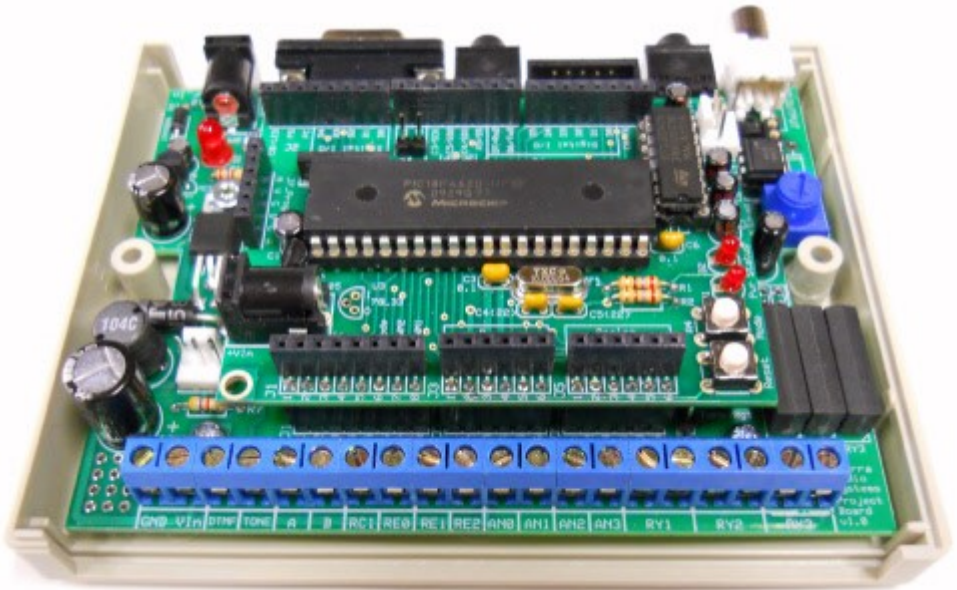


Sierra Radio Systems



HamStack

Project Board Reference Manual



Welcome

HamStack Project Board Reference Manual

Revision 1.0.3

© 2011 George Zafiropoulos, KJ6VU and John Best, KJ6K

This guide provides a broad introduction to the HamStack project board.

Sierra Radio Systems' HamStack web page – www.hamstack.com

The HamStack community support web site is hosted on Yahoo Groups with a group name of hamstack – <http://tech.groups.yahoo.com/group/hamstack/>

Microchip's web site for more info on the CPU chips, MPLAB, C18 compiler and incircuit programming software – www.microchip.com

Swordfish Basic compiler website for basic language and compiler information and general support forum – www.sfcompiler.co.uk

If you are interested in purchasing HamStack hardware, software or accessories, visit our web store at www.hamstack.com and click on the “store” link.

We believe all material in this document is correct and up to date. There is always a chance that something was omitted or incorrect. If you find any errors or have ideas of how to make the document better, please email us at support@hamstack.com

Project Board Overview

The HamStack Project board provides a convenient way to interface the CPU's signals to the real world and provides additional useful support circuits. Using the project board in the default configuration, the board provides the following IO connections and functions...

- 2 digital inputs with 10 pullup resistors to +5v DC
- 4 analog inputs with a selectable voltage range of 0-5 or 0-22 volts DC
- 3 high speed, quiet, SPST reed relays capable of switching up to 500 ma.
- 1 opto isolated digital output
- 1 RS-232 serial port
- 1 analog signal output that can generate a sine wave 0-5kHz at 0-5v DC
- 8870 DTMF decoder chip
- 1 Temperature probe input
- 3 additional general purpose CPU IO connections
- 5v DC power supply (supply rail for logic and analog chips)
- 2.5v DC power supply (bias supply for op amps)
- 3.3v DC power supply (supply rail for 3.3v parts)
- 5 pole low pass filter to condition the analog signal generators output

The combination of the Project board and a CPU board creates a powerful project platform. Open source projects are available for the project board.

Hardware Assembly Instructions

There is no critical assembly sequence. Having said that, the easiest approach is to install the lower parts first. Starting with the IC sockets, then resistors, capacitors, diodes, etc. Finally install the connectors.

