

# Polyg Build Manual

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Synthmar

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# 1 What you need

Note: All clickable links to websites are highlighted in blue.

I will assume in this manual that you have all of the basic stuff that you need to solder stuff together.

I've built mine with a very cheap [Velleman soldering iron](#), 0.5mm solder, [braided solder wick](#)(in case you gotta unsolder something) and tweezers that you can buy at [Thonk](#), so you should be ok with the bare minimum. Having a Multimeter is also a plus.

If you get into ANY kind of problems with the build then just send me an email at [halligauti@hotmail.com](mailto:halligauti@hotmail.com) with a Hi-def picture of both PCBs on both sides and some description of what's wrong :)

# 2 The build

Ok so the way I always solder modules or any electronic device is to start from the smallest components(resistors, capacitors) and work my way up to the tallest components(jacks,potentiometers,header pins). I won't get into HOW you solder SMD since there are a lot of [great tutorials for this](#) on the net.

The order i do this in is mainly

- Resistors and non polarized capacitors
- TL074 chip, DAC chip, SMD transistor, 5V regulator
- Diodes and Optocoupler chip
- Polarized capacitors(including through hole ones)
- Headers between boards and Eurorack power connector
- Teensy 3.2 and all of the jacks, potentiometers, buttons and LEDs

I will gloss over the first part since it's very basic, just check the value of the resistor or capacitor and check what part it is on the schematic and solder it<sup>1</sup>

The orientation of the TL074 chip and DAC chip can be a bit more tricky and you should ALWAYS triple check if its correct. I've messed this up myself, so be careful!!

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<sup>1</sup> I should also note that soldering the resistors at the back of the potentiometers on the TOP PCB is not necessary, it was only there for prototype purposes and experimentation with the resistor curves as according to [this article](#)

## **2.1 SMD chips, Transistor and Regulator**

So the best method for soldering SMD IC chips is to solder one pad, heat up the pad, drag the IC chip on it and then solder the other pad that's dimetric to the pad you soldered, then soldering the rest.

The following pictures show how the orientation of the TL074 IC chip and the CD4334 DAC chip should be. If the TL074 chip doesn't have a DOT to indicate the 1st pin then simply have the text in the orientation as shown in the picture. The dot should be on the left side of the picture, this is also shown on the PCBs silkscreen.

