Personal Computer World

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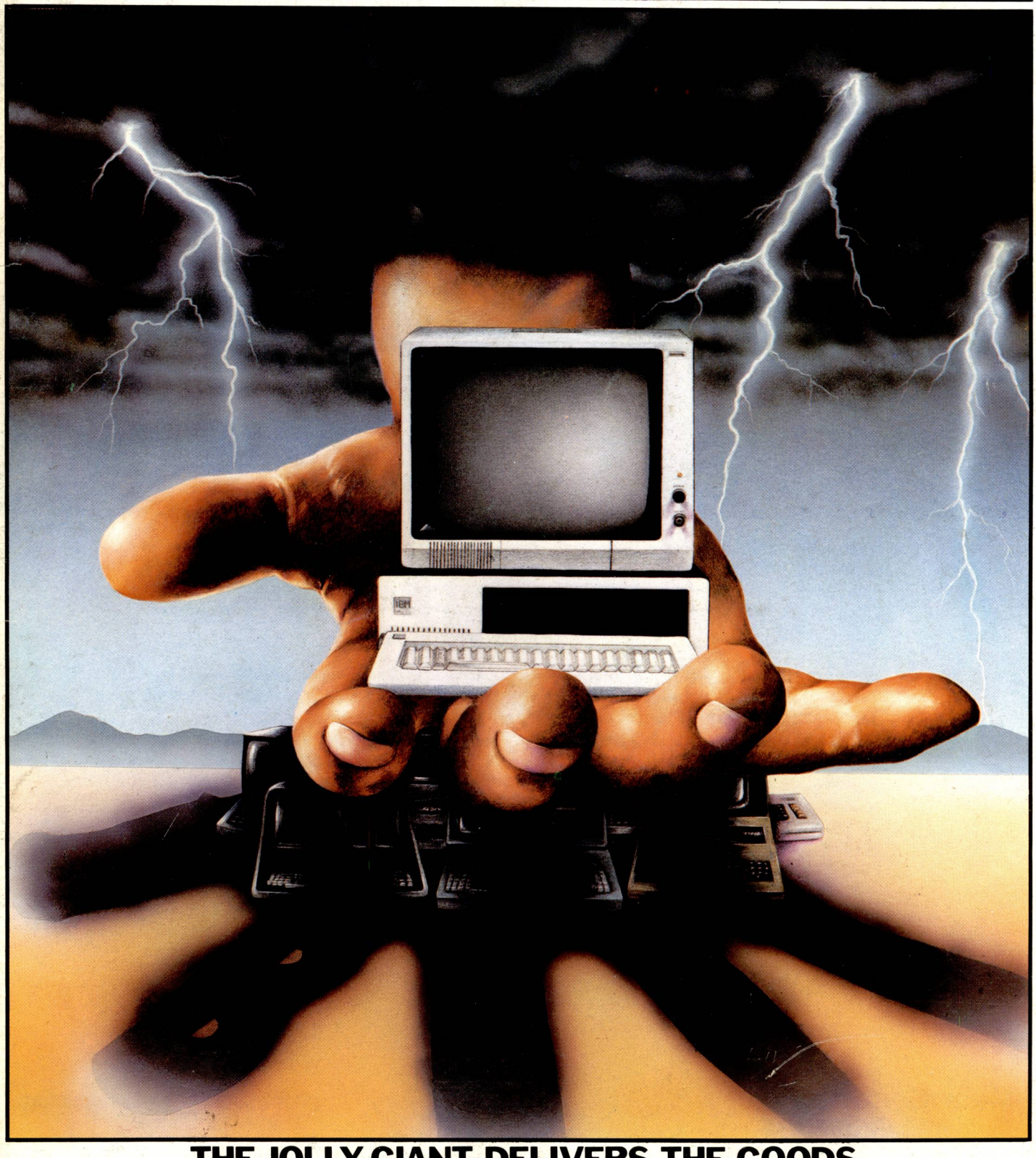
November 1981 75p

BRITAIN'S LARGEST SELLING MICRO MAGAZINE



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Let's face it, last month he went completely over the top (no pun intended) on this page. There was really no need to publish that revolting 'exploding head' shot. One outraged reader even reported us to the authorities. 'Vengeance!' cried the Editorial Department' 'Atone!' demanded the Advertising Team.

Well, he has. Normally so tight that his head squeaks when he removes his hat, our esteemed publisher has agreed to really and truthfully offer readers something for nothing. So. . . every person or company subscribing to *Personal Computer World* before 30 October 1981 will be sent a free binder. This offer applies only to new or renewal subscriptions accompanied by full payment. Knowing our publisher's behavioural characteristics we can promise you it is an offer which is not likely to be repeated.

For those of you unfamiliar with *PCW* binders, these items are sturdily constructed, lavishly covered in butter-cup yellow naughahyde and gold-blocked front and spine with the magazine's logos. They normally set you back £3.25 each and would grace even a bibliophile's shelves. More importantly, they will protect your treasured copies of Britain's largest-selling micro-computing magazine.

Get in now. Kick him while he's penitent. Even if you already have a subscription it could be monetarily worthwhile renewing in advance. This will cause utter confusion in our Subscriptions Department but, then, that's what computers are for, isn't it?

Use the coupon below or the subscription card stuffed somewhere in the magazine which has probably already dropped onto your floor. Include your remittance if you want to claim a free binder. Send to the address indicated; no stamp is required on your envelope. And congratulations on a good deal!

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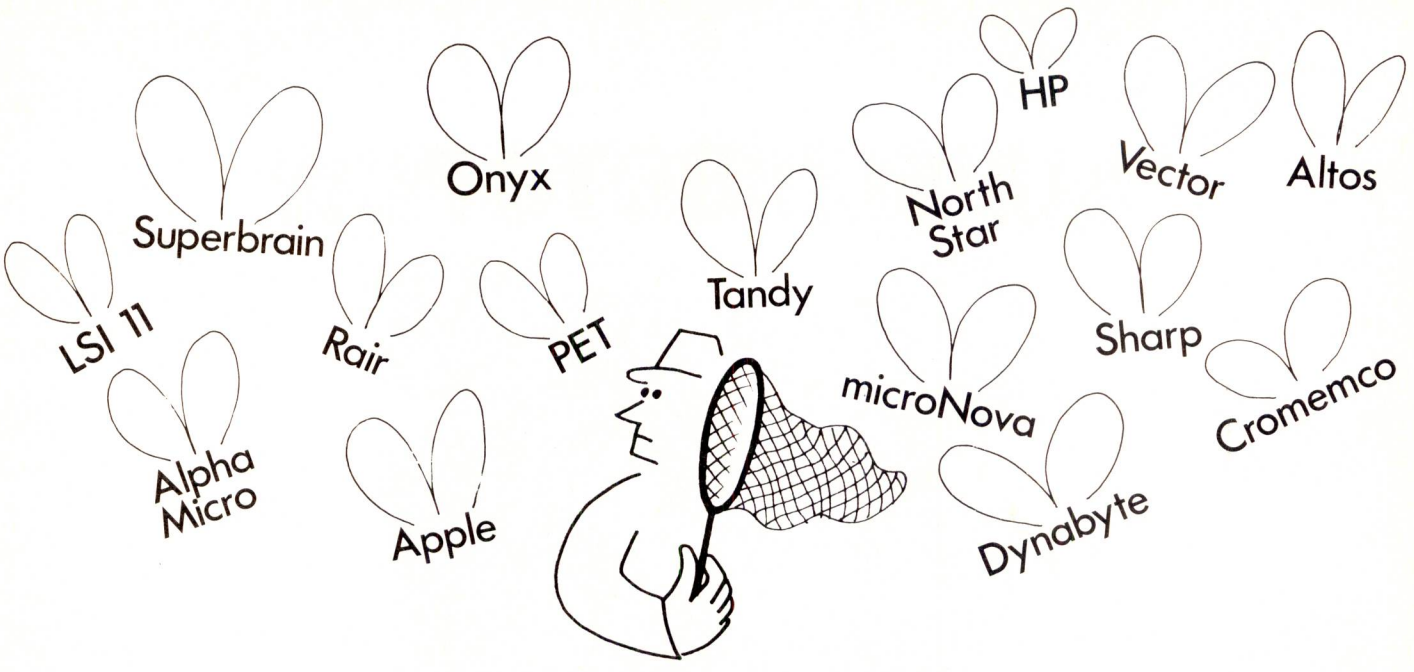

If only choosing a microcomputer was as simple as using one

Just look at the advertisements in this magazine. When can you find time to digest them all?

There are millions of chips, thousands of boards and hundreds of peripherals, software systems and application packages. How do you pick the right ones to meet your requirements?

And put them together? And make them work? And add the specials you want?

Professional Services

At Digitus we have computer professionals working full-time putting systems together. Absorbing information. Testing equipment and software. Writing programs. Training users.

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In the last two years we have supplied systems for: number processing, word processing, data processing, information management, graphics and many creative applications. Advised accountants, surveyors, archaeologists and engineers. Helped DP departments and small business men. Developed software for personnel, insurance, incomplete records, order processing, business games, linear programming, process control and terminal emulation. And were retained by other computer companies to advise on micros.

Proven Experience

This year we can put over 200 man years computer experience to work so that you can benefit from micro technology . . . in comfort.

Come and see us. Spend a few hours discussing your requirements. Attend a training course. Select a machine. Test some software packages.

Solve the micro puzzle. Buy an operational system that fits your needs.

Call for an appointment or return the slip and we will call you.

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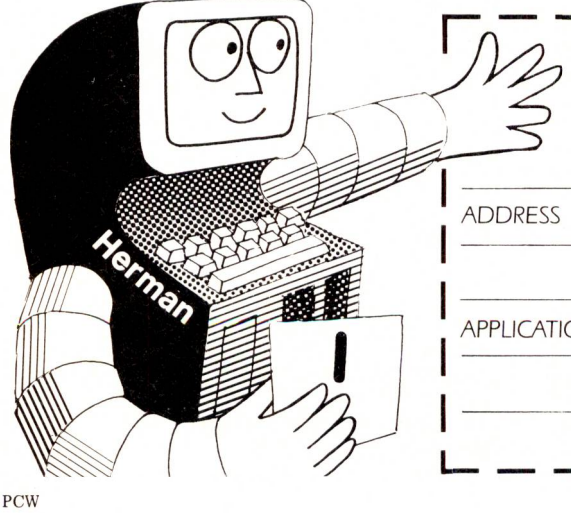

NAME

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INSIDE PCW

Volume 4 No 11 November 1981

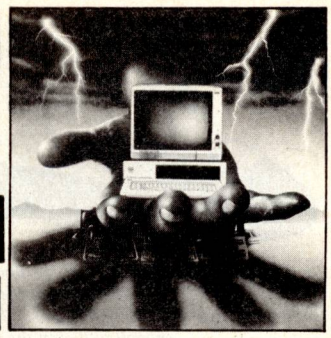


Illustration by Richard Dunn

54 NEWSPRINT: Guy Kewney reports the latest micro-happenings.

69 BANKS' STATEMENT: Martin Banks looks at the likely effects of the big companies moving into micros.

70 COMMUNICATIONS: Your chance to have your say.

75 CTUK! NEWS: Latest happenings around the 'Towns.

77 COMAL-80: Could this be the replacement for Basic?

81 CONTROL YOUR OWN SUB-STATION: D E Graham concludes his article on interfacing the ZX80/81.

93 PATTERNS: Alan Sutcliffe ponders randomness.

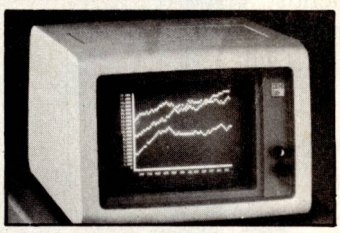
100 2nd EURO MICRO CHESS CHAMPIONSHIP: A full report on the winning games.

105 BENCHTEST: David Tebbutt brings the first ever full test of the Osborne O1.

114 CHECKOUT: Sharp's new pocket translator, the IQ3100.

116 BENCHTEST: A world exclusive — a full test of IBM's Personal Computer.

123 EURO MICRO-MOUSE '81: Robin Bradbeer reports on the recent finals in Paris.



127 COMPUTER ANSWERS: Your queries answered by Sheridan Williams and friends.

131 BOOKFARE: Malcolm Peltu reviews the latest printed words.

139 INTERRUPT: Jeff Taylor continues his look at computer literacy projects in the US.

145 CALCULATOR CORNER: Dick Pountain reviews the Casio fx702p.

147 BENCHMARK SUMMARY: A roundup of our Benchmark tests and a listing of the programs we use.

148 TJ'S WORKSHOP: More hints and tips for popular micros.

153 YOUNG COMPUTER WORLD: Especially for our younger readers.

155 NEWCOMERS START HERE: Our quick intro for those new to the micro world.

156 PCW SHOW: A report on Britain's most successful micro show.

159 DIRECT ACCESS: With Packages, full User Groups, Transaction File, Network News and Diary Data.

172 PCW SUB SET: More useful assembler language subroutines.

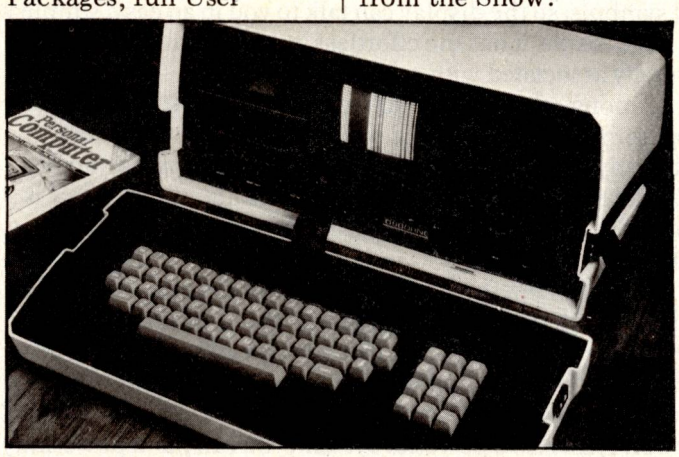
178 LEISURE LINES: J J Clessa poses another problem for your micro.

178 PROGRAMS: Our readers' latest listings.

183 BLUDNERS: Red-face time!

184 BACK ISSUES: Catch up with what you've missed.

239 CHIP CHAT: All the gossip from the Show!



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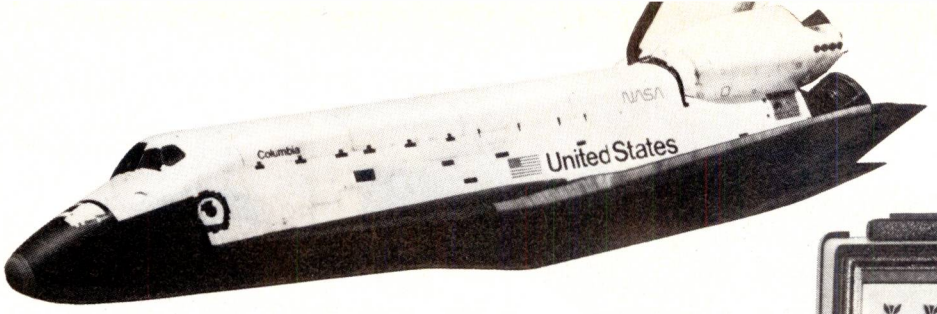


On the edge of the atmosphere, space shuttle Columbia was about to lose all contact with Earth: for 21 agonising minutes, touch-down would be touch-and-go.
As the world held its breath, the £4½ billion project relied on a £165 hand-held calculator, small enough to live in the pocket of Robert Crippen's flight suit.
The Hewlett-Packard HP-41C. Unmodified. Just as you buy it today...

Astronaut quality. Everyday simplicity. The HP-41C. £165 inc VAT*

Sooner or later, a basic calculator is too basic.

Suddenly you need to 'compute' – but with a 'computer' that's as simple and pocketable as a hand-held calculator. And, as NASA found, that means an HP-41C.

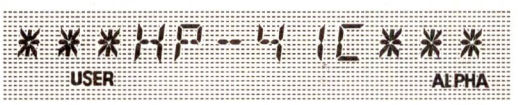
Today, a broad-ranging companion to an A-level course. Tomorrow, a fully-fledged, advanced programmable system for the businessman, analyst, researcher, technician, engineer or scientist.

Whatever your job, here's a calculator that will grow with you and your needs step-by-step into a complete calculating system – yet will always stay simple, manageable and portable.

The friendly calculator with power in reserve.

As a straightforward calculator, the HP-41C is a masterpiece of compact power.

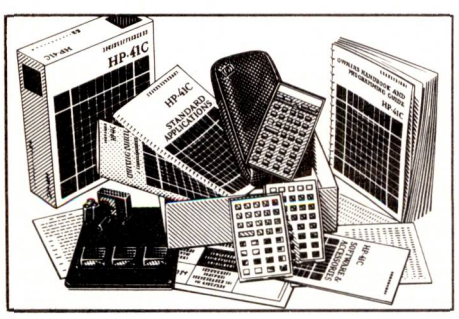
It gives you read-out in letters, as well as figures and symbols, so the display can talk to you in an easy, simple way



Yet, inside, it has the effortless, problem-solving power normally associated with computers.

Among other things, that means the HP-41C is fully programmable. You can feed its built-in 400-line memory with ready-made programs or develop your own. Its friendly style makes it surprisingly easy. And, because the memory is continuous, what you put into it stays in – even when you switch off.

But that's not the end of the story by any means. Because, unlike any other advanced programmable calculator you are likely to see, the HP-41C has behind it a highly developed package of software support representing many years of heavy investment by Hewlett-Packard. So when you buy the HP-41C you don't just *own* a powerful system; you can put it powerfully to *work*.

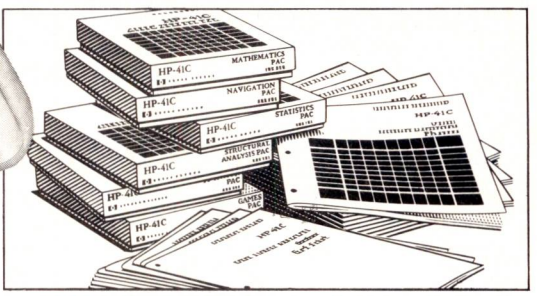


The HP-41C hand-held 'computer' in a box. £165 brings you the calculator, a comprehensive 270-page manual, owner's handbook, and programming guide, a standard applications handbook, customising overlays, HP Users' Library membership reply card, free one year's subscription to HP's User's Newsletter, batteries, carrying pouch and 12 months' full guarantee.



Proven software support – at your fingertips.

Here, the HP-41C really comes into its own with an unrivalled range of software support.



17 Application Modules – miniature plug-in solutions: maths, electrical engineering, financial decisions, games...

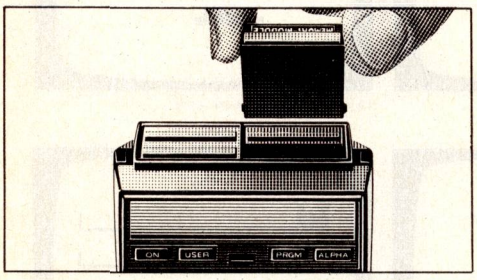
29 Solutions Books – each with up to 15 programs drawn from the best of 10,000 user-submitted programs. Each book provided with Bar Codes – for instant program entry with the HP wand.

11 Application Pacs – pre-recorded magnetic cards covering over 2,000 programs, entered through the card reader.

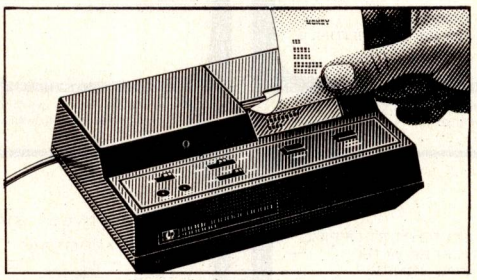
All software and peripherals are optional extras.

***Price correct at time of going to press.**

Two ways to make your system grow...

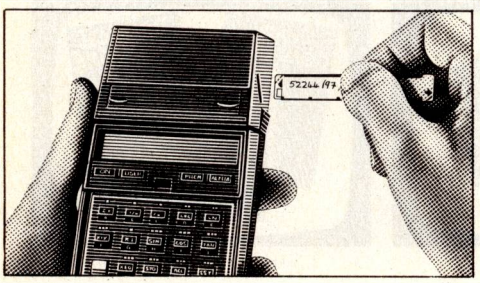


Snap-in more memory. *A single module will double the memory available. A quad module adds no fewer than 256 registers at once. Suddenly you've over 1800 lines of memory at your command.*

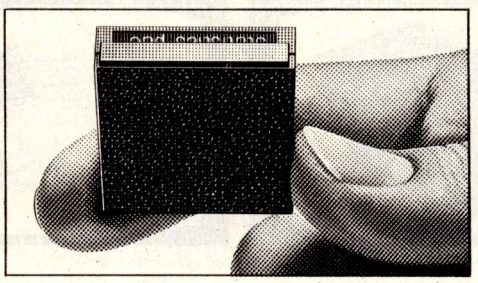


Plug-in a printer. *The HP-41C printer handles upper and lower case, in alpha, numeric and graph-plotting modes. Use it for final hard copy, or to follow program execution.*

Four ways to program your HP-41C...



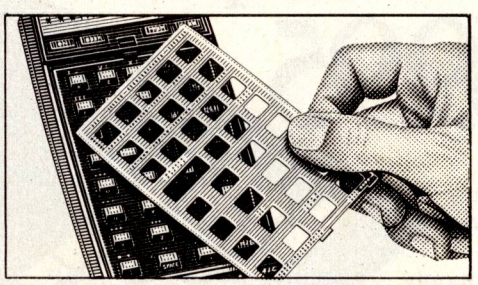
Card reader. *This reads pre-programmed magnetic cards. It can also record and read your own programs and data.*



Application modules. *These are plug-in modules each containing a whole range of ready-made programs on your chosen subject.*



Bar code reader. *A quick and easy way of loading any one of the software packages. The wand simply 'lifts' the coded program straight off the page of your HP-41C solution books.*



Keyboard customising. *Develop your own programs and enter them through the keyboard. You can assign any function or program to any key and mark them on your own customising overlay.*

Thousands of easy ways to solve problems.

Think of a problem! As an HP-41C owner you won't have far to look for the solution – or long to wait before it's locked in your system's memory. Any of HP's hundreds of pre-programmed solutions can be easily entered in any of the four ways we illustrate above. You'll certainly want to devise your own solutions, too. The guidance manual in your basic pack tells you how. If you develop an original one you could submit it to the HP-41C Users' Library. It already contains thousands of tested programs which 10,000 users world-wide are happy for you to share.

Quality from HP – the big computer manufacturer.

The HP-41C is made from the chip upwards by Hewlett-Packard, a world leader in computers. And you can tell! By the detail like the permanent inlaid key notations, tough ABS case, and gold-plated port contacts. By the elegant simplicity designed into the HP-41C's operating style. By the sort of software support only a computer giant would be capable of. By the utter reliability that is the HP hallmark throughout the world of computers.

HEWLETT PACKARD

See the HP-41C at **Comet, Xerox Stores, Wilding, Sumlock-Bondain, Landau** or these other Appointed Dealers:

Aberdeen Tyseal Office Equipment.
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Manchester Automated Business Equipment; Holdene; Wilding Office Equipment. **Matlock** Derby Office Machines.
Middlesbrough Thos. Hill International.
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Northampton A. C. Barratt & Co.
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Nottingham Bennett's (Typewriter & Office Suppliers); Trent Office Equipment. **Oxford** Reid's Office Equipment; Science Studio. **Plymouth** JAD Integrated Services.
Reading Central Southern Equipment; Reid's Office Equipment; Caversham, 38 Market Place, Reading.
Romford Wilding Office Equipment. **Royston** Herts Electroplan.
Sheffield Butlers Office Equipment.
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Southampton Leicester Typewriters.
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Sutton Landau Calculators.
Swindon Wilding Office Equipment.
Waltham Cross Wilding Office Equipment.
Watford Automatic & Electronic Calculators; Wilding Office Equipment.
Worthing Office Machinery Engineering Co.
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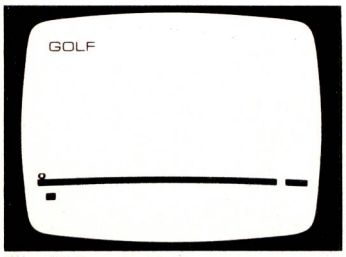
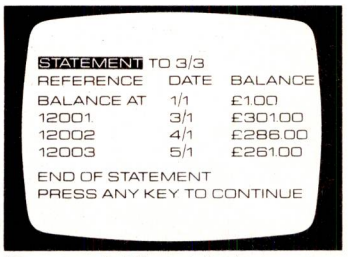
All UK Comet branches.

What would I do with a computer?



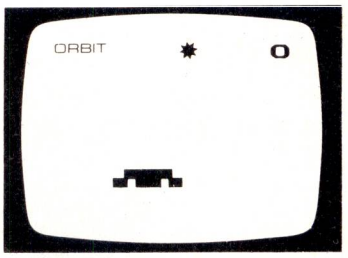
Play golf. Estimate your drive force on the fairway.



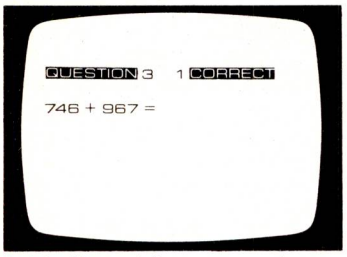
*Flummox your Bank Manager by keeping your finances at your finger tips.



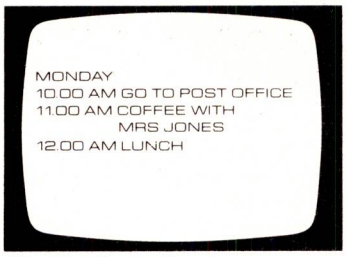
*Keep the rundown on friends, everything from their telephone numbers to birthdays.



Play Orbit and captain a spacecraft.



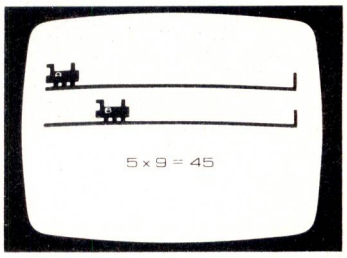
Teach the children maths from Division to Volume.



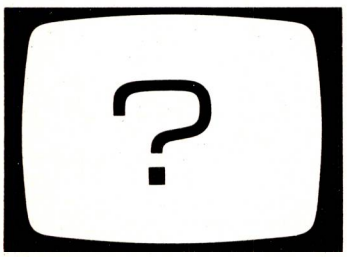
*Keep a diary of future appointments and past events.



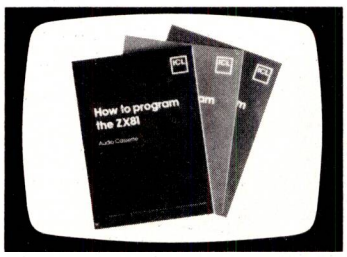
*Catalogue all your collections from coins to stamps.



*Teach the children multiplication and play trains at the same time.



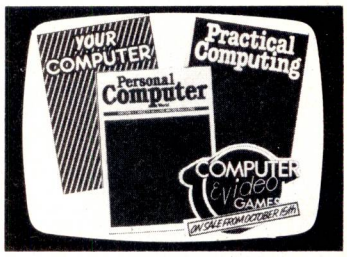
Or within a week you can write your own complex programs.



All you need to know for £14.95.



And a great range of books....



.... and magazines to help you become an expert.

The first personal computer that only adds up to £69.95



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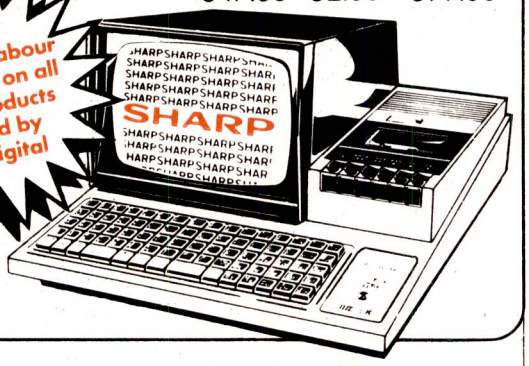

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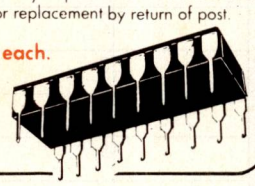

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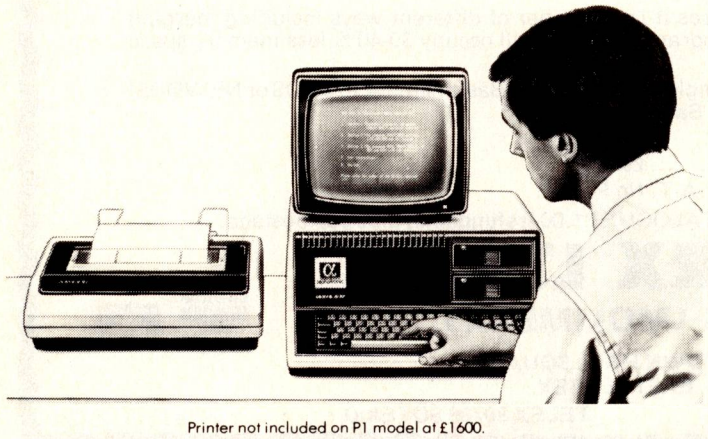

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Extended Basic from Snapp Inc. is, in our opinion, the best add on utility to the Basic Interpreters for the Model III and Model II TRS-80 machines that is available on the market at the moment. It incorporates into the Interpreter, commands which hitherto have had to be loaded in separate utilities, indeed some of the commands, to the best of our knowledge, are not even available in other utilities. What must be emphasised is that these modifications to the Interpreter are entirely transparent to the user, they literally patch the Interpreter and become an integral part of it. The enhancements unfortunately are too lengthy to explain in detail in this advertisement, but briefly they add the following functions:

Single keystroke commands to:

List first line of program
List last line of program
List previous line of program
List next line of program
Edit current line
List current line

Ten single keystroke abbreviations are provided for the Basic commands:

AUTO	CLS	DELETE	EDIT	KILL
LIST	MERGE	NEW	LLLIST	SAVE

Cross Reference

A complete cross reference utility with output either to the screen or to the printer listing all line numbers in which numeric or string variables are held. The reference may be to all variables or individual ones.

Dump Utility

A dump utility to direct to the display or printer the variables used in the program *together with their current values.*

Renumbering

A renumber utility. This is a sophisticated renumbering facility permitting not only renumbering, but also the relocation and duplication of blocks of code. It also has a higher speed execution than the present renumbering routine in the Interpreter.

String or Keyword Cross Reference

This utility will find and cross reference all keywords (commands) in the program together with, and probably most importantly, strings. That is to say, it is possible to find the whereabouts of specific words in the text of the program. Output is to the screen or to the printer.

Compression Utility

This utility takes a Basic program and compresses it in a number of different ways including merging multiple statements into single lines. Compressed programs typically will occupy 30-40% less memory space and run 7-10% faster.

In addition to the above, the Model III version adds single step entry into Basic (similar to LDOS or NEWDOS) together with the ability to recover accidentally "deleted" Basic programs.

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First there were the TRSDOS's, 2.0, 2.1, 2.2 and 2.3. Then came Newdos+, essentially a patched version of the TRSDOS's but with a number of very useful commands and utilities added. Then VTOS 3.0 and VTOS 4.0. These constituted a departure from the earlier DOS's and featured Device Independence so that devices such as the keyboard, printer, VDU and disk drives could interact directly together. Then came Newdos80 which is a rewrite of Newdos+, adding new utilities and new Basic commands, its main features being the ability to mix different capacity drives on the same cable and the ability to use variable length records. Now from LOBO International comes LDOS, the fifth generation disk operating system for the TRS-80 microcomputer. It combines most of the advantages of the preceding disk operating systems and unlike some of them, is accompanied by a complete and readable set of documentation, which includes a Technical Section containing relevant addresses.

It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

APPEND	COPY	DEVICE	DIR	DO	FILTER	KILL
LIB	LINK	LIST	LOAD	MEMORY	RENAME	RESET
ROUTE	RUN	SET	SPOOL	ATRIB	AUTO	BOOT
BUILD	CLOCK	CREATE	DATE	DEBUG	DUMP	FREE
PROT	PURGE	SYSTEM	TIME	TRACE	VERIFY	XFER

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

Hard disks in addition to single/double density, single/double sided, 8" and 5¼" floppies are supported although they may, of course, require hardware modifications. Utilities included in the package are:

BACKUP	COMMAND FILE	FORMAT	LCOMM
PATCH	RS232	KEY STROKE/MULTIPLIER	PRINTER FILTER

A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos+ and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

LDOS is totally upward compatible with TRSDOS, that is to say LDOS will be able to copy files and programs from TRSDOS disks onto LDOS formatted disks. As they are competitive disk operating systems, it is not suprising that the manual states that disks created under Newdos are not guaranteed to be compatible with LDOS, but we have not experienced any difficulty. We have done some work on investigating the compatibility of LDOS and the Video Genie and at the time of going to press we have found no incompatibilities. LDOS appears to run on the Video Genie without any problems at all. LDOS is compatible with either the Tandy or Electric Pencil lowercase modifications and Scripsit. LDOS is available for the Model I and Model III. A Model II version will be available shortly.

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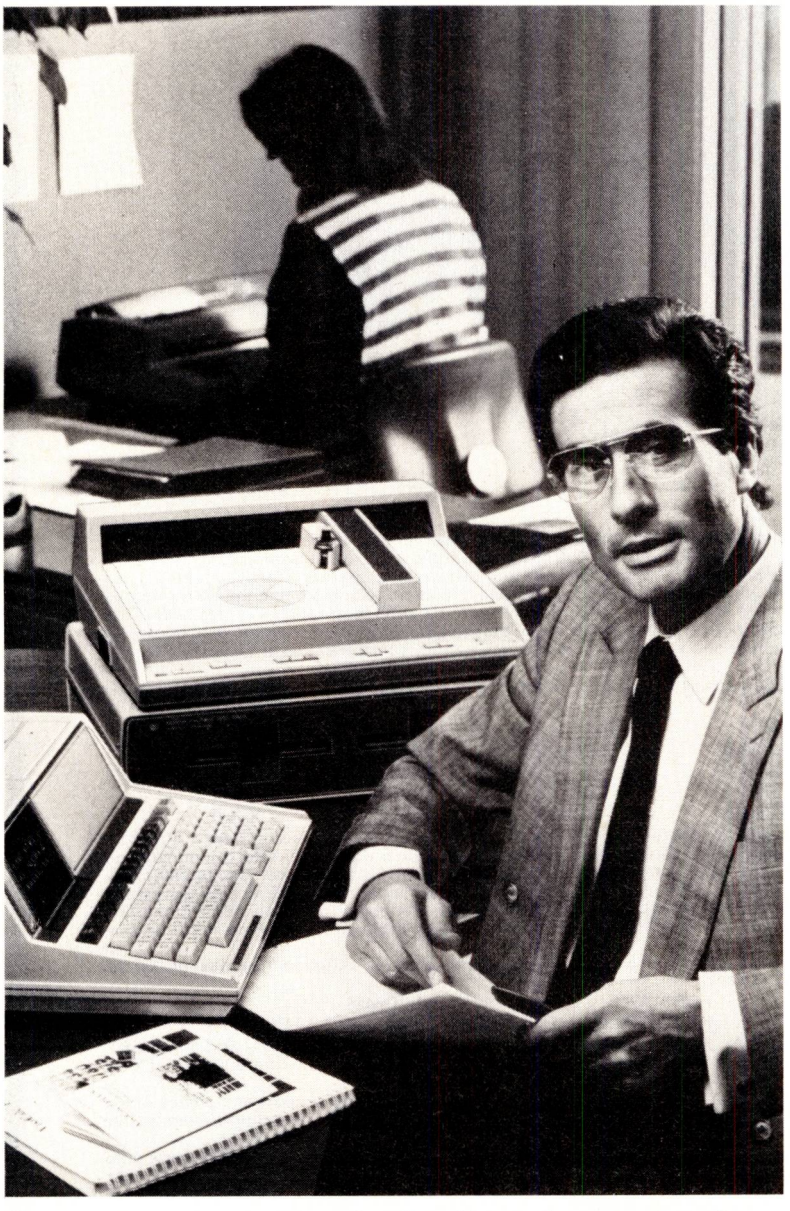

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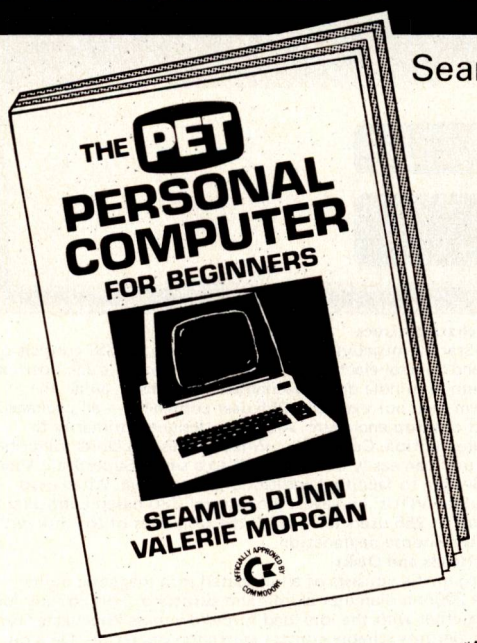

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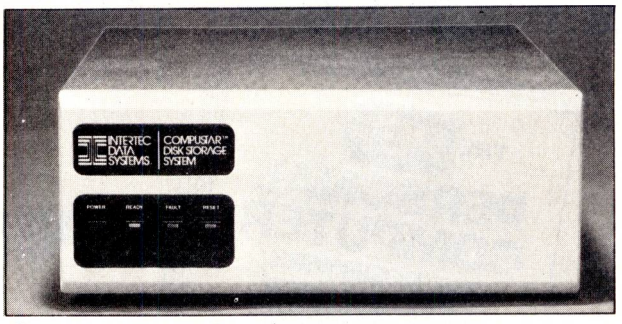
SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBAL and APL. Whatever your application' ... General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is top in its class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700K bytes of disk storage and a full 64K or RAM. All standard!

COMPUSTAR™



Functional characteristics
The CompuStar 10 megabyte Disk Storage System (DSS) consists of read/write and control electronics, read/write heads, a track positioning mechanism, a spindle drive mechanism, dual disks, an air filtration system, and our exclusive 255 user controller – all packaged in a compact desktop enclosure. Although designed primarily to accommodate multiple CompuStar Video Processing Units (described at left), the unit can easily be connected to a single SuperBrain Video Computer System to facilitate additional disk storage. When used with CompuStar VDUs, however, the integral Z80 based controller will permit up to 255 users to "share" the resources of the disk with minimal CPU response degradation.
Read/Write Heads and Disks
The recording media consists of a lubricated thin magnetic oxide coating on a 200mm diameter aluminium substrate. This coating formulation, together with the low load force/low mass Winchester type flying heads, permits reliable contact start/stop operation. Data on each disk surface is read by one read/write head, each of which accesses 256 tracks.

*** D/SIM ***
(DETERMINISTIC SIMULATOR)

01=FILE RELATED TASKS	06=VOCABULARY SECTION
02=FUNCTION TABLES	07=SET RECORD FORMS
03=MATHEMATICS	08=FIELD ATTRIBUTES
04=COMPUTE FUNCTIONS	09=PRINT FORMAT
05=AUTOMATIC PROCESSES	10=DISK SWAP
SELECT ?	

A NEW MODELLING PROGRAM. TOTALLY IN CORE. PROVIDES THE ABILITY TO TABULATE FINANCIAL (AS WELL AS OTHER) DATA AND THEN PROCESS THE DATA UNDER CERTAIN ALTERNATIVE CONDITIONS. SET-UP INITIAL CONDITIONS OF A GIVEN SITUATION AND EVALUATE THE CONSEQUENCES UNDER A GIVEN LOGICAL MODEL. ALTER THE CONDITIONS AND EVALUATE POSSIBLE ALTERNATIVE CONSEQUENCES BEFORE TAKING ACTION.

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AUTHOR TONY WINTER (M.D.;B.A.LIT;B.A. HON. PHIL;AND LECTURER)

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03=OPEN SALES LEDGER	09=INVOICE CREATION	15=AGED ANALYSIS	21=FILE MAINTAINANCE
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WHICH OPTION

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)Quit or .All or .Part or .Specific
)Quit or .Fast screen or .Slow screen or .Rapid print or .Pausing print
)Quit or .Continue or .Amend or .Delete or .Print
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AUTHOR TONY WINTER (M.D.;B.A.LIT;B.A.HON.PHIL;AND LECTURER)

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★★★ Introducing the new Bus10.00/Dbms2 ★★★

If you are interested enough to study this section of our new manual, then you are probably in need of a program embodying such features. If you understand the text, that is, if at least its meaning is a **touchstone** that fires your imagination towards **grasping** it with the mind then **you** and **it** are converging.

★★★ MULTIPLE FIELD SEARCHES ★★★
dbms2 and bus10.00

The following trajectory of a file interrogation may be set up and found to be both complex and of considerable power. Try a Sequential search that is Slow and on Multiple fields within a range say of record '1 to 30'.
Notice that the cursor prompter will move to the first field in the record form. You will be able to ask any of the following types of questions on each field. When you set the question against that field; if the carriage return is not enabled by the fact that you hit the right-hand-field-bracket, then hit (cr).

There are five types of questions you may ask against a permutation of up to sixteen fields. (Think about them).

1=straight text identity (P=P) which is to say that you can enter TONY in a name search where the record may look like TONY WINTER or WINTER TONY. the 'TONY' text is sought for in any part of the field.

2=Greater than identity (P>Q) which is to say that you may first enter the symbol > followed by a numeric value (say 100) where the records may possess different ranges of numbers in that field, and you only want 100 upwards.

3=Smaller than identity (P<Q) as '2=' above in reverse using <.

4=Not identical (P<>Q) which is to say that all records found on other criteria must not possess the stated attribute. (ie: all records with TONY but not in W.C.1.). You must first enter the symbol ~ followed by the criteria that is to be excluded from the comparison.

5=Either or identity (P~Q) which is to say that you may search for either TONY or someone in W.C.1. or telephones with a **01** in their number. Note: that only **one** match of those disjunctive premisses is sufficient to provide the truth condition establishing a match. That is to say you may find records of TONY in Birmingham and FRED in W.C.1. You must first enter the symbol ~ followed by the text. A multiple example is shown below.

Field 01=number	( )	) The question is: ?
Field 02=name	(TONY	) straight text (cr)
Field 03=postcode	(~W.C.1.	) one or
Field 04=town	(~London	) other
Field 05=income	(>5000)	greater 5000
Field 06=age	(<40)	younger than 40
Field 07=sex	(~female)	not female

02–025

★★★ MULTIPLE FIELD ATTRIBUTES ★★★
dbms2 and bus10.00

The following is a list of the field attribute arithmetic functions that may be set up against up to 16 fields per record and found to be both complex and of considerable power.

fn1=Multiply one field against another and total per record/file. **fn3=Divide** one field from another and total per record/file.
fn2=Add one field against another and total per record/file. **fn4=Subtract** one field by another and total per record/file.
fn5=Total vertical columns within a file of records. The result per record and per file.
fn6=Calculate a percentage of the value of one field and if the toggle is set to **1** then add that result to the field; whereas if the toggle is set to **–1** then simply store the result.

Example:

		record.5 . . . . . computed values . . . . . record . . . . . file	
Field 01=number	(5)		
Field 02=number	(MICRO)		
Field 03=quantity	(50)	[50,000.00]	[70,000.00]
Field 04=s.price	(1000.00)	[150.00]	[170.00]
Field 05=profit	(250.00)	[.25]	[.27]
Field 06=cost	(800.00)	[1,000.00]	[1,145.00]
Field 07=allocated	(20)	[30.00]	[450.00]

The two results to the right of the record show the use of several of the functions listed above.
Field 03 function 1 (03 * 04) has a value of 50,000.00 pounds worth of 'MICROS' for the number '5' and 70,000.00 pounds worth of for all such records so far scanned.
Field 04 functions 6 'toggle –1' (04 * .15) has the increase that is required to raise the price of record '5' by 15%, and so on averaging for all such records.
Field 05 function 3 (05 / 04) has the value of itself divided by the value found in field 04, for the record and all such records scanned. (profit margin ?).
Field 06 function 6 'toggle 1' (06 * 1.25) has the value of record '5' as if it were subject to an increase of 25%, and all such records scanned.
Field 07 functions 4 (03 – 07) has the quantity remaining in stock after allocations are subtracted.
You have a combination of **multiple field searches** of 5 TYPES and **multiple compute functions** of 10 TYPES against up to **16 fields**, using words you choose and printing only those columns in the order you desire in one SINGLE CORE PROGRAM.

02–026

contact:

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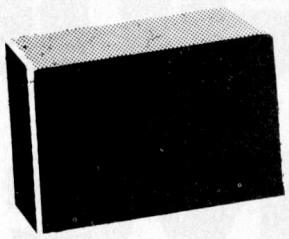

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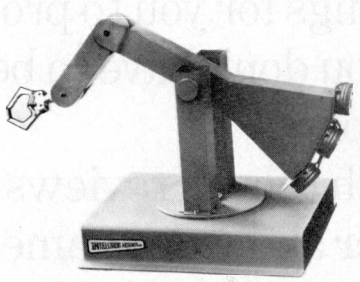
IA SMALL ARM ROBOT



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Every issue's packed with pages of games listings for you to program. And you don't have to be a computer expert.

Each month there's reviews of new computer and video games, regular pages on chess, bridge and mainframe games. Brush up or learn programming with our regular workshop, and discover the fun of creating graphics and adding sound to the games you invent yourself. There's also regular brain teasers (some with prizes) plus the secrets of beating arcade video machines.

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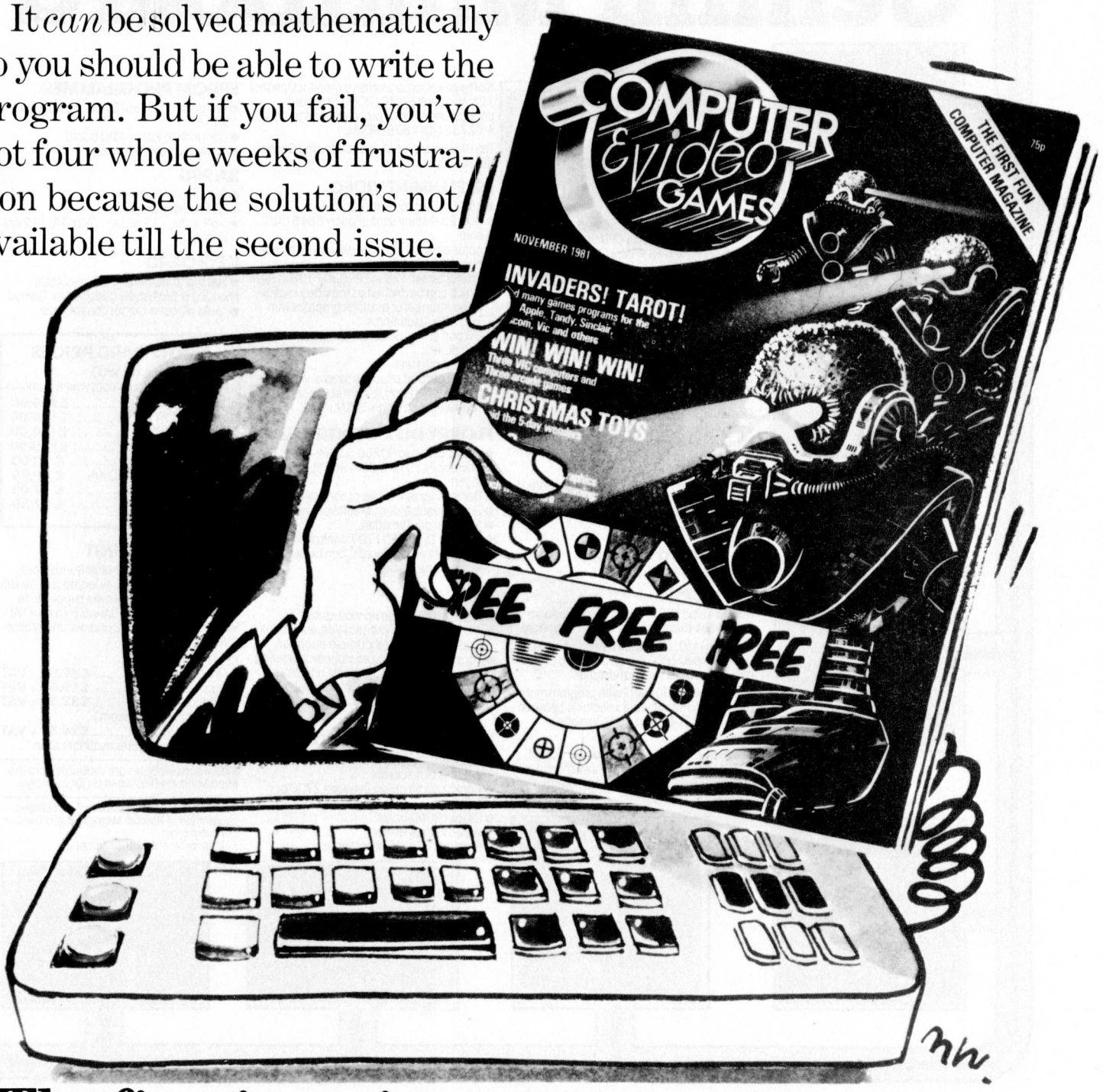
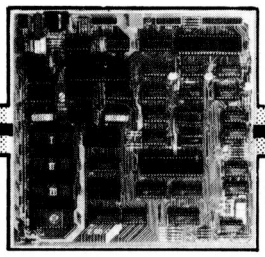


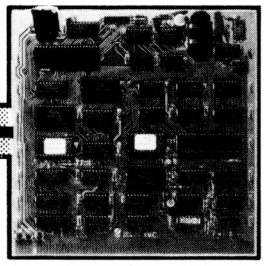
The first issue is at your newsagent now.

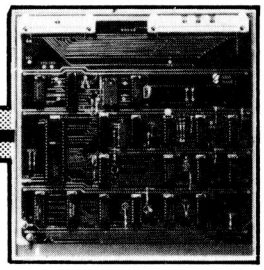
MicroValue

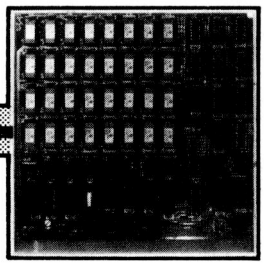
New British Microsystem. Gemini MultiBoard

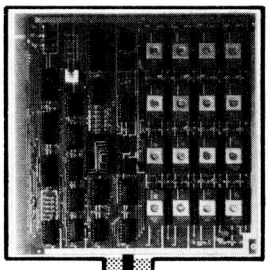


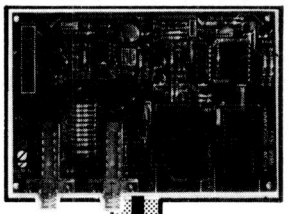


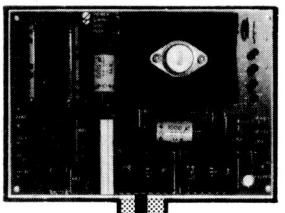












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Z80A CPU

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Parallel I/O: 8 bit ASCII keyboard socket. Uncommitted Z80A PIO giving two 8 bit bi-directional ports with handshake.

Serial I/O: 8250 UART with programmable baud rates and software selectable between RS232 or 1200 baud CUTS cassette interfaces.

Memory: 4 'Bytewyde' sockets to accept EPROM/ROM/RAM. Memory switched in/out of memory map under software control.

Software: Comprehensive monitor. Optional 12K Microsoft BASIC (ROM). Standard configuration PROM provides decodes for 4 x 2732 (4K x 8) EPROMs.

The CPU Board is fully buffered to the Gemini 80-BUS standard.

INTELLIGENT VIDEO

- Z80A microprocessor controlled.
- 80 x 25 display controlled by 6845 CRTC chip.
- Adjustable dot clock for alternative screen formats.
- Character set: 128 in EPROM + 128 in RAM which can be defined as the video inverse of the main set or as block graphics with 160 x 75 resolution.
- I/O port communication with host computer.
- Light pen socket.
- 8-bit input port allowing several video boards (each with its own keyboard) to be connected to a single CPU board.

FLOPPY DISK CONTROLLER

- Controls: Pertec FD250 5.25in 48 TPI, Micropolis 1015 5.25in 96 TPI, Pertec FD650 8in.
- Controls up to 4 drives of same type.
- Single/double density software selectable.
- Single or double sided.
- Western Digital FD1797 controller.
- Up to 8 drives (2 boards) can be used in the same system.

64K RAM

- Runs at 4MHz with no wait-states.
- 4 banks of 16K dynamic RAM, each bank locatable on any 4K address boundary.
- Page Mode supplied as standard allowing up to 4 memory boards to be addressed.
- All the memory can be used by switching out on-board CPU memory, e.g. in disk environment.

EPROM/ROM BOARD

- Accepts up to 40K of firmware.
- 4 banks of 4 sockets.
- Banks can be mixed between 2708 or 2716.
- 24-pin ROM socket.
- Wait-state generator.
- Supports Page Mode scheme.

EPROM PROGRAMMER

- Programs multi-rail 2708 or single rail 2716.
- Connects to PIO on CPU board.
- Software provided on tape.

3A PSU

- Supplies 4/5 boards.
- LED on each output.
- +5V at 3A; +12 at 1A; −5V at 1A; −12V at 80mA.

KEYBOARD

- Full alpha-numeric ● 59-keys ASCII encoded ● Exclusively designed for Gemini ● Auto repeat ● Cursor control keys

MULTIBOARD PRICES (excl VAT)

(All built and tested except where marked)

CPU (G811)	**£125.00**
Video (G812)	**£140.00**
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FDC (G809)	**£140.00**
EPROM/ROM (G803)	**£ 70.00**
EPROM PROG. (G808) Kit	**£ 29.50**
3A PSU (G807)	**£ 40.00**
Keyboard (G613)	**£ 57.50**

FLOPPY DISK UNIT

Gemini unit suitable for MultiBoard. Holds one or two 5¼in double sided, double density Pertec drives. Intergral power supply. Price £375 plus VAT for one drive, £575 plus VAT for two drives. CP/M2.2 and documentation £90 plus VAT.

KENILWORTH CASE for MultiBoard	**£49.50 + VAT**
5-Card Support Kit	**£19.50 + VAT**
VERO Frame	**£32.50 + VAT**
(also suitable for Nascom) PSU Enclosure Kit	**£24.50 + VAT**

KEYBOARD enclosures available soon.

MultiBoard Modules are available from the MicroValue dealers listed on facing page.

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MicroValue

COMPATIBLE Nasbus products from your MicroValue Dealers

GEMINI G805 FLOPPY DISK SYSTEM FOR NASCOM-1 & 2

It's here at last. A floppy disk system and CP/M

CP/M SYSTEM. The disk unit comes fully assembled complete with one or two 5¼" drives (FD250 double sided, single density) giving 160K per drive, controller card, power supply, interconnects from Nascom-1 or 2 to the FDC card and a second interconnect from the FDC card to two drives, CP/M 1.4 on diskette plus manual, a BIOS EPROM and a new N2MD PROM. All in a stylish enclosure.

Single drive system ..... **£450 + VAT**
Double drive system ..... **£640 + VAT**
Additional FD250 drives ..... **£205 + VAT**

D-DOS SYSTEM. The disk unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom PIO. Single drive system **£395 + VAT**

DCS-DOS A greatly enhanced version of D-DOS, running under Nas-Sys. Gives named files in BASIC, ZEAP, NAS-PEN and machine code programs ..... **£50 + VAT**

DISKPEN

The powerful text editor written for the Nascom is now available on a 5¼ inch floppy disk with a number of new features. **Price £43.25 + VAT.**

NASCOM COMPUTERS

NASCOM-2 Microcomputer Kit
£225 + VAT
NASCOM-1 Microcomputer Kit
£125 + VAT
Built and tested **£140 + VAT**

16K RAM KIT ..... £100 + VAT
3A PSU KIT ..... £32.50 + VAT

KENILWORTH CASE FOR NASCOM-2

The Kenilworth case is a professional case designed specifically for the Nascom-2 and up to four additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

Kenilworth case ..... **£49.50 + VAT**
2-card support kit ..... **£7.50 + VAT**
5-card support kit ..... **£19.50 + VAT**

CASSETTE ENHANCING UNIT

The Castle interface is a built and tested add-on unit which lifts the Nascom-2 into the class of the fully professional computer. It mutes spurious output from cassette recorder switching, adds motor control facilities, automatically switches output between cassette and printer, simplifies 2400 baud cassette operating and provides true RS232 handshake.

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Nascom 2 + Nas-Sys 3 + Programmers Aid
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MicroValue price £295 + VAT

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For really interesting and useful interactions with the 'outside world' the Milham analogue to digital converter is a must. This 8-bit converter is multiplexed between four channels – all software selectable. Sampling rate is 4KHz. Sensitivity is adjustable. Typical applications include temperature measurement, voice analysis, joystick tracking and voltage measurement. It is supplied built and tested with extensive software and easy connection to the Nascom PIO.

Milham A-D Converter (built and tested) ..... **£49.50 + VAT**

PROGRAMMER'S AID

For Nascom ROM BASIC running under Nas-Sys. Supplied in 2 x 2708 EPROMs. Features include: auto line numbering; intelligent renumbering; program appending; line deletion; hexadecimal conversion; recompression of reserved words; auto repeat; and printer handshake routines. When ordering please state whether this is to used with Nas-Sys 1 or 3. **Price £28 + VAT.**

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Allows monitoring of input and output of Nascom PIO. This board can generate interrupts and simulate handshake control. **Price (kit) £17.50 + VAT.**

All prices are correct at time of going to press and are effective 1st July 1981.

HEX & CONTROL KEYPADS

Hexadecimal scratchpad keyboard kit for N1/2; **Price £34 + VAT.**

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Supplied on tape for N1/2 running Nas-Sys and Nascom ROM BASIC. Features include auto line number, full cross-reference listing, delete lines, find, compacting command, plus a comprehensive line re-numbering facility **Price £13 + VAT.**

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Screenplus enables a programmer to blank or display in reverse video, selected words, letters or areas of the screen under program control. Suitable for use with either Nascom 1 or 2. 'Screenplus' (built and tested) .... **£40.00 + VAT.**

DUAL MONITOR BOARD

A piggy-back board that allows N1 users to switch rapidly between two separate operating systems. **Price (kit) £6.50 + VAT.**

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BENEATH APPLE DOS (no VAT) £12.95
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NEC GREEN SCREEN MONITOR £169.00

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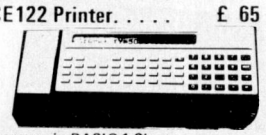

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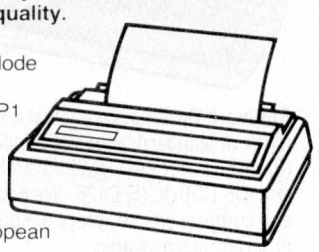

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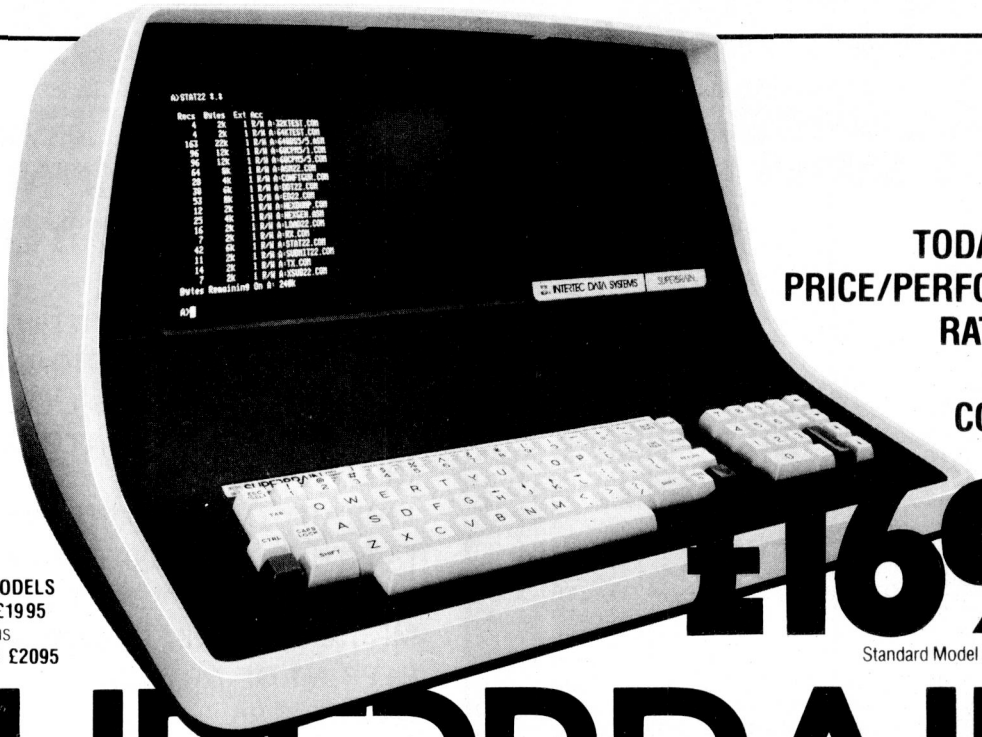

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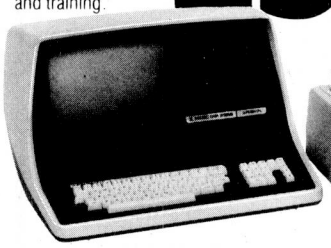

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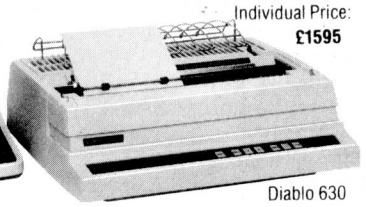

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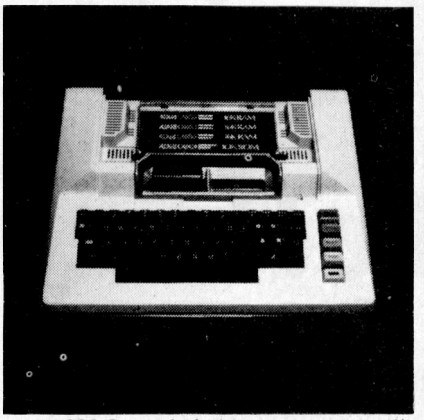
Atari 400 Console



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3 consoles available

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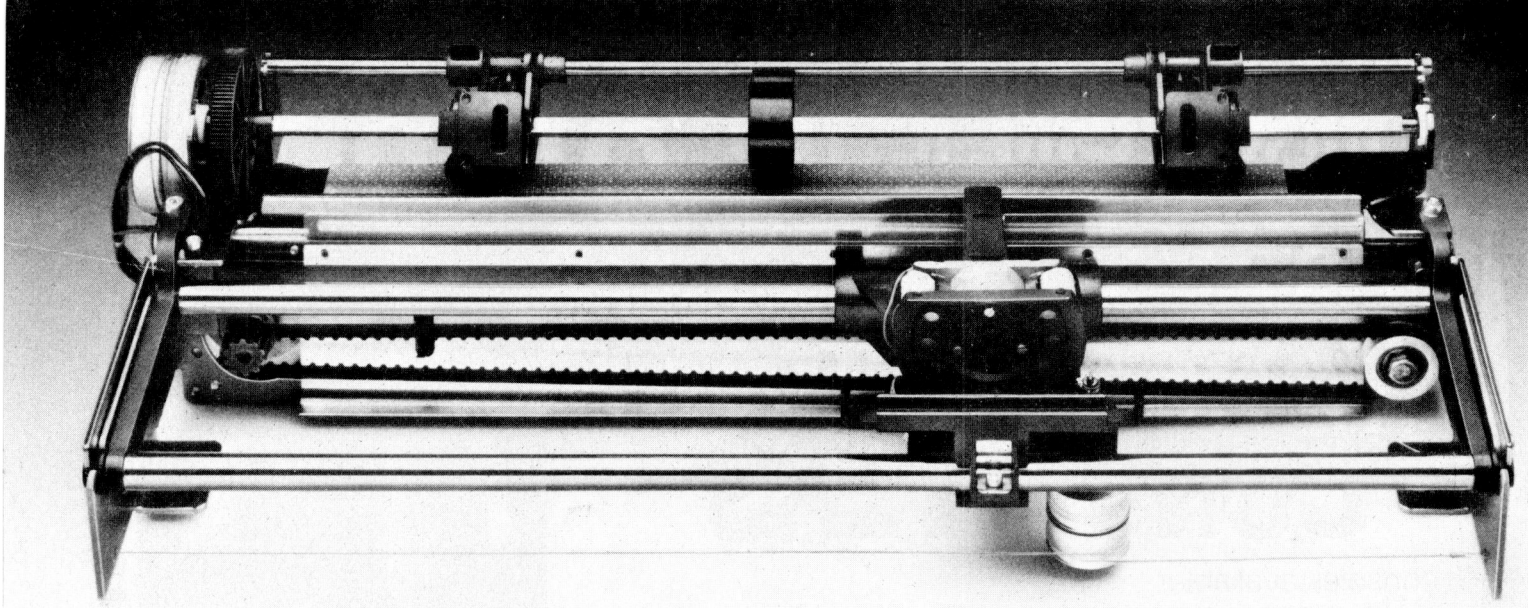

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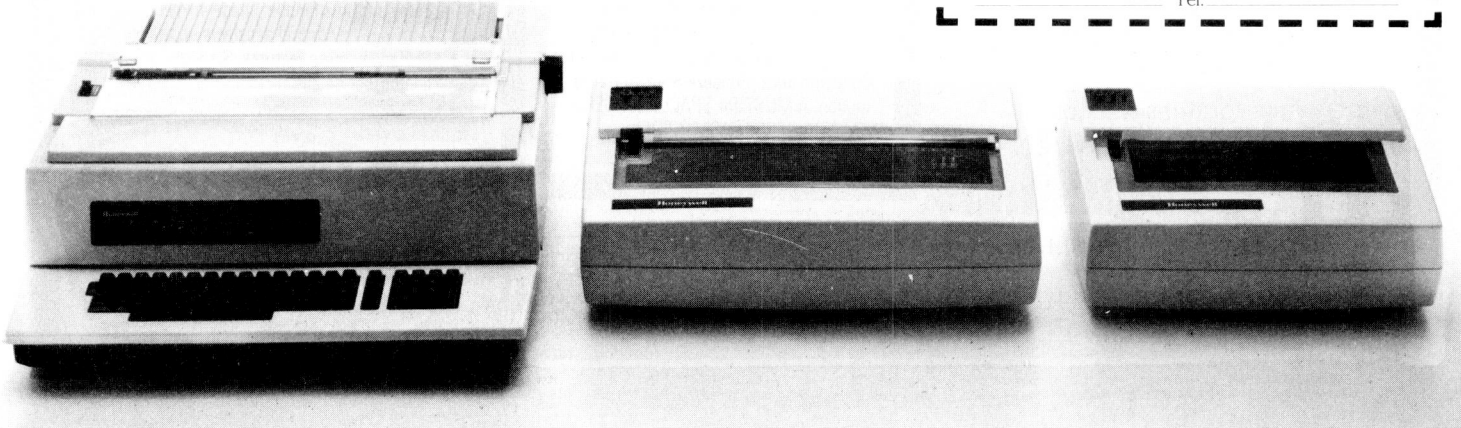

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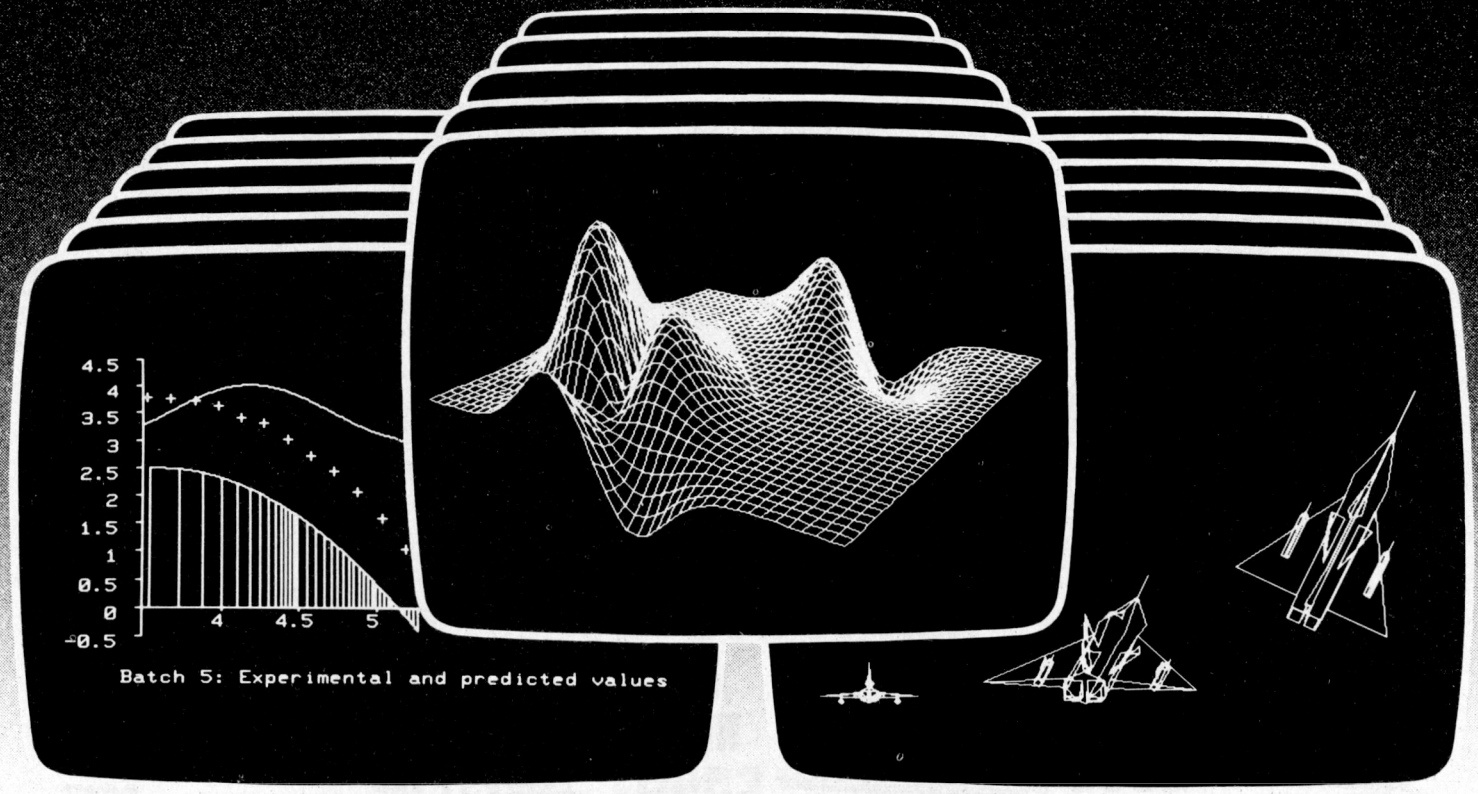

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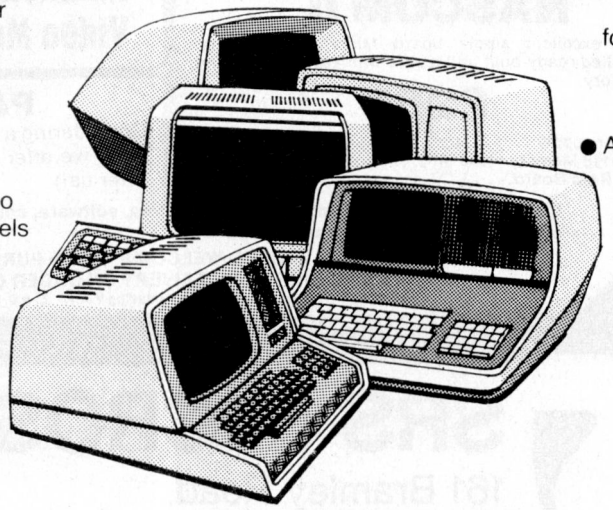

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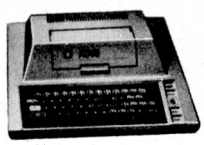

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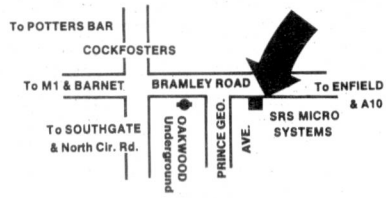

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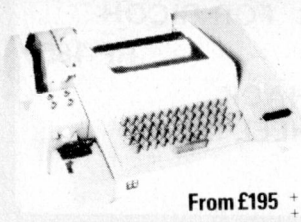

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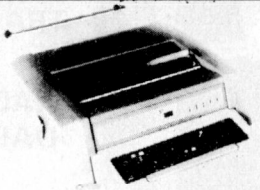

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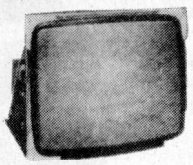

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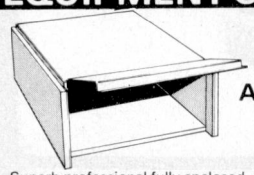

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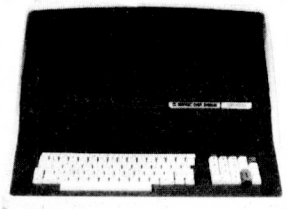

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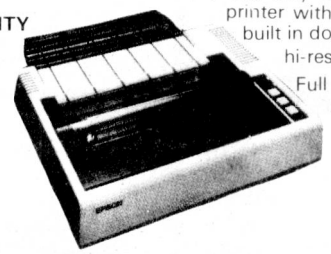

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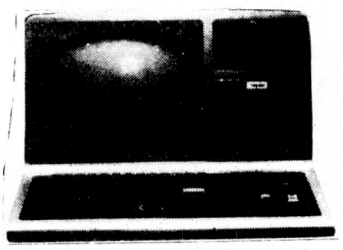

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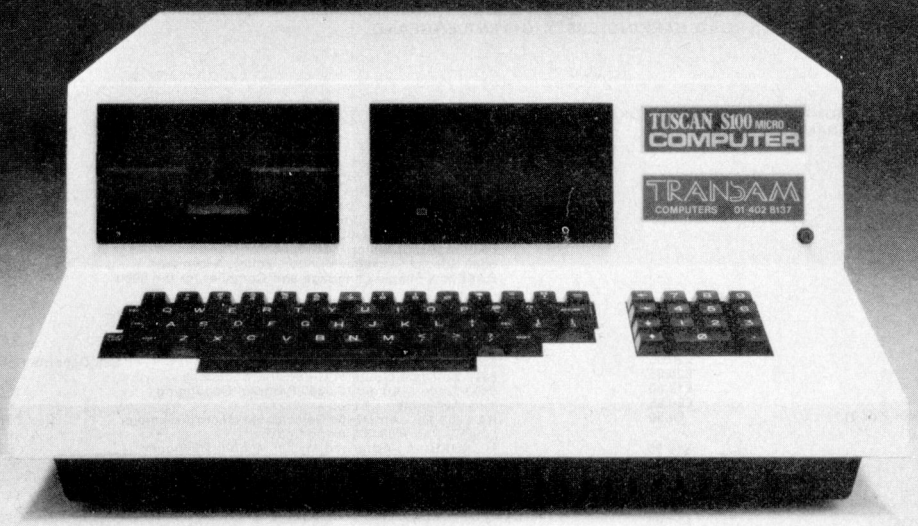

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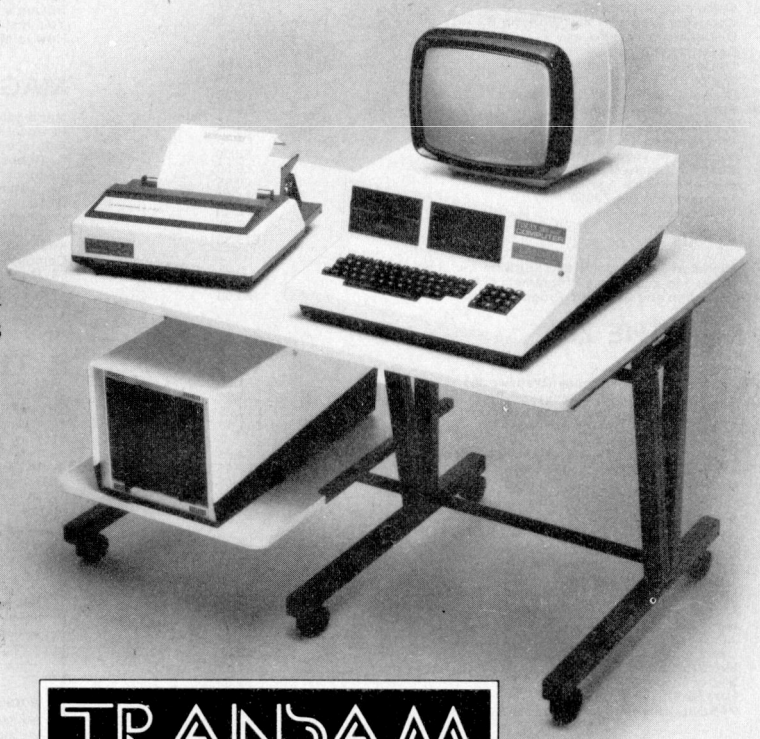

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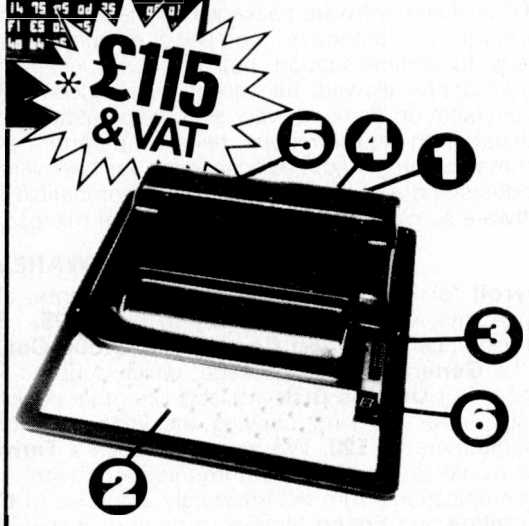

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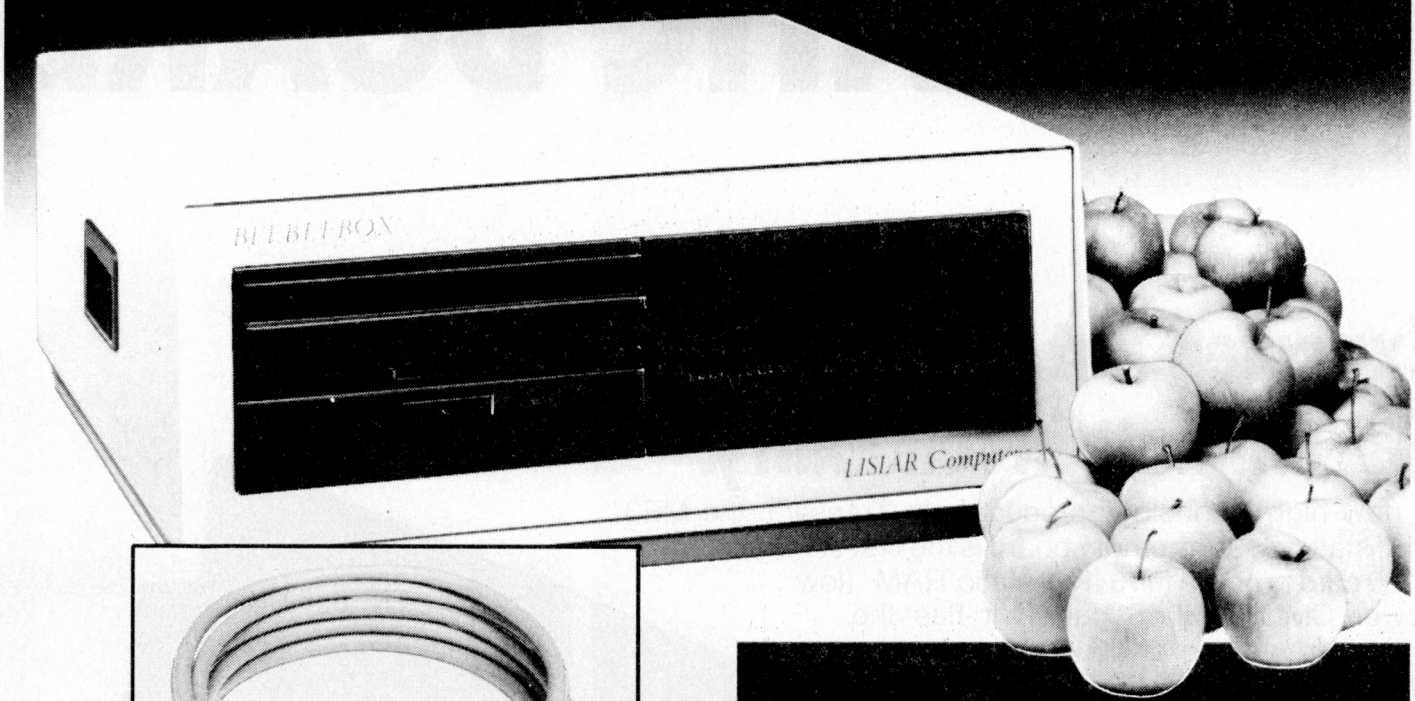

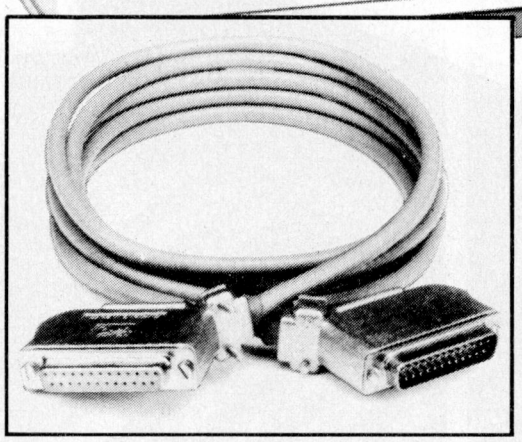

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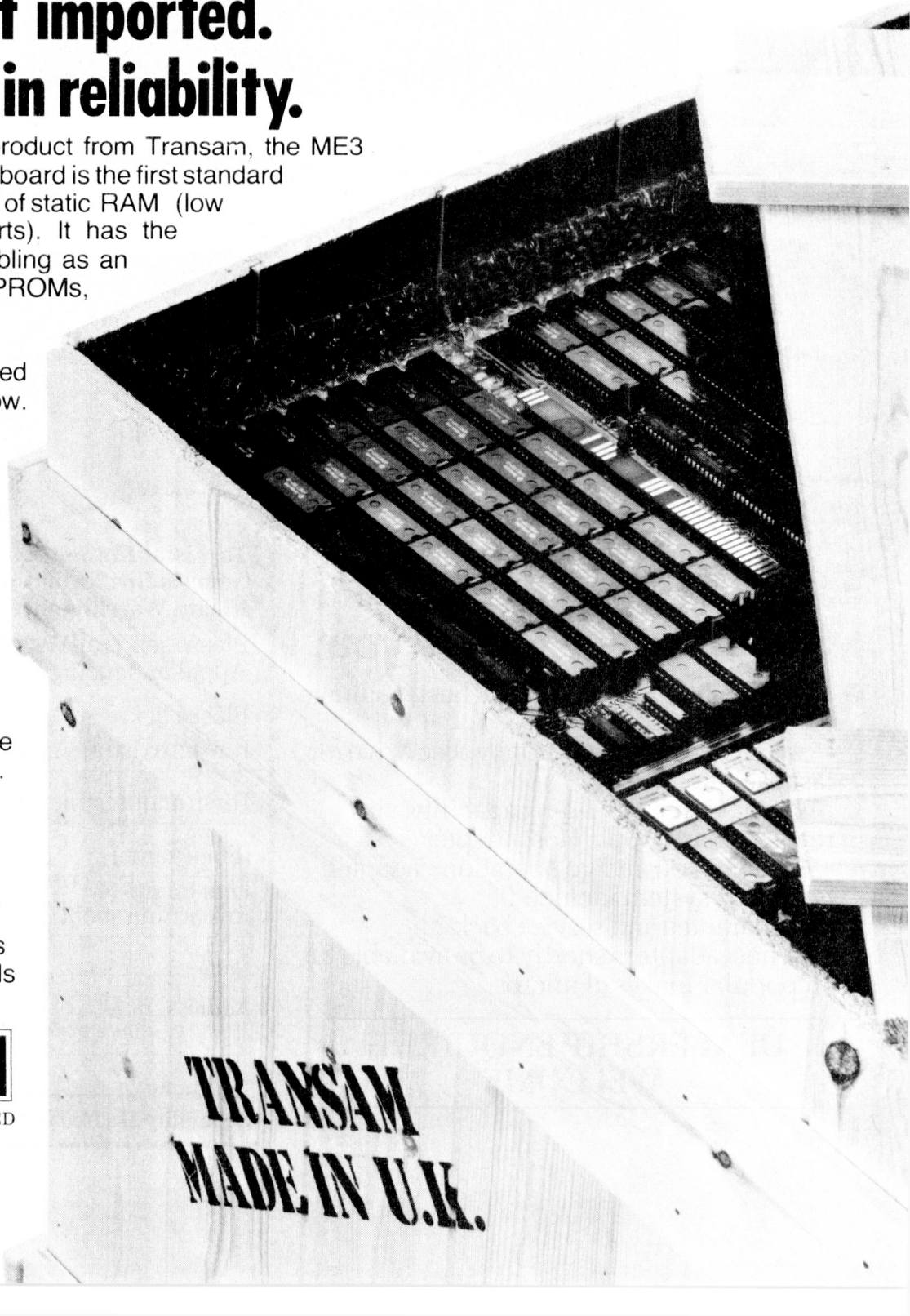
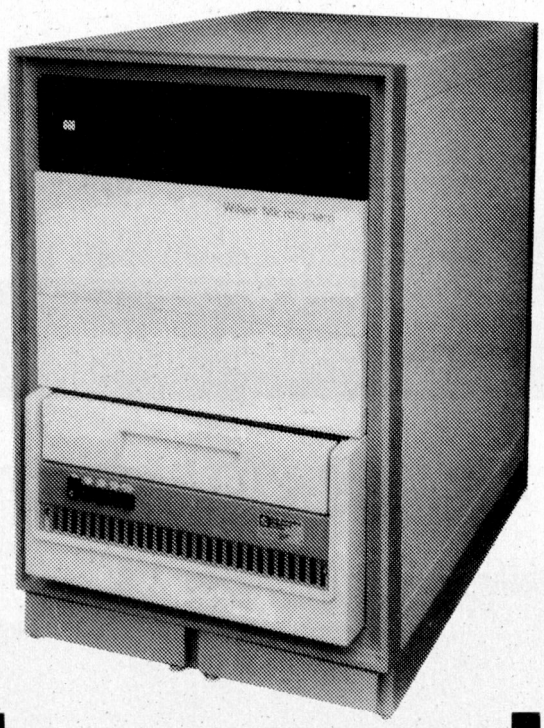


LSI-11/23 128Kb MOS
96Mb Disk Drive
VT100-AB
RT-11 License

Cost £15,950*



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TSX-Plus

Provides functionality of the DEC® RT-11 operating system for up to 12 terminals. Increase productivity of RT-11 systems. Contains no RT-11 emulator.

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TSX-Net

Allows implementation of business and scientific applications requiring distributed processing networks of TSX-Plus/RT-11 systems. Allows multiple systems to share resources.

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* Price is for fully supported system excluding V.A.T.

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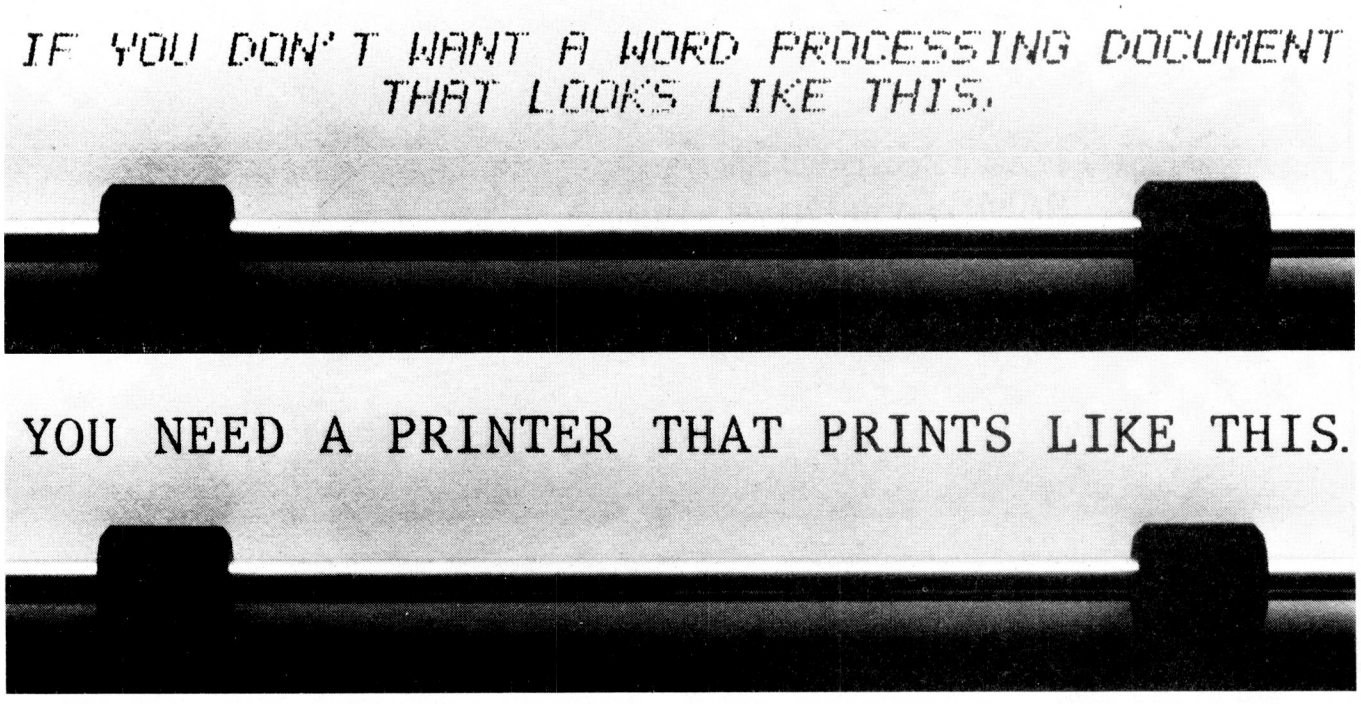

The more your system can do, the better your terminal should be. That's why, if you're adding text editing capability to your data processing system, you should also think about adding a quality daisywheel terminal to replace the matrix terminal you're using now. And the best-quality terminal you can buy is one by Qume.

