PROJECT NAME

ELYSIUM

aion
DIY GUITAR EFFECTS

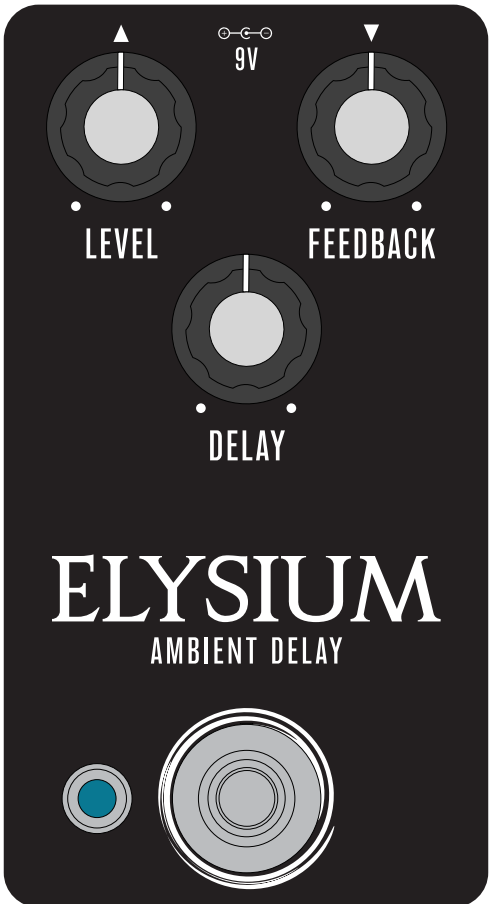
BASED ON
Ibanez® EM5 Echomachine

BUILD DIFFICULTY
Advanced

EFFECT TYPE
Delay

DOCUMENT VERSION
1.0.1 (2024-08-08)

PROJECT SUMMARY
An analog-voiced digital delay that emulates vintage tape echo units, with heavy filtering and a soft-clipping overdrive on the repeats.



IMPORTANT NOTE

This documentation is for the **kit** version of the project. If you purchased the PCB by itself, please use the PCB-only version of the documentation instead. The circuit is the same, but the instructions are completely different due to the specialized parts and assembly methods used in the kit.

Additionally, this is rated as an **advanced** project. Not only are there a lot of components packed closely together, it also requires calibration for proper operation. Read all the instructions, particularly the calibration step on pages 25-26, and make sure you know what skills are needed before you begin. If you've never built a pedal before, we recommend starting with a different kit.

TABLE OF CONTENTS

INTRODUCTION

If this is your first pedal, welcome to the hobby and thank you for choosing Aion FX. You've just joined a community of over 100,000 people around the world with a passion for building homemade noise machines using obsolete electronics technology, and we're glad to have you!

If you've done this before, it's great to see you again and we're confident you'll find this build experience an enjoyable one.

Aion FX kits are designed to empower anyone to build a high-quality pedal, no matter the skill level. The pedalbuilding hobby has traditionally had a steep learning curve, but don't be overwhelmed—we've done all the hard work for you. All you need to do is follow these instructions and you'll be on your way to transforming your tone.

There are a few things to go over before you get started.

- **You're going to have to get your hands dirty**—there's no way around it. Nothing here comes preassembled, and you'll have to learn the skills to put it all together. This document will walk you through everything you need, but be prepared to learn a few things along the way.
- **This will take time**. Plan on about two hours start to finish. It may take even longer if it's your first time building. Don't rush it. If you find yourself getting frustrated or overwhelmed, take a break and come back in a couple of hours or the next day.
- **No direct technical support is offered.** There are several DIY forums and Facebook groups with thousands of members who enjoy troubleshooting and teaching. But please be sensitive to the fact that the staff at Aion FX is minimal, and every minute spent helping individuals in private is time that can't be spent on new project development.
- **There is no implied guarantee of a final product.** Aion FX provides the ingredients and the recipe, but you are responsible for putting everything together to make it work. We've tried to make the process as clear and accessible as possible, but it must be expressly stated that purchasing the kit is not a guarantee that you will end up with a working pedal.

It's recommended to read through all of the instructions before you start, particularly if you've never built a pedal before. If you familiarize yourself with the entire process ahead of time and you know what the goal looks like, each step will make more sense.

Now, on to the fun stuff!

PACKING LIST

This is a list of all the parts that are included with the kit, grouped by value. For a list of all the parts based on their PCB part numbers, please see page 25.

If you find that any parts are missing or damaged, please fill out the Missing Parts form.

Film Capacitors

NAME	QTY
3n3	2
4n7	2
47n (0.047)	1
68n (0.068)	1
100n (0.1 or “µ1J100”)	3
1uF	7

Electrolytic Capacitors

NAME	QTY
10uF	2
47uF	4
100uF	1

MLCC Capacitors

NAME	QTY
5pF	1
47pF	2
470pF	1
680pF	1
100n (marked “104”)	4

Transistors

NAME	QTY
2N5087	1
2N5088	2
78L05 regulator	1

Resistors

NAME	QTY
30R	2
330R	1
470R	1
1k	2
3k3	1
5k1	1
9k1	1
10k	7
22k	7
33k	1
47k	5
51k	1
75k	1
100k	1
390k	2
470k	1
2M2	1

Diodes

NAME	QTY
1N5817	1
1N914	2

Trimmers

NAME	QTY
10k trimmer	1
50k trimmer	2

PACKING LIST (CONT.)

ICs

NAME	QTY
LM833	2
M65831AP	1
SN74HCU04	1
DIP-8 socket	2
DIP-14 socket	1
DIP-24 (wide) socket	1

Potentiometers

NAME	QTY
50kB	1
100kB	2
Dust cover	3
Knob	3
Mounting nut, potentiometer, 0.44"	3
Lock washer, potentiometer, 0.5"	3
Outer washer, potentiometer, 0.475"	3

Other

NAME	QTY
LED bezel	1
LED, blue	1
DC jack	1
Input/output jack	2
Mounting nut, jack, 0.54"	4
Outer washer, jack, 0.6"	2
Lock washer, jack, 0.5" (thin)	2
Enclosure	1
Enclosure screws	4
PCB, main circuit	1
PCB, footswitch	1
PCB, input/output/DC	1

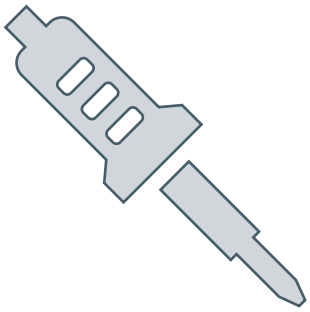
Switches

NAME	QTY
Stomp switch, 3PDT	1
Mounting nut, stomp switch, 0.6"	2
Lock washer, stomp switch, 0.6"	1
Dress nut, stomp switch, 0.77"	1

Wiring

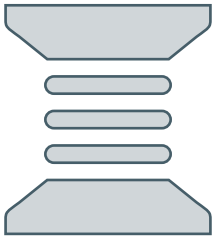
NAME	QTY
3-strand wire assembly, 70mm	2
4-strand wire assembly, 122mm	1
3-pin wire assembly header	2
4-pin wire assembly header	1

TOOLS NEEDED



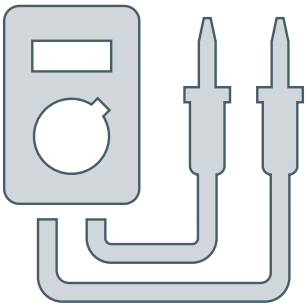
SOLDERING IRON

Temperature-adjustable is recommended. The optimum soldering temperature is 700-725° F (371-385° C) for leaded solder, or 750° F (400° C) for lead-free.



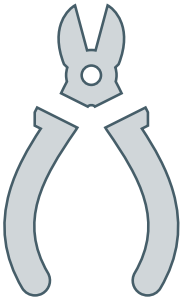
SOLDER

Preferably 63/37 or 60/40 leaded solder. Lead-free is more difficult to use, so if that's the only type you can get, it's best to watch tutorials that are specific to lead-free solder.



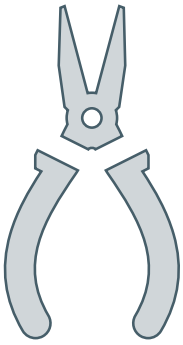
DIGITAL MULTIMETER (DMM)

Most cheap ones in the $10-30 range are fine for what we're doing. Make sure it has audible continuity testing (i.e. it beeps at the lowest resistance) and transistor hFE measurement.



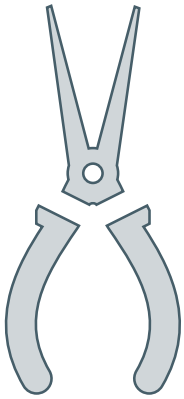
WIRE SNIPPERS

Also called nippers or wire cutters. The Hakko CHP-170 is the best you can get for less than $10.



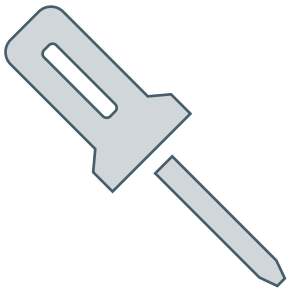
FLAT-NOSE PLIERS

Many general-purpose uses, but particularly tightening the nuts of pots, switches and jacks. Quicker than changing out sockets on a ratchet.



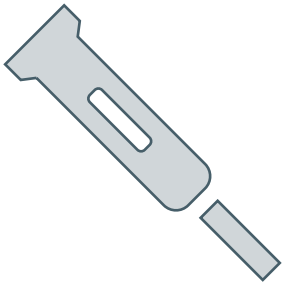
NEEDLE-NOSE PLIERS

These are used for bending leads on components and other general uses. Use the smaller type with a tip that's approximately 0.05" (1.25mm) wide.



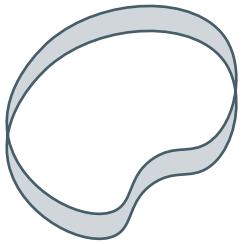
SCREWDRIVER (PHILLIPS)

Used for the enclosure screws. Get a powered driver if you'll be building a lot of pedals!



FLAT SCREWDRIVER (SMALL)

This is used for tightening the set screws on the knobs. The tip should be no more than 0.1" (2.5mm) wide.



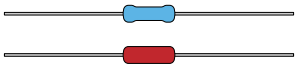
RUBBER BAND

Yes, a plain old rubber band. This is used to tighten the dress nut to avoid scratching or denting it (which can happen with metal tools).

