2013

H8-Speed Board

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Revision History and Disclaimer

Revision History		
Revision	**Date**	**Comments**
1.0	10/31/2012	Initial draft by Norberto Collado
1.1	09/22/2013	Added assembly instructions and details on Z80 configurations

The purpose of this document is to allow the surviving classic computers to continue to function.

Please don't use any of this material for any purpose other than personal hobby/interest without checking with the owner of the material.

Thank you for your understanding and consideration.

Table of Contents

Introduction

This document provides details on how to assemble the H8-Speed board design by Norberto Collado for the Heathkit H8 Computer. Also it discuss ports and registers definitions.

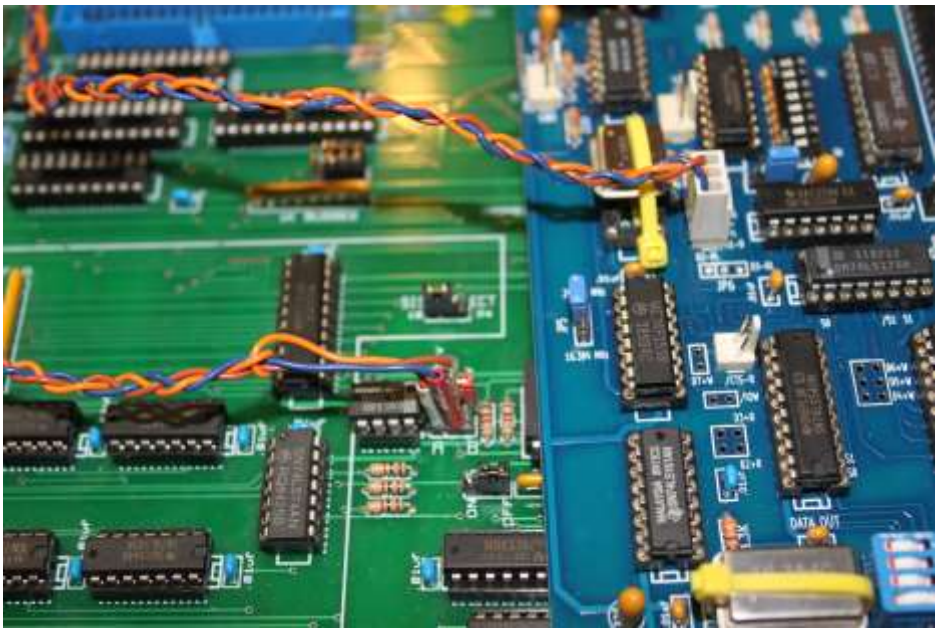
SW2 – Register Status Definition (READ ONLY @ PORT 220Q)

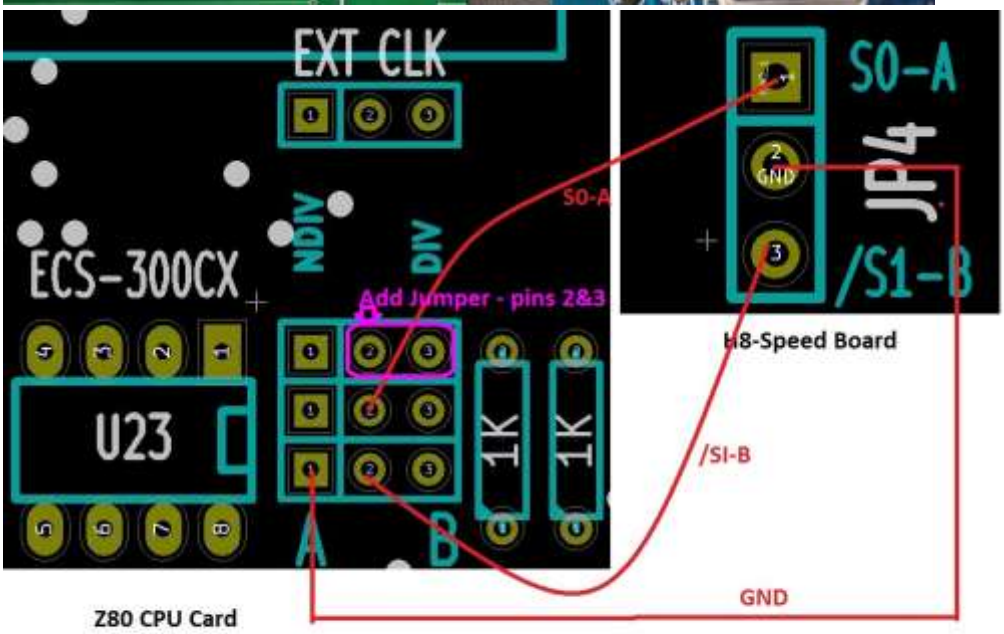
SW2-4	SW2-3	SW2-2	SW2-1	Comments
Enabled	D6	D5	D4	
0	0	0	0	2 MHz MAX SPEED ALLOWED
0	0	0	1	4 MHz MAX SPEED ALLOWED
0	0	1	0	8 MHz MAX SPEED ALLOWED
0	0	1	1	10MHz or MAX SPEED ALLOWED (second oscillator is a 10MHz and it could be any frequency osc)

