Rat Rig

13. Wiring, Firmware & RatOS

Step by Step Guide on how to assemble and wire the electronics on the V-Core 3.

Written By: Simon Davie

INTRODUCTION

This Guide is a beta version, if you have any suggestions please leave them in the comments below.

Some of the fasteners and wires used during this guide are not currently included with the V-Core kit and need to be sourced separately. Rat Rig intends to offer a complete electronics kit in the future.

By default, the recommended electronics panel is available for download here, it's called: " panel_electronics_300.dxf".

This guide is meant to assist you during the Electronics assembly of the V-Core 3.1 standard kit. All cable lengths mentioned in the guide are for the V-Core 3.1 300x300. At the beginning of the guide you will find a table containing all the different lengths of cables specified by the machine size. It is advised to practice crimping and soldering before the wiring assembly. Bad crimps or soldering jobs are the most common fault in electronics malfunctions. Never plug or unplug any components while the printer is powered on, this will lead to damaged components and even safety hazards. Avoid bending the cables into tight corners as you can damage them. If you do not feel confident with a certain step ask someone experienced to assist you. Any mistakes during this assembly will permanently damage the components. The guide contains a lot of warnings meant to keep you alert and ensure a successful build!

If you are building a custom V-Core 3.1 refer to: https://v-core.ratrig.com/electronics/ , for the wiring diagrams.

Step 1 — V-Core 3.1 Build Size

ITEM NAME	V-CORE 200X200	V-CORE 300X300	V-CORE 400X400	V-CORE 500X500
X STEPPER MOTOR CABLE	1000	1000	1000	1500
Y STEPPER MOTOR CABLE	1000	1000	1000	1500
EXTRUDER STEPPER MOTOR CABLE	1000	1500	2000	2000
Z LEFT STEPPER MOTOR CABLE	1000	1500	1500	2000
Z REAR STEPPER MOTOR CABLE	1000	1000	1000	1000
Z RIGHT STEPPER MOTOR CABLE	1000	1500	1500	2000
X END STOP CABLE	1000	1000	2000	2000
Y END STOP CABLE	1500	2000	1000	1500
4028 3-CORE CABLE EXTENSION	400	450	1000	1000
PROBE CABLE LENGTH (ADVISED)	1000	1000	1500	2000

Please note: All measurements provided in this guide are based upon building a 300x300 V-Core 3.1.

If you are building a different size, the following adjustments can be made to the stated cable lengths.

Step 2 — Mains Power

The mains power of the circuit must be done by a professional. Mains electricity can kill or severely injure

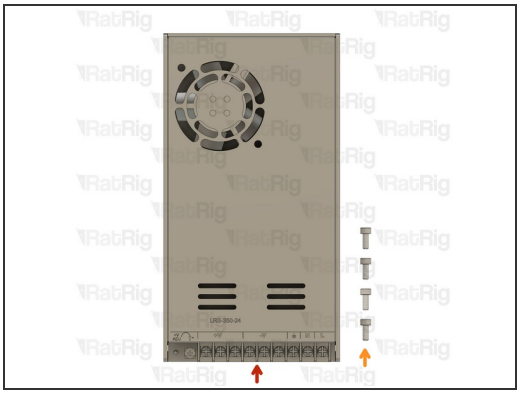
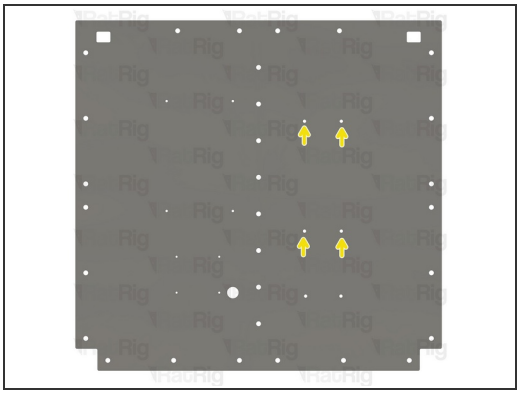
people and cause damage to property.

Step 3 — Set up - Power Supply

- On the right side of the power supply there is a switch.
- This switch needs to be set to the mains voltage in your country. Either 115V (most common in the USA / Canada), or 230V.

⚠ Setting this to the incorrect input voltage may destroy the power supply and anything connected to it.

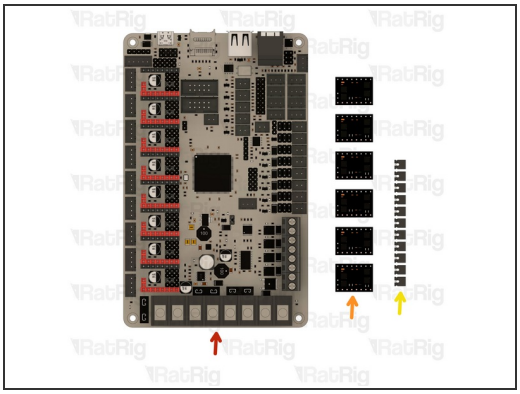
Step 4 — Mount the Power Supply

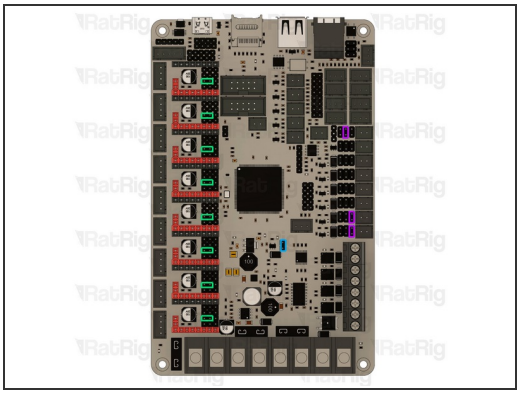



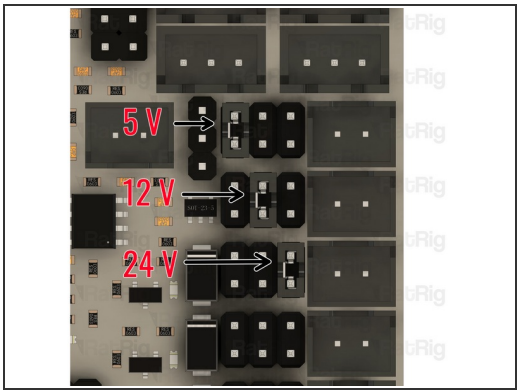

- Weho LRS 350 W Power Supply
- 4x M4x6mm Cap Head Screws
- Mount the Power Supply with the M4x6mm Cap Head Screws

⚠ Take care not to over-tighten the screws as you can damage the panel.

Step 5 — Assemble the Octopus V1.1 - Part 1







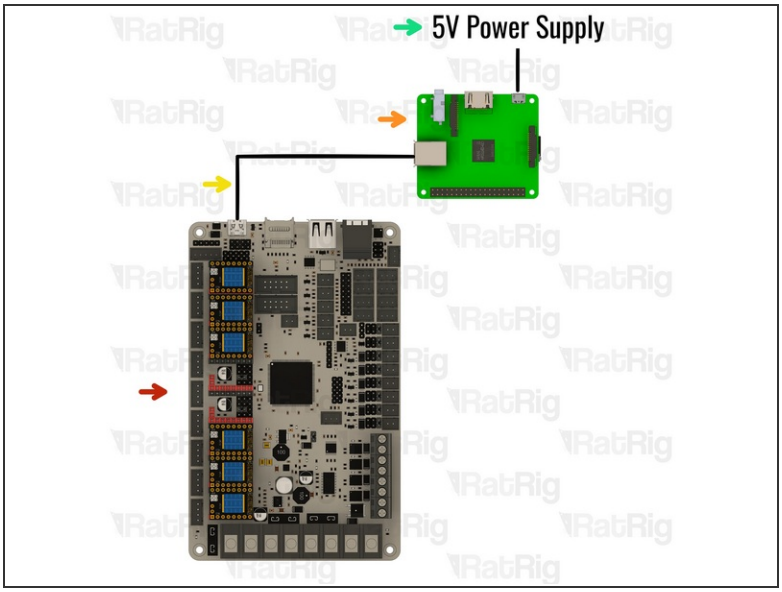
- BIGTREETECH Octopus V1.1
- 6x TMC2209 Stepper Driver
- 12x Jumpers

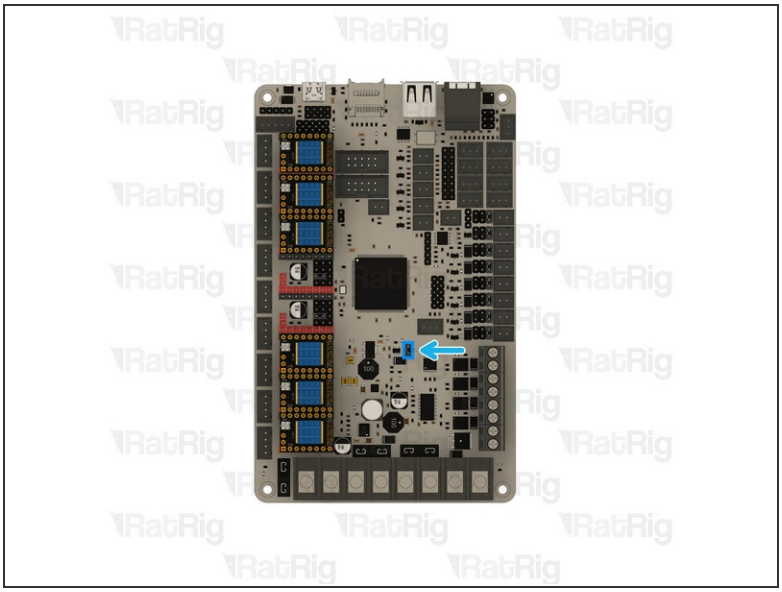
ⓘ Remove all the jumpers on the board before starting. Insert the jumpers on to the highlighted pins.

- UART mode - placing these jumpers will allow for tuning and controlling options on the printer interface.
- USB-C Power option - with this jumper the board can be powered via USB-C. This will allow you to compile and download the firmware directly to the motherboard using DFU mode, ideal for testing the board.
- Voltage Selection - Each fan output can be set to one of three different voltages (5V, 12V or 24V) depending on the jumper positions. The third image exemplifies where the pins must be placed to achieve different voltages.

⚠ The voltage selections used in the guide are for the electronics kit provided by Rat Rig. If using different fans, ensure the voltages are set correctly to avoid damage to components.

Step 6 — Prepare your control board





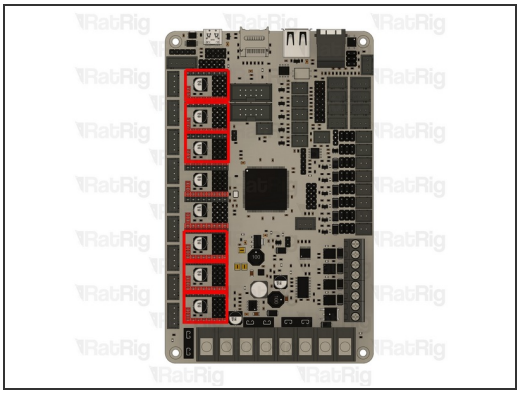
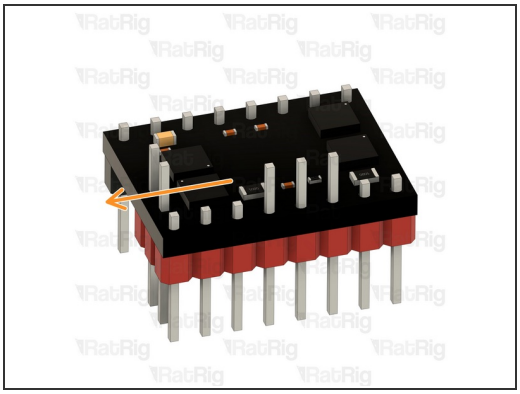
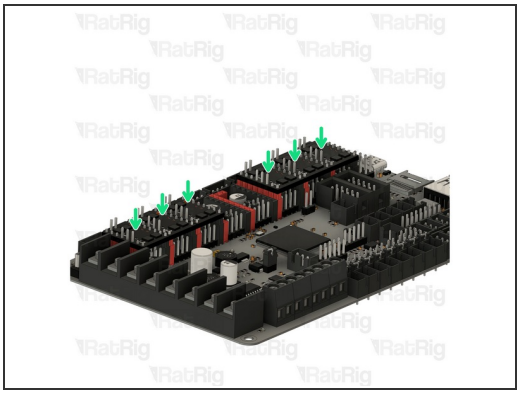
- BIGTREETECH Octopus V1.1
- Raspberry Pi
- USB A to USB C Cable
- 5V Power supply - smartphone charger for example (minimum 3 AMP is recommended)

It is heavily recommended that you flash your board and make sure it is detected in the configurator before you plug in your stepper drivers and start connecting your wiring. - Check RatOs documentation

- Remove the highlighted jumper as it will no longer be required.

