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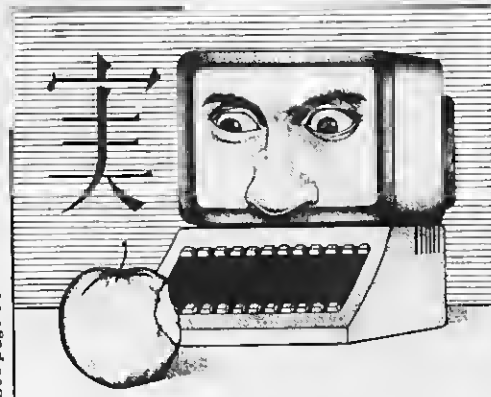
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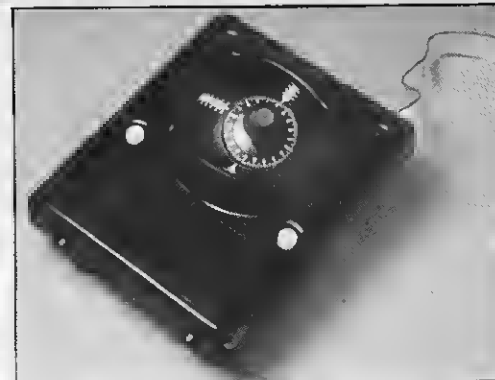
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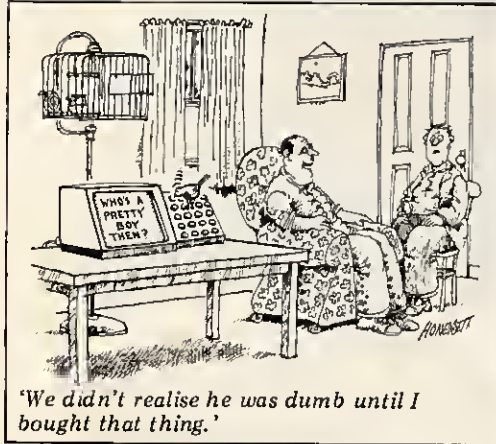
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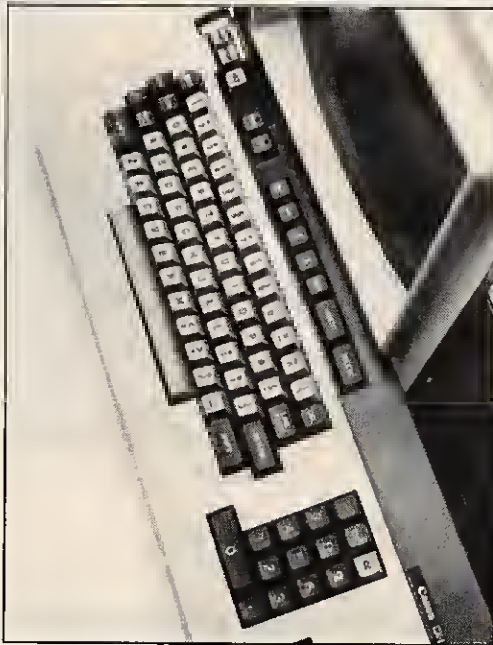
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Grovelling apologies are due to the estimable Roy Knipe, whose cover illustration to last month's issue was wrongly credited. Roy, we abase ourselves at your feet.



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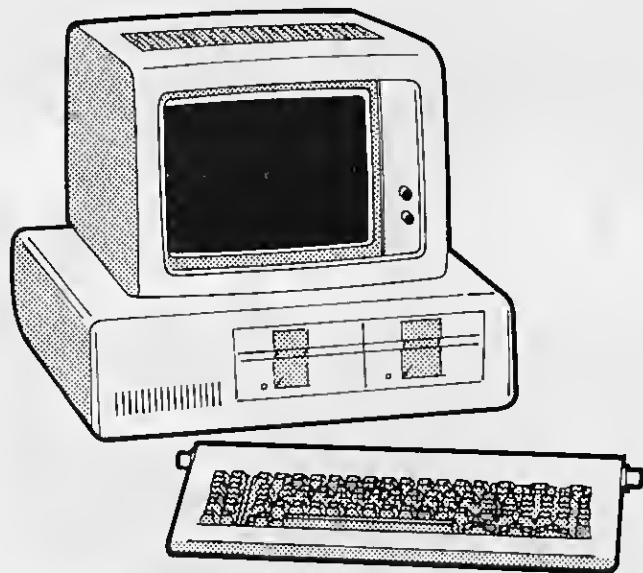
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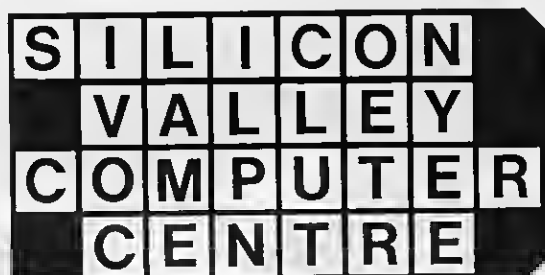
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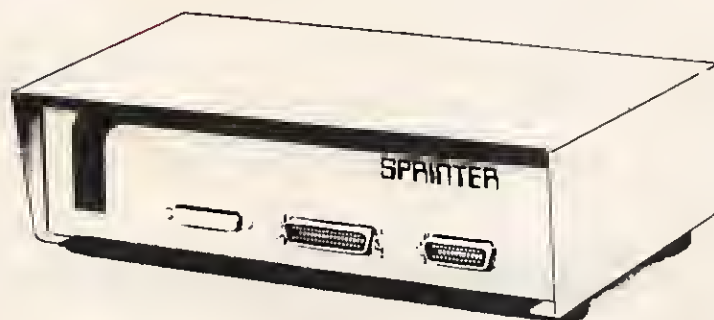
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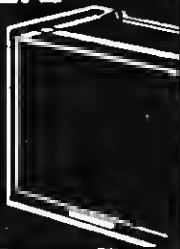
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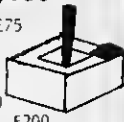
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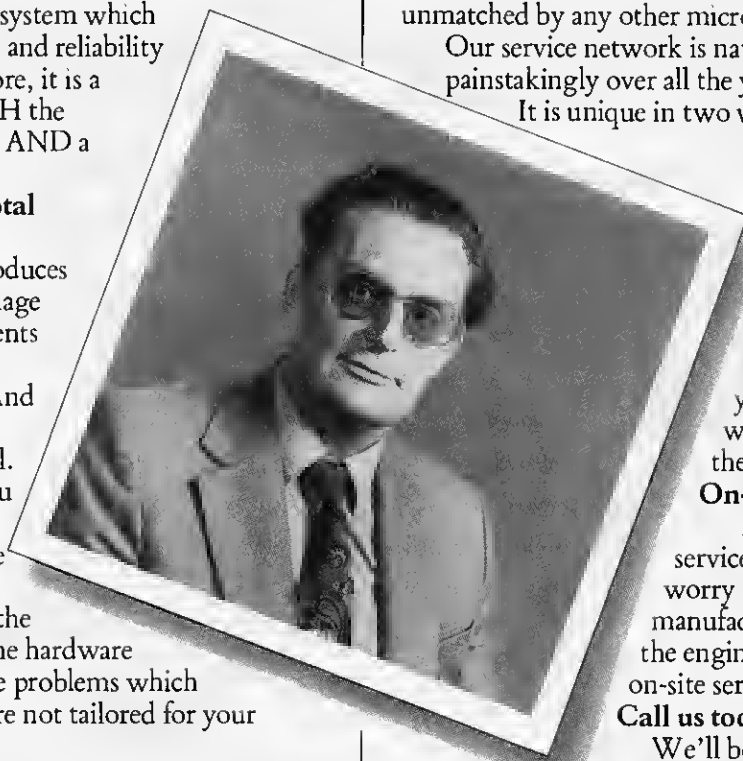
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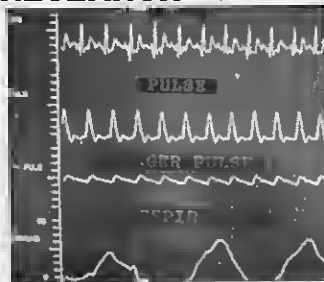
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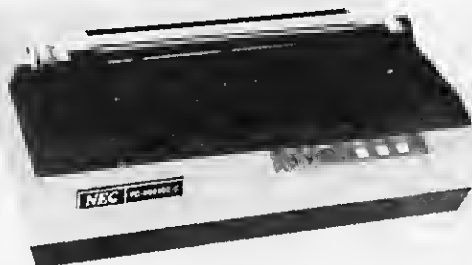
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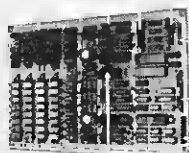
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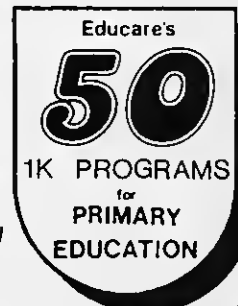
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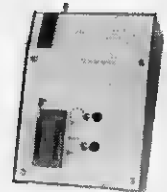
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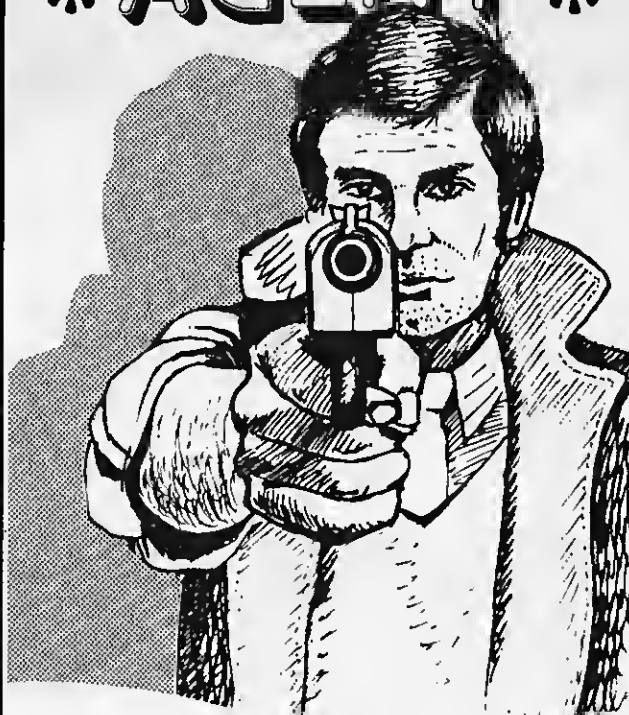
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Jupiter ACE



The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and ten times as fast as BASIC. Before the Ace all personal computers used BASIC and FORTH was only available to a privileged few.

The Jupiter Ace also features a full-size moving-key keyboard, high-resolution graphics, sound, floating point arithmetic, a fast and reliable cassette interface and 3K of RAM.

If you own a personal computer you will be aware of the limitations of BASIC. You know how slowly your programs run and how quickly your computer's memory gets filled. The Jupiter Ace is your answer.

If you already know FORTH, the Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to list and alter words that have been previously compiled into the dictionary. This avoids the need to store screens of source, allowing the dictionary itself to be saved on cassette. Comprehensive error checking removes the worry of accidentally crashing your programs.

All inclusive price

For **£89.95** you receive your Jupiter Ace, a mains adaptor, all the leads needed to connect to most cassette recorders and T.V.s (colour or black and white), a software catalogue and a manual.

The manual is a complete introduction to the world of personal computing and a course in FORTH programming on the Ace.

Even if you are a complete newcomer to computers, the manual will guide you step by step from first principles to confident programming.

The price includes postage, packing and V.A.T.

The Jupiter Ace is backed by a full 12 month warranty.

Available soon

Plug-on parallel printer interface.

For around £20.00 this will connect your Jupiter Ace to anything from high-speed dot matrix to letter-quality daisy wheel printers.

Plug-on 16K Memory Expansion

For around £30.00 you will increase the memory of your Jupiter Ace to 19K giving you instant access to enormous amounts of information.

Software

A catalogue will be sent with every machine, and includes, initially, programs for education and entertainment.

FORTH Finishes First!

Speed Comparison Chart showing times in seconds to perform one thousand operations.

Type of Operation	Jupiter Ace	88C Micro	Vic 20	Spectrum	ZX81
Empty loop	0.12	0.67	1.3	4.2	17.7
Print a number	7.5	13.5	26	19	430
Print a character	0.62	1.3	3.1	7.5	24
Add two numbers	0.45	1.4	5.5	7.5	28
Multiply two numbers	0.9	1.6	6.5	7.5	32

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.

"The Ace is an excellent way of using FORTH"

Popular Computing Weekly

"FORTH is an easy language"

Byte

only £89.95

Designed by Jupiter Cantab

Computer Designers Steven Vickers and Richard Altwasser played a major role in creating the ZX Spectrum and then formed Jupiter Cantab to develop advanced ideas in personal computing. The Ace is the result, another all-British computer to lead the world.

Technical Information

Hardware

Z80A running at 3.25 MHz.
8K bytes ROM
3K bytes RAM

Keyboard

40 Moving-key keyboard with auto repeat on every key and Caps Lock.

Screen

Memory mapped 32 column x 24 line flicker-free display with upper and lower case ascii - character set.

Graphics

Chunky graphics (64 x 48 pixels) may be plotted, unplotted or over-plotted (XOR operation). Also, the entire character set (128 characters and their video inverses) may be redefined allowing intricate shapes to be drawn with a resolution equivalent to 256 x 192 pixels.

Control Structures

IF-ELSE-THEN, DO-LOOP, OO-LOOP, BEGIN-WHILE-REPEAT, BEGIN-UNTIL, all may be mixed and nested to any depth.

Cassette

Programs and data in the compact dictionary format may be saved, verified, loaded and merged. Blocks of memory can be saved, verified, loaded and relocated. All tape files are named. Running at 1500 baud, the Ace will connect to most portable tape recorders.

Expansion Port

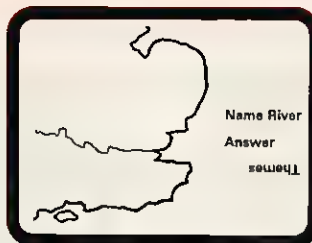
Contains D.C. power rails and full Z80 Address, data and control signals. May be used to connect extra memory and other peripherals. IN and OUT words allow port-based peripherals to be addressed.

Data Structures

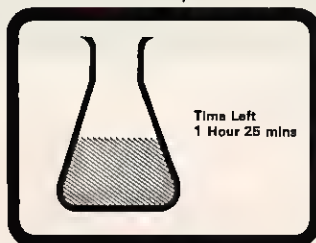
Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types. There are no restrictions on names.

Sound

Internal loudspeaker may be programmed to operate over the entire audio spectrum.



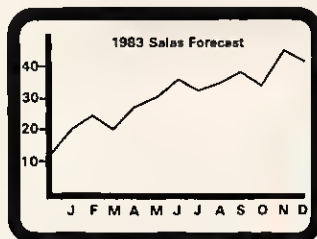
In Schools Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.



In Laboratories For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built-in quartz timer allows experiments to run all weekend.



At Home The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.



In the Office Stock control, Accounts and Financial forecasts are all possible on the Jupiter Ace. With a printer and extra memory attached you can do word processing as well.

"FORTH is very flexible"

"FORTH is compact"

Electronics and computing

"FORTH is in general very much faster than BASIC"

Computing Today

Programming in FORTH

Programming in FORTH

FORTH programs are constructed without line numbers, as words which are defined in terms of other words that already exist. Consider the following definition of the word STARS. Comments are in parenthesis and have no action.

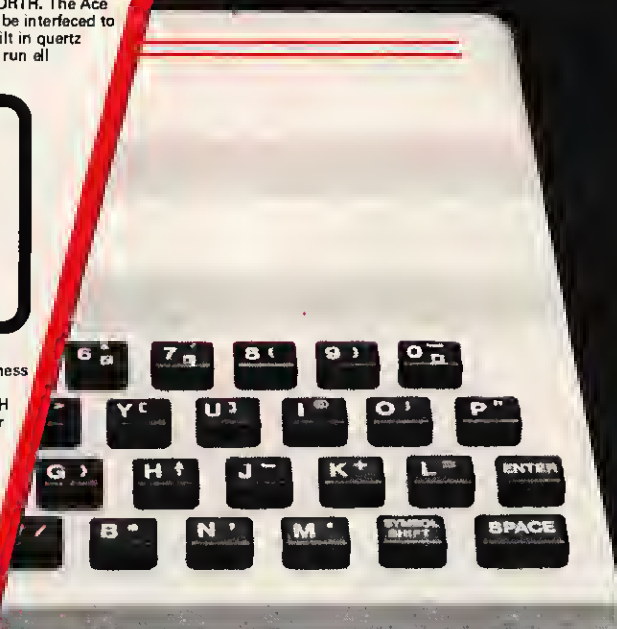
```
: STARS      (: starts word definition)
  " * * * "  (print 3 asterisks)
  200 100 BEEP (play a note for
              100 mSacs)
:
```

The semi colon at the end finishes the word definition. Now, whenever you say STARS the computer will print out 3 asterisks and sound a short tone. (Notice how the word BEEP comes after the numbers it uses, 200 and 100. This characteristic occurs throughout FORTH so that you write, for instance, 28 76 + instead of 28 + 76.)

The Jupiter Ace already has 140 FORTH words defined in ROM.

The **Jupiter Ace** is available only by mail order. Please allow up to 2B days for delivery.

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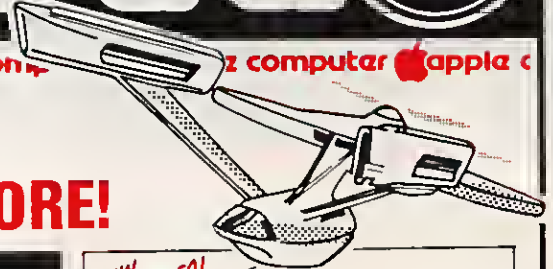
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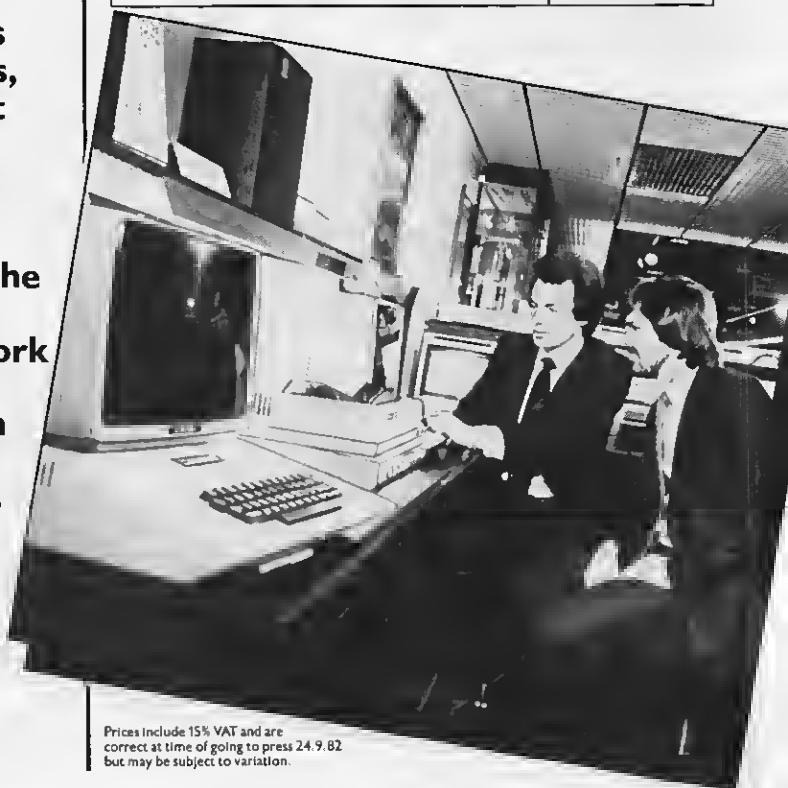


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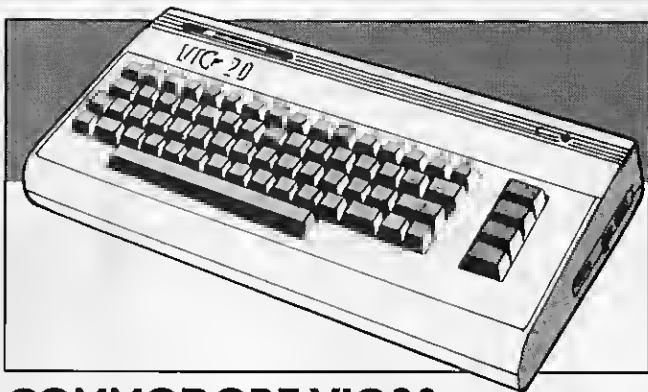
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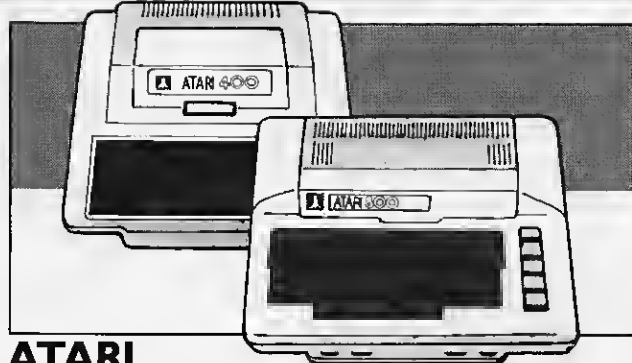
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Last issue we showed an example of 'short-listing' of employees for a prospective job. Here is an example of a garage stock file and two reports it might generate.
The record may look like this

- 1- record number (23)
- 2- part number (fiat_grill 109)
- 3- location (bin 44)
- 4- cost price (29.00)
- 5- minimum stock (5)
- 6- maximum stock (12)
- 8- current stock (3)
- 9- manufacturer (Fiat motor company)
- 10- on order (qty) (<9>)

One report might be: select??
all records where the current stock is lower than the minimum stock
When found, subtract current form maximum, and produce a printed list of the manufacturers name;
part number; and re-order quantity
Update the record in field 10 with the quantity ordered.

Another report might be: select??
all records in the file; calculate the values of current stock multiplied by cost price for each record. Add the values together for every record at location London or Glasgow or Leeds and print a list of all such records showing stock values 'individual' and for the specific locations

(next issue's example sale ledger)

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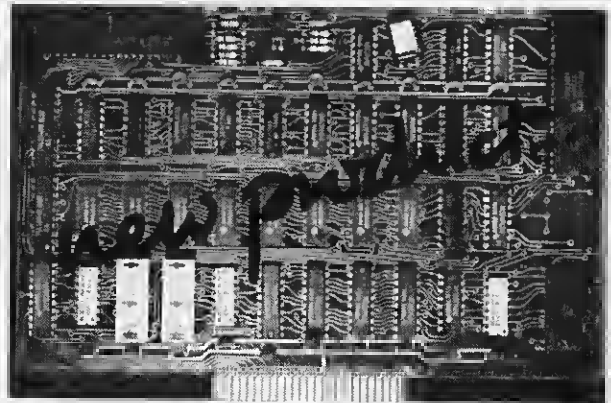
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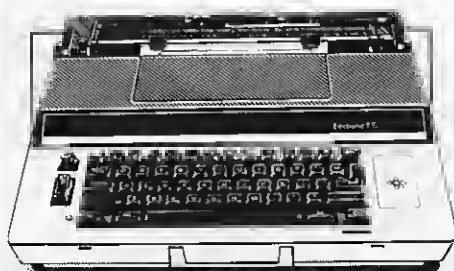
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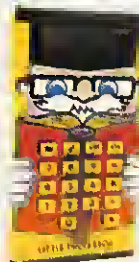
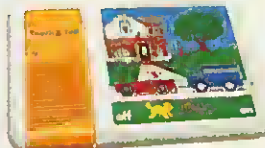
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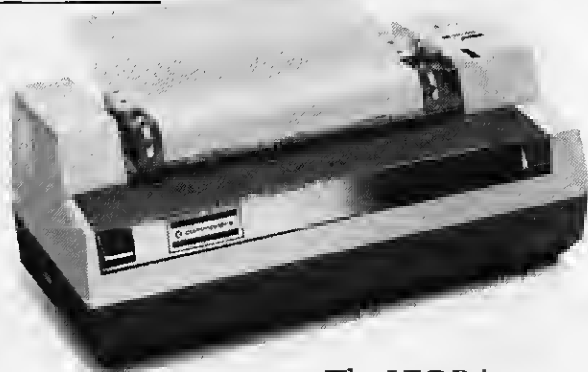
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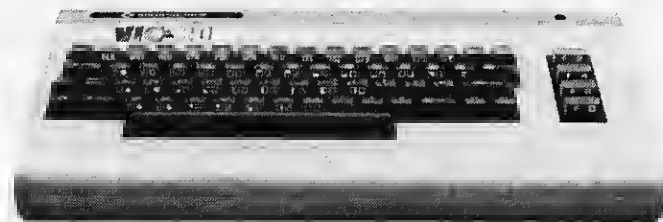
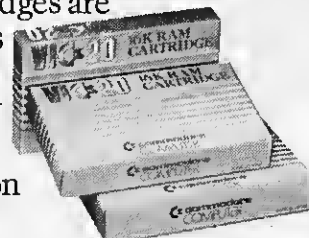


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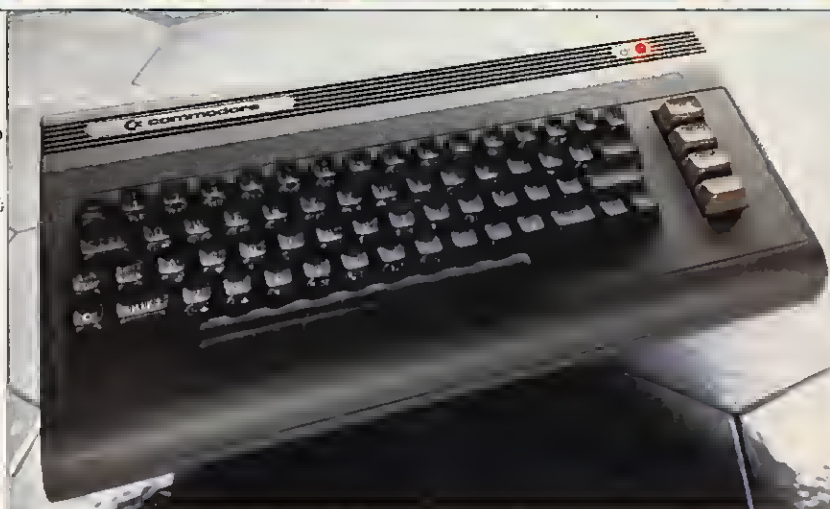
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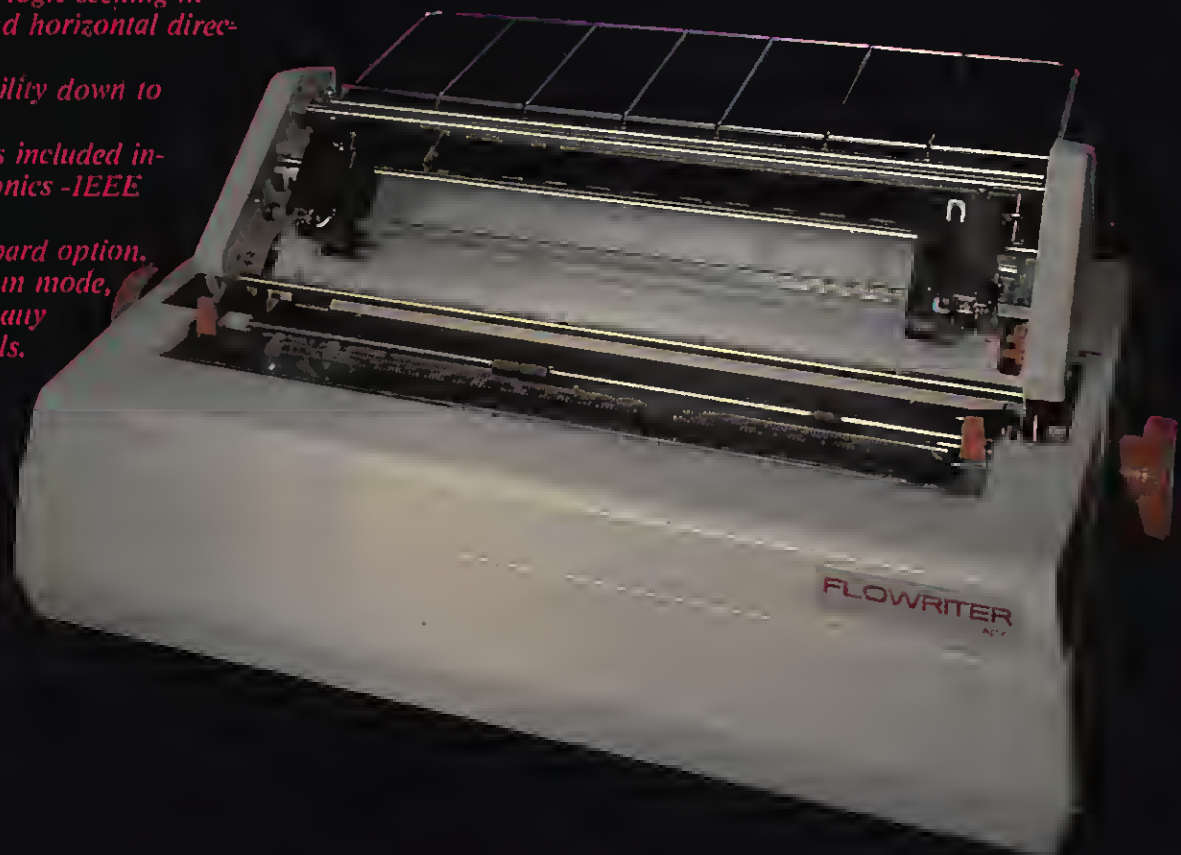
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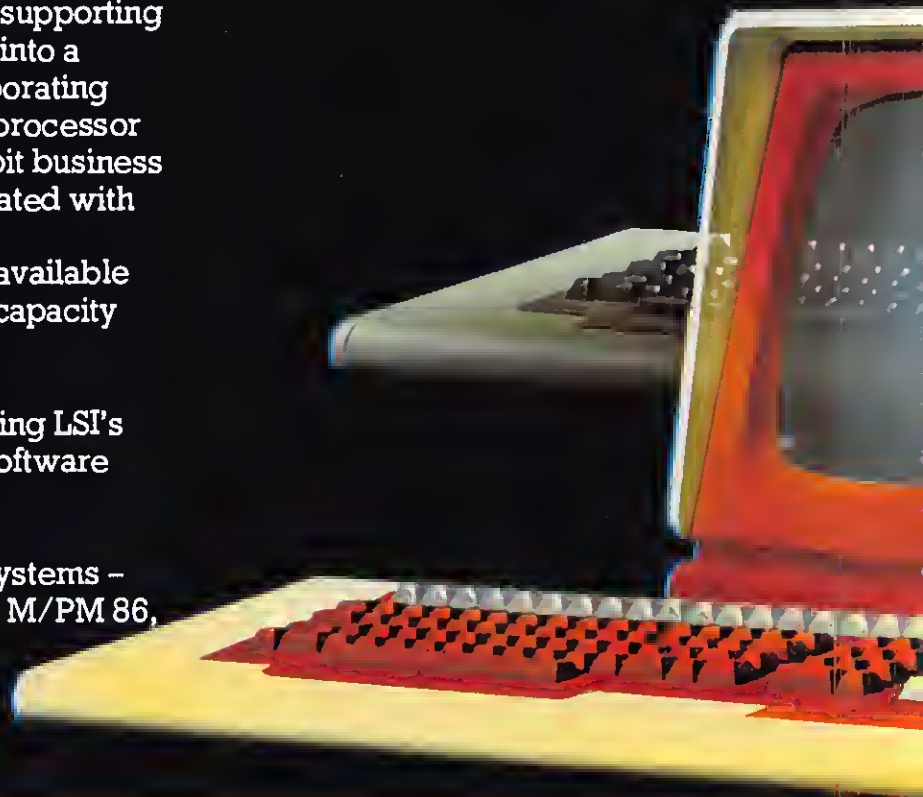
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EXTENDED MICROSOFT COLOUR BASIC (as standard). Featuring: ADVANCED GRAPHICS (set, line, circle, paint, print, draw, rotate and print using). ADVANCED SOUND 5 octaves, 255 tones. AUTOMATIC CASSETTE RECORDER CONTROL. FULL EDITING with INSERT and DELETE.
9 COLOUR, 5 RESOLUTION DISPLAY.
USE WITH ANY U.H.F. TV and/or separate P.A.L. monitor.
PROFESSIONAL QUALITY KEYBOARD. Typewriter feel. Guaranteed for 20 million depressions.
PRINTER (Centronics parallel).
JOYSTICK CONTROL PORTS.

FIRE YOUR IMAGINATION.

Learning how to use the Dragon 32 won't cause you to experience any problems. Learning what you can use it for will cause you to experience something entirely different.

Delight. Surprise. Fascination. And challenge.

The Dragon offers a range of some of the most popular computer games in the world. From those celebrated space battles to mind-boggling adventures in seemingly unfathomable dungeons and caves.

As if by magic, a simple typed message will command the Dragon to create your own drawings. Then it will colour and paint them in 9 colours.

And it's clever enough to create virtually any image you want - circles and arcs as well as straight lines.

The Dragon will also play and compose music with you, with a range of 5 octaves. And it works with any UHF TV or PAL monitor.

LEARNING THROUGH PLAYING.

All of this makes the Dragon the ideal machine to build your children's interest in the world of computers as they become increasingly more vital. School-children already enjoy using computers.

The Dragon is the first computer specifically for the family - so by enjoying yourselves at home, you and your children can soon become expert enough to create your own programs.

PRODUCT \ FEATURE	DRAGON 32	SINGLAI R SPECTRUM	ACORN ATOM	VIC 20	TI 99/4A	BBC MICRO-V
PRICE	£199	£125	£175	£190	£199	£300
STANDARD RAM SIZE	32K	16K	8K	5K	16K	16K
STANDARD AVAILABLE RAM FOR HIGH RESOLUTION GRAPHICS	26K	9K	N/A	N/A	14K	3K
EXTENDED MICROSOFT BASIC AS STANDARD	YES	NO	NO	NO	NO	NO
PROFESSIONAL-TYPE KEYBOARD	YES	NO	YES	YES	YES	YES

BRILLIANTLY SIMPLE GUIDE.

The Dragon is living proof that you don't have to be an expert in computerspeak to be an expert in computers. It comes with the easiest-to-understand instruction manual ever written for a home computer.

Every step, every explanation, is made clear - even if you're a beginner. In minutes, it will show you how to write a simple program. Within hours, you'll be fascinated. And from then on, you'll continue to be astounded by the new world which the Dragon's power and versatility will open up to you.

See the new Dragon 32 in your High Street. At under £200, it's not just the first family computer. It also has all the features an expert could wish for.

Except perhaps the jargon.

DRAGON 32 The first family computer.

To: Jean Webster, Dragon Data Ltd, Queensway, Swansea Industrial Estate, Swansea, Glamorgan SA5 4EH.
Tel: 0792 580651.

Please send me further information about the Dragon 32.

Name _____

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Dragon Quest



**£11.50
inclusive**

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based on 'Dungeons & Dragons'
includes graphics and text.



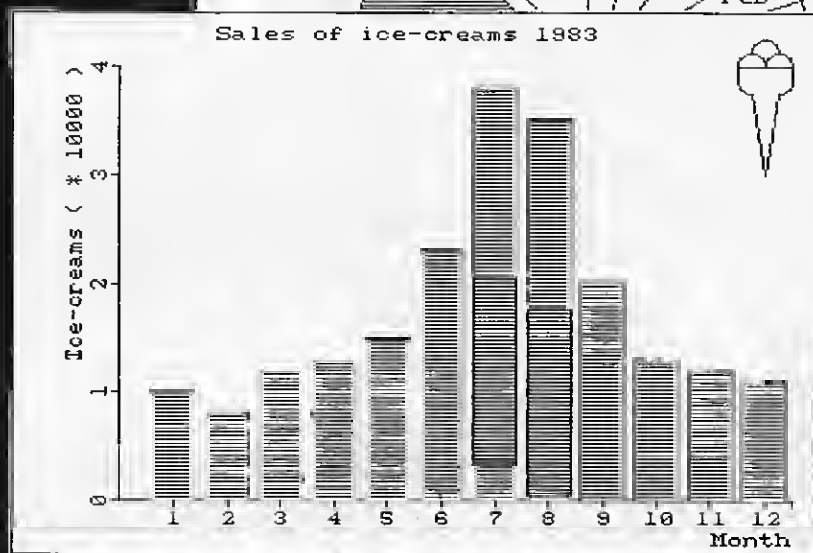
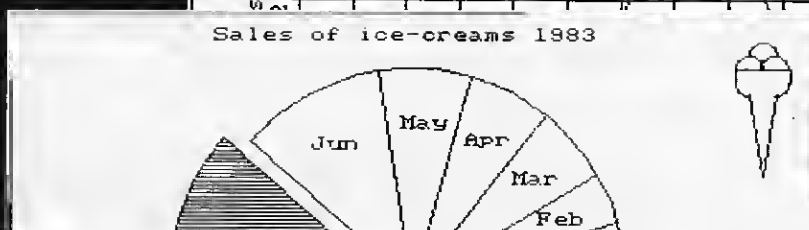
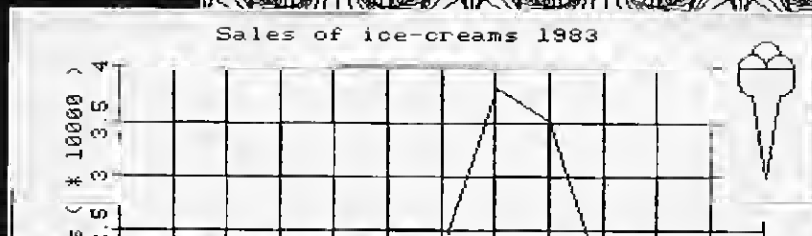
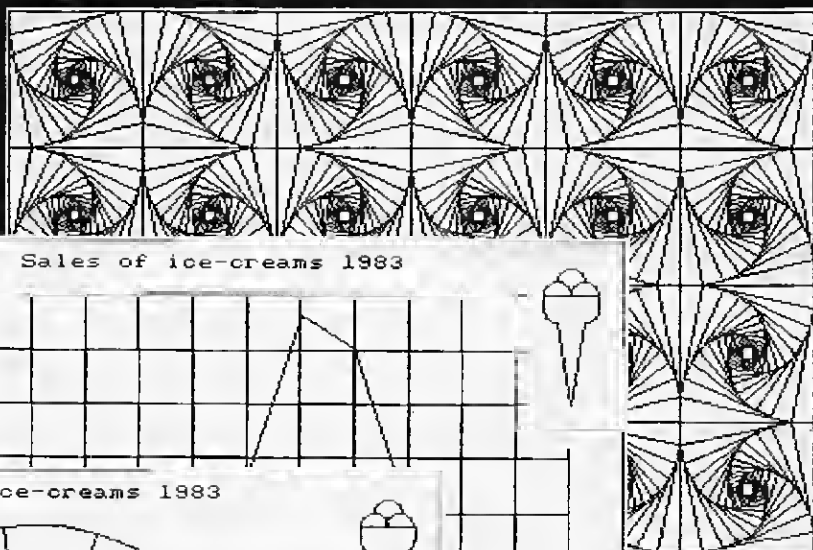
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You are lucky if you have got a TRS80 or Video Genie computer and an Epson, NEC, Anadex or HiPlot

... with Plus



```

10 ' Actual Plus program for
15 ' shown histogram printed
20 ' on Epson MX80/Graftrax
25 A=FFRAME(0,0,15,10) + FNEGCE
30 NAME(3,8,9,5,FNFS)
  "Sales of ice-creams 1983"
35 X=14:Y=7:GOSUB 75 'ice-cream
40 A=FXAXIS(3,1,1,12,5,1,
11.5,FNFS,0,"Month")
45 A=FPLOT(1-1)
50 A=FXAXIS(,0,4,1,8,-FNFS,90,
  "Ice-creams ( x 10000 )" )
55 FOR I = 1 TO 12
60 A=FNGRID(I+1,6,1,1+2,4,
1+V(I)/5000,10,2/FNUNITY)
65 NEXT I
70 A=FPINPRINT(2,2)
    
```

RAL Microcomputers is proud to introduce the general purpose plot utility system **Plus** by Upward Systems.

Generating business presentations, constructive, creative or complex drawings is just a snap with **Plus**. You simply make a BASIC program, with embedded FN-calls to one of the 45 implemented functions. All functions are coded in high speed assembly language. For instance, to draw a circle, all you have to do is type: A=FNCIRCLE(X,Y,R). That's it!

Implemented features include:

- Axis generation (with tickmarks, numbering)
- Block fill and grid functions
- Drawing of circles and pies
- Trigonometric functions in degrees
- Polygon fill functions
- Shading of rectangles
- User defined units (inches, metric, ...)
- Windowing and subwindowing
- Adjustable dotted lines
- Various print possibilities (printer vs)
- Picture storage on disk (printer vs)
- Manual control of pen (HiPlot vs)
- Reversed plotting (printer vs)
- Absolute or relative coordinates

Powerful lettering is part of the system. All letters, digits or symbols may be plotted in any direction, with any slant (italics), with any aspect ratio and in any size. Various fonts are standard in the package. Other fonts may be ordered as an option. For instance, the header of this ad was printed with the optional Gothic English font of **Plus**.

The package comes complete with an extensive manual (110 pages). The disk contains various sample programs, as well as a number of fonts.

Plus runs on a disk based TRS80 model I, TRS80 model III, Video Genie or any TRS80 compatible microcomputer with 48K RAM.

The package is compatible with TRSDOS, NEWDOS, NEWDOS/80 or LDOS.

Versions for the following hardware are available:

- Epson MX80 with Graftrax
- Epson MX82
- Epson MX100
- NEC PC8023
- Citoh 1550 and 8510
- Anadex DP9000/9500 series
- HiPlot DMP2 and DMP5

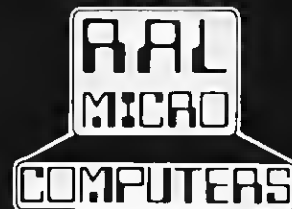
Contin. Europe:
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P.O. Box 207, The Hague, Holland

Ask for our documentation set.

When ordering, please specify your hardware configuration (computer system and graphics peripheral).

Plus is available for just £ 75.00 + VAT
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On Atari, VIC20, Commodore 64 and

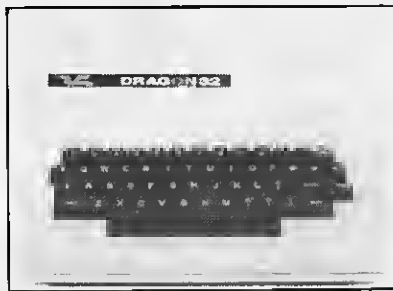
If your order contains over £120 worth of computer hardware apply now for interest free credit by telephoning: Mail-order: (0702) 552911. London Shop: 01-748 0926. Birmingham Shop: 021-356 7292. Southend Shop: 0702 554000 or write to P.O. Box 3, Rayleigh, Essex SS6 8LR.

You pay 10% down, then 10% per month for a further nine months (to nearest penny). Example: VIC20 Colour Computer. Cash Price £169.99. Credit terms: £16.99 down then £17 per month for nine months: Total £169.99. Credit quotations on request.

THE NEW COMMODORE 64

The incredible new computer from Commodore comes with 64K RAM fitted! Plus 16 colours, hi-res graphics, 320 x 200 pixels, 40 columns by 25 lines, Z80 micro processor can be added — that means you can run CP/M software, 8 independently movable Sprites with collision detection, and a sound generator with 3 voices, 4 wave-forms, envelope and filter to rival some dedicated music synthesisers. And all this at the most incredible price ever. (AF56L) Only £339.00

DRAGON 32



The amazing new British computer with a full-travel standard keyboard, a 16-bit microprocessor, 32K RAM fitted (expandable to 64K and later to 256K!), 9 colours, hi-res graphics and Microsoft extended colour BASIC (the very best BASIC to learn with). It can be used with virtually any ordinary cassette recorder, it has a printer interface (Centronics-type), joysticks are available and it's incredible value for money. (AF57M) Only £199.50

THE AMAZING ATARI COMPUTERS

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Atari 400 with 48K RAM (AF37S) £319.00
Atari 800 with 16K RAM (AF02C) £499.00
Atari 800 with 48K RAM (AF55K) £590.00

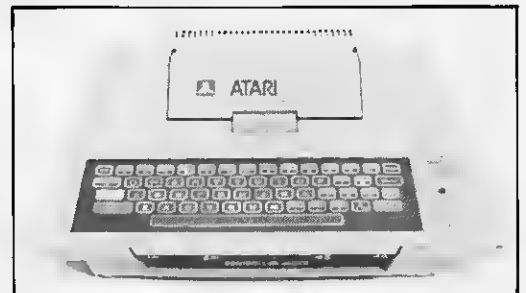
* All above with BASIC & handbooks

- Other hardware:
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 Disk Drive (AF06G) £299.95
 Thermal Printer (AF04E) £265.00
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For full details ask for our hardware leaflet (XH54J) SAE appreciated

JOIN THE U.K. ATARI COMPUTER OWNERS' CLUB

An independent users' group. Four issues of the club magazine for only £3.00! Address your subscription to Ron, Issue 1 of the club magazine featured a tutorial on character set redefinition and contained a collection of demonstration and games programs and lots more. Issue 2 featured a tutorial on player/missile graphics, an article about graphics on computers, a selection of members' contributions to the program library and much more.



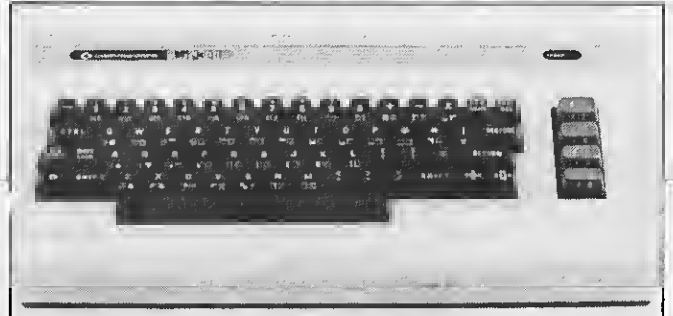
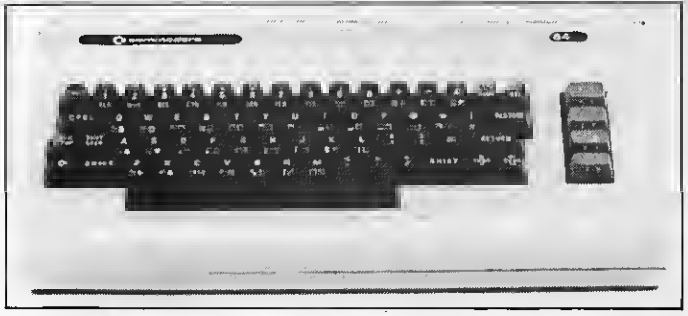
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CREDIT

Dragon 32 computer hardware

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VIC20 COLOUR COMPUTER

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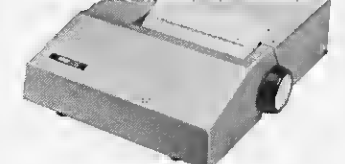
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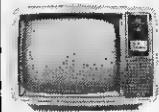
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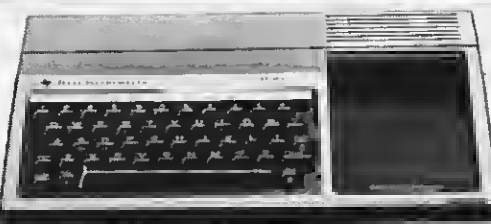


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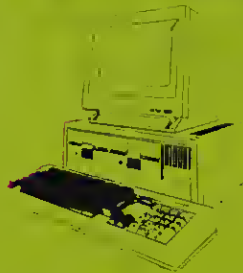


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TEXAS INSTRUMENTS

ZX Spectrum

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DEF FN	FN	LINE	OPEN #	CLOSE #	MOVE	ERASE	GRAPHICS	9 CAT	PEEK	O POKE	USR
SIN	COS	TAN	INT	RND	STR\$	CHR\$	CODE	I INPUT	IN	OUT	L LEFT
ASN	ACS	RESTORE	DATA	VERIFY	MERGE	SQR	VAL	U OR IF	J LOAD	K + LIST	SCREEN \$
READ	S NOT SAVE	D STEP DIM	F TO FOR	G THEN GOTO	H ↑ GOSUB	CIRCLE	VAL \$	Y AND RETURN	IN KEYS	PI	SYMBOL SHIFT
LN	X CLEAR	C CONT	V CLS	B BORDER	N NEXT	OVER	M PAUSE	8 POINT	INVERSE	INVERSE	BEEP
CAPS SHIFT	EXP	PAPER	FLASH	BRIGHT	OVER	INVERSE	7 ERASE	8 POINT	SCREEN \$	ATTR	BREAK SPACE
	LPRINT	FLASH	BRIGHT	BORDER	NEXT	INVERSE	6 MOVE	7 ERASE	SCREEN \$	ATTR	
	LPRINT	FLASH	BRIGHT	BORDER	NEXT	INVERSE	5 CLOSE #	6 MOVE	SCREEN \$	ATTR	
	LPRINT	PAPER	FLASH	BRIGHT	NEXT	INVERSE	4 OPEN #	5 CLOSE #	SCREEN \$	ATTR	
	EXP	PAPER	FLASH	BRIGHT	NEXT	INVERSE	3 LINE	4 OPEN #	SCREEN \$	ATTR	
	EXP	PAPER	FLASH	BRIGHT	NEXT	INVERSE	2 CAPS LOCK	3 LINE	SCREEN \$	ATTR	
	EXP	PAPER	FLASH	BRIGHT	NEXT	INVERSE	1 EDIT	2 CAPS LOCK	SCREEN \$	ATTR	

Sinclair ZX Spectrum

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First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

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The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can update later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer—available now—is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour—8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound—BEEP command with variable pitch and duration.
- Massive RAM—16K or 48K.
- Full-size moving-key keyboard—all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution—256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set—with upper- and lower-case characters.
- Teletext-compatible—user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE—16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC—incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

ZX Spectrum

Available only
by mail order
and only from

sinclair

Sinclair Research Ltd,
Stanhope Road, Camberley,
Surrey, GU15 3PS.
Tel: Camberley (0276) 685311.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard,

Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

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Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
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Total £				_____

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ZX Spectrum software: how good and how soon?

The ZX Spectrum uses an enhanced version of Sinclair BASIC, fast becoming a world standard, and unlikely to be superseded. Unique features, such as one-touch keyword entry and syntax check and report, are increasingly attracting software originators.

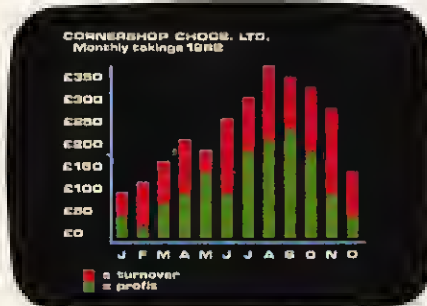
Building the software library is already far advanced, and a complete catalogue will be available in the next few months. Subjects will include sophisticated games, education, 'housekeeping', and business management. The more complex packages can, of course, be used to their best advantage with the full 48K RAM version of the ZX Spectrum.



The Sinclair ZX Spectrum can handle sophisticated games programs with high-resolution colour graphics and sound.



This major advance in computer technology maintains Britain's world-beating position in the field of personal computers.



A range of business software will soon be available, covering both specific applications (eg stock control and payroll) and general business management systems (eg matrix models).



This second generation of Sinclair personal computers demonstrates continuing commitment. Advanced technology made the ZX80/81 family a price breakthrough: advanced technology makes the ZX Spectrum a breakthrough in price and performance.

Elegant, effective, unique—the ZX Spectrum design.

'Less than half the price of its nearest competitor – and more powerful.'

'These two pictures show how it's done. On the right is the PCB from the BBC Model A Microcomputer. On the left is the PCB from the ZX Spectrum.

'It's obvious at a glance that the design of the Spectrum is more elegant.

What may not be so obvious is that it also provides more power.

'The ZX Spectrum has more usable RAM, and higher maximum RAM.

'It offers twice as many colours on the screen at any one time, plus a colour brightness control. It also offers user-definable graphics.

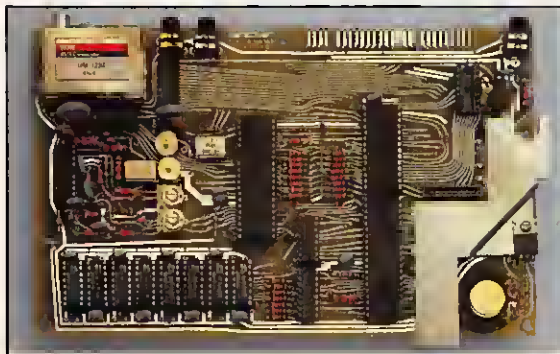
'It has data transfer rate 25% faster,

supported by a VERIFY facility.

'And it employs a dialect of BASIC (Sinclair BASIC) already in use in over 500,000 computers worldwide.

'We believe the BBC make the world's best TV programmes – and that Sinclair make the world's best computers!'

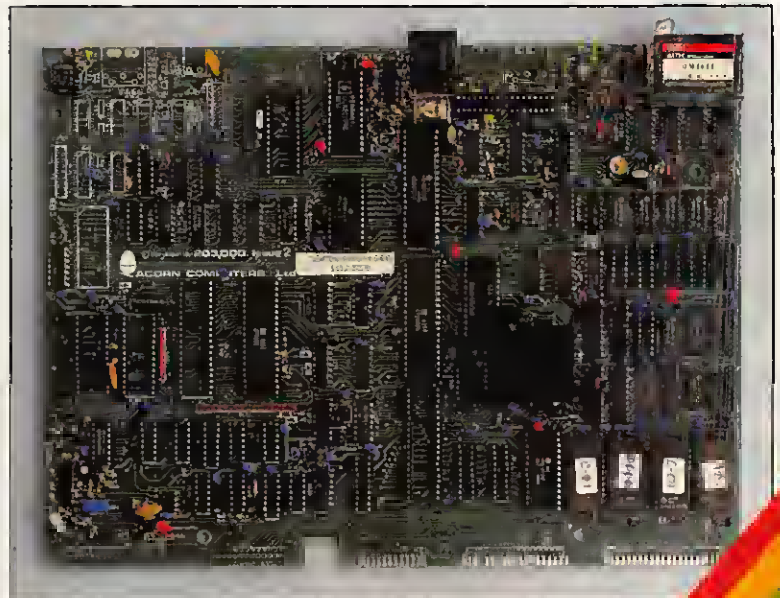
–Clive Sinclair.



Above left: internal layout of Sinclair ZX Spectrum.

Right: internal layout of BBC Micro Model A.

The illustrations are to the same scale, and demonstrate the rate of advance in microcomputer design. The ZX Spectrum uses just 14 chips to provide more power and more user-available RAM.



sinclair ZX Spectrum

PET SPEED

FAST ENOUGH FOR THE HUMAN RACE

Our alien won't hang around for slow software. He wants crisp responses and really fast processing.

For the human race too, slow PET BASIC is not good enough. When we run a program, whatever it is, we want fast efficient action, on the bounce.

Petspeed can make any BASIC program run up to 40 times faster, including disk handling. We guarantee that PETSPEED is easier to use and generates faster code than any other PET BASIC compiler for Commodore Systems.

Using PETSPEED is about as simple as it could be. Just type in the name of your program, wait a few minutes and then watch your software run up to 40 times faster.

Petspeed is not simply a compiler, it contains a powerful OPTIMISER. While PETSPEED is compiling, it breaks your program down into tiny fragments and reassembles it removing the unnecessary and simplifying the complex.

Petspeed is fully compatible with PET BASIC and can compile any program.

Also available INTEGER BASIC COMPILER - 150 to 200 times the speed of Basic. Integer Basic is for those applications where the speed of the machine is required without the inconvenience of assembly level programming. Ideal for scientific and educational users. Compatible with Petspeed.

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A S

THE 16-BIT PERSONAL

The ACT Sirius 1 is more than the UK's best-selling 16-bit personal computer. It is the only one with such a large choice of 16-bit software — business and scientific programs specially developed to take advantage of the high speed 16-bit Intel 8088 microprocessor at the heart of every Sirius.

Combine this faster and more powerful software with the advanced specifications of the Sirius 1 and you can see why more and more business users are choosing Sirius.

Because Sirius users have both the latest microcomputer technology and the powerful 16-bit software that takes full advantage of it.

Ergonomics plays a vital part in the design of ACT's Sirius 1. The screen tilts and swivels to suit the user and glare is eliminated.

The display is razor sharp, and the brilliance and contrast can be adjusted using keys on the low profile detachable keyboard.

UP TO 896 KBYTES RAM

128 Kbytes of RAM memory as standard easily upgraded to a massive 896 Kbytes ensures plenty of capacity for fully fledged business software and associated record files.

Within the basic system is 1.2 Mbytes of floppy disk storage, with 2.4 Mbytes double sided disks available as an option. More than any other comparable personal computer.

As a result, the Sirius is suitable from the start for large record processing applications. And with 5 and 10 Mbyte Winchester disk drives scheduled for early introduction, the Sirius can easily match your own organisation's growth.

SOFTWARE THAT TALKS BACK

And built into every Sirius is a revolutionary new concept: An audio decoder that can play back verbal messages and prompts under program instruction to assist the non-computer people to get acquainted with the software more quickly.

NEW 16-BIT SOFTWARE

All the big names in applications software are on the Sirius: ACT's Pulsar for accounting, WordStar for word processing, MicroModeller for financial modelling and SuperCalc the "spread sheet" program.

Plus the exciting SELECT, the only word processor that teaches you how to use it in less than 90 minutes.

And more than 100 top software companies are currently developing specialist software for every business and profession from the motor trade to solicitors.



The ACT octagon encapsulates our philosophy of providing users with a single source for their computing solutions.

ACT products include personal computers — network micro-computer systems — turnkey mini computers and a total range of services, including software development, computer field engineering, computer supplies, and a complete range of Bureau services.

The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) p.l.c., one of Britain's largest and most successful computer companies.



ACT Sirius 1 PERSONAL COMPUTER Price £2,395



MORE LANGUAGES

The Sirius has more available programming languages than any newly-introduced personal computer. MicroSoft's BASIC 86, interpretative or compiled, CBASIC, a choice of several versions of COBOL, three different PASCAL's and a full scale FORTRAN.

The benefits? Programmers and software houses are making the Sirius their first choice computer for business software development.

Unlike other personal computers, the ACT Sirius 1 is delivered with the two industry standard operating systems at 16-bit level – MS-DOS and CP/M-86. Once again a guarantee now of the widest choice of off-the-shelf 16-bit software.

And further operating systems are under development. The much vaunted UNIX and a new system to support a low cost local area network.

COMMUNICATIONS

The Sirius is the ideal communications system, with two independent RS232 communications ports in addition to parallel and IEEE 488 ports. Available NOW are all the facilities required to communicate directly with large, mainframe computers.

Further backing is available by way of a dedicated Sirius Training Centre, run by ACT and open to all.

To support the product ACT has a truly professional network of systems dealers, handpicked for its knowledge of the business environment, enabling top quality support to always be close at hand.

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Broader horizons

The BBC Microcomputer System

Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present,' comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

The BBC Microcomputer can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech. The keyboard uses a conventional layout and electric typewriter 'feel'.

You can connect directly* to cassette recorder, domestic television, video monitor, disc drives, printers (dot matrix and daisy wheel) and paddles. Interfaces include RS423, inter-operable with RS232C equipment, and Centronics. There is an 8-bit user port and 1MHz buffered extension bus for a direct link to Prestel and Teletext adaptors and many other expansion units. The Econet system allows numerous machines to share the use of expensive disc drives and printers.

BASIC is used, but plug-in ROM options will allow instant access to other high level languages (including Pascal, FORTH and LISP) and to word processing software.

A feature of the BBC Microcomputer which has attracted widespread interest is the Tube, a design registered by Acom Computers. The Tube is unique to the BBC Microcomputer and greatly enhances the expandability of the system by providing, via a high speed data channel for the addition of a second processor. A 3MHz 6502 with 64K of RAM will double processing speed; a Z80 extension will make it fully CP/M** compatible.

The BBC Microcomputer is also at the heart of a massive computer education programme. The government has recommended it for use in both primary and secondary schools. The BBC Computer Literacy Project includes two series of television programmes on the use and applications of computers.

There are two versions of the computer. Model A, at £299, offers 16K of RAM and Model B at £399 has 32K of RAM.

For technical specification and order form, send stamped addressed envelope to P.O. Box 7, London W3 6XJ and for details of your nearest stockist ring 01-200 0200.

*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.

**CP/M is a registered trade mark of Digital Research. The BBC Microcomputer is designed, produced and distributed in the UK by Acom Computers Limited.



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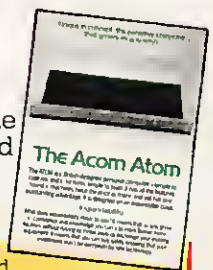
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LAST year's launch of Caltext proved that an all-British word processor could bite deep into the best of the foreign competition.

This year the bytes are coming thick and fast. Our Great British Word Processors continue.

But now with greater power and an even smaller price tag. On top of that the Caltext Micro has been launched to establish British supremacy for the business personal computer user.

But first things first, what's new about the Caltext



I find
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Word Processor?

Well, it's got the same easy to use and understand function keys that made us welcome in the beginning.

But now it's also got an in-built Winchester Hard Disc. Giving you 8mb of storage and CP/M

software that works across all the proven business packages.

The cost? Almost £1,000 less than we launched with a year ago. From just over £3,000 to be more precise.

So what about the new British built Caltex Micro?

As you'd expect, it's easy to use. With programmable function keys, CP/M and Microcobol software to cover all the business computing requirements.

But unlike some other micros it has a full communications capability and also an in-built Winchester Hard Disc option of 5mb, 10mb or 15mb.

For such a powerful micro with immense software and hardware capability you might expect to pay the earth.

Not so. The Caltex Micro undercuts most micro computers by almost half. With an average starting price of around £1,700.

We're confident a more efficient British machine could ease a lot of your processing problems.



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Don't let its size fool you.
If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.
NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

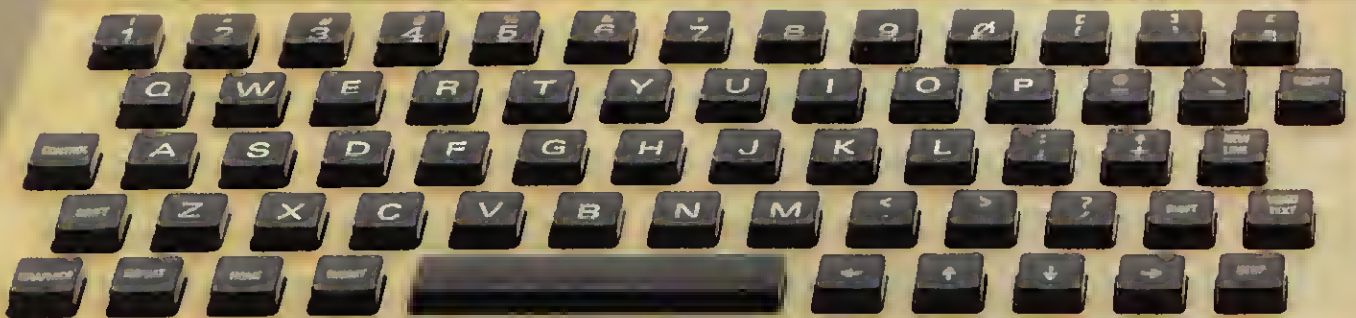
Big enough for your business.
Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.
It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

**NO OTHER MICRO
HAS THIS MUCH
POWER
IN THIS MUCH
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FOR THIS MUCH
MONEY.**

NewBrain



So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9", 12" and 24" monitors plus 5 1/4" floppy disk drives (100 Kbytes and 1 Mbyte) and 5 1/4" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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Each NewBrain order will include a FREE comprehensive user manual, a catalogue of expansion modules and peripherals, and a detailed list of available software.

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It's inherently faster and more powerful than traditional 8-bit software.

The result: More and more business users are choosing PULSAR, making it one of the industry standards on 16-bit personal computers.

Only PULSAR meets the five key requirements for 16-bit business software:

PORTABILITY

PULSAR is primarily written in the PASCAL portable language. So your investment in software is protected, regardless of how often you change your system.

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PULSAR has been developed by ACT's own software engineers as a true 16-bit system. And ACT has more than 15 years experience in business software — computer bureaux using ACT programs produce more than 3 million statements every year and handle business applications

for more than 2000 companies. PULSAR incorporates many facilities that were previously available only on large mainframe computers.

INTEGRATION

ACT supplies integrated business software, linking every aspect of business accounting. Now with PULSAR, this integration is taken a stage further with word processing and business management tools able to share information and files with accounting applications.

USER-FRIENDLY

PULSAR is really easy to use. Documentation is to the highest standards in the industry, taking the operator step by step through the system. A simple question and answer routine on the computer screen prompts the user at every turn.

TOTAL SUPPORT

ACT is used to providing on-going support for its users. Not only is there a "hot-line" to resolve queries, but also a fully equipped training school open to all PULSAR users.

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PULSAR ORDER PROCESSING

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16 BIT-SOFTWARE
FOR 16 BIT
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The ACT octagon encapsulates our philosophy of providing users with a single source for their computing solutions. ACT products include personal computers — network micro-computer systems — turnkey mini computers and a total range of services, including software development, computer field engineering, computer supplies, and a complete range of Bureau services.

The eight specialist ACT companies are each leaders in their field and are wholly owned by Applied Computer Techniques (Holdings) p.l.c., one of Britain's largest and most successful computer companies.

For more information on 16-bit Pulsar Software complete the coupon and post to ACT (Microsoft) Ltd., FREEPOST, Birmingham B16 8BR or phone 021-454 8585

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The FLEX 9 Operating System for '6809' Based Micro-Computers.

This disk operating system is now the standard single user system for machines using the powerful '6809' micro.

Having many advantages over similar operating systems for other micro-computers, this system can now be run on many different '6809' based machines.

Furthermore, the Configurable Version is available for implementation on custom '6809' computers.

Programs written to run with this operating system are almost completely machine independent, thus allowing the easy transfer of software.

There is a wide range of software available for this system, some of which is listed below. Please send for our full list.

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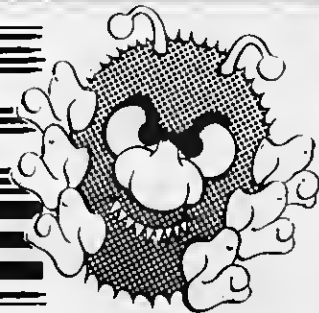
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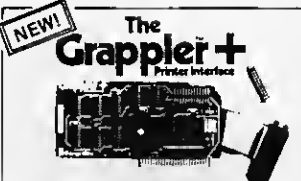


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Beeb backlog banished?

So many people seem to be going around saying how much they would like to buy a BBC microcomputer that the idea of 'more BBC microcomputers than people would be able to buy' may sound like a dream come true to buyers. By all accounts (if you are reading this in October) it is now reality.

The backlog of Model B computers has caused the builder, Acorn, a great deal of embarrassment. After all the excuses, the sad stories, the horror stories, and even the cloak and dagger stories, finally, production is running faster than orders.

All is sheer nailbiting terror in Cambridge. Will the customers who have been buying Spectrums and Dragons and even Tandys because they just weren't prepared to wait, now suddenly send in their savings? Or is it too late, and has the demand come to an end and will the new Commodore 64 steal sales?

As Chris Curry so graphically put it, 'demand is running a lot lower than production at the moment. But whether this is because that's what the demand will be, we can't tell. We think it will pick up.'

To encourage that, Acorn has started running advertisements for the BBC Computer. You may have seen one at the PCW Show. The question is, though, will anybody really believe it?

First, Acorn is now watching its chickens come home to roost in publicity terms. The machine itself has few faults, but suddenly everybody is finding out what they are — and complaining.

Next, distribution, originally entrusted so confidently to BL Marketing (the Weetabix subsidiary that sends out free tee-shirts and 50p plastic Batman capes) has been taken into the competent hands of Acorn and its brand new dual Alpha Micro computer system (!) but the only cliché that comes to mind there, has to do with fires and frying pans. Even if it's wonderful, it will take some time before people believe it.

Assuming, then, that

everybody believes that there are spare Model Bs and that they will be delivered safely, there remains the best news for Acorn yet — its user groups.

A powerful user group can save the stupidest company from itself. Unfortunately, the process is never painless and sharp cries of 'ouch' and, well, cries — have been emerging from high places in Cherry Hinton.

The user groups, besides producing newsletters without which I could not do, are putting pressure on Acorn to behave itself at its own expense.

Acorn, to put it in a nutshell (did I really type that?) is replacing the rather 'iffy' version 0.1 ROM chips with the version 1.0 ROM chips.

The new memory, with the new program loaded, is absolutely necessary for anybody who needs to attach disk, or run Prestel, or use communications, because all those things (and others) will just not happen under 0.1.

Fair enough: Acorn is supplying new ROMs free with disk, or all the other things that people really need them for.

The user groups, however, feel that since a lot of software written for 1.0 will not run on 0.1, they are entitled to have the standard version that everybody has. Acorn says 'OK, but it'll cost £10 nominal charge' — which the user groups propose to argue about in court.

My sympathies are entirely with the users.

It is roughly a year since I put myself in the position to be able, now, to say 'I told you so'. The fact was that the machine was not going to be ready on time, the Basic was going to need debugging, and production would hopelessly underestimate demand. You didn't have to be very clever to see it coming.

In that year, the users have been patient beyond belief, and have endured delay, price increase, faulty delivery service, postal dismantling of their systems, lack of dealer back-up, and general lack of 'things' (lots of things, from a Z80 add-on to disks) which

were definitely expected in late spring (and in some cases are still not ready, and won't be until next year).

To Acorn, there is a serious problem with Version 1.0 of its machine operating system. The problem is that it is still not right.

Accordingly, it is not supplying ROM chips, but EPROM chips — costlier, and in need of subsequent replacing when the factory-produced ROMs appear. Presumably, it was planning to supply the final version, in a magnificent, munificent, magnanimous gesture, free.

If it were simply a question of finding that the printer port is merely that (it was advertised as an RS432 port then I would agree with Acorn — that people who just wanted to use a printer had no need of the new ROM.

But it isn't that simple. There are lots of VDU commands, \$FX commands, and other esoteric codes, which have totally different functions under 0.1 than under 1.0. Programs written by users for their own ROM will need rewriting. Programs bought will need to be checked to ensure that they run on the version the people have.

I don't think Acorn is necessarily obliged to supply new ROMs to every owner. But I do think it is obliged to do so for everybody who asks.

As for having to check software, it is something you are warmly recommended to

do. Not even Acornsoft seems to have grasped one very important change in new machine operating software. That is, that it gives you less memory.

When you load a program from disk, it loads the disk operating program, too. You lose some of your rather valuable RAM.

The result is, simply enough, that a program supplied on tape which uses all available RAM will not run on a disk-based system, nor on one with the 1.0 ROMs in. Not, that is, without moving the value of TOP (where programs are loaded into) back to what it is under 0.1.

This particular problem is made even more delightful by Acornsoft, who have supplied a rather nice Adventure-style program called Philosopher's Quest which needs 0.1 ROM. No mention of this on the package.

Load it, some time. You'll be fascinated by what happens. You'll also be highly irritated to find that you *have* to load it from tape, taking six minutes, because obviously, there isn't room for the disk operating code, so you can't save it on disk, even if you have one.

I suppose I wouldn't gripe so much if I didn't still like the machine so much.

Sinc aid

Sinclair Research has announced a major £15



When you use a 'hard' disk storage unit capable of storing anywhere between three and twenty million characters, you are relieved of the terrible chore of changing disks — for a few months, at least. Then, suddenly, you find that the disk is full, and simply can't be changed.

This system with the Apple and the pyramid uses two hard disks (they are Rodime designs and surprisingly turn out to be cheaper and bigger than American ones) and although you cannot change the disks, you can clean them out.

It takes just about one minute, says ICE, the supplier, to copy all the information on those two disk units onto a tape cartridge (not a cassette) in the unit above. That is, if the units below are three million character devices. If they are 20 megabyte drives, it takes closer to 10 minutes and needs two cartridges. A guide to price: a three megabyte drive costs £1,350. Details from ICE on Ashford (07842) 47271.

million scheme to put the Spectrum into Britain's primary schools. This will significantly extend the Department of Industry's new £9 million 'Micros in Primaries' project and is seen by the company as a logical development of Sinclair's commitment to education.

Schools ordering the Spectrum under the Government scheme will also each receive a free ZX Printer, a free copy of the Logo language, and ten special discount vouchers, valid until the end of 1984. One voucher may be returned with each further order for a 48k Spectrum and may be used either to obtain a £45 discount on the normal price of £175 of a further free printer (value £60).

The Department of Industry's 'Micros in Primaries' scheme announced by the Prime Minister in July and will operate from 1 October to the end of 1984. All 27,000 primaries are eligible for 'pound-for-pound' support and should apply through their local education authorities. Machines supported by the scheme are the Spectrum (48k version), BBC Model B and Research Machines' 480Z. The Spectrum package includes the computer, the 'Horizons' introduction tape, RS232 interface board, cassette recorder, Microvitec colour monitor or black and white TV and a custom-built tray to house equipment, manuals and leads.

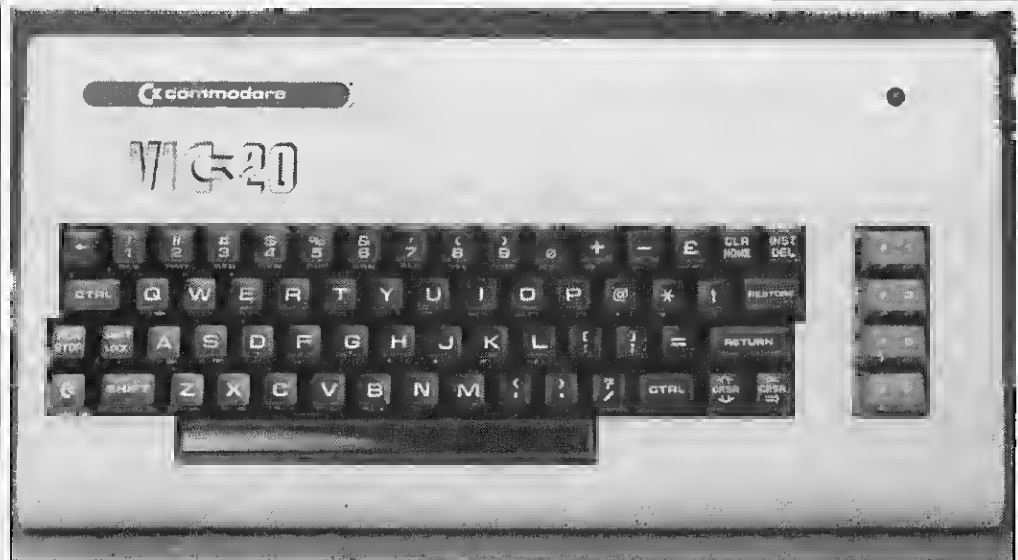
In addition to Logo, Sinclair is planning to make available the Prolog language and is cooperating with educational specialists to expand its own software range in conjunction with the Government's scheme's 150-program library. To implement this, Sinclair has appointed EJ Arnold & Sons to act alongside existing distributor Griffin and George. In conjunction with the Educational Foundation for Visual Aids, Sinclair will also produce a special videocassette to be made available to local education authorities. To coordinate all this increased activity Sinclair has appointed David Park, a Sinclair employee between 1969 and 1979, as educational manager, and former primary school headmaster John Wright as educational consultant.

Steve Mann

Lookalike launched before original!

Whisper it, but admit it: IBM made some mistakes when designing the Personal Computer.

Everybody has their own favourite reason for not spending £3000 on one. My



own is the fairly trivial one of the keyboard, which is wrong. Other people complain about the screen, still others about the amount of memory you get with the minimum version and the amount you can't plug inside it. Yet others feel that there should be more plugs inside to slot in extra features.

Since Icarus Computer Systems is not selling the IBM PC but an imitation, it has had to go out of its way to ensure that the imitation didn't suffer from all these limitations.

Apart from the keyboard, the Columbia, which Icarus will be selling, has done pretty well. You can slot both colour and monochrome display cards into the box, for instance, because you don't have to plug in extra cards to do ordinary things like run extra printers, and because there are three extra slots on Columbia.

Columbia includes a Z80 card, which is nice, but it does rather illustrate the foolishness of going 16-bit this year. In order to have software, you have to use programs which run just as fast on the Z80, and in most cases, don't run at all on the 8088.

But the letters IBM are, of course, magic, and anything to do with them will do your office typing and filing much better, if not any quicker, or any faster, than an ordinary computer. Why, everybody knows that!

Powerful plug

For £13 plus VAT you can buy a high-rise electrical plug from Power International that will protect your system from the worst excesses of the electricity supply. The device looks just like an ordinary 13-amp plug that has got stuck in a funny-mirror joke — it is around six inches tall, with the three prongs coming out of the bottom.

It isn't the most sophisticated power supply cleanser in the world but, say its

Intriguingly, Commodore has not reduced the price of its VIC-20 to £170 (including VAT) because that is less than the big Spectrum price. It has, it says, reduced it to £170 'in line with recent trends in America'.

I assume the expression 'recent trends' refers to the rapid visit which Robin Bradbeer's Spectrum made to Commodore HQ (see 'Chip Chat' a couple of issues ago) at the time of the Commodore Show.

A small, but sad aside: anybody who was thinking of buying the Bee Box as a way of providing extra memory and 40-column Prestel display for the VIC, forget I told you about it. Beelines, the company which designed the machine, has put itself into liquidation.

It isn't yet clear why Beelines went bust: ex-employees suggest that the design was flawed, while John Blackburn, the chairman, maintains that 'certain suppliers couldn't get their act together'.

My lawyers suggest that the rest of the background should wait until several court cases prepared at the time of writing are resolved.

makers, it will suppress 'transients' such as those caused by somebody on the next disk switching his typewriter on, or radio frequency interference. And it will give you 750 W of power which really should be enough for most microsystems. Details on (0705) 756715.

Briefly...

A briefcase manufacturer decided to get into the computer market.

It announced a £35 container with a handle. Inside, it was filled with foam rubber. Bits of the foam were cut out to the size of a Sinclair Spectrum or ZX81, plus tape cassette, plus printer, plus boxes of program tapes, plus power supply. And it announced a portable computing centre which, I'm assured, doesn't make the little micros overheat.

I feel sure it should be a silly idea — but for the life of me I can't see why it is. Details on (0276) 61255.

Chutzpah from Oric

It takes what New Yorkers used to call chutzpah to go into the micro market in direct competition with Clive Sinclair. A new company called Oric, therefore, has

chutzpah in plenty, because that is what it plans to do.

The machine comes (like the Sinclair Spectrum) in two varieties, a 16 kbyte memory size version, and a 48 kbyte memory version. Prices, respectively, will be £499, mail order only and £169, through dealers or mail order — that is, you can't buy the small version through dealers.

The main difference between Sinclair and Oric is in the 'extras' which are included in the latter, but which have to be added to the Spectrum. These include a Centronics printer interface but not a games paddle plug. The Oric also has a normal Microsoft Basic, which will enrage Sinclair much more than the mere fact of competition.

And an important extra which both computers will need to access Prestel — a modem connection to link the machine to the phone lines — is planned for Oric (and only Oric) at £59. This puzzles me a little: there will indeed be many modems next year, but not all of them costing £59 and I imagine Oric could get a lot of dealers for a modem adaptor.

The machine is the brainchild of Tangerine technical director Paul Johnson, and the company is being promoted by the brand new sales director, Peter Harding, who was managing director

The case for consulting professionals



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The Byteshop,
94-96 Hurst Street
Tel: 021-622 7149

Glasgow

The Byteshop, Magnet House
61 Waterloo Street
Tel: 041-221 7409

London

The Byteshop,
324 Euston Road NW1
Tel: 01-387 0505

Manchester


The Byteshop,
11 Gateway House, Piccadilly
Station Approach Tel: 061-236 4737

Nottingham

The Byteshop,
92A Upper Parliament Street
Tel: 0602 40576

Southampton

Xitan Systems
23 Cumberland Place
Tel: 0703 38740

Members of the  Comart group of companies

of Tandata Marketing until last month. Tandata specialises in Prestel connections (and is believed to be preparing to sell a large number to the Halifax Building Society).

Harding expects that, since his machine offers more features than the Sinclair, the Spectrum will have its price reduced within a few months.

But with the Spectrum currently running at a three-month order backlog, Clive Sinclair will be in no hurry to try to boost sales, and a direct clash in the market could last as long as six months.

Incidentally, Sinclair is now selling his ZX81 through other retailers than WH Smiths. There is Richard Hease's Prism distributor and three new retail chains, John Menzies (pronounced Mingus!), Wigfalls in the North, and Rank Xerox. I suppose Oric will be going headlong for Boots.

Gearing up

The tremendous capabilities of the Sirius and IBM micros are matched mainly by the lack of software which can exploit these new features. However do not despair, because there is now a usable list of ordinary business software which will at least run on the CP/M-86 family.

Two software companies of some size have now announced plans to supply business programs that print list of numbers — MPSSL and Pulsar.

Pulsar is not a new name but it is a new company. The name is the brand name of software from ACT, distributor of the Sirius, most written in MBasic, and therefore directly transferrable to run under Basic-86 on both Sirius and IBM (and Victor, but we won't talk about that now) and DEC Rainbow designs.

The company is spending enormous amounts of money advertising Pulsar on television and has published a fascinating 'newspaper' displaying its colour diamond logo (just to prove it has really done a four-ink print job) and singing the praises of the range of programs.

I particularly admired the candour of a columnist in this newspaper, who drew his readers' attention to the importance of software.

He said (and I summarise several paragraphs): 'Nowadays, people choose their software and then look for the machine to run it. . . but this has not always been the case with micros. Even now, the personal computer magazines are full of hardware advertisements with software dismissed in a few throw-away lines.'

The software which will not any longer be dismissed in a few throw-away lines in

Sirius adverts includes an accounting package, a payroll package, an invoicing package, a stock package, a nominal ledger package and a data analysis package.

It also include several products such as Pulsar Wordstar, Pulsar Select, and Pulsar Micromodeller, which is a nice touch, but I'm sure the addition of the Pulsar label won't hurt these old favourites when they are actually running.

The other company, MPSSL, has transferred its Business Operating System to the IBM Personal Computer with rather less ballyhoo about how extra wonderful 16-bit software is.

I like to see big marketing effort put behind branded software because I think the world is ready for the retail software revolution. But I do think it is a bit more candid to say, as MPSSL does, that 'the compatibility of BOS allows it to run identically on all these machines', than to imply that some indefinable magic quality will rub off on ordinary code because of the chip that runs it.

On the other hand, it is a bit optimistic to say, as MPSSL does, that 'there are half a million Apple IIs installed in the world and everyone of them is a candidate for BOS', because, although MPSSL has put the software on Apple II, it isn't just any old Apple II. You need the CP/M Apple with a hard disk to run it, starting at £4500 with BOS included.

It may be fussy of me, but I also find it a bit over-zealous of MPSSL to constantly refer to the Motorola 68000 chip, as used inside the Tandy Model 16, the Fortune 32, and other new, high powered systems, as a '32-bit' system. Even Motorola itself still refers to the chip as a 16-bit design. But I suppose it isn't really important. I feel we have a few weeks to wait yet for the real explosion in retail software.

Getting tough

People make far too much fuss about software copying and too little about software theft. Raiding is what you and I do when we 'borrow' a friend's program to try out, make a copy, and fail to delete it when we return his tape or disk.

Theft (which the industry still euphemistically refers to as 'piracy') however, is evil — and that is what Microsoft has moved against in its action against Advanced Logic Systems, a company which (Microsoft alleges) has copied the CP/M BIOS and BOOT code from the Z80 SoftCard which many people use to turn an Apple into a CP/M machine.

The difference between sampling one program and reproducing somebody else's

code in bulk without the R&D effort they spent producing it is substantial.

Microsoft's evidence appears convincing to me: it reports that 'In a declaration filed at the US District Court, an independent source confirmed that, of 4352 bytes of the BOOT and BIOS programs, only 149 bytes were different in ALS's product.'

And, added the source, 126 of those 149 were the Microsoft copyright notice, leaving a grand total of 23 characters changed.

'ALS's code also contains the initials of the Microsoft programmer who developed the software, in similar location and format to the Softcard,' added the report. The hearing is in December.

Beeb joystick

It is more fun, when you are flying a kamikaze bomber into the Pacific at Mach IV, to direct the ailerons via a genuine joystick, than by repeated and heavy bashing of the 'A', 'Z', and 'SHIFT' keys on your BBC micro. And when firing bombs at menacing aliens, it is a lot easier on the 'RETURN' key if you bash a button on the joystick box.

So I'm delighted to see a 'fully proportional' joystick for the BBC Model B (or the model A upgraded to have a paddle port). It's called the Beebstick.

Fully proportional means that you can arrange things rather more smoothly than an ordinary joysticks, which are either 'on' or 'off' in whatever direction you tilt them. A little tilt will move your aircraft gently, a hard tilt will put it into a stall. Providing the software is written properly, of course.

Beebsticks are available for rather more than your average joystick, at £29.95. The only caveat is that I don't know which programs (games, mainly) will be able to take advantage of its facilities, and you may not be able to use it as much this month as you will in six months' time.

Details from Clares, Providence House, 222 Townfields Road, Winsford, Cheshire, or phone Winsford 51374.

Disk or tape?

I'm having a little bother about Clive Sinclair's Microdrive. It offers disk-speed program loading (or will, when it is available) for Spectrum users but costs £50. The question is: is it really a disk?

My own memory tells me that Clive himself said 'yes' when I asked but his colleagues looked so puzzled when I mentioned this that I feel I must be mistaken. Asked to confirm my im-

pression, Clive refused on the grounds that the device hadn't been patented, so he just couldn't give any details.

But word is now getting around in the Amateur Computer Club that the Microdrive is indeed not a disk but an endless tape loop using very high data densities. Or at least, when it is available, it will be.

Osborne upgrade

Osborne has finally released the smart new (injection moulded) plastic case for the £1500 (inc VAT) CP/M system in the UK and everybody says it looks very smart.

However, if you want a bigger display than the five inch screen, your future isn't clear. Adam Osborne said (firmly) that an 80-column option would be available around the end of the year. People in Osborne UK don't believe him. (No, you explain it, not me: I just report what happens.)

There will be a new machine, capable of displaying 80 columns on a bigger integral screen, soon. But that won't help the long-sighted users of the present design, of course.

And the really entertaining news is that the new plastic case is designed in such a way as to make it impossible to attach a Monadapt, a device which permits an ordinary monochrome monitor to be attached. If you want a bigger add-on screen, make sure you buy the old vacuum formed yellow case.

I'm assured that an alternative monitor adaptor will be available soon.

Fun and games

Not since the days of the five 'exclusive' Onyx distributors have I had more merriment at the expense of the industry than I am having now, thanks to ACT and DRG.

You will recall that the jogging genius Chuck Peddle acquired many millions of dollars by giving the American sales rights to his Sirius microcomputer to a company called Victor.

We were told that Sirius would sell the machine in Europe as the Sirius 1, and Victor would sell it in North America as the Victor 9000.

Then, at the Hanover Fair, Victor showed up with the Victor 9000, and all the visitors were astonished — but Sirius and ACT said airily, 'Oh, we know all about that' — as if it had been part of the plan all along.

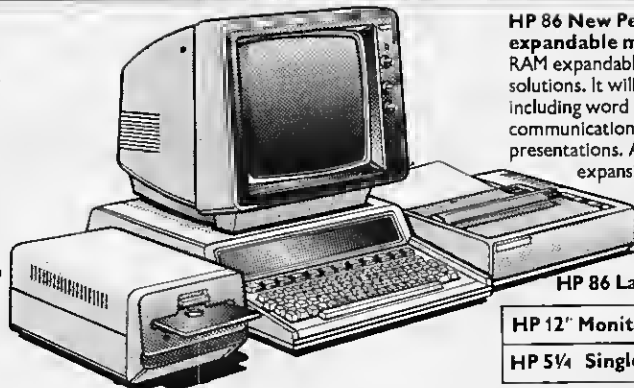
Then, at the PCW Show, micro dealer DRG showed up with the Victor 9000 and software distributor and producer TABS had the machine on its stand and DRG announced that it would

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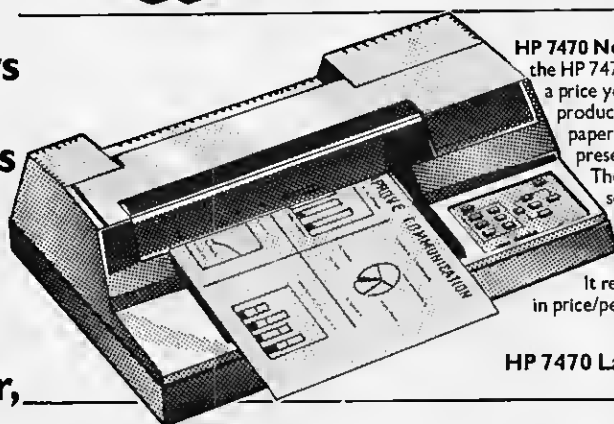
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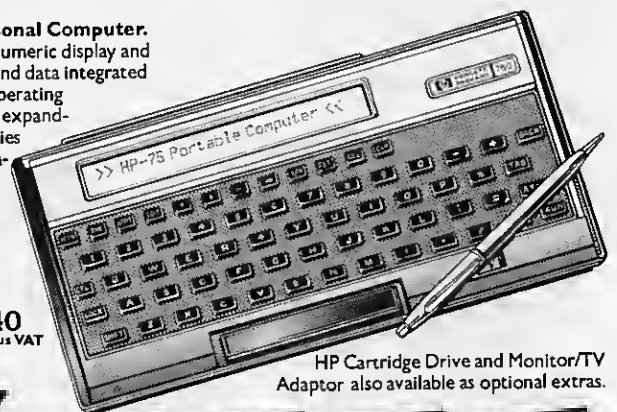
The high speed (38.1 cm/sec) Auto Pen selection plotter connects to HP 85, HP 87, HP 9826, HP 9835, HP 9836, HP 9845 and other micros including Apple and Commodore Pet.

It represents a very considerable advance in price/performance for A4 plotters.

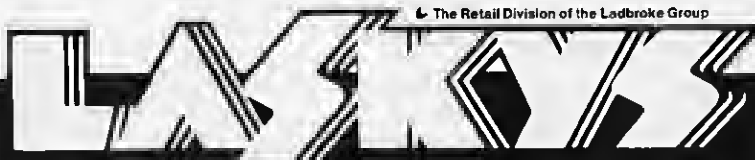
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offer better terms than ACT to dealers who preferred to deal through Victor.

Two short weeks later, I found myself reading an internal memorandum from ACT which informed ACT dealers that TABS had had its relationship with ACT and Sirius terminated. It said, moreover, that TABS customers would no longer have their machines supported by ACT.

'We're trying to start off on a friendly basis with ACT,' remarked DRG managing director Michael Kilmartin in an interview with the trade paper, *MicroScope*, recently. 'The plan is not to undercut each other, but to expand the market together.'

I'm sorry, I'll read that again: 'We're just good friends,' said Rita Chevrolet, 21.

Good, exciting show-biz stuff. Pity about the poor customers, isn't it?

Lurking Lynx

Nobody can honestly say whether it's better to arrive at an exhibition with a new computer that doesn't work (like the Computers Lynx) so that people know it exists, or whether it is better to keep it a secret until it is properly ready for the market.

The Lynx will eventually be a Z80-based machine for £225, capable of running CP/M but offering very impressive colour graphics.

The trouble is that its parent, Computers, is a very small outfit indeed, looking for outside subcontractors to build the machine which it has designed. Even on a relatively unambitious product like the Spectrum, computer buyers have learned to be suspicious of claims that a machine would be available by a certain date.

Lynx designer Dick Greenwood hopes to sell 40,000 models next year and, obviously if the machine



works and if the Basic is to an acceptable standard, the fact that the price substantially undercuts BBC and Commodore 64 micros must give it a clear chance against those rivals.

Its biggest advantage is the fact that (like the Grundy Newbrain) its memory is expandable to a lot more than the normal 64 kbytes — a system with 192 kbytes is planned at a price of £399.

But we will just have to wait for the official launch to decide how easy it will be to use this extra memory under CP/M, or what the Basic is like, or whether those prices are firm, or when it will be available.

If the answers to all those questions turn out to be good answers, then there is going to be nothing to touch the Lynx. The firm is based at 33a Bridge Street, Cambridge CA3 4AD.

Link-up

The portable one-handed typing system, Microwriter, is now linkable to standard CP/M micros — in particular,

Nifty portable from Epson.

the Superbrain and Osborne 1 machines.

The software packages needed are available directly from the software house concerned — Multitext Systems of Chester. Details on 0244 379641.

Epson emerges

Japan's best-known computer printer maker, Epson, has finally released a computer.

It is a portable computer: that is to say it is a light-weight typewriter keyboard with electronics under it and a display using liquid crystals at the top.

As long as nobody calls this a 'rival to the Osborne' (which is a two-disk CP/M machine that happens to have a handle on the case), I expect to get on very nicely with it.

The machine is called the HX20, a number which probably reflects the fact that the display is nearly adequate — it shows four lines, each 20 characters wide. However, if you want to type, you can pretend you have 255 characters per line and 255 lines down and you can move the displayed bit of text around under the screen as though looking through a magnifying glass.

Its nicest feature is the £500 price which Epson UK hopes to charge for it — that price includes the built-in minicassette tape and built-in micro printer. The most surprising thing about it is that the company has chosen to set up its permanent software with Basic, rather than Wordstar or other text editor.

It's surprising on two counts: first, Epson makes the odd printer or two and one would have thought its mind, corporately, would focus on text production; and second, the keyboard is very evidently meant for typing

Anybody who wants a portable Basic calculator can

obviously use the Sharp (Tandy) or Casio designs, and fit it in their jacket pocket, too. Why put Basic on this portable typewriter?

