

Appendix I

(VT Project Box Construction Manual)

Construction of a VT Project Box

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List of Parts for the VT Project Box

Part Description	Supplier	Supplier's Part #	Quantity
VT84 Board Construction Kit	Virginia Tech		1
Sub-mini pushbutton switch (SPST)	Radio Shack	2751571	1
Insulated Stand-offs	Radio Shack	2761381	6
Dual IC protoboard PCB *3	Radio Shack	2760159	1
Experimenters Protoboard PCB *1	Radio Shack	2760170	1
ICB90 Printed Circuit Board (PCB) *2	Radio Shack	2760148	2
2 terminal speaker jack pushbutton	Radio Shack	2740315	1
DPDT slide switch	Radio Shack	2750407	1
8" by 6" by 3" project box	Radio Shack	2701809	1
binding post (female banana plugs)	Radio Shack	2740661	2 red/2black
BNC Receptacle	Allied Electronics	713-9805	4
DB-9 connector	Allied Electronics	810-6022	1
8-pole screw terminal block	Allied Electronics	502-0508	2
Overshoot protection IC	Allied Electronics	903-4936	2
4-circuit micro-fit plug	Allied Electronics	863-0503	4
4-circuit micro-fit receptacle	Allied Electronics	863-0525	4
6-circuit micro-fit plug	Allied Electronics	863-0505	2
6-circuit micro-fit receptacle	Allied Electronics	863-0526	2
8-circuit micro-fit plug	Allied Electronics	863-0507	3
8-circuit micro-fit receptacle	Allied Electronics	863-0527	3
male micro-fit terminals	Allied Electronics	863-0536	70
female micro-fit terminals	Allied Electronics	863-0537	70
8-pin IC socket	Allied Electronics	512-4521	2
24 AWG Red wire by the 100 ft **	Allied Electronics	696-9103	~2 ft
24 AWG Black wire by the 100 ft **	Allied Electronics	696-9102	~3 ft
24 AWG Yellow wire by the 100 ft **	Allied Electronics	696-9105	~2 ft
24 AWG blue wire by the 100 ft **	Allied Electronics	696-9106	~20 ft
1/16"X12"X24" Grade XX Garolite Sheet	McMaster-Carr	85315k131	1
1/2"X1/2" 90 degree angle PVC (5ft sec.)	McMaster-Carr	8659k37	1
1/16"X12"X24" PETG Clear sheet	McMaster-Carr	85815k21	1
1/16"X12"X24" PVC Sheet	McMaster-Carr	8747k123	1
4-40 3/8" Machine screws w/ countersunk	McMaster-Carr	90273A108	8
4-40 nuts with nylon inserts	McMaster-Carr	90631A005	12
4-40 3/8" Machine screws w/ round head	McMaster-Carr	90279A108	4

* These parts can alternatively be purchased

Part Description	Supplier	Supplier's Part #
*1--Experimenters Protoboard PCB	Allied Electronics	910-2197
*2--ICB90 PCB (Dual-mini in Allied's catalog)	Allied Electronics	910-2187
*3 -- Dual IC PCB	Allied Electronics	910-2191

**The wire could be purchased at Radio
Shack in lengths more appropriate

Construction

Construction of the VT84 board

One modification made to the VT84 PCB (printed circuit board) is the two holes drilled into the board. The layout for these holes is shown in Figure 1. The proto-board (Radio Shack PN: 2760170) needs to be cut to 3.5" by 1.1", after cutting the proto-board, it should appear as in Figure 2.

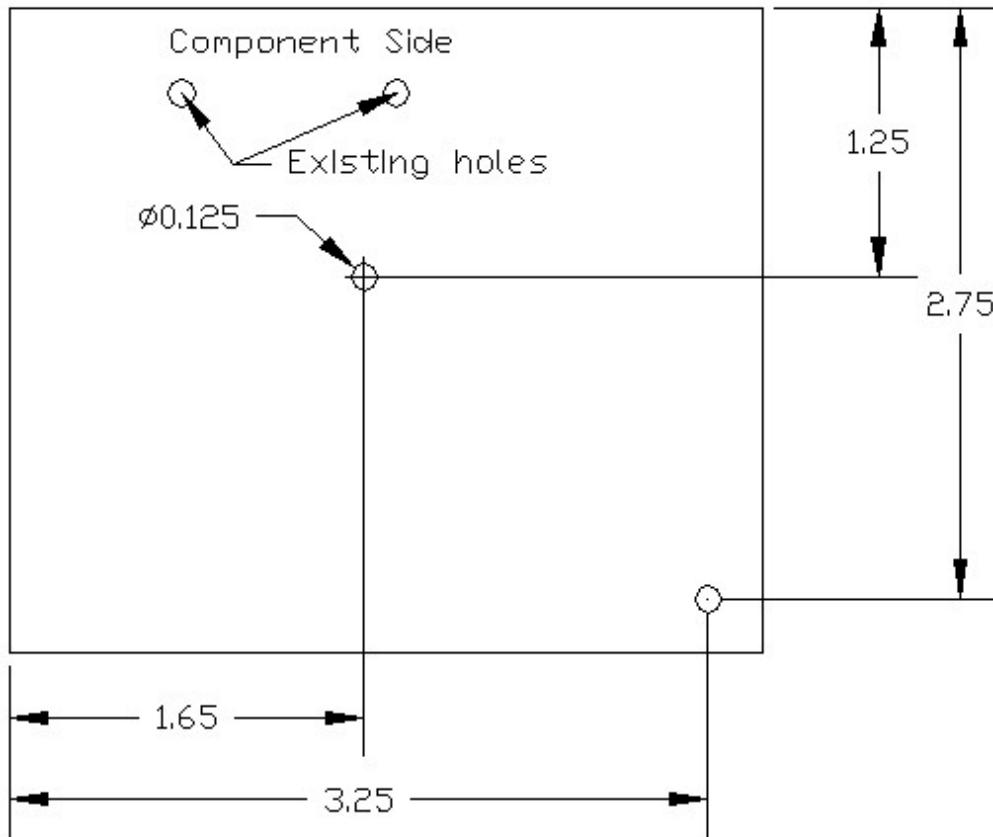


Figure 1: Hole pattern for VT84

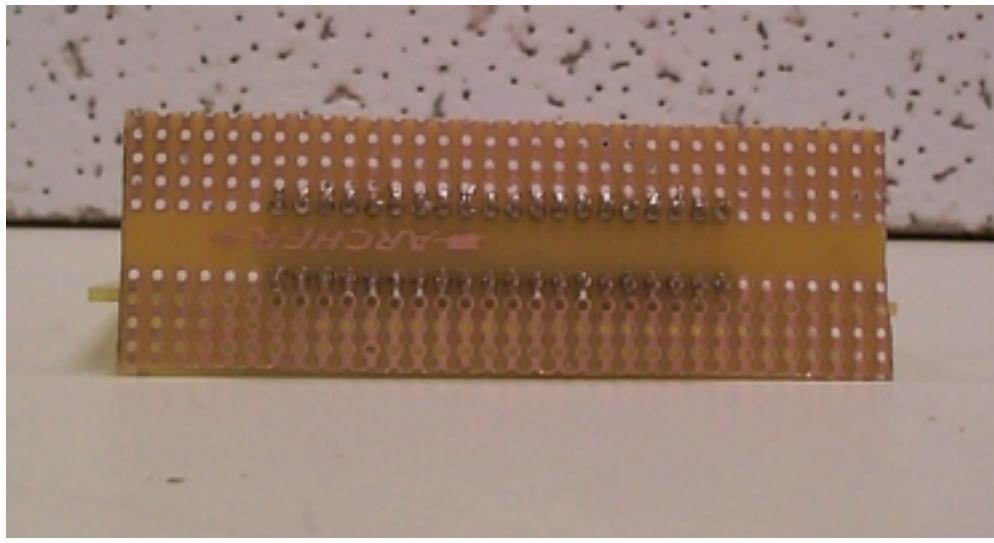


Figure 2: Resized proto-board

Construct the VT84 board using the Mechatronics website
(<http://mechatronics.me.vt.edu/VT84Construction/PICConstruction.html>), omitting the following steps:

- Step 9 – Switches
- Step 13 – 20 Pin header
- Step 14 – DB9 connector

For step 9, solder wires to the solder joints for the switches as shown in Figure 3, noting there is one solder joint that has no connection on the board and it does not need a wire attached to it. The wires should be approximately three inches long. For non-ground or non-power connections such as the switch and the DB-9 connections, it is recommended to use wire color other than red, yellow, or black.

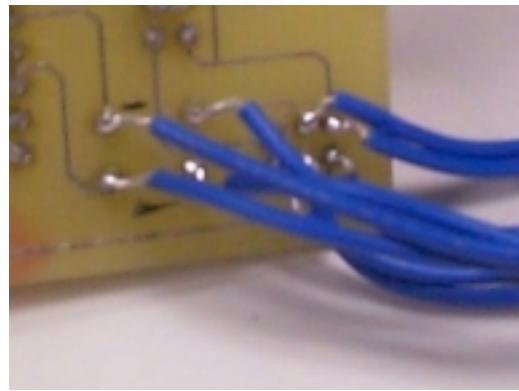


Figure 3: Wire connections to the switch pads

For step 14, solder wires to the solder joints for the DB-9 connector as shown in Figure 4, noting there are three solder joints that have no connections and they do not need wires attached to them. The wires should be approximately three inches long.



Figure 4: Wire connections to the DB-9 connector pads

For step 13 the header pins are attached to the VT84 and a proto-board. This is shown in Figure 5 and Figure 6. It is advised that the short header pins are soldered to the VT84 first. Then, tack the larger header to the VT84 and proto-board. After the alignment of the header pins are sufficient finish soldering the header to both the proto-board and the VT84 board. The connections should appear as in Figure 5 and Figure 6.

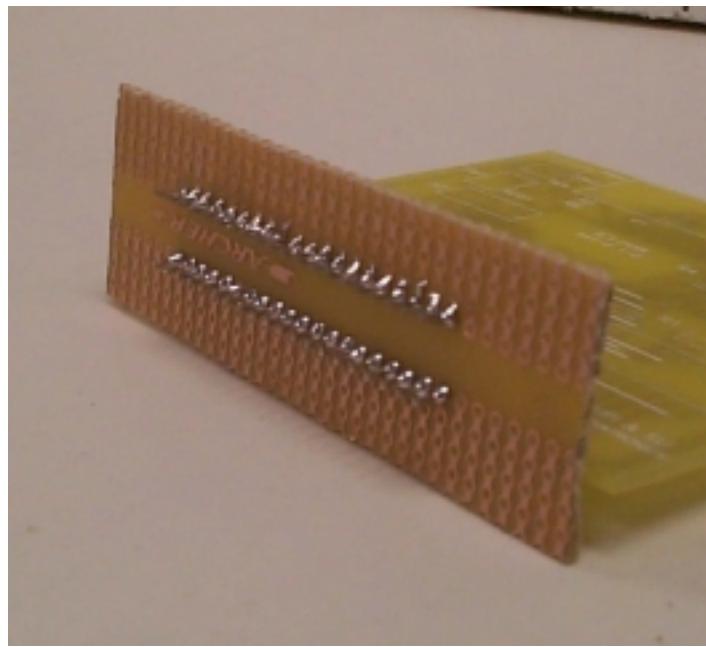


Figure 5: Solder connections of the header pins to the proto-board

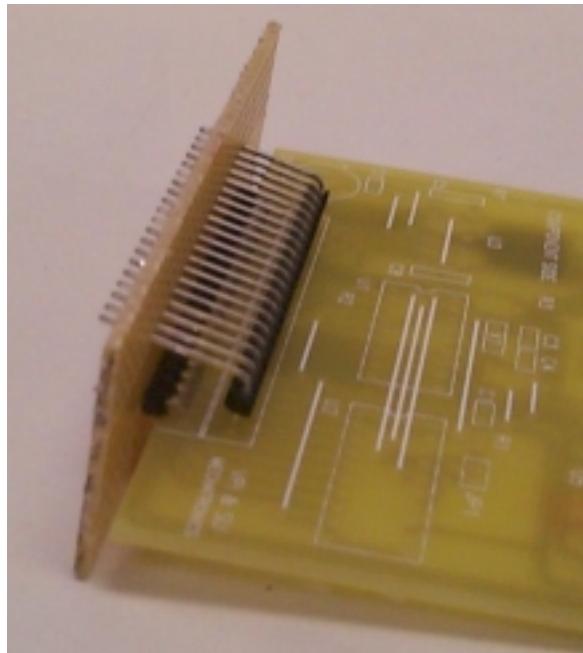


Figure 6: Header pin attachment to the proto-board and the VT84 PCB

VT84 attachment and jumpering

Using the schematic in Figure 7, wires approximately 3" long should be soldered to the corresponding pads on the proto-board. The pads corresponding to pins 11, 12, 13, and 14 are the digital output lines. The pads corresponding to pins 27, 28, 29, and 30 are the digital input lines. The pads corresponding to pins 21, 22, 23, and 24 are the analog to digital converter lines. The pads corresponding to pins 1 and 36 are the H-bridge signal lines. Also, the pad corresponding to pin 32 is the PWM signal that the PIC sends to the H-bridge. The above pads should have some color of wire attached to them to signify their function. The pad corresponding to pin 25 should have a red wire (to signify 5v) attached to it approximately 8" long and another red wire attached to the pad approximately 3" long. The pad corresponding to pin 26 should have a black wire (to signify ground) attached to it, that is approximately 8" long. The pad corresponding to pin 2 should have two 3" long black wires soldered to it. The pad corresponding to pin 3 should have a yellow wire (to signify 12v power) attached to it that is approximately 8" long.

The following pins should be jumpered together using black wire: 2, 26, and 39. The following pins should be jumpered together using yellow wire: 3 and 40. Upon completing the wire attachments the board should appear as in Figure 8.

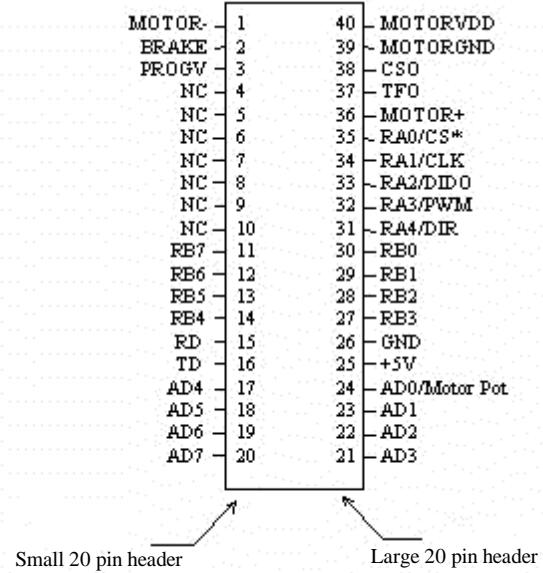


Figure 7: Pin layout for the VT84

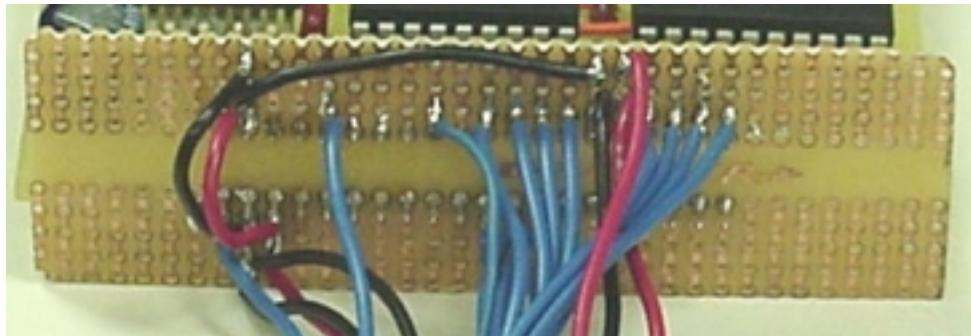


Figure 8: Wire connections on the proto-board

VT84 wire connections and connectors from the VT84 PCB

In this section the connection of wire plugs and receptacles are outlined; terminals will be attached to wires and then inserted into the plug or receptacle. Extreme caution should be used when inserting these terminals to ensure that the incoming wires are being matched to the correct outgoing wires, if this is not done correctly the box will not work.

There should be six wires coming from the DB-9 connection on the VT84 proto-board as shown in Figure 9, on the component side of the board this is marked with J1. Attach the female micro-fit terminals (Allied Electronics PN: 863-0537) to the ends of these wires. The attached terminal should appear as in Figure 10. After attaching the terminals to each of the wires, plug the terminals into a 6-circuit micro-fit plug (Allied Electronics PN: 863-0505), as shown in Figure 11 and Figure 12. On the DB-9 plug (Allied Electronics PN: 810-6022) the receptacles are numbered from one through nine. Solder 3" pieces of wire to pins 2, 3, 4, 5, 7, and 9 (Figure 13). Now, attach the male micro-fit terminals (Allied Electronics PN: 863-0536) to the ends of these wires. Before inserting

the terminals from the DB-9 connector into the 6-circuit micro-fit receptacle (Allied Electronics PN: 863-0526), follow the wires from the VT84 DB-9 solder connections and ensure these wires are going to the proper location in the connection, i.e. make sure the connections are correctly matched (see Figure 14 for example). After the proper placement of the wires has been determined insert the terminals into the receptacle.

