

Tonefiend DIY Club Tutorial: How to Install Onboard Effects

By Joe Gore



This article explains how to mount battery-powered effects inside a guitar or bass. It does not, however, cover how to make the effect circuits themselves, though you can find that info on the [Tonefiend DIY Club page](#). (A great starting point is [Project 1](#), in which you build a wicked distortion pedal while learning what the basic components and how to assemble circuits on breadboard and circuit board.)

Step 1: Audition the Effect *Outside* the Guitar or Bass. This should be a no-brainer, but I mention it because more than once, I was so confident a circuit would suit a guitar that I barreled ahead with the install, only to have to do it all again. Once you have a circuit assembled on your breadboard or PCB, try it out with the guitar it's destined for, not just whatever's closest to the workbench.

Now is also a great time to decide whether your circuit will sound best before or after your guitar's volume pot. Roll back the pot and listen — hear any cool variations? If so, you'll want to put the effect after the volume pot so you can dial in those variations later. If not, put the effect before the volume pot, so the effect always gets maximum signal, and the pot serves as a post-effect master volume. (Examples: The fuzz circuit I put in the Hello Kitty Strat only sounds best when floored, so I put it pre-volume pot. But the Rangemaster-style overdrive in the Pagey Project Paul responds beautifully to varying levels, so it went in post-volume pot.)

Step 2: Survey the Terrain. Open your guitar's control cavity and survey the space. Is there room for your circuit, and a 9v battery, and (in most cases) a bulky push-pull pot?

If not, is there anything you can remove? Might you want to replace large-format 24mm pots with smaller 16mm ones? Don't just eyeball it — try cramming the battery and circuit board in there!



This cheap Hello Kitty Stratocaster is a PERFECT candidate. You could house a family of four in there!

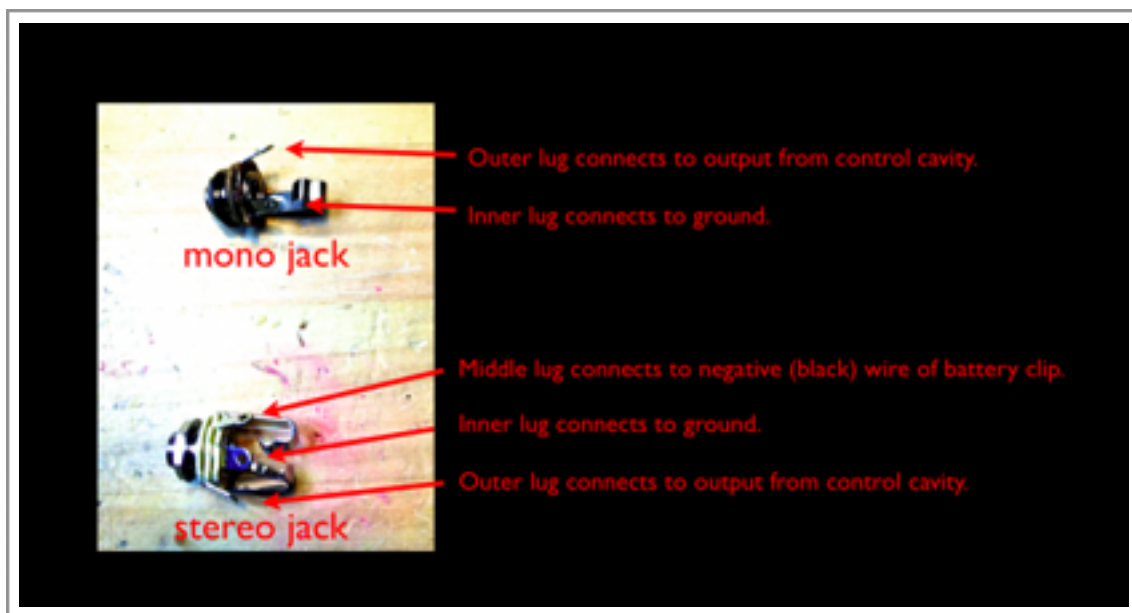
If there's not enough room, you'll need to rout out some of the body material. I'm generally too chicken to do much of this sort of work myself, but my guitar repair guy (and hero) [Gary Brawer](#) assures me that it's not a major job for a competent tech.

