



QL User appears each month within the pages of *Your Spectrum*. Look out too for the 'Complete Dossier' edition — in the shops this July.

The difference between the Z80 and 68008 processors is one of philosophy, contends Simon Goodwin, and not just a matter of a few extra bits

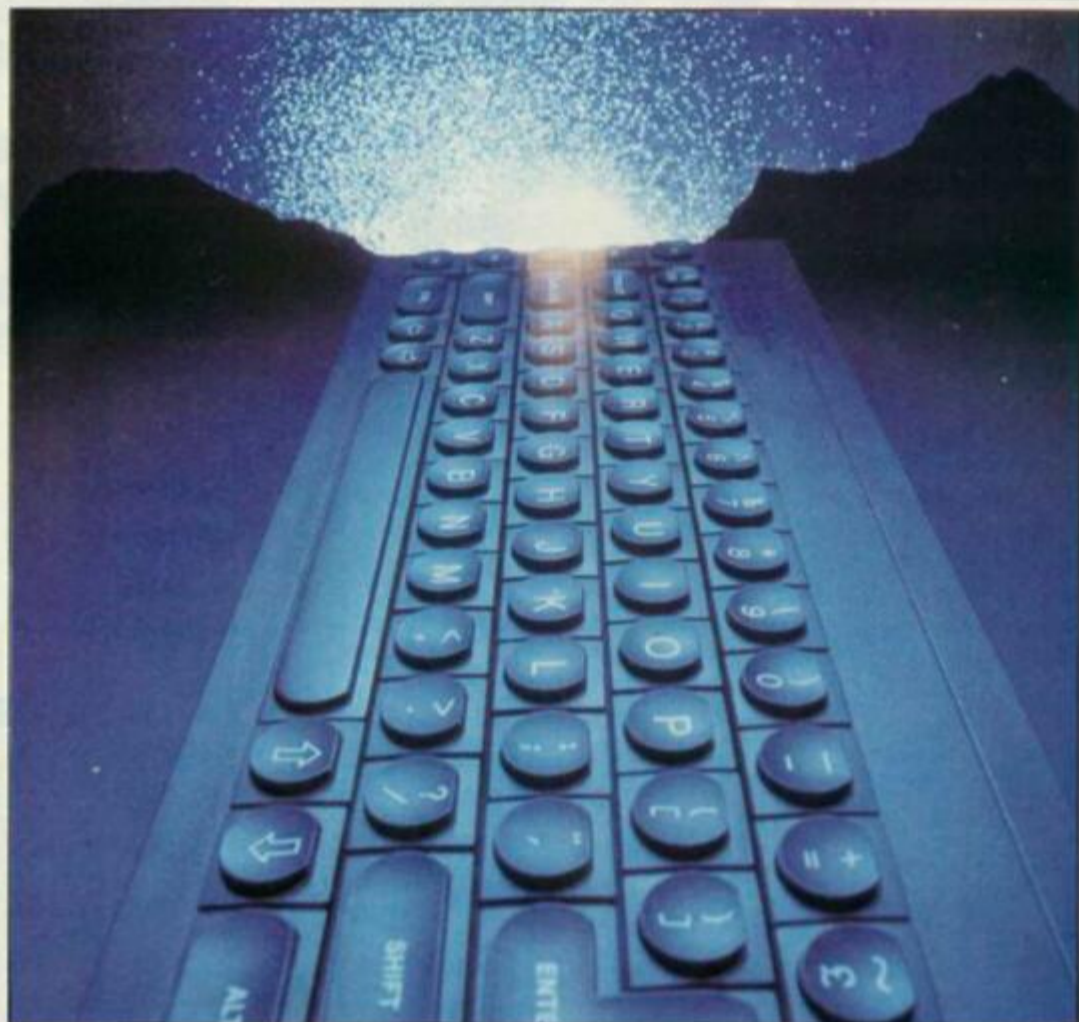
Eversince Sir Clive announced the launch of the QL there's been great fuss over the choice of processor for the new machine. Sinclair Research advertisements describe the 68008 as a '32-bit processor', while journalists rush to their fact-sheets and deduce that, with its eight-bit data bus, the processor is in fact little more than an inflated Z80.

FIRST THINGS FIRST

The first microprocessors were designed in a rather *ad hoc* manner, rather like the first computer programs. A few people thought for a while and came up with the bare bones of design — the internal timing of instructions, the interface between processor and memory, and some idea of the 'logical operations' possible — rotating values, adding, setting bits, and so on. Parts of the design were built up and tested in hand-made units, each comprising of a few hundred 'building-block' chips.

Once the bare bones were established, the race was on to flesh them out as much as possible. In essence, the designers considered each part and tried to work out all of the useful things that could be done with it. In the process they added a few registers, took away an operation, and so on until the chip — the slice of silicon used as a base for the processor — was chock-a-block with transistors. Then they tested everything and produced a book listing the 'instruction set' of the device; if anything didn't work, they just didn't mention it at all!

This approach to processor design was appropriate to the first micros; they were squashed on to quite a small area of silicon, with no room for an elaborate design. The resultant chips were hard work but great fun to program. Just because



A PROCESS OF PHILOSOPHY

an instruction worked in one circumstance didn't mean it would even exist in the next!

