WHICH MICRO? & SOFTWARE REVIEW

FULL GUIDE TO BUYING A COMPUTER

JANUARY 1983
85p

COMPUTER EDUCATION: HOW USEFUL IS IT?

PRESTEL UNDER ATTACK: BREAKING THE LAW WITH A MICRO

DATABASES: STILL IN THE STONE AGE?

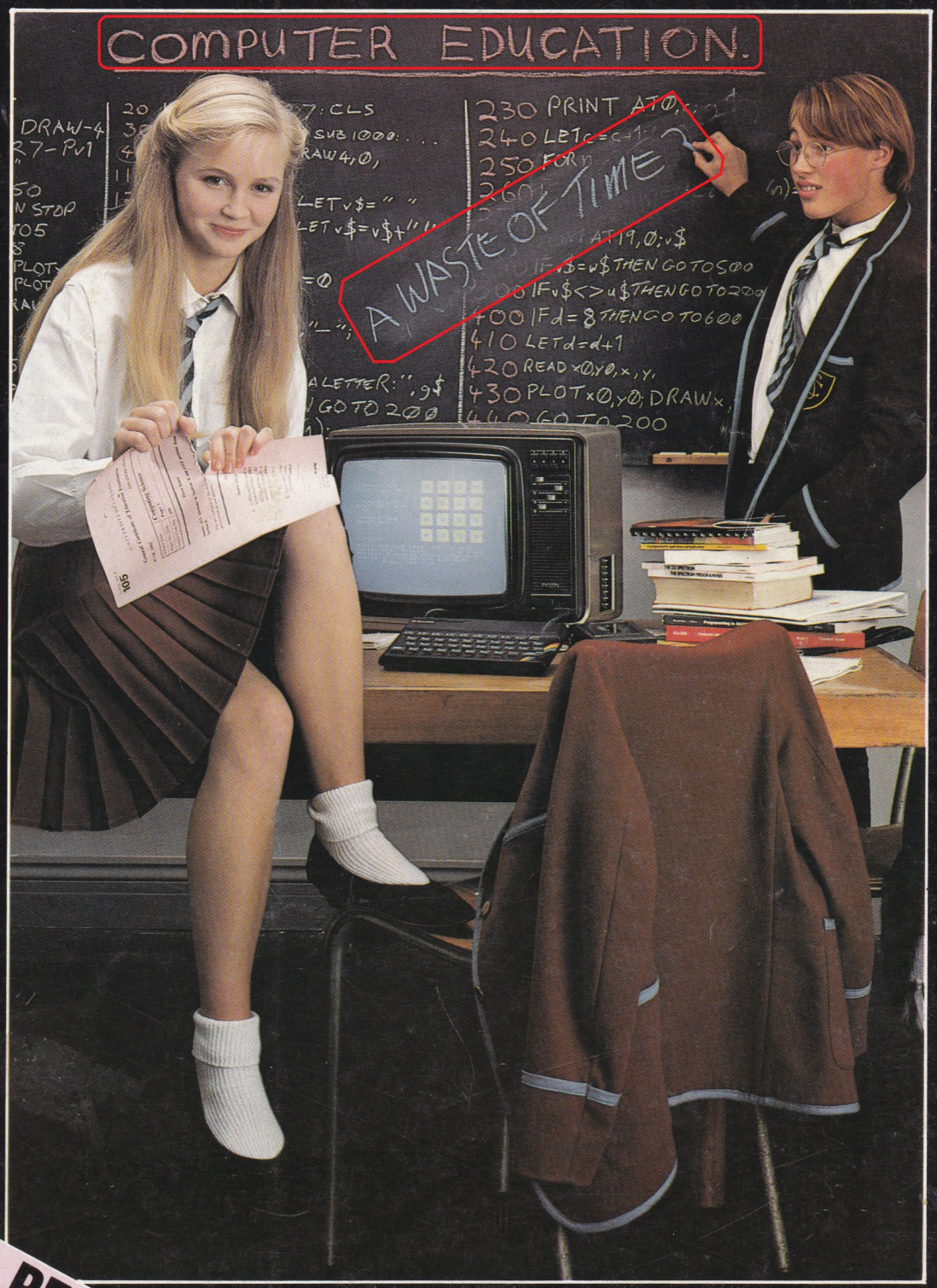
COMPUTER BLUFF: BE AN INSTANT EXPERT

HP-86 MICRO: EXPENSIVE - IS IT WORTH IT?

LATEST VIC 20, ZX 81, SPECTRUM & ATARI SOFTWARE

REVIEWS
HARDWARE: VICTOR 9000/SIRIUS, WICAT, HP-86
SOFTWARE: BBC, VIC 20, ZX-SOFT, ATARI, DATABASES, NEW RELEASES

PLUS: TOP 20 ZX SOFTWARE CHART



THREE ORICS TO BE WON
SEE COMPETITION INSIDE

THE GUIDE TO ...TERS & SOFTWARE UNDER £5000

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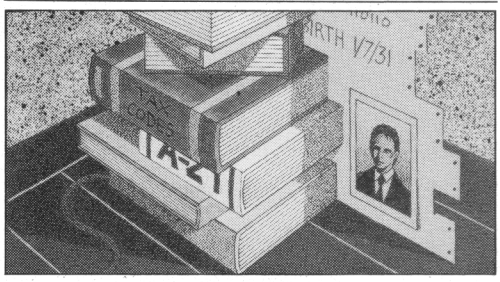

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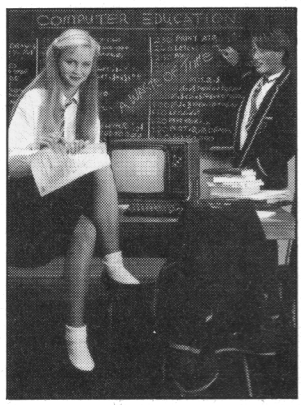