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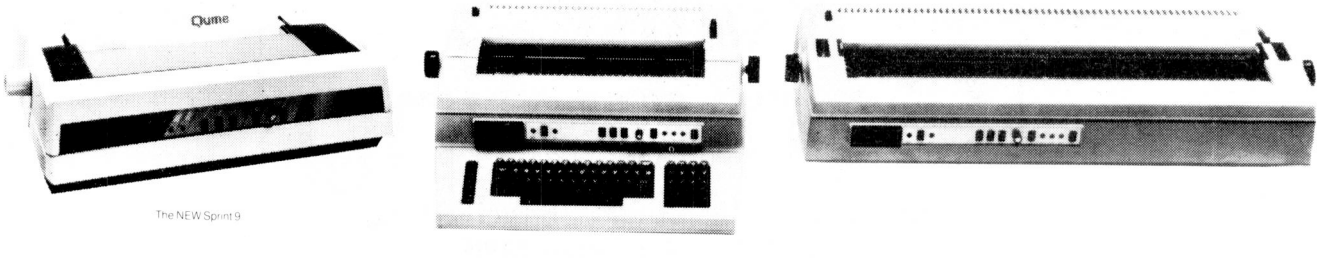
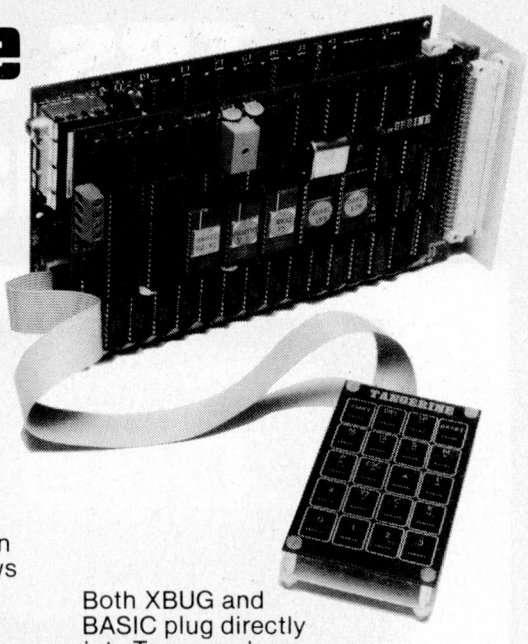


The NEW Sprint 9

Step by step with the computer system designed for tomorrow.



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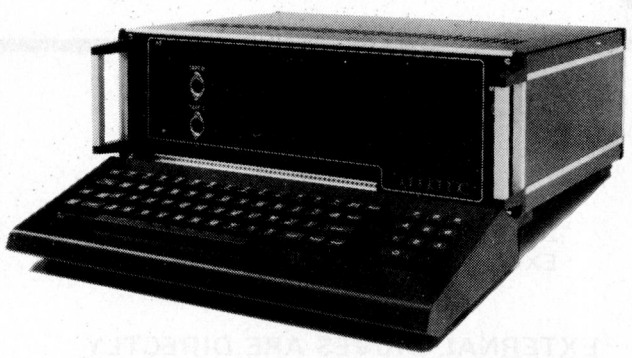
* 6502 Microprocessor
* 2K Monitor TANBUG
* Intelligent socket accepts keypad or full ASCII Keyboard
* Chunky Graphics and Lower Case Options
* Connects to unmodified B/W or Colour TV

For the first time buyer or experienced user, Microtan 65 is a superb route into personal computing. If you are looking for a sophisticated machine with the capability of expansion into a professional system, then this is the computer for you. Step by step with the computer system designed for tomorrow. . . .



6502 Microprocessor

Probably the most popular CPU (central processing unit) for personal computers, having a powerful instruction set and architecture.

2K Monitor TANBUG

The built-in 'mind' of the machine, TANBUG controls all system functions and gives comprehensive machine-code facilities. Functions include:- set and clear breakpoints, single step through program, execute program, copy block of memory, modify memory locations and much more.

Intelligent keyboard socket

For absolute beginners we can supply an easy to use 20-way Hex keypad; for the more experienced user there is a full typewriter style ASCII keyboard. Either way, Microtan will work out exactly which type you are using and act appropriately.

Chunky Graphics Options

For drawing simple lines and graphs,, or for animated games, Chunky Graphics is a low cost answer. This set of chips plug into the Microtan board and allow graphics to be built up on the screen at a resolution of 64 rows by 64 columns.

Lower Case Option

To extend the character set to 128 characters, allows for real descenders on lower case characters and a set of extra symbols and characters for simple graphics.

Microtan Accessories

20-way Hex keypad
MPS 1 Basic power supply
Aerial connector lead
Full ASCII Keyboard
MPS 2 Full system power supply
Mini — motherboard

Microtan is available ready-built or as a kit. We recommend that you should have some soldering experience before attempting the Microtan Kit, although if you do run into problems you can make use of our "Get you Going" service (telephone for details).

TANEX

* 7K Static Ram
* 10K Microsoft Basic
* 32 Parallel I/O lines
* 1 Serial I/O port
* XBUG
* Cassette Interface

The first step in expanding your system. Tanex provides the extra facilities necessary for the serious programmer. Memory expansion: Tanex has provisions for up to 7K of static RAM and up to 14K of EPROM using 2716 or 2732 chips.

XBUG and BASIC

XBUG is a 2K extension to TANBUG that contains a mnemonic assembler and disassembler and cassette firmware running at 300 Baud CUTS, standard or high speed, 2400 Baud Tangerine standard with 6 character filenames. Tangerine have taken out a full O.E.M. licence for Microsoft BASIC, the microcomputer industry standard, this is a full feature implementation with interrupt and machine code handling, and a superb program editor. Both XBUG and BASIC plug directly into Tanex and are supplied with comprehensive user manuals.

Parallel I/O

When fully expanded Tanex includes two V.I.A.s (Versatile Interface Adaptors) which implement the cassette interface and the parallel I/O ports. Software in TANBUG V2.3 enables you to plug in and use a Centronics type printer. The two V.I.A.s also contain counter timers that can be used for a variety of applications enhanced by the use of the integral handshake facilities.

Serial I/O

Also on the expanded board is a serial I/O port that can be used to interface RS232 or 20Ma loop terminals or VDU's, again all controlled by TANBUG V2.3.

Whether Tanex is purchased in a minimum or maximum configuration, Tanex will buffer the data bus and configure the system memory map for maximum expansion.

To complete Tanex, a comprehensive user guide is supplied which contains full constructional details. This manual is also available separately.

TANEX options

10K extended MICROSOFT BASIC
Serial I/O Kit
Extra RAM (2114s)
XBUG
6522 V.I.A.
2716 EPROM for your own software

Tanex (Min Config) Kit £50.95 inc VAT and P & P
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TRS 80 MODEL III
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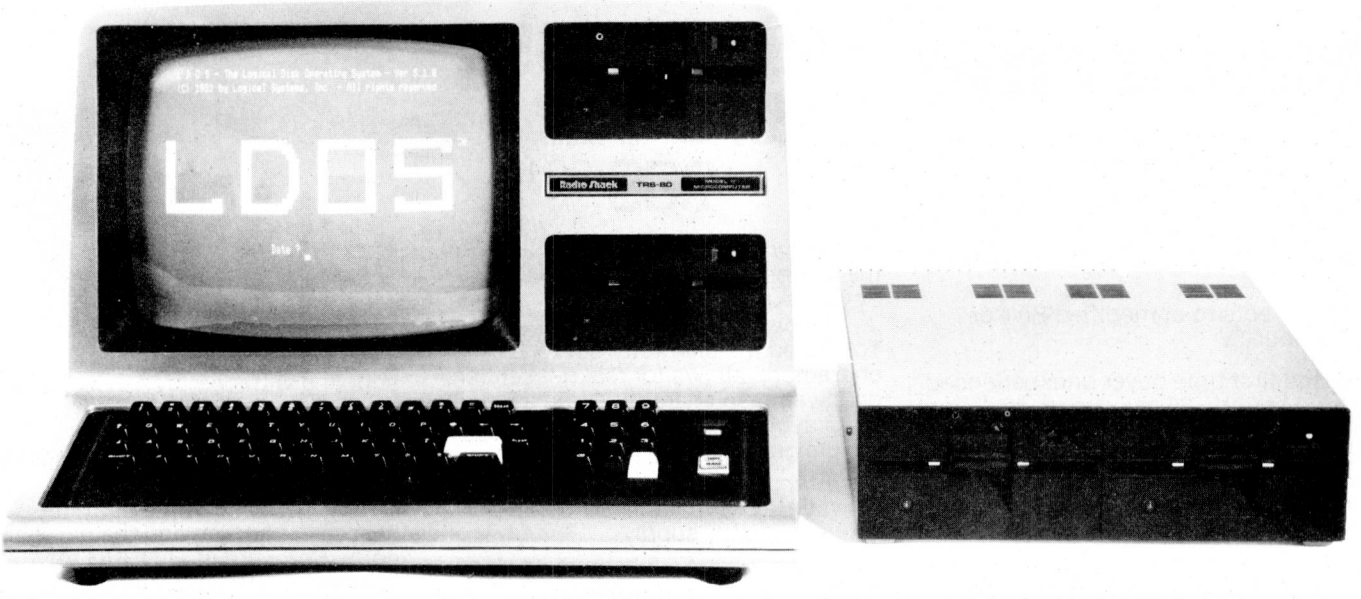

INTERNAL DRIVE PRICES

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2 x 40 TRACK DRIVES	£599
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INTERNAL DRIVE PRICES INCLUDE DISK CONTROLLER BOARD, POWER SUPPLY UNIT AND ALL CABLES AND CONNECTORS REQUIRED FOR INSTALLATION.

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1 x 80 TRACK DRIVE	£299
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LS293	46
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LS325	330
LS326	315

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LS374	48
LS375	90
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LS390	62
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LS398	275
LS399	220
LS445	140
LS447	195
LS471	620
LS490	245
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LS571	620
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3.57954M	150
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4.032MHz	290
4.19430M	270
4.433619M	120
5.0MHz	240
5.185MHz	300
5.24288M	390
6.0MHz	240
6.144MHz	240
6.5536MHz	290
7.0MHz	290
7.168MHz	290
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8.0MHz	240
8.08333M	362
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26.0MHz	383
26.69MHz	290
27.145MHz	240
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100.0MHz	323
116.0MHz	300

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(Texas)	Low Prof.	Wire Wrap
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14 pin	10p	35p
16 pin	10p	42p
18 pin	16p	52p
20 pin	22p	60p
22 pin	25p	70p
24 pin	25p	70p
28 pin	28p	80p
36 pin	-	105p
40 pin	30p	99p

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14 pin 44p, 24 pin 88p
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'D' CONNECTORS

(Cannon Type)	Plugs	Sockets	Plastic Covers
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25 way	198p	284p	195p
37 way	290p	398p	210p

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DIL Switches (SPST)
4 way 70p
6 way 85p
8 way 90p
10 way 145p
(SPDT)
4 way 190p

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	.1"	.156"
2 x 10 ways		120p
2 x 15 ways		135p
2 x 18 way	140p	145p
2 x 22 way	160p	165p
2 x 25 way	180p	185p
2 x 30 way	199p	
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Single end DIP Jumpers with 24" long Ribbon Cable
14 pin plug 145p 24 pin plug 240p
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length	14 pin	16 pin	24 pin	40 pin
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ZERO FORCE: DIL Sockets
24 way 650p 28 way 820p 40 way 975p

VIC-20

At last it is here, the long-awaited Commodore's VIC20 Microcomputer. Connects directly to any colour (or B&W) TV set. Sound reproduced through TV Speaker (Music, Language and other Sound effects). Has PET type graphics. Standard PET Basic. Full size keyboard. Has 5K Memory expandable to 32K on Board. Attractively Cased.

All this for: Only £165

Cassette Deck including a free 6 programme Cassette £34

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Watford's Ultimate Monitor IC

A 4K Monitor Chip especially designed to produce the best from your Superboard II, Superboard II Series II, UK101, and Enhanced Superboard. Facilities available are: Full Screen Editing – Home cursor/ screen clear facility – True insert/ delete – Fully programmable cursor control with meaningful sumbols on screen – Single Key Basic – True ASCII Keyboard routine – Auto remote control of tape recorder (requires only a relay) – Open line facility – Named Tape files – Two Key Video Swop (Series II only) – Bell (Series II only) – Cursor Indication of quotes mode – User definable flashing cursor character – User controllable command vectoring for your own machine code routines – Full or partial scroll-up or down (callable by programs) – Au[o list on error – Single command save (automatically returns "List") Centronics compatible printer driver Monitor Functions include: Scrolling list in Data mode – Warm restart vector – Fill memory – Search memory – Two save & three load routines – Floppy disc vector – Break handling routines – Tabular display of memory. **All this for Only: £19.95**

ETI/WATFORD'S MICRO EXPANSION SYSTEM

This versatile economical Expansion System as published in ETI Oct 1981 issue provides a cheap but reliable Expansion possibility for most of the popular Microcomputers.

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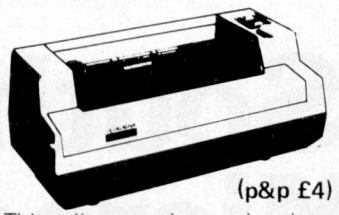

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This unihammer dot matrix printer gives normal and double width characters as well as dot resolution Graphic.
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- Character Set 5x7 matrix.
- Print Density 12CPL @ 80CPL
- Paper Feed 8" Tractor
- Parallel Interface Standard.

Other Interfaces available. IEEE/488, PET, TANDY, APPLE, RS232

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SPECIAL OFFER **£235**



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• TEX Eprom Eraser with 30 min. Electronic timer	£45
• Full ASCII Keyboard "756" Micro Case Beige/Brown ABS Attractive, for Superboard, UK101	£39 / £26
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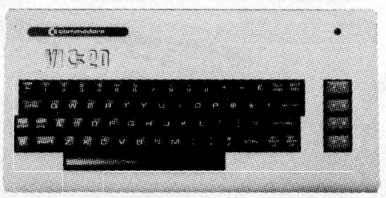
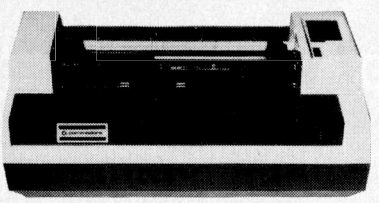
the vic centre

Adda Computers Ltd., a major supplier of computer systems to industry and business, have opened the Vic Centre in West London. Here you can see, discuss and buy everything to do with the new VIC 20 personal computer—in person or by mail. Hardware, software, technical advice and information is available from an experienced staff of experts. Even if you already own a VIC 20, get on our mailing list to know about new developments. Remember—everything has the backing of Adda's reputation, and there's a full 12-month warranty on all hardware. The Vic Centre is easy to reach—Just off the A40, close to North Acton tube station.

Not just a computer but a whole expandable system





AT ONLY £189·95 inc.VAT. Special cassette deck £44·95 inc.VAT.

The VIC 20 is a fully-fledged, easy-to-use computer. It's the core of a great expandable system, with full-size keyboard operation. First-time users can work it immediately with plug-in program cartridges, using your own colour TV to get up to 24 colours on screen, and three different sound tones. Or write your own programs in BASIC. The VIC 20 lets you build a system as needs and budget dictate. You can expand its memory to 32k Byte with Plug-in modules, and transfer data to external storage units. So the VIC 20 is more than just a personal computer—and its system will expand to put it even further ahead.

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Tractor-feed, 80 character-per-line, 30 characters-per-second printer.
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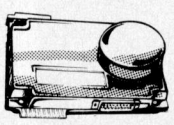
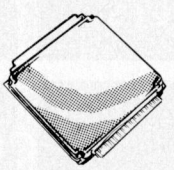
VIC-RS232 INTERFACE
Fully implemented (true levels)
RS232C-V24
BI-DIRECTIONAL INTERFACE
Allows Vic to work as Mainframe Terminal Drive a Qume Daisywheel or a Paper Tape Punch etc. etc.
FEATURE This unit contains master power supply which supports Vic's own supply when carrying Memory Expansions, Cassette Drives, Light Pens, Printers etc.

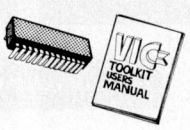


£56.35 incl VAT.

VIC-MEMORY 3K
Small size—low cost memory expansion. Plugs into Vic and reproduces memory-port. Can be used with other expansions gives a total of 6k user static ramon Vic.
FEATURE This board allows Vic to move Basic to begin at 1024 ($0400) as in Pet, and enables the use of HIGH RESOLUTION COLOUR GRAPHICS **£40.25** incl VAT.



VIC-TOOL KIT **£28.75** incl VAT.
For those who know tool kit on Pet we now have same facilities for Vic.
Renumber, Auto, Append etc.
This may be used with the stack VIC Rom Switch Board.



VIC ROM SWITCH BOARD £40.25 incl VAT.
An inexpensive unit which plugs direct on to Memory Expansion Port of the VIC and allows the insertion of up to 4 ROMS for games packs or toolkit aids, etc.
FEATURE. Simple software switch exchanges each pair of ROMS into VIC's ROM space allowing 'clashing' ROMS to be used.
FEATURE. Plug-in zero force sockets are available as optional extras to help eliminate pin damage to valuable ROMS.

TERMS AND CONDITIONS: All goods sold subject to Adda terms and conditions of sale. Full details available on request, but include: 7 day money back guarantee, Adda 12 month hardware warranty. Please allow 21days for delivery. Allow 7 days for personal cheques to be cleared. Quoted prices are inclusive of VAT.

VIC-LIGHT PEN
This high quality light pen works in both normal and Hi-Res modes on the Vic allowing simple interaction with the Vic without keyboard entry.
Easy to program and easy to use.
e.g. Menu selection. Non-keyboard entry. Teaching Games.
FEATURE touch sensitive "Enter" contacts to eliminate accidental entry.



£28.75 incl VAT.

VIC-Games Port Adaptor Cable **£14.95** incl VAT.
games port plug.
A two into one adaptor for use with both joysticks and light pens. A must for those who require full control of games with graphics.
FEATURE low-cost High quality. Robust.



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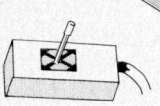

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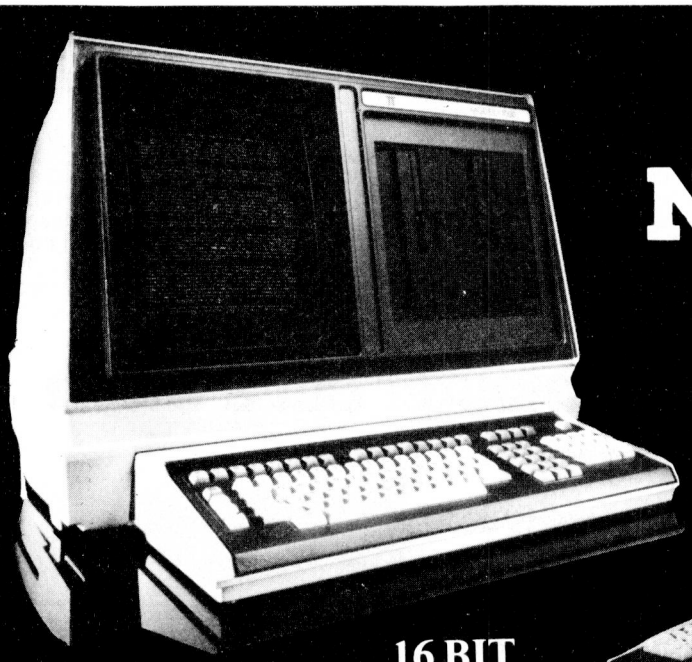

PM 1000 16 BIT CP/M86**

The PM100 is remarkably low in cost
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Future: PASCAL

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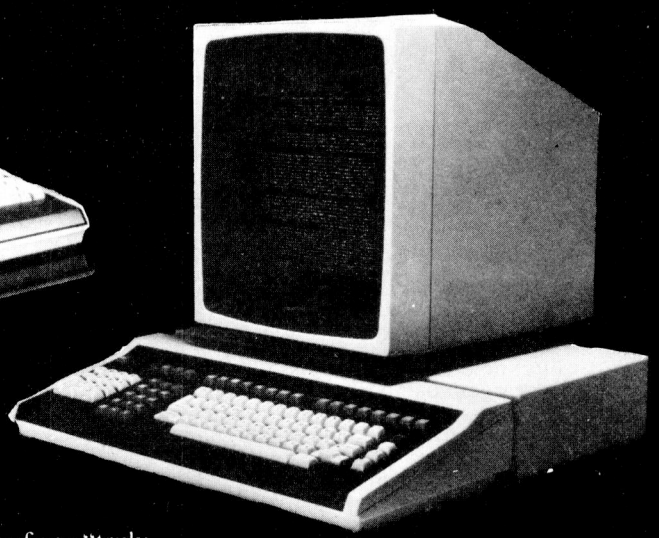

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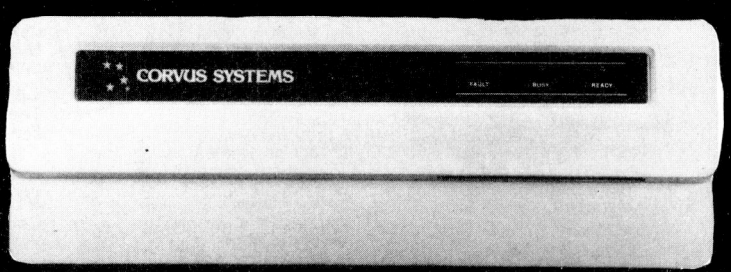

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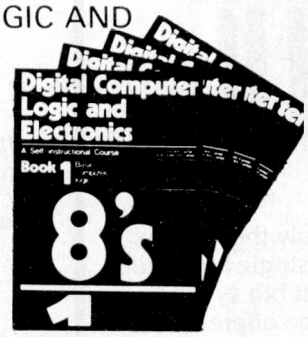

This course is designed as an introduction to digital electronics and is written at a pace that suits the raw beginner. No mathematical knowledge is assumed other than the use of simple arithmetic and decimals and no electronic knowledge is expected at all. The course moves painstakingly through all the basic concepts of digital electronics in a simple and concise fashion: questions and answers on every page make sure that the points are understood.
Everyone can learn from it - students, engineers, hobbyists, housewives, scientists. Its four A4 volumes consist of:

Book 1 Binary, octal and decimal number systems; conversion between number systems, conversion of fractions; octal-decimal conversion tables.
Book 2 AND, OR gates; inverters; NOR and NAND gates; truth tables; introduction to Boolean algebra.
Book 3 Positive ECL; De Morgans Laws; designing logic circuits using NOR gates; dual-input gates.
Book 4 Introduction to pulse driven circuits; R-S and J-K flip flops; binary counters, shift registers; half-adders.

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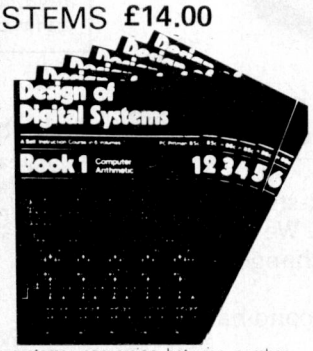

This course takes the reader to real proficiency. Written in a similar question and answer style to Digital Computer Logic and Electronics, this course moves at a much faster pace and goes into the subject in greater depth. Ideally suited for scientists or engineers wanting to know more about digital electronics, its six A4 volumes lead step by step through number systems and Boolean algebra to memories, counters and arithmetic circuits and finally to an understanding of calculator and computer design.

Book 1 Octal, hexadecimal and binary number systems; conversion between number systems; representation of negative numbers; complementary systems; binary multiplication and division.
Book 2 OR and AND functions; logic gates; NOT, exclusive-OR, NAND, NOR and exclusive-NOR functions; multiple input gates; truth tables; De Morgans Laws; canonical forms; logic conventions; karnaugh mapping; three state and wired logic.
Book 3 Half adders and full adders; subtractors; serial and parallel adders; processors and arithmetic logic units (ALUs); multiplication and division systems.
Book 4 Flip flops; shift registers; asynchronous and synchronous counters; ring, Johnson and exclusive-OR feedback counters; random access memories (RAMs) and read only memories (ROMs).
Book 5 Structure of calculators; keyboard encoding; decoding display data; register systems; control unit; program ROM; address decoding; instruction sets; instruction decoding; control programme structure.
Book 6 Central processing unit (CPU); memory organization; character representation; program storage; address modes; input/output systems; program interrupts; interrupt priorities; programming; assemblers; computers; executive programs; operating systems and time sharing.

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are the essential logical procedures used in all computer programming and mastering them is the key to success here as well as being a priceless tool in all administrative areas -presenting safety regulations, government legislation, office procedures etc.

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explains how to define questions, put them in the best order and draw the flow chart, with numerous examples.

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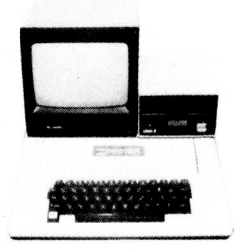

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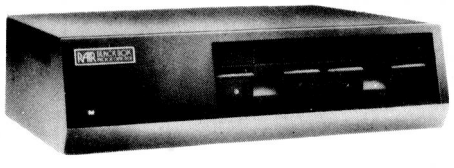

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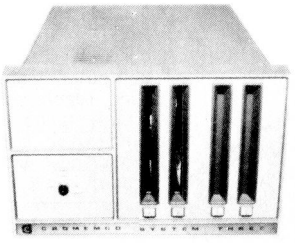

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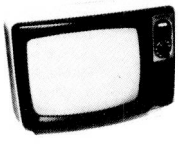



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Now available ex-stock. Special offer to ZX80 owners: We will take your ZX80 in part exchange for an Atom.

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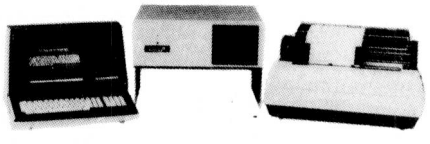

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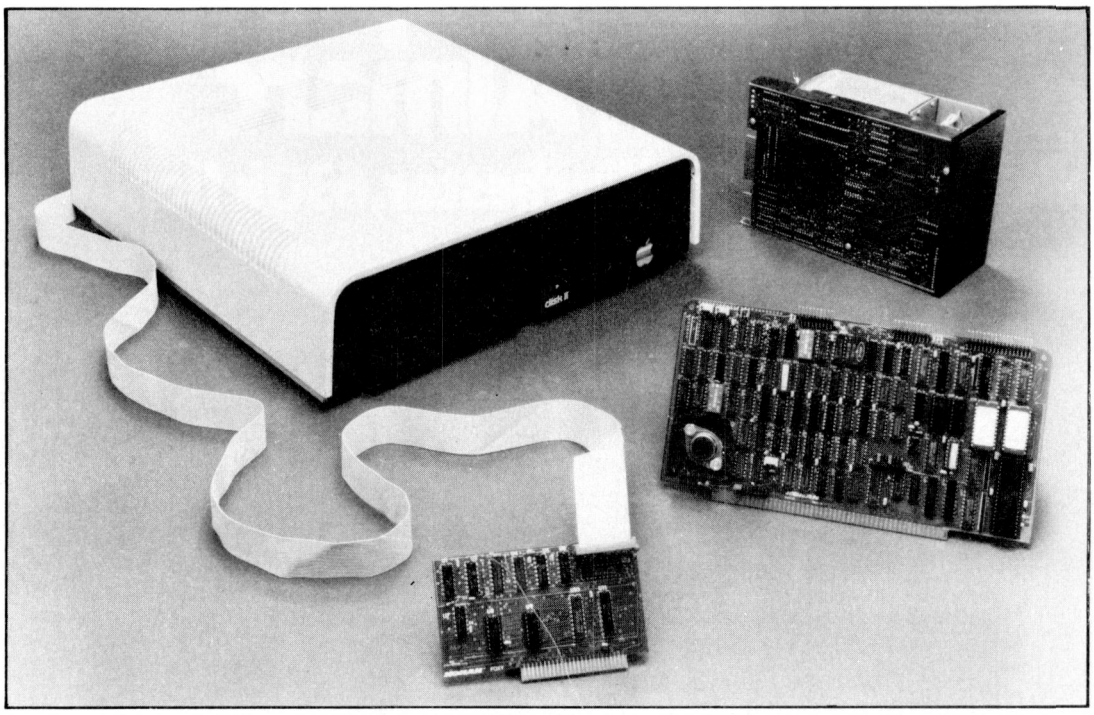

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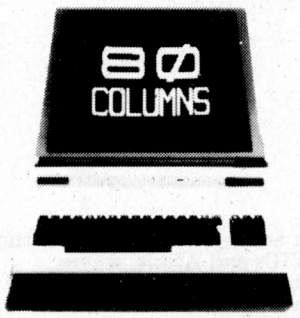

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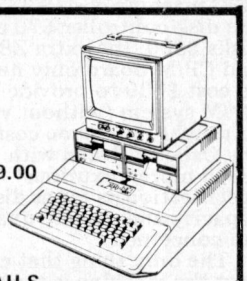

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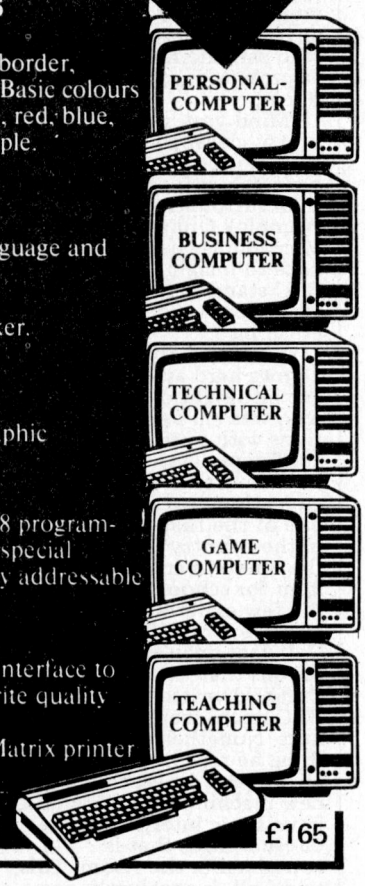

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NEWSPRINT

Guy Kewney, editor of Datalink, *presents the latest micro news.*

BBC micro -part 94

The new BBC machine, despite all the criticism there has been, is going to have to work very hard to fail, as anyone will have to admit who saw the first models, as promised, at the *PCW* Show.

Mind you, you had to be pretty clever to actually see it. If it is possible to imagine a worse crush of spectators than surrounded the Wembley Online show's Micromouse heats, all you have to imagine is the Acorn/BBC stand at the *PCW* Show with more space to fit the crush into.

Into the crowd I marched, elbows hard at work, until I got into sight of John Coll, who was answering all questions with positive and confident ease.

John Coll is Acorn's education expert. He was one of the first teachers in the country to really push the micro as an essential item for schools and one of the few experts who is also well-informed. Criticism from Coll goes deep and his accusations that virtually everything I'd written about the BBC micro were misguided, hurt. Nonetheless, the only thing he really picked me up on was the report that the new machine would include, in its Basic interpreter, the unusual Basic that is contained in the Atom. This, said Coll, is absolutely not true.

Exactly why it isn't true, I'm still not sure. All its more admirable features are there, (such as the ability to run machine code routines just by entering assembler language into the program) in improved and standardised syntax versions; strings, for instance, are given the way the rest of the world does it, as A$ rather than $A but upgrades and improvements of Atom Basic aren't the same as dropping it. I suppose 'retaining' Atom Basic sounds a bit too much like retaining its more difficult features, which, it seems, have all been tackled.

Anyway, the biggest flea John Coll could have put in my ear still wouldn't have stopped me falling in love with the machine, for two reasons.

First, it looks nice; neat and flat with a good keyboard and a square table on which to place a television of monitor, and lots of special keys on the keyboard so that you can have special functions built into your program. Its output looked nice, too. Ominous rumblings from the trade that the ultra-high resolution graphics would just make a television freak out turned out to be plain rubbish.

The more important reason for liking the machine, the one that should impress the business user, is that it is designed for a long future.

Inside, it has a design feature called The Tube. This, as we mentioned when first writing about the Proton design from Acorn (the Proton has become the BBC micro) lets you connect the computer to a second, usually more powerful machine, for which it handles all human activities. By May next year, the BBC micro will have a second, add-on processor, a Zilog Z80, running CP/M as its operating system. Some time after that (say when Motorola gets the memory management problems straightened out), a system using the Motorola 68000 will be produced, again ready to use the Proton as its front end.

The front end will handle all the housekeeping chores. It will watch the users at their key-pressing, it will watch the disks spin round, and the printer zip along, and it will listen to the phone and the television for piped or broadcast software. When it has a message worth passing on to the main processor, it will do this, as far as possible without interrupting it, through The Tube, some four kbytes of internal software.

The only serious objection to the BBC machine, the fact that it uses the obsolete and dead-end 6502 processor, is thus destroyed. As a pre-processor and operating machine, the 6502 is more than adequate for any task it is ever likely to meet in the next decade. And as a teaching machine for the next two years or so, the BBC micro is going to be enhanced, not handicapped, by the amount of educational software being generated for the Acorn Atom, much of which will transfer quite easily.

Looking at price, if a full, expandable-with-colour BBC machine costs £335 and the disk controller £70 and disks £500, the extra Z80 and CP/M board only needs to cost £300 to provide a CP/M system (without video) of roughly the same cost as the Osborne 1 and with a much more 'luxurious' specification as far as disk capacity and display quality are concerned.

The only thing that could hurt the machine is the way it is sold. It is true that nobody could afford to boost the BBC micro the way the BBC will do and that using a specialist mail-order outfit should make sure that anybody who wants one can get one. But the computer trade can see no obvious way to make money out of it, because they can't handle it.

This puzzles me a bit. Apparently it arises from the Beeb's desire to appear whiter than white and not to take too large a step into the private industry sector. But the fact is that there is no trade discount on the BBC machine. It costs £235 for the basic model, £325 for the advanced version and that is that.

Obviously there is nothing to stop enterprising shops from buying them in and flogging them at (say) £300 and £400, but for the fact that few people will want to buy them this way unless they can jump the queue. And if the retail trade can't stock the machine, will it sell software to run on it? Won't it rather denigrate it and push the virtues of the VICs and Ataris, where profits can be made on both hard and software?

Murphy strikes again

Some software has no defence against Murphy's law and can fail at any time. The time is chosen in accordance with Murphy's law, that is to say, when loading it from tape or disk, which is why people like to have a spare disk or tape of their favourite programs.

That, naturally enough, is why people like Apple Orchard sell programs designed to let users copy programs that normally cannot be copied because they deliberately deceive the operating system into miscopying them.

Apple Orchard's Copy II Plus runs on the 48k Apple II Plus, costs £40 under DOS 3.3, and can be used to copy itself. 'Unlike most other copy devices,' notes Orchard, 'further copies cannot be made from a copy.' That stops people giving a friend a copy and then watching that friend make a copy for another friend. It doesn't stop one person making a lot of copies and giving them away, of course. But on a large scale, that would be a tedious lot of work unless you were charging for the service. And not too many people would be grateful for a program which can't be copied (see Murphy's Law above) so the only likely prospect for that crime would be the sort of unscrupulous dealer who sells you an Apple at the same price as anyone else, with a 'free' set of software which he's ripped off. You buy from such a pirate at your own risk unless he guarantees to support the programs under normal guarantee terms — but he won't.

If your conscience bothers you about using a copying program, because you have read in the *Wall Street Journal* that piracy costs the publishers £6 million a year, ignore such figures as entirely spurious. Most people copy programs, most do it for

reasons other than back-up, and almost none of these copy programs which they would otherwise have paid for. And an equally unmeasurable number go on to buy a program which they wouldn't have considered buying without the judgment learned from the first. Apple Orchard is on (0908) 53595.

Compiler collection

Without giving too much away, Professor Peter Brown of the University of Kent wants it known that he is working on the answer to the problem of compilers.

The problem with compilers, he says, is that 'typically, they are too big to fit onto many computers, they operate slowly, they require frequent and lengthy maintenance to bring them up to date with new developments in computer programming and that the compilers on any two computers are often different from one another.'

Professor Brown and his colleague Peter Welch expect to solve many of these problems by putting specialist compiling machines onto their local computer network, so that the central compiling machine does all the compiling work, for all languages used around the net and for all machines used on the net.

Brown and Welch aren't saying too much about how they will do this but they are keen to hear from compiler-users, in the hope that these unfortunate people will say what's wrong with the things, and then Brown and Welch can think up solutions.

Let us hope that compiler non-users also get in touch. The reasons why someone avoids a compiler are probably at least as revealing as the reasons for using them; perhaps more revealing, since they will ask for things that compiler users have resigned themselves to doing without.

For instance, most micro users would want to sit down at the keyboard and start developing a program creatively there and then. Most professional programmers, accustomed to compilers, have developed the discipline of sitting down at a desk and designing the program first, on a piece of paper. They learned their trade, most of them, when there just weren't enough computers around to use the beasts to help the programmers but that isn't true today. Brown and Welch are on Canterbury (0227) 66822 ext 636 or 629.

Sauron strikes

Originally, Sauron was a semi-deity of the Wotan type: one-eyed, treacherous, consorter of crows and assisted by flying harpies who haunted battlefields while he tried to rule the world with the assistance of a Balrog called Loki.

This Sauron is obviously designed for the purposes of bucket print shops, since it can go a fair way towards being a typesetting tool — and at £8000 plus including VAT, just being a black word-processor wouldn't be enough.

The Sauron's desire to interfere with the life of its slaves seems to be limited to a 'program generator' which dealers will use, in order to convince customers that they are getting bespoke software 'as would be expected of a system of this calibre,' says its builder, CPS Data Systems, righteously.

It is based on the British-built Cifer 2683 intelligent terminal, with detachable keyboard with colour-coded function keys and the system has 2.4 megabytes on two floppies (quite a lot) and the Sanders Media 12/7 printer, which can change type size and style letter by letter. 'With an ordinary 60 characters per second daisywheel printer, the cost is reduced by £1000,' notes CPS. Oh, and it has a spelling correction program. Or, as some prefer to call it, a misprint detector.

Its main claims to fame, apart from all that, are error-correcting communications from one Sauron to another (presumably through Palantir modules) down a phone line and its masses of black steel. Details on 021-707 3866.

Hard work

There is, at last, some evidence that hard disks are pretty reliable devices. There is also evidence that they're pretty hard to fix. Take a product — any product — and you'll find that the man who makes it boasts of how reliable it is and the man who makes a business repairing it ruins the show by boasting how fast he can fix the hundred and one faults it suffers from and this includes hard winchester disks.

The big thing about winchesters is the fact that they can store an enormous amount of data and save or regurgitate it much faster than floppies can. And the big thing about mini-winchesters is that they are built to fit into the same box that an eight-inch floppy fits in. And the big thing about micro-winchesters is that they fit into the volume of a minifloppy, so manufacturers just whip out the old floppy and bang in the new winchester.

Almost a year ago, I heard stories suggesting that not all winchester disks were perfectly reliable. Mostly, the stories were about one particular drive, but since that was the most common drive, it wasn't surprising that most reports (of any kind) were about it.

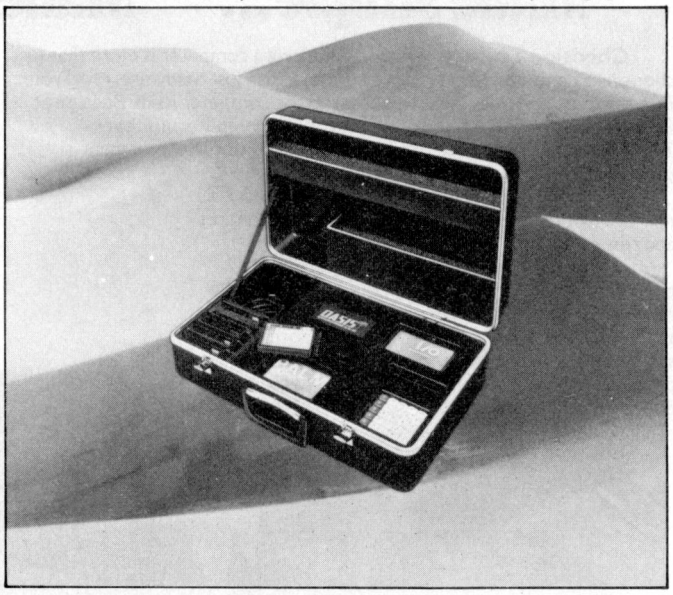
Now, after a year's nervous silence, the suppliers have been hopelessly let down by a reasoned, calm and detailed account of how hard it was to fix the things. Kode Services in Wiltshire has got itself the contract to fix them all over Britain and Europe.

John May, managing director, doesn't paint a bad picture of reliability; in fact he expects around three percent of hard disks installed to fail in any one year and suggests that the figure could (possibly) be as low as one percent.

May's company has, at last, been given a contract by three of the leading makers of hard disks — IMI, Kennedy and Seagate Technology — to maintain their products in Europe. At first, he recalls, the US makers weren't too keen. 'Two years ago,' he told journalists at a recent announcement, 'we approached a selection of US based winchester disk makers and suggested that we should become their repair agents in Europe. Initially the interest we aroused was lukewarm.' At the time, this was reasonable, says May, because they had spare production capacity. They could merely swap a faulty disk for a good one and save up all the faulty ones until the time came when they had enough to send them down the factory production line and fix them on a mass production basis. But today, this spare capacity doesn't exist and the number of disks installed is so large that even if it did, it wouldn't be enough. The result was that users were having to wait enormous times for repairs. 'European users,' he notes, 'have the additional expense and delay of shipping drives to the States.'

But setting up a repair centre isn't just a question of marking off a laboratory area. You need a clean room, a frightfully expensive thing to build and normally only attempted for making microchips. Dust is the cause.

'As you probably appreciate,' May said, 'in winchester disks, the gap



In 10 years' time, any electronic device coming onto the market will automatically keep track of what goes wrong with itself. When the engineer phones it up (it will, naturally be connectable to the phone system) it will report not only the permanent breakdowns ('photo-cell not generating current, transistors burned out on chip 27, voltage too low from stage five') but intermittent ones as well ('on Tuesday, at 6.45, when the phone rang, 17 bits of a message to the video were corrupted by interference picked up from channel six of the analogue server' or 'disk number four mis-read four tracks over the past three weeks, on a non-random basis').

Until self-diagnosis is a lot cheaper and cleverer than today, however, devices such as the Oasis, which can put any electronic computer peripheral through all its paces, are going to be essential aids to the engineer.

The Oasis, from Hal computers of Weybridge, has software which will let it test several different computer peripherals — software called a Peripheral ALgorithm Module, or PALM — and the engineer just plugs in the right module, connects your apparently faulty peripheral, and can soon find out what it won't do. It works in the US, too, on US power supplies of 115 volts at 60 Hz. Details on Reading (0734) 586802.

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Walters Computer Systems Ltd
STOURBRIDGE, 70811
The Computer Shop (Swindon) Ltd
SWINDON, 69406 1
McDowell, Knaggs & Associates Limited
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YORKS AND HUMBERSIDE
Ackroyd Typewriter & Adding Machine Co. Ltd
BRADFORD, 31835 & 32243
Allen Computers
GRIMSBY, 40568
Microprocessor Services
HULL, 23146
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LEEDS, 459459
Yorkshire Electronics Services Ltd
MORLEY, 522181
Computer Centre (Sheffield) Ltd
SHEFFIELD, 53519/588731
Holbrook Business Systems Ltd
SHEFFIELD, 484466
Estate Computer Systems
SLEAFORD, 305637
Mitrefinch Ltd
YORK, 52995

NORTH EAST
Currie & Maughan
GATESHEAD, 774540
Dyson Instruments
HETTON, 260452
Key Computer Services Ltd
NEWCASTLE-UPON-TYNE, 815157
Intex Datalog Ltd
STOCKTON-ON-TEES, (0642) 781193

MANCHESTER AREA
Byteshop Computerland
MANCHESTER, 061-236 4737
Computastore Limited
MANCHESTER, 061-832 4761
Cytek (UK) Limited
MANCHESTER, 061-872 4682
Executive Reprographic Ltd
MANCHESTER, 061-228 1637
D. Kipping Ltd
MANCHESTER, 061-834 6367
Professional Computer Services Ltd
OLDHAM, 061-624 4065
Catlands Information Systems Ltd
STOCKPORT, 061-477 6699
Catlands Information Systems Ltd
WILMSLOW, 527166

LIVERPOOL
Stack Computer Services Ltd
BOOTLE, 051-933 5511
Aughton Microsystems
KIRKBY, 051-548 7788
Rockcliff Micro Computers
LIVERPOOL, 051-521 5830
The Computer Shop (Southport) Ltd
SOUTHPORT, 77783

NORTH WEST
B & B (Computers) Limited
BOLTON, 26644
Tharstern Limited
BURNLEY, 38481
Preston Computer Centre
PRESTON, 57684

WEST COUNTRY
Radan Computational Ltd
BATH, 318483
Calculator Services & Sales (Bristol) Ltd
BRISTOL, 779452/3
Sumlock Tabdown Ltd
BRISTOL, 276685
T & V Johnson (Microcomputers Etc) Ltd
BRISTOL, 422061
A.C. Systems
EXETER, 71718
South Coast Business Machines Ltd
FERNDOWN, 893040
Milequip Ltd
GLOUCESTER, 411010
Devon Computers
PAIGNTON, 526303
A.C. Systems
PLYMOUTH, 260861
JAD Integrated Services (Plymouth) Ltd
PLYMOUTH, 662616 & 29038
J.M. Computer Services Ltd
TRURO, 71626

WALES
Sumlock Tabdown Ltd
CARDIFF, 41361
Sigma Systems Ltd
CARDIFF, 34869 & 21515
Reeves Computers Limited
CARMARTHEN, 32441/2
Computer Supplies (Swansea)
SWANSEA, 290047

SCOTLAND
MacMicro Ltd
BEAULY, 046-371 2774
Holdene Microsystems Ltd
EDINBURGH, 031-668 2727
Byteshop Computerland
GLASGOW, 041-221 7409
Gate Microsystems Limited
GLASGOW, 041-221 9372-4
Robox Ltd
GLASGOW, 041-221 8413/4
Ayrshire Office Computers
KILMARNOCK, 42972

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HOLYWOOD, (02317) 6548

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between the read-write head and the surface of the magnetic disk itself is minute.' Currently, the gap is around 18 to 20 micro-inches and a typical particle of cigarette smoke is many times wider. Smoke in a winchester would plough along the highly-polished magnetic surface, destroying data. So winchesters are air-sealed, dust-free environments and opening them up for repairs can only be done in a similarly dust-free room. Not easy, when you consider that the human body gives off five million dust particles per minute just walking along, and when you consider that the next generation of winchesters will have the heads only two-thirds of the distance away, to record more bits per inch.

Kode expects to have plenty of customers, however. 'With a few exceptions, turnaround times for repair, once the disks have reached an American plant, are now well in excess of 10 weeks,' he announced. By contrast, Kode guarantees a fortnight now and a week as soon as this can be managed.

The end result of all this is to convince me, at last, to take winchesters seriously. With reliable products available, and reasonable service, many of the horror stories currently circulating will vanish and sales resistance will become a thing of the past. And if sales boom, prices will come down, and sales will boom even more.

'I anticipate that by the end of 1982, Kode will be supporting a base of more than 100,000 disk drives in Europe. This figure refers only to those made by the three companies I have mentioned,' May added. He is in Calne, Wilts, on 0249 813771.

Prestel cutback

The decision to reduce drastically the number of British Telecom computers running Prestel (because nobody was using them) proves just how much power the Press doesn't have.

Despite endless stories about viewdata, Prestel and the Information Providers, people have failed to buy their automatic money-takers and those who bought them don't use them enough. Optimists still maintain that the move is premature and that one day it will have to be reversed.

Similarly, Michael Marshall MP went on record shortly before he vanished from his post as Parliamentary Under Secretary of State (junior minister to you) for Industry, saying that the vaguely similar teletext invention (the BBC and ITA sending pages of text through de-coders inside normal TVs) would have a remarkable future success. Marshall predicted a million teletext sets by the end of next year, then he vanished from the Department of Industry.

Even counting the undoubtedly large numbers of people using the BBC micro to get programs off the air through Ceefax, this sounds pretty optimistic. If you're not loading Basic, what good is Ceefax, anyway?

Short words

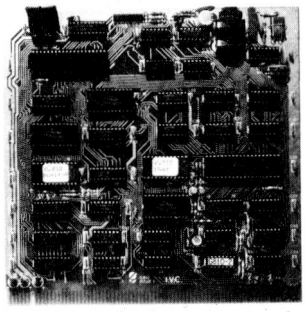
In computers as in speech, it is possible to reduce the amount of unproductive storage and communication time by a judicious reduction in the packaging density of the information medium. Or, it is quicker to explain if you use short words.

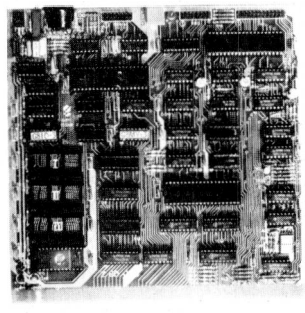
Using this method, Sage de Gale (a consultancy) reckons it can double the capacity of your floppy disk — by using shorter words. It notes that most information on a disk uses many more bits than is really needed. For instance, 400 spaces may be vital to a program but if they come together, all you need is a code for 'spaces' and another for '400' — say three bytes. De Gale reckons that it has refined this sort of technique to the point where its Archive software can pack data into half the normal space. Details from Patrick de Gale, on 086 733 529.

The other Gemini

Looking at the nice machines around today which weren't around a year ago, it is worth recalling the widespread predictions by industry pundits that this wouldn't be much of a year for new machines. Examples to prove the predictions wrong include the Chris Shelton Sig-Net, the Gemini, the Osborne, the BBC micro, and the IBM offering.

The Gemini, most frustratingly, is the best-looking bargain from the UK, which isn't all surprising since its father is John Marshall, who originally gave us the ultra-cheap Nascom. Frustratingly, because Marshall is selling all the machines he and his partner (printed circuit king Manas Heghoyan) can make, into Europe. The Gemini 80 is a strange machine. It is more a consolidation of past machines than a really new one and it owes its origins to the long gap between the collapse of Nascom and its eventual revival at Lucas Logic. History explains the sequence of events: the Nascom actually has a standard bus on which, it was intended by its designer, people could fasten odd bits





and pieces such as speech synthesiser circuits, remote control boards, extra memory, disk controllers, and so on. It's a fairly old trick in the computer business and it works pretty well: it means that people can have a big computer but can start off with a cheap one.

All the companies that moved into the Nascom market did so by designing a special add-on for the Nascom bus, or Nasbus. When Nascom went bust, their annoyance (that there would be no more Nascom customers to sell to) was very much tempered by relief (that Nascom would not be competing in their specialist areas). And very soon, they got together, to sell products in co-operation, and to plot to produce a new computer that would look enough like a Nascom that it could use their special add-ons, but little enough like that they wouldn't face legal reprisals from Nascom itself.

The Gemini is part of the result: its Gemini 80 bus is very similar to the Nasbus. However there are a lot of boards for the Nasbus that won't easily attach to the Gemini (too big, wrong shape) and for them, Gemini and the other add-on merchants have devised a sort of British answer to the S100 bus. It's called the Multiboard, and two boards in the range are shown elsewhere on this page; they can be fitted into a standard Vero case, or a special Kenilworth case.

Dealers who make compatible add-ons (they call themselves the Microvalue Group) include: Business & Leisure of Kenilworth; Electrovalue of Egham and Manchester; Target Electronics in Bristol; Henry's Radio, London; Bits & PCs, Wetherby; and of course, John Marshall's own components shop, Interface of Amersham.

Putting a system together this way is not the cheapest possible method of starting, though it can be very useful for building a system exactly the way you want it. Nonetheless, paying some £850 (inc VAT) for CPU, video board, 64k RAM, disk controller, keyboard, power supply and program memory is far from top whack. Details: (02403) 22307.

HO 'No' to data protection

The Home Office has upset people who reckon that computers can be a threat to privacy by insisting that it can look after all our interests.

Considering that the Home Office's computers and those of the police who are nominally responsible to it, are often regarded as one of the greatest such threats, this attitude can only be regarded as suspicious. So, at least, said a lot of people at the British Medical Association conference on the subject of data protection.

The BMA is concerned that people will be afraid to tell doctors things, unless there is some guarantee that the information can't be simply, automatically and rapidly transferred into publicly accessible data banks. They want a data protection authority to deal with the problem.

Not possible, the Home Office minister, Timothy Raison told the BMA. A data protection authority would create new crimes, not covered by the courts but by the authority, an unacceptable extension of the law. To me this sounds like ignoring the new crimes that actually exist, created by the mass processing power of multiple computers but I'm sure the Home Office knows best, the way it did on Citizens Band Radio....

Rair upgrade

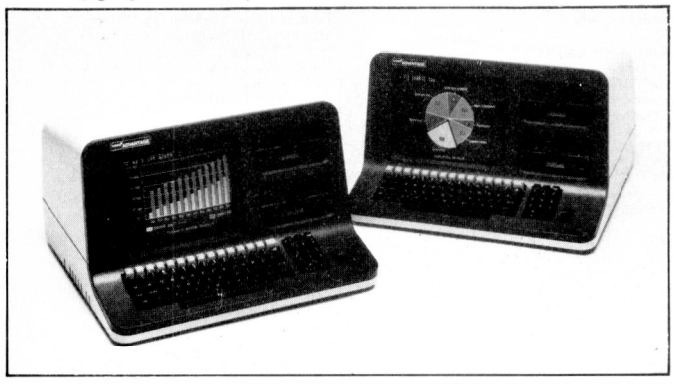
Whatever Rair says, it isn't the first microcomputer company to offer its users the option of 'state of the art' high speed 64 kbit dynamic RAM chips for memory. But at least Rair is one of the first and it is offering a 256 kbyte board (that's got at least 32 of the little things inside) for its Black Box micro at a cost of £1250.

NS Advantage

It is entirely the wrong time for North Star to launch a nice new micro costing less than $4000 when David Broad in Britain has just produced new versions of his Communicator. On its own, there is nothing to say that Comart's boss has easy opposition from America in the new Horizon. It's just that his own look-alike doesn't have to fight its way through a falling pound, whereas the Horizon would have cost £2000 in April and will cost at least £3000 now, before the import cost is added.

The new Horizon is the Advantage; unlike older Horizon machines, it has a built-in screen and very good-looking graphics. And, of course, another new feature: a keyboard. Two disks are built in, as before and both old and new versions of the machine can be linked (one day) into multi-user, local networks.

The rubbing sound you will hear if you ring Broad up to ask about the Advantage will be his hands, gleefully being wrung over the rise of the dollar and how well his Communicator will do as a result. Don't let him gloat: details from North Star in California on (415) 357 8500.



ACT starts

The biggest supplier of business software for micro users is ACT. This is the opinion of ACT, at any rate, which says that games are out and sales are three times what they were.

According to a recent announcement, some £4.75 million worth of off-the-shelf personal computer programs will come off the shelves during 1981. There are other fascinating statistics. ACT has found, for instance that, 'there are now 450 computer stores offering programs of a business nature, plus a smaller number who offer games programs.' There is also a growing number of software consultants, says ACT, 'consultants who undertake "tailoring" in addition to various micro-software houses and publishers selling by mail order.'

ACT says it expects 'a dramatic increase in the number of outlets handling the less sophisticated programs this winter, with the arrival both of a new generation of low-cost personal computers and of cartridge programs, — referring to Atari, Texas, VIC and so on. But from ACT's point of view, the more interesting development will not be the toys and the move of multiples such as WH Smith into selling cartridges for the toys; it will be the arrival of the rest of the 'real' computer industry.

The ACT study pointed to the 'steady improvement' in the quality of business software available, in the judgement of dealers at least. And it predicted the increasing involvement of the more experienced dealers in the bigger 'minicomputers', dealers who call themselves original equipment manufacturers, or OEMs because they disguise other people's original equipment with software and badges of their own.

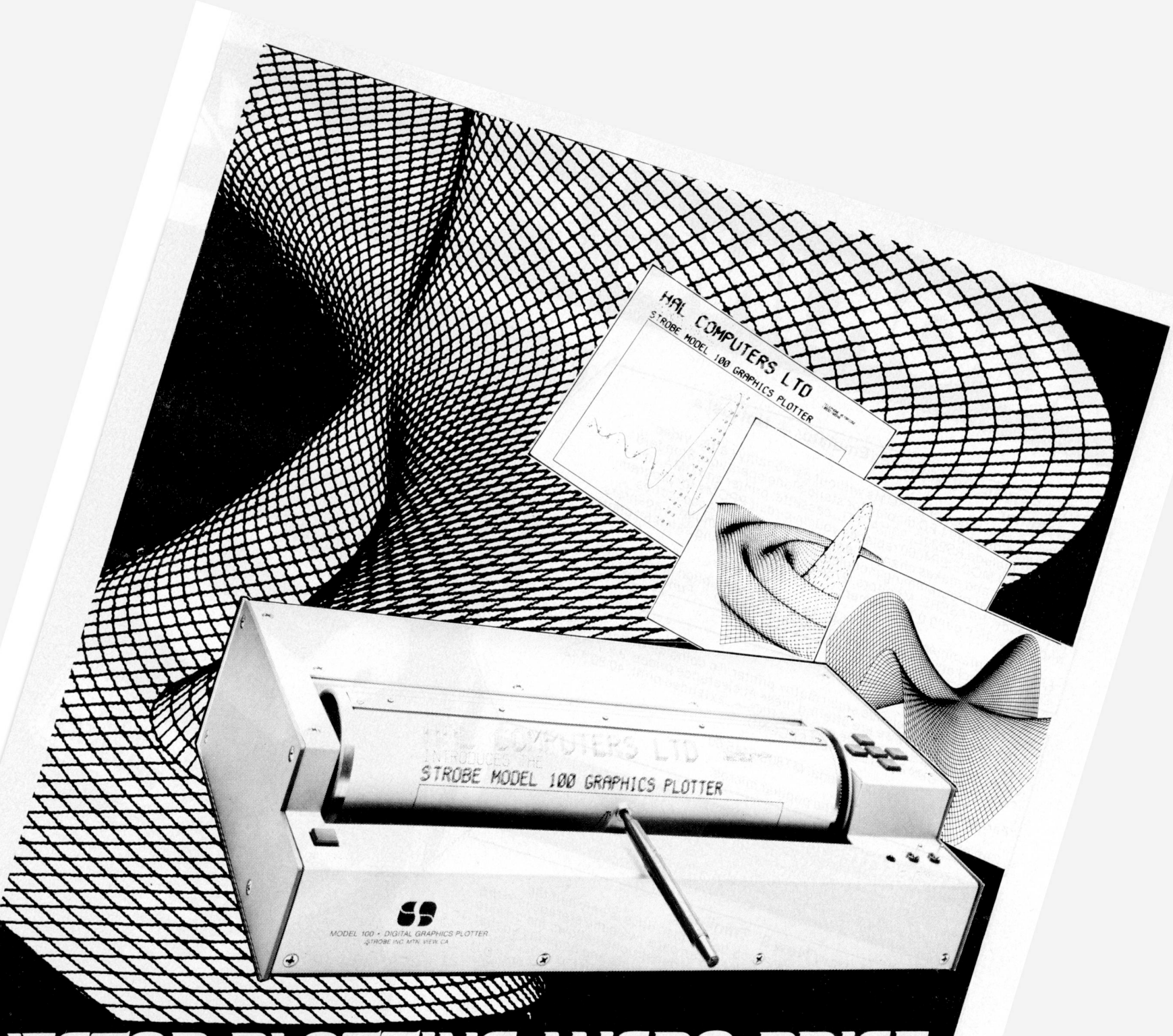
'Many of these companies have been working with mainframe and minicomputers,' says the ACT report. 'They cannot afford not to be in the micro market place and our study suggests that their involvement is causing an all round improvement in professionalism and support for the customer.

And after all that ACT says you can get its catalogue from its offices at Shenstone House, Dudley Road, Halesowen, West Midlands, or phone 021-501 2284.

Intel's analogue

The most unusual computer ever to appear for under £1000 must be the new analogue computer kit from Intel. It is built round the analogue signal processor Intel released a year or more ago and which caused wild excitement in high places where people know what an analogue signal processor is.

Normally, analogue signal processors are a trial-and-error sort of magic, where you work out component values, twiddle the adjustable bits and watch the output to see if it does what you want. The Intel device changes its internal (on chip) values



VECTOR PLOTTING, MICRO PRICE

The new Strobe Model 100 drum-type plotter gives you real vector plotting, interfacing to your computer hardware and system software, from only £690*

✳ *High resolution — 0.1mm at 7.6cm/sec.* ✳ *A4 paper capacity.* ✳ *Will plot in most colours, uses off-the-shelf felt tip pens.* ✳ *Precise operator control.* ✳ *Interactive input of coordinates.*

The Strobe Model 100 can be interfaced to any computer through two parallel 8-bit output ports and one 8-bit input port. Optional interfaces for TRS-80, Apple II*, PET*, and S-100 bus computers are currently available.*

Driver Routines *Source listings of the assembly language motor drivers and vector plot routines for use on 8080, Z80, and 6502 microprocessors are supplied with Model 100. Flow charts of these routines simplify modifications of drivers for custom machine level software.*

*** Unit price for plotter ex-delivery and ex-VAT**
*** TRS-80, APPLE II, and PET are trademarks of Tandy Corp., Apple Computer Co., and Commodore Business Machines Inc., respectively.**

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EP4000 EPROM Programmer/Emulator — Not just a programmer.

Programs a wide range of EPROMs without personality cards. Video output for editing and LED display for stand alone operation. Standard interfaces include RS232C, 20mA, TTL, cassette, printer and DMA. In EMULATION MODE EP4000 replaces your in-circuit PROMs for program development and makes changes, entries, edits simple. Accessories include Bipolar programming modules, multi EPROM simulator adaptors, buffer pods, ERASERS, Monitors, 2764/2564 programming satellite, printer and production gang programmers.

EP4000 programmer/simulator £545.00 P4000 production programmer £545.00 (9 sockets) Eraser £78.00 Monitor £88.00 Printer £395.00

Microtek MT80

Probably the most reliable small matrix printer. To coincide with the move into our new factory we are offering these at clearance prices. 9 × 7 matrix, upper and lower case — one only ARABIC — , extended print, 40,80,132 column, 125 CHARACTERS PER SECOND.

Parallel MT80P £395.00 Serial MT80S £445.00

Cables available for all of the popular micros.

DYSAN DISKETTES. Indisputably the best you can buy.

30,000 diskettes in stock. *As well as the standard range of diskettes for Apple, PET, TRS-80, etc, we also supply pre-formatted for: CPT 8000, Micom/P5002, all IBM, AES/Lanier, Atari, Nexos 2200, Wang, Zenith and P2000. For immediate delivery call our HOTLINE... Weybridge 48346/7*

The Revolutionary New 8" Thinline

Tandon's revolutionary new 8 inch floppy disc drive is only half the thickness of earlier drives so that you can pack twice the storage into the same space. In addition a new method of construction allows the drive to constantly compensate for changes in temperature and humidity so that real capacities of up to 4.M.bytes are now achievable in the usual 8 inch floppy disc drive envelope size. The TM800 series drives require only D.C. power (5v and 24v) so that they run cool and no changing of pulleys and belts is needed for manufacturers who want to ship products abroad.

Our new low profile packaging, designed and built in the U.K., complete with power supplies makes incorporation into, or addition to, existing systems simple.

APPLE II & TRS-80 COMPATIBLE MINI FLOPPIES

This is our popular TM 100 series mini floppy...
Tandon make 40,000 of these a month. Available as bare drives and packaged in single and dual cabinets with power supplies. Capacities from 100K.bytes to 1 Mbyte per drive! Compatible with TRS-80, Video Genie, SUPERBRAIN, Horizon, Zenith, SWTP, Heathkit etc., and supplied as the standard drive with many of these systems.

TRS-80 compatible (in cabinet with power supply)	*DUAL UNITS*	*40 track*	*£399.00*
		80 track	*£549.00*
	SINGLE UNITS	*40 track*	*£219.00*
		80 track	*£289.00*
APPLE II Compatible	*Single disc*	*£249.00*	
	Dual disc	*£488.00*	
APPLE Controller board DOS 3.3		*£POA*	

Prices exclude VAT and delivery charges.

SPARE PARTS SERVICE AND TRAINING

We carry a complete stock of emergency spare parts for Tandon disc drives and we can fix any drive on a short turn-round. All final testing is carried out on an in-house ATE drive testing system which can run 73 separate diagnostic programs to ensure that your drive leaves us in absolutely first class condition. A less complex calibration service is also available. Full product support exists for genuine OEM customers and we run single day training courses at regular intervals. Call our service engineering department for further information.

We carry the full range of Dysan alignment diskettes and a staff of Sales Engineers will be pleased to help you with any queries.



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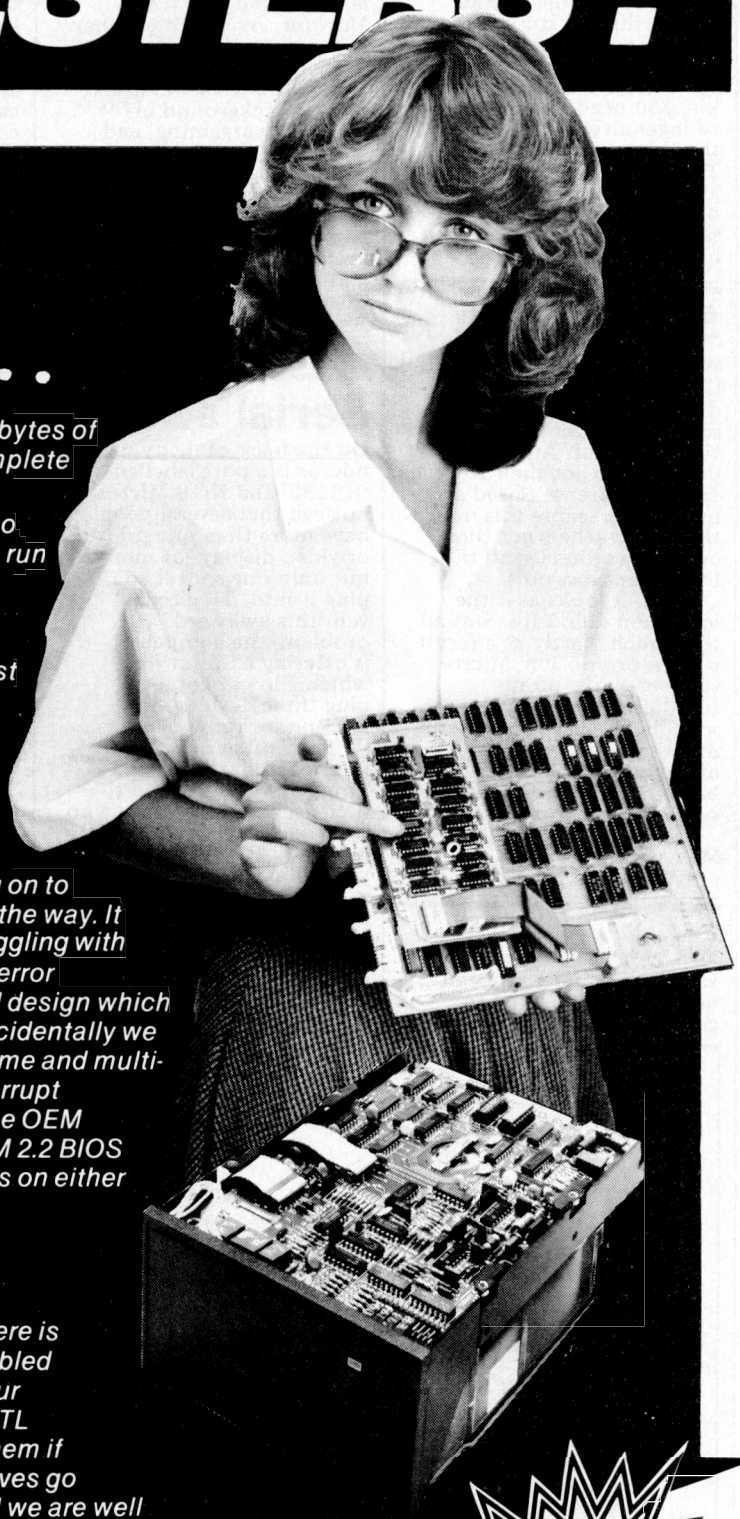
WINCHESTERS?

I've got just what you're looking for....



Our new Micro Winchester gives you from 5 to 20 M.bytes of hard disc storage from as little as £1425.00 for a complete ready-to-go, plug-in system with software.

Floppies and larger more expensive hard discs are no match for our new drives which pack enough data to run serious business or technical applications software into a mini-floppy size 5¼" unit. Your data is protected in the sealed enclosure making diskette handling problems a thing of the past. The disc is fast — 40 times faster transfer rate than a mini-floppy — yet fits into the same space and so can be used as a replacement or an enhancement.

Controllerbility

Our controller comes with a range of adaptors to plug on to most popular micros and there are more adaptors on the way. It supports two discs with ease and while others are struggling with less stable analog data separators and speed-eating error correction circuits, we use a high performance digital design which literally locks into the data stream and stays there. Incidentally we also sell digital data separator cards to OEMs. Real time and multi-tasking applications benefit from the controller's interrupt capability and macro level command structure and the OEM version features a simple software interface and CP/M 2.2 BIOS with extensive development aids. The software comes on either 5¼" or 8" diskettes together with Boot PROMs.

Service and Support

If you are impressed with the specifications so far, there is more to come. Our packaged sub-systems are assembled in-house and they carry a full one year parts and labour warranty. Our controllers are built completely from TTL logic — there are no fancy chips — so we can fix them if they ever break down. Dozens of floppy disc drives go through our workshops every month and we are well known within the industry both for our training courses and our heavy investment in computer based disc test equipment. If your Winchester ever stops working you can depend on us to fix it.

EE US N STAND 9043 AT COMPEC

For: SUPERBRAIN, S-100, APPLE II, HEATH H89, TRS-80.

DEALER ENQUIRIES INVITED

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under software control. The only trouble is that before this latest kit, you needed a hefty chunk of expensive hardware to get the software in. With this kit, you need a hefty chunk of ingenuity but at least the thing only costs £655, The dealer who told me about this is Rapid Recall, on (0494) 35634, but I dare say other Intel distributors have the SDK 2920 too.

Selling well

When Microsense first offered the Apple computer which it distributes in the UK to schools, it offered a first-time discount. And all the dealers who got their Apples from Microsense raised a huge fuss because this meant that the teachers got their computers direct, and the local agent lost out.

Well, it looks as if the local men didn't lose out all that much. Partly as a result of that promotion, Microsense can now point to 1000 Apples in UK schools, despite the Government's choice of the BBC micro and Research Machines' 380Z as official education machines.

And another 1000 says Microsense, are in universities.

War mag

Until now, there has been no magazine devoted to games software for domestic microcomputers. Now there is: it's called *The War Machine*. As the title rather betrays, it is into combat games and claims that readers 'came to microcomputers from a background in hexagon wargaming, and others are fantasy role-playing gamers.' Not for Space Invaders freaks, then. It costs £1 for the first issue, and they hope to publish it every two months. Details and postal order to MW Costello, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BU.

Serial switch

On the back of many modern micros is a port labelled 'RS232' and KGB Micros has noticed that several people have more than one printer, or video display, or modem but only one socket to plug it into. To circumvent this awkward problem, the company is offering a Softswitch which allows people to plug three devices into the one socket.

The Softswitch can do nothing about those irritating systems designers, such as Triumph Adler, who have redesigned the RS232 interface. But assuming that your video and printer have sufficiently similar RS232 plugs, you may be able to adjust your software to con you into thinking that you have two or three sockets. 'Softswitch works by sensing a user-defined two-character code, which preceeds data being transferred,' explains KGB. 'This code switches the data to the appropriate output port' and the actual switch can be as quick as you can send the code, it continues.

At the time of writing, I don't know how to change applications software to operate the switch, or what restrictions are likely to result but a small bet that changes and restrictions will occur might attract me. Details on Slough (0753) 38310.

Faster not cheaper

'Going faster' is a concept attracting several microcomputer makers who have satisfied themselves that they can't win the fight for 'going cheaper' with the BBC micro, Osborne and Gemini around.

Frankly, with the IBM machine on the horizon, 'going faster' with a Z80-based system looks like a short-term grab for glory to me and it certainly does make for vastly expensive machinery, like the MC Computers' Quasar QDP-100, costing £3380. You get a lot of disk capacity (two megabytes) and some slots to plug in S100 cards, but otherwise it's a bog-standard CP/M system without screen or keyboard, rather like the Cromemco.

I'm slightly more impressed with Paul Joyce's new machine at Graham-Dorian; he's brought in the Performance machine from MicroPro. It was designed by MicroPro, who designed the best-selling Wordstar word processor and it was designed to run Wordstar at its best, with high speed and lots of extra features and a big disk but it costs the best part of £7000. Quasar is in Northampton on (0604) 858011. Graham Dorian is in Reading on (0734) 664 345.

Golden turkey

This time they've gone too far. The Americans, I mean, with their obsession for trademarking every normal word in the English language.

Remember how Zilog earned widespread ridicule when it tried to trademark the letter 'Z'? Now somebody has trademarked 'English' as the name of a computer language.

That somebody is an outfit called Microdata Corporation in California (where else?) which has taken to advertising its business system, the Reality a silly enough name, if ever I heard one. I quote from Microdata's advert in the 24 August edition of *Fortune*: 'Microdata's Reality computer system speaks your language: English', etc, etc. At the bottom there's the line: 'Reality and English are registered trademarks of Microdata Corporation, Irvine, CA'.

Starting as of now, we're going to award an annual Golden Turkey trophy for the silliest marketing/advertising ideas in the microcomputer industry. At the moment, as usual, Britain is lagging seriously behind the Americans in this, and it's about time we got our act together. So, if you spot anything that could rival the Reality ad (and that's far ahead of anything else in the Golden Turkey ratings right now), let us know at *PCW*.

Taped tips

'Oh, you know about computers, do you? I'm thinking of getting one of these new micros: tell me, do you think I could put all my customers on one, and should I use an Apple or a PET?'

People at parties who ask this question while you're trying to pour straight can now be dealt with more kindly than with the usual beer-on-trousers diversionary gimmick. You can instead refer them to the National Computing Centre, which has released a cassette tape on 'How to choose your small business computer' which gives checklists, jobs to do before you get the system, jobs after, sources of advice, book lists, and glossary of jargon terms.

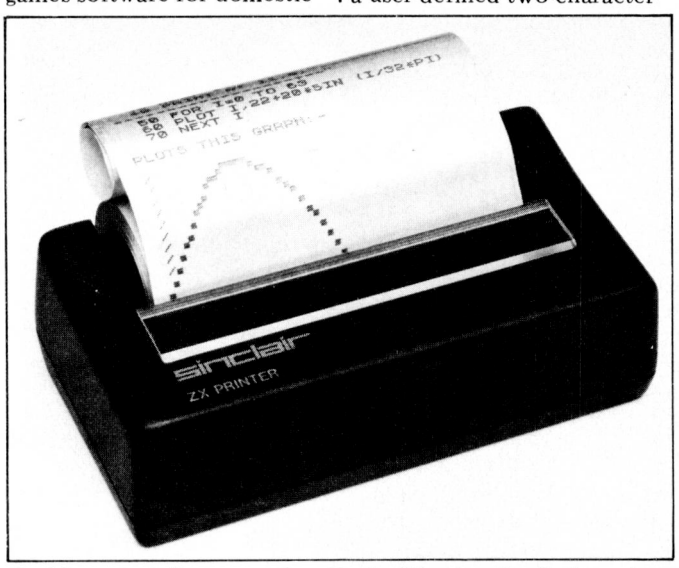
Tape and booklet cost a mere £10 from The Microsystems Centre, 11 New Fetter Lane, London EC4A 1PU or from Manchester NCC headquarters.

Whaa?

It's difficult to be sure but I think the new Uniqard is an 'ideal prototyping printed circuit card.' It is, I think, designed to allow circuit designers to put prototype boards together and know that some of the important design criteria that normally only appear in the production version, are there from the start.

If you think I must be pretty feeble not to be sure, remember first that my phone bill can't be pushed to infinite lengths, nor can I spend all week talking to everyone who puzzles me with an announcement that looks worth running.

Listen to this: 'Introduction. The Uniqard was developed as a flexible prototyping board for in-



Do I have to tell anyone that Uncle Clive has finally launched his £50 ZX printer? Surely everyone knows? You do? Great! Bet you didn't know that Sinclair sales are now running at £20 million per year, though, did you? And I'll tell you what: bet you can't get a printer yet, either.

The amazing enthusiasm of Sinclair users for their machines never ceases to amaze me, even though I think I recall saying that a high-volume sales machine like the ZX8X series would generate just such self-help enthusiasts. Latest to come to my attention is G A Bobker of 29 Chadderton Drive, Unsworth, Bury, Lancs, who produces a sort of quarterly called **ZX-Guaranteed** *with lots of free software and circuit ideas, not all of which are fully recommended by the author. Bobker is a dissident; that is to say, he is rude about Uncle Clive. If that sort of thing offends you, don't write to ask his price. Phone him instead on 061-766 5712.*



The Apple II may be less than a year away from death as the company's biggest money spinner and there may be three new machines just waiting for it to flag. But as long as people build musical instruments like this around it, Apples will continue to change hands. This is the new alphaSyntauri synthesiser, with a new operating system that lets musicians go beyond performing and recording what they played; it adds such a wide range of sound manipulations and storage options that I'm not going to try listing them or explaining them here. Suffice it to say the new system is available on the old alpha by adding a new disk of software and full details are available direct from Syntauri Corporation at 3506 Waverley Street, Palo Alto, CA 94306.

house use. Its prerequisites were low cost and minimal wiring overhead for the development of a networking microsystem in respect of memory, processor, and global/local bus buffer PCBs.

'From this objective, the concept of a flexible board for production use arose, leading to considerable savings in general inventory and stock control.'

There is more amiable waffle of this sort, totally opaque to me, followed by a row of asterisks and the statement: 'THE UNIQARD IN CONTEXT', which includes paragraphs such as: '4) Plated Through & Non-plated Through Holes. A combination (mainly plated through) achieve inherent topology and afford user-defined circuit extensions by simple through hole link.'

I can only agree. For details, contact Wessex Microcomputers (0063-22-402) in Somerset. I'm fairly sure this is something clever but for the life of me, I can't work out what.

Cunning stunt

Admire, if you will, the use of the word 'conversion' by ACT for the process of getting the Micromodeller, which some say is like Visicalc but nicer (and much pricier) to run on the modified PET. The difference is that ACT supplies a Stunt Box with the software on it.

Details from ACT Microsoft on 021-501 2284.

Zak's view

Rodnay Zaks, a name all of you will recognise from the computer book stalls, reckons that computer makers are slowing down the growth of the micro market.

Zaks released his analysis of the microworld at the recent *PCW* Show. And gave us several statistics, previously published, to show just how huge the micro market was going to be. His opinion is 'that it could be many times larger than these figures show.' What is slowing us all up, said Zaks, is the fact that both customers and technology are way ahead of the personal computer market.

Most of today's best sellers are deeply rooted in the past, he noted. Bright new chips like the Motorola 68000, the Z8000 and the Intel 8086 are not to be found in any common machine. Indeed, they are hardly to be found even in any available machine and certainly in no cheap machine, despite the fact, Zaks observed, that the Intel 8086 is now cheaper than the Z80. And the Intel 8086 has some chance of running a more modern operating system like Unix, where the eight-bit micros of today's systems, cannot.

'Unix may be all that its proponents say and be a step forward,' said Zaks (I'm paraphrasing somewhat) 'but the suppliers just don't understand that to the user, all these wonderful features and protection are useless if the machine takes 10 seconds to interpret his commands. And today's eight-bit micros are just too slow to run Unix'. So we have the old Apple II, the creaking TRS-80 (Model I banned in America, Model II very pricey, Model III still not really supported) and the PET which is strong only in Europe and has made a real mess of things in the US and is no more modern except for the MicroMainframe. On all this rather outdated hardware, we have Visicalc, Wordstar and CP/M, of which only Visicalc has any real future to it.

While the chip makers have the most amazing technology waiting, the customers are equally far ahead, he noted. 'We used to have to explain what a computer can do. Nowadays, by contrast, the customer knows what he wants. He wants indexing, forecasting, word processing, database, and other things and the machinery just can't deliver. There is a tremendous market pressure building up, waiting for the right products to emerge,' Zaks said.

I think he's right about the possibility of selling many millions — even billions-worth of micros by 1985. I'll also add my opinion that the more powerful machines won't be widely available until they are cheaply available. Who needs powerful minis, anyway? We've got those already, with masses of software already written. When powerful minis cost £335, it's a different prospect, however.

Z8000 module

One good sign that the Z8000 may be turning into a widely available chip is the release, by its designer (Zilog) of a cheap development module for engineers to play with.

It's called the Z8001 Development Module. It has some minimal monitor software, a segmented Z8000 capable of driving eight megabytes of memory but with only 16k words on the board and some input and output ports. Details from Zilog in Maidenhead on (0628) 36131.

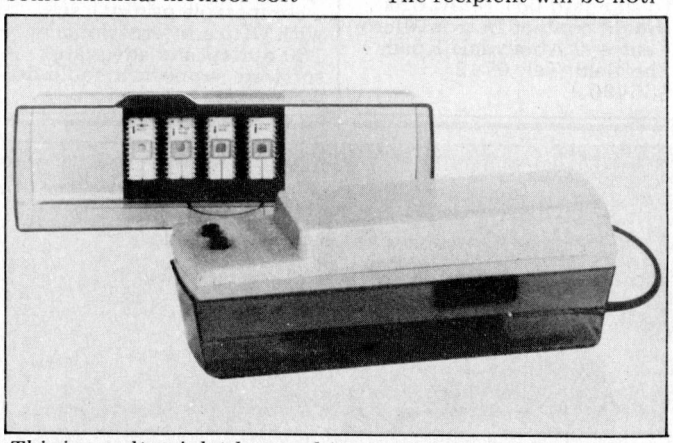
Electronic mailbox

In the September issue of US magazine *Microcomputing*, editor Wayne Green devotes his 'Publisher's Remarks' column to the need for, and the megabucks to be made from, an electronic mailbox system, ie, a system for sending text over the phone line via a microcomputer, stored for perusal at leisure by the recipient's computer.

If we skip over the issue of whether or not 'The Source' and other such networks are to be counted (Wayne doesn't mention them), then for once the little old UK is ahead of the game. Prestel called a press conference on 23 September to launch its Mailbox service. Available initially only to subscribers in London and the SE who have access to the Enterprise computer, the facility will be extended to the other computers of the Prestel network in early 1983 once PANDA is in operation.

The sender calls up a would-be recipient's account no. and then accesses a 'mailbox frame' on the Prestel computer. If he/she has an alphanumeric keyboard he/she may deposit therein a screenful of message; if only a numeric pad, then a variety of preformatted messages may be left, such as 'Order acknowledged', 'Booking confirmed', 'Congratulations' and 'Get well soon'. The latter include wonderfully artless graphics, such as a glass of champagne or a basket of flowers! The cost will be 5p per frame but is on free trial offer until January 1982.

The recipient will be noti-



This is an ultraviolet box and it costs just £45; don't try to get a suntan with it, or you'll be disappointed (it'll blind you if you manage to jimmy the safety interlock system) but for erasing eraseable memories, it could be a bargain. Details from Hi-Tek Distribution in Cambridge, tel 0954 81996.

fied that a message is waiting the next time Prestel is accessed; a directory of users will be available, obviously enough, on Prestel. With first class post now at 14p it only requires a modest Fortran program to calculate how many words your message needs to be before you break-even on such a deal. You didn't forget to add the connection charge and price of the phone call did you? Hardware permitting, though, at least your message will get there in less than four days via Prestel.

Computer cosmetics I

Ashamed of your ZX80/81s scrawny physique? Bullies will no longer kick sand in its video interface if you *conceal* it completely within a Fuller FD81. This is a case/keyboard/power supply unit into which the Sinclair PCB fits; Fuller Designs claims all Sinclair peripherals are accommodated, and that its own motherboard and 16k RAM board will follow. In kit form or assembled, from £18.95 (keyboard kit), details are available from Fuller Designs Ltd, Sandfield Park East, Liverpool L12 9HP (state whether ZX80 or 81).

Computer cosmetics II

If on the other hand you are inordinately proud of the number of Apple add-on cards you have amassed, then a transparent lid called 'Appleview' will allow the neighbours to ogle them. Such exhibitionism will set you back £17.50 plus VAT. Should your neighbour be inflamed to covet them, you can deny him/her access by adding an 'Applelock' for a further £12.00 plus VAT (also adds to standard lid). Show-offs should contact Datron Micro Centre, 2 Abbeydale Road, Sheffield. Tel: 0742 585490.

In brief

On the subject of gaming and pecuniary reward. . . Ingersoll announces that Missile Command and Asteroids are now available for the Atari Video Computer System. Several of our staff could be saved from destitution in the pubs and arcades of the West End; but only if they release Battle Zone as well.

On the other hand Tantus Microsystems announces succesful trials with a 'leading bookmaker' of a new terminal which allows direct entry of telephone bets into a computer. Advantages include 'low cost bet checking, setting and accounting'. Why not a terminal which directly debits a punters bank account without the tedious business of betting at all. . ?

Toshiba launch

Toshiba's new T-200 Small Business Computer is being launched by Office International at the International Business Show (20 October). The T-200 is to be marketed as an integrated system, which includes 80x24 screen, 560k of twin double side/double density disk, RS232C interface, a detached keyboard and an 80character 125 cps dot matrix printer with 132 character option. 64k RAM is standard and Toshiba Business Basic which is said to include 'the main utility programmes' completes the package; the press release carefully claims 'the ability to operate in CP/M 2.2' which is not the same as claiming that it's available yet. On the other hand, invoicing, ledger and payroll software are to be available on launch.

The hardware looks very neat in the picture. The package price of £2995 is not far off the mark for that spec (check a Superbrain with a comparable printer), so with Office International's 130 outlets and adequate software support, it could do well.



Contrary to this evidence, you don't have *to have a double-barrelled name to use Prestel (see 'Electronic mailbox').*

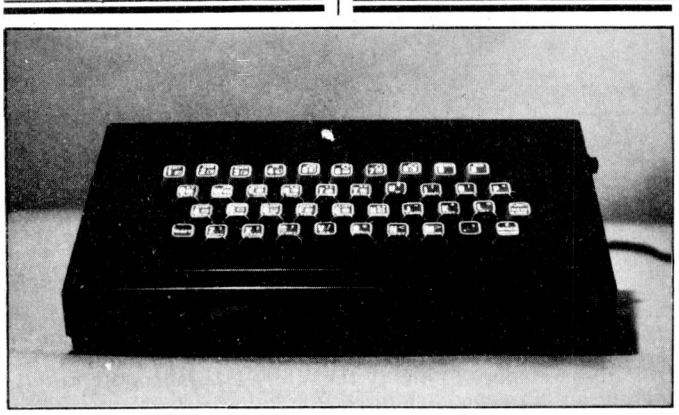


Toshiba's T-200 system. Green screen VDU plus obstructive hairstyle are said to reduce operator fatigue (see 'Toshiba launch').

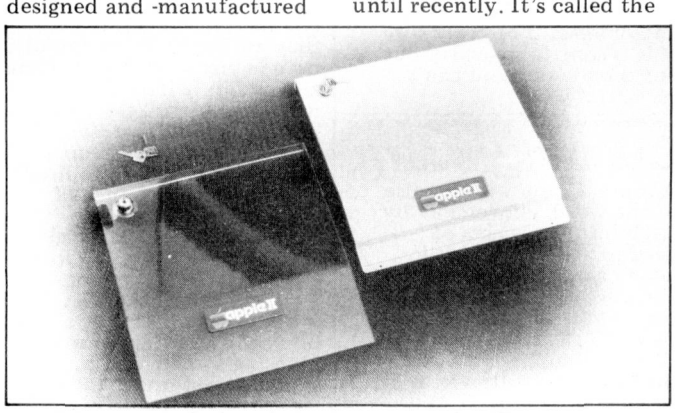
And now, the micro you can run a truck over

What has 144k of non-volatile CMOS RAM, a Z-80 compatible processor, Basic in ROM, is hand-held, British-designed and -manufactured and can be run over by a truck with impunity?

Yes, it does exist and no, I hadn't heard of it either until recently. It's called the



Conceal your ZX81 (see Computer cosmetics I)



Reveal your Apple (see Computer cosmetics II)

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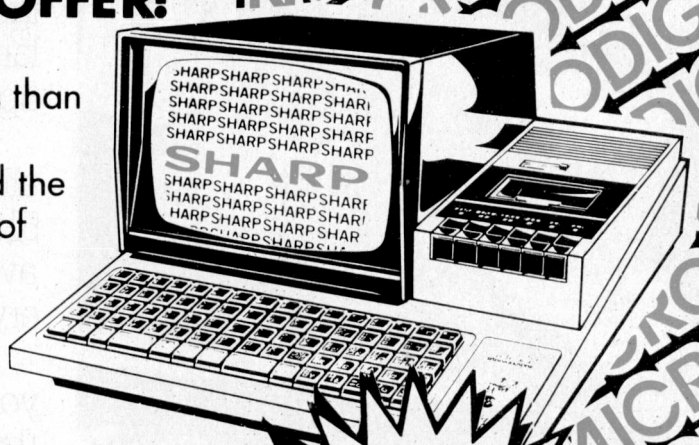

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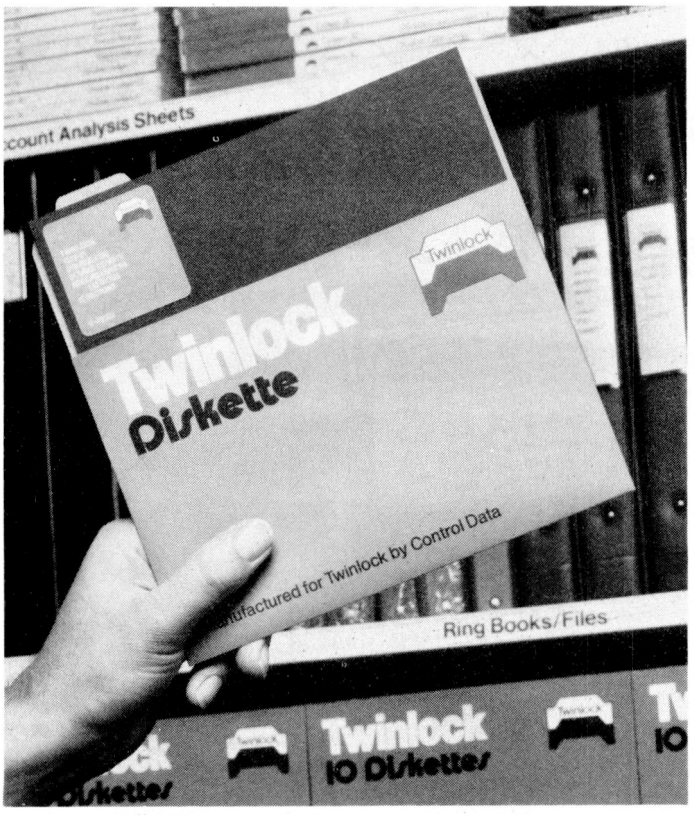

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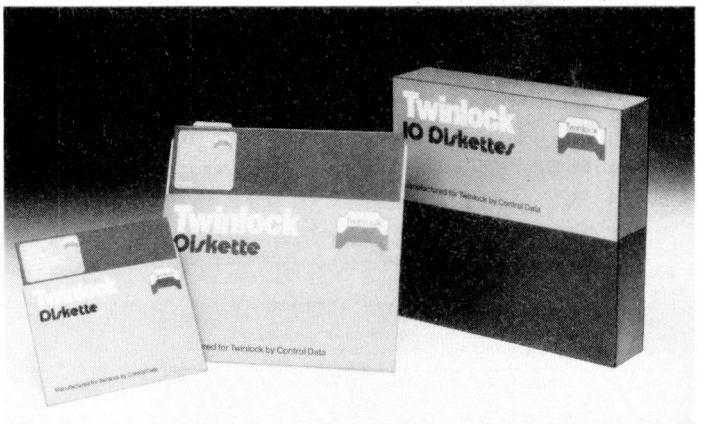


NEWSPRINT

Husky 144 (rugged, outdoor, geddit?) and it is the work of DVW Microelectronics, a subsidiary of AID (Allied International Designers Ltd). DVW has developed the Husky to a full working prototype and a first batch of virtually hand-made machines (the alloy case is sand cast and machined) will soon be available at a necessarily high £1000+ price. But AID, who are aggressively and refreshingly market orientated, are quite clear that volume production with an ABS plastic case and a PET/Apple-competitive price on both sides of the Atlantic is the ultimate aim. The first machines, though, will go to public utilities, such as the Severn-Trent Water Board, in collaboration with whom the Husky was developed. They intend to use it for complex on-site water-flow calculations.

