + icons
* window resizing, re-positioning and erasing
* drop down menus (selected by mouse)
* GEM virtual device interface

COMMUNICATIONS
* RS-232C serial modem port
* 8-bit parallel printer port
* MIDI port (also for networking use)
* VT52 terminal emulation

KEYBOARD
* standard QWERTY typewriter format
* 95 full stroke keys
* 10 function keys
* 18 key numeric keypad + cursor keys
* variable auto-repeat & key click response
* keyboard processor reduces CPU overhead

... IT'S AFFORDABLE

ONLY FROM SILICA

Finally, there's a personal computer that not only solves problems like other computers, but also solves the one problem that other computers have created. Affordability. Silica Shop are pleased to present the ST range of personal/business computers from Atari. The ST was designed utilizing the most recent breakthroughs in semiconductor technology, producing a personal computer that performs tasks with fewer parts. Which means it costs less to make. And less to buy. The latest ST computers now include built in power supplies and built in disk drives. The TOS operating system and GEM window environment are now on ROM chips which are already installed in the ST keyboard. This enables automatic instant booting when you switch on. Silica Shop are pleased to offer the complete Atari ST range. Our mail order department is situated in Sidcup and we have 4 retail outlets at Sidcup, Orpington, Lion House (Tottenham Court Rd) and Selfridges (Oxford Street). We have eight years experience of Atari products, longer than any other UK company, and are well established as the UK's No.1 Atari specialist. With a group turnover of over £5 million and in excess of 70 staff, we provide unbeatable service and support. We provide several facilities which you will find invaluable during your Atari computing life and most of these facilities are available **ONLY FROM SILICA**. We suggest that you read through what we have to offer, before you decide where to purchase your Atari ST.

FREE STARTER KIT - Only From Silica

When you purchase any Atari ST keyboard, you will not only receive the best value for money computer on the market, but you will also receive the following from Atari Corporation as part of the package:

** BASIC Language Disk * BASIC Manual * ST Owners Manual * TOS/GEM on ROM*

If you buy your ST from Silica Shop, you will also receive:

** NEOchrome - colour graphics program * 1st Word - Word Processor*

In addition, we at Silica would like to see you get off to a flying start with your new computer, so we have put together a special **ST STARTER KIT** worth over £100, which we are giving away **FREE OF CHARGE** with every ST computer purchased at our normal retail prices. This kit is available **ONLY FROM SILICA** and is aimed at providing users with a valuable introduction to the world of computing. We are continually upgrading the ST Starter Kit, which contains public domain and other licensed software, as well as books, magazines and accessories all relevant to ST computing. Return the coupon below for full details.

DEDICATED SERVICING - Only From Silica

At Silica Shop, we have a dedicated service department of five full time Atari trained technical staff. This team is totally dedicated to servicing Atari computer products. Their accumulated knowledge, skill and experience makes them second to none in their field. You can be sure that any work carried out by them is of the highest standard. A standard of servicing which we believe you will find **ONLY FROM SILICA**. In addition to providing full servicing facilities for Atari ST computers (both in and out of warranty), our team is also able to offer memory and modulator upgrades to ST computers.

1Mb RAM UPGRADE: Our upgrade on the standard Atari 520ST-M or 520ST-FM keyboard will increase the memory from 512K to a massive 1024K. It has a full 1 year warranty and is available from Silica at an additional retail price of only £86.96 (+VAT = £100).

TV MODULATOR UPGRADE: Silica can upgrade the 1040ST-F to include a TV modulator so that you can then use it with your TV set. This is an internal upgrade and does not involve any untidy external boxes. A cable to connect your ST to any domestic TV is included in the price of the upgrade which is only £49 (Inc VAT). The upgrade is also available for early 520ST computers at the same price.

THE FULL STOCK RANGE - Only From Silica

We aim to keep stocks of all Atari related products and our warehouse carries a stock of £½ million. We import many software titles direct from the USA and you will find that we have new releases in advance of many of our competitors. Unlike dealers who may only stock selected titles, we have the full range. In addition, we carry a complete line of all books which have been written about the Atari ST. A range as wide as ours is something you will find is available **ONLY FROM SILICA**.

AFTER SALES SUPPORT - Only From Silica

Rest assured that when you buy your ST from Silica Shop, you will be fully supported. Our free mailings give news of releases and developments. This will help to keep you fully up to date with what's happening in the Atari market. And in addition, our sales staff are at the end of a telephone line to service all of your Atari requirements. If you purchase an ST from Silica and would like any programming or technical advice, we have a full time technical support team to help you get the best from your computer. Because we have both the staff and the systems specifically dedicated to providing after sales service on Atari ST computers, we are confident that our users enjoy an exceptionally high level of support. This can be received **ONLY FROM SILICA**.

FREE CATALOGUES - Only From Silica

At Silica Shop, we recognise that serious users require an in-depth information service, which is why we mail free newsletters and price lists to our ST owners. These are up to 48 pages long and are crammed with technical details as well as special offers and product descriptions. If you have already purchased an ST and would like to have your name added to our mailing list, please complete the coupon & return it to us. The information service is available **ONLY FROM SILICA**.

FREE OVERNIGHT DELIVERY - From Silica

Most orders are processed through our computer within 24 hours of receiving them. Most hardware orders are sent by the overnight METRO courier service FREE OF CHARGE to customers within the UK. This method helps to ensure minimum delay and maximum protection.

PRICE MATCH - Only From Silica

We hope that the combination of our low prices, FREE UK delivery service, FREE Starter Kit and FREE after sales support, will be enough to make you buy your Atari equipment from Silica Shop. If however, there is something you wish to purchase, and you find one of our competitors offering it at a lower price, then please contact our sales department, providing us with our competitor's name, address and telephone number. If our competitor has the goods in stock, we will normally match the offer (on a 'same product - same price' basis) and still provide you with our normal free delivery. We realise that we are not the only company who will match a competitor's price. However, if you come to us for a price match, you will also be entitled to our after sales service, including free newsletters and technical support. This makes our price match promise rather special, something you will receive **ONLY FROM SILICA**. We don't want you to go anywhere else for your Atari products. So shop at Silica, the UK's No1 Atari Specialist.

SIDCUP (& Mail Order) **01-309 1111**
1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX

LONDON **01-580 4839**
Lion House (1st floor), 227 Tottenham Court Rd, London, W1

LONDON ..... **01-629 1234 ext 3677**
Selfridges (1st floor), Oxford Street, London, W1A 1AB

520ST-M

The affordability of Atari computers is reflected in the price of the 520ST-M keyboard, which is a mere £259 (inc VAT). This version of the ST comes with 512K RAM, as well as a modulator and lead for direct connection to any domestic TV. The price does not include a mouse. In addition, when you buy your 520ST-M from Silica, you will also receive the FREE Silica 'ST Starter Kit'. During 1987, many software houses will be producing games software on ROM cartridges, which will plug directly into the cartridge slot on the 520ST-M keyboard, giving instant loading without the expense of purchasing a disk drive. With the enormous power of the ST, you can expect some excellent titles to be produced, making this the ultimate games machine! If your requirement is for a terminal, then the 520ST-M can fulfill this role too. Leads are available to connect the ST to a variety of monitors, and with the imminent introduction of terminal software on ROM cartridge, the ST provides a low price terminal for business use. If you wish to take advantage of the massive range of disk software available for the ST range, you will need to purchase a disk drive. Atari have two floppy disk drives available, a ½ Mbyte model £149 and a 1Mbyte model £199. Full details of these drives, as well as the Atari 20Mbyte hard disk are available on request. If required at a later date, the mouse may be purchased separately.

£259

520ST-FM

The 520ST-FM with 512K RAM and free mouse, represents a further breakthrough by Atari Corporation in the world of high power, low cost personal computing. This model is the latest addition to the ST family, and is not only powerful, but compact. It is priced at only £399 (inc VAT) a level which brings it within the reach of a whole new generation of computer enthusiasts. When purchased from us, it comes with the FREE Silica 'ST Starter Kit' see paragraph on the left. To make the 520ST-FM ready for use straight away, Atari have built into the keyboard a ½ megabyte disk drive for information storage and retrieval, allowing you easy access to the massive range of disk based software which is available for the ST. This new computer comes with all the correct cables and connections you will need to plug it straight into any standard domestic television set. You do not therefore have to purchase an Atari monitor. If you do require a monitor however, these are available with the 520ST in the following money saving packages.

520ST-FM Keyboard Without Monitor	*- £399 (inc VAT)*
520ST-FM Keyboard + High res mono monitor	*- £499 (inc VAT)*
520ST-FM Keyboard + Low res colour monitor	*- £599 (inc VAT)*
520ST-FM Keyboard + Med res colour monitor	*- £699 (inc VAT)*

Because the 520ST-FM has its own power transformer built into the keyboard, there are no messy external adaptors to clutter up your desk space. You are left with only one mains lead, serving both the disk drive and the computer. You couldn't ask for a more stylish and compact unit.

£399

1040ST-F

For the businessman and the more serious home user, Atari have their most powerful model, the 1040ST-F with 1028K RAM. This low cost powerhouse can be introduced into a business environment as a stand-alone system, or can support a mainframe computer as a terminal. The 1040ST-F not only features twice as much memory as the 520ST-FM, but also includes a more powerful built-in disk drive. The drive featured on the 1040ST-F is a one megabyte double sided model. The extra memory facility of the 1040ST-F makes it ideal for applications such as large databases or spreadsheets. Like the 520ST-FM, the 1040ST-F has a mains transformer built into the console to give a compact and stylish unit with only one mains lead. The 1040ST-F is also supplied from Silica Shop with a free software package and 'ST STARTER KIT'. In the USA, the 1040ST-F has been sold with a TV modulator like the 520ST-FM. However, for the UK market, Atari are manufacturing the 1040ST-F solely with business use in mind and it does not currently include an RF modulator, this means that you cannot use it with a domestic TV (Silica Shop do offer a modulator upgrade for only £49). The 1040ST-F keyboard costs only £599 (inc VAT) and, unless a modulator upgrade is fitted, will require an Atari or third party monitor. There are three Atari monitors available and the prices for the 1040 with these monitors are as follows:

1040ST-F Keyboard Without Monitor	*- £599 (inc VAT)*
1040ST-F Keyboard + High res mono monitor	*- £699 (inc VAT)*
1040ST-F Keyboard + Low res col monitor	*- £799 (inc VAT)*
1040ST-F Keyboard + Med res col monitor	*- £899 (inc VAT)*

The 1040ST-F comes with a mouse controller and includes 1Mbyte of RAM. It has a 1Mbyte double sided disk drive and mains transformer, both built into the keyboard to give a compact and stylish unit, with only one mains lead.

£599

ATARI ST

To: Silica Shop Ltd, Dept PCW 0687, 1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX

PLEASE SEND ME FREE LITERATURE ON THE ATARI ST

Mr/Mrs/Ms: ..... Initials: ..... Surname: .....

Address: .....

.....

.....

Postcode: .....

Do you already own a computer
If so, which one do you own? .....

SOFTWARE

Massive Discounts

We are the most consistently, low priced advertiser in the UK.

Our prices and our products are genuine. Excellent service, totally comprehensive range and a same day delivery service* makes Digitask first choice every time!

DATABASE

	RRP	Our Price
DBASE III+	595	323
DELTA PROFESSIONAL	495	328
Q & A SYMANTEC	250	163
R-BASE 5000	295	208
REFLEX	100	57
REFLEX WORKSHOP	70	57
SAGE RETRIEVE	99	71
SSI DATA	195	169
VP INFO	65	61

WORD PROCESSORS

LOTUS MANUSCRIPT	395	237
MULTIMATE	375	193
MULTIMATE ADVANTAGE	495	247
PFS PROFESSIONAL WRITE	189	169
PFS WRITE	115	99
SAGE PC WRITE	99	71
TURBO LIGHTNING	70	47
VENTURA—DESKTOP PUBL	925	769
VOLKSWRITER III	325	187
WORD III	425	243
WORDCRAFT	475	309
WORD PERFECT	425	244
WORDPERFECT LIBRARY	149	124
WORDSTAR	295	144
WORDSTAR 2000	465	229
WORDSTAR 2000 +	549	269
WORDSTAR PROFESSIONAL	399	193

SPREADSHEETS

JAVELIN	595	343
LOTUS 123	395	227
MULTIPLAN	175	107
NOTE IT	69	59
SAGE PC PLANNER	99	71
SQZ	69	55
SUPERCALC IV	396	192
VP PLANNER	75	61

PERSONAL PRODUCTIVITY

ABILITY	99	67
EXCEL (MICROSOFT) FOR MAC	395	345
FRAMEWORK II	550	297
LOTUS SYMPHONY	550	319
PFS FIRST CHOICE	149	113
SMART	695	348
SMART SPELLCHECKER	95	87
SUPERPROJECT +	495	297
WORKS (MICROSOFT) FOR MAC	245	219

ACCOUNTS

DAC EASY ACCOUNTS	85	79
SAGE ACCOUNTANT	149	110
SAGE ACCOUNTANT +	199	143
SAGE BOOK-KEEPER	99	71
SAGE FINANCIAL CONTROLLER	299	216
SAGE PAYROLL	99	71

PROGRAMME DEVELOPM'T & LANGUAGES

CLIPPER COMPILER	595	343
PARADOX VER 1.1	550	377
QUICK BASIC COMPILER	85	75
TURBO DATABASE TOOLBOX	50	34
TURBO EDITOR TOOLBOX	50	34
TURBO GAMEWORKS	50	34
TURBO GRAFIX TOOLBOX	50	37
TURBO HOLIDAY JUMBO PACK	165	157
TURBO PASCAL	70	47
TURBO PROLOG	70	47
TURBO TUTOR	30	23
ZORLAND C	30	27

COMMUNICATIONS

CROSSTALK XVI	169	93
SAGE CHIT-CHAT (S/WARE)	99	71
SMARTERM VT-100	135	119
DATATALK		129

MOUSE

LOGIMOUSE & SOFTWARE	99	77
MICROSOFT MOUSE (BUS OR SERIAL)		133
MOUSE SYSTEMS & PC PAINT	162	145
MOUSE SYSTEMS MOUSE	143	128
SUMMAGRAPHICS SUMMAMOUSE	99	87
SUMMASKETCH 12x12 & GEM DRAW	625	569
SUMMASKETCH 9x6 & GEM DRAW	525	479

OTHER

CHARTMASTER	295	229
COPY II PC	50	38
COPY II PC OPTION BOARD	90	74
FLIGHT SIMULATOR	45	34
FONTASY	80	67
FREELANCE +	320	289
GEM COLLECTION	130	73
GEM DESKTOP	50	45
GEM DRAW +	130	119
GEM GRAPH	180	123
GEM PROGRAMMERS TOOLKIT	450	369
GEM WORDCHART	130	83
HARVARD PRESENTATION GRAPHICS	295	219
LIGHTNING (CACHÉ) Copy Protected	70	94
LIGHTNING (CACHÉ) Non-copy Protected	99	94
LOTUS HAL	120	81
LOTUS MEASURE (SCIENTIFIC)	395	343
MICROCACHÉ Non-copy Protected	125	119
NORTON UTILITIES	85	52
S/KICK (PROTECTED)	50	38
S/KICK (TRAVELLING)	70	48
S/KICK (UNPROTECTED)	70	43
S/KICK(TRAV) & S/KICK NCP	109	89
SAGE DESK SET	69	49
SAGE PC CHART	99	89
SIDEWAYS	50	34
SUPERKEY	70	47
V-FEATURE	95	89
V-FEATURE DELUXE	125	119
VCN CONCORDE	550	495
WINDOWS (MICROSOFT)	85	57

Prices do not include VAT and Carriage

DIGITASK 0342 2463

Charlwoods Business Centre, Charlwoods Road, East Grinstead, West Sussex RH19 2HH **Telex 95741**

** Please call for deta*

Ctrace

Find your programming errors the fun way with Ctrace. MIX Software's exciting C source debugger makes it so easy to track down bugs that you'll love doing it.

Your MIX C programs will come to life on the screen. You'll see your variable values change as you watch your source code execute. A unique animated trace feature highlights each C statement as it executes. It's like watching the bouncing ball as the cursor moves from one statement to the next. The internal workings of your program are revealed through 6 windows: source, output, variables, watch, memory, and sympbols. View up to 4 of these windows at the same time.

You have complete control of your program. Execute one statement at a time, or run the program at trace or full speed. Insert an unlimited number of break points to stop execution at selected statements. Insert watch points to stop execution when selected variable values satisfy your defined conditions. Interrupt the program at any time, even in the midst of reading input from the keyboard. You can even change variable values, alter the execution path or trace the flow of control backwards.

Ctrace is so simple to operate. You can almost use it without thinking. No complicated commands to remember, just press a key. Help screens list the keys and pop-up windows list the options. After 30 minutes, you'll be using Ctrace like a pro. Your productivity will improve dramatically and your programs will work more reliably. What was once a dreaded chore becomes an enjoyable experience. Debugging is fun when you have Ctrace doing all the work! So order your copy of Ctrace today and start working smarter instead of harder.

The Complete MIX C-Works Only £69.95 includes Editor, C Compiler, Ctrace, Examples, and ASM Utility.

30 Day Money Back Guarantee. Not Copy Protected. MIX C is the perfect choice for the Amstrad PC1512 and other PC Compatibles. Enquire about PCW/CPC, CPM & Apricot formats.

MIX Software, 1132 Commerce Drive, Richardson, Tx, USA (214) 783-6001 have appointed Analytical Engines as their UK Distributors and Technical Support Agents. Discounts for educational establishments. Trade enquiries.

UPGRADE
PC1512 -> 640K Kit
only £12.95 if you buy MIX C!

Only
£29.95

MIX C Compiler £29.95

You can see that Ctrace is not your typical debugger. It's powerful but easy to understand and simple to operate. MIX C is designed the same way. Unlike other c compilers, it's small and fast. In fact it's the only standard, full featured C compiler that can be operated comfortably on floppy disks. And as you would expect MIX C is easy to use. It produces a complete program listing with all errors clearly identified and explained.

Although it's small, MIX C is not a subset. MIX C supports the full K&R standard, including the extensions that are often omitted in other C compilers. MIX C comes complete with a fantastic 450 page book, a library of more than 175 functions, a blazingly fast linker, and tools for optimising your programs for minimal space or maximum speed. All this is yours for little more than the cost of most C books alone.

The combination of Ctrace with MIX C makes C programming a real joy. MIX C provides the power of a compiler while Ctrace provides an execution environment that's better than an interpreter. Now you can have the best of both worlds at a very down to earth price.

Split Screen Editor £19.95

Another great companion to the MIX C compiler is MIX Software's split-screen editor. It makes writing programs even faster and easier. With the MIX editor you can compile, link, and execute or trace your programs at the touch of a key. Compiling is fast because the MIX C compiler reads the program directly from memory. Correcting errors is easy because the editor automatically positions the cursor to the first error in the program. The editor is similar to Micropro's WordStar but with additional programming features like split-screen, macros, and much more. Together with the C compiler and Ctrace, the editor forms an integrated programming environment.

ASM Utility £6.95

MIX Software's ASM utility is available if you want to link assembly language functions to your programs. It works with Microsoft's MASM or M80 assemblers. Call assembly language functions just like C functions. Call C functions from assembly language. Lots of useful assembly language functions are included as examples.

YES! MIX C is fabulous! Please rush me:-

[ ] Comprehensive FREE 12 page colour brochure on the fabulous MIX C programming environment!

[ ] C Compiler £34.44 inc. VAT! Blazingly fast powerful linker! Massive 450 page typeset book! FULL library source code! Optimising tools! The best tutorial available!