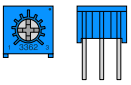
COMPONENT IDENTIFICATION

If you've never built a pedal before, you'll need to know what all the components are. These are shown actual size. (Not all of these types of components may be part of this kit.)

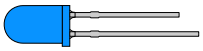
RESISTOR



TRIM POTENTIOMETER

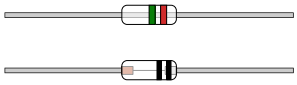


LED



SILICON DIODE

GERMANIUM DIODE



These are very fragile, so be careful when handling them.

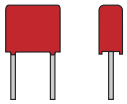
RECTIFIER DIODE

Some Schottky diodes also look like this.

SCHOTTKY DIODE

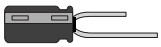
ZENER DIODE

FILM CAPACITOR



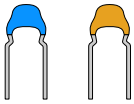
Not polarized. Color may vary by brand and type.

ELECTROLYTIC CAPACITOR



Polarized. The negative side is marked.

MLCC

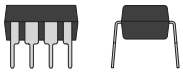


Not polarized. MLCC stands for "multi-layer ceramic capacitor."

TANTALUM CAPACITOR

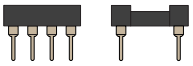
Polarized. The positive side is marked.

IC OR OP-AMP

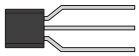


Charge pumps and delay chips also look like this. They may have more than 8 legs.

IC SOCKET



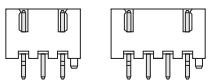
TRANSISTOR OR JFET



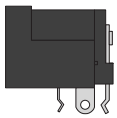
Some voltage regulators also look like this.

WIRE ASSEMBLY

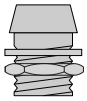
WIRE ASSEMBLY HEADER



DC JACK



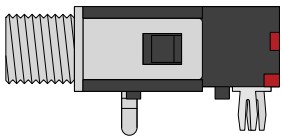
LED BEZEL



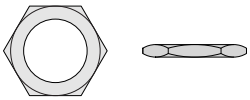
HARDWARE IDENTIFICATION

The hardware comes unassembled, so you'll need to sort & identify each of the pieces. The diagrams below are actual size, so you can set them against the printed page to identify them if needed.

I/O JACK

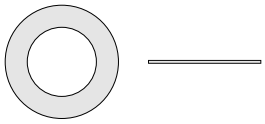


MOUNTING NUT



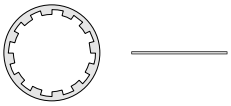
DIAMETER: 0.54" / 13.7mm

OUTER WASHER



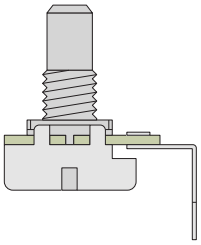
DIAMETER: 0.6" / 15.2mm

LOCK WASHER

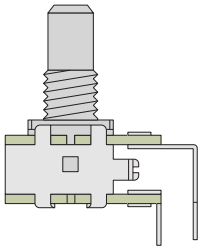


DIAMETER: 0.5" / 12.7mm

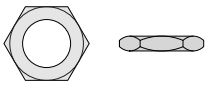
POTENTIOMETER (SINGLE)



POTENTIOMETER (DUAL)

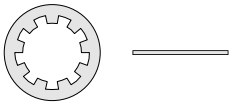


MOUNTING NUT



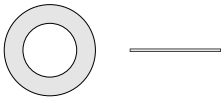
DIAMETER: 0.44" / 11.2mm

LOCK WASHER



DIAMETER: 0.5" / 12.7mm

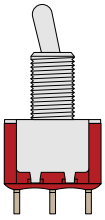
OUTER WASHER



DIAMETER: 0.475" / 12mm

KNOB

TOGGLE SWITCH



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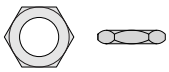
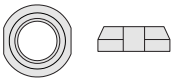


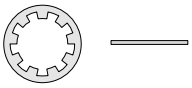
DIAMETER: 0.36" / 9.1mm

DRESS NUT



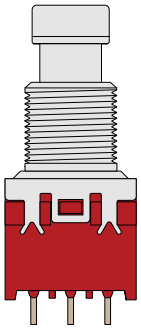
DIAMETER: 0.375" / 9.5mm

LOCK WASHER

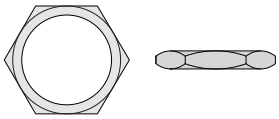


DIAMETER: 0.4" / 10.1mm

FOOTSWITCH

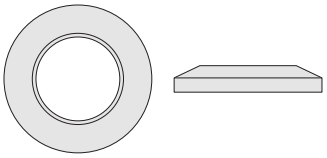


MOUNTING NUT



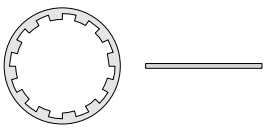
DIAMETER: 0.6" / 15.2mm

DRESS NUT



DIAMETER: 0.77" / 19.6mm

LOCK WASHER



DIAMETER: 0.6" / 15.2mm

PCB ASSEMBLY OVERVIEW

Now it's time to start building!

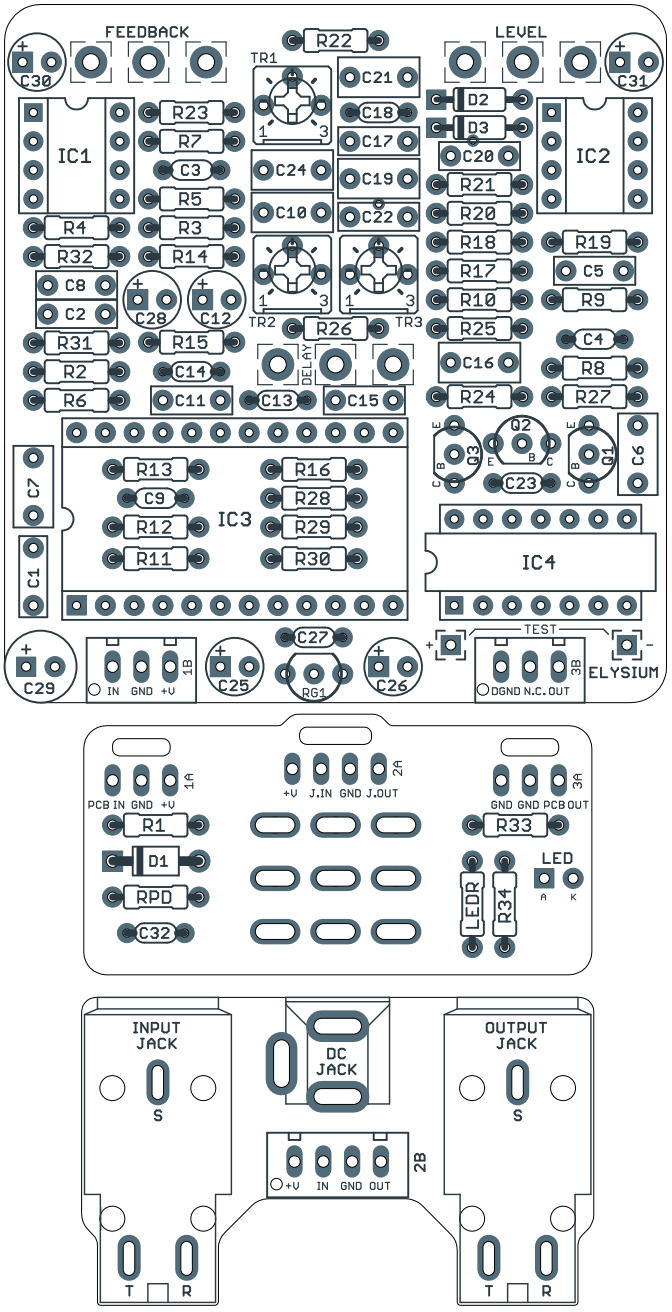
Before you begin, separate the PCBs into individual boards and break off the tabs from each using needle-nose or flat-head pliers. You should be left with the three PCBs shown to the right.

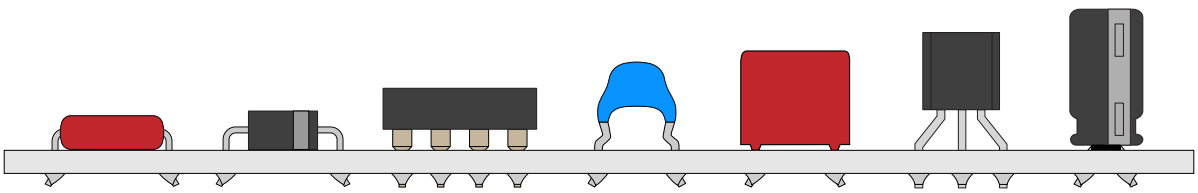
The general principle for PCB population is that you want to work in layers from shortest components (i.e. lowest-profile) to tallest so that when the PCB is upside-down, everything is making contact with the work surface and is held in place.

Generally speaking, you should populate the components in this order:

1. Resistors
2. Diodes
3. IC sockets
4. MLCC capacitors
5. Film capacitors
6. Transistors
7. Electrolytic capacitors

Not all of these component types are included in each kit, so skip them if they aren't applicable. Some types of film capacitors are taller than electrolytics, so those can be done last.