The answer may be that a word processor program is on its way. The machine comes complete with 32 kbytes of permanent program memory; and this can be increased, says Epson, to 72 kbytes. That is plenty of room for a powerful text editor, though not quite as big or complex a program as Wordstar. No plans announced yet, however.

Britain already has a sort of rival to the HX20 in the Husky, a portable micro with rather more memory, a very comparable display, but no printer nor tape. It has the added advantage of being waterproof, coupled with the drawback of using a waterproof membrane keyboard pad. Now its manufacturer, DVN Microelectronics, says that Husky is finding favour with the armed services, and with the (wait for it) water authorities.

The company has also announced that the Basic interpreter has been expanded to be able to address the entire 144 kbytes of memory in the machine. That makes it one of the biggest micro Basics in the micro business, providing you have the online software to load programs and data off host computer systems.

The full memory version costs £3423 (but I daresay some clod will be telling me that this, too, is a 'rival to the Osborne' before the month is out). Details Coventry (0203) 668181.

CBM WP

The word processing package for Commodore users which aroused such excitement at the Commodore Show has become an official Commodore Product.

At the show, inventor John Tranmer was offering it



The Corvus Constellation, a local network based on a Corvus hard disk drive, can now be used to link IBM Personal Computers together, sharing mass data storage (hard disks) and other expensive peripheral devices.



All set to star? See 'Andromeda'.

under the name Superscript, for around £30. It is now available for £250 unless you happen to be an 'educational institution' in which case it costs £50.

The bewildering range of prices is further complicated by the fact that Commodore has bought the program as a standard offering for the new VIC 64, under the name Easyscript, at £40.

Obviously, the people who raved about Superscript at £30 will want to be reconsulted for their opinions of it at £250. My own reaction is dubious: if word processors generally were worth £2250, then this would stand comparison, at least, with other packages at the same level. But even with full tutorial commercial packaging, dealer margins, and so on, the new deal is going to take me a while to feel really happy about.

On the other hand, there are people asking nearly £500 for rival products. Precision Software sells this one, on 01-398 7531.

More CBM WP

An alternative word processing package for Commodore users, the £425 (plus VAT) MicroScript, is now available for the expanded 8096 model PET, taking full advantage of the extra memory.

Supplier Supersoft points out that on the Standard 8032 PET there are 30,000 bytes of memory spare for text but on the 8096 the system can hold 90 kbytes — three 'chunks' of 30 kbytes as above.

The system has rather more spare memory than one might expect, because the software is supplied in ROM. It also has been expanded to the point where it can do calculations, using Maths Pack. This makes it possible

to print invoices with the package, says Supersoft.

Andromeda

The elegant system pictured elsewhere on this page is the Andromeda. And, despite appearances, it is a rival to the Osborne, because it is one of many very cheap systems launched by a new micro producer, ITCS. Like the Osborne, it includes a range of software for all general applications, included in the price.

The wordprocessing package is the MicroTrend package Lexicom, which is supplied with CP/M. Data management is done by another Microtrend package, Trendisk. There is the Mars financial planning package, the Plan-It accounting system, and (in my opinion the weakest item) the Micro-Link communications package to drive modems.

All this in a package which starts at £600 (plus VAT) and where a two-disk system with video display and printer interface starts at £765 (plus VAT).

However, by offering versions with fewer software options, the British company has been able to bring the entry-level (this means the value of the first cheque you have to sign to get started) down substantially below Osborne in this country.

It has a big drawback, however: in the complexity of the configuration options. There are variations on the number of software packages supplied, the number of keys on the keyboard, the size of the display screen, the capacity of the disks, availability of a carrying case, and the capability of the interfaces, to the point where I have nearly 30 pages of detailed information to analyse before being able to report on the system.

One thing is clear, even at this stage, however: anybody considering a CP/M office system should not sign a cheque until they have found out whether there is an available Andromeda to offer the same facilities. Contact ITCS in Staines, on 55554.

'A gets CP/M

Perhaps you wanted a nice Japanese built Sharp system, but also wanted CP/M, and found the choice limited? How pleased you will be to hear of the £175 board from Systems of Tomorrow, which provides an extra eight kbytes (total 56 kbytes) of memory and a normal 80-character-per-line display, for the MZ-80A, also with CP/M available to use these new facilities! You may even want to contact Paul Toland or Michel Audoin on Chesham (0494) 786989, for details.

Source of all problems

The Atlantic is somehow too much for the postal authorities to cope with. For no apparent reason, a letter posted in London can be delivered to Hounslow the next day, or failing that, the day after, but if it is addressed to somebody in California (where a letter can similarly take a day to deliver) even though it only takes an extra 10 hours to get to California, it takes an extra five days (minimum) to sort out what to do with it.

I don't understand it. I would have thought that if the Post Office merely gave the pilot the mail and said 'bung this in the first post box you see, there's a good chap' it could take three days to get from here to there.

Anyway, for those of you who have been looking for a way round this problem, let me tell you firmly: The Source is not The Answer.

I hope this is only a temporary state of affairs, because I myself used to use The Source. I used to write articles here in London, store the text on disk and then transmit it down the phone line.

This past week, when I sat down at my computer and pressed the 'transmit' button (escape 9, actually) The Source choked itself to death on the copy. (I'm telling this story in anecdotal form, since the world seems divided into those who sympathise with my problems, and those who gloat over them.)

Responsibility for safe transmission of my words to California rests as follows: with Osborne, which supplied the hardware, with Wordcraft, which supplied the comms program, with Packet Switching (Telecom) which transmits the codes across the Atlantic; with Telenet, which

distributes them to McLean, Virginia, and with Source Telecomputing, which saves them until the recipient calls in for them.

Here's a strange thing, Osborne said it wasn't its fault. Wordcraft won't accept blame, Packet Switching said the problem was with the host computer, or my terminal software. And the Source said it was my computer that was at fault.

You may not consider this relevant but, for what it's worth, I've managed to do this before, successfully, with the same Osborne, the same Wordcraft package, the same packet switched network and the same Telenet. The one thing that has changed is that The Source has decided that its software wasn't up to scratch, and has 'improved' it.

Previously, the Source used software developed by a US service called Dialcom. Dialcom software is used in this country by British Telecom on its Gold office information service. I can still transmit articles to BTGold, but not to The Source.

When I last logged on, I found that The Source was asking for 'feedback from users on the new software'.

I thought I'd let them see a copy of this little piece, as 'feedback' — I thought it might prove instructive. Unfortunately, I can't transmit it.

Great graphics

In 10 years' time, when asked 'what is a computer?' I predict that harassed parents will answer their children with the phrase: 'it's a thing that draws pictures. Eat your porridge.'

People don't think of clever uses for personal levitation, because it isn't possible. If it were possible, it would be used to eliminate elevators, to save space currently wasted in houses on staircases, as a new form of sport, recreation and goodness knows what.

Similarly, with graphics. If all computers could easily and quickly draw pictures, the way the Pluto add-on can, people would start inventing incredible ways of using pictures to make figures understandable, to illustrate training programs, and to entertain.

If the add-on costs a mere £600, I suppose the inventor might make a million.

The Pluto has been quietly advertised inside this paper for some little time but until I saw the machine running at the recent PCW Show, I hadn't a clue what it was all about. The only word I could think of to describe it adequately is incredible.

Just watching it draw a ring of dots in the form of a circle, then fill the enclosed area with colour, except for the slice of pie that it marked

off, was incredible enough — it happened so fast, and in such detail.

When you came to enquire how it did it, things got really incredible.

Inside the box Graham Rowan showed me, was the same processor chip that IBM and Sirius have made famous, the Intel 8088. With it was quite a bit more memory than either IBM or Sirius provides in the basic machine — 192 kbytes, to be precise — and the memory was much more expensive memory, too. It was 150 nanosecond memory, if you like technical data — which is fast, and is the reason Pluto can draw such detailed pictures so quickly.

Another reason it can draw so fast (a DRAW command plots 100,000 pixels in full colour, with a choice of 255 colours for each pixel, in a second) is that Rowan has double-banked it.

That means he feeds data in from one side of the memory bank, and the machine feeds it onto the screen from the other side. That means no sitting around playing 'after you, Cyril', 'no, after you Cedric' as normal display memory has to do.

The price, by the way, includes an interface to a great many computers.

The connection between Pluto and a computer is through one byte of memory in, and another out. You send commands through the command byte, and read status through the status byte.

Rowan's company reckons to have working interfaces ready for sale to Apple II, Commodore, Nascom, Sirius,

Rair, and S100 bus machines, and doesn't rate the difficulties of adding to this list very high. And it showed these things working, hooked up to a variety of programs, at the PCW Show. Nothing I have seen in the last year has impressed me as much. Rowan's company is IO Research. More on 01-959 0106.

Cheap network?

Free software is a powerful incentive to try a new idea, and it is being used as bait to attract micro users into a new networking idea.

My experiences on The Source (see elsewhere in this 'Newsprint') have left me somewhat less madly enthusiastic about a concept called Micronet 800 than I was when I saw it at the PCW Show.

Micronet 800 is a British attempt to provide Source-like services, but without going overseas, and without charging so much.

It is actually going to be based on Prestel when it is officially launched in January, and the idea is to have at least 10,000 people, all linked together on the phone via their computers, all happily loading free code onto their machine from the central database.

It then hopes to make money by selling software, information and other publishing services to these people.

The most exciting thing about Micronet 800 is the price. Plans are afoot to ensure that it costs only around



The easy way to tell that this isn't another pocket calculator, but a "book-sized terminal" is simple — look at the price.

At £350, this device is "ideal for applications around the factory floor, office or retail operation, where simple data entry and retrieval is needed with responses displayed."

It is called Transterm, and you can find more about it from Technical Designers, 2, Albone Way, Biggleswade, Beds SG18 8BN.

£50 to buy a connection to the phone network, and that users who don't dial up during the day never pay connect charges. And the subscription will be around £1 per week.

The £50 adaptor is going to be the grottiest, slowest option, of interest only to owners of Sinclair ZX81s and the like. People wanting to get faster and more sophisticated access than the basic functions of this unit will probably end up paying £90 or more, and people with CP/M machines could pay as much as £500 or more.

The really interesting question, however, is not 'why are they doing this?' but 'why on earth didn't they do it before?'

The answer is that Telecom and Prestel authorities have been resolutely waiting for television users to buy Prestel sets, secure in the knowledge that they would not be able to resist all the information stored away in their central computers.

They have also been resolutely ignoring all these dirty little computer freaks who looked like spoiling rather complex deals they had with the television manufacturing industry.

And whenever you criticised them, up until early this year, they always rejected accusations that they knew nothing about the real world of publishing by saying, 'We have the International Publishing Corporation' (that's an accounting firm with the rights to several publishing titles and their revenues) 'as one of our Information Providers.'

In August IPC finally gave up waiting for Prestel to happen and pulled out. It made the Micronet 800 deal a lot easier to push through.

There are no details worth having about it yet, though. I expect full information to be available through heavy advertising around the end of

the year. Until then, anybody wanting general information can call 01-242 6552.

Speedy printer

It is not possible for most microcomputers to control a printer and get on with other productive work at the same time without either slowing down the printer or constantly interrupting the other work.

Mutek has designed a product called Sprinter (no, that's not a misprint, they really do spell it with two 'i's) which is described as a fast printer interface but is actually a computer, to control the printer for you.

The difference between this product and previous 'buffer' devices is that this will convert the interfacing problems of going from a computer with a Centronics interface to a serial interface daisywheel machine, or vice versa.

It can also connect two different printers to the same computer.

The main advantage, however, is that you can get on with editing a document while printing a different one, all for the asking price of £249.

Details from Mutek or GB Computer Products on Wokingham (0734) 786635.

Yes, we have n bananas

The only possible justification for including Geests announcement of a micro-computer based banana counting system in these pages is that it allows me to use the above headline. Some of you may not think it was worth it, no offence to Geest.

Anyhow the Geest Micro is a 64k, 720 baud terminal with twin 5", 8" or winchester options and one is currently installed in St.



This may look like an Acorn Atom in a rat trap with a tape recorder in its vest pocket — but it is, in fact, a spreadsheet analyser called Prophet, selling at £759.

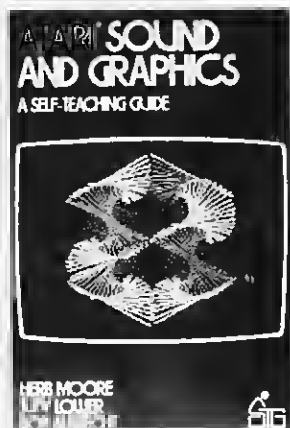
With a cheap printer, says the inventor, the system can still work for a total price of less than £1,000.

The Visicalc-type software is contained in a read-only memory chip. So the drawback of not having disks to load it is somewhat mitigated.

But, yes, it is actually an Atom with a tape recorder, and so when it comes to loading and saving data, you will have to operate the recorder.

Details from Polebrook Management Systems, Pokebrook Hall, Peterborough, PE8 5LN.

THINK COMPUTERS THINK WILEY.....



ATARI® SOUND AND GRAPHICS

by H. Moore, J. Lower, and B. Albrecht,
all of Dymax Corporation

A self-paced, self-instructional guide to artistic programming with the Atari 400 and Atari 800 microcomputers. Teaches simple programming techniques for creating sounds and images using the Atari's high-resolution graphics and sophisticated color and sonic capabilities. Programs range from games to more serious artistic applications. Teaches elementary BASIC programming in the context of each newly introduced technique.

Wiley Self-Teaching Guide

June 1982 240pp
0471 09593 1 (paper only) £6.75

THE COMPLETE FORTH:

A New Way to Program Microcomputers

by A.T. Winfield, *University of Hull*

FORTH is a new, unusual and exciting computer language. Originally developed to control telescopes, it has since been applied in many diverse fields including the animation sequences for 'Star Wars'. FORTH is a compact and fast language; faster than BASIC yet more flexible. It is more than just a language: it is a programming language, editor, assembler and disk operating system all rolled into one. In short, a complete 'environment'. This book describes the standard dialect of FORTH, together with numerous examples, exercises and complete programs.

November 1982 approx. 210pp
0905104 22 6 approx. £6.50
Published by Sigma Technical Press

ATARI® is a registered trademark of Atari, Inc.



GOLDEN DELICIOUS GAMES FOR THE APPLE™ COMPUTER

by H.M. Franklin, J. Koltnow
and L. Finkel

A unique computer game book for the Apple II microcomputer. Includes complete, ready to use game programs for the novice, and also game subroutines that can be added to, combined, and embellished by more sophisticated programmers. Shows how games can be used for education in home or school by explaining exactly what each game teaches.

Wiley Self-teaching Guide

July 1982 158pp
0471 09083 2 (paper only) £8.75

THE APPLE'S BASIC CORE:

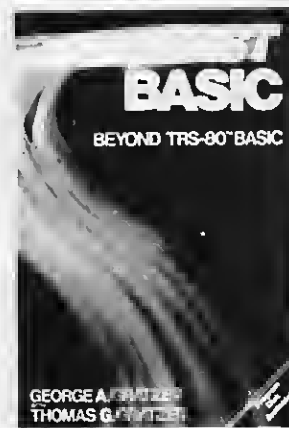
With Disk File Applications

by A. Kantaris, *Camborne School of Mines*
Specifically designed for use with an Apple II microcomputer equipped with a disc drive.

Introduces the newcomer to the BASIC programming language. BASIC statements are introduced and explained with the help of simple programs, and the user is encouraged to type these into the computer, save them on disc and keep improving them as more complex language statements and commands are encountered. This enables the user to build up a considerable library of his own programs and subroutines which become the building blocks of advanced programming techniques and disc file applications explored in the second half of the book.

November 1982 approx. 160pp
0905104 26 9 approx. £6.95
Published by Sigma Technical Press

Apple™ is a trademark of Apple Computer, Inc.



FAST BASIC: Beyond the TRS-80™ Basic

by G.A. Gratzner, *The University of Manitoba, Winnipeg, Canada;*
with T.G. Gratzner

A sophisticated programming language book designed to overcome some of the shortcomings of BASIC. It shows readers how to use fewer than 25 functions of machine (assembly) language to improve the speed of their BASIC.

July 1982 288pp
0471 09849 3 (paper) £10.00

HART'S DICTIONARY OF BASIC

by W.A. Hart

Written by a freelance computer consultant who specialises in equipment selection and the design and installation of management information systems. This dictionary aids the conversion of programs that have been written for one particular machine, to make them work on another. The main part of the book contains over eight hundred entries which summarise the actions of almost every statement, command or function that you are ever likely to encounter.

October 1982 approx. 158pp
0905104 27 7 approx. £5.95
Published by Sigma Technical Press

UNIX — THE BOOK

by M. Banahan and A. Rutter, *Department of Computer Science, University of Bradford*

UNIX is an operating system for computers ranging from main frame, through mini, to micro computers. It is rapidly becoming the standard by which other operating systems are judged. It is both an operating system and a language.

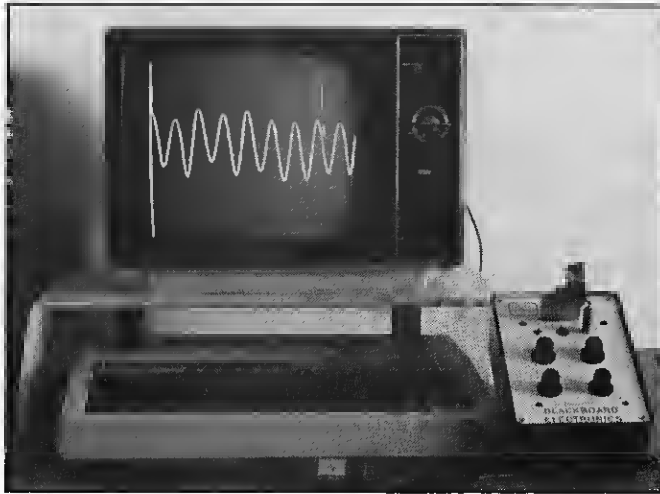
September 1982 approx. 160pp
0905104 21 8 (paper) approx. £6.50

TRS-80™ is a trademark of Tandy Corp.



John Wiley & Sons Limited

Baffins Lane · Chichester · Sussex PO19 1UD · England



An ordinary games paddle, usually, can be thought of as the analogue end of your computer's analogue-to-digital interface. On the other hand, some analogue to digital converters are a bit more than this — and the machine shown is one.

It is shown attached to a BBC Micro, monitoring signals from a microphone — you actually get to see the wave form. Not too many converters can cope with the speed.

Coming soon, promises the supplier (Blackboard Electronics) is a "superfast" converter, capable of plotting the rise and fall of radio waves.

It is aimed at school users, so the price of £190 includes absolutely everything, from power interface, software and cables to microphone, light and heat sensors — and even an infra-red detector.

Details on 061 487 2509.

Lucia counting bananas, doing the accounts and financial modelling and keeping a database or routine tasks for Geest's 300 plus banana growers in the islands.

More info from Geest Computer Services Ltd. on 0733 51231.

Z80 club

The European Z80A Club, a non-profit organisation with backing from the EEC, has been formed in Brussels. Started by Paul Glennison, the club, which is designed to cater for all Z80-based home micros, will concentrate particularly on helping people in hospital, prisoners and disabled people.

Several microfairs have already been held in Belgium, and a multi-language magazine is being produced. Paul Glennison is keen to hear from any British user groups or hobbyist organisations who would be interested in an exchange of information. Address to write to is: Paul Glennison, DBMA ASBL, Rue Abbe de L'Epee, 14, 1200 Bruxelles, Belgium.

Coming Forth

There are, as Kuma Computers points out, none of the problems of Basic compatibility when it comes to the programming language Forth.

The company has released versions of the language (as approved by the Forth Interest Group) for Sharp's MZ-80A and K (users of the B can run Kuma's CP/M version) and for the Sirius

(under CP/M-86).

The reason the compatibility problem is never serious is that Forth allows the programmer to define original instructions in terms of the base level Forth commands.

So, if you find a listing that you want to use and it has an instruction that your Forth doesn't have, you invent it. At least, that's the theory. In practice, people don't try reading each other's listings too much, because Forth is a writer's language, not a readable one, unless you go to some trouble to make your own code readable. But the same can, of course, be said of Basic.

Kuma is on (0628) 71778.

Peach colour

When Pluto is a common extra, Peachtree will no doubt rewrite its range of business graphics software to suit its extra capabilities. For today, Peachtree has announced two colour graphics products to make it easier to display information.

The information is expected to come from a typical spreadsheet or word processing program, and Business Graphics offers the user a menu of choices of how to display it.

Anybody with a CP/M-type computer can use this, together with Peachtree Graphics Language and, says the company, "it can be used to develop presentation colour graphics such as overhead projection transparencies, slides, business charts, graphs and word

charts'.

The graphics language is wider in its purpose than just displaying spreadsheet information and can be used to write programs that display graphics and which respond to user input. Details on (0628) 32711.

VIC quiz

Commodore has finally announced the Mastermind program for the VIC 20 which visitors to the Commodore Show in June will remember seeing demonstrated.

It is one of a whole package of 'educational programs' (that is, games that parents will want to see their children playing) developed and produced by Ivan Berg Associates.

Mastermind itself costs £10, and extra areas of knowledge can be questioned by buying extra tapes for £2 each, on subjects like wine and food, music, sport, films and TV.

There's also a program, Quizmaster, to allow you to write your own questions (and supply correct answers). Details through dealers.

PCW goes on line

Those of you who braved the crush upstairs in the hobby section of the PCW Show

might have noticed the launch of a new dial-up information service called Rewtel.

Operated by Radio and Electronics World magazine, Rewtel is accessible to anyone with at least a dumb terminal and a 300 baud modem/acoustic coupler and provides pages and pages of information on all sorts of subjects — mainly electronics at the moment but the list is being added to all the time.

Rewtel uses a particularly clever method of retrieving information which means that, effectively, every word entered is indexed so that, for instance, if you typed SINCLAIR SPECTRUM SOFTWARE in response to the system's prompt, you'd be presented with a list of all the pages containing information on Spectrum software.

We'll be bringing you more information on Rewtel in the next couple of months or so but the point of this piece is to tell you that PCW will be providing a considerable amount of information to the service from now on and we'll be reprinting Radio and Electronics World's exciting design for a £30 modem soon.

Meanwhile, if you have access to a modem, why not dial up Rewtel and try it out. Currently the system operates from 6pm to 9am daily and most of the time at weekends, on 0277 230959.



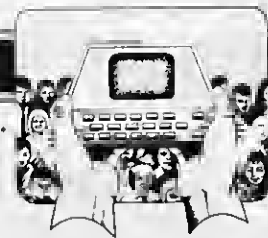
Pioneers from the long forgotten days of hex keypads and systems with a maximum of 256 bytes (not kbytes) of memory will throw up their aged and withered hands in astonishment at the sight of this Pet.

On the front of it, according to MS Electronic Marketing, (41, Palace Road, Bromley, Kent) is an 'elegantly simple keyboard which can be placed over the top of most micro-computer QWERTY keyboards'.

The thing is, apparently, that most non-typists find the sheer range of choice with 60 odd keys to press, baffling. They want a few simple choices, like "yes" or "no" or "maybe" — do the whole long struggle to provide more than 16 buttons marked 0 to F was presumably wasted.

Phone 01 464 3704.

David Tebbutt gives us the rundown on Ruislip's computer appreciation week.



I'd like to start this month with a great big thank you to Ferguson for lending ComputerTown 19 colour television sets for the PCW Show. Not only that, but they came up trumps at the very last minute after another supplier had let us down.

From all accounts the PCW Show was an enormous success for ComputerTown with its two — yes, two — stands being continuously busy throughout the event. So many people helped out that it would be impossible to name them all but I must thank John Bone (CTNE) for taking so much of the organisational responsibility this year.

Our thanks too to Sharp who kindly loaned an MZ-80A and an MZ-80B. Next Month Maggie Burton will be reporting on the details of the show. That's if she can nail John Bone long enough to interview him. In the meantime, thanks to all of you who helped make the ComputerTown stands so popular.

Do you remember Frank Fadipe, the brave man I mentioned last month? Well, he did run his computer appreciation week at Ruislip Library and from reports received it was a great success. Frank even said he'd do it again given the time and the opportunity.

I recently invited him round to chat about the week and I'd like to present the main points from our discussion because it should help others planning similar events: Frank's overall aim was to help remove the fear of the computer and to show people how it can be used as a tool in business, education and the home. One measure of his success was the family of four (mum, dad and two daughters) who popped in on their way home to lunch. They disappeared into the Acorn/BBC caravan and didn't reappear until teatime! Another example was the old lady who became so intrigued that she's now planning to

spend part of her pension on a programming course.

Frank started planning the event back in February and at that time he could have laid his hands on the IT82 caravan. In the event the decision to go ahead was postponed until South Ruislip library had run its Computerday in mid May. By then the caravan was booked for something else.

Monday and Tuesday were designated business and professional days, Wednesday to Saturday specialised in educational and personal use. Some frivolous games crept in, but in the main the event concentrated on the more thoughtful, serious variety — business simulations and the like.

The biggest problem was that a number of people dropped out at the last minute for a variety of business and personal reasons. The people who turned up and made the event a success were (in alphabetical order); Acorn/BBC, ACT, Assortment of local volunteers, Cream Computer Shop, Mass Micro, Metrotech, Pete & Pam (special thanks to Chris Galland) and John Wellsman.

Our appeal for helpers in the London Borough of Brent has brought results in that Ealing Road Library will be opening its own ComputerTown sessions soon. If you're interested then contact Mike Perry, Steve Collas or Dave Lee at the library in Ealing Road, Wembley, Middlesex HA0 4BR.

Ann Sansom, the lady who wrote from Brent originally, would love to get more Towns started in the area. If you'd like to help then please contact her at the Leisure Services Department, Library Service Headquarters, 2-12 Grange Road, Willesden Green, London NW10 2QY, telephone 01-451 3444 ext 52.

Now for news of London's first Computer Festival. It will be held from 3 to 17 April next year. The aim of the Festival is to publicise and promote the

activities of all the centres, clubs and workshops offering advice and help in the community.

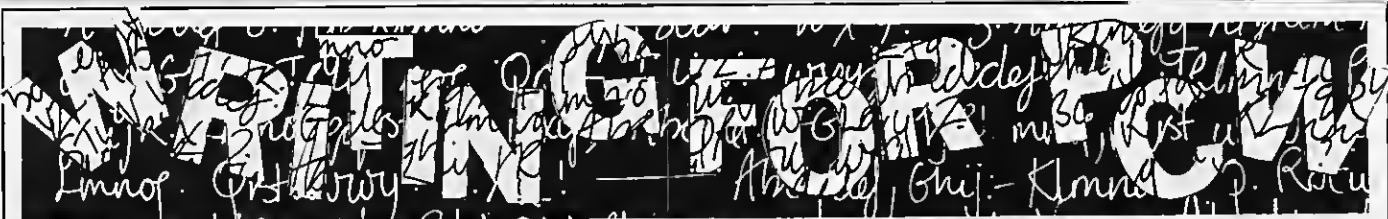
The event is being organised by a fearsome consortium comprising all sorts of clubs, councils and computer centres. The organisers are looking for external sponsorship to help cover the costs of promoting and running the Festival.

Any ComputerTown wishing to join in the fun should contact the secretary to the consortium, GLC Central Computer Service, Room 431, County Hall, London SE1; telephone 01-633 3348.

Finally, please keep those letters flowing. Guidelines are available from us (enclose an SAE) and let's see if we can't launch a few more 'Towns before the year end, eh?

We look forward to hearing from you.

Computer Town UK! is an ever-growing network of computer literacy centres where members of the public are given free access to micro-computers, courtesy of those willing to volunteer their time and equipment. Computer Towns might be found anywhere — in a church hall, a library or perhaps a school after hours. The aim is to make computers enjoyable and non-threatening and, because Computer Town is entirely non-commercial, any kind of axe-availing for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcoke, Middlesex HA4 9EL or 17 St George's Road, London NW11 0LU. Remember to enclose an A4 SAE for your reply. Please don't telephone PCW for information as CTUK! is entirely a spare-time activity.



PCW welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and phone number appear on both the article and the covering letter. If you have submitted the same work to other magazines you

should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications —

experience carries just as much weight.

Dick Pountain is always on the lookout for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading PCW will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — PCW does pay for all published work.



MORE ON THE DOS BATTLE

Peter Rodwell looks at the latest developments in the MS-DOS v CP/M-86 fight

Since my epic comparison last month of the two currently most important 16-bit operating systems, MS-DOS and CP/M-86, two things have happened: Microsoft jettied in its bigwigs to talk about future developments with MS-DOS; and I found a bug in CP/M-86 three days after last month's issue went to the printers.

Out of pure conceit, and because I am only the 1500th person to discover it, I have named the bug the Rodwell Bug. I discovered it accidentally when, in trying to get a directory listing, I typed 'DIRT' instead of 'DIR' — a Freudian slip if ever there was one. Surprisingly, I got a directory listing — but 'DIRTY' or any other suffix to 'DIR' with more than one letter is rejected, unless it happens to be the name of a program on the disk. I tried renaming the Basic interpreter 'DIRT' and running it by typing 'DIRT'; all I got was — yes, a directory.

MS-DOS does not contain this bug — nor any others, if the Microsoft people are to be believed. The purpose of the one-day seminar (held in the exotic Sheraton Skyline near Heathrow — Moet et Chandon at £47.50 a bottle!) was to present details of MS-DOS version 2 and to tell us about Xenix, Microsoft's envisaged upgrade path from MS-DOS for when you want to start getting into complicated computing.

MS-DOS 2 looks interesting. MS-DOS seems to be a Unix-type core (hence the single-byte file granularity — the file structures are Unix-style) with a shell which, in version 1, makes it look rather like CP/M, as I described last month. Unless I've totally misunderstood what was said, it is chiefly the shell which has been changed for version 2, to give, for starters, a menu-oriented system. By this I mean that, instead of typing 'DIR' to get a directory, selecting a program and then typing its name to run it, under version 2 you will be presented with a menu of commands and select your program from this. Quite how this works I've yet to see, but it sounds like a step in the right direction. Additionally, MS-DOS 2 will have a tree-structured system, *a la* Unix and Apple SOS, but until I see how it works I have reservations as to its suitability for computer-naïve end users.

What does sound good is the provision for 'context-sensitive help facilities'. This simply means that should any system error arise, a suitable error message will be generated — either by the application program trapping the error condition or, in the absence of this, by a default mechanism in the operating system itself — which varies according to what's happening at the time; none of this universal 'BDOS error on...' rubbish which has dogged end users for so long when

using CP/M! Rather than copy Digital Research and produce a multi-tasking, single user version of MS-DOS, Microsoft has decided to limit its expansion in this direction to background printer spooling only. This may not in fact be as big a limitation to many users as it might at first appear, but it would have been nicer to see an MS-DOS version of Concurrent CP/M-86.

At a more technical level, MS-DOS 2 offers virtual disk facilities if you have the RAM to spare and a terminal interface to ANSI standard X3.64 1979, to simplify the standardisation of things like cursor addressing. A macro assembler with an 8080/Z80 to 8086 source code translation utility (rather like XLT-86) is promised.

Much was said at the seminar about Xenix, which Microsoft sees as the logical upgrade from MS-DOS. This is certainly Unix but with a different shell; and everything I have seen, heard and read about Unix convinces me that it's even less fit to put before the end user than CP/M. In common with Unix, Xenix has a shell around its core. Microsoft says that systems suppliers who don't like the standard Xenix shell will be able to write their own, to give it the appearance that suits them best. This is a rather naïve approach: it's possible — and indeed reasonably easy — to customise the CP/M-80 BIOS to make the whole thing friendlier and easier to use but virtually nobody bothers to do it so I can't see the manufacturers bothering with the more complicated task of writing their own Xenix shells.

Xenix is a multi-user operating system — something which I have frequently maintained is but a folly to implement in the micro world, for these reasons: if several people want to compute, they must each be provided with a keyboard and a screen; both expensive items which, obviously, cannot be shared. They must all have a certain amount of memory in which to keep their programs and data and, as memory prices are dropping faster than DC10s, you can easily afford to give each user a useful amount of memory, too. In a microcomputer system, the cheapest component of all is the CPU so you might just as well spend about £10 or so to give each user his own CPU. Hard disks and daisywheel printers, on the other hand, are expensive and are worth sharing between users, so the obvious solution is to connect several microcomputers together with a local area network, into which are tied the shared disk and printing resources. Multi-user microcomputers simply make no sense whatsoever, either economically or technically, and I find it astonishing that Microsoft sees this as the way ahead — I guess there must be some minicom-

puter freaks in the background somewhere, as Xenix was unashamedly described at the seminar as a minicomputer operating system.

Thus we have a rather odd situation developing: Microsoft has by far the nicer single-user operating system in MD-DOS, yet Digital Research seems more in tune with the way the micro market is moving as it offers CP/NET, a networking version of CP/M as its upgrade.

Translating

In my last 'Dump I mentioned I was carrying out some tests on XLT-86, the Digital Research package which translates 8080 source code into 8086 source code. Regrettably, lack of time has again prevented my exploring this in detail and I'd be interested to hear from anyone who has been using it for a serious application.

Certainly translation offers a quick way to get your CP/M-80 software over to CP/M-86 but there are problems and penalties to pay for the convenience. Firstly, XLT-86 does not produce source code which can immediately be passed to an assembler — various tweaks have to be performed first and you really need to be familiar with the 8086 instruction set and with CP/M-86. Secondly, translated programs are less efficient than their 8-bit originals: Microsoft estimates a 30-50 percent size increase and a speed decrease of up to 300 percent. This is mainly because the translated program is not utilising the full power of the 16-bit processor but is forcing it to act like an 8-bit machine, and the code required to do this is inherently longer — and therefore slower — than true 16-bit code. It appears that many software houses are running their 8-bit software through translators and then hand-tweaking them, maybe even re-writing time-critical parts in assembler — to overcome the shortcomings of translation.

Further, many seem to regard this as a preliminary measure while the software is rewritten in C; suddenly everybody's talking about C so I have dutifully acquired a couple of books — and very interesting it is, too. Unfortunately, C compilers cost from £400 upwards, and I need three (CP/M-80, CP/M-86 and MS-DOS) to do a reasonable job of checking it out, so it doesn't look as though I'll get very far. I'm also told that C will only be popular for a couple of years and that the upcoming language is Ada — just as soon as somebody can fit it onto a micro, that is. Maybe by the time Ada appears I'll have saved up enough to buy it! **END**



BANKS' STATEMENT

Martin Banks muses on the wisdom of making predictions in the microcomputer biz, and chickens out from making his own.

Placing bets

A few years ago I was, in the course of my labours, asked to attend a conference in the fair city of New Orleans, USA. Not unnaturally, I would have much preferred to have stayed in the UK watching what was happening to the microcomputer industry here — the cut and thrust of business, who was telling the best fibs about sales figures, which companies had just gone bankrupt. But no, the editor for whom I worked banned me from such fun and sent me to the salt mines of Louisiana.

The reason for all that unwarranted cruelty (ask any journalist just how cruel such working trips abroad can be) was that New Orleans was to be the site of a conference on personal computers. Yeah, well, a conference is a conference is a conference I hear you say — and most of the time I would agree with you. This one, however, was different. For a start it was not just a vehicle for flight-testing hot-air balloons like many of the events normally are; and for a finish it was being run by one of that fair nation's most widely respected analysts of the electronics and computer industries, one Benjamin Rosen.

That fact alone made it interesting. It was a conference run by finance men, for finance men, and about the personal computer industry. Not surprisingly, the personal computer industry took note, and attended in small, but *very* select numbers (some say that's why I was there, but I would deny it).

During the course of this conference a new game came into being. To be fair, I suppose it wasn't a new game as such. The rules were as follows: someone asks the speaker (senior people from the industry) who's going to be top dog in five year's time. What was new about the game was that the speakers felt obliged to answer. They did not try to duck the issue as they normally would have done. This time, perhaps because of the heavyweight audience, they were giving straight answers — or as straight as possible, anyway.

What was interesting was the nature of the answers, and what they indicated about the perceived future of the industry. This year was, in fact, 1980. All the speakers at the conference, which included the likes of Steve Jobs (Apple), Chuck Peddle (then Commodore), John Roach (Tandy), Alan Alcorn (Atari) Dan Fylstra (Personal Software) and Portia Isaacson, were putting money on Apple and Tandy to be in the first three. That third place, the consensus said, would go to a Japanese company.

There are still three years to run on that prognosis, but even now the odds seem to be lengthening, especially on Apple.

The pace at which this particular industry develops makes playing the predictions game a fool's errand at the

best of times. It is surprising however, that the likes of IBM were ignored by all but one speaker — Portia Isaacson. She said that the number one company would be Tandy and IBM, which would be a joint venture. Apple ranked only third in her prediction, and that only after it had been acquired by a Japanese company.

Most of the assembled delegates thought these predictions to be a wizard wheeze, and therefore no doubt promptly forgot them. With the benefit of two years' hindsight, they are predictions that do not look quite so silly. They certainly bear some examination.

The first point to consider is the pace of development that has continued in the business. At the time of that conference, Sinclair had yet to launch the ZX80 in the US. Clive was a man with a reputation, to the US financial men, for flair in design and danger in manufacturing. Since then he has created a whole new personal computer marketplace around the world, and has almost certainly stopped being poor.

Nobody could really have predicted that particular event, or the scale of it, two years ago, yet the speakers at the conference knew that some events were likely. In particular they knew about IBM and the chance of it coming into the market. Despite the pace at which the market was developing, IBM was a predictable entrant. Yet only one person, Portia Isaacson, ventured to suggest that it might be amongst the leaders in five years time. Could it have been that the leaders of the industry had such a poor view of IBM, or perhaps a grand view of themselves?

With that benefit of two years' hindsight, it is perhaps possible to re-appraise those predictions, especially those of Portia Isaacson, and see where the strengths and weaknesses lie.

What the last two years have taught us is that: 1) there will always be room for something new, and that something new can happen very quickly in this business, eg, Clive Sinclair; and 2) not all the old analogies always work — only some of them.

That second, probably obscure statement refers to the Japanese, who were punted by just about everyone at that conference as the source of one of the top three companies for the future. A Japanese company was punted for the then-obvious reason that, as a nation, it had done well in just about every other industry it had looked at. Analogies abounded. Shipbuilding, motorbikes, cars, televisions, hi-fi, semiconductors. Everywhere there was an analogy of how the Japanese can take an industrial sector by the throat and make it theirs.

Yet, for some reason, no Japanese company has managed the trick in the personal computer business — well, not yet, anyway. There could be two reasons for this. One, that they are just biding their time until an appropriate moment, and two, that another analogy is in play. That analogy is of the popular music business — that while the Japanese have the world hardware market in hi-fi, they are nowhere in the software — the music that gets played on hi-fi systems. In personal computers, it is usually the case that without the right software the hardware means little.

It could be that a combination of

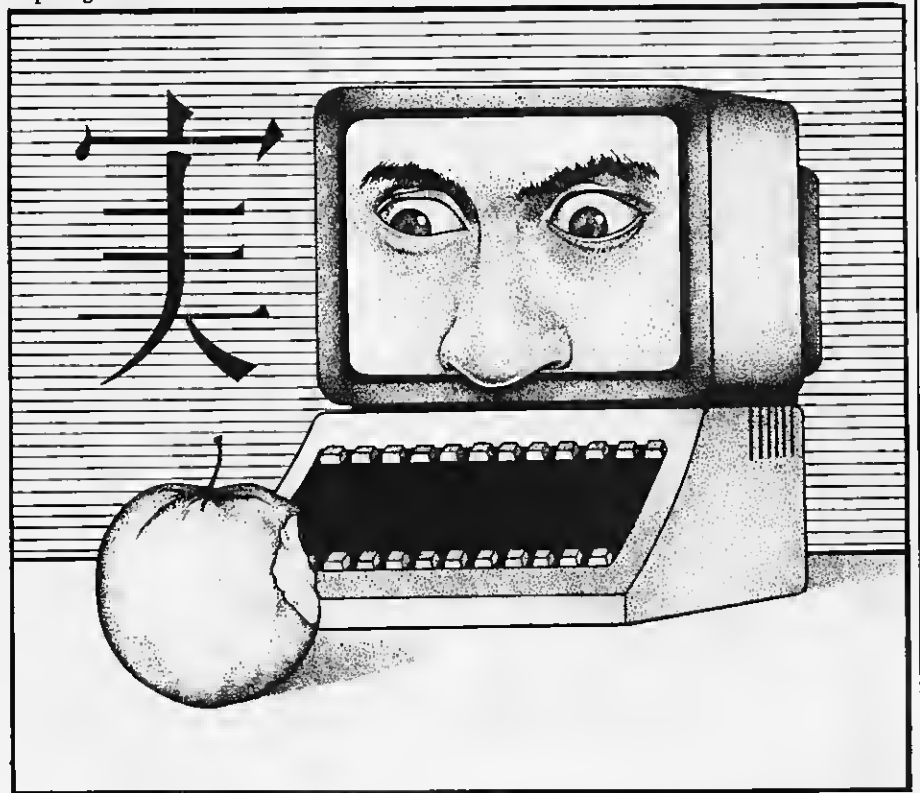


Illustration by John Ellis

these reasons prevails, and that leads back to Portia Isaacson's prediction — that third place in the world market would be taken by Apple, which would be owned by a Japanese company.

The chances are that an acquisition of this type is the best way the Japanese can make the big transition from the unfamiliar position of also-ran to market leadership. (There is also, of course, the chance that they are about to do a Sinclair and come up with something entirely new.) If acquisition it be, then whom should be purchased? Ms Isaacson's suggestion is maybe not that outlandish. Apple and its contemporary Commodore are both showing the hints of vulnerability, while having a presence in the market of considerable value.

A star of the US stock market, Apple's financial performance has recently started to plateau. Its early growth rates have diminished to levels that, while still good for industry in general, are no longer at the dramatic and significant levels of two years ago. One New York stock analyst has said that the company might be slowing down.

On top of this, the company's product range has hit a hiatus. The Apple II has been one of the outstanding successes of the industry; in many ways it helped to create the viability of the whole business.

It still sells well, but it now long in the tooth. The follow-up, the Apple III, limped into existence with a million problems, not least of which was the fact that the company was going public at the same time. The machine has since

been revamped, which took around a year, but it has been in many ways superseded by events (or more specifically systems like the IBM and the Sirius) without making any major impact.

Yet the company has an excellent international distribution set-up, generally sound marketing with only occasional public squabbling, and a software base that is worth a fortune. A Japanese company could be tempted if Apple fails to come up with something good in the next year.

In that respect, Commodore is slightly better placed. It looked almost dead on its feet a year ago, but now it has a whole range of products available (or coming, at least). It also has a good distribution set-up, especially in Europe. Commodore's biggest weakness has, however, always been the fact that its penetration of the US market has been weak, with European sales supporting the operation. As the company has broad base, with manufacturing in a variety of product areas, the right offer from a Japanese company for the micro-computer bits could be tempting.

But what of Ms Isaacson's other prophesy, that IBM would be number one in a joint venture with Tandy?

Well, apart from the fact that, at first glance, IBM stands a good chance of being number one all on its own, the suggestion of a joint venture with Tandy does make some sense. This is especially so outside the US, where IBM has yet to get its marketing act together formally.

In practice, such a venture is unlikely. IBM will no doubt announce soon enough that it is appointing dealers

in the UK. Everyone knows it is talking and planning, and knowing my luck, it will have already announced details by the time you read this.

Nevertheless, such a joint venture would have a great deal going for it. Both companies have design and manufacturing skills par excellence, both have strong marketing. Tandy has the distribution game sown up tight, while IBM has the name to put on any box that is liable to be called a computer. Last, but by no means least, the combined financial clout of the two companies would mean that no investment — either in developing new products or in bombing prices to kill the opposition — would be too excessive.

It is an interesting exercise to guess market leaders for the future, though rarely one to do in public. Already, in two years, the whole scenario on which expert judgements were based has changed significantly. I will, this time, opt out of such endeavour, but I will leave you with the latest US suggestions on the subject.

Given that there are now several personal computer markets, and that the following is not concerned with the one created by Clive Sinclair, but more about the professional and business/commercial market, then two names now emerge. For anyone who has had anything to do with the mainstream computer business it will be just like old times, for the projected leaders in the future personal computer market are — yes, you guessed it — IBM and Digital Equipment Corp.

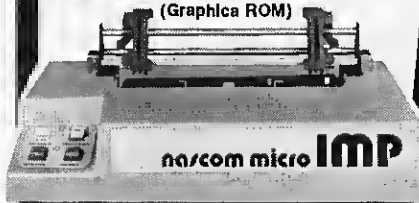
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```

0E77 1F 04 0C 0A 12 ; k
0E7C 00 00 1F 00 00 ; l
0E81 1E 02 0C 02 1C ; m
0E86 1E 02 02 02 1C ; n
0E8E 0C 12 12 12 0C ; o
0E90 3E 0A 0A 0A 04 ; p
0E95 04 0A 0A 0A 3E ; q
0E9A 1E 04 02 02 02 ; r
0E9F 14 16 16 16 0A ; s
0EA4 00 02 1F 12 00 ; t
0EA9 0E 10 10 08 1E ; u
0EAE 06 08 10 08 06 ; v
0EB3 0E 10 0C 10 0E ; w
0EB8 12 12 0C 12 12 ; x
0EBD 26 28 28 28 3E ; y
0EC2 12 12 1A 16 12 ; z
0EC7 00 04 0E 11 00 ; <
0ECC 00 00 1F 00 00 ; |
0ED1 00 11 0E 04 00 ; }
0ED6 02 01 02 04 02 ; ^
0EDE 15 0A 15 0A 15 ;

```

Listing 2 Character codes

The main part of the program is the print routine which is called every time a character is output. It makes use of a look-up table to find the dot patterns necessary to form the required character. Five of these are output for each character printed. A single dot-width is then printed to provide spacing between letters.

The program is written to drive the printer through the Z80 PIO fitted to the Nascom. It uses port 5 for data, bit 0 of port 4 in input mode for the BUSY line and bit 1 of port 4 in output mode for the STROBE line. The subroutine AOUT outputs the character in the accumulator to the printer. It outputs the character through port 5 and then repeatedly checks bit 0 of port 4 until it goes low indicating that the printer is ready to accept data. The data is then strobed into the printer buffer by taking bit 1 of port 4 low and then bringing it high again.

If the printer is connected to the serial port of the computer then lines 14-19 in the program should be replaced by a call to the NAS-SYS external command, DF 59, and the subroutine AOUT should be replaced by calling the NAS-SYS output to serial port routine SRLX; the code for this is DF6F.

The program is presented in two parts: first, the assembler listing of the printer control program (Listing 1), and second, a hex dump (Listing 2) which contains the codes necessary to print the 96 standard ASCII characters supported by the printer in its normal (10 cpi) printing mode. Since all these codes are contained in software, it's not difficult to change the values to redefine single characters or even the entire character set if necessary. To change a character each of the five bytes corresponding to that character should be replaced by codes to form the new character. Bit 0 of the code corresponds to the top dot and the bit 5 of the code corresponds to the bottom dot. As it stands, the program only prints characters in the range 20H to 7FH since these are the only ASCII codes normally supported by the printer. To print codes outside this range will need some modifications to the driving software.

Modification of the program to drive other printers with pin-addressable graphics should not be difficult but the exact details will obviously depend on the way that a particular printer controls the print-head.

```

0CC1 0044 ;** MAIN PRINT ROUTINE **
0CC1 0045 ;
0CC1 FS 0046 PRINT PUSH AF ;Save data
0CC2 0047 ;
0CC2 FE 0D 0048 CP 00 ;If carriage-return
0CC4 20 24 0049 JR Z,NEWLIN ;then start new-line
0CC6 0050 ;
0CC6 FE 20 0051 CP " " ;If code before space
0CC8 38 1E 0052 JR C,END ;then don't print
0CCA 0053 ;
0CCA E6 7F 0054 AND 07F ;Reset bit 7 if set.
0CCC 0055 ;
0CCC 5F 0056 LD E,A ;
0CCD 16 00 0057 LO 0,0 ;Put 8-bit data
0CCF 62 0058 LO H,0 ;into 16-bit
0CD0 68 0059 LO L,E ;register and
0CD1 29 0060 AOD HL,HL ;multiply by
0CD2 29 0061 AOD HL,HL ;character width
0CD3 19 0062 AOD HL,DE ;i.e. 5
0CD4 0063 ;
0CD4 11 60 0C 0064 LO OE,CHRTBL-0A0 ;Calculate address
0CD7 19 0065 ADD HL,DE ;of character data
0CD8 0066 ;
0CD8 04 05 0067 LD B,5 ;Set up loop
0CDA 0068 ;
0CDA 7E 0069 LOOP LD A,(HL) ;Get bit pattern
0CDB C6 20 0070 AOD 020 ;generate graph code
0CDD CD ED 0C 0071 CALL ADUT ;and output it
0CE0 23 0072 INC HL ;points to next code
0CE1 10 F7 0073 DJNZ LDOP ;and get next code
0CE3 0074 ;
0CE3 3E 20 0075 LO A," " ;Load accumulator
0CE5 CD ED 0C 0076 CALL AOUT ;to print space
0CE8 0077 ;
0CE8 F1 0078 END POP AF ;Retrieve data
0CE9 C9 0079 RET ;and return
0CEA 0080 ;
0CEA 0081 ;
0CEA F1 0082 NEWLIN POP AF ;If new-line POP data
0CEB 18 00 0083 JR AOUT ;and print it.
0CED 0084 ;
0CED 0085 ;
0CE0 0086 ;
0CE0 0087 ;** CHARACTER OUTPUT ROUTINE **
0CED 0088 ;
0CE0 FS 0089 AOUT PUSH AF ;Save data
0CEE 0090 ;
0CEE 03 05 0091 OUT (5),A ;Output data to PIO
0CF0 0092 ;
0CF0 DE 04 0093 LOOP1 IN A,(4) ;Input and check
0CF2 CB 47 0094 BIT 0,A ;BUSY signal
0CF4 20 FA 0095 JR NZ,LOOP1 ;If high check again
0CF6 0096 ;
0CF6 3E 00 0097 LO A,0 ;Else take
0CF8 D3 04 0098 OUT (4),A ;STROBE low
0CFA 3E 02 0099 LD A,2 ;and then
0CFC 03 04 0100 OUT (4),A ;high again
0CFE 0101 ;
0CFE F1 0102 POP AF ;retrieve data
0CFF C9 0103 RET ;and return.
0000 0104 ;
0000 0105 ;
0000 0106 ;
0000 0107 ;
0000 0108 ;** PUT CHARACTER DATA HERE **
0000 0109 ;
0000 0110 ;
0000 0111 END

```

Listing 1



'Another example of computer crime — little bastards used a pocket job to calculate the optimum trajectory for the brick.'



The PCW stand



Some just couldn't take it



An overhead view of the crush in Lower Hall 4



Sirius City attracted a few ghosts



Happy visitors enjoy a nutritious lunch

THE 5th PCW SHOW

The 1982 PCW Show exceeded all expectations and is now the world's biggest microcomputer exhibition. Steve Mann and Maggie Burton fought their way through the crowds to bring us this report.

The biggest....

Round about this time last year the percipient Pountain ended his review of the last PCW Show with the words 'Next year, 50,000 at Olympia?' This could have been construed as wishful thinking but, as it turned out, Dick couldn't have got much closer. Okay, he couldn't have foreseen that we would all end up in a converted carpark in the Barbican, but his forecast of attendance figures was just about spot-on.

This was the year the PCW Show

came of age. With a total attendance of 53,000 (this figure is adjusted to 47,000 to allow for re-admissions, exhibitors, etc) the event can now lay claim to being the largest micro-computer show in the world, outstripping even such giants as the annual West Coast Faire. Visitors from as far away as Indonesia and Tasmania jostled for a view with American micro trade figures who had come to London especially for the Show. There were 210 exhibitors, representing the whole spectrum of the industry, from small one-man businesses

making ZX81 add-ons to giants like Digital Equipment, at the Show to unveil its new range of micros.

Exhibitors were segregated according to market: the upstairs part of Hall A was designated a hobbyist/home computer area and, not surprisingly, attracted the lion's share of the attendance. With special 'Villages' set up for the Sinclair and Acorn freaks, and stands devoted to the ACC and CTUK!, this area became almost impassable at times and by the fourth day feelings of claustrophobia and fraying tempers



A flying saucer on DEC's stand

were the norm. Over in the business sectors of Hall B, things were slightly more civilised. Despite fears that trade would fall off rapidly over the weekend, business remained brisk for the whole show — but at least it was possible to move around in relative comfort.

So, what of the goodies on offer? Despite the absence of some big names — like Apple, which might have been expected to be there plugging the rumoured Super II — the show heralded the new range from DEC: the Rainbow (see preview in this issue), the Professional and the DECmate II. Also on display for the first time was the new machine from Commodore, the 64, and the Lynx, a new home computer from Computers. This is potentially very interesting, featuring 48k memory and ultra-high resolution graphics. Unfortunately, the demonstration program gave every indication of being put together in great haste and gave no real indication of the machine's capabilities. Also in

evidence was the Jupiter Ace, a new home micro that is notable for being the only machine in its range not to use Basic — it runs Forth and is claimed to be the 'fastest microcomputer in the universe'. Designed by Richard Altwasser and Steve Vickers, who had a large part in the design and documentation of the Sinclair Spectrum, the Ace is a low-cost (£89.95) black and white machine that is aimed at the game-playing fraternity.

Upstairs in the hobby section, much attention was attracted by the BBC machine. Acorn displayed a network of BBC Computers, complete with disk drives and printers (which must have been especially irksome to those who have been waiting almost a year for delivery of Model Bs with disk interface), and (equally annoying for those on the waiting list) some stands had vast piles of Beeb machines for sale over the counter. Sinclair's stand had the first copies of a new range of software for the Spectrum, produced in conjunction



Computerniks put the micros through their paces.

with ICL and Psion. At the moment this leans rather too heavily on old favourites — biorhythms, lunar landers, etc — and some of the software shows evidence of being somewhat hastily revamped ZX81 material, but it is an indication of the flood of software that will appear in the very near future for this very popular machine.

Olivetti had a very neat colour graphics demonstration for the M20 and collected large crowds at its stand, but the hit of the show (at least as far as the PCW editorial team was concerned) was the Pluto board from 10 Research Ltd. Featuring 192K or RAM to run the display, the speed and quality of the graphics had to be seen to be believed. A future development will be the link-up of Robocom's Bit Stik (see review this issue) to Pluto, which should provide the ultimate in state-of-the-art graphics.

Bug-Byte was there, too, occupying pole position at the top of the stairs in

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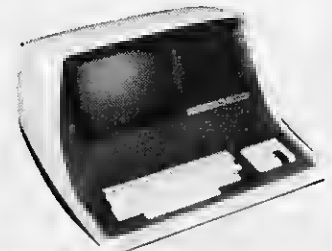
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THE 5th PCW SHOW

Hall A, and fresh from its copyright battles with Atari. Undaunted, Bug-Byte was showing off its latest bit of Spectrum software; a game called 'Spectres' that incorporates the best features of Pac-Man but which should avoid any action from litigation-happy Atari.

Getting away from games and into serious business applications, Caxton Software Ltd did good business, demonstrating their very popular Cardbox electronic card index and Optimiser, a linear programming problem-solver which answers 'what if?' questions and runs on the Apple. Caxton also gave a preview of its latest product — Sourcewriter, a Cobol source code generator running under CP/M, which has potential. Erstwhile PCW publisher Felix Dennis adopted a novel approach to the problem of keeping game-players away from his trade-only *MicroScope* stand: he built himself a front door, complete with doorbell and a 'Trade Enquiries Only' sign: this worked a treat, and the only people to be found in the *MicroScope* 'lounge' were thirsty hacks and would-be advertisers. Other magazines were well represented, even the upstart *Popular Computing Weekly*, which has attracted a certain amount of ire from certain quarters not a million miles from Oxford Street by its insistence on being known by its initials — we would remind them that a certain other PCW got there first . . . *Micro-computer Week* did a roaring trade in free plastic carrier bags and free copies of the magazine, but to no avail — they went into receivership a week or so after the Show.

But for most of us who had to spend four days at the Show the place to be was the PCW hospitality lounge. Self-conscious members of the editorial team could be spotted roaming the hall, braving the crowds and muttering furtively into their radio microphones, before diving back to the PCW lounge for a reviving gin and tonic. It was here that the bulk of the Show's business was conducted as far as we were concerned and a constant succession of visitors ensured that everyone concerned spent the four days in a state of constant mild inebriation. By the end of the last day, the entire staff could be seen sitting slumped in a corner with expressions that could only be described as zombie-like. The official story was that we were preparing for next year's Show . . .

Steve Mann

... and the best

The first thing to catch my eye at the Show this year was on Vincelord's stand. It was a heartbeat/pulse/breathing rate monitoring system called the System LE80/PH. The monitoring system was, in fact, a software package running on a 64k CP/M micro (the LE80PH) and the computer itself will run most standard CP/M packages as well. Messrs Pountain and Rodwell and myself spent some little time wired up to it watching for signs of imminent heart failure or asthma. The monitoring system is written in Pascal and can be used in

such paramedical areas as Biofeedback — especially for helping people who suffer from undue amounts of stress. (I in my crippling neurosis should be purchasing one before long . . .) It would, of course, be extremely useful as a conventional electrocardiogram in, say, an operating theatre.

Sharp was very much in evidence with all three of its micros up and running. Systems of Tomorrow provided a prototype 80 column board for the MZ-80A which, although subject to one or two minor teething problems, fulfils a definite need on this particular computer. The board also increases RAM to 56k.

Electronic Insight, who provided the network of viewdata monitors within the Barbican, had details of an Apple videotex system which consists of a single card to fit into Apple's expansion slots, providing a Prestel adaptor, built in modem and some very smooth downloading facilities for under £155. This will be on the market from the middle of October.

Zenithplan introduced the BOS multi-tasking operating system on the Sirius 1. This offers a good range of software — over 100 packages — and networking as an option and will also run on minis, which means you can link your Sirius up to a mini if you want to. BOS also runs on the Data General Micros and the ITT 3030.

Zenithplan also stocks a VT100 emulator for the Sirius. Perhaps it should have been a part of Sirius City, which had an abundance of interesting and captivating exhibits of its own, including the controversial girlie ad playing endlessly on a large TV screen — this features the dulcet tones of Tom Baker plus an exploding robot which turns into an alluring siren and — yes, you guessed it — the ACT Sirius 1. The dirty bits got cut out after an Advertising Standards Authority hate campaign. There were some real computer systems as well in Sirius city. I had a long look at a system from BusySoft called Busy-post which, as well as being a very easily used address book-type database, will save letters and print them out with specified addresses and dates on top if you want to run a mail shot. It does a lot more besides. I also had my voice recorded, relayed from one Sirius to another and played back on the speaker of the second Sirius — it's really eerie hearing your own voice coming out of a mere computer.

Molimerx featured an interesting image processing kit which consists of a

disk containing three or four digitised images and the software with which to perform such dissections as differentiation, shade separation and bass relief. The result of such experimentations can then be *SAVED*. The system costs about £25 and, according to its author, Mike Cook, it's very similar to NASA experiments on outer space photos.

Encotel was demonstrating Decision Point, a CP/M masking system which isolates the novice user from the rigours of PIP and STAT, using a question and answer format. One useful point in favour of this package is that it informs you if you haven't backed up a disk. It presents intelligible responses and prompts which anyone should be able to understand. Another CP/M masking system was Supervyz from Riva Terminals who also produces a small CP/M micro called the Episode. The disadvantage with this particular computer is that it doesn't have an integral screen — you have to buy that separately although the computer itself is very small and it comes with Supervyz as well as CP/M 2.2. Supervyz makes system configuration much easier with a series of menus.

All in all, the Show was at least profitable for every exhibitor with whom I spoke. The Dragon 32 sold 275 over the three days and the NewBrain a similar amount. Tim Moore of Kuma (ex-Newbear) told me it was 'all gravy after the first day' and Mike Barton of Romik software, who launched his games company at the Show, found himself inundated with overseas distributors. Romik Software is running a competition — information on this can be found in every blister-packed Romik package — with annual supplies of their software as prizes. This means quite a few games coming in for the winners as Romik plans to produce a minimum of one new game a month. Entry forms are also available from Romik for a nationwide games competition.

ComputerTown UK! managed to secure themselves two stands and were crowded throughout the Show. It was among other blessed ones whose stands were graced with the wonderful BBC



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Proof that there was some elbow-room!



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THE 5th PCW SHOW

Computer — running some very attractive arcade-style software. One of its stands was just opposite Mapsoft who had several Atari running arcade games as well. This probably led to an overflow of youngsters who couldn't get their itching hands on Pac Man or Star Raiders and therefore spilled over onto surrounding stands. Games, however, are not all CTUK! had to offer — more

on that in the next issue. Keep an eye on CTUK! News. The ACC was also very busy in conjunction with all the other user groups on Computer Club Avenue. Peter Whittle described it as 'hectic' and the club managed to attract ten new members per day — plus more who will undoubtedly be in touch in the next few months.

Finally, I'll finish on similar notes to

those on which Steve began. Apparently the Show will, if it keeps on growing at its present rate, be large enough to swamp the whole world by the year 1995. It was three times the size of last year's which was twice the size of the show the year before. It's almost logical to conclude that the 6th PCW Show will be four times as large as this one — and if you multiply the exact visitor figure of 47,461 by four you get 189,844. They'll have to build a whole new exhibition hall to accommodate PCW next year...

Maggie Burton

TOURNAMENT REPORT

Microchess

The third European Microcomputer Chess Tournament ran for the four days of the Exhibition and attracted some of the strongest commercial entrants and amateur programs ever. The seven round Swiss event was contested by 13 programs, one more than last year. Despite the seriousness of the event, it produced a very relaxed, friendly atmosphere. Rival operators could be seen talking over the finer points and eccentricities of their machine's moves. Members of the public took every opportunity to ask questions of the programmers and anyone else near the tables who seemed to know anything about computer chess.

Outright winner of the tournament was Advance 2.4, an amateur entry, written by Mike Johnson and David Wilson. It ran on a home made bit-slice machine that proved too powerful for many of its rivals. A little luck in the final round (where its opponent, the SciSys experimental machine Mark 5.01 Experimental was in a clearly winning position but failed to look far enough ahead to prevent a three-fold repetition of position) meant that it got through the tournament without losing a game. Its six points out of seven (two draws) gave Johnson and Wilson two trophies (overall winner's cup, and best amateur entry trophy) as well as a cash prize of £150.

Second place was taken by La Regence, the highest placed commercial entry. With only two losses and five wins this sensory board chess computer produced by Intelligent Software looked very impressive.

The cash prize of £50 for the second highest placed amateur entry was won for Mark Bryant by his program White Knight (MK 10), running on an Apple II, with a score of 3½ out of 7 — overall position, joint fifth-sixth.

The time control was 30 moves in the first hour and 23 moves in the next 46 minutes; an average of two minutes per move. This is less than the standard tournament time of 40 moves in two hours, but the show hours at the Barbican (10am to 7pm) made two rounds a day a tight squeeze. All the same, very few games were lost on time, and then usually through operator error! The games were adjudicated at move 53 by the tournament director Stuart Reuben, a FIDE international arbiter.

Tony Harrington

Results table

Advance 2.4	6
La Regence	5
Philidor	4½
Bogol	4
White Knight	3½
Mark 5.01 Exp.	3½
Cyrus II	3
Gambiet '82	3
Micromurks	3
President Turbo	3
Conchess	2½
Spectrum Chess	2
Chess '86	0

Scrabble

The Scrabble contests generated enormous interest. Unfortunately there was such a large response that at peak times during the Show people had to wait a while to play. Predictably the computer attained the highest score of

the contest — 503 points. He sure played a mean game! The human winners are as follows: 1st, Murray McBeth, with 479 points; 2nd, Richard Evans (who is only 11), with 444 points; 3rd, Andrew Margerison, with 435 points, and 4th, R P Phillips with 411.

Microwriter

Fun was had on Microwriter's stand in the form of a learning-to-microwrite contest. The fastest times were put into a pot and 10 prizewinners were drawn out and awarded prizes of Microwriters. The three fastest were: 1st, Paul Wright of Blyth Computers; 2nd, Mr R Applegate of the Ford Motor Co; 3rd, Mrs Jane Gray-Wallis of Mapperley. Other winners were: A J Cohen of Talkback Research; Nigel Packer of Span Software Consultants Ltd; Ian Dennison of London W10; Jan Gillet of Fibreglass Ltd; Ian Shaw of Mastiff Security; Roy Chandler of Long Eaton and Mr M Sandford of Leighton Buzzard. They should all be giving up handwriting very soon.



Chess Tournament winner and runner-up with Fiona Collier, PCW's publishing manager



Scrabble contest winner and runner-up with Jon Baldachin of Little Genius.

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CONDOR

Kathy Lang continues her series of database evaluations with a look at the three different versions of Condor

Condor is a system for storing and retrieving information from individual files, and also from files which need to be linked in some way. It runs under CP/M on Z80-based machines, and under MS-DOS on 8086-8088 systems. Condor comes in three flavours: the cheapest and simplest operates on single files, has simple facilities for producing printed reports and no indexing. The next version has extensive facilities for linking files of information together, while the third and most sophisticated also has powerful reporting functions and the ability to index records for faster access. Each file of data needs a definition file to describe the structure of its records, and a format file to describe the way in which data is to be displayed on the screen. The format of each record in a file must be the same, and records are fixed in length, so that a record with many empty fields takes up as much space as one which is full. Record formats can be changed relatively easily, and existing data reorganised to fit the new format. Data can be displayed or printed selectively, sorted, and written out in a form suitable for reading by other programs such as Wordstar.

Condor is operated by commands rather than by choosing options from menus, although menus can be constructed using procedures. Each command operates on the whole file, and specifies the filename. As an example, the command to select all records from a stock file where the article was bought from Mr Bloggs for less than a hundred pounds might look like this:

```
SELECT STOCKFILE WHERE  
  SUPPLIER = BLOGGS AND PRICE  
  < 100
```

This approach means, of course, that the user must either construct his own menus (or get someone else to do it for him), or become pretty familiar with all the commands before he can get going. I shall say more about that when I talk about the user image as a whole, at the end.

Constraints

The maximum record size Condor can

handle is 1023 (usable) characters. Dates are stored in Julian format, thus taking three characters, and numbers in packed format, so the total number of digits and letters accommodated will be larger, depending on the exact construction of the record. The maximum number of records is 32,767, although if you are using fairly large records you are more likely to first hit the CP/M file limits (a single floppy disk, or 8 megabytes if you are using a hard disk). You can have up to 127 fields, and the maximum length of a field is also 127 characters. Numeric data is held stored in integer format, to an accuracy of ten digits. Only money fields use decimal points, expressed as dollars.cents. Condor also distinguishes between alphabetic and alphanumeric fields, but in both cases the field is treated as a whole, with no substring facilities. You can't, therefore, ask if a particular set of characters is contained within a field. Computation uses the usual + - * / operators, but does not permit the use of brackets for altering the order of evaluation of expressions.

Data input and updating

When a file of information is first set up, Condor has three stages to go through. First, you must format the screen which is to be used for input of the data. A format may not extend over more than one screen. The formatting process has good points — you can move the cursor around to position captions and field placings as you wish, using underscores to show where the data for a particular caption is to go — and bad points, particularly the absence of any indication of the current position of the cursor relative to the start of the line, so it is hard to tell with a long field whether you have typed in the correct number of underscores, and you don't find out until the definition phase.

The definition phase of the field creation process involves specifying for each field its type, length, maximum,

minimum and default values — the default value can be used if needed during data input, and data is always then tested for correct type and for lying within the maximum and minimum values. (For alphanumeric data, these are the maximum and minimum number of characters which must be entered). If you want to, you can let all parameters except the field type be entered by Condor. Unfortunately, the order in which the parameters are entered is a bit awkward. Once you have entered the number of underscores on the screen format, and the field type during the file definition process, the size of the field is determined, and Condor can calculate it for you. But when you enter definitions, you can default only all the remaining values, not just one specific value, and the values are defined in the order type, length, then the other parameters. So you can't type in maximum and minimum values and then allow Condor to do the length calculation directly — there is a way round, or you can go through the tedious process of calculating the length yourself, but with a bit of thought the package could have made life much easier for the user at this point.

Once the file has been defined and the format of the screen described, you can begin to enter data. There are two ways to do this. Condor uses in all its examples the indirect method of creating a transaction file first — that is a new file with the same format and definition as the master file — entering data into the transaction file, and then using a Condor command to merge the two. This batch approach obliges the user to cater for possible errors such as replacing existing records by mistake because of a mistyped key value. The interactive way (which is possible in Condor but which the manual is rather coy about) avoids this problem, as the record to be amended or replaced is seen by the operator before anything drastic is done. I wasn't sure why the manual took this approach — interactive updating is just as safe as batch if the program closes the output file each time

A RELATIONAL DATA MANAGEMENT SYSTEM UNDER CP/M & MS-DOS

a record has been written, but maybe Condor doesn't do that.

Whichever approach you use, Condor uses two useful pieces of shorthand while you are entering data. You can replicate the previous record entirely with a single command (which is actually a switch: useful if several records are nearly the same, but more fiddly if only two have items in common, as the duplication facility then has to be switched off again). You can also, again with a switch and again for all fields in a record, ask Condor to use the default values entered during data definition.

Once data has been entered into a file, you can't just alter the format used to show it on the screen if this involves any changes of substance. If you want to add or delete fields you can use a Condor command called REORG; the time this takes depends on the amount of reorganisation you want to do. To change the definition of existing fields involves writing the data out to an external file and reading it back, a process which probably takes the same time however many changes have to be made.

If you simply want to change the way the data is displayed on the screen, you may alter the format file without changing anything else. But the format must contain a slot for every item of data in the record, so you can't use formats with different 'windows' on the same data — for instance to allow some people to update only parts of records where other parts contain confidential information.

Where a field needs to be calculated from the values of other fields, this is done after the initial data has been input, using the COMPUTE command. This goes through the whole database, carrying out the desired calculation once for each record. This rather clumsy device (contrasted with the approach of entering a formula into the data definition, which can be invoked automatically when the data is actually entered) provides the one reason I could find for using the batch approach to input and updating. For if data is entered direct, then the calculation process would involve some kind of additional post-processing, such as recalculating the computed fields for every record in the file, not just those which have been changed.

Displaying data on the screen

Data may be displayed by using a simple LIST command, which shows either the whole of each record or just specified items in predefined formats. You can also use the PRINT command and the more flexible REPORT command (the latter is supplied only in the third version of Condor) to get more control over formatting. There are also commands for accumulating totals, maximum, minimum and average values; sub-totals can also be computed, but in this case the file must first be sorted in order of the fields to be sub-totaled.

Records are retrieved in the order in which they are stored. If you need them to be in any particular order, you must either sort the file first, or it may be possible to use the INDEX command to

permit retrieval in particular order through the ordering of the pointers rather than of the actual records — unfortunately the INDEX command wasn't in the version I tested.

Printed reports

The facilities for printing depend on which version of Condor you have. In the starter version, there is a simple PRINT command which mirrors LIST, and prints either complete records or particular fields. Simple titling is possible; each data item is allowed the amount of space indicated in the screen format definition so, as far as I could tell, only by adjusting the screen format appropriately could you get sufficient control to print items such as mailing labels. For more sophisticated operations, and to separate the printing from the screen definitions completely, you would need the REPORT command, which is supplied only with the most powerful version of Condor. This facility provides full printing control, with the caveat that the printing of sub-totals again requires a properly ordered file.

Selection

Selection may be either direct or using a 'batch' process. The DISPLAY command shows selected records on the screen, scrolling through the file interactively, whereas the SELECT command creates a new file containing a subset of the records which conforms to your specification.

In either case, data items may be compared with constants or with the values of other fields in the same record, and tested for equality and for being less than, greater than, etc. Several selections may be combined, but within one SELECT command they must all be combined either with AND or with OR — not a mixture. So if you wanted to choose all red-headed salesmen who had reached quota last month and who lived in Yorkshire or Lancashire, you would need to issue the SELECT command to write a subfile from which you could then either SELECT or DISPLAY the records which matched the 'Yorkshire or Lancashire' test.

You can also create a subfile, using the PROJECT command, which contains a subset of fields from the master record. It is a pity the SELECT and PROJECT commands are separate, since a selection of items from selected records would involve reading and writing two files.

Sorting

You may sort on as many as 32 fields in one pass if you need to, in ascending or descending order. Sorting uses complete fields (there is no substring facility), and can sort only files which do not contain more than 128,000 characters. If your files are larger, you must SELECT in such a way as to split the file appropriately, sort the two or more separate parts, and then use APPEND to tack the files back together. Unfortunately my Benchtest file contained 1000 records of 130 characters each, so it was just over the limit. . . The SORT command always overwrites the source file with the sorted output,

so if you want to keep the source you must copy it first.

Multiple files

Condor has a range of commands for merging and relating files. The JOIN command combines two files into a merged version depending on matching of specified fields; the resulting file contains all the fields from both files except that only one copy of each field used for matching is included. The POST command allows one data file to be updated by another; the information is matched on specified fields and one or more other fields in the master file are updated with fields from the transaction file. The example used in the manual is of the updating of a sales ledger, and for this kind of work would be very valuable. The remaining commands relate data files with identical structures, and permit their combination either by merging or appending. In all these operations, fields used for comparison between files must have the same name, type and length in both files.

Calculation

At the command level, two kinds of calculations are possible. Those which permit the calculation of data items I have already described. The other kind involves accumulating totals and other statistics, which I talked about briefly under reporting. These facilities do not allow you to calculate any figures other than these statistics, so the only way to do a calculation on a group of fields and then total the result is first to store the result of the calculation for each record within that record and then do the sum. Outside the procedure facility there is no provision for memory variables. There is, however, a command called TABULATE which permits totalling and counting over several dimensions — for instance, the ever popular breaking down of your data by age and sex, provided the data is sorted by age first and then by sex within age categories.

Tailoring

I found Condor one of the easiest packages I've tried to set up for my particular terminal; it emulates a VT52 and this isn't one of those Condor supplies, but it was quite straightforward to give the necessary terminal codes, and Condor confirmed that I'd done it correctly by saying what the screen should show and then showing a test screen for checking.

Turning to the tailoring of the package in use, Condor has a number of commands which can only be used within procedures. These procedures are sets of commands which are stored in a file, and then invoked with a single RUN command. The main command used in this context is an IF. . . ENDIF (no ELSE clause) which allows the user some flexibility within such procedures. This could be used to extend the calculating facilities and to make the commands for merging data files more flexible. There are limitations, though — a maximum of nine variables are provided both for parameters and for memory variables used within the procedure, and there seems to be no way

```
SELECT CUSTOMER WHERE LAST.PURCH LT 3/1/81 <C/R>
```

The SELECT criteria may vary depending on the purpose of the mailing.

The next step is to PROJECT only the data items necessary for mailing labels. This is done by the command statement:

```
PROJECT RESULT BY NAME,COM*,ADDR*,CITY,ST*,ZIP<C/R>
```

Note: The data items projected must be the same data items in the MAILLABL database, and they must be in the same order.

It may be necessary to place the customers in order by ZIP code. This is done by:

```
SORT RESULT BY ZIP<C/R>
```

This command statement will order the RESULT from the PROJECT by zipcode.

```
TITLE 6,S,S <C/R>
```

There are 6 lines per mailing label. There are 4 lines in the MAILLABL screen. The mail labels we will use have one inch spacing. At six lines per inch and printing four lines per label, two spaces are required to keep the printer lined up on the labels. When the TITLE command is executed, the printer will skip two lines immediately. The labels should be aligned after the title command is typed.

```
PRINT MAILLABL <C/R>
```

The mailing labels are printed.

```
COLUMN REPORT FORMATS
```

The column report is useful for printing specified data items in sequential order.

Referring back to the mail label example, if we wish to report on the customers to whom we sent a mailing, we would use a columner report format.

```
SORT RESULT BY COMPANY <C/R>
```

Fig 1: Sample page of Condor manual

to control the way in which information is displayed to the operator. The procedure facility is illustrated in the manual with a procedure for putting together several commands which can be issued one at a time from the keyboard, to help an operator to issue the commands correctly and in the right order. There is also a neat and easily used feature which allows the person creating procedures to create menus to invoke them too.

Security

I couldn't find any particular facilities for preventing unauthorised access to files or to parts of records and, indeed, with so many commands to operate on complete files, it is difficult to see what security could be provided other than physical methods such as locking disks up.

Housekeeping

Condor allows the user to carry out virtually all the facilities of CP/M within Condor, even down to running CP/M programs from within the package. So users can get field directories, copy files for backup and so on entirely within Condor.

Links with other fields

Condor can read ASCII character files in a variety of formats, fixed and variable, and can also write such files. So it would be reasonably easy to write data files for use in mailing applications, for instance.

User image

As far as the general approach of the software is concerned, I personally prefer command driven systems to menu systems, provided it is possible to create menus for the novice or casual user so as to avoid too great a learning curve. In this respect Condor fits the bill. The command syntax was quite straightforward and easy to predict, and I particularly liked the extensive use of synonyms — for instance, when using SELECT one can ask for "NAME = BLOGGS" or "NAME IS BLOGGS". I was less happy with some of the details, for instance the need to bracket the equals sign with spaces. I also felt that some commands could have quite naturally been given more options, thus increasing the power of particular operations and reducing access times. For instance, one can't define selection of both particular records and of particular data items in a single command, at least certainly not outside the procedure facilities.

Another feature which I don't much like is the use of separate files for record definition, to contain the data itself and for the screen format. In data management systems of this kind the record structure is really an integral part of the data file, and would be much better stored in a header record, thus minimising the dangers of accidental erasure and incidentally economising, however minimally, on file and directory space.

I found several irritations with the file creation process, particularly the lack of a column count which made it

hard to format the screen correctly for long data items, and also the uncritical nature of the formatting process — you tend not to be told about mistakes until after the format has been saved, and so have to go back and start again, sometimes from scratch, if you make mistakes. But much worse than these minor upsets was the inability to create 'windows' for different users — you could only use another format if all the data items were included. However, my greatest irritation concerned the startup process; I couldn't find a way to avoid having to put in not only the date (in mm/dd/yy format) every time, which is fair enough, but also the licence number and terminal type!

The documentation was on the whole clear and well laid out. The main part of the manual takes you through the stages of learning about Condor, and there is a reference section in which each of the commands is described in detail. There was also a reference list of commands which could be used as a makeshift 'reference card' once I had become familiar with the system. I found the style rather ponderous in places, and I would have given a great deal for an index. I also disliked the lack of variation in typestyle, which could be confusing, and the superimposition by the UK importers of their name on every page in very large letters shadowing the manual printing.

Costs

Condor is produced in the USA by Condor Corporation, and distributed in this country by MOM Systems of Gravesend. The simplest version of Condor costs users £195. This version works only on single files, and does not have extensive report formatting nor any indexing. The second version, with multi-file functions, costs £375, while the full version, including indexing and sophisticated report formats, costs £650.

Conclusion

Condor provides a wide range of facilities for record management, and is sensibly marketed to cater for a variety of needs. Its 'economy' version is competitively priced, and would be a good buy if you did need methods of manipulating numbers but didn't need to link files together or want very flexible facilities for laying out reports. The more advanced versions have a lot of competition, both from other command-driven packages and from menu systems.

I am especially concerned about how the 'economy' and middle versions, which have no indexing, would perform with larger files. MOM told me that indexing should make little difference with any but very large files, but some people might find retrieval times rather slow without it. More details on speed should come from my next article, in which I hope to bring together most of the record management systems I have reviewed so far, in a 'half-term report' which will give some performance figures to complement the descriptive articles.

END

BENCHMARKS SUMMARY

Presenting a bumper round up of all the Benchmark Timings since PCW began, with suitable warnings as to their significance from Dick Pountain.

It's that time of the year again and PCW does its summary of Benchmark timings for all the machines tested during the past 12 months. This time, though, in response to a lot of readers' queries, we're including a full explanation and justification of the Benchmark tests. In addition, with the capable help of Multiplan, we offer a complete list of timings for all the machines tested since we began using Benchmarks, ranked in order of average speed.

The Benchmark programs (listed below) were first published by the US magazine *Kilobaud* in 1977 except for no 8 which was added by John Coll in PCW Vol 1 No 1, 1978. They are a set of Basic programs which test the speed

of execution of certain crucial routines by the Basic interpreter or compiler under test by repeating them 1000 times to allow timing with a stopwatch. Apart from no 1 which tests an empty FOR . . . NEXT loop and no 8 which tests the transcendental functions \wedge , SIN and LOG, they are so structured that by subtracting the timing of the previous test you can isolate the time due to the particular routine under examination. So taking BM4 from BM5 should give the time for 1000 GOSUB and RETURNS, for example.

The timings obtained are affected by the clock-rate of the processor upon which they are run as well as by the implementation; MBasic running on a

2MHz Z80 will obviously give slower times than on a 4MHz Z80. In addition the timings will depend on the precision of arithmetic used; some Basics support several precisions such as Integer, Short Real and Long Real (or Single and Double precision) for their variables. In these cases the BMs may be run with all the types, time permitting. In any case the type used should be stated in the results; if it isn't then assume single precision real was tested.

The Benchmarks, then, are a test of the speed of a particular Basic interpreter running on a particular machine, which is what's wanted if you wish to use them to compare various machines and how fast, relatively speaking, they are likely to run your programs. They can of course only give relative information, and even then, to make a fair appraisal, you ought to consider all eight timings and weight them according to the sort of program you would want to run — ie, is it heavy on arithmetic operations or on array accesses or whatever? Some types of program are of course 'I/O-bound', that is they involve so much disk or printer I/O that the speed of communication with these peripherals is the crucial determinant of how fast they will run and totally swamps any differences in processing speed. There is a good discussion of the strengths and weaknesses of Benchmark tests as indicators of the speed of real applications in *Dr Dobbs Journal* (May 82). Of course it is possible in principle to produce I/O Benchmarks as well, but the differing hardware standards make it rather a nightmare. The PCW Disk Benchmarks faded away for just this reason; it was found that, as written, they couldn't be run on many machines because of restrictions on record length or some other oddity. We may try again in the near future.

All you should realistically expect to gain from the Benchmark timings is knowledge of this sort; that a machine which has, say, a very slow timing for BM8 is likely to run graphics programs which involve a lot of trig sluggishly compared to one with a faster timing.

The Benchmarks have nothing at all to say about how fast the string handling, screen I/O or any graphics intrinsics might be and these may well be as important to you as any of the routines tested.

One anomaly must be mentioned at this point. As originally written and used up till now, BM8 tests only 100 loops instead of 1000. This was done in order to save Benchtesters time on really slow machines. However, in the ranked list of machines published here, I have multiplied the value of BM8 by ten to give it the same weight as the others in computing the average of the timings. These average figures are a somewhat arbitrary measure in any case, since as explained above, to indicate the relative speed of any real application the different BMs would have to be weight-

GOTO page 214

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 220
170 FOR L=1 TO 5
180 NEXT L
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM Benchmark 7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXT L
200 IF K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

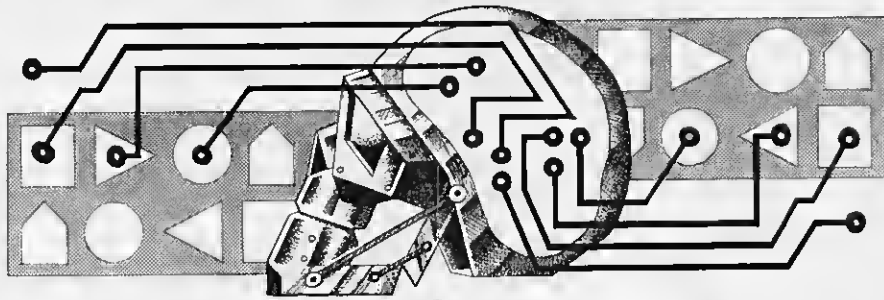
```
100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K↑2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```


Benchmark timings

MACHINE	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	AVERAGE
Olivetti M20	1.3	4.0	8.1	8.5	9.6	17.4	26.7	1.6	11.5
DAI	0.9	4.8	10.1	9.8	11.2	18.1	30.1	2.1	13.3
BBC Micro	1.0	3.1	8.2	8.7	9.1	13.9	21.4	5.1	14.6
Monroe 8820	2.1	4.2	9.9	10.5	11.0	20.1	32.0	3.3	15.4
Altos ACS 800-2	1.4	4.3	11.3	11.3	12.0	21.2	34.9	2.7	15.4
Vector Graphic VIP	1.0	3.8	10.9	10.7	11.6	20.5	32.7	3.4	15.7
ACT 800	0.9	4.6	8.5	9.4	10.1	14.9	23.4	5.6	16.0
Sharp MZ80B	0.6	4.5	8.5	11.5	13.0	19.0	27.5	5.0	16.8
Micromation Z Plus	1.4	4.4	11.2	11.3	11.5	21.2	34.9	3.9	16.9
Mimi 801 (44k CP/M)	1.2	3.7	9.9	9.8	10.5	18.6	29.6	5.4	17.2
IBM Personal Computer	1.5	5.2	12.1	12.6	13.6	23.5	37.4	3.5	17.6
* Exleigh Expert (compiled)	2.5	2.5	8.0	8.0	8.0	21.0	25.0	7.0	18.1
Osborne 01	1.4	4.4	11.7	11.6	12.3	21.9	34.9	6.1	19.9
Tandy TRS-80 Model II	1.0	5.0	13.0	13.0	14.0	23.0	35.0	6.0	20.5
Hewlett Packard HP125	1.7	5.0	12.5	12.5	14.0	26.0	40.0	6.0	21.5
Mimi 801 (62k CP/M)	1.7	4.7	12.4	12.2	13.1	24.3	38.6	6.6	21.6
Intertec Superbrain	1.6	5.2	14.0	13.9	14.8	26.3	43.2	5.6	21.9
Positron 9000	1.1	2.1	5.4	6.8	7.2	14.9	20.2	12.0	22.2
DDE SPC/1	4.8	6.2	14.7	13.9	14.7	41.1	58.1	2.6	22.4
ABC 24	1.2	4.0	16.0	15.0	16.0	25.0	38.0	8.0	24.4
Apple III	1.7	7.2	13.5	14.5	16.0	27.0	42.5	7.5	24.7
ACT Sirius I	2.0	7.4	17.0	17.5	19.8	35.4	55.9	4.3	24.8
Oki iF8000	2.2	6.4	16.8	16.8	17.9	31.8	50.7	5.7	25.0
Ohio Scientific Challenger C2 4P	1.4	7.8	15.0	16.5	17.8	27.0	39.5	7.5	25.0
Xerox 820	1.7	5.5	15.5	15.1	16.2	28.9	46.1	8.0	26.1
NEC PC 8001	1.7	8.3	18.1	17.8	18.6	29.5	49.2	7.0	26.7
Newbrain	2.0	5.8	19.2	17.5	19.2	32.0	48.8	7.0	26.8
ABC 80	1.1	2.3	11.1	12.1	12.6	17.7	23.9	13.6	27.1
Philips P2000	1.9	5.9	15.8	15.7	16.7	29.8	47.2	8.5	27.3
Commodore VIC 20	1.4	8.3	15.5	17.1	18.3	27.2	42.7	9.9	28.7
* Exleigh Expert (interpreted)	2.5	7.2	18.5	18.5	19.3	35.0	52.0	8.5	29.8
Apple II	1.3	8.5	16.0	17.8	19.1	28.6	44.8	10.7	30.4
Hewlett Packard HP85	1.8	3.8	16.3	16.5	17.7	30.0	44.8	12.7	32.2
Pasca 640	2.0	7.0	19.0	18.0	20.0	36.0	57.0	10.0	32.4
Sharp MZ80K	1.4	9.4	16.3	22.5	25.4	36.8	51.1	10.2	33.1
Exidy Sorcerer	1.8	10.0	20.7	22.2	24.3	37.6	53.7	9.6	33.3
Sharp MZ80A	1.5	9.2	16.4	22.8	25.6	37.7	55.0	10.1	33.7
Commodore CBM 8032	1.7	10.0	18.4	20.3	21.9	32.4	51.0	11.9	34.3
Transam Tuscan	2.3	13.0	26.0	27.0	32.0	48.0	68.0	6.0	34.5
Commodore PET 2001	1.7	9.9	18.4	20.4	21.0	32.5	50.9	12.3	34.7
Compucolor II	2.0	10.9	22.4	23.9	25.7	38.7	55.2	10.2	35.1
Oragon 32	1.6	10.2	19.7	21.6	23.3	34.3	50.0	12.9	36.2
Hewlett Packard HP86	3.0	5.2	19.4	18.8	20.4	36.5	56.5	13.4	36.7
Hitachi Peach	2.0	11.0	26.0	26.0	27.0	46.0	78.0	10.0	39.5
Tandy TRS-80 Color Computer	2.0	11.3	22.2	23.9	27.0	41.5	61.1	13.0	39.9
Panasonic JD700	2.8	9.1	24.6	24.7	26.2	43.9	69.7	11.8	39.9
SBS 8000	1.8	9.4	29.0	29.0	31.6	44.0	82.5	11.2	42.4
Heath HB9 (Mbasic)	2.5	9.2	25.8	26.0	27.0	46.6	73.2	13.0	42.5
Tandy TRS-80 Model I Level II	2.7	11.6	28.0	28.5	31.3	51.9	81.0	11.7	44.0
Video Genie	2.7	11.6	28.0	28.5	31.3	51.9	81.0	11.7	44.0
Cromenco System Three	1.7	4.6	14.9	17.8	19.4	30.2	41.9	22.9	44.9
Ohio Scientific Challenger C3 S1	1.7	13.1	21.6	23.7	29.2	39.6	58.3	17.6	45.4
Sinclair ZX81 (fast mode)	4.5	6.9	16.4	15.8	18.6	49.7	68.5	22.9	51.2
Sinclair Spectrum	4.8	8.7	21.1	20.4	24.0	55.3	80.7	25.3	58.5
Sharp PC3201	4.0	13.5	35.5	35.5	38.5	67.0	108.0	25.0	69.0
Casio fx9000	2.5	9.0	24.0	24.0	26.0	42.0	60.0	36.5	69.1
Atari 400/800	2.3	7.4	19.9	23.2	26.8	40.7	61.5	43.1	76.6
Texas TI 99/4	2.9	8.8	22.8	24.5	26.1	61.6	84.4	38.2	76.6
Texas TI99/4A (standard)	3.0	9.0	24.0	24.8	26.2	61.9	84.6	38.4	77.2
Texas TI99/4A (extended)	6.5	18.5	40.0	40.1	42.0	98.4	140.3	24.0	78.2
Periflex a30/a6	4.5	10.5	27.5	28.5	31.5	59.0	79.5	60.0	105.1
BASF 7120	2.4	7.0	35.0	36.5	39.0	50.0	63.0	114.0	171.6

*SORD M23

ALGY: THE ALGEBRA CHECKER



Or How To Use Artificial Intelligence To Cheat On Your Homework

Mike Liardet takes the class

This article will present a fairly simple Basic program that can verify the user's solution method for an elementary algebra problem. The program accepts algebraic statements as input, checks whether they make sense at all, and if they do it then checks to see if they logically follow from the previous statements. Without any apology, it can be unashamedly admitted that the program does not by any means have perfect performance. But just to make up for this we will show how it can be easily converted to a superior performance Boolean algebra checker. (Boolean algebra — the algebra of 'and's, 'or's, 'if-then's, etc — is simpler than the algebra of '+', '*', etc, but because the latter is more familiar to most readers we will start there.)

Like many programs in the realm of Artificial Intelligence, Algy can seem quite impressive for some examples, and quite unimpressive for others. Readers familiar with any of the Eliza programs (which simulate a psychoanalyst in a dialogue with the user) will know how easy it is for a moderately determined user to transform a previously sensible dialogue between two beings of apparently equal intellect into a conversation with one side appearing to be an imbecile. (And if they try very hard they can make the computer seem pretty stupid, too. . .)

Anyway, Algy provides a good simple start point for anyone interested in exploring the general area of automatic theorem proving. In particular, the article concludes with a list of suggestions for extensions and improvements so there is ample scope for keeping yourself up to all hours of the night!

Right! Let's assume you have your computer switched on and running Basic. Enter the following two lines of text:
X=1:A=2:B=3

```
PRINT X*(3*X+A+A)-B/B-2*A*X
```

Now, assuming your computer permits this sort of interaction, it should respond by printing the number 2. Now enter the line:

```
PRINT 3*X^2-1
```

Eureka! The computer should print the number 2 again, or at least it will do if '^' is your machine's symbol for exponentiation.

This little dialogue demonstrates the main principle behind the program. The fact is that the two algebraic expressions $X*(3*X+A+A)-B/B-2*A*X$ and $3*X^2-1$ are in fact equal for all values of X, A and B; and in particular when X, A and B have the values 1, 2 and 3. As it would take rather a long time to check equality for all possible values (there being an infinite number of them), the program Algy contents itself with checking just one set. If the user is not told what values Algy is using, and may even not know that this trick is being used at all, he is unlikely to try, say, $X+B-A$ (which is also equal to 2, but not equal to the previous expressions) or $3*X^2-(X-1)/(X-1)$ (which is equal to the previous expressions but causes a zero divide error on evaluation).

Thus far we have only looked at a method to check algebraic simplification problems, and not the 'find the value of X' type of problem. Retaining the previous values of X, A and B, enter the following three lines:

```
PRINT (X-A)*(X-B)=0
```

```
PRINT X=A
```

```
PRINT X=B
```

So far, no apparent problem, as all three lines should present the same result (probably 0 — the usual way to represent 'false', but dependent on which version of Basic you use). Now enter:

```
PRINT X=123.456
```

Unfortunately this also produces the same result! In fact just about any expression at all is likely to do the same! The fact is that for completely arbitrary values of X, A and B it is highly unlikely that any expression involving equality will be anything but false (ie, 0). Having nearly all algebraic equalities evaluating to the same value is not going to lead to a particularly rigorous checker, so the basic methodology has to be changed. Algy actually sets all the values, bar X, to arbitrary values, as before, but then applies a numerical method to assign a value to X which makes the equality true. In fact it does this as each line is entered by the user (thus ensuring it evaluates to true) then re-evaluates the original start equation to see if that is also true for these values. Consider solving $X^2-2*X+A*B*X=2*A*B$. Retaining the old values for X, A and B, enter:

```
PRINT X^2-2*X+A*B*X=2*A*B
```

```
PRINT (X-3)*(X-B)=0
```

As expected, both expressions evaluate to the same value — false (and they are not equivalent). If, however, we reset X to 3 (which is one solution to the second expression) we find that re-entering the two lines results in false for the first and true for the second, thus showing that the second is not a valid step. On the other hand, a valid step such as $(X-2)*(X+A*B)=0$ would result in true for the original expression as well, providing X is first set to either of the solutions 2 or -6 ($=-A*B$ for the preassigned values of A and B).