[ ]Split Screen Editor £22.94 inc. VAT! Compile, link, and executive at the touch of a button in six seconds! Positions cursor to first error! 112 page book! Execute DOS commands! RUN other programs! Macros! Variables! Customise! Split screen horizontally or vertically between two files! Online help! Temporarily EXIT to DOS and return exactly where you left off! WordStar compatible!

[ ] Ctrace £34.44 inc. VAT! The friendliest, most powerful, State of the Art, C Debugger in the World! 112 page book! SIX Windows! Full colour! Unlimited break points! Watch points! Customise! Expand variables to 16 levels! Much, much more! Absolutely amazing!!!

[ ]C-Works £80.44 inc. VAT! The world's friendliest, most powerful, most complete C programming environment! More than 670 pages of documentation!

[ ] ASM Utility £7.99 inc. VAT! Assembly language interface! Packed with examples!

[ ]Examples Disk £6.84 inc. VAT! Nearly 70 examples from the brilliant tutorial! FULLY tested! Give your fingers a break!

[ ]Amstrad PC1512 → 640k Memory Upgrade £14.89 inc. VAT! FULL instructions! 150nS chips! Create a 360k RAM disk! Supercharge your PC1512!

No VAT on export orders! Postage £3 inc. VAT per order UK, £5 to the rest of Europe. Worldwide AirMail £20 for C-Works!

PCW June

Name _____

Address _____

_____

_____

I enclose cheque/Eurocheque for £ made payable to:Analytical Engines Ltd

Analytical Engines Ltd., PO Box 35, Eastleigh, Hampshire, England SO5 5WU
Telephone 0703 262099

MICRONIX MARVELS

SMALL FOOTPRINT & MARVELOUS PRICES

286 MARVEL – SUPERFAST 10 MHz 'AT' COMPATIBLE TURBO

1.2 MB FLOPPY (READS & WRITES 360K DISK) AND FAST 30MB (40mS) HARD DISK ONLY £1,799

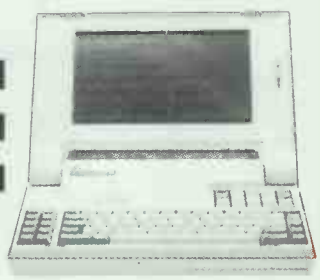
WITH 20MB HD £1,299

14" PAPERWHITE MONITOR INCLUDED

MS DOS 3.2 AND GW BASIC 3.2 INCLUDED

■ 80286–10 6/10MHz SWITCHABLE (10MHz, 0 WAITSTATE BENCHMARKED 11.5 PER NORTON – EQUIVALENT TO 12MHz ■ 640K RAM (EXPANDABLE TO 1MB ON BOARD) ■ HI-RES MONOGRAPHICS CARD ■ HI-RES 14" PAPERWHITE MONITOR ■ 'AT' TYPE KEYBOARD ■ 1.2MB HIGH DENSITY FLOPPY ■ SERIAL & PARALLEL PORTS ■ FAST 30MB HARD DISK (40mS ACCESS TIME) ■ LEGAL LICENSED BIOS ■ 7 SLOTS ■ REAL TIME CLOCK/BATTERY ■ LICENSED MS DOS 3.2 GW BASIC RELEASE 3.2 AND MANUALS INCLUDED ■ SIZE: 390 x 362 x 153mm

NEW NEC MULTISPEED LAPTOP PORTABLE



SUPERFAST 9.5MHz V30

LCD SUPERTWIST

BATTERY BACKED RAMDISK

£1395

■ LCD SUPERTWIST SCREEN ENSURES LEGIBILITY IN AVERAGE LIGHT WITHOUT EXCESSIVE BATTERY DRAIN ■ RUNS UP TO SIX HOURS FROM BATTERY ■ SUPERFAST 9.5MHz (SWITCHABLE TO 4.77MHz) V30 SUPERPROCESSOR-NORTON RATING 4.6 ■ PHOENIX BIOS ■ 640K RAM ■ 126K BATTERY BACKED RAMDISK ■ CLOCK/CALENDAR ■ 240V AC ADAPTOR ■ RGB OUTPUT ■ SERIAL & PARALLEL PORTS ■ EXTERNAL FDC PORT ■ 2 x 720K 3.5" FLOPPY ■ MS DOS 3.2 ■ SIZE: 13.6 x 12.4 INCHES ■ 11.2LBS OPTIONS: CAR LIGHTER ADAPTOR, LINK CABLE TO DESKTOP FLOPPY (ALLOWS SOFTWARE TRANSFER BETWEEN 5.25/3.5 INCH FLOPPY), CARRY CASE

PC MARVEL THE BEST OF 'XT' AND 'AT' IN ONE COMPACT SYSTEM

PC MARVEL TWIN 1.2MB FLOPPY (READS & WRITES 360K DISK) £749

14" PAPERWHITE MONITOR INCLUDED

MS DOS 3.2 AND GW BASIC INCLUDED

NEC V20 SUPERCHIP INCLUDED

PC MARVEL 1.2MB FLOPPY (READS & WRITES 360K DISK), 20MB HARD DISK £999

30MB £1,199 40MB (40mS) £1,399

■ NEC V20 8/4.77MHz SWITCHABLE ■ 8 SLOTS ■ LEGAL LICENSED BIOS ■ CLOCK/CALENDAR & BATTERY ON BOARD ■ 1024K RAM – 640K RAM FOR DOS AND 384K RAMDISK ■ 2 x 1.2MB HIGH DENSITY 'AT' TYPE DRIVES (XT FLOPPY IS ONLY 360K!) OR 1 x 1.2MB FLOPPY AND HARD DISK ■ HI-RES MONO GRAPHICS CARD WITH PRINTER PORT ■ SERIAL RS232 PORT ■ COMPACT SIZE: 390 x 362 x 153mm ■ HI-RES 14" PAPERWHITE MONITOR ■ AT TYPE KEYBOARD ■ 360K DISKETTES CAN BE READ AND WRITTEN ONTO IN 1.2MB DRIVE AND FILES CAN BE COPIED BETWEEN 1.2MB & 360K DISKETTES AND VICE VERSA (EVEN IBM 'AT' CAN'T MANAGE THAT!) ■ LICENSED MS DOS 3.2 AND GWBASIC RELEASE 3.2 AND MANUALS INCLUDED

NEW NEC APC IV POWERMATE I 'AT' COMPATIBLE

20/40MB (40mS) EGA SYSTEM:
20MB (40mS) £2495
40MB (40mS) £2795

EGA CARD AS STANDARD
MULTISYNC CGA/EGA/PGA MONITOR AS STANDARD
40mS HIGH SPEED HARD DISK AS STANDARD
INCLUDES PRINTER CABLE

■ 80286 8MHz-NORTON RATING 7.7 ■ PHOENIX BIOS ■ 640K RAM ■ CLOCK/CALENDAR ■ EGA CARD: 650 x 350 RESOLUTION-16 COLOUR ■ 14" NEC MULTISYNC CGA/EGA/PGA COLOUR MONITOR ■ ENHANCED 102 KEY KEYBOARD ■ SERIAL & PARALLEL PORTS ■ PRINTER CABLE ■ MS DOS 3.2 ■ 1.2MB 5.25" FLOPPY ■ 20 OR 40MB HIGHSPEED (40mS) HARD DISK ■ 5 x 16BIT AND 1 x 8BIT SLOTS ■ 3.5 FLOPPY SLOT ■ SMALL FOOTPRINT: 16.5" x 16.5"

micronix computers Ltd

1 Grangeway,
Kilburn,
London NW6 2BW
Tel: 01-625 0295/6/7/8/9 (5 lines)
Telex: 295173 MICROX G

Ordering Information:

Prices are exclusive of Carriage & VAT. Please add 15% to Total Cost. Carriage: Systems & Subsystems £20, Drives & Keyboards £8, Boards £5, RAM Chips £1. Monitor/Printer £15.

*Visit our brand new Showroom – off-street parking, nearest tube Kilburn (Jubilee Line) OPEN MON-FRI; 9.30am-5.30pm.
CLOSED FOR LUNCH 1-2pm. CLOSED SATURDAY.

AMSTRAD PC
SPECIAL OFFER

	RRP	Our PRICE
• 1512 DOUBLE DRIVE, COLOUR, 512K	£729	£679
• 1512 S/DRIVE, 20MB NEC HD, COLOUR	£1,069	£949

• RAM UPGRADE TO 640K £26
• NATIONWIDE ON-SITE MAINTENANCE AVAILABLE

PANASONIC PC

• FX600 XT COMPATIBLE SERIES FEATURE 95 KEY KB, 8086 7.16/4.77MHz. CLOCK, PARALLEL PORT, PANASONIC HIGH-RES CARD & GREEN MONITOR, 6 SLOTS, MSDOS/GWBASIC

• FX600 SINGLE DRIVE, 640K, MONO — £1,099
• FX600 DOUBLE DRIVE, 640K, MONO — £1,199
• FX600 S/DRIVE, 20MB NEC HD, MONO — £1,499
• SERIAL CARD £39
• JB3301 TRANSPORTABLE, GAS PLASMA DOUBLE DRIVE, 512K, SER/PAR — £1,349
• JB3301 S/DRIVE, 20MB NEC HD — £1,749

VICTOR PC

• FREE ONE YEAR NATIONWIDE ON-SITE MAINTENANCE ON ALL VICTOR SYSTEMS BY CDS
• VPC 2: DOUBLE DRIVE, 640K, MONO — £CALL
• VPC 2: S/DRIVE, 30MB HD, MONO — £CALL

HARD DISK UPGRADES PC/XT, AT & COMPATIBLES (INTERNAL)

20MB/30MB & CONTROLLER — £329/£449
40MB & CONTROLLER (40MS ACCESS TIME) PC/XT £699
20MB – AT (WITHOUT CONTROLLER) — £299
32MB – AT (40MS ACCESS TIME) WITHOUT CONTROLLER — £550

HARD CARDS

20MB/30MB HARD CARD — £349/£399

FAST 20MB CASSETTE BACKUP PC/XT, AT & COMPATIBLES

~~£950~~
NOW ONLY £599
LIMITED OFFER

WHY USE SLOW CARTRIDGE BACKUP? CASSETTE NEEDS NO TIME WASTING SERVOWRITING OR FORMATTING. BACKS UP 20MB IN 4 MINUTES! INTELLIGENT MENU DRIVEN SOFTWARE – ONE KEY COMMANDS. FILE-BY-FILE BACKUP/RESTORE, IMAGE BACKUP/RESTORE, FILE DIRECTORY AND DIAGNOSTICS. SUPPLIED WITH CONTROLLER, CABLE, SOFTWARE AND MANUAL.

IBM PC/XT COMPATIBLE INTERFACE CARDS

MULTI I/O FLOPPY CARD: MIO 100

(SHORT SLOT) £79
PERFECT FOR THE 640K MOTHERBOARD

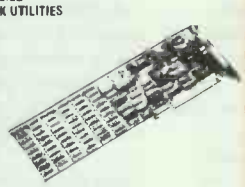
• 2 DRIVE FLOPPY DISK CONTROLLER – CABLE SUPPLIED
• 1 × RS232 SERIAL PORT & OPTIONAL 2ND SERIAL PORT (£16)
• PARALLEL PRINTER PORT
• GAMES PORT
• CLOCK/CALENDAR BATTERY
• SOFTWARE SUPPLIED: CLOCK UTILITIES

MULTI I/O CARD: DIO 200 XT

(SHORT SLOT) £69
PERFECT FOR THE 640K MOTHERBOARD

• CLOCK/CALENDAR BATTERY
• 1 RS232 SERIAL PORT: 2ND SERIAL PORT OPTION (£16)
• PARALLEL PRINTER PORT
• GAMES PORT – CABLE SUPPLIED
• SOFTWARE SUPPLIED: CLOCK UTILITIES

MULTIFUNCTION CARD: CT 6050S



WITH 0K RAM £99
WITH 384K RAM £149
COMPARE SPECS & PRICES BEFORE BUYING OTHER CARDS

• UP TO 512K RAM
• CLOCK/CALENDAR BATTERY
• 1 RS232 SERIAL PORT: 2ND SERIAL PORT OPTION (£26)
• PARALLEL PRINTER PORT
• GAMES PORT – CABLE SUPPLIED
• SOFTWARE SUPPLIED: CLOCK UTILITIES, RAMDISK, PRINTSPOOLER

COLOUR GRAPHICS ADAPTOR

WITH PRINTER PORT — £79
FULLY COMPATIBLE WITH IBM COLOUR CARD

• 2 VIDEO INTERFACES: RGB COLOUR AND COMPOSITE MONOCHROME (NOT SUITABLE FOR IBM MONOCHROME MONITOR)
• COLOUR GRAPHICS MODE: 320 x 200
• MONOGRAPHICS MODE: 640 x 200

PARADISE ENHANCED GRAPHICS ADAPTOR (EGA)

WITH AUTO SWITCH FOR MODE SELECTION – SHORT SLOT

COMPATIBLE WITH IBM EGA, IBM COLOUR GRAPHIC ADAPTOR, IBM MONOCHROME ADAPTOR AND HERCULES CARD
COMPATIBLE WITH PLANTRONICS COLOUR PLUS CARD
£225

SUPPORTS MONOCHROME AND COLOUR MODES
640×350 MONO, 720×348 MONO, 640×350 COLOUR, 640×200 COLOUR.
256K RAM ON BOARD AS STANDARD –

GENIUS MOUSE (SERIAL) FOR PC/XT/AT £99

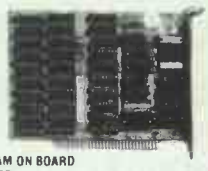
BOTH MICROSOFT & MOUSE SYSTEMS COMPATIBLE

MONOCHROME GRAPHICS CARD £79

FULLY COMPATIBLE WITH IBM MONOCHROME ADAPTOR & HERCULES GRAPHICS

• LOTUS/SYMPHONY COMPATIBLE
• TEXT MODE: 80 × 25
• GRAPHICS MODE: 720 × 348
• PARALLEL PRINTER PORT

UNIVERSAL MEMORY CARD: CT6280



WITH 0K RAM £49
WITH 384K RAM £99
WITH 512K RAM £109

• UP TO 640K (YES 640K!) RAM ON BOARD
• USE 64K AND/OR 256K CHIPS
• USE 3 BANKS OF 256K CHIPS FOR TOTAL 640K RAM

RAM CHIPS

64K (9 CHIPS) 150NS £10
256K (9 CHIPS) 150NS £20/£30 (120NS)

2MB EMS CARD FOR PC/XT/AT £349 FULLY POPULATED WITH 2MB RAM

• THIS CARD CAN GIVE YOUR PC/XT/AT BOTH EXPANDED MEMORY (LOTUS/INTEL/MICROSOFT EXPANDED MEMORY SPECIFICATION) AND THE EXTENDED MEMORY CAPABILITIES UP TO 2MB RAM. • MEMORY CAN BE ALLOCATED AS CONVENTIONAL, EXPANDED OR EXTENDED MEMORY

PC/XT ASYNCHRONOUS SERIAL CARD WITH 1 RS232 PORT — £29
PC/XT PARALLEL PRINTER CARD — £29
FLOPPY DISK DRIVE ADAPTOR — £39

IBM PC/AT COMPATIBLE INTERFACE CARDS

3MB MULTIFUNCTION CARD: MF 3000

WITH 0K RAM £179
FULLY COMPATIBLE WITH IBM AT AND COMPATIBLES
ADD £30 PER 256K RAM

• UP TO 3MB RAM ON BOARD – 1.5MB ON MAIN BOARD AND FURTHER 1.5MB ON PIGGYBACK BOARD
• MEMORY STARTING ADDRESS CONFIGURABLE AT 256K, 512K OR ABOVE 1MB
• 1 RS232 PORT – 2ND PORT OPTION
• PARALLEL PORT • GAMES PORT

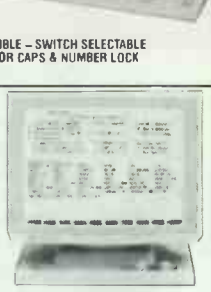
SERIAL-PARALLEL CARD FOR AT:
WITH 1 SERIAL/2 SERIAL PORTS: — £69/99
FLOPPY/HARD DISK CONTROLLER FOR AT — £199

IBM COMPATIBLE ENHANCED KEYBOARDS – SWITCHABLE

FOR PC OR AT £99

• SEPARATE CURSOR PAD
• FULLY PC/XT & AT COMPATIBLE – SWITCH SELECTABLE
• LED STATUS INDICATORS FOR CAPS & NUMBER LOCK
• 101 KEY

MONITORS



LATEST 14" FLATSCREEN PAPERWHITE MONITOR WITH TILT/SWIVEL
£149

IBM COMPATIBLE
• COMPOSITE MONOCHROME – CONNECTS TO COLOUR GRAPHICS CARD £99

IBM COMPATIBLE
• 14" PAPERWHITE TTL MONITOR — £149
• IBM COMPATIBLE: 14" MITSUBISHI COLOUR MONITOR £249
• NEC MULTISYNC CGA/EGA/PGA MONITOR — £525

micronix computers Ltd

LCS-8848: 3278/79 TERMINAL EMULATOR PC/XT/AT £549

• IRMA COMPATIBLE • HOST INTERFACE: PC/XT/AT
• NATIVE MODE COAXIAL CONNECTION TO IBM 3274/76
• 3278 MONO OR 3279 COLOUR EMULATION
• UP TO 3440 CHARACTER DISPLAY, 80 CHARACTER STATUS
• FILE TRANSFER UNDER TSO OR CMS • EAB SUPPORT
• ON BOARD CPU HANDLES 3270 PROTOCOL INDEPENDENTLY
• EASILY SWITCHES BETWEEN PC & 3278 EMULATION MODES
• LIGHT PEN SUPPORT • ASYNCHRONOUS CHARACTER INPUT SUPPORT

LCS-8261: ACCELERATOR CARD FOR PC/XT £299

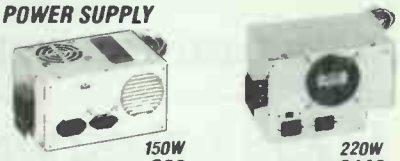
• 8MHz 80286 CPU • 80286/8088 MODE SWITCHABLE
• 8KB HIGH SPEED ZERO WAIT CACHE MEMORY
• SUPPORTS 5.0R 8MHz 80287 COPROCESSOR
• HARDWARE SWITCHABLE 8088 REMAINS IN SYSTEM FOR FULL COMPATIBILITY • HARDWARE CACHE DISABLE
• AUTOMATIC CACHE DISABLE DURING SELF TEST FOR COMPATIBILITY WITH MOST BIOSES • SOFTWARE CAN RUN UP TO SEVEN TIMES FASTER
• NO SOFTWARE PATCHES NEEDED • RUNS ALL XT/AT SOFTWARE

THE BEST BUY PRINTER VP 1814 £199

COMPARE SPECS AND PRICE OF THIS PRINTER BEFORE YOU BUY ANOTHER MAKE. IDEAL FOR AMSTRAD, IBM COMPATIBLES, BBC, ETC.

