

PROJECT NAME

APOLLO MK. II



BASED ON

Catalinbread® RAH

BUILD DIFFICULTY

■■■■□ Intermediate

EFFECT TYPE

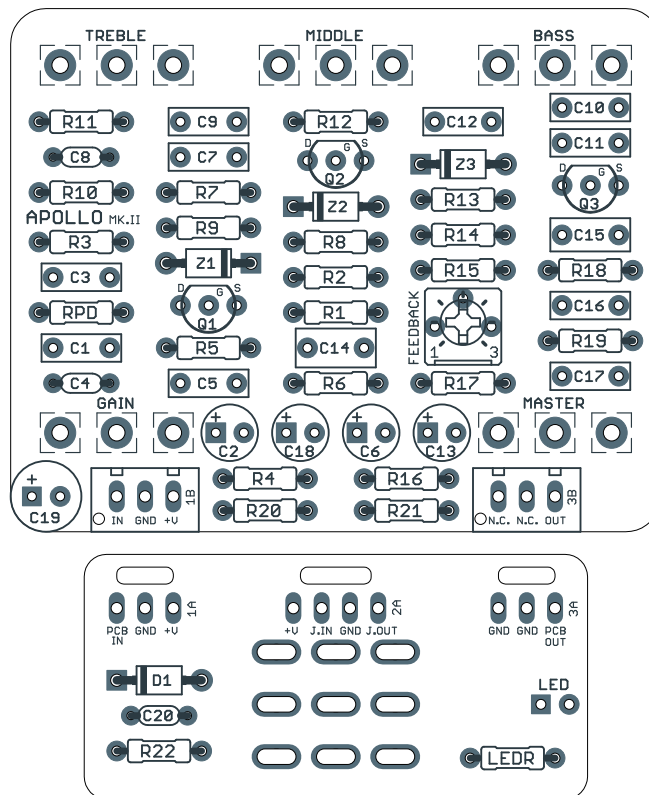
Overdrive / Amp Emulation

DOCUMENT VERSION

1.0.0 (2021-02-19)

PROJECT SUMMARY

An adaptation of the custom Hiwatt amplifier used by Jimmy Page of Led Zeppelin during their “Royal Albert Hall” performance from 1970.



Actual size is 2.3" x 1.86" (main board) and 1.78" x 0.87" (bypass board).

IMPORTANT NOTE

This documentation is for the **Mk. II** version of the project. There is also a [Mk. I](#) version, based on the WIIO. While the names are similar, the circuit and part numbering are different. Please be sure your PCB is labeled “Apollo Mk. II” before proceeding with this build document.

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INTRODUCTION

The Apollo Preamp Drive Mk. II is an adaptation of the Catalinbread RAH, based on the custom Hiwatt amplifier used by Jimmy Page in Led Zeppelin's Royal Albert Hall performance from 1970.

The RAH was originally released in 2011 as the "Royal Albert Hall Edition WIIO". (The WIIO was an earlier circuit that was also based on the Hiwatt amplifier, but voiced for the tone of Pete Townshend from The Who.) After the release of the RAH, the WIIO was discontinued.

The main difference from the WIIO is the tone stack, which was adapted from Jimmy's amp (called the "Custom Hiwatt 100 Jimmy Page") and differs somewhat from their standard amplifiers. Like the original amp, the RAH includes a midrange knob for a full three-band tonestack. A few other values were tweaked to re-voice it for Led Zeppelin's tone, but overall the RAH and WIIO are close siblings.

Due to the use of MOSFETs instead of JFETs, the RAH circuit is stiffer and less compressed than many of Catalinbread's other amp-based circuits. It has been described as "unforgiving" in this regard, including by Catalinbread themselves. It does generate plenty of its own distortion, but it takes pedals very well and benefits from a boosted or overdriven signal at the input.

The Apollo Mk. II is a direct adaptation of the RAH. The only modification is the addition of a trimmer that makes a feedback resistor variable, allowing adjustments to the gain, tone and feel of the circuit. The WIIO is also available as the [Apollo Mk. I](#).

A bit of trivia: the WIIO and RAH were developed based on recordings of concerts that were held five weeks apart (Led Zeppelin on January 6, 1970, and The Who on February 14).