This just about completes Algy's domain of expertise — the ability to deal with the algebraic functions +, -, *, / and ^; all used in expressions involving numbers, constants A, B, C and D and the variable X. It can actually deal with square roots too (if entered in the form 'S(. . .)'). With its ability to solve equations it can handle equalities, and as a final refinement it can also be made to permit the use of 'or's. A frequent step in equation solving is as follows:

```
(X-3)*(X-B)=0 (1)
```

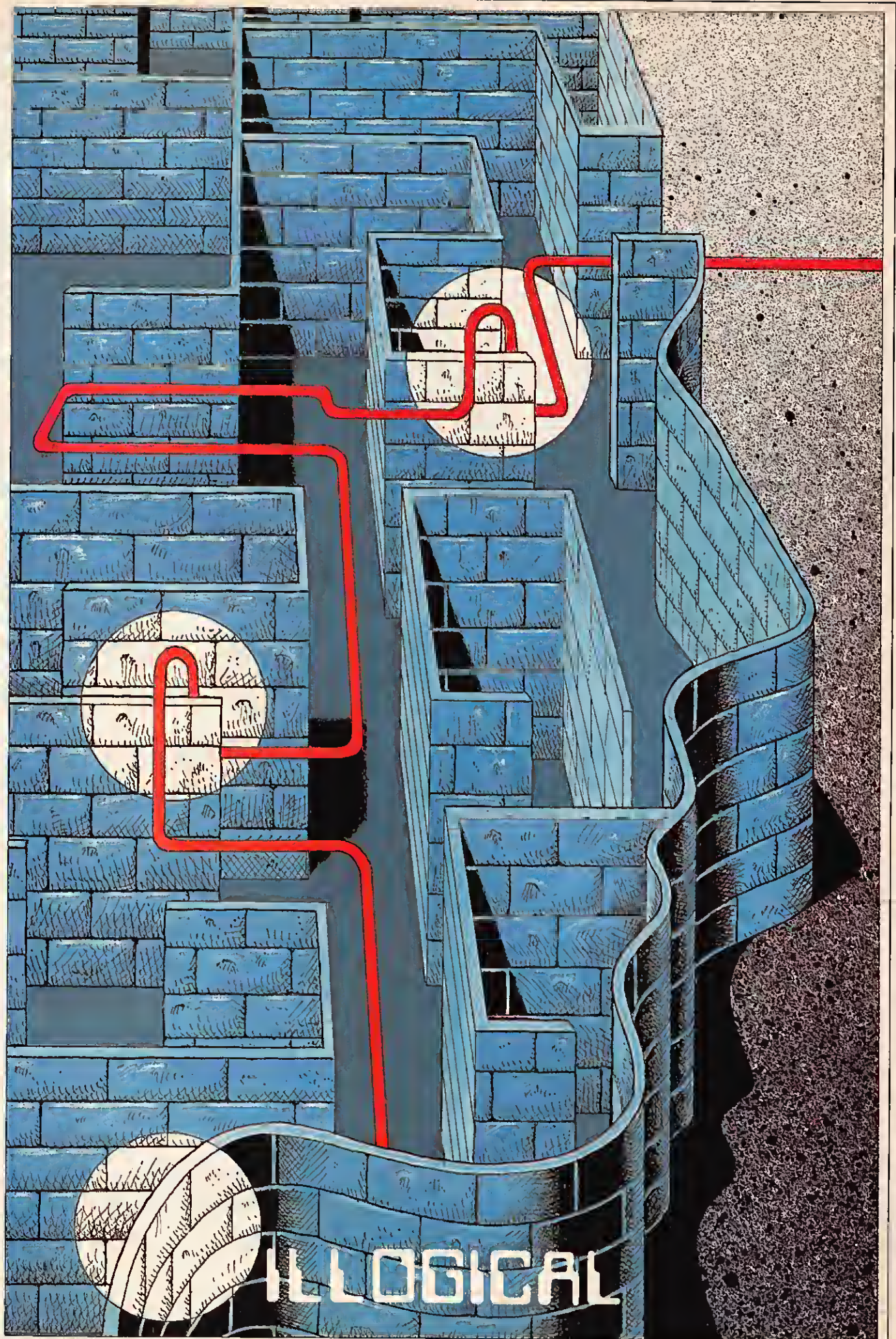
```
X=3 OR X=B (2)
```

Before doing any analysis at all Algy does some preliminary rewriting of 'OR's and '='s, for example: $X=3 OR X=B$ is rewritten as $((X-3)*(X-B))$

Except for the fact that extra brackets need to be introduced (because $X-3*X-B$ would mean something quite different), this amounts to a straightforward substitution of '=' for '=' and '*' for 'OR'. As Algy always goes on to solve the resulting expression, the rewritten expression can be considered to have an implicit '=0' at the end and Algy is only applying the step (1) to (2) above in reverse. This means that even if the user is tackling a 'simplify' problem and not a 'solve' one it still treats it as a 'solve' problem and (unnecessarily) finds a value of X which evaluates the expression to zero.

Actually, finding a solution to an arbitrary algebraic expression is not completely straightforward. Most methods either require the expression to be symbolically differentiated (worth an article in itself — see my efforts in June '82 PCW on Lisp) or else require the expression to be first rewritten

Illustration by Stuart Briers



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Personal Computer World

ALGY: THE ALGEBRA CHECKER

in a special polynomial normal form (worth a good bit of a Masters thesis — see my efforts at Edinburgh University library). Here we present a less drastic method, which is doubtless a numerical analyst's nightmare, with horrendous convergence and rounding problems, etc:

1. To find one value of x satisfying the equation $f(x)=0$ first set up two initial guess solutions $x_1=-1$ and $x_2=1$.
2. If x_1 and x_2 are sufficiently close in value (eg, closer than .0001) then return x_1 as the solution.
3. Draw a straight line through the points $(x_1, f(x_1))$ and $(x_2, f(x_2))$.
4. If this line is not parallel to the x -axis then it must cross it somewhere. Let x_1 take this point as a new value and x_2 be the old value of x_1 . Go back to 2.
5. If the line is parallel to the x -axis then let x_1 be the average of x_1 and x_2 and let x_2 be the old value of x_1 . Go back to 2.

So that just about covers all the theory behind Algy, but there remains one outstanding practical problem before we can actually implement it. Consider the following short program:

```
10X=1:A=2:B=3
20INPUT"TYPE AN ALGEBRAIC EXPRESSION";X$
30PRINT VAL(X$)
```

Suppose the user enters 'X+A+B'. In most dialects of Basic the VAL function will operate correctly only if its string argument is the text for some number. If it contains variable names or expressions it will usually fail to do what we actually want in this case, but will just return zero or cause an error message. In Algy this problem is overcome by pre-allocating a line of Basic which starts as an assignment, and then reserves enough space for whatever expression is typed by the user to be POKed in and terminated by a ':REM'. Whenever that line is executed the assignment is made using the most recent expression POKed in there. (We also have to use ON-ERROR trapping in case the user has entered something syntactically incorrect.) If you have ever heard of programs that work by self-modifying their code you will doubtless be delighted to realise that this is one of them. Unfortunately the details of where and how to poke in the expression are very much dependent on the particular version of Basic in use. The listing accompanying this article will work for Applesoft on the Apple II. If you are trying to implement Algy on another system then you may find the following points useful:

1. Most versions of Basic store the program in memory, not in the order in which lines are entered, but in order of line-number. Usually the first line of the program starts at some fixed position in memory, with the next line following immediately and so on.
2. Each character which is not a specific system function (ie, not a '+', '-', etc) is generally stored in the memory representation as just one byte, being the ASCII code for the character (most Basics have an ASC function to provide the ASCII code of a supplied character).
3. System functions may be encoded in just one byte, even if they appear in the listing as several characters. The code for a system function may bear no relation to its ASCII code and in many instances will exceed the maximum possible ASCII value of 127 decimal.
4. Each line of the program, as well as representing the text of the line as outlined above may be preceded by some extra bytes (eg, for the line number itself and the start address of the next line). There may also be some following bytes (eg, a zeroed byte to signal the end of the line). Frequently these extra bytes are not a literal text representation, but a binary encoding.
5. By setting up a line such as '10REM!!!!' it should be possible to find the memory address of the line by searching for five consecutive locations holding the same ASCII code (for '!'). Entering alternative line '10's and PEEKing at the same locations should provide some clues as to how your version of Basic stores a line of entered code.
6. If there is sufficient similarity between your version of Basic and Applesoft you may only need to alter the codes for the system functions (set up in DATA statements in Algy) and the values of LO and HI which define where in RAM to look for the lines that are subsequently POKed into. LO and HI will have to be changed in the Applesoft version too if you change the program at all or do not type in the remarks, etc.

Once you have typed in the program, make sure you SAVE it before you attempt to RUN it, in case you have got the self-modifying bit wrong and it runs amok through your newly entered program. Test the program out by comparing it with the following dialogue:

```
RUN
ALGY - THE PROOF CHECKER FOR ALGEBRA
      EQUATION SOLVING..

INITIALIZING...

NOW TYPE EQUATION YOU ARE GOING TO
      WORK WITH...

>>2*B*X^2+A*D=A*B*X+2*D*X

NOW TYPE YOUR SOLUTION STEP BY STEP
      ('END' TO FINISH)..

1>>2*B*X^2-(2*D+A*B)*X+A*D=0

2>>(2*X-D)*(B*X-A)=0
WRONG! - TRY AGAIN...

2>>(B*X-D)*(2*X-A)=0
I DO NOT UNDERSTAND!

2>>(B*X-D)*(2*X-A)=0

3>>X=D/B

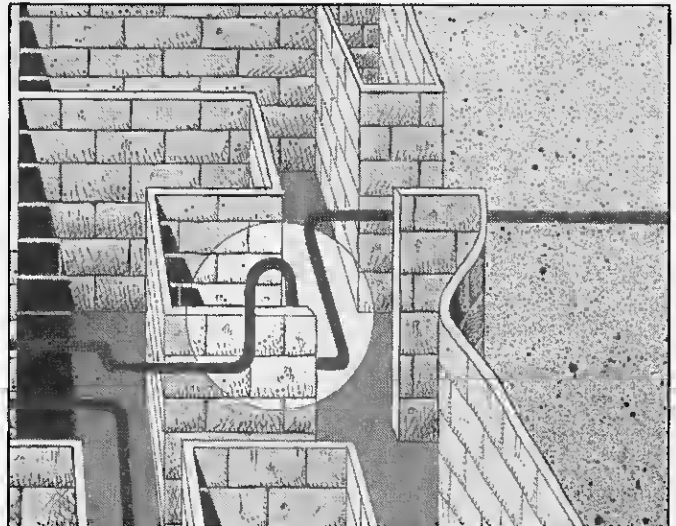
4>>X=D/B OR X=A*.5

5>>END

NOW TYPE EQUAT..etc
```

Now you actually have the program working you can start thinking of ways to improve it. Try and find a selection of different examples that can 'fool' it. Consider the program fooled if it traps a correct step as incorrect or vice versa or if it 'I DO NOT UNDERSTAND's a syntactically correct expression. Just to set the ball rolling here are a few points to consider:

1. The program will not work with equations with imaginary or complex roots.
2. The program finds only one solution to an equation. If this is also a solution of the original equation then the equation is passed as correct. If the equation has more than one solution (typically the case) then the unchecked solutions could conceivably not be solutions to the original equation.
3. Using single pre-assigned values for A, B, C and D allows for 'coincidences' to happen — eg, 'If A=1 then X+1 and X+A would be (incorrectly) seen as equal by the program. For each step, considering several values each for A, B, C and D reduces the likelihood of this happening.
4. An unlucky choice of value of, say A=1, could cause the program to fail if $\text{SQR}(-A)$ or $1/(1-A)$ is included in an equation.



ALGY: THE ALGEBRA CHECKER

5. The user is limited to using just X, A, B, C and D in the equations. By introducing a third self-modifying line (at 2080) the program could be made to set up whichever identifiers happened to be entered.

6. Most Basics have a range of powerful trigonometry functions. It should be possible to make use of them in an analogous way to the arithmetic functions.

7. Most Basics have a range of Boolean algebra functions as well. In fact, changing Algy to handle Boolean algebra instead is so easy that I cannot resist giving the solution — but first a crash-course in Boolean algebra for the uninitiated:

Boolean algebra was first formulated by George Boole in the last century in an attempt to provide a mathematical formulation for the intuitive human logic used by everyone. Instead of using symbols like '+', '*', etc, Boolean algebra has symbols like '&' ('and'), 'v' ('or'), '/' ('not'). These symbols operate, not on numbers which have an infinite range of possible values, but on propositions, which have just two: 0 ('false') and 1 ('true'). The pronunciations, given in brackets above, give some indication of how these functions work, and most readers will have some idea of what they mean from their usage in natural language and various programming languages. Because a variable in Boolean algebra can have only two values, it is not computationally prohibitive to consider all possible values for all variables in an expression. Thus it is possible to prove without any margin of error that two expressions are precisely equivalent — a considerable improvement on Algy's performance with the arithmetical algebra!

Without further ado, LOAD in Algy and make the following modifications:

```
2080 FOR A=0 TO 1:FOR B=0 TO 1:FOR C=0 TO 1:
    FOR D=0 TO 1
2090 GOSUB 9000
2105 NEXT D,C,B,A
2175 FOR A=0 TO 1:FOR B=0 TO 1:FOR C=0 TO 1:
    FOR D=0 TO 1
2180 GOSUB 9000
2200 MM=NN:GOSUB 8000:IF MM<>NN THEN PRINT
    "WRONG! - TRY AGAIN...": GOTO 2140
2205 NEXT D, C, B, A
5000 RETURN
7070 DATA /,198,&,205,v,206,>,207,=,208,<,209
```

The last line is dependent on the version of Basic you use, as also is the range of the FOR-loops (0 for false, and 1 for true in Applesoft — some Basics use -1 so beware!). Now RUN the modified program (don't forget to SAVE it first — call it Booly if you like) and see if it agrees with the rest of the universe on DeMorgan's laws, namely that $\overline{(A \& B)}$ and $(\overline{A} \vee \overline{B})$ are the same, as are $\overline{(A \vee B)}$ and $(\overline{A} \& \overline{B})$. Notice that it will also accept Boolean algebra. There should not be any problems as long as you remember that 0 and 1 mean false and true and should not be used as numbers: eg, $A < 0$ is meaningless — only $A < B$, etc, ought to be used. Now use the program to check that $\overline{(A < B \vee B < A \vee B = A)}$ is always false (ie, 0).

Finally, readers already familiar with Boolean algebra will have noticed that two well-known Boolean functions have been omitted: ' \rightarrow ' ('if-then' or 'implication') and ' \leftrightarrow ' ('equivalence'). The program can be made to handle these by redefining the subroutine at line 5000. This routine should be used to perform an immediate conversion of the user input to rewrite the symbols ' \rightarrow ' and ' \leftrightarrow ' into expressions using just '/', 'v' and '&'. The basic principles to use are:

$xxxx \rightarrow yyyy$ is converted to $!xxxx \vee yyyy$

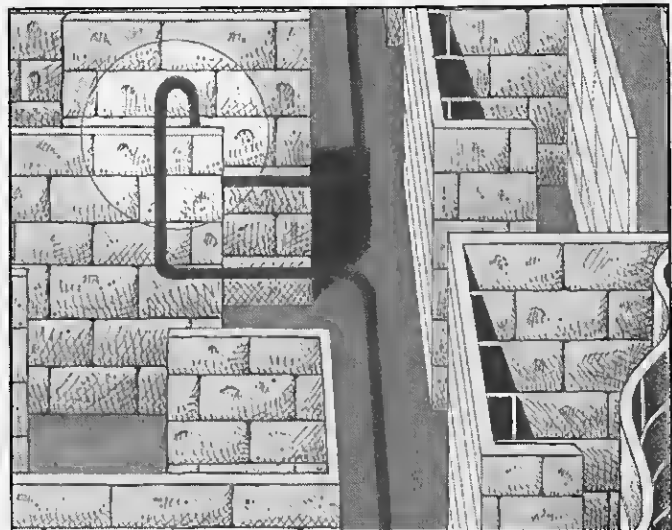
$xxxx \leftrightarrow yyyy$ is converted to

$(!xxxx \vee yyyy) \& (xxxx \vee !yyyy)$

Actually, although the conversion rules are easy enough to write down, they are not particularly easy to implement in Basic, requiring a recursive analysis of the expression (eg, consider converting $(A \rightarrow B) \rightarrow (C \rightarrow D)$). You have been warned!

Anyway, I hope the reader has found enough material in this article to stimulate some experimentation in the general area of automatic theorem proving. I personally believe that there are great possibilities in mathematics education for automatic theorem provers and personal computers and I certainly wish these sort of facilities had been around when I was learning algebra!

```
1999 REM ALGY - MICHAEL LIARDET (APPLE VERSION)
2000 PRINT "ALGY - THE PROOF CHECKER FOR ALGEBRA EQUATION SOLVING & SIMPLIFICATION"
2010 PRINT : PRINT "INITIALIZING...": GOSUB 7000
2020 PRINT : PRINT "NON TYPE EQUATION YOU ARE GOING TO WORK WITH..."
2030 PRINT : INPUT ">>>";X$
2040 GOSUB 5000: REM CONVERTS "=" & "OR" TO "-" & "&"
2050 IF LEN (X$) > LN THEN PRINT "LINE TOO LONG!": GOTO 2020
2060 S = S1: GOSUB 6000: REM MODIFIES LINE 9010
2070 S = S2: GOSUB 6000: REM MODIFIES LINE 9010
2080 A = 1.5:B = 2.5:C = 3.5:D = 4.5: REM ANY VALUES (NON-ZERO) USUALLY OK!
2090 GOSUB 3000: REM RETURNS X - A ROOT OF EXPRESSION @ 9010 (IF ER<>0)
2100 IF ER < > 0 THEN PRINT "I DO NOT UNDERSTAND!": GOTO 2020
2120 PRINT : PRINT "NON TYPE YOUR SOLUTION STEP BY STEP ('END' TO FINISH)...".
2130 ST = I
2140 PRINT : PRINT ST;";"; INPUT ";";X$: IF X$ = "END" THEN 2020
2150 GOSUB 5000: REM CONVERTS "=" & "OR" TO "-" & "&"
2160 IF LEN (X$) > LN THEN PRINT "LINE TOO LONG!": GOTO 2140
2170 S = S2: GOSUB 6000: REM MODIFIES LINE 9010
2180 GOSUB 3000: REM RETURNS X - A ROOT OF EXPRESSION @ 9010 (IF ER<>0)
2190 IF ER < > 0 THEN PRINT "I DO NOT UNDERSTAND!": GOTO 2140
2200 GOSUB 8000: IF ABS (NN) > 2 * EPS THEN PRINT : PRINT "WRONG! - TRY AGAIN...":
    GOTO 2140
2210 ST = ST + 1: GOTO 2140
2295 REM $
2296 REM $
2297 REM $
2298 REM FINOS SOLN X TO EQUATION AT LINE 9010 IF ER=0
2299 REM IF ER=1 THEN NO CONVERGENCE, IF ER=2 THEN SYNTAX OR OTHER ERROR
3000 N = NT:U1 = - 1:U2 = 1
3010 IF ABS (U1 - U2) < EPS THEN ER = 0:X = U1: RETURN
3020 IF N = 0 THEN ER = 1: RETURN
3030 X = U1: GOSUB 9000: IF ER < > 0 THEN RETURN
3040 N1 = NN:X = U2: GOSUB 9000: IF ER < > 0 THEN RETURN
3050 N2 = NN: IF N1 = N2 THEN TT = U1:U1 = (U1 + U2) / 2:U2 = TT:N = N - 1: GOTO 3010
3060 TT = U1:U1 = (U1 + N2 - U2 * N1) / (N2 - N1):U2 = TT:N = N - 1: GOTO 3010
3996 REM $
3997 REM $
3998 REM $
3999 REM FIND RAM ADDRESS (SET X) OF LN CONSECUTIVE X$ S
4000 CT = 0
4010 FOR X = LO TO HI
4020 IF PEEK (X) < > ASC (X$) THEN CT = 0: GOTO 4040
4030 CT = CT + 1: IF CT = LN THEN X = X - LN * I: RETURN
4040 NEXT X
4050 PRINT "CAN'T FIND ";LN;";";X$;"S - SORRY!": STOP
4994 REM $
4995 REM $
4996 REM $
4997 REM REWRITES X$ WITH "=" & "OR" REPLACED BY "-" & "&"
4998 REM ADDS BRACKETS TO CORRECT FOR CHANGE IN PRECEDENCE
4999 REM EG X-B=C&D OR X&A=9 => ((X-B)-(C&D))*(X&A)-9)
5000 N1$ = "(!":X1 = 1
5010 IF LEN (X$) < 2 THEN 5060
5020 FOR X = 1 TO LEN (X$) - 1
5030 IF MID$ (X$,X,2) < > "OR" THEN 5050
5040 Y$ = MID$ (X$,XX,X - X1): GOSUB 5100:N1$ = N1$ + Y$ + "(":X1 = X + 2
5050 NEXT X
5060 Y$ = MID$ (X$,XX,LEN (X$) + 1 - X1): GOSUB 5100:X$ = N1$ + Y$ + "": RETURN
5099 REM SUBR FOR 5000 - DEALS WITH FIRST "=" FOUND IN Y$
5100 IF LEN (Y$) = 0 THEN RETURN
5110 FOR Y = 1 TO LEN (Y$)
5120 IF MID$ (Y$,Y,1) = "=" THEN Y$ = "(" + MID$ (Y$,1,Y - 1) + ")" + "(" + MID$
    (Y$,Y + 1,LEN (Y$) - Y) + "": RETURN
5130 NEXT Y
5140 RETURN
5995 REM
5996 REM
```



```

5997 REM
5998 REM POKES IN EXPRESSION IN X$ AT ADDRESS S - TERMINATED BY *:REM*
5999 REM SDME SYNTAX CHECKING TOD..
6000 IF X$ = "" THEN 6080
6010 FOR J = 1 TO LEN (X$)
6020 C$ = MID$ (X$, J, 1)
6030 FOR I = 1 TO NS
6040 IF C$ = SY$(J) THEN POKE S + I - 1, VL(J): GOTO 6070
6050 NEXT J
6060 POKE S + I - 1, ASC (C$)
6070 NEXT I
6080 POKE S + LEN (X$), COLN
6090 POKE S + LEN (X$) + 1, RMARK
6100 RETURN
6996 REM #
6997 REM #
6998 REM #
6999 REM INITIALIZATION
7000 LD = 5300: NI = 48 + 1024 - 1: REM SEARCH AREA FOR '!S AND *E'S (ON APPLE II)
7010 LN = 70: REM NO EXPRESSION > 70 CHARS
7020 EPS = 0.0001: NT = 20: REM NUMERICAL TOLERANCE & NUM TRIES TO FIND ROOT
7030 X$ = "!": GOSUB 4000: S1 = X$: REM START ADDRESS OF 70 '!S
7040 X$ = "*E*": GOSUB 4000: S2 = X$: REM START ADDRESS OF 70 *E'S
7050 REM NOW FOR INTERNAL (POKE) VALUES OF SYMBOLS TO BE ENTERED BY USER
7060 REM NON-APPLESOFT WILL USE DIFFERENT VALUES...
7070 DATA +,200,-,201,*,202,/,203,^,204,S,218: REM S USED FOR SQR!
7080 RMARK = 178
7090 COLN = 58: REM COLDN & REMARK CODES TO TERMINATE POKED EXPRESSION
7100 NS = 6: REM NUMBER OF SYMBOLS
7110 DIM SY$(NS), VL(NS)
7120 FOR I = 1 TO NS: READ SY$(I), VL(I): NEXT I
7130 REM POKE IN ASSEMBLER ROUTINE THAT CORRECTS ERRDR-TRAP BUG IN APPLESOFT...
7140 POKE 768,104: POKE 769,168: POKE 770,104: POKE 771,166: POKE 772,223
7150 POKE 773,154: POKE 774,72: POKE 775,152: POKE 776,72: POKE 777,96
7160 RETURN
7995 REM #
7996 REM #
7997 REM #
7998 REM SETS UP NN, BEING VALUE OF ORIGINAL EXPRESSION ENTERED BY USER
7999 REM VALUES A, B, C, D & X MUST BE SET BEFORE CALL. RETURNS ER<> FOR ERRDR
8000 DNERR GOTO 8030
8010 NN = !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!: REM
8020 ER = 0: GOTO 8050
8030 CALL 768: REM CORRECTION FOR APPLESOFT BUG IF ERROR TRAP USED
8040 ER = 2

```

```

8050 POKE 216,0: REM APPLESOFT WAY OF UNSETTING ERROR TRAP
8060 RETURN
8995 REM #
8996 REM #
8997 REM #
8998 REM SETS NN TO VALUE OF LATEST EXPRESSION ENTERED BY USER
8999 REM VALUES A, B, C, D & X MUST BE SET BEFORE CALL. RETURNS ER<> FOR ERROR
9000 DNERR GOTO 9030
9010 NN = !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!: REM
9020 ER = 0: GOTO 9050
9030 CALL 768: REM CORRECTION FOR APPLESOFT BUG IF ERROR TRAP USED
9040 ER = 2
9050 POKE 216,0: REM APPLESOFT WAY OF UNSETTING ERROR TRAP
9060 RETURN

```



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Having agreed this, let's get on with the problem.

Look for a pythagorean triangle whose perimeter consists of a five-digit palindromic number.

However, only one of these digits appears in any of the sides — which are also of five digits each, though not palindromic.

What is the perimeter and also the digit which occurs in one or more of the sides?

Next month we come to the grand finale. I hope that you're ready.

JJ Clessa

IMPORTANT NOTICE

Lots of readers have expressed concern that, when the final part of the puzzle is published in December, they will be at a disadvantage because PCW does not arrive on the same day in different parts of the country. In order to overcome this problem and give everyone an equal chance we will be publishing the final part of the Manhunt in two national daily newspapers as well as in PCW.

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BENCHTEST
BUSINESS SYSTEM

Robin Webster gets to grips with a hefty Japanese machine!

When Canon introduced the CX-1 desktop computer into the UK at the beginning of this year, it sold the system on a direct basis to customers for around £4500.

Although a number of machines were sold at that price, the CX-1 has never really attained a strong presence in the business market, so Canon decided that it needed to develop a formal distribution network and trim the price fairly dramatically.

At the time of writing, Canon has begun to take full page adverts in the national press for the CX-1 and seems to be gearing up to take the machine around to exhibitions and generally give it a lot more exposure than it is used to.

A wide range of software is under development, including many different accounting systems, a word processing system and a powerful financial modelling system which can juggle with up to 10 different financial modes.

The price has fallen, too, and you should be able to pick one up for about £2500.

The CX-1 is not the only microsystem

Canon has on offer — there is the BX-3, which uses exactly the same hardware as the CX-1 but has a 28 character LED display and an integral printer instead of just a monitor. But as far as Canon UK is concerned, its main product will be the CX-1.

Hardware

There's no avoiding the fact that the CX-1 is quite a heavy machine. At around 55 lbs total weight the machine is portable only in the 'removals' sense — you really wish that it had wheels.

The weight is accounted for by Canon's decision to make the CX-1 as an all-in-one machine. That is, it comes with a 12in green-on-black monitor and a twin floppy disk unit housed inside a 64cm x 53cm x 33cm plastic shell. Around the back of the machine there is also a wide range of I/O ports, which we'll come to later.

The monitor is a Sanyo model and is placed to the left of the machine. Its green-on-black display is easy to read, and the contrast can be varied by a



Neat lid hides reset and stop keys



Disks hold 640k total





HEAVYWEIGHT CANON

knob set on the side. It does not have true descenders so the screen looks a bit untidy when full of text, but this is only a minor distraction. A special test program can be run to show the total character range the CX-1 can handle, which includes Greek characters and special bright characters. Although it's an 80 columns by 24 lines display, the two lowest lines are reserved as a command display area.

Right now there is no graphics package available on the machine and so only semi-graphic characters, created from a 7 x 9 dot array, can be used. Standard alphanumeric characters use only a 5 x 7 dot array.

The disk drives are set next to the monitor on the right of the machine and one is stacked atop the other. Each disk drive can provide up to 320k of storage per double-sided, double-density disk.

Rather than having just a small clip to retain the disk securely in place, as on the Apple and Superbrain drives, the CX-1 drives have hinged doors which can be locked under program control to protect disk data. Pressing the door home locks it in place, pushing it again releases it, providing no data is being transferred to or from the disk inside. A green light on each indicates when the drive is in use.

If the user wants more, just slightly more storage, this can be provided by two other drive units. The X-8300 is a stand-alone twin floppy disk unit with the two drives arranged side by side. Otherwise it is exactly the same as the standard integral unit. The other option, the X-8330, is the larger system and uses 8in double-sided, double-density disks. This unit has two drives arranged with the disk slots running vertically and each 8in disk can hold 1 Mb of data. These optional systems were not included on the Benchtest machine. Bigger drives, offering up to 30 Mb, are also on offer.

The keyboard unit is sturdy and has a good feel to it. It is also an integral part of the machine and can only be removed once the lid is off. The internal keyboard circuitry is well protected from coffee spills or dust accumulation since each key extends well beyond the underlying keyswitch mechanism. Any liquid that finds its way down into the keyboard area would more than likely be directed away from all the vital bits and pieces and towards the front of the keyboard where it could safely pool until cleaned up. There doesn't appear to be much chance of anything finding its way to the main PCBs via an accidental spillage into the keyboard works — something more than possible in the office environment.

The main alphanumeric keys are light grey with black lettering, while the special keys such as ESC, CTRL, SHIFT, LINE FEED, RETURN and CANCEL are dark grey with white lettering. Above the keyboard proper there is a row of cursor control and editing keys — these too are dark grey. Off to the right is the

numeric keypad which had been given its own return key, which is instead called START. There is no difference in the way the RETURN and START key operate.

Along the front edge of the main qwerty keys are standard Basic words such as PRINT, GOTO, INPUT, GET and END. By pressing the ESC key first and then the relevant qwerty key, it is possible to use these special Basic labelled keys to speed up programming.

On the left of the keyboard there are five remaining keys. Two, marked PROG and OPE, use small red LEDs to indicate which mode the CX-1 is operating in, and can actually be used to change the mode whenever required. The three remaining keys are yellow and offer varying degrees of stopping the machine.

The HLT key has a similar effect to that of the Basic PAUSE statement — it suspends program execution temporarily until pushed a second time.

STOP ends all processing and returns the control of the system to the ROM-resident MCX debugger. Canon decided to load the debugger system into ROM so that it would be there immediately the machine was started. The debugger allows a Basic program developed under the CX-1's own MCX operating system to be tested and debugged in an interactive manner. The debugger is activated by ending a Basic program with its starting address.

In the Canon literature, everything seems to suggest that the system disks are loaded into main memory by turning the machine off, placing the disk in drive FDO: and then switching the machine back on. 'It is necessary to set the system disk into Drive 0 before the power is turned ON,' states the CX-1 instruction manual.

The only reference to the last remaining key, the RESET button, is to be found under the Debugger Overview heading in the MCX operating system manual. Here it suggests that RESET should be depressed only if a program that has been under test terminates in some irregular way or it is known that the memory contains corrupted data. Since it seemed a bit extreme to blast the machine's electronics every time I wanted to load up another disk, I made a few tests with the RESET button and asked a member of Canon's technical staff about the problem. It soon became clear that using RESET was okay because it loaded the complete system into memory every time.

To gain entry to machine's insides,

the top half of the cream coloured plastic shell had to be lifted off — this is easily done once the few securing catches have been located and prised away from the bottom part of the shell with a screwdriver.

The CX-1 is arranged very neatly inside, and it is possible to see where the machine gets its weight from: the designers decided on a multi-storey design approach with all the large units — the monitor, the disk drives, the I/O ports and the power supply — mounted on top of a cast aluminium chassis of more than adequate thickness. All the PCBs — the CPU board, the memory boards, the CRT board and the I/O board — lie more or less hidden under all this.

The general impression is one of a very sturdy construction job. The monitor and disk unit have sheet-metal frames, which must add to the weight. The power unit is quite a big transformer since it supplies not only all the on-board equipment, but may be expected to power an extra disk unit at some point.

To enable wiring to pass between the top and lower levels, the chassis has been holed at the most suitable spots. The wiring is arranged so that it can be neatly tamed by specially placed plastic retainers — nothing looked as if it was cramped or under strain.

To the back of the machine on the right is a small fan which is the only source of cooling provided for the machine. It looked a little small for the job but even though the machine was left on for some hours during Benchtesting there were no signs of overheating. The only criticism here is that it is



Interior shows why it's so heavy!



I/O connections are arranged neatly at rear

rather noisy and so might be a bit annoying in a small office.

To get at the hidden PCBs is a fairly simple job once the screws holding the chassis to the bottom half of the plastic shell are identified and removed. Obviously aware that the machine is no Osborne 1, Canon has provided two pull-out handles on the chassis which are really necessary if the whole thing is to be lifted off the PCBs without danger of dropping it.

The CPU board, which contains the 6809 chip, lies at the bottom of the plastic shell, where moulded grips secure it in place. The board is provided with 28k of RAM and 4k of ROM, out of a maximum memory capacity of 128k. Above the CPU board on push/pull connectors lie two 32k RAM boards (16 x 2k chips) and the CRT controller board. To its right is an empty space which will eventually be filled by a special graphics board Canon is developing.

While the process of delving into the CX-1 was not difficult, it was time-consuming and you will probably have realised that this machine does not lend itself to quick board-swapping as does the Apple II.

Behind the CPU, memory and CRT boards is the I/O board which handles eight ports: three RS232 serial ports; one optional disk drive port; one light-pen socket; and three IEEE488 parallel ports.

The test machine came as standard with only the light-pen, add-on disk and RS232 ports in working order — there were no Centronics or General Purpose controller chips on the internal I/O board.

Software

The Benchtest machine was supplied with Canon's own MCX Extended Basic operating system, the CIS-Cobol system from Micro Focus, a menu-driven applications generator system called CXCat, and an MCX utilities disk called Comax II.

Since the CX-1 looks for system disks in drive FDO; the MCX Basic disk must be placed in that drive to boot it up. On loading the disk the first thing to be displayed is an indication that you are using MCX version 2.3, after which the various device handlers are loaded in sequence into memory.

The relevant device handler information is held in a file called START.COM on the MCX disk, and as each handler is loaded the CX-1 display indicates the fact with a cryptic message at the top left of the screen. An example would be line two which reads: CHBAUD USO: 1200 7ES. This simply means that the USO I/O port is set up to operate at 1200 baud, with 7-bit data, even parity, and one stop bit.

The actual process that occurs on trying to boot the MCX system up is as follows. The primary loader is held in ROM inside the CX-1 and when the machine is switched on or the RESET button is pushed this primary loader lifts a secondary loader off a fixed sector on the MCX disk.

Once in main memory, the secondary loader then looks for and loads the main MCX operating system, which is a file called MCX.SYS. The whole process from starting the system boot to actual

ly getting a system ready prompt (a \$ sign) lasts about 20 seconds. So it's not the kind of system you will find easy to live with if you have had experience of some of the other, faster loading machines on the market.

By pressing the key labelled PROG while the \$ prompt is displayed, it is possible to enter the Basic Program Edit environment, in which Basic programs can be written and edited and which provides the usual editing, auto line numbering and line renumbering facilities.

Once you have used the Basic Program Edit mode for a while it is simple to manipulate Basic statements, and MCX doesn't require you to follow any counterintuitive procedures. Programs are saved by simply typing in SAVE (Drive:) (Program name) RETURN, and loaded by typing LOAD (Drive:) (Program name). Alternatively, you can type RUN (Drive:) (Program name) as this command both loads the program into memory, if it isn't there already and then starts program execution.

For those instances where you want to keep a piece of code to yourself, for whatever reason, Canon provides the SECURE command. This stops the program from being listed or copied, or from having the XREF (cross reference) command applied to it.

A SECURED program must be given a password of up to six characters when the SECURE command is used so that the disk can be released from its protected state with the NONSEC command. As can be seen in the following section devoted to the Comax II utilities package, forgetting the password is only a temporary problem.

Moving out of the programming mode is achieved by pressing the OPE key, which returns the CX-1 to the operating mode with its \$ prompt.

To enter the operating system proper, you must type the word BYE and then press the RETURN key. This changes the \$ prompt into the O < prompt which indicates that you are now logged onto Drive O.

As with CP/M the DIR command is used to list the files stored on disk, but it is more powerful. While the CP/M DIR command displays only the bare essentials, the Canon version provides the disk name, current date and time, number of sectors on the disk being used, the number of sectors in use, the number of empty sectors, file names and types, file attributes (R/O or WE) and the date when a particular file was created. This kind of comprehensive information is obviously helpful since it makes it far simpler to keep track of how the system is being used and whether or not it's time for a clear-out of old files.

A really useful MCX facility is the WHY command. This is used whenever an error code is generated by the system. It takes the form WHY (XX), where XX is the error code returned by the system. In response to the query, the system looks into a file coded WHY and prints out the meaning of the code, so removing the chore of searching through an error code list to see what's going wrong.

Disk copying is achieved by using the DCOPY command, and this can copy a complete disk, system files and all, or just one or two specific files. The use of

the wildcard (*. * or *.File Type) method of copying a number of files at one go is provided.

The MCX operating system manual provided with the Benchtest machine was for version 2.1 of the MCX operating system and it indicated that files should be copied with the COPY command, but this did not appear on the system directory, nor could it be invoked from resident memory. After checking through the manuals and poling around various disk directories, it was obvious that a number of commands listed in the 2.1 manual — COBOL, COPY, RESBUF, RUNCBL, and VED were in fact on the CIS-Cobol disk.

Canon was one of the first companies to pick up CIS-Cobol from UK software house Micro Focus and was interested enough in having the product to actually do much of the work of converting what was at the time an Intel 8080 based package into something that could run on the Motorola 6809 based CX-1.

CIS-Cobol has become the Cobol system to have on a microcomputer, and will undoubtedly be an added attraction for anyone interested in getting an all-in-one business machine like the CX-1.

Aware of the benefits of giving the user the most flexible editing system possible, Canon has superseded the old line-oriented editor with the Video Editor (VED). This is used when running CIS-Cobol under MCX and provides a full-screen layout for editing operations. The line-oriented editor is still available under MCX but is far less exciting, though.

It's also worth noting that CIS-Cobol was recently rated at the highest level by the US Department of Defense, which more or less puts it on the same par as many mainframe Cobols that have been kicking about for much longer.

Comax II

Comax II is an add-on utilities package developed for the Canon MCX operating system by an Israeli software house called Com, and it comes with one of the most unusual system description texts I have ever seen.

To use Comax you can apparently place it in Drive O and treat it as a system disk (although I had no luck in doing this during the review). The other option is to load up the MCX operating system on Drive O and place the Comax disk in Drive 1, then log onto drive 1 (typing FD1: and then RETURN) and type GUIDE. The Comax menu screen is then displayed — there are 17 in all, from 1 to 17.

Pressing 'O' lists some screens which introduce the user to Comax almost as if it were a press release for Comax itself.

There is a message from Aviezer Eilat, director of Com Software Services in Tel Aviv. The message informs the on-looker that Comax is 'a tool for the software industry . . . it is not a product for the end-user', and how Eilat's company invests '12% of sales revenue in training, research and development'.

The user is further informed that Com is always interested in hearing from users and that if they need any help they should contact Com via the address and telephone number listed.

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HEAVYWEIGHT CANON

A nice touch is that the last screen of this introduction actually allows you to make a backup copy of Comax there and then.

Once some of the Comax utilities had been tried out, it was clear that the software was very good.

Com quite clearly wanted to show how good its product was, and even compared its utilities to Canon's slower and less comprehensive offerings. One example worth listing is the BACKUP function which Com describes thus: 'To duplicate diskettes the user may use the COPY.SYS function (copyright Canon), which takes up to 12 minutes if the diskette is full. BACKUP.SYS will copy the entire diskette, sector by sector, in two minutes, with full verification and with a media name check.'

Whenever the user needs to be aware of a particular system prompt during the menu selection session, the Comax system makes use of the CX-1's ability to display special characters that blink.

CXCat

The Canon Automatic Data Transaction System, CXCat for short, is described rather awkwardly as being a 'program-less software package'.

The company goes on to say in one of its brochures that CXCat is so adaptable that it does nearly anything, with any type of data and that the only limitation on what can be done is your own creativity.

Now if anything is going to confuse the user, this kind of thing will. There's the old suggestion that you can do all you could ever need to in the way of calculations on a pocket calculator, but this obviously only suffices if you're happy to continually punch in the data and record a zillion or so results.

CXCat should not be viewed as the solution to all the programming ills of an organisation, but rather as a neat and fairly efficient way of letting managers produce their own graphs and reports or as an aid to the development of simple business systems in a company where the DP staff are already snowed under from years of software development backlog.

To use CXCat you must first plan out your system design (the number of files you will need and the types of data to be stored in each, for example) with paper and pencil. Up to 50 master and 20 sub files can be created with the current CXCat system.

CXCat does have a few annoying little quirks — such as wiping out the whole of a column heading, which may be about 10 characters wide, if you don't fill in all the spaces accurately when you input it the first time. It might be more sensible to just give an audio warning that the system thinks something is wrong with the input and place the cursor at the beginning of the line once again, without deleting what's there. As the MCX, Canon admits that

CXCat has a number of bugs which are still being discovered and corrected.

I came across what appeared to be one when I was in the middle of trying to set up the data processing formulae which would take data from specific columns and apply arithmetic functions to them. At a certain point the system was expecting only numeric data and I accidentally pressed an alpha key. Immediately, the system displayed DATA ERROR! ZDBS17.280 and would respond only when the RETURN key was pressed. Rather than keeping me at the data processing level, it returned me to the \$ prompt, though. The ZDBS17.280 means that the program called ZDBS17 which was involved in handling the data processing function for CXCat stopped processing at line 280, but I only know that by asking — that kind of error message wasn't included in an otherwise good error list in the CX-1 manuals.

Other than the problems mentioned, there were no real horrors in using CXCat, and it is clear than an experienced user can quickly develop a range of small applications to suit his/her personal needs without having to resort to calling in a programmer.

Documentation

Generally, the Canon-provided documentation was laid out well, and you were sure that what you needed was in there somewhere. The manuals were good quality printed booklets with flexible card covers and were supplied in a couple of ring binders.

It would be nice if most computer manufacturers would take a little more care about how they present their manuals — the index at the back of the CIS-Cobol language manual was a great help, for example.

One criticism about the CXCat manual is that it was possibly a bit busy in the visual sense — there were too many illustrations provided and not enough easy-to-read text. You could get a little disorientated among the pages of illustrations. I never quite got used to it.

Prices

CX-1 with 128k memory	£2500
CIS Cobol	£190
CXCat	£150
COMAX II	£200
UCSD Pascal	£400
Printers	£500-£2000

Conclusion

As mentioned at the beginning, Canon is just beginning to push the CX-1 out onto the market in a big way. During the period of this Benchtest, new versions of both CXCat and Comax

Basic reserved words

LET	STEP	ADS
REM	THEN	MOO
OIM	USING	MAX
OPTION BASE	TAB	MIN
INTEGER	FEED	TIM
INPUT	SPACE	PI
PRINT	MSG	SIZE
FORMAT	FN	ERR
DISP	%DEL	LEN
GOTO	%REL	IDX
IF	EXP	VER
GOSUB	LOG	NUM
RETURN	LGT	CHRS
ON	SQR	COO
FOR	FRC	STRS
NEXT	RND	%CURX
REAO	ABS	%CURY
OATA	SGN	%HOME
RESTORE	FIX0	%CURSOR
END	FIX5	AND
PAUSE	FIX9	OR
DEF	FIXE	XOR
CALL	INT	NOT
PARAM	SIN	%CALL
OPEN	COS	OLIST
CLOSE	TAN	OCOPY
PUT	ASN	XTEST
GET	ACS	XTEST1
MAT	ATN	XTEST2
%SAVECRT	RAO	WHY
%LOADCRT	OMS	
TO	ARD	

System commands

ASM	DEL	PATCH
ASSIGN	DIR	REN
ATTR	EDIT	SPOOL
BASIC	FMT5	TIME
CHBAUD	FMT8	WHY
CROFF	MPATCH	X8330

arrived at Canon's Croydon offices and, according to the company, they contain many improvements on the earlier versions.

By the time this issue of PCW is on sale, Canon will have added the Wordplay word processing package to its software list as well.

My initial impressions of the CX-1 — that it was a little bit slow and not very exciting — were replaced by a good feeling about the way the machine performed at all levels. The fact that CIS Cobol, and UCSD Pascal are also on offer goes a long way to recommend the machine. The CX-1 is not sporty but should prove to be a good workhorse. **END**

Benchmark timings

BM1	3.0
BM2	6.0
BM3	21.0
BM4	23.0
BM5	24.0
BM6	41.0
BM7	54.0
BM8	39.0

All timings in seconds. For a listing and explanation of the Benchmarks, see elsewhere in this issue.

Technical specifications

CPU	Motorola 6809, 4 MHz
Memory	Maximum 128k, system uses 32k (including 4k ROM)
Disks	Twin floppy disk unit, total of 640k
Keyboard	76 keys
I/O ports	Three RS232 as standard, three IEEE ports optional, one port for additional disk drive, light-pen connector.
Screen	12in Sanyo monitor, green on black without descenders. 80 x 24 lines, 2 lines at bottom reserved for system prompts.
Operating System Languages	MCX Extended Basic. CIS Cobol, UCSD Pascal.

PREVIEW

DEC'S DAZZLING RAINBOW

Creative Computing's David Ahl delves into his past, meets some old friends and brings us the first British preview of Digital Equipment's new super-micro

It was with mixed feelings that I boarded the 7:00 am People Express flight to Boston. I was looking forward to returning to DEC, my employer from 1980 to 1974. I hoped to see some familiar faces and perhaps review some old memories. On the other hand, my main mission was to do an in-depth evaluation of the Rainbow 100 Personal Computer. Could I do an adequate job?

For the past few years I have been lulled into a sense of complacency by using the same few computers to meet most of my needs. In my office I have a TRS-80 Model III which I use mainly for word processing with Electric Pencil and financial chores with VisiCalc. At home I have an Apple on which I run mostly VisiPlot, Executive Briefing System and games. My kids have a TRS-80 Color Computer on which they are learning to program. At *Creative Computing* we have one or two of nearly everything else — Atari, IBM, Vic-20, Pet, Sinclair, NEC, and a bevy of S-100 CP/M systems.

However, with the exception of occasional use of an Altair 8800 (later hatched into an IMSAI) some three years ago, I have rarely touched CP/M — not that I was ever an expert on it. Hence, my trepidation facing a sophisticated new computer boasting CP/M as its operating system.

The weather in Boston did nothing to calm my stomach. Torrential rain and strong gusts of wind buffeted my rented Datsun as I drove out to the new Mt Royal (Marlboro) facility into which DEC had moved their Terminals and Personal Computer Groups just a few months earlier.

Pete Sanborn, manager of marketing communications for the new Personal Computer Group greeted me and showed me to the demonstration room. A light, airy room as big as any three of our offices was the home for four lonely-looking computers. The room is normally very busy with demonstrations, but I was fortunate to be visiting during Comdex and few demonstrations were scheduled. Thus, I had the place nearly to myself.

This was a mixed blessing. For an hour or more, Pete searched in vain for someone who could show me how the system worked. 'Never mind,' said I. 'I don't want a canned demo. Just give me a manual and let me learn it on my own.'

Unfortunately, that was even more difficult. As Bob Montemero, product marketing manager, explained to me later, the system is still in 'final development.' This means that the 'firmware' or the ROMs containing the system software are still being changed and modi-

fied, a process that will continue right up until volume shipments being in October.

This isn't as bad as it sounds. The current system works fine and is apparently bug free, but the software engineers are trying to wring the maximum performance from it. The bad news for me, however, was that virtually no documentation currently existed, and the little that did was in extremely preliminary form.

While Pete was searching for the 'right' people, I had the opportunity to speak with Andy Knowles, vice president group manager — whatever that means! It is a more pretentious title than Andy had when I worked for him some 12 years ago. In any event, Andy has the overall responsibility for the new personal computers at DEC. When asked why DEC hadn't entered the market earlier, he said it was simply a matter of the technology not having 'come together' to permit volume production of high quality systems with all the desired features.

Also, DEC has a history of producing as much as possible of its systems in-house. When entering a new technology, they occasionally buy components or peripherals outside, but by the time volume production is reached, DEC is usually producing the item(s). Andy was proud that virtually all the components of the personal computers are produced in-house, and he seemed almost apologetic that winchester disk drives were being furnished by Seagate.

DEC is entering the personal computer market with a rather different philosophy from practically any other vendor including IBM. From a hardware standpoint, DEC makes more peripherals and components internally than any microcomputer manufacturer.

A printer rolls off a DEC assembly line every 45 seconds, a CRT every minute. Make no mistake about it, this is high volume production! Hence, DEC has little need for other hardware or peripheral manufacturers, even on an OEM basis, in order to offer complete systems. Even giant IBM was forced to purchase printers from Epson on an OEM basis and, to this day, does not offer a letter-quality printer. DEC, on the other hand, was able to offer three printers when the systems were first announced.

Brief digression: Although this is a review of the Rainbow 100, I occasionally speak of systems (with an 's'). In fact, DEC announced four personal computers: the Rainbow 100, Decmate II, Professional 325 and 350. I hesitate to call them a family. While they use the same keyboard, CRT

and system unit/disk housing, under the skin they are quite different. The Rainbow 100 uses two microprocessors (an 8088 and Z80), the Decmate II uses a 6120 (PDP-8 on a chip), and the Professional series is built around an F11 (PDP-11/23). Thus, while some hardware and peripherals can be shared, software is not compatible across the different machines.

Hardware

The first thing that impressed me upon seeing the IBM Personal Computer was the ergonomic design, particularly the low profile, separate keyboard, previously available only on upper end terminals and minicomputers. (Andy Knowles was quick to point out that DEC had been offering a detached keyboard for the past three years with the VT-100 terminal.) The IBM keyboard is nice, but in the DEC keyboard it has certainly met its match.

The low profile DEC keyboard unit measures a long 21 in x 6.75 in. It slants from 0.6 in in height at the front to 2 in at the rear. The extra length is necessary to hold at the far right a numeric keypad which includes four program functions keys, three punctuation marks, and an ENTER key. The program function keys may be defined in software as numeric operators, but don't have to be. In addition, between the alphabetic keyboard and the numeric keypad is a set of ten keys for cursor movement and word processing manipulation. Only the cursor control keys work with the Rainbow 100; the others are for the larger systems.

Along the top row of the keyboard are 20 function keys, above which is a removable label strip beneath a hinged plexiglass cover. In total, 36 keys are firmware or software driven. In all, the keyboard has 103 keys. Their matt finish dark-on-light legends diminishes glare and ensures positive finger placement. Although the DEC promotional literature boasts that proper arrangement of keys can help eliminate errors, I found that the 'extra' key (with greater and less than symbols) located between the SHIFT and Z at the bottom left kept masquerading as the SHIFT. As a result, before correction, this paragraph, as did most of the others, started '< along . . .'. I also found it curious that the '5' on the numeric keypad was not identified by a raised dot for quick finger placement.

Other than those two minor glitches, the keyboard is as near perfect as I have seen. It is exactly the right height for those who prefer the low-fatigue, palm-on-table typing style and, indeed,

meets the European standard of having the home row keys 30mm above the table surface. The keys all provide excellent tactile and aural feedback (a low-volume keyclick reproduced by the self-contained speaker).

The keyboard has its own 8-bit microprocessor, 4k ROM and 256 bytes of RAM. It connects to the CRT display screen with a coiled 6 in cable using telephone-type modular connectors.

Upon seeing the CRT display screen, I thought, 'gee, that's small.' However, it is not the screen that is small — it is a standard 12 in diagonal CRT — but the housing. The housing measures a diminutive 11.5 in high by 13.75 in wide by 12.25 in deep. Most other housings are 25% larger. A balancing leg on the bottom of the housing allows it to be tilted from 25 degrees back to five degrees forward (for use on an overhead shelf perhaps?).

Normal display mode is white characters on a black background. Yes,

black. None of this light green on dark green or yellow on black. A reverse mode will display black on white. The surface of the screen is covered with a non-glare finish. While it needed an occasional wiping, the absence of glare was almost uncanny; I found myself wanting to touch it to reassure myself that it was really glass. However, it is highly susceptible to oily finger prints which destroy the non-glare property and are exceptionally annoying until wiped off.

The display generates 7 x 9 pixel characters including a two pixel descender for g, j, p, q, and y. Screen flicker is reduced by a 60-image-per-second refresh rate; I must confess that I could not see any difference between this display and the Model III or IBM. Normally, 80 characters by 24 lines are displayed; however, it is possible to select (in software) a 132-column width. While this is useful for looking at, say, 12 months of a spreadsheet, the 5 x 9

pixel characters used in this mode are firing to view for long periods. Nevertheless, it is valuable to be able to preview the entire 14in line printer width.

Other software-selectable features include a split screen capability which allows portions of the 24-line screen to be scrolled separately for menu selections, messages or prompts. The Select word processing package (covered later) holds three lines of prompts at the top of the screen while 21 lines at the bottom hold the scrolling text.

Also available are full- and split-screen horizontal and vertical scrolling. Double-height lines and double-width characters let one add emphasis to sections of text. Or, for even more emphasis, bold, blinking, reverse-video and underline are available.

The standard Rainbow 100 includes monochrome 'character cell' video. For some extra dollars, it can be converted to a bit-map display for either



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PCW2

comart communicator

PROGRESS REPORT



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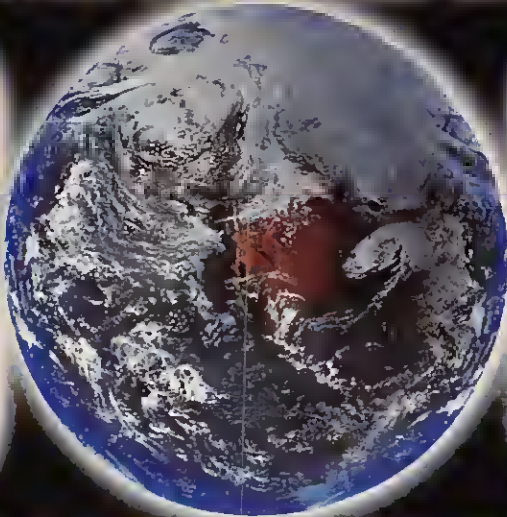
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PCW2

DEC RAINBOW

monochrome or colour output. This optional mode supports 16 colours simultaneously in the low resolution mode of 320 x 240 pixels or four colours from a palette of eight in the high-resolution mode of 800 x 240 pixels. Colour is via an RGB output (three separate outputs for red, green and blue) rather than NTSC composite video.

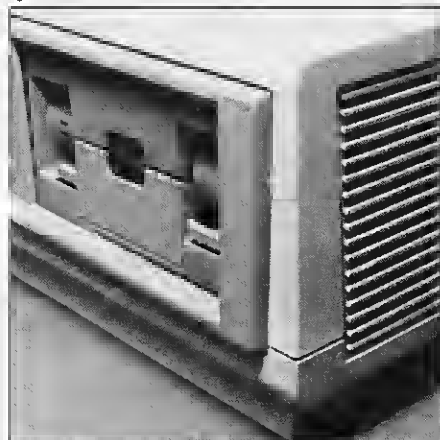
The system unit contains the microprocessors and logic circuitry power supply, disk drives, and slots for adding optional devices. The unit is designed to be positioned either horizontally on the floor or vertically on a desk or shelf. The unit is relatively large, measuring 19 in wide (shades of the rack mount days) by 15 in deep by 6 deep high (assuming vertical mounting).

The disk drives are unique. Looking like no others, each drive accommodates two single sided 5 1/4 in disks on a single spindle. Each disk stores 409.6 kbytes. With two disks on each drive, this gives a total of 819 kbytes of storage per drive, considerably more than any other currently-available small computer. Contrast this to the IBM Personal Computer, for example, which stores only 160 kbytes per drive; the Rainbow stores five times as much!

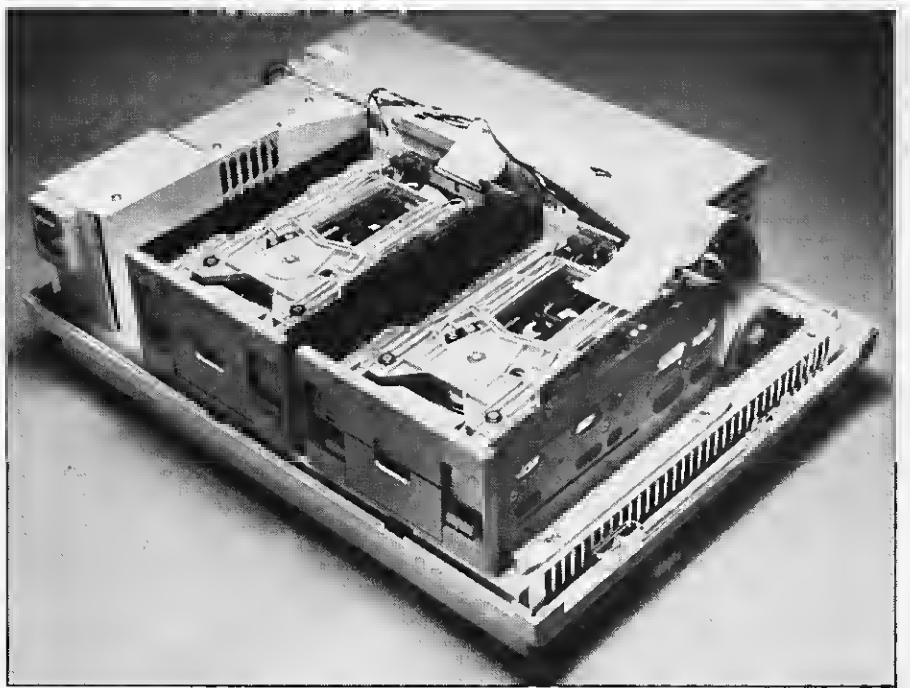
Each system unit can accommodate two drives (four disks). For those concerned with specifications, here they are: single-sided, 96 tracks per inch, 80 tracks used for storage, 10 sectors per track, 512 bytes per sector, 300 revolutions per minute.

The Rainbow 100 contains two microprocessors, an 8-bit Z80 and a 16-bit 8088. The two processors divide system function — disk operations are controlled by the Z80, while the display, keyboard, I/O port and options are controlled by the 8088. Both processors share 64 kbytes of main memory. This may be expanded to 128 or 256 kbytes (see Figure 1).

To take advantage of the dual processors, DEC created a hybrid 8-bit CP/M 80 and 16-bit CP/M 86 operating system called CP/M 86/80. This system features a capability called 'soft sense' which allows CP/M 80 and CP/M 86 application programs to run on the Rainbow 100 without operator intervention. The CP/M 86/80 operating system automatically determines if the application is an 8-bit or 16-bit program and executes the instructions with the appropriate processor and operating system.



Two doors and disks per drive



Modular construction pops apart at the press of a catch

Rainbow 100 has a built-in asynchronous/byte synchronous communications port that supports speeds up to 9600 baud with modem control. It is also equipped with a serial RS-232C printer port with programmable baud rates, parity bits, etc, for supporting a wide variety of printers as well as the three printers offered by DEC.

Construction of the main processor housing is quite unique and shows considerable thought has been applied to ease of servicing. The case top lifts off by releasing two catches at the sides; no screws are involved. Once inside the layout of the works is highly modular. Each major sub-unit — ie, power supply, disk drives, processor board and expansion cage — is separately mounted on the chassis. By depressing a small locking lever at the front of the chassis all these components are released and can be removed without the use of any tools at all. The power supply is encased in an alloy box which contains its own (quiet) cooling fan. Expansion memory and other modules slide on rails into their appointed slot as does the main board. All these components have self-aligning connectors so that refitting requires a minimum of fuss. All cable connectors used are 'foolproof'; they cannot be fitted the wrong way round.

The I/O panel displays seven LEDs which in the event of a malfunction will indicate which sub-unit is at fault. Additional fault tracing is performed by diagnostic routines in firmware which inspect the system on power up and display any errors detected on the VDU (if it's working). In the event of trouble you will have far more information available to you when you phone the engineers than on most micro systems and installing a new sub-assembly is within the capabilities of the least technical person.

Software

According to the DEC Guide to Personal Computing, 'CP/M — Control Program for Microcomputers — is characterized as a single-task, diskette-based operating environment that is well-suited to low-

cost personal computer hardware. CP/M was one of the first disk operating systems not designed for a particular computer.

'CP/M provides basic computer services. It is perhaps best known for its simple and reliable file system used with diskettes. It has been improved and rewritten over the years as faster, more reliable disk drives were introduced.' New versions have also been written to take advantage of new 16-bit microprocessors.

The Guide continues, 'The widespread acceptance of CP/M has resulted in numerous software vendors offering thousands of ready-to-run CP/M application programs.' Very true. Every issue of *Microsystems*, a magazine devoted to CP/M, is filled with descriptions of new applications and utility software for the system.

But, bear in mind, at the moment this vast library of CP/M packages cannot simply be purchased from a local computer store, popped into a Rainbow 100, and run. A large portion of the CP/M software is available only on 8 in disks. Much that is on 5 1/4 in disks has had subtle modifications added so that it runs on a specific system, a NorthStar for instance. As soon as Rainbow 100 systems start to be shipped in volume, there no doubt will be scores of software vendors converting existing CP/M software packages and writing new ones specifically for the Rainbow.

DEC has started a software program which will evaluate, rate and, in some cases, market software from third-party vendors. The lowest category is 'Digital-Tested'. This means that DEC has checked all the details of the package and found it will run as specified in the documentation. It has no known 'bugs' and meets DEC's criteria for installation, ease of use, and performance consistency.

The second category is 'Digital-Serviced'. This is the same as 'Digital-Tested' but also meets the serviceability criteria set by the DEC Software Service organization. Service contracts will be offered on software in this category. 'Digital-Developed' is the seal applied to DEC's own software products, al-

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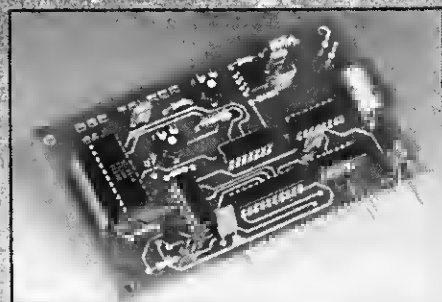
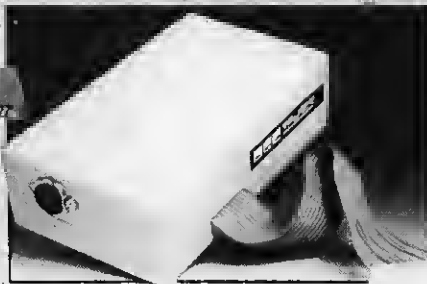


Model 01/02

Can be connected directly to the following computer systems: TRS 80 model 1 and III, LNW 80 and Video Genius.
Price £ 120,- plus VAT.

Model 03

The DGC TALKER model 03 can be controlled by any parallel interface. The configuration is standard Centronics compatible. The cable configuration can be connected directly to the following computer systems: Commodore, Vic 20, Pet.
Price £ 110,- plus VAT.



Model 04

The DGC TALKER model 04 is supplied as an insert card, of which the configuration is compatible with Apple expansion slots.

This model can be connected to Apple 2, ITT 20-20 and Pearcom.
Price £ 104,- plus VAT.

The models 01, 02 and 03 have a built-in power supply for 220/240V.

Model 04 uses the power supply of the computer system.

All TALKERS have a built-in LF amplifier and the only item neces-

sary is a loudspeaker.

The DGC TALKER is supplied with V.O.S. (Voice Operating System).

This makes it possible to expand programs written in BASIC

by speech. By using the V.O.S. the application of speech in programs becomes just as simple as the use of the screen.

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Application for more documentation.

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DEC RAINBOW

though in some cases these products have been developed by outside organisations. The following packages are in this third category.

Standard Microsoft Basic (Version 5.26) is being offered with the Rainbow 100. It is the 8086 version and runs under CP/M 86. It is loaded from disk and occupies 29k of RAM. Assuming sufficient memory is available, Basic can use up to 64k. However, even if the optional 256k option is installed, Basic can still use just 64k.

The Basic is excellent with password-protected files, dynamic string space allocation and up to 40-character variable names. Structured statements include:

WHILE/END

IF/THEN/ELSE

nested IF/THEN/ELSE

Machine language calls, CHAIN and COMMON (Fortran, here I come!) as well as Trace and error trapping are also included. Table 1 shows selected characteristics.

However, given the excellent graphics of the Rainbow 100 hardware, I found it curious that DEC did not contract with Microsoft to include any graphics functions. I also wonder why the following features, all implemented in Microsoft Basic on the IBM PC, were not implemented on the Rainbow 100: Graphics and music commands

Function keys

Device Independent I/O

TIME\$ and DATE\$

Screen editor

A spokesman from Microsoft told me that an extended Basic with these features *might* be offered by Microsoft at some future date to run under MS-DOS. The Rainbow 100 is available with MS-DOS (Microsoft Disk Operating System) as an alternative to CP/M 86/80. At this point the main advantage to MS-DOS is that under it industry standard disks can be read. Also, a few software packages are available for MS-DOS that are not available under CP/M.

Incidentally the people from DEC were prone to bragging that their Basic didn't have that nasty divide by 0.10 bug in IBM PC Basic. Sorry, guys, yes it did. But it doesn't anymore. The bug was in all Microsoft Basic implementations, and when they fixed one they fixed them all.

C, a structured language generally available under the Unix operating system, is also available on the Rainbow

100. I did not have an opportunity to use C — however, those familiar with the language will appreciate the full implementation (not Tiny C) on the Rainbow.

Before describing the word processing program, it is important to 'set the stage'. Andy Knowles and Barry Folsom, Rainbow product manager, emphasised that the Rainbow WP package is aimed at managers and occasional users who need to prepare memos, letters, and reports. For heavier WP users, they strongly recommend the DECmate II system which runs DEC's time-tested WPS Word Processing System. That said, let's look at the Select WP package for the Rainbow 100.

Select Information Systems Inc of Kentfield, CA has been marketing a word processing system for CP/M, MP/M and CDOS systems for several years. It is a comprehensive system which requires at least two disk drives, an 80-character screen and 48k or more memory.

Select was reviewed in full in the September '82 PCW.

Select is a menu-driven system. After loading, the main menu appears on the screen Page 6 of the manual emphasises, 'The best way to learn Select is to *put the manual down now!* Type "T" for Teach and take the Select tutorial.'

That is exactly what I did. It took me about 90 minutes to work through the tutorial, which combines a friendly tutorial style with plenty of hands-on practice. Each command is fully described and illustrated on the screen. An example is then presented. This is followed by a practice problem with prompting so it is nearly impossible to go wrong. Finally, a second practice problem is presented with no hints or prompting (except what would normally appear on the screen). At the end of each command, the program asks if you would like a review or if you wish to go on.

Select has all the expected features of a modern personal computer word processing package such as headers, footers, page numbering, merging blocks of text or entire documents, justification and the like. However, it has two important features rarely found in small systems: Teach and Spell.

After my document got quite long (10-plus pages), the system started to act a bit flaky. I have no way of knowing whether this was hardware or software. At the end of a line when a long word is being typed, the software moves the word to the beginning of the following line, for example the word 'started' at the beginning of this paragraph was moved when I typed the letter 'e'. However, on the next line the letters were altered and it became 'uvctvgf'. This did not happen every time, perhaps one line in every 20 or 30. I noted that it tended to occur more frequently when I was typing quickly.

Multiplan is Microsoft's answer to VisiCalc and SuperCalc. Rather than describing the entire package, I will simply note some similarities and differences between it and VisiCalc.

Multiplan, on the Rainbow 100, offers a worksheet 255 rows long and 63 columns wide for words, numbers and formulas. The biggest difference between Multiplan and VisiCalc is the

ability of one Multiplan worksheet to reference another. In other words, say one worksheet contains salary calculations consisting of employee names, regular and overtime hours, hourly rates and salaries, deductions, taxes, etc, while a second worksheet may be a summary of department expenses. In this case, the second worksheet can reference just the final department summary salary expenses from the first without having to create an intermediate file or re-enter the data.

Another difference between Multiplan and VisiCalc is that Multiplan allows the creation of up to eight windows within the display area compared with two for VisiCalc. While this may sound four times as good, in three years of fairly heavy usage of VisiCalc, I have rarely used the two-window capability and can't imagine needing three or four windows, much less eight.

A nice feature of Multiplan is the message line at the bottom of the screen which displays comments on the progress of any command, and the percentage of remaining storage.

A not-so-nice difference is the convention in Multiplan of numbering both rows and columns. Thus, in VisiCalc, a reference to Row 3 Column 2 is B3 whereas in Multiplan it becomes R3C2. Even worse is the handling of 'relative' references. This is done automatically in VisiCalc as rows and columns are shifted. Multiplan requires the user to define a relative reference in advance. For example, to add Row 1, Column 1 to Row 1, Column 2 and put the result in Row 1, Column 3 so that it may later be shifted to make room for another row requires the following commands: VisiCalc @SUM(A1+A2)
Multiplan V SUM(R[-2]C+R[-1]C)
VisiCalc: 11 keystrokes. Multiplan: 19 keystrokes. And the winner is . . .

I was also not impressed with the method of assigning labels in Multiplan. Typing any alphabetic character in VisiCalc automatically indicates a label whereas Multiplan requires that A (for alphabetic) be typed preceding a label.

Other differences are relatively minor. In most respects Multiplan behaves as expected and, like VisiCalc, is an excellent tool for asking the all-important 'what if?' questions of business planning and financial modelling.

Microsoft includes two fat 192-page instruction manuals with Multiplan. Unfortunately, I can only describe the styles as 'written by programmers for programmers'. These will soon be available in 'DEC colours', presumably written in a more user-friendly style. In addition, Bob Montemerlo mentioned the possibility of adding a tutorial Teach mode similar to that of Select. Nothing definite yet.

Expansion

The Rainbow can be expanded by adding 64 or 192k RAM boards for a maximum of 256k. A second dual floppy drive may be added to the main processor unit, giving 1.6 Mb in all. If still more mass storage is required, a 5 Mb hard disk is offered (5 1/4 in). This optional winchester disk is housed in a separate cabinet.

Average access time with the winchester disk is 95 msec and transfer rate is 5 Mbits/sec compared to 290 msec

Characteristic	Implementation
Name length	40 characters
Integer arithmetic	Yes
Multi-statement functions	No
Function recursion	Yes
Statement numbers	0 to 65535
Floating point precision	7 single 16 double
Exponent	±38
Nested IF	Yes
Link to machine language	Yes
Maximum array dimension	255
CHAIN and COMMON	Yes
Error trapping	Yes
Trace features	Yes

Table 1. Selected features of Rainbow 100 Basic (Microsoft version 5.26).

DEC RAINBOW

and 250 kbits/sec for the floppy disk system. Thus access time is three times as fast and transfer rate is 20 times as fast, a noticeable difference.

We are told that because of the sealed head/disk assembly the drive requires no preventive maintenance or adjustments. Furthermore, the winchester subsystem has firmware diagnostics that test and verify that all components of the system are working during power-up. These diagnostics also provide continuous error checking during normal operation.

The Rainbow 100 requires the extended communications option which contains a high-speed disk interface port to use the winchester disk option. This communications option also contains an additional communications port.

DEC offers a choice of three printers with the Rainbow 100: the LA50 Personal Printer, the Letterprinter 100, and the LQP02 Letter-quality Printer.

Each printer can accommodate a variety of papers: single sheet (such as letterhead), fanfold continuous paper, multipart forms, roll paper and labels. Each printer also contains internal diagnostic tests that are performed automatically on power-up. Also, all three have a local-mode self-test.

The LA50 is a dot-matrix printer with two print modes: text mode and enhanced print mode. In text mode it prints at 100 characters/second. The enhanced mode prints at 50 char/sec and creates a crisper, more uniform character than text mode. The seven-wire printhead allows for underlines and full descenders. The LA50 also prints double-width characters.

In addition, the LA50 prints bit-map graphics at 144 x 72 dots per inch. These dots are printed exactly as the pixels are displayed on the screen.

The LA50 can be set to three character-per-inch spacings: 10, 12 or 16.5. Also, lines-per-inch can be set to 6, 8 or 12. Maximum paper width is 10in although, with the compressed character spacing, 132 characters can be printed (in 8 in). Normal print width is 80 or 96 columns.

The Letterprinter 100 is a highly versatile dot matrix printer with three user-selectable or program-selectable print speeds for different quality output.

For rough drafts, internal memos or data processing, 240 characters per second produces good, clear text and numbers. The 80-character-per-second mode uses a denser dot pattern for each character and provides higher definition. In the 30-character-per-second correspondence mode, the printer overlaps two sets of dots and produces letter quality text.

The Letterprinter 100 can be placed in graphics mode at any point under software control; this allows the mixing of text and graphics on the same page. In graphics mode it prints 133 x 72 dots per inch.

For maximum creativity in designing a document, you can specify characters per inch (5, 6, 6.6, 8.25, 10, 12, 13.2, or 16.5), lines per inch (2, 3, 4, 6, 8, or 12) as well as margins, tabs and form length. These parameters can be stored in the non-volatile memory of the Letterprinter 100.

A neat feature of Letterprinter 100 is

its ability to handle up to five internal character fonts. Courier-10 and Orator-10 are built into all printers. Three additional fonts can be field installed (they are on ROM chips) or you can get additional fonts on plug-in cartridges. The fonts can be changed at any time during printing.

Thus by combining different fonts with expanded/compressed character widths and graphics printing — even on a single line — you can be very creative indeed.

The LQP02 is a daisywheel printer with a print speed of 32 characters per second. With a built-in 256 character buffer it has bidirectional printing capability and can operate at baud rates of up to 9600.

To produce bold characters, the LQP02 uses a technique called 'shadow bolding' in which characters are struck twice as in normal bold print. But unlike normal bolding, the second strike is slightly offset from the first. This makes the bold print more visible.

Characters per inch are software selectable (10 or 12) as are lines per inch (2, 3, 4, 6 or 8). Margins, tabs and form length also can be software controlled.

Maximum print width is 13.5 in or 15 in paper. With an optional forms tractor, the LQP02 can handle fanfold paper.

A graphics module is available which provides high resolution colour graphics, for which purpose a colour monitor is also included in the options.

In a very welcome break with micro-computer industry practice DEC is offering 23 months on-site service for the Rainbow, included in the purchase price.

Prices

Rainbow 100, 64k RAM, 2x400k disk drives, CP/M 80/86 including monitor and 12 month service	£2359
Additional 2x400k disk drive	£665
5 Mb winchester drive RD50	£2698
64k expansion RAM	£335
192k expansion RAM	£739
Graphics module	£549
Colour monitor	£885
Floor stand for CPU/disk housing	£65
LA50 dot-matrix printer	£599
LA100 dot-matrix graphics printer	£1732
LQP 02 daisy-wheel printer	£1960

all prices exclude VAT.

Conclusion

The Rainbow has to compete directly with the IBM PC and the Sirius. The price of an entry level system is well calculated to do just that; although the three systems don't compare exactly in features offered it is possible to make

trade-offs. The IBM has less disk capacity on offer and lacks the second processor as standard fitting. The Sirius offers RAM as standard and more disk capacity but lacks the second processor and the colour graphics option. In other words the Rainbow offers at least as good value for money as its nearest rivals and as a bonus it carries the Digital name.

Some years ago, the IBM name was thought to be worth 20 to 25% of the price of a computer. In other words a competitor would have to be more than 20-25% lower than IBM to be in the running. In the miniworld, the same is true with DEC today although the differential is probably more like 15%. However, as a result of the enormous mini customer base and excellent reputation of DEC, it is likely that the DEC personal computers will find a ready market.

Will the DEC entries harm Apple, IBM or Tandy? I doubt it. If anything, the biggest effect will be to further legitimise the personal computer itself as another blue chip name is added to the field.

Perhaps the most significant feature of the Rainbow 100 is the incorporation of both an 8-bit Z80 and 16-bit 8088 processor along with a 'soft-sense' operating system, CP/M 86/80, to automatically run applications software on the correct processor.

Selecting CP/M as an operating system instead of the more Unix-like Oasis or a proprietary DEC system is also significant since it immediately makes available a large number of practically off-the-shelf applications software packages. Having a 16-bit processor built in ensures that this will continue to be true.

Hardware-wise, the keyboard is outstanding. I also like the idea of two double density floppy disks on one drive spindle. The immediately available optional 5 Mb winchester disk means that storage should be ample for virtually any application.

I find the Select Word Processing package and Multiplan spreadsheet package curious choices. However, given the comparatively high prices of these packages, I would guess it will not be long before other software vendors jump in and widen the range of choices in these two most important areas.

Bottom line: the Rainbow 100 should have a long successful life.

Benchmarks

At the time of going to press Digital UK could not supply us with a Basic interpreter and so we were unable to run the benchmarks. We will do so as soon as possible and print the results at a later date for the sake of completeness.

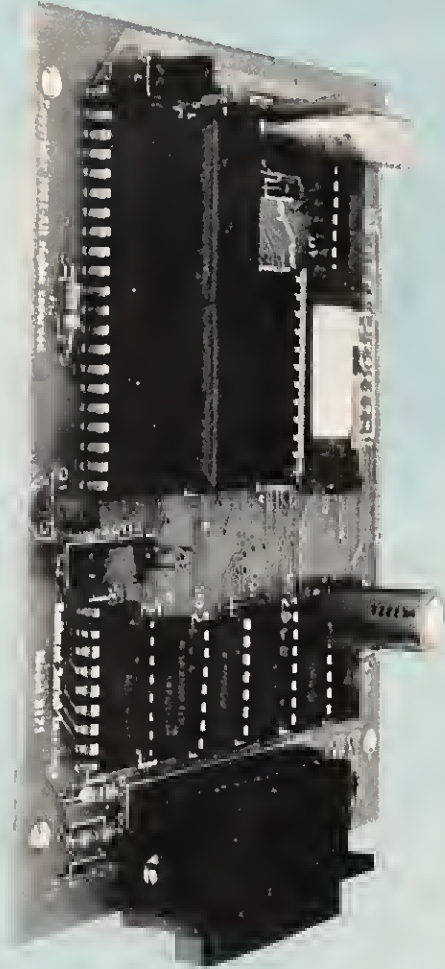
— Ed.

END

TECHNICAL SPECIFICATIONS

Processors:	Z80 and 8088
Memory:	64k RAM, expandable to 256k
Keyboard:	103 keys, including numeric pad, cursor controls and 20 function keys
Screen:	12in black on white, 24x80 or 132 chars. Optional graphics 800x240 pixels
Disk:	One double 5¼in drive built in. 2x400k
Ports:	RS232 printer, 9600 baud bi-directional async/sync comms
Operating systems:	CP/M-80, CP/M-86, MS-DOS
Languages:	Microsoft Basic, Mark Williams 'C'

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Your computer is capable of sending data at thousands of characters per second but the Epson can only print 80/100 characters per second.

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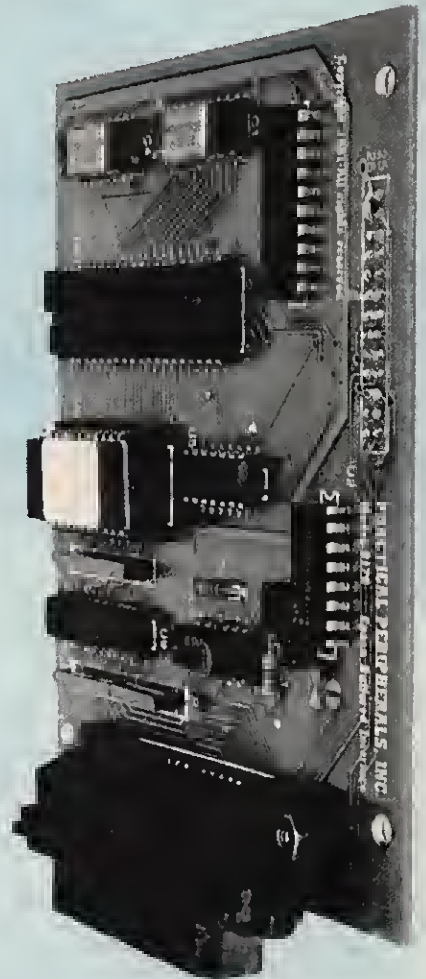
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Microbuffer model MBK-16K is a Centronics - compatible parallel interface with 16,384 bytes of on-board RAM for data buffering.

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Photography by Sandy Porter

HEWLETT PACKARD HP-75C

1982 has certainly been the year that the hand-held computer took off. The Sharp PC1500 and the Newbrain both, in different ways, extended the boundaries of what can be done with a hand-held package. Now, before the year is even over Hewlett Packard (soon to be followed by Epson) wades in with the next generation of machines.

Hewlett Packard, at the launch of the HP-75C, expressed the opinion that the demand for portable machines would grow by 130% (compared to 44% overall) within five years, and that they wanted to take a hefty slice of this business. Other major manufacturers such as Apple have declared their faith in this line of development too.

The fact is that the technology is now almost ripe to permit the manufacture of hand-held computers which have all the capabilities of the current generation of desk-top machines. It is possible now (though perhaps not commercially viable) to produce a 64k, twin-disk CP/M computer small enough to slip into a briefcase.

The current offerings are, however, not quite up to that sort of power or flexibility of application and so it is still of crucial importance to the manufacturer to identify a more limited area of application and design for his machine to be good at. The first hand-held machines were still calculator-based; their area of expertise was mathematical and statistical calculation. Other areas which can be identified are data collection (eg, for stock control), communi-

BENCHTEST PERSONAL COMPUTER

A new generation of portable computers is about to hit the market. Dick Pountain reviews the first to arrive in the UK, HP's 75C

cations (portable access to a central database) and portable word-processing. The latter application is still hampered by the lack of large enough portable displays and fast mass storage devices; Teleram is starting to make waves in the US with a bubble memory based machine but it is too expensive for any but top professionals to afford.

Hewlett Packard has identified another area with the HP-75C, that of the portable 'executive assistant'; this fits in admirably with the upmarket HP image and allows it to be priced higher than a mass market device could be.

The HP-75C has powerful general-purpose computing functions combined with special firmware, allowing it to be used as a sophisticated appointments calendar, diary, telephone book and alarm clock without any programming.

Hardware

The 75C comes in a dark brown ABS case measuring some 10 in x 5 in x 1½ in which is the size of a largeish paper-

back. You'd need a huge pocket to hold it but it slips easily into a small briefcase. It is supplied with a 'field case' which is a strong plush-lined leathercloth-covered carrying case of the type used for binoculars or electrical instruments.

The LCD display is set in a gold-coloured brushed alloy fascia; the key surround and the case back also have metal facings. The external appearance exudes quality and style and it won't look at all out of place in the back window of your Porsche.

Travelling around the case we find, at the front edge, three sockets to hold expansion ROMs and at the lower right corner an inconspicuous slot for the magnetic card reader. Underneath is a sliding lid compartment for the rechargeable Ni/Cad battery pack; this gives a minimum of 20 hours' full drain operation or several weeks of normal use. A battery low warning is issued when recharging is due and various modes of operation are disabled in turn, the highest priority being the preservation of memory contents. On the back edge of the case is a socket to attach the AC adaptor/charger which is supplied with the machine; this allows mains operation and simultaneously charges the batteries. Next to this socket are male and female sockets for the HP-IL interface loop; two HP-IL leads are also supplied.

As you would expect, the 75C runs on CMOS technology — and, as you would also expect, no details are avail-

able about the workings. The case halves are held together by those infernal barbed clips which cannot be opened without disfiguring the case, so I couldn't even look inside. Suffice it to say that one or more 8-bit processors, probably of HP's own design, are used and it comes with 16k of non-volatile RAM expandable to 24k via one of the module slots. A glance at the Benchmark timings will show that the processor is something new; they are as fast as most full size micro timings (almost the same as the Tandy Color) — which is to say ten times faster than the Sharp 1500 and other predecessors.

The keys are of the calculator type but rather larger than most; they are widely spaced so as to be very close to standard typewriter pitch. They have very short travel and a positive click when depressed. Although they feel quite unlike typewriter keys it is possible to do two-handed and even touch-typing on them after a little practice; the wide, conventionally sited space bar helps here. Upper and lower case are available along with a shift lock. The main obstacles to fast typing are the relatively small SHIFT and Return (RTN) keys; in particular the shift key must be held down as on a conventional keyboard, but somehow because it has 'clicked' one tends to release it too soon. All keys have auto-repeat.

Keys are provided for four-way cursor movement, clear display, tab and backspace as well as a toggling insert/replace so that full display editing can be done. If insert is on, the square cursor turns into a left arrow to signal the fact, elegant touch. The whole keyboard is redefinable (see below) and in particular the block of keys starting 7UJW can be used as a numeric keypad by pressing CTRL LOCK, as an alternative to the normal qwerty numbers. A keyboard overlay helps in using this mode; blank overlays are also supplied for user defined keyboards.

The three main modes of operation are selected by TIME, APPT and EDIT keys; I'll discuss these more under 'Firmware' below.

To switch the 75C on you press the ATTN (Attention) key. Auto power-off operates after five minutes unless a program is running or the STANDBY ON condition is set which allows use as a desk clock. A nice feature is that the command LOCK 'Dick' will protect the machine from unauthorised use; when switched on it requests the password and insolently switches off again if 'Dick' is not supplied. The ATTN key is made to work very hard as it is also the break key and is used as an action key instead of CR by many functions. To switch off you use SHIFT ATTN which is a rather cute bit of anthropomorphism.

The 32 character LCD display is based on a 7x5 dot-matrix and contains annunciators for ERROR, BATT low, APPT and PRGM running conditions. It is a window onto a 96 character line and can be scrolled sideways with the

← and → keys. The line width can also be set, for display or printer, by the WIDTH and PWIDTH commands. A range of Greek and accented characters can be typed using the control key; even the various control keys have a printable character which can be displayed by SHIFT I/R, in which case their normal function is not performed. Display information can also be sent to a video monitor/domestic TV, printer or plotter on the HP-IL loop by declaring these devices as DISPLAY IS. This gives a 31 line display of 32 char/line; 16 can be on screen at a time and the rest are viewed by rolling the display up or down.

Mass storage is built in in the shape of a manually operated card reader; the 10 in long cards are pulled through by hand. A mark on the card shows where to align it and clever firmware prompts you through the whole operation even telling you whether you are pulling too fast or too slow; a rule of thumb is that it should take as long as it does to say 'Hewlett Packard!'. The cards have two tracks and hold 650 bytes per track. I found saving and loading with cards to be totally reliable and in fact rather more confidence-inspiring than motor-driven card readers like those of the HP41C and T159 which are somewhat temperamental in my experience.

The Beeper is not tremendously loud but is programmable for pitch and duration; it is used by the system for alarm and appointment functions. The quartz system clock is adjustable by the user to maintain real-time accuracy; no less than 1001 independent timers are



10in cards are fed by hand



Military-style carrying case



The 75C drives a monitor via the Video Interface

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COMPSOFT'S

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available to programs for real-time processing via the ON TIMER #n . . . statement.

Firmware

The 75C has three main modes of operation APPT, TIME, and EDIT. Each has a key to select it; normally on switching on it defaults to EDIT mode but after a memory reset or battery removal it comes up in TIME mode to prompt you to set the system clock.

EDIT mode (shown by a > prompt) is the command mode in which calculations are done, Basic programs entered, loaded or run and all system functions performed. There is no separate calculator mode; direct calculations are done by merely entering an expression and hitting return without an '=' or PRINT being required. There is a variant of EDIT mode which is entered by typing EDIT TEXT. In this mode (prompt changes to :) all input is regarded as ASCII text and stored in a text file so that the machine becomes a notebook or simple word processor. Lines of text still require line numbers, though these can be generated automatically by AUTO; they enable individual lines to be found and inspected by the FETch key. The whole file may be reviewed manually with the up and down keys or automatically (without line numbers) by typing PLIST; the rate of scrolling is controlled by DELAY. String searching is possible, of which more later. All input to the 75C is via a 95 character buffer whose contents can be recalled at any time by pressing CTRL FET (the Fetch key) to see your last entry.

TIME mode invokes the system clock and calendar and displays the time and date (you can choose US or European format for the date). To set the clock/calendar you type SET when the time display is on and a 'template' is shown which reads

Mo/Dy/Yr Hr:Mn:Sc AM

The cursor is then moved to each field in turn and the correct word or figure is typed in; you can use the cursor keys or back space or, better, TAB which automatically skips from field to field. Once the clock is set you can in future omit any template field which is not to change and the computer will fill in the details itself. The reason I've described this process in so much detail is that extensive use is made of these templates by the 75's designers; there are six in TIME and APPT alone as well as ones for defining keys and assigning devices. They are the one-dimensional equivalent of a menu and they work very well and save a lot of references to the manual.

The clock speed may be adjusted to allow for variations caused by different climates or age. It is typically accurate to 1.5 minutes per month but can be held to 15 seconds per month if you use the recalibration facility.

APPT mode is used to store future appointments. Up to 600 can be held at once and they can be stored on card or tape to free memory for other uses. Appointments are set by filling in a template like that for time. When one comes due the 75C switches itself on, gives one of nine different audible alarm sounds (which vary from mild to

maddening) and displays the reminder message you've entered. If the 75C is already on and running a program the APPT annunciator comes on and the alarm sounds but the program will not be interrupted. You can inspect the message later when you've finished what you were doing. The file which contains appointments, called APPT, can be listed, edited and stored like any other file so that appointments can be altered or cancelled. A variety of options can be had when scheduling appointments; it's possible for one to be automatically rescheduled at any interval — eg, every day, every hour, every year from a single entry. Or you can demand that a particular appointment be acknowledged before it will stop pestering. All of this is obtainable without any knowledge of programming at all, though in fact the action scheduled could be to run a Basic program rather than to issue a reminder message.

Two calendars are included; the normal one being a one year one (with days of the week). An extended 10,000 year calendar can be selected (I should live so long) which can be used to answer questions such as what day of the week was the battle of Hastings or what day is Christmas in 2082. There is something fairly surreal about a manual which has sentences like 'To schedule an appointment outside of the current century . . .'

The appointment facility is impressively powerful and well thought out and I suspect that many machines will be sold on this feature alone; if one has an adventurous sex-life it could even be life-saving.

The whole of the keyboard can be redefined — a total of 194 keys — and the messages assigned can be merely typed on the display or immediately executed (ie, they include a carriage return). The DEF KEY command is used to do this and the definitions are stored in a file called KEYS. Unfortunately there is no USER mode as on the HP41C which switches between the standard and redefined key set; instead you're stuck with any redefinition you make until you explicitly undo it. It is possible to temporarily access the original definition of a key by pressing SHIFT I/R before it but this is rather

fiddly; a USER mode would have been easier to use. Sets of key definitions can be loaded from card or tape for special applications; if you want to restore the original keyboard all that's needed is to PURGE the KEYS file.

Typical uses for this facility are to provide typing aids — ie, assign frequently used words to a single key, or to set up special actions. For instance, if you define SHIFT ATTN to display the time and date then the 75 will revert to being a clock whenever it switches off. In this case you could only turn it off by typing the BYE command. You can also incorporate cursor positioning commands into a key definition and thus set up your own templates for formatted input.

While on the subject of typing aids, all the system commands and Basic keywords may be abbreviated; the shortest abbreviation accepted is often a single letter, eg, f. for FETCh and d. for DELETE.

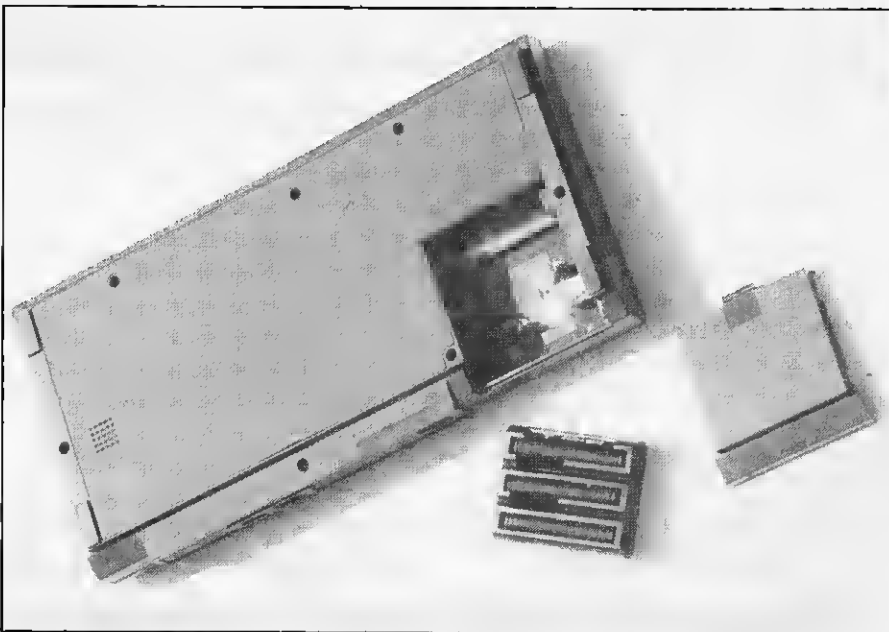
Software

Although the operating system and Basic are in ROM I have chosen to discuss them separately as 'software'.

The operating system is quite unique and in particular bears little resemblance to any previous HP software. It shows evidence of much development effort as well as an intelligent study of other operating systems, especially UCSD.

