SB4000 ASSEMBLY INSTRUCTIONS (REV 3 ASSY DOC, UPDATED 2/27/2011):

The following instructions will guide you step by step with building an SB4000. Please read through all of the instructions before proceeding with PCB / Unit assembly.

SECTION I: GENERAL INFO

WARNING:

PROCEED AT YOUR OWN RISK. SAFETY PROVISIONS SHOULD ALWAYS BE EXERCISED WHENEVER WORKING WITH ANY ELECTRONICS. THE FOLLOWING INSTRUCTIONS ARE GUIDELINES ONLY. I CAN MAKE NO GUARANTEE OF THE ACCURACY OF CONTENTS CONTAINED WITHIN THIS DOCUMENT. YOU ARE RESPONSIBLE FOR YOUR OWN SAFETY.

Typical things you will need:

Solder Iron

Multi-meter

Cutters

Lead Bender

Screw Driver

Wire Stripper

Crimper

General Assembly Guidelines:

-Lead Bending - Use common sense when bending leads on back side of board. Bend them away from surrounding traces/pads. If you don't already own one, I highly recommend purchasing a lead bender. They are available from Mouser for approx $5 USD.

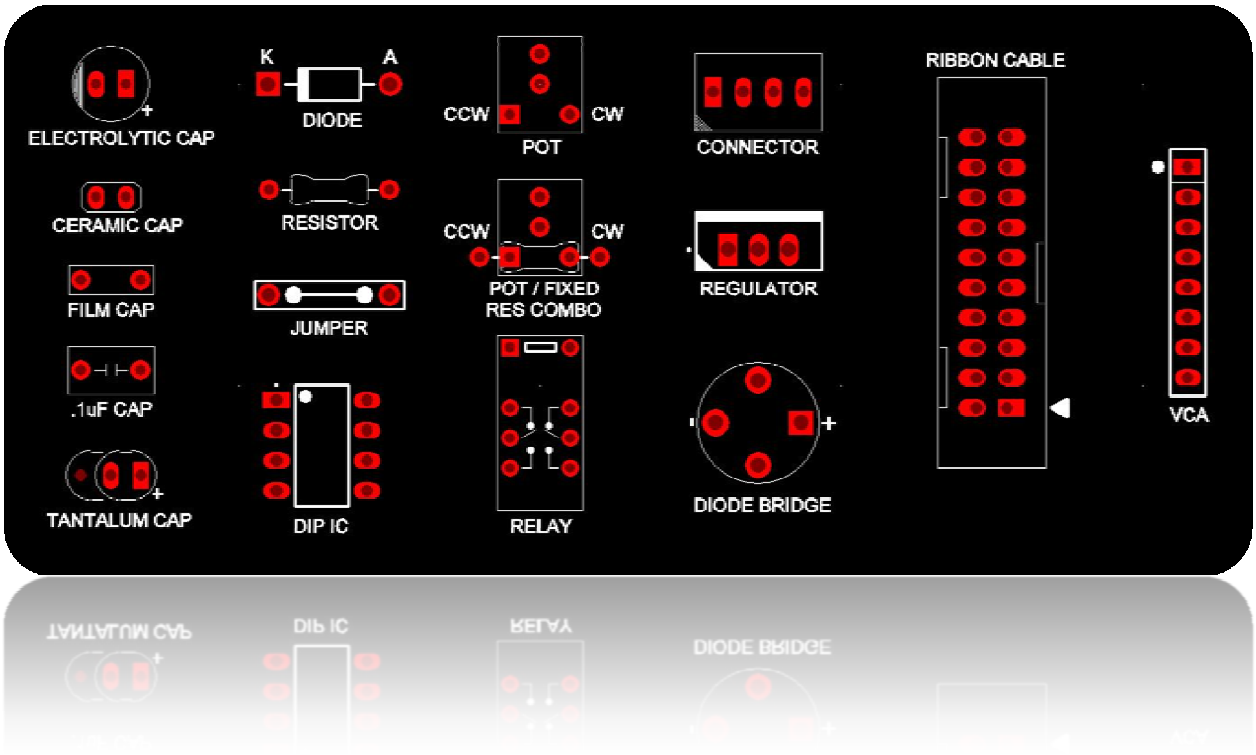
Mouser #5166-801

-Resistor Values - Check all resistor values before installing. The extra time it will take to do this upfront will help eliminate potential hours of troubleshooting later because of an incorrect value.

-Static Sensitive Components - Always ground yourself when handling Static Sensitive Devices.

-Pre-trimming Pots - Pot pre-trim values are indicated on the schematic. Default kits provide fixed resistors for setting the +/- 15V supplies on the Power Supply (VR18 & VR19). If you opt to upgrade and use a Pot on the Power Supply to trim for exactly +/-15V, **YOU MUST PRETRIM THE POTS TO 1K33,** I highly recommend using a multi-turn Pot for this application. In a worst case scenario, if you do not pre-trim them you could potentially configure the +/- 15V supply rails to be supplying 26V, causing damage to your unit.

PCB LEGEND (COMMON COMPONENTS)



THE BOARDS:

The PCB's reference designators are annotated in the following order:

1) MAIN PCB

2) CONTROL PCB

3 POWER SUPPLY PCB

You can build the majority of all 3 boards simultaneously and break them apart towards the end.

SECTION II: INSTALLING THE COMPONENTS

Update 2/09/2011: A small issue has been identified on Rev 4 boards. Please see below for an explanation and simple instructions on the fix. If you have a Rev 5 board then ignore this mod.

I recommend to install the components in the following order:

1) Resistors

2) Diodes/Diode Bridge

2) Ceramic Caps

3) Tantalum Caps

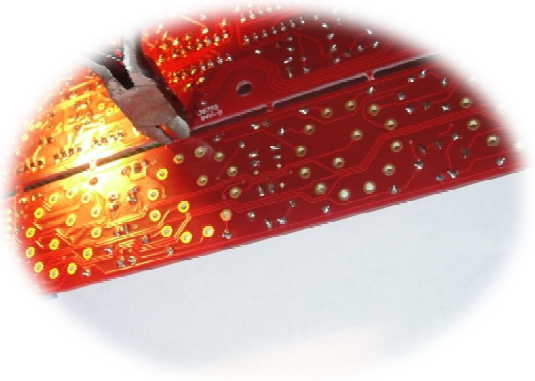
4) Film Caps

5) IC Sockets **(DO NOT INSTALL THE SOCKETS ON THE CONTROL PCB - U19 & U25)**

6) Connectors

7) Regulators

6) Electrolytic Caps



At this point the PCB's should be cleaned in an alcohol bath using 90% - 100% isopropal alcohol before proceeding. After the boards have been cleaned, it is at this point that I recommend to break them apart into individual boards.

The tabs on the board are perforated to make breaking them apart easier. Even so, it can still be difficult at times so I recommend to use a pair of cutters to weaken the tabs before trying to break the boards apart. Alternatively they can be scored using a razor blade as well.

Note:

Relays, Pots, and Switches should not be installed until after the board has been cleaned. Most of them are not sealed and are not safe to submerge in alcohol. If using sealed multi-turn pots, most are safe to install before cleaning (verify on the datasheet for the pots you are using).

