

Project 1, Part 4

Boxing Your Circuit

v03, 03.29.12

What happens next:

In Parts 1 and 2 of this series, we assembled a simple distortion circuit on an electronics breadboard and explored some possible modifications. In Part 3, we transplanted the circuit from the breadboard to a piece of perfboard. In this installment, we'll finish the project by mounting the perfboard in an enclosure.

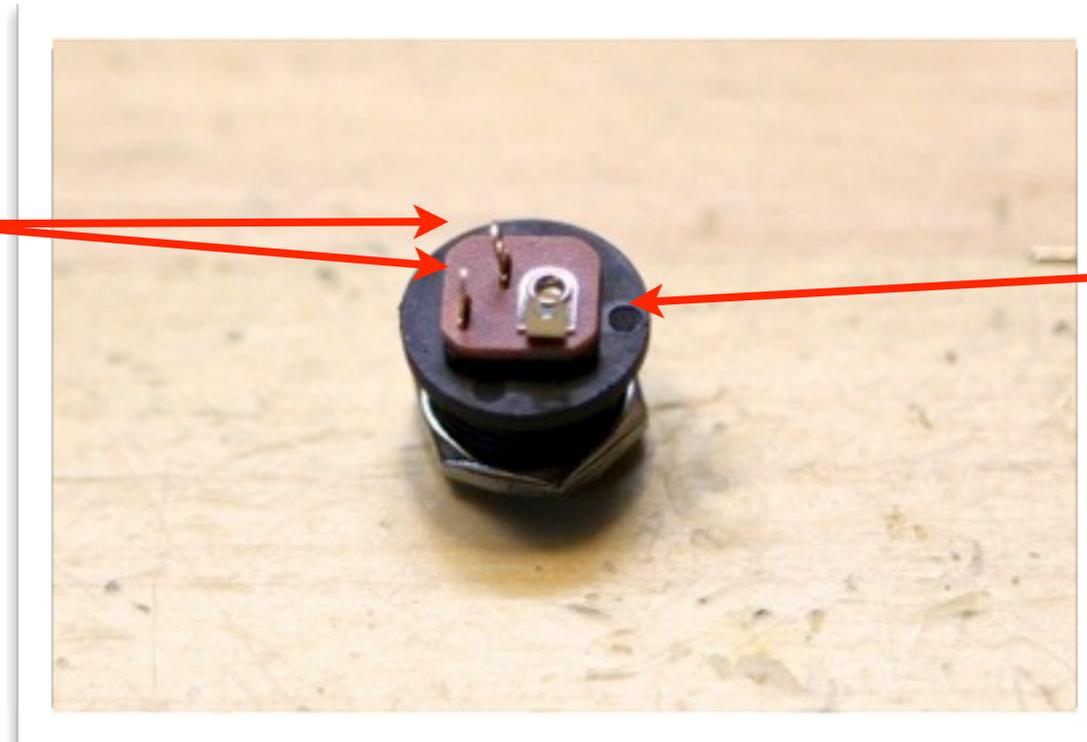
The process covered here is pretty much the same for any standard stompbox circuit. There may be more knobs, LEDs, switches, or whatever, but the basics remain the same.

Before proceeding, you'll need an enclosure. I like 1590B boxes because they're they're so compact, and that's the type shown here. If you want a little more working room, consider the slightly larger and deeper 125B. You'll need it drilled for two knobs plus an LED, which means seven holes total (input and output jacks, footswitch, two knobs, the LED, and a DC power jack).

You can buy pre-drilled—and even pre-painted—enclosures from such online vendors as Mammoth Electronics and Pedal Parts Plus. (If you're enough of a workbench stud to own a drill press, you can make your own holes quite easily, though it helps to use an Irwin-style stepped drill bit.) You can find drilling templates online: Just google the box size + “drilling template”

Meet the DC Power Jack

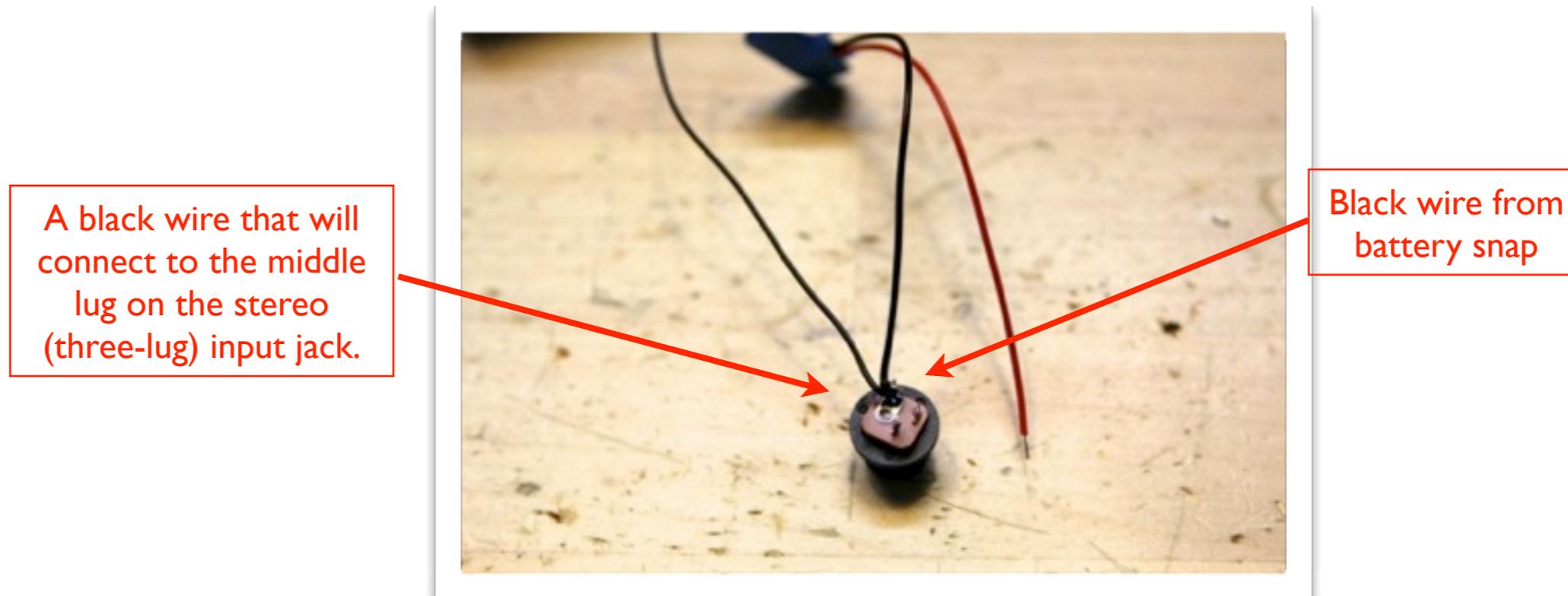
Smaller
terminals are
positive.



Large terminal is
negative.

The DC jack lets you power your pedal with a standard, negative-ground power supply. This is the ubiquitous barrel-type connector used by Boss and most other pedal manufacturers. Some DC jacks fasten via a nut that resides inside the enclosure, and some, like the one pictured here, have the nut outside the box. The latter kind can be easier to work with because it lets you a) solder the jack before screwing it into the enclosure, and b) remove *all* the electronics from an enclosure without any de-soldering, should you want to transplant an effect to a new box.