3. Assemble the Necessary Parts.

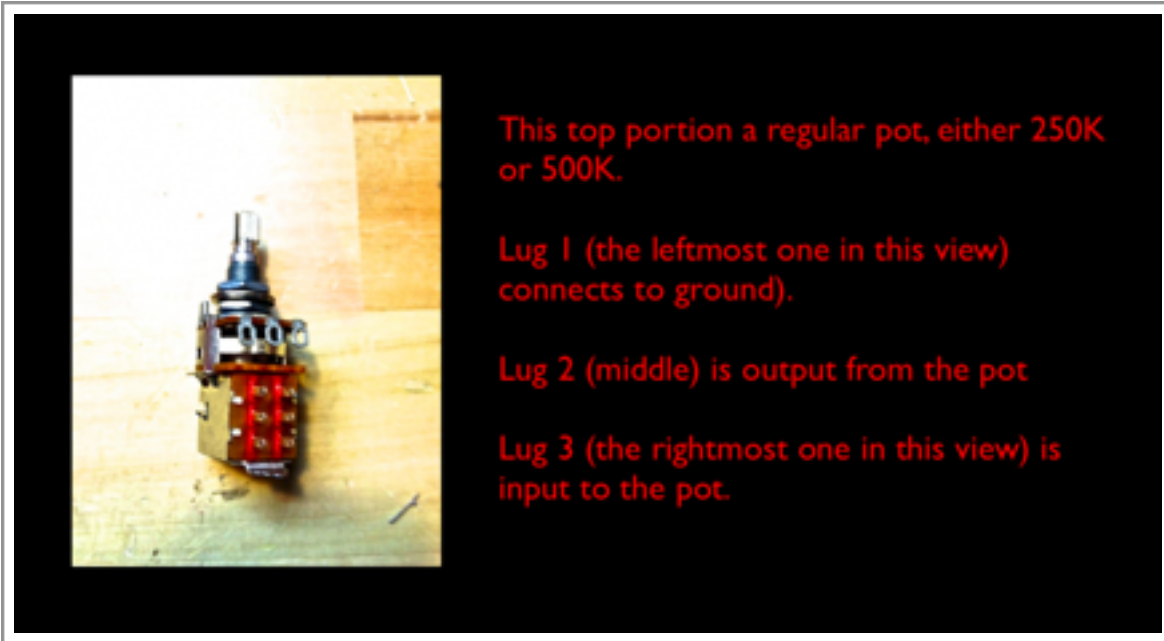
There's aren't many:

- A stereo output jack to replace your mono jack (unless your guitar has a stereo jack already).
- A push/pull pot (assuming you want to be able to switch the effect on and off). [Here](#) are some examples. Get the same value as your extant pot (usually 250K or 500K).
- A battery snap. ([Here](#) are some examples.)
- A battery clamp — either a simple metal clip, or [a battery snap with an integrated clamp](#). (Sometimes you don't need this — the battery may sit snugly between, say, two adjacent pots).
- Wire and solder, and maybe some [heat-shrink tubing](#).
- Double-sided mounting tape. ([This kind](#) works great.)

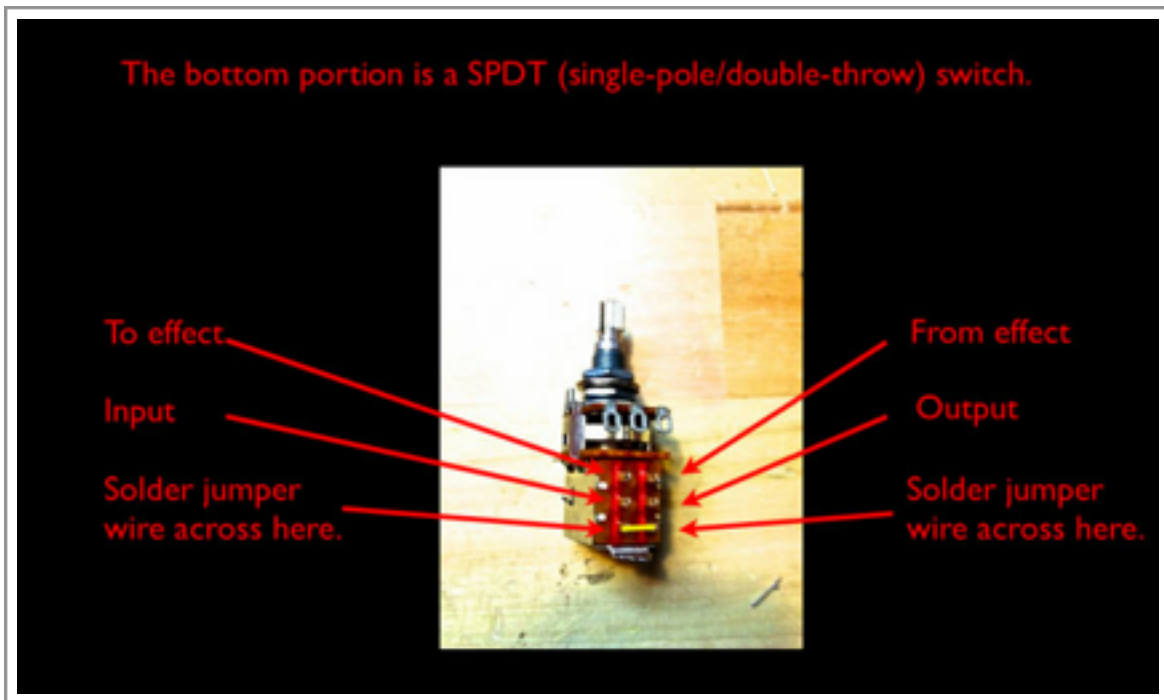
4. Replace the Output Jack. Unscrew the hardware. If it's a mono jack, remove it, either by desoldering the wires, or just snipping them close to the solder lugs. Replace with a stereo jack, and reconnect the hot and ground wires to the outer and inner lugs, respectively. The middle lug, absent on the mono jack, will connect to the ground (black) wire from the battery clip. When there's a plug in the jack, the ground wire and the battery ground are connected, enabling current to flow through the circuit. But when you unplug, the connection is broken, preserving battery life.