The machine has a very impressive specification indeed. The processor is the NSC800, a relatively new chip which uses the 8085 bus and is Z-80 compatible. The 144k of non-volatile CMOS RAM (also NSC) is paged and automatically managed to appear to the user as a continuous block.



The Husky 144, perhaps the most powerful hand-held computer to date; you can run a truck over it, but don't drop it on your foot.

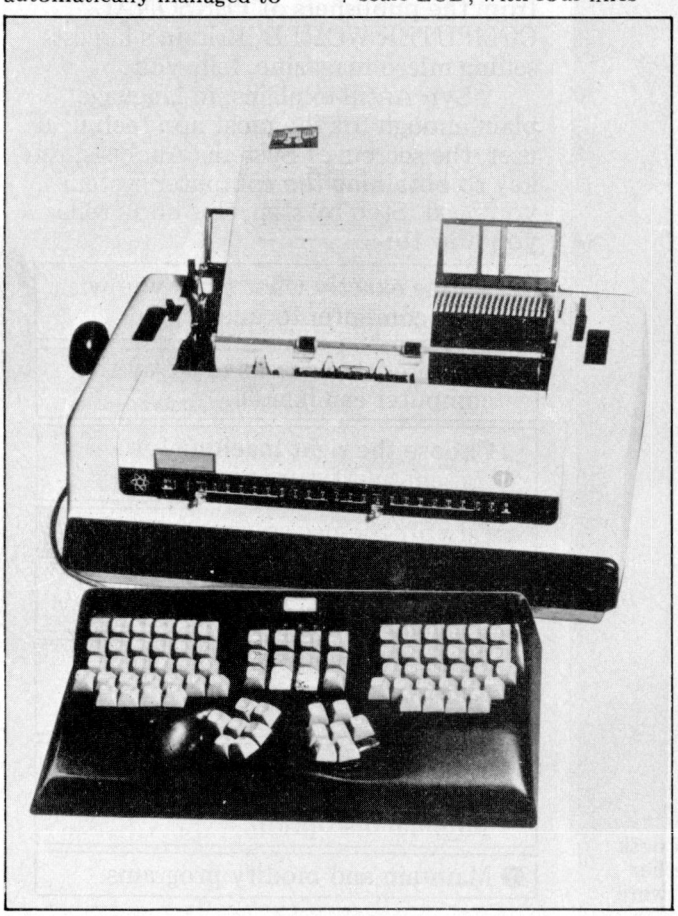
The display, of Japanese origin (Epson?), is a large-scale LCD, with four lines of 128 characters total; the first LCD of such size to be marketed in a computer product, but not the last. The keyboard is a sealed touch-sensitive job with a central numeric keypad, QWERTY and cursor/scrolling keys. 8k Basic is in ROM, a DVW implementation on the prototype, probably Microsoft on the production machines. The whole shebang is cased in a rugged alloy case, which is to a military hardware specification which includes being waterproof, shock resistant and 'Arcticised'. It weighs in at a chunky 2kg at present and is meant to be carried on a shoulder strap. Power is by 1000 hour alkaline cells with eight hour reserve cells as back up. An RS232 interface allows a printer, VDU or acoustic coupler to be connected.

The firmware has obviously received much thought; perhaps the nicest touch is that the instruction manual is held in 8k of ROM and accessed via a HELP key, which selects the page appropriate to the current activity, though you can scroll backwards and forwards through it at will. A real time clock can automatically log data with entry time and date.

As if this were not enough, DVW has set itself the heroic task of designing an outdoor-proof disk drive, also battery operated, so that the Husky can support CP/M!

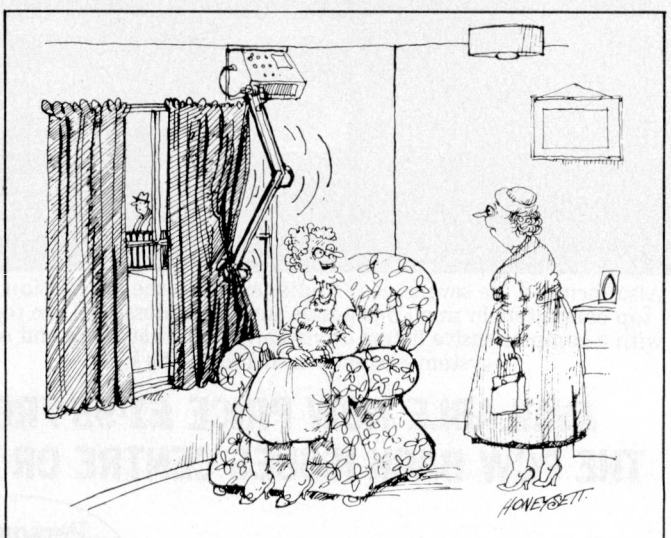
Altogether a product which deserves to succeed, though the transition from 'hand made' to volume production and a keener price will not be easy to achieve, judged by the experience of some previous British bright ideas. We hope to Benchtest the Husky very soon.

Enquiries to David Viewing, DVW Microelectonics, 10 The Quadrant, Coventry CV1 2EL. Tel: 0203 56580/27535.



This squishy typewriter, the Maltron, is normally completely useless to typists. First, it has all the keys in the wrong place (designed to be much more easily operated but in the wrong place for a fast typist who can use a qwerty machine) and second, it normally isn't attached to a typewriter; it's normally just an electronic keyboard.

Both these objections have been overcome by Ergonics, a company which has produced a qwerty version of the keyboard for dinosaur typists like me and has built it into a typewriter (illustrated) which can be expanded into a microsystem. Details on Oxford (0865) 55921.



'The computer detects any form of movement outside and automatically moves the curtain.'

DESK TOP COMPUTING

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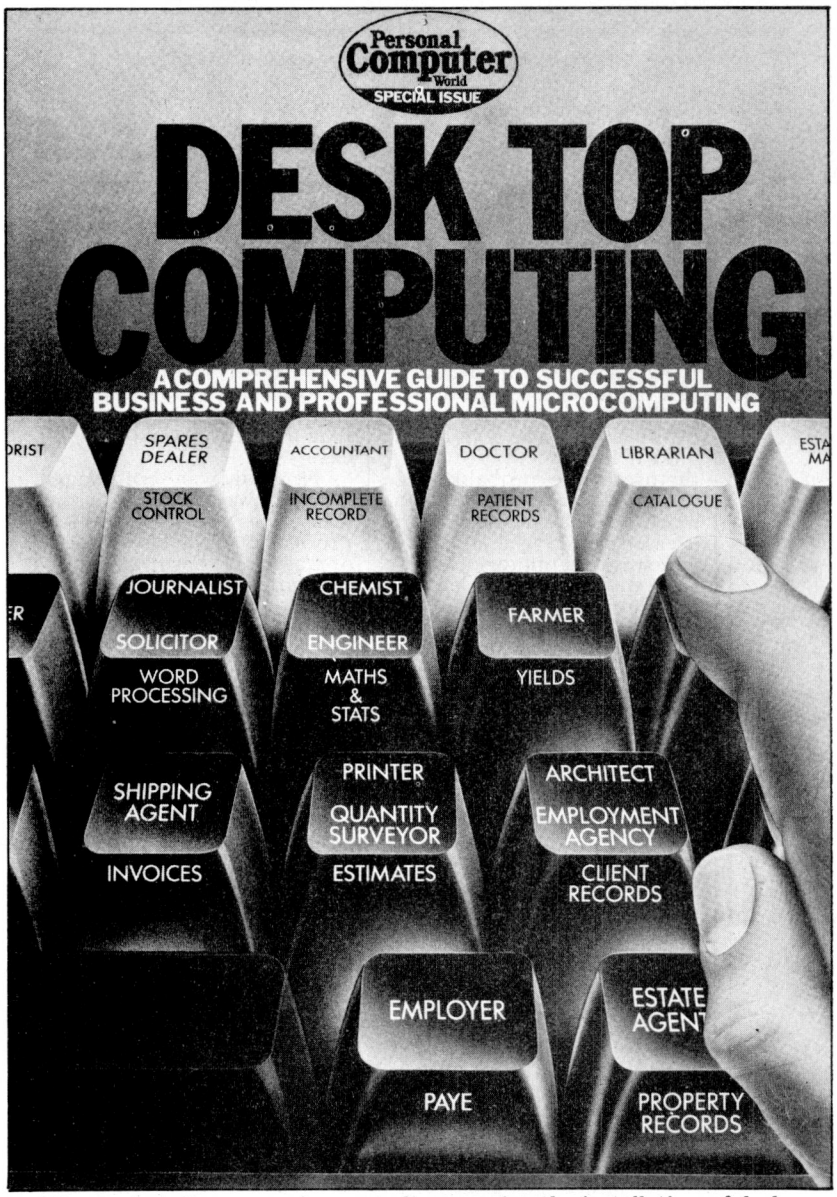

Also included are several case studies covering the installation of desk top computers in small businesses and for professional use together with a comprehensive listing of virtually every hardware and software system currently available in the UK.

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Personal Computer World SPECIAL ISSUE

BANKS' STATEMENT

LAUNCHED LEVIATHANS, MANGLED MINNOWS

Martin Banks looks at the effects on the micro industry as the big companies move in.

Imagine the scene. Ex-Hollywood B-movie actors mix nonchalantly with the ageing Florida blue-rinses on a harbour wall somewhere near Boca Raton as the most important VIP, a man with ne'er a Cary in the world, takes up the champagne bottle in his hand and says those immortal words: 'I name this ship "The IBM Personal Computer". May God bless her, and send my love to the competition.'

As 'The IBM Personal Computer' begins to glide out into its future life of tracking its manufacturer's previously uncharted waters, a wit in the crowd yells, 'Hey, that baby's heavy. I'd hate to be a minnow and have that land on my head.'

Well, there you go. I have managed to start by writing nonsense again. And even though it is nonsense, it has a potential ring of truth about it, a ring of truth that possibly bodes well for some and ill for others.

As mentioned before in *PCW* (and, doubtless, a million other places), that ultimate leviathan of the computer industry, IBM, has been threatening to launch a new baby system aimed directly at the market and users developed by the likes of Apple, Commodore, *et al*. Well, of course, it has now been and gone and done it, and by initial appearances it would seem to have done it rather well.

It is only the first of the majors to launch a full-blown tilt at this business, and there are no doubt many surprises yet to come from other companies. These will be added to the recent prouct introductions from such not-quite-leviathan-but-very-significant companies as Hewlett-Packard, Data General and Digico.

All of these must be added to the introductions that have come from the Japanese, with Sharp's PC-3201 being followed by NEC (itself a corporate leviathan, though not in that class through computers alone) launching its PC8000 range. Then again, there is Kalamazoo muscling in on the act. The company is better known for man-powered administration systems but, by the time you read this, it will have launched its own baby computer system with 'Made in Britain' written right through it.

All of these companies have taken due note of the direction the mass of users have, in fact, followed, rather than the direction they were expected to follow. When the original microcomputer manufacturers started to set themselves up, they were predominantly run by computer freaks. Their first customers were also computer freaks. It maybe seemed logical to suppose that every other customer would also be a freak.

Not so, of course, for the small business fraternity latched on pretty quickly to the things. As the technology improved, so these users could do more wondrous, and usable, things with them. They grew into a significant market.

More importantly, perhaps, they started to mark a more long-term direction for the whole computer industry, a move away from reliance on mainframes and minis, and a move away from the traditional manual methods of small business administration. Now, for a company that manufactured mainframes or minis, or manual business administration systems, this was a fact worth noting and acting upon.

IBM

Acted they now have, with the jolly blue leviathan IBM well up towards centre stage. It is perhaps on the performance of IBM's personal computer, more than any other company's, that the fate of the existing microcomputer manufacturers now hangs. If IBM gets it as right as it might at first appeared to have done, then some of these companies could be in for a rough ride. Some indeed may not make it.

I don't intend to waste too much space writing about the actual IBM machine here, for others will no doubt partake of that sport. And excellent sport it should be, for the company seems to have produced a technically advanced box of hardware based around Intel's 8088 processor. This is an interesting choice, for while not being truly *avant garde*, it provides a sound compromise between sensible engineering and the provision of advanced capabilities. There is a great deal of scope for future expansion with this beast.

On the software side, the optional CP/M 86 is also a sound move. More significant, perhaps, is the optional Pascal p-code software. This can be used, in the hands of a knowledgeable programmer, to greatly extend the applications capability of the machine.

It matters little, however, especially in the shorter term, how wonderful the system is. It could be the ultimate better mouse trap, but it won't mean a light if the company fails to market and sell it properly.

The fact that IBM is for the first time using externally provided systems software on a new product is just one indication that the company has thought long and hard about these very subjects and maybe has come up with the right answers. Looking at the system from a marketing point of view, the use of the 8088 processor falls into perspective. It is a sensible choice because it is available in reasonable and reliable quantities and at tolerable prices. This means that IBM can be sure (or as sure as anyone can in manufacturing) of a continuous supply of essential parts at good prices. It is also 'adventurous', for the processor is powerful enough to allow notable processing performance.

Put the two together and IBM becomes one of the first companies to produce a single system that gets close to the utopian 'all-purpose' machine. It can be produced cheaply enough to be directly price-competitive at the low end and it is powerful enough to be performance competitive at the high end. Add, as the jam to this substantial dollop of bread and butter, communications facilities such as the optional IBM 3270 emulator and the company is seen to cover more bases in one go than any company before it.

Given that, the potential sales volume could be enormous, so how is the company going to tackle the selling of the system?

Move number one has been restrictive, on the surface at least. Initially, the Personal Computer will only be available in the US and Canada. This again is probably a sensible move, for a variety of reasons. Not least among these is the fact that it is a market that accounts for around 50 percent of all world sales. Equally important, however, is the fact that it has the most homogenous distribution and sales network.

Four-pronged attack

IBM has chosen a four-pronged attack, and the homogenous nature of North American distribution makes this a far easier task to manage. This is particularly important for a company that has not played the microcomputer game before.

GOTO page 183

COMMUNICATIONS

PCW welcomes corespondence 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,* **14 Rathbone Place, London W1P 1DE.**

Info on BBC micro

I am sure most of your readers will have heard about the BBC television series on computers, 'The Computer Programme', which starts next January. There is already tremendous interest in the BBC Microcomputer itself and we belive that the series will do a great deal to stimulate further interest in all aspects of computers and computing. Many viewers will want to follow up the series by discovering what is available in their area in the way of courses, computer clubs or centres offering 'hands-on' experience. One way of finding out this information will be through the Computer Referral Service run by Broadcasting Support Services as part of the Computer Literacy Project.

Our address will be given at the end of each programme and anyone wanting further information can write in. To be able to answer all the enquiries we need to hear about what is going on locally. Some of the information we already have, but what we are particularly keen to learn more about are computer clubs. Clubs will have a major role to play as they can be an ideal source of informal advice and 'hands-on' experience for people who don't want to go on a formal course or who aren't quite sure what they want to do yet.

Ideally, what we would like to be able to say to people is 'here is your nearest computer club, this is when they meet, why not go along and talk to them see if this is what you want?' To do this, though, we need to know which clubs are willing to help out in this way. If any clubs are interested, could they write to us at the Computer Referral Service, P O Box 7, London W3 6XJ.
David Highton, Broadcasting Support Services, London W3

Bridge bidding

Seeing David Levy's interesting article in the May issue on how to program a computer to perform the difficult task of bidding bridge hands, I realised that he (quite understandably) was unaware of the fact that this task has already been successfully completed.

David, and maybe some of your readers as well, might be interested in knowing that my bidding system, 'Cobra' (for Computer Oriented Bridge Analysis), has been in existence for several years and will be published in book form by Victor Gollancz in November 1981.
Torbjorn Lindelof, Geneva, Switzerland

Memorite memo

I'm glad to see Vector Graphic getting a bit of publicity in your pages last month with your very full review of VG's own word processing software, Memorite. As a daily Mem3 user since it first came out at the end of last year I noticed one or two blunders and oversights.

1. Dating documents isn't compulsory. Your article doesn't make clear that you simply enter the date into the system on powering up with Memorite. Thereafter, all documents will be dated (creation or revision date) by the system. But if you don't want a file title to carry a date, or for some reason you're shy about letting the system know what day it is, you can always save documents with the WR R (Write to Disk, Raw) command'

2. Spell operates on an algorithm rather than a dictionary and there are, as you say, some surprising oversights — like Memorite not being able to spell its own name! You've described the temporary dictionary Spell creates so that it won't query a word you've already marked as acceptable. What you don't mention is that this temporary dictionary can then be converted into a permanent file, which you either append to your own dictionary or save as a subsidiary dictionary for (say) proof-reading specialist documents. Once the word 'Memorite', for example, has been included in such a file, the word will never be queried whenever the file name is appended to the end of the command string, as: SPELL < document-name > < dictionary-name >

3. The latest version of Memorite will write to a dot matrix printer. There are also extensive provisions for providing jump tables to customise both the key to screen-character and screen-character to print-character mapping. Different jump tables can be pulled in from inside Memorite, so one can to switch from, say, an English to a French character set *tres facilement.*

4. Backing up onto floppies isn't quite as tough as you suggest. Floppies aren't the best medium for this — though of course they're better than nothing — and database files that exceed the capacity of a floppy are a particular problem. But the 3003 comes with a pair of programs, Store and Restore, that allow large files to be written onto a set of floppies and then joined up again if they ever need to be shunted back to the hard disk.

5. The hard disk operates as a logical pair of drives (A: and B:) in one of its configurations; an alternative configuration sets it as a single drive.

6. The floppy drive is single-sided in one of its configurations, which gives it, as you say, a capacity of around a quarter k. But this is only to provide compatibility with Vector Graphic's earlier Micropolis drives. The Tandon drive in the 3003 is chiefly intended to operate in double-sided mode, which appears to the system as a single logical drive of around 600k capacity.

The foregoing is mostly a mopping-up operation after a very thorough and fair review and I'm really only butting in because the software (and its predecessor MEM2) has done a lot of good work for me and has already paid for itself many times over. Incidentally, I don't share your doubts about its suitability for the author/journalist. I use Mem3 for my TV scriptwriting, technical writing and journalism, and the best thing about it, as you've spotted, is the file-handling, which means you can go back to a disk months later and just by looking at the dictionary identify every file on it, as well as know each file's date of creation and last revision. Word-processing systems that don't provide this sort of chest-of-drawers for document files aren't much use to me professionally.

I agree with you that it's a pity document length should be limited to the size of the work-area. To some extent this is alleviated by a command that links files together for printing, but the real thing would be nice. The absence of full on-screen formatting is occasionally something of a problem: MEM3 will tell you where pages will break, but not where lines end, so if you want to move a page break it has to be to the beginning of a paragraph or you run the risk of introducing an unintended short line. But on the whole I much prefer the way Mem3 makes the maximum use of the screen area and lets hard-copy formatting take care of itself according to imbedded format commands.
Chris Bidmead, London NW3

ACC at PCW show

Please may I put on record as soon as possible after the event how much the Amateur Computer Club appreciated the offer to attend and organise the amateur side of the *PCW* Show. All the user groups and clubs present have also voiced their thanks.

The show was an obvious success and I like to think that the clubs contributed towards it by giving impartial advice and replying to technical enquiries which would be difficult for even the manufacturers to answer!

I would also like to thank the staff at Montbuild, the show's organisers, who could not have been more helpful and friendly.
Dr David Annal,
ACC Exhibition Organiser.

Beating Gomoku

No doubt many readers have discovered ways of beating the Gomoku program (*PCW*, August '81). Here are a couple of ways I have found:

Playing first: 35, 36,56, 24, 47, 42, 64, 52, 65, 37, 38 -win next move.

Playing second: 44, 53, 42, 65, 62, 73, 72, 71, 74- win next move.

As the program contains a random element, these plays guarantee a win.

By the way, I see from 'Chip Chat' that someone has adopted 'Othello' as a trade mark. What's his name — Shakespeare?
J Aughton, Southport.

Computopia

We were very interested, though a little puzzled, to read the comments in September's *PCW* concerning Micro-Sci disk drives, under the title 'Apple Crush'.

One of the impressions gained from the editorial was that these drives, and their users, apparently suffer great problems when trying to read ordinary Apple disks.

In our experience this is not so. The 40-track Micro-

Sci drives (A40) will boot and/or read ordinary Apple disks (35 track) with high reliability and increased speed. The additional 20k of storage is gained by accessing more tracks towards the centre of the disk. So an A40 can be considered as a standard Apple drive if desired, or the extra space can be accessed by using the modified DOS provided. The 70-track drives (A70) have twice the number of tracks of an Apple drive and require a modified DOS to take advantage of the extra storage. This DOS is capable of reading 35, 40, or 70 track disks, thus allowing the A70 to read ordinary Apple disks — but not boot them — unless the software has been transferred to the A70 DOS.

There are some programs that will not boot on either drive type, typically those using half-track security methods. Incidentally, Visicalc will run on A40 drives, although it only makes use of 35 tracks.

Pascal and CP/M, provided you wish to ignore the extra storage available, can be run unchanged on an A40, but it obviously makes sense to take advantage of the extra tracks by using the utilities available to modify each system.

In conclusion, the A40 drives can be used as Apple drive substitutes (with certain software specific exceptions), but more storage is available if required. The A70 drives can read/run ordinary Apple data/software, using the A70 DOS, but are mainly intended as higher storage devices (1/4 Megabyte).

We hope this clarifies the issue of compatibility and shows that the situation is nowhere near as dire as may have appeared from previous comments.

C Sunderland, Managing Director, Computopia Ltd.

Puzzler solved

I suspect that the problem is due to inaccuracies of floating point arithmetic. From test runs on my ZX81 it appears that numbers less than 1 (2^0) in decimal notation, with the exception of other powers of 2, eg 0.125 (2^{-3}), convert to an approximate binary form. This approximation tends to build up as an inaccuracy as calculation are made.

Although the decimal form appears to be correct when printed out, presumably the relational operator testing for equality (=) uses binary numbers. Due to the different approximation of the two numbers being compared, equality will never be satisfied as the binary forms are not identical.

A solution is to modify the program, eg by multiplying through by 10 to remove the figures after the decimal point if you suspect that the answer is not an exact power of 2. (It is interesting to note that the test for equality does however work when using steps of exact powers of 2. Try 0.00048828125 (2^{-11}) in an appropriate program).

J G Taylor, Dartford, Kent

North Star GT

The excellent article on HMSOS in your September issue highlights once more the problem of using fully the limited 64k address space in an 8-bit microcomputer. North Star, like many other companies, 'waste' 8k of this on their popular Horizon computer largely because of the way in which the floppy disk system is addressed. This effectively limits actual Basic program and data space to about 32k which is proving restrictive as program size inevitably increases.

After overcoming many teething troubles, a way has been found to overcome this. A special S100 card is used to automatically switch in and out the top 8k of RAM as required by the program and the operating system. This permits the full use of the 64k address range under DOS and up to 63k under CP/M. No modifications to existing programs are necessary.

If anyone is running out of program space on their Horizon and wants details of how to do this, telephone me on 01-788 5054.

Derek Eldridge, Tantus Microsystems, Putney.

Tandy warranty

As secretary of the North West TRS-80 Users Group, I feel that the public and prospective microcomputer purchasers should be informed of a recent problem that one of our members has experienced, with Tandy, in relation to after sales service.

It was pointed out to our member, by Tandy's Burnley store manager, that because his CPU was six months old, it was no longer within Tandy's warranty and that Tandy does not give more than 90 days' warranty on its computers.

Firstly I should like to bring to the attention of prospective purchasers that TRS-80s purchased from sources other than Tandy, of which there are many, often come with a full 12 months warranty.

Secondly, the apparent attitude of Tandy on after-sales service seems to have gone full circle. In the past, I personally have had very good after sales service, but with Tandy's recent attitude this seems to have disappeared.

On behalf of our group and the member mentioned above, I am taking steps to find out whether Tandy has the legal right, under the Sale of Goods Act, to actually reduce a purchaser's rights to a 90-day period. If Tandy's 90-day warranty stands in a court of law, prospective purchasers of a TRS-80 can decide for themselves where to make their purchase.

Melvyn Franklin, Group Secretary, TRS-80 Users' Group.

Subscript solution

Alan Sutcliffe mentioned in his article 'Patterns' (*PCW*, Aug) that subscripts in the DAI, 'even though they may be typed in as integers, are always listed — and presumably stored — as floating point numbers'. The solution to this problem is to change the default for all numeric information from floating point format (to which it is automatically set on power up) to integer format. This is done using the following command: IMP INT. Obviously when the default is changed to integer, any floating point variables required will have to be explicitly defined using the IMP command.

To eliminate the floating point subscripts from Mr Sutcliffe's program the first few lines should be altered as follows:

```
IMP INT
IMP FPT A—H
IMP FPT Q—Z
Clear 10000
Etc.
```

Michael Coughlan, The National Institute for Higher Education, Limerick, Eire

Illogical shift

I refer to the Sinclair advertisement on page 137 of the September issue of *PCW*.

Does 'Uncle Clive' know something about the British weather that no-one else knows, since his printer, will be available in 'Summer 81?'

As I write in late August, is this perhaps a late Spring in the Sinclair 'timeshifted' year?

J Farrall, Leek, Staffs.

ZX81 points

Here are a few points about the ZX81:

1) GOTOs can be followed not only by line numbers, but also variable and arithmetic expressions (in effect the ON statement).

2) It is possible to have a type of FOR...WHILE loop by using:

'IF (condition) THEN NEXT'

If the condition is true, the loop continues and if not the computer goes on to the next line.

3) When the memory is nearly full, the computer will not allow the EDIT function to be used which means a lot of unnecessary typing has to be done. This can be avoided by:

a) positioning the cursor on the required line;

b) typing CLEAR;

c) When the display goes to 0/0 then press the EDIT key.

4) The Meteors program on the cassette can be shortened (and improved) by:

a) deleting lines 135, 210, 230, 310, 315;

b) moving lines 220 to 265 and 240 to 295;

c) replacing the PAUSE and POKE statements by a FOR . . NEXT loop (FOR 1 to 20 should provide a reasonable delay);

d) Changing lines: 130 LET X=12, 250 PRINTAT 1,31;" ", 270 IF PEEK (33+P+K) . . . etc.

The game is run in the slow mode.

A Barrett, Wembley

Flying high

As a poverty-stricken, low-time private pilot recently introduced to microcomputing, I would be very interested to know if there is any software available for the simulation of instrument flying (as distinct from VMC flying) on a micro.

If there is, who sells it and what machine(s) does it run on?

B M Neary, Coventry

If any readers have the answer to this question, they could let us know through communications — Ed.

Let's get together

I am a lecturer in chemistry and have recently taken an interest in computing. With the rapid increase in the number of schools and colleges possessing their own microcomputers, I was surprised to find the lack of good educational software available. Programs written for GCE and lower school work appear to have been written by computer buffs rather than specialist subject teachers and consequently do not relate too well to their subject (rather like a badly written textbook), mathematics being the exception, of course.

At Brooklands we have three PETs in this department and are starting to build a library of educational programs, some written by our own lecturers (including

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The Microline 82A prints bidirectionally at 120 characters per second and includes a short line seeking logic that can increase throughput by 80% over equivalent unidirectional printers. A dense 9 x 9 dot pattern is used to produce crisp, clean copies, first copy to last.

In addition to normal upper and lower case, ten character per inch printing, the 82A prints both double width and condensed characters at six or eight lines per inch. Font selection, character pitch and line spacing are all standard and program-controlled.

Graphics
Microline users can generate charts, graphs and illustrations and explain them with captions of double width characters. The Microline 82A prints 64 block shapes in addition to the full character ASCII set.

Three Printers in One
Microline 82A users do not have to purchase different models for different forms. The standard platen accommodates friction and pin feed forms and optional tractors snap in place and adjust to suit form width. The Microline 82A provides versatile forms controls including vertical tab, top of form and a vertical format unit that provides switch and program selection for up to ten form lengths.

Interfaces
The Microline 82A is offered with both Centronics-compatible parallel and RS232C serial interfaces as standard equipment and TRS-80™, APPLE® and other popular small computers. IEEE 488 parallel and current loop interfaces are also available.

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- ☐ Graphics
- ☐ Dual interfaces
- ☐ Operates with TRS-80™, APPLE®, PET and others
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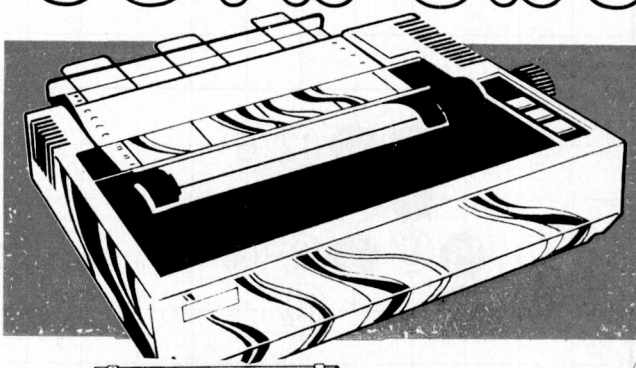

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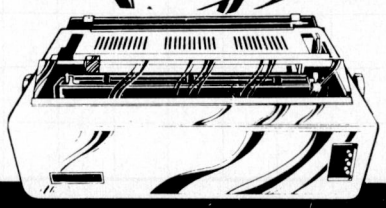

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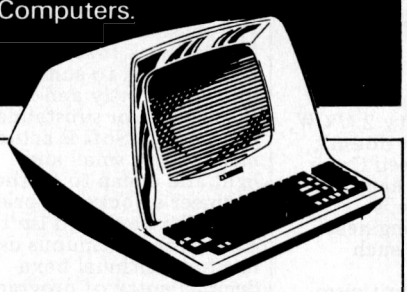

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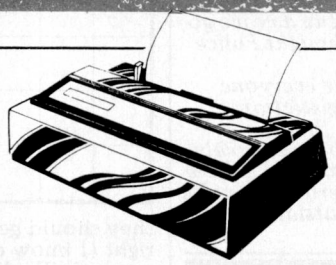

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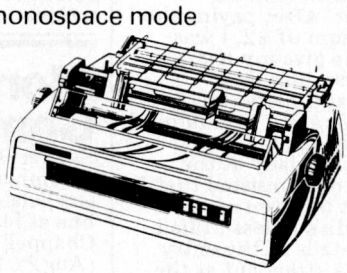
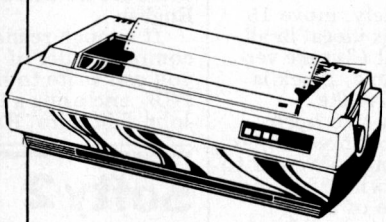
- 55 characters per second





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myself) and some by teachers of local schools with whom we have exchanged programs. At present they are limited to mainly scientific subjects including chemistry, biology, physics, geology, geography and environmental science but we are hoping to add English and French to the range.

I would like to hear from other teachers and lecturers with whom we might exchange ideas and programs. Although we would prefer exchange, we are quite happy to send listings to any educational establishment. Our own programs are written for 'O' and 'A' levels.
Michael Gilford, Brooklands Technical College, Heath Rd, Weybridge, KT13 8TT

Big brother

I am writing to tell you of my amazement at the procedure required to visit your exhibition on 10 September. After paying the requisite sum of £2, I was required to give my name and address, business interests, and spare time activities *before* I was allowed to enter the show.

The young lady at the reception desk insisted that I would not be given a coloured disk unless I filled out the details of the entry ticket. The attendant at the entrance to the show would not allow me into the hall unless I had a coloured disk on my entry ticket. All this fuss after paying the entrance fee! Despite my objections to providing the personal information demanded, both were adamant.

Having in my possession a copy of every issue of *PCW*, I have over a period of time formed the conclusion that yours is a responsible publication concerned, among other things, with the confidential nature of material in data collection systems. The events referred to above have caused me to revise my conclusion. It was unnecessary for you to know any of the details demanded on the entry ticket. A *request* for information would have been met in a different spirit but with no different end result.

To avoid further altercation, I completed the card with completely false data which, strangely enough, seemed to satisfy everybody. So some of the information that you have from the show is wrong and I wonder what use you will make of it. How many other visitors gave wrong information is hard to assess, but I am sure that I was not the only one to object to giving personal information in these circumstances. I do not object to giving personal information if there is a 'need to know' but this was not one of those instances.

The future of a police-controlled, or similar, state draws closer every time that an unnecessary demand for personal information is made. I see a future (and 1984 is near) where the processors of the police, Ministry of Transport, National Health Service, Social Services, Inland Revenue, banks, credit cards, credit rating bureaux and market research organisations are all linked. Free access to such data will be the norm. In your small way you have tended to assist this process and I, hopefully, have foiled you.
J Turner, London E11

Thanks for giving us your real name and address, Mr Turner — we'll add it to our database, ready for the day we go online to the Thought Police computer.

We can assure everyone who filled in registration forms correctly that the information will be used solely for planning next year's show and will most certainly not be passed to any outside organisations — Ed.

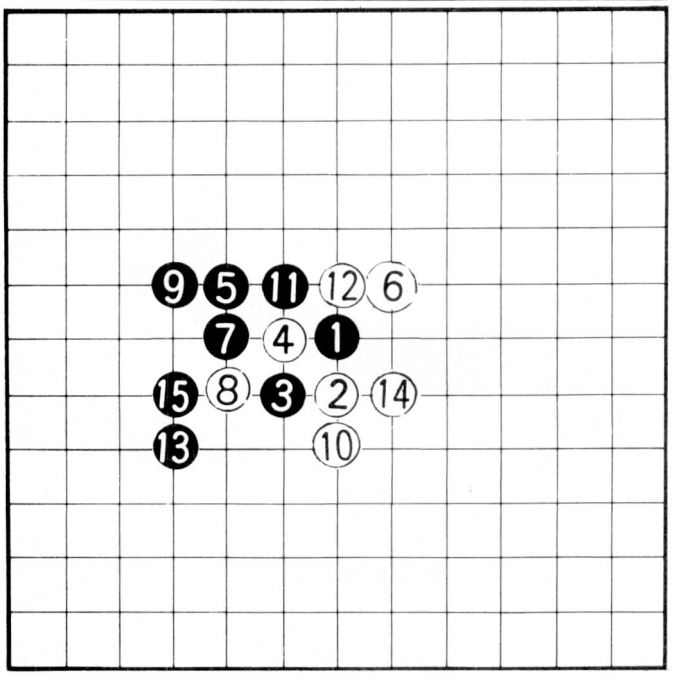
More Gomoku

Reader B E Newson, ('Communications' *PCW* Oct) claims he has a winning line as black against Bob Chappell's Gomoku program (Aug *PCW*).

Unfortunately, move 15 (see diagram) is illegal in all but the ancient Chinese versions of the game: Black is not allowed to make simultaneously two open threes (a row of three stones capable of being converted to an open four, which is a row of four capable of being converted to a row of five in two ways). The open threes here are 9—15—13 and 15—7—11.

I can't say much about the program but it can't be much cop if it doesn't point out illegal moves and as far as being 'unbeatable', there would be many people in Japan willing to take Black, with the proper rules and stake a lot of money on winning. They still tell a story there of a Danish professor of computing who claimed his algorithm made him world champion. Challenged by low-grade Renju professionals, he was ground into the board by some ridiculous margin.

Incidentally the name 'Gomoku' used by American computer hobbyists is quite incorrect but if prospective Gomoku programmers want alternative names they can choose from the Japanese Gomoku-narabe, Go-narabe, Goren, Goseki, Kakugo, Gogo, Gocho, Gorengo, Miyako-go, etc. There are also many Chinese and Western names for the game: the Chinese Wu-tzu-ch'i and the Western Go-bang and Pegity. More importantly,



they should get the rules right (I know of no accurate source in English) and realise there are several versions.

Also, in the series 'Computer Games', *PCW* has perpetrated the error that Renju is the same as Gomoku. It isn't, though it is a derivative. Renju is a far better game, played professionally in Japan, but again there are no correct rules in English.

If enough readers want the complete rules of both games you can write to me care of *PCW*, enclosing a large SAE.
John Fairbairn, Harrow

Softy 2

I have just read the 'Checkout' on Softy 2 (*PCW*, Oct) and frankly it doesn't please me much. Neil Cryer doesn't seem very happy about Softy but he is obviously not an engineer and has no use for such equipment.

Much of Neil's criticism is valid only for the prototype sample we sent you so that you could get into print while the subject was still news. There are several errors of fact in the text and much of Softy's capability has escaped mention.

Firstly the 'flimsy plastic case'. Early samples of the case, for photos etc, were taken straight from the wooden model in 0.8mm ABS. Later production is in 1.6mm ABS- and you can stand on the case. Then, in the paragraph dealing with operation, a reference is made to the MOVE command allowing a block of 110 hex bytes to be moved from one position to another — it should be 127 bytes. A bug worked its way into the article later on, with reference to the checking of any program using the screen of the host system as a window and Softy in ROM emulator mode. Finally the last paragraph is a misdirection. There is no 'more sophisticated system' that will do the same tasks that Softy does.

The idea that Softy is useful only to impoverished enthusiasts willing to program in Hex at the lowest level is quite untrue. In system developments of even modest complexity there is no substitute for an assembler. Softy forms the link between the assembler and the nascent product. Most development systems are costly and not portable in any sense of the word. I like to think that Softy was designed to suits its purpose exactly and is not thoughtless or substandard in any way. Soft is actually *meant* to be small and light and cheap to fit the engineer's pocket or briefcase. The keyboard isn't meant for continuous use nor for continual hexadecimal entry of programs. In most applications this is unnecessary. Efforts have been made to keep cost and weight down — the 'improvements' you seem to think necessary would, in fact, ruin the product. It is most unusual for any of the engineers who are our customers to be less than delighted with the facilities of their Softy.
Barry Savage, Dataman Designs, Dorchester

Dr Cryer is in fact a physicist with extensive computing experience. And it was not made clear to us that the machine supplied for review was a prototype sample. Wherever possible we try to review only production — quality items and we assume that this is what we receive unless we're told otherwise — Ed.



NEWS

David Tebbutt brings you the latest update.

THANET START-UP

Do you live in the Thanet area? If you do you'll be delighted to hear that a ComputerTown is about to open in Broadstairs public library. Opening day is 16 October and the show will run from 5 to 8 pm. Peter Kiff is the man responsible for getting this one off the ground and he and his band of helpers will be there every Friday from the 16th onwards. Well done Peter and all your anonymous colleagues. This month we've also been hearing rumours of a 'Town starting in Harrow but I'm still waiting for a letter with the details.

It's silly isn't it, but I'm almost disappointed at only hearing from one new ComputerTown this month — perhaps everyone was too busy getting along to the *PCW* Show to get their new 'Towns off the ground. Were you there? Wasn't it busy? We're going to need Olympia next year the way things are going. The ComputerTown stand was a roaring success, with lots of very serious interest shown as well as a lot of fun being had by all. Our sincere thanks go to Ingersoll who supplied all those Atari machines and to the brave band of volunteers who helped out on the stand. I've started getting enquiries already as a result of the show and that finished only a few days ago.

One of the problems all ComputerTowns face is lack of machines and lack of volunteers. I get the feeling that there are a lot of people out there with machines who'd thoroughly enjoy themselves if they came along to a 'Town night from time to time. It's no good saying to yourself 'They won't want me, I don't know enough about computers' — if you use one then you know quite enough to help out. No-one is looking for experts, just interested people willing to share their knowledge and experience (and computers). It's no good either saying to yourself 'They've probably got all the help they need, what would they want with me' — the fact is we're all short of people and every new volunteer lightens the load for everyone else. If you feel you'd like to help with ComputerTown then please don't hang back, we'd love to see you and if you're in an area without a ComputerTown, why not start one yourself? I'll send you some guidelines if you send me an SAE to the address in the box.

Last month I mentioned that I'd received a couple of letters from the Beeb. Well, this month I received a couple more. One you'll find reproduced in the 'Communications' section of the magazine this month and the other one asked me to invite all the ComputerTowns to participate in the Beebs referral scheme. The idea is that every time someone contacts the Beeb for information about computers, it can put them on to local clubs, colleges, ComputerTowns or what-have-you. I wrote an appropriate letter for the Beeb to send to all 'Towns and gave them a mailing list as well. If you've not heard yet and you'd like to be involved then drop a line to David Highton, Broadcasting Support Services, 252 Western Avenue, London W3 6XJ. I'd suggest you turn to 'Communications' first for a fuller idea of what this is all about.

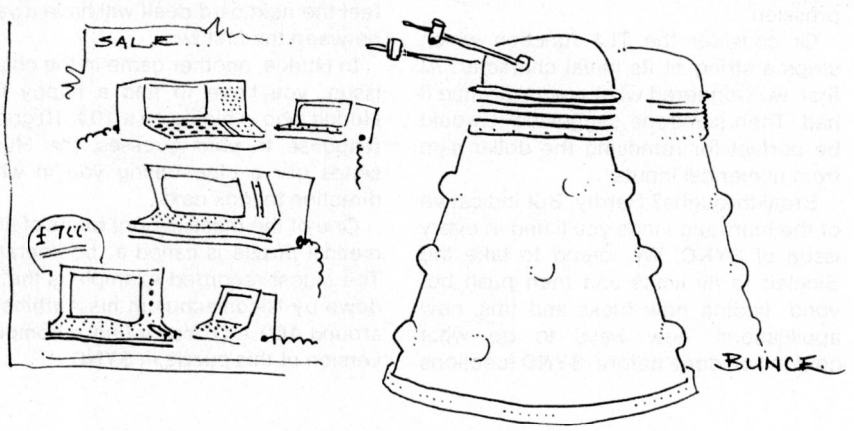
The funniest letter this month came from someone asking us to send details to them *urgently* in the enclosed SAE; a) There was no SAE; b) There was no address on the letter; and c) we couldn't read the person's signature! So if you're wondering why it's taking so long for me to write to you then you may be the guilty party. Incidentally, the urgency was stressed because this particular enquirer was leaving the country for Israel a few days after writing to me. Ho hum.

A number of people have written expressing a willingness to start ComputerTowns in their own areas. Here are their names and addresses. If you'd like to help out then I'm sure they'd love to hear from you: Francis Glenister, 13 Pridmouth Road, Withington, Manchester M20 9GN; P P Bartlett, 273 Kings Drive, Eastbourne, East Sussex BN21 2UR; Miss S Beckett, 7 Lingmoor Rise, Kendal, Cumbria LA9 7NP; John Byfield, 'Moonrakers', The Rutts, Bushey Heath, Herts WD2 1LH; Tabassam Kayani, SOBAT Computer Club, 12 Calderon Road, London E11 4EV; Wing Commander Brian Carroll RAF, The Cottage, Manor Road, Aldershot, Hants; L M Symonds, 14 The Quay, Appledore, Bideford, North Devon, EX39 1QS.

The Scottish Microelectronics Development Programme is a very active group when it comes to microcomputing and they've (inevitably) got to hear about ComputerTown. If any of you read their periodical, *Phase Two*, then keep your eyes peeled for an article about ComputerTown. They've kindly asked us if they can reprint parts of our Guidelines document.

Finally, here are the areas from which we've received letters this month: Stirchley, London (N1, N20, SW11), Bury, Cranleigh, Naunton Beauchamp, Cults, Withington, Lydiate, Wembley, Sheffield and Blackwater.

ComputerTown UK! is an ever-growing network of computer literacy centres, where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. ComputerTowns might be found anywhere: in a church hall, a library or maybe in a school after hours. The emphasis is on making computing enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL and remember to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone *PCW* for information because this project is entirely a spare-time activity.



'This new generation don't know how to enjoy themselves!'

The Sinclair ZX80 is innovative and powerful. Now there's a magazine to help you get the most out of it.

Get in sync



SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR$ function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR$ (9) and CHR$ (265) will produce identical values. In other words, CHR$ operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET X=Y=Z=W is a valid expression.

Or consider the TL$ function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of **SYNC**. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. **SYNC** functions on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And, perhaps, how to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort perhaps because it's described in so many programming manuals or because they've seen it in another program. However, sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative, clever coding. You'll find this type of help in **SYNC**.

Lots of Games and Applications

Applications and software are the meat of **SYNC**. We recognize that along with useful, pragmatic applications, like financial analysis and graphing, you'll want games that are fun and challenging. In the charter issue of **SYNC** you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurkle, another game in the charter issue, you have to find a happy little Hurkle who is hiding on a 10 X 10 grid. In response to your guesses, the Hurkle sends our a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang." The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in **SYNC**.

Hard-Hitting, Objective Evaluations

By selecting the ZX80 or MicroAce as your personal computer you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However, selecting software will not be easy. That's where **SYNC** comes in. **SYNC** evaluates software packages and other peripherals and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth, objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. **Creative Computing** is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, *Basic Computer Games* and *More Basic Computer Games* (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

Creative Computing, founded in 1974 by David Ahl, is a well-established firm committed to the future of personal computing. We expect the Sinclair ZX80 to be a highly successful computer and correspondingly, **SYNC** to be a respected and successful magazine.

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Needless to say, we can't fill up all the pages without your help. So send in your programs, articles, hints and tips. Remember, illustrations and screen photos make a piece much more interesting. Send in your reviews of peripherals and software too—but be warned: reviews must be in-depth and objective. We want you to respect what you read on the pages of **SYNC** so be honest and forthright in the material you send us. Of course we pay for contributions—just don't expect to retire on it.

The exploration has begun. Join us.

The magazine for Sinclair ZX80 users
SYNC

27 Andrew Close
Stoke Golding
Nuneaton CV13 6EL, England

COMAL-80

With the launch of the BBC Microcomputer, the subject of structured extensions to Basic has come very much into the news. Here Borge Christensen, its inventor, discusses COMAL the first and arguably the best of such extended Basics.

In the July issue of *PCW* Jonathan Palmer from Currie, Midlothian, wrote about Basic and Pascal. In many ways his letter was a very sensible one that hit an amazing lot of important points in a few lines. I am sure that his point of view is shared by thousands of people who use Basic but at the same time feel that this language is beginning to be left behind by the development of both hardware and software. My special concern is about his final statement 'So what should be done? A structured Basic seems the best idea so that one can progress from simple Basic to structured Basic without the need to learn a whole new language. After all, we do want people to use computers, don't we?' In what follows, I would like to tell Jonathan and his thousands of fellow partisans how we solved that problem in Denmark six years ago, and at the same time I shall comment on some of the items in his letter.

Before coming to the main part of my story I would like to sort out a few facts and concepts, however. It is my impression that in very many letters in *PCW* and elsewhere about Basic versus Pascal and interpreters as opposed to compilers, the *languages* and their *operational environments* are mixed up. To illustrate the problem we can take a look at one of the most user friendly Pascal systems, viz, UCSD Pascal.

The version referred to in the following is distributed by SofTech Microsystems, and I run it on a microcomputer with 64kB RAM storage and two mini diskette stations. It takes about 45 seconds to load the system and during that period of time I have to manipulate correctly three diskettes. Having been successfully loaded, the Pascal system proclaims its attendance by displaying the so-called 'Prompt Line' :

Command: E(dit, R(un, F(ile, C(ompile, X(ecute,...

and a few more items. Well, okay, let us start to write a Pascal program; it is claimed to be good for your health! The first line of the small sample program I have dug out of some highly recommended textbook goes like this:

PROGRAM FOR1;

Since "PROGRAM" begins with a "P", I'd better press the "P" key. Now what happens? The screen flickers for a split second and the Prompt Line is restored. But my "P" seems to have suffered the same fate as some of the odd particles in nuclear physics that only live for a fraction of a second. What's wrong? Why, of course! I have to switch to *Edit mode* first. This is done by pressing the "E" key — "E" for "Edit" — so that's what I do. After about five seconds the following is displayed:

>Edit: A(djst C(py D(lete F(ind I(nsrt. '

followed by a printout of some other person's program!! Since I am not interested in other persons' inferior programs, I try to type NEW, which ought to help. As soon as the "N" has been pressed the system answers with a loud BEEP, but my poor "N" has become the innocent victim of the same brutal treatment as the "P" above. By pressing "Q" and answering correctly to a menu of suggested actions, I am sent back to *command mode*. I type "F" for "File" and the *Filer* comes in saluting me:

Filer: G(et, S(ave, W(hat, N(ew, L(dir,...

Ah, there it is! I press the "N" key, and the system asks me to confirm that I really want to throw away the workfile. I do, oh, I do.

Then back to the editor, where it appears that I have to press "I" to be allowed to *Insert* the program, "D" to be able to *Delete* one or more characters in it, "X" to *eXchange* parts of it, and — *not to forget* — after each of these operations I must press a certain key to finish it and come back to *edit command mode*.

Writing to Aunt Agatha

During all this I do not get the faintest hint from the system to tell me whether the statements of my program have got a reasonable Pascal syntax or not. As far as the editor is concerned, I might just as well be writing a letter to Aunt Agatha reporting the latest family reunion instead of a sensible Pascal program.

Whether it is one or the other is not revealed until I come back to command mode and order the system to *compile* the text that I have written. It appears that I have forgotten to put a semicolon after the name of the program, whereupon it takes several seconds to reload the editor, have the site of the bug pointed out and named, and then again several seconds to get the editor into insertion mode. Having inserted the semi-colon I have to Quit the editor, Update the workfile — several seconds — and invoke the compiler to start anew on my program. Even with a beginner's tiny sixliner program all this "system ping-pong" may take several minutes, and as mentioned by Jonathan Palmer, it can take more than two minutes to catch and kill a completely trivial bug.

In the second example a system that contrasts favourably with the former will be used, viz. CBM COMAL-80 — Commodore's new Structured Basic. Disk station 0 is loaded with a diskette and the SHIFT-RUN/STOP keys of the CBM are depressed. After 15 seconds the system reports its presence and willingness to work with COMAL 80 rev 00.11

You may start typing at once:

```
10 W$="HEAP*"
20 S =W
```

It is obvious that a bug has been introduced in line 20, and the system answers with a beep and displays the following:

```
type conflict
20 S =W_
```

with the cursor marking the place where the bug has been detected. You only have to press the "$" key and then the RETURN key to be allowed to go on with your program.

After having entered the program you may have it executed *immediately* by typing the usual command RUN. An *extremely fast prerun* is first performed by the system. During this prerun *structural bugs* — such as FOR without NEXT — are discovered and reported, and you are sent back to edit mode automatically, thus being given the chance to mend your program and rehabilitate yourself. After a program has been approved by the prerun, only run-time errors may still hide in it. It is not unusual that small beginners' programs run flawlessly at the first trial. And if they do not, it is always a very straightforward affair to come back to edit mode and correct the program using line numbers as references.

Easy to get started

Let us try to analyse what it is that makes Basic programming so easy compared to Pascal programming. In Basic, lines can be entered in any order and are automatically placed in the correct sequence. *Syntax checking* takes place on a line-by-line basis as program statements are typed; thus it is not possible to store or list an invalid line of Basic. Run-time errors identify the offending statement directly by means of its line number. It is extremely easy to "get started" in Basic. Having logged on it is only necessary to type

```
10 PRINT "HI, THERE"
RUN
```

to see your first program live. Most other language systems perform badly on this test.

In Pascal you have to learn how to use a text editor to input or change programs; in Basic line numbers are used to replace and delete program statements as well as to sequence them.

COMAL-80

If your Basic system has a screen editor at its disposal it is easy to "walk around" on the screen and make minor modifications, adjusting printouts, etc. In Pascal you also need to learn a separate Operating System command language to manipulate programs and files or to specify input or output devices. Basic has its own set of simple commands (LIST, RUN, SAVE, etc) which refer in an obvious way to the user's current program, etc.

In Basic at the end of program execution, control returns *automatically* to the terminal and the program remains unaltered in the user's "workspace". It can be changed and rerun in a simple fashion, or the values of specific variables can be displayed. Many Basic systems allow particular statements (eg, assignments) to be executed in "immediate mode", ie, as commands, followed by restarting the program.

Though the features mentioned above seem to comprise genuine advantages of Basic over Pascal, *they do in fact not relate to the programming languages as such*, but rather to the *operating environment* in which they are used. The normal use of an interpreter rather than a compiler for Basic makes many of the user aids described above much easier to provide, and the lack of compiled code is not a significant problem for most reasonably small programs, although it can become so as Basic is used for more and more ambitious projects. The use of line numbers for program input and editing is an especially valuable feature. Naturally, a Basic-like *environment could be built around Pascal*, but surprisingly this has not been done.

Though Basic may live in very convenient operating environments it is still a very poor language, far inferior to Pascal. But what can be done about that? The practical difficulties associated with the abandoning of an established language make a powerful argument against "revolutionary" changes. The alternative option of an evolutionary approach, ie, *improving Basic rather than replacing it*, is an attractive one. However in choosing this option it is essential not to lose sight of the original objectives of the language, as an easy-to-learn, easy-to-use, straightforward language (or system) aimed particularly at the beginner and non-computer specialist.

Comal is born

In 1974 we faced that problem here at the States Training College, Tonder, Denmark. We had been using Basic for about two years by then to teach our maths students elementary computer science. At first everything seemed just fine. As already mentioned, Basic is easy to learn, and both the students and I wrote a lot of programs — most of them with mathematical themes — and they ran irreproachably. However, as programs grew bigger, errors became more frequent. Very often I had to sit for quite some time to find out where a student had made a mistake, and it began to irritate me that I often found it difficult to read even relatively small programs written in Basic.

I found two main reasons for that: *variable names are much too short* to give any information about what they represent, and *the exclusive use of GOTO makes it difficult to identify the structures* of the program. I discussed the problems with Benedict Loefstedt, one of the lecturers at the Institute of Computer Science, University of Aarhus, and together we designed a set of extensions of Basic in order to produce more readable and safer programs. As a model we used the algorithmic structures from Pascal — which was not a very well known language at that time — and allowed identifier names of up to eight characters. After we had designed the extensions, two students of mine, Knud Christensen and Per Christiansen, began to modify our Basic interpreter, and in 1975 we had the first version running. We called it COMAL (COMmon Algorithmic Language). At that time Basic had become such a nuisance that we wanted to get rid of the name altogether. Today we admit that it was a structured Basic we designed and implemented.

Over the years the first version — COMAL-75 — has been substantially

```
0010 DIM COLOR$ OF 10, GUESS$ OF 10
0020 DIM ANSW$ OF 3, LEGAL$ OF 30
0030 LEGAL$:=".RED.YELLOW.GREEN.BLUE."
0040 REPEAT
0050   EXEC BET
0060   EXEC WHEEL
0070   EXEC RESULT
0080 UNTIL HALT
0090 //
0100 PROC WHEEL
0110   OUTCOME:=RND(1,15)
0120   CASE OUTCOME OF
0130   WHEN 1,3,6,9,12,15
0140     COLOR$:="RED"
0150     FACTOR:=1.5
0160   WHEN 2,5,8,11,14
0170     COLOR$:="YELLOW"
0180     FACTOR:=2
0190   WHEN 4,10,13
0200     COLOR$:="GREEN"
0210     FACTOR:=3
0220   WHEN 7
0230     COLOR$:="BLUE"
0240     FACTOR:=9
0250   ENDCASE
0260   PRINT "******* ",COLOR$," WINS *******"
0270 ENDPROC WHEEL
0280 //
0290 PROC BET
0300   PRINT "WHAT COLOR",
0310   INPUT GUESS$
0320   WHILE NOT ("."+GUESS$+"." IN LEGAL$) DO
0330     PRINT "ONLY (RED,YELLOW,GREEN,BLUE) ALLOWED!"
0340     PRINT "NOW, WHAT DO YOU PICK OUT",
0350     INPUT GUESS$
0360   ENDWHILE
0370   PRINT "HOW MUCH DO YOU WANT TO BET",
0380   INPUT STAKE
0390   WHILE STAKE<10 DO
0400     PRINT "DON'T BE MEAN, MAN!"
0410     PRINT "NOT LESS THAN 10 PENCE"
0420     PRINT "MAY WE ASK FOR YOUR BET",
0430     INPUT STAKE
0440   ENDWHILE
0450 ENDPROC BET
0460 //
0470 PROC RESULT
0480   IF GUESS$=COLOR$ THEN
0490     PRINT "HURRAY, YOU WIN."
0500     PRINT "YOU HAVE STAKED ",STAKE," PENCE,"
0510     PRINT "SO YOU GET ",STAKE*FACTOR," PENCE."
0520   ELSE
0530     PRINT "SORRY, YOU HAVE LOST ",STAKE," PENCE."
0540     PRINT "BETTER LUCK NEXT TIME."
0550   ENDIF
0560   INPUT "PLAY AGAIN (Y/N)? ": ANSW$
0570   HALT:=ANSW$="N"
0580 ENDPROC RESULT
0590 //
0600 //END OF PROGRAM: WHEEL//
0610 //WRITTEN IN CBM COMAL-80//
0620 //BY BORGE R. CHRISTENSEN//
0630 //FOR PERSONAL COMPUTER WORLD//
0640 //JULY 2, 1981//
```

improved, and in 1979 I defined a new version of COMAL — COMAL-80 — which was finally further improved by a working group of academics and representatives of several manufacturers of microcomputers. In 1980 COMAL-80 was fully implemented by Commodore to run on the 4032 and 8032 microcomputers. This task was undertaken by Mogens Kjaer, Copenhagen, Denmark. Mogens Kjaer wrote the whole thing for Commodore in about four months, and even though he is a very talented programmer, you can see that the task of turning Basic into a useful modern language is not an impossible venture. In what follows I shall survey the major features of COMAL-80, and I am quite confident that Jonathan Palmer and like-minded persons will fully approve of what they come to see. The sample program I shall refer to is in no way sensational, but it demonstrates the most important facilities of COMAL-80 quite well. Please refer to the program listing while reading the following (list on page 78).

Sample program

In lines 10, 20 and 110 long identifier names are demonstrated. In COMAL-80 a variable name may hold up to 16 characters, all of which are significant. The first character must be a letter, the following may be letters or digits. Most versions of COMAL-80 also allow an extra character to be introduced in an identifier name, such as the underscore or the quote. In CBM COMAL-80 the quote may be part of a name, eg, NUMBER 'OF' ITEMS is a legal identifier name.

The IF...ELSE...ENDIF branching is displayed in line 480-550. In the IF statement the keyword IF is as usual followed by a Boolean expression. If this expression is evaluated to TRUE the block of statements between the IF statement and the ELSE statement is executed, whereas if it returns a value of FALSE, the block of statements between ELSE and ENDIF is processed. Sequential processing is then resumed with the statement following the ENDIF statement. Program structures of all types may be nested to any depth in COMAL-80.

The REPEAT..UNTIL loop is used in line 40-80. Notice that the *Boolean variable* (the flag) HALT is assigned a truth value in line 570. The difference between the assignment token (:=) and the relational operator (=) is clearly demonstrated in that line. This is the one point where I do not agree with Jonathan Palmer. It is very important to teach beginners to distinguish between the assignment *instruction* and a relational *operator*. The assignment contained in line 570 may, however, be entered thus:

HALT=ANSW$="N"

or even:

LET HALT =ANSW$="N"

The COMAL-80 interpreter automatically converts either of the two strings into the one displayed in the program list.

WHILE..ENDWHILE loops are demonstrated in line 320-360 and 390-440. The IN operator in the Boolean expression following WHILE in line 320 returns a value of TRUE if the first operand is a substring of the second operand; otherwise it outputs a value of FALSE. This is the closest we can come to *sets* in COMAL-80.

Procedures (subroutines) are *named* in COMAL. As is seen from line 100 a procedure head consists of the keyword PROC followed by the name of the procedure. The block of statements that constitute the body of the procedure is executed only if it is called by means of an EXEC (EXECute) statement. Three such statements are found in line 50-70. If you happen to stumble over a procedure during simple sequential processing it is skipped. Though it is not demonstrated in the program, the call of procedures in COMAL-80 allows passing of parameters called by value as well as called by reference. GOSUB "linenumber" should not be used in COMAL; you never know what is going on when you have nothing but an anonymous linenumber to look at. There is no doubt that GOTO "linenumber" and GOSUB "linenumber" are the two most foolish control statements that were ever invented. I am sure they will remain a disgrace to the history of computer science long after Basic has been consigned to Limbo.

A multi-branching structure is found in line 120-250. If the value of the expression following the CASE keyword matches the value of one of the expressions lined up after a WHEN keyword, the block of statements following that WHEN statement is executed. When the block is finished, sequential processing is resumed with the statement following the ENDCASE statement. The keyword OTHERWISE may be used to initiate a default case which is then inserted immediately before the terminating ENDCASE statement.

The indentations to indicate the blocks of statements are of course done automatically by the system on the listing.

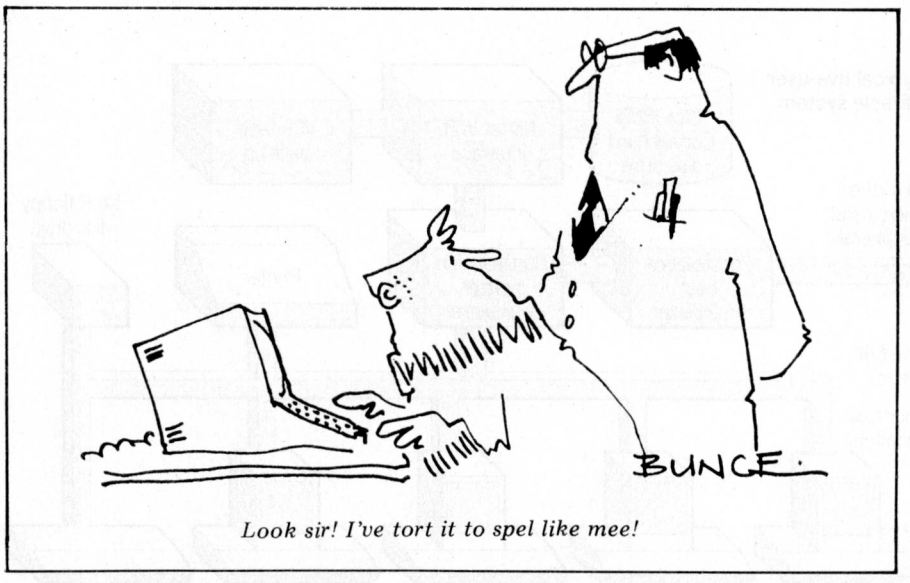
COMAL—80 also includes a very simple yet versatile file handling system, offering loading, saving and merging of programs and sequential as well as random access files.

Linking the structures

As a CBM COMAL-80 program is typed in it is, as mentioned before, syntactically analysed. If accepted by the scanner it is not just stored but converted into reverse polish notation. The prerun links the structures of the program, such that, for example, a WHILE statement contains the address of its ENDWHILE statement and vice versa, and an EXEC statement knows where to find the procedure it is calling. This means that a long COMAL program is processed much faster than the equivalent Basic program. All identifiers are converted into tokens internally, such that they occur only once in the storage. A rather nasty program has been written that will erase the symbol table (which is only used in the listing) from a program. The reader can guess what happens when an unauthorised person tries to list such a program!

After having used COMAL for more than six years now I can confirm that it is a good idea to implement a structured Basic. But if you do so, you must ensure the *generality of the structures*. We took our structures from Pascal, because we realised that better ones would hardly be designed for the next 500 years. In the meantime, Pascal has become very popular, and it is easy for one of our students who chooses to become a professional programmer to learn to use Pascal. Not long ago I got a paper called "BBC Basic" from a friend of mine in England. It describes one of the most pathetic attempts to extend Basic that I have ever seen. If that incoherent jumble is what BBC plans to use to bring the English into the Computer Age I sincerely hope you will be able to pump oil out of the North Sea for many, many years to come!

You can get more detailed information about CBM COMAL—80 by contacting Nick Green at Commodore's headquarters in Slough. A very good paper entitled "COMAL 80 — adding structure to Basic" has been written by Max Bramer at the Open University, Walton Hall, Milton Keynes, MK7 6AA (CAL Research Group Technical Report No. 3). COMAL-80 has been implemented on some Danish built microcomputer systems too. Information about one of them, the RC PICCOLO, may be obtained from Roy Atherton, Bulmershe College, Woodlands Ave, Reading RG6 1HY.



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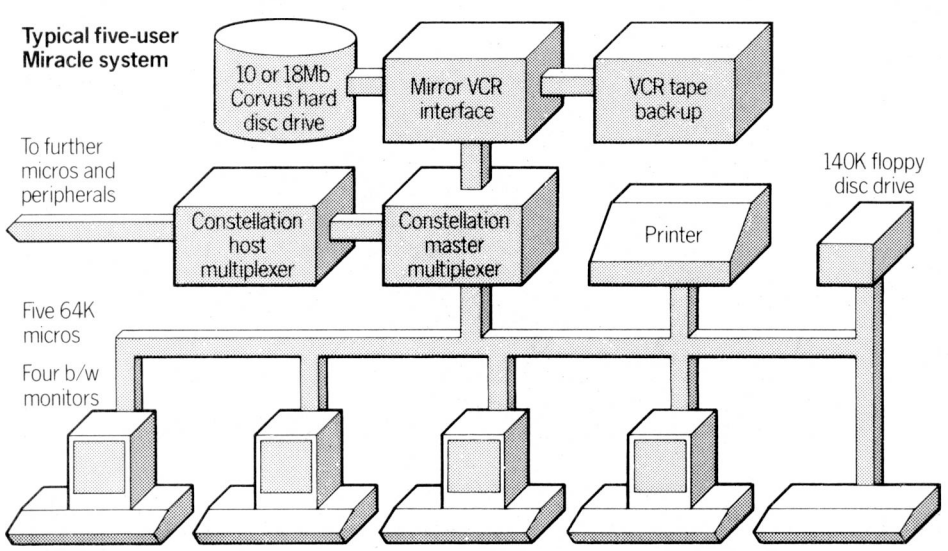

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CONTROL YOUR OWN SUBSTATION!

D E Graham describes further ways in which your ZX80/81 can control things in the outside world.

Audio output

Sound output from the ZX80 and ZX81 can be achieved in a variety of different ways with the 80/81 port board. The simplest, using a solid state buzzer, was dealt with briefly last month. Here we will have a look at two methods which allow a variable frequency note to be output to a loudspeaker. This is most simply achieved by connecting a fairly high impedance loudspeaker — a 65 ohm 2in variety was used in the prototype — directly to channel zero of the output port (see Figure 1). A succession of zeros and ones can then be POKEd to the port to produce an audio tone of quite good volume. The following programs achieve this:

```
10 REM ZX80 AUDIO
20 FOR A = 1 TO 100
30 POKE 25000, 1
40 POKE 25000, 0
50 NEXT A
```

```
10 REM ZX81 AUDIO
15 FAST
20 FOR A = 1 TO 100
30 POKE 11000, 1
40 POKE 11000, 0
50 NEXT A
```

The duration of the tone is determined by the length of the FOR loop in line 20 and its frequency by the time the ZX takes to execute each cycle of the loop. This is limited by the speed of the Basic interpreter to a couple of hundred hertz or so; while the bleep produced is useful as an audio cue, it is no use in more sophisticated applications. To extend the attainable frequency range, it is necessary to resort to a machine code subroutine which may be accessed from Basic with a USR call.

Full range audio

Reproduced below is an assembler listing of a 27-byte machine code program that may be used on the ZX80 or 81 to produce audio outputs over the frequency range 200 Hz to 25 kHz. It makes use of a number of counting loops, set up on registers B, C, and D of the ZX80 to achieve an audio output of a duration which is independent of note frequency. The differences between the implementation on the ZX80 and 81 lie mainly in where the program is to be stored within the 1k available memory.

The problem of storage is most easily resolved on the 81, and we will deal with this first. The method chosen is to store the code within a REM statement on program line 1. This has the dual advantage that it may be stored on tape with a normal SAVE command and that it is not shifted around by the ZX81's extremely busy operating system.

```
1  REM AAAAAAAAAAAAAAAAAA-
   AAAAAAAAAAAAA
10 FOR A=16515 TO 16541
20 PRINT A; " ";
30 INPUT B
40 PRINT B
50 POKE A,B
60 NEXT A
```

To fill the REM statement with the appropriate code, the program below may be used. This sets up the REM statement on line one, and allocates sufficient space for it, and then allows it to be filled with data received from a looped INPUT statement. The 27 bytes of data to be entered are as follows: 62, 0, 14, 100, 5, 194, 143, 64, 13, 202, 157, 64, 21, 194, 135, 64, 22, 255, 238, 1, 50, 0, 42, 195, 135, 64, 201. When the program stops because the screen has filled, execute CONT and continue. If you list the program after it has been run, you should find that the contents of the REM statement in line 1 have taken on a peculiar aspect.

It might be as well to test the audio routine at this stage. This may be achieved by plugging in the loudspeaker (wired as in Figure 1), and executing LET X = USR 16515. A bleep of about ½ sec duration should be heard. If not, check the contents of the 27 locations from 16515 to 16541 using the PEEK function to verify that you have entered all the data correctly. When all is functioning well, erase all of the program lines but the first, by entering empty line numbers. What remains is the single REM statement containing the audio subroutine. This should now be saved to tape, and may be reloaded and incorporated in any programs that you wish. Before treating applications of the routine, we will look at how it may be loaded on the ZX80.

It is unfortunately not possible to store the machine code audio routine in a REM statement on the ZX80, because the machine's interpreter actually checks the contents of REM statements for an end-of-line character, and will unceremoniously hang up when it finds certain unexpected data there. One way around this is to store the program in a section of memory somewhere below the stack, beginning at 17000. The data is not automatically saved to tape, but even this can be easily circumvented. Below is a program in Basic which contains the audio subroutine, and which loads it into memory when RUN is executed:

```
10  REM ZX80 MACHINE CODE
    AUDIO
20 LET A$ = "3E000E6405C-
   2744200CA824215C26C4216FFE-
   E01320060C36C42C9"
30 FOR C = 1 TO 27
40 LET B = CODE (A$) — 28
50 LET B = B*16
60 LET A$ = TL$(A$)
70 LET B = B + CODE(A$) — 28
80 LET A$ = TL$(A$)
90 POKE (16999 + C), B
100 NEXT C
```

Line 20 contains the hex code for the 27 bytes of machine code, and the remainder of the program reads off pairs

```
                        ;Z80 AUDIO SUBROUTINE
        LD      A,0
        LD      C, 100      ;DURATION
STT:    DEC     B
        JP      NZ,ONE
        DEC     C
        JP      Z,OUT
ONE:    DEC     D
        JP      NZ,STT
        LD      D,255       ;FREQUENCY
        X0R     1
        LD      (PORT),A    :PORT = 25000 FOR ZX80
        JP      STT         ;PORT = 11000 FOR ZX81
OUT:    RET
```

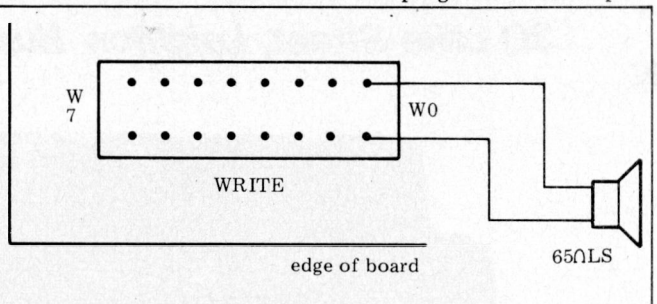

Fig 1 Connecting a loudspeaker to the output port

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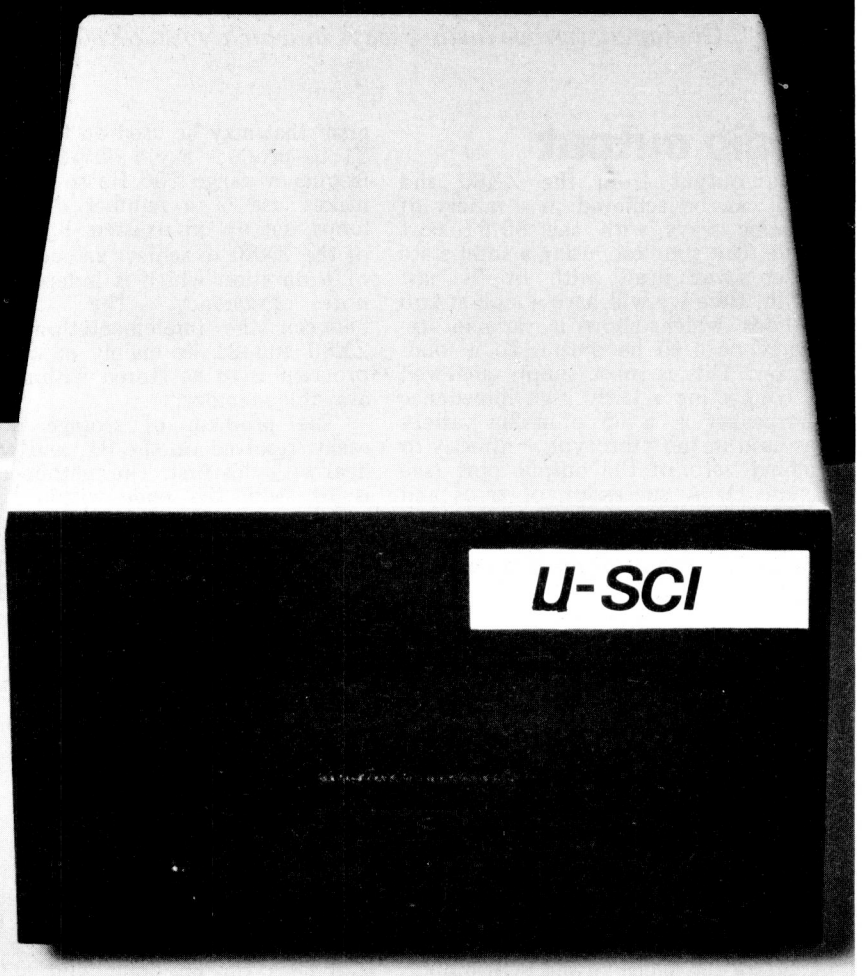

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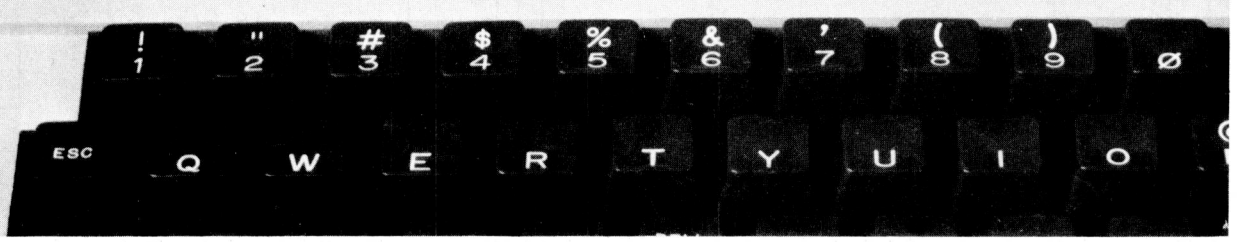

of these from left to right, converts them to decimal, and POKEs them to the appropriate locations, ie, 17000 onwards.

Once the program has been run, it may be tested by executing LET Z = USR (17000). This should again produce a bleep on the loudspeaker. If all is well the program should be saved in its entirety, and may be incorporated into any programs requiring audio output.

Using the audio generator

Both the frequency and duration of audio output from the generator program may be varied by using two POKE commands before executing the USR call. On the ZX80, the two locations are 17003 and 17017 for duration and frequency respectively, while for the '81 the locations are 16518 and 16532. Any integer between 1 and 255 may be POKEd to these addresses, with low numbers producing short durations or high frequencies. The test program below allows both durations and frequencies to be entered using INPUT statements before making the USR call.

```
150 PRINT "DURATION 1—255"
160 INPUT D
170 PRINT "FREQUENCY 1—255"  Variations for the ZX81:
180 INPUT F
190 CLS
200 POKE 17003, D                POKE 16518,D
210 POKE 17017,F                 POKE 16532,F
220 LET X = USR (17000)          LET X = USR 16515
230 GO TO 150
```

The machine code audio subroutine offers one further facility. As things stand, once the USR call has been made, the signal levels on channels 1-7 of the ouput port will all be reset to zero. This is obviously inconvenient if they are being used simultaneously for some other purpose. To get around this problem, a POKE command may be executed to address 17001 for the ZX80 or 16516 for the ZX81 just before executing the USR call. The data POKEd in this command should be the same as the last data POKEd to the output port. Thus, suppose a program were required to turn on a relay on channel two of the output port by POKEing the value 4 to the port, and at the same time needed to access the audio routine, POKEing 17001 or 16516 with the value 4 would ensure that when the USR call was made it would leave the relay in the ON position.

Sound effects

A wide range of sound effects may be produced using the audio subroutine and these may be used to add life to games and more serious programs. Here are one or two examples of effects produced by rapidly varying the output frequency using a series of FOR loops to create noises of the kind that Invader machines are fond of producing.

```
500 REM ZX80 SOUND EFFECTS
510 PRINT "DURATION 3-255"
520 INPUT D
530 CLS
540 POKE 17003,D
550 FOR A = 1 TO 10
560 POKE 17017,(255/A)
570 LET X = USR(17000)
580 NEXT A
590 GO TO 550

500 REM ZX81 SOUND EFFECTS
510 PRINT "DURATION 3-255"
520 INPUT D
530 CLS
540 POKE 16518,D
550 FOR A = 1 TO 10
560 POKE 16532, INT (255/A)
570 LET X = USR 16515
580 NEXT A
590 GO TO 550
```

These program lines should of course be entered on top of the relevant audio generating subroutines described above. To halt sound output press the BREAK key, though in real applications a further FOR loop may be inserted to exit the routine when required. The sound effect produced by the above routines may be altered considerably by changing line 550 to: FOR A = 10 TO 1 STEP —1. Also, inserting the two lines:

```
573 POKE 17017,255
575 LET X = USR(17000)

573 POKE 16532,255
575 LET X = USR 16515
```

will also change the sound produced.

Random 'music'

The following short routines, which again access the machine code audio subroutine, allow the ZX to play an infinite (though repeating) series of notes chosen randomly using its RND function. The RANDOMISE function might additionally be incorporated at some point, though this will not greatly increase the probability that the machine will hit upon Beethoven's Ninth, given long enough.

```
500 REM ZX80 RANDOM PLAYER
510 POKE 17003,100
520 POKE 17017,(15+RND(240))
530 LET X = USR(17000)
540 GO TO 520

500 REM ZX81 RANDOM PLAYER
510 POKE 16518,100
520 POKE 16532,(240*RND+15)
530 LET X = USR 16515
540 GO TO 520
```

Keyboard organ

If you want to play tunes for yourself, that can also be arranged, though it is a little harder with the ZX80, since it has no INKEY$ function for detecting keyboard presses without stopping the program with an INPUT statement. Here firstly is the ZX81 version:

```
199 REM ZX81 ORGAN-USES M/C
    ROUTINE IN REM
200 IF INKEY$ < >" " THEN
    GO TO 200
205 LET Q$ = INKEY$
207 IF Q$ = "" THEN GO TO 205
210 LET W = VAL Q$
215 IF W = 0 THEN GO TO 300
220 POKE 16532, INT(255/W)
230 LET X = USR 16515
240 GO TO 205
300 PRINT "ENTER NEW PERIOD
    1—255"
310 INPUT Z
320 IF Z < 1 OR Z > 255 THEN GO
    TO 300
330 POKE 16518,Z
340 CLS
350 GO TO 200
```

Keyboard numbers 1 — 9 play nine different notes and, if zero is pressed, the playing routine is exited so that the note duration may be altered. Values of about 100 give good results, with lower values producing a tremolo effect.

To implement the organ on the ZX80, a machine code patch could be used to implement the INKEY$ function, but here we will use a set of push buttons connected to the lowest four channels of the input port (R0-R3) using the circuit of Figure 9 of last month. The program below can play up to 15 different notes with this arrangement, depending on which combination of the four buttons are pressed. There is at present no facility for altering the duration of the note, but this may be easily added in such a way that pressing a button on say channel four initiates an appropriate INPUT routine.

```
140 REM ZX80 PUSH BUTTON
    ORGAN
145 REM USE WITH M/C ROUTINE
150 LET A = PEEK(25000)
160 IF A = 0 THEN GO TO 150
170 POKE 17017, (15 + A*15)
180 LET X = USR(17000)
190 GO TO 150
```

Some interesting effects can be obtained using the program with LDR photo-resistors substituted for the push buttons, as in Figure 12 last month. This arrangement transforms visual patterns into audio tones.

Hardwired audio

An alternative way to produce audio output from the ZX is to use a separate audio generator IC such as the NE555, which costs only 20p. The advantage of this approach is that, since the audio is actually generated by the NE555 and not by the microprocessor chip itself, the ZX can get on with other things during sound output. This means that with the ZX81 in the slow mode, for example, TV output may continue during the production of sounds. Figure 2 shows the circuit for such a generator. As may be seen, it occupies four of the 80/81 board's output channels to achieve a repertoire of eight notes. In fact, channels 0, 1 and 2 actually control the frequency generated, while channel 3 decides whether the output is on or off. Output is enabled when channel 3 is high, so that data in the range 8 to 15 produces audio output. To alter the range of frequencies produced, C may be changed. Larger values give a lower frequency, and vice versa.

To produce audio with the generator, simply POKE a value between 8 and 15 to the output port (25000 on the '80, 11000 on the '81). To stop the flow of sound, POKE 0 to the port.

As suggested above, one advantage of the hardwired audio approach is that (at the cost of an extra three output channels) audio can be output

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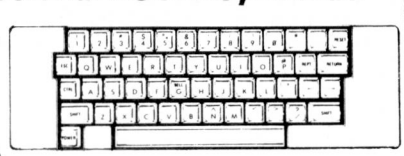

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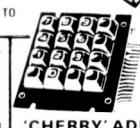

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when the ZX is occupied elsewhere. In the case of the ZX81, sound effects can be produced under Basic control, while the ZX maintains the screen display. The program below illustrates this.

```
10 REM ZX81 HARDWIRED AUDIO
     EFFECT
20 SLOW
30 PRINT "SIMULTANEOUS AUDIO
     AND SCREEN SUPPORT"
40 FOR A = 1 TO 8
50 FOR B = 8 TO 16
60 POKE 11000,B
70 NEXT B
80 NEXT A
```

Of course, faster changing audio effects can be produced in the FAST mode, but screen support will be lost in the process.

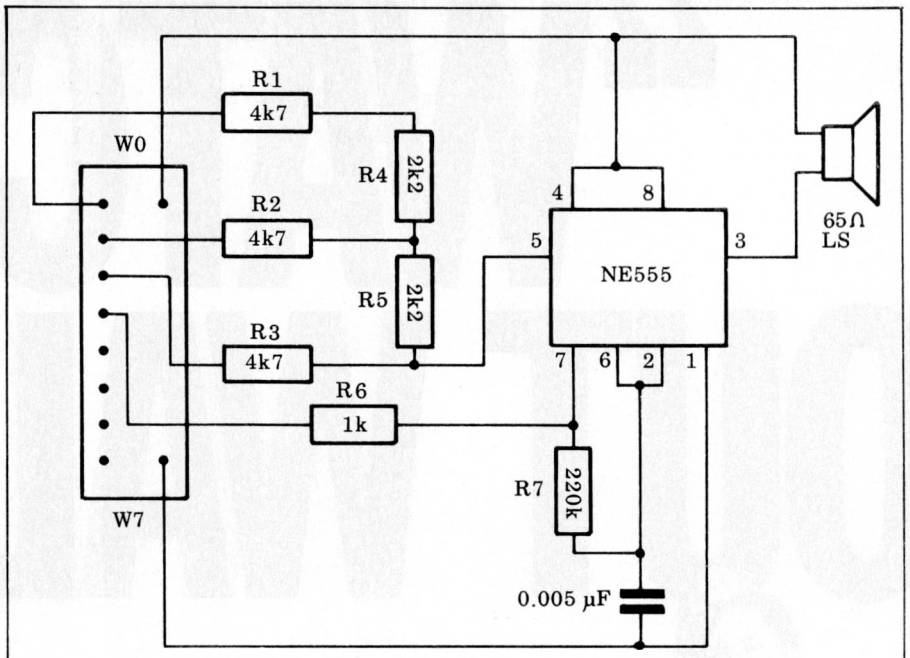

Fig 2 Hardwired audio generator. For accurate conversion, R1, R2 & R3 should be 4k 1% and R4 & R5 should be 2k 1%.

Polling a keypad

The 80/81 port board provides eight input and eight output channels which will be sufficient for many applications. If more are required for a particular task, it is often possible to increase the effective number of channels by using a few hardware tricks.

The so-called polled keyboard is a case in point. Last month the use of an 8-button keypad was discussed. This employs one push button on each of the eight input channels. It is possible, however, to economise on this set-up by using a polling technique. Suppose that a hex keypad (containing 16 switches) is to be used for data input at the 80/81 port, and on top of this we want to leave four of the eight input channels free for other devices. The circuit of Figure 3 achieves this.

It does so by grouping the 16 switches into four rows by four columns (and in fact hex keypads are often manufactured prewired in this way). The individual columns are connected to the lowest four bits of the input port (R0—R3), while the four rows are each connected to one bit of the output port (W0—W3). A short software routine may then be used to read the state of the keys. This operates by polling the keyboard row by row. To poll the top row, a high output is set up on row one by POKEing the value 1 to the output port. The input port is then PEEKed to see whether any of R0—R3 are in a high state. If so, it means that the corresponding button on the top row has been pressed. Next W1 can be made high, and the input port re-read to test the state of the keys in the second row, and so on. The principle used here is very commonly employed in microcomputer systems, and is in fact used on the keyboards of the ZX80 and 81; although of course in such cases the polling is executed by the computer's machine code operating system, rather than in Basic, which would prove somewhat slow for rapid key response.

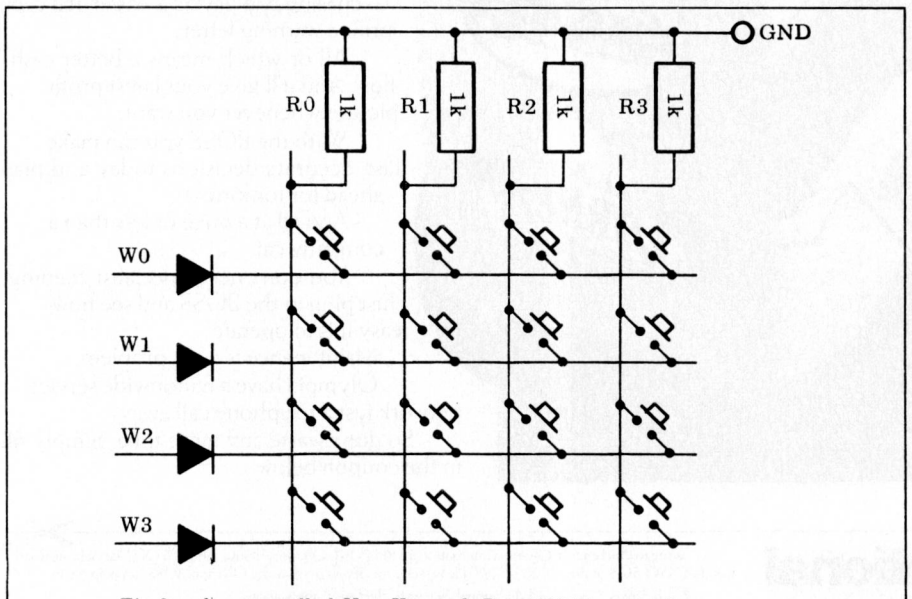

Fig 3 software polled Hex Keypad. D = IN914 or similar.
WO = channel 0 of output port = pin 1 of WRITE plug etc.
R0 = channel 0 of input port = pin 1 of READ plug etc.
Connect the ground on each resistor to pin 9 of the READ plug.

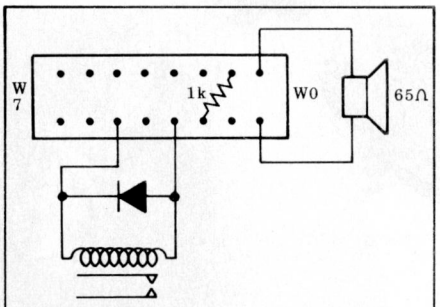

Fig 4 Connections for auto-timer. Diode is type IN914 or similar, relay is Omron type LZNZ 03 6 volt.

Auto-timer

Since the output port on the 80/81 board is capable of supporting both relay and audio output at the same time, it is possible to implement a chiming timer. In the simplest case, a program to accomplish this might request a time duration to be input and when the given time has elapsed it could switch on or off any desired device connected to a relay on the output port. It might at the same time count off the seconds with an audible bleep. The program below achieves this when used in conjunction with the circuit of Figure 4. The loudspeaker is connected to channel zero of the output port, and the relay switching the device to be timed is driven from channel one using the on-board buffer amplifier. The program first requests a time delay in seconds (though a small software change would allow it to cope with minutes or even hours). It then switches on the relay and begins counting.

```
10 REM ZX80 TIMER/CONTROLLER
20 POKE 25000,0
30 PRINT,"ZX80 TIMER"
40 PRINT "TIME IN SECS?"
50 INPUT C
60 LET B = 1
70 POKE 25000,2
100 FOR A = 1 TO 440
110 NEXT A
```

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```
130 IF B = C THEN GO TO 400
140 GO SUB 300
150 LET B = B + 1
160 GO TO 100
300 FOR D = 1 TO 10
310 POKE 25000,3
320 POKE 25000,2
330 NEXT D
340 RETURN
400 FOR E = 1 TO 100
410 POKE 25000,1
420 POKE 25000,0
430 NEXT E
440 GO TO 50
```

Timing is carried out using the loop at line 100 which may be adjusted in length to achieve an accuracy of about one part in 400. Every second a short bleep is produced on the loudspeaker (using a Basic routine rather than machine code). And after the predetermined delay the relay is switched off and a one-second bleep is produced to signal this. To run the program on the ZX81, change all 25000s to 11000 and use the FAST mode. Some correction will also be required to the length of the FOR loop in line 100 since the ZX81's Basic runs slower than that of the '80. Although this example has been kept fairly simple, one could envisage much more complex timers being implemented using similar techniques. These might, for example, use a number of relays to control a series of different devices at different times.

Logic analyser

When checking digital circuits, or even when trying to follow the operation of a particular IC, it is very useful to be able to test logic states at any point. That is to say, to test whether any point in the circuit is at a logical high or low. The logic tester to be described here does this and more. It allows the simultaneous monitoring of the logic states of up to eight separate points and also allows the results to be printed on to the screen. In this respect it will also prove useful in testing the states of switches, pushbuttons, and photocells used in experiments described in these articles.

The circuit for the analyser is given in Figure 5. As may be seen, it is extremely simple, requiring only nine pieces of wire and, for the deluxe version, nine crocodile clips or similar. The program for running it on the ZX80 is given below. For the ZX81 just alter all 25000s to 11000.