DC Jack: Negative Connection

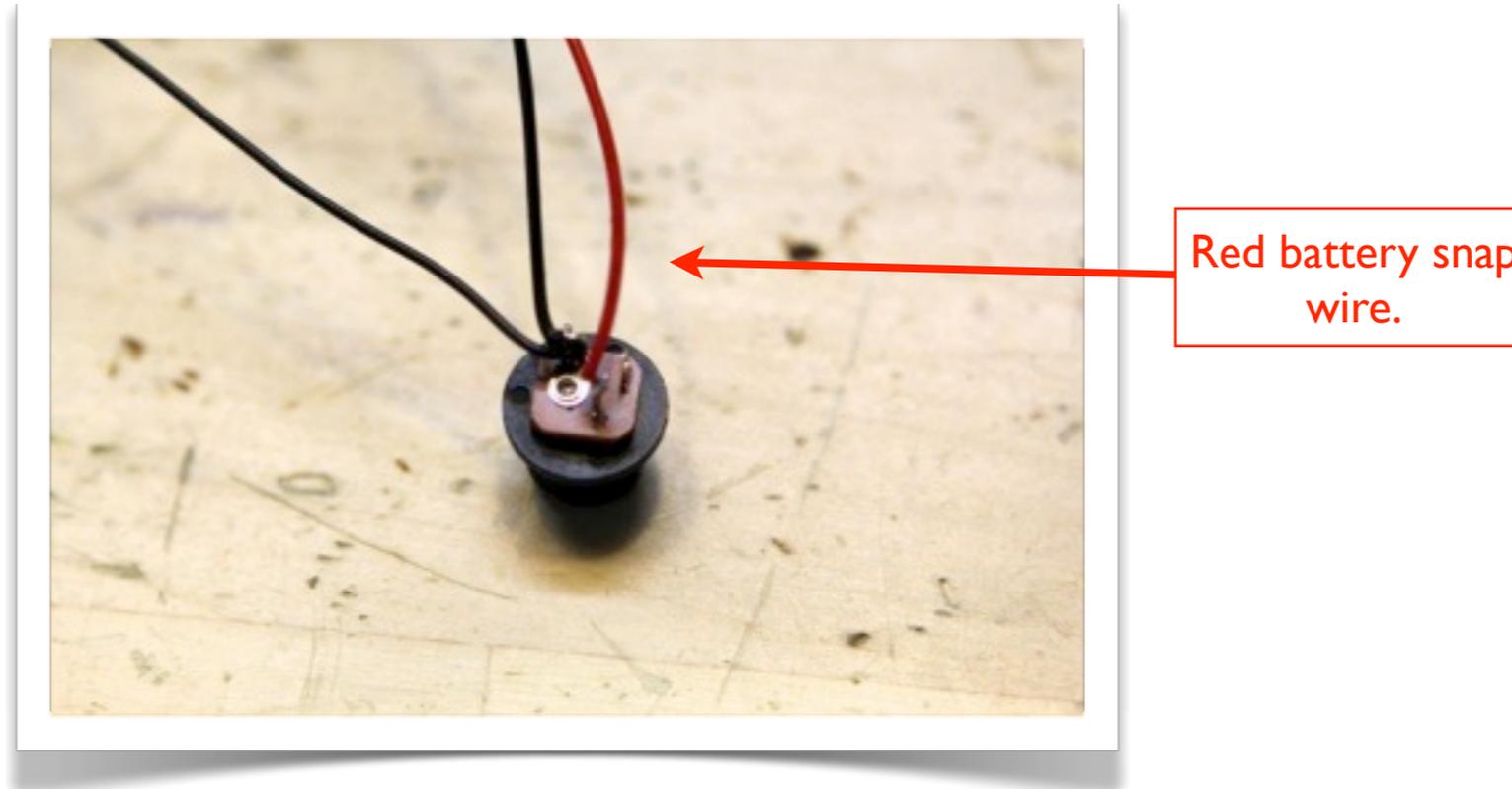


If your DC jack is the screw-on-the-inside type, you'll need to screw it into the enclosure before completing the following step.

You need to solder *two* wires into the large negative terminal: The black wire from the battery snap, and a second wire that will connect to the middle lug of the stereo (three-lug) input jack.

Before soldering, verify the needed wire length, which varies from enclosure to enclosure. The box pictured in this lesson has the hole for its DC jack on the north surface of the pedal, so I need about three inches of spare wire to reach the spot where the battery will reside, south of the footswitch. If your DC jack hole is next to the input or output jack, you'll only need an inch or so of wire.

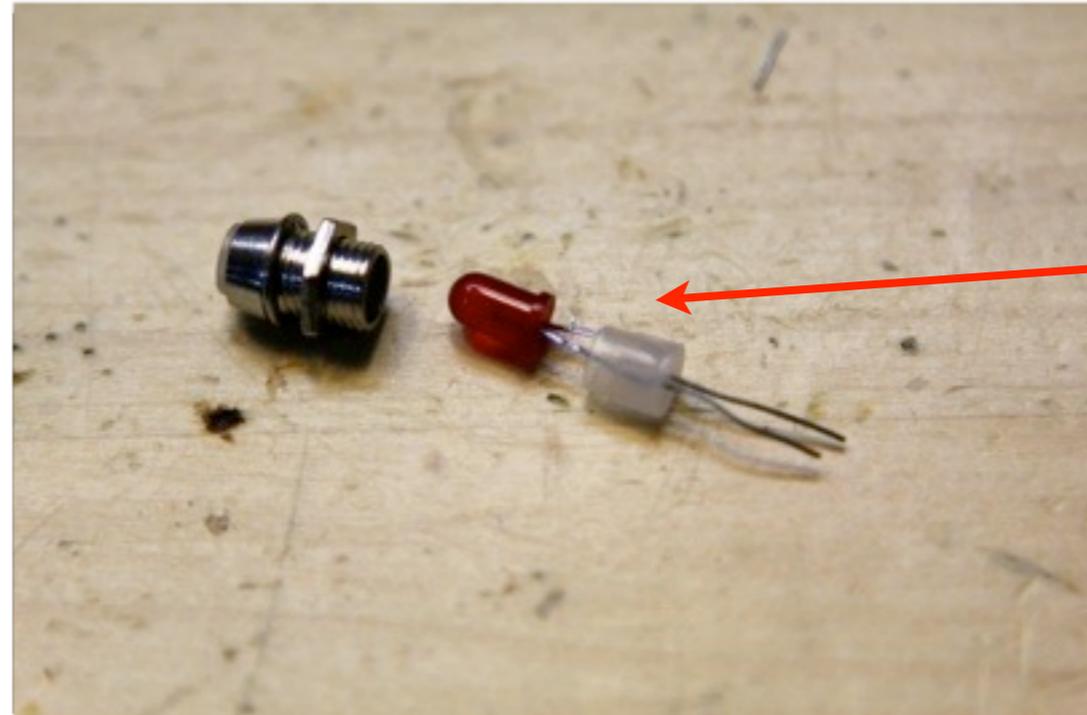
DC Jack: Positive Connection



Connect the red wire from the battery snap to DC jack's middle terminal, the one closest to the negative terminal. FYI, we'll eventually be connecting the power wire from the perfboard to the third terminal. That way, when there's no adapter connected, the effect runs on battery power. When you connect an adapter, it breaks the connection to the battery, conserving its juice.

Study this illustration closely. If you connect get the positive connections backward, the pedal won't work right.

Meet the LED Bezel



The narrower end of the LED retainer faces in toward the bezel.

Here's one common type of LED bezel, sized for a standard 5mm LED. There are many variations on this theme. FYI, you can use any color LED you like, or opt for a smaller 3mm one.

We'll be soldering wires to the LED's legs shortly, so thread them through any sort of plastic retainer that may come with your bezel. Try assembling the parts to verify that everything is oriented correctly.

Attach the Hardware

Mount all the hardware inside the enclosure. When viewed from the backside like this, the stereo (three-lug) input jack goes on the left, and the mono (two-lug) output jack goes on the right.

It's your choice whether to use or discard the big plastic nut that comes with most footswitches of this type.

You may have to finesse the positioning of the jacks relative to the big footswitch. Sometimes, as here, they'll only fit if oriented a certain way.

