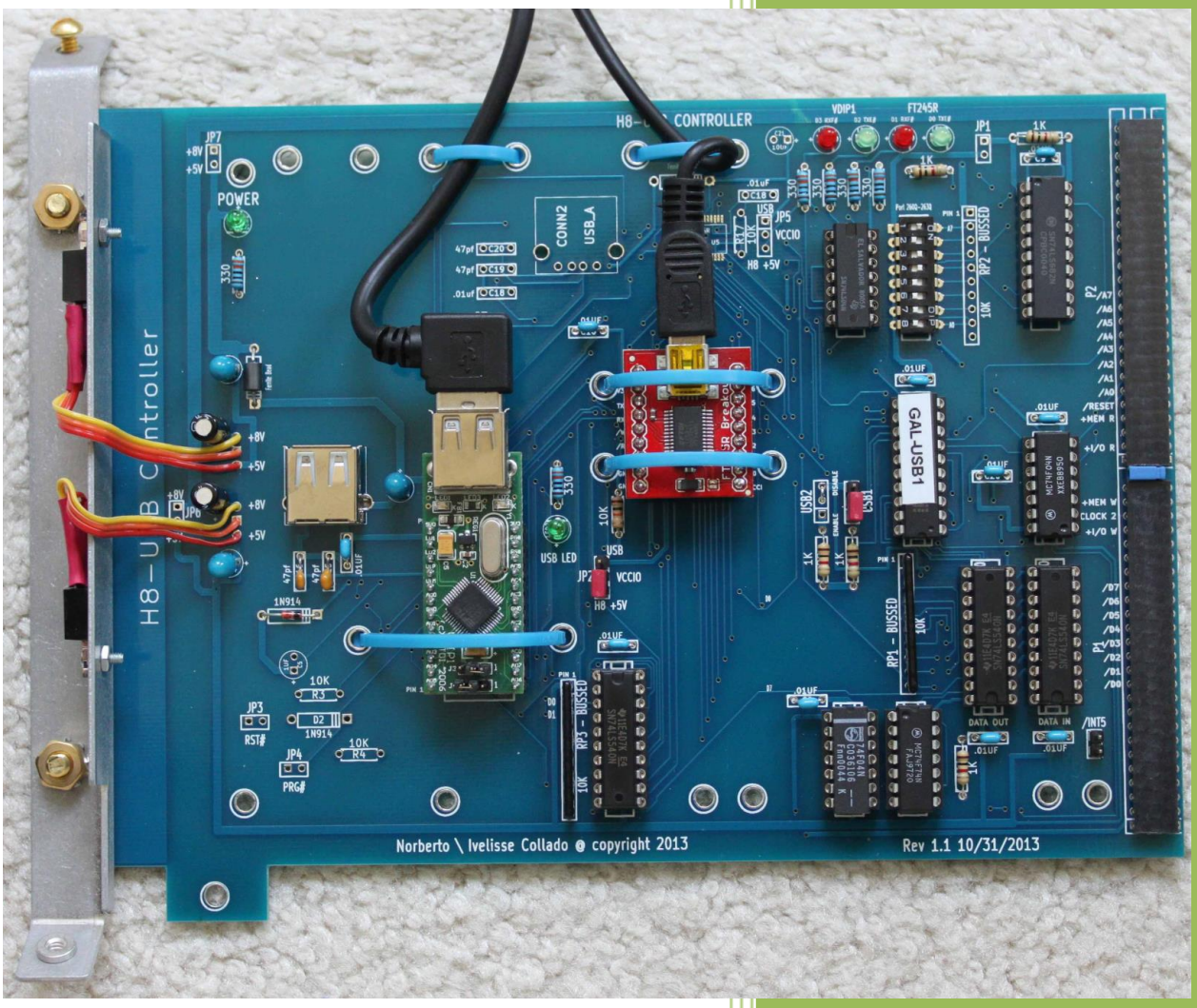
2013

H8-USB CONTROLLER



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5/5/2013

Revision History and Disclaimer

Revision History		
Revision	**Date**	**Comments**
1.0	05/05/2013	Initial draft by Norberto Collado

The purpose of this document is to “SUPPORT” those who still use these great Heathkit machines and to preserve the information of those who made a difference.

Another purpose of this document is to allow the surviving classic computers to continue to function. Without the proper software support, the hardware cannot be seen in action, and a piece of our digital history is lost. I have not included any material in this document which I believe has current commercial value. Most of the material in this document is the intellectual property of other companies or individuals. However many of the companies are no longer in existence, and I do not have current contact information to obtained permission to include them.

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 an overview on the H8-USB controller board assembly design by Norberto Collado for the Heathkit H8 Computer.

H8-USB Controller

The H8-USB controller contains the FT245R which is a USB to parallel FIFO interface and the VDIP1 Vinculum VNC1L device which supports two USB host ports. The FT245 USB interface connects to your Windows or Linux workstation for H8D images or file transfers. The VDIP1 controller allows the transfer of files between the PC and the H8 by using a USB flash media device.

The H8-USB controller is operable at any CPU speed up to 4 MHz and it mounts inside the H8 computer cabinet.

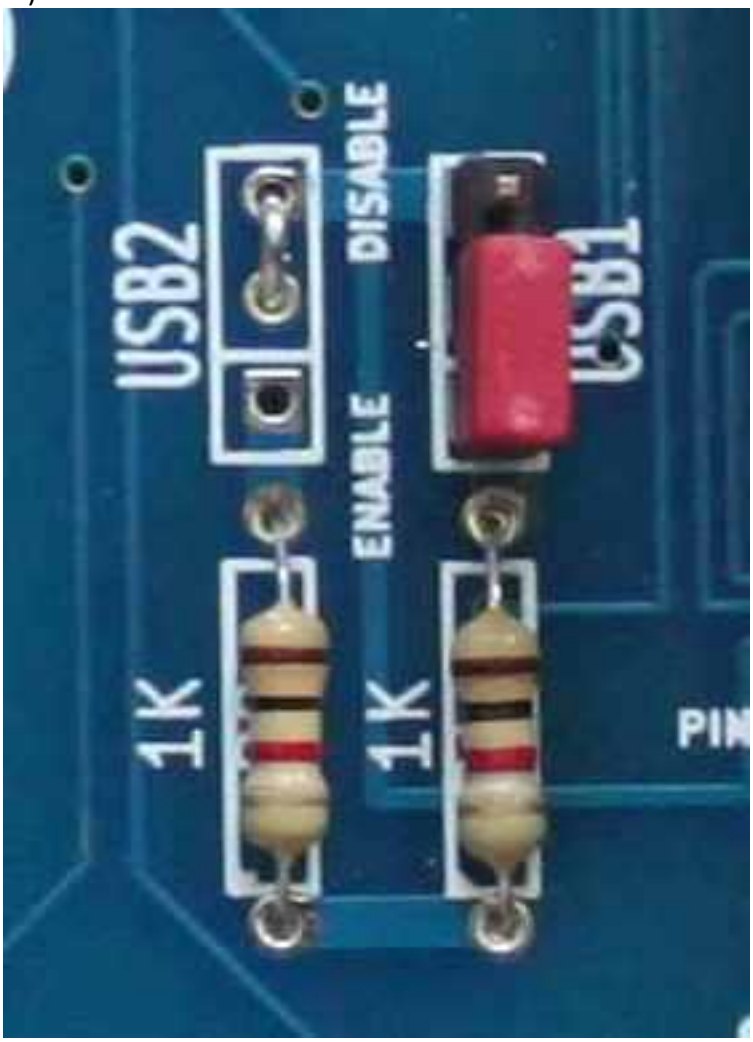
H8-USB Port I/O Configuration

The following is a table summary of the controller ports configuration.

CONTROLLER CARD	H8-PORT
USB	B0H (260Q)

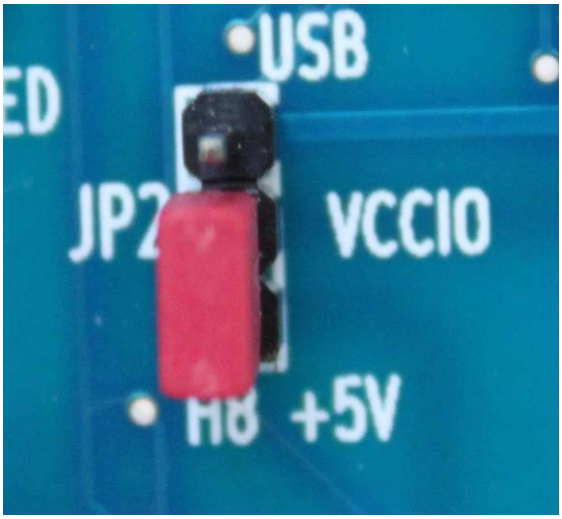
H8-USB Jumper Configuration

( ) USB2 Disabled (solder a bare wire across pin 2 and 3 as shown below)
( ) USB1 Enabled (solder a three pin header as shown, and insert a jumper between pins 1 and 2.)



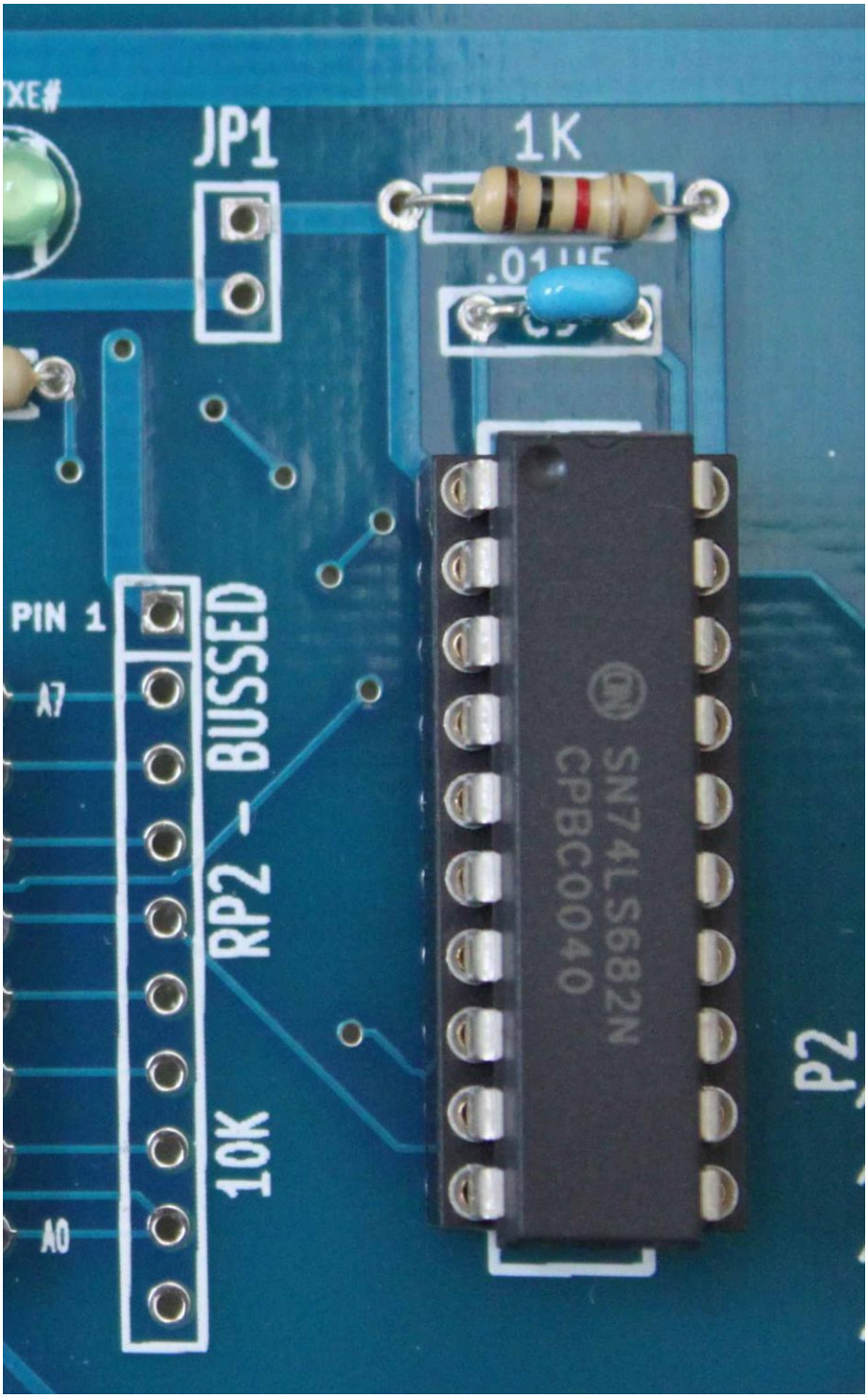
( ) Solder a two pin header for /INT5 as shown below. This jumper is to support ZMP communications utility under CP/M with interrupts. For support email: Kenneth L. Owen tx836519@bellsouth.net or check website; http://koyado.com/Heathkit/H-8_USB.html

( ) Solder a three pin header (JP2) and insert Jumper across between VCCIO and H8 +5V as shown (VCCIO gets power from the H8 power rail).



( ) If using the 74LS688 I/O decoder, then solder a two pin header (JP1) and insert a jumper. Also solder a 10K BUSSED resistor pack (RP2) for proper operation.

