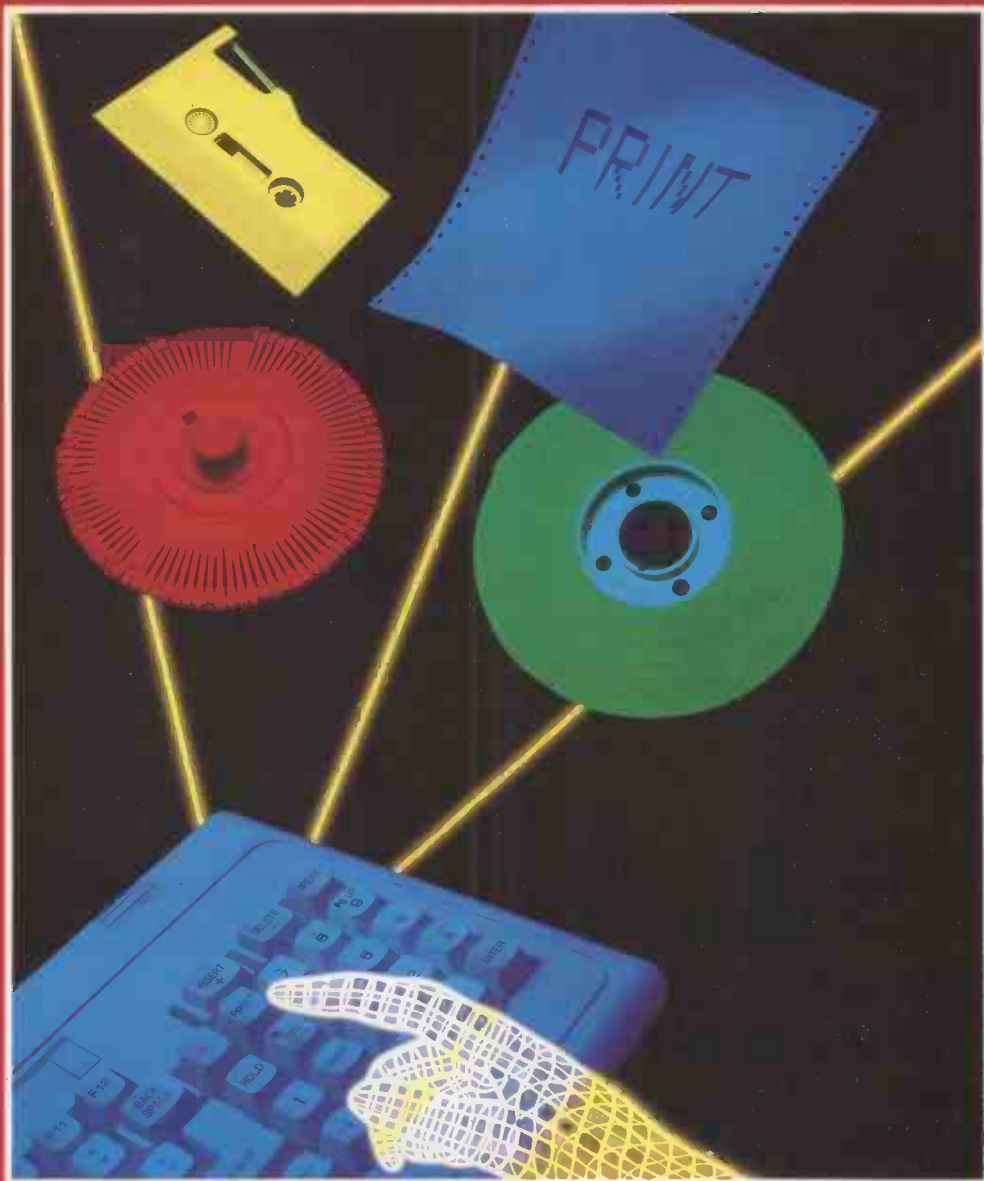


PRACTICAL COMPUTING

FOR BUSINESS AND PROFESSIONAL MICRO USERS



PRINTER SPECIAL: DAWN OF THE LASER?

HARDWARE Compaq 286 • Kaypro • Vienna PC

SOFTWARE Word Perfect • Mac music

PLUS A low-cost BBC mainframe!

GEM DESKTOP
EVERYMAN'S
MAC

The Great British Laboratory Micro System!



The CED 1401, real time heart of professional laboratory systems

High performance hardware
and

Full laboratory software – including FFTs – is standard

Demonstration programs include Spectrum Analyser, Signal Averager

The 1401 is made in Cambridge, England – and runs just as fast with Apples and IBMs too!

CED

Real-time Computers

Tel: Cambridge (0223) 316186

Science Park,
Milton Road,
Cambridge,
CB4 4BH

● Circle No. 101



PRINTERS

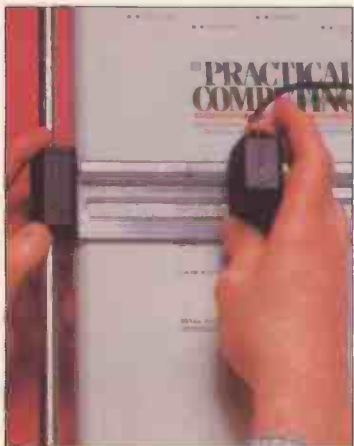
This month's special feature by *Ian Stobie* looks at printers in all their various incarnations. Starting on page 85 there is an introduction to the available technologies and current market trends. Then on page 88 *Jack Schofield* looks at what's happening among the dot-matrix printers: NLQ is becoming an almost standard feature to be found on, among many others, Epson's new LX-80. Finally, on page 92, we report on our hands-on experience with the hottest of hot technologies: lasers, in the form of Apple's new Laserwriter

85

INSIDE



Vienna PC Outstanding screen display — page 66.



Omni-Reader Cheap text-input device — page 57.

PRACTICAL COMPUTING

AUGUST 1985 CONTENTS

TWO AT-ALIKES

The elegant, sophisticated Compaq Deskpro 286 and the workmanlike Kaypro 286i are leading contenders for the title of top PC/AT clone.

Jack Schofield makes the comparison

47

GEM DESKTOP

Is Digital Research's icon, mouse and window environment the ultimate front end? *Mike Lewis* assesses its chances of bringing Mac-alike applications to each and every micro

50

OMNI-READER

Ian Stobie investigates a cheap text-scanning device which enables your micro to read typewritten copy

57

CMS 6502 RACK SYSTEM

This crate machine lets you build up a totally open BBC emulator to meet your specialised requirements. *Roger Cullis* takes the lid off

58

VIENNA PC

Glyn Moody looks at this MS-DOS machine from Northern Telecom, which has possibly the best white-phosphor VDU produced so far

66

WORD PERFECT

Is Word Perfect really so good that you should throw-out WordStar and start again? *Susan Curran* believes it might be

68

MAC MUSIC

Turn your Mac into a revolutionary music processor, or use it as a synthesiser. *Glyn Moody* with two new programs

70

HOTLINES

Before you buy that micro *Joia Shillingford* gives 10 tips on what to ask the hotline services that go with them

74

TOP 10 NON-IBMULATORS

You don't have to choose IBM. We give 10 good reasons why you could be better off with something completely different

77

INTERVIEW — BILL GATES

Glyn Moody talks to the ever-youthful boss of Microsoft, who gives his views on the Mac and the IBM PC

81

HARDWARE NEWS

Commodore's C-900 and Amiga machines

15



Flight Simulator on the AT.

IBM NEWS

Price cuts

19

SOFTWARE NEWS

How to match up incompatible files

21

GENERAL NEWS

BTG's £100,000 academic enterprise competition

23

OPEN FILE

CONTENTS

This month's details

99

IBM TO APRICOT

Writing portable code

100

CALLS FROM MBASIC

Calling machine code

102

BBC

ROM to disc transfer

108

APPLE

Reset problems solved

112

IBM

How big are your files?

114

END OF FILE

Printing Russian, Greek and Cyrillic text

116

REGULARS

EDITORIAL

Death of a nation

5

FEEDBACK

Your letters

6

ASK PC

You ask, we answer

8

NEXT MONTH

What's on the stocks . . .

13

CHIP-CHAT

Refreshing memories

29

S/W WORKSHOP

Basic style

31

COMMS LINK

Cellular radio

35

THE LEVY SERIES

Twixt

41

BOOK REVIEWS

Beesley on BBC books

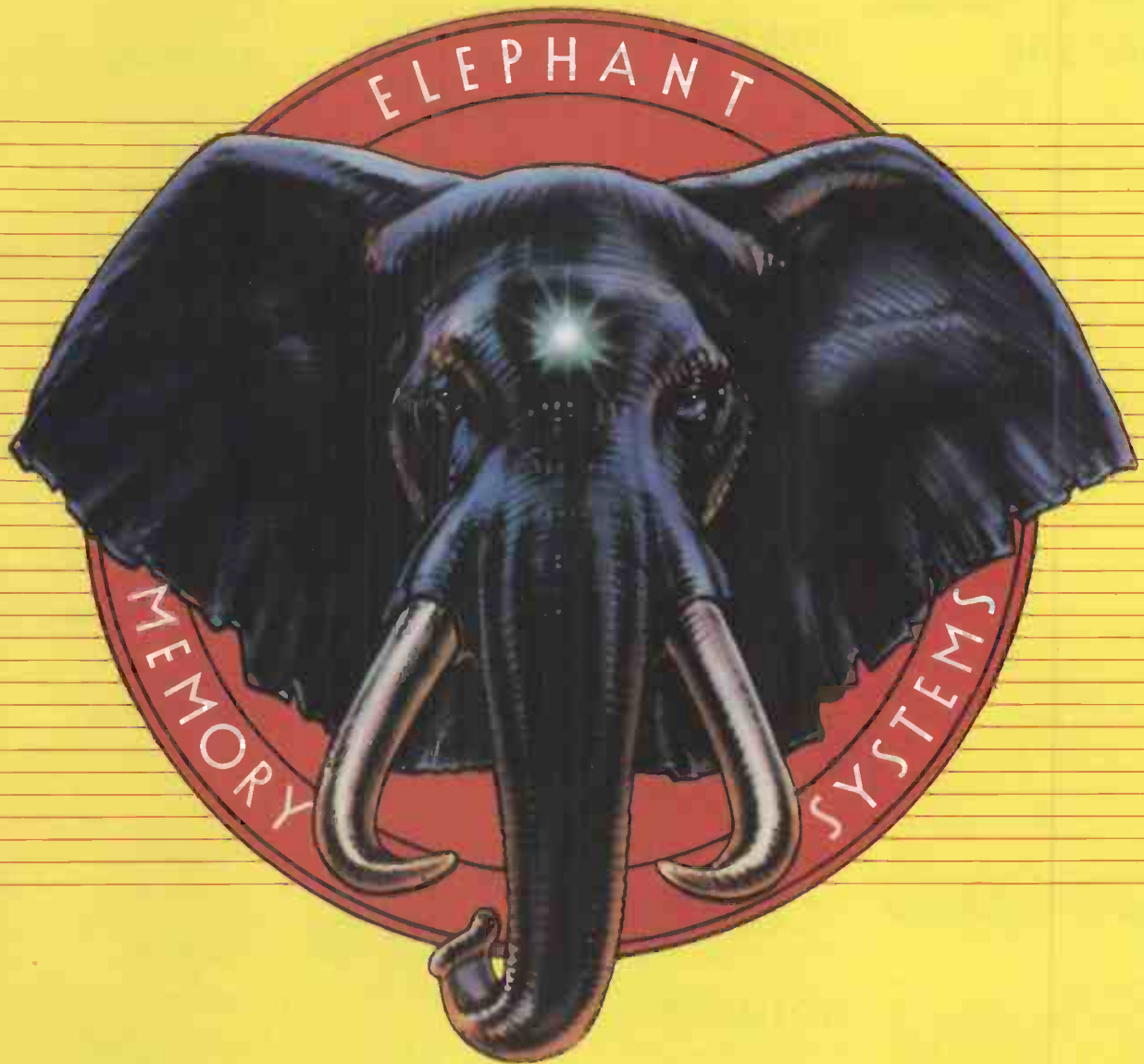
121

LAST WORD

MS-DOS mysteries

125

MORE ELEPHANTS TO TRUST



ELEPHANT printer ribbons, head cleaning disks and computer cleaning kits are now added to the ELEPHANT family to provide you with a total computer supplies package. Together with ELEPHANT MEMORY SYSTEMS disks – certified 100% error free and problem free and guaranteed to meet or exceed every industry standard – ELEPHANT is now more than ever the trusted brand that gives you the best from your computer.

Dennison

ELEPHANT NEVER FORGETS

Dennison Manufacturing Co. Ltd.

Colonial Way, Watford, Herts WD2 4JY, Tel: Watford (0923) 41244, Telex: 923321

France: Soroclass, 45, rue de l'Est - 92100, Boulogne.

Tel. Réseau de Distribution: 605.98.99, Administration des Ventes: 605.70.78, Telex: EMS 206 436 F

Germany: Marcom Computerzubehör GmbH, Podbielskistr. 321, 3000 Hannover 51, Tel: (0511) 647420, Telex: 923818

Italy: King Mec SPA, Via Regio Parco 108 BIS, 10036 Settimo, Torinese, Tel: (011) 800.93.93, Telex: 211467 KINMEC-I

Other Countries: Dennison International Company, 4006 Erkrath 1, Matthias-Claudius-Strasse 9, Telex: 858 6600

● Circle No. 136

THE BRITISH WHAT?

Whatever happened to the British micro? A couple of years ago, we seemed to be dominating at least the home micro business through Sinclair, Acorn, Dragon, Oric and Lynx, with the Jupiter Ace and Grundy Newbrain adding to the list. Since then five of these seven firms have gone into receivership, Acorn has had to be bailed out by the Italians, and Sinclair Research by a subsidiary of the Maxwell empire.

British micros never had quite the same dominance of the business market, but the story is little different there. The arrival of the IBM PC and its host of clones cut a swathe through the ranks of British manufacturers, and the number of bankruptcies doesn't even bear thinking about. There are still many small firms successfully making high-quality micros, but the only major manufacturer still flourishing seems to be ACT.

What are the prospects for the survivors? Sinclair Research, sad to say, needs new products. The Spectrum is a micro of little merit, which sold on good marketing, patriotism and price. Now that it is being undercut by superior machines only the existing software base supports it. Every Spectrum program converted to another machine is another nail in its coffin.

As for the QL, this was spoiled by being released in a botched form. Again, a new version is desperately needed, with a built-in 3.5in. disc and full Motorola 68000 instead of the cut-down 68008. Otherwise it looks likely to lose out in the battle between the Amstrad CPC-664 and the Atari 520ST.

Acorn's product line also looks weak, with the inept Electron and ridiculously overpriced BBC B+ having limited appeal. The immediate hope is that Olivetti can flog them in the underdeveloped education markets overseas before an industry-standard operating system catches on.

For the future, however, Acorn badly needs a BBC C. The only obvious option is to redesign the B to incorporate the existing National Semiconductor 32016 add-on. This would provide BBC B compatibility with an extension of remarkable power and educational appeal.

ACT is in no desperate need of new products, which is all the more reason why it ought to launch some soon. The requirement is an 80286-based machine to compete with the IBM PC/AT, allowing ACT to slide imperceptibly into proper IBM compatibility. The only worry is that ACT will neglect its U.K. and

European user base while trying to crack the American market. Look what happened to Acorn . . .

There are two other major micro manufacturers active in the U.K.: IBM and Commodore. IBM is continuing to expand its operations in Greenock, Scotland, where it makes vast quantities of IBM PCs, almost all for export. No one thinks sales of IBM's micros are going to stop.

Commodore, however, offers more cause for concern. It is not the fault of the British workforce that Commodore's product planning appears to be a shambles, and that the company's declining sales look like putting it into the red this year. However, the Corby factory appears to be churning out Commodore 64s in great quantities for Europe and Australasia. And when Commodore sorts out its product line, it should find itself selling all the main industry-standard operating systems: PC-DOS on its IBM PC clone, the Unix-like Coherent on the 900 and good old CP/M on the 128. The other products can presumably be junked. If it works, Commodore might do quite well.

The continuing success of IBM and ACT, and the possible revival of Commodore's fortunes, show that it is possible to manufacture successful micros in the U.K. and to sell them overseas. The real problems are getting both the design and marketing right, and Amstrad has shown we can do that too. If the CPC-464 was actually made in the U.K., that would be a success worth bragging about.

5 YEARS AGO...

Here at last — the 64K RAM chip is finally being shipped to European dealers and developers and is now available for the general market. Manufactured by Motorola, it has, for some incomprehensible reason, been called the MCM6665L25.

It is a 65,536-bit high-speed — 250 nanosecond access — dynamic RAM requiring eight address lines. Complete address decoding is done on-chip with address latches incorporated. Operating from a single 5V power supply the chip dissipates less than 300mW. The only reservation about this great advance in chip development is the price. A quick calculation on our 16K RAM micro shows that the price per byte of a 16K RAM is 0.3p whereas that of the 64K RAM works out more like 2p per byte. No doubt the price will eventually fall.

PC Volume 3 Issue 8



Cover feature: page 85.
Photo: Tony Hutchings.

EDITORIAL 01-661 3609
Telecom Gold 81:JET727

Editor
JACK SCHOFIELD

Deputy Editor
GLYN MOODY
Assistant Editor
IAN STOBIE
Art Editor
HUGH ANDERSON
Production Editor
JOHN LIEBMANN
Sub-editor
CAROL HAMMOND
Editorial Secretary
SUE JORDAN

Consultants
CHRIS BIDMEAD
PETER LAURIE

ADVERTISING 01-661 3612

Advertisement Manager
NITIN JOSHI 01-661 3021
Assistant Advertisement
Manager
NEIL MARCHANT 01-661 8626
Advertisement Executives
JANET THORPE 01-661 3468
IAN WALKER 01-661 8425
Advertisement Secretary
JOAN BORRELL
Midlands office
DAVID HARVETT 021-356 4838
Northern office
GEOFF AIKIN 061-872 8861
Classified
LUCY O'SULLIVAN 01-661 8163
Group Advertisement Manager
SHOBHAN GAJJAR 01-661 8441

PUBLISHER GAVIN HOWE

PUBLISHED by Electrical-Electronic Press, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500.
Telex/grams 892084 BISPRS G.

DISTRIBUTED by Business Press International Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

SUBSCRIPTIONS: U.K. £15.50 per annum; overseas £30 per annum annum; selling price in Eire subject to currency exchange fluctuations and VAT; airmail rates available on application to Subscriptions Manager, Business Press International Ltd, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. Tel: (0444) 459188.

Printed in Great Britain for the proprietors Business Press International Ltd by Greenaway Harrison Web Offset Division, Southend-on-Sea. Typeset by Lithotype Design, London EC1.

© Business Press International Ltd 1985
ISSN 0141-5433

Would-be authors are welcome to send articles to the Editor but PC cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program. Every effort is made to check articles and listings but PC cannot guarantee that programs will run and can accept no responsibility for any errors.

Line Counter

I REFER to the program Line Counter in the Commodore section of Open File on page 138 of the May 1985 issue of *Practical Computing*.

May I first point out an error in the published program, said to be for the Commodore 64. In that machine, the address of the ROM subroutine which converts an integer in AX to a decimal string and prints the string is \$BDCD, so the data in line 21 should be 205, 189.

I devised my own program for the same purpose to help me split up Basic programs into handy sections for printing. My version is shorter and more elegant. Instead of plodding through the business part of each line and counting the zeros which mark the end of the lines, it jumps straight from one line to the next using the next line address placed at the beginning of each line in Basic RAM, and counts the jumps. To convert the published program to be equivalent to mine, the following amendments are required:

13 substitute 1 for 0 or, perhaps better, 164, 43 for 160, 0.
14 DATA 72,200,208, 2,230, 89, 177, 88
15 DATA 240, 12,133, 89,104, 168, 230, 35
16 DATA 208, 2,230, 36, 208, 232, 104, 165
17 DATA 36, 166, 35, 32
delete 18 & 19
21 DATA 205, 189 (see above)

Consequentials are

7 891 instead of 905
23 118 instead of 132

For my own purposes I have added a routine which returns the number of the nth line, where n is first Poked into locations 251,252. For brevity and convenience, the first 14 bytes of the line counter routine are placed in a subroutine, which also opens the nth line routine. Then n is decremented by 1. The same technique is used, combined with a countdown, to find the address pointed to at the beginning of the (n-1)th line. Then 2 is added to obtain the address of the line number bytes of the nth line, and the integer is printed as before.

HAROLD H BROWNE,
Maidstone,
Kent.

THE EDITOR REPLIES: You are quite correct. We left the wrong line 21 in place when making the listing. It should read

21 DATA 205, 189
as you point out.

FEEDBACK

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

Write to

Feedback, Practical Computing,
Quadrant House, The Quadrant,
Sutton, Surrey SM2 5AS

WANTED...

I HAVE BEEN waiting expectantly for some years, cash in hand, for a device which I really need to appear on the market. Because it seems so extraordinary that I have not come across anything of the kind, I appeal to your readership for a solution, which I feel very certain will be of widespread interest.

What I seek is:

- A standard QWERTY keyboard computer preferably CP/M, having both a word processor, preferably WordStar, and a Basic, preferably Microsoft, in on-board ROMs or ROM cartridges.
 - A composite video interface for use with a monochrome monitor.
 - Bubble memory or battery powered with CMOS circuitry.
- Sufficient free memory to hold a few pages of text, say, 5/10K. As third choice a built-in cassette system might be acceptable.
- A serial interface and facilities to dump text or a Basic program direct from memory to another micro having conventional discs.

The purpose? To enable me to draft at home the odd letter, brief report or small segment of program. Then to carry only a single small unit to the office next day, where either letter or program can be transferred to the office micro for further editing and/or printing. I feel certain that I cannot be the only person to whom such equipment would be of the tremendous value.

PETER GOODE,
Hayes,
Middlesex.

THE EDITOR REPLIES: The Epson PX-8 and NEC-8401a both have WordStar in ROM and would seem nearest to filling the bill. The Epson is widely available, but the new NEC portable has only been launched in the U.S. Unless, of course you know different.

Matrices and complex numbers

IN YOUR March issue, page 59, there appeared a letter enquiring about matrix and complex-number handling. May I bring to your attention the Matrom, a sideways ROM for the BBC Micro, which adds matrix handling to BBC Basic? It has been used in teaching since October 1984, and can be bought for £25 from Matrom, c/o Mathematics Laboratory, School of Mathematical and Physical Sciences, University of Sussex.

I have often been puzzled by the short-sightedness of designers of programming languages who

build a fixed number system into their languages. Perhaps it is because they have failed to distinguish between the syntax and the semantics of arithmetic. The rules of algebra concerning +, -, *, but not /, are the same whether they refer to integers, complexes, elements of an algebraic number ring, or finite field, etc. All these dumber systems are useful.

The proper approach would be to restrict the programming language specification to questions of syntax, and to leave details of implementation to a library module. The module, selectable by the user and perhaps held in ROM or on disc, would deal with how numbers are to be represented in memory, how they are to be input, how

displayed on the screen, and how the primitive arithmetic operations are to be executed. Integers and/or floating-point numbers could form a default module.

Such a system is quite possible with Forth, where any word can be redefined. In Pascal you could get by if you are prepared to put up with clumsy prefix notations like plus (x,y) instead of x + y.

It is not necessary for a programming language to specify a number system, any more than it should specify the computer it runs on. It is even conceivable that one could lay down appropriate calling conventions for each processor to enable standard suites of machine-code programs to be used with any high-level language that has been designed to take advantage of them.

G C WRAITH,
Reader in Mathematics,
University of Sussex,
Falmer,
East Sussex BN1 9QH.

Finding out the hard way

AS AN avid reader of your excellent publication I have always been disappointed by the lack of in-depth review — or any review — of the various programming languages and associated compilers and development tools available. Perhaps you feel that this is too esoteric for most readers who seem to be content with Basic. As someone who specialises in instrument interfacing via IBM PCs to networks/mainframes, I had more or less despaired of being able to do such work in anything other than Basic assembler.

IBM's Basica is so incredibly powerful for interfacing and communications work that this, coupled with its interactive nature, makes development work simple. However, with complex programs of, say, 48K and over, the lack of global variables and associated subroutines makes less elegant coding than I would prefer. The failure of IBM to provide a version 2.00 compatible compiler in the U.K. is a further serious disadvantage; Basica is painfully slow. The major problem, as I see it, is that no other development systems on the IBM, such as Pascal, Fortran and C, have intrinsic communications/graphics/screen-handling support and one is at the mercy of third-party suppliers for these items. To my cost I have

discovered that the quality of such offerings is rarely acceptable. Even when they are available, the endless compile/debug, run/debug cycle is painfully slow.

The latest version of Borland's Turbo Pascal seems to change all that, even more so with the about-to-be-released Graphics Toolbox. It is superb on all aspects of screen-handling/graphics/file-handling and I have just discovered that an Asynch Manager is now available. This package essentially replicates the communications power available in Basic. All this, coupled with the almost unbelievable speed of the one-pass compiler, and the numerous handles thoughtfully proved into the BDOS/BIOS means that the full features of the IBM PC are available without need to recourse to assembly language.

The low start-up cost of Borland's package puts it within the reach of most programmers; its specification must be one of the most comprehensive available. For programs of medium complexity, where speed of development, and indeed of execution — use the 8087 version for maths-based packages — is vital, I doubt if it could be rivalled.

The point, however, is this: despite reading a whole host of computing/IBM-related magazines I still had to find out most of this the hard way. Indeed I only discovered the Asynch package because I had more or less decided to invest in a complete C development system and the Borland version was mentioned in small print at the end of a flysheet. The resultant saving in time/effort/money was considerable. Publications, such as yours, which cater for the serious user, should perhaps think a little more along these lines and less along the games/business package approach. After all, there are only so many ways of watching a

business rise/fall, or solving the Towers of Hanoi problem, vital though it is that we understand these things. There are a whole host of areas where micros are not making any impact simply because the right questions are not being asked. Even if the correct tools are being provided for the job, who knows about them?

DR BARRY CLARK,
Glasgow.

THE EDITOR REPLIES: Turbo Pascal looks outstanding, especially for the low price, but we are still waiting for our reviewer to produce his report.

Using Pip instead of Typewrit

I WAS surprised to see the routine Typewrit.Com to turn a micro into a typewriter published in the May edition of *Practical Computing*. Has it been forgotten that this facility exists under Pip? Load a disc containing Pip, and on the A> prompt type PIP LST:=CON: press Return, and the job is done.

Different printers react in different ways. The Microline 82 only prints a line when Return is pressed. This is very helpful because it is possible to correct a line before printing. However, you must use the space bar to space across the paper as you would do in envelope addressing. The Tab key will not work. The Smith-Corona TP-1 prints each letter as it is typed. In fact it behaves as described by the Lees.

A BILBROUGH,
Callow End,
Worcestershire.

JOHN AND TIMOTHY LEE REPLY: If you redefine the devices with PIP LST:=CON:

then the first line that you type appears on the screen. But when you press Return, the cursor moves to the beginning of the same line, so the second line you type overwrites the first, and so on.

Using two different daisywheel printers set up correctly for normal working with Basic or WordStar, we found that the lines overprinted one another as they did on the screen. This could be cured by changing the switch settings on the printer to Local Linefeed. An alternative is to type Control-J after every Return. This makes the printer advance a line without requiring switch changes.

The program Typewrit has the advantages that each line is shown on the screen, with no overwriting, the switch settings on the printer do not require changing, and no control characters need be typed.

Using Pip you have to use the space bar to move across the paper to the starting point for each line, which is a nuisance if you are doing several envelopes or a set of sticky labels. Typewrit remembers how far across the page you tabbed the first time. It is also a nuisance remembering that Ctrl-Z is needed to return to CP/M, rather than the usual Ctrl-C. Lastly, if you want tabs expanded under Pip, type PIP PRN:=CON:

Comm +

WE READ with interest your piece "Soft Options", page 105, in June's *Practical Computing*, regarding IBM PC software. Your list of British packages included only Unicom Rap and the Braid Mail Manager. You are clearly unaware of Lion Micro System's Comm + package.

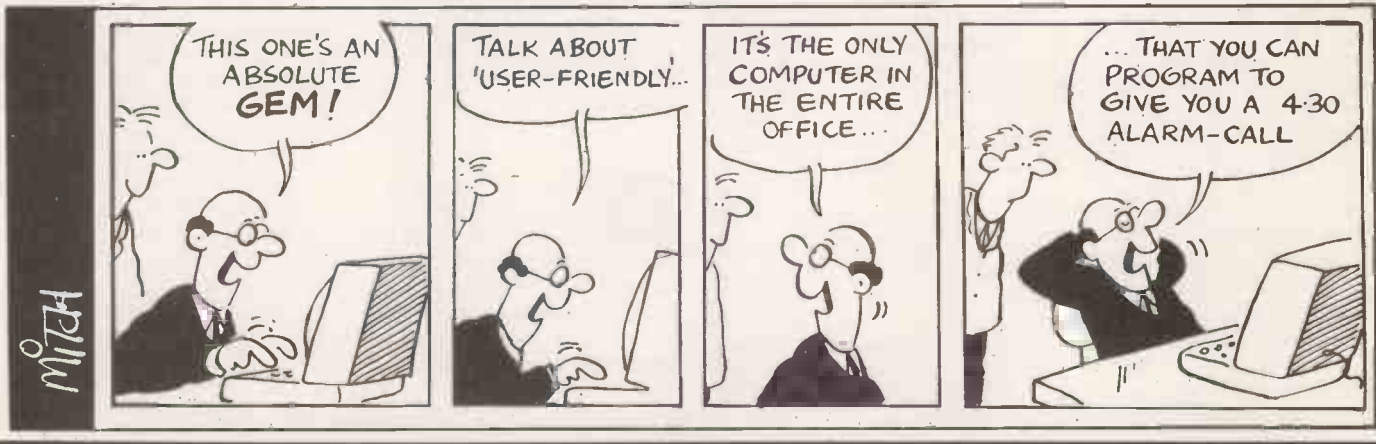
Comm + offers facilities for uploading and downloading files from systems such as Telecom Gold; Viewdata access at 1,200/75 baud; error-checking

file transfer, which is better than Bstam in so far as we can transfer all eight bits of a file over seven-bit datalines as well as offering XModem compatibility, and five other terminal emulations including ANSI. As far as we know, Comm + is the only package to include as standard an integral programming language of its own which isn't merely a script file processor, but is a genuine language written for communications. It does for communications what dBase II did for databases and offers bespoke performance at a fraction of the time and cost of writing from scratch. We also include integral text editing and formatting, including a telex formatter, as standard.

Comm + is available for 79 different CP/M-80, CP/M-86, MS-DOS, PC-DOS, MP/M and CCP/M systems, which is a range unrivalled at present.

Lastly, we'd like to point out that though Rap does error checking on Gold, our own algorithms for doing this are far more efficient — we've been asking Robin Oliphant to make them available since the end of 1982 with no luck. If Telecom Gold let users have access to the language facilities that U.S. Dialcom users have as standard, such as the Prime Assemblers, Fortran and Basic compilers and so on, we could do it ourselves. So Rap being able to do error checking with Gold isn't a technical innovation but a marketing coup... we could do it better if they'd let us. And Comm + is a better package than Rap in all other respects — it's available on a far wider range of machines, and if Gold are genuinely interested in extending facilities for users, they really ought to let us put the other end of our error checker on their system.

ANDREW MARGOLIS,
Lion Micro Systems,
London WC1E. ☐





OLIVETTI	OLIVETTI M21. 0D. 128K RAM	£1399
	OLIVETTI M24. 128K. 0D. Mono-colour	£1399/£1850
	OLIVETTI M24. 128K. SD. 10MB HD Mono-colour	£2995/£3390
	OLIVETTI M10. 8K RAM/24K RAM	£350/399
IBM	IBM PC 256K Double drives Mono-colour	£1900/£2150
	IBM PC 256K SD. 10MB HD Mono-colour	£2990/£3300
APRICOT	APRICOT PC 256K. 2X720. 9" Mono/12" Mono.	£1499/£1550
	APRICOT X1 10MB. 1X720. 9" Mono/12" Mono	£2170/£2220
	APRICOT X105. 512K. 128K. 10MB HD	£2500/£2630
	APRICOT X1205. 1MB RAM. 20MB HD	£3395/£4430
	APRICOT F141E	£750/£825
	APRICOT Portable 512K. 720K. Colour. Mouse	£1699
	POINT. Cluster Controller with DOS.	£425
SIRIUS/VICTOR	VICTOR 1. 2MB + 256K/2. 4MB + 256K.	£1695/£2050
	VICTOR 10MB HARD DISK + 1.2MB Drive + 256K.	£2790
	VICTOR (Portable) 2.4mb drives + 256K RAM	£1950
	VICTOR VI (Sirius/IBM Compatible)	£3990
	VICTOR VPC 15MB HD. SD. 10MB HD	£2650
	PC Card (Makes Sirius/IBM compatible)	£950
SANYO	SANYO 775 Colour with free software	NEW £1795
	SANYO MBC 2X720K DRIVES + monitor + Free Software	£990
	SANYO MBC 10MB HARD DISK + Monitor + Free Software	£1990
	SANYO 555 With 1000 worth software	£790
	SANYO 550-2/555-2 £1000 worth software	£799/£1159
COLOMBIA	COLOMBIA Twin disks, mono, bundled software/Colour	£1799/1895
	COLOMBIA 10mb + 320k disk + £1000 software/Colour	£2850/2940
	COLOMBIA VP PORTABLE 128K RAM/256K RAM + Software	£1299
1350	MACINTOSH Macwrite + Macpaint	£1399/£495/799
	Apple II/III	

PRINTERS	MONITOR	Harward Project Manager	£379/£2150
DOT MATRIX	MONOCHROME	Ormus II/Datamaster	£399/£425
Smith Corona FT80/D200/D300	Roland MB121 Green Amber	Everyman/KnowledgeMan	£379/£395
New LOW PRICES	Sanyo DM8112 DX (18mb)	Relux/Ensemble (Mac)	£175/£250
Canon PW1080A/1156A (NLQ)	Sanyo DM9112 12" 20mb	Wordstar Professional	£119
Canon PJ1080A (Link Jet)	Philips 7502/7522	Multi Tool Word w/Mouse	£275
Kaga Taxan KP810/910 (NLQ)	Kaga 12G (Green)	MultiMate/WordPerfect	£250/£399
Panasonic NLO 80/135	Zenith 12" Amber	Wordcraft/Samba	£299/£500
Riteman II NLQ	BMC 12" High Res	Arabic Word Processor	£199
MP165 NLO/165CPS	Zenith 12" Green/Amber	Conversion	£550/£500
Homepilot 32/34CD	Yanjin (Green/Amber/Hi Res)	Perfect II (Writer/Calc/Filer)	£395
Dataproducts 805/8070	Swivel & Tit Monitor Stand	Filevision (Mac) Macassh	£140/£295
Dataproducts 8010/8020		Jazz/Desk	£395/£290
Brother EP44 KSK/RH/R5	COLOUR	Engraphics/Helix	£290/£290
Brother M1009 TC600	Roland CC-141 14" (640x200)	CrossTalk/Sidekick	£129/£149
Brother 202NLQ	Kaga Vision-PC	Human Edge Software	Each £195
Panasonic 801/132Col LO	Kaga K12914 RGB/PAL	Expertise/Mind Proper	£650/£399
Epson P40/P80	Sinclair Vision QL	R Base 5000	£399
Epson X80 Colour	Novex 14" RGB	Norton Utilities/Xenopony	£55/£135
Epson RX101T +	Luxon 14" (Super Res. 800 dot)	Supercalc 2.0	£195/£235
Epson FX80	Dyneer 14CM 640x200	Multiplan/Trigger	£150/£450
Epson RX100FT/FX100FT	Dyneer 14CH1 720x350	Turbo Pascal Superkey	£45/£60
Epson LD150	Sanyo CD3117H (620 DDT)	Delta 4 Retrieve II	£350/£350
Fujitsu P1340/131 (24mb)	Sanyo DVT115H (720 DDT)	Smart WP/DB/S	Each £295
Shinwa CPA80/CPB800	Fidelity CM14 128mb. RGB & COMP	Microcenter	£995/£450
Shinwa CPB 136P	Microtec monitors	CPDA	£39/£50
NEC P2/P3	Princeton HK-12/SR12	Copy IPC. Copywritepe	£129/£190
Brother 202AL (190cps)		Think Tank/TK Solver	£179/£195
Brother 1009	TERMINALS	Jane (Apple) Spotlight	£22/£29
Infoscene 1100/1200	Orme DVT 102	Millionaire (Stock market simulation)	£39
Microprint FM IT (56 P)	Orme DVT 108	Chess 3D/Frogger/Pinball	£95/£25/£29
Namesman Tally M185/86	Orme DVT 211GX (Tektronics)	Spotlight	£39
N Tally M780/180	Dyner 103 (DEC VT100)	Management training series	£350
Seikosha GP700A (Colour)	Kokas ICL 12	Backgammon/Checkers/Chess	£59
Seikosha GP250A	Televideo 924/925/950	Flight Simulator	£39
Seikosha GP350A	Zenitec (Various Emulations)	Insurance Brokers System	£900
Seikosha GP100A	Hazletine Esprit III (TV1950)	News Agent System	£750
Seikosha BP5420 420CPS	Tatung VT4200	Integrated Travel Agents System	£750
Microline 82A/82P	Wyse WY50/WY75		
Microline 83P/83P			
Microline 84P			
Microline 2410P			
Siar Gemini 10X 15K			
Siar Delta 10X/15X			
Siar Radix 10X/15X			
Toshiba 2100M (LG)			
Texas Instruments 810/10			
Texas Instruments 855/10			
Anadex DP975 (240cps)			
Anadex WP600 (330cps)			
Anadex DP6500 (600cps)			
DRE-Newbury DR1 8925 240cps			
Newbury Data 8931 240cps + LO			
Newbury Data 8950 480cps			
Hermes 6128			
Anadex DP9500 (1180cps)			
Anadex DP9620 (240cps)			
Philps Mullard GP3000			
Siemens PT88 & PT89 Ink jet			
Diablo 150C Colour ink jet			
Canon Laser Printer			
HP Laser Printer			

DAISYWHEEL PRINTERS	SOFTWARE		
Brother HRI/HR15	(Please call us for any software for best prices)		
Brother HRS/35	Wordstar 2000 (IBM/Apricot)	£295	
Juki 6100/6300	Datalex (Single/Multi User)	£595/£990	
Juki 2200	Lotus 123/Symphony	£299/£399	
Queen-Data	Open Access 2 (IBM/Apricot)	£350	
Dasytype 2000	Framework/Friday	£350/£175	
QUINE Letter-Print20	Dbase III	£250/£325	
Olivetti OY450	Sensible Solution	£50	
QUINE 9/45-55	PC-Plant with Mouse	£180	
QUINE 11/40-55	Exchange (4 Im. Package)	£395	
NEC 3510 (S or P)	Card-Box/Plus	£139/£295	
NEC 2010 (S or P)	Files & Folios 80/84	£250/£450	
NEC 2050 (HR IBM)	Voikwriter Deluxe	£190	
Diablo 630 RD	PFS Reports/Writer/Graph	£350	
Diablo 630 API	File Transfer (IBM/Apricot/Sinus)	£95	
Ricoh 1200/1300	Autocal/ADE/ADE2	£990/£300/£300	
Ricoh 1630	Doodle (CAD Package for IBM/Apricot)	£695	
TEC F10 40-50	Caplan (CAD with Autodimensioning)	£1500	
Smith Corona TP14/100	Smartwork (Circuit Board Design)	£895	
Silver Reed EXP NEW	QED + Main Street Filer	£290/£150	
Brother EM101 KSR	Sage Accounts/Plus	£239/£490	
HP 2225 THINKJET	Easy Junior	£395	
	Sycero/CrossTalk	£499/£129	
	Pulsar/Pegasus (Each)	£200/£230	
	Microsoft Project	£250/£295	
	Acoustic/Headsets with SSF	£250/£275	
	Printer Stand for any printer	£79	
		Perimeter/Milestone	£650/£295

COMMO/DRE	COMMO/DRE PC 256K RAM. 12" Mono Double Drive.	£1299
	COMMO/DRE 8296 £1000 worth free software	£1499
EPSON	EPSON QX16 Taxi. Free Software	£1795
	EPSON PX-8 64k. CPM. Basic. Wordstar 120k RAM PADK.	£699
	£859	
KAYPRO	2 Twin single sided & free Soft.	£899
	KAYPRO 4 Twin double sided & free Soft	£1175
	KAYPRO 10 with 10MB HD and Free software	£1895
	KAYPRO 285 (IBM AT Compatible)	£4250
NEC	NEC APC III Mono-colour	£1850/2150
	NEC APC + NEC 2000 DW Printer + Software	£1990
	NEC PORTABLE PC2001 + £200 Free software	£290
	CANNON A200M/A200C 256K RAM. Twin drives	£1390/£1450
	HEWLETT PACKARD HP 150	£2195
	HYPERION 256K. RAM disk. 2 drives. Free software	£1995
	SINCLAIR QL/DISK INTERFACE	£320/£149
	SBC 8 with DFS. £399 COMMO/DRE 64	£450/£195
MULTI-USER COMPUTERS	NORTHSTAR DIMENSION 15MB HD. 2 User each user	£4995/£1295
	TELEVIDEO PERSONAL MINI	£9750
	ALDOS Xenix. MPM86. 1 to 8 users. Ethernet	£90A
	OLIVETTI 382 Unix V for UNIX SOFTWARE	£RING

COMPUTER ENTERPRISES INTERNATIONAL LTD.
 01-543 6866/542 4850 TLX: 946240 CWEASY G (Quote: 19005565)
EASYLINK MAILBOX: 19005565 TELECOM GOLD MAILBOX:
SHOWROOMS (OPEN Mon-Sat 9 to 6)
 85-85A QUICKS ROAD, WIMBLEDON, LONDON SW19 1EX UK
LESSINGSTRASSE 60, 5300 BONN 1 GERMANY
 Tel: 0228/220297
 Export, Educational, Dealer, Governmental, Lease, Rent,
 Consultant ENQUIRIES WELCOME. All items new and carry
 manufacturers guarantee. Prices exclusive of VAT, Installation,
 Training, Delivery and subject to change without notice. Delivery
 £10 for each item in UK, £75.00 for Europe.
PAYMENT
 By Eurocheques, Credit Cards LC, IMO, Direct Transfer

The Right Software

WHAT IS RIGHT FOR...

- ✓ Accounting
- ✓ Mailing
- ✓ Catering
- ✓ Marketing
- ✓ Employment agency
- ✓ Manufacturing
- ✓ Estate agency
- ✓ Medical profession
- ✓ Farming
- ✓ Personnel
- ✓ Insurance
- ✓ Printing
- ✓ Stock control
- ✓ Retailing
- ✓ Job costing
- ✓ Time recording
- ✓ Legal profession
- ✓ Travel agency

THE ANSWER'S MULTI-USER DATAFLEX

DataFlex. A data management system so versatile it can be adapted to most business needs. Plan the future around DataFlex and you're never tied down to a single unalterable way of doing things. Its powerful set of software building bricks lend themselves to just about all applications where fast efficient data retrieval and manipulation are of paramount importance. Add comprehensive calculating facilities and you've really got a system for all facets of business. And, of course, DataFlex is portable. So you can move your data from PC to PC, from PC network to multi user system, from 8 bit to 16 bit, without ever having to re-key. It really is the software for business on the move.

CALL US NOW

DATAFLEX

(INFORMATION MANAGEMENT) SERVICES LTD
 16 Anning Street, New Inn Yard, London EC2A 3HB
 Telephone: 01-729 4460 Telex: 27341

All trademarks are acknowledged

All £250
printers
print
like this.

Only the Epson LX-80 also prints like this.

The print on the left is certainly legible, which is quite good enough for most purposes.

But it's nothing to write home about. Or with.

That's why Epson have brought out the new LX-80.

The LX-80 is a dot matrix printer that can print in correspondence quality (like this) as well as in draft. Yet at only £255+VAT it's no more expensive than any of its less capable rivals.

This alone would make the LX-80 unique. But there's more.

Changing fonts on the LX-80 doesn't involve a complicated rigmarole as it does on other machines. By simply pressing a combination of buttons on the front, you can change from one font to another to *another to another*. As easily as that.

The LX-80 will justify or centre type if you like. It will even print your own symbols.

Alternatively, you can use the standard 1K buffer to free your computer for other tasks more quickly.

The LX-80 takes plain sheets as standard, though a variety of paper feed options are also available.

It should go without saying that the LX-80 is as reliable as Epson printers have always been. But there, we've said it anyway.

There's still more to tell, of course. But fill in the coupon - in whatever style you like - and we'll fill you in completely.



EPSON

Please send me more information on the LX-80.

Name _____ Address _____

_____ Tel No _____

PC 8

To: Epson (UK) Ltd., Dorland House, 388 High Road,
Wembley, Middlesex, HA9 6UH.

● Circle No. 138



RM NIMBUS NETWORK

POWERFUL. FLEXIBLE. AFFORDABLE.

As a stand-alone machine, the brilliant RM Nimbus has already proved itself superior in performance/price terms to any comparable microcomputer.

As a network system, Nimbus is even more impressive. Because, unlike so many 'networkable' machines, Nimbus was designed from the beginning as a network workstation, as well as a stand-alone system.

TRUE 16-BIT POWER

As a stand-alone machine, the RM Nimbus handles standard processing 2-3 times faster than the IBM or Apricot PC's, and its graphics are over ten times faster.

With the Nimbus network, this power can be brought simply and economically to as many as 64 users simultaneously. Each Nimbus station is a highly intelligent microcomputer in its own right, with stunning graphics and a high-speed network interface. So it is able to share expensive central resources such as printers, Winchester's and plotters.

SUIT-YOURSELF FLEXIBILITY

Whether you want a network to share software and data within a department, or a professional

multi-user system across the organisation, the Nimbus system will do it.

Your Nimbus network server can provide up to 80 megabytes for sharing. And you can connect up numbers of peripherals simultaneously via Piconet, Research Machines' unique input/output system. Locally, your stations can be discless, single-disc, or twin-disc, with internal memory from 320K to one megabyte.

The Microsoft Networks* operating system allows you to run MS-DOS* software, with the benefits of file and record locking, password security, and full professional multi-user software. All on a network which is easy to put together with a single run of cable and connectors.

UNBEATABLE VALUE

Because it was designed for networking, with Research Machines' experience of 1000 installed networks behind it, Nimbus becomes more economical the more you demand of it.

Considerable savings can be made by sharing software and peripherals, and these savings become greater as you increase the number of workstations.

On price to performance, the Nimbus network is unrivalled. A 320K network station costs £1123,** and server prices start at £2635.**

To find out more about the RM Nimbus network, phone Research Machines on Oxford (0865) 249866, or use the coupon below.

*Microsoft Networks and MS-DOS are trade marks of Microsoft Corporation.

**Prices quoted exclude monitor and VAT.

To: Caroline Rawle, Research Machines Limited,
Mill Street, Oxford OX2 0BW.

Please send me details of RM Nimbus network

NAME

POSITION

ADDRESS

POST
CODE

TELEPHONE

RESEARCH MACHINES
MICROCOMPUTER SYSTEMS

PC 8

WHAT IS MULTI-PROCESSING?

Multi-processing is the best possible technique designed to achieve cost effective and high performance multi-user computing. Very many advantages accrue over the networking of Personal Computers or Timesharing micros. It is also, probably, the most unknown and underestimated innovation of micro computer technology. BROMCOM are pioneers in multi-processing technology.

MAIN BENEFITS

- * Multi-access to a common database with record and file locking.
- * Sharing resources, e.g. printers, modems, telex line, etc. . . .
- * Speed far superior to conventional networking or time-sharing micros.
- * Cost much less than a network of PCs and comparable to timesharing micros.
- * Ease and low cost of expansion. Up to 16 users and more by networking.

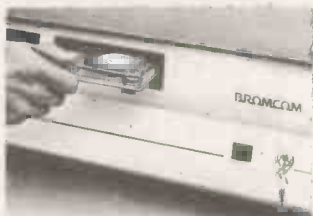


16-BIT MASTER PROCESSOR

MAIN FEATURES

- * Multi-processor system at its best. It is totally **BRITISH** designed and manufactured.
- * **16-bit Master/slave-processor based on iAPX 186** running at 8MHz with up to 1Mbyte RAM. (8-bit slaves are also available).
- * Winchester/Floppy drives operate in **DMA-mode** for fast response.
- * Choice of different operating system CP/M, MS-DOS and soon Concurrent DOS in slave processors.
- * **Integral Tape Back-up** option with up to 40 Mbyte capacity.

INTEGRAL 1/4in CARTRIDGE TAPE BACKUP



SuperStar-16 must be one of the most powerful, flexible and complete systems available on the market.

Contact:

BROMCOM

417-421 Bromley Road
Bromley, Kent BR1 4PJ
Telephone: 01-697 8933

NEXT MONTH

SPECIAL SECTION

GRAPHICS

Business graphics is a fast-growing field, to judge by the number of packages that incorporate or add graphics features. But how useful, and how cost-effective, are they? We look at the market, from simple pie charts to special presentation programs.

HARDWARE

ZENITH

Five new machines are due from Zenith, including a trendy transportable — a new implementation of the Morrow Pivot — an improved IBM PC compatible 150, and an AT-alike. We hope to preview the most interesting of the bunch, the Z-200, to see whether Zenith can follow up its achievements in the U.S. market with success in the U.K.

SOFTWARE

ALL THAT JAZZ

Lotus has finally delivered Jazz, its much-hyped do-everything business package for the Apple Macintosh. Was it worth the wait, or are programs of this size just dinosaurs on the Mac?

TOP 10 SURVEY

TRANSPORTABLES

IBM has just slashed £500 off the Portable PC to compete with the rival Compaq and Olivetti M-21 transportables, while Osborne and Kaypro are also making an impact with both CP/M and IBM-compatible machines. We check out the offerings in this exciting market.

Don't miss the September issue of

'PRACTICAL COMPUTING

On sale at W H Smith and all good newsagents after August 14.

Contents may vary due to circumstances beyond our control and are subject to change without notice.

The world didn't need another portable.

Just a better one.

The Bondwell 2 is a truly portable computer that offers instant computing power when you're on the move. And it offers some pretty remarkable features.

Small, light, powerful.

The Bondwell 2 is a 64K RAM portable that is the size of an attache case and weighs just 5.5 Kg. The fold-up LCD screen offers 80 characters x 25 lines with a brilliant resolution of 640 x 200. It also tilts 0° — 180° to offer the best viewing angle in all light conditions.

There's also a built-in 3 1/2" microfloppy disk drive with a 360K formatted capacity. So you get maximum software flexibility without the limitations of built-in ROM programs on most portables.

And because the Bondwell 2 has a CP/M 2.2 operating system you have access to a huge library of business programs.

Five top programs are offered free with the Bondwell 2 — WordStar, Mailmerge, DataStar, CalcStar and ReportStar. As well a "Scheduler Plus" program is yours, free, for better organisation of executive time.

Features. Features. Features.

Other Bondwell 2 features include a full-stroke keyboard with 8 user-defined function keys; ports for data transmission, printer and a second disk drive; expansion slots for modem, ROM/RAM card; a built-in battery which gives 8 hours of continuous use with each recharge.



The Bondwell 2 Portable.

Heavy in features. Light in weight.
And equally light on the pocket

AT **£1575**

**Barbatan
Limited**

35 - 38 High Street
Bristol BS1 2AW
Tel: Bristol (0272) 213928

Attractive trade discounts are available.
Dealer enquiries welcome.

CBM'S Z-8000 AND AMIGA ANNOUNCED

COMMODORE has announced some details of its unusual Zilog Z-8000 based machine, the Commodore 900. When it becomes available in the autumn, it will have 512K RAM as standard, upgradeable to 2Mbyte, and a 1.1Mbyte floppy; a second floppy will be optional. Ports include four RS-232s and a Centronics. The operating system will be Coherent, which is apparently a close relative of Unix. It has been acquired by Commodore from an outside firm.

There will be two main versions; the single-user as described, and the multi-user which has a 20Mbyte, 40Mbyte or 67Mbyte Winchester. Up to eight users can be supported. A notable feature will be its extremely high-resolution graphics: 1,024 by 800 pixels and 16 colours. This suggests the machine will be targeted at CAD/CAM, scientific and business-graphics applications.

The first rumours about the Amiga, Commodore's answer to

Atari's ST, suggest that it too will have high-resolution colour graphics of the same order as the 900. Indications are that it will have a 68000 CPU and a 3.5in. floppy. The U.S. launch is scheduled for the middle of July; it is unlikely to appear over here before next year. There have been conflicting reports on the pricing, but it seems likely to be over £1,500.

Meanwhile, a novel scheme has been announced to boost sales of Commodore's old stalwart, the 64. Every Commodore-64 pack, which costs £199, will entitle the purchaser to three nights' free accommodation for two people at one of over 300 hotels. These range from four star to guest houses, and are located in France and Belgium as well as the U.K. At the time of purchase you are provided with vouchers and a list of hotels. It will be interesting to see how the opposition responds.

Details on all Commodore products from local dealers.



Macenhancer

MICROSOFT has launched a hardware expansion device that allows Mac applications to use a wide range of IBM-compatible printers. The Macenhancer provides four additional ports, giving access to a total of five different peripheral devices such as printers, modems and general RS-232 equipment. In particular, it allows the Epson range of printers to be used.

Software is also provided that enables the Mac to emulate VT-52 and VT-100 terminals, allowing it to be hooked up to mainframes. The Macenhancer is accessed through the Mac's menus; active devices can be changed without dismantling equipment or exiting from an application.

The price is £250 plus VAT. More details on (07535) 59951.

NEC APC III

THE JAPANESE electronics giant NEC has launched what it believes to be a major new onslaught on European business-micro markets with its APC III. Rather unadventurously this is just an MS-DOS machine with 128K RAM, 640K floppies and a variety of hard-disc options. It does at least use the faster 8086-2.

There are RS-232 and Centronics ports and four expansion slots. A colour board is available. The high-resolution mode offers 640 by 400 pixels in up to eight colours, or in monochrome if you prefer.

More interesting is the bundled software, rejoicing in the name of the NEC Foundation Package. This has been commissioned and written in the U.K., and as well as the standard generic packages like word processing, spreadsheets and electronic mail, it also offers a Gem-like front end called, appropriately enough, Front End. A mouse is available.

The dual-floppy model costs £1,735 plus VAT, monitor included; the top-of-the-range colour version with a 10Mbyte Winchester costs £3,058. For more details telephone 01-267 7000.



The APC III: the Japanese threat?

HARDWARE SHORTS

- The Magnum portable from down under is to be distributed in this country by PM Professional Micros. Telephone: (0954) 81991.
- In the U.S. Amstrad is launching the CPC-6128, a 128K version of the CPC-664. Price is in the range \$600 to \$700; and all sales will be through the U.S. distributor

More Midases

SIRTON has added two new systems to its Midas range of micros. The Midas 286 has, unsurprisingly, an 80286 at its heart. Like the Jarogate Sprite, it uses Concurrent CP/M with PC-DOS emulation. Other operating systems include Xenix and CP/M Plus. It is claimed that up to 18 users can run off the one processor. The one-chip version of Ethernet also comes as standard.

Options include an IBM PC compatible graphics board, and an

eight-port I/O board. Prices for the Midas 286 start around £6,000.

The similarly priced Midas 68/XE is based on the 68000 processor. It runs Xenix, Unix, Idris and a CP/M emulating operating system. Unlike the Midas 286, which is aimed at business users, the 68/XE is geared more to the scientific community.

Details on both systems can be obtained on 01-640 6931.

(More news on next page)

Indescomp. A U.K. launch is unlikely this year.

- The Q+4 from CST is a multi-way expansion module. the price is £150. More on (0223) 323302.
- A miniature line driver from Picotech allows RS-232 equipment to be connected over distances of several kilometres. Prices are from £59. Details on 01-502 0728.
- An Amstrad light-pen is available from Dk'tronics for £24.95 including VAT. More

information on (0799) 26350.

- U-Microcomputers has launched hard-disc versions of its U-Man series 1000 micros with 10Mbyte, 21Mbyte or 42Mbyte Winchesters. Prices start at £3,800. More on (0925) 54117.
- Husky Hunters can now be charged from vehicle batteries. The necessary power unit costs £95. More information on (0203) 668181.

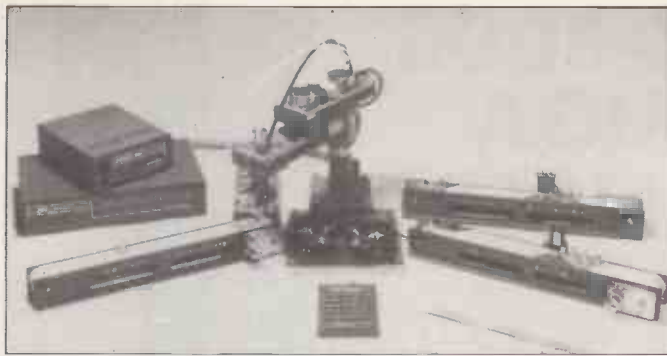
Honeywell HCX-0940

THE unmemorably named HCX-0940 from Honeywell is a 40Mbyte 8086 machine running under Concurrent DOS. It sits at the top of Honeywell's business-micro range.

Prices in this series begin at a rather steep £3,245 plus VAT for a twin 640K floppy version, and the latest addition is £6,900. Subsequent releases are likely to include Gem software. Details on (0442) 212781.

Gold Octopus

LSI COMPUTERS of Woking has launched a top-end model to its Octopus range. The Octopus Gold comes with 768K RAM as standard, as well as the dual processors of the earlier machine. Winchester drives of 10Mbyte, 20Mbyte or 40Mbyte are available. The entry-level Gold system starts at £5,300 plus VAT. New expansion boards include an IBM PC emulator boards for £220. Details on (04862) 23411.



Ivax the Scara robot

IVAX is a selective compliance assembly robot arm — Scara for short — from Powertran Cybernetics. It is designed for educational and training purposes. In industry, Scara precision-assembly robots are becoming the norm. Ivax aims to teach the principles behind the work cells approach,

with its attendant high speed and accuracy.

The basic robot arm costs £980; the Z-80 based controller costs £801.50 and the power supply unit £136.50. Alternatively, it is possible to use a BBC Micro or Apple for control purposes. More information on (0264) 64455.

Megabyte Apple card

RAMWORKS is a memory expansion card for the Apple IIe which allows a desk top of up to 736K to be set up within the Appleworks program. It includes an 80-column display facility, and larger sizes of Ramworks will also simultaneously act as RAM discs for Appleworks. Prices range from £299 plus VAT for the 128K Ramworks card, giving a desk top of 101K, to £1,199 for the 1Mbyte card, which allows a 736K desk top. More information from Bidmuthin Technologies on 01-628 0898.


BBC B + Z-80 = ?

USERS who have connected up an Acorn Z-80 second processor unit to their shiny new BBC B+ may have experienced difficulties with CP/M software. This is due to a minor incompatibility between the 1770 DFS and the CP/M BIOS. If it is any comfort, Acorn

has two solutions to the problem.

The first is a revised Disc 1 which forms part of the bundled Z-80 software; the other is a modified DFS EPROM which is currently being developed. Availability and upgrade policies will be announced shortly.

BBC's Good Companion

THE GOOD COMPANION for the BBC Micro from Bevan Technology adds a 100K 3.5in. floppy and the ability to link up to a videotape or videodisc machine. There are also extensive digital-to-analogue facilities which allow motorised units to be controlled via a Logo-like language. The cost is £347 plus VAT, and more information can be obtained on (0902) 23546. 

RM NIMBUS POWERFUL. FLEXIBLE AFFORDABLE AVAILABLE



Research machines Nimbus: 16 bit super micro.

You've read the rave reviews — now try a demonstration. The new RM Nimbus can be seen and tested immediately.

Complete with full range of software, including: word processing, spread sheet, database, accounts and graphics.

- ★ The fastest 16 bit business computer
- ★ Built-in colour hi-resolution graphics
- ★ 80186 Main processor running at 8 MHz
- ★ RM graphics processor
- ★ 8051 peripherals processor running at 11 MHz
- ★ 8910 sound processor running at 11 MHz
- ★ MS DOS version 3.05 operating system
- ★ 192 K standard RAM expandable to 1 megabyte
- ★ 2 x 720 K disk drives as standard
- ★ Hard disk option — 10, 20, 40 or 80 megabyte
- ★ Networking up to 64 stations
- ★ Interfacing up to 30 peripherals devices can be attached, (printers, instruments, modem, etc)
- ★ Full range of software now available
- ★ MS WORD, Wordstar and professional word processors
- ★ MULTIPLAN Supercalc spreadsheets
- ★ Superfile, D Base II, Datamaster databases
- ★ PEGASUS, SAGE, MULTIPAC, EASY JUNIOR accounts
- ★ CAD packages, Colour screen dump
- ★ Mouse and joystick operated painting packages
- ★ Powerful RM basic, Logo and Pascal languages
- ★ And much, much more

Telephone straightaway for an instant trial

Regional Systems
2 Greenleaf Road, Walthamstow, London E17 6QQ
Telephone: 01-521 7144

WordPerfect 4.0. Our highest marks yet.



A perfect report card. It wasn't necessarily our goal when we added the most recent enhancements to WordPerfect. We were more interested in responding to the suggestions of our users and dealers.

But a perfect report card is like icing on the cake. And it makes us more confident than ever that WordPerfect 4.0 is the most perfect WordPerfect, yet.

Easier.

Most WordPerfect 4.0 functions require only one keystroke, a simple press of a finger. And new comprehensive documentation makes learning a breeze.

Faster.

Document orientation means WordPerfect 4.0 never makes you

wait between pages. No matter how fast you type, WordPerfect won't slow you down.

Better.

WordPerfect 4.0 includes several features not found on many word processors. Like a 100,000-word phonetic dictionary; multi-page footnoting capability; table of contents and index generation; automatic outlining and paragraph numbering;

and a 4.0 network version. Get the word processor that lives up to its name (and its report card):

WordPerfect 4.0. For more

information, see your dealer. Or call or write:

new version lives up to its perfect billing.

InfoWorld

SENTINEL
SOFTWARE

Wellington House
New Zealand Avenue,
Walton-on-Thames,
Surrey KT12 1PY.
Telephone: (0932) 231164.
Telex: 916005.
Fergus G.



SSI Software
Reaching for perfection.

WordPerfect 4.0 represents a new standard of excellence

InfoWorld



UNBELIEVABLE SAVINGS

COMPUTERS

APRICOT F1e 256K	£535
APRICOT F1 256K	£775
APRICOT POINT7	£2700
APRICOT PORTABLE 256K 1x720K Drive	£845
APRICOT 256K 2x720K Drives & Monitor	£1525
APRICOT Xi 256K 10MB & Monitor	£2175
APRICOT Xi 512K 10MB & Monitor	£2595
APRICOT Xi 512K 20MB & Monitor	£2995
COMMODORE C16 STARTER PACK	£49
COMMODORE PLUS 4	£79
COMPAQ 2 2x360K drives	£1795
COMPAQ PLUS 10MB	£3195
COMPAQ DESKPRO 640K 10MB	£3275
ERICSSON 256K 10MB	£2695
ERICSSON 256K 2 x 360K	£1645
KAYPRO 286	£4195
OLIVETTI M21 128K 2 x 360KB Drives	£1450
OLIVETTI M21 128K 10MB	£2195
OLIVETTI M21 640K 10MB	£2345
OLIVETTI M24 128K 2 x 360KB Drives	£1475
OLIVETTI M24 640K 10MB	£2650
OLIVETTI 3B UNIX Range	P.O.A.
SANYO MBC 555 128K 2 x 160K Drives	£745
SANYO 775 256K COLOUR PORTABLE	£1645
VICTOR 128K 1.2MB	£1645
VICTOR 256K 10MB	£2475
VICTOR 256K 2.4MB	£1875
VICTOR VpC 256K 15MB	£2395
VICTOR VpC 256K 30MB	£3495
ZENITH 128K 2 x 360K	£1675

MATRIX PRINTERS

ANADEX DP-6500 500cps	Ex Vat. £535
BROTHER HR5	£775
BROTHER M1009 50cps (IBM)	£2700
BROTHER 2024L (190 cps) NLQ	£845
CANON PW1080A 160cps (NLQ)	£1525
CANON PW1156A 160cps (NLQ)	£2175
CANON LBP Laser Printer	£2595
DATAPRODUCTS 8070 400 cps	£2995
EPSON RX 80T 100cps	£49
EPSON LX80 100cps	£79
EPSON FX 80 160cps	£1795
EPSON FX 100 F/T 160cps	£3195
EPSON LQ 1500 200cps (NLQ)	£3275
HEWLETT PACKARD Laser Printer	£2695
HONEYWELL From	£1645
MANNESMANN MT80 + 100 cps	£4195
MANNESMANN MT180 160cps (NLQ)	£1450
MP.165 165cps + (NLQ)	£2195
NEC PINWRITER P2(P)(NLQ)	£2345
NEC PINWRITER P3(P)(NLQ)	£1475
OKI 84A 200cps	£2650
OKI 92P 160cps	P.O.A.
OKI 182 (P or IBM)	£745
OKI 2410P 350cps	£1645
OKI 2350 (P)	£1645
OLIVETTI DM4100E 120cps	£2475
OLIVETTI DM5300E (P) 220cps	£1875
PANASONIC KX-P1091 (120cps) NLQ	£2395
PANASONIC KX-P1092 (180cps) NLQ	£3495
SHINWA CPA 80 100 cps	£1675
TOSHIBA 1351 136 Cols & Graphics	
TOSHIBA TH2100H 192cps	
TREND 930 200cps (NLQ) 80cps	

DAISYWHEEL PRINTERS

BROTHER HR15	Ex Vat. £2295	£310
BROTHER HR15 Keyboard	£139	£115
BROTHER HR25	£175	£595
COMMODORE	£895	
DPS 1101 Daisywheel Printer	£279	£275
DAISYSTEP 2000 20cps	£355	£219
DIABLO 630 API	£2750	POA
JUKI 6100 18cps	£1600	£299
JUKI 6300	£190	£749
NEC 2030 Parallel 120cps	£214	£545
NEC 3550 Parallel 35cps	£319	£955
NEC 8810	£420	£1375
OLIVETTI DY450 45cps	£895	£755
QUME 11/40 RO + I/Face	£2950	£1345
QUME 11/90 90cps	£375	£1995
QUME LETTERPRO 12/20	£180	£445
RICOH RP1300S FLOWWRITER 46K IBM PC	£529	£995
RICOH RP1600S FLOWWRITER 46K IBM PC	£245	£1349
TEC A.10.30	£535	£490
TEC STARWRITER F1040 40cps	£595	£830

SOFTWARE

CAXTON CARDBOX	Ex Vat. £245	£185
DBASE II	£1495	£240
DBASE III	£1435	£325
DMS DELTA 4	£435	£350
FRAMEWORK	£815	£325
LOTUS 1 2 3	£250	£299
MICROSOFT FLIGHT SIMULATOR	£375	£45
MICROSOFT WORD	£189	£240
MULTIMATE V 3.2	£1190	£295
OPEN ACCESS	£1280	£325
PEGASUS LEDGER MODULE	£1350	£200
SAGE ACCOUNTS		£250
SMART SOFTWARE SYSTEM		£495
SMART WORDPROCESSING		£210
SYMPHONY		£425
WORDSTAR		£190
WORDSTAR MAILMERGE		£95
WORDSTAR PROFESSIONAL		£245
WORDSTAR 2000		£290

COMPLETE SYSTEMS SUPPORT AND TRAINING AVAILABLE.
FULL MANUFACTURERS WARRANTY.
MOST ITEM EX STOCK.
 Next day insured delivery available.

STORAGE AND BOARDS

Pc NET STARTER KIT	Ex Vat. £795
PLUS 5 HARD DISK DRIVES FROM	£1045
512K MEMORY UPGRADES FROM.	£150
20MB TAPE STREAMER	£895
AST, QUADRAM, HERCULES ALL AT HUGE SAVINGS	£895

VDU's & TERMINALS

CIFER T4	Ex Vat. £760
HAZELTINE ESPRIT II	£485
QUME QVT 103 (VT100 VT131)	£645
TELEVIDEO 910	£489

MAYFAIR MICROS

BLENHEIM HOUSE, PODMORE ROAD,
LONDON SW18 1AJ

TEL: 01-871 2555 / 870 3255

We accept official orders from UK Government and Educational Establishments. Mail Order and Export Enquiries welcome. Callers by appointment.

Ref: 2.01

● Circle No. 148

"Accounting software above all others"

SKYMASTER II

SINGLE OR MULTI-USER ACCOUNTING SOFTWARE
FOR THE IBM PC AND COMPATIBLES

SKYMASTER sets the standard

Perhaps the first true multi-user accounting suite for the IBM PC and compatibles available under standard PC DOS/MS DOS—SKYMASTER has been setting the standard for affordable, top-of-the-range micro accounting software. Now SKYMASTER II adds many more features with enhanced flexibility and reporting, and with lower-price single-user versions.

Straightforward upgrade path

Start off with a single-user system and upgrade to multi-user when you're ready — no re-entry of data or new software instructions to learn.

Powerful features

"...SKYMASTER is by far the most comprehensive accounts system I have reviewed to date", said a PC User magazine reviewer.

SKYMASTER II has many sophisticated built-in features such as:- foreign-currency accounting, multi-company/department capability, depot stocks, stock code up to 20 characters, eight period account ageing, design your own Invoices/orders/statements, etc., report generator links etc.

Powerful reporting

The many standard parameter driven reports within SKYMASTER II, have been enhanced with the introduction of SKYGEN—a powerful Report Generator module. SKYGEN links with all SKYMASTER modules to produce tailored reports, credit control letters, output via standard formats to other software etc.

Multi-User Specialists

The unequalled experience of SKY's Team in five years of working with Local Area Networks, means that SKYMASTER II packages will always run with the latest in network technology. The need for the true, record-locking skills of SKY are explained in our 'Layman's guide to multi-user micro software.'

Foreign-currency accounting

Any company raising or receiving orders and invoices in foreign currencies will benefit from the standard SKYMASTER ability to handle up to sixteen currencies. The system looks after currency rate fluctuation and automatically makes appropriate adjustments. Audit trails are in both sterling and foreign currency. See SKY's 'Layman's guide to foreign currency accounting on the micro.'

Flexible and easy to use

A PC Business World review, said "(SKYMASTER) achieves the difficult feat of being both flexible and easy to use".

Features such as full integration, single-key menu selection, records accessed by number or name and clear screen layouts make SKYMASTER II a pleasure to work with.

Wide range of users

The experienced SKY team have been responsible for the successful installation of many hundreds of micro accounting systems in a wide spectrum of businesses.

Whether you are a first-time user, an expanding company or a corporate concern—SKY have a solution for you.

Layman's Guide

Send for copies of SKY's Layman's guides to — 'multi-user micro software' and 'foreign-currency accounting on the micro.'

Choose from the following interlinked SKYMASTER II modules:-

Sales Order Processing/Invoicing, Purchase Order Processing, Sales Ledger, Purchase Ledger, Nominal Ledger, Stock Control—with Stock History option, Contract Costing, Payroll—with Absentee Records option, SKYGEN report generator.

For details of accounting software above all others, contact your local SKYMASTER II dealer, or send for our Information Pack (why not clip your business card to this advertisement).

13 New Road

Bromsgrove

Worcestershire

B60 2JG

Telephone (0527) 36299

IBM SLASHES PRICES

IBM has improved the attractiveness of its Portable Personal Computer, the PPC, by slashing £470 off the price. A single-disc PPC with built-in screen now costs only £1,419 plus VAT. The market for IBM-compatible transportables is very competitive, with rival models from Compaq, Olivetti

and Kaypro putting IBM under pressure.

Several other IBM products have had hundreds of pounds knocked off their prices. The 10Mbyte expansion unit for a PC is down from £1,954 to £1,275, and the one for the XT down from £1,582 to £1,071.

A new product is the fixed disc adaptor, which enables a PC to be upgraded by adding a hard disc. It costs £298. The 10Mbyte hard discs themselves now cost £782.

The prices quoted are for IBM's own retail outlets and exclude VAT. Local dealers may offer different prices.



Flight Simulator 2

THOSE unfortunate enough to have bought an IBM PC/AT or compatible will have discovered the major drawback — it doesn't run the Microsoft Flight Simulator. Microsoft has now launched version 2, which runs on the AT and also the PCjr.

The only major difference is that the RPM readout has been changed from dial to digital, though the single manual now seems more accessible. Flight is the same, so if you've learned how to land you won't need to go back to flying school.

Olivetti

OLITALK is a new communications program for the M-21 and M-24 IBM-compatible computers. It allows them to emulate almost any asynchronous terminal, with DEC VT-100, IBM 3101 and TTY included as standard. It costs £99.

The M-21 transportable is now available with a built-in self-locking 10Mbyte hard disc for £2,995 — which is claimed to be substantially below the price of competing products. The M-21 has an 8MHz Intel 8086 and can be configured with 640K of RAM.

Contact British Olivetti Ltd, PO Box 89, 86/88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666.

Plus 5 has launched versions of its hard-disc range in a case to match the Olivetti M-24. Capacities range from 5Mbyte to 110Mbyte, and prices from £1,195 to £6,350.

Contact Plus 5, Crowborough Hill, Crowborough, East Sussex TN6 2EG. Telephone: (08926) 63211.

Three-speed PC printer

IBM LOOKS SET to make an impact in the dot-matrix printer market with the Proprinter, which offers several facilities that make it particularly attractive to users.

The Proprinter offers three operating speeds: 40cps for correspondence-quality work, 100cps for memos and reports, and 200cps for drafts and high-volume work. The printer also has a neat dual paper-handling facility, which means it

has a slot through which you can slide single sheets of paper and envelopes for printing, without having to remove the normal continuous fan-fold paper.

