prophet-5 REV -1

Installation Manual

V1.01 6 May 2022

Please don't print this document.

Warning

Great care has been taken throughout the design, manufacturing and rigorous testing of this REV -1 modification kit for the Prophet-5 Rev 3 to guarantee trouble-free operation for many years to come and it has been designed so that installation is very straight-forward[1] and requires no changes to the Prophet's own electronics.

However, the instruments in which it goes are all four decades old and are complex behemoths full of hard to find and expensive parts which often have reliability issues. Experience has taught us that they can be quite temperamental when working on them and thus challenging to repair. So, it is highly recommended that you have the installation done by an experienced synth technician who knows Prophet-5's inside-out. Please note that Prophet repair lessons are not part of the kit!

At least read through this document completely to ascertain for yourself that you are able to do this installation before starting.

Preparation

First, we suggest addressing some known reliability issues and making sure your Prophet is working perfectly before installation.

1: If it still has the stock PSU: have it replaced because it was already broken by design - it runs too hot, and is a serious liability as it has no overvoltage protection whatsoever. If the power supply fails, it can take the whole Prophet down with it. We highly recommend[2] Stefan Huebner's replacement ProPSU. It comes with full protection and a new toroidal transformer that doesn't hum and leaks a lot less mains harmonics to the audio output. It can be found here:

https://techsmechsvintagesynth.com/home/propsu-prophet-5-power-supply-replacement-kit.html

2: If it still has the original tantalum capacitors[3] on the voltage rails, replace them also. There is no need to replace the ones in the audio path.

3: Do a full calibration as per the service manual. Any unnoticed issues with your Prophet will pop up and you'll be happier having them fixed before installing the REV -1.

[1] So much that legendary synth tech Kent Spong called it the most elegant mod he's ever seen in that regard.
[2] We've recently seen other solutions for the overheating problem that replace the linear 5V regulator with a switching one that runs cooler, but advise against those as they share the same transformer windings with the regulators for the analog +/- 15V supplies who's filtering at the switching frequencies is non-existent and they offer none of the much needed protection.
[3] These old capacitors suffer from field crystallization when not being used; however they are also capable of self-healing by simply running a limited current through them. Key word is 'limited' here. The ones on the voltage rails get the full power supply current at turn-on and thus fail catastrophically. The ones in the audio path only get a few mA max and simply repair themselves.

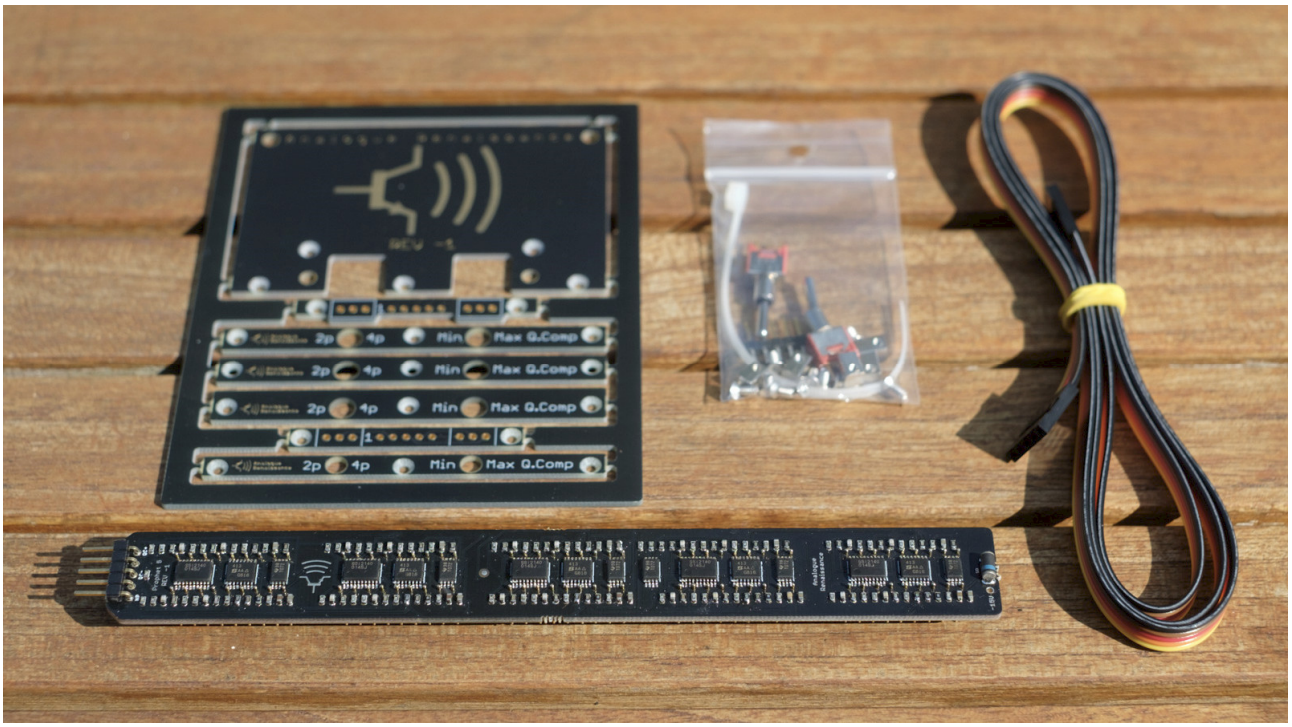
Installation

Installation consists of pulling the original CEM3320 chips from their sockets in the Prophet, installing the REV -1 module in their place, optionally assembling and mounting the included switch panel, and finally performing the filter tuning and voice volume calibration steps as per service manual instructions.

The REV -1 is fully functional without the switches so that it can be used by those who do not want to change the outside appearance of the Prophet in any way. It is normalled to 4-pole mode with half Q-compensation. But, that can be changed by installing jumpers.

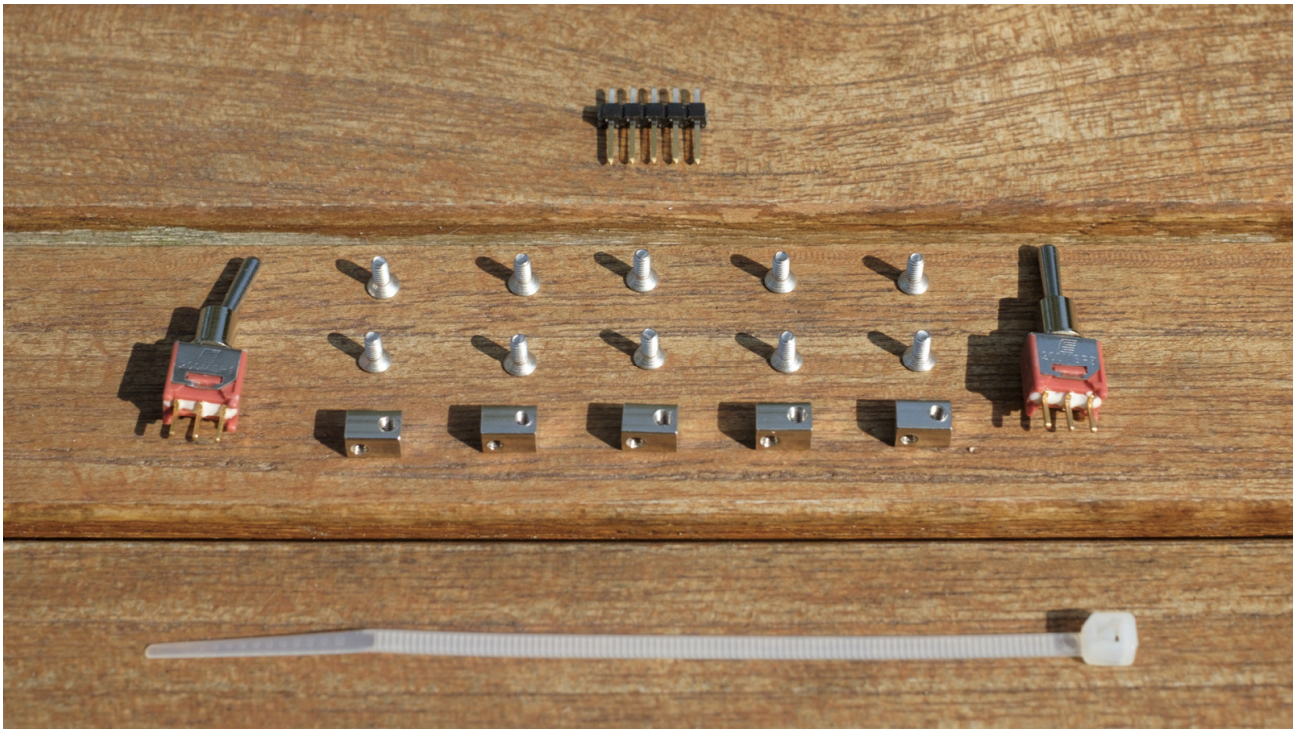
Alternatively, other switches of your liking can be used and mounted elsewhere or it can be controlled digitally by a pull-down to gnd.

Kit contents



The protective box in which your REV -1 kit comes contains the following:

- The main module
- An interconnect ribbon cable
- Mounting plate for the switches (this is stored underneath the foam in the box)
- A small zip-lock bag with the switch hardware and a cable tie



The zip-lock bag contains:

- 5-pin header connector
- 2-position switch for 2/4-pole mode selection
- 3-position switch for no/half/full Q-compensation selection
- 10x screw
- 5x mounting cube
- Cable tie

Main module installation

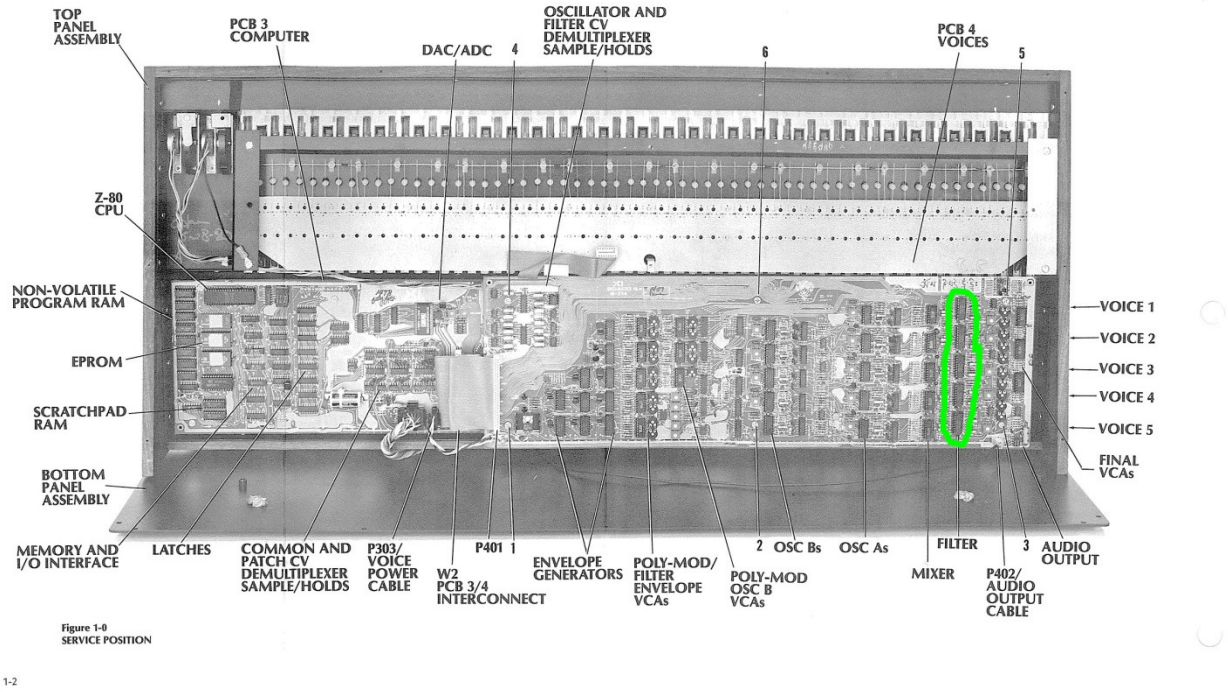
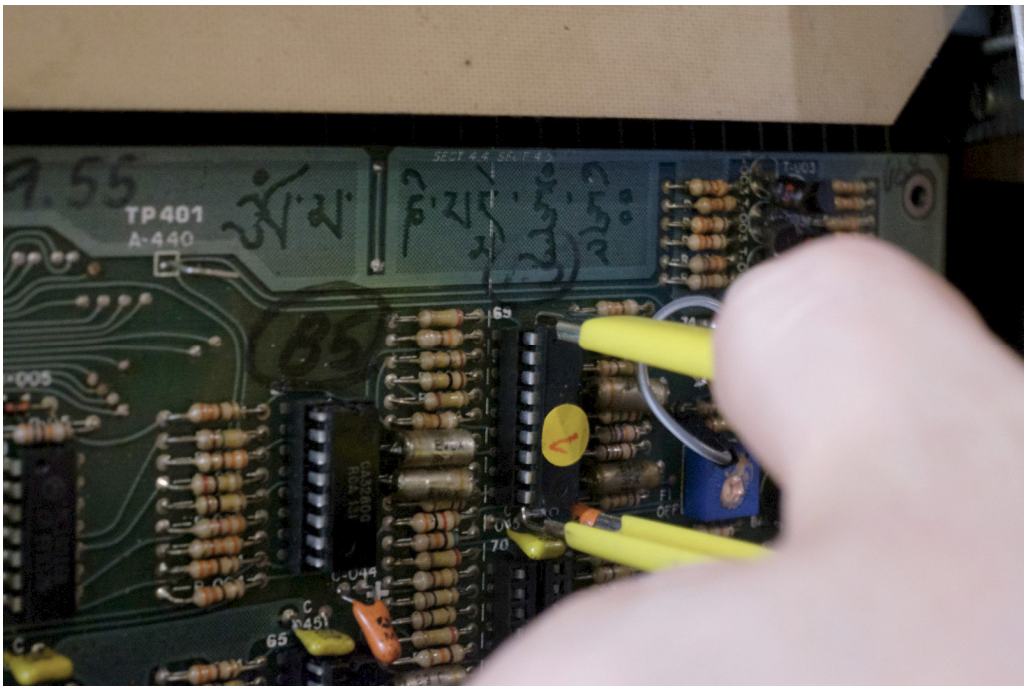


