NEUTRON SOUND

Build Guide : Orgone Accumulator V3

Build Guide v0.5 (June 2018)

Introduction

Thank you for building a Neutron Sound Orgone Accumulator digital oscillator.

This document will assist you with building the Orgone Accumulator V3, which is an SMD version of the module.

This build is not recommended for beginners to soldering or indeed SMD soldering. If you have no experience of SMD soldering it is recommended that you practice on the widely available SMD practice kits available online.

Bill of Materials (BOM)

You can view the BOM for this project here - Bill of Materials

You can use the Mouser Cart here - Mouser Cart

Please note the Mouser Cart does not contain the required Teensy, Jacks, Potentiometers or Knobs, all of which can be sourced from a range of stores depending on your location.

Builders should also note that they have a choice of power supply as indicated in the BOM – it is recommended to use the switching power option which will reduce power consumption, but works out slightly more expensive.

Stock levels vary throughout the year at any component vendor, so you may find some components out of stock if using the Mouser Cart. For most components there are usually a range of suitable alternatives available which can be identifed using the "find similar products" tool. Where there are no suitable alternatives you will usually be able to source an alternative from another vendor.

What equipment do you need to build it?

For soldering SMD projects such as this, having the following equipment is recommended;

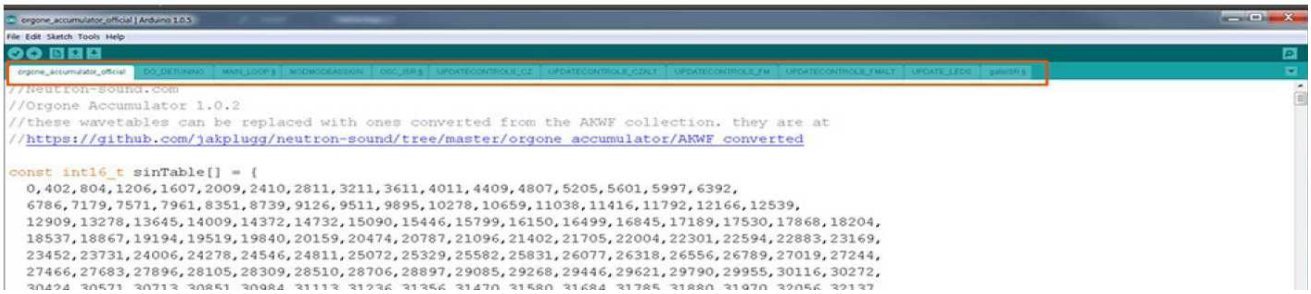
- A Soldering Iron with temperature control
- Solder (<0.7mm in diameter)
- SMD Tweezers
- Flux Pen
- Solder Braid
- Hot Air Gun – for reflow and lifting components
- Magnification – some of these components are small!
- Digital Multimeter
- A PC or Mac with Arduino IDE and Teensyduino software installed

Step 1 – Program the Teensy

Make sure you have the latest version of Arduno IDE and Teensyduino downloaded, installed and working on your computer.

Arduino IDE - https://www.arduino.cc/en/Main/Software?
Teensyduino - https://www.pjrc.com/teensy/td_download.html
Go to https://github.com/jakplugg/Orgone-accumulator and download the zip file (the green button on the RHS).

The zip file contains the main firmware. Unzip the file you downloaded from github, and remember the location. Open Arduino IDE, click file/open and navigate to the file you have just downloaded. You should see several tabs in the Arduino IDE if the file was opened properly.



Now you can go ahead and click the verify button to compile the code, then the upload button to put the firmware on your Teensy.

Overclocking

New versions of the firmware require overclocking the teensy to 144Mhz

This has been widely tested and there have been no reports of overheating or other issues .

To achieve this, you will have to edit the file “boards.txt” it is in:

```
[where you installed]\arduino\hardware\teensy
```

in the file you will see a line like this:

```
#teensy31.menu.speed.144.name=144 MHz (overclock)
```

all you have to do is remove the “#”
and save.