```
100 REM ZX80 LOGIC ANALYSER
110 PRINT TAB 4; "CHAN:";TAB 10
120 FOR A = 0 TO 7
130 PRINT 7—A;" ";
140 NEXT A
150 PRINT
160 INPUT Z
170 LET X = PEEK (25000)
180 PRINT TAB 5; X; TAB 10;
190 FOR L = 0 TO 7
195 LET Y = 7—L
200 LET P = 0
210 LET X = X — 2**Y
220 IF X >—1 THEN LET P = 1
```

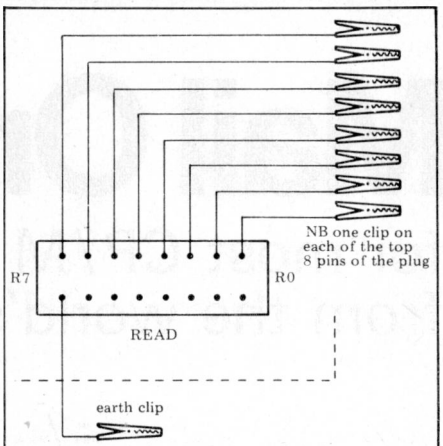

Fig 5 Connections for logic analyser (de luxe version)

```
230 IF X < 0 THEN LET X = X + 2**Y
240 PRINT P; " ";
250 NEXT L
260 PRINT
270 GO TO 160
```

When the program is run, each time that NEW LINE is pressed the input port will be read and a printout of 1s and 0s will be produced, representing the states of the eight channels. This takes the following form:

```
CHAN:  7 6 5 4 3 2 1 0
17     0 0 0 1 0 0 0 1
145    1 0 0 1 0 0 0 1
```

In this example, at the first test, channels 4 and 0 were high, while in

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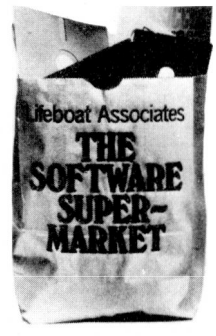

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the second, 7, 4 and 0 were high. The decimal equivalent of the combined input is also printed out — 17 and 145 respectively.

The FOR loop in this program, running from line 190 to 260, performs the task of actually identifying which of the input channels are high and which low and of producing a series of 1s and 0s accordingly.

In many applications of the input port it is useful to be able to treat each channel as a separate entity and to be able to take action on the basis of the state of any given channel irrespective of the state of the remainder. Below is a generalised routine which permits this.

```
100 REM ZX80 INPUT SEPARATOR
    ROUTINE
110 DIM D(8)
120 LET D = PEEK (25000)
    [use 11000 for the '81]
130 FOR E = 0 TO 7
135 LET F = 7—E
140 LET D(F + 1) = 0
150 LET D = D —2**F
160 IF  D > —1 THEN LET D(F+1)
    = 1
170 IF D < 0 THEN LET D = D + 2**F
180 NEXT E
```

An array D(n) is first set up and the input port is PEEKed. The routine then sets each of the eight array variables to 1 if the corresponding channel of the port is high and to 0 if it is not. The resultant data for channel 7 is held in D(8), channel 6 in D(7) and so on. Thus to discover the state of channel 4 of the input port irrespective of the states of the other channels, execute the above program followed by a test for the value of D(3). If D(3) = 0, channel 3 was low. If it is = 1, then it was high.

Burglar alarms and train controllers

The provision of eight input and eight output channels on the ZX port is sufficient to allow the ZX to be used as a systems controller in a number of different applications. The essential feature of such a control system is the collection of data from a variety of sensors and, after due processing, the control of a number of devices in response. A burglar alarm system and a model train controller both provide examples of such an application and may be implemented using the ZX port board.

In the case of the burglar alarm, sensors of many different kinds could be employed — from magnetic reed switches to detect door openings, to photocells and pressure switches. Each of the port's eight input channels could be used to monitor a group of sensors wired together, and the ZX could be programmed to indicate not only when activity had been detected on a particular group of sensors, but which group had been activated. The input separator routine discussed above should prove useful in this respect. A range of responses to detector stimulation could easily be implemented on such a system to initiate low-level warning lamps or high-level alarm switching, depending on what sequence of detectors had been activated, and under what circumstances.

In the case of the model train layout, the data to be input would consist mainly of indications as to the train's whereabouts. This could be achieved with a number of microswitches, or by light-dependent resistors mounted below the track, and facing upwards. The passage of the train could be arranged to obscure the photocell sufficiently for detection to occur. The output port could then be used to control the direction of travel of the train, the position of the points, and the state of signals around the track. In a fairly simple set-up, two relays could be used to provide stop/start and forward/reverse control, while each of the six remaining output channels could control a set of points or signals. Thus an unextended port could support up to eight position detectors, plus three sets of points and three independent signals, as well as engine control. This would be sufficient for quite complex train manoeuvres — especially if the RND function on the ZX were employed to vary the routes taken and the stops made. Using the ZX81 in the slow mode, it might even be possible to run a video timetable display, or a screen train position indicator.

Speech synthesis

The inputs and outputs of the ZX port are what is called TTL compatible. This means that they may be used to interface some of the many proprietary devices which use this logic standard. By way of illustration we will look at how a speech synthesis unit may be run from the board. The unit concerned is produced by Modus Systems Ltd, and has a fixed vocabulary of from 24 to 64 words. The vocabulary of the standard version is given in Figure 6 together with its digital value.

The Modus speech board has a six-line data bus plus three control lines labelled Latch, Start and Busy. To generate speech, the unit requires the following sequence of events to occur: data must first be put on the board's six data lines to select the word required; the Latch line must then be taken from low to high, so as to store the data presented; the Start line must then be taken from high to low to initiate speech output.

To satisfy these conditions the ZX port output socket may be connected as in Figure 7. That is to say, lines W0 to W5 are connected to the Latch and Start lines respectively. Software is then used to place the data on the bus and manipulate the state of the two control lines. In fact, by cutting one or two corners, the whole thing can be executed in two lines of ZX Basic — as may be seen from the following, which causes the word 'Three' to be spoken:

```
10 POKE 25000, (3 + 128)
20 POKE 25000, (3 + 64)
```

(Use 11000 instead of 25000 on the ZX81)

The first command puts the value 3 on the speech board's data bus and at the same time sets the Start line high, and the Latch line low. The second maintains the value 3 on the bus and takes Start low and Latch high, thus simultaneously latching the data and initiating speech output. The program is of course easily generalised to permit any word from the board's vocabulary to be output:

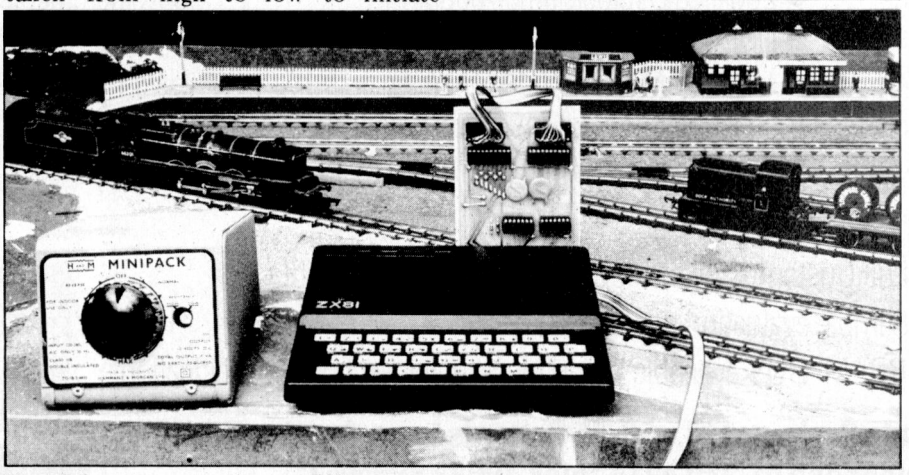
```
10 REM SPOKEN VOCABULARY
20 PRINT "ENTER A NUMBER 0-23"
30 INPUT W
40 POKE 25000, (W + 128)
50 POKE 25000, (W + 64)
60 GO TO 20
```

(Use 11000 instead of 25000 for the ZX81)

The speech board provides one further control line that has not yet been discussed: the Busy line. This is controlled by the speech board itself and is used to inform the host computer when it has finished outputting a word. This is a useful facility, since it avoids the computer having to guess when each word has been completed, during the output of a string of words, before

data	word	data	word
0	oh		
1	one	12	percent
2	two	13	low
3	three	14	over
4	four	15	root
5	five	16	em (M)
6	six	17	times
7	seven	18	point
8	eight	19	overflow
9	nine	20	minus
10	times-minus	21	plus
11	equals	22	clear
		23	swap

Fig 6 Speech board vocabulary



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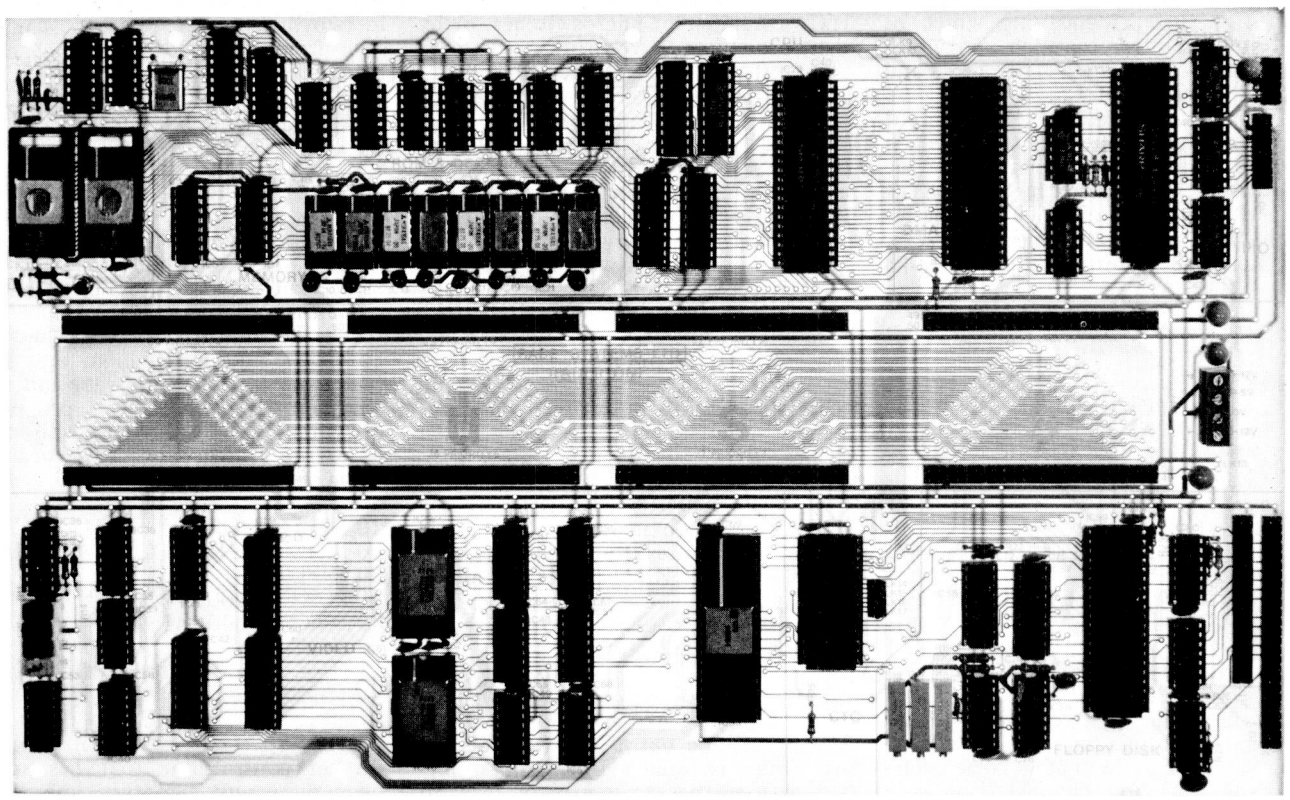

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starting the next. Without this information the computer would either run the longer words into each other, or leave too long a gap between the shorter ones.

The Busy line may be connected directly to the input port on channel 7, as in Figure 7. In this way its state can be monitored by PEEKing the port before outputting the next word. The program below uses this facility to endlessly speak through the whole vocabulary of the board at an even pace.

```
10 REM ZX81 COMPLETE VOCAB
20 REM OF SPEECH BOARD  BOARD
30 LET A = 11000
40 FOR B = 0 TO 23
50 GO SUB 100
60 FOR C = 1 TO 10
70 NEXT C
80 NEXT B
90 GO TO 30
100 POKE A, (B + 128)
110 POKE A, (B + 64)
120 IF PEEK A < 128 THEN GO TO
      120
130 RETURN
```

The Busy line is monitored in program line 120, and the program loops here until it is clear. The short delay in line 60 provides a small equal separation space between each word. To implement the program on the ZX80, change line 30 to allocate A to 25000, and bracket A in line 120. Of course a speech board can be programmed to do much more than just speak sequentially through its vocabulary. And with the principles illustrated here it should be possible to program a number of interesting applications on the ZX, from speaking calculators and speaking clock to spoken games' scores.

This concludes treatment of the ZX port, but by no means exhausts its possible applications. If you develop a novel working application of the port that you think may interest readers, then write in to the Editor giving full details.

The ZX port kit may be obtained from Technomatic Ltd at £11.50 + P&P + VAT.

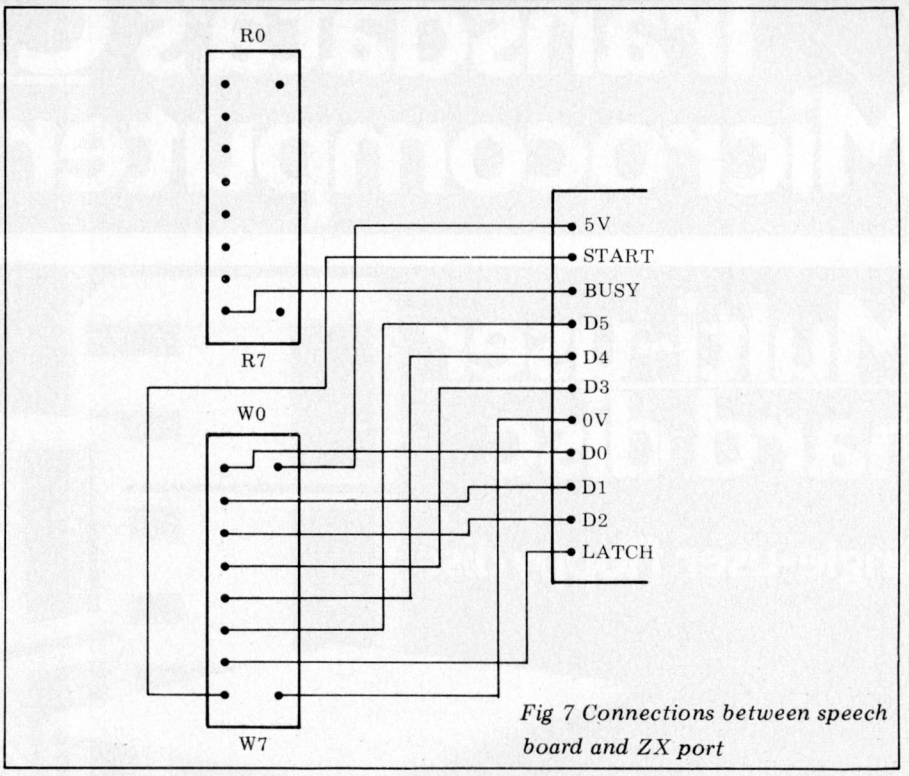

Fig 7 Connections between speech board and ZX port

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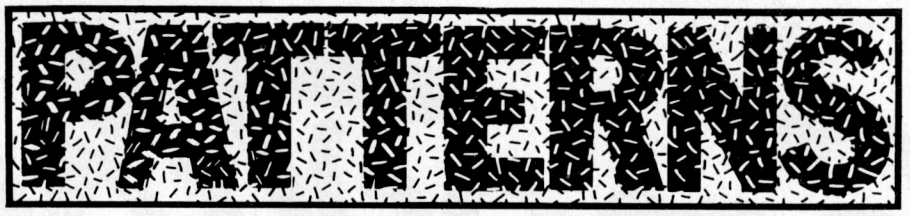

HOW RANDOM IS RANDOM?

Alan Sutcliffe continues his series with thoughts on accurate randomness

Standards for randomness is, at first sight, an odd topic for this column on patterns. Patterns are inherently interesting: they are what we pick out from the flux of our environment. To be random is to be without pattern.

The early tables of random numbers for use by statisticians were produced by someone writing down digits 'at random' until some tendency to a pattern began to emerge, say a fondness for 7 or too few occurrences of 0. Then the imbalance would be restored, the pattern destroyed. Even so, it seems likely that there were not enough of the freak patterns that do happen in random sequences. After all, if you spin a coin 1000 times it is likely that somewhere along the way it will come up heads nine or 10 times in succession, without indicating any bias in the coin.

But if a coin came up heads 12 times with no tails in such a test, would that be significant? How about 14 times? These are the kinds of question that statistics was developed to answer — and the kind of answer that can be given is that such and such a thing should only happen once in 20 tests, or once in 100 tests. A statistical test can never show something beyond all possible doubt. After all, if you deal a pack of cards for whist, each player will get a complete suit about once in every 2,235,197,406,895,366,368,301,560,000 times. And every other particular distribution is just as unlikely. Yet the cards have to be distributed somehow, however improbable that distribution is. If the same combination turns up twice in the same day (or even twice on the same planet) you would have some grounds for suspecting an irregularity.

Why we don't see the outcome of every deal of cards as an extraordinary freak is that we don't see the precise and complete pattern of it — 3 and Q of Hearts, 8 of Clubs and so on — but abstract from it a higher level pattern, two Hearts, one of them high, one Club, and so on.

As for standards, that sounds like a pretty dull subject, conjuring up images of smoked-filled rooms of worthy people endlessly debating this or that detail of a feature of a language or an interface. But that is the subject I have chosen this month: a review of some programs that test systems for conformity with the US National Bureau of Standards (NBS) standard for Minimal Basic, and a review of how my DAI computer fared with some of these test programs, particularly those for the Random function.

Minimal Basic

The American National Standard for Minimal Basic (ANSI X3.60-1978) is just what its name suggests. It is so minimal that I cannot imagine anyone producing a system now which had only the facilities stated: single letter variable names, LET required in assignments, lines to be input strictly in numerical order. But the standard is not meant to specify a complete language, rather a common core and standards for extensions to that core. Many of the test programs deal specifically with common extensions and contain the following words:

'This is a test for a non-standard feature of minimal Basic. To pass this test, the processor must either:

1. Accept the program and be accompanied by documentation accurately describing the features' interpretation by the processor, or
2. Reject the program with an appropriate error message.'

This approach, with the rest of the philosophy adopted by the authors of the test programs, is given in detail in the first volume of *NBS Minimal Basic Test Programs — Version 2, User's Manual* while the second volume is devoted to the text of the 208 test programs, with sample output from each one.

Test programs

Many of the programs are verbose and simple to the point of triviality. Seated at your own small machine, you hardly need a 30-line program to find out what the processor does with a line number containing a space; it is enough to type in one such line. But the programs were written to be called up at a terminal from a file and each one is fully self-documenting. It is easy to miss out the repetitious bits if you want to test your own computer and I think you will find it very interesting to run many of these tests.

If you are a supplier of Basic systems which may be sold to the US federal government or any of its many agencies, then you will find it more than interesting. It is proposed that sometime before the end of 1982 any such system will have to conform to the ANSI standard. That is why these test programs have been developed by the NBS, which is part of the Department of Commerce.

There are various kinds of test. There are those for simple conformity, like PRINT does print a blank line, and PRINT"A" does print A. Then there are tests for how the system reacts to common errors like an array subscript out of range. There are tests, as already mentioned, for some of the usual extensions to Basic. Another group of test programs is concerned with the accuracy of computations, particularly those for the built-in functions such as SQR and COS. These tests are informative only, since the standard does not lay down limits for accuracy. Similar to these tests for accuracy, and a shade more problematical, is a group that allow an investigation of the behaviour of the RND function.

The Documentation volume makes it clear that even taken as a whole these programs do not amount to an algorithm that can prove conformity with the standard, although one failure easily shows non-conformity. Rather, they should be seen as test data for the Basic processor, probing any weakness it may have, but never able to show it is entirely free of faults.

This is particularly true of the tests for randomness. There is no algorithm that establishes a sequence or a process as random, only tests that find patterns indicating departure from randomness and estimates of how likely such departures are in a random sequence. First of all, there is no such thing as a random number; every number is a particular number. There is certainly no such thing as a random person; any individual, however randomly chosen, will be male or female, a specific age and weight. There is not even such a thing as a typical person, for the same reasons.

But returning to numbers, even suppose a range is specified, such as 0 to 1, as for the RND function, no single number is random. Look at 0.6249, for example. Nothing very special about it, apparently, just an ordinary looking fraction, not the square of anything interesting or a simple function of pi. But suppose your random number generator gave the value 0.6249 *every time* Then you might not be too happy to accept it as random. In any case, I cheated, since tan 32^0 = 0.6249 approximately.

Donald Knuth, in his book on seminumerical algorithms, *The Art of Computer Programming*, Vol 2, takes this line of thought further to argue that there is no such thing as a random sequence: there are only particular sequences. Another problem in our relation of randomness is our natural tendency to see patterns. Take a random distribution in nature, the stars in the night sky, leaving aside the clustering of the Milky Way. What people through the ages have seen in this is not the randomness but patterns, the constellations. The same seven stars are picked out in almost every civilisation and seen as a Bear or a Plough or seven wise men.

By the way, Knuth also discusses in this book the use of the Fibonacci

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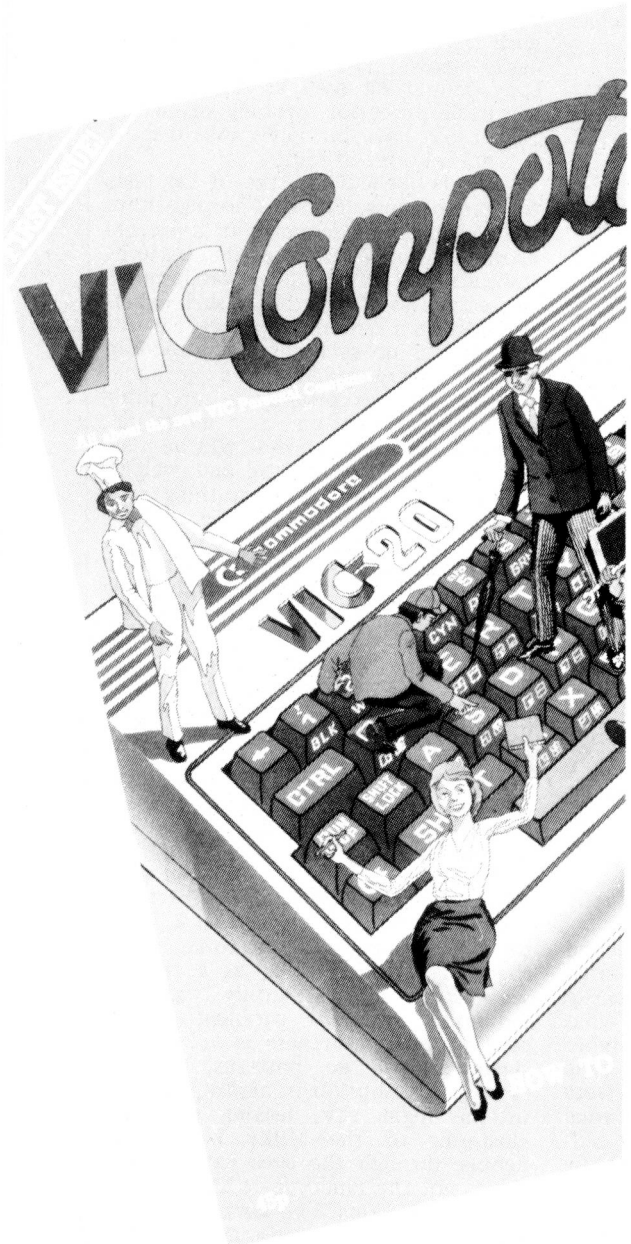

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series as a way of generating random sequences and gives a brief history of the topic. I wrote about this in my last article, and could have given Knuth as a reference. While he writes about using the rule that the next term is the sum of the two preceding ones to generate fractions, I was concerned with it for sequences of integers.

But the main reason for mentioning Knuth's book here is that the NBS test programs for randomness are based on his work, and a detailed understanding can be got from reading it. To emphasise the importance of theory in this subject, Knuth relates how many of the random generators developed during the 1970s are seriously faulty because they were designed to pass a test which was itself wrong! So you could get some surprises from running these tests on your system.

Testing the DAI

Program A tests the average value of the numbers generated by RND. It is reproduced exactly as it appears in the NBS book, together with its sample output. The program is self-documenting: the statistical theory is not explained but the result of the test is unambiguously clear: PASS or FAIL. This is at the expense of some prolixity and to run this test on your own machine you hardly need to type in the first 18 lines — it is enough to read them.

I have run this program on my DAI, which is a good machine for testing these tests since it has both a hardware and a software random number generator. The software one is called in the normal way, while the hardware generator is activated by giving a zero parameter in the call, that is RND(0). Table 1 gives the results from four tests with each one.

As has been said, no statistical test is completely conclusive but these results are reassuring. In every case the amount of deviation was within the limit set by the program. A failure should be expected from about one case in 20. In relation to this, the results look reasonably spaced, the highest being about two-thirds of the limit. One failure would not indicate a high probability of bias, but it should cause the test to be repeated a few times: it would be a cause for some suspicion, a possible clue.

While each of these NBS programs was designed as a simple go/no-go test, I think it is much more sensible to run them several times and in some cases to modify them, as I shall show later — to think of them as tools for an investigation rather than as tests to pass or fail. This is important in any statistical test, and leads to a criticism of the NBS programs.

Printing and using the value for the limit to six significant figures might lead someone to think that there is a sharp dividing line between pass and fail. It would be much better to give only three significant figures as a reminder that results near the limit are in a grey area, a shoulder of doubt between staying on

```
10 PRINT "PROGRAM FILE 132: AVERAGE OF RANDOM NUMBERS APPROXIMATES 0.5"
15 PRINT "        AND 0 <= RND < 1."
20 PRINT "    ANSI STANDARD 8.4"
30 PRINT
40 PRINT "SECTION 132.1: AVERAGE OF RANDOM NUMBERS APPROXIMATES 0.5"
50 PRINT "        AND 0 <= RND < 1."
60 PRINT
70 PRINT "THIS PROGRAM TESTS WHETHER THE AVERAGE OF A SERIES OF RANDOM"
80 PRINT "NUMBERS IS SIGNIFICANTLY FAR FROM THE IDEAL OF 0.5. IF SO,"
90 PRINT "THIS RESULT INDICATES NON-UNIFORM DISTRIBUTION AND THE TEST"
100 PRINT "FAILS. ALSO, IF ANY OF THE NUMBERS IS OUTSIDE THE ALLOWABLE"
110 PRINT "RANGE, AN IMMEDIATE FAILURE IS REPORTED."
120 PRINT
130 PRINT "                BEGIN TEST"
140 PRINT
150 REM N=8754 BASED ON SIGNIFICANCE LEVEL OF .05 AND 0.1 CHANCE OF
160 REM NOT FINDING A DIFFERENCE OF AT LEAST .01 FROM STANDARD
170 REM AVERAGE OF 0.5, AND STANDARD DEVIATION OF 1/(2*SQR(3))
180 LET N=8754
190 LET S1=0
200 LET S2=0
210 FOR I=1 TO N
220   LET X=RND
230   IF X<0 THEN 490
240   IF X>=1 THEN 510
250   LET S1=S1+X
260   LET S2=S2+(X*X)
270 NEXT I
280 LET S = SQR((N*S2) - (S1*S1)) / N
290 LET X1=S1/N
300 PRINT ,"AVERAGE","STD. DEV."
310 PRINT "THEORETICAL:",.5,1/(2*SQR(3))
320 PRINT "ACTUAL:",X1,S
330 LET A1=ABS(X1-0.5)
340 REM 1.96 BASED ON SIGNIFICANCE LEVEL OF .05 AND INFINITE D.F.
350 LET A2=(1.96*S)/SQR(N)
360 PRINT
370 PRINT "ALLOWABLE DEVIATION: ";A2
380 PRINT "ACTUAL DEVIATION:    ";A1
390 PRINT
400 IF A1>A2 THEN 430
410 PRINT "*** TEST PASSED ***"
420 GOTO 440
430 PRINT "*** TEST FAILED ***"
440 PRINT
450 PRINT "                END TEST"
460 PRINT
470 PRINT "END PROGRAM 132"
480 STOP
490 PRINT "RND#";I;" < 0: ";X
500 GOTO 430
510 PRINT "RND#";I;" >= 1: ";X
520 GOTO 430
530 END
```

Program A

```
PROGRAM FILE 132: AVERAGE OF RANDOM NUMBERS APPROXIMATES 0.5
        AND 0 <= RND < 1.
    ANSI STANDARD 8.4

SECTION 132.1: AVERAGE OF RANDOM NUMBERS APPROXIMATES 0.5
        AND 0 <= RND < 1.

THIS PROGRAM TESTS WHETHER THE AVERAGE OF A SERIES OF RANDOM
NUMBERS IS SIGNIFICANTLY FAR FROM THE IDEAL OF 0.5. IF SO,
THIS RESULT INDICATES NON-UNIFORM DISTRIBUTION AND THE TEST
FAILS. ALSO, IF ANY OF THE NUMBERS IS OUTSIDE THE ALLOWABLE
RANGE, AN IMMEDIATE FAILURE IS REPORTED.

                BEGIN TEST

              AVERAGE        STD. DEV.
THEORETICAL:    .5             .288675
ACTUAL:         .49492         .288053

ALLOWABLE DEVIATION:  6.03429E-3
ACTUAL DEVIATION:     5.07560E-3

*** TEST PASSED ***

                END TEST

END PROGRAM 132
```

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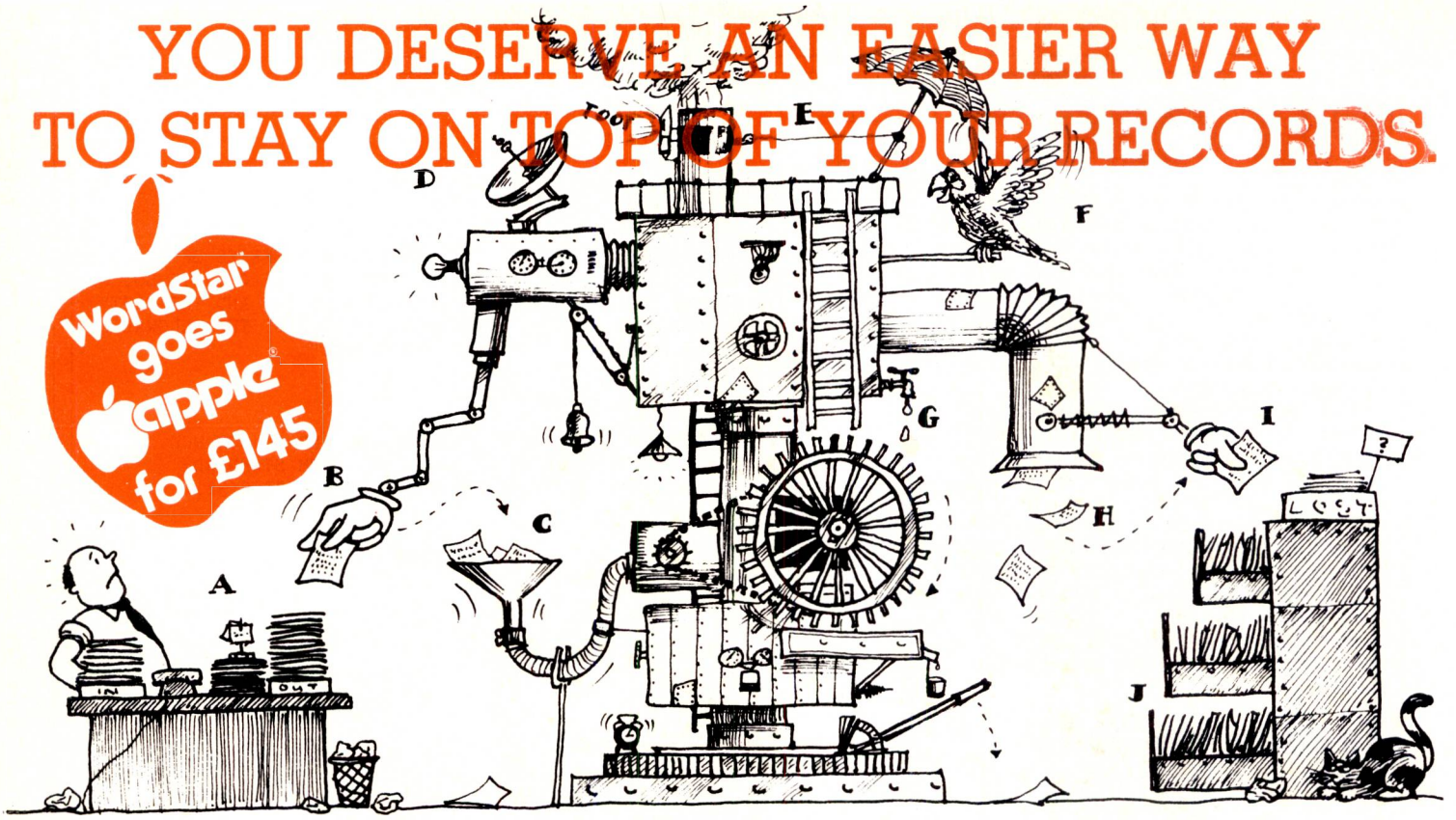

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the hard conforming carriageway and going off the road into very unlikely countryside. If the test is run once and the result is near the limit, whether just inside or just outside, the action should be the same: run it again.

One rule of thumb in any such test is that the effect of altering just one of the values in the test sequence cannot be significant. In this case it would be silly to think that if just one of the 8754 values had been near 1 instead of near 0 this could affect the result. One such change would increase the average by about 0.0001. So the fourth figure in the average can hardly matter, and the fifth and sixth figures, as given in the NBS results, are irrelevant. It's called spurious precision and should be avoided, as I have tried to do in Table 1. I leave it as a programming exercise for you to devise a routine to print the value of a Basic variable to three significant places.

This is a surprising deficiency for a National Bureau of Standards. It is compounded by the use of a constant in the computation correct only to three figures. In line 350 the value 1.96 is only approximate, like calling pi 3.14. Actually it is a little better because I think the true value is 1.960-something. It is the number of standard deviations within which 95 percent of the normal curve lies.

Notice, too, that a slightly different figure is given for the standard deviation, and therefore for the limit, for each run of the test. But since the limit is always around 0.00600 to 0.00602 this refinement hardly matters and may again suggest a precision that is irrelevant.

There is just the suspicion of something amiss in the figure in Table 1. The deviations from the hardware generator are somewhat higher than those from the software one, although they overlap. The standard deviations from the hardware are all higher than those from the software. This suggests that while the average values from the hardware are about right, they may vary away from the average, up and down, more than they should. The next test shows this dramatically.

Remember, in looking at these results, that too many values from repeated tests very near 0.5, that is, too many results with very low actual deviation, can indicate a fault just as much as too much can — a distribution that is too well behaved. An extreme example would be if the random generator produced exactly 0.5 every time. Such a generator would pass this test with zero deviation (and zero standard deviation, too). Over a long series of tests the actual deviations should have a normal distribution, with an average of 0.5 and a standard deviation of about 0.0031. But always remember that the outsider might just come up. There is a chance of 1 in 10^{8754} that all the values will be less than 0.1 in a test. If that happens, with an otherwise sound generator, let me know. It is of the same order of chance of a miracle happening without divine intervention: say a bullet passing through someone's body without doing any harm because none of the atoms collided.

		Average	Standard Deviation	Allowed Deviation	Actual Deviation
Theoretical		0.5	0.288	0.00605	—
Software	1	0.50239	0.287	0.00600	0.00239
	2	0.49704	0.291	0.00610	0.00296
	3	0.50031	0.291	0.00609	0.00031
	4	0.49977	0.289	0.00606	0.00023
Hardware	1	0.50411	0.294	0.00617	0.00411
	2	0.50060	0.293	0.00613	0.00060
	3	0.50116	0.294	0.00615	0.00116
	4	0.49692	0.295	0.00619	0.00308

Table 1 Results from NBS program 132 on the DAI computer random generators.

