Spectrum HAL

1.   Connect the EAR socket of the Spectrum to the EAR socket of
        your recorder.

2.   Position the tape to the beginning of the cassette.

3.   Turn the volume control to $\frac{3}{4}$ or to a volume you have found reliable.

4.   Set tone control to maximum treble, minimum bass.

5.   Type LOAD ""

6.   Start the cassette recorder playing.

7.   Press ENTER.

8.   Should the program fail to LOAD then use a different volume setting
        and repeat.

On correct loading you will be greeted with,

                    BMC V1.1
            (C)   1983 D. Bayliss.

*C

The C means you are now in the HAL language.

You can probably already count in three number bases, Decimal, Binary
and HEX. Now you have to learn a fourth, Octal.

In decimal we have ten digits 0 to 9. When we add to 9 we have to use
a second column to denote an overflow. ie   9

                                       $+\underline{3}$

                    12 (which means 1 ten 2 units.)

In Octal we only have eight digits 0 to 7. We therefore cannot have 9
in one column it is too big. So again we have to use the second column
to denote an overflow. 9 becomes 11. (meaning 1 eight and 1 unit)

A table of number base comparisons follows:-

DECIMAL	OCTAL	HEX
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	10	8
9	11	9
10	12	A
63	77	3E
64	100	40

HAL is based upon the idea of having 'cells' inside a computer
each capable of storing DATA. These cells are numbered and may contain
an instruction or item of data.

There is also one 'super cell' called the accumulator. It is to this
cell that all calculations are done. (there is in fact a spare accumulator
used for storing a second accumulator value, but do not worry about that.)

To enter an instruction you must first tell the computer which cell
you want the instruction to go in. So type 1 (enter)
This should now be displayed; (If not re-type the number)
*1_
This means the computer is now willing to put an instruction in cell 1.
So type LINE (enter) This means print a new line. This snould now be
displayed.
*1 LINE_
This means the computer wishes to know if a number is associated with
the instruction. In this case no number is needed so press ENTER. (If a
number had been required this would have been entered.)
Your instruction line will now be printed at the top of the screen
followed by the 'cells' below it.
Now try to enter into cell 2 the instruction JUMP and the associated number
1. If you have done this correctly cell 2 will now be at the top of the
page. If not re-read the instruction for entering the first cell and try
again.
You now have your first complete (yet very simple) HAL program which will
print lines of spaces on your screen. Now you have to RUN it.
RUN is a command so no cell number is required. (so press ENTER).
You should now see
*_
Type RUN enter. The computer now wishes to know the associated number
so enter 1. (ie RUN from line 1) The computer will now print blank lines
until you stop it by pressing SPACE.
 Now enter as a command (no cell number remember!) CLR (no number reqd.)
This is the HAL version of new.
We are now going to enter a program to add two numbers and print the result.
It must be remembered that all numbers (including cell numbers) are in
Octal.

CELL	INSTRUCTION	Number
1	TAKE	20
2	ADD	21
3	PRINT	enter
4	LINE	enter
5	STOP	enter

TAKE copies the value of cell n into the accumulator.

ADD adds the value of cell n to the accumulator.

PRINT prints the value of the accumulator AS A DECIMAL

STOP means what it says.

However cells 20 and 21 don't have a value so this will not work.

Therefore we must give cells 20 and 21 a value.

CELL	INSTRUCTION	Number
20	enter	+6 (the + means in decimal)
21	enter	10 (no prefix so Octal)

Now enter the Command RUN 1

The number 14 should now be printed. If it is not type the command DUMP 1
and check you have entered the program correctly. If you have not then
re-type the lines you have wrong. If the program was correct then enter
the command DUMP 20. You should see

20	6 (note decimal converted to octal)
21	10

correct any mistake.

On the next page is a list of HAL instructions and commands. Here is
a short program to demonstrate how programs can be formed in HAL.

CELL	INSTRUCTION	NUMBER	COMMENT (Do not enter!)
1	CAPT		
2	"EV"		Print EVEN
3	"EN "		
4	"&&"		
5	LINE		
6	STOP		
7	CAPT		
10	"OD"		
11	"D"		Print ODD
12	"&&"		
13	LINE		
14	STOP		
17		2	
20	READ		Input a DECIMAL integer.
21	DIV	17	Divide it by 2
22	XAR		Put the remainder into accumulator.

23	JNZ	7	If accumulator 0 Jump to 7
24	JUMP	1	

Now enter the command RUN 20

A HASH will appear meaning a number is to be input. So enter a number
, the program will now say whether it is ODD or EVEN.

HAL Instructions. (Where x is a cell number between 1 and 200, octal)

TAKE	x	Places the value of cell x into the accumulator.
PUT	x	Places the value of the accumulator into cell x.
ADD	x	Adds the value of cell x to the accumulator.
SUBT	x	Subtracts the value of cell x from the accumulator.
MULT	x	Multiplys the accumulator by the contents of cell x.
JUMP	x	Obey the instruction in cell x then continue from there.
JNZ	x	If and only if, the accumulator is not zero JUMP x.
JLZ	x	If the accumulator is negative then JUMP x.
DIV	x	Divide accumulator by cell x. Leave remainder in remainder reg.
XAR		Load the remainder reg. into the accumulator.
CLA		Set the accumulator to zero.
INCA		Increment the accumulator. (By 1)
DECA		Decrease the accumulator by 1.
CHIN		Input a character from the keyboard. Place it's ascii value in the accumulator.
CHOT		Print the character whose Ascii value is the accumulator.
SWAB		Swap the accumulator for the spare one.
READ		Inputs a decimal integer from the keyboard.
PRNT		Prints as a decimal the value of the accumulator.
LINE		Output a new line.
CAPT		Prints out the characters in the following cells until it reaches "&f."

HAL Commands. (Where x is as before.)

RUN	x	Start execution of program from cell x.
DUMP	x	Display cells centreing on cell x.
CLR		Restart HAL language.
LPO		Send all output to ZX Printer
LPF		Turn off ZX Printer.
SAVE		Saves program (Should VERIFY fail then type GOTO 110 and re-save)
LOAD		Loads program of given name.
INS	x	Inserts a blank cell between x and x-1. Automatically renumbers.
DEL	x	Deletes cell x. Automatically renumbers cells.

Certain Commands may take a long time (especially INS and DEL) do not worry
they have not CRASHED. If a program crashes in output to printer mode then
type CLOSE 2.