

A/C Powered Heating Pad Installation

Ender Xtender 400 / 400 XL



The standard installation of the Xtender 400 aluminum build platform requires the continued use of the Ender 3's heated build plate. The obvious negative to this approach is the size differential between the stock heat plate and the new, 400mm x 400mm aluminum plate that mount atop of the smaller plate. The advantage to this approach is simplicity of installation. Although the larger build plate does indeed require elevated print temperatures to distribute the heat, it has been noted that the heat at the edges of the larger plate is less than desirable.

A full size heat pad that distributes heat evenly and quickly to the entire surface is the optimal solution. This can be achieved in two ways; a DC powered heat pad that connects to the control board in the same fashion as the stock heater; or an AC powered heating pad that connects to a solid state relay (SSR) which switches the AC power on and off at the command of the control board.

At this point, I must issue a cautionary statement and a disclaimer. Installation of this arrangement requires interfacing with high voltage AC power. The installation is rather simple, and there are some extra add-ons that you should use to mitigate possible failures.

DISCLAIMER

I do not manufacture these myself. I provided a specification to a manufacturer that has safety certifications and performs rigorous testing. I am providing a copy of relevant sections of our Terms of Service for your review below. You may find the complete ToS at the following url: <http://www.enderextender.com/terms-of-service>

SECTION 15 – DISCLAIMER OF WARRANTIES; LIMITATION OF LIABILITY

We do not guarantee, represent or warrant that your use of our service will be uninterrupted, timely, secure or error-free.

We do not warrant that the results that may be obtained from the use of the service will be accurate or reliable.

You agree that from time to time we may remove the service for indefinite periods of time or cancel the service at any time, without notice to you.

You expressly agree that your use of, or inability to use, the service is at your sole risk.

The service and all products and services delivered to you through the service are (except as expressly stated by us) provided 'as is' and 'as available' for your use, without any representations, warranties or conditions of any kind, either express or implied, including all implied warranties or conditions of merchantability, merchantable quality, fitness for a particular purpose, durability, title, and non-infringement.

In no case shall Innova 3D LLC, our directors, officers, employees, affiliates, agents, contractors, interns, suppliers, service providers or licensors be liable for any injury, loss, claim, or any direct, indirect, incidental, punitive, special, or consequential damages of any kind, including, without limitation lost profits, lost revenue, lost savings, loss of data, replacement costs, or any similar damages, whether based in contract, tort (including negligence), strict liability or otherwise, arising from your use of any of the service or any products procured using the service, or for any other claim related in any way to your use of the service or any product, including, but not limited to, any errors or omissions in any content, or any loss or damage of any kind incurred as a result of the use of the service or any content (or product) posted, transmitted, or otherwise made available via the service, even if advised of their possibility. Because some states or jurisdictions do not allow the exclusion or the limitation of liability for consequential or incidental damages, in such states or jurisdictions, our liability shall be limited to the maximum extent permitted by law.

SECTION 16 – INDEMNIFICATION

You agree to indemnify, defend and hold harmless Innova 3D, LLC and our parent, subsidiaries, affiliates, partners, officers, directors, agents, contractors, licensors, service providers, subcontractors, suppliers, interns and employees, harmless from any claim or demand, including reasonable attorneys' fees, made by any third-party due to

or arising out of your breach of these Terms of Service or the documents they incorporate by reference or your violation of any law or the rights of a third-party.

SECTION 17 – SEVERABILITY

In the event that any provision of these Terms of Service is determined to be unlawful, void or unenforceable, such provision shall nonetheless be enforceable to the fullest extent permitted by applicable law, and the unenforceable portion shall be deemed to be severed from these Terms of Service, such determination shall not affect the validity and enforceability of any other remaining provisions.

