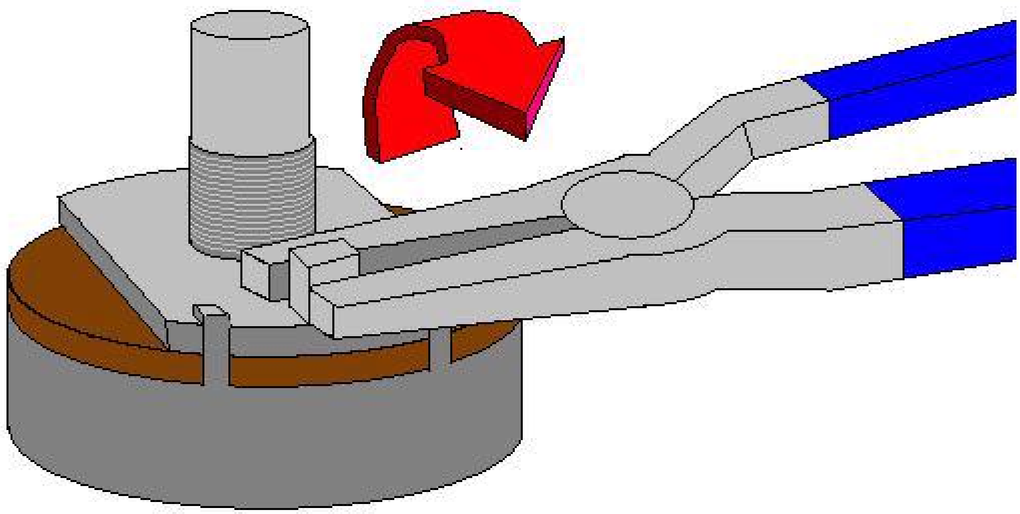
BYOC Optical Compressor Kit Instructions

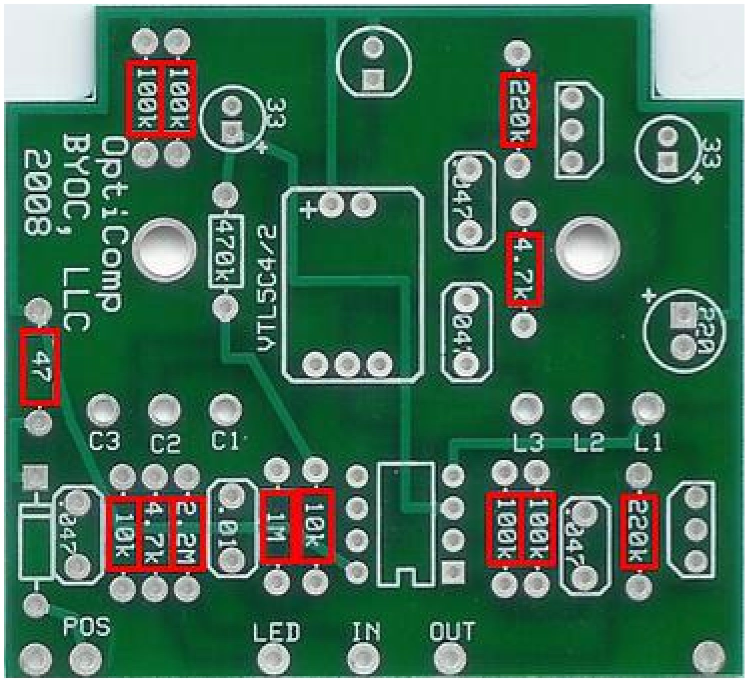
Parts Checklist for BYOC Optical Compressor Kit

Resistors:
1 - 47ohm (yellow/purple/black/gold/brown)
2 - 4.7k (yellow/purple/black/brown/brown)
2 - 10k (brown/black/black/red/brown)
4 - 100k (brown/black/black/orange/brown)
2 - 220k (red/red/black/orange/brown)
1 - 470k (yellow/purple/black/orange/brown)
1 - 1M (brown/black/black/yellow/brown)
1 - 2.2M (red/red/black/yellow/brown)
Capacitors:
1 - .01uf film (103 or 10nJ)
4 - .047uf film(473 or 47nJ)
2 - 33uf aluminum electrolytic
1 - 220uf aluminum electrolytic
Diodes:
1 - 1N4001
IC's and Transistors:
1 - TL082, TL072, 4558 or other dual op amp
2 - 2N5088
Opto-Coupler:
VTL5C4/2
Potentiometers: Be sure to snap off the small tab on the side of each pot.

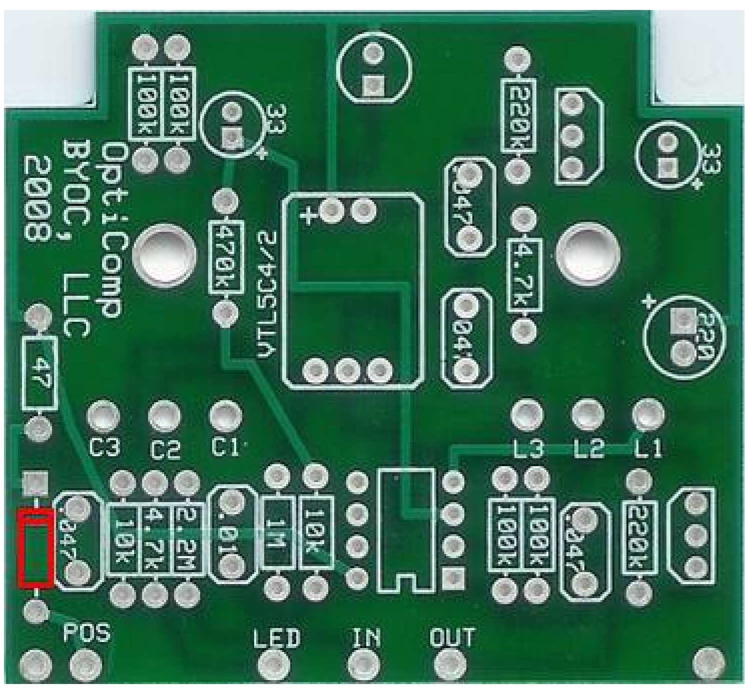


1 - A100k log
1 - B500k linear
Hardware:
1 - drilled enclosure w/ 4 screws
1 - byoc opticomp kit circuit board
1 - 3pdt footswitch
2 - knobs
1 - AC adaptor jack
1 - ¼"stereo jack
1 - ¼" mono jack
1 - battery snap
1 - red LED
hook-up wire