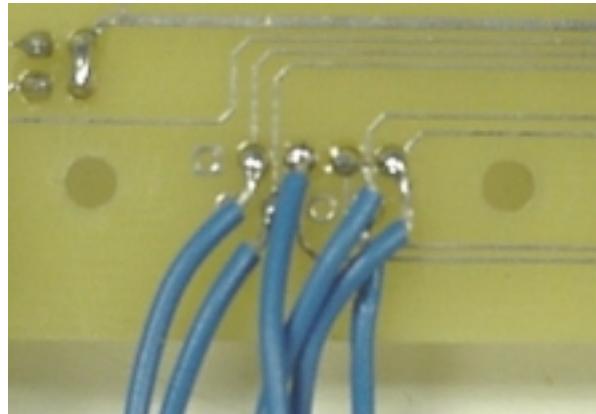


Figure 9: DB-9 wire connections on the VT84



Figure 10: Micro-fit terminal attached to wire

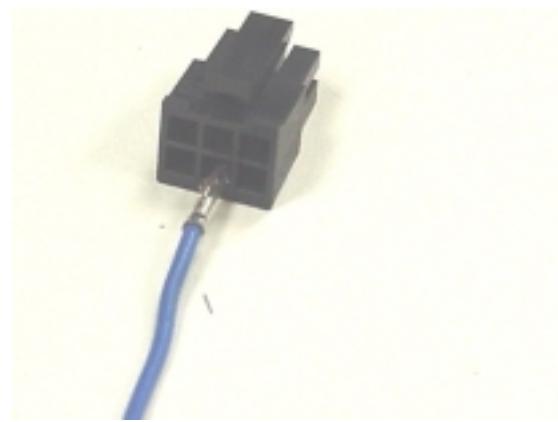


Figure 11: Terminal inserted into plug

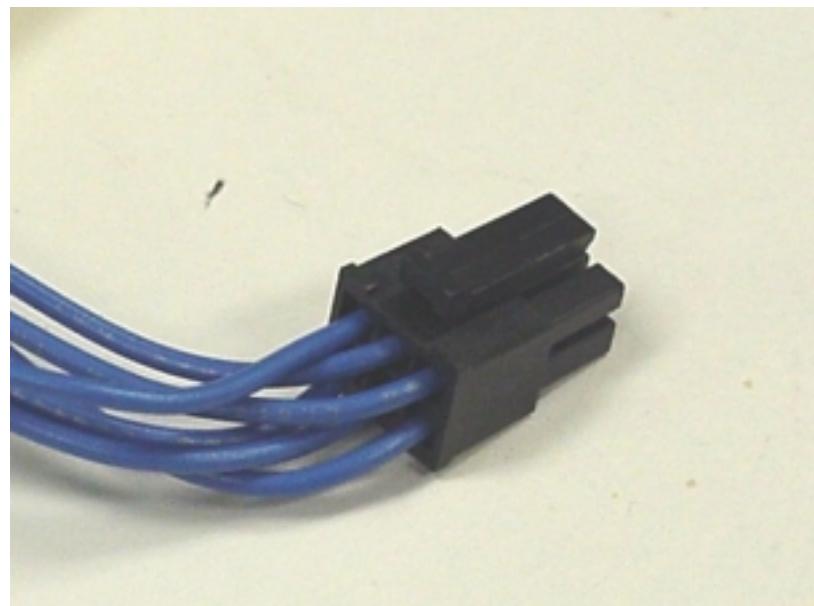


Figure 12: Finished plug from DB-9 connections

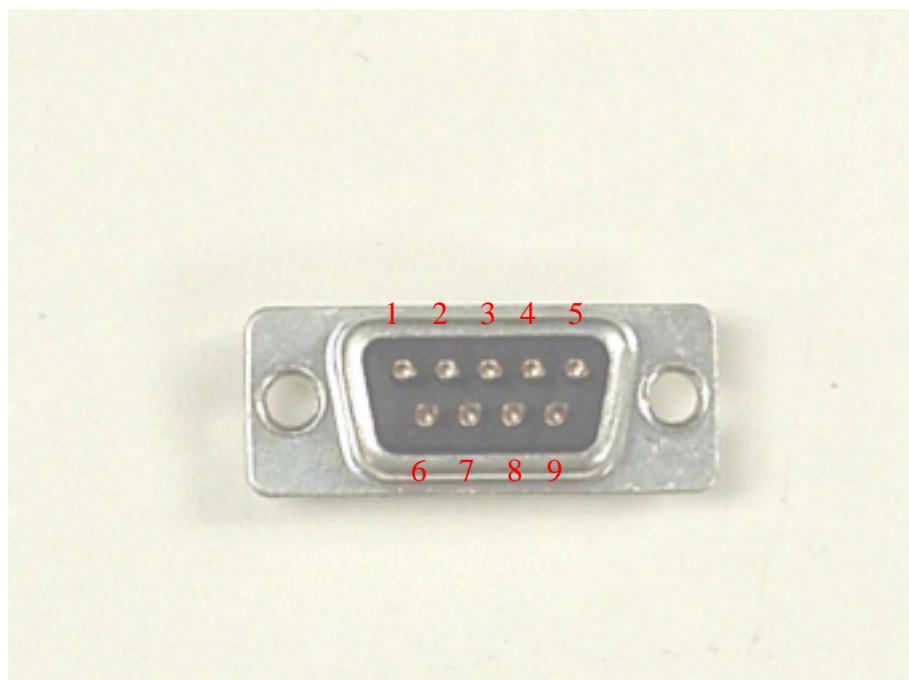


Figure 13: Pin locations on the DB-9

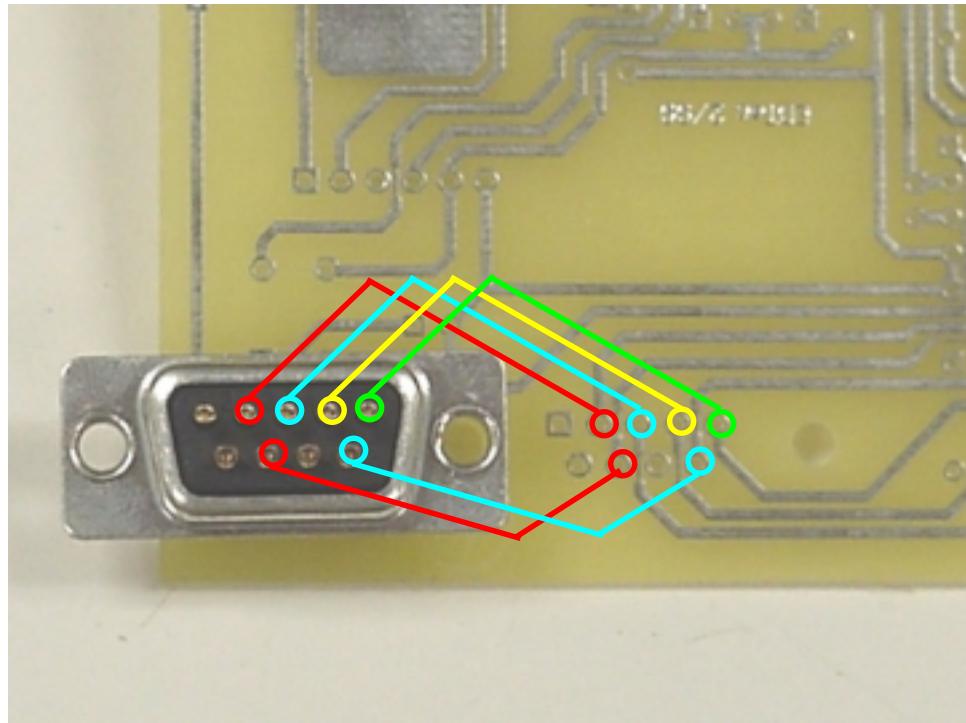


Figure 14: Wire connections between DB-9 and solder pads

There should be five wires coming from the DPDT switch connection as shown in Figure 15, on the component side of the board. The switch solder connections are marked by SW2. Attach the male micro-fit terminals to these wires, and then, plug the terminals into a 6-circuit micro-fit receptacle. Next, attach five 3" pieces of wire to the terminals of the DPDT switch (Radio Shack PN: 2750407) as shown in Figure 16. Attach the female micro-fit terminals to the wires on the DPDT switch. Before inserting the terminals from the DPDT switch into the 6-circuit micro-fit plug, follow the wires from the VT84 DPDT switch solder connections and ensure these wires are going to the proper location in the connection, i.e. make sure the connections are correctly matched (see Figure 17 for example). After, the proper placement of the wires has been determined insert the terminals into the receptacle.



Figure 15: DPDT switch wiring to solder pads

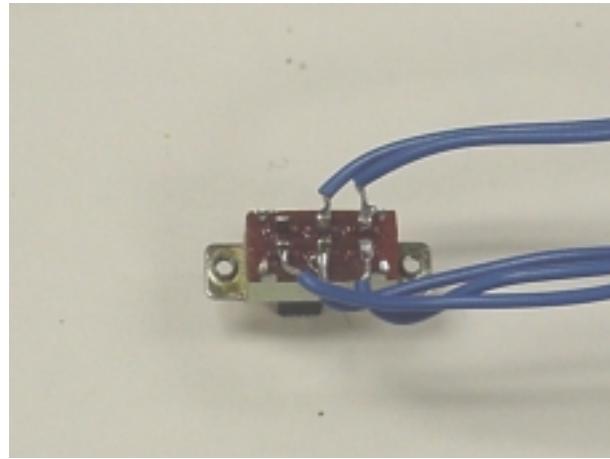


Figure 16: Wired DPDT switch

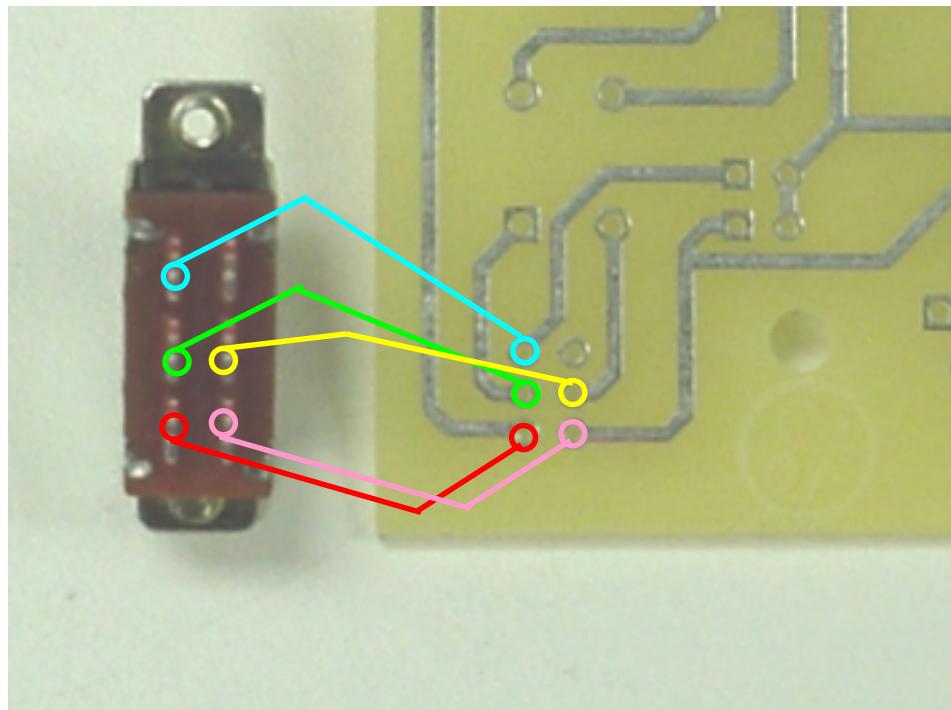


Figure 17: Example of wire connections for the DPDT switch

There should be four wires coming from the SPST momentary switch connection as shown in Figure 18, on the component side of the board the switch solder connections are marked by SW1. Attach the male micro-fit terminals to these wires, and then, plug the terminals into a 4-circuit micro-fit receptacle (Allied Electronics PN: 863-0525). Next, attach four 3" pieces of wire to the terminals of the SPST switch (Radio Shack PN: 2751571) as shown in Figure 19, attaching two pieces of wire to each terminal. It is important to note that the two pads circled in Figure 20 are connected to one terminal of the SPST switch and the pads circled in Figure 21 are connected to the other terminal of the SPST switch. Now, attach the female micro-fit terminals to these wires, and then,

plug the terminals into a 4-circuit micro-fit plug (Allied Electronics PN: 863-0503), taking care that the wires are being correctly matched.



Figure 18: Wires from the SPST momentary switch position on the VT84



Figure 19: SPST switch with attached wires

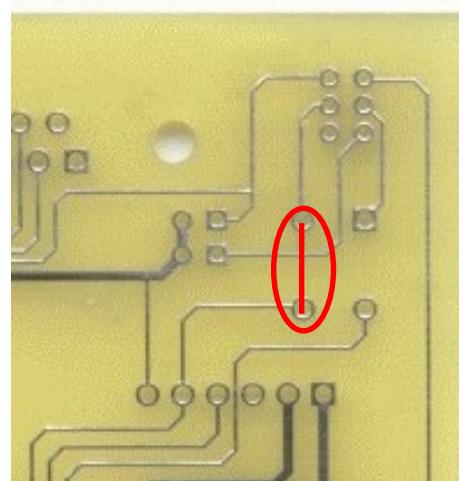


Figure 20: SPST connections on VT84 PCB

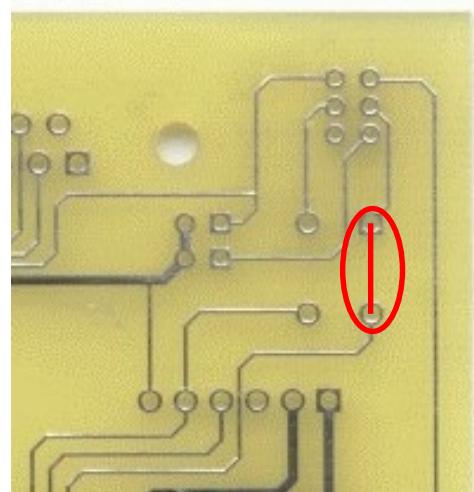


Figure 21: SPST connections on VT84 PCB

Attaching screw terminals to the PCBs

For the input side, place the 8-pole screw terminal block (Allied Electronics PN: 502-0508) into the PCB (Radio Shack PN: 2760148) as shown in Figure 22. Push the terminal block down snug against the PCB. Next, solder each of the pins on the terminal block to the PCB. This assembly is the digital input bank.

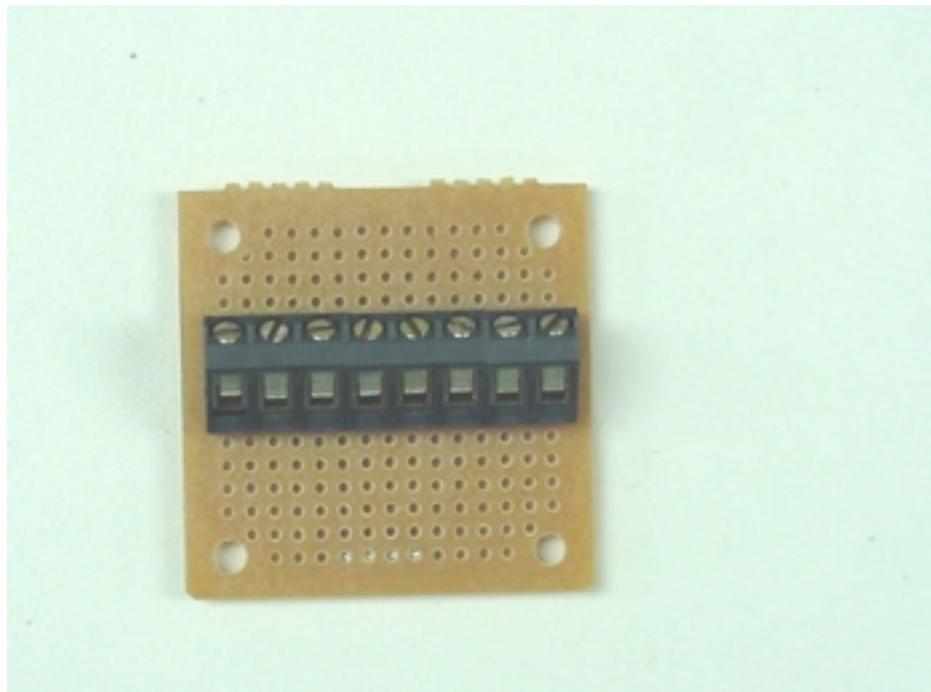


Figure 22: Input bank assembly

For the output side place the 8-pole screw terminal block (Allied Electronics PN: 502-0508) into the PCB (Radio Shack PN: 2760148) as shown in Figure 23. Push the terminal block down snug against the PCB. Next, solder each of the pins on the terminal block to the PCB. This assembly is the digital output bank.