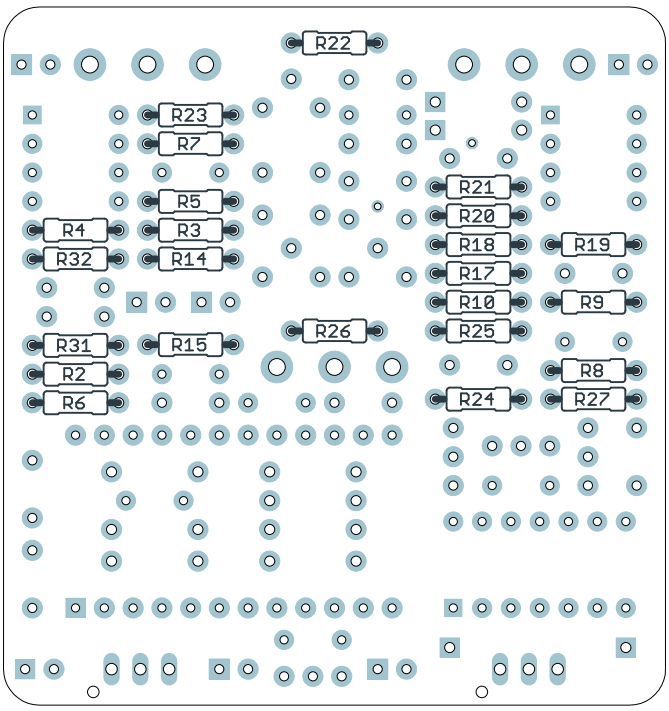
RESISTORS

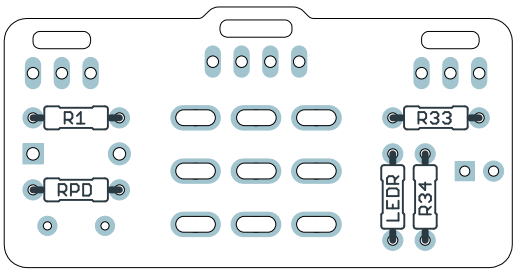
PART	VALUE
R1	1k
R2	470k
R3	47k
R4	10k
R5	22k
R6	47k
R7	47k
R8	47k

PART	VALUE
R9	10k
R10	47k
R14	22k
R15	30R
R17	22k
R18	22k
R19	33k
R20	10k

PART	VALUE
R21	1k
R22	51k
R23	75k
R24	390k
R25	9k1
R26	390k
R27	3k3
R31	10k

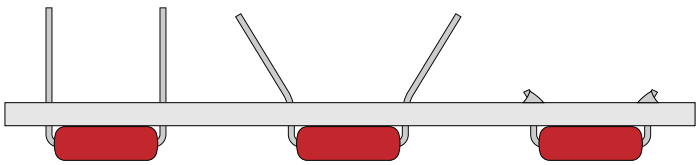
PART	VALUE
R32	10k
R33	470R
R34	100k
RPD	2M2
LEDR	10k





Note: *The resistors underneath the IC3 socket will be done in a later step. Leave them empty for now.*

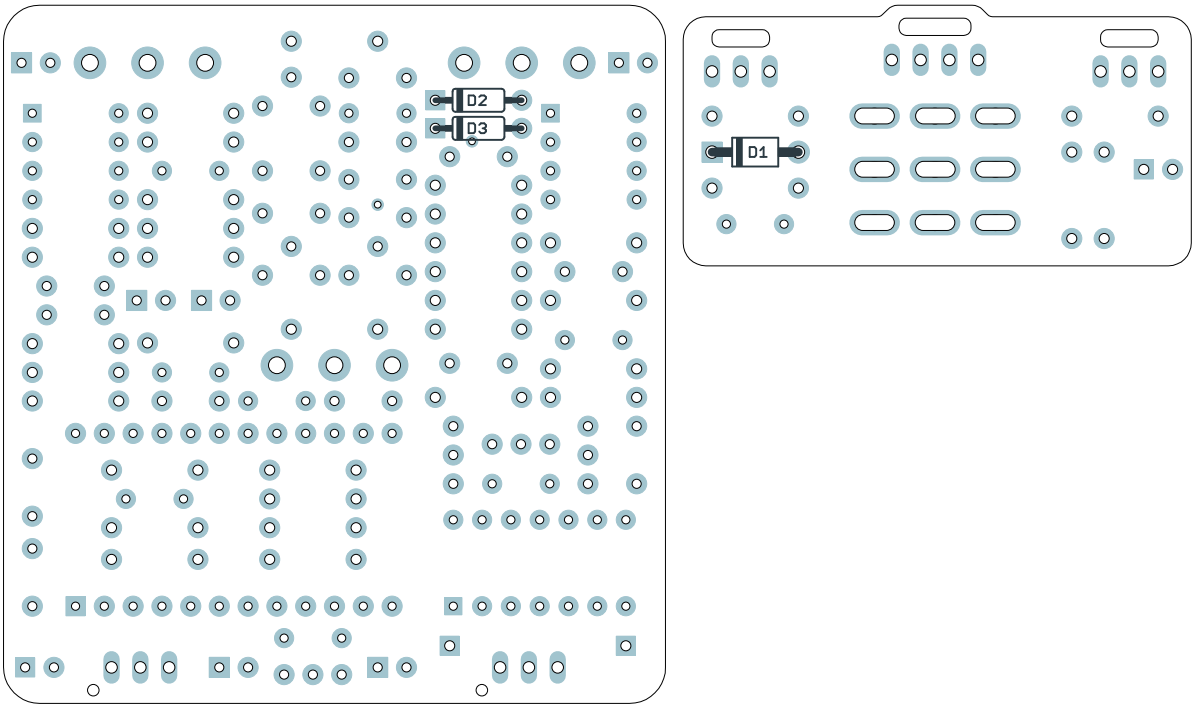
Using the parts list above, populate the resistors by pushing them through the holes and bending the leads outward at an angle to hold them in place. Resistors are not polarized, so they will work in any direction. Turn the board upside-down to keep the components held in place while you solder.



Don't try to do all of the resistors at once. You'll want to stop periodically flip the board and solder everything, then cut the leads using the wire snippers to make room for more.

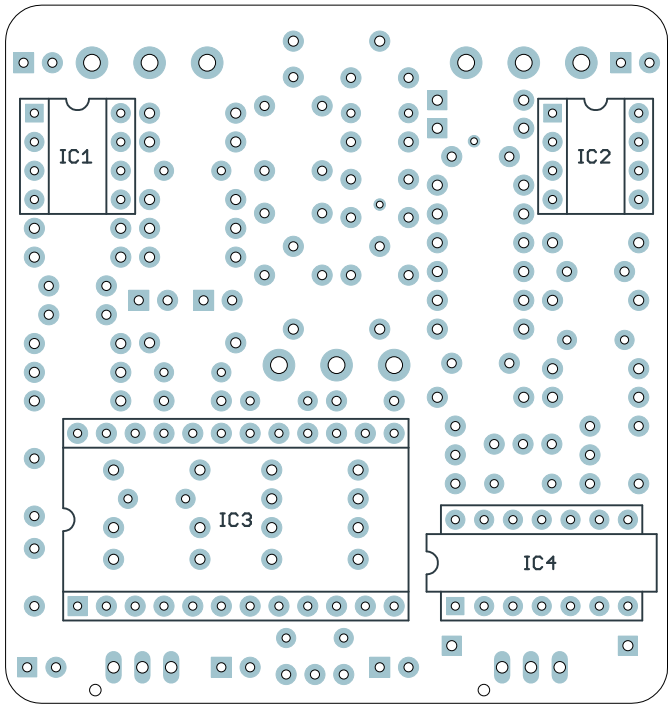
DIODES

PART	VALUE
D1	1N5817
D2	1N914
D3	1N914



Next, you'll populate the diodes. Diodes are polarized, so make sure to identify the polarity band (which indicates the "cathode", or negative side) and match the band to the footprint on the PCB.

PART	VALUE
IC1	LM833 with 8-pin socket
IC2	LM833 with 8-pin socket
IC3	M65831AP with 24-pin socket
IC4	SN74HCU04 with 14-pin socket

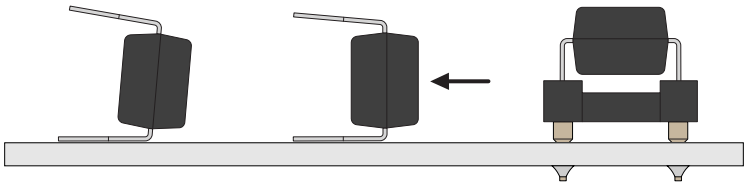


Next up are the sockets. You can't bend the leads of the sockets as with the other components, so they won't stay in on their own until they are soldered. Flip the PCB over and use gravity to hold them in place.

Installing the ICs

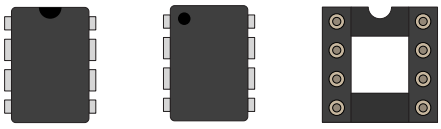
Don't insert the ICs into the sockets just yet. We will do this in a later step, after we've finished soldering the tallest components (the polarized capacitors) as well as the components underneath IC3. This information is just listed here for reference.

The legs of the ICs are bent outward slightly during manufacturing, so they'll need to be bent back inward before they can be inserted into the sockets. It's easiest to do this by laying the IC legs against the table and bending the body itself so all the legs on the side are straightened out at once. Then, flip it and do the other side.



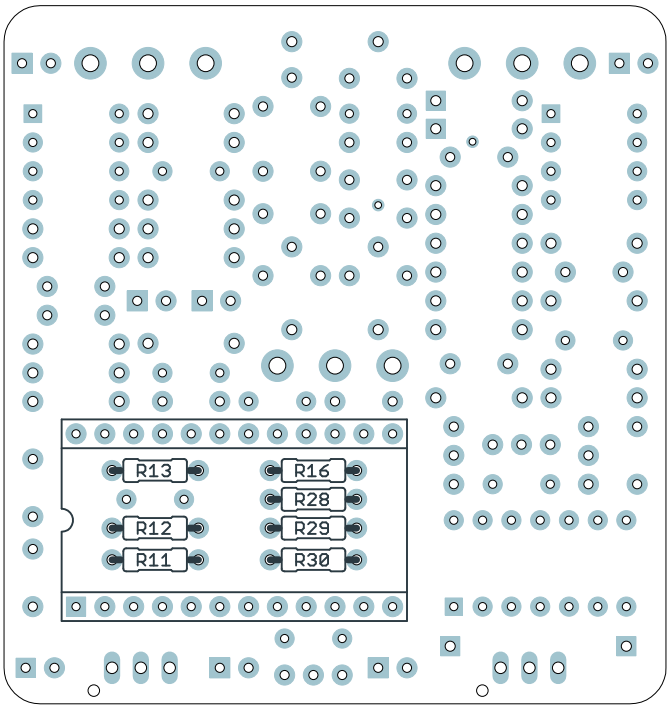
This is particularly tricky with IC3 (and to a lesser extent IC4) due to the number of legs. It may take a few tries to get them bent to the correct angle. Be very careful that every one of the legs is properly lined up with the socket before pressing down. If you encounter more than a small amount of resistance, check again to make sure none of them are misaligned.

ICs may have two different orientation marks: either a dot in the upper-left or a half-circle notch in the middle of the top side. Some ICs have both marks. This shows which way the IC should be rotated when inserting it into a socket (the socket also has a half-circle notch).