Summary of operation

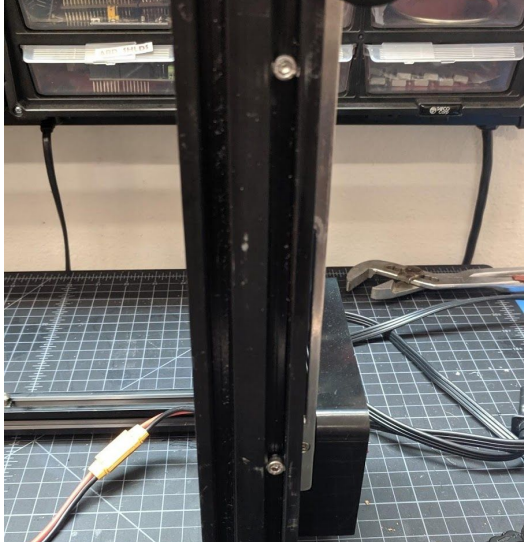
The Ender 3 control board uses a MOSFET to power the heat bed (the heat plate uses wires under a black coat of film which acts as a large resistor that generates heat). The MOSFET is a high current digital switch. Inside the heat pad are nichrome wires that generate heat in response to electrical current. The pad itself is made of silicone rubber, which is known to tolerate high heat. The solid state relay switches the AC current on and off at the command of the Ender 3's MOSFET driver and firmware.

A NOTE ABOUT THE SOLID STATE RELAY SUPPLIED IN THE KIT

It is known that there are more fake Solid State Relays available on the internet than real ones. What makes them fake is the copy-cat manufacturers use lower-power MOSFETS inside than what the label represents. The MOSFETS in this kit are 25A, which is 5 times more power than the 5 AMPS the heat pad is designed to consume. They are labelled 40A. Although we have not had any issues with these relays, **If you are concerned about this, I encourage you to source an alternative SSR.**

General installation instructions

Remove the power cord to your power supply, then remove the power supply from the frame of the printer.

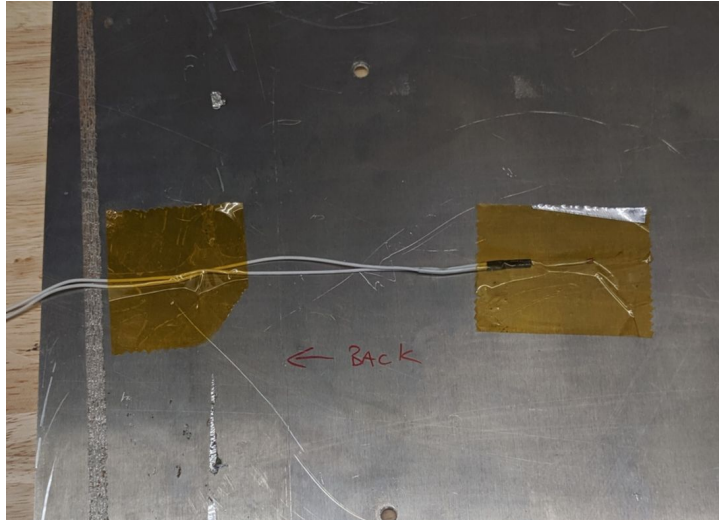


Thermistor Wire Installation

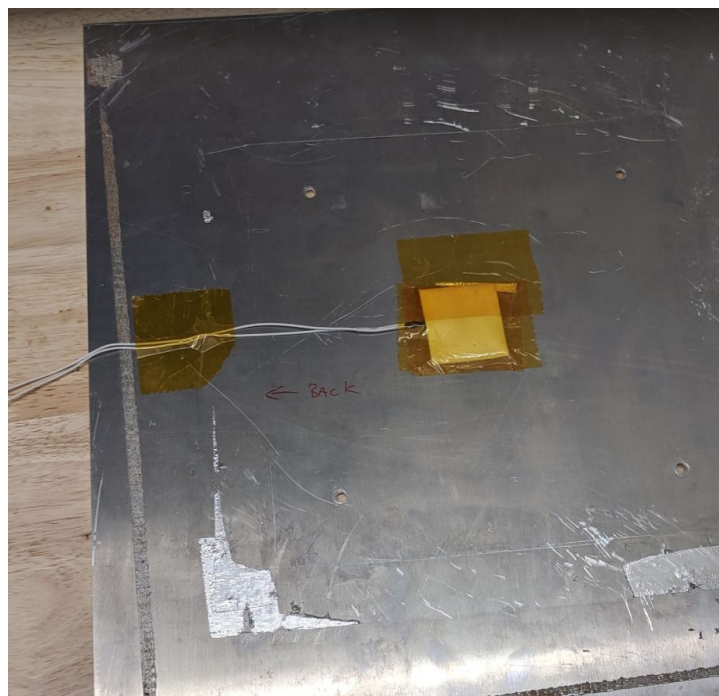
Carefully remove the gold colored Kapton tape from the underside of the stock heated bed. You should see a small insulation pad as well. We need to save these materials and re-use them.