7) Relays

8) Pots

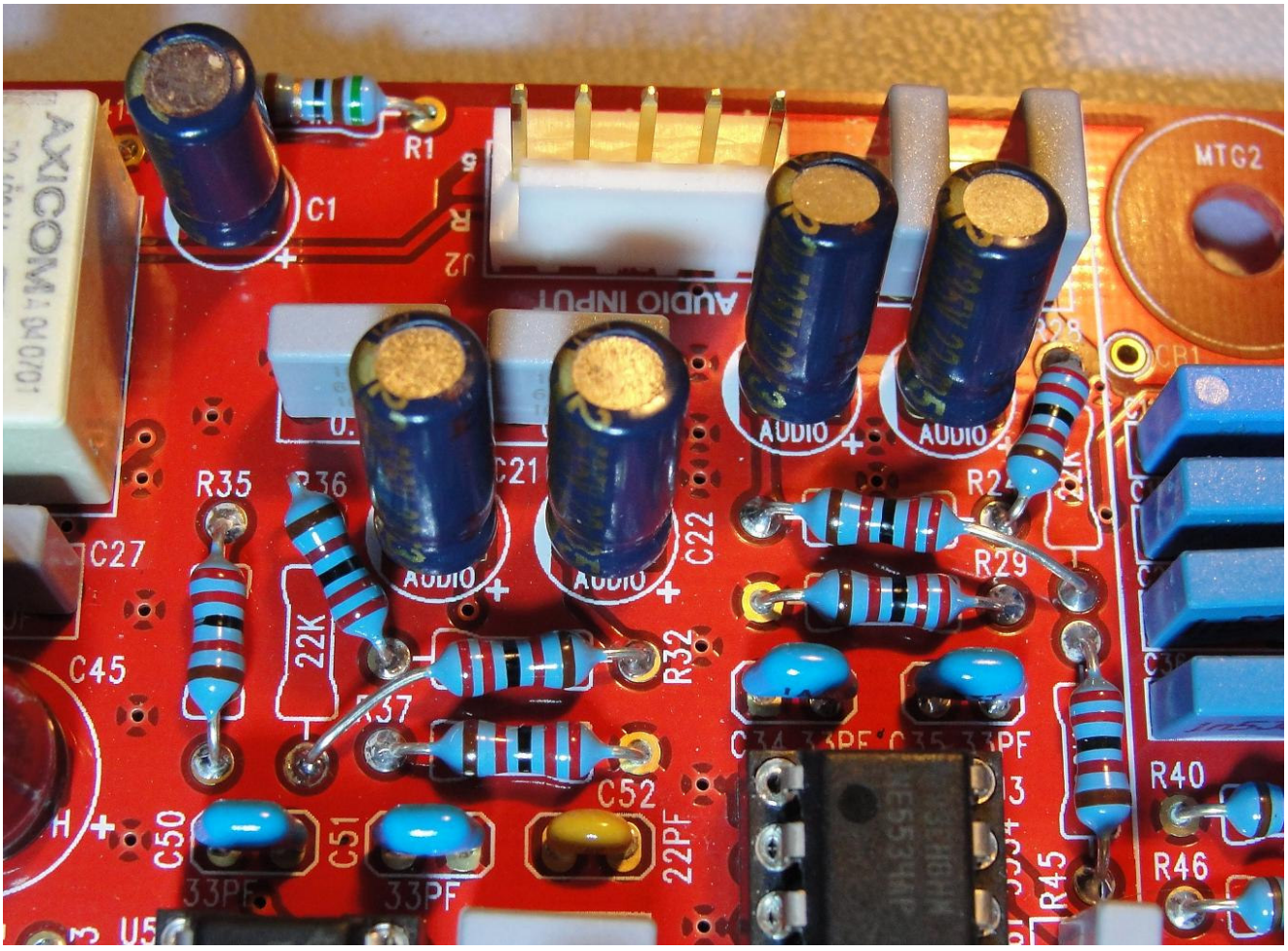
9) Control Panel Switches, Pots, and Sockets (See below for detailed assembly instructions)

SECTION II-B: PHASE MODE (FOR REV 4.0 BOARDS ONLY):

Please note, as noted above an error has been discovered on Rev 4.0 SB4000 Boards. Due to an error on the original GSSL schematic that was overlooked, that in turn made its way onto the SB4000 schematic, the unit is inverting phase when the compressor is engaged. Since this is a transparent issue, it was missed during the prototyping stage. Fortunately, it is a quick, simple fix, and it is recommended that anyone with a REV 4.0 board perform this mod. REV 5 boards will have this incorporated.

The simplest way to fix this is to crisscross the 22K resistors feeding the input de-balancing stage (R24&R28 for the left channel and R32&R36 on the right channel) as shown below. These resistors are all located near the audio input connector (J2).

If you have already installed these resistors, I recommend to just cut the leads, and use a piece of buss wire (or a diode/resistor leg) on each resistor to perform the mod. You should be able to do all of this from the top of the board without having to de-wire and de-mount the boards from the enclosure.



SECTION III: FRONT PANEL & ENCLOSURE PREP

FRONT PANEL:

If you are using one of my custom front panels, it will be necessary to drill the mounting holes yourself. The panels come equipped with 2 sets of pilot holes on the back side for par-metal & modushop enclosures. The inner most set of holes are for par-metal, the outer most are for modushop. Verify you have selected the correct set of holes, and using a very small drill bit, drill through the panel. **(NOTE: DO NOT START WITH A LARGE DRILL BIT OR YOU WILL RISK THE DRILL BIT WALKING AND THE HOLE ENDING UP IN THE WRONG LOCATION.)**

Continue to open up the holes using increasingly larger drill bits until the holes are large enough to accommodate the mounting screws.

ENCLOSURE:

If your enclosure has stiffening lips in the front (ie par-metal, etc) it will be necessary to notch out the lips to clear the front panel components. This can be done using a dremel, file, hacksaw, blowtorch, bare knuckles, teeth, or anything else at your disposal.

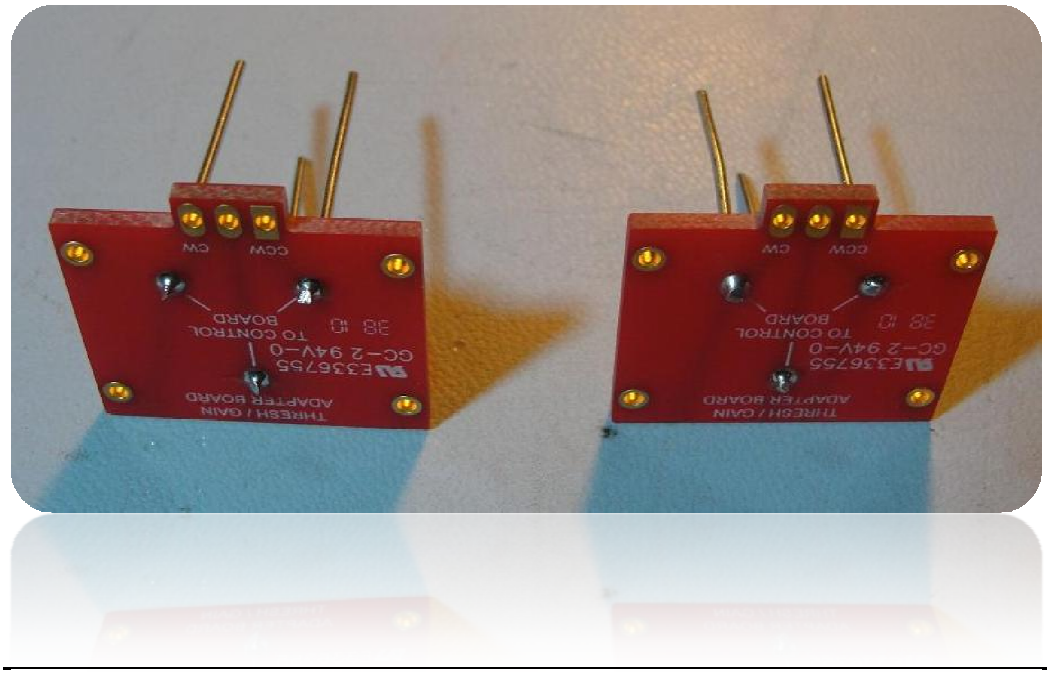
The boards should be mounted using 6-32 or M4 hardware. I recommend using 3/4" or 20mm long screws. Install them from the bottom of the enclosure and attach 3/16" or 5mm long standoffs onto them for the boards to rest on. Alternatively, you can use 1 or (depending on thickness) 2 nuts to act as standoffs, which is a cheaper solution, however ensure that the tallest board components will still clear your top panel.