RESISTORS (UNDER IC3 SOCKET)

PART	VALUE
R11	22k
R12	22k
R13	22k
R16	30R
R28	330R
R29	5k1
R30	10k

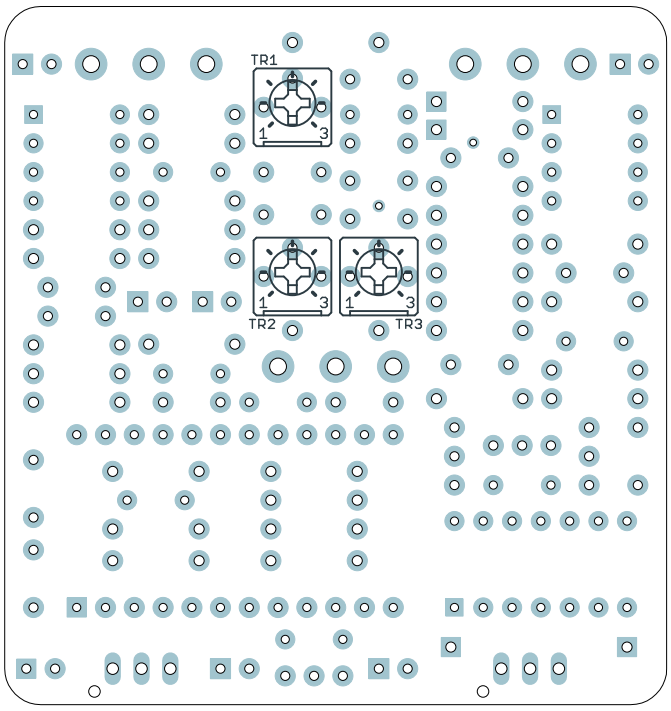


Populate the remaining resistors located underneath the IC3 socket.

These are saved until after the socket because there's not a lot of extra space, and it's possible to install them at a slight angle that could prevent the socket from fitting correctly if they go in first. However, if they're done after the socket then everything will fit in without any trouble.

TRIMMERS

PART	VALUE
TR1	10k trimmer (marked “103”)
TR2	50k trimmer (marked “503”)
TR3	50k trimmer (marked “503”)



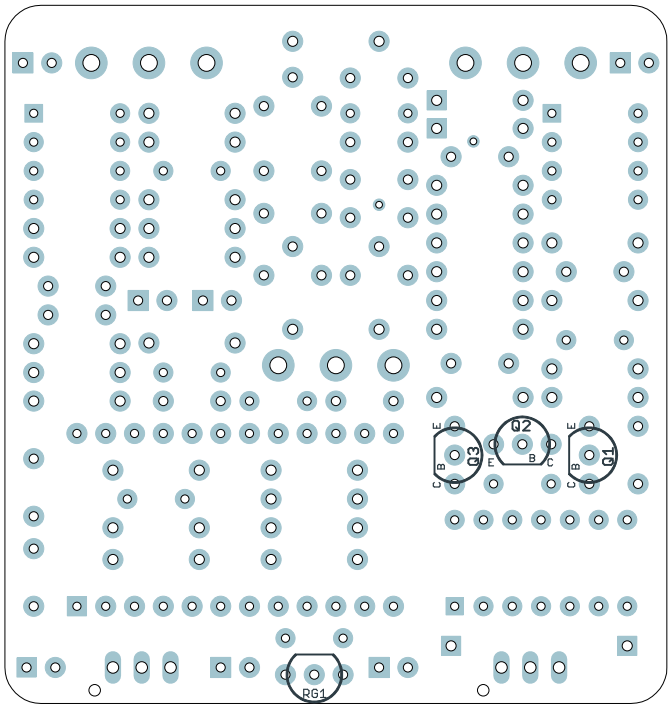
Next, we’ll do the trimmers. The value code is located on the side. The 10k trimmer will say “103” and the two 50k trimmers will say “503”. This code is etched or engraved rather than printed, so it’s easier to read with direct light reflecting off the side.

Setting the trimmers

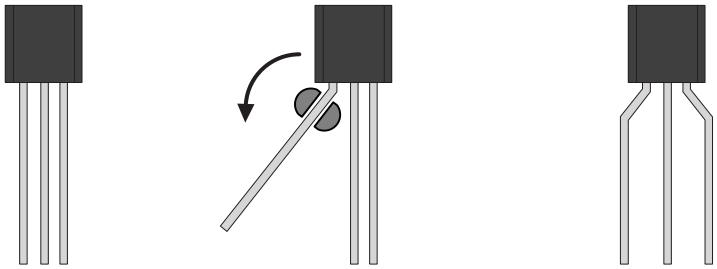
These trimmers will be used for the calibration process on pages 25 and 26 and should not be adjusted once this is completed. For now, set all three of them them to the 50% position (12:00 noon).

TRANSISTORS AND REGULATOR

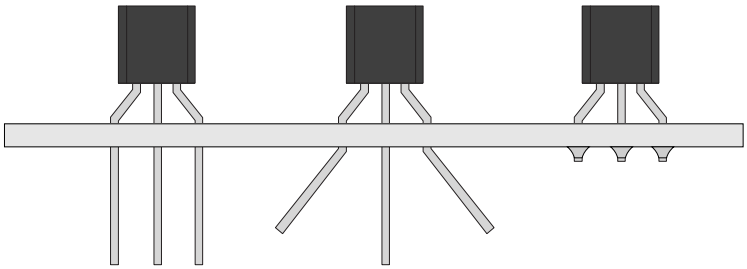
PART	VALUE
Q1	2N5088
Q2	2N5088
Q3	2N5087
RG1	78L05



Now we'll do the transistors as well as the regulator, which is not a transistor but looks like one. For each, if the legs are not already bent into 0.1" spacing, use your needle-nose pliers to bend the outer two legs as shown.



Once installed, bend the two outer legs to hold it in place on the board. Be very careful of the orientation since the four parts face in three different directions. Then, solder them in place and clip the leads.



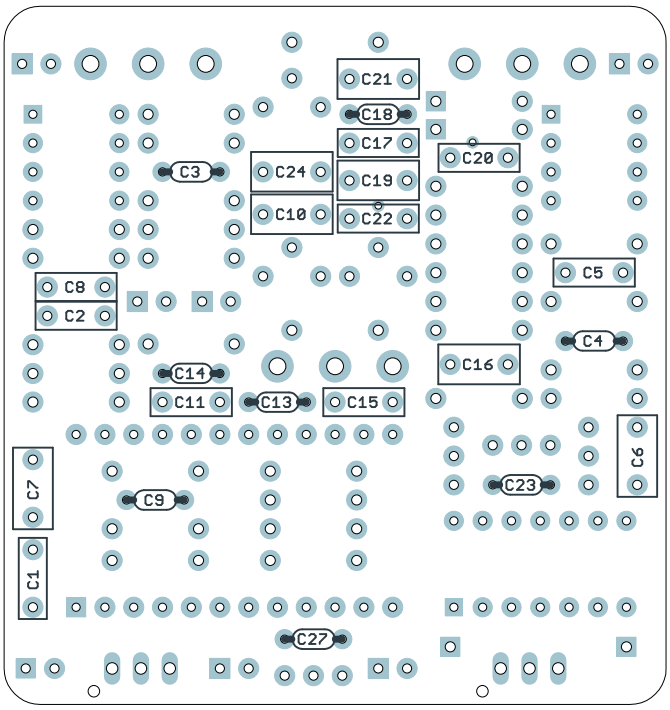
CAPACITORS (NON-POLARIZED)

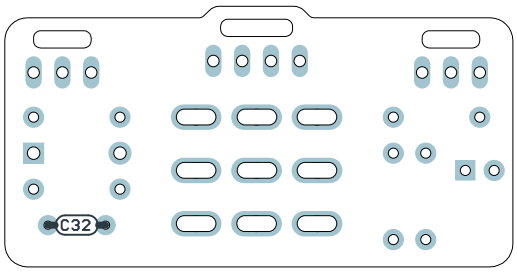
PART	VALUE
C1	47n (0.047)
C2	4n7
C3	47pF MLCC
C4	47pF MLCC
C5	4n7
C6	1uF
C7	1uF

PART	VALUE
C8	3n3
C9	470pF MLCC
C10	1uF
C11	100n (0.1)
C13	100n MLCC
C14	100n MLCC
C15	100n (0.1)

PART	VALUE
C16	1uF
C17	3n3
C18	680pF MLCC
C19	1uF
C20	68n (0.068)
C21	1uF
C22	100n (0.1)

PART	VALUE
C23	5pF MLCC
C24	1uF
C27	100n MLCC
C32	100n MLCC





Be aware that IC3 will be installed above C9, so make sure the capacitor leads are inserted all the way and that it sits as close to the PCB as possible.

After the sockets come the box film and MLCC capacitors. These are all several different heights, but there aren't as many, so just do them all at once. Bend the leads at an angle to hold them in place.

MLCCs and box capacitors are not polarized, so they will work in any direction, but to keep things neat, it's best to put them all facing the same way.

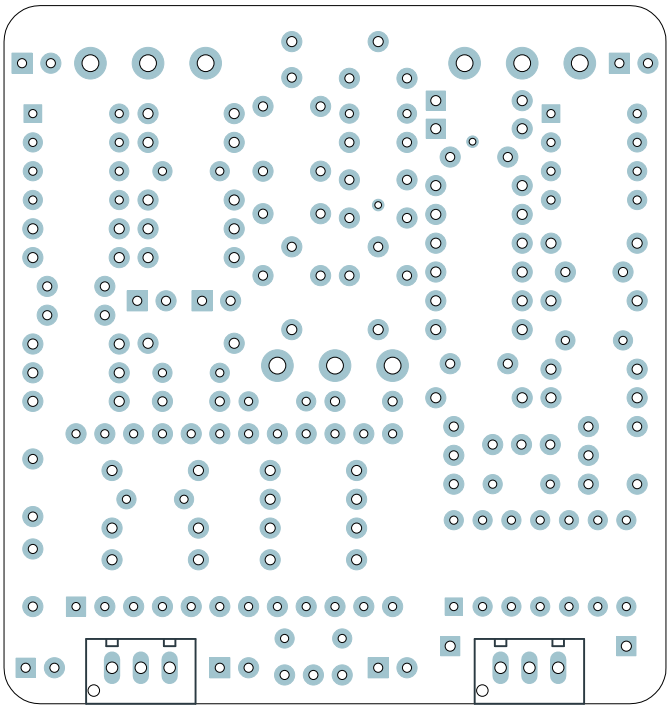
Identification: C2, C5, C8, and C17 are usually blue box-film capacitors. For these, the value is printed on the top rather than the side.