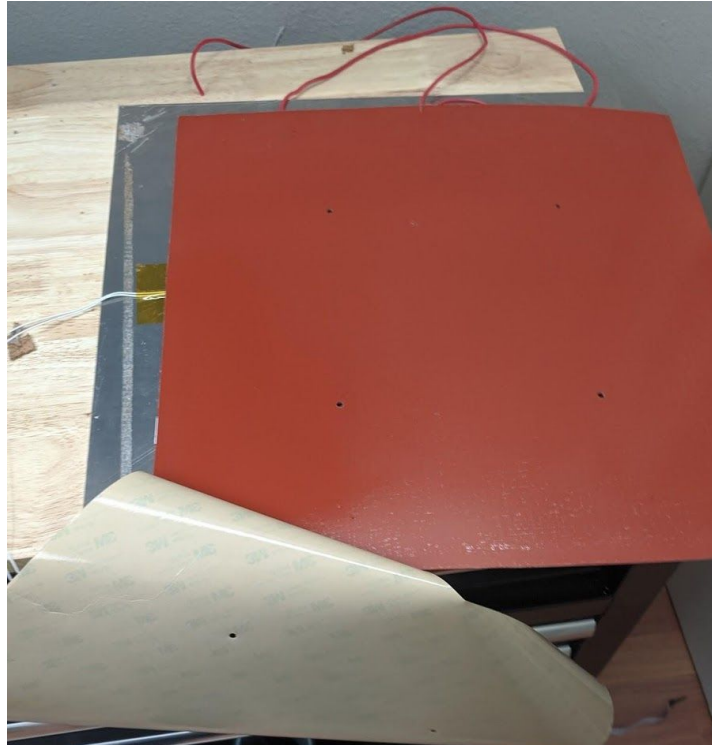
Position the thermistor on the new heat plate in the center with the wires oriented toward the back. You should ensure that your orientation of the large heat plate will mount correctly with the stock Y carriage plate. Sometimes errors happen in machining and some holes may be misaligned. These plates are drilled by hand, so there's an error factor involved. Once you have tested the alignment of the heat plate to carriage plate, position the thermistor and tape according to the picture below:



Make sure the thermistor head has good contact with the heat plate. Cover it with one layer of Kapton tape, then follow up with the layer of insulation padding and the remainder of the tape.



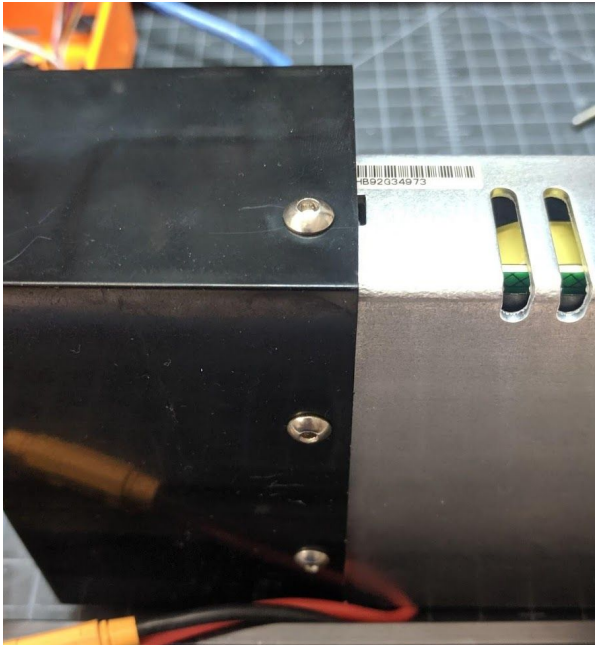
Now you're ready to attach the very sticky side of the heat pad to the plate. Warning: Once installed, you are not likely to get it removed. Remove the paper from the heat pad and carefully center the heat pad over the holes and corners, with the wires pointing in the same direction as the thermistor wires. TIP: You might have some luck by inserting the bed screws through the holes, with the plate on the table as show, screws pointing up, might help guide the pad correctly.