The Proprinter has a buffer built in, and it can also print graphics. It is being made by IBM in Amsterdam. Priced at a fairly competitive £499 plus VAT, it may even pick up sales from users of non-IBM equipment too.

Micro Five's AT-alike

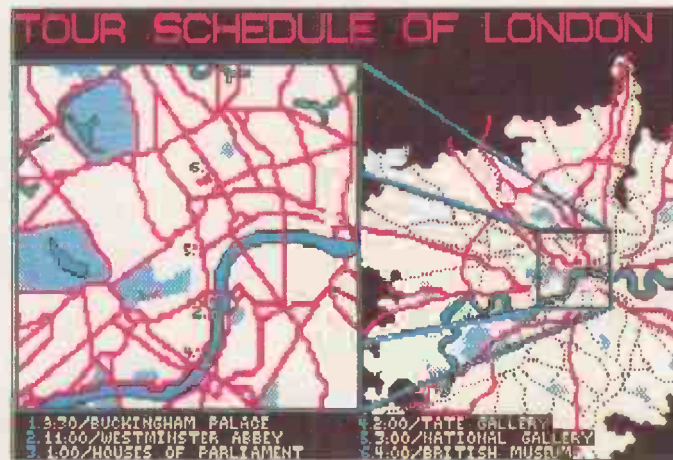
MICRO FIVE of California has launched a low-priced Series 5000 IBM PC/AT compatible micro with a specification very similar to the Compaq Deskpro 286 reviewed on page 47 of this issue.

The main features are an Intel 80286 chip which can be run at 6MHz or 8MHz, and a built-in hard disc with tape streamer backup. Micro Five offers a range of hard discs from 27Mbyte

to 116Mbyte. The tape-streamer capacity is 60Mbyte, compared to the Compaq's 10Mbyte.

Micro Five's name is not well known because it operates as a supplier to OEMs and value-added resellers (VARs) who put their own names on the machines before selling on to end-users.

Contact Micro Five in Costa Mesa, California on (U.S. area code 714) 957-1517.



PC graphics

THE Personal Presentation System, PPS, is a British graphics package offering icons and symbols which can be recalled from memory. Frames can be grabbed from other packages such as Lotus 1-2-3. Now a series of library discs is being introduced to extend the range of symbols and icons available, including maps and flags.

Contact The London Software Studio on 01-935 3033.

VCN Execuision currently offers the largest library of graphics images for the IBM PC. New subjects include maps (illustrated above), energy and utilities, and The Sports Collection.

Contact Visual Communications Network Inc., Greyhound House, 23-24 George Street, Richmond, Surrey TW9 1JY. Telephone: 01-948 8601.

File transfer

M-MASTER is a disc-to-disc file-transfer utility that allows a PC to read, write and format discs in over 70 different CP/M and MS-DOS formats. This enables files to be transferred from other machines without modems and cables.

M-Master runs in 128K RAM and a PC or compatible with two disc drives. The price is £65, including VAT and postage.

Contact C+G Consultant Services, PO Box 100-A, Surbiton, Surrey KT5 8HY. Telephone: 01-399 8530.

PC2PC

NCR has launched a local area network called PC2PC. It connects up to 64 PCs together for £449 per connection. The net is a version of the Corvus Omninet, and one PC must be designated as file server.

The NCR package comprises interface boards, software, tap box, cable, and everything else you need, right down to wirestrippers. It is claimed a network can be installed in less than two hours.

Contact NCR Ltd, 206 Marylebone Road, London NW1 6LY. Telephone: 01-725 8337.

IBM SHORTS

- Prospero's Pro Pascal compiler has now been validated Class A for the IBM PC and compatibles. Phone: 01-741 8531.
- Cipher's 5210 25Mbyte quarter-inch floppy tape backup plugs straight into an XT and costs only £995 plus VAT. Phone: (0276) 682912.
- Quantec Executive Desktop, QED+, is now available in a multi-user version. Phone: 01-228 7507.
- Practicorp has launched an IBM version of Practibase. It is claimed to read and convert dBase II files and run dBase II programs. It costs only £99.95, including VAT. Phone: (0473) 462721.
- Bonnie Blue is a £99.95 plus VAT word-processing program from Paperlogic. It offers advanced facilities, including mail merge, macros and multiple windows. Phone: 01-935 0480.
- Golden Common Lisp for the IBM PC supports more than 400 primitives and is described as an ideal Lisp-learning/AI tool for novices. It costs £545 plus VAT. Phone: (0923) 47707.

Why can't all our printers be like the JUKI 6100?

Because every business is different. Not everyone, for instance, needs the full sophistication of our remarkable 6100. (Though judging from the fact that it's one of the best-selling printers in the UK, quite a few people do). And not everyone has an IBM* computer (though for those that have we've just introduced the brand-new, IBM* graphic printer compatible 6100-I). No, not for us the 'take it or leave it' approach,

but a sensible, sensitive appreciation of individual needs and requirements. So whatever you want from your printer, you'll find a JUKI that's just right for you.

But just because you're concentrating on their differences, don't overlook the important fact that two things, at least, never change. Quality and value, for instance. In these respects, all JUKI printers are the same.

*IBM is a trade-mark of IBM Corporation.

JUKI 6100: one of the best-selling letter quality daisywheel printers in the UK. Graphic mode and full word processing support.



JUKI 2200: fully portable daisywheel printer with 2k buffer memory and full word processing support. Ideal for use at home.



JUKI 6300: high speed (40 cps) daisywheel printer with 3k buffer memory and full word processing support.



JUKI 6000: letter quality daisywheel printer designed specifically for home use.



JUKI 5520: low-cost, high quality dot matrix personal computer printer. High speed (180cps), graphic mode and optional 4-colour print function. NLQ.



JUKI 6100-I: brand-new, IBM*-compatible version of the best-selling 6100. Graphic mode and full word processing support.



JUKI

Technology true to type

JUKI (EUROPE) GMBH · Eiffestr. 74 · 2000 Hamburg 26 · F. R. Germany
Tel.: (0 40) 2 51 20 71-73 · Telex: 2 163 061 (JKI D) · Fax.: (0 40) 2 51 27 24.

Sole distributor:

 **Micro Peripheral Ltd**

Intec Unit 3, Hassocks Wood, Wade Road, Basingstoke, Hants, RG 24 ONE.

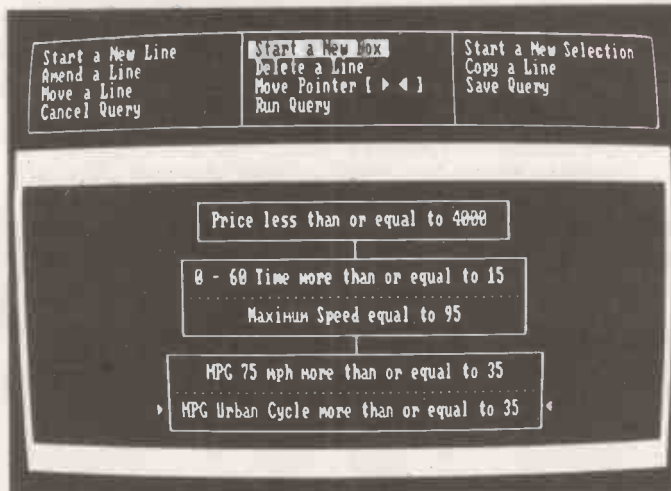
Tel.: (0256) 47 3232 (32 lines) · Telex: 8 59669 MICRO PG, Facsimile (0256) 46 1570 ● Circle No. 144

DATA INTEGRATOR

TWENTY/TWENTY is designed to retrieve data from incompatible programs like Multiplan, Lotus and dBase II. You can then query the data on-screen or construct printed reports with it.

Available for the IBM PC, with an Apricot version on the way, Twenty-Twenty addresses the problem that much business information is locked up in completely incompatible files. Much of its value is therefore lost, as it is not at all easy to spot how different pieces of information relate together.

Twenty-Twenty consists of a file integrator, a report generator and a menu-driven query system, and it also has facilities for setting up regular jobs as simple-to-run tasks. It can read data from a long list of well-known programs, including Delta, Framework, VisiCalc and Supercalc, as well as files in the common DIF and Syk interchange formats. It does not allow you to alter the data stored with any source program.



Twenty/Twenty can solve compatibility problems.

Twenty-Twenty costs £345 plus VAT and was developed by Interactive Software Products Ltd in St. Albans. It should not be confused with the similarly named 20/20 from Access Technology Inc. in the U.S. which is a very powerful

spreadsheet program also running on the IBM PC. More details on Twenty/Twenty from ISPL, 1-4 Lloyds Bank Chambers, The Maltings, St. Albans, Hertfordshire. Telephone: (0727) 36341.

Easy database

CLASMA RECALL is a record-handling and mailing package aimed at the first-time business user. It lets you design your own record layouts, and incorporates a diary which you can link to your database. The program runs on the Apricot and IBM PC and costs £395. Details from Clasma Systems Ltd, 10 Barley Mow Passage, London W4 4PH. Telephone: 01-994 4394.

Sage redesigns range

SAGESOFT has redesigned its entire range of accounting software for 16-bit machines. The new range starts with Bookkeeper, £295, a package aimed primarily at the cash trader operating under the Retailers Special VAT Scheme.

Next up is Sage Accountant, £495, which is the replacement for the existing top-selling Sage Accounts program. Sage Accountant Plus, £695, is the same program but with the addition of automatic invoicing and stock control.

Top of the range is Financial Controller, £995, designed for companies with up to 10,000 accounts and requiring a hard disc. The programs run on most MS-DOS machines including Apricot, Sanyo and IBM PC, the first three are available now, while Financial Controller is due towards the end of the year.

Contact Sagesoft plc, NEI House, Regent Centre, Gosforth, Newcastle-upon-Tyne NE3 3DS. Telephone: 091-284 7077.

Macintosh roundup

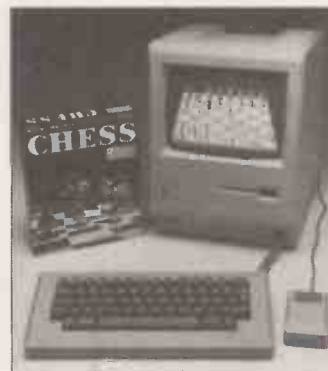
Animation Toolkit lets you create continuous moving pictures on the Macintosh. The program costs £48.20 plus VAT and will run on the single-drive 128K Mac. Contact P&P Micro Distributors Ltd, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 217744.

Maclion is a very powerful database package designed for creating complete business applications. It can handle multiple files and produce customised reports, and it helps you transfer data to it from other Mac applications. Maclion requires at least 128K and two disc drives, and costs £379 plus VAT from P&P.

Mactype is a typing tutor which will teach you either the conventional QWERTY keyboard or the alternative Dvorak layout. Pro-

ponents claim that the Dvorak layout encourages faster typing, and the Mac's completely soft keyboard can be redefined to work Dvorak-style with most applications. Mactype costs £49 plus VAT from P&P.

Maclink and Mactransfer are two communications programs for the Mac. Maclink lets you move IBM PC files to the Mac, and consists of a set of converter programs to translate between specific packages such as Lotus and Multiplan and WordStar and Macwrite. Mactransfer is a similar program for the Apple II; it lets you move most Apple word-processing files, DIF format files and also Applesoft source code across to the Mac. Maclink costs £119 plus VAT, Mactransfer £45 plus VAT. Cabling is extra. Contact P&P.



Psion 3D chess

PSION CHESS for the Mac offers you a choice of 2D or 3D display and has 28 levels of play. Price is £49.95 including VAT. Contact Psion Ltd on 01-723 9408.

SOFTWARE SHORTS

● Spellcheck II is an updated version of Beebugsoft's spelling checker for the BBC computer. Supplied on ROM it comes with a 6,000-word dictionary and works with both Wordwise and View. Price is £31 including VAT. Contact Beebugsoft on (0727) 60263.

● Tasman has released a disc-based version of its excellent Tasword word-processing program for the Amstrad. Called Tasword 464D, the new program costs £24.95 including VAT and runs on the 664 as well as the 464 Amstrad machine. Contact Tasman Software on (0532) 438301.


● Statcalc runs on both the IBM PC and Apple II and provides a set of powerful tools for statistical analysis, including regression. The Apple version costs £85 while the program is £150 on the IBM PC. Contact Dr Alan Lee, Department of Maths and Statistics, University of Auckland, Private Bag, Auckland, New Zealand.

Mac colour plots

MACPLOT enables you to get high-quality plotted output, in colour, from plotters connected to the Macintosh. Version 1.5 costs £99 and works with 15 different types of plotter. You transfer pictures to be plotted from programs such as Macdraw, Mac Chart or Jazz via the Mac's clipboard. More details from Microspot, 9 High Street, Lenham, Maidstone, Kent ME17 2QD. Telephone: (0622) 858753.

Free software

THE Free Software Handbook describes 70 of the best American public-domain programs for Z-80 based CP/M systems. The book costs £17.95. For another £10 you can get the programs too, though you have to send your own discs in — enough to take 1.2Mbyte. Most formats are supported, including Apple and BBC CP/M.

Contact Davis Ruben Associates Ltd, 1 Canonbourne, Weston sub Edge, Chipping Campden, Gloucestershire GL55 6QH. Telephone: (0386) 841181. 

GALAXY WEST ONE

BUSINESS SYSTEMS LTD
230 Tottenham Court Road, London W1P 9AE
Telephone: 01-636 7142/4102

Looking for a business system?
Let us help you.
Come to the first floor for expert
advice and unbeatable price.



**apricot XI10 WITH
10MB WINCHESTER
ONLY £2195+VAT!
PLUS**

- FREE Monitor
 - FREE Super Planner
- INTEGRATED ACCOUNTS
PACKAGE**
- FREE Invoicing
 - FREE Stock Control
 - FREE Sales Ledger
 - FREE Purchase Ledger
 - FREE Nominal Ledger
 - FREE Payroll



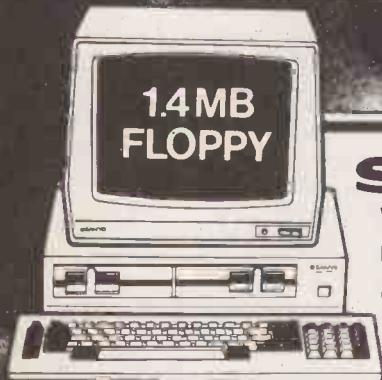
**SPECIAL
IBM COMPATIBLE
SANYO 550.**

Features dual 360K disk
drive, 256K Ram.
Full IBM Colour Graphics
(including IBM Compatible
Video Board and GW Basic).
MSDOS 2.11. Wordstar and Calstar.
FREE Hi-Res Green Monitor
Runs Lotus 123 etc

£895+VAT

Limited stock.
Offer applicable only
while stocks last.

**IBM
COMPATIBLE
550**



**SANYO 550
WITH 2x 800KB
FLOPPY DISC
ONLY £795+VAT!**

PLUS

- Includes 256K Ram and MSDOS 2.11
- FREE Monitor (Philips V7001)
 - FREE Wordprocessor (Wordstar)
 - FREE Spreadsheet (Calstar)

**Special Offer
while stocks
last**

GALAXY BARGAINS

SANYO with 10MB
Winchester 360K floppy, 256K
Ram, MSDOS 2.11, Wordstar &
Calstar and Monochrome Monitor
£1495+VAT

**SANYO 775/10MX
SPECIAL OFFER**

The portable Sanyo with
10MB Winchester disk.
Twin 360K floppies, 256K
Ram, MSDOS 2.11, Integral
9 colour monitor, FREE
Software, FREE Colour Printer
£2495+VAT

**PLUS FREE
INTEGRATED
ACCOUNTS
PACKAGE
WITH THESE
SYSTEMS**

**TRAINING
CAN BE
PROVIDED ON
ALL SYSTEMS
SUPPLIED**

22

We also stock a wide range of Printers, Monitors, Disc
Drives and Software Packages, plus many other
Computer Systems at bargain prices.

• Circle No. 145

**1 YEAR
WARRANTY &
MAINTENANCE
CONTRACTS
AVAILABLE**

OPENING HOURS MON-SAT 9AM-6PM

MAIL ORDERS TO: West One Galaxy Business Systems Ltd,
230 Tottenham Court Road, London, W1.

Cheques payable to: West One Galaxy Business Systems Ltd.



£100K COMPETITION

THE British Technology Group has announced its 1985 Academic Enterprise Competition with total prize money of £100,000. There are two classes of entry: the first is for academic researchers who have set up, or intend to set up, a new business as a means of commercialising their results. The other is for all other methods

of transferring technology from academic institutions to industry. The closing date for entries is 30 August 1985.

The competition is open to members of staff of U.K. universities and polytechnics, and postgraduate students or post-doctoral workers. It is also eligible to anyone who has left any of

these since 1 January 1980. Entries must relate to commercial exploitation of work carried out in such institutions, and is designed to encourage such transfers. Hardware and software products are eligible. First prizes in each class are £25,000, with £10,000 and £5,000 for runners-up.

Details from 01-403 6666.

On-line GAS

A WORLDWIDE consultancy and information publishing service is being launched purely as an on-line service on Telecom Gold. Global Analysis Systems (GAS) offers a three-tier service providing economic consequences of political and strategic events in 100 countries throughout the world. Systematic analysis of significant daily events is provided at 12.45p.m. every day, drawing on consultants in London, Paris, Bonn and New York.

Such services do not come cheap: the world is divided up into four regions, and the annual fee for information on each varies from £2,000 to £3,000. The daily analysis service costs £3,000. As a small consolation prize you are given a Telecom Gold mailbox free. Details on 01-606 7060.

Booming BMMG

THE CREDIBILITY of the British Microcomputer Manufacturers' Group's claim to be the voice of the British micro industry has been strengthened by the recent addition of ICL, Sinclair Research, Future Technology Systems and HM Systems to the group. This brings the membership to about 50 percent of all British micro manufacturers. The most glaring omission is ACT. Details on the BMMG from (0763) 71209.

Applecared

NOT ANOTHER expansion board for the Ile, but a credit card which is claimed to have one of the highest instant credit limits. Up to £2,500 can be obtained on the spot after fulfilling "certain criteria", allowing you to walk away with a Macintosh if you so desire. Details on (0442) 60244.

Second-hand micros

COMPUTERLINES is a new Prestel service from Interlex which allows used micros to be bought and sold. Starting on Prestel page 36,019, there are pages devoted to machines available or wanted. Anyone can access them. The cost for one of these pages is £10 per fortnight. There is also a charge of £15 for setting up the page. This is carried out by Interlex, which also advises on suitable asking prices. It is also possible to access a list of

used micros for sale via electronic mail. More details on 01-943 4366.

A more conventional alternative for selling your old and unwanted micro is provided by a new section in *Exchange & Mart*. Called Micro Mart, it covers sales of hardware, software, peripherals, books and magazines. This is in addition to a computer category within the business section. More information on both services from (0202) 670011.



Micro maintenance

GRANADA has launched a national micro maintenance service under the name of Microcare. Designed for companies who require 24 hours a day, seven days a week technical support with hotline facilities for emergencies, the

service is costed on an individual basis.

There is a network of service centres around the country and a team of mobile technicians. More information can be obtained from (0296) 84321.

Typesetting from micros

THREE new services offer micro users the possibility of converting computer files into typeset documents. Type Club offers a do-it-yourself mail order service: it claims that no special software is required. Micros for which the service is available include the IBM PC, Apple and many others. Details from PO Box 186, Poole, Dorset BH13 6DL.

Typeshare provides a phototypesetting service from financial documents. More on 01-485 9515.

The service offered by Textech allows you to send text files produced on IBM, Apricot and Apple computers to a typesetting machine. This can be done by telephone, by floppy disc or by a portable capture device. More information on (0580) 880421.

Golden oldies

THE FRENCH firm Eureka has bought Oric from its receivers, including all stocks and parts and the right to the company name and its trade names. Eureka Informatique is a Paris-based distributor of Sinclair, Amstrad and Enterprise micros. It also manufactures monitors. Although warranties have expired following receivership, existing owners will be able to apply for assistance to the French company. More from Eureka Informatique, 39 Rue Victor Masse, 75009 Paris. Telephone: Paris (010 331) 281 2002.

On the other hand, the Superbrain is now officially dead. The last batch has been bought by Professional Micros from Intertec in the U.S. Professional Micros will continue to support existing users for up to five years. Details on (0954) 81991.

Microsoft education discounts

MICROSOFT has joined the battle for the minds of the U.K.'s youth with a 30 percent educational discount on a range of products. The categories of end-user that will qualify for discounts include primary and secondary schools, further education institutions, polytechnics and universities. Details on the range of hardware, software and books covered by the scheme can be obtained on (07535) 59951.

NCC directories on disc

THE NATIONAL COMPUTING CENTRE is issuing its present paper-based directories of hardware, software and training courses, on discs. Each directory comes in the form of a pair of floppy discs, with menu-driven file-searching programs. Updates are similarly issued on disc.

Formats available include the IBM PC, Apricot and ICL PC. The cost is £75 for single copies, and £450 for annual subscriptions comprising 10 copies. More on 01-353 0011.

APPLE COMPATIBLE PERIPHERALS

NOTCHER disk capacity DOUBLER.....	£ 3.99
SATURN 128K RAM CARD for Ile.....	£ 199.00
128K RAM Card with manual & disk.....	£ 139.95
SNAPSHOT III & II+ - Dark Star.....	£ 52.00
SNAPSHOT IIe - Dark Star.....	£ 99.00
COPYKIT Software - Dark Star.....	£ 19.95
SHUTTLE MULTITASKING Software Dark Star.....	£ 19.95
Auto Dial/Auto Answer MODEM Card.....	£ 125.00
COMMS software for above.....	£ 25.00
PRESTEL Graphics ROM for Modem Card.....	£ 19.95
Disk Drive Controller Card.....	£ 34.95
13/16 Sector Drive controller card.....	£ 39.95
16K RAM (language) Card.....	£ 39.95
80 Column Card (Videx Compatible II+).....	£ 44.95
80 Col Card as above with Soft Control.....	£ 59.95
INVERSE Video ROM for above.....	£ 5.00
80/40 Column Hard Switch.....	£ 6.95
80 Column Card for Ile.....	£ 44.95
80 Column Card for Ile with 64K RAM.....	£ 84.95
Z80 CP/M Card for II+.....	£ 39.95
Z80 PLUS Card with Manual for II+.....	£ 49.95
CP/M Z80-B (6MHz) Card with 64K RAM II+.....	£ 169.95
Z80 Card for Ile.....	£ 44.95
CP/M Module for Ile.....	£ 86.00
Parallel Printer Card (Centronics).....	£ 34.95
Parallel Printer Card (Epson).....	£ 34.95
SUPER Parallel Card with manual.....	£ 89.95
Printer Buffer Card (64K dump).....	£ 129.95
Grappler + Card.....	£ 84.95
Grappler + 16K Buffer.....	£ 149.95
CHAMPION Parallel Interface (with cable).....	£ 45.00
CHAMPION + 16K Buffer (with cable).....	£ 89.00
CHAMPION + 64K Buffer (with cable).....	£ 125.00
CACHEBOX 64K Parallel inline Buffer.....	£ 125.00
Communications Card.....	£ 32.95
RS-232 Serial Interface Card.....	£ 34.95
SUPER Serial Card with manual.....	£ 89.95
7710 Asynchronous Serial Interface.....	£ 79.95
NTSC to PAL Converter + UHF Mod.....	£ 44.95
NEW PAL Card with Sound.....	£ 49.95
RGB Card (TTL output).....	£ 49.95
RGB Card (LINEAR output).....	£ 49.95
IEEE-488 Controller, cabl, disk & manual.....	£ 149.95
Eprom Blower Card (2716,2732,2764).....	£ 49.95
MK2 Eprom Blower (2716,2732,2764,27128).....	£ 59.95
NEW EPROM controller/Parallel I/Face.....	£ 32.00
EPROM Blower for 2716,32,32a,64,128,256.....	£ 53.00
8748 Writer burns 8748,8749.....	£ 149.95
A/D Card 16ch, 0-5.12v, 100 microsecs.....	£ 79.95
D/A Card 2ch 8bit, 0-1ch 16bit, 0-10v.....	£ 98.00
8 BIT AD/DA (8 or 16ch a/d, 1ch d/a).....	£ 59.95
12 BIT AD/DA (16ch a/d, 1ch d/a).....	£ 119.95
CLOCK CARD (TIME II) Card.....	£ 44.95
MOUNTAIN Clock card.....	£ 179.95
Music Card.....	£ 44.95
Wild Card.....	£ 69.95
Wild Card Plus.....	£ 99.95
Four Port Twin 6522 Card.....	£ 34.95
6809 Card.....	£ 119.95
Integer Basic Card.....	£ 32.95
LOGD Card.....	£ 59.95
Joystick (self centering).....	£ 14.95
Joystick (deluxe version).....	£ 19.95
Joystick extension cord.....	£ 3.99
Apple Compatible Power Supply 5A.....	£ 49.95
ASC II Encoded Keyboard with I/c mod.....	£ 54.95
IBM STYLE keyboard for Apple.....	£ 89.95
A/C Cooling Fan (clip on) with suppres.....	£ 24.95
Speech Card.....	£ 79.95
Replay Card.....	£ 79.95
Forth Card.....	£ 89.95
8088 Card with 64K (capacity 128K).....	£ 365.00
Light Pen system.....	£ 159.00
Graphics Table.....	£ 89.00
IMAGE Processor (col/mono/SSTV use).....	£ 199.00
SATURN/TITAN ACCELERATOR Card II+.....	£ 269.00
SATURN/TITAN ACCELERATOR FOR Ile.....	£ 299.00
IC TEST CARD TTL Version (send for info).....	£ 119.95
IC TEST CARD DSRAM, ROM/PROM/EPROM sware.....	£ 169.95

APPLE STORAGE DEVICES

CUMANA full height drive for Apple.....	£ 109.00
CUMANA half height drive for Apple.....	£ 145.00
AFD-2 half ht. SS/D0 320K floppy drive.....	£ 249.00
AFD-4 half ht. OS/D0 640K floppy drive.....	£ 289.00
AFD-4 drive controller card.....	£ 59.00
INTEC 5MB Hard Drive for Apple.....	£ 699.00
INTEC 10MB Hard Drive for Apple.....	£ 950.00
INTEC 10MB Hard Drive KIT.....	£ 875.00
5/10 MB Hard Drive Controller Card.....	£ 250.00

(Note: All INTEC drives are UK built and backed - Prices include controller card, cables, power supply, utility and diagnostic software for DOS, PASCAL & CP/M, together with 24 month service warranty.)

PRINTERS — DAISY WHEEL

BROTHER	
HR-15 Parallel 20cps.....	£ 311
HR-15 Serial 20cps.....	£ 349
HR-25 Parallel 25cps.....	£ 549
HR-25 Serial 25cps.....	£ 599
HR-35 Parallel 35cps.....	£ 690
HR-35 Serial.....	£ 729
HR-15 Keyboard.....	£ 129
HR-15 Sheet Feeder.....	£ 79
HR-15 Tractor Feed Unit.....	£ 60
HR 25/35 Sheet Feeder.....	£ 185
HR 25/35 Tractor Unit.....	£ 75
TOWA	
Daisy Junior 14cps 80col, P11.....	£ 199
Daisytype 2000 18cps 132col, P11.....	£ 219
DIABLO	
630-API 40cps.....	£ 1529
630-API Sheet Feeders, from.....	£ 229
EPSON	
DX-100 Parallel 20cps.....	£ 315
JUKI	
6100 18cps.....	£ 297
6300.....	£ 645
2200.....	£ 245
2100.....	£ 169
NEC SPINWRITER	
3510/30/15 Ser/P11/Diablo 35cps.....	£ 999
7110/15 Ser/P11/Diablo 55cps.....	£ 1429
2000 Printer 20cps.....	£ 509
Ser/P11/Diablo I/Face for 2000.....	£ 89
8800 Printer.....	£ 1289
Ser/P11/Diablo I/Face for 8800.....	£ 99
Accessories for NEC printers.....	CALL
QUME	
11/40 RO (without interface).....	£ 1165
9/45 RO (full front panel).....	£ 1525
12/20 Letter Pro IS or PJ 20cps.....	£ 445
9/55 RO (full front panel) 55cps.....	£ 1895
11/55 RO (without interface).....	£ 1359
QUEEN DATA/UCHIDA	
Daisy Wheel Parallel 18cps.....	£ 215
UCHIDA DAISY WHEEL 20cps parallel.....	£ 199
UCHIDA as above Serial version.....	£ 239
RICOH	
RP-1200 Parallel/Serial 20cps.....	£ 489
RP-1300S Parallel/Serial 30cps.....	£ 789
RP-1500S P11 or Ser 8K 80cps.....	£ 1300
EXP-500 Serial 18cps, Multi I/Face.....	£ 289
FLOWWRITER 1300 48K Multi I/Face.....	£ 1279
Elec/Mech Sheet Feeder RP-1600.....	£ 445
Tractor Unit for 1600 Models.....	£ 129
SILVER REED	
EXP-400 Parallel 10cps.....	£ 219
EXP-400 Serial 10cps.....	£ 249
EXP-500 Parallel 16cps.....	£ 259
EXP-500 Serial 16cps.....	£ 289
EXP-550 Parallel 19cps.....	£ 419
EXP-550 Serial 19cps.....	£ 455
EXP-770 Parallel 36cps.....	£ 559
EXP-770 Serial 36cps.....	£ 889
Tractor for 500.....	£ 84
Tractor for 550/770.....	£ 105
Cut Sheet Feeder for 500.....	£ 163
Cut Sheet Feeder for 550/770.....	£ 163
BK Buffer for 770.....	£ 55
16K Buffer for 770.....	£ 95
48K Buffer for 770.....	£ 259
TEC STARWRITER	
F10/40 Parallel 40cps.....	£ 830
F10/55 Parallel 55cps.....	£ 1190
Elec/Mech Single Sheet Feeder.....	£ 445
Tractor for F10 unit.....	£ 129

SOFTWARE

WORDSTAR.....	£ 189
DBASE.....	£ 229
FRIDAY.....	£ 129
FRAMEWORK.....	£ 315
LOTUS 123.....	£ 269
SYN-PWR.....	£ 239
DMS-DELTA.....	£ 369
MULTIMATE.....	£ 255
OPEN ACCESS.....	£ 310
PEACHTREE ACCOUNTS.....	£ 315
SUPERCALC II.....	£ 130
SUPERCALC III.....	£ 189
MULTIPLAN.....	£ 125
TURBO PASCAL.....	£ 204
PFS FILE.....	£ 75
PFS REPORT.....	£ 75
SIDEKICK.....	£ 42
CARD/BOX PLUS.....	£ 285
CROSSTALK XVI.....	£ 120
WORDSTAR PROFESSIONAL.....	£ 245
SIDWAYS.....	£ 49
WORDSTAR 2000.....	£ 289
FLIGHT SIMULATOR.....	£ 39
NORTON UTILITIES.....	£ 65
SPREADSHEET AUDITOR.....	£ 75
TURBO PASCAL.....	£ 49
NICEPRINT.....	£ 69
P.C. PAL.....	£ 29
** WE OFFER EXCELLENT DISCOUNTS ON JUST ABOUT EVERY MAJOR BRAND OF SOFTWARE - CALL FOR QUOTATION - **	

MONITORS

SANYO	
DM-2112 40col 15MHz + P31.....	£ 83
DM-81122C 80col 18MHz + P31.....	£ 83
CD-3125 14" Normal Res. RGB.....	£ 155
CD-3117 14" Medium Res. RGB.....	£ 275
CD-3115 14" High Res. RGB.....	£ 8
DMC 7650 IBM/APRICOT Colour Monitor.....	£ 319
YAN JEN	
GN 1211 12" Green or Amber 20MHz with tilt & swivel base.....	£ 83
ZENITH	
122E 12" 15MHz AMBER.....	£ 84
123E 12" 15MHz Green.....	£ 79
Tilt base for above.....	£ 8
ZVM-133 13" Colour Hi. Res (IBM-PC).....	£ 329
Cable for ZVM-133/IBM-PC.....	£ 15
PHILIPS	
7513 ** Green, composite 20MHz.....	£ 69
7502 12" Green IBM Compatible 20MHz.....	£ 94
CT 2007 Monitor/TV RF, CVBS, RGB.....	£ 199
TAXAN	
KX 1201G 12" 20MHz, Green, P31 tube.....	£ 89
KX 1202G 12" 20MHz, Green, P39 tube.....	£ 99
KX 1212P 12" (IBM) 20MHz, Green P39.....	£ 119
NONCHROME CABLES	
Phone/Phone.....	£ 3.75
BNC/Phone.....	£ 3.75
VideoLink for Commodore 64.....	£ 3.75
Phone/Phone.....	£ 9.00
INDESIT	
APRICOT Display 12" (beige or black).....	£ 159

PRINTERS — DOT MATRIX — NEW LOW PRICES!!!

ANADEx - 100% DUTY CYCLE	
ALL MODELS.....	CALL
BROTHER	
HR-5 Portable thermal transfer (PoS).....	£ 729
HR-5 for GMB4/VC 20.....	£ 125
EP-44 Thermal transfer (KSR).....	£ 189
M-1009 Dual Interface.....	£ 155
M-1009 (IBM) 50cps.....	£ 149
2024 NLQ 190cps draft.....	£ 889
TC 600 - Typewriter - printer.....	£ 339
DISK DRIVE for TC 600.....	£ 149
CANON - NEW LOW PRICES	
PW-1080 160cps (NLQ).....	£ 263
PW-1156 160cps (NLQ).....	£ 349
F-60 80cps Thermal DRAFT/NLQ/LQ/GR 110col.....	£ 349
PJ-1080A Seven COLOUR 37cps.....	£ 379
DATA PRODUCE - PAPER TIGER	
8010 80col 180cps draft NLQ both S&P.....	£ 389
8011 as above but IBM COMPATIBLE.....	£ 389
8020 132col 180cps draft both S&P.....	£ 469
8021 as above but IBM COMPATIBLE.....	£ 469
EPSON 8145 Serial I/Face 2K buffered.....	£ 1219
8080 COLOUR as above but colour printing.....	£ 1449
8070 132col 400cps draft LQ both P&S.....	£ 1589
8070 COLOUR as above but colour printing.....	£ 1829
EPSON	
NEW LX80 80col 100cps (16cps NLQ).....	£ 206
Tractor for LX80.....	£ 19
Sheetfeeder for LX80.....	£ 39
FX-80 80col 160cps.....	£ 409
1000 F/T 136col 160cps.....	£ 420
LQ-1500 200cps (NLQ) 4 to 16" paper width.....	£ 855
EPSON 8143 Serial I/Face OK.....	£ 29
EPSON 8145 Serial I/Face 2K buffered.....	£ 59
EPSON 8148 Serial I/Face 3K buffered.....	£ 68
XON/XOFF Serial I/Face 2K buffer.....	£ 65
EPSON/COMMODORE I/Face 2K buffer.....	£ 489
EPSON 8165 PET IEEE 2K I/Face 2K buffer.....	£ 65
EPSON PET IEEE Cable 8260.....	£ 20
EPSON 8145 Serial Card 132col.....	£ 59
EPSON APPLE Cable 8321.....	£ 79
BK Buffered parallel or serial I/F.....	£ 20
16K Buffered parallel or serial I/F.....	£ 95
32K Buffered parallel or serial I/F.....	£ 125
64K Buffered parallel or serial I/F.....	£ 159
HONEYWELL	
ALL MODELS.....	CALL
MANNESMANN TALLY	
MT-80 + 100cps.....	£ 179
MT-85 80col, 180cps, IBM (corr. qual 45cps).....	£ 289
MT-86 136col, 180cps, IBM (corr. qual 45cps).....	£ 289
MT-100 160cps.....	£ 395
MT-180 160cps (NLQ).....	£ 545
MT-280 200cps, 132col, IBM (corr. qual 50cps).....	£ 825
MICRO PERIPHERALS	
CPA-80P Parallel 100cps, 80col.....	£ 179
CPA-80S Serial version of above.....	£ 196
CPA-80Q QL version of above.....	£ 219
CPA-80C Commodore version of above.....	£ 195
CPB-80P Parallel IBM COMPAT. 130cps, 80col.....	£ 199
CPB-80S As above but Serial.....	£ 209
CPB-136 Parallel IBM COMP. 130cps, 136col.....	£ 289
MP-185 165cps 136col NLQ.....	£ 236
MP-165 QL version of above.....	£ 311
MP-1651 IBM version of above.....	£ 249
SERIAL Interface for 165 series.....	£ 55
NEC	
PINWRITER P2 80col.....	£ 349
PINWRITER P3 132col.....	£ 479
Parallel Interface for P3/P2.....	£ 129
RS232 Interface for P3/P2.....	£ 129
IBM PC Interface for P3/P2.....	£ 99
Sheet Feeder for P3.....	£ 289
Tractor Unit for P3.....	£ 119
NEWBURY DATA - Heavy Duty	
ORE-830 Parallel 180cps 132col.....	£ 1019
ORE-8840 Parallel 240cps 132col.....	£ 1189
ORE-8925 Parallel 240cps 132col.....	£ 1275
ORE-8850 Parallel 300LPM.....	£ 1959
OKI - MICROLINE	
OKI-82A P&S 120cps 80col.....	£ 75
OKI-85A 200cps.....	£ 645
OKI-92P 160cps.....	£ 315
OKI-83A 120cps.....	£ 385
OKI-2350 Parallel line printer.....	£ 1492
OKI-2410P 350cps line printer.....	£ 1529
PANASONIC	
KX-P1091 120 cps NLQ, IBM COMPATIBLE.....	£ 249
KX-P1092 180 cps NLQ, 7Kbuffer, IBM COMP.....	£ 389
RADIX	
10 F/T 200cps.....	£ 439
RITEMANN	
PLUS - (FX) 80 FT compatible 120cps 80col.....	£ 149
BLUE PLUS (RX) 80 FT comp. I 140cps 80col.....	£ 229
II - (FX) 80 compatible 160cps 80col, NLQ.....	£ 265
15 - (FX) 100 compatible 160cps 136col.....	£ 395
NEW F + 80col 105cps FRONT Loading, NLQ, 2K.....	£ 224
SEIKOSHA	
GP-100 VIC 50cps.....	£ 149
GP-100 Parallel or Serial.....	£ 149
GP-500a 50cps.....	£ 189
GP-250X 50cps.....	£ 199
STAR	
SG-10 (F/T) 120cps, 80col (50cps NLQ).....	£ 195
SD-10 (F/T) 160cps, 80col (85cps NLQ).....	£ 299
SR-10 (F/T) 200cps, 80col (80cps NLQ).....	£ 399
SG-15 (F/T) 120cps, 136col (50cps NLQ).....	£ 295
SD-15 (F/T) 160cps, 136col (85cps NLQ).....	£ 399
SR-15 (F/T) 200cps, 136col (80cps NLQ).....	£ 489
TAXAN	
KP-B10 140cps 80col NLQ.....	£ 279
KP-910 140cps 156col NLQ.....	£ 368
KP-810PC IBM VERSION.....	£ 329
KP-810PC IBM VERSION.....	£ 409
TEC	
150 Parallel.....	£ 539
150 Serial.....	£ 599
TOSHIBA - 24 Wire Head	
2100H Parallel 100cps LQ.....	£ 1339
2100H Serial 100cps NLQ.....	£ 1269
Auto Sheet Feeder for 2100.....	£

AST:	
SIX PACK PLUS with 64K & s/ware from.....	£ 279
MEGA PLUS II with 64K & s/ware from.....	£ 279
I/O PLUS II & software from.....	£ 139
I/O MINI & software.....	£ 139
MP MINI (to 384K) with 64K.....	£ 215
ADVANTAGE (128K to 3MB) with 128K.....	£ 439
PREVIEW (PC/XT/AT) mono & s/ware.....	£ 289
MONOGRAPH PLUS (PC/XT/AT) & s/ware.....	£ 365
GRAPH PAK with 64K & s/ware.....	£ 585
AST-3780.....	£ 669
AST-SNA PC.....	£ 669
AST-BSC PC.....	£ 519
AST PC OX.....	£ 839
AST 5251.....	£ 585
CC-232.....	£ 239

HERCULES:	
HERCULES graphics card.....	£ 349

INTELLIGENCE UK:	
PC EXPRESS 128K.....	£ 599
PC EXPRESS 256K.....	£ 699

LAB-MASTER:	
12 BIT DATA ACQUISITION.....	£ 445
Above with 40KHz and prog. gain.....	£1374
8 BIT DATA ACQUISITION.....	£ 499
64 CHANNEL data acquisition.....	£1799
DATA Acquisition with 80KHz.....	£1889
ORCHID TECHNOLOGY.....	£ POA

QUADRAM:	
QUADLINK (emulates Apple II).....	£ 479
QUADBOARD II with 64K.....	£ 274
EXPANDED QUADBOARD OK.....	£ 209
QUADCOLOUR 1.....	£ 199

SATURN/TITAN TECH:	
ACCELERATOR PC board.....	£ 689
ACCELERATOR PC Aux. board.....	£ 135

TECMAR:	
TECMAR RAM BOARDS — too numerous please CALL	
20029 FIRST MATE with 64K.....	£ 319
21044 CAPTAIN with 64K.....	£ 329
20005 SPEECH MASTER voice synthesizer.....	£ 339
21005 AUXILIARY VOCABULARY for above.....	£ 99
20015 PROTOZOA prototyping board.....	£ 65
20017 Extender board for PC and compat.....	£ 89
20033 AMOEBA prototyping for baseboard.....	£ 159

COMPUTERS

APRICOT	
F1.....	£ 910
PC 256K + 2 x 315K + Monitor.....	£1295
PC 256K + 2 x 720K + Monitor.....	£1529
XI 256K + 10MB + Monitor.....	£2189
XI 512K + 10MB + Monitor.....	£2499
XI 512K + 20MB + Monitor.....	£2945
SANYO	
MBC 550 128K + 1 x 160K + software.....	£ 595
MBC 55 128K + 2 x 160K + software.....	£ 789
MBC 550-2 as 550 but 360K Drive.....	£ 789
MBC 555-2 as 555 but dual 360K dr.....	£1125
CRT 36 Hi Res 12" Green Monitor.....	£ 110
CRT 50 Med. Res. Colour monitor.....	£ 279
CRT 70 Hi Res. Colour Monitor.....	£ 419
MBC 232 — RS232 I/Face board.....	£ 49
64K RAM Plug In Module.....	£ 79
EPSON	
PX-8 Portable Computer.....	£ 649
120K RAM Disk for above.....	£ 249
PX8 + 120K RAM Disk.....	£ 889
QX-10 Desk Top Computer.....	£1295

PCs AND COMPATIBLES

CANON	
A-200M 256K + x 360K drives + mono display MS-DOS, GW-Basic.....	£1449
A-200C as above but COLOUR.....	£1549
COMMODORE	
PC-10 256K + 2 x 360K drives + monitor.....	£1499
PC-20 256K + 1 x 360K + 10MB + Monitor.....	£2439
COMPAQ	
PC-2 256K + 2 x 360K drives.....	£1689
PLUS Portable.....	£3098
DESKPRO 1.....	£1725
DESKPRO 2.....	£2099
DESKPRO 3.....	£3395
DESKPRO 4.....	£4525
IBM	
Mono PC 256K + 2 x 360K drives + monitor.....	£1575
Colour PC 256K + 2 x 360K + monitor.....	£1845
Mono XT 256K + 1 x 360K + 10MB + monitor.....	£3100
OLIVETTI	
M24 128K + 1 x 360K drives Mono.....	£1365
M24 128K + 1 x 360K drives Col.....	£1799
M24 128K + 2 x 360K drives Mono.....	£1539
M24 128K + 1 x 360K drives 10MB Mono.....	£2895
M24 128K + 1 x 360K drives 20MB Col.....	£3195
M21 128K + 1 x 360K drives.....	£1399
M21 128K + 2 x 360K drives.....	£1534
SANYO	
SANYO MBC 775 COLOUR PORTABLE IBM COMPATIBLE 256K RAM + 2 x 320K DRIVES, COLOUR MONITOR + MS DOS and GW-BASIC.....	£1749

PC/XT — PERIPHERALS

384K MULTIFUNCTION CARD — SIX WAY!!!

- * 64K to 383K RAM Memory
 - * RS232C Serial Port
 - * Real Time Clock/Calendar with Battery Backup
 - * RAMDISK & PSPOOL Software
 - * Optional Games Port
- Built & Tested £289.00**

7-PLUS (TM) — 7-WAY BOARD!!!

- * 2 x serial ports
 - * 1 x parallel port
 - * Games port
 - * Clock/cal with backup
 - * 4 drive floppy controller
- £299.00**

4-LAYER PC/XT MAINBOARD

- * 64K to 1MB ON BOARD
 - * 8 Fully Compatible Slots
- Built & Tested £295.00**

PC/XT CASE

- * 8-Slot
 - * Hinged lid
 - * Includes hardware
- £99.00**

XT CONVERSION KITS FOR IBM® AND COMPATIBLES

- * NEW FAST CONTROLLER!!!
- WESTERN DIGITAL 1002 SWX-2
- SEGATE ST-506 STANDARD... **£249.00**
- * 10 MEGABYTE MR-521 5¼" WINCHESTER HARD DRIVE, 2-HEADS AVERAGE ACCESS 85ms..... **£399.00**
- * 20 MEGABYTE MR-522 5¼" WINCHESTER HARD DRIVE, 4-HEADS AVERAGE ACCESS 85ms..... **£579.00**
- * HARD DRIVE CABLE SET..... **£ 25.00**
- * UPGRADE 130WATT POWER SUPPLY..... **£149.00**

RAM CHIP SALE!!!

- 4164 64K DRAM 150Ns..... **£1.99 each**
- 4128 128K DRAM 150Ns..... **£7.49 each** (for upgrade IBM AT)
- 41256 256K RAM 150Ns..... **£5.99 each** (for upgrade Olivetti-M24, Compaq Deskpro, etc.)

MAINBOARD B-103 4-Layer PC/XT.....	£295
MEGA Mainboard PC/XT.....	£249
SUPER Mainboard PC/XT.....	£249
256K M/FUNCT. 1 par, 1 ser, cl/cal, OK.....	£169
384K M/FUNCT. 6-WAY OK.....	£289
512K RAM EXPAND (2 DIP SWITCH), OK...£	95
Parallel printer card.....	£ 39
Parallel card with 64K buffer (OK).....	£109
Monochrome (text) display card.....	£119

COLOUR/GRAPHICS Card (2 layer)	
640 x 200 b/w + 320 x 200 4 colour	
160 x 100 16 colour + light pen I/face	
text: 80 x 25 & 40 x 25	
will drive TTL MONO/COMPOSITE MONO	
COMPOSITE COLOUR/rgb Monitors.....	£149

SUPER COLOUR/GRAPHICS Card (4 layer)	
64K Display Memory — TTL mono spec:	
640 x 350 b/w with 2 pages	
640 x 350 single colour 16 intensities	
80 col x 25 rows with 32 pages.	
COLOUR/GRAPHICS specifications:	
640 x 400 mono with 2 pages	
640 x 200 16 colour 2 pages	
640 x 400 16 colour	
TEXT 40 col x 50 row	
40 col x 50 row with 32 pages mono	
PC, PC-XT, PC-AT COMPATIBLE.....	£399

MONOCHROME GRAPHIC CARD VERSION II	
720 x 348 graphic display, 2K static	
RAM buffer eliminates scroll flicker	
single parallel port standard.....	£229

MULTI I/O CARD — 5 WAY!!!	
Dual floppy controller interface	
Asynchronous RS232 serial comms port	
Parallel printer port, games adaptor	
Clock/Cal with battery backup.....	£249

EPROM WRITER CARD up to 128K.....	£175
MODEM CARD V21/V23 CCITT AA/AD.....	£169
FLOPPY DRIVE CONTROLLER (4 DRIVES).£	75
TEAC FD-55B half ht 320K floppy dr.....	£175
RS232 SERIAL I/Face, 1 port 50-9600.....£	49
SERIAL Async RS232C, 2 port 50-9600.....£	69
GAMES ADAPTOR.....	£ 39
AD/DA 12 bit 1 ch-A/D, 1 ch-D/A.....	£139

TRANS-NET NETWORKING BOARD.....	£450
NetMAIL Software.....	£550
NetSPOOL Software.....	£250
NetDISK Disk Server Software.....	£150
NetDMS Data Management Software.....	£175
NET BOOT ROM for floppiless ops.....	£ 50
NET STARTER KIT.....	£975

DX45 lockable 100pc DISKETTE BOX.....	£ 17
DX50 lockable 50pc DISKETTE BOX.....	£ 15

(NOTE: We can supply most of the above as UNPOPULATED boards for OEMs in quantity)

DIGITASK

BUSINESS SYSTEMS LTD

TEL: (0342) 24631/313427
56 MAPLE DRIVE, EAST GRINSTEAD
W. SUSSEX RH19 3UR. TLX: 957547

DISKING

means business

DISKING FREEPOST, LIPHOOK, HAMPSHIRE GU30 7BR, UNITED KINGDOM

Telephone: (0428) 722563 (24 hours)

**DISKING
customers
win**

PRIZES

The
**BEST
GOODS**

The
**BEST
GIFTS**

**POINTS
make
PRIZES**

**DISKING branded
diskettes qualify
for double points**

Here is the DISKING points system,
remember Ten Diskettes = 1 Point

To receive your FREE GIFTS

All you have to do is buy any of our superb diskettes from the advertisement overleaf, and depending on the number of disks you buy, just tot up your points to see which prize you can claim. Ten disks = 1 point and pro rata.

Just tell us which gift you want on the order form overleaf - and it's yours.

Code	Description	Worth	Points
a.	Sanyo Dictation cassette recorder	£39.00	10
b.	Lorus quartz Gents Gold plated analogue watch	£26.00	10
c.	DISKING gold/blue cuff links in presentation case	£10.00	5
d.	LCD watch, calculator & pen set (mens or ladies)*	£ 8.00	5
e.	Polaroid 'All Seasons' Sports Sunglasses Red/White	£ 6.95	3
f.	Polaroid 'All Seasons' Sports Sunglasses Blue/White	£ 6.95	3
g.	DISKING 15" x 11" gusseted Burgundy Document case	£ 5.00	3
h.	DISKING 15" x 11" gusseted Gold Document case	£ 5.00	3
j.	LCD Credit card Memory calculator with wallet	£ 5.00	3
k.	LCD Travelling Alarm or Car clock, with hourly chime	£ 4.00	2
m.	Silky smooth 'Satin gold' ballpoint pen	£ 3.00	2
n.	DISKING leather & gold/blue key fob	£ 2.50	1
p.	DISKING playing cards 2-pack set red & blue	£ 2.00	1
q.	Satin chrome 'Political' ballpen, writes red or blue	£ 2.00	1
r.	DISKING Ladies gold/blue stick pin	£ 1.00	0.5
s.	Memorex dB series C.90 Cassette tape	£ 1.00	0.5

*Very limited quantity in stock

We reserve the right to substitute an alternative gift with the same points value, as gift stock becomes exhausted.

SEE OVER
FOR

much
NEW LOWER PRICES



CAMEL PRODUCTS

NEW POLYPRINT for Spectrum



... The interface which likes to say... Ja and Oui and Si and of course YES! A Spectrum Centronics interface with multilingual chars in EPROM, as in EPSON FX80 printer. Printer driver also in EPROM. User notes show how to use EPROM for UTILS or down loadable chars.

POLYPRINT from Silicon City £44.95

PRINT-SP for Spectrum
Low cost Centr. I/F. with CABLE. S'ware on tape. £31.25

EPROM PROGRAMMERS

BB-PROM for the BBC. With fast gpm'g. ZIF skt, Vpp generator & s'ware in S.W.R. for 2764/128 EPROMS. £29.95

Q-PROM for the QL. A powerful programmer with Fast and Smart gpm'g s'ware in firmware. For 2764/128 & 'A' types, usable in ROM cartridge for your own utilities, etc. CHECK, READ, CRC, BLOW & VERIFY part or all EPROM. £69.95

Q-CARTROM reader for QL. Takes 2764 or 27128 £5.95

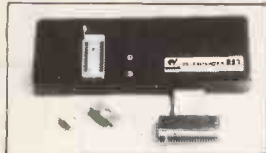
PROM-64 for Commodore C-64. Fast gpm'g. ZIF skt, Vpp generator, s'ware on tape for 2764/128 EPROMS. Full functions incl. C.R.C. £34.75

64-CART for 2X64K EPROMS for the Commodore 64. £5.95

BLOPROM-SP

A uniquely sophisticate EPROM PROGRAMMER

Eprom programmer for the 2516/32/32A/64/64A/128/128A. CHECK, READ PROGRAM & VERIFY all or part of EPROM. So immensely user friendly you'll hardly need the manual. Designed for the beginner but includes a single key entry route for the professional. Supplied as firmware, the mic driver routine alone is worth more than the price of BLOPROM-SP. No Personality Cards, or other additions, just a Spectrum. Several inbuilt safety features. Onboard Vpp generation. 28 pin ZIF socket. Cabled connector and extender plug. ABS case. £89.95



STATUS NO. OF SYSTEM --HEX
EPROM TYPE --27128
RAM START ADDR --0000
EPROM ST. ADDR --0000
JOB LENGTH --4000
TASK --CHECK

WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO RAM
Y) BLOW AN EPROM WITH GATA FROM RAM
Z) VERIFY THAT EPROM DATA IS THE SAME AS IN RAM
O TO QUIT R TO RESTART
FAST CODES AVAILABLE
D H PR WXYZ

AT LAST!

For the Spectrum user. Put your programs, utilities, Assemblers into EPROMS for instant load from the unique ROM-SP.



ROM-SP for Spectrum
Ingenious unit for Spectrum with 2X28 pin sockets and a Reset Button allows up to 16K of Basic or M/C program to RUN or LOAD instantly from EPROMs. Cabled connector and full extender card. NOTE: Does not disable Sinclair ROM. £29.95

PROMER-SP for Spectrum
An economical Spectrum programmer for 2764/128. Zero insertion force socket & software on tape. £29.95

PROMER 81-S
The very popular ZX81 programmer for 2761/32 EPROMs has been adapted to the Spectrum and the price is kept low. £24.95

DHOBI 1 UV ERASER
Compact. Mains powered. Safe. Fully cased. Up to 3 EPROMS. £18.95

DHOBI 2 With automatic timer. £22.95
Only with a Camel Programmers & while stocks last.
* YOU BETTER BELIEVE IT! *
NEW 2764 or 27128. £2.99 ea.

CRAMIC-SP NEW for Spectrum
Ingenious software paged 16K non-volatile CMOS RAM to co-exist in the same area as Spectrum ROM. Easy storage and retrieval of BASIC, M/C or DATA on a 48K Spectrum. £89.95

NIKE POWER BUFFERS
NiCd battery back-up for Spectrum ZX81/ATMOS. £17.35

DREAM-81 ZX81
64K Rampack with link options to disable 0-8-16K. Plus a 28 pin EPROM socket for 2716, 2732/2764 and 27128. £59.95

MEMIC-81 for XZ81
4K CMOS RAM with lithium battery. Easy SAVEing, 10yr storage and instant retrieval of programs. £29.95



UK. VAT extra. P+P UK Free Europe+5% No VAT on exports Overseas+10%
TEL: (0223) 314814 TLX81574 CML
One Milton Road Cambridge CB4 1UY

CAMEL PRODUCTS

Circle No. 149

SWAP

MICRO TO MICRO FILE TRANSFER SYSTEM



"Get your microcomputers talking to each other!"

SWAP allows you to transfer any programs and data between 2 computers of different manufacture. SWAP consists of 2 floppy disks and a cable configured for your 2 chosen computers. Here are some of the formats available:

IBM PC	IBM Compatibles	Sirius
Apricot	Apple (CP/M)	HP150
Televideo	Superbrain	BBC
Sanyo 555	DEC Rainbow	Kaypro

If your format is not in our extensive range we can usually produce it at little or no extra cost.

The price of SWAP is £158 (£135 plus VAT and postage and packing). Please specify your computers when ordering.

MERCATOR COMPUTER SYSTEMS LTD
3 Whiteladies Road, Clifton, Bristol BS8 1NU.
Telephone: (0272) 731079
Telex 44220 Comtel Ref 247



SWAP-SWAP-SWAP-SWAP-SWAP

Circle No. 154

The 'Classic' Menu Generator.

Eliminate all user contact with operating system commands. Use MENUGEN from Microft Technology to create menus to access all your regularly used programs.

MENUGEN is a utility which will create menus for any activity. A menu selection will run a program, call another menu, return to a previous menu, run a basic program, execute operating system commands, or exit to the operating system.

User Ltd. Selection Menu

- 1 ASPECT
- 2 Wordstar
- 3 Lotus 123
- 4 Disk formatting menu
- 5 Exit to operating system

Please type in selection number

FACILITIES INCLUDE

- UP TO 20 MENU OPTIONS PER MENU SCREEN
- UP TO 15 LEVELS OF NESTED MENU
- ANY NUMBER OF LINES OF HEADINGS AND FOOTNOTES
- USE OF COLOUR - FULLY USER DEFINABLE
- 'ARE YOU SURE?' MESSAGE OPTION AFTER ANY SELECTION
- PROMPTING FOR UP TO 16 PARAMETERS AFTER ANY SELECTION
- OPTIONAL PASSWORD PROTECTION ON MENU SELECTIONS
- OPTIONAL LOGGING OF ALL SELECTIONS TAKEN

MENUGEN is available for most CP/M, MS DOS or PC DOS micros including IBM PC/XT/AT and compatibles, Sirius, Apricot, HP150, DEC Rainbow, and many Z80 machines. MENUGEN costs £48 + VAT (£55.20) for a single user licence, or £120 + VAT (£138) for a network licence, and is available from Microft Technology Limited, The Old Powerhouse, Kew Gardens Station, Kew, Surrey TW9 3PS. To order, or for further information, telephone 01-9488255.

MENUGEN

MENUGEN is a Trade Mark of Microft Technology Ltd and is a British product.

Circle No. 155

During the past few months I have devoted rather too much space to interesting new microprocessors and their complex peripheral circuits, with the result that memory components have unfortunately been rather neglected.

This has not been due to a deliberate policy of victimisation on my part. Each month, when limbering up in preparation for setting pen to paper, I sort through a four-week hotchpotch of press releases, data sheets and news items. There are usually a number of glamour items which catch my eye, and I choose the one which appears to have sufficient depth and interest for me to then concoct a distilled brew for this column.

Every month there are numerous items which by themselves are not adequate column fodder, even though they may be interesting in a somewhat limited way. Now the pangs of guilt presumably experienced by all wielders of the censor's blue pencil have got to me, and as a penance I offer this month a bumper compendium of some of the smaller items which were passed over.

MEMORY DEVICES

The theme — for there has to be one — is memory devices, because in recent months there have been quite a number of interesting developments. Memories last got star treatment when I covered the status of 256K dynamic RAMs. At that juncture I predicted, I believe, that before too long the price per bit would drop below that of the 64K devices. That happy event has now occurred, and as a result very few designers will be bothering with 64K RAM chips any more, despite the fact that for some considerable period many more 64K chips than 256K chips will be sold for existing designs.

Surprisingly, some second-generation 256K chips with improved features are now becoming available. One such chip is the Intel 51C256H, which offers ripple mode fast addressing of a random or sequential selection of up to 512 bits within a row to give cycle times of less than 65 nanoseconds. It is fabricated using an advanced low-power CMOS process.

For some designers however, even 256Kbits per package are insufficient, and as a result memory suppliers have developed some interesting ways of producing tomorrow's memory size today, although unfortunately at a premium price. Electronic Designs Europe, for example, is selling 1Mbit dynamic RAM devices which are actually assembled from

four conventional 256K chips in leadless packages mounted on a 22-pin single in-line ceramic substrate along with appropriate decoupling capacitors. Two organisations are available, 256K by 4 and 1M by 1, which cater for most types of memory architecture.

SQUEEZED CHIPS

Another way to get a bigger device is to use one of the Micron Technology Inc. DRAM arrays which actually utilise older, but safer, unpackaged 64K chips squeezed into a single 1in. square 68-contact flat leadless chip carrier package. The MT-8064 is organised as 64K by 8, the MT-1512 as 512K by 1, and the MT-9064 as 64K by 9. In each case 10 64K chips are used to provide a redundancy factor. The 64K chips are squeezed together so tightly that it seems a shame that they all had to be sawn from their parent wafer in the first place. Perhaps this demonstrates that eventually the logic of wafer-scale integration will become inescapable.

All the devices mentioned so far are, of course, dynamic in operation. This means that they have to be refreshed continuously, or else they lose their data. The advantage of dynamic RAMs is that they provide the highest memory density of all, so the penalty of having to provide special refresh circuitry is usually acceptable.

But not always: the Hitachi HM-65256AP is a dynamic RAM device with on-chip refresh logic, making it a so-called pseudo-static memory array organised as 32K by 8. For some small systems a single 28-pin HM-65256AP package is all the RAM needed, and there is therefore an important niche for these designs. Better still would be a truly static 256K chip, and Mitsubishi has just announced that it will have a CMOS device available soon with this specification.

Not all new RAM devices are aimed at main-memory applications however. The CY-

7C401/2/3/4 series from Cypress Semiconductor are designed to act as buffers between processors and peripheral functions operating at different speeds, and are therefore organised as CMOS first-in-first-out (FIFO) memories with completely asynchronous read and write logic. The very high speed requirements and the need for on-chip address logic means that memories of this type are small, typically organised as 64 by 4 bits.

Giant strides have also been made in the other variety of main memory, namely read-only memory or ROM. Of course, ROM has generally been used to hold fixed system software such as a disc operating system and a Basic interpreter, but today it is also being increasingly used to hold applications packages such as spreadsheet, word processor and database programs.

The current state of the art seems to be about 1Mbit of masked program ROM in a 28-pin dual in-line package, fabricated in either NMOS or CMOS technology. The MSM-531000P NMOS device from Mitsubishi, organised as 128K by 8, is typical. It offers an access time of 250 nanoseconds and is ideal for the mass production of identical software — more correctly called firmware — for applications in personal computers and the like. It is not well suited for much else, however, because it is necessary to order many thousands of these devices all containing the same code.

ULTRAVIOLET LIGHT

During development or field trials it is often necessary to revise ROM-based code. This is an impossibility with masked devices, so for this stage of design erasable, programmable read-only memories or EPROMs are used. In the EPROM field, developments have been spectacular in recent months, and examples of the latest state of the art are the Intel 27512 and 27513 64K by 8 devices. They are both fabricated using an advanced



BY RAY COLES

MEMORY REFRESH

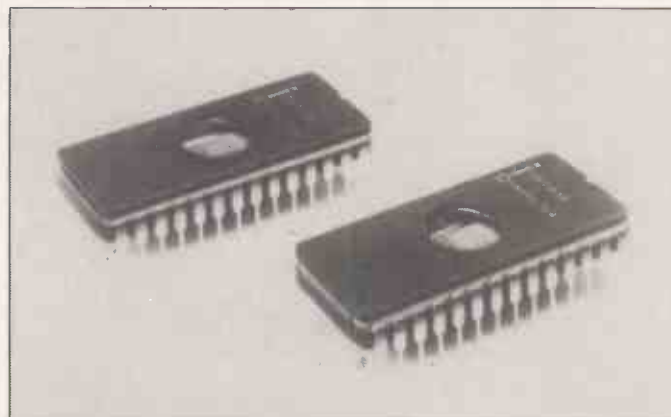
Developments in RAM, ROM and related devices are just as significant as new microprocessor technology.

NMOS process, and are erasable using short-wave ultraviolet light.

The 27513 is particularly interesting because it is organised as four 16K by 8 pages, only one of which occupies space in the microprocessor memory map at any one time. If the system software can be organised to suit, the 27513 can quadruple available code space because the pages are not selected by direct addressing, but are instead selected by the generation of a special page address sequence on the control and data buses. It is ideal for memory-limited eight-bit systems.

Also from Intel, the world leader in EPROM technology, comes the 27916 KEPROM — an unfamiliar acronym which stands for keyed-access EPROM. This 16K by 8 device is designed to discourage hackers. It foils all attempts to obtain improper access by requiring the use of an encrypted authentication handshake sequence before the stored data can be read or used as executable code. All KEPROMs contain encryption circuitry to implement a proprietary logic combination of a random number together with a confidential user-defined 64-bit key, which is programmed into a special location on the chip.

In the future there will no doubt be many more developments. Already I have seen press releases detailing soon-to-be-available 1Mbit DRAMs; they are Japanese, of course. And perhaps before long we shall even see the incredible Sinclair/Catt wafer-scale mass-storage devices. Stranger things have happened.



The Intel 27916 KEPROM: hacker-proof code at last?

COMPUTING TITLES FROM CHAPMAN AND HALL

The BBC Basic Idea



RICHARD FORSYTH AND BRIAN MORRIS

This new version of one of the best ever introductory books on BASIC — *The BASIC Idea* — is aimed at BBC microcomputer users.

The aim of this book is to turn a novice computer user into a competent computer programmer by showing readers how to use modern methods of problem analysis and design. With this expertise, readers will be able to use BBC BASIC to solve realistic problems, and have fun in doing so.

July 1985 234 x 156 c.278 pages
Paperback 0 412 24900 6 £6.95

Databases

How to manage information on your micro

PETER LAURIE

Information management is one of the things computers do well. *Databases* explains clearly how information is organised in microcomputers, how the software works and how to get hold of relevant data and keep it up to date.

June 1985 176 pages
Paperback 0 412 263807 7 £8.95

Which Peripherals?

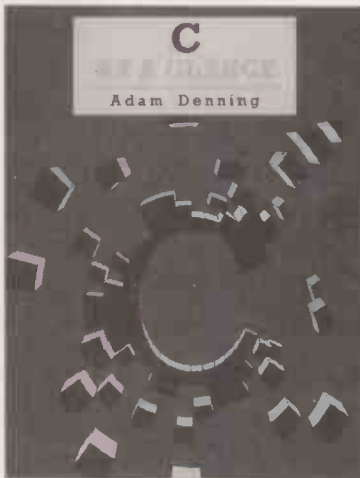
How to choose them, how to use them

PIERS LETCHER

This book will help you to find out just what your needs are and how best to fulfil them. It will save you time and money spent in fruitless sifting through dealers lists. The book gives a comprehensive guide to what is available, which add-on works with which micro; what to look for and where to go when buying peripherals for your micro.

February 1985 180 pages
Paperback 0 412 26510 9 £5.95

C At A Glance



ADAM DENNING

The computer language **C** is now regarded as one of the most important systems programming languages available, as it is compact, economical and relatively easy to use. This book aims to teach **C** to the beginner and assumes knowledge only of the host computer. The history of **C**, its basics and fundamentals and more advanced uses are all described with clarity and numerous examples are provided which demonstrate the techniques.

September 1985 234 x 156
180 pages Illustrated
Paperback 0 412 27140 0 £7.95

The Hitch-Hiker's Guide to Artificial Intelligence



RICHARD FORSYTH AND CHRIS NAYLOR

This book is a practical, do-it-yourself guide for home micro users who want to delve into the exciting world of AI (Artificial Intelligence). It begins with a clear introduction to the principles of AI with an explanation of why its concepts are so important, how it can be fun to explore on micros. The book avoids the specialist AI programming languages and presents all programs in BASIC.

August 1985 234 x 156 272 pages
BBC BASIC edition: 0 412 26970 8 £8.95
Apple BASIC edition 0 412 27090 0 £8.95

Expert Systems

Principles and case studies

Edited by RICHARD FORSYTH

This book explains the concepts behind expert systems readers who know about computing but are unfamiliar with the latest research and with what they can do themselves in building and using expert systems.

An expert system is a software package which encapsulates specialist knowledge about a particular area of expertise and is capable of making intelligent decisions within that area. Areas in which real and working expert systems are now used include medical diagnosis, geology, organic chemistry and computer fault-finding.

October 1984 234 x 156mm 244 pages
Hardback 0 412 26270 3 £20.00
Paperback 0 412 26280 0 £9.95

Chapman and Hall

11 New Fetter Lane, London EC4P 4EE.

Basic might be the world's best-known programming language but it has an awfully bad public image. How many times have we heard it described as unstructured and spaghetti-like, with some critics even claiming that Basic has the same effect on your thinking ability as poorly fitted spectacles have on your eyesight.

True, Basic has many faults, but to call it unstructured is surely to blame the tool for the shortcomings of the product. It is in the finished programs where you must look for structure; the language is merely a means to that end. To criticise Basic for the mess that some programmers make of their coding is like blaming English for the trashy novels that some writers churn out. In fact, Basic programs can be as well-structured as any, provided you are prepared to follow a few simple rules.

By far the most important of these is to avoid the Goto statement like the plague. This is easier than you might think. Assuming that you are using one of the many implementations of the ever-popular Microsoft Basic, you will always be able to get by with three control-flow constructs: If-Then-Else, For-Next and While-Wend.

Over the last few years, I must have written nearly a quarter of a million lines of Basic. If you looked through all these programs, you would find scarcely half a dozen Gotos in the lot. If you do not believe me, just remember that Pascal and C also support the Goto statement, yet how many users of these languages even know it is there, much less rely on it?

It is a different story, however, with the Goto's cousin, the Gosub. The essence of modular programming is to split large chunks of code into small pieces, so subroutines are pretty vital. The problem with Gosub is that it works with line numbers, and these have no logical connection with the job that the subroutine is doing. If your Basic supports alpha labels, be thankful and use them. Better still, take advantage of user-defined functions whenever possible.

Make each Gosub routine a distinct piece of code. Give it a name, if only in a Rem; surround it by blank lines to make it stand out, and be sure that it follows the elementary rules of modular programming. Each routine should have just one entry and exit point, a well-defined interface with the calling program, and no side effects elsewhere.

Incidentally, putting a blank line around subroutines is not always possible, because standard

```

1000 ' Program: COUNTER
      Counts the words in a text file.

      Written by M.Lewis, July 1985. Version 1.0.

1010 '
      The program displays the number of words in a specified file. The
      file is assumed to be ASCII, with lines delimited either by
      carriage-return/linefeed or just line-feed.
1020 '
      For compatibility with WordStar, high-order bits are cleared and
      dot commands are ignored.
      A word is defined as a string of letters delimited by non-letters.

1030 '
      Variables used:
      INFILES          Input file name
      STARTLINE#      Start-of-line flag
      INWORD#         Flag to say if current char is in a word
      FOUND#         Flag to say new word has been found
      CHARS           The current character

1035 '
      Constants used:
1040 '
1050 '   DOTS="."      'Introduces a WordStar dot command
1060 '   LINEFEED$=CHR$(10) 'ASCII line-feed
1070 '   TRUEX=-1: FALSEX=NOT TRUEX
2000 '

-----
Main path of program
2010 '
      GOSUB 4000          'Initialisation; open files

2020 '
      WHILE NOT EOF(1):
          GOSUB 5000      'Get next word

2030 '
2040 '   WORDSX=WORDSX+
          'Count it

2050 '
2060 '   GOSUB 6000      'Display count and closedown
      END
4000 '

-----
Initialisation routine.
      Gets file name from user and opens file; initialises flags.

4010 '
      LINE INPUT "Please enter file name ", INFILES
4020 '
4030 '   OPEN "1",1,INFILES
4040 '   PRINT: PRINT "Counting in progress"
4050 '   STARTLINE#=TRUEX: INWORD#=FALSEX
      RETURN
5000 '

-----
Get next word.
      Reads one char. at a time until complete word processed;
      takes care of high-order bits and dot commands

5010 '
      FOUNDX=FALSEX:

      WHILE NOT FOUNDX AND NOT EOF(1):
          CHARS=INPUT$(1,1) 'Get next character
          CHARS=CHR$(ASC(CHARS) AND 255)
          'Mask high-order bit
          IF STARTLINE# AND CHARS=DOTS THEN
              WHILE CHARS(1)=LINEFEED$ AND NOT EOF(1):
                  CHARS=INPUT$(1,1)
              WEND 'Skip dot command
          IF CHARS=LINEFEED$ THEN
              STARTLINE#=TRUEX
          ELSE
              STARTLINE#=FALSEX
          IF CHARS="A" OR (CHARS="Z" AND CHARS("a") OR CHARS="z") THEN
              INWORD#=FALSEX
          ELSE
              IF INWORD#=FALSEX THEN
                  INWORDX=TRUEX: FOUNDX=TRUEX
          WEND
5060 '
5070 '   RETURN

6000 '

-----
Display results and close down
6010 '
6020 '   PRINT: PRINT "No. of words:", WORDSX
6030 '   CLOSE
      RETURN

```

Listing 1. A short Basic program, written according to the rules of style described in this article. The modular structure is emphasised by the broken lines separating the various subroutines.

Basic does not support such an obvious requirement. In Microsoft Basic, you can fake it by placing a Line feed character immediately after the line number. This generates a physical line break without ending the numbered program line. If your keyboard has no Line feed key, use Control-J — or Control-Enter on the IBM PC. Alternatively, press the Tab key until the cursor wraps to the next line.

In fact, when it comes to program style, the Tab and Line feed keys are pretty well indispensable. By style, I mean the

way a program looks to a human reader rather than the computer. A well-styled program is one that is easy to understand, and therefore easy to debug and modify. Using indentations and physical line breaks to emphasise the program's structure is the first principle of good programming style.

This is most commonly done in the block statements like For-Next and While-Wend. Listing 1, a simple word-counting program, has several examples. If-Then-Else constructs are handled similarly, with the If-Then and the Else each given a physical line to itself. This



BY MIKE LEWIS

THE BASIC RULES OF STYLE

There is nothing wrong with programming in Basic, as long as you observe some simple ground rules.

arrangement can of course be nested, as line 5030 shows.

Personally, I like to go one further by placing a Tab immediately after the line number. Given that these numbers have nothing to do with the logic of the program, they ought to keep their distance from the actual code, and hitting the Tab key is the easiest way to bring this about. I also make liberal use of tabs for lining up comments. Another example of the use of this handy key is in Data statements.