USAGE

The Apollo Mk. II has the following controls:

- **Gain** controls the amount of gain coming out of the first amplifier stage.
- **Bass, Middle** and **Treble** form a 3-band tone stack adapted from the original amplifier.
- **Master** is the overall output level.
- **Feedback** (internal trimmer) controls the global feedback from the third stage back to the first. Set it just past the halfway point for the stock circuit, and then adjust it to taste.

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 (most notably potentiometers) so the second tab lists all the non-Mouser parts as well as sources for each.

[View parts list spreadsheet](#) →

PART	VALUE	TYPE	NOTES
R1	1M	Metal film resistor, 1/4W	
R2	3k3	Metal film resistor, 1/4W	
R3	3k3	Metal film resistor, 1/4W	
R4	1k	Metal film resistor, 1/4W	
R5	22k	Metal film resistor, 1/4W	
R6	1M	Metal film resistor, 1/4W	
R7	3k3	Metal film resistor, 1/4W	
R8	3k3	Metal film resistor, 1/4W	
R9	100k	Metal film resistor, 1/4W	
R10	220k	Metal film resistor, 1/4W	
R11	22k	Metal film resistor, 1/4W	
R12	100k	Metal film resistor, 1/4W	
R13	1M	Metal film resistor, 1/4W	
R14	3k3	Metal film resistor, 1/4W	
R15	3k3	Metal film resistor, 1/4W	
R16	130R	Metal film resistor, 1/4W	
R17	47k	Metal film resistor, 1/4W	
R18	10k	Metal film resistor, 1/4W	
R19	10k	Metal film resistor, 1/4W	
R20	62k	Metal film resistor, 1/4W	
R21	100k	Metal film resistor, 1/4W	
R22	100R	Metal film resistor, 1/4W	
RPD	2M2	Metal film resistor, 1/4W	
LEDR	4k7	Metal film resistor, 1/4W	
C1	3n3	Film capacitor, 7.2 x 2.5mm	
C2	22uF	Electrolytic capacitor, 5mm	
C3	100n	Film capacitor, 7.2 x 2.5mm	
C4	47pF	MLCC capacitor, NPO/COG	
C5	47n	Film capacitor, 7.2 x 2.5mm	
C6	10uF	Electrolytic capacitor, 5mm	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C7	1n	Film capacitor, 7.2 x 2.5mm	
C8	220pF	MLCC capacitor, NP0/COG	
C9	1n	Film capacitor, 7.2 x 2.5mm	
C10	47n	Film capacitor, 7.2 x 2.5mm	
C11	47n	Film capacitor, 7.2 x 2.5mm	
C12	100n	Film capacitor, 7.2 x 2.5mm	
C13	22uF	Electrolytic capacitor, 5mm	
C14	680n	Film capacitor, 7.2 x 4.5mm	
C15	220n	Film capacitor, 7.2 x 2.5mm	
C16	2n2	Film capacitor, 7.2 x 2.5mm	
C17	2n2	Film capacitor, 7.2 x 2.5mm	
C18	47uF	Electrolytic capacitor, 5mm	
C19	100uF	Electrolytic capacitor, 6.3mm	
C20	100n	MLCC capacitor, X7R	
D1	1N5817	Schottky diode, DO-41	
Z1	1N4739A	Zener diode, 9V, DO-41	
Z2	1N4739A	Zener diode, 9V, DO-41	
Z3	1N4739A	Zener diode, 9V, DO-41	
Q1	BS170	MOSFET, N-channel, TO-92	
Q2	BS170	MOSFET, N-channel, TO-92	
Q3	BS170	MOSFET, N-channel, TO-92	
GAIN	500kB	16mm right-angle PCB mount pot	
BASS	500kA	16mm right-angle PCB mount pot	
MID	100kB	16mm right-angle PCB mount pot	
TREBLE	250kB	16mm right-angle PCB mount pot	
MSTR.	250kA	16mm right-angle PCB mount pot	
FDBK.	250k trimmer	Trimmer, 10%, 1/4"	See build notes.
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.
FSW	3PDT	Stomp switch, 3PDT	
ENC	125B	Enclosure, die-cast aluminum	Can also use a Hammond 1590N1.