Figure 1-0
SERVICE POSITION

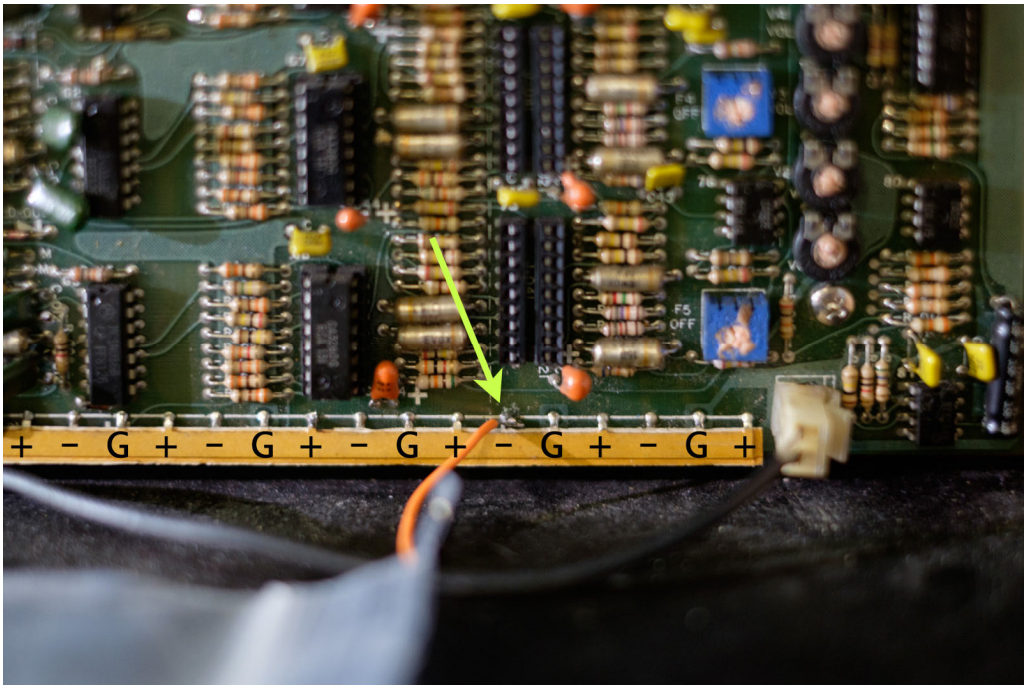
1-2

See section-1 of the ***Prophet-5 Rev 3 technical manual*** on how to open the Prophet and place it in its service position as pictured above and locate the marked 5 CEM3320 filter chips. These are labeled '*69*' to '*73*' on PCB4.

For ESD reasons we advise against the service manual instruction of placing the Prophet on a carpeted work surface. Use an ESD safe mat instead.



Carefully pull these 5 CEM3320 chips from their sockets with an IC puller and store them somewhere safe. These are hard to find and expensive parts that could be of later use.



Solder a short piece (2.5cm or 1 inch is enough) of insulated wire to the bus bar at the location indicated above. This will provide the -15V supply[4] for the REV -1 module.

The bus bar carries -15V, ground and +15V which are connected in an alternating pattern, shown in the picture above, to the PCB. Make sure you solder the wire to the correct pad or the REV -1 simply won't work. A protection diode was added to save it from the accidental mistake[5] here.

[4] It needs to be sourced externally as the original CEM3320 chips work on only -1.9V.
[5] Hi Sam!

This is the trickiest part

Insert the REV -1 main module[6] in the sockets where the CEM3320 chips used to be. The 5-pin connector should point upward and the -15V solder pad should be down and near the wire you just soldered.

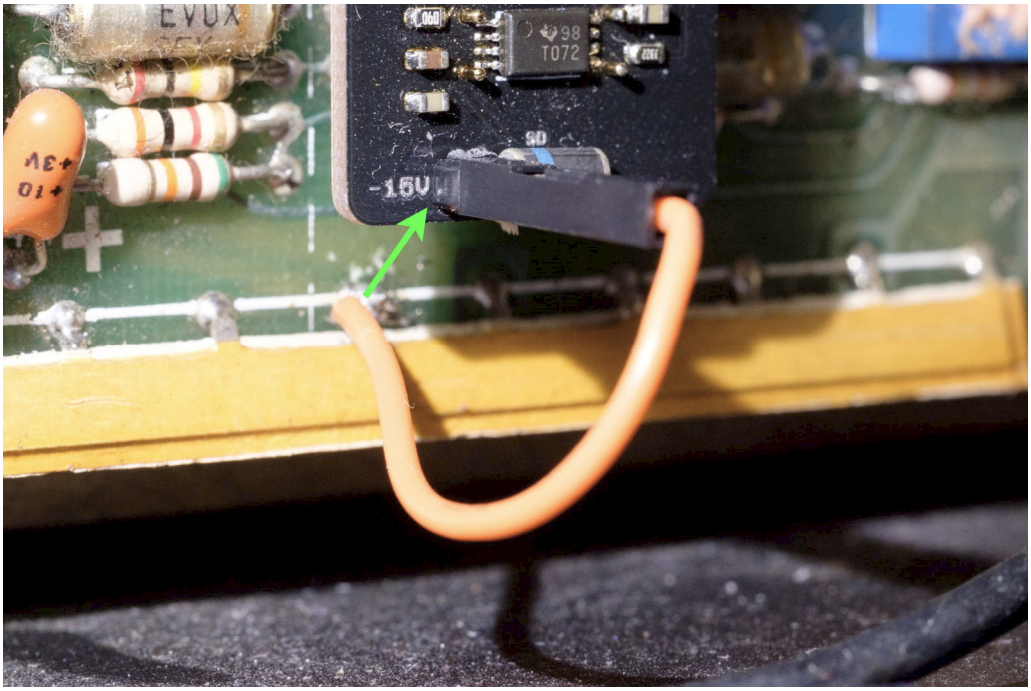
Be careful: the pins on this module are quite fragile.

Make sure you align them correctly before pushing the module down.

Some force is needed to fully insert it in the sockets. Do support the Prophet a bit with your other hand so that you don't push it back.

Any easy way is to start at the bottom or top and work your way to the other end.

[6] Pictured is an early prototype.



Solder[7] the other end of the wire to the pad labeled '*-15V*' on the main module.

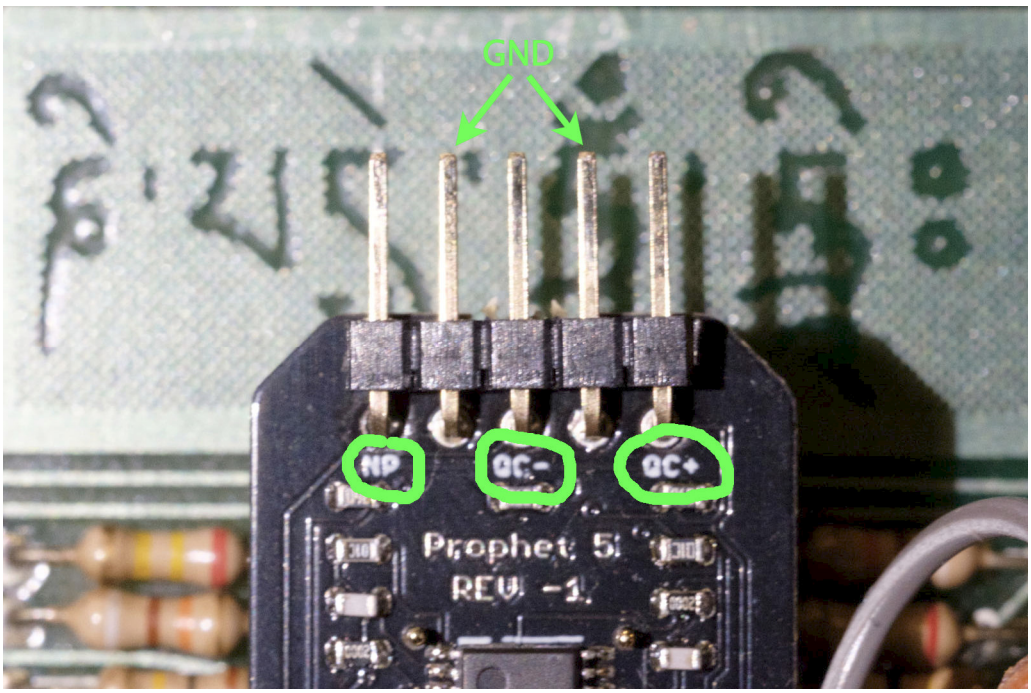
At this moment the Prophet with REV -1 should be operational. Double check if the REV -1 module is properly seated and that the -15V supply wire is connected correctly. If so, you can power the Prophet and verify that it is working properly.

Turn it off again before continuing.

[7] In the picture a connector is shown. This is used in the lab here for quick swapping modules during development and testing. You can solder the wire directly to the pad.

Using jumpers or other switches

If you intend to use the included switch panel you can skip to the next section on page 10.

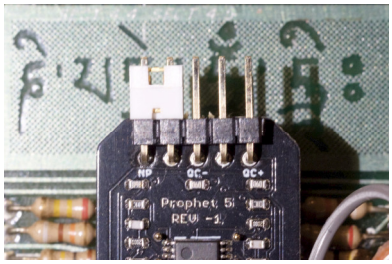


The REV -1 filter behavior is controlled by 3 control lines present in the 5-pin header connector, they are internally pulled up to +15V by a 120k resistor. The other 2 pins of the connector are GND.

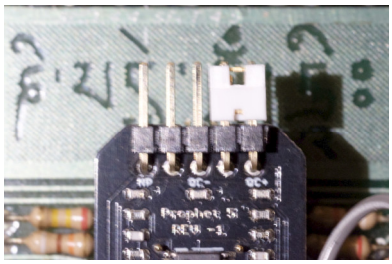
- '*NP*' controls the number of poles and is normalled to 4-pole filter mode. Shorting it to GND switches it to 2-pole filter mode.
- '*QC-*' reduces Q-compensation. Q-compensation is normalled to half and shorting this line to GND turns it off.
- '*QC+*' increases Q-compensation. Q-compensation is normalled to half and shorting this line to GND turns it fully only on.
- Shorting both '*QC-*' and '*QC+*' to GND is the same as leaving them unconnected.

This shorting to GND can be done by any kind of switches. Manual, electronic (maybe an idea for a future CPU upgrade project?) or jumpers.

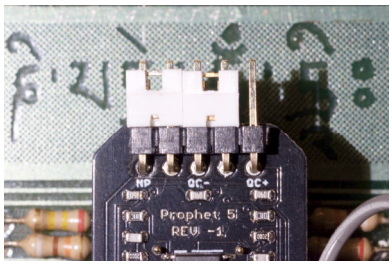
Examples:



4-pole mode with half Q-compensation.



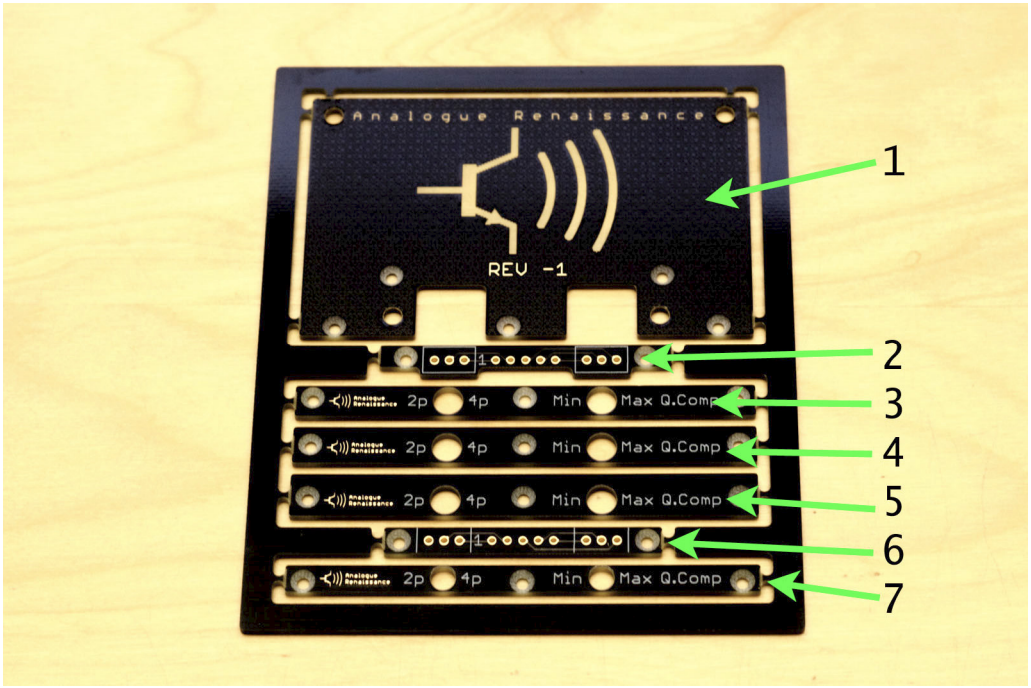
2-pole mode with full Q-compensation.



