HP Server Power Supply HP-HSTNS-PL14 modified for Ham Radio use

Matthias, DD1US, June 4th 2022, rev 1.0

Recently I bought some surplus server power supplies and modified them to use them for Ham Radio. You can get them frequently on Ebay or flea markets for less than 15 Euros each.

I decided for the HP HP-HSTNS-PL14 power supply as I found excellent information for the modification online. This power supply supplies 12V/38A. After some modifications it will also supply 13.8V / 38A.

I also added a 3D printed encasing to the power supply including an on/off switch and a voltmeter.

All the modifications are based on information others have made available in the internet. This is only a summary of the steps to modify the power supply.

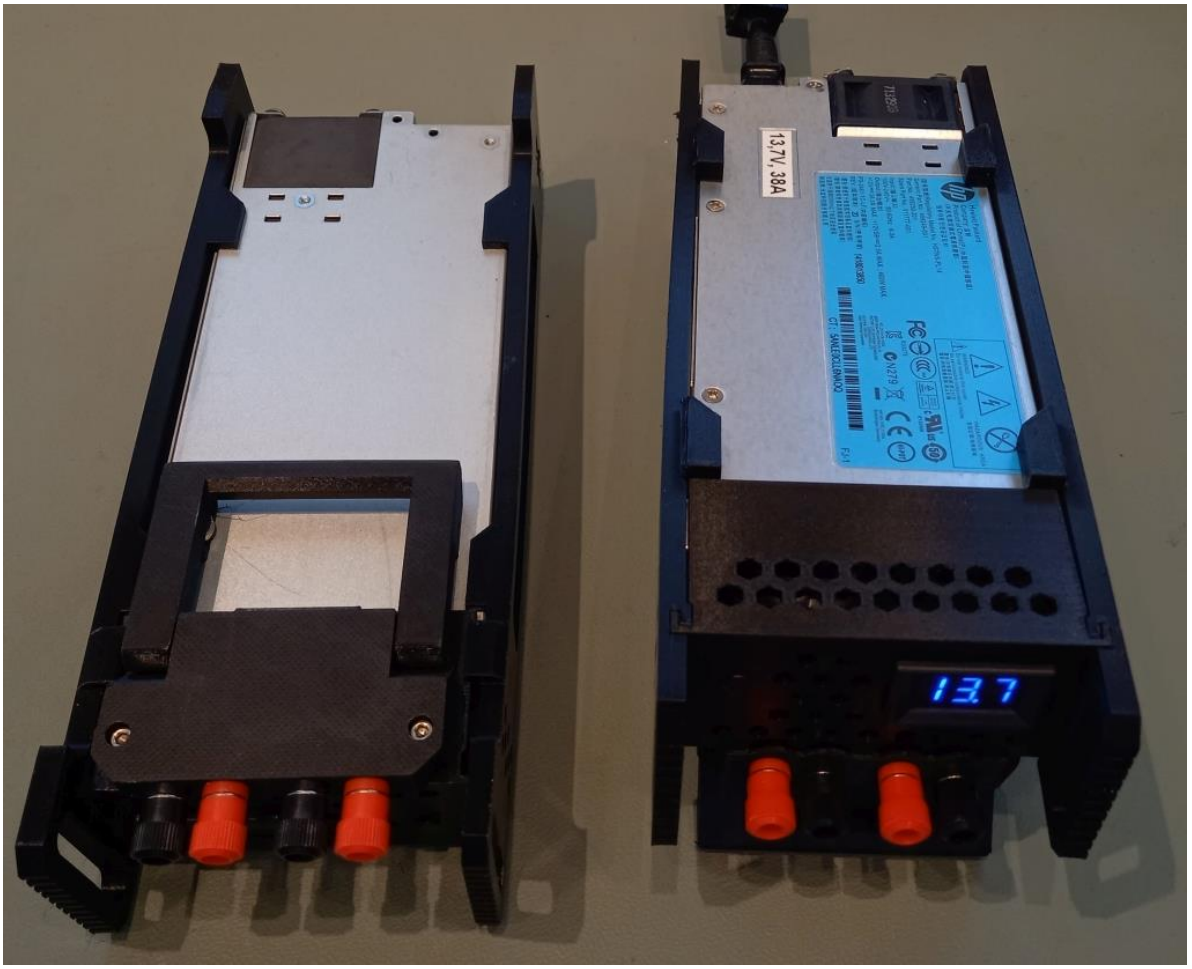
I would like to thank especially “Robert” and “pnjorge” for making their information available free of charge.

Please note, that the modifications are at your own risk. Working on high voltage power supplies can be dangerous and if you are not experienced with it, I strongly recommend to not start such a project or get help by someone else who has the needed experience.

Let me start with some pictures of my finished power supplies:


13,7V, 38A
13.6
13,7V, 38A
13.7


13,7V, 38A
13.7


13.7V, 38A
13.7


13,7V, 38A
460W
13.7

There are basically 3 steps needed:

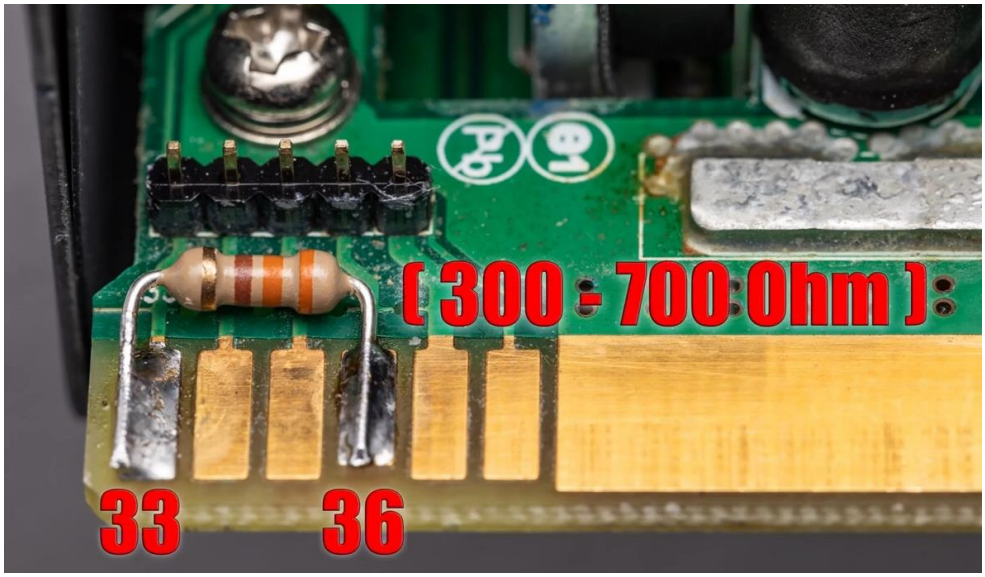
1.) Add a 330 Ohm startup resistor to the power supply otherwise it will not switch on
2.) Replace a SMD resistor to change the output power from 12V to 13.8V
3.) Integrate the power supply in a 3D printed encasing including the output plugs, voltmeter and on/off switch.