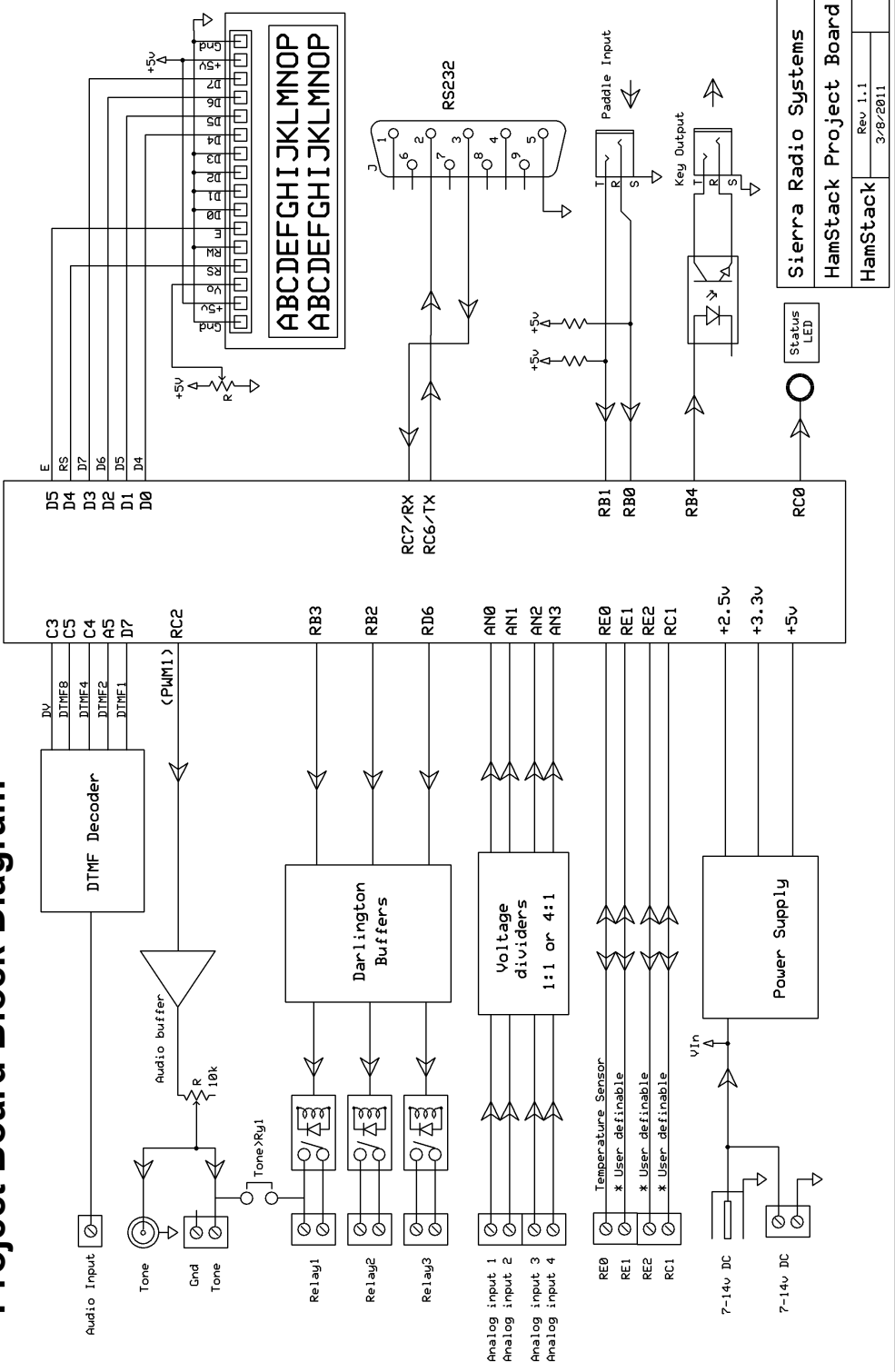
Too many parts

You may find extra parts in your kit. We do this because some components are easy to lose or install incorrectly. So just in case, we may include a few extras.

Too few parts

While we are very careful to make sure you get what you are supposed to get, we may have accidentally omitted a component. If this happens, drop us an email at support@hamstack.com and we will send you a replacement part right away.

