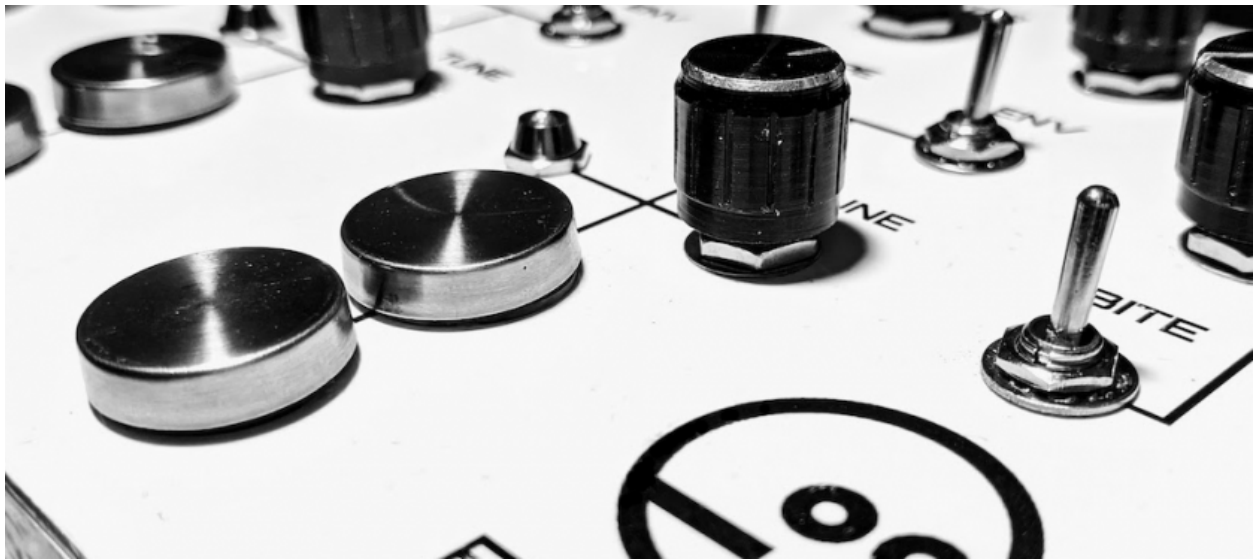# ELMYRA v1.4

by neutral labs

Build Guide

Congratulations on your decision to build the mighty Elmyra. Your life will change forever due to this experience. If nothing else, you'll be in possession of this wonderful machine that you likely did not possess before. Unless, of course, this is not your first Elmyra build, in which case I need to tell you that you are a great person.

Important!

DO NOT EMPTY ANY OF THE COMPONENT BAGS NOW! The components are grouped into the bags so that all of them can be identified without having to look up resistor ring codes. Rather leave everything inside the bags and take out what you need while soldering.

Panel

First prepare the panel. Place the 4 LED sockets in the positions
shown below and secure each one with the nut on the back.
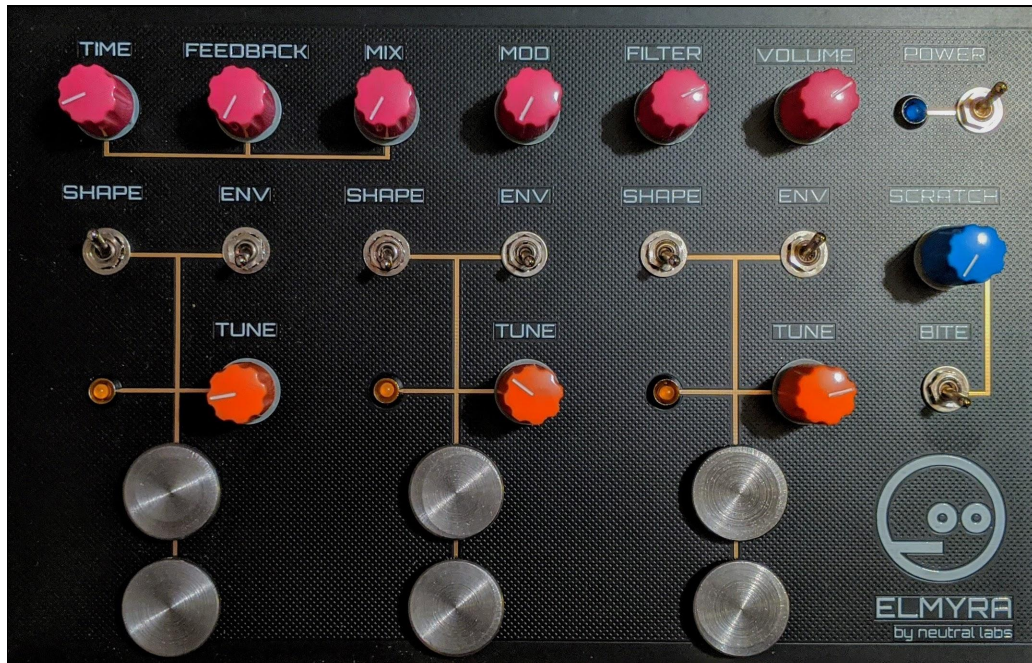
Now put in the 6 touchpads. **You must use the plastic washers under the
touchpads on the top side!** On the bottom side, tighten the nut and do
not use any washers. The nut must be in contact with the metal film
below.

