PROJECT NAME

L4 BASS PREAMP

aion DIY GUITAR EFFECTS

BASED ON
Lab Series® L4 Bass Preamp

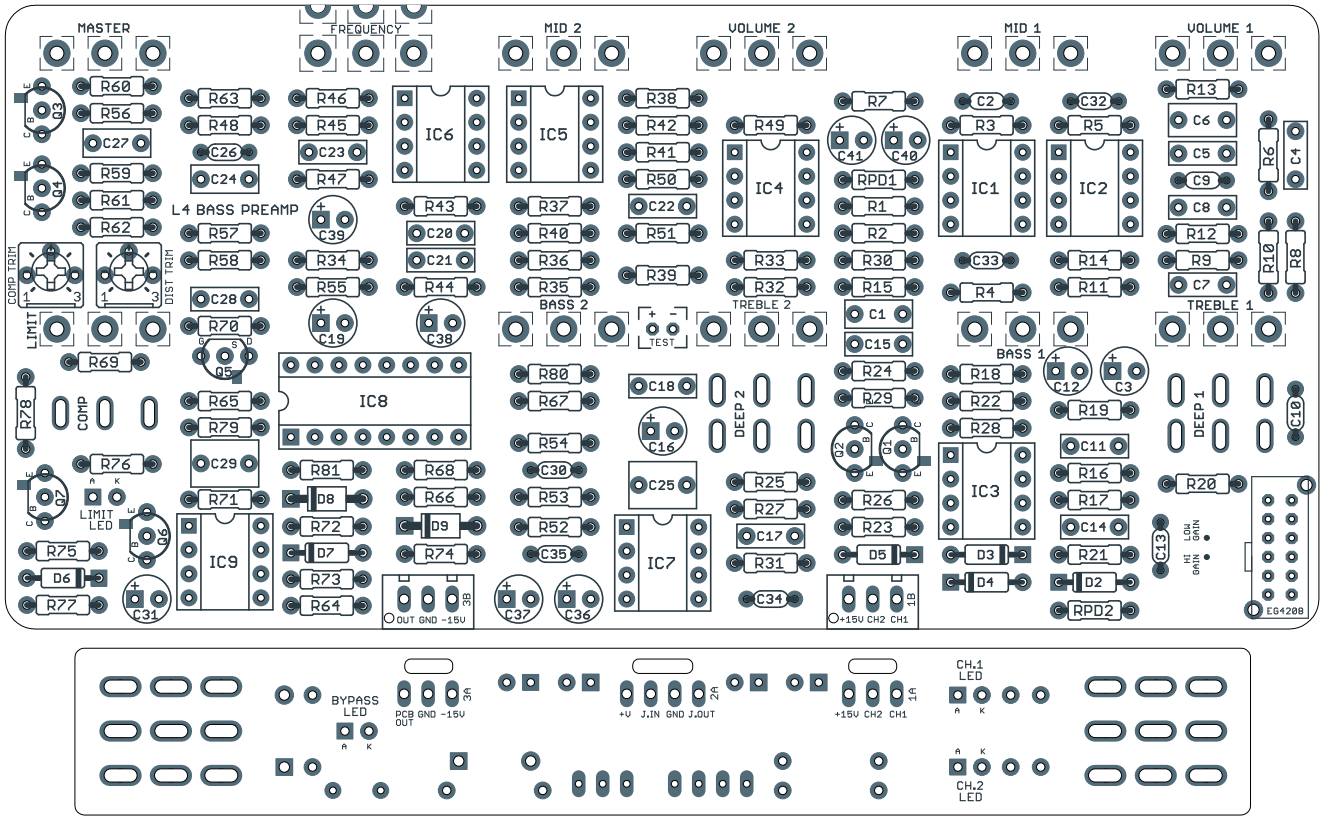
BUILD DIFFICULTY
Advanced

EFFECT TYPE
Bass preamp, overdrive & compressor

DOCUMENT VERSION
1.0.0 (2023-07-04)

PROJECT SUMMARY

A pedal adaptation of the two-channel preamp of the Lab Series® L4 bass amplifier from the late 1970s, a downtuned relative of the legendary L5.



Actual size is 5.48” x 2.61” (main board) and 4.90” x 0.71” (bypass board).

TABLE OF CONTENTS

INTRODUCTION

The L4 Bass Preamp is an adaptation of the preamp section of the Lab Series® L4 bass amplifier, originally released in late 1977, just a few months after the Lab Series L5 guitar amp hit stores. The L4 is a 200-watt head that was originally sold with a matching 2x15 cabinet, although most of them have since been separated from the original cabs.

While Lab Series was considered its own brand, the parent company Norlin also owned Moog, who was responsible for the design of the whole Lab Series lineup. The L4 and its single-channel sibling, the L2, used the L5's circuit as a starting point for the preamp design.

The overall topology—in particular the tone controls, overdrive and limiter sections—are nearly identical to the L5, with tweaks to the frequencies to make it better suited for bass. The major departure was the addition of a low-noise input section for the second channel, designed specifically for passive bass guitars. The "Bright" switches on each channel have also been replaced with "Deep" switches to enhance the bass frequencies. The multifilter feature was also removed since it was designed to enhance upper frequencies that are less important for bass.

The L4 Bass Preamp project is nearly identical to the original L4 amp. The only substantial change we've made is to convert the input stage of channel 1 from inverting to non-inverting. This reduces the noise, but the way we've designed it, the input impedance and frequency response are exactly the same as the original amp's "Lo" input (the higher-gain mode).

Channel 2 is unchanged except for one functional difference. The original amp used a complex arrangement of switching jacks to automatically configure the second channel in either low- or high-input mode depending on which input was used. We've converted this into an internal slide switch. You'll almost certainly want to keep it in the higher-gain mode all the time, even if using an active bass, since this mode has much more gain available and can always be turned down as much as necessary—but this way the low-gain mode is at least still available if you want to use it.

Lab Series® is a registered trademark of Gibson Brands. Use of the Lab Series name is not endorsed by Gibson and is used for comparative purposes only.

USAGE

The L4 Bass Preamp has the following controls:

Channel 1

- **Deep** (toggle switch) boosts bass frequencies at 100 Hz when on. When off, the signal remains roughly flat.
- **Treble**, **Mid** and **Bass** form a standard Fender-style 3-band passive EQ.
- **Volume** controls the amount of gain in the first stage, before the EQ and drive section.