• EPSON/IBM COMPATIBLE – SWITCH SELECTABLE
• 180 CPS DRAFT/36 CPS NLQ (DIFFERENT FONTS AVAILABLE)
• BI DIRECTIONAL LOGIC SEEKING
• PROPORTIONAL SPACING
• ADJUSTABLE TRACTOR AND FRICTION FEED

POWER SUPPLY



150W FOR PC/XT £89
220W FOR AT £149

PRINTERS OUTSTANDING VALUE

PANASONIC KXP 1080 PRINTER ONLY £149
80 COLUMN 100 CPS/20 CPS NLQ HARDWARE NLQ SWITCH

PANASONIC KXP 1080:
EPSON COMPATIBLE, 80 COLUMN, 100 CPS/20 CPS NLQ SPECIAL OFFER £149
PANASONIC KXP 1092:
IBM/EPSON COMPATIBLE, 80 COLUMN, 180 CPS/33 CPS NLQ £350
PANASONIC KXP 1592:
IBM/EPSON COMPATIBLE, 136 COLUMN, 180 CPS/38 CPS NLQ £399
PANASONIC KXP 1595:
IBM/EPSON COMPATIBLE, 136 COLUMN, 240 CPS/51 CPS NLQ DUAL I/F £549

PANASONIC KX3131 DAISY WHEEL — £275
EPSON FX1000 136 COL. 200 CPS/40 NLQ F/T — £450
EPSON SQ2500 INK JET — £1,099
NEC P6: 24 PIN 80 COL. 216 CPS/72 LQ — £399
NEC P7: 24 PIN 136 COL. 216 CPS/72 LQ — £499

IBM PRINTER CABLE £13 (POSTAGE £2)

• DB25 TO CENTRONICS • SHIELDED CABLE – 3 METRE

FLOPPY DISK DRIVES
½ HEIGHT DS/DD 360K (PC/XT) — £99
360K FOR IBM AT — £99
1·2 MB FOR AT — £129

VISA, ACCESS WELCOME

Ordering Information:
Prices are exclusive of Carriage & VAT. Please add 15% to Total Cost. Carriage: Systems & Subsystems £20, Drives & Keyboards £8, Boards £5, RAM Chips £1. Monitor/Printer £15.
*Visit our brand new Showroom – off-street parking, nearest tube Kilburn (Jubilee Line)
OPEN MON-FRI: 9.30am-5.30pm.
CLOSED FOR LUNCH 1-2pm.
CLOSED SATURDAY.

micronix computers Ltd
1 Grangeway,
Kilburn,
London NW6 2BW
Tel: 01-625 0295/6/7/8/9 (5 lines)
Telex: 295173 MICROX G

BATH COMPUTER SHACK

YOU'VE PROBABLY HEARD ABOUT US!

ATARI ST ✓ AMIGA

CALL US LAST FOR THE BEST DEALS

Wide range of Software and peripherals for Atari St & Amiga

★ We promise you full support and after sales service ★

See us at the Novotel ~~Atari Show Stand 87~~

Atari 520 STM keyboard only	inc VAT	£259.00
Atari 520 STFM built in drive and mouse		£399.00
Atari 520 STFM as above + mono monitor		£499.00
Atari 1040 STF with mono monitor		£699.00
Atari 1040 STF with med res col monitor		£899.000

All ST models come complete with our top value starter pack

Amiga 1000 System 1 512k	£1075.00
Amiga 1000 System 2 512k	£1250.00
	+ VAT

PLUS FREE!! £200.00 VOUCHER
to spend on software or peripherals of your choice

Part Exchange

★ New Atari and Amiga Models ★
Please call or phone for latest details and prices

Finance Available

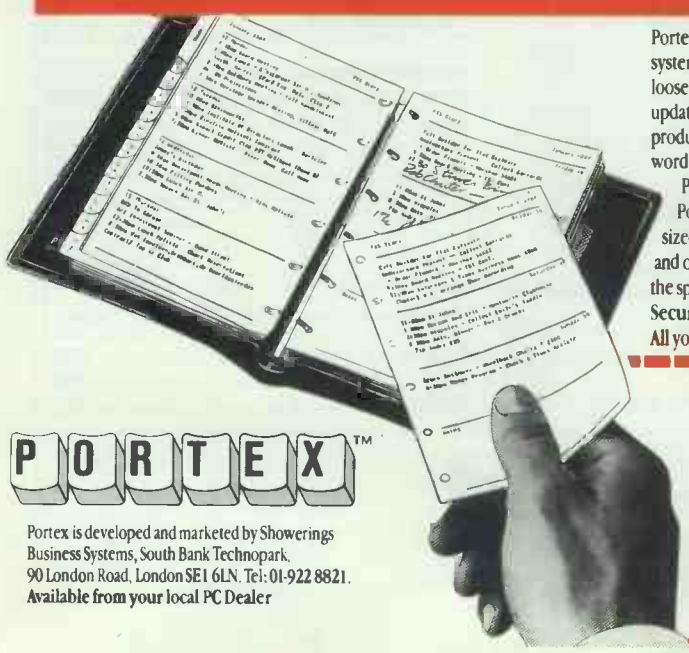
Education, Gov't Department, and volume orders negotiated with pleasure

Tel: 0225 310300 **8E, CHELSEA ROAD, LOWER WESTON, BATH, AVON** **Tel: 0225 310463**

A UNIQUE PERSONAL ORGANISER THAT'S ON YOUR PC AND IN YOUR POCKET. SEND FOR DETAILS TODAY...

CUSTOM DIARY, ADDRESS BOOK, WP, SPELL-CHECKER AND MAIL MERGE – ONLY £99

Portex, make my day!



PORTEX™

Portex is developed and marketed by Showerings Business Systems, South Bank Technopark, 90 London Road, London SE1 6LN. Tel: 01-922 8821.
Available from your local PC Dealer

Portex is the complete diary and address book system for every PC user. Custom-print a full year's loose-leaf diary for your Portex pocket binder, update your address pages, mail selected names, and produce memos, lists and reports on the integral word processor.

PC efficiency and traditional diary-keeping
Portex comes complete with its own pocket-sized leather binder. It's easy to input, organise and output pages, all on a standard printer, using the special Portex continuous paper.

Secure address lists and appointments
All your personal information is to hand yet kept secure on your PC. Just write in new diary and address details anytime, and update on your PC later.

Unbeatable price, for a life-long system
For just £99, plus VAT, you've the complete Portex system – software disks, quality leather binder, page dividers, Portex paper and a comprehensive instruction book. Send the coupon, or call, today. And let Portex make your day, every day.

Only £99 complete and ready to run – software with example files, pocket leather binder, page dividers, manual, keyboard template, and the unique Portex continuous paper.

PORTEX INFORMATION

PCU2

To Showerings Business Systems,
South Bank Technopark,
90 London Road, London SE1 6LN.

- ☐ I'm interested in buying Portex please send me more information...
- ☐ Give me the name of my local Portex dealer
- ☐ Dealer enquiry

Telephone enquiry line: 01-922 8821

Name _____
Position _____
Company _____
Address _____
_____
Telephone _____

SPECIALISTS IN AT COMPATIBLES

PRICES FROM ONLY £845

ALSO AVAILABLE THIS MONTH
ASI PC-XT's 4.77/8MHz WITH ASI PC-AT SPECIFICATION + 20Mb HD FOR ONLY **£795**

	ASI PC-AT 6-8 MHz	ASI PC-AT 10-12 MHz	ASI PC-AT 6-10 MHz
HI-RESOLUTION MONOCHROME MONITOR (HERCULES Compatible) 1.2Mb FLOPPY DRIVE	£845	£895	£945
20Mb HARD DISK (40ms access time)	£1295	£1345	£1395
44Mb HARD DISK (28ms access time) can be formatted to 66Mb	£1595	£1645	£1695

COLOUR UPGRADE
Colour Graphics Card & RGB Monitor **(16 colours)** — **add £150**

EGA ENHANCEMENT
EGA Card (256k) + EGA Monitor (Swivel Base) 64 colours (640 × 350) — **add £300**

ASI PC-AT SPECIFICATION

- ★ 640k RAM expandable to IBM
- ★ 8 Expansion slots
- ★ 1 Parallel, 2 Serial, games port
- ★ Calendar Clock with battery
- ★ Micropro "Easy" Word Processor
- ★ Utilises high quality Japanese components

ADD-ON CARDS

★ Serial RS-232 card	£25.00
★ Serial, Parallel & Games I/O Board (PC-AT)	£45.00
★ Colour Graphics Card (PC-XT/AT)	£60.00
★ Mono Graphics/Printer Adaptor	£65.00
★ Enhanced Graphics Adaptor (256k)	£145.00
★ Multi-10 Card (FDD/Serial/Parallel/Clock/Games Port)	£65.00
★ 384k Multifunction Card 384k RAM (PC-XT)	£125.00
★ 3Mb Multifunction Board with Lotus/Intel EMS (Enhanced Memory System) Solution OK	£159.00
★ Monopack Card (PC-AT/XT) Graphics/Serial/Parallel/Clock/Light Pen/Games Port	£99.00
★ Adaptec RLL Hard Disk Controller	£135.00
★ HD/FD Controller with cables (Western Digital)	£155.00
★ Flycom 1200C V21, V22 Modem	£150.00
★ Local Area Network card	Call for prices
★ LAN Cluster Kit (s/w)	
★ Novell's Advanced network Driver s/w	

ACCESSORIES

★ 44Mb (28ms) Hard Disk with Disk Manager s/w	£675.00
★ 20Mb (40ms) Hard Disk (Microscience)	£375.00
★ RGB Colour Monitor (16 colours)	£245.00
★ EGA Monitor swivel base (64 colours [640 × 350])	£345.00
★ Mouse	£45.00

HI-GRADE COMPUTERS LTD
13 KENTISH TOWN RD,
LONDON NW1 8NH
Telex: 262563 XENON G

7 DAYS TRIAL PERIOD OR MONEY BACK GUARANTEE
Please phone for confirmation of prices
ALL PRICES EXCLUDE VAT

ONLY £180
FOR A HIGH QUALITY 165CPS DOT MATRIX PRINTER
Available on purchase of one of the above systems

EDUCATIONAL AND DEALER ENQUIRIES WELCOMED
01-482 4024

For under £5,000*
A **new A1 plotter** including stand

THE
DPX 3300

1985 – A3
1986 – A2
1987 – A1

The Roland DG Plotter Range Grows!

A choice of 6 plotters from A3 – A1 with full supporting range of Cables, Paper, Film and Pens.
PLUS optional maintenance contract through
olivetti CES

*£4,800 +VAT

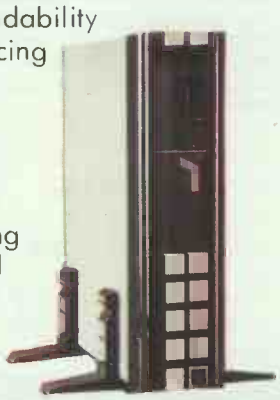
Roland DG

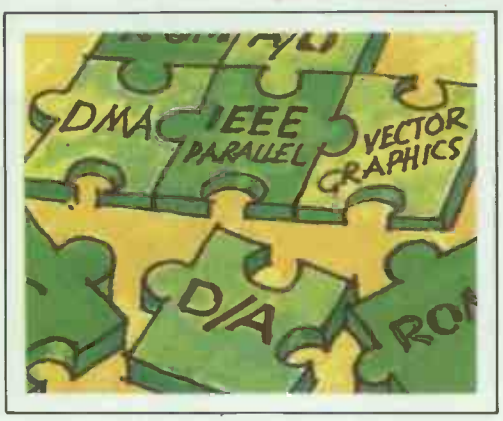
983 Great West Road, Brentford, Middx. TW8 9DN
Telephone: 01-568 4578 Fax: (01)8471528 Telex: 934470

SUPERMICROS from U-MICRO

The Interfacer Series 1000

The well-established U-Micro Series 1000 supermicro offers tremendous expandability plus lots of interfacing options.
It is also the basis of specialist packages such as CHEMMOD – Chemical Modelling and ELECTROMAN – electrochemistry research system.





The Number Cruncher Series 2000

The new U-Micro Series 2000 offers unbeaten 32 bit data processing facilities. First choice for new research applications, university teaching, advanced multiuser business applications, and OEM applications.

Both models feature 68000 cpus with 1 to 4Mb internal Ram, Winchesters up to 80Mb, Serial and Parallel ports, disks, multiple serial port options, graphics and many other options.

Operating Systems

OS9/68000, MIRAGE, TRIPOS, CP/M 68K, P-system

Languages

BASIC, FORTRAN, PASCAL, APL, FORTH, C, BCPL, LISP.

Systems from around £1000. Deals for OEM's and Education.

U-Microcomputers Ltd, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR.
Tel: 0925 54117 Telex 629279

U-MICRO

32 BIT SUPERMICROS

AC. INTERACTIVE

TOP 20 DESK TOP PUBLISHING SYSTEMS AT TOP 20 PRICES

	RETAIL	OUR PRICE
DTP COMPLETE SYSTEMS		
AMSTRAD PC1512 10MB MONO COMPUTER SENTRONICS LASER PRINTER VENTURA SOFTWARE	3889	**3258**
MACKINTOSH 512K COMPUTER LASER WRITER PRINTER PAGEMAKER SOFTWARE	7490	**5995**
IBM PCXT OR COMPATIBLE TURBO SYSTEM ADD ON CANON CX + 2MB LASER CARD 1.25MB VENTURA SOFTWARE	3734	**2864**
LASER PRINTERS		
CANON A1 + 2MB LASER CARD	2939	**2195**
CANON LB8–8 A11	3850	**2795**
CANON SERIES 2	2195	**1795**
HP LASER JET PLUS	3518	**2749**
HP LASER SERIES II	2618	**2395**
AST TURBO LASER	4150	**2995**
QMS PS-800 + POSTSCRIPT	4500	**3378**
KYOCERA F-1010	3395	**2795**
IMAGE SCANNERS		
CANON IX–12	1100	**899**
DTP SOFTWARE		
PAGEMAKER MAC & IBM	595	**P.O.A.**
MAC AUTHOR	199	**169**
MAC RAGTIME	299	**239**
MAC PUBLISHER II	175	**136**
MAC READY SET GO	169	**149**
XEROX VENTURA IBM	795	**669**

Prices shown exclude post and packing and VAT and are correct at time of printing.

WHY PAY MORE?

- Call us for our famous eye-testing Price List with over 2,000 items inc: Apple, IBM, Apricot, Epsom software and hardware, printers, monitors, disks. All at great savings.
- Fast delivery.
- Quantity discounts.
- Credit accounts for PLC companies, government depts., hospitals, local authorities, schools, colleges, universities.
- Professional advice.
- Hotline support on all products sold.

AC. INTERACTIVE

FREEPOST, LEAMINGTON SPA, WARWICKSHIRE
CV32 5HH, ENGLAND

0926-313345

VISA

NORTHWEST COMPUTER SUPPLIES (PCC LTD)

82 School Lane, Didsbury, MANCHESTER M20 0RY
Tel: 061-434 9747 MicroLink 72:MAG003

BORLAND/TURBO PASCAL

Turbo Pascal V3 with 8087 & BCD	57	Sidekik Unprotected	57
Turbo Database Toolbox (Isam etc)	39	Travelling Sidekick	57
Turbo Tutor NEW V2	25	Sidekick and Travelling Sidekick	67
Special - Turbo Pascal/Toolbox/Tutor	109	Turbo Lightning (Spell + Thesaurus)	57
Special-Turb/Tbox/Tutr/Edt/Game/Grap	190	Lightning Word Wizard	38
Graphics Toolbox (IBM compats only)	39	Turbo REFLEX : the analyst database	79
Turbo Editor Toolbox	39	Turbo Reflex WORKSHOP	57
Turbo GameWorks (inc CHESS prog)	39	Prolog	57
Holiday Special (Editor/Gameworks)	69	Prolog - Toolbox	57
Turbo "C" (check avail)	74	Eureka - Numerical Methods	57
Turbo Basic (check avail)	57	Superkey	57

IBM or Apple MAC versions only

MODEMS/COMMS SOFWARE/MICROLINK

MODEMS (AUTO ANS/DIAL)		Migent - portable	Call
Pace Linnet (V21/V23 Buff)	119	COMMS SOFTWARE	
Pace Series 4 (V21/V23)	235	Datatalk 3.27 (Prestel Graph/Kermit)	119
Pace Series 4 (V21/V22/V23)	379	Crosstalk 3.6 (inc Kermit)	99
Pace Series 4 (V21/V22/V23/V22Bis)	469	Mirror (Similar to Crosstalk)	CALL
WS4000(V21/V23 Buff)	149	DIALUP Comms (with EPAD and Prestel)	89
Steebek Quattro (all speeds + ARQ)	695		

SELECTED SOFTWARE PC/MS DOS

RBASE V (NEW SUPER VERS)	465	Norton Utilities/Commander	67/39
Dbase II / III Plus	295/399	ADVANCED Norton Utilities	99
Flying Start	55	VP-Planner / VP Info	69/69
Q & A (512k vers)	245	Sideways / Ready	42/54
PC Promise (IBM version)	145	GW-Basic (with HERC & Col Graphics)	95
Prodesign II	225	Wordstar NEW vers 4) Professional	289
Persoft Smarterm Emulators		Flight Simulator / Jet	55/42
VT220/VT240/Tek 4014	125/185/139	Hitchhikers Guide to the Galaxy	23
DOS 3.1 (most compats) Dos 3.2	57/72	ZORK 1.2 or 3 (Adventure) each	19
GEM Draw or Desktop/Write/Paint	105	Infocom games - either	19 or 23
Microsoft Windows	79	BBC Basic for IBM Compats (SUPERB)	95
Microsoft Quick GW-Basic Compiler	79	XEROX Ventura Publisher (IBM vers)	795
Lattice 'C' Compiler	245	Able One / Ability	85/90

Other software prices - Call

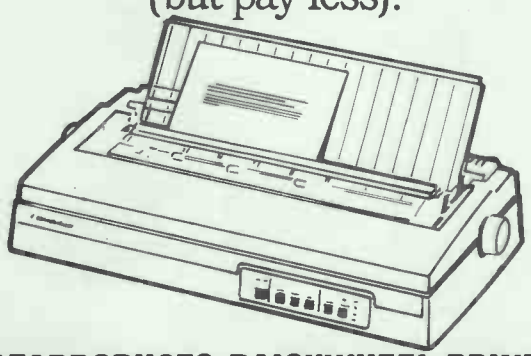
EXPANSION CARDS/MICE/CO-PROCESSORS

MEMORY UPGRADES (IBM's etc)		8087's 5mhz/8mhz/10mhz	130/180/295
64k DRAMS (256k)	40	Microsoft Mouse (Serial or Bus)	149
256k DRAMS (512k)	99	Mouse Systems Mouse with PC Paint	145
MicroPort System V v 2.2		Informix SQL for Microport	795
Operating System (2 users)	166	C/SQL Development	495
Software Development	132	4GL version	1200
Text Processing	132	Santa Cruz Xenix (Multi User)	595
(all of the above)	595	Software Development	595
Multi User License	160	Text Processing	195
Merge-86 (DOS as a UNIX job)	132	(all of the above)	1295

for latest prices/products — see ShopWindow on MicroLink

Free Postage & Packing (UK only). Manufacturer's Guarantees
All prices plus VAT at 15% (except EXPORT)
Payment with all orders — Please

How to get a £499 daisywheel printer for your IBM PC or compatible (but pay less).



DATAPRODUCTS DAISYWHEEL PRINTER 22 CPS, SERIAL I/F, 136 COLUMN WIDTH

Dataproducts DP 20 fully equipped with mains lead, self test switch, daisywheel, ribbon etc. This full-size, heavy duty (weight 26.4 lb) commercial application printer has choice of 10, 12, or 15 c.p.i. plus proportional spacing, & 100 character drop-in daisywheel. Brand new, boxed and guaranteed, limited supply. Original price £499. (Opt single bin sheet feeder £150). VAT extra.

£195

MORGAN COMPUTER CO.