Project Board Block Diagram



Sierra Radio Systems
 HamStack Project Board
 HamStack Rev 1.1
 3/8/2011

Project Board – Assembly Checklist

- C1 1uf 50v electrolytic
- C2 330uf 16v electrolytic
- C3 1000uf 16v electrolytic
- C4, C5, C6 0.1 uf monolithic
- C7 0.022 (223)
- C8, C9, C12 0.0022 (222)
- C10 0.047 (473)
- C11 Insert a wire jumper (marked 0.1uf)
- C13, C15 0.1 uf monolithic
- C14 10 uf electrolytic
- C16 10uf 50v NON-Polarized
- C17, C18 0.001 uf (102)

- D1, D5 Diode 1N4004
- D2 LED Red - T1-3/4
- D3 Diode 1N5822
- D4 Diode 1N4148

- INS1 Crystal insulator

- J1, J2, J4, J6 1x8 pin header male
- J3, J5 1x6 pin header male
- J7 RCA right angle connector
- J8, J10 3.5mm stereo jack
- J9 2X5 pin header male w/shroud
- J11 DB9 Female right angle
- J12 2.1mm DC connector
- J13 3 pin 0.1" straight male locking connector
- J14, J15, J16, J17, J18, J19, J20, J21, J22, J23 2 Pin Screw terminal block

- JU1, JU3 1x2 pin header male
- JU2 2x4 pin header male

- L1 100uh - 6 -

Project Board – Assembly Checklist

- R1, R2 Resistor 1/4W 10K Ohm
- R3, R4 Resistor 1/4W 100K Ohm
- R5 Resistor 1/4W 1.3M Ohm 5%
- R6 Resistor 1/4W 560K Ohm 5%
- R7 Resistor 1/4W 4.7K Ohm 5%
- R8 Resistor 1/4W 14.3K 1%
- R9 Resistor 1/4W 931 Ohm 1%
- R10 Resistor 1/4W 22.6K Ohm 1%
- R11 Resistor 1/4W 1.27K Ohm 1%
- R12 Resistor 1/4W 7.68k Ohm 1%
- R13, R14 Resistor 1/4W 270 Ohm

- RP1 5 resistor pack 2.2k ohms (6 pin SIP)
- RP2 4 resistor pack 10k ohms (8 pin SIP)

- RY1, RY 2, RY3 Hamlin HE3621A0500 SPST reed relay, 5v

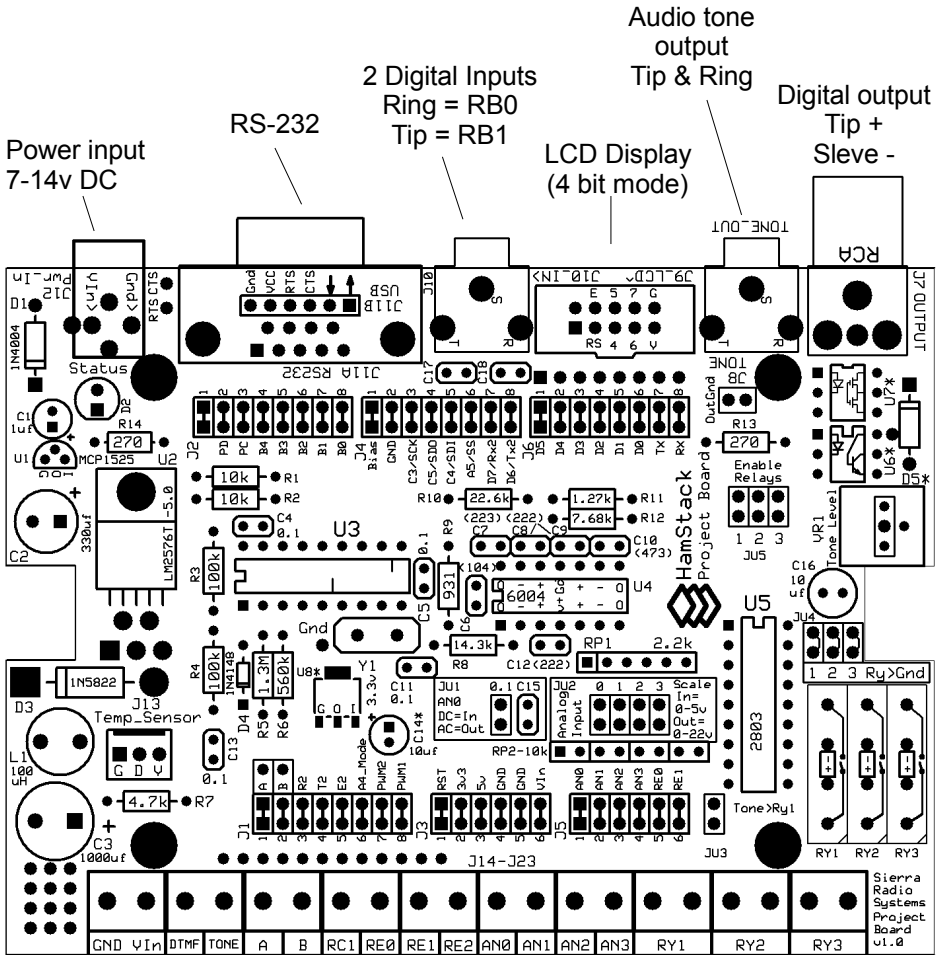
- SOC3, SOC5 18 pin IC socket
- SOC4 14 pin IC socket
- SOC6, SOC7 6 pin IC socket