Channel 2

- **Deep** (toggle switch) boosts bass frequencies at 100 Hz when on. When off, the signal remains roughly flat.
- **Volume** controls the amount of gain in the first stage, before the EQ and drive section.
- **Treble** and **Bass** form a standard 2-band Baxandall control. Each band is flat at the 12:00 position, and can either cut (CCW) or boost (CW).
- **Mid** boosts (CCW) or cuts (CW) the midrange frequency selected by the **Frequency** control.
- **Frequency** selects the frequency that will be boosted or cut by the **Mid** control, from 50 Hz at full CCW to 3.2kHz at full CW.

Both channels

- **Master** sets the output volume after the drive section of the preamp.
- **Limit** sets the threshold of the compressor at the end of the circuit.
- **Comp** (toggle) engages or disengages the compressor.

Power supply design

Like most solid-state preamplifiers of the era, the L4 ran on a bipolar +/-15V supply. This voltage can't be supplied by an external adapter, and the current draw of the circuit is too high to use a charge pump.

When developing the original Lab Series L5 Preamp, we adapted a supply scheme from Alesis rack units in the early 1990s that involved a 9VAC adapter and an AC voltage tripler. This was then rectified to bipolar +/-19V DC and regulated down to 15V on each rail.

This solution used cheap and readily-available parts, and it has worked very well for several years since the L5 Preamp was first developed. But the power adapter requirement has always been the major flaw. A 9VAC adapter will destroy most other pedals if it's plugged in, and if you own one, there's an infinitely higher chance that it'll be mistaken for a 9VDC adapter and plugged into the wrong pedal at some point.

Because of this, when developing the IVP Preamp project in 2021, we set out to find a reliable way to supply +/-15V from a standard DC adapter. Fortunately, there are a few more options available today than there were in 2015 when the L5 Preamp was originally developed, and a high-quality DC-DC converter module will give us exactly what we need.

They're not cheap (USD$9-15 each), but once you account for the fact that you no longer need a specialized power adapter, the total cost is about the same. We have begun using these DC converters in all of our preamp projects going forward, including this one.

See the build notes on page 11 for more information on the specific DC-DC converters that are recommended for use in this project.