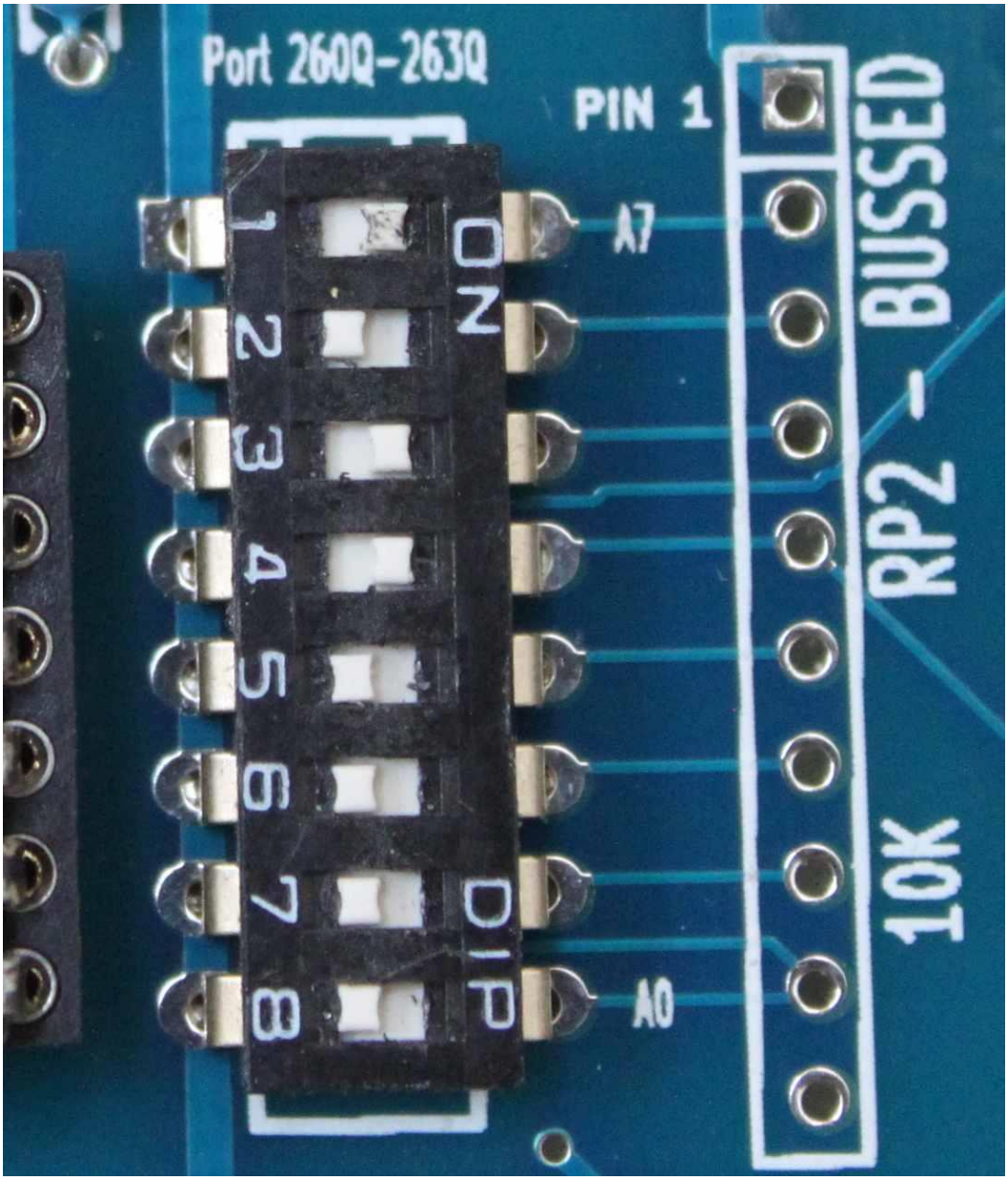
Note: If using the 74LS682 decoder as shown below, then do not solder JP1 and the RP2 resistor pack.



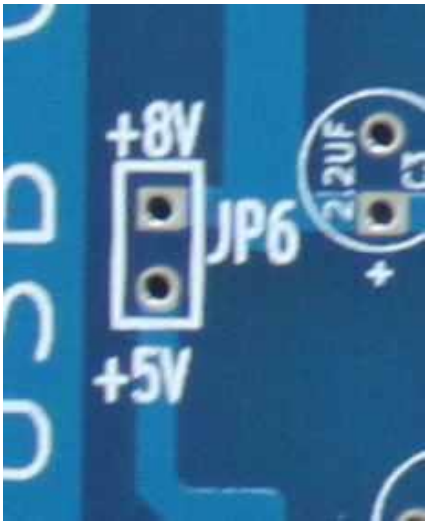
( ) Solder an 8-position DIP switch as shown and set port address to 260Q.
PORT 260Q:
SW1 = A7 = ON (2)
SW2 = A6 = OFF (0) (2+0) = 2

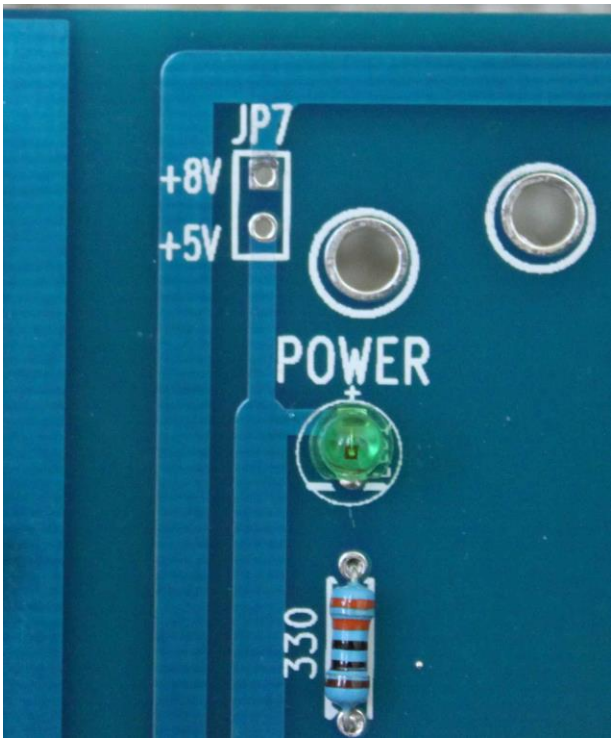
SW3 = A5 = ON (4)
SW4 = A4 = ON (2) (4+2 +0) = 6
SW5 = A3 = OFF (0)

SW6 = A1 = OFF (0)
SW7 = A1 = OFF (0)
SW7 = A0 = OFF (0) (0+0) = 0 (Q)

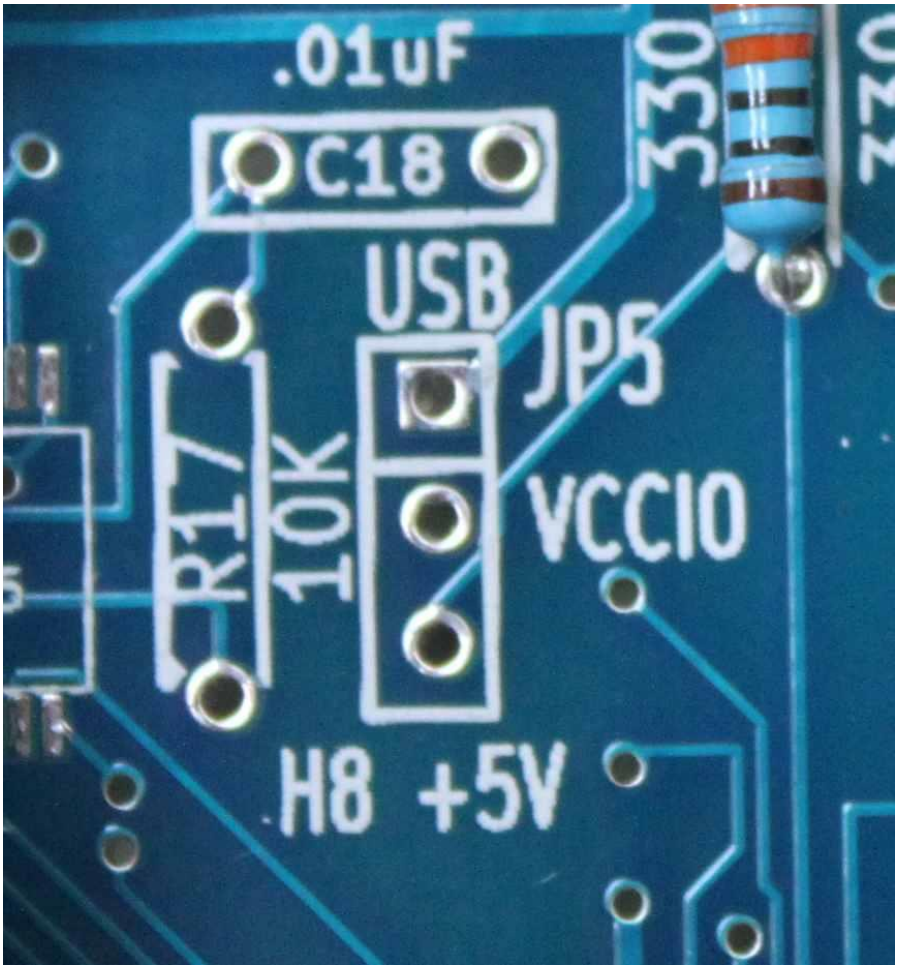


( ) **Warning:** ONLY if using the H8-USB with a PC power supply, then solder a two pin header at JP6 and JP7 locations and insert a jumper for each location. Otherwise ignore this step to avoid damaging the board.

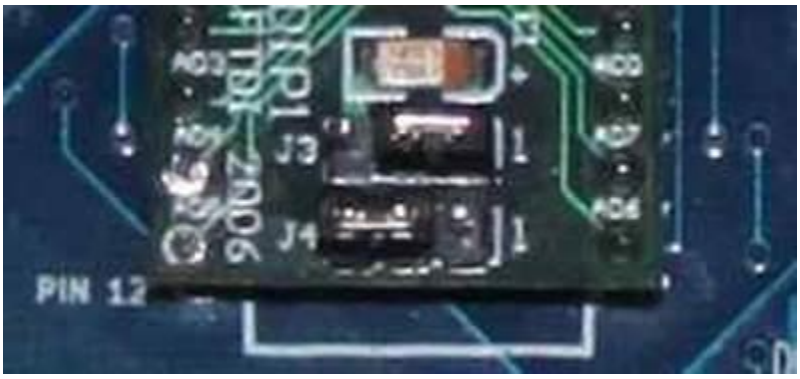

+8V
JP6
+5V
2.2UF


JP7
+8V
+5V
POWER
330

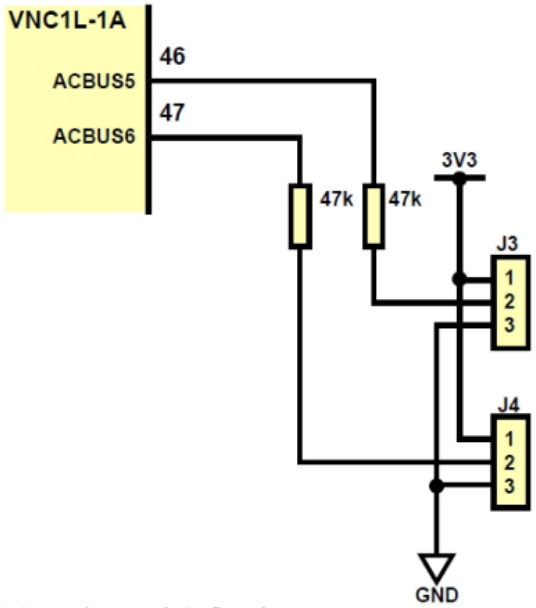
( ) Solder a three pin header at JP5 location if using the FT245 surface mount part. Insert a jumper between VCCIO and H8 +5V header. Otherwise ignore this step.



( ) VDIP1 FIFO jumper settings. J3 and J4 jumpers configuration for FIFO mode. Set J4 – Jumper across pins 2-3 (Ground), Set J3 – Jumper across pins 1-2 (High) as shown below.



Two three way jumper pin headers are provided to allow for simple configuration of the I/O on data and control bus pins of the VDIP1. This is done by a combination of pulling up or pulling down the VNC1L ACBUS5 (pin 46) and ACBUS6 (pin 47). The relevant portion of the VDIP1 module schematic is shown in **Figure 3.2**



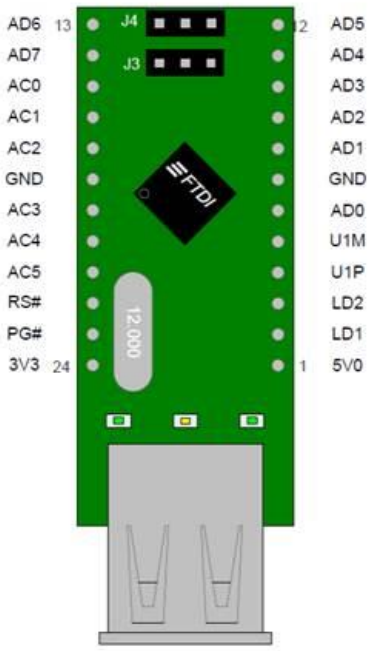


Figure 3.2 – VDIP1 On-Board Jumper Pin Configuration.

ACBUS6 (VNC1L pin 47)	*ACBUS5 (VNC1L pin 46)*	*I/O Mode*
Pull-Up	Pull-Up	Serial UART
Pull-Up	Pull-Down	SPI
Pull-Down	Pull-Up	Parallel FIFO
Pull-Down	Pull-Down	Serial UART

Table 3.2 - VDIP1 Port Selection Jumper Pins

H8-USB Interface Register Definition

The bit definition for each register is described below:

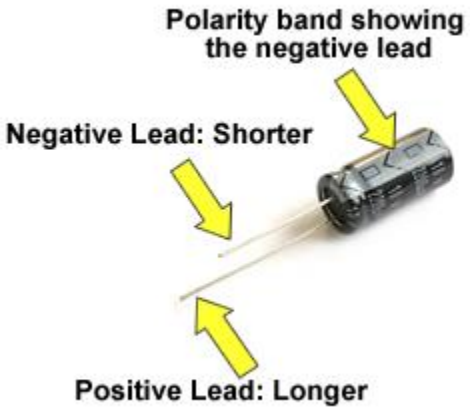
HEX Address	Octal Address	Register	Operation
0xB0	260Q	FT245 Controller	Read and Write
0xB1	261Q	VDIP1 Controller	Read and Write
0xB2	262Q	Status	Read Only

Status	Input Address (0x262Q)
bit 7	SPARE - high level
bit 6	SPARE - high level
bit 5	SPARE - high level
bit 4	SPARE - high level
bit 3	VDIP1 RXE# - When "low", do not read data from the FIFO. When "high", there is data available in the FIFO which can be read by strobing RD# low, then high again.
bit 2	VDIP1 TXE# - When "low", do not write data into the FIFO. When "high", data can be written into the FIFO by strobing WR high, then low.
bit 1	FT245 RXE# - When "low", do not read data from the FIFO. When "high", there is data available in the FIFO which can be read by strobing RD# low, then high again. During reset this signal pin is tri-state.
bit 0	FT245 TXE# - When "low", do not write data into the FIFO. When "high", data can be written into the FIFO by strobing WR high, then low. During reset this signal pin is tri-state.