For steps 1) and 2) there is a nice video in German language on youtube:

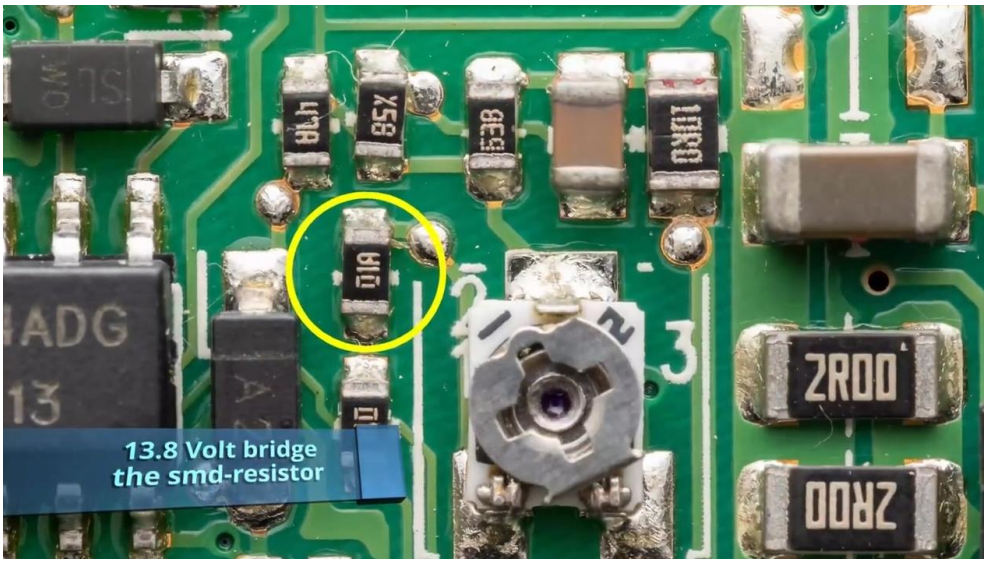
https://www.youtube.com/watch?v=KWyucJ1VKY4 (Robert's kleine Welt)

It covers well the modification of the HP-HSTNS-PL14 by adding a startup resistor and changing output voltage from 12 to 13.8V. Many thanks to "Robert" for making this information available.

1.) Here is a picture showing the 330 Ohm resistor to be added to enable the startup of the power supply when AC voltage is applied:



2.) Here is a picture with the SMD resistor to be bridged to change the output voltage to 13.8V:



Please watch the video from "Robert" to see all details of the modification.

3.) Finally, the power supply can be integrated into the 3D printed encasing.

Fortunately, “pnjorge” provides an excellent description and all necessary stl files here:

https://www.hackster.io/pnjorge/hp-server-power-supply-case-64f438

He makes all necessary stl files available here:

https://www.thingiverse.com/thing:4947889

A friend was kind enough to do the 3D printing for me. I was amazed about the many details “pnjorge” had taken into account and how precisely everything fits together. This I a well thought through project, many thanks to “pnjorge” for making this information available.

In the appendix you will find the documentation from “pnjorge” attached.

I have taken some small deviations from his description, e.g. I removed the handles on the back of the power supplies and thus also had to replace the cable ties by some small brackets. You can see the difference when comparing the pictures. Also I did not drill through the PCB to connect the output wires but added bridges between the upper and lower side of the PCB and soldered the output wires directly to the PCB.

If you have any questions or remarks please send them to the Email address given below.

Kind regards

Matthias

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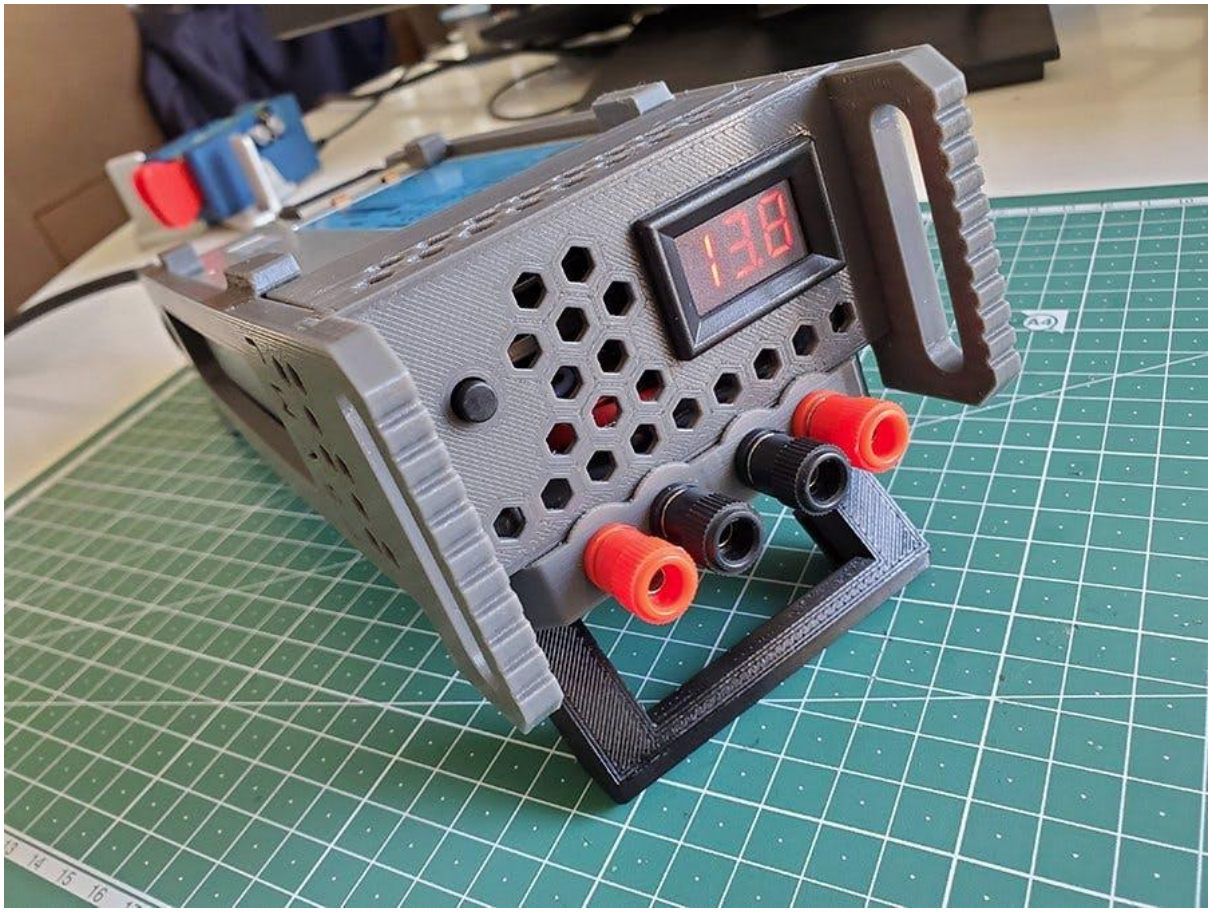
Appendix: HP Server Power Supply Case by “pnjorge”