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 →

Interactive BOM →

PART	VALUE	TYPE	NOTES
R1	10k	Metal film resistor, 1/4W	
R2	220k	Metal film resistor, 1/4W	
R3	47k	Metal film resistor, 1/4W	
R4	2k2	Metal film resistor, 1/4W	
R5	1k	Metal film resistor, 1/4W	
R6	22k	Metal film resistor, 1/4W	
R7	5k1	Metal film resistor, 1/4W	Taper resistor for Mid pot. See build notes.
R8	22k	Metal film resistor, 1/4W	
R9	22k	Metal film resistor, 1/4W	
R10	470k	Metal film resistor, 1/4W	
R11	47k	Metal film resistor, 1/4W	18k in the original amp, but 47k provides better channel matching.
R12	10k	Metal film resistor, 1/4W	
R13	2k7	Metal film resistor, 1/4W	Taper resistor for Volume 1 pot. See build notes.
R14	1k	Metal film resistor, 1/4W	Taper resistor for Volume 1 pot. See build notes.
R15	6k8	Metal film resistor, 1/4W	
R16	2k2	Metal film resistor, 1/4W	
R17	1M	Metal film resistor, 1/4W	
R18	4k7	Metal film resistor, 1/4W	
R19	4k7	Metal film resistor, 1/4W	
R20	2k2	Metal film resistor, 1/4W	
R21	220k	Metal film resistor, 1/4W	
R22	120k	Metal film resistor, 1/4W	
R23	220k	Metal film resistor, 1/4W	
R24	3k3	Metal film resistor, 1/4W	
R25	120k	Metal film resistor, 1/4W	
R26	18k	Metal film resistor, 1/4W	
R27	1k	Metal film resistor, 1/4W	
R28	4k7	Metal film resistor, 1/4W	
R29	10k	Metal film resistor, 1/4W	
R30	5k6	Metal film resistor, 1/4W	
R31	22k	Metal film resistor, 1/4W	
R32	22k	Metal film resistor, 1/4W	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
R33	470k	Metal film resistor, 1/4W	
R34	2k2	Metal film resistor, 1/4W	
R35	15k	Metal film resistor, 1/4W	
R36	2k2	Metal film resistor, 1/4W	
R37	100k	Metal film resistor, 1/4W	
R38	2k2	Metal film resistor, 1/4W	
R39	24k	Metal film resistor, 1/4W	
R40	2k7	Metal film resistor, 1/4W	
R41	2k7	Metal film resistor, 1/4W	
R42	2k7	Metal film resistor, 1/4W	
R43	18k	Metal film resistor, 1/4W	
R44	18k	Metal film resistor, 1/4W	
R45	18k	Metal film resistor, 1/4W	
R46	18k	Metal film resistor, 1/4W	
R47	1k5	Metal film resistor, 1/4W	
R48	1k5	Metal film resistor, 1/4W	
R49	2k7	Metal film resistor, 1/4W	Taper resistor for Volume 2 pot. See build notes.
R50	1k	Metal film resistor, 1/4W	Taper resistor for Volume 2 pot. See build notes.
R51	2k7	Metal film resistor, 1/4W	
R52	10k	Metal film resistor, 1/4W	
R53	15k	Metal film resistor, 1/4W	
R54	1k	Metal film resistor, 1/4W	
R55	33k	Metal film resistor, 1/4W	
R56	220R	Metal film resistor, 1/4W	
R57	10k	Metal film resistor, 1/4W	
R58	470k	Metal film resistor, 1/4W	
R59	2k	Metal film resistor, 1/4W	
R60	47k	Metal film resistor, 1/4W	
R61	3k3	Metal film resistor, 1/4W	
R62	330R	Metal film resistor, 1/4W	
R63	100k	Metal film resistor, 1/4W	
R64	6k8	Metal film resistor, 1/4W	
R65	15k	Metal film resistor, 1/4W	
R66	220R	Metal film resistor, 1/4W	
R67	220R	Metal film resistor, 1/4W	
R68	820R	Metal film resistor, 1/4W	
R69	22k	Metal film resistor, 1/4W	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
R70	3k3	Metal film resistor, 1/4W	
R71	33k	Metal film resistor, 1/4W	
R72	10k	Metal film resistor, 1/4W	
R73	10k	Metal film resistor, 1/4W	
R74	47k	Metal film resistor, 1/4W	
R75	47k	Metal film resistor, 1/4W	
R76	100k	Metal film resistor, 1/4W	
R77	100k	Metal film resistor, 1/4W	
R78	10k	Metal film resistor, 1/4W	
R79	22k	Metal film resistor, 1/4W	
R80	10M	Metal film resistor, 1/4W	
R81	2k7	Metal film resistor, 1/4W	
RPD1	2M2	Metal film resistor, 1/4W	Ch. 1 input pulldown resistor. Can be as low as 1M.
RPD2	2M2	Metal film resistor, 1/4W	Ch. 2 input pulldown resistor. Can be as low as 1M.
LEDC	10k	Metal film resistor, 1/4W	Channel 1 LED current-limiting resistor.
LEDD	10k	Metal film resistor, 1/4W	Channel 2 LED current-limiting resistor.
LEDR	10k	Metal film resistor, 1/4W	Bypass LED current-limiting resistor.
C1	220n	Film capacitor, 7.2 x 2.5mm	
C2	22pF	MLCC capacitor, NP0/C0G	
C3	22uF	Electrolytic capacitor, 5mm	
C4	10n	Film capacitor, 7.2 x 2.5mm	
C5	2n7	Film capacitor, 7.2 x 2.5mm	
C6	470n	Film capacitor, 7.2 x 3mm	
C7	15n	Film capacitor, 7.2 x 2.5mm	
C8	68n	Film capacitor, 7.2 x 2.5mm	
C9	22pF	MLCC capacitor, NP0/C0G	
C10	220pF	MLCC capacitor, NP0/C0G	
C11	100n	Film capacitor, 7.2 x 2.5mm	
C12	4.7uF	Electrolytic capacitor, 4mm	
C13	220pF	MLCC capacitor, NP0/C0G	
C14	100n	Film capacitor, 7.2 x 2.5mm	
C15	1n	Film capacitor, 7.2 x 2.5mm	
C16	4.7uF	Electrolytic capacitor, 4mm	
C17	15n	Film capacitor, 7.2 x 2.5mm	
C18	68n	Film capacitor, 7.2 x 2.5mm	
C19	4.7uF	Electrolytic capacitor, 4mm	
C20	82n	Film capacitor, 7.2 x 2.5mm	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C21	82n	Film capacitor, 7.2 x 2.5mm	
C22	3n3	Film capacitor, 7.2 x 2.5mm	
C23	10n	Film capacitor, 7.2 x 2.5mm	
C24	150n	Film capacitor, 7.2 x 2.5mm	
C25	2.2uF	Film capacitor, 7.2 x 5mm	Original amp uses 2.7uF tantalum, but 2.2uF film will work the same.
C26	220pF	MLCC capacitor, NP0/C0G	
C27	330n	Film capacitor, 7.2 x 2.5mm	
C28	68n	Film capacitor, 7.2 x 2.5mm	
C29	2.2uF	Film capacitor, 7.2 x 5mm	
C30	100pF	MLCC capacitor, NP0/C0G	
C31	10uF	Electrolytic capacitor, 5mm	
C32	100n	MLCC capacitor, X7R	
C33	100n	MLCC capacitor, X7R	
C34	100n	MLCC capacitor, X7R	
C35	100n	MLCC capacitor, X7R	
C36	22uF	Electrolytic capacitor, 5mm	
C37	22uF	Electrolytic capacitor, 5mm	
C38	22uF	Electrolytic capacitor, 5mm	
C39	22uF	Electrolytic capacitor, 5mm	
C40	22uF	Electrolytic capacitor, 5mm	
C41	22uF	Electrolytic capacitor, 5mm	
C42	22uF	Electrolytic capacitor, 5mm	
C43	22uF	Electrolytic capacitor, 5mm	
C44	100n	MLCC capacitor, X7R	
C45	100uF	Electrolytic capacitor, 6.3mm	
C46	47uF	Electrolytic capacitor, 5mm	
D1	1N5817	Schottky diode, DO-41	
D2	1N457A	Rectifier diode, DO-35	
D3	1N457A	Rectifier diode, DO-35	
D4	1N457A	Rectifier diode, DO-35	
D5	1N457A	Rectifier diode, DO-35	
D6	1N914	Fast-switching diode, DO-35	
D7	1N914	Fast-switching diode, DO-35	
D8	1N4004	Rectifier diode, DO-41	
D9	1N4004	Rectifier diode, DO-41	
Z1	1N4742A	Zener diode, 12V, DO-41	
Q1	2N5088	BJT transistor, NPN, TO-92	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
Q2	2N5088	BJT transistor, NPN, TO-92	
Q3	2N3904	BJT transistor, NPN, TO-92	
Q4	2N3904	BJT transistor, NPN, TO-92	
Q5	2N5457	JFET, N-channel, TO-92	Original uses PN4303, but 2N5457 will perform the same.
Q6	2N3906	BJT transistor, PNP, TO-92	
Q7	MPSA13	Darlington transistor, NPN, TO-92	
IC1	LF356N	Operational amplifier, DIP8	
IC1-S	DIP-8 socket	IC socket, DIP-8	
IC2	RC4558P	Operational amplifier, dual, DIP8	
IC2-S	DIP-8 socket	Operational amplifier, dual, DIP8	
IC3	RC4558P	IC socket, DIP-8	
IC3-S	DIP-8 socket	Operational amplifier, dual, DIP8	
IC4	RC4558P	IC socket, DIP-8	
IC4-S	DIP-8 socket	Operational amplifier, dual, DIP8	
IC5	RC4558P	IC socket, DIP-8	
IC5-S	DIP-8 socket	Operational amplifier, dual, DIP8	
IC6	RC4558P	IC socket, DIP-8	
IC6-S	DIP-8 socket	Transconductance amplifier, dual, DIP16	
IC7	RC4558P	IC socket, DIP-16	
IC7-S	DIP-8 socket	Operational amplifier, dual, DIP8	
IC8	LM13700N	IC socket, DIP-8	Can also use NE5517N.
IC8-S	DIP-16 socket	Inductor, 10uH	
IC9	RC4558P	Inductor, 10uH	
IC9-S	DIP-8 socket	Inductor, 10uH	
L1	10uH	Inductor, 10uH	
L2	10uH	Inductor, 10uH	
L3	10uH	Inductor, 10uH	
DC1	TEC 3-0923	DC-DC converter, +9V to +/-15V	See page 11 for more DC converter options.
COMP. TRIM	20k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P
DIST. TRIM	20k trimmer	Trimmer, 10%, 1/4"	Bourns 3362P
INPUT	4PDT slide	Slide switch, 4PDT	E-Switch EG4208
BASS 1	50kA	16mm right-angle PCB mount pot	
MID 1	5kA	16mm right-angle PCB mount pot	Original uses 2.5kA. See build notes.
TREBLE 1	50kA	16mm right-angle PCB mount pot	
VOLUME 1	10kB	16mm right-angle PCB mount pot	Original uses 2.5kA. See build notes.
BASS 2	25kB	16mm right-angle PCB mount pot	
MID 2	25kB	16mm right-angle PCB mount pot	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
FREQUENCY	100kC dual	16mm dual pot, right angle	
TREBLE 2	25kB	16mm right-angle PCB mount pot	
VOLUME 2	10kB	16mm right-angle PCB mount pot	Original uses 2.5kA. See build notes.
MASTER	25kA	16mm right-angle PCB mount pot	
LIMIT	50kC	16mm right-angle PCB mount pot	
DEEP 1	DPDT	Toggle switch, DPDT on-on	
DEEP 2	DPDT	Toggle switch, DPDT on-on	
COMP	SPDT	Toggle switch, SPDT on-on	
BYP. LED	5mm red	LED, 5mm, red diffused	
CH. 1 LED	5mm green	LED, 5mm, green diffused	
CH. 2 LED	5mm red	LED, 5mm, red diffused	
LIMIT LED	3mm red	LED, 3mm, red diffused	
DC JACK	2.1mm	DC jack, 2.1mm panel mount	Mouser 163-4302-E or equivalent.
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.
BYPASS	3PDT	Stomp switch, 3PDT	
CHANNEL	3PDT	Stomp switch, 3PDT	
ENCLOSURE	1590XX	Enclosure, die-cast aluminum	

