TB-Valhalla v1.2 (Black Panel) - Build Guide

This document details the general build procedure and wiring guide to complete the v1.0 (pre-production) version of the GeoSync TB-Valhalla desktop semi-modular synth.

The procedure to build all the GeoSync desktops is much the same, what changes is which modules are needed and the wiring of the “fixed signal paths”. This allows you to use the synth with just a CV and GATE input on the right hand side without the need for any patch cables.

The outline procedure is :

1. Build and test all the individual modules as per the appropriate build guides for said module available from http://www.geosyncsynth.com/documentation/
2. Build the PSU, mixer and mult modules (as described here)
3. Prepare the Hammond case for the PSU and mixer modules (requires some drilling and filing of the case)
4. Wire the power, ground and fixed signal paths.

We hope you enjoy your TB-Valhalla and are happy to help answer any questions or troubleshoot any issues – contact us via the contact form on the website : https://geosyncsynth.com/contact-us/

Modules Included

The GeoSync desktop synths employ a modular approach internally, that is, they are built using the same parts as the Eurorack modules themselves. This allows for simple R&D and multiple different combinations of end product.

The TB-Valhalla v1.2 was the first '303' like desktop, however after testing and end user beta feedback the VCA and envelope sections are not strictly necessary as the EFA filter module includes its own VCA and envelope – however these modules do add to the flexibility and options for further integration with a Eurorack system. This lead to a revised TB-Valhalla v2 – the first official production version.

Numbers of this v1.2 are limited and will not be re-manufactured when initial beta stocks are exhausted.

The TB-Valhalla v1.2 kit includes all the PCBs, and all rare parts needed to complete the build, however there is a standard BOM for the commonly available parts. The builder will also need to source a Hammond metal enclosure (mouser part number in the bom) and a suitable 12v AC/AC power brick – **note this is important the PSU requires a 12v AC output signal.** **DO NOT** use a DC brick!

To complete the TB-Valhalla v1.2 you will need to source the equivalent parts from the BOM's for :

- 2x TB-O partial kits
- 1x TB-EFA partial kit
- 1x GS1-A partial kit
- 2x GS1-E partial kits

The PSU, Mixer and mult pcbs also have a parts list, and the documentation on the website provides details of the additional parts as well as a summation of all parts needed in one list (so you don't need to go and merge all the individual BOMs!)

To be clear, if you order the parts in the "ALL PARTS TO ORDER" section of the BOM you will have everything you need.

Step 1 – Build and test the modules.

Follow the build guide and BOM for each of the modules in your desktop. I suggest you build, test and calibrate the function of each one individually to ensure simple integration.

When building the "control boards" use the panel as the template to mount the pots, jacks, switches and LEDs before you solder them in place. This way everything will line up nicely when it comes to final assembly.

