PROJECT NAME

IVP PREAMP

aion
DIY GUITAR EFFECTS

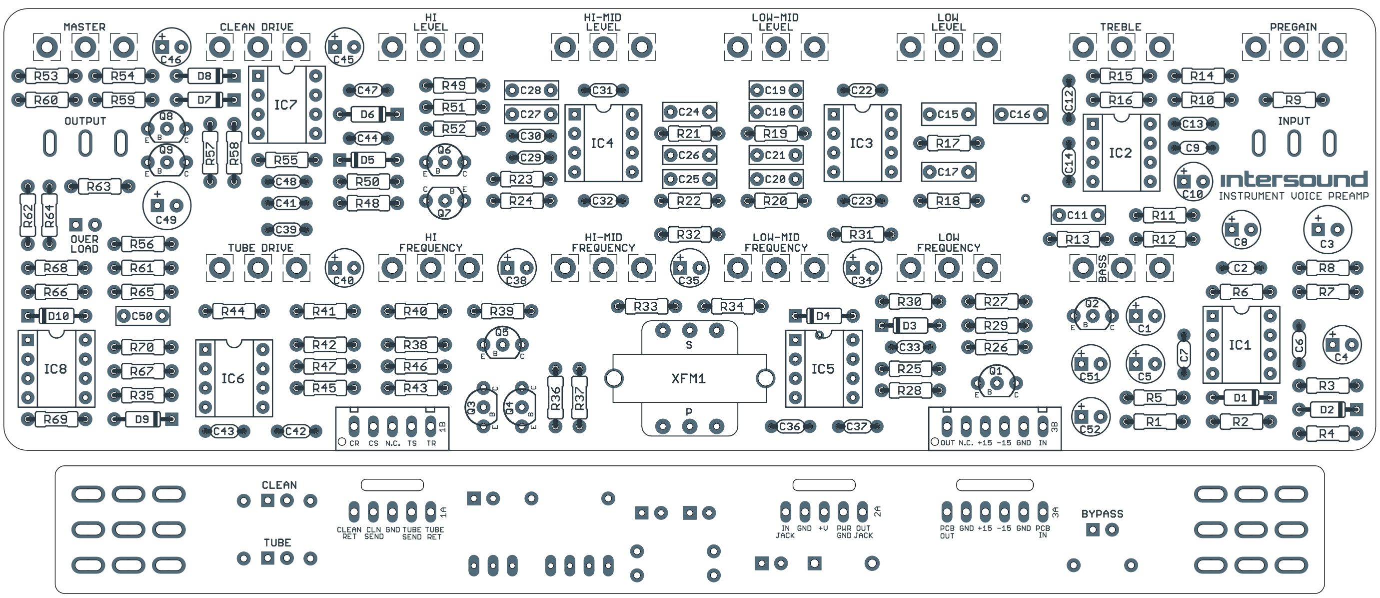
BASED ON
Intersound™ IVP™

BUILD DIFFICULTY
Expert

EFFECT TYPE
Preamp & tube overdrive simulator

DOCUMENT VERSION
1.0.2 (2024-02-13)

PROJECT SUMMARY
A pedal conversion of the Intersound Instrument Voicing Preamplifier, a rack unit from the late 1970s notably used by Steve Albini (Shellac) and Bob Weir (Grateful Dead).



Actual size is 7.15" x 2.30" (main board) and 6.61" x 0.67" (bypass board).

IMPORTANT NOTE

This is a complex circuit and it takes experience and attention to detail in order to build it successfully. If you've never built a guitar pedal before, this shouldn't be your first. Please read all of the build documentation to familiarize yourself with the project before you begin. Aion FX cannot provide direct technical support.

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INTRODUCTION

The IVP Preamp is based on the Intersound™ Instrument Voicing Preamp™, a rackmounted preamp that was first released in 1978. The IVP has a six EQ bands (four semi-parametric and two Baxandall) and two channels, clean and drive.

The drive channel, called "Tube Voice", is of particular interest and is the main reason for its enduring reputation. It uses a combination of op-amp gain, a transistor amplifier and a transformer to get its overdrive tone—no clipping diodes in sight. All of the EQ comes before the overdrive, so it can be used as a tool to get a wide variety of drive tones and clipping characteristics.

The "Tube Voice" channel doesn't quite nail the tube tone as it claims, or at least not any more than other tube emulation circuits—but it's such a unique sound that the IVP has grown a reputation in the four decades since its release. Steve Albini is perhaps the most well-known advocate of the IVP, using it as part of his own live rig as well as in the studio. It was also used by Bob Weir of the Grateful Dead.

The Aion FX IVP Preamp is a direct clone of the rackmounted unit in pedal format. It runs on the same voltage as the original, using a DC-DC converter to get +/-15V from a standard 9VDC input. The Clean and Tube Voice channels are footswitchable, and the other footswitch allows the whole unit to be bypassed. It does not include the two effects loops (pre-drive and post-drive) by default, but these can be added with a few trace cuts and extra wiring, described in the build notes.

The Isotope Amp Overdrive is another project based on the IVP, an adaptation of just the Tube Voice channel and 2-band Baxandall EQ. It's much simpler to build, but without the parametric EQ and clean channel, it's a very different piece of gear than the full IVP.

CIRCUIT DESIGN NOTES

Parametric EQ scaling

The original IVP uses 2MC (reverse audio or reverse log) potentiometers for the parametric EQ section. This value is almost impossible to find today. There are two available options to get around this:

Option 1: Use 1MC potentiometers instead of 2MC with no other changes

This reduces the frequency range of each control, raising the lower frequency by around 30% in each band, with the upper-end frequency staying the same. The lower frequencies are affected as follows:

- **Low:** 30 Hz → 40 Hz
- **Low-Mid:** 100 Hz → 130 Hz
- **High-Mid:** 450 Hz → 620 Hz
- **High:** 1.2kHz → 1.6kHz

Since the four bands overlap, and are rarely used at the lower extreme of rotation, this has almost no practical impact on the usability of the EQ. However, we can do even better than this.

Option 2: Use 1MC potentiometers and scale all resistors and capacitors in the EQ section

The gyrators can easily be recalibrated to have the same frequency range by way of something called *scaling*. Since the potentiometer (which acts as a resistor) is cut in half, all of the other resistors in the EQ section should also be reduced by half, and the capacitors should be doubled in value.

The only caveat with scaling is that it results in some non-standard resistor and capacitor values—and in the case of the capacitors, some values that don't exist. Since precision is important, we've taken the straightforward route of adding a second capacitor of the same value in parallel with each of them so that the scaled value is exact.

Option 2 is electronically identical to the way it's done in the IVP, so it's the default in this implementation. If you build it according to the parts list, each band will have the full frequency range of the original unit. But if you compare it against the original IVP schematics and want to know why there are more capacitors and different resistors in the EQ section, this is why.

Power supply design

Like most solid-state preamplifiers of the 1970s and 80s, the IVP operated on a bipolar +/-15V supply. Bipolar 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 Lab Series L5 Preamp, which uses the same supply voltage, 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.

