

PROJECT NAME

REDSHIFT



BASED ON

Blackout Effectors Whetstone Phaser

BUILD DIFFICULTY

■■■■■ Advanced

EFFECT TYPE

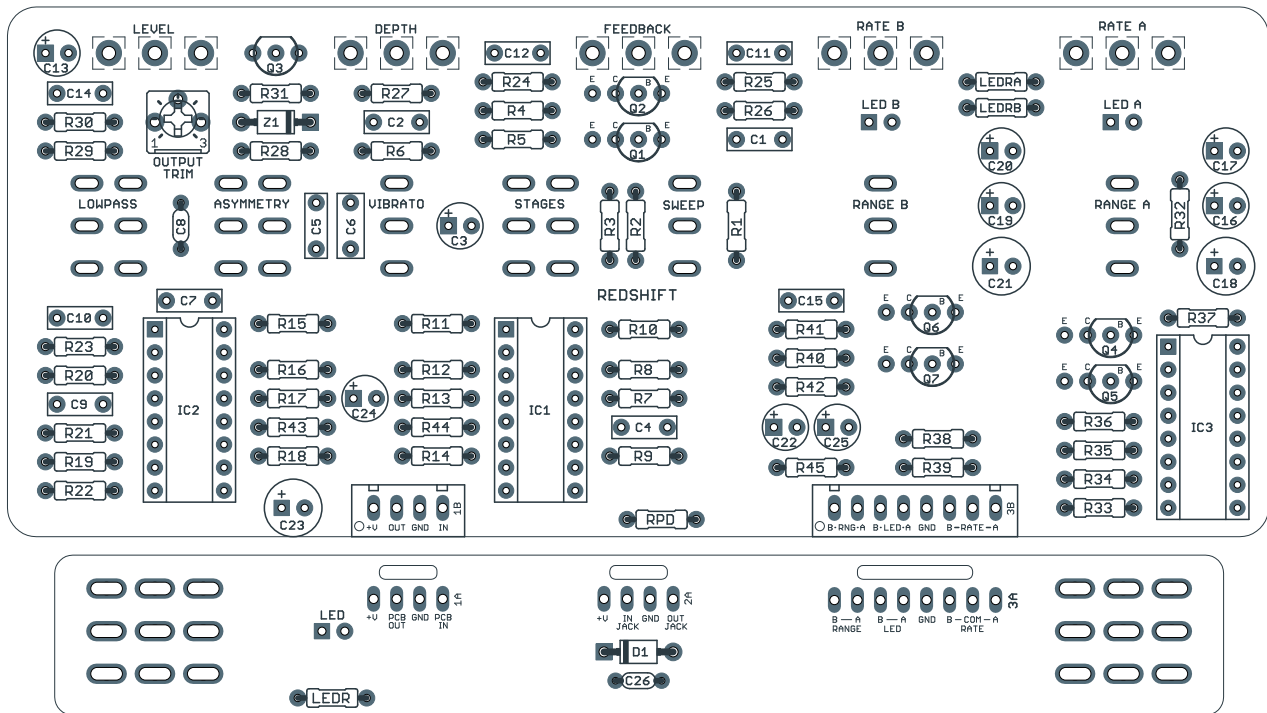
Phaser, vibrato & ring modulator

DOCUMENT VERSION

1.0.0 (2020-06-19)

PROJECT SUMMARY

Based on the Electro-Harmonix Small Stone, this tricked-out analog phaser adds several switches and knobs to greatly expand the tonal palette.



Actual size is 5.48" x 2.3" (main board) and 5.08" x 0.7" (bypass board).

TABLE OF CONTENTS

1	Project Overview	10-11	Drill Template
2	Introduction	12	Enclosure Layout
3	Usage	13	Wiring Diagram
4-7	Parts List	14	Licensing
8	Build Notes	14	Document Revisions
9	Schematic		

INTRODUCTION

The Redshift Deluxe Phaser is based on the Blackout Effectors Whetstone Phaser, originally released in 2009 and discontinued when Blackout closed their doors in 2018.

The Whetstone was based on the Electro-Harmonix Small Stone, a classic OTA phaser, but with several modifications including additional controls & switches and an output gain boost to solve the level-matching issues in the original. It also replaced the obsolete CA3094 OTA with the NE5517/LM13700, essentially a dual version of the chip with somewhat improved specifications.