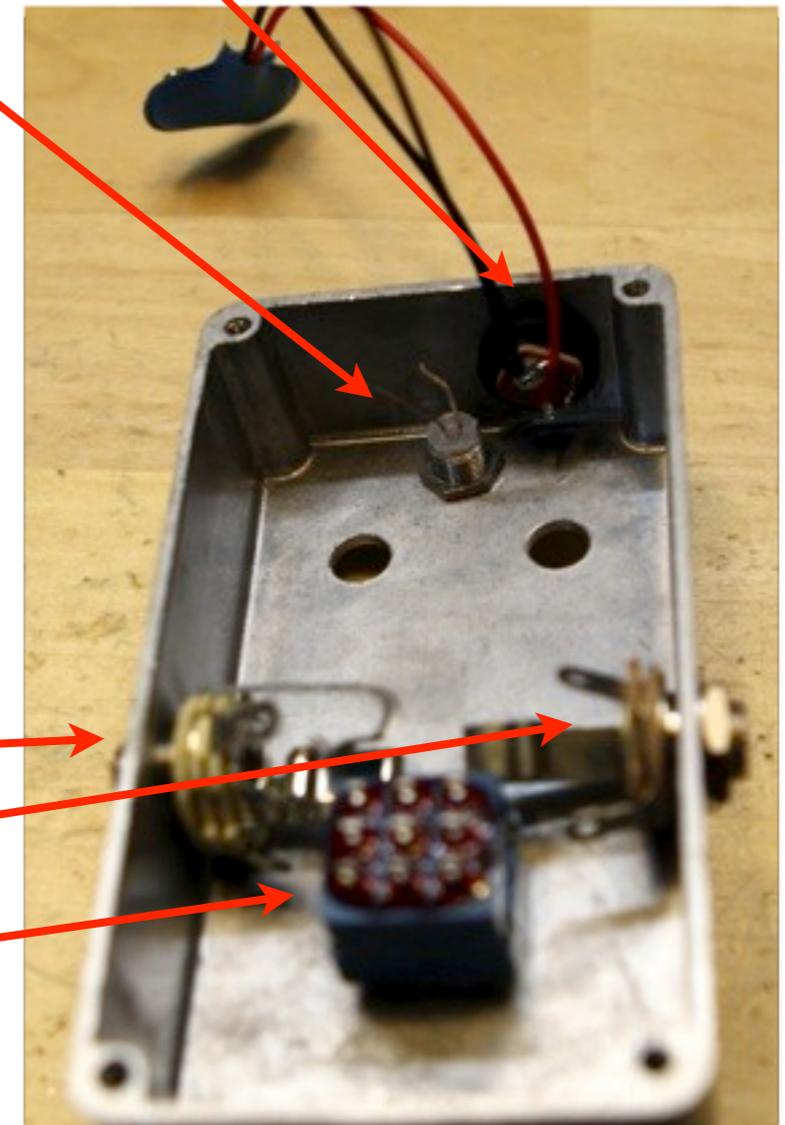
DC jack

LED assembly

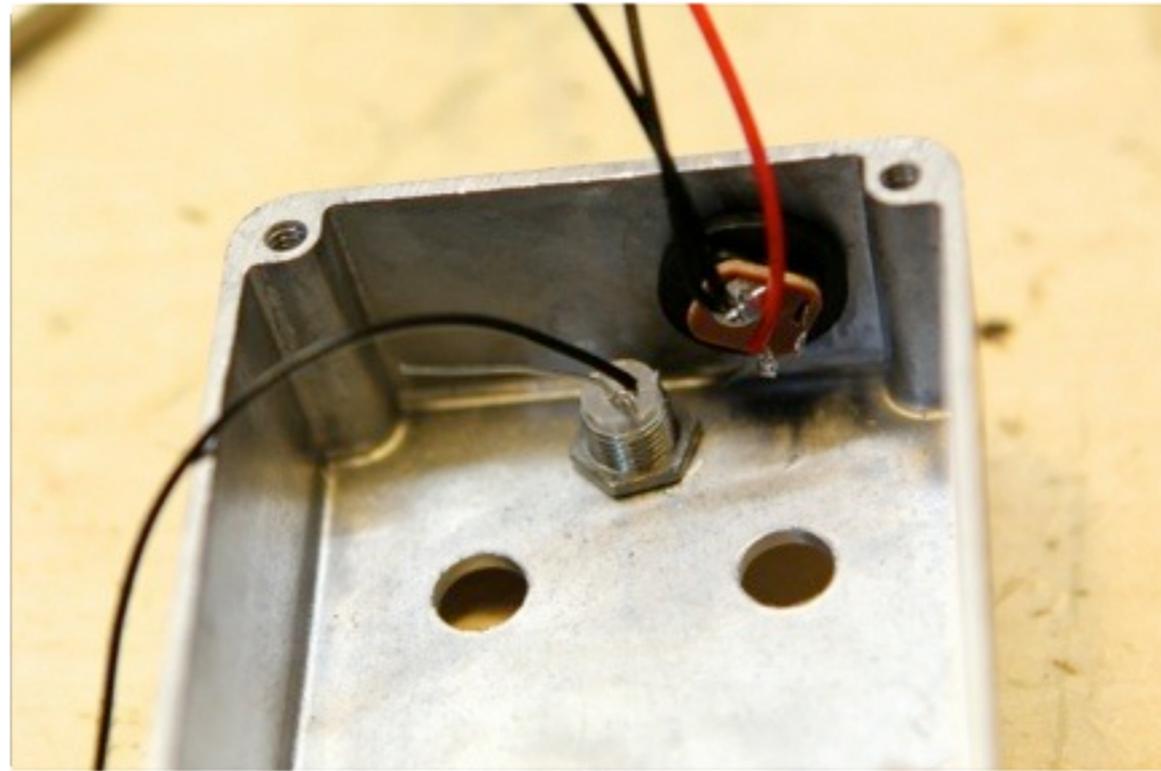
3-lug input jack.

2-lug output jack.

Footswitch

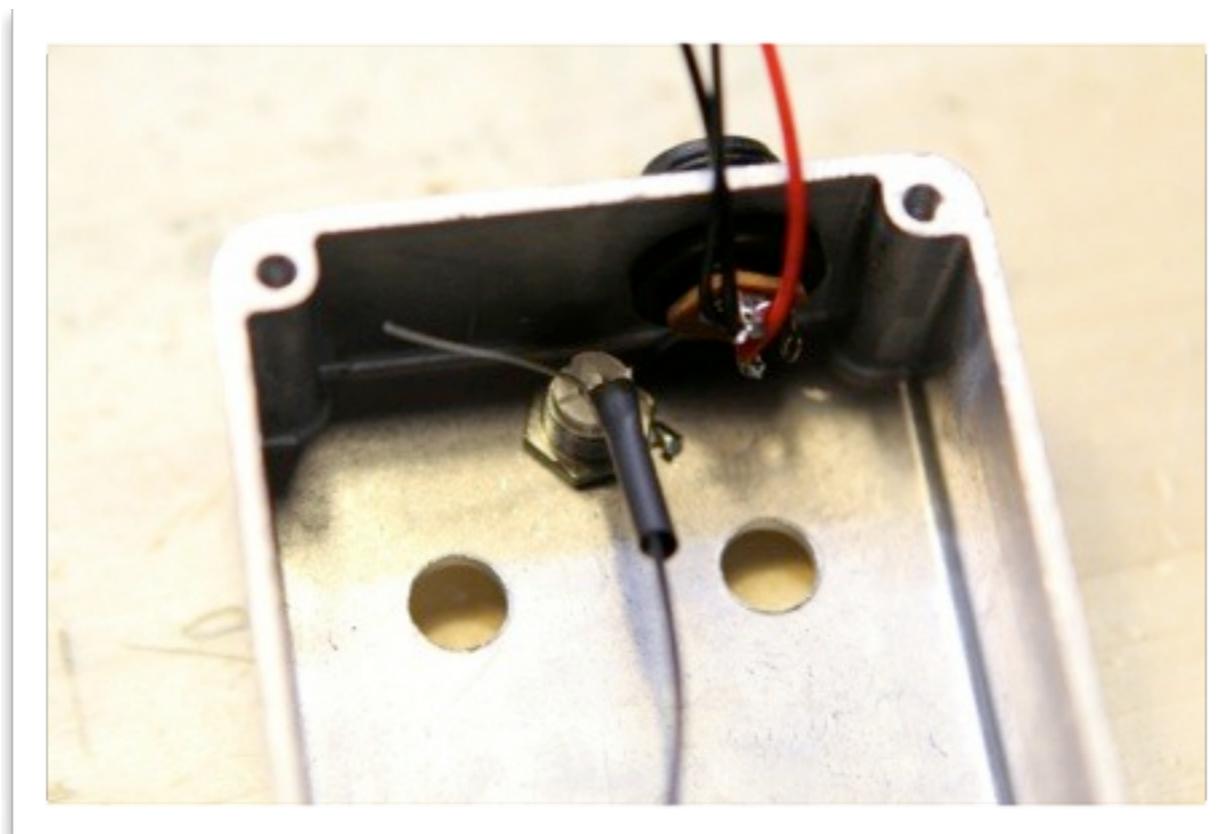


Solder the Negative LED wire



Cut a piece of black wire long enough to reach from the LED to the footswitch. Strip one end and twine it around the LED's negative leg (the *shorter leg*). Solder them together.

Apply Heat-Shrink Tubing?



