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\$295
INCL. ZX80 BASIC
MANUAL

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N.B. Your Sinclair ZX80 may qualify as a business expense.

sinclair ZX80 -British made.

Until now, building your own computer could cost you around \$600 — and still leave you with only a bare board for your trouble. The Sinclair ZX80 changes all that. For just \$295 you get **everything** you need including leads for direct connection to your own cassette recorder and television. The ZX80 really is a complete, powerful full-facility computer matching or surpassing other personal computers costing much more. The ZX80 is programmed in BASIC and you could use it for anything from chess to running a power station.

Two unique and valuable components of the Sinclair ZX80: the Sinclair BASIC interpreter and the Sinclair teach-yourself BASIC manual. The unique Sinclair BASIC interpreter: offers remarkable programming advantages — unique 'one touch' key word entry. The ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST etc) have their own

single key entry. Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately, preventing entry of long and complicated programs with faults only to discover them when you run.

Excellent string handling capability — takes up to 26 string variables of any length. All strings can undergo all rational tests (e.g. comparison). The ZX80 also has string input to request a line of text; strings do **not** need to be dimensioned. Up to 26 single dimension arrays. FOR/NEXT loops nested up to 26. Variable names of any length. BASIC language also handles full Boolean arithmetic, conditional expressions, etc.

Exceptionally powerful edit facilities, allows modification of existing program lines. **Randomise function**, useful for games and secret codes. **Timer under program control**. PEEK and

POKE enable entry of machine code instructions, USR causes jump to a user's machine language sub-routine. **High resolution graphics** with 22 standard graphic symbols. **The Sinclair teach-yourself-BASIC manual** 96 page book free with every kit.

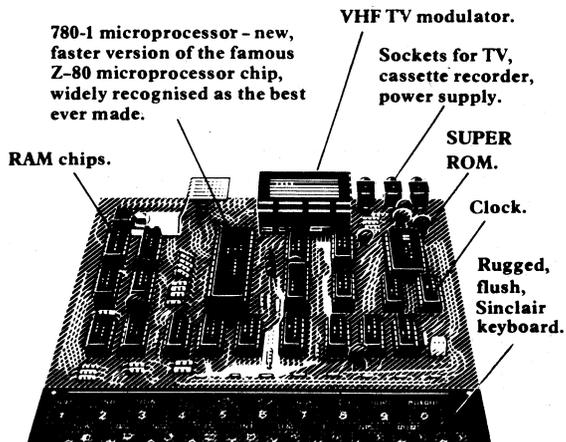
Fewer chips, compact design, volume production means **MORE POWER FOR YOUR DOLLAR!** The ZX80 owes its low price to its remarkable design; the whole system is packed onto fewer, newer more powerful and advanced LSI chips. A single SUPER ROM, for instance, contains the BASIC interpreter, the character set, operating system and monitor. And the ZX80's 1K byte RAM is roughly equivalent to 4K bytes in a conventional computer because the ZX80's brilliant design packs the RAM so much more tightly. (Key words occupy just a single byte). You can add to the memory via the expansion port, giving a maximum potential of 16K.



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	Mains Adaptor(s) (600Ma at 9V DC nominal unregulated).	\$ 9.50	
	Memory Expansion Board(s) takes up to 3K bytes.	\$ 28.50	
	RAM Memory chips — standard 1K bytes capacity.	\$ 10.00	
	Sinclair ZX80 Manual(s) free with every ZX80 computer.	\$ 15.00	
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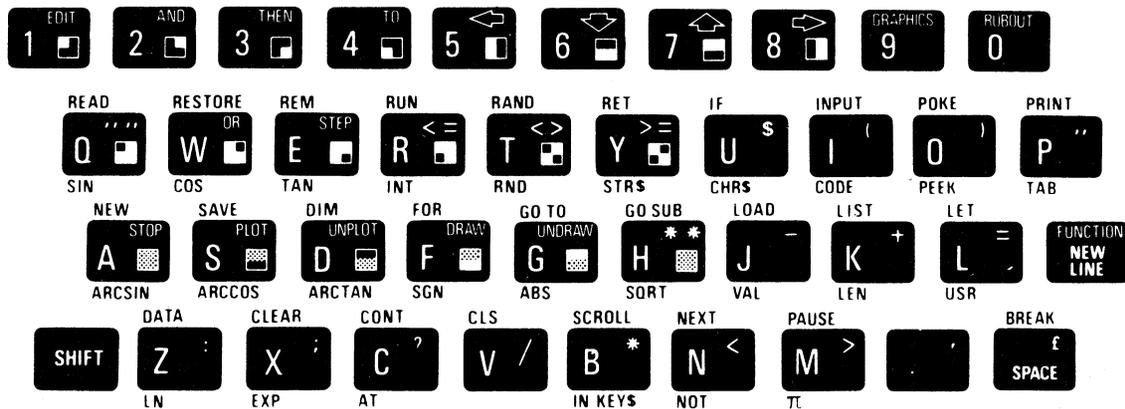


