PROJECT NAME

360 BASS PREAMP

BASED ON

Acoustic 360 preamp

BUILD DIFFICULTY

Advanced

EFFECT TYPE

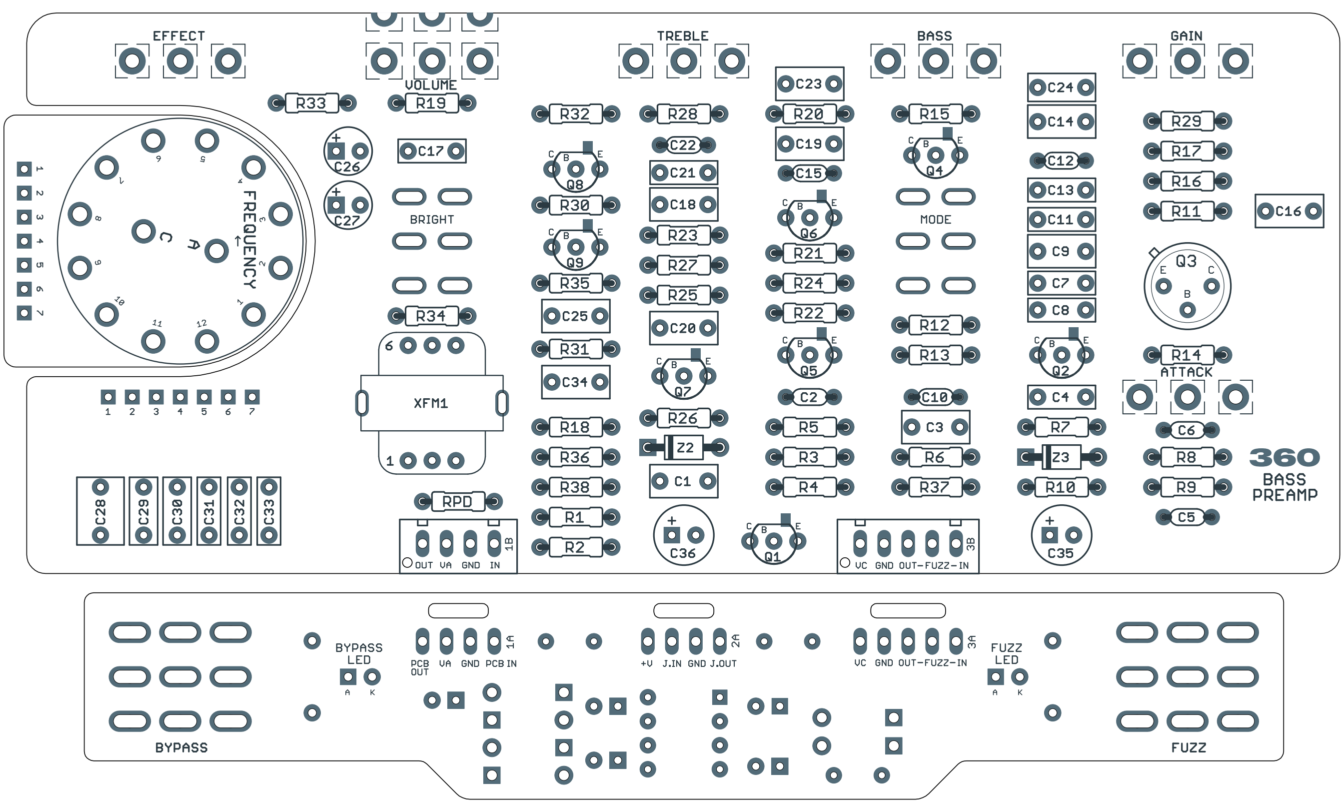
Preamp, EQ, and fuzz

DOCUMENT VERSION

1.0.0 (2024-07-04)

PROJECT SUMMARY

A very early solid-state amplifier, featuring a fuzz channel and a variable-frequency tone control. Notably used by John Paul Jones and Jaco Pastorius.



Actual size is 5.57" x 2.33" (main board) and 5.00" x 0.86" (bypass board).

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INTRODUCTION

The 360 Preamp is an adaptation of the Acoustic Control Corporation Model 360 bass preamp, first released in 1967. It is best known as the amp of choice for both John Paul Jones and Jaco Pastorius.

The 360 is a solid-state design comprised of a switchable fuzz circuit, an amplifier stage, a passive tone stack, and an active tone control with selectable frequency called “Variamp”. It uses primarily silicon transistors, with one germanium transistor in the fuzz section.

The fuzz section carries a very strong resemblance to the Mosrite Fuzzrite, which was released a year earlier in 1966. It has been converted to negative ground and utilizes NPN transistors, but the topology is nearly identical and it is clear that the designers looked to the Fuzzrite as their primary inspiration.

Acoustic also released a guitar version of the amplifier called the 260, which was used by Robby Krieger of The Doors as well as Albert King and Chuck Berry. The circuit is nearly identical, with only the Variamp frequencies changed and three other very minor component changes to raise the bass cutoff frequency. These alternate parts can be found in the build notes section later on.

The 360 Preamp is a direct adaptation of the Acoustic 360, running at the same voltage as the original (24V for the main circuit and 7.5V for the fuzz section). We added two small modifications: a “Mode” toggle switch to improve the bass frequencies of the fuzz section (adapted from our Orpheus project), and a sixth frequency mode to the Variamp control to make full use of the more standard 6-pole rotary switch. Otherwise, it is faithful to the original circuit.