Comments, of course, are *de rigueur*, even in the smallest programs. Just as a good book has an introduction, so every program should start with a comment block which prepares the reader for what is to follow. As a minimum, this should contain the program name, date written, version number, programmer's name, and a short description of the program's function.

Some programmers also like to list all the variables in the introductory comment, and even the names of files, arrays, user functions and the like. This might sound like a lot of typing, but it could save you, or someone else, a good deal of time when you need to alter the program in years to come.

The next rule is to choose variable names with great care. They should be readable as well as meaningful. A good test of a program's style is to see if you can understand it when it is read aloud, so avoid unpronounceable abbreviations. Virtually all mod-

(continued on next page)

(continued from previous page)

ern Basics offer more than the two-character variables of the original standard, so take advantage of them. Also, avoid using like-sounding names for different items: Total.Amount and Totl.Amnt, for example.

It is a good idea to make constants into variables. After all, a variable does not have to vary. Your program might test for a page break with a statement like

```
IF LINE.COUNT% = 66 THEN
  (new-page routine)
```

But it would be better to hold the magic value of 66 in a variable, and to do the test as

```
IF LINE.COUNT% =
  PAGE.LENGTH% THEN
  (new-page routine)
```

Apart from making the workings of the program that tiny bit clearer, this approach would help you out if you ever decided to switch to 72-line paper.

This rule should be followed even if the constant is truly constant. Rather than sprinkling 3.14159 around your program, set up a variable called Pi and use that instead. Nobody expects this particular value to fluctuate, but coding it this way will lower the risk of a hard-to-spot typing error.

Another good practice is to

initialise variables and constants close to where they are used. If your program does all its printing in just one module, it would be better to set the line count to zero and the page length to 66 at the start of that routine, rather than at the very beginning of the program. This will help the reader to see what the initial values are, and also simplify the job of using the same module in another program.

Always type at least one space between each word in a statement. It's true that some interpreters allow keywords and variable names to run together, but the human eye is less tolerant. Many Basics also permit the same variable name to be used for different data types. Thus Count\$ and Count% are completely different objects. But again this might be confusing to a human reader and is best avoided.

Using constants for flag settings is something you might like to consider. In listing 1, the values True% and False% are used in this way, these being much more obvious than their numeric values of -1 and 0.

As another example, suppose your program analyses a customer's payment record in order to set up a credit rating. You might have a field called Status% which contains, say, 1 for bad risk, 2 for

unknown, 3 for OK, and so on. Instead of assigning and testing these numbers directly, try re-storing them in fields called Bad.Risk%, Ok%, etc. You could then use constructions like

```
IF STATUS% = BAD.RISK% THEN
  (credit refusal routine)
```

which should be clear enough to anyone. A similar technique can be used for an index into an array, the effect being a bit like Pascal's user-declared scalars.

Incidentally, if all the variables in your program are integers, it is worth putting

```
DEFINT A-Z
```

at the head of the program to avoid the need for those irritating percent signs after every data name.

Flag settings, of course, do not have to be integers. Some programmers prefer to use character strings. So the credit status field in this example would be Status\$, and it would hold actual words like "Unknown" and "Possible". This could give rise to


```
WHILE STATUS$ = "Unknown"
  (perform status check)
```

This will serve just as well even if the strings are not intended to be seen by the program's users.

One final tip: always use paren-

theses in complicated arithmetic and relational expressions, even where the interpreter does not itself require them. I never feel completely at home with the ranking of operators, and I work on the assumption that anyone reading my coding might be equally uncertain. Brackets are a good way of breaking a complicated expression into simpler units.

By now you might be wondering what effect all these Rems, long variable names, character strings, parentheses, etc., will have on your program's running time. Good style is indeed the enemy of program efficiency. If your Basic is interpreted rather than compiled, most of the principles set out here will result in bulkier source files and slower programs; eliminating the Goto, on the other hand, will tend to speed things up.

If you are developing a highly competitive mass-market package, this could be a problem. But nobody would use interpreted Basic for a product that is to rival Lotus 1-2-3. In most cases, the additional running time of a well-styled program will be tiny, especially when compared to the savings in your own debugging and maintenance time that these principles will help you to achieve. 

POWER SUPPLY PROBLEMS?

- BLACKOUTS.
- MICRO BREAKS.
- FREQUENCY VARIATIONS.
- VOLTAGE SURGES, TRANSIENTS.
- VOLTAGE SAGS.



Eliminate them ALL with an 'ASM' Uninterruptible Power Supply from LEROY SOMER, one of Europe's largest electrical machinery manufacturers. Simply plug your computer and it's peripherals into the 'ASM' for COMPLETE PROTECTION from ALL mains disturbances.

- True 'NO-BREAK' performance.
- Output totally independent of Input.
- Self contained, zero maintenance batteries.
- 15 mins battery back-up, in standard form.
- State of the art electronic circuitry.
- Far smaller and lighter than comparable units.
- Units 0.5KVA to 5KVA.
- Cabinet or rack mounting.

Far superior to a voltage stabilizer or a 'line condition', an Uninterruptible Power Supply is the ONLY way to guarantee continuous PURE, CLEAN POWER to your business computer.

For colour brochure write or phone to:

LEROY SOMER LTD, BUILDING No.9,

RIVERSIDE WAY, UXBRIDGE, MIDDLESEX, UB8 2YF. TEL: (0895) 72373.

ATARI 520ST

POWER WITHOUT THE PRICE

THE NEW ATARI 520ST

Under the new leadership of Jack Tramiel (former boss and founder of Commodore Business Machines), Atari Corporation have marked their entry into the world of business/personal computers with a machine which leaves the competition standing. Tramiel's slogan 'Power Without the Price' has been implemented in the manufacture of the new 512K Atari 520ST colour computer which offers the user amazingly high performance at an incredibly low price. Launched as a work-station, this new system incorporates seven software packages as well as the 520ST computer with 512K RAM, mouse controller, high resolution monochrome monitor (640x400), 95 key keyboard (with 18 key numeric keypad), MIDI interface, GEM and a 500K 3 1/2 inch disk drive, all for the package price of only £651.30 (+VAT = £749). Dubbed the 'Mac beater' and the 'Jackintosh' (after Atari's Chief, Jack Tramiel), Atari's new machine has been directly compared with the Apple Macintosh RRP £2995 (+VAT = £2985) which offers similar features and capabilities but at a much higher price. Favourably reviewed by the UK's highly critical specialist computer press, the 520ST is likely to make a great impact in this country as a sophisticated alternative to an IBM PC, APRICOT or APPLE MACINTOSH. Unlike its overpriced competitors, the Atari 520ST can be linked up to a colour monitor to unleash a choice of up to 512 colours. The addition of colour brings out the full potential of graphics packages such as GEM.

USER FRIENDLY GEM OPERATING SYSTEM

The power of the ST is harnessed and made user friendly by the new operating system 'GEM' from Digital Research. GEM stands for Graphics Environment Manager and allows a user friendly colour or B/W graphics interface which closely resembles that of the Macintosh. This similarity extends to the use of moveable resizable windows, icons to represent objects such as disks and disk drives, and the use of pull down menus and a mouse. The advantage of all this is that the computer becomes extremely easy to use. GEM has now been implemented for the Acorn, ACT, Atari, IBM, ICL, and Olivetti. Software written for GEM on one computer should also run under GEM on another computer. This will enable the market to quickly produce a large library of standard interchangeable software.

FREE SOFTWARE AND FUTURE EXPANSION

The Atari 520ST comes supplied with seven free software packages as listed below: 1) TOS - Tramiel Operating System based on CPM 68K, 2) GEM Graphics Environment Manager by Digital Research (DR) giving a WIMP (Window, Icon, Mouse, Pull down menu) environment, 3) DR GEM Paint for creating graphics masterpieces, 4) DR GEM Write for word processing, 5) Logo learning language to enable you to write your own programs easily using turtle graphics, 6) DR Personal Basic a powerful user friendly version of the Basic programming language, 7) BOS operating system giving you access to dozens of business applications packages already available on the market. Designed with future expansion in mind, the ST also features a host of different interfaces to the outside world and an impressive list of accessories is planned. Atari will soon be releasing a 1000K (1MB) 3 1/2 inch disk drive, and a 15MB hard disk storage system as well as a mass storage compact disk (CD) player capable of storing an entire 20 volume encyclopedia on one disk. A full range of inexpensive printers are planned including dot matrix, daisywheel and thermal colour printers. With its unbeatable graphics, speed and software at a price which is far below that of any comparable personal computer currently on the market, the ST is all set to go battle with the competition. To receive further details of the ST from Silica Shop, just fill in the coupon below with your name and address details and post it to us.

Silica Shop Price: £651.30 + £97.70 VAT = £749.00 This price includes:
 ★ 512K RAM ★ B/W MONITOR
 ★ MOUSE ★ 500K 3.5" DISK DRIVE
 ★ GEM ★ KEYBOARD (95 KEYS)



ATARI 520ST SPECIFICATION

MEMORY
 512K RAM (524,288 bytes)
 16K ROM expandable to 320K
 Port for add-on 128K programmable ROM cartridges
 200K TOS operating system

GRAPHICS
 Individually addressable 32K bit-mapped screen with 3 screen graphics modes
 320x200 pixels in 16 colours (low resolution)
 640x200 pixels in 4 colours (med resolution)
 640x400 pixels in monochrome (high res)
 18 shades of grey in low res mode
 512 colours available in low/medium res
 8 levels of each in red, green and blue

ARCHITECTURE
 4 custom designed chips:
 GLUE Chip - MMU Memory Mgmtmt Unit
 DMA Controller - Graphics Processing Unit
 10/32 bit Motorola 68000 processor at 8MHz
 eight 32 bit data registers
 eight 32 bit address registers
 16 bit data bus/24 bit address bus
 7 levels of interrupts/56 instructions
 14 addressing modes/5 data types

DATA STORAGE
 High speed hard disk interface
 Direct memory access 1.33 Mbytes per second
 CD (Compact Disc) interface
 Built in cartridge access
 Dedicated floppy disk controller

RAM DRIVE
 500K (formatted) 512K 3 1/2" floppy d/drive
 349K (unformatted) storage capacity

SOUND AND MUSIC
 Sound Generator
 Frequency control from 30Hz to above audible
 3 voices (channels) in wave shaping sound
 in addition to a noise generator
 Separate frequency and volume controls
 Dynamic envelope controls
 ADSR (Attack, Decay, Sustain, Release)
 Noise generator
 MIDI interface for external music synthesizers

KEYBOARD
 95 key microprocessor
 Standard QWERTY typewriter styling
 Ergonomic angle and height
 85 keys including 10 function keys
 Numeric keypad - 18 keys including ENTER
 One touch cursor control keypad

MONITOR
 12" screen - high res monochrome monitor
 640x400 monochrome resolution
 85 keys including 10 function keys
 Note: Some of the above specifications are pre-release and may therefore be subject to change

VIDEO PORTS
 Display - Low Resolution - 40 columns
 Med/High Res - 40/80 plus cols
 Medium res RGB (Red/Green/Blue) output
 High resolution monochrome (Black & White)

COMMUNICATIONS
 Bidirectional centronics parallel interface for printers, or modems capable of Input/output
 RS232C serial modem/printer interface
 Floppy disk controller (Western Digital)
 Maximum baud Rate up to 19,200
 High speed hard disk interface
 2 joystick ports (one for 2 button mouse)
 MIDI interface for external music synthesizers

GEM WIMP ENVIRONMENT
 WIMP - Window Icon Mouse Pop-down menu
 Two button mouse controller
 Icons/Pull down menu/Windows
 GEM VDI - Virtual Device Interface
 GEM AES - Application Environment Services
 GEM BBT - Bit Block Transfer
 Real time clock & calendar

SOFTWARE
 GEM environment
 with user friendly Macintosh style operation
 TOS - Tramiel Operating System
 Atari's own system based on CP/M 68K with hierarchical directory & file structure plus a host of MS DOS & UNIX command structures
 BOS - Business Operating System
 to run any standard BOS business programs
 GEM desktop
 with GEM PAINT graphics mgmt system and GEM WRITE word processor
 Personal BASIC and DR Logo
 originally written by Digital Research (DR)
 Very much like those on other machines
 except for the extensive use of pull-down menus, mouse control and windows

VARIOUS
 Dimensions 470mmx240mmx60mm
 Replaceable external power supplies
 Expansion: 3 1/2" floppy disk drives 500K/1000K
 (two drives can be connected)
 3 1/2" 15MB hard disk
 CD (compact disc) drive
 Dot matrix & d/wheel prints (black)
 Thermal dot matrix (colour)
 RGB & monochrome monitors

LANGUAGES
 BASIC & LOGO supplied
 Many others will soon be available, including
 Assembler, BCPL, C, Cobol, Compiled Basic
 Lisp, Modular 2 and Pascal

MACINTOSH v F16 v 520ST

Imagine a Fat Mac - the 512K Apple Macintosh - but with a bigger screen, a far bigger keyboard with numeric keypad, cursor and function keys, and colour. That gives you some idea of what the Atari 520ST is like, except for two important things. First the Atari seems faster. Second the Atari system is about one third of the price. June 1985 - Jack Schofield - PRACTICAL COMPUTING

FEATURES OF BASIC SYSTEM	APPLE MACINTOSH	APRICOT F16	ATARI 520ST
Price includes B/W Monitor	YES	NO - extra £200	YES
Keyboard size mm (LxDxH)	330x147x50	450x167x28	470x240x60
Keyboard size ins (LxDxH)	13x5 7/8x2	17 1/2x6 1/2x1	18 1/2x9 1/2x2 1/2
3 1/2" D/Drive (Unformatted)	500K	500K	500K
3 1/2" D/Drive (Formatted)	399K	315K	349K
WIMP (Window, Icon, Mouse...)	Apple	ACT - Activity	GEM
Real-time Clock	YES	YES	YES
Polyphonic Sound Generator	YES	NO	YES
RS232 Serial Port	YES	YES	YES
Centronics Parallel Printer Port	NO	YES	YES
Dedicated Floppy Disk Controller	NO	YES	YES
Hard Disk DMA Interface	NO	YES	YES
Full stroke keyboard	YES	YES	YES
Number of keys on keyboard	58	92	95
Numeric Keypad	NO	YES (16 keys)	YES (18 keys)
Cursor Control Keypad	NO	YES	YES
Function keys	NO	10	10
16-bit processor	68000	Intel 8086	68000
Processor running speed	8MHz	4.77MHz	8MHz
RAM size	512K	256K	512K
Number of graphics modes	1	4	3
Number of colours	Monochrome	16	512
Max Screen Resolution (pixels)	512 x 342	640 x 256	640 x 400
Mouse Included	Single Button	NO - extra £95	Two Button
Replaceable External Power Pack	NO	NO	YES
Joystick Socket	NO	NO	YES
Joystick Ports	NO	NO	YES (two)
MIDI Synthesizer interface	NO	NO	YES
Monitor Size	9"	9" - extra £200	12"
RGB Video Output	NO	YES	YES

System Cost with: Mouse - Monochrome Monitor - 512K RAM - 500K Disk Drive

Price of basic system (exc VAT)	£2595-VAT	£595-VAT	£652-VAT
+ Mouse	included	£95-VAT	Included
+ Monochrome Monitor	Included	£200-VAT	Included
+ Expansion to 512K RAM	Included	£295-VAT	Included
Price of complete system (exc VAT)	£1295-VAT	£1185-VAT	£852-VAT

PRICE rounded down including VAT **£2,984** **£1,362** **£749**

"Atari's new corporate image as an aggressive low cost computer maker is likely to mirror that of Commodore where Mr. Tramiel established the maxim that 'Business is War'."
 August 21st 1984 FINANCIAL TIMES

"This is the only personal computer I know of that comes with a MIDI interface as standard."
 Peter Bright March 1985 PERSONAL COMPUTER WORLD

"The GEM version running on the Atari 68000 machines will have the additional advantage of leaving the PC user standing."
 April 6th 1985 PERSONAL COMPUTER NEWS

"It would seem that GEM offers the ideal operating system."
 March 7th 1985 POPULAR COMPUTING WEEKLY

"I found it (GEM) extremely easy to use and was very impressed with the way in which it disguises the unfriendly hardware and operating systems lurking under the surface."
 Peter Bright Feb 1985 PERSONAL COMPUTER WORLD

PRESS COMMENT

"The electronics in the machine are a work of art... The heart of the 520ST is a Motorola 68000, one of the most powerful 16-bit processors around and in many respects it is close to being a 32-bit chip... when the machine appears in the shops it'll be at the front end of the queue to buy one."
 Peter Bright June 1985 PERSONAL COMPUTER WORLD

"This machine is significantly more powerful than an IBM PC... If it's possible to design a sure-fire winning machine, this is it."
 May 11th 1985 PERSONAL COMPUTER NEWS

"... the use of GEM makes the new range of Atari computers so similar to the Macintosh (with the added attraction of colour), that they are already being called 'Jackintoshes'."
 May 2nd 1985 COMPUTING

"The new Atari ST computers truly represent to the consumer what Jack Tramiel is saying - easy-to-use computing power without the price."
 March 1985 ANALOG COMPUTING

"If (the ST) uses the most modern technology that is affordable, in a package that gives a professional impression."
 May 23rd 1985 POPULAR COMPUTING WEEKLY

"The Atari ST is one of the most elegant designs I have seen... Atari has used an original and elegant method of memory management which should make the ST faster than any other PC on the market - in any price bracket... The £4K dollar question is would I go out and spend money for one? To which the only answer is 'Try and stop me!'"
 John Lambert July 1985 ELECTRONICS & COMPUTING

"The 520ST is technically excellent... The 520ST hardware is the new standard by which others will be judged."
 July 1985 YOUR COMPUTER

SILICA SHOP

ATARI WE ARE THE UK'S No1 ATARI SPECIALISTS ATARI

At Silica we have been successfully dedicated to Atari ever since their products first appeared on the UK market. We can attribute our success largely to the Atari specialisation which we practice and to the user back-up we provide. Rest assured that when you buy a piece of Atari hardware at Silica you will be fully supported. Our mailings giving news of software releases and developments will keep you up to date with the Atari market and our technical support team and sales staff are at the end of the telephone line to deal with your problems and supply your every need. With our specialist bias, we aim to keep stocks of all the available Atari hardware, software, peripherals and accessories. We also stock a wide range of Atari dedicated books and through us, the owners on our list can subscribe to several American Atari dedicated magazines. We can provide a full service to all Atari owners and are now firmly established as the UK's NUMBER ONE Atari specialists. Here are just some of the things we can offer to our customers.

- ★ FREE POST & PACKING ON MAIL ORDERS
- ★ FREE NEXT DAY SECURICOR DELIVERY
- ★ INFORMATION MAILING SERVICE
- ★ TECHNICAL SUPPORT TEAM
- ★ HIGHLY COMPETITIVE PRICES
- ★ AFTER SALES SUPPORT SERVICE
- ★ REPAIR SERVICE ON ATARI PRODUCTS

If you would like to be registered on our mailing list as an Atari computer owner, or as a person interested in buying an Atari machine, let us know. We will be pleased to keep you up to date with new Atari developments free of charge. So, return the coupon today and begin experiencing a specialist Atari service that is second to none.

SILICA HOTLINE 01-309 1111

SILICA SHOP LTD, 1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX
SEND FOR FREE ATARI ST LITERATURE

To: Silica Shop Ltd, Dept PC 0885, 1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX

PLEASE SEND ME FREE LITERATURE ON THE NEW ATARI 520ST COMPUTER

Mr/Mrs/Ms: Initials: Surname:

Address: _____

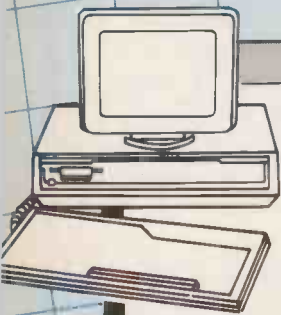
Postcode: 33

Do you already own a computer
 If so, which one do you own? _____

Circle No. 152

COMPUTER DISCOUNT STORE

VALUE AND SERVICE



SYSTEM · 1

APRICOT XI

Hard Disk + Free Printer
+ Free Integrated Accounts Software
including Payroll Training & Installation

£2495 + VAT



SYSTEM · 3

APRICOT F1

720K Disk 256K Memory
includes Free Integrated Accounts
Software

£895 + VAT

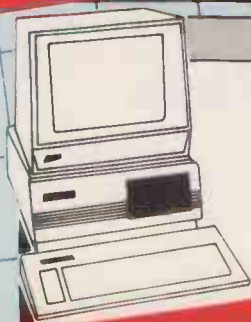


SYSTEM · 5

APRICOT TWIN DISK

+ Free Word Processor
+ Free Printer
ALSO AVAILABLE
720K Drive version
P.O.A.

£1445 + VAT



SYSTEM · 7

ZENITH Z150

(IBM Compatible) twin floppy
+ free accounts software
ALSO AVAILABLE
10 Megabyte
Hard Disk
£2,845 + VAT

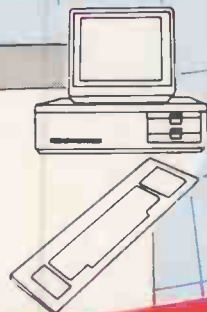
£1645 + VAT

● Circle No. 153

SYSTEM · 2

COMMODORE PC-10

(IBM Compatible)
256K ram
Free Accounting Suite
including payroll



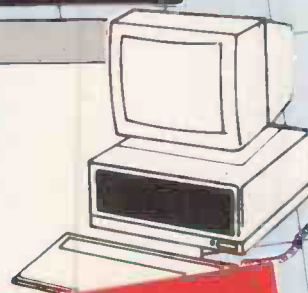
£1395 + VAT

SYSTEM · 4

OLIVETTI M24

Twin Floppy
+ Free Accounts Software

ALSO AVAILABLE
10 Megabyte Hard Disk
£2895 + VAT



£1645 + VAT

SYSTEM · 6

SPERRY

250K ram
2315K 5 1/2" Drives
+ Free Accounting Software
+ Free Printer



£1890 + VAT

SYSTEM · 8

EVALUATION SYSTEMS

AVAILABLE FROM £100 per week
ALSO AVAILABLE
RENTAL SYSTEMS
FROM
£40 per week

£100 + VAT

COMPUTER DISCOUNT STORE
58 Mount Stuart Square, Cardiff CF1 6DR
Tel: (0222)-488650/488641

Cellular radio has been operating in this country for almost half a year. For those of you who have been on the moon, in a coma or staying at Her Majesty's pleasure I will give a quick rundown on what cellular radio is.

Many years ago someone had the bright idea of making the telephone into a compact, self-contained, portable unit. The only way for this to be done is, of course, by using radio waves instead of wires. The main problem about this method is that each telephone needs to use a different frequency to communicate. Otherwise, two telephones working on the same frequency would interfere with each other. Yet separate radio frequencies cannot be allocated to each and every telephone because there are not enough to go around.

SAME FREQUENCIES

The cellular radio system was devised to overcome this problem. By using low-power transmitters on the telephones and at the base stations where the radio system links to the normal telephone network, the same frequencies can be used several times over — so long as telephones which use the same frequencies remain outside the radio range of each other. The range covered by each low-power base station is called a cell. Each cell handles a set of frequencies; the number of frequencies defines how many people can be using telephones in that area at any one time. Adjacent cells handle different sets of frequencies.

Problems inevitably arise when a telephone moves from one cell to another while it is being used. If a telephone is being used in cell A at a frequency understood by that cell, when it moves to cell B it will be ignored because it is not using one of the frequencies used by cell B. This flaw is overcome by incorporating the appropriate electronics into the base stations and telephones in order to change the frequencies as the user moves from one cell to another. The changeover takes approximately 300 milliseconds.

While changeover — or hand-off, as it is called in technical circles — takes place, the line drops. This is imperceptible to the caller and the called person, as the gap produced is extremely small compared to the number and length of gaps in human speech. I once heard that well over 50 percent of human speech is actually made up of silence.

That then, is more or less how the cellular radio system works. The result is that an almost limit-

less number of people can have telephones which they can carry in their pocket or car.

Recently, while working on an item for Thames TV's *Database*, the director of the programme borrowed two Vodafone phones from Racal to review. Racal is one of the companies running a cellular radio network in Britain; the other is British Telecom/Securicor and their system is called Cellnet. Shortly before, I had placed an order for a rather nifty looking Cellnet pocket phone.

Anyway, the models we had from Racal were called Transportables. I have been slightly wary of the word "transportable" describing a piece of equipment, ever since the time I got on a train at Charing Cross station and almost left my arm on the platform attached to an Osborne 1 micro-computer. My fears were not wholly unfounded: after carrying the Vodafone around for two weeks I was absolutely positive my right shoulder was perceptibly lower than my left.

Each telephone came in a neat looking designer shoulder bag, with "Vodafone" emblazoned in nice, big red letters across the side. If you unzip the bag, you can remove the phone and see it in all its glory. Naked, the Vodafone is a pretty unimpressive sight. I suspect more design effort was put into the bag than the phone. It is made up of three parts: handset, aerial unit and battery. The aerial unit and battery are just slabs of black plastic which lock together. When linked, they are about the size of a full-height disc drive — and about 20 times as heavy. The handset is grey and has a mouthpiece and earpiece in the same positions as on a normal telephone handset. On the back is a matrix of 16 buttons, marked: 0-9, Snd, Sto, Rcl, End, * and £. Above the buttons is a two-line liquid crystal display. The handset is connected to the aerial unit by means of a short, curly cable.

CALL PROCEDURE

The Vodafone is fairly easy to use. To make a call, you type in the number you want to dial. Each digit is displayed on the LCD when you press it. To dial the number press the Snd button. If you are calling another Vodafone, you will be connected in a few seconds. It takes up to a minute to connect to numbers which are on the normal telephone network. When you have finished your call, press End and you are disconnected. There are 99 memories which can be utilised with the Sto and Rcl (Store and Recall) buttons.

Additional features are con-

trolled at the Vodafone base station. These include outgoing call barring, call diversion, automatic alarm call, conference calls, and hold for enquiry. These functions are activated by sending a string of numbers, interspersed with * and £ symbols, to the exchange.

So much for the use of cellular radio for voice calls. The computer will be interested in the possibilities of data communications over the system. Sadly, cellular radio has a number of characteristics which make it an unsuitable medium for data transmission. There are four separate phenomena which may contribute for data corruption. Their effects are magnified many times when data transmission is attempted while actually on the move.

The first is known as Rayleigh fading, or sometimes as multipath fading. The effect of this phenomenon is unpredictable variations in the signal strength when it is received. Rayleigh fading is caused by the simultaneous reception of signals which have travelled by different paths, having been reflected off either moving or stationary objects. If different parts of a signal are received at the antenna at the same time, the signal can cancel itself out. If you know about sine waves, think of a trough and a peak being received at the same time. While Rayleigh fading is not particularly noticeable to voice users, modems are extremely sensitive to variations in signal strength.

HAND-OFF

Hand-off, the second problem, I have described already. The 300ms. break in transmission is detectable by a modem. The number of times that hand-off occurs during a call depends on whether the telephone is moving, how fast it is going and in which direction.

The third problem arises because it is sometimes necessary for the base station and cellular telephone to communicate with each other. In voice calls, this signalling takes place in the gaps in speech. When modems are communicating, there are no gaps. The number of times that this signalling will occur during a call cannot be predicted.

Finally, there is interference. All types of radio interference are covered under this heading, but the type which is come across most of all is co-channel interference. This occurs when different signals using the same radio frequencies interfere with each other. Remembering that with cellular radio, the same frequencies are reused as



BY BEN KNOX

CELLULAR RADIO DROPS YOUR BITS

Thinking of hooking up your micro and acoustic coupler through the cellular radio phone network? Then think again: life is not that simple.

often as possible, you can see that under certain conditions this type of interference can be a major problem.

For data transmission to be possible over the cellular network a system of error detection and correction must be introduced. Racal data transmission division, Vodafone, has come up with the Cellular Data Link Control (CDLC), which goes through a number of contortions to provide uncorrupted data.

To correct errors, CDLC uses a technique known as forward error correction. Simply, this means that data is sent twice and the receiving equipment selects parts of each of the two pieces to reconstruct the original data. If necessary, another system called block retransmission can be invoked. The receiving equipment can request that a block of data be retransmitted if too many errors were detected in the first transmission.

Other features of the CDLC include resistance to hand-off and blanking, asynchronous working, 1,200 baud data transfer rate, full duplex, and RS-232 compatibility. All in all, the CDLC system does seem to have solved the problems of transferring data over the cellular radio system. All that needs to happen now is for someone to convince British Telecom to use CDLC on Cellnet, instead of developing its own, incompatible system.

Business Computer Centre Ltd.

MAIN LONDON W1 DEALER FOR FUTURE COMPUTERS

The future computer is the only 16-bit processor supplied with concurrent CPM/86 as standard allowing one terminal to run more than one task at the same time and with the addition of DR-NET software provides a true multi-user environment for up to 256 user stations. The machine is also supplied with a word-processor, spread sheet and a 100 cps 80 column dot-matrix printer which are included F.O.C. built in LAN and full modem communication ports.

FUTURE FX-15 128 1 x 800K FLOPPY DRIVE.....	£1575
FUTURE FX-20 128K 2 x 800K FLOPPY DRIVES.....	£1875
FUTURE FX-30 128K 10MB HD + 800KB FLOPPY.....	£3200
FUTURE FX-30 128K 20MB HD + 800KB FLOPPY.....	£3800

OPTIONS

EXPANSION RAMS UP TO 1MBYTE.....	FROM £184 for 128K TO £995 FOR 1MBYTE
----------------------------------	---------------------------------------

All Single + Multi user software available from stock.

OFFICIAL ERICSSON DEALERS

ERICSSON 128K 2 x 360K DRIVES.....	£1550
ERICSSON 256K 2 x 360K DRIVES.....	£1640
ERICSSON 128K 2 x 360K DRIVES (COLOUR).....	£1945
ERICSSON 256K 2 x 360K DRIVES (COLOUR).....	£2030
ERICSSON 128K 10MB H/D x 360K DRIVE.....	£2550
ERICSSON 256K 10MB H/D x 360K DRIVE.....	£2690
ERICSSON 128K 10MB H/D x 360K DRIVE (COLOUR).....	£2995
ERICSSON 256K 10MB H/D x 360K DRIVE (COLOUR).....	£3280

All Ericsson Computers come complete with graphic cords as standards.

100% IBM COMPATIBILITY. All PC Software available from stock.

MEMORY BOARDS

128K MEMORY EXPANSION.....	£ 149
256K MEMORY EXPANSION.....	£ 210
512K MEMORY EXPANSION.....	£ 450
*PC NET STARTER KIT.....	£ 350

* Used in conjunction with Plus 5 Subsystems.

EXTERNAL STORAGE DEVICES FOR ERICSSON

PLUS 5 5MB + 5MB CARTRIDGE (REMOVABLE).....	£2445
PLUS 5 10MB + 5MB CARTRIDGE (REMOVABLE).....	£2545
PLUS 5 15MB + 5MB CARTRIDGE (REMOVABLE).....	£2695
PLUS 5 20MB + 5MB CARTRIDGE (REMOVABLE).....	£2795
PLUS 5 30MB + 5MB CARTRIDGE (REMOVABLE).....	£3395
PLUS 5 40MB + 5MB CARTRIDGE (REMOVABLE).....	£3645

Complete with all necessary software and connectors.

We accept official orders from Government and educational establishments. (Special discounts apply).

TELEVIDEO (SPECIAL OFFER)

TS-804 MULTI-USER 10MB HD.....	£3750
TS-806 6 USER SYSTEM 10MB.....	£2750
TS-800 SATELITES.....	£ 750
TS-802H 14MB HD.....	£3000
TS-816 16 USER SYSTEM 40MB HD.....	£6750
TS-TPC1 TELEPORTER TWIN FLOPPY.....	£1000
TS-1603 16-BIT TWIN FLOPPY.....	£1750
TS-914 WORK STATIONS.....	£ 450
TS-924 WORK STATIONS.....	£ 550

PRINTERS

A large selection of Daisy Wheel and Dot Matrix Printers are available from stock.
All equipment carries a 12 month guarantee for parts and labour.

SOFTWARE

We can supply all PC Software single, Multi-User and Multi-Tasking. We write software for customers in twenty countries including General Motors, Fiat Motor Company and National Airline where we are currently writing Software for the computerising of their ticketing operation and installing hardware in 40 of their worldwide offices which will all be online to the mainframe computer.

Installation are carried out by our own engineers. Finance and training available.

Kindly telephone for demonstration at our W1 showroom for any of the above equipment by our professional staff who will be glad to discuss your requirements with you.

Business Computer Centre Ltd.

66 WELLS STREET, LONDON W1P 3RP. 01-637 5666/7/8

One stop.

At TABS Business Centres you'll get everything you need to run a small business system.

TABS Business Centres provide a complete range of computer products to help you run your business more efficiently.

Whether you need a simple business computer to run your sales ledger and handle your correspondence or a multi-user system with an integrated accountancy package, you will find everything you need – all in one place.

You will get free expert advice from people who understand the business world, and who have a thorough knowledge of accountancy and microcomputers.

You will also get expert training on how to use your system, a professional installation service and full support for the hardware and the software.



*IBM IBM PC 64, Monitor, Keyboard, Mono Display Printer Adaptor, DOS 2.0 + Tandon Drive.

£21.76 per week + VAT
Over 36 months rental period

IBM XT, Monitor, Keyboard, DOS 2.0, Mono Display Printer Adaptor.

£37.38 per week + VAT
Over 36 months rental period



ACT APRICOT PC, 2 Disk Drives (Double Sided), 720K + 9" High Resolution Monitor – Mono.

£21.30 per week + VAT
Over 36 months rental period

APRICOT Xi 10, 1 Disk Drive + Winchester 10Mb + 9" High Resolution Monitor – Mono.

£31.97 per week + VAT
Over 36 months rental period

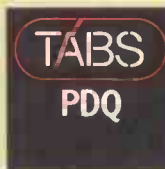


OLIVETTI M24 (Typical System), Mono Display, Keyboard + MSDOS, 2 Disk Drives 360/720Kb.

£20.69 per week + VAT
Over 36 months rental period

M24 (Hard Disk System), Mono Display, Keyboard + MSDOS, 1 Disk Drive 360/720Kb, 1 Winchester 10Mb.

£41.62 per week + VAT
Over 36 months rental period

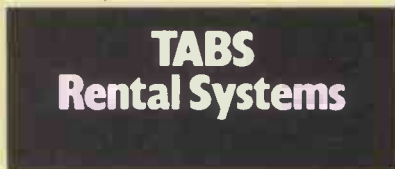


TABS PDQ 1.2, Mono Display, Keyboard + MSDOS, 2 Disk Drives 800K.

£24.44 per week + VAT
Over 36 months rental period

PDQ 10, Mono Display, Keyboard + MSDOS, 1 Disk Drive 800K + 1 Winchester 10Mb.

£41.20 per week + VAT
Over 36 months rental period



TABS Business Centres offer a Rental Plan which is ideal for companies preferring to keep their capital intact for use within the business rather than tying it up in depreciating assets. The plan allows for the system to be upgraded at regular intervals without high cancellation penalties and includes maintenance and insurance.

For your nearest one stop Business Centre 'phone:

0722-338668

*The IBM PC and XT are only available from TABS Business Centre, Salisbury and those TABS Business Centres who are IBM authorised PC dealers.

FROM £10,000 CREDIT

Simply fill in the coupon and return it to: TABS Ltd, Dolphin House, New Street, Salisbury, Wilts. Please allow 14 days for reply. The TABS RENTAL CARD is valid at all TABS Business Centres.

I WISH TO APPLY FOR RENTAL CREDIT FACILITY. ● Circle No. 105

Name _____

Address _____

Tel No. _____

Company Business Name _____

Nature of Business _____ Position _____

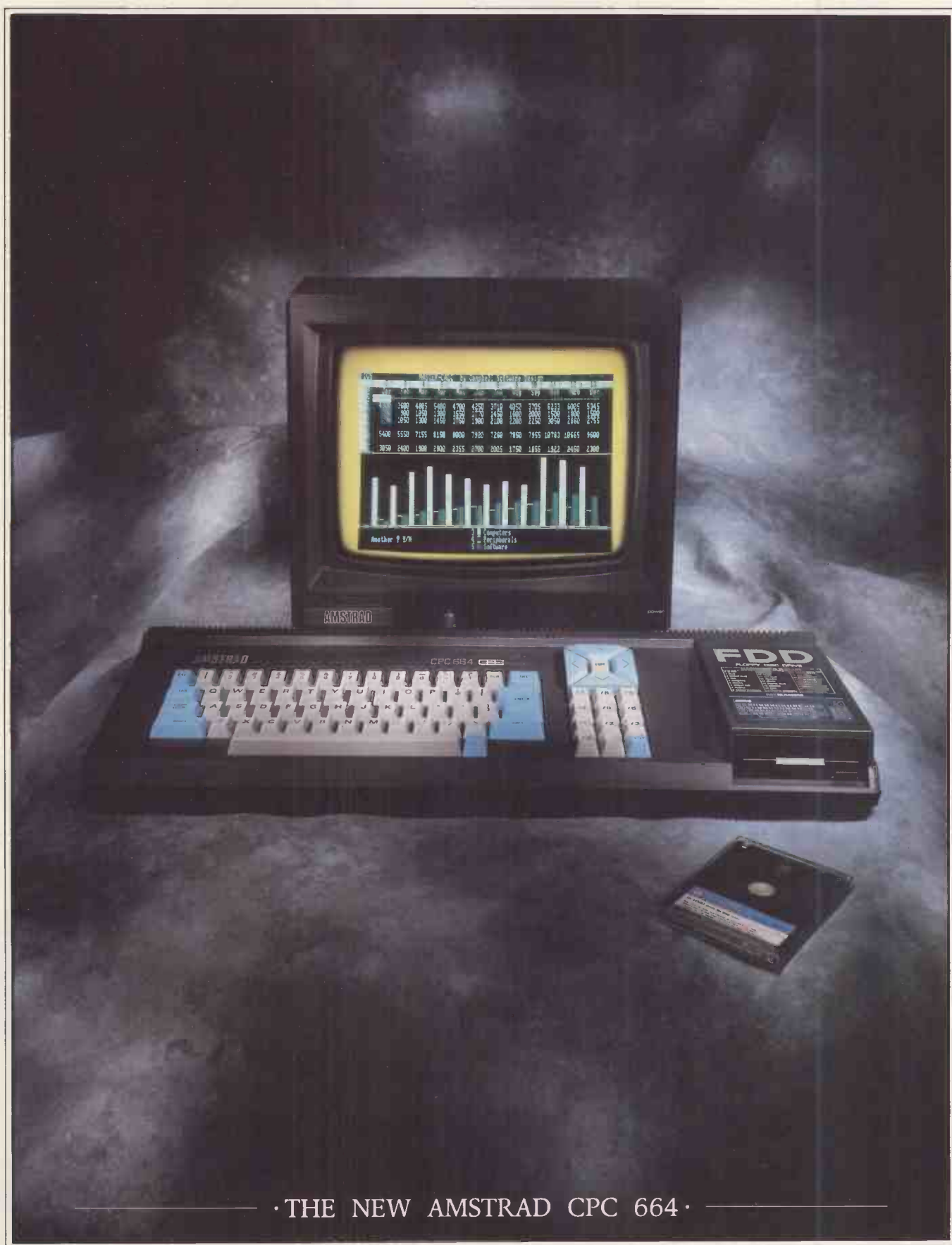
Bankers _____ Branch _____

Account No. _____ Signature _____

PC 8 85

37

• THE NEW AMSTRAD CPC 664 WITH BUILT-IN DISC DRIVE



• THE NEW AMSTRAD CPC 664 •

— AVAILABLE AT BOOTS • COMET • CURRYS • DIXONS • GREENS • JOHN MENZIES • RUMBELOWS

THE LOW COST COMPUTER FOR HOME AND BUSINESS ·

If you know anything about computers you'll know that disc drives are up to fifty times faster than cassette when you're loading and saving programs. In fact, a disc drive makes computing faster, more reliable, more efficient and more fun. But up till now the only way to gain these advantages for a home computer was to buy a separate disc drive attachment. Now Amstrad are pleased to announce the first complete home computer with built-in disc drive: The Amstrad CPC 664.

And when you buy a CPC 664 you'll find it's not just the disc drive that's built-in.

You'll get everything you need, including a monitor (green screen or full colour). We'll even give you a free CPM and Logo disc, so all you do is plug in and you're in business.

BUSINESS OR PLEASURE ·

Although a disc drive will make games more fun (and there are loads of them to choose from) it also makes the CPC 664 a serious proposition for the business user.

There are accounting, word-processing, spread-sheet and database programs (to name but a few).

Amsoft Business Control, is a complete suite of programs for integrated sales invoicing, stock control and sales ledger for around £99. (Requires an additional FD-1 disc drive around £159 and DL-2 cable around £7).

The CPC 664 is also supplied with CP/M* to help make your business more efficient and effective by providing access to the famous range of CP/M* software.



WITH COLOUR MONITOR AROUND

· £449 ·



WITH GREEN SCREEN AROUND

· £339 ·

THE HOME COMPUTER THAT MEANS BUSINESS.

HIGH PERFORMANCE

· LOW COST ·

The one thing you won't need a computer to work out is that the Amstrad CPC 664 represents outstanding value for money.

You only have to check the cost of buying all the elements separately (64K computer, disc-drive, monitor) to realise that the Amstrad package is very hard to beat.



Wordprocessing with Amword can improve the productivity of everyone from unskilled typist to trained secretary. Around £23.95.

With a green screen monitor the cost is just £339. With a full colour screen it costs £449. And after you've saved money on the price of the computer itself, you go on saving on the price of software.

There are hundreds of programs for business or pleasure available on disc (and cassette) to CPC 664 users. Many from Amsoft, others from other

famous-name software houses. Few will cost you more than £49 and most will cost you considerably less.

AN EXPANDING SYSTEM ·

There is a complete range of peripherals available to CPC 664 users which plug directly into the built-in interfaces.

These include a joystick, additional disc drive (to double your on-line storage) and the Amstrad DMP-1 dot-matrix printer. (There's also a cassette interface so that you can use CPC 464 programs on tape). And there are many more peripherals from Amstrad and other manufacturers which can be used to enhance the CPC 664.

· AMSTRAD USER CLUB ·

Join the optional Amstrad User Club and we'll keep you informed with our monthly user magazine, and information on all software as it is introduced. Your membership details

will be recorded on your personal club card, which entitles members to various privileges and offers.



Figure analysis made easy with Microspread. An easy to use spreadsheet with pull-down menus and a wide range of mathematical options. Around £49.



Please send me more information

Name _____

Address _____

Amstrad CPC 664

Amstrad, P.O. Box 462, Brentwood, Essex CM14 4EE
PC1664/3

*CP/M is a trademark of Digital Research Inc.

SPECTRUM · W.H. SMITH · WIGFALLS · AND GOOD INDEPENDENT COMPUTER STORES ·

FIRST CLASS PERIPHERALS CREATE A NEW QUALITY/COST DIMENSION

Come with us into tomorrow

A totally new low-cost source of computer peripherals is available to you now.
FIRST CLASS PERIPHERALS.

With **FIRST CLASS PERIPHERALS** you get top-quality products direct from the manufacturer. And the price we quote includes VAT, carriage, everything you need just to plug-in and play.

For starters, **FIRST CLASS PERIPHERALS** introduces the **SIDER**, a 10Mb hard disk add-on for your Apple II+ or IIe for an amazing £899 including installation software for the four major operating systems (DOS, CP/M, Pascal and ProDOS), host adaptor, power cable, manual and a full one year's parts and labour warranty. **NO HIDDEN EXTRAS.**

Very soon we'll be offering other exciting disk and tape products at equally astonishing prices.

OUR PEDIGREE

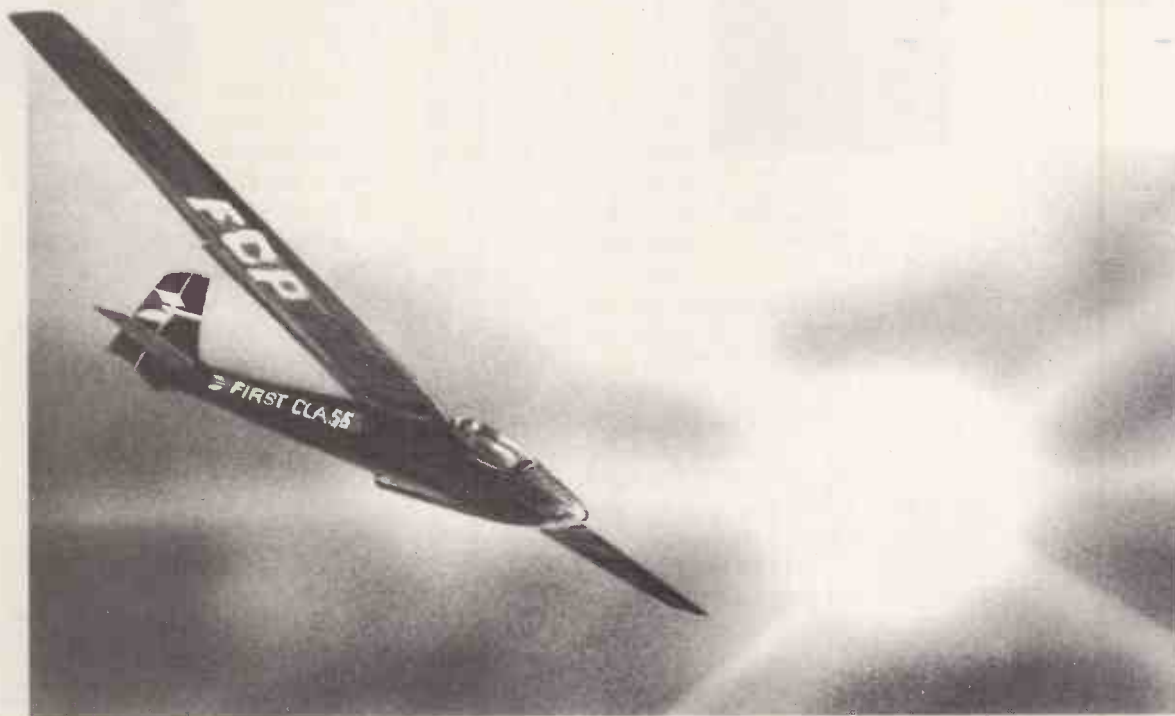
FIRST CLASS PERIPHERALS is a wholly owned subsidiary of Xebec, the leading manufacturer of disk controllers and subsystems for customers like IBM, Hewlett Packard, Toshiba and Texas Instruments. It is dedication to innovation and quality control that has brought Xebec to the top of the OEM field. The same commitment will make **FIRST CLASS PERIPHERALS** number one in the direct marketing of advanced peripherals in a value-class of their own.

Apple DOS/ProDos are registered trademarks of Apple Inc.
CP/M is a registered trademark of Digital Research

For more information just dial 100
and ask for
**FREEPHONE FIRST CLASS
PERIPHERALS**

**FIRST
PERIPHERALS
CLASS**

First Class Peripherals Ltd
Cockayne House
Crockhamwell Road
Reading RG5 3JH





BY DAVID LEVY

TWIXT

A peg-board game for two players.

Twixt is another delightful game invented by Alex Randolph, whose brick-dropping game Pferdeäppel appeared in *PC* in March. The game is marketed in the U.S. by Avalon Hill, and it sells so well in Germany that there are even Twixt tournaments for the really serious players and Twixt experts sometimes give simultaneous exhibitions against a number of weaker players. But for some reason the game cannot be found in shops in the U.K., which is a great pity because Twixt is great fun and intellectually challenging.

The game is played on a 24- by 24-peg board. The two players, Red and Black, take turns to put a peg into one of the vacant holes. If a player's peg which has just been played is then a knight's move away from one or more existing pegs of the same colour, that player joins the adjacent pegs with a horizontal bridge, provided that this bridge does not cross an existing bridge belonging to either player.

Figure 1 represents the lower left-hand corner of the board. Red has created a bridge for d4 to e2, since these two holes are a knight's move apart. Black could form a bridge between c3 and d1, but it would be illegal to make a bridge by playing in e4 because the line from c3 to e4 crosses Red's bridge from d4 to e2. A player is allowed to remove any number of his own bridges as part of a move, but this rule can be ignored when programming the game to avoid making the task unnecessarily complex.

LINE OF BRIDGES

The object of the game is to create an unbroken line of your own bridges twixt opposite edges of the board. For example, Red might be playing from north to south, in which case Black will be trying to create a bridge from east to west. Once a section of bridge is in place it may never be moved by the opponent, and a player may not place a bridge so that it intersects with any bridge already placed by his opponent.

Since the Twixt board is even larger than a Go board, the number of legal moves at any stage will be enormous in comparison with board games such as chess, draughts and Othello. Twixt is a good example of the problems of searching large game trees. Just how do you deal with a game in which the branching factor is so large that a full-width tree-search would be impossible to any substantial depth?

Consider the very first move of the game. You might think that playing a peg in one of the four central holes is a very strong move, and in fact this is true. But to take care of this situation one player places the first peg

and the opponent then decides to which player that peg belongs. According to the inventor, a good first move in Twixt is m6 because it is not so fantastic that the opponent will certainly take it, but it is good enough so that if the opponent does not take it the peg on m6 will play an important part in the game.

RAPID BRANCHING

When programming games which have a very large branching factor, that is, number of legal moves, a sensible philosophy to adopt is to be highly selective in the analysis. In a chess program, where the average branching factor is around 37, some strong programs written for microprocessors can analyse the full-width tree to a depth of seven-ply or more. A Twixt program analysing a full-width tree to the same depth, would encounter around 50,000 times as many terminal nodes. It might be possible to write a Twixt program to search fully to a depth of three- or four-ply when playing at the rate of three minutes per move, but I do not believe that player would be happy waiting so long for a response and I am suspicious as to the resulting strength of the program.

By being selective in the search process, a game-playing program can discard many of the obviously bad moves, thereby reducing the branching factor substantially. At each ply in the tree the program says to itself: "Which moves look worthwhile and which ones should I ignore?". If its selectivity criteria are accurate it will be able to discard a large proportion of the legal moves without any detriment to the final result. You could also adopt this approach in chess or any other two-person game, for example, by not allowing the program to examine moves which give away pieces for nothing. What you gain is the ability to search the game tree to a more useful depth. However, there will be

occasions when a superficially useless or bad move actually turns out to be the right thing to do but the program ignores it.

One way to select the moves which are to be examined further is to apply the terminal evaluation function to positions at every stage of the tree search. First the program generates all the legal moves from a position, and then it evaluates these moves with the same evaluation function that it applies to terminal positions. The moves are then sorted, which has the beneficial side effect of speeding up the alpha-beta search. An arbitrary cut off is applied so that the program discards all but the best n moves, or all moves whose evaluation is more than a certain amount below that of the seemingly best move.

This approach was employed in one of the earliest chess programs, written in the late 1950s for the IBM 704 mainframe. The program selected the seven best moves in the root position, then the seven best replies to each of these moves, and so on, to a depth of four-ply. Its search process, with 2401 terminal nodes on the tree, took around three minutes, in which time today's leading microcomputer chess programs can examine trees with around one million terminal evaluations.

QUICKER EVALUATION

Another method of selectivity is to apply a different evaluation function, usually one which is more sophisticated than that used for evaluating terminal positions. The reason for this approach is that there are many more evaluations carried out at the terminal positions. Consequently the terminal evaluator should be quicker and less sophisticated than the evaluation function used to select which moves are to be analysed further.

A third approach to the problem of selectivity, and one which is best used for Twixt, is to use very simple

heuristics to select those moves which, without the benefit of evaluative heuristics, look as though they might be worthy of further analysis. This makes the selectivity process much quicker.

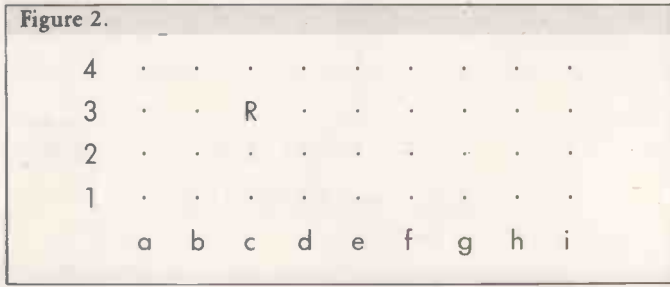
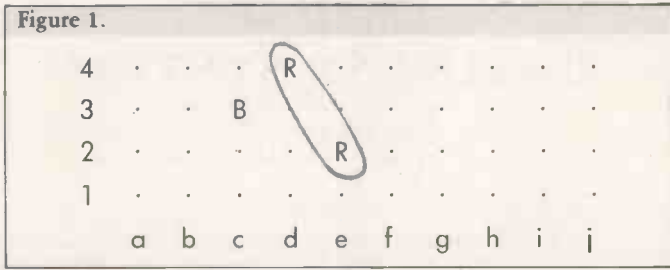
One simple heuristic which often serves this purpose is to look at moves which appeared to be quite good two-ply earlier in the tree. If the program applies its full evaluation function to each of the moves in the root position and then produces a sorted list, the moves which feature in, say, the top 10 places in the list will, in many games, have a high correlation with the top 10 list two-ply further on into the game. For most strategy games approximately half of the moves on the most likely to succeed list normally reappear on the list two-ply later.

Another heuristic useful in Twixt is to look at all moves which create bridges immediately. A less obvious concept is to examine forking moves. If in figure 2 Red were to place a peg in g3, he would be creating a two-pronged attack — hence the term fork — on the holes at e2 and e4. Placing a subsequent peg in either of those holes would immediately create two bridges, from c3 to the new peg and from the new peg to g3. Black would have no way to stop both possibilities.

Another heuristic which seems to work quite well is to look at moves which are within a certain distance of your opponent's previous move. This distance might be two rows and columns either side of the previously occupied hole, in which case there would be a maximum of 24 legal moves to examine as a result of this particular heuristic. Extending the distance to three rows or columns on either side would increase this maximum from 24 to 48, which is already making the tree too bushy.

Having created the basis for a selective search program, you must consider how to evaluate positions on

(continued on next page)



(continued from previous page)

the game tree. The evaluation function can be used in two different ways: it should be applied to all positions at one-ply so that the root moves may be sorted, thereby speeding up the search process because of the substantial number of cut offs created by the alpha-beta algorithm, and the evaluation function is also applied to all terminal positions. It might be worthwhile to use it to sort the moves selected at ply 1, but experience from chess suggests that this is only useful for the replies to that root move which is sorted to the top of the list.

It is worth using four features in the evaluation function. An important aspect of playing Twixt well is that wherever possible, moves should not only help to make progress towards your own goal but should also impede the progress of your opponent.

This is not accounted for in the evaluation function itself, but will be a by-product of the look-ahead search. As a result, on level 1, — that is, a one-ply search — the program may play aggressively but it will overlook attacking possibilities by the user.

The features in the evaluation function are as follows:

Bridges. The number of bridges already in place on the board; own

bridges minus opponent's bridges. **Potential Bridges.** The number of different moves available which will create one or more bridges for the player whose turn it is to move next. Count one extra move for each bridge in excess of one that can be created by a move.

Forks. The number of vacant holes on the board that are a knight's move away from two or more of a player's existing pegs, with no intervening bridge: score own forks minus opponent's forks.

Attack Strength. Some sort of measure is needed for the extent to which a player's bridges are working towards the ultimate goal, that of creating an unbroken line between the appropriate opposite edges of the board. If the individual bridges are well connected to each other there will be a relatively small number of lazy pegs — that is, ones which are attached to fewer than two bridges. But this concept in itself is insufficient because a ring of bridges would have no lazy pegs but would be of no real use to the player. Another aspect of attacking strength is the extent to which bridges are forward looking, say, from b1 to c3 for the player moving north to south, rather than sideways looking from, say, b1 to d2.

A count of the number of forward-looking bridges might also be a useful measure to be included in the Attack Strength feature. Score one point for a forward-looking bridge, provided that the row which it crosses has not already been crossed by another forward-looking bridge of the same colour. Score 0.5 for a forward-looking bridge if the row that it crosses has already been crossed once by a forward-looking bridge of its own colour. Score $1/(n-1)$ if the row crossed by a forward-looking bridge has already been crossed by n forward-looking bridges of the same colour. This evaluation will encourage the creation of all forward-looking bridges, but will put greater emphasis on moves that extend over rows that have not yet been crossed.


COMBINATION

You could combine the two aspects of Attack Strength into one feature: for example, forward-looking score divided by number of lazy pegs, but it is simpler to treat each of these two aspects as separate features, in which case the evaluation function will have five features altogether.

The program will then perform the tree search. It generates, evaluates and sorts all the moves in the root position. It then selects the best

n of these moves — you should choose n to be in the range 20 to 30 — and discards the rest. Your level 1 search should now play the move at the top of the list. For a higher level of skill, the program should perform a search to the appropriate ply depth, selecting which moves to examine further on the basis of the criteria already described. In the terminal positions the program applies the evaluation function, in which the weightings for each feature have been arrived at largely by experimentation.

LOOK FOR A WIN

One thing about the evaluation function seems obvious: a fork should be valued at something between one bridge and two bridges. For searches of five-ply and deeper, apply the evaluation function at four-ply, and extend the search only to determine whether or not there exists a simple forced win. The same selection criteria are used to determine which moves should be examined beyond four-ply, but the terminal evaluation should consist only of Win, Loss and Neither values. This approach should ensure that the program plays sensible strategic moves, while leaving sufficient computation time to detect straightforward races towards the edges of the board. 

ORDER NOW

THE MOST SOPHISTICATED DISC FILING SYSTEM 16K ROM EVER WRITTEN FOR THE BBC MICROCOMPUTER OPERATING ALONGSIDE YOUR EXISTING ACORN TYPE DFS ROM AND OPENING UP A NEW EXCITING PHASE AS A SUPERIOR OPERATING SYSTEM.

THE BUSINESS SYSTEM DFS

Fully compatible with any existing DFS and Torch CPN/MCP format.

Allows 255 file names on a CP/N and CP/M type screen format. CAN'T EXTEND banished for ever, COMPACT redundant as the vacant areas on the disc are gathered to gether for economic file use automatically.

Designed to facilitate ease of use — vital in the area of business programs on the BBC. Will allow the mix of BBC and Torch CPN programs on the same disc.

£39.50 inc. VAT, full fitting instructions and User Guide. C.U.C. Members only allowed 10% discount.

ONLY AVAILABLE FROM



COMPUTER USERS CLUB

69a Hadlow Road, Welling, Kent.

Tel No: 01-311 2555

● Circle No. 108

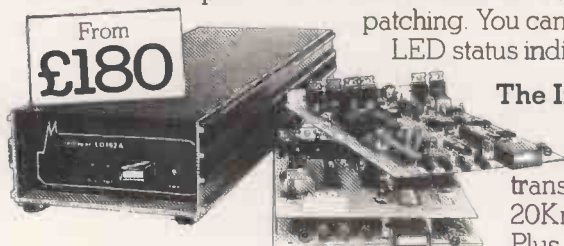
You're better connected with Modular Technology

When it comes to computer communications, it'll pay you to communicate with us first. We're specialists in the field and have developed a range of equipment unrivalled for quality, reliability, innovation - and value.

Shown here are just a few examples of our wares.

The Inter-Mover Series of Direct Connect Modems

The very latest addition to our range, this series is small in both size and price and yet offers a host of features which preclude the need for any extras. CCITT V21, V22, V23 transmission standards are available and all include auto-answer (complying with V25), answer/originate front panel selection and (except V23) analogue loopback for modem testing. There's a daisy chain connection, too, using the new BT modular jack system, front panel line selection of telephone or Modem and default V24 interface to ease and minimise interface patching. You can also benefit from V24 connect data set to line mode and the LED status indicators include DATA, DCD, and RX.



The Interdriver LD192 Mains Powered Base-Band Modem

A rugged, self-contained modem-emulating line-driver for asynchronous or synchronous full or half-duplex data transmission. Either over DC-continuous unloaded lines up to 20Km at 110bps or at speeds up to 19.2 Kbps over shorter distance. Plus many other features. BT approved for connection to leased line.

M4000 Series Multi-Mode Modems Another recent addition, this series of transmit and receive Modems are both BABT approved and conform to CCITT requirements. They are microprocessor driven, switchable between V21/V23 and are capable of working to Bell standards, answer or originate.

The number of features is astounding and includes auto-answer, self-diagnostics and a host of front-panel switches and indicators.



Low-Cost Acoustic Couplers The 3000 series. You'd be hard pressed to find another range of acoustic couplers that offers you so much - for so little. They're all instantly useable, highly reliable and completely portable. Choose from *3005* 300bps/V21 originate only. *3005/1* 300bps/V21 Answer and Originate. *3005/2* 300bps/V21 Answer and Originate with internal battery. *3005/3* As 3005/2 plus external switch controls V21 or Bell 103. *3012* 1200/75/V23 Originate only.

All are BT approved and CCITT compliant.

Please send me further details. I am particularly interested in _____

Name: _____

Address: _____

PC 8/85

Tel: _____

Modular Technology Ltd

Zygal House, Telford Road, Bicester, Oxfordshire OX6 0XB.
Tel: Bicester (0869) 253361. Telex: 837907.

Modular Technology Ltd is a wholly owned subsidiary of Zygal Dynamics plc.



FORTH = TOTAL CONTROL

FORTH programs are instantly portable across the most popular microprocessors.

FORTH is interactive and very fast.

FORTH programs are structured, modular, and easy to maintain.

FORTH gives control of all interrupts, memory locations, and i/o ports.

FORTH gives full access to DOS files and functions.

FORTH application programs can be converted to turnkey programs.

FORTH Cross Compilers can generate ROMmable code for: 6502, 6809, 68000, 8080, Z80, 8086, 6800, 6801/3, 1802, Z8, 8070, Z8000, 99xxx, LSI-11

We are the FORTH specialists, we also stock a large range of books, listings, and implementations for machines ranging from Spectrums to Macintosh to VAX.

mpe MicroProcessor Engineering Ltd
21 Hanley Road, Shirley
Southampton SO1 5AP
Tel: 0703 780084



Application Development Systems include FORTH with virtual memory, multi-tasking, assembler, full-screen editor, decompiler, utilities, and full documentation.

LMI Z80 FORTH - CPM 2.2 £95

LMI 8086 FORTH - CPM-86, MSDOS £110

LMI PC/FORTH - PC/DOS £110

MPE-FORTH 6809 - FLEX, OS9 £175

LMI 68000 FORTH - CPM 68K £225

FORTH+ has 32-bit stacks and directly accesses the whole address space of the processor.

PC FORTH+ £225

8086 FORTH+ £225

68000 FORTH+ £225

Extension Packages include floating point, cross compilers, 8087 support, colour graphics, interactive delugers

● Circle No. 110

SOFTSEL®

It's available from your local Softsel dealer.

BONSAI
112-116 NEW OXFORD STREET,
LONDON WC1A 1HJ. TEL: (01) 580 0902

CHAMELEON BUSINESS SYSTEMS
72 RICHMOND ROAD,
KINGSTON-ON-THAMES, SURREY KT2 5EL. TEL: (01) 541 1541

COLSTON COMPUTER CENTRE
11 COLSTON AVENUE, BRISTOL, AVON BS1 4UB.
TEL: (0272) 276619

COMPUTACENTER LTD
290 HIGH STREET KENSINGTON, LONDON W14 8PA.
TEL: (01) 602 8405

COMPUTACENTER LTD
THEATRE SQUARE, CIVIC CENTRE, SWINDON, WILTS SN1 1QN.
TEL: (0793) 694997

COMPUTERLAND
59-60 HOLBORN VIADUCT, LONDON EC1. TEL: (01) 248 8385

COMPUTERLAND
114 CHARING CROSS ROAD, LONDON WC2.
TEL: (01) 379 0855

COMPUTERLAND
38 EDGWARE ROAD, LONDON W2. TEL: (01) 723 3071

DATA BENCH
15-17 WEST STREET, MARLOW, BUCKS SL7 2LS
TEL: (06284) 75688

DATA SYSTEMS ELECTRONICS
41 THE BROADWAY, TOLWORTH, SURBITON, SURREY KT6 7DJ.
TEL: (01) 390 4021

DIGITUS
10-14 BEDFORD STREET, COVENT GARDEN, LONDON WC2.
TEL: (01) 379 6968

ENTRÉ COMPUTER SYSTEMS
ENTRÉ HOUSE, 17 BATH ROAD, SLOUGH, BERKS SL1 3UL.
TEL: (0753) 31222

FDS MICRO SYSTEMS
6 SALEM ROAD, LONDON W2. TEL: (01) 229 9431

GRANADA MICROCOMPUTERS
25 NEW BROADWAY, EALING, LONDON. TEL: (01) 579 3003

GRANADA MICROCOMPUTERS
119 HIGH STREET, SLOUGH, BERKS. TEL: (0753) 820966

INGRAM MICROSERVICES
MIDDLESEX. TEL: (01) 958 5709

ISTEL
PO BOX 5, GROSVENOR HOUSE,
PROSPECT HILL, REDDITCH, WORCS B97 4DQ.
TEL: (0527) 64274

OFFICE EFFICIENCY MACHINES
150-152 KING STREET, HAMMERSMITH, LONDON W6.
TEL: (01) 741 7381

PLANNING CONSULTANCY
46-47 PALL MALL, LONDON SW1Y 5JG. TEL: (01) 839 8890

SIMMONS MAGEE COMPUTERS LTD
13 YORK STREET, TWICKENHAM, MIDDLESEX TW1 3JZ.
TEL: (01) 891 4477

SOFTWARE CITY
382 KINGS ROAD, LONDON SW3. TEL: (01) 352 9220

SOFTWARE CITY
14 THAMES STREET, KINGSTON, SURREY. TEL: (01) 541 4911

SOFTWARE CITY
47 CHEAP STREET, NEWBURY, BERKS RG14 5BX.
TEL: (0635) 31696

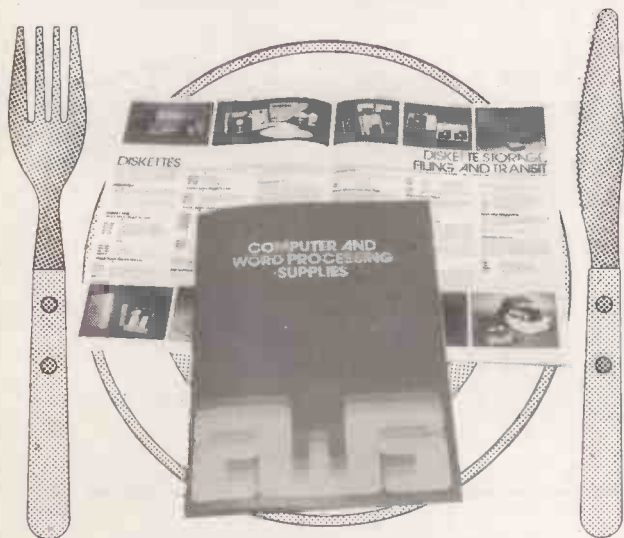
SWW COMPUTERS
HASSET HOUSE, HASSET STREET, BEDFORD MK40 1HA.
TEL: (0234) 40601

TRISOFT LTD
CROWN SQUARE, MATLOCK, DERBYSHIRE DE4 3AT.
TEL: 0629 3021

WRIGHT COMPUTER LOGIC
1ST FLOOR, ORBIT HOUSE, ALBERT STREET, ECCLES,
MANCHESTER M30 0LJ. TEL: 061 788 7050

MultiMate™

Consumables!



Don't make a meal of ordering your computer supplies phone

01 541 1188

For your free catalogue

AWS

AWS Computer Supplies, 57 Surbiton Road,
Kingston-upon-Thames, Surrey KT1 2HG

● Circle No. 111



MultimateTM? Out of the question Miss Snodgrass.

At Faucetts Bathroom Fittings Ltd, office modernization was a taboo subject. Chester Faucett the M.D. would sink into a deep depression at the very thought of spending money.

In fact his wallet bore an uncanny resemblance to the rubber washers he manufactured.

Totally leakproof.

A PLUG FOR MULTIMATE

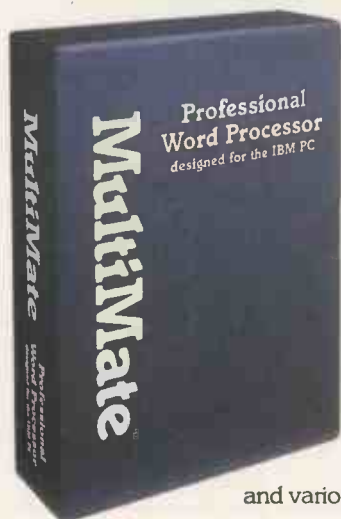
But Miss Snodgrass explained to her illustrious employer that the newest Multimate, V.3.3, is one of the most

sophisticated and powerful wordprocessing software packages available for the IBMTM PC.

It can perform over 130 functions, most requiring just one or two taps on the keyboard, making it simplicity itself to use.

Multimate has support for proportional spacing, micro justification and extended character sets.

Not to mention advanced printing capabilities; including boldface, underline, subscripts and various print fonts.



OVERFLOWING WITH FEATURES

With Multimate you can send letters to suppliers called from an existing database. Like dBase IITM for instance.

Or drain information from Lotus 1-2-3TM and wordprocess it as part of a report.

There's also provision for customized screen display, a back-up file option (before editing) and a multiple directory feature. So you can divide hard or crowded disks into smaller workspaces. Which makes flushing out the required memo, for example, simplicity itself.

And because of its file conversion capability, you can whisk data from an IBM DisplaywriterTM and use it on other IBM compatibles.

Which makes the case for Multimate pretty watertight.

It's available from your local Softsel dealer. Along with over 2,600 other titles from over 250 publishers.

Old man Faucett was so impressed he's made Multimate part of a massive new investment programme.

Along with three paperclips, a pencil and two rubbers! Multimate – the last word.

SOFTSEL[®]

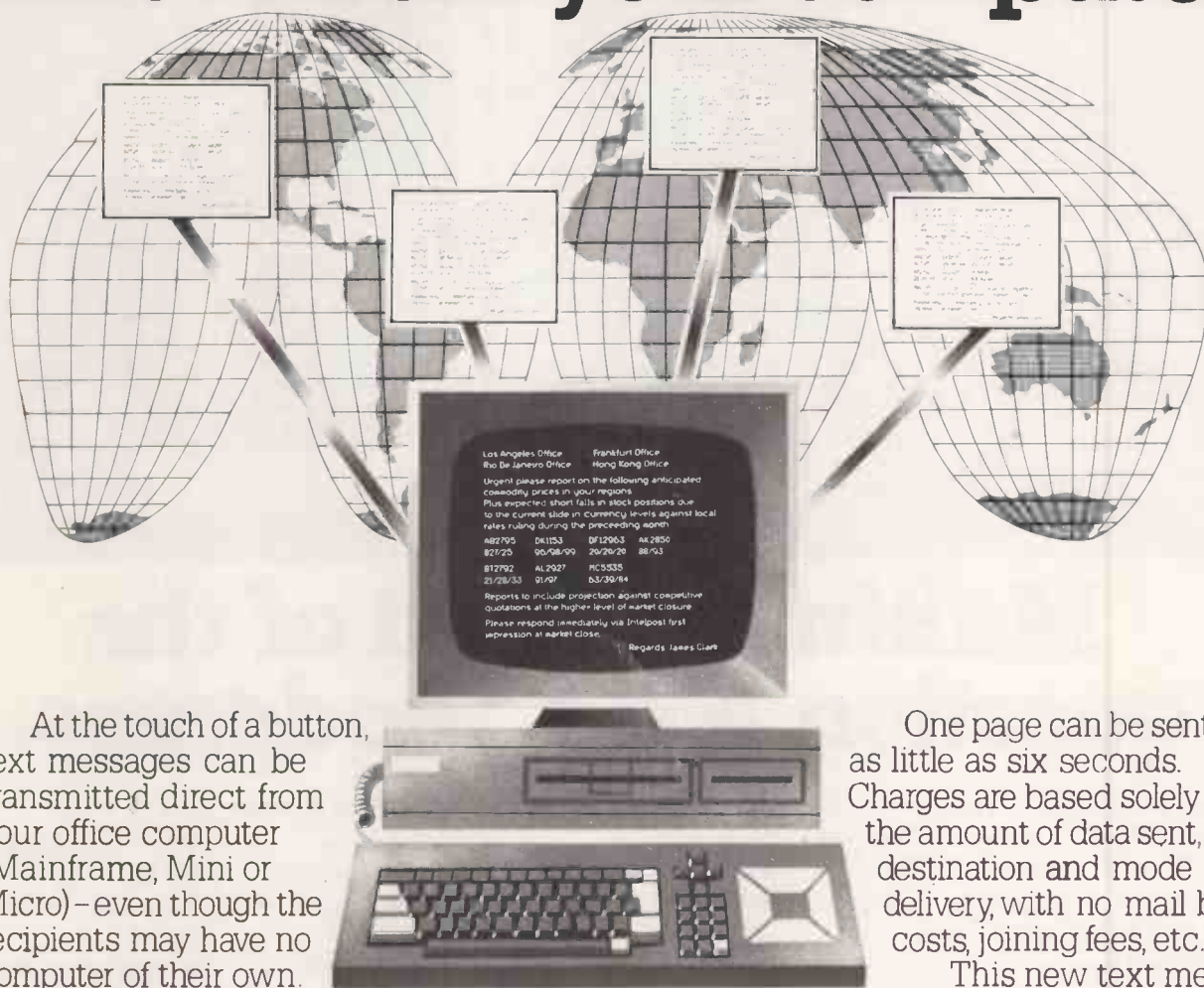
**The number one distributor of software.
In the world.**

Softsel Computer Products Ltd, Softsel House, Syon Gate Way, Great West Road, Brentford, Middlesex TW8 9DD.