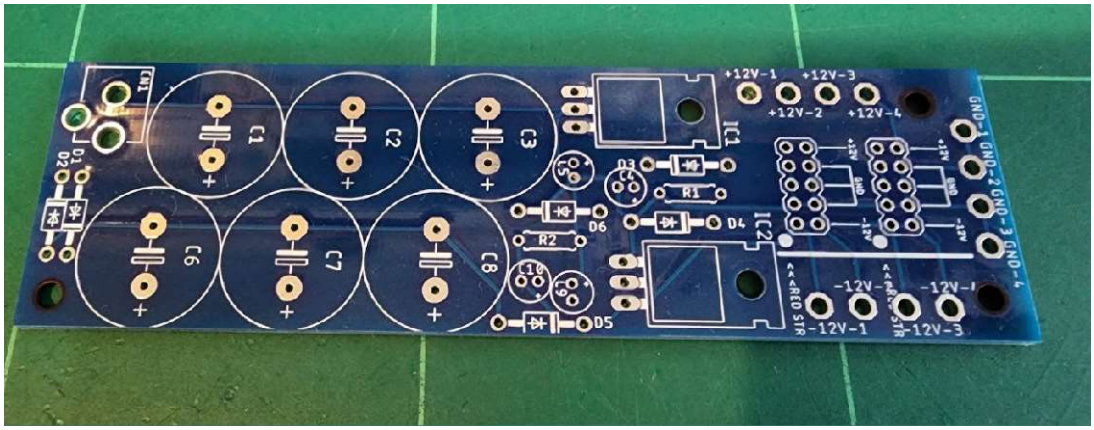
Step 2 – Build the PSU, Mixer and Mults

Building the PSU

The PSU is a simple power buffer, voltage regulator and output design. This design comes courtesy of AI Synthesis – many thanks for permission to re-use the design - as it is a small compact easy to build PCB that provides smooth power to the desktop system. The PSU is rated to around 1A of power – in testing no issues with power supply or heat from the regulators has been seen, you can of course add heatsinks to the regulators if you wish, but the system doesn't pull anywhere near 1A on either rail.

[AI Synthesis PSU : https://aisynthesis.com/product/eurorack-power-supply/]

Follow normal build ordering :

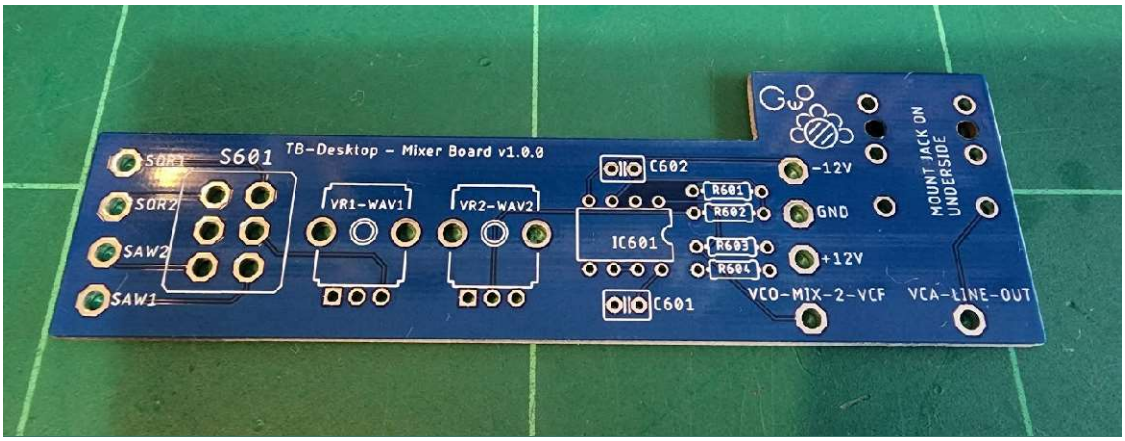


1. Add the two 2.4K resistors
2. Add the six 1N4004 diodes – ensure correct orientation
3. Add the two voltage regulators, make sure you get them in the right places, IC1 is the 7812 and IC2 the 7912 – I usually bend them at about 30 degrees to the PCB, so not completely flat against the PCB. This lets air flow all around the inbuilt heatsinks. You can of course add additional (small) finned heatsinks if you like but it is not necessary.
4. Add the four 1uf electrolytic capacitors.

5. Add the “DC style” power connector (CN1) – try and get it so the outer end is parallel with the PCB – it should overhang the PCB.
6. Add the six large 3300uF electrolytic capacitors. These should be no taller than ~20mm – see the part number in the BOM.
7. Before you add the euro power headers you can test the supply voltage.
    a. With your multimeter, probe between one of the GND pins along the right hand side edge and check the -12 and +12 outputs either in the euro connector pins themselves, or the breakout pads along the top and bottom of the PCB.
    b. You won’t get exactly 12v readings, but as long as its +/- 0.2v or so then all is good.
8. Add the two 10pin shrowded headers to the board.

Building the Mixer

The mixer provides a simple way to hard wire the signals from either the two VCO square or the two saw waves into the filter input – via individual gain controls.