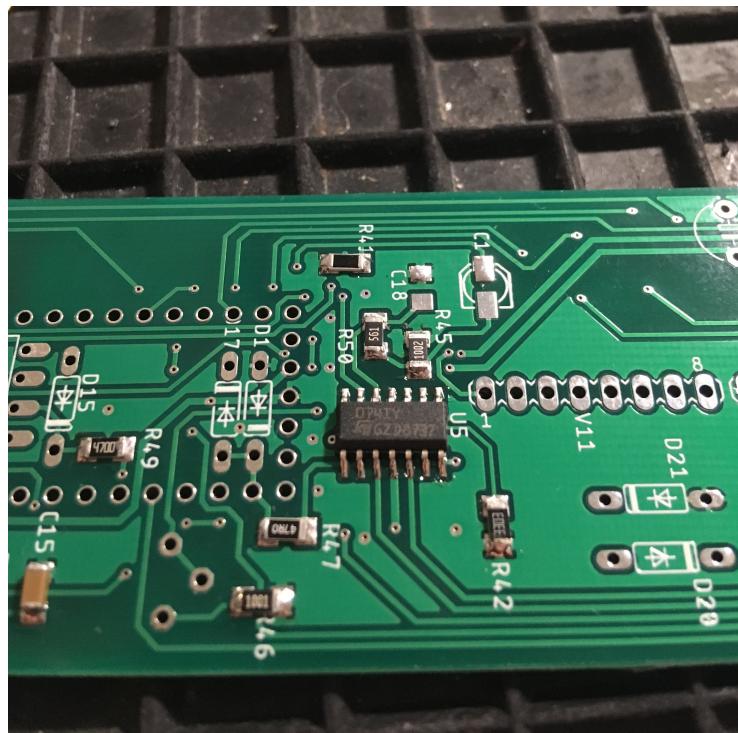


Figure 1: Orientation of TL074

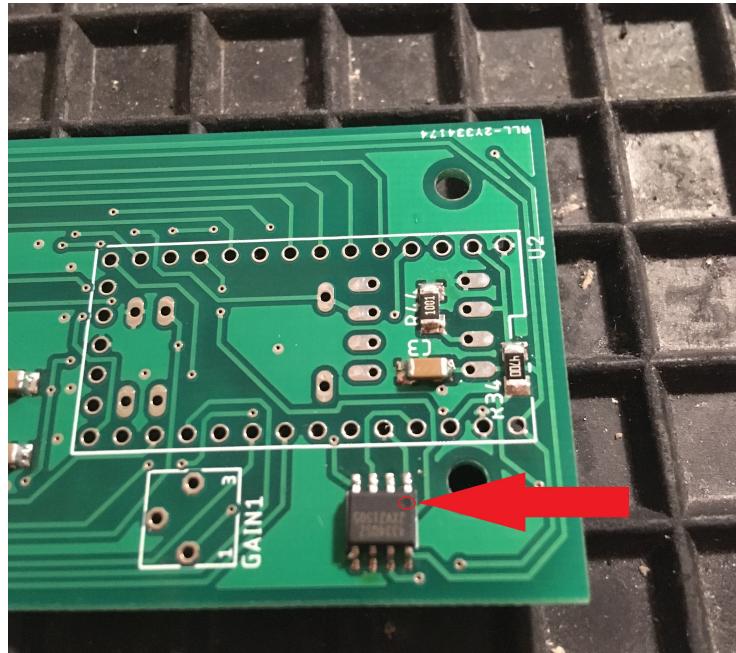


Figure 2: Orientation of the DAC chip; the dot on the chip is where the red arrow is pointing

## 2.2 Diodes and Optocoupler chip

This pretty much explains itself, just solder all of the 1N4148 diodes and the Optocoupler chip.

## 2.3 Polarized capacitors

The two  $3.3\mu\text{F}$  capacitors are easy to solder, just use the same method as with the SMD resistors and non-polarized capacitors. Be careful with the orientation!! If you don't then you might blow up a capacitor when you turn the module on, and it does NOT smell good. Also; never have your face close to one when you power something on for the first time, it burns, trust me...

## 2.4 Headers

Ok so this part might be a bit tricky, it takes a bit of wonky movement to get it just right but if you do it correctly then the headers between the boards will be PERFECT. First things first is to put plug the male headers into the female headers. Then you put the female headers into the TOP board(the one with the jacks and ect).

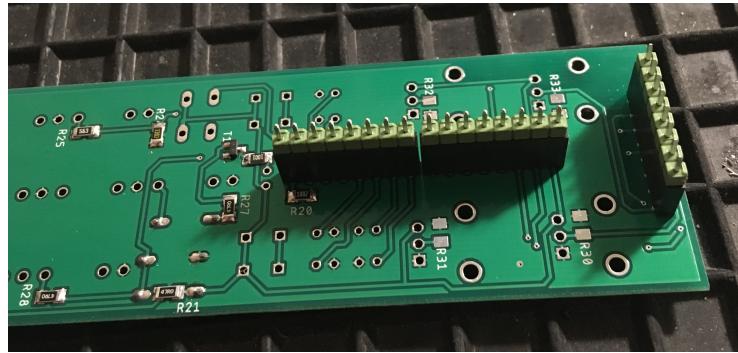


Figure 3: Put the female headers into the board and DONT solder them just yet

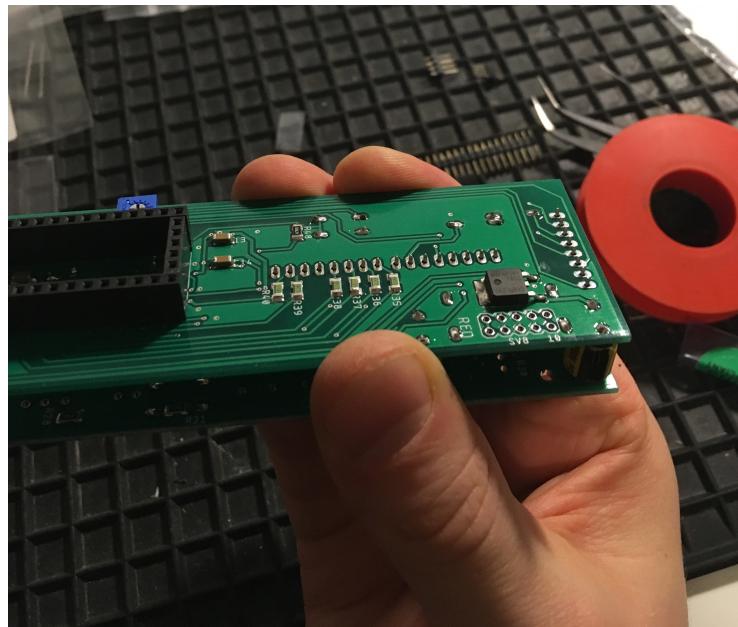


Figure 4: Then sandwich the boards together and hold them with your non soldering hand like so, and just trying to keep them as straight as possible