The Redshift is a direct clone of the Whetstone, with the exception that the 4-position rotary control for Range has been changed to a 3-position toggle and the “Fix” mode has been omitted. In the original Whetstone, the lower half of the rotation produces audible high-pitched oscillation, and the actual swept-phase frequency changes are limited to around the last 25% of the knob’s rotation.

So while it sounds good on paper, the “Fix” mode really isn’t very usable in practice, and there are many pedals that do the manual-phase effect much better than this one. This change also allows the elimination of a large and expensive rotary switch in favor of a standard 3-position toggle switch.

In addition to the removal of the Fix setting, there is one other change from the original Whetstone, in the form of an added feature: a second set of Rate/Range controls for LFO speed, and a footswitch to go between the two presets. While it doesn’t truly “ramp” (gradually speed up or slow down) like a Leslie, it does let you have a whole other effect available with the press of a footswitch.

USAGE

The Redshift has the following controls.

Potentiometers

- **Rate** controls the speed of the LFO. There are two different Rate knobs that each act as presets, and the footswitch toggles between them. The range of each Rate control is set by the corresponding Range toggle.
- **Depth** sets the ratio of phased signal that is mixed back into the clean signal.
- **Feedback** (also called Resonance or Regeneration in other phasers) sets how much of the phased signal is fed back into the input to amplify the phasing effect.
- **Volume** is the output volume of the effect, coming off of the MOSFET boost stage.

Toggle Switches

- **Range** toggles between normal, fast and slow rates, going from 40-second sweeps at the slowest all the way to ring modulation and octave generation at the fastest. Each Rate knob has its own corresponding Range toggle.
- **Stages** toggles between two and four phase-shift stages.
- **Vibrato mode** cancels the clean signal, which results in a pitch vibrato effect. (Note that Depth should be set at 100% while in Vibrato mode since its only purpose is to attenuate the wet signal.)
- **Assymetrical mode** changes the frequency capacitors in two of the phase stages for a Univibe-like asymmetrical phasing effect.
- **Lowpass mode** changes two of the all-pass stages into low-pass for a darker or mellower phase tone. Combined with Vibrato mode, lowpass mode produces more of a harmonic tremolo than pitch vibrato.
- **Sweep** toggles between “Wide” and “Shallow” sweep modes for the LFO. This also impacts the speed of the LFO, so you may need to readjust the Rate control when toggling Sweep settings.