BUILD NOTES

Setting feedback trimmer

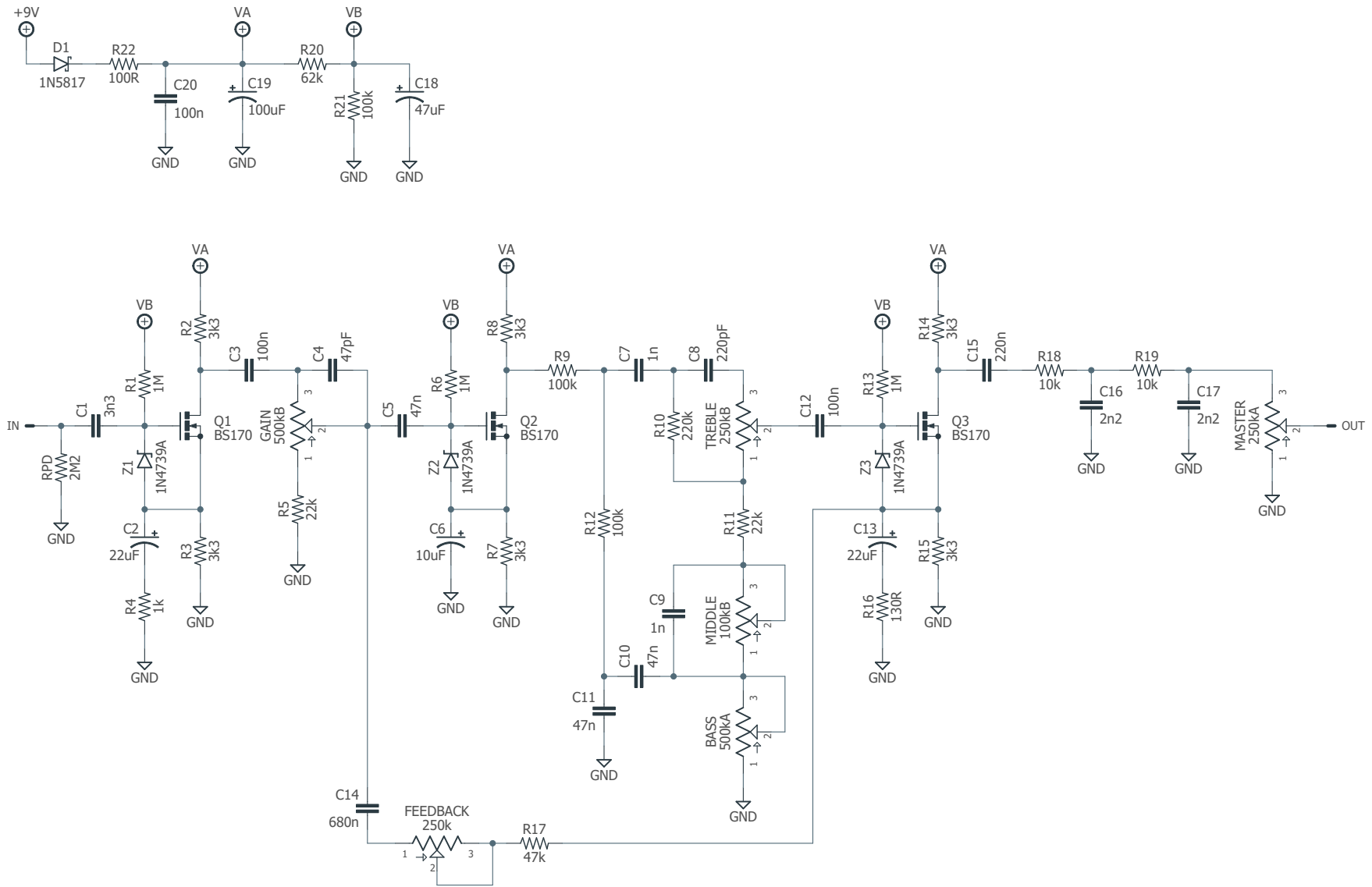
The RAH circuit contains a global feedback loop similar to the amplifier it's based on. A 200k resistor and 680n capacitor send the output from the third stage back to the point just after the gain control between the first and second stage, which reduces the gain, cuts some of the top end, and makes it feel more "amp-like".