Cover photograph by
Richard Waite

NEWS

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    5 D$=CHR$141:T$=CHR$134:P$=CHR$133:B$=CHR$132:Y$=CHR$131:G$=CHR$130:O$=CHR$1
29:F$=CHR$136:REM ALLOCATE COLOURS
   10 ON ERRORGOTO10050
   15 *FX11,0
   20 *KEY10"OLD!MRUN!M"
   21 VDU23,8202,0,0,0
   22 PROCCHORDS
   25 CLS:PRINTD$O$"ANIMAL CLASSIFICATION":PRINTD$O$"ANIMAL CLASSIFICATION"
   30 PRINTTAB(0,4)"DOES THE ANIMAL HAVE A BACKBONE?(Y OR N)"
   40 PROCYN:IF A=1 THEN5000
   60 PRINTTAB(0,6)"DOES IT CONSIST OF A SINGLE CELL?":PROCYN:IF A=1 THEN PROCPR
OTOZOA:GOTO11000
   80 PRINTTAB(0,8)"DOES IT CONSIST OF TWO LAYERS`OF  CELLS CEMENTED TOGETHER?":
PROCYN:IF A=1 THEN PROCCOEL:GOTO11000
  100 PRINTTAB(0,11)"IS IT LONG, CYLINDRICAL, WITHOUT ANY    EVIDENT PROTRUDING
EXTERNAL FEATURES?":PROCYN:IF A=1 THEN PROCPROTRUDE:GOTO11000
  120 PRINTTAB(0,14)"DOES IT HAVE A FIVE RAY PATTERN?":PROCYN:IF A=1 THEN PROCEC
HIN:GOTO11000
  140 PRINTTAB(0,16)"DOES IT HAVE AN EXTERNAL SHELL?":PROCYN:IF A=1 THEN PROCMOL
LUSCA:GOTO11000
  160 PROCCARTHRAPOD
  999 GOTO11000
 1000 DEFPROCPROTRUDE
 1010 PRINTTAB(0,14)"IS YOUR WORM COMPLETELY FLATTENED?":PROCYN:IF A=1 THEN PROC
```

Make a soft fortune

How to make money from your hobby. Sell your staggeringly original program to a software publishing house and move to Barbados on the royalties.

If your program is really wonderful, you might just be able to do that. On the other hand, it might cover the cost of the coffee you consumed during those long nights when writing it.

Kuma Computers and *Which Micro?* would be interested to hear from you if you have programs for the Sirius, Newbrain, Osborne, Sharp or Dragon machines. Kuma say that it is mainly looking for utility and application programs such as languages and information handling. So are we but we won't turn you away if you have a really ripping fun program for any other micro. *Kuma: (068) 71778.*

'Home Buying'

With the last few shopping days before Christmas now firmly upon (or behind) us, you might well be thinking of getting a home computer as a last minute, or New Year, present for one of your nearest and dearest.

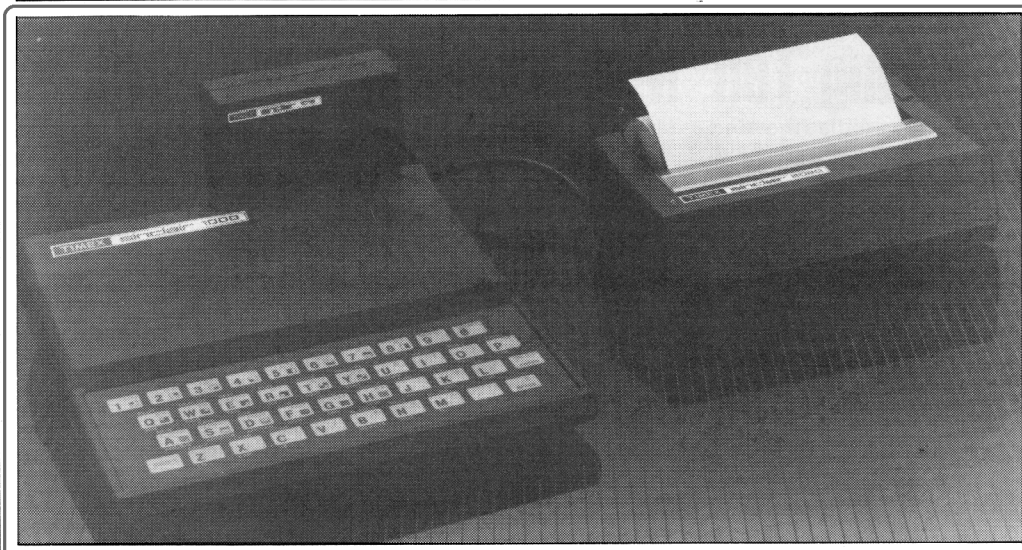
Hopefully this is not because your attempts to order a micro through the post have been thwarted. Though most micros available by mail order quote a 28 day delivery time the experience of many buyers has found this to be more than a little optimistic.

The truth is that many of the companies selling computers for the kind of price that would make them attractive Xmas presents — ie those without the kind of spare cash of Adan Kashoggi — are having trouble making the things.

As a result you could spend Xmas Eve running round trying to find an alternative to the computer that didn't turn up. Clive Sinclair's Spectrum is still rumoured to be facing delivery problems as are the BBC computers.

It will also be very difficult to get hold of the Oric and Jupiter Ace right now.

Some companies, though, have circumvented this by making their machines available through normal retail outlets. Apart from the specialist computer shops the Texas Instruments 99/4A is easily obtainable through Argos, the VIC 20 from Rumbelows, the ZX81 from W H Smiths and Boots stock the Dragon 32 as well as the VIC 20 and ZX81.



America's Sinclair 1000

The Timex Sinclair 1000 is available only in the US and is essentially the same as the ZX81. Except, that is, for only $99.95 you get twice as much standard memory (2K) as the paltry 1K of the British ZX81 priced at £50.

Quite why the Americans should be shown such favouritism is not clear but the increased memory size is well worth having.

As ZX81 users have discovered the 1K of the British version has insufficient room for anything but the shortest of programs and any serious programming or software requires the extra plug in memory pack.

The new machine also includes a resistor to deal with the 525 lines of a US television set and the keyboard wording of Rubout and Newline has been altered to Delete and Enter.

Presumably this is on the assumption that such words are more suitable for the other side of the Atlantic though I always assumed a word like Rubout was peculiarly American in itself. Still its probably better than "terminate with maximum prejudice".

Sinclair: 0276 685311.

128K Apples

For those who view their Apple II with some regret in the light of all these adverts for machines with vast amounts of memory, like 128 Kbytes, here is just the thing.

Its a plug-in memory expansion module called Ramex, from a company with the unlikely name of Vergecourt. Basically, you just stick in the expansion slots on your machine and hey presto, an extra 128 Kbytes to play around with.

What it actually does is rather clever — it pretends its a disc drive, and the software to allow it to do this is on the board along with the memory.

Anyway, sounds just the thing for Apple owners with feelings of inadequacy.

Vergecourt: (0268) 728484

Prestel

STOP PRESS — catching wind of our correspondent B T Pretzel's gaff-blowing on how you can sneak into Prestel (and Micronet 800?) British Telecom are making personal passwords mandatory from 1st December!

See page 38.

Hewlett-Packard Personal Computers

It's here. The amazing affordable **H-P 86**, the new desktop that's been hitting the headlines at around £2,000. Along with the **H-P 85** and the **H-P 87** it means there's now the **right** personal machine for every scientist and professional.

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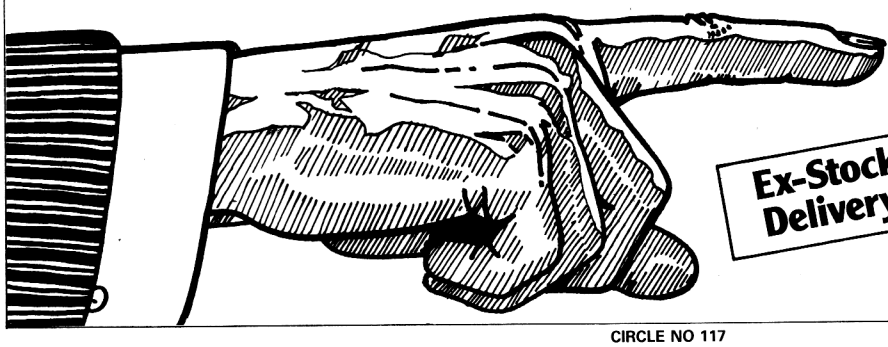

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CIRCLE NO 148

EXPENSIVE HP-86

Hewlett-Packard now the third largest micro manufacturer has launched its expensive but well-engineered HP-86

Mention Hewlett-Packard and for many people scientific calculators will spring to mind. But Hewlett-Packard has made mini and mainframe computers for some years and has recently come to the fore as a manufacturer of microcomputers. Indeed they now rank number three among micro manufacturers worldwide.

HP began as manufacturers of scientific instrumentation and their early interest in computers was for laboratory and process control applications. This is reflected in the three microcomputers which comprise the Series-80 range.

The HP-86 has a satisfyingly robust feel, which arouses immediate confidence in its reliability. Ergonomically the absence of a separate key board is disappointing and as one left handed dealer said to me, when will a manufacturer bring out a separate numeric pad that can be positioned to the user's, rather than the designer's, convenience.

The machine comes with 64 kilobytes of RAM of which a full 60K is available to the user for program and data use. This optimisation of available RAM is made possible by installing HP's Basic and the operating system in 48KB of ROM.

Both RAM and ROM upgrades are available and can be installed by the user. They come in the form of modules which simply plug into sockets on the back plate and up to four can be accommodated at once. There are two RAM modules, 64KB and 128KB, giving a maximum of 572KB of RAM.

A lot of memory for an 8-bit machine.

Five ROM modules, a ROM and a PROM drawer are available. The ROM drawer holds up to six chips mounted in individual carriers which can be added by the user. The modules are solidly made and should give no trouble. This robustness is seen too in the disc and printer interfaces which have screw retainers. In fact the backplate area reflects a quality of construction reminiscent of the aerospace industry.

The disc drives take their power through the interface cables cutting out two power lines.

HP drives have always been expensive and at £622 the disc drive for the '86 is not exactly cheap, though it does show more awareness of market pricing than its predecessors.