CIRCUIT DESIGN NOTES, CONT.

Because of this, when developing the IVP project 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$9-13 each), but once you account for the fact that you no longer need a specialized power adapter, the total cost is about the same.

See the build notes on page 13 for more information on the specific DC-DC converters that are recommended for use in this project.

Channel levels

The original IVP suffers from a very noticeable volume imbalance between the Clean and Tube Voice channels. If the Tube Voice channel is run at high drive levels (which affects its amount of distortion, not just its volume), the clean channel doesn't have enough volume to match it, meaning there's no way to switch seamlessly between Clean and Tube Voice without adjusting the master volume.

This is impractical for live use. Because of this, the volume level of the clean channel has been boosted so the range is closer to the Tube Voice channel and they can be better matched in level when switching channels. The tone is unchanged.

Input channels

The original IVP has two isolated inputs, each an exact copy of the other. These are labeled as "channels" on the front panel of the original unit, but there is no switching between the two and they are mixed together before the EQ after their respective Pregain controls, so they are not channels in the conventional sense. They serve the same purpose as a an amplifier with two input jacks, though it's a little more sophisticated since each input has its own op-amp stage.

Because of this, the pedal conversion removes one of these inputs and simplifies it down to one op-amp input stage.

Output section

The original IVP has three separate outputs: line level, unbalanced -10dB, and XLR balanced -10dB. For this project, we've converted this to a toggle switch that selects between line level and -10dB. The XLR output has been eliminated.

If you need XLR, it's recommended to use an external direct box from the -10dB output. The original IVP's XLR output is essentially just a simple direct box, with a single transformer that splits the -10dB attenuated signal into the inverted copy needed for a balanced connection. There is no active circuitry, so an external direct box will have the exact same result.

Effects loops

The IVP has two effects loops, one that comes after the EQ and one that comes after the clean & drive channels. While these loops have been omitted from the pedal conversion, they can be added back without too much trouble. See build notes for more information.

USAGE

The IVP has the following controls.

Potentiometers

- **Pregain** allows the input signal level to be reduced after the input stage. It comes after the Hi/Lo gain toggle.
- **Bass** and **Treble** form a 2-band shelving Baxandall EQ that comes before the parametric EQ section. In the 12:00 position, the frequencies are flat. Frequencies are cut when the control is rotated to the left and boosted when rotated to the right.
    - Bass affects frequencies below 200 Hz, reaching a maximum of 15dB of cut or boost at 50 Hz.
    - Treble affects frequencies above 1kHz, reaching a maximum of 15dB of cut or boost at 10kHz.
- **Low Frequency** sets the frequency for the lowest parametric band, from 30 Hz to 240 Hz.
- **Low-Mid Frequency** sets the frequency for the second parametric band, from 100 Hz to 800 Hz.
- **Hi-Mid Frequency** sets the frequency for the third parametric band, from 460 Hz to 3.6kHz.
- **Hi Frequency** sets the frequency for the highest parametric band, from 1.2kHz to 9.6kHz.
- **Low**, **Low-Mid**, **Hi-Mid**, and **Hi Level** boosts or cuts the frequency selected by the respective frequency control. In the 12:00 position, the frequency band is flat and essentially out of the circuit. Frequencies are cut when the control is rotated to the left and boosted when rotated to the right, with a maximum of 15dB of cut or boost.
- **Clean Drive** sets the volume level of the clean channel. The tone is unchanged throughout the rotation and it has no clipping, so its main use is for level-matching with the Tube Drive channel.
- **Tube Drive** sets both the gain (overdrive) and volume of the Tube Voice channel.
- **Master** is the master volume of the unit.

Switches

- **Input** sets the fixed gain of the input stage to allow it to be used with a variety of signals.
    - **Low** input mode boosts the signal level with a gain of +14.5dB, suitable for input levels as low as 50mV RMS. This is the mode that will typically be used for guitar or bass.
    - **High** input mode keeps the signal at unity gain. This mode is suitable for high-output instruments with levels as high as 8V RMS.
- **Output** selects between two types of output. This comes after the master volume in the circuit.
    - **Line Out** is suitable for going directly to a power amp or crossover.
    - **-10dB** is used if it will be followed by other effects or will be sent to a guitar amp's input.
    - Note that this switch is just a simple attenuator, equivalent to turning the master volume down slightly, and the master volume setting has a much larger impact on the output signal level.
- **Channel** (footswitch) changes between Clean and Tube Voice channels.
- **Bypass** (footswitch) bypasses the effect entirely.

Peak indicator LED

The IVP has a peak indicator LED that senses the signal level and lights up if it gets close to the range where unwanted clipping will occur. It's important to understand how this LED works, how to read its behavior, and how to use it to adjust your levels for the best sound.

First of all, peaking doesn't necessarily mean clipping. If the levels are set properly, it will occasionally blink in normal use. The goal is to adjust it so that it comes on sometimes, but not too much. If it never comes on even with heavy strumming, the internal gain is too low. Conversely, if it's on even with very low-level signals, the internal gain is too high.

The IVP has four different areas where the gain can be adjusted:

- **Pregain**: the signal level coming out of the first op-amp stage (full-range)
- **EQ**: six frequency bands that can have a cumulative impact on the overall signal level
- **Clean / Drive**: the gain of the two individual channels, with the drive channel being intentionally clipped after the gain boost
- **Master**: the master volume at the tail end of the circuit

The peak detector is located between the EQ and clean/drive sections. If it's on constantly, it indicates that some of the earlier stages may have clipped already and that the subsequent stages may clip as well (prior to any intentional clipping from the drive channel).

With all this in mind, here is the setup procedure.

1. Set the input toggle switch based on the type of signal source. Normally you'll use the "low" input mode (named to indicate that it's for low input signal levels, not that it is low gain). The "high" input mode is only needed if the signal level is so high that the pregain control is hard to adjust.
2. Set the bass, treble, and four EQ knobs to the 12:00 position (flat).
3. While strumming chords heavily, adjust the pregain control. Turn it up until the peak LED starts to blink occasionally at the highest signal levels. If it illuminates for longer than a flicker, back off the pregain control slightly.
4. Adjust the channel gain (clean or tube) to the desired level, then adjust the EQ until you have the tone you want. Depending on the EQ adjustment, this may increase the overall gain and cause the peak indicator LED to illuminate more frequently. If so, turn down the Pregain control again until it's back to normal.
5. Adjust the master volume to the desired output level.

If the pregain and EQ have been adjusted, the clean and drive channels and master volume can be at any gain or volume setting without issue. All of the potential for unwanted clipping comes before those stages, so the signal levels afterward are unimportant.

Note that if using the pre-voice effects loop, the peak detector comes before the loop, not after, so it does not detect the level of the returning signal.