DC converter selection

There are several brands and models available, all with the same pinout and similar specifications. Here are the DC converters we've found that will work in this circuit.

BRAND	PART #	MOUSER #	SUPPLY	NOTES
Traco	TEC 3-0923	495-TEC3-0923	4.5-13.2V	Preferred option. More sources on Octopart.
CUI	PQMC3-D12-D15-S	490-PQMC3-D12-D15-S	9-18V	
XP Power	IZ1215S	209-IZ1215S	9-18V	
Recom	RS3-1215D	919-RS3-1215D	9-18V	
Mornsun	WRA1215S-3WR2	N/A	9-18V	NAC Semi: https://aionfx.com/link/mornsun/

The Traco TEC 3-0923 is preferred for this circuit because its supply voltage range (4.5V to 13.2V) is perfectly suited for any type of pedal power supply. The TEC 2-0923 cannot be used since the current handling is not high enough for the full two-channel preamp.

The other brands all have a minimum supply voltage of 9V. Most nominally 9VDC adapters put out around 9.6V, which is more than enough—but one very notable exception is the Voodoo Labs Pedal Power series (and likely other similar pedalboard supplies) which regulate to exactly 9.00V.

These DC converter modules are usually specced very conservatively, so it's very unlikely that there would be any issues even if the supply voltage was slightly lower than 9V. However, operating on the extreme lower end of a spec is not ideal from an engineering standpoint, so if we're going to point you to a specific module, it's going to be the one that works reliably in all use cases.

If you are using a standard wall-wart supply that puts out more than 9V, then all this is immaterial and any of the five units listed above will work the same. All significant specifications are the same aside from this input voltage range. We haven't tried all of them directly, but their datasheets indicate they will perform identically and they have the same pinout and physical dimensions.

This is fortunate, because most suppliers don't stock more than 20 or 30 of each type at a time. So while we recommend the Traco TEC 3-0923 as the best overall, it will likely not always be in stock, especially as we release more preamp projects with converters and more people are using them.

If you're having a hard time finding any that will work, try searching Octopart for the part number shown in the Part # column. Most of these brands are also carried by DigiKey, Newark, and several other suppliers, and this engine will search all of the major distributors at once for easier sourcing.

The Mornsun unit is not available from Mouser, but it's included here because it's cheaper than the others (USD$8.22 as of the time of this writing) with the exact same specs. If you need more than one, it quickly becomes much more cost-effective than the other options.

Calibration

The L4 Preamp has two different calibration trimmers, located on the far-left side of the PCB. To set these, all you will need is a multimeter and a signal generator (which can be a computer or smartphone).

Note that all voltages are taken in AC, not DC, since we are dealing with audio signal levels. The voltages are also all RMS rather than p-p, so confirm that your multimeter measures RMS if you're not sure. Before you start, turn both trimmers all the way down.

Distortion trimmer

The distortion trimmer should be set first. This sets the level at which the overdrive kicks in. The procedure calls for a 1kHz 30mV sine wave to be inserted onto pin 13 of IC8, and for the trimmer to be adjusted until you measure **4.4V** on pin 12 of IC8.

For convenience, there is a pair of pads marked "TEST" right underneath the "Frequency" potentiometer's pads where you can insert your signal. The "+" pad connects to pin 13 of IC10 and the other is connected to ground. It's recommended to solder short pins to these pads (about 3/4" in length) to act as 'posts' for alligator clips to attach to. (The clipped leads from a 1N4004 diode work well for this since they are more rigid than normal component leads.)

If you don't have a signal generator, look for a smartphone or Mac/PC app that allows selection of wave type, frequency and gain level. These come and go, so we can't recommend anything specific, but there are several free ones available at any given time and they all do the same basic thing.