5. Your Friend, the Push/Pull Pot. Here's how they work: The upper portion is just like a regular pot. The bottom section is a simple SPDT (single pole/double-throw) switch. Here are the usual connections:



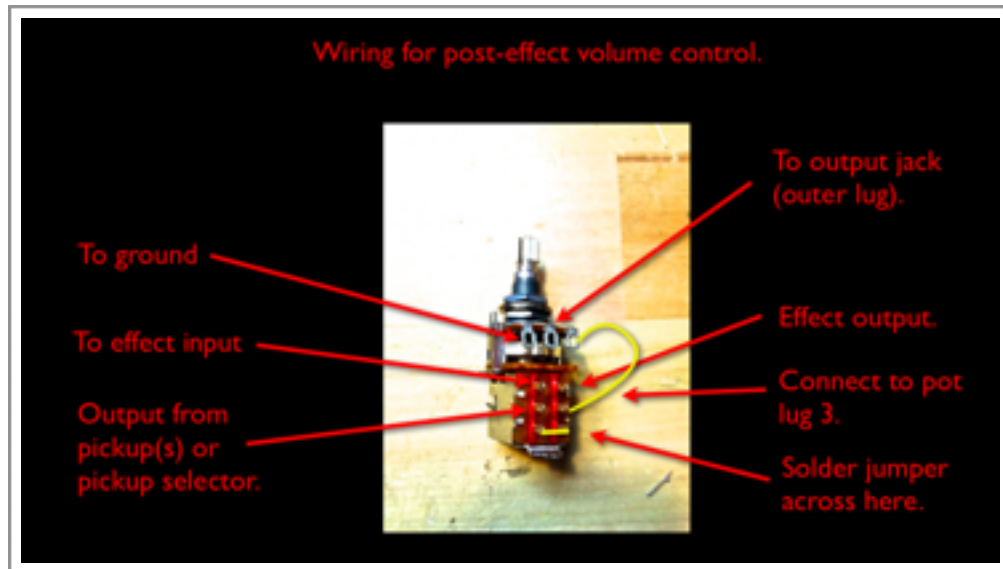
The top portion of the push/pull pot is your standard three-lug pot.



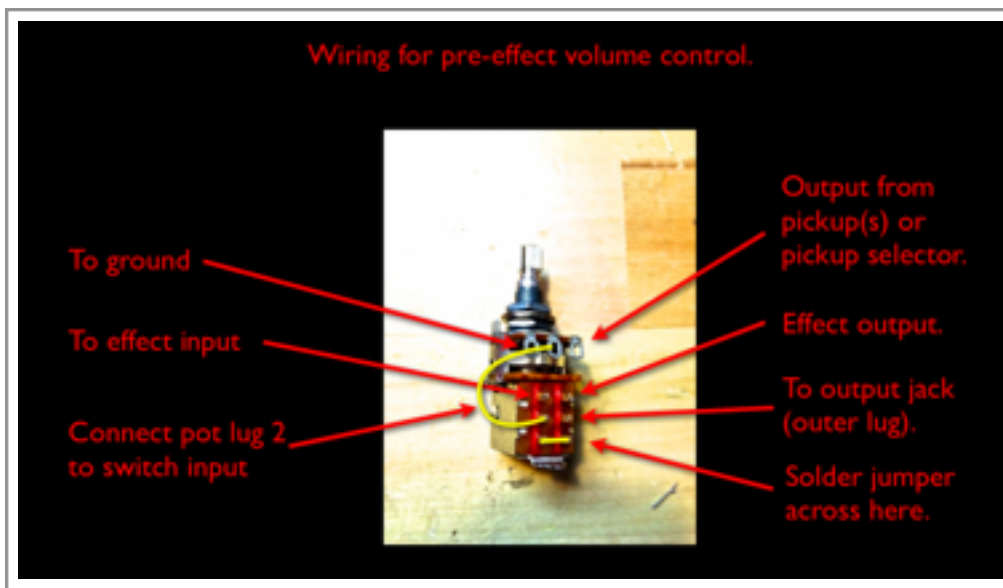
The lower portion of the push/pull pot is a SPDT switch.