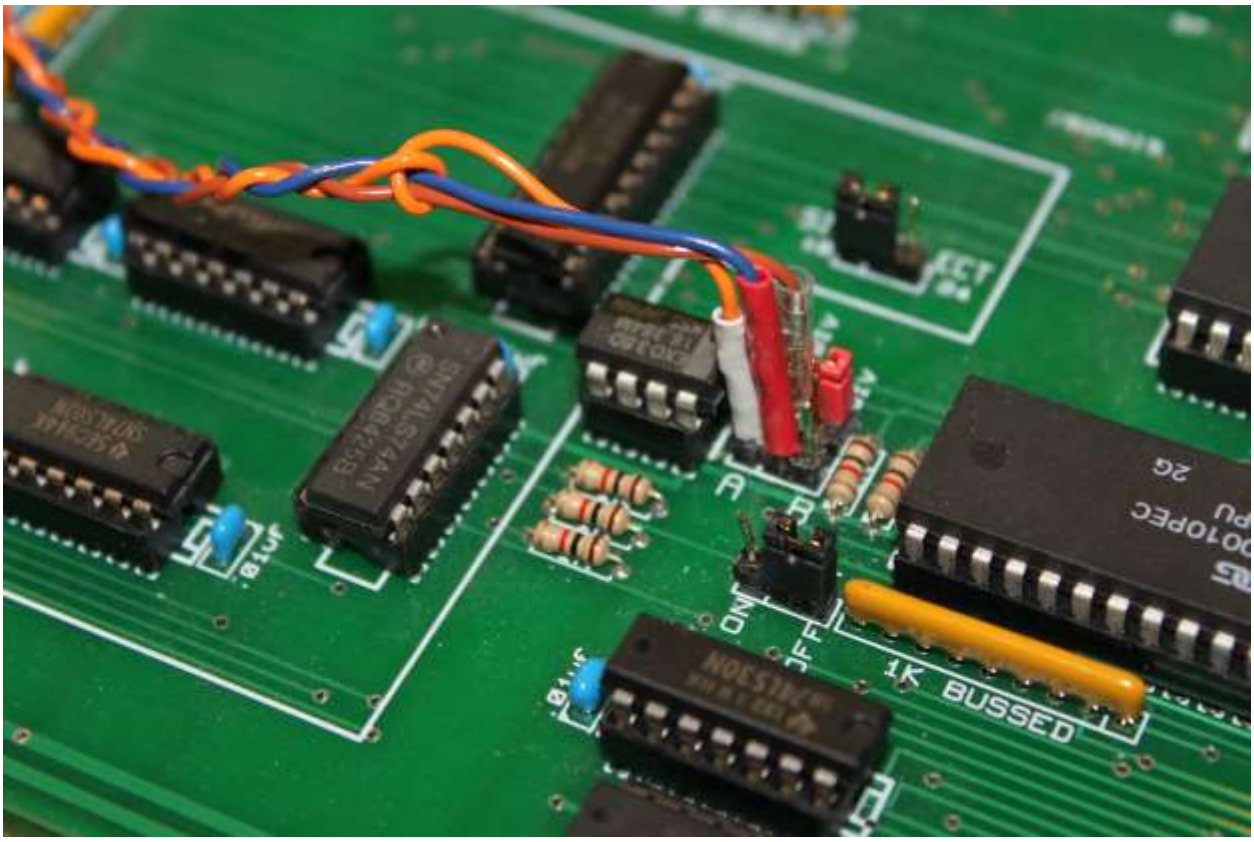
H8-Z80-64 CPU/GIDE CABLE SETUP

For all Z80 CPU boards using the ECS-300CX-16.384MHz *(Z84C0010PEG)*

1. Connect the wires as shown below in order to control the ECS oscillator from the H8-Speed board. All the connections are TTL level. No HDOS or CP/M utilities available for this configuration.



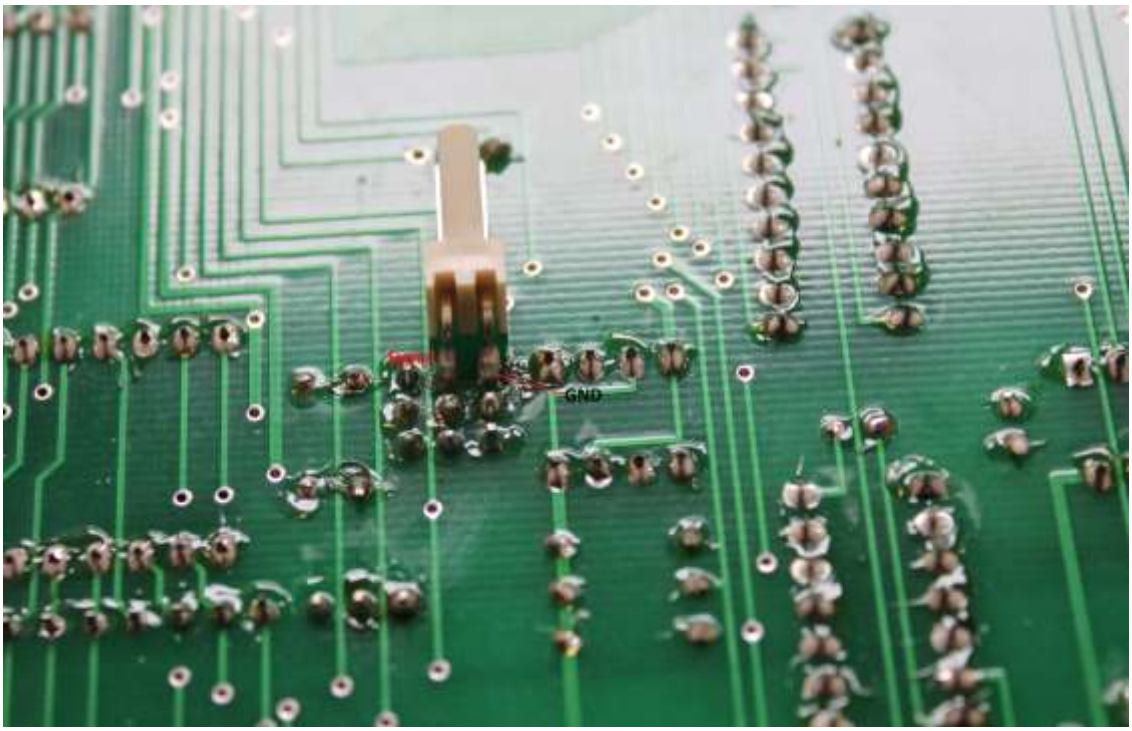




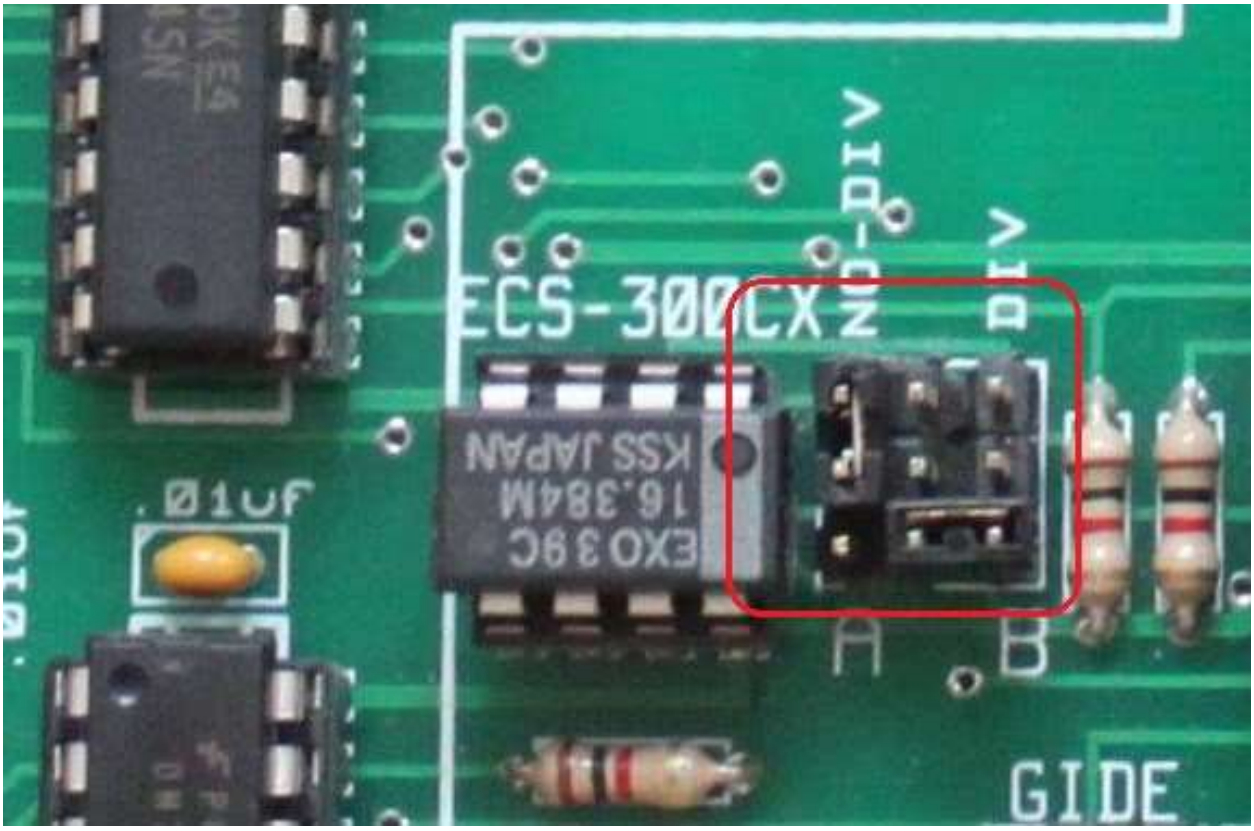
2. Port Control
    a. OUT 000Q selects 2MHz clock (default on power-on)
    b. OUT 001Q selects 1MHz clock
    c. OUT 002Q selects 8MHz clock
    d. OUT 003Q selects 4 MHz clock
    e. When reading from the H8-Speed board masks out D2-D7 and then check D0-D1 for correct clock speed status.

