

PROJECT NAME

HALO

BASED ON

Electro-Harmonix Big Muff Pi

BUILD DIFFICULTY

■■■■□ Easy

EFFECT TYPE

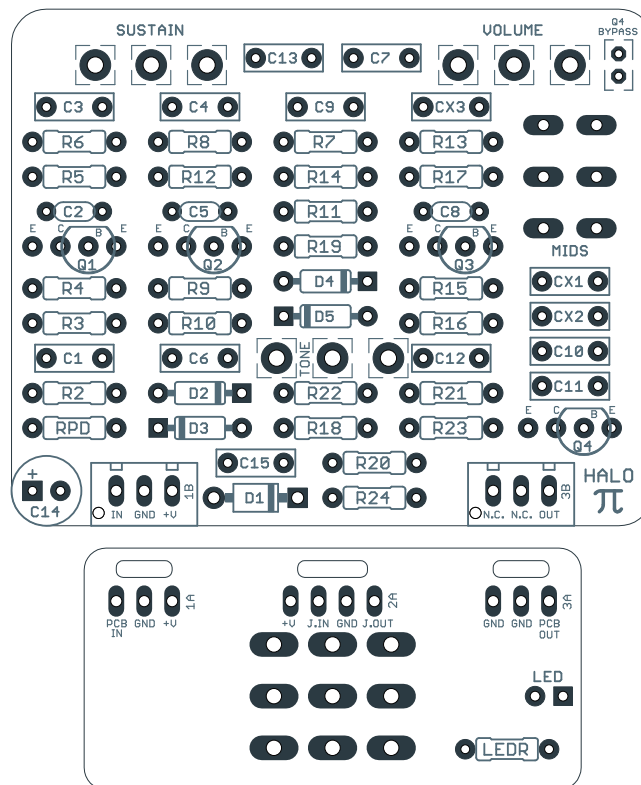
Distortion / Sustainer, Fuzz

DOCUMENT VERSION

1.0.0 (2018-07-04)

PROJECT SUMMARY

One of the most classic guitar effects of all time, its sound falls somewhere between a distortion effect and a fuzz with an incredibly long sustain.



Actual size is 2.3" x 1.86" (main board) and 2.3" x 0.86" (bypass board).

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INTRODUCTION

The Halo Distortion/Sustainer is a recreation of the Electro-Harmonix Big Muff Pi, first released in 1969. Originally marketed as a “harmonic distortion sustain”, it has been lumped together with fuzz effects, although it’s a very different animal than classic fuzz effects like a Fuzz Face or a Tone Bender.

The Big Muff is something of a “rite of passage” for pedalbuilders. It’s a pretty easy build and there aren’t a lot of things that can be messed up. There’s no biasing or gain sorting, and no rare or specialized parts are needed. It’s endlessly tweakable, with dozens of different variants (some of which sound very different) that are just a matter of substituting a few parts.

The Big Muff circuit was adapted by a number of other pedal manufacturers in the 1970s. Notably, the 4th version of the Colorsound Tone Bender, called the Supa Tone Bender and released in 1973, was based on the Big Muff circuit. The next version of the Tone Bender, called the Jumbo Tone Bender and released in 1976, changed the standard Big Muff circuit by removing the 4th transistor, a make-up gain stage after the tone control. This 3-transistor variant was copied by other manufacturers as well.

The Halo PCB allows you to easily build either the 4-transistor or the 3-transistor variant.

USAGE

The Halo has the following controls:

- **Sustain** controls the amount of drive or distortion, which also affects the amount of sustain.
- **Tone** is a control that pans between a low-pass filter (high cut) and a high-pass filter (low cut). At the 12:00 position, the bass and treble are flat, and the midrange tone response is based on the setting of the Mids switch.
- **Volume** is the overall output.
- **Mids** allows you to switch between Mid Scoop (the stock setting), Mid Hump, or Flat Mids.