SECTION IV: CONTROL PANEL ASSEMBLY:

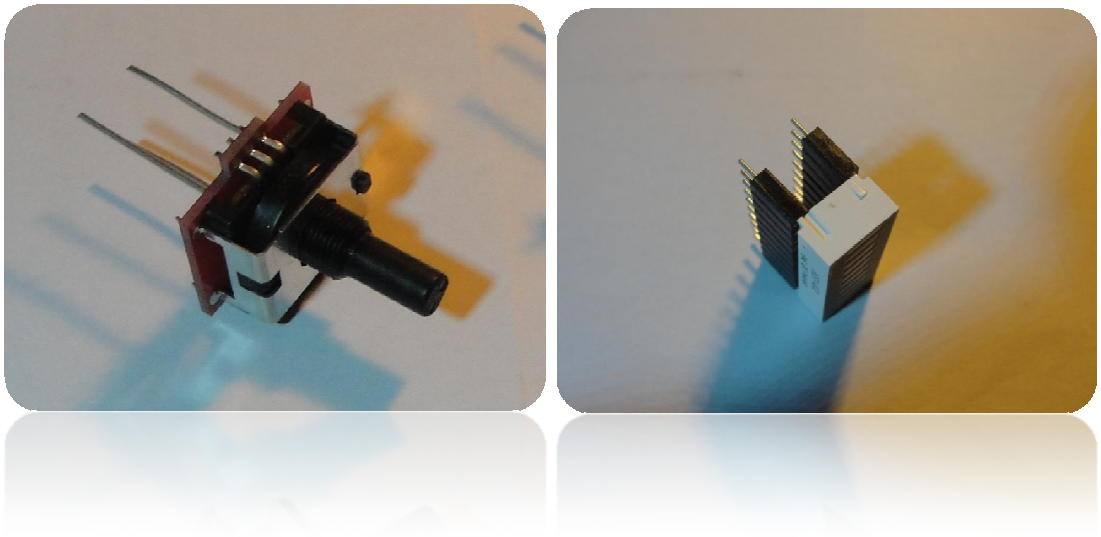
For Proper alignment the Control PCB should be assembled in context with the front panel.

(GAIN/THRESH Pots)

The boards come with an adapter board for using the Honeywell/Bourns PCB Mounted Pots so that they mount in line with the lorlin switches. The classic style solder tail lug (Alpha, etc) pots can also be used if you wish, however the PCB mount type are the easiest. Using a piece of buss wire (or a lead from a diode, etc), solder 3 pieces to each adapter board as shown. Be sure to trim the end of the leads fairly close to the board.



Next, place the pots onto the adapter boards and solder them in place. Also, place the bargraph onto the two SIP headers.

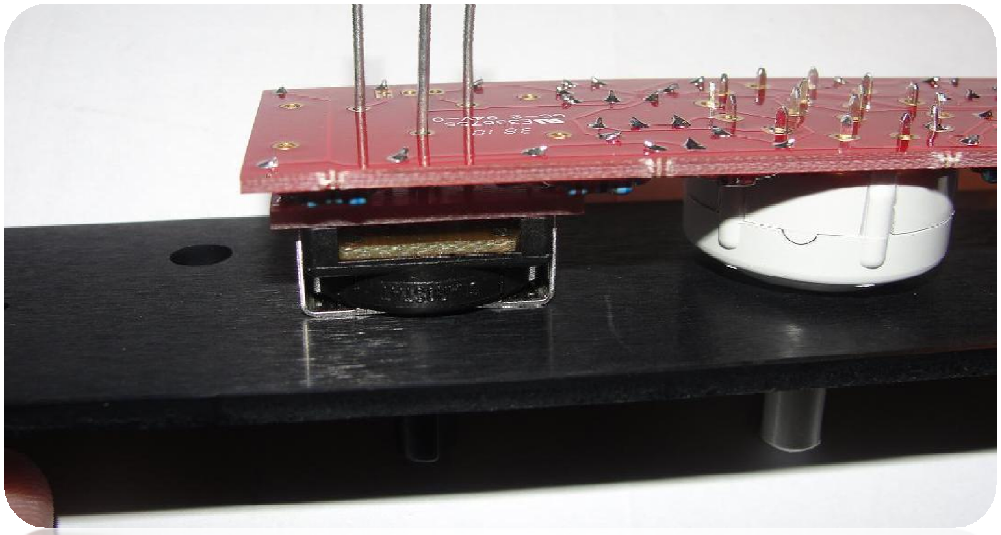


Next, place all of the switches, both pot board assemblies, and the bargraph assembly (note correct orientation) onto the control panel, however do not yet solder them.

Slide the front panel onto the control panel.

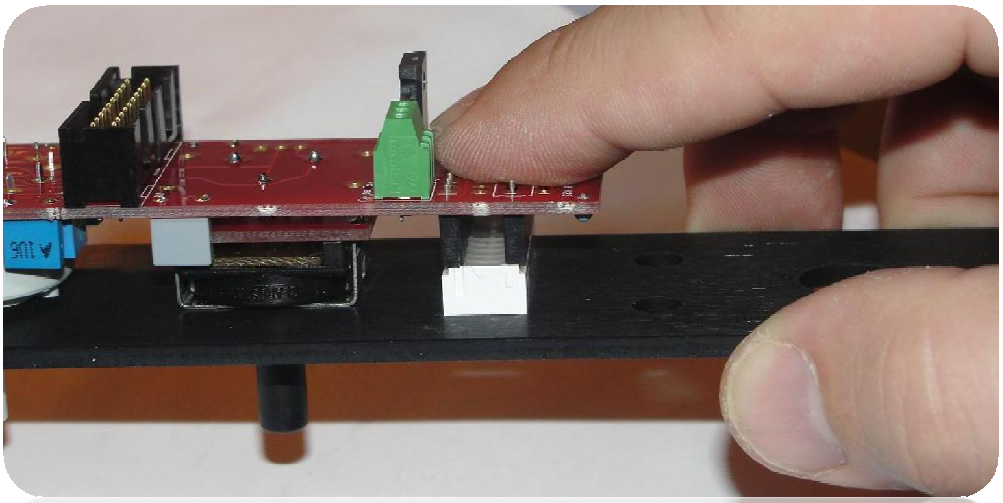
After everything is aligned, secure the switches and pots to the front panel so that they don't move.

Now turn the assembly over and solder the switches/pots in place. Trim the adapter board leads after they have been soldered.