ZX80

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SE3

Sinclair ZX80 personal computer

Science of Cambridge Ltd, of the UK, has really come up with a world-first with the Sinclair ZX80. It is easily the smallest and least expensive computer available which will interface to a TV set and cassette recorder. It features full BASIC operation with powerful editing and single keystroke functions.

by JOHN CLARKE

The Sinclair ZX80 computer would have to be one of the most inexpensive on the market today, especially considering that it has programming features which would normally be found on only the more expensive systems. To have the machine up and running, a DC power supply and television set is all that is required. A domestic cassette recorder can also be used to store programs.

Measuring 175 × 35 × 218mm (W × H × D) and weighing only 340g, the ZX80 with its own integral keyboard is very compact. Housed in a white plastic case held together with plastic rivets it gives the general impression of lightweight construction. However, the fibreglass printed circuit board fortunately gives structural strength to the case.

At the rear of the computer case are three 3.5mm sockets for the DC power supply, tape recorder microphone and

earpiece. An RCA socket is provided for the RF modulator. Also a 46-way edge connector pad is brought out carrying the Address Bus and Data Bus, along with the Z80 control lines. This bus can provide for extra memory expansion boards. Leads are supplied for the cassette interface and RF modulator.

Opening the top cover to the computer case reveals a double-sided PCB, filling the whole area of the case. The touch sensitive keyboard is allocated the first 70mm of PCB depth. The two major ICs on the PCB, the NEC Z80 MPU and the Sinclair Research "Super ROM", are mounted in IC sockets while the remaining ICs, mainly 74LS TTL, are soldered directly to the board. A small heatsink is provided for the 5V regulator.

A crystal oscillator provides the 3.25MHz clock for the microprocessor and the 1K of read/write memory con-

sists of two 2114L RAMs. Incidentally, the RF modulator for the Australian version operates at VHF channel 1.

We used the 600mA/9V DC plug pack, which is available as an accessory, to power up the computer. Connecting the coax to our TV set, we were rewarded with a reassuring cursor, a black square with a white letter K in it, at the bottom left hand side of the screen. The screen characters appear on a steady display in reverse field video (black letters on a white background). The full screen contains 32 columns by 24 rows of characters.

One difficulty with using the ZX80 becomes immediately obvious. The keyboard lacks tactile feedback, preventing the user from touch typing. With a flat sheet of plastic as a keyboard it is necessary to continually watch the keys as they are pressed.

A further problem occurs when a key is pressed and accepted by the computer: the screen will lose synchronisation for a short duration, producing severe flicker. (This could perhaps be regarded as an advantage for some, in that this flicker indicates that the key just pressed was detected by the computer!)

Operating the cassette interface is straightforward, just press SAVE to store the program on tape and LOAD to retrieve the program. It was necessary to experiment with the volume settings of the cassette recorder before the SAVE/LOAD operation was completely reliable and we suggest that you experiment with the storing of short programs to perfect these settings before any serious storage of programs is done.

Writing programs with the ZX80 can be very quick, since the keyboard has what Sinclair describes as "Key Word" entry. This means that words such as LET, RUN,



Left: the Sinclair ZX80 in action. The ZX80 is easily held in one hand, yet features full BASIC operation and single keystroke functions.

Sinclair ZX80 home computer

PRINT, GOTO, LIST etc, are printed on the screen with just one keystroke. This can be done without the use of any shift keys. Thus the syntax of the ZX80 BASIC allows one key to serve the two functions of printing key words and letters. Consequently letters cannot be used directly after a line number since the machine assumes that a keyword is required.

Two drawbacks are evident from the key word entry system. The first is that LET is not optional as it is with many other machines, but this disadvantage is far outweighed by the fact that all other key words are printed with only one key stroke. The second drawback is that only one instruction per line is allowed.