MULTIMATE IS A TRADEMARK OF MULTIMATE INTERNATIONAL CORP. IBM IS A TRADEMARK OF INTERNATIONAL BUSINESS MACHINE CORP. DISPLAYWRITER IS A TRADEMARK OF INTERNATIONAL BUSINESS MACHINE CORP. dBASE II IS A TRADEMARK OF ASHTON-TATE. LOTUS 1-2-3 IS A TRADEMARK OF LOTUS DEVELOPMENT CORP.

• Circle No. 112

Intelpost delivers messages around the world—direct from your computer.



At the touch of a button, text messages can be transmitted direct from your office computer (Mainframe, Mini or Micro)—even though the recipients may have no computer of their own.

This is a world-first service that enables you to reach most urban areas in the U.K. and 23 other countries, not to mention the hundreds of thousands of private facsimile machines worldwide. Your potential audience is enormous!

All that is required is a modem and your own or a commercially available software package.

One page can be sent in as little as six seconds. Charges are based solely on the amount of data sent, the destination and mode of delivery, with no mail box costs, joining fees, etc.

This new text messaging facility, like the established Intelpost facsimile service is unique in providing same-day delivery to many parts of Britain, Europe and America; with next-day delivery in many other countries.

Intelpost

A ROYAL MAIL SERVICE

To: Royal Mail Marketing Dept., FREEPOST (no stamp required), Room 122, 33 Grosvenor Place, LONDON SW1X 1EE

Please send me complete details on your Text Data Service.

Immediate enquiry service: Dial 100 and ask for FREEFONE INTELPOST.

Name _____

Position _____

Company _____

Address _____

Postcode _____

C/213/4629/5

COMPAQ DESKPRO 286 KAYPRO 286i

AT-EMULATORS: LUXURY v. UTILITY

By Jack Schofield

IBM's 80286-based PC/AT has set a new standard for personal computers. Two new arrivals both subscribe to it, but are radically different in other ways.

BASIC BENCHMARKS

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Deskpro 286 — 80286	0.3	1.2	2.8	2.9	3.2	5.7	9.1	9.2	4.3
Kaypro 286i — 80286	0.4	1.7	3.8	4.0	4.3	7.9	12.3	12.5	5.9
IBM PC/AT — 80286	0.5	1.9	4.6	4.7	5.2	9.1	14.6	13.5	6.8
Olivetti M-24 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2
Headstart ATS — 80286	0.6	2.5	5.5	5.7	6.2	11.2	17.6	18.2	8.4



The announcement last August of the IBM PC/AT threw all the major IBM-compatible manufacturers into a frenzy of activity. A dozen of them have since announced new machines which emulate the PC/AT, and samples are now starting to come through. The first to arrive was the Intertec Headstart ATS, which offered very small size and network capabilities, plus a low prices. The two latest releases from Kaypro and Compaq, are reviewed separately on the following pages. In terms of raw performance, however, both micros are very similar to the IBM PC/AT.

The standard eight Basic Benchmarks were run on all the available AT-alikes, plus the Olivetti M-24. On this basis, the

Compaq Deskpro 286 emerged as a clear winner, being significantly faster than the IBM PC/AT. The Kaypro and Olivetti micros ran at roughly the same speed as the IBM, with the Intertec Headstart slightly slower.

The Compaq's advantage is that it runs the 80286 chip at a slightly faster clock speed of 8MHz, compared with the 6MHz of the PC/AT. It can also be run at 6MHz if this is necessary to ensure software compatibility.

The Compaq is the only one of the 286-based machines to offer significantly better performance than the 8086-based Olivetti M-24. This is because the 80286 actually runs the PC-DOS operating system in a compatible mode where the chip emulates

(continued on next page)

BAGSHAW BENCHMARKS

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	Total
Deskpro 286 — floppy	10.5	4	4	12.5	15	16.4	5	17.5	5.3	8	13.4	75	45.5	18.2	250.3
Deskpro 286 — 30Mbyte hard	6.2	1.8	2.5	2.3	2.8	3.6	1.2	3.8	1.1	0.8	1.6	11	5.9	3.2	47.8
Deskpro 286 — RAM disc	6	1.5	2	1.5	1	1	0.7	1	0.7	0.3	1	9	5.5	0.7	31.9
Kaypro — floppy	12	12	11	23	11	24	4	26	14	8	16	89	57	21	328
Headstart ATS — floppy	16	11	10	14	14	38	12	65	18	8	17	70	48	52	393
Apricot XI — 10Mbyte hard	16	6	7	11	7	26	1	27	2	4	9	50	20	6	192

(continued from previous page)

an 8086. The enhanced Protect mode, where the full power of the 286's architecture is unleashed, is not currently accessible from PC-DOS.

The second major advance offered by the PC/AT standard, compared with the PC standard, is much faster disc operation. In most businesses, the extra disc speed is far more useful than the extra processing power.

The standard Disc Benchmarks devised by Eric Bagshaw of the National Computing Centre — see *Practical Computing*, July 1984 page 99 — were run on the Compaq, Kaypro and Headstart models. Unfortunately, samples of the IBM PC/AT and Olivetti M-24 were not to hand for these Benchmarks to be run. Again, however, the Compaq Deskpro emerged as a clear winner.

One of the problems with PC-DOS and, of course, the highly similar MS-DOS, is that it cannot address more than 640K of RAM. This is now seen as a major limitation for three reasons. First, the 8086 and 80286 can address 1Mbyte of RAM, and the 80286 can address 16Mbyte in Protect mode. Second, memory prices have dropped so rapidly that large amounts of memory — over 1Mbyte — are now affordable. Third, many software houses now seem to be incapable of writing programs that are smaller than about 400K.

The Compaq Deskpro 286 supplied for review actually had 2.2Mbyte of RAM installed, which is 1,536K more than could be accessed via PC-DOS. PC-DOS version 3.0 has a useful way of handling this. The VDisk command in DOS 3 enables virtual discs — also called RAM discs or silicon discs — to be set up very easily. The Compaq's extra memory could therefore be used to provide the maximum 640K of RAM to DOS, plus the 512K RAM discs addressed as D:, E: and F:. As an experiment, both of IBM's PC-DOS discs, including the supplementary programs, were copied into the virtual disc D:. This comprises 50 files and a total of 450.5K of code. Copying all this from D: to E: using *.* took all of four seconds. With DOS or other large programs run entirely from RAM, the performance of a micro is electrifying. For anyone with a suitable micro and DOS 3, and who can afford it, this must look like an attractive way to go.

Future versions of PC-DOS will inevitably be obliged to expand their memory address capability above 640K, and eventually provide proper multi-tasking facilities using the Protect mode of the 80286. Whether these enhancements will arrive later this year with DOS 4, or next year with DOS 5, is open to speculation and doubt. Until they do, in our view the Olivetti M-24 still offers the best price/performance ratio in the IBM-alike universe. However, 80286-based machines are clearly where most of the business-micro market is headed, and the progress being made is exciting.

COMPAQ DESKPRO 286-2

Compaq has made a fortune out of making IBM-compatible micros better than IBM. The Deskpro 286 model 2 is the latest in what is now an extensive line-up and, true to form, it beats the IBM PC/AT in almost every department. And as with the Compaq portable, the Deskpro offers better IBM compatibility than IBM's own micro.

Microsoft's Flight Simulator was one of the first guides to IBM compatibility, because of the direct use it makes of the IBM PC ROM. Nowadays all true IBM compatibles are capable of running it. However, in launching the PC/AT, IBM changed the standard somewhat, and the Flight Simulator, FS-1, would not run. Therefore Microsoft has produced version 2, or FS-2, to run on PC/ATs and on the PCjr.

The clever thing about the Deskpro 286 is that while it obviously runs FS-2, as an AT-alike should, it also runs FS-1, like a real PC-compatible micro. This is something that the Kaypro 286i, Headstart ATS and the PC/AT itself cannot do.

In other departments, too, the Deskpro 286 offers more and better facilities than the PC/AT. One problem with IBM's micros is that the monochrome and graphics displays



SPECIFICATION

CPU: Intel 80286 running at 8MHz
RAM: 512K, expandable to 8.2Mbyte
Storage: 1.2Mbyte floppy disc, 30Mbyte hard disc, 10Mbyte tape streamer; optional 70Mbyte hard disc and 360K floppy discs
Display: 12in. dual-mode amber monitor showing 80 characters by 25 lines and IBM-compatible graphics
Ports: parallel printer port, RS-232C serial port, RGB and composite-video ports
Availability: autumn 1985
Price: not known
Supplier: Compaq Computer Ltd, Ambassador House, Paradise Road, Richmond, Surrey TW9 1SQ. Telephone: 01-940 8860
 ● The Deskpro 286 model 1 is similar but comes without the hard disc and tape backup. Transportable versions will also be available.

KAYPRO 286i

Those who have used Andrew Kay's transportable micros will find the new 286i, a desk-top IBM PC/AT-alike, very familiar. Like other Kaypros it appears to be made of industrial-grade sheet metal. The finish is black and utilitarian, with moulded rubber edgings and cork discs to protect the desk top.

The system box is huge: it takes up about 360sq.in. of desk top. This machine would look perfect on a factory floor. Anyone who wants a svelte, luxury micro like the IBM PC/AT, or the almost equally stylish Compaq Deskpro, should look elsewhere. However, the Kaypro 286i does its job, which is to emulate the IBM PC/AT. It delivers a great deal of computing power, including an excellent bundle of software, at a quite attractive price.

Where the Compaq 286 and Olivetti M-24 micros compete by offering significantly better performance than the equivalent IBM micros, the Kaypro is simply a clone. The board design is very similar to that of the PC/AT, and the ROM BIOS, supplied by Phoenix Software, emulates IBM's. The colour graphics appears to be driven by a Hercules Color Card, and this leaves five of the eight expansion slots free.

In sum, the hardware is all pretty standard stuff. As with the Kaypro transportables, the



SPECIFICATION

CPU: Intel 80286 running at 6MHz
RAM: 512K, expandable to 15Mbyte
Storage: 286i B with two 1.2Mbyte 5.25in. floppy discs, 286i A with one floppy disc only
Display: 13in. RGB colour monitor showing 80 characters by 25 lines and IBM-compatible graphics
Ports: parallel printer port, RS-232C serial port, RGB port: no ports supplied with 286i A model
Availability: now
Price: model B, £4,136 plus VAT; model A, £2,674
Supplier: Kaypro (U.K.) Ltd. Telephone: (06286) 67547

"unique selling proposition" of the 286i is a bundle of Micropro software: WordStar and Mailmerge, Calcstar, Infostar and Starburst. The one important piece of software that you have to buy is a copy of IBM's own PC-

COMPAQ DESKPRO 286

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Far superior to anything else in its class. If reasonably priced, this machine should be a huge success.

are provided as separate systems, using separate cards as drivers and separate screens. Either you have the excellent monochrome character set and no graphics, or the colour-graphics facilities and low-resolution text. Like other Compaqs, the Deskpro 286 combines them so you get both.

The Deskpro 286 also runs much faster than the IBM PC/AT, thanks to its 8MHz 80286, where the IBM uses a 6MHz version. The Compaq chip will run at 6MHz, if the software requires 6MHz for compatibility. The Deskpro 286 runs the standard Basic Benchmark routines in an average of 4.3 seconds, compared with the 6.8 seconds of the PC/AT.

The Deskpro 286 is also a snappy performer of the Bagshaw Benchmarks, which measure the speed of disc operations. The Deskpro 286's floppy disc ran the 14

routines in a total time of 250 seconds — faster than the IBM PC/XT's hard disc, which takes 254 seconds. When the same routines were run from Deskpro 286's built-in hard disc, the time of 47.8 seconds was nearly twice as fast as any other machine we have tested, with the runners-up being the Jarogate Sprite at 91 seconds, and the Wyse PC at 178 seconds.

In terms of raw specification, the Deskpro 286 supplied for review offered considerably more than a PC/AT. Where the PC/AT has a built-in 20Mbyte hard disc, the Deskpro 286-2 offers a 30Mbyte model; 20Mbyte and 70Mbyte options are also available. Where IBM offers no means of backing-up important data — except on to a mass of floppy discs — the Deskpro 286 has a built-in tape streamer with a capacity of 10Mbyte per tape.

On test the Deskpro 286's performance was sparkling. The legibility of the amber dual-mode screen was outstanding, all operations were very fast, and the machine ran virtually all software thrown at it. It did not run the IBM diagnostics disc, but that is only to be expected. There were no problems reading 360K discs written by or for other IBM-compatible machines.

The keyboard has the same layout as the PC/AT, including the unimplemented Sys Req. key, but with LED indicators actually built into the tops of keys like Caps Lock, etc. The PC/AT layout is superior to that of the standard IBM PC, though it takes some getting used to.

Two drawbacks to the Deskpro 286

emerge when you try to move it about. Like the PC/AT itself, the Deskpro 286 is very heavy. But a 2.2Mbyte micro with a 30Mbyte hard disc, built-in tape streamer and massive power supply could hardly be expected to be light. Also, before you lift the machine you have to release three screws and slide the lid off, to lever a locking prong for a hard disc into the Park position.

Another drawback may turn out to be the price, which had not been divulged at the time of writing. Compaq is not known for being noticeably cheaper than IBM. However, you do tend to get more for your money, and frankly the Deskpro 286 is worth a premium over the IBM PC/AT. Unless you have a ridiculous attachment to the three little letters I, B and M, the Deskpro 286 is a far better machine to buy.

CONCLUSIONS

■ The Deskpro 286 offers a high level of compatibility with the IBM PC and PC/AT micros, to the extent that it could even be more IBM compatible than IBM's own machines. This enables it to utilise the large PC and PC/AT software base.

■ The extra convenience of the dual-mode screen display, built-in tape backup and greater expandability make the Deskpro 286 model 2 clearly preferable to the IBM PC/AT.

■ For single-user desk-top computing, the Deskpro 286 is, in terms of specification, facilities, speed and performance, the best micro ever reviewed by *Practical Computing*. For applications where the power is required, it should sell like hot cakes, almost regardless of price.

KAYPRO 286i

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Documentation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Little more than an IBM PC/AT clone. Its bundled software may not quite compensate for its lack of finesse and finish.

DOS version 3. Unlike Compaq and Olivetti, Kaypro does not supply its own version of DOS.

The system supplied for review had an Intel 80286 chip running at 6MHz, 512K of RAM and two 1.2Mbyte half-height 5.25in. floppy-disc drives. There is a battery-backed clock/calendar, and space for an 80287 maths co-processor. RAM can be expanded to 640K on the main board using 18 64Kbit RAM chips and, it is claimed, to 15Mbyte using expansion cards. The review sample was set up to include an optional hard disc, which can be added as an upgrade. There is also a single-floppy version with no colour board and no ports. In fact, on power-up the hard disc's red access light winked and we thought one might be inside, but this was not the case.

The system was run using the 13in. RGB

colour monitor supplied. This required a separate mains lead, unlike the Compaq Deskpro. The Kaypro also lacks a composite video port. While it was nice to have colour, as many of the newest IBM PC packages use it extensively, the IBM's sharp, high-resolution monochrome character set was sadly missed.

On test, the Kaypro performed impeccably. For reasons unknown it ran the eight standard Basic Benchmark routines slightly faster than the IBM PC/AT: the Kaypro's average was 5.9 seconds, compared to the PC/AT's 6.8 seconds. As the chip and DOS are identical, this presumably means that Microsoft's GWBasic is just slightly faster than its Basic.

The Bagshaw Benchmarks, which measure the speed of disc operations, produced curious results, in that times varied a great deal between tests. The total time of 314 seconds seems reasonable, though both faster and slower results were obtained, which could have something to do with the buffering.

Another feature of the drives was that they made embarrassingly loud scrunching noises when the first few tracks of a 360K disc were read, before they settled down into quiet operation. The drives themselves were efficient and reliable, and there were no problems reading 360K IBM PC discs.

The Kaypro's keyboard is laid out like the PC/AT, and feels quite good for typing. It does have the same metallic construction as the rest of the machine and, indeed, the rest

of the Kaypro range. You get serviceability with little cosmetic finish and no finesse at all. Not everyone will like it.

No problems were experienced with standard software packages, though the 286i would not run the IBM PC diagnostics disc nor Microsoft's original Flight Simulator. It did, however, happily run the new version 2, designed for the PC/AT. In these respects the Kaypro performed like the Intertec Headstart, reviewed last month. Also like the Headstart, the Kaypro is badly documented, with only preliminary notes supplied.

There is little else to say about the 286i. It does perform as an IBM PC/AT clone, it has useful free software. At a lower price than the PC/AT, the 286i should also appeal to those whose needs are for utility rather than glamour.

CONCLUSIONS

■ The Kaypro 286i is an IBM PC/AT clone, and imitates its rival about as closely as is legally advisable. This makes it a machine of huge raw power.

■ The Kaypro differs from the PC/AT in also having a huge raw appearance. That it is utilitarian is about the nicest thing one can say about a micro that is prettier than only the Advance 86B.

■ The bundled Micropro software is of known quality and is an attractive extra.

■ If the price is aggressive it should appeal to those who value functionality over glamour. The quoted price is around 10 percent less than the PC/AT. Even with the free software, this may not be quite competitive enough.

GEM DESKTOP WIMPS FOR ALL

By Mike Lewis

Digital Research's Gem brings a uniform Mac-style graphics interface to a wide range of personal computers, including the IBM PC.

The arrival of Gem marks the most realistic attempt yet to bring the marvels of overlapping windows, pull-down menus and multiple fonts to a wide range of personal computers. It is a strategically important product, for both programmers and end-users. If it succeeds it will do for graphical interfaces what CP/M did for operating systems.

The comparison is an apt one because, above all, Gem is to do with portability. Just as CP/M allowed software houses to write a program for one computer in the expectations that it would run on many others, so Gem gives them the world of Wimps — windows, icons, mice and pointers — without having to worry about the details of widely differing graphics hardware.

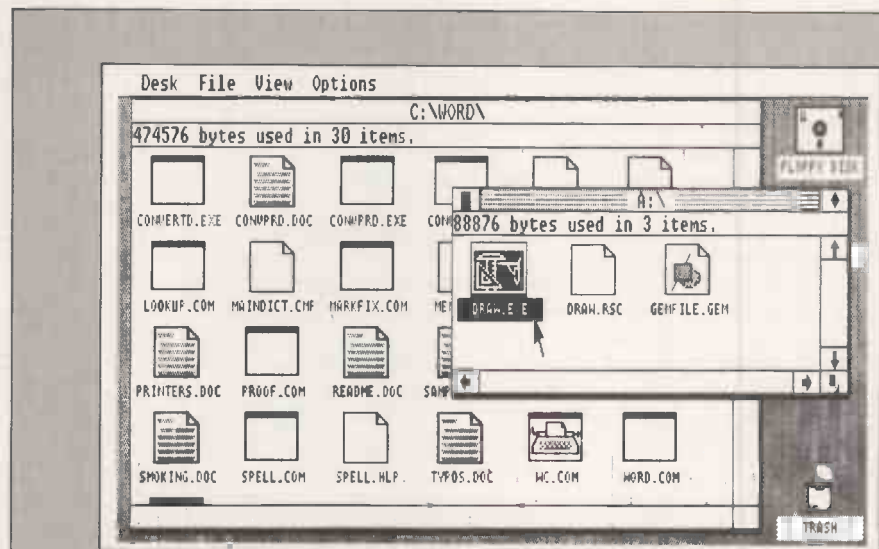
Gem is not itself an operating system, but rather a layer of software that lives between the OS and an application program. The hardware-dependent parts are provided by Gem's licensees — that is computer manufacturers and OEMs — while writers of application software gain access by means of a programmer's toolkit.

SOFTWARE YET TO COME

What Gem will do for the end-user depends on the extent to which developers of databases, spreadsheets, accounting packages, etc. make use of the goodies that it offers. So far, Gem-based packages have come in a trickle rather than a flood, but it's early days yet.

In fact, the only Gem offerings to date have originated, not surprisingly, from Digital Research. These include Gem Draw, Gem Paint, Gem Graph and Gem Wordchart, all of which should be available by the time you read this. At the moment, the only established product is Gem Desktop, which is in many ways the hub of the system.

To run Gem, you will need 256K of RAM and a graphics display. A hard disc is advisable, but not vital. The version we tried was for the IBM PC, but it ran quite happily on the closely compatible Compaq Deskpro and Olivetti M-24. Versions for other



Desktop provides a separate scrollable window for each sub-directory. Each icon in the window represents either a file or another sub-directory. The user is able to move windows to anywhere on the screen, change their size and make them overlap.



The Get Info option in the File menu brings up an information box for the currently selected object, which may be a disc, folder, application or document. In this case, it is the floppy disc in drive A which is selected, as indicated by the reversed disc icon.

systems will be supplied by the hardware manufacturers — they already exist for the Atari ST series and the entire Apricot range — but the IBM version is sold by Digital Research itself.

Of course you will also need a mouse. In fact, Gem can be made to work with various pointing devices, such as joysticks and touch-screens, provided the manufacturer supplies the necessary drivers. We used the

two-button Microsoft mouse, only the left-hand button being operative in Gem. In the IBM version you can get by with the cursor keys instead of a mouse, but it is a slow and clumsy alternative.

Installing Gem is simple, the whole operation being carried out by a batch file called GemPrep. If you are using floppies, you end up with two discs: a startup disc and the disc containing the Desktop program.

SPECIFICATION

Description: Gem is an operating system extension that lets programmers use overlapping windows, icons, mouse support, pull-down menus and multiple fonts; Desktop uses Gem to perform the common DOS utility functions

Hardware required: IBM PC family or compatibles, Atari ST or Apricot, other versions available soon; bit-mapped graphics display, 256K RAM, mouse or other pointing device

Publisher: Digital Research, Oxford House, Oxford Street, Newbury, Berkshire. Telephone: (0635) 35304

Price: Desktop costs £49.95 plus VAT
Available: now

anything useful, you have to select a disc by moving the mouse pointer to the icon and clicking the button. This switches the icon to a dark picture on a light background, Gem's standard way of highlighting a selected object.

To see what's on the disc you open the drive, either by double-clicking the icon or by selecting Open from the File menu. Gem responds by displaying the disc's root directory in a window, with an icon for each file. These so-called directory icons come in three varieties: folders, which are DOS sub-directories; applications — Bat, Com and Exe files; and documents, which are meant to cover text and data files, but are in fact anything that is not a folder or an application.

BRANCHING

Since a folder is a sub-directory, it can itself be opened to display a further window of icons. Folders may contain other folders, reflecting DOS's tree-like structure. There is a New Folder option in the File menu which serves the same purpose as the DOS Mkdir command, and you can copy files between folders, root directories and other discs.

Copying a file is simply a matter of selecting the icon, then dragging it with the mouse button held down to where you want it to go. Gem warns you if the file already exists at the destination, and also gives you a chance to rename the copy. You can copy entire discs in this way, just by dragging one disc icon on to another. If you drag an icon to the trash can, it is deleted after a suitable warning message.

The most important operation that you normally carry out at the DOS command line is to invoke an application program. In Gem, this is done simply by opening the application's icon. Before handing over to the program, Desktop invites you to enter a parameter, the name given to a command-line tail, for passing to the program. Although the application takes complete control of the screen, when it finishes the Desktop reappears exactly as you left it.

The other type of icon which you can open is a document. The aim here is merely to see what is in it, via the DOS Type command. Bear in mind that a Gem document is not necessarily text, so trying to

(continued on next page)



Digital Research's version of Gem runs on the IBM PC and compatibles. Versions for other systems will be supplied by hardware manufacturers.



Desk accessories may be invoked from Desktop or within a Gem application. The clock and the calculator are supplied with the package. Programmers who have the Gem Toolkit may add their own accessory programs.

To start Gem itself, you place the startup disc in Drive A and type GemRun. You are then prompted to swap discs, after which Desktop takes over the screen. Drive B remains free for other programs and data. You can also start Gem from a hard disc.

The aim of Desktop, in a nutshell, is to replace the DOS command line. It does not replace DOS itself or even Command.Com, but it does provide an easy way of carrying

out basic housekeeping tasks without having to remember unfamiliar commands. Experienced users might prefer the old-fashioned A> prompt, but a newcomer should find Desktop less intimidating and easier to learn.

The initial Desktop screen shows an icon for each floppy or hard disc and a trash can. There is also a menu bar with four choices: Desk, File, View and Options. To do

(continued from previous page)

open a binary file will result in a screenful of rubbish.

Opening a document in this way reveals one of the main weaknesses of Desktop, something which is also evident when you wish to format a floppy or carry out a disc-to-disc copy. In each case, Desktop steps aside and allows the equivalent DOS command — Type, Format or DiskCopy — to take over, exposing the user to precisely the sort of cryptic dialogue that Desktop is designed to avoid.

Having opened a document, it is a trifle disconcerting to see your attractive Desktop display disappear, albeit temporarily, to be replaced by a monochrome text screen, with the contents of the file flashing past and only the Control-S key to stop the scrolling. Would it have been so difficult for Digital Research to have displayed the file in a Gem-style window and to have given the user a little more control over the scrolling? As it is, relinquishing control to DOS in this way gives Desktop a decidedly unpolished appearance.

Fortunately, these are the only occasions on which Desktop's dealings with the user are open to criticism. In general, you are never left wondering what is going on and most of the system's messages are polite, clear and to the point. When you start an operation that might be either time-consuming or destructive, such as copying or deleting a file, Desktop issues an unambiguous warning and gives you a chance to back out. More confident users can switch off this feature.

A particularly interesting aspect of Desktop is the way in which documents with the same file type can be linked to a specific application. Once this is done, opening a document of the relevant type will have the same effect as invoking the application, with the document's name as a parameter.

For example, you could assign all documents of type Txt to WordStar. Then when you double click on a file named Report.Txt, Desktop will load WordStar which will in turn open Report.Txt ready for editing. To help you remember which documents work with which programs, you can superimpose special icons on the normal application and document icons. Thus there is a typewriter icon which would be suitable for a WP program, and one resembling a sheet of paper for word-processed text.

RESUME LATER

Normally, this link-up between applications and documents survives only for the current Gem session. The same is true of the various toggles and switches which you can set to disable the warning message before file deletions, for instance. However, if you use the Save Desktop function in the Options menu, all these settings are written to disc. The next time you invoke Desktop, the system will be just as you left it.

In any discussion of Gem, there is a strong temptation to make comparisons with the systems that has most furthered the Wimp cause: the Macintosh. Certainly, Gem has a

great deal in common with the Mac, at least from the user's viewpoint. This is no bad thing, because once you have learned how to operate one of these, you will know the other too.

Windows have a near identical anatomy in both systems. By manipulating the various controls around the edge of the window, you can scroll it any direction, move it, alter its size or close it altogether. The only difference is that Gem's windows also have a Full box: you click this once to make the window fill the screen and click it again to return the window to its previous size. This would be a useful addition to the Mac.

Another small difference is in the use of pull-down menus. On the Mac, you pull down a menu by pointing to it and holding down the mouse button. You may then drag the mouse to the option you want and release the button. In Gem, the menu drops

GEM DESKTOP				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Desktop provides a more natural way of using DOS and its utilities than the A> prompt. This way of doing things is likely to become the norm.

down as soon as you point to it, and the option is selected by a single click.

Desk accessories are also common to both systems. These are mini-applications which can be invoked from their own menu, either from the desk top or within other programs. Gem has just two of them, a clock and a calculator, while the Mac sports seven, including the indispensable scrapbook. Gem also lacks the equivalent of the Macintosh clipboard, a handy means of cutting and pasting between programs.

But it is from the programmer's point of view that the real differences between Gem and the Macintosh emerge. When you program the Mac, you are locked into a fairly fixed configuration. Access to the graphical interface involves working closely with the hardware and with the Mac's ROM-based service routines, and this can be quite an undertaking. You can do a lot of Mac tricks in certain high-level languages like Microsoft Basic and Mac Pascal, but these are interpreted rather than compiled and so do not appeal to software vendors.

The Macintosh is controlled by a piece of software called the finder. This, together with the ROM routines, serves as operating system, Wimp manager, and desk top. It is highly machine specific, and adding non-Apple hardware like third-party hard discs generally involves obtaining a modified version of finder.

By contrast, Gem works in co-operation

with existing operating systems, its role being confined to servicing programs that want to use the graphics interface. The programmer can communicate with DOS as before, and can continue to use all his or her favourite tools like keyboard enhancers and RAM discs. And you can use any language that permits calls to compiled library routines — although the calling sequence is particularly geared to C.

HIGHLY PORTABLE APPLICATIONS

Because all interaction with graphics devices is routed through a set of drivers, Gem programs can be highly portable. This does not mean that you can port Gem itself from an IBM to an Apricot and expect it to work. But once you have Gem on both systems, your application code can be successfully transferred, which is more than can be said for packages that try to do their own clever displays by directly accessing the computer's screen-mapped memory.

This approach also means that applications written for non-Gem environments can be used in a Gem system without change. Familiar programs like WordStar and dBase will run quite happily whether they were invoked from Desktop or the DOS command line, and they will not be put off by any Gem routines that happen to be resident in RAM. What is more, the user is not tied to Gem and can return to normal DOS operation whenever he or she feels like it.

But although these are important advantages, Gem will not succeed if it merely provides a standard, intuitive mechanism for invoking non-standard, non-intuitive applications. The future of Gem depends critically on how readily the likes of Micropro and Ashton-Tate incorporate the Gem brand of Wimps into their mass-market products.


So far the prospects are good, with around a dozen major houses promising Gem adaptations of their packages. The products include Thorn EMI's Perfect range, the Pegasus accounting system, Lifetree's Volkswriter, Plan from Chang Labs, SPI's Open Access, Compssoft's Delta, and the Prospect Graphics Library.

It is true that all these represent just announcements rather than actual discs and manuals on dealers' shelves. But with this sort of muscle behind it, Gem certainly looks like being off to a good start.

CONCLUSIONS

■ With its Mac-like user interface, its availability on a range of business micros, and its ability to work with existing applications software, Gem certainly looks like being a winner.

■ At first sight the Gem environment is nice and friendly to programmers, especially those who do not want to work too closely with the graphics hardware.

■ In spite of a few rough edges, Desktop is a highly acceptable alternative to the DOS command line. It can be mastered very quickly and so should appeal strongly to computer novices. 

Every option you'll ever need.

You're looking at ULTRAFRAME™ a powerful 8/16 bit multiprocessor you can configure to handle any application.

It's the one system that can tackle your toughest jobs today with the capacity to grow up to 36 users or tasks — within the same chassis.

Get 5" & 8" Winchester drives from 10-300MB (formatted). And backup systems appropriate to any system you design.

Now run both MS-DOS and CP/M software.

Our system lets you network IBM PC's, compatibles or other popular PC's into a serious multiuser business system. Tie PC's into the speed of an

S-100 buss with inexpensive boards and a coaxial cable.

Each PC can tap network resources including hard disks (10-300MB) and system printers with spooling.

The PC's gain the proven network

management capabilities of TurboDOS™. Run MS-DOS™ and CP/M 86 software plus true multiuser accounting and data base applications.

The industry's longest warranty.

We've built the ULTRAFRAME to last — and backed it with a full one year warranty. Plus, we give a level of old-fashioned factory support you won't get from anyone else. And on-site maintenance is available nationwide.

FRONT



BACK



ULTRAFRAME™



The multiuser system that also networks IBM PC's.

- **UP TO 36 USERS — IN PARALLEL.** Add 8 or 16 bit SLAVENET™ processor boards — each a complete Z80 or 80186 computer — to maintain fast, multi-user performance. Both 12 and 20 slot S-100 models available.
- **LOW COST PER USER.** Higher performance and lower cost per user than any micro network. True multi-user, multitasking operation plus shared resources.
- **MAINFRAME-LIKE CHASSIS & POWER SUPPLY ENGINEERING.** Continuous-duty cooling capacity. Solid state power supply circuitry for max. reliability.
- **FAST, HIGH CAPACITY HARD DISKS.** Full range of 5", 8" Winchester models from 10 to 2.4 GB, including new high-capacity 5" drives.
- **CHOICE OF BACKUP SYSTEMS.** Integral 5" or 8" floppies to 1.2 MB. BACKSTOP™ video archiving; BACKSTOP II™ start/stop tape.
- **FAST, MULTIPROCESSOR OPERATING SYSTEMS.** IBS p-NET™ and TurboDOS — access to all UCSD Pascal™ and CP/M™ software.

TurboDOS™ is a registered trademark of Software 700.

IBM PC is a registered trademark of IBM. ULTRAFRAME is a registered trademark of IBS, Inc. CP/M and CP/M 86 are registered trademarks of Digital Research. MS-DOS is a registered trademark of Digital Research.

Synamics

BUSINESS SYSTEMS LIMITED

78 Buckingham Gate,
London SW1 6PD.
Telephone: 01-222 4701/4707

I am interested in:

Becoming a dealer a distributor

More information

Name Address

Company

Tel No

PC 8/85

● Circle No. 114



WERE NOT JUST SAYING THEY'RE 100% RELIABLE.



WE GUARANTEE IT.

Not everything that claims to be totally reliable lives up to its promise. But when you're choosing floppy disks, you have to be sure of 100% reliability. Anything less can be expensive and damaging.

That's why every SKC disk goes through the most rigorous quality control and is guaranteed and certified to be 100% error free.

SKC is one of the world's leading chemical companies and all our disks are made to the highest standards

SKC disks can withstand up to 5 million passes of continuous operations on the same track.

SKC disks meet ANSI, DIN, ECMA, IBM, JIS and SHUGART specifications and are available, unformatted, in 5 1/4" Single Sided Single Density, Single Sided Double Density and Double Sided Double Density variants. A 3 1/2" disk is also available and they all have a full 5 year guarantee.

For more information contact Bridie Sumsion, Computermate Data Product, Scotia Road, Burslem, Stoke On Trent ST6 4DX, Tel: 0782-811711 or SK (Sunkyong) Europe Corporation Limited, Sunkyong House, Springfield Road, Hayes, Middlesex.

● Circle No. 115

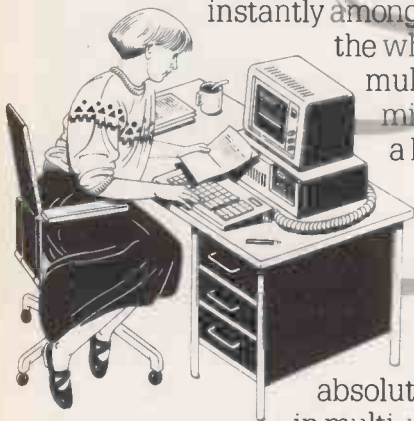
SKC FLOPPY DISKS



Multi-User. Single Choice.

A good Database Manager makes a multi-user micro into a supremely powerful office tool.

Co-workers can not only store data but share it instantly among themselves. That is the whole point of having multi-user or networked micros. With Superfile, a busy office staff can automate the flow of paper easily, quickly and make it work the way they want it to.



Reliability is absolutely essential in multi-user

software. Southdata, with its advanced Superfile database management package, has more experience in this field than most other companies. Our 8 bit multi-user Superfile was first released in 1982. It works successfully under five different multi-user operating systems and is used extensively by MoD and British Telecom.

Now we are bringing this expertise to bear on the new 16 bit network and multi-user systems.

Multi-user Superfile will work under Multi-user Concurrent CP/M (MCCP/M), Omninet, 16 bit HiNet, Torus, Xenix, Unix, Idris and will work on other



systems as they become available (like Concurrent DOS on the IBM PC AT).

Of course, multi-user Superfile has all the advanced features that make the single user version so successful. Variable length records to increase data capacity. Lightning fast searching. Fuzzy matching. Direct interfaces to most



programming languages and a multi-file database. The Superforms utility gives you an easy to set up screen forms and powerful data validation. The Super tab report generator is equally simple. Superforms II will give multi-page screen forms with large text fields which are callable from programs written in most languages.

Your data is valuable. To share it efficiently you

need the very best in database software. That leaves you with just one choice - Superfile.



SUPERFILE DATABASE MANAGEMENT

For full details, phone or write to: Southdata Ltd, 166 Portobello Road, London W11 2EB. Tel 01-229 2724 & 01-727 7564

● Circle No. 116

PC8

OMNI-READER

AUTOMATED TEXT INPUT

By Ian Stobie

By far the cheapest optical character reader so far — but one with severe limitations.

Omni-Reader is a very cheap optical character reader, designed for use with machines like the Apricot, Macintosh and IBM PC. It lets you read the information on typewritten pieces of paper directly into the computer, without the need to retype it. At £399 Omni-Reader is far cheaper than any competing product, but it does have significant limitations: for some jobs it turns out to be genuinely useful, but for others it is useless.

The problem Omni-Reader sets out to address is an important one. Many tasks such as maintaining membership lists or keeping catalogues up-to-date are highly suitable for computerisation but involve typing substantial quantities of data into the system in the first place. Since most of this data already exists on paper, a cheap way of inputting it directly would save the cost of retyping.

Optical character recognition (OCR) systems designed to do this have in fact existed for some time, but are expensive — in the £6,000 to £15,000 price range. These prices place them outside the reach of the individual user.

Since Omni-Reader is intended for users with comparatively small volumes of data to

SPECIFICATION

Description: input device which optically reads typewritten text off pieces of paper into a suitable computer

Hardware required: IBM PC, Macintosh, or ACT Apricot; also will work with any machine equipped with a suitable RS-232 interface

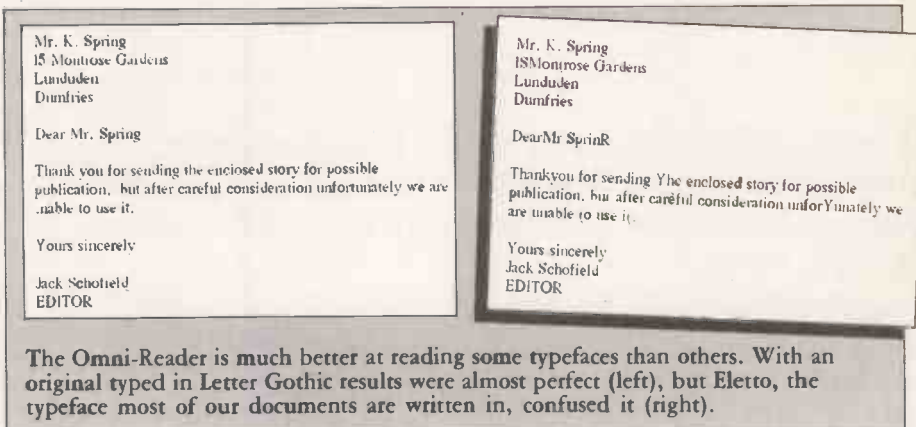
Typefaces recognised: Courier 10- and 12-pitch, Letter Gothic 12, and Prestige Elite 12

Reading speed: 150wpm claimed by the manufacturer

Manufacturer: Oberon International Ltd; made in U.K.

Price: £399 plus VAT; optional software to support IBM, Mac and Apricot is £40; available now

U.K. distributor: Oberon International Ltd, 2 Hall Road, Maylands Wood Estate, Hemel Hempstead, Hertfordshire HP7 7BH. Telephone: (0491) 34838



enter, Oberon, who manufactures it, is probably justified in making it slower and less flexible to get the price down. Reading proceeds line by line, and is almost a manual process in that the user has to physically move the read head over each line of text by hand.

Omni-Reader's other obvious limitation is in the range of material it can handle. You are restricted to reading the output from typewriters, and only the more common electric ones at that, but not printed documents or poor-quality typescript.

Physically Omni-Reader has a flat baseboard on which you place the document you wish to copy. A transparent ruler is free to move up and down the document but is kept strictly parallel to the lines of text. Slotted loosely on to the ruler, so that it is free to move in a left to right axis, is a black plastic box which contains the optical read head. At the top of the baseboard are a set of indicator lights, four of which show the pre-programmed typefaces Omni-Reader is set up to recognise: Courier 10- and 12-pitch, Letter Gothic and Prestige Elite.

Connecting the Omni-Reader up to the Mac we used for this review proved simple enough: it just plugged into the Mac's serial port. We also had Oberon's optional Omni-Reader software, available for an extra £40, which makes the installation process relatively straightforward.

All the typewritten text in our office has either been typed on old manual machines or an Olivetti ET 111 electric typewriter with carbon ribbon and Eletto 12-pitch printwheel. A look in the Omni-Reader manual showed that Eletto is somewhat similar to Prestige Elite 12, so setting the Omni-Reader to this font we tried reading several documents. It takes a while to get the hang of gliding the read head across the text at the right speed. If you get it right the Omni-Reader beeps once and the text appears magically at your current cursor position on the screen. However, we never got 100

percent accuracy with Eletto, more like 90 to 95 percent.

Text typed with an Olivetti Letter Gothic printwheel was much better — near 99 percent most of the time. But this was still not much use to us as none of our existing documents are typed in this face.

Oberon quotes a reading speed of 150 wpm, although we got nowhere near this. I expect a few days practice would speed you up, but I am not convinced that even then I could achieve 150wpm.

Generally, Oberon is realistic about the limitations of its device. Previous claims that the Omni-Reader would be able to read ordinary printed text have been abandoned. Such a task seems to be technically beyond the device, as printed fonts are generally a good deal smaller than typewriter fonts at typically 16 to 20 characters per inch as against the typewriter's 10 or 12.

OMNI-READER				
	VERDICT			
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	■	□	□	□
Ease of use	□	■	□	□
Documentation	□	□	■	□
Value for money	□	□	□	■

Brilliant value if you happen to be one of the few people who wants to do what Omni-Reader can do.

CONCLUSIONS

■ Omni-Reader is too restricted in what it offers to be of practical use to most people. However, some users may have masses of beautifully typed Courier documents which they are dying to get into a computer system, and for them Omni-Reader is worth a look.

■ Omni-Reader is a cheap product and shows the way technology is evolving.

CMS 6502 RACK SYSTEM NOT THE BBC MICRO

By Roger Cullis

This modular, rack-based system from Cambridge Microcomputer Systems allows technical and industrial users to build up a BBC-like micro tailored to their specific needs.



As an input/output device, the BBC Micro offer a wealth of facilities. It has parallel and serial outputs for printers, cassette, disc and LAN interfaces for data storage, sound and speech for aural communication and RGB, composite and modulated UHF for visual display.

There is, however, a lack of flexibility about the implementation. Regardless of whether you need all the functions, they are part of the package. You get the cassette interface, for example, even though you may always save your files to disc. Four-channel sound is there, despite the fact that your only application may be instrument control. Should you require more than one identical interface — to drive a serial printer and a modem, for example — then you would have to think again. There is no easy way of adding such I/O controllers. Hitherto, if you wanted to run BBC software on a 6502 machine you had nowhere to turn, unless you possessed your own manufacturing plant.

Now Cambridge Microprocessor Systems (CMS) has come up with a modular system which permits users to tailor the computer to their specific needs. The CMS system is based on a series of Eurocards, each one performing a particular function or group of

functions. The cards are linked together by a backplane which is either a simple pcb or a mini-rack with its own power supply.

The heart of the system is a 6502 processor card. Unlike the Acorn 6502 second processor, which is simply a 6502 CPU with 64K of RAM, the CMS controller has a much more flexible memory arrangement, with the 64K bank being divided into separate blocks. The operating system is held in ROM at the highest memory addresses, while the lower addresses can be populated by read/write or read-only memory, or simply left empty.

The card has five 28-pin sockets which serve as memory carriers. To accommodate different types, each socket is provided with two banks of wire-wrap connector pins which can be linked in the appropriate configuration to suit the pin-out of individual devices. The manual shows arrangements for most popular byte-wide ROM, EPROM and RAM chips. A pre-programmed bipolar ROM controls the addresses at which the memory devices will be located in the memory map.

The CMS 6502 may be used as a second processor to the BBC Micro or it may have its own keyboard attached to a 40/80-column terminal card.

The system can be further extended by using additional controller cards which function simply as memory carriers when their processor chip is removed. In this manner, over 500K of memory can be directly addressed by using a software paging register to look after bank switching control.

Memory socket 5 has been mapped to support a 16K EPROM. The upper half is devoted to the operating system and monitor while the lower half is available for CMS special applications packages. One such package is a communications module to permit networking of a number of 6502 systems. Other packages control specific CMS I/O Eurocards.

If an application requires a host language, this is mapped into &8000-BFFF. BBC Basic is one language which is available.

CMS supplies a sideways ROM for use when a BBC Micro model B or B+ is employed as the base processor. The controller card is initialised with either a Control-Shift or a *CMS command, and responds with the message

```
BASIC present (if it is installed at
&8000-BFFF)
CMS (1.X)
Ram at XXXX — XXXX
```

SPECIFICATION

CPU: eight-bit 6502, clocked at 1MHz

Video: high-performance colour-graphics card; low-cost 40/80-column pixel graphics with teletex

Interfaces: comprehensive range of I/O facilities including A/D, D/A, serial, parallel, IEEE

Manufacturer: Cambridge Microprocessor Systems Limited, 44a Hobson Street, Cambridge CB1 1NL

Prices: 6502 card with memory chips and BBC Basic, £199 plus VAT; low-cost 6502 controller £119; BBC Tube interface and cables, £79; digital I/O, serial and parallel, £119; memory carrier, £79; high-performance graphics card, £299; 40/80-column teletext card, £149; 13-bit data acquisition, £189; high-performance analogue card, from £205; keyboard, £139; 8in. rack with power supply and backplane, £299



EXPANSION CARDS

The High Performance Colour Graphics Card is based on the Thompson EF-9366 graphics processor chip and has a DIN connector for an RGB-drive monitor. It offers 512- by 256-pixel resolution and is capable of drawing 1.5 million dots per second. In monochrome there are 16 grey levels, while the colour mode will support eight colours per pixel, eight flashing colours or eight colours with intensity control. The ROM holds 96 ASCII characters which may be displayed in a high-density text mode of 85 characters by 32 rows in any colour combination. Character size and style — vertical, horizontal or italic — are fully user-programmable. A hardware zoom capability allows characters to be magnified in the X and Y directions by up to 16 times.

The 40/80-column Video Terminal is a low-cost alternative to the graphics processor card. In combination with the processor the video terminal card offers a convenient terminal emulator. It includes a Centronics parallel interface and an RS-422/423 serial interface. It has an 8K dedicated video memory expandable to 16K, full colour for foreground, background, border and palette, pixel graphics, and user-definable and teletext characters. It supports underlining, and reverse and flashing video.

On the Versatile Interface Board four 6522 versatile interface

adaptors (VIAs) provide 80 independent digital I/O and control lines. A 6551 Asynchronous Communications Interface Adaptor (ACIA) controls a serial interface in RS-422/423 configuration. One half of a VIA drives a fully buffered Centronics printer port. Serial transmit and receive rates and data format may be set under software control.

The 12-bit/Analogue Interface Card is designed for fast real-time data acquisition. It has eight multiplexed ADC input channels with true 12-bit accuracy and stability. There are also up to four DAC output channels, each having an op-amp current-to-voltage converter followed by an inverting amplifier with potentiometer-controlled gain to provide an output voltage of 0-10V at 10mA. There are seven TTL channels available for external control.

The high-performance Analogue/Digital Interface Board offers 16 analogue input channels with 13-bit resolution and 16 digital output lines capable of switching up to 50V at up to 0.5A. Each line has an individual LED status indicator.

Based on the MC-68488 General Purpose Interface Adaptor, the IEEE Talker/Listener Controller CMS IEEE card can act as a talker, listener or bus controller. The card meets all of the IEEE-488 1978 electrical specifications. As a bus controller it can control up to 14 devices on the instrumentation bus.

Unlike the Acorn 6502 second processor, the CMS device is endowed with a monitor which will perform useful operations such as memory dumps, priming CPU registers, cyclic redundancy checks, memory moves and verification, and screen mode changes. The operating system implements standard Acorn OS calls at the expected locations and, in addition, has an extra call Osmon, with a corresponding indirection vector Monv, at &FFC5 and &022E respectively. These locations correspond to those of the Acorn GSRead call and CNPV indirection vector which are not required for a second processor.

Another feature of the CMS card is a real-time clock with battery backup. The clock serves simultaneously as a watch/calendar, alarm and timer. Each function may be read or set and enabled or disabled individually by a defined monitor call.

The battery backup serves another purpose. In conjunction with CMOS RAM it may be used to preserve a transient program. For example, it is quite feasible to load in a

BENCHMARKS

The standard Basic Benchmarks were run — see *Practical Computing* January 1984, page 102. The differences between the three systems are due in large part to differences in the clock speeds.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
CMS 6502	1.21	6.00	15.67	17.04	19.89	29.44	44.51	95.11	28.61
Acorn 6502 second processor	0.42	2.10	5.49	5.98	6.96	10.30	15.55	35.37	10.27
BBC model B — 6502	0.65	3.16	8.20	8.93	10.42	15.41	23.26	52.55	15.32

program using a BBC Micro base processor, remove the Tube connection, unplug the CMS 6502 card from the rack and power supply and then replace it to continue running the program. This also provides a stunning demonstration of the ruggedness of the CMS system, breaking all of the accepted rules about powering down before making a disconnection.

Another indication that the CMS system is intended for industrial control rather than data processing is its performance in the standard Benchmark tests. It is slower than

the standard BBC model B by a factor of 2, and than the Acorn 6502 second processor by a factor of 3. The reason for this is that it is clocked at 1MHz, rather than the 2MHz and 3MHz of the Acorns. The slower clock rate greatly simplifies the timing problems associated with the connection of peripherals and makes the system less susceptible to electrical noise, something likely to be important in an industrial environment.

There is a good selection of expansion cards for use in conjunction with the 6502 processor. Some of those available are described in the box above.

Hitherto, control applications have fallen strictly within the province of the assembly-language programmer. This restriction has now been swept away with the launch of Multi-Basic 85, an extension of BBC Basic designed for the control of input/output devices in the CMS system. Whereas previously it was necessary to spend several months becoming familiar with the techniques of low-level languages, now an engineer with a knowledge of Basic and the characteristics of the I/O devices can cobble together a suitable program in a matter of hours.

Multi-Basic is supplied in two forms, either as a sideways ROM located at &8000 or as a normally mapped ROM at &4000. The ROMs are initialised respectively with the *Multi command or a Basic Call to &4400. The language adds a block of

(continued on next page)



(continued from previous page)

commands suitable for particular peripheral devices.

Up to 100 CMS systems equipped with a Versatile Interface Board may be linked together in an RS-422 network using the Supervisor. RS-422 was chosen because it uses balanced lines and will operate more satisfactorily in the noisy environments expected in industrial control applications. The Supervisor applications software is supplied with two powerful tools — a screen-driven utility SNet to assist in the installation and testing of a network, and a subset of Multi-Basic commands, functions and procedures for remote station access.

Seven procedures are provided for the read/write of the system versatile interface adaptors (VIAs). Typical of these is Con-

figure which has the syntax

CONFIGURE [<register name>; <device address>; <bit pattern>]

and is used to set up a 6522 VIA register. A complementary command, Fetch, will read a VIA bit pattern and save it to memory.

There are three procedures which initialise, read from and write to analogue devices. As there are two digital/analogue cards in the CMS system, it is necessary to identify which type is to be serviced.

There are six procedures by means of which the time as HH/MM/SS, date as YY/MM/DD, and period as week number/day number, may be set or read. Multi-Basic also provide six test functions for comparing the date, time and period with preset values.

The CMS system has five timers. Two of them correspond to the five-byte timers in the BBC Micro and the remaining three have four-byte accuracy. Each timer may be serviced by means of the commands RD_Timer or Set_Timer accompanied by the appropriate parameters.

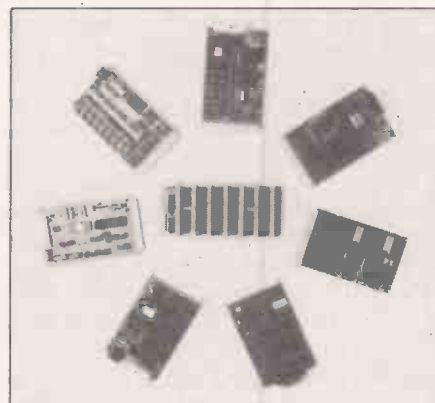
A CMS system equipped with Multi-Basic can perform a number of background operations or tasks while it is running a program in the foreground. This is made possible by interrupting the foreground program at intervals to perform the background task or tasks.

There may be any number of tasks, defined in a manner similar to the procedures of BBC Basic, between the Task and

Exit keywords. A trivial example is

```
10 *EVENTSON :REM keyword to enable
EVENTS
20 TASK fred
30 1%=1%+1: PRINT 1%
40 EXIT
```

Up to eight tasks may be active at any time. They are set in action by the Enable command and this may be at regular intervals or conditional on the pre-occurrence of a particular event.



CONCLUSIONS

- Although it will run BBC Basic programs, the CMS 6502 system is not a substitute for the BBC Micro.
- Its main strengths are its flexibility and expansion capability.
- It opens a new dimension in the development of industrial control since it is no longer necessary for the engineer to be an assembly-language programmer.

CMS 6502 RACK SYSTEM

VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Greatly simplifies design problems in industrial control by combining flexible hardware with an enhanced control Basic extension.

DISKETTES
at unbeatable prices

OLYMPIC systems
COMPUTER MEDIA SPECIALISTS

LOW LOW PRICES 5 1/4" DISKETTES

	SSDD	DSDD	SSQD	DSQD
C.D.C.	15.00	19.00	22.00	24.85
Verbatim	18.00	22.80	22.50	28.00
Nashua	18.00	21.50	23.00	24.75
Dysan	19.50	27.50	27.50	34.00
Memorex	20.00	27.50	27.50	33.50

Prices per box of ten inclusive carriage UK and VAT

SUMMER SPECIAL — FREE LIBRARY BOX
All orders received by 31 August, 1985

Official Orders from Educational and Government Departments Accepted.
Trade and Export Enquiries Welcome.

For complete list of Computer Media Products, eg Diskettes, Disc Packs, Magnetic Tapes, Printer and Electronic Typewriter Ribbons, Listing Paper and Accessories. Write, phone or telex

OLYMPIC systems

BOSTON ROAD, BEAUMONT LEYS, LEICESTER, LE4 1AA
Telephone: (0533) 358399 - Telex: 342208 (LYMPIC G)
43 NEW OXFORD STREET, LONDON WC1A 1BH, ENGLAND
Telephone: 01-240 8828 Telex: 291088/MARINE G

To: **OLYMPIC SYSTEMS** 42 Boston Rd., Beaumont Leys, Leicester LE4 1AA **PC/85**

Please Supply Boxes, Type

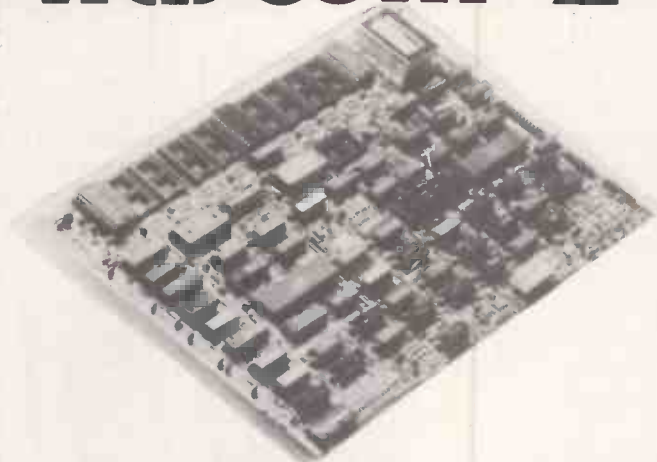
I enclose Cheque/PO for £..... inc carriage and VAT

Name Signature

Address Post Code

Circle No. 117

nascom-2



Still the most outstanding, single board computer with thousands of satisfied users in industry and the home. Full range of extensions and add-ons also available.

'Phone or write for further details now!

Lucas Control Systems

Lucas Control Systems Limited
Welton Road, Wedgnock Industrial Estate, Warwick CV34 5PZ.
Telephone: 0926 497733, Telex: 312333.

Circle No. 118

QUME

remember Qume = Quality

because it incorporates all the advantages of a world-wide organization – extensive technology resources, multi manufacturing facilities – and Qume (UK) a British company with customer service a priority.



a "wide" range of video terminals designed to satisfy virtually every application from word processing to advanced colour graphics.



also a "wide" range of Daisywheel Printers from the Sprint 12/20 for Home and Personal Computer applications to the Sprint 11/90 "the world's fastest Daisywheel Printer", ideal for clustered systems and data processing applications.

Inventory of Computer supplies include –



Daisywheels, Ribbon Cassettes, add-on Disk Drives and Sheet Feeders – all Qume original quality

a customer support organization with technical Hot-Line. Services also include personnel training, equipment maintenance and servicing.



Service Department



READING Facility

Sales and Marketing NEWBURY



a company serving British computer users directly and through a Nationwide network of appointed Distributors.

Qume®

The Quality Peripheral People

Qume (UK) Limited,

Marketing and Sales
Park Way, Newbury,
Berkshire RG13 1EE
Telephone: (0635) 31400
Telex: 846321

Service and Training Centre
Bridgewater Close, Reading,
Berkshire RG3 1JT
Telephone: (0734) 584646
Telex: 849706

A British Company of **ITT**

If you want it tomorrow . . .
call us today
01-455 9823

COMPUTERS/CALCULATORS/PLOTTERS

APRICOT		Pixy Plotter (A4 3 Pen 8 Colour)	£399.00
FI 256K/720K disk	£858.00	Epson H180 Plotter	£375.00
PC 256K/2 x 315K disks	£1225.00	SHARP PC 1500A (P/Computer with 8K ex to 24K	£147.50
Portable 256K/720K disk	£1390.00	PL 5000 Portable Computer	£1190.00
COMMODORE		CE 158 RS232 and Cent IF	£120.00
PC10 IBM compatible	£1600.00	CE 150 printer cassette IF	£125.00
PC20 IBM compatible	£2700.00	CE 159 8K Add on mem with 8AT	£79.00
SANYO		CE 152 Cassette	£36.00
MBC 775 portable (IBM compatible) 256K	£1700.00	PC 1251 (Computer)	£66.50
HEWLETT PACKARD		Casio PB 750 New Computer	£89.50
HP 4 1CV (SCI Computer)	£169.95	Epson QX-10 (desk top comp)	£1599.00
HP 4 1CX (Computer)	£259.00	EPSON HX20 Briefcase computer. 16K expandable. Serial and RS232 interface.	£375
HP 4 1C (Card Reader)	£163.50	EPSON PX-8 (portable 64K Computer/Word Processor)	£775.00
HP 7 1C (portable computer)	£410.00	Epson Modem CX21 (300 Baud)	160.00
PLOTTERS			
HP 7470A (A4 2 Pen Plotter)	£918.00		
HP 7475 (A3 6 Pen Plotter)	£1550.00		

WORD PROCESSING PRINTERS/MONITORS

NEC 2000 (20CPS)	£535.00	HR1 (16CPS)	£255.00
NEC 3530 (33CPS)	£1200.00	HR15 (3K Buffer 18CPS)	£325.00
SILVER REED		HR15 XL (20CPS)	£433.00
EXP 500 (12CPS)	£299.00	HR25 (3K Buffer 25CPS)	£555.00
EXP 770 (31 CPS-2K Buffer)	£850.00	HR35 (35CPS)	£695.00
Sheet feeder for above	£185.05	CANON Jet Printer (7 colour)	£450.00
MT EXP 500 (19 CPS)	£329.00	HP Jet Printer (150CPS)	£399.00
SMITH CORONA		HP Laser Printer	£2895.00
S/C TPI (12CPS)	£154.00	DIABLO	
S/C L100 (12 CPS-emulats Diabolo 630 Protocols)	£260.00	620 (RO)	£650.00
QUME 9/45 RO-FFP	£1900.00	630 (ECS/IBM)	£1650.00
12/20 (20CPS)	£499.00	630 (API) (IBM COM)	£1295.00
11/40 RO (Also IBM-PC7)	£1185.00	630 (KSR)	£1840.00
TEC		C150 Ink Jet	£195.00
TEC F10/40 + S/F	£1250.00	FU	£999.00
F10-55 CPS (serial/parallel)	£1175.00		
Tractor (B-Di)		EPSON DX 100 (13CPS)	£399.00
Sheet Feeder			
Mechanical Sheet F			
OLYMPIA			
ESW 103	£800.00		
TOSHIBA			

PHONE US FOR BEST DEAL

JUKI 6100 (18CPS)	£319.00	JUKI 6300 (40CPS)	£825.00
DYNEER range (X-Data) from	£289.00	COLOUR/MONOCROME MONITORS	
PHILIPS/ZENITH/SANYO/TAXAN ETC.			
DOT MATRIX PRINTERS			
OKI		SMITH CORONA	
M82A (120CPS)	£240.00	D100 (120CPS)	£249.00
M92P (160CPS)	£360.00	SEIKOSHA from	£99.00
M83A (12CPS)	£389.00	MODEMS (Dacom/Master/Epson/Interlekt/Steebek/Answercall etc.) from	£79.00
M84P (200CPS)	£625.00		
ANADEx		MANNESMAN TALLY	
DP-9000 B/(180 CPS)	£850.00	MT80 (80CPS)	£177.00
DP-9500 B/(180 CPS)	£893.00	MT160 (F/T) (160CPS)	£495.00
DP-9625 B/(240 CPS)	£1155.00	MT180 (160CPS 32 Col)	£549.00
BROTHER		EPSON	
EP44 (16CPS)	£189.00	Epson RX80T Plus (100CPS)	£190.00
Brother M1009 IBM (50LPS)	£159.00	Epson FX80 Plus (160CPS)	£320.00
STAR range from	£156.00	Epson RX80FT Plus	£215.00
CANON PW1080A (160CPS)	£274.00	Epson FX100FT Plus (160CPS)	£425.00
CANON PW1156A (160CPS)	£355.00	Epson RX100FT Plus (100CPS)	£340.00
NEC Pinwriter (132 cols) P3	£595.00	Epson LQ1500 Plus (200CPS)	£875.00
		Epson DX100 (Daisywheel)	£433.00
		TEC 1550 (180CPS)	£575.00
SHINWA CP80/II/FT	£165.00		

TECHNICAL ADVICE
01-455 9824

This is only part of our range, a telephone call will save you time and money

SOFTWARE

This is only a selection of programmes available - telephone us for your specific requirements.

APPLE II/e		IBM/COMPAQ	
Mailmerge V.3.3	£125.00	Wordstar	£195.00
Wordstar V.3.31	£270.00	Mailmerge V.3.24	£125.00
Wordstar/Mailmerge/Spellstar	£406.00	Lotus 1-2-3	£325.00
ACT - APRICOT		Symphony	£425.00
Pulsar-Wordstar	£250.00	dBase II (CP/M86)	£265.00
Mail Merge	£75.00	Wordstar 2000	£295.00
Supewriter	£250.00		

EXPORT ORDERS WELCOMED

GOODS FULLY GUARANTEED PRICES EXCLUDING VAT AND P + P.

Company and Government orders accepted by phone. Barclaycard Access Visa accepted by phone.

Tel.: 01-455 9823

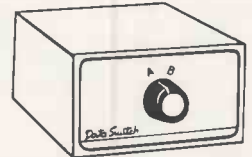
MOUNTAINDENE

22 Cowper Street London EC2

PRINTER SWITCHES FROM HOMESTEAD ELECTRONICS

LINK TWO OR MORE MICROS TO ONE PRINTER, PLOTTER, MODEM ETC. OR VICE VERSA

- ★ ROBUST CONSTRUCTION
- ★ SCREENED, METAL HOUSING
- ★ FULLY TESTED
- ★ BI-DIRECTIONAL
- ★ NO POWER REQUIRED
- ★ 12 MONTHS GUARANTEE
- ★ OFFICIAL ORDERS ACCEPTED
- ★ 24 HOUR DESPATCH



SERIAL DATA SWITCHES

RS 232/V24, 25 way 'D' sockets	
LINES 1 to 8 & 20	
Model R2 2 way switch	£49
Model R3 3 way switch	£57
Model R4 4 way switch	£65
Model R5 5 way switch	£73
Model R8 8 way switch	£110
Model RX 2 way cross-over	£65

ALL 25 LINES	
Model V2 2 way switch	£85
Model V3 3 way switch	£77
Model V4 4 way switch	£89
Model V5 5 way switch	£101
Model VX 2 way cross-over	£89

PARALLEL DATA SWITCHES

CENTRONICS. 36 way sockets	
Model C2 2 way switch	£79
Model C3 3 way switch	£99
Model C4 4 way switch	£119
Model C5 5 way switch	£139
Model CX 2 way cross-over	£119

IBM PC. 25 way 'D' sockets	
Model P2 2 way switch	£65
Model P3 3 way switch	£77
Model PX 2 way cross-over	£89

IEEE-488. 24 way sockets	
Model E2 2 way switch	£69
Model E3 3 way switch	£109
Model EX 2 way cross-over	£129

PLEASE ADD VAT AT 15%. ALL ITEMS CARRIAGE PAID
TRADE, EDUCATIONAL & EXPORT ENQUIRY WELCOME
CABLES ALSO AVAILABLE. EX STOCK & CUSTOM BUILT



HOMESTEAD ELECTRONICS

Trelawney Industrial Court
Trelawney Avenue, Langley
Slough, Berks. SL3 7UJ.
Telephone: (0753) 44269

Circle No. 121

BETTER SERVICE BETTER PRICES WIDER CHOICE

COMPUTERS SANYO (now including IBM compatible and 2 x 800k versions), **APRICOT & OLIVETTI** plus widest choice of IBM COMPATIBLES. Tailored systems from under £1000.

PLUS NETWORK SYSTEM for any combination of these computers (up to 64) at £250 per station. **PLUS** free on-site warranty. Hard disk systems, extra RAM (e.g. Apricot 128K £139). Multifunction boards, etc. all at discount prices.

SOFTWARE Full range of WP, spreadsheet and database software, etc., plus Accounts, Payroll, CAD, Communications packages, etc. All at very special prices. - eg. Wordstar 2000 £299 Sage Accounts £249 Supercalc II £145.

PRINTERS All the leading printers supplied. We specialise in Near Letter Quality Matrix Printers (from under £200) and Daisywheels.

PLOTTERS We supply a full range of plotters from A4 - £169 (MCP-80) and SILVER REED EB50, A3 - £275 (ROLAND) A1 - £2995 (HOUSTON). Use independently or as part of a CAD system.

PRINTER BUFFERS Serial/parallel in or out. 8k-512K, eg. 8K - £75 16K - £85 32K - £95 64K - £119.

THIS MONTH'S SPECIAL OFFERS!

- Shinwa CPA 80 £175
- Epson LX80 (NLQ) NEW! £209
- Kaga Taxan KP810 (NLQ) £239
- 18cps QUME compatible daisywheel £199
- Brother HR15 daisywheel £319

DISKS - SPECIAL OFFERS - POST FREE!!!

Based on 10s	DYSAN 100% guaranteed	3M Lifetime guarantee
	Per box	Per box
SSD0	£14.40 + £1.00	£11.75 + £2.75
OSD0	£20.90 + £1.45	£16.25 + £2.75
SSD0	£20.90 + £1.45	£17.15 + £3.85
OSD0	£26.85 + £1.65	£20.15 + £3.85
SONY SS	£26.50 + £3.30	AMSTRAD 3"
3.5" DS	£36.50 + £3.30	£32.50 per box of 10

VOLUME DISCOUNTS. TOP QUALITY UNLABELLED DISKS - EVEN LOWER PRICES

FANFOLD PAPER 11" x 9.5" £9.75 A4 Clean Edge £11.69 2000 sheets per box. All sizes available. Delivery £1.00 (fixed) + £1 per box. **LABELS** from £1.70 per 1,000. **RIBBONS** All types available at low prices e.g. Juki 6100 - 99p. Shinwa CP/COA80 £3.79 Epson FX/MX/RX 80 £2.49. Qume MS £2.65 Kaga/Canon £5.25. **PRINTWHEELS** from £3.79. Delivery 95p (any quantity ribbons/printwheels).

Official Government/Educational/Local 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.

A.M.A. COMPUTER SYSTEMS & SUPPLIES
Dept. B, 8 Glebe St., Beeston
NOTTINGHAM NG9 1BZ. Tel. 0602 255415

Circle No. 122

Modem WS 2000: why it's the experts' choice.

You don't need to be told about the information revolution – you already know that without efficient data communications, you and your business may not survive it.

And you know that a modem will be a vital part of your survival kit.

This is why you should choose Modem WS2000 from Miracle Technology.

Quality – In concept and construction Miracle Technology sets the standards other modem manufacturers aim for.

Quite simply, WS2000 is one of the best designed, best made modems you can buy.

It is approved for PTT use in the UK and Holland, with approval pending in other European countries.

Flexibility – As a multi-speed, multi-standard modem, WS2000 enables data transfer between almost any two computers – world-wide.

WS2000 gives instant access to the vital information sources of Prestel, Micronet, Telecom Gold and a vast range of public and private databases.

WS2000 can also convert your computer to a telex terminal, giving you inexpensive 2-way international telex facilities.

WS2000 is suitable for use with a wider range of computers than virtually any other modem, and we can offer software packages for most makes.

Versatility – No other modem offers all the facilities available with WS2000.

Its unique versatility means it can be expanded by the addition of autodial and autoanswer options (presently undergoing approval testing with BABT), plus direct computer software control of the modem and much more.

Service – A large dealer/distributor network both in the UK and abroad means you're never far from a WS2000 stockist.

And our Customer Service and Technical Departments are happy to give help and advice.

The Experts – Thousands of users depend on WS2000 – local authorities, government departments, multi-nationals, private companies and individuals.

WS2000 is the modem chosen by the BBC to demonstrate a UK-USA datalink live on TV; selected by Cable & Wireless/Western Union for their Easylink Telex Service; taken

round the world on Operation Raleigh; in action for CBS News, sending front-line war reports around the world.

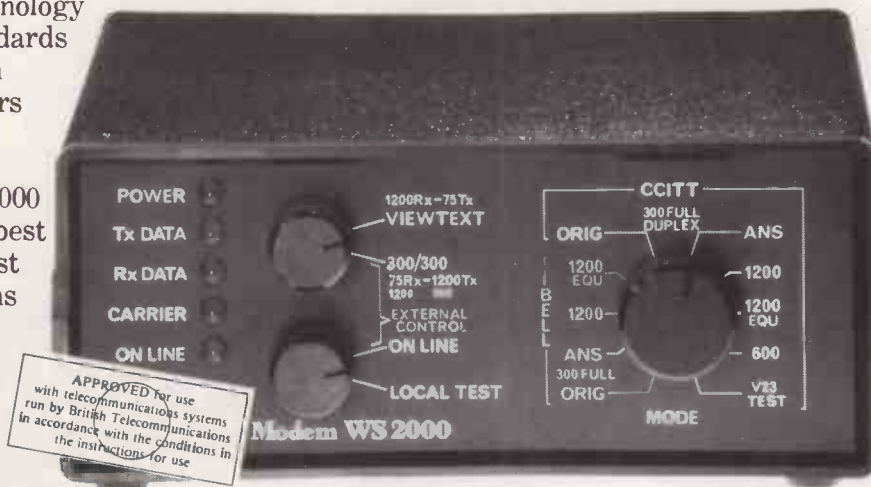
WS2000 is the modem used by people who need reliable data communications today – and every day.

WS2000, with BT telephone lead, mains power supply and comprehensive operating manual costs only £129.95 exc. (£154.73 inc. VAT & UK delivery) – you may also need a computer lead (£10.35 inc.) – specify computer when ordering.

A small price to pay for survival.

Order by cheque/Visa/Access/Trade or official order to:

Miracle Technology (UK) Ltd,
St Peters Street, Ipswich IP1 1XB.
☎ 0473 50304 ☒ 946240 CWEASY G 19002985



MIRACLE TECHNOLOGY
we thought of tomorrow, yesterday.

NO TEETHING TROUBLE.



NO GROWING PAINS.

Most accounting programs fall between two stools - too complex for the fledgeling business, too basic for the growing concern. But not Sage.

Our new, improved family of compatible computer programs will take your brainchild through from first steps to full maturity. You can cut your teeth on a system that's simple to learn and use, then upgrade easily as you grow bigger and stronger.

It's the most up-to-date accounting program on the market - the result of extensive research and improvement, embodying three years of customer feedback.

We've made computer operation even easier and incorporated colourful graphic displays, yet each program still uses only one disk! It's Sage ingenuity at its best.

At a price that won't stunt your growth!

SAGE BOOKKEEPER £295 + VAT

The computer program which keeps books for small businesses and cash traders. Start here and grow with SAGE.

SAGE ACCOUNTANT £495 + VAT

A full feature bookkeeping/accounting system to put you in full control of your business.

SAGE ACCOUNTANT PLUS £695 + VAT

The next step up from the Accountant, for the small to medium size business with an above average invoice output.

SAGE FINANCIAL CONTROLLER* £995 + VAT

Top of the Sage range of computer accounting programs. Bring the full power of a hard disk computer to bear on your business.

SAGE PAYROLL £195 + VAT

A full-feature payroll/personnel system which will completely automate the payroll function for companies of all sizes.

NEW, IMPROVED ACCOUNTS PACKAGES FROM SAGE

SAGE SOFT

Please send me more details of Sage Accounting Programs and my nearest dealer

Name: _____ Position: _____

Type of Computer: _____

Company: _____

Address: _____

Tel: _____

Sagesoft plc., NE1 House, Regent Centre, Newcastle upon Tyne NE3 3DS
Tel: 091 284 7077. Telex: 53623 SAGESL G.

BETTER SAGE THAN SORRY PC1

*Available 4th qtr. '85

● Circle No. 124

VIENNA PC WHITER THAN WHITE?

By Glyn Moody

Designed as part of an integrated office automation system, this stylish 80186-based micro with superb graphics can function equally well as a stand-alone machine.