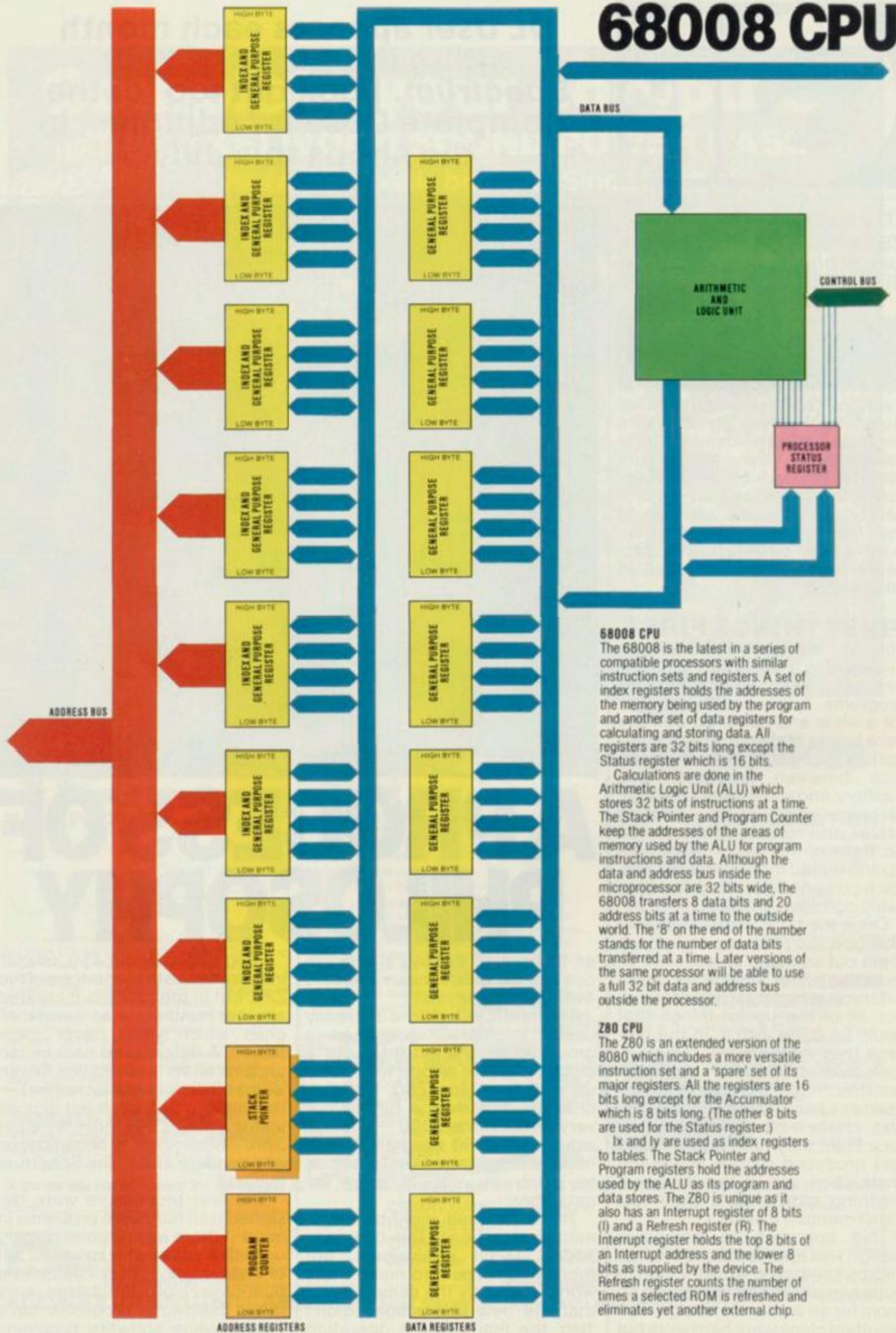
The Intel 8080 was the first really useful microprocessor; then a group of people left Intel, cut a bigger piece of silicon and came up with the Zilog Z80. Not surprisingly, this device turned out very similar to the 8080 — in fact, it would run 8080 programs quite happily. Zilog used its extra silicon to stitch on lots of extra instructions.

The 8080 had eight-bit increment instructions. The company added 16-bit equivalents, but there wasn't room to make them work, i.e. exactly the same way so that the new instructions didn't 'flag' the result of the operation (zero, overflow or whatever).

Zilog added about 450 'official' instructions to the repertoire of the Z80, but in the process it created another hundred or so 'unofficial' ones which were never mentioned! A determined hacker can uncover all sorts of oddities, like an 'eight-bit double and increment' — the missing SLL (shift left logical) instructions: CBH 30H to CBH 37H. These form a conspicuous gap on page 184 of the Spectrum manual!

The first processors were designed with hardware problems in mind — there was no point coming up with a super-whizzo useful set of instructions if they couldn't be built into a chip! In the last ten years these hardware problems have eased, while software problems have multiplied.

68008 CPU



68008 CPU

The 68008 is the latest in a series of compatible processors with similar instruction sets and registers. A set of index registers holds the addresses of the memory being used by the program and another set of data registers for calculating and storing data. All registers are 32 bits long except the Status register which is 16 bits.

