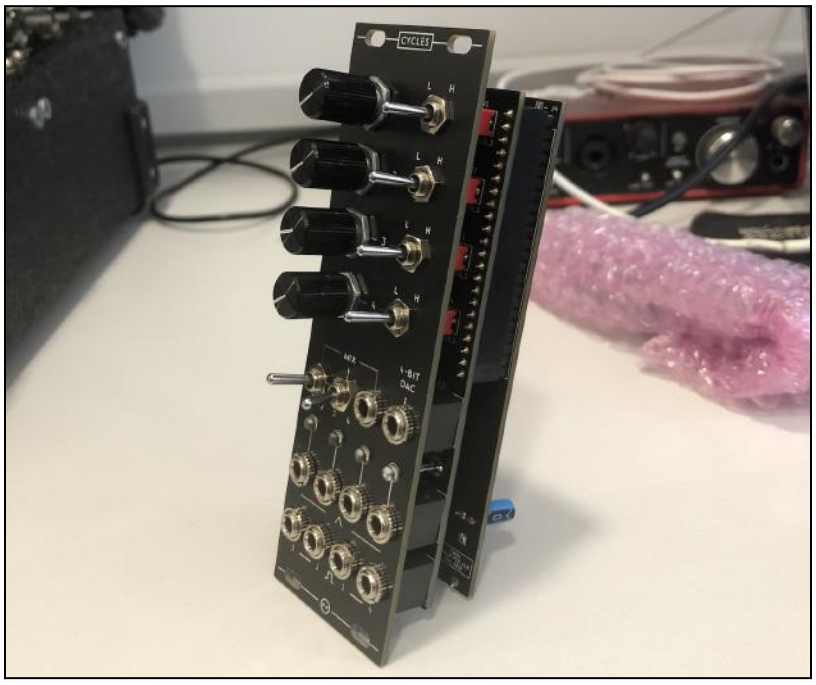


- Cycles

1 - Introduction

This build document aims to help you with the assembly of the Cycles module. It is of an intermediate difficulty and is not recommended as a very first build, make sure you understand and are confident with what you are doing as this is the best way to prevent errors.

The last section of this document talks about the capacitors responsible for the LFOs' frequency ranges. If this is not something you want to change, you can disregard that section completely. However, If this is of your interest (for a wider range, specific frequencies, etc.) please read through it before assembling the module, and make sure you understand what you are doing before doing it.

Soldering a module together is always a relaxing and gratifying moment when done properly, don't hesitate to take breaks when you feel you need to and double-check steps before progressing in your assembly.

Have fun! :)

2 - Requirements

To complete this build you need:

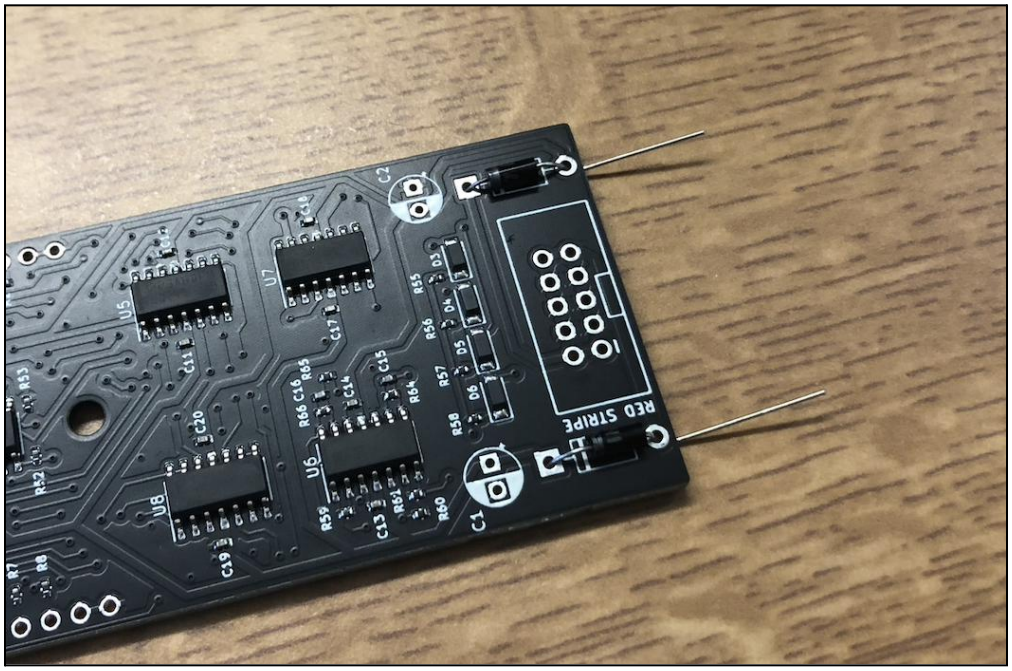
- A Soldering Iron and Solder
- Pliers and Side Cutters
- A Multimeter (optional but **extremely** recommended for testing continuity)
- Safety Glasses for assembly