HP Server Power Supply Case

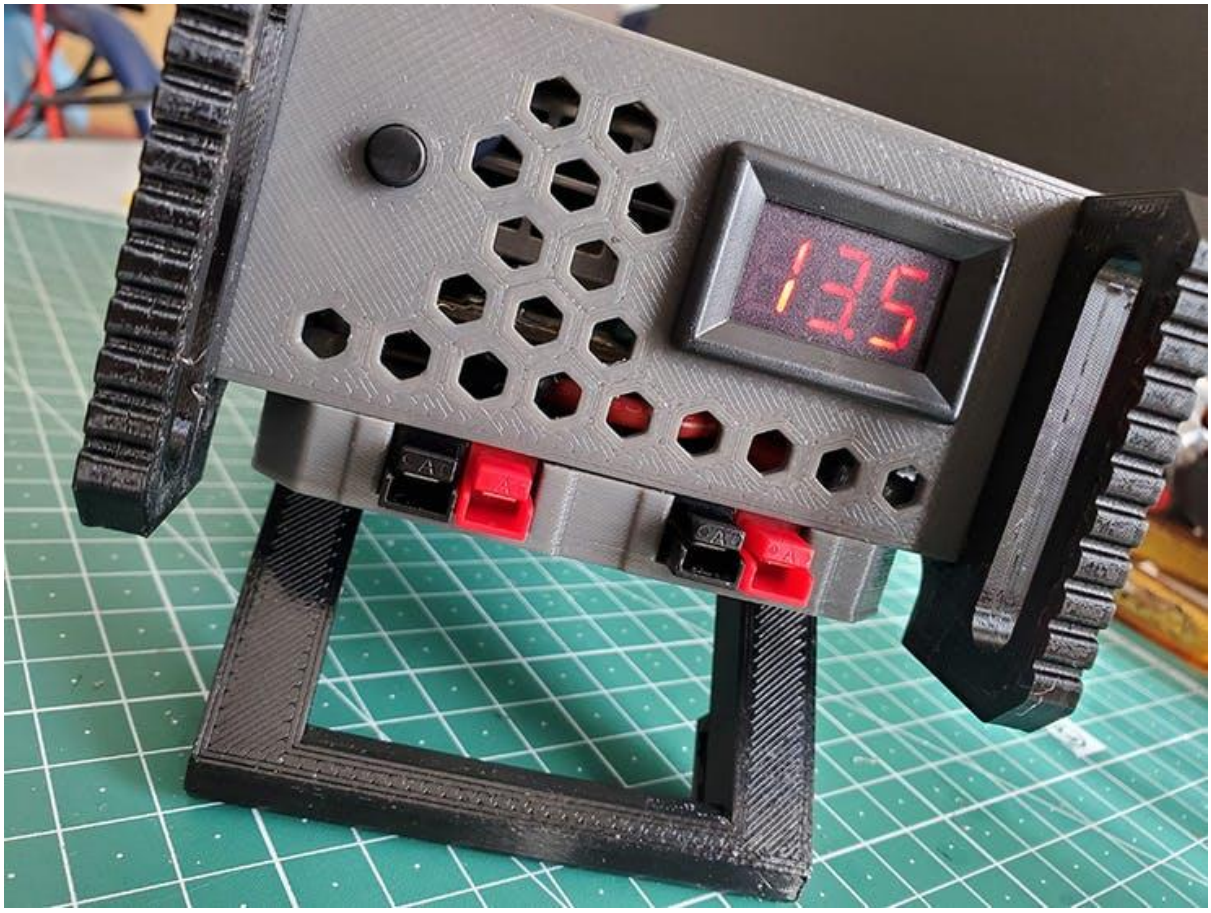
Please always have a look first at https://www.hackster.io/pnjorge/hp-server-power-supply-case-64f438 for an updated version from "pnjorge" of this description

Embellish, protect and reduce the sheet metal look of your modified HP server power supply with this 3D-printed enclosure.



Story

This is not meant to describe the voltage modification for these PSUs. Instructions for this procedure are plentiful online. As usual, even if the standard modification is very simple, care must always be taken when handling switched mode power supplies.



THE DESIGN

The following text describes a minimalist case design, meant to fit around Hewlett Packard common slot (CS) server power supply units, such as the HSTNS-PL14, HSTNS-PD14, HSTNSL-18 etc. The units can be found on the used market and provide an outstanding price to performance option for powering shack equipment. Indeed, many amateurs are using these modified units to supply 13.8V to their transceivers. I bought two of these recently for 23 Euros (..for the pair !).

This case design provides a protective embellishment to HP's original sheet metal CS box, as well as some welcome features like an on/off 'start' switch, voltmeter and bail stand. Reducing its industrial look means the unit would not go too amiss sharing a shelf with an Icom IC-7300 or a Yaesu FT-DX10. Holes in the front, top and sides of the front panel allow airflow ensuring there is still sufficient cooling provided.

THE CS

HP Common Slot (CS) power supplies are used in server machines to supply their voltage and current requirements. They have standard dimensions and can slide effortlessly into server machines.

HP common slot power supply unit document.

Some machines support two units with each backing up the other. Apparently they get replaced often in server rooms, before they have a chance to malfunction. Hence the proliferation of good used units available on internet auction and surplus sites. Untold numbers of them have been produced which drives production costs down. It's not like hamradio power supplies which are manufactured for a somewhat niche market.

Andreas Spiess: 20 dollar PSUs video.