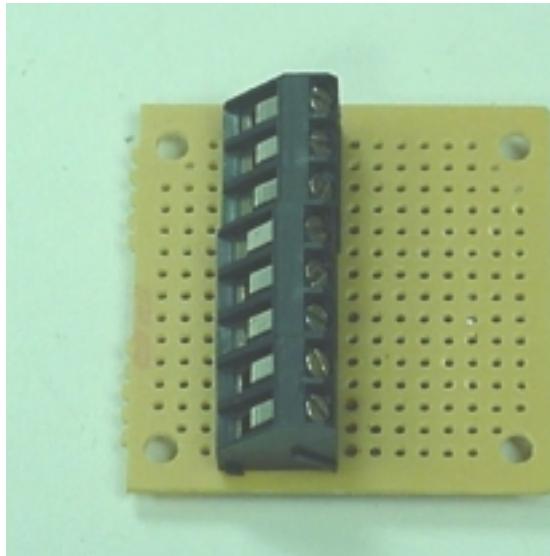


Figure 23: Output bank assembly

Large Sub-Cover assembly

Make the large sub-cover as shown in the schematics section Figures S-2.x*, the vertical panel shown in the schematics section in Figure S-4, and the modified angle made shown in the schematic section in Figures S-5.x. Make sure the short leg of the modified angle is attached to the sub-cover. Using a hot glue gun assemble these sections as shown in Figure 24. Next, attach the digital input bank at the cut out location as shown in Figure 25, using the 4-40 3/8" machine screws with countersunk head (McMaster-Carr PN: 90273A108) and the 4-40 nuts (McMaster-Carr PN: 90631A005) with nylon inserts. Then, attach the digital output bank at the cut out location shown in Figure 26, using 4-40 3/8" machine screws with countersunk head (McMaster-Carr PN: 90273A108) and the 4-40 nuts (McMaster-Carr PN: 90631A005) with nylon inserts. Next, place the BNC receptacles (Allied Electronics PN: 713-9805) in the appropriate positions as shown in Figure 27 and Figure 28, secure these using the nuts and washers included. Attach the 2-terminal speaker jack pushbutton (Radio Shack PN: 2740315) as shown in Figure 29, using 4-40 3/8" machine screws with rounded heads (McMaster-Carr PN: 90279A108) and the 4-40 nuts (McMaster-Carr PN: 90631A005) with nylon inserts.

* Any figure denoted by S means the figure is a schematic to be found in the schematics section. The x in S-2.x denotes all figures belonging to the S-2 section.

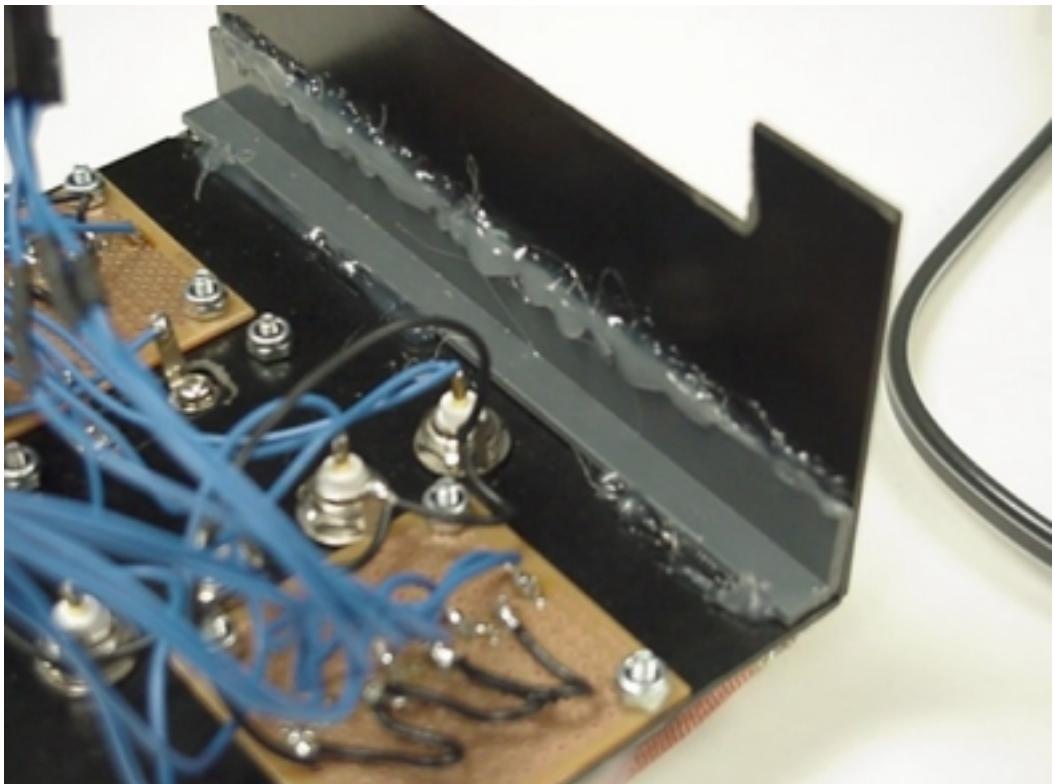


Figure 24: Large sub-cover assembly

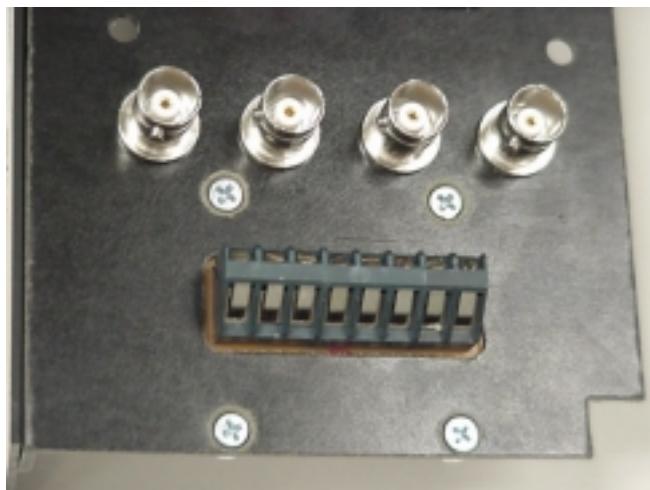


Figure 25: Input bank assembly installation (BNC connectors are not installed yet)



Figure 26: Output bank assembly installation

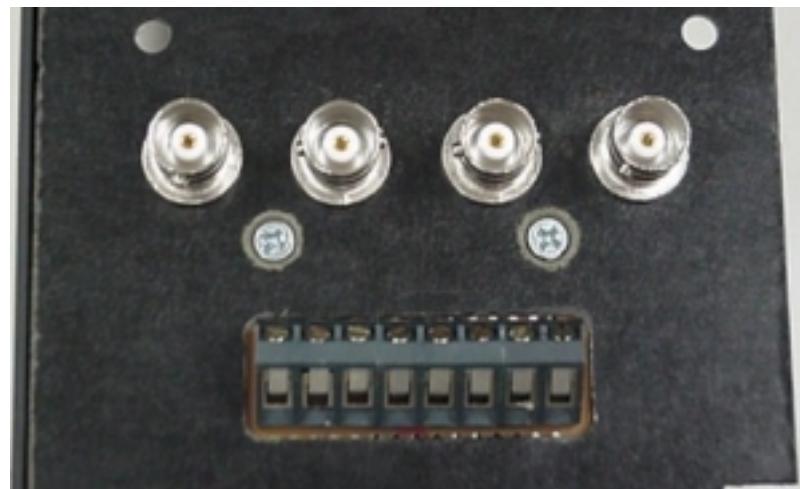


Figure 27: BNC installation



Figure 28: BNC attachment to sub-cover



Figure 29: 2-terminal speaker jack pushbutton

VT84 wire connections and connectors from the proto-board

The next steps will outline attaching the micro-fit connectors to the wires from the proto-board mounted to the VT84. First, attach the female terminal ends to the wires attached to pins 21 through 24 and 27 through 30. Then plug these wires into an 8-circuit micro-fit plug (Allied Electronics PN: 863-0507), putting the terminal ends attached to 21 through 24 on one side of the plug and the other wires on the other side. Next, take the three long wires connected to pins 3, 25, and 26, attach male terminal ends to these and insert these ends into a 4-circuit micro-fit receptacle. Then, take the wires connected to pins 1, 36, 32, 11 through 14, and one of the wires connected to pin 2, attach male micro-fit terminals to these wires, as well. Next, insert the terminal ends attached to 11 through 14 on one side of an 8-circuit micro-fit receptacle (Allied Electronics PN: 863-0527) and insert the connections to 1 and 36 next to each other on the other side of the receptacle and insert the terminal ends corresponding to pins 2 and 32 in the remaining sockets. Take the short wire attached to pin 25 and the remaining wire attached to pin 2, and attach male terminal ends to them.

Over-voltage protection IC (OVP IC) board construction

Take one half of the Dual IC proto-board (Radio Shack PN: 2760159) and place two of the over-voltage protection ICs (Allied Electronics PN: 903-4936, manufactured by Harris PN: SP721AP) on the board as shown in Figure 30. Attach a red wire and a black wire to the board as shown in Figure 31. Then, add the jumper wires as shown in Figure 32. The wires shown in the previous figures are making connections to the power and ground pins on the OVP IC. Next, attach 3" long signal wires all of the pins on the ICs that are not connected to a ground or power wire as shown in Figure 33.

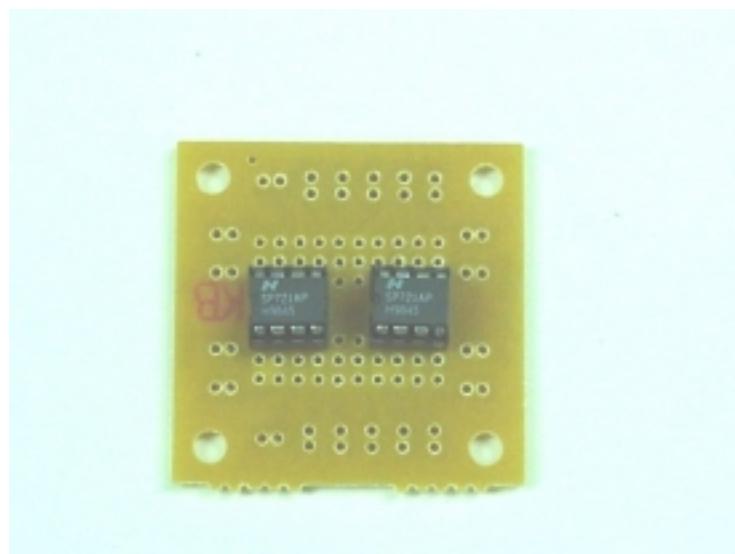


Figure 30: Over-voltage protection ICs mounted to PCB

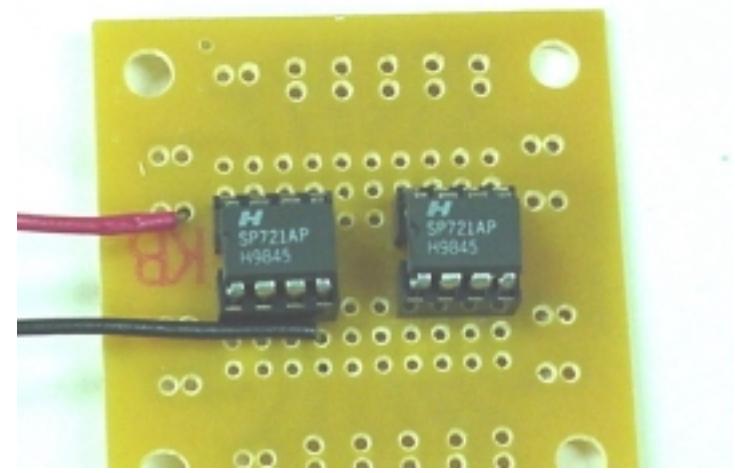


Figure 31: Power and ground wires connected to OVPIC board

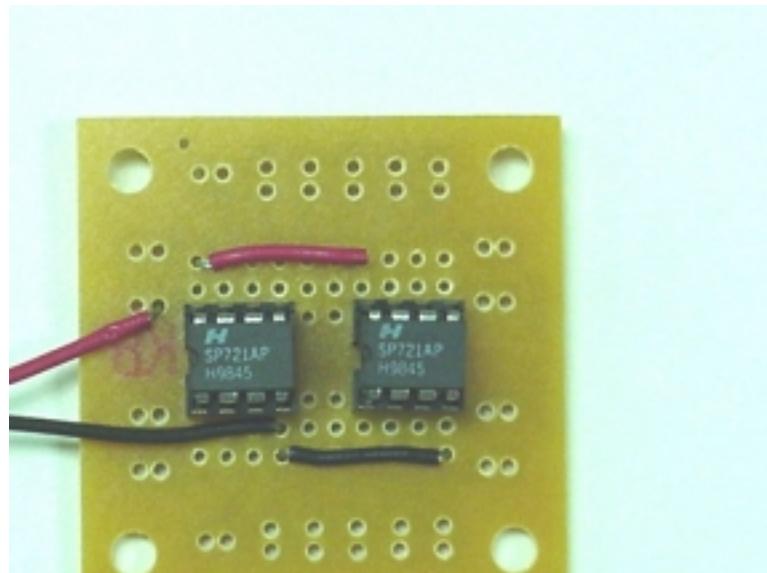


Figure 32: Jumper wires connected to OVPIC board

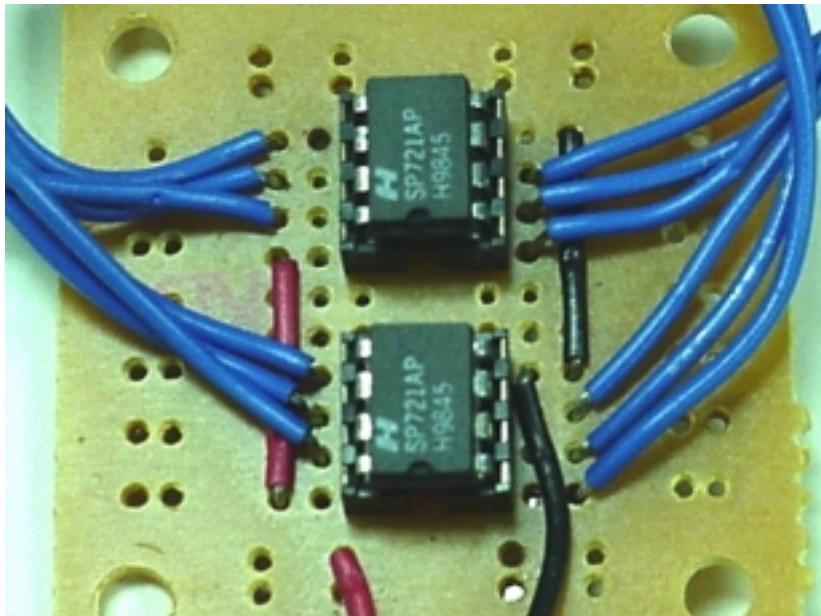


Figure 33: Figure 31: Signal wires connected to OVPIC board

Next, attach female terminal ends to all of the wires on the OVP IC board. Take four of the signal wires and insert them into 4-circuit micro-fit plug. Take the remaining eight signal wires and insert them into an 8-circuit micro-fit plug.

Now, looking at the VT84 proto-board wire connectors, find the 4-circuit micro-fit receptacle with the short red wire attached to pin 25 and a short black wire attached to pin 2. The red and black wire from the OVP IC board will go into a 4-circuit micro-fit plug; this plug will insert into the above-mentioned receptacle from the VT84. When inserting the terminal end from the OVP IC board into the plug make sure the red wire will go to red wire and the black wire will go to the black wire when the connection is made as

shown in Figure 34. After the terminals are inserted the connection can be as shown in Figure (previous).

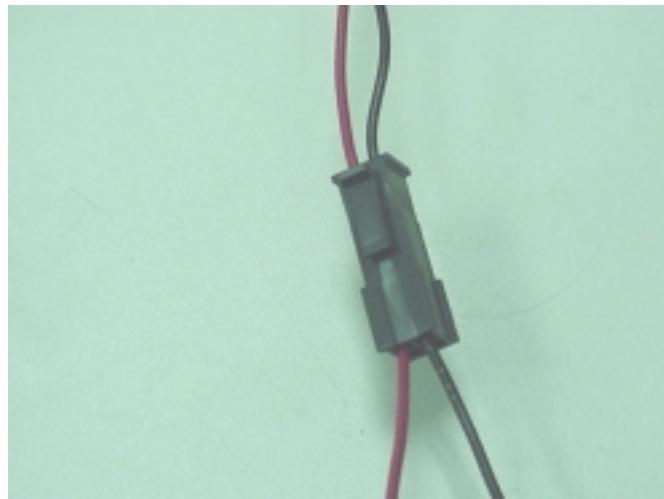


Figure 34: Proper connection of wires in connector

After this is done the VT84 with the attached proto-board can be mounted to the mounting plate along with the OVP IC board. The first step is attaching the insulated stand-offs to the mounting plate (Figure 35); do not tighten the screws tight yet. Next, screw down the OVP IC board and the VT84 board as shown in Figure 36. Now tighten all of the screws.