HP's documentation is comprehensive and lucidly written, among the best user manuals I have seen in fact, the CP/M manual could be taken as a standard primer.

The display is green on grey, clear and as easy on the eye as one would expect. A choice of nine or 12 inch monitors is available. Two sizes of screen display can be selected, 16 lines by 80 characters which is standard, or 24 by 80. A ROLL key allows one to scroll continuously through the VDU memory. The screen can be split to the user's requirements between alpha and graphics displays. The HP-86 can drive more than one monitor, a useful facility for some business and education applications.

When the computer is powered up there is a perceptible delay in the cursor appearing on the screen. This is due to a diagnostic self-test procedure which the '86 runs. The time taken depends upon the amount of on-board memory.

Our 128K machine took 10 seconds but the full blown 512K version would need in the region of half a minute.

The keyboard is a standard Qwerty and numeric pad layout. There are command keys such as RUN and LIST within the keyboard. Running along the top are seven numbered keys, familiar to HP users, which when used in upper and lower case modes give access to fourteen dedicated commands such as LOAD, STORE and INITIALIZE, obviating the need to enter these commands in full.

These keys are numbered and when programming a display of each key's function can be obtained in inverse video along the bottom of the screen. As HP's applications software becomes available, depending upon the program in use, eg word processing, each 'soft' key assumes a particular function which can be written on a plastic inlay that slots into the keyboard. But they do not work when using CP/M software.

The disc directory is obtained by the command CAT and gives essential information. The file name (up to 10 characters), the file type, the number of bytes of storage used by each file and the number of records per file. There are five types of file, Program, Binary Program, Data, Null and Extended.

These last are files not falling into any other category eg a graphics file created using the graphic module. If the module is removed this file will appear as **** indicating the inability of the HP-86 to access it in the absence of the ROM module. Disc tidying is not automatic and Null files are created as individual files are purged, these can be removed by 'packing' the disc.

Files can be made secure against unauthorised copying and deletion.

When entering a program, automatic line numbering is a convenient feature. HP Basic is more user friendly than most, syntax errors are not merely indicated they are pinpointed by the cursor.

The HP-86 is very much a programmer's computer rather than a machine for running applications packages. Indeed as many as 90 percent of HP users write their own software.

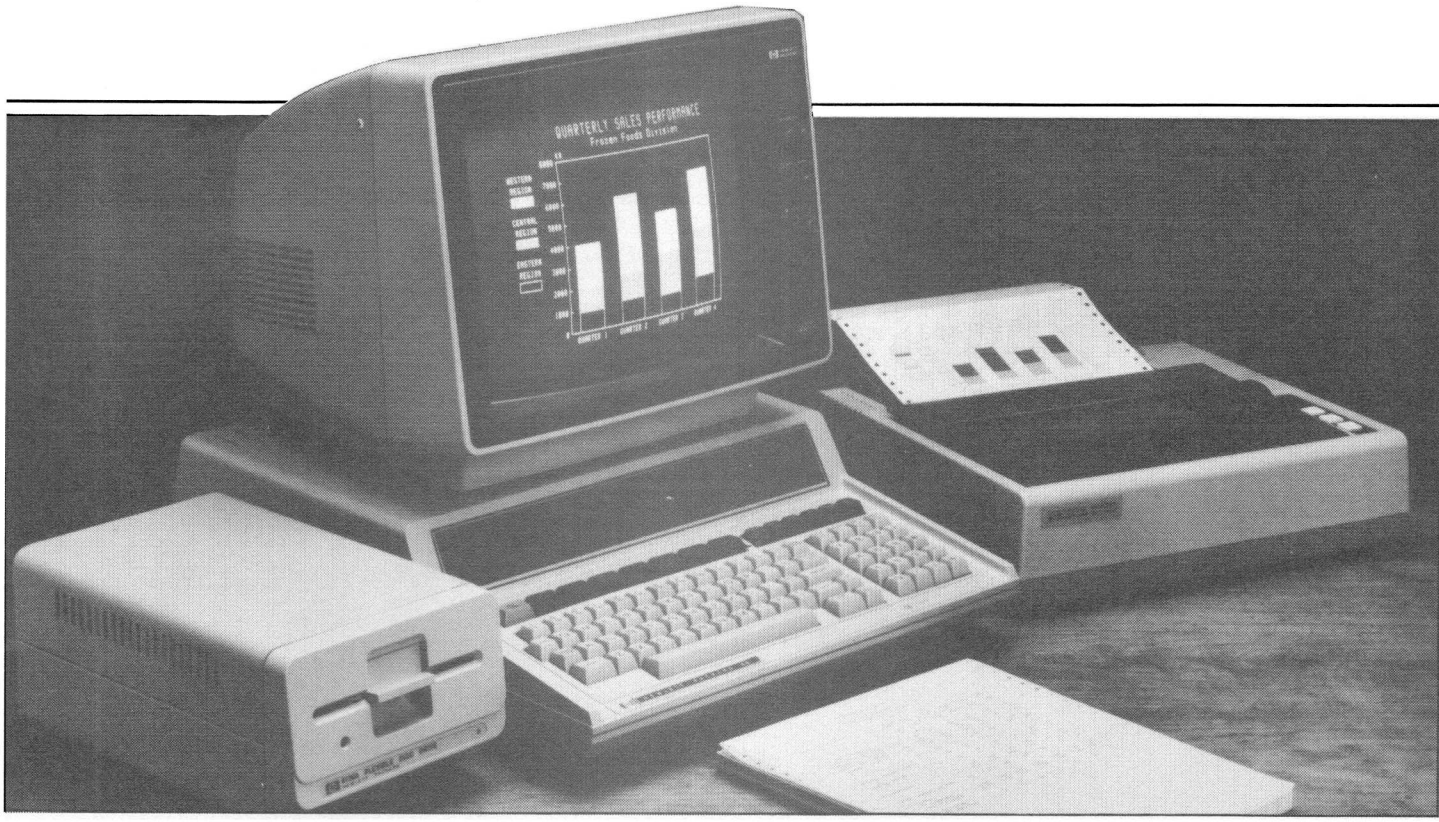
Input errors are signalled on the screen and audibly by a tone which can be disabled by the user. A feature which irritated me is that use of the reset key clears the screen but not the main memory. To do this an additional 'SCRATCH' command must be entered after resetting.

This would, however, be useful to a programmer working on a section of a large program though less so when running applications software. The usual function of the shift key is reversed on Series-80 computers, the normal mode being capitals, depression of the shift key giving lower case.

While useful to the professional programmer it is initially confusing to those used to typewriter keyboards. A "caps lock" is provided which locks down and restores the normal order of lower case until the shift key is used. A minor improvement would have been the inclusion of an 'engaged' light in this key.

The only HP applications program available with the machine was 'Hewlett-Packard' VisiCalc Plus. Visicalc is a large program requiring a lot of memory, our '86 had 128K RAM and in capacity terms had space

The CP/M manual could be taken as a standard primer



Display: Choice of nine or 12 inch monitors

to spare for the standard 63 column by 254 row VisiCalc.

A 13 column by 35 row data file, approximately 7.6KB, took a lumbering 45 seconds to load and a further 20 seconds to calculate, a lumbering total of 65 seconds.

The disc access time is slow which makes me wonder about the HP-86's ability to make great use of all that memory expansion, the answer presumably lying in hard disc.

Apart from this, VisiCalc is especially easy to use on the HP-86, the use of command keys being very logical. There is a help request and the abbreviations for the various VisiCalc commands scroll through at the top of the screen. There is also a 'home' key which returns the cursor to A1.

I used VisiCalc Plus to produce piecharts and line graphs directly from VisiCalc data, setting up being very simple by selection of displayed options. But on the debit side the graphics display was less than high resolution and piecharts were reproduced as confusing elipses.

HP-87 graphics run on the '86, display an eliptical distortion because of the difference in screen format. HP assure me that '86 VisiCalc is now available.

As one would expect from HP there is full software compatibility across the Series-80 range. When a program written for and stored in an HP-83/85 is loaded into the '86 (or '87) the program is automatically translated into a form the '86 can use. There is of course direct compatibility with HP-87 software, and RAM/ROM modules are interchangeable.

As with most new micros there is a dearth of business software and at the time of writing only HP VisiCalc was available, though by the time you read this HP's own Word 80 and Data 80 should be available.

The availability of a CP/M module allows the '86 to access a wide range of business software. Sumlock Bondain, HP's principal London dealer, has been selling the '86 since September offering Wordstar and Compsoft DMS for business applications. ■

COMMENT

The HP-86 is a well engineered but otherwise unexceptional product. Despite all the excitement about 16-bit machines there remains a large section of the market for whom the 8-bit microcomputer caters quite adequately. This market is increasingly discerning in awareness of price/features — the 'bangs per buck' quotient. Here the HP fares badly, and is overpriced costing £600 more than the IBM Personal Computer and nearly twice the price of a Superbrain. Although very user-friendly, the '86 suffers from slow disc access and the overall impression is uninspiring. It will sell on its name, excellent backup and on media compatibility into existing HP accounts.

This said, HP micros have been described as appealing to the 'Volvo' temperament and it is significant that I have yet to hear of a seriously dissatisfied HP owner.

SPECIFICATIONS

HP-86: Small business/scientific microcomputer.
Processor: HP's own 8-bit, 64 register chip.
Memory: 64K RAM, 60K user available, expandable to 512K.
Mass Storage: One or two 5.25" disc drives, 270KB each.
Display: Choice of nine or 12 inch monitors.
Interfaces: Two disc drives and parallel printer port.
Additional interfaces are available for RS-232.
HP-IL (interfacing HP calculators), HP-IB (IEEE-488 standard), GP-10 (wide data path interface) and BCD (binary coded decimal).
Plug-in modules: RAMs: 64/128KB. ROMs: Plotter/ Printer, Mathematical Matrix, Advanced Programming, Assembler Language and Input/Output for control applications. A CP/M ROM module is available giving access to CP/M based software.
Operating system: HP's, CP/M.
Main Language: HP Basic.
Media Compatibility: With HP's 83, 85, and 87.
Delivery: After 'soak testing' usually within 48 hours, through 53 strong dealer network across the UK.
Training: Depending upon the application, dealers will assume responsibility.
Warranty: 90 days.