THE MOD

The units originally supply 12V but some can be modified to increase their output voltage slightly to better fulfill the needs of our shack equipment. They use state of the art switching technology to attain 90% efficiency. This reduces power consumption and keeps server rooms eco-friendly. Their intelligent monitoring electronics includes over-voltage protection, which will shut down the unit to protect the server. This over-voltage trip threshold can be modified too, although I've never found the need for this. If originally set by default to trip at 14V, I just mod the unit to output only 13.5V as opposed to 13.8V to have a little more leeway.

460W/38A and higher 750W/62A versions are the most common and are priced accordingly on the secondhand market. For the average ham's shack, with a 100W transceiver needing maybe 20A, the 460W version is sufficient. Remember that after conversion to 13.8V output, the current available will be reduced to approximately 33A, maintaining the 460W maximum power output. Still more than enough current available though.

Most transceivers are somewhat voltage tolerant, but somewhere around 13.5V to 13.8V is considered the accepted input voltage to use. This is why you will find most commercial power supply units have a fixed output at 13.8V or 13.5V. Actually measuring them you may find they are not very accurately set. But then again, how accurate is your measuring equipment?

As an example, see power and voltage differences below:

- VE3FAL...Xiegu G90 HF Transceiver RF output measurements.
- Xiegu G90, just how accurate is internal voltage reading on the radio.

For the anal-retentive some manufacturers provide a voltage adjust control which is convenient.

Will you loose RF output power if using slightly less voltage? Maybe. It depends on the radio. But anyway, in the big 'dB picture' of things, how significant is transmitting only 80W with 12V as opposed to 100W with 13.8V for example?

THE STARTUP

These mods usually need a 'start resistor' or/and shunt to bridge a couple of the pcb pads, fooling the unit into thinking it has been inserted into a server chassis. Two methods are widely used to start the power supply and are discussed below:

Turning on a HP DPS-750RB server power supply.

THE NOISE

Switched mode power supplies will invariably generate RF noise to some extent. Manufacturers address this issue with shielding and filtering, Some have even implemented an offset control to vary the switching frequency slightly if the interference generated lands on the frequency you are trying to receive. This might be a worthwhile mod to perform on these server PSUs. If anyone has any information, a service manual or even just a circuit diagram it would be an interesting modification. Anyway, the jury is still out on whether any generated noise is a real problem. It's all relative. If operating VHF or UHF FM it's a non-issue. If HF operating from an inner city location, the surrounding RF hash will probably be so high that your switch mode power supply noise will be the least of your worries. If operating from an island in the middle of nowhere with a low noise floor, then any PSU switching birdies will be more annoying of course.

This subject and some possible solutions are addressed below:

N0SSC test.

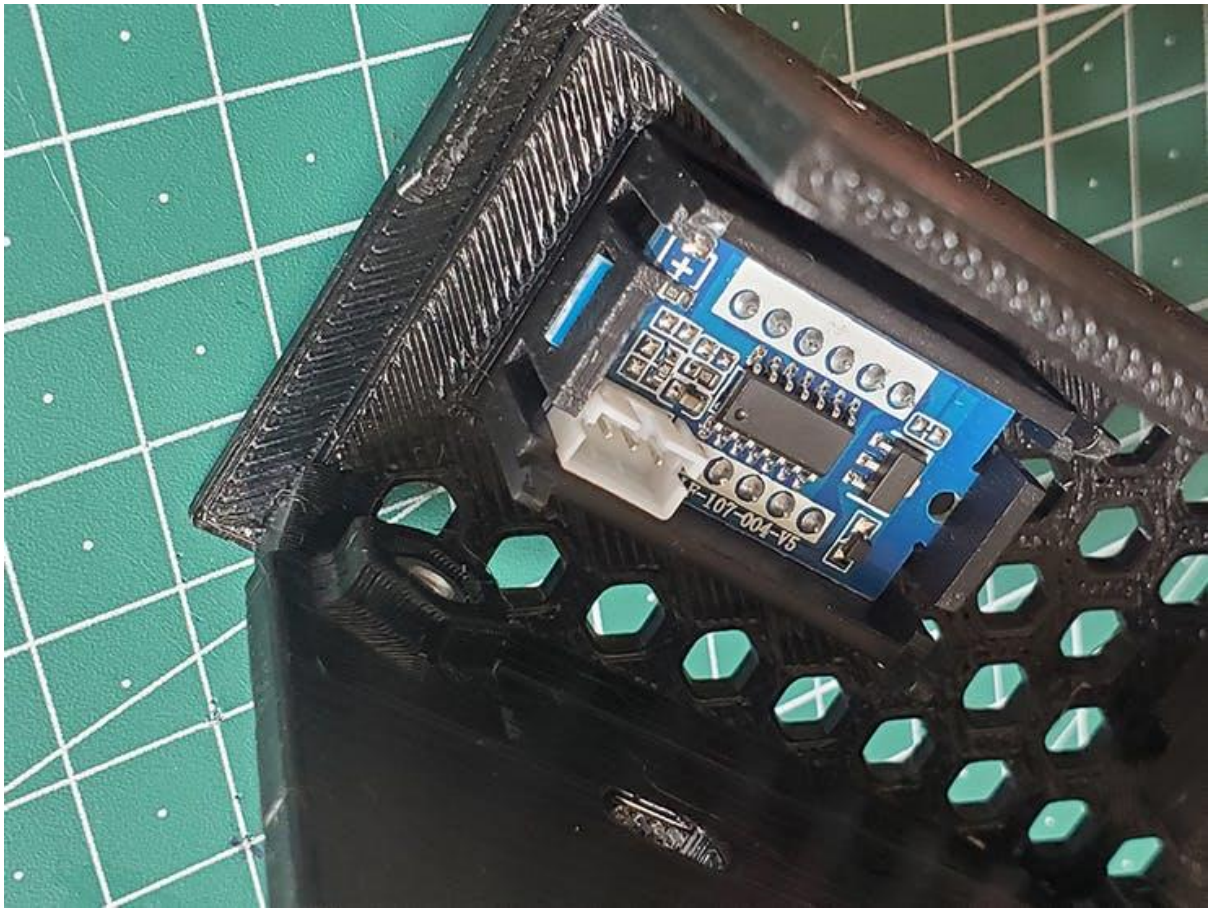
Robert's Kleine Welt. Filtering solution.(click on the 'Settings' select 'Subtitles/CC' and then click 'Auto Translate')

VA3HDL. Testing RFI in Switching Power Supplies.

THE COMPONENTS

On/Off start switch: An 8x8mm square latching on/off push switch that I had a bagful of. It's small to still allow good airflow through the front of the PSU. These square switches will fit snugly into the front panel and are cheap and easily found. Don't forget a cylindrical switch cap, often not included. There is a rear, 3D printed clip, to keep the switch in place if necessary.