When the switch is off (pushed in), the signal passes through the switch unchanged via the jumped wire. When the switch is on, however, it gets routed through your effect, like so:

You should have decided in step 1 whether you want to place your effect before or after the volume knob. Here's how volume-after-effect wiring looks:



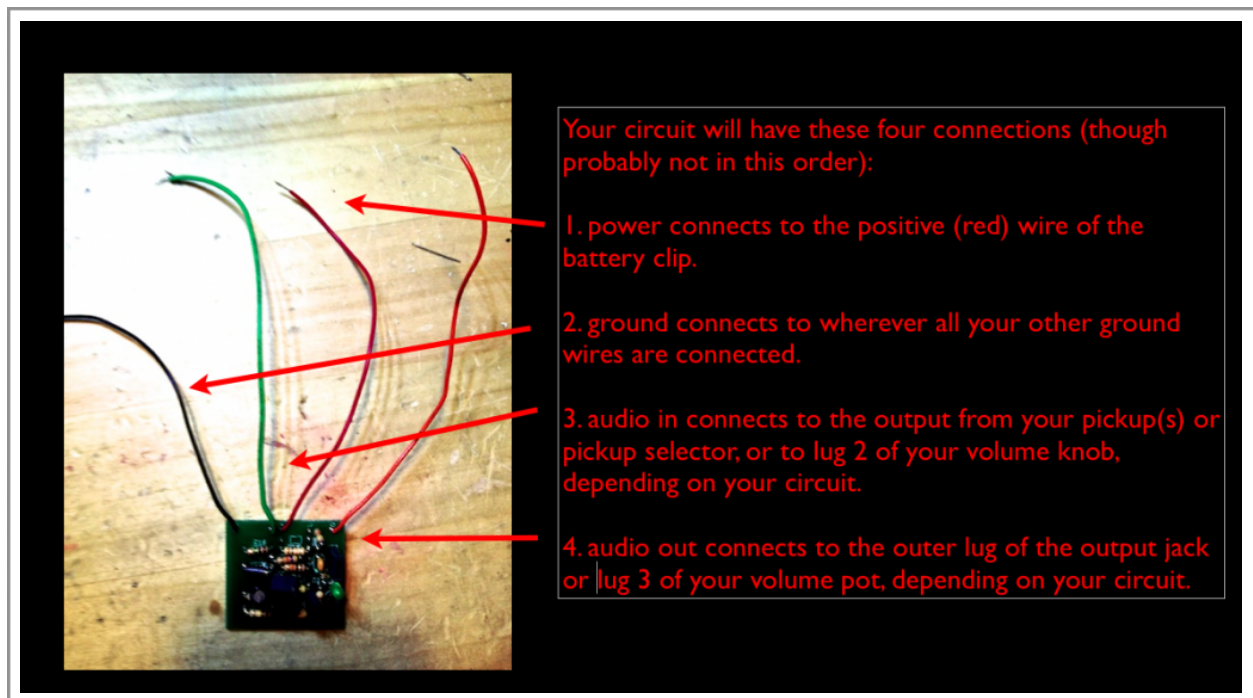
And here's the effect-after-volume wiring:



On conventional pots, it's usually easy to ground lug 1 by folding it back so it touches the pot housing, and then soldering it in place. If that's not physically possible on your push/pull pot, just solder a short length of wire to lug 1, and solder the other end to the housing. Remember, all the ground connections in your guitar must be connected (EXCEPT the battery clip's black wire, which goes straight to the middle lug of the output jack, so it's connected to ground only when a jack is inserted). You may need to solder an additional length of wire to the push/pull housing, and connect it to a ground point in your circuit (the back of another pot for example).