The basic problem for computers using CMOS memory, once they have sufficient memory for it to be a problem, is that the user will wish to keep data and/or programs in RAM rather than mass storage when possible. This means the memory must be organised in some way to allow simultaneous storage of more than one data object. Casio proposed one solution on its calculators and the fx9000 — namely to divide memory into 10 'program registers' separated by dynamically moved partitions (Epson appear to have gone this route too). HP's designers have come up with another solution altogether.

In the 75C, files are the principal data objects. As many files as will fit can reside in memory simultaneously. Basic programs are treated as files. In



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- PLEASE SEND DETAILS OF ONE DAY'S SEMINAR/WORKSHOP

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addition to text and data files and several sorts of special file. Some files are created and kept by the system itself (eg, appointment files and key definition files) while others must be created by the user. Files in RAM are no different from files on card or tape which, combined with the device independent character of the I/O routines makes life easy for the user. All files have a similar structure, which is that of a collection of numbered lines containing up to 96 characters each. There is no difference between a serial and a random access file; any file can be read either serially or randomly depending on whether or not you specify a line number. In a Basic file the lines contain program statements, in a Text file each line is treated as a contiguous string of characters; a data file is merely a Basic file full of DATA statements, the items on a line being separated by commas. Files can be opened, closed, written to or read from the keyboard as well as from a program.

When EDIT mode is entered a workfile is automatically opened to receive your input a la UCSD. At the end of input you can rename this file whereupon it becomes an independent entity. As only one workfile can exist and it is always the current — ie, open — file it is not possible to leave a non-empty workfile without naming it or purging it.

An existing file can be made the current file in place of the work file by typing EDIT 'filename' upon which its catalogue entry appears in the display — this gives the name, type, size in bytes and time and date of creation of the file. Pressing ATTN then puts you in the file to edit it. CAT ALL lists the catalog of all files in memory while CAT displays that of the current file.

Basic programs are thus treated as files which can be run either by RUN 'filename' or simply RUN if they are the current file. Text files cannot be run directly as Basic programs but a command TRANSFORM will turn a text file into an executable Basic file so that programs can be written using the text processor.

Files can be manipulated by the commands RENAME, PURGE, MERGE, COPY and NAME. MERGE writes the contents of one file into another between specified line numbers; line numbers which coincide will be overwritten. COPY duplicates a file under a new name or to a card or other specified device. NAME is used to name the workfile and open another of the same type. All these commands work in the same way within RAM, between RAM and mass storage or between mass storage and mass storage. To save a program for instance one could type COPY 'myprogram' TO 'myprogram:card' or simply COPY TO CARD if the file is the current one. Four levels of file protection are built in; a password may be assigned to limit access to a file, a 'private card' may be created by using PRCARD as the device name, which cannot be listed, altered or duplicated, and finally PROTECT creates a card which cannot be overwritten.

FETCH is a powerful command which can be used in several ways. On

its own it fetches the current line from a file being worked on. Why would that be so useful? Because I might have broken off from editing to do a calculation or some system function; that can be done at any time in any mode merely by hitting ATTN. Then a simple press of the FET key puts you back where you were. FETCH 203 displays line 203 of the current file, while FETCH 'array-bound' would fetch the first line after the current one which contains the word 'array-bound'. FETCH 'string', 203 would search for the first occurrence of 'string' after line 203; this command works in both text and Basic files.

All errors in file handling are handled gracefully: ie, the system tells you of the error and then aborts the command and allows you to try again with no harm done, unlike some operating systems I could mention. The system is also consistent in that if you know the syntax of RENAME then you know COPY as well and so on.

This is an excellent operating system which deserves to be applied beyond the confines of the 75C. With a few additions for disk-based systems it would be a very neat way of coping with the new 'RAM disks' which are finding favour in the USA.

The HP75C Basic shows some similarities to the version used on the 80 series computers but also some major differences. It is an extension of ANSI Minimal Basic, the extensions being in areas like handling of spaces in input (the 75 strips extra spaces and inserts missing ones for readability) and the handling of FOR...NEXT loops (you can halt in the middle of one without error). The manual has an appendix which enumerates the extensions and deviations from the standard. One point that will not be lost on HP users is that the 75 supplies an invisible END in program files so its use is now optional.

Rather than devote a lot of space to describing features of the Basic I will outline the new features and refer you to last month's review of the HP86 for the rest. As on the 86, arithmetic is 12 digit with a dynamic range of $10E \pm 499$, with the option of SHORT and INTEGER types to save memory. The same large range of functions as on the 80 series is supported, as are calculator and program variables. Unlike the 80 series, however, the calculator variables are not accessible to programs. Variable names are limited to single letters or letter plus single digit; a calculator variable can have the same name as a program variable but in this case they cannot be accessed from the keyboard during a program interruption. Multi-statement lines are allowed and AUTO line numbering, RENUMBER and DELETE are all supported.

No structured control statements are provided except for a single line, multi-statement IF...THEN...ELSE, but a new and powerful CALL is provided which, combined with the file oriented operating system, has the same effect as a procedure.

CALL 'filename' will execute the named program and then return control to the calling program. Variables, DIM statements and all branching and sub-routines are all of local scope, only system commands and file assignments being global, so that calling another

program will preserve the values of variables in the caller. Values can be passed to a called program by setting up a temporary data file as a go-between. When the caller reads the results back from this file it can read them into the original variables or into new ones, giving the effect of call by value or reference as required. This is a neat way of providing modular programming; instead of writing subroutines you write a separate program which you can call by its name. Since ordinary subroutines are available as well, you have the choice of being a slob if you want to (unlike the 80 series labels are not allowed for GOTO or GOSUB destinations). Recursive calls, direct or indirect, are allowed.

The ONTIMER# GOTO statement can use any one of 1001 timers as mentioned above. These timer interrupts are local to program files so if a program calls another any timer in use will continue its count while the called program is in control but will not interrupt until control returns to the caller. Timer numbers are global however; There is only one timer # 9. Any called program can therefore declare timer # 9 and modify the timer set by the calling program.

As is expected with an HP product, there is no PEEK or POKE and no obvious way of interfacing to machine code programs. That doesn't mean it isn't possible, merely that they're not telling us (yet). It will probably emerge eventually via the users groups as usual. HP's paternalistic attitude to those who would probe into the innards of their products is too well established by now to be irritating.

File access is handled by ASSIGN# 'number' TO 'filename' and then READ# or PRINT#. If a line number is included in the READ# statement you have random access. Unusually, one or two dimensional arrays can be written to a file with a single PRINT# statement.

The HP-IL loop which is used to communicate with all peripherals is handled by the ASSIGN IO statement. After physically connecting the devices together on the loop and switching them on ASSIGN IO is executed in EDIT mode. The machine then announces '3 devices on the loop' or however many there are, and then produces a template Device # 1 = ': ' for you to give a name to each device: eg, TV, PR or CASS.

From then on I/O to these devices is performed by including their name in the file name in a file manipulation command such as COPY TO 'myfile:cass'. In the case of display and printer I/O it is necessary to declare the device in use through DISPLAY IS TV or PRINTER IS PLOT. LIST IO shows a

Benchmark timings

BM1	3.0
BM2	5.0
BM3	22.1
BM4	21.8
BM5	24.3
BM6	40.0
BM7	57.3
BM8	13.9

All timings in seconds. For an explanation and listing of the Benchmark programs, see elsewhere in this issue.

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catalogue of the device assignments in use.

There are no graphics commands built into the 75C Basic but a ROM module will be available to drive a plotter. Extensions to the Basic are added by LEX (language extension) files which can be on card, tape or in ROM and can be MERGED, COPYd and PURGED like any other type. Another special file type is the LIF1 (logical interchange format) file which is used to transfer files to other 75s or other HP computers via HP-IL in ASCII form. The TRANSFORM command can be used to turn a Basic or text file into LIF1 format for transmission and vice versa.

The only software which comes with the machine is a set of 8 cards called the Owners Pac which contains three programs, an address book program, a financial calculation program and a game called PAYATTN. Ten blank cards and a head cleaning card are included too.

Expansion and potential use

The 75C comes with 16k of RAM which can be extended to 24k by adding a module to one of the ROM slots. Applications programs for maths, statistics, engineering and business use will be provided on card or in ROM and on tape from the users library. Visicalc will be available as a ROM.

The key to all the peripheral expansions of the 75C is the HP-IL loop interface. When this new interface was introduced early this year for the HP41C calculator (see Calculator Corner Jan) there was a certain amount of puzzlement that HP, inventors of the HP-IB/IEEE, should go to so much trouble for a mere calculator. The answer is now clear; it wasn't just for a calculator but in preparation for a whole new series of battery powered computers of which the 75C is only the first. HP is committed to supporting HP-IL as well as HP-IB on many of its range of peripherals and obviously hopes to establish another world standard for a low power interface; it remains to be seen whether any of the other manufacturers in the field (mainly Japanese) will support it.

At the moment HP-IL devices available include the HP82162A Thermal Printer and HP 82161A Digital Cassette Drive, both of which are battery/mains operated portables. The digital cassettes hold 128k each. A Video Interface (HP 82163) can drive a standard black and white monitor or domestic TV. HP-IL versions of the 7470 two-pen plotter and an 80 column dot-matrix printer have just been announced along with a digital voltmeter, which is the first of a range of HP-IL instruments, and 9 in and 12 in monitors. Disk drives are not at present available for HP-IL.

Conversion from HP-IL to IEEE, RS232 and BCD is possible through adaptors; the RS232 link allows the use of a modem, permission for which is currently being sought from British Telecom.

Who will use the HP75C? Given its

high price, it is mainly going to appeal to the jet-setting executive for whom the appointments feature was clearly designed. He or she will also be able to use it for limited amounts of text processing, at the level of memos rather than great tomes and also for general calculating and computing chores. As long as there are people who can afford to buy Rolex watches then the 75C has a market.

The whole kit of computer, printer, cassette drive and modem can be put into a fitted briefcase and I suspect that some blue chip firms will equip their sales staff with such outfits.

The 75C is in no sense a toy computer as its speed and the power of its Basic exceeds that of many desk-top machines; only in RAM capacity does it give anything away to its larger brethren. This being so, many applications in science and engineering which involve working in the field will be open to it, and the price is unlikely to be a deterrent in such professional areas. The appointments mode provides a particularly powerful way of doing real time data-logging and processing with a minimum of programming.

One thing is certain; for the next few years the 75C will be the ultimate status symbol among the technologically inclined.

Documentation

The manual for the 75C surpasses even HP's own high standards. It is actually thicker, at 360 pages, than the manuals for the 80 series desk-top models — which is not surprising as the 75 is a very complex beast with lots of facilities. The manual starts with an easy summary called 'Getting Started' to allow the user to manage the basic operations quickly. It then goes on to individual chapters on all the various aspects, including card operations, HP-IL operations and seven chapters on the Basic. In addition to a ten page alphabetical index it has numerous appendices covering the character set, error messages, escape codes, key functions and listings of the Owners Pac programs which are supplied with the machine. The instruction set is listed on the inside back cover and the back cover has a contents index which is used in conjunction with coloured page edges to find a chapter quickly. A small quick reference manual is also supplied. Once again it is a model for other manufacturers to follow.

Prices

HP-75C 16k RAM
(includes power supply, battery pack, field case manuals, 16 cards, HP-IL leads) £728.00

Technical data

RAM	16K expandable to 24k
System ROM	48k
Keyboard	64 keys, including four Cursor controls.
Display	32 characters, 5x7 dot matrix.
Storage	Magnetic cards 1.3k per card.
Ports	HP-IL in and out
Languages	Basic

8k Expansion RAM	£142.75
HP 82163 Video Interface	£221.52
HP 8216A Digital Cassette Drive	£413
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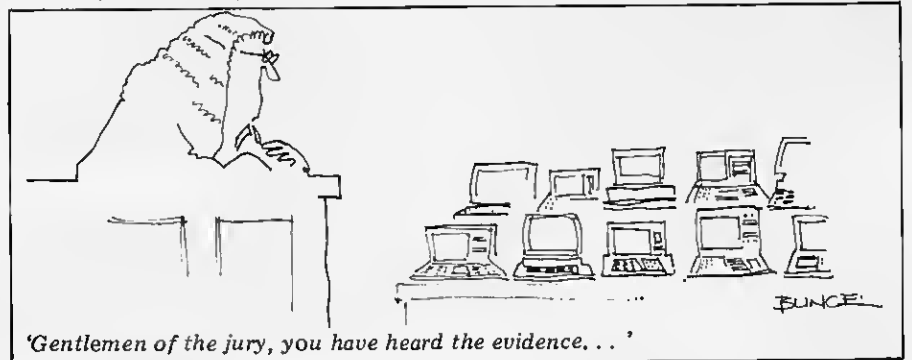
Conclusion

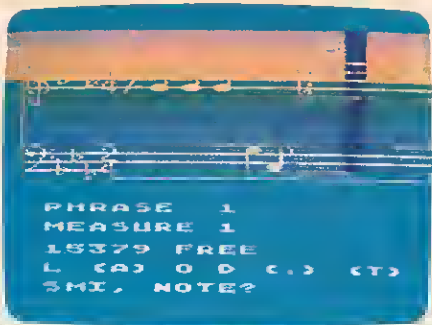
The HP75C is a prodigiously powerful and complex computer for its size and is obviously the product of a long and careful design project. It has so many unusual capabilities that it makes the average CP/M based business machine look like child's play. Because of this, jests are already being made in the trade that it's so complex that no one can use it. Nothing could be further from the truth. The attention which has been paid to the operating system and user interface mean that someone with no computer experience will be able to use its major features such as the appointments and text processing modes within a few hours. So long as one doesn't feel obliged to learn everything about it at once it is a very 'friendly' machine indeed. Some of its more powerful facilities such as real-time programming may never concern the sort of executive user at which it is partially aimed. But for the sophisticated scientific user or the third party software writer these powerful features are well enough documented to be put to immediate use.

Its price at present puts it beyond the mass market; as it is the first of a new 70 series perhaps we will see a cheaper model before long. It would be nice to see in the future models incorporating full size typewriter keyboard, more memory and making use of the large scale LCD displays which will soon be on the market.

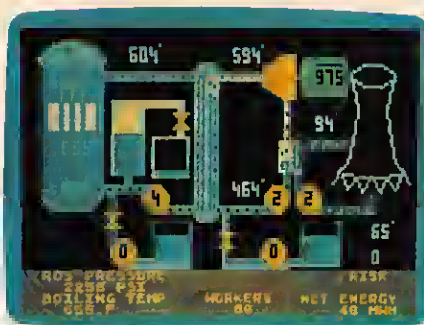
I have been a convert to the idea of portable computing for some time; the ultimate goal of microcomputer development is surely the pocket sized personal database cum calculator cum word processor cum communications station. This machine represents another large step towards that goal.

END

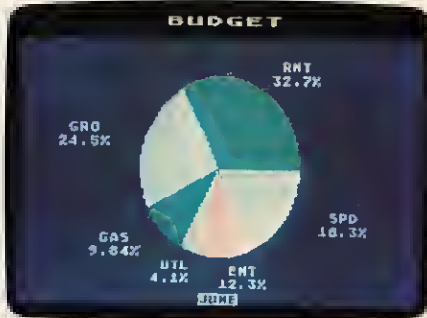




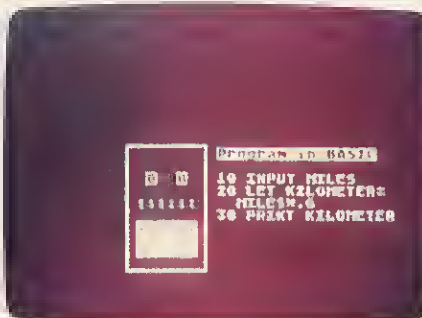
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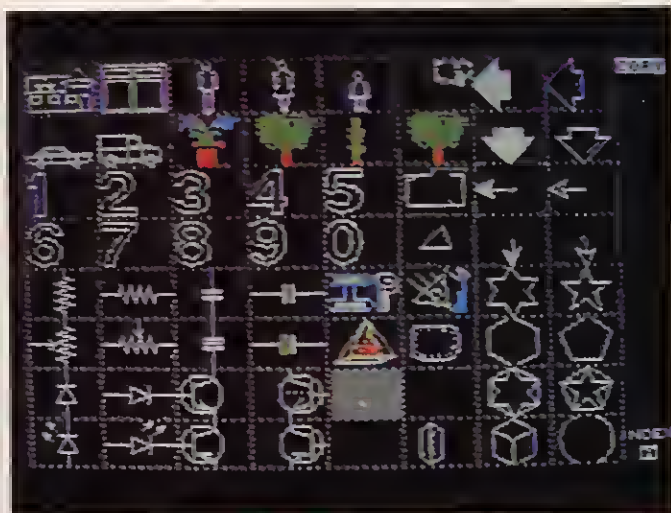
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APPLE ON A STIK

Joe Whelan takes a look at a spectacular colour graphics system for Apple II.



A demonstration of some of the system's powerful graphics including (top right) part of the library of graphics building blocks.

The era of cheap, high resolution colour graphics has at last arrived and no micro-computer manufacturer would even consider making a new micro without some form of high resolution graphics (colour is now a must). Indeed, the manufacturers are constantly trying to outdo each other in the power and complexity of their machines' graphics capabilities. One of the worst side effects of this trend is the amount of calculation required for drawing even the simplest of screen pictures; especially with commands like POKE, PEEK, MODE, MOVE, DRAW, PLOT, etc. So it was a certainty that someone would eventually make a package which would eliminate all these calculations and hence make the composing of intricate and complex diagrams very simple. Robocom Ltd. have produced the 'Robo Bit Stik' which could possibly be hailed as the first graphics package for micros that is simple, cheap and yet complete. For the moment the package is only available for the Apple II, but

new variations are under development for other micros. The system I was loaned for review consisted of a 64k Apple II (colour card and colour monitor kindly lent by Cream Ltd), the Bit Stik system and a Calcomp 81 colour plotter. The Bit Stik system can effectively be considered in two parts, the control stick and the software.

Hardware

The control stick is the only piece of hardware needed for the basic system (the plotter is an expensive add-on for hard copies and can be replaced by a dot matrix colour printer). The Bit Stik is approximately 14cm wide, 18cm long and 11cm high, making it a very substantial joystick. It is a well designed and extremely strong unit which will take a lot of punishment — unlike many other control sticks of this type. The stick can perform the normal X and Y movements, but also contains a rotatable knob for Z control (see Figure

1). The first thing that strikes any user is the almost perfectly frictionless movement in the X — Y plane, without any bias in the positioning of the stick. This means it stays wherever it's put. The feel of the stick's movement gives the impression of it not being connected, by any form of wire, to the resistance pots. On removing the top of the case the reason is found to be a very neat arrangement of counter weights for the resistance pots, set in a double-axis gimbal (see Figure 2). For those who would like to feel some friction when moving the joy stick the top of the case can be moved down so as to bring pressure pads in contact with the moving hemisphere. On top of the case there are three buttons and an ON/OFF light. The three buttons are the main means of command input to the Apple and make the keyboard almost redundant. In fact once the use of the three buttons is mastered, any time that keyboard entries are required it seems a positive bind. (What about combining a Micro-

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APPLE ON A STIK

writer and a Robo Stik? That would make the keyboard a thing of the past.)

The whole of the communications between the Bit Stik and the Apple go through the games socket, which must be the reason for the limited number of control buttons on the Bit Stik. The Bit Stik uses a 12 volt supply which is obtained from the Apple's auxiliary video plug. All the connections go through a single multi-strand cable, making the package quite neat and tidy.

Software

It is the software side of the Robo Bit Stik package which makes the system a delight. It is generally very easy to use and well documented. The system under review came with a Bit Stik master disk which was used to boot up the Apple, a library disk which contains saved screens (pages), and a work disk. When the first section of the master disk has loaded a very colourful design appears and prompts for a reply to go to either a system routine or straight into the drawing mode. The system routine allows such things as trimming the Bit Stik, formatting new disk or garbage collection on the work disk. It also has an option for what is called the 'replay module'. This allows the user to display saved screens of work and replay them. The replay can be either a single replay or looped continuously. Either of these options can be frozen, unfrozen or started again at any point in the display. This option would be very useful for such things as teaching or shop window displays.

If, in reply to the initial prompt, the drawing mode is chosen the remainder of the main core of the program is loaded. Then the system asks for the insertion of both a library and a work disk. When these two have been read the screen displays two sets of menus, one along the bottom of the screen and the other down the right hand side. Any of the options within the menus can be chosen using the Bit Stik (this is by far the best means of choosing an option from a menu driven program I have yet used and would be an excellent add-on for such things as Supercalc, etc).

The menu down the right hand side is called the 'main menu' and consists of all the main functions (see Figure 3). The default function is 'draw' and this caused the bottom menu to become the draw palette. In the draw mode there are two cursors which are used to draw or erase all the lines. The first is a static cursor, from which lines are drawn. The two cursors are easily moved around the screen and by use of a scale window, which is a piece of software that scales down the movement of the Bit Stik, very accurate control can be achieved.

The draw palette allows for the selection of drawing straight lines, circles or arcs in one of six colours and in one of four line types: one solid and three variations of dotted line. Using the cursor to pick up the line type or colour takes a fair amount of practice at first as you often tend to acquire a different colour at the same time. However, after a lot of practice, the speed with which functions can be picked up is almost blinding.

The use of straight lines and circles is

ON/OFF LIGHT

CONTROL BUTTONS

ROBO bit stick 1

TOP ELEVATION

Fig 1 Top view of the Bit Stik controller.

ROBO BIT STICK internal gimble assembly

Resistance pots

Y

X

Counter balance weights

Fig 2 A peek at the innards.

ROBO BIT STICK

Control stick rotates for plane control.

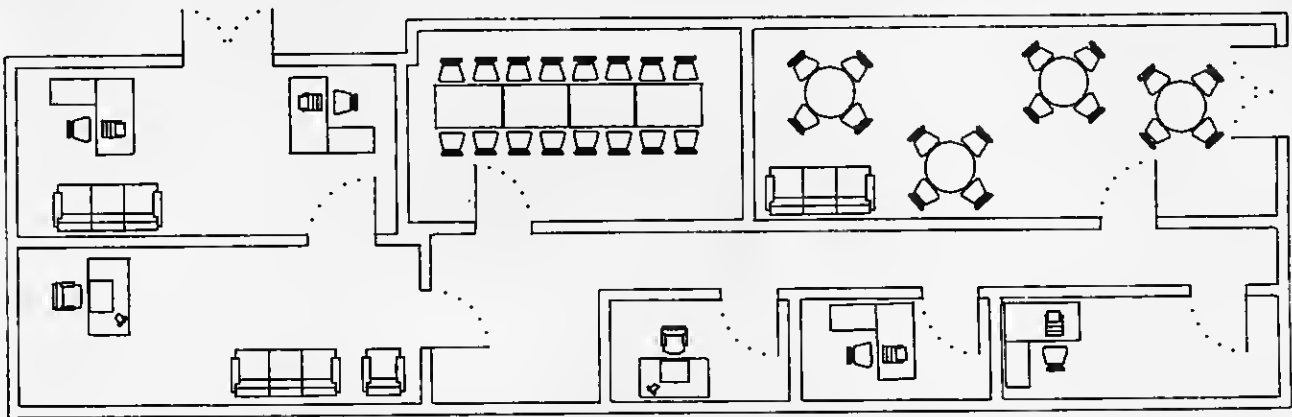
Screw to adjust friction on the X-Y controls.

Grip pad

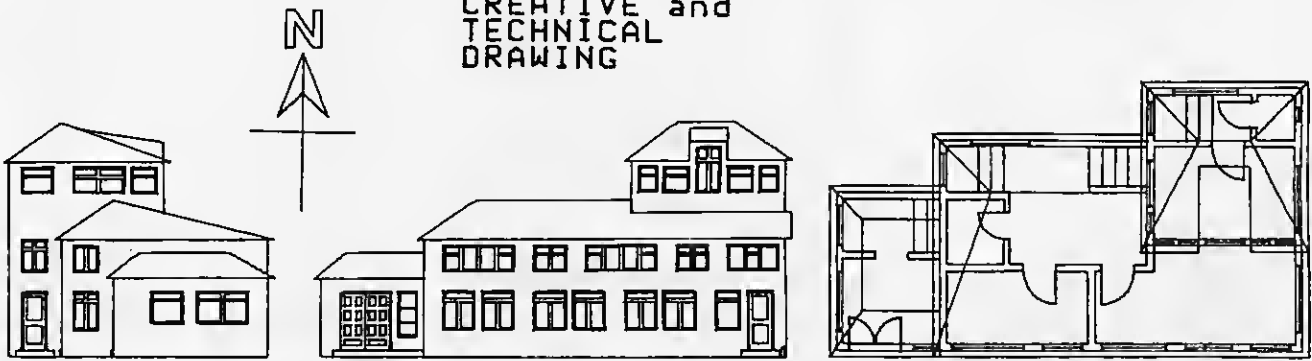
SIDE ELEVATION

Fig 3 The Bit Stik in profile.

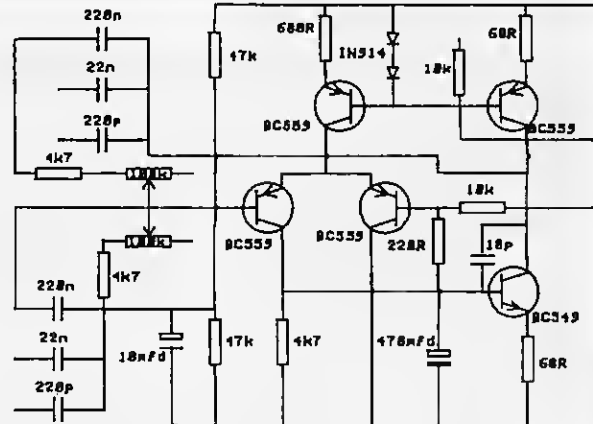
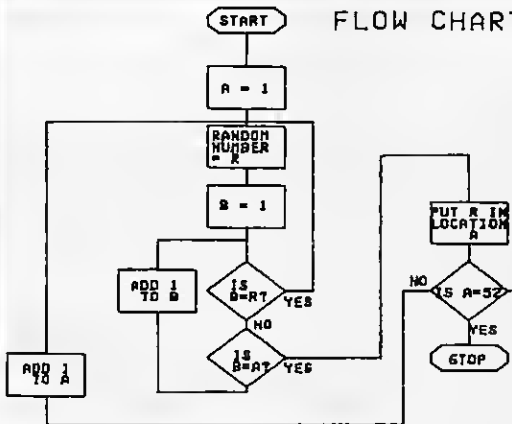
LAYOUT AND DESIGN



CREATIVE and TECHNICAL DRAWING



FLOW CHARTS



SCHEMATIC DIAGRAMS

quite easy, but the use of arcs is exactly the opposite. It is too complex to fully describe this option here, but the main problem with it is the necessity to mentally calculate a vector for the arc to follow which you then have to show to the cursor.

The other main function which is available from the draw palette is the nib function. This allows the user to set the width of any line to be drawn, in any colour or line type. This is the only way of directly filling in areas with colour on the plotter, unless you go to a lot of trouble to cross-hatch a particular shape. The nib can also be rotated while being moved around the screen, which produces a spiral effect when drawn. There is another, called stream, which allows free hand drawing. I found this very awkward as two of the buttons

need to be kept pressed down at the same time as you are trying to manipulate the cursor around the screen. It was very difficult to obtain good effects with stream as it requires very good co-ordination and a lot of practice. There is an option to attach a graphics tablet for use with the screen mode, which should make free hand drawing very much easier.

The main menu contains a function called paint, which if chosen changes the bottom menu to a colour palette. This contains all 16 of the Apple colours, which can be used to fill in any bounded area with colour. Due to the unfortunate colour handling capabilities of the Apple, any two areas of joining colour can merge together to produce quite nasty effects. The paint command was also responsible for the destruction

of quite a lot of my pictures. This is due to the colour being placed within bounded areas, and if there is a small gap the colour leaks through and fills the rest of the picture.

There are a number of ways of saving pictures which are readily obtained from the main menu. The first is to the library disk which allows for the storage of up to 96 picture units on any of three indexes. This is very good for mixing pictures units on the screen to create a new image but a major drawback is that the newly created image cannot be saved back to the library — only any newly added data from the Bit Stik is saved to the library. The only way of saving the new picture is to the work disk as a page. This is achieved using the I/O function in the main menu.

The picture can be saved either as its

APPLE ON A STIK



The map of Britain — see the bottom of column 1.

screen image or as a page. If the picture is saved as a screen image then it is stored pixel by pixel, which will eat up disk memory. The alternative is to save the picture as a page, in which case only the instructions necessary to recreate the picture are stored on disk. The exact method used to store information about any line is, of course, a company secret — however we can make a few guesses. Any straight line regardless of length occupies six bytes; these must contain the starting and finishing positions and the colour and line type. A circle occupies one less byte because only the coordinates of the centre point need be stored together with one byte for the radius. One problem I found with saving pictures to the library was that if paint was used there was a tendency for the colour to leak on saving the picture, thus destroying it. Even worse was that if leaking did not occur on saving to the library it did so when the picture was recalled. This was not a problem that occurred continuously but did so at rather annoying intervals. When a picture unit is being copied back from the library it can be expanded or contracted, rotated or have its aspect ratio altered (compressed). This picture unit can be deposited any number of times over the screen at any position, and then, if required, have its position altered at a later point using the move function.

The most exciting function available from the main menu I have left until last. This is the ZOOM function. This really has to be seen to be believed. It allows the user to expand any part of the picture to whatever depth required. Once a particular section has been expanded more detail can be added and this can be saved as a page (it cannot be saved to the library). This screen can again be expanded and even more detail added and then again zoomed and so on. The whole picture can then be stored to disk and viewed later with all

this detail still within it. As an example, one picture I drew showed a small dot, which when expanded turned into the earth. Then I expanded the area around Britain, then around London and so on. I eventually ended at a fly sitting on the windscreen of a car, and I did not have to stop there. There are problems when zooming up on a painted area due to leaking; this is because lines which appeared to join at low resolution didn't join when expanded. A problem with zoom is that it is quite complicated when doing exact design work, to find out the exact scale of the drawing shown on the screen relative to the original page or the real world.

Documentation

This consists of two booklets and a plastic card. The main manual is a 76 page booklet which gives a good description of how to set up the system and lists all the functions available on the Bit Stik system and how to use them. It gives helpful hints and warnings about things that are to be avoided. The second booklet is a rapid reference manual called 'Quickdraw'. This is a beginner's guide which contains a simple description of those commands that are most commonly used, together with a set of simple practice exercises. These two booklets are well written and easy to understand; as is the software. The plastic card is meant as a quick reference sheet which I found useless. Not because it was badly written but because the software is written so well. The control buttons perform similar functions in all modes, and so once the sequence of pressing buttons is learnt the manual becomes virtually redundant, with the plastic slip almost unused.

Conclusion

The Bit Stik system is without doubt a very well produced package which should appeal to both the hobbyist (the pictures generated by the system can be included within a Basic program, using software from the company with which I was not supplied) and the professional designer. The only reservation for the professional will be the inexact scaling during the zoom function, which may lead to errors in relative sizes; however there is a new version due out soon which will deal with this problem. For the hobbyist the nasty side effects with the paint function are the worst thing they are likely to encounter. The lack of the ability to save an altered picture back to the library is definitely a fault that detracts from the present system.

Future developments

This is where things look really exciting for the Bit Stik. The system I was supplied with was certainly let down by the strange handling of the colour on Apple II. However, as the system is now being incorporated into more modern micros as well as the Pluto board, we need not suffer for long. The first version for the Pluto board system is due out in three months with a resolution of 760 x 586 and an option of 16 colours from a palette of 255. However when the system is expanded it will eventually allow the choice of 255 colours from 16,000,000 and should be connectable to most computers. Robo-

com also plans to incorporate an arithmetic processor on the board to handle arc and circle calculations together with a sync lock to give PAL quality pictures. This means that using the Pluto board plus a winchester, together with the animation package to be released soon, it should be possible to obtain very rapid, television quality pictures displayed at the rate of five per second. They are due to release (in about five weeks) a new version of the software which will have a proper dimensionable scale. This will go from kilometres down to millimetres giving the proper relative scale measurement of rotation, instead of a number from 1 to 225, locking sizes for the nib function, the ability to save a zoom frame to the library, and 'rubber banding'. 'Rubber banding' is a facility that allows a line to be drawn on the screen to show what it will look like, but not to be committed to memory. This should be an immense help with the drawing of arcs, as the exact shape of the arc can be seen before drawing.

The company is also working on a version of the software for the Apple III and the BBC model B with disk drives. The version for Apple III is due out fairly soon and the one for the BBC machine is expected to be released sometime next year.

The future for the Robo Bit Stik can only be bright, especially with the above developments in hand. It should be able to expand its present market (which is mainly the oil, gas and electronic industries and education), especially with the new software and hardware, to such things as television, architecture and designers etc.

Prices

Robo Bit Stik + software (present version) £250
 Robo Bit Stik + software (new version) £290
 (The company will replace the software of present customers for £50).
 System reviewed (including colour monitor and plotter) £5,200
 (Other systems are available, the prices of which depend on the plotter required)

Commands available from the main menu

DRAW	PAINT	TRACE
ERASE	FIND	MOVE
C & LT	FILE	COPY
ZOOM	PAGE	CLEAR
DIGIT	I/O	MISC
WIPE		

Note: Digit is a command that allows the screen to be filled with a grid of dots to which the cursor can be locked; Trace allows you to move the dynamic cursor back through the points you have drawn so as to obtain perfect joins; Wipe clears the screen; Misc is a multi-function call, and can be used to write text; Page will return you to the base screen after a zoom; I/O is another multi-function call that handles operations with the work disk, such as saving an image or a page; C & LT redefines the colour and line type of a picture before it is copied from the library.

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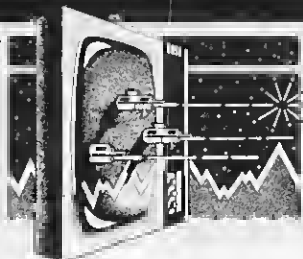
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SCREENPLAY

Dick Olney continues his series of games

reviews with a selection for the Acorn Atom

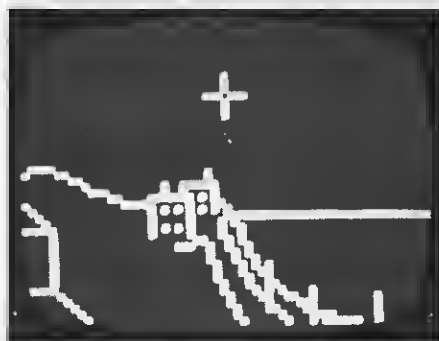


After a break last month, here is the promised Acorn Atom review. This machine has been around for several years now, but was still very much in evidence on the Acorn stand at the recent PCW Show, even if it was somewhat eclipsed by the superior but slightly more expensive BBC micro. I used a fully expanded Atom with 12k RAM and 12k ROM (including 4k floating point) which at today's prices would cost £255 including VAT, fully assembled, or £174.50 in kit form. This assured that all games would run (assuming they loaded) although not all of them used the full RAM.

Although Acorn advertises a colour

encoder for £45, this is apparently not a popular buy and consequently most of the games are in black, white and grey. I have to admit that the Atom I used was over a year old and had been in the hands of a hardware freak for most of its life, with predictable results! The machine itself was very temperamental but I'm sure that many of the problems I had in loading tapes were due at least in part to their recording quality. Those games which I could get loaded were not, I'm afraid, the most inspired selection I've seen, being mostly standard interpretations of old favourites.

When it first appeared the Atom offered powerful facilities and a degree of expandability at an economic price, but the present intense competition in the home market has rendered it outmoded and clumsy. I'm sure there are many proud Atom owners around whose machine has served them well, and there's certainly plenty of software available, but I can't help feeling it now has little future as far as games are concerned. After all, for the price of an Atom you can get a 16k machine with full colour and a cassette deck to go with it. Still, there are plenty of games available for it, and what follows is, I think a fairly representative selection.



Game: Air Attack
Supplier: Program Power
Price: £7.95

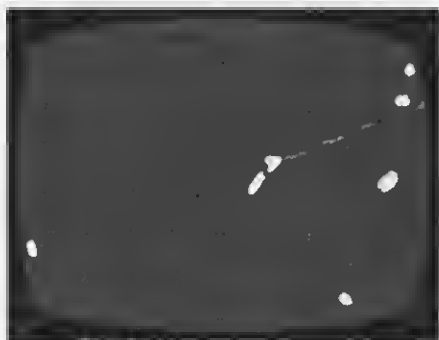
A one-player game, this has the participant take the role of a World War II

machine gunner defending the coast of England from attack by German bombers and doodlebugs. You are given a view of a rocky landscape surrounded by sea with a few buildings huddled to one side. In the centre of the screen there are the familiar crosswires which can be moved up and down using the cursor keys, and sideways with the square brackets. Every so often a direction (N,S,E or W) is flashed at you which indicates the direction of attack of an approaching 'Jerry'. There is no solid indication of the direction you are facing at any one time, though North appeared to be seaward, which was strange considering the scenario!

Moving the sights proved rather ponderous, as is often the case when using a keyboard for two dimensional movement. The Atom makes a sliding screech

as the bombers approach and these are fairly easy to hit if you can turn to face them fast enough. Doodlebugs move relentlessly towards your position, and are much more dangerous. Note that only one enemy craft is on the screen at any one time. Though the swooping bombers are quite well represented, the graphics in this game are really rather clumsy which gives the whole thing an amateurish feel. Moving crosswires around the screen at a fairly subdued pace is hardly novel and I must say I found this game pretty boring.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



Game: Acornsoft Games Pack 1
(Asteroids, Sub Hunt, Breakout)
Supplier: Acornsoft
Price: £10

The first of Acornsoft's triple packs, this one contains two old favourites and one piece of dull trivia. The Asteroids is a standard no-frills version in which there are four asteroids in every wave, each of which breaks into two when hit. You get one point for large asteroids

and two for small ones, making 20 per screen. The ship, which looks like an A, is turned using CTRL and SHIFT, while REPT gives rapid repeat firing and RETURN moves the vessel forward. The movement is steady with no acceleration or deceleration, making it easier to handle than on more sophisticated versions of the game. There are no speed options or special features, except for a top 10 of high scores, and no flying saucers as seen in arcade asteroids. The graphics and response speed are acceptable but dull and the sound almost imperceptible.

Sub Hunt is entirely textual and involves your feeding in speed (0-30 knots) and course (0=N, 180=S - clockwise) to head off an enemy submarine. After each move (treated as 12 game minutes) you are told the distance of the sub along the two relevant points of the compass (eg, 25 miles North, 18 miles East) and also its bearing. When your ship is within a mile of its prey the game ends. As you can see, this game is extremely easy to play, and

gets boring very quickly. I doubt if anyone would want to play more than 10 times in succession and would then probably never bother to load it again.

The breakout is again completely standard with no playing options. The bat is moved using the SHIFT and REPT, giving a reasonable response speed which nevertheless becomes inadequate when the ball begins to speed up. The current score and high score are displayed throughout, and each game consists of a standard three balls. The graphics and sound are disappointing, and all in all this is a boring version of a prehistoric game.

If you've got an Atom and are a big Asteroids and Breakout fan then this package could turn out to be a good buy, despite the paucity of these versions. On the whole, however, this is not a cassette to be recommended.


Presentation:
Use of graphics:
Addictive quality:
Value for money:

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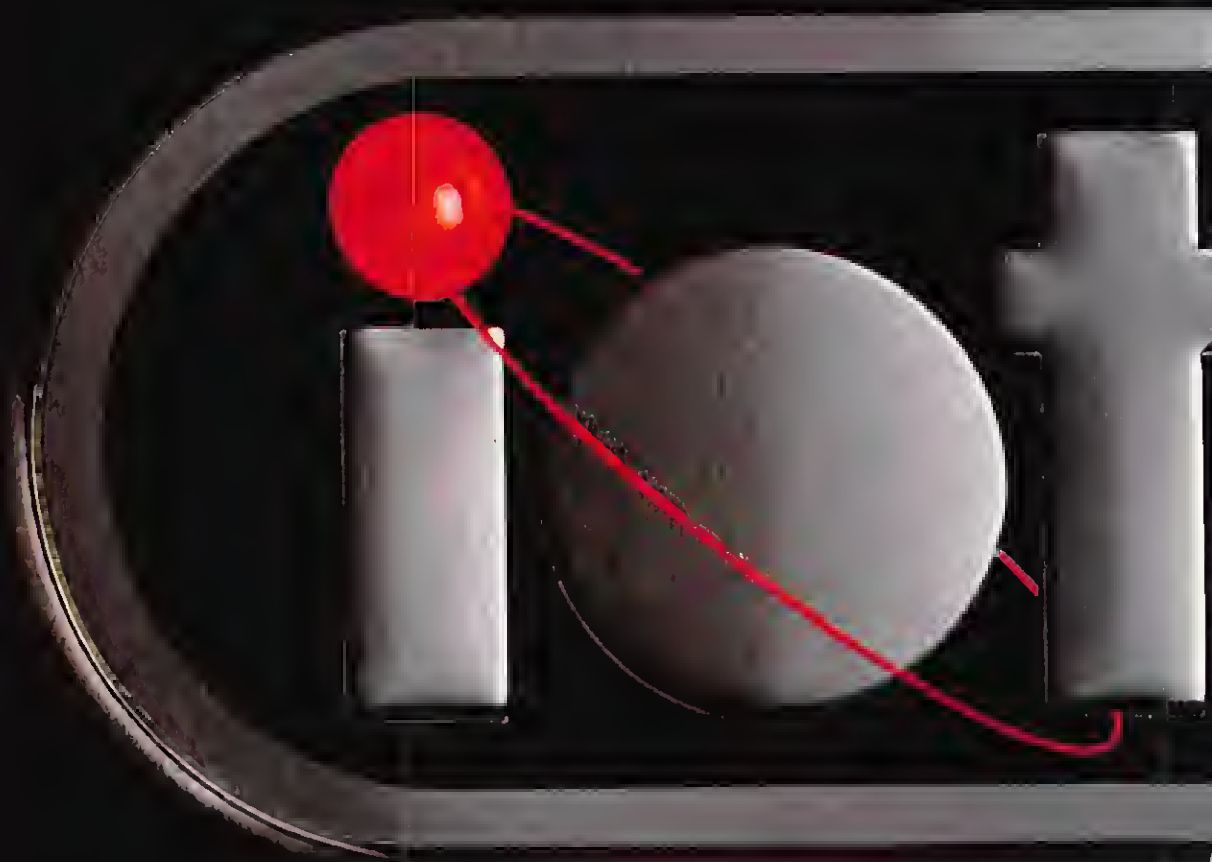
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SCREENPLAY



Game: Acornsoft Games Pack II
(Missile Base, Snooker, Dominoes)
Supplier: Acornsoft
Price: £10

The first of this trio — Missile Base — is a standard version of the popular arcade game Missile Command. Just in case there are any readers who've never seen it, the game involves defending six cities against nuclear attack using three missile bases. Attacking warheads stream down in waves, with your armoury being replenished after each wave, and one extra city awarded every 10,000 points.

On the Atom the vertical cursor, CTRL and SHIFT keys are used to fire, and the entire block of the keyboard is

used for moving the target cross. Unlike some other versions I've played, multiple firing is allowed so that you can use the traditional 'sweep' tactic (this involves letting off a sequence of missiles in a horizontal line so as to catch a whole wave of warheads). This, of course, assumes that you manage to master the keyboard movement, which would be possible with a bit of practice.

The keys are mapped onto an area covering half the screen with markers showing the vertical position of each row. The section of the screen you are firing into can be changed by pressing the space bar.

Missile Base is faithful to the original with smart missiles (which can avoid your fire) but no aeroplanes or satellites. The graphics and sound are good, but the game does suffer from the lack of colour. It's quite difficult to play to start with because of the key functions but nevertheless makes for an interesting and challenging game.

The snooker overcomes the lack of colour by numbering the balls (the reds have dots). You are presented with an aerial view of the table, the game is for two players, and normal snooker rules apply. The Z, X, C, and I keys are used to rotate the cue around the cueball,

and when it's in the desired position CTRL fires the shot. The cue is constantly pulsating and its length determines the strength of the shot. The balls move in a sort of slow jerky fashion, which is slightly disconcerting, but the final positions are fairly realistic. This game is reasonably well presented, though personally I'd prefer a real game of snooker any day.

To complete the trio there is a version of dominoes in which one player takes on the computer. This plays competently and points are accumulated at the end of each game from the tiles that the loser is left with. The only criticism I have is that there is no way of telling how many tiles the computer has left at any time during the game, a serious omission if only because it would be easy to correct.

This package offers a good selection of games which are well presented and competently designed. They would appeal more to the new user rather than the committed games freak since all three are unoriginal standards.

Presentation:
Use of Graphics:
Addictive quality:
Value for money:



Game: Galaxian
Supplier: Bug Byte
Price: £8.00

Galaxian is a direct descendant of Space Invaders which earned immense

popularity in pubs and arcades. In this version the aliens sit at the top of the screen, in two rows of eight and one of three, and take turn to swoop down at you, usually two at a time. You use the vertical cursor and CTRL keys to move your base left and right while firing with REPT.

If you're even considering buying this game I must assume that you've spent less time in pubs and amusement arcades than I, and have thus not yet tired of these old originals; or alternatively that you are an incurable Galaxian freak. If that is the case then this version is as good as any. The response speed is reasonable and the graphics crisp if not particularly inspired.

Bug Byte is not renowned for the

originality of its games (the best I've seen in this respect is probably Mazogs on the ZX81), preferring instead to produce competent versions of old favourites, of which this is no exception. It's ironic, therefore, that it should be the first company in this country to be forced to withdraw its version of Pacman. It may be that as the attraction of the old standards fade, and the copyright battles hot up, it will be forced to change its policy.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



Game: Acornsoft Adventures (Dungeon House, Intergalactic)
Supplier: Acornsoft
Price: £10

This pack actually contains four programs, with each scenario linking itself to a master called 'Advent'. The essence of this technique is to get as much of the background structure and interpretative sections into a single core program while allowing the foreground programs to impose their own unique inter-

face with the player. In this case it is facilitated by a playing vocabulary limited to seven commands which is common to all three adventures. These commands cover just the bare essentials necessary for a good adventure and the effect of this, coupled with the lack of variation in response formats, makes these games rather dry.

Dungeon is based on the classic adventure scenario which was delighting software engineers well before the advent of home computers, and as a result has probably been responsible for almost as many delays in vital research projects as Star Trek (the game). You start off in a forest and have to find your way down into a configuration of caverns inhabited by various strange characters (even the traditional endless maze of tunnels is included). The idea is to collect a prescribed amount of treasure and take it to the 'Throne Room', if you can find it. All fairly standard stuff which could certainly provide plenty of entertainment for anyone new to adventures but will

present no challenge to an experienced player.

The second game, House, is very much like Dungeon except that it is set in another favourite adventure location — a haunted house. If anything this is slightly easier than Dungeon and perhaps a little too similar. 'Intergalactic' is undoubtedly the best of this trio, if only because of the strange locations and characters you come across but the basic principles are again much the same. This package provides an excellent introduction to adventures, covering the three most common types of scenario and as such it to be recommended to any Atom owners who have yet to experience adventure games. Anybody looking for an interesting and original new adventure would, however, be extremely disappointed with all of these.

Presentation:
Complexity:
Value for money:



Game: Cowboy Shootout
Supplier: Program Power
Price: £6.95

This game was revamped three or four times during its long (comparatively) and successful arcade career. It has

always been a big favourite with the kids, and is fun to play despite its simplicity. Program Power's version holds no surprises but is very well presented with good use made of the Atom's sound facilities.

Cowboy Shootout is a two-player game, where each moves a cowboy up and down one side of the screen and attempts to shoot his opponent. The left hand player uses the cursor control keys for movement and the lock for firing, while the right uses RETURN, REPT and 1, an arrangement that works remarkably well. Each cowboy has a single cactus for cover and can also seek protection behind one of the wagons which occasionally amble across the centre of the screen. Three hits wins the game and a running total is displayed for each player in the corners of the screen.

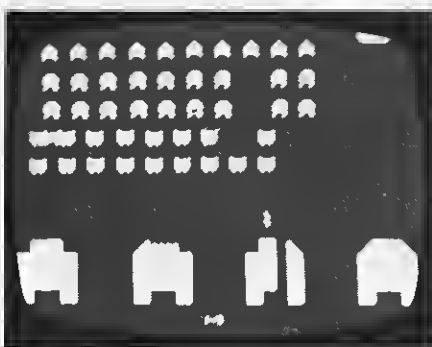
The fire button is single bullet auto-repeat, and I found the best tactic was just to keep your finger on it all the time; though this has the drawback of rapidly decimating your cactus, thus 'blowing your cover'. The start of each game is heralded by an impeccable rendering of the Bonanza theme tune and ends with the cowboy turning into a tombstone accompanied by a funeral march. At best this game is an amusing abstraction that could have strong family appeal, at worst it is trivial and uninspired.

Presentation:

Use of graphics:

Addictive quality:

Value for money:



Game: Acornsoft Games Pack 5
(Invaders, Wumpus, Reversi)
Supplier: Acornsoft
Price: £40

Yet another set of old favourites from Acornsoft. I'm sure that most readers will be familiar with all three of these games. The Invaders is completely standard with flying saucers and shelters and acceptable sound effects (the Atom is never likely to disturb your neighbours!). The response speed is very good and the game builds up to a good pace. CTRL and SHIFT are used for

movement and REPT for firing. One rather annoying feature is that the score is not displayed during the game, only at the end, and ditto with the high score, so you never know how well you're doing.

Wumpus is the game where you wander around a maze of caverns avoiding slime pits and attempting to locate the aforementioned beast. You are given warnings when you are within two moves of the wumpus or one from a pit. There are also bats, about which you are similarly warned and which will transport you randomly across the maze if disturbed. This version is entirely textual and features a maze of 30 caverns configured according to a figure entered at the beginning of the game (the same game number always gives exactly the same configuration). This game becomes trivial once you have mastered the basic principles (which shouldn't take long) and is definitely best suited to younger players.

Reversi, also called Othello, is the classic board game in which a player 'captures' his opponent's pieces by enclosing rows, columns or diagonals of

them between their own pieces. This version shows a simple graphic representation of the board and gives the option for the computer to play itself (?), one player to take on the program or two players to use the board. If you choose to play against the Atom you are given first go, which gives a slight advantage. As a prompt each legal move is labelled with a letter, which you use to enter your choice. The labelling is not used to preface the computer's move, however, and there were times when I'm sure it was cheating. Playing against the computer is really the only worthwhile option on this and it provides a challenging, though far from unbeatable, opponent.

As with most of Acornsoft games packs this one contains nothing new nor particularly inspired. Nevertheless it offers a well balanced selection that should keep young children occupied on a rainy afternoon.

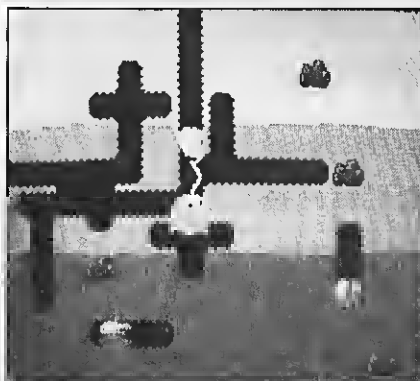
Presentation:

Use of graphics:

Addictive quality:

Value for money:

ARCADE ACE



Atari struck gold with Pac-Man and is doing its best to make sure that nobody else gets a slice of the cake. The many imitators of that game could learn much from Atari's latest arcade success, Dig-Dug, which shows how popular principles can be developed into entirely new games with their own unique appeal. Using a chunky four-way joystick you control

a cute little character who spends his time excavating tunnels underneath the ground. The aim is to kill the other inhabitants of this world, of which there are two species; Pooka and Fygar.

The Pooka are like little red balloons with white bibs, while Fygar are fire-breathing green dragons and, consequently, more dangerous. These creatures begin the game in their own short tunnels, and are unable to burrow. Eventually, however, they turn into ghouls and migrate through the earth into whatever section of the tunnel you are in at the time. If any of them catch you, or if Fygar breathe in your direction, you lose a man, of which you are allowed the standard three.

Your defence against these fearsome creatures is twofold. Dig-Dug is supplied with a pump (an air pump I assume) with which to fill them with air, whereupon they fill out and eventually explode. It takes some time

to actually kill the creatures and only one can be kept at bay at any time, so if you're being chased by two or more its best to give quick bursts of the pump. This merely stuns your foe leaving you plenty of time to escape.

The other way to kill Pooka and Fygar (which yields high points) is to dislodge one of the rocks embedded in the ground in such a way that it falls through a vertical tunnel onto their heads. This is quite tricky since the rock should not fall onto your own head, and the victims must be led into the appropriate tunnel at exactly the right time.

As I implied at the outset Dig-Dug is clearly a Pac-Man derivative (note the bonus fruit which occasionally appears in the central tunnel) but it is a novel adaptation with a strong appeal in its own right. The graphics and sound are of extremely high quality, and although the game is superficially simple it is challenging enough to keep you hooked. **END**



PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are



unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications', Personal Computer World, 62 Oxford Street, London W1A 2HG

CP/M auto-start

The subject of auto-start programs under CP/M was raised in 'Computer Answers' in the September issue of PCW. The answer given involved the use of SUBMIT and, although it works quite well, it is a somewhat clumsy method.

In fact, CP/M has a facility for auto-start programs built in, and it can easily be put into operation by using SYSGEN and DDT. Probably the best way of explaining is to use an example: let's set up CP/M to execute the command line START START.DAT after both warm- and cold-boots (refer to figure 1). The first thing to do is load CP/M into memory using SYSGEN. This should present no problems, since SYSGEN's prompts are quite clear. Having returned to CP/M, the memory image must be **SAVED** onto disk; any filename will do, and SYSGEN should tell you how many pages to store. Next, load the memory image under DDT as in figure 1, and store the command line by using SA07. The first number is the length of the command line in characters, and the following numbers are the ASCII representations of the characters themselves, in this case: OF — The command line is 15 characters long.

- 53 — ASCII 'S'
- 54 — ASCII 'T'
- 41 — ASCII 'A'
- 52 — ASCII 'R'
- 54 — ASCII 'T'
- 20 — ASCII ' '
- 53 — ASCII 'S'
- 54 — ASCII 'T'
- 41 — ASCII 'A'
- 52 — ASCII 'R'
- 54 — ASCII 'T'
- 2E — ASCII ' '
- 44 — ASCII 'D'
- 41 — ASCII 'A'
- 54 — ASCII 'T'
- 00 — Just to finish off.

The command line may then be checked using the D command.

The next thing to do is to set two flags at location 20FF: Bit 0 : 0 = do not execute command line after cold-boot; 1 = do not execute command line after cold-boot.

Bit 1 : 0 = do not execute command line after warm-boot; 1 = do execute command line after warm-boot.

This again must be done using the S command (see fig 1).

After both these changes have been made, reboot by pressing control-C, and run SYSGEN again in order to

```

DDT VERS 2.2
NEXT PC
3000 0100
-SA07
0A07 00 0F
0A08 00 53
0A09 00 54
0A0A 00 41
0A0B 00 52
0A0C 00 54
0A0D 00 20
0A0E 00 53
0A0F 00 54
0A10 00 41
0A11 00 52
0A12 00 54
0A13 00 2E
0A14 00 44
0A15 00 41
0A16 00 54

0A17 00 00
0A18 00 .
-DA07 A18
0A07 0F 53 54
41 52 54 20
0A07 0F 53 54 41
52 54 20 53
54 .START ST
0A10 41 52 54 2E
44 41 54 00
00 00 ART.DAT..
-S2 OFF
2OFF 10 13
2100 C3
-
-
- C
A SYSGEN
    
```

Figure 1

save the memory copy onto disk (again, this should present no problems). Now cold-boot, and your auto-start CP/M should be fully functional.

Lastly, a word of warning — although this works on my version of CP/M (Lifeboat Associates CP/M Version 2.23 for 64k TRS-80 Model II), other versions may use different memory addresses, so make sure you have a spare copy of CP/M, just in case it doesn't work.

Horror doc

I was pleased to read your article 'The Book of the Video' in August's issue of PCW and I agree wholeheartedly with your condemnation of the general quality of user manuals. During many recent micro evaluations, I have seen the following problems: lack of sensible organisation of the facts, and, often, of an index; masses of typographical and grammatical errors; poor printed quality (one manual I recently read was printed on a dot matrix printer without true descenders — I could only stand to read four pages at a sitting!).

There is no excuse for any of these problems as software packages are available which will organise manuals and check for errors, and solid font printers are easily available.

However, even if the manual is superb, it is not the useful product but merely a description of it, and should only be used as a reference document. The self-training of the user (after a minimum of set-up procedures) should be in the form of a program-

med learning course on the micro itself, during which reference to the manual should be minimal.

A good example of this technique is found in the Select word processing system, which has a conventional, and sometimes amusing, 90-minute training session called 'Teach'. It also has a very good manual, which leads the user through the basic preliminaries and then says 'The best way to learn Select is to put the manual down now!'

This technique of programmed self-teaching supported by a reference manual makes much more sense than wading through a badly written manual for hours before having the confidence to touch the micro itself. Steven Kay, Network Manager, OCLC Europe, Birmingham.

Olivetti M20

I would like to clarify a few points arising from your review of the Olivetti M20 Personal Computer.

The minifloppy disk units conform to the ECMA 70 standard for double density/double sided recording. This was chosen to simplify disk transfer with other computers.

Your comments concerning the Z80A outperforming the Z8001 in character manipulation seems a little strange. It would be interesting to see how you come to this conclusion.

The review machine included 160 kbytes of RAM. 58 kbytes are available for the Basic interpreter (like most versions of Basic only 64 kbytes can be addressed and some is required for

tables, buffers etc), 16 kbytes is for the display bit map, 16 kbytes for I/O buffer and assembler/machine code and the remaining 64 kbytes is PCOS (the operating system).

As we explained when the machine was collected we provided two versions of PCOS. One of these was a pre-release for which documentation was not at that time available — this was before the launch of the M20. FKILL was just one of the extra commands provided in this new release. The two versions also had different software reset methods. The current and all future releases use control reset.

Command sequences can be built using program or display editor, stored in a file and executed using the device rerouting instructions. As files and devices are interchangeable in PCOS under the new release many sophisticated operations can be carried out.

Your suggestion that passwords should be 'breakable' seem a little dangerous as it would tend to make provision of passwords a waste of time!

The PCOS and Basic manuals are, as you say, written to help the first time user. But the knowledgeable programmer can of course use the alphabetic or grouped indexes to find particular instructions.

Like most Olivetti documentation the PCOS and Basic manuals are produced first in English by English writers so I would be most interested to know which sentence 'wriggled through the translator's comprehension.'

The price of the M20 includes the manuals, PCOS, Basic, peripheral cables, spare disks and one year guarantee.

In conclusion, thank you for your review which as usual manages to cover an enormous number of points in detail but with clarity. R G Garrett, M20 Product Manger, British Olivetti Ltd.

Insecticidal notes

In May's 'Newsprint', while reporting the Keele Codes E40 system, you referred in passing to CP/M and DDT. I know what CP/M is but I'm a bit worried about DDT. I wonder if you would be so kind as to tell me more? I am introducing an Apple plug-in board, made by Triac Controls Ltd of Auckland, NZ and the present name of the

board is Apple DDT (Dynamic Debugging Tool). I do not wish to infringe copyrights or trade marks if there is an existing product of that same name.
Vernon Webb, Worcester.

DDT is a utility program supplied with CP/M which enables you to examine areas of memory (either in hex or in 8080 mnemonics) and to alter memory contents, as well as providing a range of other useful program debugging aids. — Ed.

Manhunt 1

Your Manhunt contest is an excellent idea, and trying to solve the first problem proved entertaining and enjoyable, which only goes to prove that there is always a way round if you think long enough and hard enough.

But I think we have a problem. The rules of the game state that the competition will be won by the first person to ring a certain telephone number. Obviously the December issue will contain the final problem, and there will I am sure be a mad scramble for people to solve it. But my point is that, due perhaps to your own distribution system, and certainly the Post Office, there could be a difference of several days between your readers, and competitors, receiving their magazines. The competition therefore becomes a lottery, with the possibility that the winner is home and dry before all your readers have even received the issue.

Can I suggest that, in order to overcome this problem, that you make arrangements to announce the final problem over the radio, so that at least everyone has a fair chance? Or even take a small space in the national daily papers (although even then some will receive copies before others).

I cannot help but think that unless you take some action, there may be a very sour taste in many people's mouths, which I am sure would not want.
Henry Ruddock, Sheffield.

This is one of many similar letters we have received — everyone seems to assume that the final problem is going to be as easy as the first three! In fact it's a lot harder and we're confident that a few days either way isn't going to make much difference. See the Manhunt competition for details of national newspaper advertising — Ed.

Manhunt 2

It's nice to see a competition, especially with a worthwhile prize. But I should like to know why it is assumed that we have a computer at hand.

There must be a considerable number of PCW subscribers who, like myself, have no micro or are awaiting BBC machines.

Furthermore, as the first part of the competition indicates, why is it assumed that we are all maths experts? I for one am not — I wouldn't have a clue how to even start this competition!

I am afraid it's this approach which alienates many would-be-computer users; my interest is more on the functional and creative side (ie, CAD) and the intensely technical aspects of computing frighten me away. How about a worthwhile competition to win one's first computer for the non-technically-minded beginner?

I would like to round off with a cheerful note, however, and say how interesting (if unintelligible) I find PCW.
Marcus Middlehurst, Harrow.

It seems we just can't win! Previous competitions which we've run have been heavily criticised as being too easy — or we've been taken to task for setting problems which don't require the use of a computer ('You're a micro mag — you should be encouraging the use of micros ... !). But this won't be the last competition we run — next time we'll try to come up with something which everyone can do, although, strictly speaking, it's possible (albeit very time-consuming) to solve the Manhunt without a micro. — Ed.

Handy one-liners

Although Basic can be used for both scientific and commercial applications, I am sure many programmers like myself bemoan the lack of a comprehensive set of mathematical functions as found on cheap calculators and in languages such as Fortran.

To partially remedy this situation, I present the following one-liners for inverse trigonometric functions:

1 ARC SIN(X):
DEF FNASN(X) = 180 * ATN (X/SQR(1-X*X + (ABS(X) = 1))) + 45 * X*(ABS(X) = 1)

X in radians, angle between -90° and +90°.

2 ARC COS(X):
DEF FNACS(X) = -FNASN(X) + 90

X in radians, angle between 0° and +180°.

3 ARC TAN(Y, X):
DEF FNTXY(U) = 180 * (ATN(Y/(X+(X=0))) / + 1 + (X = 0) + 1) - 135 * Y*(X = 0).

U is a dummy variable, angle between 0° and 360°. NB the boolean operators take care of division by zero and square-roots of negative numbers. Also the above expressions apply to machines with a positive truth value ie, Apple II, while

for the PET the signs before the boolean expression will have to be changed.

You can determine this on your micro by typing in PRINT (2 1) or such like. If you get a value of -1, change the signs. The PET supports the variable , else use PI = 3.141592654 as usual.

The last expression can be used to give the angle in a rectangular-polar conversion. P M Doherty, Maths and Computing Group, British Gas Corporation, Solihull.

'Too exotic'

With reference to your recent articles on computer literacy, I feel that the BBC programme and Government sponsored exhibitions are too exotic. My 'breakthrough' to understanding computers came with the realisation that a computer won't do anything unless you give it a command it understands, and the fun part is solving problems by manipulating these commands.

Most people I know imagine I use my ZX81 to a) access encyclopaedic information and feed the goldfish (vide BBC), b) play space invaders (boring), or c) work out vast mathematical calculations (brainy), and therefore just turn off.
Bridget Clarke, Norwich.

Beeb colour

I found your article 'Beeb Colour Hi-res', in the September edition, most informative but misleading. If I may quote a short section from the first paragraph: '... but unfortunately the character so defined is a text character and as such may be displayed in two colours only — background and foreground. To create more exotic shapes requires some knowledge of the screen format.'

It is on this point that I must differ. Not only is it possible to display multi-coloured text graphics but knowledge of the screen formatting is most certainly not a prerequisite to doing so.

The designers of the BBC

Micro were most kind in granting all users the ability to access (from Basic) the VDU drivers by means of the VDU command and its equivalent PRINT CHR\$(VDU number).

The following short program is a demonstration of this point. Having the basic Model A machine, it's written in MODE 5. What can be done in one MODE, however, can also be done in any other multicoloured MODE.

The essential section in the program is at line 40. Here A\$ is defined, using a combination of VDU commands in the alternative form of CHR\$(VDU no) and in A\$ we have effectively set up a small section of program, its equivalent in Basic being: GCOL 3,2 : PRINT CHR\$(240) : VDU 8 : GCOL 3,1 : PRINT CHR\$(241)

The result of this is to obtain a three-coloured character which is easily moved about the screen. Larger characters merely require the extra definitions and cursor control VDU characters inserted.
T A Richards, Shoeburyness, Kent.

Drawing the line

I have a UK101 fitted with the new hi-res board which gives program compatibility with the Atom, Apple, etc, and while a point plot program was supplied with the board, there was no line-plotting facility. After considering the clear necessity for such a facility, I have written a 6502 machine code program to plot straight lines with inbuilt MOVE TO or DRAW TO equivalents, enabling series of end co-ordinates to be joined rather than having to specify every start and end co-ordinate. The program uses the principle of line gradients but no fractional multiplication or division is used.

I now wish to expand this further with rotate, scale and shape table routines and if any of your experts can supply 6502 assembler listings or give helpful advice, this would be gratefully received.
A Katz, Edgware, Middlesex.

```

10 ON ERROR GOTO 160
20 MODE 5:VDU 5:VDU 19,2,2,0,0,0,19,3,5,0,0,0:REM Select
  graphics mode, colours
30 VDU 23,240,60,126,219,90,0,0,0,0:REM 1st half of char
40 VDU 23,241,0,24,60,60,36,66,129,0:REM 2nd half of char
50 AS=CHR$18+CHR$3+CHR$2+CHR$240+CHR$8+CHR$18+CHR$3+CHR$1+
  CHR$241
60 REPEAT:PROCLissajous:UNTIL FALSE:REM Main Loop until
  ESCape pressed
70 DEF PROCLissajous
80 TX=-1:TY=-1:X=RND(25):Y=RND(30):REM TX,TY temp Loop
  variables
90 FOR A=0 TO 2*PI STEP PI/300
100 IF X>-1 MOVE TX,TY:PRINT AS:REM Not first time round
110 TX=25*(20*COS(A*X)+25):TY=20*(20*SIN(A*Y)+30):REM keep
  on screen limits
120 MOVE TX,TY:PRINT AS
130 NEXT
140 CLS:REM ready for next sequence
150 ENDPROC
160 MODE 7:IF ERR<>17 REPORT:PRINT " at Line no ";ERL:END:
  REM reset screen on error, only report if not ESCape

```

COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts.
Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.



Taking it apart

How do I write a program that will decompile a Basic program? The program I have is called the .COM type and accesses a file BRUN.COM. Mark Ryan, Woking, Surrey

Disassembling is a comparatively simple task — but even this task cannot reproduce the original exactly. A decompiler is a different order of difficulty again. I doubt very much if a program, once decompiled, will be very easy to understand for the following reasons: all REM statements will be gone; meaningful variable names will be missing; line numbers will be in 10s and function names will have changed.

If the machine code happened to be compiled by an 'optimising' compiler, then the problem will have been worsened because a lot of the resulting code will have been compressed for efficiency. More likely still is the fact that you may not even have a machine code program to decompile — it may be in an intermediate code. You cannot decompile this if you don't know the code.

I should approach the author and get the original listing. You do not say why you want to decompile the program — but remember that professional programs are subject to copyright.

If you really are interested in the subject, then a good book to read would be 'Writing Interactive Compilers and Interpreters' by P J Brown of the University of Kent, published by J Wiley at about £7.
SW

Help in Bedford

Can you recommend a computer company in the Bedford area who could undertake to write some programs, install and maintain a small computer system to perform stock control and accounting for my company? Name and address withheld by request.

Sorry to keep repeating myself, but you should approach a professional computer consultant first. He will specify and estimate the

cost for such a system. Only then can you safely approach a few computer companies and ask for an estimate from each. If you do not want to approach a consultant then please do shop around; you needn't restrict yourself to a computer service agency in Bedford, provided that they offer the kind of maintenance agreement you require, you could go anywhere.

However, to answer your question, I am only aware of one, called Starwest Computer Services, 28 Lime Street, Bedford, tel: 0324 213557. According to its 'company profile', it offers the following services: advice, software, engineering/interfacing, service, training, in-house services. I cannot comment further and this reply should not be taken as recommending or not recommending this outfit.
SW

Tape transfer

I am getting a ZX Spectrum for Christmas and I was wondering if ZX81 games cassettes can be used with a ZX Spectrum? If not, could the programs be re-arranged so that they would work with my Spectrum?

Adrian Blant, Chesterfield

Unfortunately ZX81 cassettes cannot be loaded directly into the ZX Spectrum because it operates at 1500 baud (bits per second) as opposed to 320 baud. But most ZX81 listed programs can be converted, as long as you remember these points: FAST and SLOW no longer apply (just leave them out); SCROLL is no longer a keyword but asks you at the end of a screenful whether you wish to, or simply POKE 23692,255 directly before it is likely to need to then it will scroll automatically; most importantly PEEK and POKE locations will be different, hence if the program you are converting contains either then you should consult the Spectrum manual for an equivalent (if there is one); all the character codes are as per ASCII as opposed to NSMBDC (Non-Standard, Must Be Different Codes !!!).
James Walsh

Auto-start

I have heard that CP/M provides a powerful and very useful facility to 'automate'

the running of programs. If this is so, can you tell me more about it?

(Name and address withheld by request)

All versions of CP/M provide the SUBMIT.COM program which provides the feature you mention. Later versions (2.2 on) provide an enhancement, XSUB, while many implementations of CBIOS (the interface software between the 'standard' parts of CP/M and the particular hardware being used) provide an 'auto-start' feature in some form. In the Lifeboat Associates CBIOS, for example, this takes the form of a program AUTO.COM, which is run automatically on booting the system, once a minor (1-byte) patch has been made to the CBIOS.

With SUBMIT a whole series of commands can be entered into a file, and are all then executed one after the other, just by entering SUBMIT filename (the file with the commands can have any valid CP/M name, but must have the extension .SUB).

To give a real example, a secretary using a particular word processing system had to enter:

```
INSTALL DJ.PRL D000  
DJRAM.PRL E400  
L:  
WS
```

every time before starting to use the facility.

These commands were all put in a file (created using WordStr under the 'n' option) called UP.SUB. The SUBMIT.COM program was then copied under the name START.COM (using PIP). All the operator had to do in future was type START UP!

As the next step the auto-boot facility was patched-in and SUBMIT.COM on the disk renamed to AUTO.COM. In addition 'UP' was patched into the auto-start routine in CBIOS. Whenever the system was then booted with that disk in drive A, the whole sequence was performed completely automatically.

SUBMIT is limited in that only direct commands can be executed from the .SUB file. Thus it would not be possible to run a program like DDT which requires information to be entered in response to prompts from the running program. This has been overcome with XSUB. It XSUB is entered as the first command in a .SUB file, the appropriate responses can be built into the file, and will be read from it.

Another feature of

SUBMIT is that it is possible to put some of the commands in as variables, which are entered when SUBMIT is run. Thus it is possible to choose which files should be listed, for example, at the time SUBMIT filename is entered.

This is certainly a very powerful facility, particularly if you are writing a series of programs to be run one after the other, by inexperienced, or non-computer, operators.
P L McIlmoyle.

Multi-lingual Spectrum?

Is it possible to use other languages such as Forth or Pascal, etc, on the ZX Spectrum?

Graham Parry, Belgium

At the moment, no, but extra languages are likely to become available in the not too distant future, especially with the release of the ZX Microdrive.

James Walsh

Serious business

I own a Sinclair ZX81 with 16k RAM, shortly to be 48k. I have got past the stage of writing games and I'm now writing business software. I have written a word processor and now I'm working on a payroll package. I'm writing to ask if you could advise me on setting about writing business software in ZX81 Basic and what I could do with the programs afterwards to earn myself something for my efforts.
Paul Hills, Launceston, Cornwall

Writing business software is far from easy (especially on the ZX81) mainly because, unlike games, you are generally dealing with the needs of someone else rather than yourself. So before you can seriously embark upon what may develop into a lucrative side-line it is important to take these points into consideration:

- 1) Is there a market for your product? Make sure you are writing something that someone will want.
- 2) Check that it is user-friendly and totally bug-free. Test for incorrect inputs, and that it gives understandable answers.
- 3) Is there something similar already on the market? If so,

then is yours better?

If you have got this far then you are well on the way to having a saleable product but how do you sell it? If you feel that you know the market well enough, have some capital and a good business head than maybe you could market it for yourself. If this doesn't appeal, then find already established business software distributors in magazines. Send them a breakdown of what you have to offer, and tell them why they should market it. This sort of company is always interested in good quality original material and may make you an offer. But before you dive in check their rates, and how much advertising you would get.

James Walsh

PET info

I own a 4032 large screen PET and already own *The PET Revealed*, but the memory maps refer to old ROM and new ROM and neither seem to apply to the 4000-series. Is there anywhere I could get the memory map for the 4032?

(Name and address withheld by request)

This information has been published in the User Group Newsletter and also appears in greater detail in Ray West's book *Programming the PET/CBM*. This book contains memory maps for old, upgrade (BASIC2) and BASIC4 40- and 80-column versions.
Ron Geere, Independent Commodore Products User Group.

Loopy

I recently wanted to add a program protection routine to my school's CBM4032. The object was to display a password request when a program was DLOAded. I have developed a program to do this, but it intercepts the CHRGET routine at \$0070. However, to save from \$0070 to the end of the Basic program saves lots of other things, and upon re-load the system enters a loop and has to be reset. Am I doing something wrong, or is there a totally different way of doing it?

Andrew Howard, Ironville

Among the 'lots of other things' saved are the program start and end SAVE and LOAD address pointers at \$C7/C8 and \$C9/CA, plus the pointer \$FB/FC. The latter points to the address currently being loaded, starting equal to C7/C8's contents and increasing until reaching the end of the file. Now it happens that \$FB/FC points

to the start address used by the SAVE routine, so that loading starts with \$FB/FC pointing to \$0070 and increasing until reaching \$00FB. At this point it starts to go wrong. It loads what was saved from this location (which was \$70) so that loading continues from \$0070 until it reaches \$00FB. At this point. . .
Ron Geere, ICPUG

What's happening

In my VIC-20 I noticed something strange! When I hit a letter (not graphic) and then, holding the left shift-key down, hit the RUN/STOP key, the VIC-20 displays:
XLOAD
?SYNTAX ERROR
READY
RUN
and then the program stored in memory runs. Can you explain that to me?
P P Michaelidis, Athens, Greece.

Simple. When you press a key, say 'X', it puts X in the keyboard buffer. Pressing shift run puts LOAD <return> RUN <return> into the keyboard buffer. This also applies to PETs with Basics 1 and 2 (Basic4 puts dL''* <return> RUN <return> to load from disk). So what happens? XLOAD is examined by Basic which, not surprisingly, says ?SYNTAX ERROR and then prompts with READY only to find the RUN command waiting, so it runs your program.
Ron Geere, ICPUG

VIC upgrade

I have some queries regarding the VIC-20 and the Beelines 40-column and 32k expansion unit:

1) Is the expansion unit mounted inside or outside the standard VIC case? 2) How can the VIC be expanded to 35k when it says in the Commodore VIC advert that it is fully expandable to 27.5k? 3) Are the programs sold by Commodore, on cassette and cartridge, able to run on a 40-column machine and, if not, will they be bringing out programs for a 40-column VIC or can the expansion unit be easily disconnected to obtain a 20-column display? 4) Am I better off waiting for a VIC-40 (if there is ever such a machine?) than buying the VIC with expansion offered by Beelines?
Jonathan Hughes, Aberystwyth, Dyfed

1) The VIC-20 sits neatly on top of the Beelines expansion unit. 2) If one fits RAM in

the ROM expansion area one can have 35k of RAM, but it is not contiguous memory and needs special treatment to use it. 3) Generally, no, but Commodore's new 40-column model, the Commodore 64 will have a range of programs, some of which may run with the Beelines expansion unit. 4) Yes, the Commodore 64 will offer more features than the VIC-20 with expansion. It should be available from September onwards.
Ron Geere, ICPUG

Mystery ROMs

I have a 2001-series PET and have acquired a retrofit ROM set to upgrade to Basic2. The ROM set came without documentation and the serial numbers bear no relationship to their socket positions. There are seven ROMs, numbered 0204679, 0214679, 0220680A, 0231379, 0240780A, 0250680A, 0260680A.

Peter Bartlett, Stockport

The numbers you quote have the end two digits as the year, the previous two as the week number and the leading three digits as the ones of interest. The table below gives the more usual numbers:

Pos'n	MOS no	CBM Part no
H1	6540-020	901439-13 H2
H2	6540-022	901439-13
H3	6540-024	901439-17
H4	6540-025	901439-18
H5	6540-021	901439-14
H6	6540-023	901439-16
H7	6540-026	901439-19

Ron Geere, ICPUG

Robot controllers

Which of the following micro computers have Programmable Interface Adaptors (PIAs) or similar devices which would allow me to control devices such as robots, model railways etc -- Apple II, Sharp MZ-80K, Atari 800, TRS-80 Model III, DAI, Video Genie, PET 4032, NEC PC 8001? Could you also advise on their reliability?
M Metcalfe, Derby

In fact it is possible to use almost any kind of micro computer, or simple micro processor for such control applications, given appropriate software, and the correct interfaces. Having said that, then it is necessary to add that there can be an enormous variation in the ease with which the job can be done. For this reason the PET is undoubtedly the most popular microcomputer for such applications, as it comes ready equipped with what is a fairly full implementation of one of the most widely used control interfaces -- the

Hewlett Packard HP-IB bus, more often referred to as the IEEE-488 bus. This was designed for the control of, and acquisition of, data from laboratory instruments.

Unless your application is of an on-off nature, you will probably need some type of analogue to digital (A to D) converter on the data input side, and a corresponding D to A converter to process the outgoing control signals. These are needed because the computer operates in discrete (ie digital) changes of output or input, while most equipment generates (or needs) data that changes in a continuous manner from one value to another.

So another important factor in making your choice would be the availability of suitable A to D and D to A converters. Here the determining factor as to availability tends to be the popularity of any particular computer, as well as on its technical suitability, so your short list from the machines you mention is likely to include the PET 4032, the Apple II, the TRS-80 and the Video Genie.

However, a lot can be done just through a printer port. See, for instance, the two part article in the October and November issues of PCW on using a Sinclair ZX80 or ZX81 for such work.

I would not expect to find major differences in reliability between the machines you list.

P L McIlmoyle

Inconsistent recording

I have two ordinary cassette players. Would it be possible to connect one of them for use with my VIC-20?

A J Heaps, Derby

It would be worth your while using a proper VIC cassette recorder, since a normal audio cassette recorder, since a normal audio cassette recorder will neither give consistent results nor interact correctly with the cassette operating system.
Ron Geere, Editor, IPUG.

PET joysticks

I would like to add a joystick(s) to my 3000-series PET. Do you know of any directly compatible items? Connectors for the PET user are not easy to find. Do you know of any supplier?
J Black, London, N14

A joystick is available from Qwerty Computer Services and connectors for the user and IEEE ports from Stack Computer Services, Liverpool.
RD Geere

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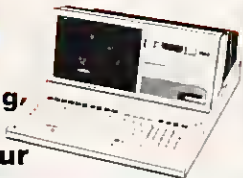
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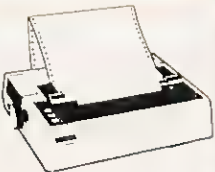
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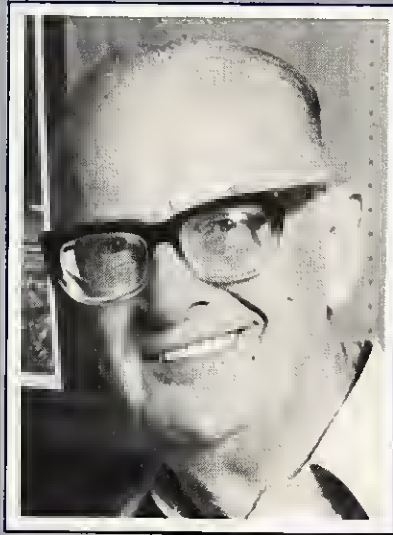
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"JUST SKIMMED THE LAST THREE ISSUES AND FOUND THEM FASCINATING..."

Arthur C Clarke



It's amazing what goes on in the basement of *Personal Computer World*. Our erstwhile subscriptions manager, for example, engaging in correspondence with Arthur C Clarke! (For the uninitiated few, ACC is arguably one of the world's most visionary living individuals: a scientist, author of 2001: A SPACE ODYSSEY and 60 or so other works, originator of communications satellites, undersea explorer, etc, etc).

Mr Clarke tells us that he has an Apple II 'languishing in the lab... too busy to touch it for weeks'. Busy, apparently, completing SPACE ODYSSEY two ('my latest, last book!') on his Archie word processor (Archives III, 5 megabyte Winchester disk, Wordstar program) with which he is obviously deeply satisfied — 'I could no more imagine going back to a typewriter than to a slide rule...'

We make no bones about our delight that Mr Clarke takes the trouble to write to us from his home in Sri Lanka and comment on *Personal Computer World* so favourably. As a subscriber to PCW, not only will you save a small fortune (see the rates below) but you can count yourself in august company. Remember that Clive Sinclair described PCW a short while ago as 'clearly one of the leading computer journals in the world'.

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CLOCK IT TO ME

Bruce Marriott continues his description of a clock/calendar card for the Apple II with a description of the software drivers.

Last month I presented the hardware needed to interface a clock/calendar card based on the OKI MSM5832 chip to the Apple II, or — in rather less detail — to other systems. This month we'll look at the driving software. Naturally, this is based on the Apple, too, but where appropriate I have included some information on amending the code for other systems.

The 6521 PIA

Since the clock chip is accessed through a 6821 PIA, it is first necessary to know how to control the PIA. What follows is

a resumé on how this is achieved — for a more complete version, see the 6821 data sheet.

The 6821 has two 8-bit ports, A and B; for the purpose of this exercise, they can be considered as identical apart from the unique addresses associated with each. The PIA has four interrupt inputs (two of which may also be used as outputs) which will be discussed later. Each port is controlled by two registers, the data direction register and the peripheral register, which, because of addressing limitations, have the same address (Figure 1), with selection between them being made by the value of bit 2 in a

third register (which has no duplicated address) called the control register. The data direction register for each port governs which bits will act as inputs and which will be outputs; writing a 0 to a bit makes it an input while a 1 makes it an output. The peripheral register allows the setting of levels on outputs and the reading of levels on inputs — a 1 in a bit indicates that it is high (+5 volts) and a 0 low (0 volts).

Figure 2 shows how ports A and B are connected to the MSM5832. It repeats information given in last month's circuit diagram but in a more easily assimilated form. The examples

CONTROL OF INTERRUPT INPUTS CA1 AND CB1

CRA-1 (CRB-1)	CRA 0 (CRB-0)	Interrupt Input CA1 (CB1)	Interrupt Flag CRA-7 (CRB-7)	MPU Interrupt Request IROA (IROB)
0	0	↓ Active	Set high on ↓ of CA1 (CB1)	Disabled — IRO remains high
0	1	↓ Active	Set high on ↓ of CA1 (CB1)	Goes low when the interrupt flag bit CRA-7 (CRB-7) goes high
1	0	↑ Active	Set high on ↑ of CA1 (CB1)	Disabled — IRQ remains high
1	1	↑ Active	Set high on ↑ of CA1 (CB1)	Goes low when the interrupt flag bit CRA-7 (CRB-7) goes high

(A ₁) RS1	(A ₀) RS0	Control Register Bit		Location Selected
		CRA-2	CRB-2	
0	0	1	x	Peripheral Register A
0	0	0	x	Data Direction Register A
0	1	x	x	Control Register A
1	0	x	1	Peripheral Register B
1	0	x	0	Data Direction Register B
1	1	x	x	Control Register B

7	6	5	4	3	2	1	0
IROA1	IRQA2	CA2 Control			DDRA Access	CA1 Control	
7	6	5	4	3	2	1	0
IROB1	IRQB2	CB2 Control			QORB Access	CB1 Control	

CONTROL OF CA2 AND CB2 AS INTERRUPT INPUTS
CRA5 (CRB5) is low

CRA-5 (CRB-5)	CRA-4 (CRB-4)	CRA-3 (CRB-3)	Interrupt Input CA2 (CB2)	Interrupt Flag CRA-6 (CRB-6)	MPU Interrupt Request IROA (IROB)
0	0	0	↓ Active	Set high on ↓ of CA2 (CB2)	Disabled — IRQ remains high
0	0	1	↓ Active	Set high on ↓ of CA2 (CB2)	Goes low when the interrupt flag bit CRA-6 (CRB-6) goes high
0	1	0	↑ Active	Set high on ↑ of CA2 (CB2)	Disabled — IRO remains high
0	1	1	↑ Active	Set high on ↑ of CA2 (CB2)	Goes low when the interrupt flag bit CRA-6 (CRB-6) goes high

Fig 1. 6821 PIA register addressing

		6821	MSM5832	Remarks
PORT A	PA ₀	A ₀		Address lines to select specific time/date
	PA ₁	A ₁		
	PA ₂	A ₂		Register
	PA ₃	A ₃		Always 6821 outputs.
PORT B	PB ₀	O ₀		Time & date Data
	PB ₁	O ₁		Bidirectional
	PB ₂	O ₂		
	PB ₃	O ₃		Control lines.
	PB ₄	HOLD		
	PB ₅	REAO		
	PB ₆	WRITE		Always 6821 Outputs.
CA ₁	D ₀	1024H2	5832 Interrupt	
CB ₂	D ₁	1 Hz	Outputs at	
CB ₁	D ₂	1/60 H2	Specified	
CA ₂	D ₃	1/3600 H2	rates	

Fig 2. 6821 PIA to MSM5832 interconnection

which follow should clarify how the PIA/5832 combination is used.

Clock set and read

The program in Listing 1 allows the clock to be set and read from (Microsoft) Basic and should thus be relatively easy to establish on most popular machines. The program was written in Applesoft Basic and has been annotated. If you are using another machine with the 6821, only a few areas will require amendment, the major one being to the address of the PIA. With the Apple, this address changes depending on which slot is used to house the card; lines 110 to 120 handle this. For most other systems the PIA will be mapped into a specific area of memory, allowing lines 110 and 115 to be deleted and line 120 modified so that variable A0 contains the base address (ie, the address of the first location in the PIA).

Other, more minor, amendments will also be necessary. In line 15 the string variable BELL\$ is set to beep the Apple's speaker; if your machine has no such facility then set BELL\$ to a null value (""). In line 50 the variable CLR is set to a value which, when CALLED, clears from the current cursor position to the end of the line. The actual CALL is only used once (in line 400) and the two lines should be modified as appropriate. Finally, a few Basic words may require clarification for non-Apples: TEXT declares that an alphanumeric display is required rather than graphics; HOME clears the display and puts the cursor in the top left-hand position; INVERSE declares that all subsequent PRINTING will be black on white; and NORMAL declares that printing will be white on black.

If your design isn't based on a 6821 then, of course, the PEEKs and POKEs to control the interface will also have to be modified; to help you with this, I have REMarked all of them to show what they're doing.

The program has been kept relatively short and simple and will not be dissected. However, it could be substantially improved to make it easier to use. For example, it could allow normal date and time entry (eg, 9/5/82 for date) or automatically calculate the day of the week (see *Some Common Basic Programs*, 3rd edition, by L Poole & M Borchers, pub Osborne/McGraw-Hill, 1979, for a suitable method). Additionally, automatic leap year bit setting, instructions and extensive error-trapping

```

10 AA$ = " CLOCK SET AND READ "
15 BELL$ = CHR$(7): REM PRINTING BELL$ BEEPS SPEAKER
20 DIM AN(12)
50 CLR = - 868: REM CALL CLR TO CLEAR SCREEN FROM CURSOR ONWA
RDS
100 TEXT : HOME : VTAB 1: HTAB (40 - LEN (AA$)) / 2: INVERSE : PRINT
AA$: NORMAL
110 VTAB 3: INPUT "ENTER CLOCK SLOT NUMBER, ";SL
115 IF SL < 1 OR SL > 6 THEN PRINT BELL$: GOTO 110
120 A0 = 49280 + SL * 16
125 A1 = A0 + 1:A2 = A1 + 1:A3 = A2 + 1
150 VTAB 5: INPUT "<S>ET OR <R>EAD ?," ;AN$
155 IF AN$ < > "S" THEN 500
199 REM SET CLOCK
200 POKE A1,0: POKE A0,255: REM CONFIGURE ADDRESS LINES ON A S
IDE AS ALL OUTPUTS
205 POKE A3,0: POKE A2,255: REM CONFIGURE CONTROL & DATA LINES
ON 8 SIDE AS ALL OUTPUTS
210 POKE A1,4: POKE A3,4: REM GET READY TO SET A & 8 SIDE LEVEL
S
220 VTAB 7: PRINT "ENTER;": VTAB 9
225 INPUT "UNITS OF MINUTES" ;AN(2)
230 INPUT "TENS OF MINUTES" ;AN(3)
235 INPUT "UNITS OF HOURS" ;AN(4)
240 INPUT "TENS OF HOURS" ;AN(5)
245 INPUT "UNITS OF DAYS" ;AN(7)
250 INPUT "TENS OF DAYS" ;AN(8)
255 INPUT "UNITS OF MONTHS" ;AN(9)
260 INPUT "TENS OF MONTHS" ;AN(10)
265 INPUT "UNITS OF YEARS" ;AN(11)
270 INPUT "TENS OF YEARS" ;AN(12)
275 INPUT "DAY OF WEEK (0 SAT, 6 FRI)" ;AN(6)
280 INPUT "NEXT FEB GOT 29 DAYS? (Y OR N)" ;AN$
285 IF AN$ = "Y" THEN AN(8) = AN(8) + 4: REM ADJUST FOR LEAP YE
AR
290 AN(5) = AN(5) + 8: REM WORK IN 24 HR FORMAT
300 PRINT : INVERSE : PRINT "SWITCH WRITE ENABLE ON (SWITCH NO.
4)";BELL$
310 INPUT "PRESS RETURN TO SET TIME" ;AN$
315 NORMAL
320 POKE A2,16: REM TAKE HOLD LINE HIGH & STOP CLOCK
330 FOR I = 0 TO 12
340 POKE A2,AN(I) + 16: REM SETUP DATA LINES
350 POKE A0,I: REM SETUP ADDRESS LINES
360 POKE A2,AN(I) + 80: REM TAKE WRITE LINE HIGH
370 POKE A2,AN(I) + 16: REM TAKE WRITE LINE LOW
380 NEXT I
390 POKE A2,0: REM TAKE HOLD LINE LOW & START CLOCK
400 VTAB 6: CALL CLR: VTAB 8: INVERSE : PRINT "SWITCH WRITE ENAB
LE OFF";BELL$: NORMAL
410 REM AUTOMATICALLY FALL INTO READ CLOCK
499 REM
500 POKE A1,0: POKE A0,255: REM CONFIGURE ADDRESS LINES ON A S
IDE AS ALL OUTPUTS
510 POKE A3,0: POKE A2,240: REM CONFIGURE 8 SIDE WITH LOWER 4 B
ITS AS INPUTS (DATA) & UPPER 4 BITS AS OUTPUTS (CONTROL)
520 POKE A1,4: POKE A3,4: REM GET READY TO SET A & 8 SIDE LEVEL
S
530 POKE A2,16: REM TAKE HOLD LINE HIGH TO STOP CLOCK
540 POKE A2,48: REM TAKE READ LINE HIGH
550 FOR I = 0 TO 12
560 POKE A0,I: REM SETUP ADDRESS
570 AN(I) = PEEK (A2) - 48: REM READ & STORE DATA
580 NEXT I
590 POKE A2,16: REM TAKE READ LINE LOW
600 POKE A2,0: REM TAKE HOLD LINE LOW (& ALLOW CLOCK TO CONTIN
UE)
610 AN(5) = AN(5) - 8: REM TAKE OUT 24 HR BIT
620 IF AN(8) = > 4 THEN AN(8) = AN(8) - 4: REM ALLOW FOR LEAP
YEAR BIT
630 VTAB 10: HTAB 8: PRINT "TIME ";AN(5);AN(4);".";AN(3);AN(2);
";";AN(1);AN(0)
640 VTAB 11: HTAB 8: PRINT "DATE ";AN(8);AN(7);"/";AN(10);AN(9)
;"/";AN(12);AN(11)
650 VTAB 15: INVERSE : PRINT "USE 30 SEC ADJUST SWITCH IF NECESS
ARY": NORMAL
660 IF AN(6) = 6 THEN TD$ = "FRIDAY": GOTO 690
665 IF AN(6) = 5 THEN TD$ = "THURSDAY": GOTO 690
670 IF AN(6) = 4 THEN TD$ = "WEDNESDAY": GOTO 690
675 IF AN(6) = 3 THEN TD$ = "TUESDAY": GOTO 690
680 IF AN(6) = 2 THEN TD$ = "MONDAY": GOTO 690
683 IF AN(6) = 1 THEN TD$ = "SUNDAY": GOTO 690
686 TD$ = "SATURDAY"
690 VTAB 18: PRINT "( BYE THE WAY: TODAY IS ";TD$;" !!)"
700 GOTO 530: REM REPEAT READ & PRINT

```

Listing 1

would also be useful, but space does not allow such a lengthy program to be printed here.

ROM software

As discussed last month, the Apple I/O facility allows each peripheral card a

256-byte driving program. Having an intelligent card makes for much easier application programming when wishing to access time and date. Listing 2 shows a Basic program that gets and prints the time and date (using the yet-to-be-given driving program) and this should be compared with the much longer and more

CLOCK IT TO ME

fiddly clock read part of Listing 1.

For convenience, I decided to use the well-known 2716 (single rail) EPROM for storing the driving programs. Although this device has room for eight driving programs, it is connected in such a way that only four spaces are available; selection of only one space is determined by the settings on two switches. Figure 3 shows how the switches relate to the EPROM memory map and where the driving program, which follows (called 'normal format') should be located.