Next time you open the arduino IDE there will be an additional item in the Tools>CPU speed for “144MHz (overclock)

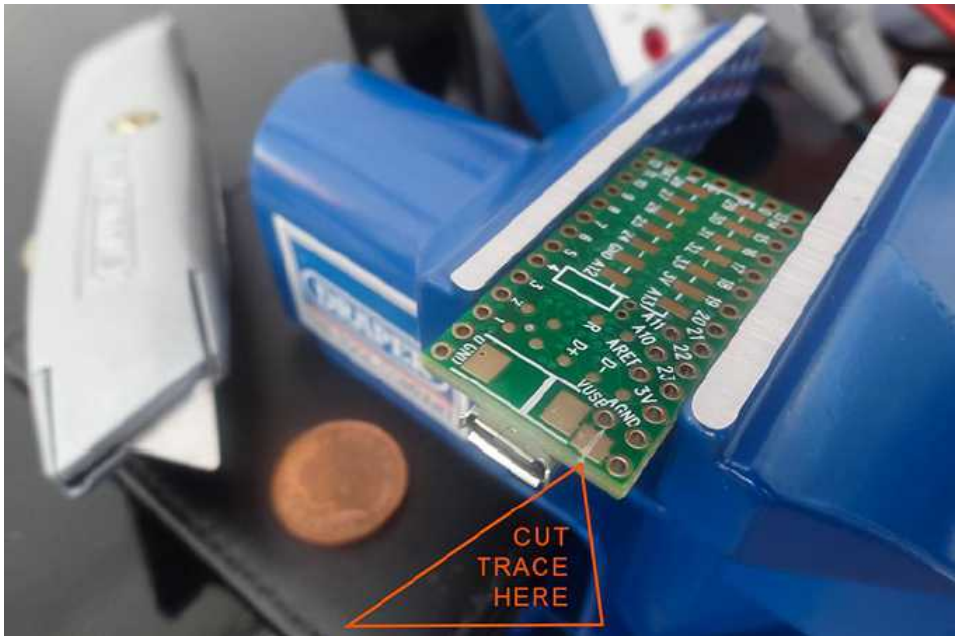
Select it before you upload the orgone accumulator sketch to the teensy.

So far I have not found any of the code needs to be edited, the program just executes faster.

At this stage you may wish to cut the power trace on the Teensy.

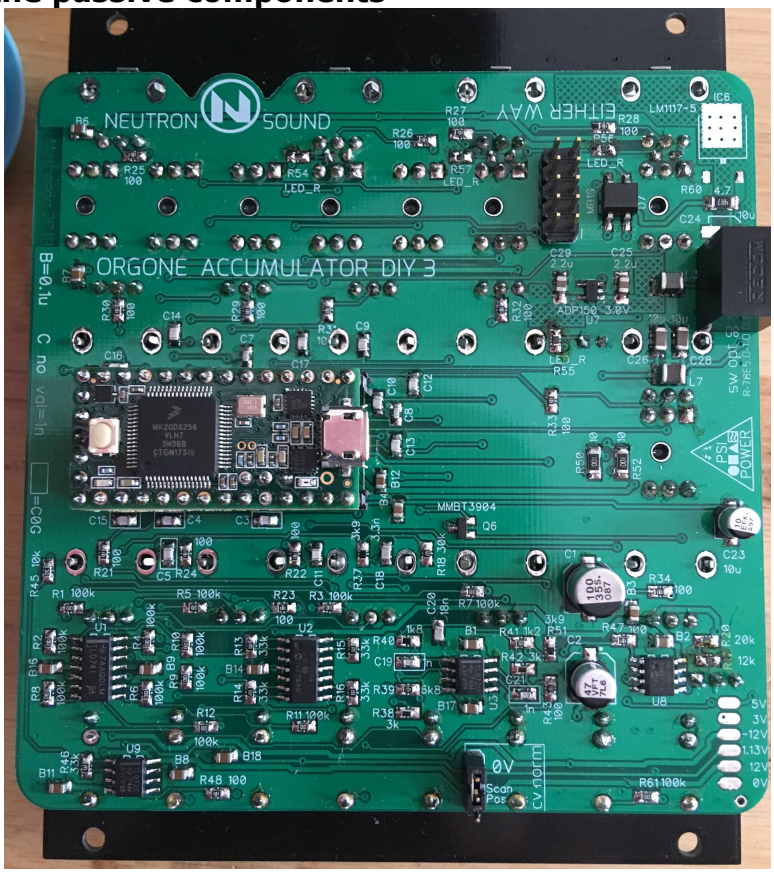
Cutting this trace still allows the Teensy to be programmed via USB while it is connected to the Modular power,however, the Teensy will no longer work on USB power alone.