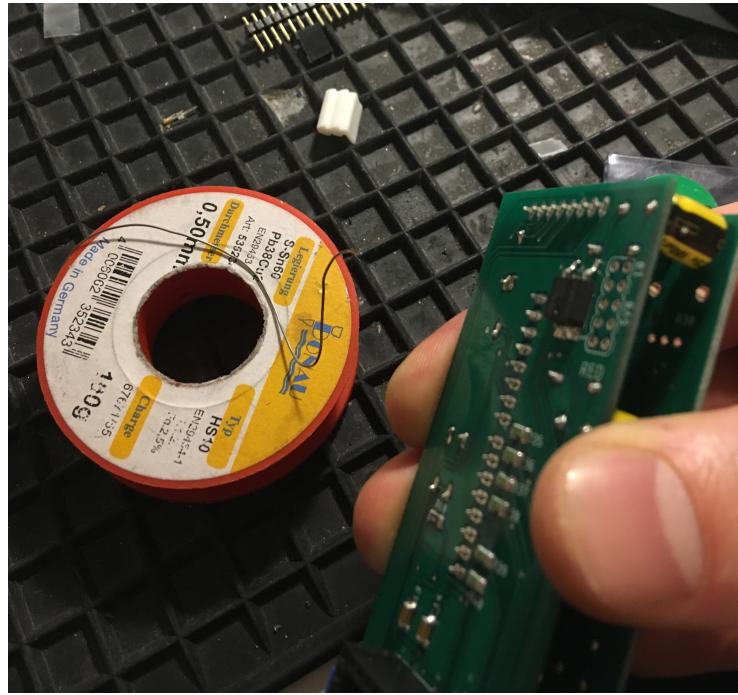


Figure 5: Now you bend the solder like shown and then you solder ONE pin on each header, on which PCB you solder one pin doesn't really matter, it's just to hold the headers in place

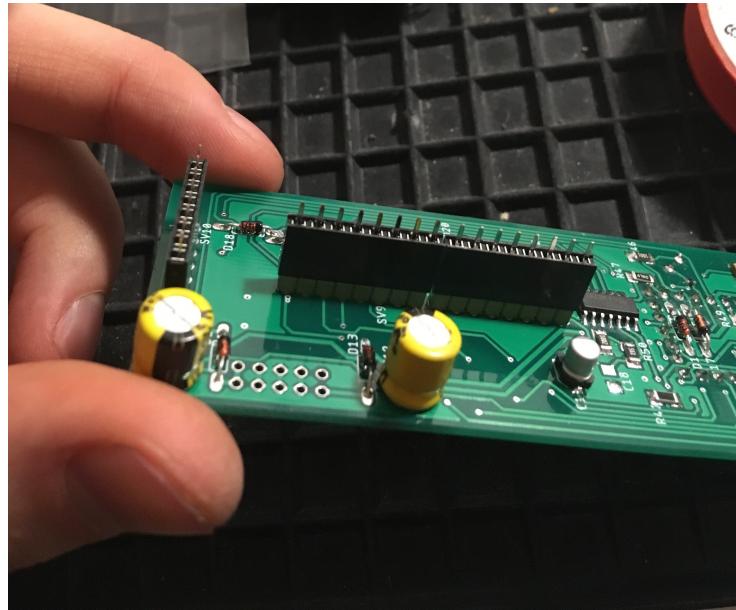


Figure 6: Now you take the loose PCB off the headers(the loose board that I have is the TOP board) and you solder all of the pins of one PCB

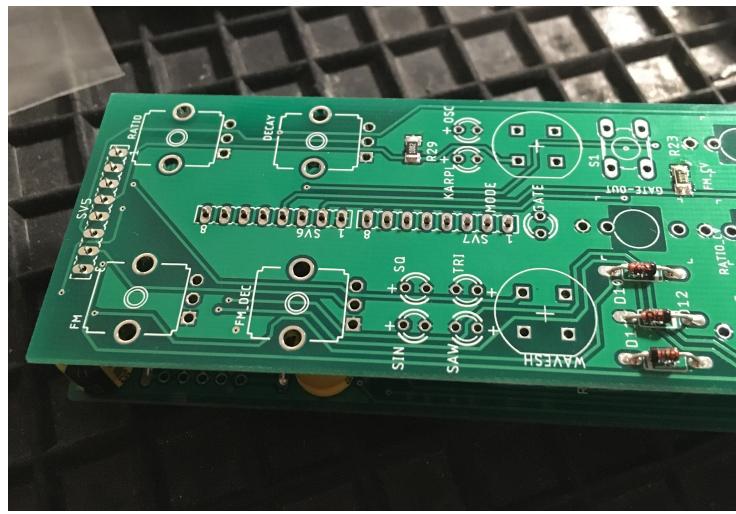


Figure 7: Then simply put the loose board back on the headers and solder all of those pins

## 2.5 Teensy soldering and cutting power trace

We do this the exact same way we did the previous header part.

