

PROJECT NAME

MAELSTROM



BASED ON

Darkglass® Microtubes B3K

BUILD DIFFICULTY

■■■■□ Intermediate

EFFECT TYPE

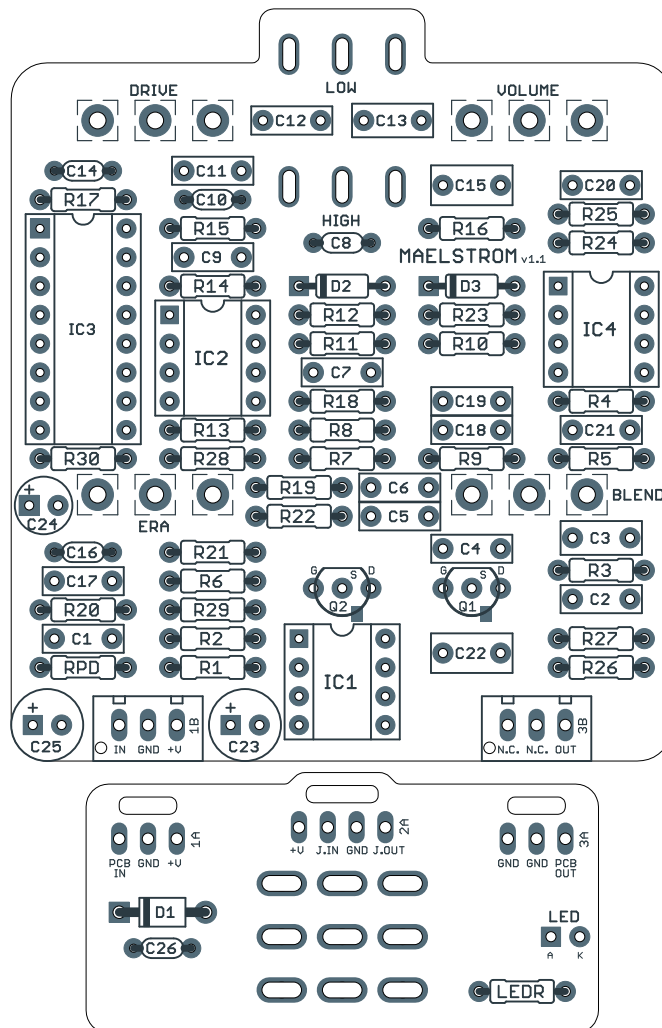
Bass overdrive / distortion

DOCUMENT VERSION

1.1.0 (2024-08-12)

PROJECT SUMMARY

A CMOS-flavored bass overdrive with tones spanning across decades, from vintage warmth to modern bite and aggression.



Actual size is 2.3" x 2.61" (main board) and 1.78" x 0.86" (bypass board).

IMPORTANT NOTE

This documentation is for the **PCB-only** version of the project. If you are building the full kit from Aion FX, please use the [kit build documentation](#) instead. The instructions are more detailed and may differ in some areas due to the specialized parts and assembly methods used in our kits.

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INTRODUCTION

The Maelstrom Bass Drive is based on the Darkglass® Microtubes B3K, a CMOS-based drive circuit, with some additional tweaks adapted from the Vintage Microtubes.

The B3K started life as the Microtubes 2K, which was originally posted to the DIYStompboxes forum by Douglas Castro in 2008. After finishing university, he moved from Chile to Finland in 2010 and started Darkglass Electronics as a commercial entity.

During this time, he continued to work on the design, and the updated Microtubes B3K became Darkglass's first product. While the original 2K was not described as a bass drive, the B3K and all subsequent Darkglass products have been designed primarily for bass players and marketed as such.

As the name implies, the original Microtubes 2K was inspired by the EHX Hot Tubes from 1979 as well as some other CMOS-based designs in the DIY community. However, by the time it had evolved into the B3K, it really bore no resemblance to any other circuits. A single CMOS stage is used for the clipping tone, contrasting with the cascaded inverters used by other similar circuits.

The Vintage Microtubes followed in early 2013. It's essentially the same circuit as the B3K, but it removes the two toggle switches and adds a new control called "Era".

The Maelstrom is a direct adaptation of the Microtubes B3K, with the Era control ported over from the Vintage Microtubes. With the Era control turned down, it's identical to the standard B3K. You can also make some more parts substitutions to build it to full Vintage Microtubes specs if you'd like.