1. Add the 4x 10K resistors
2. Add the TL072 and its power rail MLCC capacitors.
3. Add the two B10K tall trimmer pots, the dual toggle switch.
4. Turn the board over and add the ¼” jack to the underside of the board.

Building the Mult board

Really not rocket science this one… simply add the 8 jacks and solder. For space reasons you need to bend the ground pin to the side and it doesn’t matter if the ground pins touch each other.

To get the jacks all aligned correctly you may want to insert the jacks, attack them to the panel with a few jack nuts and then solder them, this way its nicely aligned with the holes in the panel. Usual euro process etc.

Breakout pads

You will have noticed on each of these three PCBs there are various breakout pads. When it comes to final assembly we will for example be providing power to the Mixer board via wires connecting the -12v, GND and +12v to one each of the relevant pads on the PSU board.

The mult board has pads to send the CV and gate (and get GND from the PSU) and the mixer has inputs and outputs to the various modules. Details are provided in the “Wiring it all up” section.

Preparing the Hammond Case

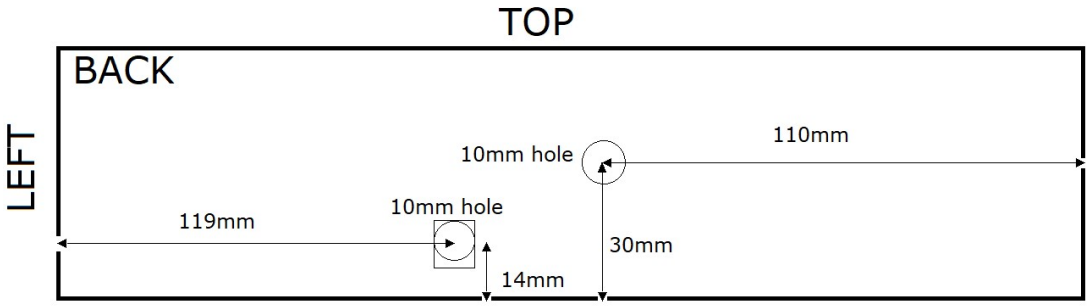
The case needs a few holes drilled and trimmed for :

- The power input
- The audio ¼" jack output
- Mounting holes for the PSU PCB.

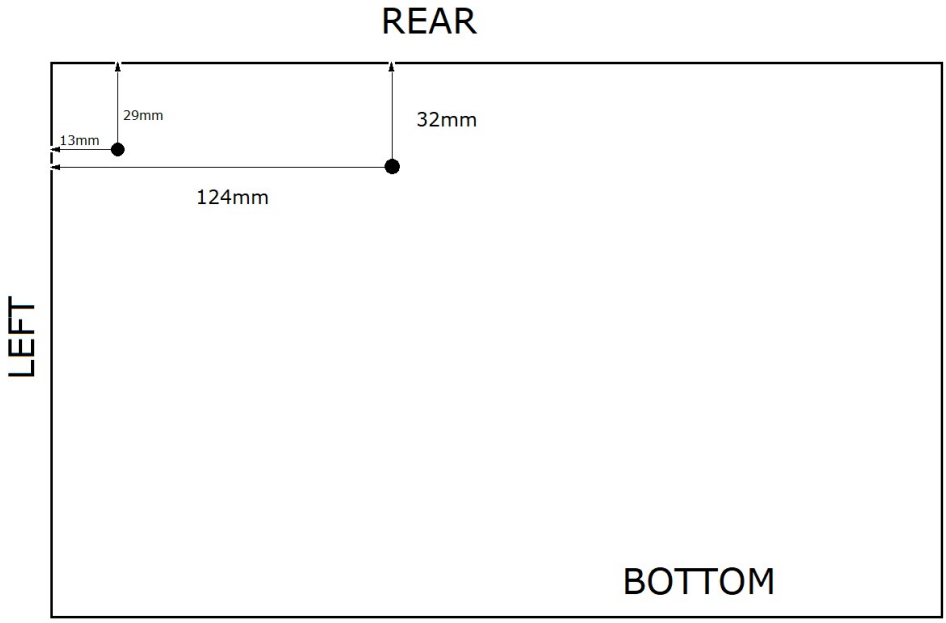
The power input is a pain, as it's a rectangle. I usually drill a 10mm hole (as shown dimensions are from the edge of the case to the center of the hole. Then use a small file to square off and turn into a rectangle. If you have a Dremel or such, then life is easier.