The Apollo Mk. II adds a trimmer in series with the feedback resistor, allowing the feedback to be varied to taste. Global feedback does several things at once with the gain, EQ and compression

The stock position is between 1-2:00 on the trimmer and this should be the starting point for any builds. From there, adjust it up or down and see if you like what it does.

If you want to omit this control, jumper the outer pins of the trimmer and use **200k** for R17.

SCHEMATIC



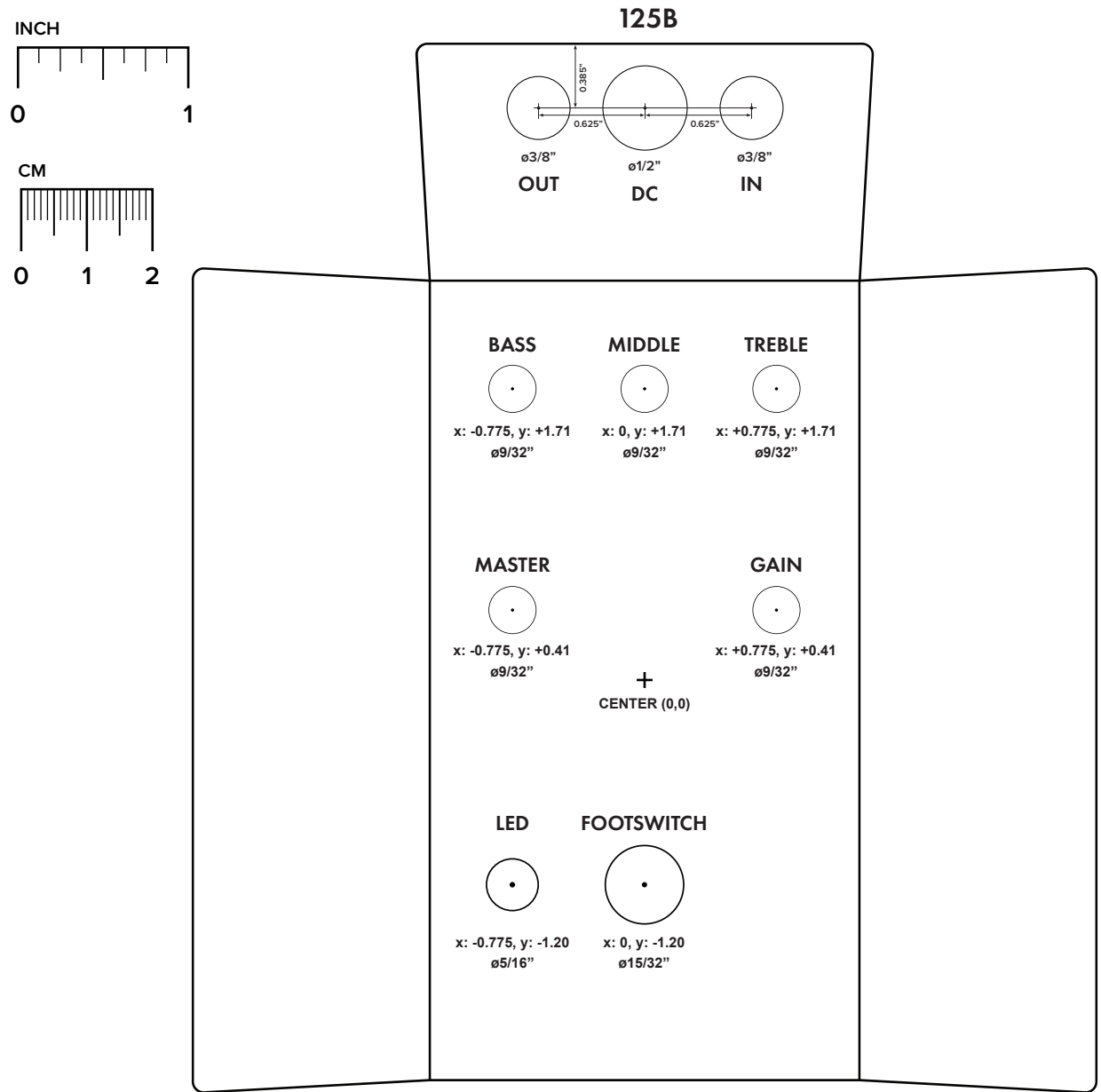
DRILL TEMPLATE

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.