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	100k	Metal film resistor, 1/4W	
R2	470k	Metal film resistor, 1/4W	
R3	10k	Metal film resistor, 1/4W	
R4	4k7	Metal film resistor, 1/4W	
R5	4k7	Metal film resistor, 1/4W	
R6	27k	Metal film resistor, 1/4W	
R7	27k	Metal film resistor, 1/4W	
R8	1k	Metal film resistor, 1/4W	
R9	27k	Metal film resistor, 1/4W	
R10	10k	Metal film resistor, 1/4W	
R11	27k	Metal film resistor, 1/4W	
R12	1k	Metal film resistor, 1/4W	
R13	27k	Metal film resistor, 1/4W	
R14	10k	Metal film resistor, 1/4W	
R15	27k	Metal film resistor, 1/4W	
R16	1k	Metal film resistor, 1/4W	
R17	27k	Metal film resistor, 1/4W	
R18	10k	Metal film resistor, 1/4W	
R19	27k	Metal film resistor, 1/4W	
R20	1k	Metal film resistor, 1/4W	
R21	27k	Metal film resistor, 1/4W	
R22	10k	Metal film resistor, 1/4W	
R23	27k	Metal film resistor, 1/4W	
R24	3k3	Metal film resistor, 1/4W	
R25	4k7	Metal film resistor, 1/4W	
R26	27k	Metal film resistor, 1/4W	
R27	22k	Metal film resistor, 1/4W	
R28	2M2	Metal film resistor, 1/4W	
R29	2M2	Metal film resistor, 1/4W	
R30	10k	Metal film resistor, 1/4W	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
R31	JUMPER	Metal film resistor, 1/4W	Sets the minimum volume. See build notes.
R32	22k	Metal film resistor, 1/4W	
R33	4k7	Metal film resistor, 1/4W	
R34	15k	Metal film resistor, 1/4W	
R35	1k8	Metal film resistor, 1/4W	
R36	1k	Metal film resistor, 1/4W	
R37	27k	Metal film resistor, 1/4W	
R38	27k	Metal film resistor, 1/4W	
R39	7k5	Metal film resistor, 1/4W	
R40	1k8	Metal film resistor, 1/4W	
R41	47k	Metal film resistor, 1/4W	
R42	100R	Metal film resistor, 1/4W	
R43	15k	Metal film resistor, 1/4W	
R44	10k	Metal film resistor, 1/4W	
R45	100R	Metal film resistor, 1/4W	
RPD	2M2	Metal film resistor, 1/4W	
LEDR	4k7	Metal film resistor, 1/4W	
LEDRA	4k7	Metal film resistor, 1/4W	
LEDRB	2k2	Metal film resistor, 1/4W	Use 2k2 for a green LED to match brightness of a red LED with 4k7.
C1	6n8	Film capacitor, 7.2 x 2.5mm	
C2	100n	Film capacitor, 7.2 x 2.5mm	
C3	10uF	Electrolytic capacitor, 5mm	
C4	6n8	Film capacitor, 7.2 x 2.5mm	
C5	6n8	Film capacitor, 7.2 x 2.5mm	
C6	220n	Film capacitor, 7.2 x 2.5mm	
C7	6n8	Film capacitor, 7.2 x 2.5mm	
C8	680pF	MLCC capacitor, NP0/COG	
C9	6n8	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	100n	Film capacitor, 7.2 x 2.5mm	
C15	100n	Film capacitor, 7.2 x 2.5mm	
C16	1uF	Electrolytic capacitor, 4mm	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C17	22uF	Electrolytic capacitor, 5mm	
C18	100uF	Electrolytic capacitor, 6.3mm	
C19	1uF	Electrolytic capacitor, 4mm	
C20	22uF	Electrolytic capacitor, 5mm	
C21	100uF	Electrolytic capacitor, 6.3mm	
C22	22uF	Electrolytic capacitor, 5mm	
C23	100uF	Electrolytic capacitor, 6.3mm	
C24	33uF	Electrolytic capacitor, 5mm	
C25	47uF	Electrolytic capacitor, 5mm	
C26	100n	MLCC capacitor, X7R	
Q1	2N5088	BJT transistor, NPN, TO-92	
Q2	2N5087	BJT transistor, PNP, TO-92	
Q3	2N7000	MOSFET, N-channel, TO-92	
Q4	2N5087	BJT transistor, PNP, TO-92	
Q5	2N5087	BJT transistor, PNP, TO-92	
Q6	2N5088	BJT transistor, NPN, TO-92	
Q7	2N5088	BJT transistor, NPN, TO-92	
Z1	1N4742A	Zener diode, 12V, DO-41	
D1	1N5817	Schottky diode, DO-41	
IC1	LM13700N	Transconductance amplifier, dual, DIP16	Original uses NE5517, which is identical to the LM13700 but obsolete in through-hole format.
IC1-S	DIP16 socket	IC socket, DIP-16	
IC2	LM13700N	Transconductance amplifier, dual, DIP16	Original uses NE5517, which is identical to the LM13700 but obsolete in through-hole format.
IC2-S	DIP16 socket	IC socket, DIP-16	
IC3	LM13700N	Transconductance amplifier, dual, DIP16	Original uses NE5517, which is identical to the LM13700 but obsolete in through-hole format.
IC3-S	DIP16 socket	IC socket, DIP-16	
TRIM	10k trimmer	Trimmer, 10%, 1/4"	
DEPTH	250kB	16mm right-angle PCB mount pot	
FDBK.	250kB	16mm right-angle PCB mount pot	
RATE_A	1MC	16mm right-angle PCB mount pot	
RATE_B	1MC	16mm right-angle PCB mount pot	
LEVEL	100kA	16mm right-angle PCB mount pot	
VIBR.	SPDT	Toggle switch, SPDT on-on	
SWEEP	SPDT	Toggle switch, SPDT on-on	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
STAGES	DPDT	Toggle switch, DPDT on-on	
ASYM.	DPDT	Toggle switch, DPDT on-on	
LOW P	DPDT	Toggle switch, DPDT on-on	
RNG. A	SPDT cntr off	Toggle switch, SPDT on-off-on	
RNG. B	SPDT cntr off	Toggle switch, SPDT on-off-on	
LED	5mm	LED, 5mm, red diffused	
LED_A	5mm red	LED, 5mm, red diffused	
LED_B	5mm green	LED, 5mm, green 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	
RSW	3PDT	Stomp switch, 3PDT	
ENC	1590XX	Enclosure, die-cast aluminum	1790NS equivalent.