Running programs can be a problem if the quantity of printout expected will be greater than the screen can hold. When the screen is full from the printout of a program, an error message will be printed indicating a full screen. The only way to overcome this problem is to test for an approaching full screen and clear the screen ready for the next screen of display. This should be by way of a routine placed before the print statement.

All the available characters, including reverse video for those available on the keyboard, can be displayed with the use of the CHR\$ function and this includes graphics and some characters not directly available from the keyboard. There are 10 graphics characters accessible directly with the keyboard and with their reverse video gives 20 fairly standard symbols found on most other personal computers.

ENTERING PROGRAMS

Microcomputers running interpreted BASIC usually display error messages when a mistake is encountered while running a program. The ZX80, however, will not accept a line which has a syntax error at the programming stage, rather than at the running of the program. Consequently the line will need correcting immediately, before the machine will accept the line.

The cursor shows what the computer is expecting to be entered next in the programming line. Initially, after the beginning of a program or new line, the cursor displays a K. This indicates the computer is expecting a keyword. After the line number and keyword has been entered, the cursor displays an L. This means the computer is now expecting a character. These two cursor symbols tell the operator that the computer will print either a keyword or character depending on the state of the cursor. In other words, it is an automatic shift.

Another cursor symbol is the S. This

means that a syntax error has occurred. This does not necessarily mean that there is an immediate error, but just indicates a potential error. For example, at the opening of quotation marks, an S will appear in the cursor indicating that these quotation marks will need to be closed before the computer will accept the line.

At the acceptance of a program line, the line is printed at the top of the screen and a cursor points to the line just accepted. This cursor is called the current line cursor. This cursor can be moved either up, down or left and right to facilitate editing a line. When the screen is full, the current line cursor hits the bottom line and the listing scrolls from then on.

When running the program, errors can still occur, even though the syntax errors have been removed. The program will

capability. Up to 26 string variables are possible and can undergo all relational tests. Two unusual string functions are the TL\$(string) which returns the string within the brackets less the first character, and the CODE(string) which returns the first character code number of the string. Another string function, in the form INPUT A\$, can request a line of text.

A unique and useful feature in the ZX80 BASIC is the capability of the GOTO statement to jump to a variable as well as a line number. This can be a powerful feature.

Only one statement per line is legal with the ZX80, but lines of unlimited length can be made in the form of extended boolean algebra expressions or PRINT statements.

The ZX80 has many of the useful BASIC



A close up of the ZX80 personal computer. Features include a touch sensitive keyboard, 1K of RAM, and an internal RF modulator for VHF Channel 1.

stop on encountering an error and list an error code. The error code is displayed as an error number followed by the line number at which the error occurred.

Perhaps the biggest drawback with the Sinclair ZX80 is that it will only perform integer arithmetic with five functions available: Plus, Minus, Multiply, Divide and Power. Results of division calculations are always truncated towards zero. For example, dividing nine by two gives a result of four.

Sinclair have a routine in their Operating Manual which allows floating point arithmetic to be performed but it is a little wasteful of the limited memory space.

The ZX80 has much string handling

statements available on more expensive machines. These are REM, RND, RANDOMISE, DIM, CLS, ABS and, to access the machine level of the machine, PEEK, POKE, andUSR.

Sinclair claim that their ZX80 is faster than all other personal computers when compared with benchmark test programs. Subjectively, we found the ZX80 to be fast, but the fact that the machine only operates with integers gives the ZX80 a definite speed advantage over floating decimal point computers, making this faster speed rather academic.

The Sinclair Operating Manual, called "A Course in BASIC Programming," is quite descriptive in the programming features of the ZX80. It helps the begin-

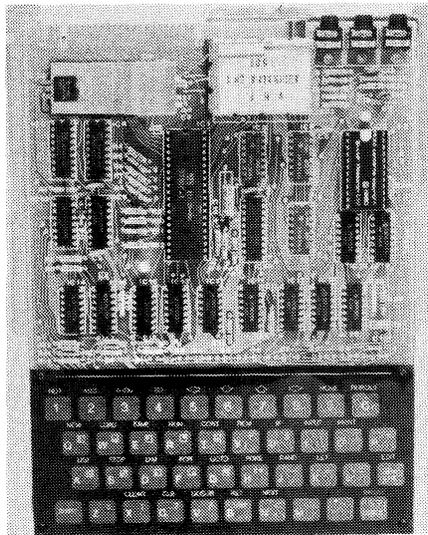
CONCLUSION

ner to get started and operate the machine effectively. For people wishing to refine their BASIC programming, however, the manual does not really help. Either experience and practice will produce a good programmer, in time, or a good book on BASIC programming will speed up the process. As far as hardware information on the ZX80, this is given minimal treatment.

