

# PERSONAL COMPUTER

THE COMPLETE COMPUTING WEEKLY

**NEWS**

WEEK ENDING MARCH 18th 35p

## HARDWARE

### THE BETTER MOUSETRAP

Full hands-on Pro-Test of  
Apple's lovable LISA

## PCN MICROPAEDIA

### ANATOMY OF THE BBC: #1

Start building your complete  
reference library of microcomputing

## LANGUAGES

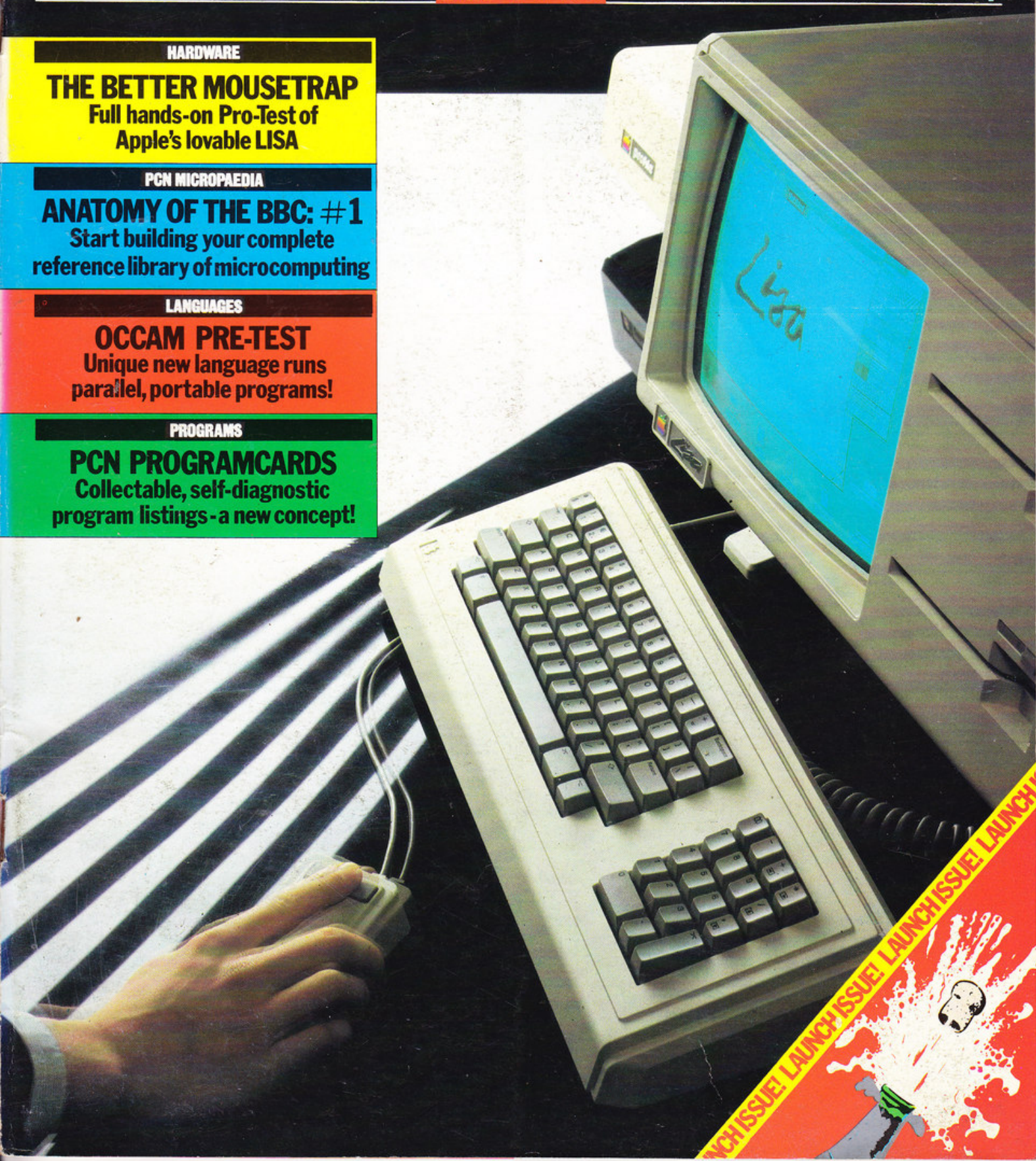
### OCCAM PRE-TEST

Unique new language runs  
parallel, portable programs!

## PROGRAMS

### PCN PROGRAMCARDS

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LAUNCH ISSUE! LAUNCH ISSUE! LAUNCH ISSUE! LAUNCH ISSUE!



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## TIMEGATE

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### GS DEFENDER—

"...Better than any other arcade game I've seen..." (Sync)

"...nicest games I've played on the ZX81. All the tapes were impressively packaged..." (Which Micro & S.R.)

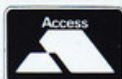
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Your space — your letters. Your reward? — £10 for the best of the batch.

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£5 for a hot shot hint. Your chance to turn a tip into hard cash.

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Club and user group contacts at your fingertips.

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A unique way to build up your listings library. Cut out and keep.

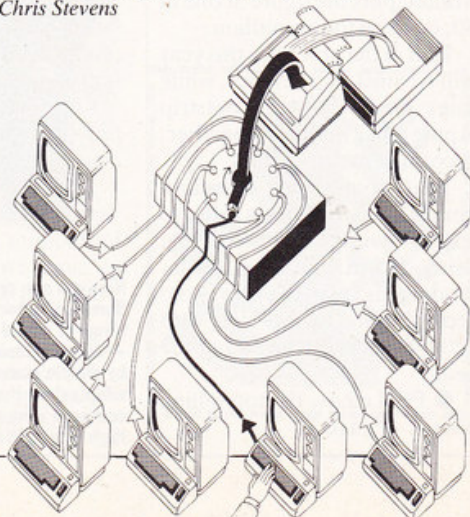
### Databasics 90

Your up-to-date guide to hardware and peripherals. Latest prices, latest specs.

### PCN Billboard 99

Buy, sell or swap through your free advertisements.

Cover photograph of Apples' ikonoclastic Lisa by Chris Stevens





# Micronet makes good

You've got to be prepared to put up with a few snags when you use Micronet 800, but it's worth the effort.

PCN put the new service through its paces last week. We downloaded a couple of the 100 free programs and checked out the news and information services.

The subscription for the Prestel-based system is £13 a quarter. You also have to buy a special adaptor (£57.35) that connects your micro to the telephone.

But, unlike the rest of the Prestel service, most of the pages on Micronet are free. All you pay when using the system is the cost of a local telephone call.

The BBC micro, Apple II, Tandy TRS80 models I and II, Commodore 'Pet' and RML 380Z machines can be hooked up. Other machines will join the list as adaptors become available over the next few months.

Using a BBC micro we found that it pays to read the manual carefully from cover to cover. For example, you may have to adjust the terminal software to work properly on your machine but this information is buried at the end of the manual.

You could also cut time by SAVEing the adjusted software on disk or 1200 baud cassette.

Your telephone could present another hitch. Five different companies make office telephones, so the handsets vary in size.

You get round this with a hard-wired modem.

Home users, except those

with a Trimphone, won't face this problem because all domestic telephone handsets are the same size and the adaptor provided should fit.

Downloading programs didn't pose any problems. On-screen instructions take you through the procedure and within a matter of seconds the software is safely loaded in your computer's memory.

## Bonus for BBC

Micronet has done BBC users a favour — the service has added 25 new BBC programs to the library of software available to its subscribers.

Micronet organiser Telemap, had little trouble finding the minimum 100 free programs for the Apple II, Tandy models I and III, Commodore 'Pet' range and RML 380Z. But it ran into a snag with the BBC micro.

Only a small amount of software free of copyright restrictions is available. So to plug the gap, Telemap turned to a software house to provide 25 programs.

The software house wrote a special emulator package that allows it to translate programs

from one machine so that they can run on a different machine,' said Richard Hease, Micronet's managing director.

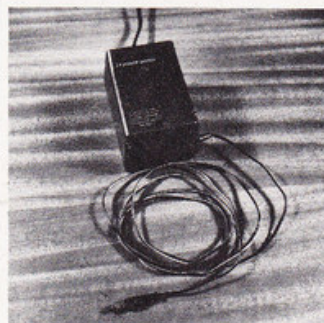
'They have adapted programs in the public domain.

This BBC bonanza has upset the Commodore Users Group, IPUG. The programs that have been used, says IPUG, were originally written for the Commodore 'Pet' or the Vic.

'The BBC machine should have been seen to have little free software available,' said IPUG chairman Mick Ryan.

But there could be good cheer for Dragon users planning to use the service. Telemap may soon do the same for that machine.

## Sinclair power pack



SINCLAIR is replacing faulty power packs for the Spectrum with little delay.

So far the company has been able to send out new power packs in place of recalled models within 48 hours.

And even last week, when the company expected returns to peak, it was hoping to make sure that Spectrum users got their units back within a few days.

Sinclair found that up to 14,000 of its Spectrum power packs could cause electrical shocks. The company claims the risk of that happening is very slight, but if you find your power pack has a black lead with a white stripe you should send it in to be replaced.

Sinclair's address is: Sinclair Research, Unit F, Borad Lane, Cottenham, Cambridgeshire.

## Micros in millions

If you buy a new machine this year you'll be in good company.

One million people will buy new microcomputers in 1983, according to a report from Key Note Publications.

Key Note estimates that there are already 965,000 of you with your own micros, and this may be a conservative figure — another research organisation, Mintel, puts the figure at one in 30, or close to two million.

Half of the new sales this year will be Sinclair machines, while sales of Acorns will outstrip Apple and Tandy put together, according to the report.

That would bring the numbers of Sinclair systems in use to 95,000, with 170,000 of you using Acorn machines. Commodore is expected to hold second place in the UK, with 320,000 users by the end of the year.

● PCN charts the top selling micros — page 5.

## Microsoft scans High Street

YOU should soon be able to buy software products like MS-DOS and Multiplan over the counter.

Microsoft, the US software house that supplied the IBM PC's operating system, is looking for retail sales in the UK. In fact, new UK general manager

David Fraser has been hired to oversee its move into the High Street.

Microsoft set up in Europe nine months ago and concentrated initially on getting systems builders started with its products.

Now, it plans to launch a

series of new games and business packages for the retail market.

Business tools thought to be on the way from Microsoft include database management, word processing, and charting utilities.

MS-DOS appears regularly on new micros but Microsoft also expects it to sell through shops, along with its games, assemblers, link loaders, business tools and other products.

Mr Fraser joins the company from Commodore, where he was UK sales manager.



Now you can create your own sound effects on your ZX81 or Spectrum. Bi-Pak Semiconductors has produced the ZON X sound generator to produce a wide range of sound effects. The unit uses the three-channel-plus-noise sound chip — which means the pitches and volumes of the three channels can be controlled by simple statements. At £25.99 for the ZX81 and £32.75 (including special adaptor) for the Spectrum, users can add sound effects to their silent games or compose a musical piece. ZON X is available from Bi-Pak Semiconductors, 63A High Street, Ware, Herts SG12 9AD, Ware 3442.





# Intel pays its way for silicon software

The day when applications software will be supplied not on floppies or tapes but on chips with their own processors is fast approaching.

It will dawn later this year in the word processing arena — Intel plans to launch an 82730 'text co-processor' chip that will cost about £25 in the autumn.

That will mean more powerful word processing at a lower cost for users, according to Intel. In the long run, the company predicts, the scope of dedicated co-processors running specific tasks alongside standard workhorse processors is virtually limitless.

The 82730 is likely to be incorporated into Intel and other manufacturers' systems to word processing. It offers 200 characters a line, 2,000 scans each frame, windows, two cursors, zoom feature, a virtual screen mode and other functions.

According to Intel it can be used with eight-, 16- or 32-bit

data buses, executes high level commands, and handles linked data structures.

'We are giving the word processor designers facilities to implement features which previously were very clumsy,' said Intel's Bill Ringer.

The 82730 will run with Intel's eight- and 16-bit processors, and also with other popular microprocessors, the company claims.

It isn't Intel's first co-processor, but it is its closest yet to an 'applications chip', and it makes the possibility of applica-

tions software embedded in silicon look more and more likely.

The 82730 can be used in combination with the 82720 graphics chip to increase the variety of output from the word processing system.

Beyond that, the 'limitless' possibilities may point to a revolution in applications software. Producers of packaged software could find that the semiconductor industry's leader has cut the ground from under their feet.

## Epson makes more of the matrix

EPSON has released two successors to the MX 80, the matrix printer that has become the Model T of the personal computer printer scene.

The FX 80 can define extra symbols or characters, 256 characters can be stored in its own RAM, which can also be used as an input data buffer. Other features include a speed of 160 characters per second and any of nine selectable bit image storage modes.

The RX 80 can print at 100 cps and has two 96-ASCII character sets, plus 11 international character sets.



## Solder snags Acorn chip switch

Any problems with the memory chips in your BBC micro could easily turn into major difficulties.

That is because Acorn has soldered the memory chips into the main board.

So, if you go get a bad memory chip it will be difficult to remove — you probably won't be able to do it yourself unless you have plenty of experience and a well-stocked tool kit. Acorns claims that soldering the chips makes the BBC more reliable because it ensures that they won't come loose in transit. Anyway, a spokesman for the company added, RAM chips don't fail.

The second half of the Acorn explanation doesn't seem to go along with the fact that the first thing that most computers do when they are powered up is to run a RAMtest. Nor does it match the experience at PCN

where RAM chips have been known to fail. It doesn't even explain the long delays in BBC deliveries.

Acorn's advice if you do have trouble with a memory chip: send it to your nearest Acorn service center.

## New disk from IBM

From June you will be able to buy a beefed-up IBM PC with up to 640 kilobytes of user memory and 2 megabytes online.

IBM has launched the XT (extended) version of its PC, with greater user memory, DOS Release 2, and a 5¼in Winchester disk. And it has a higher price tag — the minimum system will cost you £4,858.

The unit is not thought to push back any technological frontiers, despite the fact that removable Winchesters are just around the corner and IBM is the company that gave this disk technology its name.

The disk will vastly enhance storage options on the PC. The previous storage arrangements were twin 320K floppies from IBM and rather more from other suppliers. A hard disk bearing IBM's name is likely to be pricey.

Other storage options could be on the way.

## PCN THREEBIES OFFER

Or, as we prefer to call it, the something-for-nothing reward. All you have to do is to keep this PCN Threebies Offer coupon, together with the coupon that you will find in issues 2 and 3.

Save them, and we will send you a brand new, crisp green one-pound note.

What's more, there is literally no limit to the number of pound notes that we have to give away. Everybody can have one.

Make sure you get next week's issue of *Personal Computer News* to find out more.

It's money for nothing.





## Is Apple going soft?

Help may be on the way for all of you Apple users who're bothered and bewildered by the company's failure to rectify the bugs in Applesoft Basic. Disgruntled Apple users in the US are taking matters into their own hands.

APPLE, the large American user group, has asked for suggestions for a new language for the Apple II. 'The company seems to have lost its sparkle,' said Val Golding, a founder member of the Seattle, Washington-based group. 'Recently it really hasn't made much of an effort to improve the software.'

That is obviously not true of Apple users. Several have already come up with suggestions, and eight machine code programmers have offered



their services for the project.

Now Golding is planning to hold a conference to discuss proposals sometimes this autumn. He expects real work to begin in December.

'A.P.P.L.E. now has the muscle to make this possible,' Mr Golding added. 'We have enough members to make a market so we decided to do it ourselves.'

## Imagine: two more games

Imagine, the company that broke away from Bug Byte, has released its second batch of games.

Ah Diddums runs on the ZX Spectrum, while 'Catcha Snatcher' is designed for the Commodore Vic-20.

Both cost £5.50 and should be available at WH Smith and other dealers around the country this weekend.

'Ah Diddums' is a Pac-Man-like game in which toys try to evade a giant ball of plasticine.

In Catcha Snatcher the object is to prevent larcenous grannies from shoplifting. The grannies are caught and hauled off to the boss's office, while lost children are chased around a maze.

## High street selection

You may not have to travel so far to find the micro of your choice in future.

For the first time, selected branches of Boots, Greens, Curry's and John Menzies will be selling the Spectrum, as well as the other Sinclair products already in stock.

And WH Smith will soon begin to stock the Oric and the Commodore 64 as well as the Sinclair ZX81 and Spectrums.

The Oric is due to make its appearance at the high street booksellers in April but no dates are available for the Commodore machine.

## 'Organic expansion' for ZX81

If you add BASICare organic modules to your ZX81 you will eventually be able to replace your Sinclair with an 8088 16 bit processor.

BASICare's organic micro concept allows a ZX81 to be expanded to almost unlimited amounts of memory by connecting vertically stacked modules. The system uses memory paging to extend the logical 64 kilobyte address space. Other modules provide extra input/output facilities, definable display characters and non-volatile memory.

But BASICare plans to take the add-on business to its logical conclusion by ousting the Sinclair from the system and offering a processor that will make better use of its features. The company intends to exploit the

expected flood of software for the IBM PC and its compatibles by offering a 16 bit processor and the MicroSoft Disk Operating System (MSDOS).

The BASICare concept will also be broadened to accommodate other popular small micros so their users will also be able to make use of the Organic Micro. The first on the list is the ZX Spectrum. Also on the drawing board is a fast loading cassette machine.

The processor will be cased in a moving keyboard section, making the ZX81 completely redundant. Peter Choi of BASICare expects it will be another year before there are enough 16 bit applications programs to make the processor attractive to many users.

The system enables you to

tailor the features of your micro to your own requirements. Because the add-ons are modular they can be increased or replaced at will.

BASICare sees solid-state memory replacing small-capacity disk drives in home units. It claims the cost of memory chips are coming down so that large-mapped memories backed-up by low-cost tape technologies make a viable alternative to disk drive units.

PCN will take a closer look at the BASICare concept in next week's peripherals section.

## Coleco gives game away

Two US companies are using a home version of a popular arcade game to lure you to their games machine this summer.

CBS Electronics and Ideal Toys plan to give a version of Donkey Kong away with every sale of their new Colecovision games machine. The system, will set you back £130.

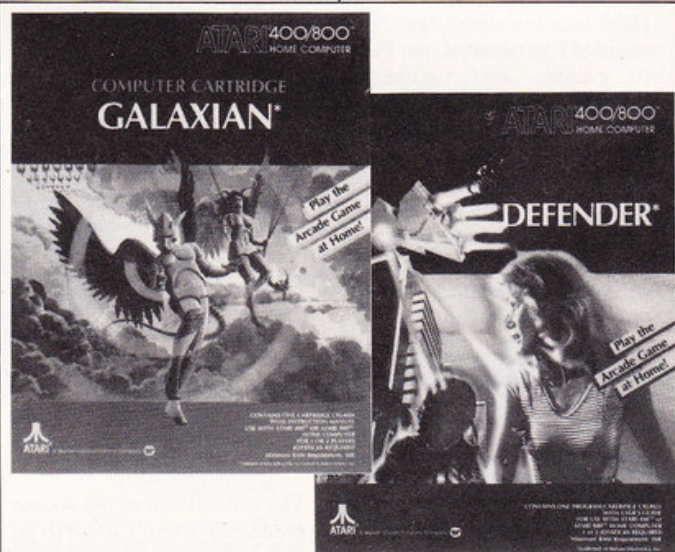
Ideal Toys' spokesman Richard Ault says the company hopes to release a computer keyboard for the Coleco machine in September, allowing the games unit to function as

a fully programmable computer.

The machine has sold well in the US and Canada since its launch last summer, and is expected to sell even better once conversion packages are released to allow you to play Intellivision and Atari VCS games on it.

In the meantime versions of Donkey Kong for Atari and Intellivision will be released with the games unit in June.

The Coleco games machines is previewed next week in PCN.



'Blast or be blasted! That's the name of the game.' Atari introduces you gently to two new software cartridges for its 400 and 800 Home Computers. On the receiving end in Galaxian are Drones, Emissaries and Hornets; Defender features aliens over-running the earth. For £29.99 each you can practice for the day when it actually happens.



## At last, VisiWord comes in

VISIWORD is on its way at last, as the company that brought you VisiCalc tries its hand at word processing.

Rapid Recall, which distributes VisiCorp products in this country, says it expects to have the package in stock for the IBM PC at the end of this month.

At £310 VisiWord isn't cheap. But Bill Tauskey, VisiCorp's word processing product manager, claims the price is justified because the package's features make it a kind of stepping stone to the eagerly awaited VisiOn operating environment.

'VisiWord is able to interface directly with VisiCalc and VisiFile', said Mr Tauskey. 'So you will be able to take information from VisiCalc, and insert it into a VisiWord document, or even do the reverse and insert information from the document into VisiCalc or VisiFile.'

This is done by means of the 'window', concept that is at the

heart of VisiOn, the integrated package due out this summer, according to Mr Tauskey. VisiWord users will be able to give a command to open a window on VisiCalc or VisiFile while editing a document.

The program will then go to the disk and retrieve the file requested, and display it in the window, an area of the screen. The user can edit the information and include it in the document.

What the user cannot do is RUN either VisiCalc or VisiFile at the same time as VisiWord is RUNNING. So you can only retrieve ready-prepared files created beforehand with Calc or File.

If you buy a copy of VisiWord now, you'll need an upgrade to use it — and any other Visi products you may have — with VisiOn although files you create will be compatible. But that will cost you 'a nominal charge, at most', according to Mr Tauskey.

## The Silicon Office — at a stroke

Sirius and Victor owners will soon be able to buy an integrated office package that has become a bestseller among Commodore users.

Silicon Office, a favourite with CBM 8096 users, offers a dedicated word processor combined with a powerful database and sophisticated calculations facilities.

The package has been revamped and upgraded by the Bristol Software Factory but the price remains the same at around £900.

Even though it's written in machine code, the program swallows up a hefty 120K of memory so the minimum RAM required for this 16-bit implementation is 256K.

'Without the limitations of 96K of memory we have been able to re-write the program to include a number of major improvements,' said Mike McDonald, of the Bristol Software Factory.

Moving between one part of the package and another has been made faster by the intro-



Mike McDonald

duction of single keystroke commands. As a result it is impossible to switch from typing a letter to looking up a report or carrying out an accounting operation.

Because all the parts of the package are interlinked it is also possible to use the calculation facilities to update the database while inserting the information in a letter you are typing.

IBM PC and DEC Rainbow users should be able to lay their hands on a version for their machines in June or July.

# PCN Charts

The prices quoted are for the no-frills models and include VAT. Information for PCN's Charts has been culled from retailers throughout the country and compiled by MRIB, London.

## Top Twenty — £1,000

1	BBC Model B	£399	(AC)
2	Sinclair ZX81	£50	(SI)
3	Newbrain AD	£228	(GR)
4	Commodore Vic-20	£170	(CO)
5	Acorn Atom	£174	(AC)
6	Apple II	£776	(AP)
7	Sinclair Spect 16K	£125	(SI)
8	Atari 800	£400	(AT)
9	Atari 400	£160	(AT)
10	Commodore 64	£345	(CO)
11	Dragon 32	£200	(DR)
12	Jupiter Ace	£90	(JU)
13	Texas TI99	£150	(TE)
14	Colour Genie	£224	(LO)
15	Oric 1	£100	(OR)
16	Sharp MZ80A	£549	(SH)
17	Commodore 500	£799	(CO)
18	Tandy TRS (C/C)	£240	(TA)
19	Epson HX20	£472	(EP)
20	Commodore 4016	£632	(CO)

## Top Ten £1,000 — £2,500

1	Sirius 1	£2,754	(SI)
2	Olivetti M20	£2,754	(OL)
3	Apple III	£2,780	(AP)
4	Osborne 1	£1,581	(OS)
5	HP 86A	£1,541	(HP)
6	Commodore 710	£1,475	(CO)
7	Xerox 820	£2,415	(RX)
8	Superbrain II	£2,185	(IC)
9	Micro-Mimi 802	£1,720	(BM)
10	Sanyo MBC 1000	£1,195	(SA)

AC — Acorn Computers. AP — Apple Computers. AT — Atari International. BM — British Micro. CO — Commodore. DR — Dragon Data. EP — Epson. GR — Grundy Business. HP — Hewlett-Packard. IC — Icarus Computers. JU — Jupiter Cantab. LO — Lowe Electronics. OL — Olivetti. OR — Oric. OS — Osborne Computers Corporation. RX — Rank Xerox. SA — Sanyo Marubeni. SH — Sharp. SI — Sinclair. TA — Tandy. TE — Texas Instruments.



# Another £600 to break the IBM colour bar

All you'll get if you hope for cheap colour graphics on your IBM Personal Computer at the moment is the blues (mental, not chromatic).

As things stand now you have to spend up to £600 on a colour monitor that understands the US standard signal, called NTSC.

This is the only form of output from the colour/graphics card supplied by IBM as an extra on the PC.

The difference between NTSC and the UK standard PAL means that UK television sets are out of the question.

And attempts to rig up an RGB monitor yield anaemic tints.

The colour/graphics card has two output sockets; one for a composite NTSC signal and the other for a 9-pin direct connection NSTC signal.

The second of these can, in theory, be used to drive an RGB video. But, in practice, applications programs treat the monitor as monochrome and any colour that gets through is vague and undefined.

Colour monitors supplied by dealers include models by Princeton Graphics, Luxor, Electra-Home and Microvitec.

IBM itself includes no colour monitor in its catalogue.

Whether the company will do so in future, or whether it will supply a colour/graphics card with PAL output, is a mystery.

IBM habitually refuses to comment on what it quaintly calls 'unannounced products'. But a spokesman confirmed last week that it doesn't regard the PC range as complete.

'If you wait until everything is in place before you launch you could wait forever,' he said. 'As soon as we had a minimum amount of equipment with the PC we launched.'

There are murmurs that IBM is developing a modulator, and a high resolution monochrome monitor is thought to be on the way. This would at least provide for monochrome graphics, unlike the screen supplied.

If you can afford almost £3,000 for a personal computer another £550 or £600 for a colour monitor might not seem excessive.

But the lingering US orientation of IBM's PC does seem a little odd, in view of the length of time that passed between the system's first US appearance and its launch in Europe.

## Acorn disk slips £100

Never let it be said that the news is always bad. Acorn has just cut the cost of its 800K disks by more than £100.

The Acorn Dual Disk Drive used to cost £918.85, but in the company's latest price list it has come down to £803.85.

The reason for this generosity, according to Acorn, is that 'the machines have been selling better than we anticipated and the opportunity was there to bring the price down.' Economies of scale, in other words.

Most of the users of the disk units are in schools or businesses, the company said. But buy now — no further price cuts are expected.

## Age of the Sage

A new system for the pricey end of the market is on the way from Bristol-based TDI.

The company is about to deliver the Sage IV, an American-built 16-bit micro that will cost £5,577 in its basic form. TDI is naturally bullish about the machine, but one of its dealers has gone further: 'I think from June onwards Data General and DEC will start losing sales,' he said.

Be that as it may, the Sage IV has — on paper — an impressive specification. Built around the 68000 processor, it has a maximum of one megabyte of RAM and is due to support up to 200 megabytes on-line.

It can also accommodate six users, and offers them a choice of four operating systems — the UCSD p-system, BOS, CP/M-68K, and Mirage (for APL work).

the disk drives, which are American, and the monitor, which comes from Italy.'

But the way things are going, the 2009 may be available in Holland before the UK. Because of links with the Dutch company Systel Automatisering, marketing and distribution arrangements on the Continent are more advanced than they are here. Three hundred units have already been ordered by an Italian organisation.

The company is now looking for dealers in the UK who can handle high volumes.



For UK users, colour costs can kill

## Insurers move into micros

It's becoming a lot easier to get insurance for your micro. But it pays to shop around.

Major companies such as Commercial Union, Eagle Star, British Engine (part of the Royal group), National Vulcan (part of the Sun Alliance group) and Trident General are now providing special policies for low cost micros.

If you are strictly a home user you may be able to extend your household contents policy. Commercial Union, for example, offers an add-on to its 'Golden Key' and 'Silver Key' policies to cover micros for both accidental damage and machine breakdown.

'We recognised that people as individuals are now buying computers in increasing numbers so we have been forced to adapt to the changing market,' a spokesman said.

The add-on costs £10 a year for equipment up to the value of

£400. Thereafter the cost is 2.5 per cent of the value of the equipment insured.

This special scheme applies only to micros used in the home. However, if you are using a micro in your business it may be possible to obtain a similar extension to your office contents insurance. The cost is

also likely to be 2.5 per cent of the value of equipment.

If you want to insure yourself against loss of data, loss of earnings or the cost of hiring a temporary replacement for your computer, all five companies offer tailor-made policies to cover you against these eventualities.

## IDS 2009 launched at IBM end of PC market

A company that cut its teeth making printed circuit boards for systems builders is to launch its own micro. Interactive Data Systems of Milton Keynes says it will have its 2009 system on sale in two or three months.

IDS managing director

James Spencer revealed that the 2009 will feature eight and 16-bit processing by incorporating Z80 and 8088 processors.

Other features promised, include an S-100 bus, twin 400K floppies and an array of programmable keys.

Spencer says the system's main appeal will lie in its overall specification in relation to its price — the 2009 is expected to sell for £1,995. He calls it 'a personal computer if you follow the IBM notation'.

The machine, he says, is 'UK designed and built except for



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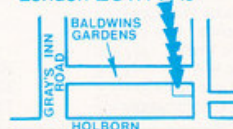
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Frogger	Rabbit	13V008	£9.99
Ski-Run	Rabbit	13V009	£4.99
Space Storm	Rabbit	13V010	£6.99
Cosmic Battle	Rabbit	13V011	£4.99
Rainbow Towers	A.S.K.	14V012	£8.95
Number Gulper	A.S.K.	14V013	£8.95
Super Worm	Rabbit	13V014	£4.99
Night Flight	Rabbit	13V015	£4.99
Rabbit Writer	Rabbit	13V016	£19.99
Chartset	Rabbit	13V017	£4.99
Rabbit Functions	Rabbit	13V018	£4.99
Rabbit Base	Rabbit	13V019	£14.99
Home Office	Navajo	16V020	£12.95
Decision Maker	Creative	16V021	£14.95
Loan Analyser	Creative	16V022	£14.95
Car Costs	Creative	16V023	£14.95
Home Inventory	Creative	16V024	£14.95
Household Finance	Creative	16V025	£14.95
Forth (cart)	Audiogenic	16V026	£24.95
Monitor (cart)	Audiogenic	16V027	£19.95
Bonzo	Audiogenic	16V028	£7.95
Tomb of Drowan	Audiogenic	16V029	£12.95
Trashman (cart)	Audiogenic	16V030	£19.95
Pit	Audiogenic	16V031	£7.95
Astro Blitz (cart)	Audiogenic	16V032	£19.95
Boss	Audiogenic	16V033	£14.95
Tank Attack (cart)	Audiogenic	16V034	£19.95
Outworld (cart)	Audiogenic	16V035	£19.95
Blockade	Audiogenic	16V036	£6.95
Amok	Audiogenic	16V037	£6.95
Vicalc	Audiogenic	16V038	£8.95
Alien Blitz	Audiogenic	16V039	£7.95
Sky Math	Audiogenic	16V040	£6.95
Space Division	Audiogenic	16V041	£6.95
The Alien	Audiogenic	16V042	£7.95
Vicat	Audiogenic	16V043	£8.95
Hangman/Hang Math	Audiogenic	16V044	£7.95
Math Hurdler/Monster Maze	Audiogenic	16V045	£7.95
Sea Wolf/Bounce Out/Vic	Audiogenic	16V046	£8.95
Code Maker/Code Breaker	Audiogenic	16V047	£7.95
Kosmic Kamikaze	Audiogenic	16V048	£7.95
Minikit	Audiogenic	16V049	£7.95
Golf	Audiogenic	16V050	£7.95
Spiders of Mars (cart)	Audiogenic	16V051	£19.95
Cloudburst (cart)	Audiogenic	16V052	£19.95
Renaissance (cart)	Audiogenic	16V053	£19.95
Satellites and Meteorites (cart)	Audiogenic	16V054	£19.95
Meteor Run (cart)	Audiogenic	16V055	£19.95
Magnificent Seven	Audiogenic	16V056	£4.95
Mikro Assembler (cart)	Audiogenic	16V057	£48.95
Castlemath	Audiogenic	16V058	£8.95
Arcadia	Imagine	05V059	£5.50
Database Management	Cosma	03V060	£19.95
Stock Control	Cosma	03V061	£19.95
Commercial Accounts	Cosma	03V062	£19.95
Home Accounts	Cosma	03V063	£19.95
Invoices & Statements	Cosma	03V064	£19.95
Character Generator	Cosma	03V065	£19.95
Home Accounts	Cosma	03V066	£19.95
Database	Cosma	03V067	£19.95

**VIC 20 cont.**

Mem Req'd	Supplier	Code No	Price
	S.T.P. (Word Processing)		
	Mailing List		
	Space Hero		
16K	Quest		
16K	Martian Raider		
	Mind Twisters		
	Shark Attack		
	Multisound Synthesizer		
	Sea Invasion		
	Space Attack		
	Vic Chess		
16K	Vic Asteroids		
	Another Vic in the Wall		
	Vic Panic		
	Cosmaids		
3K	Vic Gammon		
	Vic Scramble		
	Martian Raider		
	Myriad		
	Avenger (cart)		
	Star Battle (cart)		
	Super Slot (cart)		
	Jelly Monsters (cart)		
	Alien (cart)		
	Super Lander (cart)		
	Road Race (cart)		
	Rat Race (cart)		
	Mole Attack (cart)		
	Adventureland (cart)		
	Pirate Cove (cart)		
	Mission Impossible (cart)		
	The Count (cart)		
	Voodoo Castle (cart)		
	Sargon 2 Chess (cart)		
	Omega Race (cart)		
	Blitz		
	Hopbit		
	Race		
16K	Strategic Advance		
16K	Simplicalc		
8K	Vic Stock Control		
8K	Vic Writer		
8K	English Language		
8K	Maths 1		
8K	Maths 2		
8K	Biology		
8K	Chemistry		
8K	Physics		
3K	Apple Tree Birds		
3K	Engine Shed		
3K	Lighthouse & Subtraction		
3K	Quizmaster		
8K	Know Your Own I.Q.		
8K	Know Your Child's I.Q.		
8K	Know Your Own Personality		
8K	Robert Carrier Menu Planner		
8K	Vic Money Manager		
8K	Vic Road User & Highway Code		
8K	B.B.C. Mastermind		
8K	Type & Tune		
	Programmers Aid Cart.		
	Super Expander High Res. Cartridge		
	Machine Code Monitor Cartridge		
	Chicken Run		
	Dambuster		
	Missile Panic		
	Road Runner		
	Android Attack		
	Space Hopper		
	Star Wars 2		
	Mawai Attack		
	Space Wars/Battle Zone		
	General Knowledge Data 1		
	General Knowledge Data 2		
	General Knowledge Data 3		
	General Knowledge Data 4		
	Specialist Knowledge Wine & Food		
	Specialist Knowledge Sport & Games		
	Specialist Knowledge Sport		
	Specialist Knowledge Music		
	Cosma	03V068	£19.95
	Cosma	03V069	£19.95
	Cosma	03V070	£6.95
	Cosma	03V071	£6.95
	Romik	10V072	£9.99
	Romik	10V073	£9.99
	Romik	10V074	£9.99
	Romik	10V075	£9.99
	Romik	10V076	£9.99
	Romik	10V077	£9.99
16K	Bug Byte	02V078	£7.00
	Bug Byte	02V079	£7.00
	Bug Byte	02V080	£7.00
	Bug Byte	02V081	£7.00
	Bug Byte	02V082	£7.00
3K	Bug Byte	02V083	£7.00
	Bug Byte	02V084	£7.00
	Software Masters	08V085	£9.99
	Software Masters	08V086	£9.99
	Commodore	04V087	£19.95
	Commodore	04V088	£19.95
	Commodore	04V089	£19.95
	Commodore	04V090	£19.95
	Commodore	04V091	£19.95
	Commodore	04V092	£19.95
	Commodore	04V093	£19.95
	Commodore	04V094	£19.95
	Commodore	04V095	£19.95
	Commodore	04V096	£24.95
	Commodore	04V097	£24.95
	Commodore	04V098	£24.95
	Commodore	04V098	£24.95
	Commodore	04V099	£24.95
	Commodore	04V101	£24.95
	Commodore	04V102	£24.95
	Commodore	04V103	£4.99
	Commodore	04V104	£4.99
	Commodore	04V105	£4.99
	Commodore	04V106	£4.99
16K	Commodore	04V107	£19.95
8K	Commodore	04V108	£19.95
8K	Commodore	04V109	£19.95
8K	Commodore	04V110	£9.99
8K	Commodore	04V111	£9.99
8K	Commodore	04V112	£9.99
8K	Commodore	04V113	£9.99
8K	Commodore	04V114	£9.99
8K	Commodore	04V115	£9.99
3K	Commodore	04V116	£4.99
3K	Commodore	04V117	£4.99
3K	Commodore	04V118	£4.99
3K	Commodore	04V119	£9.99
8K	Commodore	04V120	£9.99
8K	Commodore	04V121	£9.99
8K	Commodore	04V122	£9.99
8K	Commodore	04V123	£9.99
8K	Commodore	04V124	£9.99
8K	Commodore	04V125	£9.99
8K	Commodore	04V126	£9.99
	Commodore	04V135	£4.99
	Commodore	04V136	£34.95
	Commodore	04V137	£34.95
	Commodore	04V138	£34.95
	Database	15V139	£5.50
	Database	15V140	£5.50
	Titan	22V141	£6.00
	Titan	22V142	£5.00
	Titan	22V143	£5.00
	Titan	22V144	£5.00
	Titan	22V145	£5.00
	Titan	22V146	£5.00
	Titan	22V147	£5.00
	Commodore	04V127	£1.99
	Commodore	04V128	£1.99
	Commodore	04V129	£1.99
	Commodore	04V130	£1.99
	Commodore	04V131	£1.99
	Commodore	04V132	£1.99
	Commodore	04V133	£1.99
	Commodore	04V134	£1.99

# BUY 'N TRY MEANS 80% OFF YOUR SECOND PURCHASE

**\* Personal callers welcome .... come along see our super selection!**



Our list of latest releases from the States and extensive Atari range will be sent free with every order.

Our list of latest releases from the States and extensive Atari range will be sent free with every order.