USAGE

The 360 Preamp has the following controls.

Potentiometers

- **Attack** blends between the output of the first transistor and the second transistor. Since the second transistor is where most of the distortion takes place, it acts as a drive control. It is only active when Fuzz mode is engaged.
- **Gain** is the output volume of the fuzz section. It is only active when Fuzz mode is engaged.
- **Treble** and **Bass** form a two-band Fender-style passive tone stack.
- **Effect** sets the level of the frequency selected by the Frequency rotary switch.
- **Volume** simultaneously sets the output volume of the effect and the tone of the signal between the fuzz section and tone stack. On lower volume levels, the tone is made brighter to compensate, particularly when the Bright switch is engaged.

Switches

- **Mode** (toggle switch) selects between vintage and modern. Modern mode adds significantly more midrange and bass to round out the EQ. It is only active when Fuzz mode is engaged.
- **Bright** (toggle switch) adds a treble bleed capacitor to the first half of the volume control.
- **Frequency** (rotary switch) selects between six different center frequencies to cut or boost with the Effect knob. This was called the "Variamp" in the original amplifier, and was based on the Gibson Varitone circuit.
- **Fuzz** (footswitch) engages or disengages the fuzz effect.
- **Bypass** (footswitch) engages or disengages the full preamp.

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	22k	Metal film resistor, 1/4W	
R2	(omit)	Metal film resistor, 1/4W	22k in original. See build notes.
R3	1M	Metal film resistor, 1/4W	
R4	4M7	Metal film resistor, 1/4W	
R5	100k	Metal film resistor, 1/4W	
R6	22k	Metal film resistor, 1/4W	
R7	100k	Metal film resistor, 1/4W	
R8	470k	Metal film resistor, 1/4W	
R9	680k	Metal film resistor, 1/4W	
R10	22k	Metal film resistor, 1/4W	
R11	1M	Metal film resistor, 1/4W	
R12	47k	Metal film resistor, 1/4W	
R13	100k	Metal film resistor, 1/4W	
R14	22k	Metal film resistor, 1/4W	
R15	1M	Metal film resistor, 1/4W	
R16	10k	Metal film resistor, 1/4W	
R17	100k	Metal film resistor, 1/4W	
R18	470k	Metal film resistor, 1/4W	
R19	2k2	Metal film resistor, 1/4W	
R20	8k2	Metal film resistor, 1/4W	
R21	2M7	Metal film resistor, 1/4W	
R22	680R	Metal film resistor, 1/4W	
R23	10k	Metal film resistor, 1/4W	
R24	10k	Metal film resistor, 1/4W	
R25	270k	Metal film resistor, 1/4W	
R26	680R	Metal film resistor, 1/4W	
R27	3k9	Metal film resistor, 1/4W	
R28	10k	Metal film resistor, 1/4W	
R29	680R	Metal film resistor, 1/4W	
R30	1M	Metal film resistor, 1/4W	
R31	4k7	Metal film resistor, 1/4W	
R32	2k2	Metal film resistor, 1/4W	

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
R33	680R	Metal film resistor, 1/4W	
R34	100k	Metal film resistor, 1/4W	
R35	10k	Metal film resistor, 1/4W	
R36	8k2	Metal film resistor, 1/4W	
R37	220R	Metal film resistor, 1/4W	7.5V (fuzz) supply limiting resistor.
R38	220R	Metal film resistor, 1/4W	24V supply limiting resistor.
R39	10k	Metal film resistor, 1/4W	Bypass LED current-limiting resistor.
R40	2k2	Metal film resistor, 1/4W	Fuzz LED current-limiting resistor.
RPD	2M2	Metal film resistor, 1/4W	Input pulldown resistor.
C1	1uF	Film capacitor, 7.2 x 3.5mm	
C2	100pF	MLCC capacitor, NP0/C0G	
C3	1uF	Film capacitor, 7.2 x 3.5mm	
C4	100n	Film capacitor, 7.2 x 2.5mm	
C5	100n	MLCC capacitor, X7R	
C6	150pF	MLCC capacitor, NP0/C0G	
C7	1n	Film capacitor, 7.2 x 2.5mm	
C8	6n8	Film capacitor, 7.2 x 2.5mm	Part of the Mode switch mod. See build notes.
C9	1uF	Film capacitor, 7.2 x 3.5mm	100n in guitar version.
C10	100n	MLCC capacitor, X7R	
C11	2n2	Film capacitor, 7.2 x 2.5mm	
C12	330pF	MLCC capacitor, NP0/C0G	
C13	5n6	Film capacitor, 7.2 x 2.5mm	Part of the Mode switch mod. See build notes.
C14	1uF	Film capacitor, 7.2 x 3.5mm	
C15	100pF	MLCC capacitor, NP0/C0G	
C16	1uF	Film capacitor, 7.2 x 3.5mm	
C17	10n	Film capacitor, 7.2 x 2.5mm	
C18	1uF	Film capacitor, 7.2 x 3.5mm	
C19	1uF	Film capacitor, 7.2 x 3.5mm	
C20	1uF	Film capacitor, 7.2 x 3.5mm	
C21	2n2	Film capacitor, 7.2 x 2.5mm	
C22	330pF	MLCC capacitor, NP0/C0G	
C23	1uF	Film capacitor, 7.2 x 3.5mm	
C24	470n	Film capacitor, 7.2 x 3mm	
C25	1uF	Film capacitor, 7.2 x 3.5mm	
C26	6.8uF	Electrolytic capacitor, 5mm	2.2uF in guitar version.
C27	6.8uF	Electrolytic capacitor, 5mm	2.2uF in guitar version.
C28	2.2uF	Film capacitor, 7.2 x 5mm	180n in guitar version.