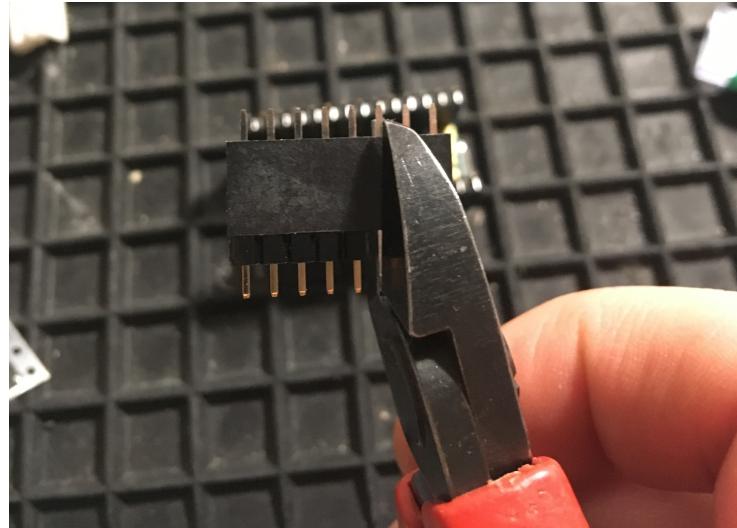


Figure 8: Cutting the female header to go with the middle part of the headers on the Teensy can be a pain in the ass, I recommend cutting it a bit farther away from the actual width you want

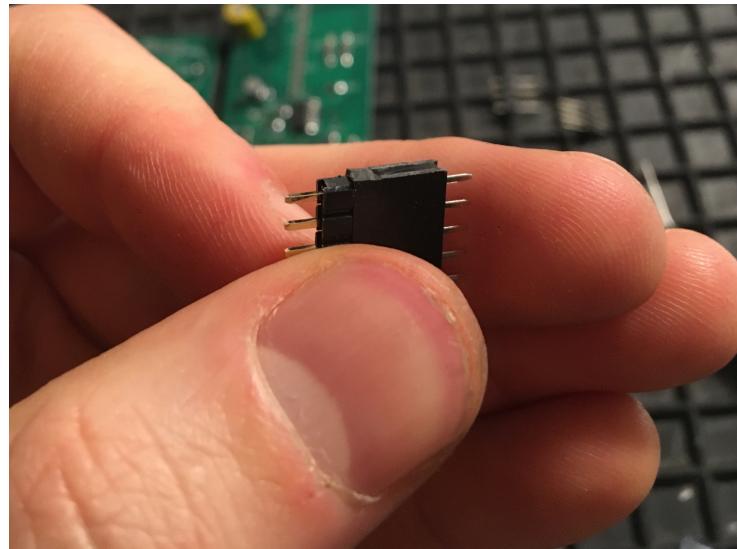


Figure 9: Then you just cut the sides of the female header with a pocket knife/exacto knife/whathaveyou until it's nice and even like shown