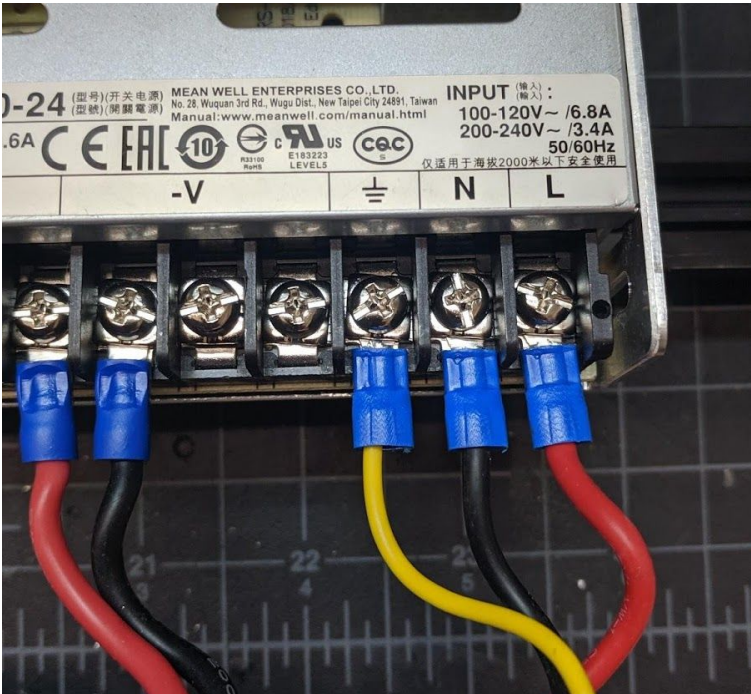
Remove the black cover that protects the terminals from probing fingers.



Remove these three screws:



You will notice the right most two terminals are labeled N and L, this means Neutral and Line, these are your AC incoming power terminals.



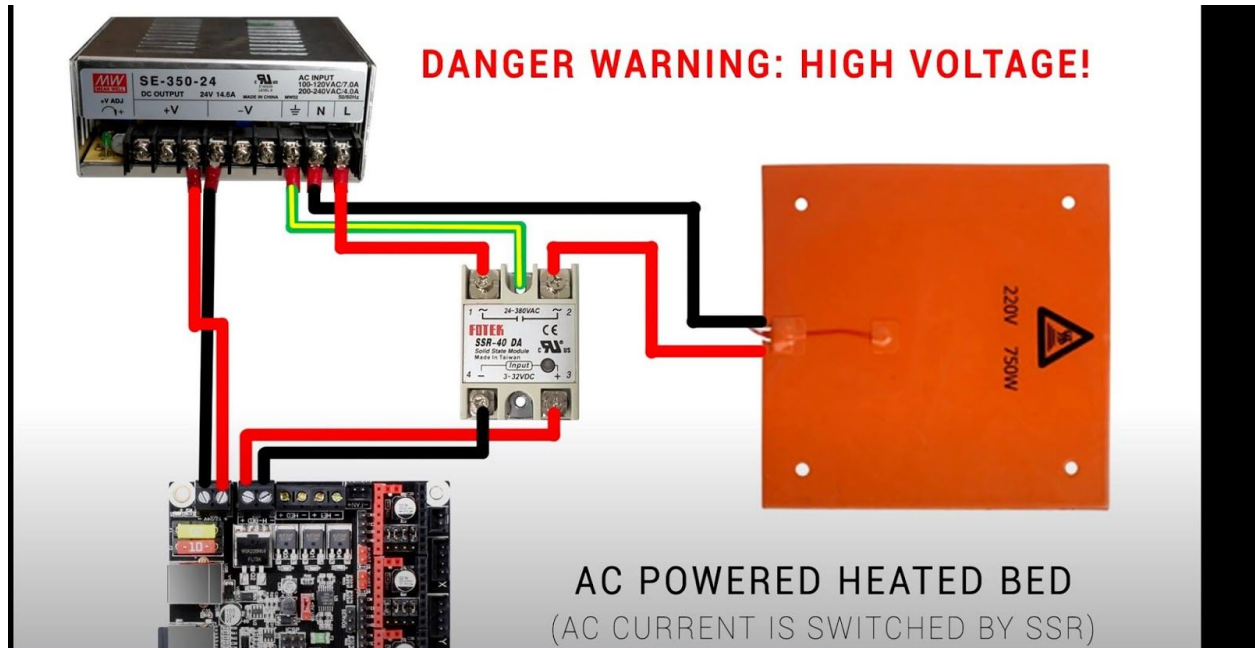
The current revision of this kit includes a short piece of wire (either red or black, depending on what we have on hand). You can connect the bare wire to the screw terminals on the power supply and SSR, but it is highly recommended that you use crimp style terminals. If you use crimp terminals, crimp them onto both ends of the wire. You will also need to crimp terminals onto the wires coming from the heat pad. I prefer the open terminals such as these:



The next step is to actually connect the wires. In explanatory form:

- One side of the SSR is labeled AC
- Connect one wire from the heat pad to the N terminal of the power supply.
- Connect the other heat pad wire to terminal #2 of the SSR
- Connect one end of the included short wire from the kit to the L terminal of the power supply and connect the other end of this wire to terminal #1 of the SSR.
- The other side of the SSR is labeled DC, and you will use the long thin black/red wires to connect these terminals to your control board, where the existing heated build plate wires connect.
- Pay attention to the black (-) and red (+) orientation of the wires.

(I am using ground of the frame, however, you may enjoy using a ground wire (Green) as shown in the diagram below) (For AC wiring, the color of the wires are irrelevant. For DC wiring, Red is Positive, Black is negative)



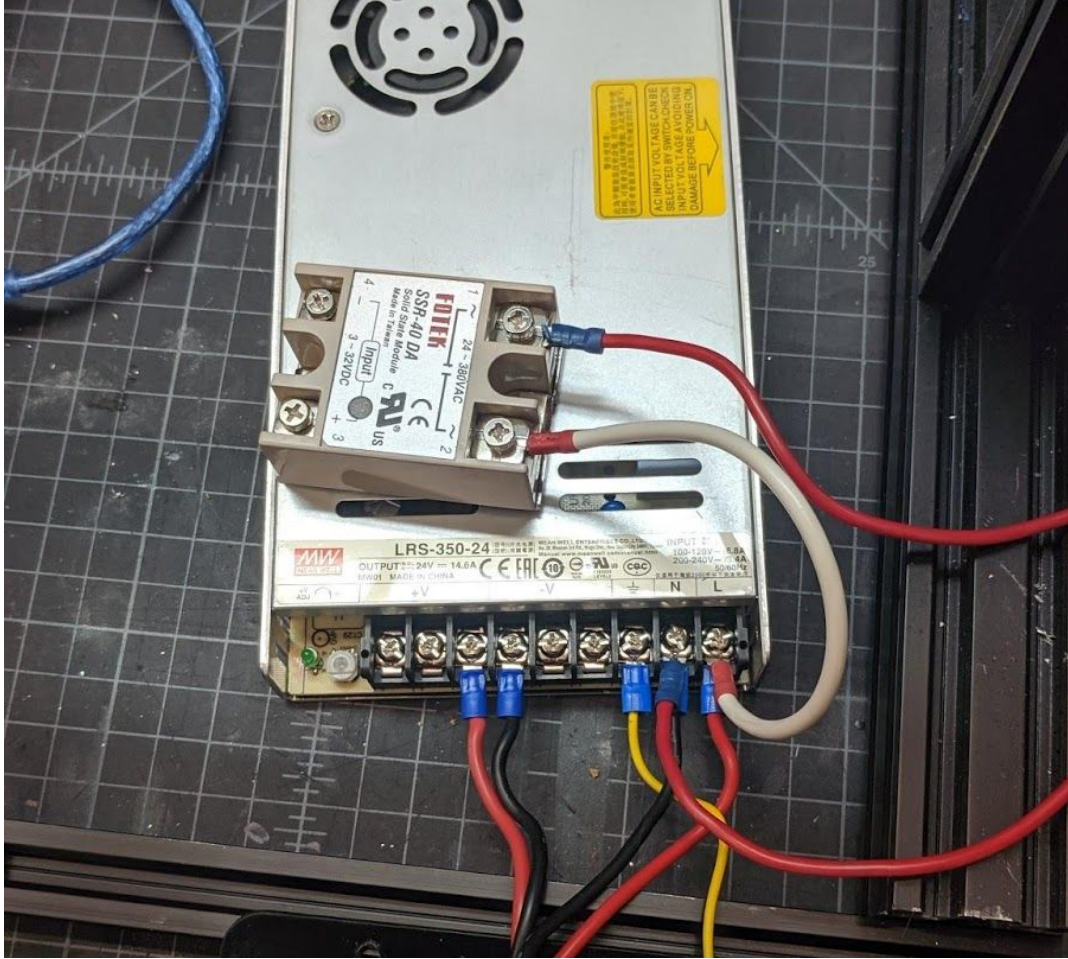
(Diagram courtesy of Teaching Tech)