PARTS LIST

This parts list is also available in a spreadsheet format which can be imported directly into Mouser for easy parts ordering. Mouser doesn't carry all the parts—notably potentiometers—so the second tab lists all the non-Mouser parts as well as sources for each.

[View parts list spreadsheet](#) →

Note: Values shown are for the Violet Ram's Head (2nd edition).

PART	VALUE	TYPE	NOTES
R2	39k	Metal film resistor, 1/4W	
R3	100k	Metal film resistor, 1/4W	
R4	470k	Metal film resistor, 1/4W	
R5	100R	Metal film resistor, 1/4W	
R6	15k	Metal film resistor, 1/4W	
R7	1k	Metal film resistor, 1/4W	
R8	8k2	Metal film resistor, 1/4W	
R9	100k	Metal film resistor, 1/4W	
R10	470k	Metal film resistor, 1/4W	
R11	100R	Metal film resistor, 1/4W	
R12	15k	Metal film resistor, 1/4W	
R13	8k2	Metal film resistor, 1/4W	
R14	100k	Metal film resistor, 1/4W	
R15	470k	Metal film resistor, 1/4W	
R16	100R	Metal film resistor, 1/4W	
R17	15k	Metal film resistor, 1/4W	
R18	33k	Metal film resistor, 1/4W	
R19	33k	Metal film resistor, 1/4W	
R20	390k	Metal film resistor, 1/4W	
R21	100k	Metal film resistor, 1/4W	
R22	10k	Metal film resistor, 1/4W	
R23	2k2	Metal film resistor, 1/4W	
R24	47R	Metal film resistor, 1/4W	
RPD	2M2	Metal film resistor, 1/4W	
LEDR	4k7	Metal film resistor, 1/4W	
C1	100n	Film capacitor, 7.2 x 2.5mm	
C2	470pF	MLCC capacitor, NP0/C0G	
C3	100n	Film capacitor, 7.2 x 2.5mm	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C4	100n	Film capacitor, 7.2 x 2.5mm	
C5	470pF	MLCC capacitor, NP0/COG	
C6	100n	Film capacitor, 7.2 x 2.5mm	
C7	100n	Film capacitor, 7.2 x 2.5mm	
C8	470pF	MLCC capacitor, NP0/COG	
C9	100n	Film capacitor, 7.2 x 2.5mm	
C10	3n9	Film capacitor, 7.2 x 2.5mm	
C11	10n	Film capacitor, 7.2 x 2.5mm	
C12	100n	Film capacitor, 7.2 x 2.5mm	
C13	100n	Film capacitor, 7.2 x 2.5mm	
C14	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C15	100n	MLCC capacitor, X7R	Power supply filter capacitor.
CX1	10n	Film capacitor, 7.2 x 2.5mm	
CX2	3n9	Film capacitor, 7.2 x 2.5mm	
CX3	JUMPER	Clipped wire lead	Jumper for a standard 4-transistor Big Muff. Use a 100n film capacitor here if building a 3-transistor variant such as the Jumbo Tone Bender.
D1	1N5817	Schottky diode, DO-41	
D2	1N914	Fast-switching diode, DO-35	
D3	1N914	Fast-switching diode, DO-35	
D4	1N914	Fast-switching diode, DO-35	
D5	1N914	Fast-switching diode, DO-35	
Q1	2N3904	BJT transistor, NPN, TO-92	
Q2	2N3904	BJT transistor, NPN, TO-92	
Q3	2N3904	BJT transistor, NPN, TO-92	
Q4	2N3904	BJT transistor, NPN, TO-92	
TONE	100kB	16mm right-angle PCB mount pot	LED current-limiting resistor. Adjust value to change LED brightness.
SUS	100kB	16mm right-angle PCB mount pot	
VOL	100kA	16mm right-angle PCB mount pot	
MIDS	DPDT	Toggle switch, DPDT on-on-on	A more common on-on switch can be used if that's all you can find, but the flat mids mode will be unavailable.
IN	1/4" stereo	1/4" phone jack, closed frame	Switchcraft 112BX or equivalent.
OUT	1/4" mono	1/4" phone jack, closed frame	Switchcraft 111X or equivalent.
DC	2.1mm	DC jack, 2.1mm panel mount	Mouser 163-4302-E or equivalent.
BATT	Battery snap	9V battery snap	Optional. Use the soft plastic type—the hard-shell type will not fit.
FSW	3PDT	Stomp switch, 3PDT	
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