Engineering Support: From HP, on-site maintenance approximately 17.5 percent of equipment value, return to HP service centre 12.5 percent. (Normal turnaround three days.)
Sumlock-Bondain, the large London Dealer operate an approved contract of their own at 15 percent. Service is also available on an as needed basis, on-site or return.
PRICE: With 64K RAM, 12 inch monitor, twin disc drives and CP/M module, £3162.40 (exc. VAT). There is no free software other than a demo disc.

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CIRCLE NO 122

COMPUTER

Can it seriously da

Don't let yourself or your child turn into a "code junkie" warns Dr Chris Reynolds of Brunel University. And over the page Josie Adams, Editor of Educational Computing, looks at how schools are coping with micros

BECAUSE of widespread misunderstanding about computers there are many hazards ahead for our teenage children. The first hazard is that parents quite naturally want their child to do well and often encourage him or her to take up a career in the new technology. To the ill-informed parent such areas look glamorous and seem to have no disadvantages. This difficulty has occurred in other technologies.

For many years University electronic departments have been faced with the problem of the student who built a crystal radio from a kit at the age of ten or eleven, and was then 'encouraged' by parents to take up a career for which he was, in all other respects, unsuited.

Many parents are now buying home computers for their children and encouraging them to use them because of the career prospects. But there are three main traps. The first is that the child is temperamentally or educationally unsuitable for computer work while the second danger is that many parents do not realise that the kind of education that can be obtained by anyone with £50, a television set, and a few hours to spare can have little commercial value in a competitive job market.

However, the biggest danger of all is the conversion of the child into a 'code junkie'. It is very easy for the bright but socially inadequate child to become addicted to computers. A home computer allows such children to spend hours in the privacy of their room writing programs whose only justification is self-gratification.

Flashing TV screens impress parents (who don't know a bit from a byte), school mates who do not yet have computers, and often teachers (who may have spent less time at a keyboard than the code junkie student). The child soon comes to associate mental masturbation on his home computer with praise and congratulations and promises of a great career.

In many cases the addiction can develop to the point where he becomes ineducable, unemployable and socially unacceptable, except in the company of similar addicts.

And what of the use of computers in education. If the school is already using the computer for teaching a range of different subjects there should be few problems. Unfortunately few schools can afford to do this on any worthwhile scale.

Most schools have little contact with working computer systems and appreciation courses which limit their practical side to mathematical applications, games and programming, can give a misleading view.

Appreciation courses and introductory books which concentrate on how computers work, or are programmed, rather than what they do, should be avoided.

Schools are now putting on courses designed to teach the basics of computer technology to students who want to specialise in this area. What is taught is strongly influenced by the current adult view of the present technology and employment needs. What relevance this may have to the computer systems they may encounter during the whole of their working life is uncertain.

It would be nice to think that children only specialise in O- and A-level computer science after they had satisfactorily completed a computer appreciation course. In fact most probably take the course because of the fashionable course title!

One other problem is that the rapid advances in computer hardware, that have led to the cheap microcomputer, have not been matched by equivalent advances in software. The computer industry is just over 30 years old. Basic, the most widely used computer language on home and educational computers, is 20 years old.

The idea that a programmer should have to 'peek' or 'poke' in machine code was widely recognised as being

PHOTOGRAPH BY RICHARD WAITE

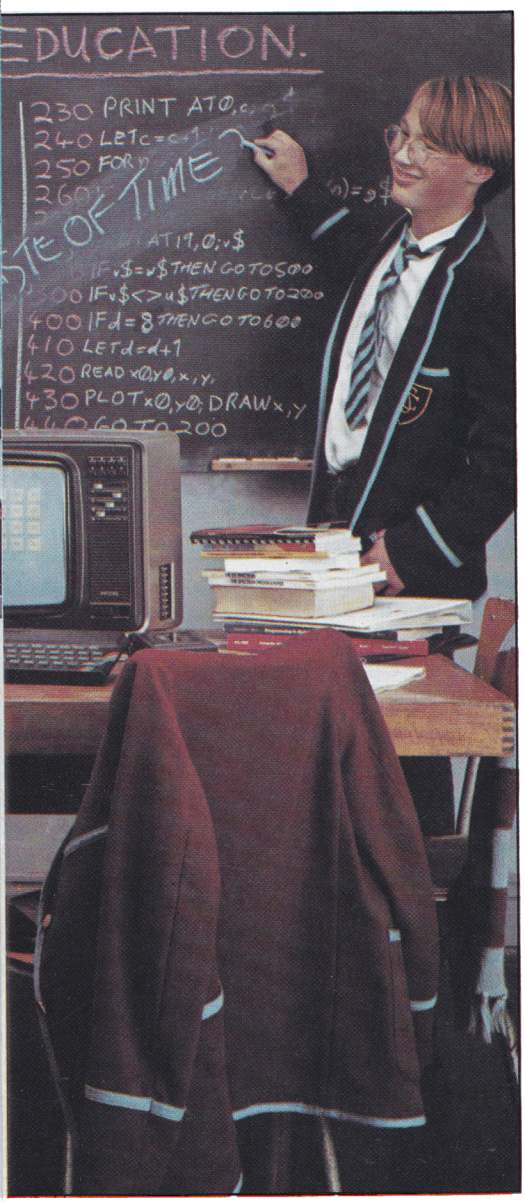
technologically primitive by the late 1960's. Even block structured languages such as PASCAL, and some modern Basics, represent little more than some of the ideas of Algol 60 presented in a more user acceptable framework dating from the mid 1970's.

Students with computer experience gained at school or at home often have to be 'retrained' when they enter university, to help them to forget the anachronisms they have learnt.

This problem of technological lag is a serious one in areas developing as fast as the computer industry. The

EDUCATION

mage your health?



difficulty arises because as people become older their powers of imagination decrease, while their experience increases. The social structure of most organisations is based on this assumption.

Staff who adapt to the then existing technology best, and do good work, get promoted to a position where they are responsible for developing the next generation of students, etc.

Unfortunately those who most fervently support the existing technology may well not be the best to assess or control it when changes are happening extremely rapidly.

In about sixty or seventy years' time most grandparents will be able to tell their grandchildren how they learnt to count on electronic teaching toys at the age of 3 or 4. However, their grandchildren will more than likely be totally unimpressed. By then the role of microcomputers in education will be taken for granted.

Once this stage is reached society will have fully adjusted to the computer revolution. In the meantime the introduction of easily accessible computer based systems of all kinds will put considerable strain on our education system.

These strains arise because children learn faster, and have much more imagination, than do their parents and teachers. Unfortunately the books, courses, languages and computers the children encounter while learning are, and will be, designed by adults who probably didn't know what a computer was until their teens, or even later!

Exactly how things will develop is hard to predict but it is important to be aware of the danger areas for the current generation of teenagers.

The widespread myth about the importance of programming is a millstone around the neck of the computer industry. If you ask almost any adult who is not closely involved with computers what they know about this new technology, you can be certain that programming will come at the top of the list of things they mention.

Errors — such as zero value bills — will also be mentioned.

It is easy to see how this has happened by looking at the history of another technology. During the 1840's most people in England were farm labourers. What would such a person have said if you had asked him about railways? He would probably have referred to the foul mouthed overpaid navvies, great ditches and embankments of mud, and disruption, black smoke and smuts, and noisy machines that frighten the livestock.

The very concept of the railway as a means of transport meant nothing to someone who had never been more than a couple of hours walk from his home village.

In fact the typical modern adult's understanding of computers is at the same level as a 19th century farm worker's understanding of railways. He confuses all the disruptive effects of the new technology with the technology itself, and is impressed by the superficial flummeries.

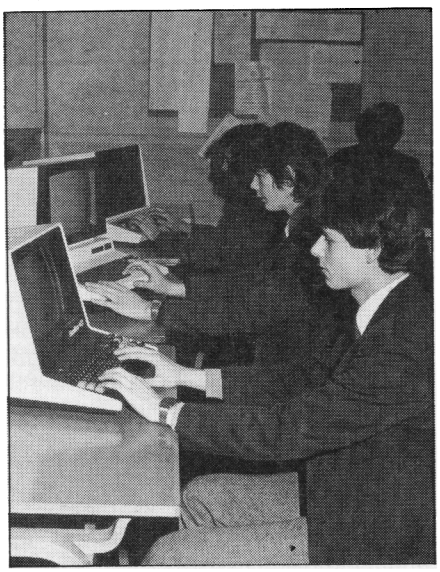