The audio jack is just a 10mm hole. The mounting holes for the PSU standoffs are 3.5mm.

The dimensions are shown for the rear of the Hammond case :



And the underside for the PSU standoff holes :



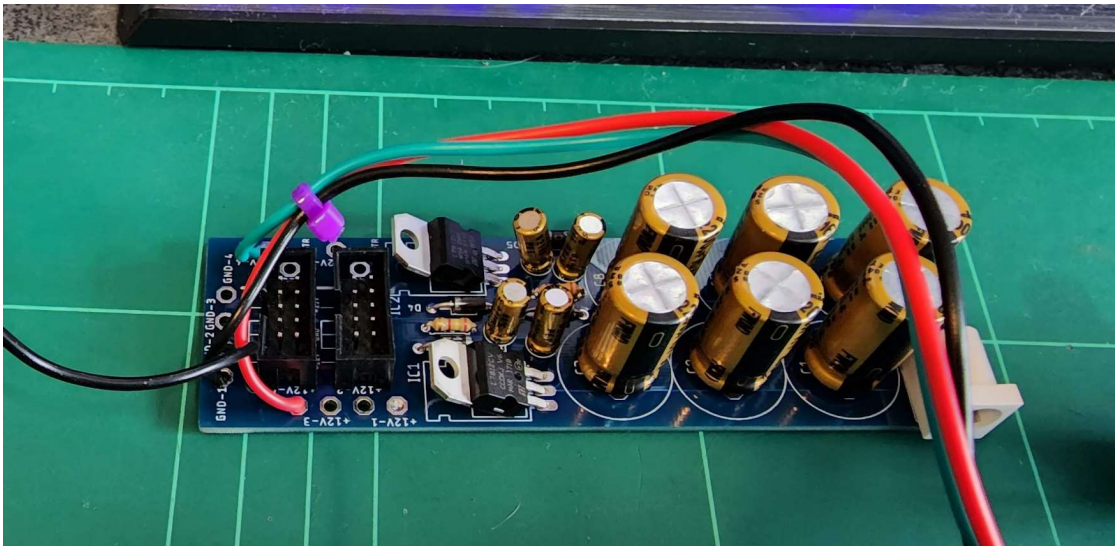
Wiring it all up!

The table below summarises the connections that need to be made and the **approximate** length of hookup wire needed. Basically all the routing lines shown on the panel itself need to be wired.

PSU +12v	MIXER +12v	20cm	
PSU -12v	MIXER -12v	20cm	
PSU GND	MIXER GND	20cm	
PSU GND	MULT GND	14cm	
MULT CV	VCO1 CV	30cm	
MULT CV	VCO2 CV	28cm	
MULT GATE	VCF GATE	24cm	
MULT GATE	ENV1 GATE	12cm	Wire both env to one gate pad on the Mult
MULT GATE	ENV2 GATE	12cm	
MIXER SQR1	VCO1 SQR	18cm	
MIXER SQR2	VCO2 SQR	18cm	
MIXER SAW1	VCO1 SAW	18cm	
MIXER SAW2	VCO2 SAW	18cm	
MIXER MIX-2-VCF	VCF-IN	20cm	
MIXER VCA-LINE-OUT	VCA-LINE-OUT	20cm	
VCF OUT	VCA IN-1	11cm	
ENV1 OUT	VCA MOD-IN-1	7cm	

