PROJECT NAME
CEPHEUS

AION
DIY GUITAR EFFECTS

BASED ON
Cornish CC-1

BUILD DIFFICULTY
▮▮▮▯▯ Intermediate

EFFECT TYPE
Overdrive

DOCUMENT VERSION
1.0.0 (2025-08-30)

PROJECT SUMMARY
An original design by the legendary Pete Cornish featuring two soft-clipping stages followed by a 3-band EQ for a natural and tweakable crunchy overdriven tone.

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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
1n	1
1n2	1
4n7	2
10n	3
22n	1
100n	1
220n	1
470n	1
1uF	2

Electrolytic Capacitors

NAME	QTY
4.7uF	1
22uF	4
220uF	3

MLCC Capacitors

NAME	QTY
470pF (marked "471")	2
100n (marked "104")	1

Transistors

NAME	QTY
BC549C	1

Resistors

NAME	QTY
51R	3
91R	1
100R	3
1k	1
1k2	1
1k8	2
3k3	2
7k5	1
10k	7
11k	3
22k	3
51k	4
100k	1
120k	2
200k	1
1M	2
10M	2

Diodes

NAME	QTY
1N5817	1
1N914	4

ICs

NAME	QTY
TL071	1
TL072	1
8-pin socket	2

Other

NAME	QTY
LED bezel	1
LED, white	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

Potentiometers

NAME	QTY
10kA	1
50kC	1
100kB	3
Dust cover	5
Knob	5
Mounting nut, potentiometer, 0.44"	5
Lock washer, potentiometer, 0.5"	5
Outer washer, potentiometer, 0.475"	5

Switches

NAME	QTY
Slide switch, 4PDT	1
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.
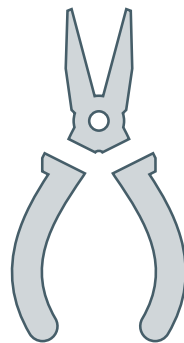
DIGITAL MULTIMETER (DMM)

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.
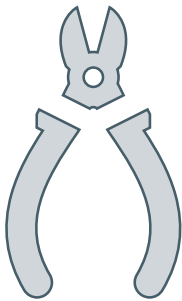
WIRE SNIPPERS

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.
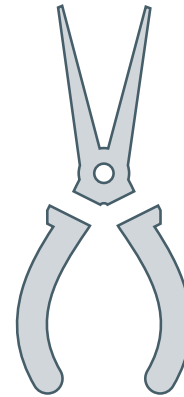
NEEDLE-NOSE PLIERS

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.
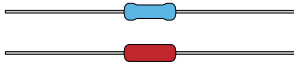
RUBBER BAND

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).
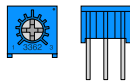
COMPONENT IDENTIFICATION

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.)
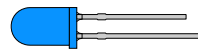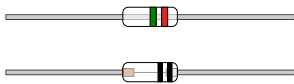
RESISTOR

TRIM POTENTIOMETER

LED

SILICON DIODE

GERMANIUM DIODE

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

RECTIFIER DIODE

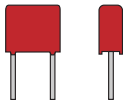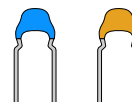*Some Schottky diodes also look like this.*

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."
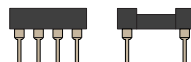
TANTALUM CAPACITOR

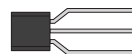*Polarized. The positive side is marked.*

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

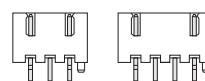*Some voltage regulators also look like this.*

TRANSISTOR WITH ADAPTER

The pins will be soldered to the adapter during kit assembly.

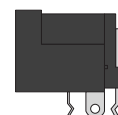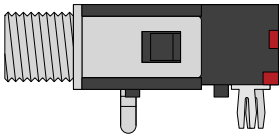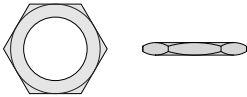### WIRE ASSEMBLY
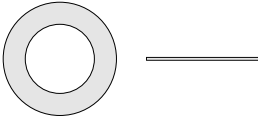
WIRE ASSEMBLY HEADER

DC JACK

LED BEZEL
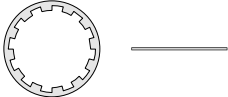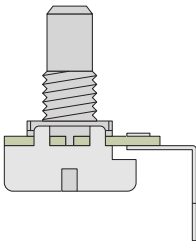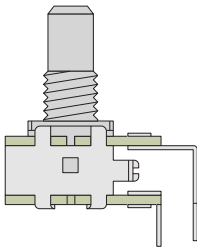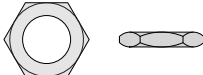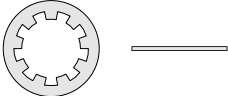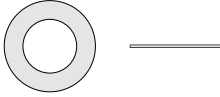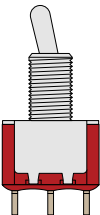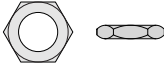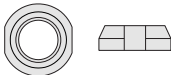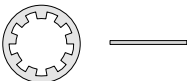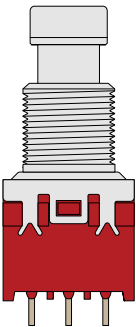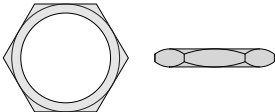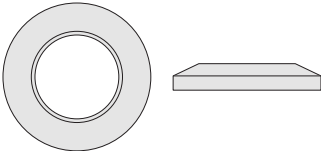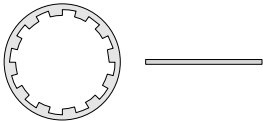
HARDWARE IDENTIFICATION

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	OUTER WASHER	LOCK WASHER
	DIAMETER: 0.54" / 13.7mm	DIAMETER: 0.6" / 15.2mm	DIAMETER: 0.5" / 12.7mm