Meter: A small 0.36" mini voltmeter with bezel. This version measures 2.4V to 30V with only two connection wires. It takes it's working supply from the measured voltage. It's small so as to still allow airflow through the psu for cooling. It's dimensions are only about 23x35xx20mm. Only this size will fit into the front panel hole. To facilitate snapping the meter bezel into the front panel, sometimes I shave a sliver off it's plastic top and bottom clips with an Xacto knife.



Powerpoles or binding posts: I designed two connection options that fix to the bottom of the front panel. One with traditional binding posts and the other with the newer Anderson Powerpole connectors.

- Binding posts are about 11mm in diameter and about 33mm long. They are cheap and easily sourced online. Use of a spring washer or some Loctite is advisable to prevent posts unscrewing themselves internally when we screw on cables having ring or spade terminals.

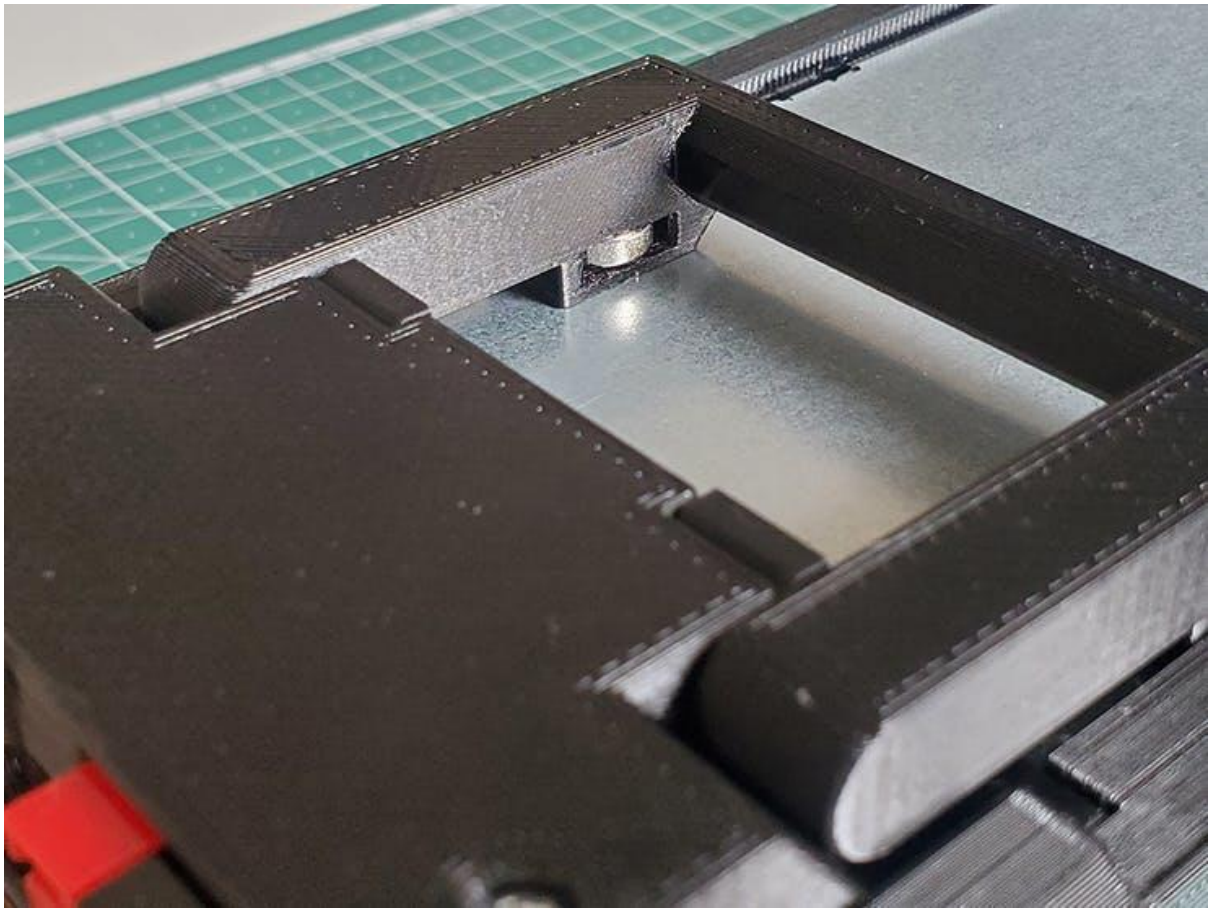
These cheap binding posts sometimes come with banana plugs to pair with on the cable side. The binding post females are acceptable but the banana plug males are usually of low quality giving a loose and unreliable connection. It's best to avoid using these. Use some good quality plugs for your cables. Alternatively use ring or spade terminals crimped and soldered to the cable ends.

- Anderson Powerpoles have become very popular. They are hassle free, quicker to connect to and cannot be plugged in backwards. They have rapidly become a new pseudo-standard in power distribution around ham shacks.

Output wire: I use 14AWG silicon wire to connect the high current output from PCB pads to the Powerpoles (or binding posts).

2x cable ties: These are used for securing the rear of side panels to the rear of the power supply and keeps everything in place.

Magnet: This is optional and used to keep the bail stand out of the way when not in use. It sticks the bail stand to the underside of the PSU and stops it swinging about if transporting the unit for example. Only one magnet is needed. Of 10mm or less diameter. Found in fridge magnets, cardboard packaging or magnetic noteboard holders. There is a slot on each sidearm of the bail stand to fit the magnet. On one side it's about 2mm high and on the other 3mm high. Different heights to accommodate different magnet thicknesses. Use hot glue if required.