6. Study the connections from your circuit board.

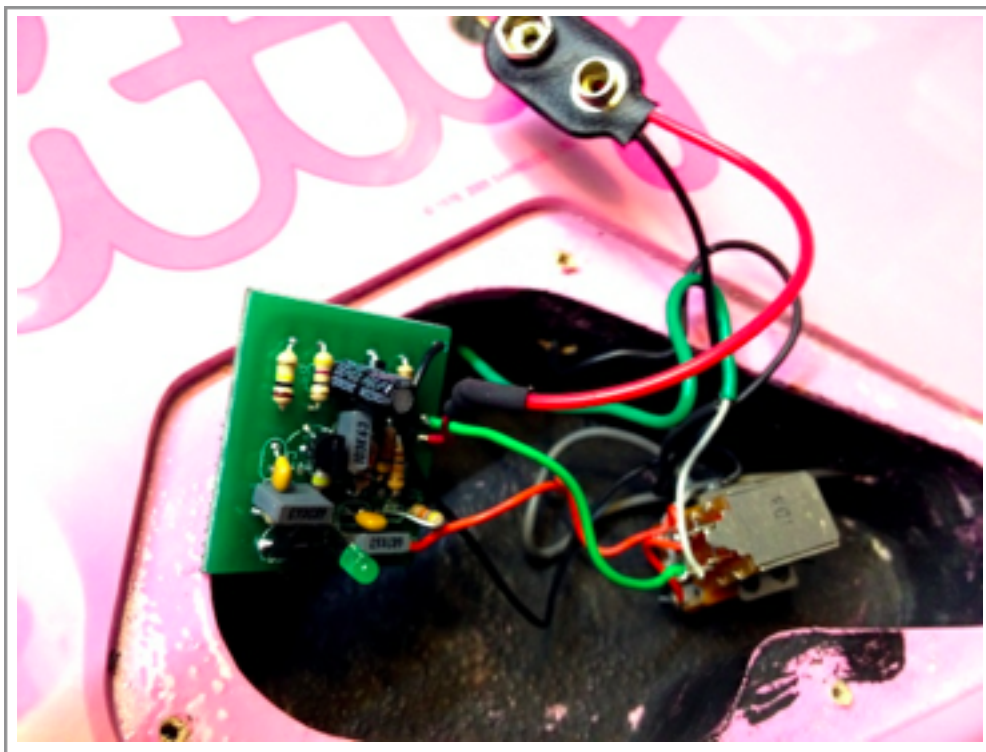
Different effect circuits have different wires sticking out of them, to put it technically. But all relevant circuits have four wires in common: audio in, audio out, power, and ground. Any additional wires will probably connect to knobs and switches. If your desired effect has some of these, you'll obviously need to drill extra holes in your pickguard or guitar, or replace your current pickup scheme with one that requires fewer pots, like single-volume/single-tone schemes, which can free up a pot or two on Strats and Pauls.



Fortunately, there are many cool circuits that require no knobs other than the volume and tone you already have. The three examples I linked to above all work great with no additional knobs (though I "cheated" with the Rangemaster and used a spare switch to toggle between two overdrive settings, though it would work fine with a fixed value). FYI, [Tonefiend DIY Club Projects 1 through 4](#) are all great candidates for no-extra-knob installs.

7. **Wire It Up!** You may need to extend some wires by soldering on extra lengths and securing them with heat shrink tubing. If your guitar has its output jack recessed into the body, you'll need to work the battery clip's negative wire through the narrow rout to solder it to the middle lug of the output jack. If your circuit board has wires extending from, as in the pic above, you can simply solder them to the appropriate wires and secure with more heat-shrink.

Here's how my Hello Kitty Strat looked at this point:



The nearly-completed circuit.

Connect a battery and verify that everything works as expected. If not, ~~give up and cry~~ recheck all your connections compare them to the above diagrams. And here's some advise that I routinely fail to follow, much to my regret: When you're completely stumped by a non-functioning circuit, turn off your soldering iron and come back later. It's amazing how often you can spot problems in an instant when you approach them with fresh eyes and ears.

8. Batten Down the Hatches!

Secure the circuit board to the side of the control cavity with double-sided tape. Secure the battery holder with tape (or screw it in, if the holder has screw holes). Tuck the wires wherever they fit. If they're a little too long, make things neater with little plastic cable ties.

Before closing up the control cavity, verify again that everything's working. It's depressingly easy to pull a wire loose or introduce a short circuit during this final assembly stage.

Screw down the control cavity cover. Play. Amaze your friends.



"There's got to be a batter way!"