Then solder the 4 pin SMD header to the back of the panel so that the
pins point toward the bottom edge. Your kit either has an angled
header (right) or a flat one (middle), they both work the same way.
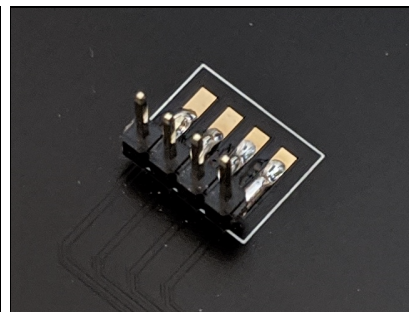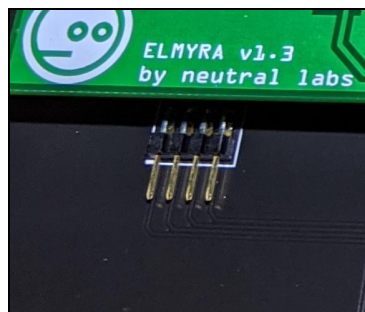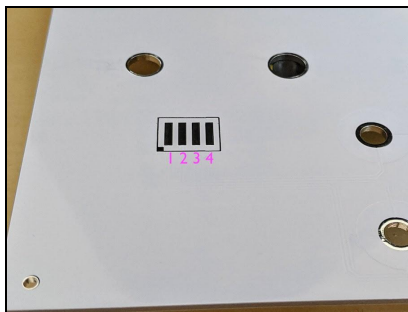
The easiest way to solder this header is to first melt just a bit of solder on one of the 4 pads on the board. Then plug the female Dupont connector of one of the 4-pin cables into the header. This will make it easy to hold while soldering without burning your fingers. Now solder one of the legs to the pad you have applied solder to. Remove the cable and solder the other legs.

Do not put any of the pots or switches in at this time. Put the panel aside and continue with the PCB.

PCB Bottom Side

Solder the bottom side components as described below the table. Where polarity matters, it means you need to pay attention which way you solder the components to the PCB or panel. Diodes have a black line on them which needs to match the line on the PCB. Electrolytic capacitors have a short leg that goes on the minus ("-") side, and they're also marked with a printed stripe on this side. The IC has a dot that must match the notch in the socket. And this in turn should match the gap on the PCB. **Double check the polarity! If the IC is flipped, you will see the infamous magic smoke and likely destroy the IC and potentially your PSU!**

(D are diodes, R are resistors, C are capacitors, U are the potentiometers as well as the IC and its DIP8 socket, S are switches and LED are, you might have guessed it, LEDs.)