If the trace is not cut, your Modular's 5v and the computers USB power will be connected together, which may result in a fried Teensy. **You may of course choose not to do this but if you dont it is essential that you disconnect the Teensy from your modular power supply before connecting the USB Cable.**



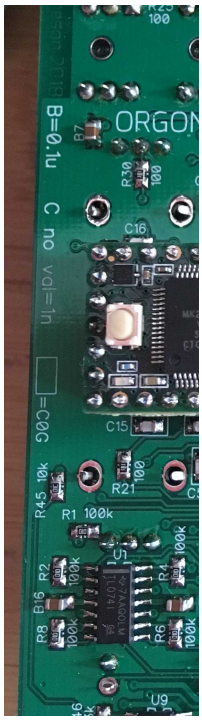
If all is good, you can put the Teensy aside in a safe place for now.

Step 2 - Solder the passive components



The Resistors / Capacitors should pose no significant issues if you are familiar with soldering SMD components.

The PCB Silkscreen is clearly marked with reference numbers and values. On the LHS of the PCB there is also a Legend specific to the capacitor values is shown on the silkscreen.



Resistors

13	100k	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R61	
5	33k	R13, R14, R15, R16, R46	
1	12k	R17	
1	30k	R18	
1	20k	R20	
17	100R	R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R43, R47, R48,	
2	3k9	R37, R51	
2	3k	R38, R42	
1	6k8	R39	
1	1k8	R40	
1	1k2	R41	
2	10k	R45, R49	
2	10R	R50, R52	
4	2.7k	R54, R55, R56, R57	You may wish to adjust the value of these resistors to suit your preference in terms of the brightness of the LED
1	4.7	R60	* R60 used for Linear Power Option only

Ceramic Capacitors

14	100n	B1, B2, B3, B4, B6, B7, B8, B9, B11, B12, B14, B16, B17, B18	
13	1n	C3, C4, C5, C6, C9, C10, C11,	805

		C12, C13, C14, C15, C16, C17	
4	1n	C7, C8, C19, C21	603
1	3.3n	C18	
1	18n	C20	
2	2.2u	C25, C29	805
2	10u	C26, C28	* C26 & 28 used for Switching Power Option only

Step 3 - Solder the ICs / MB1S / Transistor / Power etc

There are no significant challenges in soldering these components, but you may find the use of some additional flux will help with soldering and reduce the chances of solder bridges.

You only need small amounts of solder to mount these components, the use of too much increases the chances of solder bridges.

If you encounter any solder bridges or have excessive solder, this can be carefully removed using solder wick and flux.

1	MB1S	D7	
1	LM1117-5	IC6	* IC6 used for Linear Power Option only
1	FBMH3225HM202NT	L3	
1	33uH	L7	* L7 used for Switching Power Option only
1	MMBT3904	Q6	
1	TL074	U1	
2	TL072ACD	U3, U9	
1	MCP6002	U8	
1	MCP6004	U2	
1	Teensy 3.2	U4	Osh Park is cheapest
1	7805 Switching Power	U6	* U6 used for Switching Power Option only
1	ADP150 3.0V	U7	

Step 4– Solder the Electrolytic Caps

Take care to ensure the Electrolytic Caps have the correct orientation, and note that C24 is only required if you choose the Linear Power option.