	Mem Req'd	Supplier	Code No	Price
Bug Off	16K	Adventure Intl	34G052	\$21.99
The Eliminator	32K	Adventure Intl	34G053	\$17.99
Preppie	16K	Adventure Intl	34G054	\$21.99
Sea Dragon	16K	Adventure Intl	34G055	\$25.49
Stratos	16K	Adventure Intl	34G056	\$25.49
Tutti Frutti	16K	Adventure Intl	34G057	\$17.99
Temple of Asphai	32K	Automated Simuls	35G058	\$29.75
Upper Reaches of Asphai	32K	Automated Simuls	35G059	\$14.75
Invasion Orion	24K	Automated Simuls	35G060	\$18.50
Hellfire Warrior	32K	Automated Simuls	35G061	\$29.75
The Keys of Acheron	32K	Automated Simuls	35G062	\$14.75
Curse of Ra	32K	Automated Simuls	35G063	\$14.75
Danger in Drindisti	32K	Automated Simuls	35G064	\$14.75
Datestones of Ryn	32K	Automated Simuls	35G065	\$14.75
Morloc's Tower	32K	Automated Simuls	35G066	\$14.75
Rescue at Rigel	32K	Automated Simuls	35G067	\$22.00
Star Warrior	32K	Automated Simuls	35G068	\$29.75
Crush, Crumble & Chomp	32K	Automated Simuls	35G069	\$22.00
Ricochet	16K	Automated Simuls	35G070	\$14.75
King Arthur's Heir	16K	Automated Simuls	35G071	\$14.75
Monster Maze		Automated Simuls	35G072	\$29.75
Platter Mania		Automated Simul	35G073	\$29.75
Alien Garden		Automated Simuls	35G074	\$29.75
Action Quest	16K	J V Software	36G075	\$22.00
Ghost Encounters	16K	J V Software	36G076	\$22.00
Journey to the Planets	32K	J V Software	36G077	\$22.00
Gorf	16K	Roklan Corp.	37G078*	\$33.25
Wizard of Wor	16K	Roklan Corp.	37G079*	\$33.25
Battle of Shiloh	48K	Strategic Simuls	38G080	\$31.00
Tigers in the Snow	40K	Strategic Simuls	38G081	\$31.00
Firebird	4K	Gebelli Software	39G082*	\$29.50
Embargo	8K	Gebelli Software	39G083*	\$33.00
Guardian of the Gorn	32K	In-Home Software	40G084	\$22.00
Sentinel 1	24K	In-Home Software	40G085	\$22.00
Pool 400	16K	Innovative Design	41G086*	\$29.50
Choplifter	16K	Broderbund	42G087*	\$29.95
Stellar Shuttle	32K	Broderbund	42G088	\$23.55
Moon Shuttle	16K	Datasoft Inc.	43G089	\$31.40
Zaxxon	16K	Datasoft Inc.	43G090	\$31.40
Astro Chase	32K	First Star Software	44G091	\$22.00
Venus Voyager	16K	English Software Co.	45G092	\$19.95
Baja Buggies	16K	Gamestar	46G093	\$22.00
Claim Jumper	16K	Synapse Software	47G094	\$27.50
Claim Jumper	16K	Synapse Software	47G095*	\$29.95
Shamus	16K	Synapse Software	47G096	\$27.50
Shamus	16K	Synapse Software	47G097*	\$29.95
Picnic Paranoia	16K	Synapse Software	47G098	\$27.50
Picnic Paranoia	16K	Synapse Software	47G099*	\$29.95
Necromancer	16K	Synapse Software	47G100	\$27.50
Necromancer	16K	Synapse Software	47G101*	\$29.95
Survivor	16K	Synapse Software	47G102	\$27.50
Survivor	16K	Synapse Software	47G103*	\$29.95
Shamus II	16K	Synapse Software	47G104	\$27.50
Shamus II	16K	Synapse Software	47G105*	\$29.95
Stargate Courier	16K	Syncro	48G106*	\$27.50
Laser Ants	16K	Syncro	48G107	\$18.50
Laser Ants	16K	Syncro	48G108*	\$26.75
Astron IX	16K	Syncro	48G109	\$18.50

\* Denotes cartridge

These fully proven programs are designed to run on CP/M\* based machines. They have been fully audited by H.M. Customs & Excise and the Commissioners of Inland Revenue wherever necessary, and have been planned and written in the U.K. All our business software has been extensively proved in the field through our substantial user base. And remember .... the usual Buy 'n' Try terms apply .... so it's easy to upgrade as your needs grow.

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**TRYSAI** - Sales ledger. Balance brought forward, or open system option. Provides day books, audit trails, statements, cash posting, arrears schedule and account enquiry. **\$250.00**

audit trails, statements, cash posting, arrears schedule and account enquiry. ....	£250.00
<b>'TRYPUR' – Purchase ledger. Choice of balance brought forward/open item system. Day books, audit trails, remittance advices, cheque posting. ....</b>	<b>£250.00</b>

audit trails, remittance advices, cheque posting ..... £250.00

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<b>'TRYCOST'</b> - Costing program. A remarkably versatile system suitable for manufacturers, builders etc. Ideal for those needing sophisticated cost control of time and/or materials, as well as sub-contract/external supplies. Includes provision for both budgets and actuals.	<b>£300.00</b>
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Embraces monthly salaries and all deductions. Complies with all Govt. regulations, produces P60  
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When we send your software order, you'll find a return address label and a list of the buy-back prices for each item ordered.

Remember, we are pledged to buy back your software against a new purchase of equivalent or greater catalogue value, provided you purchase it from us. And you get a full six months to decide whether to keep your software or benefit from the buy-back option.

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Please rush me the following programs, and put me on the Software Centre mailing list for program up-dates and great special purchase offers.

Name .....	Code No .....	Price .....
Name .....	Code No .....	Price .....
Name .....	Code No .....	Price .....

Cheque ( ) Postal order ( ) enclosed.

Please debit my Access ( ) Barclaycard ( ) in the sum of £ ..... Account no. (   (   (   (   (   (   (   (   (   (   )

My computer is (make) ..... Model .....

Memory ..... Peripherals.....

Name .....

Address .....

Post code ..... Customer Tel. No .....

Signed ..... Please allow up to 14 days for delivery.

\_\_\_\_\_



# Sizable problem looms in disks

Users could be losers as the world's floppy disk makers dig in on the question of micro-floppy standards.

Unless a compromise is reached you might find yourself faced with the prospect of buying software on a bewildering variety of non-compatible disks, drives and formats.

And the chance of a compromise seems more remote with every passing day. Hopes raised by Shugart's expression of support for Sony's 3½in floppy have been dashed by separate moves from Hitachi and IBM.

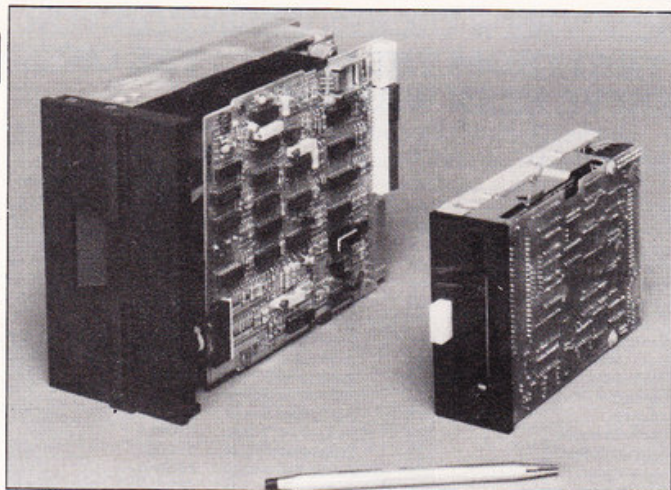
Hitachi, with the backing of fellow Japanese giant Matsushita, has put its weight behind a 3in unit. It also has the

support of another 16 Japanese and US companies, including MPI, one of the big three US disk makers.

IBM, as usual a law unto itself, has come out with a 3.9in unit. This is bound to attract backing, because IBM initiatives tend to become standards.

The fourth contender struggling for domination of the micro-floppy market is a consortium of US disk drive manufacturers. They are pushing for a 3¼in standard which they claim would be a more natural stepping stone down from 5¼in disks.

Software suppliers could also face a dilemma. Those concentrating on a single hardware manufacturer should be all



The Shugart standard: 3½in SA300 microfloppy drive for micros and the industry-standard 5¼in mini-floppy.

right, according to a spokesman for Pete and Pam Computers, but others may have to 'keep master copies and supply them on loads of different formats.'

'Provided there is one format or possibly two it's no problem,' he said, 'but if there are three or four it could be difficult.'

## Three-star ZX81 course

You may not have expected to sample the high life when you bought your Sinclair ZX81, but a hotel in the West Midlands intends you to enjoy finding your way round the machine in three-star comfort.

The Gainsborough House Hotel, Kidderminster, runs three kinds of course for beginners using Basic on the ZX81. There are evening classes of two hours a week over ten weeks, non-residential weekends, and residential weekend courses offering 14 hours of tuition.

Numbers on each course are restricted to 20, with two people to each computer. The instructors are qualified local people and the success of the venture so far (evening classes have been in progress since last October) may tempt the hotel management into a wider curriculum.

The price of a weekend's residential course is £55, which includes accommodation, meals, and a glass of sherry on arrival to give a civilised start to proceedings.

The Gainsborough House Hotel is on Kidderminster (0562) 754041.

## Makers take the rap over ads

Don't believe everything you see in the adverts. Five micro makers have been taken to task for bending the truth in the latest report from the Advertising Standards Authority.

Dragon, Olivetti, Rank Xerox and previous offenders Acorn and Sinclair all appear on the Authority's most recent list of culprits.

Dragon fell foul of the 'legal, decent, honest guidelines by claiming that its 32K of RAM made it twice as powerful as its competitors. The authority agreed with a member of the

public who pointed out that the Sinclair Spectrum was available with 48K of RAM.

Sinclair ran into trouble with its adverts on two counts. It advertised three ZX81 software packages that needed the 16K rampack add-on unit but failed to make this clear in the advert.

The company also claimed that 'All you need to run the programs . . . is a portable cassette recorder.' The implications was that any cassette machine would do. In fact, several popular makes of cassette recorders are incompatible

with the ZX81.

Acorn made a similar mistake. It claimed that any UHF television would work with the Atom micro. But, several makes of TV do not work with the machine.

Olivetti erred by comparing the price of its M20 with other machines — without pointing out that the £2,395 price quoted did not refer to the colour display version shown in the advert.

Xerox was ticked off for promoting a free offer that was not generally available.

## Acorn's Beeb bureau

Acorn has had so many queries about the BBC micro that it has set up a special service to deal with them.

Unfortunately, it will help you only if you put your questions in writing.

Acorn says that the small team at its Customer Service Centre can deal only with letters. Of course, that might be a good thing as it seems virtually impossible to get through to Acorn on the telephone these days. Send your queries and complaints to Mike Bicknell at Acorn Computers, Fulbourne Road, Cherry Hinton, Cambridge, CB1 4JN.



**DEALER'S CONTEXT** — CW/P, the cut-price Apple and Osborne dealer, has come out with a machine from Ontel. The Context is an 8-bit system that sells for £1,495. That price includes a CP/M operating system, a WordStar word processing system and a package with about the same capability as the Osborne. It is available from CW/P's London head office.

## New links in Lasky's chain

All Lasky's non-specialist branches will now stock micros.

Twenty 20 branches will stock Commodore's Vic-20, Atari 400 and 800 plus a range of software and peripherals.

Up until now, 26 specialist branches have stocked Apple, Atari, Lynx, Commodore 64 and Vic-20, Jupiter Ace, Newbrain, Osborne and Sharp.



# Now it's hunt the Ile

If you want the new Apple Ile you may have to wait. It will probably be the end of the month before you can walk into a shop and buy the machine off the shelf.

Personal Computers, in the City of London, is just one of the shops that has already run out of IIs. 'We are experiencing some difficulties in obtaining supplies from Apple but we hope to have machines in stock by next week,' said director Stuart Lakey. 'Sales have been going marvellously well,' he added.

West London Apple special-

ist Applitek also reported that it had no IIs in stock. 'They are coming in the door and going straight out again,' said Simon Rowley, a company director.

One major dealer has yet to receive any machines to sell. The dealer, who refused to be named, complained: 'We have ordered 15 machines. All that Apple has offered is three and they won't be coming in until tomorrow.'

But Lasky's in Manchester reported no problem in obtaining machines. 'We have good supplies of Apple, especially the Ile,' said store manager Mike Lowe.

Apple seemed to be surprised at the sales interest in the revamped machine and is increasing shipments into the UK to meet the demand.

'Reasonable quantities are now arriving from Cork and the stock shortage should be overcome by the end of the month,' a spokeswoman claimed.

## Dataview: wider application

If you run an IBM, DEC or Sirius personal computer, you could soon be using software that used to run on only Commodore machines.

Commodore software specialist Dataview is changing tack and adapting its products for a wider market. The first conversion will be of its word processing package Wordcraft. This is almost ready for the Sirius.

'Until now we have developed software only for Commodore machines,' a spokesman for the Essex-based com-

pany said. 'But we really don't know what their plans are—the 8000 Series could go out any day.'

Dataview has no intention of moving away from Commodore completely. In fact it has just released versions of its DTL-Basic Compiler to run on the Commodore 64, 500 and 700 systems.

The compiler has been available on earlier Commodore machines for the last two years. Originally it cost nearly £300, but now the price has come down to £99.50.



**ICL SAYS NO**—If you are a home user there is little chance you will ever be able to buy a personal computer from Britain's largest computer company. ICL said that it had no designs on that market when it released the latest upgrades to its personal computer range. Its four 8-bit micros are basically bigger, faster versions of the RAIR black box. Pictured here is Model 35, a 10 megabyte system with 256K RAM. Model 26 is a 5 megabyte system with 256K RAM selling for £4,425 and Model 25 is a 5 megabyte system with 64K of RAM—price £3,625. Model 15 is a twin floppy system with 64K RAM and sells for £1,795. The machines are now available at Traderpoint centres.

## VIEW FROM AMERICA



# Commodore declares a price war

The big news here at the moment is prices. Commodore has launched an all-out campaign to cut price tags on its machines.

The result is that some personal computers are looking more personal than ever before.

The Commodore 64 seems an excellent buy at the moment. Some New York shops are selling it for as little as \$439—a big cut from the previous standard retail price of \$595.

And there may be even better news in store for hopeful 64 owners. Some retailers are now whispering that prices could tumble to \$395 before very long.

This is good news for anyone who has designs on the 64 as a word processor. With the Quick Brown Fox, a word processing program that sells for \$65, plus the necessary disk drives and printer, it is possible to put together an effective system for less than \$1,500.



**Commodore 64 retails in some New York stores at only \$439—cut from \$595—and could drop below \$400.**

That's somewhere in the region of the cost of an IBM Selectric Mark III.

Of course, there's method in Commodore's madness. The company let it be known some months ago that it planned to downgrade the 64 from a 'personal computer' to a 'home computer' because it wanted to make way for its new 128K machine.

That model is due out here in April for a mere \$795.

And that's not all Commodore is promising for April. A new range of portable machines is also expected. This will start with a low-end, 64K RAM black and white model that weighs 12lbs, and carries a price-tag of \$950.

In case you don't have your calculator handy, that's 10lbs and \$700 lighter than an Osborne.

At the low cost end of the market, Commodore is posting ominous notices for Sinclair, Texas Instruments and Atari. The Vic-20 is being marked down to \$129, which is barely twice the cost of a discounted Sinclair with its membrane keyboard and limited memory.

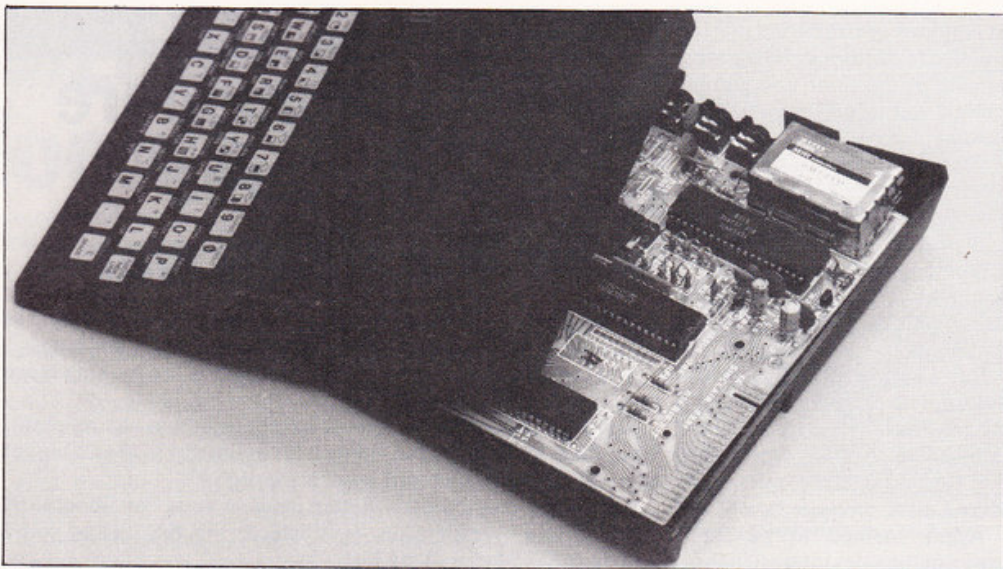
But the Atari 400 and the TI 99-4A are Commodore's real targets. Both currently retail for between \$50 and \$100 more than a Vic-20. A recent full page ad in the *New York Times* named both machines and claimed: 'Even if they gave theirs away, the Commodore Vic-20 would still be a better computer.'

It is hard to know just what all this will mean to Apple and Tandy Radio Shack. Currently, neither company seems to be devoting much energy to the common user.

Apple is still busy launching the Lisa and the Apple IIe, and its low-priced Macintosh is still strictly hush-hush. 'We don't even know what it is,' says Apple.

All of which can only keep them cheerful over at Commodore.





Bell's move into micros may cause problems for Sinclair

## PCs? Bell won't tell

From Chris Rowley in New York

Sinclair could soon be facing its most formidable competition in the USA. American Bell, the new offshoot of the giant American telephone company AT&T, is believed to have four new personal computers under wraps.

The AB 100 is expected to sell for under \$100, and is likely to cause Sinclair headaches.

But other manufacturers may have to sit up and take notice as well. Informed sources here say the AB 200 will

compete directly with the Commodore Vic-20.

The AB 300 will give Osborne a run for its money, and the biggest of the group, the AB 400, will be in the same league as the IBM Personal Computer, it is believed.

All four of these machines are expected to use the powerful 32-bit Bell Mac micro-processor developed in 1981 by AT&T's research arm, Bell Laboratories, to work with a modified Unix system.

American Bell is preserving a

discreet silence on the subject. The company has indirectly confirmed that prototypes for the machines exist, but says that many prototypes never go into production.

If American Bell does move into the personal computer market on this scale it could become a major force.

The company, created on January 1 to allow AT&T to move away from telephones and into other high technologies, is certainly one of the wealthiest start-ups in memory.

## NEC rival for Epson

From George Faas in Japan

Nippon Electric has introduced a new, powerful portable about the size of a 2in pad of A4 paper. And it weighs only 3lb 12oz.

But, don't ditch your Epsoms yet. Although the PC 8201 is on sale in Japan now for 138,000 yen (about £388), it is not due to reach the UK until the autumn.

When it does arrive, the new NEC machine could provide Epson with stiff competition. It boasts a 40 character, 8-line display that is about four times the size of the £40 HX-20.

It also offers 64K RAM expandable to 128K compared to Epson's 16K expandable to 32K. So by adding a monitor, printer and disk drive you can turn the 8201 into a desk-top system.

## NCR moves into micros

NCR is taking aim at business users. The company has moved into personal computers — albeit a bit late — with the Decision Mate V Series.

There are two machines in the range, both aimed at business and professional users. An 8-bit processor with monochrome graphics starts at £1,825.

The base price for the dual processor, which runs both eight and 16-bit programs, is £2,175.

Prices of both machines include dual flexible disk drives, 64K of main memory, an operating system and a high-speed graphics subsystem.

The machines can run CP/M80, CP/M86 and MS-DOS operating systems, and languages include Basic, Pascal, Fortran and Cobol.

The range gets high marks for its 'plugability'. It has been designed with bus plugs that allow peripherals to be plugged into the back of the unit easily.

The new range, says NCR, is intended to woo some customers away from IBM. 'Comparing like with like, our machine is cheaper than IBM's,' says Mike Couzens, head of NCR personal computer marketing division.

Hardware and software for the new machines is promised by the end of March.

## Oki upgrade aims for lab users

Those of you who are pushing back the frontiers of science with Oki micros can now upgrade to the Oki i1800 Model 30 with hard disk option and high resolution dot matrix printer.

The Model 30 was launched by Encotel Systems last week. It is basically a Model 20 with added storage and output.

It has a maximum of 256K RAM, a Z80B processor, and up to 20 megabytes on disk.

The no-frills UK selling price will be £2,800, and Encotel expects to import around 12 a month. The company estimates that there are between 20 and 30 of the previous generation, the Model 20, in the country. These are mainly in the hands of scientific users.

Encotel is in Croydon, Surrey on 01-686 9687.



**SON OF SUNDANCE** — Another promising micro range has gone the way of business respectability with the launch of Onyx Computer's Sundance 16. The 16 is the successor to the Sundance and Sundance II, and represents a 'small micro changing to a very powerful micro', according to Onyx distributor Thame Systems. 'Very powerful' in this case means bigger disk options, support for Unix as the main operating system, and the capacity to support five users. According to Thame, software written for previous Sundance models in Onyx's Cobol will run on the 16. The basic price for the system is about £9,000, and Thame expects to begin delivering in quantity late in March.



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**PCN MONITOR**

# More megabytes in less space

Portable users could soon be getting their teeth into 10 megabytes — but there's no way of knowing how much it will cost.

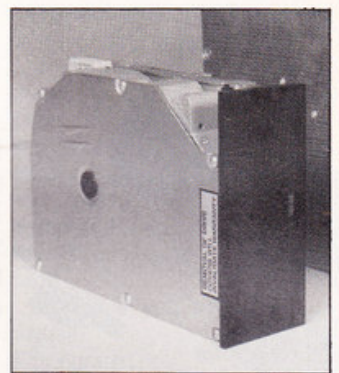
A UK company, Rodime, has come up with the world's first 3½in Winchester disk drive. It is a 1.625in × 5.25in × 4in unit that can hold 10 megabytes.

The company is happy enough to list the virtues of the device, but is cagey about price.

Rodime claims that the size, weight and low power consumption of the RO 350 make it ideal for portables.

In fact, the company believes the device could also be used in place of 5¼in disks in some cases. It can be packaged in a number of ways, and its dimensions correspond with half-height and full height 5¼in Winchester. Its electrical interface, the ST506, also comes from the 5¼in arena.

Rodime claims a mean time between failure of 12,000 hours. 'As it comes it can withstand 30g shocks,' says Dr Norman White, engineering chief at the company. 'In operation it is slightly more rugged



The Rodime RO 350 — a portable 3½in disk drive

than our 5¼in drive.'

The RO 350 comes in two versions: the 351 with five megabytes and the 352 with 10. Both use the oxide media and ferrite heads of Rodime's RO 200 series, but thin film versions are in the pipeline.

Average access time of the drives is 85 milliseconds; track-to-track is 18 milliseconds, with a power requirement of 13 Watts.

Evaluation units have just become available for manufacturers, and they should turn up in finished products soon.

## Basic from babyhood

Micro training will soon be available from the cradle to the grave — if recent moves by Commodore and Head-Line Communications are any guide.

Commodore is trying to catch them young with a lively Basic programming package it claims will delight children as young as seven.

For the more mature among us Head-Line Communications of Hereford has released a simple guide to CP/M.

The Commodore package introduces Gortek, a superhero who defends the planet Syntax against hostile Zitrons. The idea is to learn how to program the computer to help Gortek repel the invaders.

Gortek runs on the Vic-20 or Commodore 64 colour systems. It is designed for 11 to 14-year-olds, but the company claims much younger children can use it with some help.

The package costs £12.95 and is likely to be the forerunner of a

series that will progressively introduce more difficult concepts. This one doesn't go much beyond PRINT.

Head-Line Communications' *Using your CP/M Micro* is a different kettle of fish, although it also aims to give you the most benefit for the least mental agony.

Like the company's previous training package for Wordstar, the CP/M kit includes audio cassettes, reference manuals and checklists.

It is more a confidence-builder than a comprehensive guide — you will have to look elsewhere for coaching on some of the more advanced functions of CP/M.

But the omens for the product seem good. Its predecessor from Head-Line was expected to sell 200 copies in the first year. Instead it clocked up 2,000 in eight months.

*Using your CP/M Micro* costs £40 and is distributed by Newtech Publishing of Farnborough, Hampshire, tel Farnborough 510331. Commodore's software products division is in Slough, Bucks, tel Slough 74111.



# PCN Paperchase...

It's easy . . . and there are four BBC Model Bs up for grabs in this three-part competition.

Mind you, you'll have to do more than just wish for this £399 computer. Everyone does that. What we want you to do is use simple programming skills to unravel a 30-line program.

You don't even need a computer to do it — just a bit of common sense and logic.

For some reason an interesting (though not vital) bit of Basic programming for the BBC

Micro was written on separate bits of paper. Before anyone could number it an unexpected gust of grubby London air blew into our Oxford Street offices. As a result we have a sad and nasty mess that needs sorting.

For this first week's task we want you,

to unravel just the first five lines. With minor adjustments, such as a comma for a semi-colon, you should be able to run the program on any machine using Basic.

When you've decoded the first five lines and executed the resulting program you'll get a unique number. Just to encourage you, here's a clue . . . it represents an age many of us hated to say goodbye to.

Next week, in part two of this three-part competition, we'll take you a step further. But don't forget this week's solution meantime! Here's the jumbled five-liner . . .

```

• PRINT "CALCULATED NUMBER = ";CC%
• FOR N = 0 TO 10 STEP 2:CC% = CC% + A% * N: NEXT N
• CC% = CC% / A%
• IF A% < 1 OR A% > 99 THEN PRINT "INTEGER OUT OF RANGE - RERUN": END
• INPUT "PLEASE ENTER AN INTEGER (1 - 99) ",A%
  
```

We're not asking you to send in the results of each part of the competition. Just remember your answer and add it to next week's part. Then, on week three we'll print a coupon for you to complete and send to us. You'll win a BBC Model B if your correct entry is one of the first four plucked from PCN's competition hat. Good luck!





Letters come from people like you, so pull out your INKEY finger and feed us a line. If it's the best of the week's input PCN will add £10 to your spreadsheet.

Address us at Random Access, Personal Computer News, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

## Wild fantasies in Technicolor

It is my first duty and pleasure to wish your new publication every success. There is a large number of periodicals directed at personal computer owners, and, in launching yet another one, you undertake a daunting task.

When one surveys the personal computer scene, there is one predominant factor about which I'm most concerned. In the present economic climate, it is appalling that so much energy and resource is being devoted to the production, marketing, and playing of games of the Space Invader and Pac-man type.

It seems that a personal computer is evaluated, both by its manufacturer and by its prospective purchaser, entirely on its 'graphics capability', which seems to be a synonym simply for its ability to play such games. I estimate that at least 95 per cent of the software advertised for the home computer owner is of this 'junk' variety.

One cannot attach the whole of the blame for the situation to the manufacturers or the authors of the rubbish; they are in business to earn their bread, and they are able to do so most readily by meeting popular demand.

The primary cause must be the mentality of the buyer. It must be assumed that the majority of these are young people; by the accepted standards of my youth, many of these are illiterate, some are irresponsible, and all are far too affluent.

For evidence of the first-named fault, one has only to examine the popular periodicals, computer-orientated and otherwise; far too often, even some of the largest headings actually contain mis-spellings. The words 'separate' and 'principal' are favourite candidates — I wince every time I see one of the mutilations.

While I had to be content with, and derived great plea-

sure from games like Ludo and Snakes and Ladders, many contemporary youngsters will not even have heard of such games; they are content with nothing less than a full-scale implementation of their wildest fantasies, all in glorious Technicolor.

When one considers the true potential of the technological achievements of the past decade, it is extremely depressing to see them squandered in the manner described.

Doubtless, most of your younger readers will, at the very least, dub me 'square' for the foregoing comments; it is an accolade which I shall be proud to bear.

RJ Parsons,  
Whitton, Middlesex.

*From a screen junkie to a man of principal! — you're missing out on a lot of fun — Ed.*

## Strictly Tandy

As a user of the Tandy TRS 80, I am more than relieved to hear that the maker has at last expanded its software range to include the CP/M Plus version 3.0 advanced operating system.

It's about time Tandy agreed to market someone else's, as using the TRS DOS system had its limitations — namely that one couldn't use it on any other machine.

J Wilkinson,  
London, SW1.

## Techniques for teachers

I feel teachers' problems are being sadly overlooked.

This was particularly apparent from a programme on BBC television's Horizon series called *Talking Turtle* which discussed the merits of computer education. The major controversy brought out was whether teachers should use computers as a part of traditionally structured education, or whether children should grow into new technology in their own way with teachers offering help when needed.

While not backing out of such an ideological argument — which is after all questioning the whole ethos of our present education system — I must point out that in many British schools today this is an irrelevant discussion.

There aren't many classrooms here which have a

computer to five pupils. Most of them have just one machine for the school. Some may be lucky enough to have one to a classroom. But even then, the teachers handling them in the most part have little or no training. It's a bit like teaching biology and saying plants are green without knowing about chlorophyll.

If we are going to get computer education right, first we must teach the teachers. Only then can we decide what approach to take on education.

It is obviously not enough to use the micro as a teaching tool without teaching about computer techniques. It is not possible to act as a guide, gently steering pupils through their individual development paths unless that guide fully understands the machine, how it works and what its potential is.

So, let's get priorities straight. Let's make sure the teachers have been taught first.

Robert Pemberton,  
Bath, Avon

## Micro hermits

In all the euphoria over personal computers — the one-person one-computer mystique propounded by people like the founders of Apple — it seems to me that one important element has been ignored.

No one has taken into account the societal impact that such an exclusive electronic gadget in the home may have. First televisions, then videos allowed people to spend more and more time closeted in their own homes.

It seems to me that personal computers will have precisely the same effect.

As far as I am concerned people are already far too anti-social.

Roy Church,  
Upper Norwood

*There are about 300 micro clubs in the UK which is a pretty sociable scene. I don't think you need worry about 'societal impact' — Ed.*

## Bulldog Clive

I was really impressed when I heard that Uncle Clive has sold a million machines. It just proves that Britain still has its entrepreneurs — the talent and drive to make a mark on the world.

It is also encouraging at

another level because Clive Sinclair was never a brilliant scholar. In fact the story goes that he did notably badly in the classroom and only found his niche in the computer area.

There's no doubt he's both a technical whizz kid and a marketing expert. He's also got the Bulldog quality for he suffered several knocks on the way, including the production problems for his micros, but has always managed to bounce back.

It makes you proud to be British.

Ken Forster,  
Aldershot, Hants.

## Capital offence

In the last few weeks I have managed to get my hands on a friend's BBC Micro, and I am favourably impressed. However, it does seem a shame that, yet again, a Basic language allowing both upper and lower case character sets requires that key words should be in upper case.

I am sure that the majority of Basic users are now fully cognizant of these key words. It would therefore make life much easier during the debugging phase of any program if these were in lower case, so that our own declared variables, etc, could be in upper case. This would mean that errors in spelling and logic would be detected and corrected much faster.

Ray Thomas,  
Carterton, Oxfordshire

## Intermission

As a BBC micro user I am happy to see that you are doing a pull-out series on the machine.

I am sure that it will be very useful one day, but at the moment I am somewhat hampered by the lack of a cassette recorder for my machine. Although I ordered one from Acorn last September I have yet to receive it; and the company seems unable to tell me when it is likely to arrive.

Wayne Walters  
Tottenham, N17.

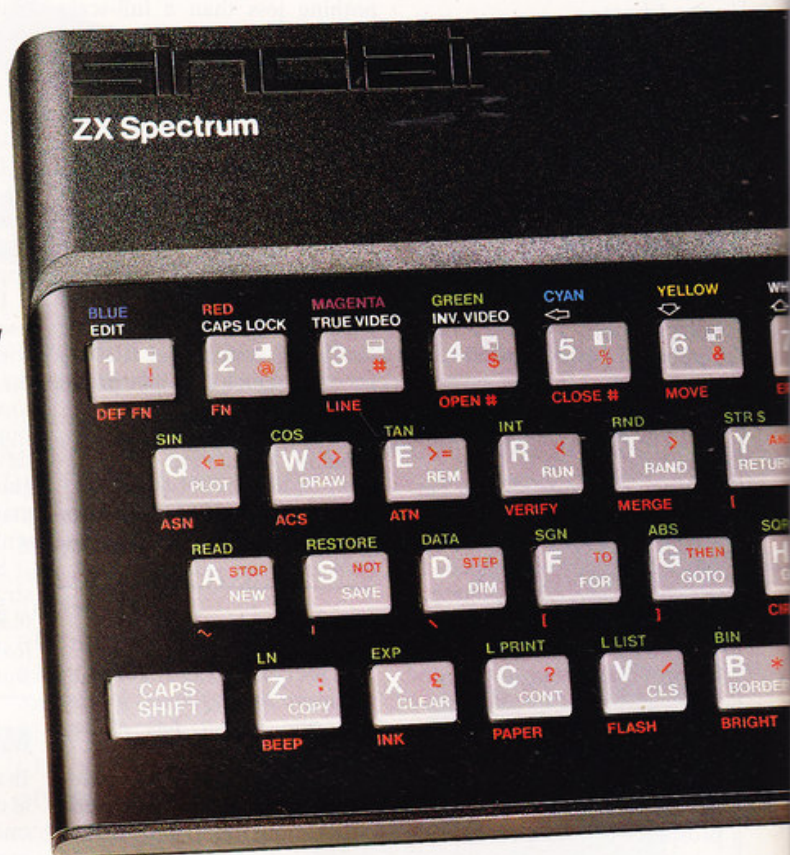
*A spokesman for Acorn admitted that there has been a shortage of cassette recorders, but assured us that 'Stocks will be replenished shortly. Mr Walters should get his recorder soon' — Ed.*



# Sinclair ZX Spect

**16K or 48K RAM...  
full-size moving-  
key keyboard...  
colour and sound...  
high-resolution  
graphics...**

**From only  
£125!**



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

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

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

## **Professional power— personal computer price!**

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

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

You have the facility to support separate data files.

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

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

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

## **Ready to use today, easy to expand tomorrow**

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

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

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



## **Key features of the Sinclair ZX Spectrum**

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



# um



## ZX Spectrum software on cassettes – available now

The Spectrum software library is growing every day. Subjects include games, education, and business/ household management. Flight Simulation... Chess... Planetoids... History... Inventions... VU-CALC... VU-3D ... Club Record Controller... there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

## ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

# sinclair

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

## The ZX Printer – available now

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

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

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



## The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

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

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.



## How to order your ZX Spectrum

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### How I shocked my Apple

I was working away on my Apple II the other day when suddenly I got a severe electric shock. Not only was I surprised, but it erased everything from the disk.

Why did it happen and what can I do to stop it?

Steve Woolley,  
Walthamstow, London E17

Sounds like a dose of static electricity. A nylon carpet underfoot, or a humid atmosphere can both build up an electrical charge. This sits around doing nothing until you touch the machine and give it an opportunity to escape to earth.

This charge may be big enough not only to surprise or even erase the information from the Apple's disks. There's even a small chance that you could hurt your Apple.

If this has happened only once, it may have been just a freak occurrence. Treat it as a reminder to back up all your disks. If you get shocks regularly, something needs to be done. For example, you could earth yourself before approaching the computer — touch something that is earthed, such as a central-heating pipe or metal window frame.

For more effective protection, place rubber mats around the work area. These could be car mats or you could buy them from computer suppliers such as Inmac.

Meanwhile, try using your computer on a different desk or carpet — and avoid wearing woolly jumpers.

### Dragon: safe from spikes

I have seen advertisements for devices that are supposed to regulate the electrical supply to machines. They suggest that without one of these the computer may be damaged.

I have a Dragon and I want to know whether I should have one of these devices. I haven't had any trouble yet though.

Simon Clarke,  
Guildford



You could use a special protector, like The Plug (left) or stick with the Dragon's built-in regulator (right) to keep your power supply clean.

The hot little power supply that comes with the Dragon 32 does all necessary regulation — the devices you have seen advertised are for protection.

There are occasional 'spikes' in a mains supply. These are power surges that may surprise a computer, making it crash or corrupt its data. Some supplies are 'dirty', which means they are inconsistent and unpredictable enough to cause similar problems.

You may also find that your Dragon is affected by other devices using your mains ring. Switching on a fluorescent light or running a power drill may cause problems, but you won't need a power protector unless you have recurrent trouble.

Large buildings with massive ring mains and machinery — lifts for example — are far more likely to suffer from poor mains than are individual homes. Either way, it is unlikely that the computer could be permanently damaged.

Simple protectors for dirty mains supplies cost about £15. You could try a neat device called The Plug from Power International on 0705-756715. For crash-sensitive applications, you can buy uninterruptible power supplies which provide battery back-up in case of a mains failure. But you'd need a very serious application to justify their cost.

You've had no problems yet. Why change things?

### Lisa and the single environment

I have read several articles comparing the Lisa machine from Apple with the VisiOn software package. I don't understand how hardware can be compared with software. Can you explain?

Olivier Pierre,  
London N7.

Although Lisa is a sophisticated piece of hardware, it's the software that comes with the machine that is causing all the fuss. Lisa stands for 'Local integrated software architecture' — its programs are very much a part of the machine.

Lisa's software and the VisiOn package attempt to do the same thing by providing a single 'environment' where the user has access to commonly needed computer applications such as graphing and spreadsheet calculations. They both use a system of 'windows' on the screen and a 'mouse' input device to make them accessible.

Both packages are based on ideas developed at the Palo Alto Research Center, California. Aside from the £11,000 Xerox Star system, they are the first two practical examples of this work.

When you read comparisons remember that VisiOn has to work on common-or-garden hardware, while Lisa is designed specially to run its software. It is only incidental that this makes Lisa a powerful micro for running other stuff.

It's likely that hardware of Lisa's calibre will become commonplace, but its software is so valuable that Apple is likely to port it on to newer machines in the future. Within the next two man centuries. (*Full Pro-Test review on Lisa, page 50*).

### A trying time loading from cassette

I spent several fruitless hours last weekend trying to load my Spectrum from cassettes. I tried two different cassette recorders and several different cassettes and got nowhere.

Several people I talked to said this is a common problem, but it's really annoying and a total waste of time. Can you tell me why this happens and what I can do about it?

Kerry McLean  
London SE 26

You're right, it is a common problem. The main thing going for cassette storage is that it is cheap, but once you have got it going it's a workable method.

Cassettes are simply an unreliable way of storing data. Ordinary cassettes are designed to record analog signals such as music and speech and are not built to the standards required for accurate recordings. It's only special tape systems that use a digital signal properly suited to computer use.

You've already made sensible steps towards pinning down the problem by swapping recorders and cassettes. But remember that expensive hi-fi equipment can filter the recording so much that the computer can't understand it.

Remember too that volume setting is critical — Spectra tend to like around a half maximum setting. If the cassettes are your own recordings check, by listening, that the recording sounds all right. Spectrum programs should be SAVED with the ear cable disconnected.

The Spectrum is very helpful when loading. You'll notice that the border colour around



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the screen alternates between two colours. When a cassette is loading properly, you should see a series of narrow stripes. If the cassette isn't reading, you'll get either just one colour or two colours swapping over occasionally.

Use this facility. LOAD a cassette and play with the volume control until you get as close as possible to the stripes. Rewind the tape and if it still doesn't work, make like Robert the Bruce's spider.

If you still can't get it to work you'll need to try different leads and preferably a different Spectrum. It is just possible that your Spectrum is defective.

Once you've got cassette loading to work, mark the position of the controls. Don't fix them in place, as you might still need to make adjustments for different tapes. Then practice SAVEing and LOADing a short program. You may need a different setting for save than you do for load.

If it's any consolation, a Spectrum has one of the most reliable and tolerant cassette interfaces of any of the cheap computers.

And there's still a chance that Sinclair will provide that £70 Microdrive it's been promising.

## Alternatives to qwerty

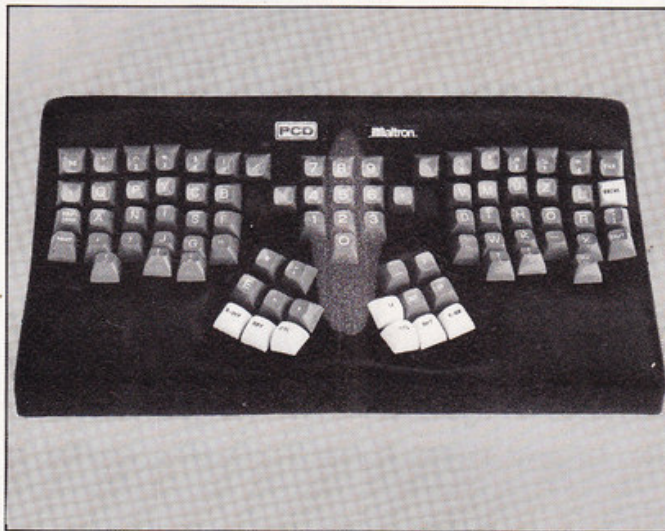
Reviews of machines often mention the qwerty type of keyboard, but I don't understand what else there could be. Can you enlighten me?

Joan Barnfather,  
London W4

Most micros have the standard qwerty layout of keys, even if machines like the Sinclair ZX81 make it hard to spot. But standards are made to have exceptions.

Next time you're in Europe, look out for their keyboards. Some countries, such as Norway, use a layout called azerty. Most manufacturers produce different keyboards for their micros depending on which country they are to be sold in.

If a keyboard isn't intended for either a trained operator or a lot of text entry the designers may go for an ABC layout. Keeping the keys in alphabetical order can be a relief to those who've never touched a typewriter. Some pocket computers and a number of data entry machines, such as the Canon TX10, use this system.



How Maltron threw qwerty overboard.