Make sure you also take a look at the Bill of Material (BOM) to check whether you have all the required components to complete the build. The documentation of Cycles is on GitHub:

https://github.com/NOH-Modular

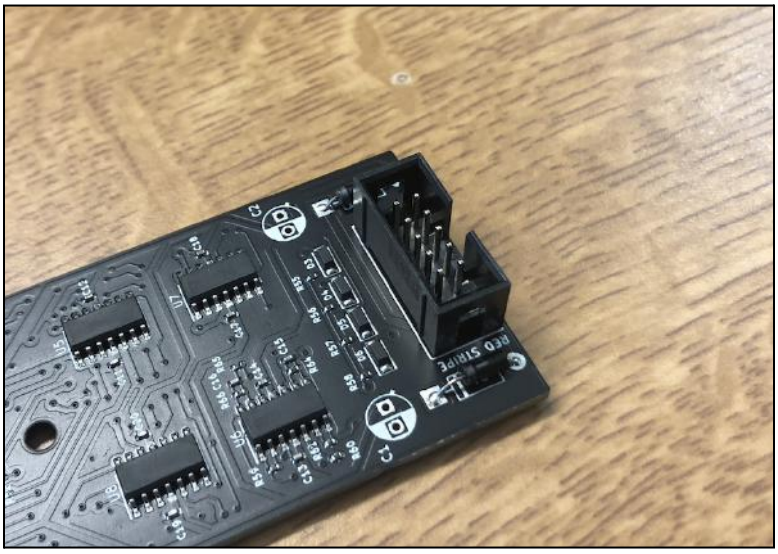
3 - Assembly Instructions

Take the circuit PCB. As this has surface-mount components, handle the board with great care and avoid touching the components with your fingers or with your soldering iron. Start by placing the diodes, check their polarity before soldering them in place, the white line on the diode should match the footprint:



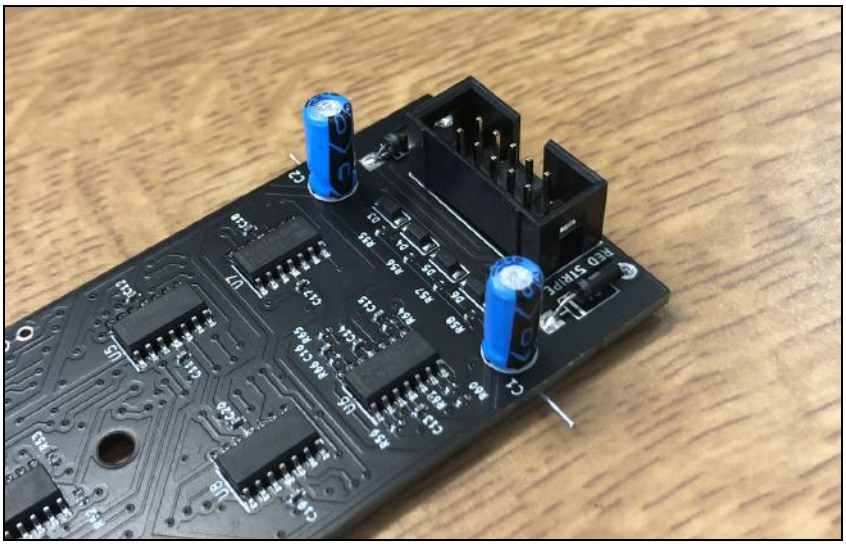
- Diodes

Now place the header, and double-check it is the right way around before soldering it in place (*See the photo below for reference*). You can start by only soldering two pins on either side of the header, check if it sits flat on the PCB, and solder the rest of the pins if it does:



- Header

Next, place the 10uF electrolytic capacitors. Again, mind the polarity of those components before soldering as it matters greatly. The white half of the footprint indicates the negative side of the capacitor (*See the photo below for reference*):



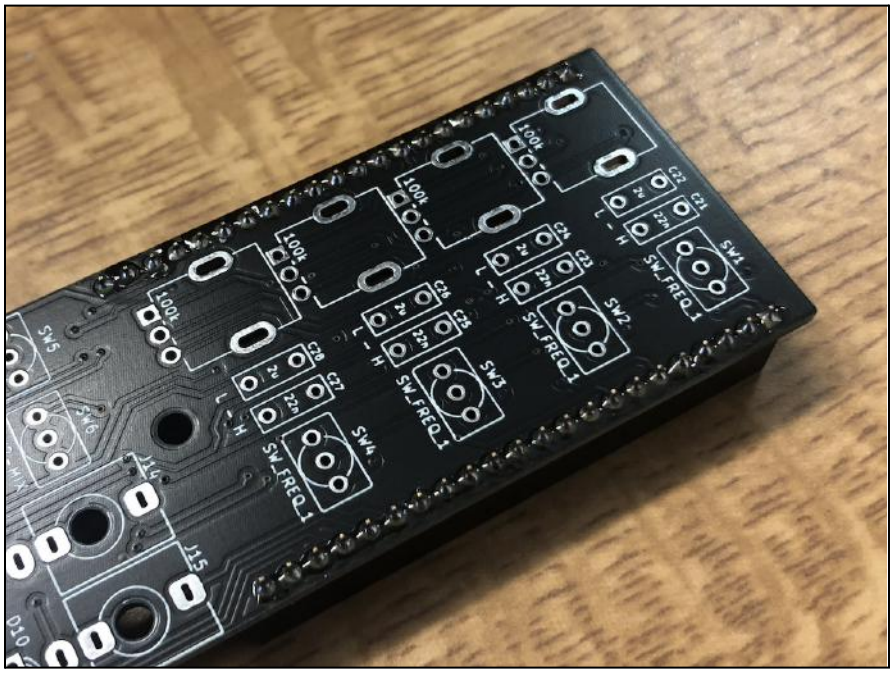
- Electrolytic Capacitors

Leave the male headers for later as you'll use the other PCB as a guide to easily get them aligned.

Now, take the hardware PCB and place female headers on the right side. If and only if you need to, cut some female headers with some side cutters to have the exact number of pins necessary. If you do cut down a female header, only use it if you are sure that you didn't break its pins. Below, you can see a cut-down 2-pin header placed next to a 20-pin header to cover all 22 holes:

- Right Side Header

Go through the same process for the left headers and make sure they are straight before soldering. You can start by soldering the pins on the edge of the headers, then check if all are still straight, sit flat on the PCB, and only solder the rest of the pins if they are:



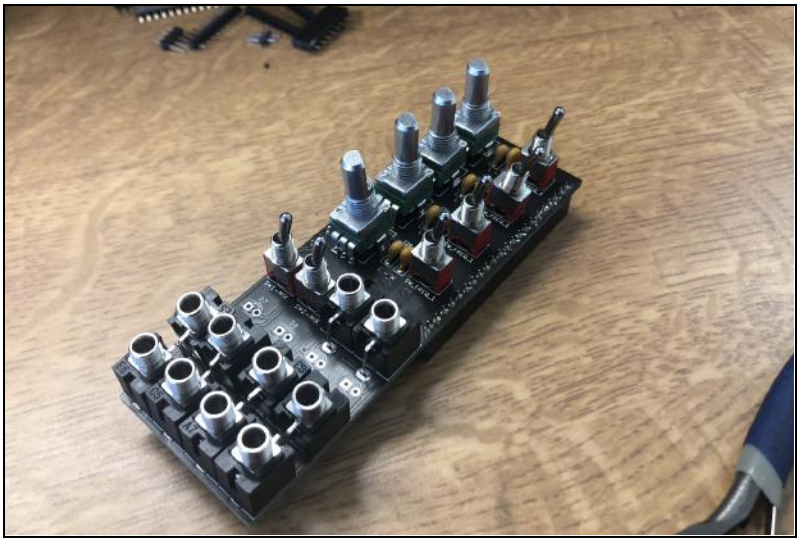
- Female Headers

Next, place the through-hole capacitors. These capacitors dictate the frequency range of the LFOs. If you want to modify the range, read through ***part 5*** of this Build Document before going further in the assembly process. If you do not mind the range, you can proceed with the 2uF and the 22nF capacitors, matching them with the indicated values on the footprints:

- Capacitors

You can now add all of the hardware components, but do not solder anything yet. Start with the B100K potentiometers. If you are struggling to fit them in place you can flatten the side-legs using some pliers. Next, place the jacks. The bottom ones will share a common hole with the ones right above them. Next, place the switches. The polarity does not matter but the Low-Profile switches are used for SW5 and SW6.

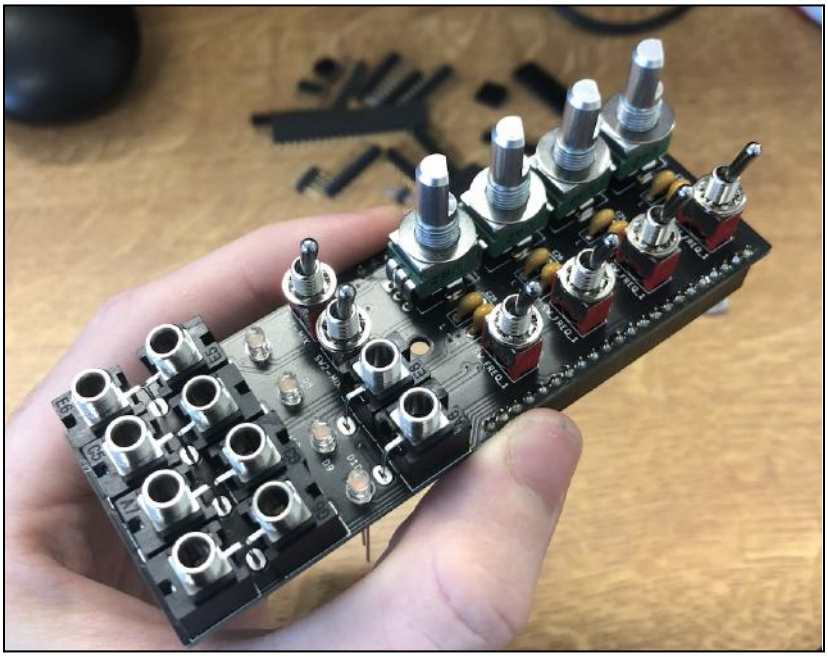
DO NOT SOLDER ANYTHING YET.