For all Z80 CPU boards below Rev 2.2 without the ECS-300CX-16.384MHz OSC

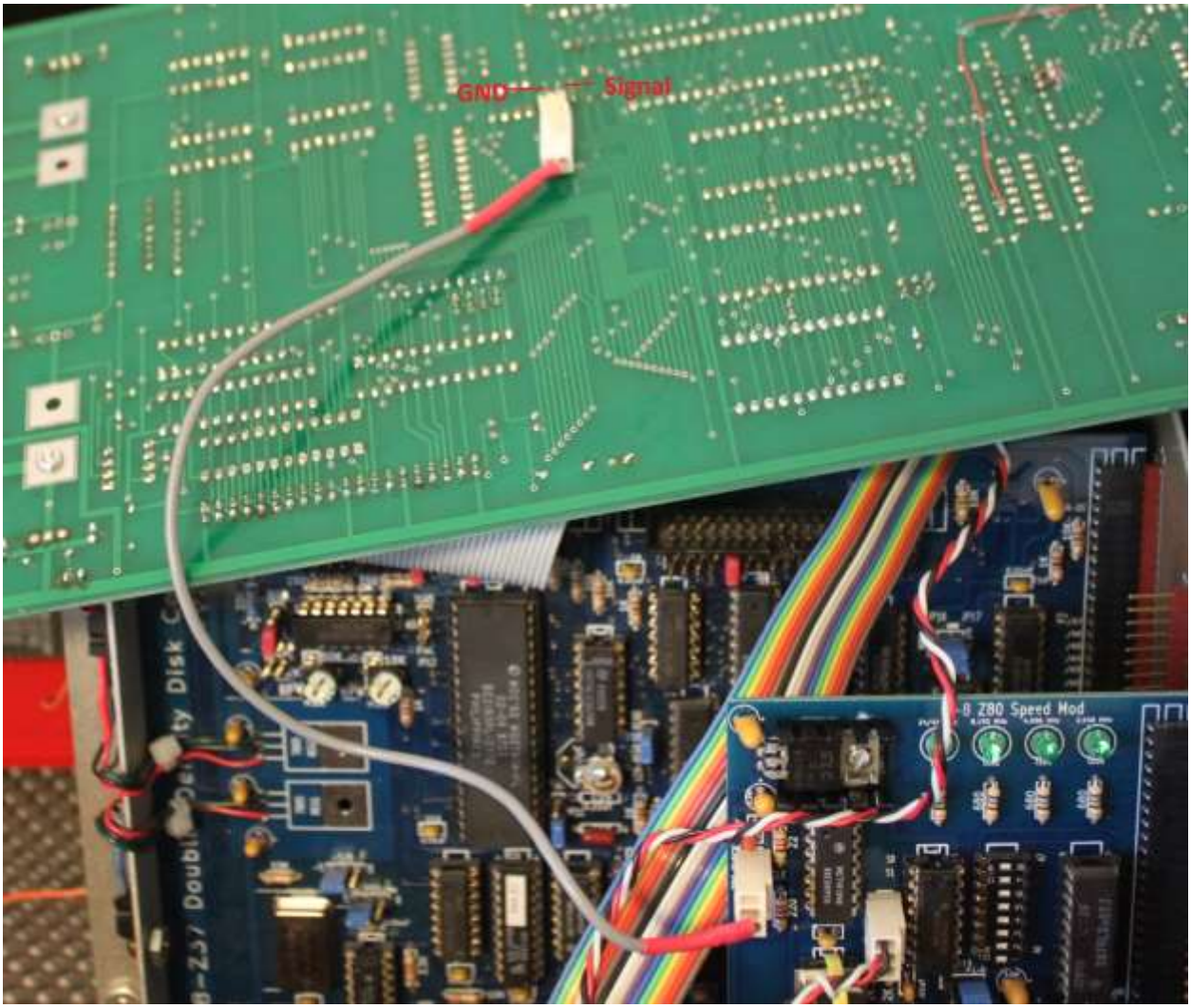
1. In order to drive properly the Z80 CPU by using an external clock, a coaxial cable must be used, otherwise the H8 and all its components becomes unstable and data corruption will occur on your media. Below are pictures indicating proper connections from the Z80 CPU to the H8-Speed board for all Z80 CPU boards below Rev 2.2. HDOS and CP/M utilities available.



Solder a two pin right angle header on side two of the Z80 board as shown above.



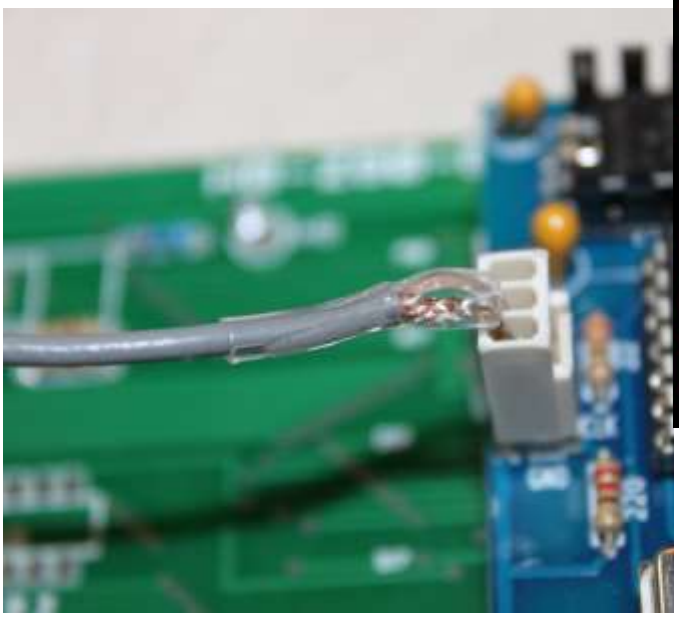
Configure the jumpers as shown above.