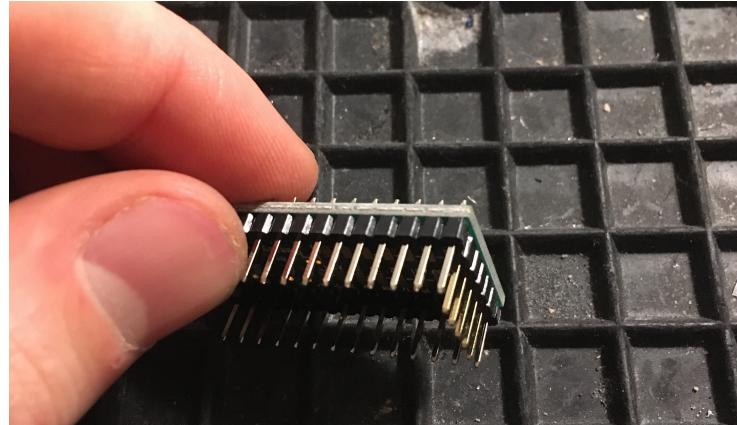


Figure 10: Put the male headers into the Teensy board and DON'T solder just yet

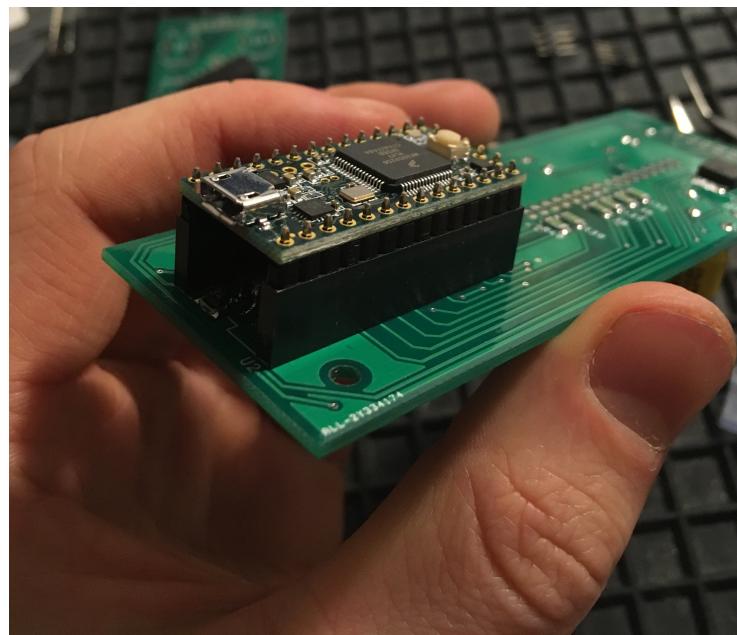


Figure 11: Plug the female headers into the male headers and put the Teensy on the BOTTOM PCB and solder the Teensy's male headers and the female headers.

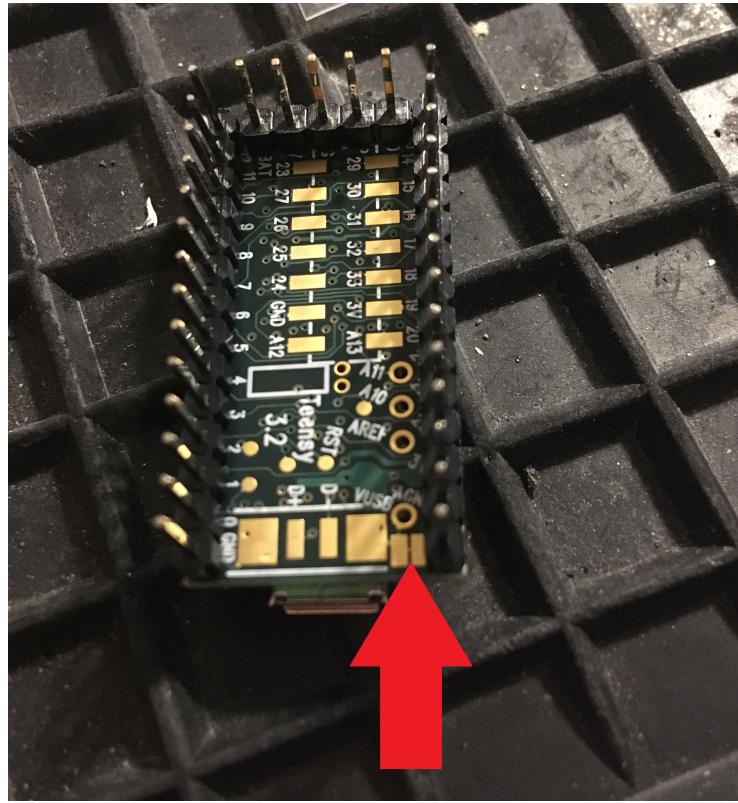


Figure 12: Now take it back out of its socket and cut this trace with a knife or anything, this is so that the USB socket will NOT power the Teensy. Only the Eurorack power will be able to power the Teensy board.