179 Tottenham Court Road, W1. 01-636 1138

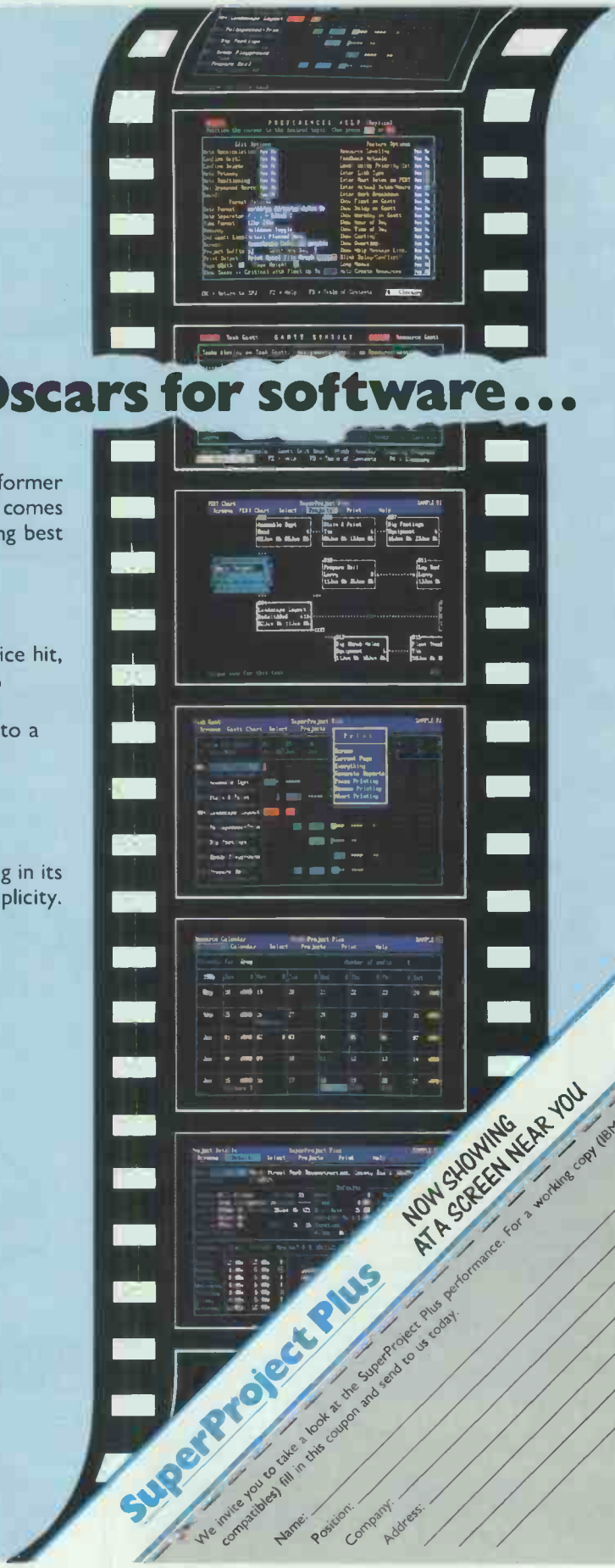
If they gave Oscars for software...

SuperProject Plus is a star performer that sweeps the boards when it comes to project management including best technical supporting cast.

It is already the biggest box office hit, with Context reporting a 27% market share – and rising as SuperProject Plus reaches out to a wider business audience.

The program content is stunning in its capability; while its theme is simplicity.

And the critics?
"Best overall project management program" –
Infoworld, October 6, 1986.



COMPUTER ASSOCIATES

Software superior by design

Micro Products Division
Edinburgh House 43-51 Windsor Road
Slough Berkshire SL1 2EQ

Tel: Slough (0753) 77733

SuperProject Plus

NOW SHOWING AT A SCREEN NEAR YOU

We invite you to take a look at the SuperProject Plus performance. For a working copy (IBM and compatibles) fill in this coupon and send to us today.

Name:
Position:
Company:
Address:

there are only two names
to remember when you want to buy a printer

OLIVETTI ...

OLIVETTI DM 100/4
80 column,
120 cps draft,
25 cps NLQ.
IBM graphics
Epson FX compatible.
Friction feed.
Centronics Interface.
RRP £299 **Our price £199**

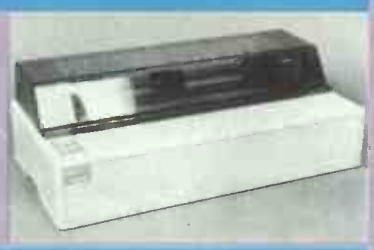
OLIVETTI DM 280/1
80 column
160 cps draft
35 cps NLQ.
Friction and pin feed,
Parallel Interface.
IBM graphics
Epson FX compatible.
RRP £479 **Our price £307**

OLIVETTI DM 285/1 (Colour)
80 column
160 cps
35 NLQ
F/T Parallel
JX compatible
RRP £555 **Our price £415**

OLIVETTI DM 286/2
80 column
18 pin NLQ
220/90 cps.
Epson FX compatible.
Colour option.
RRP £689 **Our price £589**

OLIVETTI DM 295/1 (Colour)
132 column
160 cps
35 NLQ, F/T
Parallel & Serial
(dual interface)
JX compatible
RRP £707 **Our price £526**

OLIVETTI DM 296/2
132 column
18 pin NLQ
220/90 cps
Epson FX compatible
Colour option.
RRP £859 **Our price £759**



OLIVETTI DM 590/1
132 column
192/120/48 cps NLQ/LQ
Epson JX compatible plus
Qume and Diablo.
Parallel Centronics Interface.
RRP £1083 **Our price £846**

OLIVETTI DY 450/1
45 cps
Parallel Centronics Interface.
RRP £1249 **Our price £799**

OLIVETTI DY 800/2
80 cps.
Dual Interface.
RRP £1599 **Our price £1059**

OLIVETTI PG 101 (LASER)
8 ppm
Diablo, Epson & HP compat.
6 Resident fonts.
Dual Interface.
RRP £3209 **Our price £2499**

OLIVETTI DM 290/1A
132 column,
160 cps draft,
35 cps NLQ.
Friction feed.
Parallel Interface.
IBM graphics Epson
FX compatible.
RRP £539 **Our price £363**

OLIVETTI DM 600/2
132 column
24 needle.
200/70 cps. Letter quality
LQ 1500 compatible.
Dual interface.
RRP £1151 **Our price £929**

OLIVETTI PCPR 3
132 column
18 pin
400/100 cps.
IBM Graphics compatible
Parallel Centronics Interface.
RRP £1808 **Our price £1559**

... and DIGITASK

0342 24631 Telex: 957418

Unit M, Charlwoods Business Centre, Charlwoods Road,
East Grinstead, West Sussex RH19 2HH

VISA

ADMICRA An AAAA Company

AMSTRAD Tandon ATARI Roland AUTOCAD BOS

AUTHORISED DEALER

AMSTRAD PC1512 from £449 inc. FREE 640K Upgrade

Opus. PCII from £499

Tandon PCX & PCA SUPPLIED WITH 12 MONTHS FREE ON-SITE MAINTENANCE

BASIC AUTOCAD SYSTEM — £1799

Opus System 4 (20Mb, IMB RAM) 720 x 348 resolution mono parallel & serial ports, Basic Autocad, Summamouse, Hitachi A3 plotter

ADVANCED AUTOCAD SYSTEM — £6599

Tandon PCA20 (20MB, 1MB RAM) 720 x 348 resolution on 14" screen, 1 parallel & 2 serial ports Autocad plus ADE 2 & 3. Cherry A3 digitiser, Roland DPX2000 A2 plotter and stand.

We can tailor Autocad systems to your requirements due to our extremely wide range of support peripherals (see below) **Installation and training.** Please call for details.

VIKING ULTRA HIGH REVOLUTION 19" DISPLAY. Ideal for Desk Top Publishing & CAD PLEASE CALL

ALLOY MULTI-USER Turn your XT/AT into a Novell compatible multi-user system from **£1199 per station**

ATARI 1040 ST Mono — £559

HARD DISK & MEMORY UPGRADES

IBM & Compatibles 20MB	£359
IBM & Compatibles 30MB Hardcard	£379
Sanyo Memory upgrade to 256K + RAM disk + 25% extra disk capacity	£65
Amstrad PC 1512 upgrade to 640k	£29

APRICOT ADD ONS

512k Memory Board	£115
20Mb Hard Disk Upgrade	£695
Hi Res Mono Monitor for Portable	£109

PRINTER PROMOTIONS

PANASONIC 1081	**£169**
MP 165	**£189**
STAR NL10	**£215**
EPSON FX800/1000	**£319/£399**
M. TALLY MT85/86	**£299/£399**
EPSON EX800/1000	**£399/£539**
NEC P6/P7	**£409/£499**
EPSON LQ800/1000	**£459/£619**
JUKI 6100	**£259**
QUENDATA 1120	**£169**

SHEETFEEDERS Please Call

ACCOUSTIC HOODS Please Call

PRINTER BUFFERS

Serial/parallel in/out 8K-2MB from **£79**

★ New ★ All Purpose X-buffer — Please call

FANFOLD PAPER All sizes available eg

11" × 9½" 60gm	£9.75	(2000 sheets)
12" × 9¼" 60gm	£11.69	(2000 sheets)
A4 Clean Edge — 70gm	£15.95	(2000 sheets)*
— 85gm	£9.30	(1000 sheets)
11" × 14½" 60gm	£13.50	(2000 sheets)*

Delivery £2.65 (fixed) + £1 per box.
Extra £1 per order for items marked *

LABELS 89mm × 36mm from £3.95/1000.
70mm × 36mm from £2.95/1000
Please call for other sizes.

RIBBONS for all printers eg

EPSON FX. MX. RX 80/100	£2.49/£3.75
EPSON LX. 80	£2.95
JUKI 6100 single strike	£1.15
SHINWA/M.TALLY MT80	£3.79
KAGA/CANON	£3.99
QUME MS4	£2.65
APPLE IMAGEWRITER	£3.35

PRINTWHEELS from £3.95

Delivery 95p any Quantity ribbons/printwheels

SOFTWARE SPECIALS

VENTURA DTP		£695
Supercalc 4	Lotus Eater	£195
VP Planner	Lotus Clone	£65
VP Info		£65
Perfect Writer 2		£99
Wordcraft 3.0 (IBM)		£349
Wordstar 2000		£225
Word Perfect		£265
Turbo Pascal (8087+BCD)		£55
Turbo Reflex		£69
CADpower		£259
Turbocad		£299
CADD inc. mouse		£169
Autosketch		£79
Ability-Integrated Package		£79
Moneypower		£79
Sage Financial Controller		£249

PLOTTERS — DIGITISERS etc.

Hitachi 672 A3	£449
Roland 880A A3	* £679
Roland 885 A3 SPECIAL OFFER	£929
Houston DMP42 A1	£3099
Roland DPX2000 A2	** £2495
Graphtec GP9001 A0	£6,195
Summasketch 12" × 12" digitiser	£395
Cherry A3 digitiser	£495
Logimouse with IBM support software	£85
Summamouse with GEM + Write & Paint (IBM)	£179

* inc FREE 11k buffer ** inc stand

DISKS — POST FREE Packed in tens No quibble guarantee

Prices for ONE box. All extra boxes — **10% EXTRA DISCOUNT**

5¼"	DYSAN	SONY	PRECISION
SSDD	£13.40	£11.90	£8.90
DSDD	£16.90*	£14.90	£10.90
DSQD	£23.90	£17.90	£13.90
HD1.6MB	£29.90	£27.90	—

*** DYSAN DSDD — 1 EXTRA DISK PLUS LIBRARY CASE**

SONY 3.5" SS£16.90 DS£23.90

AMSOFT 3" £28.90

LOCKABLE DISK BOXES 40 3½" DISKS £7.95
70 5¼" DISKS £9.95

Official Government/Educational Authority orders welcomed.

Please add 15% VAT to all prices (inc. carriage) Limited space precludes listing of our full range of products. Please telephone if you do not see the item you require

ADVANCED MICROCOMPUTER APPLICATIONS LTD 1ST/2ND FLOORS
40, HIGH ROAD, BEESTON NOTTINGHAM NG9 2JP Tel: 0602 252627

ADMICRA An AAAA Company

Looking for AT/XT at the most competitive prices in the UK market? The Alphatronics XT and AT, manufactured in Taiwan, have sold in thousands throughout the world under various brands. The XT already has 2000 successful corporate sales under its belt in the UK. Phone with your preferred spec for a quote.

XT

ALPHATRONICS

ALPHATRONICS

AT

640k Turbo
20Mb

ALPHA add on cards combine Japanese excellence in quality assurance with the competitiveness of Taiwanese pricing:
PC/XT expansion: Colour graphic/printer card £79 ★★ Hercules Monographic/printer card £79 ★★ I/O plus card (printer/1 optional /2 serial/game/clock) £69 ★★ 384KB multifunction (RS232/printer/ clock/game) £89 ★★ 384KB memory expansion £79 ★★ Serial port £29.
PC/AT expansion: Enhanced Graphic Adaptor £160 ★★ 3.5Mb memory expansion card (start address selectable, uses 256DRAM) £95 ★★ 2.5Mb multifunction card (parallel/serial all fully assignable LPT1/2 COM1/2/3/4 start address selectable) £99.
POWER
150 WXT power supply £79; 225W AT power supply £145

Enquiries to:

(North/Midlands): Alphatronics, Wolverley House, Digbeth, Birmingham B5 6JB. 021 643 9866

(South/London): GUARDIAN DATA SYSTEMS Ltd, Guardian House, Borough Road, GODALMING GU7 2AE. 04868 25585/8

Semaphore cards

For high quality and reliability.

4Mb MEMORY CARD

High performance extended memory card for the PC AT offering up to 2Mb on main board with a further 2Mb on piggyback board (included)

- Fully socketed memory with parity check
- Configurable start address at 256K, 512K and above 1Mb
- Extendable to max 16Mb

Zero K installed
Add £60 for each 512K memory

£189

3Mb MULTIFUNCTION CARD

Multifunction card for the PC AT offering standard I/O functions and up to 1.5Mb on main board with a further 1.5Mb on piggyback board (included)

- Fully socketed memory with parity check
- Configurable start address at 256K, 512K and above 1Mb
- Extendable to max 16Mb
- 1 serial port, 2nd optional
- 1 parallel printer port
- Game port

Zero K installed
Add £60 for each 512K memory
Add £15 for 2nd serial port

£189

MULTI I/O CARD (AT)

A short size card providing fully configurable standard I/O functions

- Short card 4 x 5"
- Parallel printer port
- One serial port, 2nd optional
- Game port

Add £15 for 2nd serial port

£69

MULTI I/O CARD (XT)

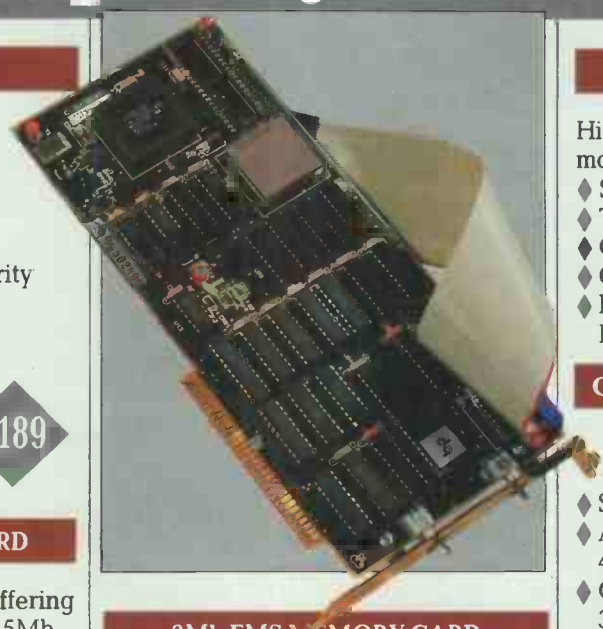
A short size card providing fully configurable standard I/O functions

- Short card 4 x 5"
- Parallel printer port
- One serial port, 2nd optional
- Real-time clock-calendar with battery backup
- Game port

Add £15 for 2nd serial port

£69

Above configuration also available with floppy disk controller.



2Mb EMS MEMORY CARD

Memory enhancement board offering a maximum configuration of 2Mb and full compatibility with the Lotus/Intel expansion memory paging specification

- Fully socketed memory with parity check
- Configurable start address at 256K, 512K and above 640K
- Software

Zero K installed
Add £60 for each 512K memory
Price is for XT card
Add £20 for AT card

£129

384K MEMORY CARD

The cost effective solution for filling out the base memory on your PC XT

- Short card 4 x 5"
- Uses 64K and 256K chips
- Configurable start address
- High reliability

384K installed

£89

1200/1200 MODEM SHORT CARD

Remarkable high performance half-size modem card

- CCITT V22/V21 Full Duplex and Bell 212A/103 compatible
- Software compatible with Hayes Smartcom II and AT command set
- Auto dial & Auto answer
- Selective COM1 or COM2 port
- Built-in speaker
- Fail-safe line protection circuit

£149

Non Approved. Prohibited from connection to any telecommunications system run by British Telecom.

MONO GRAPHICS SHORT CARD

High resolution graphics for your monochrome display monitor

- Short card
- Text Mode 80 x 25
- Graphic mode 720 x 348 Pixels
- One parallel printer port
- Full compatibility with IBM & Hercules graphics cards

£69

COLOUR GRAPHICS SHORT CARD

Colour/Graphic Adaptor with full IBM compatibility

- Short Card 4 x 5"
- Alphanumeric mode:
  40 x 25 80 x 25
- Graphics mode:
  320 x 200 4 colours
  640 x 200 2 colours
- Composite video ports

£59

All our boards are of the highest quality and reliability and we offer a full 12 months warranty.

Please note for buyers of extended memory cards we supply high speed 120ns memory as standard and can install at no extra cost. We can also supply MicroCache disk caching software to dramatically improve the speed of your XT or AT using any of our memory products.

Payment may be made by cheque or credit card.

Please add VAT to all prices.
Carriage is free within mainland UK.

For further information fill in the coupon. Or telephone Semaphore Systems on 01-435 6315 or 01-433 1255.

Please send me full details of your product range.

name_____

company_____

address_____

_____

SEMAPHORE
SYSTEMS LIMITED

7 Moreland Ct, Finchley Rd, London NW2 2PJ
Tel: 01-435 6315/01-433 1255

PC 88 TURBO

- ★ 16 bit 8088-2 processor 4.77/8 MHz
- ★ Pheonix/AMI BIOS (IBM compatible)
- ★ 512K Hi-Speed Dynamic RAM expandable to 640K/1024K on motherboard
- ★ 360K Half Height Drive
- ★ Hi-Res Monochrome Monitor
- ★ 2 Parallel Printer Ports
- ★ 2 Serial RS232 Ports (1 optional)
- ★ Clock/Calendar with battery back-up
- ★ Hi-Res Graphic Adaptor
- ★ Joystick Port
- ★ 8 Expansion Slots
- ★ 150W Approved Power Supply
- ★ Enhanced Quality Keyboard
- ★ Comprehensive User Manual set
- ★ 12 Months Warranty

From **£499**

PC 286

- ★ 80286 processor 6/8/10 MHz
- ★ Pheonix/AMI BIOS (IBM Compatible)
- ★ 512K Hi-Speed Dynamic RAM expandable to 4Mb on Motherboard
- ★ 1.2Mb Half Height Drive
- ★ 1 Parallel and 2 Serial RS232 (1 optional)
- ★ Hi-Res Monochrome Monitor
- ★ Hi-Res Graphic Adaptor
- ★ Clock/Calendar with battery back-up
- ★ Joystick Port
- ★ 8 Expansion Slots
- ★ 200W Approved Power Supply
- ★ Enhanced Quality Keyboard
- ★ Comprehensive User Manual set
- ★ 12 Months Warranty

From **£999**

PC 386

To Be Announced

The software systems which have been fully evaluated and could be supplied with BETOS computers include:

ACCOUNTING	DATABASES	WORD PROCESSORS	SPREAD SHEETS	LANGUAGES	OP. SYSTEMS
Tetraplan	dBASE III plus	Wordstar	Lotus 123	Turbo Pascal	MS DOS
SunAccount	Smart	Stellatext	Supercalc	Fortran	XENIX SYSTEM V
Omicron	Rbase	Multimate	Javelin	Cobol/level II/VS	Local Area Network
Pegasus	Symphony	Smart	Smart	Basic	
Sage	Framework	Framework	Framework	C	

HOT LINES (021) 356 3828 (01) 281 4259

IBCS Ltd

10-18 Manor Gardens
LONDON
N7 6JY
Tel: 01 272 8944

BETOS Group of Companies

Rosco Ltd

289 Birchfield Rd
BIRMINGHAM
B20 3DD
Tel: 021 356 7402
Telex: 334303 TXAGWMG

S&S £10 SOFTWARE

THE DOS UTILITIES

DOSMENU A menu-driven front end for DOS, choose any program or DOS command from a menu

FASTHELP* Your own pop-up help screens, inside any program Also has cut-and-paste from one program to another

CALC* A memory-resident pop-up calculator; use it while running your programs

PUTBUFF* Lets you put characters in the keyboard buffer, as if they had been typed from the keyboard

BUFF128* Increases the type ahead buffer from 15 to128

BURN* Blanks the screen after a given time to prevent burnin

POPCMND Inside another program, you can pop up various DOS commands, such as Type, Rename, Copy, etc.