BUILD NOTES

Bypassing Q4

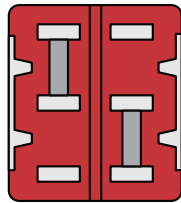
Some Muff variants such as the Jumbo Tone Bender will eliminate the last transistor gain stage. The Halo PCB makes this easy to do: just jumper the “Q4 Bypass” pads in the upper-right and omit R20-23, Q4, and C13. Also, use a 100n film capacitor for CX3 (normally jumpered). Better instructions for these variants will be added in a future version of the documentation.

Important: If you are building a normal 4-transistor Muff, you need to jumper CX3. You can use a jumper wire between the pads if you want, but even more conveniently, there are two SMD pads to the left of CX3 that can be easily connected with a bead of solder to save the hassle of using a jumper wire.

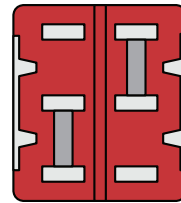
Mids Switch

The midrange switch is a DPDT on-on-on. There are two different types of on-on-on configurations for the center position depending on the manufacturer:

CONFIGURATION 1



CONFIGURATION 2



Fortunately, the way the switch is set up in this circuit, it doesn't matter which type of switch you have. The EQ response will still be flat in the middle. Just don't use an on-off-on switch - that's very different.

If you aren't able to find a DPDT on-on-on switch, you can also just use a standard DPDT on-on switch. You will still have the mid hump and mid scoop modes, but you will not have the flat mode.

Mids Switch vs. Presence Control

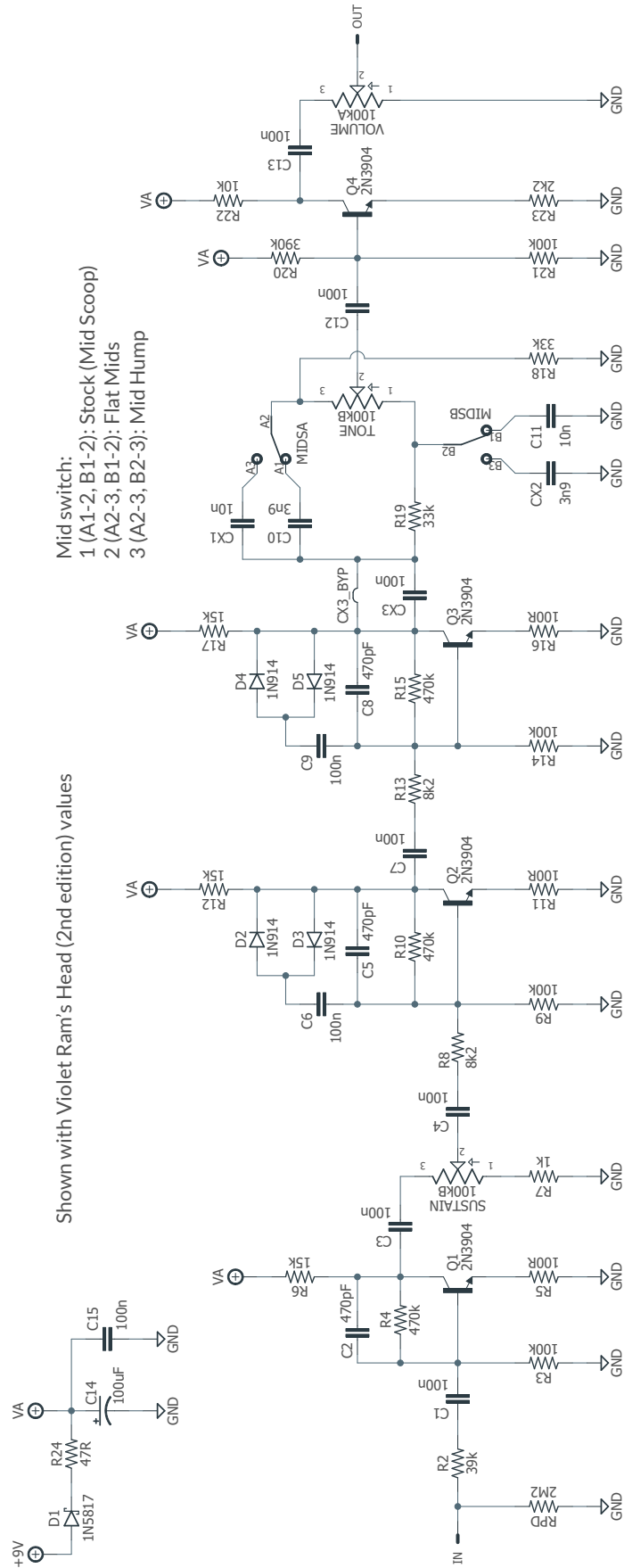
Previous versions of the Halo came with an optional modification, adding a fourth knob to control the midrange contour, called “Body” or “Presence”. (This mod was created by Jack Orman of AMZ. More information can be found in his [AMZ Presence Control](#) article.)

