Sinclair

ZX Spectrum

BLUE EDIT — 1
RED CAPS LOCK — 2
MAGENTA TRUE VIDEO — 3
GREEN INV. VIDEO — 4
CYAN — 5
YELLOW — 6
WHITE — 7
— 8
GRAPHICS — 9
BLACK DELETE — 0

SIN — Q PLOT
COS — W DRAW
TAN — E REM
INT — R RUN
RND — T RAND
STR$ — Y RETURN
CHR$ — U IF
CODE — I INPUT
PEEK — O POKE
TAB — P PRINT

READ — A NEW (STOP)
RESTORE — S SAVE (NOT)
DATA — D DIM (STEP)
SGN — F FOR (TO)
MERGE — G GOTO (THEN)
SQR — H GOSUB
VAL — J LOAD
LEN — K LIST
USR — L LET
ENTER

LN — Z COPY
EXP — X CLEAR
LPRINT — C CONT
LLIST — V CLS
BIN — B BORDER
IN KEYS — N NEXT
PI — M PAUSE
SYMBOL SHIFT

CAPS SHIFT
BREAK SPACE

FN DEF FN LINE OPEN CLOSE MOVE ERASE POINT CAT FORMAT
ASN ACS ATN VERIFY [ ]] AT IN OUT
~ ∟ \ { } ⌐ £ ⌐ ©
BEEP INK PAPER FLASH BRIGHT OVER INVERSE ATTR

Colour and sound...full-si
16K or 48K RAM... high-re

Proven pedigree

Following the world-beating success of the Sinclair ZX80/ZX81 – over 400,000 sold so far – comes the Sinclair ZX Spectrum. The ZX81 is, and will continue to be, the ideal introduction to computing – with up to 16K RAM available, and the ZX Printer. The ZX Spectrum offers even more computing capability, with colour and sound, up to 48K RAM, and high-resolution graphics.

Professional power... more capacity...personal computer price!

The power of the Sinclair ZX Spectrum comes from a new 16K BASIC ROM. So, in addition to the features of the ZX81, the ZX Spectrum gives you a full 8 colours, a sound generator, high-resolution graphics and many other features – including the facility to support separate data files.

The storage capacity of any computer is governed by the amount of RAM. The ZX Spectrum comes in two versions – with 16K, or a really massive 48K, of RAM. Yet even the 48K RAM version costs only £175 – compared to £125 for the 16K RAM model.

Many people will opt for the full 48K RAM from the outset, but if you do decide to start with the 16K version, you will be able to return your ZX Spectrum for a 48K RAM upgrade at a later date – at a cost of around £60.

A growing system

Your ZX Spectrum comes with a mains adaptor, all the necessary leads to connect to most cassette recorders and TVs (colour or black and white), and *two* manuals. If you're new to computing, you'll find both manuals of immense help.

Together, they represent a course in BASIC programming from first principles to advanced techniques. But if you already have experience of computers, you can skip much of the groundwork, and move straight into the colourful world of ZX Spectrum professional-level computing.

Either way, you don't have 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 extra on-line storage, plus an RS232/ network interface board.

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 and a roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

RS232/network interface board

For around £20, this interface – available later this year – will enable you to connect your ZX Spectrum to a whole range of printers, terminals and other computers. The astonishingly low price is possible only because the operating systems are already designed into the ROM.

Sinclair
ZX Spectrum
From only £125!

...ze moving-key keyboard...
...solution graphics...

ZX Microdrive – coming soon

Designed exclusively for use with the ZX Spectrum, the new ZX Microdrives will revolutionise personal computing.

Each Microdrive can hold up to 100K bytes on a single interchangeable microfloppy – with a transfer rate of 16K bytes per second. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum – they're available later this year, for around £50.

Professional performance for only £125 – how's it done?

Quite simply, by commitment and design. Timex and ICL are adopting Sinclair technology and Sinclair BASIC under licence for future products. Sinclair is now world leader in personal computer production.

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 and MERGE for programs and separate data files.

Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.
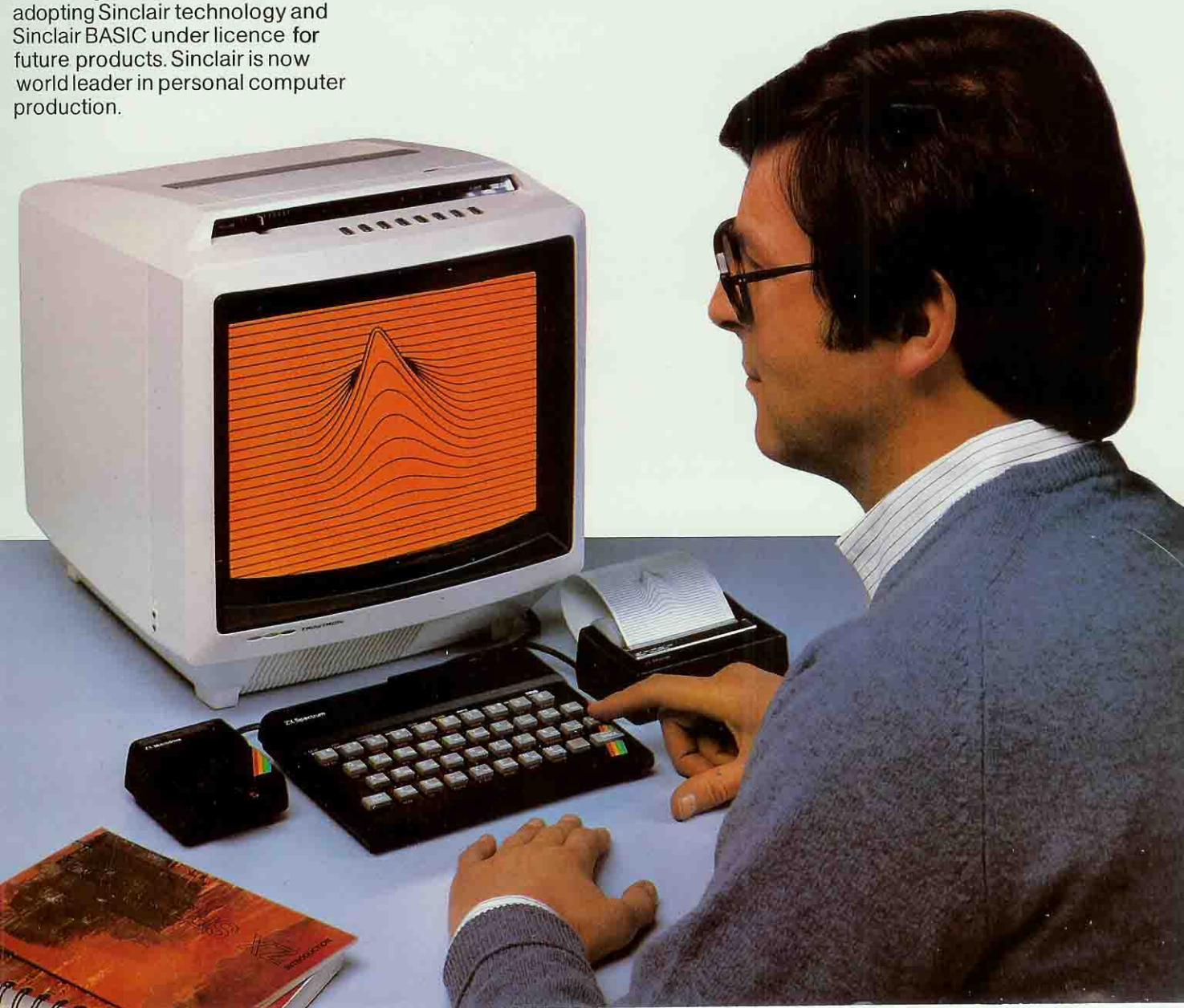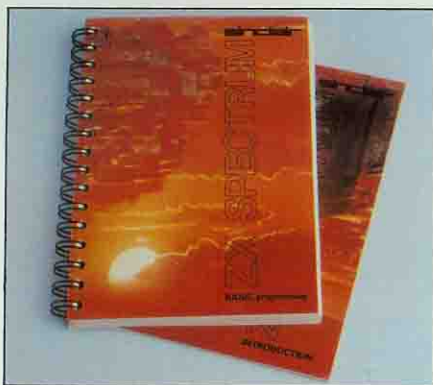
Double-manual system for the ZX Spectrum – slim introductory manual takes beginners through to programming proficiency. Advanced manual smoothes the way through difficult, complex programs.

Connect up to eight ZX Microdrives to your ZX Spectrum. Each holds up to 100K bytes on any one microfloppy. Each can transfer at 16K bytes per second – with an average access time of 3·5 seconds.

The proven ZX printer – full ASCII character set, printing at 50 cps, with 32 cpl and 9 lines per vertical inch. Reproduces exactly what's on the screen at the touch of a button.

ZX Spectrum software: how good and how soon?

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

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

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

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

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

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

How to order your ZX Spectrum

BY PHONE – Access or Barclaycard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access or Barclaycard.

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 ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £_____

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable.   Please print.

Name: Mr/Mrs/Miss

Address

PCW806

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

How the ZX Spectrum compares with other personal computers.