D BASE III PLUS UTILITIES

POPMENUS* Pull down menus for Dbase III

WINDOWS* Scrolling windows

PASSWORD* Password protection

ENVIRON* Tests the DOS Environment

PHONETIC* Phonetic coding

CURSOR* Cursor flash control

MMTODB3* Multimate to DbaseIII data transfer

DBCHECK Creates a correctly indented Dbase command file

AND FOR THE KIDS

PC PLAYTIME* Educational fun & games for 3-7 yr olds £14.95. needs colour

FOR SECURITY

UNDELETE Lets you recover files that you have accidently deleted from floppy or hard disk; also works in subdirs. £15

READONLY Makes files so that they can not be deleted or changed

ENCRYPT Encrypts files so they cannot be used without a password, also decrypts

SECRET Makes files invisible/visible to directory searches

UNFORMAT/ RESCUE Recovers data from formatted hard disks or hard disks with corrupted directories £39

DR SOLOMON'S DATA RECOVERY SERVICE
We recover deleted or corrupted files, corrupted, damaged or vanished disks, formatted hard disks. Its expensive but NO FIX-NO FEE. We can tackle ANYTHING

142 PROGRAMS NOW AVAILABLE
PLEASE PHONE FOR FREE CATALOGUE

TYPING

IANKEY Crash course in typing for beginners £26

IANKEY2 Two finger to touch typing conversion course £26

TYPEWRITER Turns your typewriter into a typewriter. Works with all printers

Send your orders to:
S&S Enterprises, Micro Division
31 Holloway Lane, Amersham
Bucks HP6 6DJ

COMMUNICATIONS UTILITIES

PC-PRESTALK* A comms package; all speeds including 1200/75, and does Prestel graphics. £20 + VAT

STFDESTF Converts any file into a form that can be transmitted over any line, even if the line can only do seven bits

FOR THE PRINTER

PRINTQ* Lets you add a file to the background PRINT queue, even while inside another program

SIDELINE Prints your wide spread-sheet printouts sideways

REDIRECT* Lets you redirect printer output to a file

SUBSTCOM Lets your serial printer substitute up to 7 desired symbols for 7 unwanted ones eg. a ¶ for a }

SUBSTLPT As SUBSTCOM but for parallel printer

CHOOSE ANY FIVE FOR £40!
£10 & £15 Programs only

All programs cost £10.00 except where stated +VAT
You can buy a package of any nine programs for £65or any five for £40.
This offer only includes our £10 and £15 programs

PLEASE ADD VAT TO ALL ORDERS

PROGRAMS MARKED * ARE FOR IBM'S AND COMPATIBLES ONLY

S&S ENTERPRISES (AMERSHAM) LTD. (02403) 4201 & 28095

CUT PRICE SOFTWARE LTD

TEL. NO. (0279) 31956/24433

LEISURE		
Wordstar 1512	69.95	59.50
Volkswriter Deluxe	44.99	37.40
Jr Wordperfect	99.95	84.95
DATABASES		
Cardbox	59.99	49.50
Tas Plus	80.44	69.50
PC Promise	69.95	59.95
VP Info	91.94	79.75
SPREADSHEETS		
Supercalc III	69.95	59.50
VP Planner	91.94	79.95
Logistics	113.85	94.95
Scratch Pad +	59.99	49.99

GENERAL UTILITIES		
Ability	113.85	94.95
Reflex	69.95	59.95
Sidekick	29.95	24.95
Open Access	149.95	127.95
Turbo Cad	99.00	84.15
Turbo Lightening	80.44	68.95
Turbo Pascal	80.44	68.95
Turbo Prolog	80.44	68.95
ACCOUNTS PACKAGES		
Sage	POA	
Compact	POA	
MAP	POA	

DESK TOP PUBLISHING		
Fontasy	79.95	67.95
Fleet Street Editor	149.95	129.95
BOOKS		
Basic Book II	9.95	
Technical Ref. Guide	19.95	
Running MSDOS	19.95	
LEISURE		
Silent Service	24.95	
Leather Goddess of Phobos	29.99	
Hitchhikers Guide	29.99	
Zork 1-2-3	29.99	
Micro Trivia	19.99	
Championship Golf	24.95	
Summer Games II	19.99	
Winter Games	19.99	
Flight Simulation II	49.95	

★★★★★

SECURICOR NEXT DAY £6.95
SECURICOR 3 DAY £3.95
ORDERS UNDER £30 CARRIAGE FOC

24 HOUR ANSAPHONE.
OVERSEAS AND TRADE ORDERS PHONE FOR DETAILS

OVER 150 TITLES IN STOCK. **FREE** 30 DAY TELEPHONE SUPPORT ON ALL PRODUCTS

INVOICES SENT UPON REQUEST

ALL PRICES INCLUDE VAT

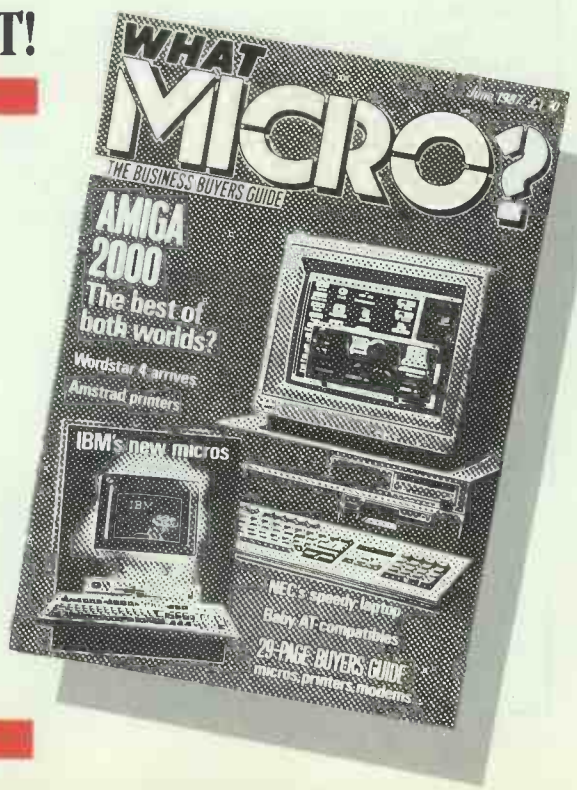
CHEQUES OR POSTAL ORDERS
BARCLAYCARD – ACCESS
Unit 6 (Dept P3), Stort House, Riverway
HARLOW CM20 2DW

WHAT'S WHAT?

WHAT MICRO? TELLS YOU WHAT'S WHAT!

The June issue of WHAT MICRO? is out now with all the facts and figures you need to make the most cost-effective buying decisions.

In the June issue we review IBM's exciting new range of personal systems, Amstrad's DMP printers, the latest offering from Commodore, Borland's Superkey, and the new version of Wordstar. Add to this the magazine's 29 page classified buyers guide and you really will be able to get to grips with what's what in the PC market.



WHAT MICRO? JUNE ISSUE OUT NOW!

Buying a personal computer these days is not the simple task it used to be. Just about every manufacturer has got something special to offer in the way of interesting gismos and bolt-on-goodies. It's all too easy to forget that when you actually have to use that little electronic business partner, inputting all your data can be harder than you think.

ELECTRONE can change all that. We have a range of products that can be used instead of, or in conjunction with your machine's standard keyboard and don't forget that with many systems the keyboard is not part of the package – you can decide on an **ELECTRONE** alternative – and what a difference that can make!

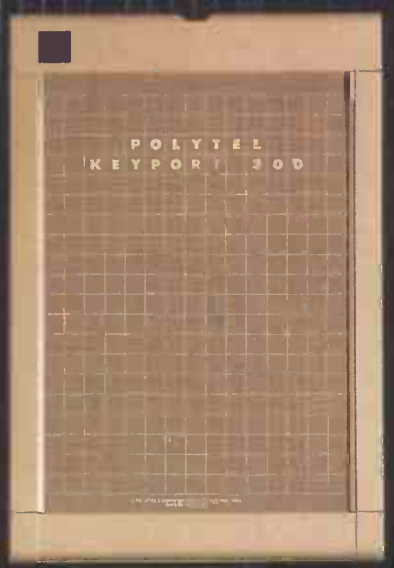
DIN-124

KEYPORT 60

Not only is an **ELECTRONE** keyboard likely to be significantly easier to find your way around, but it actually comes with our easy-to-use software that allows you to customise your board to any configuration you could possibly think of and take full advantage of those handy extra Function keys we drop in. Some Systems Houses are so impressed that they have us engrave the Function Keys for specific applications – if need be we'll even design a keyboard to fit your particular purpose.

But if this isn't enough, you can consider one of our **KEYPORT* Touch Tablets**. Offering either 60 or 300 basic "keys" (and you can double that by using the Shift feature) these clever little devices can be used again with our easy-to-use software – to store extra commands, strings, paragraphs of text, formulae or what you will, on each and every key position. They can be automatically changed whenever you use a different program and can be used inside most software applications.

Making life easier is one of the main benefits of using a computer in your business but at **ELECTRONE** we reckon that even the best hardware can be improved with a little softening-up. So if you'd like to know how we can help you and your IBM† compatible business partner, write or 'phone today for our information pack.



These Keypads are currently being used by major companies for:
Point-of-Sale
Order Entry
Databases
Accounts
Enquiry Systems
and Financial Applications including Dealing Rooms

KEYPORT 300

DIN-106

Electrone

* KEYPORT is a trademark of Polytel Computer Products Corp. †Copyright IBM Corp.

SOFTEN UP YOUR BUSINESS PARTNER

Electrone Ltd. Haywood House, High Street, Pinner, Middlesex HA5 5QA Telephone: 01-429 2433

Get the best for less at Ness

ARABIC VERSIONS AVAILABLE
EXPORT ORDERS WELCOME

THE NEW PC 386 FROM £2995

THE NESS SUPER XT TURBO 20MB £795

- NEC V20 Super processor
- switchable 4.77/8 mHz clock
- 20MB hard disk
- 1 x 360K floppy drive

THE NESS SUPER AT TURBO 20MB £1395

- a true 10 mHz computer
- switchable 6/8/10 mHz
- 20MB hard disk
- 1.2MB half height floppy

THE NESS SUPER PC-386T £2995

- Intel 80386 processor
- up to 2MB RAM on mother board
- fast 16 mHz clock
- 1.2K floppy drive
- full AT compatibility

FEATURESFEATURESFEATURES

- 100% industry compatible
- high performance
- quality build
- top-grade components
- fully supported by NESS technicians
- stand-alones or systems
- installation and after-sales engineering
- wide range of upgrades available
- many peripherals in stock
- comprehensive software
- satisfaction or money back in 14 days

★ 30MB, 40MB, 80MB AND MORE UPGRADES AVAILABLE

ALL NESS COMPUTERS COME WITH THE FOLLOWING AS STANDARD:

- professional keyboard
- parallel and RS232 serial ports
- clock/calendar with battery back-up
- monographic and printer cards
- high-resolution 12" monitor
- full set of manuals
- 8 x expansion slots
- 12 month guarantee

AT COMPATIBLE FROM £995

ADDITIONAL OVERSEAS AGENTS REQUIRED

NESS FOR QUALITY

NESS INDUSTRIES LIMITED
38-40 Upper Clapton Road, London E5 8BQ
Telex: 261840 NESS G Fax: 01-806 2743
PHONE: 01-806 1072/8904

DISCOUNT COMPUTERS

SPECIAL OFFER SAVE £46

Model	rsp ex vat	OUR PRICE ex vat
PCW range:		
PCW 8256	£399.00	£359.00
PCW 8512	£499.00	£459.00
PCW HARD DISC UNIT 10 mb	£445.00	£435.00
PCW HARD DISC UNIT 20 mb	£599.00	£579.00
FD2 2nd drive for 8256	£158.48	£135.00
DPS 8256 interface	£59.00	£52.00
SEND SAE FOR OUR HUGE RANGE OF DISCOUNT PCW SOFTWARE		
PC1512 range		
SD-MM	£449.00	£429.00
DD-MM	£559.00	£534.00
SD-CM	£619.00	£594.00
DD-CM	£729.00	£704.00
KD20-MM	£899.00	£859.00
KD20-CM	£1069.00	£1029.00
SD-MM + Dysan 10mb card	£849.00	£759.00
SD-CM + Dysan 10mb card	£1019.00	£929.00
SD-MM + Miniscribe 20mb card	£999.00	£845.00
SD-CM + Miniscribe 20mb card	£1169.00	£1015.00
PC1512 HARD DISCS & UPGRADES		
10 mb Dysan internal card	£400.00	£350.00
20 mb PLUS FIVE external drive	£399.00	£375.00
30 mb PLUS FIVE external drive	£539.00	£519.00
20 mb PLUSCARD internal card	£595.00	£555.00
30 mb PLUSCARD internal card	£695.00	£655.00
20 mb MINISCRIBE internal card	£550.00	£450.00
30 mb MINISCRIBE internal card	£650.00	£500.00
TEAC TAPE STREAMER 20 mb	£499.00	£495.00
TEAC TAPE CARTRIDGES 20 mb	£26.04	£25.00
640k MEMORY UPGRADE	£50.00	£35.00
INTERNAL FAN	£35.00	£35.00
MATHS COPROCESSOR 8087-2	£225.00	£195.00
SOFTWARE FOR PC1512		
COMPSOFT DELTA 4	£86.91	£73.88
COMPSOFT BOOKWORKER	£173.87	£147.79
WORDSTAR 1512	£60.83	£51.70
SUPERCALC 3	£60.83	£51.70
SAGE ACCOUNTANT PLUS	£199.00	£169.15
GEM COMM	£60.83	£51.70
CAMSOFT FINANCIAL MANAGER	£130.39	£110.83
MAP PAYROLL	£42.61	£36.22
MAP COMBINED PACK	£129.57	£110.14
MICROSOFT WORD JUNIOR	£60.83	£51.70
CAXTON CONDOR JUNIOR	£86.09	£73.17
GST FIRST WORD PLUS	£69.52	£59.09
FLEET STREET EDITOR	£130.39	£110.83
SANDPIPER ACCOUNTS	£130.39	£110.83

THIS IS A SAMPLE FROM OUR EXTENSIVE RANGE OF SOFTWARE
SEND FOR FULL DISCOUNTED LIST

PRINTERS

Model		rsp Ex vat	OUR PRICE Ex vat
DMP 3000	105 CPS/25 NLQ 80 column. 1 year warranty	£169	£160
DMP 4000	200 CPS/50 NLQ 132 column. 1 year warranty	£349	£325
MP165	165 cps draft/70 CQ/35 NLQ Epson/IBM compatible 80 column. 2 year warranty	£259	£199
MP200	200 cps draft/40 NLQ Epson/IBM. Interchangeable Font cards 80 column. 2 year warranty	£329	£269
MP201	200 cps draft/40 NLQ Epson/IBM. Interchangeable Font cards 132 column. 2 year warranty	£399	£359
JUKI 7200	324 cps draft/108 NLQ Multi-function includes sheet feeder Epson/IBM/Diablo 630. (24 pin). 132 column. 2 year warranty	£1625	£1462
CANON LBP-8A1	8 pages/minute LASER printer	£1950	£1750

NEW DOT MATRIX PRINTERS

Panasonic KX-P1081	120 cps draft/24 NLQ Epson/IBM compatible 80 column. 1 year warranty	£245	£180
Seikosha SL80	150 cps draft/50 NLQ Epson/IBM compatible (24 pin) 80 column. 1 year warranty	£499	£449

NEW DAISYWHEEL PRINTERS

MP26	26 cps Daisywheel Printer Epson/IBM 132 column. 2 year warranty	£260	£240
MP40	40 cps Daisywheel Printer Epson/IBM 132 column. 2 year warranty	£379	£347

THIS IS A SELECTION FROM OUR EXTENSIVE RANGE OF PRINTERS. SEND SAE FOR FULL LIST.