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
C29	470n	Electrolytic capacitor, 4mm	100n in guitar version.
C30	220n	Film capacitor, 7.2 x 2.5mm	Omit (leave empty) for guitar version, using C31 only.
C31	47n	MLCC capacitor, NP0/C0G	
C32	100n	Film capacitor, 7.2 x 2.5mm	12n for guitar version.
C33	27n	Film capacitor, 7.2 x 3mm	2n7 for guitar version.
C34	1uF	Electrolytic capacitor, 5mm	
C35	100uF	Electrolytic capacitor, 5mm	Power supply filter capacitor.
C36	100uF	Electrolytic capacitor, 5mm	Power supply filter capacitor.
C37	470n	Electrolytic capacitor, 5mm	Power supply filter capacitor.
C38	10uF	Electrolytic capacitor, 6.3mm	Charge pump capacitor.
C39	10uF	Electrolytic capacitor, 6.3mm	Power supply filter capacitor.
C40	10uF	MLCC capacitor, X7R	Charge pump capacitor.
C41	470n	Electrolytic capacitor, 5mm	Power supply filter capacitor.
C42	100uF	Schottky diode, DO-41	Power supply filter capacitor.
C43	100n	Fast-switching diode, DO-35	Power supply filter capacitor.
C44	47uF	Schottky diode, DO-35	Power supply filter capacitor.
D1	1N5817	Schottky diode, DO-41	
D2	1N5817	Schottky diode, DO-41	
D3	1N5817	Schottky diode, DO-41	
D4	1N5817	Schottky diode, DO-41	
D5	1N5817	Schottky diode, DO-41	
Q1	2N3904	BJT transistor, NPN, TO-92	
Q2	2N5088	BJT transistor, NPN, TO-92	
Q3	2N1306	Germanium transistor, NPN	Other NPN types will work. See build notes for selection info.
Q4	2N5088	BJT transistor, NPN, TO-92	
Q5	2N5088	BJT transistor, NPN, TO-92	
Q6	2N5088	BJT transistor, NPN, TO-92	
Q7	2N5088	BJT transistor, NPN, TO-92	
Q8	2N5088	BJT transistor, NPN, TO-92	
Q9	2N5088	BJT transistor, NPN, TO-92	
Z1	1N4742A	Zener diode, 12V, DO-41	
Z2	1N4749A	Zener diode, 24V, DO-41	
Z3	1N4737A	Zener diode, 7.5V, DO-41	
IC1	LT1054CP	Charge pump, DIP8	
IC1-SOCKET	DIP-8 socket	IC socket, DIP-8	
XFM1	42TL021	Transformer, audio, 4KCT/600CT	
FREQUENCY	2P6T rotary	Rotary switch, 2 pole / 6 position	Must be Alpha SR2612F. Available from Mouser (see spreadsheet).

PARTS LIST, CONT.

PART	VALUE	TYPE	NOTES
BASS	25kB	16mm right-angle PCB mount pot	
TREBLE	25kB	16mm right-angle PCB mount pot	
ATTACK	500kB	16mm right-angle PCB mount pot	
GAIN	500kB	16mm right-angle PCB mount pot	
EFFECT	50kB	16mm right-angle PCB mount pot	
VOLUME	50kB dual	16mm dual pot, right angle	Available from Stompbox Parts.
MODE	DPDT on-on	Toggle switch, DPDT on-on	
BRIGHT	DPDT on-on	Toggle switch, DPDT on-on	
BYP. LED	5mm red	LED, 5mm, red diffused	
FUZZ LED	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.
BYPASS	3PDT	Stomp switch, 3PDT	
FUZZ	3PDT	Stomp switch, 3PDT	
ENCLOSURE	1590XX	Enclosure, die-cast aluminum	1790NS equivalent.

Rotary switch

The rotary switch sub-PCB is designed for the Alpha SR2612F 2P6T PCB-mount rotary switch. We are not aware of any other brands with this form factor, so there are no cross-reference substitutes. It's available from Mouser, part number 105-SR2612F-26-21RN.

The drill template includes a hole for the anti-rotation pin. Precise drilling is needed in order for the anti-rotation pin to work. If you need to drill the hole a size larger because it's slightly out of alignment, then it loses its anti-rotation function.

The rotary switch has a daughterboard that snaps off the main board. It's recommended to solder this in place once the main PCB has been installed into the enclosure. This way, everything will be at the correct height and will not cause any stress to the joints after everything is together. Think of it as a PCB-mounted pot that requires some assembly.

When soldered to the rotary switch, the pads on the daughterboard should line up perfectly with the pads on the main PCB if the drilling is precise. However, be aware that there is not a lot of clearance between the top PCB and bottom PCB.