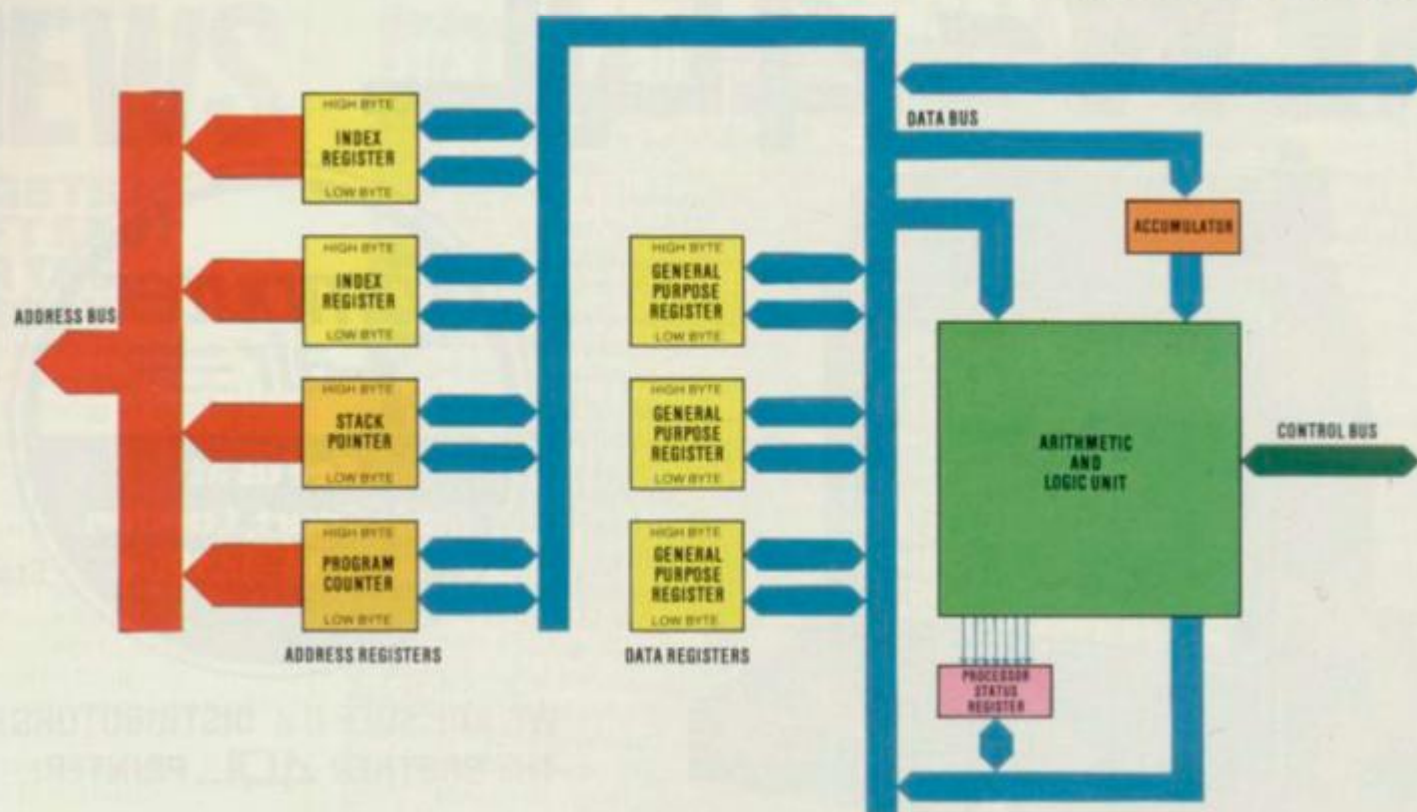
Calculations are done in the Arithmetic Logic Unit (ALU) which stores 32 bits of instructions at a time. The Stack Pointer and Program Counter keep the addresses of the areas of memory used by the ALU for program instructions and data. Although the data and address bus inside the microprocessor are 32 bits wide, the 68008 transfers 8 data bits and 20 address bits at a time to the outside world. The '8' on the end of the number stands for the number of data bits transferred at a time. Later versions of the same processor will be able to use a full 32 bit data and address bus outside the processor.

Z80 CPU

The Z80 is an extended version of the 8080 which includes a more versatile instruction set and a 'spare' set of its major registers. All the registers are 16 bits long except for the Accumulator which is 8 bits long. (The other 8 bits are used for the Status register.)

Ix and Iy are used as index registers to tables. The Stack Pointer and Program registers hold the addresses used by the ALU as its program and data stores. The Z80 is unique as it also has an Interrupt register of 8 bits (I) and a Refresh register (R). The Interrupt register holds the top 8 bits of an Interrupt address and the lower 8 bits as supplied by the device. The Refresh register counts the number of times a selected ROM is refreshed and eliminates yet another external chip.

Z80 CPU



PROGRAMMING PHILOSOPHY

The Z80 was designed specifically for ease of wiring up. The 68000, on the other hand, was approached from the point of view of programming simplicity; part of this ease stems from the fact that you don't have to throw away your programs when you move from one modern processor to a cheaper or faster one.

Motorola designed a range of processors, rather than a one-off. The original 68000 has spawned a number of versions with differing hardware requirements (including the so-called 'eight-bit' 68008 and the '32-bit' 68032) — but they can all run exactly the same software. This is what Sinclair Research is trying to say when it calls the QL 'future-proof'.

On a Z80, every register has its idiosyncracies; only the C register can be used to address ports, only the B register can be used in fast loops, only IX and IY can have an index, and so on. With the 68000 series, however, sets of registers work identically; each can be, for example, an index register, a stack pointer or a counter — the same instructions are available regardless of the register chosen. The data registers of the 68000 family are all 32 bits long, regardless of the way that data is passed back and forth between processor and memory (although this varies between members of the 'family').

This consistency makes it easy to learn the 68000 instruction set;

you don't have to cope with all the quirks of the Z80. The symmetry also makes it easy to fix bugs, alter programs and write compilers — it's much more difficult to write a good Z80 compiler because of the vast range of special cases which must be allowed for before there's any chance of producing the best code.

A good compiler for the 68000 can produce code — from a high-level language such as 'C' — which is very nearly as efficient as hand-written code. That's how QDOS and the most popular 68000 operating system, UNIX, can be written almost entirely with a compiler rather than an assembler. Compiled programs are much easier to write and test than assembled ones.

COMPLEX INSTRUCTIONS

In theory, a 16-bit micro is twice as powerful as an eight-bit machine — it can process twice as much information in a single step. In practice, though, the difference is usually much greater, because intermediate steps are usually needed to convert two eight-bit answers into a 16-bit result. The 68008 produces the 16-bit result immediately.

The 68008 incorporates complex instructions which do in one step what for a simpler processor would take many. For instance, the 68008 can perform 32-bit multiplication and division in a single and fast step. The equivalent pro-

cess would take well over a hundred steps on a Z80. The 68008 doesn't sacrifice flexibility by using its 32-bit registers — each instruction can be used in a 32-, 16- or the more concise eight-bit form.

PIPELINE PERFORMANCE

Another big difference between the 68000 family and the Z80 lies in the way the 68000 reads values from memory. The 68000, like the humble 6502, uses a technique called 'pipelining'. A processor works by fetching instructions, decoding them and then performing the appropriate actions. Whereas the Z80 performs these three actions one-by-one, the 68000 uses a completely separate unit to read instructions so that it can get on with reading the next few instructions while the rest of the processor is working out what the last one meant.