| Part	Type	Polarity matters?	Notes
D1, D2	BAT85	yes	Distortion diodes. Can be substituted by BAT54. You may try other Schottky diodes as well, but regular diodes such as 1N4001 won't have the same edge to them.
R1, R15	1 MΩ	no	

|			
R2, R17	1 kΩ	no	
R3, R5, R7, R9	47 Ω	no	
R4, R6, R8, R18	4.7 kΩ	no	You can substitute R18 for a lower value if you like the power LED to be brighter. Or for a higher value if you like it dimmer. Do not go below 50 Ω.
R10, R11, R12	220 kΩ	no	You could experiment with different resistor values for a different touchpad response. Don't go below 100k or above 1M.
R13, R14, R16, R19	10 kΩ	no	
C1, C2, C3	1000 µF	yes	
C4, C5, C6, C10, C11	1 µF	yes	
C7	3.3 nF	no	
C8	4.7 µF	yes	
C9	10 µF	yes	
C12	0.1 µF	yes	
J1	8-pin male header	no	Polarity does not matter for the header itself, but for the cables plugged into it later on!
U1	MCP6002	yes	Solder the socket without the IC first. Plug in the IC later.
MCU	Itsybitsy M0 Express	yes	Solder according to instructions below. **DO NOT SOLDER DIRECTLY TO BOARD!**

Begin by soldering the resistors, diodes and IC socket. It helps to solder one pin first and ease it in place. Pay attention to polarity.
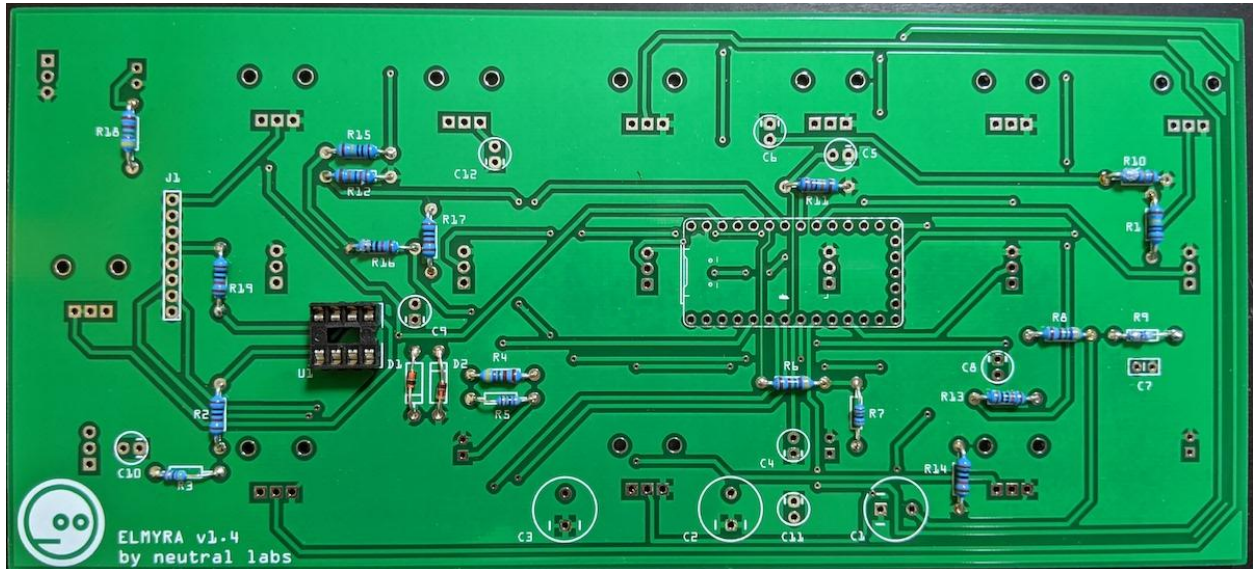