Watch the video: <https://www.youtube.com/watch?v=1VyFejiKkSQ>

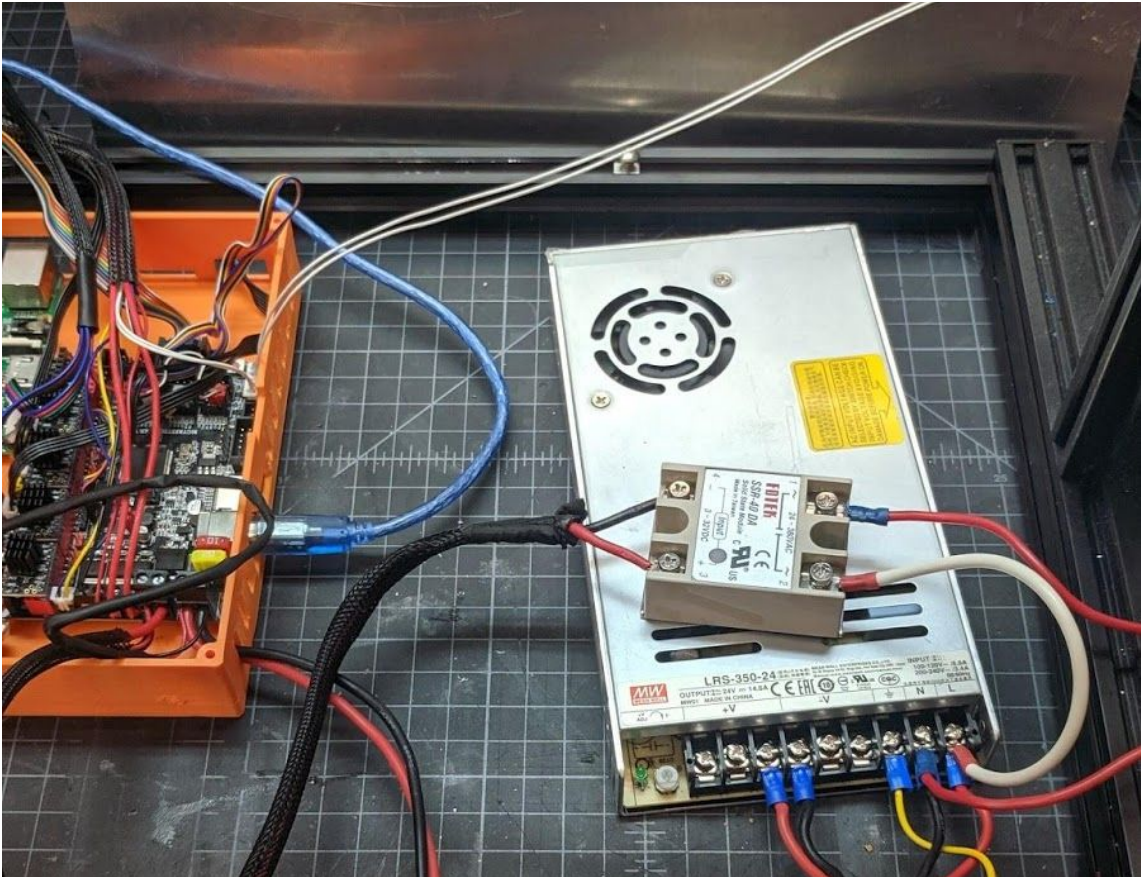
Mount the Solid State Relay (SSR) to the frame of the printer as shown in the photo below. You can print a cover for the SSR later.