The 68008 has often been criticised because it reads and writes data in small eight-bit sections; a 'true' 16-bit processor would use larger lumps. But the difference in performance between 68000 and 68008 is much less marked than you might expect because the pipeline allows the processor to get on with fetching the data piecemeal while the instruction is being decoded. So, by the time the data is needed, it's usually in the pipeline and the 68008 doesn't have to wait for it to be fetched, eight-bits at a time.

NEW - 4QL

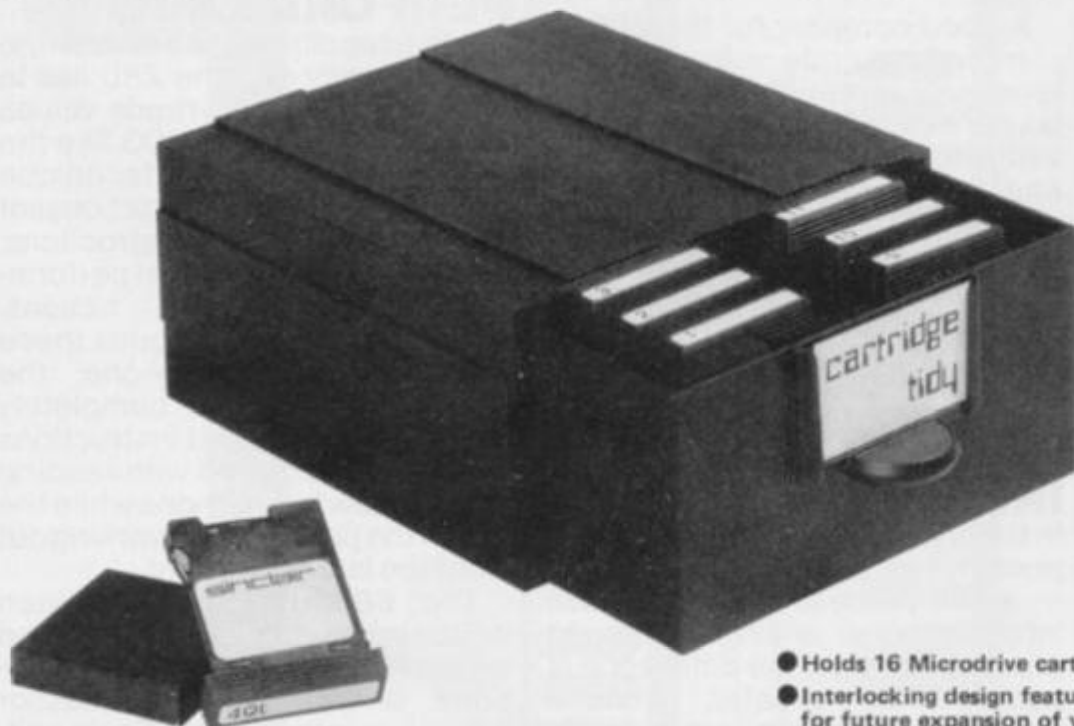


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QL NEWS

QL GETS A SOFT SPOT FOR THE SPECCY

An emulator program for the Sinclair Research QL is currently being written by Manchester computer company, Joe The Lion, enabling owners of the mythical wonder machine to run the full gamut of Spectrum software. It'll come with a cassette interface to allow the user to save QL programs to tape — a cheaper alternative to the relatively expensive Microdrive cartridges. But how is JTL managing to produce such a package when there aren't any QLs available?

Well, spokesman Lawrence Holt reports that a team of programmers involved in the project are "working mostly on paper", which seems to suggest that a certain amount of testing has actually taken place. But Mr Holt would neither confirm nor deny this, saying only that he didn't possess a QL. However, he did imply that it wasn't beyond the bounds of possibility that he might have access to one. £25 all-in, the likelihood is it'll be in great demand. Enquiries to JTL, telephone 061-366 7431.

RUMOURS-VILLE

Our spies report a couple of rumours currently circulating. First, a spokesman from a Midlands computer company tells us that a "private individual in the Birmingham area" is now the proud owner of one of Sinclair Research's new machines, and that this lucky laddie has been allowing a certain local manufacturer to work on the machine from time-to-time — giving a distinct commercial advantage over the rest.

The same source continued his revelations by disclosing that a close 'friend' employed on the QL project is claiming that plenty of the machines have been built and that they're just waiting for the ROMs to be completed and as soon as

SINCLAIRWATCH

IT'S HERE, BUT...

Only four months late, the QL has finally arrived. The latest official delivery date had been "the end of April", but Sinclair Research apparently meant that this was when its Camberley mailing house was to get its first deliveries — the early customers had their happy event a few days later, at the beginning of May. It's difficult to find out how many were delivered, but it was believed to be a few hundred at the most.

Although the number of QLs out there seems small, the number with problems occurring does not. Using the QL on a television — and even some monitors — has produced unstable pictures for many customers; some are also suffering a loss of colour. As everyone expected, the 32K ROM space has indeed proved insufficient, and an extra 9K or so (the so-called Kludge), is supplied hanging off the back.

After such delay, you'd have thought that at least the manuals would be finished — but not so. Although instructions for the Psion packages are supplied, the first customers received no details at all about SuperBasic or QDOS. Also missing is the page containing the pin-out for the monitor socket; so if you haven't got a TV — or the relevant page in the manual — you can't use your eagerly-awaited machine anyway. Presumably, delays with the documentation are as a result of a Basic which seemed to change almost

faster than the projected delivery dates.

Another long overdue event has been the arrival of Microdrive cartridges in the shops — you'll find them in chemists, newsagents, computer outlets, etc, etc. However, for your £4.95, you don't just get a tiny black box with 5p worth of video tape — as you do mail order — buying retail gives you, in addition, a large cardboard box, a plastic inlay, and a little notebook. Curiously, the only thing missing from the over-packaging is any mention of a guarantee or 'returns' procedure, should the thing fail.