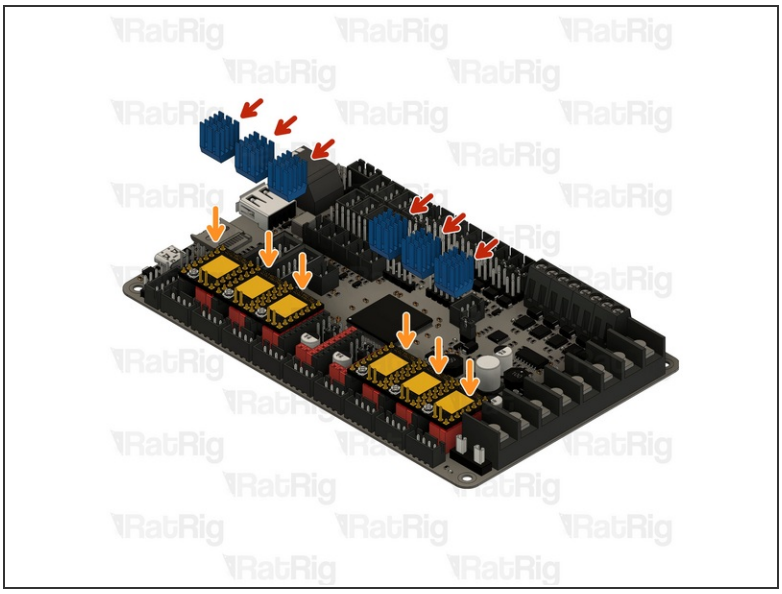
If your board flashed successfully you can proceed with the guide.

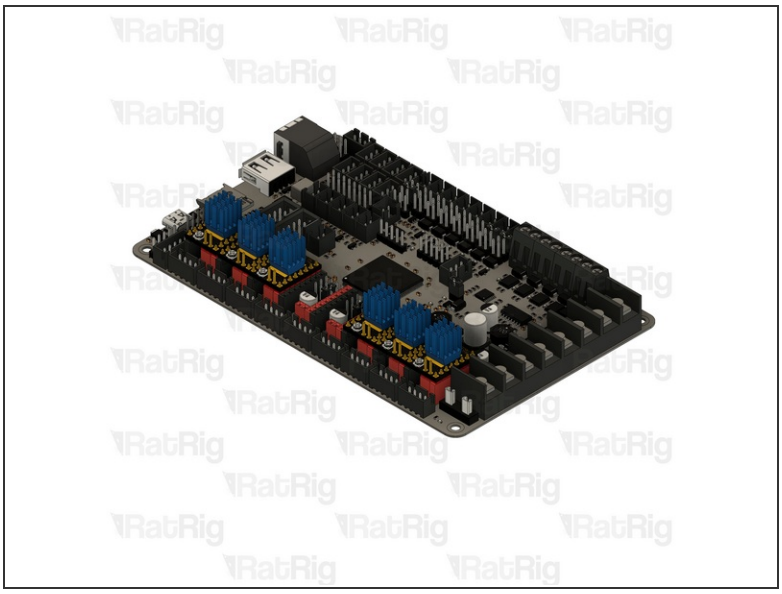
Step 7 — Assemble the Octopus V1.1 - Part 2

- Carefully insert the TMC2209 Stepper Drivers onto the slots.
- Orient the TMC2209 Stepper Drivers with the two upper pins to the outside of the board.
- Make sure the drivers are inserted all the way to ensure a reliable connection.
- Insert the TMC2209 drivers slowly while checking pin alignment to avoid damaging the components.

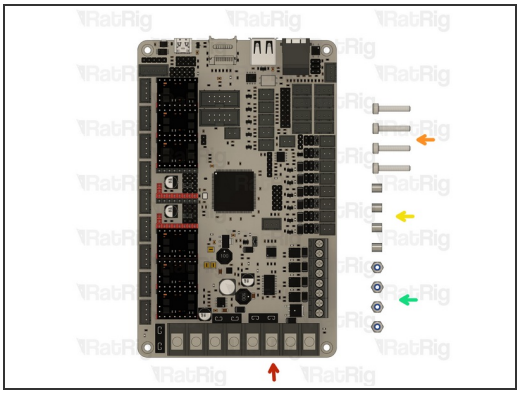
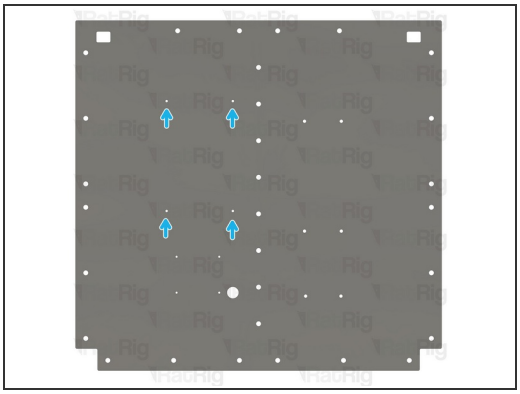
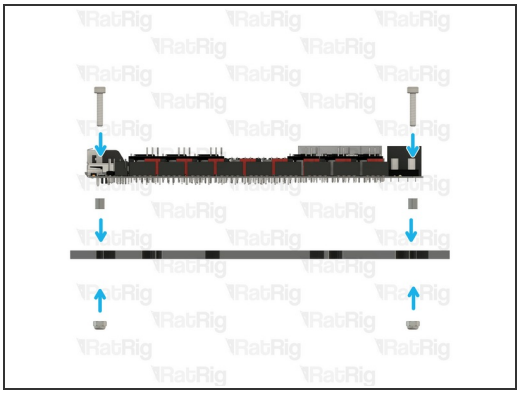
Step 8 — Stepper Motor Drivers - TMC2209





- 6x TMC2209 Driver Heat Sink
- Gently wipe down the TMC2209's top surface with a cloth and alcohol to improve adhesion with the heat sink.
- ⓘ Peel the tape off the bottom of the TMC2209 driver heat sink and centre them on the TMC2209 drivers.

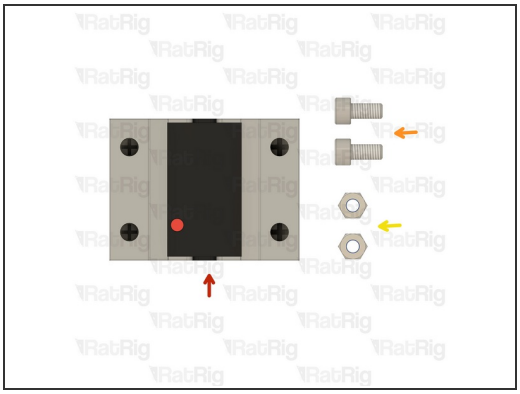
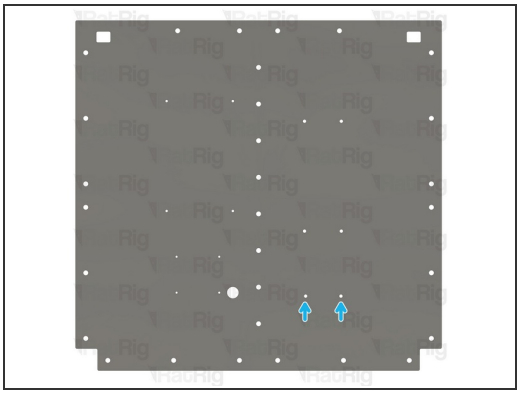
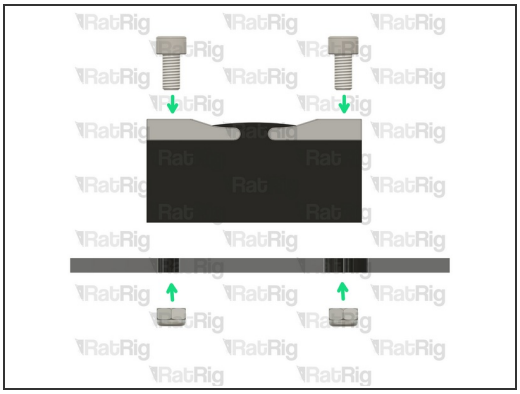
Step 9 — Mount the Octopus V1.1

- BIGTREETECH Octopus V1.1
- 4x M3x16mm Cap Head Screw
- 4x M3x5mm Nylon Spacer
- 4x M3 Locking Hex Nut
- Mount the BIGTREETECH Octopus V1.1 with the fasteners in the shown order.

⚠ Take care not to over-tighten the screws as you can damage the panel.

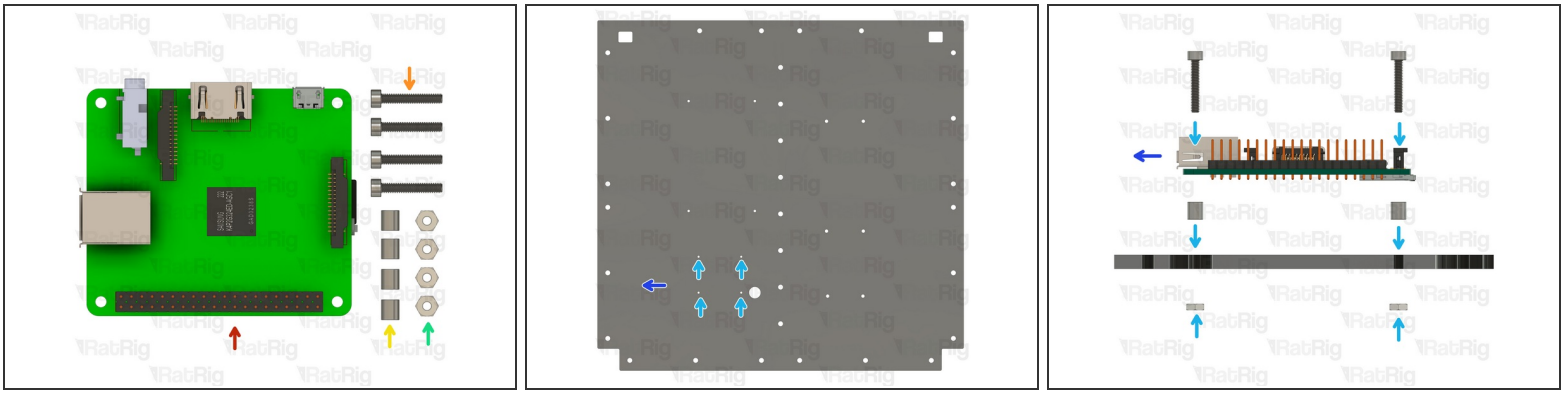
Step 10 — Mount the SSR Relay

- SSR Relay
- 2x M4x10mm Cap Head Screw
- 2x M4 Locking Hex Nut
- Mount the SSR Relay with the fasteners in the shown order.

⚠ Take care not to over-tighten the screws as you can damage the panel.

Step 11 — Mount the Raspberry Pi

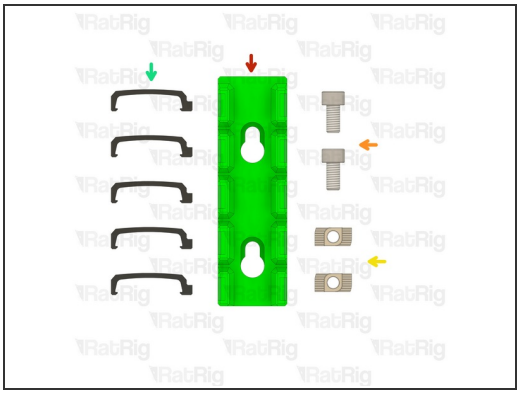
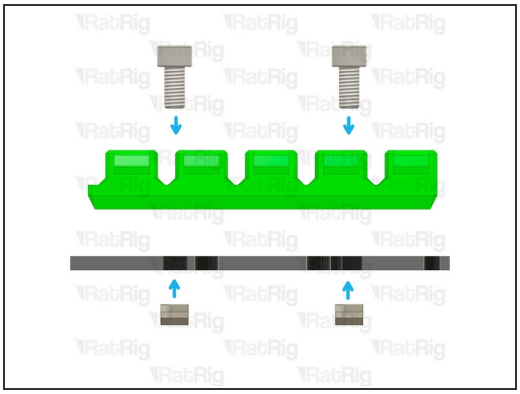
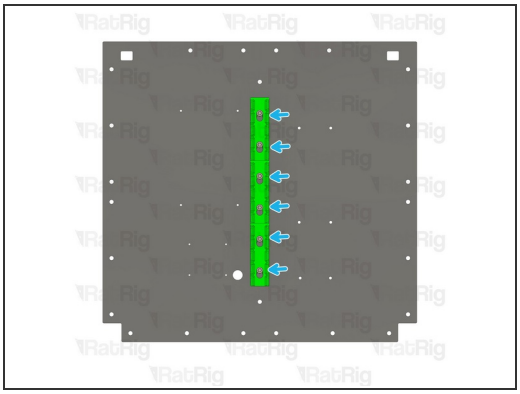


ⓘ The electronics assembly is the same regardless of the Raspberry Pi model used.

- Raspberry Pi
- 4x M2.5x16mm Cap Head Screw
- 4x M3x5mm Nylon Spacer
- 4x M2.5 Locking Hex Nut
- Mount the Raspberry Pi with the fasteners in the shown order.
- Place the Raspberry Pi so the USB ports are on the left.

⚠ Take care not to over-tighten the screws as you can damage the panel.