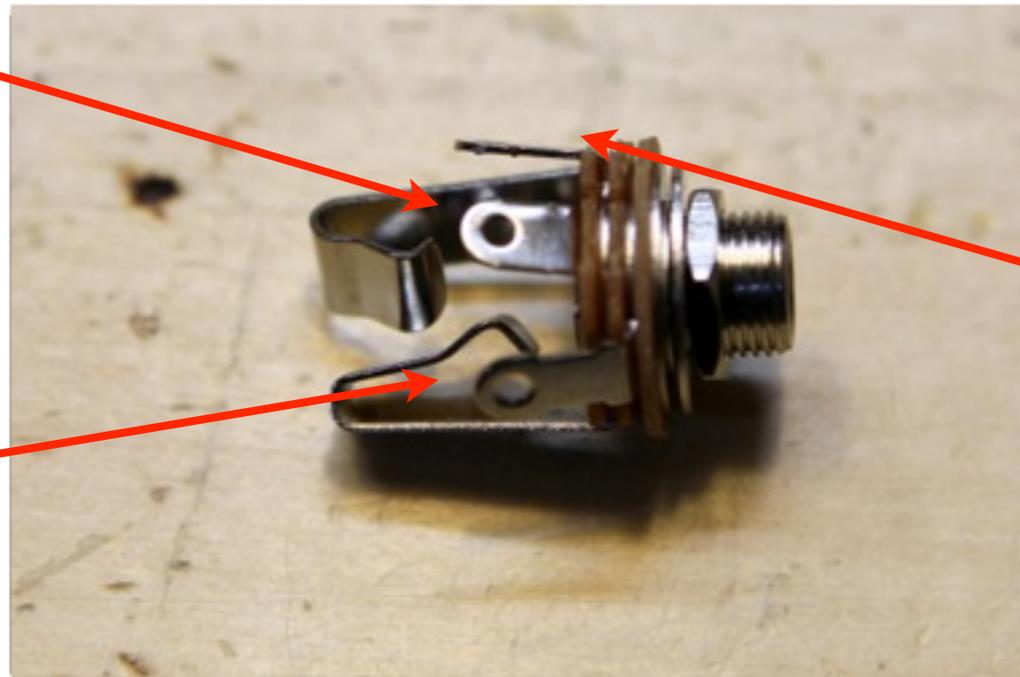
It's a good idea to use a bit of heat-shrink tubing in cases like this, where where bare wires that shouldn't touch each other reside in close proximity. Snip off a piece of 1/8-inch-diameter tubing and work it over the solder connection. Carefully apply a match, lighter, or heat gun for a few seconds until the tubing shrinks are resets, sealing the connection.

If you don't have heat-shrink tubing, a bit of electrical tape will do.

Meet the Stereo Jack

Innermost lug
(farthest from nut)
is ground.

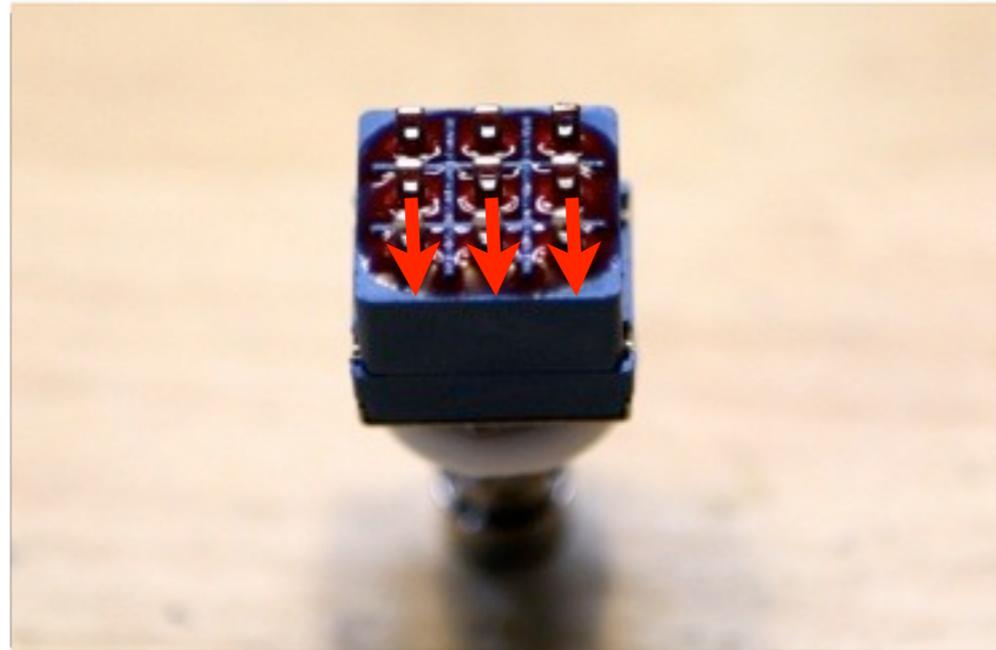
Outermost lug
(closest to nut) is
audio signal.



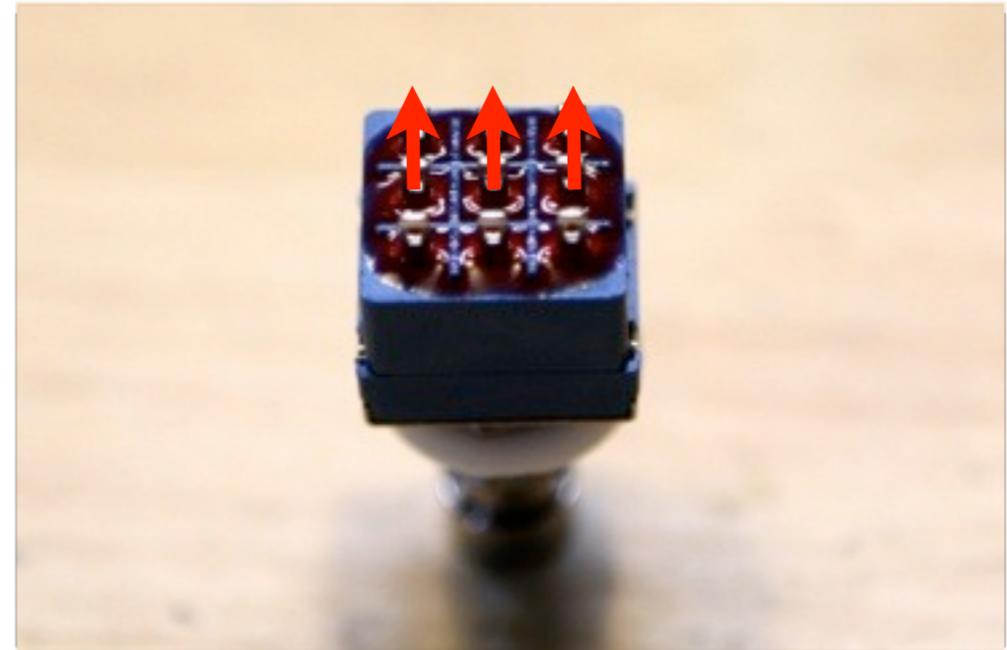
Middle lug connects
to DC jack's
negative lug.

It's called a stereo jack because it has three terminals capable of carrying two audio signals, but we're not configuring it that way. Instead, we'll use two of the lugs for ground connections. When a plug is inserted, the innermost and middle lugs are connected, so the battery's negative terminal is grounded, and current flows. When the plug is removed, the battery's connection to ground is broken, and there's no drain on the battery. Clever!

Meet the Mighty 3PDT Footswitch



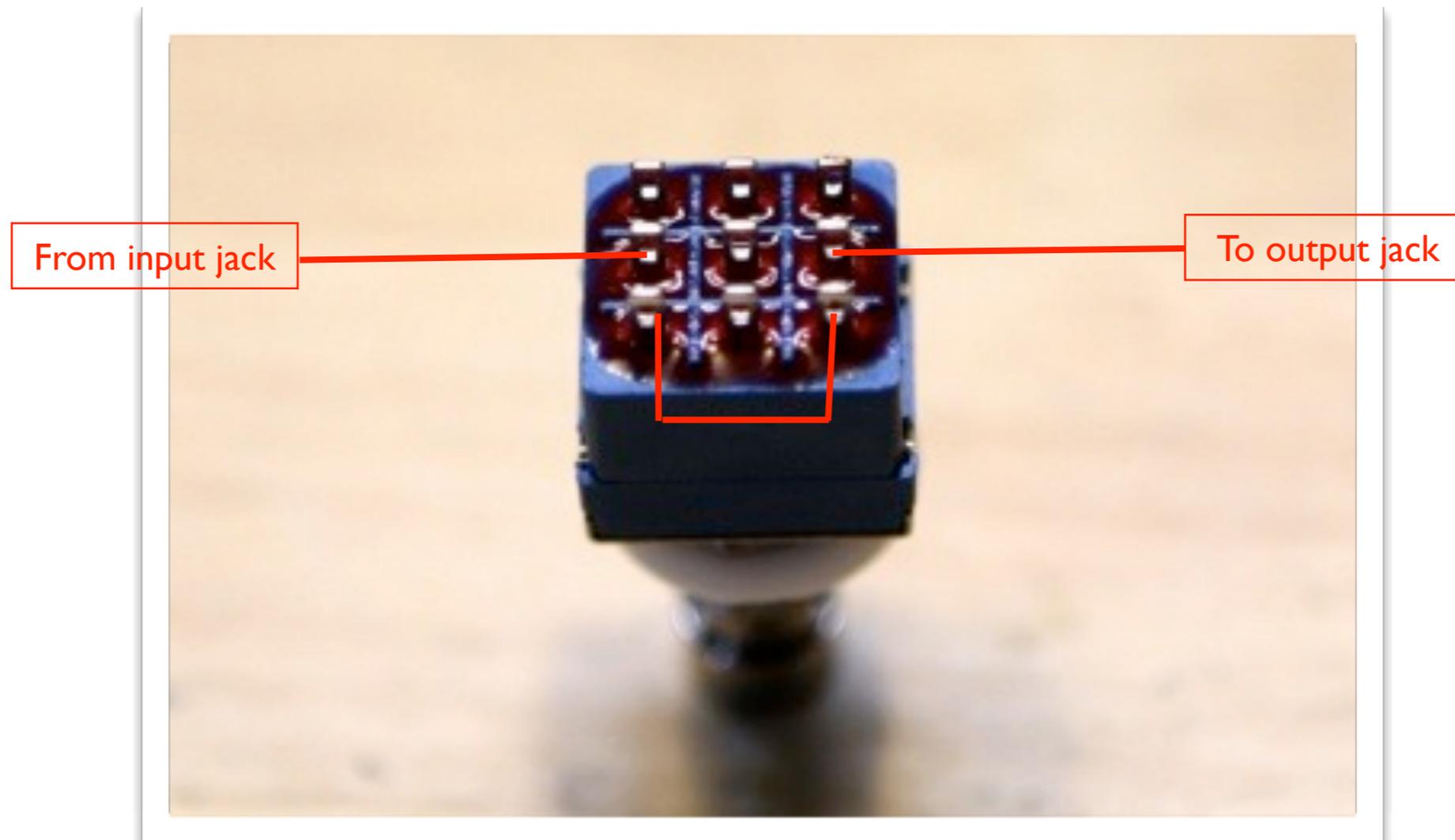
Switch off: The three middle lugs are connected to the three bottom lugs.