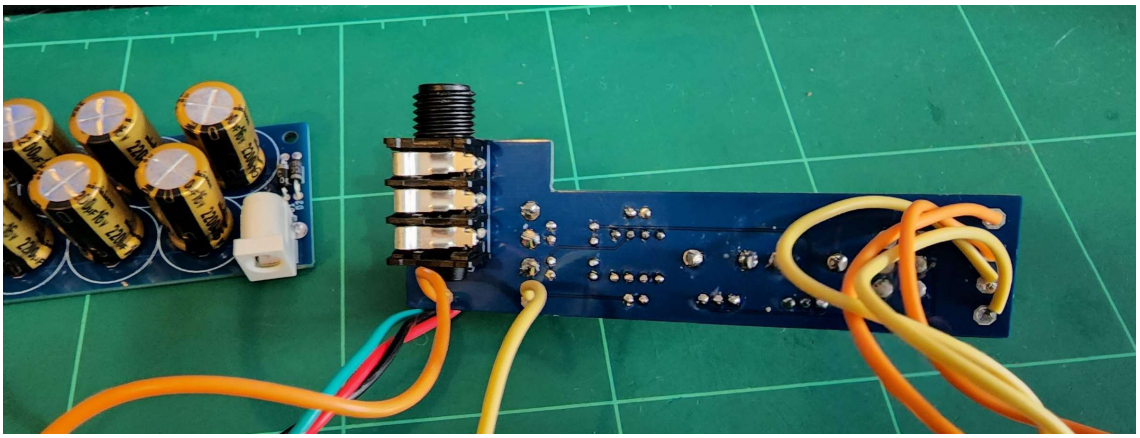
Suggested ordering :

Start by wiring the PSU and Mixer connections together, blue in table. Add the GND for the Mult, but only connect to the PSU end.



Add all the connections to the MULT board, but only connect at the MULT for now, leave the other ends dangling. Using different colours for the CV and GATE can help! Or label them!

Add all the connections to the MIXER board, but again only connect at the mixer end. Again use different colours for SQR, SAW, MIX-2 and LINE-OUT.

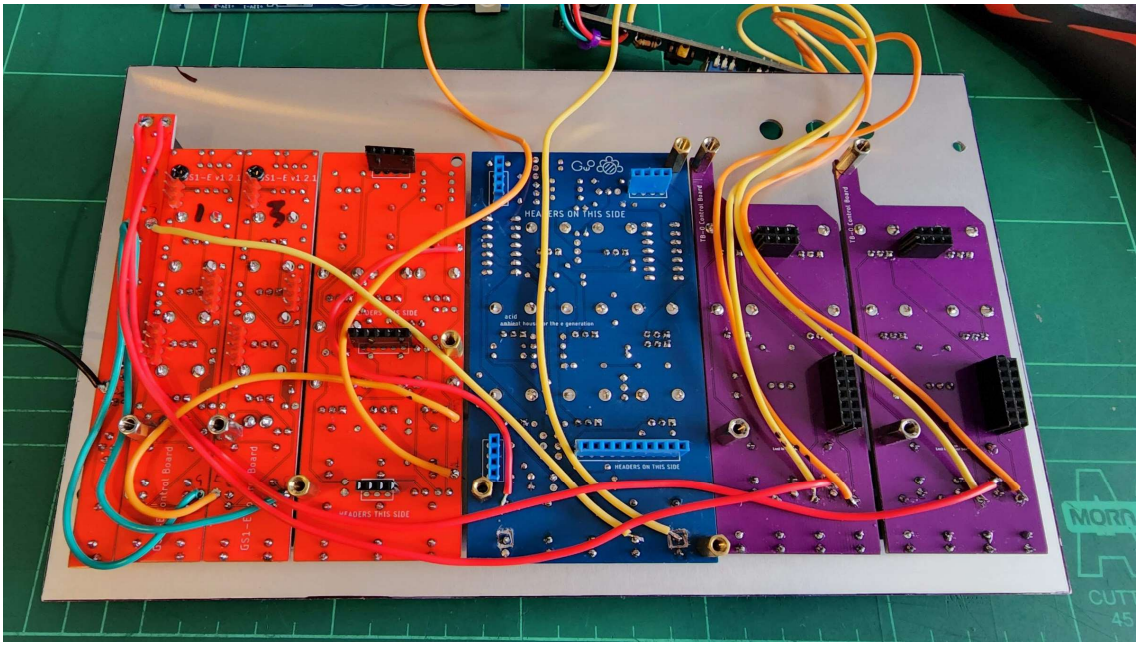


Mount the modules to the panel :

