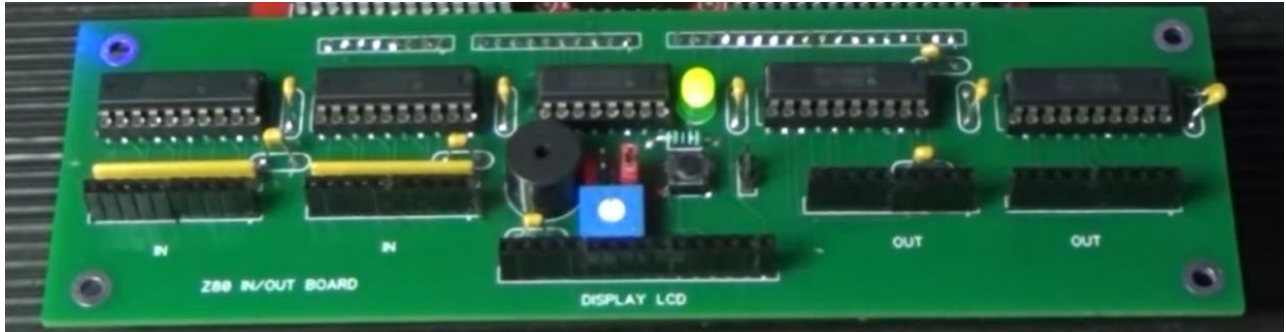


- Z80 I/O Expansion board for Z80 Minicomputer Grant Searle Z80 Project
- 4 Input ports (8 bit)
- 4 output ports (8 bit)
- LCD 2 x 16 interface HD44780
- On board User interface (button, LED, buzzer)
- PCB with all Test points for Debug
- Microsoft BASIC 4.7



PCB Top View

## DESCRIPTION

The Z80 I/O Expansion board is a daughter board to be plugged on the Z80 Minicomputer board in order to extend the I/O capability of the Z80. It offers:

- 4 8-bit INPUT ports based on SN74HCT245
- 4 8-bit OUTPUT ports based on SN74HCT374
- User interface with a LED, buzzer and input button

The board decodes the I/O operation of Z80 thanks to a 74HCT138 and is designed in order to learn Z80 hardware functions, interfaces and working principles, thanks to debug pins to be connected to a logic analyzer or to an oscilloscope. The board is exploiting a customized version of the Microsoft BASIC (version 4.7) stored on the on board EEPROM and accept commands on the RS-232 serial interface on the main board.

## TECHNICAL DATA

PARAMETER	DESCRIPTION	VALUE			UNIT
		MIN	TYP	MAX	
P	Power Consumption (Main+daughter)	1.7	1.8	2	W
$f_{clock}$	Clock Frequency (Main board)		7.372		MHz
$B_r$	Serial port Baud rate 8,N,1 (Main board)		115200		Bit/s
$V_{IN}$	Power Supply Voltage (Main board)		+12		V
$I_{IN}$	Power Supply Current (Main board)		150		mA

## PCB TECHNICAL DATA

PARAMETER	VALUE	UNIT
Dimensions Length x Width	110 x 128	mm
Colors	RED	
PCB thickness (RED, YELLOW)	1.6	mm
Layers	2	
Surface finish	HASL	
Copper Weight	1	oz
Material Details	FR4-Standard Tg 130-140C	