The trouble with this modification is that while it adds a good deal of tonal flexibility, there is no position on the body knob that removes it from the circuit and makes it 100% identical to a regular 3-knob Muff. If you look at an EQ graph of the tone control with the presence modification, it just doesn't have quite the same curve in any of the positions as the original circuit.

As a result, the new version of the Halo has been changed so that it has a 3-way switch that goes between the stock setting (scooped mids), a mid hump, or a fully flat frequency response. (The tone control still pans between a bass cut and a treble cut, only the midrange is affected.)

Some people absolutely loved the presence knob modification, and for them, they should use the previous version of the Halo which will continue to be available. But one of the requirements for the new line of Aion FX 125B projects was that if they had modifications, they still had to have a way of getting stock tones, e.g. a switch setting or a knob position—and the Presence control did not do that.

SCHEMATIC



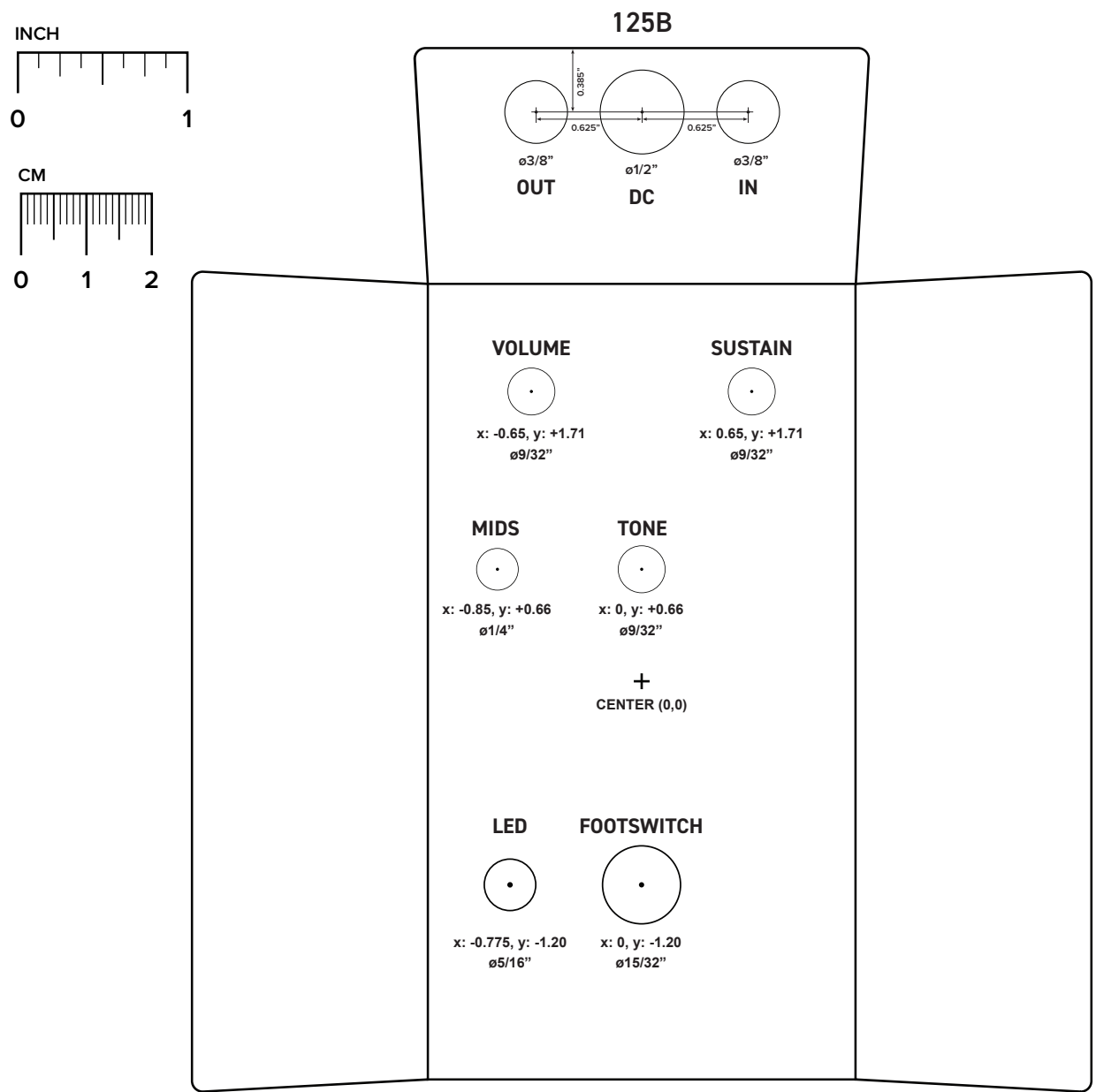
DRILL TEMPLATE

Cut out this drill template, fold the edges and tape it to the enclosure. Before drilling, it's recommended to first use a center punch for each of the holes to help guide the drill bit.

Ensure that this template is printed at 100% or "Actual Size". You can double-check this by measuring the scale on the printed page.