ATT Locoprinter System

The ATT LOCOPRINTER gives you professional letter quality printing from a 35 cps DAISYWHEEL printer using a special interface/cable to enable you to use your existing LOCOSCRIPT FILES from your PCW 8256/8512

All features supported such as Bold & Double strike. Super & Subscripts. Pitch changes from 5 to 17. Underline etc. using your standard files

Normal Price £549 — Special Price £509

MAIL ORDER DIVISION
All prices exclude vat
send cheques to

WILLOW SOFTWARE (WMI)
The Willows, Wrington Lane
Congresbury BRISTOL BS19 5BD
(0934) 834056

Special Offers on Macintosh Products

A Selection of Excellent Value Products for your Macintosh

	Price Ex VAT	Inc VAT
WORKS: Microsoft Spreadsheet, Database, W/P, Comms	245.00	281.75
MORE: Living Videotext The Successor to ThinkTank 512	275.00	316.25
RAGTIME: Orange Micro A Complete DeskTop Publishing Program	249.00	286.35
LASERSERVE: Infosphere For Laser-Spooling to disk - per User	99.00	113.85
INTERMAIL: Internet Send Messages and Files on AppleTalk (5-10 Users)	349.00	401.35
COMICWORKS: Macromind Design Your own Comics and Storyboards	60.00	69.00
GRAPHICWORKS: Mindscape Low Cost Publishing on your Mac	60.00	69.00
MAC PLUS CARRY CASE Holds Mac Plus, Keyboard and Hard Disk	39.90	45.88
IMAGEWRITER // CARRY CASE Matching Carry Case for Imagewriter & Cables	36.50	41.97
SONY 400K 3.5" Disks Box of Ten Sony Single-Sided Disks	17.30	19.90
SONY 800K 3.5" Disks Box of Ten Sony Double-Sided Disks	26.00	29.90
POSTAGE per Item	1.74	2.00

Telephone Orders - Monday to Friday: 9.30am-6.00pm
Credit Cards Welcome

Authorised Apple Dealer

STIRLING MICROSYSTEMS

The Specialist Centre for Apple Macintosh Systems

231 Baker Street, London NW1 6XE 01-935 5262

EXPANSIONS AND UPGRADES

$0110 Floppy Disk Controller for XT, 2 x 360K Drives	28.00
$0130 Colour Graphics Card, 320 x 200 dots	56.00
$0140 Monochrome Video Card, 80 x 25 Characters only	56.00
$0150 Monochrome Graphic/Printer Card	69.00
$0160 Enhanced Graphics Card	229.00
$0200 Multi I/O with Floppy Controller	78.00
$0210 Multi I/O Card	59.00
$0220 Serial Card, 1 + 1 optional	24.00
$0230 Parallel Printer Card	16.00
$0240 64K Buffered Printer Card with 16K RAM	79.00
$0250 Game I/O Card, 2 Channels	14.00
$0260 384K Multi function Card supplied without RAM	99.00
$0270 Serial/Parallel Card for AT	56.00
$0280 576K Memory Expansion Card supplied without RAM	29.00
$0290 Clock/Calendar Card	29.00
$0300 2.5Mb RAM Card for AT, supplied without RAM	126.00
$0310 2.5Mb Multi func. Card for AT, supplied without RAM	165.00
$0320 Hard Disk Controller, for XT	129.00
$1100 AD/DA Card, 12 bit	98.00
$1150 Eprom Writer	117.00
$1160 Eprom Writer (4 textool sockets)	157.00
$1180 PAL Programmer Card	314.00
$1210 8255 I/O Card	59.00
$1220 4 Channel RS232 Card for PC/XT	133.00
$1225 4 Channel RS232 Card for AT	158.00
$1230 8 Channel RS232 Card for PC/XT	249.00
$1235 8 Channel RS232 Card for AT	315.00
$1240 Bi-Synchronous RS232 Communications Card	89.00
34010 Joystick	15.00
34020 Mouse	49.00
34100 PC/XT Standard Keyboard Type 5050. PC/XT Only	49.00*
34105 AT Style Keyboard Type 5051, PC/XT/AT	58.00*
34110 Selectric Style Keyboard Type 5151, PC/XT/AT	73.00*
34200 XT 8 Slot Cabinet	54.00*
34310 150 W Power Supply Unit for PC/XT	79.00*
34320 200W Power Supply Unit for AT	149.00*
38120 PC/XT 20MB Upgrade Kit, 65mS, with cntrl, cbls etc	349.00*
38130 PC/XT 30MB Upgrade Kit, with cntrl, cbls etc	449.00*
38320 PC/XT 20MB Hardcard	399.00*
38330 PC/XT 30MB Hardcard	499.00*
38420 PC/XT 20MB Internal Tape Backup	449.00*
38425 PC/XT 20MB Ext. Tape Backup Incl Int f card	499.00*
38810 Amstrad Comp 10MB Tape Backup, Cristie	399.00*
38820 Amstrad Comp 20MB Tape Backup, Cristie	499.00*

Please add £1 per item (£4 per item marked *) and 15% VAT and send your order (or phone with VISA or ACCESS number) to
0244 371677

Western Technology

PO Box 512, Wrexham, Clwyd, LL12 0XX

We'll point you in the right connection!

RSD

DATA SWITCHBOXES

NEW

Slimline switchboxes enabling you to quickly and easily switch between micros and printers

RS232 (Serial) metal cased	Centronics (Parallel) metal cased
25-way 'D1' to 2-way £29.50	36-way Centronics 1 to 2-way Para..... £29.50
25-way 'D1' to 3-way £37.50	36-way Centronics 1 to 3-way Para..... £43.50
25-way 'D1' to 4-way £48.00	36-way Centronics 1 to 4-way Para..... £48.00

PARALLEL CROSSOVER 36-way Centronics 2 to 2 changeover crossover £39.50

BUFFER **AUTOSWITCH**

Parallel printer leads

£8.75

Centronics interface with 64k memory, copy, bypass & reset functions. Stores printing information leaving computer free for other tasks. Print sequence may be interrupted and used, later returned to original work. With 9V.AC adaptor. Also comes in 256k verison.

£165.00

Up to 4 computers can share one printer with no change of cables. Automatically scans ports and locks onto any port that transmits printing, then rescanning the other ports in sequence. With 9V.AC adaptor, also available for 8 computers/1 printer.

4-way £165 8-way £195

RS232 CABLES, MODEM LEADS MADE TO ORDER FOR ALL TYPES OF COMPUTER AND MODEMS.

75p P&P IN UK. Access & Visa accepted. Add 15% VAT to all orders

Cheques made payable to

RSD Connections Ltd., Dept PW6

PO Box 1, Ware, Herts.

Tel: 0920 5285/66284

BARCLAYCARD VISA — Access

Why settle for less than 100% function software for your PC? Why waste your time and money on "stripped down" versions or "last year's" model? LOGISTIX is the latest integrated package with Spreadsheet, Graphics, Database and Timesheet functions.

The April 1986 issue of PERSONAL COMPUTER WORLD concluded: "The range of functions provided by LOGISTIX is unusually wide. At £395 it provides excellent value for money." Now at only £99.95 it offers unbeatable value to the PC user.

LOGISTIX

SPREADSHEET

- Massive size — over 2000 rows by 1000 columns in full colour
- 74 arithmetic, financial, scientific and logical functions
- Powerful macro language with "learn" and "single step" modes for easy programming
- Full password protection for added security
- Includes sideways printing routines
- Reads files from SuperCalc & Lotus

"Verdict: An important British package which adds a new dimension to spreadsheets. This is a very high quality package."

PC USER

DATABASE

- Full sorting, finding and extraction routines
- Can read dBASE (II or III) files and even allows you to select only records matching your criteria

TIMESHEET

- Totally unique "Computerised Wallplanner" for time management, staff planning, job costing etc
- Powerful project management and Resource Allocation
- Automatic Critical Path analysis displayed

GRAPHICS

- The best selection of graph types including: line, bar, pie, gantt, spread, scatter, 3D, X-Y etc
- Graphics routines configured for AMSTRAD 1512 (also IBM·EGA, Olivetti EGC, Hercules etc)
- Wordslide generation for superior presentations
- Colour output on a wide range of printers & plotters

"Even without its Timesheet facilities LOGISTIX can give Lotus 1-2-3 a good fight."

PC BUSINESS WORLD

100%

OF THE FUNCTIONS

25%

OF LAST YEAR'S PRICE

PC VERSION NOW ONLY

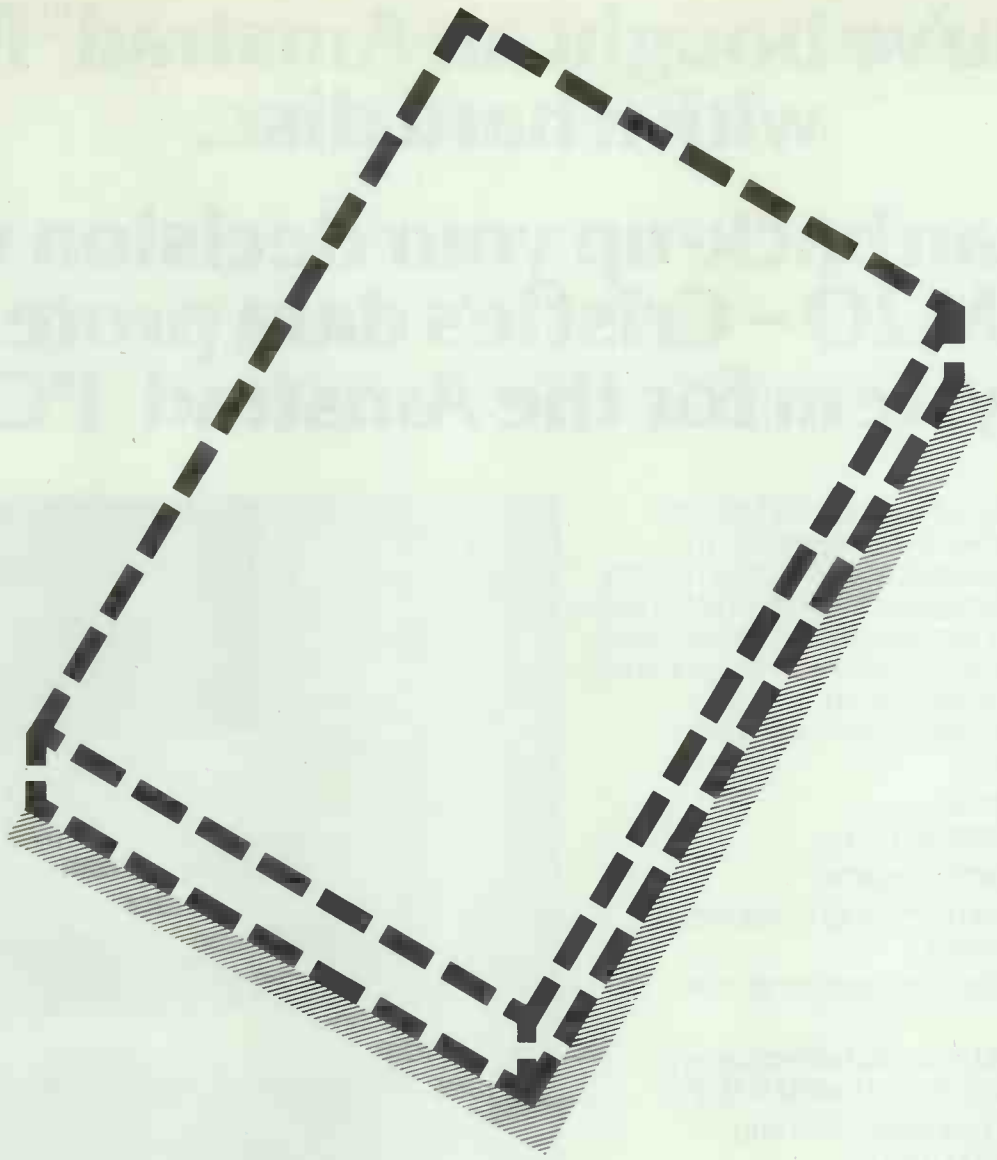
£99.95

NOT COPY PROTECTED

AMSTRAD 1512 COMPATIBLE

GRAFOX

GRAFOX Ltd, South Bank Technopark, 90 London Rd, London SE1 6LN. Tel. 01-922 8807



Your Missing Link

Please send me___copy/copies of The DataComms Book. I enclose a cheque/card no. for £29.95 including p&p with this order **Saving £5** on the published price.

PCW2·87

Name _____

Company Name _____

Address _____

_____ Telephone No _____

Signature _____ Date _____

Card No _____ ☐ Access ☐ Barclaycard

Send to VNU Business Publications BV, Directories Booksales Dept, **Freepost 25,** London W1E 6EZ, Telephone 01-439 4242.

The DataComms Book is your missing link to the data communications industry. This comprehensive book, from the publishers of The Computer User's Year Book is the newest and best guide to this increasingly complex area of computing.

Link up to Comms Equipment – get the full technical specifications on the complete range of datacomms equipment so vital for computer managers and communications specialists.

Link up to Comms Services – make sure you know of the essential services available from network developers, consultants and recruitment and training companies plus On-line services.

Link up to Comms Users – pinpoint the top 1300 comms sites in the UK.

Don't miss out on the missing link to data comms. Order The DataComms Book today.

You've bought an Amstrad™ PC with a hard disc.

We can back-up your decision with the AM20 – Cristie's data protection system for the Amstrad™ PC.

If you are using your computer for business or other serious purposes, the information you have stored on it can be very valuable. Just imagine if that information were to disappear. It can happen by hard disc failure, by an accident such as fire or theft, or by simply pressing the wrong button.

The AM20 can protect you against that happening.

The AM20 is:-

- Easy to install and use;
- Compact and portable;
- Economical to share as it requires no controller card;
- Very flexible with a wealth of user options;
- Based on a tried and tested system already on sale for the IBM (TM) PC;
- Designed, manufactured and supported in the UK.

10 MBytes from £399
20 MBytes from £499

Cristie

15 years experience in manufacturing computer peripherals.

Cristie Electronics Limited, Bonds Mill, Bristol Road,
Stonehouse, Gloucestershire GL10 3RF
Telephone: (Sales line) 045382 – 8824; (Switchboard) 045382 – 3611
Telex: 43551 Cristy G; Fax: 045382 – 5768

SOFT TOUCH COMPUTERS

apricot APRICOT APPROVED DEALER

APRICOT

XEN XI 10, 512k Ram 3½" or 5¼" Floppy, Keyboard, Green Monitor, Standard Apricot Software **£1,499.00**

XEN XI 20, 512k Ram 3½" or 5¼" Floppy, Keyboard, Green Monitor, Standard Apricot Software **£1,849.00**

XEN-I 386, 30MB, MONITOR, STANDARD S/W M.R.P. £3,367
OUR PRICE £2,699

XEN-I 386, 45MB, MONITOR, STANDARD S/W M.R.P. £4,367
OUR PRICE £3,699

SOFTWARE

Wordcraft	£299.00
Superwriter	£149.00
Easywriter	£199.00
Wordstar Version 3.4	£200.00
Word Perfect Word Library	£285.00
Open Access Version 1.06	£299.00
Volkswriter Version 3.0	£189.00
Sage Accountant	£108.00
Sage Accountant Plus	£140.00
Sage Payroll	£70.00
Sage P.C. Planner	£70.00
Framework II	£375.00
Javelin	£399.00
Database III Plus	£399.00
Sidekick	£40.00
Xchange	£299.00
Clipper	£399.00

PRINTERS

Epson FX 85 160cps	£317.00
Epson LX 86	£219.00
Epson LQ 800 180cps	£425.00
Epson EX 1000 Dual/Tractor Colour Option	£599.00
Epson LQ 1000 180cps	£565.00
Brother HR 20 Dual Daisywheel	£335.00
Brother HR 25 XL	£549.00
Brother Twinwriter 5	£999.00
Brother M1409 180cps/45cps 110 columns	£325.00
Panasonic KXPL081	£199.00
Panansonic KXPL092	£320.00
Citizen Premiere 35P	£550.00

COLOUR PRINTERS

Okimate 20	£149.00
NEC Pinwriter 7	£575.00

LASER PRINTERS

Hewlett Packard Laser Jet	£1,599.00
Hewlett Packard Jet Plus Serial Parallel	£2,199.00
Canon 8A1 Serial Parallel	£1,599.00
Kyocera F-1010 Serial Parallel	£2,699.00
AST Turbolaser	£3,000,00

ACCESSORIES

SUPPLIERS OF: DATA SWITCHES, CABLES, TONERS, DISKS, PAPER, ADD ON CARDS, MONITORS, ACOUSTIC HOODS, MODEMS AND OTHER MAJOR COMPUTERS, MONITORS AND PRINTERS.

PLEASE DO NOT HESITATE TO CONTACT SOFT TOUCH COMPUTERS, AS ADVICE AND INFORMATION IS ABSOLUTELY FREE CALL SOFT TOUCH COMPUTERS ON **01-571 7614**

24 Orchard Ave
Southall
Middx UB1 1LG

W E ' R E W I T H Y O U A L L T H E W A Y

M-TEC

NEW RELEASE
BBC BASIC (86)

for

PC compatibles, running MS DOS

£95 + VAT

Now you can use your favourite language with your favourite operating system

— — — —

the features of BBC BASIC including:

- Multi-lined named procedures.
- In-line assembler using standard mnemonics.
- Serial random and indexed disk files plus the ability to access any byte in the file.
- BBC Basic VDU commands; graphics; sound.
- Full screen editing.

You need never say GOTO again — but we won't stop you

Available from:

M-TEC COMPUTER SERVICES (UK)
Ollands Road, Reepham, Norfolk NR10 4EL
TEL NORWICH 0603 870620

When it's

Macintosh™

or

COMPAQ®

It must be

HG Computer Services Ltd
97/99 London Road
St Albans
Herts
AL1 1LN

tel. St Albans (0727) 30129

Call for FREE tickets to our Desktop Publishing Open days on June 10th and 13th and you could WIN OVER £1,500 of software

Presenting the Digitask Turbo 286 Near perfect PC/AT® emulation, without the astronomical price (from £1,253)

Call for details

Dealer enquiries welcome

Origin—Woodlands Hill, California, U.S.A.

DIGITASK

Unit M, Charlwoods Business Centre, Charlwoods Road, East Grinstead, West Sussex RH19 2HH

Telephone (0342) 24631
Telex 957418

THE NEW AGFA X55-5. LEAVE IT AND LOVE IT.

The X55-5's unique control panel gives it one outstanding advantage.

You can leave it to complete its work. Without having to worry about whether you have copied twenty documents or launched a satellite.

All its features are neatly set out on the panel's display screen, in English and a choice of three other languages. You just tell it what you want by touching the program key and the 'copy' button.

NO OTHER MID OR HIGH VOLUME COPIER HAS SUCH A SIMPLE TO OPERATE CONTROL PANEL.

No user's manual. No confusion. No sweat.

Whether you need double sided copying, image overlay, zoom reduction and enlargement, or any of the X55-5's sophisticated features, the copier gives them to you automatically and reliably.

Just as reliable is Agfa's own direct nationwide maintenance service. It has a reputation second to none. So, you'll never be sorry you chose the X55-5. In fact, you'll quickly learn to love it.

AGFA

Agfa-Gevaert Ltd., Office Systems Division, Office Copy Sales, 27 Great West Road, Brentford, Middlesex TW8 9AX. Tel: 01-560 2131.

AGFA COPIERS

CALL **LINKLINE 0800 2827 55** AND ASK FOR OFFICE COPY SALES

PagePerfect™

The Ultimate in Desktop Publishing Software

WORD PROCESSING

- Integrated WYSIWYG word processing, Emulates Wordstar and Multimate
- Imports text files from all the most popular word processors
- Spelling checker
- Thesaurus
- Hyphenation and justification
- Goto, find/replace, repeat
- Move, copy, delete, undo/redo
- Enter or automatically generate text

LAYOUT & COMPOSITION

- 9 zoom levels with full editing in all zooms
- 4 windows for simultaneous viewing and editing of 1 or 2 documents
- Pre-designed style sheets/page layout formats
- Automatic text wrap-around
- Automated composition
- White space management
- Multiple paragraph styles
- Multiple columns
- Gutters, lines, boxes, etc.

PAGINATION

- Unlimited document size
- Automatic text flow-through
- Automatic page numbering, section numbering, caption numbering
- Compound numbering
- Automatic re-numbering after additions or deletions

GRAPHICS & IMAGES

- Accepts images from the most popular charting, freehand graphics, and CAD software*
- Accepts images from many popular scanners
- Scroll-through Image Librarian
- Automatic grey scale averaging
- Pixel editing*
- Multiple contrast adjustments
- Images moveable behind image boxes
- Prints in black, white and 7 shades of grey or 6 background patterns for text
- Captions stored with images

TYPOGRAPHY

- Supports over 100 fonts from the typeface libraries of Compugraphic, Bitstream, and ITC
- Supports all Postscript fonts and Hewlett-Packard soft fonts
- Bold, italic, bold italic, underline, double underline, outline, reverse, and strike-out
- Multiple kern tracks
- No point size limitations

FILE MANAGEMENT AND UTILITIES

- Color interface for ease of use
- Status feedback
- On-line, context-sensitive help
- Installation utilities
- View command
- File tagging and masking
- Keystroke macros with paced and fast playback
- Graphic display of directory hierarchy
- Full DOS feature management of files and directories

Runs on IBM AT or Compatible with 640k and one Hard, one Floppy disk drive under DOS 3.0 or Higher. EGA supported.

£650 + VAT p&p

Desktop Publisher's Graphics

Single Page Composition System

• 18 Variable Fonts • 7 Fixed Fonts • Inbuilt Flow Chart Symbols • AV Slide Generation and Presentation • Imports text files from most popular word processors • Inputs graphics from other software, eg Lotus 123, Supercalc, Autocad, etc • Optical scanner input

Runs on IBM PC XT AT or Compatibles with 512K and twin disk drives under DOS 2.0 or Higher. HERCULES, CGA, EGA supported.