USAGE

The Maelstrom has six controls:

- **Drive** controls the amount of gain from the op-amp that is fed through the CMOS inverter stage.
- **Era** filters the tone after the clipping stage. On the low end, it's warm with a lot of midrange, and as it's turned up it adds more treble and scoops the midrange somewhat.
- **Level** sets the overall output of the drive signal.
- **Blend** pans between the buffered clean signal and the drive signal.
- **Attack** (toggle) selects between three different treble modes prior to the op-amp gain stage: Boost, Flat or Cut.
- **Grunt** (toggle) selects between three different bass levels between the op-amp boost and the CMOS clipping stages.

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](#) →

PART	VALUE	TYPE	NOTES
R1	10k	Metal film resistor, 1/4W	
R2	1M	Metal film resistor, 1/4W	
R3	100k	Metal film resistor, 1/4W	
R4	1M	Metal film resistor, 1/4W	
R5	3k3	Metal film resistor, 1/4W	
R6	1M	Metal film resistor, 1/4W	
R7	1M	Metal film resistor, 1/4W	
R8	200k	Metal film resistor, 1/4W	261k in Vintage Microtubes.
R9	6k8	Metal film resistor, 1/4W	6.65k in Vintage Microtubes.
R10	22k	Metal film resistor, 1/4W	
R11	470k	Metal film resistor, 1/4W	
R12	470k	Metal film resistor, 1/4W	
R13	1M	Metal film resistor, 1/4W	
R14	330k	Metal film resistor, 1/4W	220k in Vintage Microtubes.
R15	3k3	Metal film resistor, 1/4W	3k3 + 220n in Vintage Microtubes. See build notes.
R16	6k8	Metal film resistor, 1/4W	6.65k in Vintage Microtubes.
R17	470k	Metal film resistor, 1/4W	330k in Vintage Microtubes.
R18	10k	Metal film resistor, 1/4W	
R19	1M	Metal film resistor, 1/4W	
R20	100k	Metal film resistor, 1/4W	
R21	33k	Metal film resistor, 1/4W	10k in Vintage Microtubes.
R22	10k	Metal film resistor, 1/4W	
R23	22k	Metal film resistor, 1/4W	
R24	22k	Metal film resistor, 1/4W	
R25	47k	Metal film resistor, 1/4W	100k in Vintage Microtubes.
R26	1k	Metal film resistor, 1/4W	
R27	100k	Metal film resistor, 1/4W	
R28	10k	Metal film resistor, 1/4W	
R29	10k	Metal film resistor, 1/4W	
R30	47R	Metal film resistor, 1/4W	Jumper for v1.0 PCBs (shipped before August 12, 2024)
RPD	1M	Metal film resistor, 1/4W	Input pulldown resistor.
LEDR	10k	Metal film resistor, 1/4W	LED current-limiting resistor. Adjust value to change LED brightness.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C1	100n	Film capacitor, 7.2 x 2.5mm	
C2	1n	Film capacitor, 7.2 x 2.5mm	22n in Vintage Microtubes.
C3	220n	Film capacitor, 7.2 x 2.5mm	
C4	22n	Film capacitor, 7.2 x 2.5mm	
C5	22n	Film capacitor, 7.2 x 2.5mm	
C6	22n	Film capacitor, 7.2 x 2.5mm	
C7	22n	Film capacitor, 7.2 x 2.5mm	
C8	220pF	MLCC capacitor, NP0/C0G	
C9	100n	Film capacitor, 7.2 x 2.5mm	
C10	22pF	MLCC capacitor, NP0/C0G	220pF in Vintage Microtubes.
C11	4n7	Film capacitor, 7.2 x 2.5mm	
C12	22n	Film capacitor, 7.2 x 2.5mm	
C13	220n	Film capacitor, 7.2 x 2.5mm	
C14	22pF	MLCC capacitor, NP0/C0G	220pF in Vintage Microtubes.
C15	1uF	Film capacitor, 7.2 x 3.5mm	
C16	680pF	MLCC capacitor, NP0/C0G	1n in Vintage Microtubes.
C17	22n	Film capacitor, 7.2 x 2.5mm	4n7 in Vintage Microtubes.
C18	2n2	Film capacitor, 7.2 x 2.5mm	1n in Vintage Microtubes.
C19	2n2	Film capacitor, 7.2 x 2.5mm	1n in Vintage Microtubes.
C20	2n2	Film capacitor, 7.2 x 2.5mm	
C21	1n	Film capacitor, 7.2 x 2.5mm	
C22	1uF	Film capacitor, 7.2 x 3.5mm	
C23	100uF	Electrolytic capacitor, 6.3mm	Reference voltage filter capacitor.
C24	100uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C25	220uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C26	100n	MLCC capacitor, X7R	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
D2	1N914	Fast-switching diode, DO-35	
D3	1N914	Fast-switching diode, DO-35	
Q1	J201	JFET, N-channel, TO-92	Available from Aion FX as SMD with through-hole adapters.
Q2	J201	JFET, N-channel, TO-92	Available from Aion FX as SMD with through-hole adapters.
IC1	TL072	Operational amplifier, DIP8	
IC1-S	DIP-8 socket	IC socket, DIP-8	
IC2	TL072	Operational amplifier, DIP8	
IC2-S	DIP-8 socket	IC socket, DIP-8	
IC3	CD4049UBE	CMOS hex inverting buffer, DIP16	
IC3-S	DIP-16 socket	IC socket, DIP-16	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
IC4	TL072	Operational amplifier, DIP8	
IC4-S	DIP-8 socket	IC socket, DIP-8	
DRIVE	100kC	16mm right-angle PCB mount pot	
ERA	100kB	16mm right-angle PCB mount pot	
BLEND	100kB	16mm right-angle PCB mount pot	
VOL.	100kA	16mm right-angle PCB mount pot	
ATTACK	SPDT cntr off	Toggle switch, SPDT on-off-on	
GRUNT	SPDT cntr off	Toggle switch, SPDT on-off-on	
LED	5mm	LED, 5mm, red diffused	
IN	1/4" mono	1/4" phone jack, closed frame	Switchcraft 111X 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