Few Luddite critics of the railways would have guessed that the mechanical transport revolution would lead to the giant earthmoving equipment that has made much of the work of the navvy redundant.

Few modern adults realise that writing programming code will also become redundant as the technology advances.

For parents, teachers and others interested in the impact of microcomputers on education, I have the following advice. The sooner children are introduced to practical working computer applications the better. They should take digital watches, pocket calculators, teletext, computer aided teaching and computer games for granted.

Avoid anything that encourages children to think that programming and computers are synonymous.

Above all, make sure that they realise that writing games in 1960's computer language is little more than a time wasting fun activity, like listening to pop records, or building plastic model planes. To a computer scientist of the future, the ability to write programs will be as relevant as the ability of an airline pilot to fly a kite. ■



Strains arise as children learn faster

THE GENIUS YOU CAN TAKE TO BREAKFAST.

Now, at last, real portable computer power. The new Sharp PC 1500 pocket computer. A pocket-sized genius that will travel with you to conferences, seminars and business breakfasts.

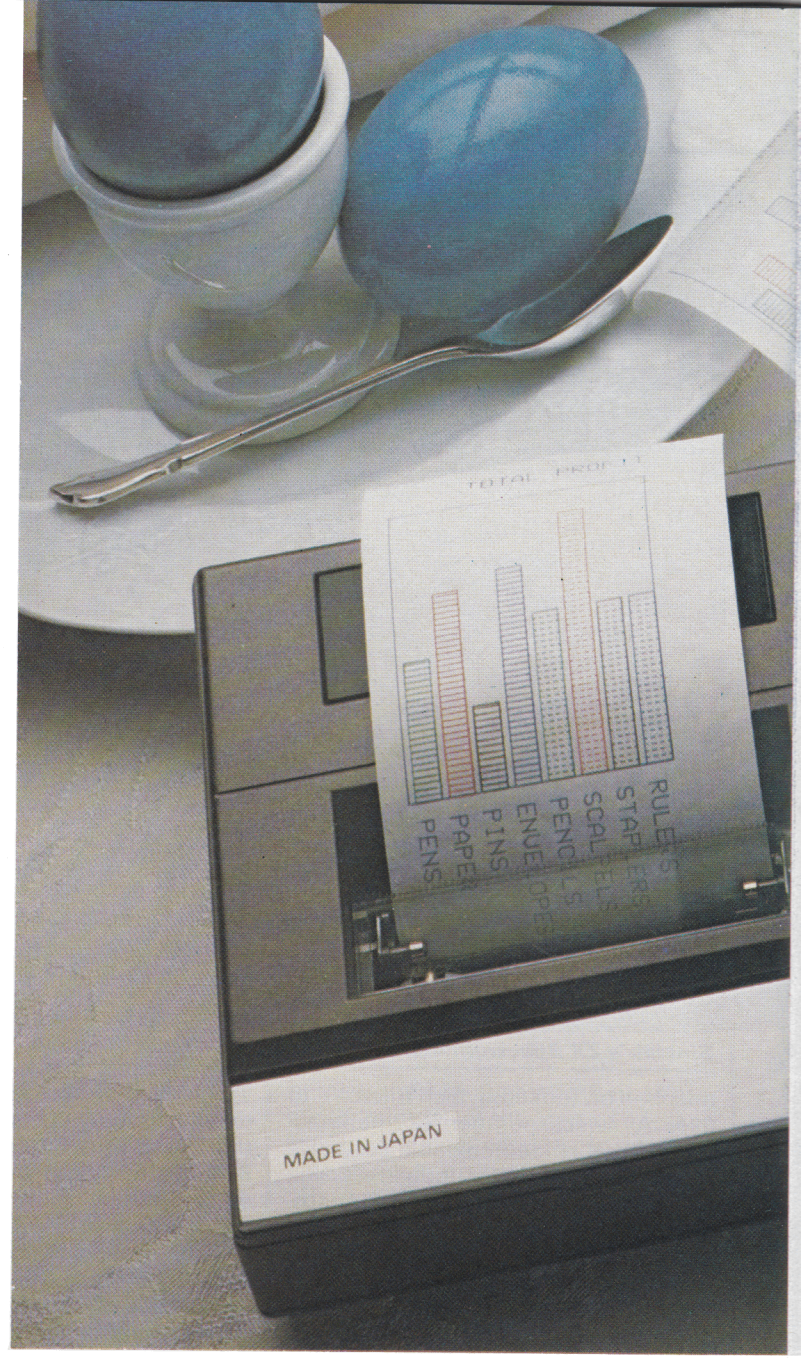
The PC 1500 has the capacity and BASIC language usage that is very nearly that of the desk-size Personal Computer. When fitted with the optional 4-colour graphic printer, it is one of the most powerful pocket computers on earth.

Chores can be handled swiftly and accurately any time of day, wherever you happen to be. Estimates, records and charts of sales, billings and other important data can be re-programmed, calculated and summoned at the touch of a button. It can even play blackjack, analyse your biorhythms or give you a beeped reminder of a scheduled meeting.

Large memory capacity, up to 11.5K bytes. 4-colour print-out. Six user-programmable keys.

The incredible new PC 1500. A revolution in pocket computers.

From Sharp. Where great ideas come to life.



SPECIFICATIONS PC 1500

Number of calculations	10 digits (mantissa) + 2 digits (exponent)
Program language	BASIC
CPU	C-MOS 8-bit CPU
Capacity	ROM: 16K bytes RAM: 3.5K bytes expandable to 11.5K bytes
Memory protection	C-MOS battery back-up
Display	7 x 156 dots mini-graphic display (English upper- and lower-case letters, numbers, special signs, etc.)

CE 150 Colour Graphic Printer/Cassette interface (Optional)

Colour Graphic Printer	
Power source	Built-in rechargeable battery
Printing digits	Standard 18 digits (36, 18, 12, 9, 7, 6, 5, 4 digits selectable)
Printing system	X-Y axis plotter system
Printing mode	Graph/Text switchables
Character sizes	9 different sizes from 1.2 x 0.8 mm to 10.8 x 7.2 mm (from 1/16" x 1/32" to 7/16" x 9/32")
Printing colours	Red, blue, green, black
Printing directions	Right, left, up, down
Minimum step width	0.2 mm (1/64")
Cassette Interface	Up to two cassette tape recorders can be connected

CE 151 Memory Module (Optional)

Capacity	4k-byte C-MOS RAM

CE 155 Memory Module (Optional)

Capacity	8K-byte C-MOS RAM

CE 153 Software Board (Optional)

140 key soft-touch definable keyboard

CE 152 Cassette Recorder (Optional)

Audio cassette recorder to match PC1500

CE 159 Battery Back-Up Memory Module (Optional)

Capacity 8K-bytes, will retain memory contents when removed from PC1500.

CE 158 RS 232 Interface

RS 232C Interface also incorporating Centronics parallel interface.

ZX Databases

TO prove that the ever-so-humble ZX81 and ZX Spectrum really are exceptionally capable computers I've been running three data management programs by wizard John Campbell, of Campbell Systems fame.

His original Sinclair filing program **Database** showed that the ZX81 with a 16k memory pack really could be used as a very fast electronic filing cabinet. It displays facts on the screen — or sends them to a printer — in five different patterns.

The program will search for any item you put in — a name, an address, a particular code or combination of codes, or even a segment of text. And it gives you your answer in a fraction of a second — that's because the main searching job of the program is all written in machine code, so the computer doesn't have to try and unravel what you mean when you give it your search instruction. You are, in effect, not typing your instructions in Basic or English (although it looks like that on the screen) but you're actually responding in the bits and bytes of the computer's own binary language.

The program always prompts you with what to do next, whether you're starting a search through records to discover a particular item, or maybe adding records to those already there. And if you're scrolling through records, an END sign is prominently displayed when there are no more to look through.

Just a couple of examples of the search facility: If a record has the word Pocahontas in the Text section, and another record has Honey-Pie as a Text item, you can search the Text areas for 'Hon' and the program will give you both those records in reply. If you search the Text field for 'Hone' or 'Poc' you'll get just one or the other. If one record has codes ABCDE and another has 103E, you'll get both if you search for code 'E'. You'll get the first one if you search for 'A' or 'EBEA', but not if you're looking for 'ABCX' as the search facility finds only those records which qualify on every character.

The number of records you put into **Database** depends only on the amount of memory which you have available, and the size of each record. I've put in several hundred records — in my case I was keeping track of the various automatic facilities on about 130 different cameras, and 120 photographic lenses.

The codes by which I categorised them all consisted of the letters A to Z, and as that wasn't enough I then moved onto inverse-video letters and graphics characters, and then numbers as well to indicate prices of equipment. So I could search out in just a second or so any equipment which cost, say, up to £100, had an automatic Pentax-screw diaphragm, manual shutter speeds and could be fitted with a bulk-film back. And to do that I'd simply type-in first of all '3' (the search facility) then I'd be prompted on the screen by N = Name A = Address T=Text I=Ints (short for interest codes). I'd type 'I' to tell the computer I wanted a search of interest codes, and it then prompts 'Give details'. Then I'd enter '1PM■' and the reply would come up on the screen before you can say almost anything.

The main difference is that besides simply listing records and then searching through them, **The Fast One** — or TFO for short — allows you to plan out how your records should appear on the screen. Instead of using the five predetermined formats 'F' 'L' 'A' 'I' and 'T' which Database provided for full or name-and-address presentation, and so on, you can define exactly what you want your records to look like.

Not only that, but you have up to 36 different choices of your presentation, which you can label from 0 to 9, and from A to Z. Then within those 36 different styles of presentation you could provide each type of screen display with up to 36 separate fields of data, defined once again by the numbers zero to 9, and by the letters A to Z.

Still with me?

These databases can compare with others costing ten times as much

Compare that with the grunt and grind of disc drives clacking and grumping as they churn through the data — they'd typically take at least four times as long to find anything.

Most of this eulogy so far has been in the past tense, because after completing the super-value (now only £8) **Database,** John Campbell immediately started work on a hugely enhanced version called **The Fast One** — now where did he get that name . . ?