Remember that qwerty applies only to the letter keys. Computers pose problems as to where to place all their extra keys such as hemiola brackets, £, # and \$, let alone CONTROL, ALT, ESCAPE and so on. It's usually irrelevant to say a micro has a qwerty keyboard, but always take a careful note of a reviewer's comments on the rest of the layout.

A one-handed keyboard such as the Microwriter's can hardly be called qwerty, and this illustrates the way keyboards can be changed around.

Some people will tell you that qwerty was designed to slow you down, but it's more correct to say it was originally designed to stop typewriters jamming. Some companies have now completely redesigned both the shape and layout of keyboards, and one successful example of this is the Maltron keyboard (above). Using one is enlightening.

## Call by reference: call by value

What do the terms 'call by reference' and 'call by value' mean?

When I asked a friend he told me that the difference lies in what is done with the information after the call is made, but now I am even more confused. John King,  
Twickenham.

Like many things in computing, you'll find they mean different things to different people. Consider a call such as CALL PROCEDURE demo (A,B). Here the parameters A and B are the information that the demo procedure is to work on.

There are two ways that the

procedure could get hold of this information. If it is a call by value then the procedure gets the values of A and B, perhaps as the top two items on the stack. The procedure would then create a couple of local variables to hold the information.

If the procedure went on to do things such as  $A=A+1$  or  $B=2*\sin(A/5)$ , it would not affect the true values of A and B. It can't — the procedure has no idea where A and B are stored. It just has a copy of their values at the time of the call.

With a call by reference, the procedure does not get the values of A and B but their location. Altering A and B in the procedure alters them in the main program.

If you want to see more, have a play with BBC Basic. Its PROC calls are made by value. Changing the value of the parameters within the procedure does not affect their values outside.

As an alternative, if you imitate a PROC by assigning values to certain variables and then using GOSUB, you are calling by reference. Alter the variables in the subroutine and you alter them in real life.

## Bitter argument

How can I tell a true 16-bit computer from a false one? I think the difference is that the pseudo ones are really two 8-bits working side-by-side, but if I'm right, is that really not as good as one 16-bit?

Richard Cox,  
London SW11.

Ever since somebody explained what a bit was to his marketing director, having eight, 16 or not quite 16 of them suddenly

became important. The bit-count for a computer depends on what sort of microprocessor it uses. After that, it's just a question of definitions.

A 16-bit micro is one that can transfer its data to and from memory 16 bits at a time — that is, it has a data bus 16 bits wide. This neatly lets us label most micros. Those using a Z80, 8080, 6502, 6800 or 8085 are only 8-bit micros. Those that use an 8086, Z8000 or 68000 are 16-bit micros.

But there are problems. The 8088 chip, for example, is exactly the same as the 16-bit 8086. It has the same registers, and uses the same instructions, but for production economy it only has an 8-bit data bus. So although it has all the 8086's main advantages over 8-bit machines — such as the ability to address lots of memory — it isn't a real 16-bit chip. It's a pseudo 16-bit chip.

Certainly the 8-bit data bus version of the 68000 (the 68008) is an 'impostor', just as the 8088 is. But once you start to consider what a chip is like on the inside (the 8088 is 16-bit internal) you stumble on a whole new set of marketing claims.

Fans of the (8-bit) 6809 will tell you that it's full of 16-bit registers. So it must be at least a pseudo 16-bit processor. On hearing this, the 68000 people will realise that it's mostly 32 bits inside. Hence the model number of the Fortune 32:16.

The point is that the number of bits isn't really important. It has about as much to do with the speed of a computer as the diameter of the cylinder heads has to do with the forward speed of a car.

It can and does make a difference, but so does the clock speed, the speed of the memory, the number of 'wait states' where the processor has to hang around while some other device uses the memory and so on. Just as speed relates to the way a car is driven it relates to the way the chip is programmed.

Some 16-bit computers do certain jobs faster than some 8-bit computers. Some pseudo 16-bit machines go faster than some 16-bit machines. Some 8-bit machines go faster still.

The big advantage is not the width of the data bus but the width of the address bus. Sixteen-bit chips (real or pretend) allow a lot more memory to be directly addressed, and memory counts in making computers do useful jobs.



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### TI logic

Here is a tip to help TI99/4A owners utilise the full power of their home computer. It will also apply to other micros.

There are frequently situations where you would like to enter lines such as:-

```
IF A=3 OR A=5 THEN 120
IF A=3 AND B=6 THEN 120
```

In TI Basic (Console Basic) you cannot use either OR or AND. You can get round this by using lots of IF... THEN lines, but there is an easier way.

The line:-  
IF A = 4 THEN 120  
is treated by the computer as follows: it evaluates the expression after IF. If it is *true* (logic value -1) then the line transfer takes place. If it is *untrue* (logic value 0) the line transfer does not take place.

Try entering:-  
PRINT 2=2 and  
PRINT 2=4

The computer looks at the logical value of the expression and interprets any non-zero answer as *true*.

Thus we can use:-  
IF A THEN 120  
and if A is not zero, the transfer takes place.

We can therefore create our own OR/AND by manipulating the logical values of the expression. To ensure that the *logical* value of the expression is properly evaluated we need to place it in brackets:-

```
IF (A=2) + (A=5) THEN 120
```

If either A=2 or a=5 then the sum of these two logic expressions will be -1 *ie true*. The + acts as an OR.

```
IF (a=2) * (B=5) THEN 120
```

If both A=2 and B=5 +(-1 \* -1), the expression is evaluated as non-zero, and the transfer takes place, but if either expression is false, the value will be zero (0 \* -1). Thus we have our AND.

By knowing how these expressions work, you can create more powerful conditional transfers than by using OR & AND themselves.

Stephen Shaw  
Stockport, Cheshire

### Lists unlocked

From time to time it's useful to be able to take a look at Basic programs you have bought, but

generally the manufacturers put a lock onto the code to prevent you from doing so, and perhaps copying it.

But there is often a way around this problem.

Instead of giving the command LIST, which will try to list the program from line 0 and fail, since line 0 is locked, command it to LIST 1. Then the listing will begin at line 1, which is frequently not locked, and you can list the whole program.

R Hoelle  
London SW10

### Converting to Hex

Many programs or utilities are easier to control and understand if hexadecimal numbers are used for input. However, the ordinary INPUT command will accept only decimal numbers or strings.

The trick is to accept the input to a string and then apply the EVAL function. This will convert the input string to internal format. Here's a sample:

```
10 INPUT "ADDRESS "A$ :A
  %EVALA$
  150 % = 0
  20 PRINT A$
  30 PRINT A%
  40 PRINT ~A%
> RUN
ADDRESS &4000
&4000
16384
4000
```

The EVAL function can also be used to pass complex formulae to a program, since it treats the input as ordinary Basic.

RJ Parsons,  
Whitton, Middlesex.

### Length of string

Have you ever wanted to print a piece of a string in Basic? You'll probably have used the MID\$(STRINGNAME\$, START, LENGTH) function, which will extract a piece of a string from the middle.

But you can also use this to decide not only how much of the string you want to print, but whether it is to be printed or not.

This is achieved by taking a piece and starting wherever you want for a given length. If you multiply the expression for the length by a *logical* expression (ie one which evaluates to 1 or 0), which contains the decision you wish to make, then if the expression is *true* the length will be left as set.

But if the expression is not *true*, then because the length is multiplied by 0, it also becomes 0. The result is a string of no length. It won't make a lot of difference to the output, even though it is printed.

Try typing in this little program and running it. You will see the 'HELLO!' appear and disappear, even though both PRINT statements are exactly the same.

```
10 WORD$ = 'HELLO!'
20 MESSAGE$ = 'HERE I AM!'
30 FLAG = 0
40 PRINT MID$(WORD$, 1, LEN(WORD$) * FLAG); MESSAGE$
50 FLAG = 1
60 PRINT MID$(WORD$, 1, LEN(WORD$) * FLAG); MESSAGE$
70 GOTO 30
Steve Harrison,
Manchester M35 0GP
```

### Things go better...

It's important to keep slots and board ends clean and 'well connected'.

The expansion slots in the Apple II are prone to build up dirt and grit but there is a simple way to deal with the problem. A pencil eraser can be used to clean the flat connections on the card.

Should this fail, and you still have dirt in the way of your data, you can try another approach. A drop or two of Coca-Cola and some finger-work with a clean rag should do the trick.

Cards which develop the 'wiggles' in their slots are another problem. It may be worth strapping them in with masking tape run from one side of the slot to the top of the card and back down to the opposing side — mast-and-stay style.

Sockets and plugs must also be kept clear of dirt. The best approach is to use a small toothbrush to clean them.

Peter Miles  
Bristol

### Chip swap

After hours of worrying about how I was going to take out the upper-case chip on my Apple and replace it with a lower-case Videx chip, I hit upon a new method of chip-removal.

Instead of employing the potentially dangerous tactic of taking a screwdriver to my circuitboard, I used the pointed

end of a Bic pen-top to ease the chip from its holes, without damaging any of the chips on the pin.

It certainly saved my chip, so I now make sure there's always a spare pen-top near my computer work-area, whenever I have to take out my chips.

Ted Brannigan  
Teesside, Middlesex

### Socket to Sinclair

If you use a ZX81 or a Spectrum you'll soon notice that the only way to clear the memory (reset is the technical term) is to adopt the rather drastic procedure of pulling the plug. In fact, Sinclair's documentation specifies this 'technique'.

The trouble is that pulling and plugging soon wears out the fit of the connections, causing the contacts to become unreliable and putting you in danger of losing a long listing.

If you can't site the micro within reach of a wall-switch, run a simple cable switch to the lead — the sort you find on a lamp cable.

Another penny-pincher on the Sinclairs is the board-edge connector, which is prone to the same fate as the power socket. The answer here is to configure an RS Component edge plug, available from many specialist stores. The base of the ZX81 or Spectrum must be unscrewed, but the operation takes only about ten minutes.

Tony Mason,  
Altrincham, Cheshire

### Home service

I have a BBC Model B micro and wanted to know which operating system it was on.

A friend told me I would have to take the top off my micro and look at the operating system chip. I didn't want to do that as it might have damaged my new micro (which is still under warranty), so I tried talking to my computer.

I knew that the BBC had a few special \* commands, so I tried asking it some questions and when I typed in \*HELP, I got the information I wanted — without lifting so much as a screwdriver.

Terry Dobbin,  
Tonbridge, Kent

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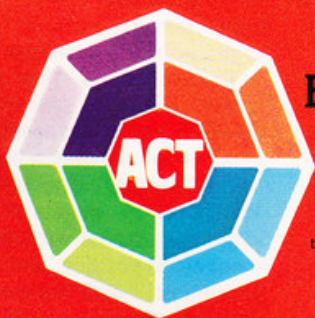
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SC1



Chess champion David Levy reveals how computers are chipping away at the masters' supremacy.

# Check-mate for mere humans?

**T**he world's strongest programs can now play at or near the level of chess masters, and the personal computer boom has dramatically increased the number of people who write their own chess programs.

Interesting feats have already been achieved by some chess programs, and here I'll be describing some of the more remarkable ones.

## Opening

Like any strong human player, chess programs can store a large number of opening variations. But programs can also invent 'new' moves in the openings — moves that may change the assessment of a whole variation.

Possibly the best example of this that I have seen is in a rather sharp variation of the French Defence: 1 e2-e4 e7-e6 2 d2-d4 d7-d5 3 Nb1-c3 Bf8-b4 4 a2-a3. This was popularised by Alekhine in the 1930s.

It is not currently considered sound, but I've used the variation a number of times in my own games, and often looked for new ideas to strengthen White's play: 4... Bb4xc3+ 5 b2xc3 d5xe4 6 Qd1-g4 Ng8-f6 7 Qg4xg7 Rh8-g8 8 Qg7-h6 b7-b6 9 Bc1-g5 Rg8-g6 10 Qh6-h4 Nb8-d7 11 Bf1-b5 c7-c6. (See diagram 1)

This position had been reached in the master game Chistiakov-Orlov, Moscow Championship 1935, in which White retreated his bishop with 12 Bb5-c4. In the standard text on this variation, *French Poisoned Pawn* by Zeuthen and Jarlmae, it is pointed out that after White captures on c6 with his bishop, Black gets a good game with 12... Qd8-c7, and if 13

Bc6xa8 then 13... Qc7xc3+ followed by 14... QC3xal.

While studying the variation I discovered a winning improvement on White's play, and in 1977 I tried this position on the World Champion program Chess 4.6, during a tournament in Seattle.

In only 90 seconds the program found the brilliant yet shallow winning idea which the Moscow masters had missed in 1935, and which had gone undiscovered for 40 years. Chess 4.6 played 12 Bg5xf6, which the spectators (and the Russians) thought could be refuted by 12... Qd8-c7, when White has two bishops attacked.

The program actually predicted 12... Qd8-c7 as the best reply, and announced that it was then planning to play 13 Bf6-d8, which wins two pawns after 13... Qc7xd8 14 Qh4xd8+ Ke8xd8 15 Bb5xc6 Ra8-b8 16 Bc6xe4.

A possible alternative to 12... Qd8-c7 is 12... Rg6xf6, but then comes 13 Bb5xc6 Qd8-c7 14 d4-d5 (the difference is that if White is allowed to capture on f6 his queen will protect the pawn on c3).

## Middle-game

At the end of the opening phase in chess, the players usually have their pieces developed in readiness for the middle-game struggle.

The middle-game can be entirely strategic, with both sides manoeuvring their pieces slowly. Each is trying to take control of certain key squares and gradually improving the positions of individual pieces.

Other middle-games can be cut-and-

thrust affairs, with sacrifices and other tactical motifs playing the decisive role.

Computer programs tend to be short-sighted in their strategic planning, because planning involves the formation of concepts, and the art of computerised concept formation is still in its infancy.

But chess programs can excel at tactical play, since a forcing sequence will often be short enough to fall within the horizon of the program.

Today most programs extend their search of the game tree in variations containing checks and captures, so it is possible for the better ones to examine such variations to a depth of 7, 9, 11 or even 13 ply (half-moves).

Probably the most beautiful combination ever played by a chess program was seen in the 1978 North American computer championship in Washington. The game was between Blitz 6.5 (White), running on a Univac 1100 computer, and Belle (Black) which executes on special chess hardware that can evaluate more than 200,000 positions per second. (See diagram 2).

In this position, with Black to move, it is clear that Black has a won game, due to its knight-for-pawn advantage. The size of Black's advantage does not detract from the delightful combination unleashed: 10... Rh8xh2.

When playing this move, Belle had 'seen' to the end of the game.

11 Kg1xh2 Qe7-h4+ 12 Kh2-gl Ne4-g3 — threatening mate on h1, and if 13 f2xg3 then 13... Nd4-f3 is mate. 13 Qd1-h5 prolongs the game for one move. 13... g6xh5 14 f2xg3 Nd4-f3 mate.

## Endgame

The endgame is the phase that sorts out the men from the boys. Although the number of pieces is reduced, the game becomes more difficult for a weaker player to understand, and the correct plan can often be as deep as 20 moves or more.

But chess programs have always played a poor endgame because of their inability to plan and their lack of conceptual understanding. Computerised endgame play has, however, improved so much during the past decade that in certain cases the computer has actually added to the grandmasters' knowledge of the endgame.

Three endings that come to mind immediately:

(a) King and queen against king and rook — a win for the queen but a very difficult one to execute. The Belle program has stored every possible K+Q v K+R position, together with the correct assessment of the position, and can win against a grandmaster with the queen, while often drawing against a grandmaster with the rook.

(b) King, rook and pawn against king and rook — often very difficult to play for both sides, but a Soviet program named Kaissa has solved this configuration.

(c) King, queen and b-pawn or g-pawn v king and queen — also very difficult in practice, but Kaissa has every possible position in its database and can play the



configuration perfectly. Grandmaster Bronstein once consulted Kaissa during an adjourned game in which he had this configuration, and won with the program's advice.

Although computer programs are not normally adept at playing the endgame positions that arise in grandmaster games, they excel at solving chess problems of the form 'White to play and mate in 2 moves'. Chess problems are not real chess, because the positions are artificially chosen to conform to aesthetic principles of problem composition. However, a number of strong human chess players find problem-solving an interesting pastime.

As a measure of the ability of even a microprocessor-based problem-solver, one cannot find a more impressive feat than that of the Scisys Chess Champion Mark V computer, which won a problem-solving match against Grandmaster John Nunn, one of the world's best problem-solvers.

Nunn and the Mark V tried to solve six problems during a tournament held in Brighton in 1981. Two of the problems required White to force mate in three moves, two were four movers, and two were five movers.

The Mark V solved all six problems in 2hrs, 28mins, 42secs, while John Nunn could solve only five of the six problems and gave up on the sixth.

The problem that defeated Nunn had won a first prize in a problem-composing tournament, but there is a flaw in the problem. It actually has more than one solution, and to conform to the 'rules' of problem composition chess problems should have only one solution within the required number of moves. (See diagram 3).

The position in question is a 'mate in four' problem composed by the Russian L Zagoruko. His solution was 1 Rd8-e8, which the Mark V found, but it first found two other solutions: 1 Ne4xc5 and 1 Ne5-g4.

## Champion chips

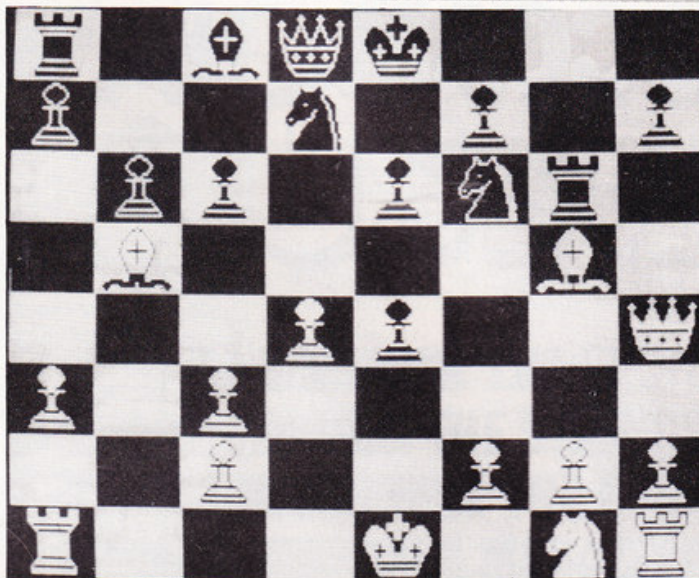
Chess programs get stronger each year, and already the best of them can defeat over 99 per cent of all chess-playing humans. There is still no program strong enough to win a match against a player of international master strength, but in certain circumstances chess programs can outperform even the best grandmasters.

In the last world championship match between Korchnoi and Karpov, for example, Karpov missed a variation which would have ended the game two moves sooner than the one he played — Mark V saw the correct move.

The cost of computing power is falling fast, and micros can now be programmed up to the level of an average-to-strong club player. There is no reason why a program which can defeat a human world champion should not be developed. This may not happen for 15 or 20 years, but one day the computer will be the master, and man the powerless slave.

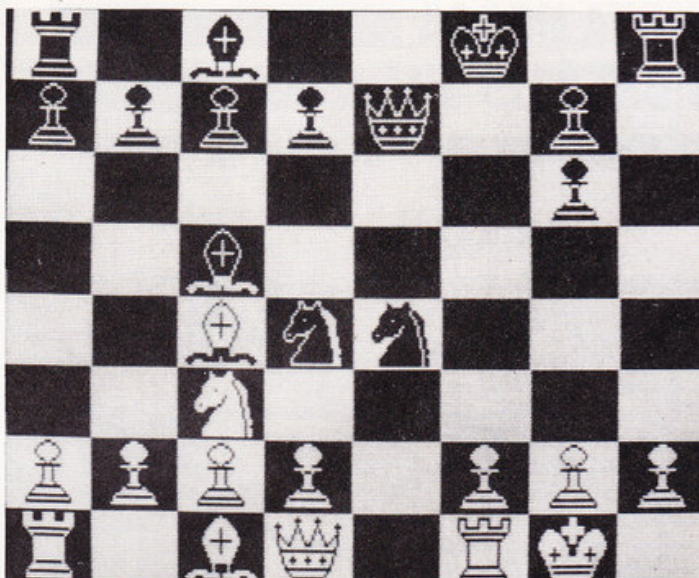
## Diagram 1

The position reached in the 1935 Moscow Championship between Christiakov-Orlov. The Russian masters missed a winning idea which computer program 'Chess 4.6' came up with in Seattle in 1977.



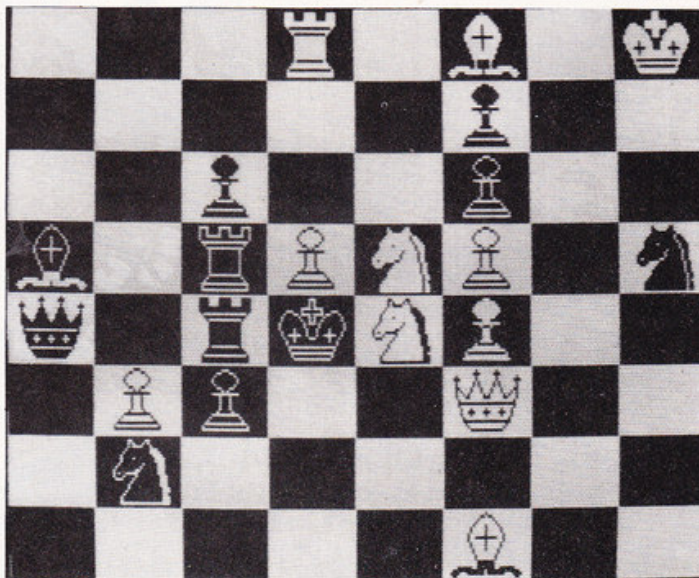
## Diagram 2

Middle-game between Blitz 6.5 (White) and Belle in the 1978 North American computer championship. Black unleashed the delightful combination Rh8xh2 which anticipated play to the end of the game four moves later.



## Diagram 3

The 'mate in four' problem which defeated Grandmaster John Nunn. Mark V computer found not only the solution (Rd8-e8) propounded by the composer of the problem, but two others as well.





Richard King introduces a language that works several wonders at once.

# OCCAM: the waiting is over

**H**ave you ever wondered why computers, which are supposed to be quick at doing repetitive tasks, often take half a day to complete a job?

The answer is that programming languages, because they are strictly sequential, allow a computer to do only one job at a time.

Occam, a new language from the Inmos team, changes all that, and very simply. At first sight it looks like a fairly ordinary language, with IF... THEN, DO... WHILE, FOR... NEXT and so on. It is a little unusual, though, in that it does not require BEGIN... END pairs, using indentation to delimit program-blocks. But that's just useful, not essential.

The really clever ideas embodied in Occam are the 'parallel process' and the 'channel'. Parallel process makes the computer act on each part of a program simultaneously, while the channel is a one-way conduit connecting the parts of the program.

If the destination process needs input from the channel, and the transmitting process is not ready, it simply stops and waits until the transmitting process has put data into the channel. When that happens the receptor can get on with the next stage.

Occam employs a strategy vastly different from that of traditional sequential programming languages. This contrasts strongly, for example, with a standard order-processing system written in Pascal.

When a Pascal program is activated the various details are entered. Upon completion, the program asks for permission to proceed, and then goes away for some time — a considerable time in many cases.

Next, the paperwork must be printed. Even the fastest printers work far more slowly than the computer, so yet again the machine is tied up. The result is that the machine takes all morning to do one fairly routine task... about the time that would have been taken without the computer.

Worse, because it's so busy doing all this work nothing else can be done. Of course, a printer-buffer can be added, but seldom larger than 16,384 characters, which is often much less than the print-run. Printer-spooling would help even more, but to work this properly requires hardware and supporting software (complicated at best, fiendish at worst).

The problem is that the machine, contrary to appearance, is mostly doing nothing at all. If one drew a diagram of the kind of operations being performed and the number of times that a given operation was performed, it would become clear that the average program spends at least 90 per cent of its time waiting either for the user to hit a key or for the printer to accept a character.

**Occam is not yet available in its fully-fledged form, as this requires a larger machine than is available.**

The current version costs £99 from Inmos, Bristol, and is an Integer-only subset of the language. Inmos says it is deliberately de-tuned so that it can run under the UCSD p-system version 4.0 or greater.

The language is intended for systems programming, where it is often necessary to do a lot of things at once.

Its final home is intended to be the Inmos 'transputer', which will consist of several (maybe even dozens) of computers, and it is in this environment that Occam will shine.

So why don't we use that dead time? No particular reason, in fact; it's just that no-one has figured out a way of keeping track of uncompleted tasks so that the program can return to them.

In Occam, however, the program would work quite differently, even though it has exactly the same processes as a conventional language. The program will still:—

Accept data and check that it's correct;  
Process any orders which are complete;  
and  
Print out the paperwork.

The difference is that these are all done *at the same time*, so if section one is stuck in a loop waiting for input, the controlling-

program ignores it and carries on with sections two and three. The result is that useful work is done, as compared with empty-looping, which is not useful.

The principles can be applied to any job. Consider a chess program. At the opening of play there are 20 possible moves for each side. Then there are 53 possible second moves and an astronomic number of third moves. The number of moves increases dramatically as the game progresses.

Sequential chess programs can only work in a reasonable amount of time by cleverly eliminating useless investigation of replies. This process of elimination is neither simple nor particularly accurate, especially if the initial reasoning is wrong.

That's because the program can only consider one chess-piece at a time. The effect of the move under consideration has to be weighed up in the light of what it will do to the position of the other pieces. This must be done for every conceivable possibility, several moves ahead. That takes time.

Imagine, however, that each piece has its own evaluation program, each running in parallel. This allows the results of possible moves to be reported to the other processes, thus speeding up the whole program.

The only problem now is who on earth is going to be good enough to play the damned thing?



Jo Lawrence



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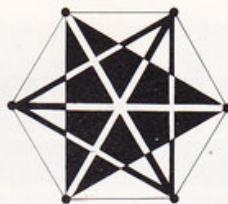
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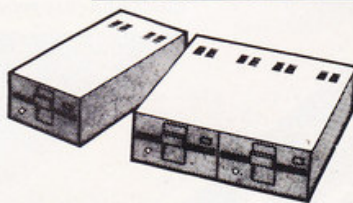


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**BBC MICRO...ATOM...ELECTRON**



Bob Maunder recommends some graphics experiments to uncover the potential of this newcomer

# Meet Oric's lively screen characters

The Oric is so new that little information on it, and practically no software, is currently available. But the machine is powerful, and a little experimentation with graphics and attribute characters reveals some of its potential.

The machine can operate in three main modes — HIRES, LORES, TEXT. The last two are similar in their resolution, and use a screen of  $39 \times 29$  positions; the x-axis goes from 0 to 38 and the y-axis from 0 to 26 (downwards).

There is a column to the left of the usable screen. This is reserved for the background colour of rose, but can have values POKED into it.

Everything displayed on the screen has two colours associated, with foreground colour, or PAPER, and background colour, or INK.

The foreground colour of the row is determined by a value in column 0.

Our example program is in TEXT mode. Information can be PRINTed on the screen in the normal way in this mode, or it can be put in a specific screen position, using PLOT. For example:—

PLOT 10,15, 'Answer'  
puts the word 'Answer' starting at Row 15, column 10. The PRINT command is used to display normal text or numeric data, while the PLOT command can be used to put special characters known as attributes on the screen.

These characters are not visible, but affect the way the rest of the information on that line is displayed, eg foreground/background colours, single or double height, flashing or steady. Appendix C of the Oric manual gives a summary of these characters.

The characters themselves are often called serial attributes, as a second attribute on a line may add to or cancel the

effect of the first. This is also why the default foreground and background colour attributes of a line appear at the beginning of the line.

One interesting feature of the Oric — used extensively in the example program — is its ability to display single and double height characters on the same screen. Double height steady characters take up two lines and have the attribute of 10 digits.

Information to be shown in double height has to appear in both modes, but to avoid having to print twice, an automatic double-printing facility is available.

This is invoked by typing CTRL-D on the keyboard or by using PRINT CHR \$ (4) in a program. Attribute 10, however, must be placed on both lines.

The Oric can also redefine characters. Any keyboard character can be defined by POKing a new set of binary patterns into the character set area of memory (byte 46080 onwards). After this, whenever the character is used it appears in its redefined form. In the example, the @ character is redefined as a robot.

In the program listed here, the principle is the ancient one of using random numbers to set the question. Ten questions are presented, and a score is given at the end.

It grabs a child's attention by displaying a number of robots and removing some of them (ie shooting them), and asking how many are left.

In response to the question the child presses the number key corresponding to an answer — there are only single digit answers and the Return key is not needed. Pressing any key generates the next question.

The program listing includes explanations of what is happening, but here is the general method:—

1. initialise screen and variables — subroutine 1000
2. for ten questions:
  - A — set question — subroutine 1200
  - B — get answer — subroutine 1400
  - C — response —
  - CORRECT — subroutine 1800
  - INCORRECT — subroutine 2000
  - REINFORCE ANSWER — subroutine 1600
3. end up — give score — subroutine 3000.

You might try adding a little variety by making the object and its fate a random choice, rather than robots getting shot all the time. Perhaps we could have Apples being eaten, loves being lost and so on. But remember, children seem to prefer the more bloodthirsty effects.

## Wanted-a better break

*THE Oric-1 was one of the first low-priced machines released to compete with the Sinclair Spectrum, and it has all the hallmarks of a first effort.*

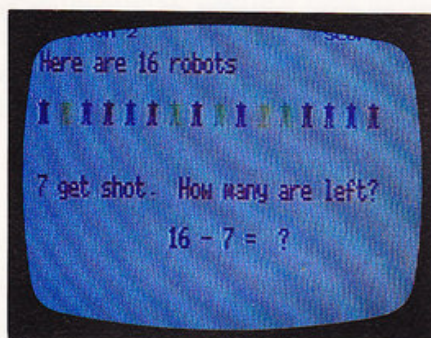
*True, the keyboard may have a nice tilt that makes it easy to use, and a far less confusing layout than either the ZX81 or the Spectrum; the keys may also have a much firmer feel than those on the Sinclair machines, but from that point on, this Cambridge-made Sinclair-killer will have to fight for every accolade it gets.*

*As well as there being little commercial software as yet available for the Oric — the machine was rushed out to be in time for the Christmas sales panic — there are still many bugs to be worked out.*

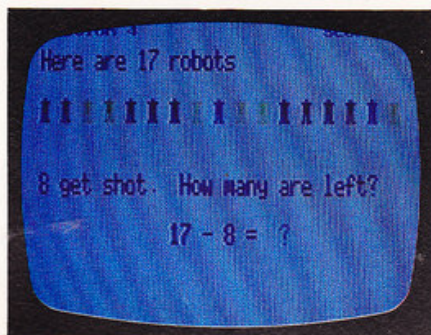
*One design fault that Oric can be expected to hear about is the lack of a Reset or Break key on the keyboard. There is a reset facility using Control C or an unmarked Break key recessed underneath the machine, but neither seems adequate for quick and easy retreats from a program. GW*



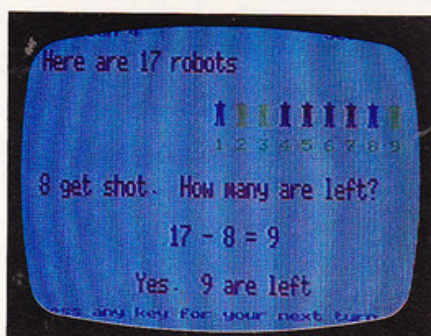




The program prompts you to shoot the colourful robots by answering the maths question posed underneath.



Having solved the first problem, you move on to another — still perhaps disturbed by the violent end met by your first set of on-screen robots.



And in the end... there are only nine robots left. You've shot the rest of them in a cold-blooded act of subtraction.

The program is quite well-documented with the REM statements showing what each part is doing. But in case they prove difficult to find here is a breakdown.

Line 120 starts with a GOSUB that

initialises the screen and variables.

Lines 130 to 180 deal with numbering the questions and making sure the program concludes when all the questions have been asked.

Line 1200 starts setting the question.

Line 1400 gets ready with the answer and

Line 1600 analyses your response.

If your response is correct, the program will jump to Line 1800 and if you make a mistake the program will tell you so by jumping to Line 2000 and printing No together with the number of robots that are left.

Unfortunately for the robots, they get zapped even if you get the answer wrong. The computer will subtract the robots for you in the programming between lines 1220 and lines 1360.

At the moment the program is only developed to subtract robots, but if you're feeling adventurous, you could adapt the program to add baby robots to the screen.

```

100 REM (C) BOB MAUNDER
110 REM Robot Subtraction
120 GOSUB 1000 'Initialise
130 Q=1
140 REPEAT
150 : GOSUB 1100 'Question & answer
160 : Q=Q+1
170 UNTIL Q>QN
180 GOSUB 3000 'Endup
190 STOP
1000 REM Initialise screen & vars
1010 PAPER 7:INK 0:PRINT CHR$(17):CLS
1020 S=0:QN=10
1030 FOR A=46592 TO 46599
1040 : READ V:POKE A,V
1050 NEXT A
1060 DATA 8,62,28,28,28,20,20,54
1070 RETURN
1100 REM Question, answer & response
1110 GOSUB 1200 'Set question
1120 GOSUB 1400 'Get answer
1130 GOSUB 1600 'Response
1140 RETURN
1200 REM Set question
1210 CLS:PRINT
1220 PRINT "Question ";Q;TAB(29);"Score: ";S
1225 PLOT 0,1,4
1230 B=2+INT(RND(1)*8):C=2+INT(RND(1)*8):A=B+C
1240 PRINT:PRINT CHR$(4);" Here are ";A;"robots"
1250 PLOT 1,3,10:PLOT 1,4,10:PLOT 0,3,1:PLOT 0,4,1
1260 PRINT:PRINT:PRINT
1265 FOR J=1 TO A
1270 PRINT " @";RC=INT(RND(1)*6):PLOT 2*J-1,7,RC:PLOT 2*J-1,8,RC
1275 NEXT J
1280 PLOT 1,7,10:PLOT 1,8,10
1290 FOR J=1 TO 6:PRINT:NEXT J
1300 PRINT " ";B;"get shot. How many are left?"
1310 PLOT 1,13,10:PLOT 1,14,10:PLOT 0,13,1:PLOT 0,14,1
1320 PRINT:PRINT:PRINT
1330 PRINT SPC(13);A;"- ";B;"= ?"
1340 PLOT 13,17,10:PLOT 13,18,10:PLOT 22,17,14:PLOT 22,18,14
1350 FOR J=1 TO 3:PRINT:NEXT J
1360 RETURN
1400 REM Get answer
1410 DK%=FALSE
1420 REPEAT
1430 : REPEAT:K$=KEY$:UNTIL K$<>""
1440 : OK%=(K$="0") AND (K$<="9")
1450 UNTIL OK%
1460 DK%=" "+K$+" "
1470 PLOT 22,17,DK$:PLOT 22,18,DK%
1480 WAIT 250
1490 RETURN
1600 REM Response
1610 IF C=VAL(K$) THEN GOSUB 1800 ELSE GOSUB 2000
1615 WAIT 150
1620 FOR J=1 TO B
1630 : PLOT 2*J,7," ":PLOT 2*J,8," ":ZAP:WAIT 60
1640 NEXT J
1650 FOR J=1 TO C
1660 : PLOT 2*(B+J)-1,10,STR$(J):WAIT 50
1670 NEXT J
1680 FOR J=5 TO 0 STEP -1
1690 : PLOT 0,17,J:PLOT 0,18,J:WAIT 60
1700 NEXT J
1710 PRINT:PRINT:PRINT CHR$(4);"Press any key for your next turn"
1720 REPEAT
1730 : PLOT 0,24,1:PLOT 0,24,4
1740 UNTIL KEY$<>""
1750 RETURN
1800 REM Response - correct
1810 PRINT SPC(10);"Yes. ";C;"are left"
1820 PLOT 10,21,10:PLOT 10,22,10:PLOT 0,21,1:PLOT 0,22,1
1830 PING
1840 S=S+1:PLOT 34,1,STR$(S)
1850 RETURN
2000 REM Response - incorrect
2010 PRINT SPC(10);"No. ";C;"are left"
2020 PLOT 10,21,10:PLOT 10,22,10:PLOT 0,21,4:PLOT 0,22,4
2030 A$=STR$(C)+" "
2040 PLOT 23,17,A$:PLOT 23,18,A$:PLOT 22,17,1:PLOT 22,18,1
2050 EXPLODE:WAIT 250
2060 PLOT 22,17," ":PLOT 22,18," "
2070 RETURN
3000 REM Endup - show score
3010 CLS:PAPER 6:INK 0
3020 FOR J=1 TO 9:PRINT:NEXT J
3030 PRINT CHR$(4);"The end. You got ";S;"right"
3040 PLOT 0,9,10:PLOT 0,10,10
3050 FOR J=1 TO 15:PRINT:NEXT J
3060 PRINT CHR$(4);"Press 1 to start again or 0 to stop"
3070 REPEAT:K$=KEY$:UNTIL K$<>""
3080 PRINT CHR$(17)
3090 IF K$="1" THEN RUN
3100 STOP

```



# Three out of every four computers going into schools are BBC Micros.

## Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

### The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

### All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

The most sophisticated version (called

Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

### Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

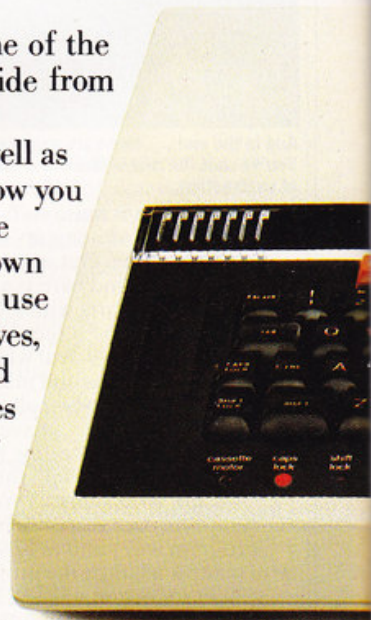
This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.

You can also plug in ROM cartridges containing games with specialist application programs.

### The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second





3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M\* compatible operating system, with all the benefits for business applications.

#### Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

#### Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

#### BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

\*Trademark of Digital Research.



#### A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

#### The best possible back-up.

Your BBC Micro comes with the backing of the BBC and an extensive dealer and service network.

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#### How to buy your BBC Micro.

If you are a credit card holder and would like to buy a BBC Micro B, or if you would like the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy a Model B directly by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants, NN8 2RL.

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# Unlock the Sirius keys



Keys used with the Modcon facility  
The seven function keys

Keys used to reprogram the micro using a console driver and escape sequence

One of the more mysterious features of the Victor/Sirius is its 're-programmable keyboard'. This facility allows you to create, for example, French or German special characters. Keys can also be assigned to do specific things, such as make noises or exit from parts of a program.

But it has been difficult to get information on this talent of the Victor/Sirius — until now.

There are three main methods of redefining the character set, each with its own procedures.

## Escape sequence

The console driver supports an escape sequence which will change key values by use of the following formula:—

```
ESC 4[n][lk][nc]
where 4 = ASCII 4
      n = 1 HEX for unshifted key
          2 HEX for shifted key
          3 HEX for alternate character key
      lk = logical key number
          (obtained from a diagram
           where all keys are given a
           logical number)
      nc = new key value
```

As an example of this method, let us redefine function key 7, unshifted, to represent ESCape. This would be coded as:—

```
ESC "4" CHR$(1) CHR$(7) CHR(27)
```

There are four disadvantages to this method: it will not change key attributes such as repeat key etc; key attribute changes are only local and for that time; keys cannot be defined as more than one character; and even if the unshifted key is redefined, the shifted key is altered to the same value.

For example, if in an application you change the unshifted left cursor key to be Control-S then the shifted left cursor key acquires the same value and you lose the ability to control the brightness of the screen.

Another problem with sending inform-

ation to the console like this is that you cannot return the machine to a known state because you cannot interrogate the key attributes. So, this method is not really very satisfactory.

## By Modcon

Just released is a utility called Modcon, which allows you to change the keyboard dynamically without reconfiguring the system every time. By using Modcon you can change the console keyboard for a particular application then change back to original attributes.

Character sets can be obtained:—

- By choosing a set on the Sysselect diskette.
- By selecting a graphics set provided with Chargraf in the graphics toolkit.
- By using Efont to modify the current set.