```
100 PRINT "NBS PROGRAM MODIFIED BY ALAN SUTCLIFFE"
110 PRINT "CHI-SQUARE UNIFORMITY TEST FOR RND FUNCTION"
120 PRINT
130 PRINT "INPUT NUMBER OF SLOTS"
140 INPUT M
150 DIM Y(M)
160 P1=50*M
170 REM ABOUT 50 VALUES PER SLOT EXPECTED
180 PRINT "INPUT NUMBER OF EXPERIMENTS"
190 INPUT N
192 PRINT "EXPT", "CHI-SQUARE"
200 REM CARRY OUT N EXPERIMENTS
210 FOR E=1 TO N
220 REM ZERO SLOT COUNTS
230 FOR I=1 TO M
240 Y(I)=0
250 NEXT I
260 REM OBTAIN FREQUENCY COUNTS
270 FOR I=1 TO P1
280 X=RND(1)
290 REM USE RND(0) FOR THE DAI HARDWARE GENERATOR
300 R=INT(M*X)+1
310 Y(R)=Y(R)+1
320 NEXT I
330 REM COMPUTE CHI*SQUARE STATISTIC
340 S=0
350 FOR I=1 TO M
360 S=S+M*Y(I)*Y(I)
370 NEXT I
380 V1=(S/P1)—P1
390 PRINT E, V1
400 NEXT E
410 COMPUTE AND PRINT CHI-SQUARE LIMITS FOR M SLOTS
420 Q1=SQR(M+M—3)
430 Q2= 2.32*Q1
440 R1=M+1.75—Q2
450 R4=M+2.08+Q2
460 Q2=1.645*Q1
470 R2=M+0.14—Q2
480 R3=M+0.14+Q2
490 PRINT
500 PRINT "CHI-SQUARE LIMITS"
510 PRINT " 1%",R1
520 PRINT " 5%",R2
530 PRINT "95%",R3
540 PRINT "99%",R4
550 END
```

Program B

Testing distribution

Having looked at the average, it is natural to look at the distribution of values in the allowed range 0 to 1; Program B enables you to do this. It is based on the NBS program, but I have modified it to allow any number of slots. The range 0 to 1 is divided into a number of equal slots and there is a count for each slot which is increased by one whenever a value occurs within the range of that slot.

At the end of a run the distribution of the values of these counts is checked using the X-square test. There is no space here to explain this standard statistical method, any more than I have explained standard deviation or normal distribution. If you are not familiar with these terms, refer to any introduction to statistics, such as *Facts from Figures* by M J Moroney (Penguin).

The NBS program works only for 21 slots and gives the values of X-square only for this case. I have therefore added a subroutine that calculates it for any number of slots. But beware — this routine gives inaccurate values for cases with fewer than 10 slots, so for these cases you should look in a book of statistical tables for X-square.

Table 2 shows the results of 10 tests with Program B for the DAI software and hardware generators. In each test there were 100 slots and 5000 samples, that is, random numbers. The chi-square limits indicate how many of the results are expected to lie below the

quoted values. For example, from Table 2, only 1 percent of the tests should have a result below 69.2, while only 1 percent should be above 134.6.

The software generator is again well behaved, with all the results well within the limits. But the results from the hardware generator are very high, with half the values above the 99 percent limit, indicating a big departure from uniform distribution.

To check this further, I next ran a simple test on each generator. 200,000 samples were distributed among 70 slots and the totals in each slot displayed on the screen as a bar chart; 70 was chosen so that the results would fit conveniently on the screen in low resolution mode.

The software generator behaves as it should, with a nice even distribution of values. Figure 1 shows a plot of the results from one test photographed from the screen and Figure 2 shows the corresponding results from the hardware generator. You don't have to know a thing about statistics to see what is happening. At the extremes of the range, near 0 and 1, there are far more values than there should be. There is also a lesser peak in the middle and some other minor peaks in between. I could not have asked for a better example to illustrate this article.

I don't want to spoil your fun too much by giving away the rest of the story, because I think you should buy or borrow this book of programs and run some of them. All I will say is that some of the other tests for randomness have intriguing names: the Komolgorov-Smirnov test for uniformity, the serial test and the gap test for randomness, the poker test and the coupon collector test for the RND function, among others.

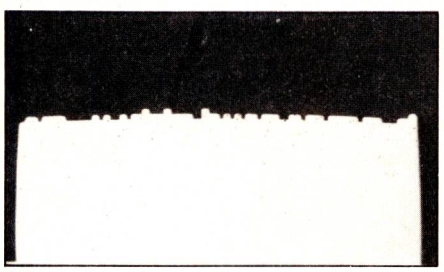


Figure 1

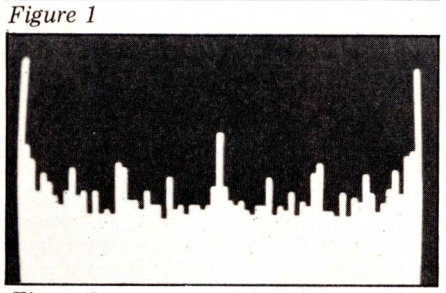


Figure 2

Expt	Software	Hardware
1	91.3	129.4
2	102.1	172.3
3	92.6	119.7
4	92.4	140.6
5	84.5	152.4
6	98.7	138.5
7	97.2	143.3
8	103.4	110.4
9	96.0	131.1
10	104.6	110.1
Chi-Square Limits		
1%	69.2	
5%	77.1	
95%	123.2	
99%	134.6	

Table 2 Result of tests of distribution of random numbers from the DAI computer, with 100 slots and 5000 samples in each test.

Crossword composition

The Computer Journal is not noted for articles of popular interest; more usually it is devoted to technical topics such as the 'Determination of Eigenvalues of Symmetric Quindiagonal Matrices'. But the May 1981 issue has a fascinating description by P D Smith and S Y Steen of their Prototype Crossword Compiler.

Input to the compiler is a diagram of blank and blocked-in squares of the usual kind. The program then attempts to fill the blank squares with words looked up in a dictionary of nearly 8000 words held on disk. The use of bit lists and heuristic tree searching allows non-trivial puzzles to be composed in reasonable time, anything from six to 600 processor seconds on an ICL 1904S. To ensure a fair trial, input diagrams were taken from puzzles in daily papers.

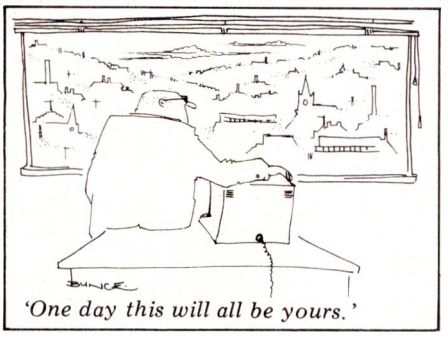
That still leaves the clues to be composed and the authors think that the simple type of multiple-definition would be easy to generate (Utensil god = PAN), but see no prospect of making up cryptic clues by program. A dictionary of anagrams could be computed once and for all. The methods described could be adapted to run on a small machine.

Further study

The City University in London is running several evening courses this winter on computing and related subjects. The list below shows the starting dates, some of the shorter classes being run twice.

Elementary Programming in Fortran, January; Introduction to Basic, October and January; Pascal and Structured Programming, October and January; Computer Music, October; Business Programming in Cobol, October.

For more information contact: Adult Education, Centre for Arts and Related Studies, City University, Northampton Square, London EC1V 0HB, telephone 01-253 4399 ext 496.



'One day this will all be yours.'

MICRO CHESS

CHESS FINAL '81

For the second year running the Personal Computer World Show played host to the European Microcomputer Chess Championship. The accommodation provided, namely a discreet suite well removed from the howling mobs, seemed somehow more in keeping with the spirit of the game than last year's site next to the bar.

Twelve programs found their way into the finals: Advance 2.0 (Dave Wilson, Mike Johnson); Albatross 3.0 (Michael J Parker); Caesar (John Lowe); Chess Champion (Sci Sys-W Ltd: David Broughton, M Johnson, D Levy, KO'Connell, M Taylor); Chessnut (Geoffrey J Bulmer); Cyrus (Richard Lang); Gambiet 81 (Microtrend Ltd: Wim Rens); Logichess (Kaare Danielsen); Microtrend Experimental (Microtrend Ltd: Wim Rens); Philidor Experimental (Philidor Software: D Broughton, D Levy, K O'Connell, M Taylor); Philidor (Philidor Software: D Broughton, D Levy, K O'Connell, M Taylor); White Knight (Philidor Software: M Bryant).

Of these entries I had only heard of the Philidor before the event and, considering the claims the programmers had made about it, it seemed natural that it would win quite easily. In the absence of the Great Game Machine (with the Granfeld and Morphy Cartridges) and other well known machines such as the Mephisto and the Sensory Voice Challenger (the winner of the 1st Official World Championship for micro-computers last year), surely there could be no doubt.

The final result was very surprising. The non-commercial entries scored very well.

As a very keen chess player, I am much more interested in the quality of the games than the bare results. Many of the games were decided, in my view, in a most random manner — but this was not the case with the games played by Cyrus. Cyrus played such good games I would have been quite pleased had I played them myself. Only in the first round did Cyrus get into a diffi-

cult position. Philidor Experimental won material and then insisted on a continual attack on Cyrus's pieces while ignoring the defence of its own king which Cyrus finally managed to checkmate.

For the remainder of the tournament Cyrus played remarkable chess and I have chosen two games for comments although all five are well worth publication.

Philidor-Cyrus: round 3

1	d2-d4	d7-d5
2	c2-c4	d5xc4
3	e2-e4	e7-e5
4	Ngl-f3	e5xd4
5	Bflxc4	Nb8-C6

Both programs are now out of their book openings. Instead of Cyrus's last move, the recommended move is Bf8-b4+6 00 Ng8-f6.

'Knights before Bishops' is an often-quoted recipe for use in opening play. The reason is that it's rarely clear which are the best squares to develop bishops, whereas knights nearly always belong as near to the centre as possible.

7	e4-eS	Nf6-e4
8	Qdl-e2	Ne4-Cs
9	Bcl-g5	Bf8-e7
10	Bg5xe7	Qd8 x e7
11	b2-b4	

The Levy *et al* programs seem to play this move a lot in different types of positions. Here it is easily understandable in that after the exchange of Philidor's b-pawn for Cyrus's d-pawn, White will have made a small gain in position. Central pawns tend to be worth more than the outer pawns because of their influence over the central squares (although this tends to be reversed as the end game approaches and outside passed pawns become very important).

11	..	Nc6 x b4
12	Nf3 x d4	Bc8-e6
13	Nd4 x e6	Nc5 x e6
14	Nbl-c3	00-0 (Ke8-c8)

This seems a most unusual decision. A human player would think twice before castling in front of so many open files. However, in this position, this move is a very good idea for several reasons: Had Cyrus played 14...00 (Ke8-g8) then Philidor could have generated a strong attacking position with moves such as f2-f4, f5-f6, Nc3-e4 and so on. Further, if (after 14...000) Philidor attempts to attack on the Queen-side, the active Black pieces should easily be able to defend. Lastly, Cyrus can now contemplate a King-side attack. The trouble with the above ideas is that they are all plans which can materialise over, let's say, six to 10 moves (12 — 20 ply). Now, for a machine to analyse six to 10 moves ahead, it would require a considerable length of time. In this tournament the machines had to play at a time rate of 30 moves by each player per hour of that player's time, so, there is no way these long range ideas could have been considered. Yet, amazingly, Cyrus castled Queen-side, easily defended its own King and successfully attacked Philidor's King!

15	a2-a3	Nb4-c6
16	Nc3-d5	Qe7-c5
17	Rfl-dl	Nc6-d4
18	Qe2-a2	C7-c6
19	Nd5-e3	Qc5 x e5
20	Racl	h7-h5

I like to imagine Cyrus's last move as the inauguration of a King-side attack, although it was played simply to increase the scope of the Rook on h8.

21	Bc4-d5	Kc8-b8
22	Bd5-C4	h5-h4

Philidor's last two moves show a common weakness of chess programs. A strong human player would not consider placing a piece on a bad square in order to make a random attack if, after a straightforward defensive move, that piece is forced to withdraw to the position from which it came. Philidor's last two moves did nothing to improve its own position, while Cyrus uses in effect the extra two moves very constructively.

	Rnd 1	Rnd 2	Rnd 3	Rnd 4	Rnd 5	
1 Cyrus	W5	W7	W4	W2	W6	5
2 Advance 2.0	W12	W3	W9	L1	W4	4
3 Logichess	W9	L2	W5	L4	W8	3
4 Philidor	W10	W8	L1	W3	L2	3
5 Philidor Expl.	L1	W11	L3	W9	W10	3
6 Caesar	D8	L10	W12	W7	L1	2½
7 Gambiet 81	W11	L1	D10	L6	W12	2½
8 Microtrend Expl.	D8	L4	W11	W10	L3	2½
9 Ch. Champ Mk V	L3	W12	L2	L5	W11	2
10 White Knight	L10	W6	D7	L8	L5	1½
11 Chessnut	L7	L5	L8	W12	L9	1
12 Albatross 3.0	L2	L9	L6	L11	L7	0

Table 1 Results

Another weakness of chess programs is that they do not 'learn' from their mistakes, so Philidor makes the same error with its next two moves.

23	Ne3-g4	Qe5-g5
24	Ng4-e3	Nd4-f3+
25	Kgl-hl	Rd8xdl+
26	Rclxdl	Nf3-d4
27	Rdl-bl	h4-h3

Cyrus gives points to moves which attack its opponents castled position.

28	Qa2-b2	h3xg2+
29	Ne3xg2	b7-b5
30	h2-h4	Nf3xh4

This is the only move in the game which disappointed me. I would have liked to have seen Cyrus play 31... Qg5-g4 with the threat of check mate next move. Only delaying moves such as Qb2-e5+ would prolong the game but then only for a few moves. The move chosen by Cyrus is still very strong, and indeed wins a lot of material, but Philidor lasts a lot longer than necessary.

32	Qxb2xb5+	c6xb5
33	Rb1xb5+	Kb8-c7
34	Rb5xg5	Nh4-f3+
35	Ng2-h4	Rh8xh4+
36	Kh1-g2	Ne6xg5

and Cyrus delivered checkmate on move 53.

Finally, the game that essentially decided the tournament. After three rounds only two programs, Advance 2.0 and Cyrus, had won all their games. They now had to play each other.

Advance 2.0 — Cyrus: round 4

1	e2-e4	c7-c5
2	Ng1-f3	Nb8-c6
3	d2-d4	c5xd4
4	Nf3xd4	Ng8-f6
5	Nb1-c3	d7-d6
6	Bc1-g5	

This is a standard opening variation known as the Sicilian Richter-Rauzer. Cyrus now goes its own way and by accident transposes into an extremely popular variation called the Sicilian Svesnikov!

6	..	e7-e5
7	Nd4-b5	a7-a6

Advance 2.0 should have played the attacked knight fo f5. Now the opening has become a Sicilian Svesnikov.

8	Bg5xf6	g7xf6
9	Nb5-a3	Bc8-e6
10	Bf1-c4	

Generally 10 Na3-c4 is considered the best move here but I'm sure most computers would give more weight to developing an unmoved piece rather than spend time improving the position of a piece already developed.

10	...	Qd8-b6
11	Bc4xe6	F7xe6
12	a3-c4	Qb6-b4
13	Qd1-e2	d6-d5!

Cyrus begins a tactical phase, resulting in the gain of material and finally checkmate. In several of its games Cyrus initiated a sequence of simple tactics, which resulted in the gain of material, but only after building up its position to the point where the tactics were justified. The significant point to consider here is that it is in exactly this manner that the majority of games between strong human players are decided. Both players will manoeuvre until one player gains the greater freedom of action for his pieces. Then, using this freedom, the player creates a sequence of threats which usually force a sudden deterioration in his opponent's position, often resulting in the gain of material. 'As usual, tactics flow from a positionally superior game.' (Bobby Fischer.)

14	Qe2-h5+	Ke8-e7

Rather dynamic play this! Yet completely in tune with the nature of the opening variation.

15	e4xd5	Nc6-d4
16	Nc4-e3	Qb4xb2
17	d5-d6+	Ke7-d8
18	Ke1-d2	

Forced to avoid the loss of a piece. But now the White king is rapidly executed.

18	...	Ra8-c8
19	Nc3-e4	Nd4Xc2
20	Ne3Xc2	Qb2-c2+
21	Kd2-e3	Rc8-c4
22	Qh5-h4	Bf8-h6+!

One of those moves any human player would have found extremely pleasant to play. If the bishop is captured, Cyrus mates in three moves. After the move played it's mate in 4.

23	Ke3-f3	Qc2-d3+
24	Kf3-g4	Qd3xe4+
25	Kg4-g3	

and the operators of Advance 2.0 resigned.

The last round was a bit of an anti-climax as Cyrus had already disposed of its main rivals. Yet again Cyrus won a nice game after Caesar managed to get a knight trapped among Cyrus's pawns.

What strikes me most about the games played by Cyrus, compared with those played by the other programs, is that Cyrus seems to co-ordinate its pieces. It gets them working well together then begins an attack for which it is well prepared.

Richard Lang kindly provided some information about his program, part of which I reproduce here.

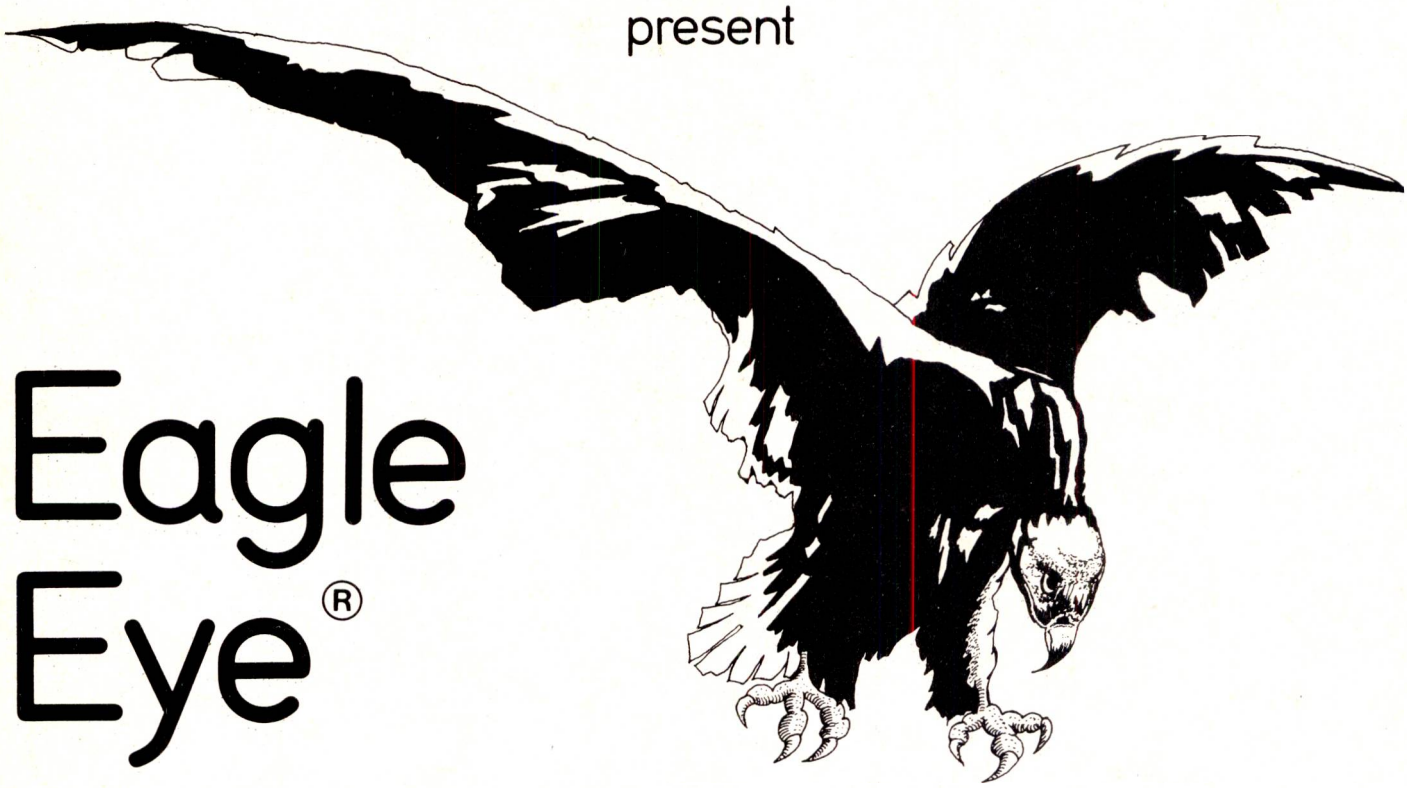
Cyrus has seven levels of play; the levels correspond to the number of ½ moves (ply) that Cyrus looks ahead (the search is automatically made deeper in the end-game and for checks at the top ply). The most useful levels are 3,4 and 5 which have average response times of about six seconds, 40 seconds and 1 minute 45 seconds respectively.

Cyrus occupies just over 7k of memory, of which about 1.25k is a table of 450 opening moves. In addition, level 5 needs a 2k workspace and level 7 needs 2.5k.

Cyrus uses depth-first alpha-beta

GOTO page 180

KSJ in association with Kent Barlow Information Associates present



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OSBORNE 01



When we heard that Adam Osborne was in town and that he had his Osborne 1 computer with him we tracked him down to a party near the Embankment. Hearing that we were prepared to work all night and most of the next day on the evaluation, he kindly handed it over. David Tebbutt takes up the tale.

Well, after years of telling everyone else what to do and handing out White Elephant Awards to those who satisfied his idea of what is excellent in the microcomputer industry, Adam Osborne has put his neck on the block and come up with an interesting hardware/software package which, with typical modesty, he calls the Osborne 1. It is a portable microcomputer comprising a keyboard, a built-in video monitor, two floppy disk drives and a whole bunch of useful software. In fact, in America, the cost of the software if purchased separately would be around $1500. The Osborne 1 including all this software sells over there for $1795, a theoretical hardware cost of just $295! Nor is the software gratuitous rubbish — it comprises CP/M, MBasic, CBasic, Wordstar, Mailmerge and Supercalc. CP/M is just about the industry standard operating system, which means that a wide range of existing and new software products will be quickly made available for the Osborne 1. MBasic and CBasic must be the most widely used Basic implementations; one is interpreted, the other compiled. At the risk of oversimplification, this means that MBasic is easier to use whereas CBasic programs run faster. Wordstar must be one of the best word processing packages around, although my personal preference (bias?) is for Spellbinder, and it comes with Mailmerge, which enables you to maintain and use mailing lists and merge details from the lists into standard letters and the like. Finally, Supercalc is what the Americans would call an electronic spreadsheet. It allows you to enter numbers, formulae or descriptions on a large matrix of rows and columns. Any cell on the grid whose value is derived from other values within the grid displays a fresh result every time that one of its component values is changed. It is similar to Visicalc but, according to people who've used both, it's also better.

So there you have it; at £1200 the Osborne 1 appears to be the answer to every would-be computerist's prayer. It does have one major drawback though — the screen is *very* small — 5in — and that's its *diagonal* measure-

Unique accessories to PET/CBM add more power

Software

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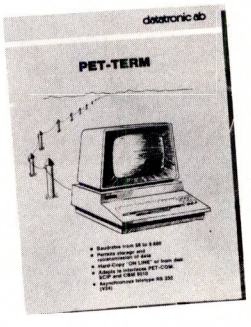
A program that turns your PET/CBM 8032 into an intelligent terminal. Supports three different interfaces: the PET-COM, the SCIP or the CBM 8010 acoustic coupler. You may communicate at up to 9600 baud, with selectable framing and parity. PET-TERM will also translate and transmit Word-Pro files. Data may be printed on the printer or saved on disk PET-TERM includes a life-time guarantee.

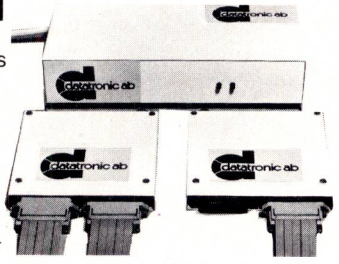


Price: **PET-TERM,** including manual **£ 90**
PET-TERM, only manual **£ 10**

Dealers are invited.

Hardware

PET-SWITCH



At a sensational price of £ 75 per unit, PET-SWITCH enables you to connect up to 16 PET/CBM computers to one disk drive and one printer. You can mix all models of PET/CBM in the same system (2001, 3032, 8032 etc). PET-SWITCH is technically superior to most of its competitors–no priority problems for example.

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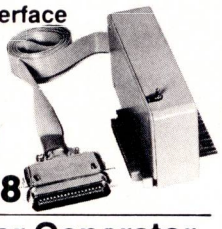
Price: **£ 72**

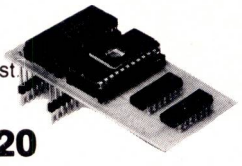
PET IEEE to Centronics Interface



This IEEE => Centronics interface is especially constructed for the PET. It is fully addressable and translates from PET-ASCII to Standard ASCII in two different modes, corresponding to PET's graphic and upper/lower case modes. This is available through a built-in switch.

Price: **£ 48**

Country specific Character Generator for the 4022 and 3022 printers



By using this board you can have Greek, French, German, or any other special characters in your printer, at a very low cost. It is already used in all Nordic countries, and several other countries have requested it.

Price: **£ 20**

Datatronic AB is since 1978 sole Swedish distributor of the Commodore computer product line, and is now market leading in microcomputer technology in Scandinavia. Datatronic AB has a long experience in both hardware and software; today Datatronic has used more than 150.000 man-hours in software and hardware development for the PET. All non-Commodore products are produced and tested in-house. The Datatronic-group, which is the fastest growing electronics group in Scandinavia, has a turnover of approximately $ 30.000.000, and employs over 200 people.

For further information contact Datatronic AB, Box 42094, S-126 12 Stockholm, Sweden. Phone 8-744 59 20 or your nearest Commodore dealer.

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OSBORNE 01

ment! To overcome this, those who really need one can buy a separate 12in monitor. In America this costs $250. Of course the machine is then less convenient to carry around. Perhaps the answer is to have the large screen situated wherever you use the machine most.

Adam Osborne neither makes nor sells the Osborne 1. He assembles it and tests it from supplied components and he puts most of the selling emphasis on the software available. In other words he's selling solutions to problems and he couples this with the sinister suggestion that you won't be able to compete in your profession without an Osborne 1. Of course such comments apply to all computers, but to read the sales literature you'd think that the Osborne was the only route to salvation. He even claims that the Osborne 1 marks the advent of the Personal Business Computer. If that's the case, I wonder how he would describe machines like the SuperBrain and Apple.

If you think you'd like one, a number of UK dealers will be getting demonstration machines in October but orders will take from three to six months to fulfil. This is expected to come down to a month or less by next summer. Adam is only authorising dealers who can demonstrate a willingness and ability to support their customers. This means that you're unlikely to find these machines in discount stores or with flaky dealers.

Hardware

The Osborne 1 comes in a cream vacuum-formed plastic case with a carrying handle at the back and a keyboard clipped on the front. A groove runs along each side of the case rather like that along the side of some Rover cars. Unlike the cars, this groove makes the Osborne easy to pick up. It's a bit of an odd shape when the keyboard is clamped in place. In fact when you stand it on end the whole thing tilts alarmingly due to the fact that the keyboard unit is designed to slope down towards the user. Although the present case is vacuum-formed, there are plans afoot for a new design using injection-moulded plastic foam. I'll be mentioning that later in the review.

When the machine is opened, you find a black bezel (front) and a grey keyboard set in a black keyplate. The



The O-1 in carrying mode.



The keyboard detaches completely — apart from the ribbon cable, of course.

machine weighs in at 26.5lbs according to my bathroom scales but Adam tells me it should weigh 24. If he's right then my scales are wrong and I'm actually my ideal weight. *(Hysterical laughter — Ed.)* With the keyboard clipped in place the effect is not unlike my wife's sewing machine except of course the O-1 is much lighter.

A disk drive is located on either side of the small 5in monitor and beneath each drive is a pocket capable of holding up to 15 disks. I had a nasty moment during the review when I thought I'd lost all the disks. I searched high and low for them and after 10 minutes of sheer panic I glanced at the machine and there they were, nicely tucked up in one of the pockets!

Along the bezel and below the monitor and disk pockets are a number of sockets and controls. Working from right to left this is what you'll find: battery socket, reset button, external video socket, contrast and brightness controls, keyboard socket, IEEE-488/Centronic parallel socket (software switchable), serial RS232C socket and a modem socket. I quite like the idea of being able to see what you've got plugged into the machine without having to grovel round the back. Quite how it looks when all the various leads are in place I can't imagine. The keyboard lead is a flat cable enclosed in a plastic braid. I presume this is to prevent the wires getting pinched when the keyboard is clamped on the front. I didn't have anything connected anywhere else. The brightness and contrast controls I found essential for getting the display just right; unless it is right it can be very tiring to use. The reset button wipes out the memory and returns you to a monitor command telling you to insert a disk and type RETURN. This then drops you into a master menu or CP/M, depending which disk you've loaded.

The review machine had almost silent Siemens' disk drives. They worked perfectly and I could only really hear them when the house went quiet in the early hours. Around three o'clock in the morning I thought I heard a budgie hopping around — it was the disk drives. I decided that I'd had enough and grabbed a couple of hours' sleep. MPI drives are installed on some Osbornes and these are just as reliable — the doors are slightly more robust but, according to Osborne they sound like 'a sack of marbles'!

The screen is interesting because it allows two display intensities plus optional underlining. If you're technical you might be wondering how Adam manages this with just eight bits per character. The answer is that he doesn't — he uses nine for the characters to be displayed. Bits 0-6 are used for the ASCII code, bit 7 for underline and bit 8 for intensity. The matrix is an unusual 8 x 10 which gives true descenders, 32 graphics characters plus the underlining mentioned just now. Another fascinating feature of the display is the lateral and vertical scrolling. The vertical didn't work on the review machine, incidentally, so I don't know whether it would be smooth or not. One thing's certain, the lateral scrolling was perfectly smooth. The screen can display 24 lines of 52 characters at a time. The screen memory can hold 32 lines of 128 characters so, using certain control keys, you can move the 'window' to any part of the screen memory. If, for example, you had completely filled the screen memory and you decided to scroll sideways, the effect would be rather like watching a cylinder revolving, because the whole screen scrolls, not just the current line.

The major disadvantage of the screen is that it's too darned small. Adam tells me that he uses it for hours on end without any trouble. I knew then just how Mandy Rice-Davies came to utter those immortal words when the judge told her that Lord Astor had denied any 'goings-on' between them: 'Well, he would, wouldn't he?' said Mandy. I digress. I did ask Adam if he'd considered putting a fresnel lens in front of the screen. He had, and the result was so much distortion that he felt it better to forget it. Here's a money-spinning opportunity for someone — invent a device that fits into one of the diskette pockets when not in use and which magnifies the screen without unacceptable distortion. Of course, if you'd like to make me rich too for tipping you off then that's just fine by me!

The keyboard is nicely laid out, with both typewriter and calculator-style keypads. A few things are on the Osborne that you perhaps wouldn't expect on a budget machine — a caps lock, a '£' sign on British versions

and a pimple on the 5 on the numeric keypad so you know where you are without looking. The keys automatically repeat after being held down for a second or so. My only criticism of the layout is that you need two hands to scroll the screen — one to hold the control key and the other to operate the 'arrow' key. I mentioned this to Adam and he told me that he was faced with the choice of giving the user single-handed cursor movement when creating text or single-handed operation when scrolling (reading) text. At least Adam's way means you can keep your place on an input document with one hand while operating the cursor controls with the other. I wish I'd thought of asking him why the control key wasn't placed next to the arrow keys. Another way of scrolling the screen is to use the control key in conjunction with the 1, 2 or 3 keys. CTRL-1 displays columns 1 to 52, CTRL-2 columns 53 to 104 and CTRL-3 columns 105 back round to 28.

Moving round the back, there's a little recess which contains the on/off switch and a circuit breaker reset button. This is where you stow the cable and plug when carting the machine around. A plastic cover is 'velcroed' over the recess to hold everything in place. The review machine didn't have appropriate slots for the UK type of plug so I had to disconnect it to make the photos look okay. Adam tells me that this won't be a problem on the UK versions of the O-1. Also at the back is the quaintest carrying handle you ever did see. It's like those leather handles you get on the old-fashioned cardboard suitcases. Adam is a firm believer that if something does a job adequately then that's just fine. To risk boring you with another quote, he says 'Better is the enemy of good, adequacy is sufficient and everything else is irrelevant.' This maybe explains the 5in screen too and it certainly explains his approach to software authorisation, which you'll be reading about later on.

To get inside the machine it is necessary to remove the bezel, which is attached by four screws, and the brightness and contrast knobs. The screws were easy but the knobs needed a very small Allen key. Once inside, you can only see the first inch or two of the various components since they all disappear into the depths of the case. I felt as if I was peering into a rather full bucket. What I could see looked clean and well made. The only noticeable thing out of place was a jumper wire from one part of the single board computer to another. Adam tells me that there were design faults on some of the earlier boards and that this must have been one of them. The front edge of the board contained all the ports and controls mentioned earlier. Ah yes, that reminds me, the serial port connection should have protruded from the bezel. As it was on the review machine it would have been difficult to attach a printer connector, for example. Once again Adam says that is being attended to. A closer examination would have involved a lot of time literally pulling the machine apart and, really, it just wasn't worth it. I had a peek inside the keyboard unit and it, too, was well made, comprising a metal keyplate in a vacuum-formed plastic shell. The keyboard itself was quite firm and I noticed that a couple of metal channels ran from end to end underneath. I presume that these were attached for rigidity.

Everything connected with the Osborne 1 has got 'Osborne' plastered all over it, even the disk sleeves. I'm not sure whether this is simply sound publicity or an ego trip by Adam. I must say I find the private man far more pleasant than the public version.

Each disk can hold up to 102,400 bytes of information. That's the equivalent of about three times the length of this Benchtest. The disks are soft sectored with 40 tracks, each comprising 10 sectors. A sector on this machine is 256 bytes. I suspect there must be some sort of software fudge to make CP/M think that the tracks are 20 sectors of 128 bytes. Adam tells me that double-density drives will be available soon, which must be good news for those with high volumes of data to process. Although Adam gets his disks from several sources, he tells me that Dysan is the major supplier. Since I use them exclusively, I was pleased to hear this. I have heard that the oxide coating is less stable on some other disks, the 'no-name' ones being the worst offenders.

Software

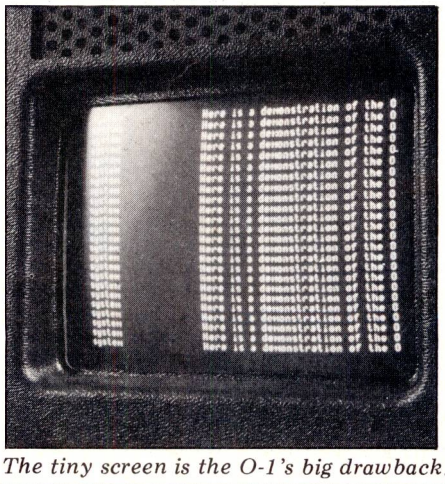
Adam Osborne has collected together a very good range of software which he supplies with the machine at no extra cost. This is sometimes referred to in the trade as 'bundled' software. Adam knew what the most popular applications were and he knew that it would be wise to stick to industry standard system software so he went ahead and wrapped up an entire package which would satisfy most people's immediate requirements and still give them the opportunity to buy other programs as their needs developed. In my view a decent database package would have rounded everything off just nicely but Adam is sticking to a few 'authorised' databases for which the customer pays extra.

Let's comment on each piece of software in turn. If you're an old hand at this game, you'll be able to skip the next four paragraphs without losing too much information.

First of all, CP/M: the name is on everyone's lips, but how many people actually know what it is? The initials stand for Control Program for Microprocessors and it was designed to facilitate the writing of programs for Z80, 8080 and 8085 processors. Although the processors in different microcomputers are the same, the bits and pieces that surround them are very different. Keyboards use different keys, printers vary, screens have different layouts, disks come in an alarming number of shapes and sizes and I/O ports have different addresses. CP/M comes between the program and these different devices and it handles transfers of information between them and the memory. Since CP/M takes care of the information transfer beyond the program and the memory, all the program has to do is to pass the information to CP/M together with some instruction on what it wants done with it. The program then just sits back and waits for CP/M to tell it that the job's been done. This all means that a program written for use with CP/M rather than for a specific machine will be widely used, provided it's worth using in the first place. All that has to be done to ensure that this will happen is that the machine supplier usually 'configures' CP/M to suit the peculiarities of your piece of equipment. By providing CP/M with the Osborne, a whole world of software opens up immediately.

You also get a few other things with CP/M. You get a whole pile of disk utilities which enable you to format, examine, copy, and generally mess around with information on your disks. The most common uses are to initialise new disks — this means writing the tracks and sectors on them and encoding a certain amount of control information for use by CP/M — and to make back-up copies of files so that you can recover from spilling beer on your master disk, for example. Another useful facility allows you to find out how much space is left on a disk. CP/M is often called an operating system and there are lots of manufacturers around who claim that their operating system is better than CP/M. Better they may be, but the fact is that on 8-bit machines, CP/M is the *de facto* standard and you'd be wise to check the availability of the packages you need before going for a different operating system.

And I've not finished yet. CP/M also includes a couple of programs of great interest to keen programmers, or programmers who want to make their programs run faster. The programs provided are an editor (ED), an assembler (ASM) and a debugging tool (DDT). The editor is an absolute dog and should only be used if you have to create programs in assembler language prior to assembling them into machine code using the assembler. ASM checks your program as it tries to translate it into machine code and if it finds anything wrong it tells you so. It can't detect errors in your program design, only in your coding. Finally, if your program doesn't work as planned then you can use the Dynamic Debugging Tool to examine the contents of various parts of memory and the registers as you step through the program. The assembler and DDT are absolutely fine, but most word



The tiny screen is the O-1's big drawback.

processing packages will allow you to edit program files a darned sight more easily than using ED.

Sticking with system software for the moment, you get CBasic and MBasic with the O-1. There are pretty much the same language except that you can execute one as soon as you've finished typing the program and, if it doesn't work, quickly amend it and have another go. The current buzz-phrase for this approach is 'quick and dirty'. If you write a Basic program using the other version then you have to compile the program using a Basic compiler. This takes longer and you can't really change the code generated by the compiler. You have to go back to your Basic code, change that and then recompile the program. The compilation process is similar to, but not the same as, the assembly process mentioned earlier. Why, you might ask, should you go to all that trouble? The answer is that the resulting program will run faster than an interpreted version and you can also embed identifying information which could trap a copyist because (s)he is most unlikely to find it. I ran the Benchmark programs on MBasic (interpreted) and they were faster than most machines we've tested. CBasic of course would have been faster still. Don't get too excited by these findings unless you are heavily into number crunching. The fact is that, in normal processing, the speed of the machine is completely nullified by the enormous time it takes for the operator to respond to the machine's promptings.

There is another tiny system program tucked in the disk which allows you to enter certain constants from time to time. The first is the speed at which you set the serial port — 300 or 1200 baud. The second allows you to change the screen size — 52, 128 or user-defined. The third allows you to enter the date and time. The time is accurate to within a few minutes per day.

That's taken care of the system programs provided, now let's look at the application programs. First of all, Wordstar and Mailmerge. Wordstar is one of the best word processing packages on the market. On the Osborne it is a little strange to use, mainly because of the small screen — see my earlier comments. Adam has wisely had the package modified so that it automatically scrolls sideways as you are typing text in. He has yet to do that with the Basic packages but he promises me that he will. If you're unfamiliar with word processing there's not a lot I can say here except that it will either increase your throughput of typed material or it will improve the quality of what you write, simply because it is so easy to 'craft' your words until you get them right. If you really want to get into word processing, I suggest you read the April 1981 *PCW* where we ran an introductory article on the subject.

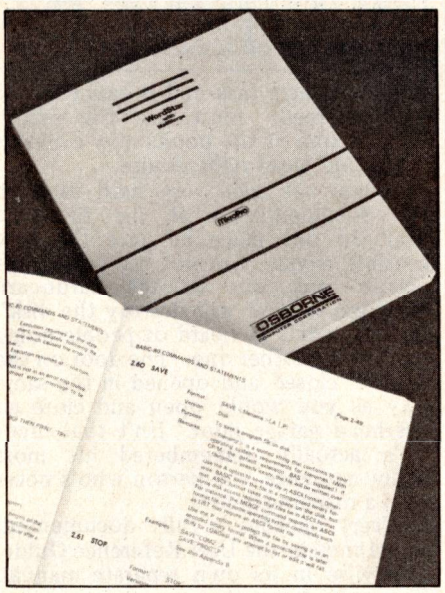
Associated with most of the good word processors is a mailing list facility which enables you to create and maintain a mailing list. Wordstar is no exception to this and it allows you to incorporate names and addresses in documents and letters so that they look as if they were prepared especially for the person receiving them. Lists can be sorted and names and addresses extracted according to your own chosen criteria. This is all done using the Mailmerge facilities.

Finally we come to Supercalc. You've probably heard of Visicalc, which is one of the biggest-selling microcomputer packages. Well, Adam couldn't get hold of Visicalc for the Osborne 1 so he decided to plump for Supercalc instead. The program makes good use of the O-1's 'shadow' mode, in which the screen characters can be displayed at half intensity. The spreadsheet grid is displayed in shadow while the entries are all in full intensity. It looks very good. Anyone who messes around with 'what-if' calculations will find this product an absolute boon. Also, are you one of those people who makes lots of calculations and at the end you realise that somewhere, way back, you'd got something wrong which messed up every figure derived since? Using Supercalc, you don't have to worry, you just change the offending number and all the others come right instantly. An interesting bonus is that the data file generated by Supercalc can be edited using Wordstar. I'm sure that's useful but I'm not too sure how useful.

Now on to the ones you pay money for. I mentioned earlier that a database would be my next choice of product. Well, Adam thinks it important too and he recommends three: DBMS, Condor and Datastar. Condor and Datastar are on his approved software list which means that Osborne will be packaging and selling them. DBMS you will have to get direct from your supplier.

Talking of Osborne-approved products, the company will be maintaining three lists: one for the USA, one for the UK and an international one. If you're a software writer and you think you'd like to get your product on to the Osborne 1 then Adam would like to receive your documentation first; then, if he approves, you send him four disks with the program on. It will be carefully examined and any comments made. You will then have to bring it up to the required standard and Osborne will then take over the entire production and marketing effort for the Osborne 1 version. You just sit back and wait for the royalty cheques to drop through the letterbox. Adam tells me that the royalties start high and reduce as sales increase. His justification for this approach is that the higher the sales the more it is due to the efforts of the Osborne Corporation. In general, Adam is not too interested in 'better' versions of what he's already selling because, apart from anything else, it dissipates the marketing effort and, if the first one was adequate for the job, is it really worth the extra hassle? I'm not sure how he equates that attitude with the fact that he'll be handling two database packages, unless they're very different.

I used almost all of the programs supplied and most of them worked just fine for the limited time I could try them. I did run into trouble once or twice when I keyed something in; it was echoed on the screen but then the most odd things occurred. The only example that I reproduced was that I'd get into MBasic, type AUTO in order to get automatic line numbering and it would give me SYNTAX ERROR. I'd try for the third time and it would do what it should have done all along and type 10 on the screen. The problem may be in the MBasic implementation or, more likely, I'd got myself a hardware fault. Adam did say that there were a few problems with the review machine's keyboard. Another problem I had, and this time I think it was the MBasic, was that I couldn't read programs which I'd previously saved using the 'A' suffix. It behaved as if I'd saved a null file. Even CP/M's TYPE command couldn't throw any light on this one. Adam thought I must have had a duff version of the software.



Documentation is of good quality.

Documentation

Since Adam Osborne started to make his way in the world with books. you should expect a high standard of documentation. And indeed the manuals are very well presented. Unfortunately the almost obligatory glitches had appeared in the books he supplied me. I don't think I encountered a really serious error — they were things like leaving out the key symbols when describing the various key functions or saying that k=1024 then claiming that the disks were 102k — they're not, they're 100k. When I pointed this out, Adam told me that 'all the manuals are undergoing scrutiny and finalisation right now'. All the books will be in a large paperback format with a glossy cover and very neat, readable typesetting inside. True to form, Adam couldn't resist the occasional homily which I found very refreshing. On the first page of his Users Reference Guide he talked about the incompatibility of the various machines on the market. He then goes on in brackets — well he printed the first bracket anyway — 'This is a deliberate marketing strategy on the part of the manufacturers. It is designed to prevent you shopping around for programs, accessories or additional computers once you've made an initial commitment to one of these products.' Later on he mentions the CP/M editor that I dislike so much — 'This editor is primitive and should not be used. Wordstar is capable of perfor-

ming the same task and is easier to use. If you really must use the editor, consult one of the books now available on CP/M.' Dead right, squire.

Adam has tried very hard to pitch the documentation at the first-time user. In one place he gave the very sensible advice, 'Do not try to get the plastic disk out of the cardboard envelope or you will destroy the disk'. Don't laugh, I've heard of people doing it. Here's another one: 'The door on the drive is closed and opened in the same way as you would open and close an overhead garage door.' Isn't that nice? He's actually remembered his most likely audience, the person who's never used a machine before.

Every package is fully documented, sometimes in the User Reference Guide, otherwise in its own separate manual. The only thing that was missing that interested me was a full technical specification of the Osborne 1. You don't need it to use the machine but it would be of interest to the curious, or to Benchtesters like me. The CP/M overview section of the User Reference book is clearer than most books on the subject although it doesn't try to go too deep with some of the more obscure facilities. I picked up a tip that I suppose I should have realised but didn't — you shouldn't use SAVE more than once since memory contents can be changed as a result of SAVEing.

The MBasic manual has simply been reset because Adam is obliged to retain the original wording until the end of this year. He'll then look at it and change it where necessary. This manual is not at all bad, though, so it shouldn't be a problem. In general, all the documentation will be brought up to the company's house style before publication.

Incidentally, I should give you the address of Osborne Computers: Osborne Computer Corporation, 26500 Corporate Avenue, Hayward, California 94545, telephone (415) 887 8080.

Users

Who'd use it? My guess is anyone who is taking computing a bit seriously and who either doesn't mind a small screen or who is prepared to forgo a little portability in favour of a separate monitor. The price is good, the facilities offered are more than adequate and, because he's plumped for CP/M, plenty of packages will be quickly available. The sort of dealers that Adam is encouraging are the sort that traditionally sell to the professionals and these are exactly the sort of people that the machine is aimed at. In fact, Adam defines the users as 'professional people using it in the course of their daily work'. It certainly isn't a fun and games machine, although I'm sure that a lot of games will sneak their way onto O-1s. The easiest way for me to describe the market is anyone other than the fun and games, colour and hi-res graphics brigades. I must admit I'm not too sure about number crunching, speed and accuracy either. You'll have to check this out for yourself.

Prices and delivery

The only price we have in the UK is 'not more than £1200' (excluding VAT) for the Osborne 1 with all its standard software (CP/M, CBasic, MBasic, Wordstar, Mailmerge and Supercalc). The price will be reviewed every three months to take account of the exchange rate between the pound and the dollar. With a bit of luck the price should only go down.

In the USA the monitor costs $250 and the Osborne $1795. If the same ratio pertains this would make the monitor £170 in the UK. Delivery at present is between three and six months; Adam says this should improve to between off-the-shelf and 30 days by next summer. I'd say this rather depends on demand.

At the moment a 90-day warranty is offered but Osborne realises that this will have to be a year for the UK market so it will be changed. In the USA, 90 days is standard.

The UK dealerships that I know of are: Rank Xerox, Datron, Crystal Electronics, Cambridge Computer Store, Comart/ Xitan/ Byte Shop/ Computerland, Adda Computers, Lion House and Microdigital. Other decisions are pending and we'll let you know as soon as we're told.

Adam plans to open a UK office with a UK person in charge. I know one of the people being considered and, if he's anything to go by, it will be a very professional organisation. The staff will be mainly British and they'll be given a lot of autonomy. We'll keep you posted on these developments as well.

Future plans

In early 1982 we should be seeing a new case. This time it will be made of injection-moulded plastic foam in a 'clam shell' arrangement. This means that the inside will be much more accessible for engineers and nosey users. The quaint carrying handle will disappear to be replaced by one moulded into the case. The machine will be lower as a result of having a thinner keyboard unit and it's expected to weigh about a pound less. The bezel is expected to be prettier too.

A battery pack is currently under development and the most likely arrangement will be a large flat unit which forms a false bottom to the Osborne 1. Adam expects this to be available by January or February 1982.

Dual-density disk drives should be announced in November or December and communication facilities in six months or so for the UK. An 80-column screen with user-defined graphics and a 52-column option is also likely to appear in the near future.

Finally, don't just expect upgrades to be up. Adam is well aware of the potential mass market opportunities for small domestic machines. He hinted at smaller Osbornes as well as bigger ones.

Conclusion

I suppose I've said it all in the Users' section. The machine is well made, offers more facilities than any other machine at the price and suffers one enormous drawback: the screen measures just 5in diagonally. This isn't a problem for occasional use — an hour or two even — but I'd hate to use it continuously. To overcome this problem, a 12in monitor is available and I would suggest that you keep this where you'd use the machine most. Making such a sophisticated machine portable was a really neat idea. I think, though, that there will be a lot of wives up and down the country who'll roundly curse Adam Osborne for what he's done.

Getting the thing going is a doddle — easier than filling a kettle and plugging it in. You'll need a printer — most people I know use the Epson MX-80 and it offers excellent value at far less than £500. Adam Osborne also uses the same printer on his machine, so it would seem ideal. You'll also need disks and stationery to get under way. And then you're in business. I recommend that you consider this machine very seriously among your options.

Benchmark timings

There is nothing wrong with the Osborne's performance on our standard Benchmarks. It came out faster overall than most other machines we've tested. You must remember though that these tests relate mainly to the computer's numerical processing speed and take no account of accuracy, string handling or disk handling. The other thing to bear in mind is that computers spend most of their time waiting for information to be transferred between themselves and their peripheral devices. Timings were made using MBasic. CBasic would have returned still faster times.
All times in seconds.

BM1	1.4
BM2	4.4
BM3	11.7
BM4	11.6
BM5	12.3
BM6	21.9
BM7	34.9
BM8	6.1

Memory map

0000	System read only space; part switches to ROM in shadow mode
4000	Post processing sequence & data buffer RAM
EA00	CBIOS entry points
F000	Memory-mapped video RAM
FFFF	Top of memory

In shadow mode the memory up to 4000H isn't available when CBIOS is operating. To get into and out of shadow memory mode you need to OUT 0 or 1 coupled with a change to location EF08H making that 0 or 1 too. These routines must be above location 4000H.

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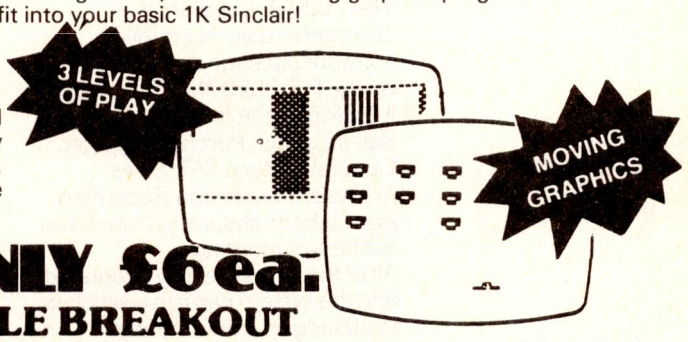

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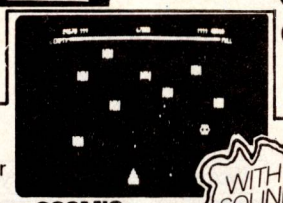

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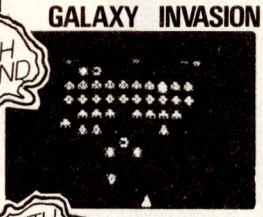

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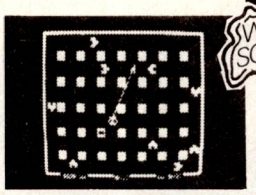

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SHARP IQ3100 MICROTRANSLATOR

John Fairbairn tests the latest in pocket translators.

As a professional linguist, I am usually assumed to pour scorn on phrase-books or their silicon-chip equivalents. But I, and especially my stomach, have frightful memories of a stay in Hungary, the one country I have been to where I did not have at least a smattering of the language. The only word I knew was for ice-cream — and that is the only thing I was given that was edible. I soon acquired an image of Hungary as a surly and depressing place, and I couldn't wait to get over the border to Czechoslovakia and "civilisation".

I have no doubt now that I am being unfair to a beautiful country, but to me civilisation is based on communication and anything that helps that along is a blessing. For example, the Sharp IQ3100 Microtranslator.

After testing this new machine for a month round the tourist haunts of London, I am happy to say it's fun and it works and it's the best around. At about £70 plus £18 for each language module it's not exactly cheap, unless you can set it against tax, but it's certainly a novel way to chat up the opposite sex.

First impressions of the IQ3100 were highly favourable: sleek, robust, and genuinely pocket-sized. Those feelings soon changed to abject terror after I read the first five pages of the otherwise satisfactory instruction book. To paraphrase them: unless you handle the tiny language modules with the skill of a brain surgeon, that's £18 up the spout. I managed to get two modules, the maximum, into the machine safely but put that down to the clove of garlic in my back pocket. But once the modules were in, the machine confirmed its robust impression, even when rammed into a shoulder bag on a crowded tube train.

In use

Then it was idiot's test time: press every button in sight and see what happens. The machine responded at once — but not in the obvious way. To get the thing to translate anything you have to read the instruction book; which means you can't accost a stranger, tap out a question for him, and then pass the machine to him for a reply — a serious design fault with no obvious solution.

Other design niggles were the alphabetically ordered keyboard (though, of course, it has to be that way for other countries), the wrist strap which surely should be at the top right corner, and the display, which is the liquid crystal type seen in the Sharp PC-1211 pocket computer (24 characters, 7x5 dot matrix, all upper case). This display is attractive, especially when it rotates to show long sentences (using the DSP key). However, at certain angles it looks blank and if you point the machine at someone in the street in bright sunlight you are apt (I speak from experience) to get some very funny looks.

Another difficulty with the display is that letter 'O' and number '0' are not differentiated (they are only slightly so on the keyboard). But the box of tricks inside *does* differentiate, and if you ask for a DOCTOR with zeroes instead of vowels you might be dead before you realise why it won't translate.

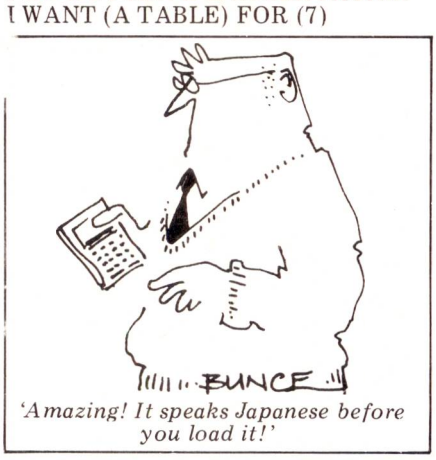
Once the machine is powered up (using the non-rechargeable one-year battery provided), you choose the languages to work in. English is built in and you can add one or two of the eight other languages so far available: Dutch, French, German, Italian, Japanese (in romanised or kana forms), Portuguese, Spanish or Swedish. The modules are easy to change — provided you take care!

You press the LNG key repeatedly until arrows point to the two languages you want (little stickers are provided for two vacant slots after SPA for the rare languages), then press the double-arrow key to alternate the arrows on the display pointing 'from' and 'to' a language.

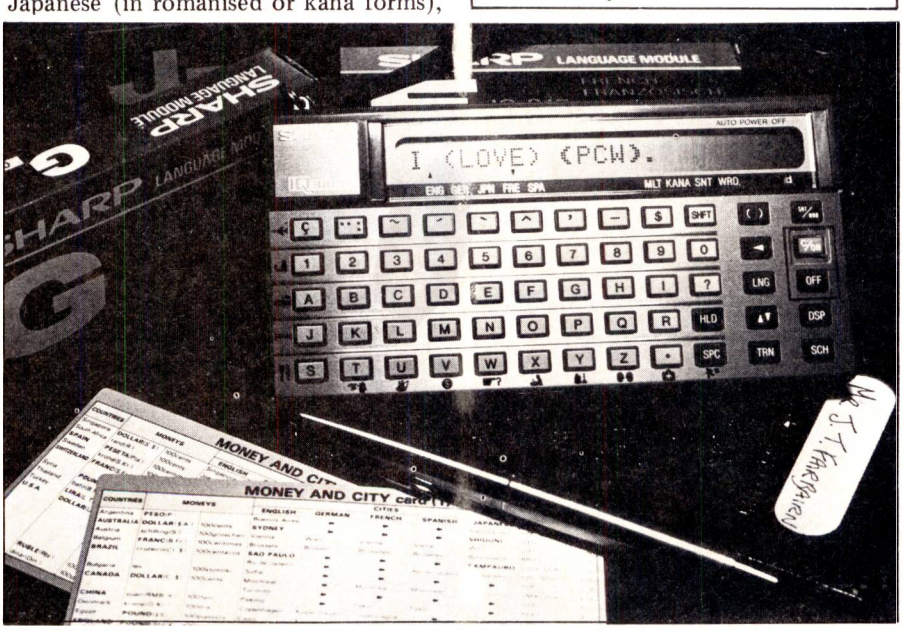
You then have a choice of typing in a word or sequence of words and translating that (pressing TRN), or of pressing the SNT/WRD key to set the machine to a category mode. In that mode you can choose sentences or words (by one or two presses of SNT/WRD). The category most appropriate, one of 14 clearly labelled round the outside (plane, Customs, transport, hotel, restaurant, sightseeing, amusement, shopping, direction, business, service, conversation, doctor, emergency) is chosen by pressing the key next to the symbol. For example, using sentences, pressing S (restaurant) brings the display DO YOU HAVE A (BAR)?

You can accept this sentence or search through all the sentences in that category (11 in this case) by pressing SCH. Stepping through SCH in this category gives next:

DO NOT HAVE A RESERVATION
I WANT (A TABLE) FOR (7)



'Amazing! It speaks Japanese before you load it!'



The IQ3100

WHAT DO YOU RECOMMEND?
PLEASE GIVE ME (A GIN FIZZ)

You can change any word in brackets (if there are two sets of brackets, use the key () to alternate between them) simply by typing in the new word, as the first key-stroke wipes out what was in brackets and the replacement letters are displayed inside them. This business can be made to work smoothly, but consider first one of the worst cases: you want a book. You find the gin-fizz phrase, which takes about 25 seconds after switching on, then type in A BOOK (at least 10 seconds), press TRN, wait for five seconds and, hey presto, you get DONNEZ-MOI (UN(UNE) LIVRE(LIRE)) S.V.P. from the French



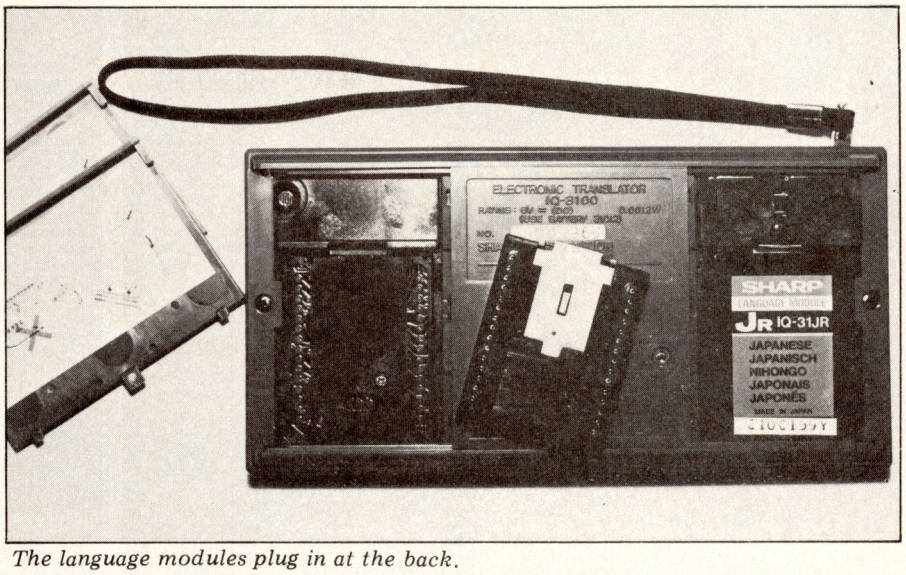
'Never mind the English-to-Spanish Hilda! Just find the PLO module!'

module. If this silly attempt to avoid saying 'give me a pound' instead of 'give me a book' could be justified on the grounds of avoiding arrest for vagrancy in Paris, good enough; but I think the excessive preoccupation with the problem of multiple meanings or genders betrays the conceit of the linguists behind the modules. The problem is there and has to be met, particularly because it is the commonest words that tend to have multiple meanings, but it seems reasonable to allow a fair measure of ambiguity, even more so when I tell you that you can't use plurals or other noun declensions or decline verbs or change tenses — in short, you get a pretty peculiar output, anyway. But it still works — so why worry about one more peculiarity?

If you made a mistake and didn't want to ask for a book, but had already typed that, it would take you about 30 seconds to step round back to the gin-fizz phrase. I'm sure you realise by this time that you have to be pretty familiar



'Oh, Arthur! Trust you *to catch something with no English equivalent!'*

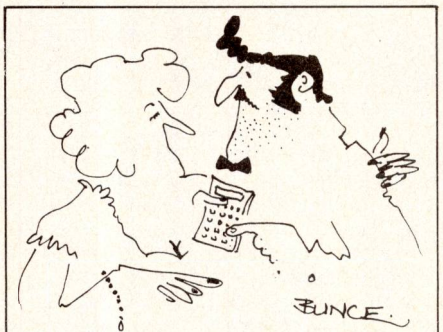


The language modules plug in at the back.

with the whereabouts of all these phrases.

Why not just type in your request straight off, without going through the category mode? Answer: input GIVE ME A NEWSPAPER gives output DONNER ME UN(UNE) NEWSPAPER. This is because it will translate literally word for word or set-phrase for set-phrase only, with no attempt to change word order or to make any other grammatical concessions. And if you try a word that's not in the 2000 or so words of the memory that word is left untranslated, usually with the addition of '!!' — and always in the case of rude words.

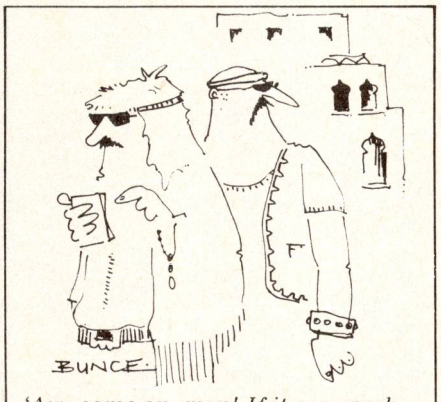
The box of tricks is, therefore, little more than a program for retrieving data from a file. Some idea of how this works can be inferred from another



'Oooh, Manuel! The things *you tap out!'*

feature, the dictionary search. Type in an initial letter or letters and by pressing SCH you can step through all the words in the memory that begin that way. Until these machines become as familiar in use as calculators are, almost the only way to find out what a foreigner is saying is to try to pick out the first letter of the most important word (the one he keeps repeating or shouting), type that in, then point the machine at him while you step through the dictionary, hoping what he's saying is in there.

I said earlier that all this can work quite smoothly, but you probably don't believe me. The point is, you use these



'Aw, come on, man! If it can speak Moroccan, how come it can't sell us any dope?'

machines in a spirit of fun or desperation, but at any rate time or egg-on-face will not be your main worries, and it is amazing how much you can murder a language and still be understood. You do become faniliar with the machine, and learn what kinds of sentences or words it will find digestible (a sort of basic English). The selection of words in the memory bank is excellent, apart from a few words like gin-fizz and Americanisms. To take one category, Customs: I asked Customs officers at Heathrow what they thought of the sentences and words relating to their work, and they thought they were very apt. No one has yet tried a machine on them.

Above all, don't forget that the IQ3100 can be used as a back-up when you already know a little of the language. It is an invaluable dictionary (and very fast when used exclusively that way), with the 2000 words being far in excess of the 800-odd words that were used successfully to render Chambers *Dictionary of Science* into basic English, and not too much below the *specialist* dictionaries of around 3000 words used in many mainframe machine-translation projects.

Conclusion

Sharp's IQ3100 is by no means the first pocket electronic phrase-book, nor are

GOTO page 182

IBM PERSONAL COMPUTER

The much-rumoured IBM Personal Computer was finally announced last month and, just to make sure it really exists, PCW *sent David Tebbutt to Florida to conduct the world's first Benchtest and to meet the people who made it happen.*

With more than a little help from its friends, IBM has come up with a real stunner of a personal computer and, much to *PCW*'s delight, it has named it the IBM Personal Computer, which must surely remove any lingering doubts about this magazine's title. The system has much to commend it both for serious and fun applications since it can grow from a fairly expensive cassette-based configuration to a full-blown twin disk/colour graphics machine which offers the competition a fair run for its money. It almost goes without saying that the computer is well made, keeping up IBM's almost legendary reputation for quality.

After watching the growing personal computer industry very carefully, IBM finally cranked its own Personal Computer project into action around 14 months ago. The public was becoming aware of the usefulness of these machines and prices were dropping to an affordable level; this was enough for the grey giant and it made its move. By swearing certain key people and companies to utter secrecy, IBM was able to discuss its plans and listen to those who already knew what the microcomputer game was all about. Microsoft, for example, was involved right from the beginning and was able to give a lot of help, particularly with the graphics and sound facilities. Later on, once a design was fairly clear, ComputerLand became involved and advised on aspects of dealer support and training. Sears, Roebuck was approached, too, and was particularly helpful when it came to packaging the products for the retail outlet.

The machine will be sold in America through IBM's own Products Centres, through sales offices within its Data Processing Division (DPD), through ComputerLand's existing network of some 170 shops and through Sears' about-to-be-opened business machine stores. At the moment the system will only be sold in the USA and Canada and IBM will not say when, if ever, it will come to Britain. Since demand is bound to be very high in North America, IBM will clearly have to gear up its manufacturing and distribution quite significantly before we will see any systems in this country.



Hardware

The minimum configuration Personal Computer comes in two parts: a System Unit, which houses the memory, processor, loudspeaker, power supply and expansion slots and a keyboard, which is connected to the system unit with a six-foot coiled flex terminating in a DIN plug. One or two 5¼in disk drives can be installed in the front of the system unit and up to five optional enhancement cards can be plugged into the slots. A monitor or domestic television is needed and, for those without disks, a domestic tape recorder with a DIN connection will be necessary too. IBM supplies an Epson printer as its standard listing device although there's no reason why you shouldn't attach a printer of your own choosing. In use, the monitor would probably sit on the System Unit while the keyboard could be used on a table or on your lap. Two little lugs allow the keyboard to tilt when on a flat surface and they tuck away if you're using it on your lap. The whole design is very pleasing and all the parts clearly belong together.

Everything about the IBM system is designed with a first-time user in mind. The company has gone overboard to make the system as easy as possible to configure and use with one of the main aims presumably being to minimise IBM and dealer post-sale involvement. Two screws secure the top of the system unit and, once removed, it is a simple matter to add memory, plug-in boards or even disk drives. IBM supplies a monochrome monitor with a very steady, clear display of 25 rows of 80 characters or you may prefer to buy your own colour monitor or even use the domestic TV, each of which gives an option of 24 rows of either 40 or 80 characters. The graphics resolution is not as good in colour as it is on the IBM display. In fact, each character is 7 x 7 dots in an 8 x 8 box compared with 7 x 9 in a 9 x 14 box for the monochrome display. IBM does issue a warning that certain televisions and monitors (not its own) can cause data errors on disk transfers. It suggests the solution is to have the screen at least 12in away from the system unit. In order to drive these colour devices you would need to plug a colour/graphics monitor adaptor into one of the spare expansion slots. This board supports colour graphics — up to 16 colours in text mode, up to four in medium resolution graphics (320 x 200) and black and white in high resolution mode (640 x 200); it also allows you to define 128 graphics characters of your own when using either of the graphics modes. The board is also designed to handle a light pen. Composite and direct drive video outputs are provided to drive a colour monitor but for your domestic TV you'd have to buy an RF modulator as well.

The IBM monochrome monitor is a very high quality 11½in green phosphor device with an anti-glare screen. It gives a rock-steady display with no trace of flickering or that high-pitched whistling

which sometimes occurs. The steadiness is achieved by using a high-persistence phosphor coating which takes a fraction of a second longer to clear than most screens, although I can think of one or two machines which are far, far worse. In normal use it's doubtful that you'd even notice it. The screen displays 25 lines of 80 characters and each character is beautifully formed thanks to the high resolution mentioned earlier. IBM has taken advantage of all eight bits of the character code by adding a ninth bit for parity checking. This means that 255 different characters are offered, ranging from little faces through the standard ASCII set to special characters for foreign currency, mathematics and graphics. A separate byte associated with each screen character is used to describe the character's status — whether it is underlined, enhanced, flashing, non-displayed or reversed. An interesting feature of the character set is that the business graphics — the ones used to display forms on the screen — comprise a mixture of single and double line shapes which makes for very neat and compact form layouts.

The monitor plugs into a monochrome display and the printer adaptor, which occupies one of the expansion slots. If you're using the Epson printer then you won't need to buy an extra card to drive it as it plugs into this same card. If you'd gone for colour then you'd need a separate printer adaptor. There's no reason why you shouldn't drive a variety of displays, or even a variety of printers if you feel so inclined. The standard device is the Epson MX-80 tractor feed machine which has had some soundproofing installed and the wire paper guide sprayed in the official IBM colour. It offers 12 different character styles and (according to the documentation) 64 graphic characters plus nine special characters as well as the standard 96 character ASCII set. It will handle multi-part (up to three, anyway) forms between 4in and 10in wide. You can buy an optional printer stand which is a very neat smoky perspex unit which can store an inch or two deep stack of continuous stationery. It does have the slight disadvantage of amplifying the printer noise so you'd have to trade off noise against neatness. The stand is a rectangular piece of perspex bent back on itself, each half being separated by plastic pillars 3in or so high. This simple design was cooked up by an IBM engineer who felt that the programmers' own design of three or four bricks was somewhat less than elegant. One thing you'll notice from the price list is that the printer comes without a cable — you have to buy it separately at $55.

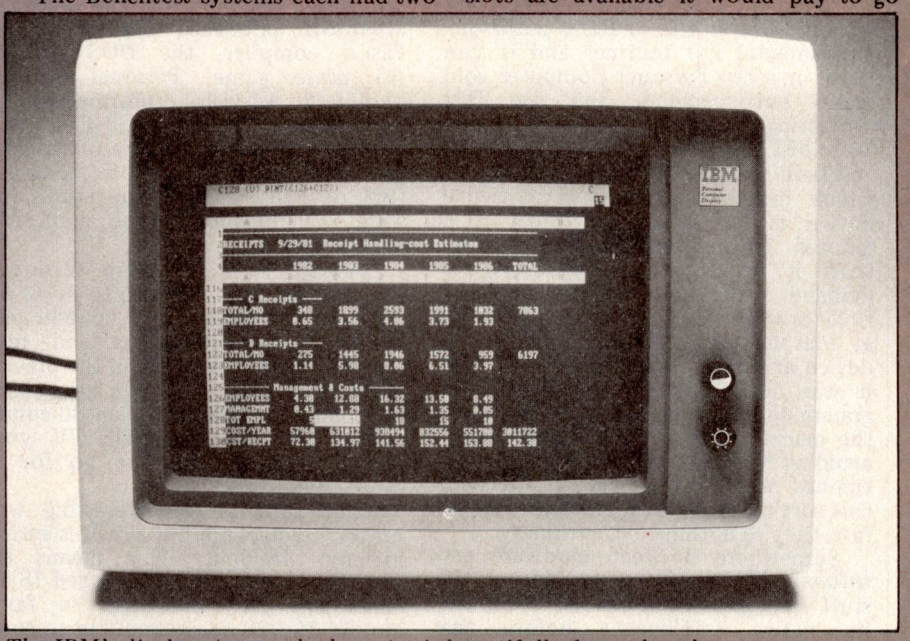
The 'typamatic' keyboard is a work of art. Offering tactile feedback and automatic repeating on certain keys, it contains every key you could ever imagine using, all in a well-designed unit which clearly owes a lot to IBM's experience in typewriter design. The only thing I disliked was that the shift keys were hard to find because they are located above a couple of other keys. To a non-typist this wouldn't cause the slightest problem but anyone used to a keyboard may experience some difficulty at first. Apart from the standard typewriter keys, it has 10 function keys, some assorted control keys and a separate numeric/editing keypad — 83 keys in all. The keyboard is a low, flat unit which weighs a surprising six pounds. I found out later that IBM actually put a heavy metal plate in purely to stop it sliding around. It's that kind of attention to detail that characterises the design of this machine.

A numeric lock and a caps lock do exactly what you might suspect but when the numeric pad is not locked it acts as an editing keypad with insert, delete, cursor left, right, up and down, page up and down, home and end functions. A touch on the control key and the character functions operate on whole word instead. You will have probably gathered from this that full screen editing is standard. The mathematical symbols appear in their normal places as well as on separate keys so that they can be accessed without the need to use a shift key. Tabbing can be both forward and backward and a 'Prtscr' key allows you to dump text from the screen to the printer. When programming in Basic, you can print most of the commonly used commands by hitting a single key with the 'ALT' key depressed. The 10 function keys are defined to give single stroke facilities such as SAVE and LOAD and you may redefine them by using the KEY command in Basic. By judicious use of the shift, alt and control keys it is possible to access 40 facilities from the function keys. A mysterious key called 'Scroll Lock' doesn't actually do anything.

The Benchtest systems each had two disk drives horizontally mounted in the front of the system unit. These looked suspiciously like the drives in my Super-Brain although IBM wouldn't confirm or deny this other than to say that it might obtain disk drives from more than one source. Each disk has a capacity of 160 kbytes held in 40 tracks each of 8 x 512-byte sectors. The drives are quite accessible even when the keyboard is pushed up close. A sensible feature is that the disk drives automatically switch off when they haven't been accessed for a second or two.

Tucked away inside the system unit is an 8088 processor which has an internal 16-bit structure, 8-bit data transfer and a 20-bit memory addressing capability. The 8-bit data bus means that the 8088 is compatible with the popular 8080/8085 processors' support circuits while the 20-bit addressing means that the processor is capable of accessing up to one megabyte of memory. An interesting gap on the processor board tells me that the IBM can accommodate an auxiliary processor — a floating point arithmetic processor or a mass memory/large scale communications handler perhaps?

The Personal Computer gives the user from 16k to 256k of RAM plus 4k or 16k of display memory on the adapter card, depending on whether it's for monochrome or colour. Up to 64k is held on the processor board and additional memory in 32k or 64k plug-in expansion boards. Since only five slots are available it would pay to go



The IBM's display: '. . . each character is beautifully formed . . .'



Rear view of the System Unit

for the 64k upgrades if at all possible. I wouldn't be at all surprised if one of the early announcements isn't an external expansion box to take more plug-in option cards.

Other cards currently available are a game control adaptor and an asynchronous communications adaptor. The game controller will accept two joysticks or four paddles which you'll have to buy from outside. The communications adaptor seems to me to be a complicated way of describing an RS232C/current loop interface which can be driven at speeds between 50 and 9600 baud. IBM intends to provide a subset of full 3270 emulation capability which should excite the odd DP manager here and there.

Working through a typical configuration, we find that a colour/graphics card takes one slot, the printer another and the disk drives another. This leaves two slots free for games, communications and extra memory (up to 64k can be on the processor board and another 16k is on the graphics adaptor). I'd say that this package will suit 99.9 percent of intending purchasers' requirements. The remaining 0.1 percent will have to compromise, buy another machine or wait for an announcement of an expansion box.

Microsoft's Cassette Basic interpreter is contained in 40k of ROM with some fundamental I/O routines and is standard in every Personal Computer sold. Basic enhancements and the Disk Operating System (DOS) are loaded from disk.

Every peripheral is interrupt-driven, which means that when a particular device is not doing anything, it is ignored. Once it has something to say then it interrupts the processor to demand attention. The processor then finishes whatever it happens to be doing at that instant, serves the interrupting device and then gets back to whatever it was doing before. This makes programming much easier and also makes the machine run significantly faster by avoiding 'waiting time'. The Benchmark timings weren't designed to highlight this sort of activity so, although they're fast, they're nothing extraordinary.

Somewhere between hardware and software lies the firmware which is the stuff that gives the Personal Computer its native intelligence before any programs have been loaded from outside. What follows is a bit of a pot-pourri of facilities thus offered.

The first thing the system does at switch-on is to run its own internal diagnostic routines to make sure that everything is working okay. Once complete, the machine 'peeps' through the loudspeaker and allows you to load programs or whatever. It is also internally programmed to react to certain key combinations. For example, if you want to 're-boot' the DOS, the system will recognise a simultaneous depression of the ESC, ALT and DEL keys. CTL with Numlock is a toggle which suspends and restarts program execution while CTL with Prtscr is another toggle which causes an echo to the printer. The keyboard has a 16-character buffer which is pretty exciting when using the word processor — you have to keep a careful count of the number of times you hit the delete key! This buffer size can be changed but I'm assured that it's a 'non-trivial' exercise.

Software

The IBM Personal Computer is supplied with a Cassette Basic developed by Microsoft and all the other packages are sold as extras. IBM will divide its software packages into the following groups: Professional, Business, Word Processing, Entertainment, Personal, Education, Computer Languages and Software Series. Each is coded with a pleasant colour, mainly pastel shades with the exception of Entertainment which is black. The colour is used on all documentation and packaging for products within that particular theme. While I was Benchtesting the machine, the only products actually available were Disk Basic, Advanced Basic, DOS, EasyWriter, VisiCalc, Adventure, General Ledger, Accounts Payable (Purchase Ledger), Accounts Receivable (Sales Ledger) and (I think) the Communications Package and Pascal Compiler. I didn't actually get to see either of the last two packages in action.

IBM didn't see any point in starting software development from scratch so it went to those companies whose products and people best met its own criteria and together they produced the IBM versions of the packages. Microsoft published the Basics, the Pascal compiler, the DOS and the Adventure game, Personal Software published Visicalc, Information Unlimited Software published Easywriter, Peachtree Software was responsible for the ledger packages and it looks as if IBM devised the communications software. I'll deal with the application programs first.

Visicalc is a hotted-up version of the program we've grown to know and love. It now allows you to edit parts of fields, handle tables and move around much faster than on the previous versions I'd seen. You can also choose between a 40-column or an 80-column display. On the domestic TV you'd almost certainly have to go for the 40-column display.

Easywriter is an interesting word processing package because it is entirely memory resident. This means that individual text files can't exceed 18,500 characters (this Benchtest so far is around 15,000 characters) but to compensate for this, a linking function allows Easywriter to treat a number of separate files as a single file for reporting purposes. Once I got the hang of it, I found this package quite pleasant to use and I think that many people will find it offers all the facilities they're likely to need. It is possible to move blocks of text around, to do word counts and even to undelete stuff provided you haven't moved the cursor since the delete took place. Even my lovely Spell-Binder doesn't offer the last two functions.

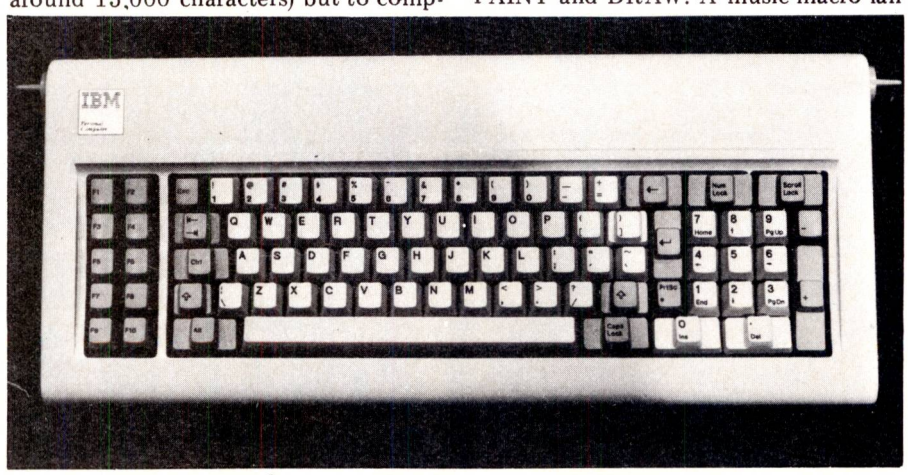
Adventure is the standard Microsoft game in which you have to overcome obstacles in an underground network of caves while collecting as much treasure as you can manage. At the moment the game is entirely textual, which is unfortunate, but I suspect that within the next few years it will be on video disks and, boy, will we have some fun then!

The ledgers are all designed for the American market and are therefore of little use here. All I'll say is that they've been professionally produced and give a good indication of the software standards that IBM is going for.

Basic

The built-in cassette Basic is a superset of Microsoft's Basic-80. It allows you to use all 256 characters, to plot in medium or high resolution graphics, play sounds through the loudspeaker and control light pens and joysticks as well as doing all the things that Basic-80 does. It can handle up to 17-digit precision, full floating — point arithmetic. It does borrow 4k of user memory to operate. If you move on to the Disk Basic you'll find that it uses 24k of memory plus an extra 1.5k if you want to use the communications facilities as well. In addition to everything offered by Cassette Basic, this version allows you to handle disk-based files, to keep track of the date and time, to handle two additional printers and to drive an RS232 port.

The Advanced Basic pinches 29k of user memory, again with an extra 1.5k if you're into communications, and it offers everything the Disk Basic does plus some additional features. This is the one that allows you to handle interrupts from the function keys, a joystick button, the light pen or the communications line. It also includes a graphics macro language which offers statements such as CIRCLE, PUT, GET, PAINT and DRAW. A music macro lan-



The keyboard has just about every key you might ever need.

guage allows you to create music and sound effects quite easily through PLAY statements and musical notation written in English. Since the functions within th macro languages are all written i machine code they operate at very high speeds. The only Basic overhead is the execution of the single statement calling the routine. Some neat effects can be achieved using the graphics macros GET and PUT which handle the transfer of arrays to and from the screen. The trick is to define a shape on the screen, imagine a box around it and define this as a two-dimensional array to be saved. A GET saves the array and a PUT will redisplay it wherever you like. If you PUT an array to the same position twice using an XOR argument this removes the array image and restores the original background. The sequence for animation then becomes PUT to the screen with XOR, calculate the new position, PUT to the screen at the old location (using XOR) and then repeat the process for the new location. Another neat trick can be played if you're in text mode. You can define an active page and a visual page. This means that one screen can be on display while your program is busily changing another page ready for display. Sound too, offers some potential because having initiated the playing process, the system gets on with it while you do something else. This means that if you want to play a musical background to a game, for example, then you can, regardless of what is happening on the screen and keyboard.

The first 40 characters of all variable names are significant. This means that the novice programmer can describe the variables in full. After a while, of course, he'll realise how much space is being gobbled up and will then either have to cut down on eloquent names or buy more memory. With 256k I don't suppose that long variable names would be a problem.

Since Microsoft Basic is pretty well the standard these days I think I'll leave you with those few tantalising glimpses of the extra facilities and move on to the DOS.

DOS

No, this isn't the same DOS as on the IBM mainframes. Some people call it PC-DOS just to differentiate but I stick to DOS for this article. Not surprisingly, it is similar to CP/M in its range of facilities but to the user it is a whole lot more friendly. For example, if you want to copy files in CP/M, you have to load the PIP facility and then give the necessary instruction to PIP. In DOS you simply type COPY, the file to be copied and the new file name. In PIP it's back-to-front — you have to start with the new file name and follow with the old file name.

Other DOS functions allow you to copy a whole disk, compare the contents of two files or a pair of disks, erase files, rename files, format a disk, list the contents of a disk, type the contents of a file and put the DOS on to another disk. Nothing unusual about that I hear you say. Well, that's true except that all the instructions are near enough in English, eg DISKCOPY.

But then we come to the other facilities: you can invoke batch files, issue messages and prompts (for DATE and TIME) while they are running and even pause and restart their operation. MODE allows you to define screen and printer characteristics and if you don't like the position of the display on the screen, you can scroll it sideways a column at a time until it suits your monitor or TV. CHKDSK examines the chosen disk and gives a status report. If you name a file AUTOEXEC.BAT it will be executed on boot-up and it can be either a program or a job stream (batch).

DOS will work on a single disk drive system, issuing appropriate prompts for the user to change disks when necessary. Other programs available on the DOS disk are a relocatable module linker, an editor and a debugger. IBM refuses to comment on the likelihood of an Assember. I saw enough clues to make me think it's a strong possibility very soon. A diagnostic disk is available which allows the user to run his own diagnostic routines, the results of which he can analyse from the descriptions given in the manual. Although I've not covered the DOS in detail, you can see that it provides everything that a user is likely to need.

Looking at it from the programmer's point of view was a little difficult without an assembler. The FCB is in two parts — the first seven bytes act as a prefix to a 35-byte FCB. The first 11 bytes of the main FCB tally with the CP/M version but after that either the terminology differs or the actual contents are different — I can't be sure. They do actually look different to me although they're the same length. I was told that although the DOS has its own entry points, it is possible to use all the CP/M calls as well. It looks as if IBM is making it as easy as possible to convert from CP/M to DOS on the Personal Computer. It will be interesting to see what CP/M-86 has to offer when it comes along.

Documentation

All the IBM documentation is excellent. It comes in a series of colour-coded, cloth-bound three ring binders which fit into matching cloth-covered boxes. If you buy a game or a package which doesn't justify the full treatment, then you get a plastic wallet, four of which just happen to fit into one of the boxes I just mentioned. Each box, which can be bought separately, measures about 8in x 2in x 9½in high. In the seven or eight hours I spent reading the manuals, I only found one error and that was in the dealer's product guide. Considering that IBM has only been working on the project for 14 months, I think it's a remarkable achievement. Mind you, I do wonder how many staff it's had beavering away — no one would tell me.

The manuals are very well written and IBM must have really thought about the target audience before writing each document because they start off talking about 4096 chars but by the time you reach the Basic manual it cheerfully uses 4k, knowing that you must have grown accustomed to some of the jargon by then. All the manuals are very clear and seem to cover all the ground necessary. They have indexes and tables of contents and appendices to save you diving around all over the show if all you need is a quick reference. Error messages are clearly explained with the appropriate actions suggested.

A 'Guide to Operations' and a Basic manual are supplied with the machine. The 'Guide to Operations' includes sections on setting up the machine, operating it, 'Problem Determination', installation of options and how to move it from one location to another. Another example of IBM's attention to detail is the fact it supplies its disks with reinforcing rings and some don't have notches so that you can't accidentally overwrite them.

Who'd use it?

The television advertisement uses a Charlie Chaplin look-alike, presumably to hook every viewer. The emphasis is on simplicity, ease of installation and fun. The music and the voice-over reminded me of the Disney wild-life films where the music changes according to the screen activity and throughout a very friendly voice explains what's going on. In the beginning there's 'Charlie' sitting on a white chair at a white table with a room-sized white box gradually shrinking before his eyes. The narrator says things like 'Once upon a time a computer was the size of a room' and, as it shrinks, he describes how IBM kept making them smaller until you could pick them up. At this point 'Charlie' picks up the machine and takes it over to his table where he unpacks it, assembles it and starts tapping the keyboard. All this is done with grossly exaggerated gestures of course. The final shot is of this rather nice machine sitting on the table next to a vase containing a single rose. Very warm, very friendly, very simple and a bit of fun too. More evidence of IBM's seriousness and attention to detail. There's not a threatening moment in the whole ad.

IBM sees its Personal Computer being used in the home, the office, the laboratory and the school. It goes further and defines its users as small businesses, the self-employed, departmental users, home users and hobbyists. It seems they've covered just about everyone there, doesn't it? I'm not too sure about the hobbyist being able to afford the machine at the moment. All the hobbyists I know are beavering away on low budget equipment with half the fun being to make these puny systems really perform. I'm not sure they'd even be happy with everything done for them. Middle class homes and all the other categories are bang on target as far as I can tell, although in Britain I suspect it would be more likely to sell to businesses, with bulk orders coming from those companies already well into data processing.

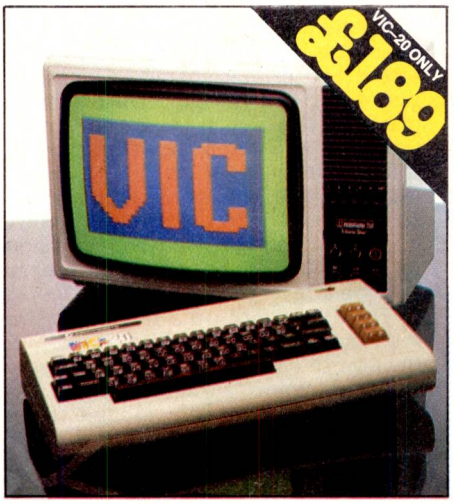
All the dealers appointed by IBM will have had to sign a strict agreement which tells them the sort of behaviour that IBM expects of them. They agree not to exaggerate the capabilities of the equipment nor to disparage other people's products. They have to agree to do warranty work regardless of where the machine was bought and they must send two sales and two engineering staff on IBM-run courses. And IBM has the right at any time to inspect the premises and interview the staff to ensure that

Commodore VIC–20

A fully-fledged, fully expandible, computer with large typewriter-style keyboard, programmable function keys, PET compatible. Gives 24 colours and sound, (to the degree that it can be used to compose music). High resolution graphics module available as extra. Speaks BASIC. Easy-to-use, even for beginners. New VIC–20 material is available and more is on the way. Supplied with easy-to-read, easy-to-use manual, suitable for beginners and children. Programs can be stored on optional VIC tape recorder. **Commodore approved supplier.**

Texas Instruments TI–99/4
(PAL colour TV compatible)

Usable literally within minutes of unpacking. Anyone can use it without previous computer experience or programming knowledge. Powerful 16K. BASIC language. Special features: high resolution graphics let you create animated displays, charts, graphs; built-in music synthesizer allows you to build notes and chords; equation calculator for maths solutions. Designed for home management, educational and entertainment use. Large amount of educational software available on modules for youngsters. Programs can also be stored using good quality tape recorder. **Texas Instruments approved supplier.**





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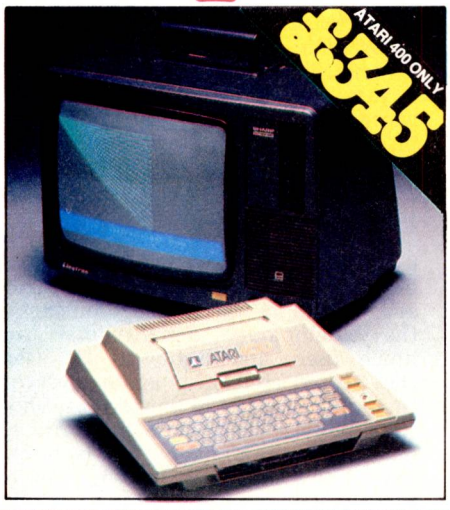

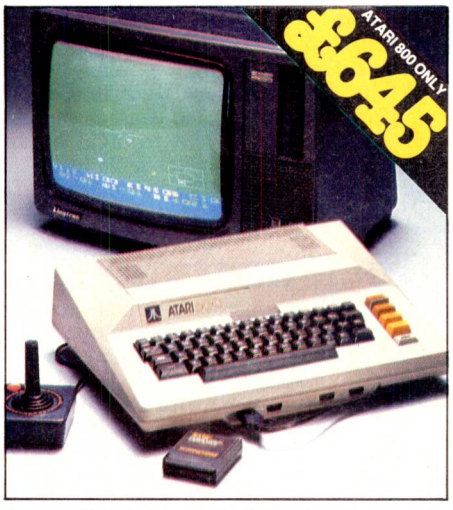

Atari 400

Brings the family music, art, education, entertainment. A general purpose personal computer that's easy to operate and offers 16 colours, each with 8 intensities; high resolution graphics; 4 sound synthesizers; 57 key alphanumeric keyboard with upper/lower case, inverse video, full screen editing, four-way cursor control, 29 graphics keys. Programming languages: BASIC, ASSEMBLER, PILOT. Programs can be stored on optional Atari tape recorder. **Atari approved supplier.**

Atari 800

Top-of-the-line personal computer. Advanced peripheral components, comprehensive software library. Modular design precludes obsolescence. 16 colours (8 intensities), 4 sound synthesizers; 57 keys with upper/lower case, inverse video, full screen editing, four-way cursor control, 29 graphics keys. Programming languages: BASIC, EXTENDED BASIC, ASSEMBLER, PILOT, PASCAL. Programs can be stored on optional Atari tape recorder. **Atari approved supplier.**

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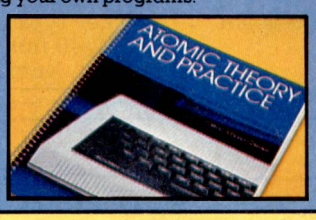

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	Power Supply	@ £ 10.20	
		TOTAL	

Dealers or Mail Order

Computer stores are stocking Atoms – there's a list below, but if you have any problems getting hold of one just fill in the coupon and we'll rush one to you within 28 days. If the machine isn't all you expected, or all we've told you, just return it within 14 days for a full refund.

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IBM PERSONAL COMPUTER

the standards are being maintained.

So, dealers, and readers, if the IBM Personal Computer ever comes to Britain, you now have some idea of what to expect. I hope it happens, but don't hold your breath waiting for it.

Future plans

It's just about impossible to discuss IBM's future plans because they won't tell you anything intentionally. I suspect that an Assembler is on the way and that, if it appears, it's 99 percent certain to come from Microsoft since they've written the editor and debug facilities. The only things I know for sure are that CP/M-86 is undergoing final testing right now and IBM will be looking at the dealer situation again in December to see whether it will be able to supply new dealers if they are taken on board. IBM's attitude is that it's better not to appoint new dealers until it can be sure of keeping them supplied.

Incidentally, CP/M-86 will cost considerably more than DOS and I'm not at all sure that it will be able to support the Microsoft Basics and Pascal which were written to run under DOS.

Prices

Just as a guide, here are some extracts from the IBM price list. ComputerLand stores will almost certainly charge different prices and not necessarily less than IBM.

System Unit (16k) with keyboard	$1265
Monochrome display	$345
Matrix printer	$755
Printer cable	$55
Printer stand	$55
Monochrome display and printer adaptor	$355
Colour/graphics monitor adaptor	$300
Printer adaptor	$150
Memory expansions	
16k kit	$90
32k option board	$325
64k option board	$540
(64k must be on-board before adding plug-in memory options)	
Disk drive adaptor	$220
Disk drive	$570
RS232	$150
Game adaptor	$50
DOS + Basic extensions	$40
Pascal Compiler	$300
Comms support	$40
VisiCalc	$200
Easywriter	$175
Adventure	$40
Ledgers	each $595



I've worked out that a typical 64k, twin disk, RS232 system with a monochrome display and a printer would cost $4575 — around £2500 in our money. This price includes the DOS and the Basic enhancements.

Conclusions

It's all been said really. This is probably the most professionally put together system I have seen. Lots of them look good then you find they fall over, or the manual is unintelligible; neither is the case with this Personal Computer. The only thing missing at the moment is a wide selection of packages, but I rather feel that the whole world and its grandmother will be frantically trying to fill that particular gap.

IBM has paid great attention to the details of the hardware, the software, the documentation, the distribution and support. In a word it's a knockout. I wish it was on sale here.

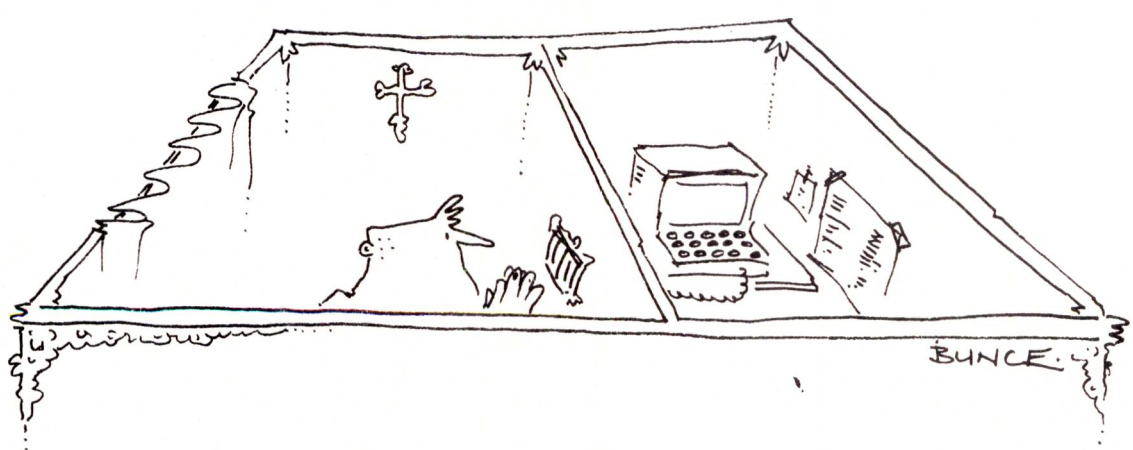
Benchmark timings

All timings in seconds.

BM1	1.5
BM2	5.2
BM3	12.1
BM4	12.6
BM5	13.6
BM6	23.5
BM7	37.4
BM8	3.5

Technical specifications

CPU	Intel 8088, 4.77 MHz
RAM	16-256k, plus 4k or 16k video RAM
ROM	40k
Disks	Up to 2 drives, each 160k
Cassette	Accepts user's own cassettes
Ports	Joystick/Paddles, RS232
Screens	Monochrome (green) 25 x 80, Colour 24 x 40 or 80, up to 16 foreground and 8 background colours, 320 x 200 and 640 x 200 graphics. Will drive monitor or domestic TV with appropriate RF modulator.
Keyboard	83 key typamatic. Tactile feedback. Auto repeat. 10 function keys (40 functions programmable). Single stroke Basic keywords . Numeric keypad.



EURO MICROMOUSE '81

Robin Bradbeer brings us his observations on the European Micromouse finals, held in Paris during the Euromicro Conference in September.

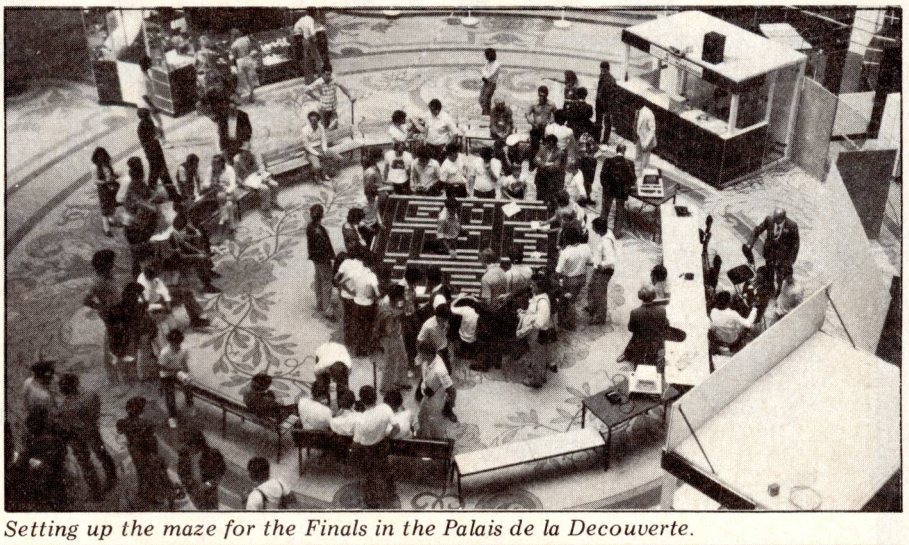
The object of a Micromouse competition is to design a robot that will negotiate a maze constructed of 3in high walls. The 'mice' are allowed 15 minutes to 'learn' the quickest way to the centre and the maze is designed to stop 'wall followers' from getting to the middle.

There had been a couple of trial heats during the previous months — one in London in July, and the other in Paris. The European contest was based on the now defunct American competition run by the Institute of Electrical and Electronic Engineers. It was resurrected by John Billingsley, a lecturer at Portsmouth Polytechnic last year. In the 1981 contest a British designed mouse — Sterling Mouse by Nick Smith — beat all the competition; this was taken as a great challenge by a number of countries, especially the Finns and the French.

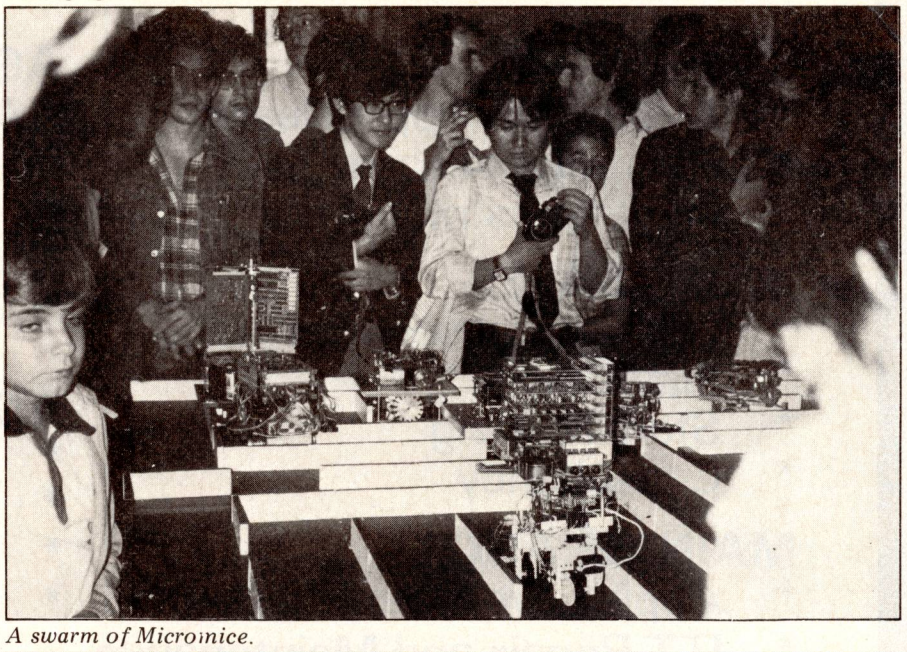
Something like 15 mice turned up for the trials at the beginning of the conference. These had a couple of days to get 'tuned up' and then an elimination contest was held to decide the top seven to enter the final, along with Sterling Mouse which was there as champion.

The line-up in the trials reflected the level of interest in each participating country. There were three Finnish, two French, two German, eight British. . . and one Japanese! The latter came all the way to Europe to get a taste of the competition.

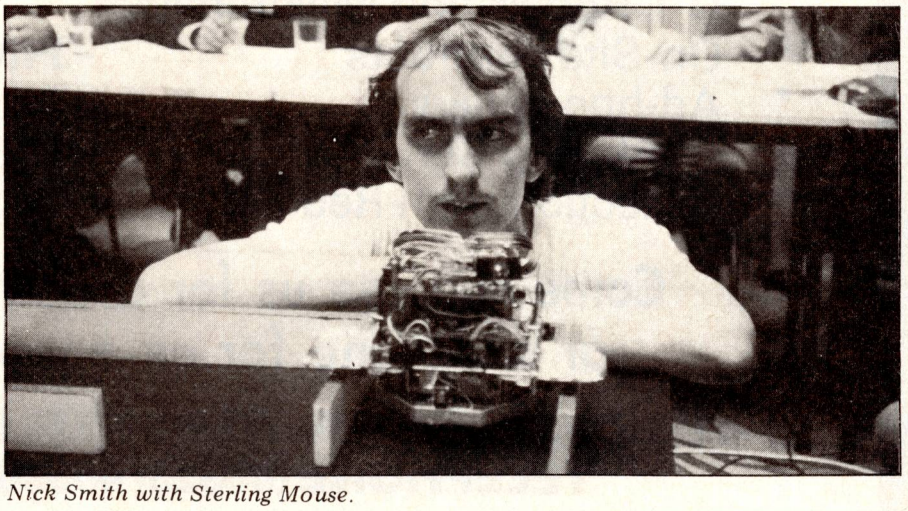
The difference in construction of each mouse also reflected the level of sponsorship available. Lorthocogitante, designed by Marc Renpauville of Paris, was constructed from bits of Fischer Technik and took him about four weekends to build. It was lacking in intelligence and Marc brought the mouse along to compare notes. Similarly, Dave Buckley from West Hampstead had a home-built mouse called Questor which was not fully operational but Dave, like Marc, wanted the experience. Both belonged to computer clubs — Marc to a small (three members!) robotics club and Dave to the 250+ members North London Hobby Computer Club. Another Club-based mouse came from Hayes Manor, a school electronics club supported by a local firm, LB Electronics of Hillingdon. Two of the schoolboys — Bob Taylor and Ralph Allen — were in Paris to represent the many in Hayes Manor School who contributed to the construction of Die Fledermaus #2. This mouse is based on a cut-down tank kit with an aluminium body to replace the original plastic. It performed at Wembley in July but was still a few weeks away from being able to complete the course in Paris.



Setting up the maze for the Finals in the Palais de la Decouverte.



A swarm of Micromice.



Nick Smith with Sterling Mouse.

A different story

Another non-starter was Speedy Gonzales. This German mouse was altogether a different story.

Speedy Gonzales cost nearly DM10,000(!) and was designed and constructed as a project over two years by electronics students from Dortmund University. It used two 8[illegible] processors in a complicated [illegible] ment, one controlling the [illegible] sensors the other solving [illegible]

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algorithms. This mouse was also a non-starter.

The main organised opposition to the British came from the Finns. They had a competition in Finland last month and only one out of five mice which entered actually finished. However, such is the dedication of most mouse-freaks that three made it to Paris and all succeeded in the trials.

The slowest mouse in the trials was Thezeus, built by Alan Dibley of Cheddar, Somerset, and based around a ZX80. Unfortunately, Thezeus blundered about so much during its first run — it took over 11 minutes — that there was no time left for subsequent runs. Superlite, another German mouse built by Klaus Waldsmidt, also from Dortmund, had a final run of 3m 6s. Next was Alan Dibley's second entry Son of Thezeus, also based on a ZX80, which took 2m 49s.

Two Finnish mice were next in line, Midnight Sun Junior and Jukka. The former was built by students from Tampere University and took 2m 36s. The latter, nicknamed Jack the Rat, was also built by students, this time from Oulu University and took 2m 32s.

In third place came the sole working French mouse, KIM, which was constructed by Te Vin Huor from Bandoufle. It took 1m 43s. The third Finnish mouse, Minitaurus, from Tampere University, took 1m 27s with the fastest trial run of 1m 15s being made by Thumper. This was the winner of the London competition and was built by three people from Wolverhampton, Andrew Keatley, Dave Woodfield and Arthur White. Thumper was one of the two mice in the competition (the other was Minitaurus) that had speech synthesis. As it moved about the maze, cries of 'West', 'East', 'There's a cat in this maze', etc could be heard among the motors' whirrings.

The final

And so the final, held in the Palais de la Decouverte, the Parisian equivalent of the Science Museum. The entrance hall is a large rotunda and about 200 people turned up to watch. Discussions between the judging panel and the organisers meant that the maze in the final was slightly different to that in the trials. It was basically designed to sort the 'blunderers' out from the 'thinkers'. It seems incredible, but all those people sat for nearly two hours watching pieces of metal trying to find their way into the middle of the maze! That shows you how enthralling micromouse competitions are.

The mice went in reverse order of best trial time with Sterling Mouse going third from last. John Billingsley did a marvellous job compering the whole thing in English and near-perfect French. (In some ways this did more to enhance the feeling that Britain was finally a part of Europe than anything else!) However, even John refused to translate 'up a creek without a paddle' when one of the contenders got stuck at a dead end.

First away was Superlite from Germany (Thezeus bowed out so that Sterling Mouse could enter). After 15 minutes it still hadn't got anywhere near the middle and the German challenge faded. Son of Thezeus, waving a small Union Jack, conked out after a couple of minutes and was allowed to withdraw temporarily. On his return later in the event Alan, who only had 10 minutes left, found that the program had got corrupted. It was instructive to compare the use of sophisticated equipment at Intel's headquarters in Paris to debug some of the software on one of the Intel distributor-sponsored Finnish mice to the use of a portable TV/cassette recorder and detached ZX80 keyboard, with Alan writing Z-80 code from his head! So Son of Thezeus retired.

The Finnish challenge

The first Finnish challenge was from Midnight Sun Junior, who could have had more than 15 minutes if it wanted to as the clock — on a PET — broke down. It got so close to the middle but its batteries ran out: exit one Finn! The next Finnish challenger, Jukka, just would not work properly and was retired. A big cheer greeted the sole French entry, KIM, with the crowd being goaded to patriotic fervour by John Billingsley at the microphone. (The French were so convinced that a native mouse would win the earlier French heats, that the prize computer did not have any export documents. As it was won by Sterling Mouse, Nick Smith had some problems later!) Unfortunately, all KIM would do was to go around in circles!

By now the crowd was beginning to get a bit restless as nothing much was happening to inspire confidence in these strange creatues. Some were even beginning to mutter about the whole thing being a bit of a con! But enter Sterling Mouse to a big cheer. On its first run it got to the middle in 3m 45s, on the second 1m 53s and on the third and final run, 1m 8s. Confidence had been restored and the battle looked alive again.

The Minitaurus team now took the centre of the arena. If you can imagine eight, six-foot high, blonde Finns all wearing Minitaurus tee shirts, then you can envisage the impressive sight presented to the crowd. Minitaurus, which was only 12 seconds behind Thumper in the trials, had been carefully 'tweaked' by its creators to win. The Finns were so determined that their seriousness rather worried the more phlegmatic Britons present. However, all Minitaurus could achieve was to move very quickly everywhere — except to the middle. It eventually got there in 6m 7s and then promptly refused to do anything more! The rather annoyed Finnish team had to retire to the corner to prepare their mouse for its *piece de resistance* later in the programme.

Finally Thumper entered, with John giving it quite a build-up. Its first run took just 1m 59s, the second 1m 44s and the third only 44s! It then repeated this time, with the team not having any more runs. Thumper received a standing ovation, especially after John had translated its mutterings into French.

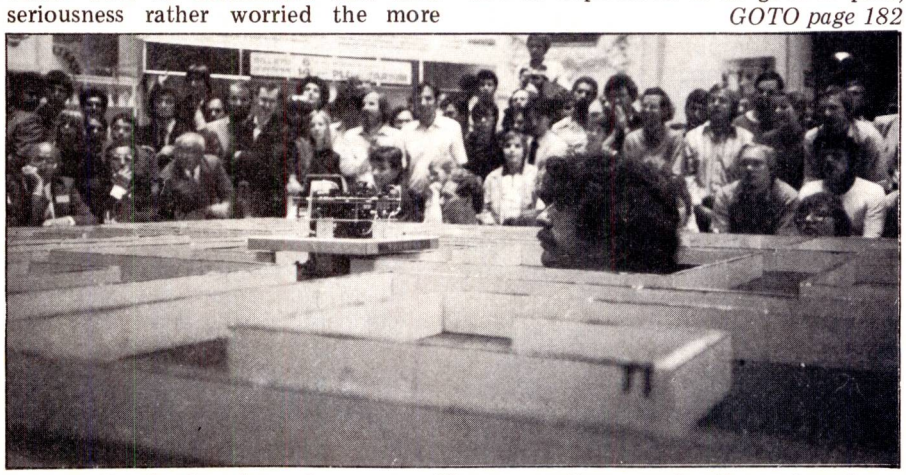
Once the maze had been conquered so successfully, Minitaurus took the stage again. A large sheet of white paper was attached to a board that covered the maze and Minitaurus began its 'dance'. While playing a whole selection of synthesised music from classical to rock, the mouse wrote its name in a circle on the paper using a pen attached to one of its 'arms'. This won the Finns at least a consolation prize for the best virtuoso performance.

The presentations themselves were rather chaotic, in the most endearing Gallic way: Thumper won its makers an MZ-80K while Sterling Mouse's creator won an HP5036 computer. All the finalists got prizes, even if it was a free subscription to a couple of French personal computer magazines.

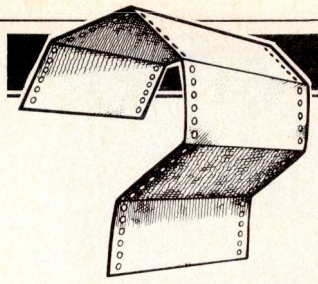
What of the future?

After that convincing show of British-make-do-and-mend — what of the future? So far we know of five events next year. First are some London Trials, being sponsored by the Association of London Computer Clubs, at the London Computer Fair in April. Although primarily a chance for mice being built by members of ALCC clubs, these are open to anybody — the Japanese have expressed an interest. Following that in July, at the Microcomputer Show, are the British Finals, to decide who goes through to the European Finals in early September. The French Finals will be held in Paris, also in July. The European Finals will be held at the Euromicro Conference in Haifa, Israel. Finally(!) there is hope that a World Finals will be held at next year's *Personal Computer World* Show, also in September. If all goes to plan,

GOTO page 182

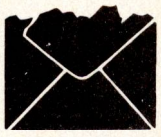


Andrew Keatley keeping a close eye on Thumper as it approaches the centre of the maze.



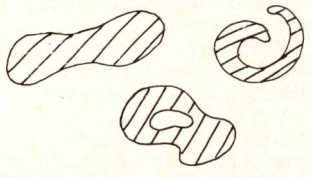
COMPUTER ANSWERS

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.



Open question

Could you tell me the principles involved in writing an INFILL or PAINT routine to block in an area bounded by a line or number of lines? It is easy to deal with simple shapes like rectangles but a routine to deal with weird shapes is defeating me. Some examples are:



Please send your answers directly to J Sharp, 11 Portrea Close, Davenport, Stockport, Cheshire. The best answer will receive a small prize.
SW

Project problem

I am about to start an O level/A level course in computer science. I am worried because I do not know what project to do. I am also unsure what to include in the project write-up (documentation).
H Singh, Birmingham

Yes, this is the time to discuss such matters, although by the time this appears in *PCW* it will probably be too late — I am writing this in August (1981!).

Well, you will get far more details from the teacher concerned at your school/college, but you should bear in mind what you are doing this project for. It is not for fun, or just something for the examiners to mark, it is to show that you have an aptitude for programming. Future employers may wish to see your project if they are employing you in a computer-related field. For that reason alone it is best to reject a games-playing program. Choose something that you can research, like a payroll program. That will give you an insight into pay that virtually no one else has and will enable you easily to work out whether you are paying too much tax when you start work. Scientific programs are usually too trivial, unless you have a good knowledge of mathematics and statistics. Stick to data processing type programs. Stock control, survey analysis, information retrieval, computer dating and estate agents' housing lists are just some examples that may sound complicated but are not, provided you keep things simple. Ask your parents or relations what they would like a computer to do in their companies. Part of the idea of a project is that you should be able to think up a project for yourself.

Program documentation is vitally important. Most students spend 95 per cent of the course writing the program and leave the documentation until too late. A better ratio is to allow at least 25 per cent of the time for the documentation. After all, the only way the examiner can tell how good your project is is to read your documentation. Documentation should provide three major items: making the program *easy to use, easy to understand,* and *easy to modify*. Think about each one of these carefully, and if your documentation doesn't fulfil them then you'll know what to do. A good idea is to come to an agreement with another student on the course who is doing a different project. Swap your write-ups and see if you can understand what the other is doing, be vicious and scathing with each other's documentation but be sure to leave enough time to get over the shock and re-write it.
SW

Feedback

In the August 81 'Computer Answers' there was a query from P G Upton regarding programs for survey data entry and analysis. I have received letters from two companies who both offer such packages. I have not tried them, so I cannot give any recommendations. Both run under CP/M and so would be of wide use. Suppliers are: Systematica, 112 Strand, London WC2R 0AA (01-836 9379); Arithmos, 59 Bancroft House, Bramlands Close, London SW11 (01-228 2452) and 2 Jubilee Road, Walkerburn, Peebleshire EH43 6AJ (089687 583).

Another previous query from R Jones requested information about running programs direct from cassette on the Acorn Atom. I have been notified of a new Utility ROM for the Atom: a program can be saved using the new command BSAVE, and only the filename need be specified. The program can then be run direct from cassette using the standard RUN command. The ROM provides an additional 17 commands, including renumber, string search, auto line numbers, etc. For further details, send an SAE to: Willow Software, PO Box 6, Crediton, Devon EX17 1DL. Again, I haven't tested this so cannot give any recommendations.

Fuzzy puzzle

Why is it that when a TRS-80 (with a modulator) or a Video Genie is connected to an ordinary TV, the display is so fuzzy? I can barely distinguish between 8 and 3! How do I make the figures as sharp as those on a ZX80?
T D Edwards, Chalfont St Giles

There is no easy solution to your problem — it will be present as long as you use a TV instead of a monitor!

Any computer which produces video output for a TV has extra links in the chain connecting the two — the computer modulator and the TV tuner and demodulator. This introduces some signal degradation and affects picture quality.

The TV circuitry is not designed to cope with the bandwidth of the signals the computer feeds to it. This means that it is also designed for a lower screen definition than a video monitor. The video circuitry can produce smaller individual points on the screen than the TV and this means the characters it produces are better defined.

The Sinclair ZX80 achieves its picture quality by producing inverse characters — ie black on white, rather than the normal white on black. This overcomes some of the loss of definition. This can be done on the TRS-80, but only at the loss of your guarantee!

The American magazine *80 Microcomputing* published in May 1981 a three chip modification which will produce inverse characters. Graphics boards such as the Programma will also produce inverse video characters.
Dr N Robinson

Which printer?

I want to buy a printer for my TRS80 which costs less than £500 (plus VAT) and has tractor and friction feed.
T G Wright, Ruwi, Sultanate of Oman

One of the biggest recent areas of growth in the computer market has been that for better and cheaper matrix printers. The new generation of printers has features which were formerly the province of the golfball and daisywheel printers. These include double density printing, superscripts, proportional spacing, variable print size, and underlining.

These features are controlled by control codes from the computer, either direct from the keyboard, or incorporated into a program.

Printers such as the Microline 80, (£300), Epson MX-80F/T (£399) and Centronics 737 (£349) — all prices plus VAT — have these features, as well as a choice of tractor or friction feed.

These enhanced printing capabilities are not accessible by the most popular TRS-80 word-processing programs, Electric Pencil and Scripsit. However, a program available from A J Harding Ltd, called Superscript allows any printer capabilities to be accessed from within Scripsit.

If money is short, then the Tandy Line Printer VII (a custom version of the Seikosha GP 80A) is only £200 (inc VAT). It is tractor feed only but single sheets can be taped to the continuous paper and fed through.

A final word of warning — dealers tend to charge about £30 (plus VAT) for the two plugs and three feet of cable which connect the printer to the computer! You can make one yourself for £5 or so.
Dr N Robinson

Tuscan change

Owing to the lack of commercial software for my standard Tuscan 2, I would like to dispense with the TCL Basic ROMs and install an EPROM board with a better served system (eg TRS—80 Level 2). Could this be made to work with the Tuscan configuration?
P A Janies, Chepstow

The problem with your interesting suggestion is that a ROM-based interpreter has not only to convert from the high-level language into machine code but it must also provide the interfacing between the programs and the screen, VDU terminal, printer, etc. Thus, while the Tuscan Basic interpreter is closely based on the interpreter Transam already had available for their Triton computer, it was still necessary for the I/O portion to be re-written for the Tuscan.

One way out of your problem, although an expensive one, would be to

Make the most of your Sinclair ZX Computer...

Sinclair ZX software on cassette.

£3.95 per cassette.



The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.



Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status–digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

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	25	Cassette 5 – Junior Education	£3.95	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£49.95	
		*Post and packing (if applicable)	£2.95	
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PCW 11

upgrade your Tuscan to take a disk drive. As you know, the Tuscan is specifically designed to make this upgrade easy. Once you have a disk it will be possible to use the CP/M operating system, which will allow you to load any of a wide variety of Basic (and other language) interpreters and compilers. If you were to use Microsoft Basic, for example, you would find a wide variety of software available. Indeed, there is a wide variety of commercial software on the market designed to run under CP/M, including machine code programs such as the well-known WordStar word processing program.

A second solution would be to learn enough about programming in Basic to be able to convert purchased programs to the TCL version of Basic. (You would need to make sure the programs you bought were in source code, not compiled into machine code, and could be LISTed). David Lien's *Basic Handbook* would be very useful here, as it gives details of the differences between many dialects of Basic and help with how to convert between them.
P L McIlmoyle

Micro RTTY

I intend to purchase a small computer to encode and decode amateur RTTY. The problem is interfacing the transceiver with the computer ports.

Does the UK101 have a suitable port? Are there other suitable models, eg ZX81 or Nascom? Can you suggest a book that would help in writing the routine for checking the port status? Is it possible to record the incoming data onto cassette while the program is decoding it?
G Caselton, Orpington

Nowhere do things move so fast as in electronics and computing! You can now buy an RTTY transceiver with built-in micro for decoding for about £300, thus solving the interfacing problem at a stroke, and not spending much more than the computer would have been. A receive-only unit is about £160. Further details of these MM 4000 and MM 2000 units can be obtained from: Catronics Ltd, Wallington Square, Wallington, Surrey. Both units work in both Murray and ASCII codes.

If you particularly want to use a separate computer then I believe that suitable combinations of hardware and software are available for the Video Genie at about £150.

A guide in doing it all yourself you could well start with *'How to Program Microcomputers'* by William Barden Jr (H W Sams & Co Inc). Chapter 23 gives a lot of useful information on I/O formatting. See also the article in *PCW* Vol 4 No. 6, July 1981.
P L McIlmoyle

List block

I have become interested in computers since the school purchased a 32k PET last September. Ever since we began programming my friends and I have been looking for a 'list block' to prevent listing but without success. Can you help?
D Waterman, Gt Dunmow, Essex

There is no simple answer to this one — no magic POKE which will render a program unLISTable. None of the software security methods known to be in use today would defeat a determined expert, knowledgeable about how Basic works, how the Charget routine operates, and able to delve into the machine code, particularly if equipped with one of the powerful machine code aids such as IPUG South East's Basmon ROM. However there are various tricks which are appropriate in various circumstances, which will give limited degrees of security within those circumstances.

Maybe you just want to leave a program running unattended at a school exhibition, and wish to prevent fiddling by practical jokers. You could cause the program to disable the STOP key and write it so that it would not crash under any conceivable circumstances. Obviously, it could not then be LISTed or modified.

There is also a program called Locksmith, recently released as a puzzle by Jim Butterfield, which may be used to treat another program so that it cannot be just LOADed; it will only LOAD and RUN. If the program disables the STOP key, then a similar security is achieved. In both cases, the PET concerned must not have a warm reset button.

The same end might be achieved in a more amusing fashion by incorporating into the program a short program called Protect. You may leave your program unattended after you have started it, as it will then respond to LIST with the statement: FOR DETAILS OF THIS AND OTHER SOFTWARE PLEASE CONTACT D WATERMAN.

If you wish to prevent the program from being LISTed, or even RUN, except by you or your agent, then you could alter one of the Basic lines to point elsewhere than to the following lines. Only a person who knows the secret POKE could then use or LIST the program. This method is discussed briefly in *The PET Revealed* by Nick Hampshire. Once the program had been POKEd, it would be as vulnerable as ever and could not be left unattended.

The most promising areas in which to experiment with a view to producing non-standard modes of operation of the PET are line linkage, as mentioned above, and the Charget routine, which may readily be modified to generate new commands and to detect additional control characters.

To obtain a free copy of Protect and Locksmith, which are public domain programs, contact the writer on Biggin Hill 71742.
B J Biddles

A simple command like POKE 1025,1 has an interesting anti-listing effect.
SW

Light pen

Do you know of a currently available light pen for the Atom.
Adrian Pegg, Benfleet, Essex

I am not aware of a light pen for the Atom. It should be possible to use a light sensor to latch the address present on the VDG address lines and read this address. The easiest way of doing this on an experimental basis would be to obtain A1-A8 from IC40, configure the VIA so that port A was in latched input mode, connect the eight address lines to PA and latch the input when the sensor detected the extra brightness present on the TV screen when the electron beam refreshes the phosphor. Using A1-A8 will result in an error of u-1 in the horizontal resolution and using one of the VDU RAM sockets to obtain the address lines will limit the use of the Atom to graphics modes 0-3.

When the system has been developed the address lines can be permanently connected to two latches with tristate outputs and the sensors will then latch the address lines and generate an interrupt. Intel 8212 chips would be appropriate for this latching. It would be necessary to develop suitable software to identify the character at the specified address.

The Atom VDU board has a light pen facility and can be inserted at 0400H and 0800H. However, it would then be necessary to write new software to print on the screen.
Robin Lowis

Expanded Atom

Do you know of any business software for the Atom? Would it be possible to run a disk system. What advantages would installing an acoustic coupler bring to talk 'intelligently' to a main-frame. Will the Proton's peripherals and software be compatible with the Atom? Lastly, will there be a Last One version for the Acorn Atom?
J Neill, Bangor, Co Down

I am not aware of any business software for the Atom. The recent announcement of floppy disks from Control Universal should encourage its development, though.

It would, theoretically, be possible to use an Atom as an intelligent terminal but it would be necessary to write suitable software to handle the mainframe's communications protocol and extra hardware would be needed to generate and receive transmissions.

I do not know what upward compatibility there will be to the Proton, we will have to wait and see. Finally, I doubt if there will be a 'Last One' for the Atom.
Robin Lowis

PET upgrade

We are trying to upgrade a 'new ROM' 2001 PET from 16k to 32k by replacing the RAMs but are unable to access more than 16k even after changing the top-of-memory pointer. Are there some hardware links we should change?
A Dobbie, Caerphilly, Mid Glamorgan

In a word, yes. This is because there are two types of RAM chip used on dynamic RAM PETs, the 4116 and the 4108. The 4108 is in fact a 4116 that only has its top or bottom half working when tested. The addressing of the top or bottom halves is controlled by two wire links, together with two others that enable the machine to work with either 4116 or 4108 RAMs.

There are also other links to indicate how much memory is present on the mother board, allowing the rest to be addressed from the memory expansion port.

A suitable configuration — one I used myself when upgrading from 8k to 32k — is as follows:

LINK	STATE
A	open
B	open
C	closed
E	open
F	closed
G	closed
H	closed
I	closed
L	open
M	open

The table only lists the links concerned with on-board memory. For a more detailed understanding you may find the electronic circuit diagrams in *The PET Revealed* to be helpful.
Julian Bane

GUESS WHAT ?

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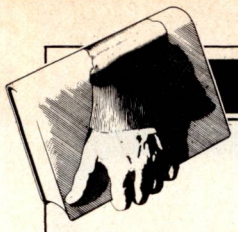

BOOKFARE

This week Malcolm Peltu reviews a new crop of introductions to micros in business applications.

A GUIDE TO THE GUIDES

The small business is the apple of everyone's eye at the moment. The government looks to small businesses as the generators of jobs, entrepreneurial spirit, etc. The computer systems vendor views the small business with the same relish that whales look at plankton.

Book publishers, providers of educational courses, even polytechnics and universities also hope to get a bit of juice out of the small business person. Explaining technology and selling technology to the end user/naive user/punter/small businessman is booming — small business is Big Business.

This month a couple of cassette tapes and a book aimed at explaining small business systems and word processors have caught my eye and ear. Before reviewing each item, I would like to provide some guidance on how to choose an introductory small business book.

Although you can't judge a book just by looking at the cover, it is possible to get a good idea of the level and style of the book and the amount of detail provided by flipping through. (The inability to do this with a tape is one disadvantage of audio material.)

By its nature, introductory material is generalised. This is a good thing. So if you see lots of detail about specific products or technology, its probably better to leave the book to a second course, after you have savoured the hors d'oeuvre.

Generalisations need not be waffle, although they are frequently couched in consultantese to give them a touch of unwarranted grandeur. Consultantese is the language developed by highly paid consultants in order to make their reports and documentation as fat as their fees.

It is said that a consultant is a person who borrows your watch to tell you the time. Many consultants, of course, have had a great deal of experience which makes their services worthwhile. The trouble is that 'good advice' can sound like just common sense. In fact, it *is* common sense to someone with experience.

Typical consultantese are phrases like, 'in regard to the proposition' and 'given that the theory has been complied with'. Anywhere where five words are used instead of one and where bland platitudes seal off the whiff of reality.

If such consultantese litters the pages, avoid the book like the plague. The language used should be the language of the real business world.

On the other hand, an attempt must be made to explain jargon. You can tell this by looking at the index or glossary. *Word Processing* by Richard Morgan and Brian Wood has a good index because it indicates the page where the word is first defined. The index strikes the right level of necessary jargon. And so does the book.

Two attitudes of jargon should be avoided — the 'you don't need to know any jargon other than hardware or software' brigade or the 'bits, bytes and Basic' merchants.

A cassette tape by Olivetti on choosing a business system uses the line about needing to know only 'hardware' and 'software' as jargon words and then goes on to mention things like VDUs, floppy disks, parameter-driven software, etc.

This de-emphasising of jargon was a natural antidote to the jargon-soaked image which computing has had in the past. Yet it is wrong to pretend that computing can be comprehended without learning some new terms.

In any case, one man's jargon is another's natural language. Word processing jargon like wraprounds, scrolling and windows sounds more 'English' than bytes, RAMs and VDUs — but it is still jargon.

The alternative approach is to get bogged down in unnecessary jargon. I have frequently lamented the type of book called Introduction to Computing which begins with binary logic, computer architecture, etc, rather than with the *uses* of the systems.

The style and mood of the book is another vital ingredient in choosing one. To me it is the poetic quality of the author which is of particular significance in raising life out of a dead topic.

By 'poetic', I mean the imagery, the analogies, the examples. I have often thought that it would be nice to bring out a book of computer analogies. 'A computer is like. . .' is how many sentences begin, before sliding down a precipice of despairing cliches and metaphors.

On this test, the tape 'How to choose your small business computer' by J Mike Eaton gets high marks. His analogy for a computer system is a barn.

Roughly (and he emphasises that it is only a rough image), the bigger the barn, the more you pay. The barn is the place where information is stored. The keyboard is equivalent to a door marked IN; the printer to a door marked OUT. The VDU screen is a window for looking into the databarn. Disks and storage are equivalent to shelves, filing cabinets, etc.

Then you need someone to rush around inside doing calculations and moving information around. This (in a not very good analogy) is the processor, says Eaton.

The barn image, however, is apt because he is trying to point out that the size of your data requirement plays a dominant role in determining the size and cost of the system.

The Olivetti tape, however, uses some corny imagery. Computers are like motor vehicles. You can get a motorcycle at a cheap price or a Rolls-Royce at a higher price. This analogy is misleading. Computers are not as single-purpose as vehicles and the difference between a Roller and a Honda tells you nothing about the factors which distinguish one computer from another. Eaton's barn, however, has the characteristic of actually being a storage area, which helps to clarify and enliven the description of a computer.

Another element of style is how the witticisms, asides, jokes and general personality of the author(s) appeal. Morgan and Wood, for example have a touch of literary class. They start with a quote from Omar Khayyam:

The Moving Finger writes;
and having Writ
Moves on; nor all thy Piety or Wit
Shall lure it back to cancel half a line,
Nor all thy Tears wash out a Word of it.

'The typewriter emulates the Moving Finger, but, because unlike the finger, it was mechanical, it was reasonable to ask if more mechanism might accomplish what Piety, Wit and Tears were powerless to do.'

They have another erudite reference when explaining macros: 'Macros is the Greek for "long" and one of the early kings of Persia was nicknamed Macrocheir or "longhand" because his reach extended to all parts of his large dominions,' they comment.

Tit-bits like this add little to an understanding of the technology but they make a great deal of difference in making the newcomer to computers feel at ease.

The key to appeal is style rather than uniqueness of content. On his tape, Mike Eaton makes a trenchant point about buying a computer: it does not really matter what computer you buy, provided it does what you want. 'If you have some irrational desire to buy a particular computer, get it,' he says. Of course, the system must have the required capabilities and the supplier should provide adequate support. But there are a multitude of systems which can do the job, and selecting one system rather than another is unlikely to make much real difference.

In the same way, I believe that a small business person (or any other newcomer to computing) should choose whichever book, course or tape appeals most and with which he or she feels at ease.

Although I have been critical of many introductory books, I cannot remember any that were actually *wrong* in what they say. The worst crimes are to be out of date, to miss out important aspects of information technology and to over-emphasise the technology rather than the uses. But when you are wanting something that gives an insight into computing potential, none of these faults are disastrous. What is important is that the essential messages get through. That is why I have emphasised factors like general feel of the book (or sound of the tape); style; wit and relevance of the imagery.

In assessing introductory material, it is important to be aware of what I call the Roots And Branches culture

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gaps. Information technology has its roots in many different activities — large-scale commercial data processing, hobbyist personal computing, automatic typewriters, telephone exchanges, etc, etc. From each of these roots, the technology has branched out. Data processing has sent its tentacles into office automation. Word processors grow into small business computers. Personal computers are sold for data processing and word processing tasks rather than for home use.

The branches intertwine and merge until you cannot see the join. But the people who have grown up in one of these cultures tends to view the world from their own cultural perspective.

A traditional DP man sees the information world in terms of databases, online terminals, communications networks, etc. Word processor buffs are into editing facilities, ergonomics of workstations, text processing and letter-quality printers with data processing and communications seen as adjuncts or as some future extensions of word processing.

Both DP and WP (word processing) experts tend to look down on personal computers as toys. On the other hand, to the personal computerist, life is a bowl of Apples, CP/Ms, VisiCalcs and WordStars, with DP and WP regarded as cumbersome old-fashioned dinosaurs. Provided the newcomer is aware of these cultural differences and makes allowances for them, little harm can be done. The newcomer will grow individual roots from his or her own 'cultural' background. The small business person will relate the technology to small businesses. The solicitor or accountant will relate it to soliciting or accounting. The community organiser will relate it to community organising. From a base of knowledge of one activity, branches will grow and the merging of information technologies will become clear.

Just remember that the label is irrelevant. Word processors, giant mainframes, intelligent terminals, personal computers are all manifestations of computing power. Do not dismiss or ignore any system because of its label. Look at what it actually does, the manufacturer's support, software availability, costs and all the other good bits of advice.

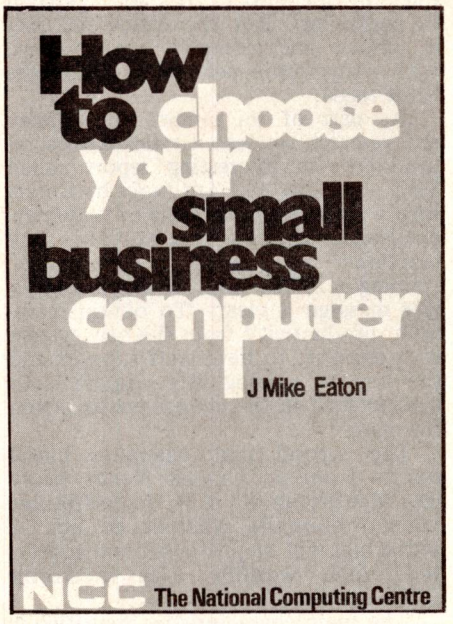
With introductory material, it is much more important to get stuck into something you enjoy reading or listening to and which you understand than to worry whether it is the ideal, most comprehensive, most updated book or tape. None of them are. But there is a lot of extremely good and useful material available.

Now for a closer look at the tapes and books I have already mentioned.

Top of my pops

Mike Eaton's tape *How To Choose Your Small Business Computer* does everything just about right. My main reservations lie with the medium, not the message.

The tape lasts about an hour. It consists primarily of Eaton talking, although it is interspersed with a female voice and snatches of muzak as chapter



headings. In addition there is a very useful little booklet with practical checklists.

These checklists give a flavour of the straightforward, practical common sense and advice given by Eaton. He gives guidelines, for example, on how to estimate file sizes. Multiply the number of customers and suppliers each by 150. Multiply items supplied to customers by 90 and actual stock items by 50. Each of these numbers is a typical number of characters needed to describe the relevant item. Add all these figures together, multiply by three for safety and future growth and the result, very roughly, is the amount of disk storage you might need. He stresses the roughness of these figures. But by offering this rule of thumb, it at least offers a feel for the size and cost of a system.

Other checklists cover how to define minimum requirements in more detail (invoices, stock items, financial analysis, payroll and special factors, like seasonal workloads), how to evaluate a software package, how to minimise risks and what to do before and after the computer arrives.

Eaton's approach is laced with the fruits of experience. As far as possible, he has no special 'computer cultural' bias. He includes the 'top end of the personal computer range'. Although his main emphasis is on data processing, he has a special section on word processors. His analogies are generally good (although I don't like his comparison of an operating system with the instinctive genetic inheritance in human beings!). In fact, for the market aimed at, I find the content almost faultless.

But whether or not you find this your cup of tea depends on your attitudes to tapes in general and to the particular production techniques used on this one in particular. With a tape, you can get on with other things while listening. On the other hand you cannot read it on a train journey or in front of the telly. A voice can be more expressive than text on a page, but it is difficult to linger over a particular item on tape and impossible to flick through as you might with a book, although you could note the timings at which particular words are spoken.

These reservations and advantages apply to any tape. In producing this tape, the National Computing Centre has gone for the single-voice lecture format. Eaton gives a relaxed and fluent talk but having a single voice becomes hypnotic and a bit boring at times. In places I found myself drifting off, then realising a chunk had passed me by without anything registering.

The Olivetti tape (see below) is much livelier because it has more voices. But, despite the reservations, I think the Eaton tape plus booklet are excellent value for money.

Sales talk

The Olivetti *Guide to Buying a Business Computer* has two advantages over the Eaton tape: it is free and it is easier on the ear. But it is nowhere near as good as Eaton's offering.

To be fair, it doesn't really pretend to rival Eaton's scope. And it is something more than just a straight sales pitch. It makes a neat complement to Eaton's views as its general drift is the same: software and support are more important than hardware.

Instead of having one person read the text, Olivetti has used a team from LBC, London's commercial news radio station. Douglas Cameron, Douglas Moffat and Anna Barrie present the information like a news report.

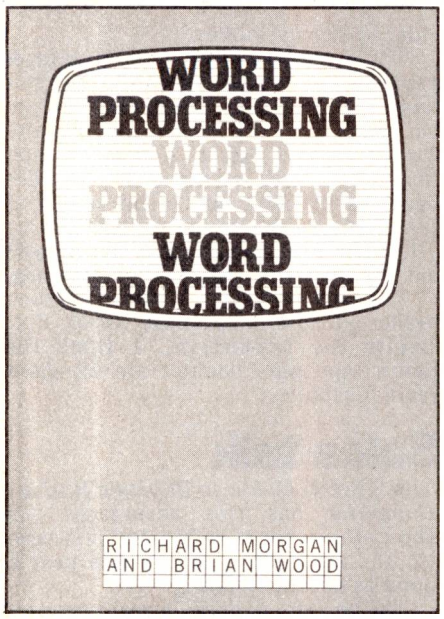
Anna acts as the news reporter providing information on a survey conducted by Olivetti of businessmen's attitudes to computers. The two Douglases comment on the fears expressed by the businessmen and give details of some Olivetti products. As the tape comes from the business computer side of Olivetti, there is an emphasis on data processing, stock control and financial and accounting management rather than on word processing. Although the LBC team raise all the right points, they are a bit too glib in dismissing problems; in some cases much too glib.

For example, the Olivetti study found that people were worried about the reorganisation needed if you install a computer. 'In fact a computer can be installed with no disruption whatsoever,' is the bland answer. This is rubbish. Every computer system leads to some form of work and job reorganisation. It is no good pretending it doesn't. The tape also summarily and incorrectly dismisses fears about system breakdowns and 'hidden costs'. But the fact that the tape is a freebie from a manufacturer will naturally alert the listener to any soft or hard sell. By showing what can be done with audio presentation and by talking much commonsense as well as much sales spiel, this is an imaginative and useful piece of sales material.

The moving cursor writes

Morgan and Wood's *Word Processing* suffers from the 'culture gap' problem. When it sticks to describing what word processors do, it is excellent both in content and style. But it begins to

BOOKFARE



become ragged when trying to relate word processing to other computing and communications developments.

The first three chapters are particularly good: What is a word processor; hardware; and software. But it loosened the tight grip of these chapters in the next one, which contains a ragbag of capabilities under the title 'machine layout'.

It has some skimpy and disappointing material on staff and the future and doesn't really deal adequately with the relationship between WP and other information technologies. Local networks, which are of great significance in office automation, are mentioned only towards the end, *en passant*. But it has some sensible material on choosing and implementing systems. The culture gap problem means that it views the world primarily down the barrel of a word processor. As an introduction to the roots of word processing, this book is a very good starting point, provided you are aware that later you will have to branch out into other subjects.

An aptitude for it

Wood and Morgan treat office staff problems primarily as an extension of computer systems development. They also focus on workstation ergonomics for operaters (VDUs and eyestrain in particular). But the office provides a unique and complex environment, with many more new staff challenges to be faced.

As part of its general consultancy and research services, Urwick Nexos has produced an interesting report called *Staff Attitudes and Aptitudes* by Emma Bird which examines some of these new challenges. The first part examines staff reactions to change, ergonomics, training and the role of trade unions. Her message is clear: 'To obtain maximum productivity from the new system it is essential to have staff support and the key to gaining this support is to involve staff in the change process from the start.'

The second part examines initial results from an Urwick Nexos study into identifying the skills and attributes which determine whether or not an individual will be proficient and contented when working with electronic office systems.

The main characteristics identified in the study were good skills in English, problem solving ability, interest in information technology, accurate and fast typing, and logical thinking.

The report is pricey for what it is, but it is meant to be viewed as part of a spectrum of publications and research activity into office systems, not just as a one-off publication. When more results of the aptitude study become available, more meat will be available to flesh out what is still a skeletal theory.

Anyone in office automation should be aware of the factors highlighted by Emma Bird. Some managers will disagree with her recommendation for more industrial democracy. But to ignore the human factor is to set the scene for strife, and will probably lead to inhumanity in the systems developed.

Management has a right to manage. But staff have a right to be treated like human beings. This report is a useful contribution to making this point.

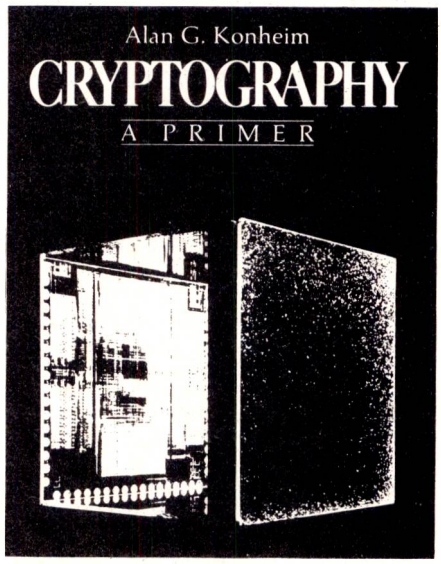
Cryptic primer

Data encryption is an important method of protecting data. A book which describes itself as the 'first accessible step-by-step guide to both theory and applications' sounds welcoming.

Cryptography — A Primer by Alan G Konheim unfortunately fails to live up to the blurb. It is more a textbook of cryptography than an 'accessible guide'. It has about 400 pages stacked with equations. As such it is of use to anyone who is prepared to delve into the subject in depth.

Konheim says the books is an introductory one because it doesn't attempt to cover all methods of encipherment. This may be true but it is still a pretty detailed and comprehensive book.

Publishers should be more careful about the way they describe books like this, particularly when the price is clearly aimed at a specialist market.



This month's Bookfare included:

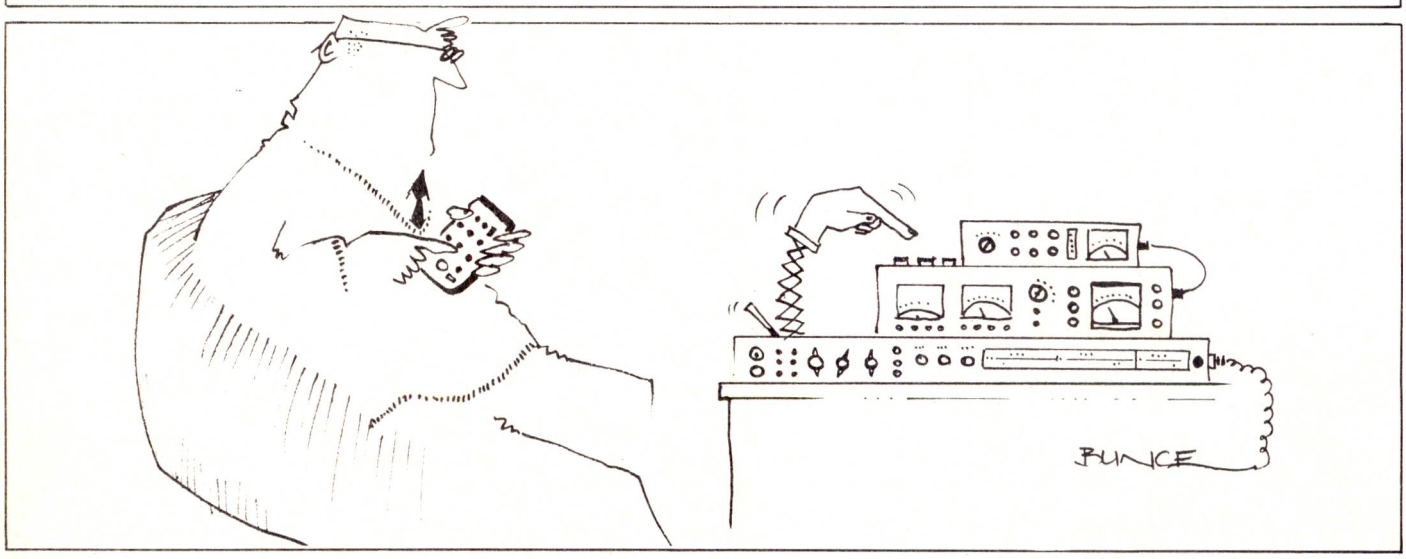
How to Choose your Small Business Computer by J Mike Eaton (National Computing Centre, cassette tape and booklet,

The Olivetti Guide to Buying a Business Computer (British Olivetti Ltd, 30 Berkeley Square, London W1X 6AH, cassette tape, free to business people.)

Word Processing by Richard Morgan and Brian Wood (Oyez Publishing, £9.95)

Staff Attitudes and Aptitudes by Dr Emma Bird (Urwick Nexos, Farnham Common, £15.00)

Cryptography — A Primer by Alan G Konheim (Wiley-Interscience, £23.40)



sinclair ZX81 PERSONAL COMPUTER





Sinclair ZX81 Personal Compu
the heart of a system that grows with you.



1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

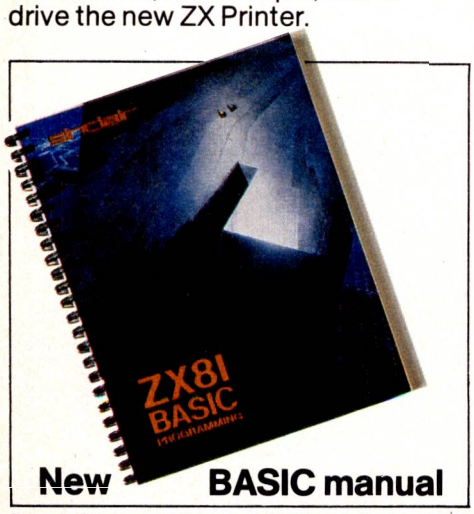
In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability
With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

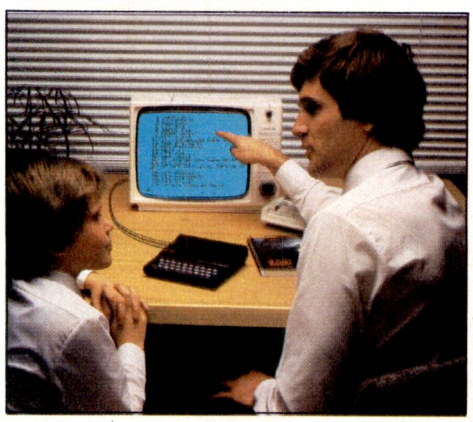
New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.





Available now- the ZX Printer for only £49.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

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 computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

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, Access, Barclaycard or Trustcard.

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

To: Sinclair Research Ltd, FREEPOST 7, Cambridge, CB2 1YY. **Order**

Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

☐ Please tick if you require a VAT receipt TOTAL £_____

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £_____

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable. _____

Please print.

Name: Mr/Mrs/Miss _____

Address: _____

FREEPOST – no stamp needed. PCW11

sinclair ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

How the ZX81 compares with other personal computers

SYSTEM IDENTIFICATION		ZX81	ZX80	ACORN ATOM	APPLE II PLUS	PET 2001	TRS 80 LEVEL I	TRS 80 LEVEL II
ROM		8K	4K	8K	8K	14K	4K	12K
GUIDE PRICE	Basic unit – inc. VAT Unit plus 16K RAM (*12K RAM)	£70 £120	£100 £150	£175 £285*	£630 £630	£435 £530	£290 £360	£375 £375
COMMANDS	LIST, LOAD, NEW, RUN, SAVE	●	●	●	●	●	●	●
STATEMENTS	PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN	●	●	●	●	●	●	●
	STEP	●		●	●	●	●	●
	TAB	●			●	●	●	●
ARITHMETIC	ABS, RND	●	●	●	●	●	●	●
FUNCTIONS	INT	●			●	●	●	●
	ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN	●			●	●		●
	ARCSIN, ARCOS	●						
STRING	CHR$	●	●		●	●		●
FUNCTIONS	LEN	●		●	●	●		●
	ASC(CODE), STR$, VAL, INKEY$	●				●		●
NUMBERS	FLOATING PT $\pm 10^{\pm 38}$	●			●	●	●	●
	INTEGERS		●	●	●	●		●
NUMERIC	A-Z			●			●	
VARIABLES	AA-ZØ				●	●		●
	An-Zn, n = any alphanumeric string	●	●					
STRING	A$ & B$						●	
VARIABLES	A$ to Z$	●	●	●				
	An$ to Zn$ n = any alphanumeric character				●	●		●
NUMERIC	SINGLE DIMENSIONAL		●	●			●	
ARRAYS	MULTI DIMENSIONAL	●			●	●		●
DISPLAY	ROWS	24	24	16	24	25	16	16
	COLUMNS	32	32	32	40	40	64	64
	LOW RES GRAPHICS (<7000 pixels)	●	●	●	●	●	●	●
	HI RES GRAPHICS (>40000 pixels)			●	●			
SPECIAL	USR (CALL, LINK)	●	●	●	●	●		●
FEATURES	PEEK, POKE (OR EQUIV)	●	●	●	●	●		●

Sinclair software on cassette.

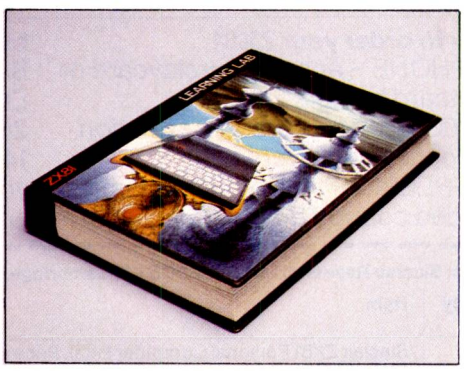


The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 – or see our separate advertisement in this magazine.

The ultimate course in ZX81 BASIC programming.



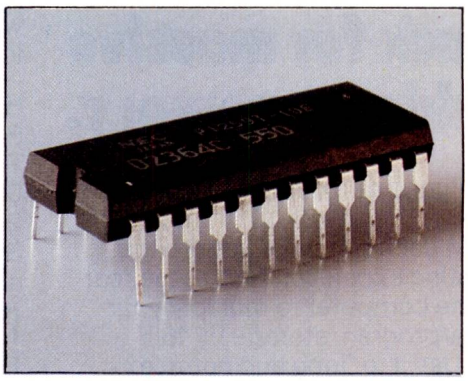
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn *on* the machine, *through* the machine. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

Full details with your Sinclair ZX81.

If you own a Sinclair ZX80...



The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

sinclair
ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

NOT-SO-OPEN SESAME

Jeff Taylor continues his look at US computer literacy projects.

Sesame Place has the largest collection of educational computers in the country, or so claim its founders in their publicity material. A joint venture of Children's Television Workshop and Busch Entertainment Group, Sesame Place is located near Oxford Valley Mall, a wealthy suburb north of Philadelphia. As Dennis Sullivan, chief software designer for the park, points out, CTW has been subsidised by grants for the past ten years; these funds are now drying up and it needs new sources of revenue. Sesame Place represents the vanguard of CTW's new commercial interests, which will be cloned in six other sites around the country. As Sullivan states, the software, designed primarily to entertain but with secondary educational value, will soon be offered for sale to the exploding home computer market: 'We took academic subjects and built games around key concepts. The educational concept came first.' (Joyce Hakansson, SP's computer games co-ordinator, in *Recreational Computing*, May-June, 1981.)

Once the park entrance fee of $5.45 is paid, tokens are available for using the computers at a cost of three for a dollar, each one worth four minutes of computer time. The token gives one access to nearly 70 Apple computers, linked in a Nestar network and bullet-proofed in heavy metal with touch-sensitive screens. Despite educational overtones, arcade mercantilism prevails, so that when four minutes are up the game is over, whether or not the user is left halfway through, frustrated by this new 'learning' experience. Whether designed to entertain or to educate, the games are disappointing on both counts, and lurking in the wings of the Computer Gallery are the old faithfuls, Space Invaders and Asteroids, to lure and satiate the addicted.

Sesame Place is, in part, aspiring to fulfil a hands-on science education function, modelled on the Exploratorium in San Francisco and on the Lawrence Hall of Science in Berkeley, from where its key staff have emerged. Yet it provides precious little education *about* computers, much less about the microrevolution. There is nothing to inform the visitor that the machines from which they are being fed canned CAI trivia are in fact microcomputers, that they are not just terminals to a manframe. As an afterthought, tucked away on a side wall is a cryptic and untitled display of Apple circuit boards, with inscrutable descriptions of functions. I observed no one being distracted from spending money on the machines in order to try to decipher this free attraction. Nowhere is there, for example, a microscope with a chip to gaze at and by which to be amazed into beginning to fathom just how potentially fundamental and pervasive is this new technology. Nowhere is there a small library in which to browse through books and journals that might be concerned with the social implications of the technology, or even a casually displayed bibliography to such. Nor are there updated newsclippings and longer articles displayed that might begin to make relevant this new technology to parents whose children are being so obsessively entertained by it. Not even a video is in evidence, on which could be shown offerings such as 'Now the Chips are Down' to the uninformed. At least, one would think, one machine could be spared to offer an educational program that begins to inform about another recent technology: the simulation of Three-Mile Island now available for the Apple.

Although I may be overcritical of Sesame Place, especially when it is seen in context with other amusement parks that offer only passive experiences built around thrill rides, it is clear that, as a commercial venture, it is designed primarily to please and entertain rather than to provoke and educate. Its commercial ties with Busch, the hand from which it is fed, prevent its presenting contentious material, although there seems little excuse, beyond lack of awareness among staff, for missing so many opportunities to demystify the technology. In fact, the Gallery can be seen to have the opposite effect; instead of exploiting the educational opportunity when a machine is down by informing passers-by that the computer is a fallible mechanism, it is chosen to display the anthropomorphic message: 'Computer is resting'.

On the positive side, Sesame Place is beginning to offer special workshops for teachers and pupils; one is called 'Meet the Playful Computer', and aims to teach how computers work and 'what they can and can't do', rather than concentrating on programming. In a very limited sense, it is beginning to offer public access to computers and to education about them. However, the cost of frequently entering the park and paying for computer time ensures accessibility to only the advantaged, a fact I was to encounter throughout my tour.

Franklin Institute

It is not so much that the Franklin Institute in Philadelphia would not like to educate about microtechnology, as one of its staff explained, as it is a lack of funds. Yet, the Institute has nine Apple computers buried in exhibits, none of which inform the visitor that they are computer-driven. It would seem an important opportunity missed not to sacrifice at least one exhibit in order to use a microcomputer to facilitate education about itself. One likely candidate, an 8ft tall plywood box with screen and keypad with which the visitor interacts in order to obtain a 'personalised' suggested tour of the Institute, might seem obviously to be a computer, reminiscent of popular mythology of what computers are supposed to look like. Yet, sitting behind the box on a shelf, invisible to the public, is a microcomputer; the remaining space is empty. The Franklin Institute cannot afford to begin to educate the public about the technology that will dominate civilisation to the end of the century, yet it can afford to perpetuate myths about the technology before an unsophisticated audience.

The CCM

The Capital Children's Museum, in a Washington DC ghetto, has just been donated 30 Atari computers, Warner-Amex being eager to publicise and dominate the personal computer market. The Museum now considers itself the largest public computer access utility on the East Coast, discounting Sesame Place which the Museum considers an arcade. The Museum is delightfully inexpensive to enter and it must be a cultural education for many of its economically-advantaged visitors to venture into a ghetto neighbourhood to reach it. The Museum is also in the genre of exciting hands-on facilities for children, and will be using the computers in its exhibit 'Communications' to open later this year, in existing exhibits, and in the 'Future Center', a computer classroom that has just begun running courses in learning how to 'play' with computers as well as how to program.

The museum is sensitive to the 'further disenfranchisement of the poor', as Executive Director Ann Lewin describes the major problem that will be exacerbated by the proliferation of computers; she sees the Museum's role as one of addressing this by providing a public-access computer centre in an area accessible to the 'permanent underclass'. Yet, in outlining the objectives for a computer activity at the Museum, staff have not included the spread of awareness concerning such social implications among the ten listed.

The 'Communications' exhibit (yet to open) sounds promising in its attempt to reveal computer applications such as graphics, robotics, text editing, electronic mail, simulations,

Over the last two year's



more than 1,000 completely non-technical users in the UK alone used one British program to keep student records, personnel files, mailing lists, sales records, parrot breeding records, man hole cover records, electoral roll records, blood donor records, pharmacy records, patient-records, stock records, library lists, dating agency files, parts files, exchange rate files, employment files, accountant and solicitors records, farm records, garage records etc, etc.

How could YOU use Compsoft's DMS* (Data Management System) this year?

*Available on CP/M with link to Wordstar or Commodore machines linking to Wordcraft, Wordpro, and Visicalc.

Designed with the non-computer expert in mind, DMS users, ranging from those in the smallest to those in the largest multi-national companies, have followed the simple screen instructions to create their own file, store, amend, sort and search for information.

Searching on multiple parameters is easy, and these pre-selected batches of records can then be processed (e.g. update all my prices by 5% and recalculate the new inventory value), displayed, passed to the report generator, or merged with other files.

Batches of data may be deleted, and the space automatically re-used. Most importantly the file structure can be amended, adding or deleting lines as required, while still retaining existing data.

Screen layouts (as many per file as you like and all password protected), calculations and print layouts can be stored on disk for future use.

DMS can store up to 1,000 characters per record, and is backed up by its own British authors from Compsoft's base in Guildford, Surrey. We are always happy to discuss your applications or arrange demonstrations with your area dealers.

DMS will run on Equinox, PET (including 96K), Rair, Cromemco, Superbrain (including double tracking machines), Apple, Cifer, Heath, North Star, Dynabyte, Vectorgraphic, Shelton, SD. In fact on any CPM-based system with floppy or hard disks.

You can contact us at

Compsoft Ltd, Great Tangley Manor Farm, Wonersh, Guildford, Surrey GU5 0PT.

Telephone: Guildford 0483 505918/39665.

games, an electronic library and musical composition, and one hopes there will be no surcharge to have access to this exhibit.

Finally, despite Museum efforts to redress potential imbalance by providing more equal access to computing, the unfortunate decision has been taken by them to charge a fee of $7 per session for classroom instruction, which must certainly exclude the 'permanent underclass' in whose neighbourhood the Museum is located, and give crucial extra advantage to the already advantaged who can afford to become computer literate.

Oakridge

Oakridge, Tennessee, infamous as the birthplace of nuclear power, is home of the Museum of Science and Energy. Formerly known as the Atomic Energy Museum, the establishment is controlled by the Department of Energy, which decided to change the name as a public relations move following Three-Mile Island. The new title is a misnomer, since, although concerned with energy, the Museum is not concerned with Science and certainly not with scientific objectivity *per se*. In 'educating' the public with regard to energy issues, the Museum offers one of the country's largest public accesses to computers. It is DOE policy deliberately *not* to educate *about* computers but, rather, *with*, and the reasons are not merely bureaucratic. Already the Museum is primarily concerned with presenting a clear image of what is to many of the public a blemished technology (nuclear). Computers have proven effective as a means for holding public attention at museum exhibits, so that to actively point out to the public that the machines they are using are in fact computers, a technology for which many of the public is blemished as well, may prove conterproductive.

For most of the people I interviewed at the Museum, this was their first time 'touching' a computer and half of them didn't realise that the machines were computers. Here is a case of free public access to computers, yet without the crucial educational point being made that these machines are manifestations of a new technology that will dominate the rest of their lives (that is, unless the technology about which the computers are being used to educate doesn't first bring mankind to a hasty end!).

As with the Franklin Institute, Sesame Place and the Capital Children's Museum, it is partly a case of not being aware of the potential social implications, and therefore not including anything to contribute towards a more informed public. Yet a new motive begins to appear here: conflicts of interest. In a sense it could be predicted that, even if aware of the need to stimulate public education concerning the social implications of microtechnology, at Sesame Place and the Capital Children's Museum the threatening and political nature of such material might be offensive to some and thereby jeopardise funding, as happens with American television.

It is interesting to note a further computer-related conflict of interest at the Oakridge Museum. The 'Energy Van' that brings the museum presentation to outlying areas has Apples on board, one of which was originally programmed to continually collect and graph data concerning the public's feelings on nuclear and other energies, so that people could access the data and add their views to the bank. Sensing that the dissemination of such information could be counterproductive to its aims, the DOE put an abrupt halt to this form of computer and energy education, claiming that the availability of such information could prejudice people. (It is a similarly elitist argument that seems to suppress information concerning the social implications of microtechnology.) The program exists on computer inside the Museum now, soon to be retired, yet only graphs visitors' responses for a given day, clearing its memory when the machine is shut off at night. The DOE sees no value in compiling a profile of data on what people actually feel about energy issues, and visitors to the museum are so illiterate of the technology and its potential social use and misuse that they would not think to question why this opportunity for democratisation is being diluted.

Three school projects

A brief stop in each of three schools en route to California yielded data that contributes to this travelogue of missed opportunities in micro-related education.

In nearby Knoxville, Mike Moshel is sponsored by the NSF to develop a Pascal teaching system using graphics. I had the opportunity to see the system field-tested in a classroom of 12 students, of whom four were women. This programming class, to run a term, attempts to operate around the limitations of having only two machines in a classroom. Students work in groups of three and the idea is that when two groups are at the machines, the rest are working at their seats on solving set problems, or on their required projects. This and another class that was testing the material had lost six students, all female. The graphics mode is meant to motivate the students to learn programming, so that typical projects are the construction of state maps, or arcade-like combat simulations. Yet, this motivation wears off quickly after the first three sessions when the hard work begins, according to teacher Bill Baird, so that in the session I observed (the eighth), few students at their seats were involved with their work but were rather passing time. The classroom itself was barren, with no windows, and there was certainly no effort to make the students aware of the microrevolution by providing books, journals, a collection of newsclippings to which they could contribute, etc. I engaged some students in coversations concerning home banking via computer which a local banking firm in Knoxville had just undertaken to promote in a big way. They were keen to contribute to this discussion, eager to speculate on the motives of the bank, yet it would not normally have been part of their experience in this programming class.

Not only was the opportunity missed to educate these students more widely concerning the social implications of microelectronics, but such exposure could prove motivating for some who otherwise might not see the relevance to their lives of learning programming. Issues such as the exploitation of Third World women by the semiconductor industry, or the threat of automation to their own future jobs (since women, the itinerant workforce, are the first to go) might have struck a responsive chord with these otherwise unmotivated female students.

The philosphy of Lamplighter School is displayed in tasteful lettering on the wall adjoining its pleasant visitors' reception: 'Not a Vessel to be Filled, but rather a Lamp to be Lighted'. A private, open-plan elementary school in wealthy North Dallas, Lamplighter is a test-bed and showcase for nearby Texas Instruments' version of Logo, a computing language developed by Seymour Papert, Professor at MIT, and author of *Mindstorms*. Papert based much of his research here among advantaged children, developing this system which purports to put the child in control of the computer rather than vice versa, which he sees as the relationship reinforced by most CAI (computer-aided instruction). Drill and practice CAI, formerly in evidence at Lamplighter, has been discreetly dropped from the curriculum in favour of the discovery-based Logo.

I was struck here by the children's obvious motivation to use Logo, and by the missed opportunity of building upon this motivation to expose these children to the possible futures with microtechnology: either the potential for a caring society, a resurgence of Ancient Athens with microtechnology the slave; or for an even more polarised and divided society, with the shrinking number of jobs going to those advantaged enough to gain access to computing skills at this early stage, and with the gulf between the haves and have-nots (the knows and the know-nots) growing ever wider. It would be an ideal opportunity to facilitate empathy in these extremely advantaged children for the present and potential future condition of the disadvantaged. Such a chord struck early could ring through these children's lives and would at last represent some effort at redressing the inequity that arises from giving children such as those at Lamplighter still further advantage through their access to computing.

Outside Albuquerque, Judith Hakes has a National Science Foundation grant to develop software to teach the Pueblo Indian schoolchildren science and maths-related concepts, using the traditional Pueblo storytelling techniques and other cultural links in the programs. I visited a school in Acoma, 60 miles west of Albuquerque, where the field development work was taking place in

a fifth-grade class. Using animated graphics, a story is told about the sun and rain, after which children in pairs play at catching raindrops from clouds, using a paddle to manipulate an electronic bucket on the screen, after which the results are graphed on paper. The idea of catching is engrained in Pueblo culture, since there is an annual feast day when gifts are thrown from the rooftops and children catch them. It represents a more humanistic use of the medium to reinforce catching rather than shooting down.

Prior to vising the school, I had the opportunity to speak to a young Indian at the Institute of American Indian Art in Sante Fe to gauge his feelings concerning this integration of Pueblo culture into schools. His response was vehemently opposed to what he saw as outsiders using Pueblo children as guinea pigs. I retorted that, if successful, this software could validate Pueblo storytelling technique as an educational method that could be used elsewhere, and in a sense be a medium for widely disseminating traditional Pueblo values.

His response was still more vehement: Pueblo children relating to computers rather than to the wisdom of their elders, the traditional storytellers, will completely decimate this dying culture which has clung so long to its traditions.

After my visit to the school, my conversation with the Sante Fe Indian came back to me. I had learned that all but three of the school's teachers, most of whom are white, commute the 60 miles from Albuquerque, and it occured to me that if indeed the traditional storytelling technique was so highly valued by the NSF project, would it not be far more sensible to use humans to tell the stories, preferably the local elders, who are otherwise unemployed? Unemployment is extremely high among the locals, whose dwellings appear devastatingly poor in comparison to the Westernised and well-equipped school. Most young people move off to Albuquerque for industrial work when they are old enough, and one can empathise with the short-term needs of Indians to gain Western skills to leave their traditional homes in order to make a decent living wage. Yet, in the not so long-term, these jobs will be automated anyway and the Pueblo will be left with no culture. The micro-revolution could make it advantageous to the Pueblo that their culture be resurrected, that their arts once again flourish. Facilitating awareness of the microrevolution, of its possible social impact among the Pueblo, could provide a means to motivate them to re-investigate their own culture.

The plight of the Pueblo reflects some more general implications of microtechnology for the Third World. The vital difference is that when Western automation brings to a sharp halt economic development in the Third World by undercutting costs of even cheap labour there and stealing back recently acquired markets, nuclear proliferation allows them a potent threat of retaliation.

This is not to say that computers are not an appropriate technology in Pueblo schools. Computer literacy could enhance employment skills in jobs that will not be so quickly automated and, as mentioned, could facilitate questioning about the implications of microtechnology for the Pueblo. But in automating traditions, the NSF project is merely attempting to foist onto the Pueblo a more palatable CAI, offering Western video values that put the computer rather than the child in control, just the kind of CAI that advantaged schools such as Lamplighter are booting out. This disturbing pattern is becoming more evident, as dedicated non-programmable machines coming onto the market threaten to find their way into disadvantaged schools in order to reinforce basic skills and improve minimal competency test scores. This in itself would not be so bad, if it were not that these systems will be bought up by poorer schools *instead of* programmable systems that can offer access to work-related computer literacy. The ironic implications are that the poor may become literate in traditional skills but in doing so will be cut out from computer-related work.

In California

From the Lawrence Hall of Science in Berkeley has emerged a handful of key personnel who are involved with other access-to-computing initiatives, such as Sesame Place and the Capital Children's Museum. After paying a $2.00 entrance fee, one has free hands-on access to six terminals and two microcomputers, programmed with specific routines, such as stockmarket games, an animal guessing game, and Joseph Weizenbaum's famous Eliza program. The nearby bookshop is filled with over 20 books to do with computing, only one of which involves itself with wider social issues, Weizenbaum's classic *Human Judgement and Computer Reason*. In style it is a book geared to an academic audience, although his arguments are extremely relevant to vital issues. There was no other material in the Hall that the average person could obtain to begin to be informed about the social implications of the technology which surrounds him at Lawrence.

The cruellest irony is that what gains mass access in the Hall *is* the program Eliza, which Weizenbaum developed to mimic a Rogerian psychotherapist in order to prove his important points concerning the dangers and limitations of artificial intelligence. Yet the Lawrence Hall of Science doesn't even see fit to at least place above the computer a modest placard briefly mentioning Weizenbaum's intentions and warnings about Eliza, and directing the interested to Weizenbaum's book for further information.

Downstairs at Lawrence are to be found rooms full of Apples, Ataris, PETs and Plato terminals. For $3 per hour you can rent time on Plato, and classes are given regularly on the microcomputers at $5 per hour. Atop a hill overlooking Berkeley and the San Francisco Bay, the Hall is accessible only by bus or car. Prices are continually rising, which further limits access. Hopes are expressed by staff, as they were at the Capital Children's Museum in Washington, that eventually the Hall can afford to subsidise access for disadvantaged people. However, I would argue that the immediate future will be the crucial time for gaining access to computers, to ensure one's foothold in the diminishing job market. As Art Luehrmann, past computer research director at the Hall and computer literacy advocate, notes, 75 per cent of the jobs by 1985 will require skills in computing. Any delay in making equal access available now is critical.

Incidentally, Luehrmann was instrumental in the establishment of the Hall's computer van, which gives wider access to computing by travelling to outlying schools. Yet, even this noble initiative does little toward balancing the equity problem since only the better schools can afford its fee of $250 per visit.

Across the Bay in affluent Marin County, Dave and Annie Fox have established what undoubtedly represents the crest of a wave of public access facilities to be set up by enterprising individuals. Housed in one section of a former school, individuals can book time on machine ($3 per hour), arrange 'computer birthday parties' in which party games are computer games, or attend classes in programming. Classes run about $5 per hour ($30 for four 1½-hour sessions). Books, periodicals and software are also available for sale.

Such an enterprise is established to cater for demand and it was bold foresight by the Foxes to predict this demand and borrow $50,000 from a bank four years ago to finance the operation. The advantaged and educated public of Marin County is quickly realising the importance of computer-related skills for their children's, and their own, future employability, and at present that is interpreted to mean programming. The Foxes have never needed to advertise the Center since this aware public quickly learned of its existence. The American free enterprise system ensures that privately-run computing centres will be springing up around the country in all areas where people are informed about upcoming skill needs and can afford to pay for this kind of service, to fill the need that schools and other public institutions are leaving unmet. Such are the consequences of *laissez faire* control of a vital resource, information, that a whole segment of the population will ensure its dominance at the expense of the rest.

A further consequence is that organisations such as the Marin County Computing Center are not in business to inform people about the social implications of new technology. Indeed, some of the implications are critical of their business and threatening to the clientele they serve. If clients demanded such information it would be different, but the product the public has been led to believe it needs is a streamlined computer literacy: programming. So yet another opportunity is missed to begin to redress the

GOTO page 182

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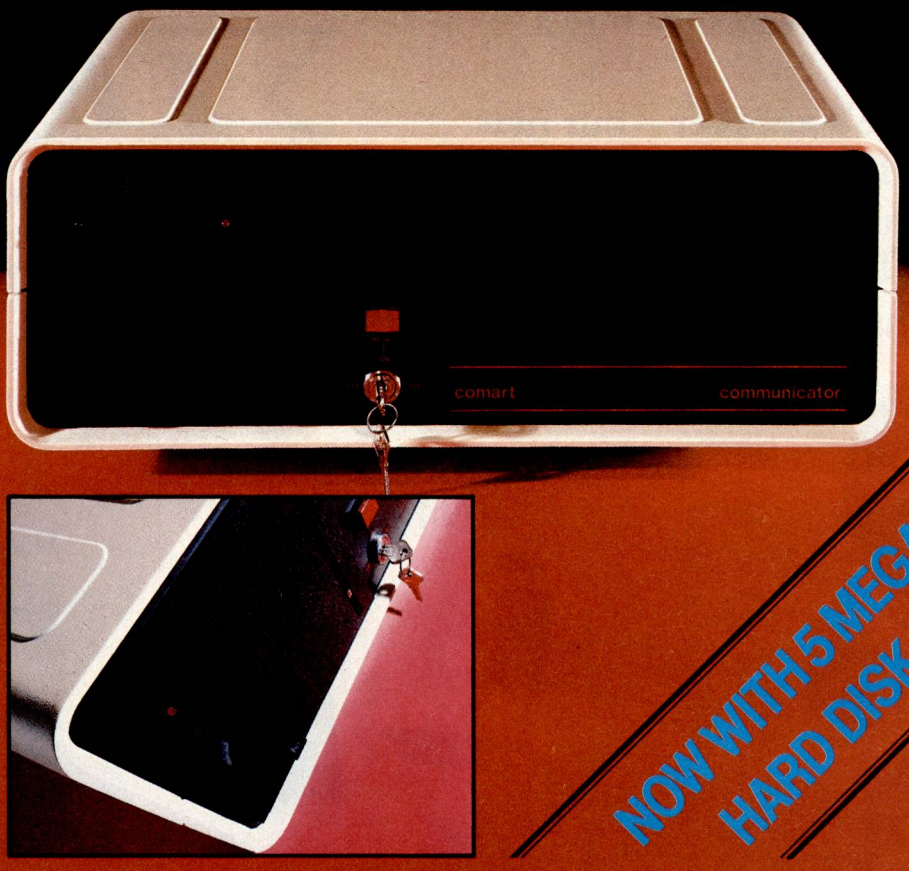

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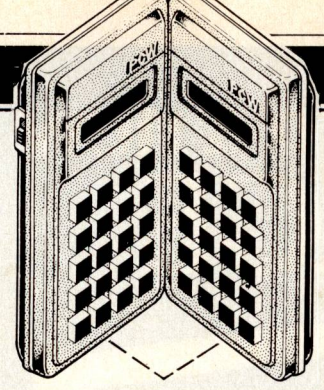


CALCULATOR CORNER

Compiled by Dick Pountain.

Casio fx702p -a Sharp contest

The arrival of the 702p marks the introduction to the UK market of a second real pocket computer, the Sharp PC1211/Tandy being the first. Next year should see Panasonic's contender enter this expanding arena, where the border between calculators and microcomputers grows indistinct. Just to add to the confusion, Casio have called the 702p a programmable calculator, which at least allows me to Benchtest it in Calculator Corner without receiving rude letters, as I have done from Sharp owners, saying 'Hands off — it's a computer!' as if some ego threat was being posed.

Since only two machines exist at present in this niche, it seems logical to compare them in this review, not to say which is 'better', since each has features the other lacks, but to orient prospective buyers toward the machine more suited to their need.

Hardware

The 702p comes in an ABS plastic case with a brushed-aluminium facing, the Casio 'house style', and, at 80x165mm, is rather dumpier or squarer than the Sharp but the same thickness. Unlike the Sharp, its travelling case is of the soft pouch type. The batteries (two Cr2032 lithium cells) are in a slide top compartment in the back and give approx 240 hours' continuous use. This same compartment contains a large, suggestive space with an edge connector which is obviously designed to receive ROM and/or RAM modules at a later date.

The keyboard is an ABCD, rather than QWERTY as on the Sharp, and has 65 keys, rather larger than those of the 502/602p but with a similar feel. There are two shift keys, F1 and F2, so that all the alpha keys support three functions while the numeric/calculator keys support two. This gives sufficient functions for the whole of the Basic command set to be implemented by single key strokes, Sinclair fashion, which is a nice facility. No lower case alphas are available and the symbols are limited to punctuation and arithmetic plus '#', '$' and '$\pi$'. The keyboard is more convenient than the Sharp's in that often-used punctuation symbols such as ",:;$ and # are not shifted functions.

The display is grey 5x7 dot matrix LCD with the unique, if useless, addition of a rotary contrast control. Though the display is slightly longer than that of the Sharp, it displays only 20 characters to Sharp's 24, the remaining space being occupied by a 'Steps Remaining' counter which is shown during program entry and editing. The now familiar Casio mode annunciators are present with the addition of TRACE and PRT (PRINT), the latter referring to the FP-2 peripheral printer which will be available soon.

Firmware

Casio has wisely carried over many of the functions and features of the 502/602p machines into the 702. These include the excellent ergonomic features of dividing the program memory into 10 registers, each of which can be executed separately by pressing P0-P9. The Basic will accept P0-P9 as a GOSUB destination in addition to line number addresses and programs can be executed either by a RUN instruction or by the relevant P button. The set of scientific functions is extensive, including hyperbolics, random number, factional, polar to rectangular and vice versa, linear regression and standard deviation in addition to all the standard Basic maths routines. Angular modes are DEG, RAD and GRAD, and INT and FRAC are both supported. A key called ANS recalls the result of the last calculation performed, rather like LAST x on HP calculators. Calculations are over the standard calculator range $10^{\pm 99}$ with 10 digit accuracy (12 digit internal). Numeric formats catered for are RND (round) to a power of 10, eg 10^{-2}, SET number of significant figures or decimal places, or may be specified in a PRINT statement by, for example, ###.##, as on the Sharp, although using it is not necessary. The arithmetic is true algebraic with 20 levels of parenthesis.

Program entry is performed in WRT mode. Line numbering is not automatic but the Basic is fully tokenised, one instruction corresponding to one step with the number remaining being displayed. Editing is performed by a cursor which goes into fast stepping when the ← or → key is depressed for more than a second. Overwrite is automatic with a backspace delete and an insert which is, annoyingly, the shift of delete. Unlike the Sharp, the 702 doesn't have a cursor up or down key. Vertical movement through the program is downward (to higher line numbers) by pressing EXE (the equivalent of ENTER or RETURN), or access to a particular line by LIST n. LIST also works in RUN mode but then it automatically scrolls down from the start and editing is not possible. I personally think the Sharp system is more convenient, since going to the next lowest line on the Casio requires you to list the line, involving at least four key strokes.

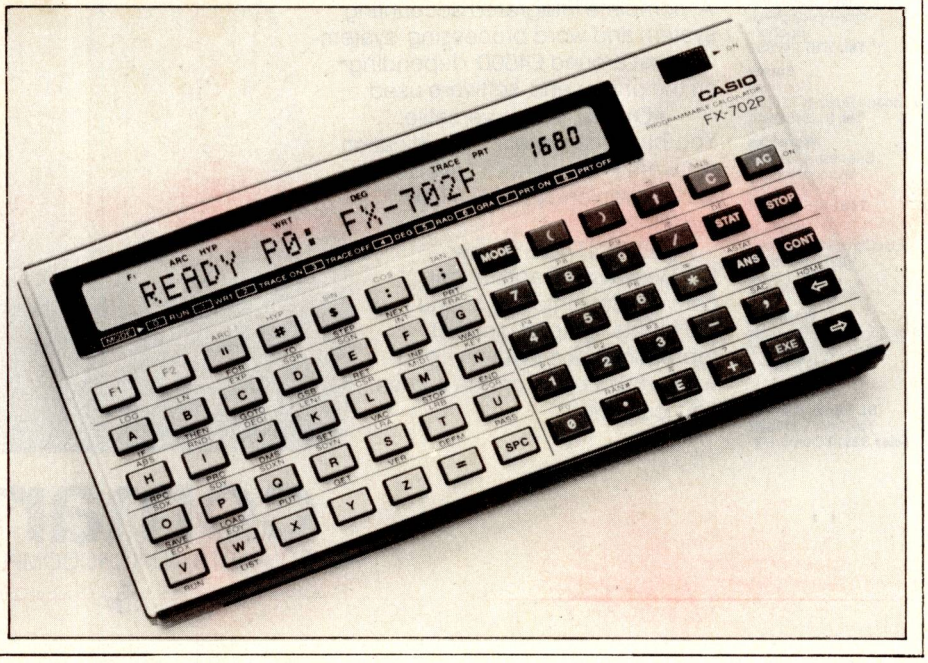
Debugging is facilitated by a TRACE mode which executes one line at a time, displaying the program register and line number. Pressing CONT steps to the next line.

The PASSword protection system has been incorporated, like that on the 602p. A protected program cannot be listed, deleted or edited without knowing the password.

Memory

Unlike the Sharp, which has automatic memory management, Casio has chosen a user-defined partition similar to that on the 602p. The starting position is 26 registers (or variables) and 1680 program steps; extra variables are selectable in blocks of 10 via the DEFM n command up to 226 variable and 80 program steps. This represents 256 bytes more memory than the Sharp, 1888 user bytes in all. Memory is, of course, non-volatile. Attempting to select more variables than the program spaces allow results in a memory overflow ERROR message and doesn't complete the program.

GOTO page 181



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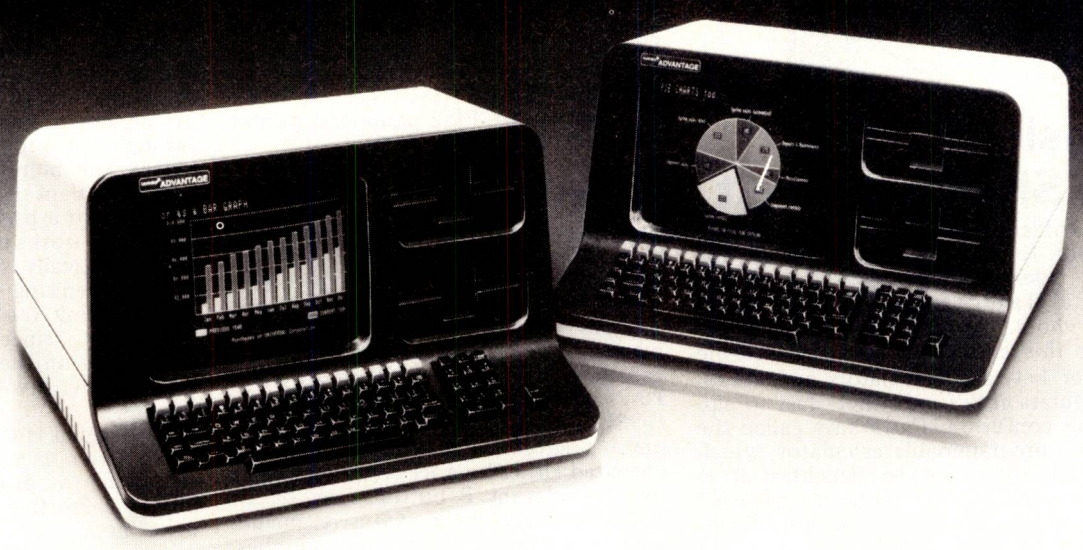

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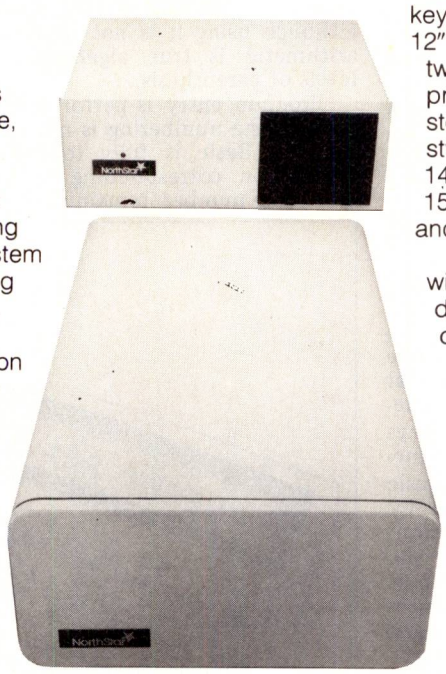

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BENCHMARKS SUMMARY

We have received a large number of requests for details of the Benchmark programs used in our Benchtests so we're reprinting them here. You'll also find the timings for machines Benchtested since October last year.

The Benchmark programs, originally published in *Kilobaud*, are fairly self-explanatory and provide a rough rule-of-thumb guide to the efficiency of the machines' Basic interpreters and, to a lesser extent, to the efficiency of certain aspects of hardware design. They should be interpreted as such, and not used as absolute guides to which machine is 'better' than another; this is a decision which involves a great many factors and which can only be arrived at by studying the full Benchtests and by forming a clear idea of which machine is best suited to the purpose to which you intend to put it.

The disk Benchmark timings which were introduced last year have not been listed, and neither have the disk timings been reproduced here as they do not apply to all machines. As different dialects of Basic have such widely different disk I/O formats, we cannot provide listings of a specific suite of programs which can run unaltered on any machine. Here, however, is a summary of what the disk tests do:

Test 1 OPEN a new file, then immediately CLOSE it.

Test 2 Using a FOR . . . NEXT loop, fill two strings, A$ and B$ with 128 As each; OPEN an existing file; using a FOR . . . NEXT loop, fill each of the 100 records, each of which contains two fields of 128 characters, with A$ and B$ in ascending order; CLOSE the file.

Test 3 Identical to Test 2 except that the records are written in reverse order.

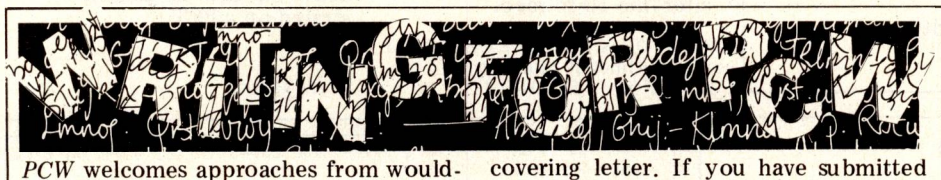
Test 4 OPEN the file; read records 1 to 100 into A$ and B$; CLOSE the file.

Test 5 Identical to Test 4 except that the records are read in reverse order.

Machine	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
SBS-8000	1.8	9.4	29.0	29.0	31.6	44.0	82.5	11.2
Transam Tuscan	2.3	13.0	26.0	27.0	32.0	48.0	68.0	6.0
Vector Graphic VIP (int)	1.0	3.0	10.9	10.7	11.6	18.2	27.1	3.4
VG VIP (S/prec)	1.0	3.8	10.9	10.7	11.6	20.5	32.7	3.4
VG VIP (D/prec)	—	4.9	39.1	39.9	40.5	49.5	61.1	3.4
ABC 24 integer	1.2	4.0	16.0	15.0	16.0	25.0	38.0	8.0
ABC 24 double prec	—	7.0	54.0	55.0	56.0	68.0	86.0	8.0
Pasca 640	2.0	7.0	19.0	18.0	20.0	36.0	57.0	10.0
NEC PC8000	1.7	83.	18.1	17.8	18.6	29.5	49.2	7.0
Sharp PC-3201	4.0	13.5	35.5	35.5	38.5	67.0	108.0	25.0
TRS-80 III ROM Basic	2.7	10.4	24.3	25.3	47.4	72.5	10.5	—
TRS-80 III disk Basic	2.7	10.5	24.6	25.6	48.3	73.8	10.8	—
TRS-80 Col	2.0	11.3	22.2	23.9	27.0	41.5	61.1	13.0
VIC-20	1.4	8.3	15.5	17.1	18.3	27.2	42.7	9.9
Oki if800	2.2	6.4	16.8	16.8	17.9	31.8	50.7	5.7

Int = Integer Basic
F/P = Floating point Basic
S/prec = Single precision
D/prec = Double precision
All timings in seconds.