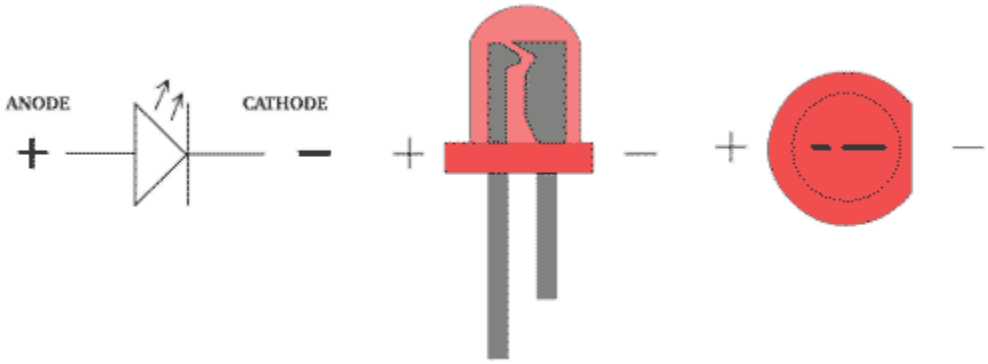
LED's	Status
VDIP1 RXE#	When "OFF", do not read data from the FIFO. When "ON", there is data available in the FIFO which can be read.
VDIP1 TXE#	When "OFF", do not write data into the FIFO. When "ON", data can be written into the FIFO.
FT245 RXE#	When "OFF", do not read data from the FIFO. When "ON", there is data available in the FIFO which can be read.
FT245 TXE#	When "OFF", do not write data into the FIFO. When "ON", data can be written into the FIFO.

H8-USB Board Assembly

1. Install all 0.01uF caps.
2. Install 47pf caps at location C15 & C16
3. Install C1, C2, C4, C4 and C6 - 2.2uF caps (observed polarity).

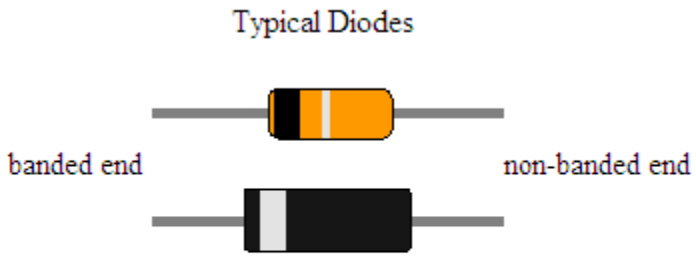


4. Install Green LED's – LED1, LED2, LED3, LED4, LED5, and LED6 (observed polarity).



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%

5. Install D1 – 1N914 diode.

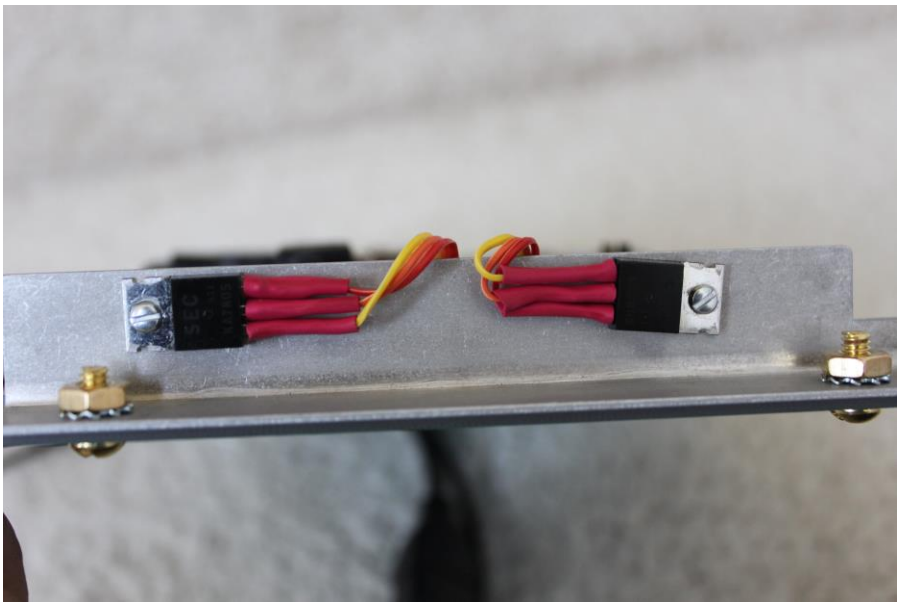


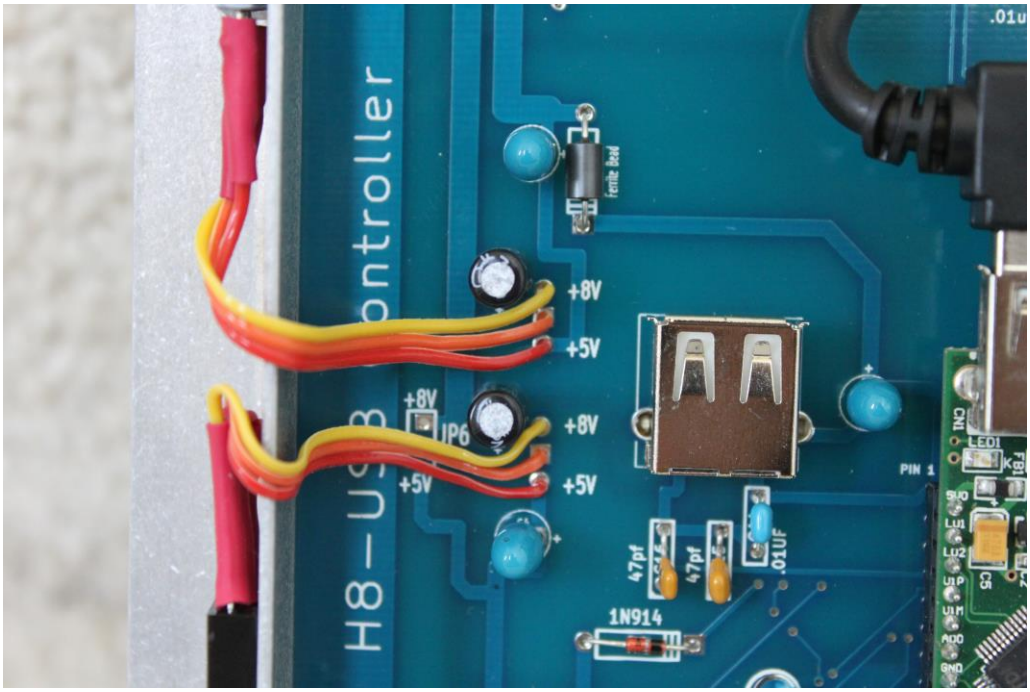
6. Install R2, R6, R7, R8, R12, and R13 – 330 OHMS resistors.
7. Install R1, R19, R10, R14 – 1K OHMS resistors.
8. Install R5 – 10K OHMS resistor.
9. Install FB1 – Ferrite Bead.
10. Install RP1, RP2 AND RP3 10K BUSSED 10 pin resistor. Pin 1 is labeled.
11. Install CONN1 USB-2
12. Install all 14 pin IC sockets.
13. Install all 20 pin sockets.
14. Install two 3 pin headers (JP2, USB1).
15. Install DIP-SWITCH
16. Install 25 PIN MB Connectors (P1,P2)
17. Install U13 – 74LS74 IC.
18. Install U3, U4, U25 – 74LS04 IC.
19. Install U26 – GAL-USB1 IC.

20. Install U20, U36, U35 – 74LS540 IC.
21. Install U1 – 74LS682 IC.

H8-USB Installing +5V Regulators

1. Install the two 7805 +5V regulators as shown below.



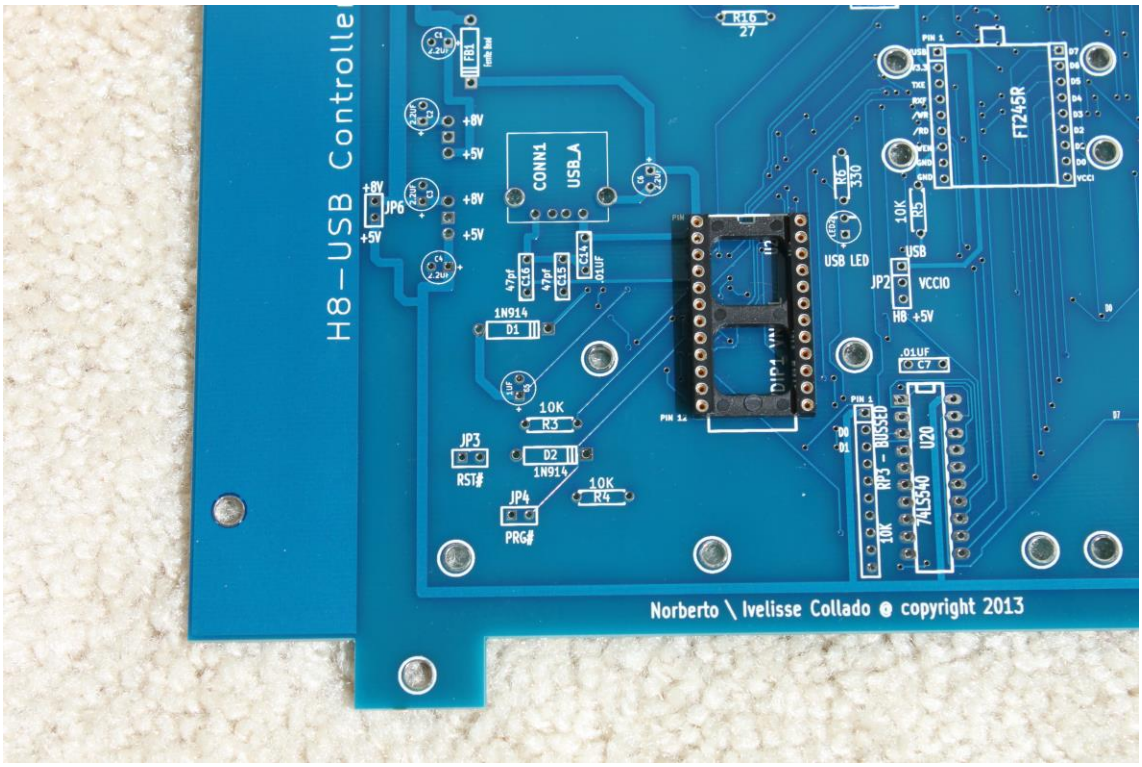


H8-USB Do not Install the following components

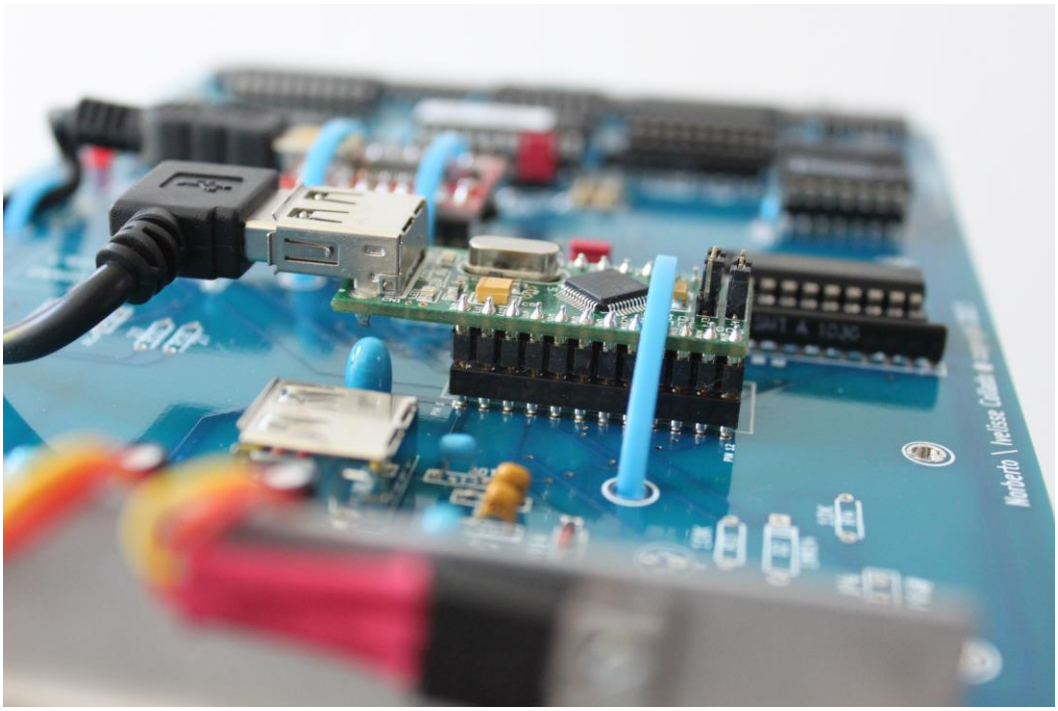
1. There are some components that are used for development purposes and do not install them as shown below.