POTENTIOMETER (SINGLE)	POTENTIOMETER (DUAL)	MOUNTING NUT	LOCK WASHER
		DIAMETER: 0.44" / 11.2mm	DIAMETER: 0.5" / 12.7mm
		OUTER WASHER	KNOB
		DIAMETER: 0.475" / 12mm	

TOGGLE SWITCH	MOUNTING NUT	DRESS NUT	LOCK WASHER
	DIAMETER: 0.36" / 9.1mm	DIAMETER: 0.375" / 9.5mm	DIAMETER: 0.4" / 10.1mm

FOOTSWITCH	MOUNTING NUT	DRESS NUT	LOCK WASHER
	DIAMETER: 0.6" / 15.2mm	DIAMETER: 0.77" / 19.6mm	DIAMETER: 0.6" / 15.2mm

PCB ASSEMBLY OVERVIEW

Now it's time to start building!

The first thing you need to do is snap apart the PCBs into 3 separate boards (if needed) and break off the tabs from each using needle-nose or flat-head pliers. You should be left with the 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	PART	VALUE	PART	VALUE	PART	VALUE
R1	10M	R11	51k	R21	3k3	R31	51k
R2	1k	R12	22k	R22	11k	R32	100R
R3	120k	R13	1k2	R23	11k	R33	10k
R4	120k	R14	51k	R24	11k	R34	10k
R5	200k	R15	22k	R25	10k	R35	100R
R6	7k5	R16	100k	R26	1M	R36	100R
R7	10k	R17	51k	R27	51R	R37	10k
R8	51R	R18	1k8	R28	10k	R38	10k
R9	10M	R19	1k8	R29	51R	LEDR	22k
R10	1M	R20	3k3	R30	91R		

Note: R1 and R9 (10M) are brown carbon-film resistors. They do not have the value printed, but they can be identified by color since all the other resistors are red.

Additionally, make sure to correctly identify the following resistors, since the "R" and "K" can be easily mistaken:

- 51R / 51K
- 100R / 100K

If the resistor values are swapped, the effect likely will not work at all, so be careful!

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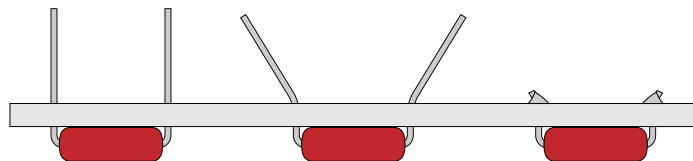
Don't try to do all of the resistors at once. You'll want to stop periodically flip the board and solder everything, then cut the leads using the wire snippers to make room for more.

DIODES

PART	VALUE
D1	1N5817
D2	1N914
D3	1N914

PART	VALUE
D4	1N914
D5	1N914
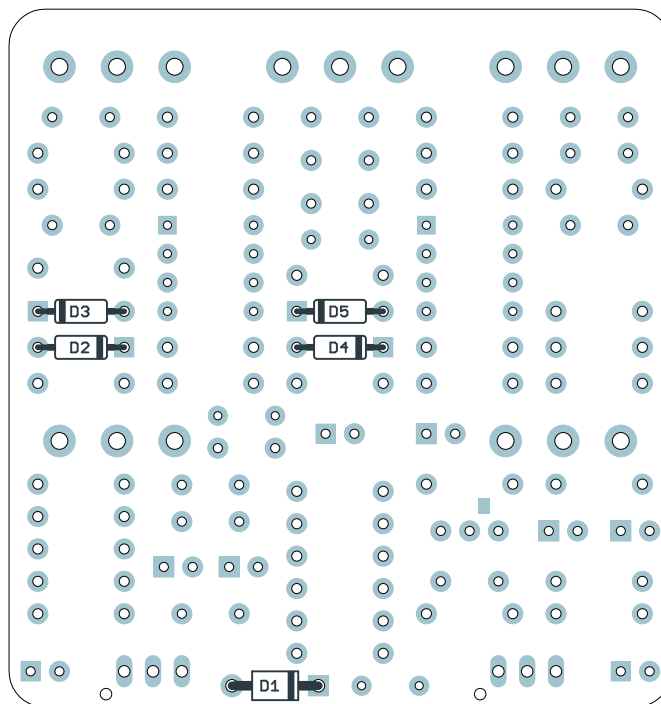
Next, you'll populate the diodes. Diodes are polarized, so make sure to identify the polarity band (which indicates the "cathode", or negative side) and match the band to the footprint on the PCB.

SOCKETS & ICS

PART	VALUE
IC1	TL072
IC2	TL071

Next up are the IC sockets. You can't bend the leads of the sockets like you can with the other components, so they won't stay in on their own until they are soldered.

Again, it's much easier to do this with gravity holding it in place for you, so you'll want install the socket before you do any of the taller components.