BUILD NOTES

Setting the volume trimmer

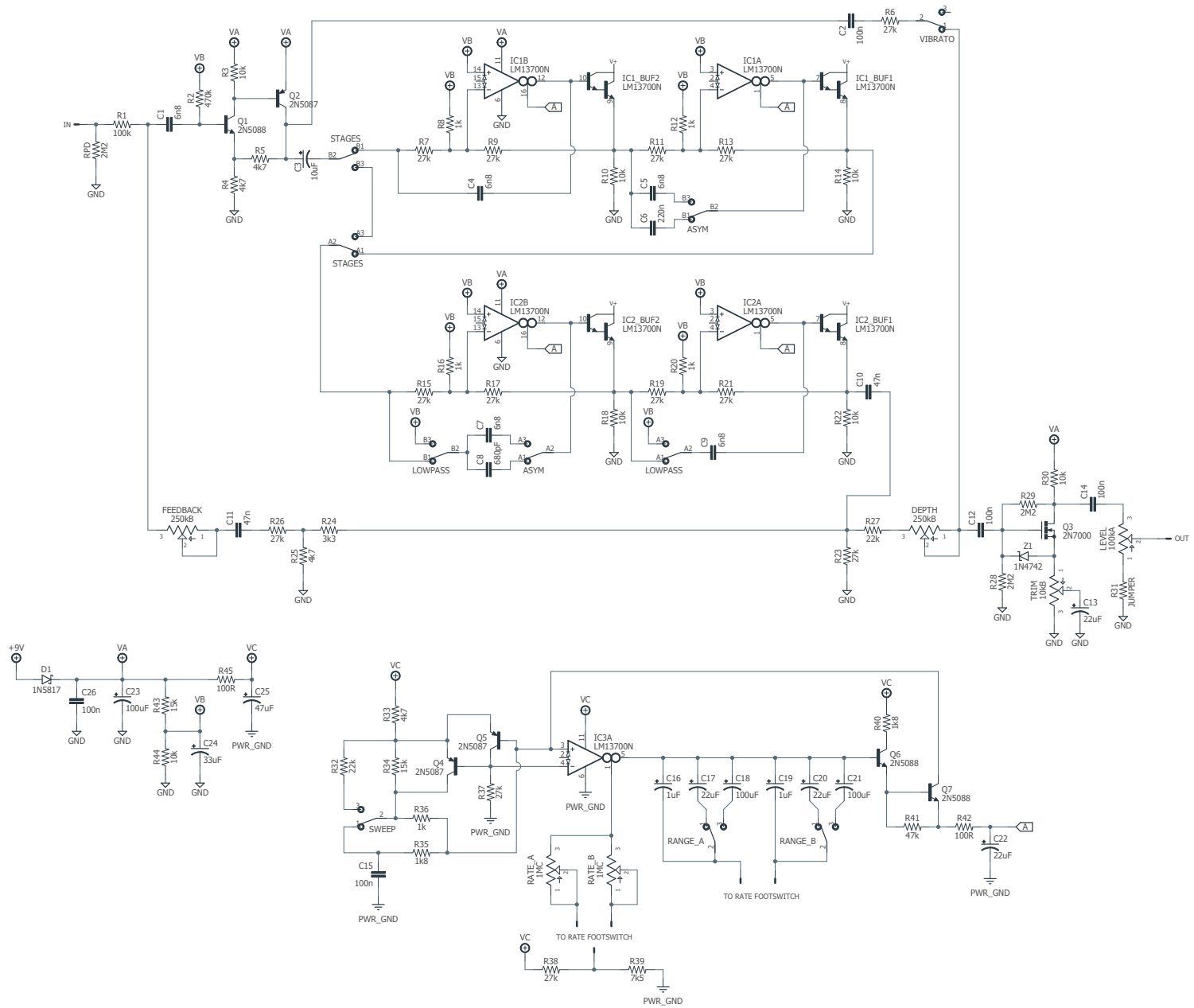
For such a large circuit, you may be surprised to find out that the only thing that needs to be set up during the build process is the volume trimmer. This controls the maximum boost level of the MOSFET output stage, which is essentially a Zvex SHO with tweaked values.