From here, hook up a 3.5mm male-to-male headphone cable and turned up the phone or computer volume to maximum, then set the frequency to 1kHz and the wave type to sine. Using a multimeter set to AC millivolt mode, adjust the volume in the app until you read 30mV. (Don't rely on the app to tell you the output signal level; they have no way of knowing the actual real-world level.)

Now, use alligator clips to connect the sleeve and the tip of the headphone cable to the two wires coming from the test pad. Since it's AC, the polarity does not matter. This will insert the signal to pin 13 of IC8 so you can adjust the trimmer as specified earlier, targeting 4.4V on pin 12.

Once you know the correct factory setting, feel free to adjust the trimmer up or down and see if you prefer it in any other position (but consider first marking the trimmer with a Sharpie so you can get back to the calibrated setting). Since this is a pedal adaptation, you may find it worthwhile to adjust the distortion so it comes on earlier than it did in the original amps.

Compressor/limiter trimmer

With the 30mV sine wave signal still inserted into pin 13 of IC8, turn the master volume up all the way and turn the compressor on (switch in the "up" position). Then turn the compressor knob up to about 2:00 (2/3 of the way up) and touch your probe to the "PCB OUT" pad on the right side of the footswitch board. Turn the trimmer until you measure **1.17VAC**.

This will get you in the range of the original amps. If you're using the L4 primarily as a pedal, you may want to set this lower so it's more sensitive to lower-level signals.

Ch. 1 midrange, Ch. 1 volume, and Ch. 2 volume potentiometer values

The original L4 amp used 2.5kA potentiometers for both Midrange & Volume of channel 1 and Volume of channel 2. This is a non-standard value today and not available from any standard parts suppliers. Tayda Electronics carries 2kA, which is certainly close enough and will work fine in this circuit. But in this project, to get as close as possible, we included parallel and tapering resistors on the PCB so standard pot values could be used.

For the Ch. 1 midrange pot, we recommend using 5kA, with a 5k1 resistor in parallel (R7). Since it's wired as a variable resistor, this drops the resistance value to 2.5k and only steepens the curve slightly.

Both volume pots are wired as true potentiometers with all three terminals used, so it's a little more complicated. For these, it's recommended to use a 10kB pot with a 2k7 resistor (R13 and R49) between pins 2 and 3, and a 1k resistor (R14 and R50) between pins 1 and 2. This will give a good approximation of a 2.5k pot, and the resulting taper will be very close to logarithmic.

LM13700 vs. CA3080

Our original L5 Preamp project used CA3080s as in the original amp. These have been discontinued for a long time, and while they have been reissued and are not terribly hard to find, they are expensive.

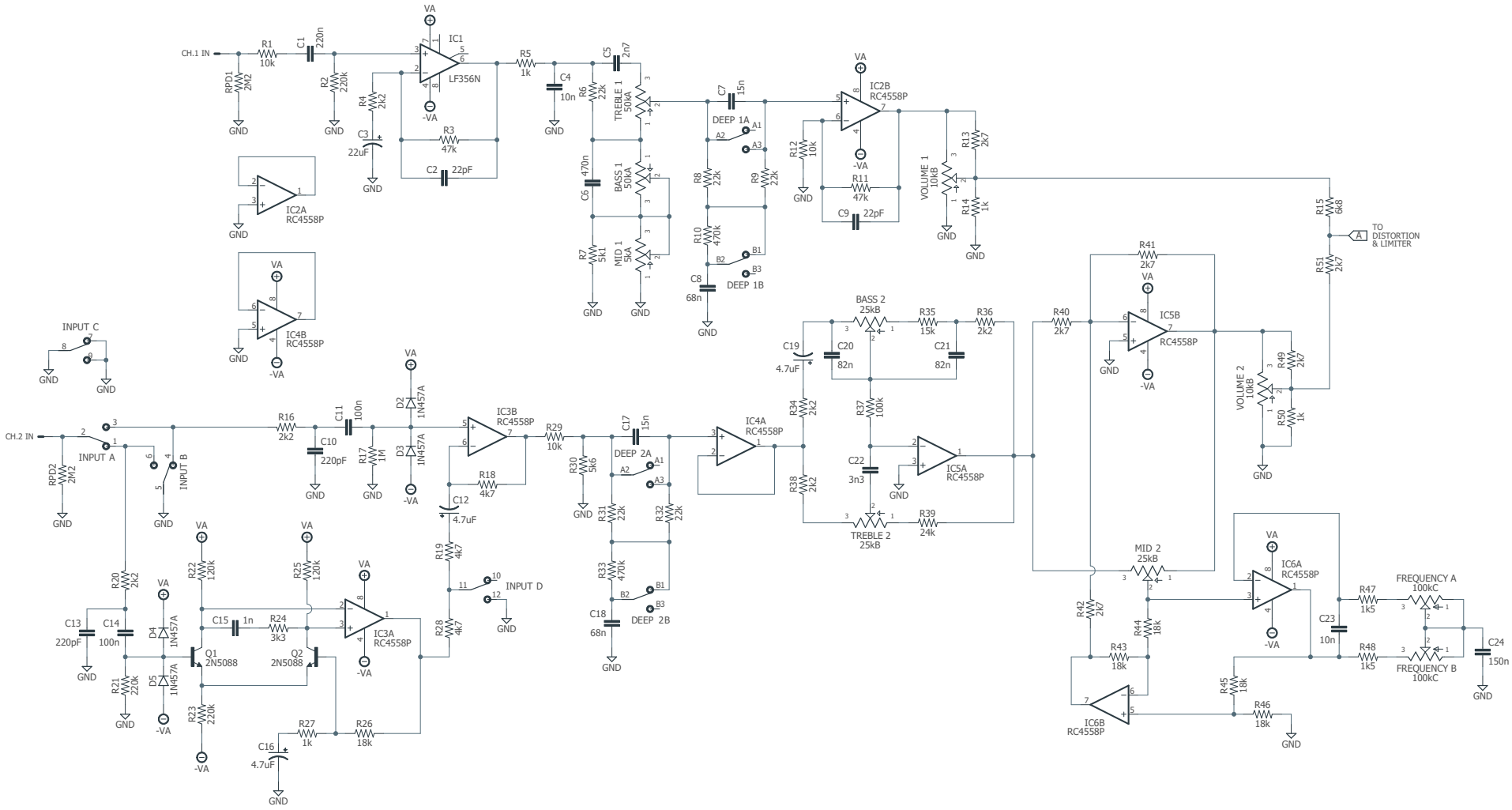
The LM13700 is essentially a dual version of the CA3080/CA3094 and is still readily available. Since the L4 circuit uses two CA3080s, it seemed like a good opportunity to replace them with a single LM13700.