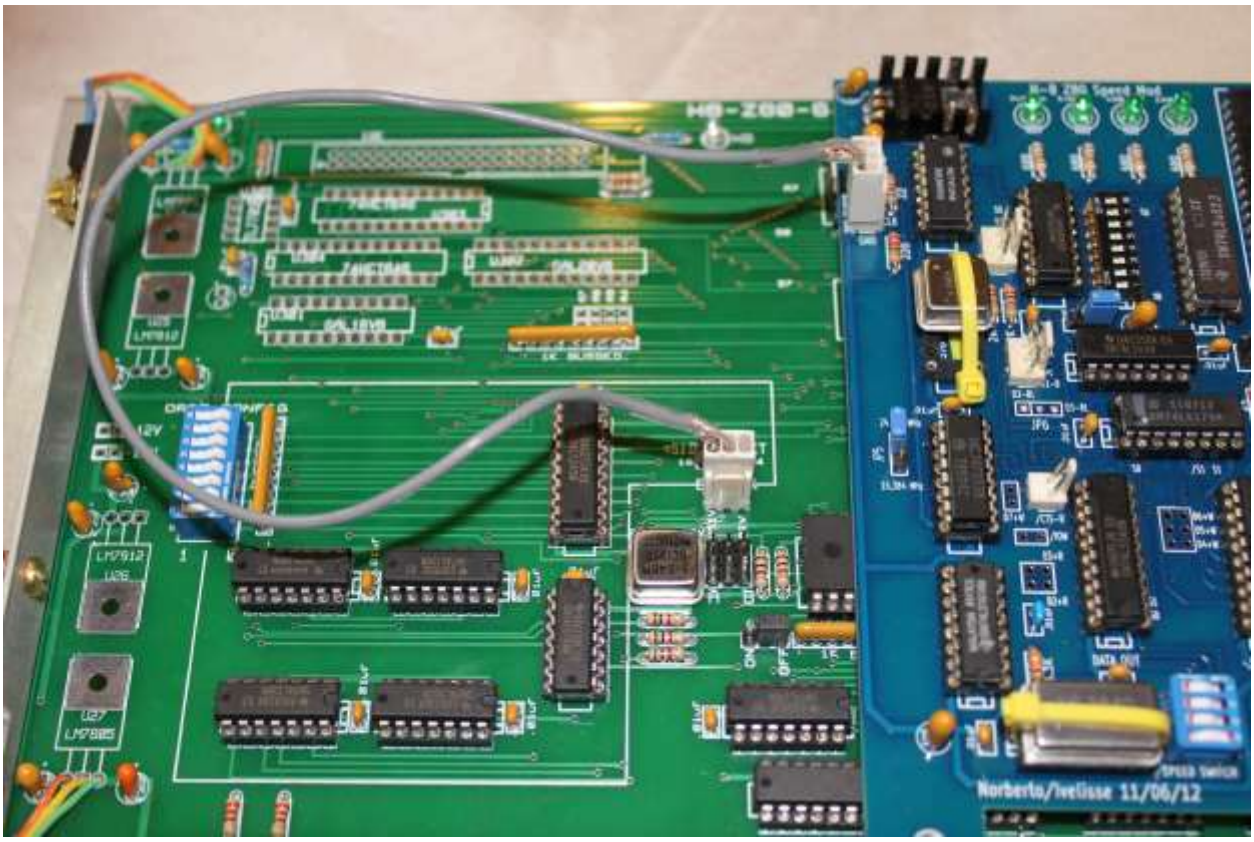


Connect coax cable as shown above.

For Z80 Boards Rev 2.2 with External Clock connector

1. In order to drive properly the Z80 CPU by using an external clock, a coaxial cable must be used, otherwise the H8 and all its components becomes unstable and data corruption will occur on your media. Below are pictures indicating proper connections from the Z80 CPU to the H8-Speed board.

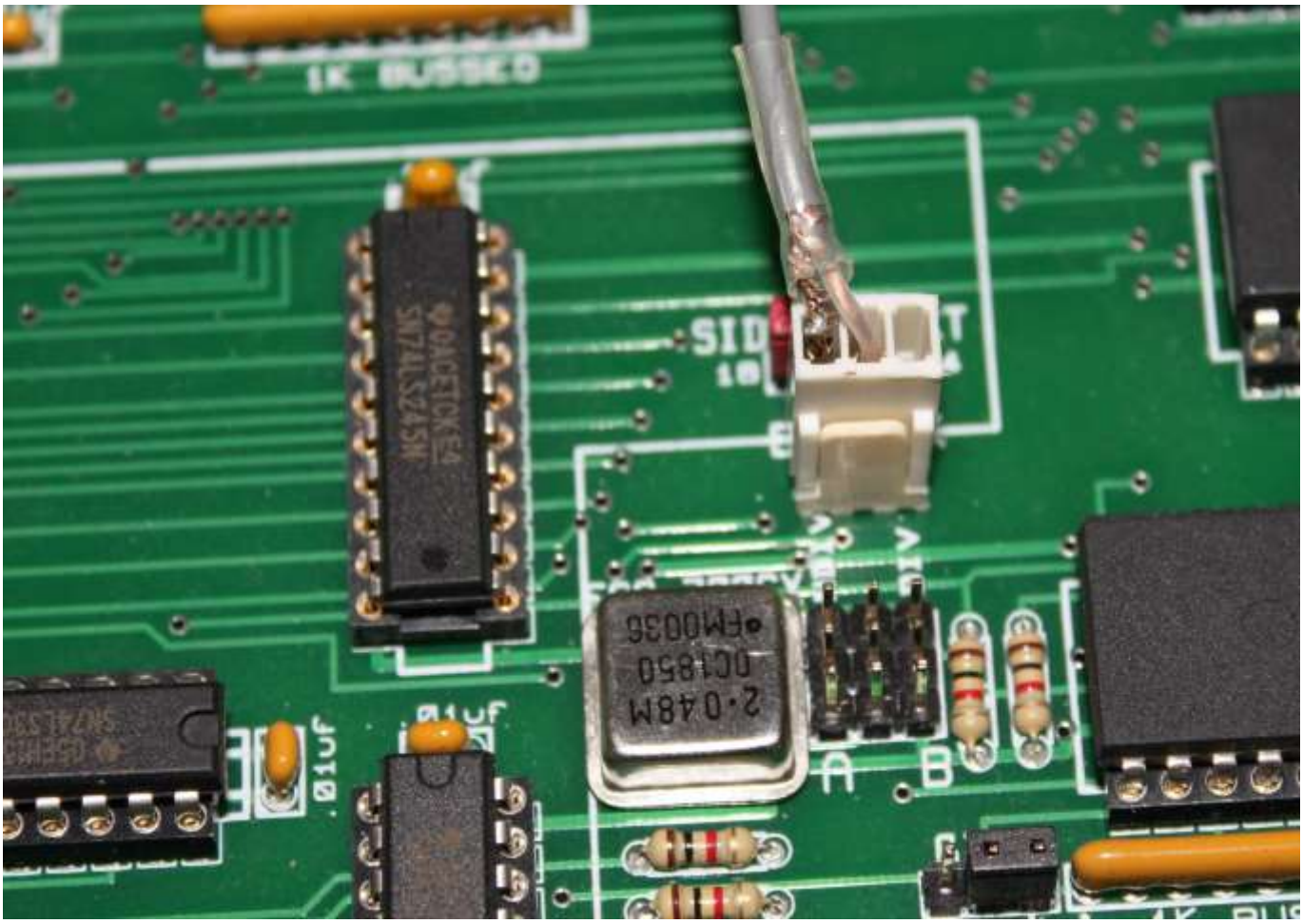




2. Port Control
    a. OUT 000Q selects 2MHz clock (default on power-on)
    b. OUT 001Q selects 4MHz clock
    c. OUT 002Q selects 8MHz clock
    d. OUT 003Q selects 16/24 MHz clock
    e. When reading from the H8-Speed board masks out D2-D7 and then check D0-D1 for correct clock speed status.