4-pole mode without Q-compensation.

Switch panel assembly and installation.

The switch panel goes on the wheel box in the gap between it and the wood strip above. The height of this gap varies quite a bit between individual Prophets. So, the switch panel can be assembled in a number of ways depending on this height.



The switch panel is based on the included plate which contains 7 parts, as shown in the picture above, which can be separated from it with break tabs.

1. Bottom plate that goes on the wheel box.
2. PCB that holds the switches and connector.
3. 6mm high front panel.
4. 7mm high front panel.
5. 8mm high front panel.

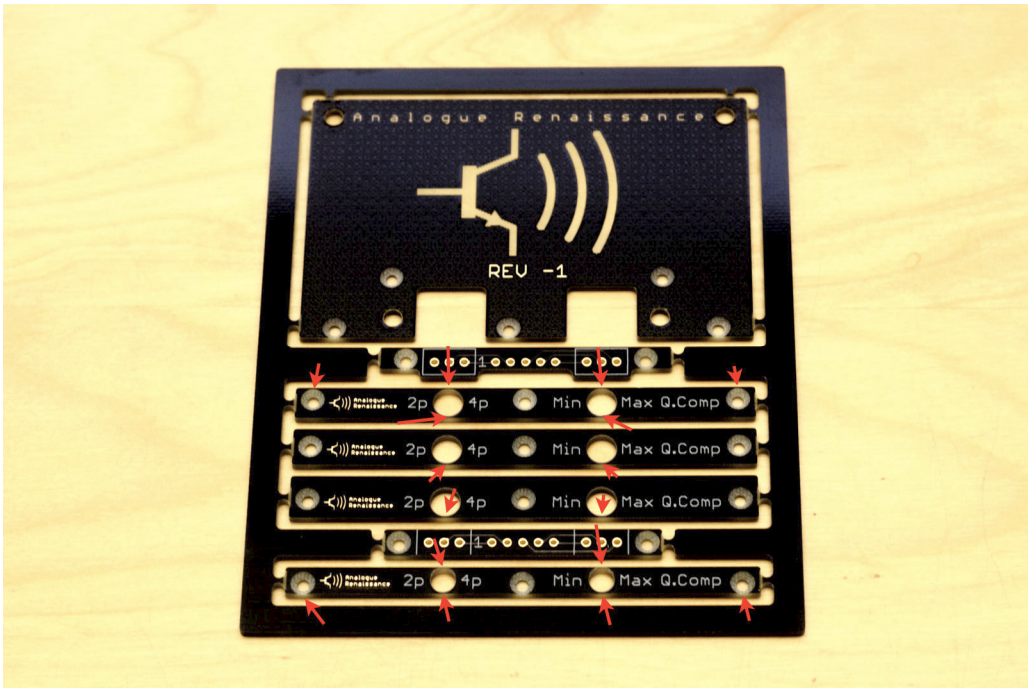
These first 5 should cover almost all Prophets even if the gap clearance is at first less than 6mm. By loosening some screws (See page 28) there is some extra play.

If the gap on your Prophet is narrower, you can use the last 2 parts for a gap clearance of 5mm. See page 28.

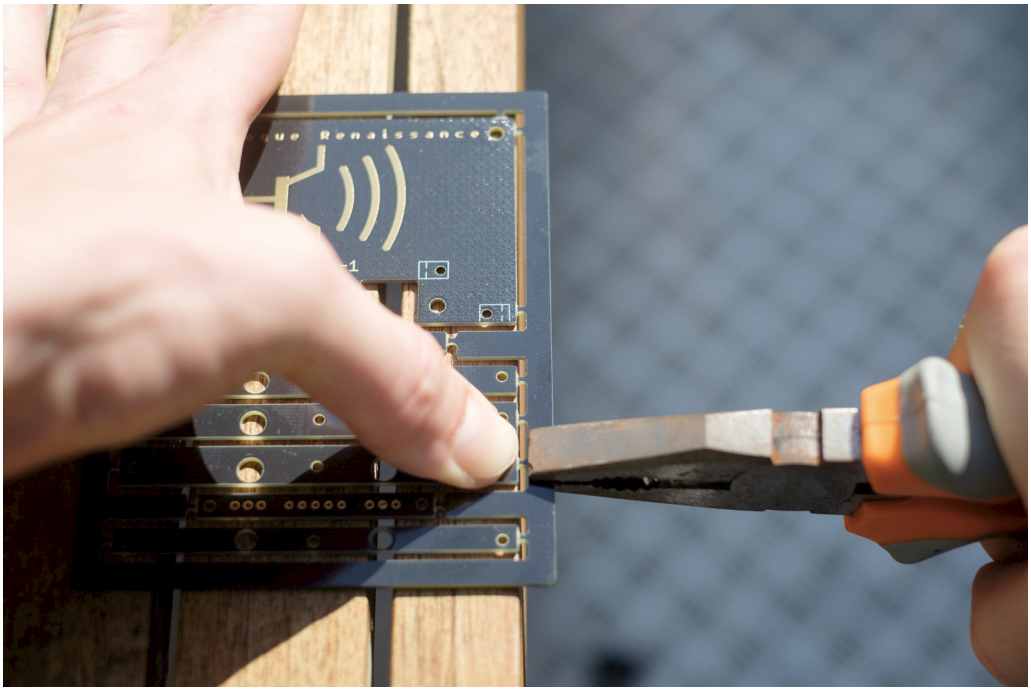
6. PCB that holds the switches and connector.
7. 5mm high front panel.

However, the required very low profile switches are not included in the kit and need to be purchased separately. Mounting will also be more difficult because there is no room for the bottom plate, and the front panel and PCB for the switches need to be mounted directly on the wheel box. Precision drilling is needed for that and we're no fan of drilling extra holes in a synth. It might be easier to disassemble the Prophet, take the wood strip to a skilled carpenter and ask to shave off a millimeter or two, so that the panel with bottom plate can be used.

Another option is using different switches (see page 8) of your choice and mount these on the back of the Prophet or on the wheel box.

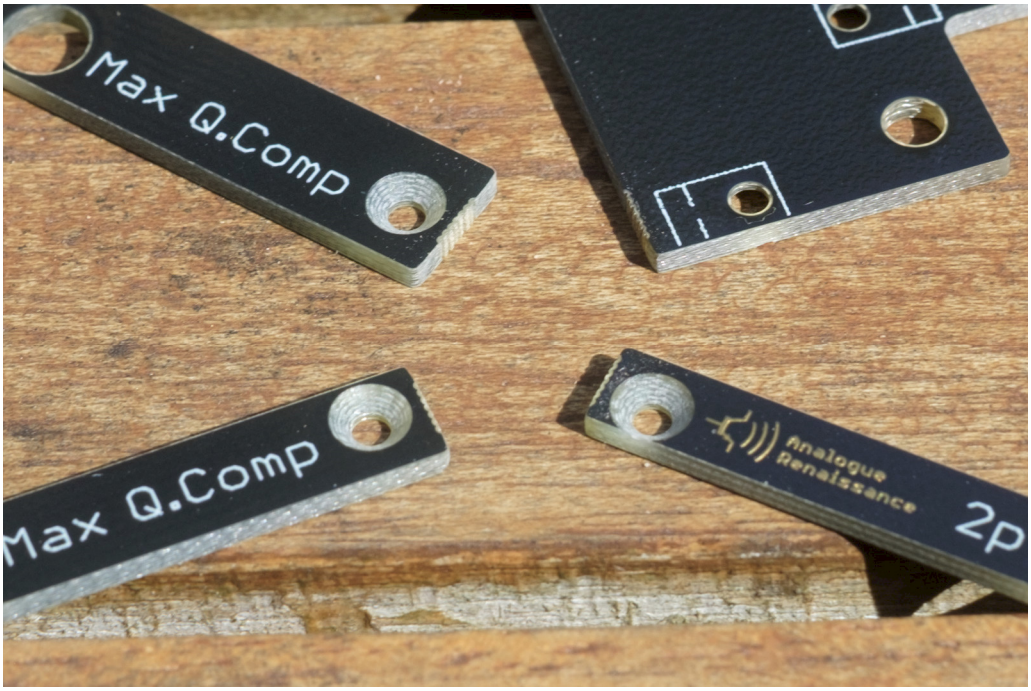


Due to the very limited available space, many parts of this panel are very thin (in some parts less than a millimeter). See red arrows pictured above. Be very careful when breaking the parts from the panel.



The recommended way of separating the parts from the panel is by holding the panel down firmly at the edge of a table close to the breakaway tabs. Then hold the other end with pliers and bend the breakaway tab downwards just until they creak. Do not bend down completely. Do the same for all of them. When this is done, flip the panel over and bend the breakaway taps down in the other direction. Repeat this until they separate. This will result in cleaner edges than when bending it down from one side immediately.

When separated, the edges at the breakaway tabs will be quite coarse.

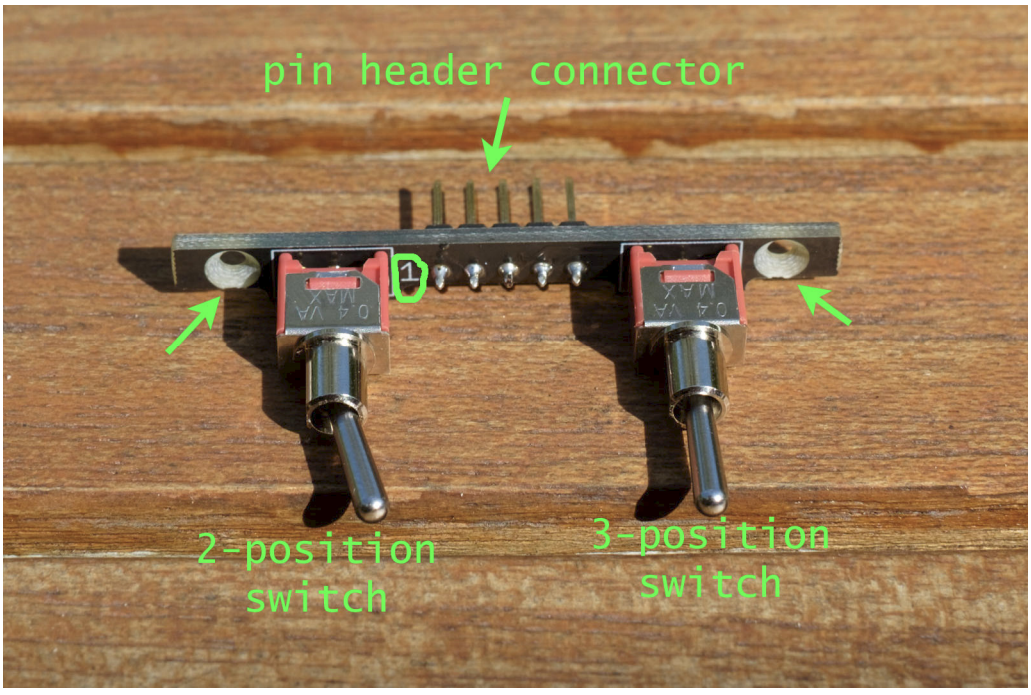


Sand these edges down a bit to smooth them out. 240 grit sandpaper does the trick.

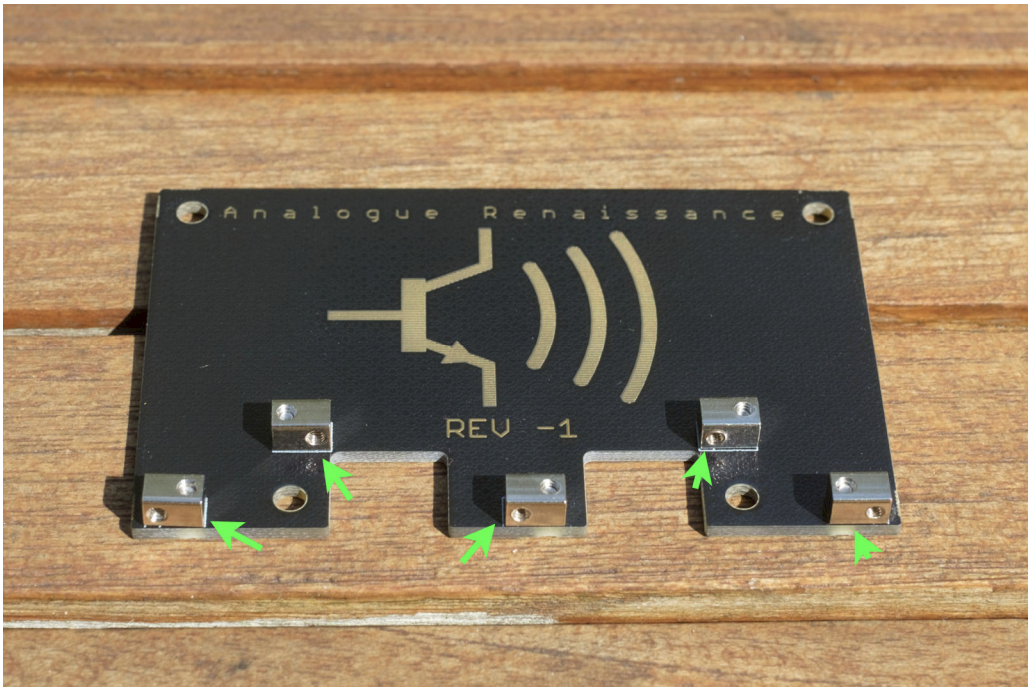
Assembly with bottom plate

This is for gap heights of 6mm and above and uses the bottom plate (labeled N°1 before on page 10), the PCB for the switches and connector (N°2) and either the front panel with 6mm, 7mm or 8mm height (N°s 3, 4 or 5).