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). 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 four legs on the side are straightened out at once. Then, flip it and do the other side.
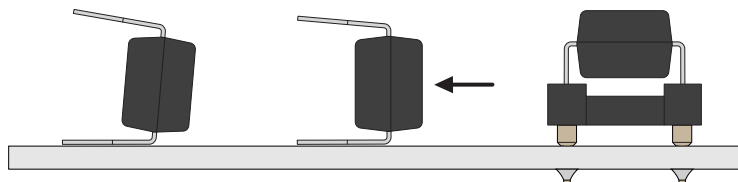
ICs may have two different orientation marks: either a dot in the upper-left or a half-circle notch in the middle of the top side. Some ICs have both marks. This shows which way the IC should be rotated when inserting it into a socket (the socket also has a half-circle notch).
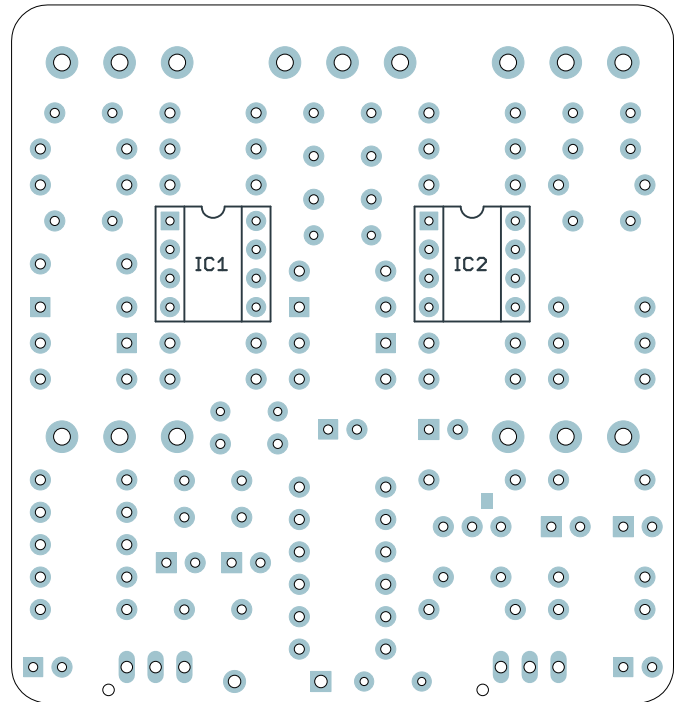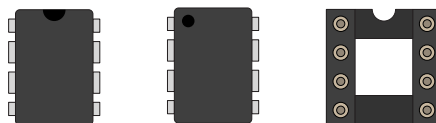
TRANSISTOR

PART	VALUE
Q1	BC549C
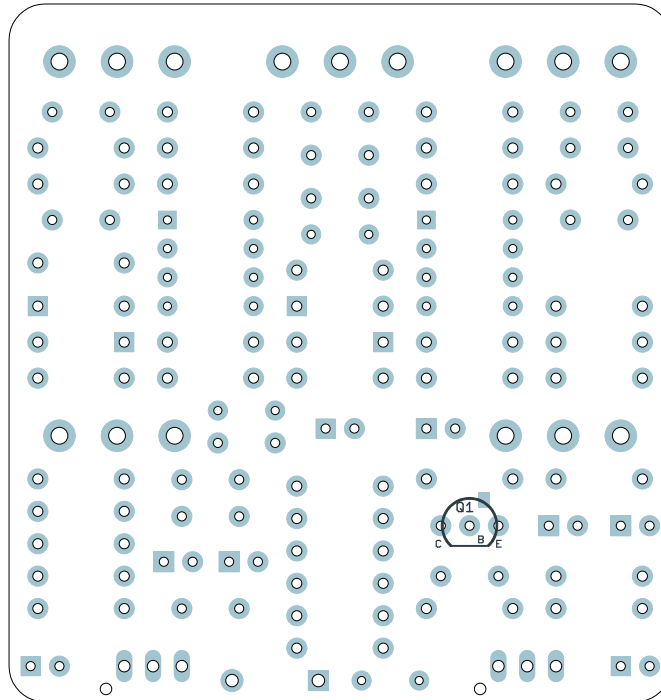
Now we'll do the transistor. If the legs are not already bent into 0.1" spacing, use your needle-nose pliers to bend the outer two legs as shown.
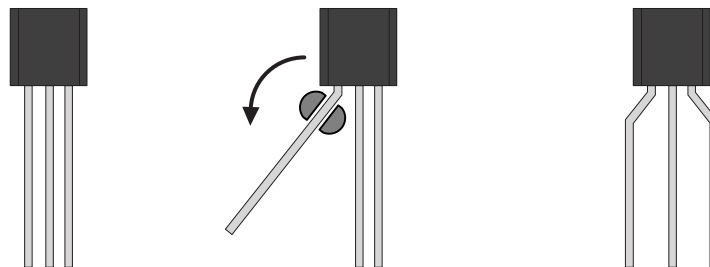
Once installed, bend the two outer legs to hold it in place on the board. Then, solder them in place and clip the leads.
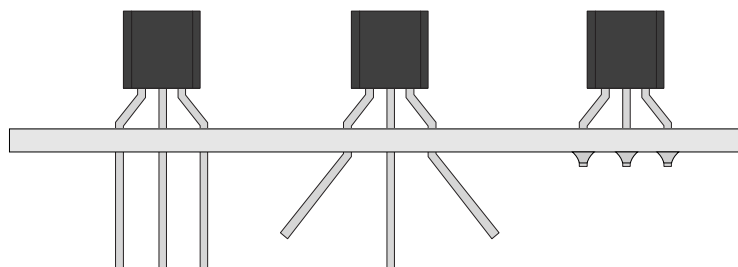
CAPACITORS (NON-POLARIZED)

PART	VALUE
C1	100n (0.1)
C3	1n
C5	10n (0.01)
C6	470pF MLCC

PART	VALUE
C7	470n (0.47)
C8	4n7
C9	220n (0.22)
C10	470pF MLCC

PART	VALUE
C11	1uF
C12	10n (0.01)
C13	4n7
C14	22n (0.022)