Step 12 — Mount the Electronics Wire Guide

- [ ] This STEP should have been completed here: 01. Frame Assembly

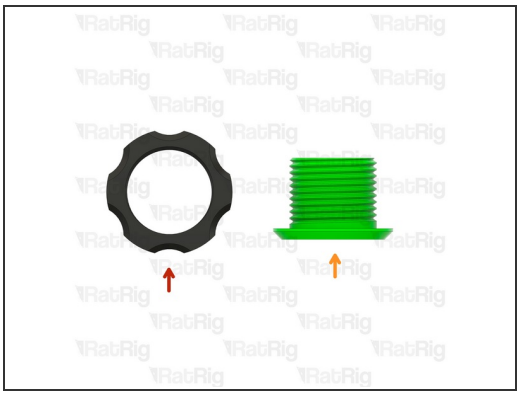
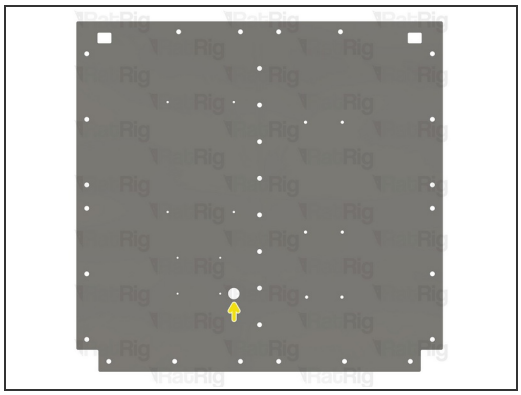
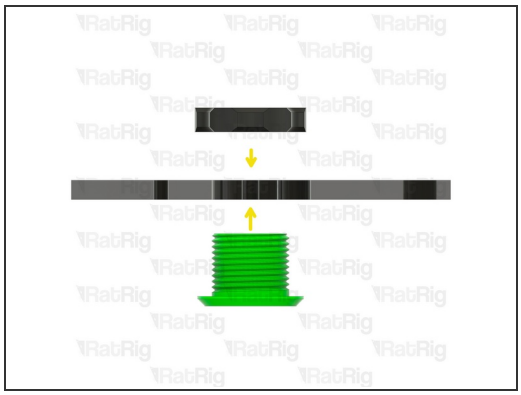
  ⚠ If you didn't mount the wire guides during the frame assembly, you need to remove the Electronics subframe in order to install the wire guides.

- 3x Electronics Wire Guide Body
- 6x M6x12mm Cap Head Screw
- 6x 3030 Drop-in T-Nut - M6
- 15x Electronics Wire Guide Clip

- [ ] Store the Electronics Wire Guide Clips aside for now, they will be needed later.

- Loosely thread the 3030 T-Nuts onto the M6x12 screws. Do not tighten them at this point.

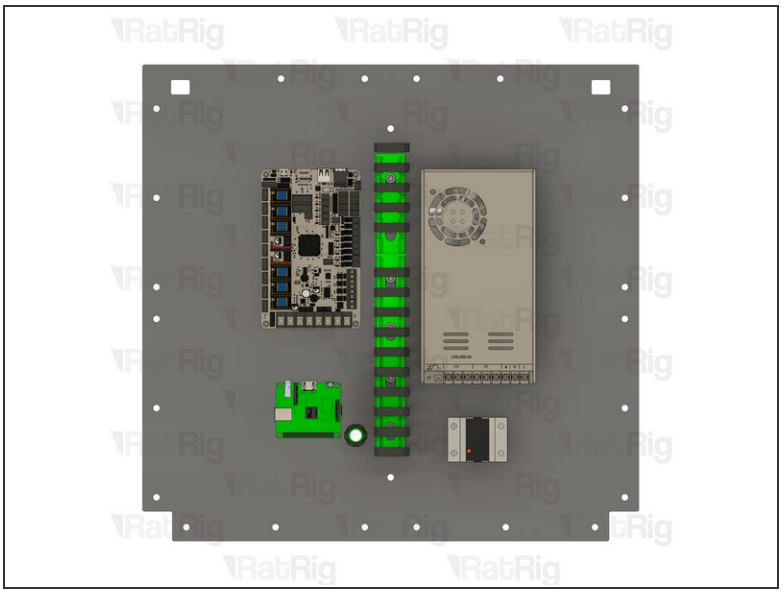
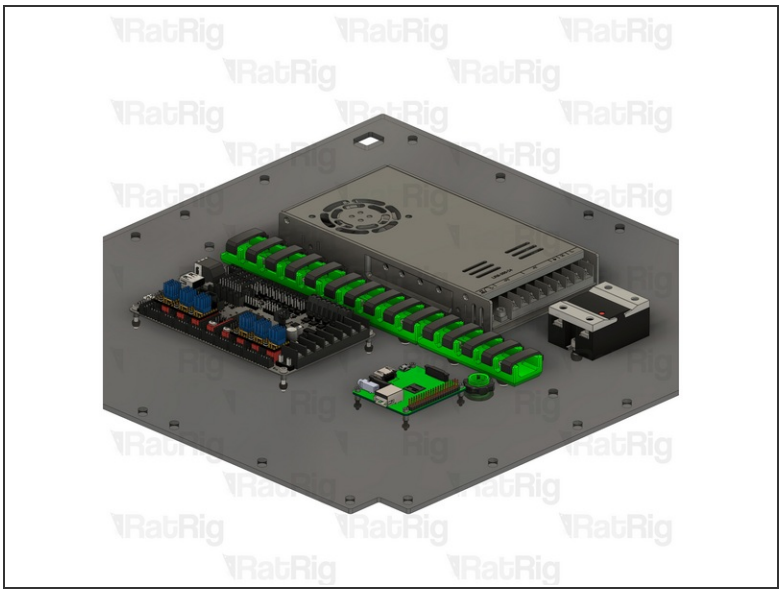
Step 13 — Mount the Panel Collar

- Panel Collar Nut
- Panel Collar Thread
- Mount the Panel Collar in the shown hole.

⚠ Take care not to over-tighten the Panel Colar as you can damage the parts and the panel.

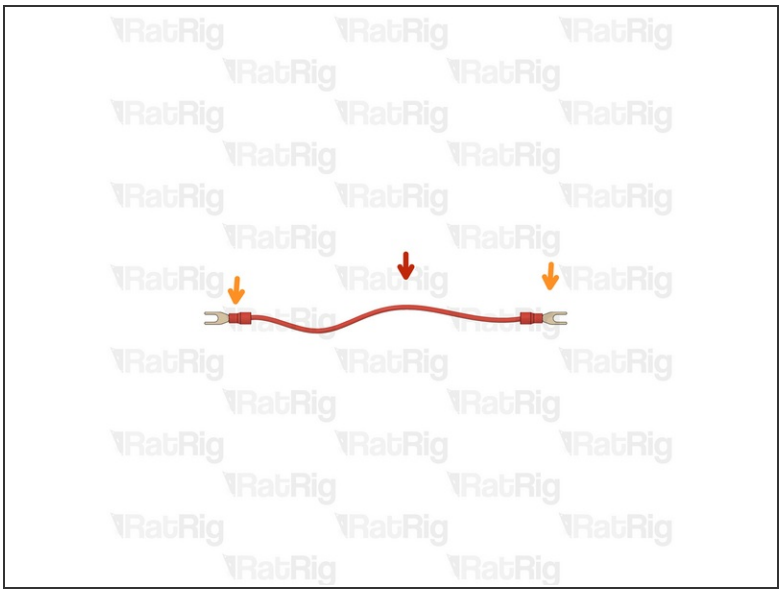
Step 14 — Fully Populated Panel

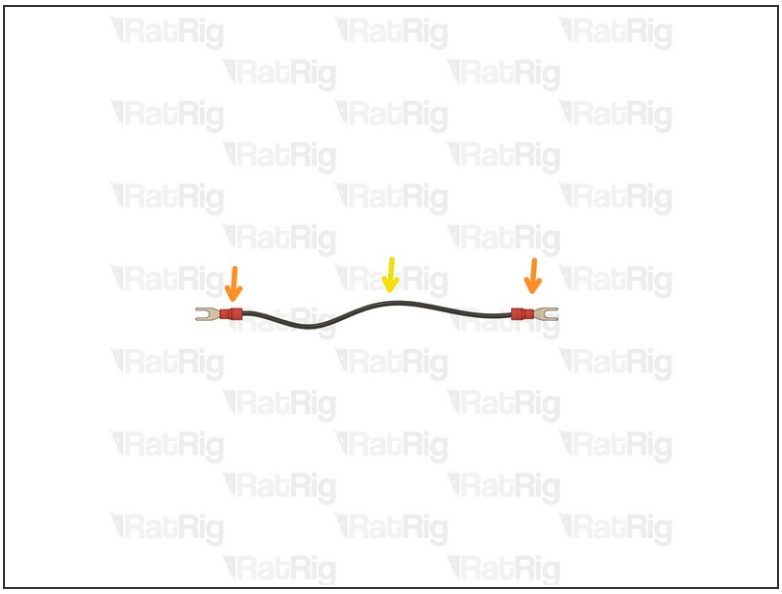



ⓘ At this stage, the electronics panel should look like the image.

⚠ If any component is oriented differently, correct the assembly now.

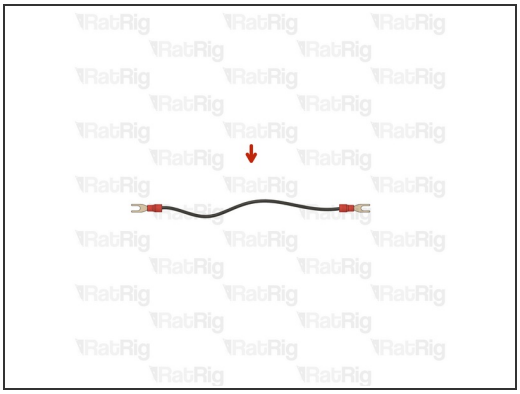
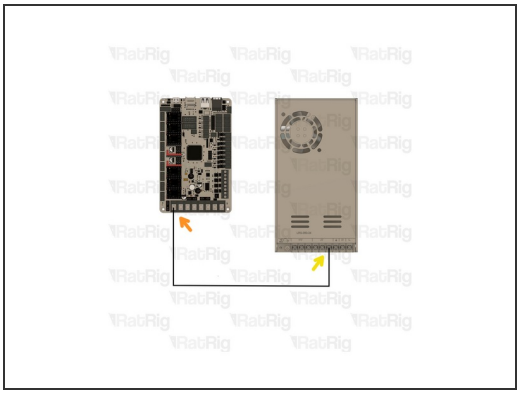
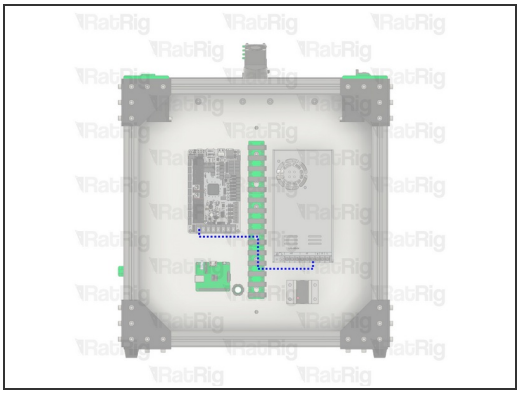
Step 15 — 24 V Circuit - Preparation





- There are two lengths of wires for each colour, carefully read the next steps. [These must be self-sourced for the time being]
- Red Wire - Used for **POSITIVE** Connections on the 24 V circuit.
- Fork Terminals - Connecting on the Board and the Power Supply.
- Black Wire - Used for **NEGATIVE** Connections on the 24 V circuit.
- Lengths:
  - 250 mm - Board-to-Power Supply
  - 200 mm - Board-to-SSR Relay

Step 16 — 24 V Circuit - Part 1

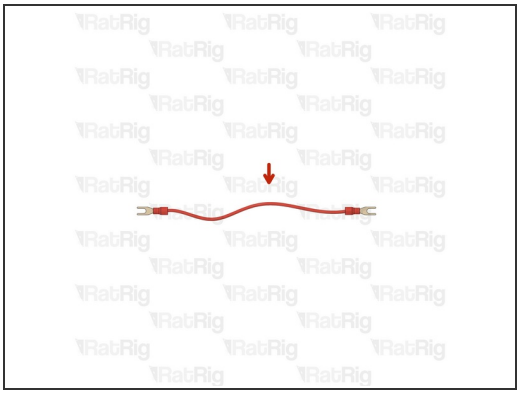
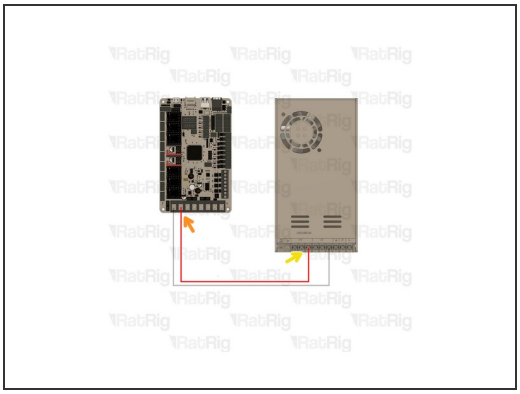
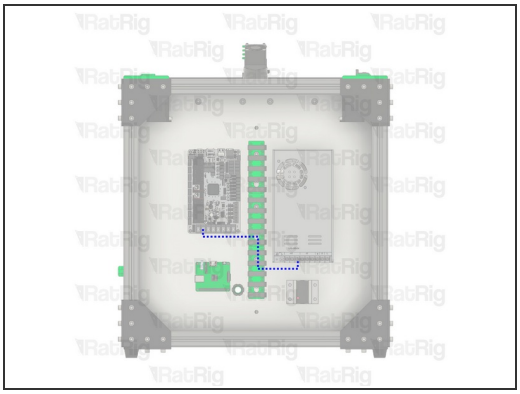




- Black Wire (Length: 250 mm)
- Insert one end on the first slot (numbered 1 on the board) and tighten the screw.
- Insert the other end on the right slot of the [- V] section on the Power Supply and tighten the screw.

⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

Step 17 — 24 V Circuit - Part 2

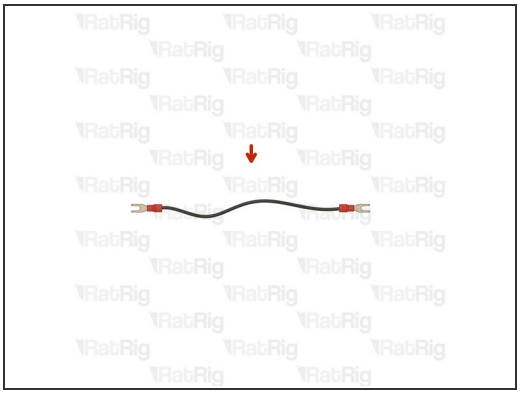
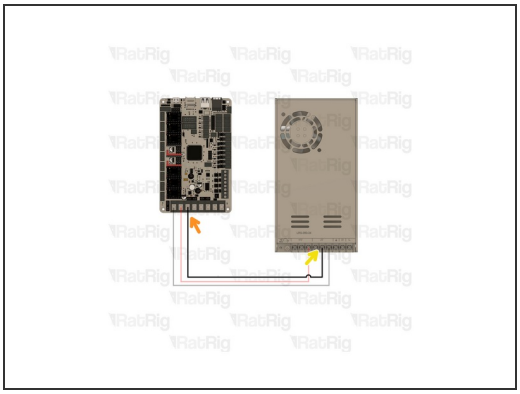
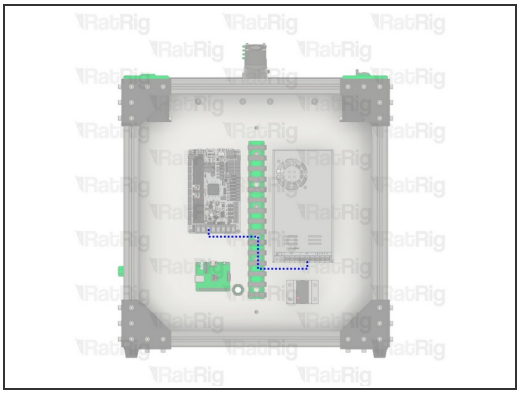




- Red Wire (Length: 250 mm)
- Insert one end on the second slot (numbered 2 on the board) and tighten the screw.
- Insert the other end on the right slot of the [+ V] section on the Power Supply and tighten the screw.

⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

Step 18 — 24 V Circuit - Part 3

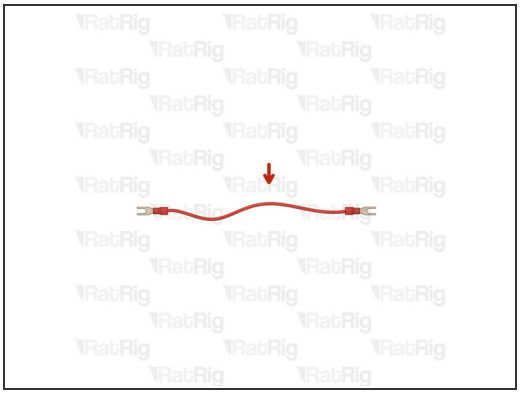
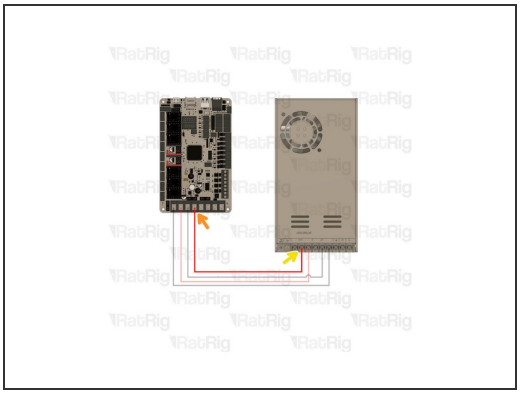
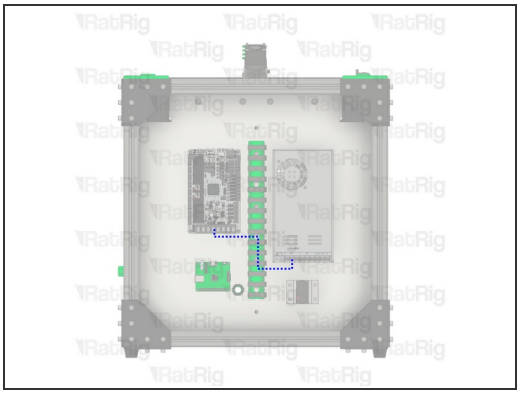




- Black Wire (Length: 250 mm)
- Insert one end on the third slot (numbered 3 on the board) and tighten the screw.
- Insert the other end on the midle slot of the [- V] section on the Power Supply and tighten the screw.

⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

Step 19 — 24 V Circuit - Part 4

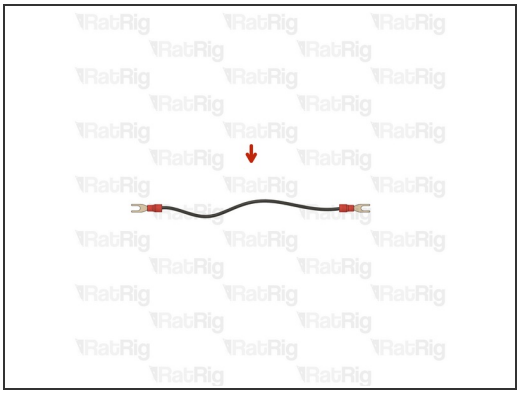
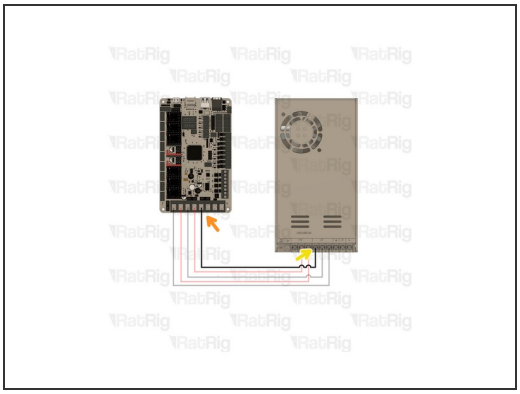
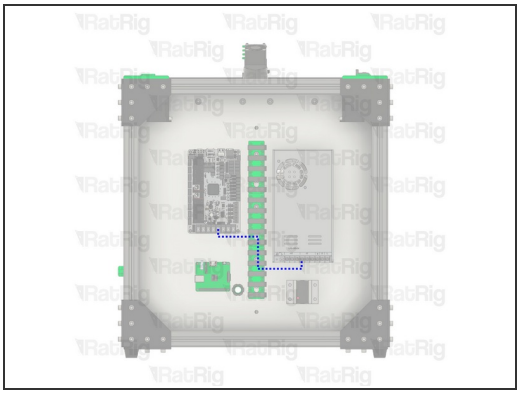




- Red Wire (Length: 250 mm)
- Insert one end on the fourth slot (numbered 4 on the board) and tighten the screw.
- Insert the other end on the middle slot of the [+ V] section on the Power Supply and tighten the screw.

⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

Step 20 — 24 V Circuit - Part 5

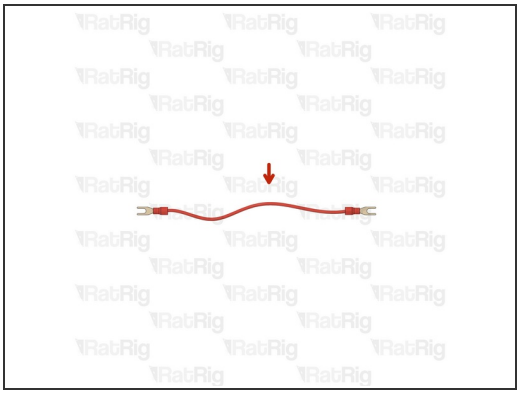
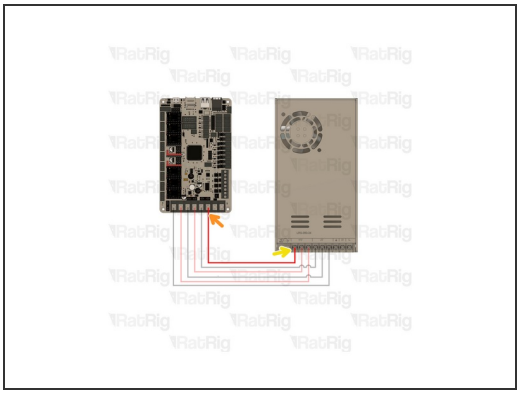
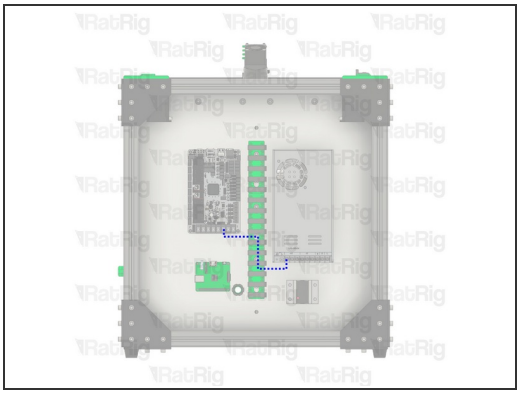




- Black Wire(Length: 250 mm)
- Insert one end on the fifth slot (numbered 5 on the board) and tighten the screw.
- Insert the other end on the left slot of the [- V] section on the Power Supply and tighten the screw.

⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

Step 21 — 24 V Circuit - Part 6

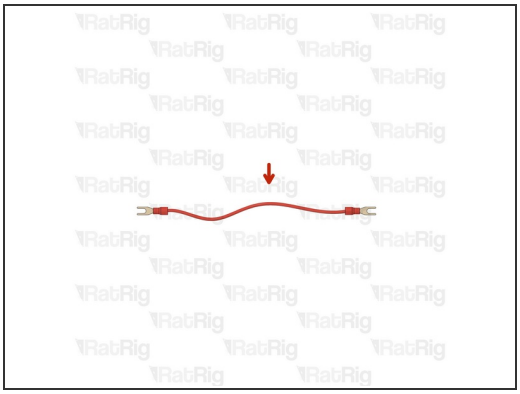




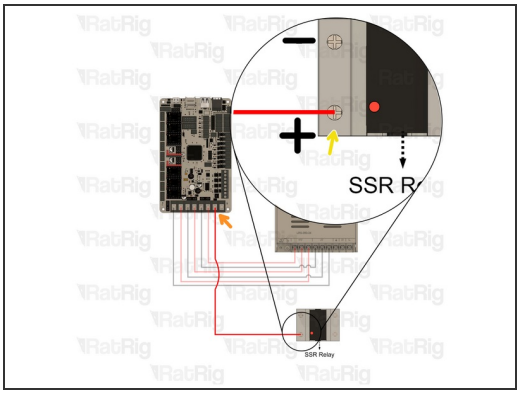
- Red Wire (Length: 250 mm)
- Insert one end on the sixth slot (numbered 6 on the board) and tighten the screw.
- Insert the other end on the right slot of the [+ V] section on the Power Supply and tighten the screw.

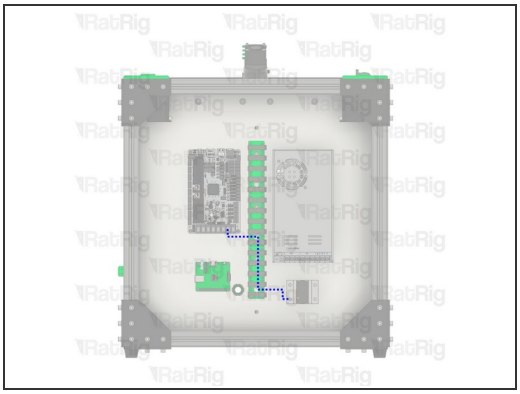
⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

Step 22 — 24 V Bed Power - Part 1







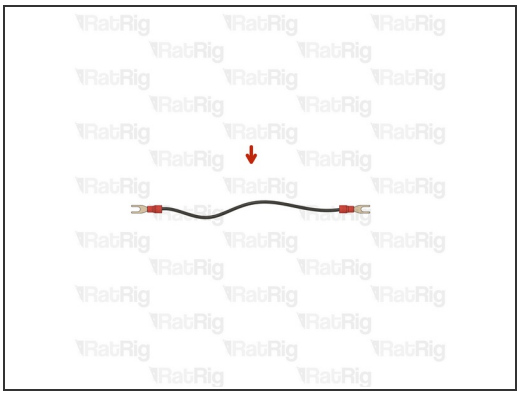
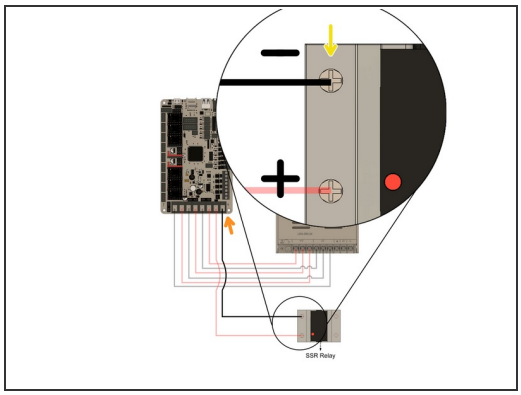
- Red Wire (Length: 200 mm)
- Insert one end on the seventh slot (numbered 7 on the board) and tighten the screw.
- Insert the other end on the SSR Relay positive terminal.