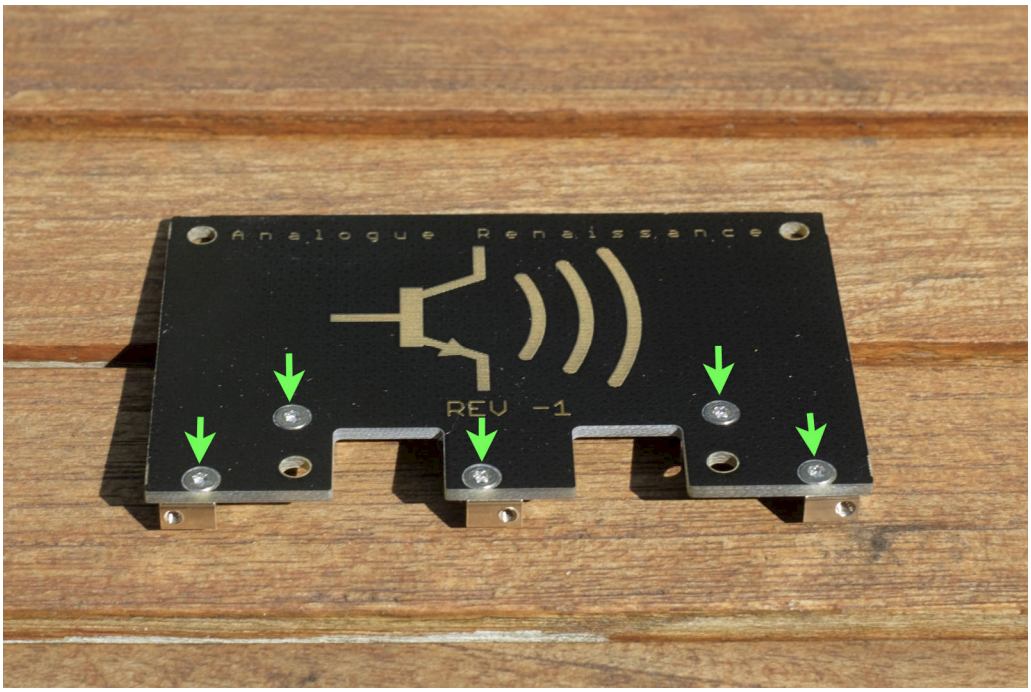
Check which one of these fits best in that gap.



Solder the switches and pin header connector to the PCB. There are 2 types of switches. One has 2 positions; the other has a 3rd center position. Feel which one is which and solder them as pictured above. They go on the same side as the countersunk holes and the 2-position switch goes near the solder pad labeled '1'. The pin header connector goes on the other side.



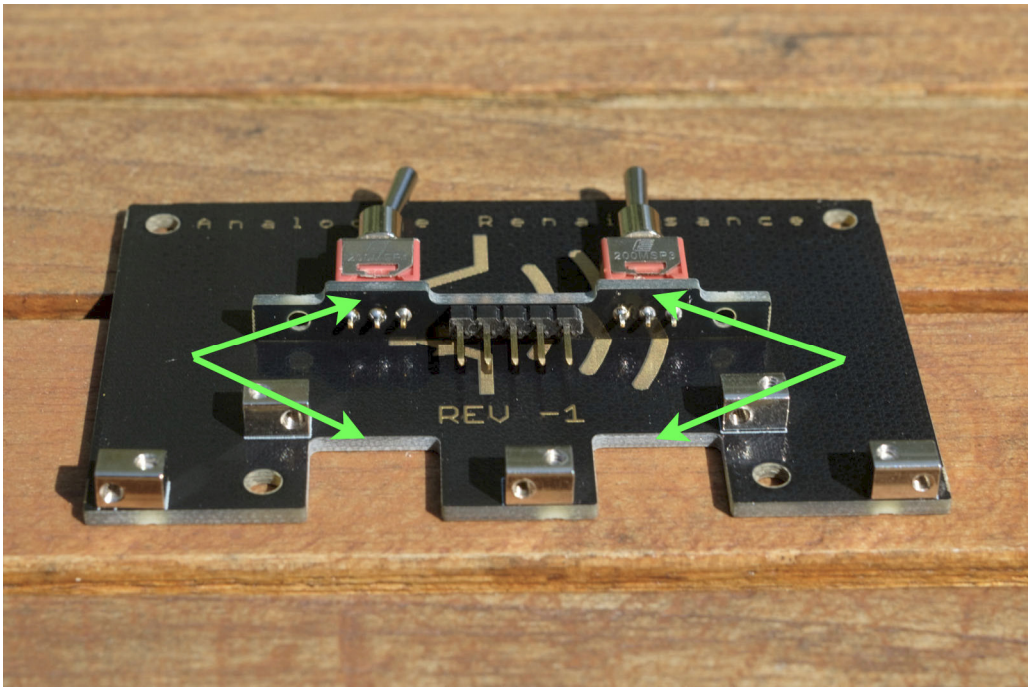
Screw the 5 mounting cubes on bottom plate. Their position is indicated by white silkscreened lines.



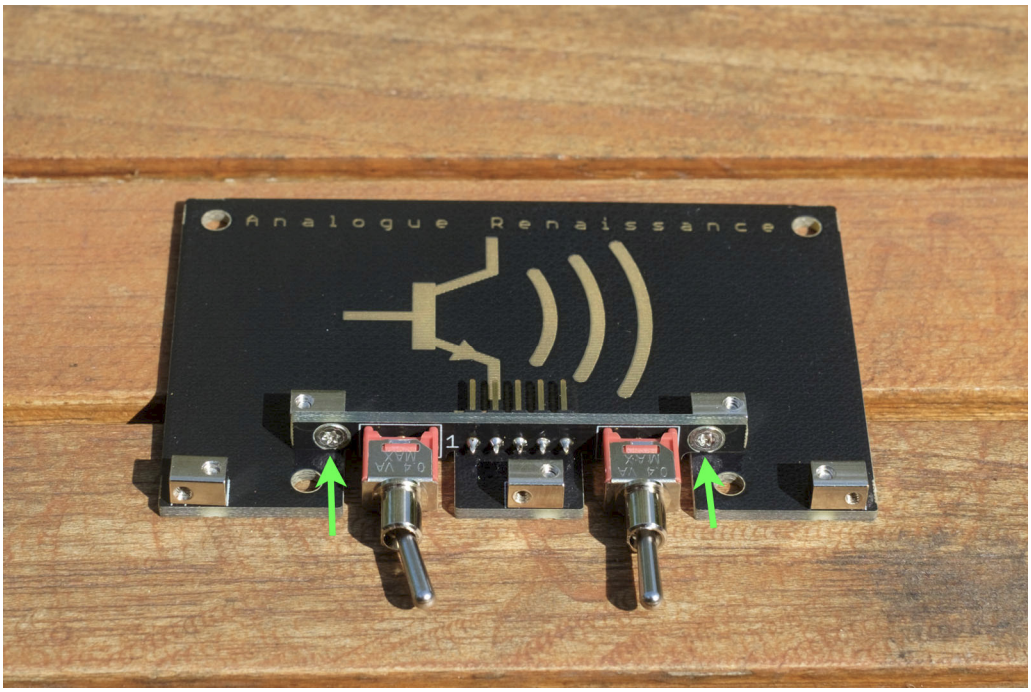
The 5 screws that hold them go in the countersunk holes on the other side. The tool needed is a Torx[8] T6 screwdriver.

Do not over tighten the screws.

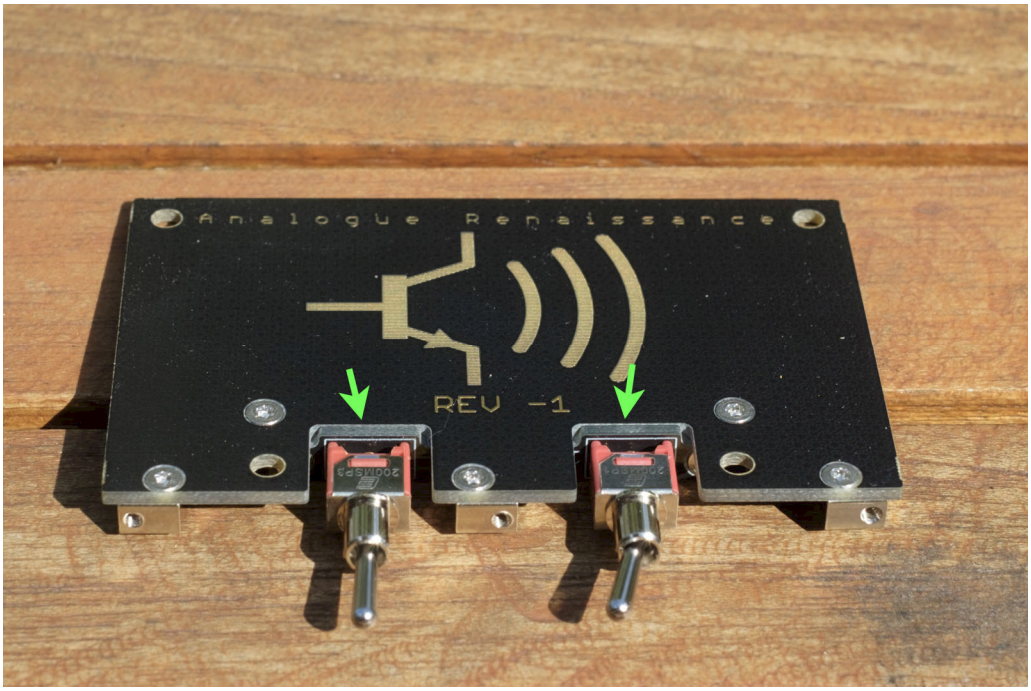
[8] The screws on the front panel are likely to be touched as they are close to the switches, pitch and mod wheels. Condensation on them is also possible for Prophets that are gigged when moved from the cold outside into hot humid venues. So, for corrosion resistance, stainless steel was chosen as screw material which unfortunately is relatively soft and small screws are already easily damaged when made from harder materials. For that reason Torx screws are used here as their hexalobular shape is more resilient than standard slotted, cross and hex shaped ones.



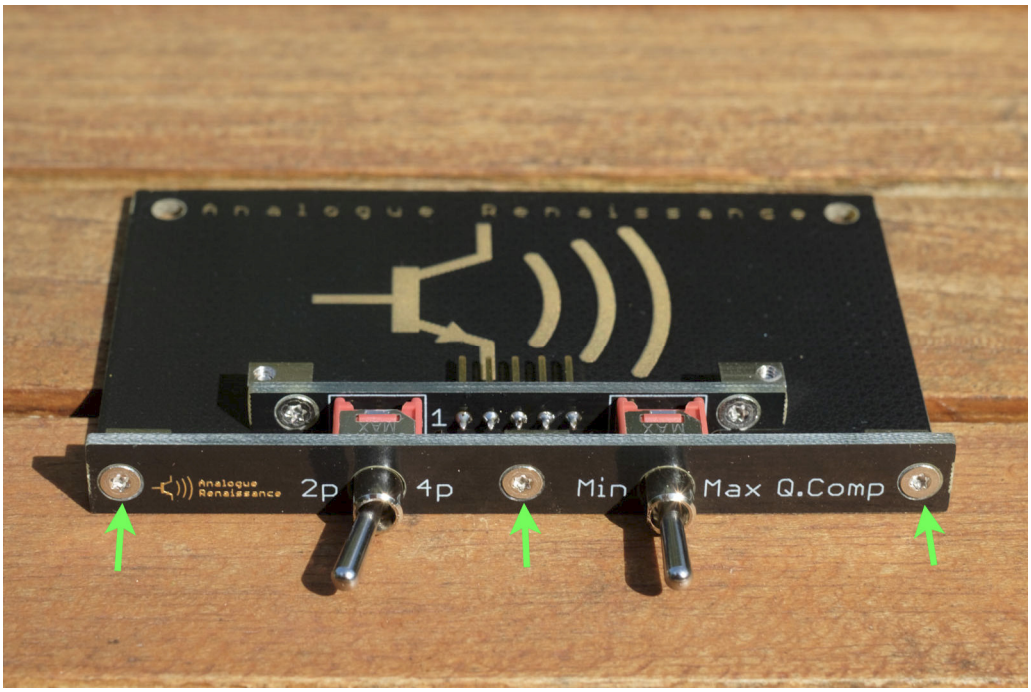
The small bumps on the switch/connector PCB go against the bottom plate in the gaps for extra mechanical support when force is exerted on the switches.