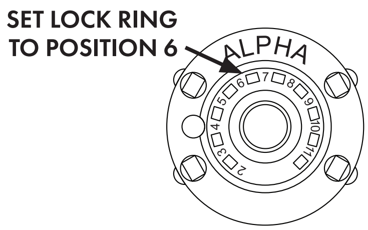
The easiest method for connecting the sub-PCB to the main PCB is via straight wires, e.g. clipped resistor leads. Solder them to the main PCB first, then thread the daughterboard through the wires and down onto the rotary switch. Solder the daughterboard to the rotary pins, then solder each of the wires on the daughterboard.

You can also use a snap-apart wire header. If you do this, the daughterboard PCB will need to sit a little higher on the pins of the rotary switch since there isn't quite the 0.1" clearance needed for the plastic insulators. Be careful because this will be extremely difficult to desolder if you make any mistakes.

Alternately, you can add another 3/8" hex nut (e.g. from 1/4" jack) on the inside of the rotary switch to mount it higher inside the enclosure. You will lose the use of the anti-rotation pin, so it's possible that the rotary switch can come loose over time due to the rotational force, but it gives enough space to run flexible wires between the main board and daughterboard in case they are slightly out of alignment.

Rotary lock washer

The rotary comes with a lock washer that physically prevents the rotary switch from going past a set number of positions. The 6-position rotary switches typically come with this lock washer set to the "6" position, so normally nothing needs to be done. But to avoid potential headaches later, always double-check to ensure the lock washer is set to the correct position before soldering anything.



BUILD NOTES, CONT.

Rotary shaft

You will likely need to cut the shaft of the rotary switch by around 0.4” to match the height of the potentiometer shaft so the knobs sit at the same level.

A rotary tool cutoff wheel works great, but you can do it with normal snippers as well—it just won’t be a clean cut this way so it may need some sanding or filing to level it off.

Guitar version

The Acoustic 260 was the guitar version of the 360. It is substantially similar to the 360, differing only in a few capacitors that set the bass cutoff frequencies and tone control frequencies.

Here are the specific changes:

- **C9:** 1uF → 100n
- **C26:** 6.8uF → 2.2uF
- **C27:** 6.8uF → 2.2uF
- **C28:** 2.2uF → 180n
- **C29:** 470n → 100n
- **C30:** 220n → omit (leave empty; use only C31 and keep it at 47n)
- **C32:** 100n → 12n
- **C33:** 27n → 2n7

Variamp circuit & transformer selection

The “Variamp” rotary control of the Acoustic 360 is a direct copy of the “Varitone” switch from Gibson ES-345, first appearing in 1959. It also appeared on other models such as B.B. King’s “Lucille” ES-355.

In the Acoustic amp, it uses a 1.5 Henry inductor and a series of four capacitors that each set the center frequency that is boosted or cut by the Effect control.

Large inductors are expensive and difficult to source. However, it turns out that the primary side of the Xicon 42TL021 transformer, readily available from Mouser, is nominally 1.5H. By wiring it up as an inductor (using it in series and leaving the secondary disconnected), it does the job perfectly as a modern replacement. This is also the transformer that is commonly used in Varitone implementations today.

Since 6-position rotaries are more standard than five, we included a sixth frequency option not found on the original amp. On the bass version, it’s 136 Hz, in between the default 100 Hz and 250 Hz settings. You can tweak C29 if you want to adjust this frequency.

Footswitch PCB component placement

Several components related to the power and switching are located on the footswitch PCB. Due to the inner enclosure height, the components are mounted on the underside of the PCB, the same side as the footswitches. The components are always mounted onto the silkscreen outline, so don’t solder anything until you’ve matched it to the outline.

Silicon transistor selection

The original Acoustic 360 used an MPSA09 for Q1 and 2N3391 for Q2 and Q4.

The MPSA09 is a low-noise medium-gain transistor, and the **2N3904** is an equivalent substitute.

The 2N3391 is higher gain, and so the **2N5088** is an equivalent. You can also use the **BC549C**, but note that the pinout is reversed so you will have to rotate it 180 degrees on the PCB.

Germanium transistor selection

The Acoustic amp used a 2N1306 for Q3. We have never measured the transistor in the actual amp, but based on the datasheet the h_{FE} range is 60 to 300, and anecdotally most of them seem to measure above 130. So this would be a fairly high-gain transistor as germaniums go.

These can be found at Small Bear Electronics as of this writing, but many other types can be used as long as they are similarly high gain.

Note that this is an **NPN** transistor. Germanium NPNs are a bit more obscure than PNP, but usually easy to find and fairly cheap since the classic fuzz circuits all used PNP types. If you inadvertently use a PNP here, it will barely pass signal in germanium mode, so be careful of the type!

C11/12 capacitors

In the original Acoustic amp, the coupling capacitor after the germanium stage is 2n5. This value isn't readily available today, so we included space for two capacitors to be used in parallel. A 2n2 box film in parallel with a 330pF MLCC is 2n53, which is well within normal component tolerance. You could also use 1n5 and 1n.

Mode switch modifications

The Mode switch in the fuzz section is adapted from the Catalinbread Fuzzrite Germanium. When engaged, it increases the size of the coupling capacitors of both sides of the blend, which allows more midrange and low-end.

In the 360, the two coupling capacitors are different values, 2n5 and 1n, unlike the original Fuzzrite where they were both 2n2. So, our default values for this project are slightly different in order to give them both roughly the same total capacitance in "Modern" mode.

It's recommended to use 6n8 for C8 and 5n6 for C13, which give roughly 8n when put in parallel with the existing capacitors (C7 and C11/C12). If you find that modern mode needs more low end, you can increase them to 8n2 and 10n respectively.