Switch on: The three middle lugs are connected to the three top lugs.

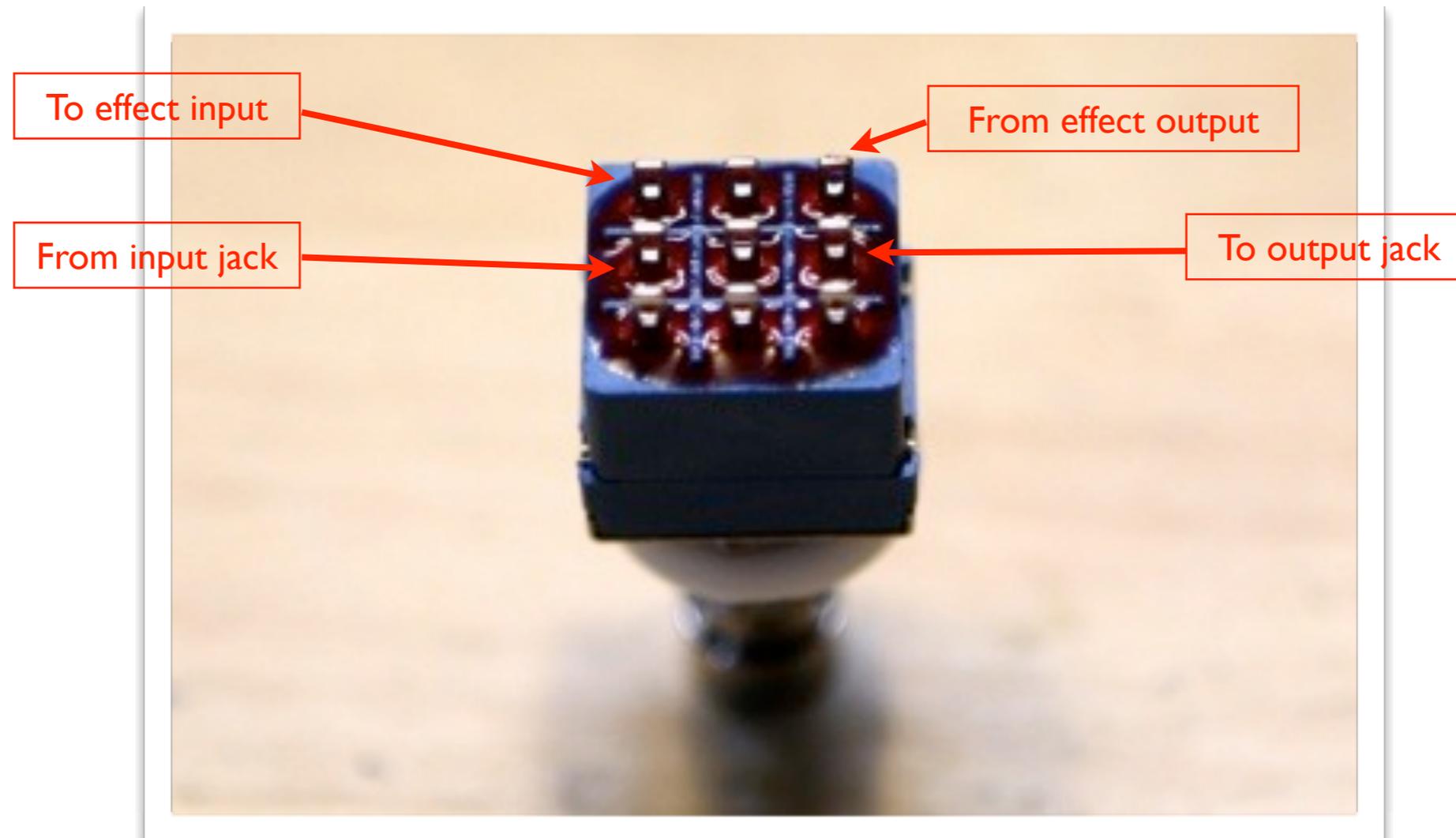
“3PDT” stands for “triple pole/double throw,” which means this is actually *three* switches, each with two possible positions (on and off).

When the Footswitch is Off..



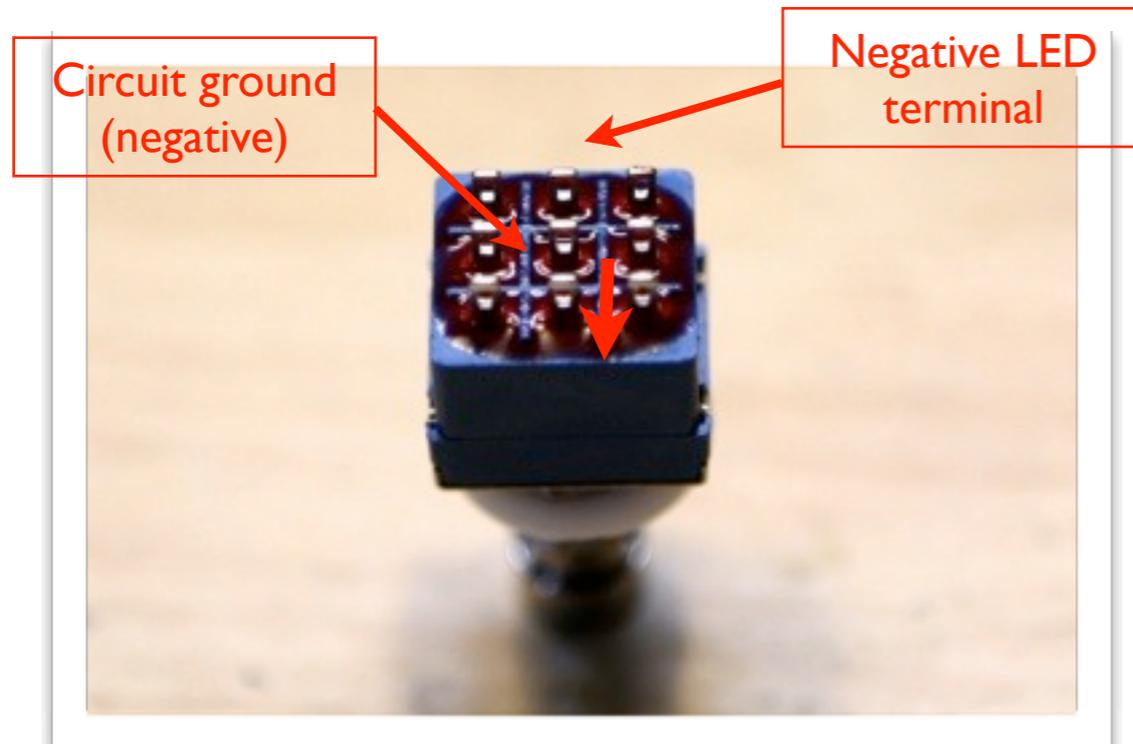
We'll be connecting a jumper wire between the lower-left and lower-right lugs. When the footswitch is in the off position, the signal will flow from the input jack through the jumper to the output jack.

When the Footswitch is On...