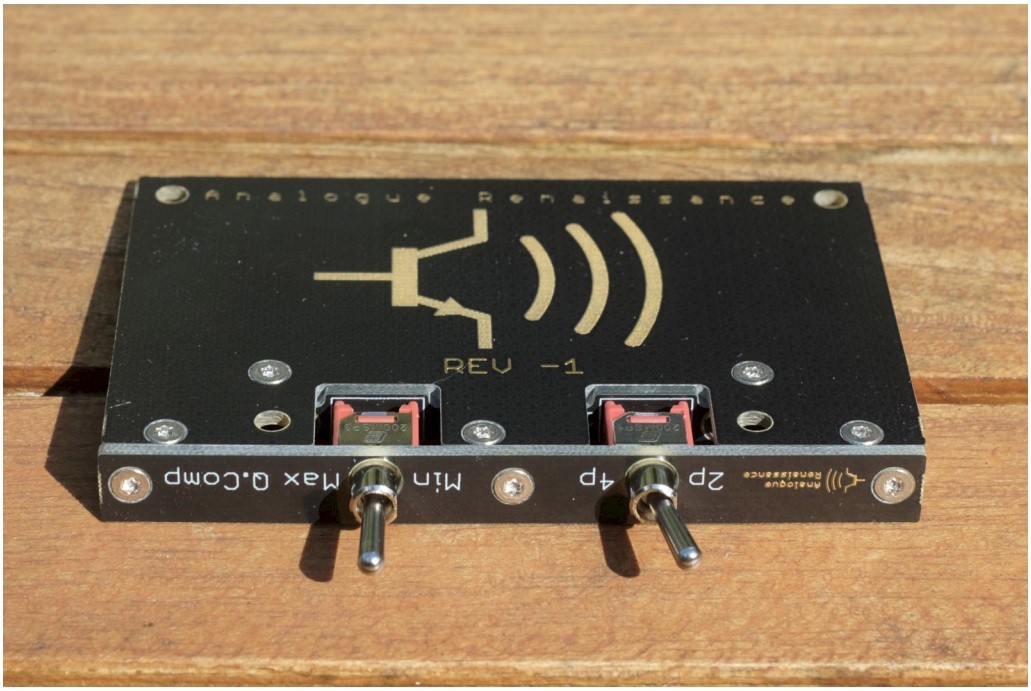
Fasten the switch/connector PCB to the 2 mounting cubes near the gaps of the bottom plate with 2 screws in the countersunk holes.



The bottom should look like this now with the bumps and switches in the gap of the bottom plate.

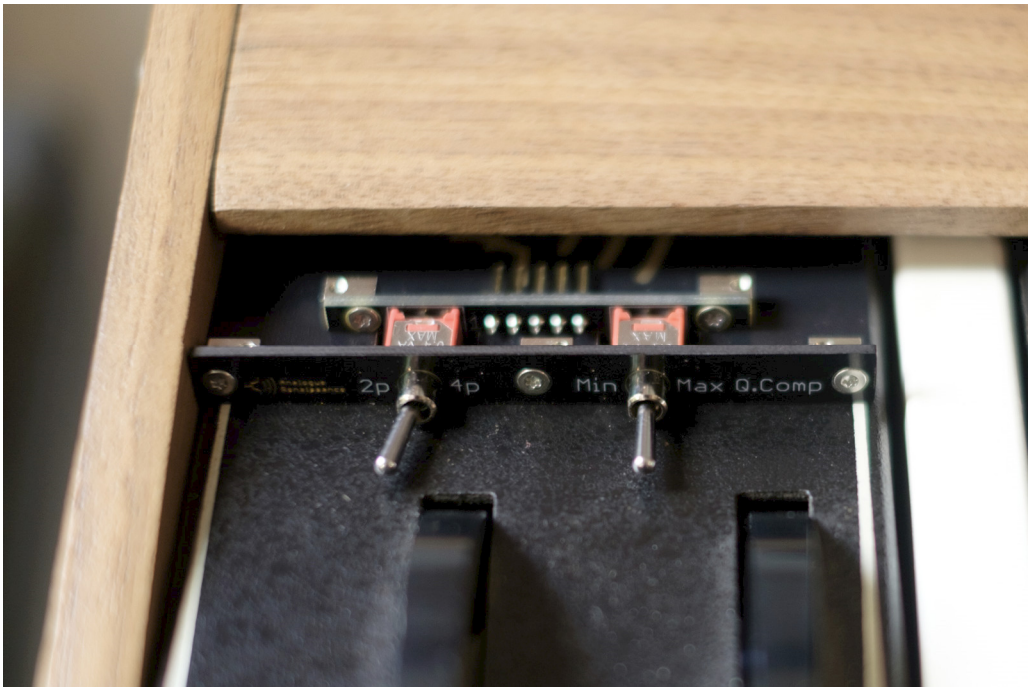


Screw the front panel whose height matches the gap between the wheel box and the wood strip above to the remaining 3 mounting cubes at the front of the bottom plate.

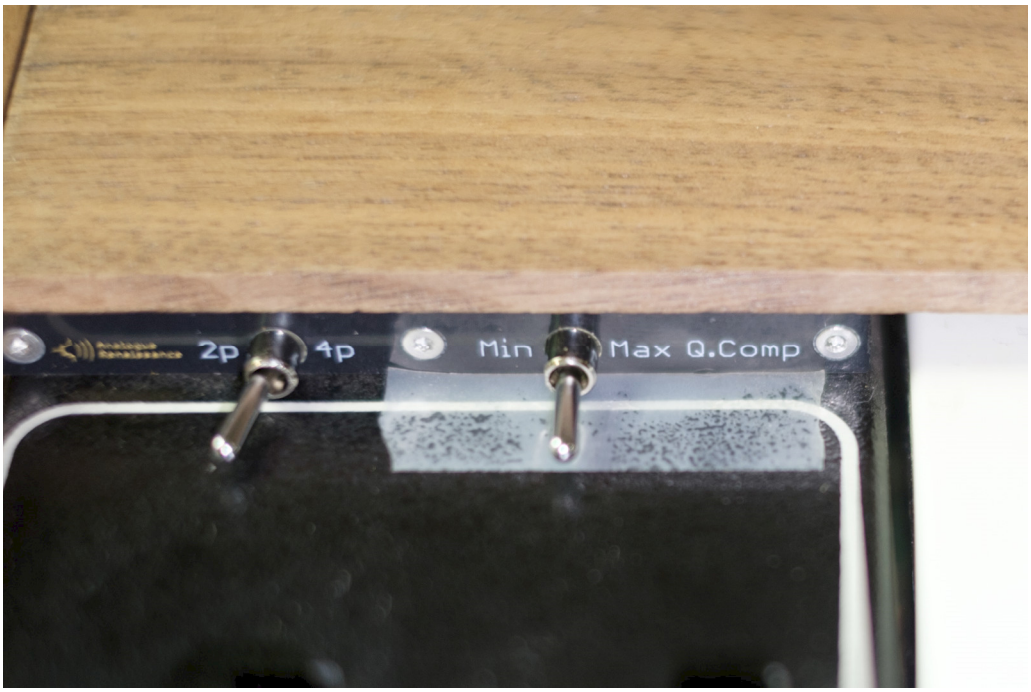


The switch panel is now complete and should like this on the bottom with the front panel flush with the bottom plate.

As a finishing touch you can paint the edges black with a permanent marker.

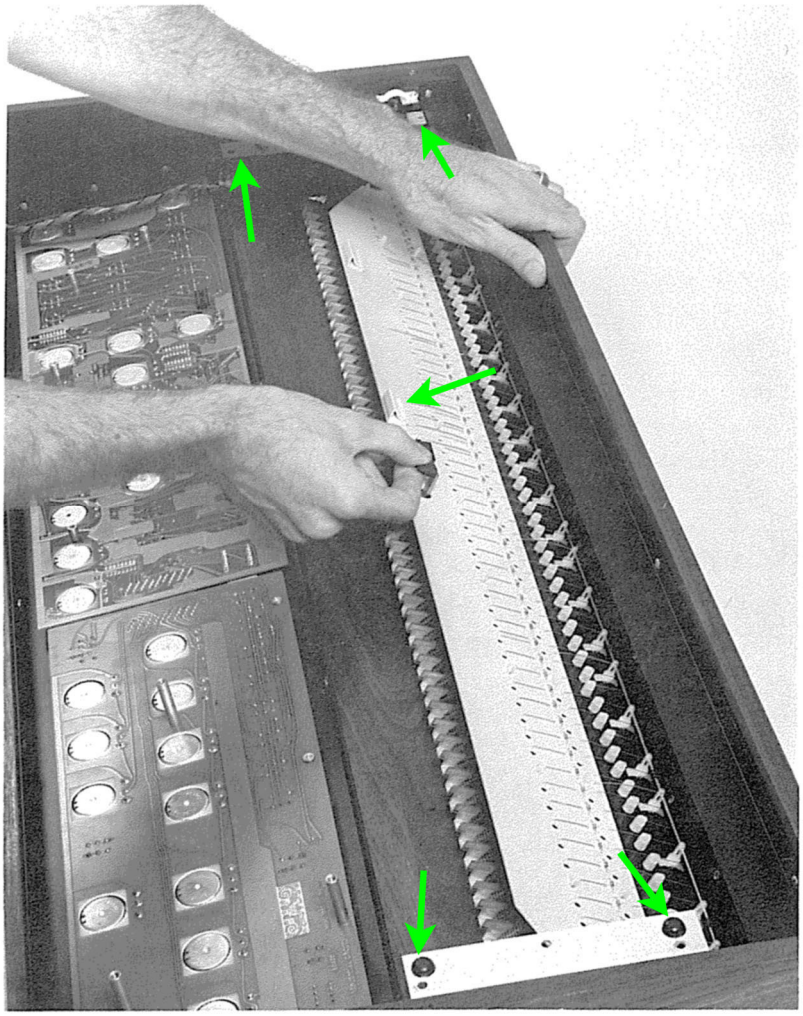


Slide the switch panel in the gap on the wheel box and check how deep you would like to mount it.



Stick a piece of tape on the wheel box that marks the preferred final position of the switch panel. In the picture above the front is flush with the wood strip above. However, ample room is available if you wish to mount it deeper so that the switches stick out less.

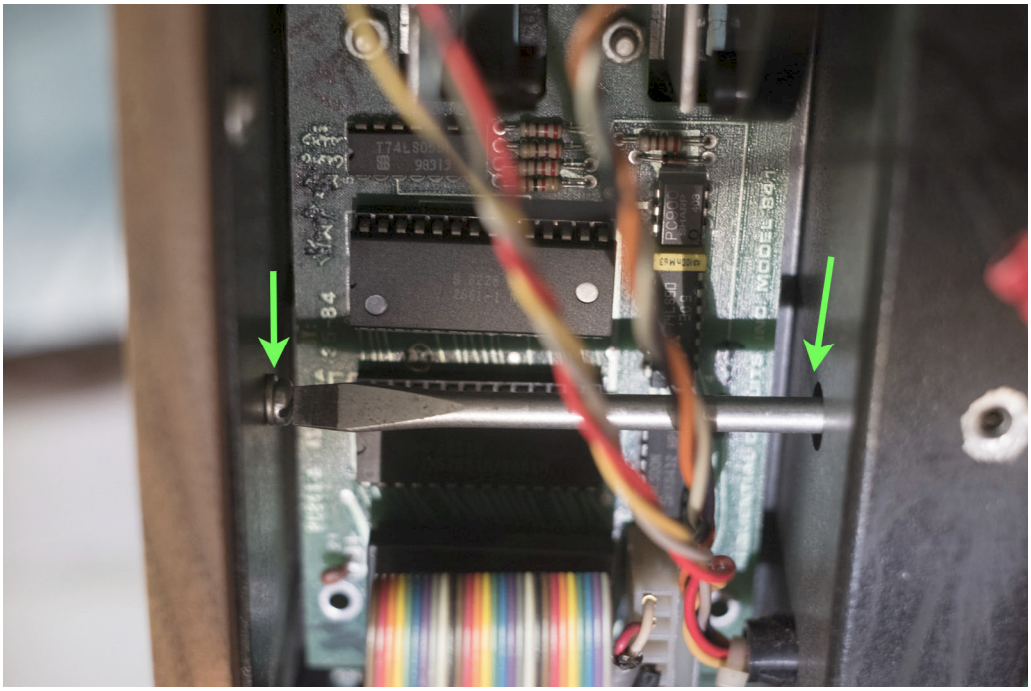
Be careful with the next part. It involves removing the keybed from the Prophet and the J-wires are very fragile and easily damaged.



To access the wheel box, the keybed must be removed. See the ***Prophet-5 Rev 3 technical manual***. This is done by disconnecting the 16-pin ribbon cable DIL connector and removing the 4 keyboard mounting screws[9]. Contrary to service manual instructions it is not needed to remove any PCB from the Prophet to do that.

Do not do this in the upright 'service position' unless you really know what you're doing. The keybed will fall from the casing and be damaged when the 4 mounting screws are removed. Lay it safely upside down with knobs and keys downward as shown in the picture above.

[9] The ground cable of the wheel box is attached to one of the keyboard mounting screws. It needs to be re-attached when the keybed is re-installed later.