NEW ADS FOR OLD

It seems the Advertising Standards Authority has finally got through to Sinclair Research and stopped the company advertising mail order products it cannot deliver. Instead of the old full-colour double-page ads, the QL is now being pushed via single-page black and white spots.

And the wording has been changed from that of its controversial predecessor. Instead of extolling the virtues of the machine, nine compliment quotes from the computer press (YS excepted) are reproduced. They made interesting reading, particularly when you consider the comments are based not on the machine, but on its published specifications.

The fact is the QL doesn't conform very well to the original spec, and ever since

BY GUTTERSNIPE

the release of the machine, it's been difficult to find a good word for Sinclair Research in the computer press — partly because so few devices have been sent out for review. Some virtues are still extolled, but less excessively than before. No more are the Psion programs "more powerful than existing products costing up to £5000", and references to 'Windows' have now been reduced to plain old 'multi-display capability'.

SPOT THE PRICE

When, in the dim and distant past, the QL was first launched, provisional manuals were given out in large quantities for the press to examine. And at the back of this tome was an order form — both for the QL itself, and some of its simpler add-ons. The price for the RS232 lead was put at £10.00, and the QL Microdrives £49.95. Since the RS232 lead has been specified as a 'free gift' for those suffering the long wait, the price has strangely risen to £14.95, and the cost of the QL Microdrive to £59.95.

In fact, the first QLs are supplied with another order form, this one giving a price of £49.95 for the 'drives. You get the impression that if you order by mail, you can claim the lower price, but if you phone-in your order, it rises a tenner for the privilege.

this has been done, they'll be plugged in and the completed units despatched — all of which sounds reasonable enough.

4 YOUR QL...

One of the on-going niggles about the QL is that it can't really be stuffed in a briefcase. So... Quantum Leap Systems has racked its corporate brain and come up with a thing called the 4QL System. It's a terminal that's specifically aimed at the executive and professional user, and it comes in a smart black unit reflecting the design of the QL. It can be used either as a desk-top peripheral base or a carrying case for the QL and its

accessories.

Incorporated in the flash design is storage for up to 30 Microdrive cartridges and it opens out to provide a monitor base with three storage compartments — one for the QL when not in use, one for the cartridges (which has a drawer action) and one for the power unit and cables.

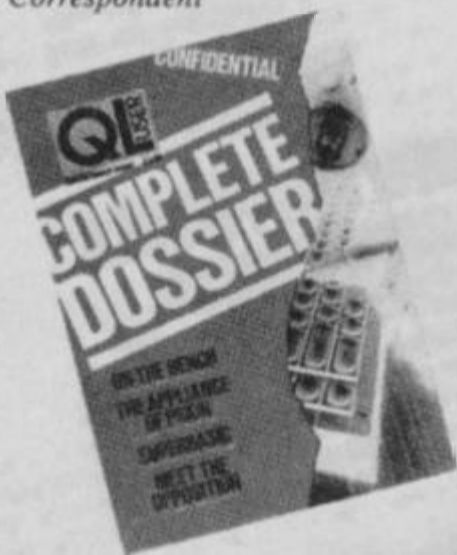
To match up with the 4QL, Quantum Leap Systems is also offering a matching black Brother HR5 printer and two 12-inch monochrome or RGB monitors in black cabinets. If you still need to be further convinced, the 4QL system will apparently be on display at The Computer Fair at Earls Court;

Mr H Hadid, the Director of the company, will be on hand to answer the difficult questions. As for prices, he said, "We haven't decided on that yet — because we don't know whether we'll be selling it as a complete package or as separates. Anyway, full details will be available on the day".

However, life's not all about waiting. For even now you can purchase a Microdrive Tidy from Quantum Leap Systems. This version holds 16 Microdrive cartridges and is priced at £6.99 (including VAT and postage). You can mail order it from QLS at 68 Foxwood Close, Feltham, Middlesex TW13 7DL.

64-Page Upgrade For The QL Available Soon!

From our Computing
Correspondent



For a microcomputer that's only now starting to filter through to customers, Sir Clive Sinclair's latest brainchild, the QL, has certainly managed to scoop up its share of editorial comment in the computing press. But where, one wonders, do they manage to get information from in a situation like this? With so few QL Computers available, magazine staff must have been tearing their hair out wondering where to look next.

And yet, somehow, the publishers of one of Britain's leading micro magazines, *Your Spectrum*, have done just that. *QL User - The Complete Dossier* is what its editor Bruce Sawford calls "a 64-page, no punches-pulled, appraisal of the micro everyone's talking about".

Tracked down to his West End editorial offices, amongst an impressive array of computing equipment (including two of the much-coveted QLs) we found Bruce, who proudly claims "This will be the one you've all been waiting for — whether you're a QL owner or just thinking about it. We're not looking to add to the criticisms of the machine, we just want to give the public what they should have had from the beginning — the complete story".

Complete with exacting tests of the hardware, evaluations of the four Psion software packages, the latest details on the modestly entitled SuperBasic, programs and news, *QL User - the Complete Dossier* has tapped the major computing journalistic talent in the UK to produce a unique look at an innovative product. Following on from the successful Spectrum computer, there are many looking to see where Sir Clive is boldly going... and this could be where they'll find it.

Without question, the QL must be one of the most rumoured of machines ever launched; but, adds Bruce Sawford "This magazine is *not* a rumour; when we say it will be available on the high street shelves within 28 days, we mean it!"

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Rumour turns to fact-latest!

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GETTING ATTACHED TO PRINTERS

In order to overcome the software problems of attaching a 'grown-up' printer to your Speccy, Dilwyn Jones sorts out how you can produce the full character set on such diverse printers as the Star Gemini 10X and the Epson FX80.