A keyboard table needs to be set up on the diskette that you are using and this can be done with the help of the Keygen utility. Type KEYGEN and the current character sets are listed. Using the cursor control keys (up, down, left, right), choose the set you want to modify and then load that with the function key indicated.

You will then see a list of keyboard options (.KB files). Pick one in the same way and load that. Displayed on the screen is a keyboard file header, which you can change by using the cursor keys, again in conjunction with the space bar.

Take the option on function key number one and a picture of the keyboard will appear. By using the cursor keys, move to the key you want to change, then take option 1-3, move to the character set and press return.

This last step can be repeated so that one key can represent a word. For instance:—

```
Move to space bar
Take option 1
Move to character 'C' ... press Return
Move to character 'H' ... press Return
Move to character 'U' ... press Return
Move to character 'M' ... press Return
Move to character 'P' ... press Return
```

As a result of this example, every time

someone presses the space bar on your Victor/Sirius, 'CHUMP' will appear on the screen, and the computer will be rendered useless.

Save the modified character set, then save the modified keyboard. Let us say you called it 'MINE.KB'.

At the beginning of the program which uses this particular keyboard, you would put the following format:—

```
MODCON source file .source ext save file
.save ext
```

The source file is the name of the file which contains the sets to be made active.

Source ext can be either KB for keyboard or CHR for character set.

Save file specifies the name of the file to be used to store currently active set.

Save ext as source ext.

So in our example you would put:—

```
MODCON MINE.KB SAVE.KB
```

And before exiting from the application program you would put:—

```
MODCON *SAVE.KB
```

This method is very easy to use and you can redefine the keys and their attributes, which is important, as well as setting up any particular character set you want to use in a given application.

The utility Efont is great fun to play with, and is used to create completely new character sets to your own design.

You are shown a sample keyboard with an enlarged dot version of the character to be changed, which you can alter by using the numeric keypad and the Return key. The Help facilities are necessary, but it doesn't take long to master the operation of Efont.

Of course, if you modify the character set too much, be careful about trying to do a screen dump — most printers wouldn't cope with it. A disadvantage of using Modcon is the time it takes to operate — about 20 seconds — which the purist would say is too long.

## Busipost

The third method of programming the keyboard has been achieved by a little company called Busisoft, which has developed a system it calls Busipost.

The system includes a keyboard table within its own tables, and when LOADING it automatically changes the keyboard to its own. This is done by including some coding in Macro-86 or MS-DOS assembler.

In other words, you put a copy of the keyboard table in a data area in your program. So, by combining the tables in one big block instead of three, a lot of time is saved. The routine is called Keyinit and can be obtained from Busisoft (which also has a screen dump routine).



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Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

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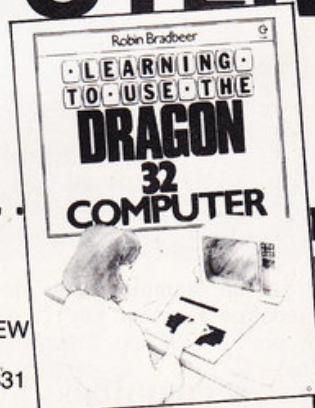
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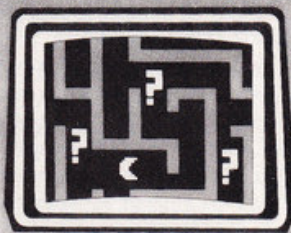


## Problem Solving in BASIC

A Guide for Beginners

For users of  
Commodore PET/VIC

Hugh Vincent



### Basic projects

'Problem Solving in Basic' by Hugh Vincent, published by Addison-Wesley at £4.95 (paperback, 150 pages).

Hugh Vincent's book represents good value for money and quite reasonably bears the Commodore seal of approval.

The title *Problem Solving in Basic* is a little misleading: it won't, for example, help sort out your cash-flow crisis. The problems referred to are set exercises within the text, much like a school textbook.

And that is probably where this book will find its home—in the classroom. It is an ideal study aid, working logically through an introduction to programming and offering sufficient reward in the way of graphics and games to maintain interest among junior programmers.

Aimed specifically at the Pet/Vic user, *Problem Solving in Basic* also includes larger projects, such as developing a calendar program and writing a maze game.

Newcomers to the world of micros will also derive benefit from the clear presentation and informative material. PW

### ZX81 switch-on

'Learning to use the ZX81 Computer' by Robin Bradbeer, published by Gower at £4.95 (paperback, 76 pages)

If you've just unwrapped your ZX81 and you're wondering what to do next, pick up a copy of *Learning to use the ZX81 Computer*, by Robin Bradbeer.

Mr Bradbeer has written for the novice who wants to use the micro for work or leisure.

Starting from the jargon-free introduction to the machine and its software, the reader is taken on a step-by-step journey of exploration.

In chapter one a little historical background about the

ZX81 is given. Then in chapter two, you switch on the micro and start finding out how to get the best out of the machine.

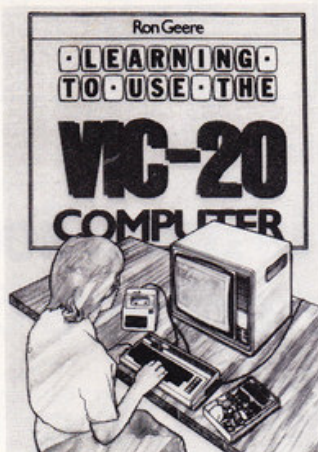
At the end of chapters two and three some self-test questions are given. This is a good

This is a good idea because it encourages you to test out the capabilities of the micro and familiarise yourself with the art of programming and drawing graphics.

The graphics chapter is well-presented. After reading this section you should be able to draw a butterfly or a space invader skilfully.

A useful feature of this paperback is the appendix, which gives the addresses of several software and peripheral companies.

Robin Bradbeer's book is well illustrated with photographs, drawings and diagrams which make the text easy to read and understand. And after reading it, it shouldn't be long before the reader feels capable of tackling the machine in a masterful way. SG



### Vic-20 made simple

'Learning to Use the Vic-20 Computer' by Ron Geere, published by Gower at £4.95 (paperback, 76 pages).

Perhaps the greatest source of wonder in personal computing is the number of people with a seemingly unshakable belief that there is easy money to be made from the business.

The alternative explanation for books like this is that computer-users have such a hunger for information that it borders on addiction.

The word 'use' in the title of this slender offering is at least accurate.

*Learning to Use the Vic* demonstrates how to load a program, gives an explanation of the keys and offers a simple introduction to the more common Basic commands such as

PRINT, DIM, FOR-NEXT.

Essentially, it is little more than a simplified and extended version of the user's guide that comes with the Vic-20.

Offering only about 60 pages of large print and simple diagrams, this slender volume is hardly worth the price of a decent games program. PW



### Apple to the core

'Enhancing Your Apple II Vol 1' by Don Lancaster, published by Howard W Sams at £12.95 (paperback 232, pages)

It isn't often these days that a book on computers—especially one on their insides—can rekindle the joy the earliest hackers found in machines.

Don Lancaster has made a career out of doing impossible things with next-to-nothing and an old TV, then writing books about it. But with *Enhancing Your Apple* he has excelled himself.

The lucid way he described the method for completely dismantling any piece of machine-code is worth the price of the book alone, but on top of this there are some very special special-effects.

He gives the humble, elderly, prosaic Apple 121 low-resolution colours plus the ability to mix text and graphics anywhere, at minimal cost. The only possible reaction is glee.

When so many authors seem afraid to trumpet the virtues of a machine, it is refreshing to find that Mr Lancaster makes no secret of his admiration for the Apple.

But he sensibly qualifies this by stating that you can control a machine as complex as a computer only by understanding its innermost workings properly, and that means machine-code.

The book puts its case forcefully, but in a readable way. Mr Lancaster suggests several improvements which will make using the machine fun once more.

But it's only when you've finished these that you realise you've learned plenty too.

*Enhancing Your Apple II* is an essential addition to the library of any Apple-owner who doesn't mind getting his hands dirty. It is also worthwhile reading to learn about some of the things that computers can do, but usually don't, or about the way that creative engineering can be applied to a real machine. RK



### Plum bluff

'Computer Bluff' edited by Dr Stephen Castell, published by Quatermaine House at £2.95 (paperback, 120 pages).

*Computer Bluff* is a must for anyone confused by computer terminology, after you've read it, you too will distinguish between the facts and the bluff.

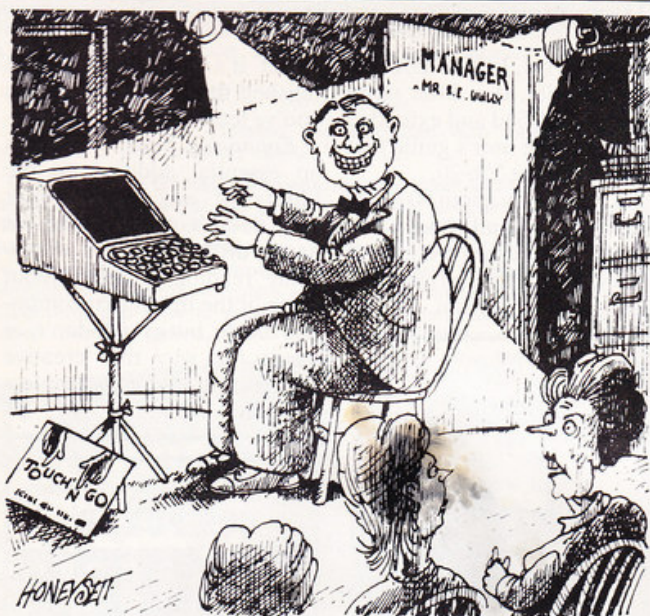
Battling with jargon, hardware, software, peripherals and know-all all at once is more than the average learner can take, and this book should act as a welcome tranquilliser.

It takes you from computer history to basic programming and has a truly magic 'grilling guide' at the end. This is designed to stop eager salespeople flogging you equipment you don't need.

All the relevant bits and pieces are explained in simple English—a sure relief to any newcomer suffering from mental indigestion. The various languages are covered, as are the main categories of computer: mainframe, mini, and micro. The buyers' guide is also excellent and while it cannot cover all the models available, it tells you what to watch for when buying a machine.

A glossary of terms and phrases is also included, and all in all, *Computer Bluff* is well worth the money. WP





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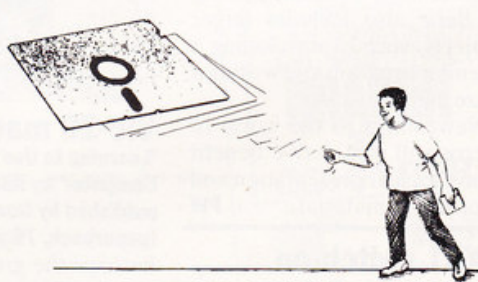
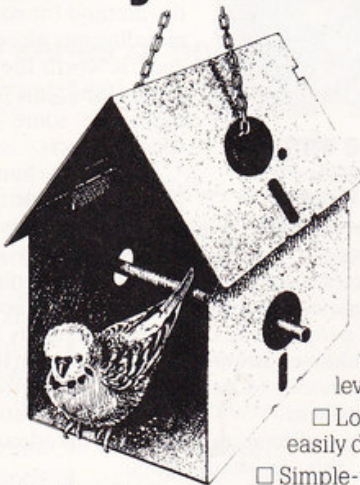
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But that's what Sinclair, which markets this VU-3D package, claims for it. 'From an image in the mind,' says the cassette label, 'create an object on the screen, rotate and view it in three dimensions, zoom in and zoom out . . .'

### Features

You can define and display solid objects in colour by drawing two-dimensional cross-sections (effectively a view of one side of the object) on a grid on the screen. You have two cursor speeds at your disposal.

You can delete, move, expand or reduce your cross-section, and then join it to a second one. In this way, you build up the image of an object as a wire-frame, a shaded or a hidden-line picture. The wire-frame images can also be rotated on the screen.

### Presentation

Although the documentation is only a fold-out sheet on the cassette label, it is really very good. Nevertheless more information would have been helpful — there is no information about the way the scaling on the z-axis works, and the maximum z value is not clear.

What you do get, along with the program itself, is an example of its use on the second side of the cassette. Here you have the wine glass and cube pictured on the cassette label ready to be loaded, to show you what the program can be made to do. You would probably do well to load this first.

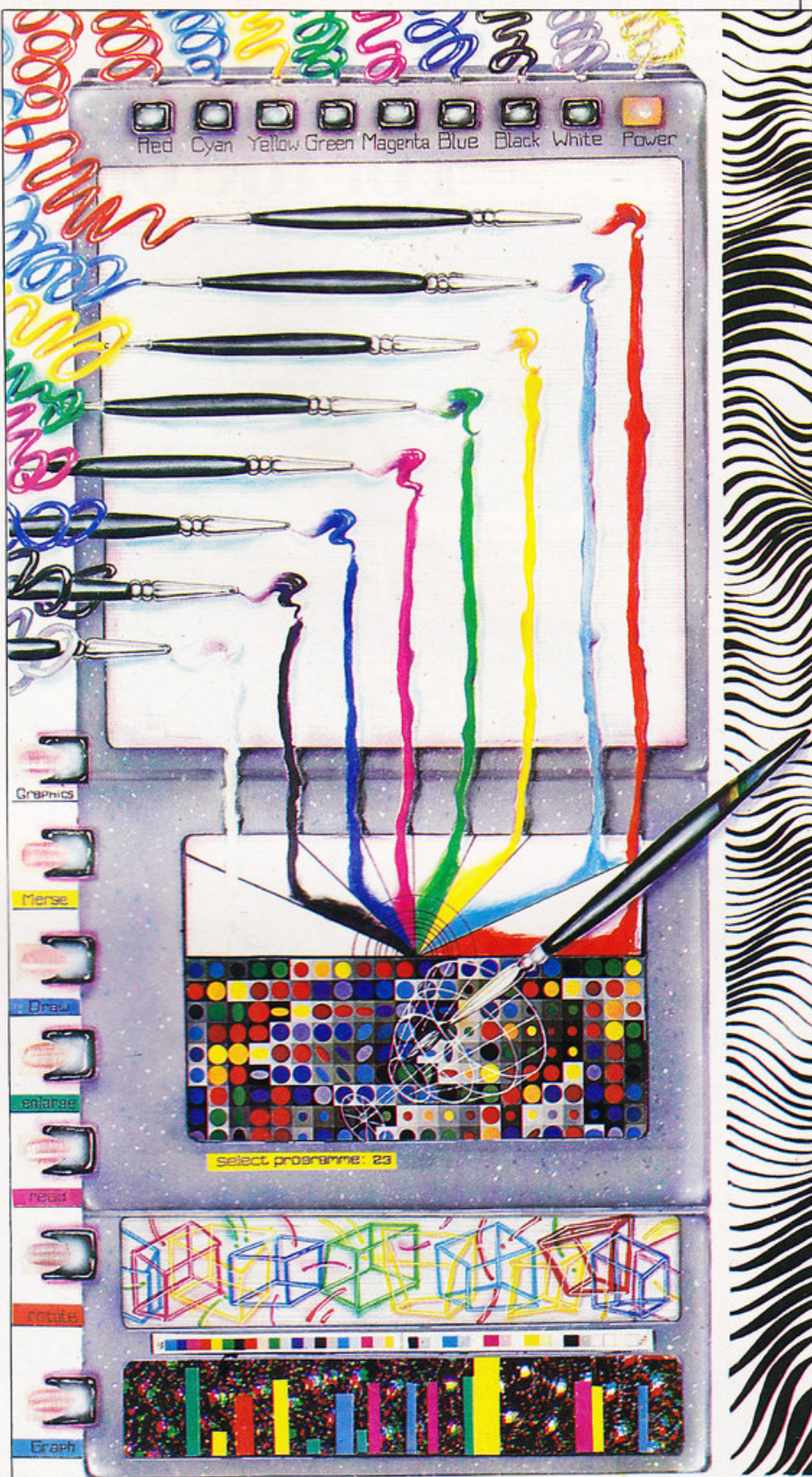
### Performance

To draw a wine glass in 3D, you start by using the cursor to draw the shape of its base. Then you use the NEXT key to move along the z-axis — the third dimension — and as you extend the shape you reduce the thickness to form the stem of the glass.

You then expand the shape or draw a new one to create the bowl of the glass. This you can do using single-key commands, such as 'D' to delete, while the shift key lets you zoom slowly in or out to view your creation. You control it all from a menu, but there is no exit from this sort of pulling the plug out.

Editing is minimal, so once you have defined your object, there's not much you can do to change it. You can alter the size of your cross-sections, but not their positions on the z-axis, so if the stem of your glass is too long, too bad.

If you could store individual cross-sections on tape, you would save a great deal of time. You can save an entire



screenful for use within your own programs, but of course you will not be able to rotate or move them.

There is another serious flaw. If you run out of memory you are sunk. No warning is

given as you approach the limit, nor any hint about how much you could expect to feed in. You cannot display or erase cross-sections, so all you can do is 'abandon file' — but not hope! Memory does seem to



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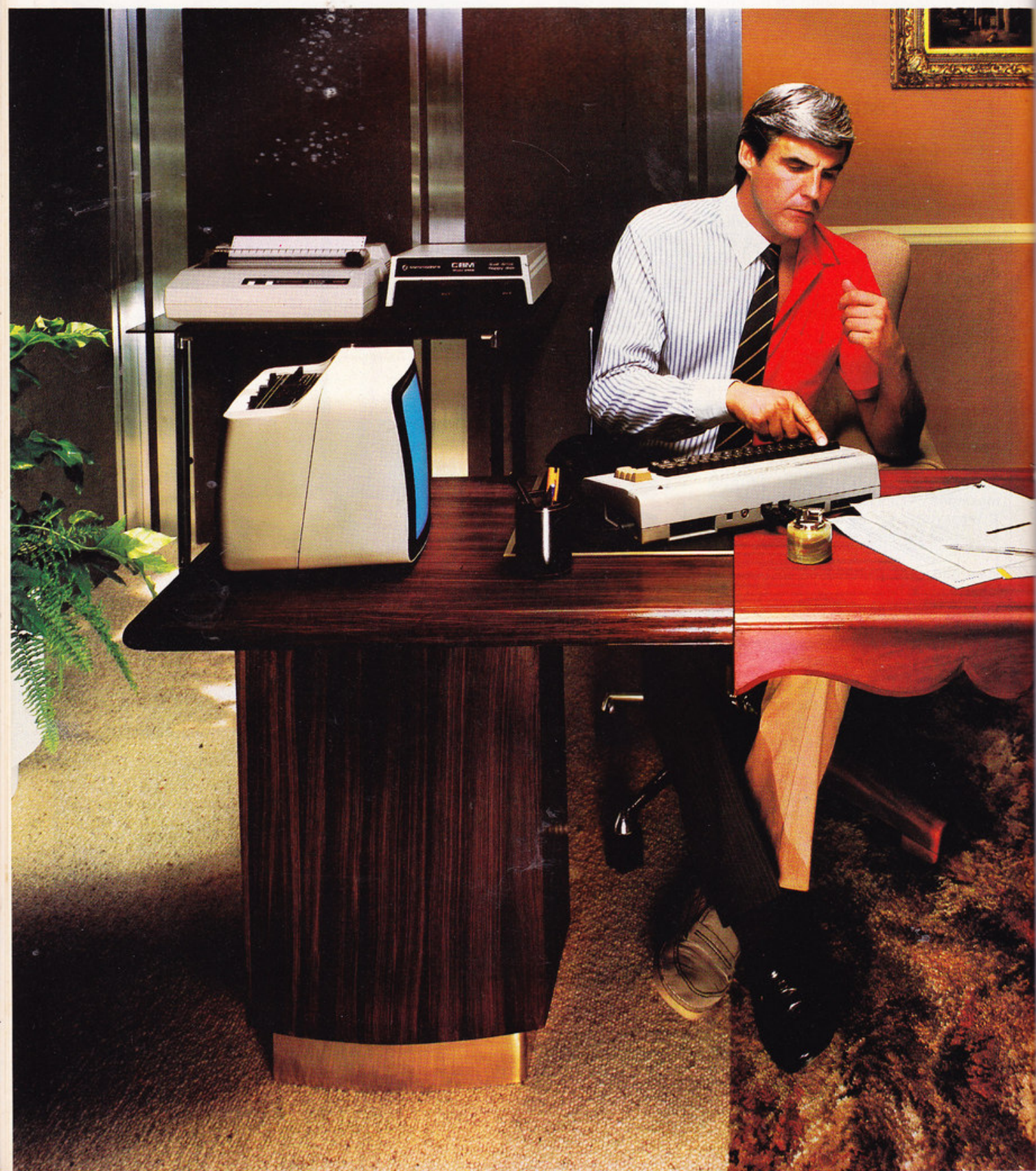
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run short quickly if your shapes get complicated.

The display, apart from some strange perspectives, is the best part. But as you watch your 3D cube performing rather stately Strauss waltzes around your wine glass, you can see the limitations of the program. You have to lay the glass on its side, because the rotation only works in two dimensions. However, I enjoyed this part, as I did the shaded and hidden-line displays.

## Overview

The cassette label claims that this is 'A sophisticated three-dimensional design and display program'. And so it is, within the limits of what can be done on a very small micro, but it is frustrating when a useful software module doesn't realise its full potential.

If Psion had produced a package you could write into your own programs, that would be much more useful.

This package is not for any kind of serious design work. It's really a toy, but that said it is certainly a good toy, giving lots of fun. But please, you lads at Psion, give us routines we can build into our own programs.

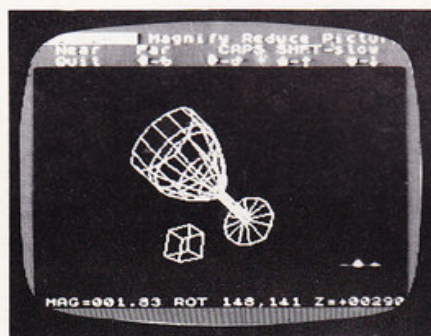
Francis Monkman

## RATING

Features	☆☆☆☆
Presentation	☆☆☆☆
Performance	☆☆☆☆
User interface	☆☆
Reliability	☆☆
Value	☆☆☆☆

## NAME VU-3D APPLICATION 3-D

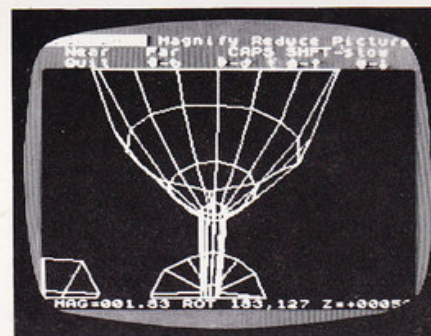
computer-aided design graphics **SYSTEM** ZX Spectrum, 48K **PRICE** £9.95 **PUBLISHER** Sinclair Research, 0276-681666 **FORMAT** Cassette **LANGUAGE** Machine code **OUTLETS** Mail order and Sinclair dealers



As the glass turns, it reflects the angle of the cube.



Bottoms up! A drinker's view of VU-3D's offering, from above.



As well as rotating the glass, you can also zoom in on the 'wire' structure.

bound), so that the manual can be folded into the smallest possible space.

## User interface

It's so easy to use GraphMagic that at first it seems it can't do all that much at all. But don't be deceived. It is, in fact, a program of considerable power, in the true sense of the term. A lot of thought has been given to the user interface and, while not perfect, it is very good indeed. The features included in the system have also been carefully selected, and this is how things should be done.

## Performance

Once GraphMagic is loaded, the main menu appears on your screen. You choose from the options presented to you by pressing the first letter of the command (this is the general rule in GraphMagic).

The menu looks like this:

MAIN MENU  
VARIABLE MENU      HELPMENU  
SYSTEM SETUP MENU    PIE GRAPH MENU  
LINE GRAPH MENU    BAR GRAPH MENU  
? PRINTER MENU  
ESC FROM GRAPHMAGIC

The other menus follow the format of the main menu. The 'display area' below the menu shows any textual data requested by a menu choice.

You also input and edit the variables used to construct your graphs here. The ESCAPE key takes you back to the previously-selected menu.

The variable menu lets you set up or change the values you will be plotting. It will usually be the first menu you will want to select.

Up to 40 variables can be set up from the keyboard, or read in from diskette, either in GraphMagic/MatheMagic format, or in the DIF format used by VisiCalc and other software. The GraphMagic manual also describes how you can use data from your own programs in GraphMagic.

Limiting variables to 40 is satisfactory except for line-graphs. I would have preferred to see at least double this number allowed here, as GraphMagic has no curve-smoothing ability.

The system setup menu is used to change the default data-diskette drive and volume, and the printer type. You can set a print-out of a graph only if your printer has a graphics output; otherwise, you will be able to print out only the variables.

GraphMagic constantly uses its system diskette. Only part of the program is held in the computer's memory, and when another part is needed it has to be read in from the system diskette.

Despite this, GraphMagic runs quite well with a single drive, and prompts you when you need to take out the system diskette and insert your data diskette.

You select the plotting menus — line graph, pie graph and bar graph — once you have got your variables set up ready to plot. Most options are available on all three. There are commands to DRAW, VIEW or ERASE a graph, SAVE it to, or LOAD it from, a diskette, to add text to the graph in memory, to see the diskette

## Graph-Magic for the Apple II and IBM PC

What makes a 'powerful' program?

Nowadays it's often thought that the most powerful program is the one with the largest number of commands and options.

GraphMagic has limited options, but it does its job well, and is genuinely effortless to use — that's what I consider to be the mark of truly powerful software.

## Features

GraphMagic can display sets of figures in graphic form and full colour. These can be anything from monthly sales to sets of scientific observations, so it is aimed equally at the business and science communities.

Versions are available for both the Apple II and the IBM Personal Computer. I tested the Apple version. The distributor, International Software Marketing, says the IBM version is similar, but more powerful. It's also more expensive at around £130.

There are three display options: line graph, bar-chart or pie chart. Several sets of figures can be compared by overlaying one graph or bar-chart onto another — for example, one year's monthly profits can be matched with similar figures for previous years.

## Presentation

GraphMagic is supplied on a copy-protected diskette, so you can't make a back-up copy. Where software is supplied in this way, it is essential that a back-up copy should also be supplied.

I couldn't find out what ISM's policy on diskette failure is (they promised to return a phone call, but didn't — I hope bona-fide customers will get better service than reviewers).

The documentation is unclear on this point, and purchasers should make sure they get either a clear undertaking, or a second copy of the diskette.

The GraphMagic manual is short (55 pages), but gives a clear and readable digest of all the basic information necessary. However, I would have preferred the standard Apple documentation format, ring-bound (it is A4, and is not ring-



catalogue, and to go direct to the variable menu.

Any graph in memory stays there until it is either specifically erased or a new graph is read from diskette. This lets you produce compound graphs by drawing a new graph on top of the one already in memory.

You can distinguish between the two sets of values by choosing different colours. This technique is particularly effective in bar-charts, where the bars can be set left, centre or right of the mark. This lets you see pairs or triplets of values side-by-side.

Graphs are stored on diskette in the format used by most graphics manipulation programs on the market. This means you can pass GraphMagic drawings to these other programs for tidying-up or improvement.

Each of the three graph menus has a 'Parameters' option, with choices varying among the three. For all three types you can add a title to the graph.

For pie-charts, you can specify line-only, alternate black-and-white segments, or coloured segments. The segments are marked with the percentage they include, and are labelled with the names allocated to the variables they represent.

For line and bar-charts you can reset the x and y-axis ranges, label the axes, and set horizontal and/or vertical gridlines. For line-graphs, you can specify dots, continuous line or line filled with a specified colour.

For bar-charts, you can choose the colour of the bars — they cannot be individually coloured, but this is a useful feature where two or more bar-charts are to be overlaid.

The help menu re-displays the main menu, but in 'Help' mode. Selecting any of the options in this mode gives you an explanation of what the option does rather than action.

This is useful for the newcomer, who can take himself on a tour around the program. But for the experienced user it might be better to attach each Help option to its appropriate 'live' menu. This allows you to get help without having to escape to the main menu and then find your way down to the option you want.

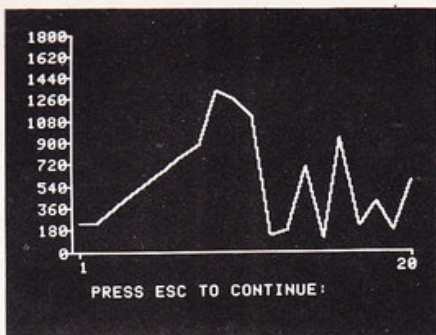
## Reliability

No program is without errors, and GraphMagic is no exception. Two have already been mentioned. The other ones, although not particularly serious, are in some cases irritating and cause unnecessary work.

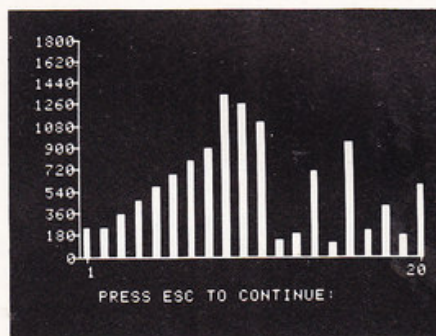
One error concerns the labelling of the y-axis when no explicit range has been chosen — that is, when GraphMagic is left to decide what y-axis range is best.

In certain circumstances, you will get labelling to a ridiculous degree of accuracy. In one case, GraphMagic selected a range of 200 to 900, with intermediate points at intervals of 77.777778. But when I selected the identical range explicitly, GraphMagic chose intermediate points at intervals of 70.

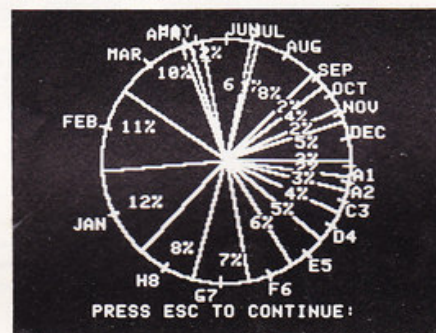
Where you have exactly 12 variables no



Compound graphs are possible with GraphMagic, one on top of the other



You can choose the colour of the bar chart, useful in superimposing a second or third.



The segments in a pie chart are marked with the appropriate percentages.

intermediate positions are marked on the x-axis of a bar-chart or line-graph. Twelve-position bar-charts are likely to be required fairly frequently for monthly figures, and I found no satisfactory way around this problem, although it was possible to use the text-addition capability to improve matters.

If when you use a single diskette drive GraphMagic requests insertion of the system diskette and you put in the wrong one, GraphMagic loses control, and drops into the Basic interpreter. And if you try to print a graph and specify a non-graphics printer GraphMagic stops dead and will not respond to any command.

This is irritating, especially if you've been working on a graph for a long time, because you will have lost all your work.

When GraphMagic is terminated normally, it fails to tidy up properly, and leaves the Apple in a state where it will occasionally behave unpredictably. The easiest solution is to switch off the Apple and start again from scratch.

## Overview

Despite the faults GraphMagic is a useful package for those requiring graphic representation of numeric data.

One user, who is familiar with the Apple but who had not read the manual and had no interest in programming, was able to find his way around the system and draw and save graphs within 15 minutes. The only problem he encountered was the use of the RETURN key, which does not act in a standard way.

Nonetheless, he liked the program, and so did I.

Even taking the errors into account, the package is good value at around £55.

Mike Whitney

## RATING

Features Presentation Performance User interface Reliability Overall value

## NAME GraphMagic APPLICATION

Business/scientific graphics **SYSTEM** Apple II, 48K, DOS 3.2 or 3.3 **PRICE** £55 approx (IBM £130 approx.) **PUBLISHER** International Software Marketing, 01-751-5791 **FORMAT** Disk **LANGUAGE** OTHER IBM P.C. **OUTLETS**

## EDG Graphics System for the BBC Model B

Now non-programmers can create high-resolution, colourful pictures on the BBC Model B micro — and there's no need for paddles, joysticks or any other special bits. It's all done from the keyboard.

Model B is the first machine to combine extensive graphics capabilities with an extensive operating environment in one inexpensive box.

Many of the software packages arriving in the near future for the Beeb, therefore, will be orientated towards colour graphics creation, generation and editing. However, the cassette-based EDG Graphics System is probably the first general-purpose graphics-creation package, and its developer — EDG Engineering International — is already producing new versions with extra facilities.

## Features

The package allows the creation of boxes, circles, lines (using solid or dotted lines), or automatic filling. These shapes can be defined partly off the screen.

Text can be presented with the graphics, complex areas can be filled with any colour, and drawing commands can be repeated. Any of the eight real colours or eight flashing colour combinations in each mode can be selected.

The pictures drawn are stored in a compressed 'picture memory', which can be SAVED on cassette and later re-LOADED and displayed. Several commands exist for removing incorrect picture elements, re-displaying and CLEARing the two picture areas.

Several aids are available grouped in a 'control panel' at the bottom of the screen. This includes a short prompt, usually of one word, and a palette of the available



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Boots





**M**easured by the hardware specification, Lisa is not a micro. It's a fair-sized mini-computer studying to become a mainframe. What else can you call a machine with a full-blown 16-bit processor, three subsidiary processors, a whole megabyte of fast RAM, 6.74Mb of disk-space and a bit-mapped screen?

The machine tested was a pre-production US version, and because of this such details as the packaging, documentation and completeness of the equipment supplied could not be checked. It was using a late-development copy of the software, and operates a little more slowly than the final version will since it's still running the concurrent debugger. In fact, I found myself in it once, for no obvious reason.

A full reset was required to restart the system. Here the machine showed some of the thought which has gone into it. When it started up again, it announced that 'Lisa has found an error on the disk. It will attempt to restore all ikons to their former positions'.

The amazing thing was seeing all but one of the ikons go back correctly. That's error-trapping. (More about the ikons later).

## Presentation

Overall, the construction appears to be sufficiently solid to stand up to the rigours of office use. It consists of a main unit, on top of which sits the 5Mb Profile hard disk. Connected to the console are the

much less wear — indeed, the disk manufacturing company Verbatim is prepared to guarantee its own Lisa-type disks for the life of the computer.

There is a deep cutaway under the front of the console which has a socket for the keyboard-cable and an illuminated button. This performs a hard reset when pressed, but is sufficiently out-of-the-way to be unlikely to be hit by accident. A bracket leg on either side prevents the cabinet falling forward.

The keyboard is on the end of a coiled cable and has one of the eight or so national versions or an ISO-standard layout with a combined numeric cursor keypad.

Unlike many recent micros there are no rows of function-keys, since, as you will see, Lisa has no need for them. The most unusual feature is that symbols from any of the eight national character-sets may be written by the user at any time.

The most useful part of Lisa is the mouse, a little box with a wire coming out of it. This plugs into the main console at the back. It has a button on the top, and on the underside a large ball-bearing in a cage. When you move the mouse around, the ball rolls against three small wheels, which produce a signal telling the computer where to point on the screen.

The screen display is black and white, very steady and clear. At 720 × 364 the resolution is good, and the screen is bit-mapped. This allows many different type-styles to be displayed in sizes ranging



keyboard, the 'mouse' and one or two printers. The usual one is the Apple dot-matrix printer, which is specially designed to work with Lisa.

## Documentation

Lisa does have documentation, but this was not available at the time of testing. However, it really doesn't need any, since it has a very powerful 'Help' utility which teaches interactively.

## Construction

The micro is very simple in appearance, just a rather hunchbacked off-white cabinet containing a 12in screen and two horizontal 5¼in disk-drives. The drives are of a new type, which takes a specially-notched floppy. This has two head-windows per side, opposite each other, and a large square cut-out in one corner.

This design allows the machine to warn the user if the disk has been put in the wrong way round. The double head-windows are there because the two heads, instead of squeezing the disk between them, are on opposite sides. This causes

from 6 point (about the size of PCN's small ads) to several inches, as well as textures, symbols and graphics all on the same screen.

There are several modes, too, such as inverse, flashing, low-intensity and combinations of these, which may be placed on various backgrounds. The result is like looking at real printing, since one of the styles at least has true proportional spacing.

## Storage-handling

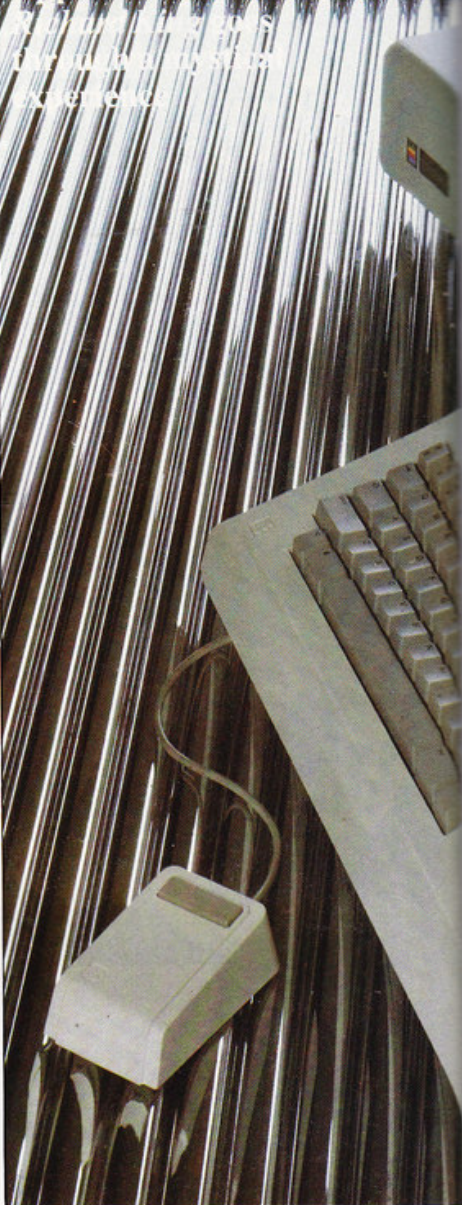
Lisa's main store is the Profile hard disk. This is where the data-files that are generated are kept. The two floppy drives, each holding 860 kilobytes, are used to store the main program modules and configuration files.

In use, all the organisation of the disk is handled by one of the subordinate processors, and the user never needs to know where a file is stored.

## Expansion

Precise details of the three expansion slots are not yet available, but it is believed that

As he lay his hands on  
Apple's iconic Lisa.



one is used for the printer-card, leaving the others for such additions as communications interfaces. They are not the same as Apple II slots, and will not use Apple II peripherals.

## Operation

The operation of Lisa where the machine really shows its paces. It just doesn't work like other machines. Instead of booting the system, calling up the file catalogue, selecting a program and then running it, or some equally complicated procedure, you see an entirely different world.

The screen comes up with a grey tone overall, a white menu-bar across the top, and little pictures scattered around. This is the Lisa-desk, which is the normal operating environment. Each of the pictures has a small label underneath.

There's a picture of Lisa itself, labelled 'preferences', the Profile, which says 'filing cabinet', a clock, calculator, clipboard and rubbish-bin, and a picture of a Lisa-type diskette labelled 'stationery cupboard'. There are also small rectangles with tags at the top, which bear names such



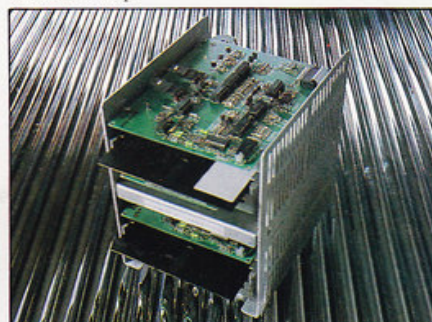


about the Lisa-desk. It can be made to point at either an ikon or an item on the menu-bar. Pressing the mouse-button twice either opens the ikon, which suddenly gets bigger, or unrolls a menu.

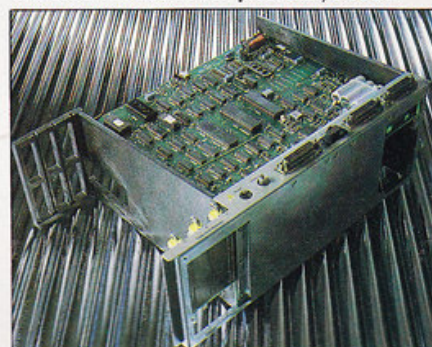
The mouse is very helpful. If you have asked for a function which will take a little time, the pointer changes into an hour-glass; much more economical than 'Please wait a moment'.