But this really bewildered me when I tried it — it's only now (nine months later?) that I properly understand it! But I'm a very dim and uncomprehending clod — anyone else would probably have mastered it aeons ago. Though John does say he's been berated for his minutely explanatory ten-page leaflet, which has now expanded to eleven, since he's added a full-page 'training example'. The documentation is meticulously exhaustive, but it's not exactly quite as conversational as I need it in order to understand its many facets.

The main menu — which, like Database, pops up as soon as the program is loaded — offers eleven different possibilities. They are Add a record; Update a record, Delete a record; Select report — now that's what threw me: the difference between a report and a record; Select records; Display/Print; Total/Average; Define Item; Format report; Spare Bytes and lastly Save the whole thing to tape again.

The massive amount of compressed machine code means that the program runs phenomenally fast — and hence, of course, its name. **The Fast One** costs £12 — a similar style of program, like, for instance Visidex for the Apple computer, costs around ten times as much.

But now, the pièce de résistance — John Campbell has now written an improved version of TFO for the Spectrum. It's called **Masterfile,** and needs the 48k version of the microcomputer as 7k is used for the really remarkable display and the variables, and another 8k of the program contains all the logic — you're left with 33k to cope with all your records.

Besides the immense variety — Paper, Ink, Bright, Normal — of ways in which you can lay out or format the report styles of each data record, the program also gives you the opportunity to draw boxes (specify row, column, depth and width) for added emphasis on particular areas. You can draw rules down and across the screen, too, making your report look exactly like a printed form — and those rules provide extra clarity when you do use a printer.

The most outstanding feature, though, of **Masterfile** is that provision is made to interrupt the **Masterfile** program, and to drop back into Basic at any stage. This gives you the opportunity to actually manipulate and process the data which you're displaying — just like Visicalc!

The Basic area available for this processing lies beneath line 5000. So you would typically go to 5000 to initialise the totals which you're going to use, then you go back into **Masterfile** to get access to the data within the records.

The program jumps itself into your specified Basic routine at line 6000 to manipulate the data — adding things, multiplying things, providing relative percentages — and then the results are re-integrated into **Masterfile** again at line 7000.

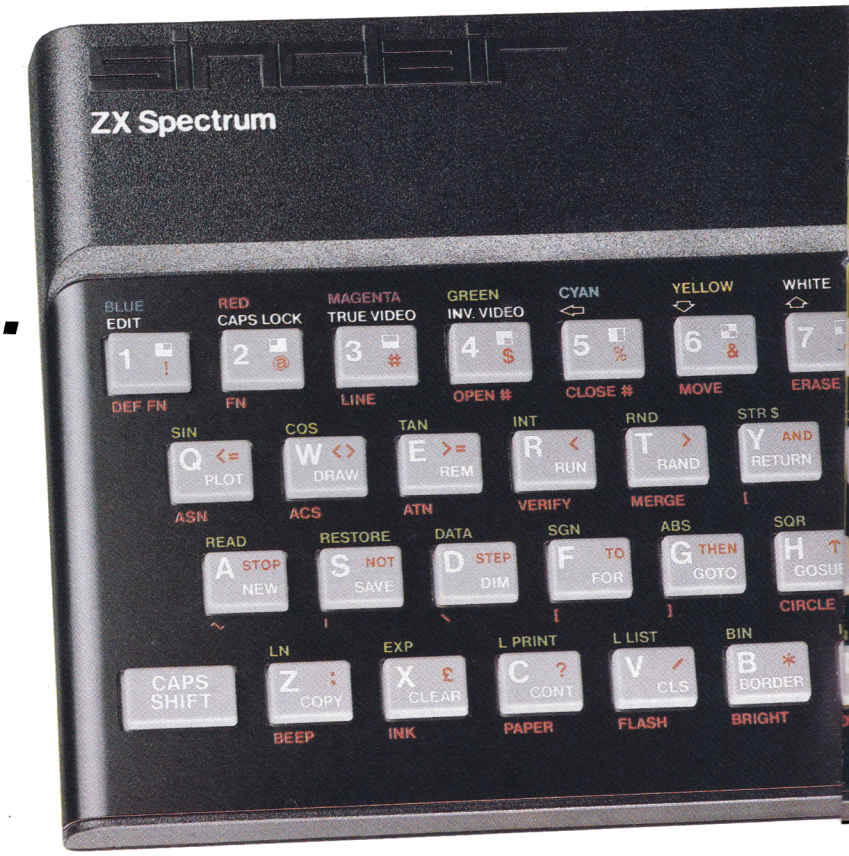
So instead of just a dumb search-and-retrieve routine, as both **Database** and **TFO** are, Campbell's file-handling program for the Spectrum actually performs jobs on the data besides just filing it away.

Masterfile costs just £15. Campbell Systems are at 15 Rouse Road, Buckhurst Hill, Essex IG9 6BL.■

Sinclair ZX Spectr

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.

rum

The ZX Printer – available now

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

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

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

The ZX Microdrive – coming soon

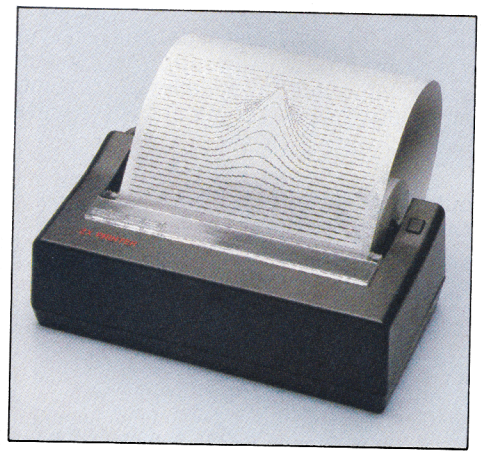
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

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

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

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

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



ZX Spectrum software on cassettes – available now

The first 21 software cassettes are now available directly from Sinclair. Produced by ICL and Psion, subjects include games, education, and business/household management. Galactic Invasion... Flight Simulation... Chess... History... Inventions... VU-CALC... VU-3D ...47 programs in all. There's 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.

RS232/network interface board

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

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

CIRCLE NO 127

sinclair

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

How to order your ZX Spectrum

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

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

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

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FREEPOST – no stamp needed. **Prices apply to UK only.** **Export prices on application.**

ZX Soft is our regular column concerned with Sinclair's ZX range (ZX 81 and ZX Spectrum). This month Steve Langford looks at some new tapes from Mill Sell and Serious Software

MANY of you will be delighted to know that *Which Micro?* has had the same problem as the rest of you. We also cannot get our hands on a Spectrum!

What we did do was to raid the *Computer & Video Games* office and 'borrow' their machine for a while. I was just getting the hang of it when they wanted it back but we have now got our own.

I must say I have been quite impressed with the thing itself and the standard of software already available.

Rise and Fall and **Safecracker** are the names of two programs on one tape from Mill Sell for a 48K Spectrum.

Rise and Fall is a game in the Kingdom or 'meglamania' genre.

In this version you have to run a toy factory (shades of Christmas?) for as long as possible.

Factors that you have to consider are: How many staff do you need? How much money is going to be put into existing lines and how much in developing new ones?

If that is not enough the computer can throw a few spanners in the toy works. These include machines falling to bits, fire and inflation.

There are three levels of play each throwing in more spanners.

Mill Sell have made good use of the computers graphics with this game but I disliked the way in which the computer arbitrarily gave you more staff in the middle of the year. This tended to throw out any calculations that you had made beforehand.

The game also gave you no say in how much to pay the workers. I'm sure that there are a number of unions around that would be delighted to talk to this company. Whatever the workers demanded they got.

Apart from the above this was generally a well put together game that I enjoyed playing.

Safecracker on the other hand made far more imaginative use of the Spectrums graphics capability.

You are given the chance to break a numeric code on a safe. But beware there is a time limit and if you exceed it the alarm rings and the police arrive and jail you.

Similar to the game *Mastermind, Safecracker* displays different signs depending on if you have the right number in the right place or whether it is the right number in the wrong place. There are five levels of play each adding an extra number as they get harder.

Rise and Fall and *Safecracker* are available on mail order from *Mill Sell, Clock Mill, Measham, Burton upon Trent.* The cost of a tape is £5.

Our last tape for the Spectrum this month comes from Serious Software and is for the 48K version. There are four games on one tape, **Reverse, Startrek, Supermind** and **Quest.**

In the first game, *Reverse,* a sequence of nine numbers are printed on the screen. Your objective is to rearrange the numbers in ascending order in the least possible moves.

This is done by reversing some of the numbers every time until they are in the right order, eg 873125469 reversing four of these numbers will give 137825469. There is a knack to this program and once you have cracked that it becomes quite boring.

Startrek is a version of the standard 'trek' game in which you are given a grid universe to explore while doing battle with the Klingons and saving your starbases from total annihilation.