1	100u	C1	
1	47u	C2	
2	10u	C23, C24	* C24 used for Linear Power Option only

Step 5 - Solder the Power Header & Jumper

Place and solder the 2x5 Header for the Power Supply and the 1x3 Header for the Jumper at the bottom of the board. Due to the use of the MB1S Bridge Rectifier the power cable can be connected either way so there is no need for a shrouded header on the module.

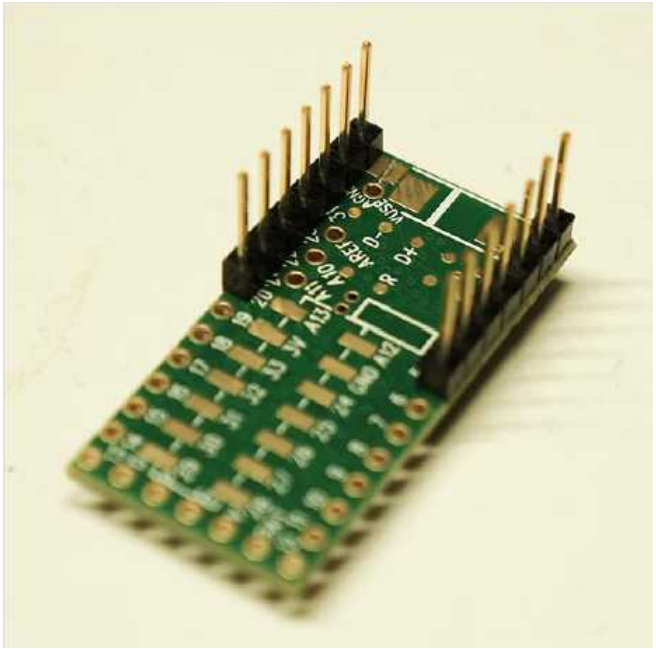
Step 6 – Teensy Hardware

This is actually the trickiest part of the build, so we will go into a bit more detail.....

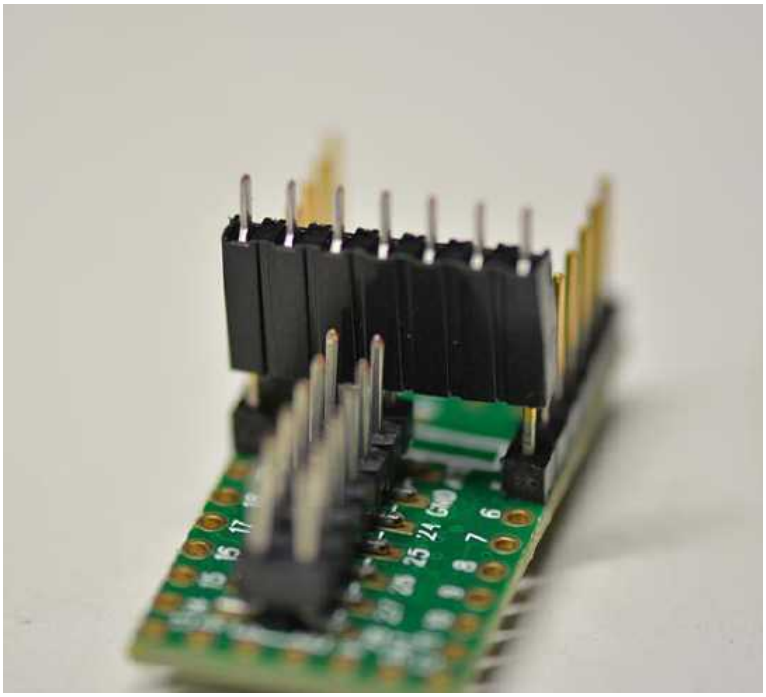
Mounting the pins on the teensy:

The Teensy needs to have pins along both long sides, along the short side, a group of three near one edge, and a special set of 14 pins in the middle which use a SMD connector. Lining these all up correctly can be tricky, so proceed as follows.