PART	VALUE
C15	10n (0.01)
C16	1uF
C17	1n2
C19	100n MLCC
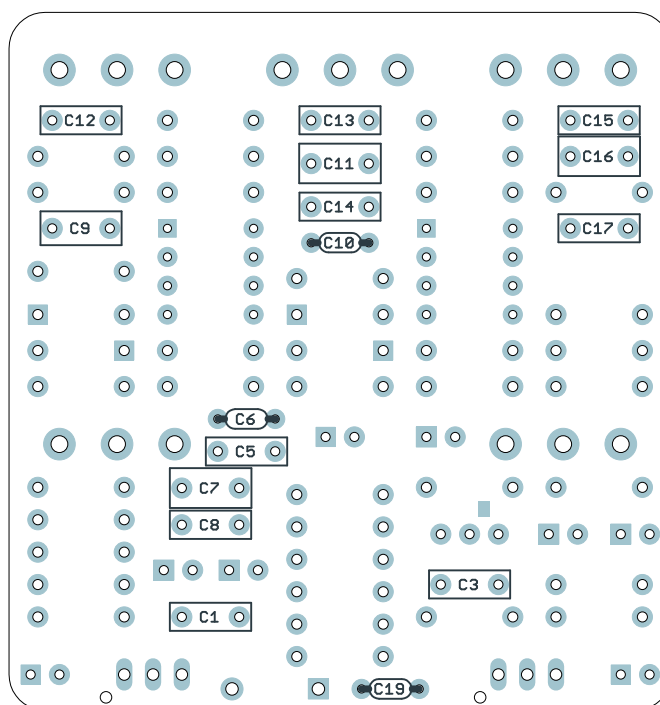
Next up are the box film and MLCC capacitors. These are all several different heights, so it's recommended to do them shortest to tallest. Bend the leads at an angle to hold them in place.

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.

Capacitor identification

Depending on the type, the box film capacitors may have their value printed on either the top or the side. Usually the red ones have it printed on the side while the blue or gray ones have it on the top.

C1 is usually red, but may read "μ1J100" on the top rather than the side. C9 (220n) may read "μ22J63". C7 (470n) may read "μ47J50" or "μ47J63".

C6 and C10 (470pF) are blue MLCC capacitors taped to cardboard strips. C19 (100n) is yellow.

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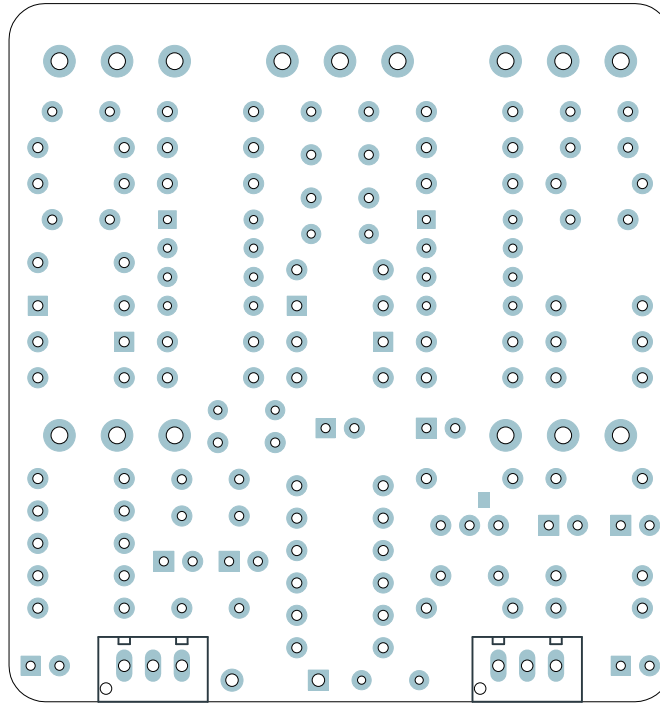
Install the two 3-pin headers (wire connectors) as shown above. These have a polarity pin, so as long as they are pressed all the way down, there's only one possible way to install them. They do fit pretty tightly in the holes, though, so press firmly.

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

CAPACITORS (POLARIZED)

PART	VALUE
C2	4.7uF
C4	22uF
C18	22uF
C20	220uF
C21	22uF
C22	220uF
C23	220uF
C24	22uF
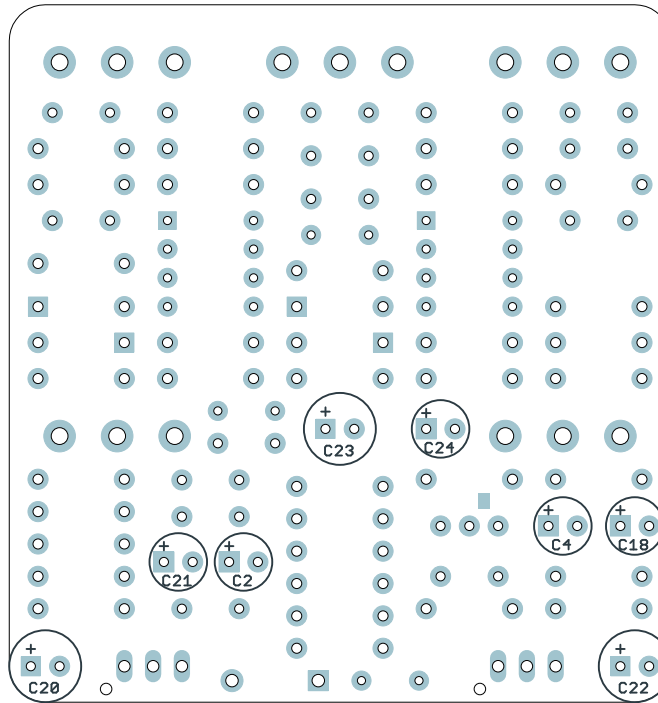
Populate the electrolytic capacitors. These are the tallest components so we save them for last. They are polarized (i.e. they will only work in one direction), so note the vertical mark that indicates the negative side. The longer leg is positive and fits in the square pad.