Listing 3 is the annotated assembler listing of the normal format driving program. This does not follow Apple's standard protocol for slot use (as briefly described in the Apple Reference Manual). Normally the Apple takes input, one character at a time, from the input device, stores it in the input buffer (\$20-2FF) and outputs it to the current output device. If the input is the clock driving routine and the output is the Apple screen (as would normally be the case) this would dictate that every time the program wanted the time and date this information would automatically be printed on the screen, which is unduly restrictive and, for most programmers, would be an irritant.

A solution to this is not to use the standard I/O protocol for every character but to fill the input buffer with all characters at the same time and hence fool the Apple into thinking that it has handled each character separately. This works fine but there's still another problem to overcome: whenever an input statement is processed a question mark is sent to the current output device (which could be the printer or a

Address (Hex)	Not Available for driving program Storage (Address line A10 permanently tied to ground).	DIL Switch Setting	
		1 (A8)	2 (A9)
400 3FF	NORMAL FORMAT	off	off
300 2FF	(FREE)	on	off
200 1FF	(FREE)	off	on
100 FF	(FREE)	on	on
0	(FREE)	on	on

Fig 3 Relationship between 2716 memory map and Apple clock card Dil switch settings

```

5 TEXT
10 D# = CHR#(4)
20 PRINT D#"IN#4"
23 INPUT DA#,TI#
24 PRINT D#"IN#0"
30 PRINT "DATE ";DA#
40 PRINT "TIME ";TI#
90 END
    
```

Listing 2

C400-	78	SEI		Stop interrupts.
C401-	A9 E0	LDA	#\$E0	Load a space character.
C403-	A4 24	LDY	\$24	Print space at current output position.
C405-	91 28	STA	(\$28),Y	
C407-	20 10 FC	JSR	\$FC10	Backspace cursor.
C40A-	A9 E0	LDA	#\$E0	Repeat above 4 lines.
C40C-	A4 24	LDY	\$24	
C40E-	91 28	STA	(\$28),Y	
C410-	20 10 FC	JSR	\$FC10	
C413-	08	PHP		Save status.
C414-	68	PLA		
C415-	8D FC 03	STA	\$03FC	
C418-	D8	CLD		Find which slot we are in. (See Page 81 in Apple Reference Manual.) (Note that there is no need to save) (the 6502 Registers, via a call to FF4A).
C419-	20 58 FF	JSR	\$\$F58	
C41C-	8A	TSX		
C41D-	8D 00 01	LDA	\$0100,X	
C420-	8D F8 07	STA	\$07F8	
C423-	0A	ASL		
C424-	0A	ASL		
C425-	0A	ASL		
C426-	0A	ASL		
C427-	AA	TAX		
C428-	A9 00	LDA	#\$00	Configure PIA as follows; A side (5832 addresses) — Outputs B side (Bits 4-7; Control) — Outputs B side (Bits 0-3; Data) — Inputs
C42A-	9D 81 C0	STA	\$C081,X	
C42D-	A9 FF	LDA	\$\$FF	
C42F-	9D 80 C0	STA	\$C080,X	
C432-	A9 04	LDA	#\$04	
C434-	9D 81 C0	STA	\$C081,X	
C437-	A9 00	LDA	#\$00	
C439-	9D 83 C0	STA	\$C083,X	
C43C-	A9 F0	LDA	\$\$F0	
C43E-	9D 82 C0	STA	\$C082,X	
C441-	A9 04	LDA	#\$04	Take hold and read lines to 5832 high.
C443-	9D 83 C0	STA	\$C083,X	
C446-	A9 10	LDA	#\$10	
C448-	9D 82 C0	STA	\$C082,X	
C44D-	A9 30	LDA	#\$30	
C44E-	9D 82 C0	STA	\$C082,X	
C450-	A0 0C	LDY	#\$0C	
C452-	84 FF	STY	\$\$FF	
C454-	A5 FF	LDA	\$\$FF	
C456-	9D 80 C0	STA	\$C080,X	
C459-	8D 82 C0	LDA	\$C082,X	Read in all time & date registers, setting high bits and storing temporarily in a part of the input buffer.
C45C-	18	CLC		
C45D-	69 80	ADC	\$\$80	
C45F-	A4 FF	LDY	\$\$FF	
C461-	99 10 02	STA	\$0210,Y	
C464-	C6 FF	DEC	\$\$FF	
C466-	A5 FF	LDA	\$\$FF	
C468-	10 EC	BFL	\$C456	
C46A-	A0 AF	LDY	\$\$AF	
C46C-	8C 02 02	STY	\$0202	
C46F-	8C 05 02	STY	\$0205	Put '/'s in correct place for format.
C472-	88	DEY		
C473-	8C 08 02	STY	\$0208	Put '.'s in correct place for format.
C476-	8C 0E 02	STY	\$020E	
C479-	A9 AC	LDA	\$\$AC	Put ',' in correct place for format.
C47D-	8D 08 02	STA	\$0208	
C47E-	AD 17 02	LDA	\$0217	Take time and date values from temporary positions and store in correct part of input buffer.
C481-	8D 01 02	STA	\$0201	
C484-	AD 1A 02	LDA	\$021A	
C487-	8D 03 02	STA	\$0203	
C48A-	AD 19 02	LDA	\$0219	
C48D-	8D 04 02	STA	\$0204	
C490-	AD 1C 02	LDA	\$021C	
C493-	8D 06 02	STA	\$0206	
C496-	AD 18 02	LDA	\$0218	
C499-	8D 07 02	STA	\$0207	
C49C-	AD 14 02	LDA	\$0214	Tens of hours value — always working in 24 hour format so remove bit 3 which is set.
C49F-	8D 0A 02	STA	\$020A	
C4A2-	AD 13 02	LDA	\$0213	
C4A5-	8D 0C 02	STA	\$020C	
C4A8-	AD 12 02	LDA	\$0212	
C4AB-	8D 0B 02	STA	\$020B	
C4AE-	AD 11 02	LDA	\$0211	
C4B1-	8D 0F 02	STA	\$020F	
C4B4-	AD 15 02	LDA	\$0215	
C4B7-	38	SEC		
C4B8-	E9 08	SBC	\$\$08	Tens of days value—reread and mask off bits (29 day Feb.) which might be set.
C4BA-	8D 09 02	STA	\$0209	
C4BD-	A9 08	LDA	\$\$08	
C4BF-	9D 80 C0	STA	\$C080,X	
C4C2-	8D 82 C0	LDA	\$C082,X	
C4C5-	29 FB	AND	\$\$FB	
C4C7-	18	CLC		
C4C8-	69 80	ADC	\$\$80	
C4CA-	8D 00 02	STA	\$0200	
C4CD-	A9 10	LDA	\$\$10	
C4CF-	9D 82 C0	STA	\$C082,X	Take read and hold lines to 5832 low.
C4D2-	A9 00	LDA	#\$00	
C4D4-	9D 82 C0	STA	\$C082,X	Load x Reg with number of characters in buffer.
C4D7-	A2 11	LDX	\$\$11	
C4D9-	AD FC 03	LDA	\$03FC	Reload status.
C4DC-	48	PHA		
C4DD-	28	PLP		Add carriage return character
C4DE-	A9 8D	LDA	\$\$8D	
C4E0-	8D 11 02	STA	\$0211	Allow interrupts again. Back from whence we came.
C4E3-	58	CLI		
C4E4-	60	RTS		
C4E5-	FF	???		

Listing 3

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DOS file) and the writing position of that device is advanced twice. If we assume — indeed force — the output device to be the Apple screen, this can be overcome by backspacing the cursor twice with overprinting by blanks.

Listing 3 shows how all this is done in practice. Some of the register contents are based on material in the excellent *What's Where in the Apple?* (W F Luebbert, Micro Ink Inc, 1981). In particular this relates to the overprinting and backspacing requirement and the setting up of registers after the input buffer has been filled.

Although the normal format listing is given in Slot 4 address space, the code itself is slot-independent since it automatically finds which slot it's in, as described in the Apple reference manual. Note, however, that in this context the call to save register values (as suggested by Apple) does not need to be executed and has not been included.

You can easily modify the program to produce different formats; you have only to arrange the time and date differently in the input buffer and remember to add a carriage return character at the end and load the X register with the total number of characters. If you want to extract the day of the week from the 5832, remember that this is available in part of the input buffer as a product of the normal format code; add the following line to the Basic program in Listing 2: 60 PRINT PEEK(534)—176

This will print a number between 0 for Saturday and 6 for Friday, which can easily be decoded to print the day names, as shown at the end of Listing 1.

For those without access to the necessary EPROM burner, ready-programmed 2716s are available which include not only normal format code but also the Mountain Computer format (popular with some Apple users) which, because of space, can't be included here.

The ROM software developed here is totally Apple-dependent and can't be used with other machines. However, there's nothing to stop you developing your own intelligent firmware specific to your machine. Probably the easiest way to do this would be to find out how variables are stored and then declare the variables *TI\$* and *DA\$* as the first variables in any program, followed by *CALLs* to the ROM software or *USR* routine to access the card and fill in the variables whenever necessary.

Timing things

As I discussed last month, the *MSM5832* can generate interrupts, allowing accurate time intervals to be produced or, as shown here, accurate timing between events. The interrupt rate should, of course, be as fast as possible for the highest resolution. The 5832 can generate interrupts at 1024 Hz so it's possible to time to the nearest millisecond, which should be accurate enough for most micro-based applications.

Listing 4 shows the machine code to set up and count interrupts, and Listing 5 gives a driving Basic program; both were written for the Apple II. The easiest way to understand how they work is to follow the listings through in the way that the computer would

```

0000:          2          LST ON
0000:          3 *****
0000:          4 *
0000:          5 *
0000:          6 *          DEMO TIMER.FP
0000:          7 *          -----
0000:          8 *
0000:          9 *
0000:         10 *          THIS CODE USES THE CLOCK II TO GENERATE INTERRUPTS WITCH
0000:         11 *          ARE COUNTED INTO AN INTEGER VARIABLE IN THE TIME BETWEEN
0000:         12 *          PUSH BUTTONS 0 AND 1 BEING PRESSED.  THE INTERRUPT RATE
0000:         13 *          IS 1024HZ AND THUS THE RESOLUTION IS (APPROXIMATELY) TO
0000:         14 *          THE NEAREST 1/1000TH OF A SECOND.
0000:         15 *
0000:         16 *
0000:         17 *          LIMITATIONS:
0000:         18 *
0000:         19 *          ONLY WORKS WITH APPLESOFT.
0000:         20 *          CLOCK II IS ASSUMED TO BE IN SLOT 4.
0000:         21 *          PRESSING RESET STOPS INTERRUPTS.
0000:         22 *          COUNTS INTO FIRST DECLARED VARIABLE
0000:         23 *          WHICH MUST BE INTEGER.
0000:         24 *
0000:         25 *****
0000:         26 *
0000:         27 *
----- NEXT OBJECT FILE NAME IS DEMO TIMER.FP.OBJO
0300:         28          ORG    $300
03FE:         29          IRQVEC EQU    $03FE          ;INTERRUPT VECTOR
C061:         30          PBO    EQU    $C061          ;PUSH BUTTON 0 - START
C062:         31          PB1    EQU    $C062          ;PUSH BUTTON 1 - STOP
C0C0:         32          SLOT4 EQU    $C0C0          ;CLOCK CARD ADDRESS - SLOT NO. 4
0069:         33          VARTAB EQU    $69           ;APPLESOFT VARIABLE TABLE POINTER
03FD:         34          TEMPY EQU    $03FD          ;TEMP STORE FOR Y REG
03FC:         35          TSTATUS EQU    $03FC        ;TEMP STORE FOR STATUS REG
0300:         36 *
0300:         37 *
0300:78        38          SEI          ;NO INTERRUPTS
0301:AD 56 03   39          LDA    IRQHAND+1 ;SETUP IRQ LINKAGE
0304:8D FE 03   40          STA    IRQVEC
0307:AD 57 03   41          LDA    IRQHAND+2
030A:8D FF 03   42          STA    IRQVEC+1
030D:         43 *
030D:         44 *          SETUP CLOCK FOR INTERRUPTS
030D:         45 *
030D:A9 00     46          LDA    #$00          ;MAKE A SIDE ALL OUTPUTS
030F:8D C1 C0  47          STA    SLOT4+1
0312:A9 FF     48          LDA    #$FF
0314:8D C0 C0  49          STA    SLOT4
0317:A9 04     50          LDA    #$04
0319:8D C1 C0  51          STA    SLOT4+1
031C:A9 00     52          LDA    #$00          ;B SIDE SETUP, LOWER 4 BITS INPUTS
031E:8D C3 C0  53          STA    SLOT4+3          ;          , UPPER 4 BITS OUTPUTS
0321:A9 F0     54          LDA    #$F0
0323:8D C2 C0  55          STA    SLOT4+2
0326:A9 04     56          LDA    #$04
0328:8D C3 C0  57          STA    SLOT4+3
032B:A9 0F     58          LDA    #$0F          ;TAKE ADDRESS LINES HIGH
032D:8D C0 C0  59          STA    SLOT4
0330:A9 20     60          LDA    #$20          ;TAKE READ LINE HIGH
0332:8D C2 C0  61          STA    SLOT4+2
0335:A9 05     62          LDA    #$05          ;INTERRUPT RATE OF 1024HZ
0337:8D C1 C0  63          STA    SLOT4+1          ;ROUTED VIA CA1 OF P1A
033A:         64 *
033A:AD 61 C0  65          START LDA    PBO          ;LOOK FOR START SIGNAL
033D:11 0 FB   66          BPL    START
033F:58        67          CLI          ;START TIMING
0340:         68 *
0340:AD 62 C0  69          STOP  LDA    PB1          ;LOOK FOR STOP SIGNAL
0343:10 FB     70          BPL    STOP
0345:78        71          SEI          ;STOP HANDLING INTERRUPTS
0346:A9 00     72          LDA    #$00          ;STOP PRODUCING INTERRUPTS
0348:8D C1 C0  73          STA    SLOT4+1
034B:8D C3 C0  74          STA    SLOT4+3
034E:8D C0 C0  75          STA    SLOT4
0351:8D C2 C0  76          STA    SLOT4+2
0354:60        77          RTS          ;BACK TO BASIC
0355:         78 *
0355:4C 58 03  79          IRQHAND JMP    IRQ          ;DUMMY JUMP - NOT EXECUTED
0358:         80 *
0358:         81 *          INTERRUPT ROUTINE
0358:         82 *
0358:8C FD 03   83          IRQ    STY    TEMPY
035E:08        84          PHP
035C:68        85          FLA
035D:8D FC 03  86          STA    TSTATUS
0360:D8        87          CLD
0361:A0 03     88          LDY    #$03          ;INCREMENT FIRST DECLARED
0363:B1 69     89          LDA    (VARTAB),Y;BASIC VARIABLE BY 1
0365:18        90          CLC          ;IT IS ASSUMED TO BE OF
0366:69 01     91          ADC    #$01          ;TYPE INTEGER
0368:91 69     92          STA    (VARTAB),Y
036A:88        93          DEY
036B:B1 69     94          LDA    (VARTAB),Y
036D:69 00     95          ADC    #$00
036F:91 69     96          STA    (VARTAB),Y
0371:AD C0 C0  97          LDA    SLOT4          ;RESET 6821 IRQ REGISTERS
0374:AD C2 C0  98          LDA    SLOT4+2
0377:AD FC 03  99          LDA    TSTATUS          ;LOAD 6502 REGISTERS
037A:48        100         PHA
037B:28        101         FLP
037C:AC FD 03  102         LDY    TEMPY
037F:A5 45     103         LDA    $45          ;NOT FORGETTING ACC - SAVED BY MON
0381:40        104         RTI          ;BACK TO LOOK FOR STOP SIGNAL

```

Listing 4

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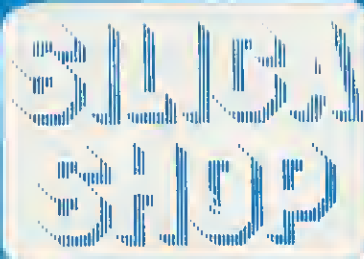
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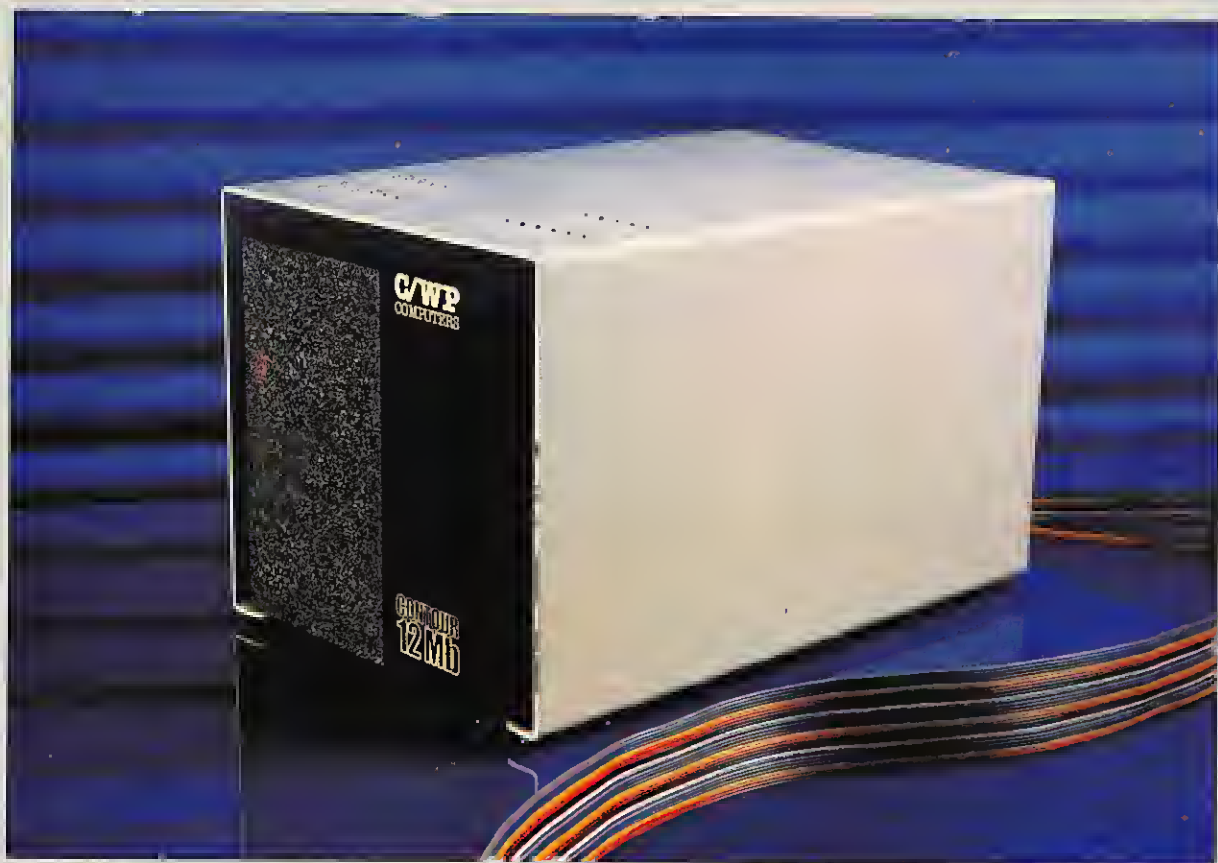


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execute them. Starting with the Basic program in Listing 5, a variable, TI%, is zeroed. This is the actual timing variable and is declared first since its absolute position in Apple memory can easily be established by referencing some page zero locations. Note also that it's an integer variable and values in it are contained in two bytes as opposed to 5-byte floating point numbers. Since we're counting interrupts, we only need an integer variable to store the total, but it does limit the maximum time that can be measured to about 32 seconds — more on this later.

Following the variable declaration, the screen is cleared, a title printed, the machine code routine (Listing 4) is loaded and the instructions are given (lines 10-50, Listing 5). The next line does a CALL to the machine code and attention now shifts to Listing 4.

First, the Apple has to be told the starting address of the routine which handles interrupts ('Setup Irq Linkage'). Then the clock card, which is assumed to be in slot 4, is configured to generate interrupts. The four interrupts which the 5832 generates all emerge together, one on each of the four data lines — see Figure 3 in last month's article. At this point (line 60 in Listing 4), the 5832 is generating interrupts but they are not yet linked to the 6502 interrupt line so the Apple knows nothing about them. Each interrupt rate line (data line) is connected to a 6821 interrupt input (Figure 2) and these are controlled by the control register — see Figure 1. Lines 62 and 63 set up the PIA's CA1 (which is connected to the 5832 data line 0 with the 1024 Hz signal) to pass interrupts through to the 6502 IRQ line. At this point the 6502 receives interrupts but ignores them as an SEI (set interrupt disable status) command was given earlier. The code now looks to see if pushbutton 0 is pressed (active when bit 7 is set) and, when this occurs, interrupts start to be handled (CLI) and a stop signal, on pushbutton 1, is looked for.

When an interrupt occurs, the Apple monitor automatically saves the contents of the 6502 accumulator and jumps through a page 3 address (which we earlier filled) to the routine starting at line 83 in Listing 4. This first stores the Y register and processor status and then increments the timing variable. It does this by using the Applesoft variable table pointer VARTAB, combined with

the knowledge that for an integer variable the data is held in bytes 2 and 3 relative to its entry; see page 137 in the Applesoft manual or *All About Applesoft* (V J Golding, a CALL APPLE magazine extra, 1981). Before finishing the interrupt routine, and apart from reinstating the temporarily-saved registers, the interrupt flag has to be cleared. When the 6821 actually detects an interrupt, a flag is set and, if the control register is suitably configured, the message that the flag is set is passed on to the micro via the interrupt line. The flag has to be reset by the micro referencing the appropriate peripheral register in the 6821, as it won't reset itself; if it isn't reset, the interrupt line will remain permanently low and the 6502 will continually execute the IRQ routine.

Eventually the stop button is pressed, interrupts are stopped and control returned to Basic. At this point, TI% now contains the number of interrupts which occurred at the 1024 Hz rate. The rest is easy: convert and round the number, print it, reset TI% to zero and start again. The CALL-950 is a reference to an Apple monitor routine that clears from the current cursor position to the end of the line.

Before you go crazy trying to test the timer, note the 32 seconds' maximum time between events. This is because the highest value an integer variable can hold is 32767 — 32767/1024 (the interrupt rate) gives 32 seconds. With a little ingenuity this can be doubled to 64 seconds with one extra line of Basic — try it!

Conversion to Microsoft Basic on a 6502 machine shouldn't be too difficult; you just need to check on where VARTAB is held in your machine's page zero memory and that integer variables are stored in the same way as in the Apple. This is something at the core of most Microsoft implementations and will probably not have changed. If you can't discover this information, then a less elegant solution is to count into two of your own declared locations at the beginning or end of the machine code and then PEEK the contents into Basic.

Concurrent processing

If an interrupt structure is properly set up, a micro can apparently handle two or more jobs at the same time. In reality, of course, the micro is only ever doing one job — but to the user it all happens so quickly that the distinction is invisible. For instance, how many

people know that their PET stops working on their problems every 1/60th of a second and goes off to update the time variable?

It would be useful to have the latest time and date continually displayed on the Apple screen, with the variables automatically updated, as on the PET, so that at any point they can be used without the hassle of INPUT TI\$, DA\$, etc. The code to do this, called CLOCK II.OBJO.HIGH, is given in Listing 6 and is quite long as I have endeavoured to keep the system as flexible as possible. Because of space limitations a complete and detailed breakdown cannot be given; the rationale for this being that most readers would prefer to have something relatively sophisticated rather than something simple (admittedly with a full explanation) and pointers to the brilliant things that are possible by adding 'a few extra lines'.

Unfortunately, at this level of software and machine interaction, it is hard to give directions for non-Apple users on how to amend the program. The best advice I can give is for you to look at the overall structure of the code and then work out the specifics for your own machine.

The CLOCK II.OBJO.HIGH code is managed from Applesoft Basic by the use of the '&' command which when encountered causes processing to jump to it via a page 3 vector. Program details and specific control mechanics are given at the beginning of Listing 6.

Before I discuss actual code, most users will want to type it in and play with it. Listing 7 is a short Basic program for testing Clock II Interrupt Handler. The section up to line 40 loads and prepares the system; those after 40 are for experimentation. Note that the machine code is BRUN not BLOADED and that ONERR is used if the clock card can't be found. Also note the setting up of the three interface variables (T%, TI\$ and DA\$) before any other variables are declared.

Lines after 40 demonstrate how to set up for printing and updating time and date to the screen. Line 110 appears somewhat lame; all that happens is that the program sits and waits at the INPUT. By this point in processing, the time and date are periodically (every second) being updated, while the programmer is collecting input from the user. In fact, your options here are many: you can interact with disk files, print results, use graphics etc. The only limitation is that the string variables TI\$ and DA\$ can't be put on the left hand side of an expression. Thus

```
TI$ = TI$ + "AM"
```

is not allowed, but

```
TT$ = TI$ + "AM" is.
```

Although not manipulated in the demonstration (but necessary in the program), print the three variables T%, TI\$ and DA\$ after you have stopped the program. T% will contain the number of seconds since &TI was given, and TI\$ and DA\$ will hold the last time and date.

The machine code in Listing 6 breaks down into three main parts: initialisation, '&' command handling, and interrupt handling.

Initialisation occurs automatically on BRUNning the code and hence is done only once. This includes discovering which slot the clock card occupies (from the EPROM software on it). If

```
5 TI% = 0
10 TEXT : HOME : INVERSE
15 PRINT " DEMONSTRATION TIMER " : NORMAL
20 D$ = CHR$(4) : PRINT D$"BLOAD DEMO TIMER.FP.OBJO"
30 VTAB 4 : PRINT "PRESS GAME PUSH BUTTON 0 TO START"
40 PRINT " AND"
50 PRINT "GAME PUSH BUTTON 1 TO STOP TIMER"
60 CALL 768
70 TI = TI% / 1024
75 TI = ( INT (TI * 1000 + .5) ) / 1000
80 PRINT : PRINT : PRINT "WELL DONE!!!!!"
90 PRINT : PRINT TI;" SECS ELAPSED BETWEEN PUSHES";
92 CALL - 958 : PRINT ""
95 TI% = 0
100 GOTO 30 : REM REPEAT TIMING
```

Listing 5

the card is not found a jump to Basic error handling occurs. The interrupt and & page 3 vectors are then set up before a return is made to Basic.

When an '&' command is given processing automatically goes to ENTRYPT at line 183 in Listing 6. Time and date string variable table entries two and three are told where their data is held and the commands following the '&' are decoded. &E (end) is looked for, then &T and finally &I. If &T is found (printing of time and date), then all variables associated with the screen at that point are saved. Note that output does not have to go to the screen - it goes to the output device current when the '&' command was given. This is so 80-column video cards can be catered for, although this will involve extra coding and saving of 80-column screen variables. Whenever &T or &I are decoded there must be an associated number between 1 and 3 to set the rate of date and time revision. The GETRATE routine checks that a valid number exists and stores it for future reference.

Most of the remaining listing consists of subroutines. SETIRQ sets the clock card to interrupt at the specified rate. PRINT updates the time and date on screen by first saving current screen

variables, then substituting screen variables it saved when the '&' command was given. The time and date are then printed and original screen variables restored. GETIME sets up the clock card and reads the time and date into variable space - note that this does not leave the clock card as an interrupt producer and JSR SETIRQ should normally be executed after JSR GETIME.

The final section is the interrupt handling code (IRQ), which saves all 6502 registers, updates the first integer variable by one and gets/stores the latest time and date. Depending on the contents of the PRINT.TD flag, the screen may also be updated. Finally the interrupt flags in the 6821 PIA are reset and the 6502 registers reinstated.

The Listing 6 machine code has not been optimised for speed or memory conservation as I suspect the savings would not justify the extra work. As an experiment I have benchmarked the system to determine the overhead involved in using this facility. Ordinarily an empty 1 to 50000 FOR...NEXT loop executes in 70.5 seconds. If &I is in operation this becomes 71 seconds and if &TI is used this comes to 72.5 seconds - a maximum increase in execution time of about three percent

which applies across the board regardless of specific coding.

Conclusion

These articles have described a low-cost, high-specification clock/calendar card for the Apple II and similar micros. The emphasis has been placed on providing suitable driving software both as an example and for direct application. Inevitably there are improvements to be made and I hope that users who develop routines and modifications will document them in a future issue...

Suppliers

A partial kit of parts comprising double sided (through hole plated) Apple card, MSM5832, programmed EPROM, Nicad, lever-operated DIL switch, DOS 3.3 (48k) disk and manual is available at £28 + VAT (incl p&p). A full kit of parts for the Apple costs £36 + VAT and a flat rate of £10 will be charged for correcting improperly built full kits. Kits and details are available from Capital Computers, 1 Branch Road, Park Street, St Albans, Herts. Technomatic Ltd will be able to supply the MSM5832 and 3.6 V PCB Nicad.

```

0000:      2      LST 0H
0001:      3 *
0002:      4 *****
0003:      5 *
0004:      6 *
0005:      7 *      CLOCK II INTERRUPT HANDLER
0006:      8 *
0007:      9 *
0008:     10 *      BY B.S.T. HARRIDYI.
0009:     11 *
0010:     12 *
0011:     13 *      THIS CODE ALLOWS THE CLOCK II TO CONTINUOUSLY COMMUNICATE
0012:     14 *      TIME & DATE INFORMATION TO A RUNNING APPLESDFT PROGRAM &
0013:     15 *      IF NECESSARY, THE APPLE TEXT SCREEN OR OTHER OUTPUT DEVICE
0014:     16 *      THE APPLE INTERRUPT SYSTEM IS USED, CONTROL BEING
0015:     17 *      EXERCISED THROUGH THE APPLESDFT COMMAND '&'.
0016:     18 *
0017:     19 *
0018:     20 * USE1
0019:     21 *
0020:     22 * &I1 CAUSES THE CLOCK TO INTERRUPT EVERY SECOND & UPDATE
0021:     23 *      THE FIRST 3 DECLARED VARIABLES:
0022:     24 *
0023:     25 *      THE FIRST VARIABLE MUST BE INTEGER & IS INCREMENTED BY 1
0024:     26 *      FOR EACH INTERRUPT - AT ANY INSTANT THIS VARIABLE HOLDS
0025:     27 *      THE NUMBER OF INTERRUPTS THAT HAVE OCCURRED SINCE
0026:     28 *      THE COMMAND WAS GIVEN.
0027:     29 *
0028:     30 *      THE SECOND & THIRD VARIABLES MUST BE STRINGS & HOLD
0029:     31 *      RESPECTIVELY TIME & DATE.
0030:     32 *      THE 1 CAN BE REPLACED BY EITHER A 2 OR 3 WHERE:
0031:     33 *      2 CAUSES INTERRUPTS EVERY MINUTE &
0032:     34 *      3 ..... HOUR.
0033:     35 *
0034:     36 * &TI AS FOR &I1 (AGAIN 1 CAN BE A 2 OR 3) BUT IN ADDITION
0035:     37 *      THE CURRENT TIME & DATE ARE OUTPUT TO THE TEXT SCREEN
0036:     38 *      & UPDATED EACH INTERRUPT, THE OUTPUT IS LOCATED ON THE
0037:     39 *      SCREEN AT THE CURSOR POSITION CURRENT WHEN THE
0038:     40 *      COMMAND IS GIVEN.
0039:     41 *
0040:     42 * &E CAUSES INTERRUPTS TO BE STOPPED.
0041:     43 *
0042:     44 *
0043:     45 * LIMITATIONS:
0044:     46 *
0045:     47 *      ONLY WORKS WITH APPLESDFT.
0046:     48 *      48K MEMORY NEEDED.
0047:     49 *      DOS MUST RESIDE IN NORMAL POSITION.
0048:     50 *      NOT RELOCATABLE.
0049:     51 *      PRESSING RESET STOPS INTERRUPTS.
0050:     52 *
0051:     53 *****
0052:     54 *
0053:     55 *
-----
NEXT OBJCCT FILE NAME IS CLOCK II.D830
9280:      57      ORG 9280
9280:     58      JMP INIT
9283:     59      SLOT DFB 100      $SLOT NUMBER ( IN FORM 40 FOR 4 ETC.)
9284:     60      RATE DFB 100      $INTERUPT RATE + 30
9285:     61      PRINT.TD DFB 100  $PRINT FLAG -IF NEGATIVE 1=CHN PRINT
9286:     62 *      TIME EACH INTERRUPT.
9286:     63      XPNF DFB 100      $SCREEN X COORD FOR PRINTING OF TIME
9287:     64      YPNF DFB 100      $SCREEN Y COORD BEFORE INTERRUPT
9288:     65      INVPNT DFB 100  $SCREEN OUTPUT TYPE (NORMAL ETC.)
9289:     66      CSWLPNT DW 100  $DEVICE HANDLER FOR PRINTING - NORMALY
9290:     67 *
9290:     68      TEMP1 DW 100      $TEMPORARY STORAGE
9291:     69      TEMP2 DFB 100
9292:     70      XTEMP DFB 100
9293:     71      YTEMP DFB 100  $SCREEN X COORD BEFORE INTERRUPT
9294:     72      TOP DFB 100      $TEXT WINDOW
9295:     73      BOTTM DFB 100
9296:     74      LEFT DFB 100
9297:     75      WIDTH DFB 100
9298:     76      YSAVTEMP DFB 100 $YSAV VALUE BEFORE INTERUPT
9299:     77      TIME DS 108      $TIME STRING
9300:     78      STOP1 DFB 100   $SIRING DELIMETER
9301:     79      DATE DS 108      $DATE STRING
9302:     80      STOP2 DFB 100   $SIRING DELIMETER
9303:     81      STOP3 DFB 100
9304:     82      CSWTEMP EDU TEMP1 $OUTPUT HANDLING ROUTINE BEFORE INTERRUPT
9305:     83      INVTMP EDU TCHP2  $OUTPUT TYPE BEFORE INTERRUPT
9306:     84      ACC EDU 145      $STORAGE OF REGISTERS
9307:     85      XREG EDU 146      $ OVER INTERRUPT
9308:     86      YREG EDU 147
9309:     87      STATUS EDU 148
9310:     88      WNDLFT EDU 120  $TEXT WINDOW LOCATIONS
9311:     89      WNDWTH EDU 121
9312:     90      WNDHT EDU 122
9313:     91      WNDPTH EDU 123
9314:     92      CHOUT EDU 124
9315:     93      VIAR EDU 125
9316:     94 *

```

```

0032:     95      INVELG EDU 132  $HCHN OUTPUT MASK
0033:     96      CH EDU 134      $HCHN OUTPUT HORIZONTAL POSITION
0034:     97      CV EDU 135      $..... VERTICAL .....
0035:     98      PZI EDU 136      $TEMP PAGE ZERO LOCATIONS
0036:     99      PZ2 EDU 137      $ONLY USED DURING INITIALISATION
0037:    100      YSAVI EDU 138  $TEMP STORAGE LOCATION FOR Y REG BY
0038:    101 *      $MONITOR COUTI ROUTINE
0039:    102      TXTPTR EDU 139  $APPLESDFT POINTER TO NEXTI TOKEN DR
0040:    103 *      $ATA ELEMENT
0041:    104      DATA EDU 10995
0042:    105 *
0043:    106      VARTAB EDU 169  $APPLESDFT ROUTINE THAT MOVES TXPTR
0044:    107      HANDLERR EDU 169  $APPLESDFT ERROR HANDLING
0045:    108      ANDVEC EDU 103F5  $JUMPS TO THIS ADDRESS
0046:    109      APPSLDT EDU 13FB  $APPLESDFT GETS SLOT NO. HERE (IF REGO)
0047:    110      IRQVEC EDU 103FE  $INTERRUPT VECTOR
0048:    111      CSWL EDU 136   $ADDRESS OF OUTPUT HANDLING ROUTINE
0049:    112      DSCBWL EDU 1A53  $DDS INTERCEPT ADDRESS OF OUTPUT HANDLING
0050:    113 *      ROUTINE (48K)
0051:    114      BASE EDU 10C0B  $BASE ADDRESS OF I/O SLOTS
0052:    115 *      INITIALISATION
0053:    116 *
0054:    117 *
0055:    118 *
0056:    119 *      FIND CLOCK SLOT NUMBER
0057:    120 *
0058:    121      INIT LDA PZI      $LDKING FOR 78 IN THE FIRST
0059:    122      STA TEMP      $LOCATION & ED IN THE THIRD
0060:    123      LDA PZ2      $LOCATION OF EACH SLOTS
0061:    124      STA TEMP+1    $RDN SPACE
0062:    125      LDA 1000
0063:    126      STA 121
0064:    127      LDA 10C7
0065:    128      STA PZ2
0066:    129      LDX 1007
0067:    130      LDY 1008
0068:    131      LDA (PZI),Y
0069:    132      CMP 1078
0070:    133      CMP 1078
0071:    134      LDY 1002
0072:    135      LDA (PZI),Y
0073:    136      CMP 10E0
0074:    137      BNE NEXT
0075:    138      JMP FOUND
0076:    139      DEX
0077:    140      TXA
0078:    141      BEQ ERROR      $CANT FIND CARD....
0079:    142      LDA PZ2
0080:    143      SEC
0081:    144      SBC 1001
0082:    145      STA PZ2
0083:    146      JMP BACK
0084:    147      ERROR JMP HANDLERR $JUMP YD BASIC ERROR HANDLING
0085:    148      FOUND TXA      $CLOCK FOUND
0086:    149      STA APPSLOT  $STORE SLOT FOR APPLESDFT
0087:    150      ASL A
0088:    151      ASL A
0089:    152      ASL A
0090:    153      ASL A
0091:    154      STA SLOT      $SAVE SLOT INDEX RELATIVE I/O C0B0
0092:    155 *
0093:    156 *      SETUP '&' AND I/O VECTORS
0094:    157 *
0095:    158      LOA IR0AND+1
0096:    159      STA IRQVEC
0097:    160      LDA IR0AND+2
0098:    161      STA IRQVEC+1
0099:    162      LDX 1002
0100:    163      BACK2 LDA ANDADRSS.X
0101:    164      STA ANDVEC.X
0102:    165      DEX
0103:    166      BPL BACK2
0104:    167      LDA TEMP1
0105:    168      STA PZ1
0106:    169      LDA TEMP+1
0107:    170      STA PZ2
0108:    171      RTS
0109:    172 *
0110:    173 *      $INIT COMPLETE - BACK TO BASIC
0111:    174      ANDADRSS JMP ENTRYPT $FOURRY JUMPS - NOT EXECUTED
0112:    175      IR0 IR0
0113:    176      TIMEADRSS JMP TIME
0114:    177      DATEADRSS JMP DATE
0115:    178 *
0116:    179 *
0117:    180 *      MAIN & ENTRY POINT
0118:    181 *
0119:    182 *
0120:    183      ENTRYPT SEI
0121:    184      LDY 1009
0122:    185      LDA 1008
0123:    186      STA (VARTAB),Y $GIVE SECOND & THIRD SIMPLE
0124:    187      LDA 100B      $VARIABLE TABLE ENTRIES (WHICH
0125:    188      STA 100A      $ARE ASSUMED TO BE STRINGS)
0126:    189      LDA 100C      $DETAILS ON TIME & DATE
0127:    190      LDA 100D      $SIRING STORAGE AREA

```

CLOCK IT TO ME

```

9324191 69 189 STA (VARTAB),Y
9326100 190 INY
93271AD 15 93 191 LDA TIMEADRS5+2
9328191 69 192 STA (VARTAB),Y
93291AD 10 193 LDY #10
932E1A9 08 194 LDA #00B
9330191 69 195 STA (VARTAB),Y
9332100 196 LDA DATEADRS5+1
93331AD 17 93 197 STA (VARTAB),Y
9334191 69 198 INY
9335100 199 LDA DATEADRS5+2
933C191 69 201 STA (VARTAB),Y
933E1A9 00 202 LDA #000
9340180 05 92 203 STA PRINT,TD ;STOP ANY PRINTING OF
;TIME & DATE
93411AD 00 204 LDY #000
93411AD 00 205 LDA (TXTPTR),Y
93471D9 45 206 CMP #045 ;"E" -- SEE IF &E
93491D0 14 207 BNE NEXT1 ;IND - SO LOOK FOR ANOTHER COMMAND
934B: 208 %
934B: 209 % END INTERRUPTS
934B: 210 %
93481AE 83 92 211 LDY SLOT
934E1A9 00 212 LDA #000
935019D 81 00 213 STA BASE+1,X
935319D 83 00 214 STA BASE+3,X
935619D 80 00 215 STA BASE+X
935919D 82 00 216 STA BASE+2,X
935C14C A7 93 217 JHP RTS
935F: 218 %
935F: 219 %
935F1C9 54 220 NEXT1 CMP #054 ;"T" -- SEE IF &T
93611D0 29 221 BNE NEXT2 ;IND
9363: 222 %
9363: 223 % PRINTING OF TIME & DATE REQUIRED.
9363: 224 %
9363: 225 %
93631AD 53 AA 225 LDA DOSCSWL ;SAVE CURRENT VALUE OF OUTPUT
936618D 09 92 226 STA CSWLPNT ;ADDRESS, THIS IS NORMALLY
93691AD 54 AA 227 LDA DOSCSWL+1 ;THE APPLE SCREEN (MONITOR)
936C18D 8A 92 228 STA CSWLPNT+1 ;HANDLING CODE & HENCE ALL
936F1A5 32 229 LDA INVFLG ;SCREEN FUNCTION LOCATIONS
937118D 80 92 230 STA INVPT ;ARE SAVED AS WELL.
937418D 06 92 231 LDA CH
93771A5 24 232 STA XPNT
93791A5 25 233 LDA CV
937B18D 07 92 234 STA YPNT
937E1A9 FF 235 LDA #FFF ;SET PRINT FLAG ON
938018D 05 92 236 STA PRINT,TD
9383120 AE 94 237 JSR GETIME ;PUT TIME & DATE ON
9386120 F2 93 238 JSR PRINT ;SCREEN IMMEDIATELY
938914C 90 93 239 JHP GETRATE
938C1C9 49 240 CMP #049 ;"I" -- SEE IF &I -
938E1D0 17 241 BNE RTS ;IND - NO MORE COMMANDS SO BACK TO BASIC
9390: 242 %
9390: 243 % INTERRUPT RATE CHECKING
9390: 244 %
93901A0 01 245 DETRATL LDY #001
93921B1 80 246 LDA (TXTPTR),Y
93941C9 31 247 CMP #31 ;"1" (1 SECOND INTERRUPT RATE)
93971F0 08 248 BEQ DOWN
93991C9 32 249 CMP #32 ;"2" (1 MINUTE .....)
939A1F0 04 250 BEQ DOWN
939C1C9 33 251 CMP #33 ;"3" (1 HOUR .....)
939E1D0 07 252 BNE RTS ;NO MORE OPTIONS SO BACK TO BASIC
93A018D 84 92 253 DOWN
93A3129 AA 93 254 JSR SETIRD
93A615B 255 CLY
93A714C 95 89 256 RTS ;OK START INTERRUPTING
;MOVE TXTPTR & GO BACK TO BASIC
93AA: 257 %
93AA: 258 % SETUP INTERRUPTS
93AA: 259 %
93AA1AE 83 92 260 SETIRD LDY SLOT
93AA1A9 00 261 LDA #000
93AF19D 81 00 262 STA BASE+1,X
93B21A9 FF 263 LDA #FF
93B419D 80 00 264 STA BASE+X
93B71A9 04 265 LDA #004
93B919D 81 00 266 STA BASE+1,X
93BC1A9 00 267 LDA #000
93BE19D 83 00 268 STA BASE+3,X
93C11A9 F0 269 LDA #0F0
93C319D 82 00 270 STA BASE+2,X
93C61A9 04 271 LDA #004
93C819D 83 00 272 STA BASE+3,X
93CB1A9 0F 273 LDA #00F
93CD19D 80 00 274 STA BASE+X
93D01A9 20 275 LDA #020
93D219D 82 00 276 STA BASE+2,X
93D51AD 84 92 277 LDA RATE
93D81C9 31 278 CMP #31 ;"1"
93DA180 06 279 BNE TRY2
93DC1A7 0C 280 LDA #00C
93DE19B 83 00 281 STA BASE+3,X
93E1160 282 RTS
93E21C9 32 283 TRY2 CMP #32 ;"2"
93E41D0 06 284 BNE MUSTBE3
93E61A9 05 285 LDA #005
93E819D 83 00 286 STA BASE+3,X
93EC160 287 RTS
93EC1A9 0C 288 MUSTBE3 LDA #00C
93EE19D 81 00 289 STA BASE+1,X
93F1160 290 RTS
93F2: 291 %
93F2: 292 % PRINT TIME & DATE (NORMALLY TO SCREEN)
93F2: 293 %
93F21A5 20 294 PRINT LDA WNDLFT ;SAVE EXISTING SCREEN
93F418D 92 92 295 STA LEFT ;FUNCTION DATA.
93F71A5 21 296 LDA WNDWTH
93F918D 93 92 297 STA WIDTH
93FC1A5 22 298 LDA WNDTOP
93FE18D 90 92 299 STA TOP
94011A5 23 300 LDA WNDBTM
940318D 91 92 301 STA BOTM
94061A5 35 302 LDA YSAV1
940818D 94 92 303 STA YSAVTEMP
940B1A5 24 304 LDA CV
94101A5 25 305 STA XTEMP
941218D 8F 92 307 LDA CV
94151A5 36 308 LDA CSWL
941718D 88 92 309 STA CSWTEMP
941A1A5 37 310 LDY CSWL+1
941C18D 8C 92 311 STA CSWTEMP+1
941F1A5 32 312 LDA INVFLG
942118D 8D 92 313 STA INVTEMP
9424: 314
94241A9 00 315 LDA #000 ;FILL SCREEN FUNCTION LOCATIONS
9426185 20 316 STA WNDLFT ;WITH TIME & DATE
9428185 22 317 STA WNDTOP ;PRINTING DATA.
942A1A9 28 318 LDA #128
942C185 21 319 STA WNDWTH
942E1A9 18 320 LDA #118
9430185 23 321 STA WNDBTM
94321AD 80 92 322 LDA INVPT
9435185 32 323 STA INVFLG
94371AD 06 92 324 LDA XPNT
943A185 24 325 STA CH
943C1AD 07 92 326 STA YPNT
943F185 25 327 STA CV
94411AD 8F 92 328 LDA CSWLPNT
9444185 36 329 STA CSWL
94461AD 8A 92 330 LDA CSWLPNT+1
9449185 37 331 STA CSWL+1
944B120 22 FC 332 JSR VTAB
944E: 333 %
944E: 334 %
944E1A2 00 335 LDY #000 ;PRINT TIME & DATE

```

```

945018D 95 92 336 AGAIN LDA TIME,X
94531F0 09 337 BEQ DATEPRT
9455118 338 CLC
9456169 80 339 ADC #0B0
9458120 ED FD 340 JSR COUT
945918E 341 INX
945C100 F2 342 BNE AGAIN
945E1E8 343 DATEPRT INX
945F18D 95 92 344 LDA TIME,X
94621F0 0D 345 BEQ FINPRT
94641E6 25 346 INC CV
9466120 22 FC 347 JSR VTAB
94691AD 86 92 348 LDA XPNT
946C185 24 349 STA CH
946E14C 50 94 350 JMP AGAIN
9471: 351 %
9471: 352 %
94711AD 92 92 353 FINPRT LDA LEFT ;PUT BACK ORIGINAL
9474185 20 354 STA WNDLFT ;SCREEN FUNCTION DATA.
94761AD 93 92 355 LDA WIDTH
9479185 21 356 STA WNDWTH
947B1AD 90 92 357 LDA TOP
947E185 22 358 STA WNDTOP
94801AD 91 92 359 LDA BOTM
9483185 23 360 STA WNDBTM
94851AD 8E 92 361 LDA XTEMP
9488185 24 362 STA CH
948A1AD 8F 92 363 LDA YTEMP
948D185 25 364 STA CV
948F1AD 88 92 365 LDA CSWTEMP
9492185 36 366 STA CSWL
94941AD 8C 92 367 LDA CSWTEMP+1
9497185 37 368 STA CSWL+1
94991AD 8D 92 369 LDA INVTEMP
949C185 32 370 STA INVFLG
949E1AD 94 92 371 LDA YSAVTEMP
94A1185 35 372 STA YSAV1
94A3120 22 FC 373 JSR VTAB
94A6160 374
94A7: 375 %
94A7: 376 %
94A7: 377 %
94A719D 80 00 378 FETCH STA BASE+X ;GET SPECIFIC TIME/DATE ELEMENT
94A918D 82 00 379 LDA BASE+2,X
94AB160 380
94AC: 381 %
94AC: 382 %
94AC1AE 83 92 383 GETIME LDY SLOT ;SETUP REGISTERS TO GET
94AB1A9 00 384 LDA #000 ;TIME & DATE
94B319D 81 00 385 STA BASE+1,X
94B61A9 FF 386 LDA #FFF
94B819D 80 00 387 STA BASE+X
94BB1A9 04 388 LDA #004
94BD19D 81 00 389 STA BASE+1,X
94C01A9 00 390 LDA #000
94C219D 83 00 391 STA BASE+3,X
94C51A9 F0 392 LDA #0F0
94C719D 82 00 393 STA BASE+2,X
94CA1A9 04 394 LDA #004
94CC19D 83 00 395 STA BASE+3,X
94CF1A9 10 396 LDA #110
94D119D 82 00 397 STA BASE+2,X
94D41A9 30 398 LDA #030
94D619D 82 00 399 STA BASE+2,X
94D9: 400 %
94D91A9 05 401 LDA #005 ;LOAD & STORE TIME &
94DB120 A7 94 402 JSR FETCH ;DATE REGISTERS
94DE118 403 CLC
94DF1A9 8F 404 ADC #0FB
94E118D 95 92 405 STA TIME
94E41A9 04 406 LDA #004
94E6120 A7 94 407 JSR FETCH
94E918D 96 92 408 STA TIME+1
94EA1A9 2E 409 LDA #02E
94EC18D 97 92 410 STA TIME+2
94ED18D 9A 92 411 STA TIME+5
94F41A9 03 412 LDA #003
94F6120 A7 94 413 JSR FETCH
94F918D 98 92 414 STA TIME+3
94FC1A9 02 415 LDA #002
94FE120 A7 94 416 JSR FETCH
950118D 99 92 417 STA TIME+4
95041A9 01 418 LDA #001
9506120 A7 94 419 JSR FETCH
950918D 98 92 420 STA TIME+6
950C1A9 00 421 LDA #000
950E120 A7 94 422 JSR FETCH
951118D 9C 92 423 STA TIME+7
95141A9 08 424 LDA #008
9516120 A7 94 425 JSR FETCH
9519129 FB 426 AND #0FB
951B18D 9E 92 427 STA DATE
951E1A9 07 428 LDA #007
9520120 A7 94 429 JSR FETCH
952318D 9F 92 430 STA DATE+1
95261A9 2F 431 LDA #02F
952818D 80 92 432 STA DATE+2
952B18D A3 92 433 STA DATE+5
952E1A9 0A 434 LDA #00A
9530120 A7 94 435 JSR FETCH
953318D A1 92 436 STA DATE+3
95361A9 09 437 LDA #009
9538120 A7 94 438 JSR FETCH
953B18D A2 92 439 STA DATE+4
953E1A9 0C 440 LDA #00C
9540120 A7 94 441 JSR FETCH
954318D A4 92 442 STA DATE+6
95461A9 08 443 LDA #008
9548120 A7 94 444 JSR FETCH
954B18D A5 92 445 STA DATE+7
954E: 446 %
954E1A9 10 447 LDA #010 ;DESELECT READING OF TIME
955019D 82 00 448 STA BASE+2,X ;& DATE REGISTERS
95531A9 00 449 LDA #000
955519D 82 00 450 STA BASE+2,X
9558160 451
9559: 452 %
9559: 453 % INTERRUPT HANDLING
9559: 454 %
9559186 46 455 IRQ STX XREG ;SAVE 6502 REGISTERS
955B184 47 456 STY YREG ;(NOTE THAT ACC IS SAVED
;AUTOMATICALLY BY APPLE MONITOR)
955D10B 457 PHP
955E1A8 458 PLA
955F185 459 STA STATUS
956118D 460 CLD
95621A0 03 461 LDY #003 ;INCREMENT FIRST DECLARED
9564181 69 462 LDA (VARTAB),Y ;SIMPLE VARIABLE WHICH
9566118 463 CLC ;IS ASSUMED TO BE INTEGER
9567169 01 464 ADC #001
9569191 69 465 STA (VARTAB),Y
956B18B 466 DEY
956C181 69 467 LDA (VARTAB),Y
956E169 00 468 ADC #000
9570191 69 469 STA (VARTAB),Y
9572120 AE 94 470 JSR GETIME ;UPDATE DIME & DATE STRINGS
95751AD 85 92 471 LDA PRINT,TD ;WANT TO PRINT TIME & DATE ?
9578119 03 472 BPL OUT ;NO
957A120 F2 93 473 JSR PRINT ;GO PRINT TIME & DATE
957B120 AA 93 474 OUT JSR SETIRD ;SETUP IRQ'S AGAIN (WHICH GETIME
;DESTROYED)
9580: 475 %
95801AE 83 92 476 LDY SLOT
958318D 80 00 477 LDA BASE+X
958618D 82 00 478 LDA BASE+2,X
95891A6 46 479 LDY XREG ;LOAD 6502 REGISTERS
958B1A4 47 480 LDY YREG ;
958D1A5 48 481 LDA STATUS ;
9590128 482 PHA ;
9592128 483 PLS ;
95931A5 45 484 LDA ACC ;(INCLUDING ACCUMULATOR)
95931A0 485 RTT ;BACK TO BASIC

```

Listing 6

TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to: 'TJ's Workshop', PCW, 62, Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.

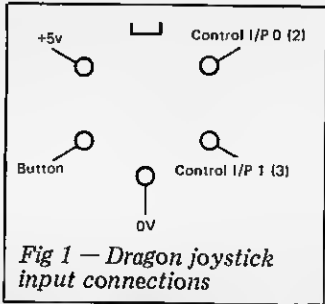
DRAGON SIMPLE JOYSTICK

Serious gamesters who invest in a Dragon 32 will probably want the 'real thing' to plug into the joystick sockets — but for those who just want to dabble or only need control in a single direction it is very easy to knock up your own linear controls. Provided, that is, you know which pins are which on the joystick ports. The Dragon manual doesn't tell you anything as useful as this but it isn't difficult to work out.

Fig 1 shows the pin connections (either joystick). Figure 2 shows how you can implement control in A and

Y directions — if you only want control in one direction simply omit one of the pots.

Rotational or slider controls are not the only possibilities: figure 3 shows a

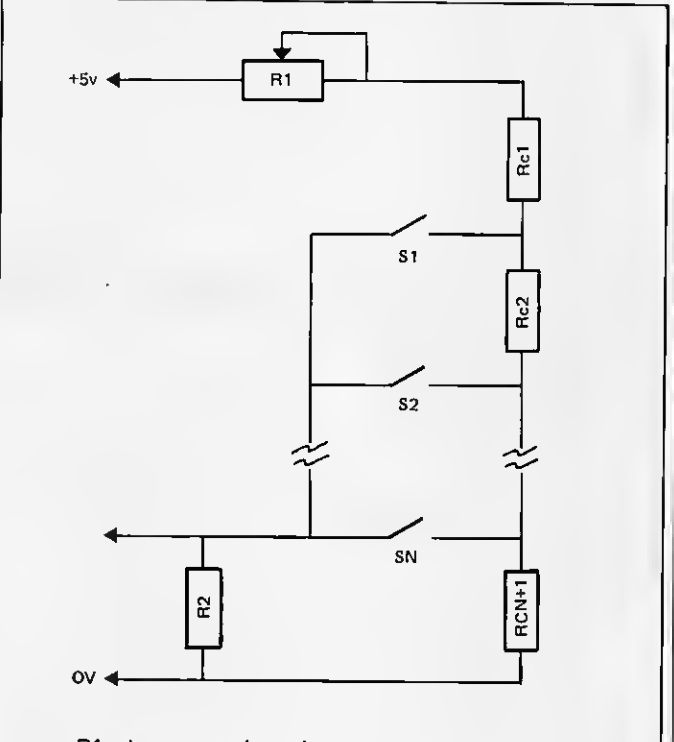
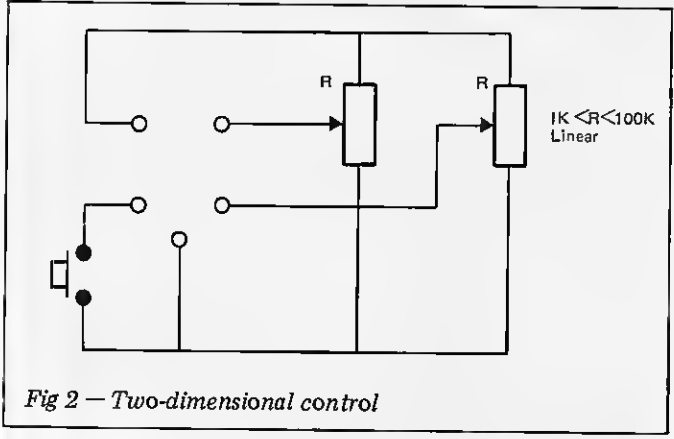


keyboard (musical or otherwise).

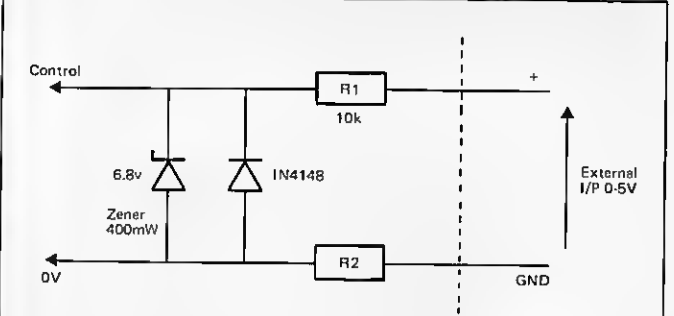
The input impedance of the control inputs is pretty high (>1 Megohm) so if you have any qualms about what

you want to connect to them the circuit of figure 4 should provide adequate insurance.

Steve Champion



R1: choose so no keys give 'borderline values'
 R2 = 100K (gives joystick (x)=0 when no key pressed)
 Rc >= 100 (keeps supply current down if S1 & SN pressed simultaneously)



Note 0V line not to be floated (connected to earth in Dragon PSU). R2 limits earth fault current.

Both resistors V4W or less. If very high voltage accidentally connected to input terminals R1 will expire before the diodes.

UK101 EVEN EASIER MUSIC

Following on from the tip in September's issue, here's an even easier way of producing 'music' on the UK101. Just stick an AM radio on the top and experiment with different lengths and series of FOR...NEXT loops. Try running differing lengths of

loops and tuning the radio to different frequencies, also the position of the radio affects the pick-up.

M J Phillips

4MHz SHARP MZ-80K

This upgrade doubles the speed of the Sharp MZ-80K without affecting the music or internal clock. It supports the standard peripherals (disks and printer) but must be switched out to list to Epson MX-80 or else a 'device not present' error is returned. Normal printing to an MX-80 is okay at 4 MHz. The upgrade occupies no extra room and so should work with the Quantum Micros Hi-Res addition, although I've not tested this. You may also require a reset switch although this is not part of the upgrade and can be fitted without the 4 MHz addition.

Parts for the upgrade:
1 - Z80A CPU
1 - Two Way Switch.
Some fine wire (three colours are helpful).
Solder and a soldering iron.

Parts for a Reset:
1 Make or break push switch.
Some wire, solder and a soldering iron.

The total cost should be around £10.

In upgrading your MZ-80K the first step is to remove the printed circuit board (PCB). This is best done with a pair of pliers. The PCB is held in by six plastic pins which go through the case of the computer. If you squeeze the spring clip part of the pin below the case it will fit through the hole; do this for all six pins. You should then have the PCB loose inside the computer.

There are five socketed cables to the PCB, disconnect all of them, making sure you know which way round they go.

Take the PCB out of the main case of the computer and remove the Z80 CPU. As the chips are totally compatible this should not affect your computer in any way. Be careful the chips are inserted *very* firmly, also make sure that the new chip is the right way round.

The next job is to extract the 4 MHz clock pulse. This comes out at pin 9 of IC9, located at the back left hand corner of the PCB near the 50 way bus. The 2 MHz signal you are currently using comes from pin 8 of IC 9; this must be disconnected by breaking the lacquer on the board and then the track leading to pin 8. Make sure the break is complete. Solder a length of

wire from the disconnected track to the common terminal on your two-way switch. Then solder one wire from the disconnected pin 8 to one to one side of the switch and from pin 9 to the other side of the switch. Your machine will now run at 2 or 4 MHz.

Doubling the clock speed will also shift your music function up an octave; this means that a 2 MHz signal must reach IC18 to correct the music. IC18 is a large socketed chip, the 8253 oscillator. This is best done by breaking the track leading to pin 9 of IC18, the thin track below the socket between two thick tracks, then solder a wire from pin 8 of IC9 to the part of the track leading to pin 9 of IC18. This completes the 4 MHz modification.

Note that tapes will only load at the same speed as that at which they were saved, this means that Basic and all the other tapes you have must be loaded at 2 MHz, so must any tapes you buy. It is possible to uprate the cassette deck so that it will load and save at twice the speed by changing

the white pulley wheel on the motor spindle to one 20mm in diameter. The wheel must be thin enough to fit in above the transformer without rubbing against it or the screws holding the cassette motor in. It must also grip the spindle tightly.

Switching from one clock speed to another often causes the MZ-80K to hang or crash. Fitting a reset switch is very simple. The PCB has a group of six holes drilled in the front right hand side marked 'reset sw', near IC 55. Solder a wire from one side of the make or break switch to the hold furthest in and a wire from the other side of the switch to the hold next to this. At any time pressing the button will return you to monitor SP 100Z. To return to Basic and retain any Basic program, type COTO£124B or for a cold start, which will give you an empty Basic, type COTO£1200.

One word of caution, the 4 MHz upgrade may invalidate the guarantee.

(Will the author of this piece please get in touch!)

TRS-80 EXIT

Re the Sept TJ 'TRS-80 Exit', why put the return address of subroutine B on the stack in the first place?

Try:
100 [FIRST PART OF
SUBROUTINE A]
110 COTO 200
120 [SECOND PART OF
SUBROUTINE A]
130 RETURN

200 [ACTION BY
SUBROUTINE B]
210 IF [CONDITION]
THEN 120
220 RETURN

Unless I've missed the point, this seems a lot easier and has the advantage of not being machine dependent.

You could put the condition into subroutine A - ie, delete line 210 and make 110 IF [CONDITION] THEN 200 ELSE COSUB 200

R Hargrave

MICROPROCESSOR DEBUGGING AID

If you have ever built a micro-computer system, switched on the power, and found that nothing happened, this simple debugging aid may be of interest to you. The problem with troubleshooting micro-processor circuits is the lack of comprehensible signals when probing around the board with an oscilloscope.

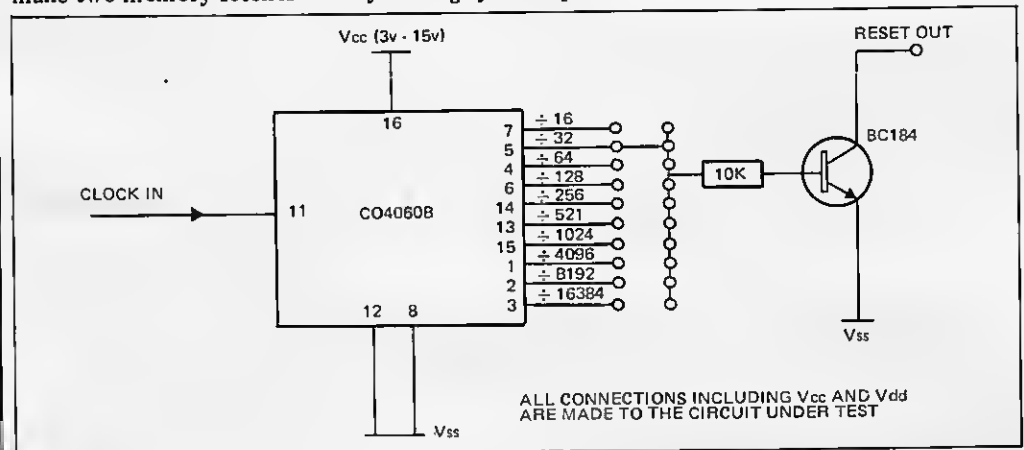
The answer is simple: the operation of any micro-computer system is predictable, following a pulse applied to the reset line of that system. A 6502, for instance, will spend 6 clock cycles sorting itself out internally, then make two memory fetches

from the reset vector at address FFFC and FFFD. Using the above circuit it is possible, when connected to a faulty microprocessor system, to examine the address bus, data bus and control signals for several clock cycles after a reset with a simple oscilloscope. (It will be necessary to trigger the oscilloscope time-base from the reset signal generated by the debugging aid.) The user should be looking for such things as broken printed circuit tracks, solder bridges or even high resistance links between tracks, many of which may be easily detected by tracing system operation

during the first few clock cycles after reset.

The debugging aid consists of a CD4060 CMOS divider integrated circuit which is fed from the clock signal of the micro under test. The output of the CD4060 drives a transistor which in turn may be used to drive the reset line of the microprocessor. This debugging reset signal may be switched to any one of 10 outputs from the CD4060 allowing a choice of the number of clock cycles to be examined.

S.K. Garratt



BEEB ROTATING CIRCLE

Shortage of memory when using graphics on a BBC Computer is a real problem (even sometimes with a Model B). The problem is that the least amount of memory that graphics can use is 10k, leaving only 3k of user memory on a model A. The following program demonstrates the use of the chunky graphics (still 80x75 resolution) of the teletext mode which uses only 1k of memory. As an added bonus, the program also shows how a simple machine code routine can be used to show successive 1k frames on the screen to build up into a movie. The program, which will work on both A and B models, allows nine frames to be shown. With a model B the program can easily be modified to show 25 frames. It draws each frame on the screen (a circle seen from different angles) at the slow plotting speed to begin with and later uses the machine code routine to show the frames quickly with the appearance of the circle rotating in 3-D.

A description of the program follows:
 Line 9: checks to see if a model A or B is being used.
 Line 15: clears the memory to be used for the frames.
 Line 20: compiles the machine code routine.
 Lines 30-76: draws the nine frames at plotting speed and loads the 1k blocks into memory.
 Lines 80-120: uses the machine code to swap the 1k blocks of memory between regions of memory with

higher order address X% and higher order address Y%. In this case X% is always the higher order address of the first byte of the 1k block it is to be swapped with. A% is the lower order address of both blocks and is always 0 in this application. Note that A%, X% and Y% are set

before the machine code routine 'SWOP' is called and are a very useful way of setting up the A, X and Y registers from Basic before entering the machine code.
 Lines 1000-1180: this is the assembly version of the machine code. There is no need to understand how it

works — all it does is swap over each byte in turn in each block.
 Lines 3000-3050: this is the plot routine which pokes the chunky teletext characters into screen memory which is at address SA.
 Lines 3060-3080: this sets up the screen memory so that only the chunky character set is seen. It does this by poking ASCII 150 into the leftmost character spaces down the length of the screen.
 Lines 4000-4050: This is the procedure that draws a circle viewed from angle THETA.

R Jewsbury

BEEB INVISIBLE FUNCTION KEYS

Here's a method of stopping user defined key functions from appearing on the screen when used. This is important — for example with graphics, when you may wish to perform a task such as redefining a logical colour without upsetting your screen display.

The solution is to precede your key definition with control characters which tell the operating system to set the text window to zero, and end the definition with a character to tell the OS to reset the default windows.

For example:
 * KEY 0| \ | @ | @ | @ | @ |
 YOUR DEFN HERE | Z
 NB: | appears as || in teletext mode (?).

J E Shaw

```
BREM A program written by R.Jewsbury showing a fast
rotating circle on screen:
9IF H1MEM>17000 THEN SA=&7C01 ELSE SA=&3C01
10H1MEM=&1AFF:Y%=&1B:HSA=SA DIV 256
15FORI%=&1B00 TO &3F00:Y%=&0:NEXT
20PROCCOMPFILE
30FOR THETA=0 TO (PI-PI/8) STEP PI/8
40PROCCIRCLE
71X%=HSA:A%=&0:CALL SWOP:Y%=Y%+&04
75NEXT
76THETA=PI:PROCCIRCLE
80Y%=&1B
90FORI=1TO8
100X%=HSA:AZ=&0:CALL SWOP:Y%=Y%+&04
105FORI%=&1TO1000:NEXT
110NEXT
120GOTO80
1000DEFFPROCCOMPFILE
100SDIM P% 500
1010I
1020.SWOP STX=&71:STY=&73:STA=&70:STA=&72
103OLDX&4
1040.L1 LDY&255
1050.L2 LDA(&70),Y
1060STA &74
1070LDA(&72),Y
1080STA(&70),Y
1090LDA&74
1100STA(&72),Y L.
1110DEY
1120RNE L2
1130INC &71:INC&73
1140DEX
1150BNEL1
1160RTS
1170J
1180ENDPROC
3000DEFFPROCPL0T(X,Y)
3010Y=74-Y
3020D=&70: !D=&0B040201: !D!4=&4010
3030 P=(X DIV2)+(Y DIV3)*40+SA
3040 ?P=?P OR(D?((X MOD2)+(Y MOD3)*2))
3050ENDPROC
3060DEFFPROCSETUP
3070FORI%=&0TO1000STEP40:?(I%+SA)=150:NEXT
3080ENDPROC
4000DEFFPROCCIRCLE:CLS:PROCSETUP
4010FOR PHI=0TO 2*PI STEP(2*PI/100)
4020 X=SIN(PHI+THETA):Y=COS(PHI)
4030 PROCPL0T(X*36+38,Y*34+38)
4040NEXT
4050ENDPROC
```

Listing 1

£ = #

BEEB PRINTER FIX

Those of you who have a printer with a parallel interface may have tried in vain to connect up your printer to a BBC Computer. For some strange reason Acorn have set the strobe on the parallel interface the wrong way around for the common types of printer (such as the Epson).

The BBC has the strobe set positive and the Epson requires a negative strobe (Acorn originally intended to have a switchable strobe line but have replaced the switch by a transistor). Various methods have been proposed for curing this over-

sight, most of which are quite drastic. The simplest method is to re-invert the strobe in between the BBC machine and the printer. This is done as follows:

- i) Connect the printer cable as normal except that the strobe line at the printer end should not be connected (pin 1).
- ii) Then connect the

strobe from the BBC machine, through a 1k resistor, to the base of an npn transistor (ie. an ZTX 300).

iii) Then connect the collector from the transistor through another 1k resistor to the strobe pin on the connector (pin 1).

iv) The emitter of the transistor is then connected to the ground line (ie, pin 19).

The resistors are used to protect the computer from surges.

The whole correction will easily fit within the connector to the printer and so produces no loose wires.

See Figure 1 for a diagrammatic explanation.

North West London
Computer Club

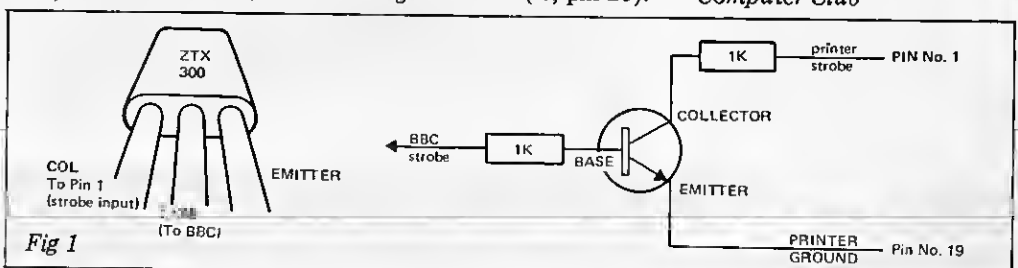


Fig 1

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PET KEYTEST

This machine code routine may be of interest to PET owners dissatisfied with the GET statement and keyboard PEEK (151/515) scan. The problem with these is that they can detect only one key pressed at a time and generally give a bad response speed.

The routine overcomes these problems by scanning the keyboard directly so that each key becomes independent from the rest. It is called through the USR function, returning 1 if the key in the argument is held down, or 0 if not. The argument must be in the range 1-80 inclusive and corresponds to the key code normally found by PEEK (151) or 515 on old ROMs. Figure 1 is a table of these codes in both decimal and hex and also gives the position of each key in the keyboard matrix.

For example, to test if the 5 key was being pressed you may write something like
500 IF USR(34) THEN 1000
instead of
500 IF PEEK(151)=34 THEN 1000

Try adding these lines to the end of the appropriate Basic loader program
500 P = 33267 : PRINT
" [CLS]"

510 D = USR(41) - USR(42)
+ 40*USR(18) - 40*USR(50)
520 POKE P, 32 : P = P + D :
POKE P, 42 : GOTO 510

When the program is RUN an asterisk will appear at the centre of the screen; this can be moved in the usual manner using the keys 2, 4, 6 and 8. This is achieved in line 510 where the four USR functions can generate 1, -1, 40 and -40 (or 0) respectively and the sum is added to the present position P. Pressing more than one key gives a combined effect, so diagonal movement can be achieved without the need for the 1, 3, 7 and 9 keys.

However, pressing certain combinations of keys simultaneously can cause an image to appear elsewhere in the keyboard matrix. The result will be that some keys are activated without being pressed. To avoid problems I would advise you to use E, S, F, C and D as the left player's controls in a two player game instead of the obvious W, A, D, X and S.

The Basic loader program

stores the routine in the second cassette buffer (starting at 826) but it can be re-located elsewhere by changing the value of KE in line 200 and re-running.
David McKeran

```

0 REM      NEW ROM DATA
100 DATA 20,9A,D0,C6,62,A5,62,C9
110 DATA 50,90,03,4C,23,D1,48,4A
120 DATA 4A,4A,49,FF,18,69,0A,A8
130 DATA 68,29,07,85,5E,A9,80,85
140 DATA 5F,A9,00,85,60,85,61,85
150 DATA 62,6A,C6,5E,10,FB,85,5E
160 DATA AE,10,E8,78,8C,10,E8,AD
170 DATA 12,E8,CD,12,E8,D0,F8,8E
180 DATA 10,E8,58,25,5E,F0,03,A9
190 DATA 00,2C,A9,81,85,5E,60
200 KE=826
210 POKE 1,KE AND 255 :POKE 2,KE/256
300 FOR X=0 TO 78 :READ H$:L$=MID$(H$,2)
310 POKE KE+X,16*(ASC(L$)-9*(H$)="A")AND15)
  + (ASC(L$)-9*(L$)="A")AND15)
320 NEXT
READY.
  
```

```

0 REM      OLD ROM DATA
100 DATA 20,A7,D0,C6,B4,A5,B4,C9
110 DATA 50,90,03,4C,30,D1,48,4A
120 DATA 4A,4A,49,FF,18,69,0A,A8
130 DATA 68,29,07,85,B0,A9,80,85
140 DATA B1,A9,00,85,B2,85,B3,85
150 DATA B4,6A,C6,B0,10,FB,85,B0
160 DATA AE,10,E8,78,8C,10,E8,AD
170 DATA 12,E8,CD,12,E8,D0,F8,8E
180 DATA 10,E8,58,25,B0,F0,03,A9
190 DATA 00,2C,A9,81,85,B0,60
READY.
  
```

	7	6	5	4	3	2	1	0
0	ctrl	home	←	(&	%	#	
	73 49	74 4A	75 4B	76 4C	77 4D	78 4E	79 4F	80 50
1	del	ctrl)	\	'	\$	"
	65 41	66 42		68 44	69 45	70 46	71 47	72 48
2	9	7	↑	O	U	T	E	Q
	57 39	58 3A	59 3B	60 3C	61 3D	62 3E	63 3F	64 40
3	/	8		P	I	Y	R	W
	49 31	50 32		52 34	53 35	54 36	55 37	56 38
4	6	4		L	J	G	D	A
	41 29	42 2A		44 2C	45 2D	46 2E	47 2F	48 30
5	*	5		:	K	H	F	S
	33 21	34 22		36 24	37 25	38 26	39 27	40 28
6	3	1	ret	:	M	B	C	Z
	25 19	26 1A	27 1B	28 1C	29 1D	30 1E	31 1F	32 20
7	+	2		?	,	N	V	X
	17 11	18 12		20 14	21 15	22 16	23 17	24 18
8	-	0	shft	>]	@	shft
	9 09	10 0A	11 0B	12 0C		14 0E	15 0F	16 10
9	=	.		stop	<	spc	[rvs
	1 01	2 02		4 04	5 05	6 06	7 07	8 08

Fig 1 Keyboard matrix

SPECTRUM DRAW

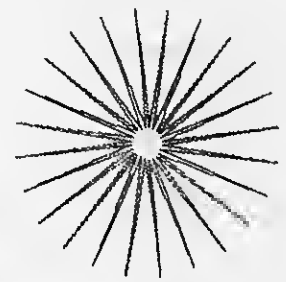
The ZX Spectrum DRAW command is fast but has a massive drawback in that the coordinates drawn are offsets of the last point plotted. However, by peeking two system variables DRAW can be persuaded to go where you want it to go rather than where it wants to go. The bytes are 23677, which holds the X-coordinate of the last point plotted and 23678, which holds the Y-coordinate.

The enclosed program is simply an example, and draws a pretty 24 point star. FN x and FN y peek the system variables and then subtract them from the absolute screen coords produced by the maths in lines 60 and 70. The net result is the offset coords needed to get DRAW to draw to the right place.

Christopher Timson

```

10 DEF FN x(x) =
  x-PEEK 23677
20 DEF FN y(y) =
  y-PEEK 23678
30 PLOT 212,88
40 FOR n=0 TO 360 STEP
  15
50 LET p=n*PI/180
60 DRAW FN x(127+85*COS
  p), FN y (88+85*SIN p)
70 DRAW FN x(127+10*COS
  p), FN y(88+10*SIN p)
80 NEXT n
  
```



ATARI MYSTERY

Atari 400 owners should try out this little problem on their machines:

Firstly, put the computer into any graphics mode (mode 3 is most effective). Then press the 'CLR SET TAB' key (on its own) about 25 times. Type the keys 'GHHGGFFD', press a few keys and watch the result. Quite mysterious eh??!

James Campbell

PCW SUBSET

Alan Tootill presents more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to: Sub Set, PCW, 62 Oxford Street, London W1A 2HG

Z80 text handling

The use of microprocessors for text handling is becoming deservedly popular, and nobody who has used a word processor is going to want to go back to typewriter and Tipp-Ex. The trouble is that text takes a lot of space, and who dares buy disks now, when we are constantly being told how much better and cheaper they will be within the year?

So text compression can be very useful. In October 1981 we had PAC/UNPAC to compress characters in the range 20H to 5FH into 6-bit portions of contiguous memory and restore them to full 8-bit characters. This month's first Datasheet, TOKN, from Bruce Tanner of Malvern, gives another way of saving space with a routine to output text that has been 'tokenised'.

The most commonly used phrases, words or groups of letters are given a single-byte token in the range 80H to FFH, allowing for up to 128 tokens. The tokens are defined in an area of memory, each definition being separated by a zero byte. These definitions are not themselves numbered, as the first is taken to be token 80H, the second 81H and so on. As the routine is recursive, a token may be used in the definition of another token. Thus, in the example given by Bruce, the first token is for

the letters TH, defined in hexadecimal as 54 48 00; the second is for THE, defined as 80 45 00; the third for THEATRE, defined as 81 41 54 52 45 00. The token 80H in the definition of THE represents the letters TH and the token 81H in the definition of THEATRE represents the word THE.

The 'tokenised' text consists of ASCII characters and tokens and must end in a zero byte. Using the three tokens already defined, the text 'THIS THEATRE IS THE THIRD OF THREE THEATRES' would be 'tokenised' into these hexadecimal bytes: 80 49 53 20 82 20 49 53 20 81 20 80 49 52 44 20 4F 46 20 80 52 45 45 20 82 53 00.

A short example like this doesn't illustrate the saving in space that can be achieved but, in a sample PCW review, Bruce counted nearly 100 'the's. If the 'the', including a space on either side, had been held as a single-byte token, space of nearly 400 bytes would have been saved on account of that one word alone.

Try the TOKN routine and then determine the 128 most space-saving tokens for normal English usage. We will be glad to publish any useful ideas on this. Once we have decided on the best tokens, we will need a routine to convert normal text to 'tokenised' text.

Datasheet

```

;= TOKN - outputs 'tokenised' text in full ASCII
;CLASS: 2 (not position independent)
;TIME CRITICAL: No
;DESCRIPTION: Outputs ASCII text, expanding tokens into full text
;ACTION: Outputs all ASCII characters. Recursively expands tokens
; into ASCII
;SUB-DEPENDENCE: subroutine OUTPUT to put the ASCII character
; in the A register to the screen/printer, etc
;INTERFACES: Two areas of memory. The first holds text consisting
; of ASCII characters and tokens, in the range 80H to
; FFH, representing groups of letters, words or phrases.
; This 'tokenised' text is terminated by a zero byte.
; The second holds un-numbered token definitions,
; separated by a zero byte. These definitions may use
; other defined tokens.
;INPUT: HL points to the first character of the 'tokenised' text
; DE points to the first character of the token definitions
;OUTPUT: Normal text starting from current video/printer position
; HL points to the end of 'tokenised' text + 1.
; DE is unchanged
;REGS USED: AF, B, DE, HL
;STACK USE: depends on the extent to which recursion caused
; by token definitions
;LENGTH: 37
;PROCESSOR: Z80
    
```

```

TOKN: LD A,(HL) ; Pick up character 7E
      INC HL ; Point to next 23
      OR A ; End of text? 07
      RET Z ; Z=1 if done 08
      PUSH HL ; Save text position 05
      BIT 7,A ; Token? 0D 7F
      CALL NZ,TKNZ ; Go if yes 04 YY YY
      CALL Z,OUTPUT ; else output character 0C XX XX
      POP HL ; Restore pointer 01
      JR TOKN ; Do it again 18 FD
TKN2: PUSH AF ; Save flags 05
      PUSH DE ; Save token defn pointer 05
      AND 7FH ; Reset bit 7 and test if zero 06 7F
      JR Z,TKN6 ; DE points to token defns 28 08
      LD B,A ; B = token number 47
TKN4: LD A,(DE) ; Search 1A
      INC DE ; for 13
      OR A ; correct 07
      JR NZ,TKN4 ; token 20 FB
      DJNZ TKN4 ; text 10 F9
TKN6: EX DE,HL ; HL = pointer 0B
      POP DE ; Restore pointer 01
      CALL TOKN ; Recurse back again 0D YY YY
      POP AF ; Restore flags 01
      RET ; Return 09
    
```

6502 arithmetic

This latest of Vincent Fojut's improvements to the 6502 arithmetic routines, SDIV46,

gives a saving of 11 bytes and, in the worst case, 1893 T-states. This is brought about largely by the use again of negative indexing at labels SDV2 and SDV3.

Datasheet

```

;= SDIV46 - 32-bit signed integer divide
;CLASS: 2
;TIME CRITICAL? No
;DESCRIPTION: Divides two signed 32-bit integers, giving
; quotient & remainder
;ACTION: Get quotient and remainder signs
; Get absolute values of dividend and divisor
; Clear accumulator
; Check for division by zero
; Shift dividend left into acc
; Subtract divisor from acc
; If acc positive, set result bit
; else add back divisor
; Repeat 32 times
; Negate quotient and remainder if signs demand
;SUB-DEPENDENCE: SNEG46 and ABS4
;INTERFACES: None
;INPUT: Dividend in M4-M7 with most significant byte in M7
; Divisor in M8-MB with most significant byte in MB
;OUTPUT: For valid calculation: carry reset, quotient in M0-M3
; with most significant byte in M3; remainder in M8-MB.
; For division by zero, carry set, arguments unchanged
;REGS USED: A, X, Y, P, M0-MB, NE, NF
;STACK USE: 4
;LENGTH: 106
;T-STATES: minimum 4237, maximum 6505
;PROCESSOR: 6502
SDIV46: LDA M7 ; Remainder sign 45 22
      STA MF ; = dividend sign 85 22
      JSR ABS4 ; Get the 20 XX XX
      STX M0 ; quotient sign 86 22
      SIX M1 ; and absolute 86 22
      STX M2 ; values and clear 86 22
      SIX M3 ; the accumulator 85 22
      LDA M8 ; Check 05 22
      ORA M9 ; for 05 22
      ORA MA ; division 05 22
      ORA MB ; by zero 05 22
      BEQ ERROR ; Jump if so 0D 4F
      LDY I+32 ; Bit count 40 20
      ASL M4 ; Shift 06 22
      ROL M5 ; dividend 26 22
      ROL M6 ; left 26 22
      ROL M7 ; through 26 22
      ROL M0 ; accumulator 26 22
      ROL M1 ; 26 22
      ROL M2 ; 26 22
      ROL M3 ; 26 22
      LDY I-4 ; Using 42 FC
      SEC ; negative indexing 38
SDV2: LDA M0+4,X ; subtract divisor 85 22
      SBC M8+4,X ; from accumulator B 05 22
      STA M0+4,X ; store to accumulator 95 22
      INX ; 0B
      BMT SDV2 ; Continue if X<0 30 F7
      BCS SDV4 ; Skip if acc positive 80 0D
      LDY I-4 ; Using negative indexing 42 FC
SDV3: LDA M0+4,X ; add 85 22
      ADC M8+4,X ; back 75 22
      STA M0+4,X ; divisor 95 22
      INX ; All done? 0B
    
```

BMI SDV3	; Continue if X<0	30 F7
BEQ SDV5	; Repeat	30 02
SDV4: INC M4	; Set results bit	E6 Z2
SDV5: DEY	; Repeat	88
BNE SDV1	; 32 times	00 00
BIT MF	; Check remainder sign	24 Z2
BPL SDV6	; Skip if positive	10 03
JSR SNEG46	; else negate	20 XX XX
SDV6: LDX L+4	; Byte count	A2 04
SDV7: LDA M0-1,X	; Transfer remainder	85 Z2
STA M7,X	; to M8-MB	95 Z2
LDA M3,X	; Transfer quotient	85 Z2
STA M0-1,X	; to accumulator	95 Z2
DEX	;	CA
BNE SDV7	;	00 F5
BIT ME	; Check quotient sign	24 Z2
BPL SDV8	; Skip if positive	10 03
JSR SNEG46	; else negate	20 XX XX
SDV8: CLC	; Clear carry to show OK	18
RTS	; Return	60 XX XX
ERROR: SEC	; Set carry to show error	38
RTS	; Return	

Z80 work for you

Simon Sellick of Pershore has something for you to work on. He has this routine, CVD, which converts any size of binary field to any size of BCD field. It isn't fully tested because he has no decimal-binary conversion for more than 4-byte binary fields yet,

but it does work on these small values. I can't resist mentioning here that the 6502 arithmetic routines, now under improvement, can easily be expanded to cater for larger numbers, provided there is the extra zero page RAM available.

Simon would like to see some improvements to his CVD so that it will handle sign and not be so abominably slow.

Datasheet

```

;= CVD - Multi-precision unsigned binary to BCD conversion
// CLASS: 2
// TIME CRITICAL? No
// DESCRIPTION: Converts an unsigned binary field of any specified
//              length to a binary coded decimal number
// ACTION: Clear BCD field to zeros
//          Move binary field to least significant end of work area
//          Repeat B * length in bytes of binary field
//          shift binary in work area left and into carry
//          double BCD in work area and add carry
//          (if carry still set, overflow error so return)
//          Restore pointer to start of BCD in work area
//          Return with BCD in work area pointed to by HL
// SUBR DEPENDENCE: None
// INTERFACES: A work area in RAM long enough for the BCD result
//              + the binary number
// INPUT: HL points to the most significant byte of binary to be
//        converted (MSB in low address)
//        DE points to a work area long enough for the bcd result
//        + the binary number
//        B = number of bytes needed for the BCD result (half the
//        number of digits wanted)
//        C = length in bytes of the binary field
// OUTPUT: Cy set if binary too big to fit the specified BCD field
//         else HL points to the BCD result in the work area
//         B = D = Cy = 0
// REGS USED: AF, HL, BC, DE
// STACK USE: 2
// LENGTH: 43
// PROCESSOR: Z80
CVD:   XOR A           ; B = no BCD bytes; C = no of AF
       PUSH BC        ; binary bytes CS
CVDL1: LD (DE),A       ; binary bytes 12
       INC DE         ; 13
       DJNZ CVDL1    ; Clear BCD accumulator 10 FC
       LDIR          ; Set up binary work area ED B0
       EX DE,HL      ; EB
       DEC HL        ; Set HL to binary 1s byte 2B
       POP BC        ; C1
       LD A,C        ; A = binary length 79
       ADD A,A       ; 87
       ADD A,A       ; 87
       ADD A,A       ; 87
       LD D,A        ; D = no of bits to shift 57
       LD E,B        ; E = no of BCD bytes to 58
CVDL2: LD B,C        ; work on 41
       PUSH HL       ; E5
CVDL3: RL (HL)      ; Double the binary, CB 16
       DEC HL        ; 2B
       DJNZ CVDL3   ; catch the 0/F in carry 10 FB
       LD B,E        ; 43
CVDL4: LD A,(HL)    ; 7E
       ADC A,A       ; 8F
       DAA          ; 27
       LD (HL),A    ; 77
       DEC HL       ; Double BCD and add binary 28
       DJNZ CVDL4  ; 0/F; BCD 0/F in carry 10 F9
       POP HL      ; Restore pointer to binary. E1
       RET C        ; 1s byte. Ret if 0/F error D8
       DEC D        ; Repeat until all 0B
       JR NZ,CVDL2 ; bits shifted 20 EC
       SBC HL,DE    ; D=0. Move HL to BCD 1s byte ED 52
       SBC HL,BC    ; B=0. Move HL to BCD ms ED 42
       INC HL       ; byte -1, 23
       RET         ; with Cy=B=D=0

```

6502 interrupt handler & relative call

I suspect this is going to cause some trouble — but here

goes. Last month we had Dave Barrow's BOX and COX to give a block exchange of page zero and stacked registers. Here, this is used in another routine from Dave — BIRCH, a Break, Interrupt and Relative Call handler.

With the 6502 processor,

either an interrupt request (IRQ) or the execution of a BRK (break) instruction in a program results in processing continuing from the address held in the interrupt vector at FFFE (low) — FFFF (high).

In BIRCH, if the break flag is unset (because no BRK instruction has been encountered in the program) an interrupt from an external device must have occurred and the routine jumps to your interrupt handling software (not provided) at IRQVEC. If the break flag is set and the byte following the BRK instruction in the program is zero, control is transferred to your break

routine (also not provided) at BRKVEC, with essential register values stored in page zero memory. If the break flag is set and the byte following the BRK instruction in program is non-zero, BIRCH provides a Relative Call to an address formed by adding the single-byte displacement at BRK+1 to the address of BRK+2.

The single-byte displacement can be turned into a two-byte displacement by replacing the 21-byte section (LDY ME ... ADC MF) by the section in Figure 1. This is only two bytes longer.

```

LDY FF           ; get lo-byte displacement
DEC MF          ;
LDA (ME),Y      ;
INC MF          ; without altering Return Address
ADC ME          ; add lo-byte Return Address
TAY            ; store in Y
LDA (ME,X)      ; get hi-byte displacement
ADC MF          ; add hi-byte Return Address
CMP MF         ; test for 0 displacement
BNE CEDAR      ;
CPY ME         ;
BEQ BRIAR      ; Break if 0, else Relative Call

```

Fig 1

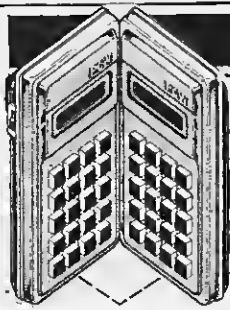
Datasheet

```

;= BIRCH - Break, Interrupt and Relative Call Handler
// CLASS: 1
// TIME CRITICAL? No
// DESCRIPTION: Utilises BRK instruction to provide a 2 byte'
//              Relative Call to address formed by adding dis-
//              placement in BRK+1 to address of BRK+2.
//              If (BRK+1)=0 then exits to a vectored Break
//              routine with essential register values stored
//              in page zero memory.
// ACTION: See comments
// SUBR DEPENDENCE: BOX - push registers, exchange M8-r with
//                  8 bytes stack. COX - inverse of BOX
//                  Vectored Break and Interrupt routines are
//                  necessary for use of those functions. Break
//                  routine should end JSR COX; RTS.
// INTERFACES: None
// INPUT: IRQ or displacement in BRK+1 (disp = 0 for Break function)
// OUTPUT: B reset on entry; exit to vectored Interrupt routine with
//         PC,P,A on stack. B set on entry:
//         Disp = 0: exit to vectored Break routine with M8-F on
//         stack; PC (return address -1) in ME,F; entry 'SP in MD;
//         present SP in MC; Y,X,A,P in M8-B (B reset in stored P);
//         A=X=0: Cy, D reset; B,1 set
//         Disp<>0: exit to displaced subroutine, register and page;
//         zero values as immediately before BRK instruction; Return
//         Address -1 on top of stack for RTS return.
// REGS USED: None
// STACK USE: (including Return Address on stack at entry)
//             IRQ: 5; Break: 10 (including JSR BOX);
//             Relative Call: 10 (including JSR BOX, JPH COX)
// LENGTH: 55
// TIME STATES: IRQ: 19; Break: 364; Relative Call: 673 fwd, 674 bwd
//              add 4 to B and RC times if disp address is $XXXX
// PROCESSOR: 6502
BIRCH PHA           ; Save A 48
       PHP          ; Get flags 0B
       PLA          ; in A and 68
       AND #$10    ; test Break flag 29 10
       BNE OSIER   ; Skip if set D0 03
OSIER JSR BOX+2    ; else Interrupt, go Int handling r'tine 6C XX XX
       CLD         ; Push, exch st,p zero keeping B and I 20 XX XX
       STY MD      ; status for later binary addition 0B
       STY MB      ; Ret Add + disp SP at BRK 84 Z2
       AND #$EF    ; Clear Break flag in stored flags A5 Z2
       STA MB      ; 29 EF
       LDY ME      ; 85 Z2
       BNE ALDER   ; Decrement stored Return Address to 00 02
       DEC MF      ; point at displacement and 06 Z2
       DEC ME      ; for RTS return C6 Z2
ALDER DEC ME       ; DEC ME C6 Z2
       LDA (ME,X)  ; Get displacement A1 Z2
       BPL SAVIN  ; skip if fwd disp and X=Sign 10 01
       DEX        ; else X=Sign CA
SAVIN BEQ BRIAR   ; Skip if diso = D for Break F0 DC
       ADC ME      ; Add lo-byte return address and 65 Z2
       TAY        ; store temporarily in Y A8
       TXA        ; Move computed hi-byte displacement 8A
       ADC MF      ; into A and add hi-byte return address 65 Z2
CEDAR PHA         ; Answer is displaced subr address-1 48
       TYA        ; Push for RTS return to displaced 98
       PHA        ; routine from COX 48
ALDER JMP COX     ; Restore regs M8-F; return to subr 4C XX XX
BRIAR TSX        ; Get present SP BA
       STX MC     ; in MC 86 Z2
       JMP (BRKVEC) ; Go Break r'tine with info in page zero 6C XX XX

```

USING CALCULATORS



In the panic leading up to the PCW Show I forgot to mention last month that Calculator Corner was three years old this October. In those three years the face of the programmable calculator has changed beyond recognition. The dividing line between hand-held computer and the programmable calculator is now very thin indeed, and this column has reflected the fact by reviewing products of both sorts.