Volume control

The volume control is a very odd dual-gang potentiometer configuration.

The first gang comes between the fuzz section and the tone control, and controls the gain of Q5 directly—note that it, along with R20 and C19, is essentially in parallel with C18 and R21. If the Bright switch is engaged, then it adds brightness at lower levels on the rotation.

The second gang is a variable resistor at the end of the schematic. But, you'll notice that it has one significant difference from a normal volume control: lugs 2 & 3 are shorted together, when the output would normally be taken straight from lug 2.

We have verified from the original service manual that this is not a mistake in the schematic. Essentially, rather than a fixed-ratio voltage divider, R36 provides a constant minimum resistance while the volume control varies from 50k (forming a 50/58k resistance ratio, or 85%) to zero.

Presumably it was wired this way in order to provide better balance with the other half of the volume control. It still gets down to zero volume, but the travel is a bit different than a standard voltage divider volume control.

Variamp circuit & transformer selection

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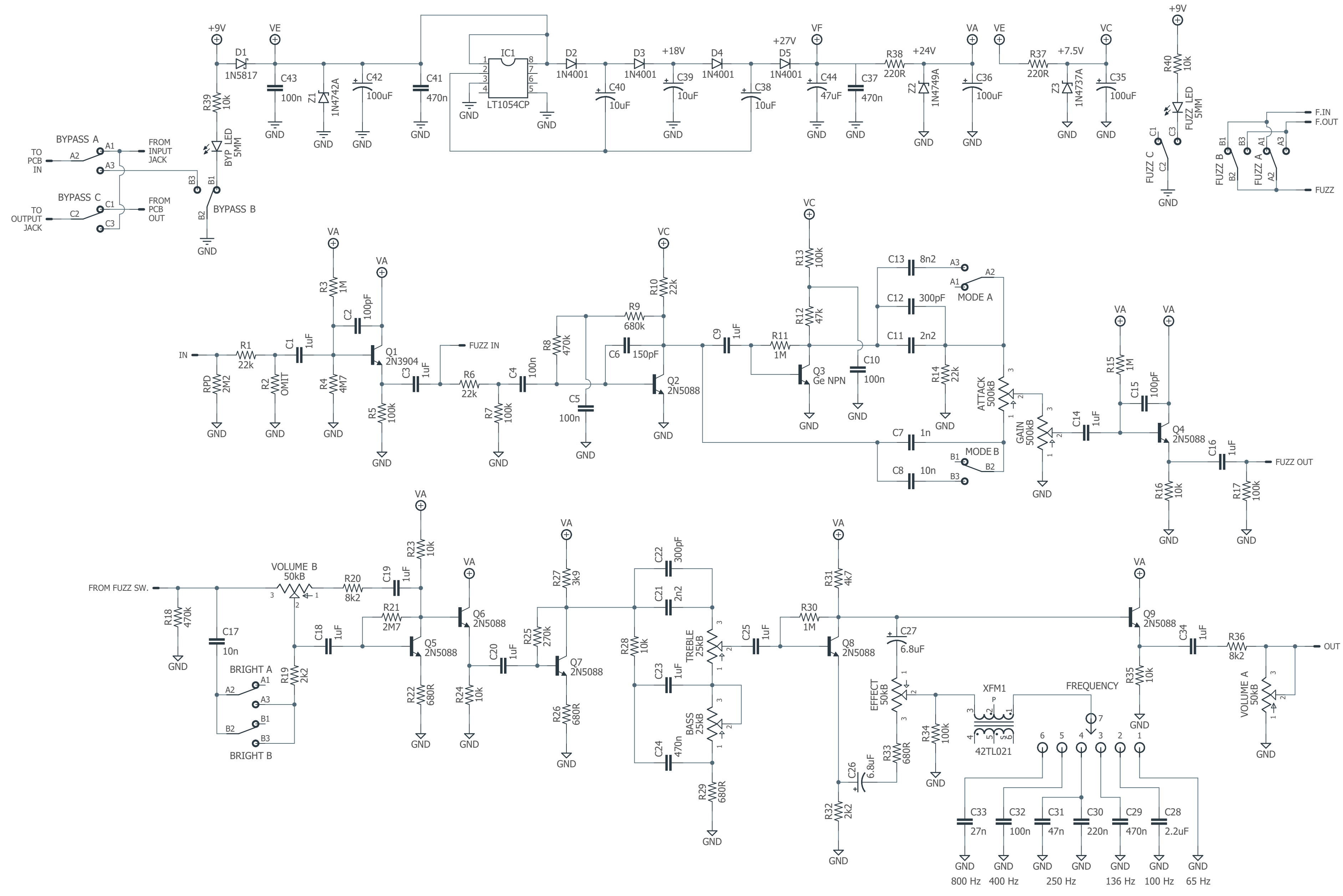
R2 resistor

The original amp had two inputs, each through a 22k series resistor. When only one of the inputs was used, the other 22k resistor was grounded via a switched jack, meaning the input signal is cut by 50%.

We have included this resistor on the PCB as R2, but since its only function is to cut the input volume, we recommend leaving it off. However, it could be argued that the entire preamp was designed around this lower signal level, so if you want to match the performance of the original amp 100% then the resistor is a crucial part of that.