Vintage Microtubes specifications

The Vintage Microtubes uses an almost identical circuit to the B3K, but with several parts substitutions to give it more of a vintage flavor.

In addition, the VMT hardwires the **Attack** switch in treble boost mode (left toggle position) and the **Grunt** switch in the highest-bass mode (right toggle position). It's recommended to include the switches in this build and just be aware of which positions correspond to the "vintage" modes.

PART	B3K	VMT
R8	200k	261k
R9	6.8k	6.65k
R14	330k	220k
R15	3k3	3k3 + 220n
R16	6.8k	6.65k

PART	B3K	VMT
R17	470k	330k
R21	33k	10k
R25	47k	100k
C2	1n	22n
C10	22pF	220pF

PART	B3K	VMT
C14	22pF	220pF
C16	680pF	1n
C17	22n	4n7
C18	2n2	1n
C19	2n2	1n

R9 and R16: The Vintage Microtubes also uses 6.65k resistors for R9 and R16 instead of 6.8k. This is almost certainly just due to manufacturing convenience, since the unit is fully SMD and many brands of precision resistors aren't available in E12 or E24 values. It's recommended to stick with 6.8k in these two positions, but you can find 6.65k metal film resistors at Mouser.

R15: The Vintage Microtubes adds a **220n** capacitor in series with R15. The Maelstrom PCB does not include space for this capacitor. It can be omitted entirely, in which case the unit will have very slightly more low-end. Or, you can "tent" it with the resistor by putting one leg of the capacitor in one pad of R15, one leg of the resistor in the other pad, and then soldering the leads together above the PCB. The order does not matter and there is no polarity.

R30 and v1.1

Version 1.1 began shipping on August 12, 2024. This version corrects an issue on v1.0 where the unused CMOS inverters were tied to the wrong supply.

The original goal was to provide a small amount of extra power filtering not found in the original circuit. But the way it was implemented, it means the voltage for the deactivated inverters (VA) is very slightly higher than the CMOS chip's supply voltage (VC), and CMOS tends to not be very tolerant of this.

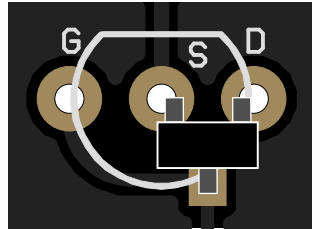
No issues were reported, but out of precaution we recommended jumpering R30 on the v1.0 boards, which makes it identical to the original B3K's power scheme.

If the PCB says v1.1 next to the "Maelstrom" text then use a 47R resistor as in the parts list.