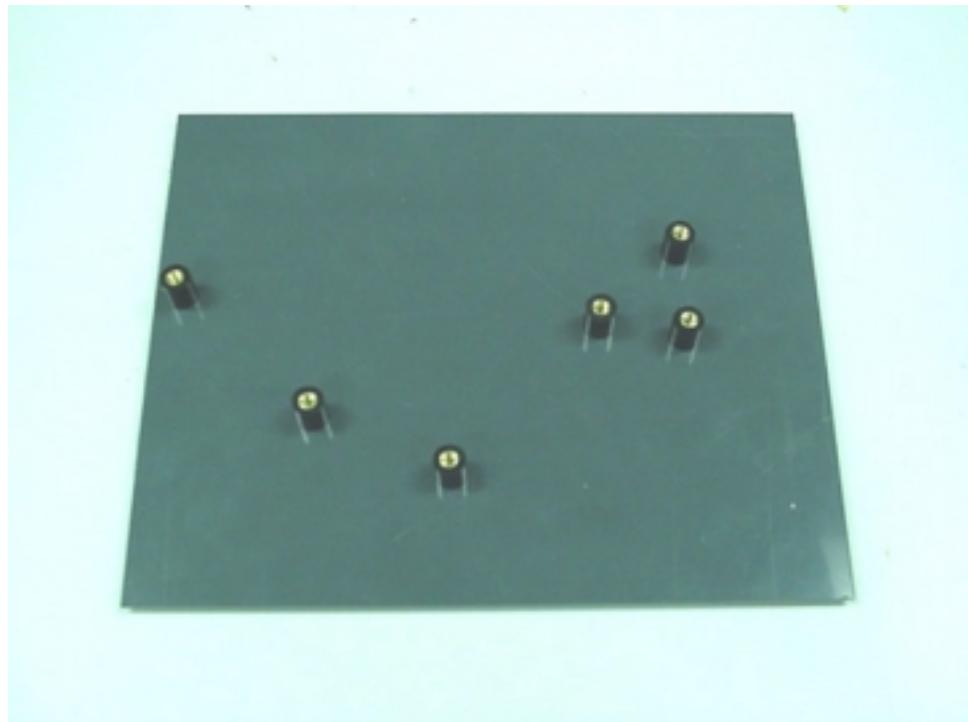


Figure 35: Mounting plate with insulated stand-offs

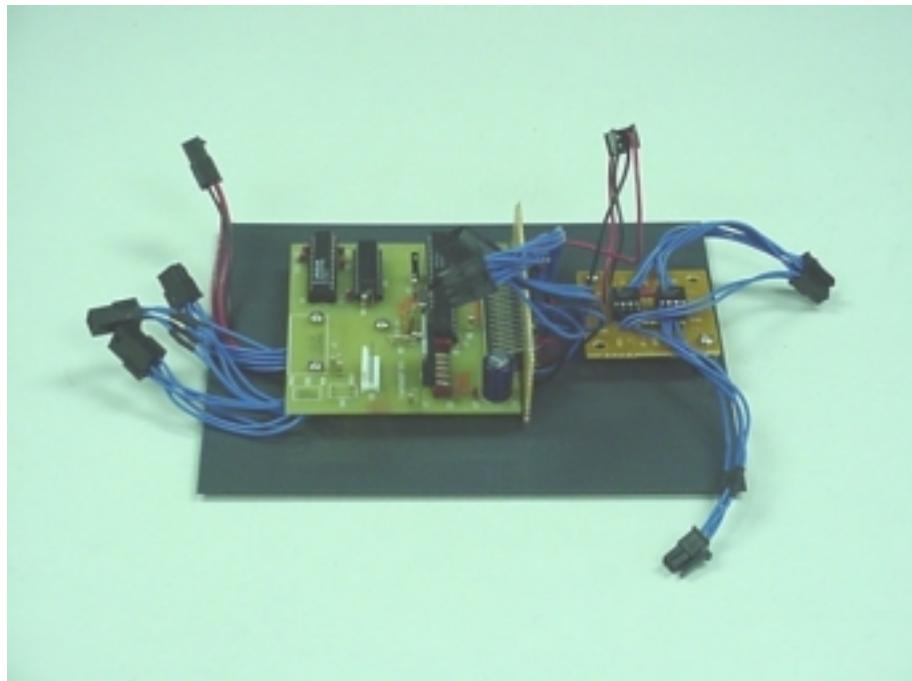


Figure 36: VT84 and OVPIC board attached to mounting plate

Small sub-cover construction and wiring

First make the box cover shown in the schematics section in Figures S-1.x. Then, taking the metal insert that comes with the 8" by 6" by 3" project box (Radio Shack PN: 2701809) round the corners of the box cover, so that it will fit in the project box. Next, make the small sub-cover as shown in the schematics section in Figures S-3.x. The next step is modifying the piece of angle used to connect the vertical panel to the small sub-cover. Using a Dremel or a file make a notch in the short leg of the angle so there is no interference between the DPDT switch and the angle when the assembly is glued together. An example of the notch can be seen in Figure 37. Next, holes to mount the DPDT switch should be drilled. This is done by placing the switch in position on the small sub-cover, and marking where the holes should be drilled on the small sub-cover. Then, drill the holes with a 0.075" or slightly larger drill bit. Figure 38 demonstrates this.

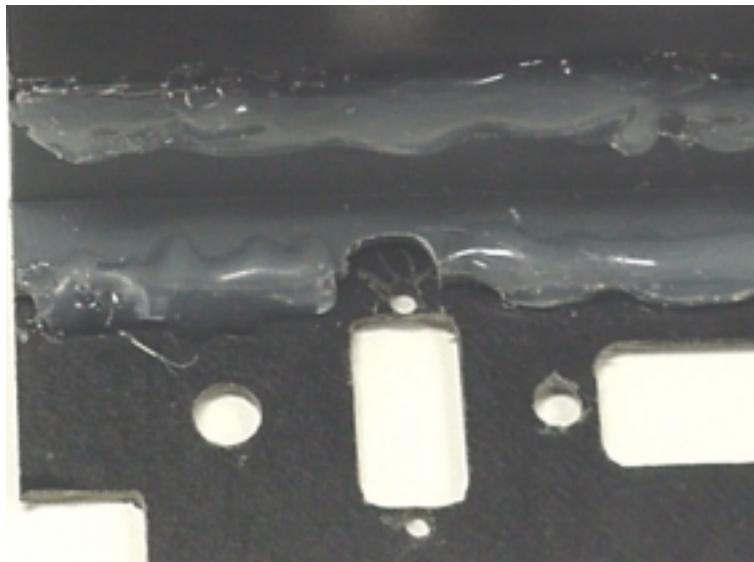


Figure 37: Notch in small sub-cover

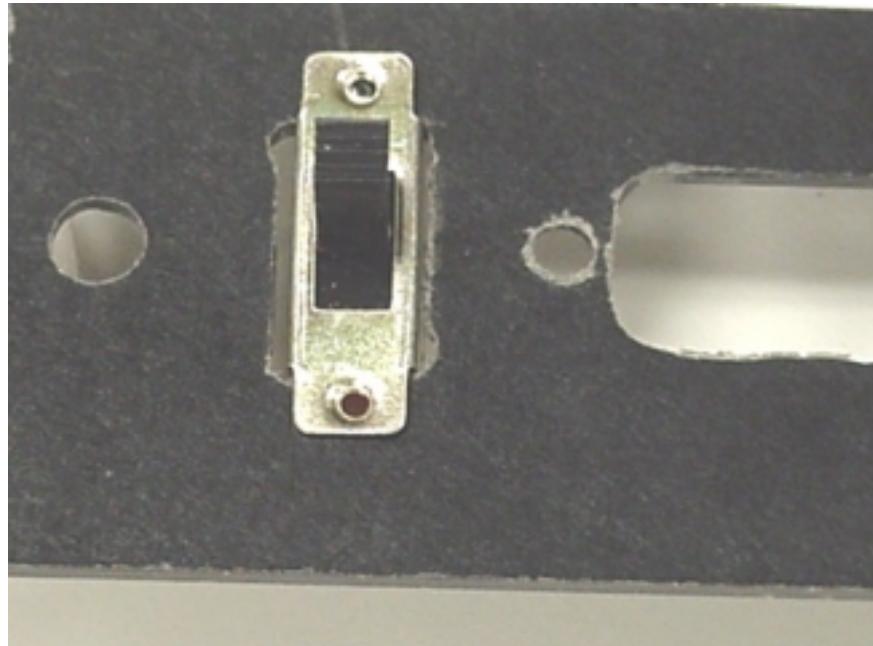


Figure 38: Placing of the DPDT switch to mark holes

Attach the small sub-cover to the box cover using the binding posts (Radio Shack PN: 2740661) as shown in Figure 39. Next, transfer the holes for the DPDT switch to the box cover. Remove the small sub-cover from the box cover by removing the binding posts. Now, drill the new holes in the box cover to 0.125" or slightly larger. The holes in the box cover should appear as in Figure 40.



Figure 39: Attachment of sub-cover to box cover using binding posts



Figure 40: Holes in box cover

Using the hot glue gun, glue together the small sub-cover, the vertical panel, and the angle as shown in Figure 41. Install the SPST switch as shown in Figure 42. Attach the small sub-cover assembly to the box cover using the binding posts as shown in Figure 43 (only use one of the supplied nuts to secure each binding post). Next, attach the DB-9 connector using the 4-40 machine screws with round heads and the nuts with the nylon inserts as shown in Figure 44. Then, place the DPDT switch in place and attach it with the screws provided as seen in Figure 45.

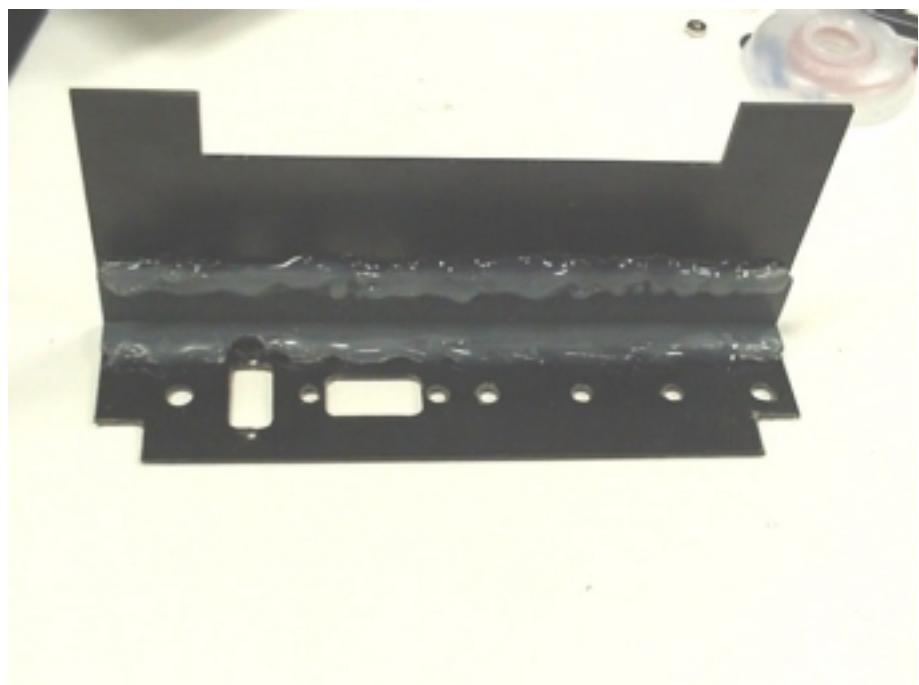


Figure 41: Small sub-cover glued to vertical panel using the angle



Figure 42: Installed SPST momentary switch



Figure 43: Binding posts installed on the box cover/small sub-cover assembly



Figure 44: DB-9 installed on the box cover/small sub-cover assembly



Figure 45: DPDT switch installed on the box cover/small sub-cover assembly

Next, take a wiring pad (Figure 46) supplied with the binding posts and solder a 3" piece of red wire to it as shown in Figure 47. Taking another wiring pad, solder a 3" piece of yellow wire to it. Next, use a 1 ½" piece of wire to connect the two remaining wiring pads and connect a 3" piece of black wire to one of these as seen in Figure 48.



Figure 46: Wiring pad

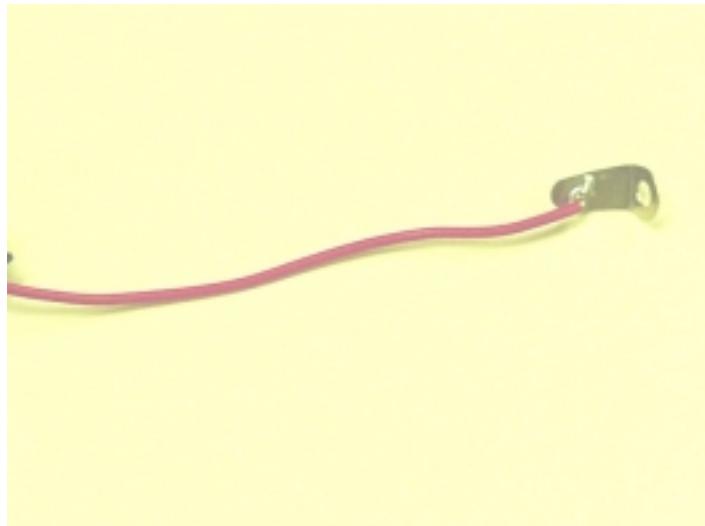


Figure 47: Wiring pad with red wire



Figure 48: Wiring pad with black wires soldered to it

Attach the wiring pads with the black wire to the black posts as shown in Figure 49. Attach the wiring pad with the red wire to the binding post indicated in Figure 50. Attach the wiring pad with the yellow wire to the remaining binding post.

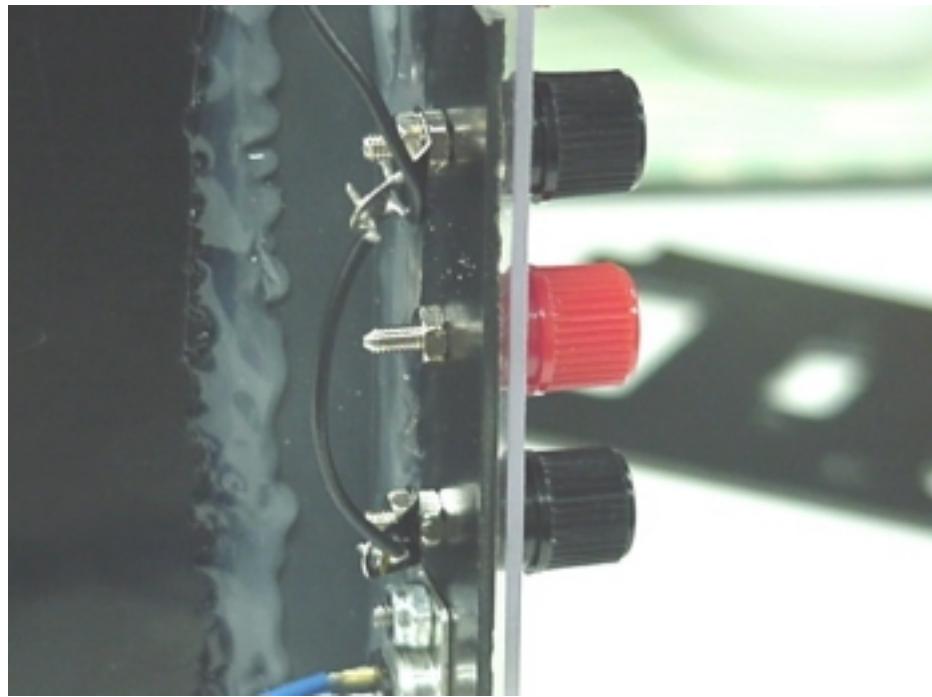


Figure 49: Wiring pad connection to black binding posts

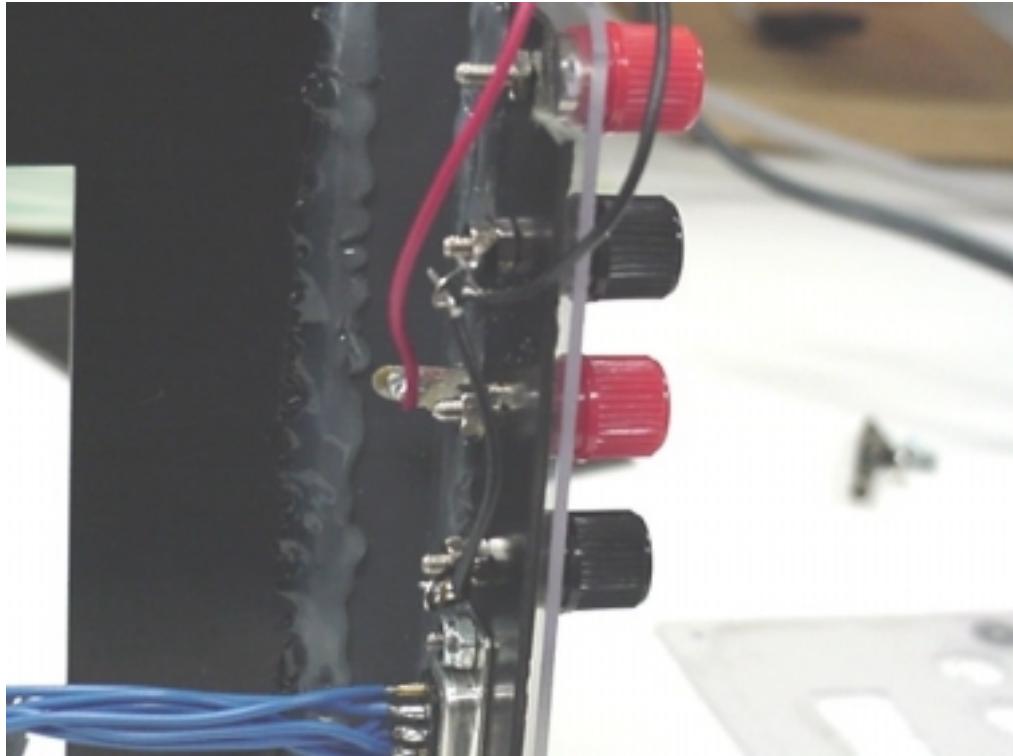


Figure 50: Red wire attachment to binding post

Take the red, yellow, and black wire and attach a female micro-fit terminal to each of them. Find the 4-circuit micro-fit receptacle attached to the VT84 with the 8" wires. Take the wires attached to the binding post and insert them into a 4-circuit micro-fit plug, so that the red wire from the VT84 will connect with the red wire from the binding post, the yellow wire from the VT84 will connect with the yellow wire from the binding post, and the black wire from the VT84 will connect with the black wire from the binding post.