H8-USB Installing the VDIP1 Controller

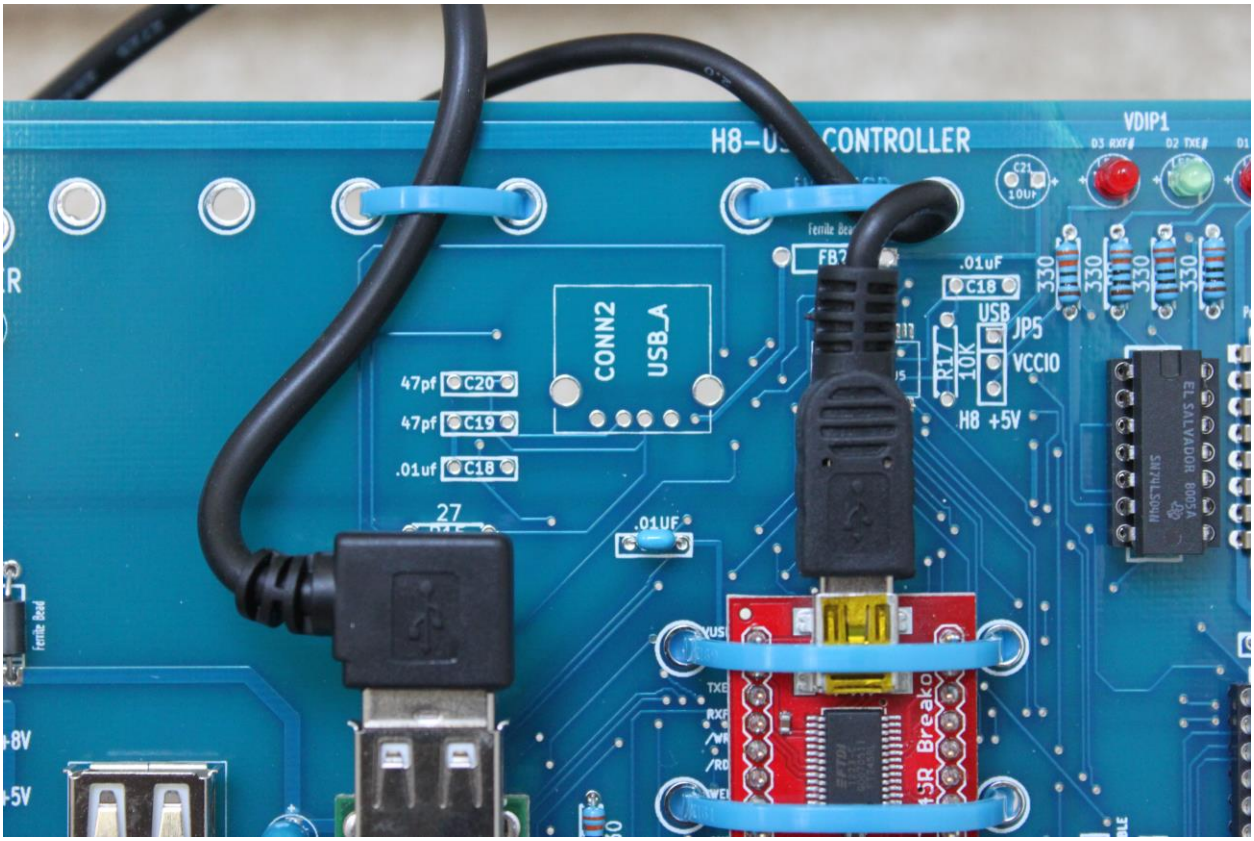
1. Solder a 24 pin machined tooled low profile socket. This is an important requirement because the VDIP1 controller uses the male SIP header.



2. Insert VDIP1 controller and secure controller with a tied-wrap.

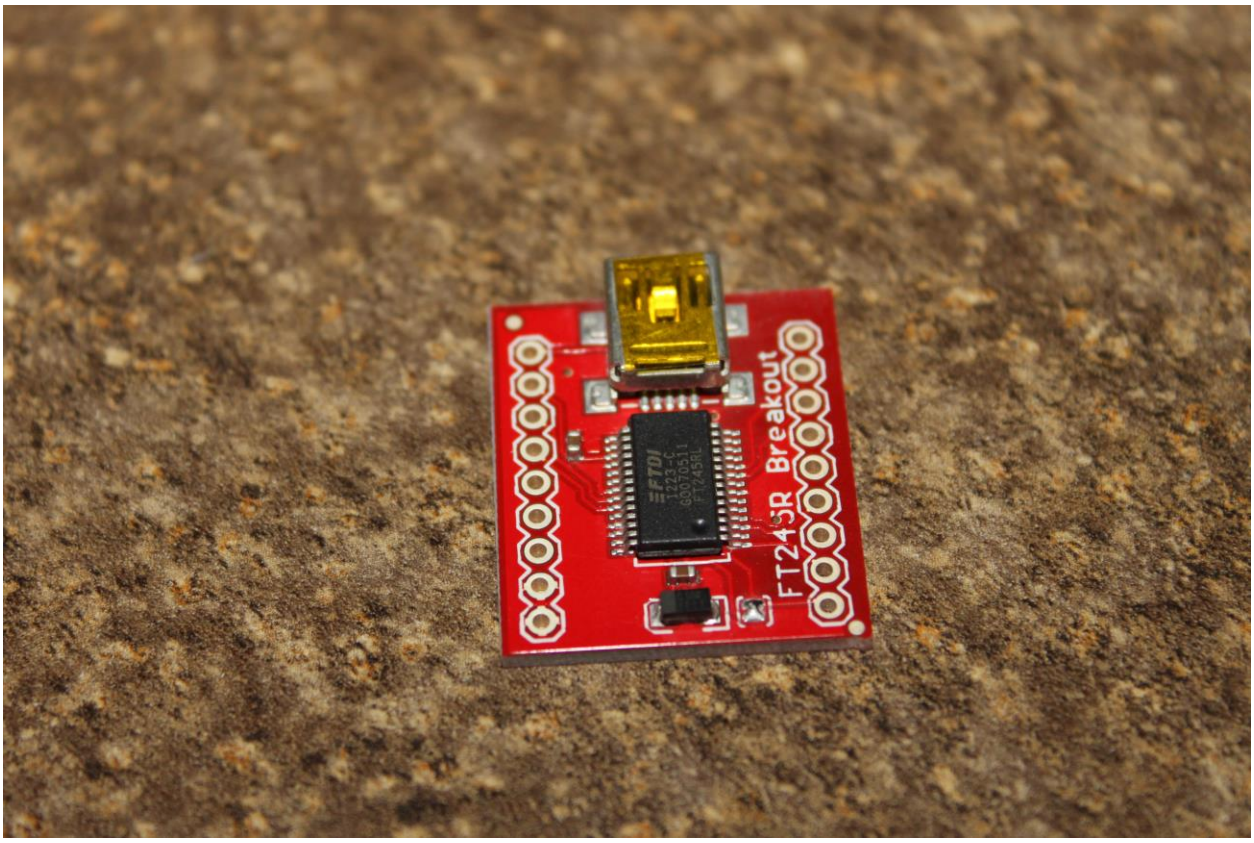


3. Insert USB cable into the VDIP1 controller and secure cable with a tied-wrap as shown.

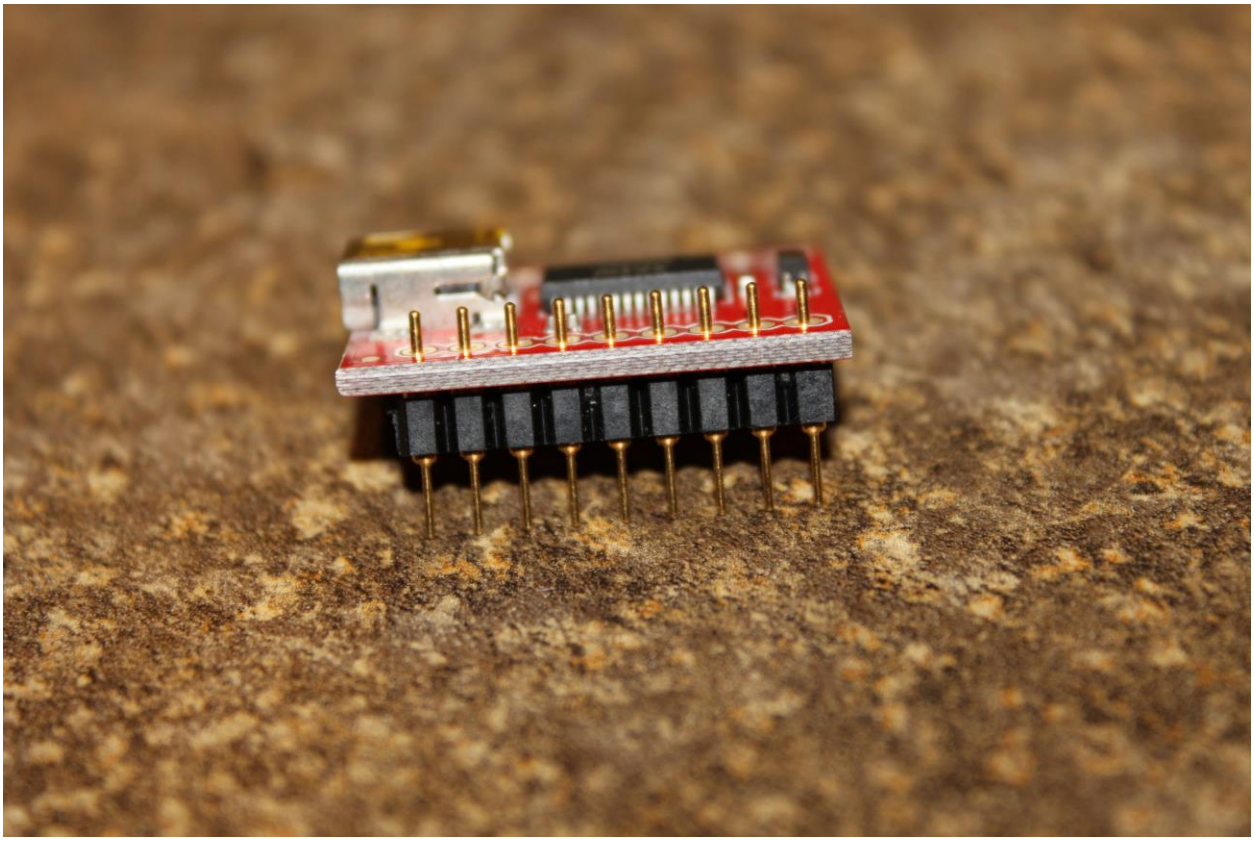


H8-USB Installing the FT245 breakout Controller

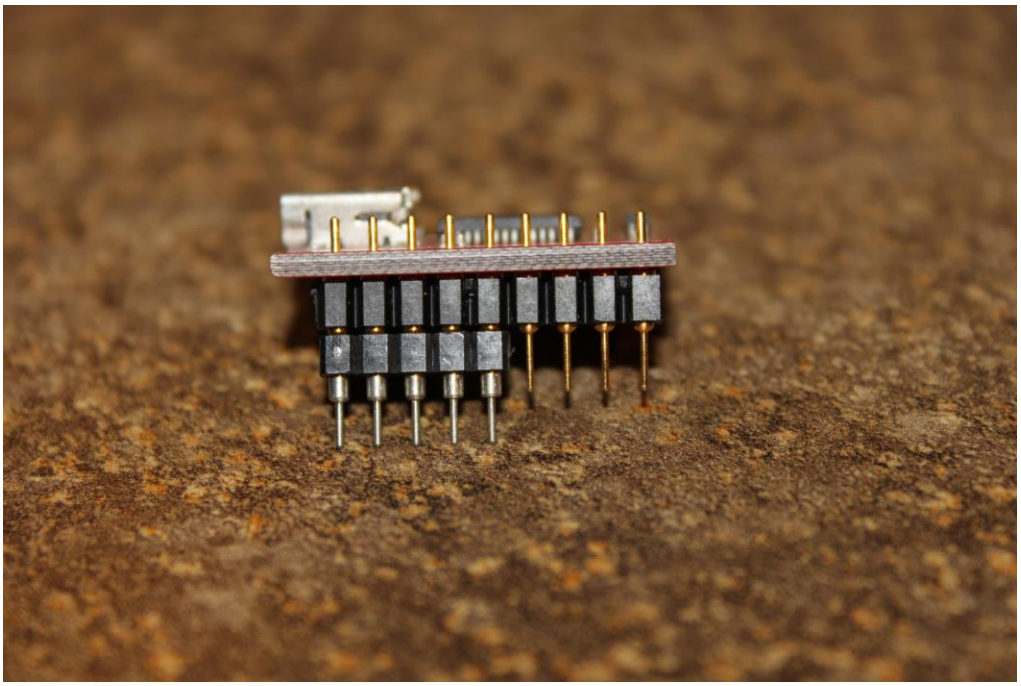
1. The FT245 breakout board comes with no header pins installed. Please follow the steps as indicated for correct placement.