As all the wires need to be soldered to the “control boards” of each module. Unscrew all the “voice boards” so you just have the control boards (the ones with all the pots an jacks)

Carefully attach each control board to the appropriate place on the panel. Secure with at least one pot nut, and a couple of jack nuts. Add the mult board also to the panel. For the envelopes, add the 3mm screw that holds the top of the board to the panel.

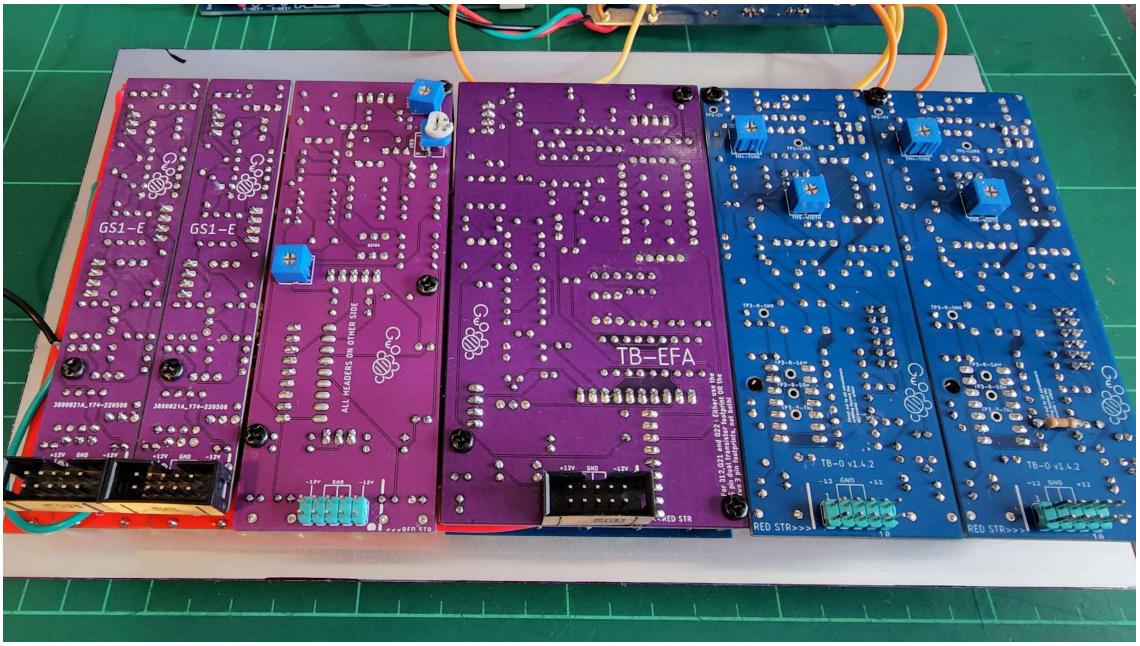
PLEASE NOTE: ***These pictures show pre-production PCBs – the final ones (red) have the breakout pads for all the connections, where on the blue and purple contol boards the wires are connected directly to the switch pin on the jacks – use for reference, but remember to connect to the breakout pads on the red PCBs you will have. (Also note the two TB-O in this prototype have the euro power connectors reversed from what you will have – so don't worry about that!)***



Now that they are all in place you can easily connect all the wires from the mixer and mult boards. Don't forget to solder the GND wire from the PSU to the mult board.