Now the wheel box[10] can be removed by unscrewing 3 screws that go in the side panel. There is a hole on the other side of the wheel box to easily access the deepest screw.

You'll likely encounter 4-decades worth of dust on top of the wheel box.

[10] The pictured Prophet has the factory midi kit. The shown electronics won't be present in the wheel box of Prophets without it.

This can be cleaned with a damp cloth or use a mild solvent like IPA when the damp cloth doesn't work.

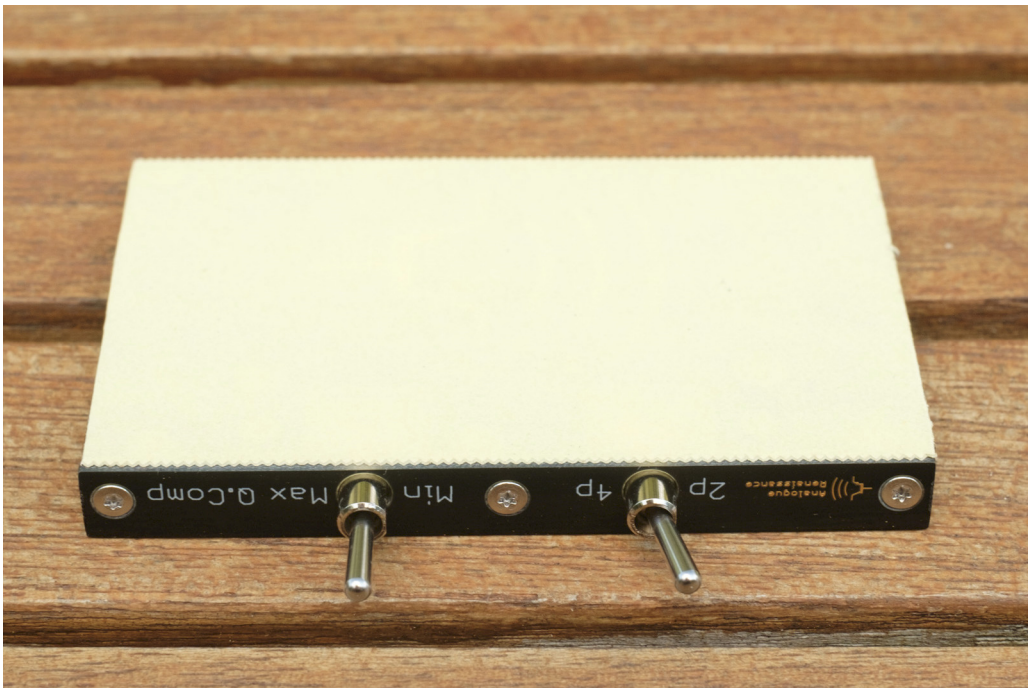
Don't use stronger stuff like acetone. It will damage the silkscreen and any other part of the Prophet you might spill it on.

There are 4 holes in the switch panel which make it possible to attach it to the wheel box with screws. If you wish to do this, consult an experienced metal worker who has the proper tools[11] and, more importantly, skills to do a precise job. It requires a column drill, securely clamping the wheel box without damaging it, center punching…

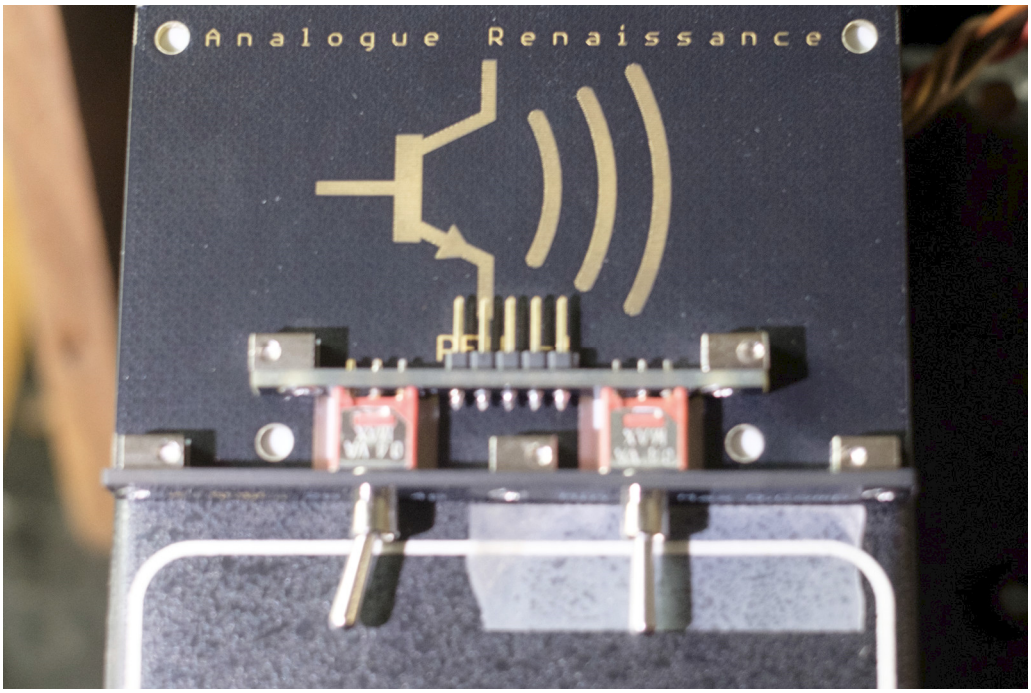
As mentioned before, we are no fan of drilling holes in synthesizers, and one of the key concepts when designing this REV -1 mod was for it to be removable from the Prophet without leaving any trace of ever having been there, so that for whatever reason, the Prophet can be restored to its original condition.

[11] For the love of <insert your favorite deity here>: Don't butcher that beautiful instrument with your hand drill. You will certainly mess it up.

We thus simply recommend sticking the switch panel on the wheel box with double-sided carpet tape. This might seem[12] a bit unreliable, but do note that only very little force is needed to actuate the switches and that the whole panel is protected by the wood strip of the Prophet above it. If you use good quality permanent-strength tape from a reputable brand[13] it will likely hold for decades[14].

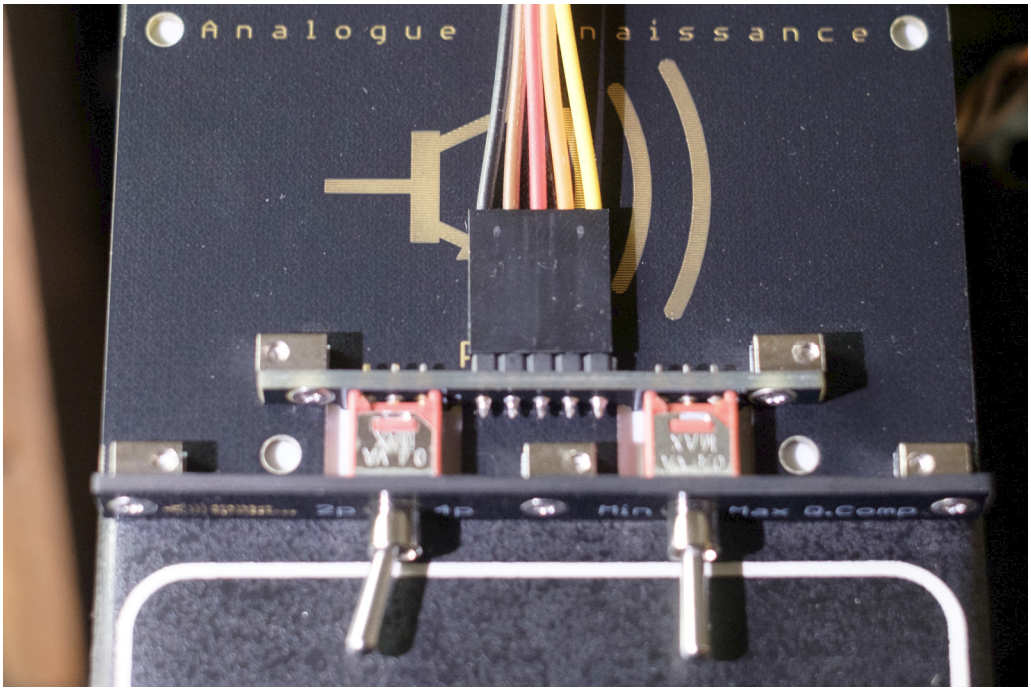


Cut a piece of double-sided carpet tape to size and stick it to the bottom of the switch panel.

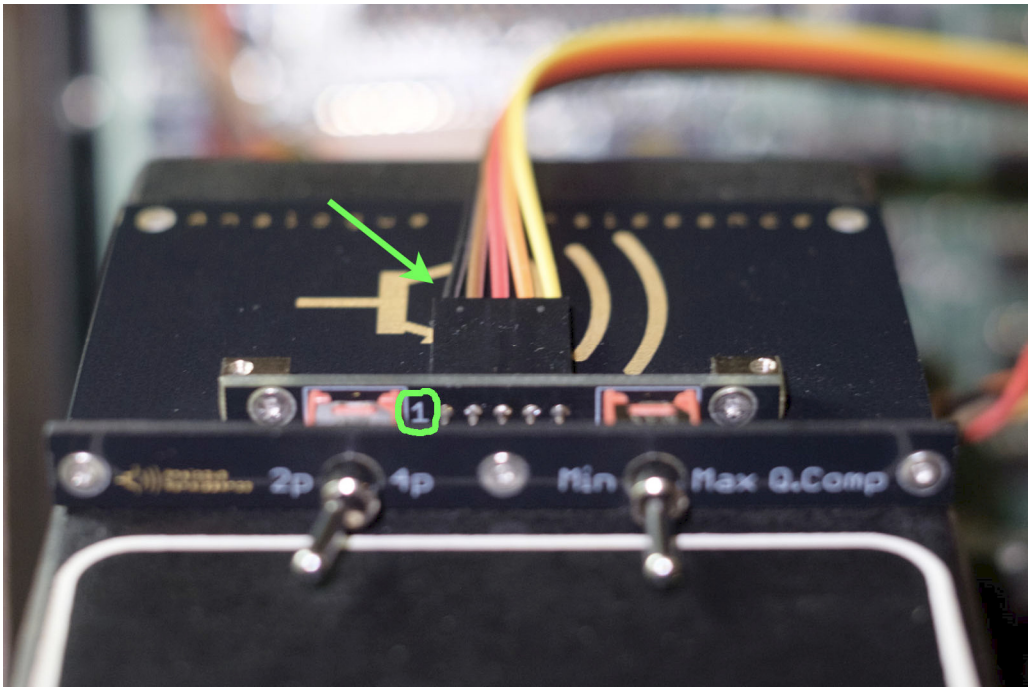


Then align the switch panel with the piece of tape which you placed to mark its intended position and press it down firmly[15].

[12] Adhesion strength was improved by etching a very fine pattern in the bottom plate which artificially increases its surface area.
[13] Stay away from the cheap no-brand stuff in the discount bins.
[14] The difficulties in removing the ancient carpet from our new lab when we moved are testament to that.
[15] Carpet tape is made from Pressure Sensitive Adhesives. The harder your press it, the more it sticks.

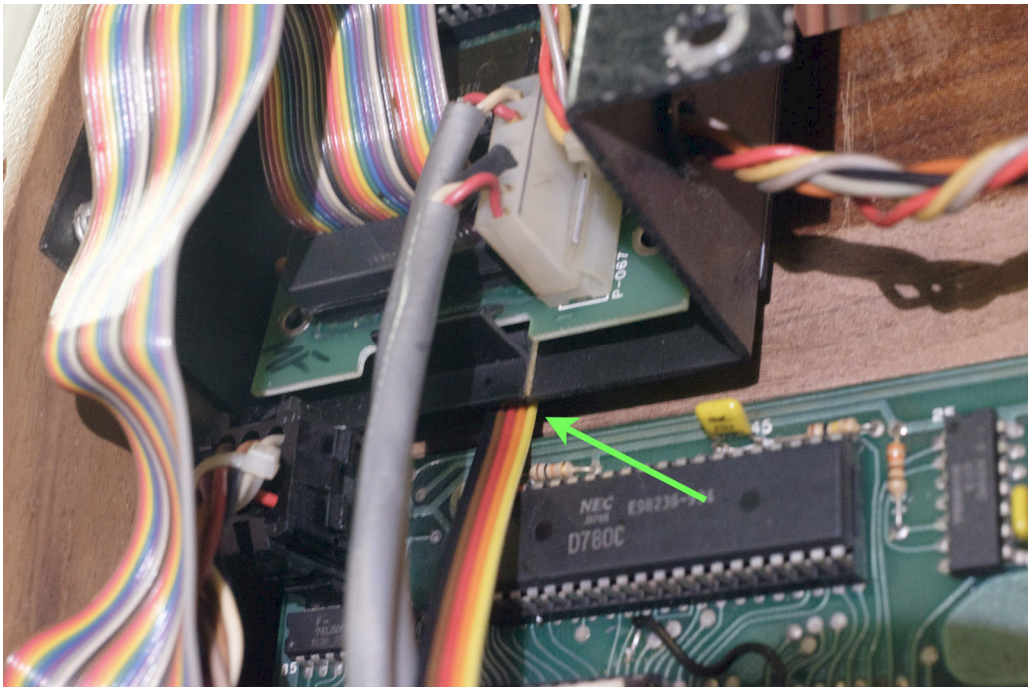


Connect the interconnect ribbon cable to the switch panel. Disconnect and reconnect it a couple of times to guarantee solid connection and you can push the contacts a little deeper with the wires than with the plastic that holds them.