C11, C15 and C22 are usually red, but may read "µ1J100" on the top rather than the side.

C3, C4, C9, C18, and C23 are blue MLCCs taped to cardboard. The value is written on the cardboard.

C13, C14, C27 and C32 (100n MLCCs) are always yellow. It can be hard to read the code since it's so small, so it's easier to identify these by color.

WIRE HEADERS

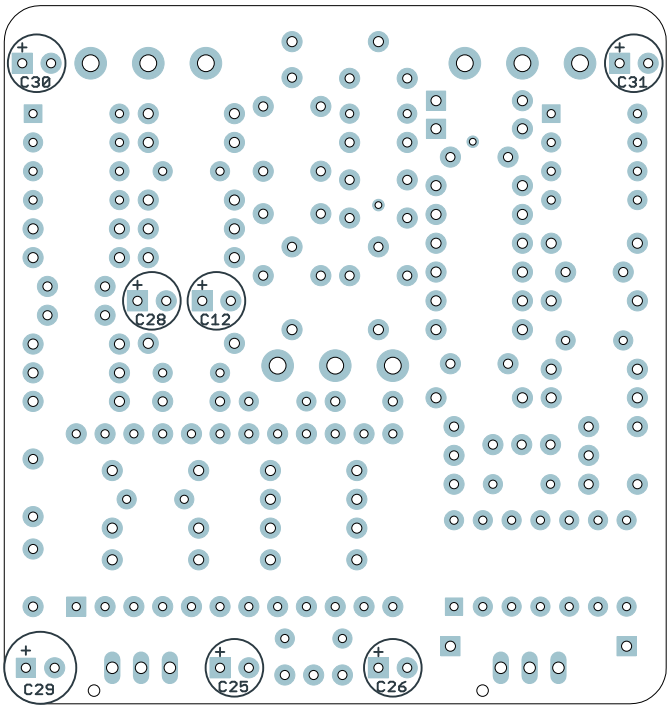


Install the two 3-pin headers (wire connectors) as shown above. These have a polarity pin, so as long as they are pressed all the way down, there's only one possible way to install them. They do fit pretty tightly in the holes, though, so press firmly.

There's also a 4-pin header on the I/O board that we will do in a later step.

CAPACITORS (POLARIZED)

PART	VALUE
C12	47uF electro
C25	47uF electro
C26	47uF electro
C28	47uF electro
C29	100uF electro
C30	10uF electro
C31	10uF electro

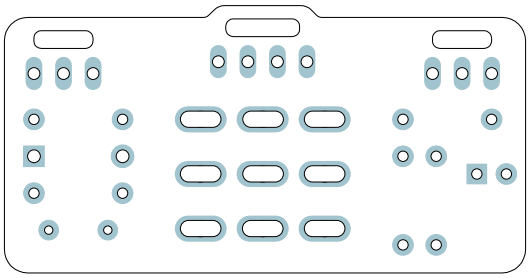


Populate the electrolytic capacitors. These are the tallest components, so we save them for last. They are polarized (i.e. they will only work in one direction), so note the vertical mark that indicates the negative side. The longer leg is positive and fits in the square pad.

These are the last of the on-board components. Now is the time to go back to page 12 and insert the ICs into the sockets.

FOOTSWITCH PCB

PARTS
3-strand wire assembly (2)
4-strand wire assembly



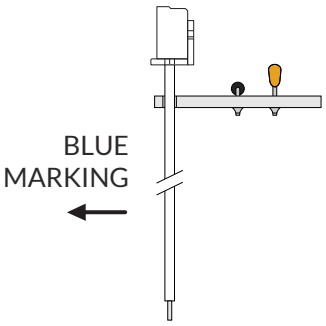
Next, it's time to finish up the footswitch board. You should have done most of the on-board components on this board in a previous step, but if not, go back and do those.

There will be one longer assembly with 4 wires and two shorter ones with 3 wires. The longer one goes in the middle and the shorter ones go on the left and right sides. The wire assemblies should then be soldered to the footswitch board as shown.

STEP 1

First, thread the wire through the strain-relief slots, with the blue side facing outward and the PCB's previously-installed components facing up.

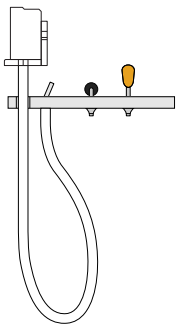
For now, pull it through as far as it can go.



STEP 2

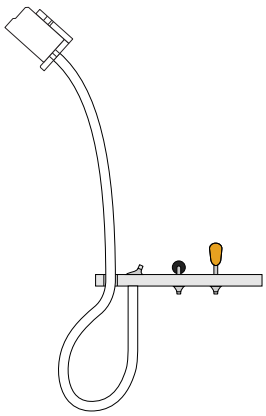
Next, bend the wires back upward and fit the ends of the wires into the solder pads.

On the top side of the PCB, bend the exposed wires backward so it holds the wire in place. Pull the header back up through the slot partway.



STEP 3

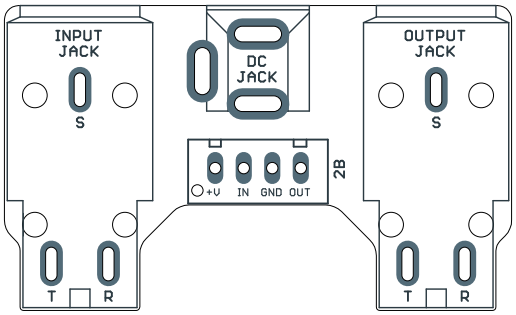
Then, solder the wires from the top. This is the trickiest part of the whole build. You want to solder the pads without touching the iron to the wires themselves and risking burning through the insulation. It helps to use a sharp or narrow tip on the soldering iron.



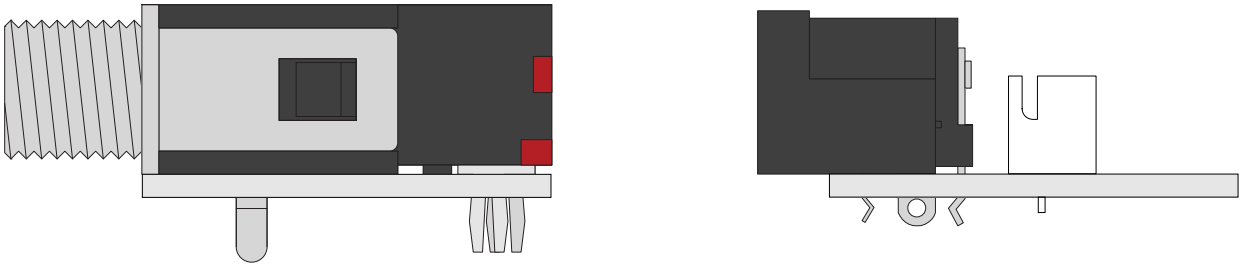
Once all three wire assemblies are soldered, set the footswitch PCB aside. We'll solder the actual footswitch and LED in a later step.

INPUT/OUTPUT PCB

PARTS
Input & output jacks
DC jack
Wire header



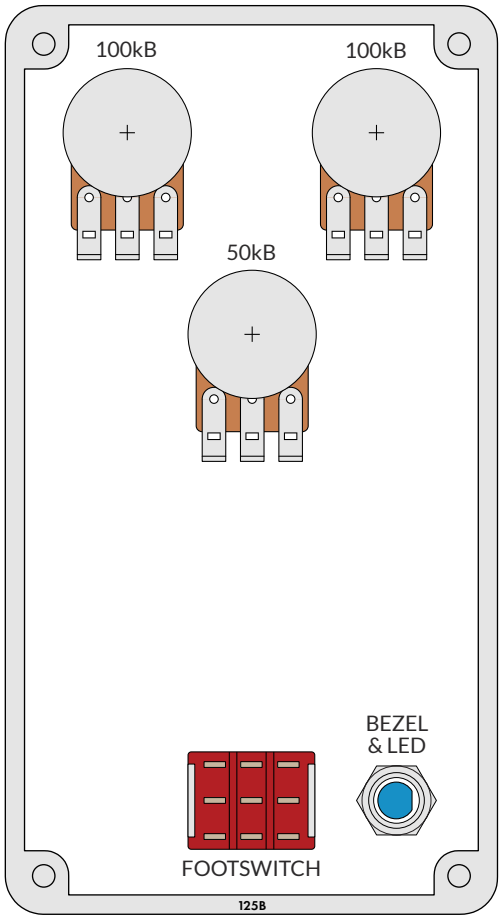
Almost done! Get the two input/output jacks, the DC jack and the wire header and snap them in place. The PCB is designed for them to fit securely, so you can do them all at once before flipping and soldering.



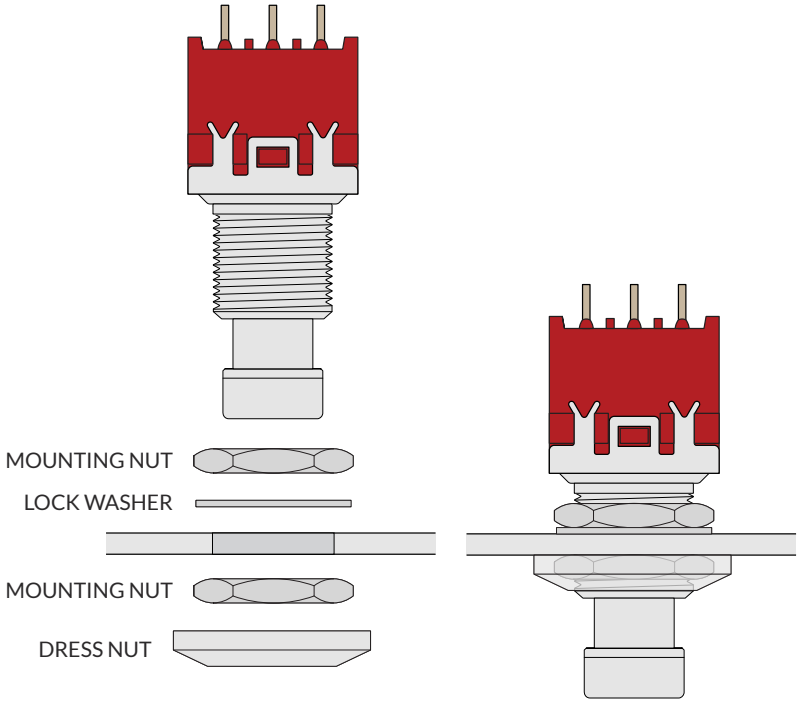
After you've soldered everything, make sure to **snip the leads on the I/O jacks as close as possible to the PCB**. There's not a lot of clearance between the bottom of this board and the top of the main PCB once everything is in place, and you don't want the pins to short against anything on accident.