Set the volume control to full, then turn the trimmer up (clockwise) until the maximum available volume is to your liking. As with the SHO, expect a bit of crackle as the trimmer is adjusted.

R31 minimum volume resistor

The output volume control on the original Whetstone has a resistor that sets the volume level when the control is at minimum. Most people expect a volume control to go all the way down to zero, so it's recommended to jumper the R31 resistor to make this happen. However, if you want it to be exactly like the original, use a 10k resistor here.

SCHEMATIC



DRILL TEMPLATE

Cut out the drill template on the following page, 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.

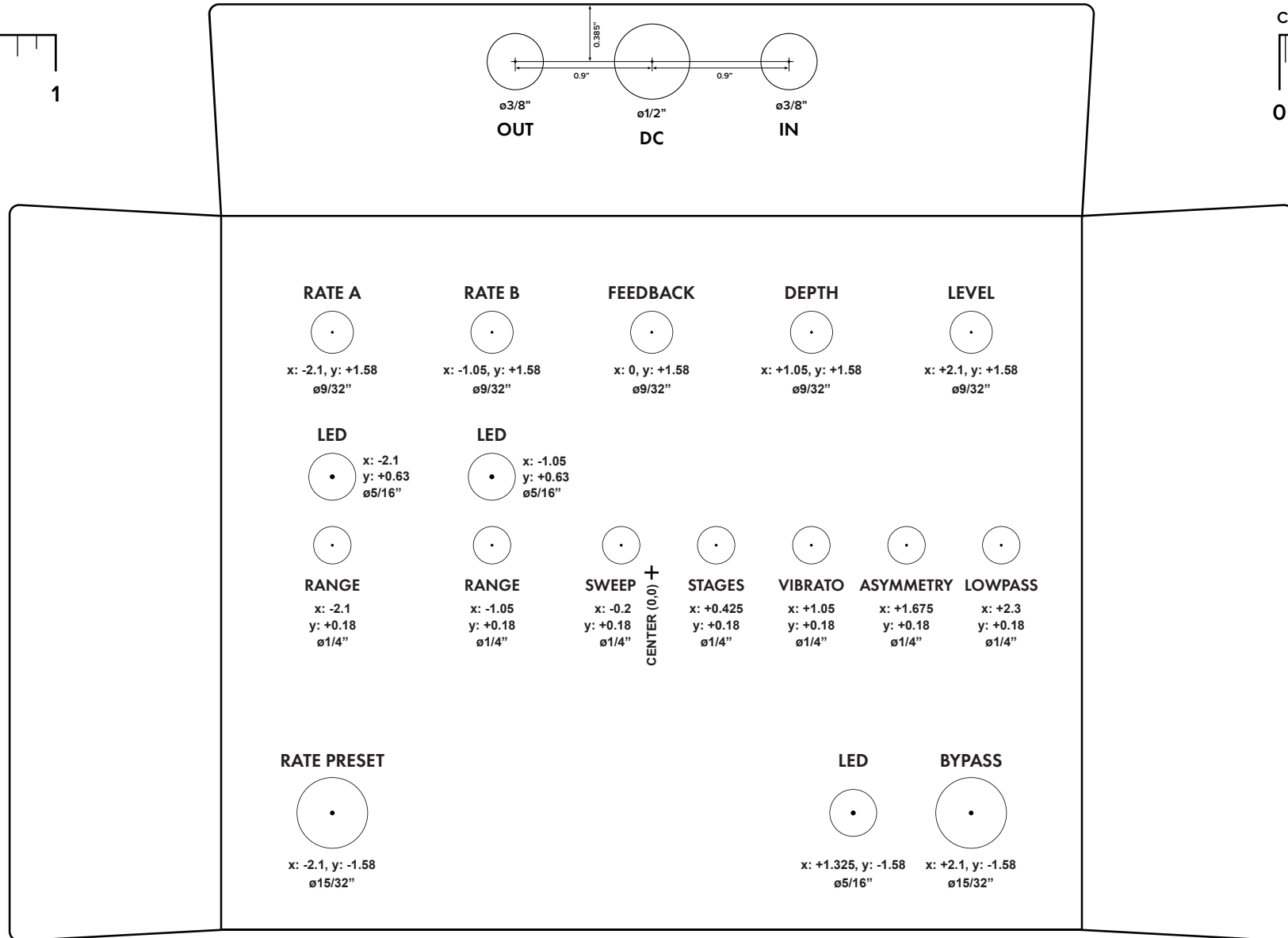
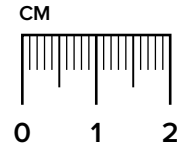
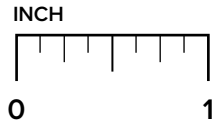
Ensure that the template is printed at 100% or "Actual Size". You can double-check this by measuring the scale on the printed page with a ruler or calipers.