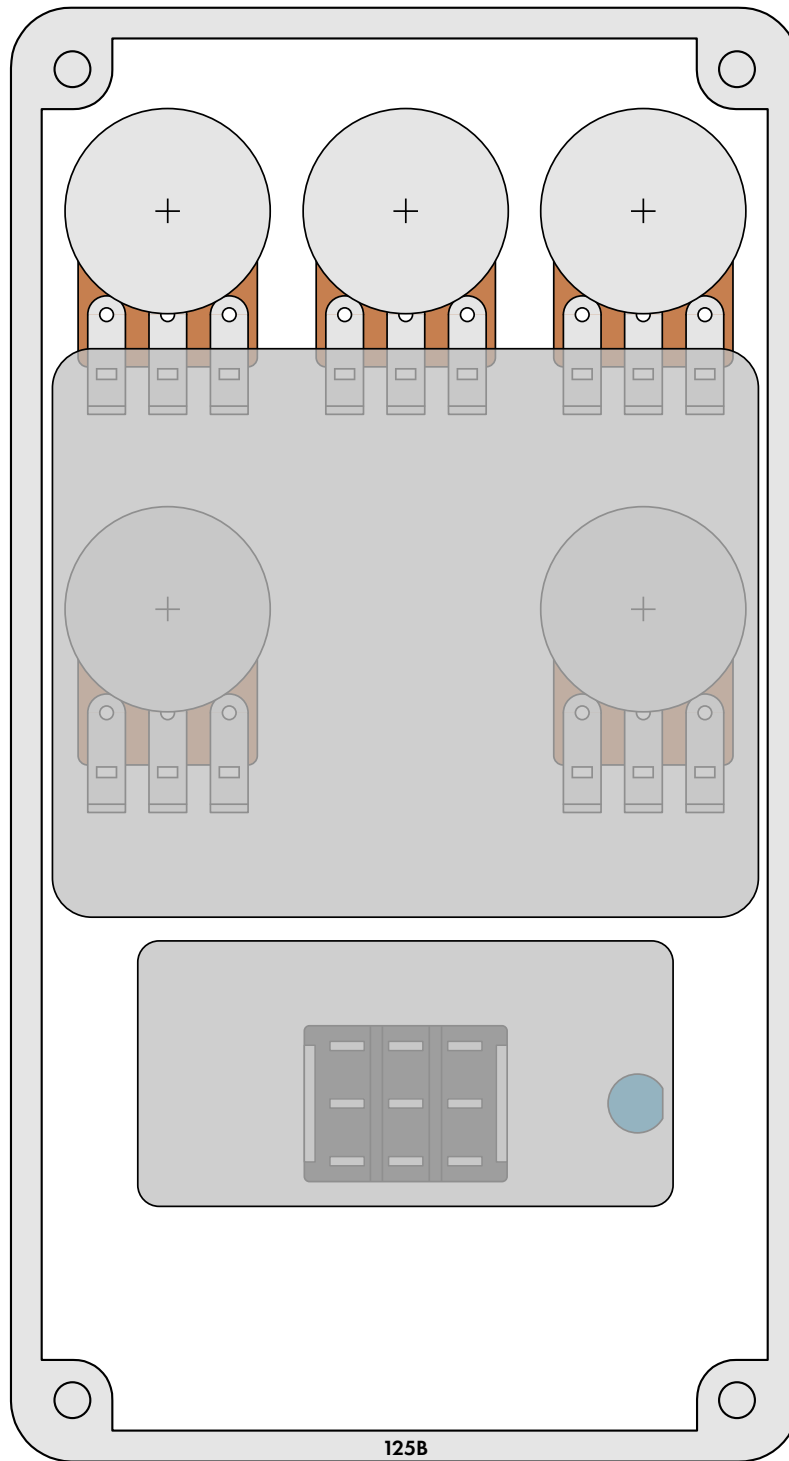
Top jack layout assumes the use of closed-frame jacks like the [Switchcraft 111X](#). Open-frame jacks will not fit in layouts with 5 or more knobs due to the placement of the DC jack.