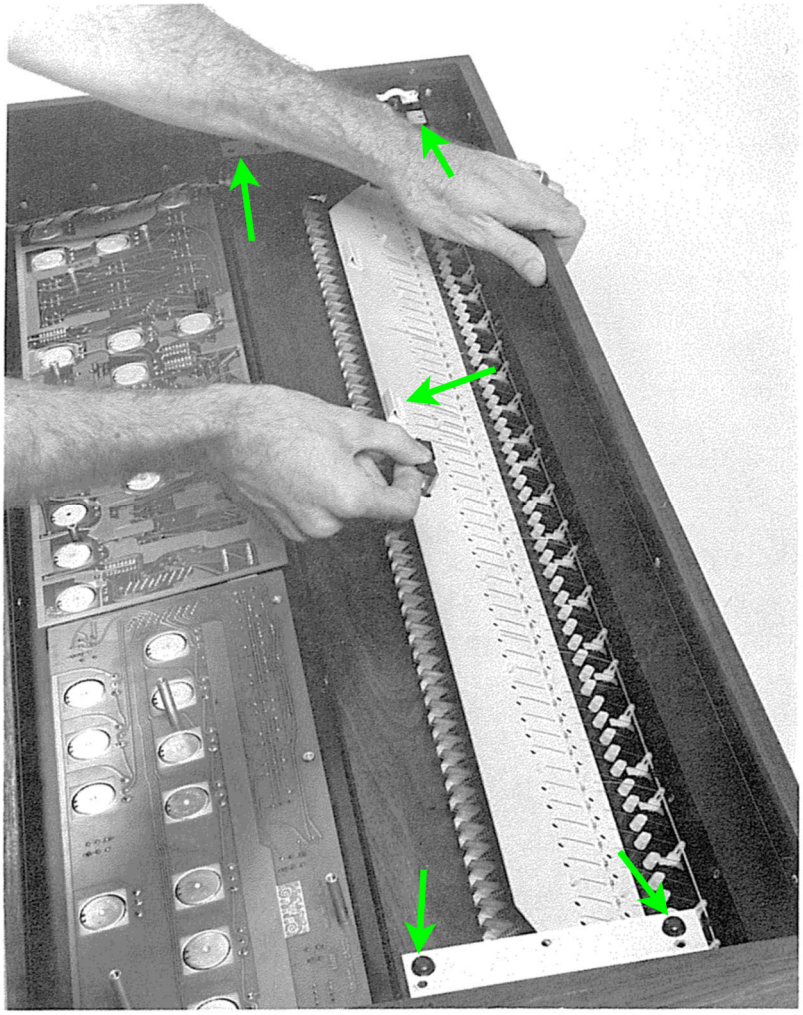


Note down which color[16] of the ribbon cable is connected to pin n°1.

[16] Your cable might have different colors than shown in the picture.

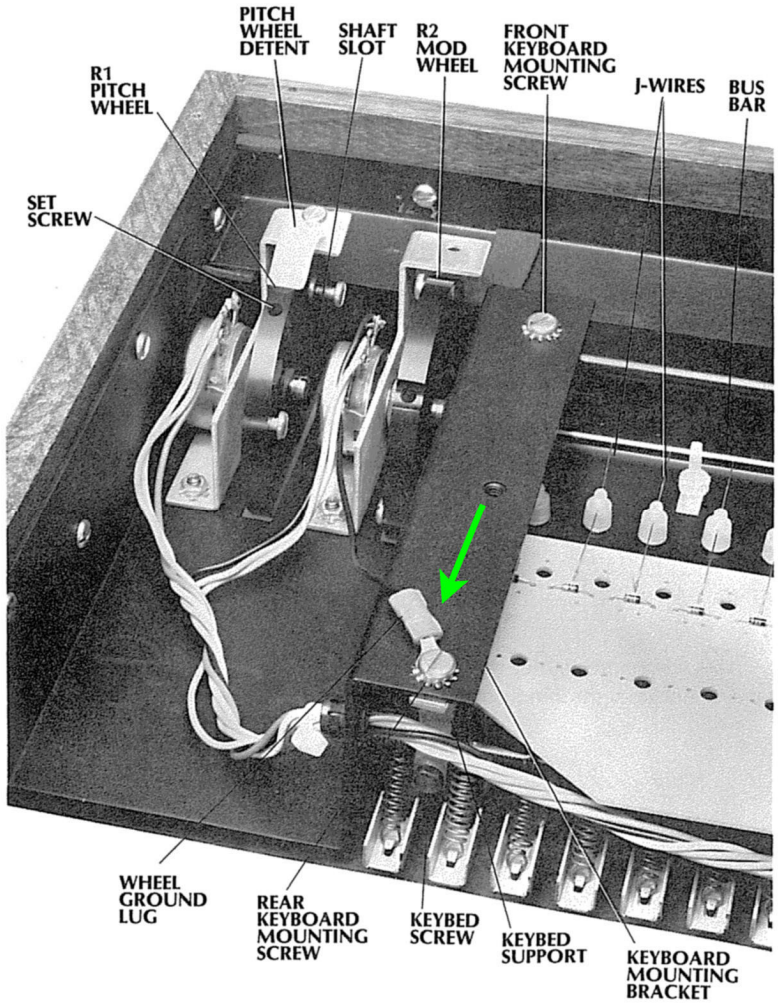


Re-attach the wheel box (now with the switch panel mounted to it) to the Prophet with the 3 screws in the side panel. The ribbon cable should stick out near the CPU.

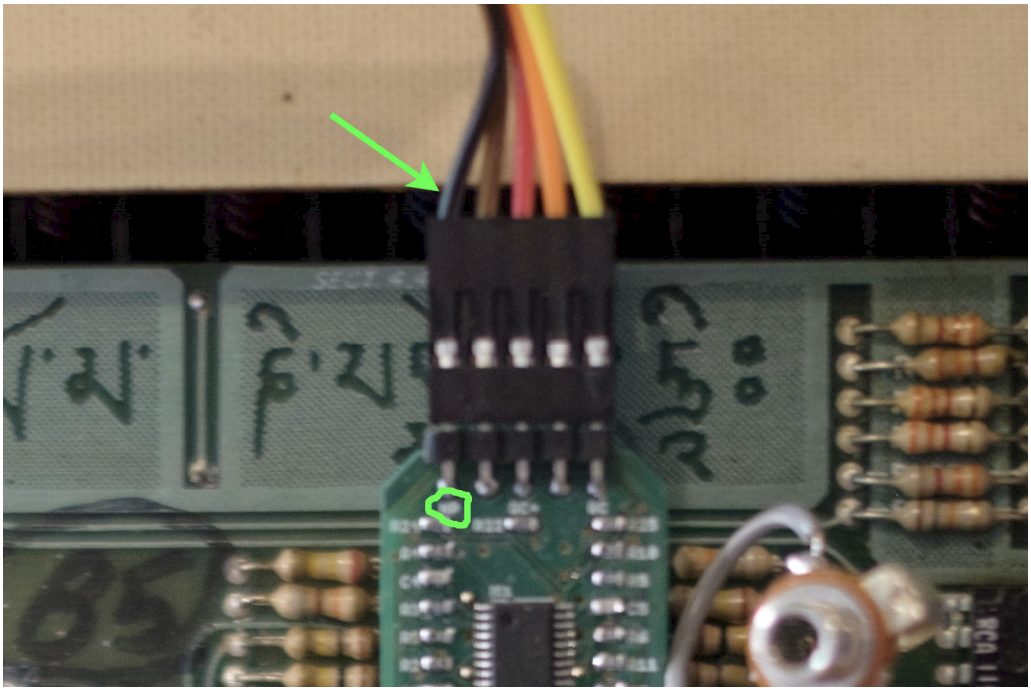


Put the keybed back in its original position, screw in the previously removed keyboard mounting screws and re-attach the 16-pin ribbon cable DIL connector.

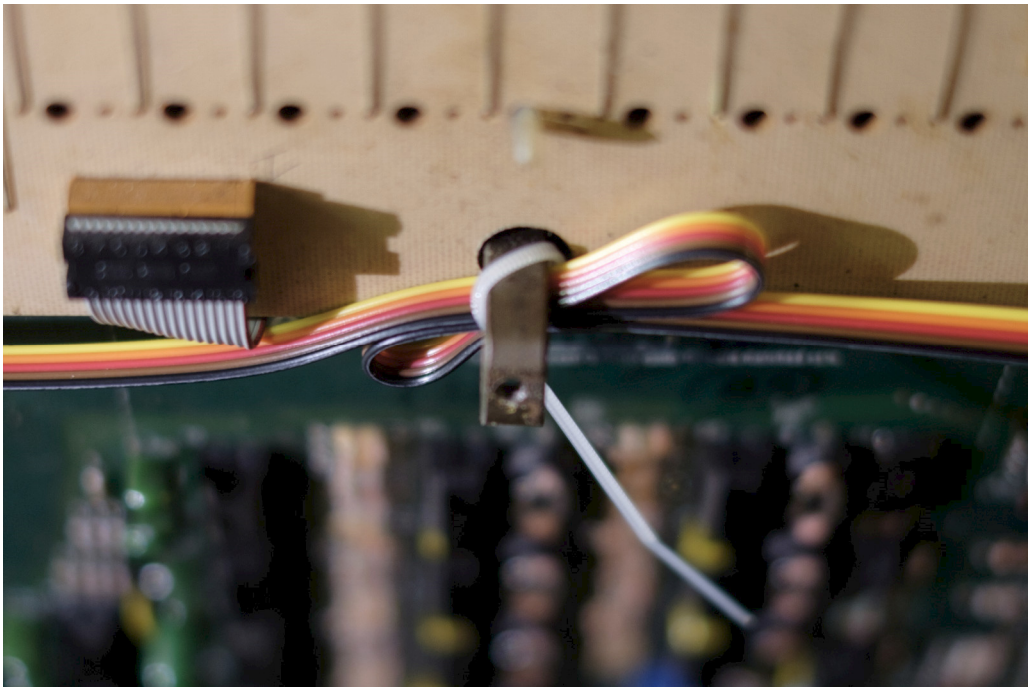
Again: be careful when handling the keybed. The J-wires are very fragile.



Don't forget to re-attach the ground lug of the wheel box at one of the keyboard mounting screws.



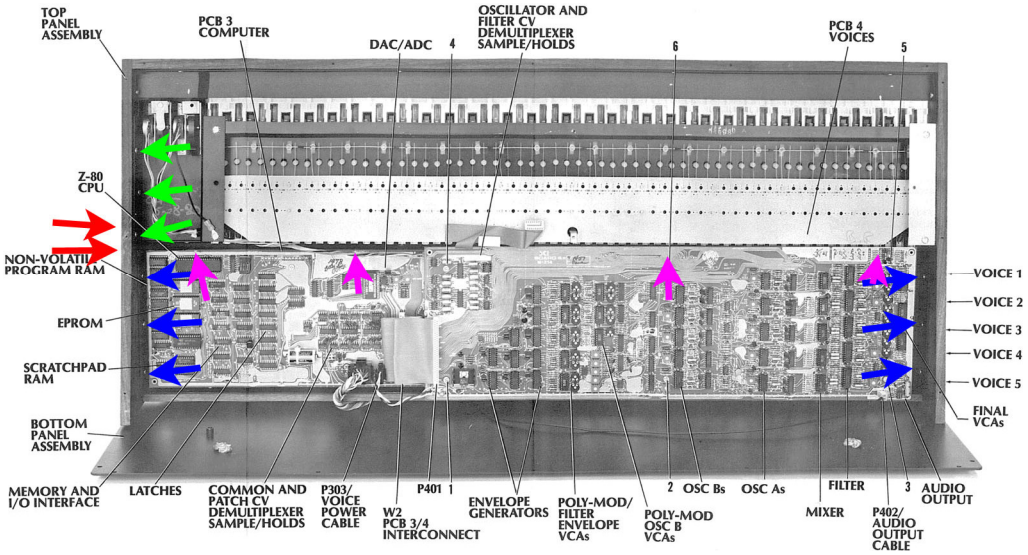
Connect the other end of the ribbon cable to the main module of the REV-1. Disconnect and reconnect it a couple of times to guarantee solid connection; you can push the contacts a little deeper with the wires than with the plastic that holds them. The color of the cable that was previously (see page 23) connected to pin '*1*' of the switch panel now needs to be connected to the pin labeled '*NP*' of the main module.



For ease of installation the ribbon cable has some slack. Coil that and tie it neatly to the center post of the keybed with the cable tie to prevent it from dangling around inside the Prophet.

Assembly without bottom plate

The minimum gap height in which the complete switch panel with bottom plate can be mounted is 6mm. This can be further reduced to an absolute minimum of 5mm. However, it is rather complicated, requires extra parts and drilling in the wheel box. And again, we are no fan of drilling holes in synths.