## 2.6 Jacks, LEDs, buttons and Potentiometers

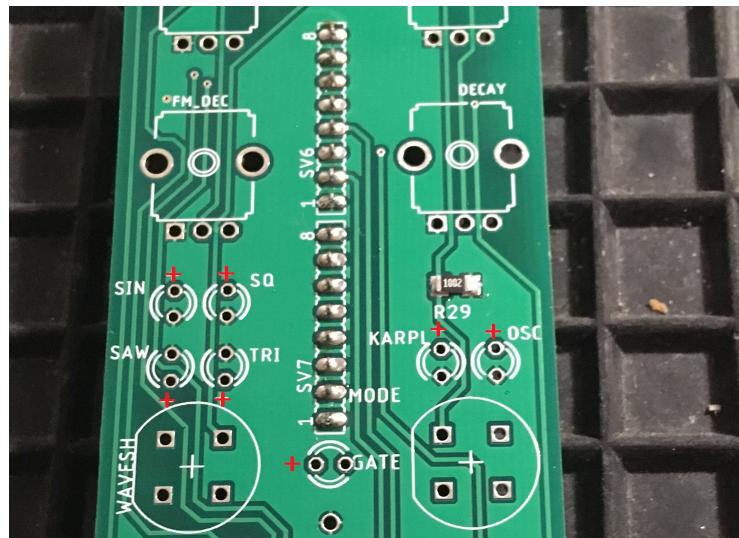


Figure 13: NOTE the polarity of the LEDs, the longer leg goes into the +



Figure 14: Put all of the switches, LEDs, jacks and potentiometers into their sockets and DON'T solder just yet



Figure 15: Now mount the panel on the module and then solder the potentiometers, jacks and the small black switch(you can solder the small black/yellow tactile switch whenever, it just snaps nicely into the board)

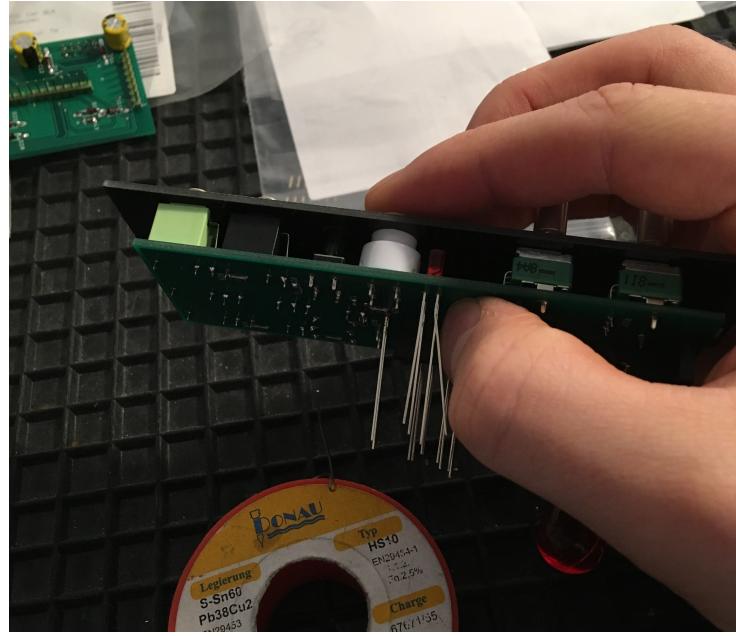


Figure 16: Now solder the white switches, best way to do this is to hold them in place with your finger and solder them in the same way as in figure 5

Now comes the trickiest part; the LEDs. It's hard to show this with pictures but what you do is to line them up as straight as you can. Best way is to solder one leg/joint, then heat up the solder joint and adjust each LED so it fits to the front panel nicely. I've included LED stand-offs in the Mouser cart, when I made this manual I sadly didn't have these stand-offs which would make it way easier to do this. I will update this in the next revision of the build manual.



Figure 17: Assuming you did everything correct you can just plug in the BOTTOM pcb, put the knobs on and you're done on the hardware side of things!

### 3 Uploading the program/Updating firmware

Uploading the program for the first time and updating the firmware is done the exact same way. Before you upload using the Arduino IDE you need to install a couple of libraries. The Teensyduino library/addon includes the MIDI library so you don't need to install that specifically, and if you already have it then that's fine also. Just use the Arduino IDE to install the other two libraries, it's super easy. The libraries are as follows:

- [Teensyduino for Arduino IDE](#)
- [Bounce2 library](#)
- [Responsive Analog Read](#)

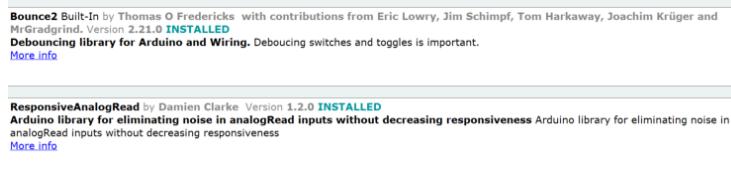


Figure 18: The libraries you need

So now the next step is to download the zip file called Polyg-Firmware.zip in the firmware folder on the [github page](#). (right click on the file and choose 'save linked content as') Extract it anywhere and click the Polyphonic-Teensy-FM.ino file to open the project.