Next solder the male header and all capacitors except for the 3 large ones (C1, C2, C3). Once more, polarity matters, except for C7!
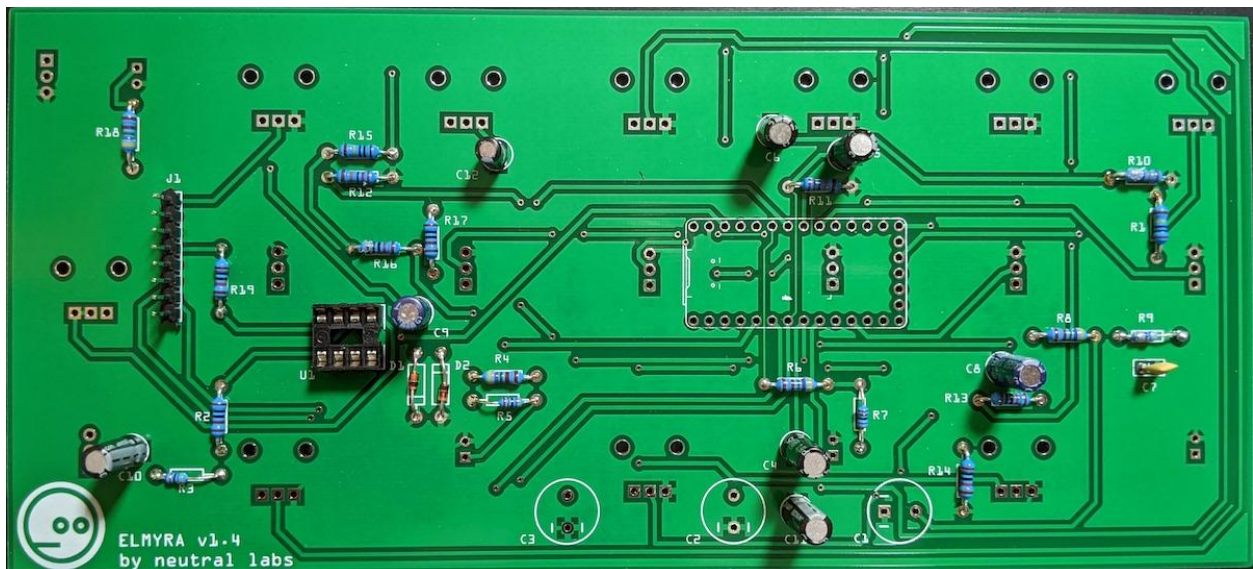