Looking back over those three years of columns I am struck by the relative lack of utility programs contained in them. This has been a deliberate policy; I have always favoured product reviews or general programming tips over applications because they are likely to be of use to a broader section of readers.

This month I am relaxing that policy to publish two applications; a text processor for the HP-41C by Petter Hesselberg of Trondheim, Norway, and a solar navigation program for the Casio fx702p by John Harvey of Teddington — both illustrate the wide scope of applications which are amenable to hand-held calculator solution.
Dick Pountain

A text editor for the HP-41C

01	<input checked="" type="checkbox"/>	LBL "TEXT"	35	GTO "SHOW"
02		FIX 0	36	<input checked="" type="checkbox"/> LBL "NEW"
03		CF 29	37	XEO "TST"
04		"NO OF REGS?"	38	STO 01
05		PROMPT	39	2
06		2	40	+
07		-	41	CLA
08		2	42	AON
09		/	43	STOP
10		INT	44	AOFF
11		STO 00	45	ASTO IND X
12		1	46	ASHF
13	<input checked="" type="checkbox"/>	LBL "SHOW"	47	1
14		XEO "TST"	48	+
15		STO 01	49	ASTO IND X
16		2	50	RCL 01
17		+	51	1
18		CLA	52	+
19		ARCL IND X	53	GTO "SHOW"
20		1	54	<input checked="" type="checkbox"/> LBL "TST"
21		+	55	RCL 00
22		ARCL IND X	56	X<>Y
23		RCL 01	57	X<>Y?
24		PROMPT	58	GTO A
25	<input checked="" type="checkbox"/>	LBL "UP"	59	X<>Y
26		1	60	TONE 0
27		+	61	RTN
28		GTO "SHOW"	62	LBL A
29	<input checked="" type="checkbox"/>	LBL "DOWN"	63	X<>?
30		1	64	RTN
31		-	65	TONE 0
32		GTO "SHOW"	66	1
33		LBL "LINENO"	67	RTN
34		VIEW X	68	END

Listing 1 A text editor for the HP-41C

The model 41C computer/calculator from Hewlett-Packard is not the hardware people usually have in mind when thinking of text processing and such. Nevertheless, it is very easy to construct a text editor for the HP-41C. What's more, it can even be somewhat useful, at least in a sort of notebook application. The following deals with one possible design for such a text editor.

As the alpha register in the HP can hold up to 24 characters, it is tempting

to use lines of 24 characters each. This, however, results in a lot of horizontal scrolling. Not only can't you see the whole line at one time, but it is also rather slow. So I decided to stick to what the display can hold — namely 12 characters per line. Thus, we need two data registers to hold one line of text, and 2n registers to hold n lines of text.

In addition, we need one register (R0) to hold the highest allowed line number, and one (R1) to hold intermediate results. This means that text line n is stored left part in register 2n, right part in register 2n+1. To have n lines of text, one needs 2n+2 or more free registers. The X-register is used as a pointer to the current line.

What functions are needed for such a notebook text editor? Obviously forward and backward line stepping, as well as the ability to create new lines. In addition, one should be able to jump directly to any line, and to find out the current line number.

It is tempting to endow the program with other and fancier attributes. One must, however, make trade-offs both on size and computing time, and the program functions surprisingly well as it stands. I added one function, but it is used only by the program and not directly by the user. It's called "TST", and checks whether you're attempting to access some non-existent line.

The first 12 lines are for initialisation only. The action starts at the segment labeled 'SHOW', which does just that. The number in the X-register is taken as the current line number; the function "TST" is then used to test its validity. If it is lower or higher than allowed, a TONE is sounded, and the line number is set to the lowest or the highest allowed line number respectively. The relevant addresses are then computed from the line number, and their contents are fetched to the alpha register. In line 24 a PROMPT is executed, to allow one to view the line. This is the program's home base, so to speak; the control flow always ends up here.

The functions 'UP' and 'DOWN' are more or less self-explanatory; they step one line forwards and backwards. 'LINENO' is even simpler: It allows you

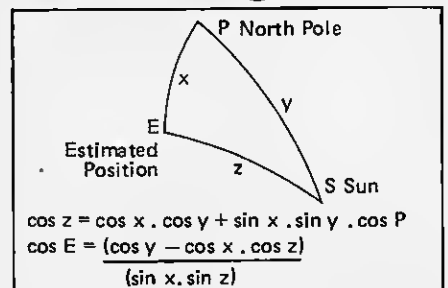
to see the current line number for the time it takes to execute 'SHOW' once.

'NEW' is used to input new text. The current line is cleared, and the HP awaits new text in alpha mode. R/S stores the new line in the proper registers, then positions the line counter to the next line. This is because one often inputs several lines at a time, but this can easily be changed by deleting lines 51 and 52.

Global labels have been used throughout the program as inbuilt comments. Changing these to local labels will result in a smaller and speedier program.

Some additional functions can easily be incorporated into this program, while others will be more difficult, or demand unreasonable amounts of computing time. There is, however, one other way, much faster and easier than my own approach: simply use the built-in program editor, for almost painless insertion, deletion, and variable line lengths. The disadvantage is that you get your display cluttered with line numbers whether you want them or not, and that display is quite small enough as it is. And besides, what fun would that be?
Petter Hesselberg

Marine navigation



This program for the Casio fx702p programmable calculator computes the altitude and bearing of the sun. This is used to find the 'Position Line' of the observer in marine navigation. Hitherto the computation of the spherical triangle which is involved has been done using 4 or 5 figure tables of cosines, sines and logs which is both tedious and error-prone.

It is assumed that the observer has taken a Sun sighting, using a sextant. He knows the time of the observation correctly within two or three seconds, and has found the sun's GHA (Greenwich Hour Angle) and declination from one of the nautical almanacs.

- Input:
- F Sun's GHA
 - D Sun's Declination
 - I Observer's estimated Longitude.
 - J Observer's estimated Latitude.
- The program computes and displays:
- W Computed altitude of Sun above horizon (no corrections)
 - T Bearing (true) of Sun.

- Three corrections are usually made:
1. Semi-diameter.
 2. Height of eye.
 3. Refraction.

John Harvey

END

LIST ALL	140 I=COS P
*** PRG LIST	160 K=COS X
	170 L=SIN X
	180 M=COS Y
VAR: 26 PRG: 1688	190 N=SIN Y
	200 C=K*M+L*N*1
PO: 54 STEPS	210 Z=ACS C
5 MODE 7	220 W=90-Z
10 WAIT 10	224 PRT "ALTITUDE (
20 PRT "G.H.A.=?"	MIDDLE.NO CORR.N.."
30 INP F	225 DMS W
40 PRT "DECL.=?"	226 STOP
50 INP D	230 O=SIN Z
60 GOTO #3	240 T=(K-C*M)/(O*N)
	250 T=ACS T
P3: 281 STEPS	260 IF P>0; T=360-T
10 WAIT 10	270 PRT "BEARING
20 PRT "EST.LONG.=?"	(TRUE)"
30 INP	280 DMS T
40 PRT "EST. LAT.=?"	290 STDP
50 INP J	300 GOTO 20
110 P=F-1	
115 IF P>180;P=P-360	
120 X=90-D	
130 Y=90-J	

Listing 2 Marine navigation on the fx702p

PROTECTIVE MEASURES

Gail Counsell examines the thorny problem of copyrighting software

These days no self-respecting programmer can be without his version of Pac-Man.

But can you copy someone else's idea for a game or a subroutine — and if you do are you risking finding the heavy hand of a lawyer descending on you?

The problem with the law as it stands is that nothing in it deals specifically with computer programs. That means the existing law has to be interpreted by the courts to see if it can apply.

Very few cases have actually dealt with the legal problems surrounding software. Things are changing fast, however, thanks to the arrival of the micro and a potentially enormous games market — Pac-Man coined over one billion dollars in its first year. Now for the bigger companies at least it is becoming worth the effort and expense of going to court — Atari, for example, seems to be actively considering suing Commodore and Bug Byte over what it claims are Pac-Man imitations.

Unfortunately, it will be some years yet before decisions are reached on cases just now being brought. Until then the position will be uncertain and programmers will have to make do with educated guesswork.

There are three possible ways in which the law could be used to protect software — patent, copyright and contract. Patent seems to have been ruled out for the time being because in 1977 a new Patent Act was passed which specifically said you couldn't patent a computer program. Some people think that in a very few cases it may still be possible to patent software. But the program would have to have some sort of industrial application and so it is very unlikely this could help the average micro user. In any case getting a patent is expensive — it costs about £2,000.

The best hope — or biggest risk depending on how you look at it — is with copyright. Its big advantage is that it is an automatic form of protection. If the program comes within all the requirements of the Copyright Act it will be covered without any other steps needing to be taken.

The snag is that it is not yet established that a computer program *can* be copyright.

The act says that several different sorts of works can be copyright. Among them are literary and artistic works, sound recordings, films and broadcasts. A judgement is expected in about 18 months' time on whether a computer program fits into one or more of these classes. It seems likely that the courts will decide that it is a literary work. Such literary works have, however, to be made by some form of 'written notation'. This can be by hand or printing or by some other 'similar process'.

Be careful though — programs on magnetic tape are the least likely to fall within this definition. So it is important always to make a habit of writing out your program by hand first. At the very least you should keep a printout of it. This may make it much easier to prove that it is covered by copyright.

'How are you to know if your program is original or not?'

A literary work need not be art! Even telegram messages in code and railway timetables have been covered.

What is necessary, though — and this is the important part — is that the work be original and made as a result of skill and labour on your part.

So how are you to know if your program is original or not?

In the first place ideas themselves are not copyright. It is the way those ideas are set down that is protected. If you arrive, by coincidence, at the same program as someone else you are not doing anything wrong. You may have a lot of difficulty in proving you had the idea independently, though, if your version was the later one!

If someone translates a poem from French to English he breaches the copyright of the person who originally wrote the poem in French. So it seems likely that translating a program from, for example, Basic to Pascal would not be allowed.

'Programmers will have to make do with educated guesswork'

In some ways the most far-reaching and disturbing aspect of the law as it stands is that translating dialects — such as Microsoft Basic to Sinclair Basic — would probably be a breach of copyright on the same principle.

Because a video game consists in part of a moving 'picture' it is also possible that it may be protected under one of the other classes — possibly as a film. In any case drawings or plans made to work out the game will be copyright as artistic works.

If when writing your program you make any notes or sketches they should be kept. You may be able to argue that someone who copies your game is breaching your copyright in those sketches.

The other side of the coin is that you must remember that slightly altering games like Pac-Man or Space Invaders may well breach copyrights

in the pictures or drawings that may have been made for those games. You breach someone's copyright whenever you copy a substantial part of their work. Whether this would cover using someone's subroutine is a difficult question. It probably depends more on how important it is to the overall game than on how long it is.

If the program, or the drawing for it, is copyright that gives the owner of the copyright certain powers.

He can stop copies being made; any copies made without his permission will belong to him and he can go to court to get back any profits that have been made as a result of any breach.

In the end, though, all these rights can only be enforced through a court action. And they often take a long time to come to a conclusion.

This is the reason why the courts can make all sorts of temporary orders — usually these are called injunctions — to maintain the status quo.

Before an order of this kind is granted it is necessary to promise to compensate for any loss suffered, if, in the end, your argument fails. It's also an expensive business — getting it may cost as much as £3,000 and even if you win you can only get about two-thirds of your costs back.

But the orders that can be made can be very wide-ranging. They can, for example, order production of disputed copies to stop at once, allow the copyright owner to go to the defendant's premises to look for copies and take them away and even require him to produce the names and addresses of people he has sold copies to.

One final practical method of protection may be by contract. You can make it a condition of sale that no part of the image or the program is to be reproduced. Provide the program in a sealed wrapper and have a clearly visible label stating that by opening the packet the purchaser agrees to accept the condition.

For this method to work, the purchaser must be able to see the condition before he buys. Also this only works against the actual purchaser and no one else. But it doesn't depend on the uncertainties of copyright.

So if you are worried about someone ripping off your programs take the following precautions. Keep paper copies of all your programs, keep drawings of all your games, and always remember many people may be frightened off simply by a stiff warning letter.

And a word to illicit copiers. It may not in practice matter that much if you adapt or borrow another program for your own use. But if you aim to make your fortune out of it then you may well find yourself in the law courts. And what will happen then is anyone's guess.



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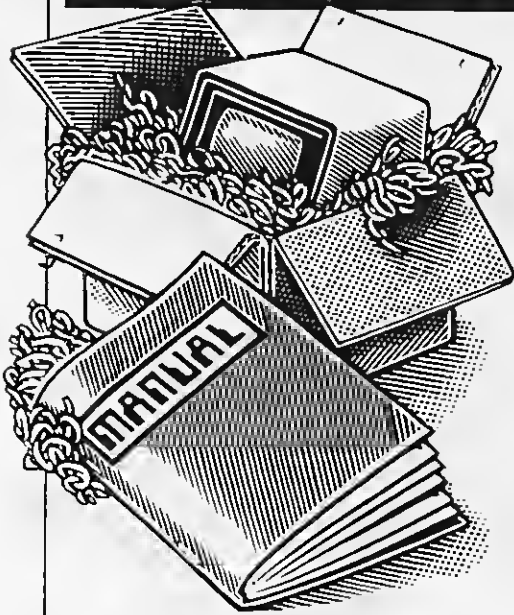
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NEWCOMERS START HERE



This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, PCW will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, processing it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or bits as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex**. The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary

or hex (machine code programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the programming language is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To run such a program the computer uses an **interpreter** which picks up each English-type instruction, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit (**CPU**), a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board (**PCB**) or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultraviolet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer

won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

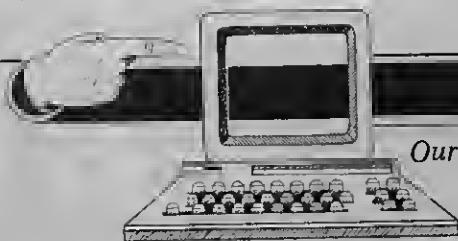
Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit (**VDU**), which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record (**hard copy**) of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output (**I/O**) requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone system allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.



IN STORE

Our bi-monthly guide to microcomputer systems. Updates should be sent to:
Dick Olney, PCW, 62 Oxford Street, London W1A 2HG

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 24 (£3195)	AI 09237-70578(19)	64k RAM; Z80A: dual 5 1/4" F/D (600k); 12", 24 x 80 VDU; 2 x RS232 ports; 3 x P/P	CP/M; MP/M Basic; Cobol; Fortran; Pascal.	ABC 26 with dual 8" F/D (2.3Mb) £4500. Options: 10Mb H/D £4000. BT 4/81 (S).
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM; Z80A: C: 12", 16 x 40 b&w VDU; 4680 bus; 1EE 488; RS232 port.	DOS Basic (16k ROM); Fortran; Pascal; A; Multi user Basic.	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5 1/4" F/D (320k) £895; dual 8" F/D (2Mb). BT 1/80. (1)
ACT Sirius 1 (£2349)	ACT 021 454 8585 (50)	128-512k RAM; 8088; dual 5 1/4" F/D (1.2M); 12", 25 x 80 VDU; 2 x RS232 ports; 2 x P/P	CP/M 86; U: Basic; Cobol; Fortran; Pascal	High res graphics. Options: 10 Mb H/D; dual 5 1/4" F/D (2.4 M) BT 2/82.(S)
Adler Alphantronic (£1895)	Adler 01-250 1717	48-64k RAM; 8085A: dual 5 1/4" F/D (320k); 12", 24 x 80 VDU; S/P; P/P	CP/M; Basic; CBasic; Fortran; Cobol	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Alpha Micro (£5650)	Alpha Micro (UK) Ltd: 01-250 1616 (TBA)	64k — 1 Mb RAM; 16 bit; dual 8" F/D 2.4 Mb); 6 S/P.	Multi-user OS; Basic; M/A; Pascal; U; Fortran; Cobol	Modular. Expands to 1200 Mb, 24 terminals or multiprocessor system. (E)
Altos ACS 800-2 (£2995)	logitek: 02572 66803 (33)	64k RAM; Z80A; dual 8" F/D (1 Mb); 2 x RS232 ports; 2 P/P.	CP/M; Basic; CBasic; Cobol.	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 8000-10 (£6675)	As above.	280k RAM; Z80A: single 8" F/D (500k); 10 Mb H/D; 5 x RS232 ports; P/P; network RS422 port; DMA	CP/M; MP/M; Basic; Cobol; Fortran; APL; Pascal.	Multi-user/multi tasking. Up to 4 users. Options: 10Mb; mag tape backup (S + H).
APL Signet (£1750 or £130pm)	Micro APL: 01-834 2687	64k RAM; Z80A; dual 5 1/4" F/D (380k); 2 x RS232 ports.	CP/M; APL; Basic; U; Fortran; Cobol; Algol; Forth	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Apple (UK) 0442 48151 (200+)	16-48k, RAM; 6502; 8 I/O slots.	OS; Basic; Pascal; Fortran; Cobol; Pilot	280 x 192 high resolution graphics; Option: single 5 1/4" F/D (116k) £349.
Apple II (£2496)	As above	128-256k RAM; 6502B; dual 5 1/4" F/D (286k); 12", 24x80 VDU; RS232 port; P/P.	SOS; Basic; Pascal;	Options: single 5 1/4" F/D (143k) £384; 5Mb H/D £2256. (E) BT 5/82
Atari 400 (£199 inc VAT)	Atari UK: 01-900 0511 (40)	16k RAM; 6502; C int; cartridge slot; 12 x 20 TV int; RS232C port; touchpad k/b; Opt: C £40	OS (10k ROM); Basic (8k ROM); Pilot; Forth.	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets. BT 10/80. (1/B).
Atari 800 (£499 inc VAT)	As above.	16-48k RAM; 6502; C int; 4 x cartridge slots; 12 x 20 TV int; RS232C port. Opt: single 5 1/4" F/D (90k) £345; 16k RAM £65.	As above.	As above. Software & RAM on cartridge modules. Up to 4 disk drives. BT 10/80. (1/B).
Athena 8285 (£5694)	Butel-Comeo Ltd: 0703 39890 or 01-202 0262 (TBA)	64k RAM; 8085A: dual 5 1/4" F/D (644k); 12" 25 x 80 VDU; 150 cps printer; RS232 port.	AMOS; T/E; Basic; Cobol; Fortran; Pascal; APL; M/A.	Extended ASCII K/B with numeric pad; graphics. Options: dual 8" F/D (2 Mb); up to 1200 Mb H/D.
Atom (£120)	Acorn: 0223 312772 (35)	2-12k RAM; 8-16k ROM 6502; Full K/B; C int; TV int; 20 I/O lines; 1 P/P. Options: 80 col printer £199, Prestel adaptor £120.	Basic in 8k ROM; A Cass O/S.	High resolution graphics on bigger model: colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC. BT 7/80(B).
Attache 201 (£8000)	COLT 01-572 3784 (10)	64k RAM; Z80; dual 8" F/D (2.4 Mb); 12" 24 x 80 VDU; 180 cps printer.	Basic; Fortran; Cobol.	Upgradable to multiuser system with 18 Mb H/D. Full range of business packages included software dealers TBA. (S)
BASF 7120 (£4400)	BASF: 01-388 4200 (12)	88k RAM; 2xZ80A; 3 x 5 1/4" F/D (480k); 12", 24 x 80 VDU; RS232 port; P/P	DOS; (OASIS) Ex Basic; Cobol U. A; CP/M	H/D available soon. Also 7125 with 960k F/D £4900 and 7130 with single F/D (430k) & 5Mb H/D £6300. Disk controller has own Z80A. BT 9/80
BBC Micro (£299 inc VAT)	BBC Micro Systems 14 Station Road Kettering Northants (no tel)	16-32k RAM; 6502; C int; TV int; RS423 port; P/P; Option: single 5 1/4" F/D (100k) £230	MOS; Basic A	Video text & second processor int. 32k model with Econet and disk interface £399. BT 1/82 (1)
Billings BC-12 FD: (£3995)	Mitech: 04862 23131 (TBA)	64k RAM; Z80A; dual 5 1/4" F/D (640k); 12", 24 x 80 b&w (or b&g) VDU.	DOS; Basic; Fortran; Cobol; A	With dual 8" F/D (2 Mb) £5995. Additional dual 8" F/D £300 option: 50Mb H/D. (S).
Bonsai SM3000 (£2750)	Bonsai 01-580 0902	64k RAM; Z80; dual 5 1/4" F/D (700k); 12", 24x80 VDU; RS232 port; P/P	CP/M; Basic; Cobol; Pascal; Fortran	Many floppy and hard disk options. Applications software avail. from Bonsai.

List of Abbreviations

A Assembler
BT Bench Tested
C Cassette
E Extensive
F/D Floppy disk

G/C Graphics card
H Hardware
H/D Hard disk
I Introductory
Int Interface

M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port

S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are exclusive of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
C/09(£3500)	SWTP Ltd: 01-491 7507 7507 (16)	64k RAM: 6809: dual 5¼" F/D (700k) 9", 24 x 80 VDU: 2 S/P: 1 P/P.	TSC FLEX: <i>Basic: Fortran Pascal: A: Dis A: T/E: U.</i>	Expandable to S/09 UniFLEX 32 user system. (H)
Canon BX-3 (£3000)	Canon 01-680-7700.	32k RAM: 6809: dual 5¼" F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: Basic: A. <i>Cobol: Pascal</i>	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5¼" F/D (640k) £1500.
Canon CX-1 (£2850)	As above.	32k RAM: 6809: dual 5¼" F/D (640k): 12", 24 x 80 VDU: 3 x V24 ports: P/P: light pen.	OS: Basic: A:	Price includes installation & training. Extensive application support offered. Options: dual 8" F/D (1Mb) £3300.(S)
Canon TX-25 (£1450)	As above.	16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 lps printer. Option: 2 x RS232 port.	Basic: A	Fully integral unit. Cassette is Cannon's own design (8k). Can be used with communications. (S).
Challenger IP & C4P (£220 & £395)	CTS: 0706 79332 Millbank Computing: 01-549 7262. Mutek: 0225 743289. Watford Elec: Watford 40588 (18)	4.32k RAM: 6502: C int: RS232 port. Options: dual 5¼" F/D (160k) £550: for C4P dual 8" F/D (1.15 Mb) and 20MB H/D	O/S: Basic (8k ROM) <i>Ex Basic: A.</i>	D/A conv: colour capability. Runs OSI business software on 8" F/D Plato educational soft- ware avail soon. BT 4/80. (S).
Challenger 2 (£150)	As above	48k RAM: 6502: dual 8" F/D (0.5 Mb): RS232 port.	OS65U: Ex Basic: A.	Designed as low cost business system (S).
Challenger C3 (£2334)	As above	32-56k RAM: 6502: 6800: Z80: dual 8" F/D (1.15 Mb): 2-16 S/P.	OS65U: Basic: <i>CP/M: Fortran: Cobol</i>	Expandable to multi-user (8) system. Options: C3B & C3C H/D units, 74 Mb for about £8500. (S&H).
Cleno Conqueror (£2475)	Cleno Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8" F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: CBasic-2: Pearl I: <i>U Fortran: Cobol: Pascal</i>	With 2.4Mb F/D £2950. Also H/D systems with 10 Mb H/D & tape drive £5430.
Comart Communicator (£1995)	Comart 0480 215005 (25)	64k RAM: Z80A: dual 5¼" F/D (780k): 2 S/P: P/P.	CP/M: <i>Basic: Cobol: Fortran: Pascal</i>	With 1.5 Mb F/D £2295. With 4.8 Mb H/D & 790k F/D £3795. Option: 18 Mb H/D. £3395 (S).
Commodore PET 16k, & 32k (£550 £695)	Commodore: 0753 79292 (150)	16-32k RAM: 6502: C: 9" 25x40 VDU: IEEE-488 port: Options: dual 5¼" F/D (353k) £695: same but (950k) £895	O/S: Basic (in 8k ROM): <i>Forth: Pilot: Pascal: Comal: Lisp: A</i>	CBM 8032 with 80-col screen (32-96k) BT 12/80. £895 Field service avail. (1).
Commodore Vic 20 (£200)	Commodore: 0753 79292 (150)	5-32k RAM: 6502: C int: 22 x 23 TV int: S/P: P/P: Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5¼" F/D (170k). BT 9/81(S).
Compucolor II (£1175)	Dyad Developments: 08446 729 (TBA)	16-32k RAM: 8080: 13" 32x64 8-colour VDU: single 5¼" F/D (5k): RS232 port.	DOS (ROM): Ex-Basic (ROM): A. <i>M/A: T/E: Fortran: U</i>	32k version £1295. High resolution graphics. 6-month subscription to user magazine inclusive BT 9/79. (S).
Compucorp 625 (£6000)	Compucorp: 01-952 7860 (17)	48-60k RAM: Z80: dual 5¼" F/D (630k): 9". 16x80 VDU: 40 col printer: RS232 port, P/P.	Basic: A: <i>Fortran: Pascal: U</i>	IEEE-488 Controller and S100 int. Many applications packages avail. (E).
Compucorp 655/ 665/675/685 (from £5050)	As above	60k RAM: Z80: Up to 4x5¼" F/D(160k-2.4 Mb): 9", 20x80 or 12" 20x80 or 20" 60x80 VDU: 40-col printer: RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Computermart 2000 DS (£1500)	Computermart: 0603 615089	32-256k RAM: 8085: dual 8" F/D (1-2 Mb): S/P: P/P.	CP/M: <i>Cis Cobol: Basic: Fortran</i>	Expandable to multi-user, multi-tasking, multi-processor 96 Mb H/D system (around £15000).
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£2627/£2873/ £4893/£6118).	Datron: 0742 585490. Comart: 0480 215005 MicroCentre: 031- 556 7354 (18)	64k RAM: Z80: dual 5¼" F/D (346k) on System Zero, System 2 & Z2H: dual 8" F/D (1.2 Mb) on Sys 3: 10 Mb H/D on Z2H: S/P: P/P.	CDOS: <i>Basic: Cobol: Fortran: RPG II: Lisp: A: W/P: Multi- user Basic. Cromix.</i>	System 2 & 3 expandable to Multi-user (max 7) £8373 System 2: £10252 System 3. Options: dual 8" F/D (996k): 11.2Mb H/D. BT 10/79 (E).
DAI (£595)	Data Applications (UK): 0285 2588 (7)	48k RAM: 8080: C int: 24x60 VDU int: RS232 port: over 20 industrial ints. option: dual 5¼" F/D £595	Basic (ROM): U	Colour graphics up to 255 x 335: 3 notes & noise generator: PAL O/P to TV: Paddle int: H maths option. (1). BT 10/80.
Diablo 3000 (£6250)	Business Computers Ltd: 01-207 3344	32k RAM: 8085: dual 8" F/D (1.3 Mb): 12", 24x80 b&w VDU: 45 cps printer.	DOS: Basic: DACL: A: U.	Selection of business packages included (S).
Digital Micro- systems DSC-3 (£3530)	Modata: 0892 41555 (14)	64k RAM: Z80A: dual 8" F/D (1.14Mb): 4xRS232 ports: EIA port.	CP/M: CBasic: <i>Cobol: Fortran: Pascal: PL/I</i>	Expandable to multi-user system with 10-28 Mb H/D. Extensive software avail. (S).
Digital Micro- systems DSC-4 (£4395)	As above	128k RAM: Z80A: single 8" F/D (500k): 11 Mb H/D: 4x RS232 ports: 2 P/P.	CP/M: Basic-E: <i>CBasic: Cobol: Fortran: Pascal.</i>	Also DSC-3 with 64k RAM. Options: 128k RAM £1295: up to 4 Mb F/D and 20 Mb. H/D. (H).
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM: 8085: dual 5¼" F/D (1 Mb): 9", 16x64 green VDU: 132 col 165 cps printer: N/P.	O/S: D Basic: <i>CP/M: CBasic: Micro Cobol.</i>	Up to 5 work stations: fully integrated system. Options: additional dual 5¼" F/D (1 Mb): 12-24 Mb H/D.(S).

List of Abbreviations

A Assembler	G/C Graphics card	M/A Macro assembler	S Software
BT Bench Tested	H Hardware	N/A Not available	S/P Serial port
C Cassette	H/D Hard disk	N/P Numeric pad	T/E Text editor
E Extensive	I Introductory	O/S Operating system	TBA To be announced
F/D Floppy disk	Int Interface	P/P Parallel port	U Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Dynabyte 5000 Series (£1780)	Metrotech 0895 58111(35)	64k RAM; Z80; S100 bus; 2 ser ports; 1 par port; any com of 5 1/4" F/D (630k), dual 8" F/D (1Mb), 9/27/45 Mb H/D, 32/64/96 Mb Cart Module Disk.	CP/M; MP/M; CP/Net, CBasic, MBasic Cobol, Fortran, Pascal, PL/1-80	All systems expandable to multi-user and net working. CP/M inc in base price for F/D system, MP/M for H/D systems.
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM; Z80; 10 Mb-1200 Mb H/D; 6xS/P; 1 P/P.	CP/M; CBasic: <i>Cobol; Fortran.</i>	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).
Exidy Sorcerer (£695)	Liveport Data Products: 0736 798157 (27)	48k RAM; Z80; RS232 port; 1 P/P; S100 connector; 30x64 VDU int. N/P.	O/S: Basic (ROM); T/E: A: CP/M; Algol: Fortran: Basic: 80. Pascal: W/P.	High-resolution graphics capability: user programmable character set, Option: single 5 1/4" F/D (316k) £600
Gemini Multiboard (£500)	Micro Value 02403 28321(7)	64k RAM; Z80; 25 x 80 VDU int (with Z80); Option: dual 5 1/4" F/D £690.	CP/M: Basic: <i>Cobol; Pascal Fortran AP/L: Comal</i>	Modular system. Other options inc ROM board & EPROM programmer. BT 2/82 (H&S).
Gemini Galaxy 1 (£1450)	As above	64k RAM; Z80A; dual 5 1/4" F/D (800k); 12", 25x80 VDU; RS232 port; P/P; C int	CPM: Basic: <i>Comal; Pascal: AP/L: A</i>	Options: dual 5 1/4" FD (800k); dual 8" F/D (2.4Mb)
Gimix System 68 (£2000)	SEED: 05433 78151; Windrush 0692 505189	16-64k RAM; 6800/6809; dual 5 1/4" F/D (500k); 2xRS232 ports.	OS-9; Flex Basic: Pascal; A: Dis A: T/E:U	With dual 8" F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Haywood 3000 (£2121)	Haywood: 01-428 0111. (TBA)	64k RAM; Z80A; dual 5 1/4" F/D (800k); RS232 port; P/P. Opt: 15" 28x80 VDU £799.	CP/M: Basic: <i>Cobol; Fortran: Pascal: W/P.</i>	Also system 7000 with 8" F/D (2.5 Mb) £3100. (S)
Haywood Hinet (£8000)	Haywood 01 428 0111	64k RAM; Z80A; dual 8" F/D (1Mb); 11Mb H/D; RS232 port; RS422 port; P/P.	CP/M; HiNet: Basic; Cobol: Fortran: Pascal	Local area network, up to 32 users. Range of H/D avail.
HP 85 (£1830)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM; C.P.U.: 5", 16x32 VDU; C(200k); 64 cps printer; 4 P/P. Options: dual 5 1/4" F/D (540k) £1408; fusi 8" F/D (2.4 Mb) £3744.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £222. (S).
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM; Z80; dual 5 1/4" F/D (320k); 2xS/P; 1 P/P;	CP/M: C/Basic: <i>Cobol; Fortran.</i>	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM; Z80; dual 8" F/D (1 Mb); 2xS/P; 1 P/P	CP/M: CBasic: <i>Cobol; Fortran: MicroCobol.</i>	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Intecolor 8000 (£2999)	Dyad Developments: 08446 729 (TBA)	8-32k RAM; 8080; 19", 80x48 colour VDU; single 5 1/4" F/D (90k); Option: up to 26 Mb H/D.	DOS(ROM); Ex-Basic: A:M/A:T/E: Fortran: U	High res graphics avail: Many options including size of F/D and VDU. (S).
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48k RAM; 6502	Monitor: A: ExBasic: Dis A.	360x192 high res graphics. Ex-Basic in 6k ROM; Options: single 5 1/4" F/D (116k); £425; 16k RAM, £110; RS232 port, £96; 32k system, £931; 48k system £995; (B).
Ithaca DPS1 (£3995)	Ithaca: 01-341 2447 (10).	64k RAM; Z80; dual 8" F/D (1 Mb); 2xRS232 ports; 4xP/P; Opt: H/D.	CP/M: Basic: <i>Cobol; Fortran: Pascal: A: U.</i>	Z8000 16-bit processor board avail. IEEE/S100 (8 or 16 bit) compatible. (E).
Kemitron K2000 E (£2300)	Kemitron 0244 21817 (3)	64k RAM; Z80A; single 5 1/4" F/D (150k); 12", 24x80 VDU; 2xS/P; P/P	CP/M: Basic: <i>Cobol; Fortran Pascal: A</i>	Extensive range of support cards and industrial interfaces.
Kemitron K3000 E (£3300)	As above	64k RAM; Z80A; dual 8" F/D (2Mb); 2xS/P; P/P	CP/M: MP/M; Basic: <i>Cobol; Fortran: Pascal: A</i>	Up to four screens and four printers can be attached. Options: 10Mb H/D.
LX-500 (£3500)	Logabax Ltd: 01-965 0061 (13)	32k RAM; Z80; dual 5 1/4" F/D (180k); 12" 25x80 b&w VDU; 100 cps printer.	DOS: Basic: A.	Other printers available. (S)
LSI M-One (£4200)	LSI Computers: 04862 23411 (20)	8-16k RAM; 8080; dual 8" F/D (1.2 Mb); 12", 24x80 b&w VDU	FMOS: A	Choice of standard business packages included in price. (S).
LSI M-Two (£6000)	As above	64-128k RAM; 8085A; dual 8" F/D (1.2 Mb); 12", 24x80 VDU; 60 cps printer	Elsie: CP/M: Basic: <i>Cobol; Fortran: Pascal: A: U</i>	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S).
LSI M-Three (£2400)	As above	64k RAM; Z80A; dual 5 1/4" F/D (350k); 12", 24x80 VDU; RS232 port; P/P	CP/M: Basic: <i>Cobol; Fortran: Pascal: A</i>	Option: 10Mb H/D.
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM; Z80A; dual 8" F/D (1 Mb); 4xRS232 ports.	CP/M: APL: U: Basic: <i>Fortran; Cobol; Word-2star Algo: Pascal: Forth.</i>	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm.
Marinchip M9900 (£4990)	Microprocessor Eng. 0703 775482	128k RAM; 9900; dual 8" F/D (2Mb); 4xRS232 ports.	NOS: Basic: Pascal: W/P; SPL: Forth: Meta	Multi-user/multi-tasking OS. Options: H/D up to 120 Mb.
Megamicro (£6080)	Bytronix: 0252 726814(5)	56k RAM; Z80; dual 8" F/D (500k); 12", 20x80 green VDU; 180 cps printer; 2 S/P; 2 P/P.	CP/M; U: Basic: A: M/A.	Range of bus. packages now avail. from Ludhouse of Streatham. (H&B).
Micro Trainer 1 (£650)	Hewart: 0625 22030 (N/A)	16-32k RAM; 6800/6809; 10" 16x24 VDU; 2xC int; Opt: dual 5 1/4" F/D (160k) £595; 8k RAM £17.	Basic: A: Pascal: PL/M: W/P	SS50-based system. Graphics avail. Int card with real time clock £17. (1).
Microtan 65 (£69)	Tangerine: 0223 60488(6)	1k RAM; 6502; 32x16 TV int; Exp up to 328k RAM.	2k TANBUG monitor; 2k A, disassembler, cassette firm ware; 10k Microsoft Ex. Basic.	Options: bulk I/O modules, hi-def graphics, CP/M, system racking, ASCII keyboard, Prestel adaptor (S&H).

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Millbank Sys 10 (£2995)	Millbank: 01-788 1083(6).	65k RAM; Z80: dual 5 1/4" F/D (700k); 12", 24x80 VDU: 2x RS232 ports: RS4449 port: P/P.	CP/M: <i>Basic: Cobol;</i> <i>Fortran: Pascal: PLI;</i> W/P.	One high level lang. included. 12-month warranty. Main- frame conim. package. H/D avail. soon. (S&H)
MS5001 (£7450)	BMG Ltd: 0793 37813 (N/A)	64k RAM: 8085: dual 8" F/D (1 Mb); 12", 80x24 VDU: 80 cps printer: RS232.	CP/M: <i>Basic: Cobol;</i> <i>Fortran: MP/M.</i>	Price includes desk mounting and one computer. Hardware & software support. Leasing arrangements available. (E).
MSI 6816 (£1200)	Strumech: 05433 4321 (5)	16-56k RAM: 6800: dual 9" 16x64 b&w VDU: C int: 1 S/P: 1 P/P.	Basic: A.	Graphics & PROM programmer available. (S&H).
MSI System 12 (£8000)	As above	56-184k RAM: 6800: 10 Mb H/D: single 8" F/D (500k) 24x80 VDU: 1 S/P: 1 P/P.	SDOS: Basic: CBasic: U.	As above. Business packages avail. Up to four terminals. (H&S).
Munroe EC8800 (£2150)	Fi-Cord Int. 061 445 7716	128k RAM: Z80A: single 5 1/4" F/D (320k); 3xRS232 ports: P/P	Munroe Multitasking System: <i>CP/M: Basic;</i> <i>Cobol: Fortran: Pascal</i>	High res colour graphics. Option: single 5 + " F/D. (320k). £495
Munroe OC8820 (£2990)	As above	128k RAM: Z80A: dual 5 1/4" F/D (640k); 9", 24x80 VDU: 3xRS232 ports: P/P	As above	5MB H/D avail soon. BT 4/82.
Nascom 3 (£416)	Lucas Logic 0926 497733	8-60k RAM: Z80: dual 5 1/4" F/D (700k); RS232 port: P/P.	Basic: <i>Pascal: A: CP/M;</i> <i>Cobol Fortran</i>	Options dual 5 1/4" F/D (700k) £685: 48k RAM £130.
NEC PC 8001 (£599)	IBR 0734 664111	32k RAM: Z80A: P/P Option: dual 5 1/4" F/D (326k) £699	Basic N: (24k ROM) <i>CP/M: Fortran: Cobol;</i> <i>Pascal.</i>	Colour monitor £359 (low res) or £579 (high res) both 12", 25x80 many expansion units avail. (E) BT 6/81
Newbrain MB (£199)	Grundy: 0223 350355 (TBA)	32k-2 Mb RAM: Z80A: Nat 420: 2xC int: TV int: 2xV24 ports.	CBasic (16k ROM): A.	Graphics. Battery or mains. Options: 1/2 Mb RAM £450 16 char display £30.(E).
North Star Horizon (£1975)	Comart: (25) 0480 215005. Interam 01 675 5325 (30): Tradér Comp 01-328 3484 (21)	56-63k RAM: Z80A: dual 5 1/4" F/D (360k); 15", 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: <i>Cobol: Fortran: Pascal.</i>	Options: 3-26 Mb H/D, multi-user.
North Star Advantage (£2195)	As above	64k RAM; Z80A: dual 5 1/4" F/D (720k); 12", 24 x 80 VDU: S/P.	GDOS: CP/M: <i>CBasic;</i> <i>MBasic: Fortran: Cobol;</i> <i>Pascal</i>	Price includes business graphics & demo software. 6 slot expansion.
Oki if 800 (£3000)	Encotel. 01 686 9687	64k RAM: Z80A: 2k ROM: dual 5 1/4" F/D (768k); 12", 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge.	Basic: A: <i>CP/M</i> <i>Cobol: Fortran:</i>	Fully integral unit. Graphics. Options: dual 5 1/4" F/D (560k): RS232 port: PP. (I). BT 10/81
Onyx C8000 (£6875)	Onyx Dist Ltd: 0734 664343 Colt 01-577 2150. (TBA)	64k RAM: Z80: 12 Mb Cartridge: 10 Mb H/D: 4 S/P: P/P	CP/M: <i>MP/M Oasis;</i> <i>Unix: Fortran: Pascal;</i> W/P	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis.(E) BT 3/81.
Osborne 1 (£1250)	Osborne 0908 615274(30)	64k RAM: Z80A: dual 5 1/4" F/D (200k); 5", 24x52 VDU: RS232 port: P/P	CP/M: Basic: W/P: <i>Cobol</i> <i>Fortran: Pascal</i>	Integral system in weatherproof carrying case. Will run on battery pack. Option: dual 5 1/4" F/D (400k). BT11/81.
Oscar (£2560)	IDS Ltd: 0908 313997(30)	64k RAM; Z80: dual 5 1/4" F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: <i>Basic: Pascal</i> <i>Fortran: Cobol: W/P:A</i>	Also avail. with dual 5" F/D(1.6Mb) £2905 and 8" F/D(2 Mb) £3380. Advanced video board. S&H).
Panasonic JD 800M, JD850M (£3300, £4350)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	56k RAM: 8085A: 4k PROM: dual 8" F/D JD800M (500k): JD850M (2.4 Mb); 3xRS323 ports. P/P	CP/M: Basic: A <i>Micro-</i> <i>Cobol.</i>	Option: 8.4 Mb H/D £2725 (up two). BT3/80(S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01- 554 6222	64k RAM: MCP 1600: 2x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code: no interpreter needed. Avail- able with dual 8" F/D (2 Mb) £3900.
Pasca 640 (£2500)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM: Z80A: dual 8" F/D (512k): 12", 24x80 VDU: RS232 port: P/P	CP/M: <i>Basic: Cobol;</i> <i>Fortran: Pascal: A: W/P;</i> U	Maintenance contracts avail. Option: 5-20 Mb H/D. (S) BT 5/18
Periflex 630z564 (from £2250)	Sinfrom: 0734 85464(5)	64k RAM: Z80: dual 5 1/4" F/D(1.2 Mb); 2xRS232 ports. 1 P/P.	CP/M: <i>Basic: Fortran;</i> <i>Cobol:A</i>	One-day installation training on site included in price. Option: dual 5 1/4" F/D(630k) £464, dual 8 1/4" F/D(1 Mb) £1025. 35 Mb H/D. BT 6/80 (S&H).
Periflex I024/64 (from £2750)	As above	64k RAM: Z80: dual 8" F/D (1.2 Mb); 2xRS232 ports: 1 P/P.	As above	As above
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5 1/4" F/D (140k); 12", 24x80 VDU: RS232 port.	PDOS: UCSD p-system: <i>Pascal: Basic Fortran:A.</i>	With 48k RAM, Pascal and Basic £3300: BT 12/81.(S).
Powerhouse 2 (£1125)	Powerhouse Micros: 0422 48422 (TBA)	32-64k RAM: Z80A: 5" 29x96 VDU: RS232 port: external bus.	4k Monitor: <i>FDOS;</i> <i>Basic: ExBasic (14k</i> <i>EPROM)</i>	VDU has flexible screen logic. Options: <i>FDOS & Basic</i> £210: graphics card £200. (H).
Powerhouse 3 (£2600)	As above	32-64k RAM: Z80A: dual 5 1/4" F/D (350k); 5", 29x96 VDU: RS232 port: external bus.	As above	VDU as above. With 1.2 Mb F/D £3500. <i>ExBasic & FDOS</i> in 14k EPOMs £300. (H).
Prince (£3045)	Digico: 04626 78172 (50)	48-64k RAM: 2xZ80: dual 5 1/4" F/D (800k); 2xRS232 port: 12", 24x80 VDU	CP/M: <i>Basic: Pascal;</i> <i>Fortran: Cobol: W/P:A;</i> T/E:U	High res graphics. Options: single 5 1/4" F/D (400k) £600: dual 8" F/D(2 Mb) £2000 5-10Mb H/D. Rentals avail. (S).

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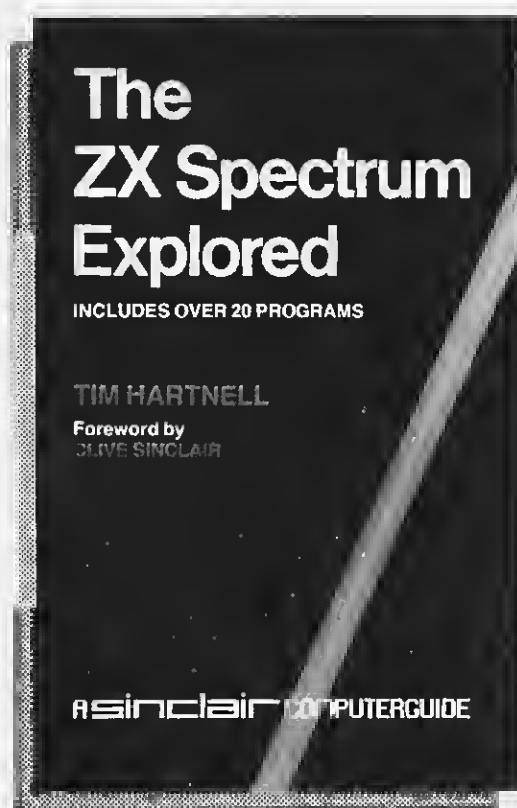
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The ZX Spectrum Explored



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In this practical guide — with programs throughout — Tim Hartnell takes his readers from their first steps in programming to how the ZX Spectrum can be used as a tool at home, at work and for education. He looks at the use of sound, colour and 3D graphics, and shows how to write programs in BASIC, as well as how to use machine code on the ZX Spectrum.

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Quantum 2000 (£2250)	Quantum Comp Sys 0532 458877	64k RAM: Z80A: dual 8" F/D (2.4Mb): 12", 24x80 VDU: C int: P/P	CP/M Basic: <i>Cobol:</i> <i>Fortran: Pascal: A</i>	Many expansion boards avail inc high res colour graphics. Option: 5-10Mb H/D.
Raand SP1 (£4500)	Raand: 0506 33372 (TBA)	64k RAM: MCP 1600: dual 8" F/D (2 Mb): 12", 24x80 VDU: RS232 port: P/P	Pascal <i>ADA: Basic</i>	Based on Microengine (with integrated P-code). Up to 4 F/D drives. 64k RAM expansion avail. BT 12/80. (S).
Rair Black Box 3/30 (£3750)	Rair: 01-836 6921 (N/A)	64-512k RAM: 8085: dual 5 1/4" F/D (500k): 6 Mb H/D: 2xRS232 ports.	CP/M: Basic: <i>Cobol:</i> <i>Fortran: M/A</i>	64k RAM expansion £500. 256k RAM £1250. Up to 16 RS232 ports.
Research Machines 380Z (£1867)	Research Machines: 0865 49866 (N/A)	16-56k RAM: Z80A: dual 5 1/4" F/D (300k) RS232 port. P/P.	ExBasic: A: T/E: U: CP/M: <i>Fortran:</i> <i>Cobol: Algol: Pascal.</i>	High res colour graphics. Many possible systems. With 56k RAM & dual 8" F/D (1 Mb) £3347.
Research Machines Link 480Z (£550)	As above	32-64k RAM: Z80A: C: 2xS/P: P/P	Basic: A: T/E	High res colour graphics. Network station.
S/O9 (£7000)	SWTP Ltd: 01-491 7507(16)	128k RAM: 6809: dual 8" F/D (2 Mb): 12", 24x80 VDU: 2xS/P: 1 P/P.	UniFLEX: <i>Basic:</i> <i>Pascal: Fortran: A: Dis A:</i> <i>TIE: U:</i>	Expands to 32 users, 768k RAM, 90 Mb H/D, UNIX 'look alike'. (S&H).
Saracen (£1925)	Bytronix 0252 726814 (TBA)	32-64k RAM: Z80: dual 5 1/4" F/D (800k): 2xRS232 ports.	CP/M: <i>Basic: Cobol:</i> <i>Fortran: Pascal: A:</i>	Applications packages & maint. contracts avail. With dual 8" F/D (2 Mb) and 64k RAM, £2676. (E).
SBS 8000 (£1449)	Manhattan Skyline Ltd: 0801 3442: C Itoh 01- 353 6090 (TBAz7)	64k RAM: Z80A: 12", 16 x 64 VDU: 1 P/P: RS232 port (extra £133)	ExBasic (24k ROM): <i>DOS</i>	Options disk control card £237: dual 5 1/4" F/D (368k) £795: dual 8" F/D (2 Mb) £1400. BT 11/80. (S)
SEED System 1 (£2000)	Strumech: 05433 78151 (S)	32-56k RAM: 6800: various disk options: 12", 24 x 80 VDU: RS232 port: P/P	DOS: Basic U: <i>Fortran:</i> <i>A: Pilot: Strubal: T/E</i>	Graphics. PROM programmer Also system 19 multi-user (£3000). (E)
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-48k RAM: Z80: C: 10" 24 x 40 VDU: Option: dual 5 1/4" F/D (289k) £695	Basic, A. CP/M: <i>Pascal: Fortran:</i> <i>Forth</i>	Graphics: loudspeaker. BT 10/79 (B)
Sharp MZ-80B (£1095)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	Basic: A: <i>Pascal: FDOS</i>	High res graphics. Options: dual 5 1/4" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC3201 (£2995)	As above <i>CP/M: Cobol</i>	64k RAM: Z80A: dual 5 1/4" F/D (500k): C int: 12", 25 x 80 VDU: 70 lpm printer.	DOS: U: Basic: CP/M: <i>Cobol.</i>	Various expansion cards avail. BT 7/81 (I&B)
Sinclair ZX81 (£50-kit, £70-built- prices inc VAT).	Sinclair: 0276 66104 (100+)	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port.	Basic (8k ROM).	Advanced 4-chip design. Printer now avail. soon BT 6/81
Sinclair ZX Spectrum (£125)	As above	16-48k RAM: Z80A: 16k ROM: T.V. int.	Basic	Options: 32k RAM £60. RS232 port and microdrive disks avail soon. BT 6/82
Signet 202 (£2295)	Interram 01-675-5325 (30)	64k RAM: Z80A: dual 5 1/4" F/D (400k): 12", 24 x 80 VDU: 2x RS232 ports: 80 col printer.	CP/M: <i>Basic: Fortran</i>	Options: dual 5 1/4" F/D (800k): 3-12Mb H/D, Multi user.
Smoke Signal Chieftan (£1800)	Windrush 0692 405189: Seed 05433 78151 (TBA).	32-64k RAM: 6800/6809: dual 5 1/4" F/D (500k): 2 x RS232 port.	DOS: 68/FLEX: <i>Basic:</i> <i>Fortran: Cobol: A:</i> <i>Disc A: Pascal: U.</i>	With dual 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H).
Solitaire WP & BS200 (£6750 & £8200)	Solitaire KPG: 01- 995 3573 (TBA)	64k RAM: 8085: 14" VDU (with own CPU): 45 cps printer: CPU port: dual 5 1/4" F/D (700k) 8" F/D (1.02 Mb) with BS200.	DOS: Basic	All solitaire systems are compatible: anmd can be upgraded to multi-user H/D system. (S)
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 0903 814523 Exleigh Bus. Mach. 0735-66577.(10)	48k RAM: Z80: 8k ROM dual 5 1/4" F/D (245k): 24 x 64 green VDU: RS232 port: N/P	O/S: Basic: A: <i>Fortran: Pascal.</i>	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M223 Mk II-VI (£4078)	As above	64k RAM: Z80: 8k ROM: dual 5" F/D (700k): 12", 24 x 80 green VDU: RS232 ports: S100 bus: N/P	O/S: Ex Basic: <i>CBasic: Multi-User</i> <i>Basic: Fortran:</i> <i>Cobol</i>	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3770) (TBA)	Digital Data: 01- 573 8854	64-1024k RAM: 8085 A-2: dual 5 1/4" F/D (90k): 12", 24 x 80 VDU: 2 x RS232 ports: Option: single 8" F/D (1 Mb) £1090:	Mikados, Comal: Pascal: A.	With 32k RAM and single F/D (Comal only) £1995. Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1750)	Icarus: 01-485 5574 (45)	64k RAM: 2 x Z80: dual 5 1/4" F/D (320k): 12" 25 x 80 VDU: 2 x RS232 port.	CP/M: A: <i>Basic:</i> <i>Cobol: Fortran: APL:</i> <i>Pascal</i>	Limited graphis, Mainframe int avail. Full range of appliation packages avail. Also avail with 700k & 1.5 Mb F/D. BT 8/80. (S&H)
System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM: Z80: dual 5 1/4" F/D (700k): 12", 24 x 80 VDU: 2 x RS232 port: P/P	CP/M: <i>Basic: Fortran:</i> <i>Pascal: Cobol: PL/I: W/P</i>	12 month warranty. Maint. contracts. Applications packages avail. Choice of high level language in price. (E)
System 20 (£3500)	Extel: 01-739 2041 (TBA)	64-512k RAM: Z80A: dual 8" F/D (1 Mb): 12", 24 x 80 VDU: 3 x V2	CP/M: E Basic: <i>M Basic:</i> <i>Pascal: Cobol: Fortran</i>	Maintenance contracts avail (132 field service engineers). Expands to multi- user system. Options 13.7 Mb H/D £5799: 27.4 Mb H/D £6674. (S)
Tandberg EC10 (£3250)	Tandberg: 0532 774844 (N/A)	64k RAM: 8080 A: single 8" F/D (250k): 12" 25 x 80 VDU: 7 x RS232 ports: printer int.	CP/M: Ex Basic (24k) <i>Multi-user Basic:</i> <i>Pascal: Cobol: A: U:</i>	Up to 7 terminals. Includes V28 comms port. (S&H)

List of Abbreviations

A Assembler	G/C Graphics card	M/A Macro assembler	S Software
BT Bench Tested	H Hardware	N/A Not available	S/P Serial port
C Cassette	H/D Hard disk	N/P Numeric pad	T/E Text editor
E Extensive	I Introductory	O/S Operating system	TBA To be announced
F/D Floppy disk	Int Interface	P/P Parallel port	U Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Tandy TRS-80 Model I (£252)	Tandy: 0922 648181 (200)	4-48k RAM; Z80: C: 12", 16 x 64 VDU: RS232: P/P	Basic (4k ROM): A.	Fully expandable. Option: single 5 1/4" F/D (175k) £320 (up to 4). Many extras available. 32k RAM £304. (I)
Tandy TRS-80 Model II (£2347)	As above	64k RAM; Z80: single 8" F/D (500k) 12" 24 x 80 VDU: 2 x RS232 port: P/P	Basic M/A <i>Fortran: Cobol</i>	Option: single 8" F/D (500k) £782 (subsequent £391, up to 4).
Tandy TRS 80 Model 3 (£500-£1700)	As above	See Model 1 Levels I and II		Fully integral unit. Up to 2 integral and 2 external 5 1/4" F/D. BT 8/81
Tandy TRS-80 Colour (£304)	As above	4-16k RAM; 6809: 8-16k ROM: C: 16 x 32 TV int: RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £390 (I). BT 9/81.
TECS (£1200)	Technalogs Computing Ltd: 061-793 5293 B&B Computers Ltd: 0204 26644 (TBA)	4-56k RAM; 8k PROM: 6800/6809: 2xC: TV int: 2xRS232 ports: internal viewdata modem & printer port.	FLEX: Basic: <i>Pascal: TDOS: A: T/E: Pilot: Fortran: Cobol.</i>	Fully viewdata compatible. Options --- dual 5 1/4" F/D (320k) £850: dual 8" F/D £120. (S&H).
Terodec PBM-1000 (£4020)	Terodec: 0734 664343 (40)	80k RAM; Z80A: single 5 1/4" F/D (819k): 6Mb H/D: 2xS/P: P/P	CP/M CP/Net CBasic: <i>Fortran: Pascal: Cobol</i>	System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £5995 (S&H)
Terodec Delta (£3770)	As above	64k RAM; Z80A: dual 8" F/D (2 Mb): 2 S/P: 3 P/P. Options: 10 Mb H/D: Tape.	CP/M: <i>MP/M: CP/Net: CBasic: Fortran: Pascal: Cobol: Basic.</i>	2 user system with 10 Mb H/D £7750 4 user system with 40 Mb H/D & tape back up £12050. (S&H)
TI 99/4A (£299)	TI: 0234 67466 (TBA)	16-48k RAM; Z80: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 tones & noise: P/P.	OS: Basic.	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5 1/4" F/D (92k each): Speech Synthesiser.
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A)	24k RAM; Z80: single 5 1/4" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: <i>Basic: Fortran: Pascal: Cobol:</i>	Options: single 5 1/4" F/D (190k) £155: single 5 1/4" F/D (370k) £285: 16k RAM £162: 3 Mb H/D £1450: 20 Mb H/D £2970 (S&H)
Tuscan Starter Kit (£299)	As above	8k RAM; Z80: Cint: 56-key K/B Options: Case £110: 5 x S100 sockets £20: TV int £3.50	8k Basic.	Fully assembled version £499 BT 1/81 (H&S)
Vector MZ (£2650)	Almare: 0602 52657 (3)	56k RAM; Z80A: dual 5 1/4" F/D (630k): 3 S/P: 2 P/P.	CP/M: <i>Basic: Algol: Cobol: Pascal: Fortran: Coral: CBasic: A:</i>	High resolution graphics. Also system B with video board & terminal £3450. (E)
Vector System 2800 (£4600)	As above	56k RAM; Z80A: dual 8" F/D (2.4 Mb): 3 S/P: 2 P/P	As above	High-res graphics. Fully expandable to 5005 multi-user system (max 5) £5400.
VIP (£2650)	Almare 0602 52657 (3)	64k RAM; 3k ROM; Z80B: single 5 1/4" F/D (630k): 12", 24 x 80 VDU: RS232 port, 3 x P/P	CP/M: <i>Basic: forttran: Cobol: Pascal: A.</i>	Up to 3 additional F/D drives. Options: dual 8" F/D (2 Mb) £1063, 32 Mb H/D (TBA). (H&S). BT2/81
Genie 1 (£299)	Low Electronics: 0629 2430 (N/A)	16k RAM; Z80: 500bps C: 16 x 64 TV int: extra C int: 1 P/P.	Basic (12k ROM): <i>Pascal: A M/A: Fortran</i>	Options: single 5 1/4" F/D (184k) £220; dual 5 1/4" F/D (368k) £375 (I)
WH8 (£352)	Heathl 0452 29451 (N/A)	16-64k RAM; 808A (or Z80): 4 S/P. Option: single 5 1/4" F/D (102k) £241.	OS: HDOS: CP/M: <i>Fortran: Pascal: Basic</i>	Kit. 3 drives max. Colour graphics avail. (S&H) BT 2/80.
Xerox 820 (£1845)	Business Comp Sys 01 207 3344	64k RAM; Z80: single 5 1/4" F/D (162k): 12", 24 x 80 VDU: 2 x RS232 ports: P/P	Monitor: <i>CP/M: Basic: Cobol: Fortran: Pascal.</i>	With 8" F/D (500k) £2250. CP/M £95. BT 1/82 (S + H)
Zentec (£4838)	Zygal Dynamics: 02405 75681 (TBA)	32-64k RAM; 2 x 8080: dual 5 1/4" F/D (256k): 15", 25 x 80 VDU: RS232 port.	OS/: A: U: <i>Basic: Cis Cobol</i>	User programmable character set. Option: dual 8" F/D (1 Mb). (S)
Zenith WH-11A (£2673)	Heath Ltd: 0452 29451 & 01-636 7349 (N/A)	LSI 11: 16-32k RAM; 25 x 80 VDU: S/P: P/P.	O/S: <i>Basic, Fortran: A: U.</i>	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £1717 (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM; Z80: single 5 1/4" F/D (102k): 12" 24 x 80 b&g vdu: RS232.	<i>Basic: A: HDOS: CP/M: MBasic: CBasic: Fortran.</i>	3 x 5 1/4" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Thames Systems: 084421 5471 (N/A)	64k RAM; Z80: dual 8" F/D (600k): RS232 port: MCZ1/20A only 1 P/P: Option: 10 Mb H/D £7100	RIO: O/S: <i>Cobol: Basic: Fortran: Pascal: M/A: U.</i>	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol; up to 5 terminals with 40 Mb H/D. (S&H).
Z-Plus (from £400)	Rostronics Ltd: 01-870 4805 (16)	64k RAM; Z80A: dual 8" F/D (0.5/1Mb): 12" 24 x 80 VDU: 4 S/P: 1 P/P	CP/M: <i>MP/M: A: U: Basic: Cobol: Fortran: Pascal: APL: PL/I: Algol.</i>	Complete with furniture. Various business packages avail. Option: 20 Mb H/D £4000. BT 12/79 (S&H)

SINGLE BOARDS

Machine (Price from)	Main Distributor (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Acorn System 1-5 (£65-£1600)	Acorn: 0223 312772 (35)	11/8k RAM; 6502: EPROM socket: Hex K/B: C int: 8-digit LED display: up to 16 ports. Options: Eurocard 64-way connector: VDU card: full K/B card.	1/2k monitor: <i>Basic. Pascal: Forth: DOS.</i>	Kit. Programmable address linking. On-board 5 V regulator. linking. On-board 5 V regulator. Can be expanded to disk-based system. (S&H)
AEX-09 (£750)	Micro Design 0908 663655	8k RAM; 32k PROM: 6809: 16 I/O lines: RS232 port: RS422 port.	OS-9: (<i>Basic: Pascal: Fortran avail soon</i>)	Full A/D & D/A conversion facilities. 4 x 8 bit outputs. (H)
Aim 65C (£259)	Pelco: 0273 722155(7)	1-4k RAM: Full K/B 2 x C: 20 char LED: 20 char thermal printer: RS232 port.	A. Disc A: T/E: 8k monitor: <i>Basic (8k ROM): PL65. Forth</i>	Expandable using RM65 models to full disk systems. (E)

List of Abbreviations

A Assembler
BT Bench Tested
C Cassette
E Extensive
F/D Floppy disk

G/C Graphics card
H Hardware
H/D Hard disk
I Introductory
Int Interface

M/A Macro assembler
N/A Not available
N/P Numeric pad
O/S Operating system
P/P Parallel port

S Software
S/P Serial port
T/E Text editor
TBA To be announced
U Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are exclusive of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
BEX-09 (£850)	Micro Design 0908-663655	64k RAM: 6809; 64k PROM: 2xRS232 ports: P/P	1k Monitor	Multi-processor interfaces on board.
Bigboard (£450)	Maclin-Zand 01-837 1165 (N/A)	64k RAM: Z80, F/D controller: 24 x 80 VDU controller	2k monitor: <i>CP/M: Basic; Fortran; Cobol; Pascal: A.</i>	Many options. Will support up to four 8" F/D drives. BT 3/81. (E)
Biproc (£119)	B L Micros: 0494 44307. (TBA)	1k RAM: Z80; TV int: RS232 port. Opt: 4k RAM £8; K/B £30.	2k Monitor: A.	With 9980 instead of Z80 £155 as well as Z80 £180. Kit. (H)
Cromeco SC (£355)	Comart: 0480 215005 (25) Datron. 0742 585490.	1k RAM: Z80A; 8k EPROM sockets: RS232 port: 3 P/P. Option: S100 bus.	Monitor: <i>Basic.</i>	5 program interval timers. Can put own Basic program in EPROM. (E)
Elf II (£50)	Newtronics: 01-348 3325 (N/A)	¼-64k RAM: RCA 1802; Hex K/B; 2-digit LED; TV int; C int: RS232. Options: Full K/B; VDU card.	1k monitor: A: Dis A: T/E; Elf-bug <i>Tiny Basic: Basic.</i>	TTY N-line decoders. Low resolution graphics (high res avail). Kits or built. Full range of peripherals. (H)
Explorer (£82)	As above	4-64k RAM: 8085; Full K/B. RS232 port: 6 x S100 bus: C int: 1k video RAM.	2k monitor: <i>Basic (8k) CP/M: Basic Fortran; Cobol.</i>	Supplied in kit or built. Full range of peripherals including F/D. (H)
Hewart 6800S (£299)	Hewart: 0625 22030 (N/A)	16k RAM: 6800; full K/B VDU int: 2 x C int: 1 S/P; 2 P/P; Option: 16k RAM £90	1k monitor: A: T/E.	Can be upgraded with 6809. (H)
Hewart 6800 Mk 111 (£152)	As above	1k RAM: 6800; VDU board	1k monitor.	Options: single 5¼" F/D (75k) £350; PROM programmer £32. (H)
Kemitron Z80 Starter (£240)	Kemitron 0244 21817 (3)	Z80A: 16k PROM: 2xS/P; 24 channel parallel I/O	ZEMON monitor: Basic	Expandable to 64k RAM and disks.
Microaxis 1 (£250)	Micro Design 0908 663655 (N/A)	1k RAM: 1-8k PROM: 6809; 8 channel A-D system: 12 optically isolated I/O lines.	1k monitor	Designed for industrial control. Can be expanded to F/D system. (H)
MPC 09 (£750)	As above	64k RAM: 48k PROM: 6089; RS232 port: 50 I/O lines: 4 timers: 1 W audio amplifier.	1k monitor: <i>Multi-tasking OS</i>	As above.
MPE 9900 (£385)	Microprocessor Eng 0703 775482	2-8k RAM: 9900; 4-32k EPROM: 2xRS232 ports: P/P	Basic: <i>Forth</i>	Designed as industrial controller.
MPE 6809 Graphics-A (£450)	Microprocessor Eng. 0703 775482	24k RAM: 8-16k EPROM: 6809; 2xRS232 ports: 2xP/P	G <i>Forth</i>	320x256 Pixel graphics (8 colour). Applications packages may be placed in EPROM.
Microtan 65 (£69)	Tangerine: 0353 3633 (6)	2k RAM: 6502; 16 x 32 TV int; Options: 64 Pixel graphics £6.50	2k monitor, <i>Basic</i>	TANEX expansion kit with 7k RAM: 4k EPROM sockets: 14k Basic: 4 S/P; 32 P/P £145. (E)
Nascom 1 (£125)	Lucas Logic 0926 497733	4k RAM: Z80; Full K/B; TV int: 2 P/P; 1 S/P. Options: 16k RAM £140; single 5¼" F/D (250k); £240 (4 disk controller £127).	2k monitor: <i>B Basic; Tiny Basic: A: T/E: U.</i>	Kit. Built version £140. Also Nascom 2 with 8k Microsoft Basic in ROM £225 (no RAM). (S&H)
77/68 (£90)	Newbear: 0635 30505 (N/A)	4k RAM: 6800; LED; C int: VDU int.	1k monitor: <i>Basic</i>	Expandable to 64k RAM with F/D. (B)
79/09 (£65)	As above	1k RAM: 6809; P/P; S/P	2k Monitor.	Designed to upgrade 77/68. (H).
SBC 100 (£135)	Airamco: 0294 57755 (TBA)	1k RAM: Z80; 8k ROM: S100; 1 S/P; 1 P/P.	1k monitor: <i>DOS in ROM</i>	Kit. Available assembled £196. (E)
Superboard (£188)	(as Challenger)	4-8k RAM: 6502; 10k ROM; full K/B; VDU int: C int.	Basic (8k ROM)	Options: RS232 port: single 5¼" F/D (100k) £316; 8k RAM £188. (S&H)
Smoke Signal SCB 68 (£181)	Windrush: 0692 405189 (TBA)	1k RAM: 6800/6809; 8k EPROM: 1 S/P.	2k monitor	Fully expandable to 64k RAM with F/D. (H)
SYM-1 (£160)	Newbear: 0635 30505 (N/A)	1-4k RAM: 6502; C int: VDU int: 2 x 6522 ports. Option: TV int.	4k monitor: <i>Basic A.</i>	Expandable to 64k RAM with F/D. (B).
Tuscan (£299)	Transam 01-405 5240 (N/A)	8k RAM; 8k ROM; Z80A: 5 x S100 slots: RS232 port: TV int: C int: 1 P/P.	2k monitor: <i>8k Basic; CP/M: Pascal</i>	High res graphics available. Can be expanded to F/D system. BT 1.81. (S&H)
UK101 (£149)	Comp Shop: 01-441 2922 (4)	4k RAM: 6502; full K/B; 16 x 48 VDU or TV int: C int: RS232 port, Options: 4k RAM £16	2k monitor: 8k Basic; <i>Dis A: U.</i>	Graphics. Expansion & colour avail. Kit or fully assembled. (S&H)
Windrush 6801 (£175)	Windrush: 0692 405189	2k RAM: 6801/3/5; 12k EPROM: S/P; 3 P/P	2k Monitor	Designed for industrial control & dedicated small systems. (H)
ZCB (£260)	Almarc: 0602 625035 (3)	1k RAM: Z80A; 3 PROM sockets: RS232 port: 3 P/P	<i>Will take any 2708/16=32 software.</i>	S100 bus compatible. Expandable to full system. (E)

ACC NEWS

The big news this month in Computer clubs can only be 8008. Our friends, BT (British Telecon — sorry Telecom, alias the Post Office) have been pushing a thing called Prestel, which has featured from time to time in this column. It's a computer database that you can talk to over the phone, and has a response time that makes Ceefax look silly, not to mention far greater power —

the pages look similar, however.

The minimum control for Prestel is a numeric keypad with the extra keys * and #. On logging in to Prestel, you come up at page 0, which is a top level index; there are a number of options available at this level (eg, for news type 1, etc), which leads you through a true structure, each choice taking you down the tree. There are a maxi-

mum of 10 routes from each node, corresponding to the ten numeric codes on the keypad.

As in teletext, continuation pages are provided but, unlike teletext, the first one always comes up first, and one pages through at one's own speed by pressing #. In addition, one can bypass the routing and go directly to a page, thus *292500# will immediately display page

292500. Various other combinations of * and # cause other things to happen.

Attached to the Prestel system are a few hundred companies known as information providers (IPs) whose business (for which they pay BT handsomely) is to make information available to Prestel subscribers. They get rewarded for this service to humankind by 'page charges' (the little

DEFENDER*

NEW GAME. PRIVATE PROPERTY.

'Defender' is the latest of Atari's video games to become available.

Since it is an ATARI® game we have exclusive rights to exercise all copyrights and other rights connected with 'Defender.'

We lead the field in the development of video games. And it's due to our considerable investment of time and resources that our games have become so popular. And due also, of course, to the people who have enjoyed the games.

Unfortunately, however, some companies and individuals have been copying ATARI games, gaining profits at Atari's expense.

We must protect our investment so we can carry on investing in the development of new and better games.

So consider this a warning both to intentional pirates and to individuals unaware of the copyright laws.

Any manufacture, sale or other dealings in games which reproduce any of the copyrights in 'Defender,' or any unlawful use of the name 'Defender' (or imitation of it) is an infringement of Atari's rights.

Atari will protect its rights by vigorous action against all infringers. Regardless of what computer or other apparatus is used in playing infringing games.

We would also appreciate the co-operation of legitimate software developers in the protection of our property.

And if you happen to be selling a software product which performs a game similar to 'Defender' (or any other ATARI game) please contact us immediately.

Write to the attention of: Graham Daubney, Atari International (UK) Inc., 185 Ealing Road, Alperton, Wembley, Middlesex.



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number on the top right of the page — hopefully '(p)', by which the user pays for each page accessed, with BT taking a five percent commission to cover administration, the rest going to the IP. Alternatively, the information provider can obtain his income by charging a subscription for his customers to enter a 'Closed User Group' (CUG). He then puts up pages which may be only accessed by customers that he has named as belonging to the appropriate CUG. He then puts up pages which may be accessed only by customers that he has named as belonging to the appropriate CUG.

Other facilities currently on Prestel include an electronic mail box system, so that users can send messages (assuming that they are equipped with alpha terminals) to each other. For those who have numbers, * and # only, there are pre-written greetings cards with graphics which may be sent. A related facility is the response frame, by which IPs can get information back from the customer, such as the details of an order for some equipment, or the entry to a competition. You don't have to be an IP in order to enter data on a response frame or mailbox page.

Well, so much for the quick run through the state of Prestel as it is at the moment, but what is 8008? Well *800# takes you to an electronic magazine on Prestel, known as Electronic Insight, which is run by Telemap (a part of EMAP — East Midlands and Allied Press — a publishing group). Now, Electronic Insight has allocated an area for the computer clubs, much as PCW has this column for the ACC, only on Prestel. This area, called 'MicroScope', starts at page 8008, which you can get to from page 800, or you can type *8008# at any time to get there.

So what is going on in this area *8008#? Well, that is up

to the clubs. The ACC will have responsibility for managing the area 8008 via its Prestel Subcommittee, in collaboration with Electronic Insight and BT Prestel. The idea is for the local clubs and national user groups to use Prestel for four purposes:

1. As a medium for the exchange of software. Clubs will be able to put up programs in CET telesoftware format (I believe there are some differences over the standard in the 8-bit code case, but it is hoped that an agreed standard will be used in 8008 material). Some material may be public domain, and available for all users, but some clubs may want payment for their tele-software, and this will probably be achieved via a closed user group; a subscription buying the right to download the programs into the user's micro. An alternative is page charges, but due to the way Prestel accounts for these, this would be very hard to administrate on 8008.

2. To promote the clubs; the ACC club database will be on *8008# (this may take a little time to set up: it's a lot of typing or a very tricky file conversion job).

3. To allow club members to gain experience, via their clubs, of editing on the Prestel Database.

4. As a Bulletin Board and Mailbox between club members.

One of the major new features of 8008 is, therefore, that Prestel editing, the creation of viewdata page structures and the production of telesoftware will no longer be only the province of IPs, but that these ideas will be available to a wider community via the clubs.

If your club or user group would be interested in going on to 8008, could you please contact me, or ACC Chairman Peter Whittle at 49 Bartlemas Road, Oxford, OX4.

I hear a rumour, from quite impeccable sources, that there will be a new

Prestel adaptor out in the new year; this will essentially be a 1200/75 modem with RS232 output, and is expressly designed for computer use, since it has no page formatting or video output features (compare the MicroTantel, which can have RS232 output (or CUTS) but also has a simple keyboard and the circuits to drive a colour telly). But the good news is the price: although not yet fixed, it will be 'under £50'.

Another Prestel feature that needs a plug is the gateway concept. There is a PDP-11 in Herts, running RSX-11M (my favourite operating system) that has a port onto Prestel. *288056# will link you up, and you can interact with their machine (if the link is free; note it only works on Enterprise and Derwent) — you will need a log-in code for some, but not all functions. Also on a gateway is a company called Baric — they have four lines, not just one. It strikes me that gateways are likely to be developed in a big way on Prestel, but at the moment my spies can give me no definite information.

One rather annoying feature of Prestel editing is that, at the moment it has to be done on the Duke computer in London, which makes it mighty expensive in phone charges if you live outside the London area. I hear that this might be changed, but at the moment our new friends on 8008 will have to lump it. Of course, you can do what Telemap do (if you're rich) and have an out-of-area phone installed. Yes there is a genuine 01- phone in Telemap's office in Peterborough. Technology never ceases to amaze me — and neither does its price: this line has an enormous rental charge.

ACCumulator, the ACC's newsletter, has a new editor. Leon Heller, of the National TRS-80 users group, will now edit the newsletter, assisted by a motley collection of

ACC committee people. So, please note this new address for submission of articles for ACCumulator: Leon Heller, 8 Morris Walk, Newport Pagnell, Bucks, MK16 8QD.

Also in the ACC vein, we have a new librarian for the 6502 library: Andy Leader, of Church Farm, Stratton St Michael, Norwich, NR15 3QB is the man who will tend to your 6502 needs. Remember to quote your ACC membership number when contacting him.

I have received some info from the Walsall Computer Club, which meets in the Park Hall Community School in Park Hall Road, Walsall. Contact the Secretary, Patrick Bryan at Walsall 21769. Meetings are the second and fourth Mondays in every month; 6.45 — 9.45 pm. So if you live in the Walsall area, roll up!

Get your club a plug... write to me and it will happen like magic. I might also have your entry on the ACC club database checked — you should have had a mailing from the ACC in August, which included the details of your entry for you to correct. If you are running a club and didn't get this mailing, then you are not on the database — so write to me or Peter and tell us about yourselves.

Hope to see some of you at Microfest '82 at Manchester (11-12 December); it is hoped to hold a meeting of the North-West Association of Computer Clubs on the Sunday there. Contact Peter Whittle (address above) for details.

Personal

Desperate owner of modem 3A has problem talking nineteen to the dozen. Does anybody out there know how to make the infernal machine run at 300 baud? Peter Whittle (address above) would like to know.

TRANSACTION FILE

Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for co-operating.



*Genie I... 16K Video with Bionic RAM 3 months old, with printer adapter & software worth hundreds of pounds inc Aceel 12 Edtasm etc, £250. Tel: 092 82 5112 eve.
 *Acorn Atom... 8K ROM, 12K RAM complete with VIA, printer interface, Euro-connector, manual, books & games inc Space Invaders, £160 ono. Tel: 061 485 3319 eve or weekends.
 *Intellivision... 6 months old, good cond plus Auto Racing, Star Strike, Space Battle, Space

Armada, Skiing, Aerosmash, cartridges, £280, will sell for £180. Tel: Billingie 894006 (near Wigan, Lanes) anytime.
 *UK101... 8K new monitor exc cond, power supply hardly used £100 ono. Tel: 01-272 8027 eve, ask for Colin.
 *Sharp MZ-80K... as new, guaranteed 4 versions of Basic, 2 assemblers, disassembler, RBug, Pascal Interpreter, Pascal Compiler, Forth, Fortran, Sargon Chess, Backgammon, Othello, Database, many more, £450.

Software includes Startrek, Chess, etc. Tel: D Smith 0245 73057.
 *Teletype ASR33... 2 available, both complete with paper tape reader & punch, stand & full manuals. Also CE-121 cassette interface for Sharp PC-1211 computer, all very cheap. Tel: 051 342 5069 anytime.
 *ZX81 — with 64k audio super 2 RAMpack manual books tapes etc, £100 ono, PC1211 and printer £105 ono. Tel: 0908 679101 ex371 (work) or 052526 484 eve.

*IME 10001 Accounting Machine... M10-70's non-working 20 TTL boards, electric typewriter, massive PSU, 16 character fluorescent display (Matrix), large 6' x 4' x 3' spares/repair. Offers. Tel: 0908 78217.
 *Commodore PET... 32K 3032 series C/W Computhink disc drive & Printern Printer £750 + VAT complete. Tel: Watford 24253, contact T Newman.
 *UK101 — 8k RAM, moulded case, external heatsink, inc leads and several games, bargain at

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£125. Two 49 note key boards, brand new in box £25 each, contacts extra. Sittingbourne (0795) 22210.

★ Video Genie I - 16k; manuals, ooxed, as new, plus a fre programmes, only £195; phone 01-388 2662 during working hours.

★ HP41C. . . inc Statspak, Surypak memory modules many programmable magnetic cards & books cost £600 April 1981, asking £220 rarely used. M Rogers, Muhlalstr 83, 61 Da-Eberstadt, W Germany.

★ Acorn Atom. . . 6K + 21K RAM, 12K ROM (F. Point), word processor, 4 amp PSU £200 (worth £300). Tel: 01-643 1186 (Surrey).

ZX81. . . 16K Sine built, leads, PSU, manual, little used + Sinc cassettes 2,3 & 4 & Invaders & books, magazines, articles, etc, £180 ono. Tel: Brighton 833492.

★ Unused Apple cards. . . disk (5¼) controller Z80, Epson 1/F, 16K RAM, Integer Basic priced @ £55, 80 Colcard priced @ £95. Modified AP11 Euro+ with 16SFKS shiftlock 48K+ 150NS RAM for £425. Cheques M Rogers, Muhlalstr 83, 61 Da-Eberstadt, W Germany.

★ TRS80. . . M1, L2, boxed, exc cond, leads, manuals, mags, books, amplifier, CTR80 cassette, Edt/asm, Defend, Temple of Apshai, The Count, Star Trek, worth £450+, £300 ono. Tel: Brighton 38510.

★ Casio FX102P. . . pocket computer, non volatile memory with FA2 tape interface, hardly used, imnae cond, £100 ono. Margaret Barratt, 30 Fordway Avenue, Blackpool. Tel: 0253 32373 anytime.

★ Microtan 65 Tanex. . . 8K RAM, Basic, Tanbug V2.3, XBug, chunky graphics, toolkit, ROM, Invaders ROM, ASCII keyboard, Hex keypad, case, manuals, 8K M/C games, £150. Tel: Reading 332260.

★ Sharp PC1211. . . hand held complete with cassette, interface, original boxes, manuals, applications & keyboard overlay. Cash needed for Sharp PC1500, Jeff Askew, 30 High Street, Shoeburyness, Essex. Tel: 03708 7741.

★ Acorn Atom. . . 11K RAM & power supply. Complete with all leads & manuals, worth £170+, will accept £135. Tel: Walton-on-Thames (09322) 22022 (Surrey).

★ Microtan - 65 with power supply. As new, £70. 1 Dunchurch Close, Balsall Common, Nr Coven-

try, West Midlands, Tel: Berkswell (0676) 3432.

★ Video Genie - 16k, EG3003 fully upgraded, lower case + sound, 10 months old, complete: leads, manuals, books + over £100 s/ware £185 ono. AC Balmra, 19 Grosvenor Avenue, Newcastle Upon Tyne. Tel: 813539.

★ Acorn Atom - 12k RAM, minimum ROM. As new, virtually unused. Still in manufacturers box. Power supply included. Only £150 ono. Phone 031-229 0388 anytime.

★ PET - 4032 with toolkit ROM 4040 double disk drives, manuals. Dust cover, all as new cond £900 ono. Phone Binbrook 378 eve only.

★ Sharp MZ80K - 48k hardly used, some games s/ware + one years supply PCW all for £250 no offers. Tel: 840 3447 eve. 574 2388 ex 421 days. Ask for Kevin.

★ TRS80 - 16k Lvl2, mod 1 with green screen and CTR-80 over £100 worth of s/ware, invaders etc. Must sell soon. Offer over £295, secures. Tel: Stoke on Trent 503531.

★ 32k Genie - monitor, floppy tape, wafers, printer, New ROM. 1/case joysticks. Heaps s/ware inc extended Basic, programming course, wordproc, chess, invaders, much more. Manuals. Upgrading £675ono. Hitehin 813942 after 6.

★ HP41CV - incorporating QuadRAM) complete with card reader & printer with recharger. As new cond. £440 ono. Or may sell separately. Tel: 01-727 9657.

★ ZX81 - with Memotech 64k, mint cond. £130. Sine built, original packaging, leads, power supply, books. Delivery in North or East London. Phone 01-803 4081 eve.

★ Apple II - Videx 80-col card £140. 12in monitor £90, Epson MX80 F/T with interface £320, colour card £50, easywriter 80-col word processor £90. Phone 01-868 1096 eve.

★ TRS80 - Model 1 L II, 48k RAM, with cassette and TV lead, also some s/ware £325. Tel: 01-549 3950 after 6.

★ Casio fx602 - with FA-2, printer and Sony cassette recorder in neat DIY integration unit. Case, recharge batteries, £150. Apple switching, psu, 240v. Fan. £25 phone for more info 0533 785105.

★ HP41CV - calculator built in Quad RAM. Giving maximum memory capacity. Exc cond.

£185, tel: Ponteland 25564 Newcastle Upon Tyne.

★ Acorn Atom - 12k RAM, 16k ROM (FP plus Ross utility) 6522, 5V3A PSU, magic and get acquainted books, 1200 baud programs (Cylon attack, defender inc). £260 ono. Phone 0375 70368.

★ S100 - Z80 CPU inc CTC, PIO, PIC, s/ware, write Protect £175. VDU 16x64 display, £95. Transum 64k, Static RAM £150. I/O board, motherboard and PSU boxed. Any offers? Tel: 0788 74347.

★ Sharp PC1211 - cassette interface and pocket computer. k/board overlay, over 100 progrs. 1.9k memory. Full instruction and Basic manuals. Contact Jason on 01-553 5617 cost when purchased £137.75 quick sale £62.

★ PET 32K - Basic 4, 3040 disk, cassette, Trendcom printer, Command-D, KRAM filing system, Pronto-PET reset Visicale, Papermate + green screen, dust covers, manuals, disks etc, new price £2150, accept £1400, Tel: 01-427 4088 anytime.

★ TRS80 - 16k, Level 11 complete with Green Screen VDU and CTR80 cassette together with loads of s/ware, 6m-old. Tel Sheerness, Kent 07966 64039 the lot for £350.

★ VIC20 - Purchased 30.3.82, one owner, standard 5k RAM and PSU, leads, manual etc. + one edition of VIC Computing £155. Phone (0942) 723195 after 5.

★ PET 4032 - 12in screen + cassette and wordprocessor, games and payroll cassettes, etc, 9m-old. List price £750 approx on offer £575 ono. Bedford (0234) 42460.

★ PET 2001 - 8k Old ROM, integral cassette deck, plenty of games s/ware and books. Please phone for details. £350 ono. Tel: Darrell Dennies 01-790 6368.

★ Mattel Intellivision - g cond. still boxed with 14 cartridges, £250. Tel: 051 430 0162, Whiston, Liverpool also Interton VC4000 TV game with 13 cartridges £120.

★ TRS80 Model 1 - Business/personal system. Cost +£1800 inc 48k RAM, dual drives, green vdu, praxis daisywheel printer, scripset, upper/lower case, recorder, games/utilities, will demonstrate offers £1000, phone Mike 01-674 1363.

★ ZX81 - +16k RAM; exc cond; £95. Owner moving upmarket. Write Patrick Addison, Beachley House, Clepston, Gwent NP6

7YG or Tel: (02912) 2061.

Acorn Atom - 8k ROM and 12k RAM psu, leads, 1 manual, exc cond, 4 months old, rarely used, telephone Bristol (0272) 422158 after 5, price £165 ono.

★ Video Genie - + Bionic ROM sound s/ware scramble, firebird, maze, escape assembler - monitor machine manual + 'More TRS-80 Basic' books, new £425 but only £300. Tel: Welwyn Garden City 27887.

★ GP80A - 80 column printer, Centronics inteface, with paper £140 ono, 5¼in disk drive SSSI £90 ono. Tel: 01-876 5380.

★ Atom - 12k + 12k VIA. 6522, new keyboard, factory built, PSU, books, Software, Invaders, Astrobirds, Lander, packs 1,2,6. Lowe power RAM!! £260 ono. J Rieh 50 Newport Road, Saffron Essex CB11 4BS Tel: 232 42.

★ Wanted - software for the BBC Micro, must have good graphics taken on disc or cassette. Write to P Swali, 13 Woodberry Gardens, N Finchley, London NW12 0HD quality software.

★ ZX81 - Sinclair built with 16k RAM + QS, character board, (produce own characters) with cassette recorder & games inc Invaders, Nightmare Park etc, only £95. Tel: Brighton 36228.

★ ZX81 - + 16K RAM. Ex. con Sinclair built. All leads and power supply inc RAM pack, 1 month old, 3 cassettes. £80 ono. Tel: Southport (0704) 213996 (Steve).

★ Osborne - 01 Approx. 6 months old, virtually unused & in perf cond. Complete with manuals & diskettes & software. List over £1500, £1,159 incl delivery. Tel: Nigel Fareham (0329) 233641.

★ Sharp MZ-80K - 48K RAM 10 months old, hardly used, £350. Also Sharpgames tape, Space Invaders, Asteroids, World Cup etc, £8. Write: The Prince of Wales Inn, Lingfield, East Grinstead, Sussex.

★ UK101 - 16K 1/2 Mhz. Tagwa, M/Board 300/600 baud Mon OZ home brew case of software included, £230 ono. Tel: John 0803 864457 now!

★ UK101 - 8K, cased. Mother-board kit with extra 8K RAM. Cegmon monitor, 12K Basic, 4800 baud cassette interface, toolkit, uprated power supply. Programmes, books, manuals, £250. Tel: West Drayton 48834.

★ ZX81 - plus unique keyboard (WRTY), 16K RAM, printer + stationery and programs, £110 ono. Tel: 026 02 4882

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Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

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★ Centronics 730-4 - Serial Dot - Matrix printer, gc, works well, manual inc. £280. Tel: Staplehurst 892496 w.ends & late eve.

★ Acorn Atom - 12k + 12k, Acorn built, 5v PSU, leads, manual, etc, many programs, Bates Toolkit fitted, £220. Tel: Southampton (0703) 559792.

★ Nascom II - 16k 3A PSU, Basic toolkit portable TV, FDC-PCB, Zeap assembler, DIS-ASM Manuals. Worth £500. Only £300. Tel: 01-262 4005 room 10.

★ Apple II - computer, 2 disk drives centronics 737 printer visicale Appewriter plus gobetween + CCA data management system £1,450. Telephone Marlow 73074.

★ ZX81 - Sine built, in new cond. complete with all leads etc, £45 ono, tel: Cambridge 860014 eve.

★ 32K Pet - small keyboard; integral cassette deck; new ROM, toolkit, machine-code break swith, connection for sound box. Many games. 16m-old. Just been serviced. £375ono Phone 01-399 6166.

★ 32K Pet - new Rom, superchip, toolkit; micro. Internal speaker, reset buttons, 2022 matrix printer. Full set manuals + m/c books. w/p programme cassette deck. Some 60 games £750. Phone Erith 41018.

★ Nascom II - 3Amp-PSU 16k RAM portable TV, 8k-basie, Zeap-asm DIS-Asm Basic, toolkit, FDC PCB Manuals £300. Tel: 01-262 4005 room 10, Address Raymond 2, Westbourne Crescent, London W2 3DB.

★ 2001 - Pet, 8k integrnl cassette deck, games inc wartrek, microchess, invaders, pet revealed, with reset and interrupt buttons £240. ono. Tel: Byfleet 41866 (Weybridge) pwc.

★ ZX80 - 1k Sinc built, both ROMs available inc manuals, leads, PSU + 10 games for 4k ROM zx80 only. Upgrading to Sinc Spectrum. £50. Ring Leeds 0532-717457. Dave eve.

★ Sharp PC1211 - + cassette interface, Still boxed with 3 manuals, cost £130 offers around £80. Tel: David on Kingston Blount (0844) 51201.

★ Nascom 1 - Gemini 5-slot expansion with 32k RAM. Advanced 4k Hisoft monitor assembler, disassembler and fast hisoft Pascal. Full documentation. Offers about £220 considered Tel: 0533 785105 after 6.

★ Acorn Atom - 12k + 12k, floating points ROM, 6522 via, toolkit ROM, chess cassette, leads, manual 5A PSU cassette, 'Getting Acquainted' book, cost £300+ accept £200 or sensible offer. 01-508 2895.

★ NEC 8023B - matrix printer, 100CPS, proportional spacing, high resolution graphic, subscript & superscript, l/casc decoder, parallel interface, will work with any computer £395 no VAT needed, 1-yr guarantee 0632-328564 Mr Kwan.

★ TRS-80 L II - 16k £100+, s/ware, library 100, chess, invaders. Forth assembler/editor. £250 ono. Ashford (Kent) 0233-23066.

★ S100 - cards various RAM 8k, £70, 32k, £140 FDC £80, 6809 CPU £80, Newbury 7000 VDU £150 ICL 7181 £70, Oscilloscope 10-18u £20. Tel: Portsmouth 699593 for details, etc.

★ Acorn Atom - 12k+12k colour Acorn built power supply lots of books and magazines via connectors, asteroids etc, for more info, phone Simon 272 7044 price £210. ono.

★ UK101 - 8k RAM cased, extra large heat sink all connecting cables, manual + users info, invaders, extended monitor plus other progs. Bargain £199 Smith 01-455 4726.

★ MZ80k - 48k with £1000 s/ware, year old, as new. CP/M, languages-Pascal, machine code, assemblers, business s/ware, games, 110, serial interfaces, Newbear progs. Demo possible £695. Tel: Mike 0344 884336.

★ 20K - Vic 20 + cassette deck, all in original packaging with manuals etc. £220 or swop Genie I or II phone Huddersfield (0484) 656078 Geoff Stainton.

★ Wanted - cheap colour television for use with Spectrum colour computer. Any offer under £200 considered. Also ZX printer £20 and/or cassette recorder £20? WS Smith. Tel: Bliddenden 291503.

★ ZX81 - Sinc built, new and complete with PSU manual leads games, £47 cash and collect from Kensington, London Tel: 01-602 1849.

★ Apple II - Europlus 48k, dual drives, (DOS3.3) b&w BMC monitor, paddles, silentype printer, Appewriter, all leads and manuals, as new, (complete for word-processing) £1300. Tel: 0953 83450 or 09538 82370.

★ Teac FD50C - disk drive. Brand new, boxed, £150 or exchange, Apple II disk or offers. Tel: Crowborough (08926) 62970.

★ Intellivision computer - 11 games, auto racing; sea battle, space battle, armour battle, star strike, soccer, boxingk, space armada, golf, checkers and backgammon. Going for only £180. Tel: 01-381 5312.

★ Superboard II - in black ABS case with power supply, modulator, Cegmon, 8k RAM, manuals & 4 cassettes, £95 ono. Tel: 01-310 8894. London SE2.