SPECIFICATION

CPU: 80186 running at 8MHz; a second 80186 is dedicated to graphics handling
RAM: 256K as standard, expandable up to 768K

ROM: 16K self-test and bootstrap
Dimensions: main unit box 13.7in. (350mm.) wide by 16.5in. (420mm.) deep by 8.5in. (216mm.) high

VDU: 15in. white phosphor, 80 columns by 27 lines, nine by 13 pixels character matrix; overall resolution 800 by 420 pixels; refresh rate 71Hz

Keyboard: full QWERTY with numeric keypad, 10 function keys, cursor keys, IBM 3270 terminal-emulation keys

Mass storage: 1.2Mbyte floppies, 10Mbyte or 20Mbyte Winchester

Hardware options: optical mouse, ink-jet, dot-matrix or daisywheel printers

Interfaces: two RS-232s, with optional further two

Software in price: none

Software options: MS-DOS 2.11, Gem, Level II Cobol, MSBasic, GWBasic, Vienna family of software including word, diary, plan, chart and paint options

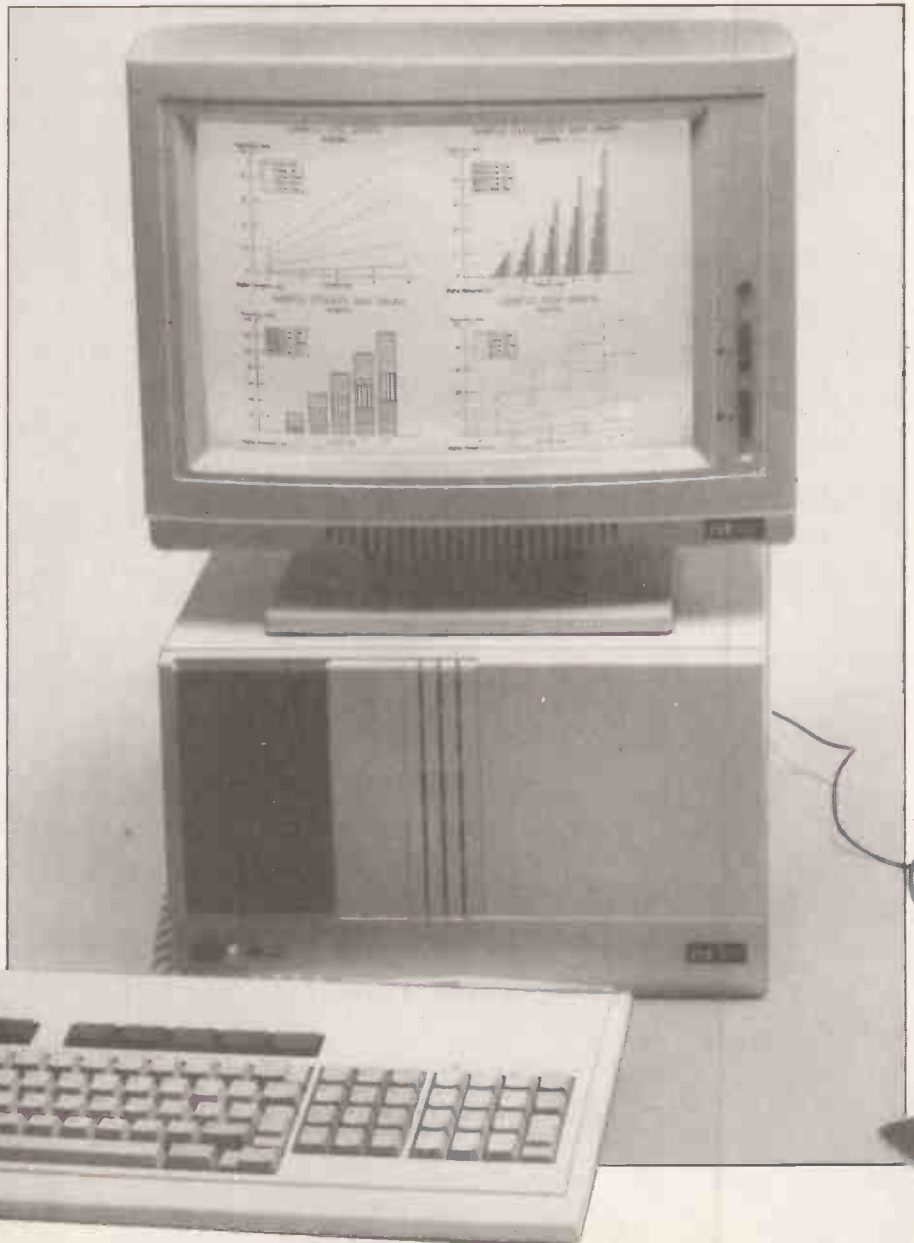
Price: double floppy, 256K RAM £3,100; 10Mbyte Winchester £3,760; 20Mbyte Winchester £4,563; VDU and keyboard £446; MS-DOS about £58, Gem and optical mouse about £300

Manufacturer: Northern Telecom Data Systems Ltd, Maylands Avenue, Hemel Hempstead, Hertfordshire HP2 7LD. Telephone: (0442) 41141

The Vienna PC is a stylish premium product from the international telecommunications company Northern Telecom. Conceived principally as part of the Vienna Office, a complete medium-size integrated office-automation system, the Vienna PC can nonetheless function as a stand-alone 80186-based MS-DOS micro. It is notable chiefly for the fast high-resolution graphics capabilities of its white phosphor

screen. The cost for a system with 256K RAM and a 20Mbyte Winchester is about £5,000.

The Vienna Office represents a major assault on the European market by Northern Telecom, which is the second-largest manufacturer of telecommunications equipment in North America, with total revenues of \$4.4 billion in 1984, and 47,000 employees worldwide. The Vienna system,



The screen phosphor has been chosen to be as easy on the eye as possible so that prolonged use is less stressful.

including the PC, has been designed specifically for the European market, and initially is only being sold there.

Apart from its name and the various national keyboards and character sets available, the European slant is also evident in the concern for neat good looks, and in fact it won the European 1984 Ergodesign Award. The overall look of the three-piece setup is smart, and only marginally spoilt by the bulk of the main system box.

At the front of the main unit is the on/off switch and disc drive. The model reviewed here had one 1.2Mbyte floppy and a 20Mbyte Winchester. There are also dual-floppy versions and a 10Mbyte hard-disc model. Apart from the cable which goes to the power supply on the right-hand side next to the fan, the rear panel sports only a couple of RS-232 sockets and the main cabling for the terminal.

The terminal port occupies one of five expansion slots. Options available include extra RAM cards, taking the basic 256K up to a maximum of 768K, and two more serial ports. No parallel ports for printers are offered since Northern Telecom tends to sell its own varieties of serial printers, which can handle the full range of international character sets. For example, it sells an ink-jet printer from Siemens for about £600. There is no Reset button, which can be inconvenient.

The keyboard plugs into the VDU rather than the main systems box. It is ultra-thin, with keys that are nicely sprung but which may rock slightly too much for some. The keyboard layout is generous to a fault. In addition to standard QWERTY keys, numeric keypad and 10 function keys, there is also a facility for emulating an IBM 3270 terminal. To this end there are extra markings inscribed on the sides of many keys as well as additional keys. There are extensive soft-key definition facilities.

PAPER-WHITE SCREEN

Perhaps the chief point of interest of the new system, and certainly its chief glory, is the screen and graphics facilities. Northern Telecom has made efforts to procure a very high-quality display unit suitable for intensive office work, the visual properties of which match those of paper as closely as possible. The unit chosen has a white phosphor of a creaminess which makes even the Mac's white screen look garish. Easiness on the eye is enhanced by the 71Hz refresh rate for the screen, which makes for a rock-steady picture. The overall resolution is an impressive 800 by 420 pixels, with a nine by 13 matrix for alphanumeric characters. To save power and the precious phosphor, the screen automatically goes blank after several minutes' non-use. Pressing the Shift key reactivates it.



BENCHMARKS

The figures below show the time in seconds taken to run the standard Basic Benchmarks — see the January 1984 issue of *Practical Computing* for details. The Vienna emerges as a respectably fast machine, marginally slower than the RML Nimbus, also an 80186 MS-DOS machine, and even closer to the IBM PC/AT.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Vienna — 80186	0.6	2.2	4.8	5.0	5.2	10.0	15.6	16.6	7.4
Sprite — 80286	0.5	1.6	3.5	3.5	4.2	7.8	11.6	9.3	5.3
Nimbus — 80186	0.5	1.8	3.9	4.0	4.6	8.5	13.2	13	6.2
IBM PC/AT — 80286	0.5	1.9	4.6	4.7	5.2	9.1	14.6	13.5	6.8

Wisely, Northern Telecom has capitalised on this high performance by allocating a second 80186 purely for screen graphics handling. The results are impressive, and nowhere is this more apparent than in the implementation of Digital Research's Gem. This is available for about £300, which includes the cost of an optical mouse. Like the keyboard, the mouse plugs into the base of the VDU.

OPTICAL TRACKING

Instead of using the trackerball principle of measuring the movement of the mouse by detecting how much a small ball in the base has rolled, the optical mouse employs a reflective sheet to work out the change in position. On the plus side, problems of dirt and slipping are avoided, but you are restricted in movement to the mirror pad, which may be useful on a crowded desk.

Gem is discussed in greater detail on page 50 of this issue. Whatever your feelings on the wisdom or otherwise of this approach, there is no denying that on the Vienna it looks very plausible. In particular, Gem graphics features, such as zooming, show Northern Telecom's micro to tremendous advantage. The images are drawn very fast, with excellent Infill routines and clean curved edges.

As a part of the Vienna Office, the Vienna PC is able to run most of the constituent application packages. These include all the usual options like word processing, spreadsheets, graphing and databases. Functioning as async terminals, Vienna PCs can also communicate with the Vienna Office central controller. Eventually it will be able to communicate via Ethernet and Cheapernet.

Paying the extra for MS-DOS, which is not included in the price of the hardware, opens up access to the large number of programs written to run under the operating system. Although the Vienna PC is not an IBM compatible, Northern Telecom claims it is possible to swap some data discs between them.

Northern Telecom has recognised that there is at least one PC-DOS product that many Vienna PC users could well want to use: Lotus 1-2-3. Therefore, it has adapted the program so that the low-resolution colour graphics will work on the Vienna's high-resolution monochrome monitor.

There is a uniform set of manuals for each of the component parts of the system. The user manual for the Vienna PC itself is well produced and comes complete with tasteful illustrations of Viennese sights but, regret-

tably, without an index. If it seems rather thin, this reflects Northern Telecom's desire to keep the user firmly outside the systems box. Even taking the cover off is awkward and for this review we decided not to violate the delicately textured paintwork. Installation procedures are normally carried out by an engineer from the company.

This whole approach reflects the fact that the Vienna PC is conceived of as very much an integral part of the whole office-automation strategy of Northern Telecom. That said, the PC exists in its own right as a serious and viable business system. Its overall design, its speed, and above all its superb graphics facilities are strong recommendations for it.

VIENNA PC				
	VERDICT			
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

The Vienna PC is an up-market MS-DOS machine with an up-market price tag. The graphics on its white phosphor display are superlative.

CONCLUSIONS

■ The Vienna PC is stylish up-market MS-DOS micro, originally designed as part of a larger office system but quite able to stand on its own feet.

■ The high-resolution white screen is one of the best we have ever reviewed. It could well overcome the continuing reluctance on some people's part to come to terms with the dreaded VDU.

■ As befits such a classy system, the price is not cheap at around £4,000. Similarly, the size of the system box means that it is no retiring wallflower.

■ Although it lacks IBM compatibility, the Vienna PC is well enough served by MS-DOS programs and the packages which form the Vienna Office. Provided you are content with functional rather than fancy software, being locked out of the IBM-clone world should prove no desperate problem.

■ Anyone impressed by the Mac approach to micro life but wishing to remain within the MS-DOS fold may well find the fast and effective implementation of Gem very tempting on the Vienna.

■ Minor grouses include the closed box approach and the lack of a Reset button.

WORD PERFECT 4.0

THE ALL-ROUNDER

By Susan Curran

This word processor for the IBM PC and compatibles is good enough to challenge WordStar as the standard general-purpose package.

Word Perfect is one of the many U.S.-produced word processors for the IBM PC and compatibles. This review is of version 4.0, which I tested on an IBM PC/XT with 256K of RAM. On most compatibles, the program will work with a minimum of 192K. It requires two disc drives and will handle colour if you have a colour monitor.

This is a general-purpose word processor, with a great deal of power and a correspondingly high price tag. The normal cost is £425, though it may still be available through lower-priced launch offers. The producer, Satellite Software International, is also offering a special trade-in price of £250 for those who have a copy of various other well-rated IBM word-processing packages, including WordStar, Multimate and Samna Word.

The version which I reviewed was not anglicised. However, as we go to press SSI has released the U.K. spelling dictionary, along with a database and spreadsheet package which link to Word Perfect.

Word Perfect is a clean screen word processor: it comes straight up with an editing screen, which includes nothing but a brief note of the document number, page, line and cursor column position. It is possible to swap between documents 1 and 2, but not to window both at once. There is no ruler marking tabs and margins, and there are no on-screen control codes — not even for hard Returns. As far as possible, text is laid out on-screen exactly as it will be printed. Line spacing is echoed correctly on-screen, though justification is not reproduced.

SPECIAL CODES FOR FORMATTING FEATURES

Almost all the formatting features are handled by special codes. The Tab key produces a special Tab code, for example, rather than a row of spaces; the Indent key an Indent code. These codes are incorporated into the document, and have an effect upon its format either immediately, or when it is printed. The effect of many of the codes, including header and footer codes, page positioning and page numbering, is

not obvious on-screen. In order to revise such features it is necessary to inspect the codes, and delete them if necessary before entering new ones, on a special Reveal Codes screen.

This should not be confused with the sort of toggled Codes On/Codes Off arrangement that programs such as WordStar employ. The Reveal Codes mode is cumbersome in the extreme, and cannot be used for normal editing. Only a few lines are displayed at once, with the text often dwarfed by a mass of lengthy narrative code descriptions. The cursor can be moved, but haltingly, and with much screen flicker. It is not possible to insert text or carry out other commands in this mode, only to delete.

Almost all commands in the program are handled via the function keys. The 10 keys

WORD PERFECT 4.0				
PC VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

If I were using Samna Word or WordStar on a PC, I'd be inclined to make the swap to Word Perfect.

are each given four different functions, used alone and with Shift, Control and Alt. A four-colour template is provided with the program, which explains as clearly as is possible which combination does which. All the same, I do not like this arrangement. It is inevitably confusing when, for example, F7 is used for Exit, Print, Math/Column mode select, and Footnote select. Fortunately, there is a Cancel key which enables you to undo the effect of mistakenly chosen selections. There is also an Undelete buffer. These provisions ensure that with familiarity the program operation is not as horrendous as it appears at first sight.

Like so many IBM word processors, Word Perfect does not automatically reformat text on-screen when amendments are made to it. It is possible to reformat either by giving a Rewrite command, or by scrolling the cursor line by line down the text. Reformatting in either case is moderately fast, but tends to be a little hit-and-miss. If lines are shortened by deletions, sufficient words are not always

brought up from the next line to straighten the right-hand margin, and it is necessary to fiddle around deleting spaces in order to format adequately. I also found disconcerting the program's tendency to keep re-formatting while blocks are being defined. There is no way of switching off the re-formatting during this type of operation.

One other formatting failing is the tendency of Word Perfect to leave occasional spaces at the start of lines in mid-paragraph, producing a jumpy left-hand margin. Again, it is possible to edit them out, but they should not be there in the first place.

The program scrolls very smoothly in all directions, and the cursor commands are clear and effective, though not as copious as in some programs. Word Perfect shows page breaks on-screen, but it is not particularly page-orientated, and text can be moved across pages at will. Page breaks are adjusted dynamically as editing progresses.

The program defaults to right justification, which is not echoed on-screen, and to a very energetic hyphenation routine, which perpetually requests hyphenation decisions, not all of them sensible. I was relieved to find that these and other defaults can be altered in the setup program. The hyphenation zone can be abolished or set to different widths. Word Perfect defaults to a push-forward Insert mode, but it is possible to toggle between this and an Overwrite mode. Among other defaults which can be selected are widow/orphan protection to keep paragraphs neat, underline style, and page number position.

It is difficult to think of any command that is missing, or that is not handled well. There are all the usual block moves, copies

SPECIFICATION

Description: word-processing package with built-in mail merge, indexing and spelling checker

Hardware required: IBM PC with at least 192K of RAM — graphics card is optional; also available for various MS-DOS machines including the ACT Apricot, and some brands of local area network

Publisher: Satellite Software International Inc., Orem, Utah, U.S.A.

Price: £425 plus VAT; £250 when traded for existing word processors

U.K. supplier: Sentinel Software Ltd, Wellington House, New Zealand Avenue, Walton-on-Thames, Surrey KT12 12PY. Telephone: (0932) 231164. Available now

This is Word Perfect's newspaper-style columns feature. It is possible to define up to five text columns across the page, and the program helps in calculating suitable spacing for evenly or unevenly sized columns. Here, I am using two even columns

with a three-character spacing in between, and justification to even up the effect. Column 2 appears on screen beneath column 1, but on paper the two will of course print out side by side. It is easy to move text from column to column following edits.

● **Multi-column printing:** up to five columns are possible.

- I. This is an automatically-numbered outline.
- II. It provides for up to seven levels of
 - A. indentation, and the entire
 - B. outline can be revised and
 - C. renumbered again and again.
- III. Though this outline is generated directly on the keyboard, it is also possible to produce tables of contents automatically from documents which contain numbered subheadings.

● **Flexible formatting outlines can be generated automatically or from the keyboard.**

This is how Word Perfect text looks after light editing. I have made several insertions into this paragraph in order to show the failings I mention in the text. You can see that there is an occasional raggedness to be seen in the left margin, and that the right margin (though the text has been reformatted after the edit) still misses some short words that would have fitted from previous sentences. Though these imperfections can be dealt with manually (through deletions and insertions) they are an annoyance when editing lengthy passages. The a few lines above is an example of what I mean.

For this sample I have switched on the 'hyphenation zone' with its default size. I find the hyphenation excessive during my normal work, so my version of the program omits hyphenation in its default settings.

The program asks for hyphenation decisions during text entry, as well as in subsequent reformats. The zone size can be varied to suit individual requirements.

● **Edited text sometimes ends up looking decidedly ragged.**

and deletes, and no annoying restrictions on their use. Search and replace has many options, and works efficiently. There is a handy Indent command, which will indent either or both margins. Tab and margin changes are easily handled, and there is a Binding Width command allowing for alternate left and right wide margins. There are headers and footers — up to three of each, which will work on an odd/even basis — a footnote or endnote system, provision for producing tables of contents, a newspaper-style columns feature, and a maths mode which will handle simple calculations.

It is a pleasure to find a program with a simple to use macro feature. Macros can be used to automatically call up often-used words, saving repetitive typing. For instance, I used Alt-W as a macro name for Word Perfect, in writing this review. More complex macros can include command sequences, and could, for example, streamline an elaborate form-letter operation. All macro definitions are automatically stored on disc.

File handling is sensible, and there is a neat List Files menu from which it is possible to edit, delete, rename or prepare outside files for editing using Word Perfect. The program will automatically back up files during editing sessions, and you can select the backup interval for yourself.

The merge feature seems easy to use, though I did not attempt to push it to its limits. Text can be retrieved from a secondary record file, or entered from the keyboard. Fields in the secondary merge file can be used in the primary document in any order. Merged documents can be saved in their merged form, or printed straight out. It is not possible to select or sort records for merging without using the additional database package, which I did not test.

PRINT TIME

The program is very good on printer support, and its printer section can be edited to cater for special needs. It will queue files for background printing, and there is full support for queue handling. It is possible to print blocks, pages or full documents without first saving them. Special printer commands, such as Escape sequences, can be sent to the printer from within the program.

The spelling checker works fast and efficiently, and all checking is done in context. The program claims to have a 100,000-word dictionary, but it seemed to offer a lot of common words for confirmation, not all of them obviously because the version I used was unanglicised. It is possible to add to the dictionary, edit it, or create subsidiary dictionaries. There is a wild-card lookup, to enable you to check the spelling of words

when typing them. It is only possible to obtain a word count as a side-effect of a spelling check.

My only major difficulty with the various commands came with the page formatting. Endless attempts failed to position the text properly on the paper in my FX-80, and I sometimes could not induce the Top Margin command to work properly, or the conditional End of Page command. As the program seemed so reliable otherwise, I blame this on my own blindness to some special requirement.

DOCUMENTATION

It seems to be obligatory now for word processors to have fat manuals. Word Perfect's is at least well arranged, and the reference section is cut down to a well-filled 112 pages. The tutorial section is much more expansive, and I found it to be a little exasperating. It takes you key press by key press through a fairly random selection of program features, with the emphasis on rote following rather than comprehension. However, I did not find the program difficult to learn.

There are special training-orientated manual sections to cover the more complex features of the program, including the merge facility and the maths feature. The help features on disc are comprehensive and context-sensitive.


The program comes on unprotected discs, unless you buy the special educational version. I had no difficulty in installing it on my computer, or in adapting the defaults. I have used it almost full-time for a month, and carried out some very heavy editing of long — up to 20 pages, single spaced — documents on it. In that time, I have not succeeded in hanging the program, or losing more than a couple of words of text unintentionally. In my opinion, it does a very good job of sustaining reliability without hedging users around with too many restrictions and confirmations of commands.

CONCLUSIONS

■ On first acquaintance, I found Word Perfect a rather unattractive program, with confusing key assignments and appalling, clumsy code handling. With experience these prove to be less of a drawback.

■ The formatting imperfections are exasperating. Otherwise the program is extremely usable, very reliable and very powerful.

■ At £425 plus VAT it is expensive, and its lack of U.K. support is a foiling.

■ Overall, I have not seen a better all-round PC word processor. 

MAC MUSIC PROGRAMS OF NOTE

By Glyn Moody

Two music packages which apply the Macintosh's visual interface to good effect.

Writing music on present-day micros is a laborious process. Either you have to specify each note as a pitch and a duration, or else there is some complicated system using a re-configured computer keyboard. Furthermore, limitations in the character sets available mean that, at the end of the day, the results are crude and of little practical use to a musician. What is needed is a high-resolution system that can cope with the very special characters and layout logic of notes and staves, and which also has a way of placing notes on the staves that is natural to the user.

The Mac is an obvious contender. To start with, its graphics-based icon system parallels the representation of music by an array of functional symbols. Equally, the mouse is ideal for placing notes on staves. To harness these capabilities for music processing, all that is needed is software that handles the logic of note groupings, key signatures, time signatures and so on.

TRUE MUSIC PROCESSOR

Professional Composer is a package offering just such facilities. It has been written by Mark of the Unicorn Inc. for the Fat Mac. It should be emphasised that this is not just another music synthesiser package, though it does have limited playback facilities. It is a true music processor which allows you to enter and manipulate musical notation as easily as spreadsheets and word processors handle numbers and words.

Professional Composer can cope with up to four single staves, a double piano staff, or a single staff combined with a piano staff. As a default, single staves bear a treble clef; you can change a clef by pulling down the Symbols menu. Selecting Clefs causes a palette bar to appear on the left-hand side of the screen on which can be found alternatives like bass, tenor, alto and unpitched percussion clefs!

Time and key signatures are called up from the Basics menu, which is pulled down in the same way. On selecting them, windows appear which allow standard time signatures to be chosen, or more unusual ones to be entered by hand. Another window allows you to scroll through the keys

— both major and relative minor — and select the appropriate key signature.

The method of entering notes is similarly mouse-orientated. A small cursor is moved around the staff and clicked to select a particular pitch. Notes of various duration can be placed at this pitch by pulling down a Symbols menu, and selecting Notes. This causes a palette bar to appear on the left-hand side of the screen on which can be found the musical symbols for notes ranging in duration from a breve to a hemidemi-semiquaver. Accidentals including double sharps and double flats are also obtained from here.

Other palette bars allow rests, dynamics, ornaments and articulations to be added in precisely the same way. Ornaments and dynamics appear over and under the notes respectively.

In addition to this visual, two-stroke system of entering notes, it is also possible to speed up the process by using the mouse in conjunction with the keyboard. Pitches are still chosen using the on-screen cursor, but note-durations are determined by the key which is depressed at the same time: D is a crotchet and C a quaver, for example. Holding down the Shift key as well gives you rests instead.

A line of music can be built up relatively easily and quickly. Errors can be corrected by placing the cursor to the right of the offending note and pressing the Backspace. One problem with this is that deleting a whole string of notes requires you to move the cursor several times, unlike word processing where Backspace/Delete moves the cursor back for you.

SPECIFICATION

PROFESSIONAL COMPOSER

Description: A music processor which allows you to enter and edit music on a conventional staff, play it back and generate high-quality printed output

Hardware required: 512K Apple Macintosh

Price: £429 plus VAT

U.K. distribution: P&P Micro distributors Ltd. Telephone: (0706) 217744

MUSIC WORKS

Description: Synthesiser with printout facilities

Hardware: 128K Apple Macintosh

Price: £68.30 plus VAT

U.K. distribution: Softsel Computer Products Ltd. Telephone: 01-844 2040

PROFESSIONAL COMPOSER

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[] A genuine innovation that could do for composers what the word processor has done for authors — if only it were cheaper.

As well as the host speed and metronome markings brought in from the Basics menu, it is possible to place text in a variety of styles on the staves. This allows expression marks and lyrics to be added.

The Edit menu allows you to cut and paste or copy and paste just as with text systems. Sections are first selected by dragging the cursor over them. Transpositions by key or by interval are available from the Variations menu. Music can be saved at any time with a single mouse operation.

INTELLIGENT ATTEMPTS

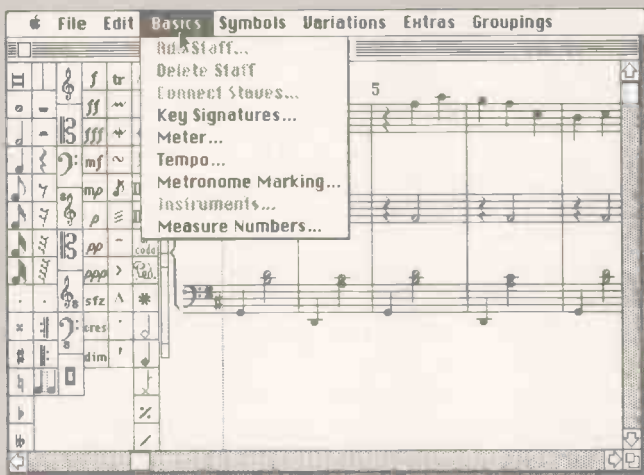
Chords can be built up on each staff, but it is not possible to have simultaneous notes of different duration in a chord on the same staff. The program is sufficiently intelligent to space out notes in an attempt to align main beats. Initially no check is made as to whether there are too many or too few notes in a bar, though an option on the Extras menu will carry one out. Bar lines must be entered by hand.

On their own the features mentioned so far would produce output that was functional, but hardly exceptional or indeed practical for the performer. Professional Composer does, however, have many more refining features that enable music entries to be brought to printed music quality.

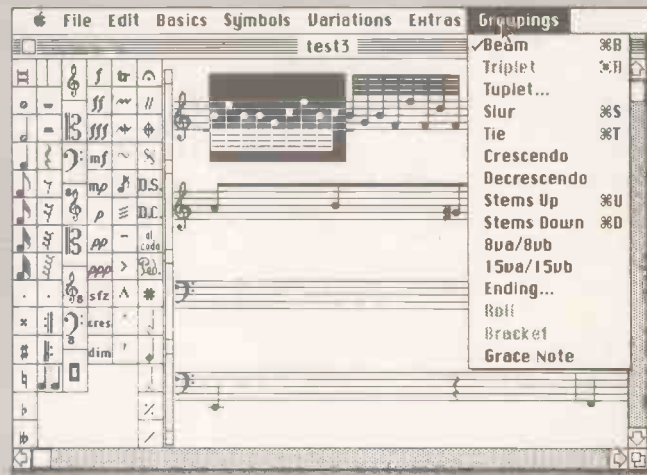
Most of the more advanced features are called up from the Groupings menu. As its name suggests, this is primarily concerned with functions of groups of notes. For example, the raw input of notes results in a rather ragged row of separate heads and tails. By selecting a group and then using the Beam option from Groupings, the tails of notes are neatly joined up. Triplets and n-uplets can be specified if required; you can mark five notes to be played in the time of

(continued on page 72)

PROFESSIONAL COMPOSER



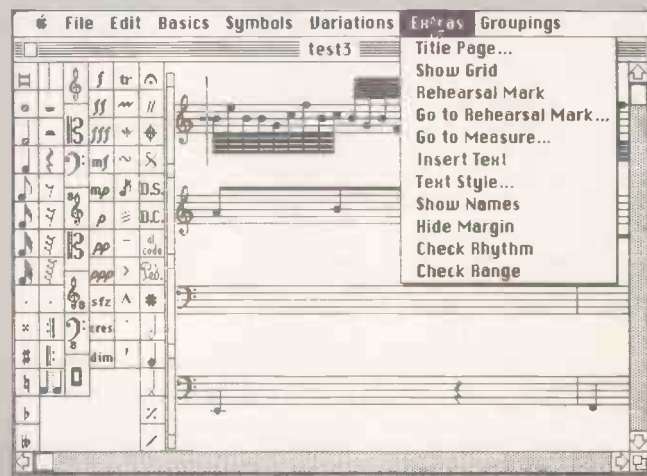
Professional Composer allows you to select musical notes and signs from palette bars called up from the Symbols menu. The Basics menu handles keys, tempo and metres.



After a group of notes has been selected, the Beam command on the Groupings menu joins them up. Similarly, slurs, ties and crescendos can be formed.

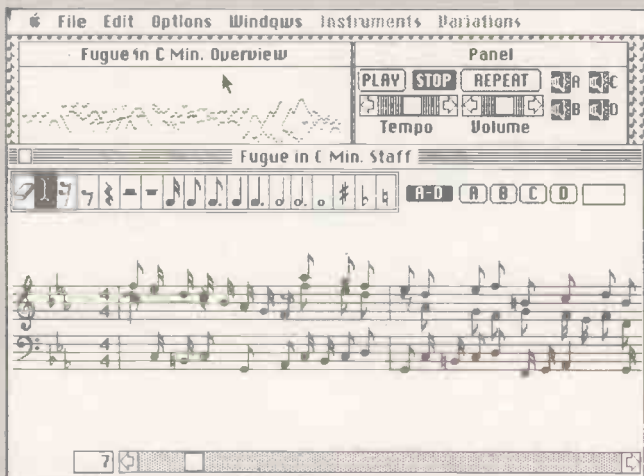


Professional Composer's version of Bach's fugue in C minor from *The Well-tempered Clavier*. The beams of note groups have been joined using the Groupings menu.

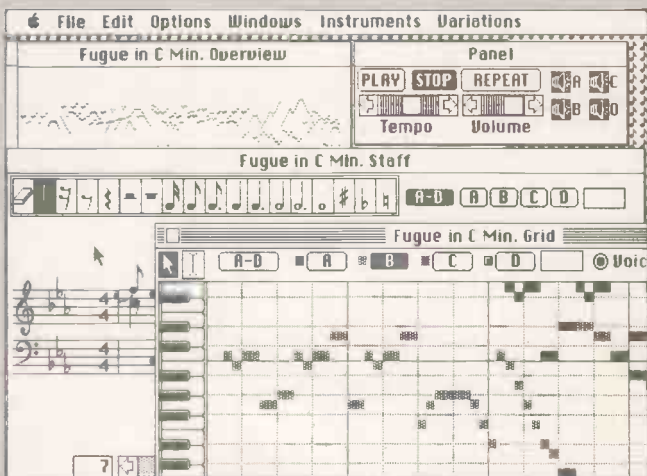


The Extras pull-down menu allows text to be inserted, and rehearsal marks set up. You move within the score by using the scroll bars at the bottom of the screen.

MUSIC WORKS



The same Bach piece produced by Music Works. The tempo and volume can be altered using the cursor by sliding them along. The musical Overview is in the top left-hand corner.



As an alternative to conventional musical notation, it is possible to use a piano keyboard to place notes by daubing them on a grid. Different voices use different shadings.

(continued from previous page)

four, and so on. Other features available from the Groupings menu include crescendos, 8va/8vb, rolls and slurs.

It is details of this kind that make Professional Composer such a considerable advance. They allow you to cope with most types of music likely to be encountered in the ordinary run of things, though some of the more adventurous experiments of contemporary music are beyond the program's capabilities. Another limitation is that only a maximum of four staves can be used. Within those limitations, the quality of the final printed output is excellent, and certainly good enough to be played from. Both full scores and parts can be produced. In combination with, say, a laser printer it is probably good enough to use as commercial artwork.

Before initiating the printing process you may invoke a Preview facility. This allows you to view on-screen a reduced image of the page as it will appear on the printer.

Although Professional Composer is not intended as a synthesiser, it does have a very useful though limited playback feature. It is not possible to change the speed or the timbre, nor does the playthrough pay any attention to markings on the score. But it does provide a very simple and quick aural check on the notes you are feeding in. In particular, it is very easy — and enjoyable — just to throw in a few notes, see what they sound like, and then edit them as required. To this extent, Professional Composer opens up whole new vistas in composition.

As befits a top-notch product, the manual is excellent. After a short introduction — enough to get you up and playing — with plenty of screen dumps and white space, there is a comprehensive run-through of the facilities. A short reference guide to the various menus follows, then a glossary and list of symbols used, and their meaning. There is a good index.

BEYOND THE REACH OF MOST MUSICIANS

The main problem with the whole package is the price; £429 plus VAT is quite unrealistic. No composer short of Andrew Lloyd Webber is going to be able to afford both a 512K Mac and this program. Music copyists, for whom potentially it also represents a breakthrough, will find it way beyond their means. It is probably only viable for music publishers and fat cats on the rock and commercial music scene. Nonetheless, Professional Composer gives a glimpse of features which the next generation of music processors could well offer for a more affordable price.

In comparison, the price of Music Works from Hayden Software is something to sing about: £68.30 plus VAT. But it should be said at the outset that not only is it not in the same class as Professional Composer, it is not strictly speaking competing.

Music Works does offer extensive facilities for entering music, but it is geared much more to making the Mac into a easy-to-use synthesiser. As a rough indication, it can be

said that Music Works produces output at about the first level of Professional Composer — that is, without the subtleties of note groupings and so on. Music Works does, however, offer some interesting additional features.

The main screen for note entry has two staves, with fixed treble and bass clefs; up to four voices can be added, all of which are displayed on the two staves. As on Professional Composer, a mouse-driven cursor is used to place a note on the staff and to select the duration from a small palette bar. One refinement over the other package is that the cursor rather neatly turns into the symbol selected. Notes are removed from the staff by selecting the Eraser symbol, which in practice is more exact than the backspace technique of Professional Composer.

The range of symbols is more restricted: the longest note is a semibreve and the

MUSIC WORKS				
VERDICT				
	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

A cheap way of turning the Mac into an easy-to-use synthesiser.

shortest a semiquaver. There are no double sharps or flats. In some other respects, though, Music Works is more sophisticated.

For example, after you have chosen a time signature from the Windows menu, any notes you enter are automatically apportioned within bar lines, taking account of any notes already present. Similarly, bars are filled out with rests where necessary. One problem is that no matter where the other notes in the bar are positioned, rests tend to float upwards, which can make for a slightly confusing layout.

Music Works also caters for those who cannot read or write music. From the Windows menu, selecting Grid causes a small piano keyboard to appear at the left of the screen. Notes are then entered by daubing small blobs opposite the relevant position on the keyboard. Durations are determined by the length of the blob, and the grid is used to set the temporal position in the bar. The vertical and horizontal scroll bars are used to move to different parts of the keyboard or grid. An indication is given of the current octave and note.

As with Professional Composer, there is a range of cut, copy and paste facilities for speeding entry of music. It is also possible to transpose sections. One innovative feature is the window dubbed Overview. Using dots and lines it present a scaled-down version of your score, giving you an interestingly global view of a piece. Compositions are limited to

1,024 crochets beats, that is 64 bars of 4/4 time or 128 of 2/4, which precludes the possibility of setting up longer pieces on Music Works.

Music Works comes into its own as a music synthesiser. In playback, you can alter the loudness and speed. If you are really enamoured of your masterpiece you can loop it indefinitely. As the score is played, a vertical line moves across the Overview window as an indication of relative position. Double-clicking the Overview window during playback causes the relevant bar to appear in the main staff.

It is also possible to assign a number of instruments to voices. These show up on the grid version of the music by small letters that appear within the heads of the blobs themselves. The range is rather limited: a piano, organ, trumpet, chime and kazoo. Changes can be made to the sound envelopes using the Variations menu.

More interesting is the possibility of setting up two synthesisers. The first starts from a basic sine wave, and the second from a square wave. Using the cursor it is possible to modify these on the screen to produce weird and wonderful waveforms which can be tried out and modified if necessary in another effective application of the Mac's visual approach.

A GOOD FIRST STEP FOR NOVICES

All in all, Music Works is well suited to anyone who wants to experiment with music on their Mac. It would also form quite a useful introduction to the whole world of musical notation for someone with little or no previous experience.

Instead of the grand ring-bound manual of Professional Composer, there is a useful down-to-earth stapled booklet which includes a quick run-through of basic musical terms and ideas. There are also numerous examples included on the disc, which should provide food and background music for thought.

CONCLUSIONS

Professional Composer offers a simple and effective way of entering and editing music. Its range of facilities allow both full scores and parts to be printed out to high quality.

Music Works uses similar techniques to turn the Mac into a limited but eminently usable synthesiser. There is also a printout feature.

Professional Composer is overpriced for its likely end-market of musicians. Later products of this type will probably be progressively cheaper.

By contrast, Music Works seems very reasonably priced at just under £80 including VAT.

Limitations of Professional Composer include only allowing a maximum of four staves, and restrictions on how chords can be built up.

Music Works is also limited to four voices, which correspond to the four internal voices of the Mac.

The manual accompanying Professional Composer is superlative. That for Music Works is workmanlike and quite adequate.

How much persuasion do you need to buy a world beating business computer?

New 80286 Super Micro with Massive Memory and Networking as Standard

Incorporating Intel's new IAPX 286 high performance chip, up to 6 Megabytes of main memory, 256K of disk cache buffering, multi-user and Ethernet networking facilities as standard - Sprite is a fully developed business machine packed with state of the art technology.

CCP/M86 and IBM PC AT Compatible

Sprite was designed specifically to support concurrent and multi-user processing. The next generation of increasingly sophisticated, faster, more productive software packages will demand more computer memory and processing power. Sprite will run these new programmes effortlessly, under concurrent CP/M86 with PC mode or Xenix for IBM PC AT compatibility.

Technical Specification

- 6MHZ 80286 Main Processor
- 2 to 18 users
- 512K to 6Mb main memory (no wait state)
- 21 to 140 Mb 5 1/4" Winchester disk
- 790K Floppy (IBM PC compatible)
- 256K byte intelligent cache buffer
- 80287 Arithmetic co-processor option
- Ethernet controller as standard with 'Cheapernet'
- IBM PC compatible colour graphics option
- 4 RS232 ports with synchronous & modem support
- 3 parallel ports, centronics compatible
- Intelligent 8 port RS232 expansion option
- S100 and IBM PC bus compatible
- Digital research multi-user CCP/M86 with PC mode, windows, GSX and DR-NET
- Microsoft Xenix (for IBM PC/AT compatibility)

1 Year's Free Maintenance

In the unlikely event of your Sprite breaking down, our free maintenance contract guarantees an engineer at your site within 24 hours.

Based on Proven Technology

Sprite has been developed by Jarogate, a leading force in the specialist computer market. Clients include: Marconi, Duracell, Vauxhall and other leading names. Companies not easily persuaded.

Excellence at an Ordinary Price

Starting at £4,995 Sprite costs no more than its rather ordinary rivals, it's just technically far superior. We're confident that a demonstration will provide all the persuasion you need to make the right decision. Compare Sprite's performance, price and support package with anything else. Then decide. For further details return the coupon now, or telephone: 01 671 6321.



I'd like to know more about Sprite: (tick as appropriate)
 Please arrange a demonstration Please send me more information
 Please send me your dealer pack

Name _____ Title: _____

Company _____

Address _____

Tel: _____

Return to Jarogate Ltd., 197-213 Lyham Road, Brixton, London SW2 5PY.
 Tel: 01 671 6321 Telex: 8950094

JAROGATE SPRITE 

Computing ahead of its time

All software products described are covered by trademarks of the companies of origin.



COMPUTER HOTLINES 10 QUESTIONS TO ASK

BY JOIA SHILLINGFORD

HOW CAN you tell if a computer hotline is hot or just lukewarm? Whether you are thinking of buying a computer or already own one, it's in your interest to find out. The service you phone for advice on your computer may come in many different guises. It may be called a hotline, helpline, customer service line or simply technical support. But beneath the different titles these services all have the potential to help you get the most out of your hardware and software.

A wise computer buyer will test the temperature of the hotline before purchasing the product, and the 10 questions posed in this article should help you to do so. Some of them should be asked of a company representative. Answers to others can sometimes be gleaned by phoning the hotline itself and asking a few questions.

The best way to find out whether reality matches up to the claims made by a company about its telephone support is, of course, to track down an existing user. A good company will help to introduce you to some other users before you buy, though arranging this yourself obviously makes sure

you are not being palmed off with someone who will just feed you the company line.

Computer companies usually opt for one of two approaches in providing telephone support. Some, like Digital and Tandy, provide a hotline directly to end-users, though Tandy customers can also ring their local store. Others such as ACT, IBM and Apple have a hotline for their dealers, who in turn provide telephone support to customers.

With effective dealer communications both approaches can be made to work. All things being equal, direct support of the end-user will tend to have the edge in terms of speed of problem resolution and up-to-the-minute product knowledge. However, getting to know your local dealer can also have its advantages as you may be able to pop in with your computer and explain face to face what the problem is.

At the moment the trend is towards computer hotlines. As computers become easier to use, and manuals, training discs and help files become more straightforward, some companies are hoping that their hotlines may become the primary means of customer support. If it does happen a number of computer firms should start to rethink the way that their hotlines are organised.

How quickly is the phone answered?

1 You would be surprised how often customers are kept waiting. Digital is one company which has taken steps to avoid these delays. Its PC hotline staff pace themselves using a traffic-light system. A red light flashing indicates that a call has been kept on hold for more than 20 seconds. Amber shows that a call is waiting and a green light is the all clear signal which means that all calls are being answered without delay.

A number of computer hotlines have their own switchboard. This means that enquiries can reach the appropriate person more quickly than if they have to go through the main company switchboard. Apple has installed a new switchboard to improve the speed with which calls to its dealer hotline are answered during peak periods.

Do the hotline staff know what they are talking about?

2 It should not take you long to find out if they don't, but there are also some pointers to look for in advance. The background of the hotline staff is important. Typically this will be in computer support or engineering. Familiarity with common customer applications is also useful.

Perhaps even more important is the aptitude for acquiring new technical knowledge, and the training provided by the company. This should be a combination of structured courses and time for the support person to experiment with the company's

products on their own. They should also have had a chance to work through the manuals and the records of common problem solutions, and spend some time answering calls on the hotline while under supervision.

Staff should be on the hotline phones regularly, not just as a fill-in between other tasks. This will enable them to consolidate their knowledge. Hotlines which are answered by whoever happens to be near the phone when it rings are unlikely to provide the user with satisfactory support.

Will you get called back if your problem can't be solved on the spot?

3 Though most computer hotlines say that they will call back if a problem can't be solved immediately, the less efficient ones sometimes forget. It is time wasting and annoying to have to keep ringing back to get an answer. Talk to other users to find out what a particular company actually does.

If the hotline staff can't resolve a tricky problem, do they have access to other technical staff who can?

4 A good hotline will be able to answer most people's questions most of the time. However, problems will occasionally arise which require a fix from the development team. This means that there must be clear escalation procedures for problems that have been reported to hotline but cannot be solved by the hotline staff.

Tandy's hotline telexes the firm's Texas headquarters when it needs further assistance. Apple U.K. uses the phone or electronic mail to contact its technical specialists in the U.S. Digital has brought a large number of its technical specialists — including those who operate the hotline — under one roof. Previously they had been scattered among several locations up and down the country. Customers benefit from this policy of pooled expertise because some support staff of Digital's PC products will be close at hand.

At what times is the hotline open?

5 There is no point in paying for hotline support if it is not there when you need it. Apple offers an 8.30a.m. to 6.30p.m. helpline. Digital's customers can have the support of a 24-hour helpline if they are willing to pay extra for cover outside office hours.

ACT and Tandy operate hotlines during office hours, but say that calls will often be answered at other times. IBM's dealer hotline is staffed from 9a.m. to 5p.m. Messages can be left with an answering service at other times.

Are the caller's details logged and analysed?

6 Many computer hotlines make a note of the customer's or dealer's name, company name, phone number, problem and the date of the call. Fewer make good use of the information they have gathered. Efficiently managed customer records mean that when you phone a hotline twice in one day — perhaps your problem wasn't solved the first time — you won't have to explain yourself all over again.

Any computer company interested in making improvements to its product or service should not overlook the importance of the feedback provided by callers to its hotline. Persistent calls about a particular piece of software may point to a bug, or an inaccurate or misleading passage in the manuals or help files. They may even indicate a need for simpler software or new software that can cope with a commonly required application.

IBM, Digital and ACT analyse hotline calls regularly, breaking the calls down into specific areas. Digital also gains useful feedback from an annual survey of how its customers have fared.

ACT looks at three main areas; applications and software, communications and networking, and languages and operating systems. Tandy has plans to analyse its log of calls, but does not yet do so. Apple analyses its call records from time to time.

Are the solutions to common problems recorded for reference purposes?

7 Both Apple and Digital log the answers to common questions in electronic databases. Users benefit because their questions can be answered quickly, and the company also saves money in the long run.

Apple has recently added a technical bulletin board to its older problem database to keep dealers informed of new solutions to technical problems. Apple's bulletin board runs on an Apple II and contains recent problem solutions. In the last year, Apple has also added technical agony aunt pages to its dealer magazine *Appletalk*.

Is the hotline supplied with all the necessary manuals and equipment?

8 The last thing you want to do when you ring a hotline is to wait while someone tracks down the appropriate manual. If you are the first person to explain that every time you hit the circumflex key a light comes on but nothing prints up on the screen, the hotline person should be able to copy your actions on a terminal just like the one you are using — preferably without moving away from a phone. In this way, finding out the solution to your problem should only take minutes.

The customer service line at Tandy has at its disposal every piece of equipment and software Tandy has ever sold in the U.K. ACT equipment is also on order in anticipation of the merger of ACT and Tandy telephone support departments.

Is there a charge for using the hotline?

9 Telephone assistance from dealers is usually free of charge. So is the hotline service they contact when a customer asks them something out of the ordinary. It is worth checking whether there is any charge for a user hotline.

Tandy's hotline is free of charge, Digital's is free for the first 12 months; subsequently customers can get hotline support if they have opted for an after-sales support contract. The Fixed Fee service is the cheapest of these and costs £25.

The benefits of a good hotline in terms of reduced down time and perhaps more efficient use of your system are likely to be well worth the charges you will have to pay.

What is the attitude of the hotline staff?

10 If you feel patronised by the hotline staff or blinded by computer science then their attitude is wrong. Pitching an explanation at the right level is a difficult skill to acquire, but experienced hotline people should have a feel for the type of user they are talking to. They should be able to differentiate between the boffin and the beginner, and provide anyone with an appropriate explanation.

The hotline person should avoid jargon unless he or she is sure that the enquirer will be able to follow it. A competent hotline person should have a friendly manner so that users feel at ease with them. Staff should not just be picked for their technical agility, but also for their ability to communicate well.

PC communication problems?

As a professional, you need fast, *automatic* access to your data source; typically, FINANCIAL & BUREAUX services, TELECOM GOLD, PRESTEL, MAIL BOXES & MULTISTREAM. But do you need the headaches and frustrations of manually establishing a data link?



By using our **MULTICOM** software (IBM compatible) and **COMPACT PLUS** modems, life is made very simple for you. From a single keyboard command, your data link is established, a dialogue opened with the remote end, and log-on procedures completed *automatically*. It really is that simple.



FREE
subscription
to
TELECOM GOLD

The Professional Way to Communicate

Find out how you can enjoy FREE subscriptions to TELECOM GOLD!

Tel: 0276 27122 or contact your local dealer

COMPACT COMMUNICATIONS LTD.,
Forum House, 1 Millmead
Staines, Middx.

communicate with compact

● Circle No. 157

PC SOFTWARE: OVER 40% DISCOUNT!

Just look at some of our prices!

DBASE III	290	RRP 550	-47%!
FRAMEWORK	295	RRP 550	-46%!
DBASE II	222	RRP 395	-43%!
WORDSTAR PRO	242	RRP 399	-39%!
SUPERCALC 3.2	219	RRP 360	-39%!
LOTUS 1-2-3	265	RRP 430	-38%!
SYMPHONY	385	RRP 595	-35%!
MULTIMATE	263	RRP 399	-34%!
MULTIPLAN	129	RRP 190	-32%!
FRIDAY!	125	RRP 175	-28%!

Most popular business micros supported!
Unlike some of our competitors, these prices will be held until next publication date! (IBM-PC prices shown excluding VAT)

Call us NOW on 0480 53044 for further details!

Elite Computer Systems

40 SAPLEY ROAD · HARTFORD · HUNTINGDON · CAMBS PE18 7YQ

● Circle No. 158

SOLID STATE DESK TOP SWITCHING DEVICES (FULL TWELVE MONTHS GUARANTEE)



No Problems with Cable Lengths or Data Loss/Errors
Having Separate Ports. Avoids Over-loading Computer
Metal case with built-in power supply and fitted plug

THE PRINTERSHARERS

(SEVERAL MICROS TO 1 PRINTER)

PARALLEL: 3 WAY 6 WAY

(AS BBC) £65-(b) £129-(c)

CENTRONICS: 2 WAY 3 WAY

(36 PIN) £95-(c) £105-(c)

SERIAL RS232 3 WAY - £65-(b)

RS423 3 WAY - £40-(b)

5-Din (As BBC)



THE PRINTCHANGERS

(1 MICRO TO SEVERAL PRINTERS)

PARALLEL - 26 PIN

3 WAY - £70-(b)

CENTRONICS - 36 PIN

2 WAY - £95-(c)

2 WAY - £105-(c)

SERIAL RS232 3 WAY - £65-(b)

RS423 2 WAY - £40-(b)



THE PRINTERCROSSOVERS

(2 MICROS TO 2 PRINTERS)

PARALLEL - 26 PIN £75-(c)

CENTRONICS - 36 PIN £95-(c)

SERIAL RS232 £70-(b)



PRICES ARE EXCLUDING VAT. Postage: (b) £2-(c) £2.50

KEYZONE LTD

U 14, REGENERATION HOUSE, SCHOOL ROAD,
PARK ROYAL, LONDON NW10 6TD.

Telephone: 01-965 1684/1804 Telex: 8813271



● Circle No. 159

As the business micro world turns a deeper shade of Big Blue every day, you might wonder if there are any reasons left for buying other than IBM. Does the adage "Nobody ever got fired for choosing IBM" mean you have to be a masochist to do otherwise?

The Apple Mac for one, shows you don't. There may have been a time when cynics — and that includes the odd journalist — were sceptical. Technically superb, the Mac was a closed system and perversely incompatible with the Apple II. Hence there were very few programs available for it — generally the kiss of death for a machine — and none of the third-party add-ons which made the Apple II so versatile and popular. It all looked a little too like the sad and sorry tale of the now-defunct Lisa.

But the biggest problem, software starvation, seems to have been fixed. A glance at the Spring issue of the Macintosh's *Buyer's Guide* reveals some 550 packages, not bad going for a machine that is less than two years old. Another small indication of the Mac's coming-of-age is Bill Gates's enthusiasm for the machine. Coming from the supplier of IBM's PC-DOS, this seems to pass beyond simple prudence in backing both horses in a two-horse race — see this month's Interview on page 81.

What is emerging in the Mac is an innovative and stylish machine that is also viable in a business context. If desk-top

HOW TO AVOID THE BLUES

Compatibility is not everything. Glyn Moody introduces our selection of 10 micros from those you could dare to buy instead of an IBM clone.

metaphors, mice and icons appeal, the Mac has very definite advantages over the stuffed-shirt approach of IBM.

Ironically, the biggest threat to the Mac is unlikely to be the Big Blue bully, but Jack Tramiel's Mac-like Atari 520ST. Some uncertainty still surrounds this product: for example, can it possibly be that good at that price, and will there be any software? If it can, and there will, it could well be a very serious business proposition. And at £700, even the most hardened of IBM addicts might well be tempted.

Even sticking with boring old MS-DOS can have its advantages. If you make clones, then you have succeeded if you are as near to IBM as copyright laws allow — hardly a recipe for innovation or excitement. But without the Holy Grail of compatibility, you are forced to offer a little extra to compensate.

Most of the MS-DOS machines listed overleaf have a more than a *souçon* of specialness. For example, there is the touch-screen option from Hewlett-Packard, the speech-recognition system from Texas Instruments, the advanced graphics from RML and Northern Telecom, the dual-processor system from Epson, and the fully integrated, upgradeable family from ACT. Each of these are particular virtues not offered by the IBM PC, yet which may in specific applications prove perfect.

Specialisation is the keynote of survival in the world outside the IBM fold. A case in point is the Pinnacle from TDI. Running

under the powerful — but in business circles relatively obscure — p-System, this very fast machine is almost indifferent to the concerns of clonedom. If you want a p-System engine, perhaps for in-house development, or just a system with little degradation when supporting up to seven users, you can concentrate on specifics such as "Does it do what I want?" rather than generalities like "How compatible is it?"

Of course heterodoxy has its price. It is true you are likely to be cut off from the hottest mainstream developments, which almost certainly will come through on the IBM first. You will not be the first on your street with the latest colour integrated package complete with icons, pull-down windows, built-in expert system, and bells and whistles requiring the special 80386 board with 4Mbyte RAM expansion. But then are you buying a computer to use now or to be trendy with tomorrow? **PC**

SUPPLIERS

Apple Macintosh: Apple Computer (U.K.) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244. Circle no. 361.

Apricot: Apricot U.K. Ltd, Shenstone House, Dudley Road, Halesowen, West Midlands B63 3NT. Telephone: 021-501 2284. Circle no. 362.

Atari ST: Atari Corporation (U.K.), Ltd, Atari House, Railway Terrace, Slough, Berkshire SL2 5BZ. Telephone: (0753) 33344. Circle no. 363.

Epson QX-16: Epson (U.K.) Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892. Circle no. 364.

HP-150 II: HP Ltd, PC Group, King Street Lane, Winkersley, Wokingham, Berkshire RG11 5AR. Telephone: (0734) 784774. Circle no. 365.

Pinnacle: TDI Ltd, 29 Alma Vale Road, Bristol BS8 2HL. Telephone: (0272) 742796. Circle no. 366.

RML Nimbus: Research Machines Ltd, Mill Street, Botley Road, Oxford OX2 0BQ. Telephone: (0865) 249866. Circle no. 367.

Sprite: Jarogate Ltd, 197-213 Lyham Road, London SW2 5PY. Telephone: 01-671 6321. Circle no. 368.

Ti Professional: Texas Instruments Ltd, International Data System Division, Manton Lane, Bedford MK41 7PA. Telephone: (0234) 67466. Circle no. 369.

Vienna PC: Northern Telecom Data Systems Ltd, Maylands Avenue, Hemel Hempstead, Hertfordshire HP2 7LD. Telephone: (0442) 41141. Circle no. 370.



**APPLE MACINTOSH****£1,795**

The Mac represents the *ne plus ultra* of the non-IBMulators. Most other machines run under MS-DOS — which is at least an approximation to IBM's PC-DOS — but Apple gives you idiosyncrasies all the way. The processor is a 68000, and the operating system quite different from the staid approach of practically all other machines. Even if the Mac did not pioneer the use of icons and the desk-top metaphor, it is certainly responsible for its popularisation. If you like this approach, or just want to be different, the Mac could be for you. The earlier problems of software starvation seem to have been largely overcome, with new and exciting packages every month. The only disadvantage is the price.

FOR Innovative and genuinely new. Sleek in looks and use.

AGAINST Limited expansion possibilities. Low disc capacities.

**APRICOT PC****£1,595**

ACT'S Apricot is the U.K.'s one great hope among micro manufacturers. This Birmingham-based company has progressed from selling the Sirius to designing and building a very reasonably priced range of micros. At the bottom is the Apricot F1, costing just under £895 excluding a monitor, and offering a very cheap MS-DOS entry-level system. The mainstays of the family are the semi-transportable PC and XI, dual 3.5in. floppies and Winchester versions respectively. More recently 40Mbyte file servers have been introduced for the 32-user network which ACT also offers. More gimmicky and more fun is the Apricot FP, the transportable with built-in limited voice-recognition facilities. The fact that there is a complete compatible family is a tremendous strength.

FOR Compatible family. Large U.K. user base.

AGAINST Poor keyboard on F series.

**ATARI 520ST****£699.99**

The Atari ST is the joker in the micro pack at the moment. Its spec is amazing: for a mere copper under £700, VAT included, you get a 512K micro with a 720K 3.5in. floppy, monochrome screen and a bundle of Digital Research's software including the innovative Gem package — reviewed on page 50 of this issue. Gem provides a Mac-clone front end, with all the paraphernalia of icons and a mouse. The question is: can Tramiel bring it off? With memories of another wonder machine — the Sinclair QL — and its attendant problems still fresh in the memory, a little scepticism would probably be advisable. Another factor to bear in mind is that there will be relatively little software available for the first year. But if the ST is still around after that, it could be unbeatable.

FOR Excellent spec. Cheap. Versatile.

AGAINST Limited availability. Lack of software.

**EPSON QX-16****£2,100**

The QX-16 is something of a hybrid system. While it certainly goes well beyond mere MS-DOS compatibility, it stops short of trying to ape the IBM PC even in simple matters like the keyboard layout or accepting expansion cards. The Epson further hedges its bets by including a Z-80 which eventually will allow you to run CP/M. But perhaps the chief interest of this system is its front end, called Taxi. Once again, this is modelled on flavour of the month, the Mac. What is special about it is that it simply sits on top of MS-DOS and lets you run unmodified files from it directly. This can provide a very soft and comfortable interface.

FOR Icon-based front end to MS-DOS. CP/M capability.

AGAINST Price. Hybrid system.

**HEWLETT-PACKARD 150 II****£3,300**

The HP 150 began life as a machine based around a truly innovative concept. Instead of using an unfriendly keyboard — which many executives seem unwilling to do anyway — and rather than opting for trendy mice, Hewlett-Packard went for a touch-screen. This allows you to select the option you require, simply by touching the appropriate area on the screen. A grid of infrared beams detects the precise position. This seemed a nice idea in theory, but it has failed to win the hearts or the corporate desk tops of the world. As a result, HP has downgraded the touch-screen to add-on status. Nonetheless, if this approach appeals to you, the HP 150 II which includes the touch-screen is a solid machine with useful bundled software.

FOR Fast processing. Built-in printer option.

AGAINST Price. No parallel port.



PINNACLE

£6,690

The Pinnacle is a thoroughbred machine produced as a joint venture between the British firm TDI, which is based in Bristol, and Pinnacle Systems Incorporated of Dallas. It uses the increasingly popular 68000, and is one of the first machines to push it to something like its limits. For example, the processor runs at a cool 12MHz with no wait states, which adds up to the fastest machine we have benchmarked. However, it is not a general business machine like the others in this Top Ten. In particular it is conceived of as a p-System engine, and it is not possible to run standard MS-DOS software. However, more standard operating systems like CP/M-68K and BOS are available, granting access to a number of ready-written packages.

FOR Speed. Multi-user capability.

AGAINST Mainly a p-System engine. Not totally user-friendly.



RML NIMBUS

£1,695

Hitherto Research Machines has been better known as a purveyor of high-quality specialist machines to the educational market at an equally high price. But with the Nimbus it has produced an impressively fast and powerful general-purpose machine that could well appeal to a wide range of users because of its MS-DOS standard operating system and its exceptional graphics. These are largely due to an 80186 running at 8MHz in conjunction with a custom graphics chip designed by RML. The price is also very attractive: about £1,700 for a system with two 3.5in. discs, colour monitor and IBM-type keyboard. The machine is built to RML's customary high standard.

FOR Price. Speed. Graphics.

AGAINST Limited software on 3.5in. floppies.



SPRITE

£5,630

Like the IBM PC/AT, Jarogate's Sprite is based on the latest chip from Intel, the 80286. Taken together with its 21Mbyte Winchester as standard, it provides a passable hardware imitation of Big Blue's next blockbuster, although it is not intended as a clone of any kind. The Sprite does have a PC mode under its operating system, Concurrent CP/M. During review, the operating system proved one of the few weak points in a generally impressive and solidly built machine. Later releases of Concurrent DOS will presumably have ironed out some of the bumps. A big plus is the built-in Ethernet interface, which in conjunction with the fast multi-user capabilities of the machine, means that the Sprite could well be a good buy for small- and medium-sized offices which are likely to expand.

FOR Speed. Built-in Ethernet. Expandability.

AGAINST Concurrent DOS is wobbly.



TI PROFESSIONAL

£3,795

The TI Professional stands out from the crowd of MS-DOS machines by virtue of an add-on feature, its speech recognition. Using special circuitry you can train the micro to recognise groups of up to 50 words and short phrases, each one of which is assigned to a string of ASCII characters. Particular applications might be setting all the common functions like Block Move, Save, etc. in WordStar to be voice activated. In this way you can keep your hands permanently on the keyboard. It is also possible to store chunks of continuous speech, though this is currently very memory intensive. The main drawback is the price, which is a hefty £1,250 for the speech unit alone. ACT's FP machine has some of these voice facilities and costs about the same for the whole machine.

FOR Several voice input and output features.

AGAINST Cost of voice system. Memory-hungry.



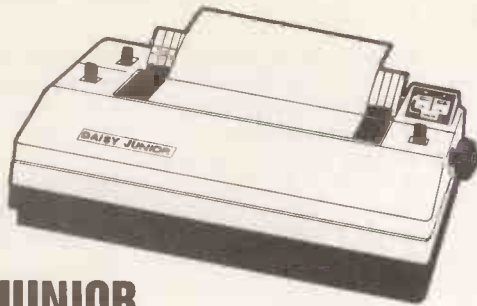
VIENNA PC

£3,100

The Vienna PC forms part of an office-automation system from the North American telecommunications firm Northern Telecom. It is reviewed in greater detail on page 66 of this issue. Apart from its 80186 main processor, its chief claim to fame is the very high-graphics resolution of 800 pixels by 420 pixels, available on its white phosphor screen. A further 80186 processor is dedicated to handling the bit-mapped graphics. These facilities are put to good use working with Digital Research's Gem, which provides a mouse-driven front end. The Vienna PC is unusual in that it offers a customised version of Lotus 1-2-3 which will run on its monochrome screen. There is a range of standard software applications available as part of the Vienna Office system.

FOR High-quality screen. Good graphics.

AGAINST Price. Bulk of systems box.



DAISY JUNIOR

FEATURES INCLUDE:

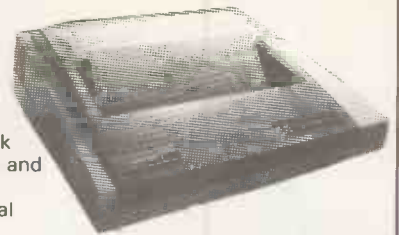
- 14CPS (max. at 12CPI) ● Qume Ribbon and Daisywheel ● Qume Compatible ● 10" Platen ● Friction and Pin Feed ● Bi-directional ● 7K Memory ● Multi-copy Facility
- Parallel or Serial Interface
- Auto Underline ● Low Noise
- Full compatible with all Software including IBM

£199.00 + VAT!

MANNESMANN TALLY

MT-80 +

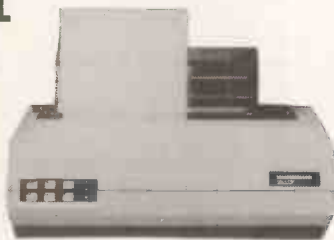
100 CPM, Bi-directional, Alternative font – optional, 4k buffer, italics, super/subscript and bit image graphic I to r, 103 semigraphic units, international specials US, German, French, Spanish, Swedish, Greek, Danish, Japanese, 192 ASC II characters.



£175.00 + VAT!

MANNESMANN TALLY

JULY-AUG SPECIAL MT280



- Bi-directional ● 16" paperwidth ● 2030 character buffer ● 200cps ● 50cps corres ● 10/12/16.6/20 character pitch ● serial V24/RS232C + 8 bit parallel ● 9x9 data processing 18x24 correspondence ● 60dbA ● proportional spacing ● auto right justification ● auto centering ● 96 USASCII + 27 international characters + IBM PC + 8 national sets ●

£799 + VAT

MANNESMANN TALLY

MT 440 series

**400cps Bi directional
650cps tabulation speed**



Character matrix (H x W)
Matrix dimensions (H x W)

9 x 7/18 x 40 selectable
3.08 x 1.52 mm/
3.27 x 2.03 mm selectable
400/100 cps

Print speed (10 cpi)
Print quality
OCR character fonts
Character set

Data processing/correspondence

128 characters

Character pitch

10/12/16.7 cpi with 9 x 7 matrix
10 cpi with 18 x 40 matrix

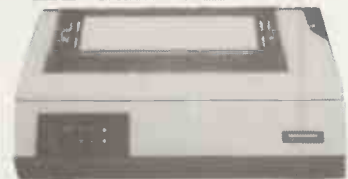
Characters per line:
132 characters at 10 cpi
165 characters at 12.5 cpi
220 characters at 16.7 cpi
Large character printing

FROM

£1,795 + VAT

MANNESMANN TALLY

MT490



Character Matrix (H x W)
D.P.
Correspondence
Matrix Dimensions (H x W)D.P.

9 x 9
18 x 48
3.25 x 1.9 mm

Print Speed @ 10cpi
D.P.
Correspondence

400cps
150cps

Pinthead
Character Set

18 needles
128 characters (ISO
multinational
plus IBM PC
Optional
N/A

OCR-A, OCR-B
Barcodes
Large Character Printing
Characters per Line

132
158
—
198
225

@ 10.0cpi
@ 12.0cpi
@ 12.5cpi
@ 15.0cpi
@ 17.1cpi

Graphics Densities:
Horizontal
Vertical
Code Compatibilities

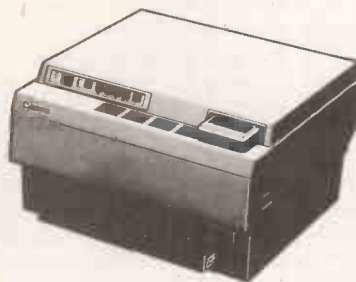
60/120/240 dpi
72/144 dpi
ANSI/Epson/IBM PC/MT*

From £1845 + VAT

LBP-8A1

- Print Mode: Landscape/portrait
- Positioning: all point addressable by 1/300 inch
- Character Pitch: Multiple Character Pitches in a line 10, 12, 13.3, 15 CPI, P.S. etc.
- Line Pitch: Multiple Line Pitch in one page 6, 8, 8.7 LP1 etc.
- Multiple Font: Maximum 15 fonts/page (internal font, font cartridge)
- Overstrike Printing: Available Character
- Enlargement: Doubling in two directions

Canon



£3195 + VAT

All prices exclude VAT and carriage. Add £3.00 parcel post. £8.00 special delivery. Make cheques/POs payable to: NEWTRENDS TECHNOLOGY, SOUTHBANK HOUSE, BLACKPRINCE ROAD, LONDON SE1 7SJ Tel: 01-735 8171/01-582 9566 Telex 29 5555

INTERVIEW

BILL GATES founder and President of Microsoft

INTERVIEWED BY GLYN MOODY

How are things going to pan out between the Mac and the IBM PC?

I THINK that's very clear: the Mac will be number 2. The Mac plus Excel is a far superior solution to the IBM plus 1-2-3. And until you have serious software, a machine is not a serious machine, despite the power and ease of use the Mac has brought. A year ago they had no software, now they've got a ton of software and that's helping a lot. But they need a few milestone packages which push it to the point where a guy who works with numbers says, "Look, get me a Mac, because the Mac with a Laserwriter lets me do my job in a far better way than I could do in the past."

In what way do you think Excel moves beyond the previous generation of packages?

OUR CLAIM is very simple: it's the world's greatest spreadsheet, it's the best way of working with numbers. And that was our very straightforward goal in doing the thing.

How do Topview and Windows sit together?

TOPVIEW is a very nice utility that allows you to run multiple applications. I don't know of a single software company that's writing applications that require Topview because there's really nothing Topview lets you do that's unique. It's not compatible with the network, it uses up a lot of memory, it doesn't use batch files: there are some limitations. Windows happens to run multiple applications, but Windows is a sub-system that supports graphics, and a graphics user interface. So unless you like the graphics applications we'll be including in with Windows, then you shouldn't buy Windows.

What has been the problem with the release dates of Windows?

WHEN you're building the foundation you're telling everyone to put their application on top of, it's a very significant responsibility to get the thing small and fast and good. We underestimated how tough that was going to be to get it exactly right. We've had good feedback from software developers in terms of what they really want, and speed and things like that. Also there were some things about "should we work with old applications?" and we decided we should; "should we work without a mouse?" and we decided we should. That's one of the more fantastic features we've put in. In our case it's a graphical user interface that doesn't require the mouse to use the menus although it supports it very fully. And it's a very substantial system, not only Windows

itself but the development tools that go with it. We underestimated the process.

How important for Microsoft is networking?

WE HAVE two real thrusts. One is graphics, the other is networking. Networking has gone so smoothly and we've gotten so much support that it's probably gotten a little less attention. But it is one of our greatest successes to have people like IBM, ACT and HP — almost everyone is behind MS-Net — and therefore having all the software developers using the MS-Net protocols. It's gone super well for us. The key market right now that DOS machines sell into is the office market, and in the office market, all the machines will be networked eventually.

How do you see that squaring with the multi-user capacity?

THERE IS obviously some trade-off when you're solving a particular problem. In the long run, as people want to use graphical applications we think that a single user, networked, will be the dominant approach. But we see a very significant role for multi-user systems like 286-based systems running Xenix where the cost per terminal is much lower, and the ease of setting things up and controlling the data is far greater today than it is in the network case. So that's a market that will flourish. Because the 286 chip is really great: it's the first inexpensive microprocessor that has the performance, and the memory management. Coupled with a 20Mbyte hard disc it's the first popular machine that's adequate for Xenix and Unix-type applications. Because we got IBM to announce Xenix we're going to get applications momentum behind Xenix. It'll get it to critical mass.

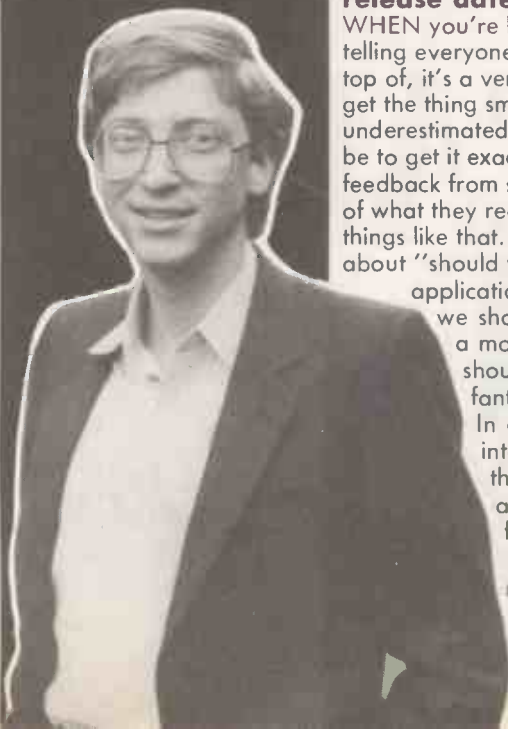
Do you think Xenix will take off now?

OVER 70 percent of the Unix systems in the world today are Xenix so we've done very well with customers like Intel, Radio Shack and Altos. But even so it's fallen short of market predictions. I think the 286 will help that, and IBM's involvement will help that. We need to get up to like 400,000 systems in the next year-and-a-half to make sure that the software companies involved make a good living in Xenix applications.

How do you see PC-DOS developing in the future?

I'VE TALKED about multi-tasking, and I've talked about Windows being on top of that, and there are some extensions we can do in the network area. Another key thing is to track the Intel chip developments, the 286, and then the 386. That, in whole, is a full set of activities for the next three years.

Programming has always been central to Bill Gates's life. He took a programming job after leaving school and before going up to Harvard. He left university after only two years in order to set up Microsoft in 1974. Gates was also actively involved in the writing of code for Windows and adapting MS-DOS for the IBM PC. Today, looking even younger than his mere 29 years, Gates presides over a company whose latest turnover is expected to top \$140 million. He and his co-founder Paul Allen remain the majority shareholders.



THIS WILL DO NICELY!



Now you've seen the new (and vastly improved) Practical Computing, make sure you receive it regularly every month by returning this card.