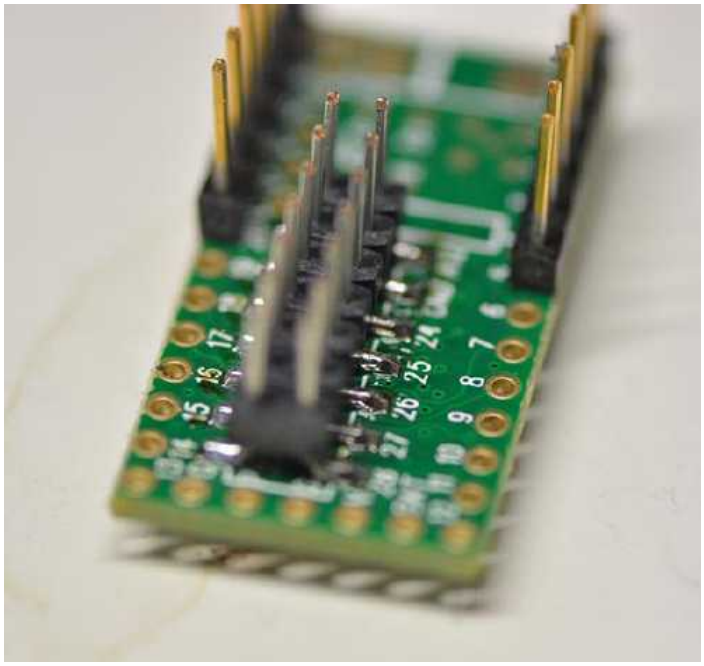
Instead of the 14 rows you might expect for the two long sides, break off 2 rows of seven from the breakaway pin strip. These will cover half of each long side, nearest the USB connector. This makes getting at the SMD pins easier, while also giving you an alignment point.



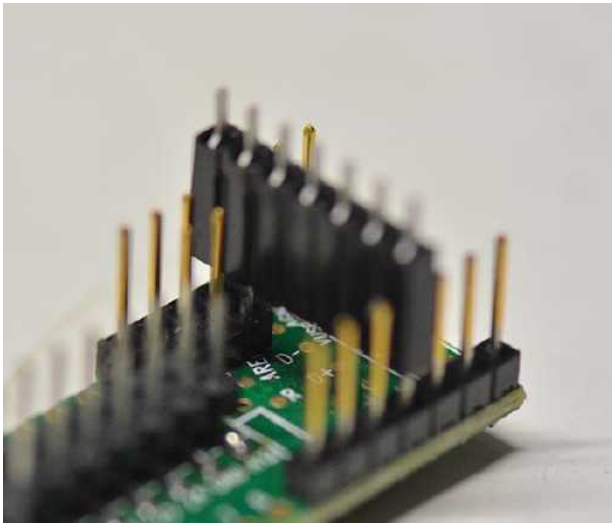
Get the 7 pin female board header, we are going to use that as an alignment tool, we will call it “alignment tool” for now. Solder in 2 of the 7 pin rows, at the USB end of the Teensy. Just solder one pin for now. Make sure they are vertical and flush to the teensy (you can use “alignment tool”) Now place the alignment tool over the rows you soldered, and also the SMD header,