Thus, moving the mouse to point to the stationery cupboard and 'opening' it makes it suddenly expand on the screen. Now a small version appears in the top corner next to a larger label. Underneath are several folder-ikons, variously labelled.

Make the mouse now point to 'spare stationery', and it can be moved out onto the desk-top.



Looking at the board, you wouldn't think that each of these drives has its own processor, a 6504.



The system has three expansion connectors which are unusual in being zero insertion force (ZIF).

Point to the stationery cupboard ikon, press twice, and it shrinks back to its original size, leaving the spare stationery folder on the desk.

Point at that, press twice and look inside. More folders. Take one out and put the rest away. Look at the new folder labelled 'cash-flow'.

Ahah! — a full set of blank pages prepared for doing the monthly cash-flow. There's a form for putting in the raw figures, an attached graph and calculation sheets for budgeting, forecasts, and performance analysis.

Fill in the figures and watch the calculation take place.

Point at the menu-bar and select Edit. Snip out the results using the 'cut' option and leave them on the clipboard. Put that sheet away and get out the others, cutting and pasting as necessary to transfer figures from one sheet to another.

Soon the job is done, filed and printed out. The four or five sheets which come out of the printer are exact copies of what

you've just prepared on the screen, looking clean, neat and professional.

The interesting thing is that apart from the use of the mouse, you didn't do anything differently from normal, everyday procedure, did you? Nor did you have to learn any jargon (ikon? Well, maybe) or even type anything other than the words you'd have written, dictated or typed in the usual way.

This is what makes Lisa so revolutionary. The simple idea of treating everything, including the machine itself, as objects which may contain other objects and which have attributes.

Part of the subtlety is in the way an attribute is viewed in the Lisa system. It is best considered as a cause rather than a result.

Take a door, for example. Paint it red. The door now has the attribute of being painted red, or it does from the normal viewpoint. Considered from Lisa's viewpoint, the door *causes* red light to be reflected. The result may be the same, but the Lisa attitude allows more flexibility.

Pointing at the picture of Lisa and pressing the mouse button twice allows the user to set his personal preferences for certain functions. In other systems this would involve some lengthy and complicated installation procedure.

The other ikons are the same. The clock and calculator explain themselves. The garbage bin represents the only way of removing an unwanted document or folder from the system.

The clipboard is very clever. It's a stash, and on it goes the result of the last 'cut' operation. If you want to 'paste' information into a new document, the material added will be the top item on the clipboard. Obvious . . . so obvious that we've never thought of it.

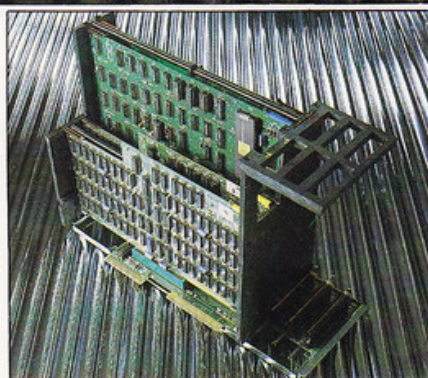
The programs in Lisa are seen as sheets of paper of different kinds. There's writing-paper, drawing-paper, graph-paper, list-paper, calculator-paper and project-paper. That's all you need, although you can set up pads of paper with specified details and keep them in the stationery cupboard.

Each type of paper has similar attributes, so once you've learned how to use one kind, the others are easy, since they all work the same way.

## Maintenance

Lisa will be covered by Apple for a period of 12 months from purchase (as for all Apple products) with a further year's maintenance at 8 per cent of retail cost. If the machine does go wrong, it can be returned to the dealer, who will send it to Apple for replacement or repair.

An optional extended warranty will be on offer, though the cost has not yet been finalised. In a new departure, Apple is also negotiating a special national maintenance agreement for Lisa with a third party; formerly there was no central co-ordination. Details should be released soon, and the company will take Apple's 8 per cent into account when setting the charges.



The large chip just visible is the heart of the system, the massively powerful 68000.

as 'blank paper', or 'budget 1983-4'.

These little pictures are collectively called 'ikons', and their shape is representative of their use. Thus the rectangles are 'folders' where documents are kept, and the Profile ikon labelled filing cabinet is where the folders are kept.

There is also a little arrow on the screen which points NNE. This is the mouse-pointer. When the mouse is moved around on top of a real desk the pointer moves



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Childs play. HUHT! They warned me of the weird packaging,  
but they didn't say I'd have to stop and control not just one but two  
or even more garbage pods. Then prod them, push  
them, toward that black hole, and oh, it's so very, very  
panic, musn't panic, so empty.  
spinning and turning, always turning, towards me, against  
me, at me. And I'm alone.  
No way out, nowhere to hide, on my own, my own... own...  
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## Support

Lisa has little need of huge libraries of software, since just about anything you could want to do on a desk is easy to do. However the Unix operating-system will be available with its associated languages.

More interestingly, Apple says it will be releasing a toolkit in the near future that will allow programmers access to the Lisa control-program. This means that everyone will be able to invent their own ikons which will be activated just like the existing ones.

One possible ikon might be a small picture of an Enigma coding machine. I leave it up to the reader to imagine what that might do.

## Throughput

The nature of Lisa makes it impossible to measure its processing power in normal terms. My subjective assessment is that it is much more efficient than conventional systems, not least because all the programs and data-files are immediately available to the system. That means no more disk-swapping

## Overview

No mini-builder would have the nerve to introduce a machine like this with a price-tag of less than £35,000. And with software that would probably mean spending closer to £80,000, a fact which must be taken into consideration when assessing value-for-money.

Apple will be selling Lisa for \$12,000 in the US and about £8,000-£10,000 in the UK. Put simply, for this much hardware that is dirt cheap.

When the incredible sophistication of the software is added to the equation, Lisa simply falls off the graph. It is not valid to compare any other machine with it. No exceptions. None.

The problem is that, even though the price is practically giveaway, it's still a big pile of pennies — outside the reach of most individuals. The majority of buyers will be businesses, so it's not going to be seen in everyone's front parlour.

The most significant thing about Lisa will be its effect on software development. Hardware is still far more highly-developed than software.

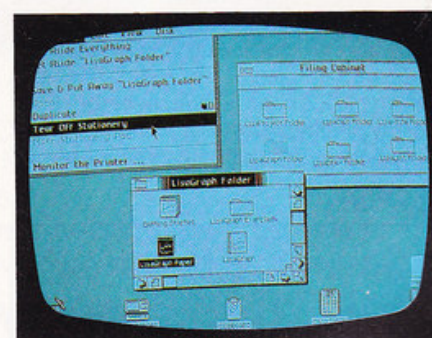
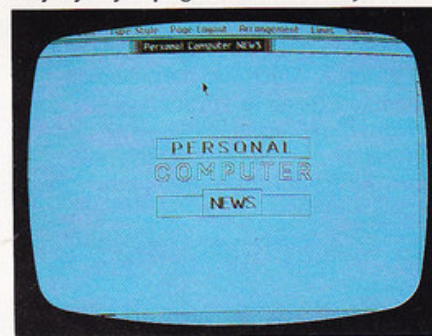
The average program is a hopeless mess, and when integrated with other programs — even those written by the same person — horrendous inconsistencies appear in



The Apple Dot Matrix Printer (reviewed on page 61) is designed to do 1:1 reproduction of the screen



Lisa's keyboard looks ordinary but it's different: every key may be programmed individually.



Point at an ikon, push twice on the mouse and Lisa becomes active, performing the intended function. Putting the PCN logo on screen took moments.

the resulting edifice.

Lisa shows us that there is a better way. Programmers will be quick to learn the lessons, and we can expect to see a vast improvement at the user's end of programs in the near future.

PCN SECOND OPINION  
I love Lisa

The next revolution in personal computing? Eliminates the need for expensive programmers? These are just some of the claims being made for Apple's new Lisa. We've heard it all before — or something very like it.

But a second look at Lisa will soften even the hardest of cynics, and may even raise a shudder from the odd 'expensive programmer'. It really is a micro you can use 'with one hand tied behind your back'.

I've been in the computer business a fair number of years, and during that time any number of 'revolutionary' new ideas — in hardware, software, or systems and program design techniques — have been proposed.

'Brilliant innovations' regularly fail to make the slightest impact, and this has bred a degree of cynicism in me, and in the vast majority of old computer hands. We must be the despair of the bright young things propounding similar notions.

Anyway, PCN asked me to travel up to Apple UK. There I could see this absolutely marvellous new system they were about to launch. With it they would change the basis of microcomputing as we know it.

You will understand I was not immediately convinced. But I came away from Apple in a rather different, and subdued, frame of mind. The Lisa hardware is impressive. There is one megabyte of RAM, a 68000 main CPU (with two or three less exotic ones besides), and so on. The software — well, here is something even a hardened professional has to admit is a breakthrough in user-to-computer communication.

But more importantly, Lisa promises to have a profound effect on the future of personal computing.

Few of the individual ideas that have gone into Lisa are original to Apple. For example, we've seen the mouse and the desktop screen before.

But what I find so impressive is the way that, put together, they present an absolutely consistent face to the user. It behaves the same regardless of which of the programs you are using.

On the top of this the whole system can be controlled by one hand, apparently resting idly on the desk-top.

There is the mark here of one mind — a collective mind, maybe — which has imposed an iron discipline upon designers and programmers.

Because of this they have produced a system which is a whole, and not merely a collection of parts. I am consumed with envy of the designers and programmers who had the privilege of being involved in the production of this truly innovative system. Lisa, I love you.

Mike Whitney

## TECHNICAL SPECIFICATIONS

<b>Price:</b>	About £8,000 (to be confirmed)
<b>Processor:</b>	Motorola MC68000 running at 8MHz
<b>RAM memory:</b>	1Mb
<b>ROM memory:</b>	16K, self-checking routines and bootstrap
<b>Text screen:</b>	Up to 86 by 31, depending on typestyle
<b>Graphics screen:</b>	364 by 720 black and white
<b>Keyboard:</b>	77 key detached. All keys programmable
<b>Interfaces:</b>	2xRS232, 1 parallel. 3 ZIF connectors to system bus with DMA and vectored interrupts, memory-mapped.
<b>Storage:</b>	2x5¼ in Twiggies, each 860k, plus 5Mb on ProFile
<b>OS/Language:</b>	LISADESK
<b>Other languages:</b>	Bsic, Pascal, Cobol, Lisa editor development utilities
<b>Distributor:</b>	Apple
<b>Software supplied:</b>	LisaWrite, LisaDraw, LisaList, LisaGraph, LisaCalc, LisaProject



Ian Scales puts words into the mouth of a Sinclair and tests its elocution levels.

# Spectrum finds its voice

**T**HE DCP Speech Pack hails (can't resist) from Norwich and is the work of an inventive young entrepreneur called David Palmer.

In designing his product Mr Palmer traded versatility for ease of use and price, delivering one of the cheapest units on the market for one of the cheapest computers — the ZX Spectrum.

The DCP Speech Pack plugs onto the Spectrum's board, requires no additional power supply and has no 'on-board' controls other than a recessed volume notch which may be adjusted by screw-driver.

As well as its built-in speaker the Speech Pack has an audio socket for an external speaker and the Sinclair bus sticks out from the back so other peripherals can be attached.

The pack is housed in the familiar black plastic case beloved of electronics enthusiasts. The casing is robust enough, but when the Speech Pack is attached to the Spectrum its thick foam-rubber feet lift the rear feet of the computer a good half-centimeter from the table. Vigorous key-punching puts a fair amount of strain on the rather fragile looking board edge.

The problem can be rectified by shaving most of the rubber off, but one hopes DCP will take note and make the appropriate adjustments.

## WORKING ORDER

The Speech Pack is simple to use. The data which generates each individual word is resident in read only memory in the pack. Each word is coded with a number so all the user need do is enter the appropriate number after the correct Basic command (OUT) in a program and the word or words will be generated in the desired place and order when the program is run.

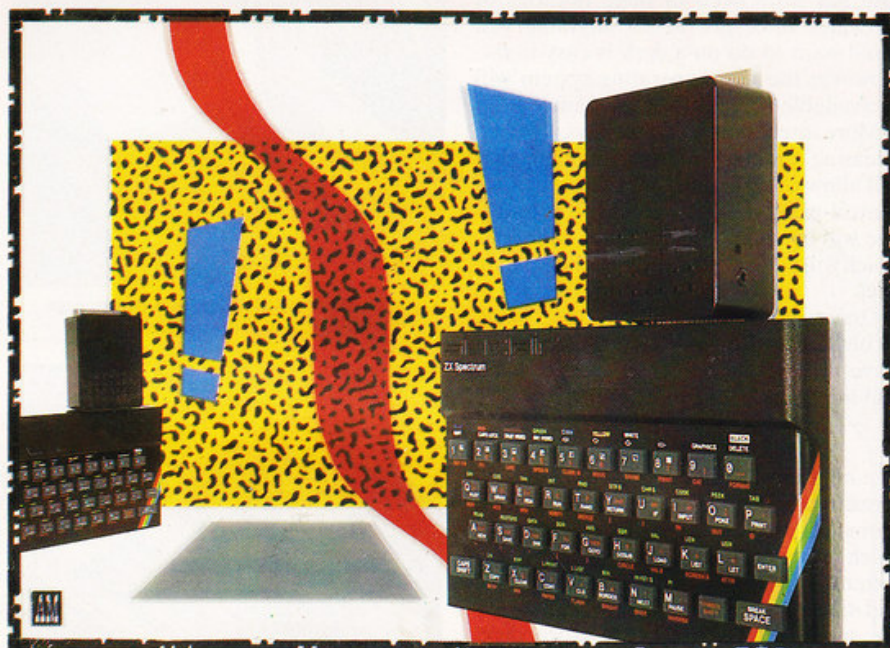
When integrating the Speech Pack with a program the user first defines the memory location of the ROM chip. This could take the form

LET S = 255

Later in the listing the programmer simply calls up an appropriate word with, say, OUT S, 62, which actually produces the word 'cancel'.

Words may be strung together to form meaningful phrases with judicious use of a PAUSE command to prevent gibberish. (Identifying words from a stream of gibberish could form the basis of a good game, by the way.)

The standard Word Pack chip in the Speech Pack contains all the numbers from



zero to 20, then 30, 40 etc, and hundred, thousand, million. It also contains all the letters from A to Z and a few useful words such as 'and' and 'at'.

There are three additional chips costing £14.95 each which can be added to the system to expand its vocabulary.

Word Pack 2 occupies the same memory address as the Speech Pack's standard Word Pack and takes its number codes from 72 to 143.

## UPGRADING

Word Packs 3 and 4 use a different address, pack 3 starting with 'abort' at code 0 and continuing alphabetically through 67 words to 'level'.

Pack 4 picks the list up at code 67 (load) and ends at code 130 (zone). For this reason pack 3 must be bought before pack 4, but as they form a comprehensive alphabetical listing it makes sense to buy them together.

## Sounding them out

Why should you want your micro to talk to you?

Well, speech synthesis opens up new possibilities in menu-driven programming — and it's a lot of fun.

At the moment speech synthesizers are spoken for by the add-on specialists. Flick through the small ads of micro mags and you'll soon see how the volume is rising.

PCN will be keeping its ear to the ground to bring to your attention a representative sample of synthesizers in terms of the micros they serve, the way they work and how much they cost.

This Pro-Test series will build up to a special feature on speech programming which will include a look at applications that have been developed.

## VERDICT

The quality of output is fairly good, thankfully lacking the Dalek inflection traditionally associated with such devices. Even so, the words do fall short of BBC English. They would probably sound clearer if put through an external audio system.

Instead of making the Spectrum a 'zapped up' ZX81, Sinclair designed a slightly different architecture and in doing so sent the add-on specialists back to their drawing boards to modify their products.

The review model came with the four-page ZX81 manual. A photocopied addendum explained that the Basic statement OUT must be used instead of POKE and that the address values had been changed.

Users, a covering note says, will be sent the modified manual as soon as these have been prepared.

The product is guaranteed along consumer lines with a 12-month warranty on parts and labour.

The Speech Pack makes an adequate voice output device. In gaining simplicity, however, the user sacrifices flexibility: with ROM-based items such as this you are limited to the words on the list.

Other speech devices allow you to make up the words yourself using vowel and consonant sounds. This makes the programming procedure a mite more complicated and it can take much experimentation to get a word just right. Over the coming weeks PCN will move up through the range of word-output devices and evaluate the strengths and weaknesses of competing brands.

**Name:** DCP Speech Pack.

**Manufacturer:** DCP Microdevelopments.

**Price:** £49.95.

**Outlets:** Mail order and selected dealers. Contact DCP microdevelopments, 0603 712482.



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A device which lets the Commodore Vic and 64 off the peripherals hook is reviewed by Mike Ryan

# Vic switches to economy drive

Full-blown computer networking systems have their disadvantages. The fact that very few are yet available indicates how difficult it is to make them friendly enough for the average user, or users.

Perhaps the main reason for netting micros is to enable them to share peripheral devices which are too expensive to justify being dedicated to each user. What's required by way of 'intermediate technology' is something that can hook up micros to one circuit to allow a clever black box to decide who is next with the printer or disk drive. This would certainly be an advance on manually chopping and changing cables.

Such a solution has been provided for Vic-20s and Commodore 64s by a Swedish company called Handic and is being sold in Britain by Kobra Micro Marketing.

The Vic/64 Switch can be used only with Commodore's serial connection and the only peripherals available using this standard are the Vic printer and the Vic disk

drive. Up to eight computers can share the same device.

## Setting it up

The Switch is housed in a smart black and white metal box measuring 10x4.5x2.5in and weighing 2lb 6oz. On the front it has nine small red lights marked Power and 1 to 8. On the back there is a two-pin power connection, eight 6-pin DIN sockets similar to the serial port on the back of the Vic, and a matching six-pin OUT socket for connecting to the disk drive or printer.

It seems well constructed — there is a neat board inside, and no ugly wires can be seen. The little red lights on the front for numbers 4 and 5 were pushed back inside the body when I received the review model. But you can take the case apart by removing only four screws, and the wire mounted lights can easily be bent back into place.

It's easy to get the Switch working, even without reading the instructions. The test

model had a non-standard two-pin power plug which would not fit even a shaving adaptor.

Three lengths of Vic to Switch leads are available, 3m, 6m, and 12m. It is recommended that leads longer than 12m are not used.

Each Vic/64 is plugged into the IN sockets numbered 1 to 8. The instructions recommend that the computers are switched on first and the Switch powered up last. As there is no power switch on the box this means either plugging the Switch in to the mains last or turning the power on at the wall. Not all the slots need to be taken up, and any combination of 1 to 8 can be used.

## Features

Once the power to the Switch is on then all the Vic/64 lights should be out, leaving only the power light showing. If one of the computer lights is showing, this indicates that the Vic/64 may not be switched on. If it is on, then pressing RUN/STOP and RESTORE together should clear the light.

If someone wishes to leave the net then their connecting cable should be pulled out of the Switch before turning off the computer's power.

This should avoid interference to the remaining users.

## Up and running

Once the system is set up and switched on, each user carries on as if the disk or the printer is connected to his machine only. If more than one asks to use the device at the same time, then the clever logic in the Switch puts them into a queue and passes the printer/disk to them one at a time, and according to their number.

So if 2 and 7 both ask at the same time when 6 is already using the peripheral, then 7 will be given the printer/disk approximately 0.5 seconds after 6 finishes. In this way no one computer receives preferential treatment.

Students can therefore each practise opening and closing disk files and storing data from programs on to disk for later retrieval. As long as they do not try to access the disk at the same time the Switch will allow them to operate as if the disk was theirs alone.

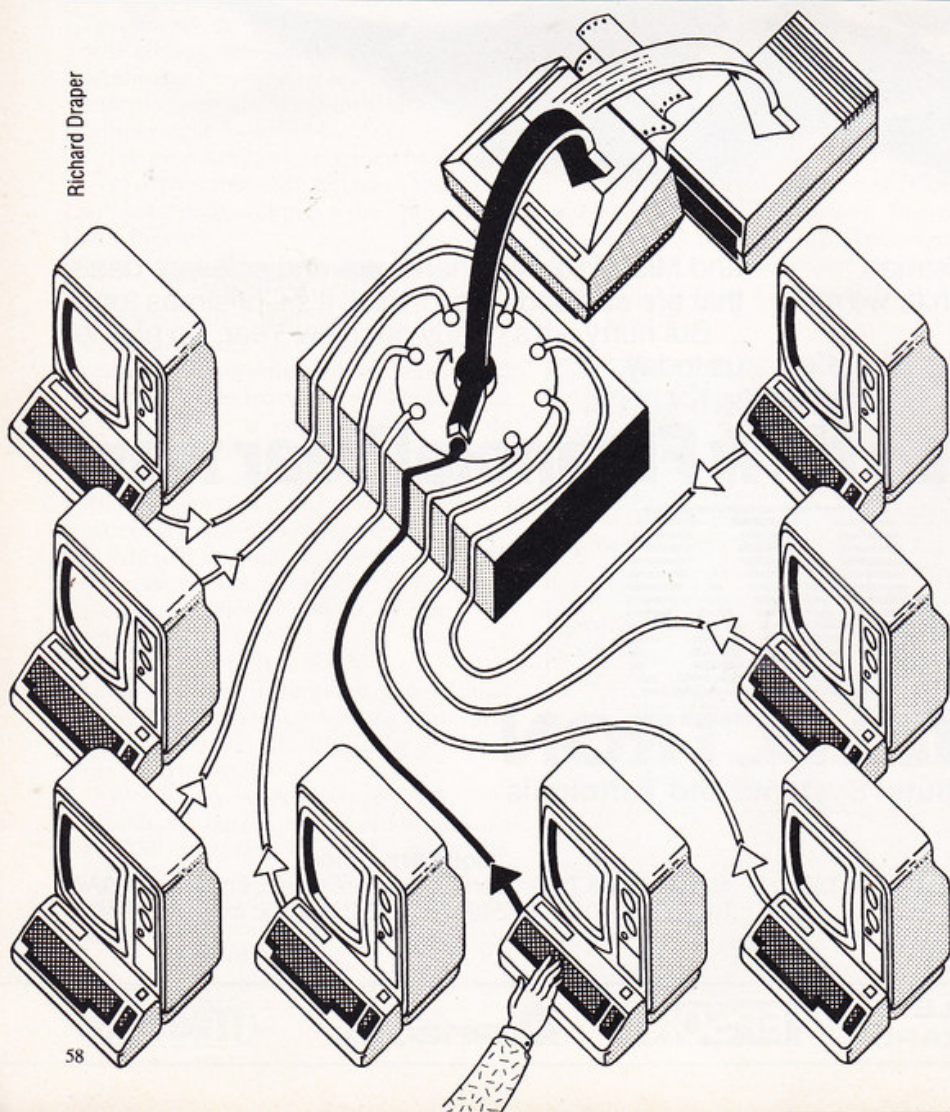
Education is not the only area where the Switch will be useful. Vic-20s and Commodore 64s could be used as data entry terminals, share a common disk, and one of the eight could collate the information input by the other seven.

## Conclusions

The Switch is a very useful device for any set-up where expensive peripherals need to be shared between several users. Handic is a Swedish firm, but the Switch is sold in this country by Kobra Micro Marketing, an offshoot of ADDA, a very reputable UK micro firm. Therefore one presumes that support for it in this country will be good.

**MACHINE** Vic/64 Switch peripheral sharing device. **Price** £97.75 (inc VAT) **AVAILABLE:** Kobra Micro Marketing, 04912 2512.

Richard Draper





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Andrew Tollyfield tests the Silentye's smarter brother, which takes Apple into the office

**A**pple continues to forge its way up-market amid much trumpeting and hoop-la with the launch of the Lisa and the arrival of the Super IIe. The company also announced the availability of its dot matrix printer, definitively called DMP. We understand a DWP will follow.

The DMP is Apple's follow-up to its only other printer, the Silentye thermal, which aimed to please the hobbyist with its price and challenge the cryptographer with its text quality.

The quality of the print is crisp and clear. It is not of true letter quality — as produced by good daisy wheel printers — but some of the printing modes produce a standard acceptable in most cases.

Two weaknesses are evident from the machine supplied for review. The first is documentation. A 32-page guide to setting up the printer takes you through removing a restraining card from inside the printer, inserting ribbon and paper, switching on and obtaining a print-out.

At this point two programs on an Apple disk should take over and demonstrate how to set up the various options, such as characters per inch and language set.

The first of these is at an elementary level, and could be useful for anyone who has not used a printer to list Apple programs before. It is tedious for an experienced user.

The second and more important program, DMP Exerciser, should allow the setting and testing of many options. This failed to operate correctly except in the printing of high-resolution graphics, possibly because the Apple interface card sent with the review model was not the one described in the manual.

Finding out what facilities were offered therefore required close examination of the reference card. Some documentation illustrating the different character formats and means of selecting them is essential for the serious user.

The second, less serious, weakness is that of interfaces. The printer is supplied with a parallel interface only, whereas the current trend appears to be to supply both parallel and RS232 interfaces on printers in this price-range. This and the supplying of information on an Apple disk suggests that it is really intended specifically for the Apple range of computers rather than as a general-purpose printer.

### Setting it up

The packaging in which the printer arrived was adequate for careful transport, but I doubt whether it would stand much mishandling. This is surprising, considering the secure way Apple computers and disk drives are normally packed.

The printer looks smart (naturally it comes in Apple colours), is compact (15in x 11in x 5in) and well-constructed.

At nearly 6kg it is considerably heavier than many of its rivals — this reflects its solid construction, incorporating a metal chassis and baseplate. The top and sides are plastic, and the two top sections — which can be removed to obtain access to

# A crisp Apple printer

**Machine:** Apple Dot Matrix Printer  
**Price:** £489 (inc VAT)  
**Speed:** 100cps  
**Interfaces:** parallel centronics  
**Contact:** Apple, (0442) 60244



Print quality of the Apple's Dot Matrix Printer is good, with sharp, clear characters and fine alignment.

print head and paper tractors — are rather more flimsy, though probably adequate.

Access to the ribbon cartridge and print-head is good, and loading the paper is considerably easier and quicker than on many machines.

The printing format is switch and software selectable, the switches being reasonably accessible once the top has been lifted off, although a small screw-driver makes this considerably easier. Knowing the correct switch settings is, however, a different matter. The only source of information is the reference card mentioned earlier.

The documentation generally leaves much to be desired. The set up information is presented painstakingly slowly — to the extent of being patronising — and there it ends. There are no technical details (power consumption, weight and so on) no circuit diagrams, not even a list of functions.

### Facilities

The DMP has three indicators on the front showing power on, paper-out and printer-selected. Three front push-switches are used to control top-of-form, line-feed and printer select. The power on/off switch on

the side protrudes somewhat and could be accidentally switched on or easily knocked and broken. It would be better if it were recessed.

If the TOF button is pressed when the printer is switched on it enters a self-test mode in which the character set is printed repeatedly until power is switched off. The printer is available only with a parallel interface, but this appears to be Centronics-compatible, since other parallel interface cards appear to function equally well.

The review model came supplied with parallel interface card and connection lead, but normally these would be extras costing £92. No figures are given on the buffer size but from experiments it would appear to be about 1K.

Seven language character sets are provided as standard (US, Italian, UK, German, Swedish, French and Spanish) and in addition the reference card gives codes for loading and using a custom set, although no further clues are given on this option.

Seven different character widths are switch- or software-selectable — 9, 10, 12, 15, 17 characters per inch, with fixed spacing — or, with proportional spacing, 160 or 144 dots per inch.

In addition the spacing between characters in the proportional modes can be set to between 1 and 6 dots. Vertical spacing is 1/6in or 1/8in or completely variable in increments of 1/444in from zero to 99/144in. Reverse line feeds can also be generated.

The left-hand margin and tab positions can be set by software, and form-length can be set to 66 or 72 lines. Characters can be printed in standard, bold or elongated type or with underline.

Tractor and friction feed are standard and are lever-selectable. The tractor feed is unusual in that paper is pushed rather than pulled through the machine, but it seems to work. The carriage width is 10.5in.

### How it runs

No figures are quoted for printing speed, though 100CPS seems realistic for full 80-character lines with line feeds.

The print-head is adjustable to three preset positions to allow multiple copies. The noise level is low for an impact matrix printer of this type, acceptable in all but the quietest environments.

The print quality is extremely good with sharp, clear characters and good alignment, even with bi-directional printing.

### Overview

The DMP has the quality of construction and print-out that one would expect from Apple. It is a versatile, well-built printer which will give good results when used with business programs on the Apple. With the existing network of Apple dealers, servicing it should present no problems.

There are certainly cheaper printers providing similar features, so it may not find favour in the hobby market. For the small business Apple system, however, it should serve its function well.



A colourful clash is promised at the Spectrum end of the market. Richard King tests the TX8000

**T**he Textet TX8000 sneaked onto the stage very quietly. This was amazing modesty for a machine that in almost every detail is targeted straight at the Sinclair Spectrum.

I tested a pre-production sample. Textet said that a few points remained to be cleared up, in particular the documentation and the tweaking of the TV signal.

## Presentation

The micro arrives packed in foam, which should be strong enough to survive the rigours of the mails. All leads were included, but no demo tape. Textet apologised for this, and said that one should have been included.

The machine was easy to set up, needing only the power and TV leads to be connected; the tape-recorder can be plugged in at any time.

## Documentation

The TX800 is aimed at customers who will be encountering computers for perhaps the first time, so the introductory session must be covered with extreme care in the production manual.

The one received with the machine was obviously very preliminary — *Setting up the TX800 personal computer* was covered in a single page, but this seemed adequate for a confident person.

Apart from this, it had several omissions, the most serious of which was the absence of any explanation of the many (up to five) uses of a key. Since a machine at this price (£98) can be intended only for the tyro, the complexities of multi-function keyboards *must* be made clear at an early stage to avoid disillusionment.

In the complete explanation of the Basic, several keywords appeared on the machine but were not mentioned in the text. These were COLOR, USR, SOUND, INP, OUT and COPY. Textet explains that this was a straight translation from the Chinese. Does that mean that the manufacturer didn't have these words implemented when it was written?

A short quick-reference chart of the keywords was included, but was little better than a list of words in natural groupings. No attempt was made to provide syntax-diagrams, parameter lists, limits or precedence, which means that you will have to experiment to find out what works and why, leaving aside what the expected result may be.

A list of the printable ASCII codes offered no information about what happens if codes 0 . . . 31 and 91 . . . 256 are printed. Finding out may be very interesting.

Textet assures us that a completely rewritten manual is being prepared. I hope the final version will be better than average because, despite my comments, I felt that the machine was fairly well presented.

## Construction

The case is cream-coloured plastic and seems sturdy enough to withstand use by younger hands. The upper ventilation slots



would make it extremely difficult for anything large to be pushed in, but the ones underneath are not so impenetrable.

## Keyboard

The calculator-type keyboard closely resembles that of the Sinclair Spectrum. It has printed legends in white and dark brown on the 45 tan-coloured rubber keys,

with smaller white printed legends.

This marking reveals that it is multi-function with auto-repeat and uses single-key entry for Basic. A useful touch is the way that related keywords are grouped.

Other advances over the Spectrum are that keywords on the TX8000 may be entered either by using the single-key method, or explicitly spelled. Being forced

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to use single-key entry may speed learning, but it's patronising.

The key-spacing is correct for typists but this does not mean that it's suitable. For one thing, there is no space-bar, just a slightly larger-than-normal key at bottom right, where the right-hand shift-key would normally be.

Lower-case is also absent since the shifted values of the letter keys are mostly used for the block graphic characters. Only X, C, V and B seem to have no shifted value.

The most important control-keys are on the right and have inverse legends above them. The topmost is BREAK, below that and to the right is the FUNCTION key which is shift-RETURN, then the editing keys INSERT and RUBOUT, and INVERSE. The four lower-right keys, used for cursor-movement, have little arrows to show their effect.

There is no RESET button, which is annoying. The manual suggests that the best way to get out of an infinite loop is to 'pull the plug'. I don't agree. If I write a program with a bug like that in it, I want to be able to stop the program and look at the variables to find out what happened. RESET is just the ticket if BREAK won't work.

## Screen

The TX8000 will drive a normal TV tuned to channel 36-ish or a composite video colour monitor. A monochrome monitor can also be used, of course, but...

The display is a fairly small area in the centre of the screen surrounded by a dark green field, which has an unlit border. On a Sony Trinitron the image was steady and moderately clear.

The red and orange showed a marked slushiness at the edges, although the other colours were acceptably sharp. Colour differentiation was rather poor, too. Cyan and green were as near as dammit the same, and the white was greyish.

The screen has two modes, 0 and 1. Mode 0 is the text display consisting of 16 lines of 32 characters. Mode 1 is pixel graphics divided 128x64, and Textet is stretching the term a little to call it 'high resolution'.

Although the machine doesn't have lower-case, it has Sinclair-style block characters each made up of a 2x2 set of points.

## Storage

Mass storage is on cassette and Basic provides a rudimentary COS, with CSAVE, CLOAD, CRUN and VERIFY. There is no mention of file-handling or block-records, and so no real data-handling capacity.

The most frustrating part of getting to know a machine of this type is trying to find the correct setting for playback. I almost ran out of unrepeatable expletives.

## Expansion

At the back are the sockets for TV, composite video colour monitor, tape and power. There are also two metal plates

labelled 'memory expansion' and 'peripheral' which, pinned in by screws, hint that the company may have plans for the machine.

Power is supplied through a low-voltage co-axial plug, as in many lower-end machines, driven by a plug-in converter. This plug is not robust enough to withstand constant use.

The tape-socket is unusual; the cassette-recorder lead supplied has two normal 3.5mm jack-plugs at the recorder-end — the computer end is a 3.5mm stereo jack, so you won't be able to use any old length of cable with a plug at each end.

Textet says disk-drives of some kind, other accessories and a 64K memory expansion unit will be introduced as soon as possible. No dates. Details of interfaces

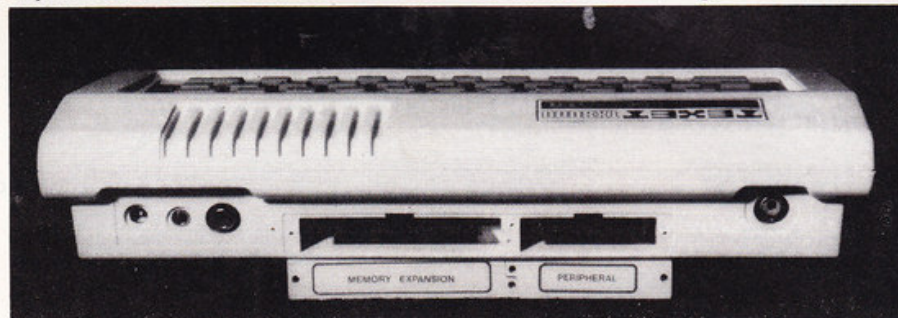
GOSUB may be resorted to. This is not allowed in many Basics, especially those descending from Applesoft or Pet Basic.

Editing is fairly sophisticated, being accomplished by the function keys on the right. The lower four move the cursor, with the → key acting as a COPY key; the others just move. INSERT and DELETE are different. They work anywhere, even on old text left on the screen.

There were no facilities for machine-level programmings, which makes the USR function hard to get at, but overall the implementation appears to offer a reasonable mix of facilities which should prove popular with its owners.

## Support

Textet has been making calculators for the



Left to right: power, tape, monitor, memory and peripheral plates, TV

will be available, and more information will be in the new manual. Add-ons from other companies will have to wait till then.

## Software

The Basic is of a fairly standard Microsoft type, with IF... THEN... ELSE, but no more sophisticated control-structures.

Accuracy is only to six digits — not really enough even for simple household accounting. The largest number would be 999.99 in pennies, the last digit being left out because it's always slightly wrong. Arrays seem to have only two dimensions.

This is not as bad as it first seems, since each dimension may be as large as memory will allow.

The graphics commands are a little weak. No PLOT... TO, LINE (x1, y1, x2, y2) or equivalent, but this could be remedied with a small machine-code library accessed by the USR command. I hope the makers or some enterprising programmer will provide this and other utilities.

There is no ON... GOTO/GOSUB command on the TX8000, which will annoy some users. Instead, the calculated

High Street outlets for some time, and clearly that's where the TX800 is aimed. No doubt many software houses will write for this micro. One hopes the quality will be better than the shoddy (but nice and cheap) stuff that people feed their long-suffering Spectrums, Beebs, Vic-20s and the like.

Textet promises a one-year guarantee, and repairs will be done at the Manchester headquarters. The company also says that the shops will be expected to exchange the machine if problems crop up early.

## Overview

It's a pity Textet chose to be so modest with its memory: 8K is tiddly these days and not much cheaper than 16K, which is itself pretty mean. Some more advanced mass-storage and improvements in arithmetic precision would make the TX8000 useful in modest applications, although it will always be limited by the 32-character screen and lack of lower-case.

But with the enhancements hinted at by those two metal plates on the back — say 48K or more — this could be a very nice beginner's machine at a reasonable price.

## SPECIFICATIONS

Price:	£98
Processor type/speed:	Z-80A running at 3.58MHz
Standard RAM/max RAM:	8K-64K with expansion
Text screen:	32 x 16
Graphic screen:	128 x 48
Keyboard:	45 calculator-type keys with auto-repeat
Storage:	Cassette
Interfaces:	Serial and parallel
OS/language(s):	Basic
Other languages:	None
Distributor:	Textet — sales will be through high street stores
Software supplied:	Demonstration tape



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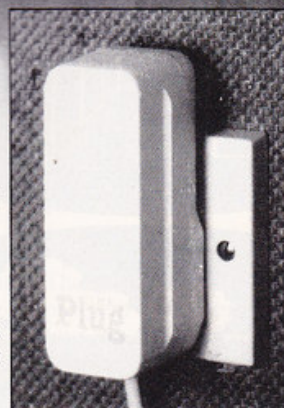
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## ZX Spectrum Software

### CENTIPEDE

**CENTIPEDE AND PAINTER.** By the time you read this our latest release for the Spectrum should be available... Centipede is a full colour machine code arcade game where the object is to defend yourself with your Laser against a fast moving centipede which weaves in and out of the mushroom patch. There are other versions of this game but we think you'll prefer ours because we always strive for an extra dimension of realism, which makes all the difference!

Painter, is another well-loved arcade game. Here you must paint in between the numbers on a multicoloured screen before you have to overlap. Price for SPECTRUM is £5.00.



### SPECMAN & FROGGER

**FROGGER AND SPECMAN**, two excellent games for the price of one! SPECMAN is probably the best version of its type with great machine code graphics and sound effects with 3 to 5 ghosts, power pills and a real munchie man who munches away in all directions, unlike cheaper versions! Frogger is a 2-screen representation of this arcade classic and has full colour Hi-Res Frogs, Cars, Roads, Logs, Turtles and Riverbank. Plus super sound effects. Both on one cassette for the Spectrum, price £5.00.

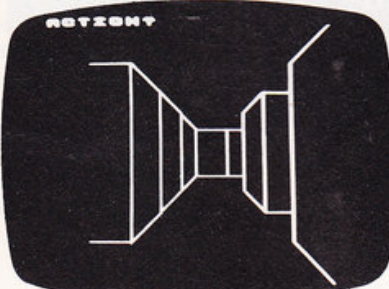
### HOW AND WHERE TO GET

#### PRODUCTS

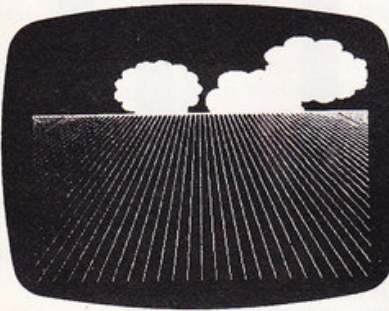
There are three ways to get the tape that you require. Firstly you can go to one of around fifty retailers in the UK and some more overseas; there is at least one in every town and several in major cities. Secondly you can ring our Telesales on 061-366 8223 and Alison or Shirley will take your order and tell you of any other games in which you might be interested. Lastly – the most popular way – is to write to us at the above address.



SPACE CITY, Jan 83



BEEBMAZE, Feb 83



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**December/January Issue:** Program Features: Space City (invader-type game), Breakout, Artist (Joystick painting program); Rescue (miraculously retrieves programs after bad loading or 'Bad Program' message); and Pack – a program to compact Basic programs. PLUS Disc System Review, Software reviews – including Wordwise, Book reviews, Adding Joystick interface to model A; How to access the video controller chip; and ideas for the newcomer; plus a new crop of Hints and Tips.