You won't want to miss what we have lined up for the future – more applications features, more on multi-user systems, more

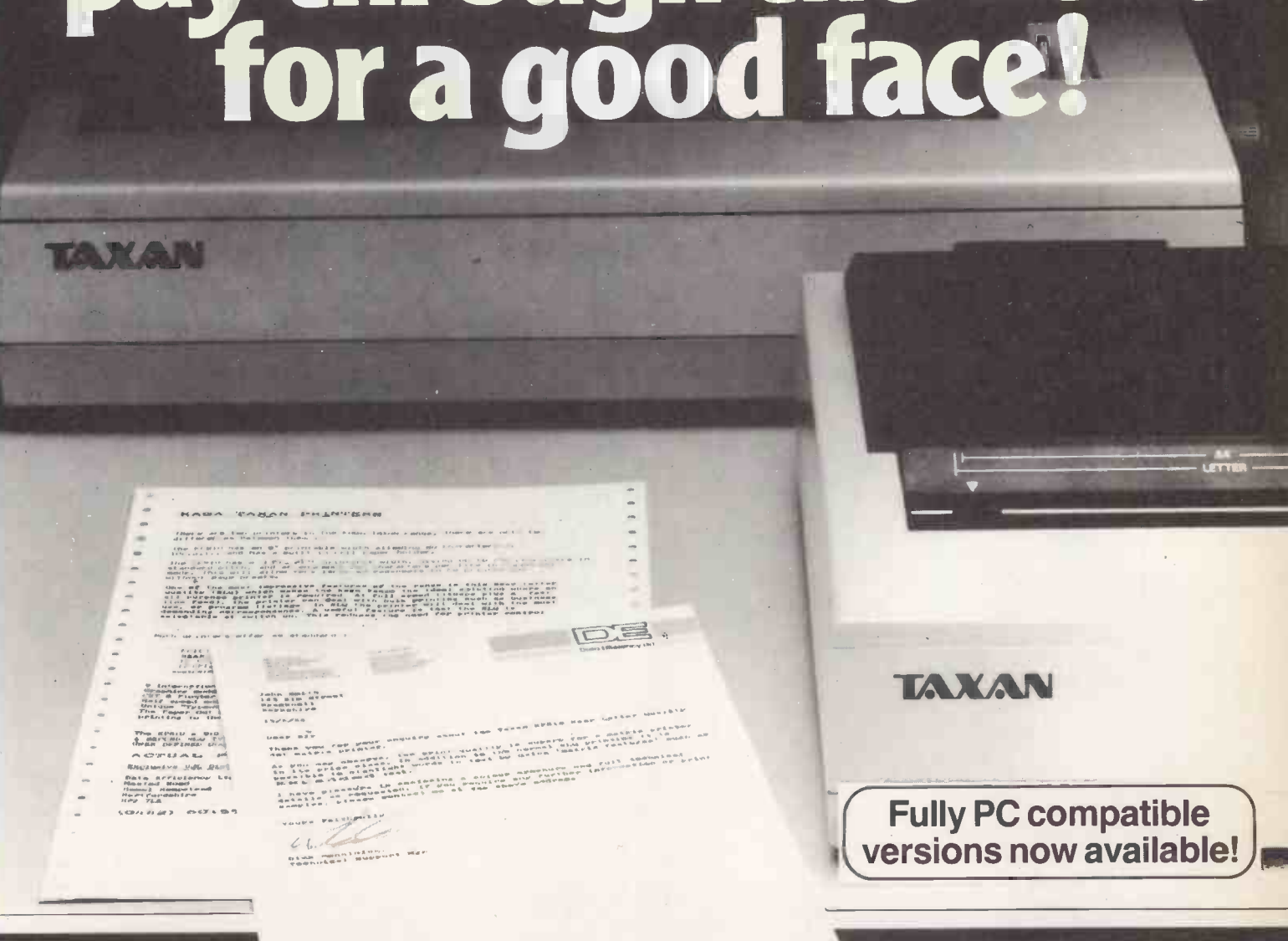
problems answered, more on communications and more view-points from industry leaders.

What more could you ask for? Except to receive it regularly, of course!

PRACTICAL COMPUTING

*Get it regularly –
send the card – today!*

Now you need not pay through the nose for a good face!



Fully PC compatible versions now available!

Because Taxan dot matrix printers combine quality, value for money and proven reliability.

Print Quality

Both the KP810 and KP910 have all the standard features found in dot matrix graphics printers, but when it comes to Near Letter Quality (NLQ) printing both really excel – producing output equalling or exceeding the quality of much higher priced units.

Features

- * 140 cps print performance
- * NLQ double pass printing
- * Downloadable character sets (DRAFT standard, NLQ optional)
- * Wide choice of optional NLQ typefaces available in ROM
- * Unique incremental printing mode
- * Friction and tractor feed
- * Standard Centronics interface (serial option available)
- * Fully compatible with all popular software packages including Lotus 1-2-3, Applewriter, Wordwise etc.

* KP910 prints extra wide – 156 char/line (normal) and 265 char/line (condensed) – ideal for Spreadsheets

Value for money

KP810 (80 column) around £339 (plus VAT)

KP910 (156 column) around £429 (plus VAT)

PC compatible versions

KP810PC (80 column) around £399 (plus VAT)

KP910PC (156 column) around £499 (plus VAT)

Prices correct at time of press

Distributed exclusively to dealers nationwide by DDL. Call us for the address of your nearest stockists.



THE NEW FORCE IN DISTRIBUTION

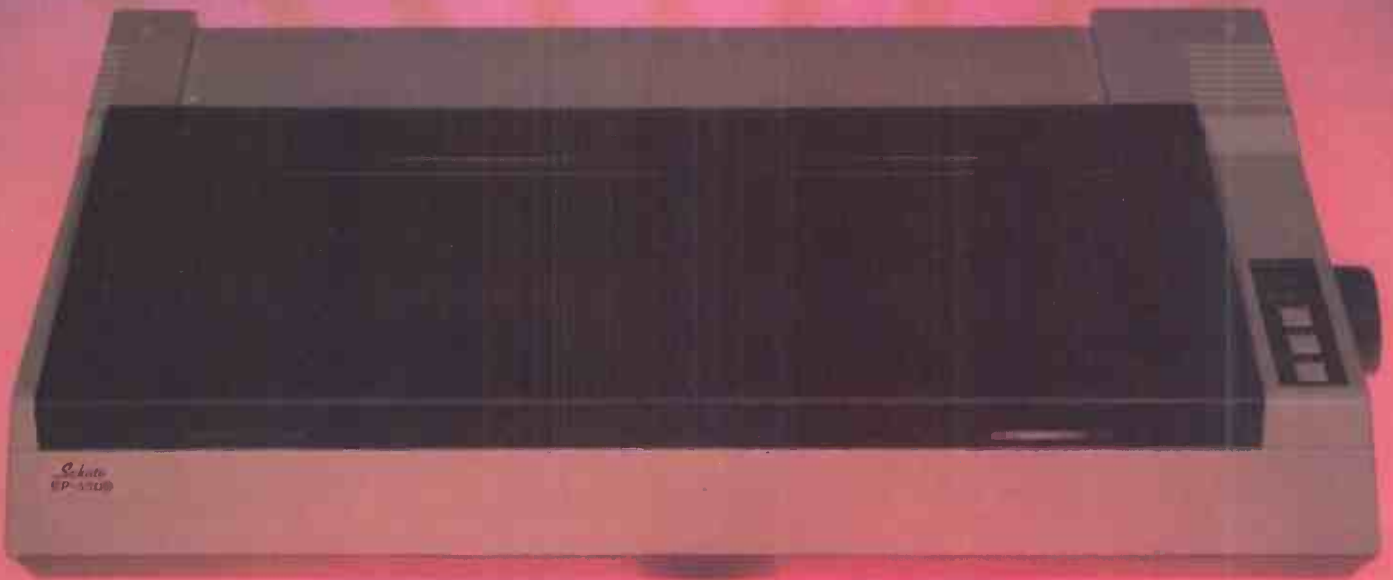
5 King's Ride Park,
Ascot, Berks. SL5 8BP
Tel: 0990 28921
Telex: 846303 DD LTD G.

On the quiet . . .

Less than 55 dba, 180 cps
Epson or IBM PC
compatible. Near-letter-
quality, multi-font
character set, friction and
tractor feed, high

resolution bit image
graphics, 136 or 80
column models.
All this and more at a
price you will not believe.
Call now for full details.

SAKATA SP5500



datafax

Datafax House Bounty Road Basingstoke Hants RG21 3B2
Tel: (0256) 464187 Telex: 268048

datafax

sole UK distributor for Sakata peripherals. Datafax acknowledge all trade marks shown

● Circle No. 126

P R I N T E R S
WHICH

Daisywheel and dot-matrix printers have captured the upper and lower ends of the printer market. Now they are being threatened by other types of printer which are quiet, cheap, fast and can produce high-quality output. Ian Stobie looks at the kinds of printer available.

PRINTER?

For a long time daisywheel printers have dominated the market for high-quality personal computer printing, while dot-matrix printers have taken the lower-quality high-speed end. This picture is now changing. Daisywheel printers are under attack from two directions: at the top of the price range by laser printers costing little over £3,000 and at the bottom by a new generation of much improved matrix printers with prices starting below £300.

Noise is a fundamental attribute of daisywheel printers, as they work by impact — banging fully formed embossed characters through a ribbon on to the paper. It is not unusual for an unenclosed daisywheel to put out around 65db(A) or more, making it too noisy to sustain a telephone conversation in the same room. The only thing you can do to overcome the problem is to put the whole printer in an acoustic enclosure or a different room, which adds to the expense and inconvenience.

Daisywheel printers are slow because they work in basically the same way as electric typewriters, spinning a single character into position in turn and printing one character at a time. The top speed attainable with this technique is 90cps, but the more typical office machines range between about 20cps and 55cps. In fact, quoting speed in the industry-standard fashion of characters per second tends to overrate the amount of actual printing you can get through because cps figures make no allowance for things like the time wasted at the end of each line.

Despite their high-tech name laser printers are really little more than photocopiers with the electronics to allow computers to drive them. They print a page at a time and are capable of producing letter-quality output at high speed — from about the equivalent of 300cps. Because they are based on photocopier parts they are quite civilised for the office environment. They are very quiet compared

to a daisywheel, coming in below the 55db(A) level, and sounding about a quarter as noisy. However, despite dramatic reductions in the price of the technology laser printers are still quite expensive: the cheapest, like the Canon LBP-8 and Hewlett-Packard Laserjet, still cost over £3,000. These machines really make most sense for the higher-volume daisywheel user, printing between 400 and 4,000 pages a month.

Dot-matrix printers have the reputation for being almost as noisy as daisywheels while giving lower quality. But they do print quickly, at speeds between 100cps and 500cps. Matrix printers mark the paper in a number of different ways, but all build up the character from a pattern of dots to get that familiar computer-printed look. Yet far from becoming obsolescent, matrix printers are going from strength to strength.

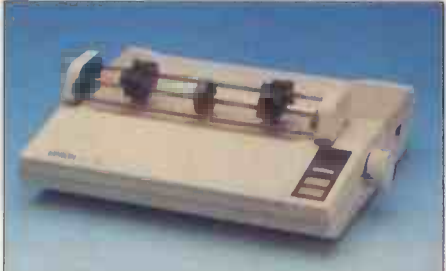
The latest machines have dramatically reduced noise levels and offer much better print quality. The previous generation of machines generally formed each character from a seven by five or a rather more readable nine by nine pattern of dots. The latest machines use nine by nine for printing at high speeds, but also let you print using an 18 by 18 matrix giving near letter quality, although admittedly at a slower speed. Characters formed on an 18 by 18 matrix still do not look as good as those produced on a daisywheel, but more expensive machines get closer using more complicated print heads containing 18 or 24 pins to mark the paper.

In this survey on printers we assess these two challengers to the daisywheel, until now the workhorse of word processing and other high-quality business printing. On page 92 we look at laser printers, including the new and very powerful Apple Laserwriter, while on page 89 we look at what the latest low-cost dot-matrix printer from market leader Epson is capable of doing for its price of £255.

(continued on next page)



Dot-matrix graphics.



Epson LX-80: NLQ at low cost.



Apple Laserwriter: top quality and speed.

DIFFERENT TYPES OF PRINTER COMPARED

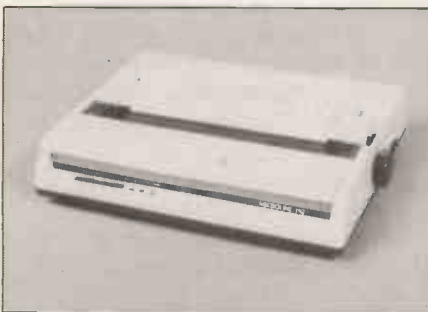
(continued from previous page)

Apart from price, the most important factors to consider when comparing different types of printer are print quality, noise, paper choice and running cost.



The high-speed Qume 11/90 Plus.

Daisywheel These printers work by banging embossed plastic or metal characters through an inked or carbon ribbon on to paper. The characters are mounted on the end of a multi-stemmed disc which looks vaguely like a daisy, hence the name. Print quality is excellent and indistinguishable from a good-quality office typewriter. You can change the typeface by changing the daisywheel and almost all daisywheel printers offer proportional spacing which makes the output look better and saves space. Other advantages are the ability to print on normal office stationery and produce simultaneous copies with multi-part stationery. However, daisywheels are dreadfully noisy and slow. Speed is related fairly directly to price. For example, a cheap one like the £249 Uchida DWX-350 goes at 20cps while the faster £799 Juki 630 goes at 40cps. The Qume Sprint 11/90 Plus, which is probably the fastest daisywheel on the market at 90cps, costs £2,398.



Oki Microline 192: much quieter.

Dot matrix The most common type of matrix printer is the impact dot matrix, which works by banging a set of metal pins through inked or carbon ribbon on to the paper. The print head consists of a vertical line of pins which are moved horizontally over the paper, selected needles firing at each position to build up the pattern of each character and eventually an entire line. Print quality depends mainly on how many pins there are in the head, usually nine, 18 or 24. A modern nine-pin head produces readable output, forming

characters on a nine by nine matrix, which is quite acceptable but not really good enough for business correspondence.

Many of these machines offer a near letter quality (NLQ) mode. Here print quality is improved by making a second, third or even fourth pass over characters already printed, filling in the dot pattern but incurring a speed penalty in the process. A more expensive way of getting better quality without speed loss is to have more pins in the print head, 18- and 24-pin heads being the most common. Such heads produce much better print quality but it is still not up to daisywheel standard.

Like daisywheels, matrix printers can print on ordinary paper and can be used with multi-part stationery to produce simultaneous copies, and running costs are low. Most people use special continuous fan-fold paper rather than standard office stationery, which means their printer has to be equipped with a tractor paper-feed mechanism, as this allows the machine to print unattended.

Normal print speed
Near Letter Quality
hes - 10, 12, 17 & 5, £
NLQ output is more presentable.

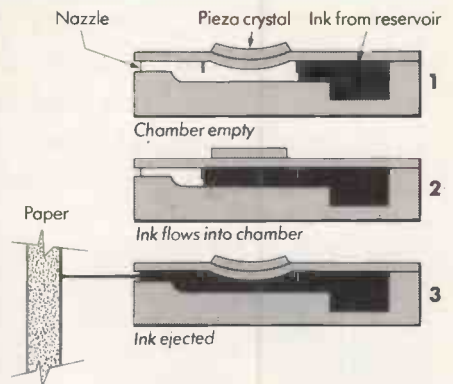


Graphics printout from Honeywell M-34.

Matrix printers are noisy, but the better modern ones such as the Oki Microline 192 at £399 are getting close to 55db(A). This machine has a nine-pin head and runs at 160cps normally, with a 40cps in NLQ mode available. A faster printer is Honeywell's M-34CQ, which also has a nine-pin head but runs at 265cps normally and 70cps in NLQ mode, and costs £945. One of the fastest matrix printers is the Anadex DP-6500 which runs at 540cps and costs £2,730.

Inkjet These work by shooting a fine stream of ink directly on to the paper without using a ribbon. In the most common design, ink emerges from a vertical bank of nozzles in a way analogous to an impact dot-matrix printer. The technique used to actually propel the ink varies; Hewlett-Packard machines use tiny heaters to literally boil it out, while Epsoms squelch it out under mechanical pressure exerted by a set of piezo-electric crystals.

The great advantage of ink-jet printing is that it is quiet; the loudest noise usually comes from the paper transport mechanism rather than the printing itself. As most ink-jet printers build up characters in exactly the same way as a matrix printer the print quality is little different. In the long term ink-jet printers have greater potential as you



The piezo-electric ink-jet element.

can pack more tiny ink nozzles into a print head than metal needles.

The big problem with ink-jet printers is that they work best with very absorbent paper, which means you probably have to end up buying a special stock of ink-jet paper, which pushes up running costs. Most ink-jet models will print on ordinary computer paper or letterheads, but if the paper is at all shiny the ink tends to stay on the surface, making your output easy to smudge. Also it does not look so good when it goes dry because the dots do not tend to spread out in the way that they should.

In speed terms most ink-jet printers are quite good, at least up to comparably priced impact dot-matrix printers. The Hewlett-Packard Thinkjet, which costs £399, prints at 150cps, using a 12-nozzle print head; HP claims a noise level of only 50db(A) for this machine. Epson's new SQ-2000 prints at 176cps using a 24-nozzle print head and costs £1,825.



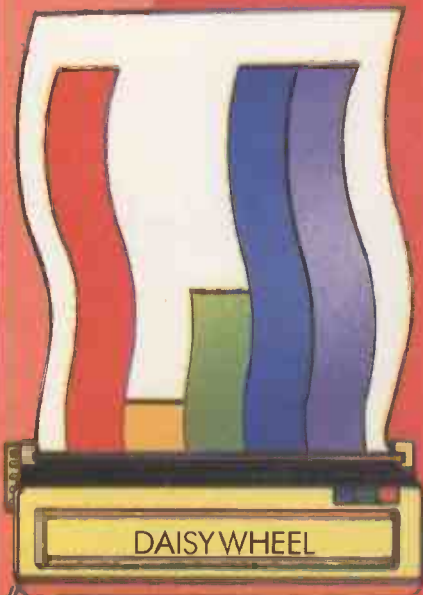
Thermal transfer Epson P-80.

Thermal transfer Works by melting dye from a special ribbon on to paper. Like impact matrix and most ink-jet printers the characters are formed from a matrix of dots. Thermal-transfer printers are quite and very cheap to manufacture; the problem is the running costs are high and there is a lack of paper flexibility. The thermal ribbons can only be used once and are relatively expensive. Output quality tends to be best on smooth papers.

However, thermal-transfer technology is improving, and the best machines now offer good results on the right paper. Another advantage is that the technology does not

(continued on page 89)

P R I N T E R S



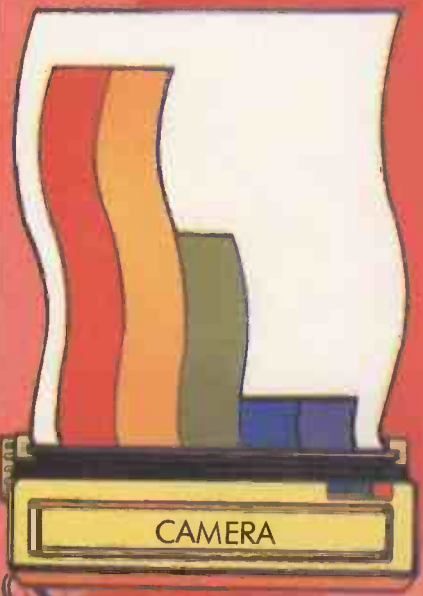
£250-
£3,000



£200-
£3,000



£400-
£2,000



£100-
£10,000



£100-
£1,500



£3,000-
£10,000

KEY

PRINT QUALITY	
QUIETNESS	
SPEED	
PAPER CHOICE	
CHEAPNESS IN USE	

Samleco DX 85

The lowest cost, most versatile high speed Dot Matrix Printer yet.

You told us what you wanted so we went ahead and did it.

Features include:

- ★ Automatic paper loading
- ★ Epson compatibility
- ★ Range of languages
- ★ Normal, condensed and double width characters
- ★ Full graphics
- ★ Interchangeable plug-in interfaces to suit all micros
- ★ IBM PC Compatible version
- ★ Combined friction and adjustable pin feed
- ★ Suitable for all commercial and business applications
- ★ Can connect to

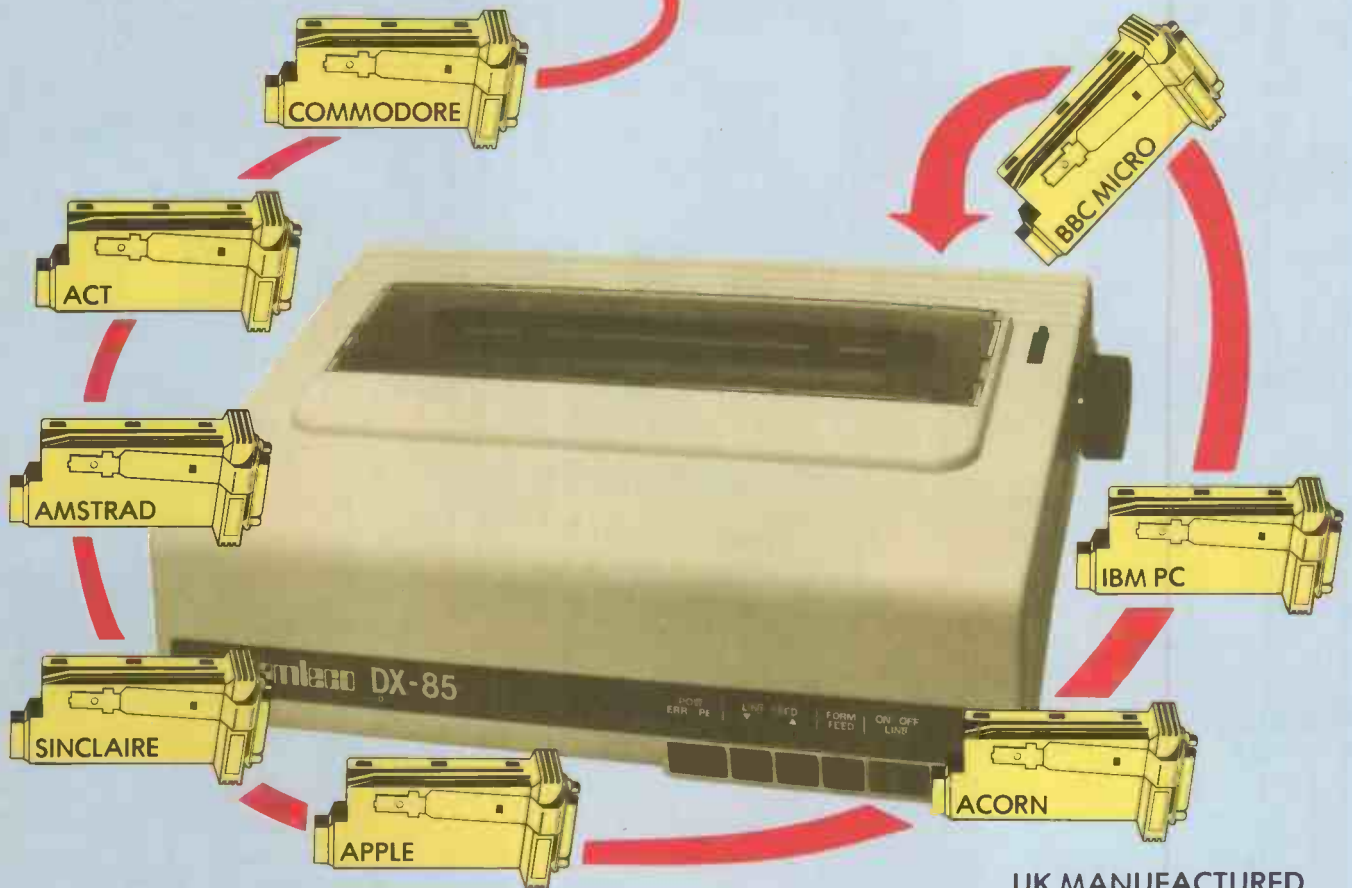


most computers ★ Robust construction
★ Latest technology ★ Ribbon cartridge or spools.

Specification:

Speed: 120 cps, bi-directional, short line seeking. **Columns:** 80 to 136, (at 17 cpi). **Matrix:** 9 x 9. **Character set:** Full 96 ch ASCII with 11 language variants. **Graphics:** Uni-directional, bit image. **Forms handling:** Forward/reverse with programmable line spacing. **Interfaces:** Centronics parallel, RS 232 serial, Commodore. **Size:** Width 370mm, Depth 280mm, Height 130mm, Weight 6kg.

Suitable for direct connection to all leading PCs and Business micros using plug-in interface cartridge.



Someone had to do it...

Samleco Ltd

9 Falcraces Ind. Est., Dedworth Road, Windsor, Berks SL4 4LE, England.
Tel: Windsor (07535) 54717/8. Telex: 838791.

● Circle No. 127

(continued from page 87)

require much power, so many battery-powered printers use a thermal-transfer mechanism. The Epson P-80X, for instance, has a 24-element head, is battery powered and costs £250. One of the most impressive thermal-transfer printers is IBM's Quietwriter for the IBM PC, which at £1,316 offers excellent print quality at 60cps.

Laser These machines work exactly like photocopiers but with a lot of heavy computing power and a laser imaging system. Laser printers offer very good print quality, fast speed and quiet operation. Running costs are low since you can print on ordinary copier paper, as well as letter-heads and transparency foils. The price depends partly on speed, which ranges between eight and 12 pages a minute, but rather more significantly on how good the machine is at handling graphics and exotic type founts.

The lowest-cost approach is adopted by the Canon LPB-8, which at £3,195 produces print which looks much the same as that from a good daisywheel. Apple goes to the other extreme with the Laserwriter, which at nearly £7,000 lets you produce near typeset-quality material. For the ordinary office user Hewlett-Packard's middle way may be the most appropriate. Its £3,595 Laserjet prints like an IBM typewriter but has optional plug-in type founts and prints whole-page graphics at a lower resolution than the Apple offering — 75 dots to the inch, which is similar to a typical matrix printer.

Camera systems These work by photographing the screen. No comparison of printers would be complete without mentioning the option of photographing a display. This approach may make sense for preparing slides of graphics screens for graphics slides to be used in business presentations. If you know what you are doing the results can be of excellent quality, but the technique is only suitable for special use. Apart from simply using an ordinary camera, as most magazines do, there are a number of purpose-designed camera systems on the market. Best known is the Polaroid Palette, which costs £1,395 and works with Polaroid print or colour-slide film to avoid processing delays.

SUPPLIERS

Anadex: (025672) 3401
Canon: 01-773 3173
Epson: 01-902 8892
Hewlett-Packard: (0344) 773100
Honeywell: (0442) 42291
IBM: 01-578 4399
Juki: Micro Peripherals Ltd, (0256) 473232
Oki: X-Data Ltd, (0753) 72331
Polaroid: Sintrom, (0734) 875464
Qume: (0635) 31400
Uchida: CPU Peripherals, (0932) 246433

Impact dot-matrix printers are already unbeatable for high print speeds at a modest price. Now their type styles are being smartened up as well.

THE NEW DOT-MATRIX STANDARD

By Jack Schofield

When Juki and Silver Reed launched their low-cost daisywheel printers, it looked for a while as though the dot-matrix manufacturers were in for hard times. Suddenly daisies approached dots in terms of price and convenience, while the image quality was far superior.

However, the dot-matrix market rapidly saw a dramatic improvement in quality with the launch of the Canon PW-1080 and Taxan KP-810/KP-910 printers offering a near letter quality (NLQ) option. As well as printing in ordinary dot-matrix type, these printers are able to print more carefully defined characters in a slower mode. Epson's entry into this market was the LQ-1500, with a 24-pin matrix able to print draft quality at 200 characters per second (cps) or near letter quality at 67cps. It is to take nothing away from the quality of the LQ-1500 to observe that it is not in everyone's price range.

EPSON LX-80



Epson's new NLQ dot-matrix printer, the LX-80, is about one-quarter of the price of the LQ-1500. It has a nine-pin matrix, and the printing speeds are 100cps for draft quality, and 16cps for near letter quality. The base price of this printer, £255 plus VAT, should ensure it has a wide appeal.

Unlike previous Epson printers, the LX-80 has low, sleek lines — somewhat like a sports car, compared to the boxy look of the previous models. The footprint is very slightly larger. There is some fluting on both sides, which is presumably there as much for its cosmetic value as to dissipate heat.

The front right of the LX-80 has the usual array of three buttons and four indicator lights. Again they have been restyled to look

racy. They also have new functions, in that they can be used to select the type style when the printer is on. Pressing the top two buttons at the same time makes the Ready light go out and the On Line light start to flash. This is the Selectype mode. The On Line button can then be pressed up to six times to select the print mode. The options are: Reset, NLQ, Emphasised, Double-strike, Condensed and Elite.

It is possible to combine more than one of these options to get a grand total of 12 different styles, including double-strike/condensed/elite, though actually trying to do this gets very confusing. If you try for a style that is not allowed, however,

(continued on next page)

(continued from previous page)

the LX-80 simply ignored the incorrect entries. Of course, these styles can also be set by transmitting codes to the printer in the usual way, including codes embedded in text.

The LX-80's ROM has 96 ASCII characters in standard, italic and NLQ forms, plus 32 graphics characters and 11 international character sets. The international sets include the usual European languages with two sets to cover Danish and Japanese. They can be selected via software or by using the DIL switches.

In NLQ mode, the printer also offers four methods of justification. Text can be ranged left or right, centred or filled — which is Epson's term for justifying or aligning at both sides. For justification by the printer, text has to be sent to the buffer one paragraph at a time. Underlining, subscripts, superscripts, user-defined character sets and dot graphics are also possible, and the usual paper-spacing commands are available.

Lifting the lid at the front of the LX-80 reveals the very small, new ribbon cartridge. It is carried on the platform with the print head, instead of being a separate carriage-length ribbon of the usual Epson type. At £3.95 it costs about half as much, and it is easier to install. Sales of the LX-80 will undoubtedly be such that the ribbon is easy to obtain. However, there are already a couple of dozen similar and incompatible ribbons on the market. It seems a shame to have added yet another.

The nine-pin print head prints bi-directionally at 10, 12 or 17 characters per inch. In NLQ mode, the print head makes two passes per line, and prints in one direction only. The NLQ typeface has a total of 18 dots vertically, with the two rows of nine dots interlaced.

The back of the printer has a power socket, an I/O port, and — wonder of wonders — two small panels through which you can change the two DIL switches SW1

SPECIFICATION

Type: impact dot-matrix printer with nine-needle print head

Speeds: 100cps draft, 16cps in near letter quality mode

Typefaces: Pica and Elite with expanded, compressed and emphasised modes

Features: roman and italic printing, superscripts, subscripts, underlining, dot-addressable graphics

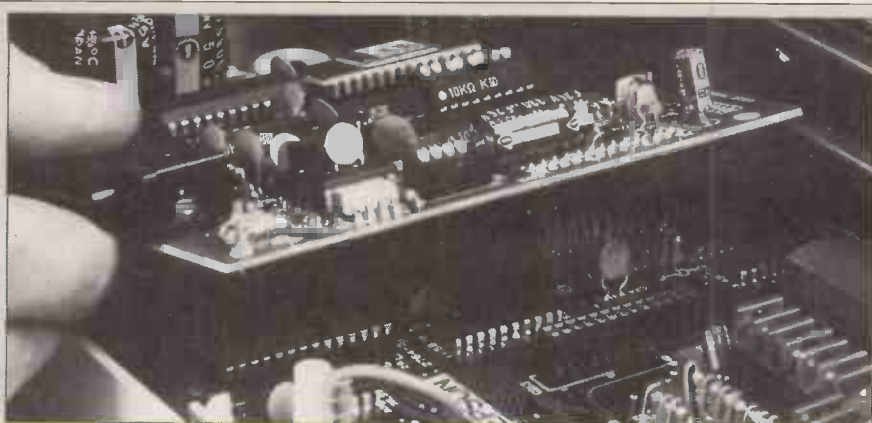
Paper: single-sheet friction feed, up to 8in. wide; tractor option

Ports: Centronics eight-bit parallel port; serial option; Commodore and Atari options to follow

Dimensions: 85mm.(3.3in.) x 420mm.(16.6in.) x 310mm.(12.4in.); weight 5.2kg. (11.5lb.)

Price: £255 plus VAT; tractor feed £20; cut-sheet feeder £55; ribbons £3.95

Supplier: Epson (U.K.) Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892



NLQ FOR OTHER EPSONS

While the LX-80 replaces the current RX-80 model, the rest of the range has been upgraded, with a + added to the model number. The RX-80F/T+, RX-100+, FX-80+ and FX-100+ all now offer touch-selectable type styles as standard and an NLQ option. The 8647 serial and 8177 parallel boards can be retrofitted to existing FX-80 and FX-100 printers. The 8190 board offers a choice of two NLQ faces: roman and sans serif. During NLQ printing, the paper is advanced by half a dot between passes.

lazy dog.
lazy dog.

The fine serifs of the LX-80's NLQ type help to improve readability.

and SW2. For those who have struggled for years with old MX-80s and the like, it is a boon to be able to change these switches without unscrewing four screws on the base of the printer and lifting the lid off.

The back of the LX-80 also has a parallel interface, which peeps through a rather large hole. This is to allow room for an extra printed circuit board to be piggybacked on top, if this is required to provide a serial port. We tried fitting the Hanzon serial board, which provides full Apple Macintosh emulation, and it worked fine. Either of the Epson serial boards for the FX printers should fit. Epson also plans to provide boards for use with Commodore and Atari printers, which are currently non-standard in design. These boards should be available later this year.

One tradition which has, regrettably, been followed is that the ports are sited on the back, where the printer cables may interfere with the paper feed. Epson's only concession is a flimsy pull-out plastic paper guide to hold fan-fold paper away. This is marked "no handle" to discourage you from using it to carry the printer.

The LX-80 also features a 1K print buffer, which is very handy as it means you get back control of the micro more quickly, so you can start the next task. Epson also offers optional 32K and 128K buffer boards, but we did not have one to try inside the LX-80.

The manual is spiral bound, clearly printed, and vastly better written than some previous Epson handbooks. It has nine appendices, a good index and a useful Quick Reference card.

In use, the printer works fast and

efficiently, as you would expect of an Epson. There is nothing special about the 100cps draft mode, and the italic fount is, as usual, slightly gappy. However, the NLQ mode produces a very attractive typeface, which is made even more readable by the fine serifs. The end result looks to be of a much higher quality than you would normally expect from a printer of this price.

There is only one major drawback to the LX-80: it is noisy. In draft mode the sound is somewhat high-pitched and penetrating; in NLQ mode it has more of a rasp to it. Standing the printer on a foam pad helps a little. In many situations the noise will not matter, but it is not ideal for a quiet office.

EPSON LX-80

VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Value for money	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Very good all-round performance and extra versatility at an attractive price. It sets a new standard for low-priced dot-matrix printers.

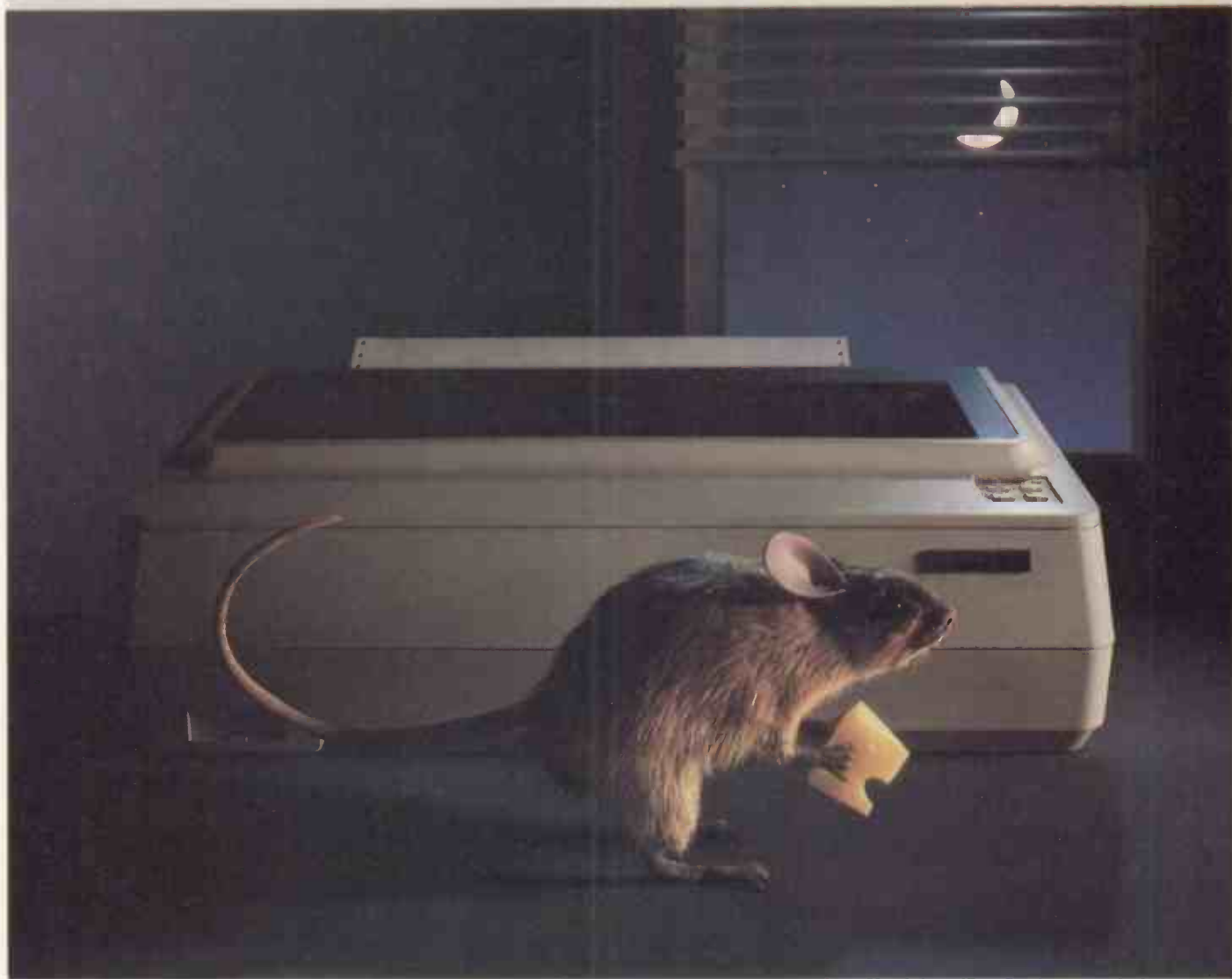
CONCLUSIONS

■ The Epson LX-80 is versatile, thanks to its fast 100cps draft mode and 16cps near letter quality mode. The NLQ face is attractive and very readable, though not really suitable for business letters.

■ The design shows several improvements over previous Epson models, and only the high noise level lets it down slightly. The availability of a low-cost cut-sheet feeder is a welcome feature, and unusual at this price level.

■ The LX-80 is good value for money at £255 plus VAT, though the tractor feed adds £20 to the price for heavy users of continuous stationery.

The New MT 85/86 printers are as quiet as a...



Take a listen to the new MT85 and MT86 serial matrix printers. They're amazingly quiet. Which makes their performance definitely something to shout about.

The MT85 is a compact 80 column printer, while the MT86 offers a full 136 column width. Both print high speed draft output at 180 cps. And high quality

correspondence at 45 cps in various types. Then there's compressed, expanded and bold print for even more variety. And of course graphics.

Flexibility doesn't stop there either. Both printers take continuous fan fold and single sheet stationery in their stride. And they're totally compatible via plug-in interface modules—IBM PC

and Apple Macintosh included.

The new MT85 and MT86 from Mannesmann Tally. Europe's leading matrix printer manufacturer.

The quiet revolution in print. Contact us now for our literature pack.



**MANNESMANN
TALLY**

MANNESMANN TALLY LIMITED, MOLLY MILLARS LANE, WOKINGHAM, BERKSHIRE, RG11 2QT. TELEPHONE (0734) 788711

IBM PC and Apple Macintosh are registered trademarks.

LASER PRINTERS: PHOTOCOPIERS WITH BRAINS

By Ian Stobie

Speed, flexibility and outstanding resolution are what you get for the substantial asking price of these units.

With prices starting at around the cost of many complete computer systems, laser printers need more than just the glamour of the word "laser" to justify them. In fact the machines are from the outside rather unglamorous, looking like small office photocopiers. However, inside they are packed with electronics and they have unequalled power to beautify documents sent to them for printing.

Laser printers are now cheap enough to compete with the daisywheel for the top end of the high-quality word-processing market. To the user, the laser holds out the promise of greater speed and much reduced office noise levels, as well as a great deal of choice in the final appearance of the printed output. Laser printers are inherently well suited to producing mixed text and graphics, which is an increasingly important requirement among business users. Most laser printers have no difficulty producing overhead-projector transparencies, and the more expensive machines like the Apple Laserwriter can produce near typeset-quality artwork suitable for later high-volume reprinting on a litho press.

Interestingly, the laser printer's flexibility in handling graphics and typography has little to do with the laser-printing method itself, which is just a way of marking the paper. The key thing is that a laser printer prints a whole page at a time and holds a complete image at full resolution of the page it will print in its own internal buffer. With this complete dot-for-dot page image held in its memory it makes sense to give the printer its own local processing power to manipulate it. Most laser printers can print in a range of different type sizes and styles, and reduce, enlarge and rotate the printed image.

Laser printers are therefore quite intelligent. But as memory and processor components are continuously falling in price, what laser printers can do today many other sorts of printer may be able to do tomorrow. Laser printers just happen to be first to make full use of the possibilities offered by the whole-page bit-mapped buffer.

Expensive laser printers have been around for the last 10 years, and it is still possible to spend several thousand pounds on a laser printer. Such machines are used for high-volume high-speed applications such as producing mass mailings of personalised letters complete with handwritten signature and company logo. Here we are only interested in the new generation of low-cost office laser printers, which all cost under £10,000.

One of the reasons laser printers have fallen in price, apart from the falling price of the necessary electronic components, is that photocopying technology itself is getting cheaper. Canon has pioneered the throwaway photosensitive drum, previously one of the most expensive parts of a machine. To get good-quality copies you must either have a really expensive drum which will last for



The Ricoh LP-4120 laser printer.

years, or else one which is so cheap you can throw it away before it starts to deteriorate. The Canon-built printer mechanism used by both Apple and Hewlett-Packard uses a throwaway drum built into the same unit as the toner, which you have to renew periodically anyway. You replace the dual toner/drum cartridge every 3,000 or so pages. A new one costs just under £100.

Compared to a good daisywheel printer using carbon ribbons, laser printer running costs are not excessive, working out around 3p or 4p a sheet. The main difference is in the initial outlay, which is obviously higher. Even so, the comparison is more favourable to the laser than it looks at first sight. You do not need to buy an acoustic hood as the laser printer is inherently quieter, and a single-sheet feeder is already built-in.

The greater speed of the laser printer means you can do the work of several daisywheels. Assuming a full page of text and eight pages per minute, a laser printer is going at about 300cps, as against an absolute top speed of 80cps for the very best daisywheel. Taking these considerations into account the laser printer looks a good bet for anyone with a fairly heavy print workload — from say 500 pages a month upwards. At lower volumes a daisywheel printer will still be the more cost-effective solution.

LOW-COST LASER PRINTERS

	Speed (pages per minutes)	Graphics	Mechanism	Price
Apple Laserwriter	8	excellent	Canon	£6,995
Canon LBP-8	8	poor	Canon	£3,195
Hewlett-Packard Laserjet	8	good	Canon	£3,595
Ricoh LP-4120	12	average	Ricoh	£8,500

Suppliers: Apple, (0442) 60244; Canon, 01-773 3173; Hewlett-Packard, (0344) 773100; Ricoh from Nexel Ltd., (084421) 3151

HOW LASER PRINTERS WORK

Laser printing involves three stages — preparing a page image in memory, drawing it with light and finally transferring it to paper.

Stage 1. This starts with the arrival of a string of characters at the printer. In addition to the text itself this string might contain information about the type styles to be used, and graphics encoded in some form. The printer uses this information to build up a bit map of the complete page in memory.

Stage 2. The bit-map image is transferred to a light-sensitive drum. The drum is first given a uniform electrostatic charge. As the

drum rotates it is scanned with a laser light which flickers on or off under the control of the bit map held in memory. Where the beam strikes the drum, charge is destroyed.

Stage 3. This stage employs exactly the same technology as many photocopiers. A strongly coloured plastic-based powder, called the toner, is brought into contact with the rotating drum. Toner can be given an electrostatic charge, and charged powder sticks to the parts of the drum which correspond to dark parts of the image. The toner image is then transferred to a sheet of paper, and finally melted on to it by hot rollers.

Different brands of laser printer adopt slightly different approaches at each stage. Printers with good graphics capability need much larger areas of memory. The Apple Laserwriter uses nearly 1Mbyte of RAM just for the page map.

Different manufacturers use different light sources at the laser imaging stage. Canon uses a semiconductor laser while Ricoh uses a more powerful gas laser which allows faster drawing on the drum. Laser printers used purely for typesetting may take special papers to get higher resolution, and so the second and third phases may be different.



SPECIFICATION

Printing technique: laser xerography; uses Canon LBP-CX mechanism

Print processing: Motorola 68000 processor running at 12MHz, 1.5Mbyte of RAM, 0.5Mbyte of ROM containing Postscript interpreter and fonts

Print quality: 90,000 dots per square inch; supports full-page graphics

Built-in fonts: Times, Helvetica and Courier plus a set of special symbols; bold, italic, outline, etc. available for each font; minimum font size 4 point; other Mac fonts can be printed at slightly lower resolution

Speed: eight pages a minute once printing commences; takes from a couple of seconds to several minutes to start up, depending on the complexity of the image

Noise: same as quiet photocopier, under 55dB(A)

Paper: A4 or foolscap photocopier paper, letterheads or overhead-projector transparency film; envelopes and labels can also be used via manual feed

Consumables: replacement drum and toner cartridge costs £99, last a claimed 3,000 pages

Interfaces: Appletalk and RS-232C

Compatibility: supports full Mac graphics through Appletalk; supports Diablo 630 daisywheel commands through RS-232C

Size: 715mm.(28.2in.) x 470mm.(18.5in.) x 410mm.(16.2in.); weighs 37kg.(77lb.)

Price: £6,995 plus VAT, available now

Manufacturer: Apple Computer Inc.; made in the U.S.

Supplier: Apple Computer (U.K.) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244



Appearances can be deceptive — inside and out the Laserwriter resembles a photocopier.

APPLE LASERWRITER

Like several other new laser printers, Apple's Laserwriter is built around a basic printing mechanism supplied by Canon. But Apple's printer is at £6,995 about double the price of most other Canon-based machines. What accounts for the difference is the massive processing power which Apple has added, making the Laserwriter itself a more powerful computer than the Macintosh it connects to.

The Laserwriter is designed for use both as a dedicated printer for a single Macintosh, and as a printer attaching to a local area network, and thus shared between several machines. It comes equipped with an RS-232C interface so it can also be used with other brands of computer, such as the IBM PC. However, in this case you lose the Macintosh's graphics ability, and the Laserwriter then functions more as a faster, quieter daisywheel printer.

Used with Apple equipment the Laserwriter offers the ability to incorporate drawings into documents and to print anything you can display on the Macintosh screen. In addition you can print using the

same typefaces that traditional typesetters use, such as Helvetica and Times.

Physically the Laserwriter looks like a small photocopier. It takes up a similar amount of desk space too, and weighs 77lb., but considering what it contains it is quite compact. It prints on to single-sheet paper, either ordinary A4 copier paper or letterheads, and comes with a 100-sheet input tray. You can also feed in envelopes and overhead-projector transparencies singly through a manual feed on the other side of the machine.

The Laserwriter connects to the Macintosh through an Appletalk connector box and cable. You need one box for the printer and one for each Macintosh you wish to connect to it; they cost £50 each. We were in fact using Appletalk as no more than a printer cable, as we only tried the Laserwriter with one Macintosh. According to Apple the system will still work with the printer placed up to 1,000 feet away from the machines it serves.

The way the Laserwriter and Appletalk work are fundamentally related. At £50 a

connection Appletalk is a very cheap network, which reflects Apple's belief that the real network market lies in ordinary cost-conscious offices. But keeping the cost down means accepting lower transmission speeds. Appletalk is slow by network standards, sending no more than 29Kbyte of data a second.

The Laserwriter hardware can print at 90,000 dots per square inch, and at a full resolution this requires a bit map of almost a megabyte for each page. To assemble the bit map in the Macintosh itself would therefore make no sense, as transmitting each page

(continued on next page)

(continued from previous page)

across the network to the printer would take over half a minute. Instead, the Mac sends a compressed description of the page written in a language called Postscript. Typically it occupies less than 8K and transmits across Appletalk in less than a second. Inside the Laserwriter is a 68000 processor, 1.5Mbyte of RAM and 500K of ROM containing some pre-defined founts and a Postscript interpreter. The Laserwriter runs the Postscript program to generate the page-image bit map it needs to print from.

To use the Laserwriter with Mac software you need first to install the Laserwriter printer driver which generates the Postscript page descriptions. The driver must be present on every start-up disc you want to use with Laserwriter. The installation process is quite simple but it takes up a lot of disc space — usually around 98K. You can reduce this by throwing away founts you do not want to use.

Postscript is actually a proper programming language, like Logo or Forth, and the printer driver is really a program generator. Postscript describes a page in terms of the mathematical properties of the shapes on it rather than as a bit map or any other static data description.

The significance of Postscript is that it is completely independent of the hardware used, and a description in Postscript remains the same whatever the resolution of the system, unlike a bit map. Postscript is being

APPLE LASERWRITER

VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ease of use	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Value for money	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A wonderful, creative tool from Apple, but unless you can share the cost among several users in a network it is expensive.

adopted by a number of different companies, and has some chance of becoming an industry standard. It was developed independently of Apple by Adobe Systems Inc., a company formed by a number of people from Xerox's Palo Alto Research Centre. Parc is widely recognised as the source of many of the best ideas in the computer industry, including the windows, icons and mouse interface adopted by Apple for the Macintosh itself.

This gives the Laserwriter good prospects for broader compatibility outside the Apple universe. After all, the Laserwriter just expects a page to arrive in Postscript, it does not matter where from. If, for example, you have access to a proper typesetting machine which runs Postscript, it may be possible to typeset directly from Mac print files.

We used the Laserwriter with several

One advantage to using a fount originally designed for typesetting is that it lets you put more text on a page. This is because founts such as Times and Helvetica are proportionally spaced. By contrast Courier, originally a typewriter fount, is monospaced - each character takes up the same width on the page.

Helvetica

One advantage to using a fount originally designed for typesetting is that it lets you put more text on a page. This is because founts such as Times and Helvetica are proportionally spaced. By contrast Courier, originally a typewriter fount, is monospaced - each character takes up the same width on the page.

Courier

Laserwriter's output: using founts designed for typesetting saves space and looks neat.

packages, including Macwrite and Macpaint, and there is no doubt that the output quality is impressive. The resolution of 300 dots per inch horizontally and vertically compares very favourably with the 80 by 80 offered by the Imagewriter, Apple's conventional dot-matrix printer for the Mac. The output generally looks like a very good photocopy of typeset material, without the random splodges found on many photocopiers. We did not have time to print enough copies to see whether quality degrades as the drum nears the end of its life after a claimed 3,000 pages.

While the Laserwriter's resolution looks good to the untrained eye, professional typesetting systems generally start at resolutions of 400 dots per inch. The difference is noticeable, especially at the small type sizes, but the Laserwriter is probably good enough to allow companies to produce more price lists, catalogues and reports in-house.

There are some definite drawbacks to using the Laserwriter. Before printing each new page there is a delay of about 30 seconds on most of the text pages we printed, and up to 10 minutes on some complex graphics pages. Apple quotes a speed of eight pages a minute, but this refers to subsequent copies of the same page once the Laserwriter has figured out how to print the image.

None of this would matter if you could do something else on your Mac while waiting for the Laserwriter to print, but on our setup we could not. We understand that spooling software to allow this is still being written. Obviously, on a network several people have to be able to send jobs to the printer and get on with productive work while their jobs wait to be printed. At the moment, this problem restricts the Laserwriter to producing multiple copies of fairly short documents.

With text, best results are obtained from the Laserwriter when you print in Helvetica, Courier or Times, its built-in founts. You can print in other Mac founts such as Venice or Geneva, but these are not much

improved in resolution terms over the Imagewriter. Normally the printer converts any Mac fount, such as New York or Geneva, to the nearest good Laserwriter fount, unless you override this function.

The Laserwriter lets you scale the printed image to make it either bigger or smaller, or turn it sideways. This is particularly useful for making overhead transparencies, which we found came out very well. For producing graphics, the Laserwriter works best with Macdraw. The printer driver can easily convert Macdraw images into Postscript commands, producing very fine lines and good resolution. The Laserwriter cannot do much to enhance Macpaint pictures, as they already consist of bit maps at about the resolution of the Mac's screen; they come out crisp and clear but still consisting of big, discernable dots.

It is likely that we will be seeing a new crop of graphics packages that make full use of the Laserwriter. One obvious application area is page makeup for people who want to produce professional-looking newsletters and brochures for volume printing at a proper print shop. We hope to review several such packages soon.

CONCLUSIONS

■ Undoubtedly a superb printer, the Laserwriter, has speed, quietness, stunning graphics and professional-quality typefaces going for it.

■ These spectacular features probably double the price. Many Apple users might have preferred a more modest machine like the HP Laserjet, at a price closer to a top-line daisy-wheel printer.

■ Once it gets going the Laserwriter is quick, but you may have to wait some minutes before the machine starts to print a new page, especially with graphics. It would help if the machine let you get on with something during the wait, but it does not. Print spooling is definitely a necessity.

■ Apple's documentation for the Laserwriter is superb. It is full of helpful, illustrations and suggestions, and is written in clear English.



Seikosha. Advanced business printers for every size of business.

Whether you're in business in a small way or running a vast Multinational, you need the most advanced, reliable, high performance printer you can buy.

And that means Seikosha.

Because Seikosha produce a range of up-to-the-minute printers to suit everyone, from the smallest to the largest volume business user.

What all Seikosha printers share in common however, is an unbeatable combination of high speeds, superb quality printing (including NLQ), low noise levels and the most advanced multi-function features you'll find today.

Of course this is no more than you would expect from the "House of Seiko".

Take the BP 5420 for example.

Fast, quiet and designed for heavy duty use, it combines high speed quality print at 420 cps (draft) and 104 cps (NLQ) with an 18K buffer. For ease of operation all user controls, plus the selector switch

for the 8 built-in fonts, are located on the front panel of the printer. Parallel and serial interfaces are standard.

Then, exclusively for the IBM PC and compatibles are the BP 5420I and BP 5200I.

The BP 5420I combines most of the features of the BP 5420 printer with all IBM characters, symbols and graphics as standard. The BP 5200I operates at 206 cps (draft) and 103 cps (NLQ) and represents one of the best value printers of its kind on the market.

Finally, the compact SP NLQ printer series meets the needs of smaller businesses.

Available from all leading computer dealers. Distributed exclusively by DDL. For details of your nearest stockists contact:



THE NEW FORCE IN DISTRIBUTION

5 King's Ride Park,
Ascot, Berks. SL5 8BP
Tel: 0990 28921
Telex: 846303 DD LTD G.

NATIONAL COMPUTER SERVICES

LOWEST PRICED DOT-MATRIX PRINTER??!!

SMITH CORONA Fastext 80 cps £129

LOWEST PRICED DAISYWHEEL PRINTER??!!

DAISY JUNIOR 14 cps £189

LOWEST PRICED DAISY PRINTER/TYPEWRITER??!!

JUKI 2200 with internal serial/parallel interface £259

LOWEST PRICED NLQ PRINTER??!!

MICRO P 165 16cps NLQ 75cps £249

UK BEST SELLING NLQ PRINTER — LOWEST PRICE??!!

CANON PW 1156A 160cps NLQ 27cps £369

OTHER PRINTERS AT LOW LOW PRICES!!

EPSON RX80 £193 MICROLINE 82 £235

BROTHER HR25 £627

TRADE WAREHOUSE PRICES

UK ORDERS ADD 15% VAT & £7 + VAT for CARRIAGE

NATIONAL COMPUTER SERVICES

The Sussex Suite, City Gates, 2-4 Southgate
CHICHESTER, West Sussex PO19 2DJ, England

Tel: 0243 778479 (5 lines)

Telex: 869181 Fax: 0243 780382

● Circle No. 130

OVER 220 AMSTRAD CASSETTE TITLES IN STOCK

OVER 110 NOW AVAILABLE ON DISC

CPM SOFTWARE

Macro 80, Microsoft Basic, Microsoft Basic Compiler, Turbo Pascal, BBC Basic (Z80), Purchase Ledger, Payroll, Database, other titles on request.

● TAPE TO DISC TRANSFERS ●

HARDWARE

CPC464 3" Disc, Timatic 5¼" 2nd Disc @ £149, CPC664 now available and Timatic 5¼" 2nd Drive @ £149. 3" 2nd Drive £99.

RS232 INTERFACES

Full spec. dual RS232 £59, Full Board includes RS232 and Rom Software, 8 bit parallel printer port, BBC compatible user port £89.

Also available Maxam Assembler & Quma Assembler.

Mail order welcome. Please send sae for full list to:

TIMATIC SYSTEMS LTD

NEWGATE LANE
FAREHAM, HANTS PO14 1AN
Tel: FAREHAM (0329) 239953

FAREHAM MARKET
FAREHAM, HANTS
Tel: FAREHAM (0329) 236727

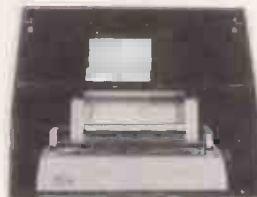


● Circle No. 131

VENTGUARD

ACOUSTIC COVERS

The Sound of Silence
for the
Electronic
Office



Brother: CPT:
Diablo: Epson,
Facit: Honeywell,
IBM: JUKI,
Mannesman-Tally,

NEC: Olivetti: Philips,
Qume: Ricoh: Tandy,
Wang: Wordplex: Xerox.

Phone us now for
instant attention or write to:

**T. MAT Limited, Sullivan Way, Loughborough
Leicestershire LE11 0QS**

Telephone: Loughborough (0509) 217171 Telex: 341819

● Circle No. 132

LOWEST PRICES IN PHONE THE UK?

Action line

MATRIX PRINTERS

FOR

Mannesman Tally ■ NEC Pinwriter ■ OKI Microline ■ Epson ■ Digital
Dataproducts Paper Tigers. **NEW!** Smith Corona

LETTER QUALITY AND LINE PRINTERS

Uchida ■ Dyneer ■ Brother ■ NEC Spinwriter ■ Dataproducts full range

VDUs AND MONITORS

Wyse ■ Televideo ■ Tatung ■ Digital ■ Hazeltine ■ Dyneer

GRAPH PLOTTERS

Hewlett-Packard ■ Gould

PLUS A FULL RANGE OF COMPUTER FURNITURE

GET ON OUR
MAILING LIST -
HUNDREDS OF
GREAT BARGAINS
EVERY MONTH

MANCOS COMPUTERS

TRADE WAREHOUSE

Action line

018405666

0618610757

TOP-LINE CHOICE / BOTTOM-LINE PRICES

Mancos Computers, Unit 3, Albany Road Trading Estate, Manchester M21 1BH

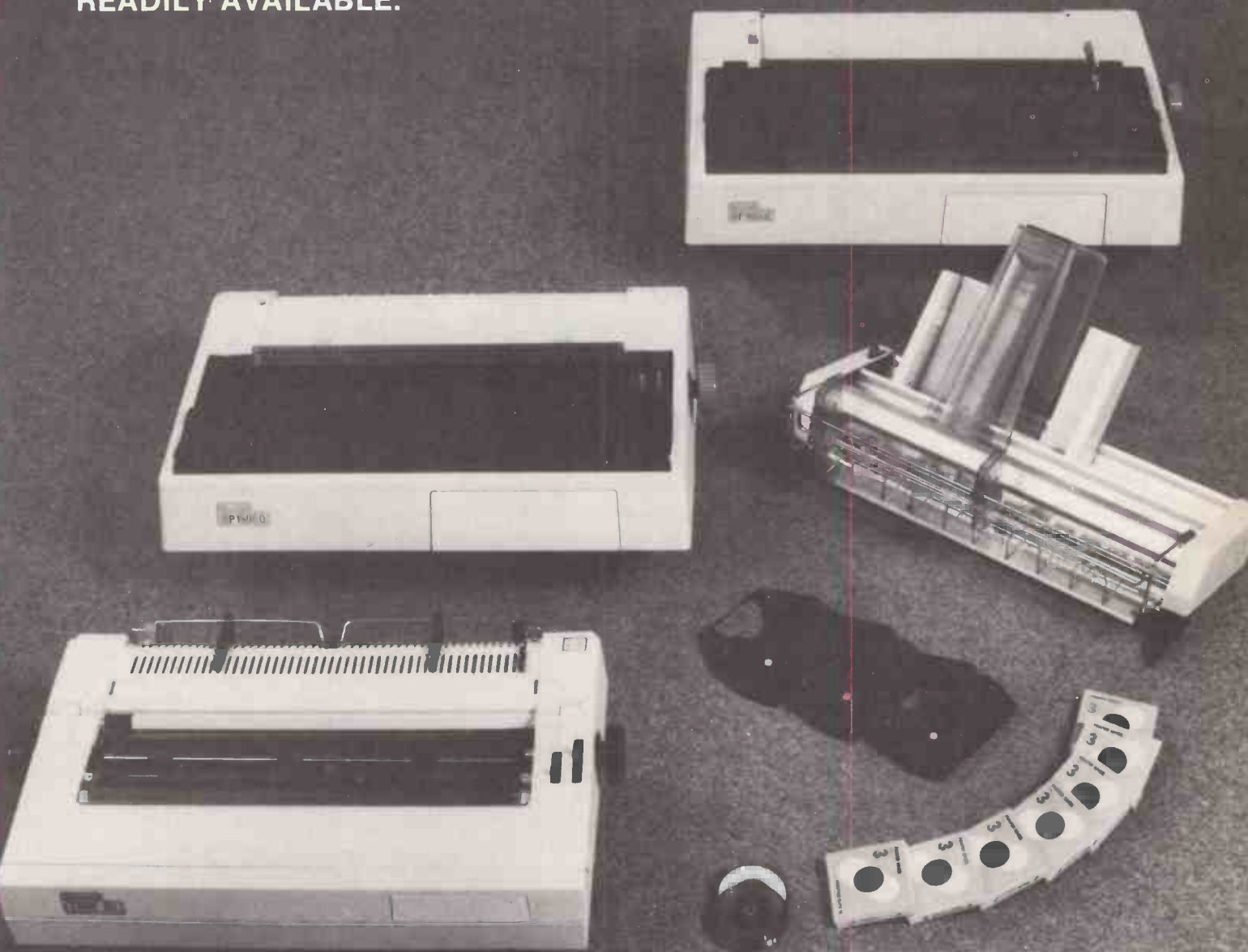
● Circle No. 133

aculab

PERIPHERALS LIMITED

TOTAL SUPPORT FOR QUALITY PRINTERS

CONSUMABLES AND TECHNICAL SUPPORT
READILY AVAILABLE.



PART OF THE ACULAB PERIPHERALS RANGE
OF QUALITY DAISYWHEELS AND LASER
PRINTER PRODUCTS.

Unit A, Station Approach
Leighton Buzzard,
Beds. LU7 7LY
Tel. 0525-371393
TELEX. 946240 REF. 190 10735

97

● Circle No. 134



**Only one
printer range
will run both**

If your computer printer operates with a micro running software written for the IBM Graphics Printer, it won't be able to handle software produced for the new IBM Colour Printer.

The new Dataproducts 8000 Series on the other hand, will.

In fact, thanks to their unique built-in switching capability, they're the only dot matrix printers on the market to offer this dual mode capability.

And a whole lot more.

Superb colour graphics, superb mono graphics – and a host of built-in features that you'd expect from the world's largest independent printer manufacturer. Features like three print speeds including letter

quality, optional auto sheet feed and proven reliability.

Remember, for IBM PC, XT and AT or compatibles, only the Dataproducts 8000 Series will run IBM Graphics or IBM Colour Graphics at the flick of a switch.

Send for more information on the Dataproducts dot matrix and daisywheel printers, compatible with IBM and other leading micro software.



 **Dataproducts**
computer printers

**Dataproducts Limited, Unit 1,
Heron Industrial Estate, Spencers Wood, Reading,
Berkshire RG7 1PJ. Tel: (0734) 884777.**

Please send me details on the only printer range that will run IBM Graphics and IBM Colour Graphics at the flick of a switch.

Name _____

Position _____

Company _____

Address _____

Tel: _____

To: Dataproducts Limited, Unit 1, Heron Industrial Estate,
Spencers Wood, Reading, Berkshire RG7 1PJ.

PC 8/85

OPEN FILE

In Open File we offer programming tips and free software to key in — from demonstration routines to ready-to-use business programs. As well as major feature programs, every month we publish a selection of software written by our readers.

We welcome serious software for any of the micro systems listed opposite, especially short routines and utilities. Programs can be in machine code, Basic or any other language.

Submissions should include a brief description which explains what your program does, and how it does it. If possible it should be typed, with lines double-spaced. We need a printed program, which should be listed from a fully debugged, working program. Hand-written listings cannot be accepted. A tape or disc of the program helps if it is in a standard format.

When printing listings, please remember to use a new ribbon or double-intensity printing — faint listings reproduce badly. Use plain paper only, and try to list the program across either a 35-character or a 70-character width. Also, make sure all special graphics, inverse video characters or any other non-standard symbols are either

listed correctly or else include Rem statements to explain them fully.

Each program listing, tape or disc must have your name and address on it, or we cannot promise its safe return. A stamped addressed envelope is appreciated.

If you write in with a comment, correction or enquiry please state the machine and the program title.

We pay at least £10 for any programs used, or £35 per page and pro rata for part pages.

OPEN FILE MONITORS

Amstrad	Ian Stobie
Apple	Bill Hill
BBC	Nicholas McCutcheon
Commodore	Mike Todd
CP/M	Jack Schofield
IBM PC	Jack Schofield
Tandy	John Wellsman
Research Machines	Ian Stobie
Sharp	John Hooper
Sinclair QL	Glyn Moody

FEATURES

100

PROGRAM PORTABILITY

Writing programs on an IBM PC to transfer to an Apricot

102

MACHINE-CODE SUBROUTINES

How to link a machine-code subroutine to an MBasic program running under CP/M

BBC

108

ROM DISC: Transferring paged ROMs to disc

APPLE

112

ON RESET GOTO: A routine to disable the Reset key

IBM

114

DIR BYTE-SUM: A program to tell you how many free bytes there are on disc

KEY UTILITY: Work out when the special keys have been pressed

DOS PROMPT: Change the system prompt in PC-DOS

SYSTEM CHECK: Check the facilities of an IBM PC

END OF FILE

116

PRINTING FOREIGN TEXT: Extra characters for the Epson FX-80

PROGRAM PORTABILITY

Kenneth Haynes explains how IBM PC programs can be written with an eye to transferring them on to Apricot micros.

PORTABILITY is not simply a question of choosing the right language and the right compiler. What matters most is programming technique.

When using Basic, machine-specific code should be avoided. This is because this type of programming in Basic tends to use a surprisingly large amount of code and leads to the inevitable path of two separate program source codes. It is a practice which should be avoided as it can lead to a host of problems when the time comes to modify or update your program code. If machine-specific code is to be used, it would be advisable to use a library-orientated language such C.

There is surprisingly little incompatibility between IBM Basic (Basica) and the Microsoft Basic supplied with the Apricot, MSBasic, with the exception of some display, communication and initialisation functions. First, we will look at the two functions which are the basis for most program incompatibility problems; the Clear Screen and the cursor positioning screen addressing functions.

As you can see from table 1, the Basic formats for the IBM and Apricot are quite different. This is because Basica is MSBasic which has been adapted especially for the IBM PC, whereas the version of Basic supplied with the Apricot has not been modified. At first sight this may seem unfair. After all, if IBM can do it, why not ACT? While ACT has not modified the supplied Basic it has, however, supplied the programmer with a staggering number of Escape sequences, some of which are so powerful that the IBM equivalent would take up 10 times the amount of program code.

An example of this is Escape " ", which copies the entire screen display into the keyboard buffer, which is 2K in size. Although this is rather an obscure example, it does illustrate the sheer power and ease with which the Escape sequences can be utilised. However, a full listing of the Escape sequences is not supplied with the Apricot's documentation, thus making the purchase of the *Apricot Technical Reference Manual*, which retails for around £25, a necessity for the serious programmer.

The main problem is to be able to utilise either of the formats

TABLE 1.

	IBM	Apricot
Clear Screen	10 CLS	10 PRINT CHR\$(&H1B)+CHR\$(&H45);
Position Cursor	20 LOCATE (ROW,COL)	20 PRINT CHR\$(&H1B)+CHR\$(&H59)+CHR\$(ROW+32)+CHR\$(COL+32)

TABLE 2.

```
10 REM Program code.
20 ROW = 10 : COL = 10 : GOSUB 1000
-
-
-
999 $include: Stdio.o.inc
```

Using the Include technique. The file Stdio.o.inc should contain one of the machine-specific formats shown in table 1.

TABLE 3.

```
push bp          } Save register contents
push ax
push dx
mov bp,sp        ; Copy stack pointer into bp
mov ah,06h       ; Set up ah for function 6
mov dl,1bh       ; Escape code
int 21h          ; Send code to VDU
mov dl,59h       ; ASCII for "Y"
int 21h          ; Send code to VDU
mov al,byte ptr 6 [bp] ; Move row co-ordinate into al
add al,20h       ; Add 32 decimal to row co-ordinate
mov dl,al
int 21h          ; Send code to VDU
mov al,byte ptr 4 [bp] ; Move column co-ordinate into al
add al,20h       ; Add 32 decimal to column co-ordinate
mov dl,al
int 21h          ; Send code to VDU
pop bp           } Restore register contents to entry values
pop ax
pop dx
ret 4            ; Number of arguments * 2
```

How the row and column co-ordinates can be picked up by the cursor position function. The row and column arguments are passed via their addresses.

```
11020 A1%(1)=0
11030 GOSUB 19000
11040 RETURN
12000 REM ***** OPEN WK *****
12010 A1%(0)=1
12020 A1%(1)=0
12030 A1%(3)=10
12040 FOR I=0 TO 9:A2%(1)=1:NEXT
12050 GOSUB 19000
12060 RETURN
13000 REM ***** INPUT LOC *****
13010 A1%(0)=28
13020 A1%(1)=1
13030 A2%(0)=1
13040 A3%(0)=16383
13050 A3%(1)=16383
13060 GOSUB 19000
13070 RETURN
18000 REM ***** CALL BSX *****
19000 DEF SEG=8H61:BSX%=0
19010 CALL BSX%(A1%(0),A2%(0),A3%(0),A4%(0),A5%(0))
19020 DEF SEG:RETURN
OK
```

Machine-specific code should be avoided at all costs.

shown in table 1, in such a manner that we may still utilise the same program code. Table 2 shows the most commonly used solution for such a problem: the Include statement.

This method is fine for most programs, but large programs with tight memory constraints or programs with which the execution speed is paramount should utilise an assembly subroutine. The reason for this is that the Include method involves the constant re-assignment of the row and column co-ordinates prior to the cursor addressing routine being called. Having utilised a cursor addressing assembly routine, the routine would no longer be placed in the Stdio.o.inc file — see table 2 — and the call would remain resident in the program code.

The call would now read
 nnnn CALL LOCATE%(10,10)
 where Locate% is an integer variable which contains the offset to the assembly routine address. The segment to the address is set using the Def Seg statement prior to the call. Clearly, some assembly knowledge is required and great care should be taken to observe the Call statement's conventions. Table 3 shows one way of passing the row and column co-ordinates to the assembly routine and sending the appropriate codes to the VDU.

Manuals of previous releases of Basic have been less than helpful when it comes to explaining assembly language interfacing with Basic, and the Basica and MSBasic manuals supplied with the IBM and Apricot computers appear to be no exception. However, if you can lay your hands on a copy of the *Sirius 1 Basic-86* manual you will find that it covers the subject admirably, and is useful even to the less experienced assembly programmer. You will find all the information you will need to utilise the technique described on pages 16 and 104 to 107 of the manual.

Table 4 lists the compiler compatible functions — that is, those functions which the compiler will accept — which differ between Basica and MSBasic. It is those

functions which were added to Basic to enable the programmer to access some screen- and communication-handling routines which are the ones to avoid.

The Apricot functions in table 4 which have no Basic equivalent in MSBasic should not be used. IBM's Pos function will return the current column position of the cursor. On the Apricot it will return a value between 1 and 2,000, depending on the position of the cursor, relevant to the entire screen where the screen display is 25 lines by 80 columns.

A similar problem occurs with IBM's CrsLin function which returns the cursor's current line number. Again, the nearest to this in MSBasic is Pos. If the cursor position needs to be calculated, the best method to use would be to place the appropriate code in the Include file Stdio.inc as in table 5. Then Gosub 2000 will place the screen relative position of the cursor into the integer variable Position%, and we can work out the row and column co-ordinates from this value.

However, care should be taken so as not to use the variable Position% for any other purpose. The function Width can be utilised in much the same way as Pos(X) except no returned value is required. If the program is to be used with either a monochrome or colour monitor, Basic is not the best language to use as, depending on the number of monitor dependent functions, a global variable will need to be initialised and a conditional call made to whichever routine is needed, depending on the type of monitor indicated by the global variable. This produces far more program code than would normally be acceptable and the program execution speed would be reduced. Again, this problem could be overcome by using assembly-language routines, but this calls for a far greater level of expertise and would dramatically increase the

development time and costs. In this case, a library-orientated language should be used.

As any C programmer will know, a program written in the C language is nothing more than a series of functions. So, in the case of our incompatible functions, no provision would have to be made in the program code for them.

The Clear Screen function in listing 1 is programmed to clear the Apricot's screen. So in order to make it flexible we must remove the function Clear_Scr and place it in a separate source file. In this case, we would put all the VDU related functions — Clear Screen, cursor positioning, direct screen addressing, etc. — in libraries called, for example, vdu_apr and vdu_ibm. We would link in the appropriate file at link time, that is

```
A>ln myprog vdu_opr
```

Bearing in mind that we may be using machine-specific code, thought should be given to the other areas in which creating libraries would be advisable. For example, input/output functions and, if possible, grouping together other machine-specific functions which fall into neither of the categories mentioned.

To the programmer unfamiliar with libraries it may seem a little confusing at first, but all we are doing is following the basic C programming conventions, which can be picked up in very little time by those familiar with another programming language. As I mentioned earlier, the colour monitor does add a further complication to our task but using the C language the solution is quite simple.