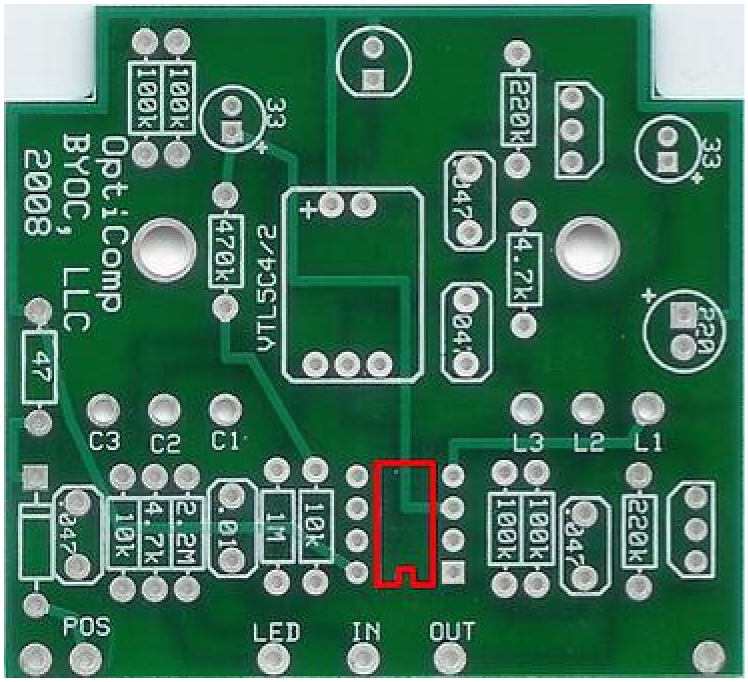
Populating the Circuit Board



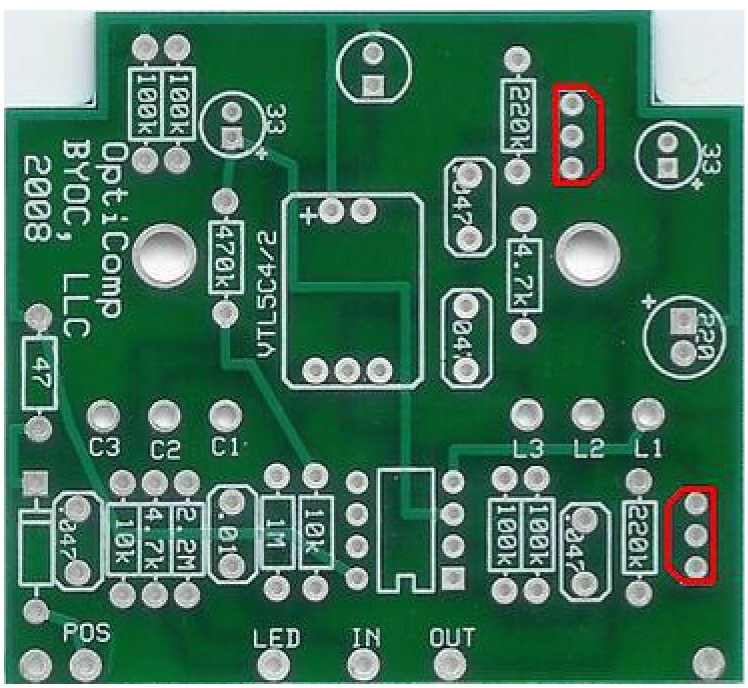
Step1: Add the resistors. Resistors are not polarized so they can go in the PCB in either direction. **THE 47ohm RESISTOR WILL BE OMITTED ON NEWER PCBs.**



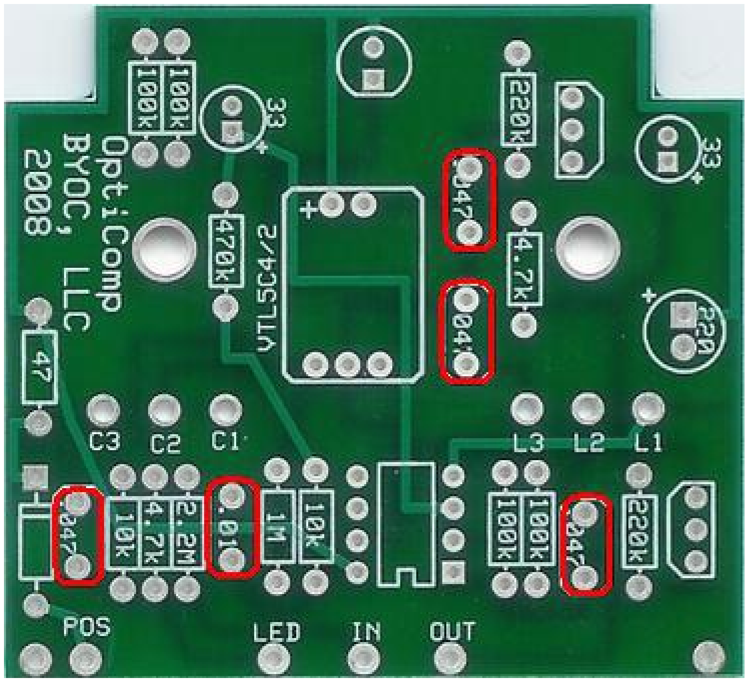
Step 2: Add the larger black plastic diode with silver stripe(1N4001). Make sure the stripe matches up with the layout on the PCB. The cathode(striped end) goes in the square solder pad. The anode goes in the round solder pad.



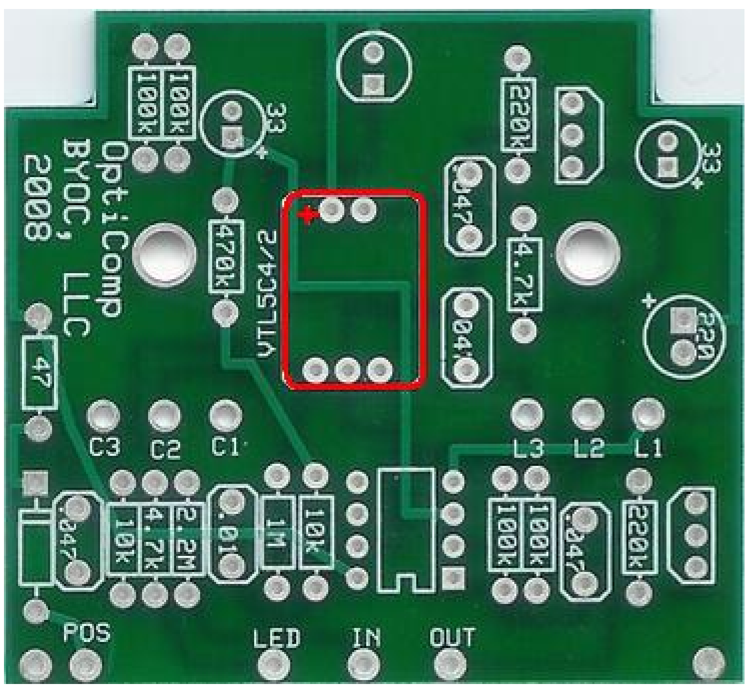
Step3: Add the Op Amp. Pin 1 of the op amp will go in the square solder pad. Pin 1 is sometimes denoted by a small dot in one corner on the top of the chip. This dot should be in the same corner as the square solder pad on the PCB. Sometimes there will also be a U-shaped notch in one end. Match this notch up with the notch in the layout. Usually there is only one type of marker or the other for orienting the OpAmp, but if there are both markers, always defer to the U-shaped notch first.



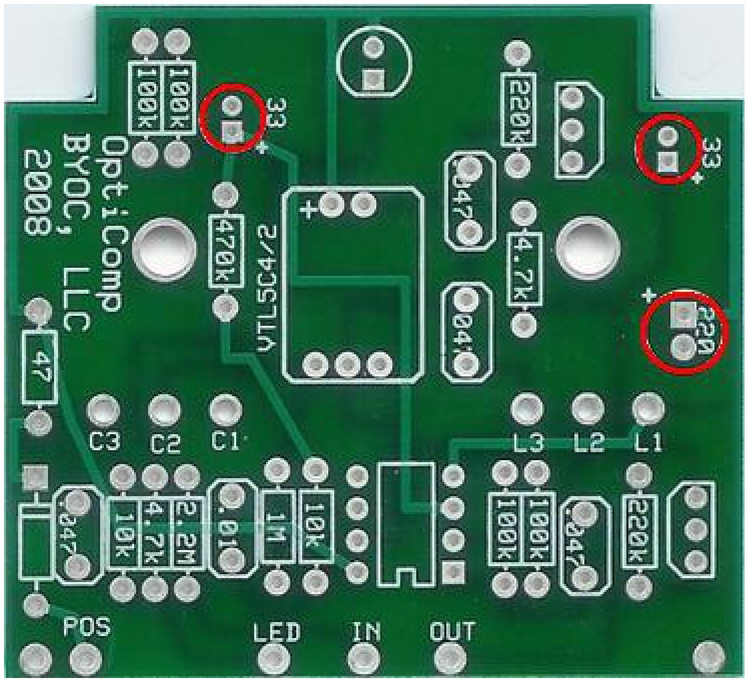
Step 4: Add the transistors. Make sure to match the rounded back of the transistor with layout



Step 5: Add the metal film capacitors. These are not polarized and can go in the PCB in either direction.