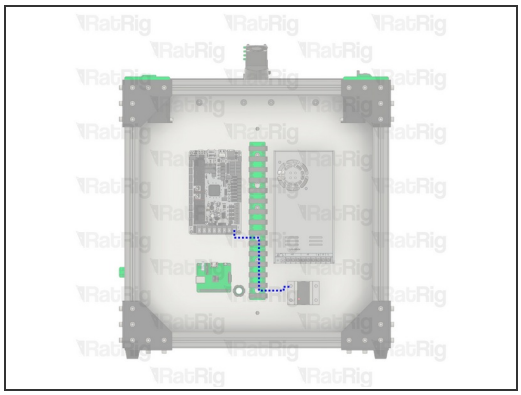
⚠ It's crucial that the polarity is correct, incorrect wiring will result in severe damage. Double-check your connections using the images. If you have any doubts about your SSR Relay connections please check the supplier datasheet.

⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

Step 23 — 24 V Bed Power - Part 2



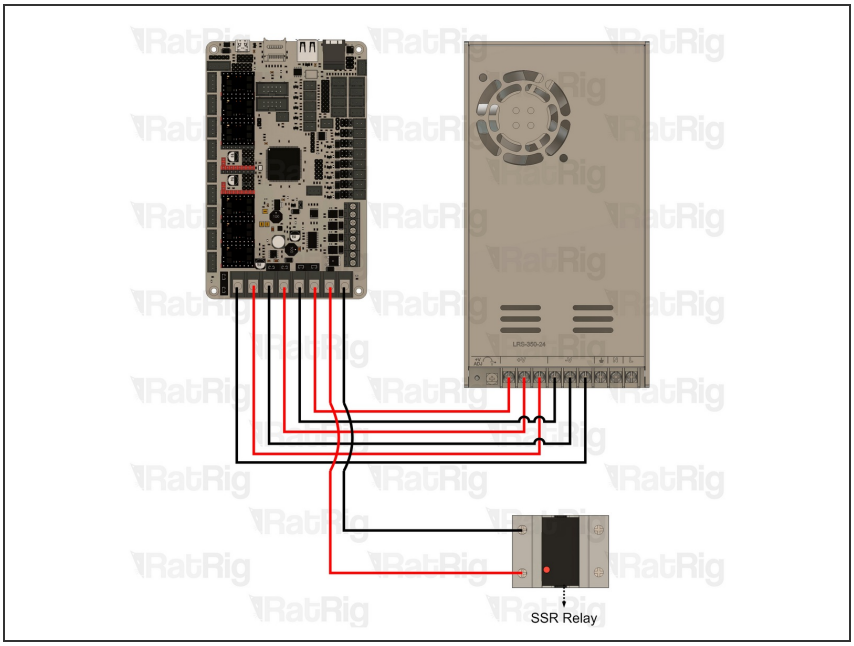
- Black Wire (Length: 200 mm)
- Insert one end on the eighth slot (numbered 8 on the board) and tighten the screw.
- Insert the other end on the SSR Relay negative terminal.

⚠ It's crucial that the polarity is correct, incorrect wiring will result in severe damage. Double-check your connections using the images. If you have any doubts about your SSR Relay connections please check the supplier datasheet.

⚠ After tightening the screws, pull the wire to make sure it's firmly connected. If the wire releases/moves when pulling, reinsert it and tighten the screw.

- Route the wire accordingly.

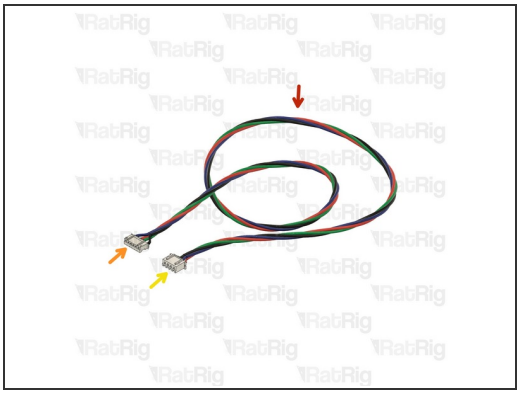
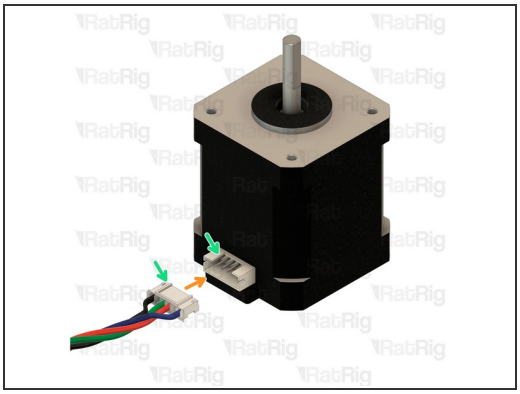
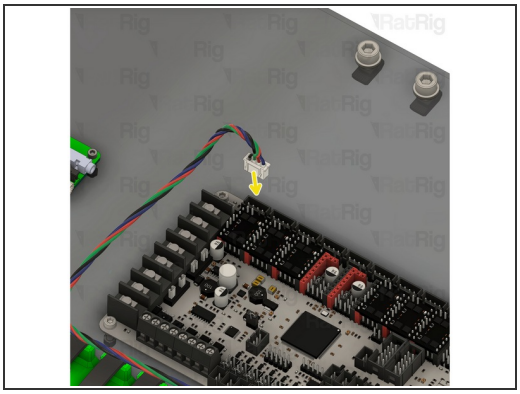
Step 24 — Checkpoint 1



Before moving on to the next step, check all the wires. The connections must look like the picture.

⚠ Double check the polarity is correct with the previous Steps. Always place the wire with POSITIVE (+ V) polarity in the positive slot on Board and the NEGATIVE (-V) with the negative slots on the Board. **Incorrect polarity will kill the board**

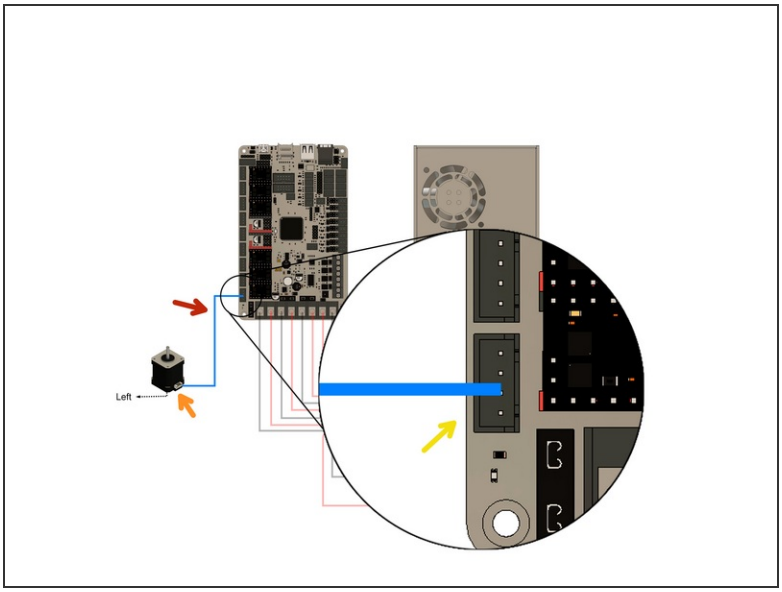
Step 25 — Stepper Motor - Preparation

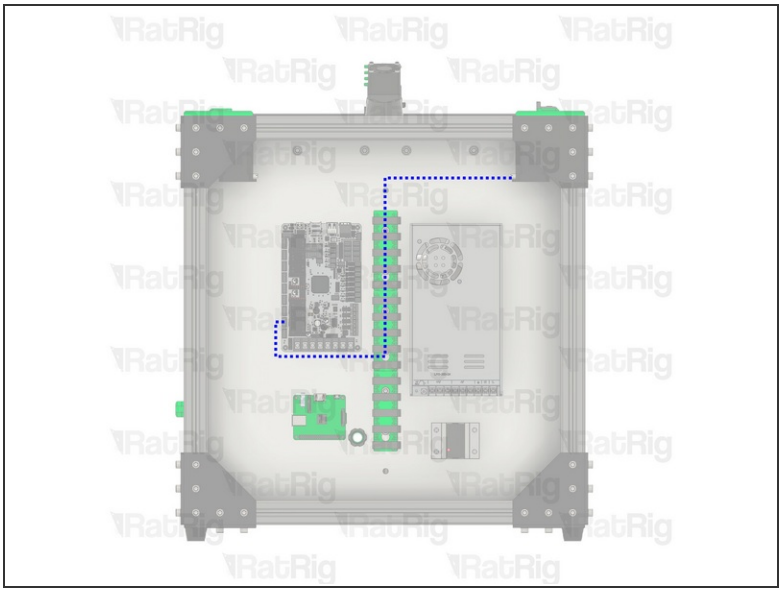




- Stepper Motor Wire
- There are different lengths of cables, please read the next steps carefully.
- Stepper Motor Connector (wider connector / JST PH6P)
- Control Board Connector (narrower connector / JST XH2.54)
- Make sure the connectors are oriented correctly with their sockets. The "key" on the connector should align with the "gap" on the sockets.

⚠ Make sure the cables don't touch the TMC2209 heat sinks as they get hot and can damage the wires, leading to component failure.

Step 26 — Stepper Motor Cables - Left

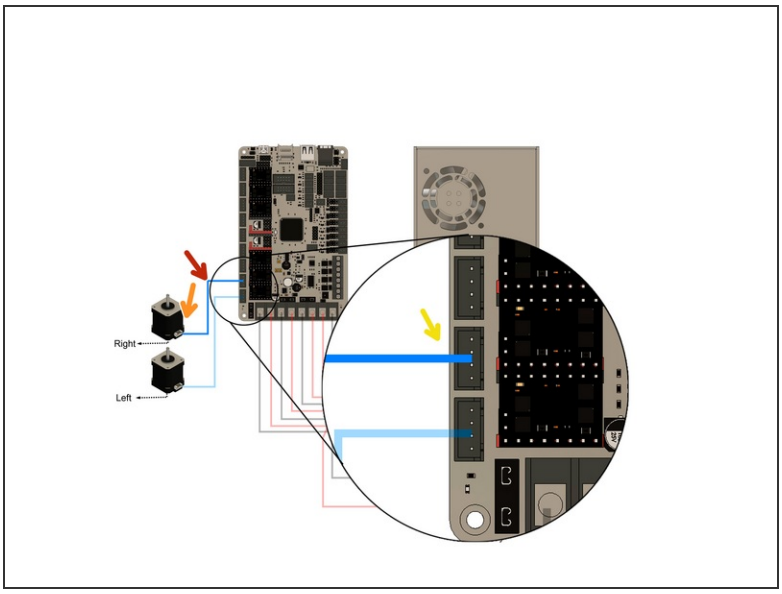


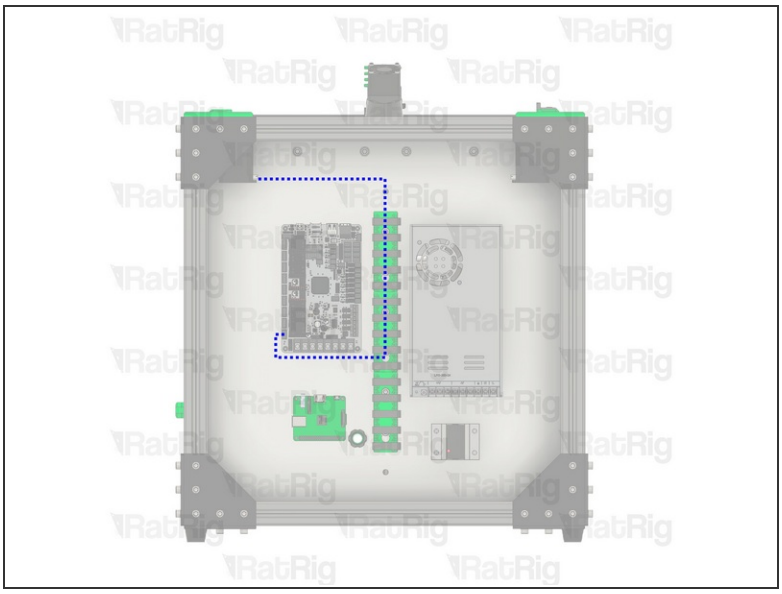


- Refer to **Step 20** on how to wire a Stepper motor.
- Stepper Motor Wire (Length: 1m)
- Stepper Motor Connector (wider connector / JST PH6P)
- Control Board Connector (narrower connector / JST XH2.54) - First connector counting from the bottom.
- Route the cable accordingly.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 27 — Stepper Motor Cables - Right

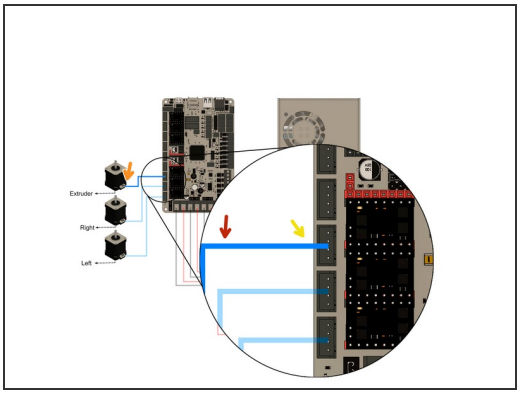


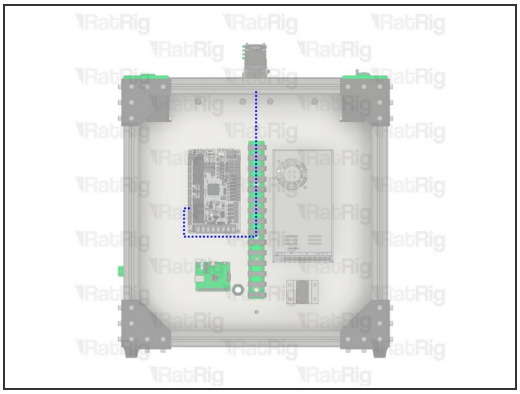
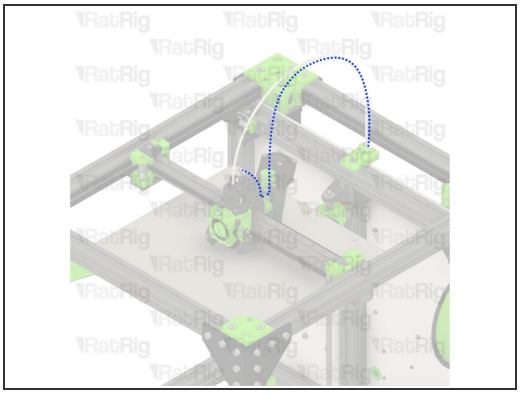