- U1 MCP1525 2.5v precision voltage reference
- U2 LM2576T-5.0
- U3 8870 DTMF decoder
- U4 Microchip MCP6004 op amp
- U5 ULN2803
- U6 H11D1 opto isolator, high voltage
- U7 Not included
- U8 AP1117E33G-13 3.3v SMT regulator

- VR1 Pot, 10k, 1 turn top adjust with small knob

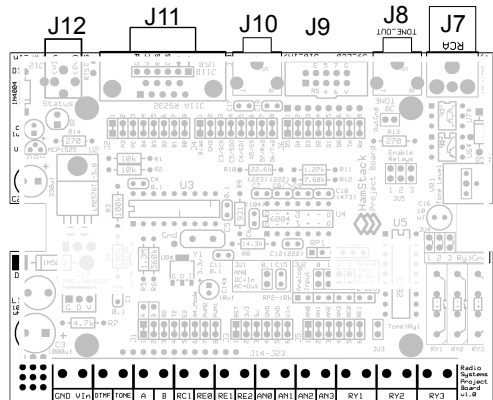
- Y1 Crystal, 3.579 MHz

HamStack Project Board External Connections



- | | |
|---------------------------------------|----------------------------|
| 1 Ground | 11 AN0 – Analog in 0, GPIO |
| 2 Vin – External 7 to 14 v DC input | 12 AN1 – Analog in 1, GPIO |
| 3 DTMF – Audio input to DTMF decoder | 13 AN2 – Analog in 2, GPIO |
| 4 Tone – Audio tone out | 14 AN3 – Analog in 3, GPIO |
| 5 A – User defined interconnect pin | 15 Relay 1 common |
| 6 B – User defined interconnect pin | 16 Relay 1 normally open |
| 7 RC1 – GPIO, PWM2 output | 17 Relay 2 common |
| 8 RE0 – GPIO, Temp probe, analog in 4 | 18 Relay 2 normally open |
| 9 RE1 – GPIO, analog in 5 | 19 Relay 3 common |
| 10 RE2 - GPIO | 20 Relay 3 normally open |

IO Connectors



J14-J23

J7 Optoisolated Output

RCA jack. This connection provides an opto isolated output which can be used for high DC voltage switching applications like keying a transmitter. The CW keyer example uses this connector for the key input to a CW transmitter. You can choose to install either a transistor output or a solid state relay by installing the proper component into the board.

The sleeve is connected to the emitter of U6 the opto isolator and the tip is connected to the collector. If using the solid state relay, one side is connected to the tip and the other to the sleeve.

J8 Digital inputs

3.5mm stereo jack. This connection provides two digital inputs. Ring is connected to CPU pin B0, and tip is connected to CPU pin B1. Both inputs are pulled up to 5v through a 10k resistor. This is used in the CW keyer example for the paddle inputs.

J9 LCD display

The LCD display interface plugs into this 10 pin header connector. The connector provides 4 bits of data (D4, D5, D6, D7) and two control signals (RS, E) plus +5v DC power and ground to the LCD interface. These signals connect to the CPU PORTD bits 0-5 respectively.

J10 Tone output

3.5mm stereo jack. This is the audio output jack for the tone generator created using the CPU's PWM 1. After the PWM signal is filtered by a 5 pole low pass filter, it passed through pot R14 to set the level and then a 10uf non-polarized capacitor to the RCA connector. This signal also is connected to J13 pin 8.

J11 RS-232 serial interface

DB9 female. This is the RS232 connection. The CPU board includes a TTL to RS232 level translator and the RS232 signals are routed through the inter-board connector to the IO board then out to this jack. Pin 2 is Tx, pin 3 is Rx, pin 5 is ground.