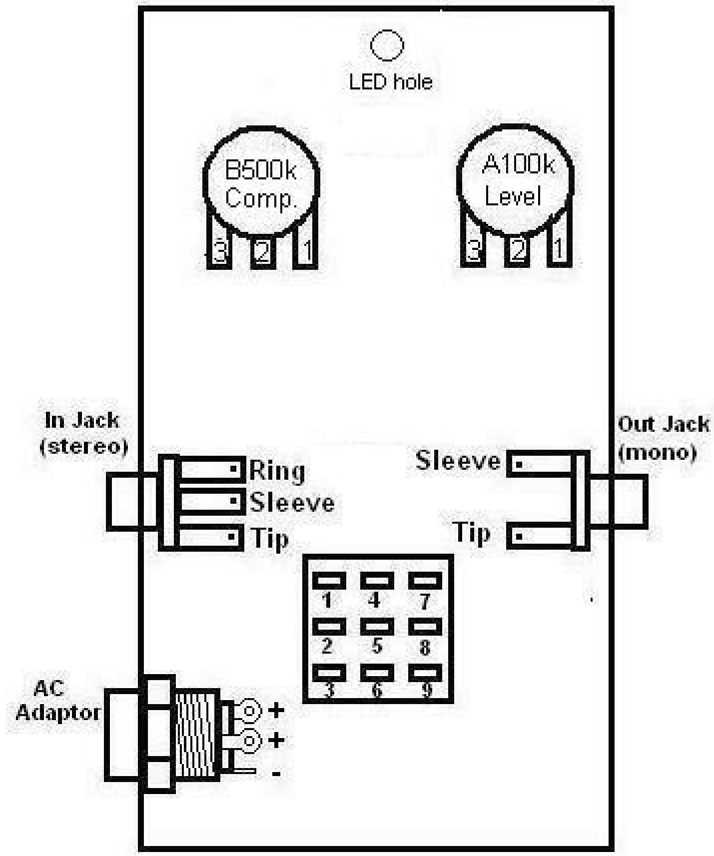
Step6: Add the Opto-Coupler. It should be fairly obvious that the side with 3 leads goes in the side that has 3 solder pads and the side that has 2 leads goes in the side that has 2 solder pads. The writing on the opto-coupler should be facing up. The positive end will be marked with a “+” and should match up with the “+” on the layout.



Step 7: Add the aluminum electrolytic capacitors. These will be the can shaped caps. They are polarized so make sure to orient them correctly. The longer lead is the positive lead and goes in the square solder pad. The shorter lead is the negative lead and goes in the round solder pad. The negative lead will be denoted by a stripe or some sort of marker running down the side of the capacitor.

SOME PCBs WILL CALL FOR 100uf IN PLACE OF THE 220uf AND 47uf IN PLACE OF THE 33uf CAPACITORS. YOU SHOULD IGNORE THIS AND USE THE 220uf IN THE SPACE MARKED FOR 100uf AND USE THE 33uf's IN THE SPACES MARKED FOR 47uf.

Assembly

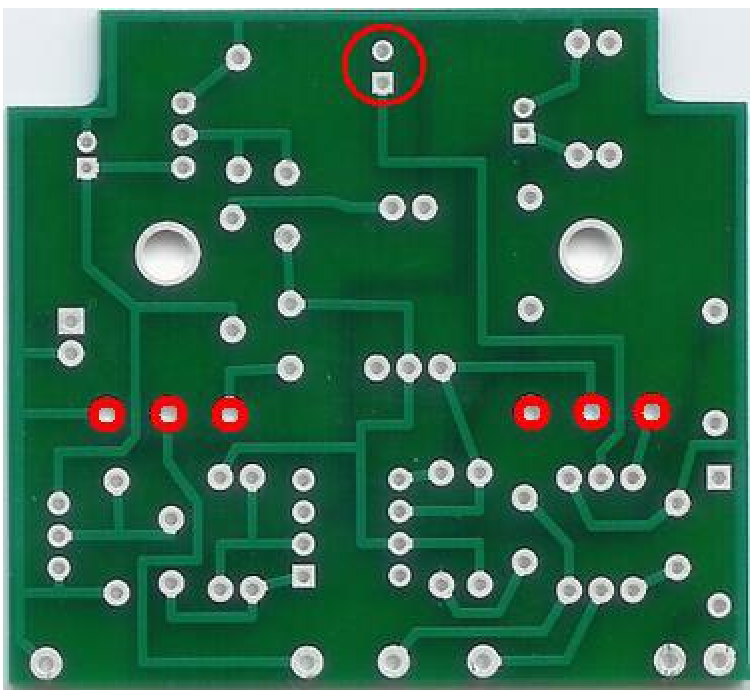


1. Install the jacks first. If you are looking down inside the enclosure, the mono jack goes on the right side and the stereo jack goes on the left. Place the washer on the outside of the enclosure. Use a 1/2" wrench to tighten
2. Install the AC adaptor jack. The bolt goes on the inside. Use a 3/4" or 14mm wrench to tighten
3. Install the potentiometers so that the solder lugs are pointing down. The washers go on the outside. Use a 10mm wrench to tighten but only snug. Do not over tighten the pots. You should leave the pots somewhat loose until they are soldered to the PCB so that it will be easier to mount them.
4. Install the footswitch. The first bolt and metal washer go inside. The plastic washer and second bolt go on the outside. It does not matter which side you designate as the "leading edge" of the footswitch as long as you orient it so that the flat sides of the solder lugs are aligned in horizontal rows, not vertical columns.

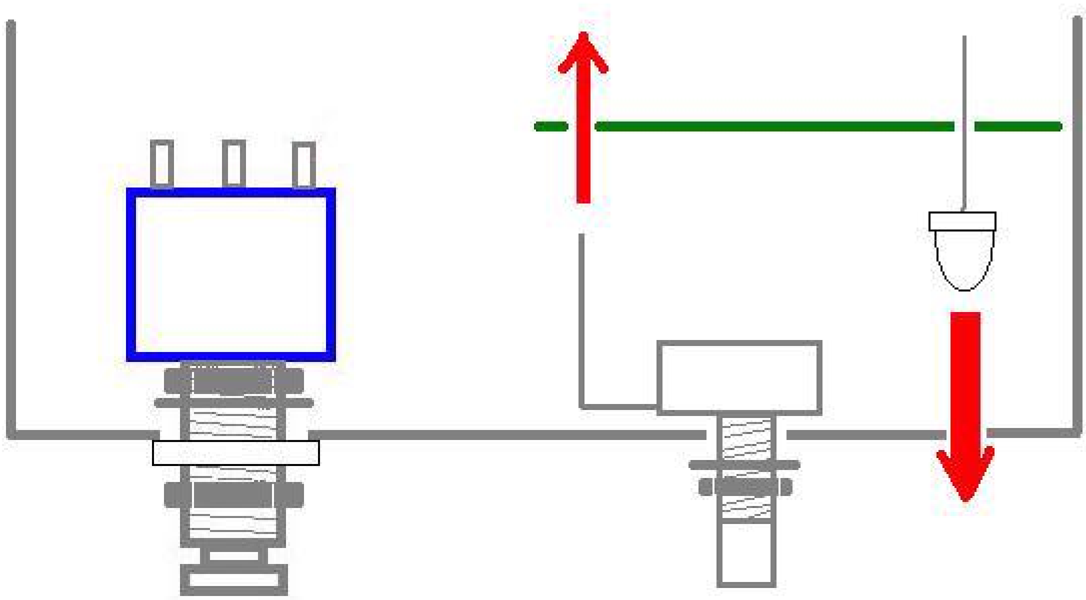
Mounting the Circuit Board

PC Mounted Potentiometers: Some kits will come with PC mounted pots depending upon availability. If your kit has PC mounted pots follow these steps for mounting the circuit board.

Step1: Understand that the LED, and both potentiometers will be mounted and soldered directly to the underside of the PCB. You should do the actual soldering on the topsid of the PCB. Read through all the steps in this portion before doing anything so that you can get the "big picture".



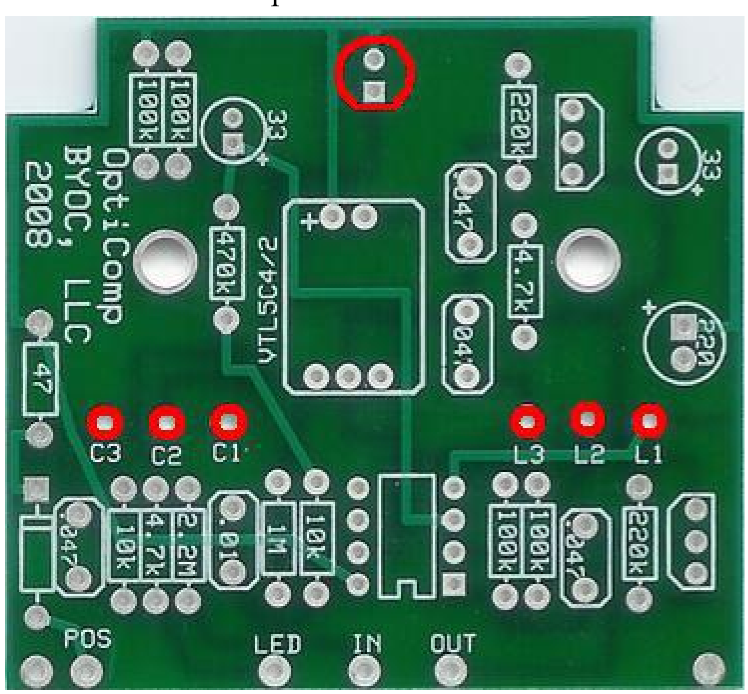
Step 2: Install the LED but do not solder it or clip the leads. You will insert the LED into its eyelets. Make sure the longer lead goes in the round eyelet and the shorter lead goes in the square eyelet. Yes this is correct! Longer lead in the round eyelet. Shorter lead in the square eyelet. Now bend the leads of the LED so that it will not fall out of the PCB when you flip it over.