- Refer to Step 20 on how to wire a Stepper motor.
- Stepper Motor Wire (Length: 1m)
- Stepper Motor Connector (wider connector / JST PH6P)
- Control Board Connector (narrower connector / JST XH2.54) - Second connector counting from the bottom.
- Route the cable accordingly.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

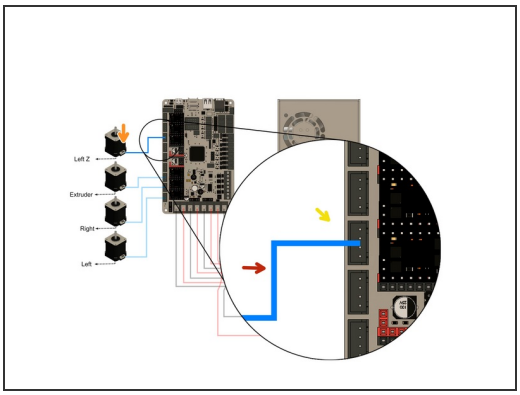
Step 28 — Stepper Motor Cables - Extruder

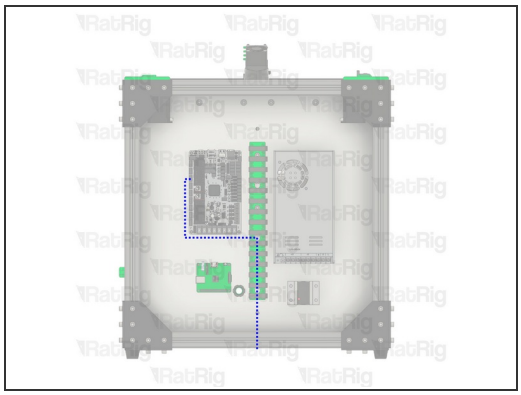
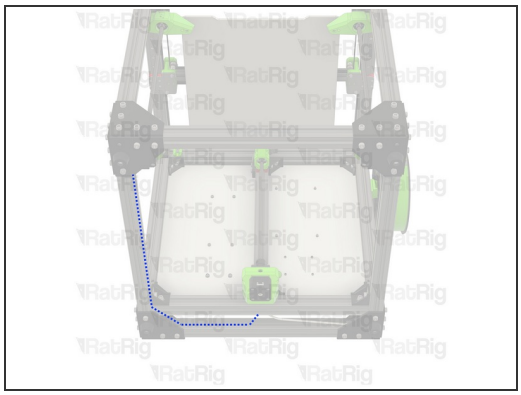


- Refer to **Step 20** on how to wire a Stepper motor.
- Stepper Motor Wire (Length: 1m)
- Some Extruders like the LGX Lite and the Orbiter have an embodied cable. Ignore the designated cable above.
- Stepper Motor Connector (wider connector / JST PH6P)
- Control Board Connector (narrower connector / JST XH2.54) - third connector counting from the bottom.
- Route the cable accordingly.
- If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 29 — Stepper Motor Cables - Z Left

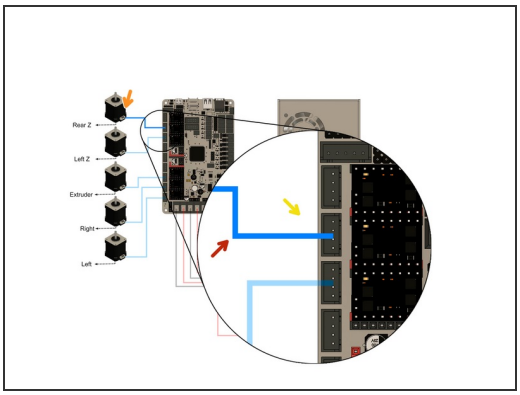


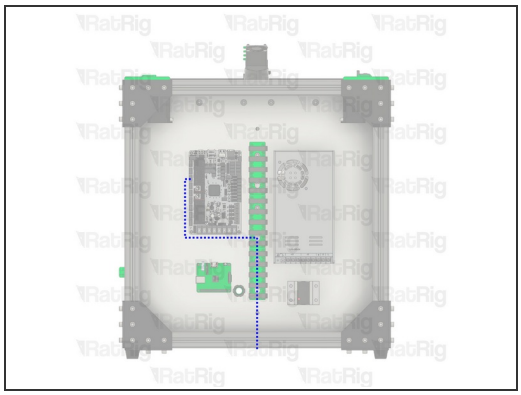
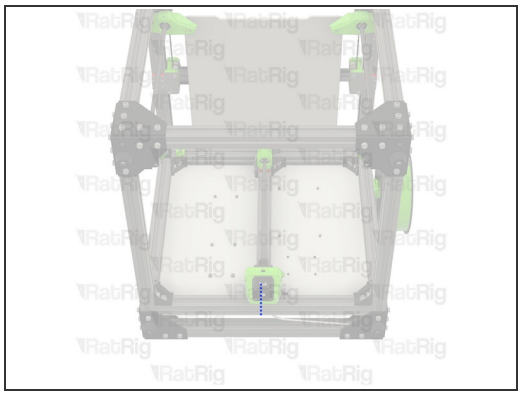



- Refer to **Step 20** on how to wire a Stepper motor.
- Stepper Motor Wire (Length: 1.5m)
- Stepper Motor Connector (wider connector / JST PH6P)
- Control Board Connector (narrower connector / JST XH2.54) - seventh connector counting from the bottom.
- Route the cable accordingly. (Bottom View) Place the cables inside the extrusions to help route them.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 30 — Stepper Motor Cables - Z Rear

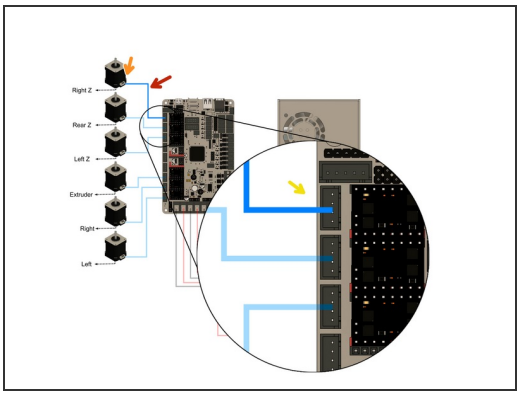


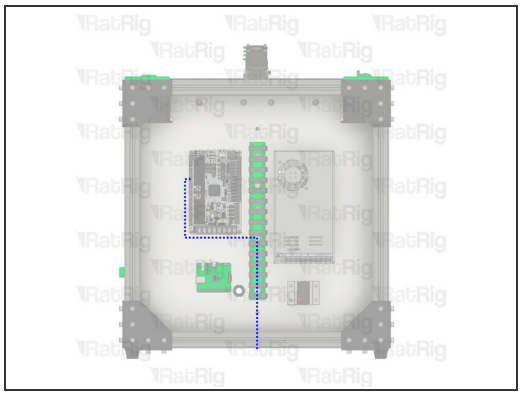
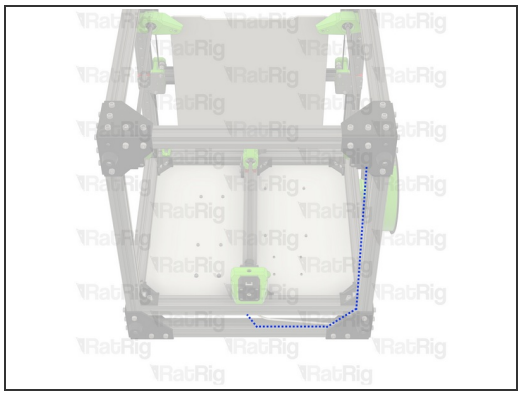



- Refer to **Step 20** on how to wire a Stepper motor.
- Stepper Motor Wire (Length: 1m)
- Stepper Motor Connector (wider connector / JST PH6P)
- Control Board Connector (narrower connector / JST XH2.54) - Eighth connector counting from the bottom.
- Route the cable accordingly. (Bottom View) Place the cables inside the extrusions to help route them.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 31 — Stepper Motor Cables - Z Right

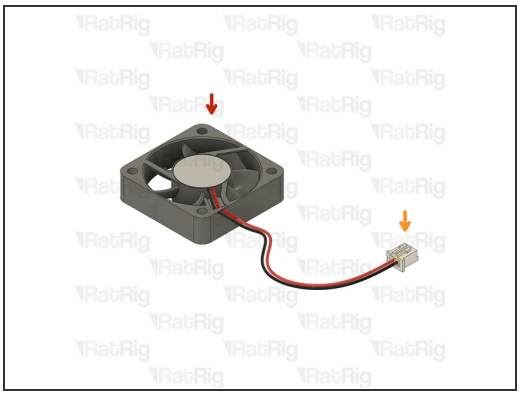
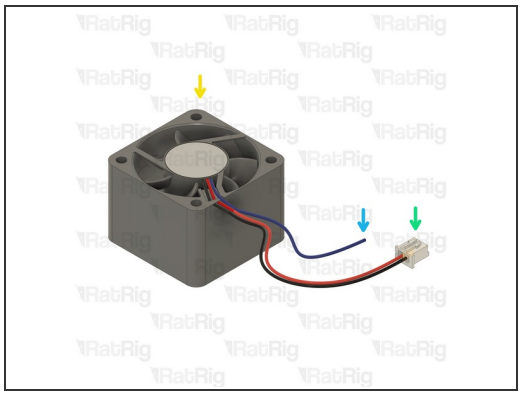
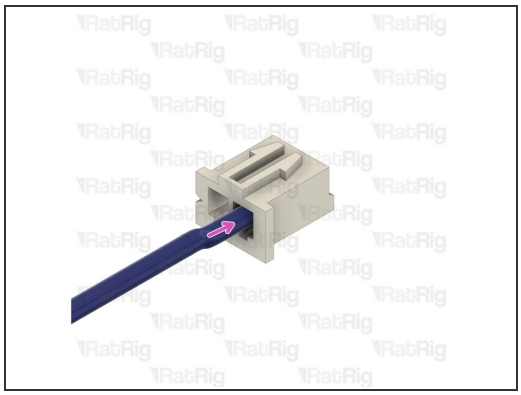


- Refer to **Step 20** on how to wire a Stepper motor.
- Stepper Motor Wire (Length: 1.5m)
- Stepper Motor Connector (wider connector / JST PH6P)
- Control Board Connector (narrower connector / JST XH2.54) - Last connector counting from the bottom.
- Route the cable accordingly. (Bottom View) Place the cables inside the extrusions to help route them.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 32 — Fans - Preparation

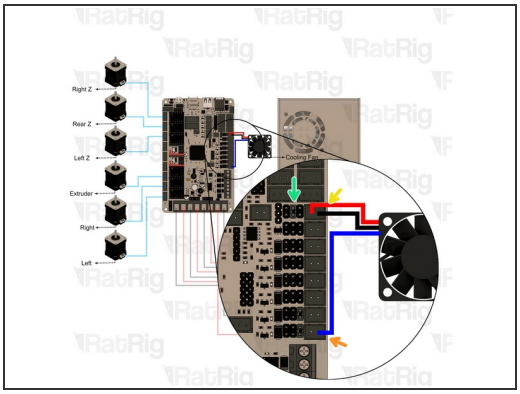




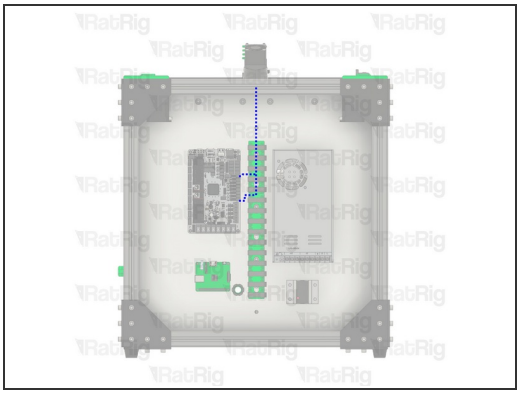
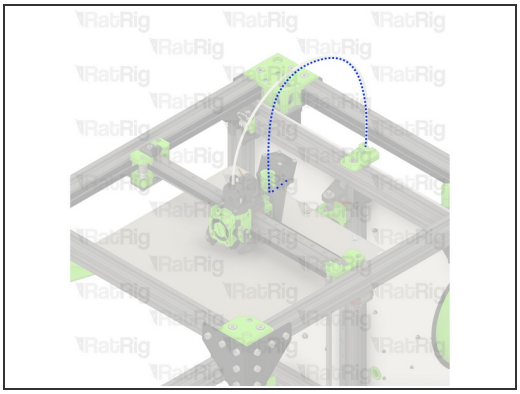
ⓘ The Hot End fan is a 4010 - 24V while the Cooling fan is a 4028 - 12 V, read the next steps carefully to avoid damaging the Fans. You will fry your fan if you don't supply the correct voltage!