- Potentiometers, Jacks, and Switches

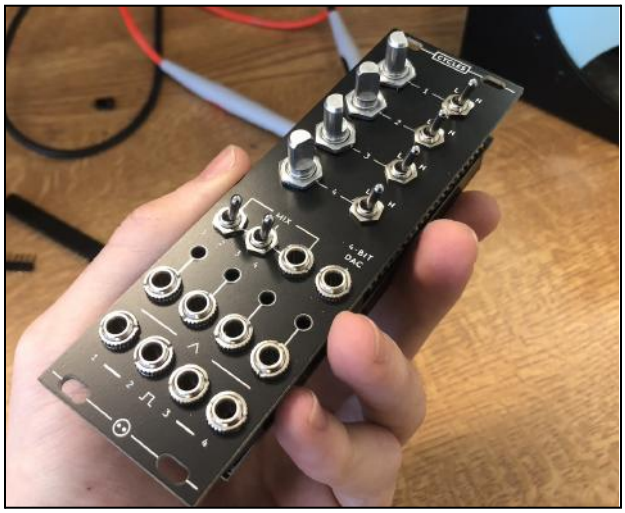
Finish by placing the LEDs, minding their polarity. The square pads on the PCB are where the short leg // flat side of the LED should go. Add washers to the switches and the pots so that they are at the same height with the jacks. Your PCB should look something like below.

DO NOT SOLDER ANYTHING YET.



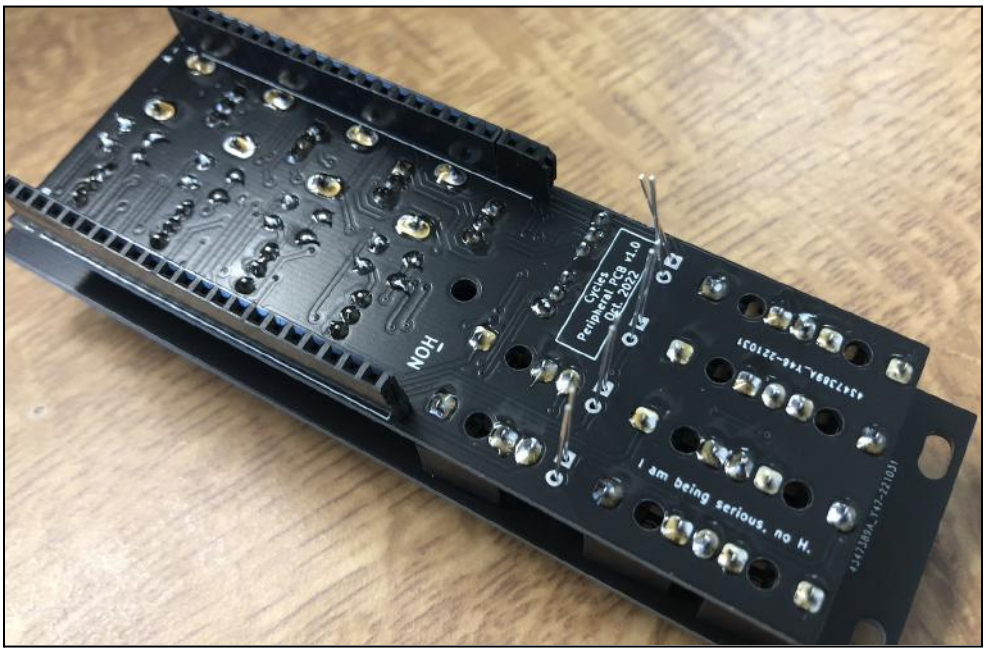
- LEDs and washers

Carefully place the front panel on top of everything and hand tighten the components with nuts. While you do this, check the backside of the PCB to make sure that all pins are still in their respective holes. Be careful when handling the PCB as nothing has been soldered yet, so components might disconnect from it.