Step 3: Now mount the PCB with LED onto the leads of the potentiometers. This move may take a little finess. It's best to leave your pots somewhat losely mounted to the enclosure so that you can easily move them to line up with the eyelets on the PCB. You may need to bend the leads of the pots into place if they were bent in shipping.

Step 4: once you have the PCB in place, snug the nuts of the pots and toggle switch with your fingers.

Step 5: Move the LED into place by guiding it with the leads that are sticking out of the top side of the PCB.



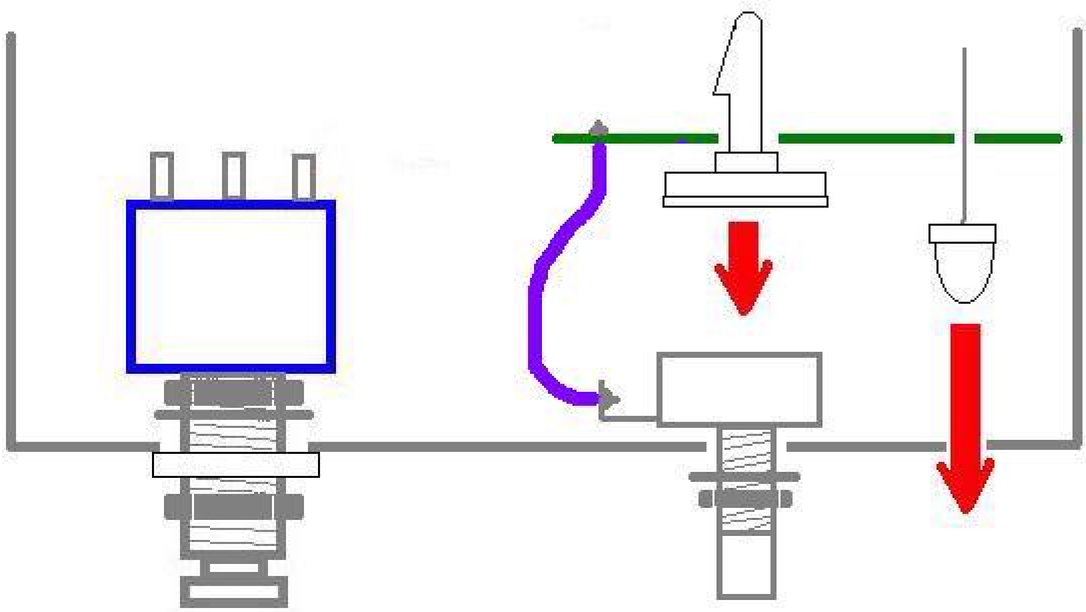
Step 6: Solder the LED and pots on the top side of the PCB. Clip the excess LED leads. Do not clip the leads of the pots.

Solder Lugged Pots: Some kits may come with panel mounted pots with solder lug termination. If you kit has these style pots, follow these steps for mounting the PCB.

Step 1: Connect the pots to their eyelets on the PCB with hook up wire. Insert the wires from the underside of the PCB and solder on the topside. Lug 1 of the A100k LEVEL pot gots to the L1 eyelet. Lug 2 of the LEVEL pot goes to the L2 eyelet. Lug 3 of the LEVEL pot goes to the L3 eyelet. Lug 1 of the B500k COMPRESSION pot goes to the C1 eyelet. Lug 2 of the COMPRESSION pot goes to the C2 eyelet. Lug 3 of the COMPRESSION pot goes to the C3 eyelet.

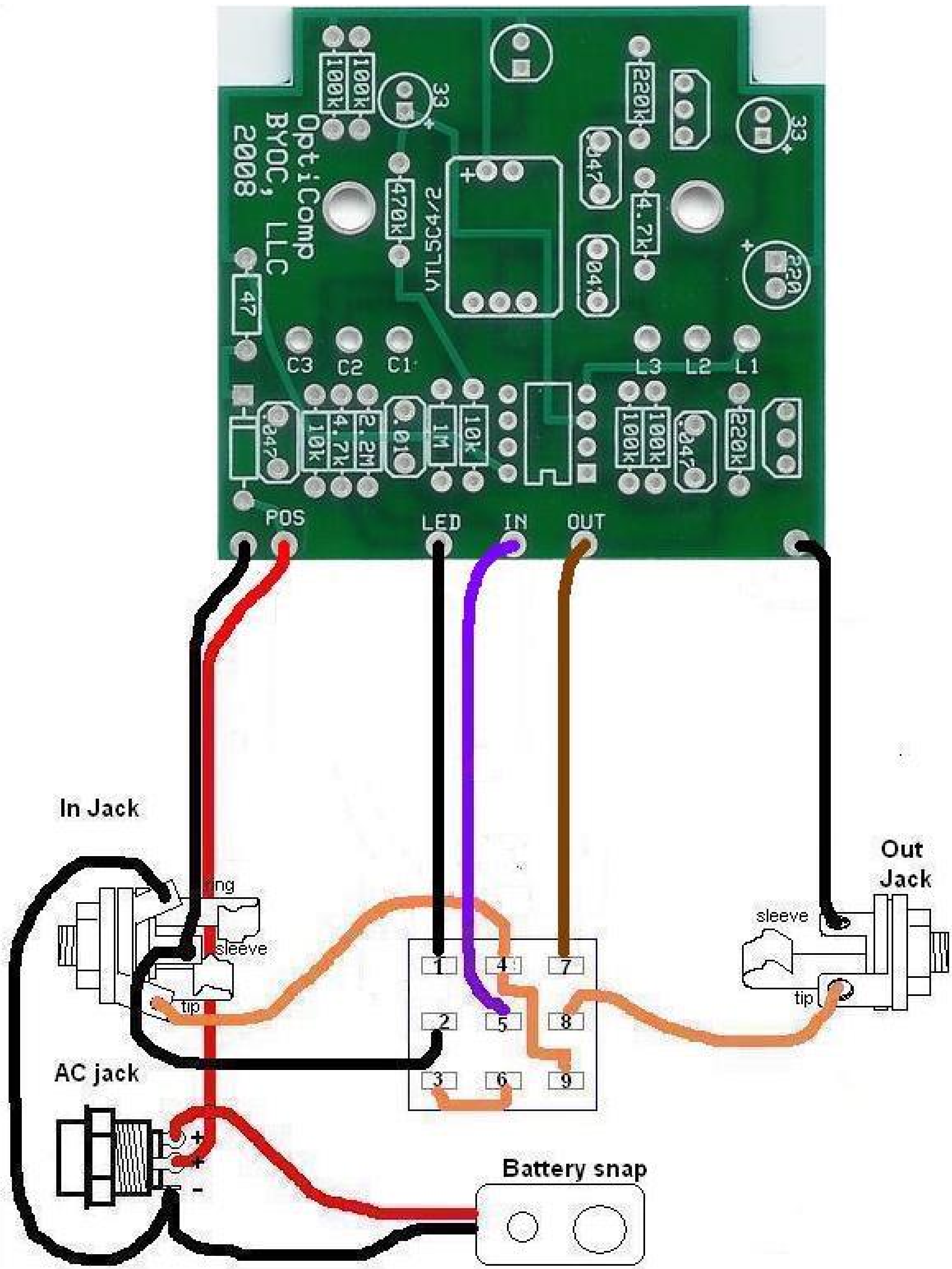
Step 2: Install the self-adhesive nylon standoffs from the underside of the PCB into the large mounting eyelets, but do not remove the paper backings yet.

Step 3: Install the LED into the underside of the PCB, but DO NOT SOLDER IT YET! The longer lead goes in the round pad and the shorter lead goes in the square pad. Not that's not a typo. Yes that is correct. Longer lead in the round pad. Shorter lead in the square pad. Bend the leads of the LED outward on the topside of the PCB so that it does not fall out when you flip it over.



Step 4: Now remove the paper backings from the standoffs and adhere them to the backs of the pots. It's a good idea to clean the backs of your pots with some rubbing alcohol first.