The Enterprise has long and short range scanners, phasers and photon torpedoes and warp drive. Navigation was a bit hit and miss as there was no navigate command available. You do have to be quick to destroy the Klingons and firing phasers uses up your energy at a remarkable rate. You can, of course, refuel the Enterprise at the nearest starbase. Good graphics and fun.

Supermind is as it sounds a Mastermind game. You can select the number of colours, up to a maximum of nine, to decode.

I found it slightly difficult to distinguish the colours making this game a little difficult to play, and there was no facility for giving up and asking the computer what the colours were. This meant that you could go on *ad infinitem* and still not get anywhere.

The last program on this tape is an adventure game called *Quest.* The object here is to collect as much treasure as possible in a finite complex of rooms.

You will have to fight the wandering monsters though, and to do this you are given 10 arrows and three wishes as well as your bare hands.

I found it impossible to explore the dungeon at a reasonable pace for as soon as you exit the first room a veritable hoard of monsters descend out of the darkness one after the other.

I managed to kill 15 monsters in three minutes and moved a total of three rooms before I caught my last breath. Unfortunately this did tend to spoil the point of the game and I only played the game a few times before giving up on it.

This is a word only game with no graphics.

Four games on one tape must be considered good value but I wish the standard was slightly higher. *Startrek* was the only game I would play again.

These are available from Serious Software, 7 Woodside Road, Bickley, Bromley, Kent. It costs £6.95. Supermind, Quest and Reverse are available for the 16K Spectrum at £5.50.

Two tapes arrived recently that were unusual because both were for a **1K ZX81.** Tape A has 10 1K games programmed in machine code. The 10 are **Connection, Galaxians, Canyon, Asteroids, Astro Blaster, Defender, Squash, Scramble, Sketch** and **Cosmic Raider.**

All of the games are of a high quality considering the memory limitation. I especially liked the *Defender* and *Scramble* programs.

Tape B is 10 Basic programs which include **Space Shuttle, Bi-Plane** and **Destroyer.** These tapes are really good value for money and I can highly recommend them to all owners of the 1K machine.

Tape A costs £3.50 and Tape B £2.50. If you buy both the cost drops to £4.25. They are available from **Ian Morrison, 17 Winton Circus, Saltcoats, Ayrshire KA21 5DA.**

Finally I would just like to wish you all a good Christmas and New Year — why not write to ZX Soft either just for the hell of it or with tapes for review: **ZX Soft, Which Micro? Petersham House, Hatton Garden, London EC1.** ■

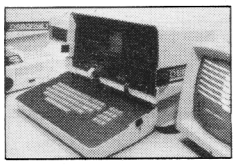
NAME	PRICE	USE	RAM	COLOUR	CPM	LANGUAGE	INTERFACE	SUPPLIER
Cromenco Personal Computer	£1095-£1795	Business Education	64K	No	Yes	Basic Cobol Fortran	RS-232	Comart 0480 215005

COMMENT: Three piece system including software and optional printer. Ergonomically designed keyboard which is detachable and the 12in monitor shows an 80 character by 25 line display. The single 5¼in floppy disk drive has a capacity of 390K. At £1795, this outfit also includes a 120 characters per second daisy wheel printer.
SOFTWARE: The Cromenco Personal Computer is supplied complete with a word processing package and a financial spreadsheet, so it's ready to use. Plus the vast range of CPM based software available when you need it.

Sanyo MBC1000	£1195	Business	64K	No	Yes	Most	RS-232	Sanyo Watford 46363

COMMENT: Three piece system with typewriter style keyboard and numeric keypad, that is detachable from the computer and monitor. Double, sided, double density disk drive. Five programmable function keys.
SOFTWARE: Using CPM gives a choice of 2000 plus packages.

Osborne 1	£1250	Business	64K	No	Yes	Basic Most	RS-232C IEEE 488	Osborne 0908 615274



COMMENT: First of the truly portable micros that comes with its own built-in case to produce a weatherproof package. The keyboard folds down on the computer to form a lid with the total package weighing 24lb. Standard typewriter style keyboard with separate numeric keypad. Built-in twin 5¼in floppy disk drives producing up to 60 pages of typed text on each disk. Small monitor measuring 5in across fitted in between the two disk drives providing a 52 character window on a 128 character line. Optional extras include modem, battery pack and double density disk drives.
SOFTWARE: The Osborne comes complete with CPM as its operating system, plus Wordstar including Mail Merge, Supercalc, M & C Basic. £800 worth of software in a micro costing £1250 complete. Plus the possibilities of using CPM, the most popular operating system in the world for any extra software you need.

Hewlett Packard HP86A	£1251	Business	54-500K	No	Yes	Most	RS-232	Hewlett Packard 03446-3100

COMMENT: Desktop micro using separate disk drives for program loading and a separate monitor. Typewriter style keyboard with separate numeric keypad and 14 user definable function keys.
SOFTWARE: The HP86A uses the Hewlett Packard Series 80 software including statistics and engineering packages costing from £68 to £143. There are also four specialised programs for the HP86A. These are Visicalc Plus £178, Graphics Presentation £178, Basic Training Pack £68 and Word 80 £178. Plus the vast range of programs under CPM.

Compucolor 11	£1275	Home Education Business	64K	Yes	No	Basic	RS-232C	Dyad Developments 08446 729

COMMENT: Single piece micro with single disk drive and colour monitor with detachable keyboard. Typewriter style keyboard with options of boards with special function keys or numeric keypad. Standard keys have clearly marked dual functions. Extensive colour graphics facilities.
SOFTWARE: Range of programs in Basic available.

Andromeda 12L	£1299	Business	64K	No	Yes	C-Basic	RS-232	Kram Electronics 0533-27556

COMMENT: The Andromeda has twin 5¼in floppy disk drives mounted alongside the monitor, while the keyboard is separate and has typewriter style plus a numeric keypad. There is also a light pen facility.
SOFTWARE: Using CPM there is a choice of over 2000 programs available including Wordstar.

Mimi 802	£1350	Business Education	64K	No	Com-patible	Most	RS-232C	British Micro 0923-48222/43956

COMMENT: British made micro with twin double sided, double density 5¼in disk drives included in the price. Colour coded keyboard with numeric keypad and 17 programmed function keys. Options include a Winchester hard disk, high resolution graphics and matching monitor with choice of orange or green display. Disk format conversion facility. Light pen socket.
SOFTWARE: Mimi uses OS/M as its operating system, which is compatible to CPM, so there is a wide range of programs already available including Wordstar. British Micro are developing Trojan — a major software innovation that simplifies the learning process and makes creating programs simple. British Micro are already using this product themselves to generate new programs for the Mimi.

TRS-80 Model 111 Business	£1399-£1699	Business	48K	No	No	Basic Cobol Fortran	RS-232C	Tandy 0922-648181

COMMENT: Desktop machine incorporating 12in monitor, one or two 5¼in disk drives and a keyboard with separate numeric keypad. The TRS-80 Model 111 can be bought with one or two disk drives and an extra two can be added later on. In the USA TRS-80 was the first large selling microcomputer and it had been the largest seller until Sinclair came along.
SOFTWARE: Programs for the TRS-80 are available in a wider range than even Apple packages. Apart from the range of programs from Tandy, Molimerx have an extensive range of software for this micro. Most of the independents also have TRS-80 programs.