J12 DC power input

2.1mm coaxial jack. This is the external power input jack. Any voltage from 7-14v DC will work. The board also has solder pads to install a 2 point screw terminal block instead of the coaxial jack.

HamStack Project Board - Jumpers

JU1 – AN0 Analog / Digital selector

IN = DC couple the AN0 input to A/D converter for DC voltage measurements

OUT = AC couple the AN0 input through a 0.1 uf capacitor for AC measurements

JU2 – Analog input voltage divider

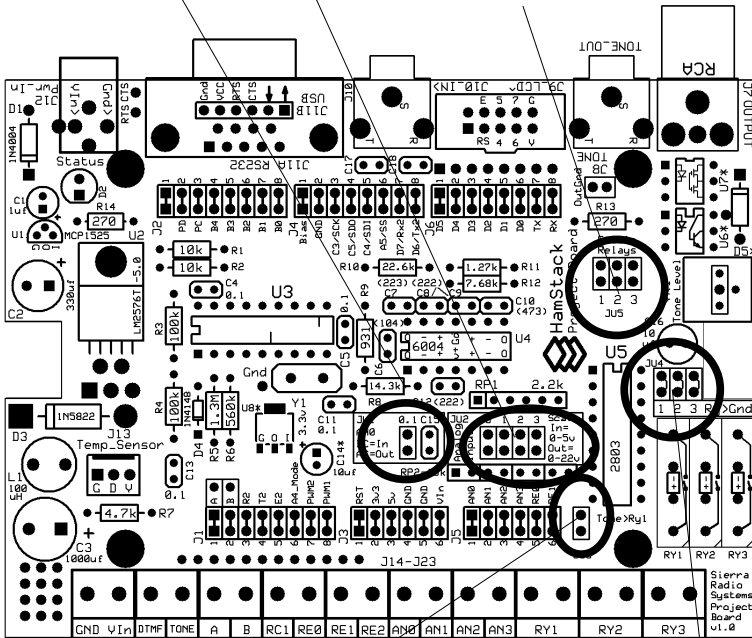
IN = divide by 4.5 setting the range 0-22.7v DC

OUT = divide by 1 setting the range to 0-5 v DC

JU5 – Enable Relay

IN = Connects RB2, RB3, RB4 CPU pins to relay buffer.