After inserting the terminals the plug and the receptacle can be joined. The plugs and receptacles corresponding to the switches and the DB-9 connection can also be connected now.

Large sub-cover wiring

First, take two wires and strip one end off of each of them. Next, twist the ends together and solder the two wires together as shown in Figure 51. Make 12 of these two-wire twists.



Figure 51: Twisted wire pair

Reference the digital input bank's pins as shown in Figure 52. Next, attach one two-wire twist to each of the following input bank's pins: 1,3,5, and 7 (Figure 53). Then, use three short pieces of black wire and connect pins 2 and 4, 4 and 6, and 6 and 8 as shown in Figure 53. Attach a 3" piece of black wire to pin 8 of the digital input bank as shown in Figure 53.



Figure 52: Input bank referencing

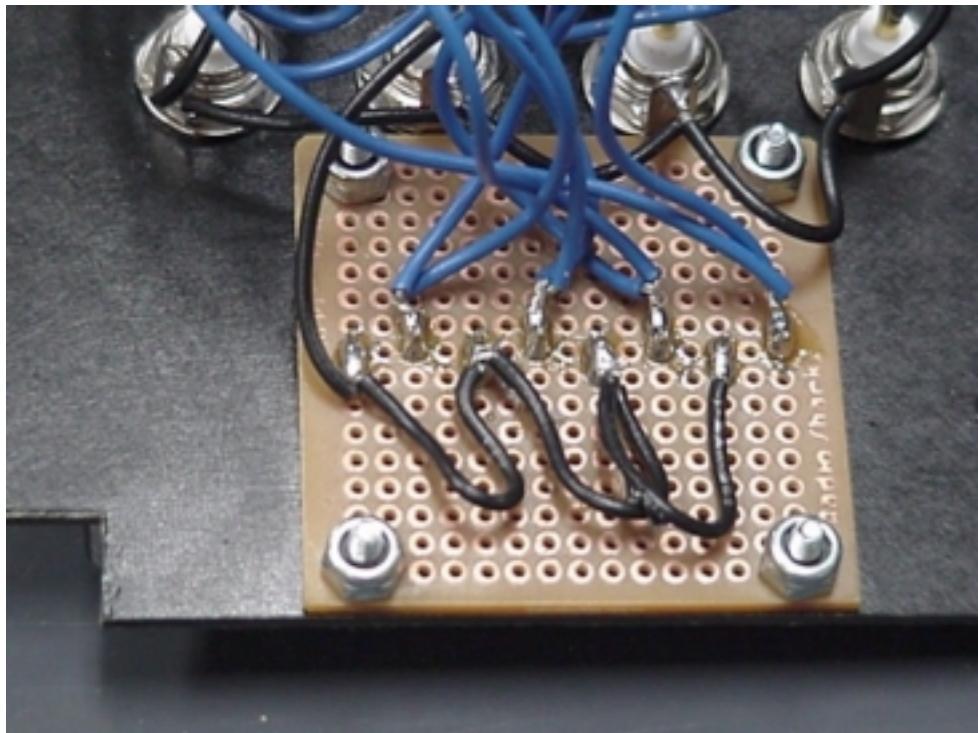


Figure 53: Input bank wiring

Reference the digital output bank's pins as shown in Figure 54. Next, attach one two-wire twist to each of the following output bank's pins: 1,3,5, and 7 (Figure 55). Then, use three short pieces of black wire and connect pins 2 and 4, and 4 and 6 as shown in Figure 55. Attach a 4" piece of black wire to pin 2 and pin 6 of the digital output bank as shown in Figure 55. Attach a 3" piece of signal wire to pin 8 of the digital output bank (this pin will carry the PWM output signal from the PIC) as shown in Figure 55.



Figure 54: Output bank referencing

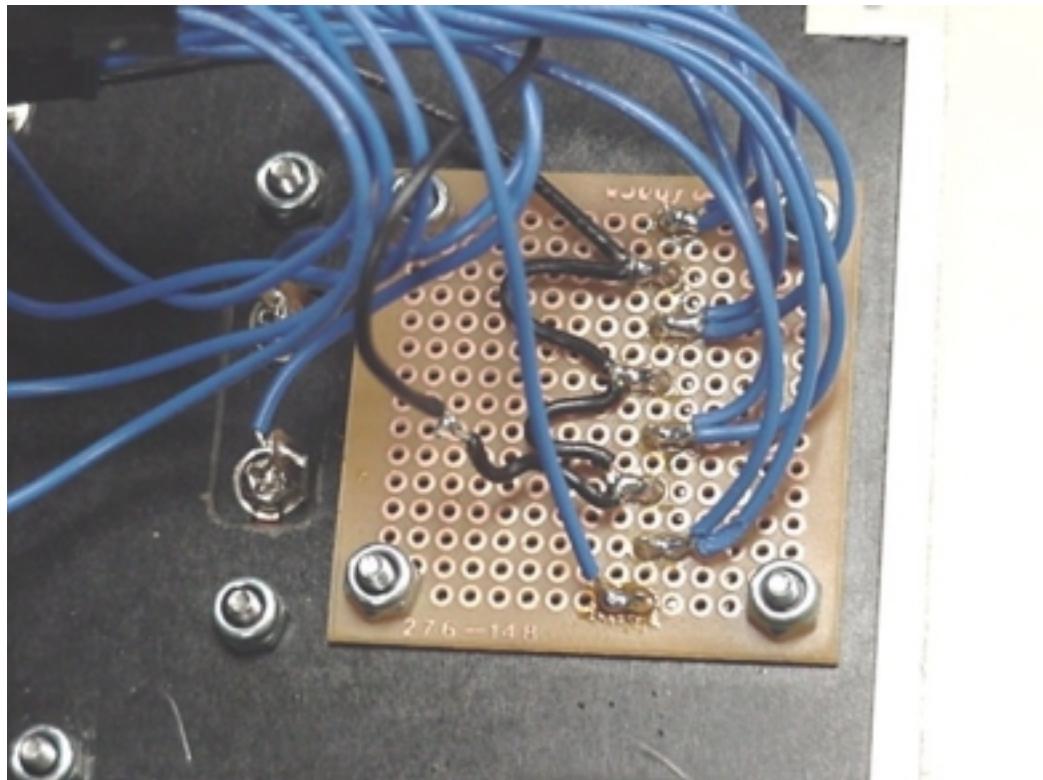


Figure 55: Output bank wiring

Take the remaining four two-wire twist and solder one to each post of the BNC receptacles as shown in Figure 56. Attach a 3" piece of wire to each post of the 2-terminal speaker jack pushbutton as shown in Figure 57.

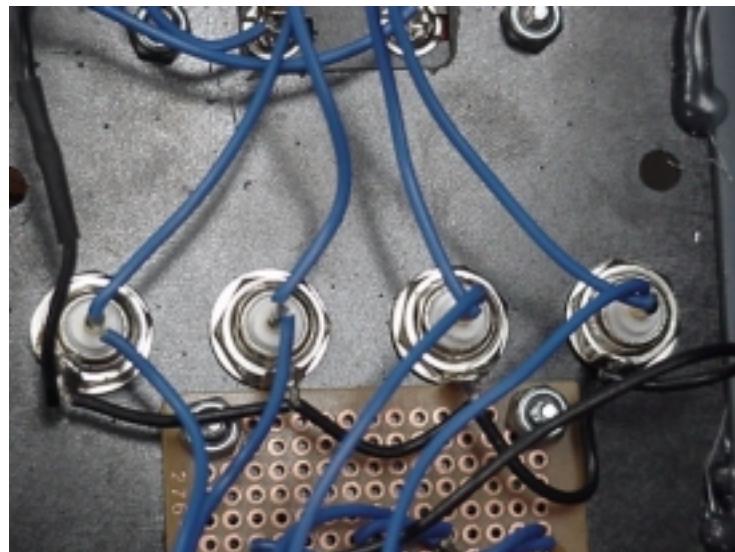


Figure 56: BNC receptacle wiring

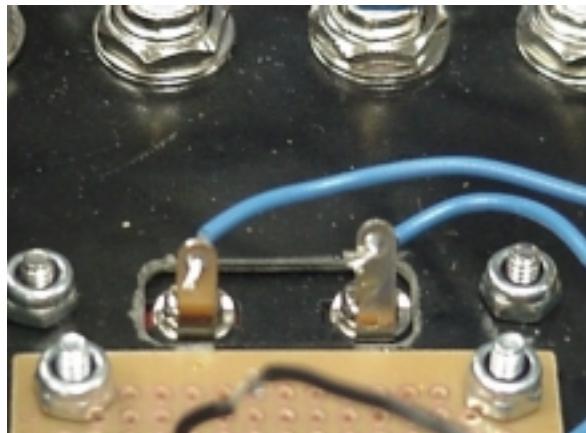


Figure 57: 2-terminal speaker jack pushbutton wiring

Reference the BNC receptacles as shown in Figure 58. Take the 3" black wire from the digital input bank and twist the end of it together with a 1" piece of black wire. Solder the twisted end to ground terminal on the BNC referenced as 1 as shown in Figure 59. Next, take one of the 4" black wires attached to the output bank and twist the end of it together with a 1" piece of black wire. Solder the twisted end to the ground terminal on the BNC referenced as 4 as shown in Figure 60. Next, take the 1" piece of black wire attached to the BNC receptacle label as 1 and twist it together with another 1" piece of black wire. Solder this pair of wires to the ground terminal referenced as 2. Next, take the loose 1" piece of black wire soldered to the BNC receptacle label as 2 and twist it together with the 1" piece of black wire soldered to the BNC receptacle label as 2. Solder this pair of wires to the ground terminal referenced as 3. An example of the jumper wires between the BNC ground terminals can be seen in Figure 59.

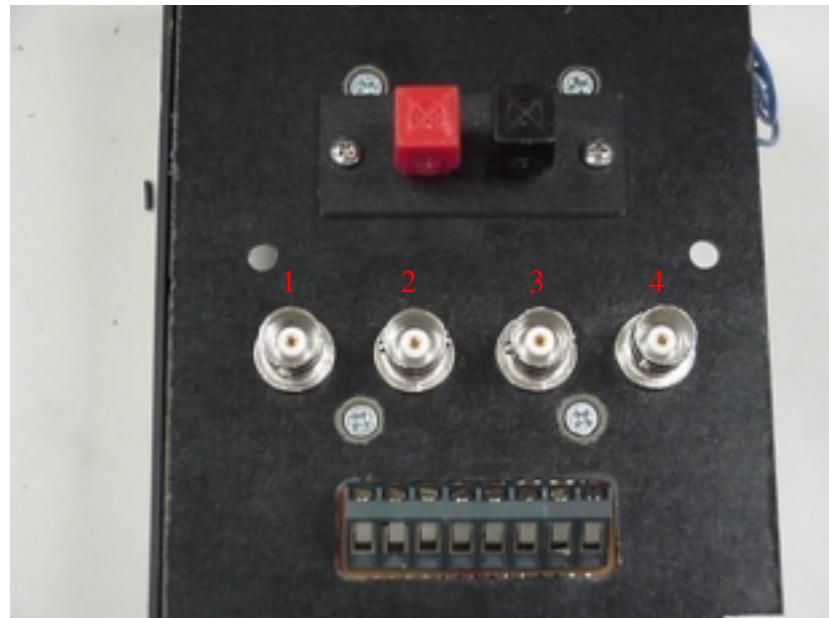


Figure 58: BNC receptacle referencing

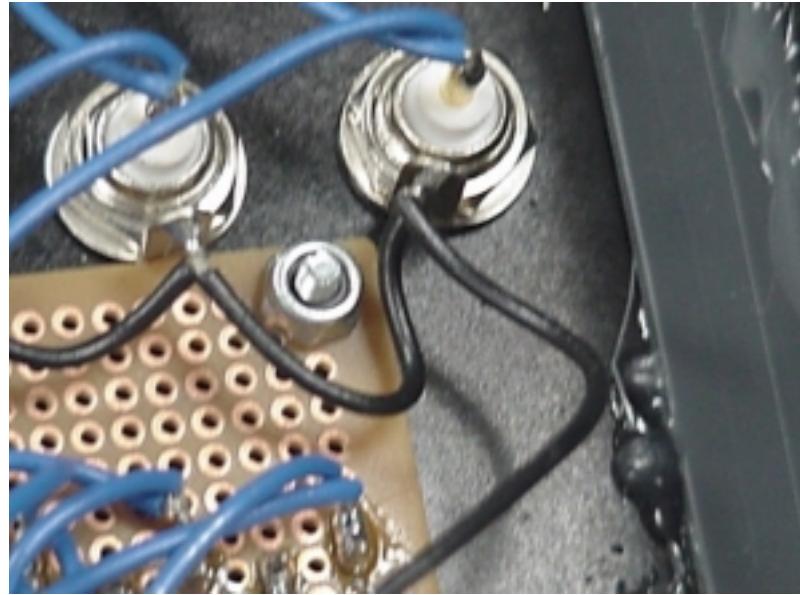


Figure 59: Connection to BNC 1

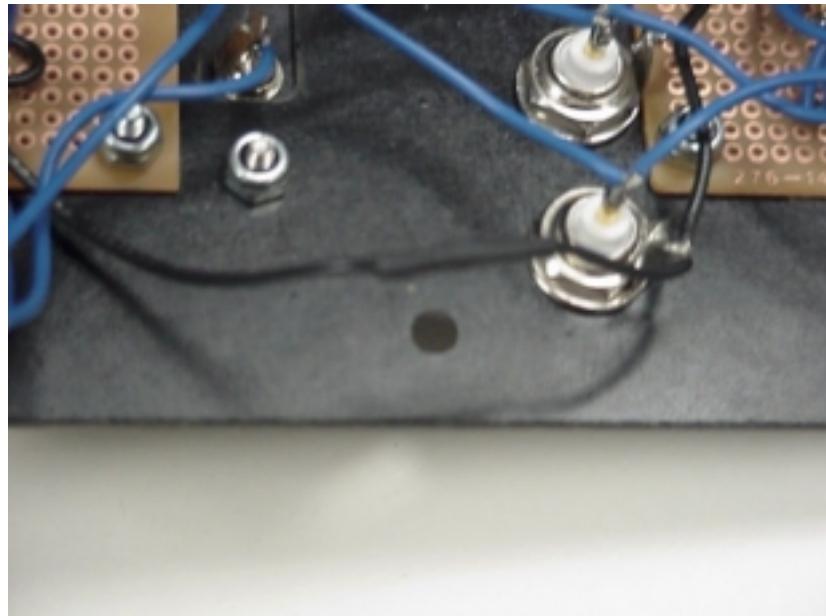


Figure 60: Connection to BNC 4

Large sub-cover connector attachment

The wire connectors should appear similar to the ones in Figure x when this section is complete.

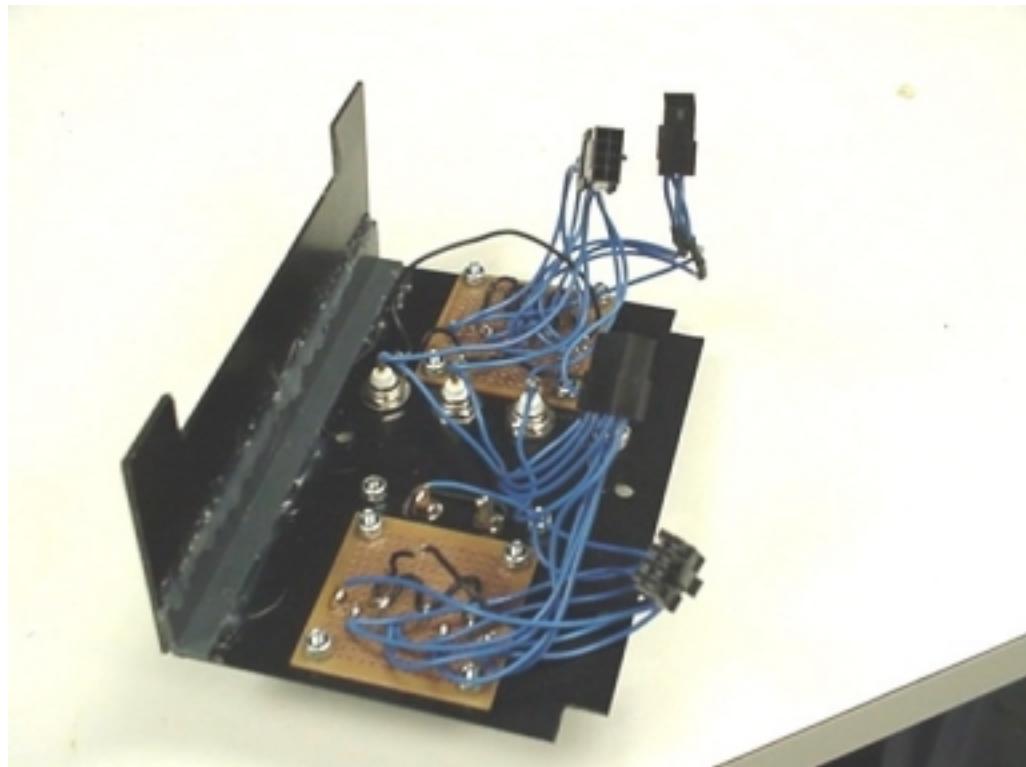


Figure 61: Connections on large sub-cover

Take the signal wires attached to digital input bank, and the BNC receptacles, and attach male micro-fit terminal to them. Next, take four of the eight wires attached to the digital output bank and attach male micro-fit terminal to them. Insert one wire with the male terminal from each of the input bank pins referenced as 1,3,5, and 7 into a 4-circuit micro-fit receptacle. Insert one wire with the male terminal from each of the BNC receptacles into an 8-circuit micro-fit receptacle. Take the four wires from the digital output bank with the male terminals and insert them into the 8-circuit micro-fit receptacle with the wires from the BNC receptacles. The placement of the wires into these receptacles is not important because these receptacles attach to the plugs from the OVP IC board. These receptacles and plugs can now be connected.