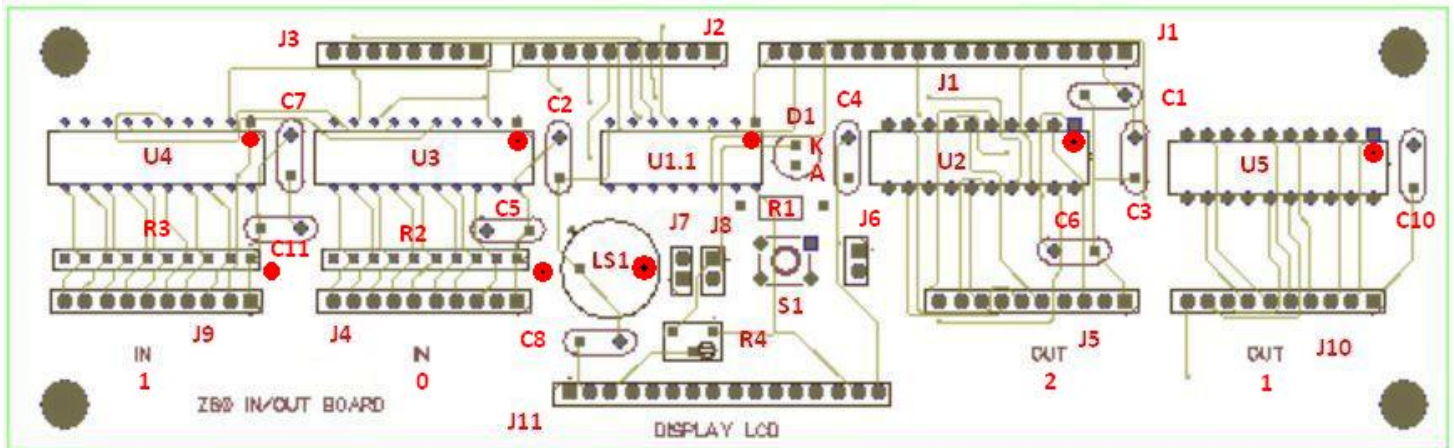


## BILL OF MATERIALS

- C1,C2,C3,C4,C5,C6,C7, C8, C10, C11 : 100nF ceramic
- D1: led diode green
- LS1 buzzer piezo +5V
- J1 header female 18 pin (signal bus) MOUNT BOTTOM SIDE
- J2: header female 10 (I/O Interface) MOUNT BOTTOM SIDE
- J3: header female 8 (I/O Interface) MOUNT BOTTOM SIDE
- J8,J6,J7: header male 2 pin (LED,SWITCH,BUZZER)
- J4,J5,J9, J10, header female 10 (I/O Interface)
- J11: header female 16 (LCD Interface)
- R1 390 ohm
- R2,R3: resistive network 10Kohm
- R4 potentiometer 10Kohm
- S1 tactile switch
- U1.1: 74HCT138
- U2, U5: SN74HCT374
- U3, U4: SN74HCT245
- Z1.1: 16 pin socket
- Z2,Z3,Z4,Z5: 20 pin socket

## ASSEMBLY INFORMATION

Please use sockets and mount IC with PIN1 as indicated by the point as per following figure. J1, J2 and J3 are mounted BOTTOM side.



PCB Top view with references

## HARDWARE MODIFICATION on Z80 Minicomputer board

In order to obtain the power supply from Z80 Minicomputer main board these 2 modifications are needed on the Z80 minicomputer board::



- 1) Connect PIN 1 of J6 connector of the Z80 board to C12 positive terminal (+5V)
- 2) Connect PIN 2 of J6 connector of the Z80 board to C12 negative terminal (GND)

## POWER UP AND SOFTWARE TEST

Connect the I/O board to Z80 board trough J1, J2, J3 connectors. Power up the Z80 board follow the indications on the Z80 Minicomputer Datasheet. Insert jumpers on J8,J6,J7: header male to test the on-board LED,SWITCH and BUZZER. Connect the LCD HD77480 on the J11 connector. Trim the R1 potentiometer to adjust LCD contrast.