So, first check if you can't increase the gap height a bit by following methods:

- Loosen the 2 screws on the side panels that hold the wood strip. (red arrows in the above image)
- Loosen the 3 screws that mount the wheel box (green)

Quite likely you can already squeeze it in now. If not, further disassembly is needed. PCB4 (voices) and PCB3 (computer) have to be removed. See the ***Prophet-5 Rev3 technical manual***. When this is done you can:

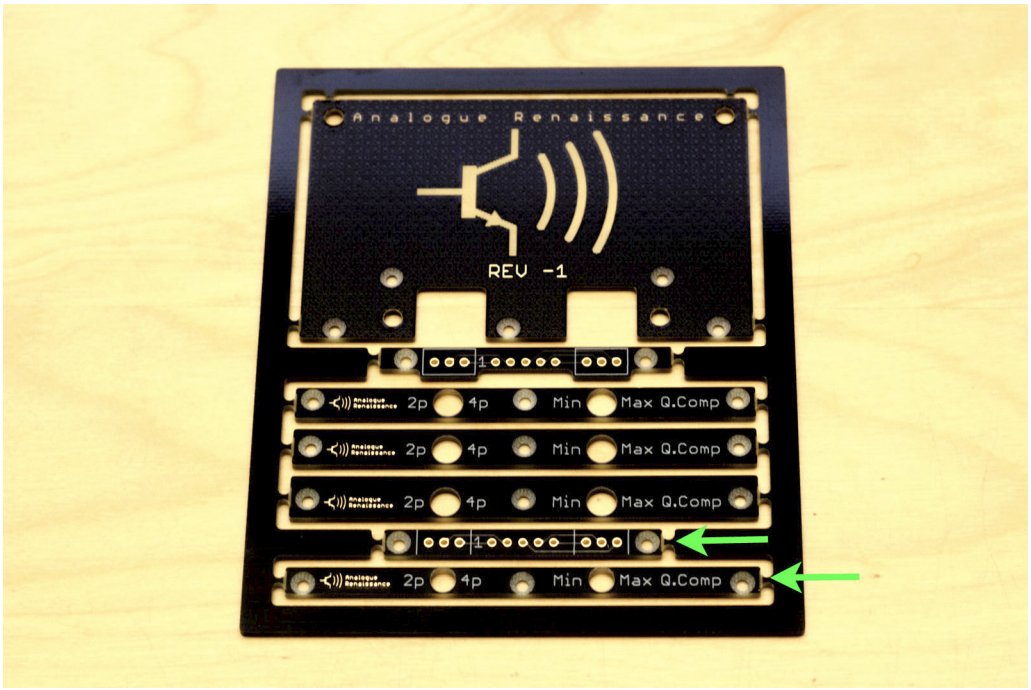
- Loosen the 6 screws that mount the Prophet's front panel on the side panels. (blue)

Try to squeeze in the switch panel again. If no success even further disassembly is needed. PCB1 and PCB2 that hold the front panel switches and pots need to be removed. You can then:

- Loosen 4 more screws that hold the wood strip (pink).

If you can't squeeze it in now, you're already this far and could just take out the wood strip completely and have a skilled carpenter shave of a millimeter or so to make it fit.

If this is not an option and a 5mm gap is available you can[17] use the 2 extra parts included on the switch panel.

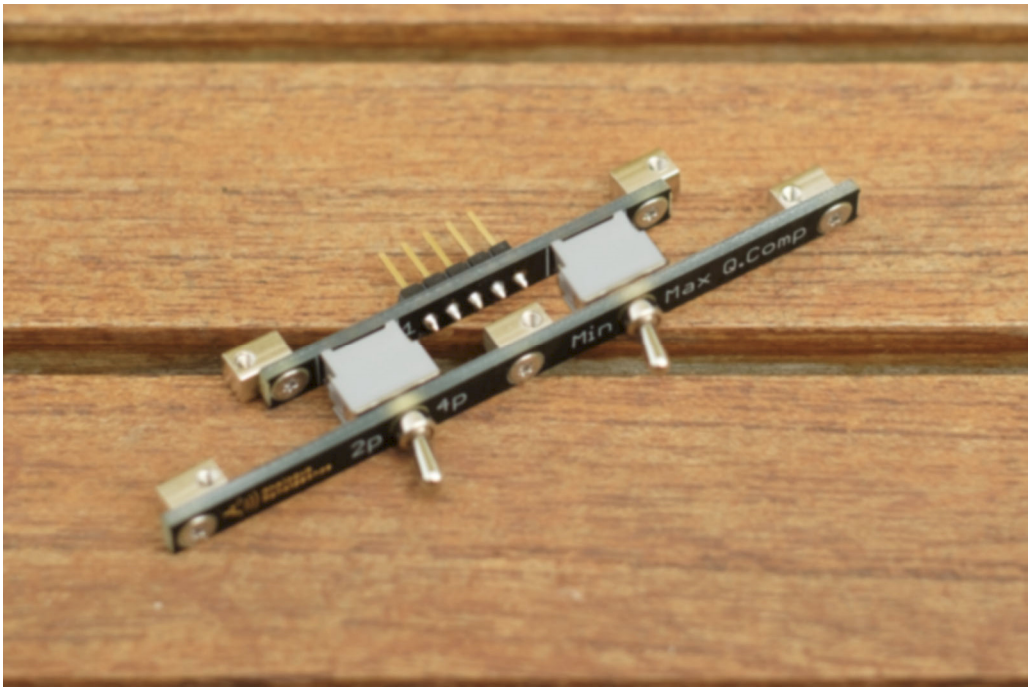


The top one is a 5mm high PCB for holding the switches and the 5-pin header connector. The bottom one is a 5mm high front panel. These ones are to be mounted (with the mounting cubes) directly on the wheel box instead of first on the bottom plate and then on the wheel box.

For this you need to buy even smaller switches than the ones included in the kit. They have an exact 5mm thickness that matches the extra PCB and front panel. These are:

- Knitter-Switch ATE 1 D (2-position switch)
- Knitter-Switch ATE 1 E (3-position switch)

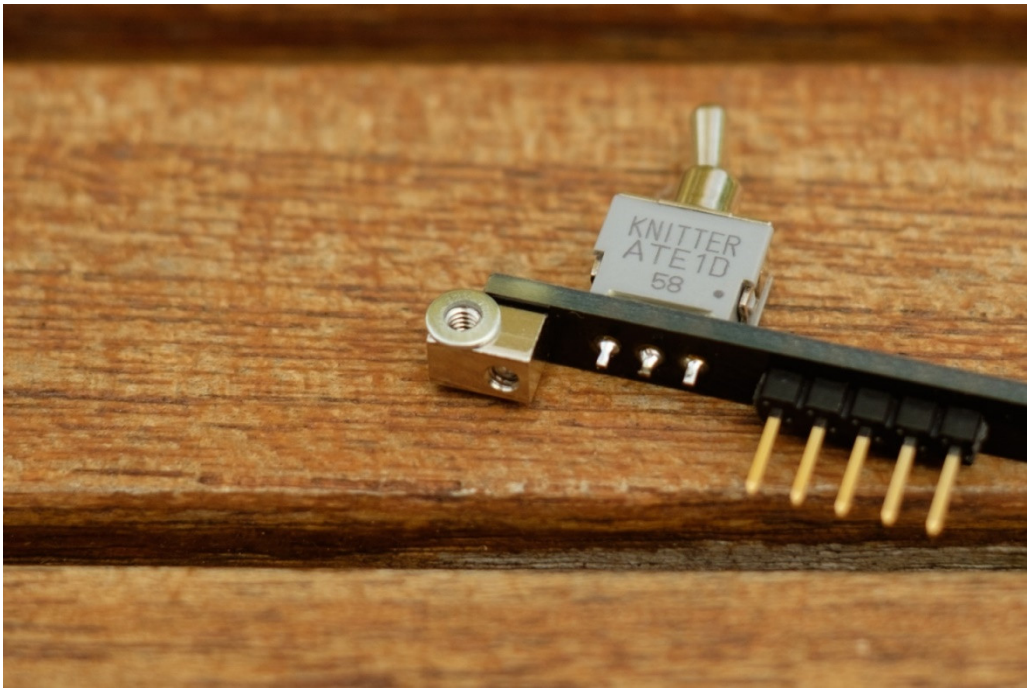
[17] As mentioned on page 8: You can also use alternative switches on the back panel for example.



Assembly is pretty much the same as with the bottom plate, except you don't screw the mounting cubes on the bottom plate, but instead on the PCB and front panel as shown above. So, see these instructions on page 13 and onwards.

Use the 2mm holes in the bottom plate as template for drilling[18] the holes in the wheel box.

[18] We're not going to drill holes in our Prophet as there is no need for it, so have no picture to show this in this document. But, if you do, please take some pictures and be so kind to provide them to us so we can add them to this manual.



The 5mm thin PCB will bear the load of the switches being actuated. To maximize its strength with little available material, the mounting cubes on it are offset a bit to the center so that the walls of the holes in which the screws go have maximum thickness. Add M2.5mm washers (they are 0.5mm thick) to compensate for this offset when screwing it to the wheel-box.

The rest of the procedure is the same as for the switch panel with bottom plate. So, see these instructions on page 23 and onwards.

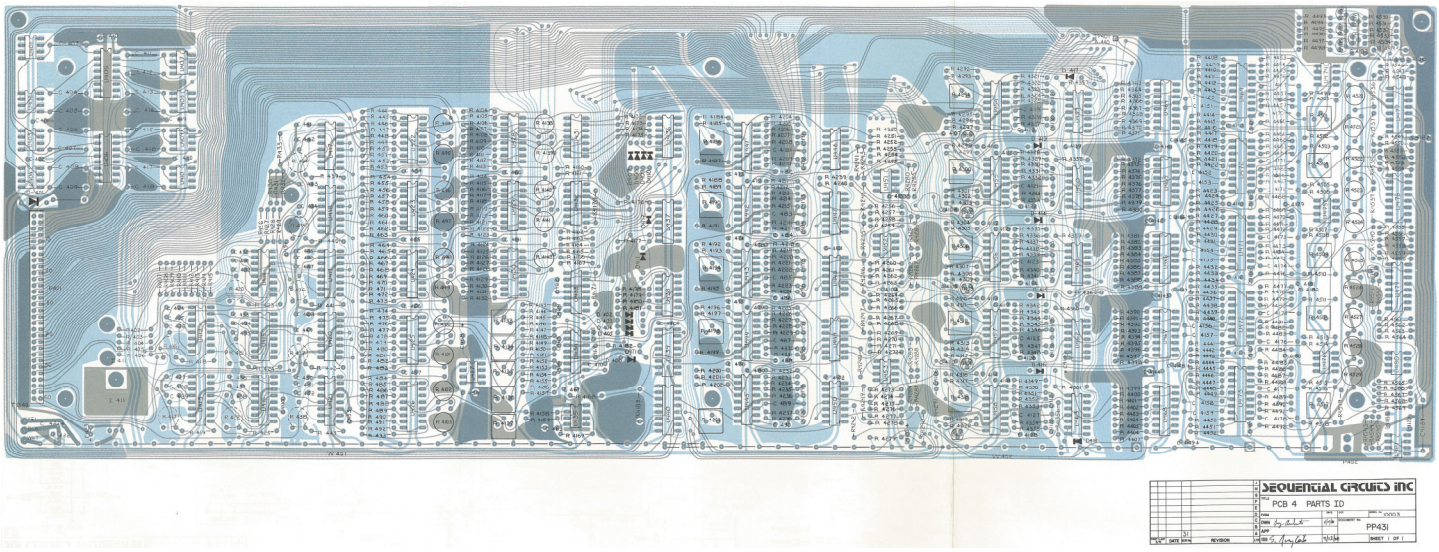
Calibration

The calibration of your Prophet is mostly unaffected. So, if it was calibrated before there is no need to do a full calibration[19] again. But, it wouldn't hurt.

The only 2 parts that do need to be calibrated are.

- 4-20 FILTER TUNING
- 4-22 VOICE VOLUME

See '*Section 4 - SERVICE'* in the *Prophet-5 Rev 3 technical manual* on how to do that.



The versions of the technical manual circulating on the net have black and white illegible images of the PCB layout. Above is a high resolution (zoom in!) one in color[20] which eases finding test points and trim pots during calibration.

When this is done, you can close your Prophet and it is ready to be played again.

Enjoy!

Forum

If anything concerning installation of this REV -1 modification kit is unclear: Please check this forum thread and post your questions if not resolved yet.

https://forums.syntaur.com/t/analogue-renaissance-rev-1-for-prophet-5/2317

We'll keep an eye on it.

[19] The REV -1 benefits from the self-limiting nature of the SSI2140 (and its predecessor, the legendary SSM2040) by maximizing dynamic range and signal-to-noise ratio. A side effect is that the A440 reference tone generator is now more quiet compared to the voices. To the untrained ear it might now be harder to hear the oscillators beating against it, which is needed to do 4-16 VCO SCALE TRIM. If that is an issue: temporary lower the volume of the individual voices (see table 4-5 and section 4-22 VOICE VOLUME in the Prophet-5 Rev 3 technical manual) during that adjustment, or simply do this with an oscilloscope instead. Trigger it with the signal on TP401 (A440 test point) and view the audio output. "Beating" is now shown by the waveform moving left or right. The faster it moves the more out-of-tune. A stable waveform means that it is in tune with the A440 generator. Another option is to use generate the 440Hz tone externally (with your computer or phone for example) so that you can match its level to the oscillators.

[20] Thanks Rob!

Changelog

V1.01: Added extra suggestion to lower individual voices volume during 4-16 VCO SCALE TRIM to better hear beating of the oscillators, which are louder with the REV -1, against the A440 reference.

V1.0: initial version.