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.

Important: Due to the high number of PCB-mounted parts, it's crucial that the drilling be accurate, especially the row with seven toggle switches. Since the PCB uses slotted holes for the toggles, there's not a lot of room for error.

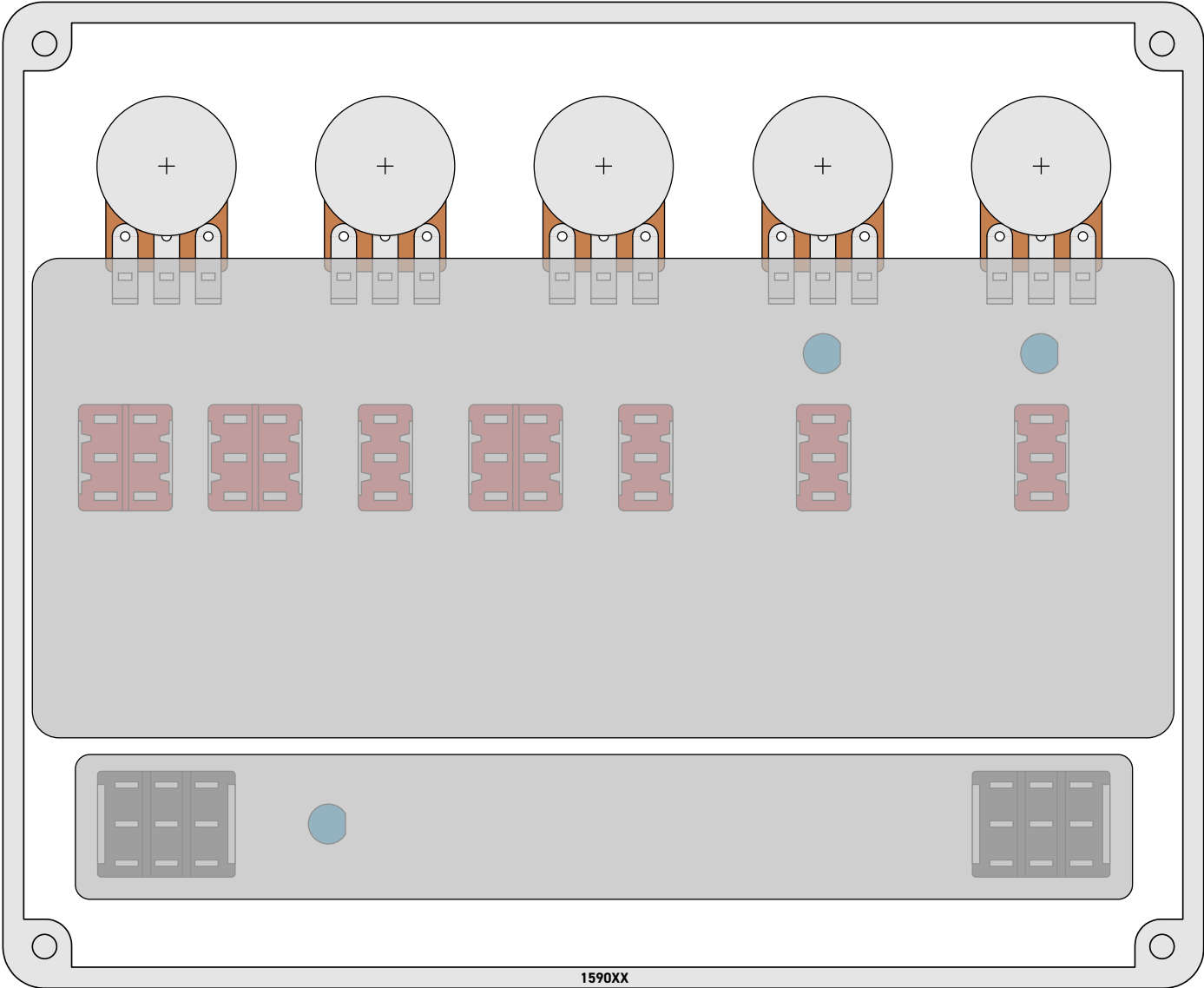
If the toggles don't align to the PCB, you can always drill one step larger (9/32") to allow a little more room correct any errors. The toggle switch washer and nut will still fully cover the hole.