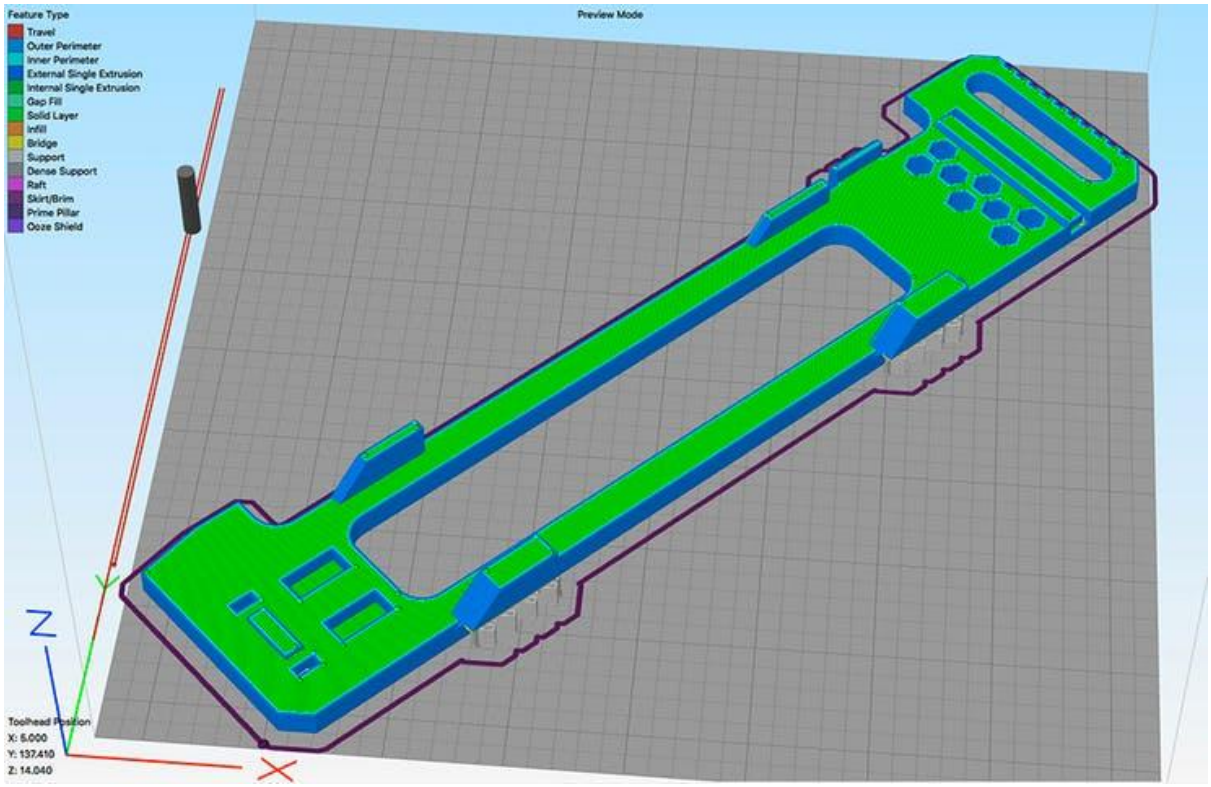
2x nuts and bolts: Short M3 size, to securely fix the Powerpole (or binding post) mount to the underside of the front panel.

THE PRINTING

The 3d model STL files required are available on my Thingiverse account. Link at the end.

I printed everything on an inexpensive Ender 3. It has 220 x 220mm of bed real estate. However, the size of the build surface actually measures 235 x 235mm. Diagonally, end to end, it's about 330mm.

[Ender 3 Bed Size: What Is It Really?]



So, to print the long left- and right-hand side panel bodies, I diagonally rotated each by 45deg across the bed. There's just about enough space. You might need to move the bed clips to one side and the other as otherwise the extruder will bump into them.

Printing diagonally means the top, bottom and infill layers will print square on and not diagonally. Will this affect strength? A little maybe, but still acceptable. An infill of 15% was used and supports positioned in the usual places. Use tweezers or needle nose pliers to remove all support material from the trickier places like where the side panels will slot into the front panel.

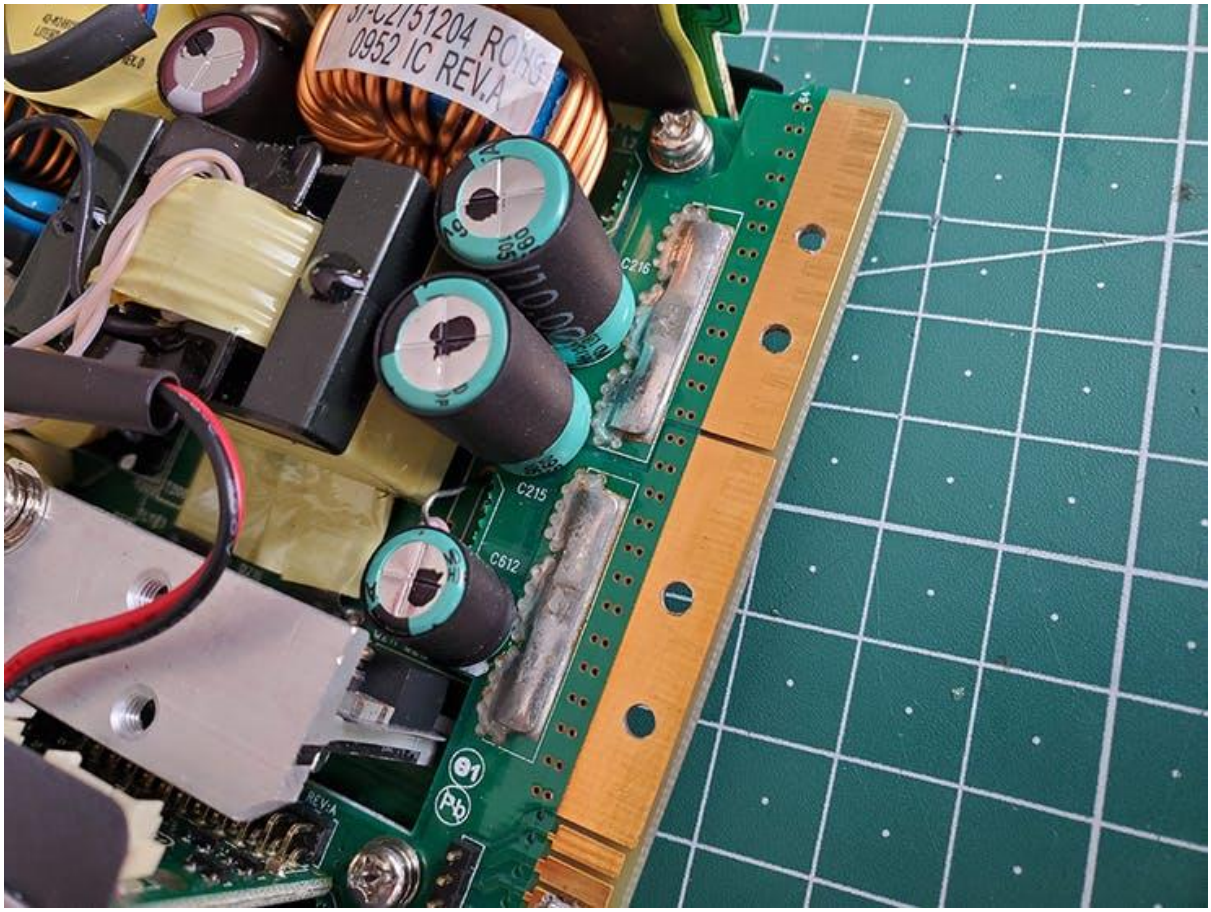
For filament it's best to use PETG. It's a bit fiddlier to dial in than PLA but provides more strength and flexibility. PLA is too brittle and will probably break as parts need to slide and clip into each other.