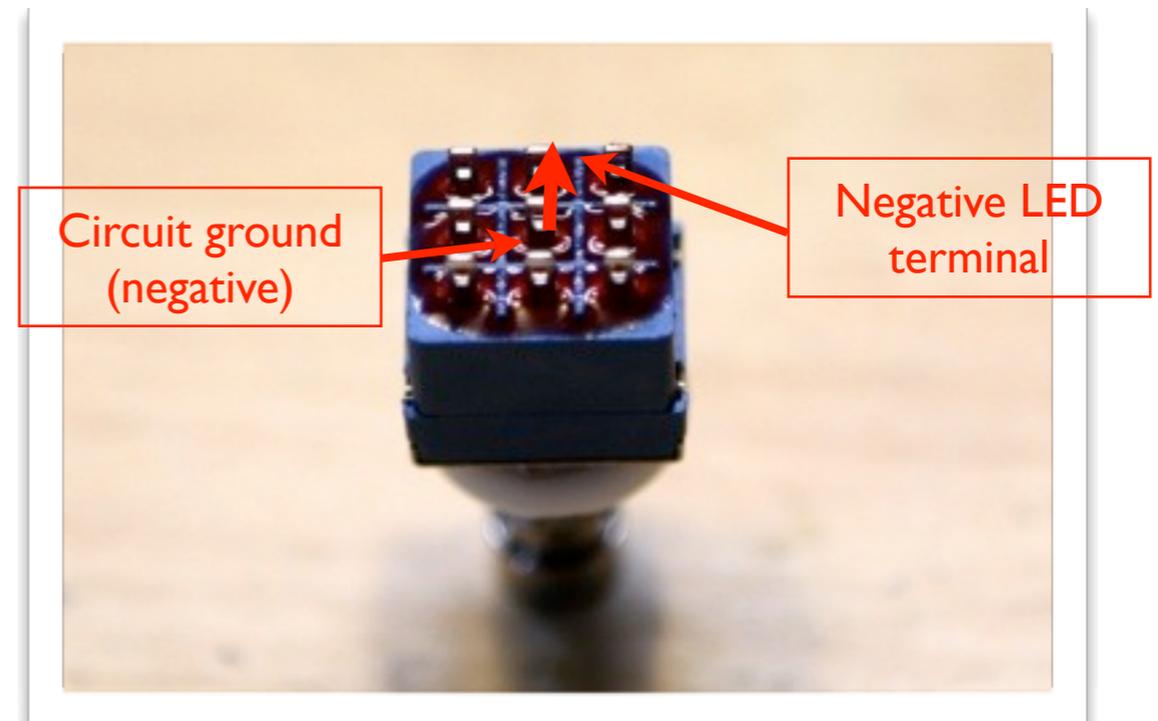


When the footswitch is on, the signal from the input jack is routed into the perfboard circuit via the upper-left lug. The effected sound returns at the upper-right lug (and in this project, via our volume pot), before exiting to the output jack through the right middle lug.

How the LED switching works



Switch off: There is no connection between the negative leg of the LED and the circuit's ground, so the light is off.



Switch on: The LED is connected to ground, so the light glows.

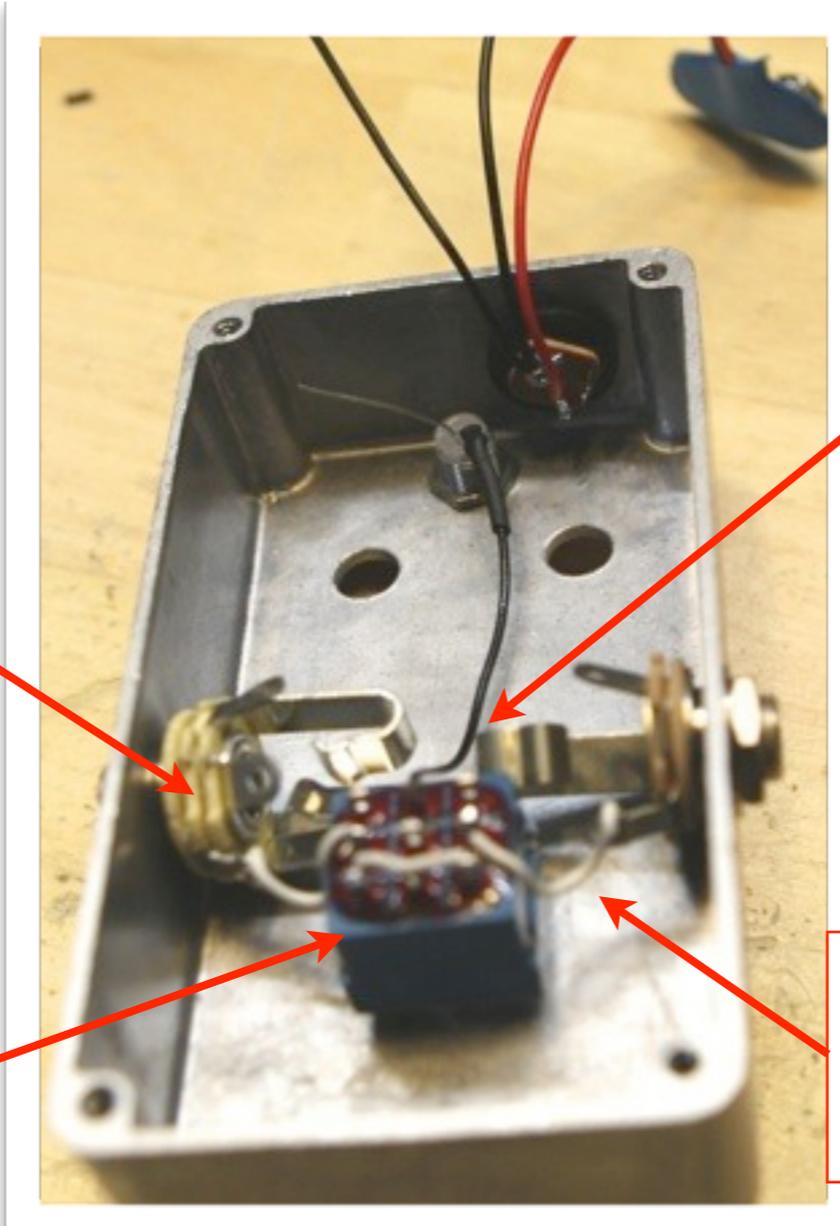
Back to Soldering!

Connect outermost lug of input jack to the left-middle footswitch lug.

Connect the wire from the LED's negative leg to the upper-middle footswitch lug.

Solder a small piece of wire between the lower-left and lower-right footswitch lugs.

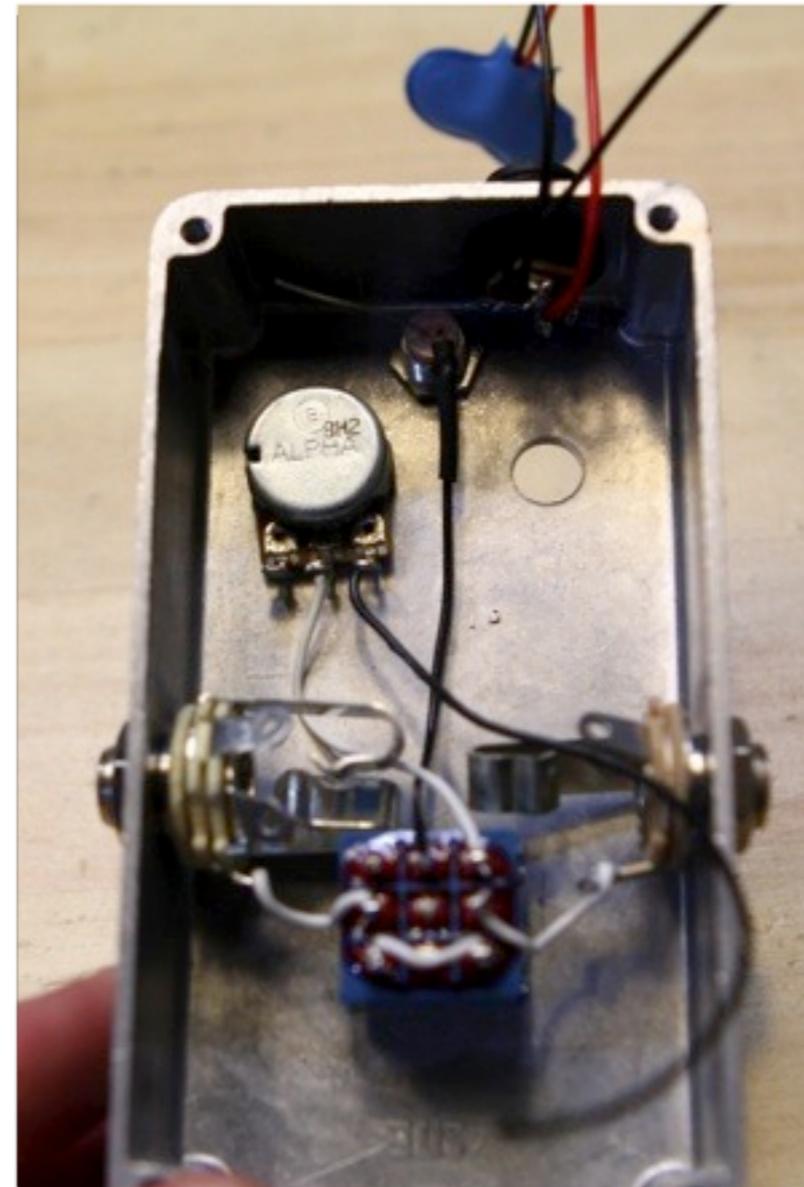
Connect outermost lug of output jack to the right-middle footswitch lug.