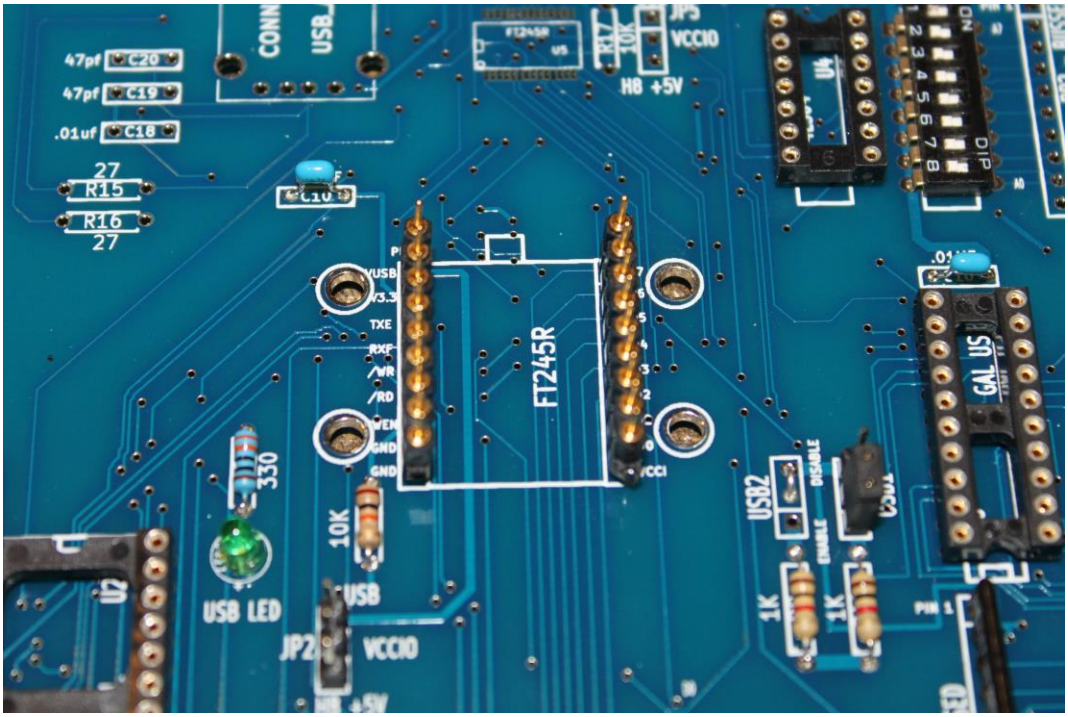
2. Insert the 1x9 male machined pin headers. The header can only be inserted in one direction to mate properly with the female SIP. **Do not solder the header to the FT245.**



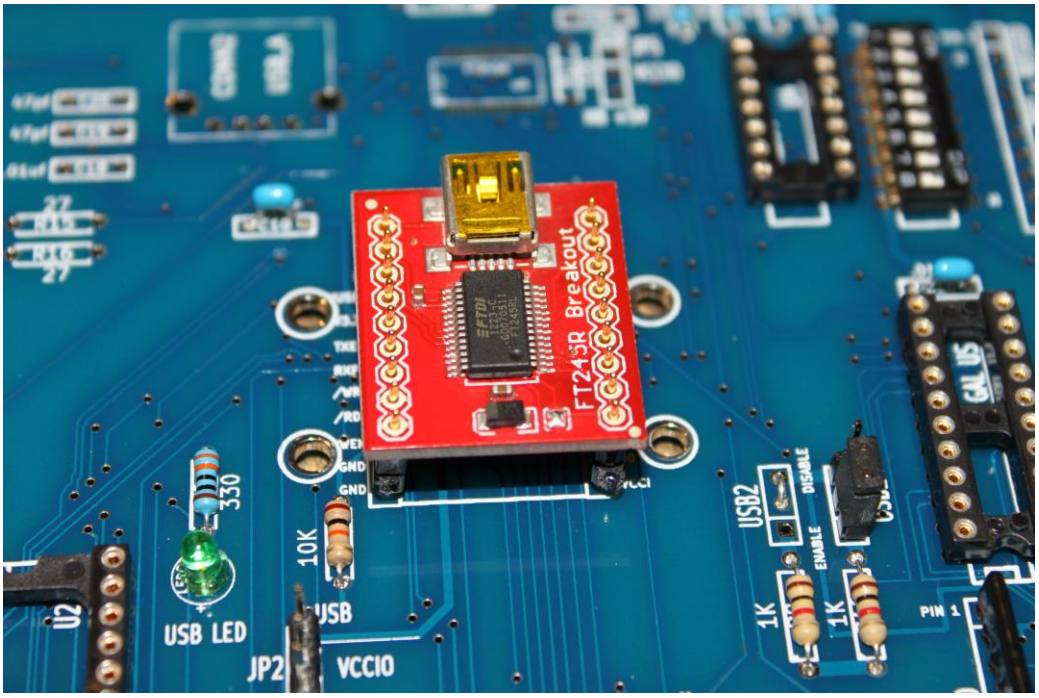
3. Insert the female SIP header to ensure that we have the correct orientation. **Do not solder the header to the FT245.**



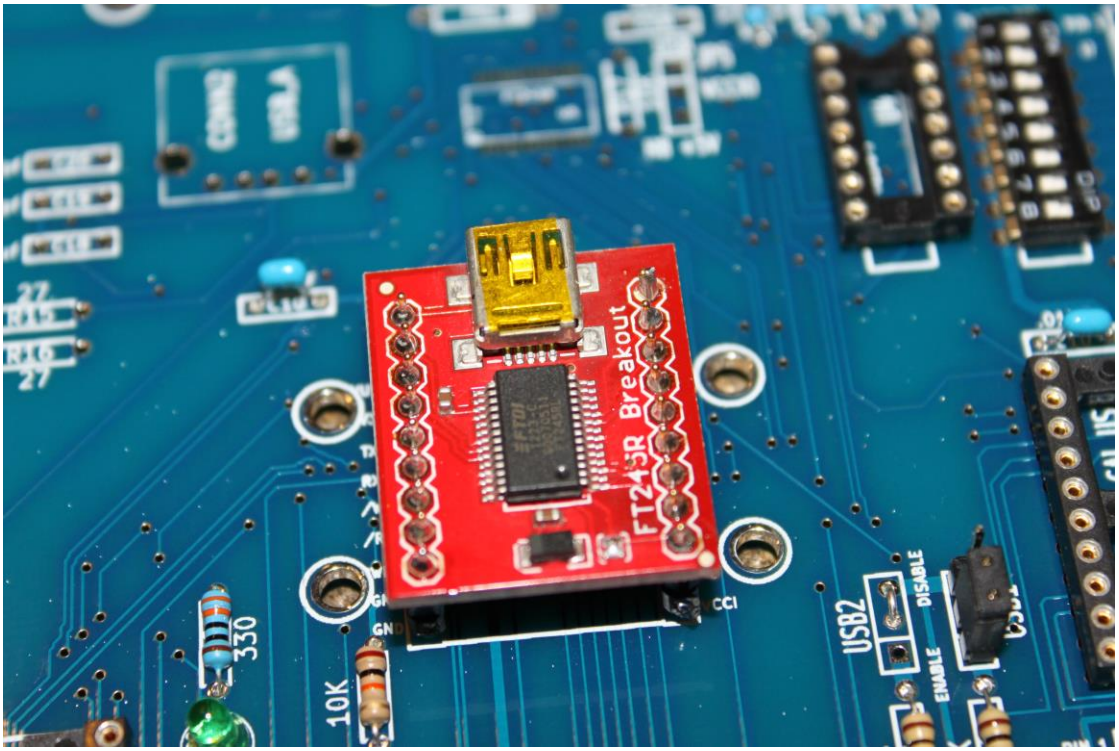
4. Insert 1x9 machined pin header and female SIP header on both sides of the FT245 board. **Do not solder side two yet!**



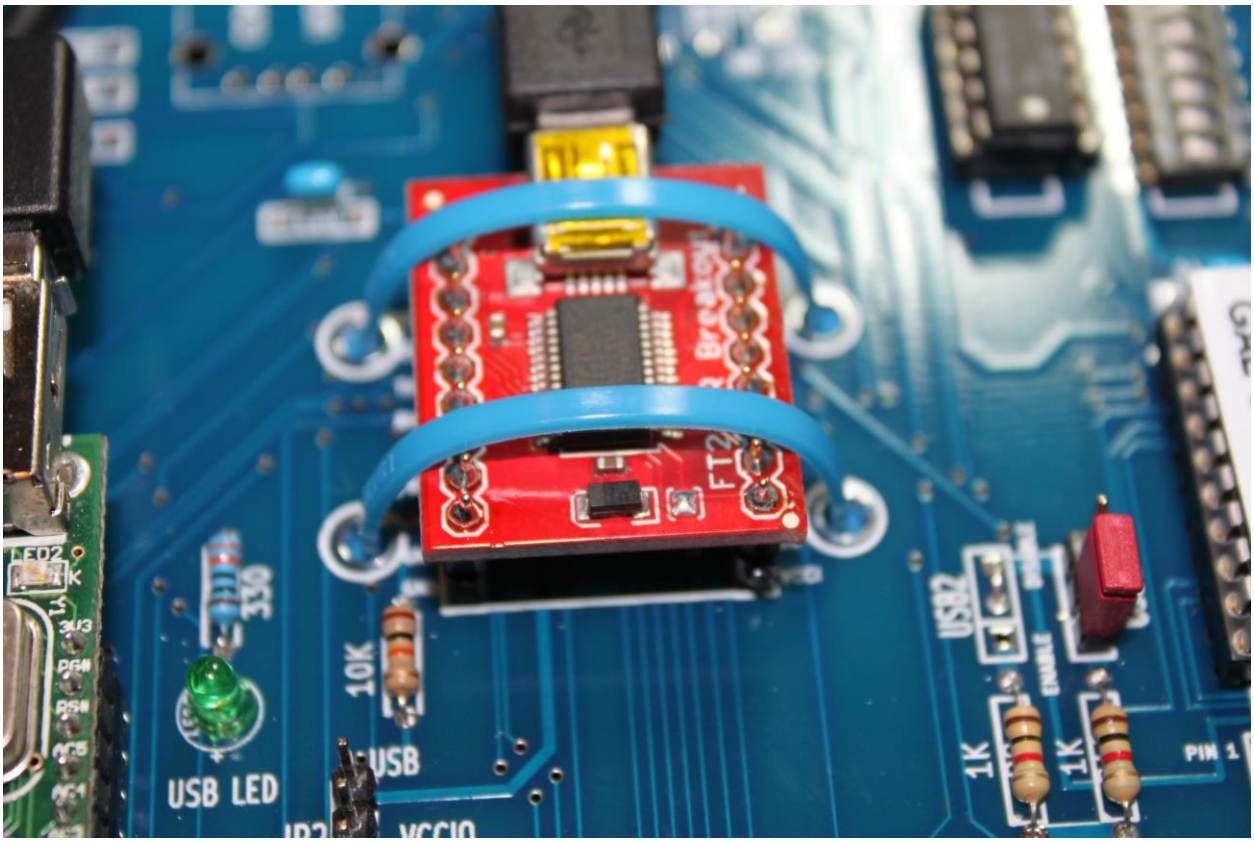
5. Place FT245 board on top of the 1x9 machined pin headers.



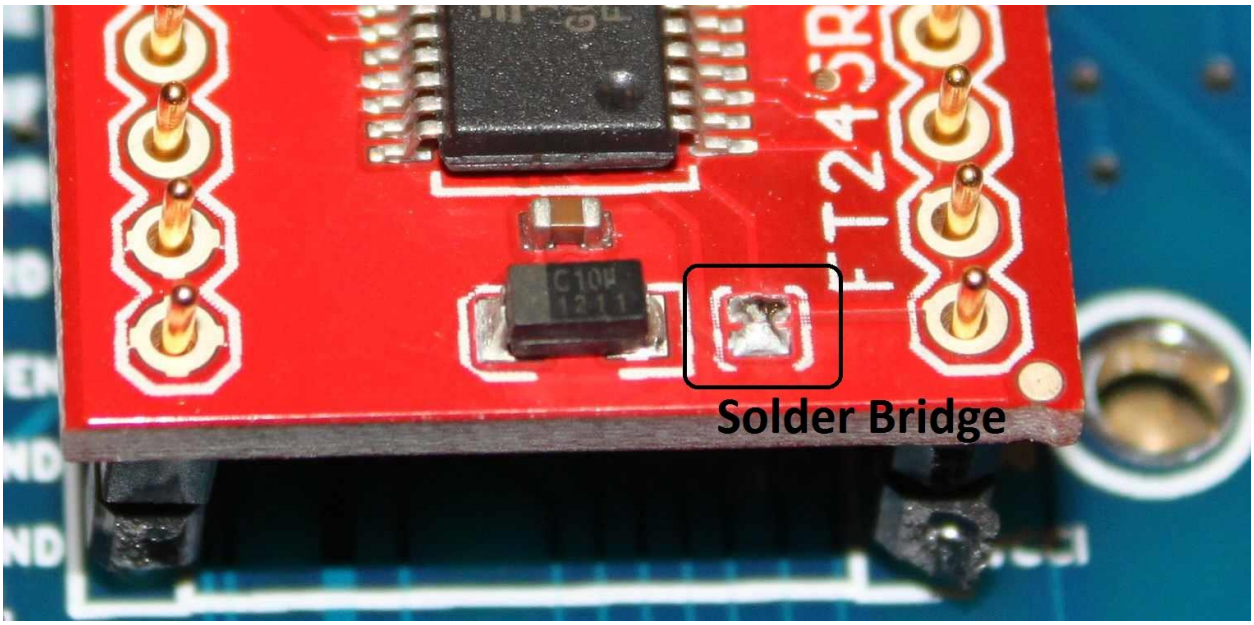
6. While pushing down on the board, solder the 1x9 male pin headers from the top of the board.



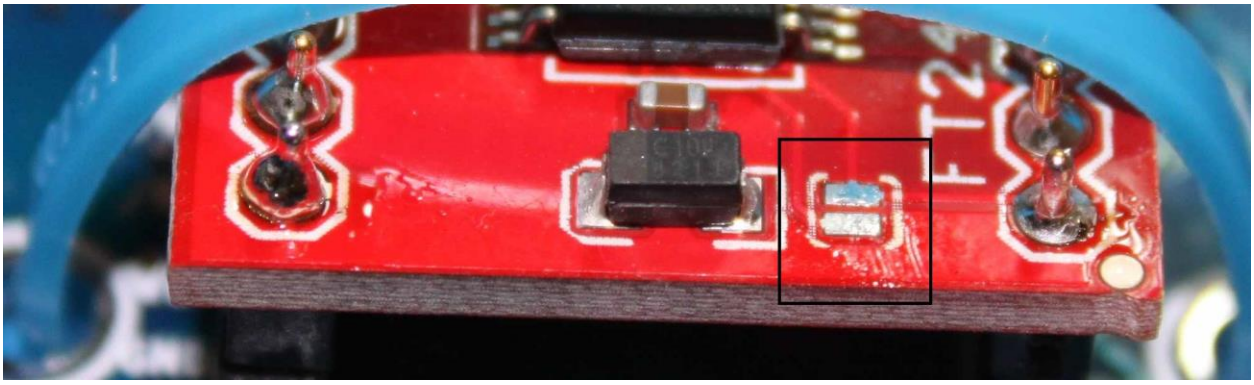
7. Now solder side 2 of the 1x9 pins and then add two tied-wraps' to keep board in place.