★ HP41C - programmable calculator. Extra RAM + ROM (stats + maths). Superb manuals. 12m-old. £120 06374 493 (Cornwall).

★ Nascom 3 - 48k with Naseom dual disk drive CP/M & CBasic £1050 ono. Also Nascom 2 with Gemini Drives £850, call 023 979656 day.

★ ICL Termiprinter - type 7075 only £75. Also ICL VDU 7181/4 and kboard only £50. All in w/o. Manuals included. Tel: 01-669 4265 eve and w.ends.

★ PET 32k - cassette deck, toolkit, Rabbit ROM, reset key, Pet Revealed, £200+ worth of programs include: Microchess, hellfire, apshai, 'Cursor' mags, extramom, arcades 1-8, Super Glooper. Tel: 021-360 3895 anytime.

★ Aculab - floppy tape for TRS-80 £9 with progs worth £150! Phone 01-202 5285. Selling because upgrading to disks.

★ Acorn Atom - 12k+12k FP Rom 6522 via chip, printer interface Acorn built. PSU manuals, cost £296.70 and £50+ s/ware (books, games, tapes) £195 ono. Tel: 0742 (Sheffield) 339147 after 6.

★ William Stuart - colour graphics board for Nascom 1 £20, also Chiptester program and h/ware £10. Back issues of PCW CT PC and INMC newsletters. Tel: John 0698-53392.

★ Acorn Atom - 12k ROM 9k RAM mounted on board with cassette recorder, PSU and leads + cassettes with progs, books: Getting Acquainted, ATOM Magic £180 ono. Portsmouth (0705) 382617.

★ Acorn Atom - 12k + 12k Acorn built, psu leads, s/ware inc games and disassembler £150 ono for further info, if interested phone: Liverpool 051-521 4320.

★ Nascom II - 48k graphics, NasSys1, NasSys3, Zeap, Nas.Dis, Debug, toolkit, sargon AY-3-8910 soundboard with documentation, boxed inc variety of s/ware - £300, tel: Lancaster 0542-36592.

★ VIC-20 - with 8k expansion and cassette recorder. Also includes invaders, viemen, breakout and many more, + 2 books, £240 for quick sale. Tel: Albrighton 090722-2717 after 6.30.

★ Microtan 65 - HEXkbd PSU tanex manual, s.invaders ready to run. Phone 01-505 2131 after 5 ono £80.

★ UK101 - 16k cased Cegmon sound toolkit inverse video 1.2 Meg 300/600 baud many programs + data articles etc £200 ono. Tel: Medway 576561.

★ PET 32k - Basic 4.0 large k/board cassette. Superior board with socketed not soldered memory chips. White screen, manuals + masses of quality s/ware. £475. Tel: Danny Doyle, Buckingham 02802 3346.

★ VIC 20 - cassette unit VIC revealed, 3k RAM cartridge, joystick, many s/ware programs and back issues of VIC computing only £215 for quick sale. Tel: 249 9895 eve only.

★ Secondhand Apple Disks - £13 each, Gorgon, Sneakers, Orbitron, Softporn, Starmines, Spaceeggs, GP, Bandits, Starcruiser, Marauder, Wizard, Princess, Missile-defense, Coptrobbers, dark-forest, £16.

★ Atlantis. £9 Planetoids, Mission, Asteroids - 01-505 4470.

★ ZX81 - Sinc built + 16k RAM, PSU, leads, manual, s/ware on tape and books worth £45 inc. QS Defender, Invaders, Asteroids. Cost new: £165. Sell for £90 ono. Reading 0734-54576.

★ PET - 16k, large keyboard, green screen, new ROM. Cassette and progs inc. pwo. Niek Hampshire's 'Pet Graphics'. £425. Tel: S/land 0783 47393 e/w.ends.

★ Printer! - Tally 1602 as new, stand 160 CPS 5x7 DOT Matrix Bi-Dir, RS232 working now or 20mA current loop with plug in card supplied. Tel: 0732, day 862217 eve 62227 Knight.

★ PET - 4016, 16k with cassette deck, Micro assembler & toolkit chips, cover, manual, PET graphics many progs, per cond. Memory expansion possible. £600. Tel: Histon 3014 (near Cambridge) eve.

★ Apple II - Europlus, 48k, 2 disk drives, one with controller (D)S 3.3) 14in colour monitor MX80F/T1 printer, two programs some games manuals, hardly used £1800 ono. Tel: 01-640 1886. eve.

★ PET 2001 - 32k, large keys, new ROMs cassette over 75 progs inc Asteroids, Startrek and Car-Race 6385. Ring 01-940 2254 anytime.

★ Nascom 2 - 16k RAM, graphics ROM, smart case, + toolkit, V&T assembler and games tapes. £275. Tel: 01-749 3829.

★ Sharp PC1211 - pocket computer, printer/cassette interface, cases and adapter, 9 months old, manuals and some tape s/ware printer spares, paper and ribbon, £120. Phone Yateley (0252) 872253.

★ Cased 16k - ZX81 printer, DK, graphic ROM, cassette recorder, large kboard, s/ware, inc Asteroids, Defender, Scramble full working order. £140. Will split, swop or Negotiate. Ring Ian (0256) 780770 eve.

★ VoxBox Voice Synthesizer - + manual. Suit all old ROM PETS. Used only once, selling because of change of computer. Sell for £55 ono. Will pay postage. Tel: 0724 858569 after 5.

★ Spectrum - no frills EDIT & ASSEMBLE generating Z80 machine code for compact source programs. Cassette £8.60. Details SAE to I Krishnan 12 Gles House, 160 Westbourne Grove, London W11 2RJ.

★ Atari 800 - + cassette, joystick, Atari user group membership, analogue mag, subscription many cassettes, games, books etc. £550 ono. Tel: Basildon (0268) 2847711.

★ UK101 - cased CEGMON, 8k RAM assembler and prog tapes, Recorder, 6502 books, offers over £180. Canvey Island 692776 eve.

★ TRS-80 - Model 1 Level II + s/ware and all leads, manuals etc. Exc cond, quick sale, only £250 ono. Also Casio tone MT-30 synthesizer £65 ono. Tel: Telford (0952) 604276.

★ BBB - Psychic Asteroids game for 32K machines. Superb colour graphics with amazing sound effects. Highscore and Binus Ships. Send to J P Riggs, 68 Gomer Lane, Gosport, Hampshire PQ12 2QN.

★ Sharp MZ-80K - software. Collection of games/utility cassettes at £3.00 each. SAE for list. Loverseed, 38 South Parade, Bramhall, Stockport, SK7 3BJ.

★ Sharp MZ80K - arcade games pack Space Invaders, Defender, Pack-Man & Break-out. All written in M/C with exc. graphics & full sound effects £12. KM Orr, 75Parkhall Road, East Finchley, London N2.

★ Superbrain - model QD + discs & software. Offers to 01-866 2532.

★ Sharp MZ80K - 48K, original packing, Basic & games, £300. Buyer collects. Dave Wright, 28 Bannerdale Rd, Sheffield S7 2DL.

★ Acorn Atom - 12K + 12K 6522 VIA & printer buffers, Acorn built, 4 months old, 3 amp PSU, manuals, leads, games cassettes unfinished Elektor 13K card, £180 ono. Tel: 01-549 2365 evenings.

★ V/Genie - sound, cursor, keys, cover, 12" professional monitor, technical & many other books. Loads of software incl. Editor Assembler, Chess, Invaders, £650 worth, £400. Tel: Steve on Lewes 77194 evenings & weekends.

★ T159 - with printer & some cards. All manuals, exc cond., £120 ono. Tel: 0632 818383 (day).

★ T1-58 - programmable calculator manuals library module charger includes statistics module also sourcebook of programmes VEC £50, 01-573 4810.

★ As new - one computhink side. Drive 400K Suit Pet 3000 series. Original price £1000 - £250 ono and as above 800K £300 ono. Tel: Barry 051-922 9888 after 8pm.

★ Commodore - 40 col. 32K Basic 4, with dual disk drive DOS 2.1 and Commodore. Tel: 0492 67288.

★ Acorn Atom - 12k RAM, tool box ROM, buffers, printer drive, connectors PSU + leads, tapes inc Asteroids, Invaders, Galaxjans etc. Manual + Getting Acquainted £195 01-337 7968.

★ Nascom 2 - PSU 16k RAM TV 8K Basic, toolkit, Zeap-Asm, Dis-Asm Fdc PCB Manuals only £260. Tel: 01-221 6864 (10-5) 01-262 4005 address Raymond London 10, 2 Westbourne Crescent London W2 3DB.

★ Basic VIC20 - Four months old, boxed with cassette player, joystick, Alien and Avenger cartridges, various s/ware, books and relevant magazines. Ideal for beginner £240. Phone: Cheshire 061 436 4426 after 5.30.

★ fx702, fx602p, fp10 - plus fa1. Must sell all. Only few months old. A snip at £120 the lot. All boxed, contact Mr R Barnes, 2 Stanton Rd, West Croxdon, Surrey.

★ AVT - green screen, high resolution monitor, 12" model DM210G. Metal cased, anti glare filter, only 3m-old, reason for sale, emigration. £100 ono. Phone 01-459 6133 eve/w.ends.

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★ Nascom 2 — with 16k RAM B board, Microsoft Basic, Zeap, graphics, toolkit, Kenilworth case, mains cassette player, all leads supplied. All parts as new. Worth £650+, will sell for £450 ono. Andy Fawthrop 061-485 6222 ex 297 days.

★ 32K PET — (3008 with professionally fitted extra memory). Toolkit plus arrow chips. Manuals £435. Haddock. Phone (0204) 852868.

★ Apple II — Europlus 48k. exc cond, paddles, s/ware, manuals (inc Apple II reference manual), TV modulator £495 ono. Tel: Peterborough 54232.

★ VIC 20 — with cassette unit, all leads, 1/0 blank cassettes, 'Getting Acquainted' book. Unit only, use twice, cassette still boxed, not used at all as new £185 ono. Phone Colin 01-550 7180.

★ Atari 800... 32K RAM, tape recorder, assembler & editor, joystick, games cartridges, many books & other programs, 2 months old. Price around £600. Tel: 01-794 9655.

★ Chess System III with printer, only £50. Tel: 01-381 5312.

★ TI 99/4A — wanted, software & accessories, especially extended Basic Command Module, Speech synthesiser, Speech Editor & RAM expansion unit. Tel: 01-206 0796 evenings & weekends.

★ ZX81 — Sinc built, PSU, leads etc. £50. Also 32k D-RAM pack fac built £40, also 3 s/ware tapes inc Nightmare Park and Music £10. Tel: Romford 22063 anytime (Dave).

★ Acom Atom — 12k RAM 16k, ROM fully expanded, inc VIA, toolbox etc. Various progs, books and information, 3A 5V, PSU leads etc. £200 (0202) 698016 eve and w/ends.

★ GP-80D — Printer with Sharp interface, very little use. Print lower case and full sharp graphics with double width and 300+, listing paper all for £250. Offer accept. Phone: Mr P C Lee 01-977 6389.

★ Atari 400 — 16k Basic cart, assembler, editor Star Raiders and Prog recorder. Cost Price over £450. Sell for £320 ono. Ring 300 7633 ask for Rob.

★ Acorn Atom — 12k RAM 12k RAM + floating point. S/ware inc: Asteroids, Breakout, also Transformer Magic Book, all leads, (owner bought Apple) £170 ono. Phone 01-675 0413 after 6.

★ ZX81 — and 16k RAM, both Sinclair built, PSU, Manual, Sinclair games cassette 4 (Lunar Lander etc), book, some mags. £75 ono. Apple eve/w.ends. Kaz 01-444 5499.

★ Transam Tuscan — starter, fully working, 8k RAM, 8k Basic, 12A PSU cost £350. Accept £150 ono, Paul Coleman, 2 Norwich Street, Cambridge CB2 1NE.

★ Doublevision — by Computer Stop. 80x24 video display with upper and lower case suitable for Apple II or Apple II plus. Complete with manual. Practically new £75 (½ price) phone Caterham 47285.

★ Sharp MZ-80K — 48k RAM, extended Basic, Pascal, Zen Assembler, listings for above, circuit diagram, reset switch, dust cover, 8 months old, £349. Phone 01-958 4109 after 7.

★ Superboard — 8k, Cegmon, enhanced Basic, 48x32 display, 2 MHz, monitor, teletype, cassette recorder, s/ware, oodles of components inc SC/MP micro. keyboard, power supplies £350. Herriard 407 (nr Basingstoke).

★ Colour graphics — output from most computers. Connects via RS232 or Kansas City interface with domestic television. Also receives viedata (Prestel). £189.95 inc. Also teletext add-on adaptor. Tel: 0272 502008 after 6.

★ VIC20 — 8k expansion cassette, deck space invaders cartridge, joystick introduction to Basic cassettes and manuals £220. ono. Tel: 0865 725 851.

★ UK101 — 16K, colour, sound, U/defined graphics, numeric keypad, EPROM sockets, cassette control, RS232 output. Much software incl. games, adventures, Assembler, Invaders, £200, huyer collects. D Hunt, Tel: Irvine, Ayrshire (0294) 52250.

★ Pet 4032 — 32k with Basic 4. £495. 4022 printer £295. both per cond, hardly used, complete with manuals and cables. Tel: 061 904 9901.

★ TRS80... 48K (model 1), two discs, cassette, VDU, line printer II, Visicalc, exc cond, manuals, packaging as new, £990. Tel: 0632 818383 (day).

★ TRS-80 pocket computer — 1.42K approx, also included are case, manual and cassette interface with batteries all v.g.c. Accept £100 o.n.o. Tel: Mr D. Scott on Glenrothes Fife TEL: 01-675 0413 after 6.

★ TVI 912 — and TVI 950 VDU, 24x80 character display, full upper. Lower case ASCII speed 75-9600. RS232 interface £330. TVI950 as previous with detachable keyboard and advanced editing £475. Tel: 01-908 0501 eve.

★ MZ80K — 48k Dec '81. 2yr guarantee, Sharpsoft user notes. Some s/ware £350 ono. Tel: 021 430 2631.

★ HP31E — Scientific calculator, rechargeable with adapter and instruction booklet, £11. Phone Belfast 671734 after 4.

★ Apple II — Europlus 48k, disc-drive, discs, DOS 3.3 £300, worth s/ware, inc Pascal, Fortran, Games, RF Modulator, manuals, £825 ono. Ask for Miles on 01-302 4839 after 7.

★ PET 2001 — old ROM, 8k RAM + toolkit & Superchip ROMs on expansion board, 30+ cassettes of games, diagnostics, ASMPack/Memfix assembler, lots of documentation inc. 'PET Revealed'. £300. Tel: Harpenden 63566.

★ MEGASTOR — 8-inch Double disk drive with Apple II controller card, 1.1mb capacity, DOS and CP/M compatible £800 o.n.o. Tel (0742) 685450 after 6pm

★ Apple II — + 64K, disk, DOS 3.3, 3.21, dual AY-3-8910 sound board, Pascal system, 12 inch Hitachi monitor, software £1400. Complete sets PCW, Practical Computing. Offers Garry Fuller 01-886 5789.

★ Video Genie — 16K £3003 plus manuals plus £50 software all leads £250 phone 01-330 3661.

★ VDU terminals — with fast core memory, green display and good PSU. Working units suitable for computer interfacing £15.00. ASC II cased keyboards 76 Reed switched keys £10. Phone Horsham 69835

★ Genie — EG3003 in original box plus over 50 progs including 10 adventures, arcade games, sargon chess, various monitors. Sound through TVI 7 months old. £275 o.n.o. can deliver. Tel: 0706 65444.

★ ZX Spectrum — 48k virtually unused. Bought only as insurance in case. My BBC Micro never arrived. Yours for just £160. Tel Joe on 639 6074 after 6.

★ Sale 4000 — series Pet + Dual disk drive £1000 inc upto £800 s/ware. D Milnes, 13 Delmont Close, Whitelee Road, Batley, West Yorkshire, Tel: Heckmono wike 405552, will sell s/ware in separate lots.

★ TRS-80 — 16k LII with VDU, PSU, cassette, language and technical manuals, s/ware, books, worth £600 new, accept £275. James Bridson, Barnsley (0226) 41753.

★ Wanted — 24k additional memory for 2001 8k PET (small keyboard). £50 offered for unit in working order, also cheap printer wanted for PET, any condition and disc drive, Brighthouse (0484) 719689.

★ MZ80K — Floppy disc drive wanted with interface card etc, also will copy any cassette, just for price of return postage. Contact Mark, 16 Cookson Road, Hornthorn FY5 2RL, Lancs 0253-826332.

★ Wanted — TRS 80 16k, L2. S/ware not needed. reasonable price paid. Details and price, tel: S Waring, Colwyn Bay, (0492) 56601.

★ UK101 — 8k, altered circuit gives extremely clear display, exc 9 inch National monitor, 300/600 baud, cassette recorder, s/ware, 7 books, magazines, absolute bargain, £185 ono. 30 computer magazines 'CT' 'PC' £. 70 electronic magazines 'He' 'EE' £ Tel: 01-856 2797.

★ VIC20 — datasette Alien (cart) + cassettes for £85. Atari game-console + combat, superman, chess, warlords, Maze craze, Pac-Man, Asteroids, Laster Blast, invaders, (ROM) for £95. The lot £150. Tel: Cosham in Hants (Cosham) 375681 eve. Remember the lot for £150.

★ Acorn Atom — 12k RAM +12k ROM +PSU, some games 4m. old, with bounce free keyboard, lead and manual inc £165 ono. Ring Eastcot 01-868 5654.

★ Printer — Nascom Imp. 80 columns upper/lower case at 50 lpm. Friction/tractor feed 9½in paper, 1k character buffer, RS232 interface. Little used. Cost £373. Accept £175 ono: Portsmouth 817643.

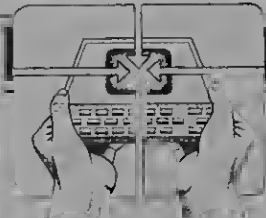
★ Nascom 1 — plus case. Unexpanded. 3A power supply £95. Per working order. Must sell for need of cash. Tel: 0603 613698 eve.

★ Sinclair ZX81 — personal computer with 16k RAM pack and games, exc cond, £80 ono. Phone Harlow 32610.

★ TRS80 L2 16K CTR80A — cassette tandy VDU £150 + software £40 books and manuals, light pen. Excellent condition 1½ years old £230. Tel 0272 503848 (Bristol).

CTUK! CONTACTS

For further information on ComputerTown UK! see 'CTUK News' or Prestel page 3574831



BJ Candy
9 Oakwood Drive
Gloucester GL3 3JF

Tony Cartmell
54 Foregate Street
Worcester WR1 1DX

R L Saunders
14 St Nicholas Mount
Hemel Hempstead
Herts

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear
NE8 1TL

Brian Taylor
Tonbridge Area Library
Avebury Avenue
Tonbridge
Kent

Ray Skinner
62 Central Avenue
Billingham
Cleveland
TS23 1LN

Keith Taylor
Carter Hydraulic Works
Thornbury
Bradford B3D 8HG

Alan Hooley
21 Brammay Drive
Tottington
Sury BL8 3HS

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

Andrew Holyer
10 Masons Road
Mannings Heath
Horsham
Sussex RH13 6JP

Derek Knight or Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
Middx

Roger Shears
18 Woodmill Lane
Bittme Park
Southampton
SO2 4PY

Bill Gibbings
3 Longholme Road
Retford
Notts DN22 6TU

Chris Cooper
110 Church Road
Hanwell
London W7

Christopher Bates
Ashford Main Library
Church Road
Ashford
Kent

Chris Woodford
31 Hopley Road
Anslow Burton-On-Trent
Staffordshire

Mike Perry, Steve Collas
or Dave Lee
The Library, Ealing Road,
Weembley,
Middlesex HA0 48R

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Gardenways
Chilworth Towers
Chilworth
Southampton SO1 7JH

Lyn Antill
1 Defoe House
Barbican London EC2

Alan Sutcliffe
4 8 Infield Road
Wokingham
Berks RG11 1SL

Peter Earthy
46 High Street
Church Stretton
Shropshire
SY6 6BX

Brigitte Gordon
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New Addington
Croydon CR0 0RT

Richard Powell
22 Downham Court
South Shields
Tyne & Wear

Pam Pollicott
South Ruislip Library
Victoria Road
South Ruislip
Middx

Peter Jarvis
c/o Health Dept
Corporation of London
Guildhall
London EC2

CTUK! CONTACTS

JM A Kilburn
(Headmaster)
Shawfield Norden
Community Middle School
Shawfield Lane
Norden
Rochdale
OL12 7QR

Derrick Daines
18 Cuttings Avenue
Sutton In Ashfield
Notts

Phillip Joy
130 Rush Green Road
Romford
Essex

Robin Bradbeer
Polytechnic of North London
Holloway Road
London N7

Andrew Stoneman
135 Birchdale Avenue
Newcastle-Upon-Tyne
Tyne & Wear

Pete Shaw
15 St Vincent Road
Clacton-on-Sea
Essex CO15 1NA

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

Peter J Kiff
52 Stone Road
Broadstairs
Kent CT10 1DZ

David Sharp
5 Bridgenhall Road
Enfield
Middx

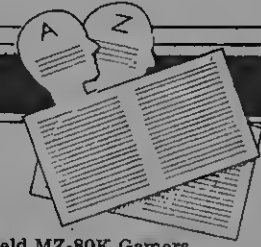
Rex Shipton
17 Woodlands Avenue
Eastcote
Middx

Derek Moody
2 Victoria Terrace
Dorchester
Dorset DT1 1LS

Patrick Colley
52 Queensway
Caversham Park Village
Reading
Berks RC4 0SJ

Susan Kelly
Head of Reference
Services
PO Box 4
Civic Centre
Harrow
Middx

USER GROUPS INDEX



These are alterations and additions to the complete listing published in the August issue. The next full listing will appear in the February 1983 edition

INTERNATIONAL
Belgian Micro Club Informatique de Mons. Contact: H N Perin (secretary), Cbee De Binche 101, B-700 Mons, Belgium.

NATIONAL
UK DAI User Group, newly formed. Newsletter planned — ideas welcome. Contact: Dave Atherton, 16 Douglas Street, Atherton, Manchester M29 9FB. Tel: 0942 878210.

Mk14 User Club — due to the non-existence of hardware/software suppliers, the club has now unfortunately disbanded. Any Mk14s still in use will be hard wired in some application or used in very basic training. Sirlua User Group — anyone interested? If so, contact Edward Hasted with ideas or opinions at 12 Chesterfield Street, London W1X 7HF.

TOWNS
Birmingham Amateur Computer Club. Meetings 1st and 3rd Wednesdays monthly in the Club Room (donated by kind permission of CBS Consultants), Watery Lane, Small Heath, Birmingham. New members invited. Contact Mike Bayliss on 021-743 7197, or just turn up at 7pm.

Birmingham & Region Apple Group (BRAG). New Independent group for Apple II and III users. Contact: The Secretary, BRAG, 125 Berryfield Road, Sbdon, Birmingham B26 3UU. Tel: 021-743 7197.

Blackburn Microcomputer Users (Mu) — meets once monthly. Wide range of micros covered. Talks, demonstrations arranged. Contact: R C Pickup, tel: Blackburn 22085.

Cheltenham New Group for those interested in micros for primary schools. Contact Pat Heslip.

Arthur Dye CP School, Springbank Road, Cbelenham, Glos.

Crawley/Horsham PET group. Will readers please note that Richard Dyer is now no longer connected with this club.

Liverpool BBC Microgroup 1st meeting was 25 August. Now held on 3rd Thursday monthly at Stem. 117 Grove Street.

Liverpool, at 7.30pm. Affiliated to the Merseyside Microgroup — enquiries to Fred Shaw, 14 Aihany Ave, Eccleston Park, Prescot L34 2QW.

PACE — Preston Atari Computer Enthusiasts. Other micros welcome but most members are Atari owners. Membership fee £5 pa adult, 16 and under £2.50 pa. Meetings 3rd Thursday monthly. Contact: R Taylor, 177 Forest Drive, Lytham St Annes, Lancs. Tel: 0263 738192.

Sheffield MZ-80K Gamers Group. Contact Noel Williams, 29 Buttermere Road, Sheffield S7

2AX. Programa & games development bi-monthly newsletter, reviews of commercial games. Towcester Computer Club has now been integrated with the South Northants Computer Users Group which meets weekly (Wednesdays) at 7.30pm at the A6 Rangers hall, Watling Street, Towcester. Contact: Simon Clark, 83 Watling Street West, Towcester, Northants NN12 7AG. Tel: 0327 52191.

ZX-Aid Sinclair users' club meets 1st and 3rd Thursdays monthly (7.15) at a local church hall. Members invited from Walsall and West Bromwich areas. Contact: Conrad Roe, 25 Cherry Tree Ave, Walsall WS5 4LH (please enclose SAE). Tel: Walsall 26455.

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull... (Forum-80 H,Q) Tel: 0482 859169. System operator Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm to 10.00pm.

Forum-80 London... Tel: 01-747 3191. System operator Leon Jay. Electric mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00 pm.

Forum-80 Milton... (TRS-80 Users Group 80-Net) Tel: 0908 555660. System Operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00 pm.

Forum-80 Holland... Operator: Nico Karssemeyer, tel 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

CBBS London... Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1500-2200.

Mailbox-80 Liverpool... 051-220 9733. System Operator: Peter Toothill. Electronic mail, downloading TRS-80 information.

ACC... members bulletin board, Peter Whittle (0908 44252)

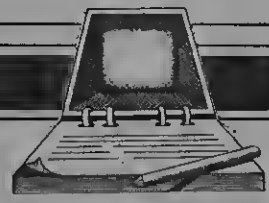
ABC-80... Stockholm, Sweden) Tel: 010 458 190522.

University Research Computer... Sweden. Tel: 010-458 23660, guests use password "55.66" for access.

Elfa... Sweden 010 468 7300 706

Tree Tradet... Sweden 010-458 190522.

DIARY DATA



Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

London	(Wembley Conf. Centre) Software Expo. Contact: Interco Business Consultants Ltd, 01-948 3111	8-10 Nov.
Holland	(Amsterdam) Comdex Europe.	8-11 Nov.
Plymouth	(Holiday Inn) Business Equipment Exbn. Contact: Douglas Temple Design Group, 0202 20533	10-11 Nov.
London	(Royal Horticultural Hall) Breadboard '82. Contact: Argus Specialist Publications Ltd, 01-437 1002	10-14 Nov
London	(Olympia) Compec. Contact: IPC Exbns Ltd, 01-643 8040	16-19 Nov
London	(Alexandra Pavilion) Electronics Hobbies Exbn. Contact: IPC Exbns Ltd, 01-643 8040	18-21 Nov
Glasgow	(Kelvin Hall Business, Data Processing & Education Exbn. Contact: Scottish Industrial & Trade Exbns Ltd, 031 225 5486	23-27 Nov
Manchester	(Belle Vue) Northern Computer Fair Contact: IPC Exbns Ltd, 01-643 8040	25-27 Nov



PROGRAMS

PCW is interested in Basic or Pascal Programs for any popular micro — please tell us which one you wrote your program on and how much memory it uses.

Make sure your programs are fully debugged before you send them in on cassette (although we will accept disks) with a clear listing on plain paper. Documentation would be welcome, and if you want it returned please label everything with your name and address and include an SAE. Send contributions to: Maggie B, PCW Programs, 62 Oxford St, London W1A 2HG.

PCS

PEDRO COMPUTER SERVICES

Programming Aids

UN-NEW: If you typed N19 and lost your program without saving, UN-NEW will let you recover it. Price: £10.00
 DUMP: You just touch a single key and the entire screen is copied onto the printer. This can happen even while running a program. Price: £10.00
 DISK UN-NEW A050: If recovery is needed program on your 8050. Price: £12.00
 ASSEMBLER: for the IIR WATSON BOOK OF ASSEMBLY LANGUAGE PROGRAMMING. Price from £7.00
 TINY BASIC COMPILER: A true compiler that turns your BASIC programs into fast machine code programs. You add new ROMs. Price: £30.00
 VITAL: Evolving, new semimicro style language. Easy to learn with 60+ powerful commands. Price: £10.00
 Also available for VIC Price £30.00

Hardware

CB2-Soundmax: de Luxe Soundbox less Arcade game with programming manual. Price: £17.50
 TV Interface: for both 20 and 80 ch. FEts. Video out RF out for connection to home TV. Price: £35.00
 Telephone Interface: Use your PET to dial your telephone. Stores 40 names and phone numbers. More than one screen page of names and numbers possible. 20 lines and numbers per page. Price: £25.00
 All-in-one board: interface to all computers with on-board supply, 4-bit output port and disc program. Price: £55.00
 A2300: Schottky endline to digital converter assembled and ready for use. Includes example with disc program and well documented handbook. Features include 8-bit output port, precision reference voltage, and many others. Price: £35.00
 PET ROM WRITER: Now you can program D15 and other utilities into 2K and 1K 13H1M. Price: £55.00

Books

IIR WATSON BOOK OF ASSEMBLY LANGUAGE PROGRAMMING Price: £10.00
 THE DR. WATSON BOOK OF ASSEMBLY LANGUAGE PROGRAMMING for VIC. Includes Assembler Cassette. Price: £17.00
 PET MACHINE LANGUAGE GUIDE. Price: £8.00
 PET REVELAID. Price: £10.00
 LIBRARY III PET SUBROUTINES. Price: £10.00
 THE VIC REVEALED. Price: £10.00

VIC Programs

MC FIFTH: 4 Games on one cassette. Price: £5.00 (3.5K)
 STARTER: Lighting in the galaxy. Price: £5.00 (3K & 4K)
 IATA-BASIC: Relevelled system. Price: £2.00 (1K & above)
 RIKI'S CHARACTER GENERATOR. Price: £7.00 (1K & above)
 THE CYBER MAN: 216 levelled them. Price: £7.00 (3.5K)
 MIGHTY MIGHT: Desktop lights ship. Price: £7.00 (3.5K)
 Please add 1.20 VAT except for school & 20% off p.p. (UK). 50 hand written only, all orders please add 11.50 if you require 2nd or 3rd copies. Add on disk, speedily 3500+400 or 800 isomer.

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Compression Assembler NEW £12

The best of its kind for the Nascom, this full Z80 assembler compresses source to half the normal size. Thus bigger programs fit in memory & loading/saving is twice as fast. As a bonus it assembles 3000 Ipm! It is 6k and includes a Z8AP conversion utility.

Extension Basic 200 sold £15 (£25 in ROM)
 Adds these keywords to ROM BASIC: IF, ELSE, REPEAT, UNTIL, WHILE, WEND, AUTO, BREAK, CALL, CHECK, COPY, DEC, DELAY, DELETE, EDIT, FIND, GET, HEX, INKEY, INLIN, LINE, PLOT, PRINT @, PUT, RENUMBER, REDUCE, SPEED, TEST, TRACE, VDU, WRAP, XLIST & XREF. And you can add more yourself. EB is only 4K.

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 229 Hughenden Road, High Wycombe, Bucks. HP13 5PG

There are a few languages which PCW has covered in recent articles for which I'd welcome programs from anyone who feels qualified to write them. These are Logo, Forth and Comal. Basic and Pascal are all very well, but as we've publicised these three languages and they seem to be catching on in some quarters, some follow-up in the form of real programs would seem appropriate — and interesting. In the meantime, for those who program only in Basic or Pascal, keep the contributions rolling in — especially for recent machines like the ZX Spectrum and BBC Micro. I'd also like some volunteers to referee programs for the Spectrum, BBC, Ataris, Sharp MZ-80A (no programs for this one as yet — why not?) and expanded VIC-20. If you think you can provide me with an informative second opinion on other readers' programs then drop me a line — I'd love to hear from you.
 I know keying-in is a tedious exercise

at the best of times and I also know that the potential for error is enormous. Therefore, if you type in a program for PCW — or any other magazine for that matter — and find it doesn't work, please check it thoroughly against what is in the magazine before calling to complain. Many of the programs printed in PCW are run by me and I'd stake my life on the fact that a good 90 percent of them are error-free. However, it's a human failing to think yourself right and everyone else wrong and I'm certainly not one to boast about my talents as a typist. Please, if you think there's a bug in one of our programs, don't just get on the phone about it — check your typing first and make sure you haven't missed out a DATA item or got a POKE wrong. Finally, if we do discover something wrong in a program, a Bludner will always follow within a couple of months.
 Maggie Burton

PianoComputer

by A Lake

If there are any Apple II users about who fancy themselves as Rick Wakeman or Jean-Michel Jarre, this program could put them on their way — sort of. It converts the Apple keyboard into a musical instrument with keys arranged much

like those on a piano and even puts a picture of a more realistic piano keyboard on the screen to tell you where you are. I ran it on an Apple II Europlus without any frills so it should work on any Apple II.

```

10 REH *****
20 REH x x x
30 REH x PIANOCOMPUTER II. x
40 REH x (C) A.LAKE 1982 x
50 REH x x x
60 REH *****
70 REH LEHGH:5201 ($1451) BYTES
100 LOHEM: 16384: TEXT
101 TUN# = "A0GHUHGDAGCHUHGFHKLPLKHA0GHUHGDGJL?FHKLACGHUHGD"
110 HV = 23:HH = 28:TV = 21:TH = 28
120 SOUND = 770:FR = 768:OUR = 769
130 ONERR GOTO 1580
140 OC$(0) = "LO":OC$(1) = "HI"
150 GOTO 520
160 VTAB 22: HTAB 28: PRINT OC$(0C)
170 HOOE = 1: GOTO 990
175 REH ***** LOOP START *****
180 VTAB 24: HTAB 1: GET R$: HCOLOR= 0
190 R = ASC (R$)
200 IF R$ = CHR$(27) THEN OCTAVE = NOT OCTAVE: VTAB 22: HTAB 28: PRINT
OC$(0C): GOTO 180
210 IF R = 52 OR R = 53 THEN HOOE = NOT HOOE: PRINT "
(N$(NN)) - 1: POKE FR,30: POKE OUR,255: CALL S0: GOTO 180
220 IF R > 48 AND R < 53 THEN HOOE = R - 48: GOTO 990
230 XDRAW 1 AT (T(R) + 8 * OC - OC) * 14 - 7,Y( FN Y(T(R)))
240 NO = NO + 1: VTAB NV: HTAB NH: PRINT NO;" "
```

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 Tel: 051-327 5070

PROGRAMS

```

250 IF HODE = 1 THEN 270
260 R = ASC (R$) : N$(NN) = N$(NN) + R$ : IF LEN (N$(NN)) > 250 THEN NN = N
    N + 1
270 TE = 1 + POL (0)
280 IF TE = 256 THEN TE = 255
290 VTAB TV; HTAB TH: PRINT TE;" ";
300 POKE FR,A(R,DC); POKE DUR,TEHPOI CALL SOUND
310 XORAW 1 AT (T(R) + B * DC - DC) * 14 - 7, Y( FN Y(T(R)))
320 GOTO 180
325 REM ***** LOOP END *****
330 REM ***** PLAY BACK *****
340 IF LEN (N$(0)) < 1 THEN VTAB 24; HTAB 1; INVERSE : PRINT " NO TUNE
    IN HEHORY "; FOR T = 1 TO 2000; NEXT : MODE = 1; VTAB 24; HTAB 1; NORMAL
    : PRINT " "; GOTO 990

350 GET R$
360 VTAB NV; HTAB NH: PRINT " ";
370 FOR HH = 0 TO NN
380 FOR T = 1 TO LEN (N$(HH))
390 OC = 0
400 IF HO$ = "AUTOPLAY" THEN 410
401 VTAB 24; HTAB 27; GET Y$; IF Y$ = "H" THEN OC = 1
410 R = ASC ( MID$( N$(HH), T, 1))
420 XORAW 1 AT (T(R) + B * OC - DC) * 14 - 7, Y( FN Y(T(R)))
430 NO = NO + 1; VTAB NV; HTAB NH: PRINT NO
440 VTAB 22; HTAB 28; PRINT OC$(OC)
445 TE = POL (0); IF TE = 0 THEN TE = 1
446 VTAB TV; HTAB TH: PRINT TE;" ";
450 POKE FR,A(R,DC); POKE DUR,TE; CALL SOUND
460 XORAW 1 AT (T(R) + B * OC - DC) * 14 - 7, Y( FN Y(T(R)))
470 NEXT T, HH
480 VTAB NV; HTAB NH: PRINT "END"; VTAB 22; HTAB 7; GET R$
490 NO = 0; R = ASC (R$)
500 IF R < 52 AND R > 48 THEN HODE = R - 48; GOTO 990
510 GOTO 330
520 REM ** INITIALISATION **
530 HOME : PRINT "PIANOCOMPUTER (C) A.LAKE 19B2"; PRINT : INPUT "O
    YOU WANT THE INSTRUCTIONS ?"; R$; IF LEFT$( R$, 1) = "N" THEN 550
540 GOTO 1090
550 REM
560 OIH G(21), A(90, 1), T(100)
570 HODE = 1
580 HCOLOR= 3; SCALE= 1
590 G(3) = IIG(7) = IIG(10) = IIG(14) = IIG(17) = 1
600 Y(0) = 143; Y(1) = 120
610 DEF FN Y(X) = 2 * X - INT (X)
620 HC$ = "2041??1=20<01=30<088=005<>0103?00?<1=0751>00034<0503203??7408=1
    302;<0103;>0103!9042018?<1=20<0>B=0?=>88=0?<>0003=0>760010004003?3820
    640<2=150>361>1>0700"
630 FOR T = 1 TO LEN (HC$) STEP 2
640 X = ( ASC ( MID$( HC$, T, 1)) - 48) * 16 + ( ASC ( MID$( HC$, T + 1, 1)) -
    48)
650 POKE 769 + ((T + 1) / 2), X
660 NEXT
670 POKE 232, 61; POKE 233, 3; SCALE= 1; ROT= 0
680 FOR T = 1 TO 12 STEP 0.5
690 IF T < > INT (T) AND G(T - .5) = 1 THEN 710
700 READ A; READ B; A(A, 0) = B; T(A) = T
710 NEXT
720 FOR T = 8 TO 21 STEP .5
730 IF T < > INT (T) AND G(T - .5) = 1 THEN 750
740 READ A, B; A(A, 1) = B
750 NEXT
755 REM *** DRAW KEYBOARD ***
760 HGR
770 FOR T = 0 TO 279; HPLT T, 100 TO T, 160; NEXT
780 HCOLOR= 0
790 FOR T = 14 TO 279 STEP 14; HPLT T, 100 TO T, 160
800 HCOLOR= 0
810 IF G((T) / 14) = 1 THEN B30
820 FOR Y = T - 4 TO T + 4; HPLT Y, 101 TO Y, 130; NEXT
830 NEXT
840 HOME : VTAB 21
860 H$ = "READY" : HODE"
870 HOME : VTAB 21
880 PRINT " MODE PLAY TEMPO"
890 PRINT " RECORD RANGE"
900 PRINT " PLAY-BACK NOTE $"
910 GOTO 160
920 :R = 7
930 FOR A = 1 TO 100; IF T(A) = R THEN PRINT A, "A(A)", " ";
940 NEXT : NEXT
945 REM ** NOTE FREQUENCY DATA **
950 DATA 65, 250, B7, 235, B3, 220, 69, 210, 68, 200, 70, 185, 84, 175, 71, 165, 89, 155
    , 72, 144, B5, 135, 74, 128, 75, 120, 79, 114, 76, 108, B0, 104, 59, 98
960 DATA B, 90, 21, 80, 21, B0
970 DATA 65, 120, B7, 114, B3, 108, 69, 104, 68, 98, 70, 90, 84, B0
980 DATA 21, 196
990 FOR T = 21 TO 24; VTAB T; HTAB 7; PRINT " "; NEXT
995 HO$ = ""
1000 VTAB HODE + 20; HTAB 7; PRINT CHR$( 106);
1010 NO = 0
1020 IF HODE = 2 THEN VTAB 24; HTAB 1; PRINT "IS THIS A NEW TUNE (Y OR
    N) ? "; GET R$; IF R$ = "Y" THEN FOR T = 0 TO 5; S$(T) = " "; NEXT
1030 VTAB 24; HTAB 1; PRINT " ";
1040 ON HODE GOTO 180, 180, 330, 1041
    
```

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PROGRAMS

```

1041 N$(0) = TU$ + TU$IND$ = "AUTDPLAY": GOTD 330
1050 DATA 71,81,89,77,72,73,85,69,74,65
1060 DATA ..75,60,79,57,76,53
1070 DATA B0,50,59,47,,,8,43,,,21,39
1080 DATA .....
1090 HOME
1100 INVERSE
1101 REM *** INSTUCTIONS ***
1110 PRINT " PIANDCONPUTER " "I NDRNAL
1120 PDHE 34,2
1130 SPEED= 150
1140 PRINT " YOU MAY USE THE APPLE AS A SYNTHESISER"
1150 PRINT "BY USING THE MIDDLE RDHS DN THE KEYBOARD"
1160 PRINT "AS YDU NDULD A PIAND KEYBOARD."
1170 PRINT
1180 PRINT : PRINT " THE WHITE PIANO KEYS CDRESPOND TD THE"
1190 PRINT "RDN DF KEYS 'A' TD THE RIGHT-ARRDN,"
1200 PRINT : PRINT "THE SNARPS & FLATS ARE DN THE RDN ABDE,"
1210 PRINT : PRINT "PRESSING A NUMBER KEY FRDM 1 TD 4 WILL"
1220 PRINT : PRINT "CHANGE THE NDDE DF DPERATION,"
1230 PRINT
1240 PRINT "NDDE 1 YOU CAN PLAY WHAT YOU LIKE AND"
1250 PRINT " THE CDPUTER WILL NOT REMEMBER"
1260 PRINT " WHAT YOU HAVE DDNE,"
1270 PRINT : PRINT "NDDE 2 YOU CAN ENTER A TUNE AT ANY "
1280 PRINT " SPEED AND THE CDPUTER WILL"
1290 PRINT " REMEMBER THAT TUNE FDR YDU TD"
1300 PRINT " PLAY BACK LATER."
1310 PRINT " IF YDU MAKE A MISTAKE,PRESSING"
1311 PRINT " '<' WILL DELETE IT FRDN MEMORY"
1330 PRINT : PRINT "NDDE 3 THE CDPUTER WILL PLAY BACK TNE":
1340 PRINT " TUNE YDU RECORDED IN NDDE 2"
1350 PRINT " TD A RHYTHM YDU TAP OUT USING"
1360 PRINT " ANY KEY (EXCEPT RESET),"
1361 PRINT : PRINT "NDDE 4 THE CDPUTER WILL PLAY IT'S"
1362 PRINT " FAVOURITE TUNE FDR YDU,"
1370 PRINT : PRINT "YOU CAN CNDOOSE BETWEEN TWO NDTE RANGES"
1380 PRINT : PRINT " LDW - FRON MIDDLE-C TD HIGH-C"
1390 PRINT : PRINT " HIGH - FRON HIGH-C TD VERY HIGN G !"
1400 PRINT : PRINT "TD SWITCH BETWEEN THESE TWO RANGES,NIT"
1410 PRINT : PRINT "<ESC>."
1420 PRINT : PRINT "DURING PLAY-BACK,USING 'H' WILL GIVE A"
1430 PRINT : PRINT "HIGH-RANGE NOTE,ANY OTHER GIVING A LOW " : PRINT "DNE
"
1440 PRINT
14450 PRINT "IF YDU CDCONNECT AN AMPLIFIER TD TNE "
14460 PRINT : PRINT "CASSETTE-OUT SOCKET,YDU WILL BE ABLE TD"
14470 PRINT : PRINT "ENJUY HIGNER DUALITY SOUND,"
14480 PRINT : PRINT "IF YDU HAVE A CASSETTE ATTACHED,YDU CAN"
14491 PRINT "RECDRO YDUR ONN MUSIC."
1500 PRINT : PRINT "I RECDMEND,FOR TWO PART TUNES,RECORDING"
1510 PRINT "ONE VOICE DN CASSETTE AND THEN PLAYING "
1520 PRINT "THE OTRER VOICE ALONG WITH THE RECORDING"
1530 PRINT : PRINT "YDU CAN USE THE APPLE'S INTERNAL SPEAKER"
1535 PRINT ",THE CASSETTE FORT DR FDR TNE ULTIMATE IN "
1536 PRINT "CDPUTER SYNTHESED CAT'S CDORUS,BOTN : "
1550 PRINT : PRINT "YDU CAN CHANGE TNE LENGDN DF NDTE USING " : PRINT "PAD
DLE (0),"
1560 SPEED= 255: POKE 34,0
1570 GOTD 560
1580 REM **** ERRDR HANDLING ****
1581 REM ** PRESSED WRONG KEY (IGNORE)
1590 IF PEEK (222) = 53 AND PEEK (218) + PEEK (219) * 256 = 190 THEN 1
B0
1595 IF PEEK (222) = 53 AND PEEK (218) + PEEK (219) * 256 = 230 THEN 1
B0
1600 PRINT "UNEXPECTED ERROR" : GOTO 1605
1605 REM (UNEXPECTED ERROR)
1610 STOP

```

Moon Module

by Quentin King

Okay, okay, I confess - it's lunar lander really, but it's a good lunar lander. It took me ages to win and I really enjoyed playing it. It's for the Apple II and uses a shape table to define a rather neat little module which you steer using one of the joysticks. Steering the ship in the right direction is a little hard to get used to as it's done by positioning a tiny dot under the ship which determines the

angles of thrust - which is applied with the joystick button. The aim is, of course, to land your module on a flat part of the moon surface but the difference is that you have to take off again and fly through a hole at the side of the screen. This is barely large enough to admit the module so precise control is necessary. To alter difficulty you can alter the amount of fuel you have, the

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PROGRAMS

amount of thrust given per unit of fuel and the gravitational constant. You can also create your own moon surfaces and save them onto disk. Moon module contains full instructions. The author suggests starting out with 0.7 for thrust/fuel and 0.08 for the gravitational constant.

```

10 REM *****
20 REM * MOON MODULE *
30 REM *
40 REM * LISTING BY BYTESHOP *
50 REM * OF LONDON. *
60 REM *
70 REM * COMPLETED ON 9/8/82 *
80 REM *****
90 REM
94 REM *****
95 REM ** SET UP CONSTANTS **
96 REM *****
100 B% = 1:D% = 3:J% = - 16287:H% = 10:C% = 28672:G% = 128:V% = 33:Z% = 15:T% =
6:R% = 273:E% = 13:Q% = 6:C = 6.99999999:D = 81.169021:B = .448799:P = 3.141592:
D$ = CHR$(4)
110 ROT% = 0: SCALE = 1: TEXT : HOME : IF PEEK (232) = 25 THEN 200
120 DATA 162,0,134,249,162,32,134,250,160,0,177,249,73,255,145,249,200,208,247,
232,224,64,208,238,96,1,0,4,0,45,36,63,36,45,36,45,54,45,54,63,54,45,5,0
130 FOR I = 768 TO 811: READ A: POKE I,A: NEXT : POKE 232,25: POKE 233,3: POKE
C% + B%,0: HGR : TEXT : HOME
194 REM *****
195 REM ** INSTRUCTIONS **
196 REM *****
200 PRINT TAB (13)"MOON MODULE": PRINT : PRINT
210 PRINT " YOU ARE IN CONTROL OF A LUNAR DESCENT"
220 PRINT "MODULE. YOUR MISSION IS TO LAND ON A"
230 PRINT "FLAT SITE, TAKE OFF AND FLY OUT OF THE"
240 PRINT "ENTRY HOLE. YOU MAY ONLY LAND ONCE AND"
250 PRINT "ON TOUCH-DOWN, YOUR VERTICAL SPEED MUST"
260 PRINT "BE LESS THEN 15.": PRINT
270 PRINT " YOU CONTROL YOUR CRAFT BY VECTORING"
280 PRINT "ITS ROCKET MOTOR (USE PADDLE 0), AND"
290 PRINT "FIRING PULSES OF THRUST (USE BUTTON 0). "
300 PRINT "A DOT UNDERNEATH YOUR CRAFT"
310 PRINT "THE DIRECTION OF THE THRUST.": PRINT : PRINT
344 REM *****
345 REM ** ENTER VARIABLES **
346 REM *****
350 INPUT "ENTER THRUST PER UNIT OF FUEL";A$: IF STR$( VAL (A$)) < > A$ OR
VAL (A$) > 100 OR VAL (A$) < - 100 THEN 350
360 T = VAL (A$): INPUT "ENTER GRAVITATIONAL CONSTANT ";A$: IF STR$( VAL (A$))
< > A$ OR VAL (A$) > 100 OR VAL (A$) < - 100 THEN 360
370 G = VAL (A$): INPUT "ENTER UNITS OF FUEL (20-250) ";A$: IF STR$( VAL (A$))
< > A$ OR VAL (A$) < 20 OR VAL (A$) > 250 OR VAL (A$) < > INT ( VAL (A$)
) THEN 370
380 PP% = VAL (A$)
394 REM *****
395 REM ** MENU **
396 REM *****
400 HOME : PRINT TAB (18)"MENU": PRINT : PRINT
410 PRINT TAB (12)"1. START GAME.": PRINT
420 PRINT TAB (12)"2. CREATE MOON.": PRINT
430 PRINT TAB (12)"3. LOAD MOON.": PRINT
440 PRINT TAB (12)"4. RE-ENTER THRUST ETC...": PRINT
450 PRINT TAB (12)"5. EXIT PROGRAM.": PRINT : PRINT : PRINT TAB (12)"SELECT O
PTION : "
460 POKE - 16303,0: GOSUB 630: VTAB 15: HTAB 28: POKE 216,0
470 GET A$: IF A$ < "1" OR A$ > "5" THEN 470
480 PRINT : PRINT : ON VAL (A$) GOTO 500,900,800,350,490
490 TEXT : HOME : PRINT "THANK YOU FOR PLAYING.": END
494 REM *****
495 REM ** START GAME **
496 REM *****
500 IF PEEK (C% + B%) = A% THEN PRINT TAB (12)"NO MOON IN MEMORY": FOR I =
1 TO 1000: NEXT : HTAB 1: CALL - 868: GOTO 460
510 POKE - 16297,0: POKE - 16304,0:P% = 0:F% = PP%: GOSUB 630: PRINT : PRINT
TAB (8)"PUEL : "P% TAB (23)"V.SPEED : 0": VTAB 22
520 HCOLOR = 0: HPLLOT 0,I TO 0,E%: HCOLOR = 3:X = 0:Y = 8:X1 = 1:Y1 = 0:X% = X:Y%
= Y: XDRAW B% AT X,Y: POR I = 1 TO 1000: NEXT
524 REM *****
525 REM ** MAIN LOOP **
526 REM *****
530 A = PDL (A%) / D:D% = C - A / B:Y1 = Y1 + G: IF PEEK (J%) < G% OR F% = A%
THEN HTAB V%: PRINT INT (H% * - Y1) " "; FOR JJ = 1 TO 10: NEXT : GOTO 550
540 X1 = X1 + T * COS (A + P):Y1 = Y1 + T * SIN (A + P):F% = F% - B%: HTAB Z%:
PRINT F% " "; HTAB V%: PRINT INT (H% * - Y1) " ";
550 X = X + X1:Y = Y + Y1:X1% = X:Y1% = Y: IF X1% > A% AND X1% < R% AND Y1% > T%
AND PEEK (C% + X1%) > Y1% AND PEEK (C% + X1% + D%) > Y1% AND PEEK (C% + X1%
+ Q%) > Y1% THEN HCOLOR = A%: HPLLOT X% + L%,Y% + B%: XDRAW B% AT X%,Y%: XDRAW B%
AT X1%,Y1%: HCOLOR = D%: HPLLOT X1% + D1%,Y1% + B%:L% = D1%:X% = X1%:Y% = Y1%: GO
TO 530
555 REM ** HIT SOMETHING! **
560 ON P% GOTO 600
565 REM ** LANDED ? **
570 IF INT (H% * - Y1) < - Z% THEN 610
580 FOR I = C% + X1% TO C% + X1% + Q%: IF PEEK (I) = Y1% THEN NEXT : GOTO 650
590 GOTO 610
595 REM ** FINISHED ? **

```

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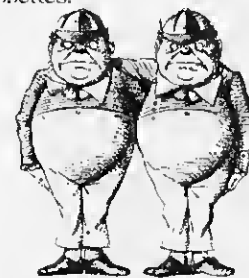
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PROGRAMS

```

600 IF X1% < B% AND Y1% > T% AND Y1% < E% THEN 700
604 REM *****
605 REM ** CRASHED **
606 REM *****
610 FOR I = 1 TO 18: CALL 768: NEXT I: XDRAW B% AT X%,Y%: BCOLOR= A%: HPLLOT X% +
  L%,Y% + B%: GOSUB 620: GOTO 750
615 REM ** SUBROUTINES **
620 HCOLOR= 0%: FOR I = B% TO 278: HPLLOT I, PEEK (I + C%): NEXT I: RETURN
630 VTAB 21: HTAB 1: PRINT SPC(159):: VTAB 20: PRINT: RETURN
644 REM *****
645 REM ** LANDED **
646 REM *****
650 VTAB 21: HTAB 1: FLASH: PRINT " THE EAGLE HAS LANDED "
NORMAL: VTAB 20: PRINT: HCOLOR= A%: HPLLOT X% + L%,Y% + B%: GOSUB 620
660 IF PEEK (J%) < G% THEN 660
670 PRINT SPC(40): XDRAW B% AT X%,Y%:Y% = Y% - 1: X = X%: X1% = X%: Y = Y%: Y1% =
  Y%: XDRAW B% AT X%,Y%:Y1% = Y% - 1: P% = 1: GOTO 530
694 REM *****
695 REM ** FINISHED **
696 REM *****
700 XORAW B% AT X%,Y%: HCOLOR= A%: HPLLOT X% + L%,Y% + B%: GOSUB 630
710 PRINT: FLASH: PRINT " CONGRATULATIONS !!! YOU DID IT. ": NORMAL
FOR I = 1 TO 5: PRINT CHR$(7);: NEXT I: GOSUB 620
744 REM *****
745 REM ** END OF GAME **
746 REM *****
750 GOSUB 630: HTAB 15: PRINT "GAME OVER": PRINT: PRINT TAB(10)"PRESS BUTTON
  0 TO RESTART": PRINT TAB(10)"PRESS SPACE FOR MENU": VTAB 20: PRINT
760 IF PEEK (J%) > G% THEN 510
770 IF PEEK (-16384) = 160 THEN 460
780 GOTO 760
794 REM *****
795 REM ** LOAD MOON **
796 REM *****
800 HGR: VTAB 21: HTAB 15: PRINT "LOAD MOON.": PRINT: PRINT TAB(10)"ENTER M
  OON'S NUMBER "
810 VTAB 23: HTAB 30: CALL - 868: INPUT A$: IF A$ < > STR$(VAL(A$)) OR V
  AL(A$) < > INT(VAL(A$)) OR VAL(A$) < 0 THEN 810
820 ONERR GOTO 840
830 PRINT D$"BLOAD MOONE"A$: GOTO 850
840 VTAB 23: HTAB 1: CALL - 868: PRINT TAB(10)"MOONE"A$ DOES NOT EXIST.": F
  OR I = 1 TO 1500: NEXT I: POKE C% + B%, 0: GOTO 460
850 HCOLOR= D%: FOR I = B% TO 278: HPLLOT I, 159 TO I, PEEK (C% + I): NEXT I: HPL
  OT 0, 159 TO 0, 0 TO 279, 0 TO 279, 159: GOTO 460
855 REM ** GET YES/NO **
860 GET A$: IF A$ < > "Y" AND A$ < > "N" THEN 860
870 RETURN
894 REM *****
895 REM ** CREATE MOON **
896 REM *****
900 HOME: HTAB 14: PRINT "CREATE MOON": PRINT
910 PRINT "INSTRUCTIONS: USE PADDLE 0 TO MOVE THE"
920 PRINT "FLASHING DOT UP AND DOWN, PRESSING"
930 PRINT "BUTTON 0 WILL CAUSE THE DOT TO MOVE"
940 PRINT "FROM LEFT TO RIGHT ACROSS THE SCREEN"
950 PRINT "DRAWING IN THE LINES BENEATH IT.": PRINT
960 PRINT "WHEN YOU WISH TO MAKE A FLAT LANDING"
970 PRINT "SITE, PRESS BUTTON 1. THIS WILL CAUSE"
980 PRINT "LINES OF CONSTANT LENGTH TO BE DRAWN"
990 PRINT "UNTIL THE BUTTON IS RELEASED.": PRINT
1000 PRINT "ENTER DRAWING SPEED (10-FAST, 60-SLOW)"
1010 VTAB 16: CALL - 868: HTAB 19: INPUT A$: IF A$ < > STR$(VAL(A$)) OR
  VAL(A$) < 1 OR VAL(A$) > 100 OR VAL(A$) < > INT(VAL(A$)) THEN 1010
1020 K% = VAL(A$): HGR: HCOLOR= D%: HPLLOT 0, 159 TO 0, 0 TO 279, 0 TO 279, 159: F
  OR I = B% TO 278
1030 IF PEEK (J% + B%) > 127 THEN HCOLOR= D%: GOTO 1050
1040 H = 9 + PDL(A%) * 150 / 255: HCOLOR= D%: HPLLOT I, H: FOR J = 1 TO K%: NEXT
  I: IF PEEK (J%) < G% THEN HCOLOR= A%: HPLLOT I, H: GOTO 1030
1050 HPLLOT I, 159 TO I, H: POKE C% + I, H: NEXT
1060 HOME: VTAB 22: PRINT TAB(14)"RE-DRAW (Y-N) ?": GOSUB 860: HTAB 1: CALL
  - 868
1070 IF A$ = "Y" THEN A$ = STR$(K%): GOTO 1020
1080 PRINT " DO YOU WANT TO SAVE IT? (Y-N)"; GOSUB 860: IF A$ = "N" THEN 4
  00
1090 HTAB 1: CALL - 868: PRINT TAB(14)"ENTER NUMBER ";
1100 INPUT B$: IF B$ < > STR$(VAL(B$)) OR VAL(B$) < > INT(VAL(B$))
  OR VAL(B$) < 0 THEN HTAB 27: VTAB 22: CALL - 868: GOTO 1100
1110 ONERR GOTO 1140
1120 PRINT D$"VERIFY MOONE"B$: HTAB 1: VTAB 22: CALL - 866: PRINT "MOONE"B$ A
  LREADY EXISTS. OVERWRITE?"; GOSUB 860
1130 IF A$ = "N" THEN HTAB 1: CALL - 868: GOTO 1080
1140 IF PEEK (222) < > 6 THEN 1170
1150 VTAB 1: PRINT: ONERR GOTO 1170
1160 PRINT D$"SAVE MOONE"B$, "A", "C", "L280": GOTO 400
1170 VTAB 22: CALL - 868: HTAB 10: FLASH: PRINT " DISK ERROR ": NORMA
  L: FOR I = 1 TO 2500: NEXT I: GOTO 400

```

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PROGRAMS

Letterwriter

by E Peffer

This program was written to help a handicapped person produce typewritten text using a small keyboard 8k PET. Adapting it for use with other computers and printers should present little in the way of difficulty beyond changing the POKEs as required.

It works by using keys for control functions which are not required in normal textual entry, eg, @, \$, [. The advantage of this is that, while losing some symbols such as '&', only single stroke commands are necessary to control text processing. A menu is available at any time using the 'home' key which clears the screen, prints the menu and then retrieves it afterwards. The cursor is represented by a dot instead of the usual square. The keys used are as follows:

@ - carriage return and line feed

[- line feed only

left arrow - copies all data from the screen to the printer (not including control codes)

> - shift to lower case for alphabetic only

< - shift to upper case as above

\$ - terminate the program and close any files

Hash - clear the screen ready for fresh page

& - file page - ie, copy screen onto cassette drive no 2

/ - read file ie obtain a page of recorded data from cassette drive no 1

'RVS' - prints the address held in lines 6020-6060 after requesting the date which is also printed onto the letter up arrow - selects cursor movements which are indicated by a reversed cursor symbol. These are: 8-up; 4-left; 2-down; 6-right; 1-insert space at cursor position; 3-delete character at cursor position; 5-return to normal mode.

The address contained within the program is, of course, fictitious and can easily be changed by editing the program. For some instructions the control key will need to be pressed twice. As the program appears, it needs an external cassette player in addition to the internal one. For 'old ROM' PETs with an internal cassette only, the following changes should be made in addition to the normal software patch:

```
3003 OPEN 1,1,1,A$
3004 LET FP=1:PRINT#1,A$
3007 PRINT#1,PM
3020 PRINT#1
```

```
10 POKE 135,28
90 PRINT"3"
95 COTO 500
99 REM*** HELP TABLE
100 PRINT"INSTRUCTION TABLE"
102 PRINT"@;-RETURN"
104 PRINT"[;-NEW LINE"
106 PRINT"_;-PRINT IT"
108 PRINT">;-SHIFT TO LOWER CASE"
110 PRINT"<;-SHIFT TO UPPER CASE"
112 PRINT"$;-STOP PROGRAM"
114 PRINT"#;-CLEAR SCREEN"
118 PRINT"&;-FILE THE PAGE"
120 PRINT"\;-READ FILE"
121 PRINT"RVS;-STANDARD ADDRESS"
122 PRINT"^;-SELECT CURSOR MOVES"
124 PRINT" 1;-INSERT CHARACTER"
126 PRINT" 3;-DELETE CHARACTER"
128 PRINT" 8;-CURSOR UP"
130 PRINT" 4;-CURSOR LEFT"
132 PRINT" 2;-CURSOR DOWN"
134 PRINT" 6;-CURSOR RIGHT"
136 PRINT" 5;-RETURN TO NORMAL"
200 PRINT"TYPE ANY LETTER WHEN READY"
210 GET A$:IF A$="" THEN 210
215 RETURN
500 PRINT"3";
501 POKE 59468,14
502 LET P=32768:PH=P:REM PH=PMAX
503 SH=0
510 POKE P,42:IF P>PH THEN LETPH=P
515 GET A$:IF A$="" THEN 515
520 LET X=ASC(A$)
525 IF X=62 THEN SH=128:COTO 510:REM SHIFT DOWN
527 IF X=60 THEN SH=0:GOTO 510:REM SHIFT UP
529 IF X=95 THEN 1000:REM PRINT IT
531 IF X=32 THEN 420:REM SPACE BAR
533 IF X=95 THEN PRINT"3":GOTO 502:REM CLEAR SCREEN
535 IF X=36 THEN 9000:REM STOP PROGRAM
537 IF X=91 THEN POKE P,27:P=P+40:COTO 510:REM NEW LINE
539 IF X=64 THEN POKE P,0:CO$UB1200:GOTO 510:REM RETURN
541 IF X=94 THEN POKE P,32:COTO 2000:REM MOVE CURSOR
543 IF X=20 THEN P=P-1:POKE P+1,32:COTO 510:REM SPACE BAR
```

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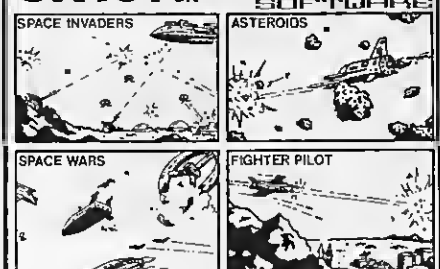
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PROGRAMS

```

545 IF X=38 THEN POKE P,32:GOTO 3000:REM FILE THE PAGE
550 IF X=92 THEN 4000:REM READ FILE
555 IF X=19 THEN GOSUB 5000:GOSUB 100:GOSUB 5100:GOTO 510:REM HELP
560 IF X=18 THEN 6000
590 IF X>191 THEN X=X-128:GOTO 620
595 IF X<32 GOTO 620
600 IF X>96 THEN X=X-32:GOTO 620
610 IF X>63 AND X<96 AND SH=0 THEN X=X-64
620 POKE P,X
625 LET P=P+1
627 LET PZ=PEEK(P)
630 GOTO 510
1000 REM***PRINT IT PHOTOGRAPH SCREEN***
1002 POKE P,32
1004 PF=P
1005 LN=0
1010 OPEN 3,4
1012 PRINT#3,CHR$(13)
1013 NL=0
1015 FOR X=32768 TO PH
1030 N=PEEK(X)
1032 IF N=27 THEN X=X+39:GOTO 1070
1034 IF N=0 AND PEEK(X+1)=32 THEN P=X:GOSUB 1200:LET X=P-1:GOTO 1070
1036 IF N=42 THEN 1070
1040 IF N=64 THEN N=N+32:GOTO 1064
1050 IF N>31 THEN 1064
1055 IF N=0 THEN 1089
1060 N=N+64
1040 IF N>64 THEN N=N+32:GOTO 1064
1050 IF N>31 THEN 1064
1055 IF N=0 THEN 1089
1060 N=N+64
1064 IF N=32 OR X>=PH THEN 1070
1066 B=B+CHR$(N)
1069 GOTO 1080
1070 LET LN=LN+LEN(B)
1071 IF LN>70 THEN 1074
1072 IF NL=0 THEN PRINT#3," ";
1073 PRINT#3,B;" ";B$="";LN=LN+1:NL=1:GOTO 1080
1074 PRINT#3:PRINT#3," ";B$;" ";LN=LEN(B)+1:B$="":GOTO 1080
1080 IF N=27 THEN PRINT#3,CHR$(10):GOTO 1089
1082 IF N=0 THEN PRINT#3,CHR$(13),CHR$(13),CHR$(13):GOTO 1089
1089 NEXT X
1090 PRINT#3
1100 CLOSE 3
1105 P=PF:POKE P,42
1110 GOTO 510
1200 REM RETURN TO START OF LINE
1210 FOR T=0 TO 24
1220 LET SR=32768+T*40
1230 IF P-SR<40 THEN P=SR+40:RETURN
1240 NEXT T
2000 REM CURSOR MOVE
2001 LET Z=P2:GOTO 2010
2002 LET Z=PEEK(P)
2010 POKE P,170:REM REVERSE CURSOR
2020 GET A$:IF A$="" THEN 2020
2030 LET X=VAL(A$)
2032 ON X+1 GOTO 2035,2090,2040,2110,2060,2080,2070,2010,2050
2035 POKE P,43:GOTO 2020
2040 POKE P,2:P=P+40:GOTO 2002:REM CURSOR DOWN
2050 POKE P,2:P=P-40:GOTO 2002:REM CURSOR UP
2060 POKE P,2:P=P-1:GOTO 2002:REM CURSOR LEFT
2070 POKE P,2:P=P+1:GOTO 2002:REM CURSOR RIGHT
2080 POKE P,Z:GOTO 510:REM CURSOR STOP
2090 FOR P1=P:TOP=P:O=PEEK(P1-1):POKE P1,O:NEXT P1:POKE P+1,32:GOTO 2002
2110 FOR P1=P+1:TOP=P:O=PEEK(P1+1):POKE P1,O:NEXT P1:POKE P,32:GOTO 2002
3000 IF FP=1 THEN 3007:REM FILE IT
3001 GOSUB 5000:INPUT "NAME OF FILE":A$
3002 POKE 243,58:POKE 244,3
3003 OPEN 2,2,2,A$
3004 LET FP=1:PRINT#2,A$
3005 GOSUB 5100
3007 PRINT#2,PH
3010 FOR X=32768 TO PH
3020 PRINT#2,PEEK(X)
3030 NEXT X
3050 GOTO 510
4000 REM READ A FILE
4010 IF FL<>0 THEN 4020
4015 FL=1:OPEN 1,1,0
4017 PRINT#3;" "
4018 INPUT#1,A$:PRINT"FILE IS "A$
4019 INPUT"IS IT CORRECT "A$:IF LEFT$(A$,1)<>"Y" THEN CLOSE:FL=0:GOTO 500
4020 INPUT#1,PH:PRINT#3;" "
4025 IF (ST)AND 64 THEN PRINT"END OF FILE":GOTO 4070
4030 FOR X= 32768 TO PH
4040 INPUT#1,RD
4050 POKE X,RD
4060 NEXT X
    
```



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PROGRAMS

```

4070 LET P=PH
4080 GOTO 510
5000 REM,SAVE SCREEN
5005 SS=7160
5010 FOR SP=32768 TO PH
5020 SX=PEEK(SP)
5030 POKE SS,SX
5040 POKE SP,32
5050 SS=SS+1
5060 NEXT SP
5070 RETURN
5100 REM ,GET SCREEN
5105 PRINT"3";
5110 SS=7160
5120 FOR SP=32768 TO PH
5130 SX=PEEK(SS)
5140 POKE SP,SX
5150 SS=SS+1
5160 NEXT SP
5170 RETURN
6000 REM***ADDRESS ROUTINE
6002 GOSUB 5000
6005 INPUT "DATE "|D$
6007 GOSUB 5100
6010 OPEN S,4
6015 GOSUB 6100
6020 PRINT#5,"IMAGINATION"
6025 GOSUB 6100
6030 PRINT#5,"54 GUESSHORK STREET"
6035 GOSUB 6100
6040 PRINT#5,"LEIGHTON BUZZARD"
6045 GOSUB 6100
6050 PRINT#5,"BEDS LUY 5VV"
6060 PRINT#5,CHR$(27)|CHR$(14)|"TEL:-02968 8109"
6065 GOSUB 6100
6070 PRINT#5,D$
6072 PRINT#5," "
6074 PRINT#5," "
6080 CLOSE 5
6090 GOTO 510
6100 FORSC=1 TO 45:PRINT#5," ";:NEXT I:PRINT#5,CHR$(27)|CHR$(14)|
6110 RETURN
9000 IF FP=1 THEN CLOSE 2
9005 IF FL=1 THEN CLOSE 1
9007 POKE 59468,12
9010 PRINT"3"
READY.
    
```

Logic

by D Johnston

If you are a puzzle magazine enthusiast, this program will generate as many puzzles as you want. It needs a little over 3k of RAM to run on a C1E Superboard with the Cegmon monitor. Two problems with it are that it won't run on a standard UK101 (48x16 screen) or Superboard (24x24 screen) because the C1E has a 48x32 screen. If you like this kind of puzzle, it's worth fiddling about with the screen values until it fits. Modifications for an enhanced (48x32) UK101 are given at the end of the listing. This leads me on to the second

problem, which is that the UK101 has neither an Escape key nor the CALL function, both of which are required in this program. The given modifications cope with this in lines 90,96,110 and 5. Instructions are contained within the program as REMs and are, unfortunately, not too specific — although it shouldn't be hard to learn how to use it. It's a well-conceived and executed program with good graphics and should provide Superboard users with some interesting diversions.

```

10 A=53248+64*4+5:REM TOP LEFT OF GRID
12 PRINTCHR$(26)
13 REM PUT GRID ON SCREEN
14 FORI=0 TO 24*64 STEP 128:FORJ=0 TO 22*256 STEP 2:POKEA+I+J,148:NEXTJ,I
16 A=A+63
18 FORI=0 TO 22*64 STEP 128:FORJ=0 TO 24*256 STEP 2:POKEA+I+J,149:NEXTJ,I
20 A=A-63
22 FORI=0 TO 24*64 STEP 512:FORJ=0 TO 22*256:POKEA+I+J,187:NEXTJ,I
24 A=A-1
26 FORI=0 TO 24*256 STEP 8:FORJ=0 TO 24*64 STEP 64:POKEA+I+J,187:NEXTJ,I
28 A=54685
    
```

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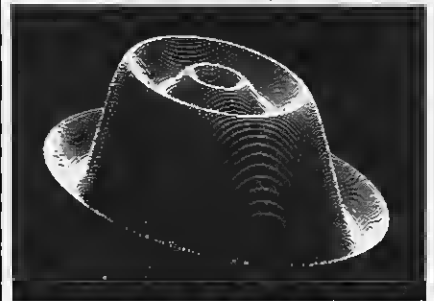
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PROGRAMS

```

30 FORI=0T07:FORJ=0T015:POKER+J+64*I,32:NEXTJ,I
32 A=54101
34 FORI=0T07:FORJ=0T07:POKER+J+64*I,32:NEXTJ,I
35 GOTO38
36 FORI=1TOLEN(A#):POKER+I,ASC(MID$(A#,I,1)):NEXT:RETURN
37 REM CLEAR CURSOR AND PUT NAMES BESIDE GRID
38 A=53248+64*I:POKER,32:A=A+127
39 DIMA$(13)
40 FORI=1TO12:READA$:A$(I)=A#:NEXT
42 DATAJOHN,DAVE,BILL,ADAM,RED,GREY,BLUE,FAWN,No.2,No.4,No.6,No.8
44 FORJ=1TO12:A#=A$(J):GOSU836:A=A+128:NEXT
45 GOTO48
46 FORI=1TOLEN(A#):POKER+I*64,ASC(MID$(A#,I,1)):NEXT:RETURN
48 A=53248-59
50 FORI=1TO12:READA$:A$(I)=A#:NEXT
52 DATACARD,PLAY,SOLO,GAME,No.2,No.4,No.6,No.8,RED,GREY,BLUE,FAWN
54 FORJ=1TO12:A#=A$(J):GOSU846:A=A+2:NEXT
55 GOTO64
56 FORI=1TO4:READA$:A$(I)=A#:NEXT
58 FORI=1TO4
60 X=INT(4*RAND(1)+1):IFA$(X)=" "THEN60
62 X$(I)=A$(X):A$(X)=" ":NEXT:RETURN
63 REM WORK OUT ANSWERS AND PRINT CLUES
64 RESTORE
66 GOSU856:FORI=1TO4:B$(I)=X$(I):NEXT
68 FORI=1TO8:READA#:NEXT
70 GOSU856:FORI=1TO4:C$(I)=X$(I):NEXT
71 GOSU856:FORI=1TO4:D$(I)=X$(I):NEXT
72 GOSU856:FORI=1TO4:E$(I)=X$(I):NEXT
73 REM SET WINDOW TO RIGHT OF GRID
74 POKE546,18:POKE547,29:POKE548,209:POKE549,221:PRINTCHR$(30);
76 PRINT"1: "B$(1)" "C$(1)" NOR Mr "C$(4)" LIVES AT "D$(3)
77 PRINT
78 PRINT"2: Mr "C$(2)" LIVES AT "D$(2)" WHICH IS NOT "E$(1)
79 PRINT
80 PRINT"3: "B$(3)" HAS A "E$(2)":IFE$(3)="RED"THENPRINT" ";
81 PRINT" DOOR BUT IS NOT "D$(1)", ";
82 PRINT"WHICH IS NOT "E$(2)
83 PRINT
84 PRINT"4: NEITHER "B$(2)" NOR Mr "C$(3)" LIVES AT "D$(4);
86 PRINT" WHICH HAS A "E$(4)" DOOR"
87 PRINT
88 PRINT"5: "B$(4)" RESIDES AT "D$(4)
89 PRINT
90 PRINT"KEY (ESC) TO CHECK ANSWERS"
92 A=53248+4*64+4:REM CURSOR AT TOP LEFT OF GRID
94 D=PEEK(A)
95 POKER,161
96 CALL-767:K=PEEK(531)
97 REM CHECK FOR 1,2,3,4,0,X & RUB OUT
98 IFK=49THENPOKER,D:A=A-64:GOTO94
100 JFK=50THENPOKER,D:A=A+1:GOTO94
102 IFK=51THENPOKER,D:A=A+64:GOTO94
104 IFK=52THENPOKER,D:A=A-1:GOTO94
106 IFK=79THENPOKER,K:DD=D:GOTO94
108 IFK=88THENPOKER,K:DD=D:GOTO94
109 IFK=95THENPOKER,DD:GOTO94
110 IFK<>27GOTO94
111 REM COMPARE ANSWERS - IF WRONG THEN LIST CORRECT ANSWERS
112 PRINTCHR$(30);
114 FORI=1TO3
116 PRINT8$(I)" ";:INPUTA$:IFA$(I)C$(I)THEN200
118 PRINT"LIVES AT No."::INPUTA$:IFA$(I)RIGHT$(D$(I),1)THEN200
120 PRINT"WITH A DOOR COLORED ";:INPUTA$:IFA$(I)E$(I)THEN200
    
```

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PROGRAMS

```

121 REM *COLOUR IS SPELT COLOR TO FIT IN SCREEN*
122 PRINT: NEXT
130 PRINTCHR*(30);
132 PRINT:PRINT"WELL DONE"
134 PRINT:PRINT"YOU GOT IT"
136 GOTO210
199 REM LIST ANSWERS
200 PRINTCHR*(30); "SORRY YOU ARE"
202 PRINT"WRONG"
204 PRINT:FORI=1TO4
206 PRINTB*(I)"C*(I)" LIVES AT "D*(I)" WITH A "E*(I)" DOOR"
208 PRINT: NEXT
210 PRINT:PRINT"DO TRY AGAIN"
211 REM RESET WINDOW
212 POKE546,47:POKE547,128:POKE548,208:POKE549,64
214 END
300 REM *** LOGIC ***
302 REM * BY D JOHNSTON *
304 REM INSTRUCTIONS:-
306 REM USE GRID TO WORK OUT THE ANSWERS
308 REM USE AN X FOR A FALSE STATEMENT
310 REM USE AN O FOR A TRUE STATEMENT
312 REM USE 1,2,3,4 TO MOVE THE CURSOR
314 REM MOVES UP,RIGHT,DOWN,LEFT RESPECTIVELY
316 REM RUB OUT WILL PLACE UNDER THE CURSOR;
318 REM THE CHARACTER BEFORE AN O OR X WAS PRESSED
320 REM ANSWER FULL NAMES AND COLOURS BUT
322 REM ONLY THE DIGIT FOR THE NUMBERS
    
```

MODIFICATIONS FOR UK101

```

5 POKE11,0:POKE12,253
10 A=53259+64*4+5:REM TOP LEFT OF GRID
28 A=54616
32 A=54112
38 A=53259+64*3:POKEA,32:A=A+127
48 A=53259-59
74 POKE546,47:POKE547,128:POKE548,208:POKE549,64
90 PRINT"KEY (SPC) TO CHECK ANSWERS"
92 A=53259+4*64+4:REM CURSOR AT TOP LEFT OF GRID
96 C=USR(C):K=PEEK(531)
110 IFK<>32GOTO94
212 POKE546,47:POKE547,11:POKE548,208:POKE549,71
OK
    
```

Walls

by Martin Stiby

The object of this game is to avoid three marauding walls which are hell-bent on destroying you. It's a rather eccentric variation on the breakout theme and will run on any Atari with a joystick. You use this to position your man, who has to dodge through the holes in the walls for as long as possible. It includes

instructions and should be pretty straightforward to use. The ">" is the clear screen character (ESC CTRL CLEAR) and all text underlined in this listing should be in inverse video. Some of the lines on this listing run on by one or two characters to the next line.

```

1 GOTO 4000
10 X=USR(W1,RND(G)*55):PI=L:MI=6:IF RND(I)>.5 THEN PI=LL:MI=-6
11 IF T=6 THEN SC=SC+400
15 SC=SC+100:POSITION 7,F:7 #6:SC:POKE 707,14:T=6:MI=M*(RND(G)+SP):RETURN
20 X=USR(W2,RND(G)*55):P2=L:M2=6:IF RND(F)>.5 THEN P2=LL:M2=-6
25 SC=SC+100:POSITION 7,F:7 #6:SC:M2=M2*(RND(G)+SP):RETURN
30 X=USR(W3,RND(G)*55):P3=L:M3=6:IF RND(F)>.5 THEN P3=LL:M3=-6
35 SC=SC+100:POSITION 7,F:7 #6:SC:M3=M3*(RND(G)+SP):RETURN
    
```

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PROGRAMS

```

100 P1=P1+M1:IF P1<L OR P1>LL THEN GOSUB 10
110 P2=P2+M2:IF P2<L OR P2>LL THEN GOSUB 20
120 P3=P3+M3:IF P3<L OR P3>LL THEN GOSUB 30
130 POKE H1,P1:POKE H2,P2:POKE H3,P3:SOUND F,P1,TN,P1:SOUND G,P2,TN,P1:SOUND H,P3,TN,P1
150 A=STICK(F):IF A=14 OR A=10 OR A=6 THEN IF VT>G THEN X=USR(UP):VT=VT-G
160 IF A=13 OR A=9 OR A=5 THEN IF VT<112 THEN X=USR(DOWN):VT=VT+G
170 IF A=11 OR A=10 OR A=9 THEN IF MP>47 THEN MP=MP-G:POKE MN,MP:IF STRIG(F)=F THEN IF T=G THEN
D=-1.5:GOSUB 500
180 IF A=7 OR A=6 OR A=5 THEN IF MP<210 THEN MP=MP+G:POKE MN,MP:IF STRIG(F)=F THEN IF T=G THEN D
=1.5:GOSUB 500
190 IF PEEK(NIT)<>F THEN 600
200 GOTO 100
200 T=F:SOUND G,F,F,F:F=SOUND N,F,F,F:MP1=MP
510 SOUND F,MP1,TN,P1:MP1=MP1+D:POKE MN,MP1:IF MP1<L OR MP1>LL THEN 580
515 IF PEEK(NIT)=F THEN 510
520 S=PEEK(NIT):IF S/2=INT(S/2) THEN 540
530 FOR A=BS+VT-3 TO BS+VT+8:POKE A,F:NEXT A:S=S-G
540 IF G/4=INT(S/4) THEN 560
550 FOR A=BS+VT+125 TO BS+VT+136:POKE A,F:NEXT A:S=S-2
560 IF S/8=INT(S/8) THEN 580
570 FOR A=BS+VT+253 TO BS+VT+264:POKE A,0:NEXT A
580 POKE 707,8:FOR A=MP1 TO MP STEP SGN(MP-MP1):POKE MN,A:SOUND F,A,TN,P1:NEXT A:POKE CL,F:RETUR
N
600 SOUND G,F,F,F:F=SOUND H,F,F,F
610 POSITION F,F:FOR A=6 TO 30:PRINT #6;"aaarab!";:FOR B=F TO 14 STEP N:SOUND F,A+8,12,8:POKE 7
07,8:NEXT B:NEXT A
620 SOUND F,F,F,F:POKE H1,F:POKE H2,F:POKE H3,F:POKE MN,255:GRAPHICS 16+POSITION 2,2:PRINT #6;"f
inal score was"
625 POSITION 8,3:PRINT #6;SC:IF SC=N1 THEN HI=SC
630 POSITION N,5:PRINT #6;"highest score is ":POSITION 8,6:PRINT #6;N1
635 POSITION N,9:PRINT #6;"PRESS FIRE BUTTON":POSITION N,10:PRINT #6;" FOR ANOTHER GO!"
640 IF STRIG(F)<>0 THEN 640
650 IF STRIG(F)=0 THEN POKE CL,F:GOTO 4170
4000 R=PEEK(106)-64:GRAPHICS 0:GOSUB 5000:FOR A=1536 TO 1690:READ B:IF B=34 OR B=35 THEN IF A<1
542 THEN B=8+R
4010 POKE A,B:NEXT A:POKE 764,255
4020 POKE 54279,R+32:POKE 53277,2:POKE 623,1:POKE 704,56:POKE 705,206:POKE 706,106
4050 DATA 104,104,104,105,3,141,34,6,105,54,141,37,6,162,120,169,51,157,3,34,169,204,157,4,34,20
2,202
4060 DATA 208,242,162,12,169,0,157,16,34,157,75,34,202,208,247,96
4070 DATA 104,104,104,105,131,141,77,6,105,54,141,80,6,162,120,169,36,157,131,34,169,219,157,132
,34,202,202
4080 DATA 208,242,162,12,169,0,157,16,34,157,75,34,202,208,247,96
4090 DATA 104,104,104,105,3,141,120,6,105,54,141,123,6,162,120,169,85,157,3,35,169,170,157,4,35
,202,202
4100 DATA 208,242,162,12,169,0,157,16,35,157,75,35,202,208,247,96
4110 DATA 162,119,189,131,35,157,132,35,202,208,247,104,96
4120 DATA 162,138,189,252,34,157,251,34,232,208,247,104,96
4130 R=(R+32)*256:FOR A=R+900 TO R+1019:POKE A,0:NEXT A:FOR A=R+958 TO R+964:READ B:POKE A,B:NEX
T
4135 DATA 28,28,8,62,8,20,20
4140 M1=1536:M2=1579:M3=1622:H1=53248:H2=53249:H3=53250:L=40:LL=220:SP=1.5:TN=10:P1=B:N1=0:F=H1
B=1:H=2
4150 CL=53278:BS=R+517:VT=58:NIT=53263:MN=53251:DOWN=1665:UP=1678:PRINT "ARE YE READY ?"
4160 IF PEEK(764)=255 THEN 4160
4170 GRAPHICS 16:POKE 559,42:FOR A=8 TO 30:PRINT #6;"the walls";:NEXT A:POSITION 6,F:PRINT #6;"
":MP=120
4180 SC=F:P1=F:P2=F:P3=F:POKE MN,MP:POKE CL,F:T=F:GOTO 100
5000 SETCOLOR 2,0,0:PRINT "":PRINT " the walls by Martin Stiby "
5010 PRINT "":PRINT
5020 PRINT " You are living sometime way in the"
5030 PRINT "future. Walls have rebelled against"
5040 PRINT "their human masters and are set on"
5050 PRINT "killing you."
5060 PRINT " You must dodge the three walls,"
5070 PRINT "which are trying to make you touch"
5080 PRINT "the lethal wallpaper they are covered"
5090 PRINT "in, for as long as possible."
5100 PRINT " There will always be two holes in"
5110 PRINT "a wall, which you can pass through."
5120 PRINT "Also you have super-human strength"
5130 PRINT "with which you can knock out a hole"
5140 PRINT "in a wall. This you can only use when"
5150 PRINT "you are strong enough i.e. when you"
5160 PRINT "are bright white in colour. To use"
5170 PRINT "this strength - press the joystick"
5180 PRINT "button and move in the direction you"
5190 PRINT "want to go, but you score more points"
5200 PRINT "if you don't make use of this. Score"
5210 PRINT "is at the top. ";:RETURN
    
```



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PROGRAMS

MZ80K Area Filling Curve

by Peter Dixon

This program is on a rather mathematical vein, but it must serve as an example to anyone wishing to write programs of any kind of complexity. It's thoroughly annotated and therefore easily followed and provides plenty of instructions and background in the form of PRINT statements. 'Curve, as listed, needs a 36k machine to run, but a subset of it without REMs or PRINTs will just squeeze onto a 20k model.

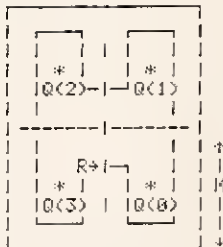
Its actual purpose is to demonstrate the first three stages in the construction of an area-filling curve according to the

theory on this subject discovered by Italian mathematician Giuseppe Peano in 1890. Apart from presenting a mathematical theory of the type which is likely to crop up in a degree course, it also generates an attractive pattern which makes full use of the MZ-80K's limited graphics capability.