The only change that this required was to add a second 100k resistor (R77) to cut the compressor LED's voltage in half, since the LM13700's I_{ABC} pin sits at twice the voltage of the CA3080's pin. This extra resistor prevents the LED from staying on all the time, which was the only side-effect of substituting the LM13700 in place of the CA3080.

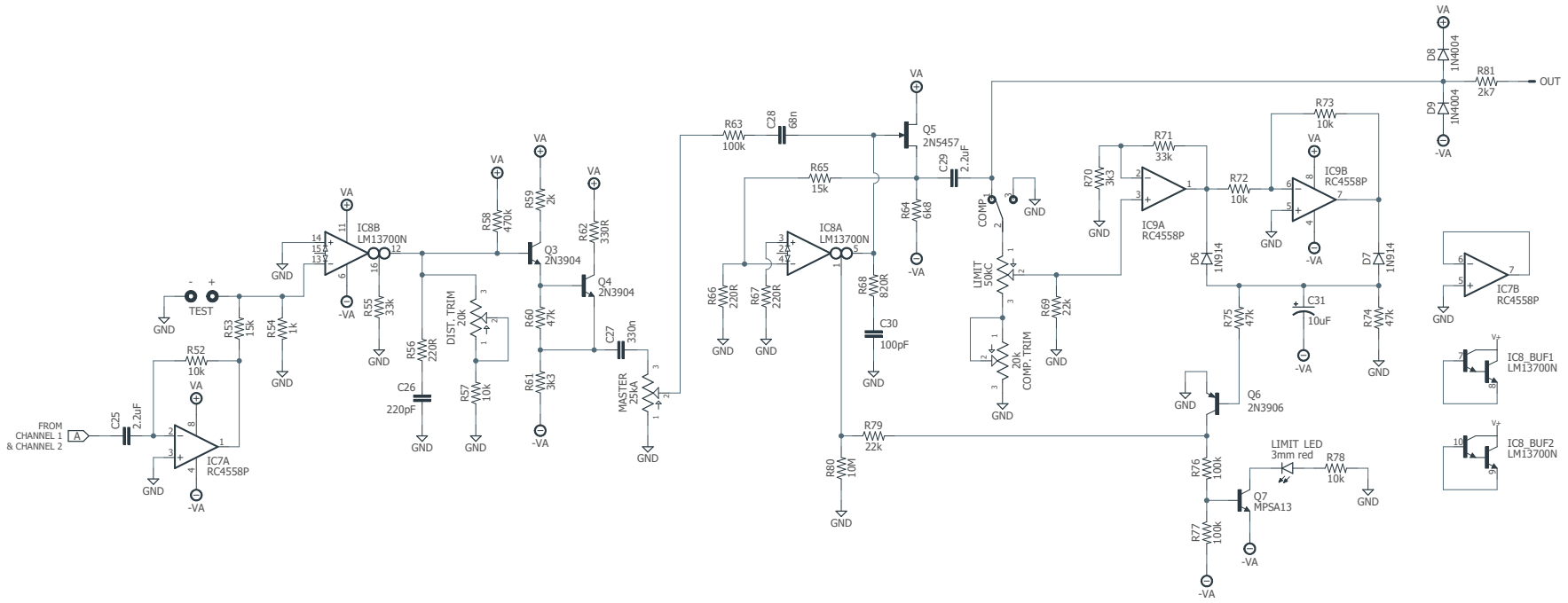
Bypass PCB component orientation

Due to the height of the DC converter and electrolytic capacitors, the components on the switching PCB are mounted on the bottom, the same side as the footswitch. This is in contrast with most other Aion FX projects where the switch is mounted on the bottom of the switching sub-board and the components face up. Components are always mounted to the side with the silkscreen footprint.

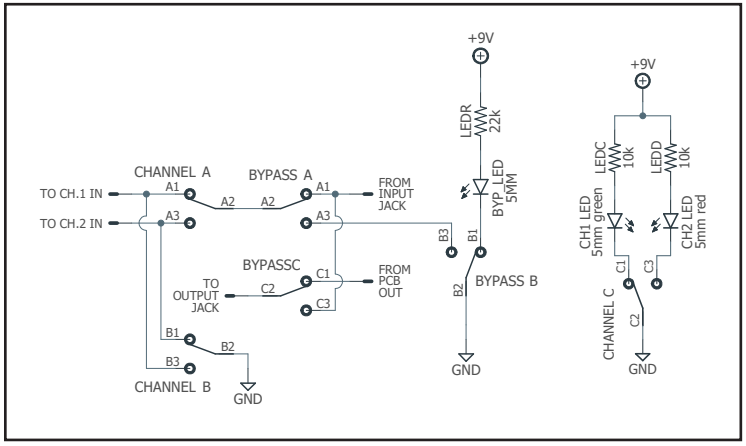
SCHEMATIC (CHANNEL 1, CHANNEL 2)



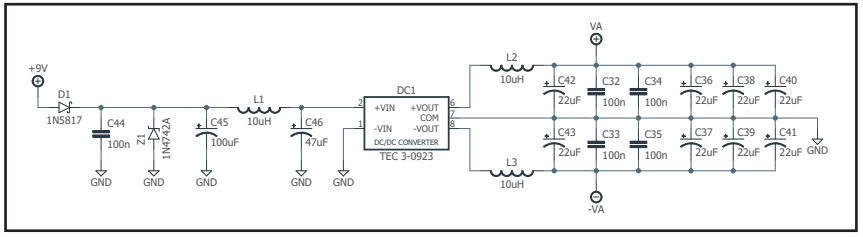
SCHEMATIC (DISTORTION, COMPRESSOR, SWITCHING, POWER)



Channel switching & bypass



Power supply



DRILL TEMPLATE INSTRUCTIONS

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.