Then place C1, C2 and C3 into their place and solder. I need not remind you to check the polarity, right?
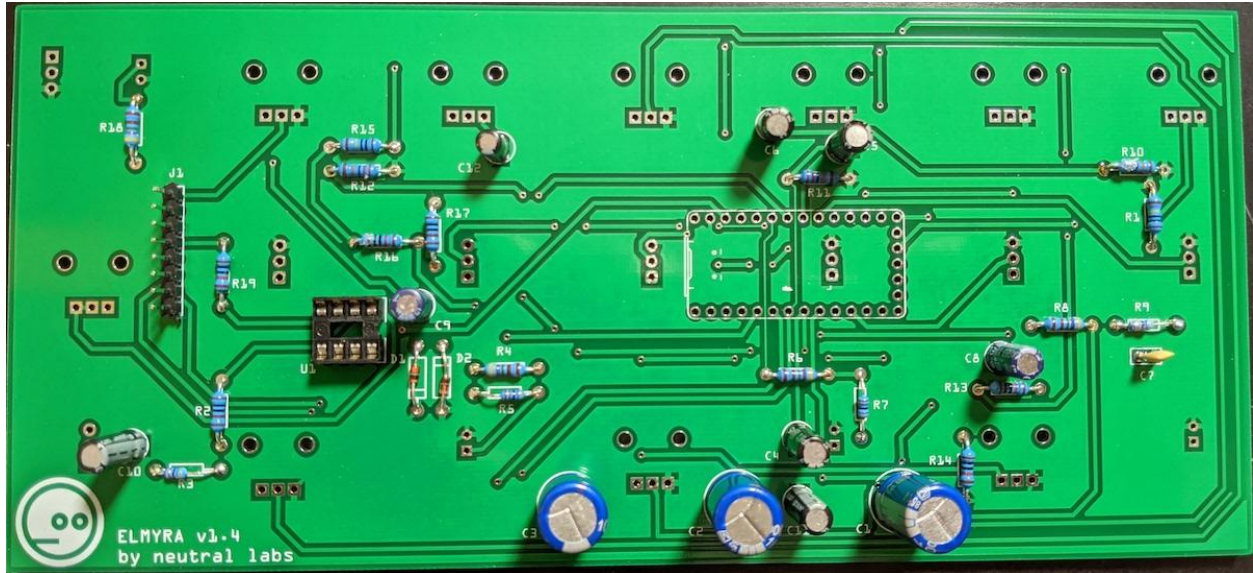
Next, break and solder the male headers to the ItsyBitsy board on the bottom (unpopulated) side. **DO NOT SOLDER THE ITSYBITSY DIRECTLY TO THE PCB!** Then break the long female header strip apart as needed by making a small cut on both sides with a sharp knife and then snap it along the edge of your workbench. Beware: You will lose 1 pin for each cut. A wire cutter also works. You might want to use a file to remove burrs and make everything fit nicely. Put the headers onto the PCB and push in the completed ItsyBitsy board to hold the headers in place.
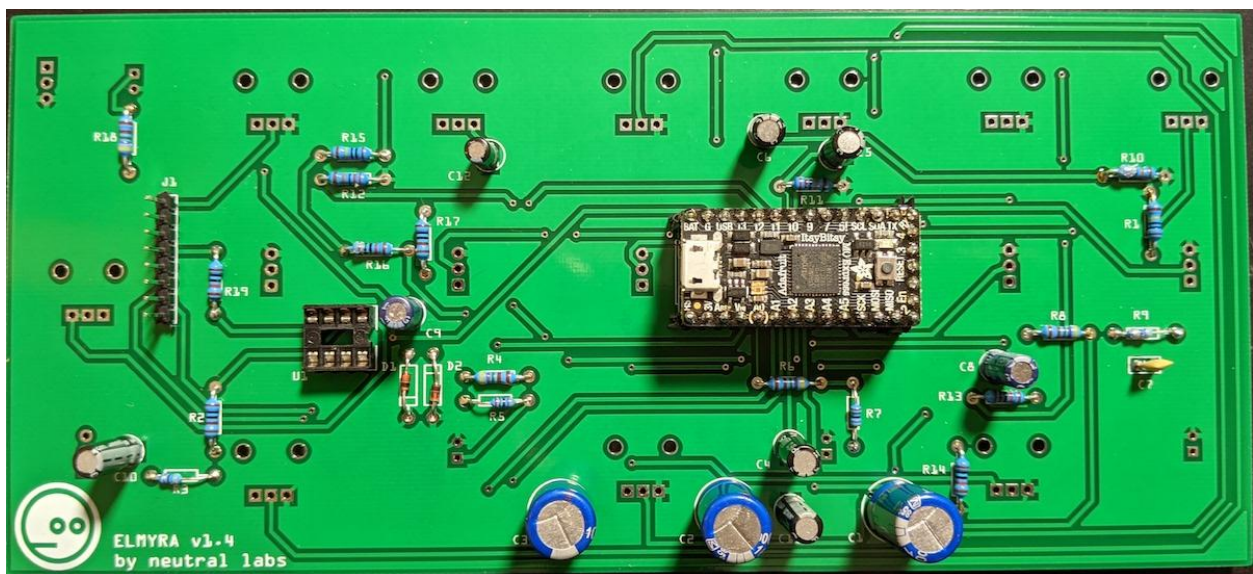
Solder the female header pins on the other side. After soldering, unplug the ItsyBitsy board again. It should look like this:
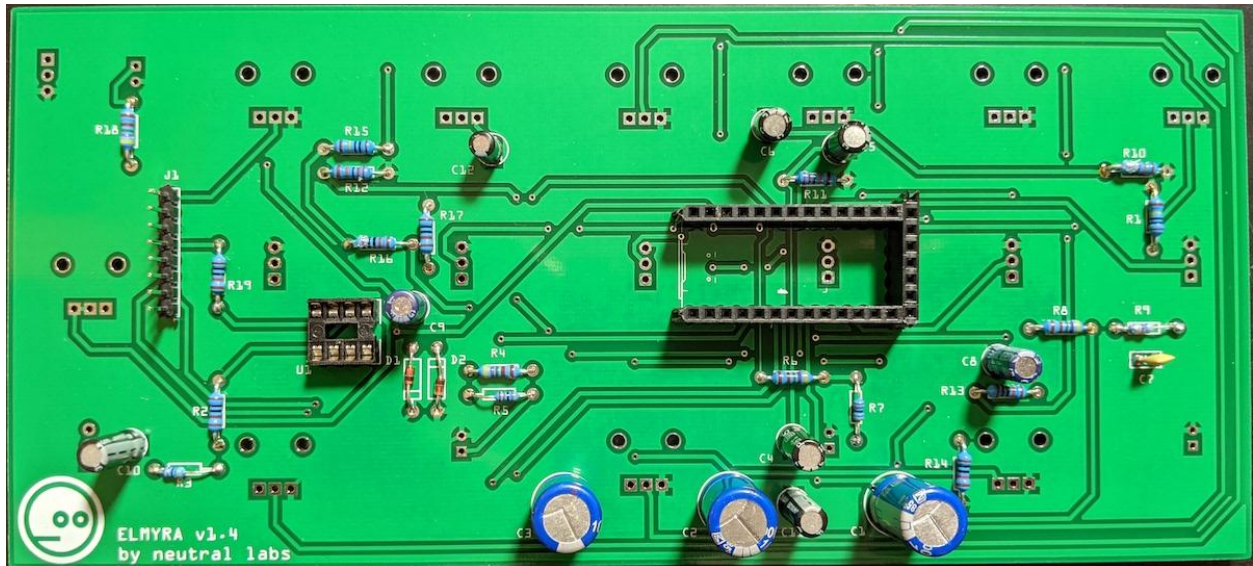
The bottom side is done. You can plug the MCP6002 in its socket now (check polarity!).

