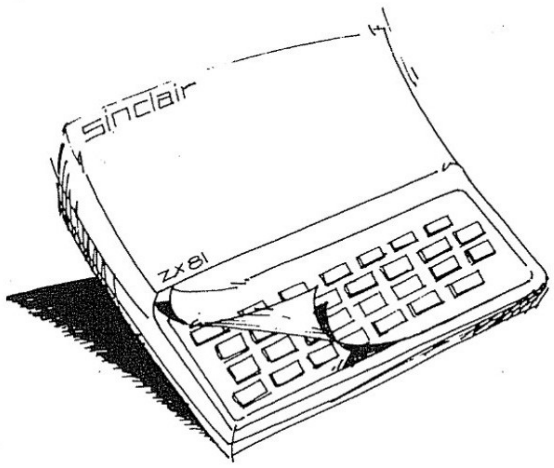
Change the meaning of the keys on your keyboard



How does the ZX know that such and such a key has been pressed by the user ? It is a specialized routine of the system monitor program [ZX81 ROM] which takes care of the interpretation of the keyboard. It begins at the address 02BB (Dec.699). It is a particularly interesting routine; correctly retrieved by the user, it allows the user to modify the meaning of all the keys of the ZX81 keyboard in the direction he wishes. We will give an illustration of these possibilities of diversion with a small purely demonstrative darts game program, but the applications can be much larger: when will a judicious reader present us with a program based on this method to transform the QWERTY keyboard? in AZERTY keyboard?

THE KEYBOARD DECODING ROUTINE

Each key on the keyboard has a unique position in height and width; it belongs to a certain row and to a certain column. If the double register HL of the Z80 microprocessor is associated with the column number, it is easy by this means to make each key correspond to a unique number in HL resulting from a unique combination of column / H, row / L.

Rather than in row and column, for simple reasons (do not exceed the number 8 for the value of the index), the ZX keyboard is divided into distribution zones modeled on the rows and columns according to the division shown below.

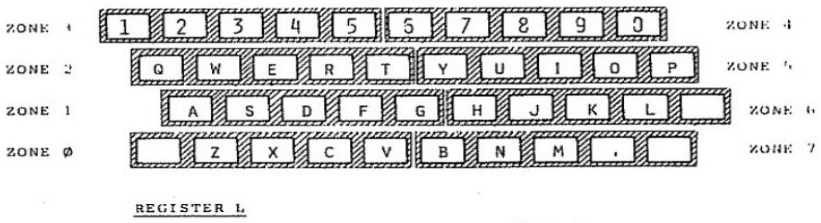


Fig. 1

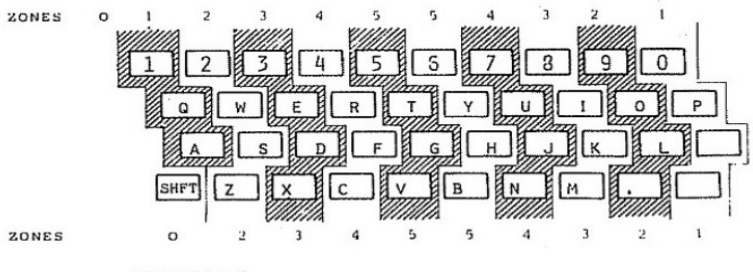


Fig. 2

This gives 5 areas for the columns (10/2) and 8 areas for the rows. The reader will easily verify that, following this principle, it is impossible for two letters or graphic signs or BASIC words to give the same HL combination, this for each level (with or without SHIFT, in particular) because, and this is one of the properties of ZX, each touch can have several levels of meaning; but we will see that this level, too, is indicated in HL.

The binary codes produced in HL by the press of a key are shown in the table below:

KEYBOARD ZONE	CONTENT OF REGISTER L	CONTENT OF REGISTER H (with SHIFT pressed)	CONTENT OF REGISTER H (without SHIFT)
0	11111110		
1	11111101	11111100	11111101
2	11111011	11111010	11111011
3	11110111	11110110	11110111
4	11101111	11101110	11101111
5	11011111	11011110	11011111
6	10111111		
7	01111111		
NULL	11111111	11111110	11111111

Each value corresponds to the binary equivalent of the expression which it is easy to calculate and to implement in a program:

N = 2 ^ 8-1-2 (n ° zone).

If SHIFT was pressed we subtract an additional 1.

A SHORT BUT ESSENTIAL PROGRAM

The small program below comprises a very short development in machine language of half a dozen instructions: its purpose is to transfer the contents of H and L registers of the Z80 into the B and C registers after calling the routine. keyboard decoding. This is compulsory for the ZX81 because the return of the USR function is done automatically by reading these other registers.

This program is quite slow because, in order not to confuse the reader in the deductions, the duration of the PAUSE has been set to be long. But it is susceptible to numerous adjustments.

```
4082:CD;BB;02     CALL $02BB
4085:44           LD B,H
4086:4D           LD C,L
4087:C9           RET
```

The short section in machine language has the following meaning: fetch the routine starting at step 02BB (CALL BB 02) either in decimal 205, 187, 2, transfer H to B (68), L to C (77) and return to BASIC system.

```
  10 REM 123456
  20 PRINT "KEEP YOUR FINGER ON
A KEY"
  50 LET A=16514
  60 POKE A,205
  70 POKE A+1,187
  80 POKE A+2,2
  90 POKE A+3,68
 100 POKE A+4,77
 110 POKE A+5,201
 115 PAUSE 1000
 140 PRINT "KV=";USR 16514
```

If we returned the H and L registers to the ROM printing routine, the character carried by the key would be displayed on the screen. We could naturally subject the contents of H and L to an appropriate treatment before returning to the printing routine to, for example, transform the representative value of Q into a representative value of A, with the idea of making a French keyboard: we did not attempt the experiment because it is difficult to use the ZX as a typewriter, but this should normally be possible: any reader who has come to the opposite conclusion is kindly requested to let us know as soon as possible...he would do us a favor.

Igor BOURDAIN