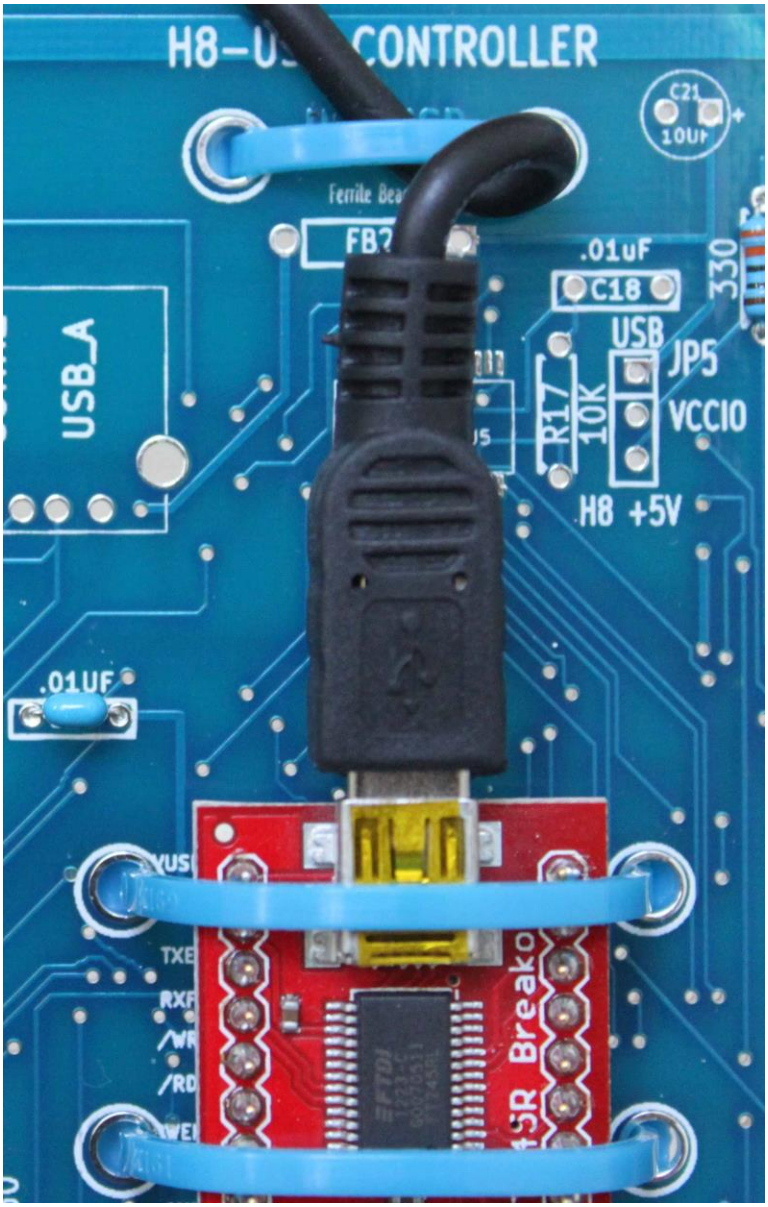
8. There is a solder bridge on the FT245 that we need to remove.



9. Using desoldering braid remove the solder bridge as shown below (from Radio Shack)



10. Attached and secure USB cable as shown. Keep USB cable perpendicular to the H8-USB board to avoid stressing the FT245 USB female connector.

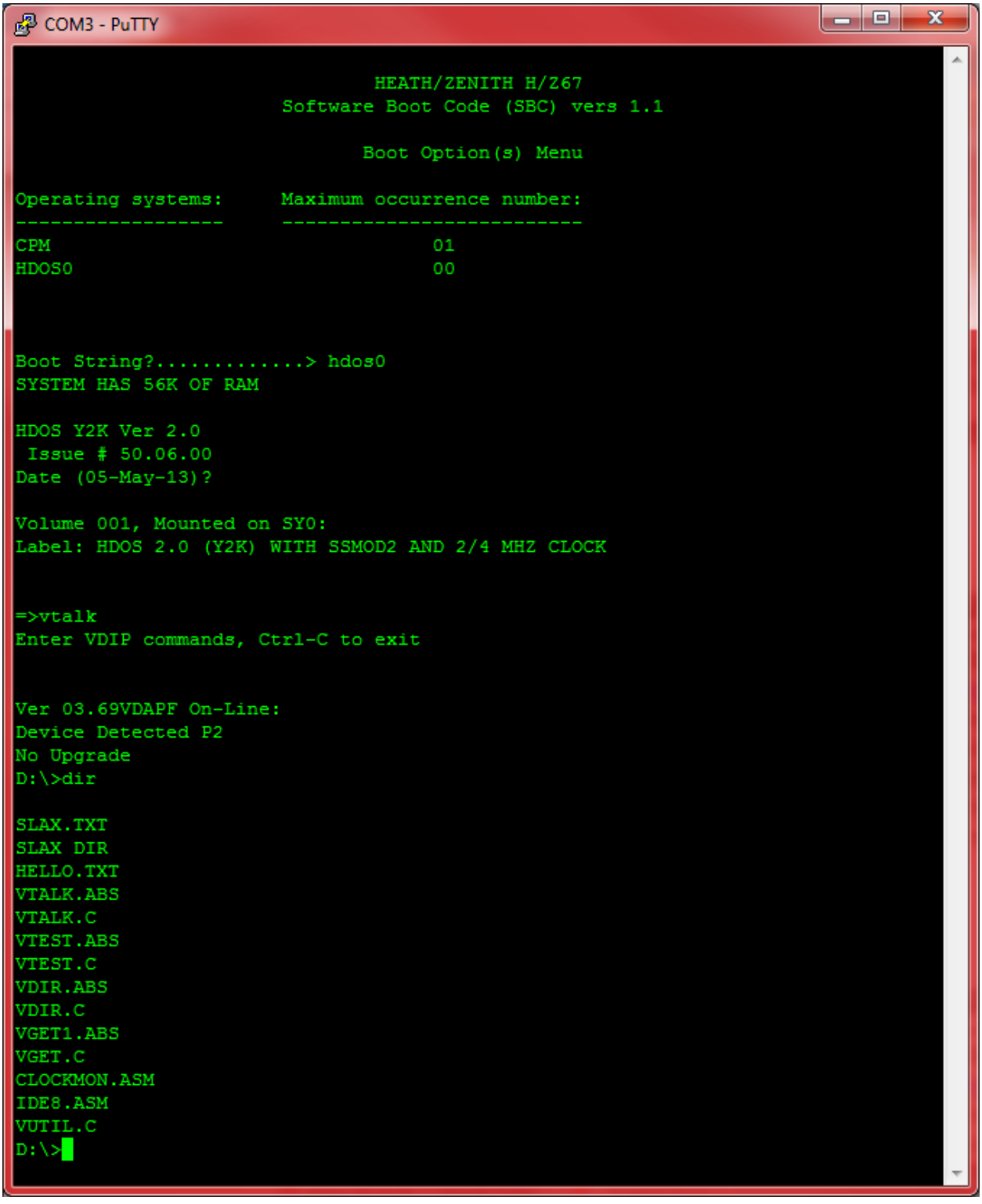


H8-USB Testing the VDIP1 Controller with Glenn HDOS Utilities

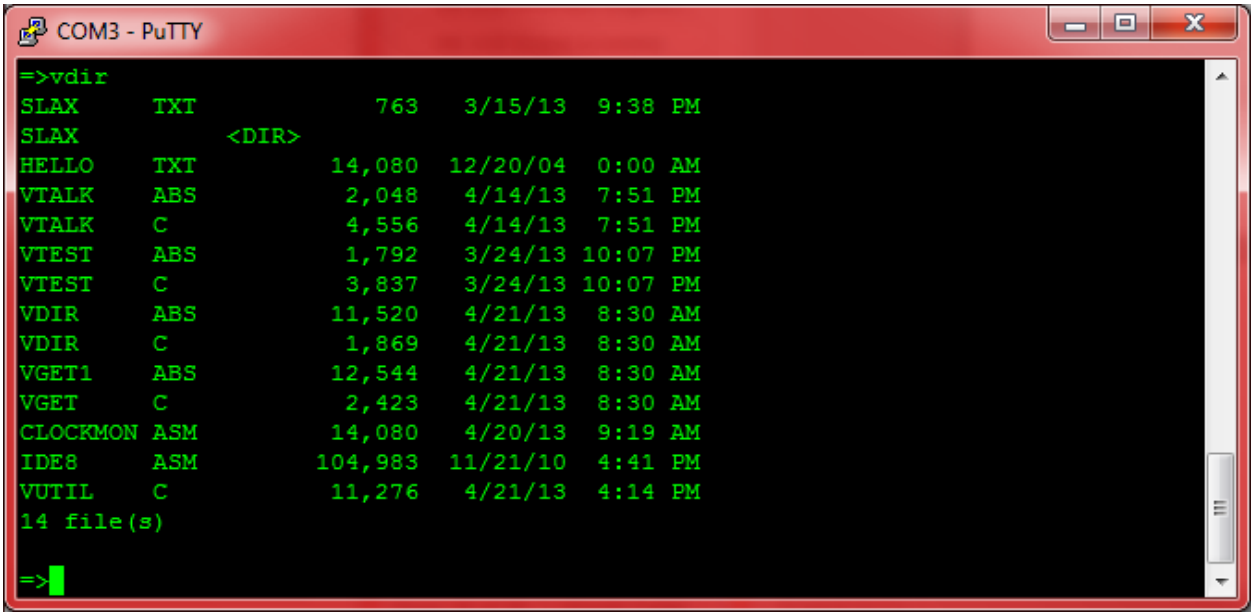
1. Download VTALK.ABS utility from the following website by Glenn Roberts; http://koyado.com/Heathkit/H-8_USB.html
2. Insert a FAT32 formatted USB flash device into the VDIP1 controller.
3. From the HDOS prompt type VTALK.ABS
4. Press the enter key to get the VDP1 prompt. Type DIR to display USB contents.
5. Type Control-C to exit the VTALK utility.
6. That completes the test of the VDIP1 controller.

Email: Glenn Roberts glenn.f.roberts@gmail.com

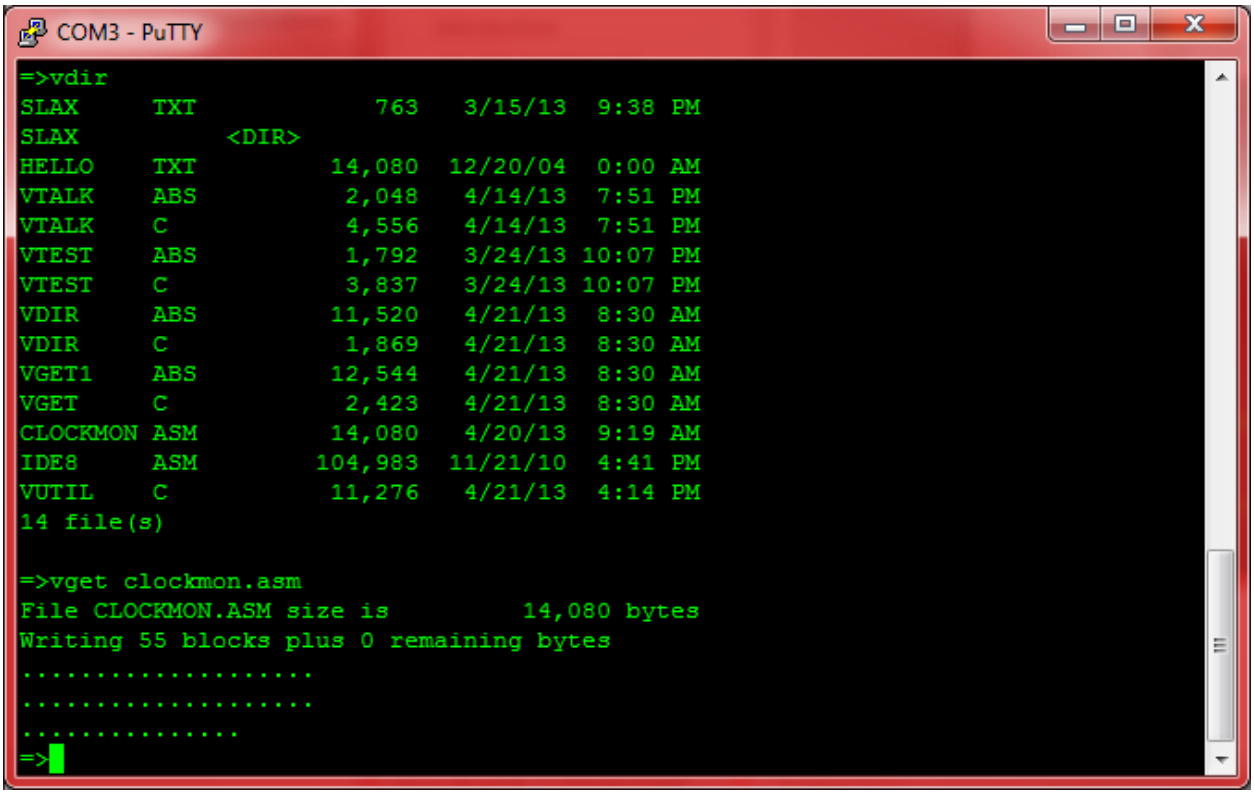
VTALK:


COM3 - PuTTY
HEATH/ZENITH H/Z67
Software Boot Code (SBC) vers 1.1
Boot Option(s) Menu
Operating systems:
Maximum occurrence number:
CPM
01
HDOS0
00
Boot String?.....> hdos0
SYSTEM HAS 56K OF RAM
HDOS Y2K Ver 2.0
Issue # 50.06.00
Date (05-May-13)?
Volume 001, Mounted on SY0:
Label: HDOS 2.0 (Y2K) WITH SSMOD2 AND 2/4 MHZ CLOCK
=>vtalk
Enter VDIP commands, Ctrl-C to exit
Ver 03.69VDAPF On-Line:
Device Detected P2
No Upgrade
D:\>dir
SLAX.TXT
SLAX DIR
HELLO.TXT
VTALK.ABS
VTALK.C
VTEST.ABS
VTEST.C
VDIR.ABS
VDIR.C
VGET1.ABS
VGET.C
CLOCKMON.ASM
IDE8.ASM
VUTIL.C
D:\>

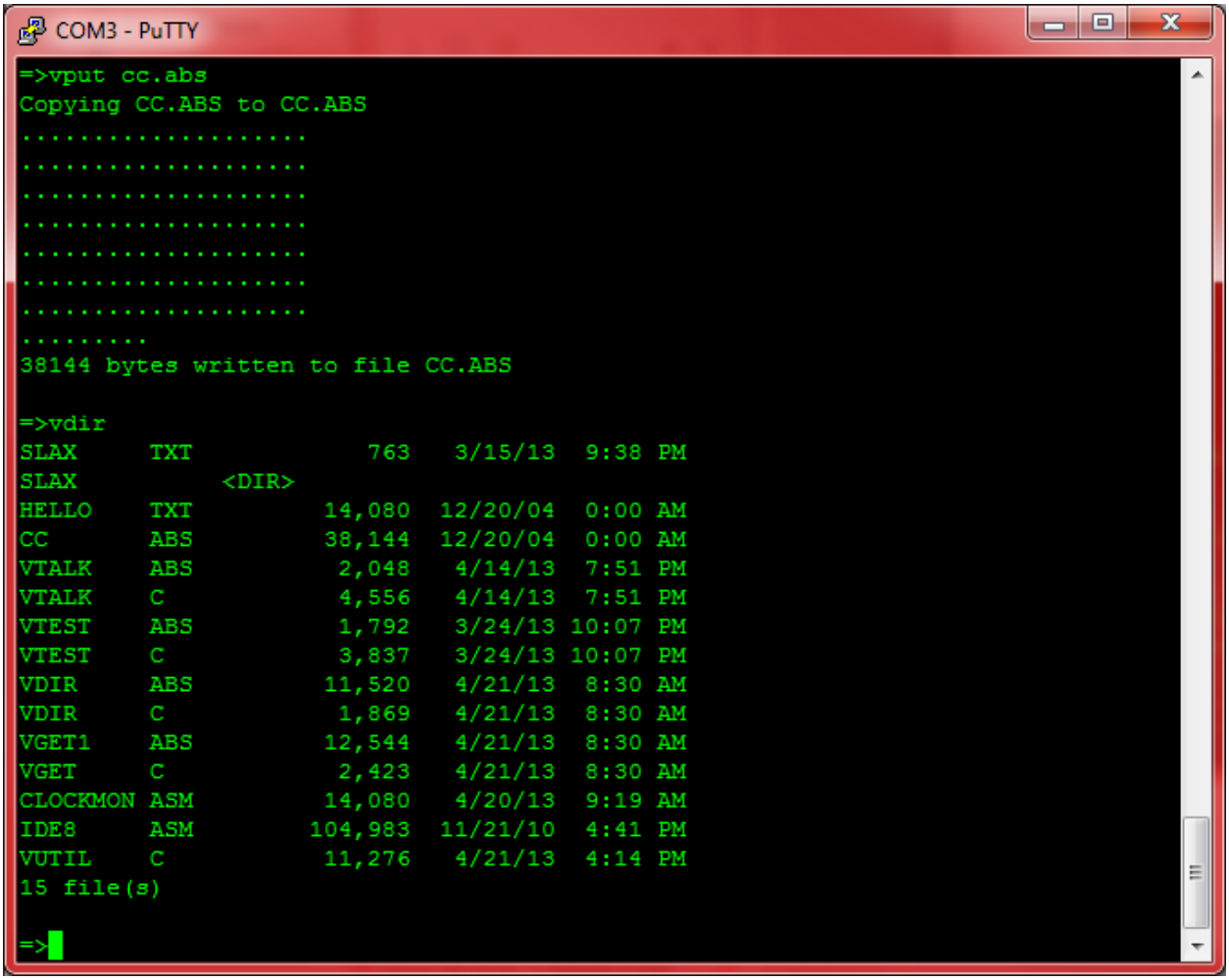
VDIR:


COM3 - PuTTY
=>vdir
SLAX TXT 763 3/15/13 9:38 PM
SLAX <DIR>
HELLO TXT 14,080 12/20/04 0:00 AM
VTALK ABS 2,048 4/14/13 7:51 PM
VTALK C 4,556 4/14/13 7:51 PM
VTEST ABS 1,792 3/24/13 10:07 PM
VTEST C 3,837 3/24/13 10:07 PM
VDIR ABS 11,520 4/21/13 8:30 AM
VDIR C 1,869 4/21/13 8:30 AM
VGET1 ABS 12,544 4/21/13 8:30 AM
VGET C 2,423 4/21/13 8:30 AM
CLOCKMON ASM 14,080 4/20/13 9:19 AM
IDE8 ASM 104,983 11/21/10 4:41 PM
VUTIL C 11,276 4/21/13 4:14 PM
14 file(s)
=>

VGET:

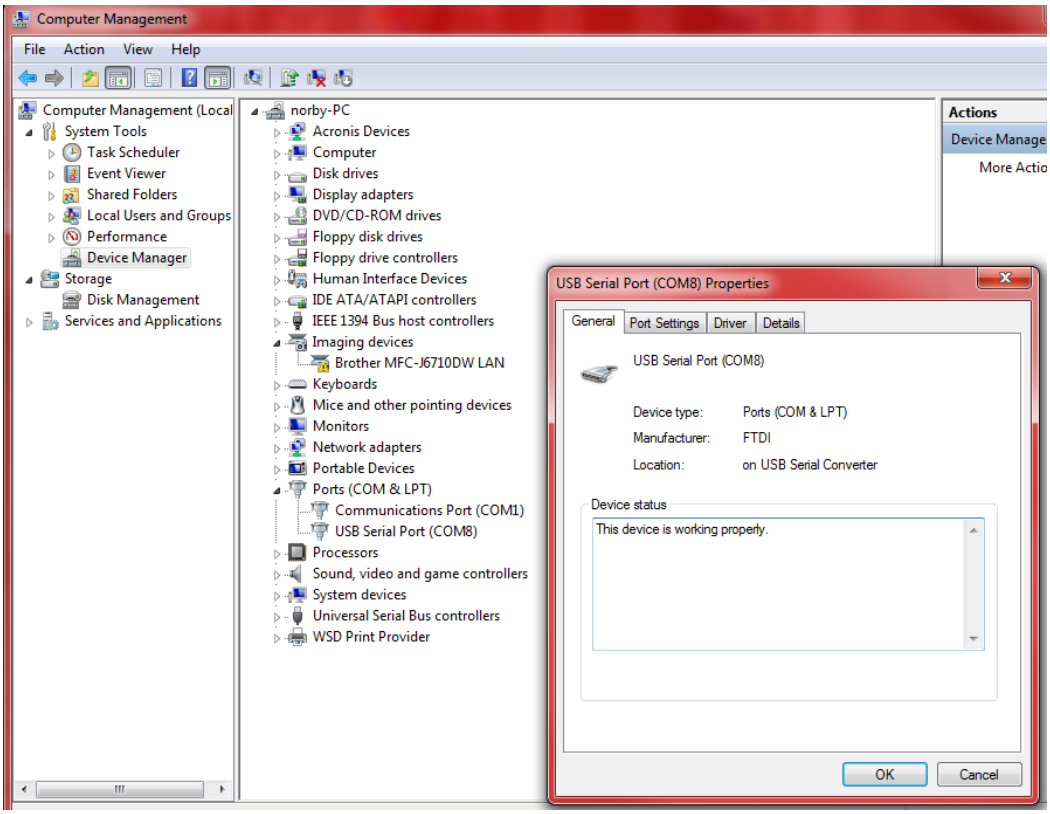

COM3 - PuTTY
=>vdir
SLAX TXT 763 3/15/13 9:38 PM
SLAX <DIR>
HELLO TXT 14,080 12/20/04 0:00 AM
VTALK ABS 2,048 4/14/13 7:51 PM
VTALK C 4,556 4/14/13 7:51 PM
VTEST ABS 1,792 3/24/13 10:07 PM
VTEST C 3,837 3/24/13 10:07 PM
VDIR ABS 11,520 4/21/13 8:30 AM
VDIR C 1,869 4/21/13 8:30 AM
VGET1 ABS 12,544 4/21/13 8:30 AM
VGET C 2,423 4/21/13 8:30 AM
CLOCKMON ASM 14,080 4/20/13 9:19 AM
IDE8 ASM 104,983 11/21/10 4:41 PM
VUTIL C 11,276 4/21/13 4:14 PM
14 file(s)
=>vget clockmon.asm
File CLOCKMON.ASM size is 14,080 bytes
Writing 55 blocks plus 0 remaining bytes
.....
.....
.....
=>

VPUT:


COM3 - PuTTY
=>vput cc.abs
Copying CC.ABS to CC.ABS
38144 bytes written to file CC.ABS
=>vdir
SLAX TXT 763 3/15/13 9:38 PM
SLAX <DIR>
HELLO TXT 14,080 12/20/04 0:00 AM
CC ABS 38,144 12/20/04 0:00 AM
VTALK ABS 2,048 4/14/13 7:51 PM
VTALK C 4,556 4/14/13 7:51 PM
VTEST ABS 1,792 3/24/13 10:07 PM
VTEST C 3,837 3/24/13 10:07 PM
VDIR ABS 11,520 4/21/13 8:30 AM
VDIR C 1,869 4/21/13 8:30 AM
VGET1 ABS 12,544 4/21/13 8:30 AM
VGET C 2,423 4/21/13 8:30 AM
CLOCKMON ASM 14,080 4/20/13 9:19 AM
IDE8 ASM 104,983 11/21/10 4:41 PM
VUTIL C 11,276 4/21/13 4:14 PM
15 file(s)
=>

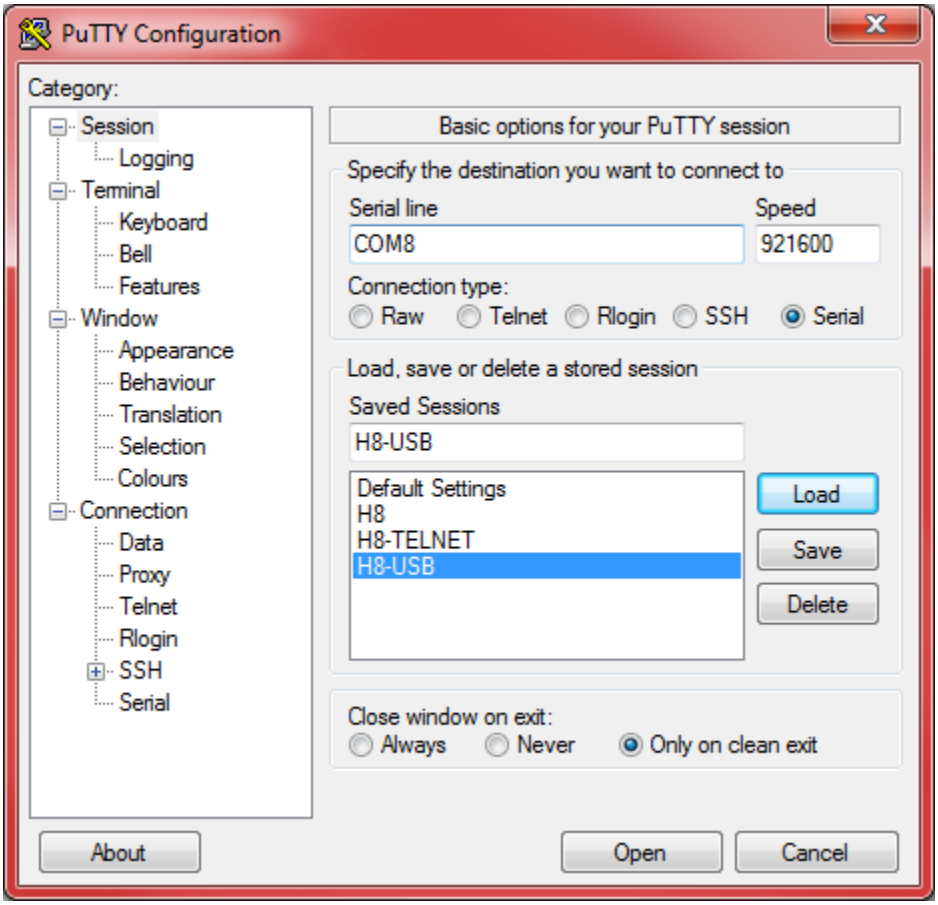
H8-USB Testing the FT245 Controller with Windows

1. Download from the ftdichip web site the Windows driver for the FT245 controller; http://www.ftdichip.com/FTDrivers.htm
2. Insert FT245 USB cable into the Windows PC.
3. Open the Device Manager to find the port number. In my case is COM8.



4.

5. Open Putty and configured it for COM8 (in my case) as shown below. The baud rate does not matter anymore because we are doing FIFO data transfers. COOL!



6. Reset the H8 computer. Here is where the power of the H8 front panel comes to life.
7. On the H8 press, MEM and type 000 260

8. On putty type the letter “A”, nothing will be displayed.

9. On the H8, press the “IN” key (5) and the display on the H8 will display 101 260 XXX

10. Press the “OUT” key (6) on the H8 front panel and the putty application should display the character “A”. How about that for the H8 without the need to set up any baud rate.

11. That completes the test of the FT245 controller. ☺

Note: if the above test fails that could mean that the Port address (260Q) is not set properly. Please review SW1 settings. Also it could be that a component was placed backwards (not all the components are facing the same direction). Finally re-flow side 2 of the board to ensure that everything is soldered properly.