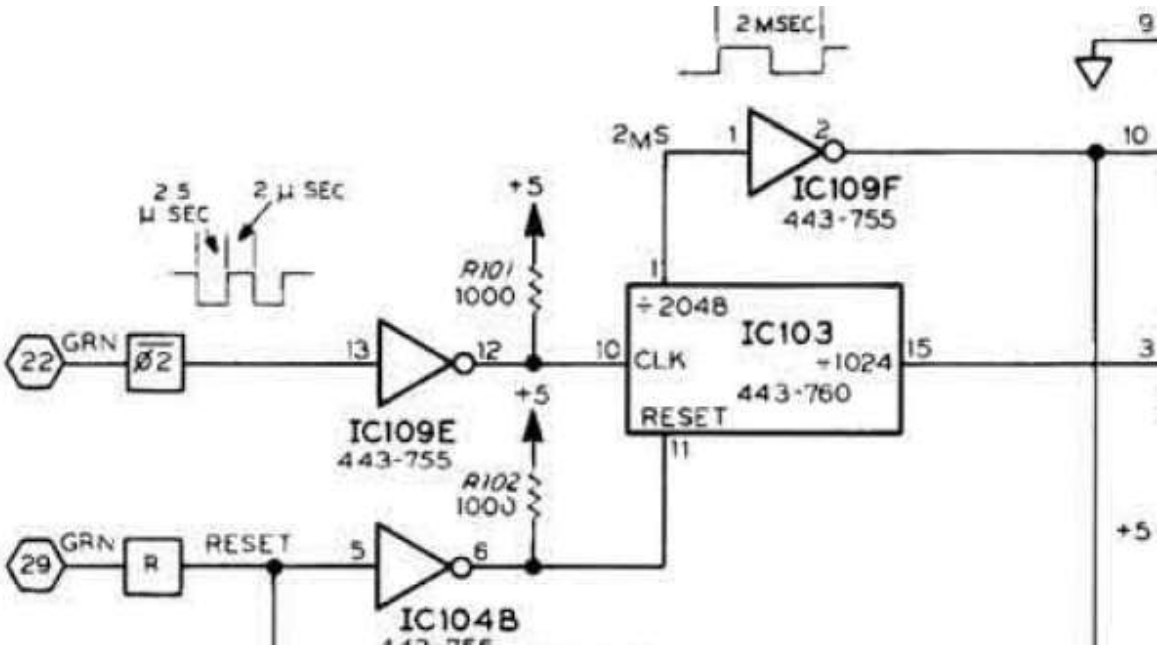
D1	D0	Comments	PORT (Write/Read)
0	0	2 MHZ	220Q
0	1	4 MHz	220Q
1	0	8 MHz	220Q
1	1	MAX Speed	220Q

3. A B Jumper Settings (None required)



RUNNING THE H8 ABOVE 8MHz

1. On power-on or system reset the default clock oscillator is 2 MHz's. Use the front panel to select a different frequency and be aware that the front panel max frequency is 8 MHz, and beyond that the front panel is non-operational. To fix this issue replace IC103 on the H8-front panel with a high speed part (Jameco – 45920 – 74HC4040). This update allows the H8 to operate above 8MHz.



PORT ADDRESS SELECTION

1. All switches “**OFF**” selects port 00Q. SW1 “**ON**” and SW2-SW8 “**OFF**” selects Port 001Q and so on. SW1 is “**A0”** and SW8 is “**A7”**.
2. The default address is 220Q. Set Switch 8 = ON and Switch 5 = ON to enable the default address and the remainder switches to the “OFF” position as shown below.

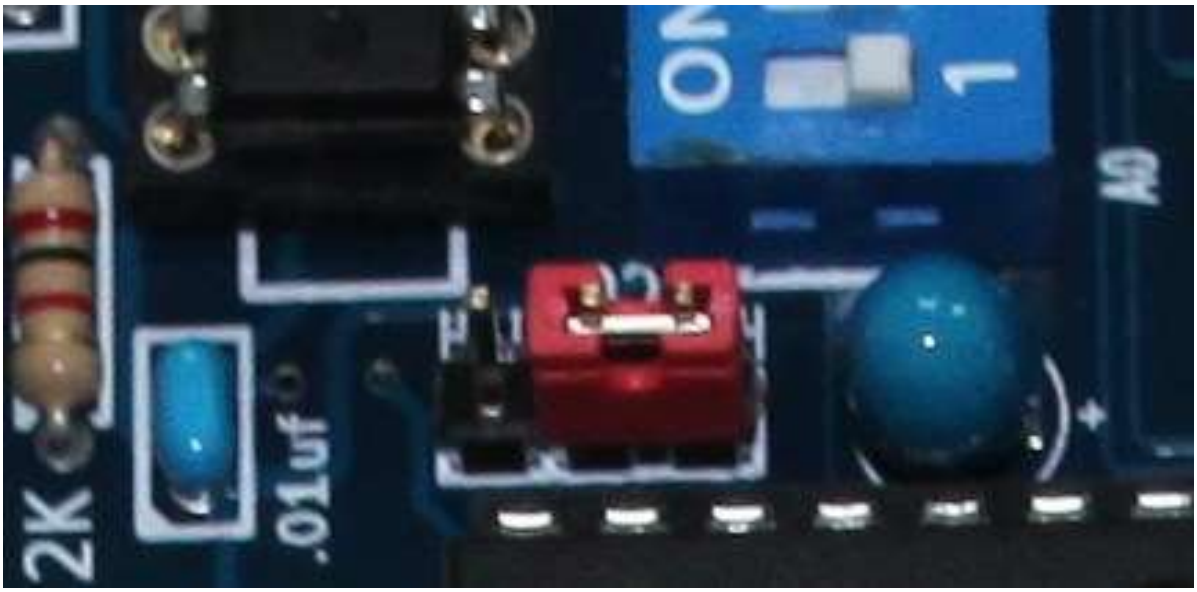
H8-SPEED BOARD	220-220Q	OSC

3. Configure the 4-position speed switch as follows for max speed selection; Switch 1, 2, and 3 = OFF and switch 4 = ON as shown below.