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	10k	Metal film resistor, 1/4W	
R2	2M	Metal film resistor, 1/4W	
R3	2M	Metal film resistor, 1/4W	
R4	51R	Metal film resistor, 1/4W	
R5	51R	Metal film resistor, 1/4W	
R6	43k	Metal film resistor, 1/4W	
R7	2M	Metal film resistor, 1/4W	
R8	10k	Metal film resistor, 1/4W	
R9	20k	Metal film resistor, 1/4W	
R10	43k	Metal film resistor, 1/4W	
R11	5k6	Metal film resistor, 1/4W	
R12	5k6	Metal film resistor, 1/4W	
R13	220k	Metal film resistor, 1/4W	
R14	3k3	Metal film resistor, 1/4W	
R15	3k3	Metal film resistor, 1/4W	
R16	20k	Metal film resistor, 1/4W	
R17	820R	Metal film resistor, 1/4W	
R18	13k7	Metal film resistor, 1/4W	Can also use 14k, or two 27k resistors in parallel.
R19	820R	Metal film resistor, 1/4W	
R20	13k7	Metal film resistor, 1/4W	Can also use 14k, or two 27k resistors in parallel.
R21	820R	Metal film resistor, 1/4W	
R22	13k7	Metal film resistor, 1/4W	Can also use 14k, or two 27k resistors in parallel.
R23	820R	Metal film resistor, 1/4W	
R24	13k7	Metal film resistor, 1/4W	Can also use 14k, or two 27k resistors in parallel.
R25	20k	Metal film resistor, 1/4W	
R26	13k	Metal film resistor, 1/4W	
R27	13k	Metal film resistor, 1/4W	
R28	10R	Metal film resistor, 1/4W	
R29	10R	Metal film resistor, 1/4W	
R30	51R	Metal film resistor, 1/4W	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
R31	100k	Metal film resistor, 1/4W	
R32	JUMPER	Metal film resistor, 1/4W	Used for effect loop modification. See build notes.
R33	100k	Metal film resistor, 1/4W	
R34	20k	Metal film resistor, 1/4W	
R35	10k	Metal film resistor, 1/4W	
R36	4k7	Metal film resistor, 1/4W	
R37	10k	Metal film resistor, 1/4W	
R38	1k1	Metal film resistor, 1/4W	
R39	1k1	Metal film resistor, 1/4W	
R40	430R	Metal film resistor, 1/4W	
R41	36k	Metal film resistor, 1/4W	
R42	430k	Metal film resistor, 1/4W	
R43	47k	Metal film resistor, 1/4W	
R44	4k7	Metal film resistor, 1/4W	Original value is 13k. See build notes.
R45	18k	Metal film resistor, 1/4W	Original value is 36k. See build notes.
R46	10k	Metal film resistor, 1/4W	
R47	10k	Metal film resistor, 1/4W	
R48	20k	Metal film resistor, 1/4W	
R49	13k	Metal film resistor, 1/4W	
R50	13k	Metal film resistor, 1/4W	
R51	10R	Metal film resistor, 1/4W	
R52	10R	Metal film resistor, 1/4W	
R53	100k	Metal film resistor, 1/4W	
R54	20k	Metal film resistor, 1/4W	
R55	4k7	Metal film resistor, 1/4W	
R56	20k	Metal film resistor, 1/4W	
R57	13k	Metal film resistor, 1/4W	
R58	13k	Metal film resistor, 1/4W	
R59	10R	Metal film resistor, 1/4W	
R60	10R	Metal film resistor, 1/4W	
R61	51R	Metal film resistor, 1/4W	
R62	100k	Metal film resistor, 1/4W	
R63	1k1	Metal film resistor, 1/4W	
R64	510R	Metal film resistor, 1/4W	
R65	47k	Metal film resistor, 1/4W	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
R66	47k	Metal film resistor, 1/4W	
R67	4M7	Metal film resistor, 1/4W	
R68	4k7	Metal film resistor, 1/4W	
R69	160k	Metal film resistor, 1/4W	
R70	220k	Metal film resistor, 1/4W	
LEDC	4k7	Metal film resistor, 1/4W	
LEDR	10k	Metal film resistor, 1/4W	
LEDT	10k	Metal film resistor, 1/4W	
C1	47uF	Electrolytic capacitor, 5mm	
C2	47pF	MLCC capacitor, NP0/C0G	
C3	100uF	Electrolytic capacitor, 6.3mm	
C4	47uF	Electrolytic capacitor, 5mm	
C5	47uF	Electrolytic capacitor, 5mm	
C6	100n	MLCC capacitor, X7R	
C7	100n	MLCC capacitor, X7R	
C8	10uF	Electrolytic capacitor, 5mm	
C9	47pF	MLCC capacitor, NP0/C0G	
C10	10uF	Electrolytic capacitor, 5mm	
C11	47n	Film capacitor, 7.2 x 2.5mm	
C12	470pF	MLCC capacitor, NP0/C0G	
C13	100n	MLCC capacitor, X7R	
C14	100n	MLCC capacitor, X7R	
C15	470n	Film capacitor, 7.2 x 3mm	
C16	68n	Film capacitor, 7.2 x 2.5mm	
C17	68n	Film capacitor, 7.2 x 2.5mm	
C18	120n	Film capacitor, 7.2 x 2.5mm	
C19	120n	Film capacitor, 7.2 x 2.5mm	
C20	6n8	Film capacitor, 7.2 x 2.5mm	
C21	6n8	Film capacitor, 7.2 x 2.5mm	
C22	100n	MLCC capacitor, X7R	
C23	100n	MLCC capacitor, X7R	
C24	68n	Film capacitor, 7.2 x 2.5mm	
C25	1n2	Film capacitor, 7.2 x 2.5mm	
C26	1n2	Film capacitor, 7.2 x 2.5mm	
C27	6n8	Film capacitor, 7.2 x 2.5mm	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C28	6n8	Film capacitor, 7.2 x 2.5mm	
C29	820pF	MLCC capacitor, NP0/C0G	
C30	820pF	MLCC capacitor, NP0/C0G	
C31	100n	MLCC capacitor, X7R	
C32	100n	MLCC capacitor, X7R	
C33	22pF	MLCC capacitor, NP0/C0G	Original uses 20pF here. 22pF is the closest common value.
C34	10uF	Electrolytic capacitor, 5mm	
C35	10uF	Electrolytic capacitor, 5mm	
C36	100n	MLCC capacitor, X7R	
C37	100n	MLCC capacitor, X7R	
C38	10uF	Electrolytic capacitor, 5mm	
C39	22pF	MLCC capacitor, NP0/C0G	Original uses 20pF here. 22pF is the closest common value.
C40	10uF	Electrolytic capacitor, 5mm	
C41	22pF	MLCC capacitor, NP0/C0G	Original uses 20pF here. 22pF is the closest common value.
C42	100n	MLCC capacitor, X7R	
C43	100n	MLCC capacitor, X7R	
C44	47pF	MLCC capacitor, NP0/C0G	
C45	10uF	Electrolytic capacitor, 5mm	
C46	10uF	Electrolytic capacitor, 5mm	
C47	100n	MLCC capacitor, X7R	
C48	100n	MLCC capacitor, X7R	
C49	100uF	Electrolytic capacitor, 6.3mm	
C50	10n	Film capacitor, 7.2 x 2.5mm	
C51	100uF	Electrolytic capacitor, 6.3mm	
C52	100uF	Electrolytic capacitor, 6.3mm	
C53	100uF	Electrolytic capacitor, 6.3mm	
C54	47uF	Electrolytic capacitor, 5mm	
C55	10uF	Electrolytic capacitor, 5mm	
C56	10uF	Electrolytic capacitor, 5mm	
Z1	1N4743A	Zener diode, 13V, DO-41	
D1	1N914	Fast-switching diode, DO-35	
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	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
D6	1N914	Fast-switching diode, DO-35	
D7	1N914	Fast-switching diode, DO-35	
D8	1N914	Fast-switching diode, DO-35	
D9	1N914	Fast-switching diode, DO-35	
D10	1N914	Fast-switching diode, DO-35	
Q1	2N3904	BJT transistor, NPN, TO-92	Substitute. Original uses 2N4401.
Q2	2N3906	BJT transistor, PNP, TO-92	Substitute. Original uses 2N4403.
Q3	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2N5210.
Q4	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2N5210.
Q5	2N5088	BJT transistor, NPN, TO-92	Substitute. Original uses 2N5210.
Q6	2N3904	BJT transistor, NPN, TO-92	Substitute. Original uses 2N4401.
Q7	2N3906	BJT transistor, PNP, TO-92	Substitute. Original uses 2N4403.
Q8	2N3904	BJT transistor, NPN, TO-92	Substitute. Original uses 2N4401.
Q9	2N3906	BJT transistor, PNP, TO-92	Substitute. Original uses 2N4403.
IC1	LF356N	Operational amplifier, single, DIP-8	
IC1-S	DIP8 socket	IC socket, DIP-8	
IC2	TL072	Operational amplifier, dual, DIP-8	
IC2-S	DIP8 socket	IC socket, DIP-8	
IC3	TL072	Operational amplifier, dual, DIP-8	
IC3-S	DIP8 socket	IC socket, DIP-8	
IC4	TL072	Operational amplifier, dual, DIP-8	
IC4-S	DIP8 socket	IC socket, DIP-8	
IC5	RC4558P	Operational amplifier, dual, DIP-8	
IC5-S	DIP8 socket	IC socket, DIP-8	
IC6	RC4558P	Operational amplifier, dual, DIP-8	
IC6-S	DIP8 socket	IC socket, DIP-8	
IC7	RC4558P	Operational amplifier, dual, DIP-8	
IC7-S	DIP8 socket	IC socket, DIP-8	
IC8	RC4558P	Operational amplifier, dual, DIP-8	
IC8-S	DIP8 socket	IC socket, DIP-8	
DC1	TEC 3-0923	DC-DC converter, +9V to +/-15V	See build notes for alternatives.
XFM1	42TM018	Transformer, audio, 10KCT/10KCT	
L1	10uH	Inductor, 10uH	Bourns 78F100J-RC
L2	10uH	Inductor, 10uH	Bourns 78F100J-RC
L3	10uH	Inductor, 10uH	Bourns 78F100J-RC