To sum up, we must report mixed feelings towards this computer from Sinclair. On the one hand it has many good features, especially the time-saving software, and some quite unique additions not found on other microcomputers. On the other hand, though, the computer has some shortcomings that render it less effective than its special features would indicate.

Clearly, the biggest feature is its very low cost. It is easily the least expensive BASIC personal computer which interfaces with a TV set. On that score, it just cannot be beaten by any other computer on the market. So for those wishing to learn BASIC programming for a small initial outlay, the ZX80 must be considered.

Memory expansion boards are available and many programs are available on cassette, ranging from



Inside the Sinclair ZX80. Unlike other computers, the ZX80 will not accept a line which has a syntax error at the programming stage.

games to education to utility packs.

Suggested retail price of the Sinclair ZX80 is \$295, which includes the ZX80 Basic manual and sales tax. Our review sample came from Rod Irving Electronics, 425 High Street, Northcote, Victoria. The Sinclair ZX80 is distributed in Australia by Sinclair Equipment (Australasia) Pty Ltd, 308 High Street, Kew, Victoria, 3101. 

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MicroAce Z-80 computer kit from the USA

There is no question that the prices of computers are dropping all the time. It is now possible to obtain a complete computer in kit form which can be programmed in BASIC for under \$200. The MicroAce is the system in question and it can be connected to any standard TV set.

We reviewed the Sinclair ZX80 computer in our December, 1980 issue. While reporting on some shortcomings of the system, our reviewer concluded "Clearly the biggest feature is its very low cost. It is easily the least expensive BASIC personal computer which interfaces with a TV set. On that score, it just cannot be beaten by any other computer on the market." At that time the Sinclair ZX80 was selling for \$295.

Things move quickly in the Micro world, and today our statement is no longer true. MicroAce, the United States licensee of Sinclair Research, have come out with a kit computer which is identical in every respect to the Sinclair ZX80, but which Dick Smith sells in Australia for \$199.

Since the MicroAce computer uses the same hardware and software as the ZX80, readers can refer to our December review for these details. The plastic case of the MicroAce is black, the Sinclair machine is white — this is virtually the only difference between the two, except for the price!

For those who haven't seen the previous review, the MicroAce is housed in a plastic case measuring 175mm ×

35mm × 218mm (W × H × D), and all up it weighs just 340g. An integral touch-sensitive keyboard occupies 70mm of the PCB, and sockets at the rear of the case provide for DC power and cassette connection. A video modulator on the board allows the computer to be connected to any TV set, and there is a 46-way expansion connector carrying the ZX80 address, data and control lines.

Versions of the computer are available with either 1K or 2K of RAM. The BASIC interpreter resides in a 4K ROM and makes extensive use of code compression techniques to make the most of the limited memory available. Program statements are entered with a single keystroke, and the computer is programmed to catch syntax errors at the time the program is entered, rather than at execution time.

In addition to circuit board, components and case, the MicroAce kit includes a UHF modulator, an antenna splitter which allows the family television set to be switched between the antenna for normal program reception and the computer video output, and cables and plugs for making connections to a cassette recorder. A VHF modulator is

available for use with a television set without a UHF tuner. Also separately available is the 9V plugpack for DC power.

Accompanying the kit is a BASIC manual which also includes instructions for assembly, circuit diagrams and an introduction to the MicroAce. The assembly instructions are general, without step-by-step procedures, but the experienced constructor should have no trouble putting the kit together. The beginner will need to brush up on



This is what the finished unit looks like. All you need to build it is some solder and a small soldering iron.

soldering techniques before starting assembly.

As a kit the MicroAce is very well presented. The 205mm × 158mm circuit board is of heavy duty fibreglass, and is double-sided with plated through holes. White outlines and labels on the component side of the board identify the position of each part, and a solder mask prevents problems caused by splashes of solder etc. Sockets are provided for all but three of the ICs in the kit.

All in all the MicroAce kit looks like a winner. Its 4K integer BASIC, keyboard program entry and "error-proof" syntax indicators make it well-suited for those just learning programming, and certainly the price is right.

The MicroAce kit is available from Dick Smith Electronics branches and re-sellers in all states.