As the 3D pieces will slot together and fit around the power supply with its fixed dimensions, the size of each print is important. Calibrate your E-steps. Even between different filament colours from the same manufacturer. Using the horizontal size compensation setting in Simplify3D may help too. Your mileage may vary.

Size compensation Tutorial Simplify3D #09. (click on the 'Settings' select 'Subtitles/CC' and then click 'Auto Translate')

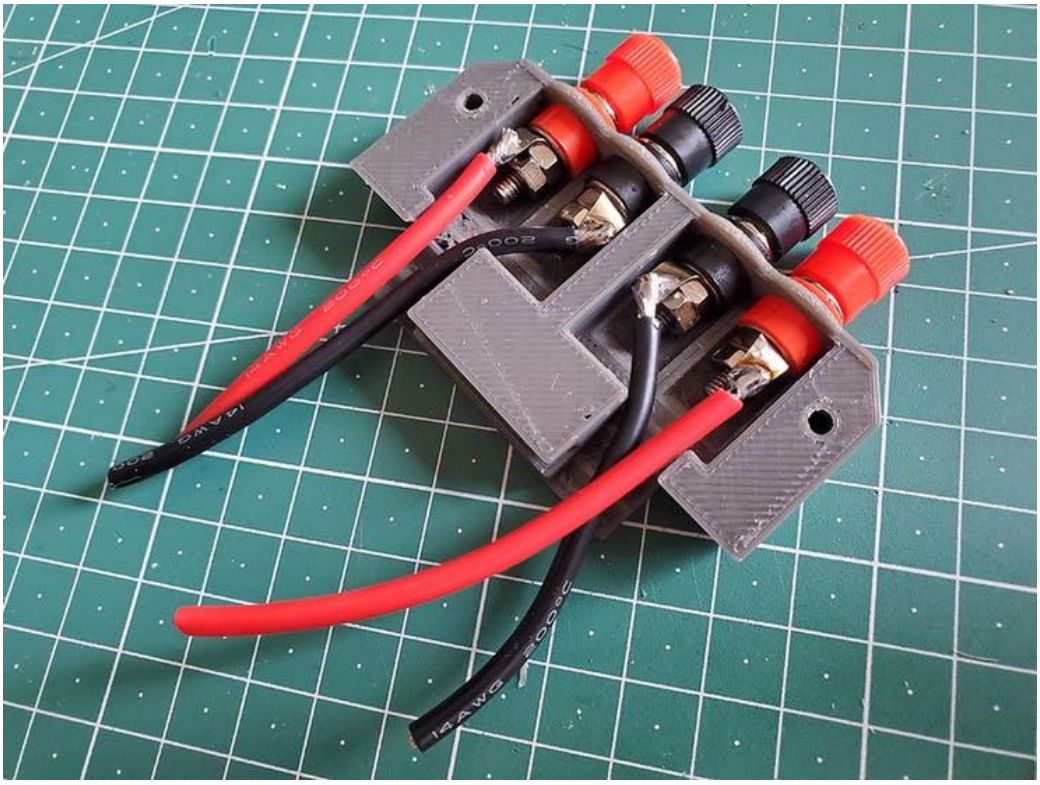
THE BUILD

Carefully drilling four 2.5mm diameter holes in the PCB allowed me to tap off two negative and two positive outputs with 14AWG wires. There doesn't appear to be any tracks passing between these copper pads but beware of multilayer boards. Routing through the bottom of the PCB and soldering on both sides gives a low resistance path to the front panel connectors. Keeping the wires short at about 7cm and connecting from underneath is tidier and blocks less airflow.

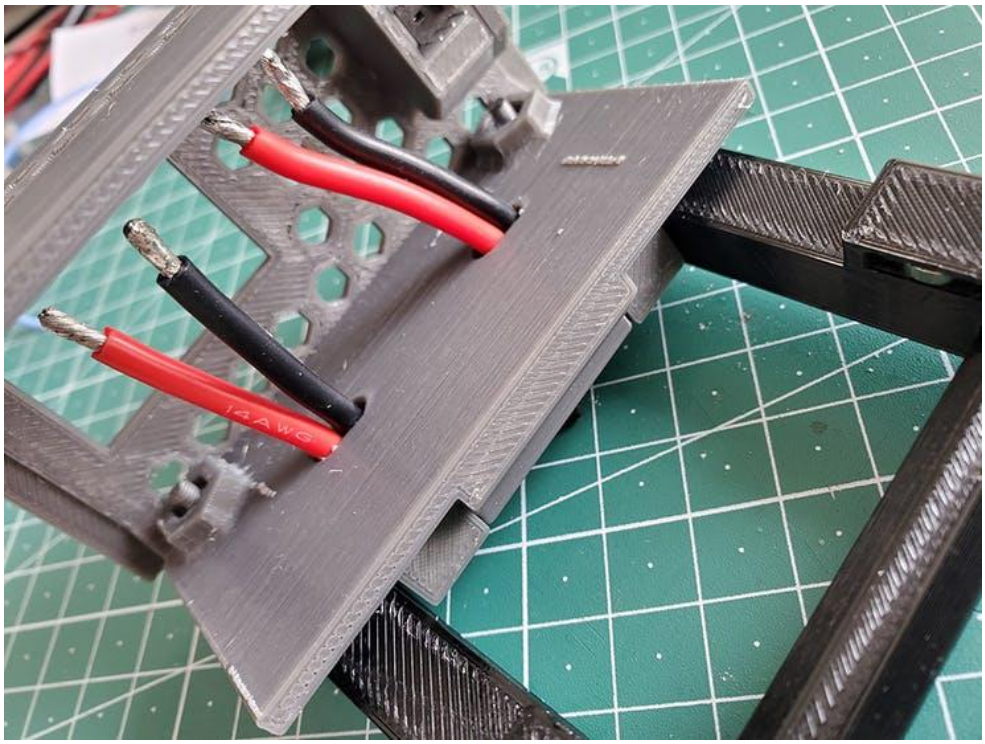


First solder up your four Powerpoles and seat them in the lower 3D printed mount with approximately 7cm of 14AWG to make the connections between Powerpoles and the 2.5mm PCB holes that were drilled in the pads.