ENCLOSURE LAYOUT: PANEL MOUNTS

Attach the hardware to the enclosure as shown. (The I/O board is done in a later step.)



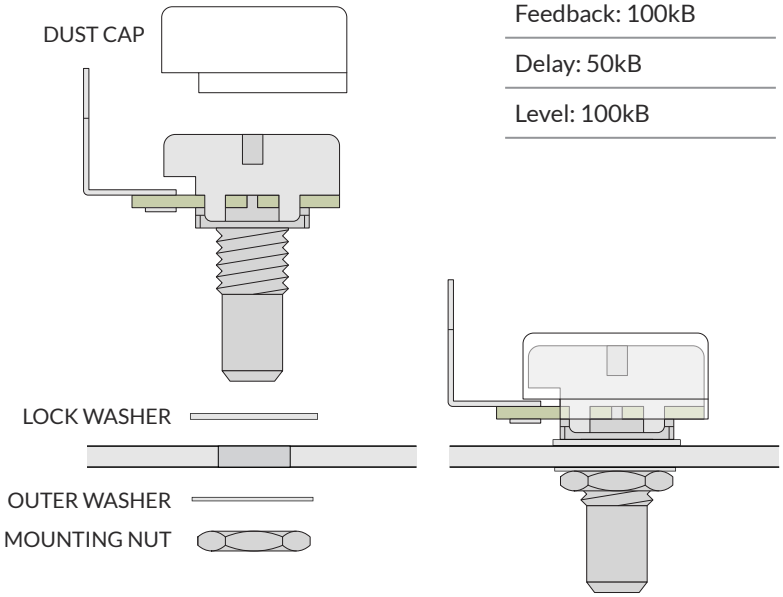
FOOTSWITCH



The dress nut fits over the top of the mounting nut and is for aesthetic purposes only. Wrap a rubber band around it to use as a grip when tightening. Avoid using metal tools on it or you run the risk of scratching or denting it.

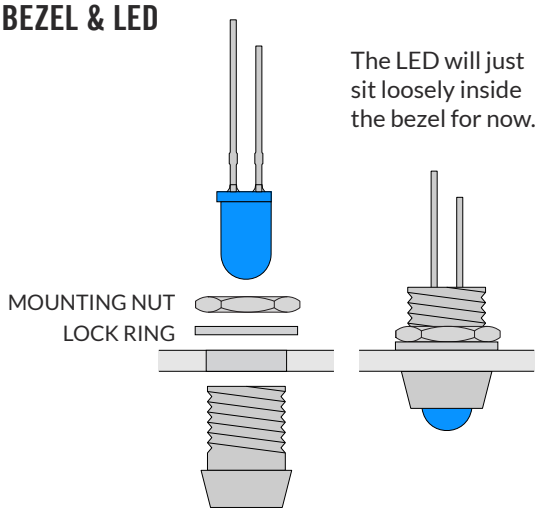
POTENTIOMETERS

Feedback: 100kB
Delay: 50kB
Level: 100kB



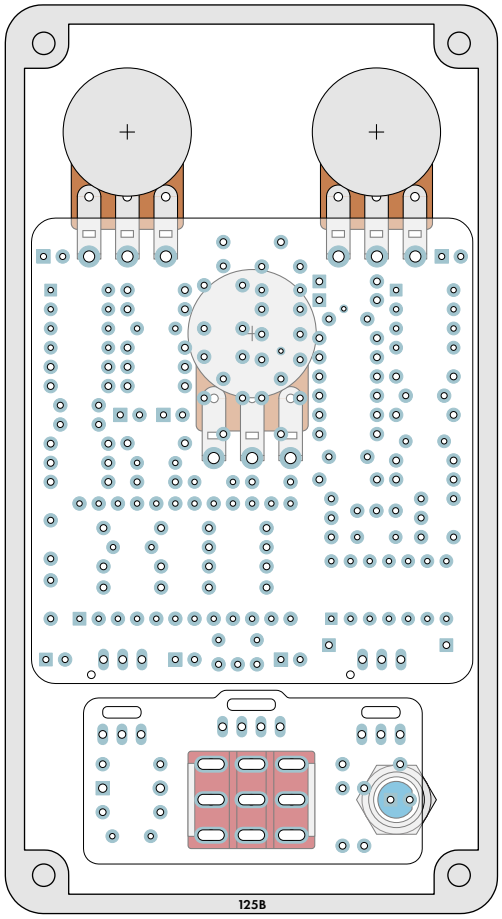
BEZEL & LED

The LED will just sit loosely inside the bezel for now.



You'll need to hold the bezel in place when tightening the nut. Be aware that the bezel is fairly sharp. Try using a rubber band for grip instead of just pressing your finger against the bottom.

ENCLOSURE LAYOUT: MAIN & FOOTSWITCH PCBS



After all the components are affixed to the enclosure as shown on the previous page, place the main PCB on top of the potentiometers as in the diagram to the left.

You may need to adjust the position of the potentiometers slightly if they are not aligned straight.

Once all of the pins are through and the PCB is laying flat, solder each of the pins from the top, being careful not to touch any of the surrounding components with the soldering iron.

After you've finished soldering the pots, **clip the leads as close as you can to the main PCB**. This is important because the input/output PCB overlaps them and you need to avoid any of the components shorting.

Next, do the same thing with the footswitch board—the 3PDT footswitch and the LED.

Before soldering, double-check to **make sure the flat side of the LED is facing to the right**, as shown in the diagram, and that the short leg is coming through the pad on the right. It won't work if it's turned the other way.

Why solder everything inside the enclosure before testing it?

"Rock it before you box it" is conventional wisdom in pedalbuilding, and you'll often hear it recommended that builders should test the circuit before putting everything inside the enclosure.

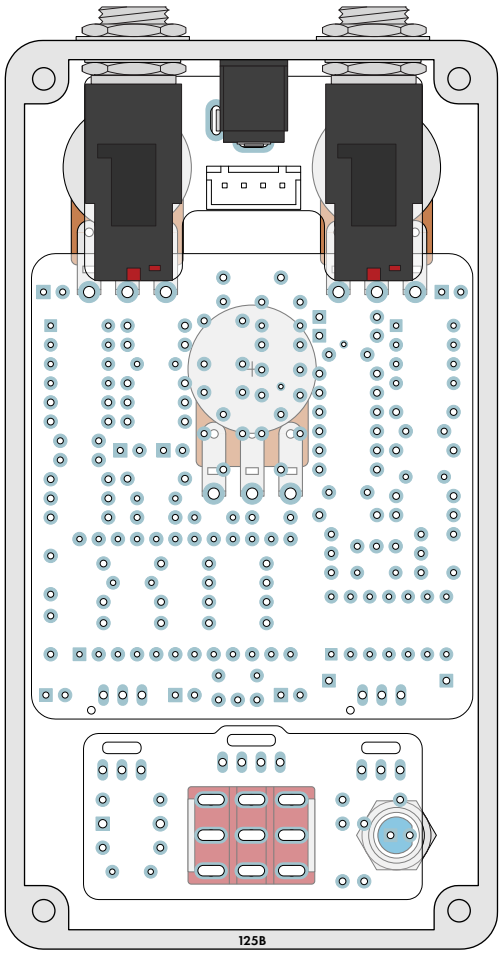
However, Aion FX projects are designed to be extremely easy to remove from the enclosure for troubleshooting, with no desoldering required—so with these kits, it's actually much easier to "box it before you rock it".

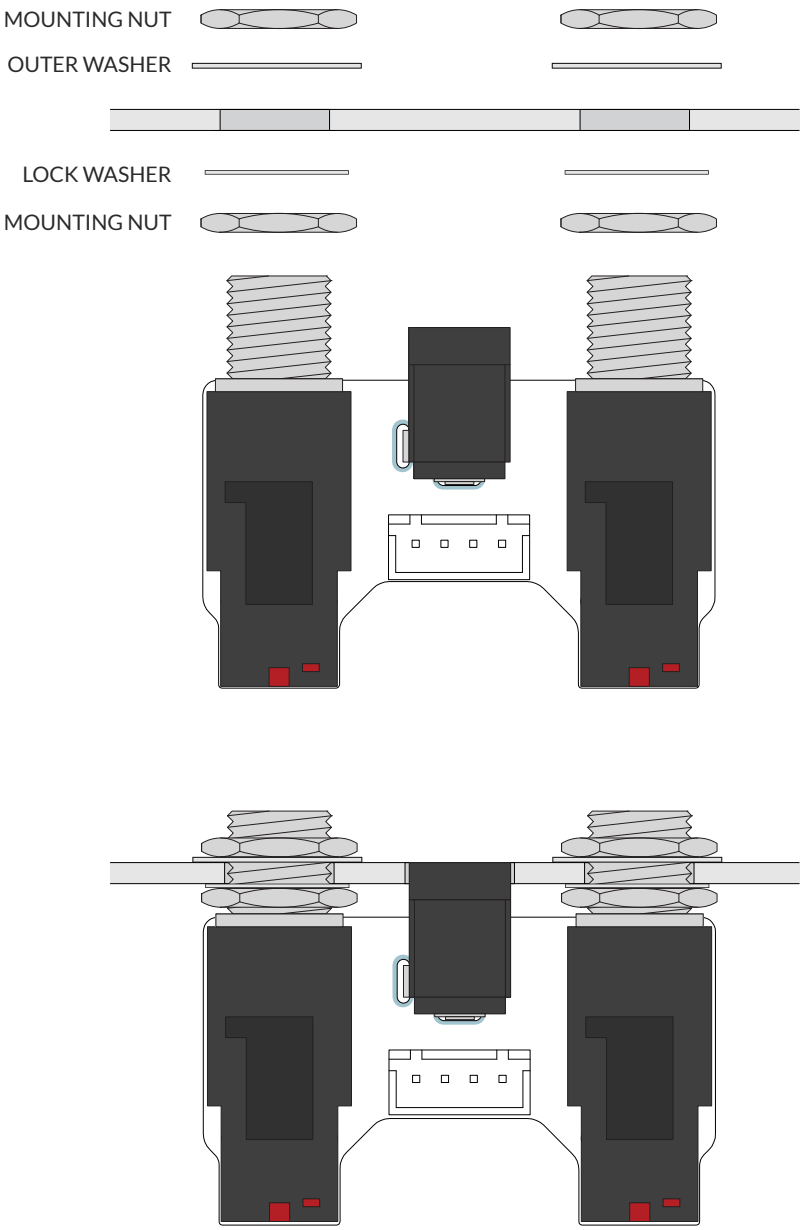
If you've read the documentation carefully and followed all the instructions, there's a good chance you will get it right the first time.