£150 + VAT p&p

FULL HARDWARE AVAILABLE

PLUS FULL BUREAU SERVICE INCLUDING SCANNED IMAGES ON DISK FILE

ELDONCRAY LIMITED

137 Stewart Road
Bournemouth BH8 8PA
Tel: 0202 293407/21505
Fax: 0202 298325
Telex: 418217 BHNEWS G

The electronic communications package for the Macintosh™ Office

◊ The solution to communication across AppleTalk.

◊ Send or receive mail at any time, without leaving what you are doing, with the TopMail desk accessory.

◊ Send files of any type, even programs, with your mail.

◊ Mail server runs in background mode, leaving the Macintosh free for other uses.

◊ Works with minifloppy, HD20, or any compatible hard disc.

◊ Price £250 (plus VAT) provides a mail server for an unlimited number of users.

TopMail

Recommended TopMail Stockists:
Actiondata Ltd, London: (01) 586 3203/DPS Computers Ltd, Basildon: (0268) 23471 K.R. Computer Services Ltd, Nottingham: (0602) 505352/McQueen Ltd, Edinburgh: (031) 558 3333/Personal Computers Plc, London: (01) 377 1200/Second City Systems Ltd, Birmingham: (021) 707 8739 (Business), (021) 359 4621 (Education)/Stirling Microsystems Ltd, London: (01) 935 5262

or for further information contact:
Human-Computer Interface Ltd, 11 Brunswick Walk, Cambridge, England CB5 8DH. Telephone: (0223) 314934. TopMail was developed by Topexpress Ltd.

4

Emmanuel St.

The AMSTRAD Computer Centre for Cambridge

• *full support for all Amstrad micros*
• *technical advice* • *software*

we know computers

1 Business & Professional Tel: 0223 65335/4

Low-cost Systems 4 Tel: 0223 358264

Cambridge Computer Store
1&4 Emmanuel Street, Cambridge

DACOM SYSTEMS

Modems for your PC...

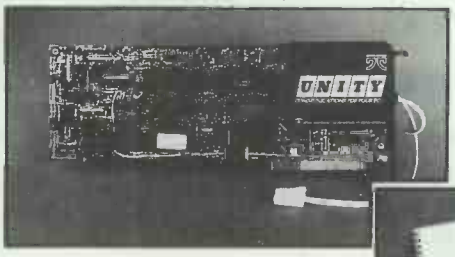
The Choice is Simple.

Dacom have developed a range of communication packages to give PC users access to today's wide range of communication services.

Each UNITY package comes complete with an internal auto-dialling modem to suit your application, DATATALK communications software and full documentation ... the choice is simple.

UNITY

- V21 (300 BPS) + V23 (1200/75 BPS)
- Error correction
- Hayes compatibility
- Autoanswer/ autodial
- Datatalk software



UNITY Gold

- V21 + V23 + V22 (1200/1200 BPS)
- Half card format
- Hayes compatibility
- Audio call monitor
- Complete package

UNITY Quad

- V21 + V23 + V22 + V22 BIS (2400/2400 BPS)
- MNP error correction
- Extra asynchronous port
- Audio call monitor
- Complete with Datatalk

Dacom also supply a complimentary range of stand alone modems and communication equipment.

For details phone Dacom Systems now on (0908) 322322 and we will be pleased to discuss your individual requirements

UNITY

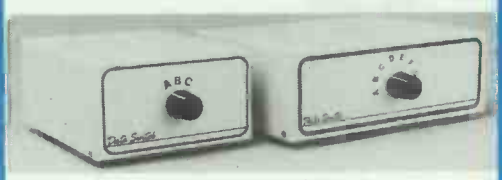
COMMUNICATIONS FOR YOUR P.C.

Trust Dacom to Communicate

Dacom Systems Limited
26-27 Heathfield
Stacey Bushes
Milton Keynes
MK12 6HR
England
Tel: 0908 322322
Telex: 82477

PRINTER SWITCHES
DIRECT from the MANUFACTURER

LINK TWO OR MORE MICROS TO ONE PRINTER, PLOTTER, MODEM ETC. OR VICE VERSA.



- ROBUST METAL HOUSING
- ELECTRONICALLY TESTED
- 28 DAYS APPROVAL
- 12 MONTHS GUARANTEE
- OFFICIAL ORDERS ACCEPTED
- 24 HOUR DESPATCH

SERIAL DATA SWITCHES

RS 232/V24.25 way 'D' sockets

ALL 25 LINES

MODEL	SWITCH	PRICE
DV2	2 way	£59
DV3	3 way	£69
DV4	4 way	£79
DV5	5 way	£89
DVX	2 way cross-over	£79

LINES 1 to 8 & 20

DR2	2 way	£49
DR3	3 way	£57
DR4	4 way	£65
DR5	5 way	£73
DR8	8 way	£109
DRX	2 way cross-over	£65

9 way 'D' sockets ALL 9 LINES

DN2	2 way	£45
DN3	3 way	£52
DNX	2 way cross-over	£59

PARALLEL DATA SWITCHES

CENTRONICS.

36 way Amphenol sockets

MODEL	SWITCH	PRICE
DC2	2 way	£65
DC3	3 way	£79
DC4	4 way	£95
DC5	5 way	£109
DCX	2 way cross-over	£95

IBM PC.25 way 'D' sockets

DP2	2 way	£59
DP3	3 way	£69
DP4	4 way	£79
DP5	5 way	£89
DPX	2 way cross-over	£79

IEEE-488.24 way Amphenol sockets

DE2	2 way	£89
DE3	3 way	£109
DEX	2 way cross-over	£129

PLEASE ADD VAT AT 15%. ALL ITEMS CARRIAGE PAID

Trade, Educational & Export enquiries welcome. Cables also available. Ex stock & Custom built.

HOMESTEAD DATA PRODUCTS LTD

145 EDINBURGH AVENUE, SLOUGH. SL1 4UA
Fax (0753) 691037 Telex 846086 CABLIN-G

Tel:(0753)691661

AMSTRAD

PC 1512SD Mono	£516.35
PC 1512DD Mono	£642.85
PC 1512SD Colour	£711.85
PC 1512DD Colour	£838.35
PC 1512HD20 Mono	£1033.85
PC 1512HD20 Colour	£1229.35

WORDSTAR £79.35 REFLEX £79.35

SUPERCALC £79.35

PRINTERS

CANON	
PW1080A	£286.35
A55	£516.35
EPSON	
LX80	£240.35
FX800	£435.85
LQ800	£573.85
JUKI	
6100	£286.35
6200	£516.35

MONITORS

MICROVITEC	
1431	£193.20
1451	£251.85
1431 AP	£251.85
1451 AP	£286.35
KAGA/ TAXAN 12"	£113.85
PHILIPS 7502	£90.85

PART EXCHANGE YOUR BBC B FOR ANYTHING WE CARRY IN STOCK

PLEASE PHONE FOR DETAILS ON WHAT YOU CAN EXPECT FOR YOUR OLD COMPUTER

BBC MASTER

MASTER PRICES

MASTER 128	£449.00
TURBO UPGRADE	£125.00
512 UPGRADE	£228.85

CUMANA DISK SYSTEMS

CSX100	£102.35	CS 400S	£159.85
CSX 400S	£136.85	CD 800S	£274.85

SPECIAL OFFER

AMSTRAD PC 1512

Double Disc Drive
Mono Monitor•DMP3000 Printer
Wordstar and Supercalc

£803.85

ALL PRICES INCLUDE VAT

BARGAIN BASEMENT TO CLEAR

APRICOT F2 + MONITOR + MOUSE	£458.85
APPLE 2e DISK DRIVES	£148.35
APPLE 128K MACINTOSH	£458.85

COMPSHOP PRICE PROMISE — We guarantee to match the price on equipment offered from stock through any other supplier.

Educational enquiries and orders welcome.

Quotations given.

One year warranty on all products.

COMPSHOP was established in 1978 and has continually offered the best in micro computers to discerning customers.

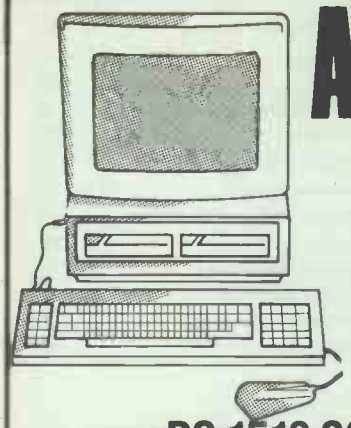
We sell only computers and peripherals, and therefore can offer the support many other shops cannot.

VISA AMERICAN EXPRESS DINERS CLUB INTERNATIONAL

14 Station Road, New Barnet, Hertfordshire, EN5 1QW
(Close to New Barnet BR Station - Moorgate Line)
Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G
OPEN (BARNET) - 10am - 7pm - Monday to Saturday

NEW BRANCH ALSO AT
311 London Road, Camberley, Surrey. GU15 3HE
Telephone: (0276) 22677/29212

SUPERTEC COMPUTER OFFERS



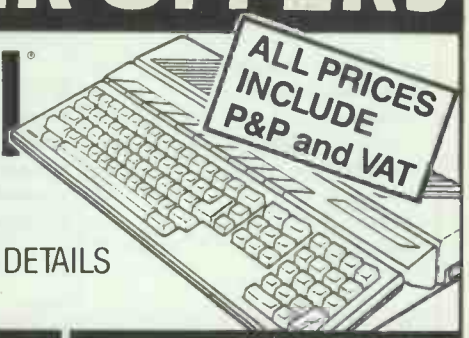
AMSTRAD

PC 1512 SM	£516.35
PCW 8526	£458.85
PC 1512 DM	£642.85
PCW 8512	£573.85
PC 1512 SC	£711.85
PC 1512 DC	£838.35

PC 1512 SOFTWARE

Wordstar 1512	£69.95	Sidekick	£29.95
Supercalc 3	£69.95	Various Games (Eg. Pitstop II	£19.95

ATARI



MANY ST SYSTEMS AVAILABLE FROM STOCK — CALL FOR DETAILS

ST GAMES

E.G. STAR GLIDER
DEEP SPACE — ARENA
SUNDOG — THE PAWN
HACKER — SILENT SERVICE
FLIGHT SIMULATOR II
PLUS MANY MORE

ST SOFTWARE

Including:
KUMA - HABA - ATARI - PHILON
CASHLINK - SOFTWARE PUNCH
CHIPSOFT (ST ACCOUNTS)
BATTERIES INCLUDED
Call for details and prices

PRINTERS . . . PRINTERS . . . PRINTERS

Including: EPSON ● BROTHER ● MANNESMANN TALLY

STOP PRESS!

Call for details of NEW Mannesmann MT910LASER PRINTER

FULL RANGE OF ROLAND MULTI-PEN PLOTTERS AVAILABLE

PERSONAL SHOPPERS WELCOME
MON — FRI
9 a.m. — 5 p.m.

BULLETIN BOARD
0268 293639 (24 HOURS)
300 BAUD

CUMANA D/D DRIVES FOR ST

CSA 354 (Single) **£159.00** CSA 358 (Twin) **£269.00**

DISKS

5¼" SS/DD (Pack of 10)	£7.50
3½" DS/DD	£2.50 ea.
3½" SD/DD	£1.95 ea.

MODEMS by Miracle Technology

WS2000	£125.00
WS4000 Auto-dial/Auto-answer	£195.00

SUPERTEC LTD. CORNWALLIS HOUSE, HOWARDS CHASE, BASILDON, ESSEX SS14 3BB Tel (0268) 282308

LINK

Call 01-799 9911

LINK XT

8088-2 Processor
Legal Bios
512K up to 640K
2 × 360K Floppys
Parallel + Serial RS232 Ports
150W Power Supply
84 Keys Keyboard
T.T.L. 'Hi-Res' 12" Mono
Monitor + Swivel Stand
8 Expansion Slots
Clock, Calendar + Back up battery
12 months warranty on-site (London)
Full set of manuals

XT.T

8088-2 Processor
Legal Bios
Turbo 8MHz Switchable to 4.77MHz
AT Box
512K up to 640K
2 × 360K Floppys
Parallel + Serial RS232 Ports
150W Power supply
84 Keys Keyboard
T.T.L. 'Hi-Res' 12" Mono
Monitor + Swivel stand
8 Expansion Slots
Clock, calendar + Back-up battery
12 months warranty on-site (London)
Full set of manuals

XT.T 20

8088-2 Processor
Legal Bios
Turbo 8MHz Switchable to 4.77MHz
AT Box
512K up to 640K
Seagate 20Mb + WD Controller
2 × 360K Floppys
Parallel + Serial RS232 Ports
150W Power Supply
84 Keys Keyboard
T.T.L. 'Hi-Res' 12" Mono
Monitor + Swivel Stand
8 Expansion Slots
Clock, Calendar + Back up battery
12 months warranty on-site (London)
Full set of manuals

OPTIONS:

Modems	From £95
EGA Cards	From £168
Colour Monitors	From £299
Printers	Call
20MB + Controller	£349
20MB + Controller	Call

Atari 1040 STF Mono	£608
1040 STF Colour	£728
520 STM	£249
20MG	£499
Commodore Amiga 1000	£999

TRADE AND EXPORT WELCOME

Link Business Systems Ltd
Premier House
10 Greycoat Place
London SW1P 1SB
Tel: 01-799 9911

All Prices exclude VAT/Delivery

ADVERTISERS INDEX

MICROMART ADVERTISERS INDEX

PASCAL LANGUAGE

Marshall Pascal is a newcomer with promise. Look out for the new Metaware 386 compiler.

PASCAL INTERPRETERS

ALICE Pascal Intrprtr.	PC-DOS	£ 80

PASCAL COMPILERS

Marshall Pascal	MS-DOS	£150
Metaware Prof.Pascal	MS-DOS	£430
Metaware Prof.Pas/386	MS-DOS	£645
Microsoft Pascal v3.32	MS-DOS	£180
Oregon Pascal-2	MS-DOS	£360
Prospero Pascal v2.23	MS-DOS	£220
Turbo-Pascal MS-DOS &	PC-DOS	£ 60
UCSD Pascal (Pecan)	IBM-PC	£ 80
UCSD Professional	IBM-PC	£155
Pro-Pascal v2.14	CP/M-86	£220
Turbo-Pascal	CP/M-86	£ 60
Pascal MT+ v5.6	CP/M-80	£ 99
Pascal MT+ v5.6.1	CP/M-80	£290
Pro-Pascal v2.18	CP/M-80	£220
Turbo-Pascal	CP/M-80	£ 49
MCC Pascal	ATARI ST	£ 75
UCSD Pascal (Pecan)	ATARI ST	£ 80
UCSD Pascal (Pecan)	APPLE][	£ 80

We have many Pascal Libraries. Enquire

LINKERS

Plink-86 Plus	MS-DOS	£295
Link & Locate	MS-DOS	£250
Plink-II	CP/M-80	£315
SLRNK (Z80)	CP/M-80	£ 45
SLRNK-PLUS (Z80)	CP/M-80	£150

MODULA-2 COMPILERS

New Farbware compiler. FTL is an excellent value learning tool at a good price.

Pecan P-Sys. w.Mod-2	PC-DOS	£ 80
Farbware Modula-2	MS-DOS	£ 75
FTL Modula-2	MS-DOS	£ 45
Interface M2-SDS	PC-DOS	£ 75
Interface M2-SDS-XP	PC-DOS	£185
Modula 2/86 BLS v2.0	PC-DOS	£ 90
Modula 2/86 BLS/8087	PC-DOS	£130
Modula 2/86 BLS/512K	PC-DOS	£200
Modula Corp.PC Mod.2	PC-DOS	£150
Modula 2/86	CP/M-86	£410
FTL Modula-2	Z80/CP/M-80	£ 45
Hochstrasser Mod.2	Z80/CP/M-80	£100
Turbo Modula-2	Z80/CP/M-80	£ 55
TDI Modula-2	ATARI 520ST	£ 75
MacModula-2	MACINTOSH	£100

Library source is available with some compilers. Please enquire about other utilities available.

PRICES AND DELIVERY

Prices do not include VAT or other local taxes but do include delivery in UK and Europe. Please check prices at time of order, ads are prepared some weeks before publication.

For other products in our range please ask us to send you a complete price list.

PROLOG LANGUAGE

Arity Standard	PC-DOS	£ 85
Arity Prolog v4.0	PC-DOS	£260
Arity Interprtr+Compil.	PC-DOS	£585
Chalcedony Prolog /I	MS-DOS	£ 90
PROLOG Professnl.	MS-DOS	£225
Micro-PROLOG v3.1	MS-DOS	£ 60
Prolog-86 v2.01	MS-DOS	£115
Prolog-1 v2.2	MS-DOS	£299
Prolog-2 Personal	PC-DOS	£145
Prolog-2 Programmer	PC-DOS	£495
Prolog-2 Professional	PC-DOS	£995
Turbo-Prolog v1.1	PC-DOS	£ 60
ADA Educ.Prolog	MS-DOS	£ 45
ADA FS Prolog	MS-DOS	£ 55
ADA VMI Prolog	MS-DOS	£ 85
ADA VML Prolog	MS-DOS	£165
Prolog-1 v2.2	CP/M-86	£299
Micro-Prolog v3.1	CP/M-86	£ 60
Micro-prolog v3.1	CP/M-80	£ 45
Prolog-1 v2.2	CP/M-80	£225

PROGRAMMING TOOLS

Ada Compilers	Algol Compilers
Assemblers	Assembler Libs.
Basic Compilers	Basic Interpreters
Basic Utilities	Basic Libraries
BCPL Compilers	C Compilers
C Interpreters	C Libraries
C Utilities	Cobol Compilers
Comms.Libraries	Cross Assemblers
Database Libs.	Debuggers
Dis-assemblers	Editors
Engineers Libs.	Expert Systems
Forth	Fortran Compilers
Fortran Libraries	Graphics Libraries
Icon	Linkers
Lisp	Modula-2
Nial Interpreters	OPS 5
Pascal Compilers	Pascal Libraries
Prolog	Screen Libraries
Smalltalk	Snobol

We stock many items for which there is no space in these advertisements.

FORTRAN COMPILERS

New V4.00 from Microsoft now mean four excellent 77's to choose from.

Lahey F77L v2.20	MS-DOS	£380
RM/FORTRAN 77 v2.11	MS-DOS	£400
MS-FORTRAN 77 v4	MS-DOS	£250
Pro Fortran 77 v1.15	MS-DOS	£320
Pro Fortran v2.144	MS-DOS	£220
Utah Fortran	MS-DOS	£ 35
Pro Fortran v2.1	CP/M-86	£220
Pro Fortran v1.25	CP/M-80	£220
Nevada Fortran v3.3	CP/M-80	£ 35
Pro Fortran 77	ATARI 520ST	£120

We have Fortran Graphics Libraries and Scientific Subroutines in stock.