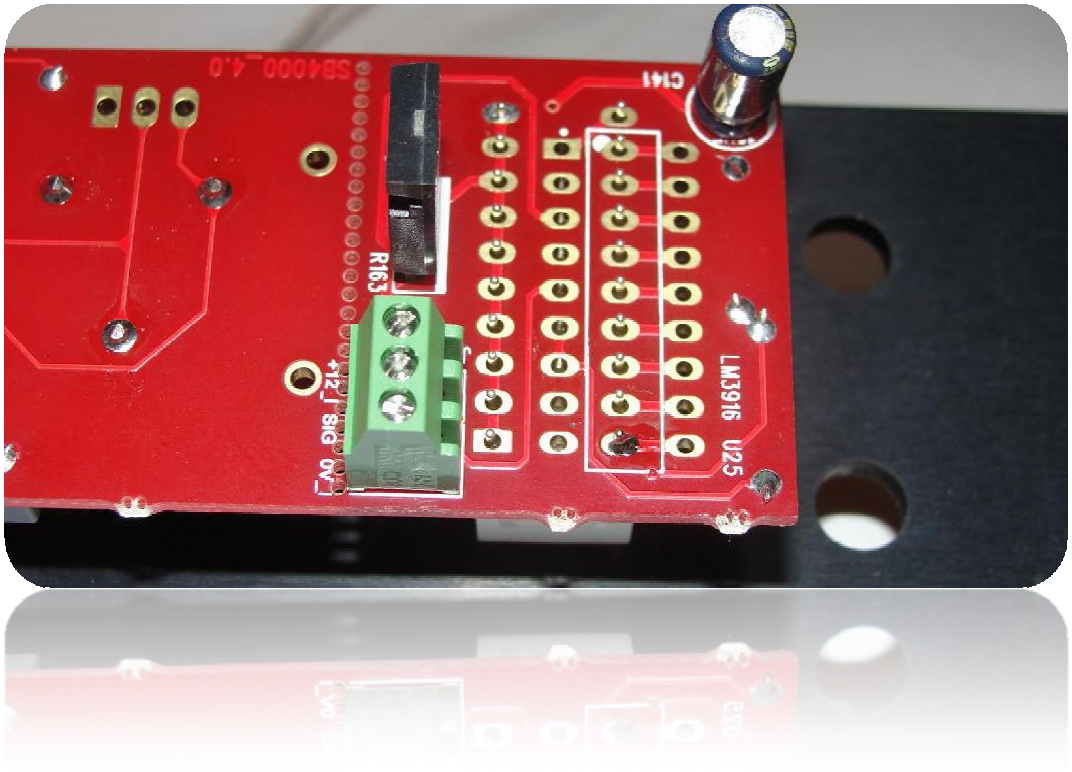


Mounting the bargraph: (Note, Trying to hold the bargraph in place and solder at the same time can be quite tricky. It is much easier if you have someone to assist you. It can be done without help, however it may take a little time and patience to get it perfect.

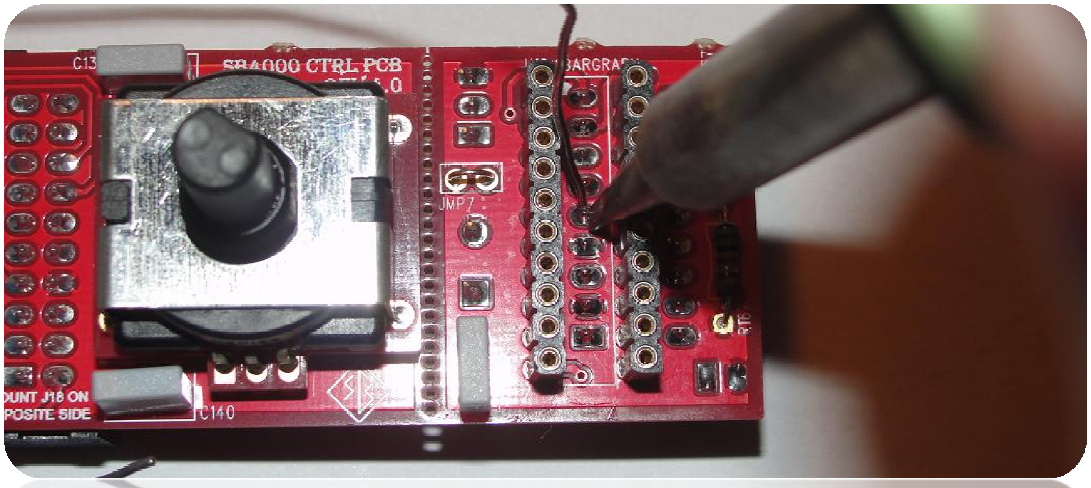
Press the bargraph flush against the back face of the front panel as shown. Ensure the bargraph LEDs are aligned with the front panel text.



Next, (lightly) solder 2 far corners of the SIP sockets as shown. Ensure the bargraph LEDs are still aligned with the front panel text. Once it is properly aligned, proceed to solder the rest of the SIP socket leads.



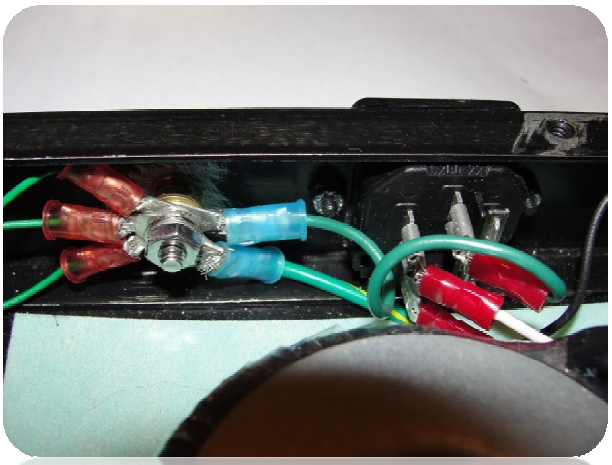
Once you have completed soldering the bargraph in place, remove the control board from the front panel, and remove the bargraph from the SIP sockets. Install the 18 Pin DIP socket for U25 and solder it to the control board. (Note: you will have to hold your solder iron straight down. Be careful not to melt the bargraph SIP sockets.) Once you have soldered the socket in place, install U25 (LM3916), and reinstall the bargraph onto the SIP sockets. The control board is now complete, you can now mount it to the front panel.



SECTION V: GROUNDING

There are multiple ways to ground the unit however the default method resulted in the lowest noise figures. I recommend following the default grounding instructions below first, and to only attempt other methods should your particular setup result in issues.

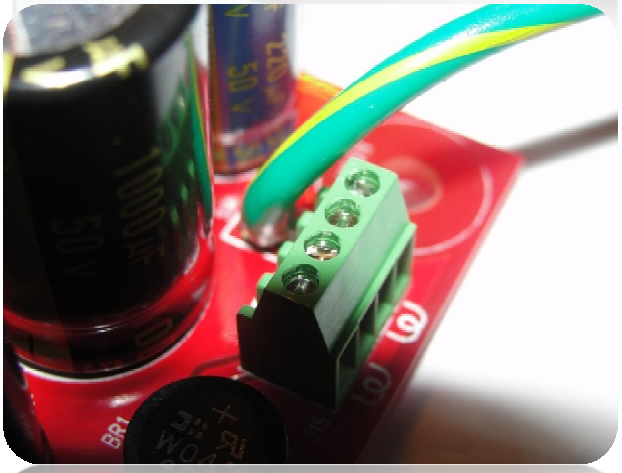
Star Ground Point:
As always, a star ground point should be installed as close to your IEC connector as possible. Be sure to remove any paint, alodine, etc, from around the star ground point to ensure a solid ground connection.



IEC Ground:
A wire should be connected from the ground tab on the IEC inlet to the star ground point.

Enclosure ground:
If you are using a multi-piece enclosure (ie: parmetal, modushop, etc), be sure to remove any paint, alodine, etc, around the mounting holes to ensure a solid ground connection to all pieces of the enclosure.

Power Supply Ground:
A 14 or 16 gauge wire should be soldered directly to the "SG1" point located on the power supply board. The other end of this wire should be connected to the chassis star ground.