It is rather slow to run and could be speeded up by removing REMs and suchlike although this would detract from the value of the explanation given. Apart from that, it is easy to use and need only be keyed in and run.

```

50 PRINT"CURVE AN AREA-FILLING CURVE"
55 PRINTTAB(13):"By P.G.Dixon"
60 PRINT" This program displays the first three"
65 PRINT" of a sequence of curves, the limit of"
70 PRINT" which is a curve passing through every"
75 PRINT" point of a square."
80 PRINT" Press E for further explanation."
85 PRINT" any other key to run the program."
90 FORX=1TO300:NEXT:REM---Delay after
95 REM---typing "RUN".
100 GETA#:IFA#=" "THEN100
105 IFA#="E"THEN130
110 DIM PX(255),PY(255)
115 DIM QX(127),QY(127),SX(4),SY(4)
120 REM-The point P(K) has coordinates
125 REM-(PX(K),PY(K)), etc..
130 M=8:D=M/2:N=4
135 REM--If rewriting this program for
140 REM--a machine with hi-res
145 REM--graphics, make M a suitably
150 REM--large power of 2.
155 QX(0)=3+D:QY(0)=D
160 QX(1)=3+D:QY(1)=3+D
165 QX(2)=D:QY(2)=3+D
170 QX(3)=D:QY(3)=D
175 REM
180 REM
185 REM
190 REM
195 REM
200 REM
205 REM
210 REM
215 REM
220 REM
225 REM
230 REM
235 REM
240 REM
245 REM
250 REM--Lines 300-795 draw one curve
255 REM--The points Q(J) (J=0 to N-1)
260 REM--are the vertices of the zeroth
265 REM--previous curve, the zeroth
270 REM--curve being a square with
275 REM--vertices Q(0) to Q(3) as
280 REM--shown above.
285 REM--The point P moves round the
290 REM--new curve which is then
295 REM--labelled P(K) (K=0 to 4N-1).
300 D=D/2:PRINT"0"
305 IFD=2THEN PRINT"FIRST":
310 IFD=1THEN PRINT"SECOND":
315 IFD=0.5THEN PRINT"THIRD":
320 PRINT" CURVE"
325 RX=M:RY=M-D:REM--R=Starting &
330 REM--finishing point.
    
```



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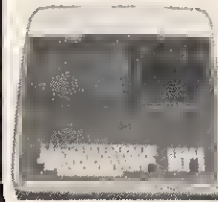
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PROGRAMS

```

335 PX=RX:PV=RV:PD=90
340 REM--Start with P=R moving in
345 REM--the direction PD=">".
350 K=0:QX=QX(0):QY=QY(0)
355 REM--Q moves round the old curve.
360 REM
365 REM *****
370 FOR J=1 TO N:REM * START OF LOOP *
375 REM *****
380 REM
385 SX(1)=QX+D:SY(1)=QY+D
390 SX(2)=QX+D:SY(2)=QY-D
395 SX(3)=QX-D:SY(3)=QY+D
400 SX(4)=QX-D:SY(4)=QY-D
405 REM--Here (QX,QY)=(QX(J-1),QY(J-1))
410 REM
415 REM      *
420 REM      Q(J)
425 REM
430 REM
435 REM
440 REM
445 REM      |
450 REM      |-----+-----+
455 REM      |
460 REM P->|-----*-----*
465 REM      |      S(3)      S(1)
470 REM      |
475 REM      |      |Q= *      | 4D
480 REM      |      |Q(J-1)|
485 REM      |
490 REM      |-----*-----+
495 REM      |      S(4)      S(2)
500 REM      |
505 REM
510 REM
515 IF J<N THEN QX=QX(J):QY=QY(J):GOTO 550
520 QX=RX:QY=RY
525 REM--The point Q has been moved
530 REM--one place along the previous
535 REM--curve.
540 REM--Lines 550-555 make S(B) the
545 REM--nearest of the S(I) to P.
550 FOR A = 1 TO 4: IF ABS(SX(A)-PX)
+ABS(SY(A)-PY) <= 2*D THEN B=A
555 NEXT A
560 GOSUB 905:REM--Draw line segment
565 REM--from P to S(B), make S(B)
570 REM--the new P, then set S(B)=(0,0)
575 REM--to remove it from further
580 REM--consideration.
585 REM-- The next S(B) is that
590 REM--S(I) on the same vertical or
595 REM--horizontal as P, which is
600 REM--furthest from Q.
605 FOR A=1 TO 4
610 IF (SX(A)<>PX)*(SY(A)<>PY) THEN 630
615 REM-- '*='AND', '+='OR'
620 IF B=0 THEN B=A:GOTO 630
625 C=A
630 NEXT A
635 IF ABS(SX(B)-QX)+ABS(SY(B)-QY)<ABS(SX(C)-QX)
+ABS(SY(C)-QY) THEN B=C
640 GOSUB 905:REM--Draw line, etc..
645 REM-- The next S(B) is the only
650 REM--S(I) on the same vertical or
655 REM--horizontal as P.
660 GOSUB 880:REM--Find S(B), then
665 REM--draw line, etc., as before.
670 REM-- The last S(B) is found in
675 REM--the same way.
680 GOSUB 880
685 REM *****
690 NEXT J:REM * END OF LOOP *
695 REM *****
700 REM--We now join the last point
705 REM--of the curve to the starting
710 REM--point, R.
715 UX=PX-D:UY=PY-D:UX=RX-D:UY=RY-D
720 K=0:REM--Trick to avoid K=256
725 REM--giving an error in line 1355.
    
```

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PROGRAMS

```

730 GOSUB990:REM--Join U to U.
735 PRINT"00000000000000000000"
740 REM--This positions the cursor
745 REM--near the bottom of the screen
750 IF D<1 THEN 800
755 REM--For final curve D=0.5.
760 PRINT"Press any key to continue"
765 GETA#:IFA#=""THEN 765
770 REM--Now make the 'present curve'
775 REM--into the 'previous curve'.
780 N=4:N1=N-1
785 FOR K=0 TO N1
790 QX(K)=PX(K):QY(K)=PY(K):NEXT K
795 GOTO 300:REM--Draw next curve.
800 PRINT"End of program--Press R to repeat"
805 PRINT TAB(22);"E for explanation"
810 PRINT TAB(22);"Q to quit."
815 GETA#:IFA#=""THEN815
820 IFA#="Q"THEN END
825 IFA#="E"THEN 1390
830 IFA#="R"THEN 130
835 GOTO815
840 REM
845 REM *****
850 REM * SUBROUTINES *
855 REM *****
860 REM
865 REM--Lines 880-890 make S(B)
870 REM--the nearest of the remaining
875 REM--S(I) to P.
880 FOR A=1 TO 4
885 IF(SX(A)=PX)+(SY(A)=PY)THENB=A
890 NEXT A
895 GOSUB 905
900 RETURN
905 PX(K)=SX(B):PY(K)=SY(B)
910 UX=PX-D:UY=PY-D
915 UX=PX(K)-D:UY=PY(K)-D
920 REM--The '-D' in above is only
925 REM--needed to ensure integer
930 REM--co-ordinates for the third
935 REM--curve. On a hi-res graphics
940 REM--machine,omit '-D' but make
945 REM--H large enough to keep
950 REM--co-ordinates integer.
955 REM--Lines 990-1350 draw a
960 REM--straight line from U to V.
965 REM--Without hi-res graphics,we
970 REM--must draw the line by one of
975 REM--4 routines,depending on its
980 REM--direction. In each, U moves
985 REM--to V as the line is drawn.
990 IF UX>UY THEN 1245
995 IF UY>UY THEN 1205
1000 REM--The following pixels will
1005 REM--be used:
1010 REM-- PIXEL DISPLAY CODE
1015 REM ↓ 28
1020 REM ↑ 29
1025 REM ← 69
1030 REM → 80
1035 REM ↗ 88
1040 REM ↘ 90
1045 REM ↖ 92
1050 REM ↗ 93
1055 REM ↘ 120
1060 REM | 121
1065 REM--but the arrows are never
1070 REM--displayed; they merely
1075 REM--record the direction
1080 REM--the curve is heading at the
1085 REM--end of each segment.
1090 REM *****
1095 REM * VERTICAL LINE UPWARDS *
1100 REM *****
1105 IF PD=80 THEN PD=121
1110 IF PD=90 THEN PD=29
1115 IF PD=69 THEN PD=28
1120 POKE 53941+UX-UY*40,PD
1125 REM--The minus sign in the above
1130 REM--formula occurs because we

```

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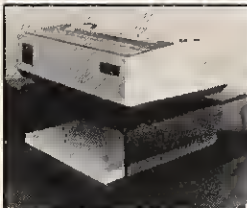
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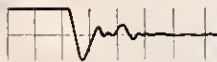
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PROGRAMS

```

1135 REM--think of UY as increasing
1140 REM--as we move UP the screen.
1145 REM--53248 is the start of the
1150 REM--video RAM; 25 lines of 40
1155 REM--characters, with addresses
1160 REM--increasing from top-left
1165 REM--to bottom-right.
1170 UY=UY+1
1175 IF UY<UY THEN POKE 53941+UX-UY*40,121:GOTO 1170
1180 PD=80
1185 GOTO 1355
1190 REM *****
1195 REM * VERTICAL LINE DOWNWARDS *
1200 REM *****
1205 IF PD=88 THEN PD=121
1210 IF PD=90 THEN PD=93
1215 IF PD=69 THEN PD=92
1220 POKE 53941+UX-UY*40,PD
1225 UY=UY-1
1230 IF UY<UY THEN POKE 53941+UX-UY*40,121:GOTO 1225
1235 PD=88
1240 GOTO 1355
1245 IF UX>UX THEN 1320
1250 REM *****
1255 REM * HORIZONTAL LINE TO RIGHT *
1260 REM *****
1265 IF PD=90 THEN PD=120
1270 IF PD=80 THEN PD=92
1275 IF PD=88 THEN PD=28
1280 POKE 53941+UX-UY*40,PD
1285 UX=UX+1
1290 IF UX<UX THEN POKE 53941+UX-UY*40,120:GOTO 1285
1295 PD=90
1300 GOTO 1355
1305 REM *****
1310 REM * HORIZONTAL LINE TO LEFT *
1315 REM *****
1320 IF PD=69 THEN PD=120
1325 IF PD=80 THEN PD=93
1330 IF PD=88 THEN PD=29
1335 POKE 53941+UX-UY*40,PD
1340 UX=UX-1
1345 IF UX>UX THEN POKE 53941+UX-UY*40,120:GOTO 1340
1350 PD=69
1355 PX=PX(K):PY=PY(K):REM--New P.
1360 SX(B)=0:SY(B)=0
1365 REM--S(B)=(0,0), removing it from
1370 REM--consideration as a future P.
1375 B=0:K=K+1:RETURN
1380 REM
1385 REM *****
1390 REM * FOUR PAGES OF EXPLANATION *
1395 REM *****
1400 PRINT"B The problem of finding an area="
1405 PRINT"of filling curve is, technically, that of"
1410 PRINT"of finding a continuous function f(t)"
1415 PRINT"of one real variable, whose values are"
1420 PRINT"of points in the plane (i.e. pairs of real"
1425 PRINT"numbers), such that the set of all"
1430 PRINT"values of this function is a set of"
1435 PRINT"non-zero area.
1440 PRINT" This problem was solved by the
1445 PRINT"Italian mathematician and logician"
1450 PRINT"Giuseppe Peano in 1890."
1455 PRINT"PRESS ANY KEY TO CONTINUE"
1460 GETA$:IFA$=""THEN1460
1465 PRINT"B Peano's original paper is"
1470 PRINT"Sur une courbe, qui remplit toute une"
1475 PRINT"aire plane, Mathematische Annalen,"
1480 PRINT"vol. 36 (1890), pp. 157-160."
1485 PRINT" Since then many other such curves"
1490 PRINT"have been found (invented?), and it is"
1495 PRINT"one of these, due to the German"
1500 PRINT"mathematician David Hilbert, which is"
1505 PRINT"represented in this program."
1510 PRINT"PRESS ANY KEY TO CONTINUE"
1515 GETA$:IFA$=""THEN1515
1520 PRINT"B. A curve filling a square of side 1 is"
1525 PRINT"constructed as the limit of a sequence"
1530 PRINT"of curves. (Technically, the function"
1535 PRINT"of (t) is the uniform limit of a sequence"

```

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PROGRAMS

```

1540 PRINT"(Of continuous functions.) This program"
1545 PRINT"(displays the first three curves in this"
1550 PRINT"(sequence. It shows, in the first few"
1555 PRINT"(cases, that"
1560 PRINT"(a)the nth curve is obtained from the"
1565 PRINT"( (n-1)th by a distortion by a distance"
1570 PRINTTAB(17):"n"
1575 PRINT" less than (1/2) , and"
1580 PRINT"(PRESS ANY KEY TO CONTINUE"
1585 GETA$:IFA$=""THEN1585
1590 PRINT"(b)the nth curve passes within a"
1595 PRINTTAB(17):"n+1"
1600 PRINT" distance (1/2) of any point of the"
1605 PRINT" square."
1610 PRINT"(From (a) it follows that the sequence of"
1615 PRINT"(curves converges. From (b) it follows"
1620 PRINT"(that the limit curve fills the square."
1625 PRINT"(A full explanation may be found in:"
1630 PRINT"(Topology' by J.G.Hocking & G.S.Young"
1635 PRINT"(Addison-Wesley,1961) Section 3-3."
1640 PRINT"(Press E to repeat explanation pages."
1645 PRINT" Q to quit."
1650 PRINT" any other key to run the program."
1655 GETA$:IFA$=""THEN 1655
1660 IFA$="E"THEN 1390
1665 IFA$="Q"THEN END
1670 GOTO 110
    
```

RML Restore

by Barry Taylor

This program runs on the RML 380Z MDS system. If you've accidentally erased a file with the extension '.BAS' using the CPM 'ERA' command or a Basic 'ERASE' command it can now be restored to its rightful place in your directory. Memory usage is negligible and it works by reading the directory track sector by sector. If the file name is found and is preceded by the value E5

hex then this value is set to 0 and the sector written back to the disk. It will restore the whole file whatever its size and should prove to be a valuable system utility — especially for people like me who are accident prone with their disks — or who don't think properly about what they really want to keep before erasing files.

```

1 REM RESTORE by B.M.Taylor
2 REM Version: 2.2
3 REM Date: DEC 1981
4 REM Language: BASIC 5.0
5 REM This program will restore a BASIC
6 REM program on a Mini Disk which has
7 REM been erased.
8 REM The name of the program should be
9 REM entered without the extension .BAS
10 CLEAR 200,140
20 B=PEEK(&11C)+256*PEEK(&11D)+1
30 B1=INT((B+7)/256)
40 B2=B+7-B1*256
50 B3=INT((B+12)/256)
60 B4=B+12-B3*256
70 POKE B,ADD:POKE B+1,&21
80 POKE B+2,B2:POKE B+3,B1
90 POKE B+4,&F7:POKE B+5,&1A
100 POKE B+6,&C9:POKE B+8,3
110 POKE B+10,B4:POKE B+11,B3
120 D=VARADR(D*)
130 POKE D,128
140 POKE D+2,B4:POKE D+3,B3
150 C$=""
160 F=0
170 C=-1
180 PUT 12
190 ?"Restore v. 2.2"
200 ?
210 INPUT"TYPE NAME OF BASIC PROGRAM : ",F$
220 IF F$="" THEN 210
230 A$=F$+LEFT$(C$,B-LEN(F$))+".BAS"
240 ?"DRIVE (A/B/C/D) = ":
250 A=DET()
260 IF A)95 AND A(10) THEN A=A-32
270 IF A(65 OR A)60 THEN 250
280 ?CHR$(A)
    
```

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```

290 ?
300 POKE B+7,A-65
310 IF LOOKUP(CHR$(A)+"",F$)=0 THEN 340
320 ?"FILE "":F$:"" STILL EXISTS"
330 GOTO 370
340 READ S
350 IF S=-1 THEN 530
360 POKE B+9,S
370 CALL B
380 IF ASC(MID$(D$,2,1))=65 THEN 530
390 FOR X=1 TO 97 STEP 32
400 B%=MID$(D$,X+1,B)+"",MID$(D$,X+9,3)
410 IF A$(B%) THEN 460
420 C=C+1
430 IF C() ASC(MID$(D$,X+12,1)) THEN 560
440 POKE B+11+X,C
450 F=1
460 NEXT X
470 IF F=0 THEN 340
480 POKE B+5,81C
490 CALL B
500 RESET
510 ?"FILE "":F$:""
520 GOTO 340
530 IF F=0 THEN 560
540 ?"FILE "":F$:"" HAS BEEN RESTORED"
550 GOTO 370
560 ?"FILE "":F$:"" CANNOT BE RESTORED"
570 ?
580 END
590 DATA 1,4,7,10,13,16,3,6,9,12,15
600 DATA 2,5,8,11,14,-1
    
```

BENCHMARKS SUMMARY

continued from page 111

ed according to the frequency of their use in the application (which would be different for every application). Even if this were possible, it would be stretching the significance of the figures way beyond their actual usefulness. Nevertheless, I felt that the result would be less arbitrary if BM8 were given its proper weight; not to have done so would be unfair to machines which have fast transcendental arithmetic, and maths is after all a not insignificant part of any computer's job. If your application will never require transcendental functions then take the ranking with an even larger pinch of salt than I already recommend; by taking such an average we are giving an overall measure of speed which favours no particular class of application. It can be argued that doing this is unfair to otherwise fast machines with slow arithmetic; for instance the Positron 9000 is comfortably top of the list if BM8 is taken at face value. Also keep in mind that BM8, more than any of the other Benchmarks, is crucially dependent on the efficiency of the algorithms chosen to implement the arithmetic rather than on the hardware, so a new release of an interpreter could dramatically alter a machine's performance in it. It should also be borne in mind that some machines are computing more digits of precision than others in BM8.

To avoid this agonising decision in future BM8 from now on will count

1000 loops like the others (it's printed that way on this page) and the Bench-testers will just have to yawn and lump it.

Whither the Benchmark Tests in the future? At the time they were invented Basic and Assembler were the only languages of any importance on micro-computers. Since then Pascal, Forth, C,Cobol and to a lesser extent Fortran and Lisp have made their mark. Chris Sadler and Sue Eisenbach have already produced an excellent set of Pascal Benchmarks which we also summarise annually. I am in the middle of producing an equivalent set of Forth Benchmarks which will appear before too long.

As to the other languages, if anyone out there feels strongly enough about it to produce a set of universally applicable programs then we'll be interested in seeing them. The problem is that, unlike Basic, these languages are almost never supplied as the principal or only language on a given machine and so the opportunities to run the tests will be few. Since most of them will be running under CP/M or some other DOS, they could be run purely as a test of the compiler/interpreter, but the results would only be comparable if run on the same hardware.

Since Basic is unquestionably still the most important microcomputer language (to the chagrin of its growing number of critics) I would like to see the Benchmarks extended eventually to cover string handling and graphics if any way

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TECHNOLOGY

BENCHMARKS SUMMARY

Continued from page 111

can be found around the profound differences in the way different Basics do these jobs. A test for the speed of screen updating would also be of great value to users of word processors and spread sheets; this is really a hardware test but it might be done through a Basic program.

Notes on the table of Benchmarks

1) A few machines are not included in the table because the full set of Benchmark timings were not available. This may be because the machine has an unorthodox Basic (Acorn Atom) or integer only Basic (Sinclair ZX80) or because the original reviewer screwed up (no names, no pack drill).
2) For machines tested in the last year, all versions of Basic tested are included where applicable. For machines tested

before Nov '81 one version only (single precision) is included.

3) Not all the machines in the list will still be on sale in the UK, and a few never were.

4) The average timing column by which the machines are ranked is computed by summing BM1 to BM7 plus 10 times BM8 and dividing by 8.

5) In as much as the ranking is of any significance (see discussion above) the interesting things to note are that in the top four machines only one, the Olivetti, has a 16-bit processor, and that the ageing 6502 and 8080 are both represented. Surprising how important software is, eh? It's also intriguing to relate the rankings to price. With a couple of exceptions it appears that money can buy speed.

6) Don't buy a machine solely on the strength of its ranking in this table unless you're also prepared to buy a car solely on its 0-50 mph time.

LEISURE LINES

by J J Clessa

Quickie

No prizes no answers. Name two Olympic events in which the winner crosses the finish facing backwards.

Prize puzzle

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(c) A rectangular pyramid which has a line of six balls on top and thereafter has each ball resting on four others.

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BLUDNERS

Well, the most popular section of PCW is back again with an apology to Robert Newman who wrote ZX81 Star Trek in the October issue. We didn't print his name with the program.

Secondly, and also in October PCW, TJ's Workshop contained an article called 'PET Camera Tester'. Line 10 of the program listing should contain POKE 59459 instead of 49459. In the machine code program, the words 'must

not be delayed' should read 'must not be omitted'. This should make the commentary much more intelligible.



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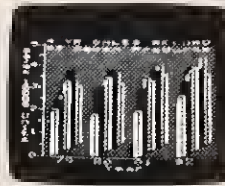
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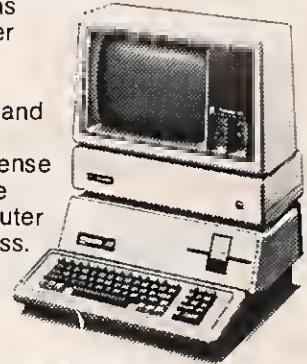
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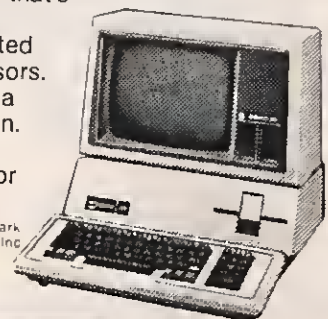
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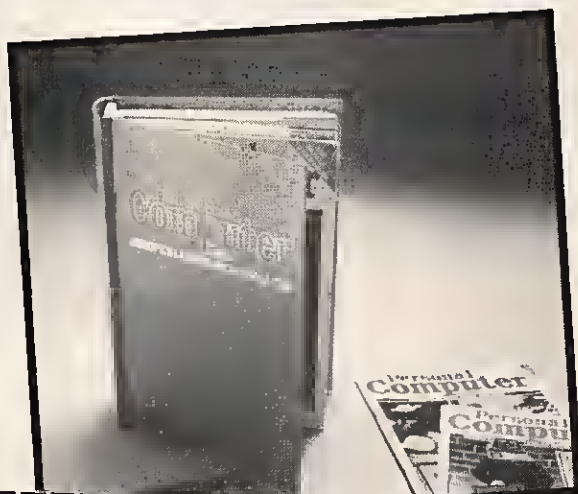
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Benchmark: Onyx C8002/Benchmark: Bigboard/Micro music software package/ALC circuit/Commons report/HP 43C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing, PET Bouncy.

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Benchmark: Pascal 640/WP Benchmark: Magic Wand/PET colour/Low-cost digital tape system/Using calculator printers on micros/Apple music-making/Multi-user Benchmark: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.

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June 1981
Benchmark: NEC PC-8001/Multi-user Benchmark: MP/M/Benchmark: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchmark: Wordpro 4 plus/Budget tape interface/Further Casio quirks/Programs: UK101 Zor, PET Chords.

Volume 4 No 7
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Benchmark: Sharp PC-3201/Multi-user Benchmark: Acorn Eonnet/Case study: Accident investigation on TRS-80/Zilog Z8 family/WP Benchmark: Format-80/

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Volume 4 No 8
August 1981
Benchmark: Tandy Model III/Viewdata update/WP Benchmark: Spellbinder/Printer survey/Microholism/Programs: ZX80

Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.

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Benchtests: Tandy Color Computer, Commodore VIC/Checkouts: Hi-Tech Speakeasy, Tantel/Multi-user Benchmark: HMSOS/WP Benchmark: Memorite III/Word proc program for PET/Apple dealership run by spastics/Printer facing extra/Calc Corner: Casio fx602p review/Programs: PET Arithmetic test, ZX80 Eldorado, 380Z Memory test.

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November 1981
Benchtests: Osborna 01, IBM Personal Computer, Checkout: Sharp IQ3100 Microtranslator, Calc Corner: Casio fx702p, PCW Show report, Benchmark Summary, Euro Micro Chess Championship report, Programs: TRS-80 Sheepdog trial, ZX81 Sun and Planets.

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Benchtests: Sharp MZ-80B Phillips P2000/School network/BBC Micro inside story/'Turtie' Graphics for Apple/Forth language/Curve fitting/Calc corner: HP14C review/Programs: PET Fantasy, ZX81 Battleships and cruisers.

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Benchtests: BBC Micro, Xerox 820/Frames of Reference (new series)/ZX81 Printer Checkout/Digital Drummer for PET/Calc Corner: Benchmarks/Programs: MZ-80K Fortune, TRS-80 Reaction Timing, ZX80 Laybrinth, Apple Letters.

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Benchtests: Sirius-I, Casio fx-9000p, Gemlni Multiboard/Word Processor Benchmark: Script 2.0/Plotter Checkout: Watanabe/Hardware feature: High Density VDU card project/Music system: FREQUOT/Calc Corner: Aerial Navigation/Programs: Pet Haemophilia, Pet Cheese, TRS-80 Extra, Sharp PC1211 Exam, Personality test.

Vol 5 No 3 March 1982
Benchtests: Texas Instruments 99/4A, Hewlett-Packard 125/Choosing a Database/Comsoft DMS reviewed/Screenplay (new series)/Calc Corner: Hewlett-Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks,

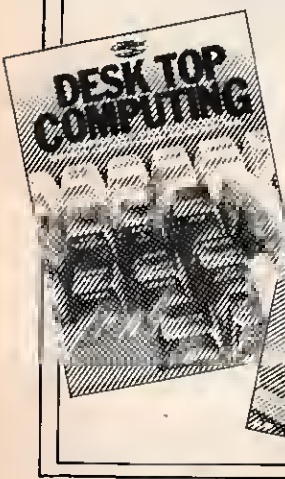
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Vol 5 no 5 - May 1982

Benchtests: Apple III, Hitachi Peach/Database Benchtest: dBase II/3D Graphics Made Easy/Equation Solving/Calc



Corner: fx 602 quirks/Programs: PET Mini-Animate, MZ-80K Catch, Apple Maze, Atari Sums For Kids, ZX81 Book Index, PET Stockmarket, Microtan 3D Rotation, Extra for MZ-80K, UK101 Crossword Notepad. With free Word Processing Supplement containing a summary of all PCW's WP Benchtests.



Vol 5 No 6, June 1982
Benchtests: Sharp MZ-80A/ZX Spectrum/Database Benchtest: DBMS2/West Coast Faire Report/Lisp/VIC 20 games/Calc Corner: Sharp PC1500/Programs: RML Altered Basic/VIC-20 Large Charac-

ters/BBC Breakout/VIC-20 Trailblazer/MZ-80K Next-to-Last-One/MZ-80K Tarot.



Vol 5 No 7, July 1982
Benchtests: Mimi 801/Newbrain/Database Benchtest: Silicon Office/UCSD p-System/BBC Computer in-Depth/Apple II games/Calc Corner: T188/Programs: ZX81 Hypocycloids/BBC Character Generator/TRS-80 Truth/PET Doc/TRS-80 Screen Dump/UK101 Screen Converter/PET boxes/Atari Earth.



Vol 5 No 9, September 1982
Benchtest: Olivetti M20/Word Processor Benchtest: Select for NEC/Database Benchtest: Aquila/Checkouts: Microwriter Revisited, E40 Data Compression/Screenplay: ZX81 Pt II/DIY Logo/P for Perfect/Beeb Colour Hi Beeb Colour Hi Res/RS232/Calc Corner: HP15 and 16C reviewed/Programs: Video Genie Extended Basic, ZX81 Alpha-betising, PET File Comparison, BBC Music Player, PET Virus, BBC Radar, PET German Game, TRS-80 Cardshuffler.



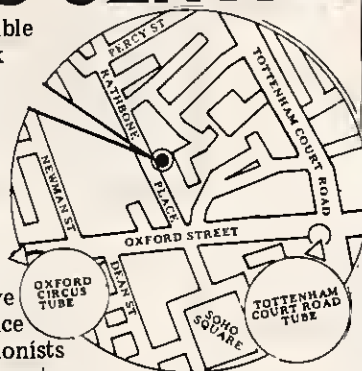
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Benchtests: Sord M23/Dragon 32/Database Benchtest: Cardbox/Preview: Sony SMC-70/UCSD p-System/RS232 Interface/Sirius graphics/NCC Show report/ZX81 Speech Checkout/Calc Corner: Casio fx602p/Programs: TRS-80 Quadrangle/UK101 Conversion of units/PET Mopup/Apple Lifespan/Apple Trees/Nascom Snail Racing/UK101 Long Multiplication & addition.



Vol 5 no 10 October 1982
Benchtests: HP-86; Positron 9000/Database Benchtest; Personal Pearl/3D Graphics for BBC Computer/Hashing Techniques/Designing Your Own Database/CP/M-86 v MSDOS/Clock-Calendar Card for Apple II/Calc corner: hints for Sharp PC122/Programs: ZX81 Star Trek; PET Knockout; PET Trains.

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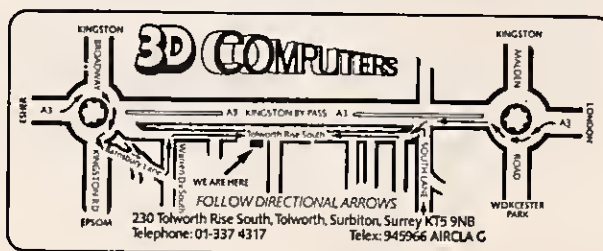
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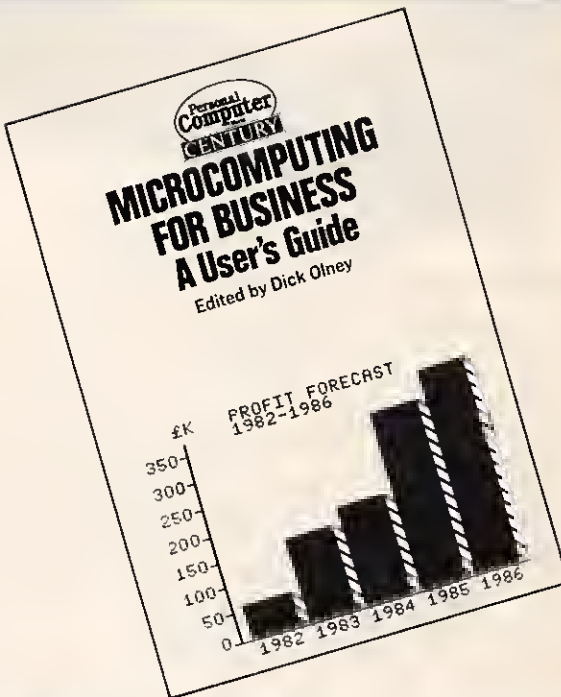
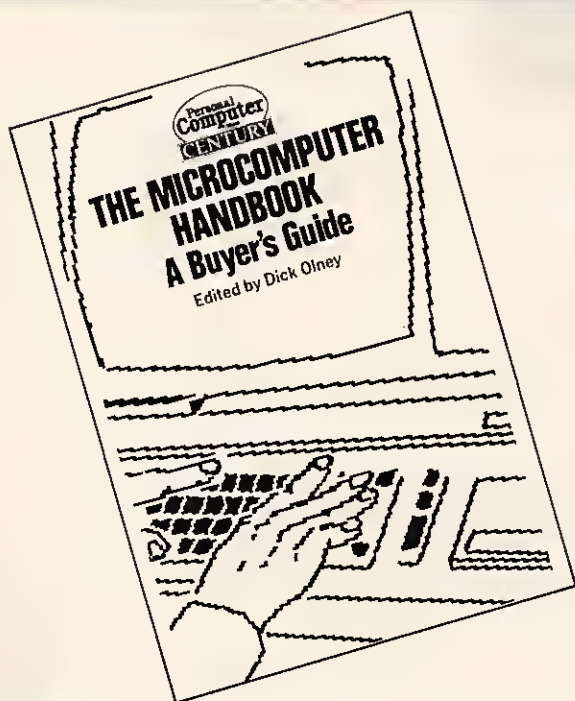
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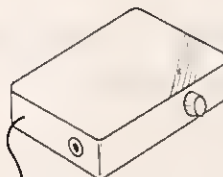
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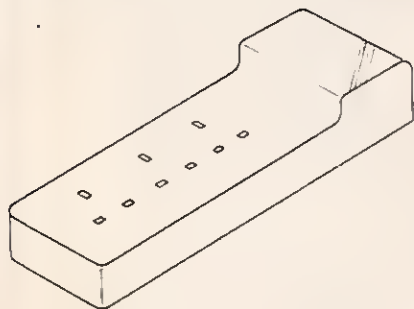
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We accept Armed Forces and all Ministry of Defence Establishments orders over £50.00 in value. All other customers cheques with order please payable to DISKING. If you are a large establishment, and can not raise cheques without an invoice please post or telephone us your order, and we will send a pro-forma invoice by return, for your accounts department to pay against.

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First TEN-PACK (Mini or 8")	£1.80
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QTY	DESCRIPTION	PRICE EXC VAT
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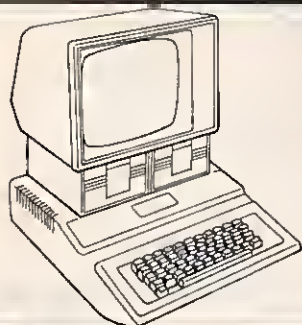
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* CP/M is a registered trade mark of Digital Research

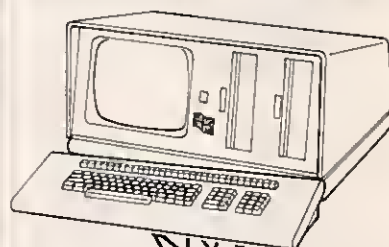


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SILICON OFFICE - for powerful reporting	£3550
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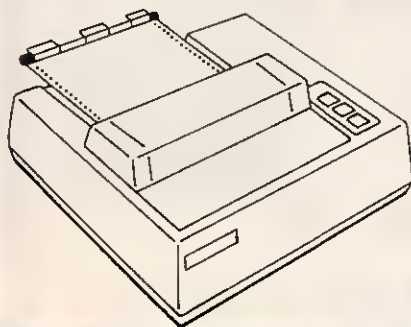
For demonstration on your premises ring 891-4477

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- 64K
 - 2 x 5 1/4" Floppies
 - Separate keyboard with numeric pad
 - 12" Green screen 80 columns
 - User programmable function keys
 - includes C/PM operating system
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Microline 80	£210
Microline 82A	£299
Microline 83A	£470
Microline 84 200cps	£849

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Software for CP/MTM

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WORDSTAR	MICROPRO's comprehensive word processing system	250.00
MAILMERCE	Added power to WORDSTAR for mailing lists, standard letters, etc	60.00
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BASIC Compiler	Compile your BASIC-80 programs for speed and protection	190.00*
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dBASE II	Relational Database Management from Ashton Tate	380.00
dUTIL	Programming aid for dBASE II	50.00
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PLI-80	Digital Research PLI Compiler	310.00
BT-80	Record Retrieval for PLI-80	125.00
MAC	Digital Research 8080 Macro Assembler	57.00
SID	8080 Symbolic Debugger	47.00
ZSID	Z80 Symbolic Debugger	63.00
DESPOOL	File Print Spooler for CP/M	31.00
TEX	Tex editor	63.00
SPELLBINDER	Lexisoft's Wordprocessing and Office Management System	275.00
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All products are available in 8" SD, SS, Superbrain 5" SS, North Star Horizon QD format except those marked * which are not available in North Star format.

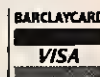
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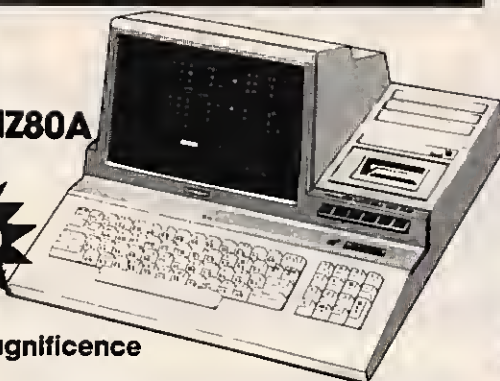
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Z80A C.P.U. • 48K RAM • 4K ROM • Industry standard QWERTY keyboard with numeric pad • 9" GREEN C.R.T. • 1200 bd cassette • Music & sound • Real time clock • Enhanced BASIC • Full editing facilities • Internal expansion

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Quantum HI-RES FOR MZ80K

High resolution plotting on your MZ80K down to a resolution of a single dot within a character cell.

A new BASIC is supplied with the following additional commands: LINE, WIPE, G SET, G RESET

Quantum HI-COPY FOR MZ80K

This combination of hardware & software not only allows printing of the full Sharp character set, but allows a full High Resolution print of the actual screen it used with the Hi-Res graphics option.

Available in 2 versions

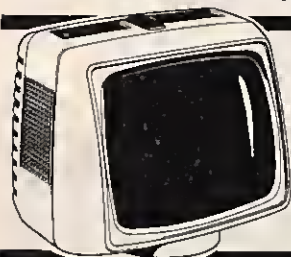
QUANTUM GP100A HI-COPY
SEIKOSHA GP100A, Interface, ROMS & screen dump BASIC.

£300.00 +VAT
including printer

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SPECIAL OFFER Quantum Hi-Res Only £70.00 if purchased with Quantum GP100A Hi-Copy
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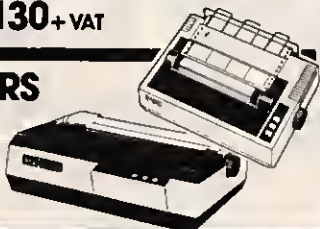
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A high quality data display monitor, ideal for all Nascom & Gemini systems. 20MHz resolution. Available in amber or green phosphor.

£130 +VAT

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Epson MX100 Type III ... £499 +VAT
NEC 8023A £389 +VAT
SEIKOSHA GP100A £215 +VAT



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All the products on these two pages are available while stocks last from the MicroValue dealers listed below. (Mail order enquiries should telephone for delivery dates and post and packing costs.) Access and Barclaycard welcome.



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Amersham Computer Centre Ltd.,
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Ookfield Corner, Sycamore Road.
Tel: (02403) 22307. Tx: 837788.

BIRMINGHAM
Skytronics Ltd.,
80 Bristol Street.
Tel: 021-622 6436

BRISTOL
Target Electronics,
16 Cherry Lane.
Tel: (0272) 421196

EGHAM, SURREY
Electrovalue Ltd.,
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Gemini GALAXY 1 CP/M COMPUTER SYSTEM

A Multiboard based 80-BUS computer

HARDWARE

- ★ Twin Z80A CP/M System.
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- ★ 800K Disk Storage (Formatted).
- ★ 80 x 25 Screen Format.
- ★ Inverse Video.
- ★ Prog Character Generator.
- ★ 160 x 75 Pixel Graphics.
- ★ Centronics Parallel I/O.
- ★ RS232 I/O.
- ★ Light pen Interface.
- ★ 59-Key ASCII Keyboard.

SOFTWARE INCLUDED

- ★ Full 64K CP/M 2.2 with screen edit facility.
- ★ COMAL-80 structured BASIC.
- ★ GEM ZAP Assembler/Editor.
- ★ GEM PEN Text Editor.
- ★ GEM DEBUG debugging software.

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£1,450
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QUIBS-Quantum INTEGRATED BUSINESS SYSTEM

A business accounts package developed for the Galaxy, menu driven.

1. **SALES LEDGER** full VAT reports, statement, credit note + invoice facilities.
2. **PURCHASE LEDGER** full VAT reports, statements, remittances.
3. **NOMINAL LEDGER** 250 analysis heads, trial balances, accruals & repayments.
4. **STOCK CONTROL** costing reports, price lists, etc.,

The system is fully integrated. Comprehensive audit trails are printed. Specially developed for Multiboard based systems.

£400 +VAT
Specify disk format when ordering

Quantum DATAFLOW

A Data base management and information retrieval package. Allows searching, sorting, report printing, file printing and label printing. Anything which is filed manually can be filed more efficiently with DATAFLOW.

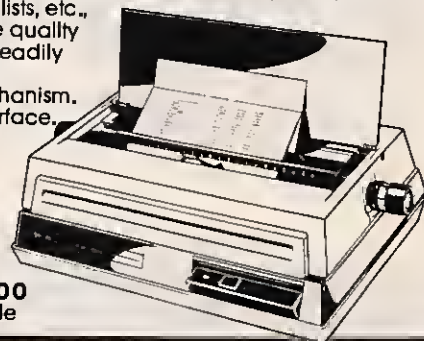
For all multiboard CP/M systems.

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- ★ Simple reliable mechanism.
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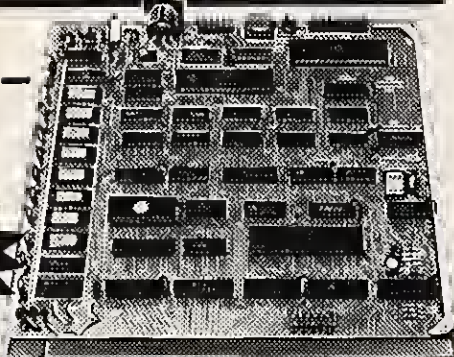


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MicroValue

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Gemini**

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The Gemini GM813 is a new 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces — RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RPM monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

OTHER 80-BUS PRODUCTS FOR nascom & Gemini SYSTEMS

GMB16 GEMINI I/O BOARD

The new GMB16 Gemini I/O board takes a unique approach to the problems of interfacing your Nascom or Gemini Multi-board to external devices. This 80 Bus and Nas-Bus compatible card is supplied fully built, populated and tested and includes three Z80 PIOs, a CTC and a Real Time Clock with battery back-up. In addition, a range of 'daughter' boards that attach straight to the I/O board are under development, catering for a wide variety of interfacing requirements.

**GMB16 Gemini I/O board
MicroValue price —
£125+VAT**

**Prototyping daughter board
MicroValue price —
£18+VAT**

EVB14 EV COMPUTERS IEEE-488 BOARD

The EV Computers' IEEE-488 card is an 80 Bus and Nas-Bus compatible card designed to fully implement all IEEE-488 interface functions. This built and tested card gives the user a very cost effective and versatile method of controlling any equipment fitted with a standard IEEE-488 or GPIB interface.

**MicroValue introductory
price £140+VAT**

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Provides 32K bytes of battery backed RAM. Page Mode is fully supported offering 1 x 32K or 2 independent 16K pages of memory retained for over 40 days without external power. **MicroValue price £170+VAT**

SOFTWARE FOR THE Gemini MULTIBOARD SYSTEM

COMAL 80 — The extended BASIC with powerful PASCAL structures at **£100+VAT**
GEM PEN — A comprehensive text editor and text formatting package at **£45+VAT**
GEM ZAP — A very fast Z80 assembler with comprehensive screen editing at **£45+VAT**
GEM DEBUG — A debugging utility program including trace and disassembly features. **£30+VAT**

COM-PAS — An Interactive PASCAL system with on-screen editor. Generates Z80 machine code. **£150+VAT**

COPY 58 — Allows transfer of programs and files between Gemini DDDS and Superbrain DD & QD formats. **£30+VAT**

LIST/REPAIR — LIST replaces the CP/M TYPE command and provides paging, headings, line numbering, etc. REPAIR is for G809/G815 systems and allows reading and writing of individual disk sectors to assist recovery of lost data. **£25+VAT**

G-BASIC — 8K Graphics BASIC for RP/M or CP/M **£25+VAT**

GEM-GRAPHIC — Links with Microsoft BASIC, providing 20 extra commands for GM812/IVC **£35+VAT**

SOFTWARE FOR THE GEMINI DISK SYSTEM FOR NASCOM 1 OR 2

Choose from either the industry standard CP/M 2.2 D.O.S. or POLYDOS — a unique, versatile and well presented DOS that includes an editor, assembler and adds disk commands to the Nascom BASIC.

CP/M 2.2 — for use with GMB05 **£100+VAT**
POLYDOS 1 — for use with GMB05 **£90+VAT**
CP/M 2.2 — for use with GMB15 **£100+VAT**
POLYDOS 2 — for use with GMB15 & GMB09 **£90+VAT**

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Tel: (0473) 78295**

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Tel: (0532) 458877**

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Henry's Radio,
404 Edgware Road.
Tel: (01) 402 6822 Tx: 262284
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Computer House,
58 Battersea Rise,
Clapham Junction.
Tel: 01-223 7730**

**MANCHESTER
E.V. Computing,
700 Bamage Lane,
Bumage.
Tel: (061) 431 4866
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Skytronics,
2 North Road, The Park.
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NASCOM 3 AVAILABLE FROM MICROVALUE

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied, built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.

**48K system
MicroValue price —
£499+VAT**

**Dual floppy disk unit
(0.7 MB storage)
MicroValue price —
£685+VAT**

**CP/M 2.2
MicroValue price —
£100+VAT**



NASCOM 2 KIT £225+VAT

Built & Tested £285+VAT

**NEW LOW
PRICE**

80x25 VIDEO FOR nascom

Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with onboard Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Built and tested.

£125+VAT

GM802 64K RAM card ONLY £125+VAT

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gives Nascom 2 graphics capability to your Nascom 1.
only £20+VAT**

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(inc. parts list)
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NAS-GRAPH PAC — provides 20 additional commands to Nascom BASIC.

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LOGIC SOFT RELOCATOR — A software relocating package which

allows disassembly and reassembly from anywhere on the memory map. **MicroValue price £13+VAT**

HASPEH **RRP £30+VAT . MicroValue price £20+VAT**
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Gemini DISK SYSTEM FOR nascom

GM809 — full Nas-Bus floppy disk controller card — drives up to 4 drives — optional B" expansion — **£125+VAT.**

GMB15 — Double density disk system.

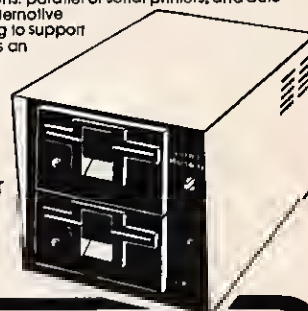
With a thousand in daily use, the Gemini Disk system is now the standard for Nascom and Gemini Multiboard systems. Single or twin drive configurations are available, giving 350K storage per drive. The CP/M 2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers, and auto single-double density selection. An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 2. It includes an editor and assembler and extends the Nascom BASIC to include disk commands.

**Single drive system
(G809, G815/1)
£450+VAT**

**CP/M 2.2
package
(G513)
£100+VAT**

**Double drive system
(G809, G815/2)
£675+VAT**

**POLYDOS 2
£90+VAT**



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Purpose-Built *ONLY* £485
Daisywheel
Printer

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**SMITH CORONA
TP-1**



- Microprocessor Controller
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- Lowest cost purpose-built Daisywheel

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Tel: 01 202 2277

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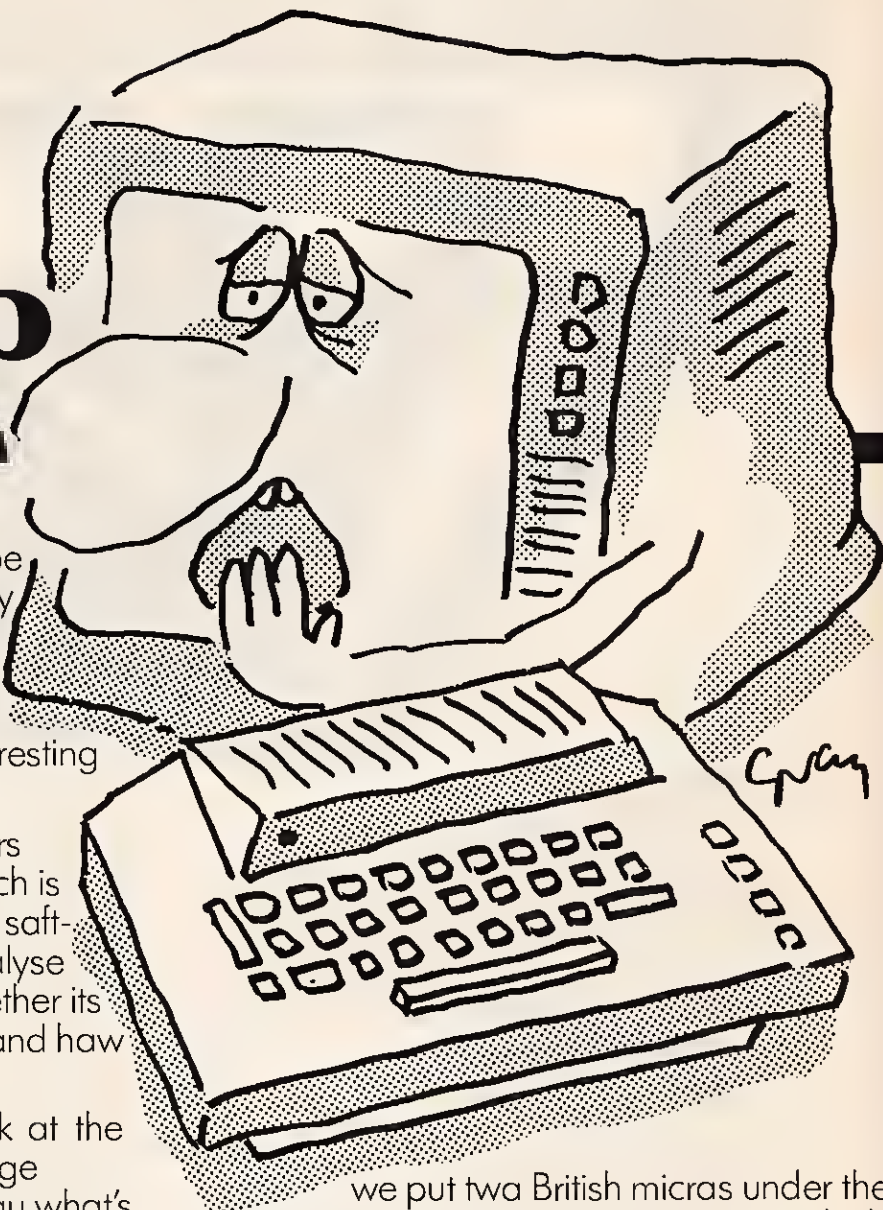
GETTING THE MOST FROM YOUR MICRO?

These days, there seem to be new developments in micros every five minutes. How can you stay in touch? Which Micro & Software Review brings you all the most important news and the most interesting facts every month.

As well as our unique buyers guide to software packages (which is updated every month) we review software in depth. This month we analyse PLANNERCALC and tell you whether its low cost represents good value, and how it stacks against VISICALC.

We also take a long look at the new cash flow forecasting package CASHFAX. Every month we tell you what's available, what's in the pipeline and what's right for you – over a range of software for home, business and school users.

We don't stint on hardware coverage either. Not only do we publish the most extensive buyers guide available (over 100 micros in detail) but we also publish reviews that really take machines apart. This month



we put two British micros under the microscope – the new 64K MIMI 802, which made us wonder whether British could be best again. And the £89.95 JUPITER ACE which is not only very cheap, it's also the world's first micro to use FORTH. Does that make for speed, versatility and ease of programming – or should it have been left with the mainframes?

With all this you get the best news, an informative (and fascinating) letters page, and a problem-solver section written by two of the most respected experts in the business. November's issue is at all good newsagents from October 15th. Don't miss it.

THE A TO Z OF MICROS

**WHICH MICRO?
& SOFTWARE REVIEW**

INNOVATIVE TRS 80-GENIE SOFTWARE

from the professionals

LDOS

VERSION 5.1
THE TRS-80™ OPERATING SYSTEM
MODEL I AND III

- * DDUBLE Sided & DDUBLE Density support.
- * AUTDMATIC Density recognition.
- * 35, 40, 77, 80 and any other track counts are supported.
- * All available drive stepping rates are supported.
- * Hard Drive support, can be HANDLED AS A SINGLE DRIVE.
- * Hard drive partitioning, one drive can act as up to six.
- * Intermix 5", 8" and Hard drives, up to a total of 8 drives.
- * Compatible with the Model I Radio Shack Expansion Interface.
- * Upward compatible with TRSDDS (2.3 & 1.2 as documented).
- * Fully supports Microsoft language products for the TRS-80.
- * Complete media compatibility Model I to Model III and back.
- * Full support for LDBD's LX-80 interface.
- * Full support for AERDCDMP LC double density controller (DDC).
- * Full support for PERCDM's DDUBLER II.
- * Complete documentation (well over 250 pages).
- * Complete technical information.
- * A Quarterly LDOS users magazine (The LDOS QUARTERLY).
- * A liberal update policy.
- * An enhanced BASIC (LBASIC) including:
 - > Upward compatible with Microsoft Basic.
 - > High speed LDAD and SAVE.
 - > Run multiple programs with common variables.
 - > BLDCKED (variable length) files are supported.
 - > DDS commands may be executed from LBASIC.
 - > Built in string array. SDRT.
 - > Single stepper for debugging.
 - > Several new statements and file modes.
- * A compiled JDB CDNTRDL LANGUAGE (JCL).
- * CDNVert utility to move files from Model III TRSDDS.
- * An Extended Debugging and Monitor program (with disk access).
- * CMDFILE for movement of disk and/or tape system (/CMD) files.
- * Device independent operation.
- * Full LINKing, RDUTEing, FILTERing and SETing are supported.
- * MiniDDS feature for constant access to certain DDS commands.
- * RS-232 DRIVER for serial support.
- * Sophisticated communications software included.
- * Wildcard characters and partial Filespecs are supported.
- * DATED FILES, show when a file was last written to.
- * Backup: Mirror, by Class, if Modified, by Date, by Extension, etc.
- * Selectable PURGE for fast disk "cleanup" of unwanted files.
- * Print formatter, for control of printer output.
- * Built in printer SPDDLER, to both disk and ram.
- * Joblog to record all system operations with time stamps.
- * UPPER and /lower case support, throughout the system. *
- * Blinking cursor with selectable cursor character.
- * 128 character TYPE AHEAD buffering for keyboard input.
- * Assign strings to individual keys with Key Stroke Multiply (KSM).
- * SUPER FAST operation with the SYSRES feature.
- * Extensive user control and system feedback.
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DATA-WRITER

Data-Writer is, for most microcomputers, a new concept in Database Management. It adapts techniques which have been known and used on mainframe computers for quite a long time. A "normal" microcomputer Database Management program constructs its file in a single plane and is probably more accurately described as a file handling system. All of the data written into each record is filed away on disk in the same place, and it is all recalled and acted upon by the computer as one chunk of data.

Data-Writer approaches Database Management in an entirely different manner in that, subject to one or two requirements, it is not concerned as to how the database came about or the form of it. Indeed, one of the most attractive features of the program is that the data itself can even be written on a word processor — not by Data-Writer at all. So far as we have been able to ascertain, any word processor may be used that writes a plain ASCII file. Certainly AJEDIT and Scripsit are supported. If you do not have a word processor, or do not wish to use it for the manufacture of your database, then there are sections in Data-Writer which in themselves constitute mini word processors and enable the user to manufacture a database very easily.

In the foregoing paragraph we use the words "word processors" in the plural, and this gives a clue to a rather important feature of Data-Writer. The whole concept of the software is that it is a Management program. A number of earlier databases have suffered very seriously from what the author no doubt thought was economic writing, in that if a section of a program (for instance the mini word processing section) is used by a number of sections, only one is included and is accessed by various sections. At first sight this might indeed appear to be economic writing and we suppose in fact it is, but the result is that the disks are continually thrashing around as access is made to them. Disk access is probably the slowest task that the CPU carries out and if it is done frequently it slows the program down very considerably. Many past Database Management programs have suffered from this deficiency. Data-Writer on the other hand has a mini word processor in each section of the program where it is needed. This has the great advantage of obviating the necessity for the drives to be thrashing around, but almost as importantly means that the format of the mini word processor can be changed for the various sections of the program, so that the best advantage can be made of it in each. Thus every section is entirely separate and gives a very high degree of efficiency and user friendliness.

There are very few restrictions with Data-Writer. The number of records which one can handle in any given database is, essentially, unrestricted although any that span disks would have to have different names. In any event as the Sort section of the program does have a restriction of sorting 4,500 records at a time, this effectively imposes a restriction on the length of the file if one intends to be able to sort it all at one time. The maximum number of fields permitted to a record is 20 and the maximum number of characters per field depends on whether you use the Entry section of Data-Writer to enter your data or whether you use a word processor. In the latter case the maximum number of characters per field is 240. In the former it is 35. The maximum number of characters per field label or title is 20.

Data-Writer has a very powerful mathematical section whereby many complex mathematical functions can be carried out on your data. Up to 20 equations may be defined per run. The section will have available 10 scratch pad memories for use and as the calculations are carried out in double precision they will be carried to 16 decimal places.

Data-Writer also contains a very powerful "Mail Merge" section. Almost any personalisation can be added to a letter or report, and once again the letter or report may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be of any length up to 6,000 characters, which we believe is about two and a half A4 sheets.

The Sort is a two level one and supports the extraction of stipulated data from a field. It is what might be called of fair speed. The two key levels make it powerful but as the Select section is so good, the Sort does not get used as often as would be the case in other Databases.

Data-Writer is made up of 10 sections or sub-programs as follows:

Entry	Manage	Maths	Sort	Letters
Edit	Statistics	Select	Labels	Reports

We have already mentioned many of them, others such as Edit are self-explanatory. The Labels section enables you to create pretty well any form of label required, including the ability to have them printed up in a form one to four across format. The Letters section enables you to create a form letter in Data-Writer if you do not wish to use an external word processor. Statistics is a method for searching the database for errors, and as the title suggests, extracting essential statistics from it.

The important sections not yet touched upon are Manage and Select. Taking the latter first, this section enables you to create a sub-set of the database by selecting from the file contents. It is immensely powerful and supports nine equivalency relationships, such as "less than" or "greater than" etc. Furthermore, the two logical relationships AND and OR may be used freely. In this way one can Select from the database to pretty well any specification required. The Management section of the program enables the user to completely re-structure his database without having to Edit it manually. New fields may be added or old ones deleted. They may be re-arranged or even appended one field to another. Indeed, this can be taken even further in that the whole database may be merged or split as required.

The Reports section enables the user to write reports such as inventories, accounts, bibliographies, insurance coverage report, in fact an endless list of applications. Because the Report section contains its own Text Editor, the report contents and format can be controlled at will and literally an infinite number of formats may be adapted.

Data-Writer is one of the most powerful Database Management systems that we have seen available for a microcomputer and certainly is the most powerful that we have seen for the TRS-80 and Video Genie machines. Once the database has been manufactured, either by Data-Writer or a word processor, one has complete and utter control over it and the ability to manipulate any part of it; not only the ones mentioned above, but many others which we have not had the space to list. Data-Writer is compatible with the Model I and Model III Tandy machine, the original Video Genie, together with the Genie I and II. A version for the Model III Genie will be available shortly.

Data-Writer is Compiled Basic, hence its DDS compatibility is dependent upon the compatibility of the Microsoft Compiler. Due to Microsoft's disinterest in supporting any other DDS apart from TRSDDS and the non availability of a Tandy Model III Compiler, we recommend customers to use Data-Writer with TRSDDS or LDDS on the Model I and the proprietary DDS supplied on Data-Writer for the Model III. Other DDS's may well be compatible after patching and as we have said the criteria is whether they are compatible with the Microsoft Compiler.

Data-Writer — All Models £78.00 + V.A.T. = £89.70

P & P £1.25



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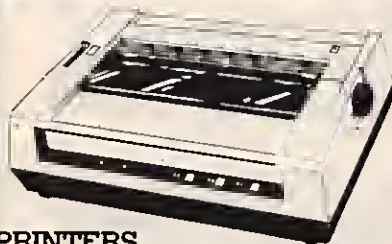
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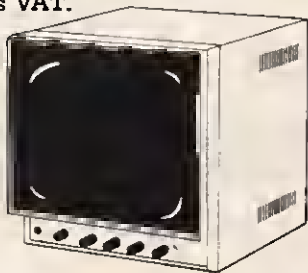
Genie I and II accessories



PRINTERS

The EG 3085 is quiet, fast and efficient. Prints at 100 characters per second and printing is bi-directional at 80 or 136 characters per line. Suitable for use with other systems, it has three typestyles, adjustable pin or friction feed and single sheet or roll paper facilities. £425 plus VAT.

If you don't want to pay that much for a printer, consider the EG 603. It doesn't match the EG 3085 in certain areas, but you will still get 100 c.p.s. bi-directional, a range of character styles, forward and reverse feed and pin/friction feed, with 96 characters and 64 graphic patterns. £235 plus VAT.



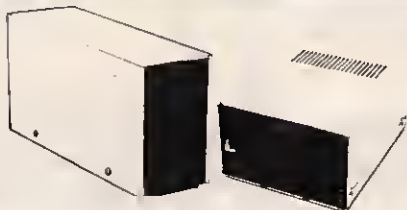
MONITORS

Available in 9" and 12" sizes, with white, green or amber display, Lowe A.V.T. monitors are sturdy, attractive, easy to operate and feature an easy view screen with smoked anti-glare display filter. Compatible with most popular micros on the market. From £75 plus VAT.

EQUIPMENT COVERS

Beat the dirt, coffee spills and sticky fingers when your computer and monitor are not in use with these top quality black leather covers.

Genie CV1 £5 plus VAT.
12" monitors CV6 £6.20 plus VAT.
9" monitors CV3 £4.20 plus VAT.



DISK DRIVES

If you want fast, reliable program storage, true random access file handling and access to many computer languages, we can meet your needs. The EG 400T provides storage of up to 184320 bytes per floppy disk and comes complete and tested, in a stylish colour matched cabinet. £220 plus VAT.

The EG 401 AT offers dual disk drive with 368640 bytes of useable storage and comes complete with a power supply ready to connect to an expander box. £365 plus VAT.

DOUBLE DENSITY ADAPTOR

Allows the use of standard minidisk drives in double density, with virtually double the storage capacity. The EG 3021 is equally at home in the Genie or TRS-80 expander boxes.

A double density disk operating system will be needed, such as smallDOS provides. £72 plus VAT.



EXPANDER BOX

The updated EG 3014 expander box allows for up to four disk drives with optional double density. It connects to a printer, or RS 232 interface, or S100 cards. Not bad value at £190 plus VAT (16K version) or £200 plus VAT (32K version).

*The EG 3014 will work with TRS 80 by using the EG 3023 Tandy Adaptor.

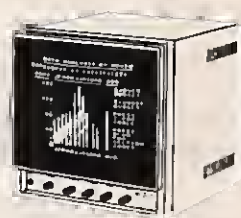
TECHNICAL MANUALS

Full technical details of Genie Hardware (all you ever wanted to know about Genie).

Genie I/II Technical Manual
£10 - No VAT.
Expander and accessories (EG3014)
£10 - No VAT.

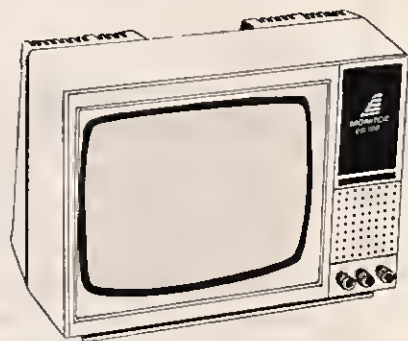
smallDOS

Powerful, yet reasonably priced, the Genie smallDOS contains 21 library commands, 7 utilities, LBasic, disk basic and bogs of information, including a reference manual and 40 page beginners guide to disk usage. £35 plus VAT.



HIGH RESOLUTION GRAPHICS

Increase graphic resolution capabilities of your Genie seventy-three fold with the LE18 HI-RES unit. It offers bit image graphics of 73,728 points, a resolution of 384 x 192, and uses a separate 16K of video memory to achieve its resolution. Graphics are intermixable with text or existing pixtel graphics, and animation, reverse video displays and use of programmable graphic characters are possible. £86 plus VAT.



GENIE MONITORS

Two good performance, low priced 12" monitors, either to match your Genie or compatible with a wide range of other systems. Good resolution and band width and, of course, they free your television set for the other type of programmes you like to watch!

The EG 100 12" in black & white costs £69 plus VAT.
The EG 101 12" with green phosphor is £79 plus VAT.

BUSINESS SOFTWARE

Specifically written for the Genie II computer, with disks and a suite of packages from the renowned house TRIDATA. The suite includes SALES LEDGER, PURCHASE LEDGER, PAYROLL and STOCK CONTROL. Each package is a very reasonable £175 plus VAT. Full details are available on request.



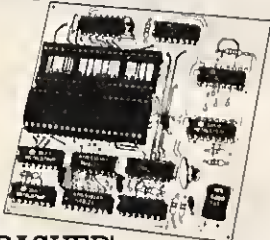
SYSTEMS DESK

Even a compact modular computer system like the Genie benefits from being used on a custom designed system desk. The SD-1 system desk is designed to accommodate a complete Genie System and has a special upper shelf to support the display monitor at the best level. The desk is flat packed for easy delivery and finished in attractive teak and charcoal colours. £81.40 plus VAT.

FRED MUSIC SYNTHESISER

Beethoven might well roll over at this stereo music synthesiser: it can produce six simultaneous notes over the whole audio range and provide sound effects. FRED comes complete with a software compiler, full instructions and a demo tune.

It is simply plugged onto the Genie 50 way bus and has two outputs for an audio amplifier. £51 plus VAT.



EG 3203 TANDY-BASHER!

If you are a TANDY user, read on! The EG 3203 is bus converted to allow Genie peripherals to be used with Tandy Model I computers. £18.40 plus VAT.

(Just in case there might be a few strange souls who want to convert in the opposite direction, there is the 50/40 converter which generates a Tandy compatible 40 way bus from a Genie.) £34 plus VAT.

EG 3016 PARALLEL PRINTER INTERFACE

The EG 3016 is a simpler interface allowing a Centronics parallel compatible printer (EG 603, EG 3085) to be connected directly to the Genie keyboard without the need for an expander box. £38 plus VAT.



BUS EXTENDER

A most useful accessory, allows two bus using devices to be connected simultaneously to the Genie - when using the Hi Res and expander for instance. £21 plus VAT.

EP1, EP2, EP3

Genie I and Genie II have ROMS offering 13.5K Microsoft BASIC, of which the final 1.5K BASIC are custom written extensions contained in EPROMs.

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EP3

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For Video Genie Systems, the LE-19 connects direct to the Genie bus and allows one of these EPROMs to be fitted externally. £26.50 plus VAT.



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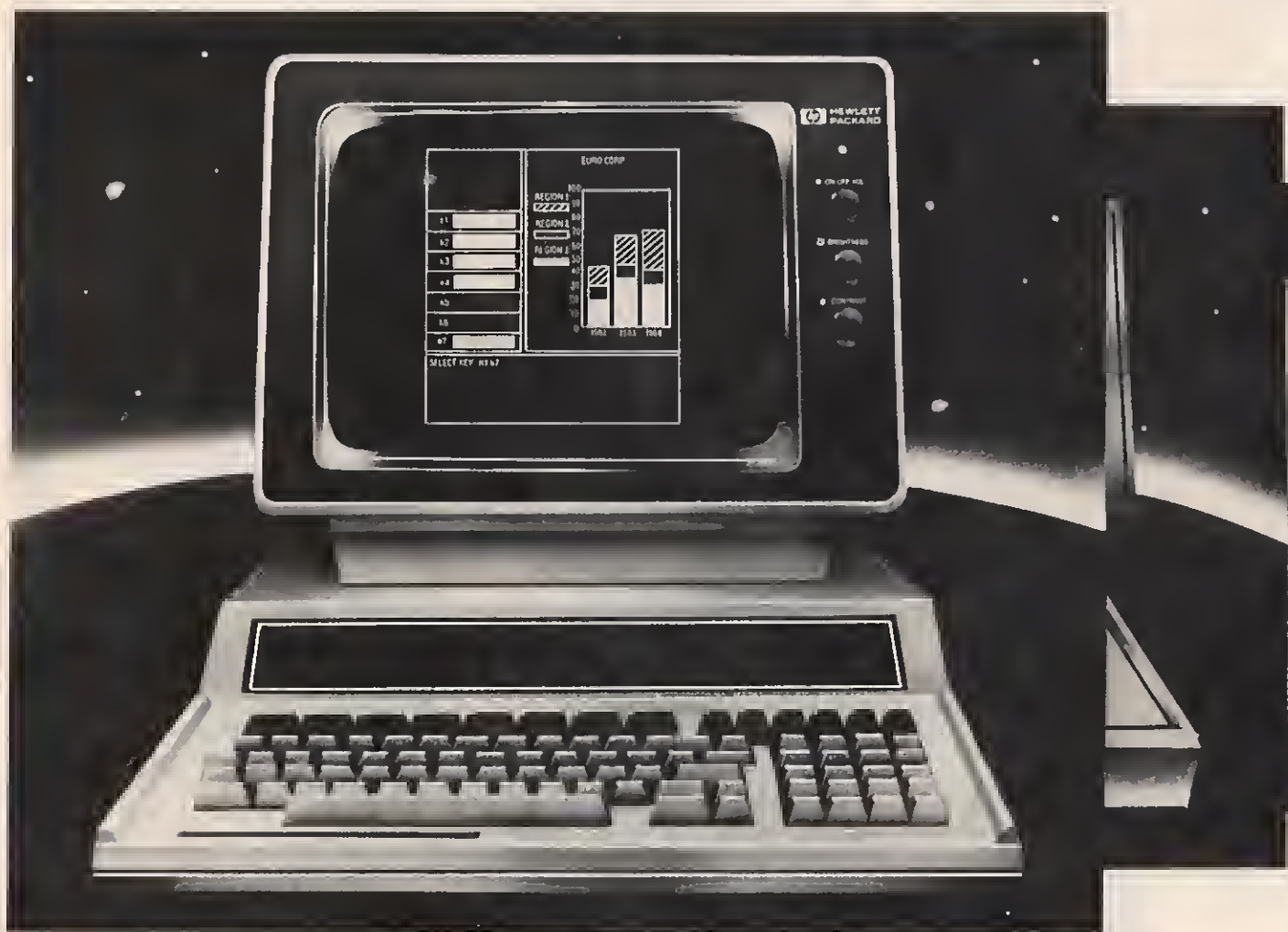
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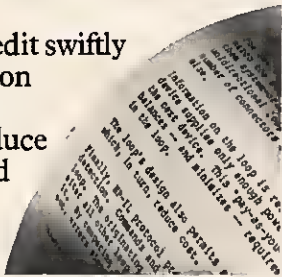
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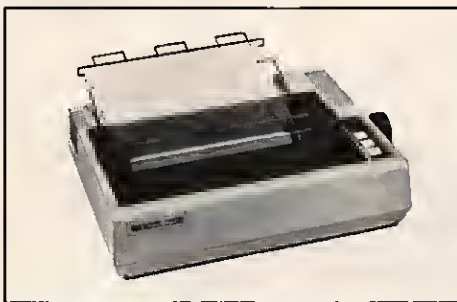
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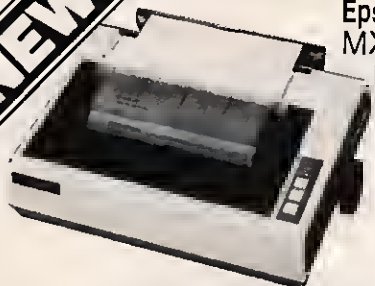
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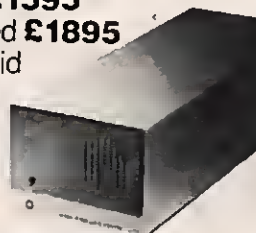
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Small business systems*

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NOVEMBER 25-27, 1982**

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The brains we're talking about are the printed circuit, silicon-chip variety and you'll find them (thinking hard) in the vast range of exhibits at The Northern Computer Fair. The show covers the fields of personal computing, home computing, small business systems and associated software, through computer books to video games, with a special attraction being the ZX 81 Sinclair Village. So whether you're a businessman (or woman) who needs to keep up to date with the latest developments in this fascinating field, a die-hard computer enthusiast, or simply interested in the subject, you'll find what you're looking for at the Northern Computer Fair.

Ticket prices at the door are £2.00 for adults and £1.00 for children under 16, but special party rates are available for 20 people or more with the organiser admitted free. For more information contact IPC Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ. Tel: 01-643 8040.

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Honeywell Information Systems Italia is a reality in the world of printers and is out to prove it. Today marks the birth of a second generation of matrix printers created, designed and produced in Europe to meet European demands. Printers characterised by intelligent engineering, total reliability, safety and completeness.

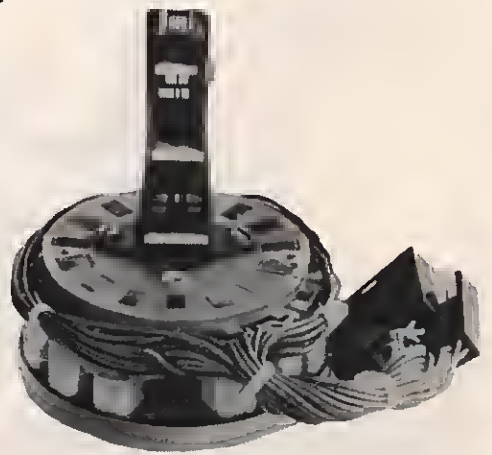
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To supplement those small printers already operational, such as the L11 and S11 80-column series and the larger L31 and S31 132-column series capable of linking with all parallel or serial interface systems, which have been recently updated, Honeywell Information Systems Italia proudly announces the birth of the L32, R32 and L38. These new printers go to enrich an already glittering range of products. They are designed for a professional public, those very people who demand always higher standards of product quality, work continuity, operational simplicity and enhanced speed.

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FOR TOMORROW'S SYSTEMS TODAY

MEMO
From the Chairmans Office

TO: Mrs Powers.
Can you let me have your thoughts on a design for a compact stand alone Microcomputer suitable for all office users to sell at around £1000. It must connect to all peripherals so customers can build up their own systems.

S.S.

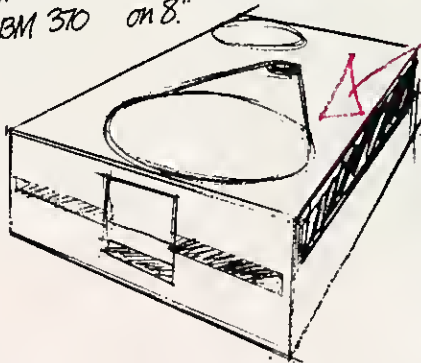
It must be a Z80 based microprocessor. That will give a really fast 4Mhz.

It will need 64K RAM and 12K of EPROM. 8 timers will be useful. That will all fit very tidily on a single PCB.

The operating firmware will go partly on disc and partly on the EPROM making it CP/M compatible.

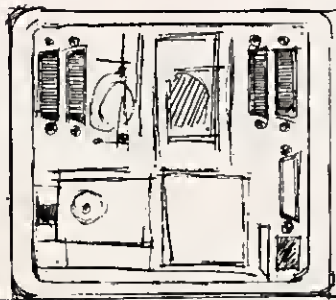
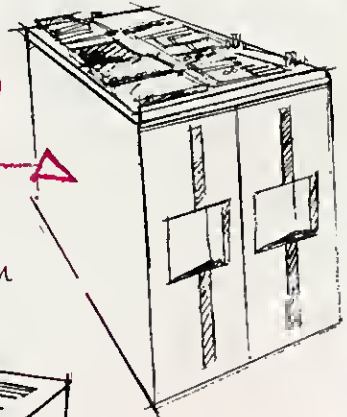
P.S. Automatic baud sensing is a must. It will adapt to any terminal.

Storage. Let me think, twin 5 1/4" discs, that will be the minimum. That's 800K of storage. Hard disc? Start at 6Mb and go up to 12Mb. We can use IBM 370 on 8"



I will swivel the drives 90° and put the board on top. And put them in a really strong metal case.

23cm x 36cm x 22cm.



COMMUNICATIONS. We will need the best possible ARS232 and 1 - Centronics will cope with anything.



Stress that it's British.

MegaSoft Ltd, our associate company can provide the operating software. They can offer features like mixed 5" and 8" disc usage, CP/M, high speed sector skew etc. The CP/M will give us hundreds of available software packages like Accounting, Word processing, PAYE, Sales forecasts etc.

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Comprises of 2 x 6821 P.I. A. I.C.S.
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Backplane Accommodates up to 11 x 80 pin
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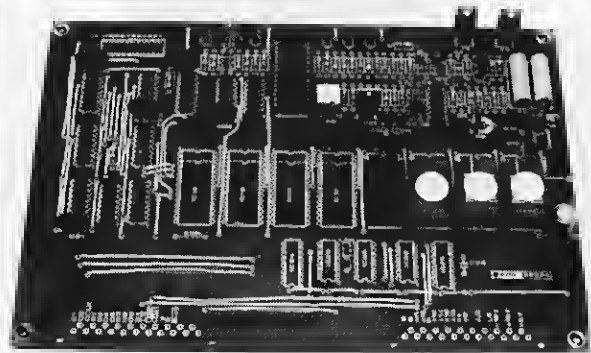
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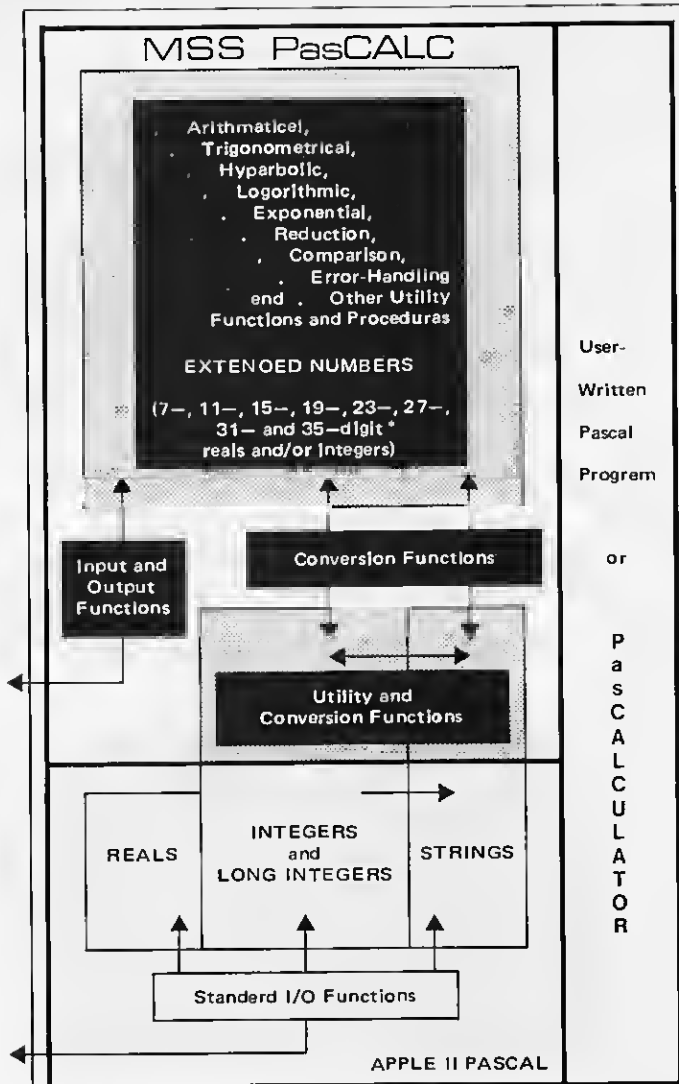
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Logical Relationship between a User-Written Pascal Program, Apple Pascal and PasCALC.

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Find enclosed cheque/PO for £73.60 for one set of PasCALC and PasCALCULATOR software for precision levels 7, 11, 15, 19, 23, 27, 31 and 35.*

* Circle five precision levels unless you want the standard set (underlined)

Allow two weeks for delivery

PCW 1

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Pascal is the most versatile high level language generally available for microcomputers today, and its popularity is steadily growing. Now, to enhance APPLE II Pascal 1.1, MSS (Mathematical Software Services) brings you

PasCALC

Enhancement in Depth

Extended Number TYPE gives a choice of precisions from 7 to 35 digits, and allows you to mix integers and reals in your Pascal calculations.

Enhancement in Function

More than 70 functions and procedures (see the diagram) for Extended Numbers, Pascal integers, long integers and strings.

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PasCALC is written in Pascal, designed with the aim of making greater computational power available to general user and specialist alike. It requires a 48K APPLE II with at least one disk drive, and it can be used by any Pascal program — such as

PasCALCULATOR

which is distributed with PasCALC. PasCALCULATOR is a powerful interactive (conversational) command processor for doing calculations at the keyboard. Simply boot Pascal, exec PasCALC and away you go. For example, you can find $(1/(S*\text{SQRT}(2*P)))*\text{EXP}[\text{SQR}[X-M]/(S^2*2)]$ in only one step!

- 26 names (A..Z) available for keeping intermediate values during the session.
- Ten commands can be RETAINED at any one time for later recall, saving time and reducing keying errors.
- Commands can be REPEATED too — ideal for observing convergence of a result.
- Full Extended Number 'mixed' arithmetic and range of precisions, with many built-in functions.
- Both parentheses (priority of calculation) and built-in functions [brackets] can be nested to any depth.
- Optionally printed session log—no need to write down results at the keyboard.
- Both e and π (to 35 digits) are automatically set up at the start of every session.

Extract from Optional Log (Precision Level 15)

```

Enter command:
Y:=Y+P^(2*LOG(10-(5*E/4)))
0.936471836457736E0
Enter command:
A:=0.125E1
0.125000000000000E1
Enter command:
X=SIN(P-EXP[A/(B+Y)]^D)
-0.185890363973163E1
Enter command:
RETAIN
Retained as command 5
Enter command:
A:=0.15E1
0.150000000000000E1
Enter command:
COMMANDS
X=SIN(P-EXP[A/(B+Y)]^D)
0.826354927584729E-1
Enter command:
LISTV
-----
LIST OF VARIABLES
A = 0.150000000000000E1
B = 1
O = 5
E = 0.271828182845905E1

```

PasCALC and PasCALCULATOR: £64.00 plus £9.60 VAT or \$144.00 including insured airmail delivery.
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That's before you switch it on.

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Appearances can be deceptive as a look at the credentials of the Columbia PC machine will tell you.

Operating system software is MS-DOS® or CP/M 86®.

Its 16 BIT 8088 hardware configuration provides 128 K RAM with parity, two RS-232 serial ports, Centronics parallel printer port, DMA controller, eight levels of interrupt, dual floppy disc system with one megabyte storage,

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Not bad for the standard version.

Examine your options

Columbia like to leave your options wide open. So they've included 256K RAM boards, 8087 arithmetic co-processor for high speed math functions, dual RS-232/RS-422 boards, and a Winchester disc based system.

The Columbia PC's expansion capability can easily accommodate just about any imaginable hardware configuration including one megabyte RAM and 10 megabyte disc.

It's here now

And you know the other great thing about the Columbia PC? It's here now. Available off the shelf. And Icarus have a nationwide dealer network waiting to start deliveries.



**16 BIT
IBM PC
COMPATIBLE**

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with the **UCSD p-System Version IV**
if you are developing applications packages the UCSD p-System now lets you reach the widest possible marketplace with the minimum investment and the minimum of fuss.

The "p-machine"

The p-System was developed at the University of California at San Diego (UCSD) from the concept of an "ideal machine" which can be mimicked by any ordinary microprocessor (in which the machine architecture is dictated by production convenience), and it allows the generation of screen and processor independent software.

Established at last

The system has a new release, Version IV, and already it's very popular. It's fitted and running on the latest microcomputers being delivered by IBM, Apple, ITT, Texas Instruments, Philips, Xerox, DEC, Tandy, Northstar, Allos, Osborne, Superbrain and others.

The same friendly face

On each of these machines, the user is presented with the same friendly face, the same easy-to-use operating system, the same p-machine code. So the same programs run without recompilation. And it helps you write very large programs too - with lots of separately constructed pieces, programs can be much larger than the memory of your machine.

What you get

The UCSD p-System gives you a complete programming development system which lets you write programs in UCSD Pascal. You get a screen editor, a line oriented editor, a compiler for UCSD Pascal, a native code assembler, a linker, a debugger, a filer and a host of utilities - such as disk recovery.

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Total adaptability and expandability



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During the next few months we will be announcing the availability of TROJAN - a major software innovation that totally simplifies the learning process and use of micros, and dramatically eases the creation of new applications programs. We are using it and generating applications software in record time - so we can guarantee its performance.

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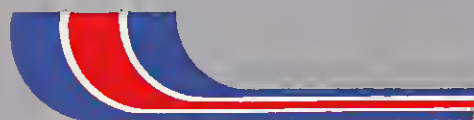
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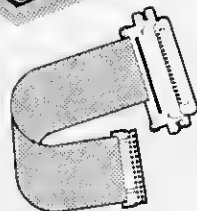
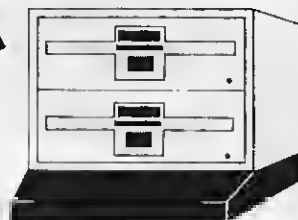
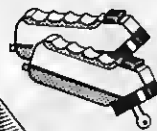
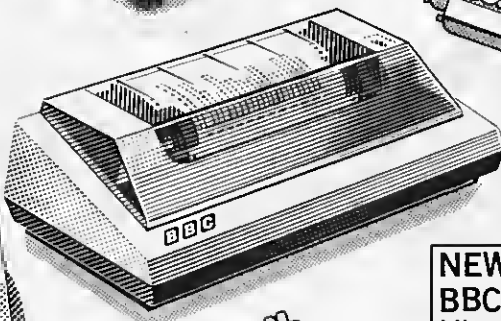
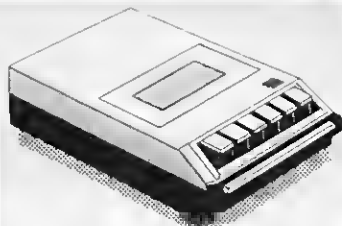
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ISBS-W

A totally integrated suite of software designed for microcomputers which use Hard disks or Winchester disks. The user can choose from any combination of modules and add others at a later stage if required.

1.0 Business Controller

The business control module acts as a task manager and supervisor for all users and mainfile updates. Operators will feel at ease with the menu prompting when selecting tasks such as order processing, invoicing, accounting modules and word processing. The controller is used to set the system parameters, typically the number of disk units and sizes, number of printers, passwords and authorization codes. You can develop your own application modules for those special jobs and have them incorporated in the business control menu.

2.0 Accounting

The system offers a comprehensive range of facilities to meet the most demanding accounting applications. The modules cover tasks such as sales and purchase ledger, payroll and nominal ledger. Management reports including the P/L and Balance sheet can be produced from the data captured by the system. Audit trails are produced for all transactions entered, with batch totals where applicable. In addition to the main accounting reports, pre-printed output includes statements, cheques and remittances, and also payslips and bank giro.

3.0 Stock & Order Processing

Stock levels can be checked quickly using the on-line enquiry module, and the operator can also allocate stock if required. Order processing allows orders to be entered and maintained until all items and quantities have been shipped. Invoices and order acknowledgements can be produced on line if required with automatic release of stock and drawdown from the orders file. Pre-printed invoice stationery can be used and the layout can easily be modified using the built in formatter.



4.0 Word Processing

To complete the suite, the word processing module offers one of the most sophisticated systems found on today's microcomputers. It includes all the standard features that you would expect to find in a WP system, such as tabs, justification, margins, global search and replace, proportional spacing etc. In addition there is a merge document option to produce those personalised mailshots and labels, and also a built in spelling checker with a 10,000 word (expandable) dictionary.

ISBS-F

ISBS-F is a comprehensive system designed for first time users of floppy disk systems. It can be fully integrated or each module can be used individually, adding others at a later date, which makes it an ideal choice for the first time user.

1.0 Stock Control

The programme allows fast interrogation of any stock line and produces 11 comprehensive reports to achieve optimum stockholding. Amongst the many features, including stock updates, release and goods inwards, the system has the option to define stock groups allowing for parts explosion.

2.0 Order Entry & Invoicing

Invoices can be produced quickly and easily, either by referring to an order already entered, or by entering data at the invoice stage. If necessary, part orders can be sent, as the system can keep track of each order until it is completed. Release of stock and posting of invoices to the Company Sales System is carried out automatically.

3.0 Company Sales System

Customers can be set up as open item or balance forward accounts, and statements can be produced easily at anytime. An online enquiry and comprehensive credit control reports allow you to monitor customer credit limits and help maintain a healthy cash flow. The system can handle part payments and unallocated cash, and produces a full audit trail of payments received.

4.0 Company Purchases System

Target payment dates can be assigned to each supplier invoice, to plan cash flow and to help speed payment procedure. There are reports to show ageing of invoices and the system also has the facility to print cheques on preprinted stationery or payment advices on Company letterheads.

5.0 General Accounting System

The main feature on this programme is the flexibility of the cost code system, which allows you to design final Company reports such as the Profit and Loss Account and Balance sheet. Comprehensive budget reports can be produced, showing any variances between budget and expenditure for your own chosen accounting period.

6.0 Payroll

Employees can be paid by cheque, cash or bank giro transfer, on a weekly, monthly or hourly basis, depending on the Company requirements. The system is fully maintained and incorporates all new legislation. Some of the facilities include overtime, holiday pay, coin analysis reports, and production of P11/P60 forms at year end.

7.0 Names and Addresses

Names and addresses of customers and suppliers together with any others you may wish to keep a record of, can be stored centrally in this system. Names are retrieved by the programmes for completion of invoices, statements etc., by use of an id code unique to each name. A report generator allows you to design and store your own reports.

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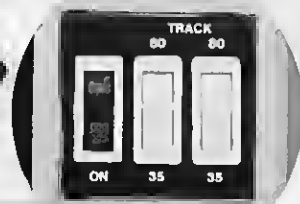
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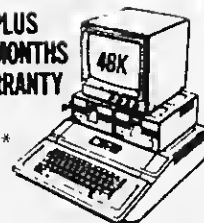
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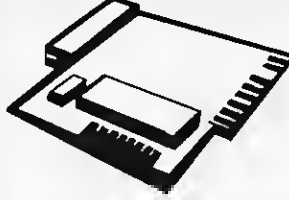
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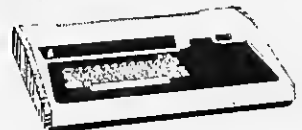
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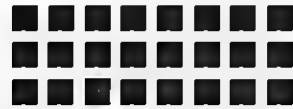
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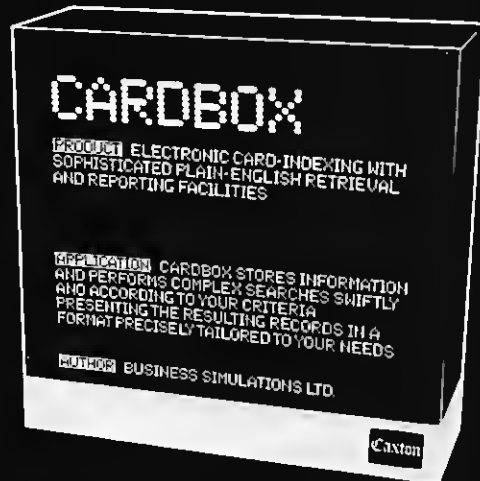
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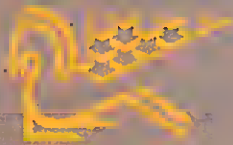
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VIC-20
OSI
SINCLAIR
TIMEX

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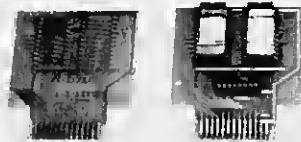
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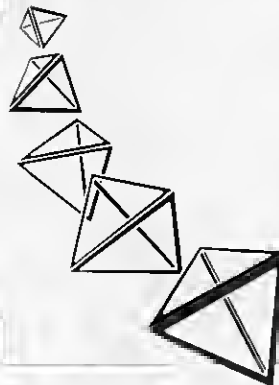
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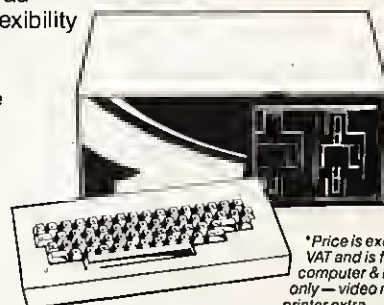
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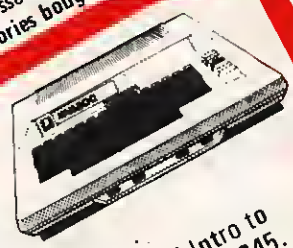
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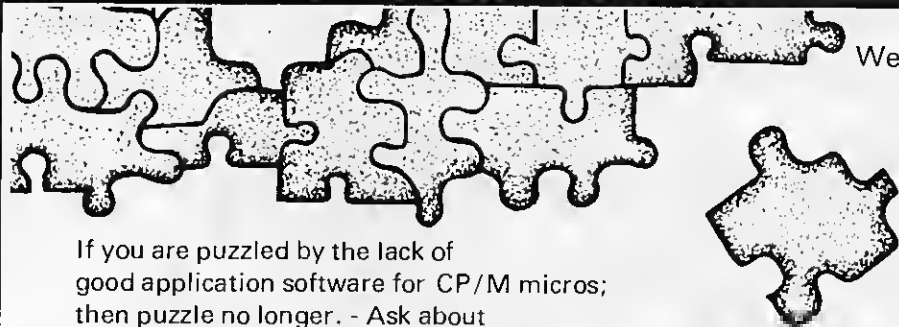
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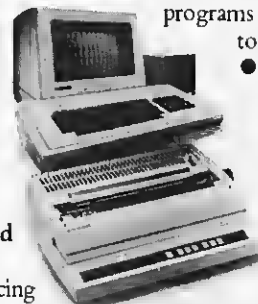
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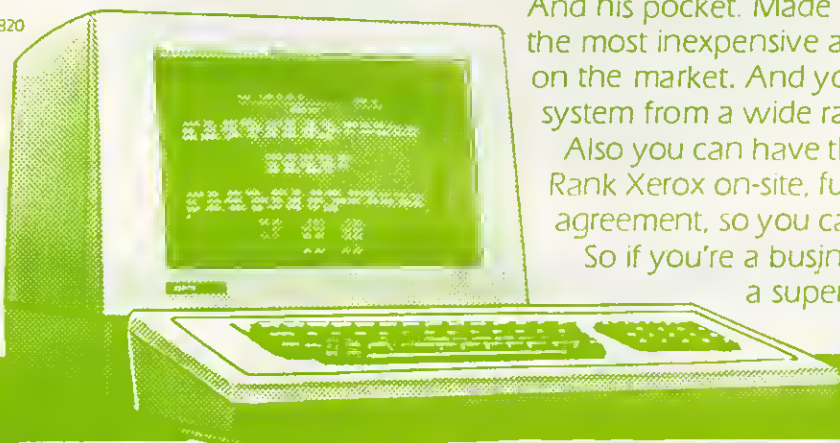
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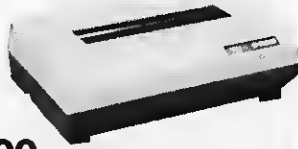
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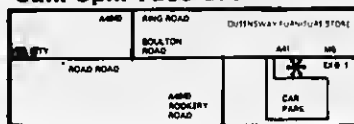
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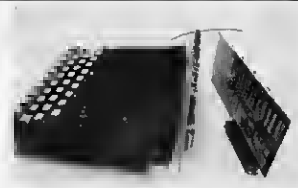
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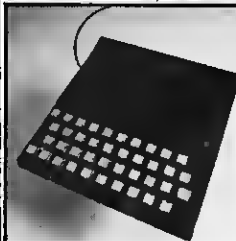
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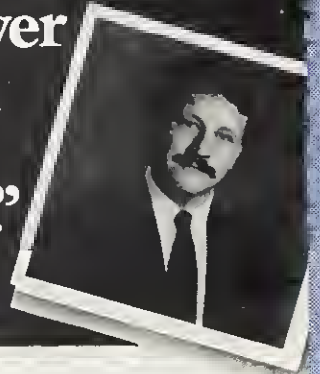


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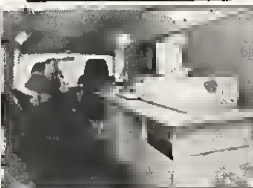
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CHIP CHAT

Cloudy rumours have been circulating in the fast-moving micro world of a new and mysterious 'user group'. The supposed title of this qabalistic organisation is 'Would-Beeb', and it's open to anyone who has paid for his BBC micro but is still waiting for it. A hit-squad is at present being formed in readiness to swoop unrelentingly down on Acorn Computers in a massive coup, the aim of which is to liberate thousands of enslaved BBC Computers held in captivity. It's believed that the original idea was masterminded after several long-suffering customers were treated to the traumatic sight of a PCW Show stand made up almost entirely of a network of new Beeboms. Vengeful activities are rumoured to begin at Acorn's next exhibition stand. . . And talking of user groups, we hear that Beebug pundit Sheridan Williams has recently taken delivery of a spanking new Ferrari. . . Meanwhile, in all the confusion of the PCW Show festivities, tired and emotional Sub Editor Steve Mann

awoke one morning to find himself in bed with a plastic robot, which is perhaps an interesting gesture towards the honourable goal of 'user-friendliness'. . . *Microscope's* 'trade lounge' supplied far more in the way of booze and peanuts than it could ever have paid for in advertising sales. Perhaps this was because most of the 'trade visitors' were thirsty 'journalists'. . . The Show was, of course, not without the customary bikini-clad young ladies handing out bumf and blab on something possibly micro-related. Rumour has it that Editor Rodwell borrowed one of these unlikely costumes and thus provided some light entertainment in the exhibitors' lounge. Naturally the man in question denies such vicious claims. Drunks and groupies also mingled with quality company in the PCW lounge during the Show. Several of the industry's most illustrious figures spent most of their time in the lounge, slinking off home to sleep off their hangovers when the fun was all over. . . What with

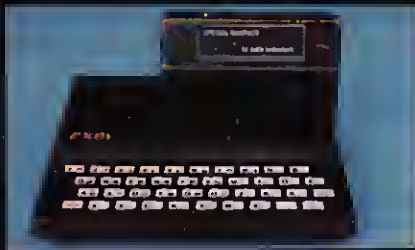
fighters breaking out in the aisles (which were too narrow) between rival gangs of schoolkids all wanting to play PacMan, pensioners piling up in their hundreds on the escalators and a four-hour wait for lunch in the exhibitors' restaurant, the Show was similar in conception to the outer circle of Hell. However, penance duly suffered by all, the Editors' nightmare broke all the records and was a booming success — for everyone, that is, apart from the claustrophobic among us who finally ended up cringing sweatily in loos, lounges and other people-free recesses, unable, by force of extreme paranoia, to tolerate any more. . . Saga time in the PCW Ivory Tower comes round again with a deluge of invoices from Ingersoll Electronics (*Who they? — Ed*). The offending triplications relate to an Atari system and software borrowed in complete innocence by arcade magus Dick Olney. These were reviewed in April '82 and were returned

straight away. Some weeks later an invoice arrived for the PCW team for the price of the system, including some software — which Olney had never seen before. Several nasty editorial letters and more invoices later, this deluge of bureaucracy seems to have abated — maybe they sacked the computer responsible. While on the subject of Atari, after filing lawsuits against the world and his brother for use of the themes behind several of their games, it's rumoured that Atari International now find themselves locked in a legal wrangle with the Pacman Peanut Co (honest!) of the USA. . . An anonymous informer also made it known that 'Atom Power', as quoted in Acorn's ads, is only realistically available in monotone — unless you have extra RAM. Few users have bothered with the colour card as, rumour has it, unless you have enough memory, it melts the computer. Never mind, boys — we all make mistakes.

END

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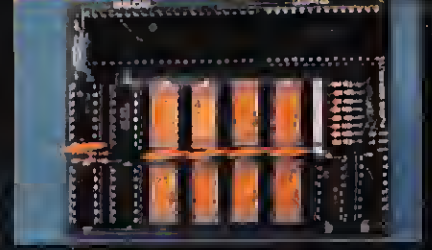
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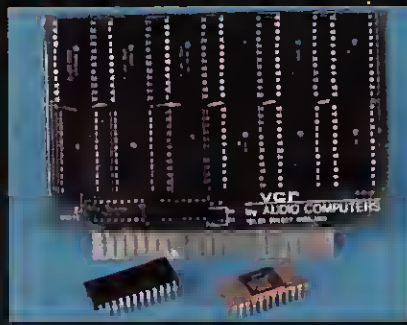


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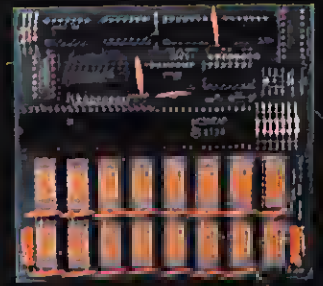


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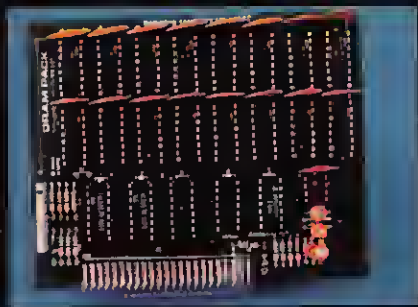
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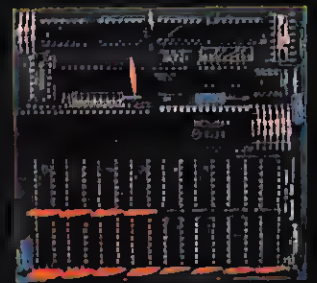
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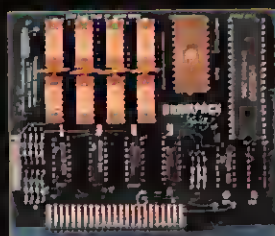


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