## BASIC Programs

```

10 REM * Lampeggio LED a 0.5 secondi *
5 PRINT "Premere CTRL+C per uscire"
10 GOSUB 100
20 OUT 0,1
30 GOSUB 100
40 OUT 0,0
50 GOTO 10
95 REM ** Subroutine che imposta il ritardo **
    
```

```

100 FOR A = 0 TO 300
110 NEXT A
120 RETURN
    
```

```

10 REM * Lampeggio LED e intermittenza BUZZER
a 0.5 secondi *
5 PRINT "Premere CTRL+C per uscire"
10 GOSUB 100
    
```



```

20 OUT 0,3
30 GOSUB 100
40 OUT 0,0
50 GOTO 10
95 REM ** Subroutine che imposta il ritardo **
100 FOR A = 0 TO 80
110 NEXT A
120 RETURN

10 REM * Azionamento LED e BUZZER su Pulsante
*
5 PRINT "Premere CTRL+C per uscire"
10 X = INP(0)
30 IF X<>255 THEN 60 else 50
50 OUT 0,0
55 GOTO 10
60 OUT 0,3
70 GOTO 10

10 REM * Lampeggio 8 LED porta 0 alterni a 0.5
secondi *
5 PRINT "Premere CTRL+C per uscire"
10 GOSUB 100
20 OUT 0,85
30 GOSUB 100
40 OUT 0,170
50 GOTO 10
95 REM ** Subroutine che imposta il ritardo **
100 FOR A = 0 TO 300
110 NEXT A
120 RETURN

10 REM * Lampeggio 8 LED porta 0 alterni a 0.5
secondi *
5 PRINT "Premere CTRL+C per uscire"
10 GOSUB 100
20 OUT 1,85
30 GOSUB 100
40 OUT 1,170
50 GOTO 10
95 REM ** Subroutine che imposta il ritardo **
100 FOR A = 0 TO 300
110 NEXT A
120 RETURN

1 REM * Conta in binario sulle uscite *
2 REM ***** avanti e indietro *****
5 PRINT "Premere CTRL+C per uscire"
10 FOR I = 255 TO 0 STEP -1
20 OUT 0,I
30 GOSUB 200
50 NEXT I
60 FOR B = 0 TO 255
70 OUT 0,B
80 GOSUB 200
90 NEXT B
100 GOTO 10
195 REM ** Subroutine che imposta il ritardo
**
200 FOR A = 0 TO 300
210 NEXT A
220 RETURN

1 REM * SUPERCAR *
5 PRINT "Premere CTRL+C per uscire"
20 OUT 0,1:gosub 200
30 OUT 0,2:gosub 200
40 OUT 0,4:gosub 200
50 OUT 0,8:gosub 200
60 OUT 0,16:gosub 200
70 OUT 0,32:gosub 200
80 OUT 0,64:gosub 200
90 OUT 0,128:gosub 200
100 OUT 0,64:gosub 200
110 OUT 0,32:gosub 200
120 OUT 0,16:gosub 200
130 OUT 0,8:gosub 200
140 OUT 0,4:gosub 200
150 OUT 0,2:gosub 200
160 OUT 0,1:gosub 200
170 OUT 0,0:gosub 200
191 GOTO 20
195 REM ** Subroutine ritardo **
200 FOR A = 0 TO 80
210 NEXT A
220 RETURN

1 REM **** TEST Display LCD Z80 I/O board****
96 gosub 1000 : REM *** Inizializza il Display
***
101 OUT 1,42:gosub 2000 :REM *
102 OUT 1,42:gosub 2000 :REM *
103 OUT 1,32:gosub 2000 :REM
104 OUT 1,80:gosub 2000 :REM P
105 OUT 1,105:gosub 2000 :REM i
106 OUT 1,101:gosub 2000 :REM e
107 OUT 1,114:gosub 2000 :REM r
108 OUT 1,32:gosub 2000 :REM
109 OUT 1,65:gosub 2000 :REM A
110 OUT 1,105:gosub 2000 :REM i
111 OUT 1,115:gosub 2000 :REM s
112 OUT 1,97:gosub 2000 :REM a

```



```

113 OUT 1,32:gosub 2000 :REM
114 rem *** seconda riga ***
115 gosub 2400
201 OUT 1,32:gosub 2000 :REM
202 OUT 1,84:gosub 2000 :REM T
203 OUT 1,69:gosub 2000 :REM E
204 OUT 1,83:gosub 2000 :REM S
205 OUT 1,84:gosub 2000 :REM T
206 OUT 1,32:gosub 2000 :REM
207 OUT 1,76:gosub 2000 :REM L
208 OUT 1,67:gosub 2000 :REM C
209 OUT 1,68:gosub 2000 :REM D
210 OUT 1,32:gosub 2000 :REM
211 OUT 1,90:gosub 2000 :REM Z
212 OUT 1,56:gosub 2000 :REM 8
213 OUT 1,48:gosub 2000 :REM 0
214 OUT 1,32:gosub 2000 :REM
215 OUT 1,32:gosub 2000 :REM
216 OUT 1,32:gosub 2000 :REM
134 goto 3000 : REM *** Salta alla fine del
programma ***
1000 REM *** Init Display ***
1010 OUT 1,56
1020 gosub 1500
1030 out 1,1
1040 gosub 1500
1050 out 1,12
1060 gosub 1500
1070 OUT 1,6
1080 gosub 1500
1085 out 1,60
1090 gosub 1500
1100 return
1500 REM *** Command ***
1510 out 0,0
1520 for i = 0 to 100
1530 next i
1540 out 0,32
1550 for e = 0 to 10
1560 next e
1570 out 0,0
1580 return
2000 REM *** Write Display ***
2010 for i = 0 to 100
2020 next i
2030 out 0,128
2040 out 0,160
2050 out 0,128
2060 return
2100 REM *** Clear LCD ***
2110 out 1,1 : gosub 1500
2120 return
2200 REM *** Back Home ***
2210 out 1,2 : gosub 1500 ***
2220 return
2300 REM *** Riga 1 ***
2310 out 1,128 ; gosub 1500
2320 return
2400 REM *** Riga 2 ***
2410 out 1,192 : gosub 1500
2420 return
2500 REM *** Riga 3 ***
2510 out 1,148 : gosub 1500
2520 return
2600 REM *** Riga 4 ***
2610 out 1,212 : gosub 1500
2620 return
3000 end

```

**ADDITIONAL INFORMATION**

The following figure represents the Expansion board mounted on the Z80 Minicomputer board driving the LCD display.

**ORDERING INFORMATION**

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