Main Board Grounds:
There are 2 grounds on the main board: 0V and 0V_I (Isolated). They are isolated from each other on the main board. An individual wire for each ground should be connected to the power supply board (See wiring instructions below). The 2 grounds become a single point on the power supply board at the cap bank.

XLR Grounds:
On the left and right XLR inputs, connect a ground wire between Pin 1 on both XLR's. Also run a wire from Pin 1 of one of the XLR's to the star ground point (use whichever XLR is closest to the star ground). Repeat the same method for the output XLR's, and the External Input XLR's (if present).

SECTION VI: WIRING

MAIN BOARD CONNECTOR WIRING:

J1 (AUDIO OUTPUT)

J1-1 – LEFT + (PIN 2 ON MALE XLR)
J1-2 – LEFT - (PIN 3 ON MALE XLR)
J1-3 – 0V (DO NOT USE)
J1-4 – RIGHT - (PIN 3 ON MALE XLR)
J1-5 – RIGHT + (PIN 2 ON MALE XLR)

J2 (AUDIO INPUT)

J2-1 – LEFT + (PIN 2 ON FEMALE XLR)
J2-2 – LEFT - (PIN 3 ON FEMALE XLR)
J2-3 – 0V (DO NOT USE)
J2-4 – RIGHT - (PIN 3 ON FEMALE XLR)
J2-5 – RIGHT + (PIN 2 ON FEMALE XLR)

J3 (EXTERNAL/KEY INPUT)

J3-1 – LEFT/MONO SEND
J3-2 – LEFT/MONO RETURN
J3-3 – RIGHT SEND
J3-4 – RIGHT RETURN

J4 (+/-12V, +/-15V, 0V POWER CONNECTOR)

J4-1 – +15V (TO J14-1 ON POWER SUPPLY)
J4-2 – +12V (TO J14-2 ON POWER SUPPLY)
J4-3 – 0V (TO J14-3 ON POWER SUPPLY)
J4-4 – -12V (TO J14-4 ON POWER SUPPLY)
J4-5 – -15V (TO J14-5 ON POWER SUPPLY)

J5 (+/-12V, +/-15V, 0V POWER CONNECTOR)

J5-1 – +12V_ISOLATED (TO J15-1 ON POWER SUPPLY)
J5-2 – 0V_ISOLATED (TO J15-2 ON POWER SUPPLY)

J6 (RIBBON CABLE)

CONNECTS TO J18 ON CONTROL BOARD

J7 (METER)

J10-1 – “+” (+ TAB ON METER)
J10-2 – “-” (- TAB ON METER)
J10-3 – “A” (ANODE - FOR 1.9V – 2.1V METER LED)
J10-4 – “K” (CATHODE - FOR 1.9V – 2.1V METER LED)

J8 (EXTERNAL INPUT TOGGLE SWITCH)

J8-1 – “C” (COMMON PIN ON EXTERNAL INPUT SWITCH)

J8-2 – “N/O” (NORMALLY OPEN PIN ON EXTERNAL INPUT SWITCH)

J9 (IN/OUT AND LEFT/RIGHT TOGGLE SWITCHES)

J9-1 – “C” (COMMON PIN ON I/O SWITCH)

J9-2 – “N/O” (NORMALLY OPEN PIN ON I/O SWITCH)

J9-3 – “C” (COMMON PIN ON L/R SWITCH)

J9-4 – “N/O” (NORMALLY OPEN PIN ON L/R SWITCH)

J10 (SIDECHAIN MONO/STEREO SWITCH – AKA “TURBO”)

J10-1 – “C” (COMMON PIN ON SWITCH)

J10-2 – “N/O” (NORMALLY OPEN PIN ON SWITCH)

J10-3 – “A” (ANODE - FOR 1.9V – 2.1V ILLUMINATED SWITCH)

J10-4 – “K” (CATHODE - FOR 1.9V – 2.1V ILLUMINATED SWITCH)

J11 (COMPRESSOR IN SWITCH)

J11-1 – “C” (COMMON PIN ON SWITCH)

J11-2 – “N/O” (NORMALLY OPEN PIN ON SWITCH)

J11-3 – “A” (ANODE - FOR 1.9V – 2.1V ILLUMINATED SWITCH)

J11-4 – “K” (CATHODE - FOR 1.9V – 2.1V ILLUMINATED SWITCH)

J12 (VU METER)

J12-1 – “+12V_I” (TO J17-1 ON BARGRAPH)

J12-2 – “SIG” (TO J17-2 ON BARGRAPH)

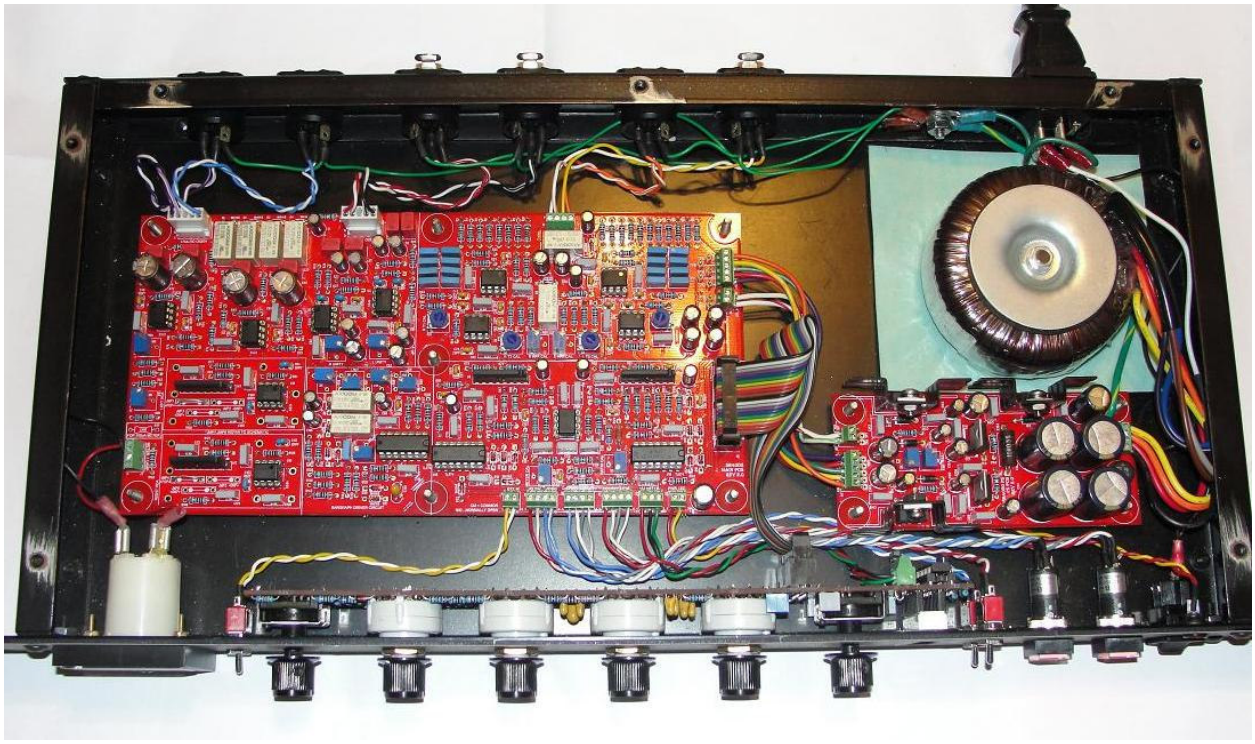
J12-3 – “GND_I” (TO J17-3 ON BARGRAPH)