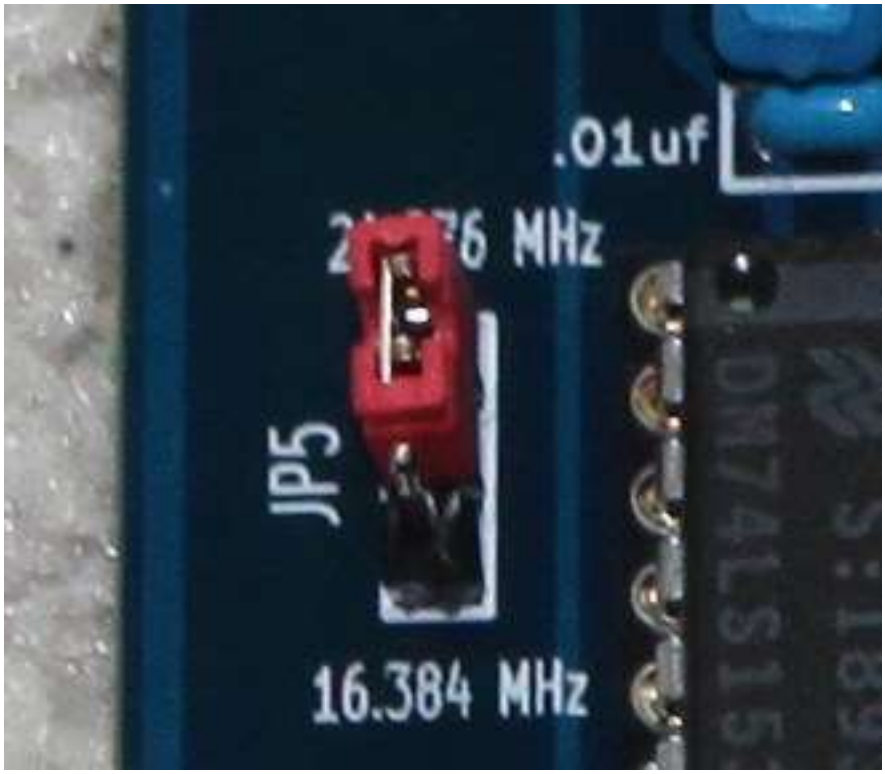
JUMPERS CONFIGURATION

1. Set JP3 to “S-“ position as shown below

2. Set JP2 to “L-H” position as shown below



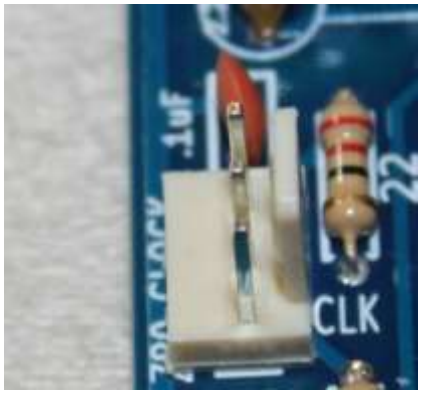
3. Set JP5 to “24.576 MHZ” position to enable secondary oscillator. Usually this secondary oscillator is a 10MHz part when using a 10MHz Z80 CPU. Beyond 10 MHZ a Z84C0020 is required.



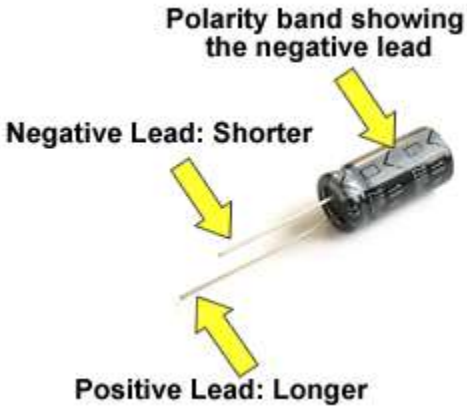
H8-SPEED BOARD ASSEMBLY

( ) Install all (8-pcs) 0.01uF caps.

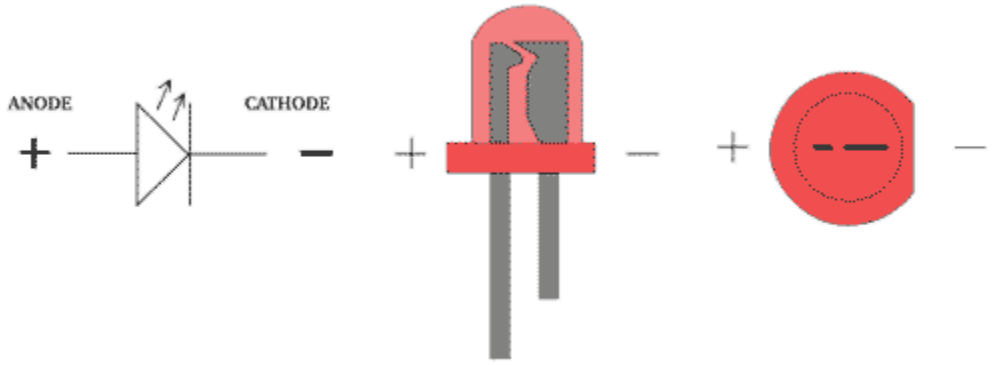
( ) Install 0.1uF cap 1-pcs



( ) Install all (4-pcs) 2.2uF caps (observed polarity).



( ) - Install Green LED – LED0, LED1, LED2, LED3 (observed polarity).



Resistor Band Color Reference				
Color	*Band 1*	*Band 2*	*Multiplier*	*Tolerance*
Black	0	0	x 1	not used
Brown	1	1	x 10	not used
Red	2	2	x 100	not used
Orange	3	3	x 1000 = 1K	not used
Yellow	4	4	x 10000 = 10K	not used
Green	5	5	x 100000 = 100K	not used
Blue	6	6	x 1000000 = 1M	not use
Violet	7	7	not used	not used
Gray	8	8	not used	not used
White	9	9	not used	not used
Gold	not used	not used	divide by 10	±5%
Silver	not used	not used	divide by 100	±10%
None	not used	not used	not used	±20%

( ) Install R1, R2, R3, & R4 - 680 OHMS resistors

( ) Install R5 - 22 OHMs resistor

( ) Install R6 - 220 OHMs resistor

( ) Install R7, R8, and R9 - 2K OHMS resistors

( ) Install R10 - 3.3K OHMS resistor

( ) Install all 14 pin IC sockets.

( ) Install all 16 pin IC sockets.

( ) Install all 20 pin sockets.

( ) Install three 3 pin headers (JP2, JP3 & JP5)

( ) Install 8 positions DIP-SWITCH (SW1)

( ) Install 4 positions DIP-SWITCH (SW2)

( ) Add thermal compound to the regulator and heath sink.