PCB Top Side

Now place all the components on the top side of the PCB according to the table below. Be sure to put the LEDs all the way in at this time. Pay attention to LED polarity. **DO NOT SOLDER ANYTHING YET OR YOU MAY NOT BE ABLE TO FIT THE PANEL!**

Part	Type	Polarity matters?	Notes
U2 - U11	10 kΩ linear pot	yes	
S1 - S8	SPDT switch	no	Unscrew the top nut, remove both washers for now (keep the knurled washer and discard the anti-rotation one if it's there), screw in the bottom nut to about 1 mm before the stop.

LED1 - LED3	orange LED	yes	The short leg towards the PCB top edge (flat side of the printed circle).
LED4	blue LED	yes	The short leg towards the PCB bottom edge (flat side of the printed circle).

Carefully place the panel on top of the PCB and wiggle it into position. There are 2 ways to do this: Either force the switches to remain in the (non-existing) middle position, which can take some convincing. Or put them all in the down position and slightly tap the switches one by one with a long object (e.g. a screwdriver), until they're all in their mounting holes. Press the panel into place. Once everything is snug, put washers and nuts (hand-tight is enough for now) on top of only the U2 and U11 pots and flip everything over.

Push the LEDs all the way into their sockets. Be careful not to bend their legs.

Solder all the top panel components now. The switch holes may be a bit larger than needed (to accommodate for several types of switches), but it's easy to get the switches aligned if you solder only their middle pins first, then align, then solder the other 2 pins.

Your PCB top side should look like this after soldering. (You don't actually have to remove the panel. It was just done for the picture.)

Now put the ItsyBitsy back in place. It's not a good idea to put on and tighten all the nuts now. Better wait until everything else is complete, in case you need to troubleshoot.

Connect Panel and PCB

You can now connect the panel and PCB with the provided 4 pin Dupont cable. Use the cable that has Dupont connectors on both sides. The one that has open wires on one end will be needed later to connect the input and output jacks.

Check the panel and PCB images below and connect as follows:

- panel pin 4 to PCB pin 5
- panel pin 3 to PCB pin 6
- panel pin 2 to PCB pin 7
- panel pin 1 to PCB pin 8
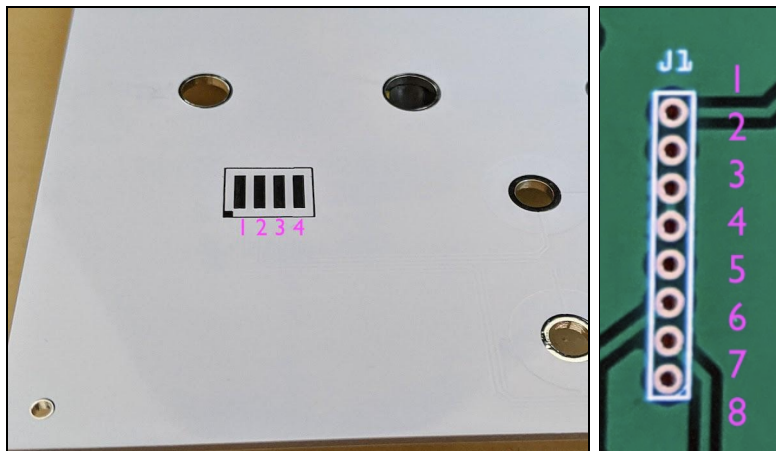
Power and Audio In/Out

Cut the single wire in 2 and solder it to the jacks as shown below. This is for the ground (GND) connection between the jacks. When soldering 2 pieces of wire to a single lug, it can help to make the solder connections in 2 different places on the lug to avoid the first wire coming loose when soldering the second one.