OUT = Isolate relays from CPU

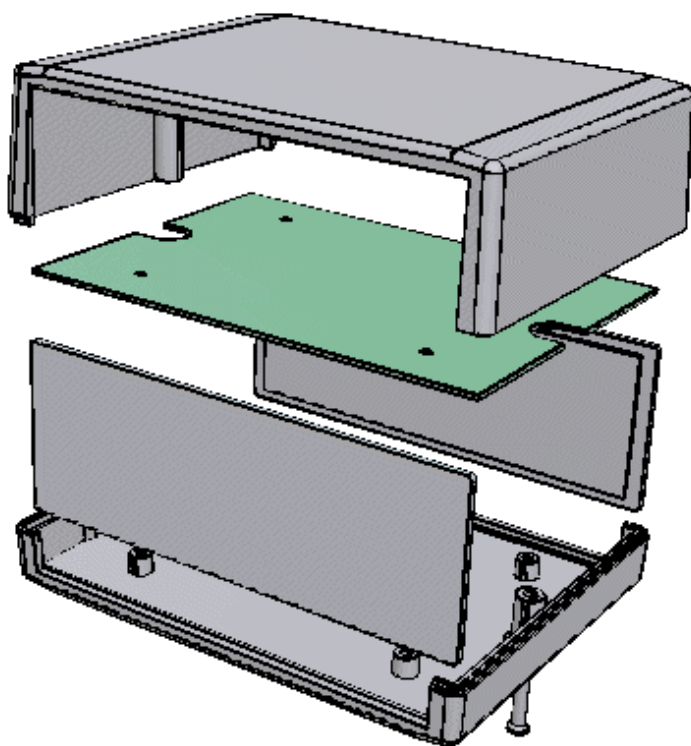


JU3 – Route tone output to RY1

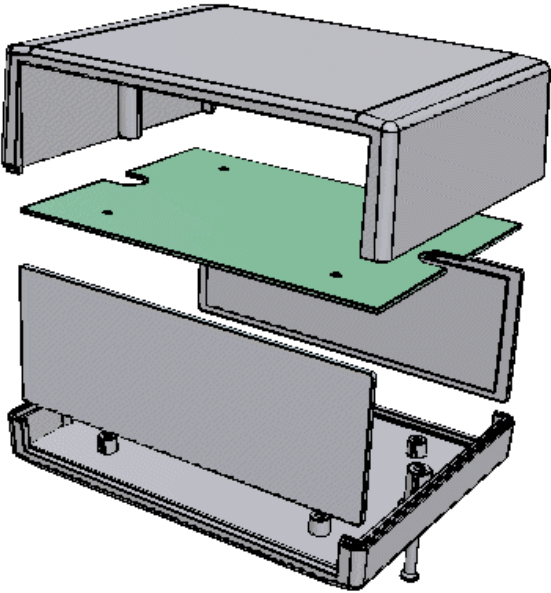
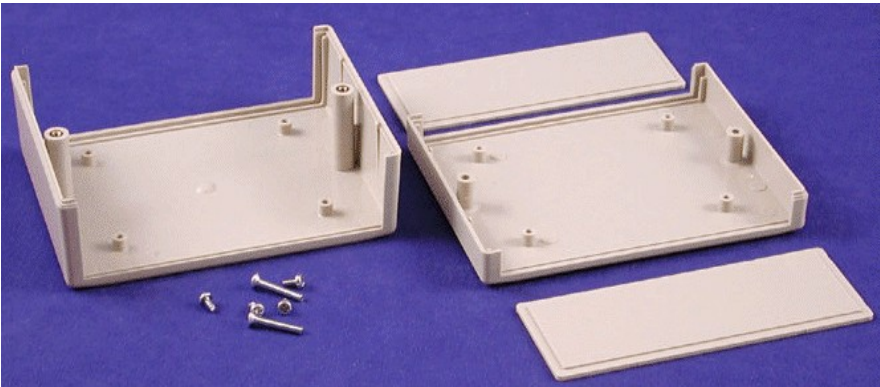
When jumper is inserted, the output of the tone generator will be routed to the RY1 common pin

JU4 – Set relay common to ground
When jumper is inserted, the relay's common lead will be tied to ground.