Input connector

On the VT84 board assembly locate the connector attached to pins 21 through 24 and 27 through 30. The wire coming from pin 24 corresponds to the BNC receptacle referenced as 1. Using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the BNC receptacle referenced as 1 into that position.

The wire coming from pin 23 corresponds to the BNC receptacle referenced as 2. Next, Using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the BNC receptacle referenced as 2 into that position.

The wire coming from pin 22 corresponds to the BNC receptacle referenced as 3. Then, using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the BNC receptacle referenced as 3 into that position.

The wire coming from pin 21 corresponds to the BNC receptacle referenced as 4. Using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the BNC receptacle referenced as 4 into that position.

The wire coming from pin 30 of the VT84 corresponds to the digital input bank pin referenced as 1. Using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the digital input bank pin referenced as 1 into that position.

The wire coming from pin 29 of the VT84 corresponds to the digital input bank pin referenced as 3. Using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the referenced as 3 into that position.

The wire coming from pin 28 of the VT84 corresponds to the digital input bank pin referenced as 5. Using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the digital input bank pin referenced as 5 into that position.

The wire coming from pin 27 of the VT84 corresponds to the digital input bank pin referenced as 7. Using an 8-circuit micro-fit receptacle match the positions of these wires on the micro-fit connectors, and insert the male terminal from the digital input bank pin referenced as 7 into that position.

This should fill the entire micro-fit connector. After the receptacle is filled with the terminals the connection can be made to the plug from the VT84.

Output connector

There should be eight wires remaining now. These wires should be from the digital output bank, and from the 2-terminal speaker jack pushbutton. Attach female micro-fit terminals to each of these wires. On the VT84 board assembly locate the connector attached to pins 11 through 14, 1, 36, 32, and 2. The wire coming from pin 14 of the VT84 corresponds to the digital output bank pin referenced as 1. Using an 8-circuit micro-fit plug match the positions of these wires on the micro-fit connectors, and insert the female terminal from the digital output bank pin referenced as 1 into that position.

The wire coming from pin 13 of the VT84 corresponds to the digital output bank pin referenced as 3. Using an 8-circuit micro-fit plug match the positions of these wires on

the micro-fit connectors, and insert the female terminal from the digital output bank pin referenced as 3 into that position.

The wire coming from pin 12 of the VT84 corresponds to the digital output bank pin referenced as 5. Using an 8-circuit micro-fit plug match the positions of these wires on the micro-fit connectors, and insert the female terminal from the digital output bank pin referenced as 5 into that position.

The wire coming from pin 11 of the VT84 corresponds to the digital output bank pin referenced as 7. Using an 8-circuit micro-fit plug match the positions of these wires on the micro-fit connectors, and insert the female terminal from the digital output bank pin referenced as 7 into that position.

The wire coming from pin 32 of the VT84 corresponds to the digital output bank pin referenced as 8. Using an 8-circuit micro-fit plug match the positions of these wires on the micro-fit connectors, and insert the female terminal from the digital output bank pin referenced as 8 into that position.

The wire coming from pin 2 of the VT84 corresponds 4" black wire attached to the digital output bank. Using an 8-circuit micro-fit plug match the positions of these wires on the micro-fit connectors, and insert the female terminal from the digital output bank pin.

The wires coming from pin 1 and 36 of the VT84 corresponds to the 2-terminal speaker jack pushbutton. Using an 8-circuit micro-fit plug match the positions of these wires on the micro-fit connectors (the red pushbutton goes to VT84 pin 36 and the black to the VT84 pin 2), and insert the female terminals from the 2-terminal speaker jack pushbutton into that position.

This should fill the entire micro-fit connector. After the plug is filled with the terminals the connection can be made to the receptacle from the VT84.

Final Assembly

Print out the labels on the next page and place them on the box as shown in Figures 62-64. Now attach the large sub-cover to the box cover using the 4-40 screws with the round head and the nuts with nylon inserts. All plugs and receptacles should be connected together at this point. Now, place the whole assembly into the project box and secure with the attached screws as shown in Figure 65.

Run

Prog

Reset

**Serial Cable
Connection**

+ 5V -

**RB4 \pm RB5 \pm RB6 \pm RB7 PWM
Digital Outputs**

PWM (H-Bridge Output)

+ 12V -

**RB0 \pm RB1 \pm RB2 \pm RB3 \pm
Digital Inputs**

AD0 AD1 AD2 AD3

Run

Prog

Reset

**Serial Cable
Connection**

+ 5V -

**RB4 \pm RB5 \pm RB6 \pm RB7 PWM
Digital Outputs**

PWM (H-Bridge Output)

+ 12V -

**RB0 \pm RB1 \pm RB2 \pm RB3 \pm
Digital Inputs**

AD0 AD1 AD2 AD3

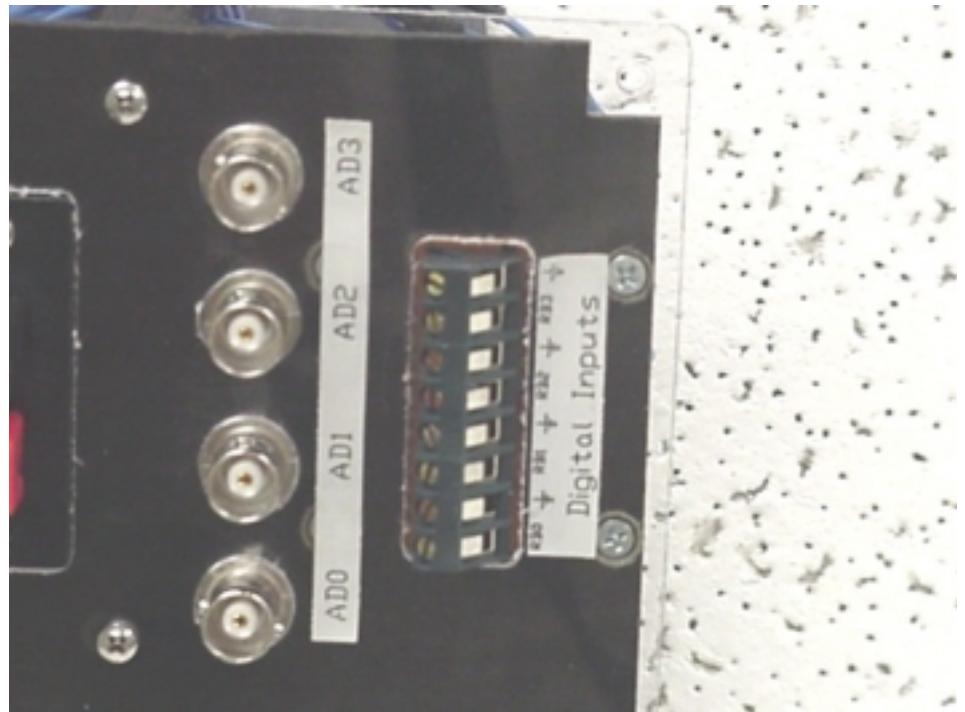


Figure 62: Input bank labeling

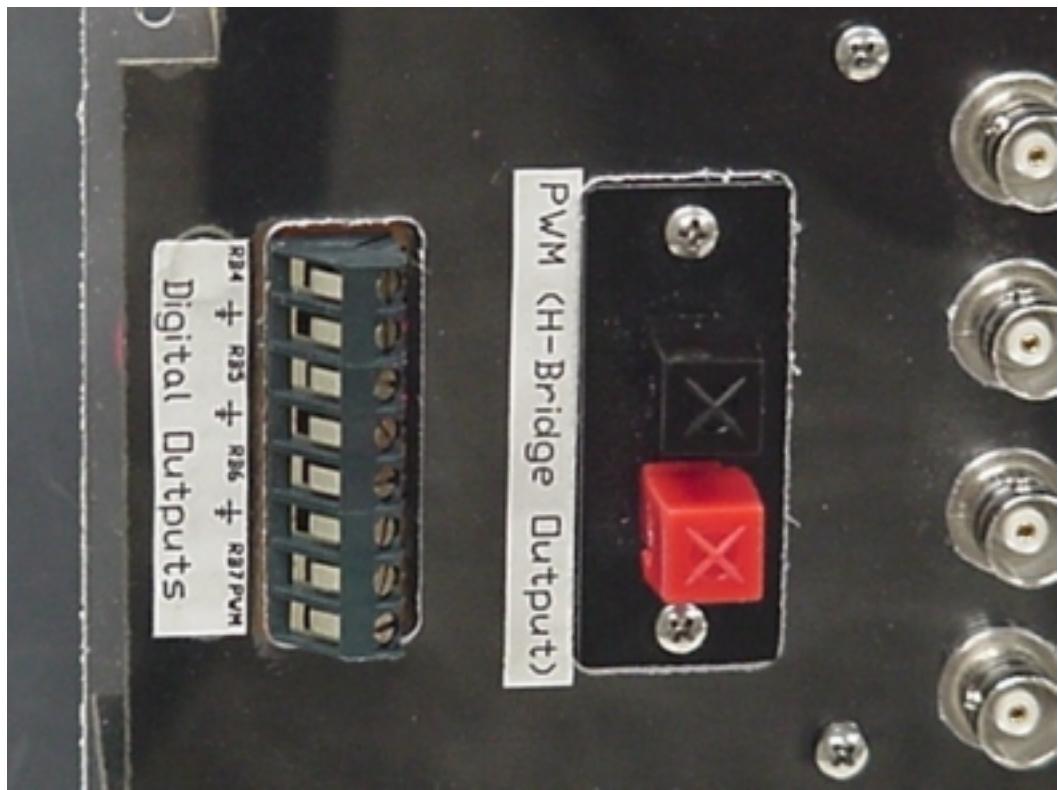


Figure 63: Output bank labeling



Figure 64: Power and programming labeling

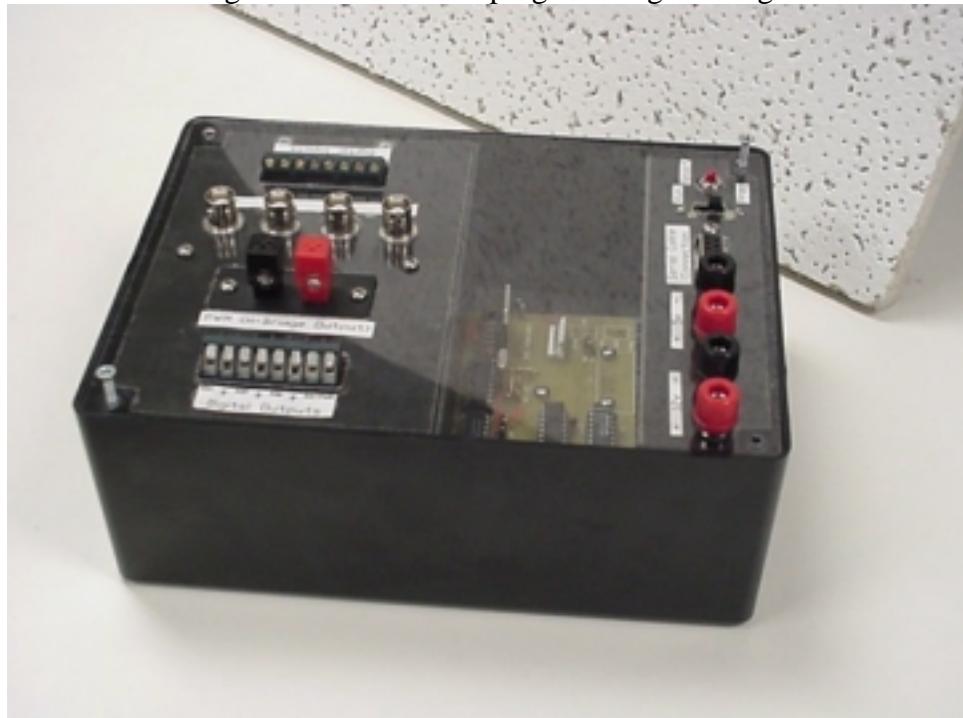


Figure 65: Completed box

Schematics

Assembly drawing

Figure S-0.1 is the wire frame assembly drawing of the box interior

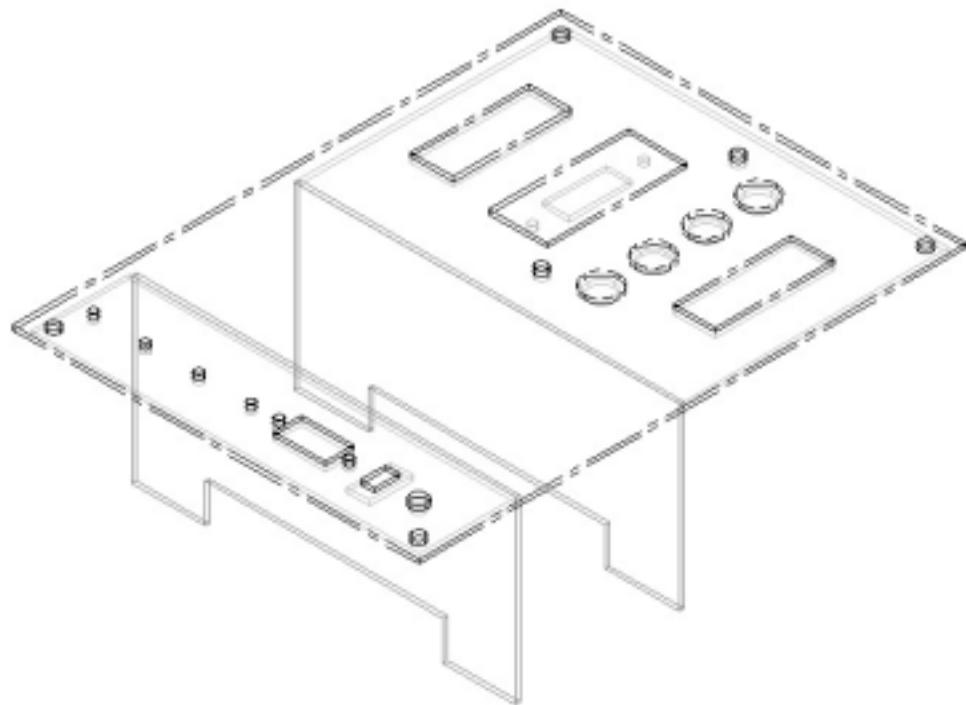
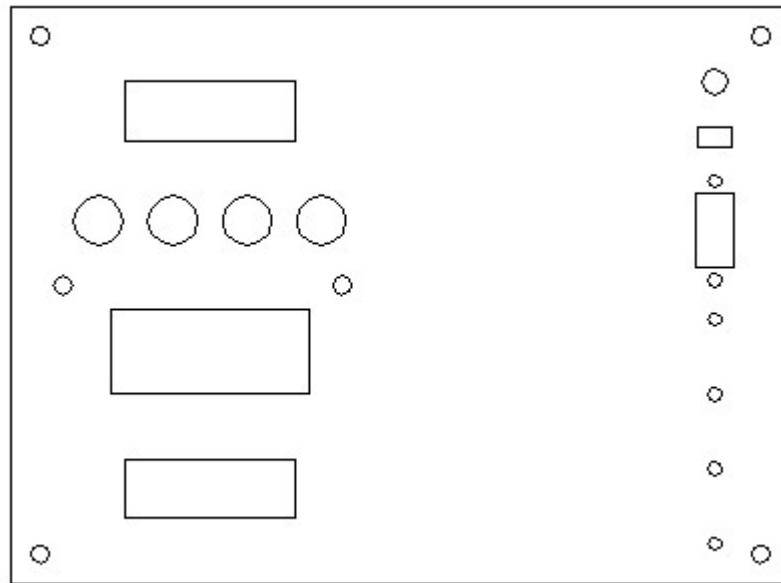