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.

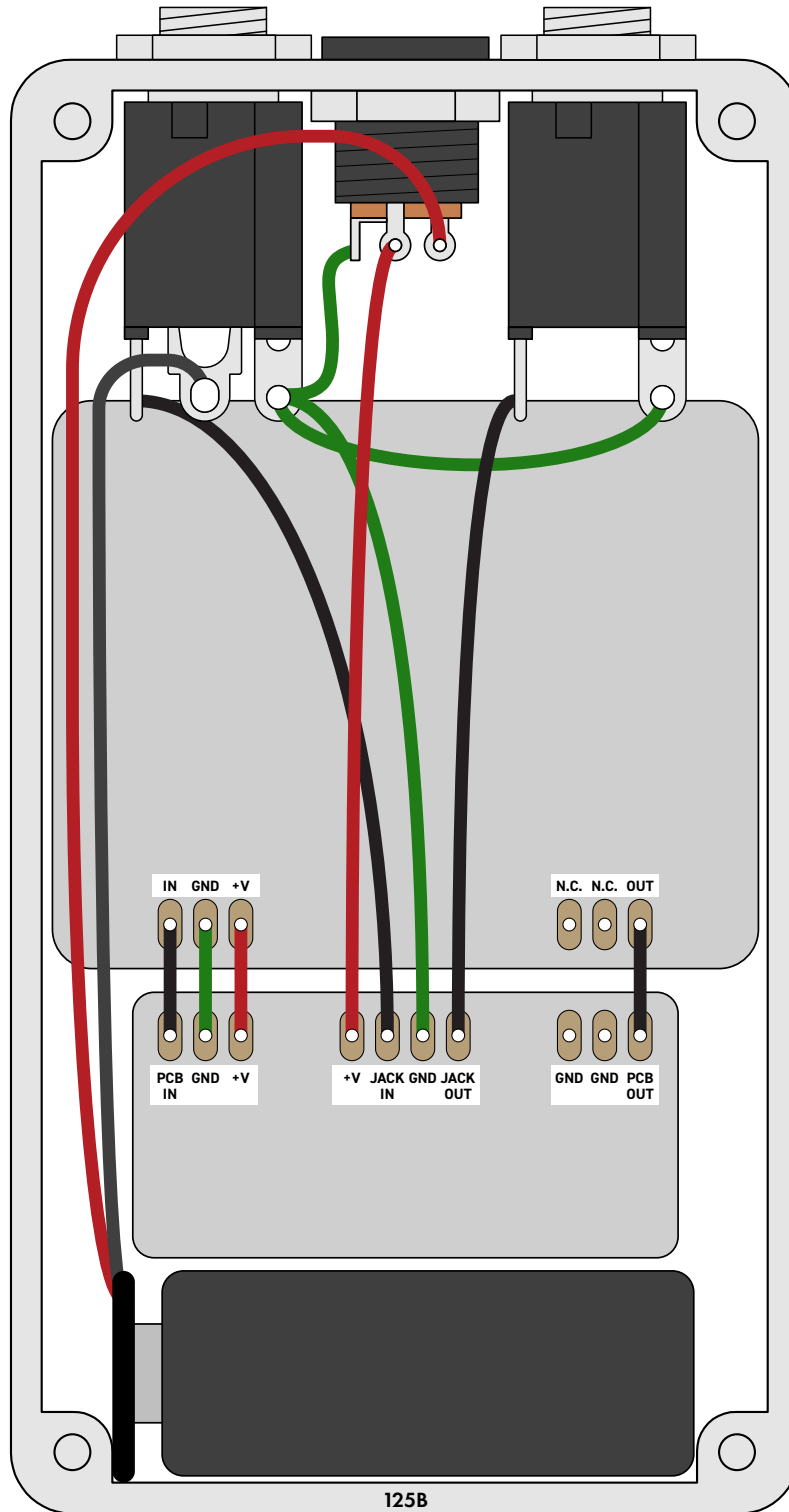


ENCLOSURE LAYOUT

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



WIRING DIAGRAM



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 (2021-02-19)

Initial release.