```
BM1   300 PRINT "S"
      400 FOR K=1 TO 1000
      500 NEXT K
      700 PRINT "E"
      800 END

BM2   300 PRINT "S"
      400 K=0
      500 K=K+1
      600 IF K<1000 THEN 500
      700 PRINT "E"
      800 END

BM3   300 PRINT "S"
      400 K=0
      500 K=K+1
      510 A=K/K*K+K-K
      600 IF K<1000 THEN 500
      700 PRINT "E"
      800 END

BM4   300 PRINT "S"
      400 K=0
      500 K=K+1
      510 A=K/2*3+4-5
      600 IF K<1000 THEN 500
      700 PRINT "E"
      800 END

BM5   300 PRINT "S"
      400 K=0
      500 K=K+1
      510 A=K/2*3+4-5
      520 GOSUB 820
      600 IF K<1000 THEN 500
      700 PRINT "E"
      800 END
      820 RETURN

BM6   300 PRINT "S"
      400 K=0
      430 DIM M(5)
      500 K=K+1
      510 A=K/2*3+4-5
      520 GOSUB 820
      530 FOR L=1 TO 5
      540 NEXT L
      600 IF K<1000 THEN 500
      700 PRINT "E"
      800 END
      820 RETURN

BM7   300 PRINT "S"
      400 K=0
      430 DIM M(5)
      500 K=K+1
      510 A=K/2*3+4-5
      520 GOSUB 820
      530 FOR L=1 TO 5
      535 M(L)=A
      540 NEXT L
      600 IF K<1000 THEN 500
      700 PRINT "E"
      800 END
      820 RETURN

BM8   300 PRINT "S"
      400 K=0
      500 K=K+1
      530 A=K↑2
      540 B=LOG(K)
      550 C=SIN(K)
      600 IF K<100 THEN 500
      700 PRINT "E"
      800 END
```



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 look-out 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.

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*, **14 Rathbone Place, London W1P 1DE.**

LOOPY SHARP

I have come across a baffling problem concerning an MZ-80K Basic program containing a series of consecutive loops contained within two nested loops. During the course of writing, the program was saved on tape and loaded back later for further work. More work was done, including the deletion of one of the consecutive loops. The program worked and was saved on tape. When later loaded back, the outer loop of the group refused to increment, giving a syntax error on the line 'NEXT J'. I spent many hours trying to find out what had happened, and it became evident that to edit a once-saved program within such a loop system is courting disaster. Rewriting the whole section does not help, and neither does replacing the deleted loop. The only way to cure this if you wish to retain the outer FOR. . . NEXT loop as such is to rewrite the entire program. Luckily there is a way round this by altering the form of the outermost loop. Listing 1 is an example of the enclosed consecutive loops. After deleting loop 3, J refused to increment, so the following cure was effected:

```
480   FOR J=1 TO H
490   FOR C=1 TO 25: PP$ = MID$(NB$(J),C,1): X$ = PP$
500   FOR D=1 TO 37: P$ = MID$(A$,D,1)
510   IF X$ = P$ THEN G=D: GOTO 530
520   NEXT D                                        Loop 1
530   Q$ = MID$(B$,G,1)
.
.        Thence to two more consecutive loops 2 and 3
.
.
650   NEXT C
.
.
.
750   NEXT J
```

Listing 1

```
470   J=1                                  (added line)
480   IF J > H THEN GOTO 760               (rewritten)
.           Then as before
.
750   J=J+1: GOTO 480                      (rewritten)
760   —— program continues from 480
```

There seems no way of knowing whether editing within a loop system is going to produce this odd effect or not, but once it has happened the above two remedies appear to be the only ones. Whether this is a peculiarity of Sharp Basic I do not know. In his book, *Basic Basic*, James S Coan hints at this in the summary to Chapter 3-2: 'Caution is urged against inadvertently changing the loop variable within the loop. . .' although he does not enlarge further. I would be very glad to know whether this effect can be prevented, or if it can be predicted from the sort of editing one has in mind.

Now, RUN the following program:

```
10    FOR X = 3.1 TO 2.1 STEP —.5
20    IF X = 3.1 GOTO 100
30    IF X = 2.6 GOTO 110
40    IF X = 2.1 GOTO 120
50    PRINT "50",X: NEXT X
100   PRINT "100",X: NEXT X
110   PRINT "110",X: NEXT X
120   PRINT "120",X: END
```

You will get:

```
100   3.1
110   2.6
120   2.1
```

as you would expect. Now, alter line 10 to read:

```
10    FOR X = 3.1 to 2.5 STEP —.3
```

and alter lines 30 and 40 to:

```
30    IF X = 2.8 GOTO 110
40    IF X = 2.5 GOTO 120
```

RUN this and you will get:

```
100   3.1
 50   2.8
 50   2.5
100   2.2
SYNTAX ERROR IN 100
```

There are countless sets of numbers which will run with no trouble, and just as many which will not. It appears to be a fundamental requirement of Sharp Basic that in a statement as at line 10 FOR X = a TO b STEP C, a and b should be integers, but c need not be. The MZ-80K manual is misleading in that it says that the initial value and final value (ie, a and b) may be variables, constants or equations.

I am grateful to Paul Streeter of Sharp UK who referred the problem to Japan; their way round this one is, using the second example values above, to change lines 20 to 40:

```
20    IF INT(X*10) = 31 GOTO 100
30    IF INT(X*10) = 28 GOTO 110
40    IF INT(X*10) = 25 GOTO 120
```

In this form the program works whatever the value of a and b. It is interesting to note that, if only a printout of the results is needed without the GOTO direction, which is obtained by altering line 20 to:

```
20    PRINT X: NEXT X: END,
```

the program will again work with any values of a and b. The above can also be demonstrated on a PET.

G Hayward

LOWER CASE LISTer

This PET program will let you produce listings with lower-case characters. You have to store the program as an ASC data file on tape, using OPEN 1,1,1:CMD 1:LIST to save it on cassette 1. Close the file with PRINT 1:CLOSE 1 and then use this program to translate the tape file to the printer. The program also allows a doubled character title to be used, as well as allowing double-spaced lines and splitting the listing into pages, which prevents program lines being printed on perforations.

M Clampitt

```
100 rem lists on printer a programme saved in asc form on tape
110 poke 59468,14
120 print chr$(147)
130 input"Name of programme";z$
140 print:input"Double (d) or single (s) spacing";y$
150 if len(y$)>1 then y$=left$(y$,1)
160 open 1,1,0
170 open 4,4
180 print#4,chr$(14);z$
190 get#1,a$
200 if st=64 or st=128 then close 1:close 4:end
210 a=asc(a$)
220 if a>64 and a<91 then a=a+32
230 if a>192 and a<219 then a=a-128
240 if a=13 or a=141 then a$=chr$(13)+chr$(10):z=z+1:goto 270
250 if a<32 or a>126 then 190
260 a$=chr$(a)
270 if a$=chr$(13)+chr$(10) and y$<>"s" then a$=a$+a$
280 print#4,a$;
285 if z>58 or(z>29 and y$<>"s") then z=0:print#4,chr$(12)
290 goto 190
```

ATOM + SEIKOSHA = GRAPHICS

The Seikosha GP-80A is a good low-cost printer which would be a useful extension to an Acorn Atom microcomputer. The Atom has the necessary output port, edge connector and inbuilt driving software to use the printer without a special interface. However, it is necessary to put in one extra link within the Atom case. The reason for this is that the Seikosha printer has a graphics facility which requires an eight-bit ASCII input whereas the Atom only outputs seven bits. No internal alteration is required to the printer.

The link should be connected from bit 3 of the output port C, from the 8255 PIA (location #B8002) to the DATAB line on the printer connector. The DATAB line is on pin 17 of the connector in the fifth row of solder pins away from the edge of the board; it's the fifth from the left as you look over the board. The 8255 bit 3 output line is conveniently located on pin 7 of the cassette DIN connector (SK2). As you look over the board you see two rows of four pins soldered in SK2. It is the leftmost pin on the row nearest the edge of the board. A 74LS244 buffer must be positioned in the IC50 socket and the printer edge connector fitted. ICI, the 6522 VIA, is used.

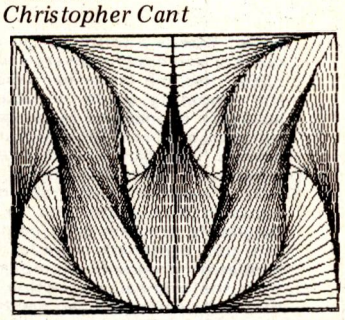
When the Atom is reset (as at switch-on) bit 3 of Port C is set low which is as required for normal character use of the printer. When graphics are needed this bit should be set high. For full instructions as to the required printer control codes for graphics see the GP-80A manual. Bit 3 is also used by the colour board, so when the graphics bit is set the display colour may change and vice versa. The Atom routines for outputting data to the printer are located at #FEFB. These recognise the control codes to turn the printer on and off and also send the character code contained in location #FE.

As an example of the use of Seikosha in graphics mode, here's a program to dump the Atom's high resolution graphics screen onto the printer. It also surrounds the display with a border. Also shown is an example of its printout. The general slowish speed of the printer, together with its strange way of dealing with graphics data, results in each plot taking approximately four minutes.

I have found it best to assemble the hi-res dump program at #2800. It takes up #B4 bytes, so it will not overwrite any Basic program (assuming it starts at #2900) but will destroy most floating-point values. The best practice is to save the program on tape (*SAVE "HIRES" 2800 2865 2800) so that you can run it easily. So, if one types (CNTRL U) before doing the hi res display and then types (ESC) once when the plot is done, followed by *RUN "HIRES" (without text display) the entire screen can be printed out without any extra 'text' being added onto the screen.

The program has to output the 256*192 display as a set of 28 lines of seven bits. Any particular byte is displayed normally as a horizontal line. However, the printer requires the information in vertical lines seven bits long. Thus, the program takes in seven 'horizontal bytes' and shifts the bits out to the printer. As the horizontal resolution is 256 points, the number of bytes to be shifted in each line is 256/8 = 32. In addition, the program includes several mask words to avoid redundant information past the end of the graphics display and to add on a border.

Christopher Cant



```
  5DIMLL10
  10IN."ASSEMBLE TO"Q
  12IN."LIST"L
  15F.I=QTO10:LLI=Q:N.
  16P.$21
  20F.I=QTO1
  30P=Q
100E
110:LL0 LDA @2
120     JSR  #FEFB START PRINTER
130     LDA @8
140     JSR  #FEFB ENTER GRAPHICS MODE
150     LDA @#7F
160     STA  #8A   MASK1
170     LDA @#7F
180     STA  #81   HI RES
190     LDA @#E0   POINTER
200     STA  #80
210     LDA @0
220     STA  #8D   BLKCNT
230     LDX @1
240     STX  #8B   MASK2
300:LL1 LDY @0     blk
310     STY  #89   LCOUNT
320     LDA @#1B        [
330     JSR  #FEFB ESC [
340     LDA @#10        [
350     JSR  #FEFB POS [  TAB
360     LDA @0          [
370     JSR  #FEFB HP  [
380     LDA @#70        [
390     JSR  #FEFB LP  [
392     LDA  #B002 SET
394     ORA @8     GRAPHICS
396     STA  #B002 BIT
397     LDA @#7F
398     AND  #8A   (MASK1)
399     JSR  #FF10 PRINT LEFT MARGIN
400:LL2 LDX @7     line
460     CLC
500:LL3 LDA  (#80),Y xfer
510     STA  #81,X
520     TYA        MOVE FROM
530     ADC @#20   GRAPHICS
540     TAY        MEMORY TO
550     DEX        ZERO PAGE.
560     BNE  LL3
580     LDY @8
600:LL4 LDX @7     loop0
610:LL5 ASL  #81,X loop1
620     ROR  A
630     DEX        SHIFT OUT
640     BNE  LL5   7 BITS
650     ROR  A     AND PRINT.
655     ORA  #8B   MASK2
660     AND  #8A   (MASK1)
670     JSR  #FF10 (PRINT)
680     DEY
690     BNE  LL4   (LOOP0)
700     INC  #89
710     LDY  #89   LCOUNT
730     CPY @32    BLOCK DONE?
740     BNE  LL2
800     LDA @0
810     STA  #8B   MASK2
820     LDA @#7F
825     AND  #8A   (MASK1)
830     JSR  #FEFB PRINT RIGHT MARGIN
840     LDA  #B002
850     AND @#F7   EXIT
860     STA  #B002 GRAPHICS
870     LDA @13
880     JSR  #FEFB (CR)
900     LDA @224   (7*32)
910     CLC
920     ADC  #80   INCREMENT
930     STA  #80   HI RES
940     LDA @0     POINTER
950     ADC  #81
960     STA  #81
1000    INC  #8D   BLKCNT
1010    LDA  #8D
1020    CMP @27    ALL DONE?
1030    BMI  LL6   (BACK)
1040    BNE  LL7   (END)
1050    LDA @#3F
1060    STA  #8A   MASK. BOTTOM LINE
1070    LDA @#20
1080    STA  #8B   MASK2
1090:LL6 JMP  LL1  back
1100:LL7 LDA @#F   end
1110    JSR  #FEFB CHAR MODE
1120    LDA @3
1130    JSR #FEFB  STOP PRINTING
1140    RTS
4000]
4010IFL P.$6
4020N.
4030P.$6,&Q" -> "&P'
4040E.
5000PCLEAR4:MOVE0,1:DRAW255,190:DRAW0,
    190:DRAW255,1
5050DRAW0,1
5100LINKLL0:E.
```

AUTO ATOM

This is a short Basic program which will automatically number the lines of a Basic program as it is being typed in. The lines can be incremented by any value and can be started from any value. There is also a check in the program in case the size of the program exceeds the amount of memory the user has and a check for the line number being too large (ie, over 32767).

The program should be typed into the Atom exactly as in the listing but keywords can be shortened as usual (ie, PRINT becomes P). The program should be loaded into the lower text part of the VDU (#8200) and run. It will automatically place the program you are typing in the memory from #2900 onwards. The program is halted by typing a (cr) after a line number is printed; it will then tidy up by setting top and placing you where the program is. You will then set the prompt and the program may be listed and changed as usual. To place the program in a different memory area you must change line 50 from C = #2900 to C = #XXXX.

Andrew Smith

```
 10 REM ANDREW B. SMITH
 20 REM (C) 1981
 30 REM
 40 DIM T(60)
 50 C=$2900: @=5
 60 ?C=$0D: C=C+1
 70 INPUT "START AT LINE " F
 80 INPUT "STEP " S
 90 FOR L=F TO 32767 STEP S
100    PRINT L
110    !C=L
120    B=?(C+1)
130    ?(C+1)=?C
140    ?C=B
150    C=C+2
160    INPUT $T
170    IF $T="" THEN GOSUB 270: END
180    FOR J=0 TO LEN(T)
190       ?C=T?J
200       IF ?C<>T?J THEN PRINT "NO MEMORY LEFT!": END
210       C=C+1
220    NEXT J
230 NEXT L
240 PRINT "NO MORE LINE NUMBERS LEFT!"
250 GOSUB 270
260 END
270 ?C=$20
280 C=C+1
290 ?C=$0D
300 C=C+1
310 ?C=$FF
320 C=C+1
330 ?18=$29
340 !$0D=C
350 RETURN
```

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by Ted Birkhead and Roger Wagner

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TJ's WORKSHOP

SHARP TIPS

Here's a selection of tips for the Sharp MZ-80K.

PEEK (17828) allows continuous input from the keyboard with only one key press. In other words, if in, say, a game, you want to move the cursor across the screen, continually PEEKing this location will return the ASCII value of the key for as long as it's pressed. You must first POKE 10167,1 to allow access to non-video RAM, then GET a string from the keyboard (but don't wait for it with an IF... THEN statement). Decide whether the right key has been pressed with IF PEEK (17828)=n THEN... where n is the ASCII value of the right key. Here's an example:

```
30    GET R$
40    IF PEEK(17828)=65
      THEN 60
50    GOTO 30
60    REM CONT WITH
      PROG
```

This checks to see if 'A' has been pressed and loops back if it hasn't. Note that this is for SP-5025 Basic only, not disk Basic.

If you accidentally type NEW, you can still save your Basic program onto tape with the USR calls 33 and 36.

Now a bumper bundle of PEEKs and POKEs. The following disables the BREAK key during a program: POKE 6636,0: POKE 8767,0: POKE 8768,0: POKE 8769,0. To re-enable the BREAK key, use POKE 6636,205: POKE 8767,218: POKE 8768,133: POKE 8769,19. This will prevent a user from BREAKing a program and copying it, as the only way to exit then is to reset the machine. POKEing 10682,1 before you SAVE makes the program run automatically on reloading, and POKE 4360,0: POKE 10680,0 disables SAVE and LIST. If you POKE 10681,0 before SAVEing, the reloaded program won't SAVE or LIST (unless re-POKEd). POKE 18440,0: POKE 18441,0 will change line number 1 to 0 with the result that the line can't be deleted or altered without renumbering the program or re-POKEing the number. Useful for copyright notices, etc.

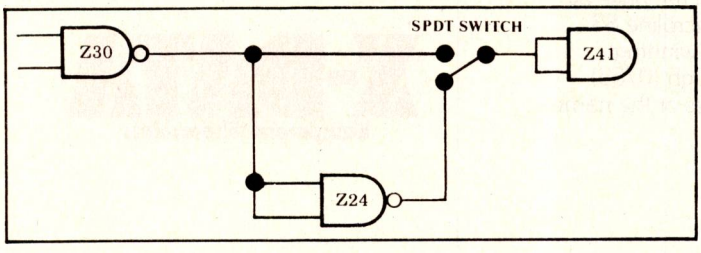
POKE 59555,0 switches off the CTR; POKEing a 1 into the same location switches it on again. POKE 4464,1 changes to lower case, and a 0 reverts to upper. POKE 57347,4 changes the LED from green to red and POKEing a 5 to the same location reverts it to green. POKE 4465,x (where x is from 1 to 40) moves the cursor x places across the screen and POKE 4466,y (with y from 1 to 24) moves it down x lines.

Finally, if you want to fit a reset switch to your MZ-80K, there's a socket on the main PCB marked 'RESET SW'. The centre pair of holes in the socket are dummies but you can wire a small push-to-make switch across either of the other two pairs. Pressing the switch will put the machine back into the monitor without clearing the memory.

Phil Clark

TRS-80 INVERSE VIDEO

Several readers have pointed out that the TRS-80 mod in last month's 'TJ's' could overload Z24 by connecting its output to its own input, causing it to oscillate. This can be overcome by using an SPDT switch, as shown below.



TRS-80 LIFESAVER

This program is an invaluable utility to any disk-based TRS-80 owner who uses either 'Electric Pencil' or 'Scripsit'.

Should an error occur in saving text to disk or should there be any software or hardware failure, the user could be in a situation of having valuable text in the memory of the computer with no means of recovering it.

In the majority of cases RESCUE will transfer this text to disk; there is however a possibility that the latter part of a relatively large block of text could become degraded by Basic's string storage and stack. As an alternative there is a machine language program called HELP which is guaranteed to save all 'Pencil' or 'Scripsit' text after a reboot, DOS error or disk crash.

Laurie Shields

```
        TRS80 SCRIPSIT & ELECTRIC PENCIL
        ================================

   RECOVERY OF TEXT FROM MEMORY AFTER A REBOOT
           DOS OR HARDWARE FAILURE



 5  REM  COPYRIGHT (C) 1981 LAURIE SHIELDS
10  ON ERROR GOTO 80
20  CLS:
    PRINT:
    PRINT "F I L E   R E S C U E"
30  PRINT:
    INPUT "SCRIPSIT OR PENCIL"; A$
40  IF LEFT$( A$, 1) = "S" THEN N = 32610 ELSE
    IF LEFT$( A$, 1) = "P" THEN N = 27650 ELSE 30
50  LINEINPUT "FILESPEC ? "; A$:
    OPEN "O", 1, A$
60  IF N ) 32767 THEN N = N - 65536
70  C = PEEK(N):
    PRINT CHR$(C);:
    PRINT#1,CHR$(C);:
    N = N + 1:
    IF C () 0 THEN 60 ELSE
    FOR N = 1 TO 256:
    PRINT#1, " ";:
    NEXT:
    GOTO 90
80  CMD"E"
90  CLOSE:
    END


PROCEEDURE:
===========

1.    DON'T SWITCH OFF.

2.    RE-BOOT DOS WITH WITH ENTER KEY DOWN

3.    FORMAT NEW DATA DISC IF NECESSARY.

4.    ACTIVATE BASIC.
      (BUT WITH ONLY 1 FILE IF IT WAS PENCIL TEXT)

5.    DO NOT USE ANY NEWDOS TYPE CMD COMMANDS.

6.    RUN "RESCUE"

7.    ORDER 'HELP/CMD' BEFORE IT HAPPENS AGAIN.
```

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Your COMPUTER WORLD

Compiled by Derrick Daines

Illogicality

There's a lot of illogicality in the world, isn't there? Only a month before writing this, various self-styled experts were widely criticising teachers because of the spate of lamentable city riots. It was said that discipline in the schools was nonexistent and that this was a contributory factor in causing the riots.

My young friend Stewart Sargaison of Berkhamsted has prompted these thoughts in a lively correspondence we've been having. In writing about the effect on employment of new technology in general and computers in particular, he writes, '. . . I can't see the point in the "right to work" . . . People look forward to retiring, but shy away from redundancy. . . '

At first, one is inclined to nod and think that this is another example of illogicality that Stewart has pointed out, but is it? Are people being illogical in not wanting to be thrown out of work? I remember my father telling me off in very strong terms for being an idle layabout and I remember how furious he was when I got sacked from my first job. Being reared in a society that considered work to be the right and proper function of man, even today I find extreme difficulty in sitting down to do nothing in particular. I always experience a vague feeling of guilt if I spend an evening watching television, for instance — I always think of the million other things that I should be doing.

Stewart would probably say that this is a function of my upbringing and he would be right in part, but I suspect that it goes much deeper than that. I suspect that it is a part of what I perceive as my worth as a person. I actually believe that the need to be up and doing something — exploring and manipulating the environment — is something that is an inbuilt part of mankind, going back to the origin of the species. As for retirement, any doctor will tell you that the person who retires from active life is dead very soon afterwards. For a long retirement, you have to keep working — which sounds daft, but really means that when you retire you have to find something else to do — gardening, bowls, or something.

When I retire — which won't be for a long time yet *(who are you kidding? — Ed)* —I'm going to spend days on the golf course and evenings computing, which brings me round to the thought that the DHSS could do a lot worse than give all unemployed youngsters a small computer instead of unemployment benefit one week!

It won't happen of course — there are far too many difficulties in the way — but just think of the benefits! Not only would we be keeping folks mentally stimulated, but we would have enormous spin-offs. Production of machines would soar — with increased trade generally — and countless people would be fitting themselves for a computing future once the recession lifts. Besides, I simply cannot imagine any computer nut lifting his nose from the keyboard long enough to be aware that there was a riot going on, let alone wanting to go and join in! What do you think?

I would be very interested to hear from any unemployed reader who is managing to keep sane because of an interest in computing, or who has found employment through his own efforts in that field. We hear so much of gloom and doom that it would be nice to publicise the 'get-up-and-go' that I know young folks are capable of.

Too much

In another piece of correspondence, a writer wanted to know why I was in favour of Space Wars at first and have now turned against it. I wouldn't say that I've turned against it exactly, but it does remind me of a story of a young bride who tearfully said to her husband of one week, 'I can't understand you! You *liked* baked beans on Monday, Tuesday, Wednesday, Thursday, Friday and Saturday, and now suddenly on Sunday, you don't like them any more!'

So please — no more Star Wars or similar shooting games, OK?

Daniel Haywood of Ormskirk very kindly wrote to say that he agreed with my definition of a good computer game (July 1981 *PCW*) and added that he thought that different skill levels are 'a good thing'. He's right, of course. He says, 'I think it's great knowing you have mastered one skill level and are good enough to go up to the next.' I couldn't put it better myself.

He also asks if Acorn will be likely to provide a new ROM for the Atom. There are a lot of people interested in this question, Daniel, and it all depends on how the Acorn people add up their sums. If they think that there's money to be made out of it, they will. Personally, I think that they'd be silly not to, but they might consider that they can get more folk to buy the Proton by witholding the ROM from us Atom users. They'd be wrong because I suspect that other folks will be ready to provide 'BBC-compatible' ROMs for all sorts of machines, including the Atom. The trick for Acorn will be to offer their ROM at the right time to maximise their profits and 'wrong-foot' the 'cowboy' suppliers.

Programs received

Obstacle Course & Drawing Board (ZX80) by Stephen Bootes (10) of Hartwell. Wumpus, Breakout & Super-Meteor (TRS-80) by Andrew Bennett of Southam, Warwick. Snake Winder, Zap!, Spacey Shoot, Moonlander, Missile Shoot and Rebound by Daniel Haywood (14) of Ormskirk Lancs. Quadratic Equation Roots (ICL 1900) by Jon Harvey (16) of Prestwich.

Mugtraps

The supply of Mugtraps appears to be drying up, so we'll call a halt to that particular correspondence, if you don't mind. A reader in Bolton wanted to 'punish' a wrong-user by putting the machine in an infinite loop, which was not quite what I had in mind when I started this thing off.

Stewart Sargaison (again!) had a similar idea when he sent this one, and I'll let him have the last word:-

```
10 INPUT "YOUR NAME", N$
20 IF  N$  =  "DERRICK  DAINES"
      THEN CRASH
```

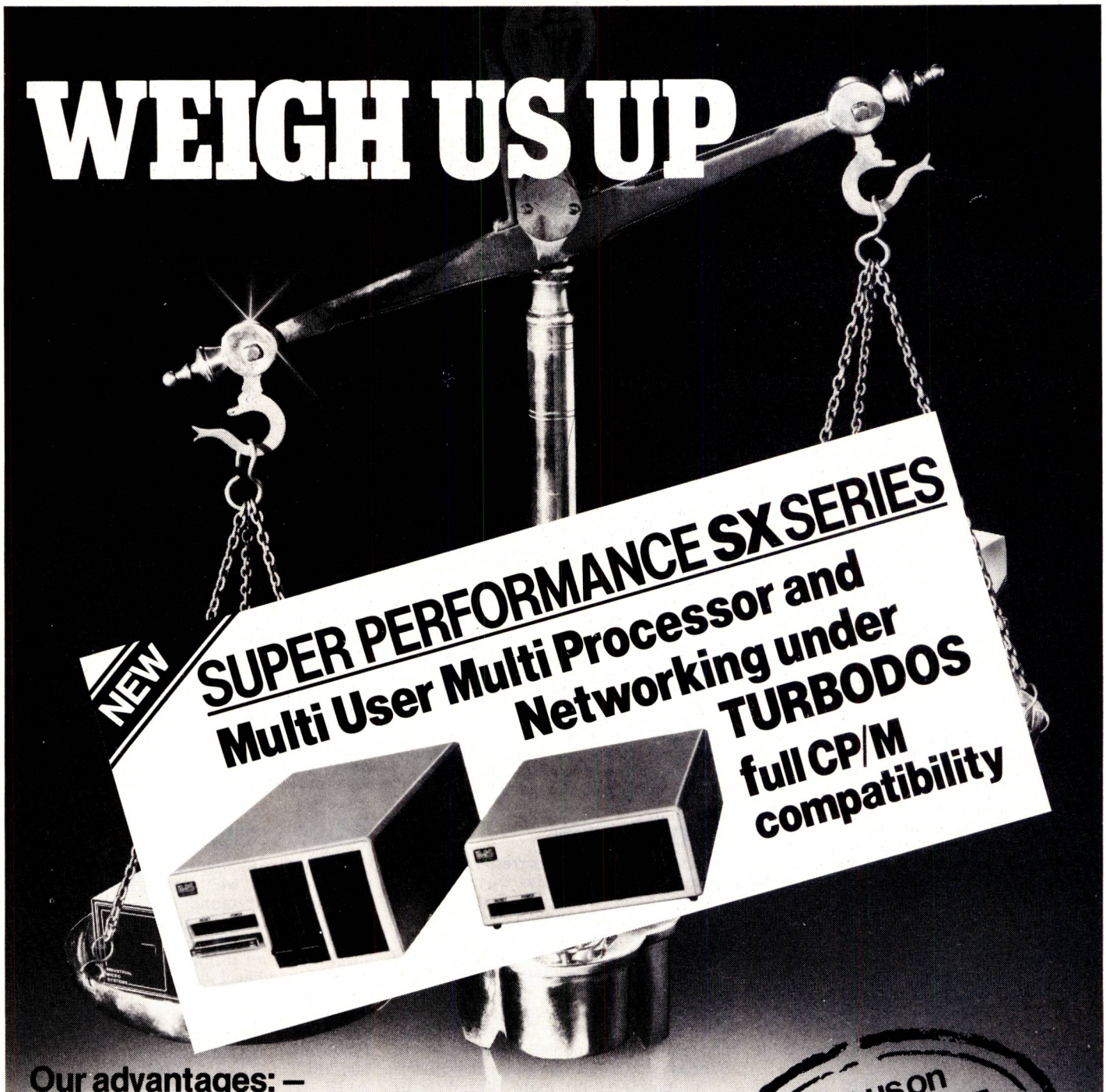
(Sniff!)

ZX80 Obstacle Course by Stephen Bootes

The object of this program is to reach the top left-hand corner of the board by travelling on the black squares only. To start, type '5' and then move using the arrow keys. When there isn't a path for you to follow, or you want to give up, type '1'. At the end of the game the computer tells you how many moves you have made.