Figure S-0.1: Wire frame assembly drawing of the project box

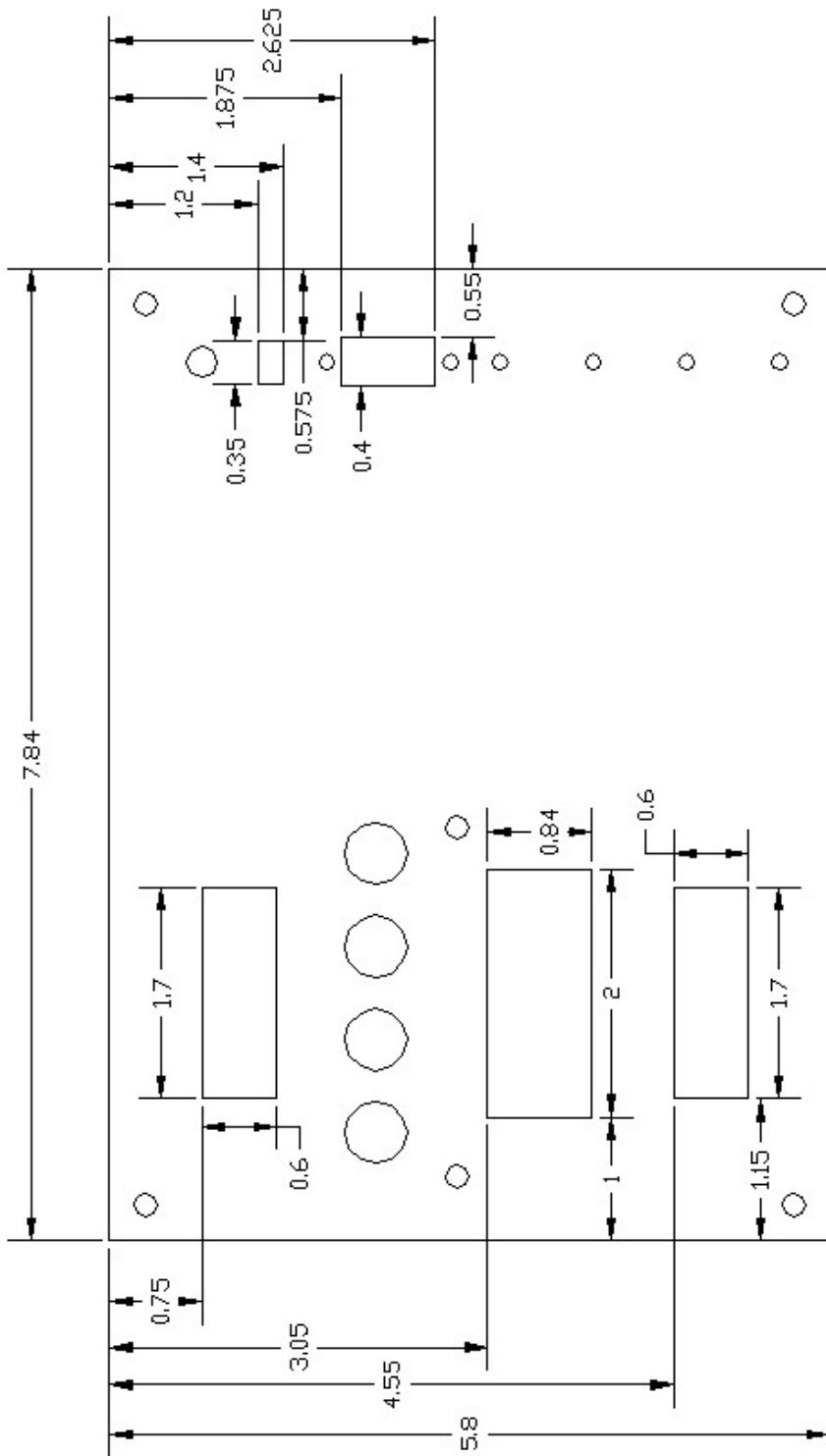
Box cover

Figure S-1.1 is the clear cover for the project box. Figure S-1.2 is the schematic for machining the cover and the square holes on the cover. Figure S-1.3 is the schematic for drilling the holes in the cover.

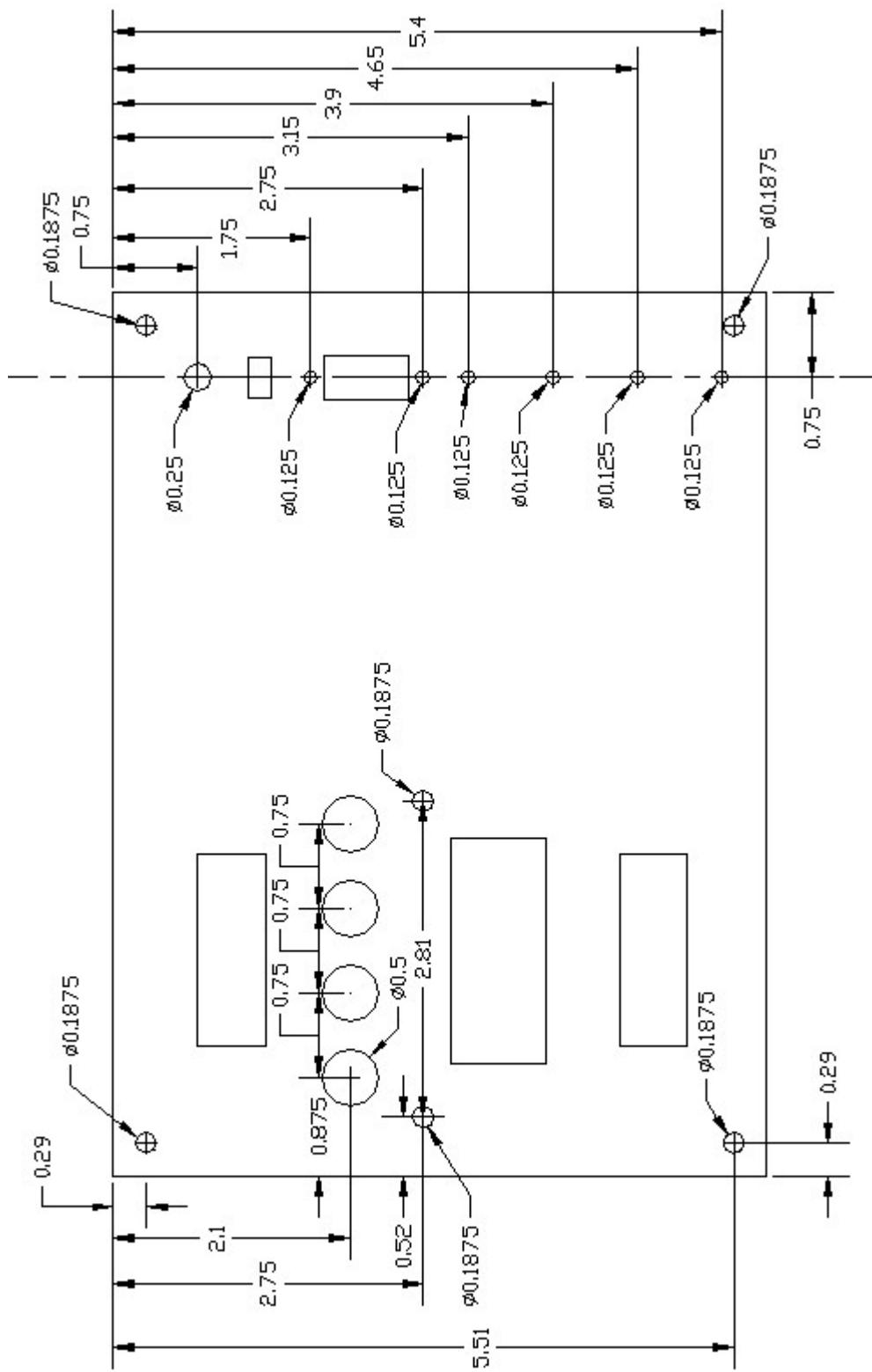


S-1.1: Diagram of Project Box Cover

Box Cover Material: PETG clear sheet 1/16" thickness



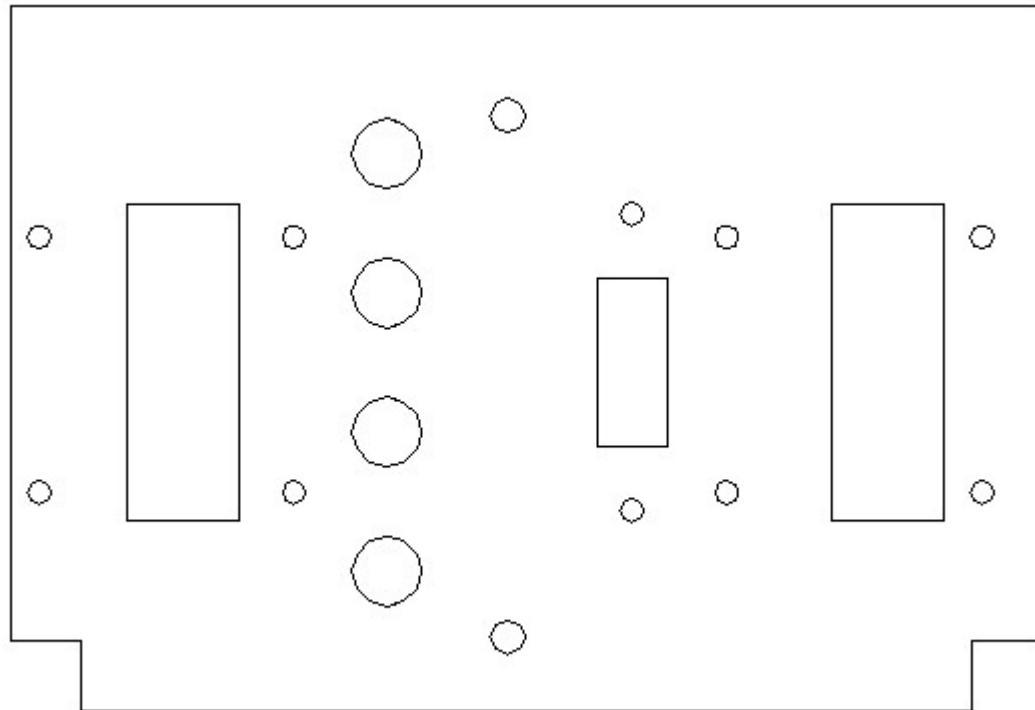
S-1.2: Cutout schematic of Box Cover



S-1.3: Hole cutout schematic of Box Cover PETG clear sheet

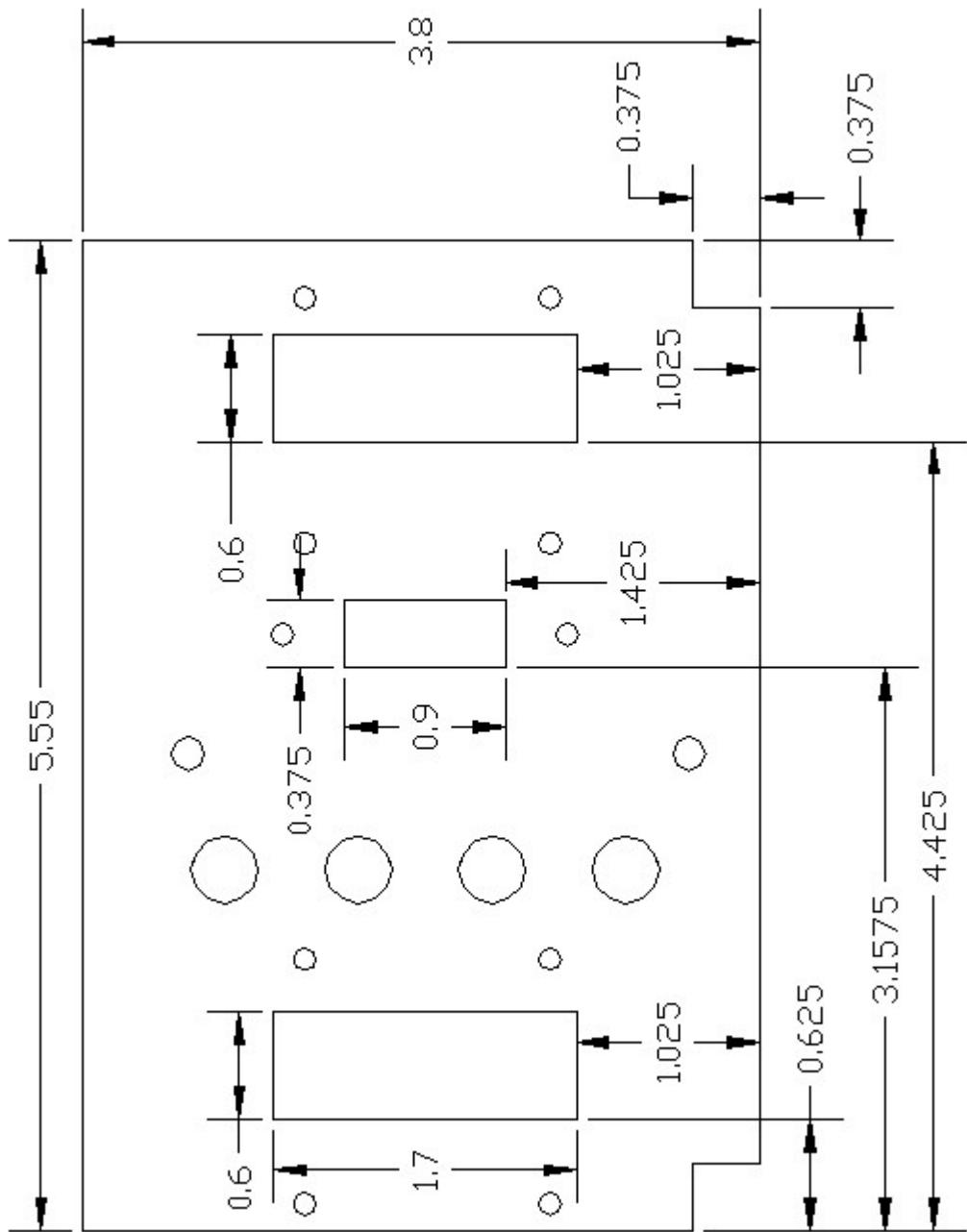
Large sub-cover

Figure S-2.1 is the black garolite large sub-cover for the project box. Figure S-2.2 is the schematic for machining the large sub-cover and the square holes on the large sub-cover. Figure S-2.3 is the schematic for drilling the holes in the large sub-cover. Figure S-2.4 shows which holes to countersink on the sub-cover