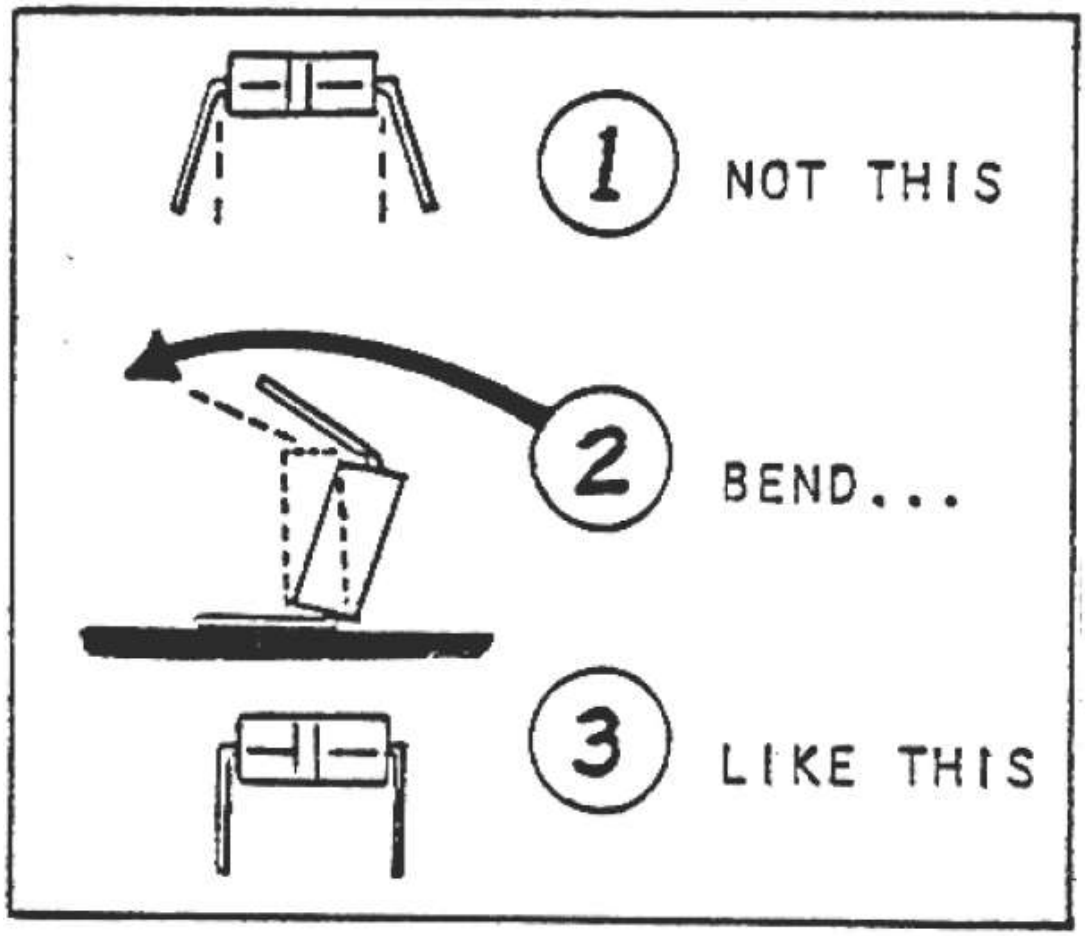
( ) Install U2 – 7805 Regulator along with the heat-sink.

( ) Solder OSC #1 – 16.384 MHz (is included with the board). Make sure R10 (3.3K) resistor does not touch the osc can. The resistor is too close to the metal frame of the osc. If it touches, then the +5v will short to ground overheating the 7805 regulator.

( ) Using the soldering iron on a “14 Pin Machine Tooled Low Profile Soldertail” socket (JAMECO P/N: **37197)**, remove pins 2, 3, 5, 6, 9, 10, 12, 13. Solder part into OSC # 2 position. This socket allows using half or full cans oscillators.

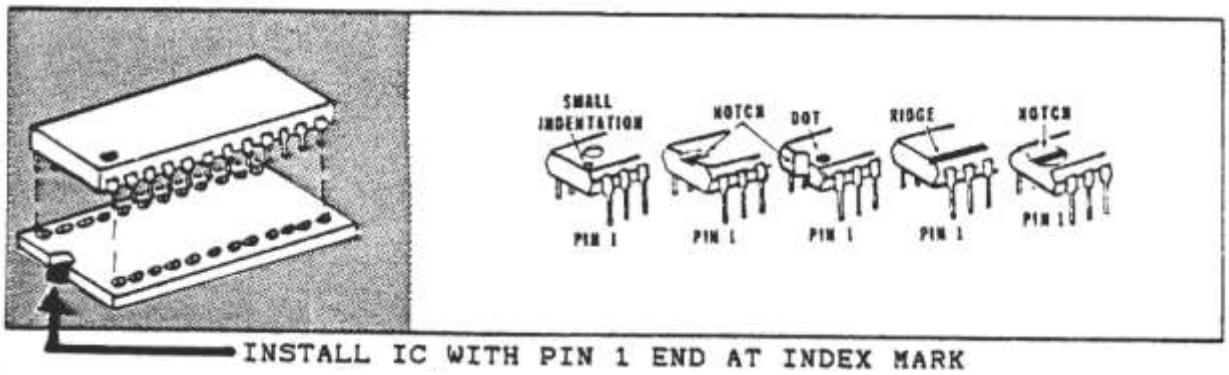
( ) Install OSC # 2 into socket – 10MHz or any other frequency supported by the hardware (Z84C0010PEG) and add a tie-wrap to keep oscillator in place.

( ) Straighten any bend pins on the IC's. The pins should be parallel to each other and at right angles to the case. Some IC's may have their pins spread out slight as shown below. If so, align the pins by gently pressing against a table top and bending as shown below.



STRAIGHTEN THE LEADS

( ) When installing the IC's, align the notch and/or dot with the index mark on the board as shown below. Be sure all the pins enter the holes of the socket, and then press the IC into its socket.