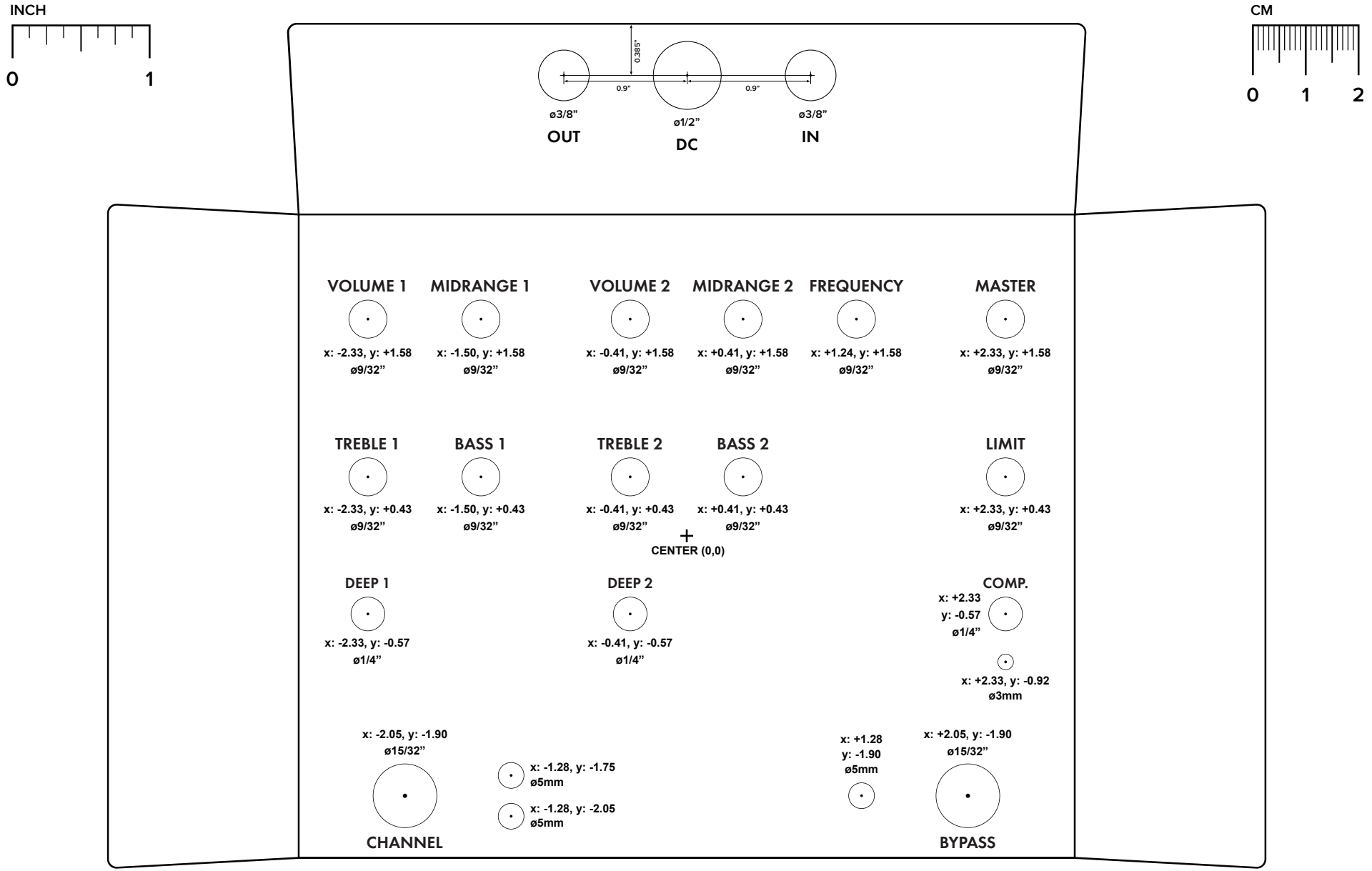
Ensure that the template is printed at 100% or "Actual Size". You can double-check this by measuring the scale on the printed page with a ruler or calipers.

The LEDs are sized for plain LEDs with no bezel, mounted directly to the PCB. If you don't have a 5mm bit for the bypass and channel LEDs, use 7/32". If you don't have a 3mm bit for the limit LED, use 1/8".

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

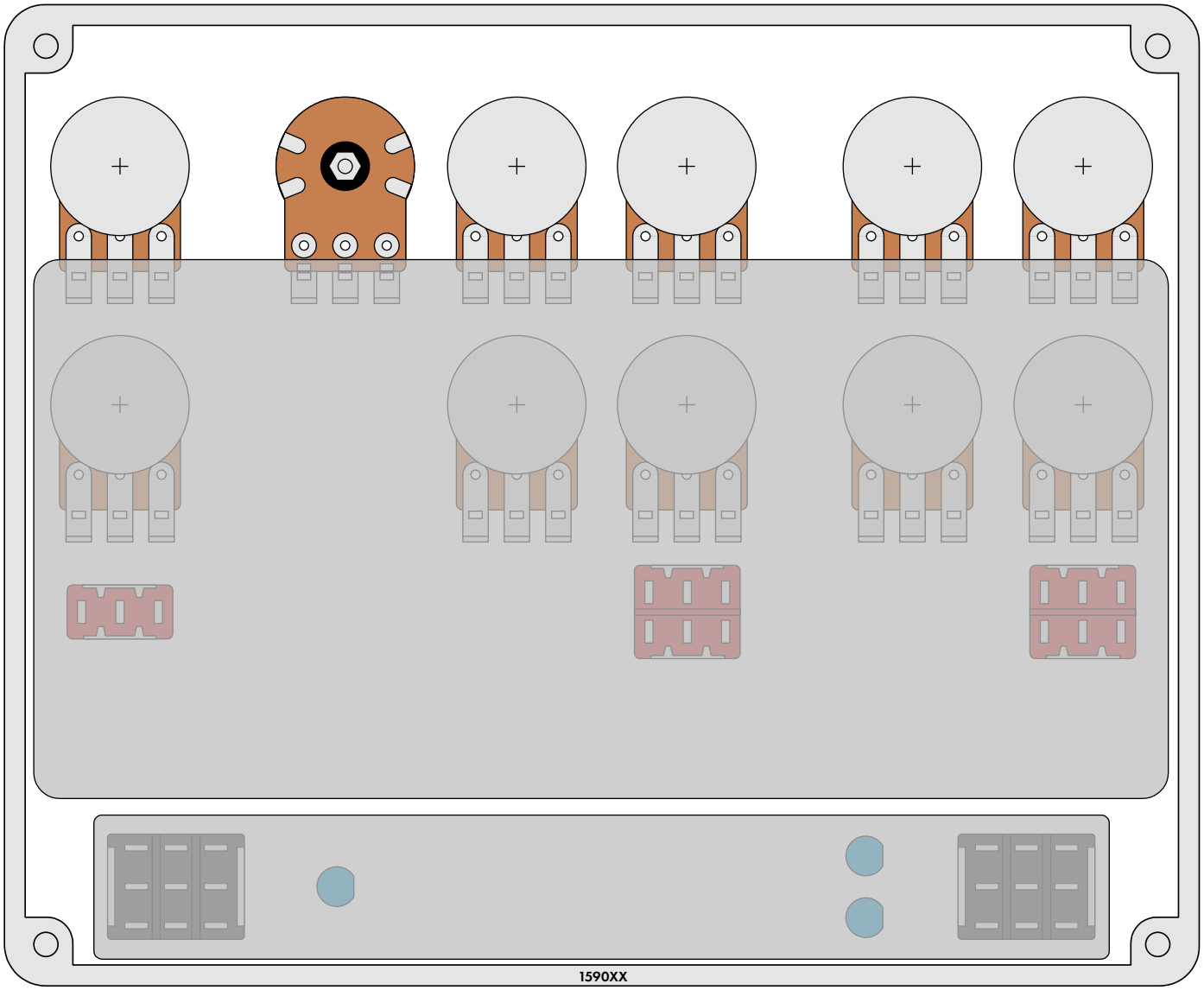
If the toggles don't align to the PCB, you can always drill one step larger (9/32") to allow a little more room correct any errors. The toggle switch washer and nut will still fully cover the hole.