S-2.1: Large Sub-Cover Diagram

Large Sub-Cover Material: 1/16" thick Grade XX Garolite sheet

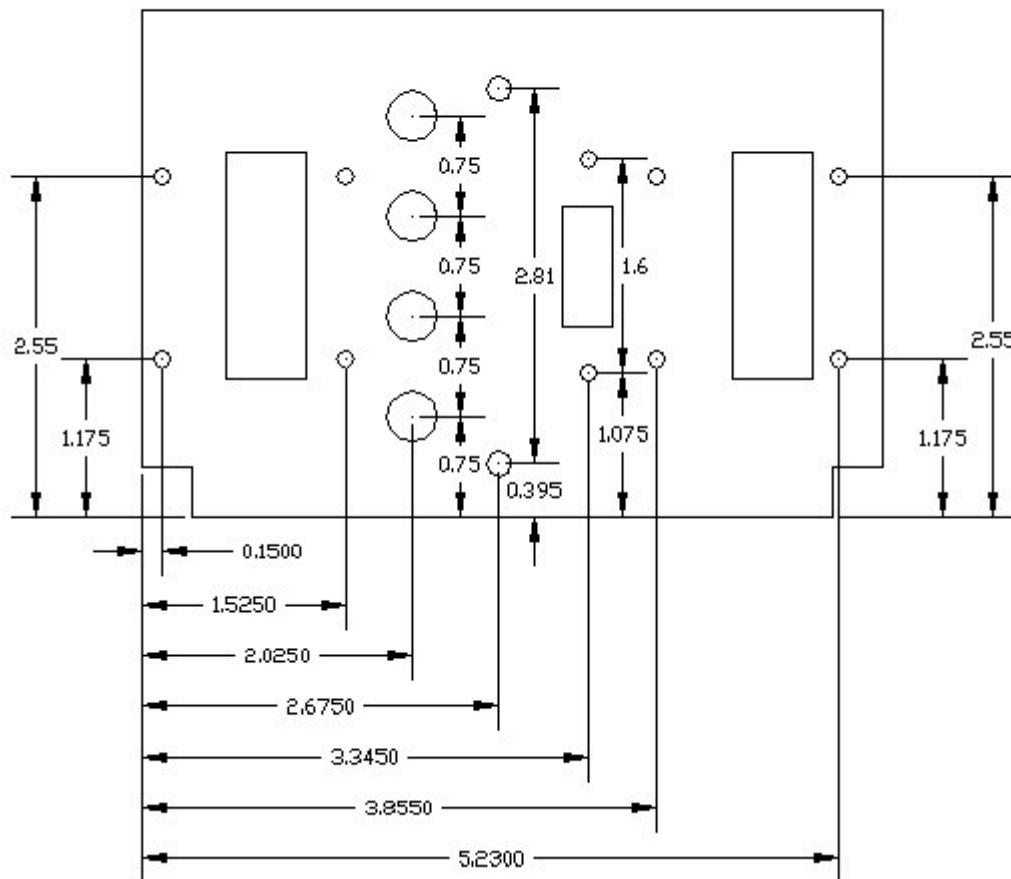


S-2.2: Large Sub-Cover cutouts

All small holes
have a diameter
of 0.125

All large holes
have a diameter
of 0.375

All other holes
have a diameter
of 0.1875



S-2.3: Large Sub-Cover Hole cutout diagram

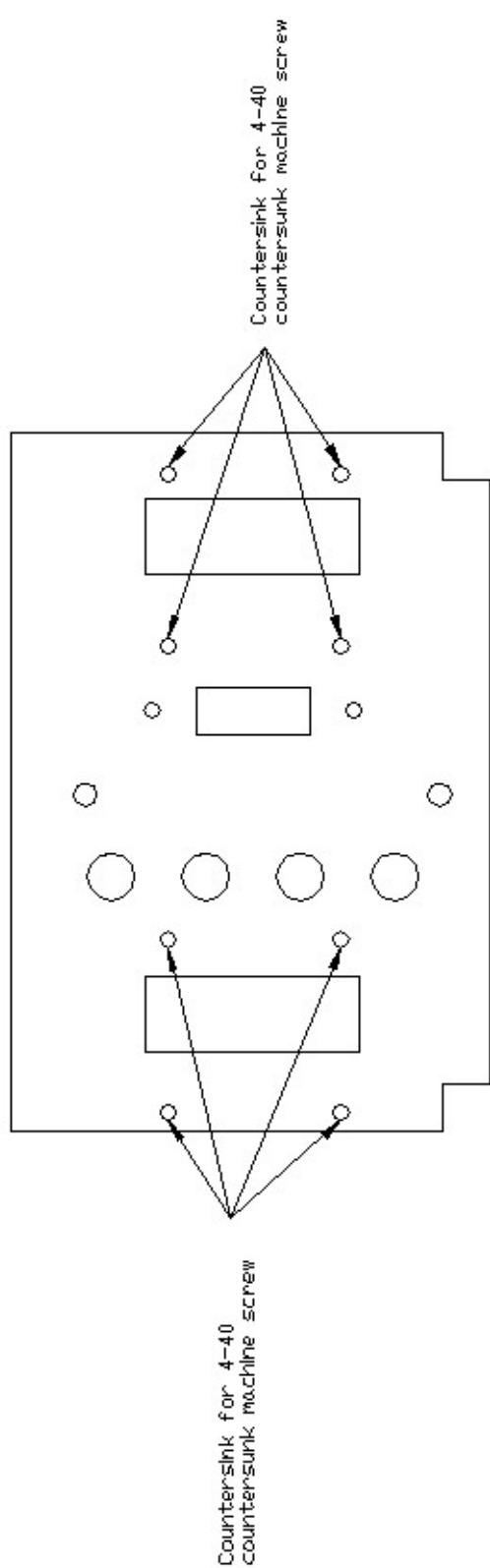
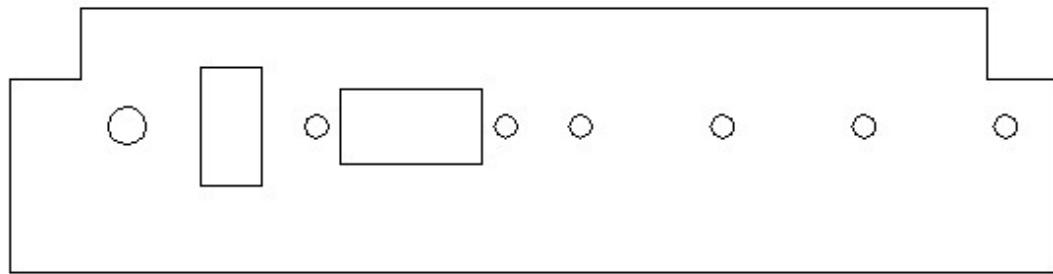


Figure S-2.4: Countersink diagram

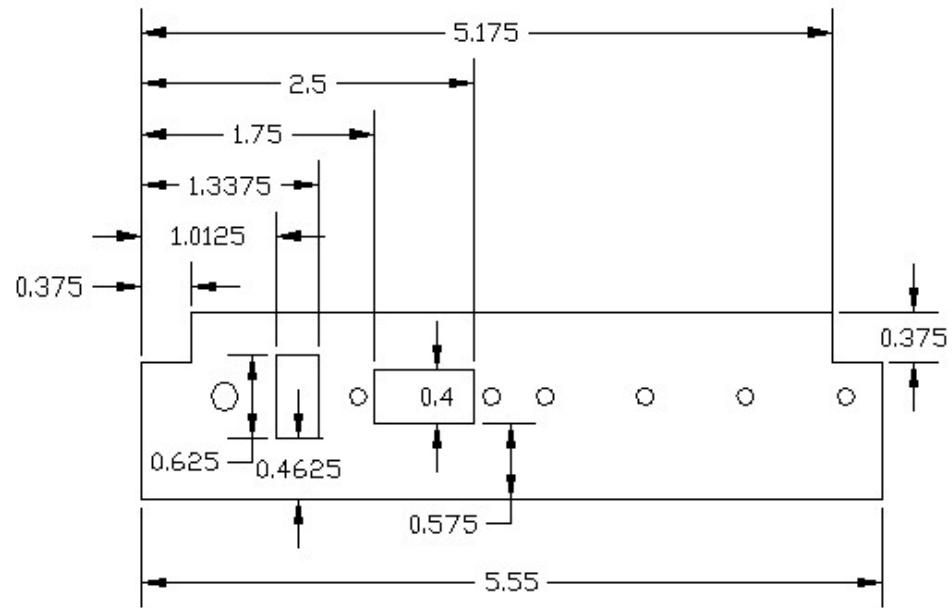
Small sub-cover:

Figure S-3.1 is the black garolite large sub-cover for the project box. Figure S-3.2 is the schematic for machining the large sub-cover and the square holes on the large sub-cover. Figure S-3.3 is the schematic for drilling the holes in the large sub-cover.



FigureS-3.1: Small sub-cover diagram

Small Sub-Cover Material: 1/16" thick Grade XX Garolite sheet



FigureS-3.2: Small sub-cover cutout dimensions

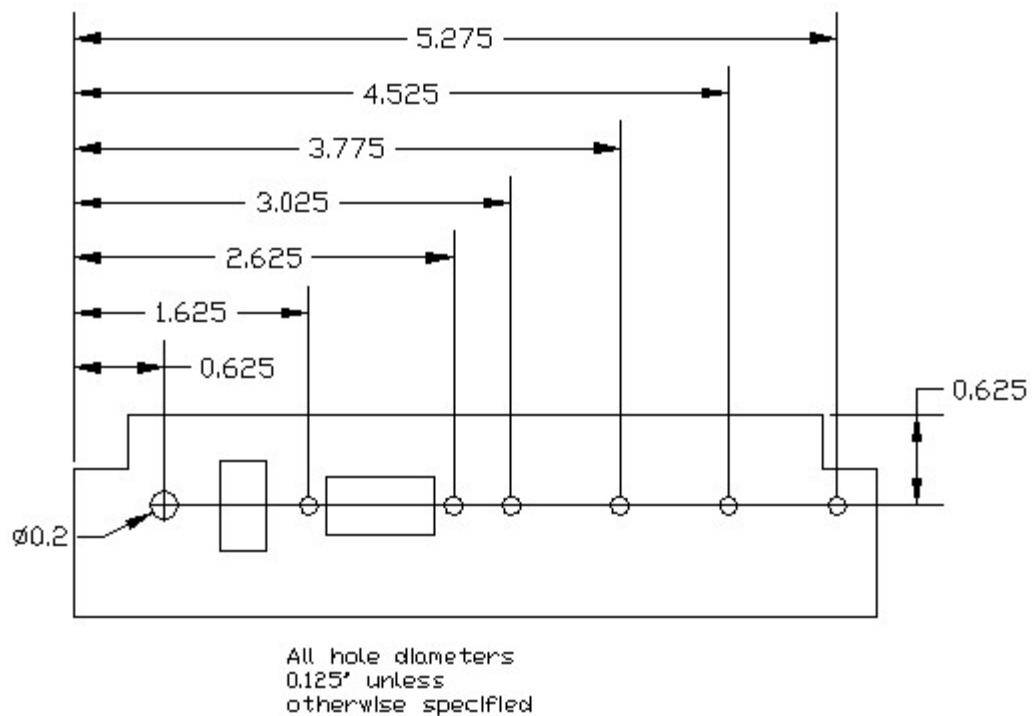


Figure S-3.3: Small sub-cover hole cutout pattern

Vertical panels:

Figure S-4.1 is the black garolite vertical panel for the project box. The vertical panels are located at the edge of the sub-covers, as shown in S-0.1. Two of these need to be created.

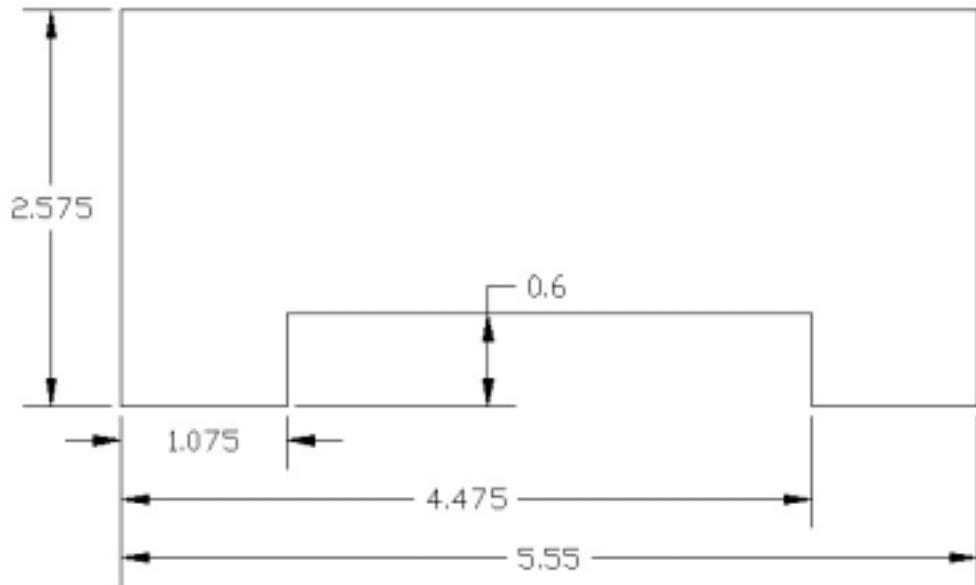
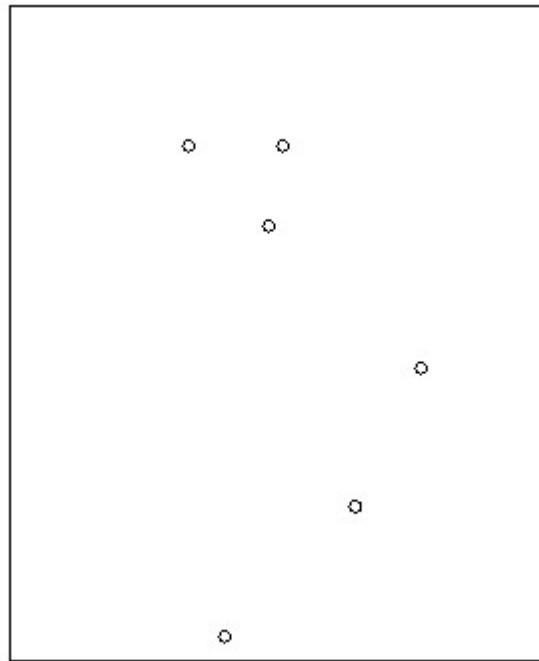


Figure S-4.1: Vertical panel schematic

Small Vertical Panel Material: 1/16" thick Grade XX Garolite sheet

Mounting plate:

Figure S-5.1 is a diagram of the mounting plate. Figure S-5.2 is the schematic of the mounting plate.



S-5.1: Diagram of mounting plate

Mounting plate material: 1/16" thick Grade XX Garolite sheet

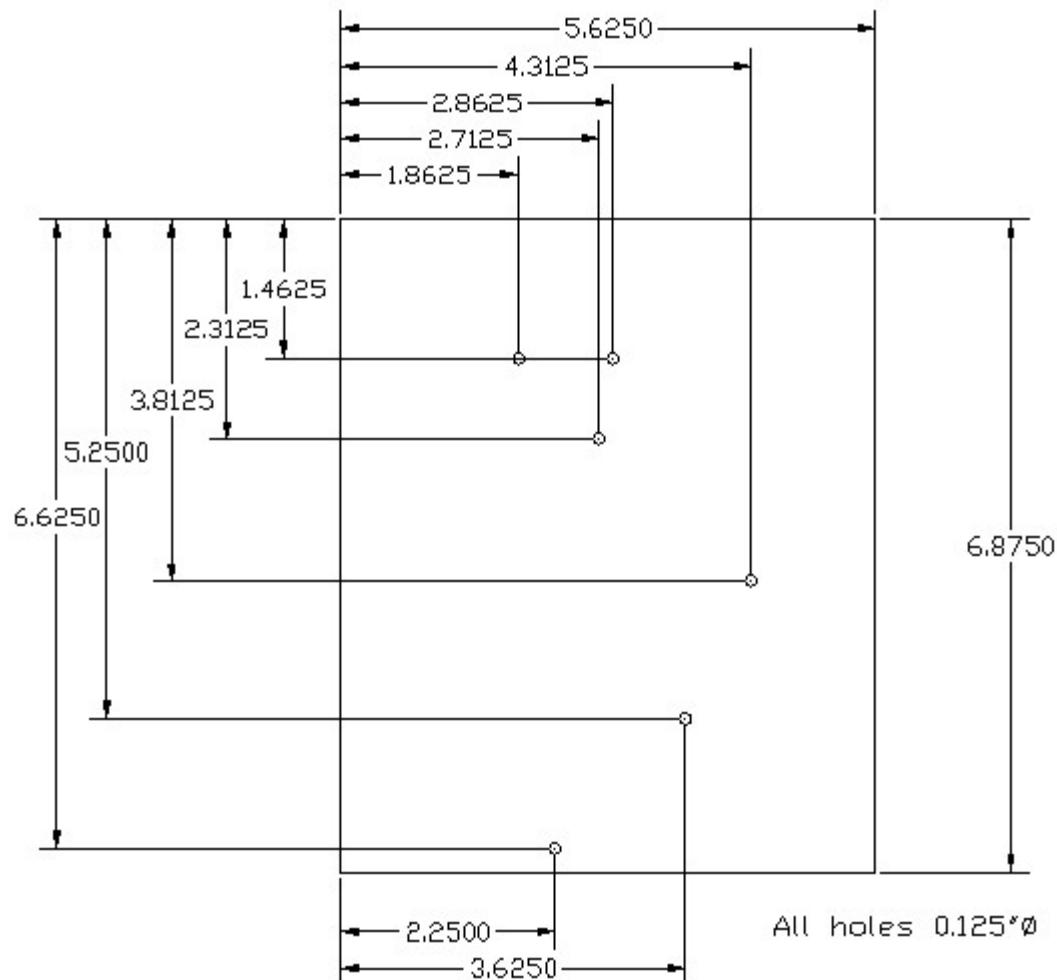


Figure S-5.2: Schematic of mounting plate

Modified angle

Figure S-6.1 and Figure S-6.2 show the schematic for the modified PVC angle

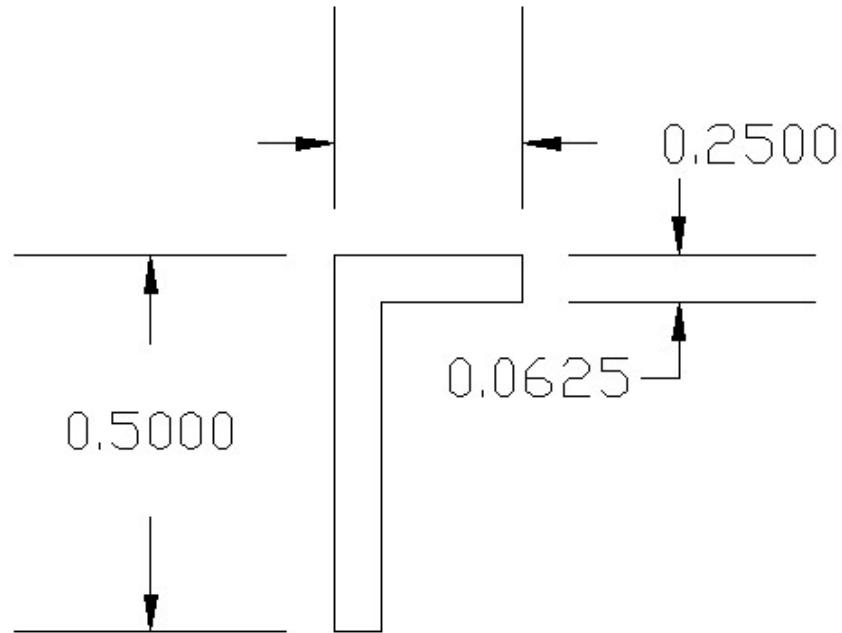


Figure S-6.1: Front view of modified angle



Figure S-6.2: Side view of modified angle

Modified angle material: $\frac{1}{2}$ " by $\frac{1}{2}$ " 90 degree angle $\frac{1}{16}$ " thick PVC in 5 foot section.
Used on page 15 and page 23.