- Hot End 4010 Fan - 24V
- 24V Power connector (JST2)
- Cooling 4028 Fan - 12 V
- 12V Power connector (JST2 - crimping required)
- PWM Cable - Pulse width modulation is a modulation technique that generates variable-width pulses, in this case it controls the supplied voltage to the fan regulating it's speed more efficiently.
- On Delta and Nidec fans the blue wire is the PWM wire, on Sanyo's it's the brown wire. If you're unsure, refer to your fan's datasheet as you will need to crimp a JTS2 as shown.

⚠ The part cooling 4028 fan cable requires an extension. Either solder, or use connectors, to extend it by 450mm with 3-core cable.

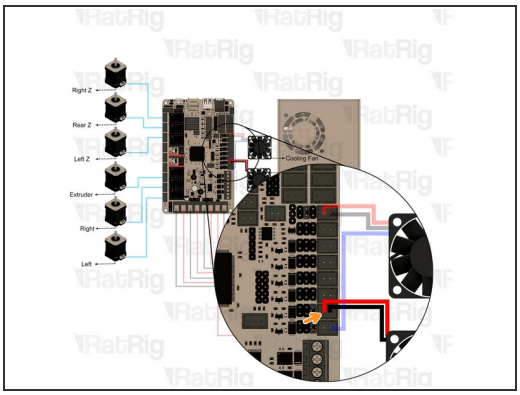
Step 33 — Cooling Fan Install

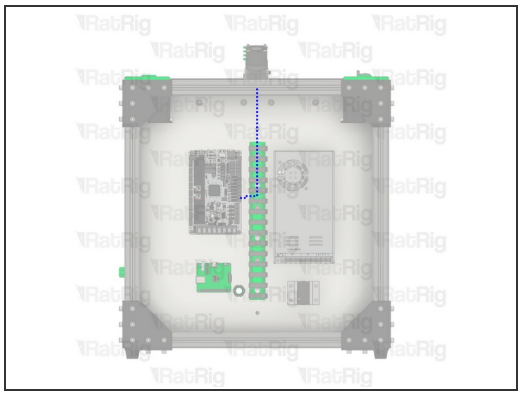
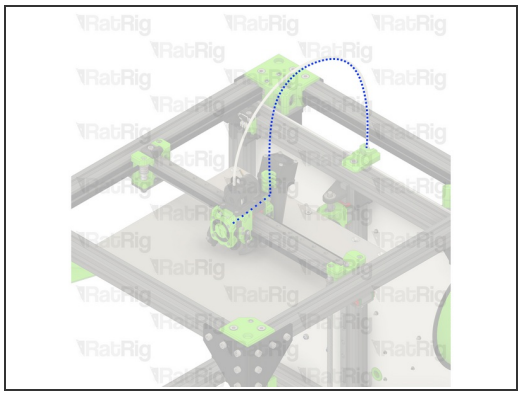


- Cooling 4028 fan - 12 V
- Connect the PWM wire to the negative pin (the one closest to the outside of the board) of the first connector on the board.
- Connect the positive and negative wire to the referred slot where the 12V jumper was placed.
- Check once again if the jumper is placed in the right position to supply 12V to the Fan - **Step 3**
- On boards with fan voltage selection (such as the Octopus boards), the voltage doesn't matter. The selector only changes which source the positive pin is connected to. We don't use the positive pin, we use the negative, which is connected through a MOSFET.
- ⚠ Please read this carefully. You will fry your fan if you don't supply the correct voltage!
- Route the cable accordingly.

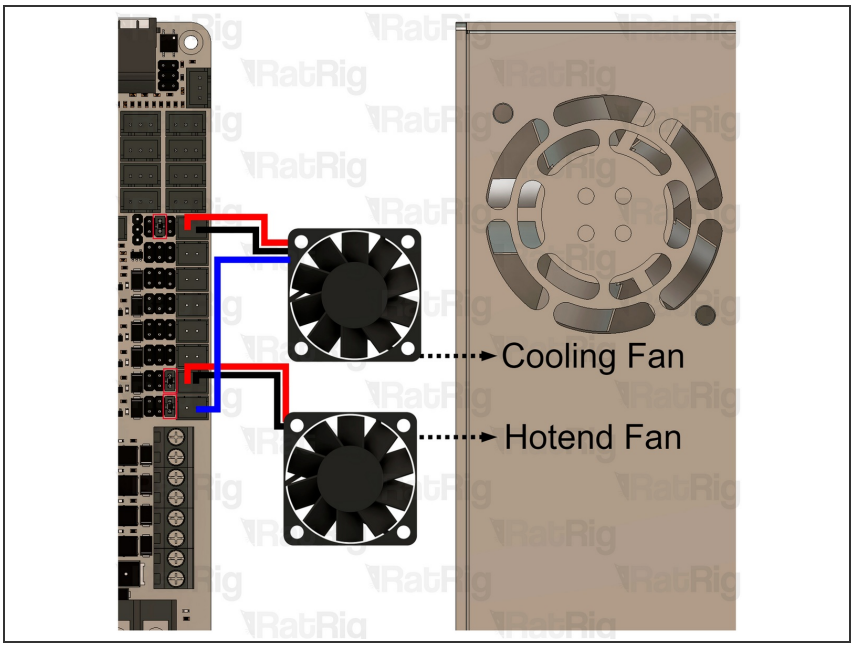
Step 34 — Hot End Fan Install



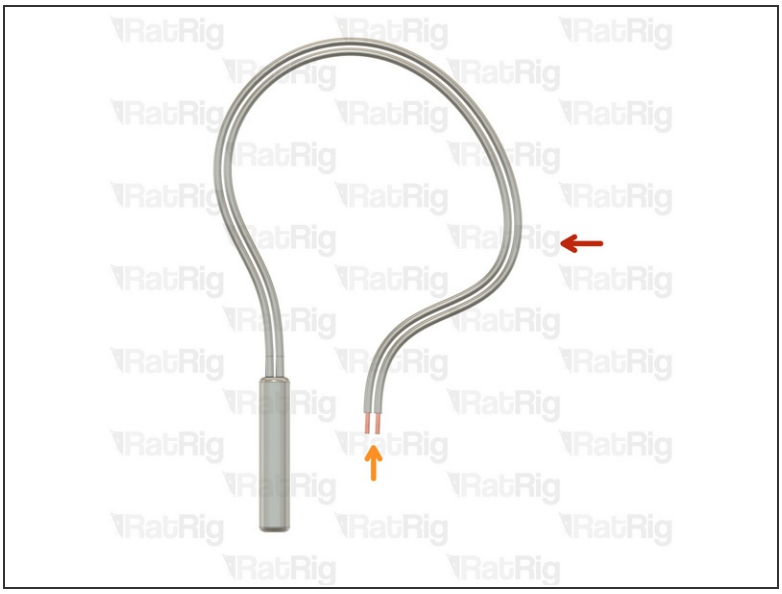
- Hot End 4010 fan - 24V
- Connect the positive and negative wire to the referred slot where the 24V jumper was placed.
- Check once again if the jumper is placed in the right position to supply 24V to the Fan - **Step 3**
- Route the cable accordingly.

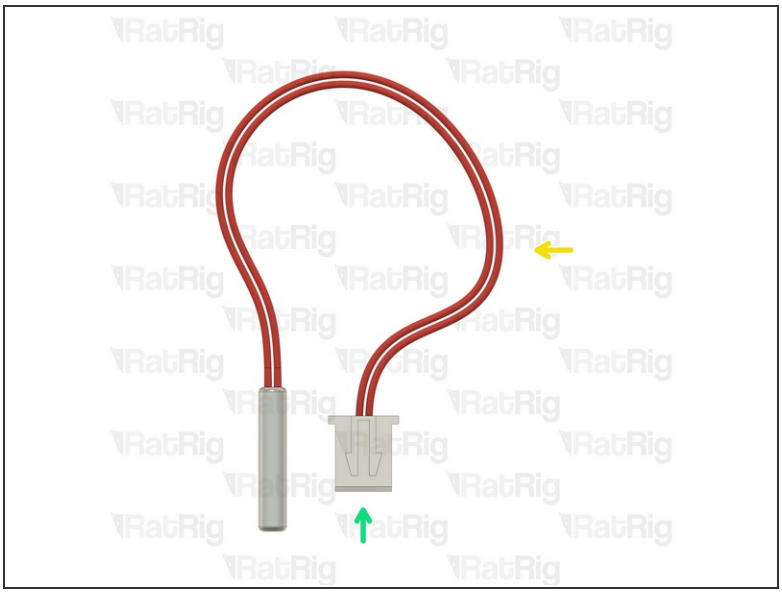
Step 35 — Checkpoint 2



- Before moving on to the next step, check all the cables. The connections must look like the picture. Take your time to ensure the previous steps are correct.
- ⚠ On some fans (verified on Sanyo Denki's) disconnecting the ground pin while 12V is connected to the fan will cause a high voltage on the tachometer pin, this can fry your mcu. Do NOT connect the tachometer pin if you do this

Step 36 — Hot End Heater + Thermistor - Preparation





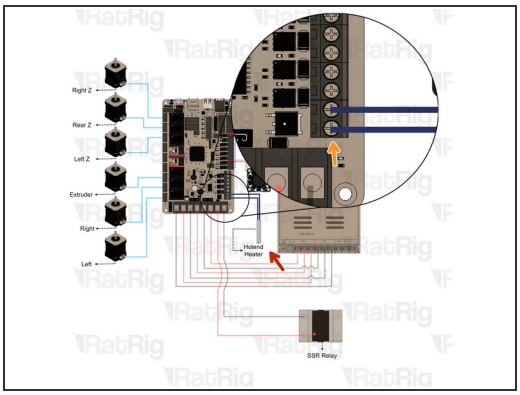
- Hot End Heater
- The Heater Cable is connected via a screw terminal so there is no need for a dedicated connector.

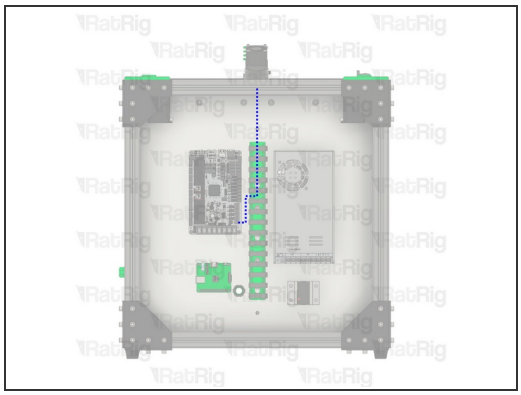
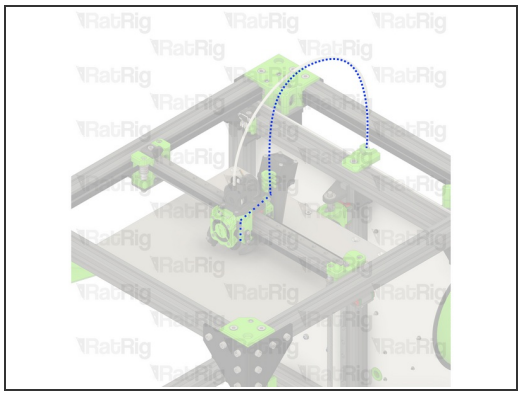
ⓘ The heater is a resistor, notice that when connecting it you don't have to worry about cable order as resistors don't have polarity.

- Hot End Thermistor
- Thermistor Connector (JST2)

ⓘ The thermistor is a resistor that strongly varies with temperature. When connecting a resistor you don't have to worry about cable order as resistors don't have polarity.

Step 37 — Hot End Heater Install



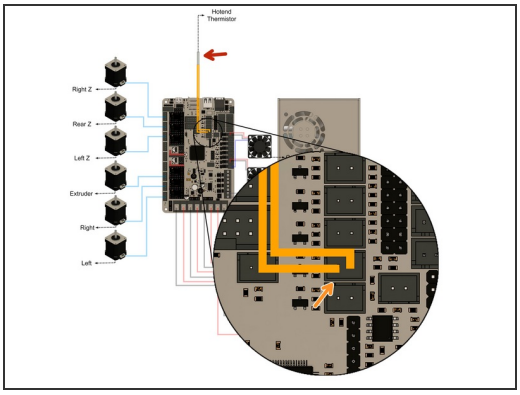



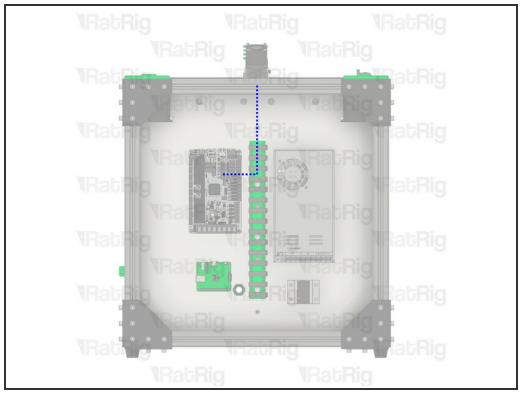
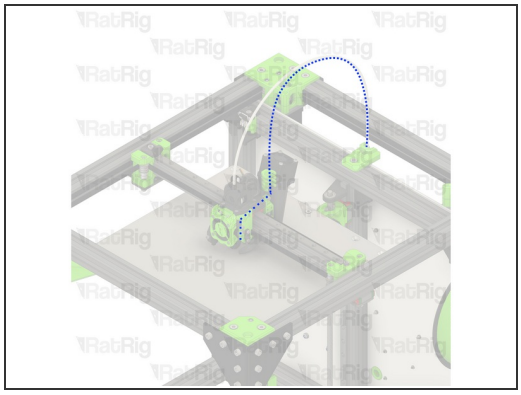
- Hot End Heater 24V
- Insert the cable ends on the designated slots and tighten the screws.