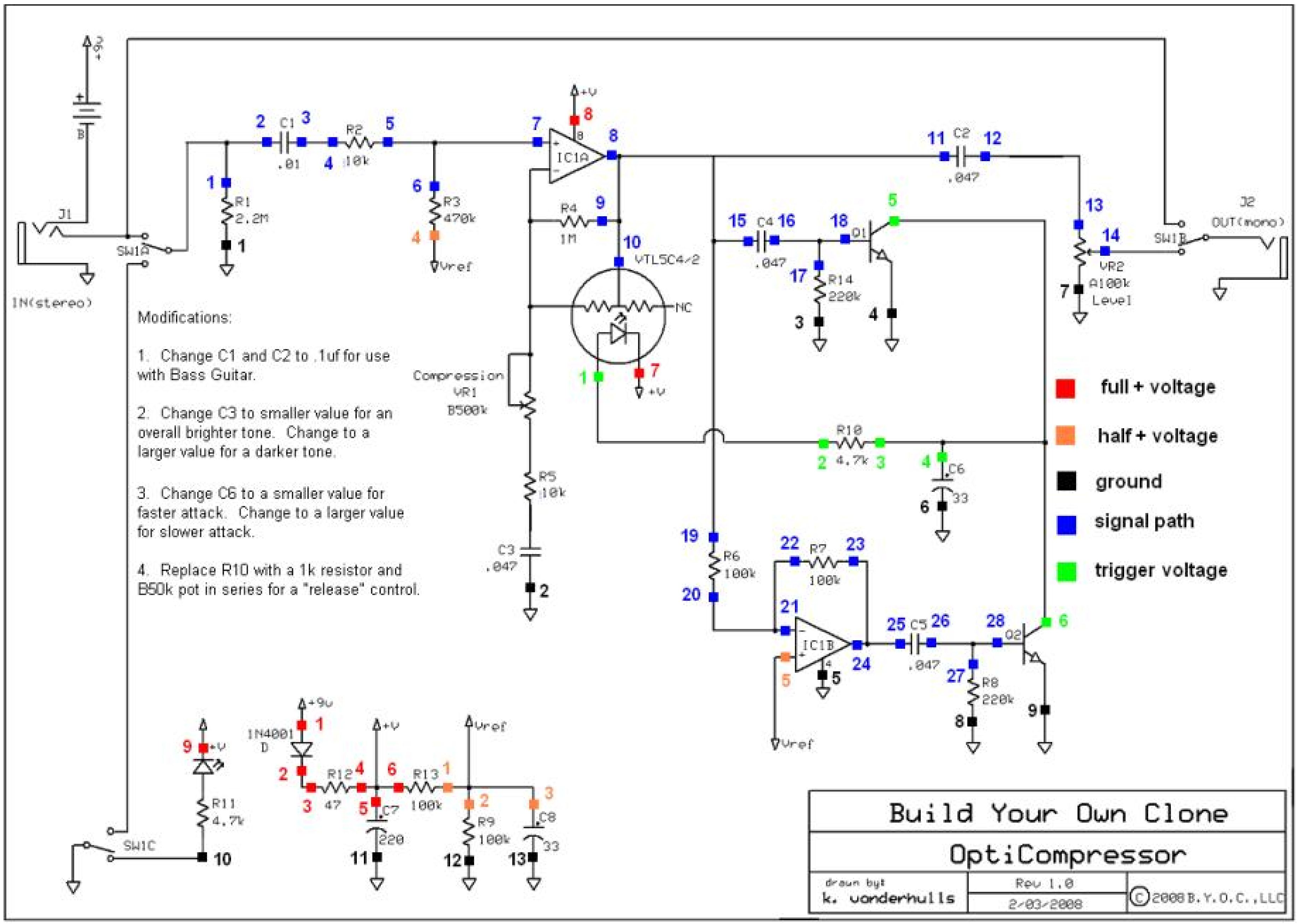
Step 5: Grab the LED by the leads that are sticking out of the topside of the PCB and guide it into place. Solder it from the topside and clip the excess leads.


OptiComp
BYOC, LLC
2008
POS
LED
IN
OUT
In Jack
ring
sleeve
tip
AC jack
Battery snap
Out
Jack
sleeve
tip

Finishing Touches

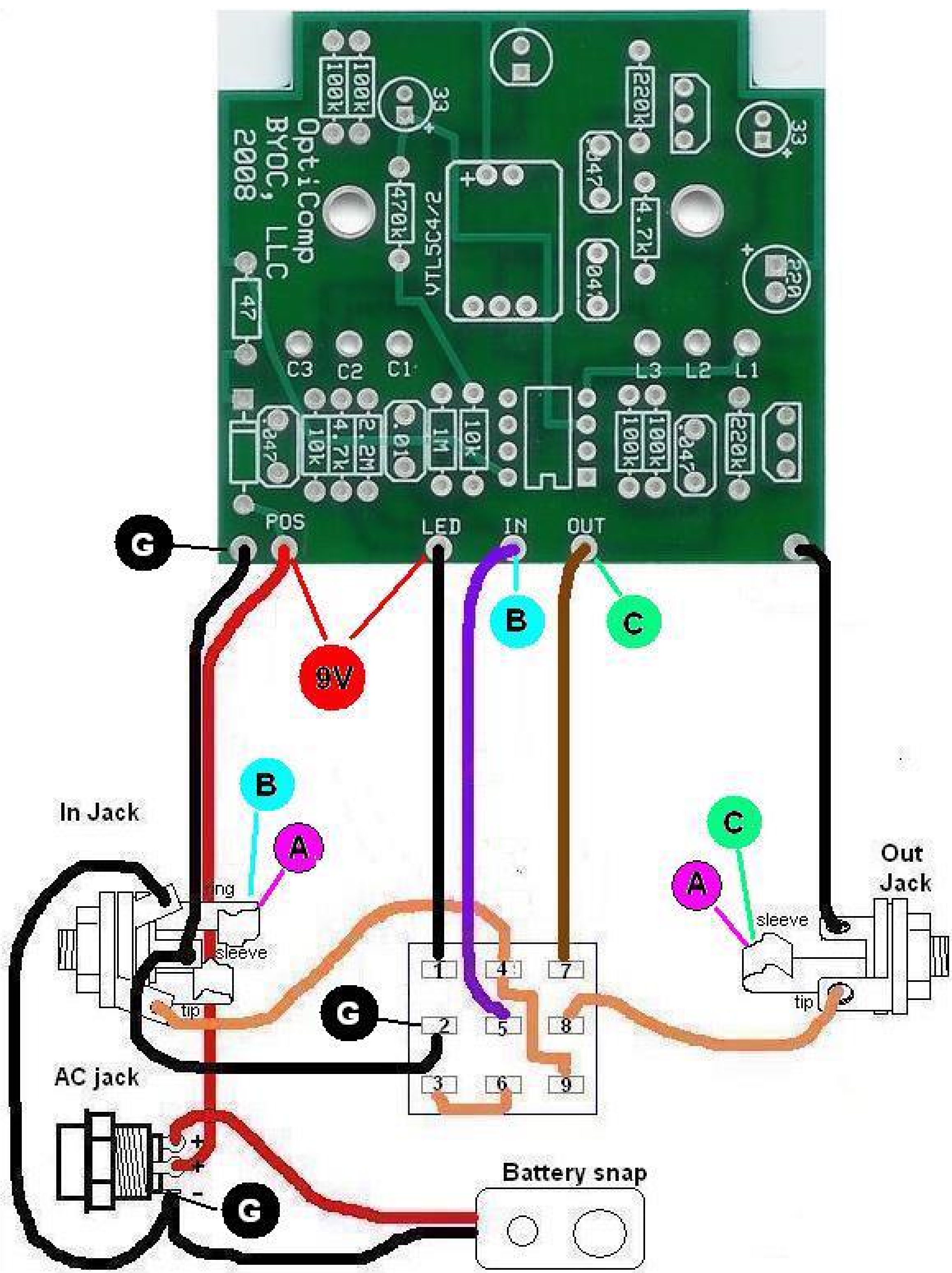
Install the base of the enclosure with the 4 screws that came with your kit. Add the rubber bumper feet...unless you're a velcro person. Add the 2 knobs. Be sure not to tighten the set screw inside the knobs too tight or you may strip them. If you've got any problems that you can't figure out yourself, visit board.buildyourownclone.com for technical support. Please read the trouble shooting guide first.