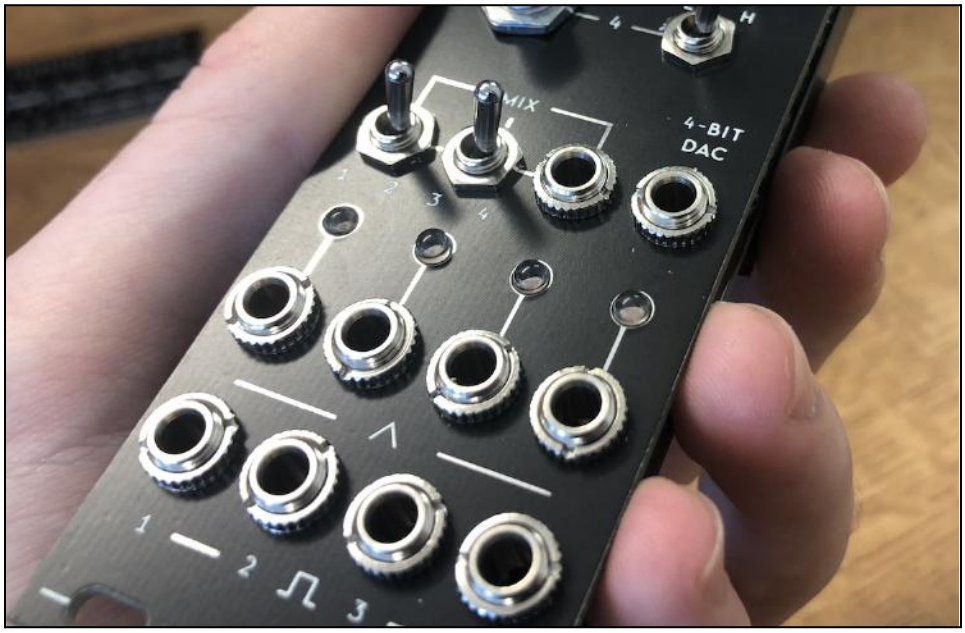
- Front Panel

Double and triple-check that the components sit flat on the PCB. You can now solder everything but the LEDs as they still need to fit in their holes. Be careful not to touch the headers with your soldering iron.



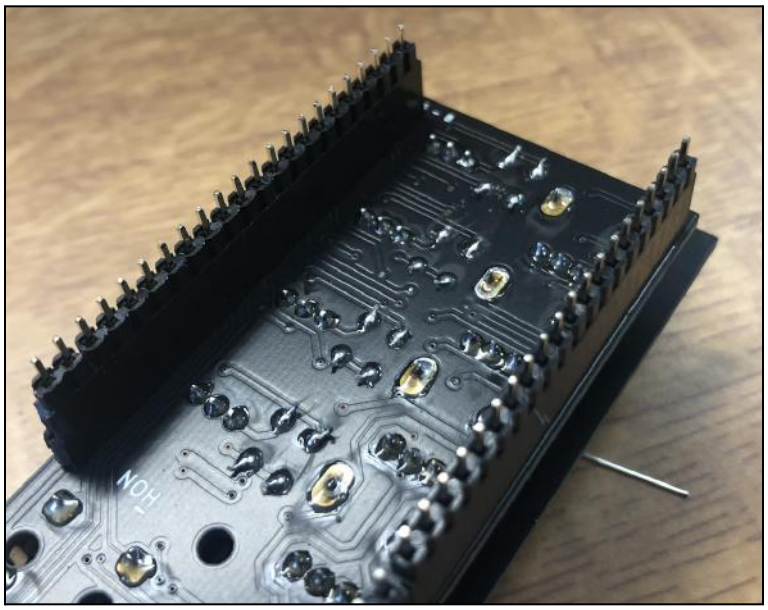
- Soldered Jacks, Potentiometers, and Switches

Turn the whole thing around and use the legs of the LEDs to guide them into their respective holes. After pushing far enough, you can solder them in place.