```
 10 LET A=1
 20 LET Z=296
 30 FOR Q=1 TO 386
 40 LET C=RND(3)
 50 IF C=1 THEN PRINT CHR$(9);
 53 IF C=2 THEN PRINT CHR$(128);
 55 IF C=3 THEN PRINT CHR$(128);
 57 NEXT Q
 60 GO SUB 110
 70 LET A=PEEK(16396)+PEEK(16397)*256
 80 POKE A+Z,148
 90 GO TO 60
100 STOP
110 INPUT K
115 LET T=1
120 IF Z=33 THEN GO TO 200
123 IF K=1 THEN GO TO 300
125 POKE A+7,9
130 IF K=8 THEN LET Z=Z+1
140 IF K=5 THEN LET Z=Z-1
150 IF K=6 THEN LET Z=Z+33
160 IF K=7 THEN LET Z=Z-33
170 LET T=T+1
180 RETURN
190 STOP
200 CLS
210 PRINT "CONGRATULATIONS - "
220 PRINT "YOU COMPLETED THE OBSTACLE"
230 PRINT "COURSE IN ";T;" GOES"
240 STOP
300 CLS
310 PRINT "GOOD TRY BUT YOU DID NOT"
320 PRINT "COMPLETE THE OBSTACLE COURSE."
330 PRINT "YOU MADE ";T;" MOVES"
340 STOP
```

WEIGH US UP



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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 languge** 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** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet 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**.

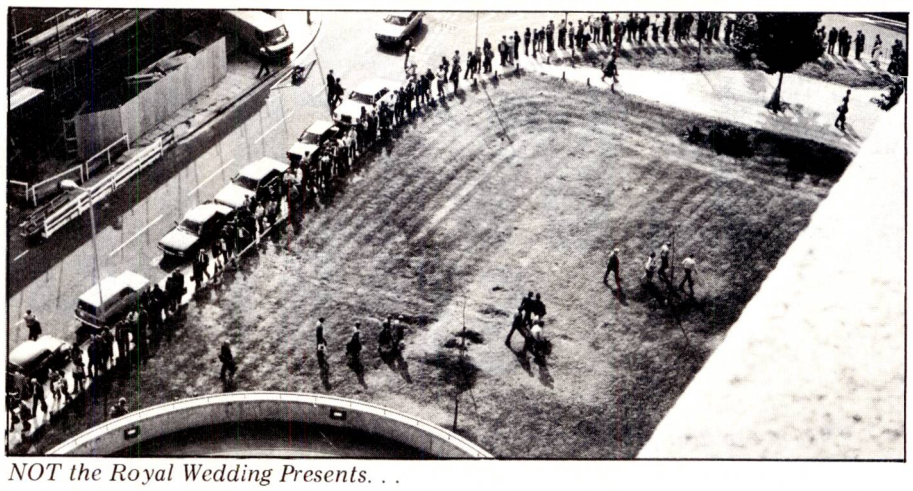
The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial 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 sytem 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.

THE PCW SHOW 1981

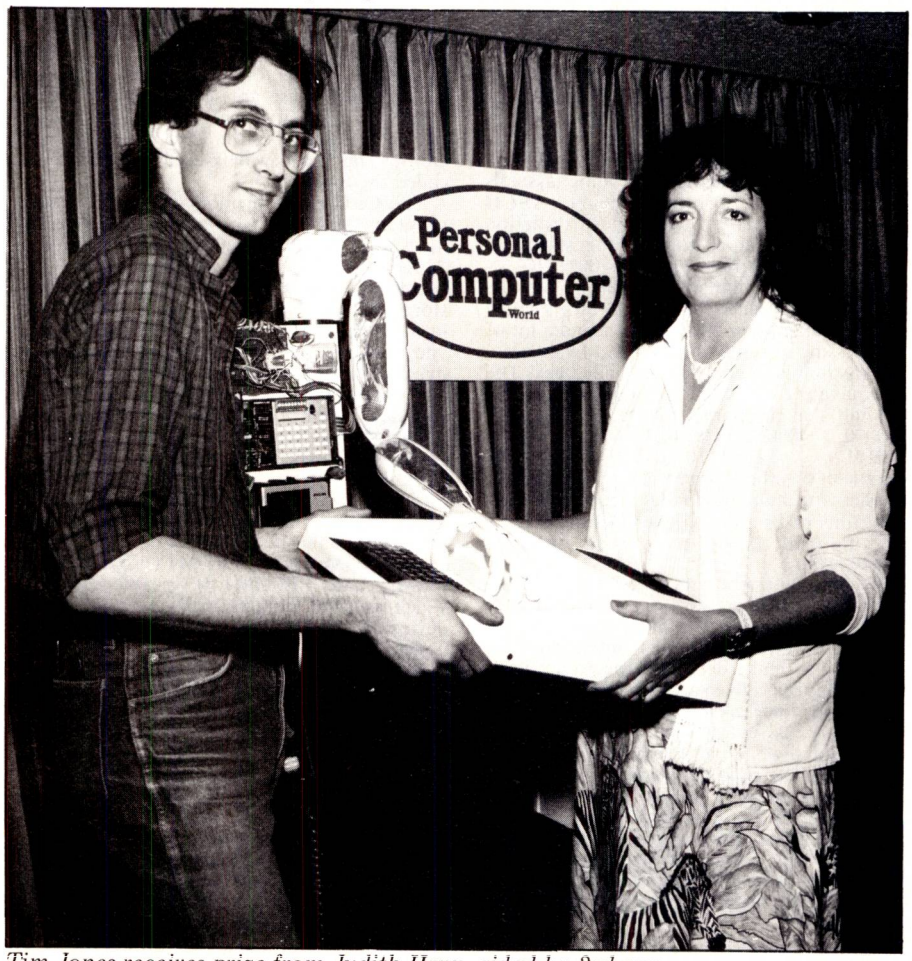
OUT OF THE GHETTO!



NOT the Royal Wedding Presents. . .



David Ahls of Creative Computing in newsvendor mode.



Tim Jones receives prize from Judith Hann, aided by 3rd arm.

Being acutely aware of *PCW*'s dramatic increase in circulation since 1980 we, in our wisdom, allowed for twice as many visitors as last year. Imagine our embarrassment when the first day dawned to a queue approximately ¼-mile long, stretching around the corner and out of sight. Only by gradually jettisoning the more time-consuming of the registration procedures and opening a second entrance could we get the eager throng in fast enough to prevent mayhem on the streets of Hammersmith. Such mass activity soon attracted *The Times*, *Guardian* and ITN News to the scene; as David Tebbutt remarked to me on the first day, 'We've reached critical mass!'; in other words, microcomputing in the UK has emerged from the ghetto and into the limelight.

Inside the hotel the two floors were packed almost beyond endurance; only the enthusiasm and goodwill of visitors and exhibitors kept it manageable. The hotel's air conditioning struggled hard to keep the temperature only subtropical. Several American visitors remarked that there was more action than at the West Coast Faire, which we grudgingly accepted as a compliment.

It's not possible to identify a single biggest attraction, as there were at least eight among the 72 exhibitors.

Acorn had the prototype BBC Micro on display with some impressive graphics. The waiting time to see it, unless you had tungsten elbows like Guy Kewney, was on a par with that for the Royal Wedding presents.

Atari's large stand offered the public its first view of the neat 400 and 800 and the disk drives. The Thorn-EMI games software attracted a pullulating swarm of schoolboys to the stand, despite the fact that it was ostensibly on the upstairs 'business' floor. It's easy to see why: their darts game has quite the best colour graphics I've seen on a micro.

The Last One had over 6000 visitors to their stand and dispensed over 10,000 order forms (see 'Chip Chat' for amusing anecdote). They seemed happy.

NEC officially launched its PC8000 and several mouthwatering peripherals at the Show. The most intriguing of these was a neat digital plotter which scuttles across at intervals to pick up a different coloured pen from a stack of about ten. At their reception, high-up Japanese execs made plain that they're after the business market; no doubt wise, but, if they made it UK TV-compatible, the PC8000 could eat into the hobby market as well.

Sinclair had their long-awaited ZX81 printer on show and took orders indecently fast. They also sold all the '81s they had brought; rather charming to see people walking away from a computer show with one under their arm (smacks of 'sell 'em cheap and pile 'em high).

Least seen but most requested item was the Osborne 1. If I had a pound for every enquiry, etc. . . The machine (there only being one in the country — the one tested in this issue) made a brief appearance on Microtrend's stand on Thursday afternoon.

Personal Computers' stand boasted the Alpha Centauri synthesiser lashed up to an Apple II. Proper keyboard, and an impressive range of sounds and effects was broadcast far and very wide through a NAD/A&R hi-fi rig. Never did pluck up courage to play some Booker T for them instead of those curious teatime muzak tunes. . .

An event witnessed by ITN and BBC but not the public at large was the award of a DAI computer by Judith Hann of 'Tomorrow's World' to Tim Jones, winner of the IYDP competition. Tim's robot arm was by far the most lifelike seen so far; as a student of industrial design and engineering he produced a strikingly professional effort using vacuum-formed plastic shells and ingenious pneumatic powered 'muscles', all controlled by an Acorn card via solenoids and air valves. In addition to its potential as an aid for the disabled, Tim is developing the arm (in conjunction with a fashion firm) for animated window dummies, in order to be self-financing. Perhaps there is still some hope for Britain in microtechnology. . .

It was rather surprising but heartening to see mini-makers Digico with their own stand, bearing their new Prince micro. With a spec and price quite similar to SuperBrain, this machine could make a dent in the business market if marketed aggressively, particularly if Digico can extend mini standards of after-sales support into the long-suffering micro market.

The activity on the club/hobby floor is covered below by Rupert Steele. Suffice to say that there was a lot of it.

To all the exhibitors, thanks for exhibiting.

To the 16,500 visitors who came, thanks for coming. To Montbuild, the organisers, thanks for organising. To the rest of the computer press, thanks from the Catering Manager (Alcoholic Beverages Div). Next year 50,000 at Olympia?

Dick Pountain

Conglomeration of clubs

Certainly an overwhelming majority of visitors to the home and hobbyist area of the show will have noticed or stopped at the ACC stand. For the benefit of those who didn't, the ACC itself distributed the space among various local clubs and user groups. Thanks must go to Dr David Annal of the ACC for his excellent work in administrating the whole operation.

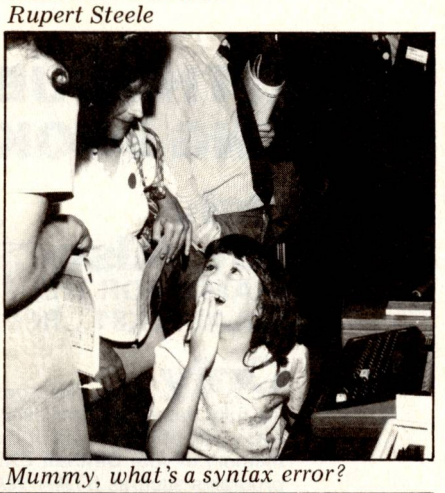
A database was run on the stand which had details of all the user groups and clubs known to the ACC. Visitors were able to ask for details of their nearest club and a printout of the information was given to them. However, the ACC's records do seem to have some gaps — notably in Cambridgeshire and Shropshire.

Advice to bewildered newcomers was easily forthcoming from the enquiry desk. One good suggestion was that people join a club before buying a computer, thereby learning a little more about which machine would suit them best.

If you have a club and have not been in touch with the ACC before, drop them a line care of Vernon Gifford (ACC), 111 Selhurst Road, London SE25 6LH. Information can also be updated in this way. ACC details are available from Rupert Steele, St John's College, Oxford.

Finally, for all of you who weren't there, here's a run-down of what the computer clubs had to offer. The TRS-80 Level 1 User Group was demonstrating a Tiny Pascal which attracted much interest. According to the Atom User Group, existing Atom users will be able to get a PROM to mimic the BBC machine. The National ZX80/81 User Group found that, instead of being deluged with complaints about failed hardware or late delivery, folks were exchanging software ideas. The Association of London Computer Clubs attracted crowds with a robot arm and a micromouse (Questor) just back from Paris. They are organising a national Robotics and Micromouse conference at Imperial College on Saturday 28 November. Vernon Gifford (address as before) will have details, and the registration fee is £9.50.

Rupert Steele



Mummy, what's a syntax error?



PCW/Microdigital Competition winner J.C. Haines (left) receives prize from Bruce Everiss of Microdigital. Editor Rodwell presses flesh.

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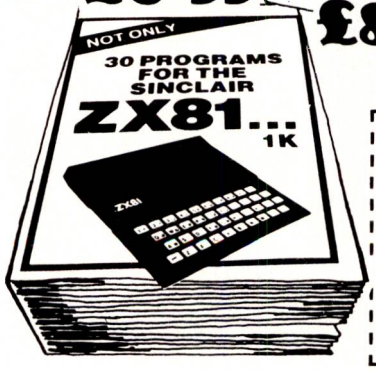

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PACKAGES

DIRECT ACCESS

PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to: **Dick Olney,** *PCW,* **14 Rathbone Place, London W1P 1DE.**

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.

All details published are the latest made available — some may have changed since this issue went to press.

Code	Company	Telephone
A1	ACT/Petsoft	021-501 2284
A2	Arden Data Processing	0533 22255
B1	B + B Computer Ltd.	0204 26644
B2	Beam Business Centre	061-831-7292
B3	Benchmark Computer Systems	0726 61000
B4	Bristol Software Factory	0272 23430
B5	Byte Soft Systems Ltd	0533 531441
C1	CAP-CPP Products Ltd.	01-404 0911
C2	Commodore	01-388 5702
C3	Compsoft	0483 39665
C4	Comput-a-crop	0507-604271
C5	Computastore Ltd.	061-832-4761
C6	Computech	01-794 0202
C7	Compass	Standish 426252
D1	Data Bank	0509 217671
E1	Engineering Sciences	01-437-4894
G1	Graffcom Systems Ltd.	01-727 5561
G2	Grama (Winter) Ltd.	01-636 8210
G3	Great Northern	0532 589980
G4	Alan Greenhalgh Ltd	01-520-0218
H1	A.J. Harding	0424 220391
H2	Hartford Software	0606 76265
H3	H.B. Computers	0536 83922
H4	Hipposoft	0337 76023127
I1	Intereurope Software Design	0734 786644
I2	Intex Datalog Ltd	0642 781193
J1	T.V. Johnson	0276 20446
K2	Keen Computers	0602 412777
L1	Lifeboat Associates	01-836 9028
L2	Liveport (Exidy Sorcerer Firmware)	0736 798157
L3	Ludhouse (Computing) Ltd.	01-679 4321
M1	Micro Computer Applications Ltd.	0734 470425
M2	Microteck.	Orpington 26803
M3	Microsys Ltd	051 426 7271
P1	Padmede Computer Services	0251 421892
P2	Personal Computers Ltd.	01-626 8121
R1	Rockliff	051-521 5830
S1	SMG Micro Computers	0474 55813
S2	The Softwarehouse	01-637 2108
S3	Stage One Software	0202 23570
S4	Systematics International	0440 61121
S5	Sumlock Bondain	01-250 0505
S6	Stemmos	01 602 6242
S7	Software Aids Int	01-204 9396
T1	Tridata Micros Ltd.	021 622 6085
V1	Vlasak Electronics Ltd.	0494-448633
X1	Xetal	061 682 7555

Applications

Machine	Application	Price	Code
Appointments planner	Commodore/ Computhink	£100	S3
	Challenger	£25	C7
Assembler dev	PET/CBM	£50	L2
Bank accounts	Apple II	£10	D1
	Commodore/ Computhink	£100	S3
	ITT 2020	£10	D1
	PET	£10	D1
Bill of materials	CP/M	£500	B5
Bonds/pension quotations	Commodore/ Computhink	£100	S3
Budgeting package	MCZ Zilog	£500 +	I1
	Apple/Apple II	£125	P2
Bureau de change	CBM	£8	H3
Cash flow	Apple II	£125	P2
	Apple II	£80	V1
	CP/M	£250	L3
	CP/M	£95	B5
	PET	£8	A1
Cash register	Apple II	£10	D1
	ITT 2020	£10	D1
	PET	£10	D1
CBasic	Tandy Model II	£70	M1
Company secretary	CP/M	£450	C4
Conference organiser	MCZ Zilog	£500 +	I1
Contract costing	Apple II	£500	P1
	CP/M	£2000	L3
CP/M & utilities	Tandy Model II	£150	M1
Credit control	Apple II	£98	P2
	PET	£650	B4
Customer file	Famos	£1000	M2
Database management/Information retrieval	ACT800	£225	H4
	Apple	£150	A2
	Apple	£150	K2
	Apple	£60-140	S2
	Apple	£150	S5
	Apple II	£75	P2
	Aple II/ITT 2020	£100	S4
	Commodore/ Computhink	£45-250	S3
	CP/M	£150-750	C4
	CP/M	£100	G3
	Cromemco	£250	B3
	Famos	£1500	M2
	North Star Horizon	£250	B3
	PET	£170	C3
	PET	£325	A1
	PET	£225	H4
	PET/CBM	£75	B1
	PET/CBM	£50/150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	Superbrain	£300	S6
	Tandy Model 1	£25-80	M1
	TRS-80	£60	S2
	TRS-80	£150	J1
	TRS-80	£32.50	H1
	8000 Series	POR	C2
Disk operating system	PET/CBM	£150	B1
Estate agent	Apple	£850	A2
	Apple	£850	S5
	Apple	£850	K2
	Apple II	£175	P2
	Apple II/ITT 2020	£750	S4
	CBM	£30	H3
	Commodore/ Computhink	£250	S3
	CP/M	£750	C4
	North Star Horizon	£750	B5
	PCC 2000 Simpelec Triton 3	£350	B3
	PET	£25	A1
	Superbrain	£600	S6
Equipment lease/rent/HP	CP/M	£400	G1
Financial modelling	CP/M	£400	G1
	Apple/Apple II	£450	P2
	CP/M	£95	B5
Financial planning	Apple II/ITT2020	£250	S4
General ledger/NL	Apple	£300	A2
	Apple	£300	S5
	Apple	£300	K2
	Apple II	£455	P2
	Apple II	£225	V1
	Apple II	£295	C6
	CBM	£200	H3
	Commodore/ Computhink	POR	S3
	CP/M	£500	L3
	CP/M	£375	L1
	CP/M	£500	C4
	CP/M	£400	G1
	CP/M	£400	M3
	CP/M	£200	B5
	CP/M	£275	S6
	CP/M	£275	S7
	Cromemco	£250	B3
	ITT 2020	£295	C6
	ITT 2020/Apple II	£250P	S4
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£200	C2
	Sharp PC3201	£450	P2
	Superbrain	£400	M3
	Superbrain	£400	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£225	H1
	TRS-80 I	£225/325	T1
	TRS-80 II	£425	T1
	Vector	£400	C5
	8080/Z80	£357	L1
	8080/Z80	£275	G3
Hire purchase	Cromemco	£400 +	B3
Incomplete records	Apple	£250	S2
	Apple	POR	K2
	Apple II	£425	P2
	Apple II	£450	P1
	Commodore/ Computhink	£750	S3
	CP/M	£750	M3
	CP/M	£250	B5
	North Star Horizon	£750	M3
	Superbrain	£750	M3
	Tandy Model 1	£40	M1
	TRS-80	£40	H1
Industry Factory loading	Apple	£360	X1
	CP/M	£360	X1
	PET	£300	X1
Industry work study	Apple	£990	X1
	CP/M	£990	X1
	PET	£750	X1
Integrated accts	Altos (CP/M, MP/M)	£300	B1
	Apple II	£450	P1
	Apple II	£300	P2
	Apple II	£855	V1
	Commodore/ Computhink	POR	S3
	CP/M	£950	L1
	CP/M	£1500	C4
	CP/M	£1100	G1
	CP/M	£990	M3
	CP/M	£690	B5
	CP/M	£850	S7
	Cromemco	£950	B3
	Famos	£2000	M2
	ITT 2020	£450	P1
	MZ-80K	£150	P2
	North Star Horizon	£950	B3
	PET/CBM	£300	B1
	North Star Horizon	£990	M3
	PET/CBM	(£50)	C2
	PET/CBM	£650	J1
	PET/CBM	£650	G2
	Superbrain	£990	M3
	Superbrain	£1200	S6
	Tandy Model I	£350	M1
	Tandy Model II	£350	M1
	TRS-80	£75	J1
	Vector	£1000	C5
	8000 Series	POR	C2
	8080/Z80	£950	L1
	8080/Z80	£995	G3
Investment portfolio	TRS-80	£20	S2
Invoicing	Apple	£295	S2
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£140	V1
	Challenger	£25	C7
	Commodore/ Computhink	POR	S3
	CP/M	£325	L1
	CP/M	£150-350	C4
	CP/M	£250	M3
	CP/M	£150	S7
	Cromemco	£100	B3
	North Star Horizon	£100	B3
	North Star Horizon	£250	M3
	PET	£350	A1
	PET/CBM	£25-50	B1
	PET/CBM	POR	J1
	Superbrain	£250	M3
	Superbrain	£150	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£25	H1
	TRS-80I	£75	T1
	TRS-80II	£125	T1
	8080/Z80	£325	L1
	ITT 2020	£300	P1
Job costing	Apple II	£300	P1
	Apple	£990	X1
	CP/M	£700	C4
	CP/M	£350	M3
	CP/M	£990	X1
	ITT 2020	£300	P1
	North Star Horizon	£350	M3
	PET	£750	X1
	Superbrain	£350	M3
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Job order control	8080/Z80	£275	G3
Leasing	Cromemco	£400 +	B3
Legal precedents	CP/M	£1100	C4
Letter writer	Apple II	£80	V1
	CP/M	£150	M3
	North Star Horizon	£150	M3
	Superbrain	£150	M3
Lisp	PET/CBM	£75	C2
Lotteries	PET	£45	H2
Mailing List	Altos (CP/M, MP/M)	£75	B1
	Apple	£300	A2
	Apple	£50-150	S2
	Apple	£300	S5
	Apple	£300	K2
	Apple II	£40	P2
	Apple II	£50	D1
	Apple II/ITT 2020	£100	S4
	CBM	£35	H3
	Commodore/ Computhink	£100	S3
	CP/M	£50-150	C4
	CP/M	£250	G1
	ITT 2020	£50	D1
	PET	£45	H2
	PET	£50	D1
	PET	£15	A1
	PET/CBM	£75	B1
	PET/8032	£75/150	S1
	Tandy Model I	£40	M1
	Tandy Model II	£75	M1
	TRS-80	£50-150	S2
	TRS-80	£25/38/55	H1
Mail shot	Apple	£14	S2
	Apple II	£40	P2
	Challenger	£25	C7
	Commodore/ Computhink	£125	S3
	CP/M	£200-360	C4

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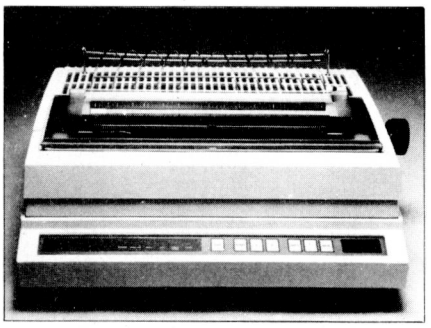

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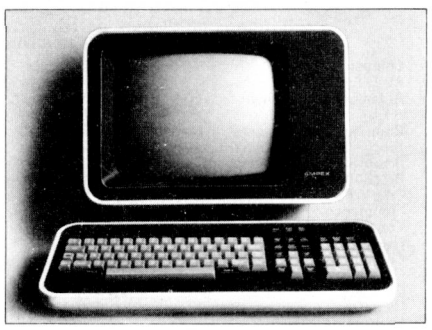

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Application	Machine	Price	Code
	CP/M	£90	M3
	CP/M	£75	S7
	MCZ Zilog	£250	I1
	North Star Horizon	£90	M3
	PCC 2000 Simpelec Triton 3	£450	B2
	Superbrain	£90	M3
	Tandy Model I	£75+	G4
	Tandy Model II	£75	M1
	Tandy Model II	£75+	G4
Membership accting	Apple/Apple II	£75	P2
	PET	£85	H2
Motor Dealer	Famos	£5000	M2
Order entry/invoicing	CP/M	£350	G1
Order processing	CP/M	£550	L1
	8080/Z80	£550	L1
Office admin	Apple II/ITT 2020	£100	S4
Packages		E1	
Pad to plotter systems	Apple II	£250	P2
Pascal	Apple/Apple II	£299	P2
	PET/CBM	£120	C2
Payroll	Apple	POR	A2
	Apple	£200	S2
	Apple	POR	S5
	Apple	POR	K2
	Apple II	£200	P2
	Apple II	£375	V1
	Apple II	£375	C6
	Apple II	£10	D1
	Apple II/ITT 2022	£250P	S4
	Challenger	£25	C7
	CBM	£10	H3
	CP/M	£450	L3
	CP/M	£475	L1
	CP/M	£495	C4
	CP/M	£500	G1
	CP/M	£390	M3
	CP/M	£500	B5
	Cromemco	£350	B3
	Famos	£1500	M2
	ITT 2020	£375	C6
	ITT 2020	£10	D1
	North Star Horizon	£350	B3
	North Star Horizon	£390	M3
	PET	£200/350	C5
	PET	£50/25 195	A1
	PET	£50/195	I2
	PET	£10	D1
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	Scorcerer	£250	L2
	Superbrain	£390	M3
	Superbrain	£400	S6
	Tandy Model I	£249	M1
	TRS-80	£200	H1
	TRS-80I	£218	T1
	TRS-80II	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	Sorcerer	£250	L2
	Tandy Model I	£249	M1
	TRS-80	£200	H1
	TRS-80I	£218	K1
	TRS-80I	£218	T1
	TRS-80II	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
Personnel records	Apple II	£98	P2
	CP/M	£450	C4
	MCZ Zilog	£500+	I1
	PET	£85	H2
Petaid report generator	Commodore/ Computhink	£125	S3
Petsoft programs	PET/CBM	£160	J1
Planning/Maintenance	PET/8032	£595	S1
Postal advertising response package	Apple	£350	S2
PR/advertising package	Commodore/ Computhink	£1000	S3
Price lister	CBM	£12	H3
Printers job control	Commodore/ Computhink	£250	S3
Production analysis	Apple II	£75	P2
	CP/M	£700	C4
	PET/CBM	£300	B1
Prof appts groups	8080/Z80	£275	G3
Prof appts individ	8080/Z80	£220	G3
Prof client billing	8080/Z80	£330	G3
Programming aids	Apple II	£40	P2
Property management	CP/M	£450-1000	C4
	CP/M	£400	M3
	North Star Horizon	£400	M3
	Superbrain	£400	M3
Purchase ledger	Apple	£300	A2
	Apple	£300	S5
	Apple	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II/ITT 2020	£250P	S4
	CBM	£350	H3
	Challenger	£25	C7
	Commodore/ Computhink	POR	S3
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£200	B5
	CP/M	£275	S7
	Cromemco	£250	B3
	ITT 2020	£295	C6
	ITT 2020	£300	P1
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	Superbrain	£400	M3
	Superbrain	£300	S6
	PCC 2000 Simpelec Triton 3	£350	B2
	PET	£300	B4
	PET	£95/120/ 350	A1
	PET/CBM	£200	C2
	PET/CBM	POR	J1
	PET/8032	£395	S1
	Sharp PC3201	£300	P2
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£225	H1
	TRS-80I	£225	T1
	TRS-8011	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
Quotation estimating	Apple II	£300	P1
Revolving credit	Cromemco	£400+	B3
Sales ledger	Apple	£300	A2
	Apple	£300	S5
	Apple	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II/ITT 2020	£250P	S4
	CBM	£350	H3
	Challenger	£25	C7
	Commodore/ Computhink	POR	S3
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£200	B5
	CP/M	£275	S7
	Cromemco	£250	B3
	ITT 2020	£295	C6
	ITT 2020	£300	P1
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	PCC 2000 Simpelec Triton 3	£350	B2
	PET	£300	B4
	PET	£800	C1
	PET	£95/350	A1
	PET/CBM	POR	J1
	PET/CBM	£200	C2
	PET/8032	£395	S1
	Sharp PC 3201	£300	P2
	Superbrain	£400	M3
	Superbrain	£300	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	TRS-80	£225	H1
	TRS-80I	£225	T1
	TRS-80II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
Salesman	Apple II	£10	D1
	ITT 2020	£10	D1
	PET	£10	D1
Screen generator	MCZ Zilog	£75+	I1
S/L, P/L & stock control	Apple/Apple II	£900	P2
	CP/M	£1000	L3
Solicitor's complete record accounting	Apple	£3000	S2
Solicitor's package	PET/8032	£750	S1
Statistics	Apple	£150	G3
	Apple II	£100-195	P2
	TRS-80	£45	S2
Stock control/ recording	Altos (CP/M, MP/M)	£300	B1
	Apple	POR	A2
	Apple	POR	K2
	Apple	POR	S5
	Apple	£150	G3
	Apple	£80	S2
	Apple II	£75/300	P2
	Apple II	£10	D1
	Apple II	£285	V1
	Apple II	£300	P1
	Apple II/ITT 2020	£500	S4
	CBM	£35/25	H3
	Challenger	£25	C7
	Commodore/ Computhink	£100/250	S3
	CP/M	£325	L1
	CP/M	£500-1500	C4
	CP/M	£350	G1
	CP/M	£900	M3
	CP/M	£500	B5
	Cromemco	£450	B3
	Famos	£1500	M2
	ITT 2020	£10	D1
	ITT 2020	£300	P1
	MZ-80K	£150	P2
	North Star Horizon	£450	B3
	North Star Horizon	£900	M3
	PCC 2000 Simpelec Triton 3	£350	B2
	PET	£12/25/ 350	A1
	PET	£10	D1
	PET	£195	I2
	PET	£300	B4
	PET	£15	A2
	PET/CBM	£300	B1
	PET/CBM	£150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	PET/Computhink	£250	R1
	PET/8032	£395	S1
	Sharp PC3201	£300	P2
	Superbrain	£900	M3
	Superbrain	£300	S6
	Tandy Model I	£30-50	M1
	Tandy Model II	£300	M1
	TRS-80	£48	S2
	TRS-80	£200	H1
	TRS-80	£115	J1
	TRS-80I	£200	T1
	TRS-80II	£375	T1
	8080/Z80	£275	G3
	8080/Z80	£325	L1
TAP business system	PET	£125	H2
Text file librarian	Apple II/ITT 2020	£125	S4
Time/cost recording	Apple	£450	S2
	Apple II	£300	P1
	Commodore/ Computhink	POR	S3
	CP/M	£400	G1
	CP/M	£200	M3
	Cromemco	£250	B3
	ITT 2020	£300	P1
	North Star Horizon	£250	B3
	North Star Horizon	£200	M3
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B1
	Superbrain	£200	M3
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Travel agency accts	Superbrain	£800	S6
	Tandy Model I	£225	G4
	Tandy Model II	£225	G4
Travel Agents Dairy	Tandy Model I	£100	G4
	Tandy Model Ii	£100	G4
Travel Ticket Sales	Tandy Model I	£225	G4
	Tandy Model II	£225	G4
Utilities	Apple/Apple II	£40	P2
	Apple II	£20	C6
	ITT 2020	£20	C6
Utility set	CBM	£78	H3
Various engineering	Tektronix		E1
VAT	PET	£17.50	A1
VAT master	CBM	£25	H3
VAT register	TRS-80	£15	H1
Vet package	PET/8032	POR	S1
Video message	Apple	£200	G3
Warehousing	PET/8032	POR	S1
Word processing	ACT 800	£375	H4
	Apple	£60	S2
	Apple	£75	K2
	Apple	£75	S5
	Apple	£75	A2
	Apple II	£150-300	P2
	Apple II	£75	J1
	Apple II	£120	V1
	Apple II	£40	D1
	Apple II/ITT 2020	£180/95	S4
	CBM	£35	H3
	Commodore/ Computhink	£120	S3
	CP/M	£150-260	C4
	CP/M	£400	G1
	CP/M	£250	M3
	Famos	£500	M2
	ITT 2020	£40	D1
	MCZ Zilog	£500+	I1
	North Star Horizon	£250	M3
	PET	£85/65/ 40/20	H2
	PET	£40	D1
	PET	£375	H4
	PET	£25/325	A1
	PET	£325	C5
	PET/CBM	£75/150	C2

PACKAGES

Application	Machine	Price	Code
	PET/CBM	£75/150	J1
	PET/CBM	£75/150	G2
	Superbrain	£250	M3
	Tandy Model I	£50/75	M1
	Tandy Model II	£175-240	M1
	TRS-80	£30/60/90	S2
	TRS-80	£45/95	J1
	TRS-80	£15	H1
	Vector	£400	C5
	8000 Series	£250	C2

Machines

Machine	Application	Price	Code
ACT 800	Database management/	£225	H4
	Word processing	£375	H4
Altos (CP/M, MP/M)	Integrated accts	£300	B1
	Mailing list	£75	B1
	Stock control/recording	£300	B1
Apple	Contract costing	£450	P1
	Database management/ information retrieval	£150	K2
	Database management/ information retrieval	£150	A2
	Database management/ information retrieval	£60-140	S2
	Database management/ information retrieval	£150	S5
	Database management	£75	P2
	Estate agent	£850	S5
	Estate agent	£850	A2
	Estate agent	£850	K2
	General ledger/NL	£300	K2
	General ledger/NL	£300	A2
	General ledger/N/L	£450	P2
	General ledger/NL	£300	S5
	Incomplete records	POR	K2
	Incomplete records	£250	S2
	Incomplete records	£450	P1
	Incomplete records	£450	P2
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Invoicing	£295	S2
	Invoicing	£300	P2
	Job costing	£450	S2
	Job costing	£990	X1
	Mailing list	£300	K2
	Mailing list	£300	A2
	Mailing list	£40	P2
	Mailing list	£50-150	S2
	Mailing list	£300	S5
	Mail shot	£14	S2
	Payroll	POR	S5
	Payroll	POR	K2
	Payroll	POR	A2
	Payroll	£200	S2
	Postal advertising response package	£350	S2
	Purchase ledger	£300	K2
	Purchase ledger	£300	P2
	Purchase ledger	£300	A2
	Purchase ledger	£300	S5
	Quotation estimating	£300	P1
	Sales ledger	£300	A2
	Sales ledger	£300	K2
	Sales ledger	£300	S5
	Sales ledger	£300	P2
	Solicitor's complete record accounting	£3000	S2
	Statistics	£150	G3
	Statistics	£100/195	P2
	Stock control/recording	£150	G3
	Stock control/recording	POR	K2
	Stock control/recording	£300	P2
	Stock control/recording	POR	A2
	Stock control/recording	£80	S2
	Stock control/recording	POR	S5
	Time/cost recording	£450	S2
	Video message	£200	G3
	Word processing	£75	K2
	Word processing	£75	A2
	Word processing	£60	S2
	Word processing	£300	P2
	Word processing	£75	S5
Apple II	Bank account	£10	D1
	Cash flow	£80	V1
	Cash flow	£75	P2
	Cash register	£10	D1
	Database management/ information retrieval	£98	P2
	General ledger/NL	£225	V1
	General ledger/NL	£450	P2
	General ledger/NL	£295	C6
	Incomplete records	£300	P2
	Integrated accts	£855	V1
	Integrated accts	£450	P1
	Integrated accts	£300	P2
	Invoicing	£140	V1
	Invoicing	£300	P1
	Invoicing	£300	P2
	Job costing	£300	P1
	Letter writer	£80	V1
	Mailing list	£50	D1
	Mailing list	£40	P2
	Mail shot	£225	P2
	Pad to plotter system	£250	P2
	Payroll	£375	V1
	Payroll	£200	P2
	Payroll	£375	C6
	Payroll	£10	D1
	Personnel records	£75	P2
	Production analysis	£75	P2
	Programming aids	£40	P2
	Purchase ledger	£315	V1
	Purchase ledger	£300	P1
	Purchase ledger	£300	P2
	Purchase ledger	£295	C6
	Sales ledger	£315	V1
	Sales ledger	£300	P1
	Sales ledger	£300	P2
	Sales ledger	£295	C6
	Salesman	£10	D1
	Statistics	£100-195	P2
	Stock control/recording	£285	V1
	Stock control/recording	£300	P1
	Stock control/recording	£300	P2
	Stock control/recording	£10	D1
	Time/cost recording	£300	P1
	Utilities	£20	C6
	Word processing	£120	V1
	Word processing	£150-300	P2
	Word processing	£40	D1
	Word processing	£75	J1
Apple II/ ITT 2020	Database management/ information retrieval	£100	S4
	Estate agent	£750	S4
	Financial planning	£250	S4
	General ledger/NL	£250P	S4
	Mailing list	£100	S4
	Office admin	£100	S4
	Payroll	£250P	S4
	Purchase ledger	£250P	S4
	Sales ledger	£250P	S4
	Stock control/recording	£500	S4
	Text file librarian	£125	S4
	Word processing	£180/95	S4
CBM	Bureau de change	£8	H3
	Estate agent	£30	H3
	General ledger/NL	£200	H3
	Mailing list	£35	H3
	Payroll	£10	H3
	Price lister	£12	H3
	Purchase ledger	£350	H3
	Sales ledger	£350	H3
	Stock control/recording	£35/25	H3
	Utility set	£78	H3
	VAT master	£25	H3
	Word processing	£35	H3
Challenger	Appointment Planner	£25	C7
	Invoicing	£25	C7
	Mail Shot	£25	C7
	Payroll	£25	C7
	Purchase Ledger	£25	C7
	Sales Ledger	£25	C7
	Stock Control	£25	C7
Commodore/ Computhink	Appointments planner	£100	S3
	Bank accounts	£100	S3
	Bonds/pension quotations	£100	S3
	Database management/ information retrieval	£45-250	S3
	Estate agent	£250	S3
	General ledger/NL	POR	S3
	Incomplete records	£750	S3
	Integrated accts	POR	S3
	Invoicing	POR	S3
	Mailing list	£100	S3
	Mail shot	£125	S3
	Petaid report generator	£125	S3
	PR/advertising package	£1000	S3
	Printers job control	£250	S3
	Purchase ledger	POR	S3
	Sales ledger	POR	S3
	Stock control/recording	£100/250	S3
	Time/cost recording	POR	S3
	Word processing	£120	S3
CP/M	Bill of materials	£500	B5
	Cash flow	£250	L3
	Cash flow	£95	B5
	Company secretary	£450	C4
	Contract costing	£2000	L3
	Database management/ information retrieval	£150-750	C4
	Database manatement/ information trerieval	£100	G3
	Equipment lease/rent/ HP	£400	G1
	Estate agents	£750	C4
	Financial modelling	£400	G1
	Financial modelling	£95	B5
	General ledger/NL	£500	L3
	General ledger/NL	£500	C4
	General ledger/NL	£400	G1
	General ledger/NL	£375	L1
	General ledger/NL	£200	B5
	General ledger/NL	£275	S7
	General ledger/NL	£400	M3
	Incomplete Records	£250	B5
	Incomplete Records	£750	M3
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Integrated accts	£1500	C4
	Integrated accts	£1100	G1
	Integrated accts	£950	L1
	Integrated accts	£690	B5
	Integrated accts	£850	S7
	Integrated accts	£990	M3
	Invoicing	£325	L1
	Invoicing	£150-350	C4
	Invoicing	£150	S7
	Invoicing	£250	M3
	Job costing	£700	C4
	Job costing	£990	X1
	Job costing	£350	M3
	Legal precedents	£1100	C4
	Letter Writer	£150	M3
	Mailing list	£50-150	C4
	Mailing list	£250	G1
	Mailing list	£75	S7
	Mail shot	£200-360	G4
	Mail shot	£90	M3
	Order entry/invoicing	£350	G1
	Order processing	£550	L1
	Payroll	£450	L3
	Payroll	£495	C4
	Payroll	£500	G1
	Payroll	£475	L1
	Payroll	£500	B5
	Payroll	£390	M3
	Personnel records	£450	C4
	Production analysis	£700	C4
	Property management	£450-1000	C4
	Property management	£400	M3
	Purchase ledger	£500	L3
	Purchase ledger	£450	G1
	Purchase ledger	£425	L1
	Purchase ledger	£500	C4
	Purchase ledger	£200	B5
	Purchase ledger	£275	S7
	Purchase ledger	£400	M3
	Sales ledger	£500	L3
	Sales ledger	£500	C4
	Sales ledger	£450	G1
	Sales ledger	£425	L1
	Sales ledger	£200	B5
	Sales ledger	£275	S7
	Sales ledger	£400	M3
	S/L, P/L + stock control	£1000	L3
	Stock control/recording	£325	L1
	Stock control/recording	£500-1500	C4
	Stock control/recording	£350	G1
	Stock control/recording	£500	B5
	Stock control/recording	£900	M3
	Time/cost recording	£400	G1
	Time/cost recording	£200	M3
	Word processing	£400	G1
	Word processing	£150-260	C4
	Word procesing	£250	M3
Cromemco	Database management/ information retrieval	£250	B3
	General ledger/NL	£250	B3
	Hire purchase	£400+	B3
	Integrated accts	£950	B3
	Invoicing	£100	B3
	Leasing	£400+	B3
	Purchase ledger	£250	B3
	Revolving credit	£400+	B3
	Sales ledger	£250	B3
	Stock control/recording	£450	B3
	Time/cost recording	£250	B3
Famos	Customer file	£1000	M2
	Data base	£1500	M2
	Integrated accts	£2000	M2
	Motor dealer	£5000	M2
	Payroll	£1500	M2
	Stock control	£1500	M2
	Word processing	£500	M2
ITT 2020	Bank account	£10	D1
	Cash register	£10	D1
	General ledger/NL	£295	C6
	Integrated accts	£450	P1
	Invoicing	£300	P1
	Job costing	£300	P1
	Mailing list	£50	D1
	Payroll	£10	D1
	Payroll	£375	C6
	Purchase ledger	£300	P1
	Purchase ledger	£295	C6
	Sales ledger	£300	P1
	Sales ledger	£295	C6
	Salesman	£10	D1
	Stock control/recording	£10	D1
	Stock control/recording	£300	P1
	Time/cost recording	£300	P1
	Utilities	£20	C6
	Word processing	£40	D1
MCZ Zilog	Budgeting package	£500+	I1
	Conference organiser	£500+	I1
	Mail shot	£200	I1
	Personnel records	£500+	I1
	Screen generator	£75+	I1
	Word processing	£500+	I1
MZ-80K	Integrated accounts	£150	P2
	Stock control/recording	£150	P2
North Star Horizon	Database management/ information retrieval	£250	B3
	Estate agent	£750	B5
	General ledger/NL	£250	B3
	General ledger/NL	£400	M3
	Incomplete records	£750	M3
	Integrated accts	£950	B3
	Integrated accts	£990	M3
	Invoicing	£100	B3
	Invoicing	£250	M3
	Job costing	£350	M3
	Letter writer	£150	M3
	Mail shot	£90	M3
	Payroll	£350	B3
	Payroll	£390	M3
	Property Management	£400	M3
	Purchase ledger	£250	B3
	Purchase ledger	£400	M3
	Sales ledger	£250	B3
	Sales ledger	£400	M3
	Stock control/recording	£450	B3
	Stock control/recordng	£900	M3
	Time/cost recording	£250	B3
	Time/cost recording	£200	M3
	Word processing	£250	M3
PCC 2000 Simpelec Triton 3	Estate Agent	£350	B2
	General ledger/NL	£350	B2
	Mail Shot	£450	B2
	Purchase ledger	£350	B2
	Sales ledger	£350	B2
	Stock control/recording	£350	B2
	Time/cost recording	£350	B2
PET	Bank account	£10	D1
	Cash flow	£8	A1
	Cash register	£10	D1
	Credit control	£650	B4
	Database management/ information retrieval	POR	C1

PACKAGES

DIRECT ACCESS

Machine	Application	Price	Code
	Database management/ information retrieval	£325	A1
	Database management/ information retrieval	£225	H4
	Database management/ information retrieval	£170	C3
	Estate agent	£25	A1
	General ledger/NL	£1000	C1
	Industry factory loading	£300	X1
	Industry work study	£750	X1
	Invoicing	£350	A1
	Invoicing	£400	C1
	Job costing	£750	X1
	Lotteries	£45	H2
	Mailing list	£15	A1
	Mailing list	£50	D1
	Mailing list	£45	H2
	Membership accting	£85	H2
	Payroll	£50/195	I2
	Payroll	£10	D1
	Payroll	£50/25/ 195	A1
	Payroll	POR	C1
	Payroll	£200/350	C5
	Personnel records	£85	H2
	Purchase ledger	£95/120/ 350	A1
	Purchase ledger	£1000	C1
	Purchase ledger	£300	B4
	Sales ledger	£300	B4
	Sales ledger	£800	C1
	Sales ledger	£95/350	A1
	Salesman	£10	D1
	Stock control/recording	£195	I2
	Stock control/recording	£10	D1
	Stock control/recording	£12/25/ 350	A1
	Stock control/recording	£15	A2
	Stock control/recording	£300	B4
	TAP business system	£125	H2
	VAT	£17.50	A1
	Word processing	£40	D1
	Word processing	£85/65/ 40/20	H2
	Word processing	£375	H4
	Word processing	£25/325	A1
	Word processing	325	C5
PET/CBM	Assembler dev	£50	C2
	Database management/ information retrieval	£75	B1
	Database management/ information retrieval	£50/150	C2
	Database management/ information retrieval	£150	G2
	Database management/ information retrieval	£150	J1
	Disk operating system	£150	B1
	General ledger/NL	£200	C2
	Integrated accts	£300	B1
	Integrated accts	£(50)	C2
	Integrated accts	£650	G2
	Integrated accts	£650	J1
	Invoicing	POR	J1
	Invoicing	£25-50	B1
	Lisp	£75	C2
	Mailing list	£75	B1
	Pascal	£120	C2
	Payroll	£150	G2
	Payroll	£150	J1
	Payroll	£150	C2
	Petsoft programs	£160	J1
	Production analysis	£300	B1
	Purchase ledger	£200	C2
	Purchase ledger	POR	J1
	Sales ledger	POR	J1
	Sales ledger	£200	J1
	Stock control/recording	£150	C2
	Stock control/recording	£300	B1
	Stock control/recording	£150	G2
	Stock control/recording	£150	J1
	Time/cost recording	£300	B1
	Word processing	£75/150	J1
	Word processing	£75/150	G2
	Word processing	£75/150	C2
PET/ Computhink	Stock control/recording	£250	R1
PET/8032	Mailing list	£75/150	S1
	Planning maintenance	£595	S1
	Purchase ledger	£395	S1
	Sales ledger	£395	S1
	Solicitor's package	£750	S1
	Stock control/recording	£395	S1
	Vet package	POR	S1
	Warehousing	POR	S1
Sharp PC-3201	General ledger	£450	P2
	Sales ledger	£300	P2
	Purchase ledger	£300	P2
	Stock control	£300	P2
Sorcerer	Payroll	£250	L2
Superbrain	Database	£300	S6
	Estate agent	£800	S6
	General ledger	£400	M3
	General ledger	£400	S6
	Incomplete Records	£750	M3
	Integrated Accts	£1200	S6
	Integrated Accts	£990	M3
	Invoicing	£250	M3
	Invoicing	£150	S6
	Job costing	£350	M3
	Letter writer	£150	M3
	Mail shot	£90	M3
	Payroll	£400	S6
	Payroll	£390	M3
	Property management	£400	M3
	Purchase ledger	£300	S6
	Purchase ledger	£400	M3
	Sales ledger	£300	S6
	Sales ledger	£400	M3
	Stock control	£300	S6
	Stock control	£900	M3
	Time recording	£200	M3
	Word processing	£250	M3
	Travel agency accts	£800	S6
Tandy Model I	Database management/ information retrieval	£25-80	M1
	General ledger/NL	£90	M1
	Incomplete records	£40	M1
	Integrated accts	£350	M1
	Invoicing	£90	M1
	Job costing	POR	M1
	Mailing list	£40	M1
	Mail shot	£75 +	G4
	Payroll	£249	M1
	Purchase ledger	£90	M1
	Sales ledger	£90	M1
	Stock control/recording	£30-50	M1
	Travel Agency Accts	£225	G4
	Travel Agents Dairy	£100	G4
	Travel Ticket Sales	£225	G4
	Time/cost recording	POR	M1
	Word processing	£50/75	M1
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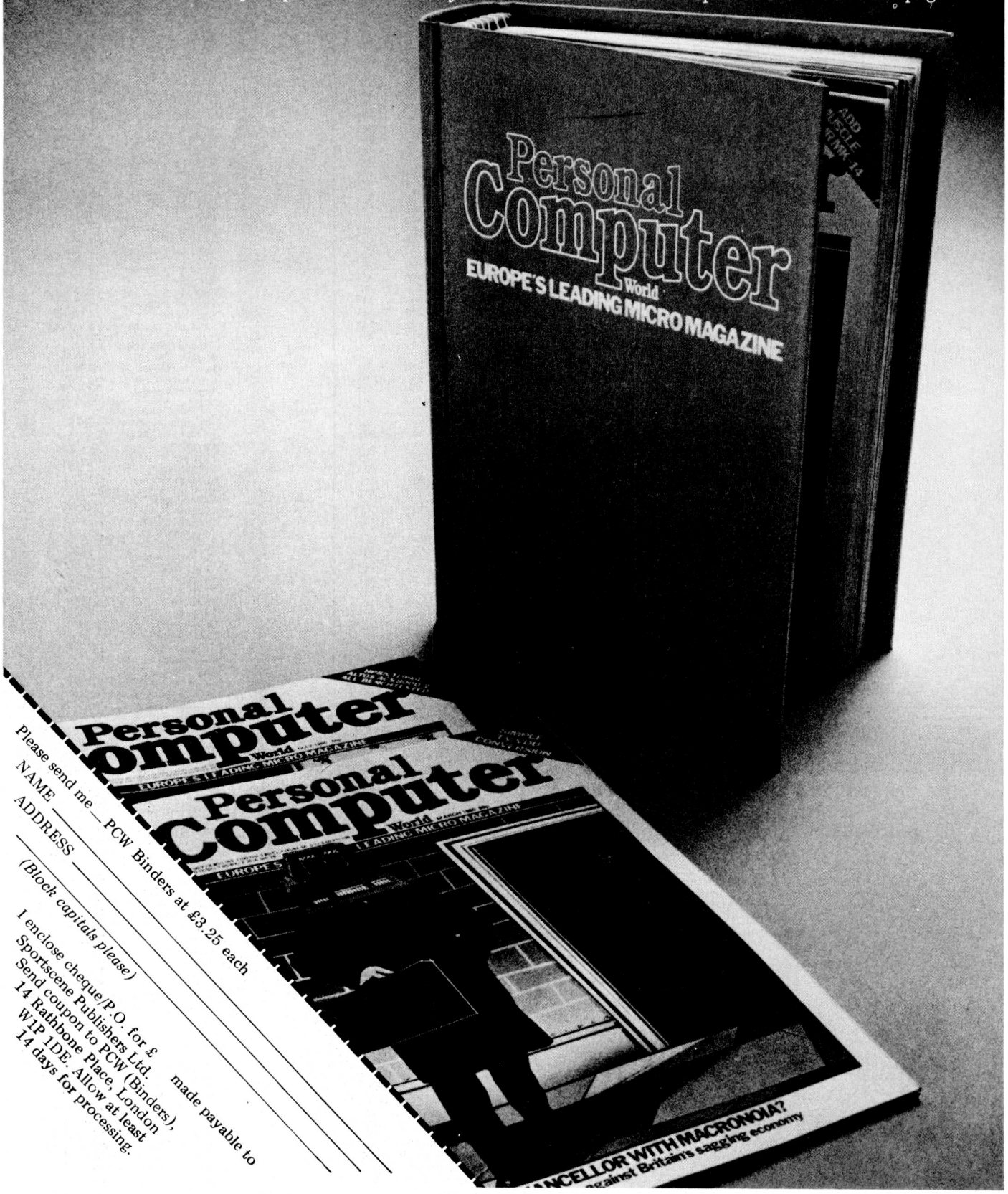

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Casio fx501P. . . prog calc, 128 program steps, 11 non-volatile memories, complete with manual and program library, £40 ono. Tel: (0803) 844229.

CBM 3032. . . Toolkit, Tensai deck with counter and sound, dustcover, books £525. PET 2008, Dustcover, books £275. Tel: 047483 493 S W Wiltshire.

Acorn Atom. . . 8k RAM, 8k ROM, new Acorn 8k RAM/ROM card, buffers, connectors, 3A PSU, new keyboard. £200/offers. Stevens, Burnham-on-Sea (0278) 785504.

PET 4008. . . with manuals, Invaders, Jailbreak, Cosmiads, perfect cond, £395. Ring (0792) 781370.

ZX80. . . Making the Most of your ZX80 Linsac/Bug Byte cassettes, incompatible with my ZX81! (blush): 01-274 3205 after 5 w/days anytime w/ends. C Andrew, 19 Burbage Road, London SE24 9HJ.

ZX81. . . programmable character generator built & cased, £35. Repeating key module, £2.50. 3k memory expansion £15. (these would also work on ZX80) K Purkiss, 4 Asby Rd, Asby, Workington, CA14 4RR.

Centronics. . . interface for PET and Toolkit to fit old 8k PET (mounted on separate PLB). D Johnston, 12 Balgillo Rd, Broughty Ferry, Dundee DD5 3LU.

IBM 3982. . . recond golfball printer, ex cond, inc Aculab 735p parallel interface, 3 golfballs & spare ribbons, need dot matrix for business, £500 ono. Tel Steward, 0642 315123 (home) 243370 (work)

Microtan 65. . . built to Micron standards, Tanex Basic in EPROM Xbug, lower case, graphics, PSU, in superb case, Tangerine ASCII keyboard and case, hex keypad, manuals and many games and tapes inc. space invaders with sound effects, exc cond, £275 ono. Phone 0253 591805.

ZX81+16k RAM. . . Sinc built, 4 books, 2 tapes of software, executive carrying case, £140 ono. Also Videomaster Starchess TV game, hardly used, £40 ono. Contact David on 01-478 5249 after 21 Sept.

Nascom 2. . . 32k RAM, profesionally built & boxed, Naspen, Zeap assembler, graphics ROM, revas disassembler (cassette), inc. tape recorder and games software, £450. View in Oxford or London. Tel Paul Hoggett, Oxford (0865) 727375 (work).

TRS80 4k LI. . . CPU, £190. Tel: Bath (0225) 310688.

Acorn Atom. . . 12k + 12k, inc PSU, leads & manual, software inc Invaders, Acornsoft packs 1, 3 &4, plus lots more (inc books), £250 ono. Tel: 01- 431 1493 (after 6.00), 01-435 0431 (8-5)

UK101. . . Wemon monitor for sale due to upgrading to 32x48 display, £16. Tel: Sedgley 74804.

Nascom 2. . . 32k RAM 4MHz no waits, Nas Sys 3, Zeap 2/EPROM, Nas-Dis Debug/tape, Bits & PCs toolkit/EPROM, chess & space invaders, castle int, port probe, 3 D/N vero rack & case, fan, etc, £690 ono. Tel (0983) 402549.

HP67. . . programmable with maths and games packs, spare battery pack, etc, original cost over £300, £150 or part exchange for micro computr. 07554 2343 office hours.

Compukit UK101. . . ready built, cased, 8k RAM, new Wemon monitor, also manual, all leads, software inc sea battle, asteroid runner, also cassette recorder with tape counter, £220. Phone Buckingham 3796.

ZX81. . . Sinc built, inc PSU and manual plus cassette recorder, only £65. Phone (0706) 226907 eve (Lancs)

Casio fx502p. . . very good cond, manuals and extra programs, £60 ono. Tel: 0487 812812.

Sharp PC1211. . . with manuals overlays, cassette interface, accept £80. Also HP29C prog calc, coninuous memory, 99 steps, 30 memories, manuals, accept £40. Martin Stabb, Tel Bristol 39242h 423957w.

Video Genie 16k. . . extra keys ample socket, hardly used, + 12" portable TV, plus a fortune in programs, all for £275. Tel 01-904 8512, eve.

Vido Genie. . . 6 months old, as new in orig box, manuals, books, some programs inc space invaders and other games, £275. Tel: didcot 814656 after 6 or w/ends.

PET 8k. . . old ROMs, integral cassette, with the PET/CBM Guide +32 progs, £350. Tel: Dursley (Glos) 3532.

ZX81. . . Sinc built, all leads, manual, adaptor, and packaging, as new, £60 ono. Tel: Maidstone 51499 (eves)

Wanted

Nascom computer, if possible with some expansion, anyone want to sell for around £160? contact David, 01-478 5249 after 21 Sept.

Superbrain (CP/M). . . programs wanted: games/business/programming, etc, anything to assist a newcomer to computing. 51 Burgess Rd, Bassett, Southampton SO1 7AP.

16k RAM. . . pack for ZX81. Tel 0795 521280 pm/w/ends.

Will pay. . . immediate cash for a neat metal cabinet with S100 motherboard and power supply, Z80 CPU, RAM and disk controller. Mr Back, Walton-on-Thames 44825, eve.

TCL Pascal. . . programs for CBM3032. Anyone interested in exchanging programs/games? Write: John Douglass, Gimenenstr 1, CH6300, Zug, Switzerland.

Wanted. . . handbook circuits etc. for ICL 7181 VDU. Buy or loan against deposit. Have several for sale. Mr Adamson, Woodend, Victoria Rd, Kingsdown, Deal, Kent. Tel: Deal 03045 3788.

USER GROUPS INDEX

DIRECT ACCESS

Once again, here is a revised listing of user groups and clubs. The next full listing will appear in March with updates in the issues between. Send entries to: 'USER GROUPS', *Personal Computer World,* 14, RATHBONE PLACE, LONDON W1P 1DE.

INTERNATIONAL

Apple Users Group Europe. President: K Giese, Hackstucker 11, D-4320 Hattingen 15, West Germany. Tel 02324 52240.

CP/M. IRL. Irish CP/M Users' Group. Meets monthly in Dublin area, membership IR £5 pa. Newsletter: CP/M.MAG. Contact: Doug Notley, Gardner House, Ballsbridge, Dublin 4, tel: 01-686411.

DENSPET: group specifically for exchange or original programs for MTU 200x320 dot matrix hi-res PET add-on. Send sample of your work or £2.50 ($2.50) & receive sample in return plus newsletter sub & lists of available programs. Contact: DENSPET, Rock House, Ballycroy, Westport, Co Mayo, Eire.

DAInamic: European DAI personal computer users' club. Has over 500 members, publishes a bi-monthly newsletter with most articles in English. Contact: DAInamic, Heide 98, 3171 Westmeerbeek, Belgium.

Microcomputer Users Club: recently established for program writing and exchange, emphasis on 6502/Z80 users. Contact c/o Synthetronics Microcomputers PO Box 151, 1322 Hoevik Norway.

KAOS — the official 6502 users' group of Australia. Has a range of projects within special interest groups: hardware, software, amateur radio, Pascal, education, Publishes monthly newsletter. Contact: Mr Ian Eyles, 10 Forbes St, Essondon, Victoria, Australia 3040.

Group/380. Recently established for information interchange on microsystems equivalent to IBM 360/370 main frames, newsletter, access to a computerised database listing relevant software. Annual sub: $10 for individuals, $25 for organisations. Contact: Mokurai Cherlin, PO Box 1131, Mount Shasta. CA96067. USA.

Ithaca Intersystems and S100 Bus Users' Club. Formed to 'organise the construction and design of software and hardware based on Ithaca or other S100 systems.' Contact: George Brooke, Sebastian Baverstrasse 20c, 8000 Munich 83, W Germany.

NATIONAL

6502 User's Club. Holds regular meetings and welcomes new members. Contact: Walter Wallenborn, 21 Argyll Avenue, Luton, Beds or Joe Manifold, 16 Bunyan Close, Pirton, Hitchin, Herts.

9900 Users Group. Contact Chris Cadogan, Dept. Computer Science, University of Manchester, Manchester M13 9PL.

Amateur Computer Club. National organisation with seminars, local group meetings. Bi-monthly newsletter 'ACCUMULATOR'. 6800, Z-80, and 2650 libraries. Founded 1972. Fee £4.50 SAE Jim McDonald, 1 Carlton Court, Studley Grange Road, London, W7 2LU.

Amateur Computer Club, 2650 Library. 2650 related data and technical assistance only. No meetings, no newsletter. Contact Roger A Munt, 51 Beechwood Drive, Feniscowles, Blackburn, Lancs. BB2 5AT (0254 22341).

Apple Music Synthesis Group. Interested in ALF, Mountain Hardware, Alpha Syntauri and Soundchaser systems. Contact: Dr David Ellis, 22 Lennox Gardens, London SW1 enclosing an SAE.

Atom User Group. Quarterly newsletter, software library, technical help when possible. Some local groups. Membership £4 pa including newsletter. Contact Richard Meredith, Sheerwater, Yealm View Road, Newton Ferrers, S Devon, PL18 1AN.

BASUG — British Apple Systems User Group. Now incorporates the UK Apple User Group, Caters for all current and prospective Apple/ITT 2020 users. Publishes magazine called Hard Core, meets fornightly at Park Street, just south of St Albans. Contact: Martin Perry, BASUG, PO Box 174, Watford WD2 6NF.

Commodore Pet Users Group publishes a monthly magazine — the official voice of Commodore. For membership details contact Margaret Gulliford on Slouth 74111.

Compucolor II User Group (UK). Quarterly newsletter: Hardware and software advice: Program library and exchange; links with other CCII national groups. Contact: Bill Donkin, 19 Harwood Avenue, Bromley, Kent 01-460 2626 (eve).

CP/M Users' Group (UK). Annual sub £6. S/ware library, newsletters, meetings, 'help' service. Contact: 11 Sun Street, Finsbury Square, London EC2M 2PS, tel: 01-247 0691.

EZUG: Educational ZX80/1 Users' Group. Annual sub £2.50 (UK), £3 (rest of Europe), £6/$12 elsewhere Bimonthly newsletter Large SAE for sample newsletter (UK & Eire only). Contact: Eric Deeson, Highgate School, Balsall Heath Rd, Highgate, Birmingham B12 9DS

FX500-P Users Association. For Casio FX501-P & FX502-P users to communicate with each other and to work together. SAE to Max Francis, 38 Grymsdyke, Gt. Missenden, Bucks HP16 OLP.

Ithaca Audio S-100 bus UK User Group. Contact: Dave Weaver, 16 Etive Place, Bumbernauld, Glasgow. G67 4JE. Phone 02867 36570.

MUSE is an organisation for co-ordinating activity in schools and colleges. Meetings are held regionally and nationally. Full details from Muse, Freepost, Bromsgrove, Worcs B61 0JT.

National Acorn Atom User Group. Publishes monthly program magazine. For free copy and club details send large SAE (15½p) to Alan Carr, 105 Fairhole Avenue, Gidea Park, Romford, Essex.

National RML User Group, c/o RML Ltd., PO Box 75, Oxford.

National TRS-80 Users' Group. Activities include a computerised bulletin board service (see 'Network News'). Contact: Brian Pain, National TRS-80 UG, 40A High Street, Stony Stratford, Milton Keynes, tel (0908) 566660 (office) 564271 (home).

National ZX80 and ZX81 Users Club. Publishes monthly magazine *Interface*. For free copy and club details send a large SAE (15½p) to 44-46 Earls Court Road, London W8 6EJ.

Sharp PC-1211 Users Club for all PC-1211/TRS-80 Pocket Computer users. Membership of £5 pa. includes newsletter containing programs etc. Contact: Johnathan Dakeyne, 281 Lidgett Lane, Leeds LS17 6PD.

Sharp MZ-80 Users Club. Free membership: Extensive library and facilities. Details on meetings & Newsletters (SAE please) from: Paul Chappell, Computer Centre, Yeovil College, Yeovil, Somerset. BA21 4AE.

Sharp MZ-80k User Group. Contact: Joe LP Seet, 16 Elmhurst Drive, Hornchurch, Essex RM11 1PE. Tel: 04024 42905.

Sharp MZ-80K user group (and shortly PC3201/00 and 80B) £3 per annum for three news letters. Send cheque/POs tips, articles and sales to Mr R Erdine, 271 Meadow Rd, Sheffield S8 7UN

TI 99/4 Users Group — TIHOME offers access to a software library and sends out a monthly newsletter. Contact: P M Dicks, 157 Bishopsford Road, Morden, Surrey.

Transducer. The club for those interested in robotics, micro's and micro hardware. Send 25p to D Stockqueler 66 Waterloo Rd, Penylan, Cardiff for sample newsletter and details.

Tangerine Users Group (TUG), 16 Iddesleigh Rd, Charminstre, Bournemouth, Dorset BH3 7JR. Tel: 0202 294393.

TRS-80 Level 1 User Group. Software library and quality newsletter (write for details and free copy). £5.00 pa. N Rushton (LIUG), 123 Roughwood Drive, Northwood, Kirkby, Merseyside L33 9UG.

TRS-80 Medical & Laboratory Users Newsletter. Free quarterly newsletter detailing interests, programs & applications. Send SAE & details of interests to: Dr N Robinson, The Residency, Northwick Park Hospital, Harrow, Middx.

UK101/Superboard User Group (Computer User Aids). Newsletter, software library and technical service. Membership £4.60 inc VAT per 6 months — £5.00 overseas. Apply to Adrian Waters, 9 Moss Lane, Romford, Essex — Romford 64954.

UK Intel MDS Users Group. Contact: Lewis Hard, Space Intelligence, The Old Coach House, Court Row, Upton Upon Severn, Worcestershire. WR8 0NS.

UK Pilot Users Group — SAE for fact sheet on Pilot versions available Common Pilot Reference Manual £5. Contact: Alec Wood, Wirral Grammer School for boys, Cross Lane, Bebington, Wirral, Merseyside L63 8AQ.

National T158/9 Club: bi-monthly newsletter, program exchange etc. Annual sun £5.50 or, if you include a program with your cheque then it's £3.50. Contact: R M Murphy, Dept. of Electronic Engineering, University College Swansea, S. Wales.

CP/M Users' Group (UK). Annual sub £5. S/ware library, newsletter, 'help' service. Contact: 11 Sun St, Finsbury Sq. London EC2M 22D.

British Apple Systems User Group For Apple II and ITT 2020 users. Meets 1st Tues eve & 3rd Sun afternoons monthly at The Old School, Branch Rd, Park St, St. Albans (on A5 about 2 miles south of city centre). Contact: John Sharp, Garston (09273) 75093 or David Bolton, Park Street (0727) 72917.

Mk 14 Club. Bi-monthly magazine called 'Complement and Add''. Contact: Geoff Phillips, 8 Podsford Rd, London NW9 6HP.

Independent PET users Group Contact: IPUG, 57 Clough Hall Rd, Kidsgrove, Stoke-on-Trent. Staffs.

UK Apple Users Group, Contact (Keen Computers) 5 The Poultry, Nottingham. Tel: 0602 583254/5/6.

Cosmac Users Club (proposed). For people using the RCA 1802, Cosmac ELF, ELFII, Super ELF etc. Those interested contact James Cunningham at 7 Harrowden Court, Harrowden Road, Luton LU2 0SR (enclosed sae, please).

Ohio Scientific UK User Group. Independent of OSI, an important role will be the disentangling of poor documentation. There will be regular newsletters and membership is at present £5 per year. The group will initially be concerned with the practical aspects and applications of OSI systems — rather than with games. Contact Tom Graves at: 19a West End, Somerset, BA16 0LQ.

Compukit User Club. Details, contact P. Crabb Esq., 21 Jones Close, Yatton, Avon (0934 834808).

77/68 Users Group. Quarterly Newsletter. Free membership for 1st year if you buy the 77/68 instruction manual, £1.50 thereafter. Contact: Newbury Computing Store, 40 Bartholomew St, Newbury, Berkshire.

Compukit User Club. Details contact S H Grisvenor Esq, 11 Bernard Rd, Oldbury, Warley, West Midlands (021-422 3298)

11s Users Group. A sort of help service only. No meetings, no newsletter. Contact: Pete Harris, 119 Carpenter Way, Potters Bar, Herts, EN6 5QB. Tel: 0707 52091 or 01-248 8000 ext 7065.

ZX80/81 National Software Association. Annual sub £6, incs cassette of software. Bi-monthly newsletter, software available on cassette. Send SAE for details. Contact: 15 Woodlands Rd, Wombourne, Staffs WV5 0JZ.

Educational Users' Group for TRS-80 & Video Genie. Offshoot of Nat TRS-80 UG, other TRS-80/Vid Genie users welcome. Contact: D J Fatcher, Head Teacher Beaconsfield First & Middle School, Beaconsfield Rd, Southall, Middx.

REGIONAL

Central Scotland Computer Club. Meets the first and third Thursdays each month in Falkirk College of Technology, Grangemouth Road, Falkirk. Secretary, J Lyon, 78 Slamannan Rd, Falkirk, FK1 5NF 22430.

East Anglian Computer Users' Group. Meets: Crane Community Centre, Telegraph Lane East, Norwich. Contact: Gill Rijzl, 88 St Benedict's St, Norwich NR2 4AB, tel: (0603) 29652.

Grampian Amateur Computer Society. Meets 2nd Monday every month. New premises are in Thistle Lane, Aberdeen. Contact Alan Hird, 20 Harcourt Road, Aberdeen, Tel: 90224) 33102.

IPUG South East. Meet 7.30 3rd & 4th Thursday. Charles Darwin School, Jail Lane, Biggin Hill. Bi-monthly newsletter. Contact: M Ryan, 164 Chesterfield Drive, Sevenoaks. Tel: (0732) 53530.

MACC (Midlands Amateur Computer Club) meet every Friday evening 7.00pm onwards. . . no sub, no magazine. Contact: John or Roy Diamond Tel: Coventry (0203) 454061.

Merseyside Nascom Users' Group. Now independent, with 150 members. Meets 1st Mon monthly, 7.30pm at Mona Hotel, James Street, Liverpool. Contact: T Searle, 14 Hawkeshead Close, Maghull, Liverpool L31 9BT.



PASCAL PROGRAMS FOR SCIENTISTS AND ENGINEERS
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INSIDE BASIC GAMES
This book teaches you how to design error-free interactive BASIC programs including games and other "real-time" situations. Eight different kinds of computer games (a total of 14 games) are described in detail, then completely explained and analyzed in order to illustrate how the games were designed and developed in BASIC. All facets of game program design, including program structuring, cursor positioning, randomization and other concepts are discussed. Programs for games such as Hangman, Ten-Key Flicker and Taxman are coded in Microsoft BASIC and versions are provided for PET/CBM, APPLE II and TRS-80.

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USER GROUPS INDEX

DIRECT ACCESS

Merseyside TRS-80/Video Genie Users' Group. Contact: Peter Tootill, 101 Swanside Rd, Liverpool L14 7NL, tel 051-220 9733.

Merseyside Microcomputer Group. Special interest groups: PET, Apple, 380Z, SC/MP, Education (Mr M Trotter, 051-652 1596). Contact: Fred Shaw 14 Albany Avenue, Eccleson Park Prescot, Merseyside L34 2QW tel: 051-426 5436.

TRS-80 — North West Group, (for 6 issues). Meetings last Wednesday monthly (not Dec) Contact: Melvyn D. Franklin, 40 Cowlees, Westhoughton, Bolton, BL5 3EG. Tel: 0942 812843.

380Z User Group Northern Home Counties: inc Herts, Cambs, Oxon. Contact: Sheridan Williams, 35 St Julian's Road, St Albans, Herts AL1 2az.

6502 User's Club (Southern Region). Welcomes all 6502 Users — Acorn, Aim, Apple, Atari, Atom, Kim, Microtan, PET, SYM, Superboard, UK101 etc. Regular Newsletter. Contact: Steve Cole, 70 Sydney Road, Gosport, Hants.

Northwest Computer Club. Fortnightly meetings 25p attendance fee. No subscriptions. Contact: John Lightfoot, 135 Ashton Drive, Frodsham, Warrington, Cheshire WA6 7PU. Tel: 0928-31519.

ACC (Merseyside 380Z Users Group). Contact: Alan Pope, Paal Enterprise, 37 Stuart Rd, Crosby, Liverpool L23 0QE.

Northeast PETs. Contact: Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham. They meet the 2nd Monday of each month for software tuition and the 3rd Monday for hardware tuition (both in addition to normal activities). They start at 7.00 pm and meet in the PET Lab, Newcastle Polytechnic, Ellison Building, Newcastle upon Tyne.

A PET group is being formed on the Sussex/Surrey border,presently centered on Crawley & Horsham. Aims to meet monthly & produce a monthly newsletter. Contact: Richard Dyer, 33 Parham Rd, Ilfield, Crawley RH11 0ET.

Southern Users of PETs Association, free membership, meet first Wed. each month. £1.50 for monthly newsletter. Contact 42 Compton Road, Brighton BN1 5AN.

North-East RML 380Z Users' Group. Meets monthly at Micro-Electronics Education Centre, The Polytechnic, Newcastle upon Tyne. Contact: M Hatfield or R Reed, Computer Unit, Northumberland Building, The Polytechnic, Newcastle-upon-Tyne NE1 8ST. Tel: 26002 ext. 268 office hours.

Manchester Computer Club (formerly the Amateur Computer Club (Northwest Group)). Meets 1st & 3rd Thursdays monthly at St Peter's Chaplaincy, Precinct Centre, Oxford Rd, Manchester. Contact: David Wade, 28 Hazel Rd, Altrincham, Cheshire WA14 1JL, tel 061-941 2486.

Anglia Computer User Group. Contact Jan Rejzl, 128 Templemere, Sprowston Rd, Norwich NR3 4EQ.

Pennine & District Computer Club. Open at both 26 and 51 Mill Hey, Haworth, W. Yorks. each Sat & Sun 10am to 10pm. Systems books, magazines, members shop. Contact: club at w/ends on Haworth 43007 or chairman, Douglas Bryant, on Bradford 569660.

Computer Education Soceity of Ireland. A voluntary organisation that consists of a national body and an expanding number of local brnches. Their brief is to monitor computer education in Ireland. *National CESI* (£3pa) — Dairmuid McCarthy, 7 St Kevin's Pk, Kilmacud, Blackrock, Co. Dublin. *Cork branch* (£1 extra) — Michael Moynihan, Colaiste an Spioraid Naomh, Bishopstown, Cork. *Dublin branch* (£1.50 extra) — Jim Walsh, CBS Naas, Co Kildare, *Limerick branch* (£1 extra) — Sr Lourda Keane, Convent FCJ, Laurel Hill, Limerick, *Waterford brnach*(£1 extra) — Mr Hugh Dobbs, Newtown School, Waterford. *Kilkenny branch* (£1 extra) Sr Helen Lenehan, Presentation Secondary School, Kilkenny.

Surrey Microprocessor Society. (SUMPS) Covering Surrey plus bits of South London and other adjacent counties. Anyone interested in joining, call Mike on 01-642 8362

Wirral Microcomputer Users' Group. Meets at Mons at Birkenhead Technical College. Contact: J Phillips, 14 Helton Close, Nocturum, Birkenhead, Merseyside L43 9HP. Tel 051-652 0268.

COUNTY

Cornish Radio Amateur Club — Computer section meets on the second Monday of every month at the SWEB Social clubroom, Pool, Redruth. New members welcome — contact Bob Reason, 24 Mitchell Road, Camborne, Conwall TR14 7JH.

South East Essex Computer Society, holds monthly informal computer evenings plus lectures. Open to anyone over 14. Contact R Knight at Southend-on-Sea 218456.

N Herts area CBM/PET/VIC users' group. Regular meetings, talks, affiliated to IPUG. Contact: P Mortiboy 2 Spurr's Close, Hitchin, Herts SG4 9OE, tel: Hitchin (0462) 54435.

North Kent Amateur Computer Club. Meetings first Thursday of each month, usually in Biggin Hill. New members and visitors always welcome. Contact Barry Biddles (sec), Biggin Hill 71742.

PET Users' in West Lancs, Meetings on the third Thursday of each month at Arnold School, Blackpool. Contact: David W Jowett, 197 Victoria Road East, Thornton, Blackpool. FY5 3ST. Tel: Cleveleys 869108.

LPRINT is the newsletter of the East Midlands TRS-80/VG User Group. For a FREE sample copy send large SAE to: Mike Costello, 17 Langbank Avenue, Rise Park, Nottingham. NG5 5BH.

ACC (Merseyside 380Z and BBC Atom Users Group) Contact: Alan Pope, Paal Enterprise, 37 Stuart Road, Crosby, Liverpool L23 0QE.

Manchester area TRS-80 Users' Group Contact: Francis Glenister, 13 Pridmouth Road, Withington, Manchester M20 9GN, tel: 061-445 7191.

West Midlands Amateur CC. meet 2nd & 4th Tuesdays each month at Elmfield School, Love Lane, Stourbridge. Further details John Tracey, 100 Booth Close, Brierley Hill, West Mid. 0384 70097.

West Midlands RML User Group, c/o BECC, The Bordesley Centre, Camp Hill, Stratford Road, Birmingham B11 1AR.

South Yorkshire Personal Computing Group. Meets 7.30, second Wednesday each month. St George's Building, Mappin Street, Sheffield. Visitors always welcome. Contact: Paul Sanderson, 8 Vernon Road, Totley, Sheffield. Tel: 0742 351895.

Suffolk Microcomputer Club. Meets monthly, produces newsletter, sub £5 pa. Contact: Mr S Pratt, c/o Microtek, 15 Lower Brook St, Ipswich, Suffolk IP4 1AQ tel: 0473 50152.

Amateur Computer Club of North Staffordshire. Call or write to Mr M Turner (chairman) ACCNS, 542 Lightwood Rd, Lightwood, Stoke-on-Trent ST3 7EH (0782) 324639 eve.

Gwent Amateur Computer Club. Covering the Gwent and Cardiff areas, the club has its own computer room and technical library. Meetings are held once a week on Wednesdays at 10 Park Place, Newport. Contact Ian Hazell on 0633 277711 office hours.

Thames Valley Amateur Computer Club. Meetings 1st Tues monthly. From November on at the Southcote, Southcote Lane off the Bath Rd, Reading, Berks. Start 7.00pm. Contact Brian Quarm (Camberley 22186) or Brian Steer (Slough 20034)

Would anyone interested in setting up an Apple Users Group in the Bucks/Berks area contact: Steve Proffitt, tel 01-759 5511 ext 7298 day, or Marlow 73074 eve or w/ends.

The Leicestershire Personal Computer Club. Meetings held the 2nd Monday in each month, at Leicester University and Loughborough University alternately. They start 7pm. Membership is £2 per annum £1 for under 16s). Contact Ms Jill Olorenshaw (Club Secretary) c/o Arden Data Processing, Minicipal Buildings, Chrles Street, Leicester (0533 22255) OR Mr Dick Foden (club chairman) at 11 Gaddesby Lane, Rearsby, Leicester.

Lincolnshire Microprocessor Society. Various meeting places. For up-to-date information contact: Hon Sec. Mr Eric Booth, Senior Common Room, Bishop Grosseteste College, Newport, Lincoln.

MACRO (Medway Amateur Computer & Robotics Organisation). Meets monthly, sub £3. Contact: Ms Christine Webster, 13 Ladywood Rd, Cuxton, Rochester, Kent. Tel: 0634 78517.

Merseyside Microcomputer Group. Several sub-groups including: 380Z Users Group (Alan Pope on 051-924 2470): Computer Education Society (Mr M Trotter on 051-652 1596): SC/MP Special Interest Group (Bob Perrigo on 051-677 6716): PET Special Interest Group: 6800 and 77/68 Special Interest Group: Apple Special Interest Group: The secretary is John Stout of the Dept. of Architecture, Liverpool Polytechnic, 53 Victoria St, Liverpool L1 6EY (051-416 5536).

NE RML 380Z Users Group. Meets monthly at MEC, Newcastle-upon-Tyne Polytechnic, Coach Lane Campus. Contact: M Hatfield or R Reed, tel: 26002 ext 268 (office hours)

North Lancs User Group. Contact John Robinson, 12 Harold Ave., Blackpool, Lancashire.

Oxford Microcomputer Club. £5.00 pa. Contact: S C Bird, 139 The Moors, Kidlington, Oxford OX5 2AF. Tel: Kidlington (08675) 6703.

Anyone interested in forming a Suffolk Computer Users' Club should contact Ian on Ipswich 831353 eve/w/ends.

South Shropshire: Ludlow & Dist Microcomputer Club. Meets 7.30 2nd Monday monthly at Diocesan Education Centre, Lower Galdeford, Ludlow. Contact: David Pauli, 32 High St, Leintwardine, Craven Arms, Shropshire, tel: 05473 287.

West Yorkshire Microcomputer Group. Formed following an inaugural meeting on Oct 23rd, a varied diary of events has been drawn up. For details contact the Chairman, Philip Clark, Care Computers Services, 15 Wellington St, Leeds LS1 4DL (0532 450667) OR the Secretary, Keith Knaggs, Price Waterhouse & Co., Leeds (0532 448741).

TOWNS

Bedford Amateur Computer Club. Recently started, no further details as yet. Contact: Mr R Bird, 7a High Street, Great Barford, Bedford MK44 3LB, tel 0234 870763.

Bournemouth Area Computer Club. Meets monthly at the Kinson Community Centre. Contact: Peter Hills, 54 Runnymede Ave, Bournemouth, Dorset. BH11 9SE. Tel Northbourne 6547.

Brunel Computer Club: meets alternate Wednesdays, 1900-2200 hrs at St Werburgh's Community Centre, Contact: Mr R Sampson, 4 The Coots, Stockwood.

Bristol Computing Club. £4.00 pa. Meetings 3rd Wednesday monthly. Contact: Leo Wallis, 6 Kilbirnie Road, Bristol. BS14 0HY. Tel Bristol 832453

Cambridge Microcomputer Club. Meets 3rd Wednesday monthly at Portland Arms, Cambridge. Contact: Duncan Mackay, 4 High Street, Waterbeach, tel: 63137 (day).

Cheltenham Amateur Computer Club. Meetings 4th Wednesday monthly, 7.30pm start. Contact: Mr M Pullin, 45 Merestone Drive, the Park, Cheltenham, GL50 2SU (Cheltenham 25617).

Derby & District Branch of IPUG meets monthly in Derby. For details contact Raymond Davies, 105 Normanton Road, Derby DE1 2GG. Tel (day) 41025 (eve) 514016.

Derby Microcomputer Society. Meets fortnightly at Derby Lonsdale College, Uttoxeter Road, Derby. Contact: Mike Riordan, 172 Blagreaves Lane, Littleover, Derby Tel (0332) 769440.

Exeter and District Amateur Computer Club. General meetings 2nd Tuesday monthly, specialist meetings 3rd or 4th Tuesday. £7.50 adults pa. Contact: Doug Bates, 2 Station Road, Pinhoe, Exeter, EX1 3SA.

Grimsby Computer Club. Meets fornightly on Mondays at 7.30 pm. Contact: Jenson Lee, 29 Park View, Cleethorpes. Tel: 32559.

Harpenden Microcomputer Group — Informal meetings are held on alternative Monday evenings. Contact: David James, 5 Ox Lane, Harpenden, Herts. AL5 4HH. Tel: (05827) 5366 (eve).

Harrow Computer Group meets on alternate Wednesdays at 7pm in room G43 of Harrow College of Higher Education. Summer meetings in the 'Plough', Kenton, Contact B Butcher, 01-950 7068.

Hartlepool, Cleveland. Is anyone interested in starting a TRS-80 users group in this area? If so, please contact Ian Nicholson, 3 Thirsk Grove, Hartlepool, Cleveland TS25 1LT.

IOW TRS-80 Users Club: Meets last Friday in every month at 7.30pm at the London Hotel, Ryde: Contact Mr M Collins, 11 Star Street, Ryde, Isle of Wight. Ryde 614589.

Leeds Microcomputer Users Group. Meets fortnightly on Thurs eve in Leeds, new members welcome. Contact: Paul O'Higgins, 20 Brudenell Mt, Leeds 6, tel (0532) 742347 after 6.

The SOBAT Computer Club (Leyton). Meets in first week of each month at 12 Calderon Road, London E11 4EU. Anyone (inc beginners) is welcome. Membership fee only £1 pa, inc newsletter. Specialised information, and access to several different kinds of microcomputers. Contact Mr T Kayani: 01-556 5423 eve.

DIRECT ACCESS

USER GROUPS INDEX

East London Computer Club. Meets every Friday at 7.30 in term at North East London Polytechnic, Romford Rd Precinct, Stratford E15. Contact John Grieve, 01-553 4761.

North London Hobby Computer Club. Workshops four evenings a week during term time. General meetings open to all last Wednesday of each month. Contact Secretary DELE, Polytechnic of North London, Holloway Road, London N7 8DB. Communications Group — interfacing personal computers with Prestel/teletext and Networks like PC Net and The Source. Every Thursday 6.30 — 9, Room 2/5, Tower Block, Holloway Road. ZX81 User Group every Monday during term-time 6-9pm. Room 3/4. Tower Block, Holloway Road.

Oxford University Microcomputer Society. Meets weekly in Clarendon laboratory, Oxford, visiting speakers, micros available for programming. Contact: Richard Ash, Christchurch, Oxford.

South Oxford Computer Club. Covers Wantage, Abingdon, Didcot, Wallingford and Newbury. Meets 1st Tues monthly at The Star, East Ilsley. Contacts: Mike 0235 834402; Malcolm, 0235 816949; Paul, 0235 815305; Rocky, 0635 34456.

SELMIC (South East London Microcomputer Club). Meets fortnightly at Thames Polytechnic, Woolwich. Contact: Peter Phillipps, 61 Craigerne Road, London SE3. Tel: 01-853 5829.

Manchester Computer Club. Meetings 1st and 3rd Thursday monthly in the Computer Science Building, Manchester University, Oxford Road. Contact D Wade, 28 Hazel Road, Altrincham, Cheshire, WA14 1JL. Tel: 061-941 2486.

Medway Atom Users' Group. Meets last Tues monthly during school terms at St John Fisher School, Ordnance St, Chatham. Contact: Clem Rutter, (0634) 42811 (day).

Newcastle-upon-Tyne Personal Computer Society: meets first Tues each month in Room D103, Newcastle Polythechnic.Over 60 members sub £5.00. Several sub-groups inc. PET, TRS-80 and S100 (Last one meets weekly). Contact Pete Scargill, Secretary on 0632 573905.

Orpington ZX80/81 Computer Club. Meeting each Friday. Contact: R A Pyatt, 23 Arundel Drive, Orpington, Kent BR6 9JF. Tel: 66 20281.

Plymouth and District Amateur Computing Club. Subscription £5.00 pa. Meetings last Wednesday monthly. Contact: Mr S A Bell, Secretary, Plymouth and District Amateur Computing Club, 31 Victoria Place, Stoke, Plymouth, Devon.

Southampton Amateur Computer Club. Meets 2nd Wed monthly, Medical Sciences Building, Bassett Crescent East, Southampton (alternative venue Aug & Sept). Contact: P Blitz, 'Gardenways', Chilworth Towers, Chilworth, Southampton, tel: 0703 766161.

Would anyone interested in forming a computer club in the Portsmouth area please contact Dave Cocker on Portmouth 751156.

Sunbury Computer Club, meets last Tuesday each month. 40p/meeting £4pa (under 18½ price) enquire to: S N Taylor, 8 Priory Close, Sunbury-on-Thames TW16 5AB.

Local IPUG Group meet other PET users and make friends. Contact G Squibb initially. 108 Teddington Pk Rd, Teddington, Middx.

Would anyone interested in joining an informal Computer Club in the Tonbridge or Tunbridge Wells area please contact either Chris Wallwork (Tunbridge Wells 37682) or Ray Szatkowski (Tonbridge 355960).

Worle Computer Club: meets alternate Mondays 1900-22.30 at Woodsprings Inn Function Rooms, Contact: S Rabone, 18 Castle Rd, Worle, Weston-Super-Mare, Avon, tel: 0934 513068.

Worcester & District Computer Club. Meets 2nd Monday monthly at 8pm, Old Pheasant Inn, New Street, Worcester. Contact: D Stanton, 55 Vauxhall St, Rainbow Hill, Worcester. WR3 8PA.

York Computer Club. Meetings 8pm Mondays at Holgate WMC New Lane, Acomb, York. Further info K Thomas, York 38239.

Croydon micro/small computer group. Contact Vernon Gifford, 111 Selhurst Road, London SE25 6LH.

East London Amateur Computer Club. Meets 7—10pm on 2nd & 4th Tuesdays monthly at Harrow Green Library, Leytonstone, London E11. Contact: Fred Linger, 01-554 3288.

Richmond Computer Club. Meets 8.00 2nd Monday monthly, Richmond Community Centre. Contact: Bob Forster, 01-892 1873 (eve).

TRS-80 Independent User Group. Recently formed in Birmingham. Contact Mike Bayliss, 021-743 7197.

Anybody interested in forming a microcomputer users club in the Towcester (S. Northants) area, please contact R J Wellsted, 20 Hampton Court Close, Abbey Chase, Towcester, Tel: Towcester 51354 eves.

Ashfield Computer Club. Meets 1st & 3rd Thurs each month at Carsic Junior School, membership £3 pa. Contact Deric Ellerby. tel 0380 75376 or Derrick Daines tel 0380 56198

Anyone interested in forming a micro group in the Doncaster area, contact Mr P Flinders, tel Doncaster 78954 or Doncaster 868 379, 6—9pm.

SALISBURY, Is anyone interested in forming a microprocessor and computer society in this area? SAE to David Bone, Flat 2, 24 St Mark's Rd, Salisbury, Wilts.

Shipley College Computer Group (Sorcerer/6800). They meet Tuesdays (software) and Wednesdays (hardware/advanced) between 7.00 & 9.00 pm. Contact Paul Channell on Shipley 595731.

Microsoc the Oxford University micro group holds shared meetings with the Oxford Microcomputer Club. Contact: M. Bourla, St. John's College, Oxford.

Scunthorpe & Dist Microprocessor Society. Contact: G Hinch, 21 Old Crosby, Scunthorpe, S Humberside DN15 8PU.

Sunbury Amateur Computer Club. Meets 1st Friday monthly whenever possible, 20p per meeting. Contact: S Taylor, 8 Priory Close, Sunbury-on-Thames TW16 5AB, tel Sunbury 86649.

Manchester Atom Users' Group. Meets last Tues monthly during school terms at Abraham Moss Centre, Crescent Rd, Manchester 8. Contact: John Ashurst, 061-370 5121 ext 27 (day), 061-681 4962 (eves).

Anybody in the Warrington area interested in forming a Mattel Intellivision TV Game group to organise meetings, competitions and lay foundations for the forthcoming computer addition? Tel Warrington 62215 after 4 pm.

BAUD (Bristol Apple Users and Dabblers). Contact: Geoff Smythe, Datalink Microcomputer Systems Ltd, 10 Waring House, Redcliffe Hill, Bristol BS1 6TB, tel (0272) 213427.

Brunel Technical College Computing Club. The club divides into two sections. . . the "skilled" and the "not skilled". They share alternate Wednesdays at the College. Contact: S.W. Rabona at 18 Castle Road, Worle, Weston-Super-Mare, Avon, BS22 9JW (0934 513068).

Anyone interested in forming a computer club in Cornwall, catering mainly for PET, ZX80 and UK 101 computers should contact: M F Grove, 35 Causeway Head, Penzance, Cornwall.

Peterborough Computer Club. Recently formed, eets on first and third Mondays each month at Adult Education Centre, Brook Street, Peterborough. Contact: T Marchant, tel Peterborough 76681 after 6 weekdays, anytime weekends.

Computer Club. Business & Word Processor section meets Fridays 7.30, Scientific & Recreational Saturdays 10.00. Contact: L. Boxell, 8 Vane Terrace, Darlington. Tel: 0325 67766.

Southgate Computer Club. The club recently held its AGM and adopted a formal constitution. Annual subscription will be £2.50 from January 1981, including a club newsletter; full-time students under 18 pay half-cost. The club now has 83 members. Contact: Panos Koumi, Southgate Computer Club, 33 Chandos Avenue, London N14.

West London Personal Computer Club. Meets first Tues. each month at Willesden Technical College. Also visits, special int. groups, demos, problem surgeries. Contact: Graham Brain, 81 Rydal Cres, Perivale Middx, Tel: 01-997 8986

TRS80 User Club (Chelmsford). Now part of the National TRS80 User Club. Contact: Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

A Crawley computer club has recently been formed, open to anyone interested in personal computing, with or without computing facilities. contact either Mr J. Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex (Crawley 542509) — or — Mr J. M. Clarke, 31 Hyde Heath Court, Pound Hill, Crawley, West Sussex (Crawley 884207)

Birmingham Computer Club. To be formed shortly, catering for all micro users. Fortnightly meetings planned but venue not yet fixed. Contact: Dr M Bayliss, 021-743 7197.

Southampton Amateur Computer Club. Meets 8 pm 2nd Wed each month (not July — Sept) at Medical Science Building, Bassett Cres. East, Southampton. £3 pa, OAP, & students £2. Newsletter & special int. groups; 2 yrs old, 80 members soon setting up another club in Portsmouth area. Contact: P G Dorey, Dept Physiology, The University, Southampton SO9 3TU or Andy Low, Tel: (0703) 555 605 ext 34.

Springfield Computer Club. Special interest in Sorcerer but beginners and others welcome. Meetings 1st Friday monthly. Contact: Stephen Cousins, 1, Aldeburgh Way, Springfield, Chelmsford, Essex CM1 5PB. Tel: 0245 50155.

TRS80 User Club (Chelmsford). Now part of the National TRS80 User Club. Contact: Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

The Colchester Microprocessor Group. Meetings held at the University of Essex on the second and fourth Wednesdays of each month — 7.30 pm start. Membership is open to all, on payments of £5 annual sub (£1 for full-time students). Contact: the Information Centre at the University on the evening of the meeting.

NETWORK NEWS

Here is a list of all British (and one Dutch) personal computer networks. As more networks appear — and as more facilities are added to existing ones — we'll report them in this section, which appears monthly.

Forum-80 Hull. . . Operator: Frederick Brown, tel 0482 856169. Facilities: electronic mail, software up/down loading, Forum-80 Users' Group, PET users' section, shopping list. Hours: 7 days/week, midnight-0800, Tues & Thurs 1900-2200, Sat & Sun 1300-2200.

Forum-80 London. . . Operator: Leon Jay, tel 01-286 6207. Facilities: electronic mail, program downloading. Hours: Tues, Fri, Sat & Sun 1900-2300.

80-NET . . . Operators: Leon Heller & Brian Pain, National TRS-80 Users' Group, tel 0908 566660. Facilities: electronic mail, software for downloading, newsletter, TRS-80 information. Hours: 7 days/week, 1900-2200.

CBBS London. . . Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 010 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Friedrichshafen, W Germany	Euro Congress for Word Proc-Intertext. Contact: Int Bodensee-Messe, Meistershofener Str 25, 7790 Friedrichshafen.	21-25 Oct
Stuttgart, W Germany	Hobby Electronics & Minicomputers Exbn. Contact: CES, 01-236 0911	21-25 Oct
London	(Bloomsbury Centre) Computer Graphics Exbn. Contact: Online, 09274 28211	27-29 Oct
London	(West Centre Hotel) Viewdata Exbn. Contact: IPC Exbns, 01-643 8040	4-6 Nov
Cologne (W Germany)	Business Communications Congress & Trade Fair. Contact: Int Trade Fair Agencies 01-409 0956	4-6 Nov
Mexico city	Technology for the People Int Fair. Contact: TRTP, Casa Postale 187, 1215 Geneva, Switzerland	6-12 Nov.
Madrid, Spain	Int Office Equip & Computers Exbn. Contact: CITEMA, Plaza de conde de valle Suchil 8, Madrid 15	13-20 Nov
London	(Olympia) Computer Peripherals & Small Computer Systems exbn & conf.Contact: IPC exbns 01-643 8040	17-20 Nov
China (Guangzhou)	Word Processing Machinery, Equip & Technology exbn. Contact: Industrial & Trade Fairs Ltd 021-705 6707	4-8 Dec

CTUK! CENTRES

Here's an updated list of people organising ComputerTowns. Don't forget to enclose an SAE if you write to your nearest 'Town for details.

Lyn Antill,
1 Defoe House,
Barbican,
London

Peter J Kiff,
52 Stone Road,
Broadstairs,
Kent CT10 1DZ

Patrick Colley,
52 Queensway,
Caversham Park Village,
Reading,
Berks RG4 0SJ

Pete Shaw,
15 St Vincent Road,
Clacton-on-Sea,
Essex C015 1NA

Vernon Gifford,
111 Selhurst Road,
Croydon,
London SE25 6LH

David Tebbutt,
7 Collins Drive,
Eastcote,
Middx HA4 9EL

John Stephen Bone,
2 Claremont Place,
Gateshead,
Tyne & Wear NE8 1TL

Mike Baker,
5 Edinburgh Road,
Hanwell,
London W7 3JY

Pete Rowan,
10 Lambton Road,
Jesmond,
Newcastle-on-Tyne NE2 4RX

Steve Haynes,
5 Guinea Street,
Kingsholm,
Gloucester GL1 3BL

Ted Broadhead,
27 Cardinal Road,
Leeds LS11 8EY

Andrew Holyer,
10 Masons Field,
Mannings Heath,
Horsham, Sussex RH13 6JP

Brigitte Gorton,
18 Purbright Crescent,
New Addington,
Croydon CR0 0RT.

Steven Christian,
51 Burnstones,
West Denton,
Newcastle-on-Tyne NE5 2DF

Vernon Quaintance,
50 Beatrice Avenue,
Norbury,
London SW16 4UN

Bill Gibbings,
3 Longholme Road,
Retford,
Notts DN22 6TU

Philip Joy,
130 Rush Green Road,
Romford,
Essex.

Richard Powell,
22 Downham Court,
South Shields,
Tyne & Wear

Derrick Daines,
18 Cuttings Avenue,
Sutton in Ashfield,
Notts

Keith Taylor,
Carter Hydraulic Works,
Thornbury,
Bradford BD3 8HG

Alan S Waring,
50 Drayton Gardens,
Winchmore Hill,
London N21 2NS

Alan Northcott,
Rushmoor,
464 Reading Road,
Winnersh,
Wokingham,
Berks RG11 5ET

Alan Sutcliffe,
4 Binfield Road,
Wokingham,
Berks RG11 1SL

Tony Cartmell,
54 Foregate Street,
Worcester WR1 1DX

Tom Graves,
19a West End,
Street,
Somerset BA16 0LQ

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ZX81

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PET MACHINE LANGUAGE GUIDE
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PCW SUBSET

Alan Tootill presents more useful assembler — language subroutines. If you'd like to contribute your routines (for any of the popular processors), send them to: Sub Set, PCW, 14 Rathbone Place, LondonW1P 1DE.

Extra 6500 instructions

Many general-purpose routines are written to meet a need for instructions not provided in a processor's instruction set. ROTREX, our first Datasheet this month, from Dave Barrow of Hemsworth, offers no fewer than seven extra instructions to the 6502. Just think how many other useful instructions could be added to the 6502 and other popular processors! Then do it, and send the results to 'Sub Set'.

Datasheet

```
; = ROTREX — 6502 register rotate, transfer and exchange package.
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION:  TXY transfers index X to index Y.
;/                EXAY exchanges the accumulator and index Y.
;/                RRAXY rotates to the right the accumulator,
;/                      index X and index Y.
;/                TYX transfers index Y to index X.
;/                EXAX exchanges the accumulator and index X.
;/                RLAXY rotates to the left the accumulator, index
;/                      X and index Y.
;/                EXXY exchanges index X and index Y.
;/ ACTION: TXY Y ← X or
;/         EXAY A ⟷ Y or
;/         RRAXY ↳ A → X → Y┘ or
;/         TYX X ← Y or
;/         EXAX A ⟷ X or
;/         RLAXY └A←X←Y┐ or
;/         EXXY X ⟷ Y
;/ SUBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT:  None. A CALL is made to TXY, EXAY, RRAXY, TYX,
;/         EXAX, RLAXY or EXXY depending on the action required
;/ OUTPUT: As shown in ACTION plus normal N and Z flag informat-
;/         ion output for transfers. P is unaltered by rotates and
;/         exchanges.
;/ REGs USED: YP or AY or AXY or XP or AX or AXY or XY
;/ STACK USE: 4 in all cases
;/ LENGTH: 56
;/ TIME STATES: 72 or 68 or 65 or 68 or 64 or 59 or 42
;/ PROCESSOR: 6502
ROTREX EQU   $0100        ; for normal page one stack base.
TXY    TAY                ; Y ← A,A ← X, then A ⟷ Y.  A8
```

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```
        TXA                     ;                       8A
EXAY    PHP                     ;                       08
        SEC                     ; for XYAP restore.     38
        .BYTE   $2C             ; starts dummy instruction 2C
RRAXY   PHP                     ; (BIT $1808) to skip next
                                ; 2 bytes               08
        CLC                     ; for YXAP restore.     18
        PHA                     ; put A A X on stack & Y
                                ; into A.               48
        PHA                     ;                       48
        TXA                     ;                       8A
        PHA                     ;                       48
        TYA                     ;                       98
        CLV                     ;                       B8
        BVC     REPAST          ;                       50 0C
TYX     TAX                     ; X ← A,A ← Y, then A ←→X. AA
        TYA                     ;                       98
EXAX    PHP                     ;                       08
        CLC                     ; for YXAP restore.     18
        .BYTE $2C               ; starts dummy instruction 2C
RLAXY   PHP                     ; (BIT $3808) to skip
                                ; next 2 bytes          08
        SEC                     ; for XYAP restore.     38
        PHA                     ;                       48
        PHA                     ;                       48
        TYA                     ;                       98
        PHA                     ;                       48
        TXA                     ;                       8A
REPAST  TSX                     ; make X index stack and point BA
        INX                     ; to first A pushed.    E8
        INX                     ;                       E8
        INX                     ;                       E8
        STA     ROTREX,X        ; replace stacked A by X or Y. 9D 00 01
        BCC     YXAPO           ; jump if RRAXY or EXAX. 90 0D
XYAPO   PLA                     ; restore X Y A P with  68
XYAP1   TAX                     ; X getting X or Y,     AA
XYAP2   PLA                     ;                       68
XYAP3   TAY                     ; Y getting A,          A8
        PLA                     ; A getting what X didn't. 68
        PLP                     ;                       28
        RTS                     ;                       60
EXXY    PHP                     ; put P A Y X on stack and 08
        PHA                     ; restore Y X A P.      48
        TYA                     ;                       98
        PHA                     ;                       48
        TXA                     ;                       8A
        PHA                     ;                       48
YXAPO   PLA                     ; restore Y X A P       68
YXAP1   TAY                     ;                       A8
YXAP2   PLA                     ; X gets Y if EXXY      68
YXAP3   TAX                     ; X gets A if PRAXY or EXAX. AA
        PLA                     ;                       68
        PLP                     ;                       28
        RTS                     ;                       60
```

Byte-misers treat

Take a good look at the fifth byte of the ROTREX package. Here the program wants to jump over the next two bytes and, since the carry has just been set anyway, could BCS +2 (BO 02). But that takes two bytes of code, so the single byte 2C is used instead. This, with the next two bytes, forms the BIT $1808 instruction, which can alter the N, Z and Y flags of P without affecting the routine. The same byte-saving trick is used again at the 20th byte.

There are other byte-saving techniques possible with other processors. Send in any you can think of to Sub Set and we will put them all together.

Using Rotrex

Other useful 6502 'instructions' can be built up from the elementary functions in ROTREX. Dave Barrow sent

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three which, apart from the Z flag in the 16-bit case, return the correct status; something not done by the PHA, go-through-A, PLA method:

```
1) Transfer the stack pointer to index Y:
TSY     JSR     EXXY        ; save X in Y.
        TSX                 ; get SP
        INX                 ; past return
        INX                 ; address.
        JMP     EXXY        ; restore X, move
                            ; SP to Y & return.
2) Increment A:
INCA    JSR     EXAX        ; A to X preserving X.
        INX                 ; A + 1 not altering Cy or V.
        JMP     EXAX        ; restore A X & return.
3) Arithmetic shift left XY:
ASLXY   JSR     RRAXY       ; rotate Y into A.
        ASL     A           ; double it.
        JSR     RRAXY       ; rotate X into A.
        ROL     A           ; double + Cy from Y.
        JMP     RRAXY       ; rotate to correct
                            ; registers & return.
```

Now for M6800

Ron Yorston, from Reading, wanted instructions to push the index register onto the stack and pull it off again in his M6800 system. These next Datasheets from him, PUSHX and PULLX, do this and affect no other registers or flags. This means that a subroutine may begin by saving the IX register contents on the stack and end by pulling them off again, but still pass results to the calling program in the flags.

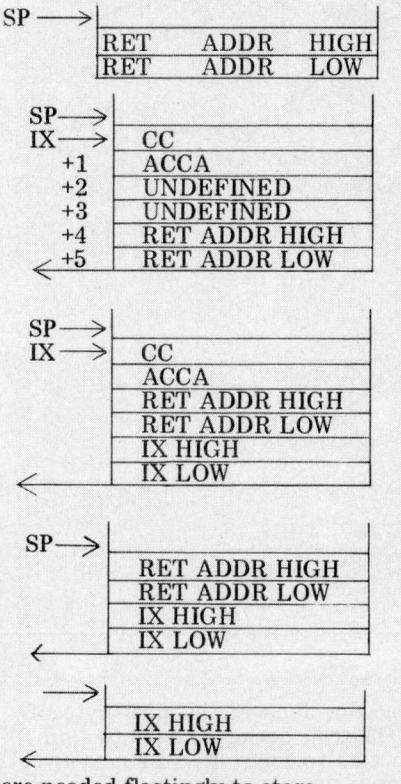
To help readers not too familiar with the M6800 processor, I have added detailed ACTION sections to the documentation. These could be replaced to show only the net effect of the routines thus:

For PUSHX: ↓ (IXL)
SP ← (SP) — 1
↓ (IXH)
SP ← (SP) — 1

For PULLX: SP ← (SP) + 1
↑ IXH
SP ← (SP) + 1
↑ IXL

Datasheet

```
;= PUSHX — Push the IX register
;/ CLASS: 2 (local RAM used fleetingly)
;/ TIME CRITICAL?: No
;/ DESCRIPTION: Pushes IX onto the stack without affecting other
;/              registers or flags.
;/ ACTION:
;/
;/          SP ← (SP) — 2
;/          ↓ (ACCA)
;/          SP ← (SP) — 1
;/          ACCA ← (CC)
;/          ↓ (ACCA)
;/          SP ← (SP) — 1
;/          I bit ← 1
;/          Memory ← (IXH)
;/          Memory + 1 ← (IXL)
;/          IX ← (SP) + 1
;/          ACCA ← (IX) + 4
;/          IX + 2 ← (ACCA)
;/          ACCA ← (IX) + 5
;/          IX + 3 ← (ACCA)
;/          ACCA ← (Memory)
;/          IX + 4 ← (ACCA)
;/          ACCA ← (Memory) + 1
;/          IX + 5 ← (ACCA)
;/          IXH — (IX) + 4
;/          IXL — (IX) + 5
;/          SP — (SP) + 1
;/          ↑ ACCA
;/          CC — (ACCA)
;/          SP ← (SP) + 1
;/          ↑ ACCA
;/          SP ← (SP) + 1
;/          ↑ PCH
;/          SP ← (SP) + 1
;/          ↑ PCL
;/ SUBr DEPENDENCE: None
;/ INTERFACES: Two bytes of RAM are needed fleetingly to store
;/              the original value of the IX register. The interrupt
;/              mask is set whilst this RAM is in use but a non-
;/              maskable interrupt could still affect the RAM. For
;/              PUSHX to be considered re-entrant, any NMI service
```



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```
;/                routine should not be allowed to affect the local
;/                RAM or call PUSHX.
;/ INPUT: None
;/ OUTPUT: The contents of IX are stored on the stack and the
;/          stack pointer is decremented twice.
;/ REGs USED: None
;/ STACK USE: 4
;/ LENGTH: 35
;/ TIME STATES: 95
;/ PROCESSOR: M6800
PUSHX:  DES              ; make space on stack.      34
        DES              ;                           34
        PSH     A        ; preserve ACCA             36
        TPA              ; and CC.                   07
        PSH     A        ;                           36
        NOP              ; to ensure SEI effected    01
        SEI              ; turn off interrupts       OF
        STX     LRAM     ; store X temporarily.      FF XX XX
        TSX              ; point to stack with X.    30
        LDA     A 4, X   ; move return              A6 04
        STA     A 2,X    ; address                  A7 02
        IDA     A 5, X   ; on                       A6 05
        STA     A 3, X   ; stack.                   A7 03
        LDA     A LRAM   ; put                      B6 XX XX
        STA     A 4, X   ; X register               A7 04
        LDA A LRAM + 1   ; on                       B6 XX XX
        STA     A 5, X   ; stack.                   A7 05
        LDX     4,X      ; regain A and CC.         EE 04
        PUL A            ;                          32
        TAP              ;                          06
        PUL A            ;                          32
        RTS              ;                          39
```

Datasheet

```
; = PULLX — Pull the IX register
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION: Pulls IX off the stack without affecting other
;/              registers or flags.
;/ ACTION: ↓ (ACCA)
;/         SP ← (SP) — 1
;/         ↓ (ACCB)
;/         SP ← (SP) —1
;/         ACCA ← (CC)
;/         ↓ (ACCA)
;/         SP ← (SP) —1
;/         IX ← (SP) + 1
;/         ACCA ← (IX) +3
;/         ACCB ← (IX) +5
;/         IX + 5 ← (ACCA)
;/         IX + 3 ← (ACCB)
;/         ACCA ← (IX) + 4
;/         ACCB ← (IX) + 6
;/         IX + 6 ← (ACCA)
;/         IX + 4 ← (ACCB)
;/         IXH ← (IX) + 3
;/         IXL ← (IX) + 4
;/         SP ← (SP) + 1
;/         ↑ ACCA
;/         CC ← (ACCA)
;/         SP ← (SP) + 1
;/         ↑ ACCB
;/         SP ← (SP) + 1
;/         ↑ ACCA
;/         SP ← (SP) + 3
;/         ↑ PCH
```

SP →		
IX →	CC	
+1	ACCB	
+2	ACCA	
+3	RET ADDR HIGH	
+4	RET ADDR LOW	
+5	IX HIGH	
+6	IX LOW	

SP →		
IX →	CC	
+1	ACCB	
+2	ACCA	
+3	IX HIGH	
+4	IX LOW	
+5	RET ADDR HIGH	
+6	RET ADDR LOW	

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```
;/              SP ← (SP) + 1
;/              ↑ PCL
;/ SUBr DEPENDENCE:  None
;/ INTERFACES: None
;/ INPUT: None
;/ OUTPUT: The IX register is loaded from the stack and the
;/              stack pointer is incremented twice.
;/ REGs USED: None
;/ STACK USE: 3
;/ LENGTH: 30
;/ TIME STATES: 95
;/ PROCESSOR: M6800
PULLX:  PSH     A           ; save A B.                 36
        PSH     B           ;                           37
        TPA                 ; save condition codes.     07
        PSH     A           ;                           36
        TSX                 ; point to stack with X.    30
        LDA     A 3,X       ; switch IX, Ret addr on stack. A6 03
        LDA     B 5,X       ;                           E6 05
        STA     A 5,X       ;                           A7 05
        STA     B 3,X       ;                           E7 03
        LDA     A 4,X       ;                           A6 04
        LDA     B 6,X       ;                           E6 06
        STA     A 6,X       ;                           A7 06
        STA     B 4,X       ;                           E7 04
        LDX     3,X         ;                           EE 03
        PUL A               ; restore condition codes.  32
        TAP                 ;                           06
        PUL     B           ; restore A B.              33
        PUL     A           ;                           32
        INS                 ; fix                       31
        INS                 ; stack                     31
        RTS                 ;                           39
```

Z80 improvements

One of the reasons for printing your routines is for others to try them out and suggest improvements. In the July issue, in the penultimate item, we gave a few lines of code, SAY, for allowing output messages to be set in the code at the place where they are invoked. This code has been criticised with some ferocity by Andrew Bain of Welwyn Garden City, for needlessly destroying the contents of HL and A. He suggests:

```
SAY:    EX      (SP),HL     E3
        PUSH    AF          F5
SLP:    LD      A,(HL)      7E
        INC     HL          23
        CP      "\          FE 5C
        JR      Z,EXIT      28 05
        CALL    OUT         CD XX XX
        JR      SLP         18 F5
EXIT:   POP     AF          F1
        EX      (SP),HL     E3
        RET                 C9
```

This merits documenting into a Datasheet, but I am running out of space and so leave it to you.