Schematic, Understanding the Circuit, and Trouble shooting



Modifications:

1. Change C1 and C2 to .1uf for use with Bass Guitar.
2. Change C3 to smaller value for an overall brighter tone. Change to a larger value for a darker tone.
3. Change C6 to a smaller value for faster attack. Change to a larger value for slower attack.
4. Replace R10 with a 1k resistor and B50k pot in series for a "release" control.



OptiComp
BYOC, LLC
2008
POS
LED
IN
OUT
G
9V
B
C
In Jack
ring
sleeve
tip
A
AC jack
Battery snap
Out
Jack
1
2
3
4
5
6
7
8
9

Checking your wiring

1. **NO POWER:** If you have a completely dead pedal and your LED will not light up, this is usually a good sign that you are not getting power to the circuit. First you need to make sure that you are using a fresh battery or good power supply. Even though this pedal can run on 12v - 18v, let's use 9v for trouble shooting purposes to keep things simple. Also make sure you have a plug in the IN jack. This acts as your power switch. Now let's make sure you have a good ground. Set your Digital MultiMeter to test for continuity. Continuity is the setting where the meter makes a noise when you touch the two probes together. Now test the “G” locations in the wiring diagram and make sure that there is continuity between all.

***If you don't get continuity between all 3 locations, you likely have a bad connection somewhere in the black wire.**

Now set your meter to test for 9VDC. Make sure you do not set it to test for AC. And if you do not have an auto-ranging meter you will need to set it for the proper voltage. You want to set it to test for the lowest voltage without going under 9V. This will probably be 20V on most meters. With the pedal/footswitch in the engaged position, you should get approximately 9VDC when you touch the red probe to the POS eyelet and the black probe to the LED eyelet. You will probably get a little more than 9V with an adaptor and a little less than 9V with a battery.

If you are not getting a reading here, keep the red probe on the POS eyelet and move the black probe to one of the “G” locations.

***If you do not get a reading now, you likely have a bad connection somewhere along the red wire.**

If you don't get a 9V reading at the POS and LED eyelets, but you do get a 9V reading at the POS eyelet and one of the ”G” locations, there is a possibility that you have a faulty footswitch or a bad connection at lugs 1 and/or 2 of the footswitch. Test for continuity between lugs one and two of the footswitch. Make sure to press the footswitch on and off so that you are certain that you are engaging the throw between lugs 1 and 2 one way or the other.

***If you are getting continuity between lugs 1 and 2, then you likely have a bad solder joint at lugs 1, 2, and/or the LED solder pad.**
***If you are not getting continuity between lugs 1 and 2 regardless of what state the footswitch is in, then you likely have a faulty foostswitch.**

2. **NO BYPASS:** Set your DMM to test for continuity. Touch the probes to the “A” locations which would be the TIPS of the 1/4” jacks. When your footswitch is in the bypass state, you should have continuity between the two “A” locations. Test lugs 8 and 9 of the footswitch for continuity.

***If you get continuity between lugs 8 and 9, but no continuity between the 2 “A”**

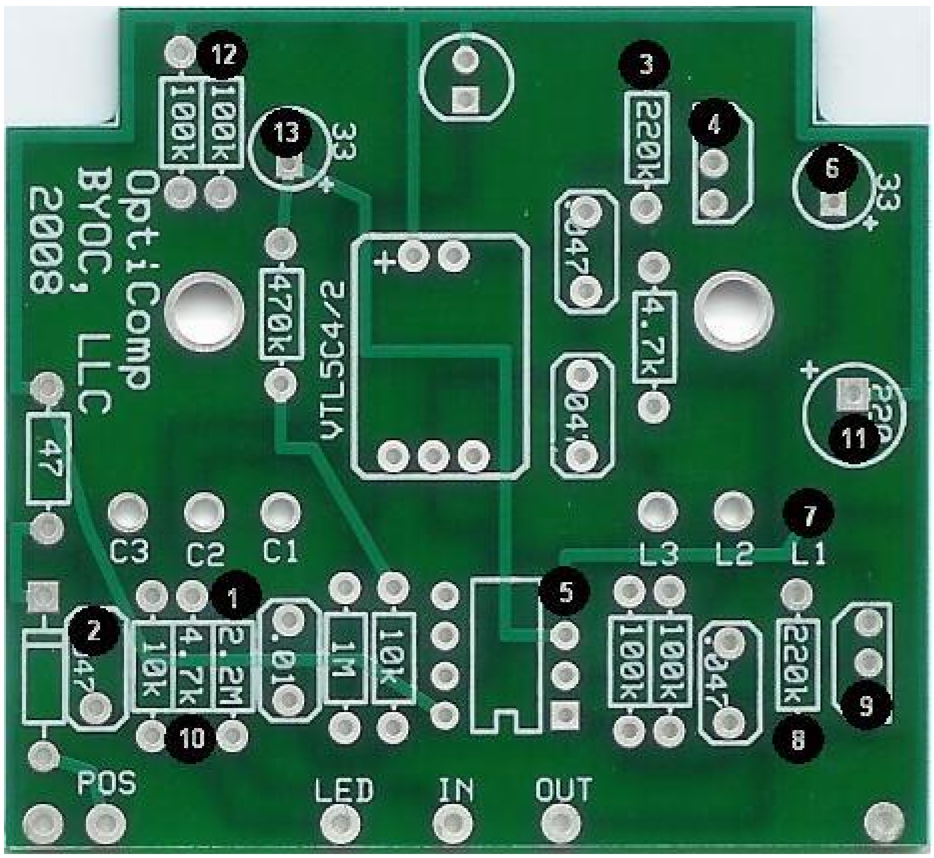
locations, then you likely have a bad solder joint somewhere along the orange wiring. This also includes the jumper connection between lugs 4 and 9.
***If you do not get continuity between lugs 8 and 9 and you are certain that the footswitch is in the bypass state, then you likely have a faulty footswitch.**

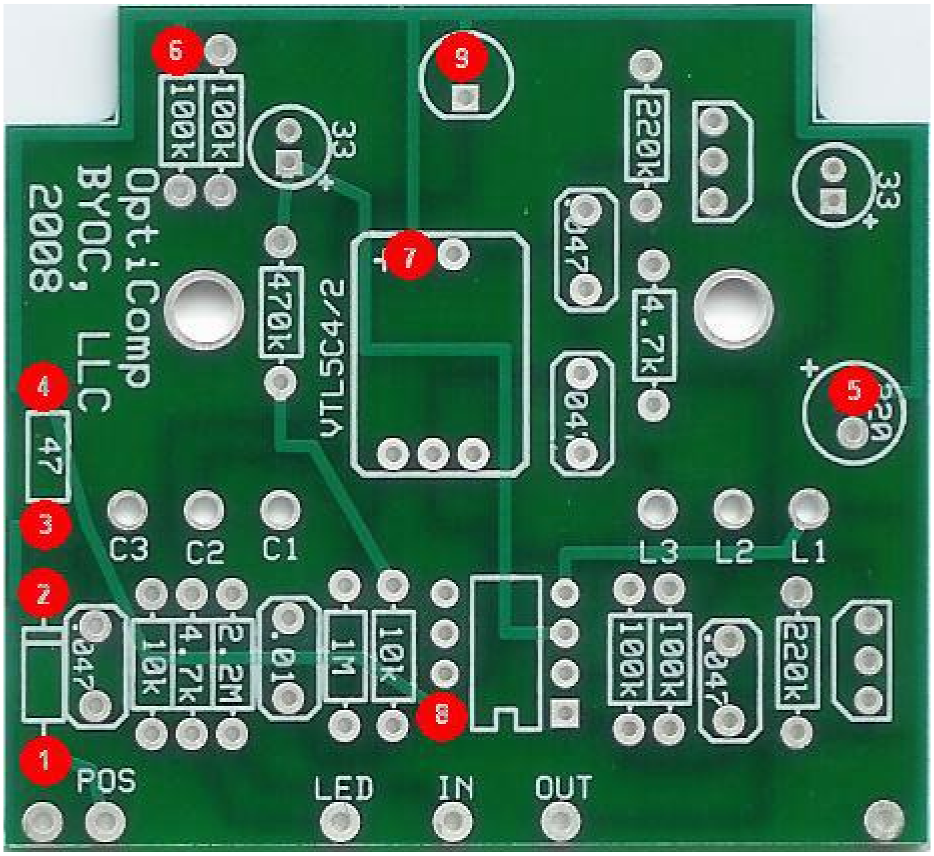
3. BYPASS WORKS, BUT THE EFFECT DOES NOT: This could be any number of problems located on the PBC, but let's check your offboard wiring first and make sure that you are getting signal to and from the PCB to rule that problem out. Set your DMM to test for continuity. Make sure your footswitch is in the "ENGAGED" state. You should get continuity between the two "B" locations and between the two "C" locations. If you do not get continuity between the "B" locations, check for continuity between lugs 4 and 5. If you do not get continuity between the "C" locations, check for continuity between lugs 7 and 8,
***If you get continuity between lugs 4 and 5, but no continuity between the "B" locations, then you likely have a bad solder joint along the purple wire.**
***If you get continuity between lugs 7 and 8, but no continuity between the "C" locations, then you likely have a bad solder joint along the brown wire.**
***If you don't get continuity between lugs 4 and 5, or lugs 7 and 8, and you are certain that your footswitch is in the engaged state, then you likely have a faulty footswitch.**