**February Issue:** Program Features: BEEBMAZE – Find your way through the random maze, guided by 3D views from inside the maze – an excellent game. FIVE-DICE – A Beeb implementation of YAHTZEE (R), a novel dice game. Also a listing of WINDY FIELD – a creation from Acornsoft. SPIROLOT screen doodler, and a complete memory display program in a user key. Plus Machine Code Screen Dumps for the Epson and Seikosha Printers; articles on USING FILES, IDEAS ON ANIMATION (including a Rotating Cube program) an Introduction to the Use of Procedures, a Survey of Books on the BBC Micro, and a Roundup of Disc System Hints. PLUS a variety of HINTS, TIPS AND INFO, including a single VDU command to perform a SIDEWAYS SCROLL. WIN A COLOUR MONITOR, WORDWISE WORD PROCESSORS AND ACORN SOFTWARE GRAPHICS BOOKS IN OUR THIRD SOFTWARE COMPETITION.

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# SPORTS

## ATARI

**NAME** Darts **APPLICATION** Darts game **SYSTEM** Atari 400 or 800, 1 joystick **PRICE** £19.95 approx. **PUBLISHER** Thorn EMI, 01-836 2444 **FORMAT** Cassette **LANGUAGE** Assembler **OUTLETS** Laskys, Micro C, major retailers

Mention computerised darts to anybody and they'll spend ages trying to work out how it can be done. Play Thorn-EMI's Darts cassette on your Atari 400 or 800 and you'll still be left wondering.

It's a well-presented program, and a nice party trick for the children, but it's a weak substitute for the real thing — which incidentally costs about the same.

### Objective

You control a shaky-handed darts player, in a game which follows the rules of darts exactly. Up to three can play, of whom one can be the Atari itself. And just like the real thing, you can choose 1001, 901, 501 or 301 up, with or without a double to start.

### First impressions

Darts comes in a bookshelf box with Thorn's customary instruction booklet and software catalogue. The presentation would be faultless, if only that beautiful box would shut properly.

### In play

Darts provides an impressive, if murky-coloured, three-dimensional display of an oak-beamed pub, a dart board and a player. Moving the joystick produces a blow-up of the

board at the bottom right of the screen.

To throw, you position a crude hand just under the point you want to hit and push the fire button. The player will lob a small green dart, and there is a realistic if unexciting thud as it hits the board.

The program is simple to use. The game begins after you've sat through an irrelevant and annoyingly recurrent tune. You can set your own skill level and that of the Atari's player between '0' and '9'. But you can't set skill levels individually for each of the players and so you can't handicap a good player.

The higher the skill level, the more the hand shakes and jitters as you aim. So if you want to beat the Atari put its skill level on 9 not 0.

### Verdict

The program works well. Its little instruction booklet might be a little superficial, but there's nothing that isn't made obvious after you've played a few games.

The problem is that the game isn't very interesting. Of course, it can't compare with the atmosphere of a real darts game, but it might have provided an interesting and original arcade game.

As it stands, Darts might have some novelty value. It certainly doesn't prove you can computerise any old game.

Max Phillips

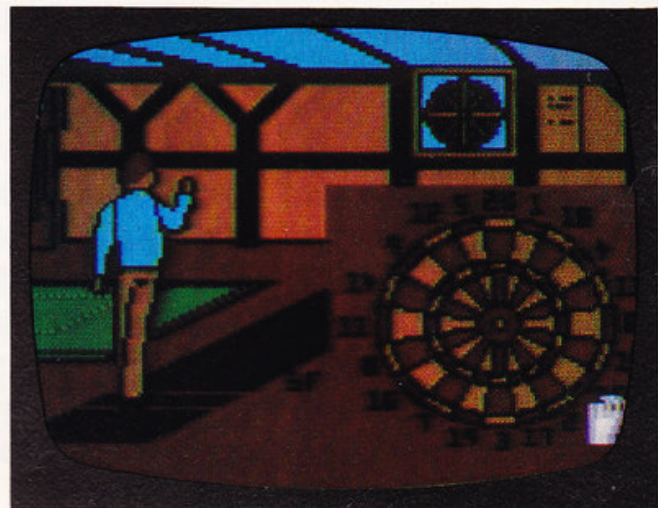
#### RATING

Lasting appeal: 🐹🐹🐹

Playability: 🐹🐹🐹🐹

Use of machine: 🐹🐹🐹🐹🐹

Overall value: 🐹🐹



## ATARI

**NAME** Soccer **APPLICATION** Football game **SYSTEM** Atari 400 or 800, 1-4 joysticks **PRICE** £29.95 approx. **PUBLISHER** Thorn EMI 01-836 2444 **FORMAT** Cartridge **LANGUAGE** Assembler **OUTLETS** Laskys, Micro C, major retailers

It looks as though Thorn-EMI wants to be big in microcomputing. The company is no longer just the faceless contractor that builds so many British micros, but now hopes to make a killing in software.

Its Soccer cartridge for the Atari 400 and 800 shows how serious it is.

### Objective

Soccer lets you vary the number of players controlling each team. You can have up to four joysticks, all on one side, two against two or whatever. Each side can also be computer controlled.

There's a time limit for the game, and you can set the Atari's skill from unbeatable to very unbeatable.

### First impressions

For most people, Soccer will be a surprisingly realistic game. But what is impressive is the feat of moving a game for the IntelliVision's fancy hardware onto a machine like Atari.

### In play

Soccer starts with a weak title screen that stays there for a set time. It precedes every game, but there is no way to skip it.

'Joystick O' lets you select all the possible game options, and anyone who thinks you need a mouse to make fast, accurate selections should try this.

Soccer displays a three-dimensional football pitch about three times the width of the screen. If the ball leaves the

screen, the pitch scrolls sideways as on *Match of the Day*.

There are 22 animated players, a rolling ball, pitch-markings and so on. Each game is accompanied by realistic kicks and whistles, though it might have been brightened up with a little cheering. During play, each joystick controls one player. Pressing the 'fire' button shifts control to the free player nearest the ball.

Picking up loose balls (it does sometimes stop dead on the pitch) and tackling is a simple matter of running over the ball. Passing and shooting are done by running in the right direction and pressing 'fire'.

Soccer is basically a schizophrenic one-man show. To pass, you run at the man you're aiming for, press 'fire', wait until the ball gets near him, and then press 'fire' to take control of him. It's even more complicated with two, three or four joysticks on the same side, as people keep 'becoming' each other and getting lost.

Practise with your friends before you take on the Atari, not the other way round. It never loses a tackle, always picks up the ball first time and switches between players instantly and accurately.

### Verdict

The real design success of the program is its support of up to four joysticks. Whether you're playing two against two or four against hopeless odds, Soccer is a very social arcade game. It's also going to sell a lot of joysticks.

Max Phillips

#### RATING

Lasting appeal: 🐹🐹🐹🐹🐹

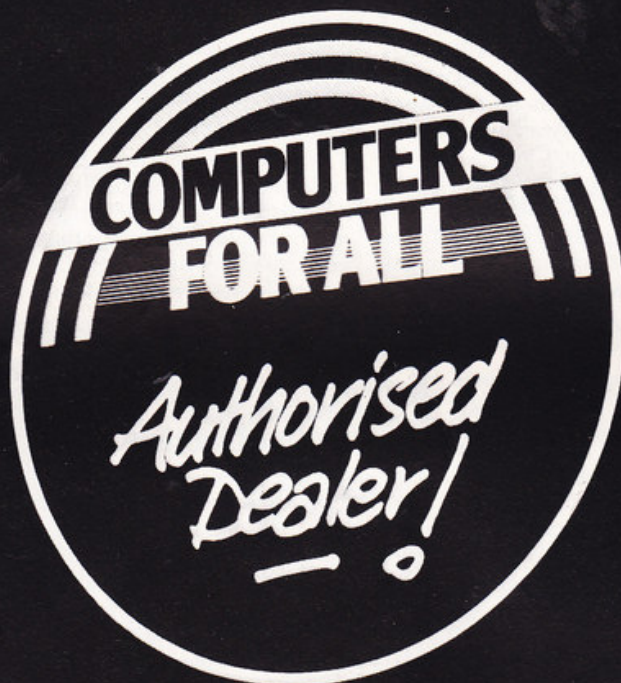
Playability: 🐹🐹🐹🐹

Use of machine: 🐹🐹🐹🐹🐹🐹

Overall value: 🐹🐹🐹🐹



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A SMASH HIT at the ZX Microfair (most of the other software houses wanted a copy, a game not to be missed!)



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# ADVENTURE

BBC

**NAME** Castle of Riddles  
**APPLICATION** Adventure game  
**SYSTEM** BBC Model B **PRICE** £9.95  
**PUBLISHER** Acornsoft,  
0223-316039 **FORMAT** Cassette  
**LANGUAGE** Basic **OUTLETS** Mail  
order and BBC dealers

'About a week ago,' begins the wizard, 'one of the local upstart warlocks — curse him! — sneaked into my castle and made himself at home. He booby-trapped the entire place, and worst of all, he found my Ring of Power. I MUST HAVE IT BACK!'

The wizard stares piercingly at you. 'Can you do it?' he asks. 'Can you get my ring back for me?'

This is the setting of Castle of Riddles, an adventure with the added lure of a £3,000 haul of Acorn hardware and software prizes for those who manage to crack its secrets by the end of this month. But you'll have to cudgel your brains pretty hard to earn your share of the prize.

## Objectives

You are a professional adventurer and swordsman, setting out to find the Magic Ring of Power. On your way, you may collect treasure, and you must avoid booby-traps.

You score points for picking up treasure and depositing it in a safe, but if you are killed, you will have to start all over again. This is no easy adventure. I spent the best part of a weekend battling with it, and never managed to get into the castle at all. But I cannot fault the packaging — the cassette comes

in a classy black cardboard wrapper with fold-out instructions, hints and the introductory story.

I found the instructions quite clear. It was playing the game that turned out to be the problem.

## In play

This is strictly a text adventure, with no graphics to lighten it. You use straightforward questions and answers to progress towards your goal; you may travel north, south, up, etc. You can call up a description of your immediate surroundings and an inventory of your possessions at any time.

But the real test comes in learning to use or avoid the objects you meet, and I found it took me some time to come to grips with the program's vocabulary to work out what I was or was not allowed to do.

If you get killed, the game goes straight back to the start, so you would be well advised to save moves on tape before you attempt anything dangerous.

## Verdict

In its early stages this game looks impossible. It is certainly not one to dabble in while cooking your dinner. If you are prepared to devote the time, it can provide days of entertainment, but if you prefer the *Mirror to The Times*, stick to Frogger.

Roger Tiplady

## RATINGS

Lasting appeal 🐾🐾🐾🐾

Playability 🐾🐾

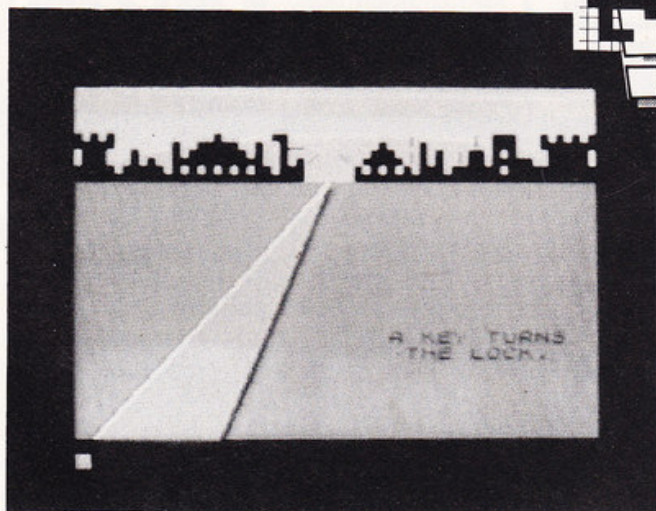
Use of machine 🐾🐾

Overall value 🐾🐾🐾

YOU ARE STANDING SOUTH OF THE WIZARD'S CASTLE WHICH STANDS ON A HILL ABOVE A VAST FOREST TO THE SOUTH. PATHS GO NORTHEAST AND NORTHWEST AROUND THE CASTLE WALLS, AND A DARK GATEWAY LEADS NORTH INTO THE CASTLE. THE CASTLE WALLS ARE UNCLIMBABLE, BUT THERE ARE LEDGES AND RAMPARTS VISIBLE FAR ABOVE

:NORTH  
AS YOU MOVE NORTH, A PORTCULLIS CRASHES DOWN BEHIND YOU, BLOCKING THE EXIT  
IT IS PITCH DARK

:HELP  
NOTHING HAPPENS



# SPECTRUM

**NAME** Pimania **APPLICATION**  
Adventure game **SYSTEM** ZX  
Spectrum, 48K **PRICE** £10  
**PUBLISHER** Automata,  
0705-735242 **FORMAT** Cassette  
**LANGUAGE** Basic **OTHER VERSIONS**  
BBC 32K, Dragon, ZX81 16K  
**OUTLETS** Mail order

appeal, in fact, lies in its lack of playing instructions — you just have to figure it out for yourself.

The game starts with the ubiquitous Pi-Man, laughing at you. That gives you a taste of things to come. From time to time, he will re-appear, demanding comfort, or taking the mickey out of you.

## In play

'It's up to you, Rog!' the screen informs you as it sets yet another riddle. And if your answer is wrong it tells you: 'I've got better things to do than to listen to this!' Find a TV dinner and try to eat it, and you may be abruptly told: 'It's off!'

From time to time, the program will play you a tune to fit the situation. Perhaps a Beatles song will accompany you to sleep.

And at any time, if in the Pi-Man's eyes you transgress, you may be forced to start all over again. You can take a breather, but you cannot save the game, and there is no points system, so you can never know whether you are working along the right lines or not.

## Verdict

Pimania is an original and amusing game, and worth the outlay, especially taking into account the possibility that you might be the one to find the Golden Sundial. I reckon it has a pretty long-lasting appeal.

You even get appalling Pimania disco music from Clair Sinclive and the Mystery Man on the flip side of the cassette. Have a go.

Roger Tiplady

## RATING

Lasting appeal 🐾🐾🐾🐾🐾

Playability 🐾🐾🐾

Use of machine 🐾🐾🐾🐾

Overall value 🐾🐾🐾🐾

Remember Kit Williams' *Masquerade*? The book started a treasure hunt witnessed with great fascination by the media last year, and it ended in the successful unearthing of a golden hare worth several thousand pounds.

Pimania follows in its footsteps with another *real* hidden treasure. This time the quest is for the Golden Sundial of Pi — worth £6,000. It is a treasure dripping with gold, diamonds and lapis lazuli, and it's yours if you can find where it is hidden.

## Objectives

Pimania, set in the dimensions of both time and space, subjects the player to the same kind of see-sawing between thrills and setbacks as *Masquerade*. In the hunt you have to solve bizarre riddles and overcome bewildering obstacles.

While you're doing this you are alternately helped, hindered or entertained by a cartoon character dubbed the Pi-Man.

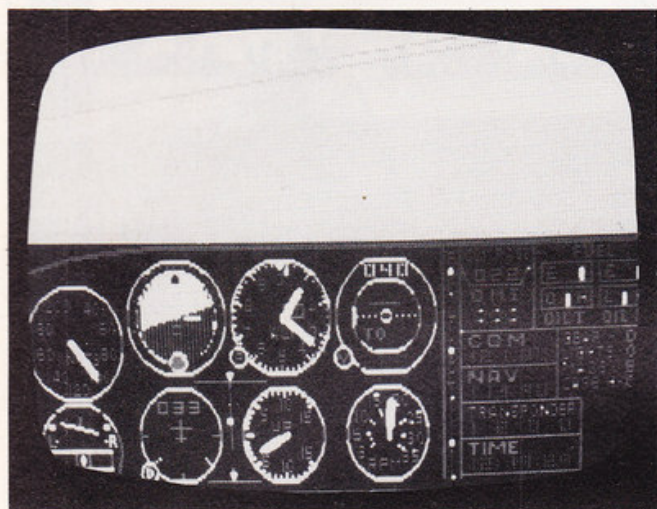
This is essentially an adventure game, in which you move on through questions and answers, using various objects along the way. Valium is just one of those available for the really baffled seeker.

## First impressions

The cassette comes with loading instructions, but the rest is up to you. Part of the game's



# FLIGHT SIMULATOR



IBM

**NAME** Flight Simulator  
**APPLICATION** Flight simulator  
**SYSTEM** IBM PC, 64K, colour graphics adaptor, 1 disk drive  
**PRICE** £35 **PUBLISHER** Microsoft, 04427-75091 **FORMAT** Disk  
**LANGUAGE** Machine code **OUTLETS** IBM and Microsoft dealers

There are flight simulators and there are flight simulators, but this one is the real McCoy. Far more than just a game, the Microsoft simulator is realistic enough to qualify as a serious training aid for prospective pilots, or those with a passion for flying and no cash to indulge it.

Even the simplest flight in this mock Cessna 182 plane is fraught with complexity, especially when landing, so if what you want is a cheap and cheerful flip around the block, this program is not for you.

## Objective

As a pilot, you can select and fly a vast number of routes about the North American continent. You have a choice of 22 detailed airport layouts to take off from or land at, in weather conditions ranging from daylight with no wind and not a cloud in the sky through to pitch darkness and solid clouds with a tornado raging.

And when you have had enough of serious flying, a bonus in this package is 'British Ace', a European World War I dogfight game. As the British ace pilot, you must shoot down at least five German fighters — with different capabilities — and bomb aerodromes and factories.

You battle it out in real time, so it is advisable to learn to handle your aircraft using the flight simulator program before tackling this game. This is one situation where learning on the job will not see you through.

## First impressions

My first attempts to take off, fly and land ended in disaster. Time after time, the messages 'Crash' or 'Splash' flashed on the screen to let me know that, once again, I had written off my aircraft and myself.

Even when I finally got the hang of it sufficiently to get off the ground and tackle a 25 knot surface wind and some cloud and turbulence, brown paper bags were called for as I steered my way through some amazing attitudes.

Then it was panic stations as I headed into cloud and the view ahead became completely opaque.

While I was recovering from this shock, my aircraft did a poor impression of a ship, till it was a relief to get back onto dry land again.

The program comes packaged simply and neatly in a green box with a glossy illustration of cockpit and runway. There is a 100-page instruction manual, which is easy to read and understand.

Illustrations and maps explain the aircraft controls and instruments clearly, but I would advise anyone using the simulator beyond simple flights to invest in a full set of navigational maps and flying manuals, to get the most out of the program.

## In play

The program starts by asking you to select your monitor type so it can format the best possible graphic display. You then select demonstration, flight or back-up mode.

If you choose to fly, the instrument panel appears, and your aircraft is placed on the runway of Meigs airport, just outside Chicago, pointing due north. If you prefer to take off from somewhere else, it's easy to move your aircraft to any position within your program's 'world' — and that includes the whole of North America.

Once you have picked your starting point for the flight, taxi-ing is easy and take-off straightforward — unless you set adverse environmental conditions.

In the air the plane responds realistically, given the limitations of a two-dimensional cockpit view. You can choose from nine viewing angles, which helps to compensate for this. But the elevator and trim controls are distinctly sluggish, and the sound is so bad that it's best turned off.

Navigation is not at all easy, and needs to be well thought out and planned before take-off. Once you are within range of your destination, the really difficult part begins, as it is no mean feat to gauge the distance of the runway.

Lots of practice is the only solution here. During this phase, information from the air

traffic controller — scrolled across the top of the display — is rather sparse. More would help, and would add to the realism, since a pilot would normally be in radio contact with the airport at this time.

## Verdict

This is a program for the dedicated, suitable for people who are prepared to spend many hours in the 'cockpit' learning how to fly. Its long-term appeal for them is undoubted, though less serious flyers could soon admit defeat.

The instrumentation is excellent, generally with a rapid response to the controls, and the layout is well designed. With so many variables available for the pilot to set, it can be tailored to fit just about any level of skill.

Unfortunately, with such a large area of the world to cover and display, the resolution of the screen gives a rather jerky and lumpy appearance. Colours, too, are not quite realistic, and although the graphics are excellent, I have to fault it on sound effects.

All in all, though, this is a remarkably well designed program, and a real bargain. But don't expect to be able to fly an aircraft once you have mastered it.

Nigel Cross

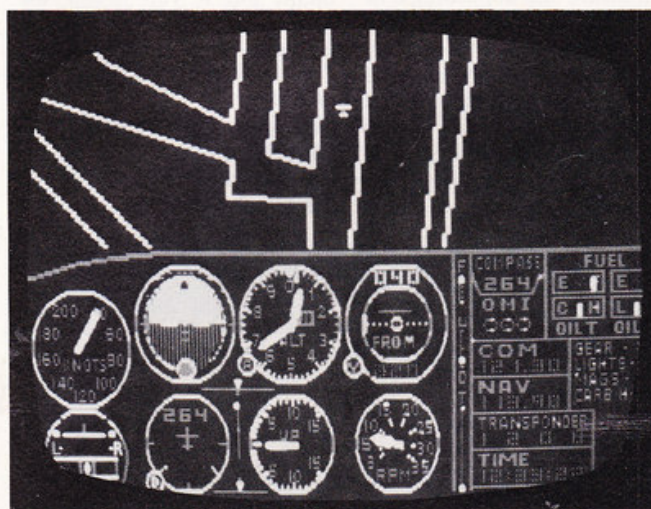
## RATING

Lasting appeal — ★★★★★

Playability — ★★★★★

Use of machine — ★★★★★

Overall value — ★★★★★



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48 colours. A number in this control panel tells you the amount of the 'picture memory' used up.

The cursor pinpoints where shapes will be drawn — it takes the form of a flashing cross with good use of contrasting colours so it can be seen on all backgrounds.

Points for lines, squares and circles are set by hitting the space bar. A grid can be overlaid on the picture being drawn to aid in drawing scale objects.

## Presentation

Documentation is currently a 27-page instruction book. Salamander says the final version will be similar, but spiral-bound.

It starts with a short introduction describing most features, including some mysterious things called 'guidelines'. These may be the short prompts for all the commands, but the term is never used again throughout the manual.

The LOADING instructions are short and simple. The next 12 pages provide enough information for most of us to start using the system, and after this come ten pages of more detailed information. This includes a memory map of the running system.

There is a quick reference summary of all the commands available on the last page. The manual is written in clear English, but the last paragraph in the introduction makes it clear who the manual is aimed at. Readers must be familiar with the various terms as defined by the turgid BBC user guide.

Having ploughed through the 500-odd pages of this guide the reader must be a computer literate. But the non-computer user attracted to the BBC machine's graphics will find the EDG manual fairly difficult.

## Getting started

As a tape-based system this package is simple to use. The instructions are clear, but the file name on the cassette didn't coincide with the name in the manual.

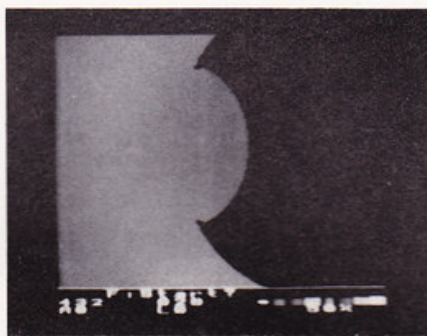
As with most interactive systems, an hour of using the system is a better teacher than an hour reading the book. The first few pages of the manual are enough to get you started if you know the BBC micro, and the hardest thing to learn empirically is cursor control. This is because cursor speed increases the longer the cursor key is pressed.

In fact, any key-press is counted, so a series of quick taps also constitutes holding the key down.

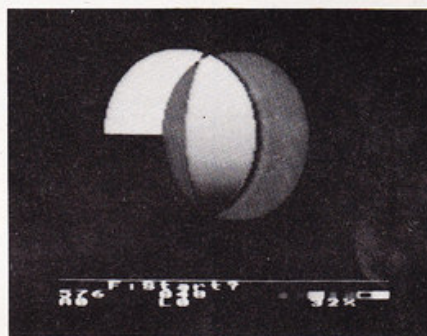
## User interface

There are three types of audio feedback to help you use the keyboard without having to look at it too much. The general shape commands are mnemonic: eg C—circle, L—line, A—arc, B—box, F—fill, G—grid, so it's easily remembered. However the control keys get a bit confused, especially X with CTRL-X and Z with CTRL-Z.

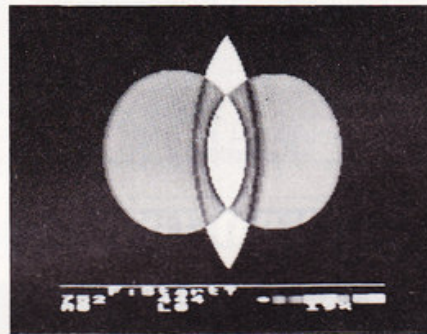
You can sometimes lose your picture, because things are done as soon as the



First stage of the EDG graphics build-up: squares, circles and lines in place.



Stage two: the shapes are filled in with contrasting colours.



The finishing touches, drawn from a palette of eight colours.

required key is pressed, but the image can usually be recovered.

## Performance

Generally the package is very fast, but circle drawing is quite slow, and the speed at which shapes can be filled varies a great deal.

A complex shape-fill naturally has to make more decisions, so is slower, and the picture item DELETE command must be used with care since it takes time to redraw a complex picture.

Although Salamander describes this package as sophisticated and suitable for applications in the home, business and education, it is not until page 23 of the manual that you are told clearly that it is a picture creation system, and not an editor.

The things it *cannot* do are important. It cannot remove any items except the last, it cannot move, rotate or enlarge any shape, and the graphics created *cannot* be attached to Basic programs easily. This last facility would have been very important in the education field.

## Reliability

This program is not crashproof. Some-

times the system stops completely, responding to nothing. Surprisingly this crashing seems to be caused by something quite natural, such as changing the colour after a function is requested (such as 'fill') but before you specify where it should be done. Nowhere does the documentation say that colour changes cannot be done at any time.

There are no error messages, but invalid input is answered with a low-pitch beep.

## Overview

This package is probably good for static pictures on the BBC screen using squares, circles, arcs, lines and text, but it is difficult to produce general curves. The package is good for geometrical shapes and patterns, but no good for fluent shapes. The use of the colour capabilities of the BBC micro-computer is very good.

The system is not an editor, as there is no way of changing or moving picture elements.

Despite this, the package is a good way to create simple pictures and diagrams quickly. As the first of its kind it will be used extensively, although for schools I believe Logo will be more popular. I will use it, but first I have to find out how to use the pictures created from Basic programs. Because of this weakness I have to give it a low rating for overall value.

Perhaps Salamander should supply a description of the memory format with the package.

Mel Pullen

## RATING

Features —   
Presentation —   
Performance —   
User interface —   
Reliability —   
Overall value —

**NAME** EDG Graphics **APPLICATION** Picture drawing graphics **SYSTEM** BBC Model B **PRICE** £24.95 **PUBLISHER** Salamander Software, 0273-771942 **FORMAT** Cassette, soon disk **LANGUAGE** Basic and machine code **OTHER VERSIONS** Dragon and Oric under development **OUTLETS** Mail order and BBC and Acorn dealers

## NEXT WEEK

A PCN Pro-Test of Microl's Spreadsheet package for home or business accounting and financial planning for the Spectrum C. We measure it against its more expensive rivals VisiCalc and SuperCalc.

BBC micro users (Models A and B) will hang on every word of David Janda's assessment of Wordplay, a WP (sorry, text formatting) package from Hexadecimal Press.

Mike Whitney reviews one of the versatile Chartman trio of graphics packages that can cater for a range of users—from lab technician to salesman and home budgeter.



## CLUBS

### AVON

**Worle** Computer Club. Meets at Woodsprings Inn Function Rooms on alternate Mondays at 7-10.30pm (annual subs: £12).

The club has 'skilled' and 'unskilled' sections, with a bias to software rather than engineering. Machines used are Sharp, Tandy, Vic-20 and BBC.

Contact S W Rabone, 18 Castle Road, Worle, Weston-super-Mare, Avon, tel: 0934 513068.

### BEDFORDSHIRE

**Bedford** Amateur Computer Club. Meets at Star Rowing Club, Bedford, on the first and third Tuesday of each month at 8pm (annual subs: £3).

Meetings alternate between talks and demonstrations.

Contact Rowan Bird, 74 High Street, Great Barford, Beds MK44 3LB, tel: 0234 870763.

**Chiltern** Computer Club. Meets at Five Bells, Eaton Bray, Near Dunstable, Leighton Buzzard on second and fourth Monday of each

Clubnet keeps you in touch with the microcosm of personal computer enthusiasts throughout the UK. Clubs are listed alphabetically by county and user groups alphabetically by speciality.

Entries include up-to-date information as far as possible, and group organisers should let us know of any changes, particularly a move to a new address.

Just started your own club? Drop us a line and we'll spread the word. Write to: Clubnet, Personal Computer News, 62 Oxford Street, London W1A 2HG.

month (annual subs: £2 senior members, £1 under-14s).

Informal exchange of programs and information.

Contact Steve Butts, 42 Wallace Road, Eaton Bray, Bedfordshire MK43 2DF, tel: 0525 220922.

**Luton College** Computer Club.

Contact John Rodger, tel: 0582 3411.

**Luton** Computer Club.

Contact J P Fletcher, 1 Trowbridge Gardens, Luton, Beds LU2 7JY, tel: 0582 450687.

### BERKSHIRE

**Easthampstead** Computer Club. Meets at Easthampstead Park School, Easthampstead Park Mansions, Bracknell, on the first Wednesday in month at 8pm.

Contact Brian Poulton, 0344 84423.

### ACORN

**Acorn Atom** User Group (annual subs: £4).

This group doesn't meet but produces a quarterly newsletter.

Contact Peter Frost at 18 Frankwell Drive, Coventry, tel: 0203 613156.

**Manchester** Acorn User Group. Meets at AMC, Crescent Road, Crupsall, Manchester 8 on every Tuesday except school holidays (annual fees: £1).

Weekly informal get-together for micro enthusiasts. Problem-solving and discussion.

Contact John Ashurst at 192 Vendure Close, Failsworth, Manchester, tel: 061-681 4962.

**National** Acorn Atom User Group.

Produces monthly program

## USER GROUPS

magazine.

Contact Alan Carr, 105 Fairhole Avenue, Gidea Park, Romford, Essex.

**Medway** Acorn User Group. Meets at St John Fisher School on the last Monday of the month at 7pm (fees: 50p a meeting).

This club also has a weekly pub session at 9pm Thursday at the Fox & Hound, Chatham. Under 16s must be accompanied.

Contact Clem Rutler, c/o St John's Fisher School, Ordance Street, Chatham, Kent, tel: 0634 42811 (day), 0634 373459 (eve).

### APPLE

**Bristol** Apple Users & Dabblers. Meets at 10 Waring House, Recliff Hill, Bristol BS1 6TB, once a month (library fee: £20 a year, meetings: 20p).

Informal group, produces a monthly newsletter.

Contact Ewa Dabkowski, c/o Datalink, 10 Waring House, Recliff Hill, Bristol BS1 6TB, tel: 0272 213427.

## PCN DATELINES

### UK EVENTS

Event	Dates	Venue	Organiser
Scottish Computer Show	March 15-17	Holiday Inn & Albany Hotel, Glasgow	Arthur Nolan, Clapp & Poliak Europe, 54 Chapel Street, Manchester M37 AA. 061-832 4242
Invitational Computer Conference & Exhibition	March 15	Hilton International Hotel, London	Text 100, 10 Barley Mow Passage, Chiswick, London W4 4PH 01-994 6477.
Compec Wales	March 22-24	University College, Cardiff	Tony Kynaston, IPC Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey 01-643 8040
Computer Open Day Exhibition	March 31	Holiday Inn Hotel, Plymouth	Tony Kaminiski, Couchmead Communications, Couchmead House, 153/155 High Street, London SW1P 4QF. 01-778 1102
HP 1000 Users Exhibition & Conference	April 26-28	Heathrow Penta Hotel, London	Heather Smith, Conference Services, 3-5 Bute Street, London SW7 3EY 01-584 4226
Computer Technology Exhibition	April 13-16	Newton Aycliffe Recreation Centre, Durham	Jan Huntley, Sedgefield District Council, Green Lane, Spenny Moor, County Durham. Spenny Moor 816166

### OVERSEAS EVENTS

Event	Dates	Venue	Organiser
International Computing Exhibition	March 28-31	Royal Dublin Society, Dublin	Sean Lemass, SDL Exhibitions, 68 Fitzwilliam Square, Dublin 2 Dublin 763871
International Computer, Communication & Robot Exhibition	April 14-20	Seoul, Korea	Korea Economic Daily, 441 Chunggrimdong, Chung-ku, Seoul 100
Compec Europe Exhibition	May 3-5	Centre Rogier, Brussels	Tracey Cannon, IPC Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey 01-643 8040





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Each program — on one, two or more cards — is presented with notes at the appropriate point alongside, so that you can understand and anticipate the action on-screen.

As well as complete programs, a subroutine with an example of its use will be printed each week from the PCN library.

## This week

The first program, from Gary Mills, of Maida Vale, London, demonstrates a method of entering shapes to the Apple II which is easier than having to code hexadecimally and type through the monitor.

The second is an elegantly structured Pascal program from Miklos Shawl of

Paddington Green, London, which results in printing the correct moves for the 'Towers of Bramah' problem.

Jim Hoggett of York sent us his Biorhythm program. Not all readers will be equipped with the appropriate plotter but most hobbyists will be able to modify it for other output.

On the last page of the ProgramCard section is the subroutine entry with example program. This feature will build up over the weeks into a comprehensive selection relieving newcomers to micros (and some experts) of having to re-invent the programming wheel.

If you have a comment on any program featured, please quote the reference number on the ProgramCard.

Our aim is to give ProgramCards the widest possible scope in machines catered for, languages and applications. If you'd like to submit a program, see the instruction below.

If you'd like to see your program run on PCN ProgramCards:—

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● Include brief operating notes if the program doesn't include obvious prompts or instructions.

The cards hold a maximum of 45 lines, so programs should be written to break up logically into card-blocks. You will be paid for your published program on a sliding scale from £5, plus a replacement cassette or disk.

In sending us your program you relinquish copyright in it.

PCN is building up a test panel for submitted programs. If you'd like to be a member please send details of experience and specialties to:—

Programs Editor, Personal Computer News, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

## PCN ProgramCards

### Shape Table Utility Card 1 of 3

8301STU1/3

A program to facilitate the entry of shapes into a predefined table resident on disk (set up with appropriate shape count, etc). An added feature is the option to display the entered shape before saving on disk.

```
10 HIMEM: 20480
20 D$ = CHR$ (4): M% = 70

25 TEXT : HOME
30 INPUT "PLEASE TYPE TABLE NAME "; B$
40 IF B$ = "" THEN PRINT "TABLE CREATION ENDED": END
50 ONERR GOTO 100
60 PRINT D$:"VERIFY "; B$;" , D2"
70 PRINT D$:"LOAD "; B$;" , A$5000, D2"
80 POKE 232,0: POKE 233,80
90 GOTO 120

100 PRINT "TABLE NOT FOUND - PLEASE RETRY": GOTO 30
110 PRINT "INVALID ENTRY": PRINT CHR$ (7): RESUME

120 ONERR GOTO 110
130 INPUT "ENTER SHAPE NUMBER "; X%
140 IF X% = 0 THEN GOTO 580
150 IF X% > M% THEN PRINT "INVALID ENTRY": GOTO 120
160 BS = ( PEEK (20480 + 2 * X%) + ( PEEK (20481 + 2 * X%) * 256
170 IF BS = 0 THEN GOTO 200
180 IF X% = M% THEN GOTO 210
190 IF (( PEEK (20482 + 2 * X%) + ( PEEK (20483 + 2 * X%) * 256) = 0 THEN
    GOTO 210
200 PRINT "SHAPE NOT IN SEQUENCE": GOTO 120

210 CT% = 0: BS = BS + 20480: ONERR GOTO 750
220 PRINT "ENTER VECTOR DETAILS": Y% = 1: GOTO 360

230 GET A1$
240 IF A1$ = "E" THEN PRINT "END": RETURN
250 IF A1$ = "M" THEN X = 0: AL$ = " MOVE": GOTO 280
260 IF A1$ = "P" THEN X = 4: AL$ = " PLOT": GOTO 280
270 PRINT "INVALID ENTRY": PRINT CHR$ (7): GOTO 230
```

Machine: Apple II.  
Requirements: 48K.  
Language: Applesoft Basic.  
Application: General interest.

Protect shape table memory. D\$ is DOS indicator. M% is max. number of shapes.

Accept table file name, blank entry ends program. Load file (if present). Set shape table. Bypass errors.

Not on disk.

Error.

Select shape to enter. Zero assumes display only. Check shape is in sequence.

Error.

Zero counter (CT%). Calculate base address. Prompt, Skip ahead.

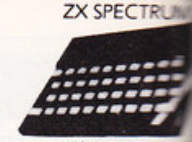
Entry routine for action.

Error.



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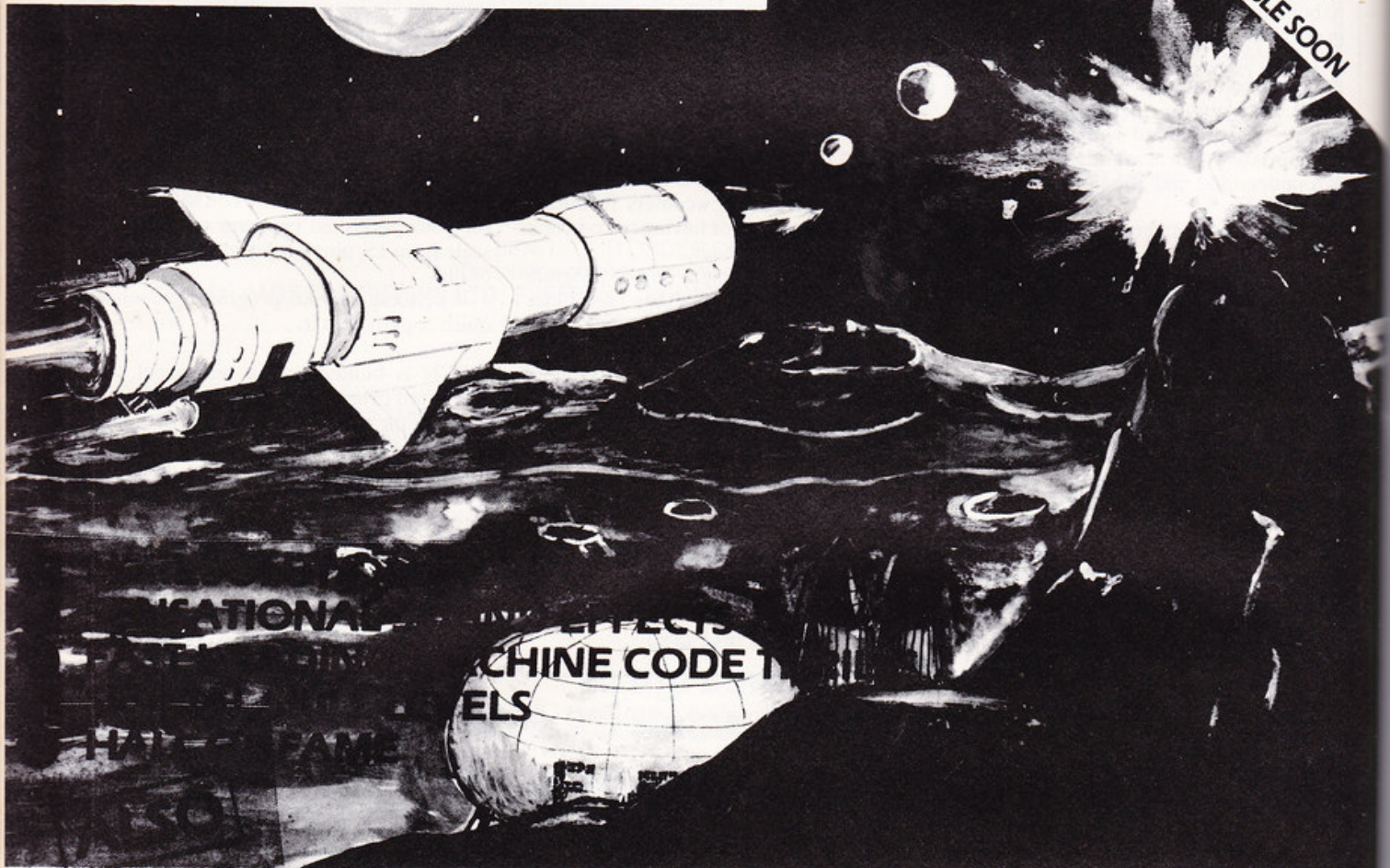
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## PCNProgramCards

### Shape Table Utility Card 2 of 3

8301STU2/3

```
280 GET A2$
290 IF A2$ = "U" THEN AR$ = " UP": GOTO 340
300 IF A2$ = "R" THEN AR$ = " RIGHT": X = X + 1: GOTO 340
310 IF A2$ = "D" THEN AR$ = " DOWN": X = X + 2: GOTO 340
320 IF A2$ = "L" THEN AR$ = " LEFT": X = X + 3: GOTO 340

330 GOTO 270

340 PRINT "VECTOR NUMBER = "; Y%; AL$; AR$
345 Y% = Y% + 1
350 RETURN

360 A% = 0: B% = 0: C% = 0
370 GOSUB 230
380 IF A1$ = "E" THEN GOTO 510

390 A% = X
400 GOSUB 230
410 IF A1$ = "E" THEN GOTO 520

420 B% = X
430 GOSUB 230
440 IF A1$ = "E" THEN GOTO 530

450 C% = X
455 IF C% > 3 THEN C% = 0: SW = 1
460 IF C% = 0 THEN IF B% = 0 THEN IF A% = 0 THEN PRINT CHR$(7); "LAST
    3 ENTRIES IGNORED - PLEASE RE-ENTER": Y% = Y% - 3: GOTO 360

480 IF C% = 0 THEN IF B% = 0 THEN POKE (BS + CT%), A%: A% = 0: B% = 0: CT% =
    CT% + 1: GOTO 760

490 IF C% = 0 THEN A% = A% + B% * 8: POKE (BS + CT%), A%: A% = 0: CT% = CT% +
    1: GOTO 780

500 A% = A% + B% * 8 + C% * 64: POKE (BS + CT%), A%: CT% = CT% + 1: GOTO 360

510 POKE (BS + CT%), 0: GOTO 540
520 POKE (BS + CT%), A%: CT% = CT% + 1: GOTO 510
530 A% = A% + B% * 8: GOTO 520
```

Entry routine for direction of shape

Error  
Display entry

First vector

Second vector

Third vector

Third vector can only be a move—checks and re-aligns where necessary or requires re-entry.