BUILD NOTES

Using SMD JFETs

The J201 JFET is no longer available in through-hole format. This PCB uses a hybrid through-hole/SMD outline for each JFET. An extra “G” (gate) pad is included to accommodate surface-mount devices without the need for adapters. SMD JFETs should be oriented as follows:



All surface-mount JFETs use the same pinout, so this configuration will fit any type that we’re aware of. However, always check the datasheet if you’re uncertain—they’re difficult to desolder.

J201 adapters

Many DIY builders are intimidated by the small size of surface-mount parts. Aion FX offers [pre-soldered J201s on adapters](#) so they can easily be used as through-hole parts.

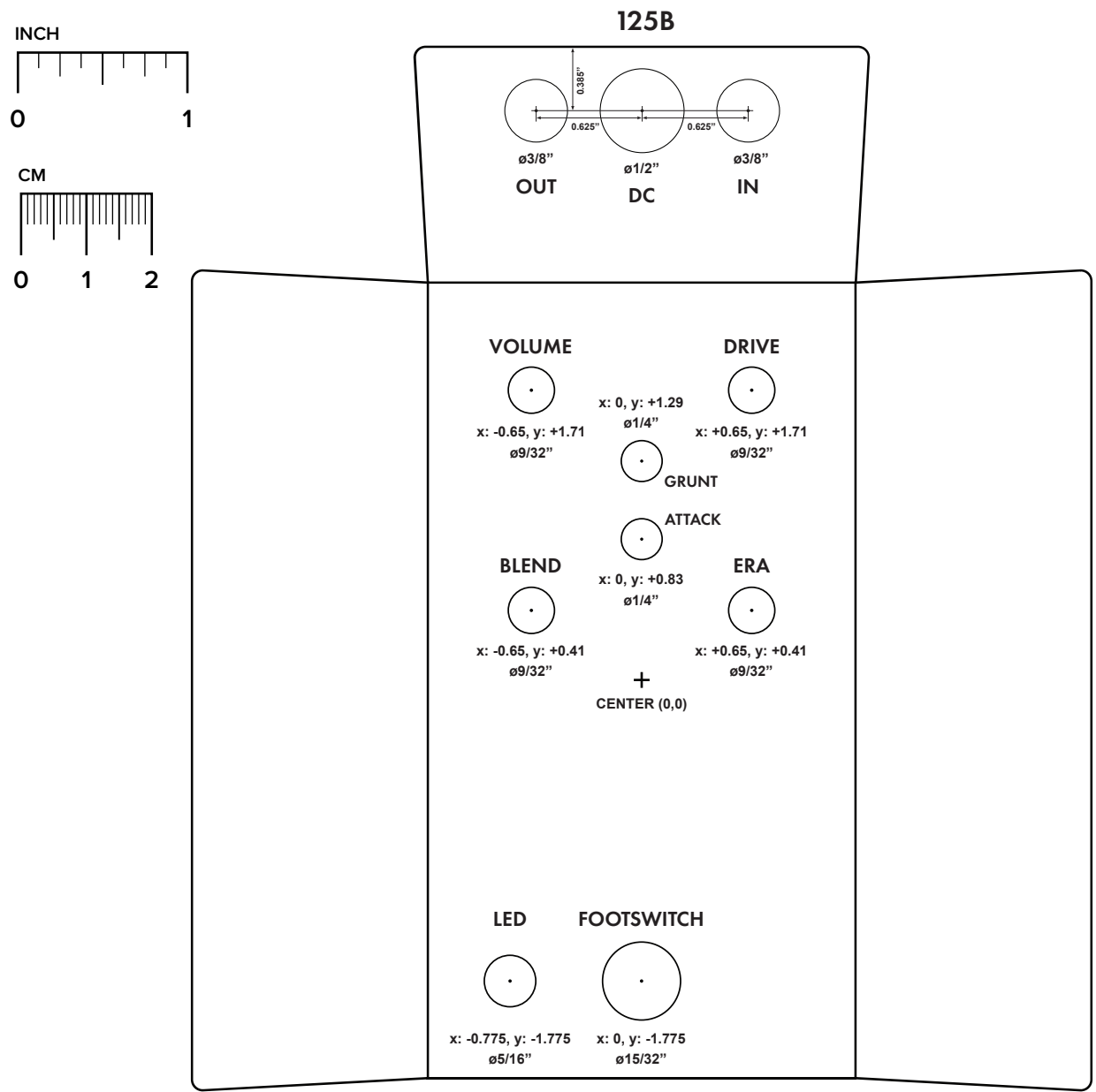
DRILL TEMPLATE

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.