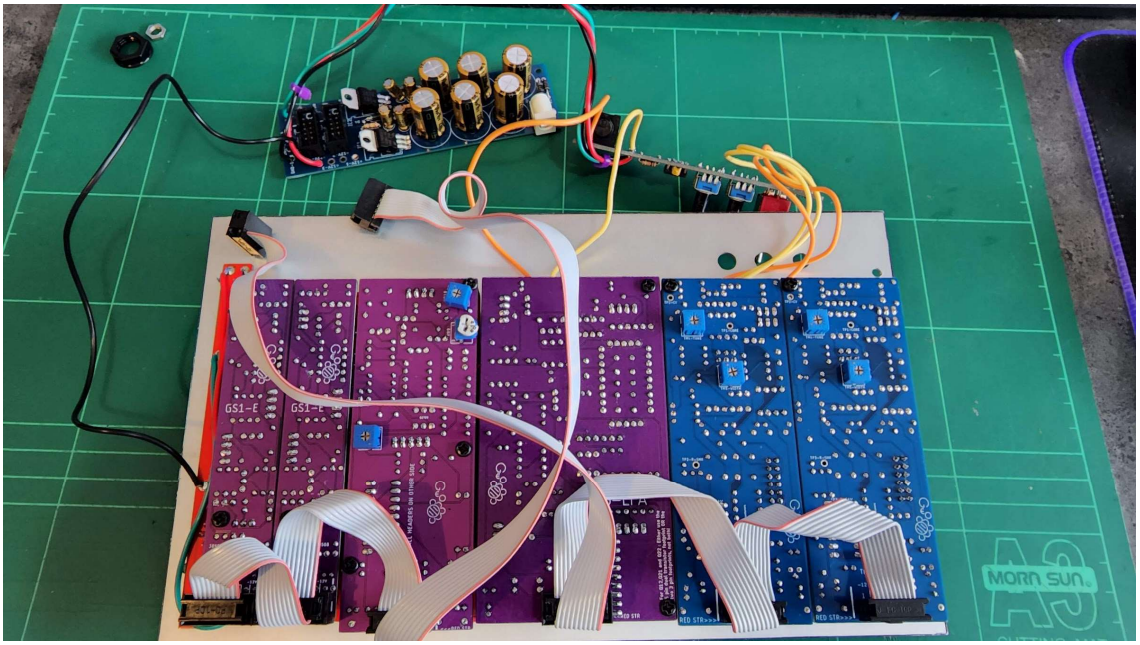
Then add the "internal" ones, so the VCF OUT to VCA IN and ENV1 OUT to VCA MOD IN.

Place all the "voice boards" back onto their respective "control boards" and screw them to the standoffs to "rebuild" the modules.



You should now have the panel with all the modules connected and wired, and the Mixer and PSU boards dangling from their various wires.

Add the eurorack power distribution cables to the modules and flatten the cables to keep them tidy as they daisy chain to the modules. Leave the other end free, these will connect to the two PSU eurorack headers.