+9V
VE
D1
1N5817
C43
100n
Z1
1N4742A
C42
100uF
C41
470n
IC1
LT1054CP
D2
1N4001
C40
10uF
D3
1N4001
+18V
C39
10uF
D4
1N4001
C38
10uF
+27V
D5
1N4001
VF
C44
47uF
C37
470n
R38
220R
+24V
Z2
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VA
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100uF
VE
R37
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+7.5V
Z3
1N4737A
VC
C35
100uF
+9V
R40
10k
FUZZ LED
5MM
FUZZ C
FUZZ B
FUZZ A
F.IN
F.OUT
FUZZ
R39
10k
BYP LED
5MM
BYPASS A
TO PCB IN
FROM INPUT JACK
BYPASS C
TO OUTPUT JACK
FROM PCB OUT
BYPASS B
GND
IN
R1
22k
RPD
2M2
R2
OMIT
C1
1uF
R3
1M
R4
4M7
C2
100pF
Q1
2N3904
FUZZ IN
R5
100k
C3
1uF
R6
22k
R7
100k
C4
100n
R8
470k
C5
100n
R9
680k
C6
150pF
R10
22k
Q2
2N5088
C9
1uF
R11
1M
R13
100k
R12
47k
Q3
Ge NPN
C10
100n
C13
8n2
C12
300pF
C11
2n2
MODE A
R14
22k
C7
1n
C8
10n
MODE B
ATTACK
500kB
GAIN
500kB
C14
1uF
R15
1M
C15
100pF
Q4
2N5088
C16
1uF
FUZZ OUT
R16
10k
R17
100k
FROM FUZZ SW.
R18
470k
C17
10n
VOLUME B
50kB
R20
8k2
C19
1uF
R23
10k
R21
2M7
C18
1uF
R19
2k2
BRIGHT A
BRIGHT B
Q5
2N5088
R22
680R
Q6
2N5088
C20
1uF
R24
10k
R27
3k9
R25
270k
Q7
2N5088
R26
680R
C22
300pF
C21
2n2
R28
10k
TREBLE
25kB
C23
1uF
BASS
25kB
C24
470n
R29
680R
C25
1uF
R30
1M
R31
4k7
Q8
2N5088
C27
6.8uF
EFFECT
50kB
R33
680R
C26
6.8uF
R32
2k2
R34
100k
XFM1
42TL021
FREQUENCY
C33
27n
C32
100n
C31
47n
C30
220n
C29
470n
C28
2.2uF
800 Hz
400 Hz
250 Hz
136 Hz
100 Hz
65 Hz
Q9
2N5088
C34
1uF
R36
8k2
R35
10k
VOLUME A
50kB
OUT

DRILL TEMPLATE

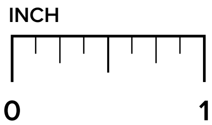
Cut out the drill template on the following page, fold the edges and tape it to the enclosure. Before drilling, it's recommended to first use a center punch for each of the holes to help guide the drill bit.

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 LEDs next to the footswitches are sized for a 5mm LED bezel, available from several parts suppliers. Adjust the drill size accordingly if using something different, such as a 3mm bezel, a plastic snap-in 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 rotary switch. There's not a lot of room for error.