ENCLOSURE LAYOUT: INPUT/OUTPUT PCB

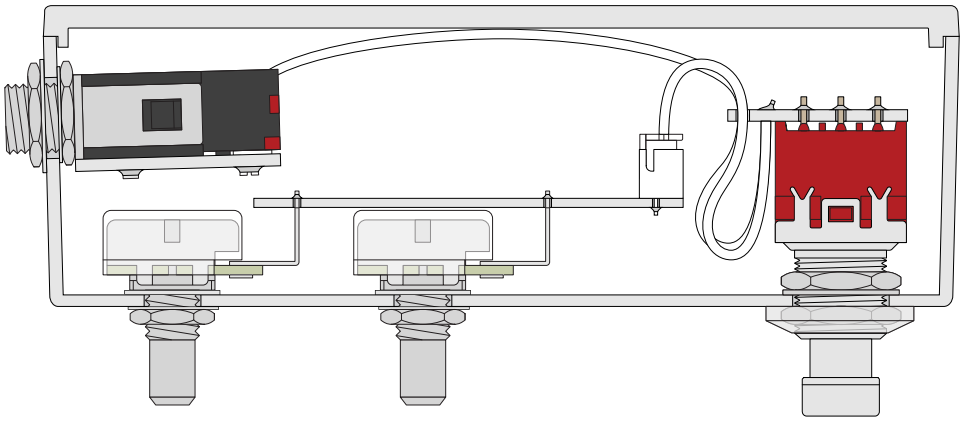
Affix the input/output PCB to the north-facing panel of the enclosure as shown.

Note the use of two mounting nuts on each of the jacks, one inside and one outside. The inner nut acts as a spacer to set the DC jack flush with the outside of the enclosure. The inner nuts should be threaded as far down as they can go.





After everything is in place, just plug the 3 wire assemblies into their respective headers and make sure they're secure. Here is a cross-section of the inside of the completed pedal.



At this point, you have completed the full circuit as far as the electrons are concerned. Plug in a 9-volt supply and test it out with a guitar and an amplifier.

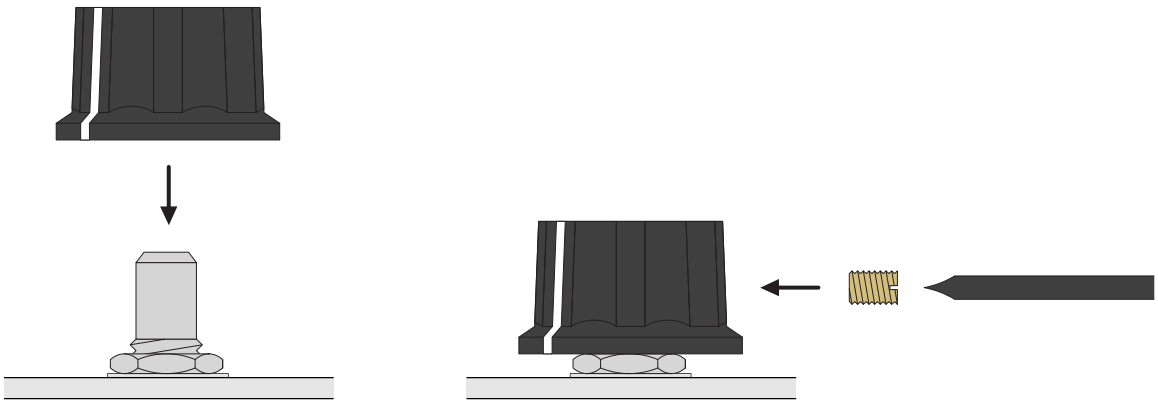
Test the bypass switch a few times, then start turning the knobs and see if everything sounds OK. Note that it has not been calibrated yet, so we're only testing to make sure it passes signal (both dry and delayed) so we can proceed to the next step. We'll evaluate the sound as part of the calibration process.

Installing the knobs

Even though we're not finished, it's helpful to have the knobs installed for the calibration process. Turn the potentiometer shafts all fully counter-clockwise, then put on the knob and rotate until the indicator line is aligned with the dot on the enclosure that shows the zero point. Affix the knobs to each of the potentiometer shafts as shown in the diagram below.

Using a small flat-head screwdriver (no more than 0.1" / 2.5mm in diameter), firmly tighten the set screw until it presses against the shaft of the potentiometer and holds the knob in place.

Be careful not to over-tighten or you may damage the set screw. But if it's not tight enough, the knob will be more likely to fall off or lose its alignment with the markings on the enclosure.



CALIBRATION

Once we've verified that it passes signal, we're ready to calibrate. First we'll start with the delay range.

Calibrating the delay range

TR2 and TR3 allow the low and high end of the delay range to be tuned for optimal performance. This is best done with test equipment that can measure frequency (e.g. an oscilloscope, frequency counter, or some multimeters), but it can be done by ear as well and the results are not noticeably different.

For either method, start with both trimmers at the 50% (noon) position. Set Level at full up and Feedback at 50%.

Calibrating by ear

Set the Delay knob to minimum (shortest delay time, or fastest repeats). Adjust the trimmer labeled TR2 to preference. You can set it for a quick 30-50ms slapback delay, or go even shorter and get pseudo-reverb sounds with the Feedback knob turned up.

Next, set Delay to maximum (longest delay time, or slowest repeats). Adjust trimmer TR3 to preference. The target is around 800-1000ms of delay time. At some point glitches or artifacts will start to appear in the repeats, so if you hear those then back off slightly until they go away—although if you like the sound of these artifacts, they won't cause any harm.

The two trimmers are somewhat interactive, so after adjusting TR3, turn the delay all the way down again and see if TR2 needs to be adjusted. If you do adjust TR2 a second time, then go back and do TR3 a second time as well.

Typically, the 50% setting is pretty near the optimal range for both trimmers, so don't be surprised if it sounds pretty good before you adjust anything.

Calibrating by frequency measurement

Directly below IC4, there are two test pads marked "+" and "-". It's recommended to solder wires to these pads so you can easily clip probes or test leads to them. Short resistor leads will work fine.

Set Delay to minimum (shortest delay time, or fastest repeats). Adjust TR2 until the frequency on the + test point reads 4MHz. This is the factory setting for the original EM5, but it's reported that the chip works well up to 8MHz if you want a faster delay available, approaching reverb territory.

Next, set Delay to maximum (longest delay time, or slowest repeats). Adjust TR3 until the frequency reads 650kHz. Again, this is the factory setting for the original EM5, but you can go down to 450-500kHz for even longer repeats. If you hear artifacts or noise in the delay signal, turn the frequency up slightly until they go away.

Note that the frequency will likely drop slightly after the unit has been powered on for a few minutes. When we measured an original EM5, it measured 650kHz to 4 MHz across the delay range, but dropped to 625kHz and 3.8 MHz when we took a second set of measurements a bit later.

These are both well within normal operating range, so this behavior won't normally make a difference. But if you've just barely trimmed out the artifacts and you notice they reappear once the unit warms up, then just trim them out again and they should stay out this time.

CALIBRATION, CONT.

Setting the feedback (repeats) range

The maximum range of the feedback control is set by the TR1 trimmer. Begin by setting it to the 50% (noon) position, and set the Feedback knob to maximum.

On the original EM5, the repeats knob was set to maximize feedback without reaching self-oscillation or infinite repeats. So to match this, turn TR1 while listening for the point of self-oscillation, and then turn the trimmer down slightly once you get there.

Some people like infinite repeats in a delay, so if you want this sound available at the upper end of the range, feel free to set the trimmer a little higher. It won't cause any problems.

FINAL ASSEMBLY

If everything calibrated OK, you're all done! Affix the back panel with the four screws provided and make some music.

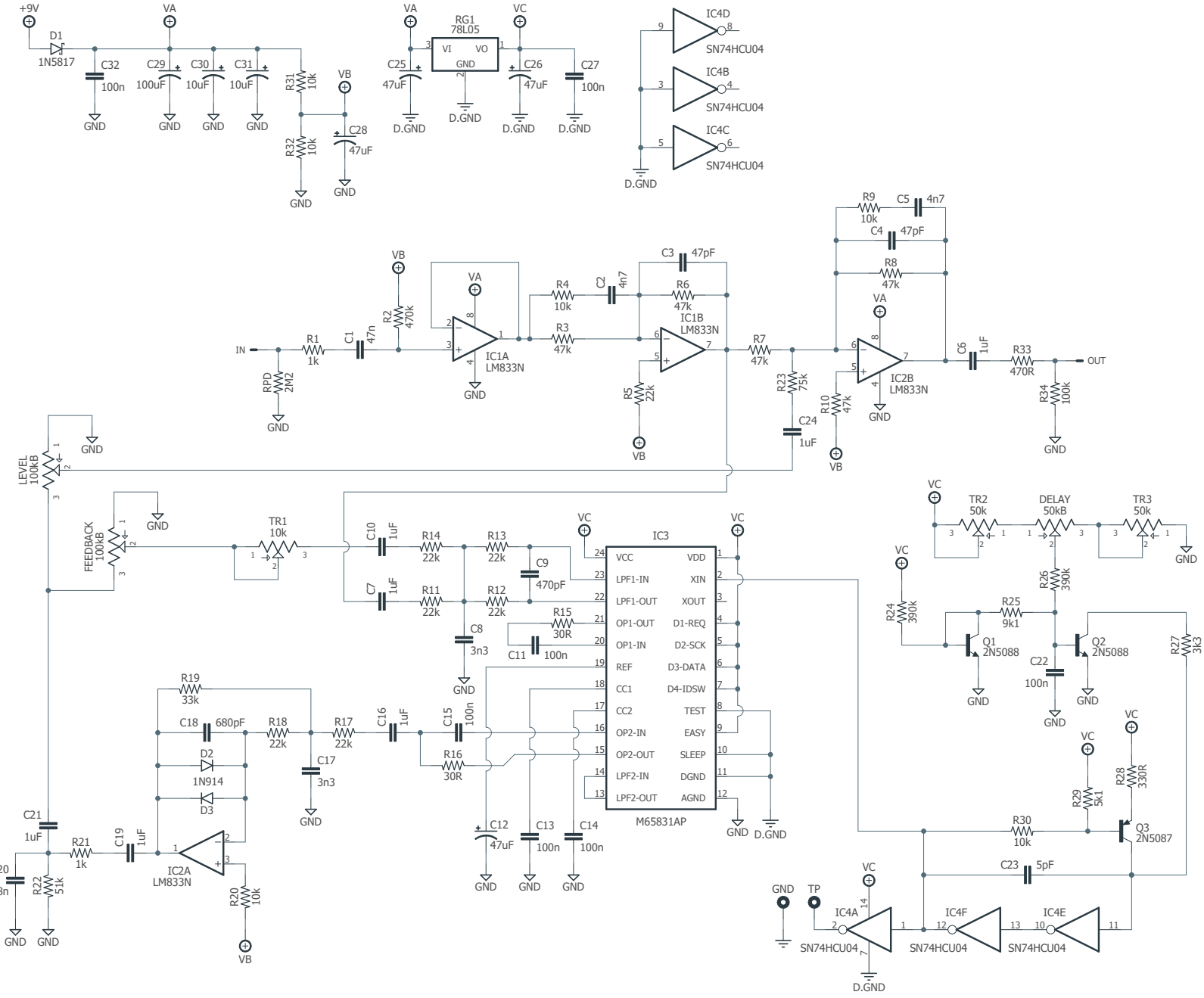
If doesn't work, or doesn't sound quite right after calibration didn't work, don't be discouraged. See page 29 for troubleshooting info.