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
PREGAIN	50kB	16mm right-angle PCB mount pot	
BASS	50kB	16mm right-angle PCB mount pot	
TREBLE	50kB	16mm right-angle PCB mount pot	
HI	25kB	16mm right-angle PCB mount pot	Original uses 50kB, but all resistors (including potentiometers) have been scaled to 50% and capacitors doubled to allow 1MC pots to be used with the same range of frequency. See circuit design notes for more details.
HI-MID	25kB	16mm right-angle PCB mount pot	
LOW-MID	25kB	16mm right-angle PCB mount pot	
LOW	25kB	16mm right-angle PCB mount pot	
HI FREQ	1MC	16mm right-angle PCB mount pot	Original uses 2MC, but 1MC is the closest available. The resistors and capacitors have been scaled for the same frequency range. See circuit design notes for more details.
HI-MID FREQ	1MC	16mm right-angle PCB mount pot	
LO-MID FREQ	1MC	16mm right-angle PCB mount pot	
LOW FREQ	1MC	16mm right-angle PCB mount pot	
CLEAN DRIVE	50kA	16mm right-angle PCB mount pot	
TUBE DRIVE	50kA	16mm right-angle PCB mount pot	
MASTER	50kA	16mm right-angle PCB mount pot	
INPUT	SPDT	Toggle switch, SPDT on-on	
OUTPUT	SPDT	Toggle switch, SPDT on-on	
CLEAN LED	5mm green	LED, 5mm, green diffused	
TUBE LED	5mm	LED, 5mm, red diffused	
BYPASS	5mm	LED, 5mm, red diffused	
OVERLOAD	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.
PRE-V. SEND	NMJ6HC-S	1/4” phone jack, stereo, switched	Neutrik NMJ6HC-S. Part of optional effects loop mod.
PRE-V. RET.	NMJ6HC-S	1/4” phone jack, stereo, switched	Neutrik NMJ6HC-S. Part of optional effects loop mod.
POST-V. SEND	NMJ6HC-S	1/4” phone jack, stereo, switched	Neutrik NMJ6HC-S. Part of optional effects loop mod.
POST-V. RET.	NMJ6HC-S	1/4” phone jack, stereo, switched	Neutrik NMJ6HC-S. Part of optional effects loop mod.
DC	2.1mm	DC jack, 2.1mm panel mount	Mouser 163-4302-E or equivalent.
BYPASS	3PDT	Stomp switch, 3PDT	
CHANNEL	3PDT	Stomp switch, 3PDT	
ENCLOSURE	1590DD	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 other models 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 Digi-Key, 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 less than half the price of the others (USD$5.87 as of the time of this writing) with the exact same specs. So if you need more than one, it quickly becomes much more cost-effective than the other options.

Bypass PCB component orientation

Due to the height of the DC converter, 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.

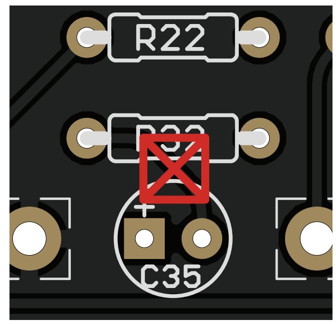
Using the external effects loops

The original IVP had two effects loops. The first, called "Pre Voice", comes after the EQ and before the clean/drive channels. The second, called "Post Voice", comes after the clean/drive channels and before the master volume and output section.

The default build configuration of the IVP does not use these effects loops since they aren't terribly practical in a pedal conversion. However, they can be added with a few simple trace cuts, some offboard wiring, and four drill holes.

The wiring diagram for the effects loops is located on page 21. Aside from the extra wires and jacks and two 51R resistors, each loop requires a trace cut. Here are descriptions of each of the modifications.