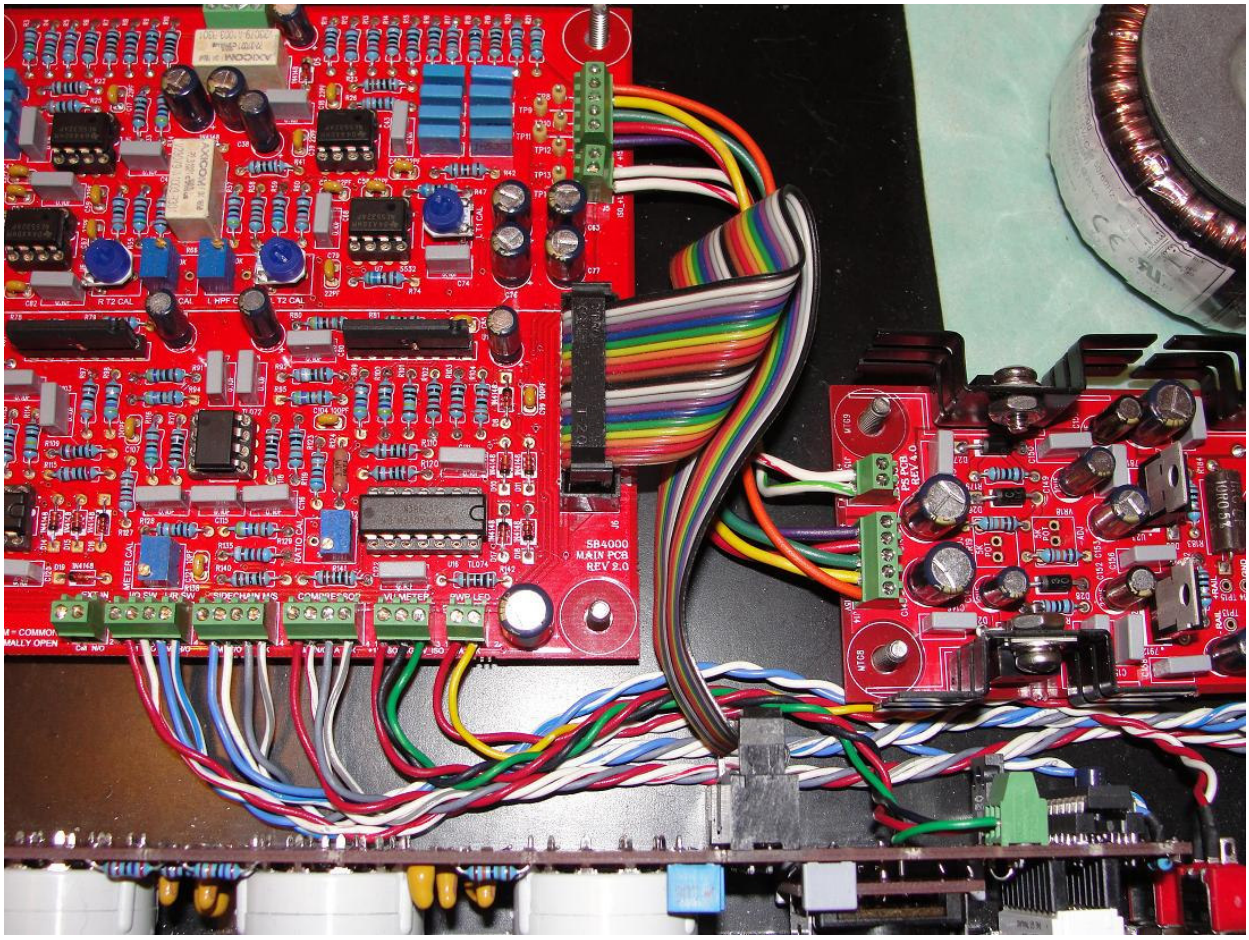
J13 (POWER LED)

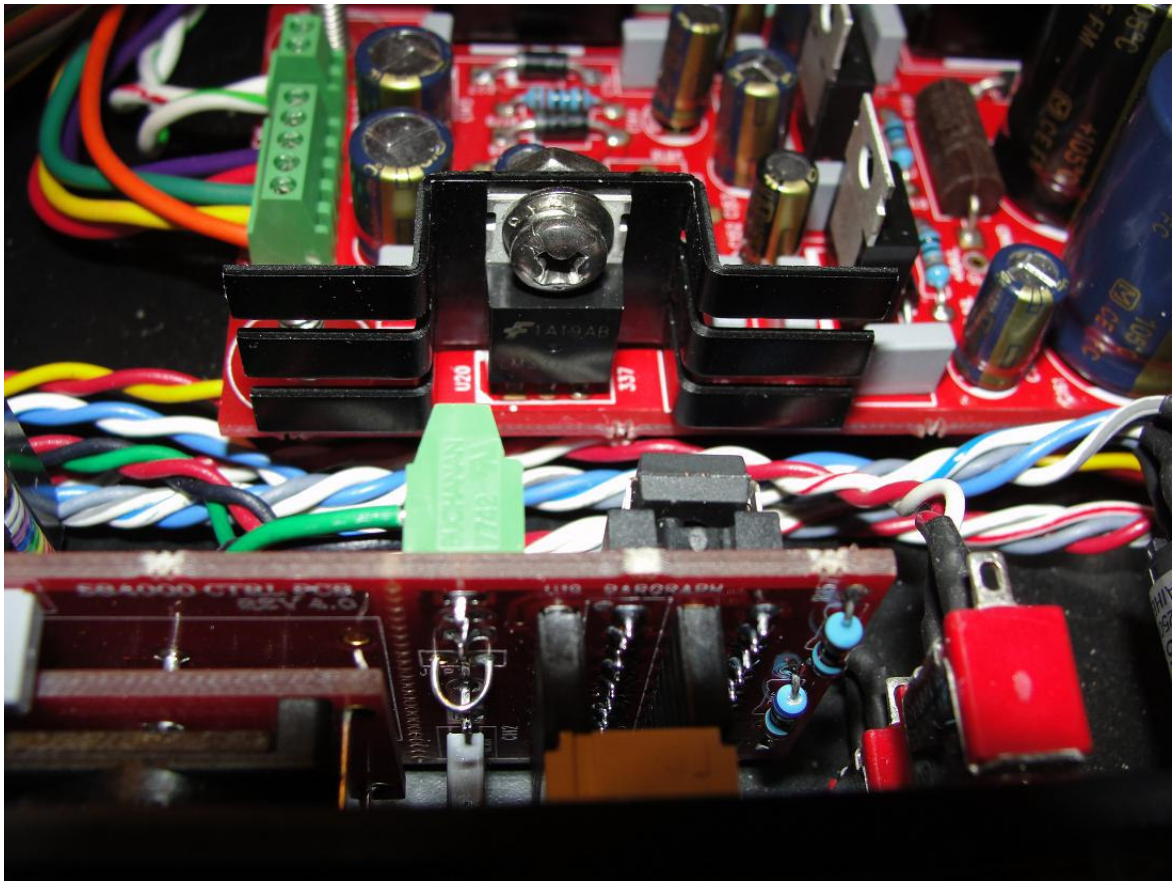
J13-1 – “A” (ANODE - FOR 1.9V – 2.1V LED)