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

4PDT slide switch
3-strand wire assembly (2)
4-strand wire assembly
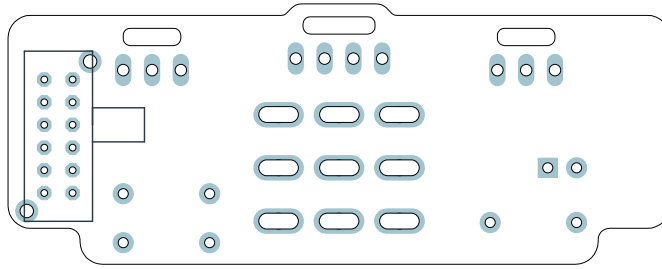
Next, it's time to finish up the footswitch board. You should have done most of the on-board components on this board in a previous step, but if not, go back and do those.

It's easiest to start with the slide switch. Fit it in as shown in the diagram above, with the slide lever facing to the right. Be careful—the pads are small. Make sure you don't accidentally "bridge" two pads together when soldering or you will have issues with the bypass.

The wires are next. 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.

BLUE MARKING
←
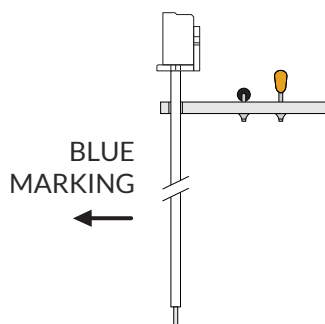
STEP 2

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.
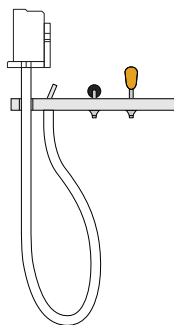
STEP 3

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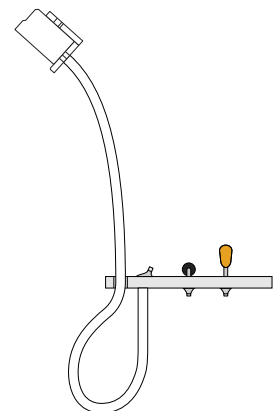
Once all three wire assemblies are soldered, set the footswitch PCB aside. We'll solder the actual footswitch and LED in a later step.

INPUT/OUTPUT PCB

PARTS

Input & output jacks

DC jack

Wire header
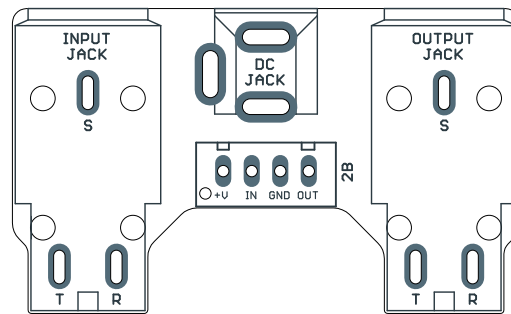
Almost done! Get the two input/output jacks, the DC jack and the wire header and snap them in place. The PCB is designed for them to fit securely, so you can do them all at once before flipping and soldering.
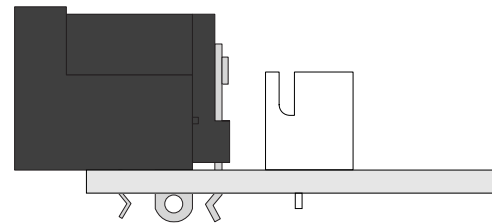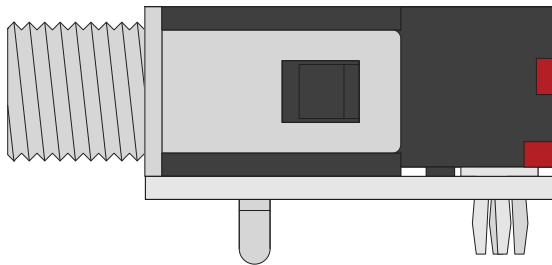
After you've soldered everything, make sure to **snip the leads on the I/O jacks as close as possible to the PCB**. There's not a lot of clearance between the bottom of this board and the top of the main PCB once everything is in place, and you don't want the pins to short against anything on accident.