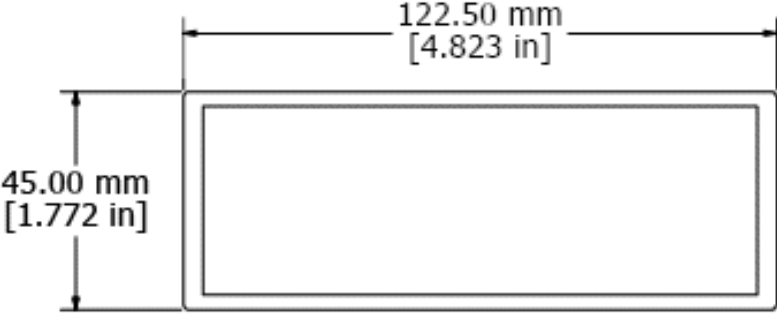
Project Board



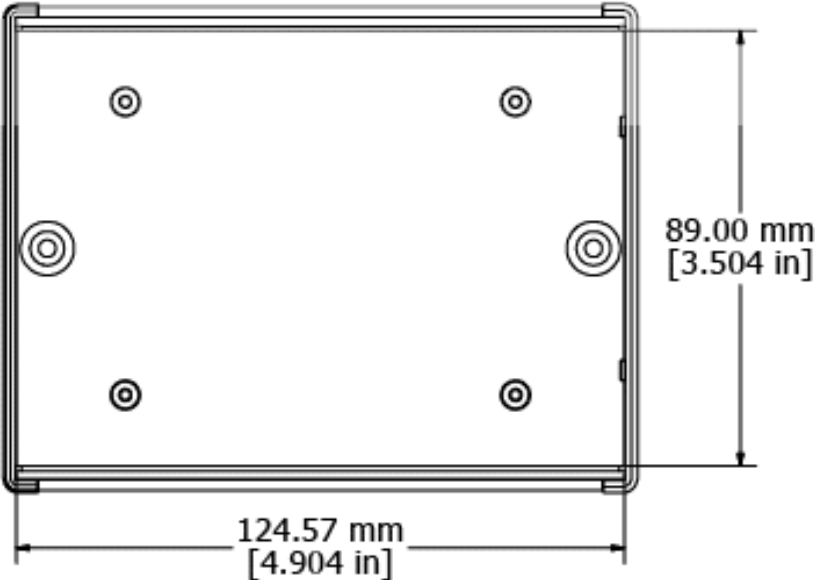
Project Chassis Box



Project Chassis Box



Front and rear panel

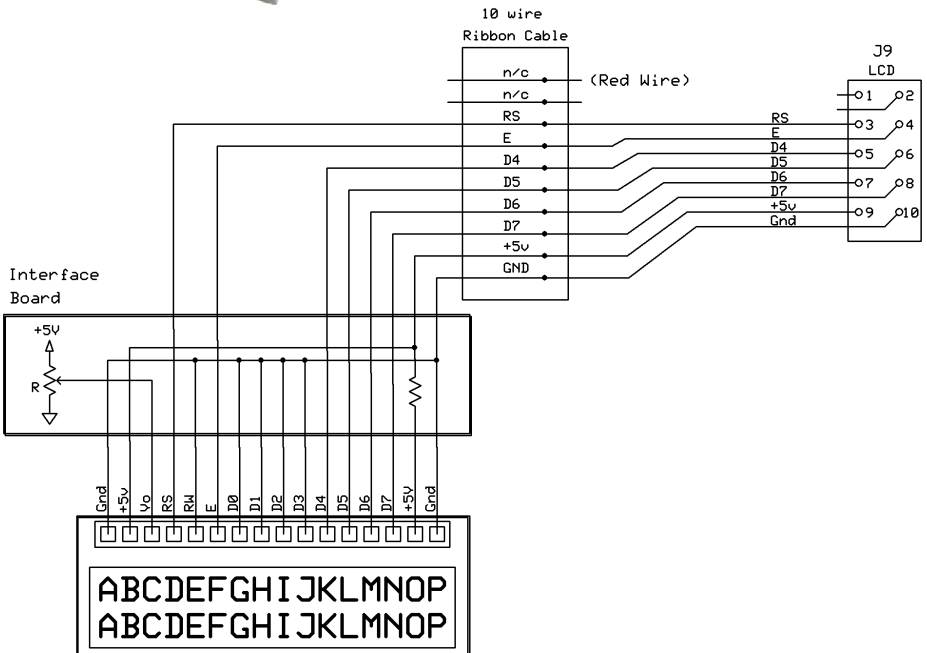
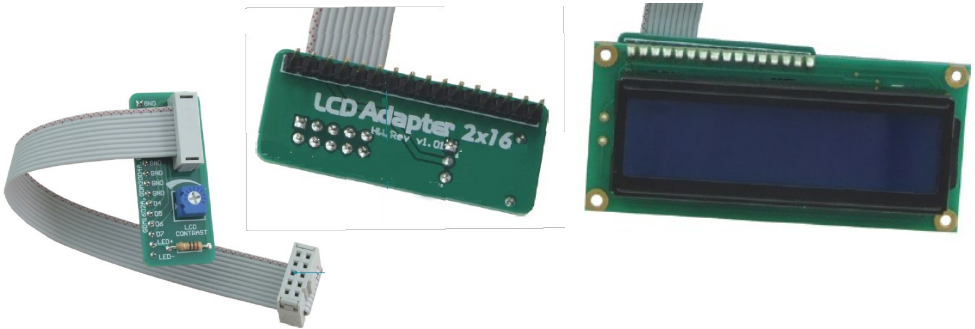


Top view

2 x 16 LCD Display with 4 Bit Interface

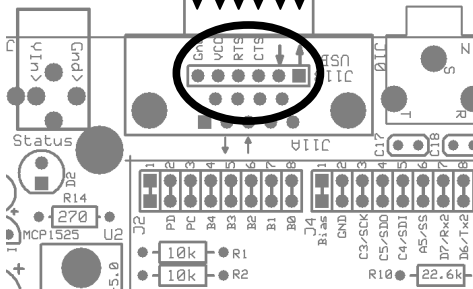
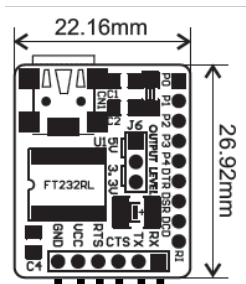
The Project Pack includes a 2 line by 16 character backlit LCD display and an interface board. The interface supports the standard 4 bit Hitachi control signals. There are 6 signals that must be hooked up. These are Data 4, 5, 6, 7, (called D4, D5, D6, D7) and the RS and E control lines. The interface cable supplied is a 10 wire ribbon cable with a 2x5 pin header connector on the end. When using the HamStack Project board that supports this connector, you just plug it in and go.