For example, suppose that we wanted the program to leave the screen blue every time we used the Clear Screen function, we could just add the statement Color 10,1 prior to clearing the screen. But this statement would not be valid on a monochrome monitor, so in order to overcome this problem we use a global variable, the status of

TABLE 4.

IBM	Apricot	Comments
Beep	PRINT CHR\$(7);	Apricot format should be used on both machines.
Circle	—	
Cls	PRINT CHR\$(&H1B)+ "E";	See table 1.
Color	—	
Com	—	
CrsLin	Pos	Format difference.
Draw	—	
Key	—	
Line	—	
Locate	PRINT CHR\$(&H1B)+ CHR\$(&H59)+ CHR\$(ROW+32)+ CHR\$(COL+32);	See table 1.
LOf	—	
MkDir	—	
On Com	—	
On Key	—	
On Pen	—	
On Strig	—	
Open	—	
"Com...	—	
Paint	—	
Pen	—	
Play	—	
Point	—	
Pos	—	Format difference.
PSet	—	
PreSet	—	
Screen	—	
Sound	—	
Stick	—	
Strig	—	
VarPtr\$	—	
Width	—	Format difference.

The compiler-compatible functions which must be avoided in order to maintain machine-independency. Many IBM commands have no equivalent on the Apricot.


TABLE 5.

IBM	Apricot
2000 POSITION%=POS(DUMMY%)+ CRSLIN(DUMMY%)	2000 POSITION%= POS(DUMMY%)
2010 RETURN	2010 RETURN

which indicates whether we have a colour or monochrome monitor attached to the computer. This basic principle will work with all the monitor related functions as shown in listing 2, where col_mon is the global variable.

It is possible to place all the machine-specific functions in one library, but this is bad programming practice as it tends to

make finding a particular function difficult.

When using C you must carefully plan the use of such functions prior to their implementation, otherwise you may well end up with a program full of functions which call another function which in turn calls another function and so on, just to perform the simplest of operations. 

LISTING 1.

```
moin()
{
printf("text text text");
/* When a key is pressed, the next function
(clear_scr) will clear the screen. */
clear_scr();
exit();
}
clear_scr()
{
putchor(27);
putchor("E"); /* Clears the Apricot's screen */
}
```

LISTING 2.

```
function_name()
{
if (! col_mon)
{
/* monochrome function code */
}
else
{
/* colour function code */
}
}
```

MACHINE-CODE SUBROUTINES

David Dawe details the techniques required to link a machine-code subroutine to an MBasic program running under CP/M, with examples for 8080 and Z-80 systems.

MACHINE-CODE subroutines can often provide a solution to special requirements which are not catered for directly in MBasic. In addition, when certain processing tasks are proving annoyingly slow, a machine-code subroutine may be the answer. The code so produced is often faster in operation than that obtained by compiling pure MBasic source code.

Before you rush in to coding you must first decide where to put the machine code in memory. MBasic itself loads under CP/M at 100hex and stretches up to a little beyond 6000hex. Your Basic program and variables go above this and use the space up to CP/M's FDOS.

MBasic can be loaded using the /M: switch to free a space, but at this point you might not know what value to specify for the top of MBasic. So proceed by loading your Basic as normal and then type:

```
PRINT HEX$(PEEK(7)*256)
```

Location 7 contains the high byte for the starting address of the CP/M FDOS. On my 56K North Star using CP/M 2.2 I obtain the value C500hex. This now gives some idea of where code may be placed. If in future I boot up MBasic using:

```
A>MBASIC /M:&HC000
```

then I have 500hex bytes free for my machine code.

Alternatively MBasic 5 can resize itself using the Clear command:

```
CLEAR,&HC000
```

Now you might think that an MBasic program which Peeks location 7 and then resizes itself automatically using Clear would run with the same free space for machine code, whatever the size of RAM available. However, this approach is not without its draw-

LISTING 1.

```
10 REM MAKE AN AREA FOR THE CODE
20 CLEAR,&HC000
30 MLOC=&HC000

40 REM PUT CODE INTO MEMORY
50 FOR J=0 TO 16
60 READ N
70 POKE MLOC+J,N
80 NEXT J

90 REM CALL IT WHEN EVER I WANT IT
100 CALL MLOC
110 END

120 DATA 14,9,17,9,192,205,5,0,201
130 DATA 72,69,76,76,79,10,13,36
```

backs, since the code you need to use will probably have its origin fixed. Z-80 freaks hold your horses! I know you have relative jumps, but you don't have any relative Calls and any useful subroutine will contain Calls and so cannot be considered relocatable unless it contains some very clever stack manipulations.

The link between MBasic and machine code is via one of the two statements USR and Call. The former exists in MBasic 5 only to achieve compatibility with earlier versions. Use of Call is much better, and it is this technique that is covered here. Call provides the ability to use a machine-code subroutine, and in addition allows a number of parameters to be passed

to the subroutine and also to collect the returned values.

As an example of Calling a machine-code program without parameter passing, let us write a routine to print "Hello" — a common introduction to many computing techniques. The procedure to print a string under CP/M is to write code that Calls the BDOS function number 9. A 9 must be placed in the C register, and the DE register pair must contain the address of the message to be printed. This message must terminate with a \$ sign.

MBasic protects itself by saving all registers before responding to your Call, but if parameters are passed then the registers are required and you may have to save

them in a local area or on the stack. It is unlikely that you will need to allocate a separate stack area since MBasic's is quite big enough. The source code is shown in figure 1.

The source code must be assembled to determine the object code. We also have to decide how MBasic is to place this code in memory at the location allocated. The process of assembly may use ASM or ZASM, etc., or it may be done manually by looking up the hex codes and calculating the decimal equivalents using an origin of C000. The manual method is just as quick for small routines and gives the results shown in figure 2.

Placing these values in Basic Data statements gives listing 1, our first program with a machine-code subroutine.

The next step is to write a program that passes a value to be processed by the subroutine. At this point it is important to realise the difference between the types of variable that MBasic uses, and the way in which they are stored. There are four types of variable: integer variables, such as A%, use two bytes; single-precision variables, such as A or A!, use four bytes; double-precision variables, such as A#, use eight bytes; and string variables, such as A\$, use up to 255 bytes. Integer variables are stored low byte then high byte in the same way that machine code deals with 16-bit values. This means that providing the value you want to process lies in the range -32,768 to 32,767 then you should always use integers as parameters to be passed.

Single-precision variables use a three-byte mantissa and a one-byte exponent, while double-precision values have a seven-byte mantissa plus one-byte exponent. The format is similar to the normal representation. String variables are as long as you make them, subject to the 255-character maximum, but there is a three-byte overhead which gives the length of the string and the address where it is stored.

The next example, which passes a parameter to the subroutine, is again chosen for its simplicity. It passes a value of A%, where A% is less than 128, and doubles it. This restriction ensures that the result can be contained in a single byte. The MBasic part of the program is simply to clear space as before, input the value of A%, Call the subroutine, and print out the new value of A%. The Call is simply written as

```
CALL MLOC(A%)
```

but the hurdle we now have to overcome is how to locate where A% is stored in memory so that we can double it.

Having Called the machine code

FIGURE 2.

Hex	Decimal
0E 09	14 09
11 09 C0	17 09 192
CD 05 00	205 05 00
C9	201
48 45 4C 4C 4F 0A 0C 24	72 69 76 76 79 10 13 36

FIGURE 1.

```
MVI C,9 ;BDOS function 9
LXI D,MESS ;address locator
CALL 5 ;call cpm
RET ;return to MBASIC
MESS: DB 'HELLO',10,13,'$' ;the message + CRLF & $

LD C,9
LD DE,MESS
CALL 5
RET

MESS: DEFM 'HELLO'
DEFB 10,13,36
```


the HL register pair contains the address of the location where MBasic is storing the value of A%. HL does not contain the value of A%. We must now pick up the value from the address pointed to by HL. This will give the low byte of A% — which is all that is needed since A% is small — doubles it and replaces it where it came from. The necessary code is shown in table 1. The calling program might be as shown in listing 2.

If the subroutine needs HL, then the present contents must be stored for later. The code in figure 3 does much the same as before but deals with larger numbers, as both bytes of the integer are considered in the doubling code. If you use Zilog code then the routine may be simplified by using some of the Zilog-only instructions.

The calling program is much the same as before but uses the following Data lines. Change the limit of the For statement in line 50 to 20:
1000 DATA 34,19,192,94,35,86,
33,0,0,25,25
1010 DATA 235,42,19,192,115,
35,114,201,0

Another example of passing a single parameter is given in the following very useful program. It is used to change the currently logged disc drive from within MBasic without going down to operating-system level. CP/M function number 14 is used by simply using the machine code shown in figure 4. Since this code is totally relocatable it can be placed anywhere in RAM. The MBasic program given in listing 3 Peeks CP/M to determine its size and places the subroutine at the top of RAM, having Cleared a space for it. This calling activity only changes the logged disc drive temporarily, until MBasic is exited. It is also necessary to

FIGURE 3.

INTEL		ZILOG	
ORG	0C000H	ORG	0C000H ;origin of free space
SHLD	KEEP	LD	(KEEP),HL ;save pointer
MOV	E,M	LD	E,(HL) ;xfer var to DE
INX	H	INC	HL
MOV	D,M	LD	D,(HL)
LXI	H,0	LD	H,0 ;zero HL
DAD	D	ADD	HL,DE ;add DE to HL
DAD	D	ADD	HL,DE ;twice
XCHG		EX	HL,DE ;xfer result to DE
LHLD	KEEP	LD	HL,(KEEP) ;restore pointer
MOV	M,E	LD	(HL),E ;replace var in memory
INX	H	INC	HL
MOV	D,M	LD	(HL),D
RET		RET	
KEEP:DS	2	KEEP:	DEFS 2

LISTING 4.

C000		ORG	0C000H	
C000	46	MOV	B,M	;xfer length to B
C001	23	INX	H	;xfer str addr to DE
C002	5E	MOV	E,M	
C003	23	INX	H	
C004	56	MOV	D,M	
C005	1A	MORE:LDAX	D	;get char from string
C006	EE20	XRI	20H	;modify the ASCII pattern
C008	12	STAX	D	;put it back
C009	13	INX	D	;bump pointer
C00A	05	DCR	B	;decrement count
C00B	C205C0	JNZ	MORE	;done ?
C00E	C9	RET		

FIGURE 4.

INTEL		ZILOG	
MOV	E,M	LD	E,(HL) ;get passed var
MVI	C,14	LD	C,14 ;BDOS fn 14
CALL	5	CALL	5 ;go set drive
RET		RET	;return to MBASIC

change the least-significant nybble of location 4, where CP/M keeps a note of the currently logged drive, if you want to return to the newly selected drive after a System command.

When passing single- and double-precision variables you should proceed as before. But be careful, since the address passed in HL is the address of where to find

the four- or eight-byte representation of the variable. Handling of these bytes by your subroutine will be much more complicated than using two-byte integer values.

String variables are handled similarly, but this time HL contains the address where you find the three-byte descriptor for the actual string. The first byte pointed to is the string length, and the next two are the string address. As an example, the calling pro-

gram will pass a string of uppercase letters and the subroutine will change the string into lower case. The program also works for the opposite conversion.

The technique relies upon the similarity of the ASCII codes used for the upper- and lower-case letters. XORing the pattern for A with 20hex gives the pattern for a, and vice versa. The subroutine in 8080 code is shown in listing 4, and the calling program is shown in listing 5.

If more than one variable is to be processed then the Call takes the form

CALL(var1,var2.....varN) and, having Called, the register contents are as follows: HL the

(continued on next page)

TABLE 1.

Intel	Zilog	Hex	Dec
MOV M,L	LD (HL),L	7E	126
ADD A	ADD A,A	87	135
MOV L,M	LD L,(HL)	77	119
RET	RET	C9	201

LISTING 2.

```
10 REM MAKE AN AREA FOR THE CODE
20 CLEAR,&HC000
30 MLOC=&HC000

40 REM PUT CODE INTO MEMORY
50 FOR J=0 TO 3
60 READ N
70 POKE MLOC+J,N
80 NEXT J

90 INPUT "WHAT VALUE TO DOUBLE";A%

100 REM CALL IT WHEN I WANT IT
110 CALL MLOC(A%)
120 PRINT "THE DOUBLED VALUE IS ";A%
130 END
140 DATA 126,135,119,201
```

LISTING 3.

```
100 *****
110 ***** XDISK *****
120 *****
130 '
140 'Program to change logged disk drive from MBASIC
150 '
160 'PROGRAM BY D F DAWE
170 'CORNWALL MICROELECTRONICS CENTRE
180 '
190 CLEAR ,PEEK(7)*256+PEEK(6)-10
200 INPUT "WHICH DRIVE IS REQUIRED....";DRIVE$
210 D#=ASC(DRIVE$)-65
220 IF D#=0 OR D#=1 THEN 240 ELSE 200
230 RESET
240 POKE 4,(PEEK(4) AND &HF0)+D#
250 DEST=PEEK(7)*256+PEEK(6)-10
260 FOR J=0 TO 6
270 READ N
280 POKE DEST+J,N
290 NEXT J
300 CALL DEST(D#)
310 CLEAR,PEEK(7)*256+PEEK(6)-2
320 END
330 DATA 94,14,14,195,5,0,201
```

LISTING 5.

```

10 REM MAKE AN AREA FOR THE CODE
20 CLEAR,&HC000
30 MLOC=&HC000
40 REM PUT CODE INTO MEMORY
50 FOR J=0 TO 14
60 READ N
70 POKE MLOC+J,N
80 NEXT J
90 INPUT "WHAT IS YOUR STRING";A$
100 REM CALL IT WHEN I WANT IT
110 CALL MLOC(A$)
120 PRINT A$
130 END
1000 DATA 70,35,94,35,86,26,238,32,18,19
1010 DATA 5,194,5,192,201
    
```

LISTING 6.

```

ORG 0C000H
NUM EQU 8 ;total number of vars
SHLD AP1 ;save addr of var1
XCHG DE ;xchg DE with HL
SHLD AP2 ;save addr of var2
MVI A,NUM-2 ;count of remainder
LXI D,AP3 ;addr of local store
MOV H,B ;xfer table addr to BC
MORE: MOV C,M
INX H
MOV B,M
INX H
XCHG ;point HL to local store
MOV M,C ;save addr of var locally
INX H
MOV M,B
INX H
XCHG ;restore table pointer
DCR A ;decrement count
JNZ MORE ;done ?

<< your subroutine fits in here >>

RET
AP1 DS 2 ;store for addr of var1
AP2 DS 2 ;store for addr of var2
AP3 DS (NUM-2)*2 ;store for var 3-8
    
```

(continued from previous page)

address of var1; DE, the address of var2; and BC the address of an area of memory where MBasic is storing a table of two-byte addresses which indicate where the remaining variables may be found. When dealing with string variables the contents of HL, DE or the table address, as appropriate, will give the string descriptor location.

Your subroutine must know exactly the type and number of the variables to be passed. Having Called the subroutine we are immediately faced with the problem of unloading the registers of the vital information that they contain before we can use them ourselves. Thus we must set up a local storage area to accept them or use the stack. For a total of eight variables we might proceed using a local storage area, as in listing 6.

Listing 7 is a working example, coded in Z-80 mnemonics, of passing two variables. It uses the stack for noting the contents of DE and HL. The subroutine call takes the form

```
CALL MLOC(F%,A$)
```

where A\$ is a string which is to be processed and F% controls what is to be done with it. Only alphabetic

LISTING 7.

```

ORG 0C000H
;FIRST STORE PASSED PARAMETERS...HL & DE IN USE
PUSH HL
PUSH DE
;NOW MULT FN NUMBER IN A BY 2
LD A,(HL) ;get function number
CP 4 ;valid functions are 0 to 3
JR NC,ERROR ;invalid so return
ADD A,A ;double it
LD C,A ;and put in creg
LD B,0 ;zero breg
LD HL,TABLE ;get table addr
ADD HL,BC ;and offset to reqd jump
;HL NOW POINTS TO REQUIRED JUMP TABLE ENTRY
JP (HL) ;go there

;
;
ERROR: POP DE ;restore stack & return to basic
POP HL
RET ;and return to MBASIC

;
TABLE: JR FN0
JR FN1
JR FN2
JR FN3

;FUNCTION 0 TO TRANSLATE TO LOWER CASE
FN0: POP DE ;restore parms
POP HL
CALL COLLECT ;reposition parms
MORE0: LD A,(HL) ;get character
CALL FIX0 ;fix it
INC HL ;bump memory pointer
DEC B ;decrement char count
JR NZ,MORE0 ;more ?
RET ;done
FIX0: CP 'Z'+1 ;is it above letter 'Z' ?
RET NC ;skip it
CP 'A' ;is it below letter 'A' ?
RET C ;skip it
ADD A,20H ;upper case bias
LD (HL),A ;replace
RET

;FUNCTION 1 TO TRANSLATE TO UPPER CASE
FNI: POP DE ;restore addr
POP HL
CALL COLLECT ;reposition addr
MORE1: LD A,(HL) ;get character
CALL FIX1 ;fix it
INC HL ;bump memory pointer
DEC B ;decrement count
    
```

LISTING 8.

```

100 CLEAR,&HC000
110 MLOC=&HC000
120 PRINT "DEMONSTRATION OF PARAMETER PASSING"
130 FOR J=0 TO 128
140 READ N
150 POKE MLOC+J,N
160 NEXT J
170 INPUT "Message required";A$
180 FOR F%=0 TO 3
190 CALL MLOC(F%,A$)
200 PRINT A$
210 NEXT F%
220 END
230 DATA 229,213,126,254,4,48,9,135,79,6
240 DATA 0,33,19,192,9,233,209,225,201,24
250 DATA 6,24,28,24,50,24,69,209,225,205
260 DATA 121,192,126,205,41,192,35,5,32,248
270 DATA 201,254,91,208,254,65,216,198,32,119
280 DATA 201,209,225,205,121,192,126,205,65,192
290 DATA 35,5,32,248,201,254,123,208,254,97
300 DATA 216,214,32,119,201,209,225,205,121,192
310 DATA 126,205,65,192,35,5,200,126,205,41
320 DATA 192,35,5,32,248,201,209,225,205,121
330 DATA 192,126,205,65,192,35,5,200,126,205
340 DATA 41,192,35,5,200,254,32,40,238,24
350 DATA 243,235,70,35,94,35,86,235,201,129
    
```



```

JR      NZ, MORE1      ;more ?
RET                                ;done

FIX1:  CP      'z'+1    ;is it above letter 'z' ?
RET                                ;skip it
CP      'a'            ;is it below letter 'a' ?
RET                                ;skip it
SUB     20H           ;subtract bias
LD      (HL), A       ;replace
RET

;FUNCTION 1 TRANSLATE FIRST CHAR TO UC & REMAINDER TO LC
FN2:   POP     DE      ;restore stack
POP     HL
CALL    COLLECT
LD      A, (HL)      ;first char
CALL    FIX1        ;force upper case
INC     HL          ;bump memory pointer
DEC     B           ;decrement count
RET     Z           ;done ?

MORE2: LD      A, (HL) ;get next char
CALL    FIX0        ;force remaining chars to lc
INC     HL          ;bump memory pointer
DEC     B           ;decrement count
JR      NZ, MORE2   ;more chars ?
RET     Z           ;done

;FUNCTION 3 FIRST LETTER OF ALL WORDS UC REST LC
FN3:   POP     DE      ;restore stack
POP     HL
CALL    COLLECT     ;reposition addr
LD      A, (HL)    ;first char
CALL    FIX1        ;fix it
INC     HL          ;bump memory pointer
DEC     B           ;decrement count
RET     Z           ;done ?

MORE3: LD      A, (HL) ;get next char
CALL    FIX0        ;fix it
INC     HL          ;bump memory pointer
DEC     B           ;decrement count
RET     Z           ;done ?
CP      ' '         ;was last char a space ?
JR      Z, LOOP     ;yes ..so treat next as first
JR      MORE3      ;no ...treat for lc

;SUBROUTINE TO COLLECT PARMS AS REQD
COLLECT: EX DE, HL  ;swop de & hl
LD      B, (HL)    ;put length in b
INC     HL
LD      E, (HL)    ;low byte of string address
INC     HL
LD      D, (HL)    ;high byte of string address
EX      DE, HL     ;swop back again
RET     Z           ;done
    
```

characters are affected by this. If F% is set to 0 then all translation is to lower case. If F% is set to 1 then all translation is to upper case. If F% is set to 2 then only the first character is translated to upper case; the rest will be lower case. If F% is set to 3 then the first character of each word is translated to upper case; the rest will be lower case. This is an excellent example since it shows how much faster strings can be processed by machine code, rather than by using MBasic's string-handling functions.

The demonstration Calling program is shown in listing 8. If you need to pass a number of values which are in the range 0 to 255, it might be easier to Poke them into the free memory area directly and let your subroutine take them up from there. You may even place results back into such locations and on returning to MBasic pick them up again by Peeking them.

On a practical note, the biggest problem you will face in using the ideas presented in this article is converting the machine code into the MBasic Data statements. The method I use is to write the source code using any standard editor,

and then assemble it to produce the Intel standard .Hex file using ASM or ZASM/Link, etc. Having obtained the .Hex file I simply run the program shown in listing 9, which reads the .Hex file and writes a .Dat file which contains the MBasic Data lines as required.

The lines start from any line number and increment by 10. They have 10 items of data on each line. In addition, a final value is added to the data which gives the total number of items preceding it.

LISTING 10.

```

10 PRINT " DEMONSTRATION OF MACHINE CODE CALL"
20 PRINT
30 PRINT "Each time you hit a key I will"
40 PRINT "print a message using a m/c subroutine"
50 PRINT "Hit ESC to finish"
60 PRINT:PRINT
70 X$=INPUT$(1)
80 IF X$=CHR$(27) THEN END
90 CALL CODE
100 GOTO 70
    
```

LISTING 11.

```

PUBLIC CODE
BDOS EQU 5
PRSTR EQU 9
CODE: MVI C, PRSTR
      LXI D, MESS
      CALL BDOS
      RET
MESS: DB 'This message was printed', 10, 13
      DB 'by a machine code subroutine', 10, 13
      DB 'of a MBASIC program', 10, 13, '$'
      END
    
```

This figure is helpful since it gives the looping total for Poking the data into memory. The looping figure should be one less than the last item in the Data. The .Dat file may be loaded or even merged as required, since it is an ASCII-format file. I have been using this program for some time, and so far it seems to cope with all I have demanded of it.

If you have Bascom, the Microsoft Compiler, then any programs saved in ASCII can be compiled directly using the sequence:

```

A>BASCOM=PROGRAM
and then linked with
A>L80 PROGRAM/N,
PROGRAM/E
    
```

This is the standard use of the compiler. Watch out for the common pitfalls of using some form of coding that is acceptable for interpreted Basic but which is not supported by Bascom.

The more professional approach is to write your subroutine and MBasic program separately and combine them at link time. This avoids all the awful Poking and Data statements. Write the MBasic

part of the program as before, but this need now only contain the Call statement. Since there are no Data, Pokes or even an address of the machine code, the interpreted version will not run as before.

Secondly, write the subroutine. This should have a label which is referenced by the Call in the MBasic statement, and is defined as a Public or Global variable. Use Bascom to compile the MBasic part and presumably M-80, as this is part of the compiler package, to assemble the machine-code part without an origin. Note that M-80 assumes a .Mac extension.

Finally, link the two together. The linker will decide where to place the subroutine in memory and arrange for the MBasic part to find it correctly, which is why you must not specify the absolute address of the subroutine in your program.

The MBasic in listing 10 makes a simple Call to a subroutine that prints a message. This program I have called .MBDemo.Bas and saved it in ASCII format using

```

SAVE "MBDEMO", A
(continued on next page)
    
```

LISTING 9.

```

10 PRINT "*****"
20 PRINT "***** HEX2DAT *****"
30 PRINT "*****"
40 PRINT
50 PRINT "Program to convert a .HEX file into"
60 PRINT "a .DAT file which may be merged into a MBASIC program"
70 PRINT "ready for POKing into memory as a M/C subroutine."
80 PRINT
90 PRINT "THE LAST ITEM IN THE DATA IS THE NUMBER OF PRECEDING BYTES"
100 PRINT
110 INPUT "STATE FILENAME TO CONVERT"; N$
120 DIM B%(500)
130 OPEN "I", #1, N$+ ".HEX"
140 LINE INPUT #1, A$
150 GOSUB 440: FB=NB
160 CLOSE
170 OPEN "I", #1, N$+ ".HEX"
180 WHILE NOT EOF(1)
190 LINE INPUT #1, A$
    
```

(listing continued on page 106)

(continued from previous page)

Having returned to CP/M using the System command you can now invoke the compiler to produce a .Rel file from the MBasic source code with

A>BASCOM=MBDEMO

The machine-code routine I have called MCDemo.Mac simply prints the message. Note the Public declaration of the label Code, which will be searched for during link time. This subroutine, shown in listing 11, must now be assembled using M-80 to produce another .Rel file. To do this

A>M80=MCDEMO

You must now use the L-80 linker to link together the .Rel files which were obtained from the MBasic program and the subroutine. You must also specify that the library file Baslib is to satisfy any references to code required by the linker. The command line

A>L80=MBDEMO, MCDEMO/S, BASLIB/S, DEMO/N/E

does this and also outputs the resulting code to a file called Demo.Com. This is the alternative compile and link procedure, invoking Obslib. The switches used in the link command are as follows: /S means search this file for undefined globals; /N means this is the name of the file to be saved; and /E means exit L-80 and return to CP/M.

LISTING 9.

(listing continued from page 105)

```

200 GOSUB 440
210 IF NB=FB+I THEN 250
220 FOR K=1 TO NB-(FB+I)
230 I=I+1:B%(I)=0
240 NEXT K
250 FOR J=10 TO LEN(A$)-2 STEP 2
260 X$=MID$(A$,J,1):GOSUB 500:L=Z
270 X$=MID$(A$,J+1,1):GOSUB 500:R=Z
280 I=I+1:B%(I)=L*16+R
290 NEXT J
300 WEND

310 INPUT "STATE NUMBER OF FIRST DATA LINE";LN
320 N=I
330 OPEN "O",#2,N$+".DAT"
340 I=0
350 PRINT #2,LN;"DATA ";
360 FOR J=1 TO 10
370 I=I+1
380 IF J<>10 THEN PRINT #2,RIGHT$(STR$(B%(I)),LEN(STR$(B%(I)))-1);"
390 IF J= 10 THEN PRINT #2,RIGHT$(STR$(B%(I)),LEN(STR$(B%(I)))-1)
400 IF I=N THEN 540
410 NEXT J
420 LN=LN+10
440 REM Find address for the bytes in A$
450 NB=0
460 FOR J=4 TO 7
470 X$=MID$(A$,J,1):GOSUB 500:NB=NB+Z*16^(7-J)
480 NEXT J
490 RETURN
500 REM CONVERSION SUBROUTINE
510 IF ASC(X$)>64 THEN Z=ASC(X$)-55
520 IF ASC(X$)<64 THEN Z=VAL(X$)
530 RETURN

540 PRINT #2,RIGHT$(STR$(I),LEN(STR$(I))-1)
550 CLOSE
560 END
    
```

**Unicorn
Business Systems**



15 Ticknall Road, Hartshorne, Burton-on-Trent
COMPUTERS

- APRICOT F1 + Software.....£ 900
- APRICOT PC + Software + Monitor.....£1385
- AS ABOVE but with 2 x 720K.....£1525
- SANYO MBC 550 1 x 160K + Software.....£ 590
- SANYO MBC 550 2 x 160K + Software.....£ 675
- SANYO MBC 555-2 2 x 360K + Software.....£1165
- SANYO 555-4 2 x 800K + Software.....£1205
- OLIVETTI WYSE Altos.....£P.A.O.

COMPLETE SYSTEMS: RING FOR OTHERS

<p>SANYO MBC 550 Sanyo Monitor Printer £400 Free S/ware Cable £1095</p>	<p>SANYO MBC 555-2 Sanyo Monitor Printer £1000 Free S/ware Cable £1645</p>	<p>APRICOT PC ACT 9" MONITOR Printer Free Software Cable £1695</p>
---------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------

0283 212442/0530 412333

DWP-1120 £299
NOW REDUCED TO:
Daisy Wheel Printer £225



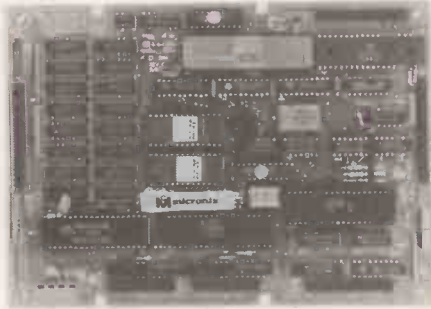
- Printing speed: 20CPS
- 13" paper capacity
- 96-character printwheel
- Spacings: 10-12-15-PS
- Printwheel & ribbon: Qume compatible

curzon systems ltd.
38 STANLEY AVENUE
ST ALBANS
HERTS AL2 3AZ **0727 50674**

● Circle No. 163

PLEASE NOTE OUR NEW ADDRESS
VISIT OUR NEW SHOW ROOM

MICRONIX ESB-1 32 BIT MULTIUSER COMPUTER



NOW AVAILABLE ESB-MATE EXPANSION BOARD

upgrades ESB-1 to 4 user!
512K RAM, 2 serial ports,
parallel port SASI Hard Disk
interface, clock/calendar
£399 + VAT

★ 68008 8 MHz CPU ★ 128 RAM (expandable to 256K) ★ Up to 64K EPROM
1 Floppy disk controller for 5¼", 3", 3½" drives ★ 2 RS232 serial ports
★ Mounts directly on 5¼" drive ★ 2 x 8bit parallel ports ★ Full debug monitor
with single line assembler and disk loader ★ Expansion bus ★ Power
requirement: +5V/1.5A, +12V/100mA, -12V/100mA.
Available as a Bareboard with Monitor ROM and IFL Chip Set £199 + VAT =
£228.85 or completely assembled £499 + VAT = £573.85 128K Expansion
Board (recommended for OS9/68000) £199 + VAT = £228.85 - OS9/68000
real time, multitasking, multiuser Operating System (similar to UNIX)
£300 + VAT = £345 C Compiler, BASIC 09, PASCAL and FORTRAN available.
ESB-MATE with 512K RAM, 2 serial, parallel, clock £399 + VAT

IBM PC/XT COMPATIBLE SYSTEMS

Full IBM PC/XT compatibility at low, low prices. Completely assembled systems ready to run.

640K RAM, TWIN 360K DRIVES, COLOUR/MONO CARD,
83 KEY KEYBOARD with green monitor.....£1300+VAT
with 14 inch hi-res colour monitor.....£1600+VAT
640K RAM, SINGLE FLOPPY, 20MB HARD DISK,
83 KEY KEYBOARD with green monitor.....£2000+VAT
with 14 inch hi-res colour monitor.....£2300+VAT

The following boards and peripherals are available to build a system of your choice:

1. IBM PC/XT compatible motherboard (same as MEGABOARD)
8 slots, RAM up to 1MB with 128K/640K RAM.....£260/£360+VAT
2. Colour/graphics adapter 320x200 up to 16
foreground and 8 background colours 640x200
mono graphics.....£160+VAT=£184.00
3. Multifunction board with OK RAM (up to 256K), 2 serial,
1 parallel, clock, ramdisk, printspool.....£160+VAT=£184.00
- 3a. Same as above with Ok RAM (up to 384K).....£200+VAT=£161.00
4. Floppy disk controller (up to 4 drives).....£ 80+VAT=£ 92.00
5. 5.25 inch floppy disk drive 320/360K.....(each) £120+VAT=£138.00
6. 108 key professional UK keyboard.....£160+VAT=£184.00
- 6a. 83 key keyboard.....£135+VAT=£155.25
7. 135W switched power supply with fan.....£140+VAT=£161.00
- 7a. 135W replacement power supply for IBM PC.....£160+VAT=£184.00
8. Metal system Box-flip top cover.....£100+VAT=£115.00
9. Hercules Compatible Board 80x25 text
720x348 Graphics with parallel port.....£260+VAT=£299.00

CARRIAGE: system £20, system box £15, kb/disk/PSU/board £5

ADD-ONS FOR IBM PC/COMPATIBLES

64K RAM upgrade (9 chips).....£ 13.50+VAT=£ 15.53
128K RAM upgrade for AT (9 piggybacks).....£ 63+VAT=£ 72.45
256K RAM upgrade (9 chips).....£ 54+VAT=£ 62.10
256K RAM Board - fully populated.....£ 140+VAT=£ 161.00
512K RAM Board - fully populated.....£ 240+VAT=£ 276.00
83 key keyboard.....£ 135+VAT=£ 155.25
108 key UK keyboard.....£ 160+VAT=£ 184.00
20MB Half-height HD + controller + cables.....£ 800+VAT=£ 920.00
20MB Half-height Hard Disk for AT.....£ 600+VAT=£ 690.00
70MB Hard Disk for AT (30mS access time).....£2000+VAT=£2300.00

MONITORS

14 inch hi-res Microvitec monitor 640 dots.....£400+VAT=£ 460
PHILIPS 12" green.....£100+VAT=£ 115

THE ERICSSON PC

INCREDIBLE OFFER - COMPARE OUR PRICES BEFORE YOU BUY
ELSEWHERE

FREE 640K RAM UPGRADE WITH ANY ERICSSON SYSTEM
20MB, 1 DRIVE, MONO, 640K RAM SYSTEM.....ONLY £2200+VAT
SAME AS ABOVE BUT WITH COLOUR MONITOR.....ONLY £2500+VAT

640K RAM,
MONO
TWO DRIVE
SYSTEM
ONLY £1500
+VAT



FULL
12 MONTH
ON-SITE
WARRANTY
BY
ERICSSON

PRINTERS

KAGA 810 80 column, 160 CPS/27 CPS NLQ.....£240+VAT=£276
QUEN DATA daisy wheel 18 CPS.....£260+VAT=£299.00
FUJITSU DPMG 91 IBM compatible
180 CPS/60 CPS NLQ.....£360+VAT=£414

DISK DRIVES FOR BBC

MX152A 400K single 80T/DS, 40/80T switch.....£100+VAT=£115
MX252A 800K twin, PSU, 40/80T switch.....£240+VAT=£276

DRIVES FOR APPLE II, IIe, IIc & MACINTOSH

MX150APL for APPLE II & IIe.....£120+VAT=£ 138
MX150A/IIc for APPLE IIc.....£160+VAT=£184
MAC-400 for MACINTOSH 400K 3.5inch.....£249+VAT=£286.35

DISKETTES

5.25" SSDD 48 TPI, single sided (10).....£15+VAT=£17.25
5¼" DSDD 48 TPI, double sided (10).....£18+VAT=£20.70
5¼" DSDD 96 TPI double sided (10).....£23+VAT=£26.45
5¼" high density 77 track for IBM AT (10).....£50+VAT=£57.50
3.5" single sided (10).....£39+VAT=£44.85
3.5" double sided (10).....£49+VAT=£56.35

METAL ENCLOSURES FOR SYSTEMS & DRIVES

Single drive box.....£10+£2.60 P&P+VAT=£ 14.49
Dual drive box - vertical or flat type
(takes MX45 PSU - PSU extra).....£20+£5 P&P+VAT=£ 28.75
System box for ESB-1 (takes two
5¼" drives and MX100 PSU).....£99+£11 P&P+VAT=£126.50

VISA, ACCESS WELCOME



Ordering Information:

Prices are exclusive of VAT unless stated otherwise. Unless otherwise stated,
Postage/Carriage free within UK for advertised prices only - special or
discounted prices will attract postage/delivery charges at cost. All goods are
subject to availability and prior sale. Prices are subject to change without notice.
We accept VISA and ACCESS.

* Visit our brand new Showroom - off-street parking, nearest tube Kilburn
(Jubilee Line) OPEN MON-FRI: 9.30am - 5.30pm



1 Grangeway,
Kilburn,
London NW6 2BW
Tel: 01-625 0295/9 (5 lines)
Telex: 295173 MICROX G

● Circle No. 164



ROM DISC

GAVIN CRADLE has submitted a program that enables paged ROMs to be transferred on to disc so that they can be loaded into and run from sideways RAM.

The program operation can be divided into five main actions. First list all the paged ROMs in the

machine. Then you enter the number of the ROM to be saved, activate the selected paged ROM, and copy the ROM from &8000 to RAM at &3000. Finally you save 16K of RAM, starting at &3000.

The file name used for saving the ROM is its title. If the ROM's

title is more than seven characters long the first seven characters are used. Any spaces embedded in the name are replaced with a - character, so Disc Doctor becomes Discdo-. All ROMs are saved under the R. directory.

The program is written in Basic 1, and because line 270 sets P% to &1900 the program should be typed in, then saved. It can then

be reloaded with Page set to &3000 to Run.

This utility is most useful for looking at any of the paged ROMs other than the DFS as the OS does not allow access to other ROMs while one is being executed. The object code can be saved and *Run later to save another ROM for inspection and/or running in sideways RAM.

ROM DISC

```

10 REM M/C routine to copy a specified paged rom down
20 REM from &8000 to &3000 then save it onto disc.
30 REM
40 REM Written by : Gavin J. Cradle.
50 REM Started : 8th February '85
60 REM Finished : 13th February '85
70 REM BASIC 1 version.
80
90 MODE7:VDU23;8202;0;0;0;:PRINT "Assembling in progress."
100 oswrch=&FFEE
110 osrdch=&FFED
120 osnewl=&FFEF
130 osbyte=&FFF4
140 oscli=&FFF7
150 osword=&FFF1
160 roml=&7D
170 romh=&71
180 current=&72
190 romno=&73
200 froml=&74
210 fromh=&75
220 toL=&76
230 toh=&77
240 svl=&78
250 svh=&79
260
270 FOR pass=0 TO 1
280 P%=&1900
290 [
300 OPT pass*2
310 .romdisc
320 JSR init
\Initialisation section.
330 JSR proms
\List all paged roms.
340 JSR selrom
\Select the rom.
350 JSR move
\Move the rom.
360 JSR save
\Save the rom.
370 LDX #0
380 .pf
390 LDA finil,X
400 BEQ opf
410 JSR oswrch
420 INX
430 JMP pf
\Inform the user that the rom has been saved onto
440 .opf
450 JSR osrdch
\disc and ask whether any more are to be moved.
460 CMP #78
470 BEQ exit
480 CMP #89
490 BEQ romdisc
500 JMP pf
510 .exit
520 LDA #0
\Switch the escape key
530 STA &258

```

```

\back on.
540 LDA #26
550 JSR oswrch
560 LDA #12
570 JSR oswrch
580 JSR osnewl
\Clear the screen and
590 RTS
\return to BASIC.
600 .init
610 LDA #1
\Switch the escape key
620 STA &258
\off.
630 LDA #0
640 STA froml
650 STA toL
660 LDA #880
\State where the rom is
670 STA fromh
\to be moved from and
680 LDA #830
\where it is to be moved
690 STA toh
\to.
700 LDA #87C
710 STA 87
\Set HIMEM to its correct
720 LDA #0
\value for MODE 7.
730 STA 86
740 LDX #0
750 .p1
760 LDA title,X
770 BEQ op1
\Print out the title
780 JSR oswrch
\screen for the utility.
790 INX
800 JMP p1
810 .op1
820 JSR osnewl
830 LDA #28
840 JSR oswrch
850 LDA #0
860 JSR oswrch
870 LDA #23
880 JSR oswrch
\Set up a text window
890 LDA #39
\that will leave the top
900 JSR oswrch
\four lines of the screen
910 LDA #4
\displayed.
920 JSR oswrch
930 LDA #170
940 LDX #0
950 LDY #255
\Find out the high & low
960 JSR osbyte
\bytes of a table holding
970 STX roml
\details of the types of
980 STY romh
\roms in the machine.
990 LDA &F4
\Save the number of the
1000 STA current

```

```

\currently selected rom.
1010 RTS
1020 .proms
1030 LDX #0
1040 .p2
1050 LDA roms,X
1060 BEQ op2
1070 JSR oswrch
1080 INX
1090 JMP p2
1100 .op2
1110 JSR osnewl
1120 LDY #15
1130 .list
1140 STY &FE30
\Patch in a rom.
1150 STY &F4
1160 LDA (romL),Y
\Is there a rom in this
1170 BEQ nsock
\socket?
1180 LDX #9
1190 LDA #32
1200 .p3
1210 JSR oswrch
1220 DEX
1230 BNE p3
1240 TYA
1250 CMP #10
1260 BMI less
1270 LDA #49
\Print out the rom
1280 JSR oswrch
\number.
1290 TYA
1300 CLC
1310 ADC #38
1320 JSR oswrch
1330 JMP ptitle
1340 .less
1350 LDA #32
1360 JSR oswrch
1370 TYA
1380 CLC
1390 ADC #48
1400 JSR oswrch
1410 .ptitle
1420 LDX #15
1430 LDA #32
1440 .pspaces
1450 JSR oswrch
1460 DEX
1470 BNE pspaces
1480 TYA
1490 PHA
1500 LDY #0
1510 .pit
1520 LDA &8009,Y
\Print out the title
1530 BEQ opit
\of the paged rom.
1540 JSR oswrch
1550 INY
1560 CPY #7
1570 BNE pit
1580 .opit
1590 JSR osnewl

```

(continued on page 110)



Epson's new
'15-seconds-to-draft-
an-A4-page'
printer at 200 cps.

EPSON LG-1500

109

ROM DISC

(continued from page 108)

```

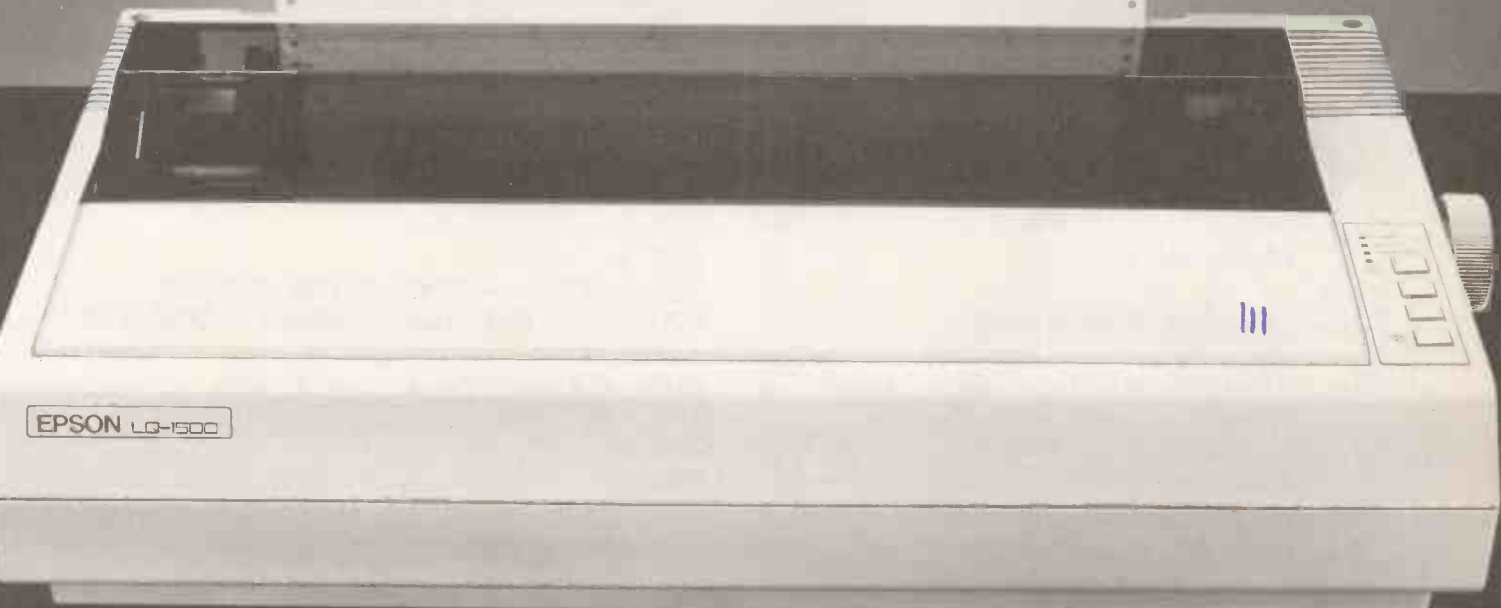
1600 PLA
1610 TAY
1620 .nsock
1630 DEY
1640 CPY #0
1650 BPL list
1660 LDA current
\Patch the rom in use
1670 STA &FE30
\before this routine
1680 STA &F4
\was called.
1690 RTS
1700 .selrom
1710 JSR osnewl
1720 LDX #0
1730 .p4
1740 LDA selprnt,X
1750 BEQ op4
1760 JSR oswrch
1770 INX
1780 JMP p4
1790 .op4
1800 LDA #0
1810 STA romno
1820 STA &80
1830 STA &81
1840 STA &82
1850 LDX #block MOD 256
1860 LDY #block DIV 256
1870 JSR osword
1880 LDA &80
\Work out what the
1890 CMP #13
\number is of the rom
1900 BEQ error
\that is to be copied
1910 LDA &81
\onto disc.
1920 CMP #13
1930 BEQ lessten
1940 LDY &80
1950 CPY #50
1960 BCS error
1970 LDY &80
1980 CPY #48
1990 BEQ switch
2000 LDA #10
2010 STA romno
2020 LDA &81
2030 SEC
2040 SBC #48
2050 CLC
2060 ADC romno
2070 STA romno
2080 JMP check
2090 .switch
2100 LDA &81
2110 STA &80
2120 .lessten
2130 LDA &80
2140 SEC
2150 SBC #48
2160 STA romno
2170 .check
2180 LDY romno
2190 CPY #16
2200 BCS error
2210 LDY romno
\Ensure that there is
2220 LDA (roml),Y
\actually a rom in
2230 BEQ error
\this socket.
2240 RTS
2250 .error
2260 LDA #7
2270 JSR oswrch
2280 LDA #12
\Errors cause the routine
2290 JSR oswrch

\to clear the screen,
2300 JSR proms
\print out the rom titles
2310 JMP selrom
\& ask you to reselect.
2320 .move
2330 LDA romno
2340 STA &FE30
2350 STA &F4
2360 LDX #&40
2370 LDY #0
2380 .downl
2390 LDA (froml),Y
2400 STA (tol),Y
\Move the specified
2410 INY
\paged rom down from
2420 BNE downl
\&8000 to &3000.
2430 INC fromh
2440 INC toh
2450 DEX
2460 BNE downl
2470 LDA current
2480 STA &FE30
2490 STA &F4
2500 RTS
2510 .save
2520 LDX #sblock MOD 256
2530 LDY #sblock DIV 256
2540 STX svl
2550 STY svh
2560 INC svl
2570 INC svl
2580 INC svl
2590 INC svl
2600 LDA romno
2610 STA &FE30
\Save the specified
2620 STA &F4
\paged rom in the R
2630 LDY #0
\directory on the
2640 .name
\disc using the roms
2650 LDA &8009,Y
\name as the filename.
2660 BEQ ename
2670 CMP #32
2680 BEQ cspace
2690 .notspc
2700 STA (svl),Y
2710 INY
2720 CPY #7
2730 BNE name
2740 .ename
2750 LDA current
2760 STA &FE30
2770 STA &F4
2780 LDX #sblock MOD 256
2790 LDY #sblock DIV 256
2800 JSR oscli
2810 LDA #32
2820 LDY #7
2830 .cname
2840 STA (svl),Y
2850 DEY
2860 BNE cname
2870 RTS
2880 .cspace
2890 LDA #ASC"-"
2900 JMP notspc
2910 .tjtle
2920 ]
2930 !PX=&20200716
2940 PX!4=&28839D84
2950 PX!8=&47202943
2960 PX!12=&6E697661
2970 PX!16=&202E4A20
2980 PX!20=&64617243
2990 PX!24=&202E656C
3000 $(PX+28)=" 10/2/85. "

+CHR$156
3010 PX!40=&8D0D0A0A
3020 PX!44=&20202020
3030 PX!48=&20202020
3040 $(PX+52)=" ROM to disc
utility."
3050 PX!72=&208D0D0A
3060 PX!76=&20202020
3070 PX!80=&20202020
3080 $(PX+84)="ROM to disc
utility."+CHR$0
3090 PX=PX+105
3100 [
3110 OPT pass*2
3120 .roms
3130 ]
3140 !PX=&2020200C
3150 $(PX+4)=" Rom number.
"
3160 PX!17=&20202020
3170 PX!21=&20202020
3180 $(PX+25)=" Rom title."
3190 PX!36=&20200A0D
3200 PX!40=&85F202020
3210 PX!44=&85F5F5F5F
3220 PX!48=&85F5F5F5F
3230 PX!52=&820205F5F
3240 PX!56=&820202020
3250 PX!60=&85F202020
3260 PX!64=&85F5F5F5F
3270 PX!68=&85F5F5F5F
3280 PX?72=&85F
3290 PX?73=0
3300 PX=PX+74
3310 [
3320 OPT pass*2
3330 .selprnt
3340 ]
3350 $PX="What no. rom do y
ou want to copy ?"+CHR$0
3360 PX=PX+35
3370 [
3380 OPT pass*2
3390 .block
3400 ]
3410 !PX=&30020080
3420 PX?4=&839
3430 PX=PX+5
3440 [
3450 OPT pass*2
3460 .sblock
3470 ]
3480 $PX="S.R. 3000
6FFF 8000 8000"+CHR$13
3490 PX=PX+32
3500 [
3510 OPT pass*2
3520 .fini
3530 ]
3540 !PX=&0A0A0A0C
3550 PX!4=&20202020
3560 PX!8=&20202020
3570 $(PX+12)="ROM successf
ully copied."
3580 PX!36=&0A0A0A0D
3590 PX!40=&80A202020
3600 PX?44=&820
3610 PX?45=&820
3620 $(PX+46)="Do you want
to copy any more ?"
3630 PX!76=&0A0A0A0D
3640 PX?80=&820
3650 PX?81=&820
3660 $(PX+82)=" Press 'Y' f
or yes and 'N' for no."+CHR$0
3670 PX=PX+120
3680 NEXT pass
3690 PRINT:PRINT"Use *SAVE ROMDISC
1900 "; "PX;" 1900 to savethe objec
t code."
3700 END

```


Epson's new
'widest-ever-spreadsheet'
printer.



EPSON LG-1500

ON RESET GOTO

ON OLDER versions of the Apple II+ it was possible to accidentally press the Reset key instead of the Return key because of their proximity. Later versions of the II+, and the IIe, solved this problem by only allowing a Reset when the Ctrl and Reset keys are pressed simultaneously. Sometimes it would be nice to disable

the Reset key so as to make a program idiot-proof. Jason Smith has sent in a routine to do just this.

When Reset is pressed, the Autostart ROM causes a branch to the address specified by the contents of addresses 1010 (\$3F2) and 1011 (\$3F3). The default values stored at these locations after DOS has been booted at power-up


are the DOS Restart address.

Decimal Addr. Contents	Hex Addr. Contents
1010 191	\$3F2 \$8F
1011 157	\$3F3 \$9D
1012 56	\$3F4 \$38

The value stored at address \$3F4 is the result of an EOR of the value stored in \$3F3 with the value \$A5.

If you put a different address in these locations then you can force the Apple to jump to your own routine. The short machine-code routine starting at \$300 in listing 1 will branch to a line number in a

Basic program each time Reset is pressed.

Listing 2 is a Basic program that demonstrates how the machine-code routine can be used. The Basic program changes the Reset vectors to point to the machine-code at \$300. To define which line the machine-code routine will jump to when you press Reset, set the Basic variable LI to the required line number and call the subroutine starting at line 200. Replace the Reset vectors with the original values when you have finished using the program. 

LISTING 1.

ASSEMBLER

```

ORG      $300
JSR      $03EA      ;Make sure DOS is connected
JSR      $DAFB      ;Print a <CR>
LDA      £$00      ;Hi-byte of BASIC line no.
STA      $51        ;Store in Page Zero
LDA      £$00      ;Lo-byte of BASIC line no.
STA      $50        ;Store in Page Zero
JSR      $D941      ;Find line in BASIC program
JSR      $D7D2      ;and start execution there

```

MACHINE CODE

```

0300: 20 EA 03 20 FB DA A9 00
0308: 85 51 A9 00 85 50 20 41
0310: D9 20 D2 D7


```

LISTING 2.

```

10  REM ON RESET GOTO DEMO
13  REM SET UP RESET VECTORS
15  POKE 1010,0: POKE 1011,3: POKE 1012,166
16  :
20  LI = 100: GOSUB 200
25  :
30  PRINT : PRINT "PRESS 'RESET',
    OR ANY OTHER KEY TO END"
40  IF PEEK ( - 16384) > 128 THEN
    250
45  FOR J = 1 TO 100: NEXT J
50  GOTO 30
60  :
70  :
99  REM RESET WILL BRANCH TO LIN
    E 100
100 PRINT : PRINT : INVERSE
110 PRINT "YOU PRESSED IT!!":
    NORMAL
120 PRINT : PRINT
130 GOTO 30
140 :
150 :
199 REM CHANGE LINE NUMBER
200 Z = INT (LI / 256): POKE 775
    ,Z
210 POKE 779,LI - Z * 256
220 RETURN
230 :
240 :
250 REM DEACTIVATE RESET VECTOR
    S
260 POKE 1010,191
270 POKE 1011,157
280 POKE 1012,56
290 END

```


A black and white photograph showing a hand in a white sleeve holding a sheet of paper. The paper has text printed on it. Below the paper is an Epson printer. The printer has a control panel on the right side with several buttons and a dial. The number '113' is handwritten in blue on the printer's top surface. The printer's front panel has a label that reads 'EPSON LQ-1500'.

Epson's new
'near-as-makes-no-
difference-to-
typewriter-quality'
printer.

EPSON LQ-1500

113

DIR BYTE-SUM

JOHN PALMER of Maidenhead doesn't like the fact that Dir only tells you how many bytes there are free on a disc, but not how many bytes your files add up to. He has therefore written a small Basic program, Dir.Bas, to do this.

To use it, you first type in the four-line batch file listed here, using the command

COPY CON BYTES.BAT
and press F6 or Ctrl-Z to end.

Bytes.Bat creates a disc file, Dir.Lst, which contains an image of the normal screen output. It then runs the Basic program Dir.Bas to list the specified files and print the number of bytes of disc space taken up. This Basic

program finally returns you to the system level.

The variable parameter %1 enables you to specify the files required in normal syntax. For example, to list all the Basic files starting with Fred you would enter BYTES FRED????.BAS and it would tell you the space consumed.

The program works with both floppy and hard discs, and could be enhanced by including, say, Tree in the batch file, then modifying Dir.Bas to print a summary of the bytes in each directory and sub-directory. For hard-disc users, that would be really useful.

KEY UTILITY

```
10 REM TEST FOR SHIFTS, CONTROL, ALT, IN
S AND LOCK KEYS
20 DEF SEG=64
30 CLS
40 LOCATE 8,11:PRINT "INS  CPLK  NMLK  SCL
K  ALT  CTRL  LSFT  RSFT"
50 X=PEEK(23)
60 LOCATE 10,10
70 FOR I=7 TO 0 STEP -1
80 PRINT SGN(X AND 2^I);SPC(2);
90 NEXT I
100 GOTO 50
```

DOS PROMPT

```
PATH=C:\;DOS21UK
KEYBUK
WTDATIM
ECHO OFF
CLS
PROMPT Jack $t$h$h$h$h$h$h$h$_$n$g
TYPE MENU.TXT
```

SYSTEM CHECK

```
10 REM System Features
20 GOSUB 1000 ' Check system
30 CLS
40 SCREEN 0,0,0
50 WIDTH 80
60 PRINT "This IBM PC has : "
70 PRINT
80 PRINT RAM;"k Memory"
90 PRINT DISKS;"Floppy disk drive(s)"
100 PRINT HDISKS;"Hard disk drive(s)"
110 PRINT RS232;"Serial port(s)"
120 PRINT PPORTS;"Parallel port(s)"
130 PRINT GA;"Games adapter(s)"
140 PRINT " ";MON$(CM);" monitor"
150 PRINT " is the current display"
160 END
1000 REM SYSTEM
1010 DEF SEG=64
1020 RAM=PEEK(19)+PEEK(20)*256
1030 DISKS=1+(PEEK(16) AND 192)/64
1040 HDISKS=PEEK(117)
1050 PPORTS=(PEEK(17) AND 192)/64
1060 RS232=(PEEK(17) AND 14)/2
1070 GA=(PEEK(17) AND 16)/16
1080 MON$(0)="Monochrome"
1090 MON$(1)="Colour"
1100 DEF SEG=0
1110 CM=ABS((PEEK(1040)=157))
1120 RETURN
```

DIR BYTE-SUM

BASIC PROGRAM

```
100 REM PROGRAM = DIR.BAS
110 REM
120 REM A$ = INPUT RECORD CONTAINING D
IR LINE
130 REM B = INSTR TARGET VARIABLE
140 REM C = FILE COUNTER
150 REM D = BYTE COUNTER
160 REM E = BYTE TOTAL COUNTER
170 REM
180 CLS:OPEN "DIR.LST" FOR INPUT AS #1
190 WHILE NOT EOF(1)
200 INPUT #1,A$
210 B = INSTR(A$,"Volume"):IF B <> 0 TH
EN 270
220 B = INSTR(A$,"Directory"):IF B <> 0
THEN PRINT A$:PRINT:GOTO 270
230 B = INSTR(A$,"bytes free"):IF B <>
0 THEN 270
240 B = INSTR(A$,"<DIR>"):IF B <> 0 THE
N PRINT A$:GOTO 270
250 IF A$ = " " OR A$ = "" THEN 270
260 C = C + 1:D = VAL(MID$(A$,13,9)):E
= E + D:PRINT A$
270 WEND
280 PRINT:PRINT C "files found, totallin
g" E "bytes.":PRINT:CLOSE:SYSTEM
```

BATCH FILE

```
ECHO OFF
DIR %1 >DIR.LST
BASICA DIR.BAS
ECHO ON
```

KEY UTILITY

ONE OF THE problems with the IBM keyboard is that you can't tell when any of the special keys have been pressed to set Insert, Caps Lock, Num Lock, Scroll Lock, Alt or Ctrl — or, indeed, the left and right Shift keys. If you want to write a user-friendly program, this is something you can take care of.

Mike Curtis points out that there is a simple way to tell by Peeking location 23, and his Key utility shows how it's done. If you run the program, this shows 0 when each of these keys is not pressed, and 1 when it is.

It is also possible to force the Control key on by

```
10 DEF SEG=64
20 POKE 23,4
```

DOS PROMPT

IT IS supremely easy to change the system prompt in PC-DOS. All you have to do is type the word "prompt", and then whatever you want the prompt to be, such as PROMPT System crash and press Return.

There are also some special features, described on pages 10 to 18 of the DOS manual, which enable you to get non-ASCII characters into it. Each must be preceded by the \$ character.

For example, \$d will set the date as the prompt, and \$t the time.

Especially useful for people with hard discs is \$p, which makes the prompt into the name of the directory you are in at the time — such as C:/SALES/MPLAN or whatever. \$p\$g will include the >.

If you want to change the prompt, include a line in an Autoexec.Bat file so that this is done whenever the machine is restarted or turned on. An example is given above left.


In this case the time, \$t, is reduced to show only hours and minutes by the use of repeated destructive backspaces, \$h. The underline character, \$_, starts a new line, and then \$n\$g provides the standard prompt, such as C>. The result is a two-line prompt of the form

```
Jack-15:17
C>
```

at 3.17pm. Resist the temptation to construct very fancy prompts. They become tedious if you see them often.

SYSTEM CHECK

ANOTHER small utility from Mike Curtis provides a simple way to check the facilities of an IBM PC, just as the IBM diagnostics disc does.

In line 1110, CM returns 0 if a monochrome monitor is fitted, and 1 if it is colour. 

A black and white photograph of an Epson printer. A hand is shown placing a label into the printer's input tray. The label has three sections of text. The printer is white with a control panel on the right side. The Epson logo and model number 'EPSON LQ-1500' are visible on the front left. The number '115' is handwritten in blue on the front right.

Epson's new
adhesive label
printer.

Epson's new
adhesive label
printer.

Epson's new
adhesive label

EPSON LQ-1500

115

PRINTING FOREIGN TEXT

A PROGRAM from Alan Mackay defines Russian, Greek and Turkish characters for the Epson FX-80 printer. It is written in Microsoft Basic avoiding machine-specific commands, and so should run with little alteration on most machines.

As many characters as possible are designed to correspond to similar characters in the familiar Latin alphabet, which makes it easier to find characters on the keyboard and recognise them on the screen. When the program is run, the appropriate character set is

downloaded into the printer's memory and remains there until the printer is reinitialised or turned off. You can then go ahead and run other programs normally, but whenever a file is printed the characters will come out as the foreign equivalent.

The program should be of use in schools and other places where Russian, Greek or Turkish text is required but a special printer is not available. Labels can be stuck on the computer's keyboard if necessary to help with character identification.

```

ABCDEFGHIJKLMNPOQRSTUVWXYZ\[\?/
АБЦДЕЖГХИЙКЛМНОПРСТУВШЖЪЗЩЦЭЭ
abcdefghijklmnopqrstuvwxyz=-_]*
абцдефгхийкпмнопрстувшжнзчяряб
    
```

English to Russian.

```

ABCDEFGHIJKLMNPOQRSTUVWXYZ
ABCDEFΓGHIXIKΛMNOPΘΡΣΤΩΨΞΥΖ
abcdefghijklmnopqrstuvwxyz
αβγδεϕζηιηκλμνοπερωψξυζ
    
```

English to Greek.

FOREIGN TEXT. RUSSIAN.

```

10 REM change type font
20 REM program name RUBBIAN
30 REM copyright A.L.Mackay
40 REM Birkbeck College, London
50 REM Microsoft Basic for Nascom II micro
60 REM and EP80N FX-80 matrix printer
70 REM set infinite line width
80 WIDTH LPRINT 255
90 REM initialise printer
100 LPRINT CHR$(27);"@";
110 REM type style condensed enlarged
120 LPRINT CHR$(27);"!";CHR$(52);
130 REM set left margin
140 LPRINT CHR$(27);"1";CHR$(8);
150 REM copy original characters
160 LPRINT CHR$(27);";";CHR$(0);CHR$(0);CHR$(0);
170 REM select download set
180 LPRINT CHR$(27);"%";CHR$(1);CHR$(0);
190 DEFINT I-N
200 DIM L(11)
210 REM number of characters to be re-defined
220 N=51
230 DIM A$(N)
240 REM N characters to be replaced
250 DATA W,w,\,l,C,c,X,x,?,/
260 DATA Q,q,D,d,y,L,l,Y,y,=-
270 DATA _ ,j,U,u,B,b,G,g,H,h
280 DATA I,i,j,k,N,n,P,p,R,r
290 DATA S,s,t,V,v,Z,z,*F,f
300 DATA m
310 FOR I= 1 TO N
320 READ A$(I)
330 NEXT I
340 LPRINT
350 REM if there are descenders in new chars.
360 REM then attribute is 11, otherwise 139
370 REM list of attribute chars.
380 DIM M(N)
390 FOR I=1 TO N
400 READ M(I)
410 NEXT I
420 DATA 139,139,11,11,11,11,139,139,139,139
430 DATA 139,139,139,139,139,139,139,139,139,139
440 DATA 139,139,139,11,139,139,139,139,139,139
450 DATA 139,139,139,139,139,139,139,139,139,139
460 DATA 139,139,139,139,139,139,139,139,139
470 DATA 139,139
480 REM redefine characters
490 FOR I=1 TO N
500 LPRINT CHR$(27);"&";CHR$(0);
510 LPRINT CHR$(ABC(A$(I)));CHR$(ABC(M(I)));
520 LPRINT CHR$(M(I));
530 FOR J=1 TO 11
540 READ L(J)
550 LPRINT CHR$(L(J));
560 NEXT J
570 NEXT I
580 REM data for N characters
590 REM 11 items for each
600 REM data for RUBBIAN
610 LPRINT
620 DATA 0,254,0,2,0,254,0,2,0,254,0
630 DATA 0,62,0,2,0,62,0,2,0,62,0
640 DATA 0,252,0,4,0,252,0,4,0,252,3
650 DATA 0,124,0,4,0,124,0,4,0,124,3
660 DATA 0,0,252,0,4,0,4,0,252,3,0
670 DATA 0,0,124,0,4,0,4,0,124,3,0
680 DATA 0,130,108,16,0,254,0,16,108,130,0
690 DATA 0,34,20,8,0,62,0,8,20,34,0
700 DATA 0,68,0,130,0,146,0,146,68,56,0
710 DATA 0,36,0,66,16,66,16,66,36,24,0
    
```

```

720 REM
730 DATA 0,254,0,16,0,124,130,0,130,124,0
740 DATA 0,62,0,8,0,28,34,0,34,28,0
750 DATA 0,3,4,250, 0,130,0,130,0,255,0
760 DATA 0,3,0,62,0,34,0,34,0,63,0
770 DATA 0,62,0,18,12,0,0,62,0,0,0
780 DATA 0,4,0,194,60,128,0,128,0,254,0
790 DATA 0,0,50,12,32,0,32,0,62,0,0
800 DATA 0,48,0,32,0,62,0,18,0,12,0
810 DATA 0,240,0,8,0,8,0,8,0,254,0
820 DATA 0,0,56,0,4,0,4,0,63,0,0
830 REM
840 DATA 0,98,4,152,0,144,0,144,254,0,0
850 DATA 0,0,27,0,36,0,36,0,63,0,0
860 DATA 0,129,64,33,18,12,16,32,64,128,0
870 DATA 0,1,64,33,18,12,16,32,64,0,0
880 DATA 0,254,0,146,0,146,0,146,12,0,0
890 DATA 0,0,108,18,128,18,128,18,140,0,0
900 DATA 0,254,0,128,0,128,0,128,0,128,0
910 DATA 0,0,62,0,32,0,32,0,32,0,0
920 DATA 0,0,130,68,40,16,40,68,130,0,0
930 DATA 0,0,34,20,0,8,0,20,34,0,0
940 REM
950 DATA 0,254,0,4,8,16,32,64,0,254,0
960 DATA 0,0,62,0,4,8,16,0,62,0,0
970 DATA 0,0,62,128,4,72,16,128,62,0,0
980 DATA 0,0,62,0,8,0,20,0,34,0,0
990 DATA 0,254,0,16,0,16,0,16,0,254,0
1000 DATA 0,0,62,0,8,0,8,0,62,0,0
1010 DATA 0,254,0,128,0,128,0,128,0,254,0
1020 DATA 0,0,62,0,32,0,32,0,62,0,0
1030 DATA 0,254,0,144,0,144,0,144,0,96,0
1040 DATA 0,0,63,0,36,0,36,0,24,0,0
1050 REM
1060 DATA 0,124,130,0,130,0,130,0,130,68,0
1070 DATA 0,28,34,0,34,0,34,0,34,0,0
1080 DATA 0,32,0,32,0,62,0,32,0,32,0
1090 DATA 0,130,124,130,16,130,16,130,16,108,0
1100 DATA 0,0,62,0,42,0,42,16,6,0,0
1110 DATA 0,0,68,130,0,146,0,146,108,0,0
1120 DATA 0,0,20,34,0,34,0,42,20,0,0
1130 DATA 0,0,62,0,18,0,18,12,0,0,0
1140 DATA 0,130,16,170,0,124,0,170,16,130,0
1150 DATA 0,28,34,0,34,93,34,0,34,28,0
1160 REM
1170 DATA 0,62,0,16,8,4,8,16,0,62,0
1180 REM test data
1190 LPRINT
1200 LPRINT CHR$(27);"4";
1210 LPRINT "English to Russian"
1220 LPRINT
1230 LPRINT CHR$(27);"5";
1240 LPRINT CHR$(27);"4";
1250 LPRINT "ABCDEFGHIJKLMNPOQRSTUVWXYZ\
WXYZ\[\?/- ]*"
1260 LPRINT CHR$(27);"5";
1270 LPRINT "ABCDEFGHIJKLMNPOQRSTUVWXYZ\
WXYZ\[\?/- ]*"
1280 LPRINT CHR$(27);"4";
1290 LPRINT "abcdefghijklmnopqrstuvwxyz"
1300 LPRINT CHR$(27);"5";
1310 LPRINT "abcdefghijklmnopqrstuvwxyz"
1320 LPRINT
1330 LPRINT CHR$(27);"4";
1340 LPRINT "Russian to English:"
1350 LPRINT CHR$(27);"5";
1360 LPRINT
1370 LPRINT "ABV8DEXZIKLMNOPBTUFHC=W\Y*7Q_"
    
```

(continued on page 118)

If you haven't guessed by now,
Epson's new printer is the
LQ 1500. It's everything in one.
And this is the coupon to
send off for details.
Or tel: EPSON FREEPHONE

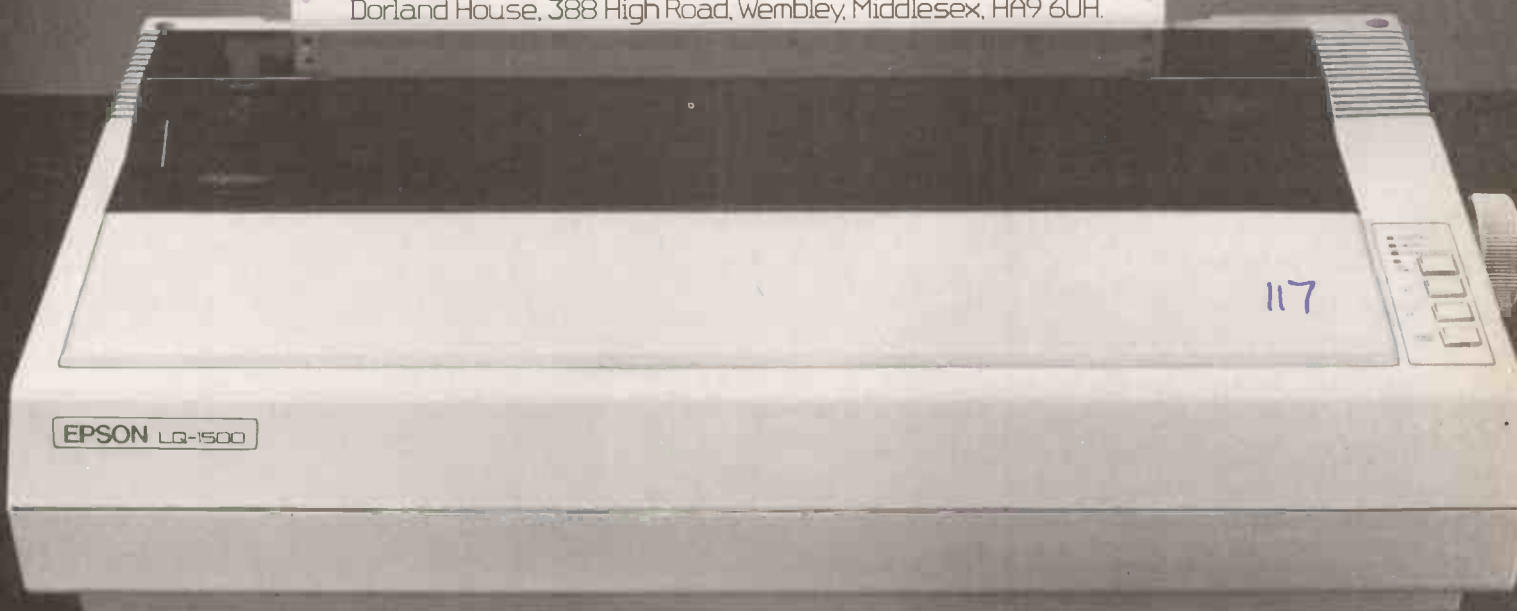
Name _____

Position _____

Company _____

Address _____

To: Epson (UK) Ltd.
Dorland House, 388 High Road, Wembley, Middlesex, HA9 6UH.



24 pin impact dot matrix, 200 cps, 67 cps NLQ mode, 101-406 mm paper width, up to 272 characters per line.
Options: single or double sheet feeder, tractor, parallel and serial 2K or 32K, IEEE 2K.

EPSON

FOREIGN TEXT. RUSSIAN.