Pre-voice loop

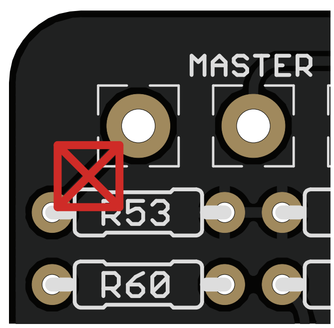


The first effects loop is enabled by cutting the trace shown to the right, from R32 to C35, on the top side of the PCB. After making the cut, do a continuity check with your multimeter to make sure the left pad of R32 has no connection with the right pad of C35.

From there, solder one wire from R32's left pad to the Send jack as shown in the wiring diagram, and another wire from the right-side pad of R33 to the Return jack. (This pad is connected to the right-side pad of C35, but it's easier to solder the wire to a resistor than the underside of a capacitor.)

R32 (jumper), C35 (10uF) and R33 (100k) should still be installed as normal. The wires need to share the pads with the components. The easiest method is to elevate the resistor above the PCB slightly before soldering and then solder the wire underneath the lifted leg.

Post-voice loop



The second effects loop is enabled by cutting the trace shown to the right, from the left lug of Master to the left lug of R53, also on the top side of the PCB. As before, do a continuity test with the multimeter to verify no connection.

Solder a wire from R53's left pad to the Send jack as shown in the wiring diagram, and a second wire from the left-most lug of the Master potentiometer to the Return jack. R53 (100k) should still be installed as normal.

Both of these loops have an additional 51R resistor that is shown in the wiring diagram between the Send and Return jacks. The way it's wired, this resistor is in series with the only Send jack of each loop, and is out of the circuit entirely when nothing is plugged into the Return jack.

The Send jacks can be used to send a copy of the signal offboard, but only the Return of each loop is wired as a transfer jack. This means that unless the Return jack is used, the signal will not be interrupted.

Clean channel volume

The original IVP has one severe but easily remedied design issue: the clean channel's maximum volume is much, much lower than the drive channel's maximum.

While this can be compensated on a per-channel basis by adjusting the master volume to get the same levels, channel switching is almost unusable in a live setting unless the drive channel is set very low and the clean channel is set at maximum.

Fortunately, we only need to adjust two resistors that set the gain and mix ratio of the clean channel in order to boost its level relative to the drive channel and allow it to match the drive channel volume.

R44 sets the gain ratio of the potentiometer. By reducing it from 13k (stock) to 4k7, the range of the clean level knob is almost tripled.

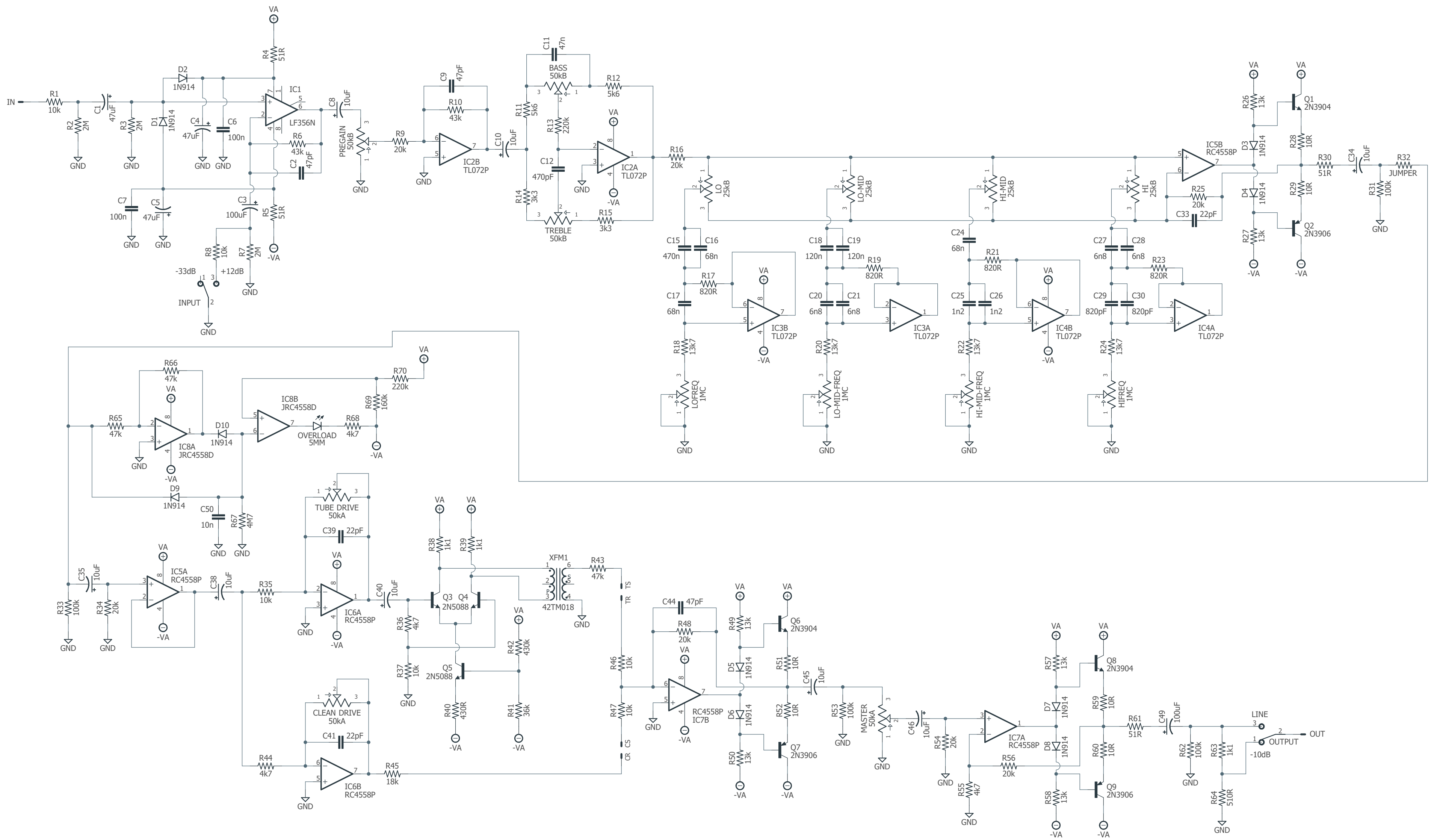
R45 sets the mix ratio of the clean channel relative to the drive channel. It's already mixed about 25% higher than the drive channel, but it's not enough. By reducing the resistor from 36k (stock) to 18k, the mix is more like 2:1.

With these two changes, the clean channel can keep up just fine with the drive channel, with no change in tone. This project uses the modified values by default.