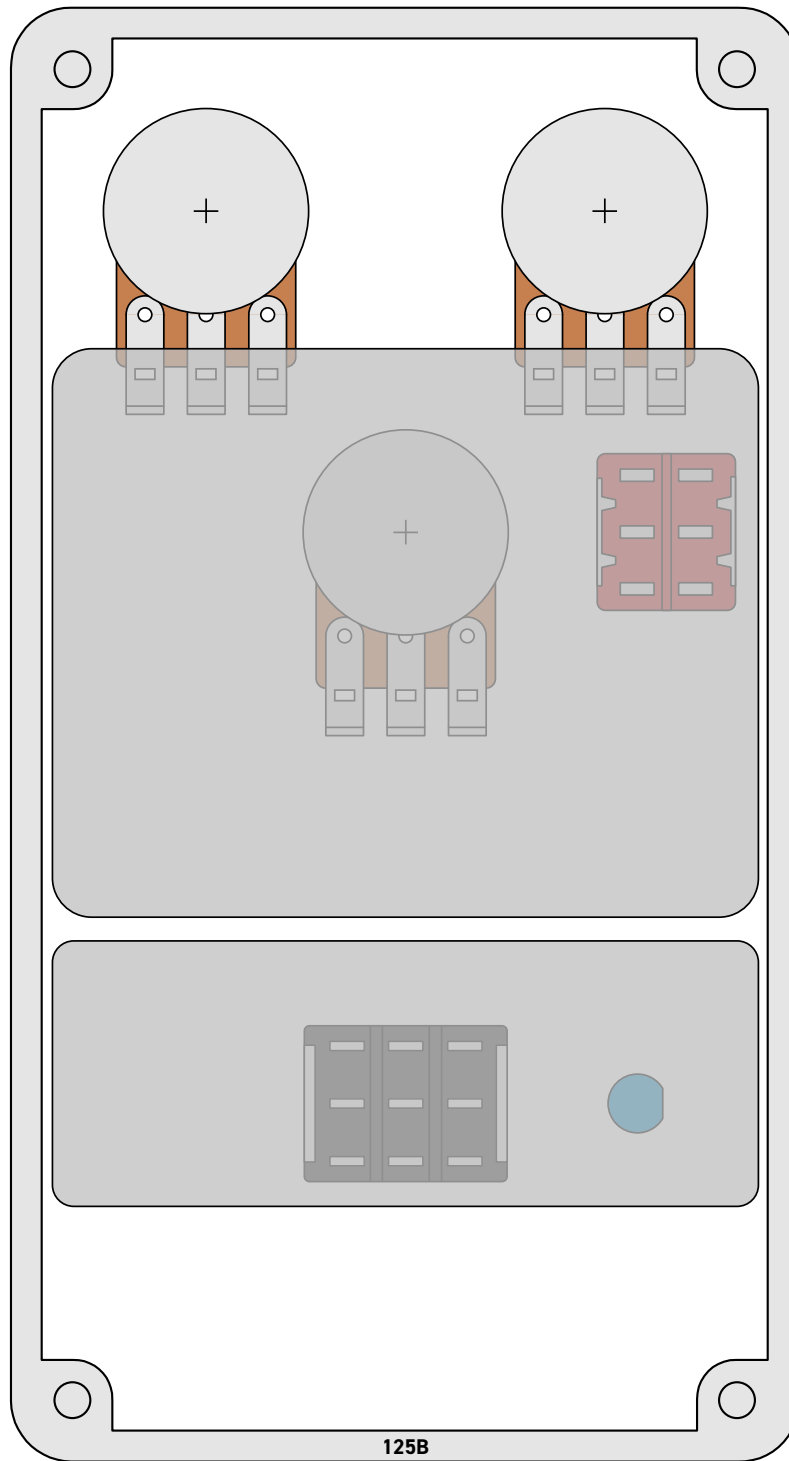
Top jack layout assumes the use of closed-frame jacks like the [Switchcraft 111X](#). If you'd rather use open-frame jacks, please refer to the Open-Frame Jack Drill Template for the top side.

LED hole drill size assumes the use of a [5mm LED bezel](#), available from several parts suppliers. Adjust size accordingly if using something different, such as a 3mm bezel, a plastic bezel, or just a plain LED.