STAR GEMINI OUTPUT

The character set produced on the Star Gemini 10X.

```

! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~
* - . : ; < = > ? @ A B C D E
A B C D E F G H I J K L M N O P
Q R S T U RND INKEY* PI FN POIN
T SCREEN* ATTR AT TAB VAL*
CODE VAL LEN SIN COS TAN
ASN ACS ATN LN EXP INT SQR
SGN ABS PEEK IN USR STR*
CHR* NOT BIN OR AND (<= >
= <> LINE THEN TO STEP
DEF FN CAT FORMAT MOVE E
RASE OPEN * CLOSE * MERGE
VERIFY BEEP CIRCLE INK P
APER FLASH BRIGHT INVERSE
OVER OUT LPRINT LLIST
STOP READ DATA RESTORE N
EW BORDER CONTINUE DIM R
EM FOR GO TO GO SUB INPU
T LOAD LIST LET PAUSE
NEXT POKE PRINT PLOT RUN
SAVE RANDOMIZE IF CLS
DRAW CLEAR RETURN COPY

```

Even though the character codes of many printers are different to those of the Spectrum, it's still often possible to hard copy the entire Speccy set. Taking the Gemini 10X printer, first load the tape supplied with the interface, then make the following changes (as directed by that tape) and you'll find that the printer will be able to correctly print the entire character set and listings in the Spectrum's 32-character screen format. The changes to make are as follows:

How many characters per line (80)? 32
What code for backspace (127)? "8"

Now modify the character codes for these characters when prompted:

↑ (up arrow) change to 164
£ (pound sign) change to 195
| (vertical bar) change to 245
© (copyright symbol) change to 203

User-defined graphics A to U
Change the codes to 65 (A) up to 85 (U) so that user-defined graphics come out as upper case letters (as in their undefined state on the Spectrum) rather than lower case letters.

Block graphics Fortunately, the Gemini 10X comes with Spectrum-style block graphics in its standard character set, but the codes are different to those of the Spectrum. You need to make the following changes:

Spectrum code	Printer code
28	32
29	227
30	225
31	231
32	228
33	234
34	229
35	236
36	226
37	230
38	233
39	235
40	232
41	238
42	237
43	239

STAR GEMINI SOFTWARE

The Basic program which sets the Star Gemini's facilities and loads the machine code.

```

10 REM Spectrum/Star Gemini10X
20 REM Kempston parallel
30 REM interface and software
40 POKE 23609,100: REM bleep
50 CLEAR 64735
60 PRINT FLASH 1: " Please wait... "
70 LOAD "printcode"CODE 64736,632
80 CLS
90 PRINT BRIGHT 1: FLASH 1: "
Stop the tape "
100 PRINT USR 65150
110 REM get values to send to
120 REM printer. End of data
130 REM is 0.1
140 RESTORE
150 READ byte
160 IF byte=0.1 THEN LPRINT :
STOP
170 LPRINT CHR# 27:CHR# byte:
180 GO TO 150
190 SAVE "GEM10X" LINE 40
200 SAVE "printcode"CODE 64736,632
210 GO TO 190
220 REM data to set up printer
230 REM reset printer
240 DATA 27,64
250 REM skip over perforation
260 REM for 50 lines/page
270 DATA 27,78,16
280 REM left margin=20 chars
290 DATA 27,77,20
300 REM right margin=51 chars
310 REM (line length=32 chars)
320 DATA 27,81,51
330 REM emphasised print
340 DATA 27,69
350 REM select USA character
360 REM set, character 35=hash
370 DATA 27,55,0
380 REM signal end of data
390 DATA 0.1

```

Newline characters You'll be asked how many codes — combinations of carriage return (CHR# 13), line feed (CHR# 10), and vertical tab (CHR# 11) — the printer needs. This depends on how the little dip switches, visible on the back of the printer, are set up. Look at the switch marked '4' — if you set it to 'on' then a line feed is performed automatically for every carriage return code received by the printer. It's up to you which to use — if it's 'on' reply 1 to the query, and if it's 'off', reply '2'. For '1' enter '13' as the code number'; for '2' enter '13' and '10'.

You've now completed this part of

GETTING ATTACHED TO PRINTERS

the software and you should save it on tape as described in the instructions. Now type NEW to get rid of the Basic part, but do *not* switch off or do anything to erase the machine code in memory.

Now you have to enter the short Basic program which sets up several printer facilities and loads the machine code.

Having carefully checked that all numbers are correct, type GO TO 190, which will make as many copies of the software as you require. The program will auto-RUN on loading. *It would of course be very naughty to break copyright law by making unauthorised copies of the Kempston machine code software.*

When you type NEW, Stream 3 is reset to its default state to drive the ZX Printer. This is why you're told to use the RANDOMISE USR command to reinstate the printer driver software — so it's included here along with the POKE that sets up the keyboard bleep (that I find so indispensable).

When you run the program you may find that some of the characters are slightly different to those on the Spectrum; for instance, the zero is not slashed, although there is enough difference between '0' and 'O' to avoid confusion. The pound symbol looks rather weird but it's still a genuine pound sign, and the copyright symbol appears distinctly squashed. That, however, is a small price to pay for being able to print out the entire Spectrum character set on a printer of this price.

Those who are familiar with the Gemini 10X may ask why I've not made use of the 'download character set' facility. The answer is that only character codes 32 to 26 may be re-defined in this mode and the other character codes above 26 cannot be used and are printed as spaces. Not all the character set can be squeezed into the 'download RAM' area.

Note that the Kempston software, like most others (including the ZX Interface 1), prints an extra space between THEN and any following keyword — it's quite normal and there's nothing you can do about it.

Next we'll consider the case of the Epson FX80, which in its standard state is not capable of printing all of the Spectrum character set; it does, however, have full 'download character set' capabilities so a suitable set may be defined for use with the Spectrum. This has to be loaded into the FX80 every time it's switched on. As before, load the Kempston tape and make the following changes:

How many characters per line (80)? 32
What code for backspace (127)? "8"

Now modify this character code when prompted:

© (copyright symbol) change to 144

User-defined graphics A to U
Change the codes to 193 (A) up to 213 (U) so that user-defined graphics are printed as upper case italic letters (user-defined graphics similarly appear as capital letters in their undefined state on the Spectrum).