( ) Install U1, U2 – 74LS540

( ) Install U3 – 74LS175

( ) Install U4 – 74LS00

( ) Install U5 – 74LS682

( ) Install U6 – 74LS138

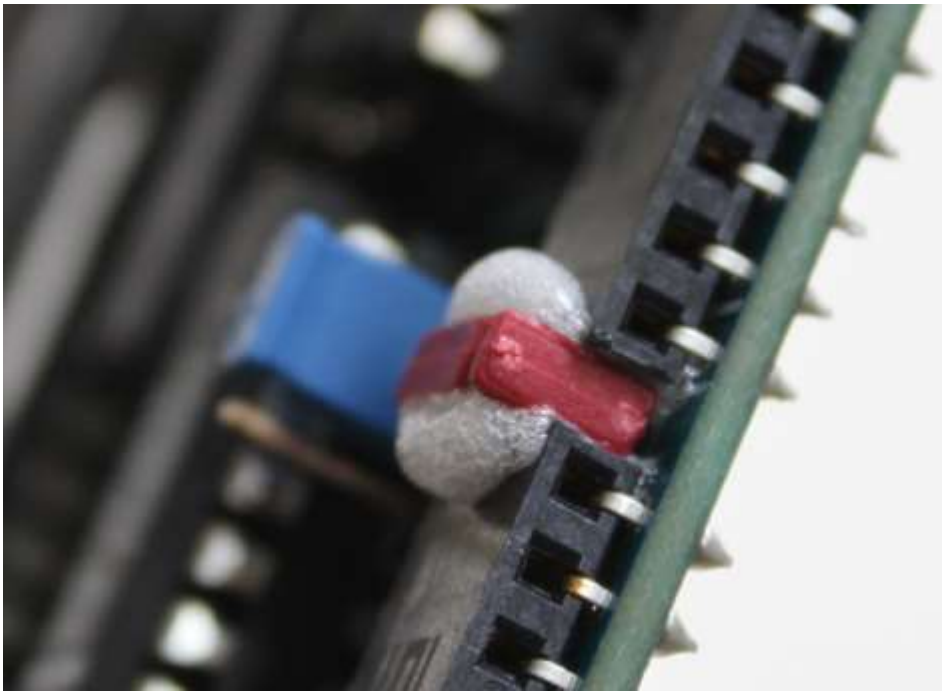
( ) Install U7 – 74LS161

( ) Install U8 – 74LS153 or 74F153

( ) Install U9 – 74F04

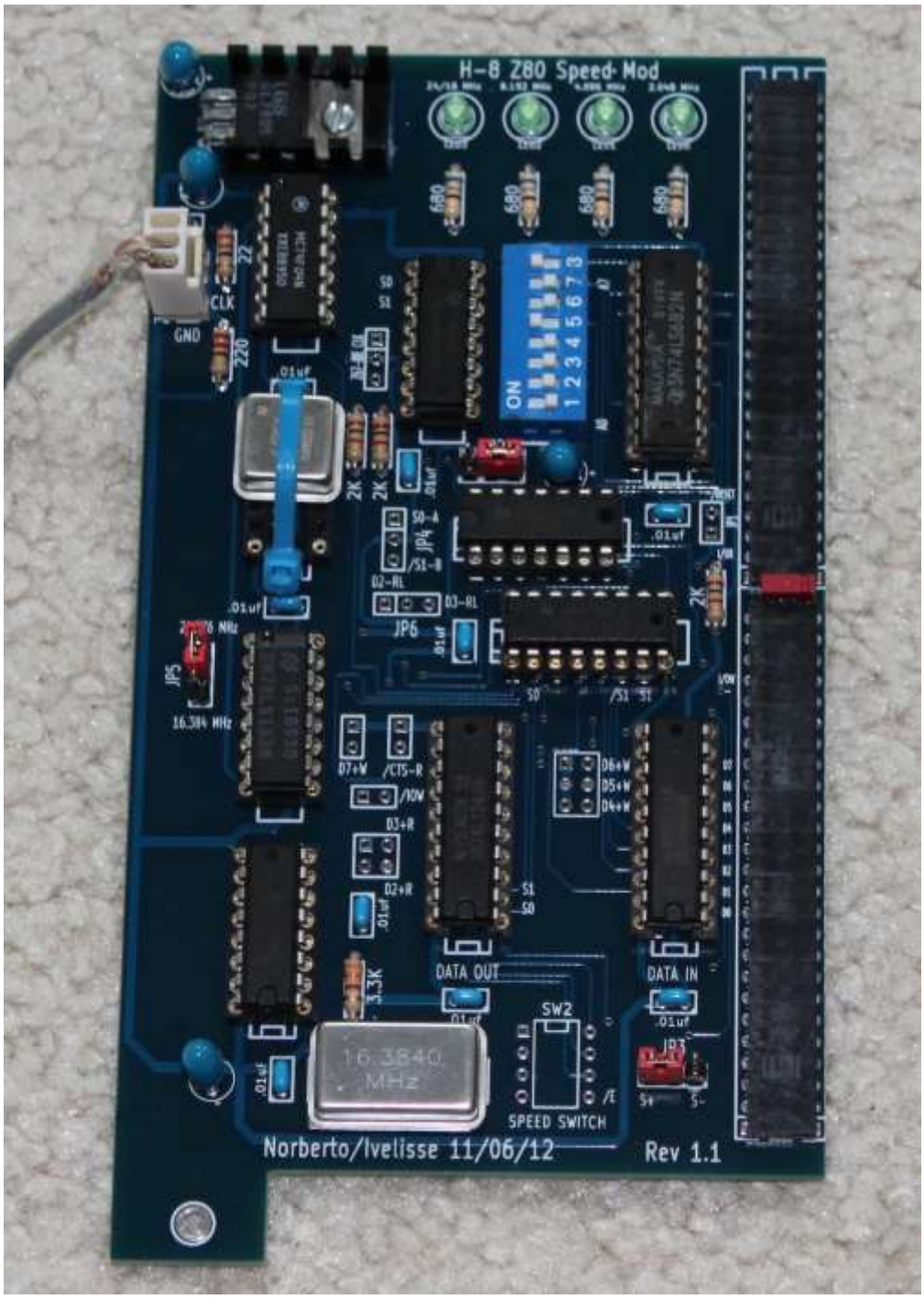
( ) Solder P1 and P2 25 pin female connectors (SAM1009-25-ND)

( ) Glue a 2 pin jumper SHORT BLK (Jameco – 19141 – BOM Line 32) to protect the board from shorting the -18V and the +18V to the +8 Volt rail and to the Ground rail as shown below. **If the +-18Volts rails get shorted to ground then the four diodes on the motherboard will burn-out and will also destroy the +-12 Volts regulators on the Serial Communications board.** Please use Gorilla Glue and use proper orientation as shown on the picture.



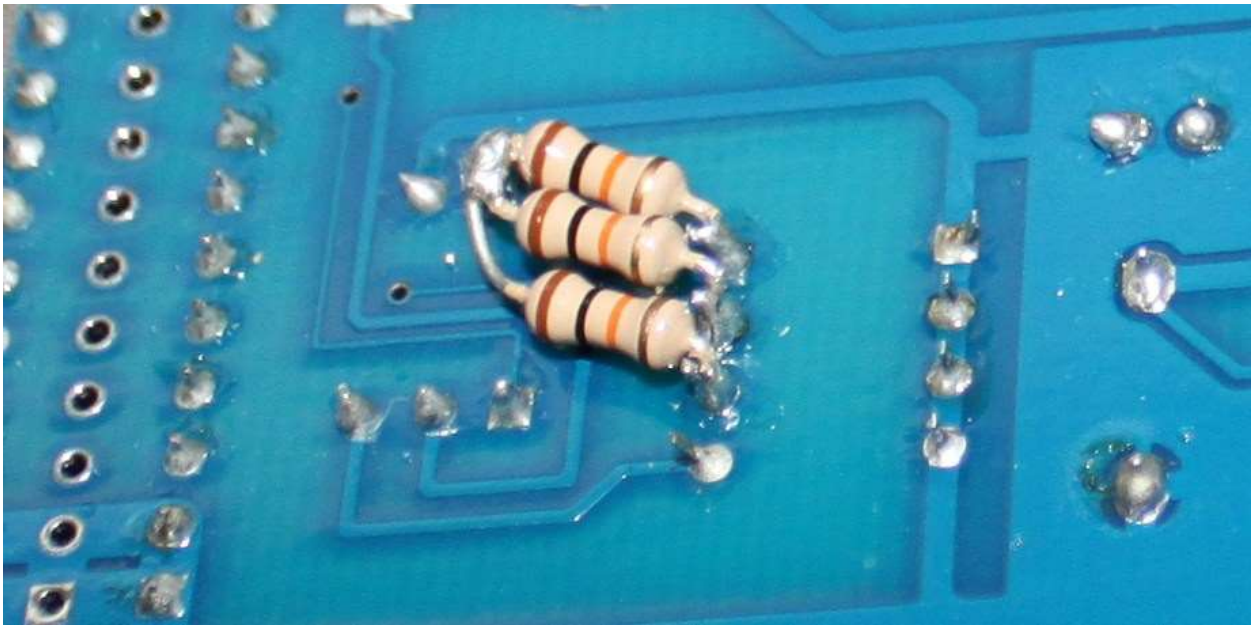
H8-SPEED BOARD

ASSEMBLED BOARD (**update picture – SW2 missing**)



H8-SPEED BOARD REWORK

( ) Solder three 10K resistors as shown below to avoid reading false data from SW2.



H8-SPEED BOARD BOM

H8-Speed BOM link