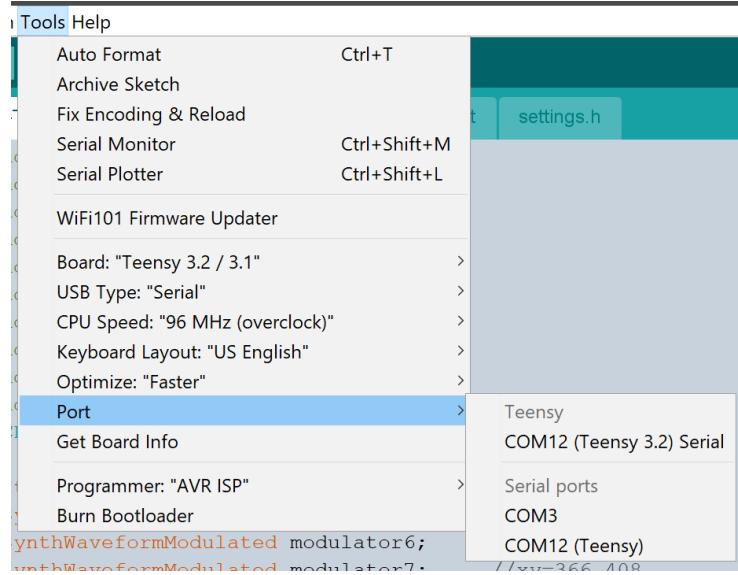


Figure 19: Before you do anything you need to adjust a couple of settings, the appropriate settings are shown here. The COM port will vary from my port number most likely, mine is COM12 in this case.

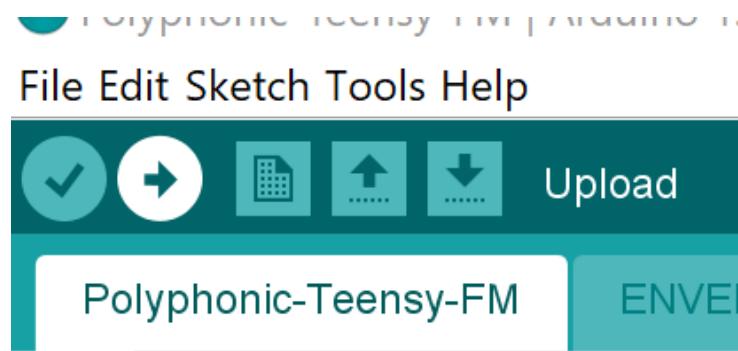


Figure 20: Now push the upload button

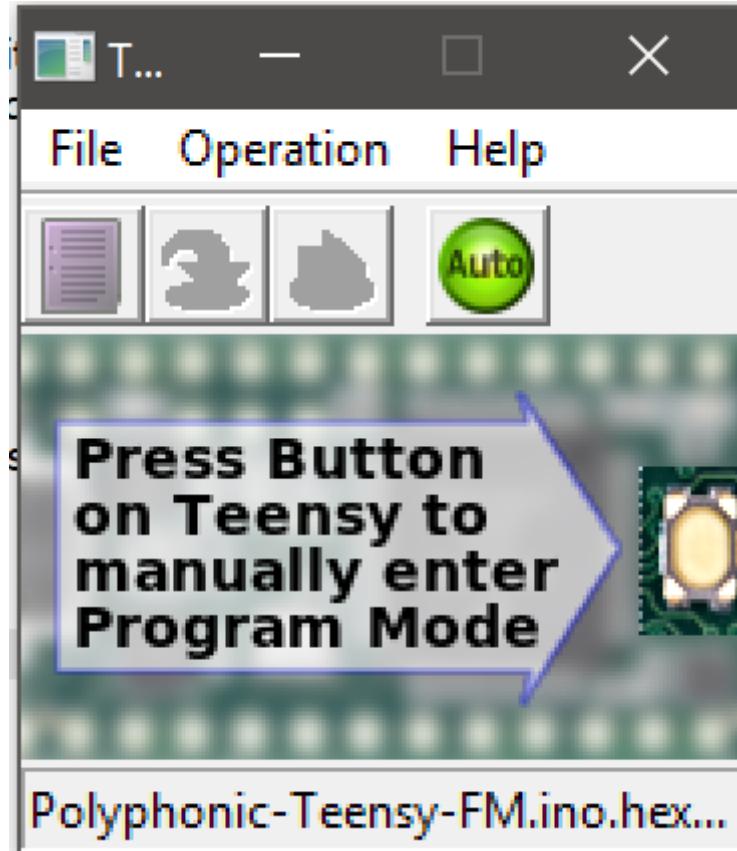


Figure 21: And when this window pops up you push the reset button as depicted in figure 22