Block graphics These are catered for by re-defining the printer's character set in the Basic program that follows.

Newline characters As before, these are to be set up depending on how you want the dip switches to be set up. Mine is arranged that only one code be sent to the printer, a CHR\$ 13.

Now enter the Basic program which sets up the printer every time you want to use it.

After carefully checking that all the many numbers are correct, type GO TO 190 which will save the software to tape until you press the Break key. The program will now autoRUN when you load it back into the computer. I've included a sample printout of the character set from the printer. You'll

notice the block graphics are different — personally I prefer them to be that way since this leads to less of a confusion on listings.

To alter them you'll need to change lines 470 to 620 of the Basic program as shown in the FX80 printer manual. 

EPSON OUTPUT

The character set produced on the Epson FX80.

```

! " # $ % & ' ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ `
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9
A B C D E F G H I J K L M N O P
Q R S T U V RND INKEY# PI FN POIN
T SCREEN# ATTR AT TAB VAL#
CODE VAL LEN SIN COS TAN
ASN ACS ATN LN EXP INT SQR
SGN ABS PEEK IN USR STR#
CHR# NOT BIN OR AND (<=>)
=<> LINE THEN TO STEP
DEF FN CAT FORMAT MOVE E
RASE OPEN # CLOSE # MERGE
VERIFY BEEP CIRCLE INK P
APER FLASH BRIGHT INVERSE
OVER OUT LPRINT LLIST
STOP READ DATA RESTORE N
EW BORDER CONTINUE DIM R
EM FOR GO TO GO SUB INPU
T LOAD LIST LET PAUSE
NEXT POKE PRINT PLOT RUN
SAVE RANDOMIZE IF CLS
DRAW CLEAR RETURN COPY

```

EPSON SOFTWARE

The Basic program which sets up the Epson FX80's facilities and loads the machine code. As in the Star Gemini software, you can SAVE the program using the command GO TO 190 — both programs will autoRUN when re-Loaded.

```

10 REM Spectrum/Epson FX80
20 REM Kempston parallel
30 REM interface and software
40 POKE 23689,100: REM bleep
50 CLEAR 64735
60 PRINT FLASH 1: " Please wait... "
70 LOAD "printcode"CODE 64736.
632
80 CLS
90 PRINT BRIGHT 1: FLASH 1: "
Stop the tape "
100 PRINT USR 65150
110 REM get values to send to
120 REM printer. End of data
130 REM is 0.1
140 RESTORE
150 READ byte
160 IF byte=0.1 THEN LPRINT :
STOP
170 LPRINT CHR# 27:CHR# byte:
180 GO TO 150
190 SAVE "EPSON" LINE 40
200 SAVE "printcode"CODE 64736.
632
210 GO TO 190
220 REM data to set up printer
230 REM reset printer
240 DATA 27.64
250 REM skip over perforation
260 REM for 50 lines/page
270 DATA 27.70,16
280 REM left margin=20 chars
290 DATA 27.100,20
300 REM emphasised print
310 DATA 27.69
320 REM copy ROM cg fonts
330 REM into download set
340 DATA 27.58,0,0,0
350 REM select download set
360 DATA 27.37,1,0
370 REM select ASCII 128 to 159
380 REM and ASCII 255 as
390 REM printable characters
400 DATA 27.54
410 REM data:character.attribut