ENCLOSURE LAYOUT: PANEL MOUNTS

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

100kB   100kB   100kB

50kC   10kA

BEZEL & LED

FOOTSWITCH

125B

FOOTSWITCH

MOUNTING NUT
LOCK WASHER
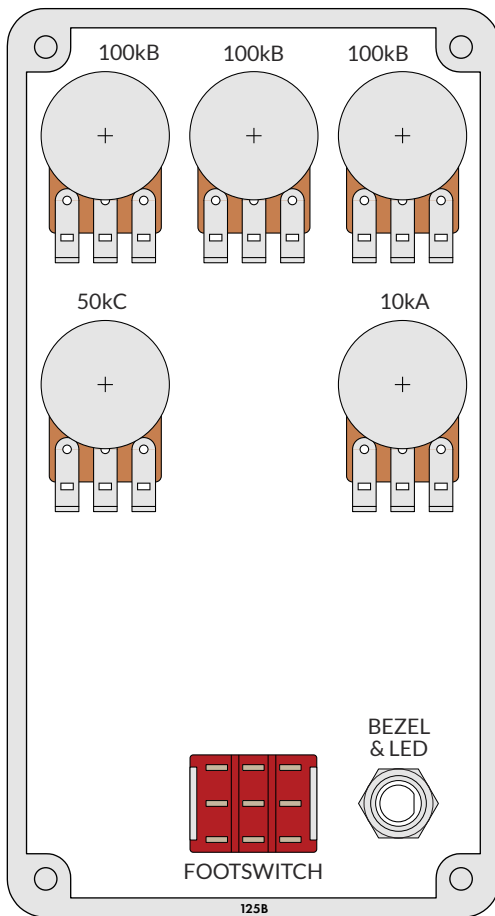
MOUNTING NUT
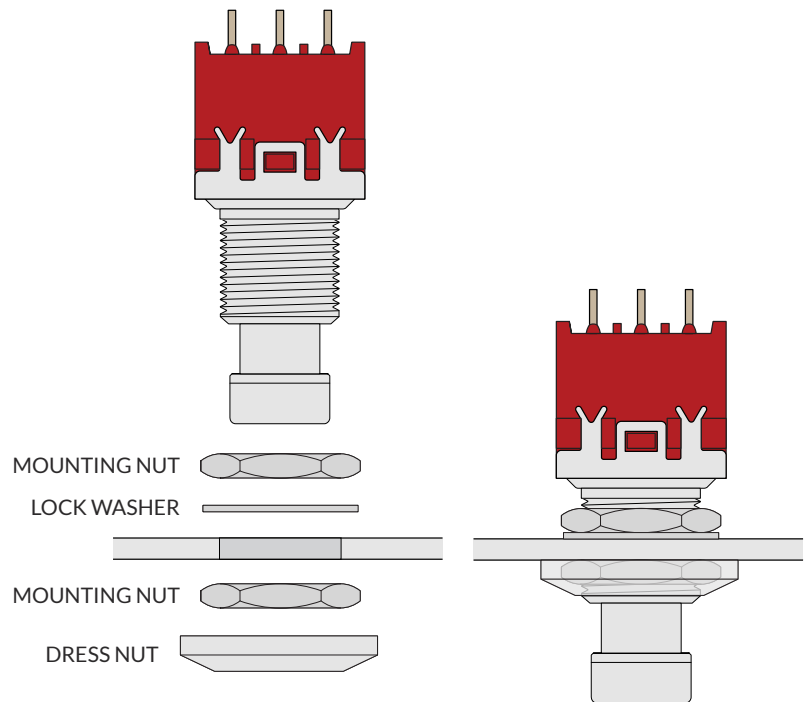
DRESS NUT

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

DUST CAP
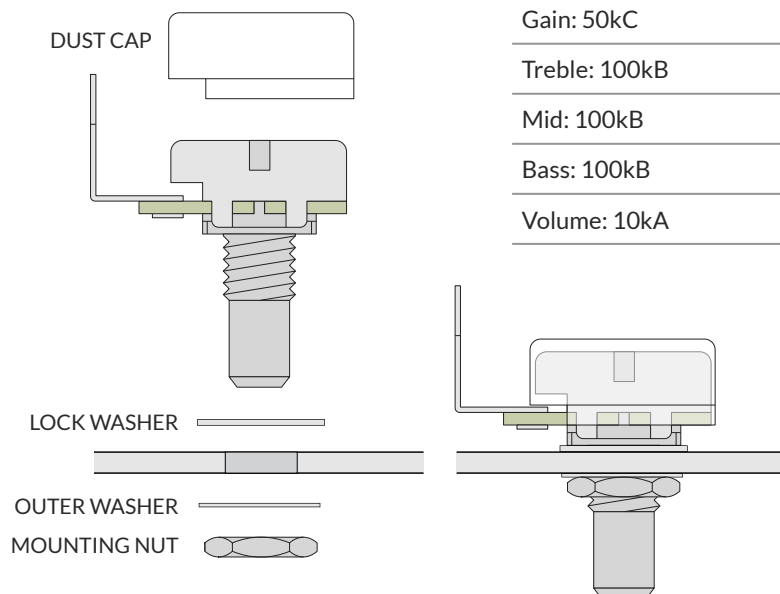
Gain: 50kC
Treble: 100kB
Mid: 100kB
Bass: 100kB
Volume: 10kA

LOCK WASHER

OUTER WASHER
MOUNTING NUT

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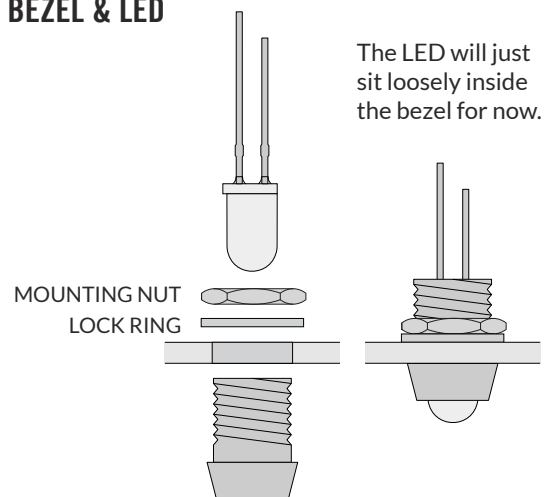
The LED will just sit loosely inside the bezel for now.

MOUNTING NUT
LOCK RING

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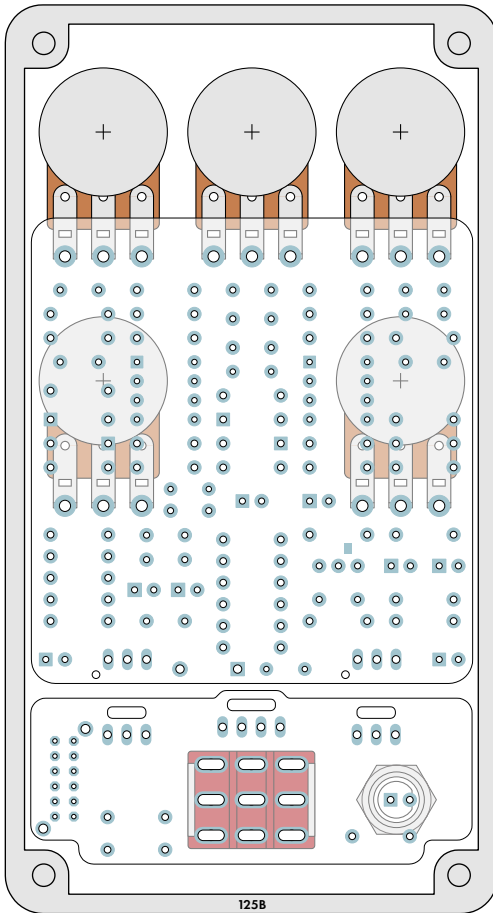
After all the components are affixed to the enclosure as shown on the previous page, place the main PCB on top of the potentiometers as in the diagram to the left.