Figure 22: Push this button to upload the program

## 4 Final adjustments

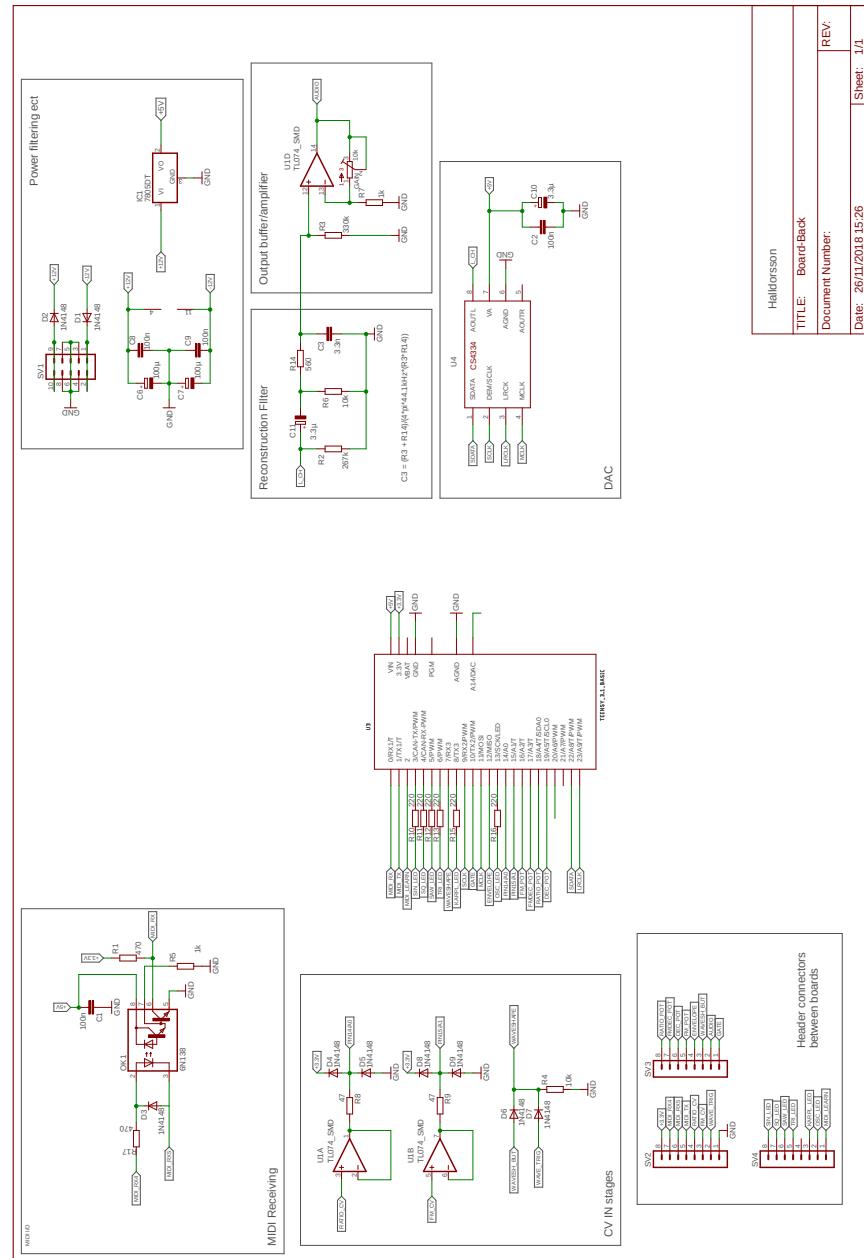
Ok so now you've got the firmware uploaded and you've plugged the bastard in and hopefully it works! Now you've got to adjust the GAIN trimmer on the back of the module. The best way to do this is to get a MIDI keyboard<sup>2</sup>, play 8 notes at the same time(hold them all) and then adjust until you've gotten rid of any kind of noticeable distortion, clockwise is adding gain and counterclockwise is reducing gain. I found it best to do this with the Sine waveshape. I should also note that the amplitude of the audio output WILL depend on how many notes you are playing since they are all added together, so if you only play one note it will sound quieter than when you play all 8 notes.

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<sup>2</sup>To set the MIDI channel of the module please refer to the user manual

## 5 Schematics

### 5.1 BOTTOM PCB schematic



## 5.2 TOP PCB schematic