R40 value

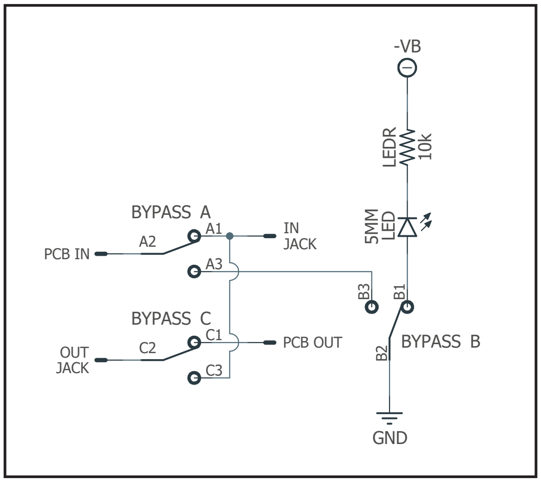
Both revisions of the IVP factory schematic show R40 as 43R. However, the parts list in the service manual lists it as 430R, and it's been verified in multiple actual units as being 430R. It appears to have been an error in the first version of the schematic that was inadvertently copied over to the second version, but it does not reflect production units.

SCHEMATIC (MAIN CIRCUIT)

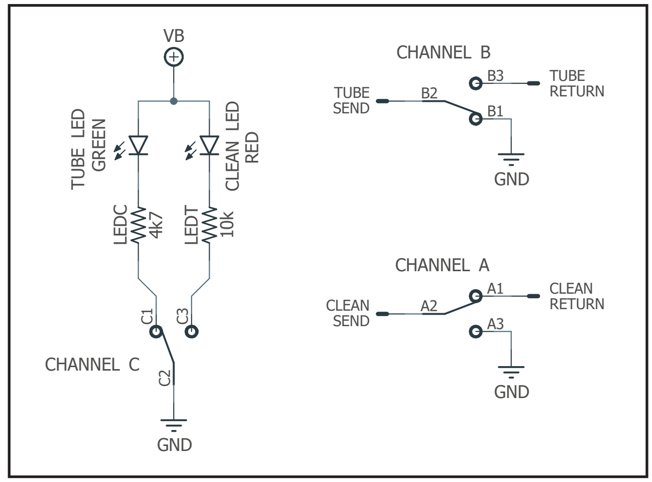


SCHEMATIC (POWER AND SWITCHING)

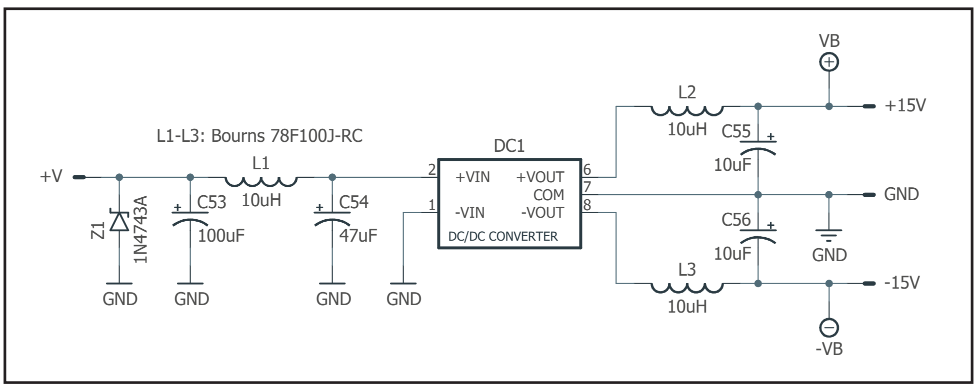
Bypass switching



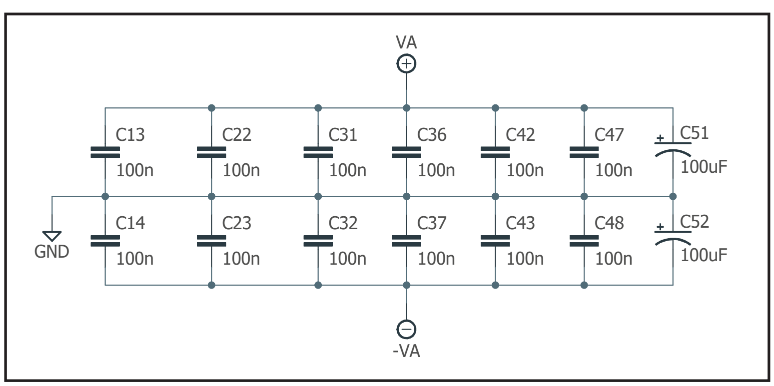
Channel switching



Power supply



Power filtering



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.

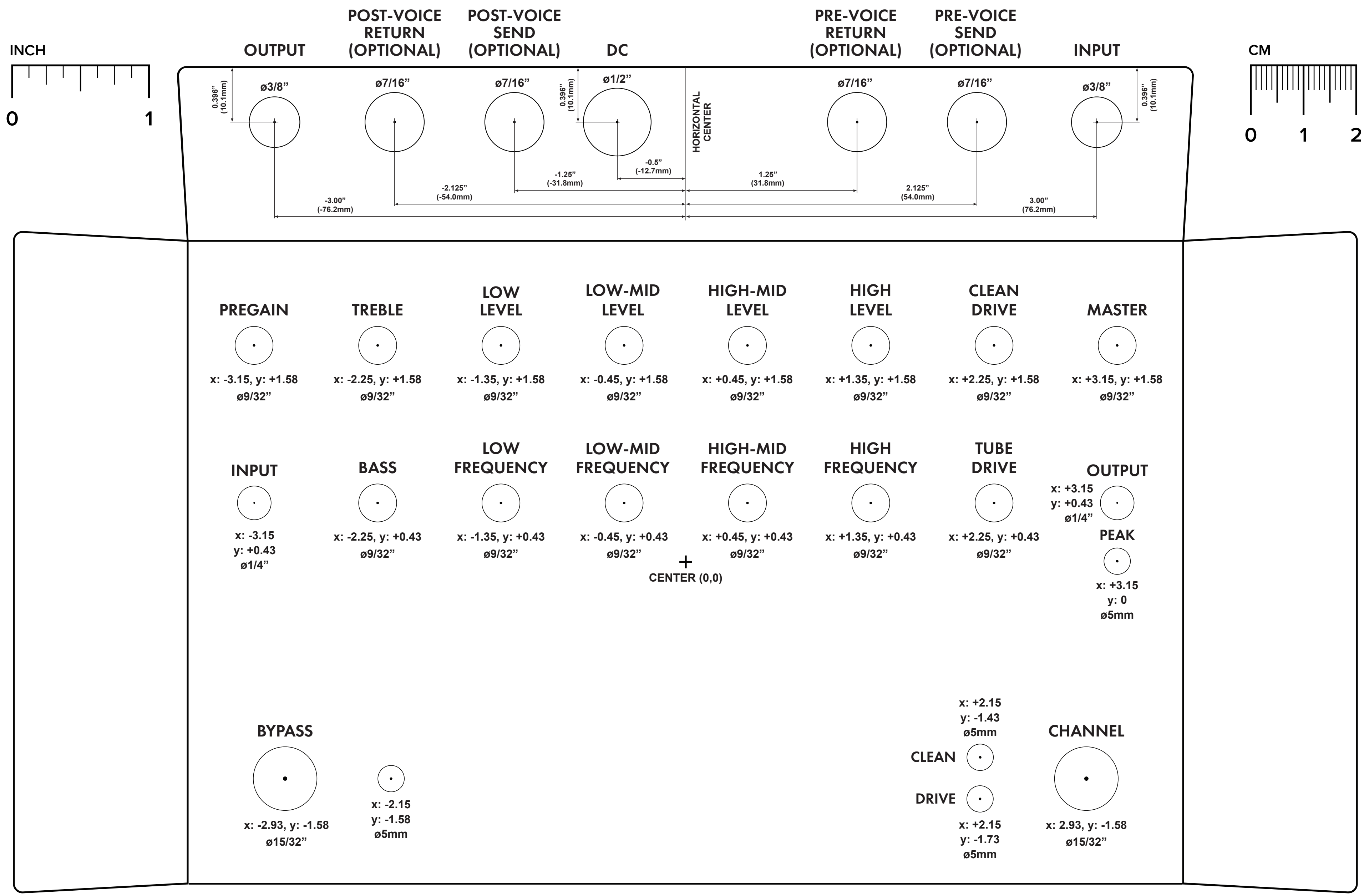
Ensure that the template is printed at 100% or "Actual Size". You can double-check this by measuring the scale on the printed page with a ruler or calipers.