Now solder the remaining Dupont cable to the 3 solder lugs as indicated in the picture below.
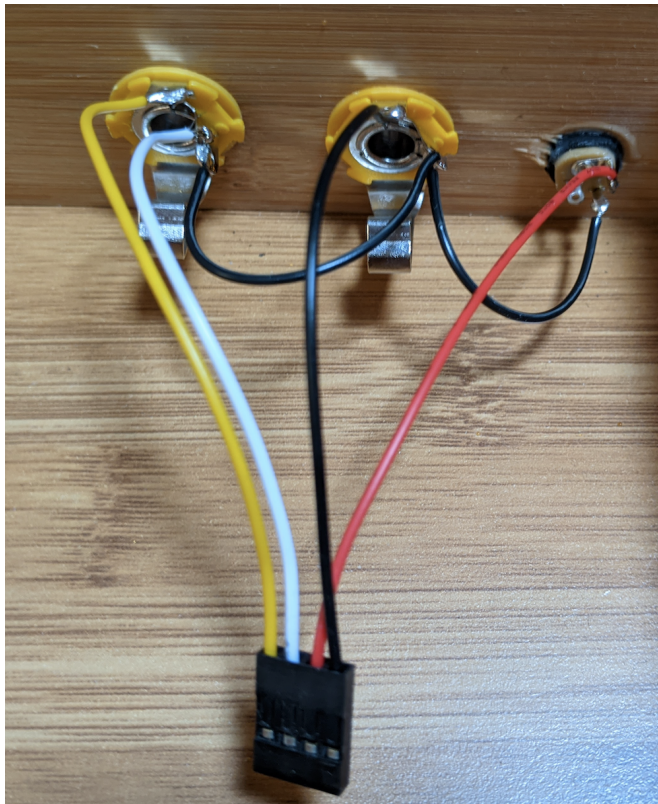
Make sure there is no accidental solder connection between lugs. Also watch for loose strands of wire, especially between the 5V and GND inputs. A short in this location might damage your power supply.

Arrange the wire so that a plug will not touch or even jam it when plugged in. It helps to keep the wires reasonably short for this reason.
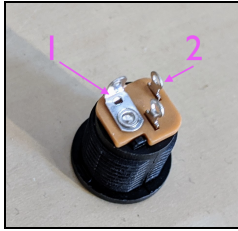
Just for reference, the GND lug on the DC jack is pin 2 in the picture on the left and the 5V lug is pin 1.

Leave the 3rd lug on the jack unconnected.

Also for reference, the GND lug on the audio jacks is the one that connects to the sleeve of the plug, and the signal lug is the one that connects to the tip, as shown in the picture on the left.

The Dupont cable connects to the male header J1 on the PCB as follows:
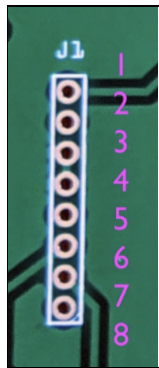
- audio out tip to PCB pin 1
- power jack pin 1 (+5V) to PCB pin 2
- power jack pin 2 (GND) to PCB pin 3
- audio in tip to PCB pin 4

Make sure you connect this cable the right way! Using the colors from the image above, the black wire would go on top (J1 pin 1) and the yellow one on the bottom (J1 pin 4). Your cable may have a different color scheme.

(Almost) Done!

Connect the USB power cable and turn the device on by flipping the power switch down. If something seems not right, better turn the device off immediately and investigate. If everything is working, the only tasks left are to put the knurled washers and nuts back onto the switches, the washers, nuts and knobs onto the pots and finally to secure the panel to the case using the 4 screws.

Now go create some noise!

If you need help or want to share photos, audio and/or video of your creations (please do), send a message to admin@neutral-labs.com