H8-USB FT245 Utilities by Dan Emrick

The following website contains a link to the FT245 utilities by Dan Emrick.

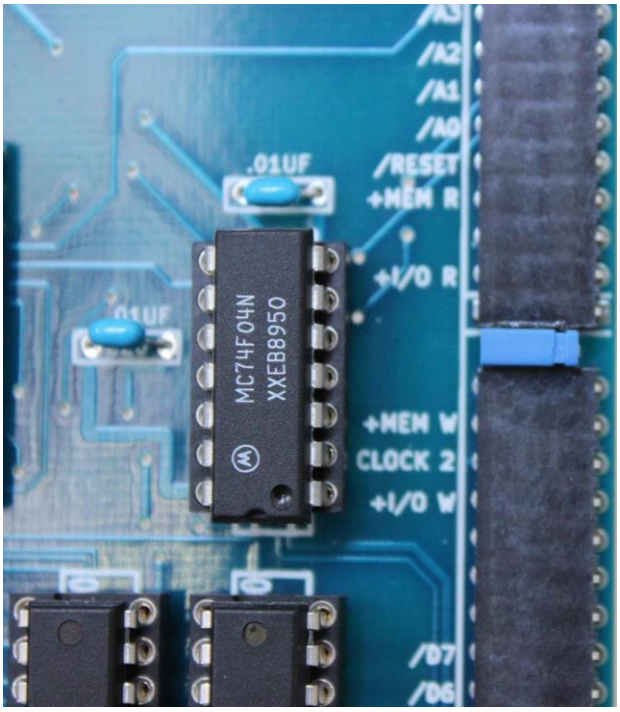
http://koyado.com/Heathkit/H-8_USB.html

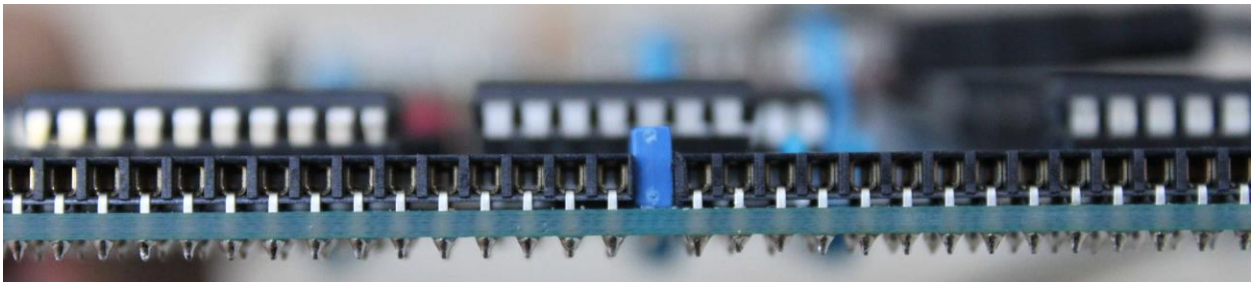
Email: Dan Emrick dsemrick@verizon.net

H8-USB Installing H8 backplane Key pin

This is the most important and simple operation that we need to do in order to avoid burning out the H8 motherboard diodes when the board is inserted and it is off by one pin.

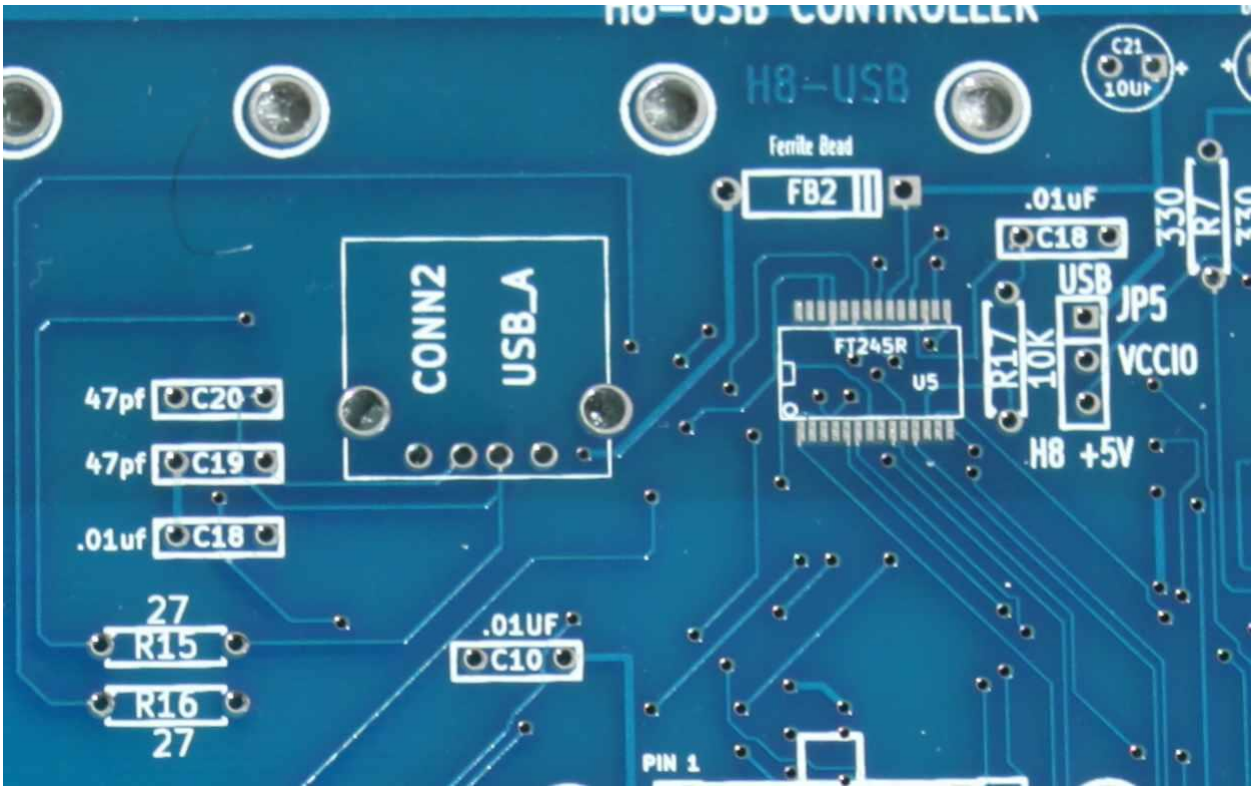
Using Super Glue attached a SHORT BLOCK as shown below;



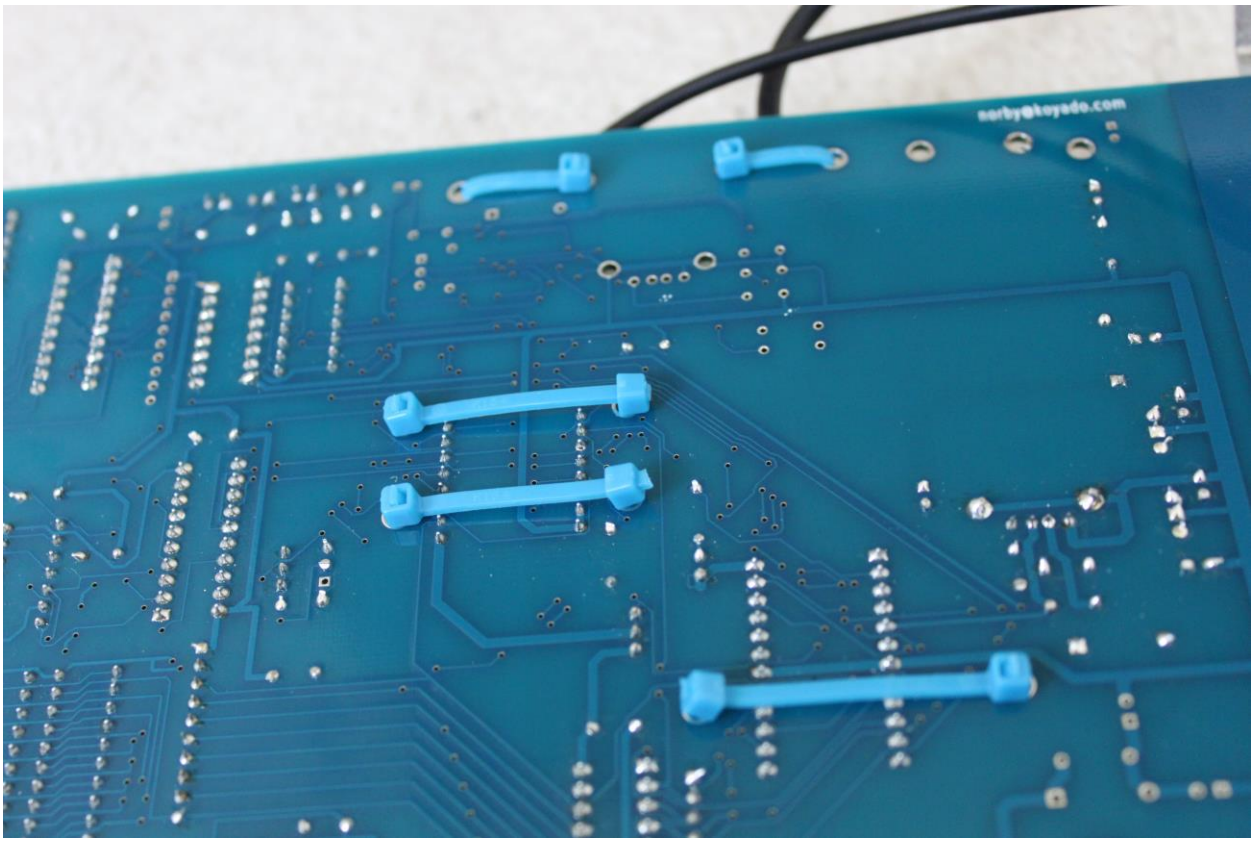


H8-USB FT245 Surface Mount Circuit

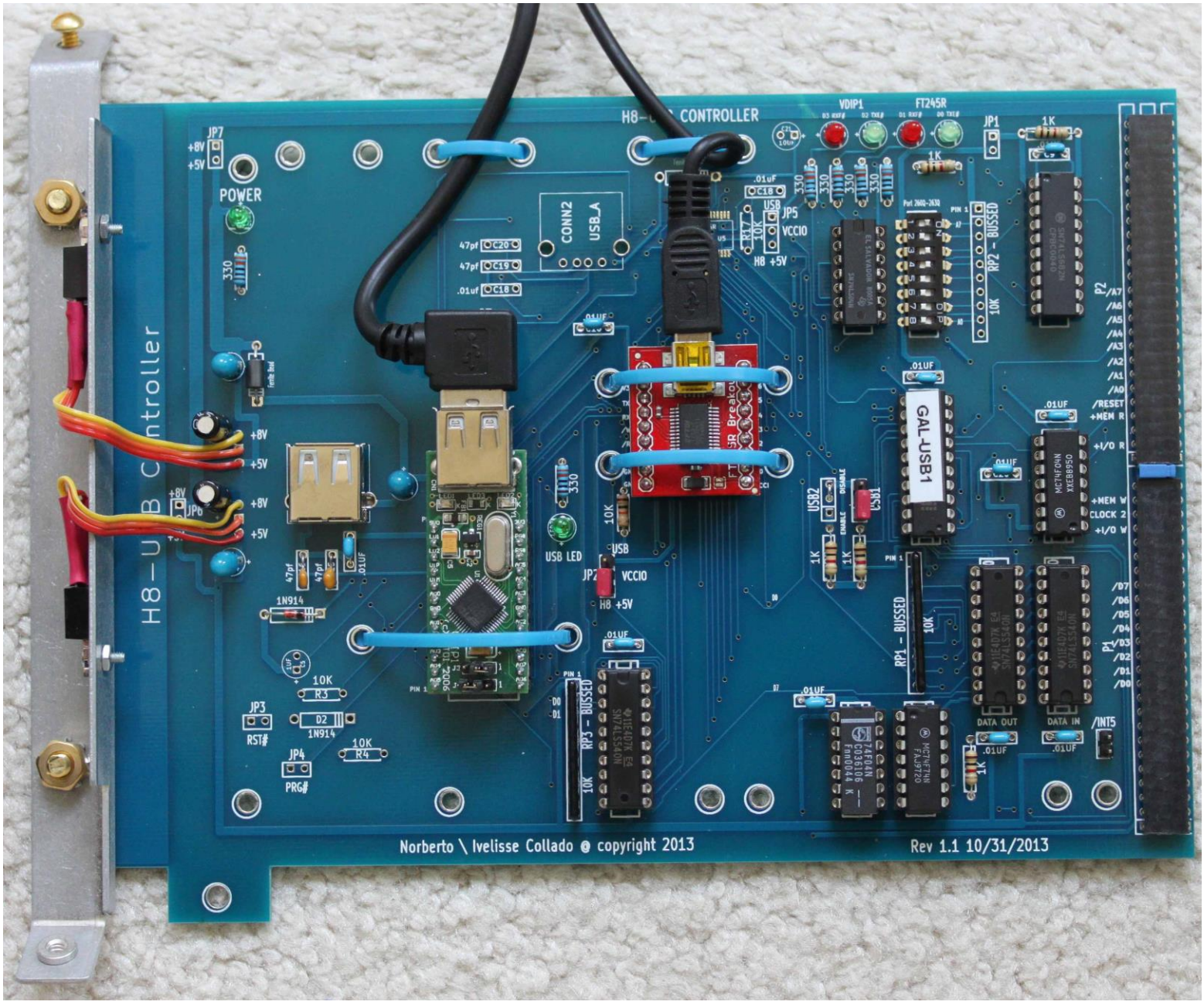
1. If soldering the FT245 surface mount part; then do not install the FT245 Breakout board.
2. Instead install the following components to support the FT245 soldered part;
   CONN2 USB_A, R15, R16, C20, C19, C18, FB2, R17, JP5, C18 & C21.
3. Use a right angle USB cable to be able to close theH8 chassis.



H8-USB TIED-WRAPS



H8-USB Board Fully Assembled by Norberto Collado



H8-USB Fully Operational