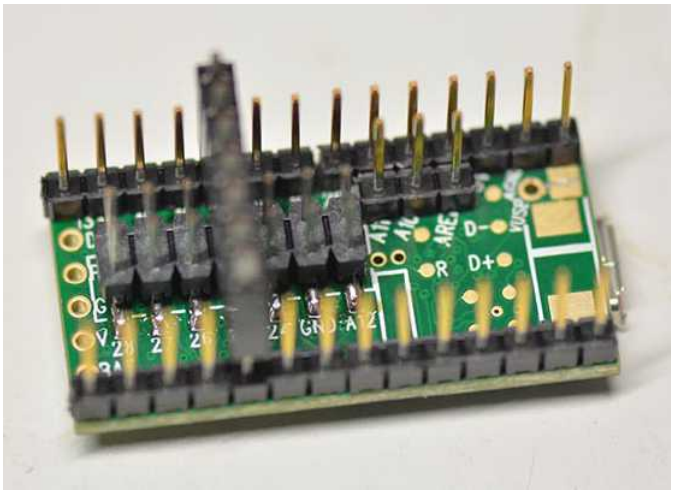
Solder a couple of the SMD pins, and then remove the “alignment tool” Now you can solder the rest of the SMD pins fairly easily.



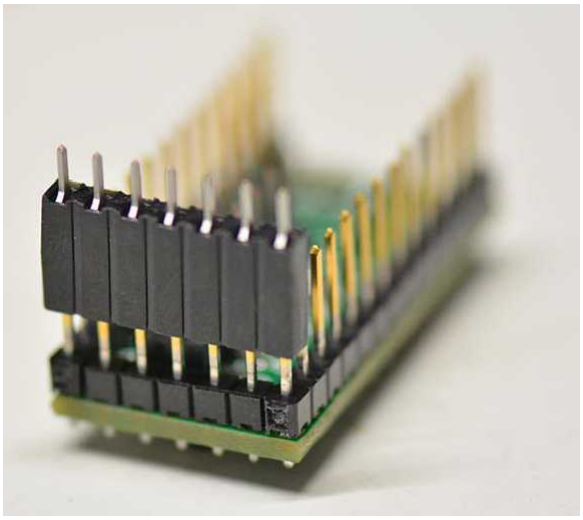
Now break off 3 pins from the breakaway header and use the alignment tool to hold them in the 3 holes marked AREF A10, and A11 on the Teensy. And solder one pin, to hold them in place.



Now you can break off 2 more strips of 7 pins and place them along the remaining side holes. The alignment tool can be used again You may need to file or sand the ends of the strips you cut, if they interfere with the strips already in place. Just solder 1 pin on each for now.

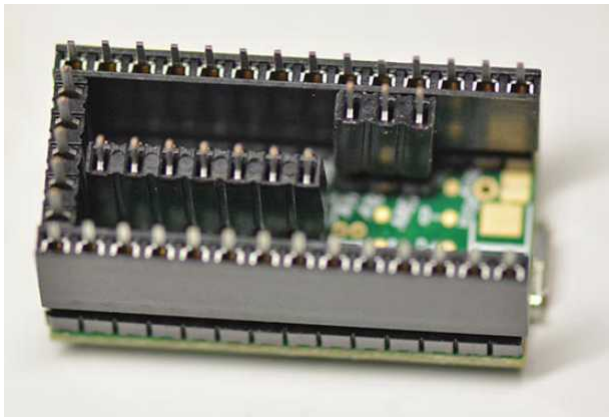


Now utilize the alignment tool yet again for the remaining 5 pins at the short end of the Teensy. You may now retire the alignment tool and call it a board header again. Again solder only 1 pin.



Mounting the Board Headers

You can put all the headers on their respective pins, to align them all. You will not be able to push them all the way down though; this is fine. Press the 7 pin one on the middle row of the SMD pins first and use that as a guide for how far to press the others. Note that only the "middle" row is used on the SMD header. It is the row that goes down the middle of the Teensy. The other row is just to add stability to the SMD contacts if you have to remove the Teensy.



It can be a bit tricky to get all the header pins in to the Orgone Accumulator board, and you may need to move the pins/header a bit to make if work nicely. This is why you only soldered one pin on each (Idea thanks to hexinverter). Solder all the board headers to the PCB, then all the Teensy pins to the Teensy. Be careful not to get any solder on any Teensy components.