Store shape entry then continue.

Store correct entry on end of shape.

## PCNProgramCards

### Shape Table Utility Card 3 of 3

8301STU3/3

```
540 IF C% = M% THEN GOTO 120
545 BS = BS - 20480
550 CT% = CT% + 1: HH = INT ((BS + CT%) / 256): LH = (BS + CT%) - HH * 256
560 X% = X% + 1: POKE (20480 + 2 * X%), LH: POKE (20481 + 2 * X%), HH
570 X% = X% - 1: SW = 1: ONERR GOTO 110
575 GOTO 650
580 ONERR GOTO 110
590 INPUT "ENTER SHAPE NUMBER TO DISPLAY "; X%
595 ONERR GOTO 750
600 IF X% = 0 THEN GOTO 25
610 IF X% > M% THEN PRINT "INVALID ENTRY": GOTO 580
620 BS = (PEEK (20480 + 2 * X%)) + (PEEK (20481 + 2 * X%)) * 256
630 IF BS = 0 THEN PRINT "SHAPE NOT IN FILE": GOTO 580
635 BS = BS + 20480
640 IF PEEK (BS) = 0 THEN PRINT "SHAPE NOT IN FILE": GOTO 580
645 ONERR GOTO 110
650 INPUT "ENTER SCALE "; Y%: IF Y% = 0 THEN GOTO 30
655 HGR : HCOLOR = 3
660 ROT = 1: SCALE = Y%
670 XDRAW X% AT 139, 96
680 VTAB 24: INPUT "HIT RETURN TO CONTINUE PROGRAM": A$
690 IF SW = 0 THEN GOTO 580
700 TEXT : HOME : INPUT "DO YOU WANT TO SAVE THIS SHAPE? "; A$
710 IF A$ = "Y" THEN GOTO 730
720 GOTO 650
730 PRINT D$; "BSAVE "; B$; ", A$5000, L$4400, D2"
740 GOTO 30
750 PRINT "UNEXPECTED ERROR! "; PEEK (222); " LINE NUMBER "; (PEEK (218) +
    PEEK (219) * 256): END
760 IF SW = 1 THEN B% = X: SW = 0: GOTO 430
770 GOTO 430
780 IF SW = 1 THEN A% = X: SW = 0: GOTO 400
790 GOTO 400
```

Update shape table index. Skip to display shape

Entry point and verification for display only

Allows selection of scale to display, then program continuation. SW indicates shape entered (1), display only (0).

If shape entered allow to save on disk

Save function

Omigod! What a boob!

Third vector SW setting, see 480

Second vector SW setting, see 490.



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Towers of Bramah Card 1 of 2

An elegant structured program giving the solution to the 'Towers of Bramah' problem (also called 'Towers of Hanoi' or 'Trilogic game', as featured in *Doctor Who*) using recursion.

For use on any machine with ISO Standard Pascal. Others may require small but obvious changes.

**This is always a good idea to indicate to yourself and others the program requirements and descriptions.**

*Most* is defined to limit the number of discs in use. *Tower* is defined with three aspects: *left*, *middle*, *right*. *Small* is defined to be in the range 1 to *most*. *Number of discs* is of the form *small*.

Procedure *introduce* is at logic level 1 and prints the nature of the problem.

Procedure *Displaymove* accepts parameters *source* and *destination* of type *tower* at logic level 1.

Towers of Bramah Card 2 of 2

Procedure *Print* accepts parameter *name* of type *tower* at logic level 2 so that the program will print 'LEFT', 'MIDDLE' or 'RIGHT' according to the active tower.

Returns to logic level 1 of procedure *Displaymove*, performing the function of printing each disc movement, calling procedure *print* for the tower name.

Procedure *move* accepts parameters *discs* of type *small*, *first*, *second* and *third* of type *tower* at logic level 1, initially from main program, thereafter calling itself to redefine the order of the active towers until all moves are effected and printed by the call on procedure *Displaymove*, eventually returning to the main program.

The main program calls procedure *introduce*, prints question, accepts entry then calls procedure *move* until complete and ends.



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# PCNProgramCards

## Biorhythm Card 1 of 2

8301B1/2

A program to produce personal biorhythms on a plotter for an eight-week period using simple input. For those without a plotter the appropriate code can be changed for use on any output medium.

```

100 JR$ = "000031059090120151181212243273304334"
200 MA$ = "JANFEBMARAPRMAJUNJULAUAGSEPOCTNOVDEC"
300 DM$ = "312831303130313130313031":D$ = CHR$(4):GOTO 2200

500 PRINT A$: INPUT "":DT$
600 IF DT$ = "" THEN RETURN
700 D% = VAL ( MID$ (DT$,1,2))
800 M% = VAL ( MID$ (DT$,4,2))
900 Y% = VAL ( MID$ (DT$,7,2))
1000 IF M% < 1 OR M% > 12 THEN GOTO 2000
1100 LY% = Y% / 4
1200 DM% = VAL ( MID$ (DM$, (M% * 2 - 1),2))
1300 IF Y% = 0 THEN GOTO 1500
1400 IF Y% = LY% * 4 AND M% = 2 THEN DM% = 29
1500 IF D% < 1 OR D% > DM% THEN GOTO 2000
1600 DAYS% = ( VAL ( MID$ (JR$, (M% * 3 - 2),3))) + D% + Y% * 365 + LY%
1700 IF Y% = 0 THEN RETURN
1800 IF Y% = LY% * 4 AND M% < 3 THEN DAYS% = DAYS% - 1
1900 RETURN
2000 PRINT "NON-VALID DATE - PLEASE RETRY": GOTO 500
2200 PRINT "NAME:": INPUT "":NM$: IF NM$ = "" THEN END

2700 A$ = "DATE OF BIRTH":GOSUB 500
2800 IF DT$ = "" THEN GOTO 2200
2900 DB$ = DT$:BD% = DAYS%
3000 A$ = "FORECAST START DATE":GOSUB 500
3100 IF DT$ = "" THEN GOTO 2200
3150 IF BD% > DAYS% THEN PRINT "DATE TOO EARLY - RE-ENTER": GOTO 3000
3200 FD$ = DT$:DL% = DAYS% - BD%
3300 PRINT D$:"PR#5":PRINT "M100,400":D$:PRINT "X1,50,56":D$
3600 PRINT "D2900,950,100,950,100,1500":D$:PRINT "X1,50,56":D$
3800 PRINT "D2900,950,100,950,100,400":D$
3900 D% = VAL ( MID$ (FD$,1,2))
4000 M% = VAL ( MID$ (FD$,4,2))
4100 Y% = VAL ( MID$ (FD$,7,2))

```

Machine: Apple II.  
Requirements: 32K & Watanabe Digiplot, in slot 5.  
Language: Applesoft Basic.  
Application: General interest

Calendar definitions in Julian, short Alpha and days per month. D\$ is DOS indicator. Skips past date routine.

Date routine prints prompt and accepts date in DD/MM/YY format.  
1/01/1900  
≤date≤31/12/1999.  
Returns DAYS% as the number of days from 31/12/1899.

Name prompt and input. If blank then program ends.

Sets date of birth prompt and calls date routine and stores values.

Sets forecast date prompt and calls date routine—this entry must be later than date of birth. Stores date and number of days lived.

Draws full axes on plotter.

Extract day, month, year values from forecast date.

# PCNProgramCards

## Biorhythm Card 2 of 2

8301B2/2

```

4200 PRINT "S2":D$:PRINT "M100,300":D$:IX% = 0
4300 A$ = MID$ (MA$, (M% * 3 - 2),3) + "."
4400 PRINT "P":A$:Y%:D$
4500 DM% = VAL ( MID$ (DM$, (M% * 2 - 1),2))
4600 LY% = Y% / 4
4700 IF Y% = 0 THEN GOTO 4900
4800 IF Y% = LY% * 4 AND M% = 2 THEN DM% = 29
4900 A$ = STR$(D%)
5000 IF D% < 10 THEN A$ = " " + A$
5100 X% = 78 + IX% * 50
5200 PRINT "M":X%:",350":D$:PRINT "P":A$:D$
5300 IX% = IX% + 1: IF IX% = 57 THEN GOTO 6000
5400 D% = D% + 1: IF D% < DM% + 1 THEN GOTO 4900
5500 D% = 1:M% = M% + 1: IF M% > 12 THEN M% = 1:Y% = Y% + 1
5600 IF IX% < 3 THEN PRINT "M120,300":D$:GOTO 4300
5700 IF IX% > 52 THEN PRINT "M2750,300":D$:GOTO 4300
5800 X% = 100 + IX% * 50:PRINT "M":X%:",300":D$:GOTO 4300
6000 PRINT "M100,1700":D$
6100 PRINT "PBiorhythmic Forecast for ":NM$:D$
6200 PRINT "M100,1600":D$
6250 M% = VAL ( MID$ (DB$,4,2)):A$ = MID$ (MA$, (M% * 3 - 2),3) + " 19"
6300 PRINT "P" DATE OF BIRTH ": VAL ( MID$ (DB$,1,2)): " ":A$: VAL ( MID$ (DB$,7,2)):D$
6330 PRINT "M1500,1700":D$:PRINT "PPHYSICAL CYCLE ":D$
6360 PRINT "M1500,1650":D$:PRINT "PEMOTIONAL CYCLE ":D$
6400 PRINT "M1500,1600":D$:PRINT "PMENTAL CYCLE ":D$:GOSUB 7200
6550 PRINT "M1850,1700":D$:PRINT "D2400,1700":D$
6600 CD% = 23:GOSUB 7600:GOSUB 7200
6750 PRINT "M1850,1650":D$:PRINT "D2400,1650":D$
6800 CD% = 28:GOSUB 7600:GOSUB 7200
6950 PRINT "M1850,1600":D$:PRINT "D2400,1600":D$
7000 CD% = 33:GOSUB 7600
7100 PRINT "M1500,2400":D$:PRINT D$:"PR#0":TEXT:HOME:GOTO 2200
7200 PRINT "M1500,2400":D$:PRINT D$:"PR#0":TEXT:HOME
7400 FOR A = 1 TO 10:PRINT CHR$(7):NEXT A
7500 INPUT "CHANGE PEN THEN PRESS RETURN ":A$:PRINT D$:"PR#5":RETURN
7600 SP% = DL% - (INT (DL% / CD%) * CD%):X = 0
7700 Y = SIN ((SP% + X) * 6.28318 / CD%)
7800 PY% = 950 + Y * 500:PX% = 100 + X * 50
7900 IF X = 0 THEN PRINT "M":PX%:",":PY%:D$
8000 PRINT "D":PX%:",":PY%:D$:X = X + 0.2: IF X > 56.2 THEN RETURN
8200 GOTO 7700

```

Eight-week calendar is plotted across the bottom of the chart, allowing for year-end over-run and leap years.

Title and name printed.

Date of birth title and value printed as DD MMM 19YY.

Prints cycle headings and allows change of pen.

Selects cycle and plots line against heading then appropriate cycle (CD% = 23 - physical, 28 - emotional, 33 - mental) and returns to allow another input.

Pen change routine. Aligns off paper.

Cycle plotting routine using a sine wave from 0 to 2π radians.



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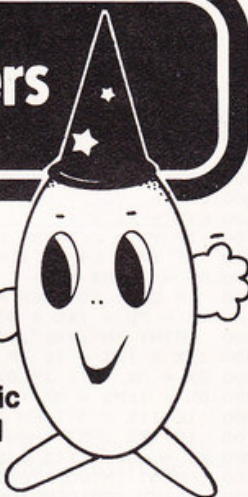
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## PCNProgramCards

### Subroutine Roman Card 1 of 1

8301SubR

A subroutine to perform conversion of standard Arabic numerals to Roman representation in either upper or lower case. Useful for documentation purposes.

CONVERT Arabic TO Roman NUMERALS

REQUIRES

R\$ Number to convert  
R1\$ Roman numerals

LOCALS

J do-while number left  
K do while digits left  
R0 Index to R1\$  
R0\$ Work-string

FLAGS

R1 lower-case  
R2 long 4  
R3 long 9

OUTPUT - R\$ Roman number

```
4599 DEF FN DI(X) = X - (INT (X / 10) * 10)

4600 R = VAL (R$):R$ = "":R0$ = "": IF NOT R OR R = > (4000 + (1000 * NOT
NOT R2)) THEN R$ = "Invalid": RETURN

4601 R1$ = "IVXLCDMivxlcDM":R0 = 2 + (7 * R1): FOR J = 0 TO 1

4602 IF NOT R3 THEN IF FN DI(R) = 9 THEN R0$ = MID$ (R1$,R0 - 1,1) +
MID$ (R1$,R0 + 1,1):R = R - 9
4603 IF NOT R2 THEN IF FN DI(R) = 4 THEN R0$ = MID$ (R1$,R0 - 1,1) +
MID$ (R1$,R0,1):R = R - 4
4604 IF FN DI(R) = > 5 THEN R0$ = MID$ (R1$,R0,1):R = R - 5
4605 FOR K = 0 TO 1: IF FN DI(R) THEN R0$ = R0$ + MID$ (R1$,R0 - 1,1):R
= R - 1:K = 0
4606 NEXT :R$ = R0$ + R$:R0$ = "": IF R THEN R = R / 10:R0 = R0 + 2:J = 0

4607 NEXT : RETURN
```

Although written in Microsoft Basic this should work with only minor changes on all machines. It can be defined as a procedure in BBC Basic.

R\$ is input number from program. R1\$ defined at 4601.

Note that R is also used as a local variable.

Flag settings are 0 — off: 1 — on. R1 — lower case selection. R2 — long 4 (IIII not IV). R3 — long 9 (VIIII not IX). R\$ returned to program.

Extract low order digit. Can be moved elsewhere in program.

Set local values and check that number is valid (4000 or 5000).

Define Roman string, upper/lower selection.

Main loop converting lower order digit according to flag settings.

Perform loop until string converted then return to main program.

## PCNProgramCards

### Roman Year Lister Card 1 of 1

8301RYL

A short program to demonstrate the use of subroutine ROMAN. Gives a list of years in Arabic and Roman with all facilities available. With appropriate changes should work on most machines.

```
10 REM "A Program To Demonstrate The Use Of Subroutine : ROMAN"

100 INPUT "Start Year Number = ";A%
110 IF A% < 1 THEN PRINT "Zero Entry Not Allowed": GOTO 100
200 INPUT "Final Year Number = ";B%
210 IF B% < A% THEN PRINT "Entry Must Be Greater Than Start": GOTO 200
300 INPUT "Lower Case (Y or N)? ";A$: GOSUB 600
310 IF SO = 9 THEN GOTO 300
315 R1 = SO
320 INPUT "Long 4 (Y or N)? ";A$: GOSUB 600
330 IF SO = 9 THEN GOTO 320
335 R2 = SO
340 INPUT "Long 9 (Y or N)? ";A$: GOSUB 600
350 IF SO = 9 THEN GOTO 340
355 R3 = SO
400 SW = 0
410 FOR N = A% TO B%
420 R$ = STR$ (N): GOSUB 4599
430 IF R$ = "Invalid" THEN PRINT "Out Of Range - Conversion Ended": GOTO 500
440 IF SW = 0 THEN HOME : PRINT "ARABIC ROMAN":SW = 1
450 PRINT " ";N;" ";R$
460 NEXT N
500 INPUT "Another List? (Y or N) ";A$
510 IF A$ = "Y" THEN GOTO 100
520 END
600 SO = 9
610 IF A$ = "Y" THEN SO = 1
620 IF A$ = "N" THEN SO = 0
630 IF SO = 9 THEN PRINT "Incorrect Entry - Please Retry"
640 RETURN
```

ISAVE

Machine: Apple II.  
Language: Applesoft Basic.  
Application: General interest.

Entries are obvious

Calls answer checking routine. SO = 9 is error

Calls answer checking routine. SO = 9 is error

Calls answer checking routine. SO = 9 is error

Year list loop. SW = 0 to print headings on first time only. Calls ROMAN. If year goes out of range then terminates gracefully.

Allows another list or exit.

Checks answer to prompts and returns flag setting-SO or error value-SO = 9.



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## **WIZARD-80 80-Column Card**

Lets you see exactly what you will get when typing/editing 80-column format. Displays upper/lower case. Compatible with CP/M, word processors, modems, software and all current Apple II expansion boards.

## **WIZARD-16K 16K RAM Memory Card**

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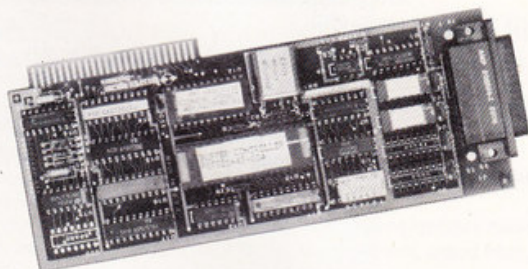
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# DATABASICS

This eight-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions. PCN keeps you up to date in two-week cycles, alternating between hardware and software.

**PRICE** Specifications listed for each machine indicate what you get for the basic price quoted, which includes VAT.

**PROCESSOR TYPE** A microprocessor is the heart of the computer. The Z80 and 6502 are popular 8-bit chips. The 8088 and 68000 are common 16-bit chips. If a machine has an 8-bit and a 16-bit processor we have listed the 16-bit only.

**SPEED IN MHz** Speed of the clock used to drive the microprocessor, measured in MegaHertz (thousand cycles per second).

**STANDARD RAM** Amount of main memory used on the system. The capacity is expressed in kilobytes.

**MAX RAM normally at extra cost** Amount of memory the system can be expanded to.

**MAX CHARACTERS lines x columns** The number of characters that can be displayed across the screen and the number of lines down.

**METHOD (at extra cost)** This indicates the way the computer displays information. M on its own means that a monitor is included in the basic price. Tv indicates that you can plug the computer into a television set (M+T) indicates that the monitor costs extra. LCD = Liquid crystal display.

**COLOUR CAPABILITY** tells you whether the machine can give colour at the basic price quoted.

**MAX DOT RESOLUTION** gives the maximum number of points across the screen by the number of points down the screen that are available for graphics.

**KEYBOARD** This tells you the type of keyboard that comes with the machine. W = word processing, C = calculator and T = touch-sensitive.

**No OF FUNCTION KEYS** refers to the number of keys that can be used for different jobs by different programs.

**NUMERIC PAD** indicates whether the machine has a separate calculator-style group of number keys to enter data quickly.

**INTERFACES BUILT-IN** shows the number of standard connections built into the machine.

**CASSETTE FACILITY** gives a yes or no as to whether or not the machine can use a cassette to store data.

**CAPACITY PER DISK AND DISK SIZE** tells you how many disk drives come with the machine, and the amount of data in kilobytes (K) or megabytes (Mb) they can be stored on each drive. There are two sizes for discs, 5 1/4" or 8", and they can be floppy (F) or hard (H).

**OPERATING SYSTEM** gives the program that looks after the general running of a computer.

**LANGUAGES INC** is a column which lists the programming languages that come with the machine at the basic price.

**OTHER LANGUAGES AVAILABLE** indicates whether or not other programming languages are available for the machine.

**DISTRIBUTOR** To find which company distributes the machine refer to the distributor table from the code listed in this column. The table gives the distributor's name and telephone number.

All details given are the latest available. We ask distributors to let us know as soon as machine specifications change so Databasics can be kept right up to date. This guide has been meticulously researched and the information collected from individual distributors listed.

## PRICE GUIDE

Sinclair ZX81	£50	Commodore 4016	£632	Transam Triscan	£1,983	LSIM4	£2,472	DEPC325	£3,080	Convex Concept	£4,887
Tandy TRS-80 Pocket	£57	Research Machine 480Z	£650	IDS Datamachine	£1,995	Canon CX-1	£2,500	Direct 1000	£3,093	ICL PC Model 31	£4,939
Sharp PC1251	£80	Dai PC	£684	Tandy TRS-80 Model	£1,999	North Star Advantage	£2,524	Equator	£3,099	Cromemco System 3	£5,170
Jupiter Ace	£90	Apple II	£776	Kenilworth 83N	£2,012	Adler Alphatronic P2U	£2,524	Clenlo Table-Top 925	£3,105	Micro Five 1000	£5,175
Casio FX 702P	£90	Commodore 500	£799	Caltech Micro	£2,064	IO Tech Iona	£2,539	ITT 3030	£3,105	Fortune 32:16 System 2	£5,204
Oric	£100	HP 75C	£883	LSIM3	£2,064	Quantum 2000	£2,587	Monroe OC8810	£3,162	Zeus 4	£5,405
Sinclair Spectrum	£125	Sharp M280B	£900	Haywood 9000 Composite	£2,064	Seed System 19	£2,600	HP Series 200 Model 16A	£3,211	Hawk Model 2110	£5,462
TI TI-99/4A	£150	Commodore 8032	£1,129	Hawk Model 110	£2,070	Enterprise 1000	£2,645	Samurai	£3,214	Molecular M200	£5,744
Atari 400	£160	Commodore 710	£1,144	Positron 9000	£2,134	Britannia Baby	£2,657	Torch	£3,214	Altos 800/15	£5,744
Commodore Vic 20	£170	Fujitsu FM8	£1,150	Research Machines 380Z	£2,147	Adler Alphatronic P3	£2,696	Sord M223	£3,277	Durango F85	£5,744
Sharp PC1500	£170	Sanyo MBC 1000	£1,195	Future Computers FX-20	£2,156	Eagle II	£2,702	Kontron RS180	£3,306	Mann Chip M9900	£5,750
Acorn Atom	£174	Commodore 8096	£1,374	Comart Communicator	£2,180	Almarc 801	£2,708	Columbia PC 1600-1	£3,392	SW Tech Products S019	£5,805
Tandy TRS-80 Pocket 2	£179	Pascal 640	£1,437	Superbrain JR	£2,185	DEC Rainbow 100	£2,714	Digico Prince	£3,392	BASF 7100	£5,842
Tandy TRS-80 Model 1	£199	Microdecision	£1,444	Adler Alphatronic P2	£2,197	HP 87XM	£2,571	Barcellos AMT 100	£3,450	Sord M243	£5,842
Dragon 32	£200	Positron 900	£1,259	Rair Black Box 3/20S	£2,242	Facit 6520	£2,645	Kalamazoo 1050	£3,450	Archives IV	£5,905
Sord M5	£218	NEC PC8000	£1,454	Genie III	£2,242	Olympia Boss Model A	£2,645	Cromemco System 2	£3,560	ICL PC Model 32	£6,037
Colour Genie	£224	Irvine Business Systems	£1,489	Sanyo MBC 2000	£2,242	ICL PC Model 10	£2,754	Digital Microsystems 3	£3,576	Rair Business Computer	£6,037
Camputers Lynx	£225	Televideo K2000E	£1,495	Kenilworth K2000	£2,242	Millbank SX10	£2,754	Decision-1 Computer 012	£3,674	Superstar	£6,296
New Brain A	£228	HP 86A	£1,541	Toshiba T-200	£2,242	Olivetti M200	£2,754	Televideo TS1602-C	£3,714	Digital Microsystems 4	£6,210
Tandy TRS-80 Colour	£240	Osborne I	£1,581	TMK 332	£2,242	Victor 9000	£2,754	Adds Multivision	£3,795	Racal 6000	£6,327
BBC Micro Model A	£249	Signet 10025	£1,599	Bonsai SM 3000	£2,294	Apple III	£2,780	Panasonic JD800M	£3,795	Eagle 1600	£6,497
Genie II	£299	APL Signet	£1,610	CAL PC	£2,294	Sanyo MBC 4050	£2,817	Kenilworth K3000	£3,795	Compucomp 675	£6,989
Multitech MPS II	£299	Zenith 289-81	£1,668	North Star Horizon	£2,294	Bonsai SM 4000	£2,817	DEC PC 350	£3,850	Sundance I	£7,003
Nascom 2	£327	Basis 108	£1,683	Sanyo MBC 1250	£2,294	Logica VTS Vitesse	£2,863	Vector 4	£3,852	Diablo 3000	£7,250
Genie I	£330	Tandy TRS-80 Model III	£1,699	Casu Mini C2	£2,300	Decision-1 Computer 011	£2,869	Sage II	£4,019	Pascal Mod. Microengine	£7,003
Commodore 64	£345	Commodore Spr. Pet 9000	£1,719	Sharp PC3201	£2,300	Eagle III	£2,869	C-1010	£4,190	Onyx 5001 MU	£7,607
BBC Micro Model B	£399	Gemini Galaxy 2	£1,720	HP 85	£2,360	Zenith 289-81	£2,978	Tandy TRS-80 Model 16	£4,199	Haywood Hinet	£8,205
Atari 800	£400	British Micro Mimi 803	£1,720	Sord M23P	£2,369	Monroe OC8800	£2,990	Hytech H4500	£4,310	Altos 856-10	£9,631
Datasc Micro Controller	£431	Microsolution Brit. Genius	£1,840	HP Micro 100, 120	£2,369	Philips P3500	£3,000	BMC OK11800, Model 20	£4,360	Micro Five 3000	£10,480
Cortex	£454	Toshiba T-100	£1,900	IBM PC	£2,392	Tandberg EC10	£3,003	ADS 42	£4,500	Sundance 16	£11,442
Epson HX20	£472	Sord M23	£1,932	Xerox 820 Model II	£2,415	Archives 1	£3,003	Televideo TS-80ZH	£4,533		
Nascom 3	£549	Transworth BC2	£1,949	Kenilworth 83G	£1,953	Cromemco System 1	£3,025				
Sharp M280A	£549										

## ABBREVIATIONS

Ap: APL	£4,887
As: Assembly	£4,939
Ba: Basic	£5,170
Co: Cobol	£5,204
Cm: Comal	£5,405
Fr: Fortran	£5,462
Pa: Pascal	£5,663



# HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display		Graphics	Keyboard		Interfaces built-in				Storage		Operating system	Languages inc	Distributor	Comments
						Max characters lines x columns	Method (at extra cost)		Type of keyboard	No. of function keys	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility				
Acorn Atom	£174	6502	1	2K	40K	32 x 16	Tv(M+)	●	256 x 192	W					1	●	Cassette	BaAs	A1	A real hacker's machine
Adds Multivision	£3,795	8085A	5	64K	256K	80 x 25	M		640 x 240	W 28	1			1			CP/M2.2, Muon	Ba	A3	Designed for business
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80 x 24	M			W 6	2			1	3		CP/M	Ba	T1	Good software choice
Adler Alphatronic P2U	£2,524	8085A	3	64K		80 x 24	M			W 6	2			1	3		CP/M	Ba	T1	£327 buys extra storage
Adler Alphatronic P3	£2,696	8085A	3	64K		80 x 24	M			W 6	2			1	3		CP/M	Ba	T1	Adler with biggest disks
ADS 42	£4,500	8085A	4	32K		40 x 8	M		40 x 8	W	3			3		●	Holland Automation	Ba	A2	Intelligent cash register
Almarc 801	£2,708	Z80	4	64K	512K	80 x 25	(M+)	●		W	2			11			CP/M		A4	8-bit range goes to 20Mb
Almarc 1601	£3,445	8086	8	128K	1Mb	80 x 25	(M+)	●		W	2			11			CP/M86		A4	Pseudo 16-bits go to 20Mb
Altos 800/15	£5,663	Z80	4	192K	208K	80 x 24	M			W 8		1					MP/M		L1	Costly, standard CP/M machine
Altos 856-10	£9,631	8086	10	512K	1Mb	80 x 24	M			W 16	6						Xenix	Xenix	L1	The 16-bit Altos
APL Signet	£1,610	Z80A	4	64K		80 x 25	Tv(M+)	●		●	2						APL, CP/M	APL	M1	*APL terminal recommended
Apple II	£776	6502	1	48K	128K	40 x 24	Tv(M+)	●	256 x 192	W				8		●	SOS, DOS	Ba	A5	Plenty of software, extras
Apple III	£2,780	6502	2	128K	256K	80 x 24	(M+)	●	560 x 192	W	1			4			CP/M		A5	Will emulate Apple II
Archives I	£3,003	Z80	4	64K		80 x 25	M	●	240 x 100	W 23	2	1		1	5		CP/M		S1	Standard CP/M + graphics
Archives IV	£5,905	Z80	4	512K		80 x 25	M	●	240 x 100	W 23	1			1	3		CP/M, MP/M		S1	Disk variation
Atari 400	£160	6502B	1.79	16K		40 x 24	Tv	●	320 x 160	T				7		●	Cassette		A6	Games computer
Atari 800	£400	6502	1.8	16K	48K	40 x 24	Tv(M+)	●	320 x 192	W				7	4	●	Cassette	Ba	A6	Versatile, good graphics
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80 x 24	TvM			W 8	1	1		2	3		CP/M	BaCo	B1	Up to four users
BASIF 7100	£5,805	Z80A	4	64K		80 x 24	M			W 26	1						BOS	Ba	C2	Hard disk promised
Basis 108	£1,683	6502	1	64K	126K	80 x 24	TvM	●	820 x 168	W 15	1			6		●			C1	Apple bus, Z80, 80 columns
BBC Micro Model A	£299	6502	1.8	16K	32K	40 x 30	Tv(M+)	●	320 x 256	W 10				1			MOS	BaAs	A1	Upgradable to Model B
BBC Micro Model B	£399	6502	2	32K		80 x 30	Tv(M+)	●	640 x 256	W 10				5	3		MOS	BaAs	A1	No-compromise machine
BMC OKI II 800, Model 20	£4,360	Z80B	5	64K	256K	80 x 25	M	●	640 x 200	W 15	1					●	CP/M	Ba	E1	Built-in printer
Bonsai SM 3000	£2,294	Z80	2	64K		80 x 24	M		80 x 24	W 14	1						CP/M		B2	CP/M business machine
Bonsai SM 4000	£2,842	8088	5	128K	256K	80 x 24	M			W 14	1						CP/M, MP/M, MS-DOS		B2	Pseudo 16-bit version
Britannia Baby	£2,657	8085	6.14	64K		80 x 25	Tv(M+)		80 x 25	W 11	2	1					CP/M	AsBaCo	B3	Cobol language included
British Micro Mimi 803	£1,720	Z80A	4	64K		80 x 25	(M+)		512 x 256	W 17	1	1		1			OS/M		B4	This is CP/M compatible
C-1010	£4,197	6502	1	64K	128K	80 x 24	TvM		256 x 192	W 12	1	1		1	8		CP/M, DOS, UCS DP	Ba	C4	Utility disk available
CAL PC	£2,294	8088	5	128K	256K	80 x 25	TvM	●	256 x 512	W 36	2	1		1	5		CP/M	Ba	C5	Also Z80B processor
Caltext Micro	£2,019	Z80A	4	64K	256K	80 x 24	TvM			W 36	1			3			CP/M		C5	Range of software included
Canon CX-1	£2,500	6809	4	128K	256K	80 x 24	M		80 x 25	W 15	3	1		2			MCX	BaAs	C6	Pascal, Fortran as extras
Camputers Lynx	£225	Z80A	4	48K	192K	40 x 24	Tv(M+)	●	248 x 256	W	1	1				●	Cassette	Ba	C7	Idiosyncratic — will take CP/M
Casio FX 702P	£90	Cust.		2K		20 x 1	LCD			C						●	Cassette	Ba	C8	Pocket computer
Casu Mini C2	£2,300	Z80A	4	64K			(M+)			●	4	1		6					C9	*Choose your own terminal
Clenio Pronto	£3,795	Z80A	4	64K	1Mb		Tv(M+)			●	2	2		18			CP/M	Ba	C10	*Choice of terminal
Clenio Table-Top 925	£3,105	Z80A	4	64K	128K	80 x 25	M	●		W 11	2	2					CP/M		C10	Watch out for the weight
Columbia PC1600-1	£3,392	8088	4	128K	1Mb	80 x 24	M	●	640 x 200	W 10	2	1		8			CP/M, MS-DOS	Ba	L1	An IBM lookalike
Commodore Vic 20	£170	6502	1	5K	32K	22 x 23	Tv(M+)	●	176 x 158	W 4				1	3		Kernal	Ba	C3	Very popular home micro
Commodore 64	£345	6510	1	64K	128K	40 x 25	Tv(M+)	●	320 x 200	W				3			Kernal	Ba	C3	Good value for money
Commodore 500	£799	6509	1	128K	896K	40 x 25	Tv(M+)	●	320 x 200	W				1			Kernal	Ba	C3	Available by summer?
Commodore 4016	£632	6502	1	16K	32K	40 x 25	TvM			W				1	3		Cassette, PETDOS	Ba	C3	The original PET
Commodore 710	£1,144	6509	2	128K	896K	80 x 25	TvM	●	512 x 512	W	1			3			Kernal	Ba	C3	Might be a long wait
Commodore 8032	£1,029	6502	1	32K		80 x 25	TvM			W				2	3		Cassette, PETDOS	Ba	C3	The 80-column PET
Commodore 8096	£1,374	6502	1	96K		80 x 25	TvM			W				2			Cassette, PETDOS	Ba	C3	
Commodore Super Pet 9000	£1,719	6502	2	96K		80 x 25	TvM			W	1	1		2	3		Cassette, PETDOS	Ba	C3	Top of the Commodore range
CompuCorp 675	£6,780	Z80	4	64K	256K	80 x 20	M			W 20	1			4			CompuCorp		C11	Unusual O/S



Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display		Graphics	Keyboard			Interfaces built-in				Storage		Operating system	Languages inc	Other languages available	Distributor	Comments	
						Max characters lines x columns	Method (at extra cost)		Colour capability	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots						Cassette facility
Cortex	£454	9995	12	64K	1Mb	40x24	Tv(M+)	●	W 12	●	1				1	●		BaAs		M2	Notably for kit building		
Corvus Concept	£4,887	68000	8	256K	1Mb	120x60	M		W 10	●	2			1	4	●	2x390K5¼F	Merlin CPM	Pa	●	K1	A4 shaped screen	
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80x24	M		W	●	2	1		10			2x390K5¼F	CP/M		●	C12	Business CPM micro	
Cromemco System 1	£3,025	Z80	4	64K		80x24	(M+)	●	W 20	●	1			8			2x390K5¼F	CDOS, Crom		●	C12	Designed for business	
Cromemco System 2	£3,560	Z80	4	64K		80x25	(M+)		W 20	●	1			21			2x390K5¼F	CDOS, Crom		●	C12		
Cromemco System 3	£5,170	Z80	4	64K		80x25	(M+)		W 20	●				21			2x1.2Mb8F	CDOS, Crom		●	C12	Large business machine	
DAI PC	£684	8080	2	48K		60x24	Tv(M+)	●	W		1					●		Ba					
Datasc Micro Controller	£431	Z80	2	16K		40x24	Tv(M+)		W		1			1		●		Ba	●	D1	Mainly used in labs		
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132x24	M	●	W 20	●	2			3			2x400K5¼F	CP/M		●	D2	Competitor for IBM PC	
DEC PC 325	£3,080	PDP11/23	N/A	256K		132x24	M	●	W 20	●	2			1			2x400K5¼F	P/OS		●	D2	Very powerful	
DEC PC 350	£3,850	PDP11/23	N/A	256K		132x24	M	●	W 20	●	2			4			2x400K5¼F	P/OS		●	D2	Excellent graphics	
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*		*		3	1		1			2x400K5¼F	CP/M	Ba	●	I2	*Buy your own terminal	
Decision-1 Computer MDC-012	£3,674	Z80A	4	64K	192K		(M+)*		*		3	1		1			1x400K5¼F + 1x5Mb5¼H	CP/M	Ba	●	I2	*You choose the terminal	
Diablo 3000	£7,250	8085	3	32K	64K	80x24	M		W 8	●	1			4			2x1.8Mb8F	DACL	Ba	●	B5		
Digico Prince	£3,392	Z80A	4	64K		80x25	M		W 50	●	2			7			2x400K5¼F	CP/M		●	D3	Unusual keyboard	
Digital Microsystems DMS-3	£3,576	Z80A	4	64K		80x25	(M+)*		*		3			1			2x512K8F	CP/M		●	D4	*Choice of terminal	
Digital Microsystems DMS-4	£6,210	Z80A	4	128K	½Mb		(M+)*		*		4						2x512K8F	MP/M		●	D4	*Depends on terminal chosen	
Direct 1000	£3,093	Z80	4	64K		80x25	M		W		2						2x300K5¼F	CP/M		●	D5	Standard CPM machine	
Dragon 32	£200	6809E	1	32K	64K	32x16	Tv(M+)	●	W			1		4	1	●		Cassette	Ba			D6	Tandy colour lookalike
Durango F85	£5,744	8085A	5	64K	196K	80x64	Tv(M+)		W	●	4			12			2x1Mb5¼F	Star Basic	BaCo	●	C5	CP/M compatible	
Eagle II	£2,702	Z80A	4	64K		80x24	M		W	●	2	1		1			2x500K5¼F	CP/M	Ba	●	M3	Regular CPM machine	
Eagle III	£2,950	Z80A	4	64K		80x24	M		W	●	1						2x1Mb5¼F	CP/M	Ba	●	M3		
Eagle IV	£4,190	Z80A	4	64K		80x24	M		W	●	2	1		1			1x1Mb5¼F + 1x12.5Mb5¼H	CP/M	Ba	●	M3		
Eagle 1600	£6,497	8086	8	128K	512K	80x25	M	●	W 24	●	2	1		8			1x1Mb5¼F + 1x12.5Mb5¼H	MS-DOS, CPM 86		●	M3	The full colour Eagle	
Enterprise 1000	£2,645	*	8	64K			M		W 10	●	2			2			2x358K5¼F	Enterprise		●	D7	Micro Nova 16-bit	
Epson HX20	£472	6301	1	16K	32K	20x4	LCD		W 13	●	2			2		●		Cassette	Ba			E2	Powerful portable
Equator	£3,099	Z80A	4	64K	48K	80x24	M		W	●	2	1		12			2x350K5¼F	CP/M, MP/M, Turbo DOS		●	E3	Two bigger models available	
Facit 6520	£2,645	Z80	4	64K	128K	80x24	M		W 8	●	2						2x320K5¼F	CP/M, Facit DOS	Ba	●	F4	Concurrent printing	
Fortune 32:16 System 2	£5,204	68000	6	256K	1Mb	80x24	M	●	W 16	●	1			20			2x800K5¼F	Unix		●	I12	Genuine 16-bit	
Fujitsu FM8	£1,150	6809	1	64K		80x25	(M+)	●	W 10	●	1	1		4	1	●		Flex	Ba		S11	Good for business graphics	
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80x25	M		W 20	●	2			2			2x800K5¼F	CP/M 86, MS-DOS		●	E1	Still on a promise	
Genie I	£330	Z80	1.7	16K	48K	64x16	Tv(M+)		W		1	1		1		●		Cassette	Ba	●	L2	Compatible with TRS 80 I	
Genie II	£299	Z80	3.25	16K	48K	64x16	Tv(M+)		W 4	●	1			1		●		Cassette	Ba	●	L2	Speeded-up Genie I	
Genie III	£2,242	Z80A	4	64K		80x24	M		W 8	●	1	1		3		●	2x700K5¼F	New DOS	Ba	●	L2	CP/M costs extra	
Colour Genie	£224	Z80	2.2	16K	32K	40x24	Tv(M+)	●	W		1	1		2	1	●		Cassette	Ba		L2	Home games machine	
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80x25	M		W 10	●	1	1		5		●	2x400K5¼F	CP/M		●	G3	Most CPM languages	
Hawk Model 110	£2,070	Z80A	4	64K	256K	*	(M+)*	●	*		2	1		3			2x390K5¼F	CP/M, MP/M2		●	L3	*Choose your terminal	
Hawk Model 2110	£5,405	Z80A	4	64K	256K	*	(M+)*	●	*		2	1		3			1x390K5¼F + 1x21MbH	CP/M, MP/M2		●	L3	*Choose your terminal	
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80x25	M		W 34	●	2			8			2x320K5¼F	CP/M	As	●	H1	Designed for network	
Haywood Hinet	£10,982	Z80	4	64K	128K	80x24	M		W 34	●	3	1		1			1x11Mb8H	CP/M		●	H1	Large network machine	
HP 75C	£883	Cust.	N/A	16K	24K	32x1	(M+)		C					1	4	●	1.3K card reader	HP	Ba		H2	Calculator/computer	
HP 85	£2,360	Cust.	N/A	16K	32K	32x20	M		W 8	●	1			4	4	●		Cassette	Ba	●	H2	Engineers' machine	
HP 86A	£1,541	Cust.	N/A	64K	512K	80x24	M		W		1	1		2	4			HP	Ba	●	H2	Selection of monitors	
HP 87XM	£2,571	Cust.	N/A	128K	640K	80x24	M		W 14	●	1	1		3	4			HP DOS	Ba	●	H2	Special technical uses	
HP Series 100, 120	£2,362	Z80A	3.68	64K		80x24	M		W 8	●	2			1				CP/M	Ba	●	H2		
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80x25	M		W 5	●	1			2				HP	Ba	●	H2	Genuine 16-bit	
HYTECH H4500	£4,310	Z80	4	64K	208K	80x25	M		W 26	●	1			3			2x403K5¼F	CP/M	Ba	●	H3	Standard CPM micro	
IBM PC	£2,392	8088	4.7	64K	576K	80x25	(M+)	●	W 10	●	1			5			1x360K5¼F	MS-DOS	Ba	●	K2	Slow but reliable	
ICL PC Model 10	£2,754	8085	3	64K	256K	80x24	Tv(M+)		W 11	●	2			8			2x700K5¼F	CP/M	Ba	●	I3	Repackaged Fairchild Box	