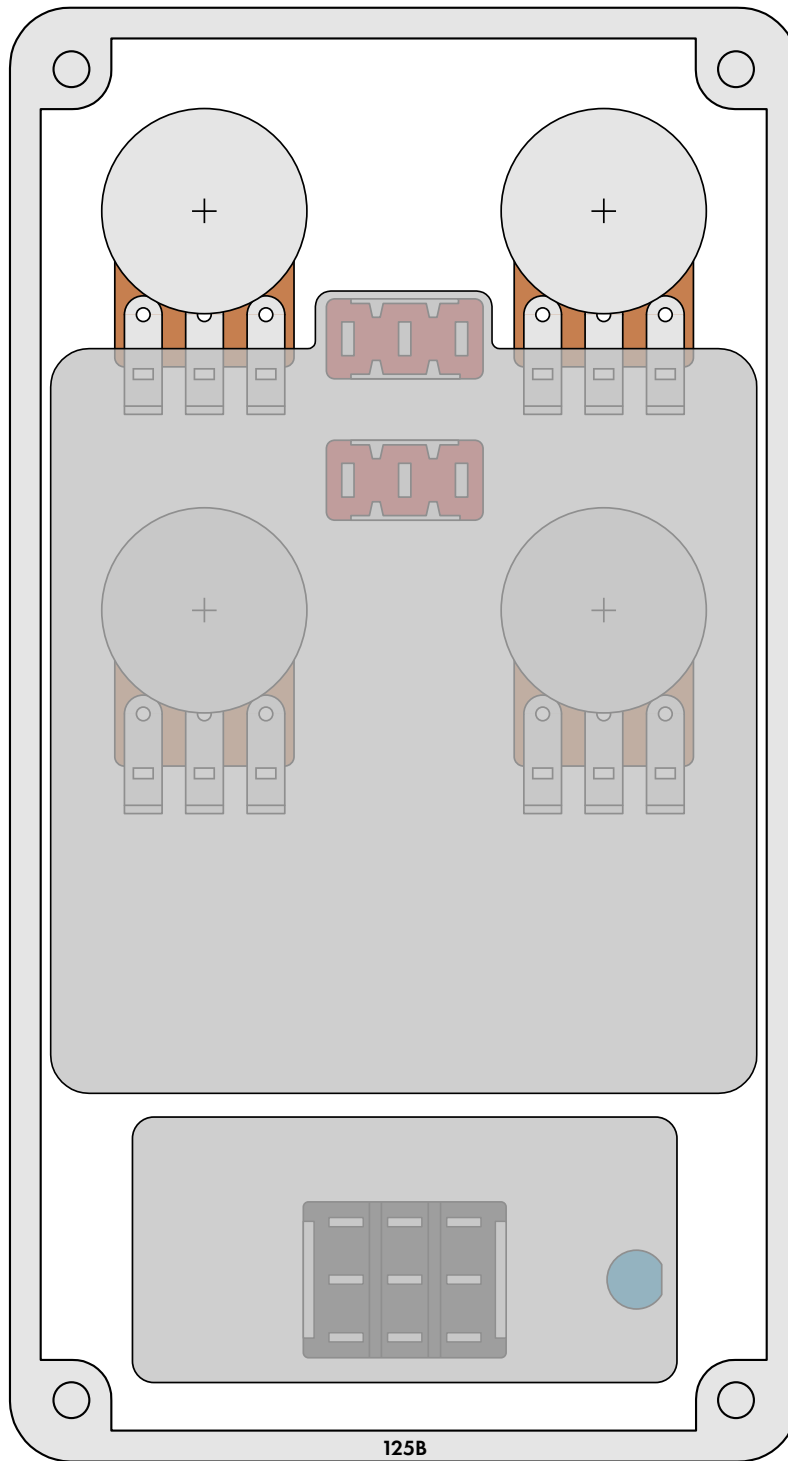
Top jack layout assumes the use of closed-frame jacks like the [Switchcraft 111X](#). If you'd rather use open-frame jacks, please refer to the [Open-Frame Jack Drill Template](#) for the top side.