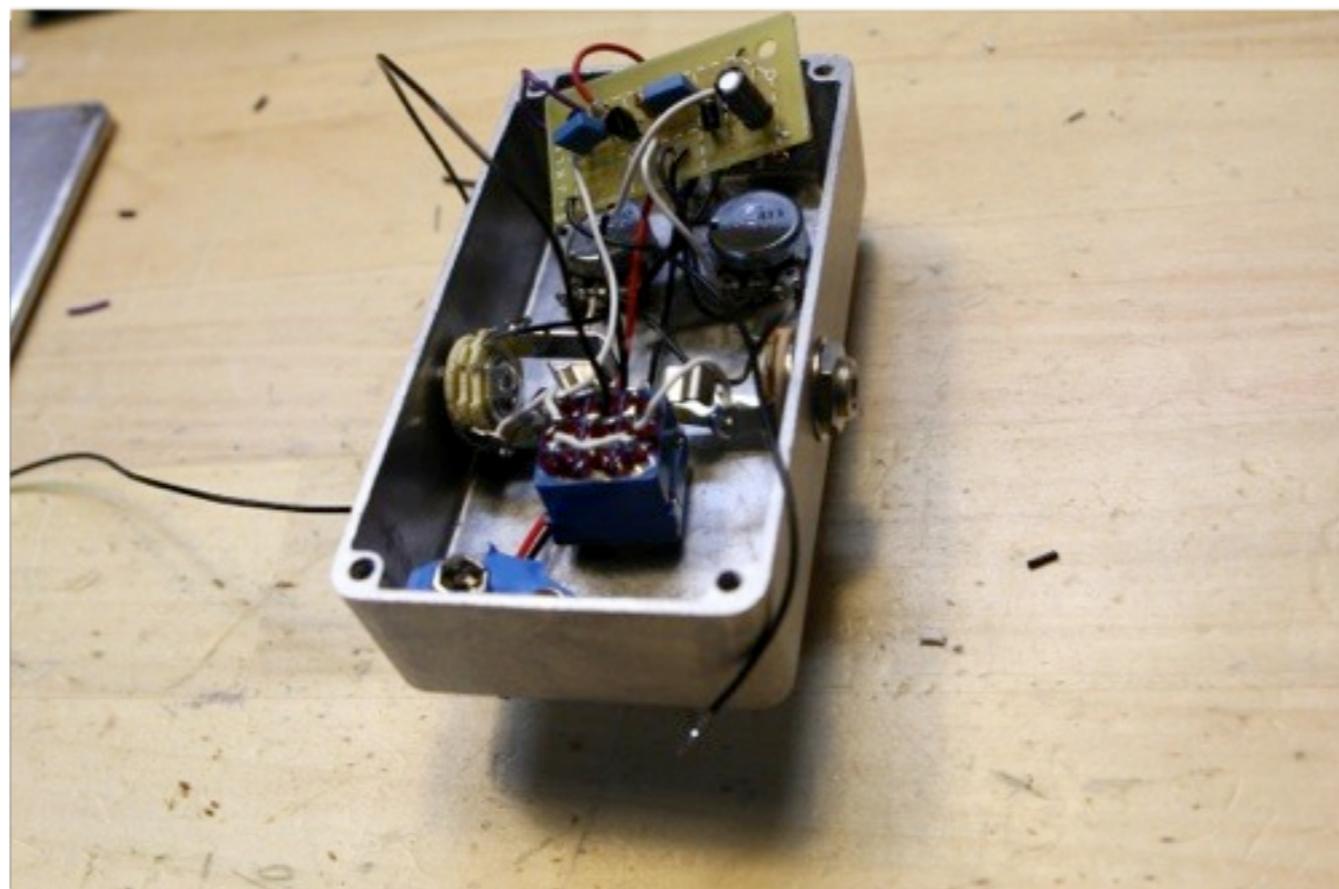
Install the Volume Pot

Install your A100K volume pot. It can go in either hole, though I prefer the left one, so the knob is on the right when you're using the pedal.

This is the very last stage in the circuit, trimming the volume of the effect before it returns to the footswitch. Connect lug 2 (middle) to the upper-right footswitch jack with white wire. You'll need two or three inches of black wire to connect lug 1 (the rightmost one, when viewed as shown) to ground, which we'll do in a moment. If you've already connected a wire to lug 3 (the leftmost one when as viewed here), desolder it now. We'll be connecting the output from the perfboard here in a moment.



Install the Gain Pot

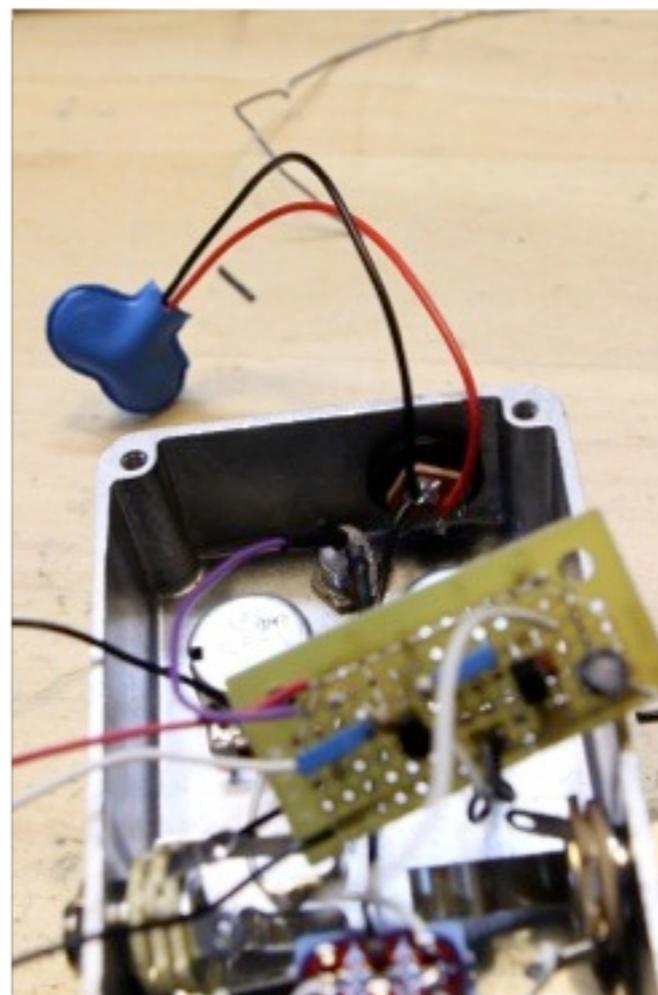


Screw the C10K (or B10K) gain pot into the enclosure. All three terminals should already be wired to your perfboard. Organize the mess of wires as best you can, weaving the battery snap down toward the area below the footswitch, where the battery will reside.

Connect the Power and LED

Connect the wire from the 4.7K LED-protection resistor (the one we added near the end of Part 3, which appears here in purple) to the positive (longer) leg of the LED. If you're going to use heat-shrink tubing, make sure to slip the tubing over the wire *before* you solder.