ICL PC Model 31	£4,939	8085	6	128K	256K	80x24	(M+)	80x24	80x24	W 11	4	8	1x250K5/4F + 1x5MbH	CP/M, MP/M	Ba	●	I3	
ICL PC Model 32	£6,037	8085	3	256K		80x24	(M+)	80x24	80x24	W 11	8	8	1x250K5/4F + 1x5MbH	CP/M, MP/M	Ba	●	I3	
IDS Datamachine	£1,995	Z80	4	64K	1Mb		Tv(M+)			W 12	2	15	2x400K5/4F	CP/M	Ba	●		*Depends on terminal
IO Tech Iona	£2,539	Z80	4	69K	960K		M	●	160x75	W 12	1	8	2x400K5/4F	CP/M	Ba	●	I4	Good colour versatility
Irvine Business Systems	£1,489	Z80	4	64K		80x25	M			W	2		2x400K5/4F	CP/M	Ba	●	I5	Inexpensive CP/M machine
ITT 3030	£3,105	Z80A	4	64K	256K	80x24	Tv(M+)	80x24	80x24	W 8	1	1	2x280K5/4F	CP/M, BOS	Fr	●	I6	Bog-standard CP/M machine
Jupiter Ace	£90	Z80	3.25	3K	51K	32x24	Tv(M+)	64x46	64x46	C		1					J4	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K		80x24	Tv(M+)	80x24	80x24	W 10	1		2x250K5/4F	Kalamazoo		●	K3	Only Kabor language
Kemtron K2000E	£2,242	Z80	4	64K		80x24	(M+)	80x24	80x24	W	2	11	1x300K5/4F	CP/M		●	K4	Scientific keyboard
Kemtron K3000	£3,795	Z80	4	64K	256K	80x24	(M+)	80x24	80x24	W	2	14	2x1Mb8F	CP/M, MP/M		●	K4	Large CP/M micro
Kenilworth 83G	£1,953	Z80A	4	64K		80x25	TvM	160x75	160x75	W 10	1	5	2x350K5/4F	CP/M		●	K5	Run of the mill
Kenilworth 83N	£2,012	Z80	4	64K		80x25	TvM	160x75	160x75	W 10	1	5	2x350K5/4F	CP/M	Ba	●	K5	
Kontron RSI 80	£3,306	Z80	4	64K	128K	80x25	M	256x512	256x512	W 16	2	8	2x303K5/4F	Kontron	Ba	●	K6	Basic business machine
LSI M3	£2,064	Z80	2.5	64K		80x24	M	80x24	80x24	W 31	1		2x200K5/4F	CP/M		●	L4	Foreign characters
LSI M4	£2,472	8088	5	128K	256K	80x24	M	160x72	160x72	W 31	2	1	2x400K5/4F	CP/M 86, CPM80		●	L4	Pseudo 16-bit
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80x24	M	640x288	640x288	W 12	1	4	2x1Mb5/4F	CP/M, MS-DOS	Ba	●	L5	High-res colour graphics
Marin Chip M9900	£5,750	9900	3	64K	1.6Mb	24x80	M	24x80	24x80	W 8	4	12	2x1.2Mb8F	MOS, MDEX	Ba	●	M2	Genuine 16-bit
Micro Five 1000	£5,175	8088	8	128K	512K	25x80	TvM	512x512	512x512	W 20	10	2	2x1Mb5/4F + 2x6.3Mb5/4H			●	F2	*Choose your own O/S
Micro Five 3000	£10,350	8086	5	128K	1Mb	25x80	TvM	512x512	512x512	W 20	5	3	1x10Mb8F			●	F2	*Choose your own O/S
Microdecision	£1,144	Z80	4	64K		80x24	(M+)				2		1x200K5/4F	CP/M	Ba, Pilot	●	I2	*Terminal extra
Microsolution British Genius	£1,840	Z80	4	64K		80x24	TvM	80x24	80x24	W 21	1		2x160K5/4F	CP/M		●	M4	'Genius' by nature?
Millbank SX10	£2,754	Z80A	4	65K	256K	80x25	M	80x25	80x25	W 10	2	1	2x350K5/4F	CP/M	As	●	M5	Scientific applications
Molecular M200	£5,462	Z80	4	64K	320K		(M+)				2	1	1x10Mb8H + 1x500K8F	CP/M	BaAs	●	G1	*Terminal required
Monroe EC8800	£2,990	Z80A	3	128K		40x24	M	240x240	240x240	W 32	3	3	1x320K5/4F	Monroe	Ba, Pilot	●	F1	Only 40-character screen
Monroe OC8810	£3,162	Z80A	3	128K		80x24	M	80x24	80x24	W 32	3	2	1x320K5/4F	Monroe	BaPa	●	F1	Bigger model available
Multitech MPFII	£2,999	6502	1.2	64K		40x24	Tv(M+)	280x192	280x192	C	1	1		Cassette	Ba	●		
Nascom 2	£327	Z80A	4	2K	64K	16x48	Tv(M+)	48x96	48x96	W	1	4		NAS, SYS	BaAs	●	L6	Old reliable
Nascom 3	£549	Z80	4	48K		16x48	Tv(M+)	48x96	48x96	W	1	4		NAS, SYS	BaAs	●	L6	Newer, still reliable
NEC PC8000	£1,454	Z80	4	32K	64K	80x25	M	160x100	160x100	W 10	2	1	2x300K5/4F	CP/M, NEC, DOS	Ba	●	N1	Superb colour graphics
New Brain A	£228	Z80A	4	32K	512K	80x30	Tv(M+)	640x220	640x220	C	2	1		Cassette	Ba	●	G2	Ivory tower dream
North Star Advantage	£2,524	Z80A	4	64K		80x24	M	80x24	80x24	W 15	1	5	2x360K5/4F	CP/M, North Star DOS		●	C12	Solid and trusty
North Star Horizon	£2,294	Z80	4	64K	512K	80x24	M	80x24	80x24		2	1	2x360K5/4F	North Star DOS	Ba	●	C12	*Buy your own terminal
Olivetti M20D	£2,754	Z8000	3	160K	512K	80x25	M	512x256	512x256	W	1	5	2x320K5/4F	PCOS	Ba	●	B6	Real 16-bit
Olympia Boss Model A	£2,645	Z80A	4	64K		80x28	M	80x28	80x28	W 10	1	4	2x140K5/4F	CP/M		●	O1	Useful 28 lines on screen
Onyx 5001 MU	£7,607	Z80A	4	128K	256K						5	1	1x7Mb5/4H	CP/M	Ba	●	T2	*Terminal extra; other models
Oric	£100	6502A	1	16K	48K	40x28	Tv(M+)	240x200	240x200	C		1		Cassette	Ba	●	O2	Delivery delays
Osborne 1	£1,581	Z80	4	64K		52x24	M	128x32	128x32	W 10	1	1	2x185K5/4F	CP/M	Ba	●	O3	Wierd 52-column screen
Panasonic JD 800M	£3,795	8085A	4	60K		80x24	M	80x24	80x24	W 21	3		2x250K8F	CP/M	Ba	●	P1	Larger model costs £5,002
Pasca 640	£1,437	Z80A	4	64K		80x24	M			W	1	1	2x250K8F	CP/M		●	W1	Regular CP/M micro
Pascal Modular Microengine	£7,003	WD9000	2	128K							4		2x1.2Mb8F	UCSD	Pa	●	P2	*Terminal extra
Philips P3500	£3,000	Z80A	4	64K	320K	80x25	M	80x25	80x25	W 11	2	3	2x0.6Mb5/4F	Turbo-DOS	Co	●	P3	
Positron 900	£1,259	6809	1	64K	256K		(M+)				4	1		O/S 9	Ba	●	P4	*You choose your terminal
Positron 9000	£2,134	6809	1	64K	256K	80x24	TvM	480x240	480x240	W 12	4	1		O/S 9	Ba	●	P4	
Quantum 2000	£2,587	Z80A	4	64K	192K	80x25	M	160x75	160x75	W 18	1	5	3x860K5/4F	CP/M		●	Q1	Mono, low-res graphics
Rair Black Box Model 3/20S	£2,242	8085	5	64K	512K	80x24	(M+)				2	8	2x1Mb5/4F	CP/M	Ba	●	R1	*VDU extra; many versions
Rair Business Computer	£6,037	8088	5	256K	1Mb	80x25	M	80x25	80x25	W 10	2	4	1x19Mb5/4H + 1x1Mb5/4F	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit
Racal 6000	£6,327	Z80	5	64K	256K	80x26	M	80x26	80x26	W 21	1	1	1x600K8F	CP/M		●	R2	CP/M languages available
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40x24	Tv(M+)			W	1	4	2x144K5/4F	CP/M	Ba	●	R3	Widely used in schools
Research Machines Link 480Z	£650	Z80A	4	32K	256K	40x24	Tv(M+)			W 4	2	1		Cassette	Ba	●	R3	CP/Net version available
Sage II	£4,019	68000	8	128K	512K		(M+)				2	1	2x640K5/4F	UCSD-P System	BaAs, PaFn	●	T3	*Terminal extra
Samurai	£3,214	8086	4.6	128K	768K	80x25	M	720x400	720x400	W	3	1	2x1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics
Sanyo MBC 1000	£1,195	Z80A	4	64K		80x25	M	80x25	80x25	W 17	1	1	1x320K5/4F	CP/M	Ba	●	L1	Standard CP/M model
Sanyo MBC 1250	£2,294	Z80	4	64K		80x40	M	640x400	640x400	W	1	1	2x640K5/4F	CP/M	Ba	●	L1	High-res graphics
Sanyo MBC 2000	£2,242	8085A	5	64K		80x24	M	80x24	80x24	W 24	2	1	2x328K5/4F	CP/M	Ba	●	L1	Big disk model costs £3,622
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80x24	M	80x24	80x24	W	1	1	2x640K5/4F	CP/M 86	Ba	●	L1	Pseudo 16-bit
Seed System 1	£2,300	6800	2	32K	64K	80x24	M	80x24	80x24	W 3	2	8	2x160K5/4F	DOS 68 Flex	Ba	●	S2	Ageing business machine



Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display		Graphics	Keyboard			Interfaces built-in					Storage		Operating system	Languages inc	Other languages available	Distributor	Comments
						Max characters lines x columns	Method (at extra cost)		Colour capability	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics	No. of IEEE 488	No. of others	No. of expansion slots	Cassette facility					
Seed System 19	£2,600	6809	2	48K	1Mb	80×24	M		W 3	●	2				8		2×160K5¼F	OS-9		●	S2	Latest from Seed	
Sharp MZ80A	£549	Z80	2	48K		40×25	M	80×50	W							●	Sharp Basic	Ba	●	S3	CP/M facility extra		
Sharp MZ80B	£900	Z80A	4	64K		80×25	M	320×200	C 10	●						●	Sharp Basic	Ba	●	S3	Unusual keyboard		
Sharp PC1251	£79.95	Cust.	.58	4.2K			LCD	24×1	C 18	●					1	●	Sharp Basic	Ba		S3	10 program areas		
Sharp PC1500	£170	Cust.	1.3	3.5K	11.5K	26×1	LCD	156×7	C 6	●	1	1			2	●	Cassette	Ba		S3	Optional 4-pen plotter		
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80×25	M	160×50	W 10	●					5		2×500K5¼F	Sharp Basic	Ba	●	S3	Powerful Sharp Basic	
Signal 10025	£1,599	Z80B	6	64K		80×24	M	512×512	W	●	2	1			1		2×200K5¼F	CP/M, Macnos	●	A14	Choice of keyboards		
Sinclair ZX81	£50	Z80A	3.5	1K	16K	32×24	Tv	64×44	C						1	●	Cassette	Ba		S4	Sold a million		
Sinclair Spectrum	£125	Z80A	3.5	16K	48K	32×24	Tv	256×192	C						1	●	Cassette	Ba	●	S4	Very popular home micro		
Sirius I	£2,754	8088	5	128K	896K	80×25	M	800×400	W 7	●	2				4		2×600K5¼F	CP/M 86, MS-DOS	●	A7	IBM style		
Sord M5	£218	Z80A	4	4K	16K	40×24	Tv(M+)	256×196	C			1			2	●	Cassette	Ba		S5	Home computer		
Sord M23	£1,932	Z80A	4	128K		80×25	M		W 14	●	2	1	2	3			2×330K5¼F	Sord O/S, SB80	●	S5	CP/M compatible		
Sord M23P	£2,369	Z80A	4	128K		80×25	Tv(M+)	640×200	W 14	●	2	1	2	2			2×290K3½F	Sord O/S, SB80	●	S5	Complete with suitcase		
Sord M223	£3,277	Z80	4	64K		80×25	M		W	●	2				4		2×350K5¼F	Sord O/S, SB80	●	S5	Standard business machine		
Sord M243	£5,842	Z80	4	192K		80×25	M	640×400	W 15	●	4	1	4				2×1Mb8F	Sord O/S, SB80	●	S5	Large and powerful		
SW Technical Products SO/9	£5,750	6809	2	256K	1.2Mb	80×24	M		W 15	●	1	1					2×1.5Mb5¼F	Flex, Uniflex	●	S6	Heavy worker		
Spectrum	£11,442	68000	8	256K	4Mb		(M+)	*	*		4				16		2×720K5¼F	Mirage	Ap	●	M1	*As terminal	
Sundance I	£6,969	Z80A	4	64K	256K	132×24	M		W 4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine	
Sundance II	£8,205	Z80A	4	128K	256K	132×24	M		W 4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance	
Sundance 16	£10,480	Z8001	6	256K	1Mb	80×24	M		W	●	5	1				●	1×14Mb5¼H	BOS		●	T2	Tape backup for hard disk	
Superbrain JR	£2,185	Z80	4	64K		80×24	M	560×240	W	●	1						2×160K5¼F	CP/M	Ba	●	I1	Bigger models available	
Superstar	£6,296	Z80	4	64K		80×24	Tv(M+)	80×24	W		1	1			8		1×10Mb5¼H+1×400K5¼F	CP/M 80	Ba	●		Very early machine	
Tandberg EC10	£3,000	8080A	2	64K		80×25	M		W	●	7					●	1×250K8F	CP/M, TOS	Ba	●	T4		
Tandy TRS-80 Model I	£199	Z80	1.7	16K	48K	64×16	Tv(M+)	128×48	W									TRS-DOS	Ba	●	T5	Old faithful	
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80×24	M	80×24	W 2	●	2	1					1×500K8F	TRS-DOS	Ba	●	T5	Big business machine	
Tandy TRS-80 Model III	£1,699	Z80A	2	48K		64×16	M	128×48	W	●	1	1	1			●	2×184K5¼F	TRS-DOS	Ba	●	T5		
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80×24	M		W 2	●	2	1					2×1.2Mb8F	TRS-DOS	BaAs		T5	True 16-bit	
Tandy TRS-80 Colour Computer	£240	6809E	1	16K	32K	32×16	Tv	256×192	W	●	1					●		Cassette	Ba	●	T5	Very popular	
Tandy TRS-80 Pocket Computer	£57	Cust.	1	1.9K		24×1	LCD	24×1	C 5	●						●		Cassette	Ba		T5	Single-line display	
Tandy TRS-80 Pocket Computer 2	£179	Cust.	1.3	2.6K	16K	26×1	LCD	156×7	C 6	●						●		Cassette	Ba		T5	Plotter available	
Televideo TS-80ZH	£4,533	Z80	4	64K		80×24	M	80×24	W 15	●	2				1		1×256K5¼F+1×7Mb5¼H	CP/M		●	C13	Recently upgraded	
Televideo TS-800 Series	£1,495	Z80A	4	64K		80×24	M	80×24	W 15	●	2				1			CP/M		●	C13	Standard CP/M machine	
Televideo TS 1602-C	£3,714	8088	5	128K	256K	80×24	M	576×424	W 15	●	2				1		2×256K5¼F	CP/M-86		●	C13	Graphics, but no colour	
Texas Instruments TI-99/4A	£150	9900	3.5	16K	52K	32×24	Tv(M+)	256×192	W	●	2				2	●		DOS	Ba	●	T6	This has sprite graphics	
TI System 200-250	£6,695	9900	4	64K		80×24	M	190×96	W 12	●	1						1×5Mb5¼H	UCSD-P, PX10		●	T6	Bigger version available	
TMK 332	£2,242	8085A	5	64K		80×24	M		W 22	●	2	1					2×320K5¼F	CP/M	Ba	●	P5	*6502 I/O processor	
Torch	£3,214	Z80*	4/2	96K		80×30	TvM	640×256	W 15	●	1	1	4			●	2×400K5¼F	CP/M	Ba	●	T7	CP/M compatible	
Toshiba T-100	£1,900	Z80A	4	64K	96K	80×25	TvM	640×200	W 8	●	1	1	1		2		2×256K5¼F	CP/M	Ba	●	O4	We'll be reviewing this	
Toshiba T-200	£2,242	8085	2.6	64K		80×24	M	80×24	W 15	●	1						2×256K5¼F	CP/M	Ba	●	O4		
Transam Truscan	£1,983	Z80A	4	64K		80×24	TvM	640×288	W	●	2	1	1	5			2×190K5¼F	CP/M		●	T8	S-100 machine	
Transfec BC2	£1,949	Z80A	4	64K	256K	80×24	M	80×24	W 13	●	2	1			8		2×386K5¼F	CP/M		●	T9	Fully definable characters	
Vector 4	£3,852	8088	5	128K	256K	80×24	M	640×312	W 15	●	1	1	1	2			2×630K5¼F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit	
Victor 9000	£2,754	8088	5	128K	896K	80×25	M	800×400	W 7	●	2	1	4				2×600K5¼F	CP/M 86, MS-DOS	Ba	●	D9	Another IBM clone?	
Wilkes YD8110	£4,025	8086	5	128K	896K	80×24	M	960×624	W 21	●					6		2×1.2Mb8F	CP/M 86	Ba	●			
Xerox 820 Model II	£2,415	Z80A	4	64K		80×24	M	1024×512	W	●	2	2			2		2×160K5¼F	CP/M		●	R4	M1-res graphics	
Zenith 120-22	£2,978	8088	5	128K	192K	80×25	M	640×225	W 18	●	2	1	1	5			2×320K5¼F	CP/M, MS-DOS, Z Basic		●	Z1	Graphics includes turtle	
Zenith Z89-81	£1,668	Z80	2.5	48K	64K	80×24	M		W	●	2	1					1×100K5¼F	CP/M	Ba	●	Z1	Nothing special here	
Zeus 4	£5,400	Z80	4	64K	320K	80×25	(M+)	80×25	W 11	●	10						1×6Mb5¼H+1×250K5¼F	CP/M, Muse	As	●	M5	Designed as multi-user	



# To all owners of Sinclair ZX Spectrum computers URGENT

If you have bought, or received as a replacement, a Sinclair ZX Spectrum computer since January 1st, please check your power supply (mains adaptor) *now*. We believe that a batch of adaptors from one of our suppliers is faulty, and in certain circumstances might conceivably prove dangerous.

## Make these checks

1. Did you obtain your Spectrum after 1 January 1983?
2. Is the lead from the power supply to the computer black and white?
3. Is the shape of the plug like illustration B?

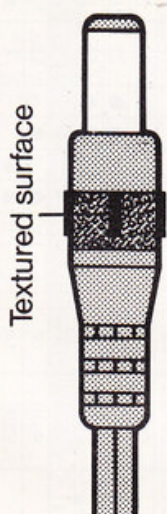
If (*and only if*) the answer to *all three* questions is YES, post the power supply to us at the address below *with your name and address enclosed*. We will replace the power supply as soon as possible.

Do *not* return your Spectrum computer, which is perfectly safe – as are the power supplies with all ZX81 computers and ZX Printers.

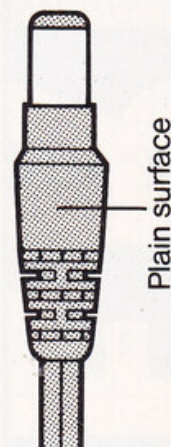
Please accept our apologies in advance for this inconvenience.

Send your power supply to:

**Sinclair Research Ltd**, Unit F, Broad Lane,  
Cottenham, Cambs., CB4 4SW.



PLUG A:  
safe.



PLUG B:  
possibly  
faulty.

# sinclair



# PERIPHERALS

## MONITORS

These have been split into **colour** and **monochrome**.

**Screen size** is a diagonal measurement in inches. Nearly all monochrome monitors accept a **composite video** signal from the computer and most computers are equipped with composite video output. Colour monitors feature a wider range of **signal** systems than mono and it is important to match the output of your computer to the input of the monitor.

An **audio channel** will enable sound to be output from a speaker inside the monitor. **Mono tint** refers to the colour of the text on a mono monitor. Some monitors come with an **anti-glare filter** to relieve operator discomfort.

**Band width** refers to the frequency range of signals to which the monitor can respond in MegaHertz. **Dot resolution** indicates the number of dots which can be displayed across the screen: the more dots, the sharper the picture.

**Dimensions** indicates the area the unit occupies on the desktop.

Make & Model	Price inc VAT	Screen size (inches)	Signal				Audio channel	Anti-glare filter	Band width (in MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
			Modulated PAL	Unmodulated PAL	TTL RGB	75 Ohm linear	32 bit 4 bit TTL						
Crofton C1401	£300	14	●		●				10	600	37×42	10	C15
HM 2713	£3,120	13	●		●				25	720	54×40	36	B9
HM 2719B	£2,553	19	●		●				25	960	50×49	46	B9
HM 2719C	£3,042	19	●		●				25	960	50×49	46	B9
HM 3619	£3,548	19	●		●				45	1280	50×44	48	B9
Lion Cub 1431-TTL	£286	14	●		●				7	585	65×57.5	11.5	S7
Lion Cub 1436	£316	14				●			7	585	65×57.5	11.5	S7
Lion Cub 1439	£339	14				●			7	585	65×57.5	11.5	S7
Lion Cub 1441-TTL	£546	14	●		●				15	585	65×57.5	11.5	S7
Lion Cub 1445	£633	14			●	●			15	895	65×57.5	11.5	S7
Lion Cub 1449	£604	14			●	●			15	895	65×57.5	11.5	S7
Lion Cub 1451-TTL	£430	14	●		●				10	653	65×57.5	11.5	S7
Lion Cub 1455	£483	14			●	●			10	653	65×57.5	11.5	S7
Lion Cub 1459	£459	14			●	●			10	653	65×57.5	11.5	S7
Lion Cub 2031-TTL	£344	20	●		●				7	585	65×57.5	11.5	S7
Lion Cub 2035	£431	20			●	●			7	585	65×57.5	11.5	S7
Lion Cub 2036	£390	20			●	●			7	585	65×57.5	11.5	S7
Lion Cub 2039	£371	20			●	●			7	585	65×57.5	11.5	S7
Lion Cub 2051-TTL	£646	20	●		●				10	940	65×57.5	11.5	S7
Luxor Digital	£574	14	●		●			●	25	800	N/A	15.7	P7
Luxor Linear I	£597	14	●		●			●	25	800	N/A	15.7	P7
Luxor Linear II	£643	14	●		●			●	25	800	N/A	15.7	P7
TM 22	£329	6			●	●			5.5	N/A	22×34.5	4.1	J2
VM 14 PSN	£378	14			●	●			5.5	300	47×40	13.6	J2
Wolf Cub 1435-TTL	£358	14			●	●			7	653	65×57.5	11.5	S7
Wolf Cub 1446-TTL	£587	14			●	●			15	895	65×57.5	11.5	S7
Wolf Cub 1456	£454	14			●	●			10	653	65×57.5	11.5	S7

## COLOUR MONITORS

## MONOCHROME MONITORS

Make & Model	Price inc VAT	Screen size	Composite video	Audio channel	Mono tint	Anti-glare filter	Band width (MHz)	Dot resolution	Dimensions (cms)	Weight (kilos)	Distributor
AVT DM 210G	£138	12	●		Green	●	12	750	30.8×29.6	9.5	L2
EG 100	£77	12	●		Green		8	700	37.5×29	8	L2
EG 101	£91	12	●		Green		12	700	37.5×29	8	L2
LEDM 091D	£99	9	●		B&W	●	12	750	22×24	5.4	L2
LEDM 0910	£121	9	●		Green	●	12	750	22×24	5.4	L2
Luxor 10	£212	10	●		Orange	●	22	625	N/A	8	P7
Luxor 15	£283	15	●		Orange	●	22	625	N/A	13	P7
M9	£131	9	●		Green		15-22	650	22.4×25.7	5.7	P7
M12	£144	12	●		Green		15-22	800	29.3×30	9.3	P7
Novex	£114	12	●		Green		12	750	N/A	N/A	P7
N12 1003	£112	12	●		Green		24	800	23×26.5	7	P7
Prince	£126	12	●		Green		24	800	33×50	7	C15
PM 102	£126	9	●		Green	●	24	800	22×28	7	C15
PM 1201	£138	12	●		Green		24	800	33×50	7	C15
Zenith ZVM121	£99	12	●	●	Green	●	15	N/A	29×29	6.5	P6

## DISK DRIVES

This section is divided into categories covering 5 1/4 in and 8 in floppy disks.

Disk data **capacity** is measured in kilobytes (K): one kilobyte = 1,024 characters. A **no of disks** column is included because some disk units contain two disk drives.

Manufacturers can vary the number of disk data **tracks** and these are divided into sectors. This **sectoring** system allows the information to be stored and retrieved by reference to a timing mark on the disk so the computer can keep track of its rotation. The system can be hard, where reference is kept by a hole in the disk, or soft, where the disk position is monitored by magnetic signals. Some drives have one read/write head for each side of the disk so the buyer has a choice between **single or double-sided** drives. **BS** means that the drives are both single and double-sided.

As disk technology advanced it became possible to cram more data onto the floppy so drives will feature either **single or double** (data) **density**. **BD** means that the drives are both single and double density.

The interface acts as an interpreter so the computer and disk can exchange information. Each device must have the same interpreter before a useful cable connection can be made. The **connect to** column allows you to match the disk interfaces to those included in the disk drives or available at extra cost.

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to							Distributor		
							I-EEE	RS232	BBC	Apple II	St Shugart	Nasbus	Gemini		20ma	Others
<b>8" DISK DRIVES</b>																
ACP 700 (AC)	£293	1Mb	1	77	Soft	DS,DD							●	E5		
ACP 750 (DC)	£316	1Mb	1	77	Soft	DS,DD							●	E5		



Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to	Distributor
							Apple II BBC RS232 I-EE	Others
<b>8" DISK DRIVES</b>								
ACP 1500 (DC)	£403	2Mb	1	77	Soft	DS,DD		● E5
Caldisk 142M	£465	500K	1	77	Both	SS,BD		● E5
Caldisk 143M	£522	1.2Mb	1	77	Both	DS,BD		F3
Caldisk 143M-1	£465	500K	1	77	Both	SS,BD		F3
Canon X 8330	£1,200	2Mb	2	153	Soft	DS,DD		● C6
Control Data 9404B	£684	800K	1	77	Both	SS,BD		M7
Control Data 9406-4	£1,144	1.6Mb	1	77	Both	DS,BD		M7
Eicon FD8/1D/DD	£1,438	1Mb	1	77	Soft	SS,DD		E6
Eicon FD8/1D/SD	£1,397	500K	1	77	Soft	BS,SD		E6
Eicon FD8/2D/FBR	£1,740	1Mb	2	77	Soft	DS,SD		● E6
Eicon FD8/2D/DD	£2,013	2Mb	2	77	Soft	SS,DD		E6
Eicon FD8/2D/SD	£1,972	1Mb	2	77	Soft	SS,SD		E6
Eicon FD8/1D/FBR	£1,240	500K	1	77	Soft	DS,SD		● E6
F 311	£1,725	1.2Mb	2	76	Soft	DS,SD		● B11
F 320	£2,300	2.4Mb	2	76	Soft	DS,DD		● B11
FD 801	£184	800K	1	48	Soft	SS,BD		B6
FD 802	£242	1.6Mb	1	48	Soft	DS,BD		B6
Tandy Model 11	£999	486K	1	77	Soft	SS,DD		T5
M 2894	£499	1.6Mb	1	77	Soft	DS,DD		A10
M 2896	£493	1.6Mb	1	77	Soft	DS,DD		A10
Megastor 11 DD	£1,133	2Mb	2	77	Soft	DS,DD		V1
Megastor 11SD	£1,018	1Mb	2	77	Soft	DS,SD		V1
Megastor 111	£1,121	2Mb	2	77	Soft	DS,DD		V1
R.M. FDS-2	£3,789	1Mb	2	77	Soft	DS,SD		R3
Tandy Model 16	£949	1.2Mb	1	77	Soft	DS,DD		T5
Tandy Model 16	£1,549	2.5Mb	2	77	Soft	DS,DD		T5

## 5 1/4" DISK DRIVES

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to	Distributor
							Apple II BBC RS232 I-EE	Others
Atari	£299	90K	1	40	Soft	SS,SD		● A6
BASF 6106	£195	500K	1	48	Both	SS,BD		B10
BASF 6108	£240	500K	1	48	Both	DS,BD		B10
BASF 6118	£279	1Mb	1	96	Both	DS,BD		B10
Canon X8300	£600	640K	2	80	Soft	DS,DD		● C6
CD 40	£679	400K	2	40	Both	SS,BD		● C17
CD 50A	£424	500K	2	40	Both	SS,BD		C17
CD 50E	£569	1Mb	2	80	Both	SS,BD		C17
CD 50F	£712	2Mb	2	80	Both	DS,BD		C17
CD 80	£765	800K	2	80	Both	SS,BD		● C17
CD 80D	£949	1.6Mb	2	80	Both	DS,BD		● C17
Commodore 2031	£454	171K	1	35	Soft	SS,DD		C3
Commodore 4040	£799	343K	2	35	Soft	SS,DD		C3
Commodore 8050	£1,029	1.9Mb	2	77	Soft	SS,DD		C3
Commodore 8250	£1,489	2Mb	2	154	Soft	DS,DD		C3
Control Data 9408	£221	250K	1	40	Both	SS,BD		C16
Control Data 9409	£272	500K	1	40	Both	DS,BD		C16
Control Data 9409T	£420	1Mb	1	80	Both	SS,BD		C16
Control Data ZL141	£225	250K	1	40	Both	SS,DD		M7
Control Data ZL141B	£175	250K	1	40	Both	SS,DD		M7
Control Data ZL142	£360	500K	2	40	Both	SS,DD		M7

Make and Model	Price inc VAT	Capacity	No. of disks	Tracks	Sectoring	Sides and density	Connects to	Distributor
							Apple II BBC RS232 I-EE	Others
Control Data ZL241	£295	500K	1	40	Both	DS,DD		M7
Control Data ZL241B	£240	500K	1	40	Both	DS,DD		M7
Control Data ZL242	£490	1Mb	2	40	Both	DS,DD		M7
Control Data ZL291	£380	1Mb	1	80	Both	DS,DD		M7
Control Data ZL291*	£405	500/1Mb	1	40/80	Both	DS,DD		M7
Control Data ZL291B	£320	1Mb	1	40/80	Both	DS,DD		M7
Control Data ZL291B*	£345	500/1Mb	1	40/80	Both	DS,DD		M7
Control Data ZL292	£640	2Mb	2	80	Both	DS,DD		M7
Control Data ZL292*	£665	1/2Mb	2	40/80	Both	DS,DD		M7
CS 40	£482	200K	1	40	Both	SS,BD		C17
CS 50A	£229	250K	1	40	Both	SS,BD		C17
CS 50E	£305	500K	1	80	Both	SS,BD		C17
CS 50F	£397	1Mb	1	80	Both	DS,BD		C17
CS 80	£523	400K	1	80	Both	SS,BD		C17
CS 80D	£627	800K	1	80	Both	DS,BD		C17
Cumana AS100	£252	200K	1	35	Soft	SS,BD		C17
Cumana DA8035	£857	655K	2	80	Soft	SS,BD		C17
EG 401AT	£370	102K	2	40	Soft	SS,BD		L2
FD 501	£100	250K	1	40	Soft	SS,BD		B6
FD 502	£124	250K	1	40	Soft	DS,BD		B6
FD 592	£383	1Mb	1	80	Soft	DS,BD		B6
Gemini 825	£403	400K	1	80	Soft	SS,DD		G3
Gemini 825	£518	800K	1	160	Soft	DS,DD		G3
Gemini 825	£661	800K	2	80	Soft	SS,DD		G3
Gemini 825	£776	1.6Mb	2	160	Soft	DS,DD		G3
Lowe EG 400AT	£426	200K	2	40	Soft	SS,BD		L2
Lowe EG 400T	£253	102K	1	40	Soft	SS,BD		L2
M 4853	£311	1Mb	1	80	Soft	DS,DD		A10
M 4854	£368	1.6Mb	1	77	Soft	DS,DD		A10
Megastor NOIS	£1,034	1.2Mb	2	80	Soft	SS,DD		V1
Multi Floppy Drive	£592	8Mb	5	770	Soft	DS,DD		H4
RM MDS-1	£1,950	144K	1	40	Soft	DS,SD		R3
RM MDS-2	£2,147	288K	2	40	Soft	DS,SD		R3
Scorpio 8	£863	8Mb	5	770	Soft	SS,DD		H4
Sharp MZ80 FB	£856	560K	2	70	Soft	DS,DD		S3
Tandy Colour	£449	175K	1	40	Soft	SS,DD		T5
Tandy 26-1160	£299	75K	4	40	Soft	SS,SD		T5
Tandy 26-3023	£299	156K	4	35	Soft	SS,DD		T5
Tandy Model 1	£389	90K	1	35	Soft	SS,SD		T5
Tandy Model 111	£369	175K	2	40	Soft	SS,DD		T5
TM 101-4	£282	1Mb	1	160	Soft	SS,DD		H4
TM 102-2	£393	2Mb	1	160	Soft	SS,DD		H4
TM 848-1	£389	800K	1	77	Soft	SS,DD		H4
TM 848-2	£513	1.6Mb	1	154	Soft	DS,DD		H4
TM 50-1	£147	250K	1	40	Soft	SS,DD		H4
TM 100-1	£158	250K	1	40	Soft	SS,DD		H4
TM 100-2	£221	500K	1	80	Soft	SS,DD		H4
TM 100-3/3M	£216	500K	1	80	Soft	SS,DD		H4
TM 100-4/4M	£247	1Mb	1	160	Soft	DS,DD		H4
Tracker 1	£373	1Mb	2	80	Soft	SS,DD		D11
Tracker 2	£497	2Mb	2	80	Soft	DS,DD		D11



# MODEMS

A modem interfaces a computer and the telephone system so computers can communicate over long distances. It converts data to electrical pulses or sounds that can be sent down the line. A modem can be connected to the line directly or acoustically. **A D** in the connection column represents direct link, while **A** indicates acoustic. The acoustic coupler is like a female telephone handset with a speaker in the coupler opposing the phone's mouthpiece and a microphone opposing the earpiece. **A B** in this column indicates that both methods of attachment are available. **Baud** rate shows the speed with which the data is transmitted.

The modem must be connected to the computer through an interface. The interface column lists the main interfaces featured on each modem. **Asynchronous** means that data may be transferred at intervals as available or as needed. **Synchronous** data is transmitted at regular intervals. **Simplex** transfers data in one direction, while **Half duplex** can transmit/receive in either direction, but not simultaneously. **Full duplex** transmits and receives information in both directions at once.

Some modems can **originate** a call or start a two-way conversation. **Answer** means they can respond to a call from another computer.

Make and Model	Price	Data Rates (baud)	Connection	Interface	Capabilities					Distributor
					Asynchronous	Synchronous	Simplex	Half Duplex	Full Duplex	
AJ 311	£387	300	B	RS232	●	●	●	●	●	A9
AJ 1222	£736	1200	D	RS232	●	●	●	●	●	A9
AJ A211	£316	300	A	RS232	●	●	●	●	●	A9
AJ 1234	£736	1200	A	RS232	●	●	●	●	●	A9
AJ 1256	£736	1200	B	RS232	●	●	●	●	●	A9
AM 211	£387	300	B	RS232	●	●	●	●	●	A9
Bermac 1200/1 Model A	£414	1800	D	RS232	●	●	●	●	●	B7
Bermac 1200/1 Model B	£460	1800	D	RS232	●	●	●	●	●	B7
Sendata 700 Series A	£253	300	A	RS232, 20ma, V24	●	●	●	●	●	B8
Sendata 700 Series B	£224	300	A	RS232, 20ma, V24	●	●	●	●	●	B8
Sendata 700 Series C	£309	600-1200	A	RS232, 20ma, V24	●	●	●	●	●	B8
Sendata 700 Series D	£309	75-1200	A	RS232, 20ma, V24	●	●	●	●	●	B8
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