DRILL TEMPLATE



ENCLOSURE LAYOUT

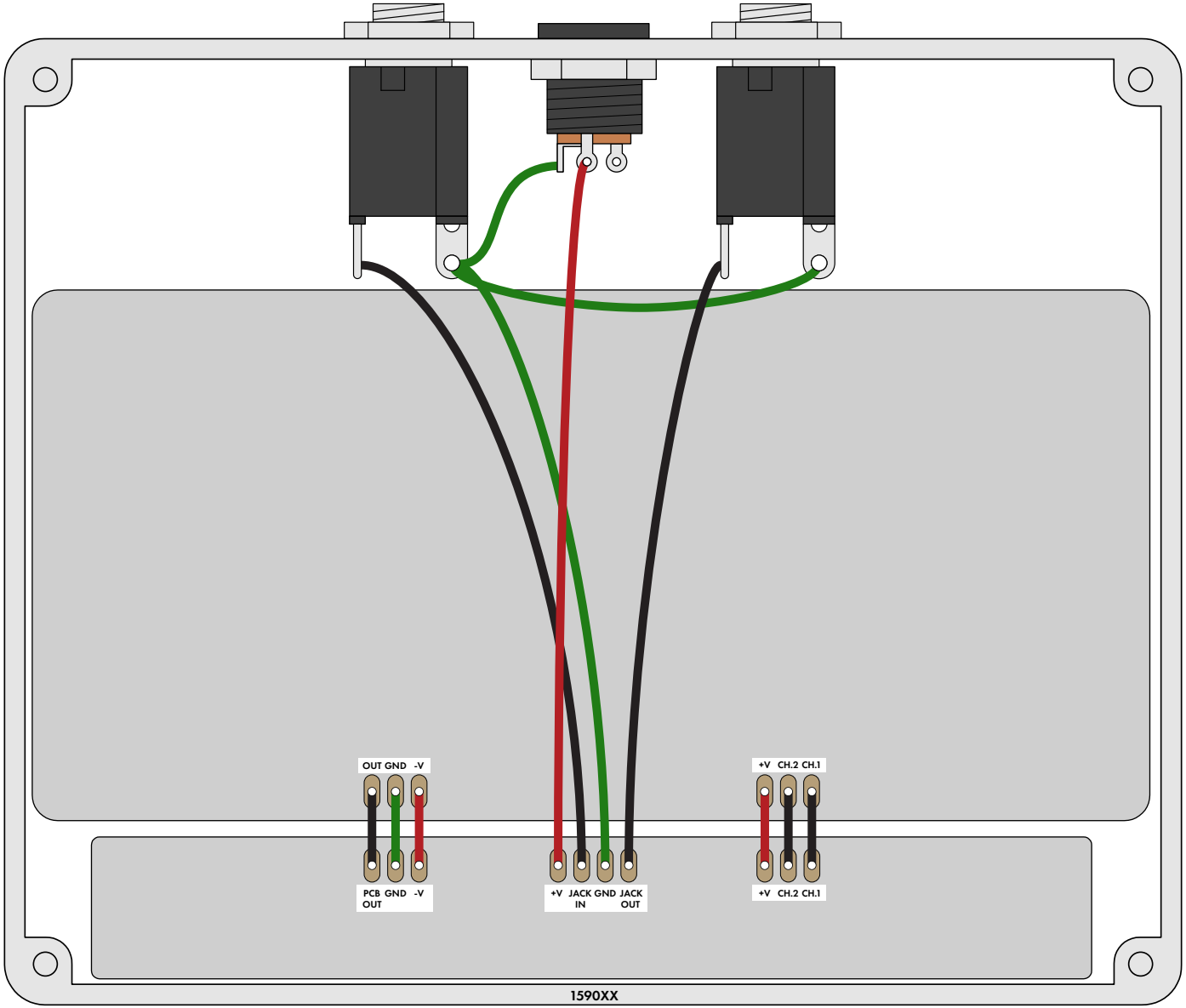
Enclosure is shown without jacks. See next page for jack layout and wiring.



Note: The upper pads for the dual-gang gain potentiometer appear to be cut in half. **This is intentional!** It's called a *plated half-hole* or *castellated via*, and it's used so that the PCB can lay flat across the pots instead of angling upward for the dual pot.

Solder it like you would if they were normal pads, but bend the upper set of pins forward slightly so they make contact with the inside of the pads.

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 (2023-07-04)
Initial release.