The LED drill holes are sized for plain LEDs with no bezel. If you don't have a 5mm bit, use 7/32".

The DC jack is offset by 0.5" to account for the additional screw anchor in the center of the 1590DD enclosure's long side.

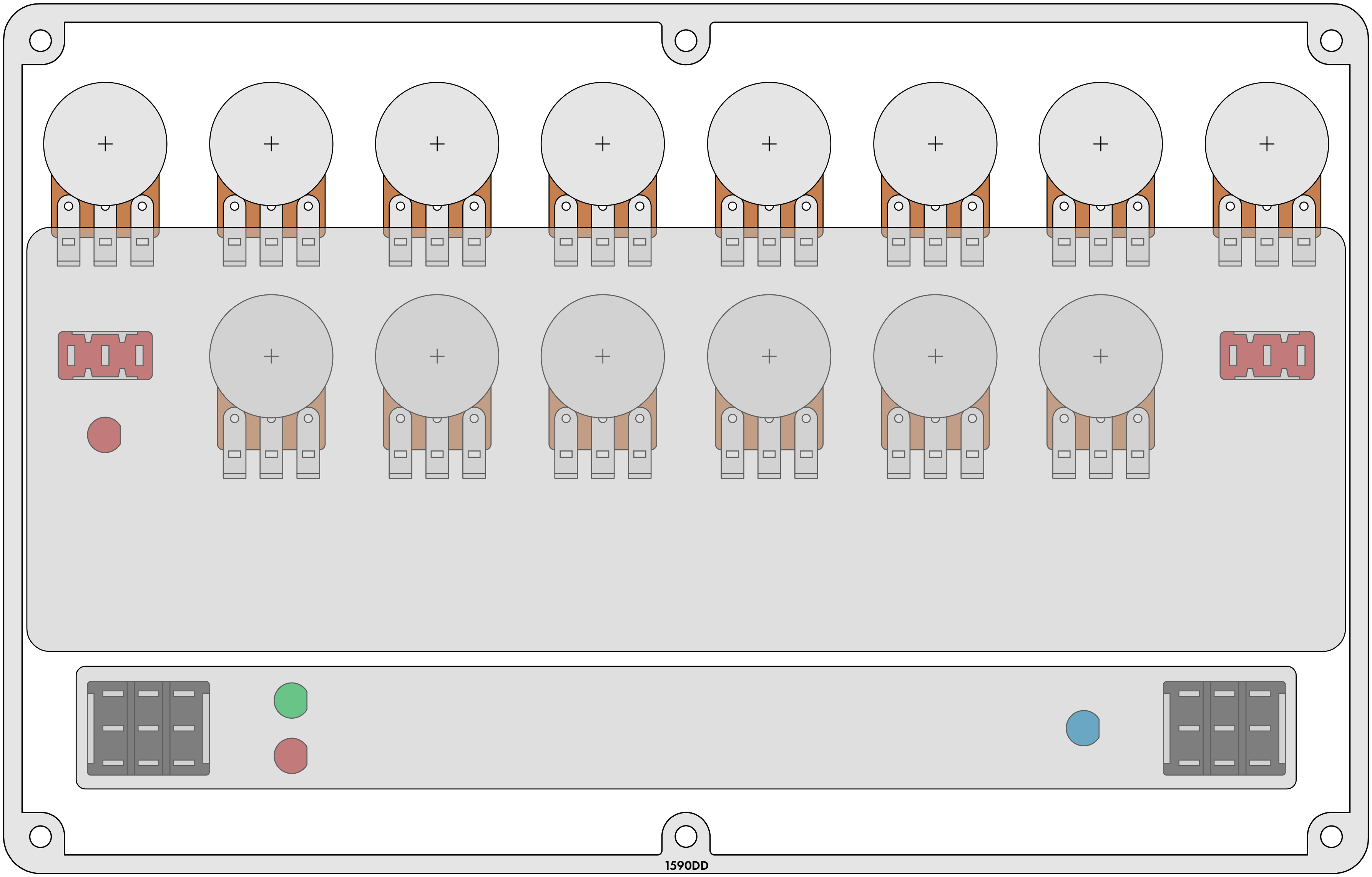
The drill template includes holes for the optional effects loop jacks. The process for adding these is described on page 14. If you're not using these, the four holes should be omitted.