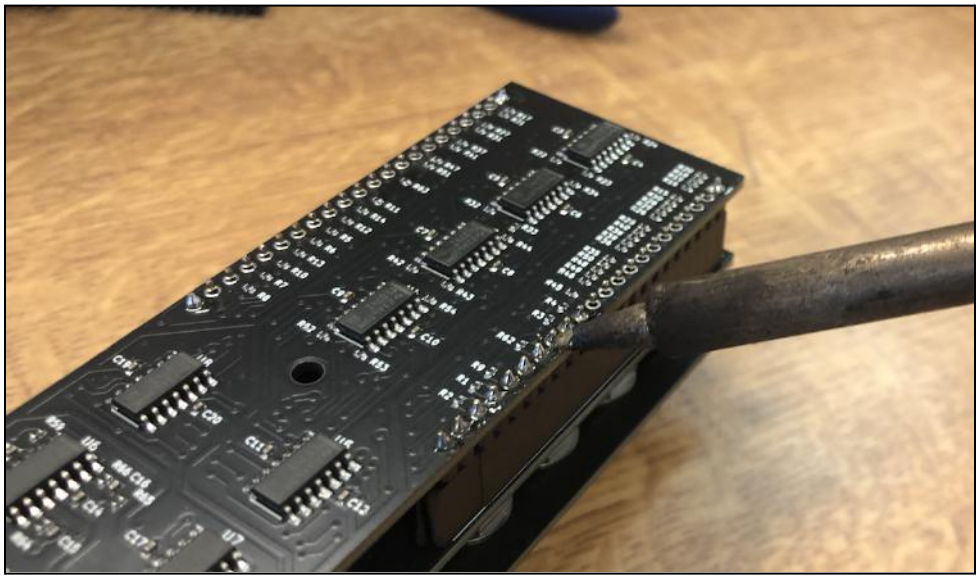
- LEDs

Next, insert the male headers in the female headers. You can cut some using side cutters to fit in the 22 holes, but again be sure not to use broken ones. Also, make sure it is the longer side of the male pins that you insert in the female ones (*See photo below for reference*).



- Male Headers with the smaller side of the pins sticking out

Carefully connect the circuit PCB by placing it on top. Make sure it sits flat on the headers before soldering. To ensure you don't break any components while soldering the pins, your soldering iron should never go above the PCB. The soldering tip should always touch the outer-side of the pins (*See the photo below for reference*).



- Good Way to Solder the Male Headers

4 - Final Checks

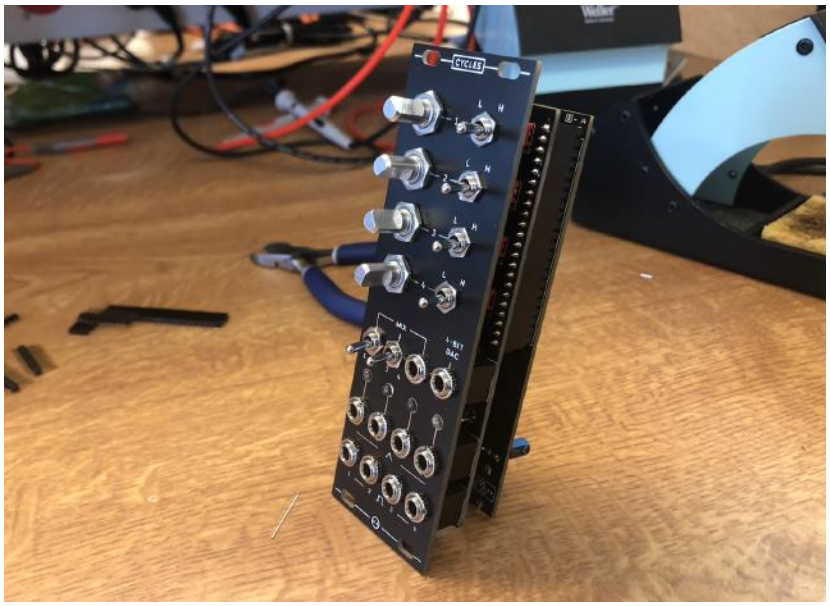
While the assembly might be finished, it is not a good idea to plug power through before inspecting the module.