Step 7 – Pots / Jacks / Switches / Trimmer & LEDs

Mount the Pots / Jacks / Switches & Caps / Trimmer and LEDs **BUT DO NOT Solder**

Pay particular attention to the LED Polarity. Some LEDs have a flat side, which is marked on the board, and LEDs have a longer leg. This is the positive lead.

Ensure you place the B10k & B100k potentiometers in the correct location.

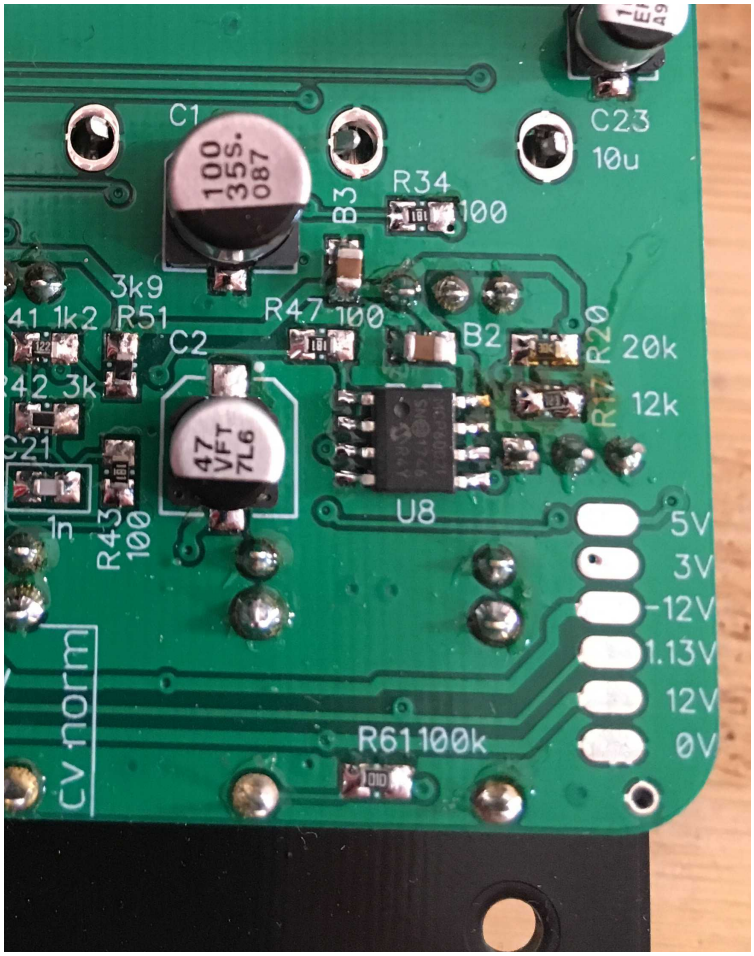
Mount the panel to get a proper fit and ensure everything seated as it should be. The Trimmer should be easily accessible through the panel.

Once everything has been seated correctly and the panel fits correctly, solder the Pots, Switches, LEDs and Jacks.

Step 10 – Clean & Inspect your work and check the voltages

It is good practice to both clean your work and inspect your work under magnification as the build progresses. Prior to powering up for the first time it is worth double-checking for solder bridges etc which may cause damage or malfunction. Pay particular attention to components such as the ADP150, which is the most likely part on this build to have a solder bridge.

The PCB has useful pads on the bottom RHS which allows you to check the various voltages. Whilst the Teensy is removed power the module and check the +- 12v and 5v voltages at these pads using a multimeter. Once you have checked those you can connect the Teensy and check the 3v and 1.13v voltages.



If there are any issues you may need to check for bridges / shorts, missing components or components with the wrong orientation.

At this stage, particularly after any touch up work, it is worth having a final clean of your completed PCB to remove any flux residue as can be seen in the vicinity of R17 / R20 in the picture above. You can do this using swabs and Isopropyll Alcohol (IPA).

If the voltages are as expected, power off and connect the Teensy. At this stage if you have not done so already, you can mount the button caps of the switches and the knobs of your choice.

The module should be ready to use!