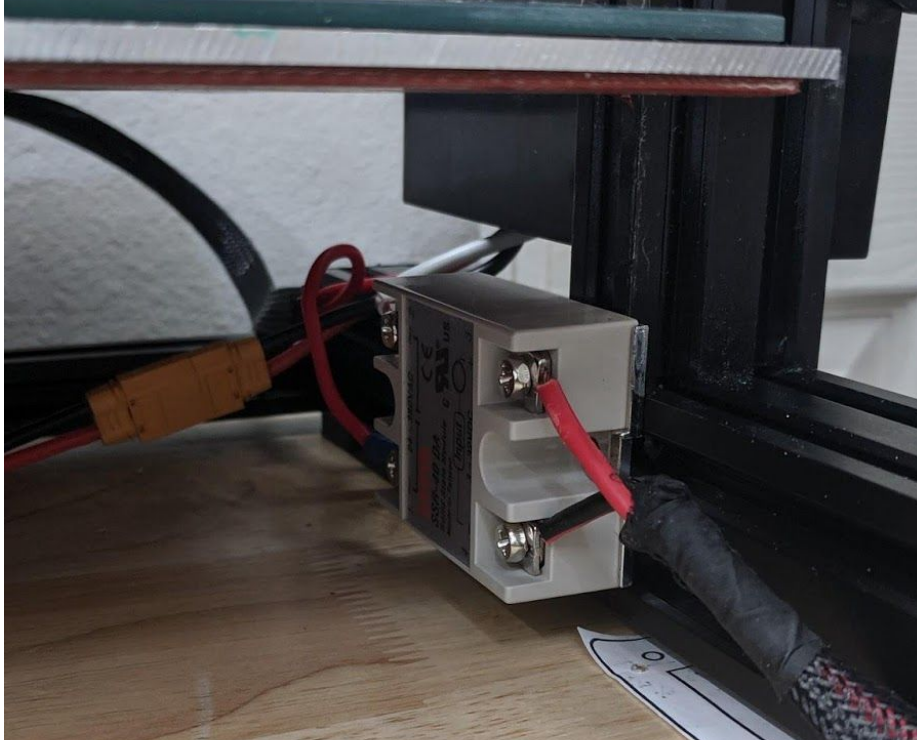
You have two terminals remaining on the SSR, +/- . These will connect to the printer's control board, paying close attention to polarity +/- .

You have some choices here, but my choice was to use the wire from the original heated bed, since I'm not going to use it. If you do not want to cut this wire, you'll have to find some wire to use.. This wire will not encounter any movement so it does not need fancy cover etc. Once you've attached it to the proper terminals of the control board (labeled Heated Bed + / -) connect the terminal end of the wires to the SSR.



The final arrangement of the wires are shown below. The red wires at the bottom right go to the heat pad.





Safety precautions and additional steps

This project involves electricity. I'm not responsible for your skill, lack of, or anything that happens after this is installed.

As you can see I have mounted the SSR to the printer frame. Use the included plastic cover to protect yourself from the bare terminals, or use this one from thingiverse if you like it better:

<https://www.thingiverse.com/thing:408480>