C LIBRARIES

DATABASE

Btrieve		MS-DOS	£190
Btrieve/Network		MS-DOS	£460
CBTREE	(source any C)		£ 80
C-Index/Plus	(source any C)		£175
C-ISAM (L,MS)		MS-DOS	£225
C-to-dBase (source CI)		MS-DOS	£120
C-tree	(source any C)		£245
db-VISTA	(most C's)	MS-DOS	£145
db-VISTA	(with source)	MS-DOS	£360
db-QUERY single-user		MS-DOS	£145
db-QUERY multi (w.sce)		MS-DOS	£360
Lattice dBCII	(L)	MS-DOS	£170
Lattice dBCIII	(L)	MS-DOS	£170
SoftFocus Btree	(source any C)		£ 55
Softfocus ISAM	(source any C)		£ 30
Virtual Memory File Man.		PC-DOS	£150

GRAPHICS

Essential Graphics	PC-DOS	£195
GFX Graphics	PC-DOS	£ 50
GraphiC (CI,L,DS,MS3)	PC-DOS	£255
GSS Kernel	PC-DOS	£350
GSS Lattice Binding	PC-DOS	£110
GSS Graph.Tlkt (L,MS,+)	PC-DOS	£330
GEM Prog.Toolkit (L)	PC-DOS	£405
GSX Prog.Toolkit (DR)	PC-DOS	£270
Multi-HALO (CI,L,MS3)	PC-DOS	£185
MetaWINDOWS (CI,L,MS3)	PC-DOS	£100
MetaWINDOWS Plus	PC-DOS	£140

SCREEN & WINDOWS

Blaise View Manager	PC-DOS	£245
Curses Screen Mngr. (L)	PC-DOS	£140
Entelekon Windows(s'ce)	PC-DOS	£ 99
Multi-windows (MS,L)	PC-DOS	£230
Panel (Most Compilers)	MS-DOS	£205
Vitamin C (source)	PC-DOS	£175
Windows for Data (most)	PC-DOS	£215
Windows for C (most C)	PC-DOS	£145
Greenleaf Datawindows	MS-DOS	£110

GENERAL FUNCTIONS

Greenleaf	(source)	PC-DOS	£ 95
Smorgasbord	(source)	PC-DOS	£150
Blaise Tools 2	(source)	PC-DOS	£ 75
Blaise Tools Plus (sce)		PC-DOS	£135
ESI Utility Lib	(source)	PC-DOS	£130
Entelekon Funct	(source)	PC-DOS	£ 99
Phoenix Pforce	(source)	PC-DOS	£235
Phoenix Pforce C++ (sce)		PC-DOS	£235
Security Library object		MS-DOS	£ 95

COMMS LIBRARIES

Blaise Asynch	(source)	PC-DOS	£125
Greenleaf Comms	(source)	PC-DOS	£ 95
Novum Comms.	(source)	PC-DOS	£140

SCIENTIFIC LIBRARIES

Wiley Scientific Lib.	ANY C	£135
Mathpack 87 (L,MS)	MS-DOS	£110

PROGRAMMERS UTILITIES

PC-Lint	MS-DOS	£ 85
Pre-C (Phoenix Lint)	MS-DOS	£175
Figureflow C-DOC	MS-DOS	£165
C-BROWSER	PC-DOS	£190
C Toolset	MS-DOS	£ 90
Lattice Cross Ref.	MS-DOS	£ 40
Lattice Text Utilities	MS-DOS	£ 85

REAL TIME & MULTI-TASKING TOOLS

Csharp (CI,L2,MS3) s'ce	MS-DOS	£480
Concurrent C (PC/MPX) sce	MS-DOS	£ 60
Multi C (L,MS,CI)	PC-DOS	£125
Multicomms (L,MS)	PC-DOS	£125
Multiforms (L,MS)	PC-DOS	£125
Multi Windows (L,MS)	PC-DOS	£250
Op.Sys.T'box (MS) s'ce	PC-DOS	£ 70

DISK COPYING SERVICE

We can copy files to and from 400 disk formats including CP/M, CP/M-86, MS-DOS, PC-DOS, ISIS, APPLE, SIRIUS, BBC, TORCH, APRICOT, HP150, TRSDOS, DEC RT- 11, IBM BEF, ATARI520, AMSTRAD.

£10.00 + disk + VAT

with discounts on small quantities and disks are normally despatched within 24hrs of receipt.

For more information call us.

GREY MATTER GREY MATTER GREY MATTER

4 Prigg Meadow, Ashburton, Devon TQ13 7DF.
TEL. (0364) 53499

4 Prigg Meadow, Ashburton, Devon TQ13 7DF.
TEL. (0364) 53499

4 Prigg Meadow, Ashburton, Devon TQ13 7DF.
TEL. (0364) 53499

CHIP CHAT

We hesitate to mention silly products and events on this page, as doing so tends to produce dozens of phone calls asking for telephone numbers and availability details. But throwing caution to the wind, we've included another batch. On your own heads be it. . .

Adam Osborne figures large in this issue with his court case with Lotus, and his ambivalent remarks about his VP-Expert product. Osborne has a very economical approach to software distribution. His company, Paperback Software, supplies products in the form of a paperback manual with the disks slotted into the back cover. Ring binders and linen boxes are considered expensive and wasteful. At the moment, it seems, 'wasteful' is defined in Silicon Valley as a bus-load of attorneys travelling up a Californian mountainside and skidding off the road into the ravine. All the attorneys die. *But there was an empty seat on the bus.* That's wasteful. . .

Apologies to Paul Bailey of Digital Research and David Fraser of Microsoft for this one. We can't tell exactly whose product is being referred to, but the following words were found in the AUTOEXEC.BAT file of a newly purchased Amstrad PC1512:

'You were well-advised against buying an Amstrad PC1512DD. Now that you have purchased it, you will realise that the software accompanying this machine is crap. You are therefore a moron.'

Honest, Mr Sugar, we're not complaining about your hardware, and the bulletin board operator mentioned alongside wasn't using one of your machines . . .

ISD, UK distributor of the PC-SIG software library, obviously doesn't believe that new technology has a place in its office. We were sent an invoice ISD had issued. It was produced on a typewriter and was covered in Tippex. Seems that even correcting ribbons are too high-tech for them.

A resounding response

We'd like to extend our sincerest thanks to the many thousands of you who took the time to complete the Reader Survey we published in April. The information you have provided will help us ensure that *PCW* continues to reflect your interests and aspirations.

With so many people responding, it seems a shame that we have only six prizes to offer. But the massive number of responses *does* mean that our six chosen charities will each receive a handsome sum.

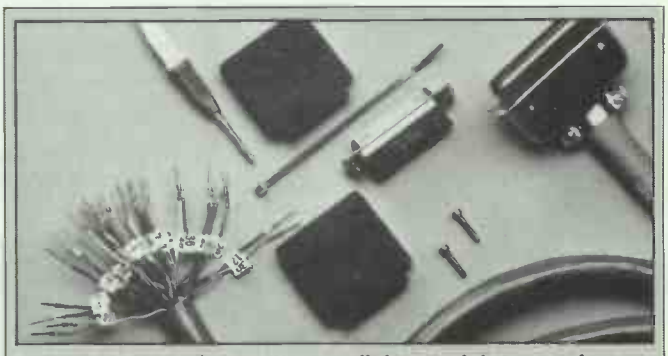
Now for the prize-winners:

Four Infocom games: Mick Lord, Chesham, Bucks
Miracle WS2000 modem: JH Delaney, Blackpool, Lancs
Two Borland products: CY Man, Mill Hill, London
Volkswriter 3: DA Bilton, Chesterfield, Derbyshire
Words & Figures: AJ Park, Nantwich, Cheshire
Psion Organiser II: TG Knott, Cambridge

Thank you all for writing in, especially those of you who added personal comments.

If you really want to be intimidated, imagine working with this 37in Mitsubishi colour monitor in your bedroom. When the picture of Big Brother comes up on the screen, you should be able to count the hairs up his nostrils.

'The Drawer' must be the ultimate in designer computer furniture. This 130-disk capacity firepoof bolt-on goodie will set you back a mere £488. It reminded us of a man we met who ran a bulletin board. He'd had three houses burn down yet still refused to back up his disks. Must be all these people who were burning the midnight oil on his chatlines.



We never knew how easy parallel-to-serial conversions were until we came across this kit from Inmac. The Centronics end of the cable is supplied finished while 'the RS-232 end of the cable is individually terminated and clearly labelled so that the precise configuration can be assembled.' Someone at Inmac obviously got their wires crossed.

This month

Removable hard disks seem to be a facility that has never caught on, but we were pleased to be given the opportunity of thoroughly trying out Tandon's PAC286 (which appears on our cover). Will *this* idea catch on? Turn to page 96 to find out what Guy Kewney discovered.

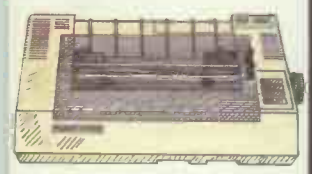
Perhaps the most exciting product to enter the office this month was the Hercules InColor card. Over 3000 characters and 64 colours to choose from got Dick Pountain really excited. Page 110 reveals the colourful graphic possibilities.

The review of IBM's Model 30 (page 104) follows on from the UK scoop Benchtest we published last month. Read *PCW* for the best and earliest in-depth reviews.

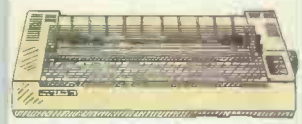
You must now know that the Personal Computer World Show in September is the micro event of the year. This year the show will host the British Microcomputing Awards. And if you'd like to influence the nominations, send your suggestions to 'BMA nominations' c/o PCW. See pages 58 and 261 for details.

By the way, if you've ever wondered what the hand that rocks the *PCW* cradle looks like — that of editor Derek Cohen — here it is.

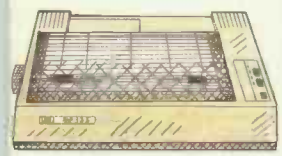
MP 165 DOT MATRIX
This proven best selling NLQ printer offers the user the very best in low cost matrix printing.
Speed: 160cps (Draft), 35cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £229.**



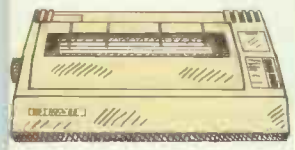
MP 200 DOT MATRIX
A fast NLQ quality printer, using the latest state of the art technology – IC Font Cards.
Speed: 200cps (Draft), 40cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £329.**



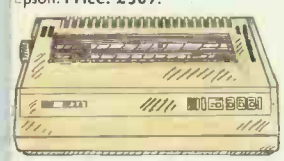
MP 201 DOT MATRIX
This 136 column, 200cps, NLQ printer offers the best value in the market place – you can't buy better. A range of Font Cards are available.
Speed: 200cps (Draft), 40cps (NLQ). **Columns:** 136. **Compatibility:** IBM/ Epson. **Price: £349.**



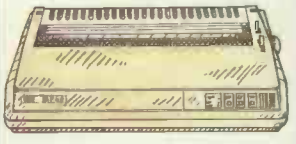
MP 135 DOT MATRIX
A low cost, high performance printer using the latest technology to produce print that makes draft quality look like NLQ.
Speed: 135cps (Draft), 27cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £169.**



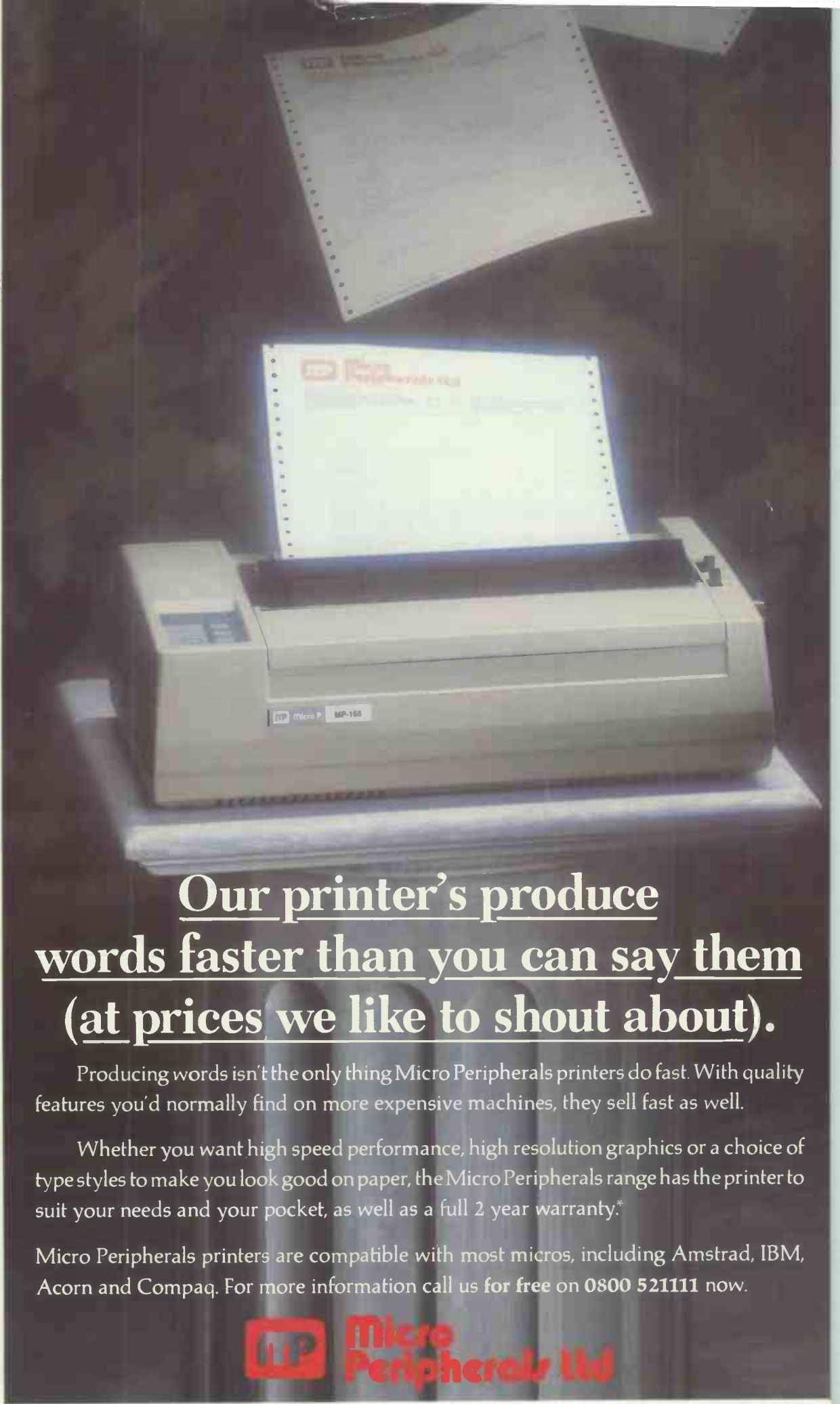
MP 480 DOT MATRIX
Another prime example of Micro Peripherals bringing fantastic value for money in a 480cps dot matrix printer at less than a pound per character per second.
Speed: 480cps (Draft), 74cps (NLQ). **Columns:** 80. **Compatibility:** IBM/ Epson. **Price: £369.**



MP 26 DAISYWHEEL
A feature rich very quiet (57dB) printer. Universal compatibility with almost all personal computers at an unbeatable price.
Speed: 26cps. **Columns:** 132. **Compatibility:** Diablo 630 Interface: Parallel + serial. **Price: £259.**



MP 40 DAISYWHEEL
A very fast, quiet printer packed with features and compatible with virtually all computers and at a fantastic price.
Speed: 40cps. **Columns:** 132. **Compatibility:** Diablo 630 Interface: Parallel + serial. **Price: £379.**



Our printer's produce words faster than you can say them (at prices we like to shout about).

Producing words isn't the only thing Micro Peripherals printers do fast. With quality features you'd normally find on more expensive machines, they sell fast as well.

Whether you want high speed performance, high resolution graphics or a choice of type styles to make you look good on paper, the Micro Peripherals range has the printer to suit your needs and your pocket, as well as a full 2 year warranty.*

Micro Peripherals printers are compatible with most micros, including Amstrad, IBM, Acorn and Compaq. For more information call us **for free** on **0800 521111** now.

Micro Peripherals Ltd

Intec 2, Wade Road, Basingstoke, Hampshire RG24 0NE.
Telephone: 0256 473232.
Telex: 859669 MICRO P G Facsimile: 0256 461570.

Units 5 & 6, Newhallhey Road, Rawtenstall, Rossendale, Lancashire BB4 6HL.
Telephone: 0706 211526 Facsimile: 0706 228166.

*The 2 year warranty excludes printheads and ribbons. All prices are RRP Ex. VAT. IBM, Epson & Diablo are trade marks and are recognised.

Why waste time with BASIC, PASCAL or C when you can develop faster programs more quickly with PCL...

PCL is a major fourth generation high level language, implemented as the fastest interpreter on earth. It is specifically designed for the IBM PC/XT/AT and compatibles.

PCL gets the maximum performance out of its hardware. It combines the flexibility of an interpreter with an execution speed that puts most compilers to shame.

PCL is a well structured procedural language along the lines of C or Pascal but without the restrictions and idiosyncrasies of either. It is easier to learn yet offers considerably more features than both.

PCL has over 330 built-in functions, providing high level support for:

- ★ sophisticated windowing and menu building commands. Extremely fast screen displays
- ★ extended text-manipulation and scientific function set
- ★ array arithmetic
- ★ character and numeric sorting
- ★ powerful file I/O, directory and disk management
- ★ dynamic record structures
- ★ DOS command interface
- ★ RS232 communications up to 19200 Baud handled by built-in background tasks

...and much more.

Apart from its high level functions **PCL** also offers HEX and binary arithmetic and most standard assembler mnemonics. Arrays can make use of all DOS addressable memory. Decimal arithmetic to 16 digits. Automatic 8087/80287 support.

Any program can call on the **PCL** interpreter itself at run time and pass it one or more source lines for immediate execution. Useful for spread-sheets, data dictionaries etc.

Any application written in **PCL** can be made RAM-resident with a single command. It can then be invoked from any other application with just two key strokes. **PCL** can also be used as a RAM-resident full scientific calculator.

PCL sample program to display a sorted list of all files on the current disk directory:

```
CHAR DIRECTORY[300,45],X; INTEGER N
X=?DIR "*.*"; N=0
WHILE LEN X > 0 THEN DO
   N=N+1; DIRECTORY[N]=X; X=?DIR
ENDDO
DIM DIRECTORY,N; SORT DIRECTORY
? DIRECTORY
```

PCL is the ideal language for beginners and experts alike since it is easily learned and offers great programming power. **PCL** has a clear and simple syntax, without reserved words, and a block structure which encourages the writing of very readable programs. Extensive built-in debugging features help you to pinpoint errors, should your program ever go wrong.

You will find that program development is much quicker with **PCL** than with third generation languages where you have to waste time re-inventing the wheel. **PCL** allows you to concentrate on making sophisticated and extremely fast programs in record time.

Benchmarks, comparing TURBO PASCAL 3.0 with **PCL 2.0**

Description	PASCAL	PCL	
Empty loop × 10000	.25	.04	525%
BYTE Magazine decimal arithmetic Benchmark:	31.88	14.82	115%
With 8087:	6.29	6.09	3%
Display 24 lines of 80 characters on standard colour display:	2.7	.15	1700%
Mono or EGA display:	2.45	.04	6025%
Format & display 100 decimal numbers:	1.51	.42	260%
With 8087:	1.35	.25	440%
Convert 1000 decimals to character strings:	3.89	3.17	23%
With 8087:	2.87	1.04	176%
Convert 1000 character strings to decimals:	8.18	2.43	237%
With 8087:	3.48	1.12	211%
Catenate two 10 byte strings × 1000:	58	.32	81%
String search x 1000	1.03	.28	268%
Sequential write, 1000×90 byte records	7.5	2.9	159%
Sequential read, 1000×90 byte records	7.4	2.5	196%

All timings are in seconds. They were taken on a standard IBM PC with PC DOS 3.1, a real-time clock and a 10MB hard disk.

Minimum system requirements: 256K RAM, mono or colour monitor, 1 disk drive, PC DOS or MS DOS version 2.1 or later.

PCL comes on a 5¼" diskette with a comprehensive manual including many programming examples. Not copy protected. 30 days money back guarantee.

Order **PCL 2.0** for £100 (including VAT and UK postage) from:

CALEND
P.O. BOX 94
TWICKENHAM TW2 6DD
Telephone: 01 894 7409