DRILL TEMPLATE

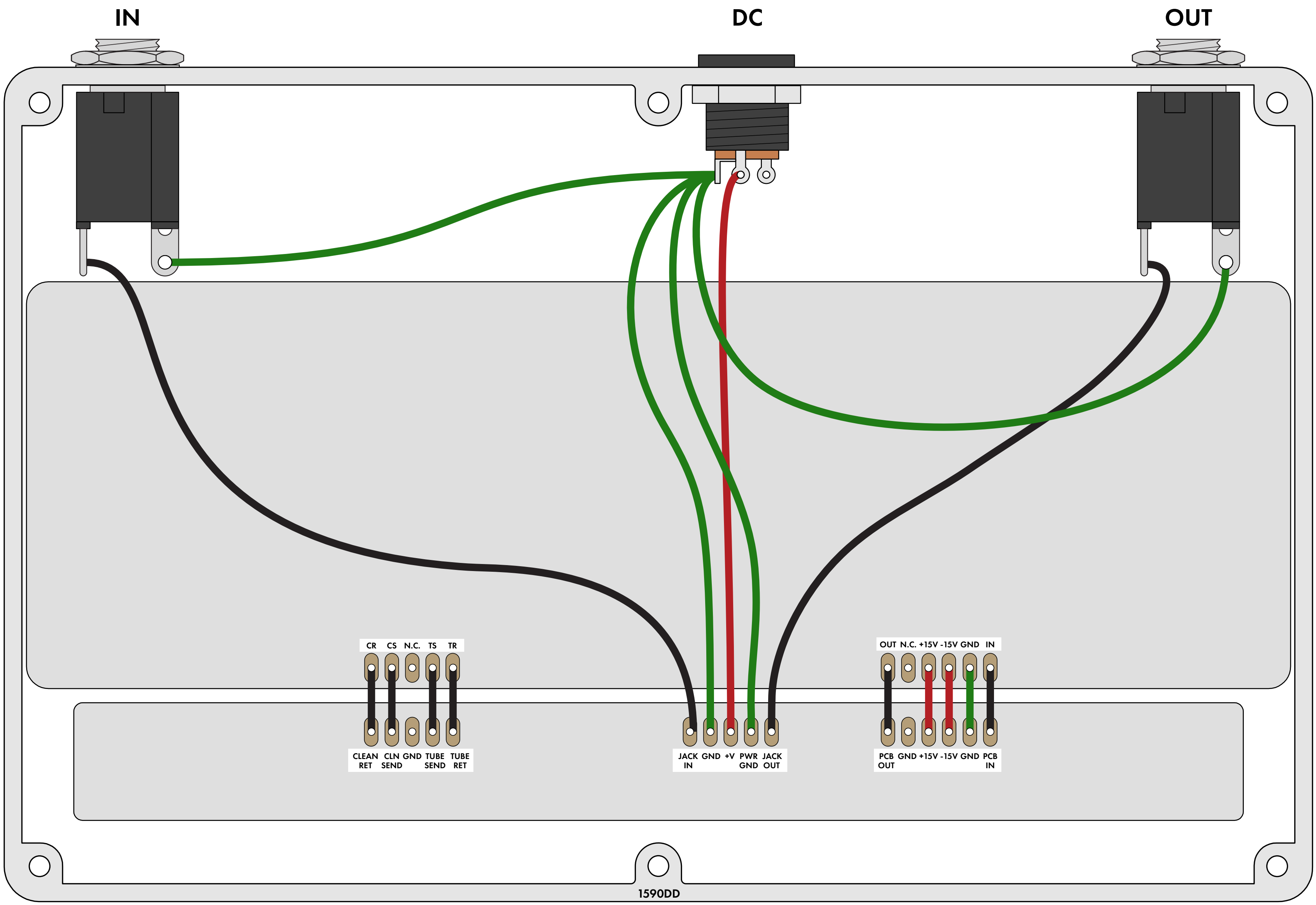


ENCLOSURE LAYOUT

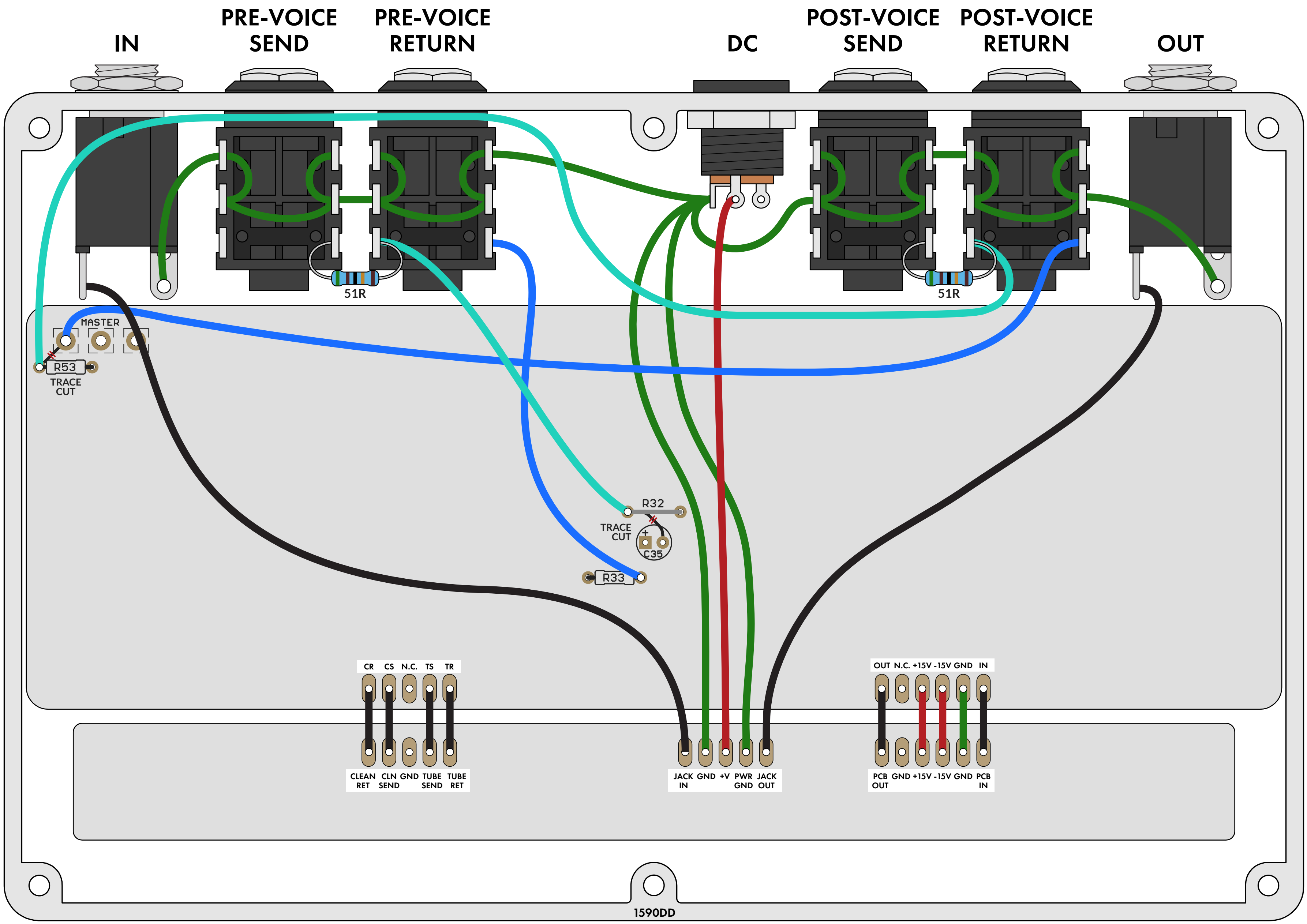
Enclosure is shown without jacks. See next page for jack layout and wiring. If using effects loops, see alternate wiring diagram on page 21 and information on page 14.



WIRING DIAGRAM (NO EFFECTS LOOPS)



WIRING DIAGRAM (WITH EFFECTS LOOPS)



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!)

Intersound™, Instrument Voicing Preamp™, and IVP™ are trademarks of Aion FX.

DOCUMENT REVISIONS

1.0.2 (2024-02-13)
Added further technical information to the Usage section on page 5.

1.0.1 (2021-11-22)
Updated trademark declaration to include "Instrument Voicing Preamp" and "IVP".

1.0.0 (2021-07-30)
Initial release.