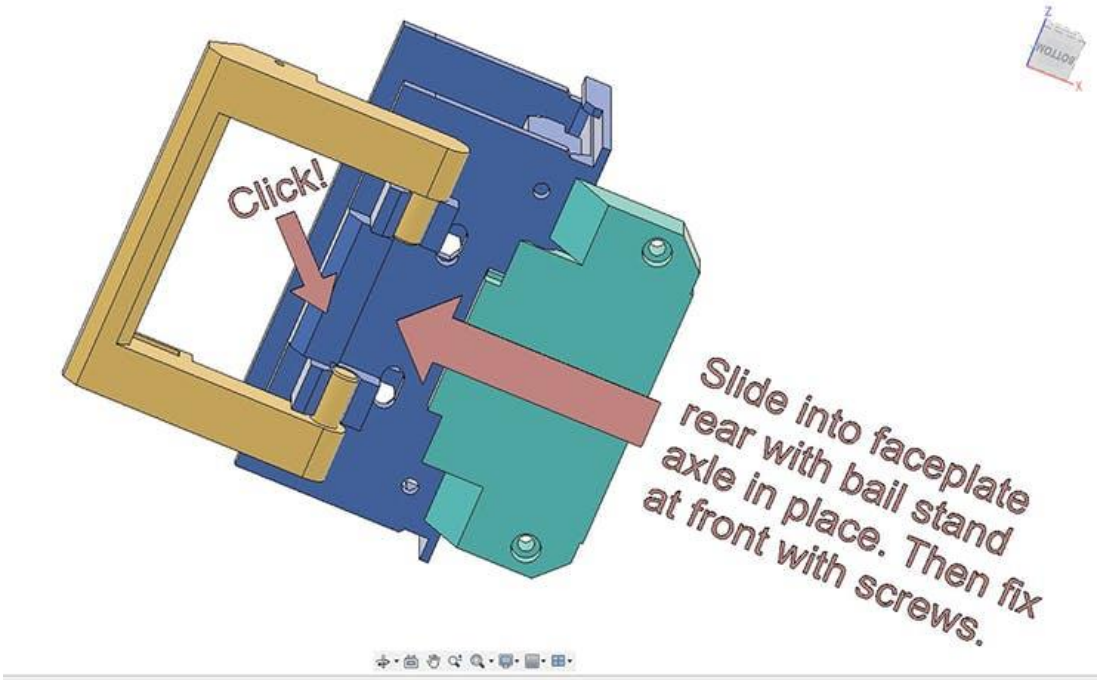
The procedure is the same if using binding posts, except these connectors are screwed in to the front of the 3D printed mount with small bolts. Best to use spring washers or some Loctite on each, to avoid these bolts unscrewing at a later date with overzealous or repeated connecting of the radio's power cables.



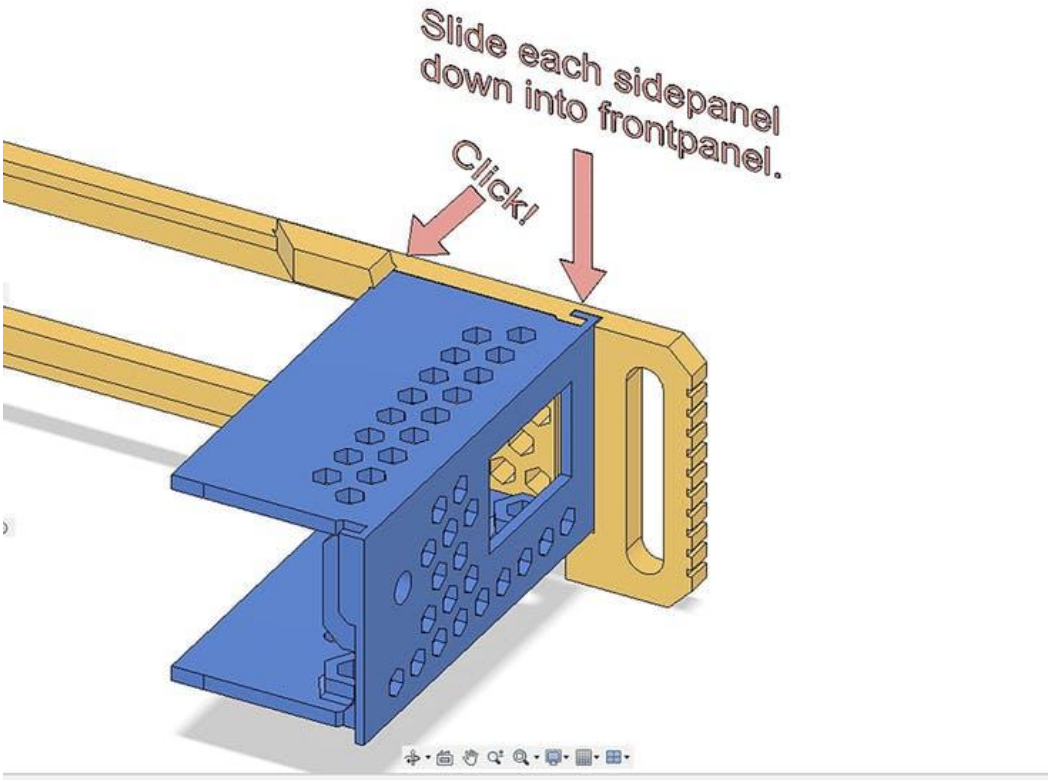
Route each pair of wires in through the two holes in the front panel's base just behind where the Powerpoles will be. Then solder all four wires to the holes in the PCB paying attention to polarity.



The lower Powerpole (or binding post) base needs to slot into the bottom side of the front panel with the bail stand in place. The base and the front panel will loosely sandwich the bail stand axle. Push the base into the front panel then the two M3 screws can be inserted and tightened.



Each side panel needs to slot into the front panel by sliding in from the top. Then the power supply should push into and this arrangement. It can be a bit fiddly and why PETG is better because a certain amount of flexibility is needed here. Then at the rear there are holes for attaching cable ties to fix each side panel to the rear of the power supply.



THE CAVEATS

As mentioned before, care is needed when working with these PSUs even when switched off and unplugged from the mains electricity. Be mindful that they are notorious for holding high voltages on their capacitors long after powering off. When making the voltage adjustment use insulated tools and abstain from touching anything, including the control board which does carry high voltages.

THE EPILOGUE

No doubt that for a frugal ham prepared to tinker a bit, these switched mode power supplies are an economical option for powering shack gear. Commercially available hamradio power supplies, giving similar performance, can cost ten times more.

Can we power Yaesu's newest 4000 Euro transceiver with this 15 Euro power supply? Yes we can..but would we?