If the toggle switches 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.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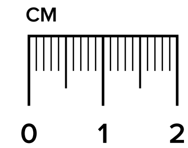
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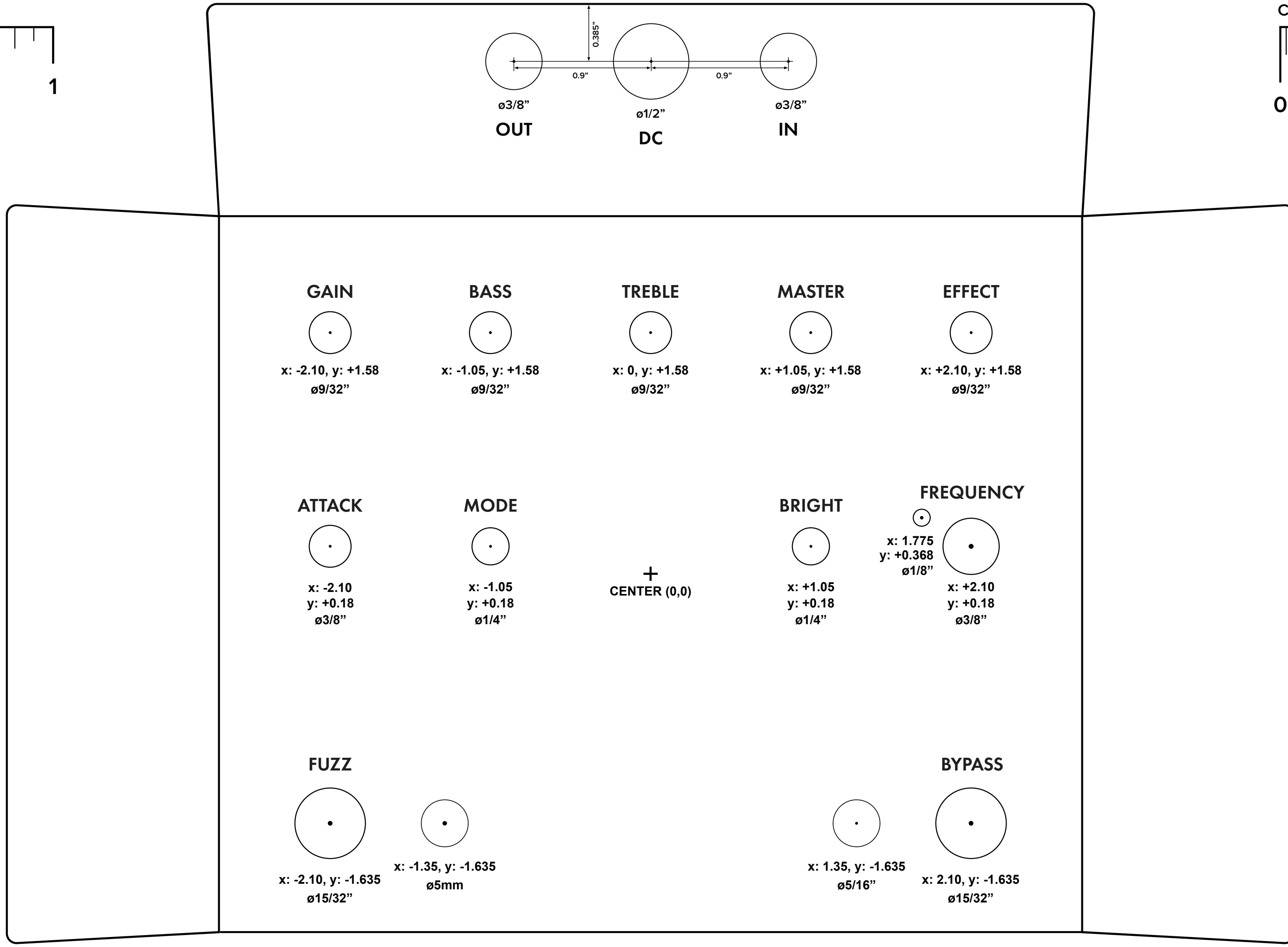
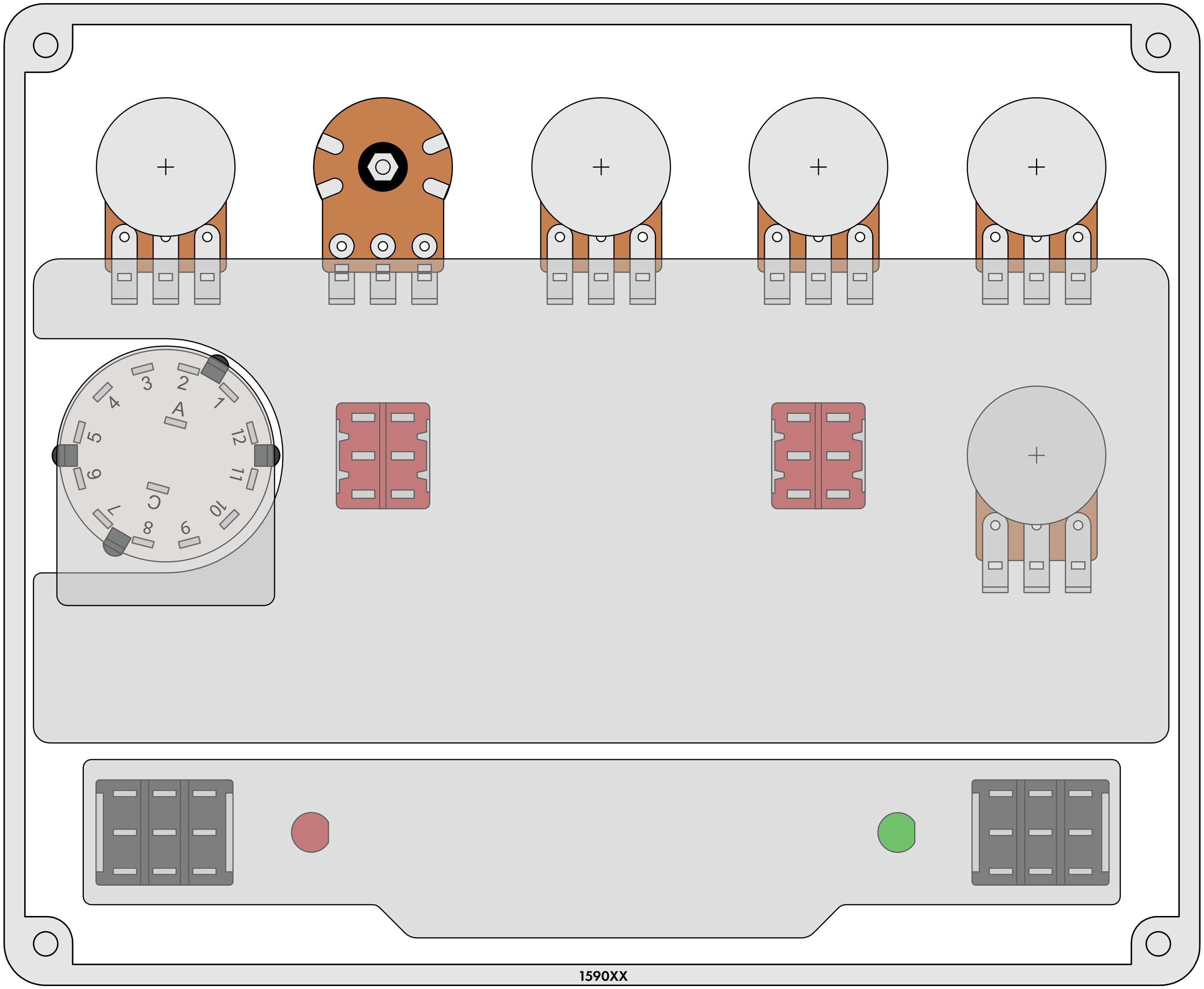
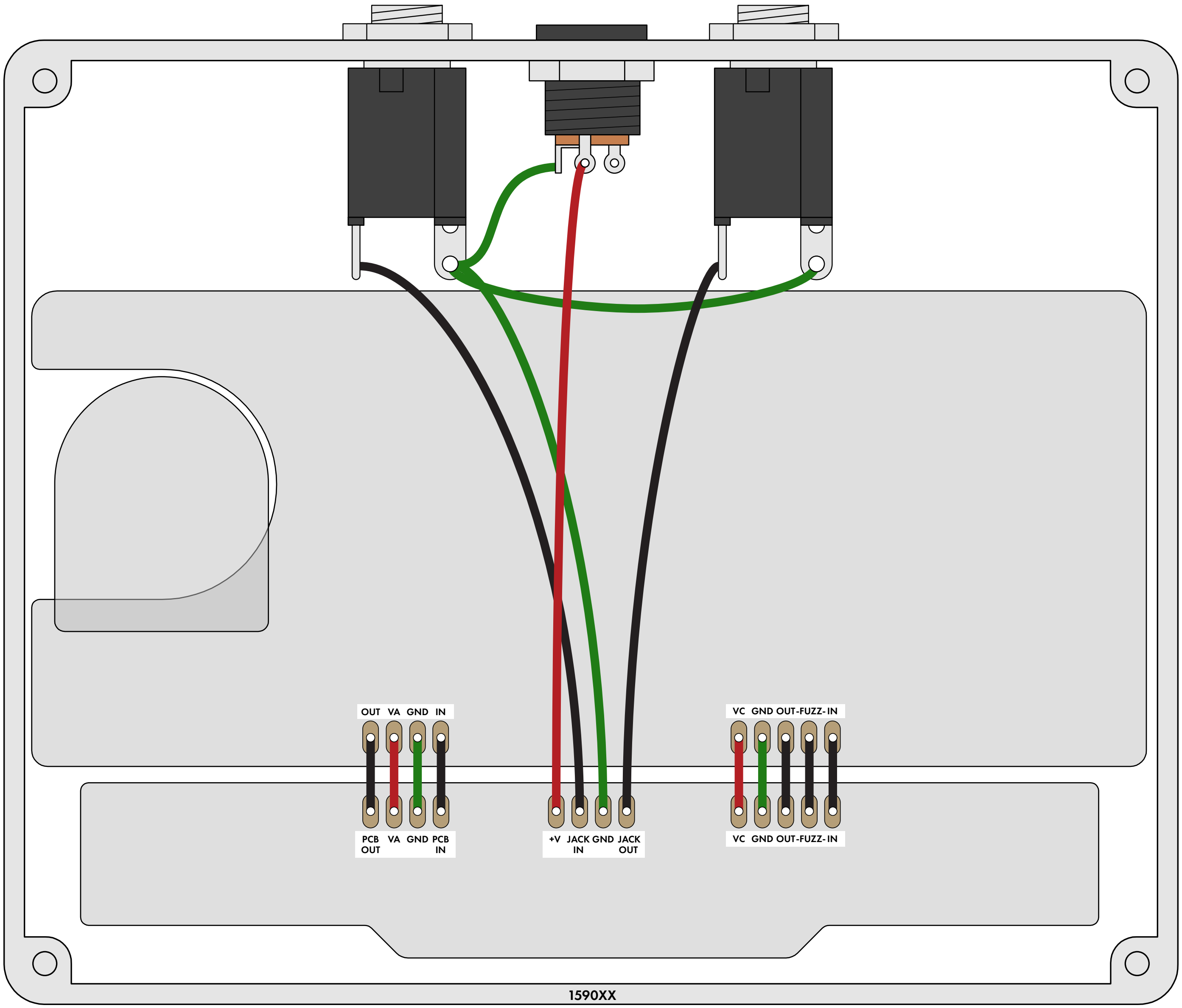

0.385"
0.9"
0.9"
ø3/8"
OUT
ø1/2"
DC
ø3/8"
IN
GAIN
x: -2.10, y: +1.58
ø9/32"
BASS
x: -1.05, y: +1.58
ø9/32"
TREBLE
x: 0, y: +1.58
ø9/32"
MASTER
x: +1.05, y: +1.58
ø9/32"
EFFECT
x: +2.10, y: +1.58
ø9/32"
ATTACK
x: -2.10
y: +0.18
ø3/8"
MODE
x: -1.05
y: +0.18
ø1/4"
CENTER (0,0)
BRIGHT
x: +1.05
y: +0.18
ø1/4"
FREQUENCY
x: 1.775
y: +0.368
ø1/8"
x: +2.10
y: +0.18
ø3/8"
FUZZ
x: -2.10, y: -1.635
ø15/32"
x: -1.35, y: -1.635
ø5mm
x: 1.35, y: -1.635
ø5/16"
BYPASS
x: 2.10, y: -1.635
ø15/32"

ENCLOSURE LAYOUT

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



WIRING DIAGRAM



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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.

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DOCUMENT REVISIONS

1.0.0 (2024-07-04)
Initial release.