- Start with a visual inspection, looking for any pins you forgot to solder, pins you soldered too much and shorted to other pins, or bad solder joints.

- Check the polarities of components where polarity matters (Power Header, Diodes, Electrolytic Capacitors, and LEDs).

- Look for any damage on the boards, specifically whether tracks got damaged.

- Finally, using a Multimeter, check for shorts between the power pins (12V to GND, 12V to -12V, and GND to -12V). If it beeps when it shouldn't beep, go back through your visual inspection.



- Finished Module

You can finalise your build by adding the knobs and adding a ribbon cable, making sure the red stripe matches the "RED STRIPE" indication on the PCB.

When powered up, you should see the LEDs flashing at the speed of the LFOs. If one LED is always bright, it might be because the LFO's frequency is either very high or very low.

Well done! I hope your build went smoothly :)

5 - Changing the Capacitors

This section aims to help you customise the module by changing the frequency range of each LFO. This means that you are not following the assembly guide and are taking the risk of breaking the module. If you are confident with what you are doing and aware that this is not part of the build, then proceed with some DIY goodness! The calculations and results were done using Multilayer ceramic capacitors, other types might not work.

On the hardware PCB, There are two capacitors and a switch labelled “L” and “H” per LFO. What the switch does is feed either of the two capacitors to the LFO circuit, meaning that you can switch between two frequency ranges. To calculate one of the two ranges based on the capacitor’s value, you have the following equations:

$$\bullet\ Minimum = \frac{1}{40\,000\,000 * C}\ [Hz] \qquad \bullet\ Maximum = \frac{1}{400\,000 * C}\ [Hz]$$

If you want to know how long it would take to loop in seconds (for slow LFOs), simply take the inverse of your result. Below is an example using a 1uF capacitor:

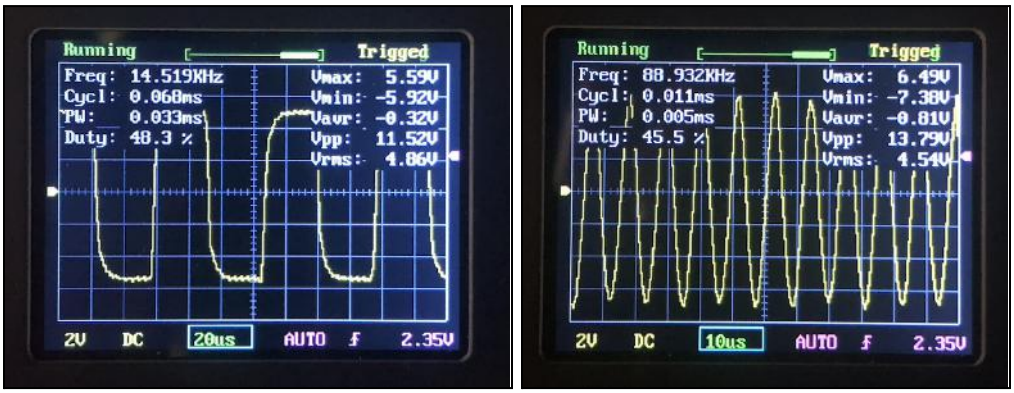
$$\bullet\ Minimum = \frac{1}{40\,000\,000 * (1 * 10^{-6})} = 0.025\ [Hz] = 40\ [seconds]$$

$$\bullet\ Maximum = \frac{1}{400\,000 * (1 * 10^{-6})} = 2.5\ [Hz]$$

Measurements show that the range isn't exact due to the tolerance of the components and the circuit, specifically the minimum value which can sometimes be halved (more range!).

There is a limit to how high or how low you can push these values.

- The LFO can go to values as low as at least 3min, but the LFO will become less and less precise in shape lower than this value, or simply not work.
- The LFO can go up to at least 90kHz. However, the square//triangle waves will lose their sharp edges more and more starting at around 10kHz (which is still at audio rates).



- Square wave at 15kHz (Left) and Triangle wave at 90kHz (Right)