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.

MOUNTING NUT

OUTER WASHER

LOCK WASHER

MOUNTING NUT

125B
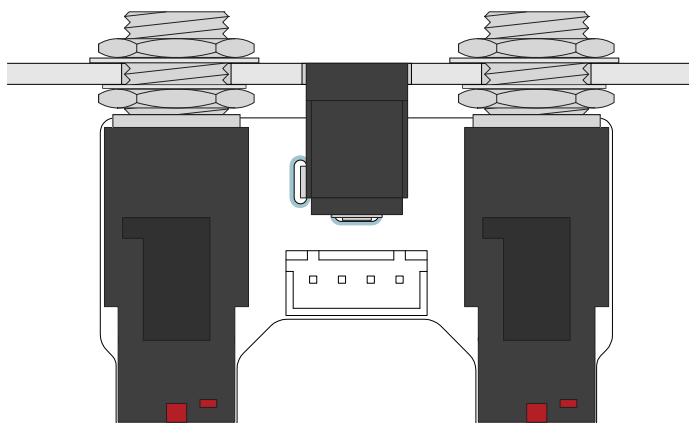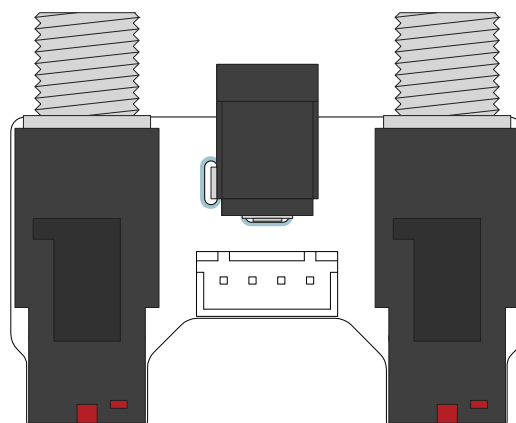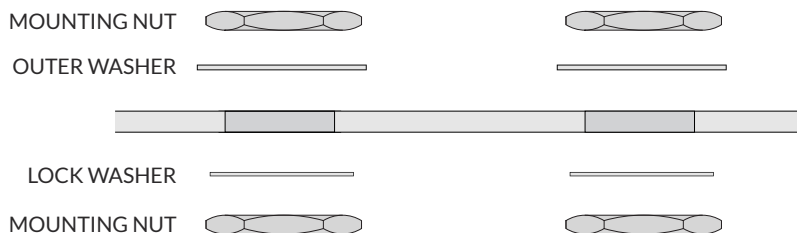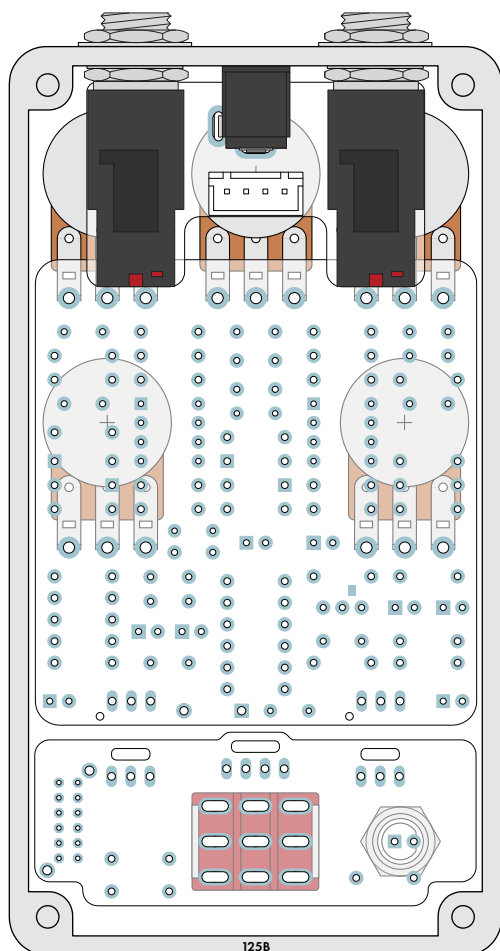
FINAL TESTING & ASSEMBLY

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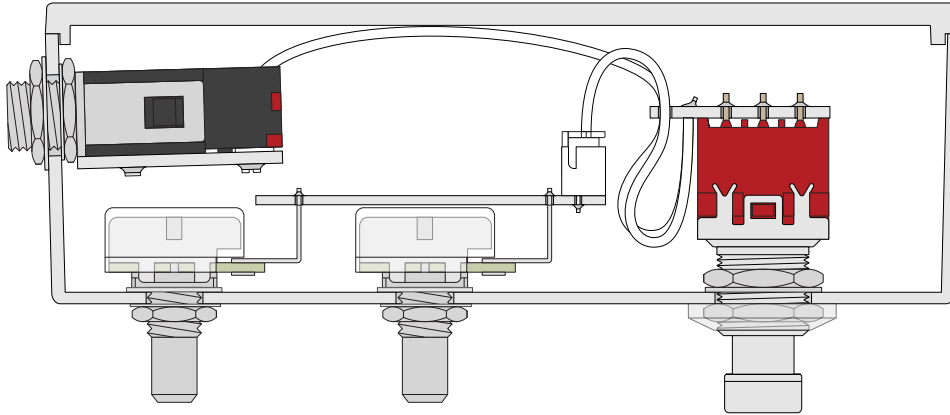
At this point, you have completed the full circuit as far as the electrons are concerned. Plug in a 9-volt supply and test it out with a guitar and an amplifier.