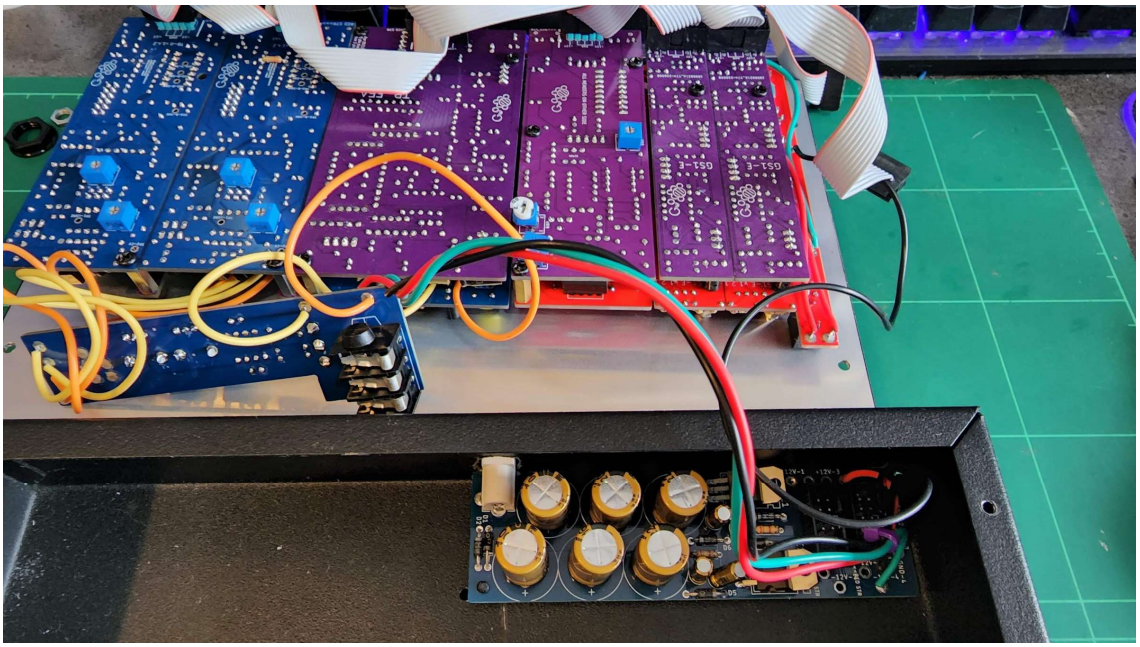
Mounting the PSU and Mixer boards

You should now be able to mount the PSU and Mixer boards to the case/panel. Be careful not to scratch the panel while doing this, it's the most fiddly part.

Mounting the PSU.

Having tested the hole all line up for the standoff and power input in the case. Use a 10mm long plastic 3mm bolt (in kit) and push through the case from the bottom. Secure these two with a plastic nut.

Bring the panel to the case as if it were going on the top, but flip it behind the case to sit upside down and you should have enough give in the cables to mount the PSU into the bottom of the case. Mount the PSU board over the bolts and secure with another plastic nut. (provided in the kit) Make sure the "DC" connector fits nicely into the hole on the rear panel.



Mounting the Mixer.

The mixer can then be attached to the rear via the ¼” jack and secured (loosely for now) with the plastic jack nut.

Bring the panel to the top of the case, connect the two eurorack power cables to the PSU and carefully push the mixer board into place, the two gain pots through their holes and the toggle switch through its hole and use the switch nut to secure it to the panel. **You only want to get the nut onto the start of thread** – this may involve wiggling the mixer board up a little so you can get the switch toggle through the hole – we can tighten the ¼” jack nut and toggle switch nut later.

Now that its connected you should be able to carefully lower the whole panel into the case, making sure you don't crush or crimp any of the wires as you do so, and finally you can tighten the mixer board nuts into place.

Before going any further you may want to do a quick power on test. You can power up and check the two gate manual triggers cause the LED to flash as a simple way to check power is flowing. Of course you can connect a CV and gate and take the output from the VCA euro out and check its all functioning.

Once you are happy, screw the panel via the four screws along the sides and add all the other pot, jack and switch nuts and add your pot knobs.

Using the synth

All those tedious wires mean the synth is “ready to go” when you power it up. There is a fixed signal path as per the various connection lines (dotted/dashed etc) on the panel.

The minimum you need is a CV and Gate input, and one of the two outputs, euro level (from the VCA) or ¼” line level from the rear.

The VCF needs a gate to trigger its internal VCA, so you do need both CV and Gate.

No sound, make sure you have the “Drive” on the VCF up, the Input level on the VCA IN1, the modulation in 1 on the VCF turned up and the mixer VCO1/2 Gain controls up. Envelope 1 will need to have some length of envelope to trigger the VCA also.

As all the hard wired paths use the “switch” pin on the jacks, you can bypass any of the hard wired signal flow by inserting a cable to that jack.

For more detailed info on each module, see the build guides and product pages on the website.

ENJOY!