Checking your PCB

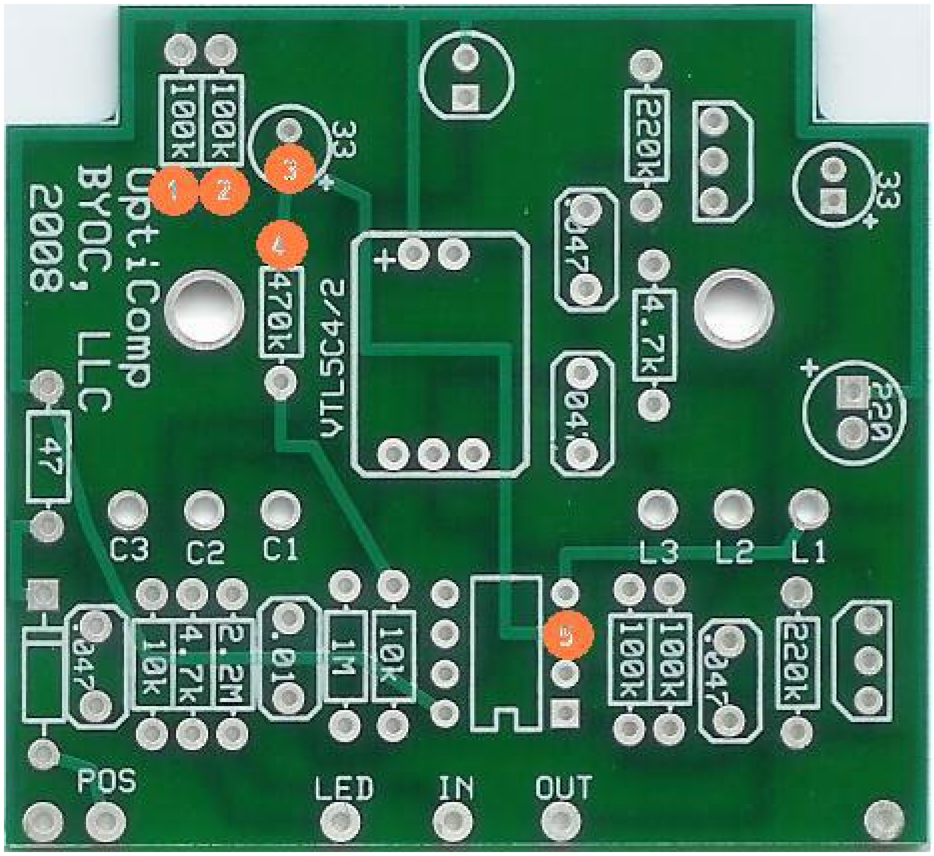
Ok....So Now you know bypass is working, signal is getting to and from the PCB, and that the PCB also has a connection to +9V and ground. If you're still haveing trouble, it's time to check your work on the PCB. Keep in mind that the PCB is simply a means of connecting one component or wire to another component or wire. So when you touch your probe to the test location, you want to touch the probe to the exposed component or wire lead at that location and not to the PCB solder pad.

1. Check all ground connections. Set your DMM to test for continuity. Touch one probe to the sleeve of either jack and touch the other probe to the various “BLACK” test locations on the PCB.

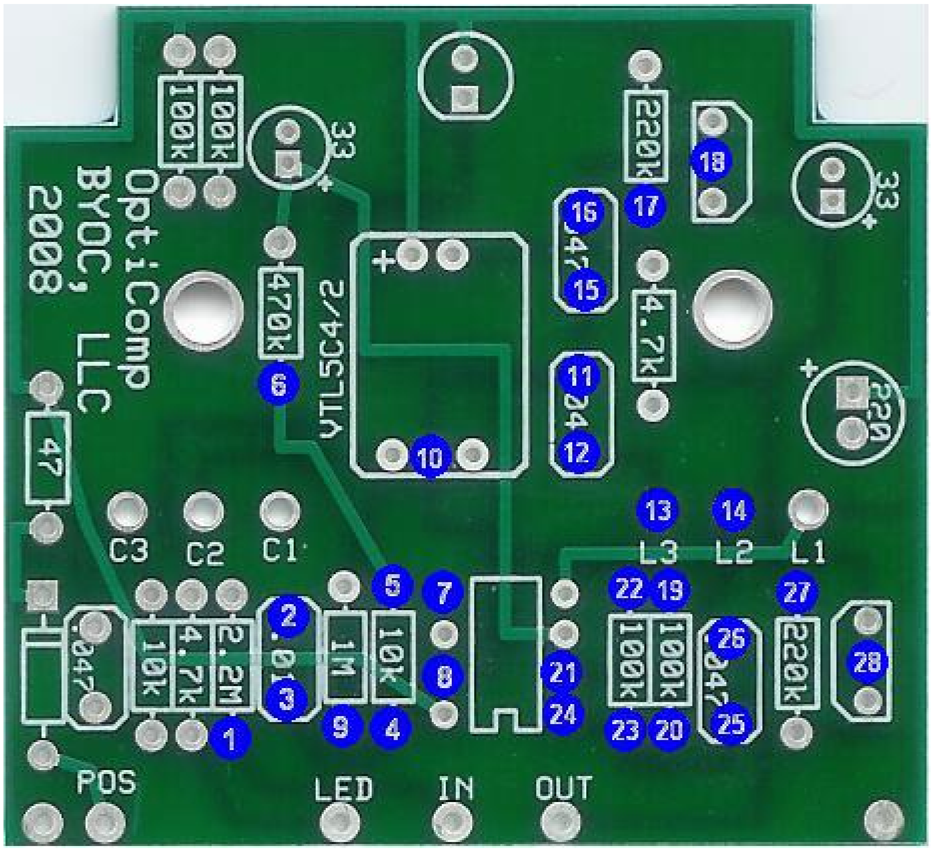




2. Check all Full Positive Voltage connections. The term "Full Positive Voltage" is used, because after D1 and R12, the voltage will be slightly diminished. Your positive voltage may be 9V at "RED" location 1, but drop to 8.5V at locations 2 and 3, and then drop again to 8.2V at location 4. This is to be expected. But "RED" locations 4 - 8 should all remain constant and should be somewhere between 9V and 8V. Set your DMM to test for 9VDC. Touch the black probe to the sleeve of either jack. Touch the red probe to the various "RED" test locations on the PCB.