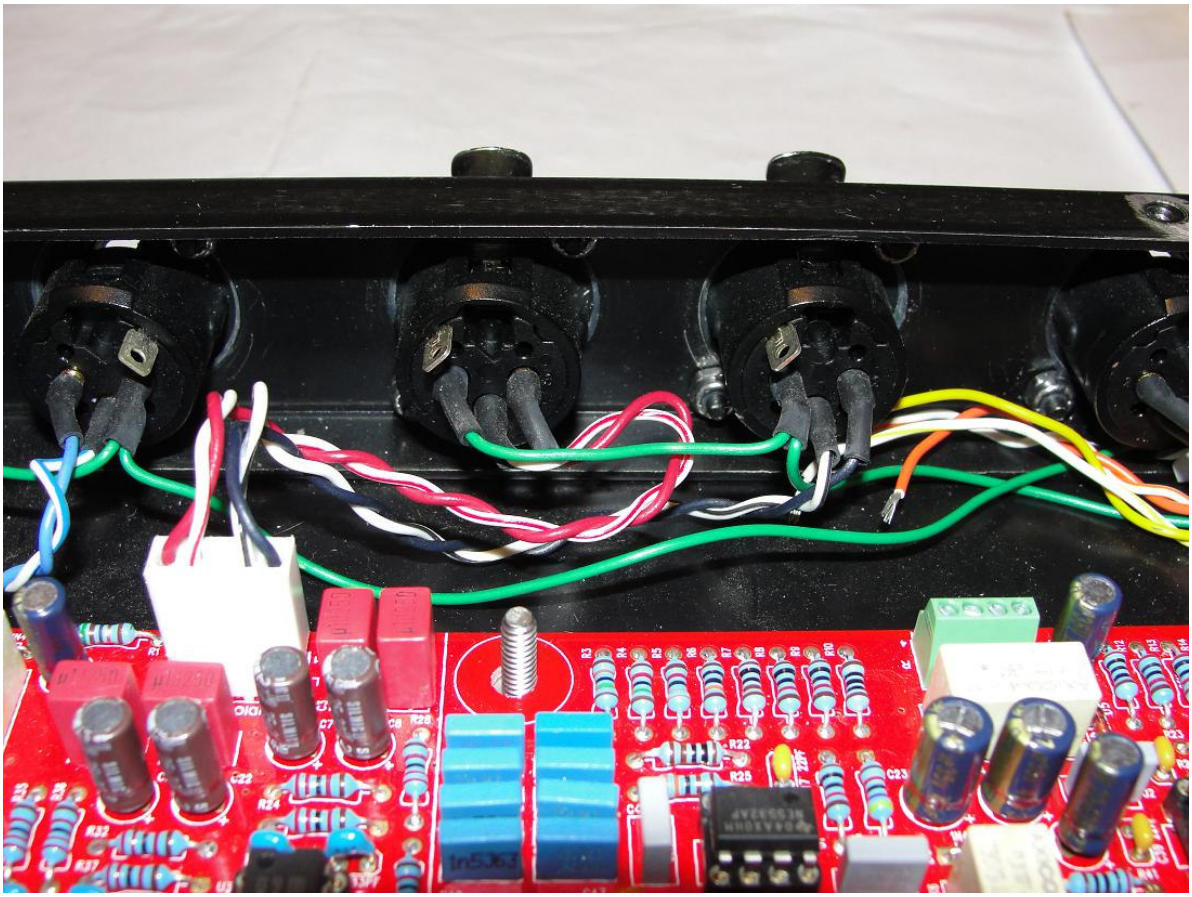
J13-2 – “K” (CATHODE - FOR 1.9V – 2.1V LED)

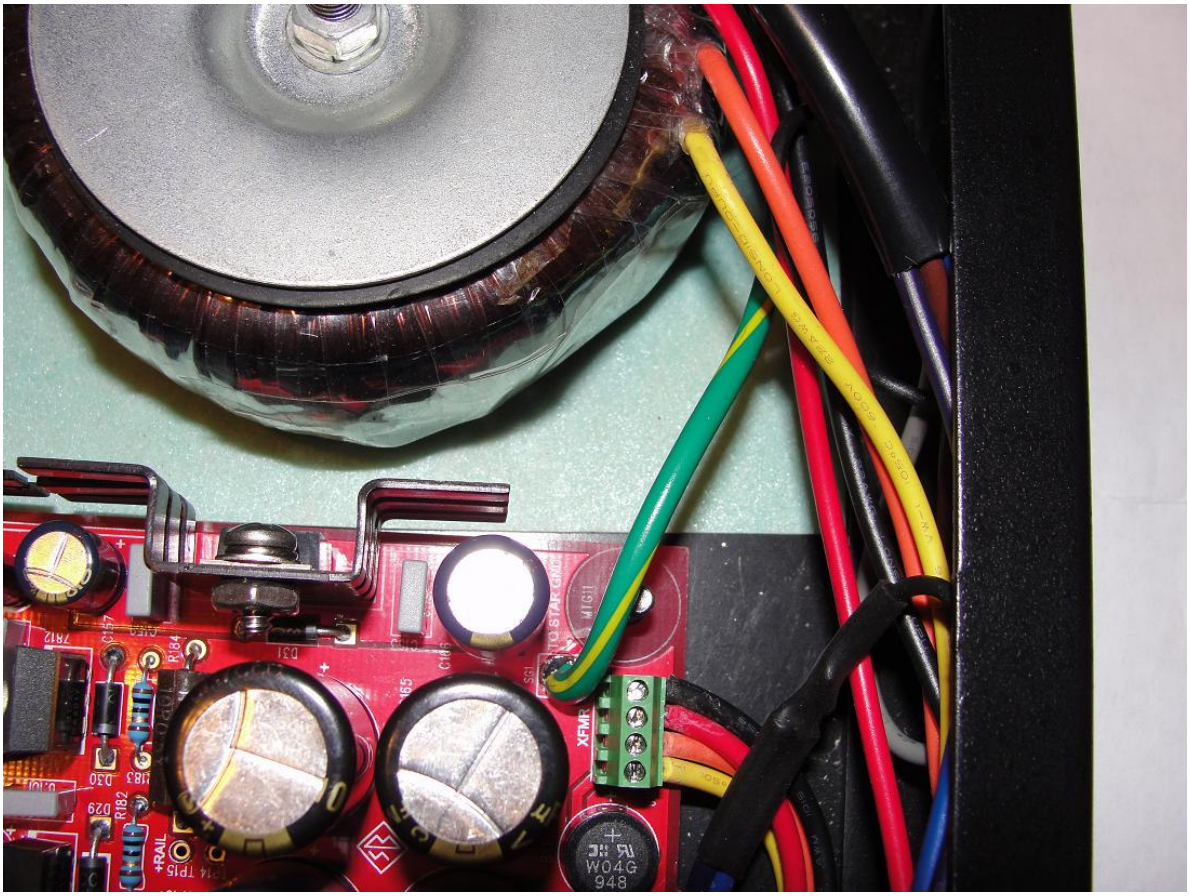
COMPLETED ASSEMBLY PICS:







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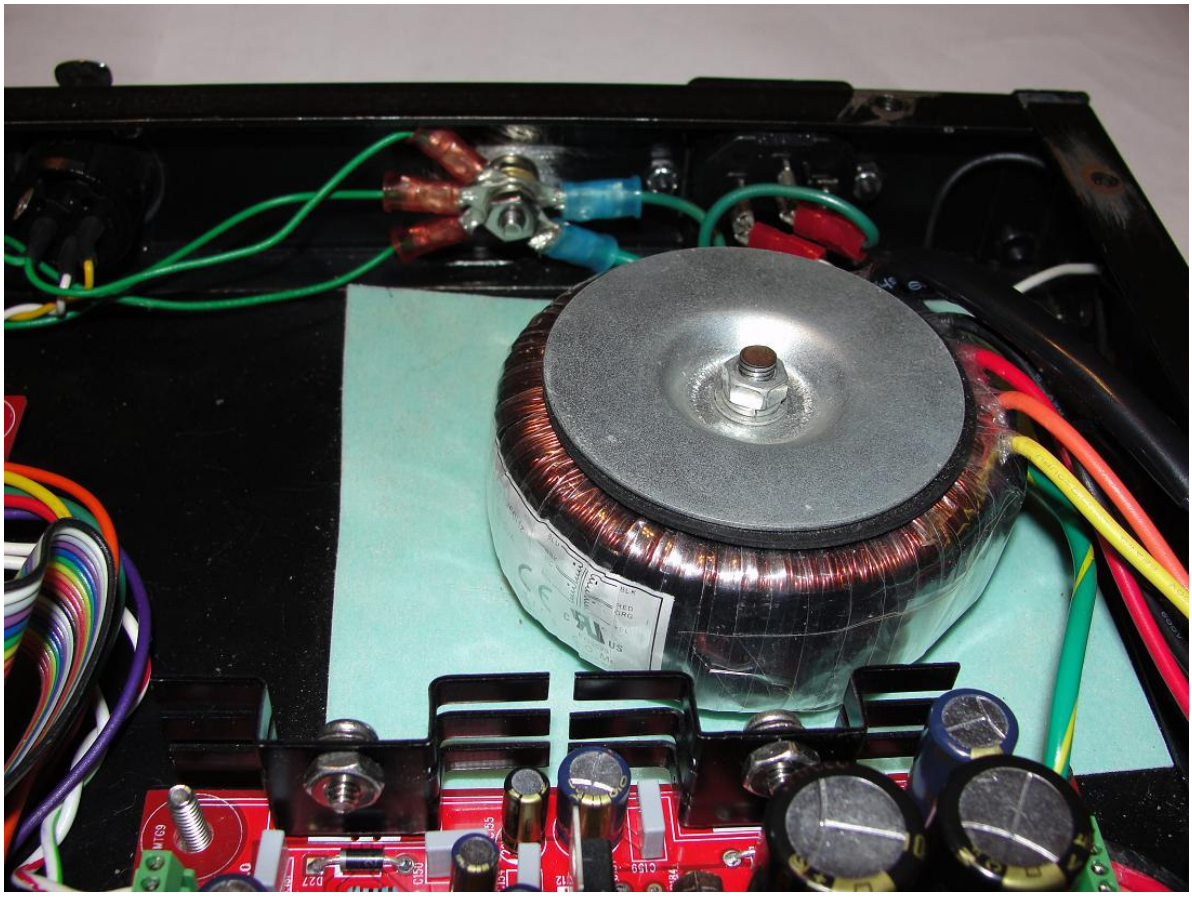

SECTION VII: Calibration

1) Power Supply:

Once all the boards are populated wire your transformer to the Power Supply Board.

DO NOT CONNECT THE POWER SUPPLY BOARD TO THE MAIN BOARD YET.

Turn the unit on and verify all 5 voltage rails are correct (+/-15V, +/-12V, +12V_ISO)

If voltages are correct turn unit off and wire the power supply to the main board, but do not connect the control board or bargraph yet (I recommend this just because if there is a problem it will help determine if it's coming from the main board or control board). Turn the unit on and quickly measure the +15V rail and if it checks out quickly turn the unit off. Repeat this for the -15V, +/-12V and ISO12V rails. If everything looks good then hook up the control board and repeat checking all the rails.

2) Unity gain:

With the unit in bypass, export a 1Khz test tone into the unit and back into your DAW. Note the L/R levels. Engage the compressor, and adjust VR1 (Right Channel) and VR2 (Left Channel) until you get the same levels as were seen when in bypass.

Alternatively, if you have a DMM that measures true rms, measure the AC voltage on the output XLR's between Hot and Cold (Pins 2&3) with the unit in bypass and adjust VR1 & VR2 until you get the same voltage with the unit engaged.

3) CV Levels:

With the unit in SSL Mode (aka stereo Sidechain, aka Turbo), export a 1Khz test tone. Measure the AC voltage between TP8 and ground and TP10 and ground (TP8 & TP10 are located near J3 & K5). Write these voltages down. Note* - If you don't get any voltage at TP10 it means you are not in SSL mode.

Adjust VR8 until the AC voltage at TP11 measures the same as TP8.

Adjust VR7 until the AC voltage at TP12 measures the same as TP10.

TP11 & TP12 are located near the sidechain VCA's (U9 & U10).

4) Meter/Ratios:

Export a 1Khz test tone through the unit and back into the DAW. Adjust your volume levels so your DAW meter reads somewhere around -10dbfs. Now adjust the threshold knob on the compressor until there is 10db of compression (DAW should read -20dbfs). Adjust VR17 until the meter on the compressor shows 10db of compression.

5) Ratios:

With the unit in 2:1 ratio setting, export a 1Khz test tone through the unit and back into the DAW. Adjust your DAW levels so the return from the compressor in the DAW reads approx -10dbfs. Now adjust the threshold on the compressor until there is about 10db of compression (DAW input level should now read approx -20dbfs). This ensures the baseline for calibrating the ratios is past the compressor's "knee".

Now increase the level of the test tone by EXACTLY 10db (I use a gain plugin to do this, most DAW's should have one). Adjust VR16 until there is only 5db of gain on the output of the compressor (DAW input should read -15dbfs).

Repeat this entire process for the 4:1 and 10:1 settings. Also repeat the meter calibration (Step 4) in between each step.

For 4:1 setting, a 10db input level increase should result in only a 2.5db increase on the output.

For 10:1 setting, a 10db input level increase should result in only a 1db increase on the output.

Note* - getting all 3 ratio settings to read exactly the correct ratio is nearly impossible, this is normal and the same case even on the original SSL. If you get the 2:1 and 4:1 settings exact, chances are the 10:1 setting will be slightly off, etc. The goal is to adjust VR16 until all the ratio positions read as close to correct as possible.

5) T1 & T2 Filters:

With the unit in SSL Mode (aka stereo Sidechain, aka Turbo), export a 1Khz test tone on just the Left Channel. Make sure your HPF setting is in the "off" position. Adjust the threshold until there is exactly 10db of compression. Now set the HPF setting to T1. Adjust VR10 (L T1 Cal) until your meter shows exactly 10db of compression. Repeat for the T2 setting (VR9/L T2 Cal).

To calibrate the right channel, now export a 1Khz test tone on both the L & R channels.

With the Unit in the T1 setting, measure the AC voltage at TP11. Now adjust VR5 on the right channel until TP12 reads the same as TP11.

For the T2 setting, measure the AC voltage at TP11, and then adjust VR6 on the right channel until TP12 reads the same as TP11.

5) THD:

If using trimmable VCA's you'll need to adjust VR3 & VR4 for desired THD. In order to do this you will need a distortion analyzer software, I recommend using RMAA. Simply run an RMAA test through the compressor and adjust VR3 & VR4 for lowest THD. You will likely need to repeat the RMAA test multiple times.

6) Bargraph Adjustment:

In order to precisely calibrate the bargraph, you'll need either a DMM that measures True RMS or another piece of gear with a VU meter. 0dbvu on the bargraph (first red light) should light up with a +4dbu signal. The trick is getting the volume of test tone into the compressor to be exactly +4dbu.

If you have a true RMS DMM, with the unit in bypass export a 1Khz test tone and measure the AC voltage on the output XLR's between hot and cold (Pins 2 & 3). Adjust the level of the signal until you have exactly 1.228VAC. Engage the compressor and adjust VR15 until the 0dbvu light (first red light), lights up.

Alternatively you can hook another piece of gear with a VU meter up to the compressor, export a test tone, and adjust VR15 until the bargraph reads the same as on the other piece of gear's VU meter.

If you don't have either one of these items, then just pre-trim VR15 between Pin 1 (CCW) and the wiper to 3.82K and call it a day, it should be close enough.

That's it, start compressing.