Signet 202S	£1400-£1750	Business Education	64K	No	Yes	Most	RS-232C	Micro APL 01-834 2687

COMMENT: Compact machine with twin 5¼in drives each 188K. Supplied complete with the Micro Span self-teaching interactive software system, taking the beginner through the entire system in 14 days. Similar version with double sided, double density drives available £1750.
SOFTWARE: Using CPM a vast range of packages are available including Wordstar. The APL Z-80 4.1 Interpreter and Micro Span self-teaching system costs £450. Microtask project development utility £200, Microfile data storage utility £200, Microphot graphics utility £200, Microlink communications utility £200. Microform forms generator £200. Wordstar £300. Mail Merge £100, Spellstar £125, Supersort £125, Calcstar £150. Three compilers are also available for Pascal, Fortran and Basic £200 each.

NAME	PRICE	USE	RAM	COLOUR	CPM	LANGUAGE	INTERFACE	SUPPLIER
Canon TX25	£1450	Business	15-31K	No	No	Basic Assembler	RS-232C	Canon 01-680 7700

COMMENT: Desktop computer using the 6809 processor with built-in 20 column display and 26 character dot impact printer producing red or black originals and two copies. Built-in disk drive for Canon floppy disks, 4in diameter with 8K capacity. The principal use for the TX25 is creating application software.
SOFTWARE: None supplied. User creates the packages in Basic or Assembler.

Galaxy 1	£1450	Business Education	64K	No	Yes	Most	RS-232C	Gemini 02403 28321

COMMENT: Two piece computer with the twin 5¼in floppy disk drives housed separately. Twin Z80 processors with each of the disk drives having 400K storage. 80 column display on monitor — extra — with pixel graphics facility. Cassette and light pen interfaces also supplied.
SOFTWARE: CPM is the operating system chosen for the Galaxy and supplied with each machine you have — Comal-80 structured Basic, GEM-Pen text editor formatter, GEM ZAP Z80 editor/assembler and GEM DEBUG, a de-bugging utility. With the vast choice available, under CPM, you can use everything from Wordstar to the most specialised program.

Tuscan Dual	£1449-£2365	Home Education Business	60K	No	Yes	Most	RS-232	Microsystems 01-405 5340

COMMENT: Supplied with either twin 5¼in or twin 8in floppy disk drives and typewriter style keyboard with 71 keys and separate numeric keypad. Additional monitor shows 64 columns and 32 graphics characters.
SOFTWARE: Using CPM over 2000 programs are available. Plus the Microsystems catalogue that contains over 100 packages.

Kaypro 11	£1495	Business	64K	No	Yes	Most	RS-232	LSI Computers 04862-23411

COMMENT: Kaypro is another portable computer on the lines of the Osborne. However the Kaypro has larger capacity disk drives and a 9in monitor. The keyboard has a separate numeric keypad and there are programmable function keys. The entire system is housed in a steel case with the keyboard folding on top to provide a lid.
SOFTWARE: Although the Kaypro uses CPM, it's supplied with software ready to use. Microplan — a financial modelling package, Select — the latest word processing package and M-Basic a powerful programming language. Options include dBase 11, Spellguard and a whole range of CPM based programs currently over 2000.

Merlin	£1500	Business	48K	No	Extra	Basic	Centronics	CT Maddison Ltd. 0993-73145

COMMENT: A single piece micro combining screen, keyboard and twin disk drives in one unit. The Merlin uses the Z80 chip and has a detachable 76 key keyboard, with numeric keypad and 5 programmable special function keys. The matt green screen provides a 64 x 16 line display. The twin disk drives offer from 200K to 1.5 MB capacity. As extras Maddison are working on CPM, am RS-232 interface, hard disk option and special hi-res graphics.
SOFTWARE: The Merlin uses LDOS and is supplied with Microsoft Basic in ROM. LDOS is Tandys TRS DOS, so you can use the range of TRS-80/Genie software — an extremely wide range.

Research Machines 380Z	£1601-£3347	Home Education Business	32-56K	Extra	Yes	Basic Forth	RS-232 IEEE 488	Research Machines 0865-49866

COMMENT: The RML range has sold largely to schools and colleges with its CPM operating system and wide range of interfaces. It has been included in the Department of Industry Micros in Schools Scheme. The basic micro consists of the typewriter style keyboard with separate disk drives. A wide range of plug-in boards extend the RMLs possibilities. It can be bought complete with monitor and can load programs and data from disks or cassettes. To reduce the cost of an RML outfit, deduct the cost of the drives and load your programs from a cassette recorder.
SOFTWARE: Apart from the vast range of programs available under CPM — currently over 2000 including Wordstar, RML also supply a catalogue of software from a wide range of independent companies. Currently there are over 75 programs covering education, games, commercial and financial programs and statistics. Prices range from £5 to £80.

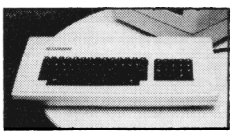
Televideo TS1600	From £1629	Business	128K Plus	No	CPM86	Most	RS-232	Encotel 01-680 6040

COMMENT: Televideo's first entry into the 16 bit world, using the 8088 chip. The TV1600 series range from a single work-station right through to a multi-user system with satellite user stations. The basic 16 bit range comprises the computer including monitor and disk drives in a single unit, with separate typewriter style keyboard and numeric keypad. Options on hard disk storage go to 10Mbytes and more. This 16 bit Televideo can plug-in to your existing 8 bit system.
SOFTWARE: A limited but fast increasing number of business programs are becoming available for 16 bit micros covering most fields.

Hewlett Packard HP87	£1739	Business	32-544K	No	Yes	Most	RS-232	Hewlett Packard 03446-3100

COMMENT: Single piece desktop business micro with integral monitor for 24 line display combined with typewriter style keyboard having separate numeric keypad and special function keys. Can be connected to mainframe computers. Program loading and data storage from separate 5¼in floppy disk drives with hard disks available as optional extras.
SOFTWARE: Accepts the Hewlett Packard range of Series 80 software including statistical and engineering packages, a whole host of programs under CPM, plus Visicalc Plus, Graphics Presentation and Word 80 each £178 and Basic Training pack £68.

Xerox 820 & 820-11	£1750-£2350	Business	64K	No	Yes	Most	RS-232	Rank Xerox Uxbridge 51133



COMMENT: Based on the Z80 chip, the Xerox 820 range is a three part system comprising monitor, keyboard and floppy disk drives. The new 820-11 has a monitor with 80 character display with green on black option. The keyboard is typewriter style with a separate numeric keypad. Though the 820 is supplied with 5¼in drives, 8in drives and hard disks can be used. Provision for communication with other micros making the 820-11 an intelligent terminal.
SOFTWARE: Apart from the range of over 2000 programs available under CPM, Rank Xerox also have a wide range of application programs in their catalogue.

Digico Prince 11	£1790-£5500	Business	64K	No	Yes	Most	RS-232	Digico 04626-78172

COMMENT: Range of British micros mainly single unit construction comprising typewriter style keyboards with numeric keypad and monitor. The models range from the basic without any drives to a combination of 800K 5¼in. floppy disk drive and 5Mbyte hard disk. Extensive facilities for expanding the system to multi-user, multi-terminal use.
SOFTWARE: Apart from the 2000 plus packages available under CPM, Digico also produce a range of packages including ones for company sales systems, company purchase systems, general accounting, lease, rental and hire purchase, name and address, order entry and invoicing, payroll, stock control, time recording, word processing, integrated business systems, sales administration and bills of quantity.