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.

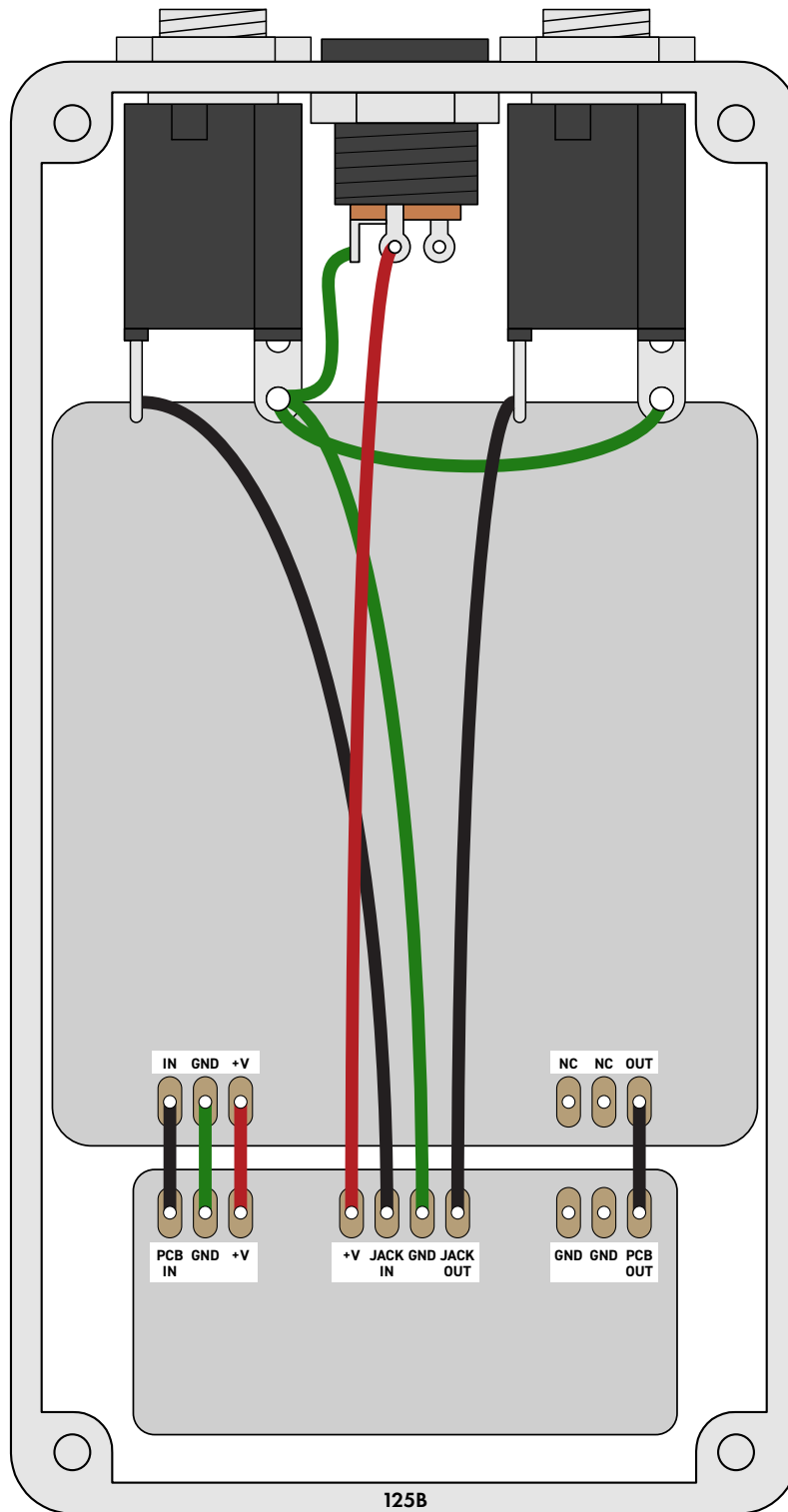


ENCLOSURE LAYOUT

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



WIRING DIAGRAM



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

1.1.0 (2024-08-12)

- Corrected R30/VC junction. R30 is now 47R for v1.1 PCBs. See build notes for details.
- Changed LEDR to 10k to work with a wider variety of LEDs.

1.0.1 (2022-12-08)

Changed R30 to a jumper.

1.0.0 (2021-11-12)

Initial release.