USAGE

The Elysium has three controls:

- **Delay** (called "Speed" on the EM5) sets the delay time, going from short to long as you turn it up.
- **Feedback** (called "Repeat" on the EM5) sets the number of repeats. Due to the heavy filtering in the delay path, each repeat has degraded sound quality, especially the treble content, resulting in an ambient wash that doesn't conflict with the dry signal. Depending on how the unit is calibrated, the upper end of the Feedback range can get into self-oscillation or infinite repeats.
- **Level** sets the volume level of the delay signal. The dry signal is unaffected and always unity gain.

SCHEMATIC


+9V
D1
1N5817
C32
100n
VA
C29
100uF
C30
10uF
C31
10uF
R31
10k
R32
10k
VB
C28
47uF
GND
VA
RG1
78L05
VI
VO
GND
VC
C25
47uF
C26
47uF
C27
100n
D.GND
IC4D
IC4B
IC4C
SN74HCU04
IN
R1
1k
C1
47n
R2
470k
IC1A
LM833N
RPD
2M2
R4
10k
C2
4n7
C3
47pF
R6
47k
IC1B
LM833N
R3
47k
R5
22k
R7
47k
R9
10k
C5
4n7
C4
47pF
R8
47k
IC2B
LM833N
R23
75k
C24
1uF
R10
47k
C6
1uF
R33
470R
R34
100k
OUT
LEVEL
100kB
FEEDBACK
100kB
TR1
10k
C10
1uF
C7
1uF
R14
22k
R11
22k
R13
22k
R12
22k
C9
470pF
C8
3n3
R15
30R
C11
100n
IC3
VCC
LPF1-IN
LPF1-OUT
OP1-OUT
OP1-IN
REF
CC1
CC2
OP2-IN
OP2-OUT
LPF2-IN
LPF2-OUT
VDD
XIN
XOUT
D1-REQ
D2-SCK
D3-DATA
D4-IDSW
TEST
EASY
SLEEP
DGND
AGND
M65831AP
R16
30R
C12
47uF
C13
100n
C14
100n
TR2
50k
DELAY
50kB
TR3
50k
R24
390k
R26
390k
R25
9k1
Q1
2N5088
Q2
2N5088
C22
100n
R27
3k3
R19
33k
C18
680pF
D2
1N914
D3
R18
22k
R17
22k
C16
1uF
C15
100n
C17
3n3
C21
1uF
R21
1k
C19
1uF
C20
68n
R22
51k
IC2A
LM833N
R20
10k
R28
330R
R29
5k1
Q3
2N5087
R30
10k
C23
5pF
TP
IC4A
IC4F
IC4E
SN74HCU04

FULL PARTS LIST

Resistors

PART	VALUE
R1	1k
R2	470k
R3	47k
R4	10k
R5	22k
R6	47k
R7	47k
R8	47k
R9	10k

PART	VALUE
R10	47k
R11	22k
R12	22k
R13	22k
R14	22k
R15	30R
R16	30R
R17	22k
R18	22k

PART	VALUE
R19	33k
R20	10k
R21	1k
R22	51k
R23	75k
R24	390k
R25	9k1
R26	390k
R27	3k3

PART	VALUE
R28	330R
R29	5k1
R30	10k
R31	10k
R32	10k
R33	470R
R34	100k
RPD	2M2
LEDR	10k

Capacitors

PART	VALUE
C1	47n film
C2	4n7 film
C3	47pF MLCC
C4	47pF MLCC
C5	4n7 film
C6	1uF film
C7	1uF film
C8	3n3 film
C9	470pF MLCC
C10	1uF film
C11	100n film

PART	VALUE
C12	47uF electro
C13	100n MLCC
C14	100n MLCC
C15	100n film
C16	1uF film
C17	3n3 film
C18	680pF MLCC
C19	1uF film
C20	68n film
C21	1uF film
C22	100n film

PART	VALUE
C23	5pF MLCC
C24	1uF film
C25	47uF electro
C26	47uF electro
C27	100n MLCC
C28	47uF electro
C29	100uF electro
C30	10uF electro
C31	10uF electro
C32	100n MLCC

ICs

PART	VALUE
IC1	LM833
IC2	LM833
IC3	M65831AP
IC4	SN74HCU04

Sockets

PART	VALUE
IC1-S	DIP-8 socket
IC2-S	DIP-8 socket
IC3-S	DIP-24 socket
IC4-S	DIP-14 socket

Diodes

PART	VALUE
D1	1N5817
D2	1N914
D3	1N914

Transistors

PART	VALUE
Q1	2N5088
Q2	2N5088
Q3	2N5087
RG1	78L05

Potentiometers

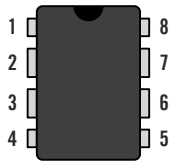
PART	VALUE
Feedback	100kB
Delay	50kB
Level	100kB

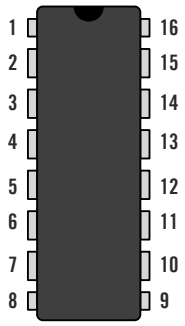
Trimmers

PART	VALUE
TR1	10k trimmer
TR2	50k trimmer
TR3	50k trimmer

TROUBLESHOOTING INFORMATION

If you finish building the kit and find that it doesn't work right, we've written a separate in-depth Troubleshooting Guide that applies to all of our kits. The main troubleshooting process is covered there. Here you will find information specific to this kit that will help with that process.





Voltages

The following voltages are taken from our prototype unit using a **9.60V** supply. Your measured voltages won't be exactly the same due to variance in power supplies and component tolerances.

Note that IC pins are labeled counter-clockwise from the upper-left, as shown in the diagrams to the right. Voltages taken with Delay control at maximum.

IC1

PIN	VOLTAGE
1	4.79
2	4.79
3	4.58
4	0
5	4.65
6	4.66
7	4.52
8	9.31

IC2

PIN	VOLTAGE
1	4.64
2	4.66
3	4.65
4	0
5	4.64
6	4.67
7	4.80
8	9.31

IC4

PIN	VOLTAGE
1	4.88
2	0.14
3	0
4	5.05
5	0
6	5.05
7	0

PIN	VOLTAGE
8	5.04
9	0
10	0.47
11	2.73
12	4.88
13	0.48
14	5.05

IC3

PIN	VOLTAGE
1	5.05
2	4.88
3	0.10
4	5.05
5	5.05
6	5.05
7	5.05
8	0
9	5.05
10	0
11	0
12	0

PIN	VOLTAGE
13	2.53
14	2.53
15	2.53
16	2.53
17	0.86
18	0.81
19	2.53
20	2.54
21	2.53
22	2.53
23	2.53
24	5.05

RG1

PIN	VOLTAGE
1	9.31
2	0
3	5.05

Q1

PIN	VOLTAGE
E	0
B	0.50
C	0.50

Q2

PIN	VOLTAGE
E	0
B	0.50
C	2.67

Q3

PIN	VOLTAGE
E	5.04
B	4.89
C	2.73

SUPPORT

Aion FX does not offer direct support for these projects beyond the provided documentation. Replacements and refunds cannot be offered unless it can be shown that the circuit or documentation are in error or that the included components are non-functional.

Where to get help

The three best places to ask for help are the DIY Stompboxes forum, the DIY Stompboxes Facebook group, and the r/diypedals subreddit. These communities have more than 150,000 members between them and they are very accommodating to new builders.

When posting a troubleshooting request, always include the following:

1. A thorough description of the problem you are experiencing
2. A photo of the inside of the pedal
3. A list of all the measured voltages of each of the pins, described on the previous page

While we cannot offer direct, private support, you may send a link to your public troubleshooting thread to Aion FX using the contact form on the website. There is no guarantee that we will be able to join the discussion and help solve your problem, but this improves the chances.

It benefits the whole community if the troubleshooting process is public because then people who have the same issue in the future may come across it when searching. And if you do get help, remember to pay it forward! The best way to learn new skills is to help others. Even if you've only built one pedal, you have more experience than someone who is brand new, so you have something to offer.

RESALE TERMS

These kits may be used for commercial endeavors in any quantity unless otherwise noted. It's okay to sell individual builds locally or online, or even to offer a service to build pedals based on these kits.

No direct attribution is necessary, though a link back is always greatly appreciated. The only usage restriction is that you cannot "goop" the PCB or otherwise obscure the source. In other words: you don't have to go out of your way to advertise the fact that you use Aion FX kits, but please don't go out of your way to hide it. The guitar effects industry needs more transparency, not less!

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DOCUMENT REVISIONS

1.0.1 (2024-08-08)
Added link to troubleshooting guide on page 29.

1.0.0 (2024-01-26)
Initial release.