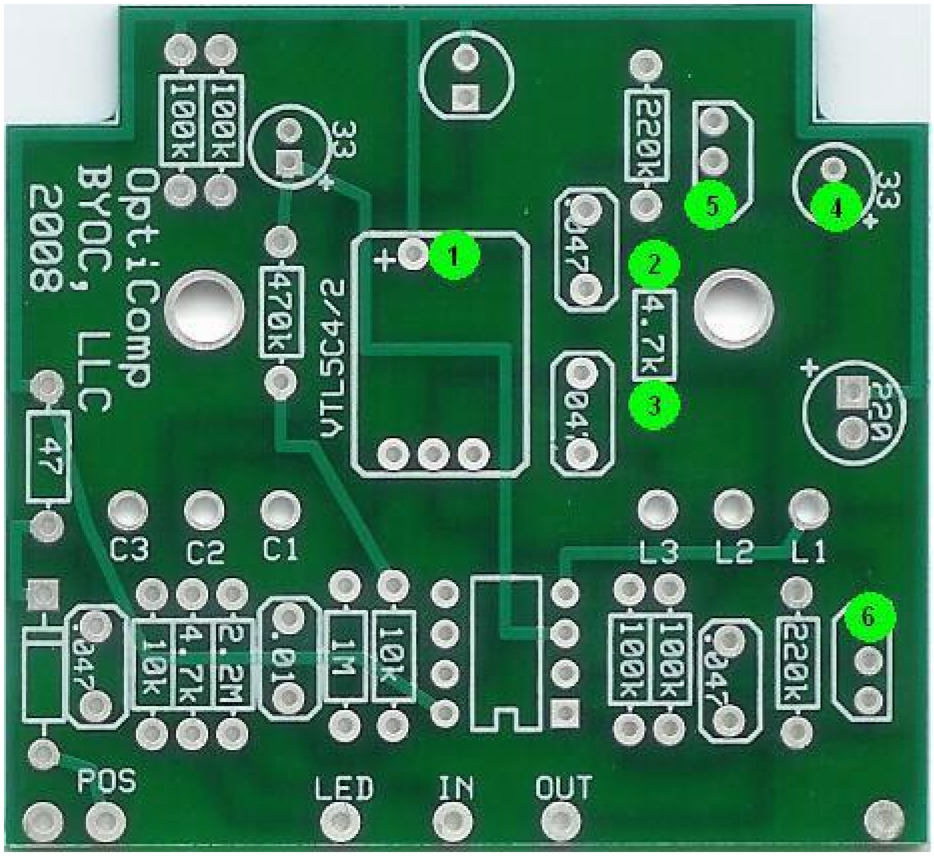


3. Test all Half Positive Voltage "ORANGE" locations. This reading should be approx. half of what your Full Positive Voltage is. 4.5V to 4V is to be expected. Set your DMM to read 5VDC. Touch the black probe to the sleeve of either jack. Touch the red probe to the various "ORANGE" test locations on the PCB.



4. Test the audio signal path. Do this using a Signal Test Probe. If you look at the schematic, you'll see that "BLUE" locations 1 - 14 make up your direct signal path in order between the INPUT of the circuit and the OUTPUT of the circuit. A bad solder joint anywhere along here or installing your op amp incorrectly will obviously mean no sound.

But if you study the schematic, you'll see that the audio signal splits 3 ways at the output of IC1A (Pin 7/BLUE 8). One branch goes to BLUE 11, which would begin the signal output path. The other two splits branch off to make up the envelope triggers - the first branch being BLUE 15 through 18 and the second branch being BLUE 19 through 28. A bad solder joint along either of these two braches of the signal path would still permit the pedal to pass sound, but the actual compression would not work correctly. Both the Compression and Level knobs would have some function in terms of increasing/decreasing output and gain, but if you had a problem in this area of the circuit you would notice very uneven compression or no compression at all.



5. The Trigger Voltage Path. This is really where all the action of this pedal is happening. Before getting into how to test this part of the circuit, let's understand what it is doing. It's really quite simple...assuming you actually understand what a compressor is supposed to do. A lot of people don't.

First we need to understand what an opto-coupler is. An opto-coupler is an LED (light emmiting diode) just like the status light that lights up when you turn the pedal on, and an LDR (Light Dependent Resistor) housed in a single device. An LDR is a resistor whose resistance drops when it is exposed to light. And the amount of that resistance drop depends on how bright the light is. So if we apply a voltage to the LED portion of the opto-coupler, this will change the resistance of the LDR. And the amount of voltage that we apply to the LED portion of the opto-coupler will have an affect on how much the resistance of the LDR portion changes.

The next thing we need to understand is the op amp (operational amplifier) and how it is used in this particular circuit. An op amp can have many many different functions, but in this circuit the op amp is serving to amplify an audio signal. We're not going to get into the how and why of voltage gain configuration. Just know that IC1A is a non-inverting configuration. The amount of gain is set by two things. The first is the Compression knob. The compression knob sets the minimum and maximum range within which the second thing can operate in. Turning the compression knob up allows the second thing a wider range of voltage gain. Turning it down would have an inverse effect. The second thing that sets the about of gain is the 1M resistor and the LDR that run in parallel between pins 6 and 7 of IC1A. The most important thing to understand here is that, the more resistance between pins 6 and 7, the more output IC1A will produce. The less resistance between pins 6 and 7, the less output IC1A will produce.

Now let's bring the functions of the LDR and the op amp together.

We know that when the LDR is in an “at rest state”, it is at maximum resistance. So when no voltage is being applied to the LED portion of the opto-coupler, and thus no light is being applied to the LDR, this means that the op amp is amplifying the guitar signal to the circuit's fullest potential. And when a voltage is applied to the LED portion of the opto-coupler, and thus applying light to the LDR, this means that the op amp is not amplifying the guitar signal to it's fullest potential, and perhaps even diminishing it.

So what we can assume at this point is this: The more voltage applied to the LED portion of the opto-coupler, the less signal output we get. And the less voltage applied to the LED portion of the opto-coupler, the more signal output we get.

So what controls the voltage that is applied to the LED portion of the opto-coupler? The envelope trigger.

This circuit actually has two envelope triggers or envelope followers that work in parallel. The second trigger is preceeded by IC1B, so it does not receive the same amount of signal as the first. Having two triggers in parallel helps to smooth out the compression, and having two triggers with uneven input signals adjusts the taper of the transistion. None the less, the two transistor based envelope triggers are identical and the way they work is very simple. You can better understand the relationship between the envelope triggers and the LED portion of the opto-coupler better by looking at the LED status light and R11 on the schematic.

The cathode of the LED status light is connected to +V. R11 is connected to ground on one end when the footswitch is in an ”engaged” state, and the other end is connected to the anode of the LED status light R11 is there to make sure the LED doesn't get too much current and burn out. But if you increase the resistance of R11, the LED status light will get dimmer. And if you decrease the resistance of R11, the LED status light will get brighter.

Like op amps, transistors can be used for many different things. But in this case, they are acting as variable resistors. The LED of the opto-coupler and the transistors in the envelope triggers are basically do the same thing here as R11 and the LED status light. The cathode of the LED is connected directly to +V. The anode is connected to the collectors of the two transistors(if we ignore R10 and C6). The emitters of the transistors are connected to ground. When an input signal is applied to the base of the transistors, the resistance between their collectors and emitters decreases and the LED becomes brighter.

So....
1. The harder you strum the guitar, the stronger the signal being applied to the base of the

transistors.

2. The stronger signal being applied to the base of the transistors, the less resistance there will be between the anoded of the opto-coupler LED and ground.

3. The less resistance between the anode of the opto-coupler LED and ground, the brighter the LED will light up.

4. The brighter the opto-couler LED lights up, the lesser the resistance the LDR of the opto-coupler will be.

5. The lesser the resistance of the opto-coupler LDR, the less the op amp will amplify your guitar signal.

This means, the harder you strum your guitar, the more your signal gets cut. And the softer you strum your guitar, the more your signal gets boosted. This is compression - an effect that produces an even output signal regardless of input signal strength.

Now to use this knowledge to help troubeshoot a problem in the trigger voltage path. Assuming that you've used a Signal Test Probe to determine that signal is reaching the base of the transistors(BLUE 18 and BLUE 28), you need to have some sort of input signal in order to test the Trigger Voltage Path. Set your DMM to 9VDC and touch the red probe to any Full Positive Voltage location. Then touch the black probe to the various "GREEN" test locations on the PCB. You should notice the voltage increase as guitar signal is applied and the voltage drop as the guitar signal strength decays.

Unfortunately, we cannot see the LED because it is encapsulated in the opto-coupler. It would be easy to tell if we had problem with the opto-coupler itself if we could see the LED. You can install a regular LED into the LED end of the opto coupler to see it work.

*If you are getting a trigger voltage to the anode of the opto-coupler LED, and you are getting an unaffected dry signal, first check for cold joints on Pin 6, R4, the opto-coupler, and lug 2 of the compression knob by testing for continuity throughout all those components on all the ends you did not check when testing for audio signal. Also test for continuity between Lug 3 of the compression pot and R5, and continuity between the other end of R5 and C3. If all that checks out, then you may have installed your opto-coupler incorrectly or you may have a faulty opto-coupler.

*If you are getting input signal to the base of the transistors, but you are not getting any trigger voltage, then you may have installed both transistors incorrectly or both transistors may be faulty.

*If you are getting input signal to the base of the trasistors, but you are getting a very choppy compression, you may have installed one of the transistors incorrectly or one transistor may be faulty. Unfortunately because both transistors are in parallel, there is no way to determine which is suspect, so take a guess. Maybe you'll get it on the first try.