```

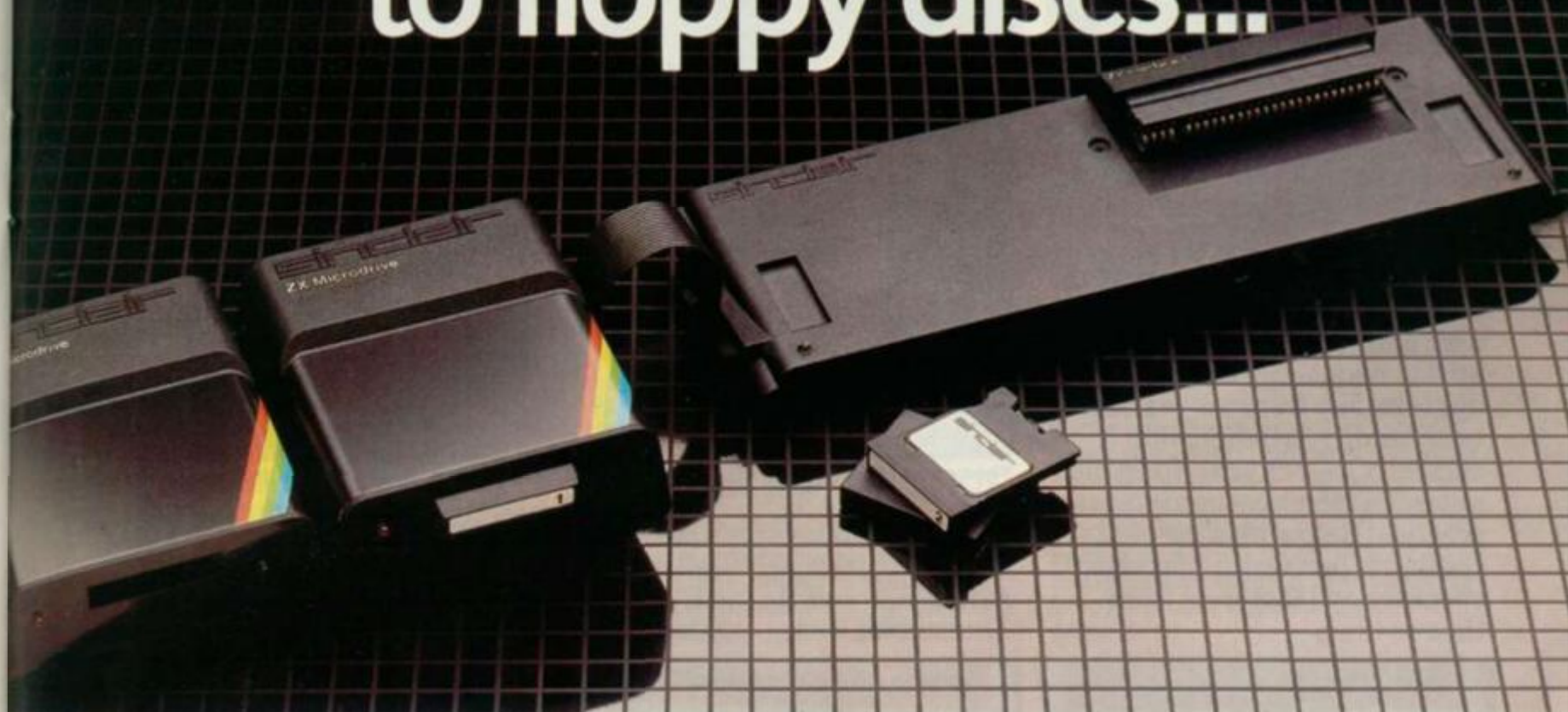
```

e,pattern0...pattern10
420 DATA 27.38,0,35,35,136,36,0
,255,0,36,0,255,0,36,0,0
430 DATA 27.38,0,94,94,168,0,0,
16,32,64,191,64,32,16,0,0
440 DATA 27.38,0,96,96,154,0,17
,0,127,128,17,128,1,128,65,1
450 DATA 27.38,0,124,124,183,0,
0,0,0,0,126,0,0,0,0,0
460 DATA 27.38,0,144,144,138,60
,66,153,164,129,164,129,164,129,
66,60
470 DATA 27.38,0,128,128,138,0,
0,0,0,0,0,0,0,0,0,0
480 DATA 27.38,0,129,129,138,25
5,0,129,0,129,0,241,0,241,0,255
490 DATA 27.38,0,130,130,138,25
5,0,241,0,241,0,129,0,129,0,255
500 DATA 27.38,0,131,131,138,25
5,0,241,0,241,0,241,0,241,0,255
510 DATA 27.38,0,132,132,138,25
5,0,129,0,129,0,143,0,143,0,255
520 DATA 27.38,0,133,133,138,25
5,0,129,0,129,0,255,0,255,0,255
530 DATA 27.38,0,134,134,138,25
5,0,241,0,241,0,143,0,143,0,255
540 DATA 27.38,0,135,135,138,25
5,0,241,0,241,0,255,0,255,0,255
550 DATA 27.38,0,136,136,138,25
5,0,143,0,143,0,129,0,129,0,255
560 DATA 27.38,0,137,137,138,25
5,0,143,0,143,0,241,0,241,0,255
570 DATA 27.38,0,138,138,138,25
5,0,255,0,255,0,129,0,129,0,255
580 DATA 27.38,0,139,139,138,25
5,0,255,0,255,0,241,0,241,0,255
590 DATA 27.38,0,140,140,138,25
5,0,143,0,143,0,143,0,143,0,255
600 DATA 27.38,0,141,141,138,25
5,0,143,0,143,0,255,0,255,0,255
610 DATA 27.38,0,142,142,138,25
5,0,255,0,255,0,143,0,143,0,255
620 DATA 27.38,0,143,143,138,25
5,0,255,0,255,0,255,0,255,0,255
630 REM signal end of data
640 DATA 0.1

```


Sinclair ZX Microdrives and ZX Interface 1

The affordable alternative to floppy discs...



...in the shops, now!

The unique ZX Microdrive system sets the ZX Spectrum apart from all other computer systems.

At a fraction of the cost of floppy discs, it gives fast access to 85K of program and data on Microdrive cartridges. And it opens up exciting possibilities through an RS232 interface and local area network.

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ZX Microdrives are controlled by ZX Interface 1.

For their compact size, they're massively powerful. Each interchangeable Microdrive cartridge stores at least 85K of program and data!

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And when you want to display the data again, Microdrives give you lightning-fast access:

- Just 3.5 seconds to access a typical file.
- Only 9 seconds to LOAD a typical 48K program.

ZX Microdrives use the Spectrum's own power supply.

Your first Microdrive is connected to Interface 1 by a Microdrive lead. Then, up to 7 more Microdrives can be added using Microdrive connectors. That gives you a minimum of 680K bytes of on-line capacity.

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With each Microdrive, you'll receive a Microdrive connector and Microdrive demonstration

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ZX Interface 1 – the multi-purpose controller. £49.95

ZX Interface 1 is a multi-purpose device. It controls up to 8 Microdrives. And it adds file-handling and communication facilities to your Spectrum.

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- **The ZX Net** Now you and your friends can transfer programs and data on a local area network – or even play computer games together.

The ZX Net makes it easy, and fast!

It links between 2 and 64 Spectrums, transmitting at 10,000 characters per second. (So a full screen is transferred in around 3 seconds!) With the ZX Net, only one person need type in a program. And a Microdrive or printer can be shared by everyone in the network!

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With each ZX Interface 1, you'll receive a connecting lead for the first Microdrive; a ZX Net

lead with jack plugs; plus a comprehensive manual.

An RS232 lead is available as an optional extra at £14.95.

Available from: larger branches of Boots • WHSmith Computer Stockists • Greens Computer Centres • Spectrum Computer Stores • and larger branches of John Menzies • Dixons • Laskys • Currys • John Lewis Partnership • Rumbelows • British Home Stores • House of Fraser and many other good computer stockists nationwide.

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There is a full range of ZX peripherals – including ZX Interface 2 for joystick and ROM Cartridge capability, alongside the only computer that supports them – the ZX Spectrum!

For more information, telephone Sinclair Research Ltd, on 0276 685311.

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