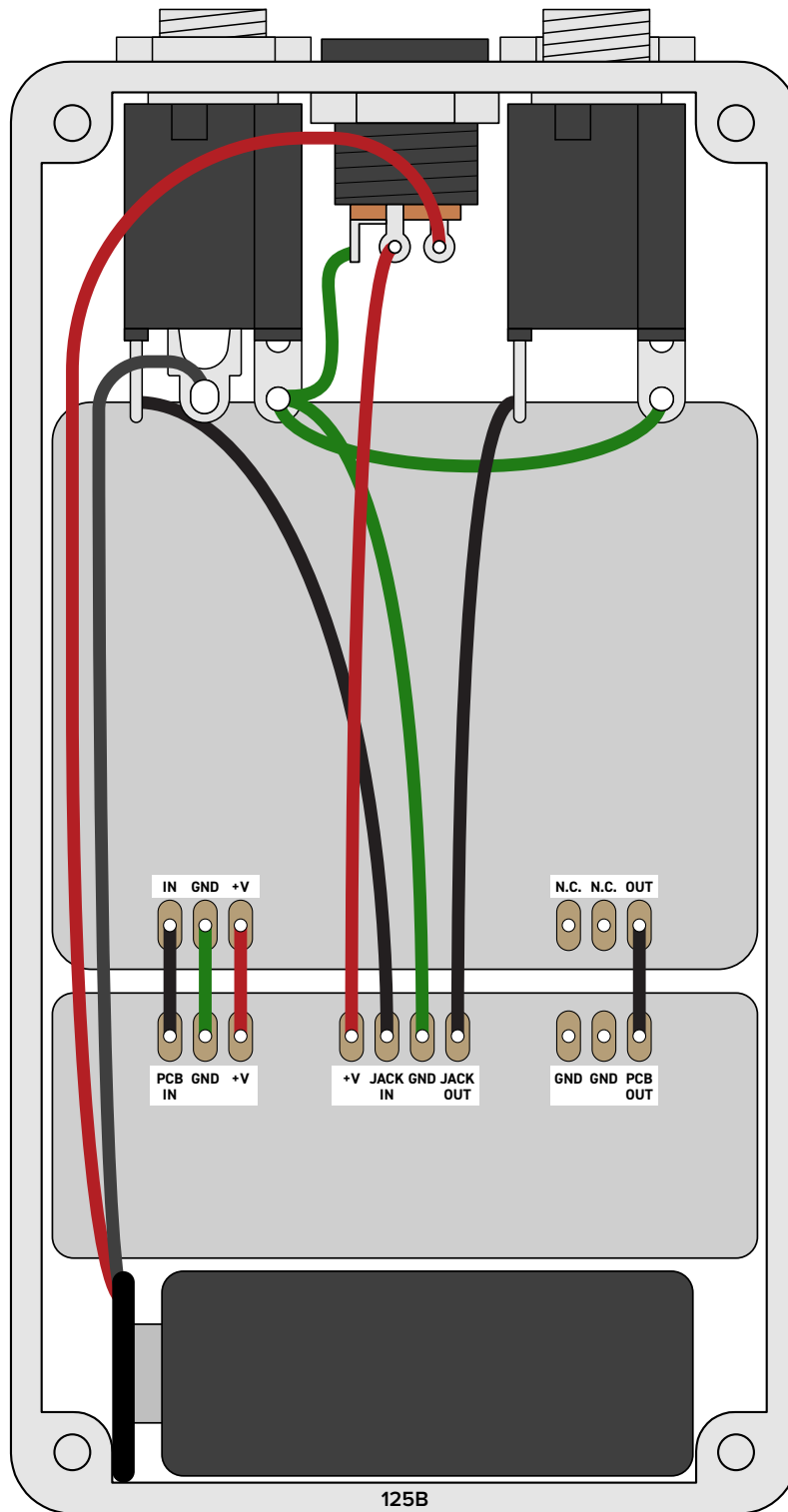


ENCLOSURE LAYOUT

Enclosure is shown without jacks. See next page for jack layout and wiring.



WIRING DIAGRAM



*Shown with optional 9V battery. If battery is omitted, both jacks can be mono rather than one being stereo.
Leave the far-right lug of the DC jack unconnected.*

LICENSE & USAGE

No direct support is offered for these projects beyond the provided documentation. It's assumed that you have at least some experience building pedals before starting one of these. Replacements and refunds cannot be offered unless it can be shown that the circuit or documentation are in error.

All of these circuits have been tested in good faith in their base configurations. However, not all the modifications or variations have necessarily been tested. These are offered only as suggestions based on the experience and opinions of others.

Projects may be used for commercial endeavors in any quantity unless specifically noted. No attribution is necessary, though a link back is always greatly appreciated. The only usage restrictions are that **(1) you cannot resell the PCB as part of a kit without prior arrangement, and (2) you cannot "goop" the circuit, scratch off the screenprint, or otherwise obfuscate the circuit to disguise its source.** (In other words: you don't have to go out of your way to advertise the fact that you use these PCBs, but please don't go out of your way to hide it. The guitar effects industry needs more transparency, not less!)

DOCUMENT REVISIONS

1.0.0 (2018-07-04)

Initial release.