The interface board must be soldered to the LCD display. Mount the interface board to the back of the LCD display and solder the 16 pins in place.



USB to TTL Serial Adapter


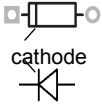


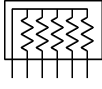



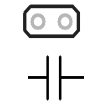



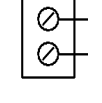

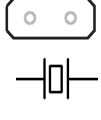

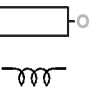
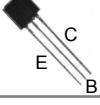
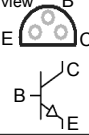

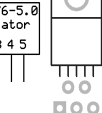
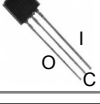


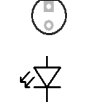


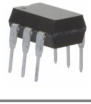
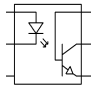


The optional serial to USB interface converts the TTL signals from the CPU board to USB for connection to a PC. If you use this board with your Project Board, make sure you DO NOT install the DB9 connector on the project board. When using this adapter, remove the MAX232 level converter chip on the CPU board.




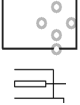

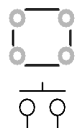



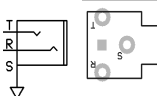





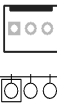

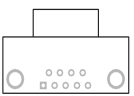










The adapter is installed with a 6 pin SIP male header.

1. Do not install the DB9 connector.
2. Solder the six pin male header to the Project Board PCB.
3. Slip the USB adapter on to the 6 pin header and solder it in place.
4. Install the FTDI serial driver on your PC.
5. At this point you are ready to talk from the PC to the Project board through the USB connection.

Component Identification Guide

	<p>Diode Common part: 1N4004 The band on the diode is The cathode side.</p>			<p>Integrated circuit Make sure pin1 is in the right position. Pin 1 is indicated by the dot.</p>
	<p>Resistor pack Multiple resistors in a package. Values indicated by a 3 digit number. IE "103" means 10k</p>			<p>Resistor Quarter watt. Value indicated by color code.</p> 
	<p>Dipped monolithic capacitor. 3 digit number. IE "103" means 10,000 pf or 0.01uf.</p>			<p>Electrolytic capacitor Insert positive lead into the square solder pad. Long lead = positive.</p> 
	<p>Terminal block Screw terminal block.</p>			<p>Crystal Make sure the crystal insulator is installed under the crystal case to prevent shorting out.</p> 
	<p>Inductor Sealed inductor.</p>			<p>NPN transistor TO-92 plastic case transistor (PN2222)</p> 
	<p>LM2576 Switching voltage regulator TO-220-5 case</p>			<p>Linear voltage regulator TO-92 plastic case (78L05, etc.)</p> 
	<p>LED (Size: T1) Insert long lead (anode) into the square solder pad.</p>			<p>LED (Size: T 1-3/4) Insert long lead (anode) into the square solder pad.</p> 
	<p>Optocoupler with optically isolated darlington transistor. 6 pin DIP package</p>			<p>Solid State Relay 6 pin DIP package</p> 

Component Identification Guide

	<p>DC coaxial power jack</p> 		<p>Pushbutton Momentary contact pushbutton.</p> 
	<p>Jumper block</p> 		<p>3.5mm stereo jack</p> 
	<p>Shunt</p> 		<p>RJ45 Tab up configuration with built in LEDs.</p> 
	<p>3 Pin connector</p> 		<p>DB9 connector</p> 
	<p>Reed Relay SPST The reed relay is fast and quiet. Make sure pin 1 is in the proper orientation.</p>		<p>40 Pin machined IC socket Install socket with the dimple on one end pointing toward pin 1.</p>
	<p>Crystal Insulator Make sure the crystal insulator is installed under the crystal can.</p>		<p>6-18 Pin machined IC socket Install socket with the dimple on one end pointing toward pin 1.</p>
	<p>3 pin connector Molded plastic connector with alignment tab</p>		<p>Contact point Inserted into molded plastic connector</p>
	<p>8 Amp power relay This power relay is designed to switch medium power loads. Each set of contacts supports up to 8 Amps.</p>		<p>DS18S20 Temperature sensor using the DS OneWire interface in a TO-92 plastic case</p> 
	<p>100 uh inductor This inductor is used in the switching power supply.</p>		