	ZX Spectrum	BBC Micro Model A	VIC 20	ATARI 400	TI 99/4A	TRS 80 Colour
Guide price–basic unit inc. VAT	£125	£300	£190	£345	£300	£450
Standard RAM	16K	16K	5K	16K	16K	16K
Standard RAM available using high-resolution graphics	9K	3K	N/A	7K	14K*	10K
Maximum RAM	48K	32K	29K	16K	48K	32K
Sound generator	√	√	√	√	√	√
Colour available	8	8	16	16	16	9
Maximum colours on screen at one time	8	4	16	4	16	8
FLASH	√	√				
BRIGHT–or equivalent	√				√	
High-resolution graphics (>40000 pixels) available for PLOT & DRAW	√	√		√		√
User-definable graphics	√				√	
Full upper/lower case ASCII	√	√				√
User definable character set	√	√	√		√	
Screen display (columns x rows)	32 x 24	40 x 25	22 x 23	40 x 24	29 x 24	32 x 16
Auto-repeat on all keys	√	√		√	√	
Cassette interface for all normal recorders	√	√			√	√
Baud (data transfer) rate	1500	1200	300	1200	450	1200
LOAD & SAVE	√	√	√	√	√	√
VERIFY	√		√			
MERGE	√					

*But PLOT & DRAW not available

Elegant, effective, unique–the ZX Spectrum design.

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

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

'It's obvious at a glance that the design of the Spectrum is more elegant. What may not be so obvious is that it also provides more power.

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

'It offers twice as many colours on the screen at any one time, plus a colour brightness control. It also offers user–definable graphics.
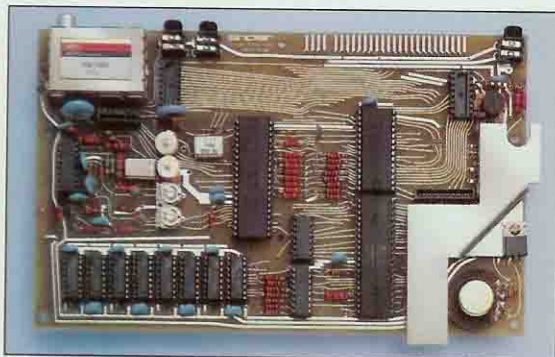
'It has data transfer rate 25% faster, supported by a VERIFY facility.

'And it employs a dialect of BASIC (Sinclair BASIC) already in use in over 400,000 computers worldwide.

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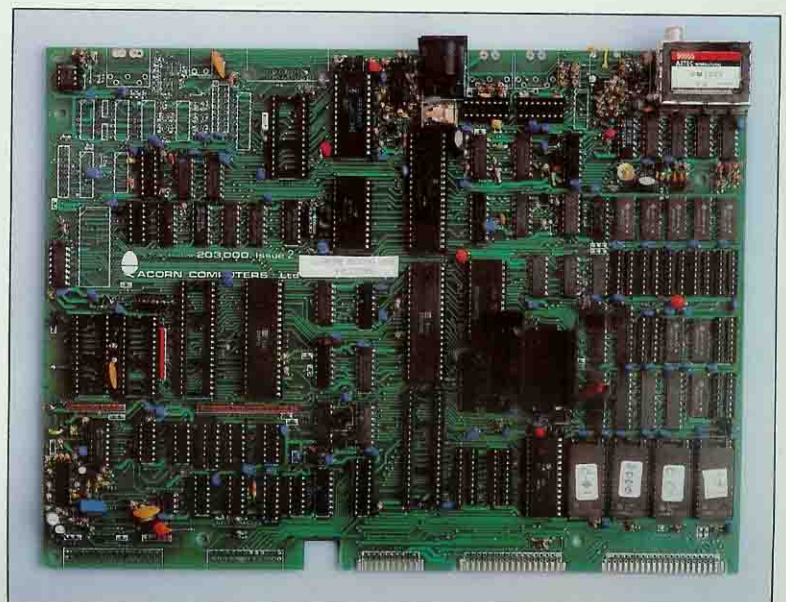
– Clive Sinclair.

Above left: internal layout of Sinclair ZX Spectrum.

Right: internal layout of BBC Micro Model A.

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

Sinclair ZX Spectrum–technical data.

Dimensions

Width   233 mm
Depth   144 mm
Height   30 mm

CPU / memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.

16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive–or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of $+$, $-$, $\times$, $\div$, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3 \times 10^{-39}$ to $+7 \times 10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. $=$, $>$, $<$, $>=$, $<=$ and $<>$ may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with $+$. String variables or values may be compared with $=$, $>$, $<$, $>=$, $<=$, $<>$ to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY. ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

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