DRILL TEMPLATE

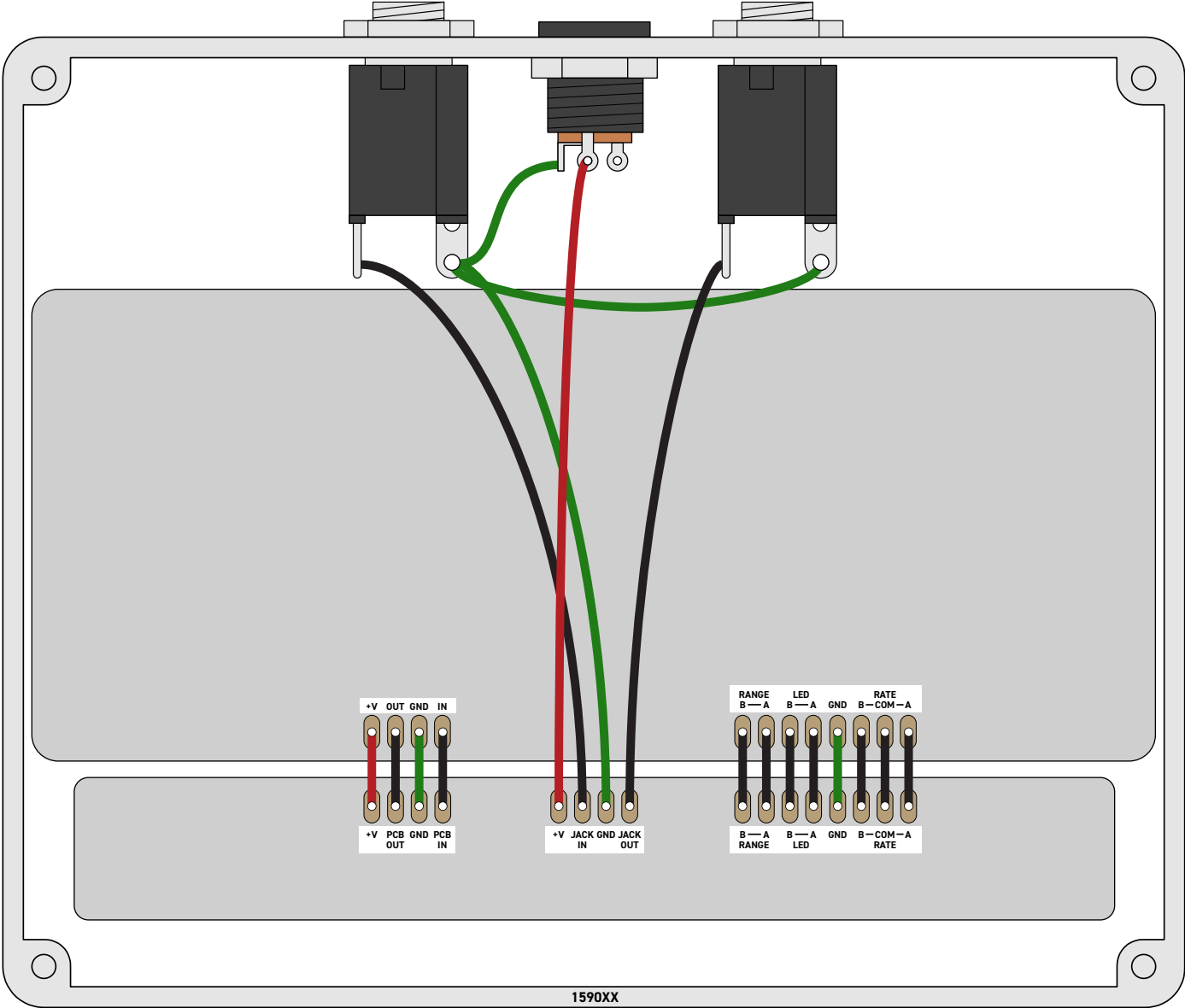


ENCLOSURE LAYOUT

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 (2020-06-19)

Initial release.