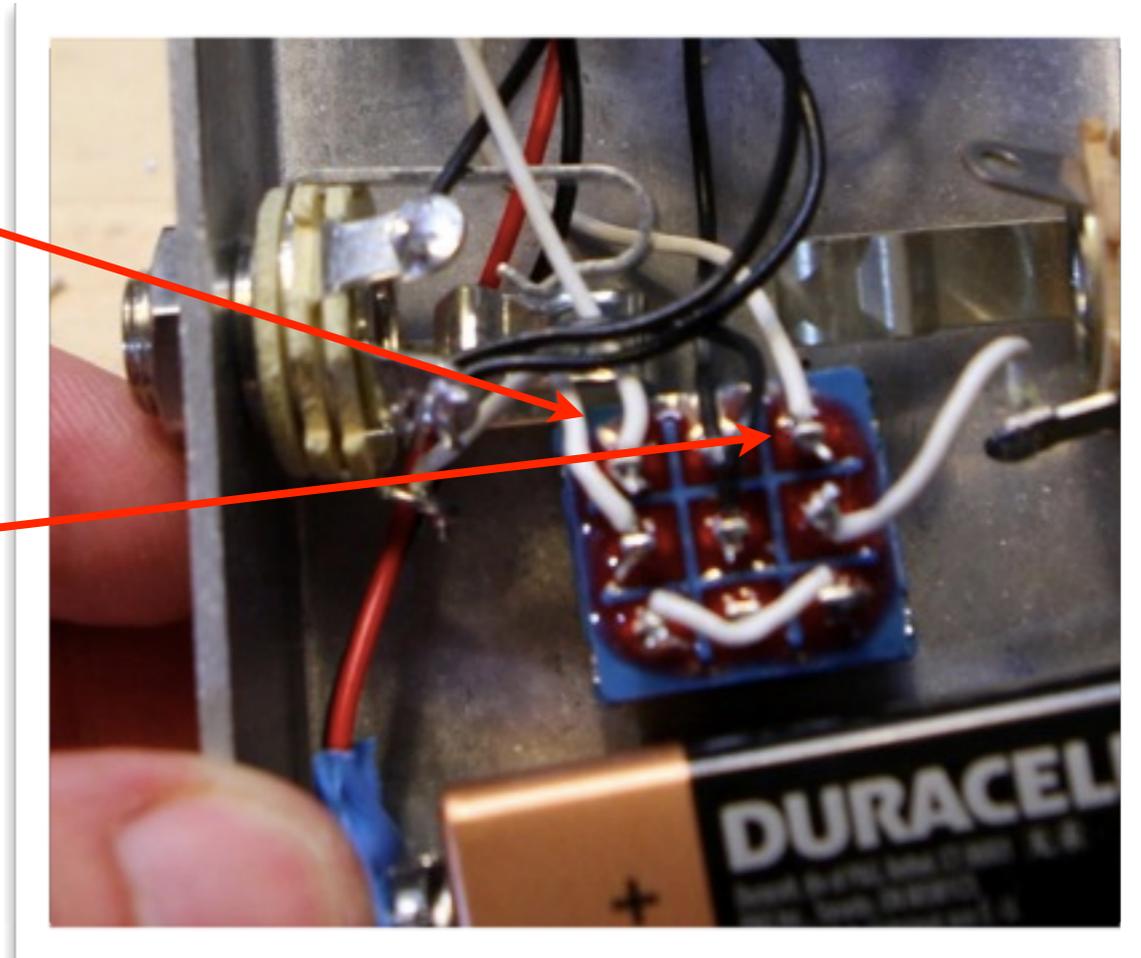
Also, solder the red power wire from the perfboard to the unused lug of the DC power jack—the one furthest from the large negative jack.



Connect the Effect Input and Output

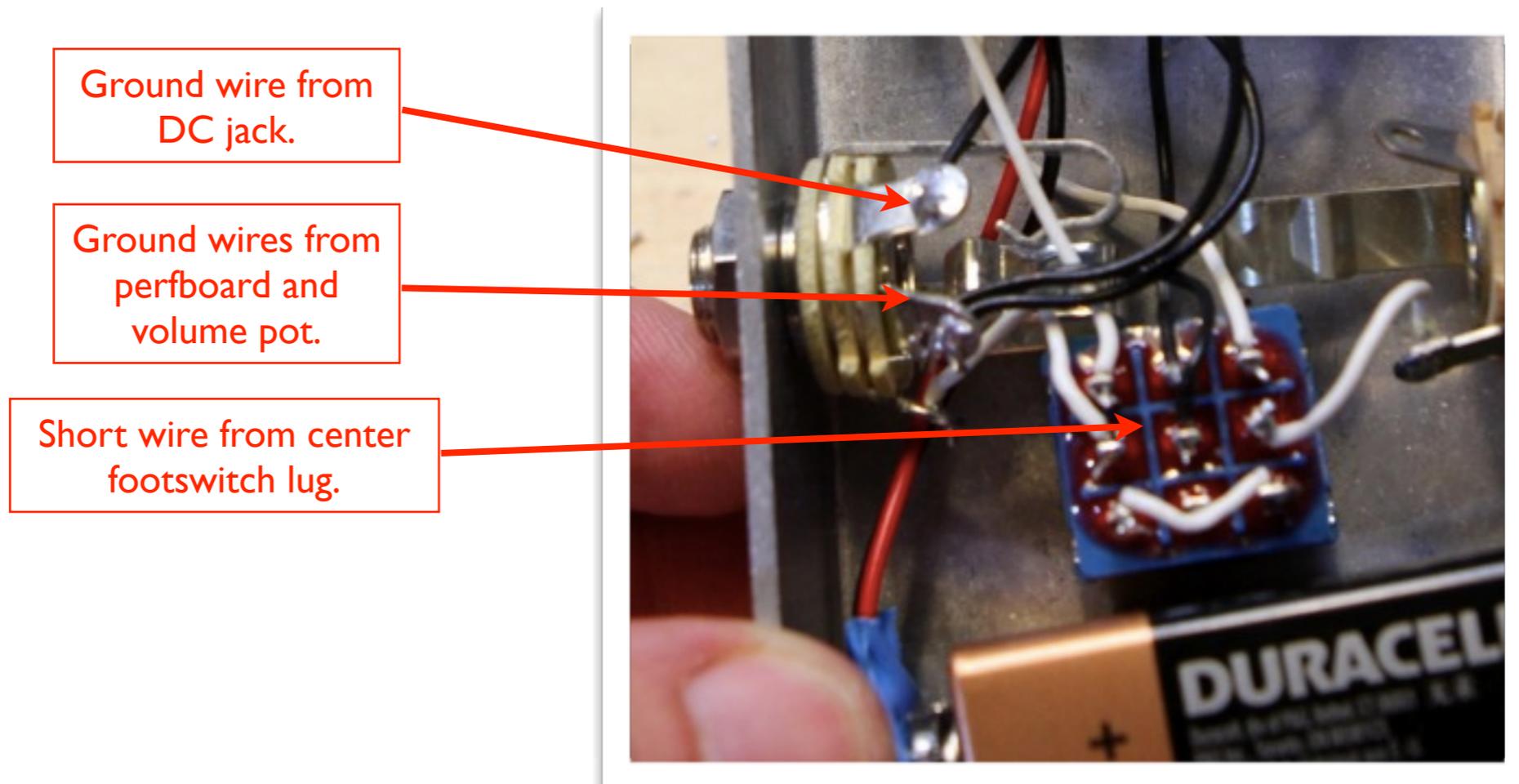
To perfboard input.

From volume knob.



Solder the output wire from the perfboard to the empty lug 3 of the A100K volume pot. Next, solder the perfboard's input wire to the footswitch's upper-left lug.

Connect All the Ground Wires



All the ground wires in a circuit must be connected for the circuit to work properly. There are many ways to achieve this, but I recommend uniting them at the innermost lug on the input jack, simply because it's a nice, big, easy-to-solder hole. You need to connect *three* wires here: the black ground wire from the perfboard, the black ground wire from the A100K volume pot, and a third short wire connecting this input jack lug to the center lug of the footswitch (to complete the LED ground connection explained on page 13). Finally, solder the loose ground wire from the DC power jack to the input jack's middle lug.

Cross Your Fingers!

Before we fasten everything down, test your work.

Try plugging in the pedal. (Remember, with the top of the pedal facing you, your guitar goes into the right jack.) When you click the footswitch, the LED should illuminate, and you should sound awesome.

If only the light or the effect are working, recheck the relevant connections. verify that you connected everything to the correct lugs, especially on that tricky input jack.

If you have no light and no awesome sound, confirm that you hear your guitar when the pedal is bypassed. If not, it's probably a bad ground connection. You should definitely sort this out before messing with anything connected to the perfboard.

Fasten Down the Perfboard



Fasten the perfboard assembly to the back of the tone pots, preferably using a short length of double-sided foam tape. This will keep the components in place and prevent any perfboard components from shorting out from contact with the pots.

Arrange the Wires



You might want to use a small cable tie to organize some of the messy wires—especially if you’ve inadvertently made some of them longer than necessary. This step is strictly cosmetic.

Check again that everything is working. If so, screw down the enclosure’s black plate and check again. Sometimes a short will appear only after you screw on the back, especially if the components are tightly packed. You can use additional lengths of double-sided tape applied to the inside of the enclosure back to prevent shorts.

Finishing Touches



Add your knobs of choice. Apply stickers, because stickers are cool. Enjoy.