To make the string match, CPSTR, in the same issue, position-independent, both David Yeomans of Halifax and Roger Hargrave of Crawley suggest:

```
CPSTR:  LD      A,(DE)      1A
        INC     DE          13
        CPI                 ED A1
        RET     NZ          C0
        RET     PO          E0
        JR      CPSTR
```

Simon Sellick of Pershore thought a string length limit (in register B) of 256 bytes adequate, and gave this:

```
CPSTR:  LD      A,(DE)      1A
        CP      (HL)        BE
        RET     NZ          C0
        INC     HL          23
        DJNZ    CPSTR       10 F9
        RET                 C9
```

CP/M file-name checks

Simon Sellick also sent a string compare routine, SUBP, which edits strings according to the following rules:
1. The first byte must be an ASCII upper-case letter.
2. Remaining bytes must be either ASCII digits or ASCII upper-case letters.
3. Trailing spaces are added to the string to the length specified.

This might seem to have rather limited application, but Simon finds it can be used to avoid CP/M's unhappy knack of allowing the creation of in-

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valid file names which cannot then be destroyed using CP/M because the name doesn't follow the above rules. Not all Z80 systems support CP/M (and disks) but the day might not be far off when they will. I, for one, have applied for an increase in my Barclaycard credit limit, just in case there is any truth in these stories about Osborne's computer.

Datasheet

```
;= SUBP — CP/M File Name Check
;/ CLASS: 1
;/ TIME CRITICAL: No
;/ DESCRIPTION: Tests that a string consists of a leading upper-
;/                 case ASCII letter + a number of upper-case
;/                 ASCII letters or digits and fills to the specified
;/                 length with trailing spaces.
;/ ACTION: See listing comments.
;/ SUBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT:   HL points to the first byte of the string
;/          B contains the actual length of the string
;/          C contains the required string length
;/ OUTPUT:The result of the edit is in Z, C and HL.
;/          If the carry is set
;/          Then if the Z flag is set
;/                  Then a character at (HL) is bad.
;/                  Else B and C parameters are incompatible.
;/          Else the string at (HL) is good and space-filled.
;/          Endif
;/ REGs USED:     AF BC HL
;/ STACK USE: 2
;/ PROCESSOR: Z80
SUBP:   LD   A,C      ; return if                    79
        CP   B        ; actual string length         B8
        RET  C        ; < required length            D8
        PUSH HL       ; save string pointer.         E5
        LD   A,(HL)   ; get 1st byte.                7E
        JR   SBP2     ; jump to test for ASCII u.c.  18 09
SBP1:   LD   A,(HL)   ; get next byte.               7E
        CP   "0       ; jump out as error            FE 30
        JR   C,SBP7   ; if < 1st ASCII digit.        38 1C
        CP   ":       ; jump to accept               FE 3A
        JR   C,SBP3   ; if last ASCII digit.         38 08
SBP2:   CP   "A       ; jump out as error            FE 41
        JR   C,SBP7   ; if < 1st ASCII u.c. letter.  38 14
        CP   "[       ; jump out as error-           FE 5B
        JR   NC,SBP7  ; if > last ASCII u.c. letter. 30 10
SBP3:   INC  HL       ; point to next byte.          23
        DEC  C        ; decrement trailing space cnt.0D
        DJNZ SBP1     ; & edited bytes count until 0.10 EB
        INC  C        ;                              0C
        LD   B,C      ; pre-decrement in             41
        JR   SBP5     ; case no spaces required.     18 03
SBP4:   LD   (HL)," " ; put space in next byte.      36 20
        INC  HL       ;                              23
SBP5:   DJNZ SBP4     ; repeat until trailing space  10 FB
SBP6:   POP  HL       ; count 0. Restore pointer.    E1
        OR   A        ; reset C.                     B7
        RET           ;                              C9
SBP7:   INC  SP       ;                              33
        INC  SP       ; 'loose' saved pointer.       33
        XOR  A        ; set Z to show bad character. AF
        SCF           ; set C to show error.         37
        RET           ;                              C9
```


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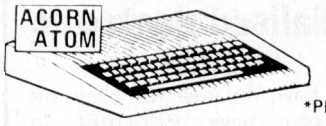

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LEISURE LINES

by J J Clessa

There was a very good response to the August puzzle — about 200 entries were received. Most of these had the correct answer. Many had used micros and calculators for solution but some had found analytical methods by which the problem could be solved. The correct answer, to the nearest second, is 142, ie 2m 22s.

The randomly-plucked winning entry came from Stephen Grant of Horsham in Sussex. Nice going, Stephen! Your prize will soon be winging its way to sunny Sussex.

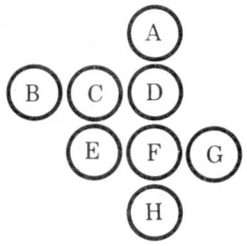
Quickie

No answer, no prizes. There is one word on this page which is not spelt correctly — can you find it?

Prize puzzle

An exercise in logic this month.

1. There are eight pens, A to H as shown, and each pen contains either a cow, a horse, a pig or a sheep.



2. At least one of each type of animal is present.
3. At least the pig is penned between two cow pens.
4. Every horse is penned between two pig pens.
5. No cow is penned next to a horse.
6. There is only one sheep, and its pen is not next to that of a pig.
7. At least two pig pens are contiguous.

Which pen is the sheep in?

Answers on *postcards*, please, to arrive not later than 30 November, to: November Prize Puzzle, Leisure Lines, *PCW*, 14 Rathbone place, London W1P 1DE.

PROGRAMS

TRS-80 Sheepdog Trial

by Simon Williams

This is written in Level II Basic and takes up about 8k of RAM. All the instructions are contained within the program. Note that the '^' character denotes a space.

```
10 GOTO 200
19 '*** MOVE SHEEPDOG
20 I=VAL(INKEY$): IF I<1 OR I>9 GOTO 20
30 DV=DX+DM(0,I-1):DW=DY+DM(1,I-1):DP=P+DW+DV
40 L=-2: U=2: IF DM(1,I-1)=0 IF DM(0,I-1)=-3 U=0 ELSE IF DM(0,I-1)=3 L=0
50 OF=0: FOR N=L TO U: IF PEEK(DP+N)>32 AND PEEK(DP+N)<>128 OF=1
60 NEXT: IF OF=0 AND DV>1 AND DV<62 AND DW>=0 AND DW<1024 PRINT@DY+DX-2,B$;:
   PRINT@DW+DV-2,D$;: DX=DV: DY=DW
99 '*** MOVE SHEEP
100 FOR N=0 TO K: SD(N)=SQR((ABS(DX-SX(N))/3)↑2+(ABS(DY-SY(N))/64)↑2)
110 IF SD(N)>3 SD(N)=0: NEXT ELSE NEXT
120 IF SD(0)+SD(1)+SD(2)=0 C=C+1: IF C>SL AND S>0 S=20-(C-SL)/3: RETURN ELSE
    RETURN
130 IF SD(0)>SD(1) IF SD(0)>SD(2) M=0 ELSE M=2 ELSE IF SD(1)>SD(2) M=1 ELSE M=2
140 SX=SX(M)+SGN(DX-SX(M))*-3: SY=SY(M)+SGN(DY-SY(M))*-64: SP=P+SX+SY
150 L=-2: U=1: IF SY=SY(M) IF SX-SX(M)=-3 U=0 ELSE IF SX-SX(M)=3 L=0
160 OF=0: FOR N=L TO U: IF PEEK(SP+N)>127 OF=1
170 NEXT: IF OF=0 AND SX>XL AND SX<59 AND SY>63 AND SY<960 PRINT@SY(M)+SX(M)-2,
    B1$;: PRINT@SY+SX-2,S$;: SX(M)=SX: SY(M)=SY
180 SD(M)=0: GOTO 120
199 '*** INITIALISE
200 DEFINT A-Z: DIM DM(1,8),SD(2),SX(2),SY(2): FOR M=0 TO 1: FOR N=0 TO 8: READ
    DM(M,N): NEXT N,M
210 DATA -3,0,3,-3,0,3,-3,0,3,64,6[illegible]4,0,0,0,-64,-64,-64
220 B$="^^^^^^": B1$="^^^^^^": S$=CHR$(131)+CHR$(175)+CHR$(143)+C[illegible]175)
230 D$=CHR$(131)+CHR$(173)+CHR$(140)+CHR$(156)+CHR$(129): P=15[illegible]: K=0
299 '*** TITLE GRAPHICS
300 CLS:FOR M=1 TO 40: READ X,Y,Z: FOR N=X TO Y: SET(N,Z): NEXT N,M
310 DATA 10,25,12,10,25,13,58,73,12,58,73,13,82,97,12,82,97,13,106,117,12,106,
    117,13,10,21,16,10,21,17,34,45,16,34,45,17,58,67,16,58,67,17,82,91,16,82,91,
    17,106,117,16,106,117,17,6,21,20,6,21,21,58,73,20,58,73,21,82,97,20,82,97,21
320 DATA 10,15,24,26,31,24,40,45,24,58,67,24,74,79,24,94,99,24,16,17,25,46,47,25
    44,47,28,74,79,28,94,99,28,16,17,31,12,15,32,26,31,32,40,45,32,108,115,32
330 FOR M=1 TO 30: READ X,Y,Z: FOR N=X TO Y: SET(Z,N): SET(Z+1,N): NEXT N,M
340 DATA 12,17,6,12,17,8,16,21,22,16,21,24,12,21,30,12,21,32,12,21,46,12,21,48,
    12,21,54,12,21,56,12,21,78,12,21,80,12,21,102,12,21,104,12,17,118,12,17,120
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PROGRAMS

```
350 DATA 24,32,10,26,30,18,25,31,24,25,31,32,25,31,38,29,31,46,25,32,62,24,32,
    72,25,27,80,29,32,80,24,32,86,25,32,92,25,32,100,24,32,106
360 PRINT@723,"COPYRIGHT 1981, S.WILLIAMS"
370 SX(0)=47: SY(0)=128: DX=56: DY=128: I=4: FOR X=1 TO 7: GOSUB 30: NEXT
380 I=7: GOSUB 30: I=1: GOSUB 30: FOR X=207 TO 216: PRINT@X,"-";: NEXT
390 K=2: C=0: FOR N=1 TO 1000: NEXT
399 '*** INSTRUCTIONS
400 CLS: PRINT@25,"SHEEPDOG TRIAL"
410 FOR N=89 TO 102: PRINT@N,CHR$(131);: NEXT
420 PRINT@130,"THE IDEA OF THE GAME IS TO DIRECT A SHEEPDOG "D$" TO GUIDE↓
    ^^^THREE SHEEP "S$" THROUGH AND AROUND A SERIES OF OBSTACLES↓
    ^^^DEPICTED ON THE SCREEN. THE CONTROLS FOR THE SHEEPDOG ARE"
430 PRINT"^^AS SHOWN WITH, FOR INSTANCE, THE '8' MOVING THE DOG^^7^^8^^9↓
    ^^UP THE SCREEN AND THE '6' MOVING IT TO THE RIGHT.^^^^4^^5^^6↓
    ^^THE '5' CAUSES THE DOG TO STAND STILL. THE SHEEP^^^^^1^^2^^3"
440 PRINT"^^^WILL ONLY MOVE WHEN PROMPTED BY THE PROXIMITY OF THE DOG.↓
    ^^THE COURSE IS DIVIDED INTO 4 SECTIONS, EACH WITH AN OBSTACLE↓
    ^TO GUIDE THE SHEEP THROUGH OR AROUND. POINTS ARE DEDUCTED FROM"
450 PRINT"^^^A MAXIMUM SCORE IN EACH SECTION FOR AN EXCESSIVE NUMBER OF↓
    ^MOVES. THE COURSE IS SHOWN IN AN INSET IN THE TOP LEFT OF THE↓
    ^^^^SCREEN. AVOID CORNERS, ALTHOUGH THE SHEEP CAN ALWAYS BE"
460 PRINT"^^^^^^^^^^^RETRIEVED. GUIDE THEM INTO THE PEN TO FINISH.↓
    ^^^^^^^^^^^^^^^^^^^^^PRESS SPACE BAR TO START";
470 IF INKEY$<>" " GOTO 470
499 '*** SECTION 1
500 CLS: S=20: XL=19: SL=24
510 FOR M=0 TO 320 STEP 64: FOR N=0 TO 15: READ D: PRINT@M+N,CHR$(D);: NEXT N,M
520 DATA 51,150,179,179,179,147,137,144,32,32,160,140,140,32,45,170,32,149,72,
    69,68,71,69,170,160,168,161,71,65,84,69,170,176,178,179,179,147,169,32,170,
    32,130,164,176,176,144,32,170
530 DATA 70,79,82,68,130,164,133,170,84,82,69,69,42,162,132,170,52,80,69,78,136,
    133,137,144,131,131,131,131,131,129,50,170,131,131,131,131,131,131,131,131,
    131,131,131,131,131,131,131,131
540 PRINT@390,"SECTION 1";: PRINT@448,"SECTION SCORE"S;: PRINT@512,"RUNNING
    SCORE"PS;
550 DX=55: SX(0)=43: SX(1)=46: SX(2)=52: DY=128: SY(0)=128: SY(1)=256: SY(2)=320
560 PRINT@546,CHR$(152);CHR$(149);: PRINT@559,CHR$(152);CHR$(149)
570 PRINT@609,CHR$(191);CHR$(134);: PRINT@622,CHR$(191);CHR$(134)
580 PRINT@165,S$;: PRINT@300,S$;: PRINT@370,S$;: PRINT@181,D$;
590 GOSUB 20
600 FOR N=0 TO 2: IF SX(N)>34 AND SX(N)<46 AND SY(N)=576 AND S(N)=0 S(N)=
610 NEXT: PRINT@461,S;
620 IF S(0)=0 OR S(1)=0 OR S(2)=0 OR SY(0)<768 OR SY(1)<768 OR SY(2)<768 OR DY<
    640 GOTO 590
630 FOR N=1 TO 500: NEXT: C=0
699 '*** SECTION 2
700 RS=S: S=20: SL=28: PRINT@398,"2";: PRINT@461,S;: PRINT@525,RS; STRING$(40,
    32); PRINT
710 PRINT@DX+DY-2,B$;: DY=DY-640: PRINT@DX+DY-2,D$;
720 FOR N=0 TO 2: PRINT@SX(N)+SY(N)-2,B1$;: SY(N)=SY(N)-640: PRINT@SX(N)+SY(N)
    -2,S$;: S(N)=0
730 FOR M=512 TO 704 STEP 64: FOR N=37 TO 42: READ D: PRINT@M+N,CHR$(D);: NEXT
    N,M
740 DATA 32,176,164,164,136,144,138,152,187,185,155,166,32,130,32,191,32,129,32,
    32,152,143,145,32
750 GOSUB 20
760 FOR N=0 TO 2: IF SX(N)=40 AND SY(N)>704 AND S(N)=0 S(N)=1
770 NEXT: PRINT@461,S;
780 IF S(0)=0 OR S(1)=0 OR S(2)=0 OR SY(0)>255 OR SY(1)>255 OR SY(2)>255 OR DY>
    383 GOTO 750
790 FOR N=1 TO 500: NEXT: C=0
799 '*** SECTION 3
800 RS=RS+S: S=20: SL=51: PRINT@398,"3";: PRINT@461,S;: PRINT@525,RS;STRING$(30,
    32): PRINT: PRINT: PRINT
810 PRINT@DX+DY-2,B$;: DY=DY+640: PRINT@DX+DY-2,D$;
820 FOR N=0 TO 2: PRINT@SX(N)+SY(N)-2,B1$;: SY(N)=SY(N)+640: PRINT@SX(N)+SY(N)
    -2,S$;: S(N)=0: NEXT
830 FOR M=256 TO 320 STEP 64: FOR N=30 TO 49: READ D: PRINT@M+N,CHR$(D);: NEXT
    N,M
840 DATA 150,158,166,154,166,166,166,172,139,178,166,165,153,153,155,158,178,
    166,150,148,138,32,32,133,32,129,133,130,32,130,32,129,32,133,130,138,32,
    133,130,32
850 GOSUB 20
860 FOR N=0 TO 2: IF SX(N)=40 AND SY(N)<256 AND S(N)=0 S(N)=1
870 NEXT: PRINT@461,S;
880 IF S(0)=0 OR S(1)=0 OR S(2)=0 OR SY(0)<768 OR SY(1)<768 OR SY(2)<768 OR DY<
    640 GOTO 850
890 FOR N=1 TO 500: NEXT: C=0
899 '*** SECTION 4
900 RS=RS+S: S=20: XL=7: SL=21: PRINT@398,"4";: PRINT@461,S;: PRINT@525,RS;:
    PRINT@286,STRING$(20," ");: PRINT@350,STRING$(19," ");
910 PRINT@DX+DY-2,B$;: DY=DY-640: PRINT@DX+DY-2,D$;
920 FOR N=0 TO 2: PRINT@SX(N)+SY(N)-2,B1$;: SY(N)=SY(N)-640: PRINT@SX(N)+SY(N)
    -2,S$;: S(N)=0: NEXT
930 FOR N=0 TO 9: READ D: PRINT@652+N,CHR$(D);: PRINT@908+N,CHR$(D);: NEXT
940 FOR N=723 TO 851 STEP 64: PRINT@N," ";: NEXT: DATA 151,131,131,151,131,131,
    151,131,131,149,
950 FOR Y=33 TO 41: SET(24,Y): NEXT: PRINT@1007,CHR$(188);CHR$(176);
960 FOR X=34 TO 62 STEP 2: READ D: FOR Y=D TO D+2: SET(X,Y): SET(X+1,Y): NEXT
    Y,X
970 FOR X=80 TO 92 STEP 2: READ D: FOR Y=D TO D+2: SET(X,Y): SET(X+1,Y): NEXT
    Y,X
980 DATA 21,21,21,22,22,22,22,23,23,23,24,25,26,27,27,39,40,41,42,43,44,45
990 PRINT@672,"**";: PRINT@738,"**";: PRINT@805,"**";
1000 GOSUB 20
```


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PROGRAMS

```
1010 FOR N=0 TO 2: IF SX(N)>14 AND SX(N)<20 AND SY(N)>639 AND SY(N)<896 AND S(N)
     =0 S(N)=1
1020 NEXT: PRINT@461,S;
1030 IF S(0)=0 OR S(1)=0 OR S(2)=0 GOTO 1000
1099 '*** FINISH/REPLAY
1100 PRINT@97,"YOU HAVE COMPLETED THE COURSE";
1110 PRINT@164,"WITH A TOTAL OF"RS+S"POINTS.";
1120 PRINT@239,"AGAIN (Y OR N)?";
1130 I$=INKEY$: IF I$="N" CLS: END ELSE IF I$<>"Y" GOTO 1130
1140 RESTORE: FOR N=1 TO 228: READ D: NEXT: GOTO 500
```

ZX81 Sun and Planets

by C Ward

This program calculates the day-by-day positions of the inner planets relative to the Sun; day zero is 1 January 1980.

```
 10 LET A=327.95626
 20 LET B=0
 30 LET C=-258.47927
 40 LET D=-135.14322
 45 PLOT 30,20
 46 PRINT "SUN"
 50 PLOT 30+SIN(A/180*PI)*20,20
    +COS(A/180*PI)*20
 60 PRINT "MARS"
 61 PLOT 30+SIN(B/180*PI)*13.180432,20
    +COS(B/180*PI)*13.180432
 65 PRINT "EARTH"
 70 PLOT 30+SIN(C/180*PI)*9.5330396,20
    +COS(C/180*PI)*9.5330396
 75 PRINT "VENUS"
 80 PLOT 30+SIN(D/180*PI)*5.1013216,20
    +COS(D/180*PI)*5.1013216
 85 PRINT "M"
 90 LET A=A-0.5240327
100 LET B=B-0.98561
110 LET C=C-1.6021291
120 LET D=D-4.0923507
130 PAUSE 40
140 CLS
150 GOTO 45
```

CHESS FINAL'81

Continued from page 101

search with the killer heuristic and employs selective 'pruning' of the tree. The amount of 'pruning' is increased in complex situations to keep the thinking time reasonably constant. Cyrus examines about 200 positions a second and includes an allowance for future captures in each assessment.

Cyrus is the result of about six months spare time work by its author. Version 2 is currently being planned and will be considerably stronger.

Three points are worth stressing here: firstly, Cyrus only uses around 7k whereas all the other computers use considerably more: Logichess 2.1 uses 26k for instance. Secondly, version 2 promises to be stronger. M Stean, one of England's International Grand Masters discussed Cyrus's games with the author, finding them most impressive. He estimated the strength of Cyrus to be around 170 on the BCF grading scale (equal to about 1960 on the international list). If Cyrus is really this strong now what will it be like when improved?

Finally, Cyrus is in fact a better player than its author!

Clearly most people would like to know how Cyrus would fare against the best commercially available computers and how it would stand up to human opposition. I am afraid we will have to wait a while before that can be answered. No doubt all the big names will be competing for the World Micro Computer Chess Championship (to be held in Hamburg, 21-29 September.) Unfortunately, Cyrus will not be taking part. Still, there is no doubt everyone interested in chess programs is going to hear a lot about Cyrus in the coming months.

Thanks must go to the organising committee, D Levy, K O'Connell, *PCW*, the tournament director, Peter Morrish, Stewart Reuben (FIDE International Arbiter) and Graham Lee. Kaane Danielsen would like to thank Dylan Harris and John John Jones of Thames Polytechnic for operating his program and Nascom for loaning the machine on which it ran. Thanks also to Cetronic for supplying the mains conditioners.

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Continued from page 145

Software

The Casio Basic is closer to 'normal' Basic than that used by the Sharp, which is both good and bad news since some of the more unorthodox features of the Sharp Basic, such as GOTO (string variable) and IF (string variable) are useful and attractive.

The 702 Basic has its high points too, though. One and two dimensional arrays (up to 200 elements) are catered for and they may be numeric or string arrays (or mixed if you can stay in control of your subscripts). Strings may be stored in the usual string variables A$,B$ etc (seven characters max) or in a special 30 character variable called $. The string functions LEN() and MID() are supported, but MID(n,m) only works on the contents of $. String addition is allowed.

No fewer than six sorts of variable names are allowed; A-Z are the 26 fixed registers, A0 to A9 through T0-9 are the 200 user assigned variables and A(n) is the form for array variables plus their string equivalents. Thus A(10) is the same register as B0, and A(18,7) is the same as S7. As on the Sharp, A and A$ cannot be defined simultaneously.

'Key' is the equivalent of the keyboard GET; when used in a loop it waits for a character from the keyboard, which allows input to start execution without a return. Good news for interactive games fans! WAIT is a programmable pause which determines how long a PRINT statement will display its output — from 0.05 to 50 seconds.

CSR is equivalent to TAB and specifies the place in the display at which a printed result will appear. CSR and the PRT (PRINT) instruction with which it is used can both accept an expression for their argument, which is a nice touch allowing all sorts of dynamic displays to be set up.

GOTO and GSB may both take a numeric variable or any expression as argument to allow indirect jumps; both may also specify a P register. Subroutines are nestable to ten levels, and FOR. . . NEXT to eight. The conditional IF may be followed by THEN and a line number (direct or indirect) or by ; and a command or assignment. The biggest omission in this otherwise remarkably comprehensive Basic is that no Boolean operators are included; the Sharp by contrast has full Boolean logic and advanced programmers may well miss them. You pays your money and takes your choice: string functions or Boolean operators.

Bulk storage

The 702p stores onto cassette using the same adaptor (FA-2) as the 602. I don't have one and so cannot report directly on cassette storage. Programs are SAVEd by filename; individual P registers can be saved and loaded. Chaining is automatic; a program can be chained or overlaid from tape by suitable choice of line numbers. Data is transferred by PUT and GET and individual blocks of variables may be saved. Remote control of a suitable recorder is provided for. All this is gleaned from the manual, which is no better than we have come to expect from Casio and quite unintelligible in places. The program library is the standard Casio issue, the same programs from the 502 and 602 libraries translated into Basic.

Benchmarks and conclusions

I applied my new standard Benchmark (see Calc Corner, Sept) to the 702 and my earlier suspicion was confirmed: it is very fast, as fast, in fact, as the 602p which is my current record holder. This is quite remarkable, given that it uses interpreted Basic, and is in stark contrast to the Sharp. I print the full table of Benchmarks again, since I have now performed the Sharp test myself instead of using *Microcomputing*'s figures.

To summarise, I liked this machine a lot. Only the fact that I had a broken wrist at the time of writing stopped me sitting up all night with it; the features are such that several months would be necessary to really plumb its depths. It has all the ergonomic features which

Machine	Time taken (secs)	Memory used	% of total memory
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Casio 702p	20	77 steps	4.6

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EURO MICROMOUSE '81

Continued from page 126

the *PCW* Show competition will be attended by American mice. The state-of-play in America, as far as micromice are concerned, is not really too clear but maybe a well-sponsored event will bring some interest in the competition alive in its birthplace.

Some aspects of the competition will have to be amended. Mice are getting quite intelligent and very fast. Whether cross-overs will be allowed, or some restrictions on how they are built, or even cost-limits imposed is still up in the air. What is clear, though, is that interest in this rather amusing aspect of robotics and artificial intelligence is growing and some of the spin-offs will probably be applicable to more serious situations in the home, with handicapped people, and even in industry.

If you are interested in knowing more about the competition — or micromice in general — contact: John Billingsley, Department of Electronics, Portsmouth Poly, Anglesea Road, Portsmouth. For more information about the London Computer Fair Trials contact: Fred Linger, c/o East London Amateur Computer Club, 82 The Drive, Ilford, Essex.

INTERRUPT

Continued from page 142

growing imbalance by at least informing the haves about the potential plight of the have-nots, and of the further potential conflict that poses for the entire society, which the riots in Britain signal.

I have once again, as I did earlier for Britain, painted a dismal scenario which seems to indicate that the present course of events is ensuring that, in its social impact, microtechnology will model itself after that fundamental technology, the development of writing, and will lead toward a more hierarchical and polarised society. Next month I shall investigate the origins of hope that ComputerTown UK! brought flickering from that earlier scene: the elusive ComputerTown USA!

SHARP IQ3100 MICROTRANSLATOR

Continued from page 115

its features novel, but in my opinion it is streets ahead of the opposition, both in design and price. The Graig and Lexicon machines are not the sort of thing an executive wants to take onto an aeroplane, at least in the first-class section. Moreover, they and the Oddpod, which is very similar to the IQ-3100, cost well over £100.

Finally, should you wait until machines that are cheaper/actually translate/play Space Invaders come along before you buy? I used to work on machine translation myself and now, as part of my normal job, I follow the Japanese technical press, including personal computer magazines. Nothing I have gleaned leads me to believe there will be any drastic new developments in the near future — but as a linguist who's had to translate phrases like 'of the' at least a billion times, I'd love to be proved wrong.

A review of Graig and Lexicon machines appeared in *PCW* December 1979. The only work on translation using personal computers that I know of was a French-English/English-French Dictionary program in Basic that appeared in *Byte* January 1980, pp. 206-208. Thanks are due to Sharp in Manchester for the loan of the review IQ3100, but sets are at present only available from PHS Nelson Ltd of Burnley, who have bought the entire UK stock.

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BANKS' STATEMENT

Continued from page 69

The four prongs are constituted of both internal and external selling. Internally, special groups are being established within the company to sell the system direct to end users (this will presumably largely hinge around the system's 3270 emulation capacity as well as, in the longer term, the company's interest in local area networking). Not unnaturally, it is also selling the system through its own 'shops'.

Externally it has gone for two major retail chains. In the specialist computer area it has selected the Computerland chain, with some 160 outlets nationwide. The other is Sears, Roebuck & Co, one of *the* major chains (like Marks & Spencer with knobs on), which is setting up a business systems selling operation in selected stores. With this range of outlets, it should be able to sell to all potential users of such a widely applicable machine.

Another possible reason for restricting itself to the US only is that it may well not have the expertise yet to manage the European market. Unlike the US, European distribution is a mishmash of local dealers and distributors, with no clear-cut national names like Computerland in the US (not here, there: to save D Broad suing me).

To penetrate this market, IBM will have to deal with the local dealers. Though it has its own shops, in the UK for example (all two of them), the individual retail companies will have to handle the system for IBM to achieve significant penetration. So, before it attacks Europe, the company can be expected to set up some form of internal distribution group or company to manage the operation. This, then, will deal with the dealers. The chosen few, at a guess between 30 and 50 of them around the UK, will be getting the equivalent of a million Michelin stars.

But that is enough about IBM in particular, and the other leviathans in general. What is their collective entry liable to do to the 'minnows', the companies that started the whole goddam business in the first place? There are two generalised schools of thought here, and at present it is hard to choose between them. The first is that the 'credibility' they will give to the overall market will expand it considerably, and that all present will be able to take their share. The second is that the minnows will be effectively mangled and trodden underfoot.

In practice, there is liable to be a mixture of the two. Certainly there will be added credibility for the microcomputer market. Everyone has heard of IBM, even my Auntie Vera, and knows that they make computers (which do great harm to gas bills — and other horror stories). Some of the original manufacturers, however, are liable to suffer.

These will no doubt include some of the smaller companies, though if they are sensible, they will 'cherry pick' applications areas or provide other specialist reasons for users to keep them in business. The main sufferers could well be those companies that are now at the top of the microcomputer pile — companies like Apple, Tandy and Commodore. Apple could suffer because it is narrowly based, having been built up solely out of the micro business. It is, however, the darling of Wall Street, and the rumours about Apples IV and V show it is still developing new products. Tandy is, well Tandy, a very large and broadly based company.

But Commodore? Well, the PET is now long in the tooth, and it is significant that new PET-based products marketed by Commodore are not all developed by Commodore. They could be a favourite for something, which could range from a new system, via a takeover, to demise.

BLUDNERS

An entire line seems to have fallen off the very bottom of page 54 last month's 'Newsprint' — the fine (the last on the page) should have read: 'With the decision to sell. . .' And heavens knows how, but the headlines in 'Leisure Lines' became Transposed so that what should have been the Quickie became the Prize Puzzle, and vice versa.

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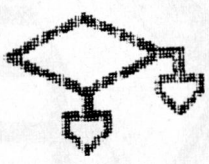

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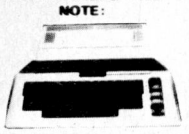

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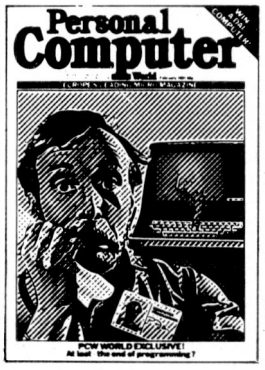

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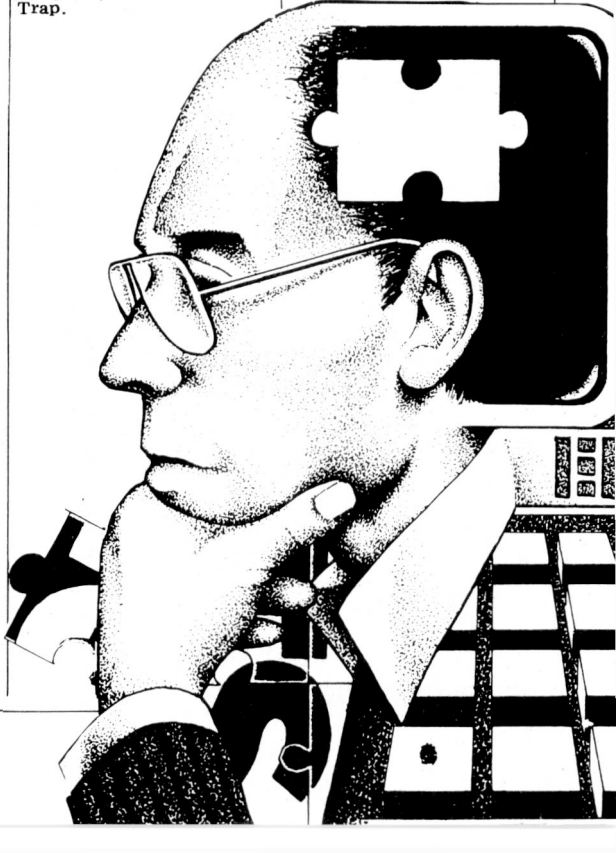



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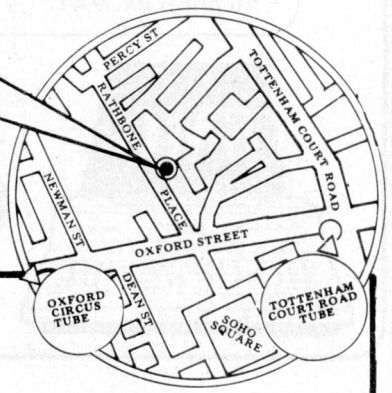

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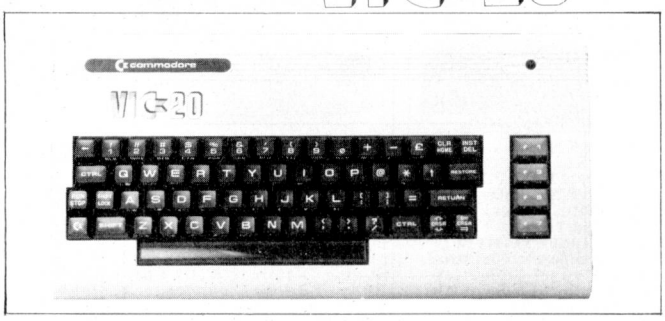

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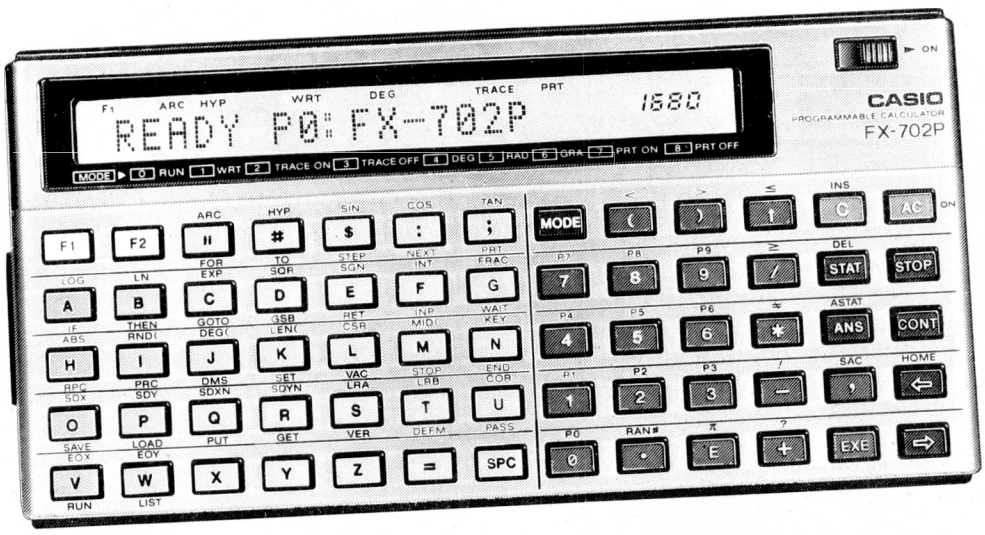

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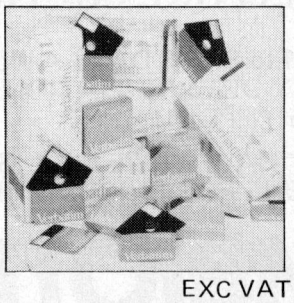

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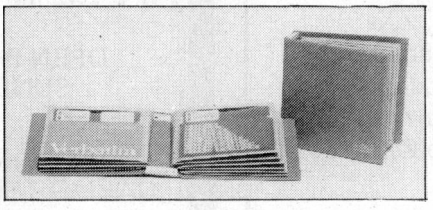

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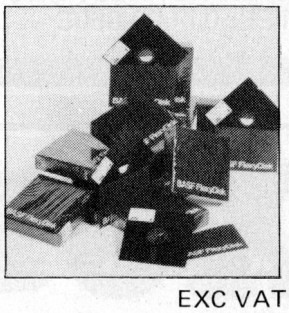

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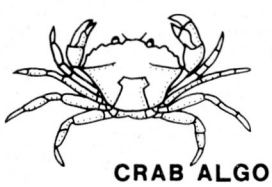

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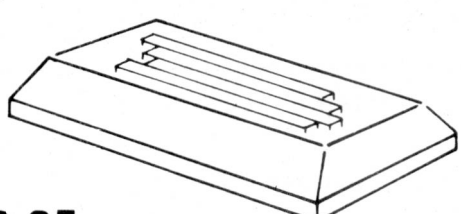

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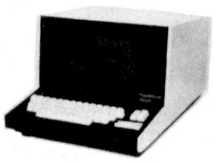

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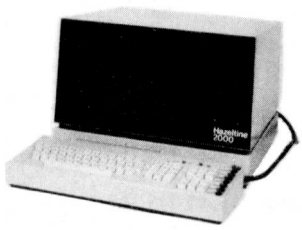

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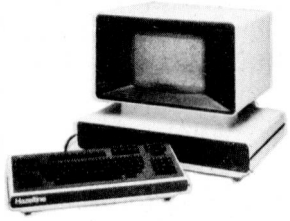

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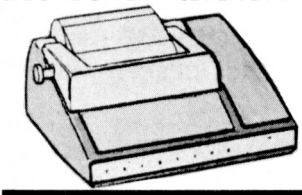

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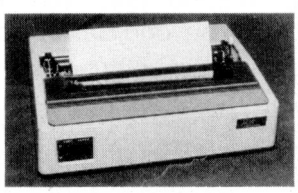

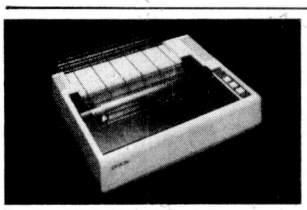

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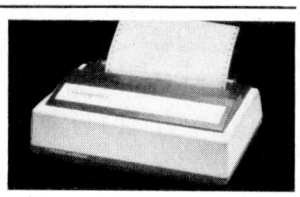

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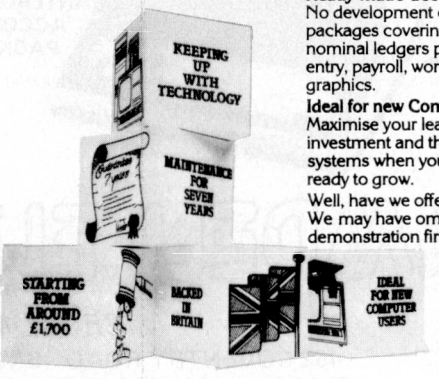

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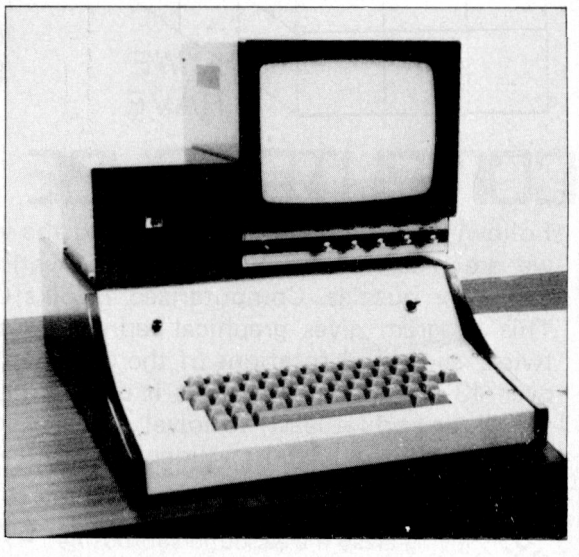

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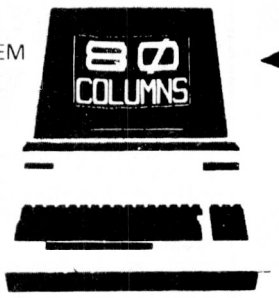

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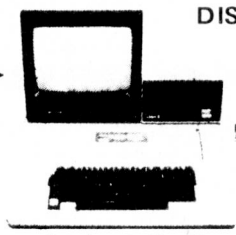

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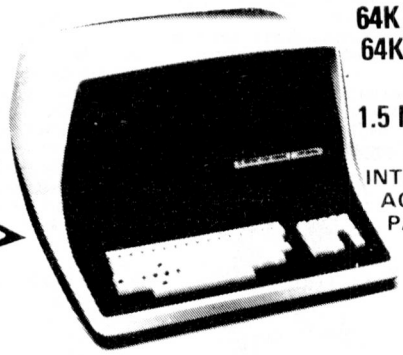

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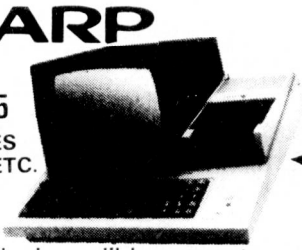

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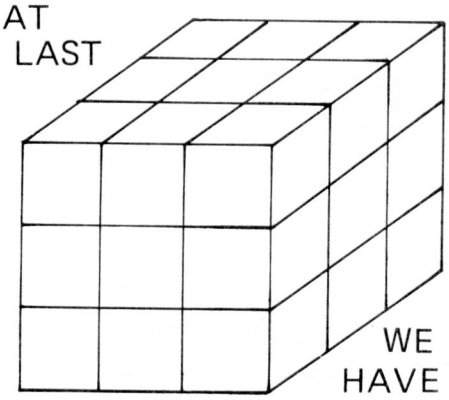

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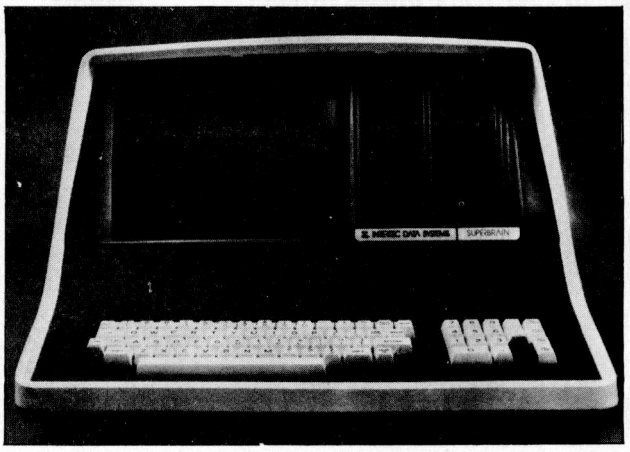

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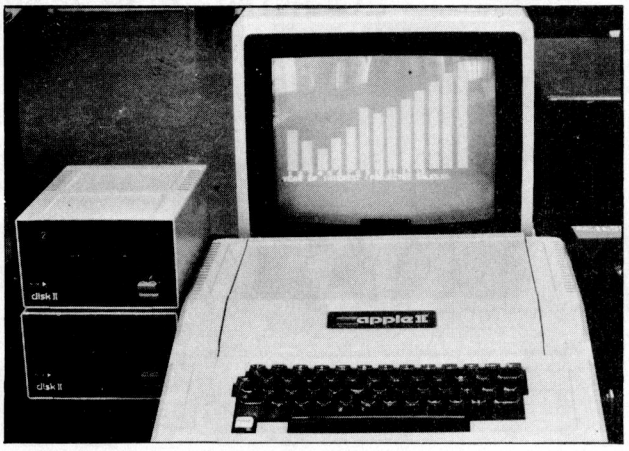

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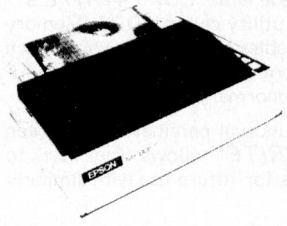

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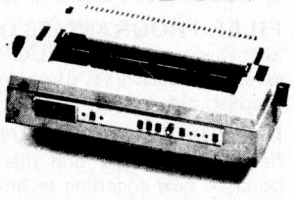

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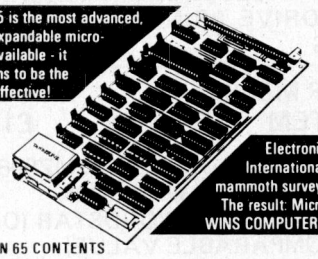

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The MICROTAN 65 kit has won widespread acclaim for its superb presentation. We pay attention to detail!

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Used to connect Microtan to Tanex.
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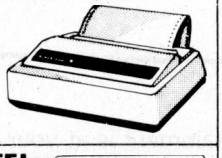

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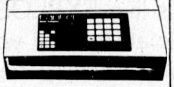

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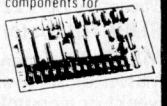

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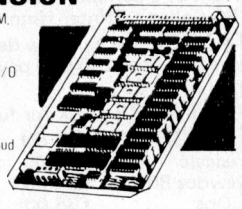
TANEX EXPANSION



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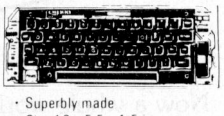

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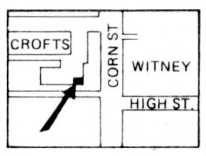

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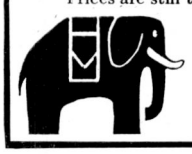

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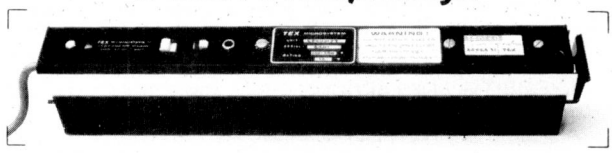

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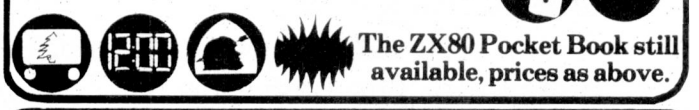

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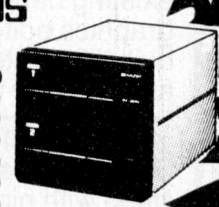

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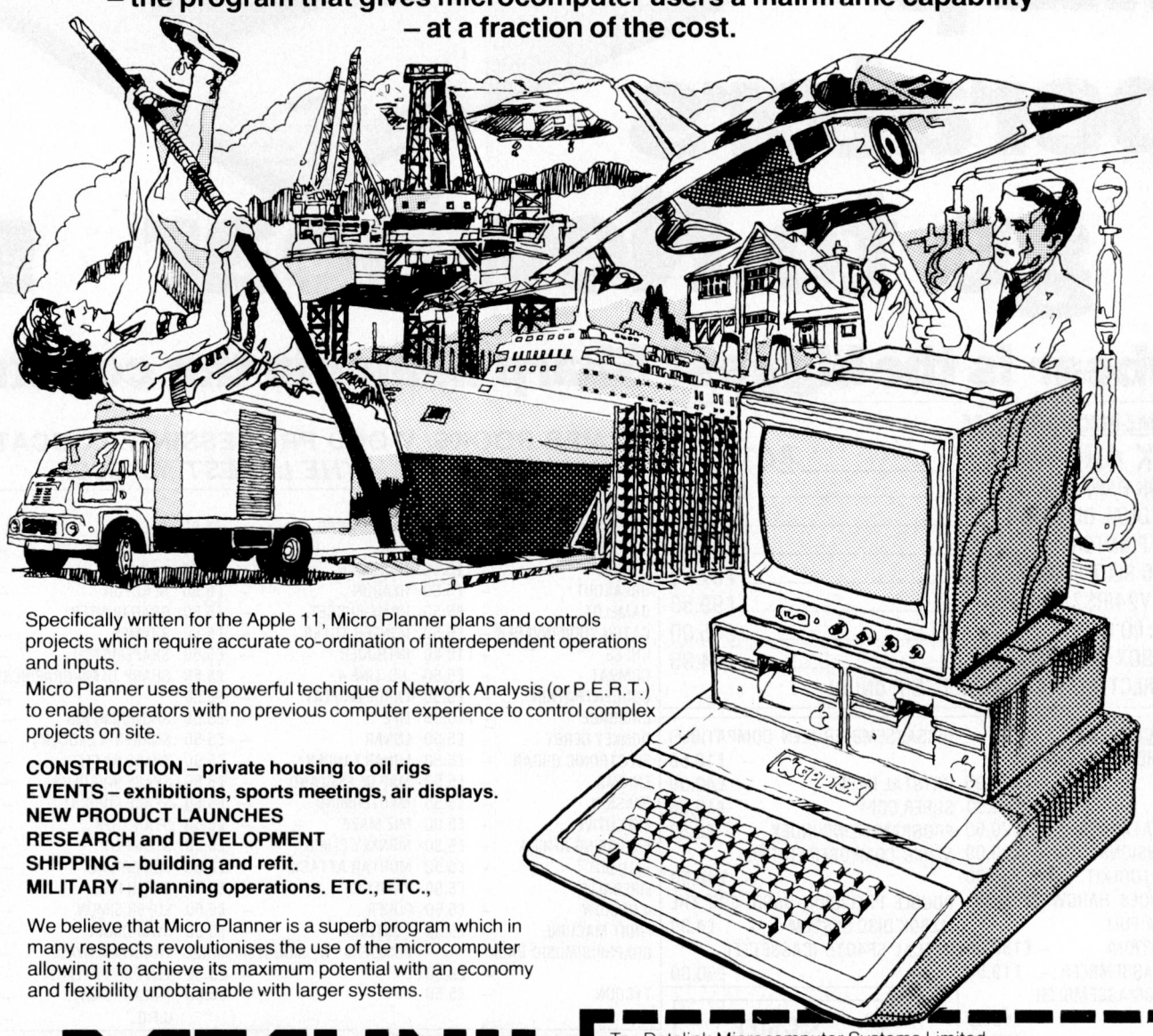

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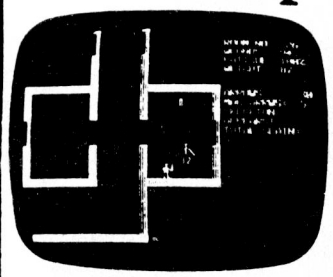

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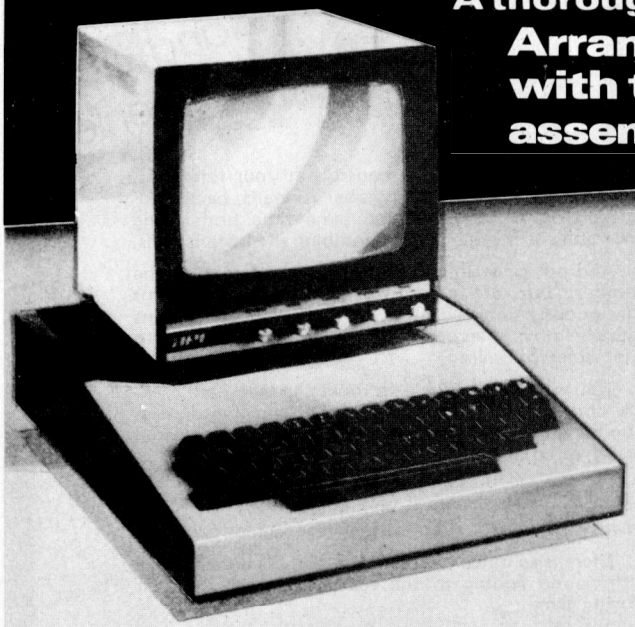

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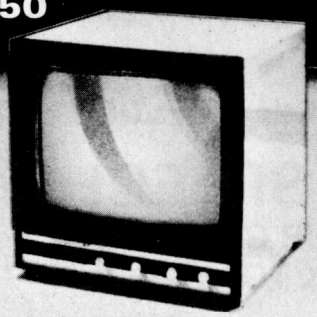

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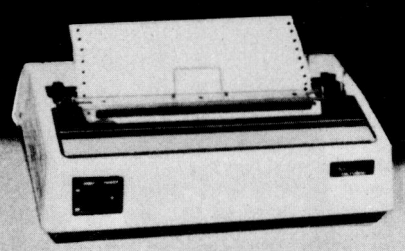

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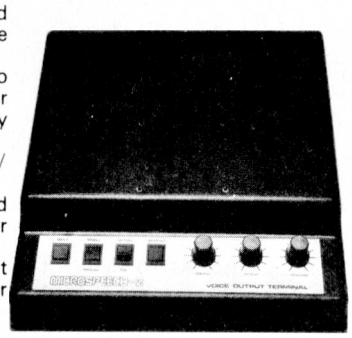

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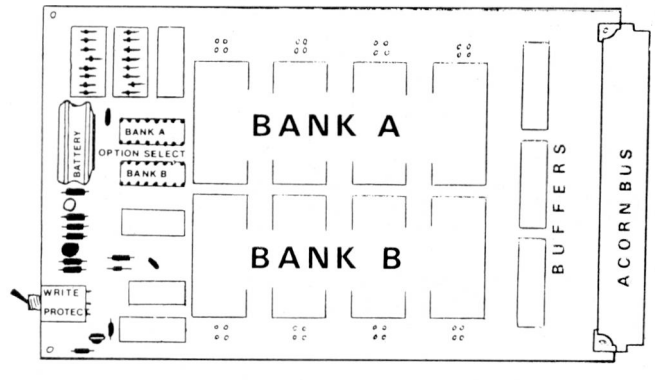

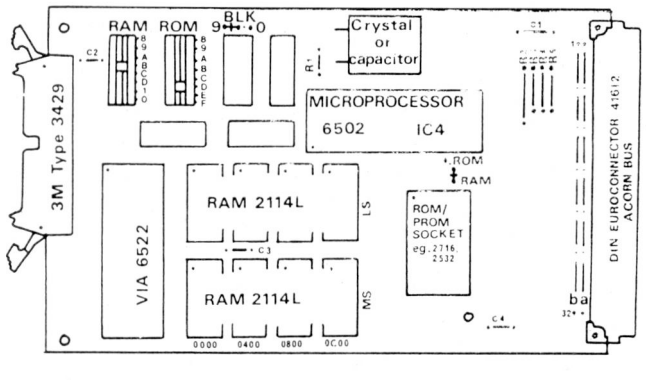

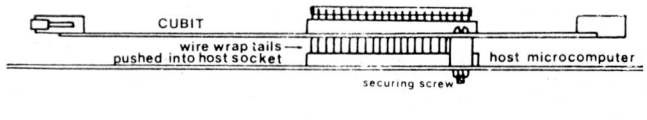

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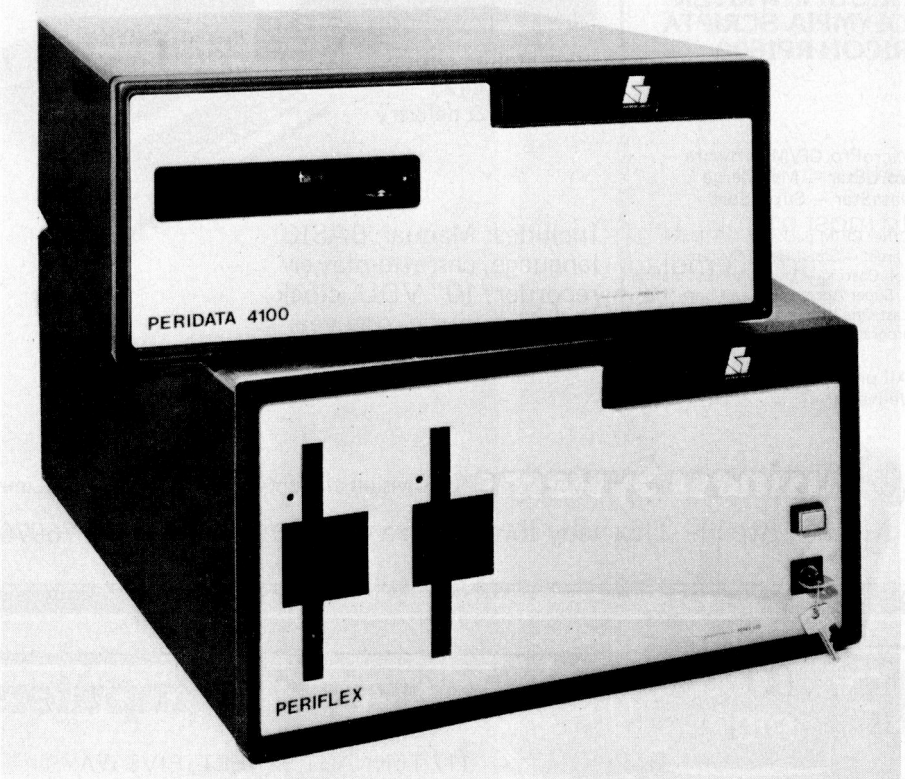

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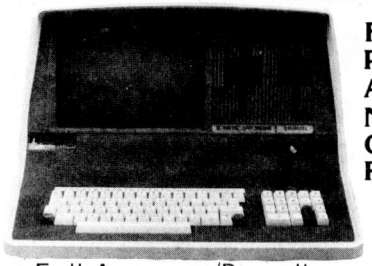

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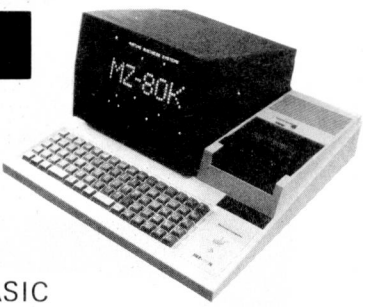

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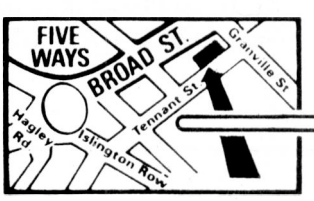

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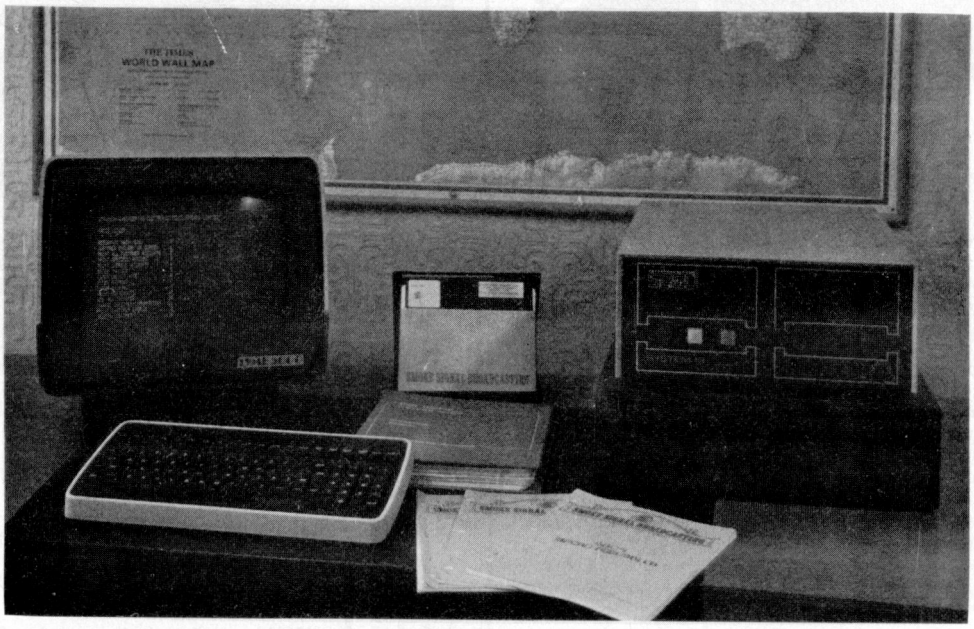

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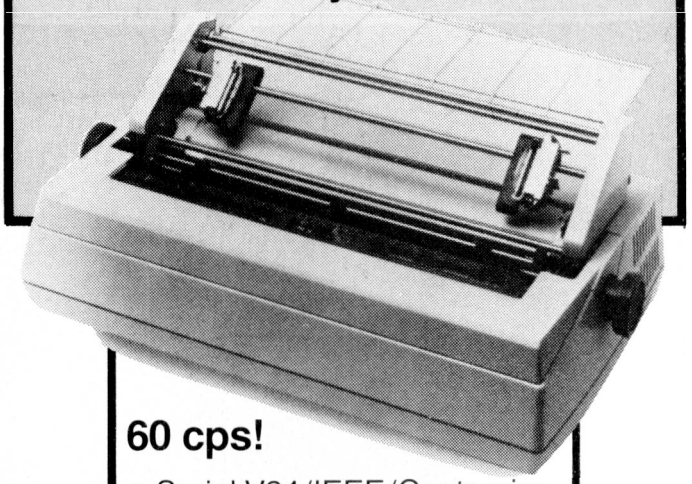

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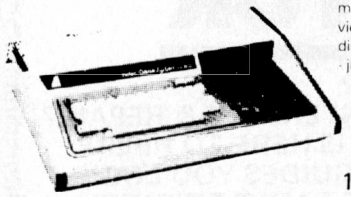

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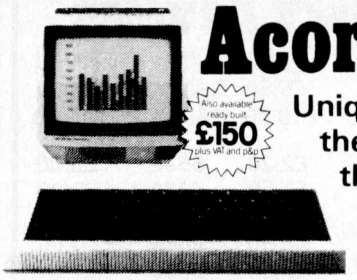

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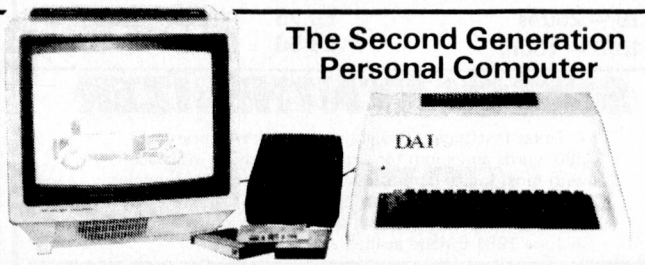

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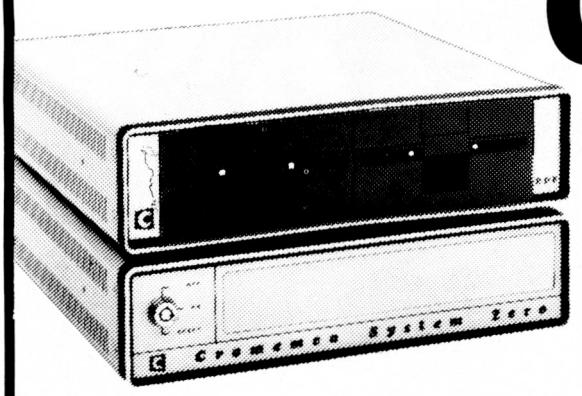

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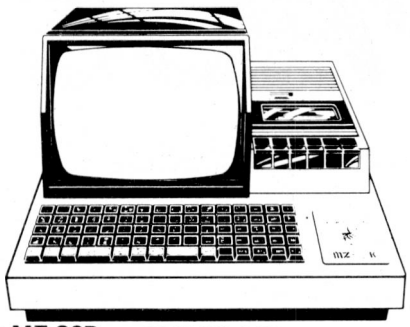

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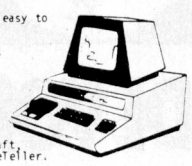

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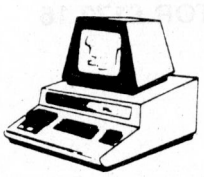

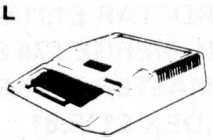

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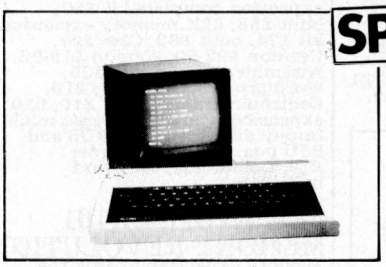

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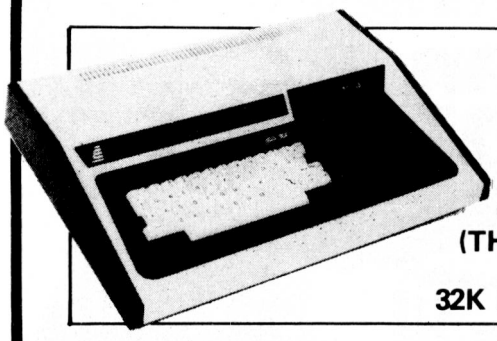

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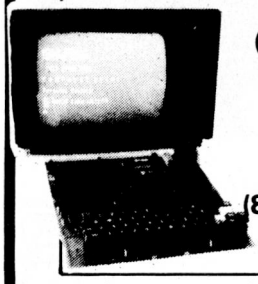

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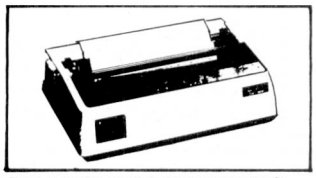

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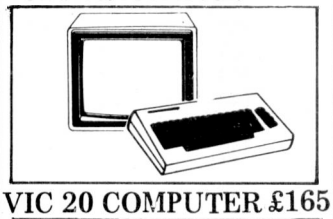

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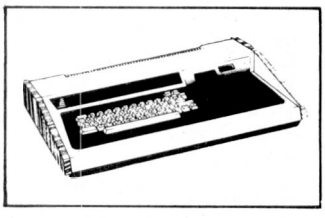

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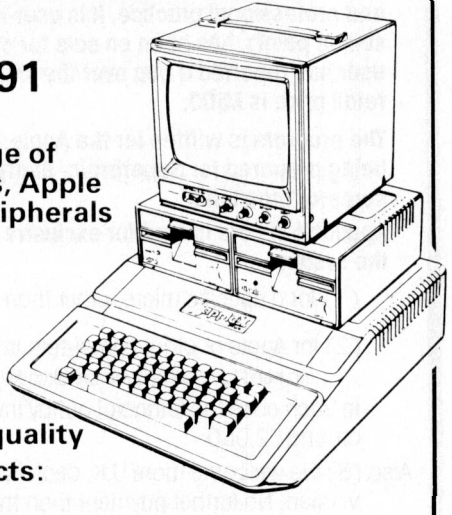

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p01>                    _
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@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^
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>_
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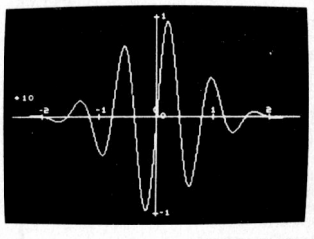

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```
DISASSEMBLER
HEX START ADDRESS?0835F
END ADDRESS?00400
BRK/RTS OPTION?Y
CODE STORAGE TEXT SPACE?
(EG. 029)?N
 835F  24 91      BIT 091
 8361  10 11      BPL 08374
 8363  A9 00      LDA #000
 8365  85 09      STA 009
 8367  85 0B      STA 00B
 8369  85 0C      STA 00C
 836B  A9 0A      LDA #00A
 836D  85 0B      STA 00B
>
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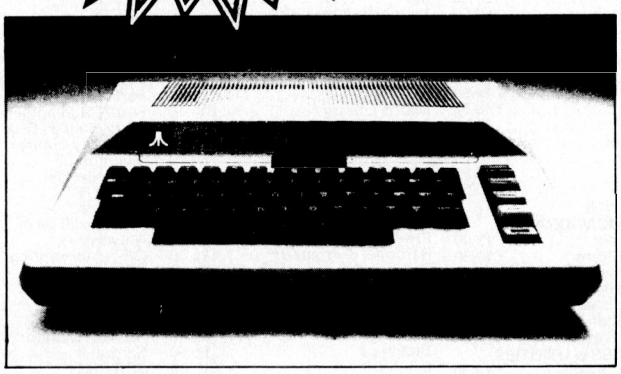

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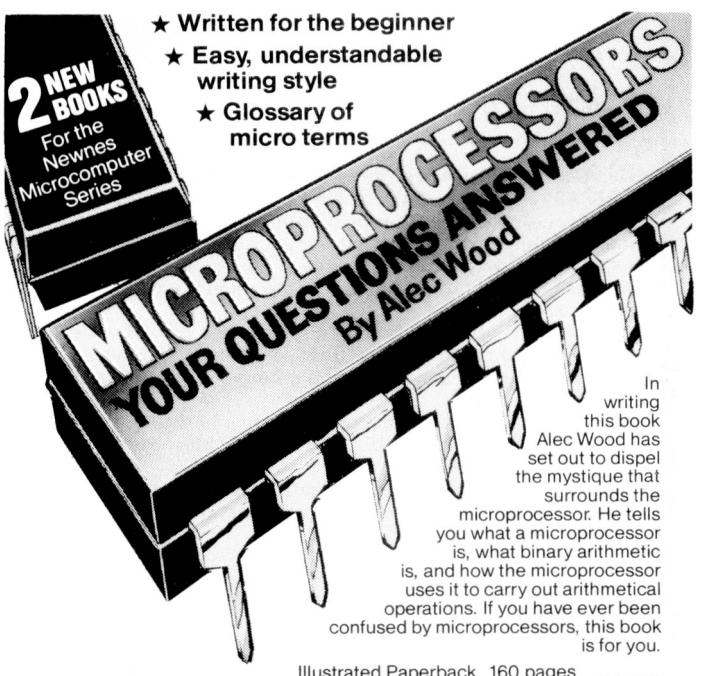

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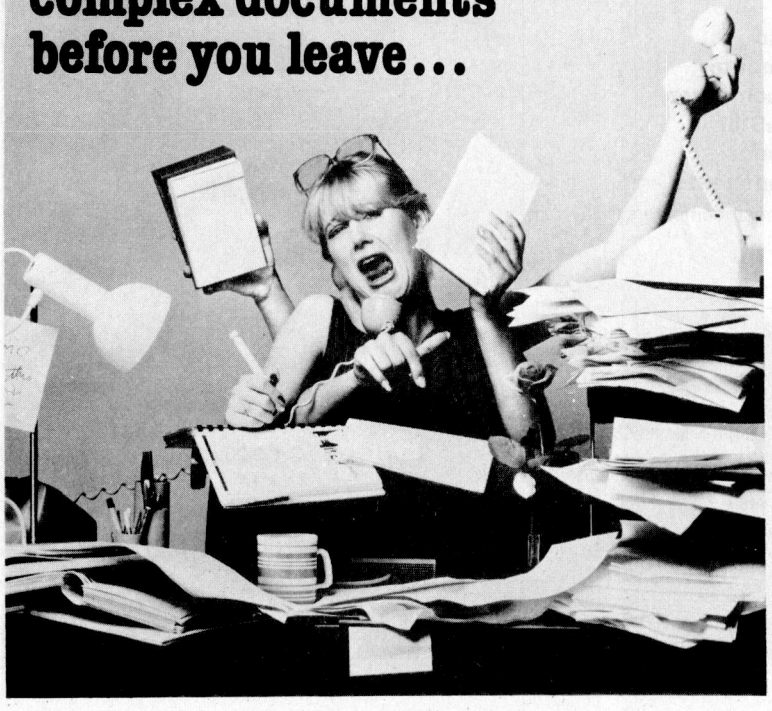

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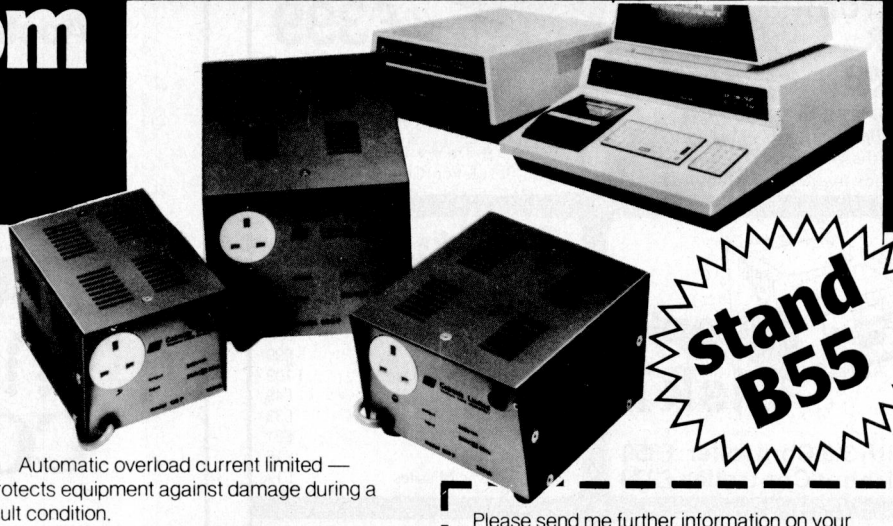

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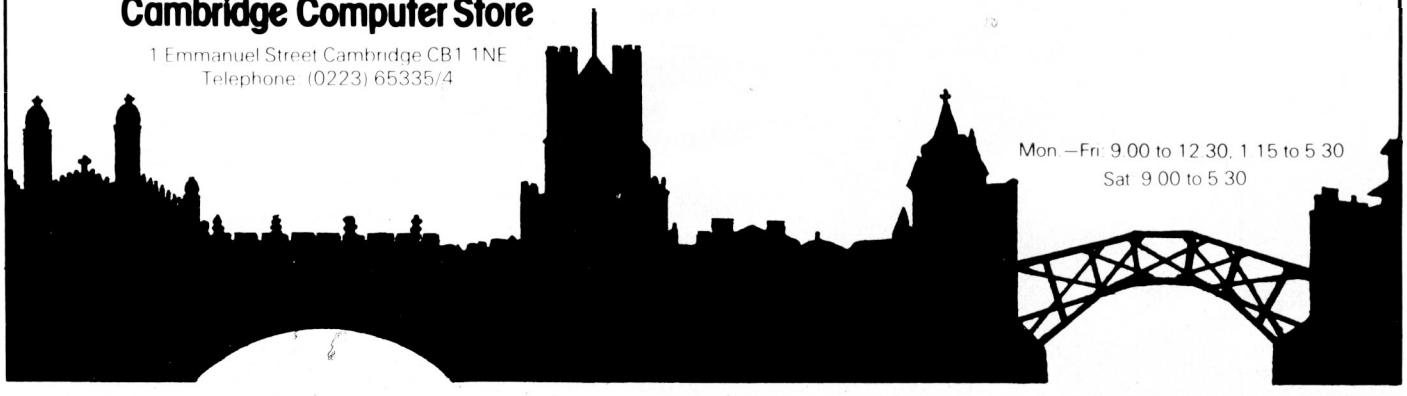

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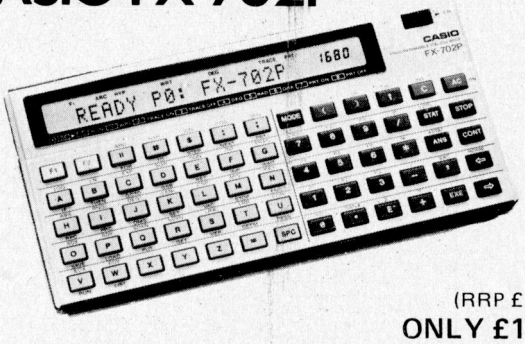

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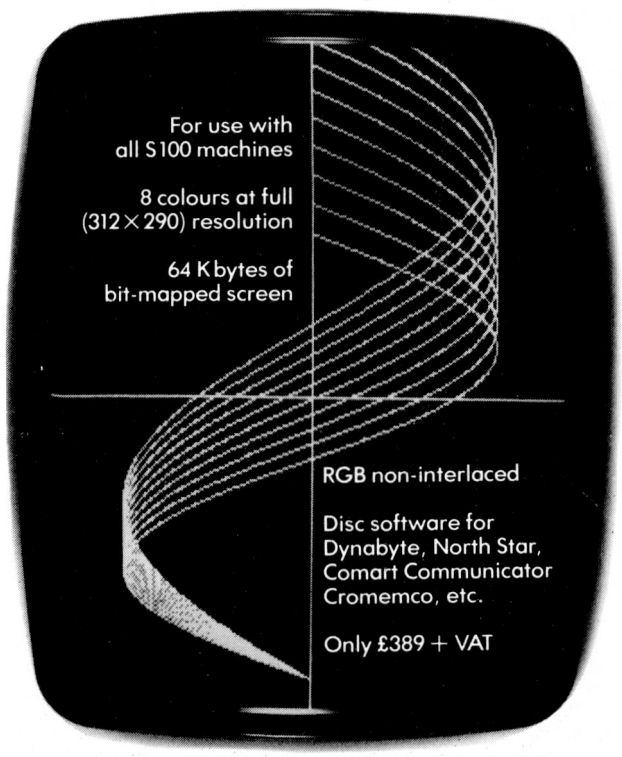

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ZX81 VIC-20 ACORN ATOM SUPERB SOFTWARE

ZX81 16K SOFTWARE

The following is a list of our 16K ZX81 Software (which fit into 11K)

Code and contents	Details
AIR TRAFFIC CONTROL:	An absorbing simulation of air traffic control over a busy airport. Animated display shows radar screen with moving aircraft with name tags and a list of call sign, height, speed, heading is displayed; by contacting the pilot you must bring in all the planes without them hitting the mountains or running out of fuel.
INVADERS + Self play vers:	A ZX81 implementation of the arcade game with full screen, and a self play version is supplied.
PHONE BOOK:	Now you can keep all your friends' and relatives' phone numbers on cassette, uses very fast data retrieval technique.
DATE 81:	Computer dating program. . . who will it pick for you?
16/81/2 ADVENTURE ATLANTIS:	You are shipwrecked in the middle of a terrific storm. . . in this game you can become very rich. . . or you may be marooned on a desert island for ever!
BREAKOUT + self play vers:	A ZX81 implementation of the arcade game with full screen, and a self play version is supplied.
TRANSL8R:	Translates any European language into any other! This program stores its vocabulary on cassette.
COMPUTAPUNT:	Keeps statistical records of horses' or dogs' performances in races – and will make predictions on future races.

both packs contain the four programs described; these programs come with user instructions and are loaded and ready to run. Pack: 16/81/1 and 16/81/2 are £4.95 each or £5.95 for both incl.

VIC20 5k RAM VOLKSCOMPUTER

Tapebook 15:15 VIC-20 programs at £3.95: Tapebook 30 = £5.95 incl.
See list of ZX81 Tapebooks for details!

ACORN ATOM (original ROM) f/p not required

Code	Contents
a/1	STAR TREK: sound effects, damage control, help, animated display + all features found on other versions available, requires 6K + 4K upper text area min. PHONE BOOK: keep records on a data tape of useful phone nos, menu driven. FRUIT MACHINE: 6K + mode3 graphics; £6.95 inc
a/2	GALAXIONS, PIANO, requires 6K + 6K £6.95 inc

Both a/1 and a/2 for £8.95

CONTROL TECHNOLOGY, 39 Gloucester Road, Gee Cross, Hyde, Cheshire SK14 5JG. 061-368 7558

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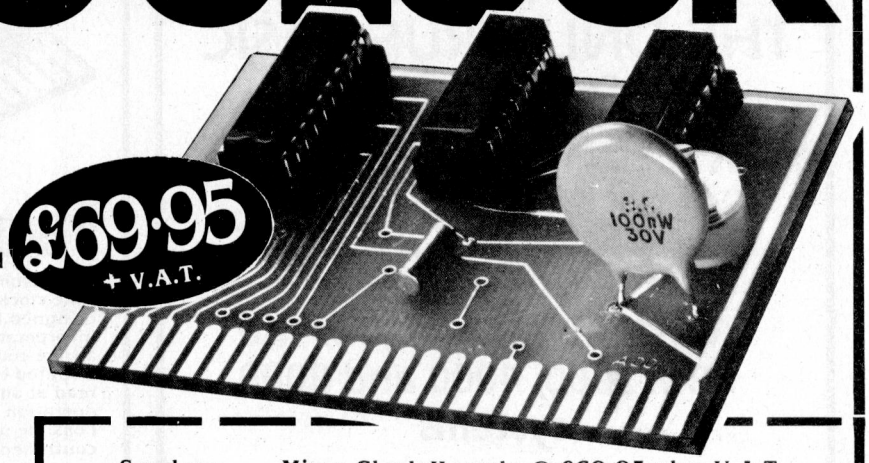
MICRO CLOCK



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```
10 FOR A% = 1T0100:FORB% = 1T010
20A$ = A$ +"1"+" 2"+" 3"+" 4"+" 5"+" 6"+" 7"+" 8"+" 9"+" 0"
30NEXTB%:A$ = "":NEXTA%
```

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```
00010 IF A = 3 PRINT B
***** ERROR 04 at 005 IN 00010: THEN OR GOTO EXPECTED AFTER IF
00020 IFA$<>"" THEN100 A$
      ***** WARNING 02 AT 012 IN 00020: SUPERFLUOUS
      CHARACTERS IGNORED
```

* The compiler is written COMPLETELY in MACHINE CODE for extremely fast compilation.
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REM/INTEGER	A,B
REM/STRING	NAME,C,D
REM.LIST	Indented listing
REM.XREF	Cross ref. map of program
REM.STOP	Enable run/stop key
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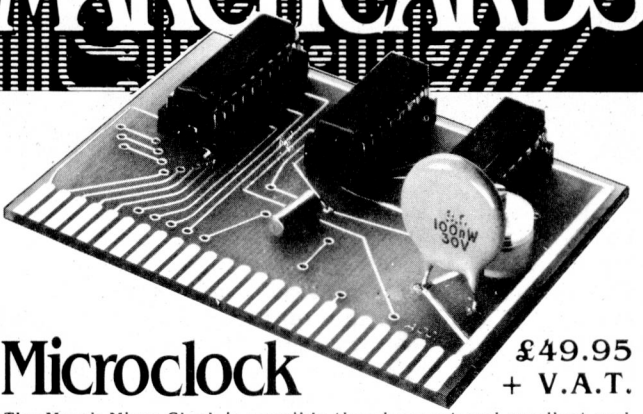

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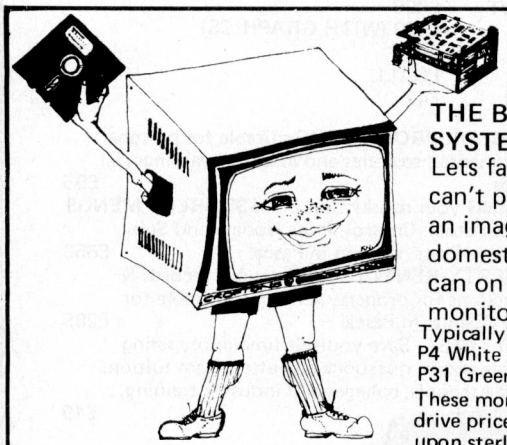

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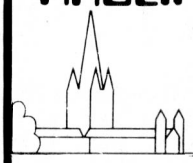

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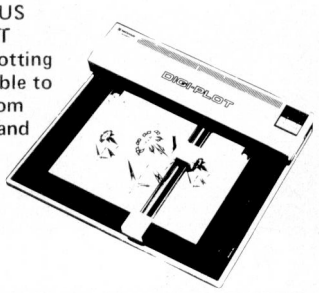

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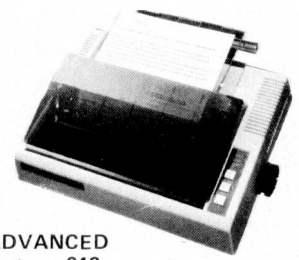

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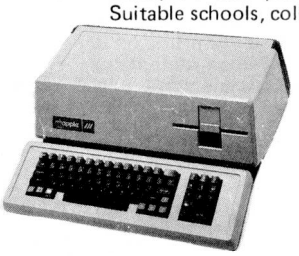

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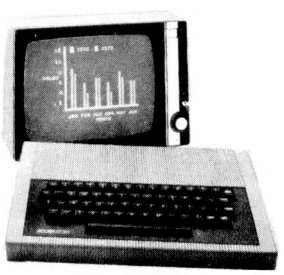

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Cambridge Learning 49
Cardiff Micros 232
Cascade Computers 227
Casio 186
Cetronics 231
Chromasonic 53
Comart 143,146
Commercial Data Systems 160
Commodore PET 56,57
Comp Shop 240,IBC
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EMG 226,228,230
Easicomp 218
Electronic Brokers 190
Elfton 237
Equinox 154
Essential Software 111,158
Fergusson 124
Fulcrum 235
Fuller 188
GW Computers 18,19,20
Gate 228
Gemini 208
General Northern 192
Geveke 160
Granata 84
Grange Electronics 191
Guestel 130
HCCS Associates 202
Hal 59,60,61,132
Happy Memories 198
Harding 12,13
Helistar 198
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Hisoft 229
Hitech 234
Honeywell 30
Hunting Business Systems 214
ITT 112
Independent Comp Eng 52
Intelligent Artefacts 21
Interam 96,103
Interface ZX80/81 229
Intex 236
KGB Micros 28
Kansas City Systems 208
Katotek 102
Keen 80
Kelly's 194
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Microstyle 217
Microtek (Orpington) 211
Microtek (Ipswich) 150
Microvalue 24,25
Micro 8 16
Midwich 221
Modmags 223
NSC 50
Newbear 204
Newnes 230
Newtronics 207
Northamber 72,73
Olympia 86
Tim Orr Design 208
Oxford Computer Systems 219
Personal Computers OBC
Personal Computer Palace 229
Petalect 91
Pete & Pam 26,125
Phipps Associates 200
Photo Acoustics 214
Portatel 221
Prentice-Hall 17,205
Printout 94
Professional Data Systems 224
Program Power 87
Qume 42
Rade 90
SBD Consultants 212
SMG 186
SRS Microsystems 32
ST Commercial 212
Sharp 97
Sharpsoft 189
Sinclair 128,135-138
Sintrom 213
WH Smith 6
Spangrade 218
Spider Software 216
Spreebond 84,194
Startech 191
Strumech 215
Superior Systems 201
Swanley 226
Symbiotic 188
Tangerine 43
Technomatic 218
Teleprinter Equipment 144
Telesoft 192
Templeman Software 222
Tempus 233
Tex 198
Transam 35,40
Transdata 92
Twinlock 66
Video Services (Bromley) 222
Watford Electronics 45
Westfarthing 228
Westwood 214
Wilkes 41
Windfall 234
X-Data 152
Xitan 46

ChipChat

Wow! Did we have a Show! Almost 16,500 of you turned up at the Cunard over the three days, making it the country's most successful micro show ever. . . Mike 'Hello Sailor' Sterland insisted on dressing his stand staff as Midshipman Hornblower look-alikes then spent the entire show explaining to everyone the obscure connection — the show was at the *Cunard* Hotel, geddit? *(No — Ed)*. . . 'Bumper' Harris dropped — or, rather, stumped — by the Acorn stand to see the BBC Micro and was amused to see an Acorn minion lift the machine's lid every ten minutes and spray the inside with an instant-ice aerosol. . . Winfried Hofacker of Elcomp showed us his Atari monitor. Very impressive, except that just as Winfried was explaining that the English was absolutely perfect, the word 'adress' appeared on the screen. . . When Sinclair ran out of Barclaycard slips, people became so desperate that they started nicking them from nearby stands. . . Overheard in the coffee shop: one American asking another if he had any fragmentation grenades with which to clear a path to see the ZX Printer . . . Microsoft's Alan Boyd has at last found a use for the Sorcerer — as a paperweight . . . When asked 'Have you got an Apple?' one of the girls on the stand of a 'certain other micro magazine' rummaged in her handbag and said, 'No, but would you like some peanuts?'. . . An American couple joined the end of the Show queue and when, after a *very* long time, they reached the registration desk, asked for two single rooms. . . Until they met the luscious Susan Ben-David, The Last One's programmers thought that SBD stood for Silent But Deadly. . . The lovely Viv Collins sold a ticket to one man and said 'Thank you, sir'. He replied, 'Actually, I'd rather be called Madam.' Closer inspection revealed that he was in fact wearing ladies' clothes. . . How's this for cheek: a punter sat down for a demo at The Last One's stand and, after being shown how it worked at great length, used it to produce a suite of business programs, which he listed out on a printer. Then he scuttled off around a corner where his client was waiting and sold the listings for £150!. . . And no, he wasn't from Comp Shop. . . Felix Dennis, our publisher, having ensured that 16,439 people paid for their tickets, finally gave in at 3.30 on the last day and told a man he could go in for free. Felix could hardly believe his luck when the man insisted on paying even though the show was closing in half an hour . . . Even Vince Cohen liked the Show. . . And how about the two men who spotted a sign at the Show which said 'The Last One'. One turned to the other and said, 'What a pity, it seems to be going so well!'. . . The biggest disappointment was the failure of 'Legless' and 'Bumper' to perform their promised dance on the flyover after the Show. 'Bumper' stalked off in a huff after 'Bogey' had failed to recognise him and 'Legless' was too, well, tired and emotional to oblige, despite the encouragement of the crowds blocking the flyover. . . Finally, our sincere thanks to all of you who braved the queues and the crush to help make the show a success; we hope we see you all again next year in a bigger (and better air-conditioned) location — Hyde Park, maybe?

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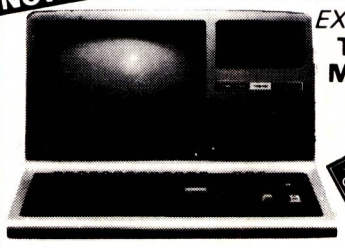

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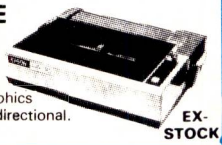

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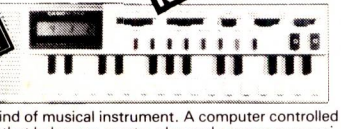

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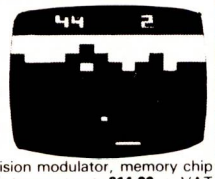

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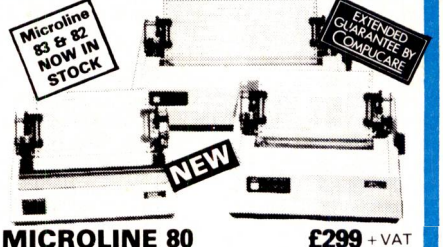

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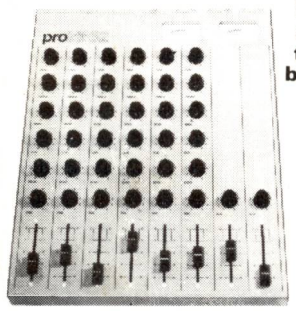

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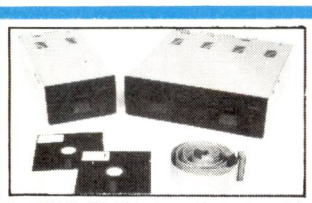

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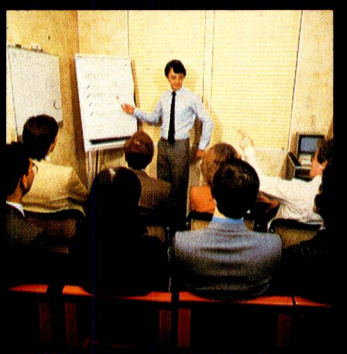

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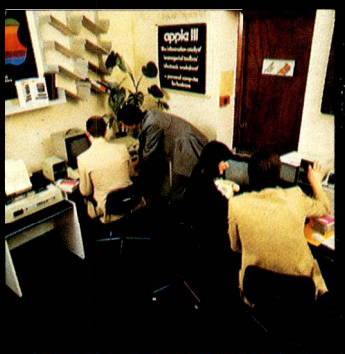

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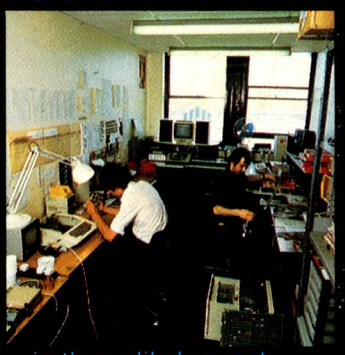

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