Test the bypass switch a few times, then start turning the knobs and see if everything sounds OK. If it works, great! If not, don't be discouraged. See page 26 for troubleshooting info.

Finishing touches

Now, just a couple of things for the final assembly. Turn the 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.
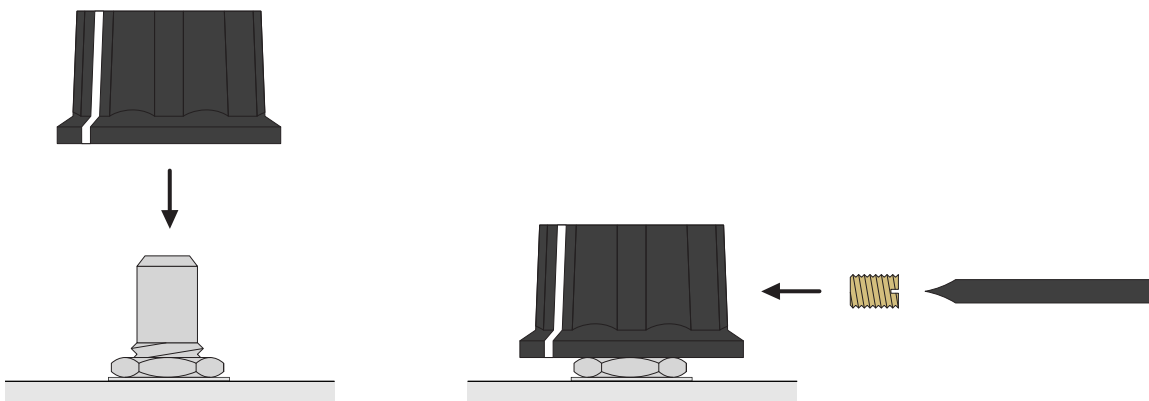
Last, just close the panel on the back using the four screws. That's it!

USAGE

The Cepheus has five controls:

- **Gain** controls the amount of gain in the first op-amp stage.

- **Bass** boosts or cuts frequencies by +/-13dB at 70 Hz.

- **Mid** boosts or cuts frequencies by +/-15dB at 1.5kHz.

- **Treble** boosts or cuts frequencies by +/-16dB at 5kHz.

- **Volume** is the overall output level.

Internally, there is a slide switch that selects between true bypass and buffered bypass modes. The buffered bypass mode is better in almost every scenario, but for larger pedalboards or more complex impedance matching, true bypass mode may be preferred.

SCHEMATIC

FULL PARTS LIST

Resistors

PART	VALUE	PART	VALUE	PART	VALUE	PART	VALUE
R1	10M	R11	51k	R21	3k3	R31	51k
R2	1k	R12	22k	R22	11k	R32	100R
R3	120k	R13	1k2	R23	11k	R33	10k
R4	120k	R14	51k	R24	11k	R34	10k
R5	200k	R15	22k	R25	10k	R35	100R
R6	7k5	R16	100k	R26	1M	R36	100R
R7	10k	R17	51k	R27	51R	R37	10k
R8	51R	R18	1k8	R28	10k	R38	10k
R9	10M	R19	1k8	R29	51R	LEDR	22k
R10	1M	R20	3k3	R30	91R		

Capacitors

PART	VALUE	PART	VALUE	PART	VALUE	PART	VALUE
C1	100n film	C7	470n film	C13	4n7 film	C19	100n MLCC
C2	4.7uF electro	C8	4n7 film	C14	22n film	C20	220uF electro
C3	1n film	C9	220n film	C15	10n film	C21	22uF electro
C4	22uF electro	C10	470pF MLCC	C16	1uF film	C22	220uF electro
C5	10n film	C11	1uF film	C17	1n2 film	C23	220uF electro
C6	470pF MLCC	C12	10n film	C18	22uF electro	C24	22uF electro

Diodes

PART	VALUE
D1	1N5817
D2	1N914
D3	1N914
D4	1N914
D5	1N914

Potentiometers

PART	VALUE
Gain	50kC
Bass	100kB
Mid	100kB
Treble	100kB
Volume	10kA

Transistors

PART	VALUE
Q1	BC549C

Switches

PART
3PDT stomp
4PDT slide

ICs

| PART	VALUE
IC1	TL072
IC2	TL071
DIP-8 socket (2)	

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 **9.6V** supply. Your measured voltages won't be exactly the same due to variance in power supplies and component tolerances. However, if you see anything more than +/-0.5V from the listed voltages, it's a good indicator of an issue, and the exact voltages can help narrow it down.

Note that IC pins are labeled counter-clockwise from the upper-left, as shown in the diagram to the right. Transistors have their pins labeled on the PCB.
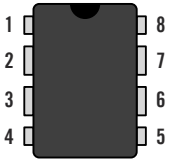
IC1

PIN	VOLTAGE
1	4.45
2	4.45
3	4.04
4	0
5	4.43
6	4.44
7	4.44
8	8.89

IC2

PIN	VOLTAGE
1	0.14
2	4.56
3	4.56
4	0
5	0.14
6	4.56
7	9.12
8	0

Q1

PIN	VOLTAGE
C	9.31
B	5.48
E	4.98

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!

LEGAL INFORMATION

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Any use of trademarks is for comparative advertising purposes only under fair use. It is not an endorsement of this product by the trademark holders.

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DOCUMENT REVISIONS

1.0.0 (2025-08-29)
Initial release.