(continued from page 116)

```

1380 LPRINT CHR$(27);"4";
1390 LPRINT "ABVGDZXIKLMNOPSTUFHC=W\Y*?Q_"
1400 LPRINT CHR$(27);"5";
1410 LPRINT "abvgdexziklmnopstufhc-w\y*/q]"
1420 LPRINT CHR$(27);"4";
1430 LPRINT "abvgdexziklmnopstufhc-w\y*/q]"
1440 LPRINT CHR$(27);"5";

```

GREEK

```

10 REM change type font
20 REM program name GREEK
30 REM copyright A.L.Mackay,
40 REM Birkbeck College, London
50 REM Microsoft Basic for Nascom II micro
60 REM and Epson FX-80 matrix printer
70 REM set infinite line width
80 WIDTH LPRINT 255
90 REM put Greek characters into Italic set
100 REM initialise printer
110 LPRINT CHR$(27);"@";
120 REM type style condensed enlarged
130 LPRINT CHR$(27);"!";CHR$(52);
140 REM set left margin
150 LPRINT CHR$(27);"1";CHR$(8);
160 REM copy original characters
170 LPRINT CHR$(27);"1";CHR$(0);CHR$(0);
CHR$(0);
180 REM select download set
190 LPRINT CHR$(27);"%";CHR$(1);CHR$(0);
200 DEFINT I-N
210 DIM L(11)
220 REM number of characters to be re-defined
230 N=37
240 DIM A$(N)
250 DATA a,L,X,F,g,G,l,x,f,D
260 DATA d,m,P,h,e,z,n,p,W,j
270 DATA Q,q,r,w,i,k,y,t,u,U
280 DATA c,b,J,R,B,H,s
290 FOR I=1 TO N
300 READ A$(I)
310 NEXT I
320 LPRINT
330 REM if there are descenders in new chars.
340 REM then attribute is 11, otherwise 139
350 REM list of attribute chars.
360 DIM M(N)
370 FOR I=1 TO N
380 READ M(I)
390 NEXT I
400 DATA 139,139,139,139,11,139,139,139,11,139
410 DATA 139,11,139,139,139,11,139,139,139,11
420 DATA 139,139,11,11,139,139,139,139,139,139
430 DATA 11,11,139,139,139,139,139
440 REM redefine characters
450 FOR I=1 TO N
460 LPRINT CHR$(27);"&";CHR$(0);
470 LPRINT CHR$(128+ASC(A$(I)));CHR$(128+
ASC(A$(I)));
480 LPRINT CHR$(M(I));
490 FOR J=1 TO 11
500 READ L(J)
510 NEXT J
520 FOR J=1 TO 11:LPRINT CHR$(L(J));:NEXT J
530 NEXT I
540 REM data for N characters
550 REM 11 items for each
560 REM data for GREEK
570 LPRINT
580 DATA 0,28,0,34,0,34,20,8,20,34,0
590 DATA 0,2,4,8,16,32,64,128,112,14,0
600 DATA 0,2,0,146,0,146,0,146,0,128,0
610 DATA 0,24,36,2,76,16,100,128,72,48,0
620 DATA 0,32,64,135,0,138,84,40,64,128,0
630 DATA 0,6,24,96,128,0,128,0,128,0,128
640 DATA 0,130,0,132,64,40,16,8,4,2,0
650 DATA 0,40,85,128,85,0,85,34,64,32,0
660 DATA 0,16,41,2,86,16,100,128,40,16,0
670 DATA 0,2,4,10,16,34,64,130,112,14,0
680 REM
690 DATA 0,0,76,162,16,130,16,130,76,0,0
700 DATA 0,3,12,48,68,0,4,8,52,64,0
710 DATA 0,6,24,96,128,0,128,6,152,96,128
720 DATA 0,34,0,34,20,8,20,34,64,2,0
730 DATA 0,0,20,42,0,42,0,34,20,0,0
740 DATA 0,1,0,177,8,66,136,66,140,64,0
750 DATA 0,32,18,12,2,0,4,8,16,48,0
760 DATA 0,34,4,56,0,32,0,32,28,34,0
770 DATA 0,128,120,5,128,127,128,5,120,128,0
780 DATA 0,0,64,60,0,64,0,64,63,0,0
790 REM
800 DATA 0,28,34,80,130,16,130,20,136,112,0
810 DATA 0,12,18,8,34,8,34,8,36,24,0
820 DATA 0,7,24,32,4,64,4,64,8,48,0
830 DATA 0,96,16,0,11,20,104,128,16,96,0

```

```

840 DATA 0,0,0,0,0,60,2,0,2,0,0
850 DATA 0,0,62,0,8,16,36,0,2,0,0
860 DATA 0,32,12,48,2,0,2,4,56,0,0
870 DATA 0,32,0,60,2,32,2,32,0,32,0
880 DATA 0,28,34,0,2,28,2,0,34,28,0
890 DATA 0,50,72,2,132,0,132,2,72,50,0
900 REM
910 DATA 0,48,72,1,68,1,68,1,70,32,0
920 DATA 0,127,128,4,160,4,160,4,88,0,0
930 DATA 0,6,56,192,16,0,16,6,56,192,0
940 DATA 0,6,24,96,144,0,144,0,144,96,0
950 DATA 0,2,0,134,64,170,0,146,0,128,0
960 DATA 0,2,132,72,32,24,36,2,64,128,0
970 DATA 0,12,16,34,0,34,0,52,8,32,0
980 LPRINT "English to Greek:"
990 LPRINT
1000 LPRINT "ABCDEFGHIJKLMNPOQRSTUVWXYZ"
1010 LPRINT CHR$(27);"4";
1020 LPRINT "ABCDEFGHIJKLMNPOQRSTUVWXYZ"
1030 LPRINT CHR$(27);"5";
1040 LPRINT "abcdefghijklmnopqrstuvwxy"
1050 LPRINT CHR$(27);"4";
1060 LPRINT "abcdefghijklmnopqrstuvwxy"
1070 LPRINT CHR$(27);"5";
1080 LPRINT
1090 LPRINT "Greek to English:"
1100 LPRINT
1110 LPRINT CHR$(27);"4";
1120 LPRINT "ABGDEZJQIKLMNXOPRSTYFHWU"
1130 LPRINT CHR$(27);"5";
1140 LPRINT "ABGDEZJQIKLMNXOPRSTYFHWU"
1150 LPRINT CHR$(27);"4";
1160 LPRINT "abgdezjqiklmnxoprstyhfwuc"
1170 LPRINT CHR$(27);"5";
1180 LPRINT "abgdezjqiklmnxoprstyhfwuc"

```

TURKISH

```

10 REM change type font
20 REM initialise printer
30 LPRINT CHR$(27);"e";
32 REM type style condensed enlarged
34 LPRINT CHR$(27);"!";CHR$(52);
40 REM copy original characters
50 LPRINT CHR$(27);"1";CHR$(0);CHR$(0);CHR$(0);
60 REM select download set
70 LPRINT CHR$(27);"%";CHR$(1);CHR$(0);
80 DEFINT I-N
90 DIM L(11)
100 REM number of characters to be re-defined
110 N=10
120 DIM A$(N)
130 REM N characters to be replaced
140 DATA [,w,/,!,w,q,l,x,X,0
150 FOR I=1 TO N
160 READ A$(I)
170 LPRINT A$(I);
180 NEXT I
190 LPRINT
200 REM if there are descenders in new chars.
210 REM then attribute is 11, otherwise 139
220 REM list of attribute chars.
230 DIM M(N)
240 FOR I=1 TO N
250 READ M(I)
260 NEXT I
270 DATA 139,139,139,139,139,11,11,11,11,11
280 REM redefine characters
290 FOR I=1 TO N
300 LPRINT CHR$(27);"&";CHR$(0);
310 LPRINT CHR$(ASC(A$(I)));CHR$(ASC(A$(I)));
320 REM attribute "a"
330 LPRINT CHR$(M(I));
340 FOR J=1 TO 11
350 READ L(J)
360 LPRINT CHR$(L(J));
370 NEXT J
380 NEXT I
390 REM data for N characters
400 REM 11 items for each
410 REM data for TURKISH
420 LPRINT "TURKISH"
430 DATA 0,0,28,162,0,34,0,162,28,0,0
440 DATA 0,0,60,128,2,0,2,128,60,2,0
450 DATA 0,0,34,0,62,0,2,0,0,0,0
460 DATA 0,0,0,66,0,254,0,66,0,0,0
470 DATA 0,60,64,130,64,2,64,130,64,60,0
480 DATA 0,56,68,1,68,1,70,0,36,0,0
490 DATA 0,25,128,37,64,37,64,37,128,30,0
500 DATA 0,32,84,1,84,1,86,0,84,8,0
510 DATA 0,72,132,33,132,33,134,32,132,24,0
520 DATA 0,120,132,1,132,1,134,0,132,72,0
530 REM test characters
540 FOR I=1 TO N
550 LPRINT A$(I);
560 NEXT I

```


MicroSight



NIMBUS VISION

A complete image capture system including an 80186 based microcomputer with high resolution graphics, mouse, a high quality vidicon camera and a video digitiser with up to 512 x 512 pixel resolution. Applications include video displays, image analysis, object counting etc. Complete systems from

£2950 + VAT

MICROSIGHT

For connection to a range of microcomputers, MicroSight systems can provide a low cost image capture facility up to 512 x 512 resolution either by scanning or frame grabbing. Packages including camera, interface, software for disk storage, hard copy and display are available for IBM PC, Apricot, Hewlett Packard, BBC Model B etc from

£900 + VAT

MICROEYE

Video interface with 512 x 512 x 8 resolution

£495 + VAT



MicroScale image analysis software to run with MicroSight Systems

- * Particle sizing and Orientation
- * User definable scaling
- * Hard copy and disk file dumping of results
- * Dimensioning
- * User definable windows

Available for IBM PC, AT, RML Nimbus, Hewlett Packard 9816, Apricot, BBC Model B etc from

£950 + VAT

For further details contact:-

DIGITHURST The image analysis people

Digithurst Ltd.
Leaden Hill, Orwell, Royston,
Herts. SG8 5QH Telephone (0223) 208926

NEW from **NEC...**



APC III dual
1.4MB floppy
from **£1499**
11MB hard disc
+ floppy
from **£2399**

STANDARD FEATURES

- **SPEED:** full 8MHz 8086-2 16 bit processor (true 16 bit data).
- **CAPACITY:** two 5 1/4 inch disk drives (640K each formatted).
- **MEMORY:** 128K user ram + 64K graphics + 8K text video.
- **OPERATING SYSTEM:** MSDOS 2.11 standard. Full screen ICON graphic display menu. (Needs 256K RAM).
- **HIGH RESOLUTION:** 8 x 16 dot screen character definition (25 lines of 80 characters). 14 inch high speed screen with tilt and turn base.
- **AWARD WINNING NEC 7220** graphic controller. 256 standard character set includes maths/Greek and graphic symbols.
- **ADDITIONAL 256** user-programmable shape character set.
- **DETACHABLE KEYBOARD:** fast buffered top quality keyboard, numeric keypad, 12 function keys enabling 60 functions to be programmed, with template.
- **SERIAL RS-232:** to 9600 baud synchronous/asynchronous.
- **PARALLEL** printer port.
- **TOP VALUE** from Japan's top micro company.
- **GW BASIC** Microsoft language standard, full graphic commands.
- **PRICE:** top value for money from:-
- **FREE SOFTWARE:** Communications, Text Editor, Typewriter.

OPTIONAL EXTRAS

- **EXPANDABLE USER MEMORY:** in 128K units to maximum 640K RAM.
- **10MB HARD DISKS:** INTERNAL OR EXTERNAL.
- **8 COLOUR MONITOR SCREEN.**
- **VERY HIGH RESOLUTION GRAPHICS:** 640 x 400 x 8 colour or mono graphic screen, up to 192K RAM additional to user memory.
- **32 BIT HARDWARE ARITHMETIC PROCESSOR:** 8087-2 at 8MHz — fast!

OTHER NEC BARGAINS

- NEC Spinwriter 20 chars/second, quality printer: **£425**
- NEC PC-8201 16K battery portable computer: **£299**

SOFTWARE

- ALL GENERAL MSDOS SOFTWARE.
- AUTOCAD:** CAD GRAPHIC DESIGN PACKAGE now available, best value hardware.
- ACCOUNTS:** Pegasus, Sage, Multisoft, etc.
- WORD PROCESSING:** Wordstar, Spellbinder, Lex, etc.
- LANGUAGES:** C, CB-86, CBASIC-86, Microsoft BASIC, COBOL, FORTRAN, PASCAL, PI/1, etc.
- DATABASE:** DBASE II, Rescue, Friday!, DataStar, Delta, etc.
- SPREADSHEETS:** Supercalc 2 and 3, etc.
- COMMUNICATIONS:** Asynch, SDLC.

* (prices exclude 15% VAT)

Brighton Computer Centre

130 Lewes Road, Brighton BN2 3LG
(0273) 673114 Mon-Sat 10am-6pm

Please send me further details of the NEC APC III

Name

Company

Address

..... Tel.....

Application PC 8/85

EXCLUSIVE

brother CE-50 Super

- Dual role – typewriter – printer
- Host of added features – 10, 12, 15, proportional, red/black, bold, centring, underline etc.
- Accepts – Std., Int'l., ASCII and Symbol daisywheels
- Ribbons – Correctable, Multistrike, Fabric and Coloured
- Integral parallel interface – direct connections to home and business computers
- Logic seeking, bi-directional printing – faster than Brother HR-15!!
- Without doubt – the most affordable printer ever offered
- Dataplus – UK Distributor, Brother CE-50 Super



ONLY £399 + VAT



DATAPLUS

DATAPLUS - PSI LTD 39-49 ROMAN ROAD
CHELTENHAM GL51 8QQ TEL: 0242-30030/37373 &
573573 (24 Hr) EASYLINK 19004620 TELECOM GOLD 83: JBC013

● Circle No. 168

NOW AVAILABLE

A LOW COST DISC BASED PROFESSIONAL ACCOUNTING PROGRAM

For The BBC Computer

"Micro-Trader"

INTEGRATED SALES PURCHASE AND NOMINAL LEDGERS

Designed for business use by a business man. "Micro-Trader" is a fully integrated program in which all Sales and Purchase Ledger Transactions are automatically updated to the Nominal Ledger.

"Micro-Trader" offers full Sales and Purchase Ledger facilities including SALES INVOICE and STATEMENT PRINTING with a capacity of 450 accounts and 3000 transactions per month in each Ledger.

Normal Income, Expenditure, Assets, Liabilities & Journal Posting in the Nominal Ledger with full Reporting for individual accounts, Audit Trail, Trial Balance, Profit & Loss and Balance Sheet.

"Micro-Trader" is certified by Customs and Excise for V.A.T. extraction. A V.A.T. Return produced in 2 minutes!!!!

STOCK CONTROL and MAILMERGE programs can be added

ONLY £200 + V.A.T.

PHONE TODAY FOR A FREE FACT SHEET

MEADOW COMPUTERS

HEBWEES MEADOW, LOWER EVINGAR ROAD, WHITCHURCH, HANTS.

Telephone: Whitchurch (025682) 2008

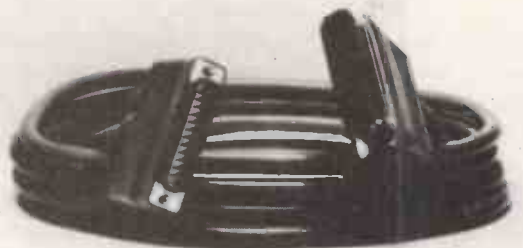
● Circle No. 169

Connexions
SPECIALIST COMPUTER CABLES

CABLES

Our low cost, high quality and fast helpful service has meant we are now established as the UK's top manufacturer of solder, IDC and moulded computer interface cables.

**For advice or a price
Phone 01-441 1282**



SMC SUPPLIES

11 Western Parade, Great North Road, Barnet, Herts EN5 1AD
Tel: 441 1282, 441 1698, 441 0535, 441 1225. Telex: 295181 SMC G

● Circle No. 170

BABBLING BOOKS

With the machine itself settling into maturity, Simon Beesley finds that books on the BBC Micro are waning in number but improving in quality.

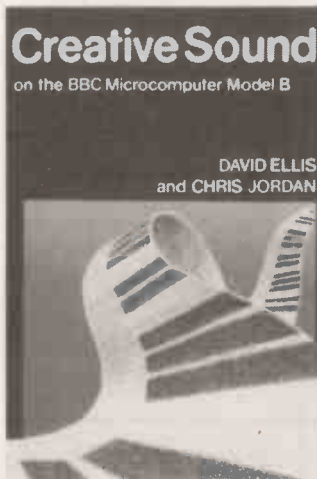
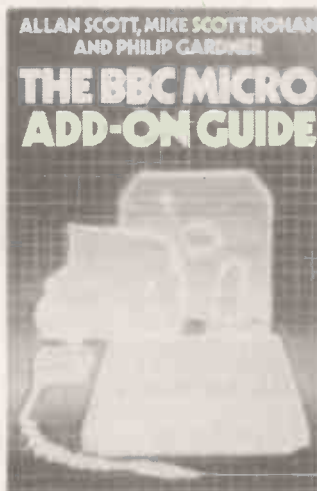
BBC OWNERS who fear that the machine will soon pass into obsolescence can take heart from the continuing flow of new BBC books. Admittedly it is not as great as it was: no longer the raging torrent of yesteryear, more a babbling brook. But the quality of these books is generally much higher now. Instead of being directed at an imaginary beginner who is perpetually baffled, most of them take a more practical and detailed stance.

The BBC Micro Add-On Guide is a good example. Without assiduously reading four or five computer magazines every month it is impossible to keep up with the range of new BBC products. This guide does it for you.

Naturally books of this sort soon become outdated. The prices given are already too high, particularly for disc drives which a few months later are almost 25 percent cheaper. There is also no mention of Acorn's Music 500 or the excellent AMX mouse and its icon-based software. Both products were released after publication. But the book manages to cover most of the add-ons currently available and, more importantly, gives a fair appraisal of each.

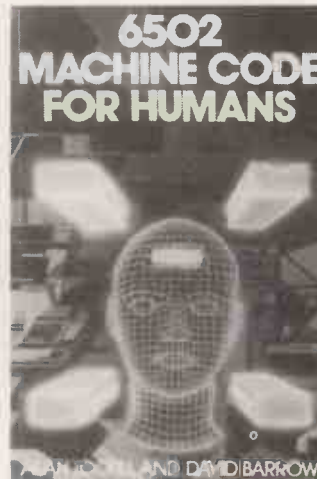
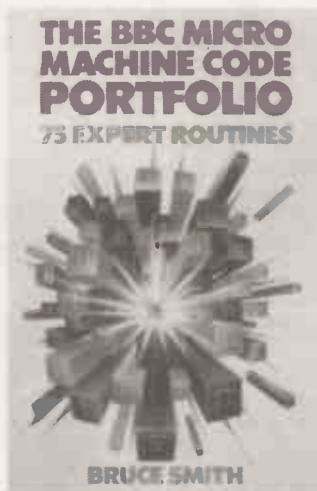
On the software front, *Business Applications on the BBC Micro* by Susan Curran and Margaret Norman provides a similar service. First the authors give a good account of what to expect from the various types of business programs — including specialised applications such as accounting and stock control. Then they supply reviews of most of the leading products. A pity, though, they could not get hold of a copy of View to round off their survey of word processors.

Hardware buffs who are prepared to wield a soldering iron are catered for by *Interfacing the BBC Microcomputer* by Colin Opie and *BBC Hardware Projects* by Don Thomasson. Of the two, Colin Opie's book is stronger on explaining the principles involved in interfacing. It gives more detail on how to program the hardware, including a useful section on programming the VIA. *Hardware Projects* is more for those who want ready-made projects to go to work on. Along with construction details it provides diagrams of circuits, boards, and connectors for



a variety of devices — light pens, hex keypads, 255-way controllers, and such like.

Disk Programming Techniques for the BBC Microcomputer by Michael Coleman is one of a series of personal computer books published by Prentice-Hall International. In common with the



rest of the series it is attractively produced and has the look of a high-quality textbook. But although it includes a very useful section on creating serial and random access files its treatment of the subject is not quite as advanced as one might hope.

A rather curious feature of the book is the author's practice of heading each chapter with irrelevant quotes — a bad habit probably caught from Boris Allan. His intention is humorous and after quoting Hamlet, "in form, in moving, how express and admirable", he comments: "Hamlet . . . had probably just succeeded in formatting his first ever disc".

Another book in the Prentice-Hall series is *Applied Assembly Language on the BBC Microcomputer* by Edward Ball. He says in the preface that books on assembly language are often dry texts on computer science: this one

BOOK REVIEWS

is meant to be more attractive to beginners. In fact almost every book on BBC assembly language makes the same claim. So, as you might expect, there is not much new material here. The two most interesting chapters are on animation and writing a word processor in machine code.

People who submit machine-code programs to magazines often apologise for the quality of their programming. What they need is not another course on assembly language but advice on how to write more efficient code. I have only seen one book that sets out to do this: *6502 Machine Code for Humans* by Alan Tootill and David Barrow. It tries to find the most effective code for a number of common tasks. While not specifically aimed at the BBC Micro its routines are easily modified.

However, you do not have to be fluent in machine code to write adequate programs. Rather you can simply cobble together routines that are already available. Bruce Smith's *The BBC Micro Machine Code Portfolio* is designed for just that purpose, and supplies 75 procedures ready to be incorporated in your own programs.

Creative Assembler can also be treated in the same spirit, as a library of routines, hints and tips. But coming from Jonathan Griffiths — the author of Acornsoft's superb Pacman game, Snapper — the book is something of a disappointment. There is too much on an elementary level, and not enough on the art of designing an arcade game.

The Advanced User Guide has become an essential reference work for BBC owners. Adder Publishing has followed it up with the *Basic ROM User Guide* by Mark Plumbley, which gives a comprehensive description of the workings of the Basic interpreter. Although it contains a number of handy example programs and a section on adding new commands it has less practical application

(continued on next page)

BOOK REVIEWS

(continued from previous page)

than the earlier book; but it is of considerable interest nonetheless. The two books stand as a model for how to produce a microcomputer reference guide: they are clearly written, well presented, and are largely free of padding.

Computer book titles often bear only a tenuous relation to their contents. Jeremy Ruston's *Advanced Programming Guide to the BBC Micro* is a case in point. Inside the cover it calls itself the BBC Micro Compendium and this is a better description for it. The author hops about from topic to topic — from recursive programming to floating-point arithmetic — until he finally settles down and hatches out

listings for two compilers, Froth and Slug. Froth is a threaded language similar to Forth, while Slug is a structured language which generates assembly language statements. Since Jeremy Ruston is a talented programmer this approach is quite fruitful. The book has some interesting snippets of information and a number of entertaining diversions such as a program for writing text on a tube.

Of all the books under review by far the best buy is *Creative Sound* by David Ellis and Chris Jordan. The authors are particularly well

qualified for their subject matter: David Ellis is a musician, composer and programmer, while Chris Jordan designed the BBC's Sound and Envelope commands. Their approach is to talk about the field of computer music in general and then show what is possible on the BBC Micro. The result, over 300 pages, is a book that is full of fascinating digressions and jam-packed with information. It ranges over such topics as the history of synthesisers, psychoacoustics, computer assisted composition, sound effects, and using micros

as musical trainers. Equally impressive is the accompanying software — over 200K's worth of Basic and machine-code programs given as listings and also available on tape or disc.

Creative Sound is probably not for the complete beginner, who may find it a little heavy going in places. Anyone else with just a smattering of musical or programming knowledge will certainly enjoy it. Indeed I can think of few computing books that I have read with as much interest as this one. [K]

BABBLING BOOKS

The BBC Micro Add-On Guide by Allan Scott, Mike Rohan and Philip Gardner. Published by Collins, £6.95. ISBN 0 00 383008 8

Business Applications for the BBC Micro by Susan Curran and Margaret Norman. Published by Granada, £7.95. ISBN 0 246 12530 6

Interfacing the BBC Microcomputer by Colin Opie. Published by McGraw-Hill, £8.95. ISBN 0 07 084724 X

BBC Hardware Projects by Don Thomasson. Published by Melbourne House, £9.95. ISBN 0 86161 139 X

Disk Programming Techniques for the BBC Microcomputer by Michael Coleman. Published by Prentice-Hall, £7.95. ISBN 0 13 215930 9

Applied Assembly Language on the BBC Microcomputer by Edward Ball. Published by Prentice-Hall, £7.95. ISBN 0 13 039389 4

6502 Machine Code for Humans by Alan Tootill and David Barrow. Published by Granada, £7.95. ISBN 0 246 12076 2

The BBC Micro Machine Code Portfolio by Bruce Smith. Published by Granada, £7.95. ISBN 0 246 12643 4

Creative Assembler by Jonathan Griffiths. Published by Penguin, £5.95. ISBN 0 14 00 7809 0

Basic ROM User Guide by Mark Plumley. Published by Adder Publishing, £9.95. ISBN 0 97929 04 5

Advanced Programming Guide to the BBC Micro by Jeremy Ruston. Published by Interface Publications, £7.95. ISBN 0 947695 21 4

Creative Sound by David Ellis and Chris Jordan. Published by Acornsoft, £9.95, £17.95 with cassette, £19.95 with disc. ISBN 0 907876 22 6

SOLVENT ABUSE?

FACT. Solvents can damage your disk drive.

FACT: Wet Disks can attract dust into your disk drive.

FACT. PRO-GUARD uses no Solvent.

FACT. PRO-GUARD disks are dry.

FACT. PRO-GUARD uses a brand new non-abrasive material.

FACT. PRO-GUARD is tested and approved by experts.



PRO GUARD

3 1/2 and 5 1/4 DRY CLEANING DISKS AVAILABLE NOW

EUROPEAN & UNITED KINGDOM TRADE ENQUIRIES WELCOME:
GUARDLINE DISPOSABLES LTD
1 WOLSEY ROAD
HEMEL HEMPSTEAD, HERTS
Telephone: (0442) 56860/47275

THE ELECTRONICS MAGAZINE
PROFESSIONALS CAN'T RESIST.

Wireless
ELECTRONICS &
World

84 advanced
microcomputer

Optical-fibre
communication

System
design

Electronics and Wireless World is the only electronics magazine to really tempt the professionals.

It's the only one they take the trouble to pick up for themselves.

That's because it's written for the engineer who sees electronics not only as a job, but also as a hobby.

It's written on a technical level that doesn't talk down to you.

It keeps you up to date with all the latest products and processes, applications and equipment.

And it covers every industry where electronics is involved.

Just one look at the new look magazine and you'll see why it gets professionals like you out of the office, and down to the newsagents.

**ELECTRONICS &
Wirelessworld**

The leading magazine for electronics engineers.

MAKE YOUR PC MULTI-USER FOR ONLY £595

IT SOUNDS UNBELIEVABLE BUT ITS TRUE!!

With **FORMULA IV**, the Applicator Creator, your computer system can become multi-user without the need for hardware modification. Formula IV is the **ONLY** software that will convert **IBM PC, XT, AT**, and compatibles into multi-user application systems.

Just connect two inexpensive terminals to your **PC and PRESTO!** — you have just created a true multi-user system that triples the power of your computer.

FORMULA IV contains a wealth of features, including a relational database system, a powerful query language, an on-line help facility, a free format report generator, plus menu generation capabilities. **FORMULA IV** combines the power of a computer language with the simplicity of a word processor.

PHONE TODAY FOR DETAILS OF THIS AMAZING PROGRAM.

Check our prices on these IBM compatibles

Ferranti PC860

Canon A200

Commodore PC10

Ring for software special offers

CARRERA COMPUTING

12 Lyons Avenue

Hetton-Le-Hole

Tyne & Wear

DH5 0HS

Tel: SUNDERLAND (0783) 267816 Open 7 days 9.00 a.m. — 9.00 p.m.

● Circle No. 177

LUTTERWORTH SOFTWARE

THE NUTCRACKER SUITE

Why use a sledgehammer to crack a nut? Most word-processors are too powerful, too complex and too expensive. The Nutcracker Suite's three programs are really easy to use. You can even print text as you enter it. Has word-wrap and paragraph reforming, plus line and page editing functions using every key in the most natural way. Reads and unscrambles Wordstar files. Saves and prints in 100% ASCII format. Special printer control program also included.

Winner C.T.A. Award Best Business Program 1984

THE ULTIMATE DIARY

Event based diary for every professional. Events can be entered with a frequency tag (e.g. every two weeks, every three months, annually, even every second Tuesday!), and will re-appear in all future reports. Reports for today's events, this week's events, this month's events. Calendar for any month up to 2083. Simple search routine (any field) with wild cards. Up to 5000 separate entries, which can easily be amended or deleted.

MICROFILE

Powerful flat form database. User can set field lengths and labels for any number of separate databases. Up to 16 fields and 32,767 records. Search or sort on any field. Print format options, allowing mail-merge, on both automatic and inspection basis. Superbly easy to use with all prompts on screen.

EACH PROGRAM IS ONLY £43 + VAT (£49.45)

FORMATS: IBM PC DOS/APRICOT MS DOS

Ask your dealer for a demo, or send cheque to:



LUTTERWORTH SOFTWARE,



126 NEW WALK, LEICESTER LE1 7JA (Tel. 0533 550822)

● Circle No. 174

PRINTER REPAIRS AND SERVICE TEL: 061-428 2014

- * DOT-MATRIX & DAISYWHEEL
- * COLLECTION & DELIVERY SERVICE
- * FAST TURNAROUND
- * 3 MONTH WARRANTY ON WORK
- * FIXED RATES — FIRM QUOTES
- * WORKSHOP CONTRACTS AVAILABLE

A + G COMPUTERWARE
PO BOX 34
CHEADLE
CHESHIRE SK8 4PT

● Circle No. 175

LAST WORD

By Boris Allan

INVESTIGATING MS-DOS

Should comparative benchmarks for disc operating systems be treated with suspicion?

More than any other facet of computers, the various forms of disc operating systems DOS do not lend themselves to simple comparisons. At a very simple level, how can I compare an MS-DOS implementation which provides 360K discs, with an Acorn DFS which gives a possible 400K per disc, but which splits the storage into two separate sides, each of 200K? Is the 400K of the Acorn DFS worth more or less than an MS-DOS 360K? Can the MS-DOS 360K store more information than the Acorn 400K?

In general, 360K for MS-DOS is worth more than a 400K for some other DOS versions because of the way in which the information is stored on the disc. For many versions of DOS, disc files are stored in contiguous sectors on the disc so if a file is erased, unfillable gaps may appear on the disc. Some DOS versions have commands such as Compact or Crunch which can be used to reorganise disc storage by moving files to fill empty sectors. If there is a good deal of disc file creation and manipulation within an application, compacting is a frequent necessity, as in UCSD Pascal.

MS-DOS uses a more sophisticated method of storing files, based on the idea of linked lists. Each section of a file in MS-DOS has a pointer to the next section, and so a particular file does not have to be stored in contiguous sectors. Therefore, with MS-DOS there is no need to Compact or Crunch — although it does help if files are tidied every so often, by use of Copy *.* from one disc to another.

So when investigating benchmarks for disc systems you need different kinds of benchmarks for different types of DOS. My first benchmarks were designed to compare the performance of the same version of DOS across several computers. Because of the increasing importance of 16-bit systems, I chose to start with PC-DOS/MS-DOS.

MS-DOS — in which I include PC-DOS — claims to be a fairly sophisticated system, and I decided that one of the features I would investigate would be the effects of different MS-DOS configurations. I decided to investigate only a few facilities at first and then examine the facilities over a fair

BASIC FILE CREATION PROGRAM

```
10 FOR I=1 TO 15:OPEN"o",I,CHR$(64+I)+".1":NEXT I
20 FOR M=1 TO 10
30 FOR I=1 TO 15
40 FOR J=1 TO 60:PRINT# I,"rstuvwxyz":NEXT J
50 NEXT I
60 NEXT M
70 FOR I=1 TO 15:CLOSE I:NEXT I
80 FOR I=1 TO 15:OPEN"o",I,CHR$(64+I)+".2":NEXT I
90 FOR M=1 TO 10
100 FOR I=1 TO 15
110 FOR J=1 TO 60:PRINT# I,"rstuvwxyz":NEXT J
120 NEXT I
130 NEXT M
140 FOR I=1 TO 15:CLOSE I:NEXT I
150 FOR I=1 TO 15:OPEN"a",I,CHR$(64+I)+".1":NEXT I
160 FOR M=1 TO 10
170 FOR I=1 TO 15
180 FOR J=1 TO 60:PRINT# I,"rstuvwxyz":NEXT J
190 NEXT I
200 NEXT M
210 FOR I=1 TO 15:CLOSE I:NEXT I
```

number of different MS-DOS configurations — by which I mean different ways of setting up MS-DOS for the same computer.

As the storage of files in MS-DOS is by the linked-list system, I produced a special disc with files having many non-contiguous sectors. The example disc was produced by running a short Basic program which produces a disc with 30 files.

The way in which the first 15 files — those with extension .1 — are created means that

consecutive elements of the files are very widespread. These first 15 files are produced a portion at a time, in 10 distinct sections. The next 15 files — with extension .2 — are created in a similar manner, and finally the first 15 files are extended even further with another 10 sections.

Each of the files with extension .1 occupied 13,312 bytes, and the files with the .2 extension occupied 6,656 bytes. But there were many non-contiguous sectors for both types of file. There were 55,296 bytes free on a 360K disc.

The configuration of MS-DOS is altered by use of a Config.Sys file. The first element of the configuration to be altered was the number of disc buffers by forming a Config.Sys file with varying Buffers= commands. In MS-DOS, a disc buffer is 0.5K of memory set aside for intermediate storage of disc files. The default number of buffers is two, and thus the total disc buffer area is 1K. The number of buffers can be set to 98 — that is 49K — and so I wanted

(continued on next page)

ADVANCE 86B RESULTS

Buffers	Format	Mixed copy	Clean copy
2	41.4	100.3	99.4
10	41.5	97.8	93.0
20	41.4	98.0	93.7
30	41.7	98.0	94.3
40	41.6	98.4	93.4
50	41.6	98.4	93.4
60	41.5	129.1	105.2
70	—	138.8	118.0
80	41.7	124.0	94.7
90	41.4	122.7	93.1

Timings in seconds.

(continued from previous page)

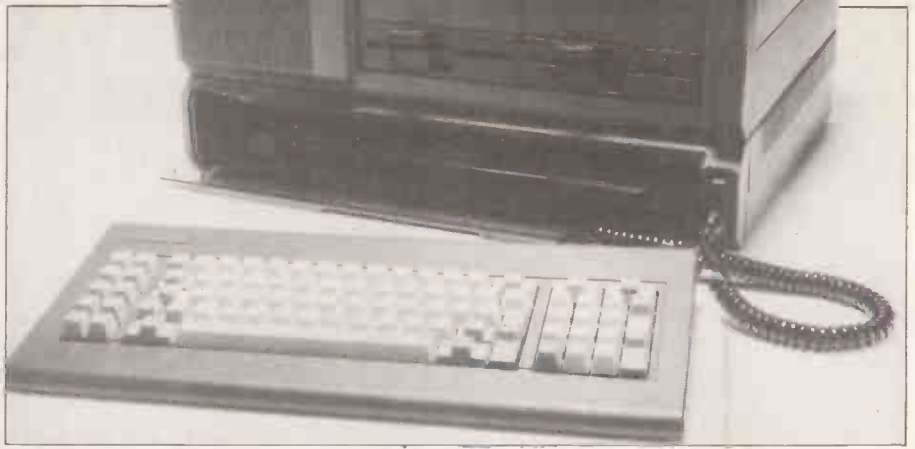
to investigate performance with varying numbers of buffers. Later I was going to examine the effects of other parameters.

The investigation used three tasks: formatting a disc; copying the standard mixed disc files by use of Copy *.* B:; and taking the new, clean arrangement of files on the second disc, and copying those to a new disc.

The first task was introduced because essentially it is independent of the buffers, and thus should not alter in time taken. The copying of the mixed files was set as a worst-case scenario, which could then be compared to the third task. The intention was to investigate the extent to which non-contiguous files slowed down copying.

The results for the Advance 86B are shown in the table. They indicate that special attention should be paid to the results for 70 buffers. The time taken to format a disc is effectively constant, except for the case of 70 buffers. In the case of 70 buffers it was impossible to format, and bad disc sectors were reported. Both types of copying worked for 70 buffers, but there was a degradation in performance, tailing off either side of 70 buffers.

As MS-DOS takes up 29K, and 70 buffers is equivalent to 35K, the DOS and buffers were taking up 64K of memory. The Intel 8086/88 processor divides memory into 64K segments, and to move from one segment to another requires a modification of the segment register. Unlike, for example, the



All MS-DOS buffers behave badly when 70 buffers are set, not just the Advance.

Motorola 68000 series, there is no simple address register which can point to anywhere in memory. An address register for the 8086 can only point to 64K, and which 64K is determined by the segment register.

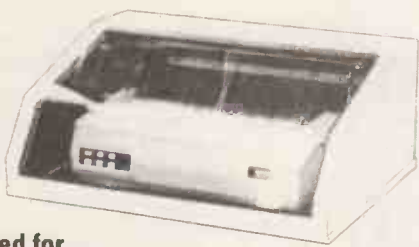
The problem with MS-DOS on the Advance 86B seems to be tied into the use of segments, and it seems as if the handling of inter-segment addressing is not as clean as it should be. The next question was to establish whether the possible inter-segment confusion was a specific Advance 86B problem, or a general MS-DOS design fault. Chris Williams examined the effect of setting buffers to 70 on other MS-DOS machines, including the IBM PC.

All the MS-DOS/PC-DOS machines

examined so far were found to have problems with 70 buffers. For an Apricot with 256K the system claims to have run out of memory, and the machine is completely paralysed. The extra problems for the Apricot may be due to the lack of a DMA chip, but I do not have any real explanation. The unreality of specifying 70 buffers is immaterial, because there should not be strange results for a standard facility. This particular MS-DOS fault for all machines examined is indicative of a basic design flaw which may have other, less obvious, consequences. What this has shown is that benchmarks designed to really test a DOS can have a far wider utility than merely comparing speeds. PC

Lynnem Acoustic Hoods

As approved and recommended by British Telecom and IBM.



Designed for today's office

Lynnem Computer Products have over 15 years experience in providing the complete solution to the problems of noise caused by today's office equipment.

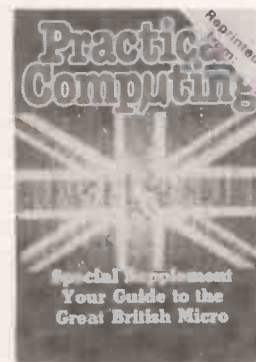
Built to meet your exact requirement

So before you buy an acoustic hood talk to our experts and compare ours with the Rest!

Lynnem Computer Products Ltd
277 London Road, Burgess Hill
Sussex RH15 9QU Tel: 04446 3377/6632

REPRINTS

a ready made sales aid



If you are interested in a particular article or advertisement in this publication why not take advantage of our reprint service. We offer an excellent, reasonably priced service. For further details and a quotation

Ring Michael Rogers on 01-661 3457

Telephone Simon Vickers 01-661 8163

ADVERTISEMENT RATES

Copy Date

Rates quoted below are subject to the addition of 15% VAT.

Display Rates

£18.00 per single	
Column Centimetre	
Minimum 5cm x 1 col	
One Insertion	: £18.00 per scc
Three Insertions	: £17.25 per scc
Six Insertions	: £17.00 per scc
Nine Insertions	: £16.50 per scc
Twelve Insertions	: £16.00 per scc

Micro Ads.

Lineage 40p per word minimum of 20 words. Prepayable.

Shopwindow advertisements for the October edition will be accepted up to 25th August subject to space being available.

Post to

Practical Computing, Classified Department, Room H211, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

FORTH = TOTAL CONTROL

FORTH 83 — Professional FORTHS from Laboratory Microsystems. Screen editor, assembler, utilities, full documentation. Special version for IBM PCs and 100% compatible. State disc format with order. CPM-80 £95+VAT, CPM-86/MS/PCDOS £190+VAT.

QL FORTH-83 — screen editor, macro-assembler, decompiler, turnkey compiler, binary overlays, floating point, colour, graphics, sound, 'hash cache' fast compiler, and 70 page manual — £29.95.

NEWBRAIN FORTH in PROM — includes screen editor, full integration to NEWBRAIN i/o handlers, Z80 macro-assembler, floating point, graphics, decompiler, utilities, and manual — £51.75.

ORAGON FORTH cartridge — split screen editor, sound colour, decompiler, overlays, joystick and timer support, full documentation, and complete source code — £35, CoCo version £45.

Do-it-yourself FORTH. Installation manual — How to do it, model, definitions, editor — £7. Source code: 6502, 6800, 6809, 8080, Z80, 8086/8088, 9995, 1802, 68000, Z8000, VAX, Apple II, LSI-11 — £7 each.

Implementations for Spectrum to VAX, and a range of FORTH books. **81**



MicroProcessor Engineering Ltd
21 Hanley Road, Shirley
Southampton SO1 5AP
Tel: 0703 775482

• Circle No. 320

CAPTURE THE FUTURE WITH YOUR MICRO

Bored with games and want to do something worthwhile? Finding manuals difficult and frustrating? Do you want the advantages of programming skills? Do you want your own 'expert' to show you how to do it?

Then you need

'TAKING CONTROL OF YOUR MICRO'

- * EASY and ENJOYABLE steps to practical BASIC
- * EXAMPLES to see and EXERCISES to do
- * FEEDBACK MODULES give you PERSONAL GUIDANCE
- * STRUCTURED for HOME, SCHOOL and COLLEGE
- * For BBC SPECTRUM and COMMODORE micro-computers

TAKING CONTROL OF YOUR MICRO gives you the helping hand you need to gain the skills, advantages and benefits in TOMORROW'S WORLD.

Price only £25.00 includes delivery UK. Please state your micro

Contact: SS software

18 Fernbank Drive, Eckington, Sheffield S31 9HG
DON'T BE LEFT BEHIND >>> MAKE 1985 YOUR YEAR TO LEAP

AHEAD **103**

• Circle No. 322

Superbrains
NEW OR SECOND HAND
WE BUY, SELL + REFURBISH

MICROMODS.LTD.
53 ACTON RD., LONGEATON, NOTTINGHAM
NG10 1FR. Tel: 0602-724264 **32**

• Circle No. 323

SCIENTIFIC SUBROUTINE LIBRARY

VOLUME 1 — STATISTICS AND CURVE FITTING

Mean, SD, Normal Distribution, Partial Expectation, Chauvenets, Criterion, Least Squares Fit to a Polynomial and Arbitrary Function, Repetitive Least Squares Fits, Covariance Matrix, Chi-Squared Statistic, Matrix Inversion, Solution of Linear Simultaneous Equations.

VOLUME 2 — LINEAR PROGRAMMING

Reduction of a Simplex Tableau, Integer Programming, Partial Integer Programming, Conversational Linear Programming System, Least Cost Mix Problem.

VOLUME 3 — FURTHER STATISTICS

Ranking, Quantiles, Frequency, Correlation Coefficient, T, Chi-Squared and F Distributions and their Inverses, T Test, Chi-Squared Test, Wilcoxon Test, Linear and Multiple Regression, ANOVA 1-way and 2-way.

VOLUME 4 — TRANSFORMATIONS AND SORTING ALGORITHMS

Fourier and Fast Fourier Transforms, Numerical Integration and Differentiation, Harmonic Analysis, Interpolation, Coordinate Transformations, Exchange Sort, Quicksort, Shellsort, Tree Sort. All routines are written in BASIC for easy implementation on any machine.

Machine readable source code — £75 plus VAT per volume.

(Most disk formats plus QL microdrive now available)

Manuals including full source listings with implementation notes and documentation — £25 per volume.

CP/M TO DEC FILE TRANSFER

Software to read and write RT-11 format RX01 diskettes under CP/M80. Supplied on 8" SSSD diskette — £25 plus VAT.

SERVICES

Micro Logic Consultants specialise in scientific data processing and the interfacing and control of laboratory instrumentation. We can advise you on the best approach to your problem, or provide a complete solution. Contact Derek Clifford on 0860 319482.

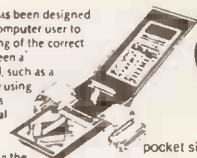
MICRO LOGIC CONSULTANTS LTD.

57 Station Rd., Southwater, Horsham,
W. Sussex RH13 7HQ
Telephone 0403 731818

• Circle No. 321

SUSS BOX

The DUPLEX SUSS-BOX has been designed to enable the less skilled computer user to have a better understanding of the correct working connection between a computer and a peripheral, such as a printer. This is achieved by using the commonly used signals (wires) of the RS232C serial data cable specification, a matrix-block and special connector pins. By inserting the connector pins into the SUSS-BOX's matrix-block at the axis of two incoming signals the user can quickly establish a firm connection. The signals are routed into the SUSS-BOX by two 25 way D type connectors: 1x female, 1x male. The SUSS-BOX also provides a lamp for each signal to show its condition when connected in line, ie high or low. SUSS-ADAPTOR & CABLES available.



£59.95
+ £1.25 P&P
+ VAT

CWO

OCTET/HERMIT

Typewriter Interfaces



Ideal for
TELECOM
GOLD

ADD ON TO THE OLIVETTI ET121 OR HERMES TT21 ELECTRONIC TYPEWRITER AND HAVE THE BENEFITS OF THESE FEATURES:

- A DAISY WHEEL PRINTER for your computer
- A COMPUTER TERMINAL (True KSR)
- A TELEX TERMINAL using the Duplex DIAL-TEXT mode
- A COMMUNICATING TYPEWRITER (DIAL-TEXT Compatible)
- A REMOTE PRINTER (using DIAL-TEXT mode)

• New
LOW
prices

DUPLEX COMMUNICATIONS (UK) LTD.

2 Leire Lane, Duntun Bassett, Nr. Lutterworth, Leicestershire LE17 5JP
Tel. 0455 202154 **107**

• Circle No. 325

LOW PRICES IN THE NORTH WEST?

PCs	Ex. VAT
APRICOT 256K 2x315K Drives & Mon.....	£1345.00
APRICOT 256K 2x720K Drives & Mon.....	£1545.00
APRICOT Xi 256K 10MB & Mon.....	£2200.00

PC SOFTWARE

WORDSTAR 2000.....	£295.00
FRIDAY.....	£135.00
PEGASUS LEDGER MODULE.....	£200.00
PSION EXCHANGE.....	£345.00
ESTIMATOR.....	£245.00

PC PRINTERS

EPSON LQ 1500 200 cps.....	£895.00
STAR SR-15 MATRIX.....	£475.00
SILVER REED EXP 770 (p).....	£675.00
OLIVETTI DY 450 45 cps (p).....	£780.00

The above are only examples
Ring now for your low price deal

CITY COMPUTERS
Queens House, Queens Road
Chester CH1 3BQ
Tel: 0244 47019 **110**

• Circle No. 326

SPECIAL OFFER

3 1/2" FUJI Microdisks

SS/DD £29.95
DS/DD £39.95

5 1/4" FLOPPY DISKS

PRICES PER BOX

	1-4	5-9	10+
SS	29.95	29.50	28.10
DS	39.95	39.30	38.70

Full Lifetime Guarantee

99P EACH (Some in that EXCL. VAT)

REPLACEMENT GUARANTEE
If any disk should fail, return it for free replacement.

SEE10 LIBRARY CASES (Hold 10 disks)

5 1/4"	1-4	5-9	10+
3 1/2"	1.95	1.85	1.75
	1.85	1.68	1.75

DELIVERY

Disks (per box)	1-4	5-9	10+
Library Cases	75p	50p	40p
Library Cases (free with disk)	60p	30p	25p

HOW TO ORDER

To total order value add Delivery, then add 15% VAT and send to:

IDS Computer Supplies
P.O. BOX 416, BANCROFT, MILTON KEYNES MK13 0QX. Tel: (0900) 310895. **104**

• Circle No. 324

BUSINESS OR SERIOUS HOBBY

THE ONLY WAY YOU WILL BEAT OUR NORMAL PRICES IS TO JOIN OUR DISCOUNT GROUP. WE DARE NOT PRINT THEM!!
Apricot, Atari, Amstrad, Brother, Cannon, Commodore, Cumana, Enterprise, Epson, GCC, Juki, Mannesmann Tally, Mitsubishi, Opus, Philips, Sanyo, Sakata, Soryyivemissedyou, Sinclair, Solidisk, Tatung, Torch, Triumph, Adler.

THIS MONTH'S SPECIAL

CANON PW 1080A NLO Dot Matrix £240 + VAT - £276.00 Inc. VAT
ACORN MUSIC 500 FM Synth £150 + VAT - £172.50 Inc. VAT
AMSTRAD 664 Colour + Drive £374 + VAT - £430.10 Inc. VAT
GREEN SCREEN MONITOR 9" HI-RES £43 + VAT - £49.45 Inc. VAT

We carry most leading brand names.

For more information on how to get our monthly price list of genuine discount prices and details of the other services we offer, contact:

COMPUTER DISCOUNT GROUP

8 WESTWOOD LANE, WELLING, KENT, DA16 2HE

TELEPHONE: 01-301 3745/03224 48561

102 CALLERS BY PRIOR APPOINTMENT ONLY

• Circle No. 327

USED MICROCOMPUTERS at BARGAIN PRICES

We have a number of 8 and 16 bit micros for sale which are surplus to our requirements.

These include:

Apple II inc CP/m £400
North Star Horizon £450
Columbia Portable £1025

Phone or write for details of these and others.

The SOFT OPTION (UK) Ltd. School Lane, Colsterworth, GRANTHAM, Lincs (0476) 860171

111

• Circle No. 328

FERRANTI 'ADVANCE 86b

Still available for under

£800 (128Kb module)

also Printers from £199 & Screens from £90

LONGSEER LIMITED, FREEPOST 19

Middletons Lane, Norwich Norfolk, NR6 5BR.

Tel: (0603) 487199

110

• Circle No. 329

ATTENTION PC/MS DOS SOFTWARE DEVELOPERS

PROGRAMMERS TOOLKIT FOR IBM PC AND COMPATIBLES

A set of 14 utility programs providing UNIX-like facilities under PC-DOS or MS-DOS.

Package Includes:

MAKE equivalent to UNIX make command, rebuilds programs with minimum recompilations after one or more source files modified. Same spec as UNIX version, including macros, built in and definable rules and 11 command line options.

XCOPY equivalent to UNIX copy command (plus extra features). Copies files, directories, or whole file trees. l command line options, including archive option which copies only files modified since last backup. Also permits disk change it destination fills up part way through operation.

grep (pattern matcher), WC (word count), ls (file list), tee (for splitting pipes), cat (file concatenation), rm (file remove), find (searches tree for files), touch (updates file date/time stamp), mv (moves files), hd (hex-dump), chmod (changer file attributes)

All the above accept starnames, where relevant, and multiple arguments (eg grep main *.c)

£59.95 free postage

Demo Diskette also available for £3, this demonstrates how the above are used and produces sample output. (included in full package)

AXIS SOFTWARE, Orient House 42/45 New Broad Street, London EC2M 1QY

mail order only please

114

• Circle No. 330

DISK COPYING/FORATTING/ FILE TRANSFER

WE CAN TRANSFER YOUR DATA BETWEEN OVER 500 DIFFERENT MACHINES.

FORMATS INCLUDE:

CPM, CPM86, MSDOS, PCDOS, UNIX, XENIX, TAR, RT11, MDOS, IBM BEF, ISIS, FLEX, VICTOR SIRIUS, TORCH, ACORN, MISC. TYPESETTING/WORD PROCESSING

* OVERNIGHT SERVICE — most formats returned by next day's Post
* £10.00 + VAT per copy (Blank disks not included)
* DISCOUNT for Bulk



A.L. DOWNLOADING SERVICES
MAIL ORDER UNIT 101
11 PARKWAY
LONDON SW14 4JZ

109

• Circle No. 331

SECOND USER EQUIPMENT NETWORK UPTO 254 MICROS with a 10 mbyte MICROMITE FILESERVER complete with 3 "Apple" interface boards and cables Interface Boards for other Micros are readily available for ACT SIRIUS: Epson QX10; IBM PC

Maintenance available from Micromite Services Ltd

Cost New over £8,000

Offers around £4,000 please

Also 3 seconduser Epson HX20

computers available @ £200 each

CONTACT: Tim Woodruff, Valldata Services Ltd OAKWOOD HOUSE, SPA ROAD, MELKSHAM, WILTS (0225) 705957

108

• Circle No. 332

CAPTURE THE FUTURE WITH YOUR MICRO

Are you bored with games?
Do you find manuals difficult and frustrating?
Do you want the advantage of programming skills?
Do you want your own 'expert' to show you how to do it?
Then you need 'TAKING CONTROL OF YOUR MICRO'

- * Easy and enjoyable steps to practical BASIC.
- * Examples to see and exercises to do.
- * Feedback Modules give you Personal Guidance.
- * Structured for home, school and college.
- * For BBC Spectrum and Commodore micro-computers.

TAKING CONTROL OF YOUR MICRO gives you the help you need to gain the skills, advantages and benefits in TOMORROWS WORLD.

Price only £25.00 includes delivery UK. Please state your micro.

Contact:

SS Software, 18 Fernbank Drive, Eckington, Sheffield S31 9HG. 101

Don't be left behind. Make 1985 your year to leap ahead.

• Circle No. 333

SEX PROBLEMS?

Solve all your RS232 problems with our universal cable. Plug and socket at both ends of the one metre cable.

Price £29

GENDER CHANGERS

M m3,£180, M F=£17.00, F F=£16.00

All are 3' long

ALSO

One metre Centronics cables:
Amstrad £13.00
BBC £11.20
IBM £30.00

One metre RS232:
Commodore 64 £30.00
Epson PX-8 £20.00
Epson HX-20 £16.00
Please add £2.00 per metre to above prices for longer lengths. All prices include VAT, Postage, and Packing in Europe.

See our range of computer/printer cables, communications cables, custom cables, interfaces, data-switches.



WATCH THIS SPACE FOR FURTHER DETAILS OR ring our 24hr answering service on (0223) 322394 TYPED LTD, 30 CAMPKIN ROAD, CAMBRIDGE CB24 2NG.

DEALER ENQUIRIES WELCOME

115

• Circle No. 334

SHOP WINDOW

CP/M USER groups disk. Libraries. 300 +, volumes, £1.50/vol. Copying free. Also disk format translation, £6.50/DSK. Most formats possible. SAE or phone R. Smith, 138 Holtye Rd., E. Grinstead, Sussex RH19 3EA. (0342) 313883. 169M

SOFTWARE. Probably your cheapest inclusive source. Eg, WordStar 2000 £340, WordStar Professional £285, Lotus 1-2-3, £355 including VAT, carriage. Call Scimitar Business Services. (0705 823052, evenings) to discuss your requirements. 179M

TRS 80 Model II £600 + VAT. Model IV with integral 5M hard disk £1,300 + VAT. Model 100 32K £350 + VAT. Also printers and cassette. Ring Southampton (0703) 551582 any time. All with guarantees. 184M

COMPUTER WEEK. 9-14 year olds, 27-31 August, daytime, Berkshire. Write: Avion Leisure Care, 62 Elder Road, Bisley, Surrey. 187M

TANDY TRS 80 Model 2, 64K, two printers, 1 Daisywheel, software, WP and accounting manuals, Inmac discs and tapes equipment, very little used. Plus training £2,200 o.n.o. Tel. 07842 52031. 195M

SHARP MZ700, 711, 713 software for home and business. I.E. "Stockcontrol 750" £29.95. "Programmers Kit" (for Basic) £15.95, etc. C.W.O. or SAE for complete list. Maysoft (DMB), 50 Thompson Avenue, Colchester. Essex CO3 4HW. 197M

CASIO — Portable Computer (P.B. 700). 16K + FA.10 Interface printer, + micro-cassette. RRP.£492. Bargain at £260. Tel: 01-373 0645. 199M

BBC, Cumana 40 track dual discs, colour monitor, 32K sideways RAM, speech synth, Beasty controller, Shinna printer, Pascal, Exmon, Wordwise, disc Doctor, and other Roms, much software including Forth. £1100 ono. Phone: 04207 443 after 6pm. 200M

SIRIUS 1.2meg TWIN floppy disc with green screen £1050 ono Sirius 10 meg, green screen. Good condition software available. Phone 0423 57126. 201M

AMSTRAD SHARP MZ700 Spectrum software the cheapest games software around prices between 75p to £1.75 send SAE to Pacetapes 40 Bainton Grove, Clifton, Nottm. NG11 8LG. 202M

IBM SOFTWARE: Lotus 123, Wordstar, Wordstar Professional, dBase II, dBase II tutorial, dutil utilities, quickcode program generator. All with accompanying literature and never been used. £400 or will swap for Sinclair QL. 01-624 1816. 203M

FUTURE FX20 TWIN 820K disk drives 128K RAM with CP/M86 MS DOS Supercalc 2 Spellbinder Dastatar etc. V.Iittle used & still under manufacturers guarantee £1250 o.n.o. Also available EPSON RX80F/T printer offers? Telephone Oxford (0865) 882604 evenings. 204M

SUPERBRAIN Z80 CPM with integral Monitor, discs & keyboard. QD Model (2x350Kb), enhanced with many useful features including Micromods "Supervid" video enhancements and excellent Superbios operating system. Superbios provides capability of reading other 5" floppy formats in addition to many other enhancements. System also equipped with an 8" disc making it ideal for software developer. Can be expanded with Winchester if needed. £700.00 plus VAT. buyer collects. Tel: DEAN (0594) 562256. 205M

CP/M-IBM user group. disk libraries 800 + volumes 12000+ items also cheap disk format translation service most formats possible. Sae/Tel R. Smith 138 Holtye Rd., East Grinstead, Sussex RH19 3E (0342) 313883 211M

SHOP WINDOW

RAIR BLACK BOX and ICL PCs (8 bit). Bought sold exchanged repaired and advice given. Ring 0628 71243 (Maidenhead). 206M

COMMODORE 9090 7½Meg hard disk perfect order £850 ono Keith Webb Tel 0386 792785 any day/evenings (suits any 8000 series). 207M

TRS-80 MOD I, 48K, two disks, Epson dot-matrix printer with Grafrax +. LDOS V5.1.3 DOS, visicalc, books, manuals. CPU enhancements: lower case, extra reset, screen de-glitch. £695 (0602) 761566 day, (0949) 37586 evenings. 208M

SCIENTIFIC COMPUTER SIMULATIONS for the Spectrum 48K. Electrodynamics, rotation, gravity, relativity. For further information contact: Anlma Scientific Computing, 23 Crawley Avenue, Hebburn, Tyne & Wear. Telephone 0632 832825 & 0632 834556. 209M

SHARP MZ80B + 64K + MZ80FD dual floppy drive + MX80 P6 Tractor friction printer. All interfaces, G-Manual. 100's business/games program Assembler/Disassembler cheapest anywhere £1,900, will accept £1,400. Tel. No. 0454 413511. 210M

SUPERBRAIN for sale. 64K CPM with 10Megabyte integral Winchester disk £995 or nearest offer. Phone Brian Taylor 0422 41152. 212M

WORD PERFECT, The Report-Writer's dream, available at only £285 (incl. carriage, VAT) from Scimitar Business Services, Portsmouth 823052 (evenings). 213M

PRACTICAL COMPUTING, all issues to date including launch issue July/August 1978. Offers to 8 Kingsland Gardens Close, Plymouth, Devon. 214M

APRICOT Xi10-S, 512K RAM 10MB hard disk, 12" monitor. Complete new unrequired system and carry cases. Software includes: Wordstar, Superwriter, Supercalc, Superplanner, £2,750 + VAT. 042 482 417. 215M

COMPETENT person required to write, control and graphics program for science education. 380Z Apple or BBC. Indicate experience. Box No. 216 216M

TANDY Business Systems, TRS 80 Mod. I, 48K, double density, upper/lower case, numeric pad, twin 40-track drives double density 360K, twin 80-track drives double density 720K, Tandy Lineprinter VIII, with all covers and cables on Tandy System Desk in perfect working order, including complete set of accounting software, word processor and spreadsheet, £750, will split. Tel. (028 373) 3574. 217M

IBM PC compatible Business Computer, with monitor and Epson RX80 F/T printer. Twin half-height 360K drives, 256K memory, 8 expansion slots, will take internal hard disk, complete with PC DOS 2.11 etc. £1,495. Tel. (028 373) 3574. 218M

TANDY TRS 80 Model III, 48K, twin 40-track drives, £550, Lineprinter VIII £100, twin 40-track D/D external drives, half height £175, twin 80-track D/D external drives £150, all with cables and covers. Tel. (028 373) 3574. 219M

DISK COPYING SERVICE

Moving data and program files from one machine to another is often made difficult because different manufacturers have adopted different disk format standards.

We can copy your files to and from over 250 disk formats including CP/M, CP/M-86, MS-DOS, PC-DOS, ISIS, APPLE, SIRIUS, TORCH, APRICOT, HP150, DEC RT-11, and IBM BEF.

Disks are normally despatched on the day they are received.

Our charge is £10.00 + disk + VAT. Special prices for quantities.

For more information call us.

GREY MATTER

4 Prigg Meadow, Ashburton, Devon TQ13 7DF. TEL. (0364) 53499 10

● Circle No. 335

When replying to Classified advertisements, readers are recommended to take steps to protect their interests before sending money.

SELL IT WITH

PRACTICAL COMPUTING

SHOP WINDOW

MICRO ADS. Order Form

Classified Rates

Lineage 40p per word
Minimum 20 words prepayable.
Box No. £7.00 extra

Display Adverts.

Rate per single column
Centimetre: £18.00
Minimum 5cm
SERIES Discounts
Available on request
Contact: Simon Vickers on
01-661 8163.

Method of Payment

Cheques etc should be made payable to BUSINESS PRESS INTERNATIONAL LTD. and crossed. I enclose herewith cheque/PO for

£.....

Post to:

Cut out the order form and return together with your remittance to:
Classified Department,
Practical Computing,
Room H211, Quadrant House,
The Quadrant, Sutton,
Surrey SM2 5AS.

Conditions of Acceptance

Micro Ads are accepted from Private readers only and must be submitted on (or a photocopy of) this order form. All Advertisements must be prepaid.

Please insert the following advertisement in Practical Computing				LINEAGE		
				Cost per insertions		
				1 Ins.	15% VAT	TOTAL
				£6.00	£0.90	£6.90
				£8.00	£1.20	£9.20
				£10.00	£1.50	£11.50
				£12.00	£1.80	£13.80
				£14.00	£2.10	£16.10
				£16.00	£2.40	£18.40
				£18.00	£2.70	£20.70

Box No. Required YES/NO

No. of Insertions
(50p discount for 2 ins.)

NAME (Please include initials) _____

ADDRESS _____

THIS FORM SHOULD BE RETURNED BY 25TH AUGUST FOR THE OCTOBER ISSUE

Company Registered Number: 151537 (ENGLAND). Registered Office: Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

PEGASUS ACCOUNTING

Regarded by many accountants as the very best accounting software available. Pegasus comprises eight modules, most of which will operate alone or will work together in a totally integrated system. We have professional staff, in London and the Midlands, fully trained to install and support Pegasus. Prices and details on request. We are authorised Pegasus dealers.

COMPUTER-AIDED DESIGN

As specialist consultants in this field we can supply either software only or a total system configuration with full support. We are suppliers of AUTOCAD, DOODLE and a number of other CAD packages. The productivity benefits of CAD are enormous — the cost of a system is almost certainly much less than you would expect. In most cases our clients have found a system pays for itself within 3 to 12 months!

MULTISOFT ACCOUNTS

A system offering top-level functionality at a very reasonable price. Recent press reviews have highlighted Multisoft as one of the most powerful micro-based accounting systems currently available. We concur. Very impressive indeed! Please telephone for further information. We are officially appointed Multisoft dealers.

CHIT-CHAT

The new telecommunications package from Sagesoft which we feel represents outstanding value for money.

- Micro-to-micro file transfer.
- Top of the range EMI Datatek modem.
- Free subscription to Telecom Gold (worth £100).
- Access to Viewdata and Prestel.
- Electronic mail, telecommunications and telex. List price £399 our price £325.

BEST UK SOFTWARE PRICES?

0629-3021

- * Over 400 leading software packages
- * Independent advice in making your choice
- * Professional staff + network of consultants
- * Most formats. All programs latest versions

DBASE II £239

WORDSTAR PROFESSIONAL £265

	List Price	Our Price		List Price	Our Price
MULTIMATE ver.3.3	399	265	ASCOM	170	149
SPELLSTAR	145	99	MS CHART	245	199
VOLKSWRITER DEL.	295	215	DELTA GRAPH	195	169
MS WORD	400	299	ENERGRAPHICS	350	265
SUPERCALC III	360	199	EXECUVISION	320	279
MULTIPLAN	190	145	DR C COMPILER	295	225
SUPERCALC II	195	145	PASCAL.MT +	325	245
DATAMASTER	495	395	LEVEL II COBOL	965	720
DMS DELTA 4	495	375	MS BASIC	385	310
KNOWLEDGEMAN	450	359	MS PASCAL	295	235
PERTMASTER 1000	650	545	QUICKCODE	200	149
MS PROJECT	245	199	SYCERO	595	495
SUPERPROJECT	385	299	D UNTIL	69	58
CARDBOX	195	169	SMARTKEY II	75	69
CARDBOX PLUS	300	269	SUPERSORT	145	108
OPEN ACCESS	550	325	SAGE PAYROLL	195	145
SMART	635	549	SAGE A/CS/PAYROLL	495	359
WORDCRAFT	425	359	SAGE PLUS/PAYROLL	795	575

SAGE ACCOUNTS £245

SAGE PLUS £485

All prices exclude V.A.T. Carriage is charged at £2+V.A.T. parcel post or £5+V.A.T. 1st Class. Please phone or write for our comprehensive price list.

Local Authority, Government and European enquiries welcome

Further discounts may be negotiated for large orders

TRISOFT LTD

INDEPENDENT MAIL ORDER DISTRIBUTORS OF QUALITY SOFTWARE
Trisoft Ltd, Crown Square, Matlock, Derbyshire DE4 3AT. Telephone: 0629/3021

HARDWARE SERVICE

Please telephone for prices and details of our optional installation service. We supply:-

APRICOT

U.K.'s highest selling serious business micros; we supply the full range from the F1 to xi20s.

OLIVETTI

M21 and M24. In our opinion the Olivetti range offers the finest IBM-compatible, single-user hardware available.

NORTH STAR DIMENSION

The only 100% PC-compatible multi-user, multi-processing system currently available. Will accept up to 12 work stations and runs all IBM "off-the-shell" software. Tremendously cost-effective as compared to IBM PC networks; up to 60MB central storage. Entry-level, 2 screen configuration with 15MB central storage — only £5875, R.R.P.

SPECIAL OFFERS

IBM/APRICOT ONLY

For July/August only

DBASE II.....	£225
* DBASE III.....	£295
* FRAMEWORK.....	£295
LOTUS 1-2-3.....	£289
SYMPHONY.....	£399
WORDSTAR PROFESSIONAL.....	£245
* WORDSTAR 2000.....	£275

* Not available for the Apricot

DISKS PER BOX OF 10

SONY 3.5" DSDD.....	£39.95
DYSAN 5.25" DSDD.....	£23.45
3M 5.25" DSDD.....	£19.95

Please add £1.00 carriage per order.

● Circle No. 178

PRACTICAL COMPUTING

Advertisement Index

A	Aculab Ltd.	97	Digitask Business Systems	24/25	L	Leroy Somer	32	Q	Qume (UK) Ltd	61	
	A&G Computerware	124	Digithurst	119		Lucas World Service Ltd	60		R	Regional Systems	16
	AMA Computer Supplies	62	Disking International	26/27		Lutterworth Software	124		Reprints	126	
	Amstrad Consumer Electronics	38/39				Lynnem Computer Products	126		Research Machines	12	
	Associated Book Publishers	30	E						S	Sage Soft	64/65
	AWS Computerware	44	Elite Computer Systems	76		Mancos Computers	96		Samleco	88	
B	Barbatan Ltd	14	Epson (UK) Ltd	10/11/109/111/113/115/117		Mannesmann Tally	91		Sanyo Maruberni	0BC	
	Brighton Computer Centre	119	Electronics Wireless World	123		Mayfair Micros	18		Sentinel Software	17	
	Brom com	13				Medow Computers	120		Silica Shop	33	
	Business Computer Centre	36	F			Mercator Management			Sky Software	18	
C	Camera Computing	124	First Class Peripherals	40		Consultants	28		SK (Sunkyong) Europe	54/55	
	Cambridge Micro Electronics	28				Microft Management			Softsel Multimate	44/45	
	CED Realtime Systems	IFC	G			Consultants	28		SMC Supplies	120	
	Computer Discount Store	34	Gemini Micro Computer	JBC		Microprocessor Eng Ltd	44		Southdata Ltd	56	
	Computer Enterprises		Guardline Disposables Ltd	122		Micronix	107		Synamics Business Systems	53	
	International	9				Miracle Technology	63				
	Computer (Hardware & Software) Supplies	42	H			Modular Technology	43				
	Compact Communications	76	Homestead Electronics	62		Mountaindene	62		T	TABS	37
	Curzon Systems Ltd	106							Timatic Systems Ltd	96	
D	Datafax Ltd	84	I			N	Nation Computer Services	96	TMAT	96	
	Dataflex Cimformation	9	Intelpost (Royal Mail Services) 46			Newtrends Technology	80		Trisoft	130	
	Data Products	98							U	Unicorn Business Systems	106
	Dataplus-PSI	120	J			O	Olympic Systems	60			
	DDL	83, 95	Jarogate Ltd	73					W	West One Galaxy	22
	Dennison Mfq Co Ltd	4	Juki (Europe) GmbH	20		P	Practical Computing	82			

If you are a standard size and all your clothes fit you perfectly, you're the rag trade's ideal customer.

But, for most of us, buying a new outfit is far from simple: right size but wrong colour, right colour but wrong size, sleeves too short, legs too long...

CUSTOMISED COMPUTERS

at off-the-peg prices

... With a Gemini all you have to do is decide what you want your micro based system to do for you.

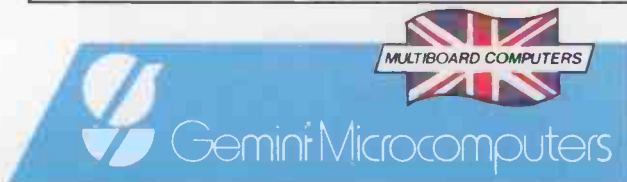
Each system can be tailored to individual needs. No wasted capacity so no wasted money. Add to that a choice of hundreds of CP/M software packages and your Gemini system really starts to show its versatility. It's even flexible enough to allow a D.I.Y. system to be manufactured to your own specification.

And when your needs grow or diversify, so too can your Gemini's capabilities and memory. You can even integrate your system to link up to 31 terminals to give a full local area network.

If you want to know more about the technical 'ins and outs' of our remarkable and easily expandible modular system, just write to us for our brochure.

If you're not that interested in RAMs, ROMs, LANs and CPUs, then just pop into one of our customer-friendly, hand-picked dealers who will tailor a system to your needs.

Gemini produce a large range of compatible boards, ensuring the maximum flexibility and ease of upgrade in the expansion of any Gemini based computer system. Whilst the Gemini system uses CP/M, the addition of a 16 bit card will allow you to run many popular programs now being generated.



Setting Fashion Trends

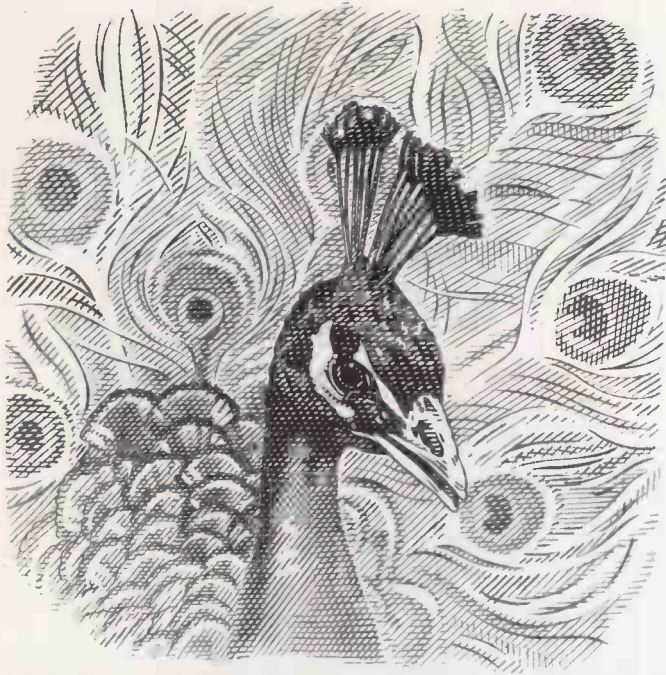
Gemini Microcomputers Ltd, 18 Woodside Road, Amersham, Bucks, England. HP60BH. Tel: (02403) 28321. Telex: 837788

● Circle No. 103

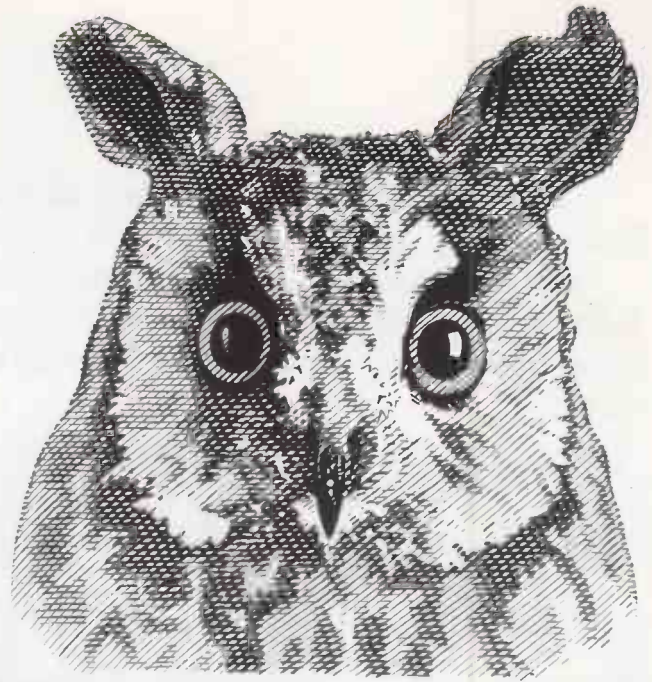
Please send me further information on the remarkable and easily expandible Gemini modular system
Please send me the name and address of my nearest customer-friendly Gemini dealer
(Please tick)

Name _____ Address _____ Post code _____ Tel. No. _____

POST TO: GEMINI MICROCOMPUTERS LIMITED



“My portable micro is IBM compatible?”



**“My portable micro is IBM compatible.
And it has a colour screen?”**

There were once two businessmen in the market for a portable micro computer.

The first, a proud and somewhat shortsighted man, snapped up the first IBM compatible machine he encountered. Thinking he'd done wonderfully well.

The second, a wise old bird, considered the options carefully and settled on the Sanyo MBC 775.

His patience was admirably rewarded.

Not only did his chosen machine have full IBM compatibility, with twin 360K disk drives, 256K RAM expandable to 640K RAM, but also a colour screen.

The only portable micro with a colour screen.

The price of £2,150 included not only the monitor but £500 of free software like Calcstar, Wordstar, and GW Basic.

And he was given the opportunity to join the Sanyo Micro-Users Association, giving direct access to product and software information.

For full details ring Sanyo Business Systems on 0923 46363.

And remember the moral of the story is, see Sanyo, then decide.  **SANYO** ● Circle No. 102