⚠ After tightening the screws, pull the cable to make sure it's firmly connected. If the cable releases/moves when pulling, reinsert it and tighten the screw.

- Route the cable accordingly.

Step 38 — Hot End Thermistor Install

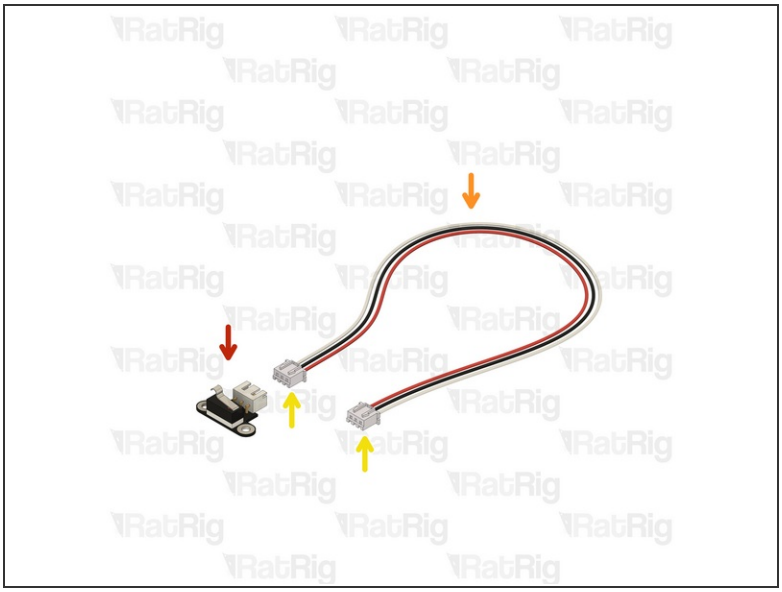


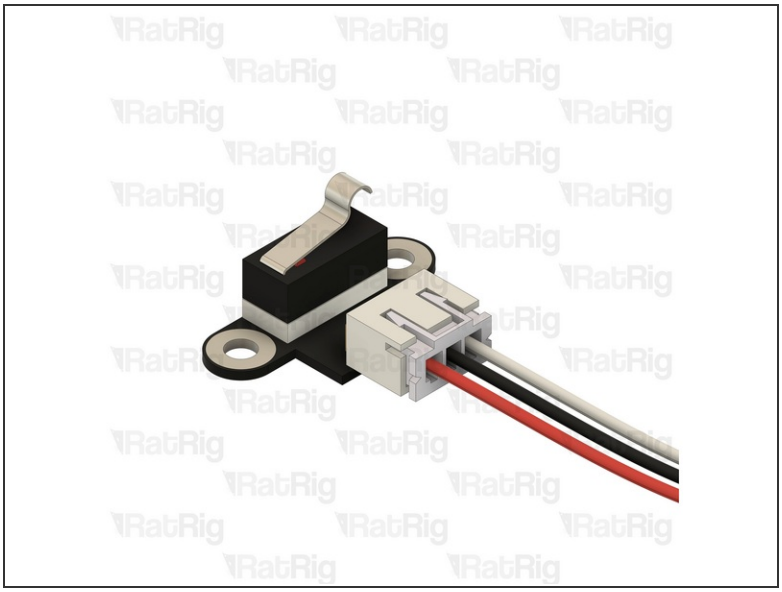



- Hot End Thermistor
- Plug the connector into the designated connector.
- Route the wires accordingly.

⚠ The thermistor wires are very fragile, bending them past its threshold can damage the conductors within, leading to wire failure.

Step 39 — Endstops - Preparation

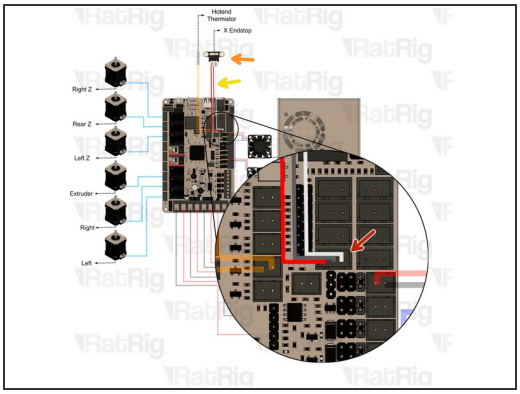


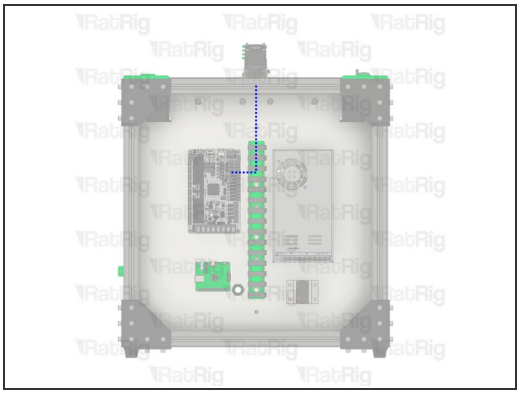
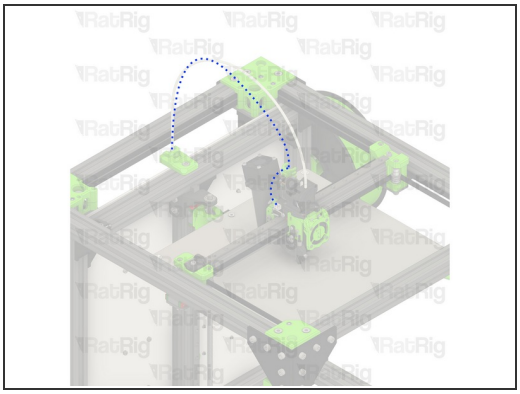


⚠ Warning: Check your cables. Incorrect endstop wiring can damage your board. If your kit isn't from the latest iteration, it may contain different endstop cables.

- 2x End Stop Body
- End Stop Cable:
  - ⓘ X End Stop - Length: 2m
  - ⓘ Y End Stop - Length: 1m
  - ⚠ If you are building a different V-Core3.1 size please refer to **STEP 1** for the cable length.
- JST3 Connector

Step 40 — X Endstop Install



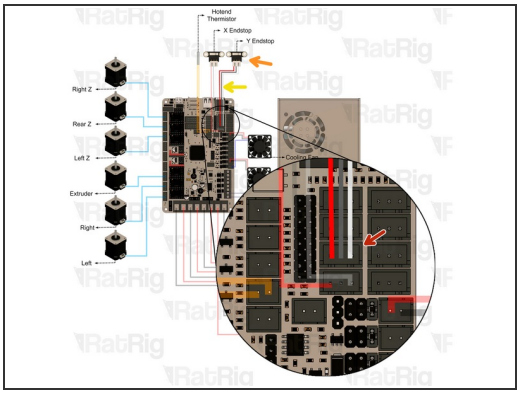



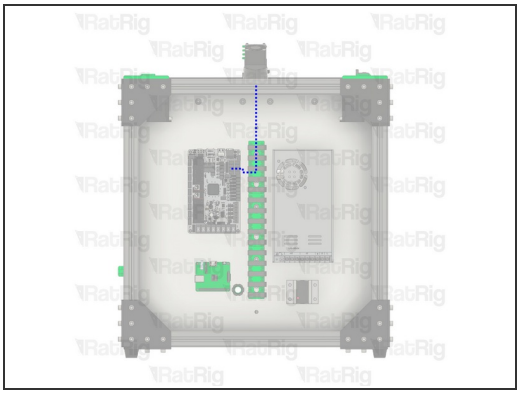
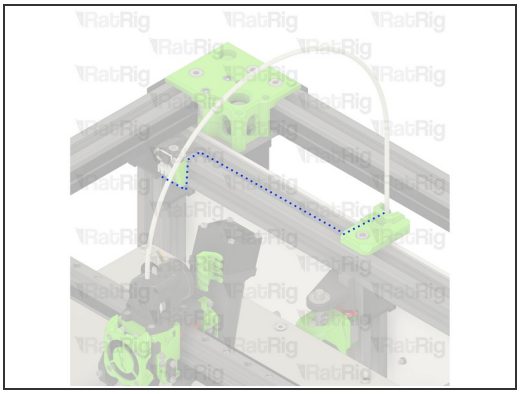
⚠ Warning: Check your cables. Incorrect endstop wiring can damage your board. If your kit isn't from the latest iteration, it may contain different endstop cables.

- Connect the JST3 connector to the lowest slot on the left.
- X Endstop Body
- X End Stop Cable (Length: 2m)
- Route the cable accordingly.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 41 — Y Endstop Install



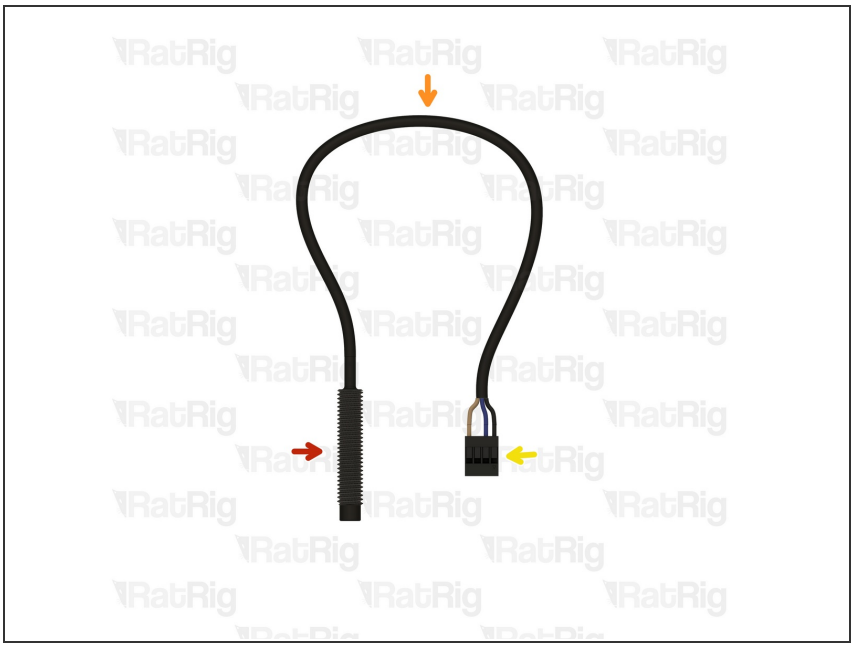



⚠ Warning: Check your cables. Incorrect endstop wiring can damage your board. If your kit isn't from the latest iteration, it may contain different endstop cables.

- Connect the JST3 connector to the lowest slot available on the left.
- Y Endstop Body
- Y End Stop Cable (Length: 1m)
- Route the cable accordingly. Place the cables inside the extrusions to help route them.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 42 — Probe

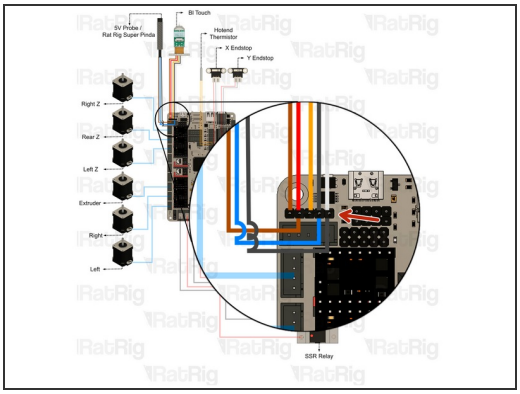


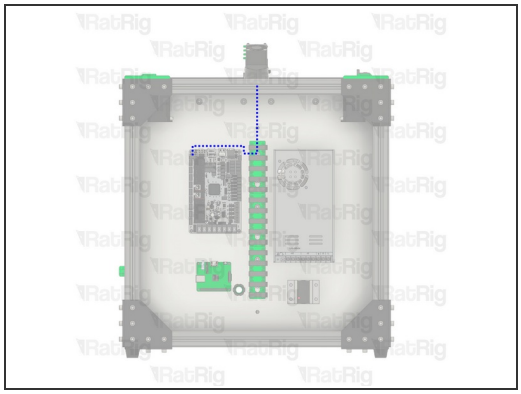
- Probe
- Cable (Length: 2m)
- Dupont Connector

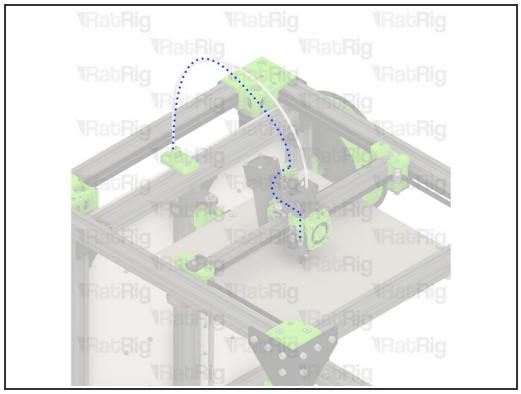
The provided probe doesn't come with a Dupont connector. You will have to crimp the dupont connector. The cable can be cut to length before crimping the dupont connector (Advised Length: 1m for the V-Core 3.1 300x300).

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 43 — Probe Install







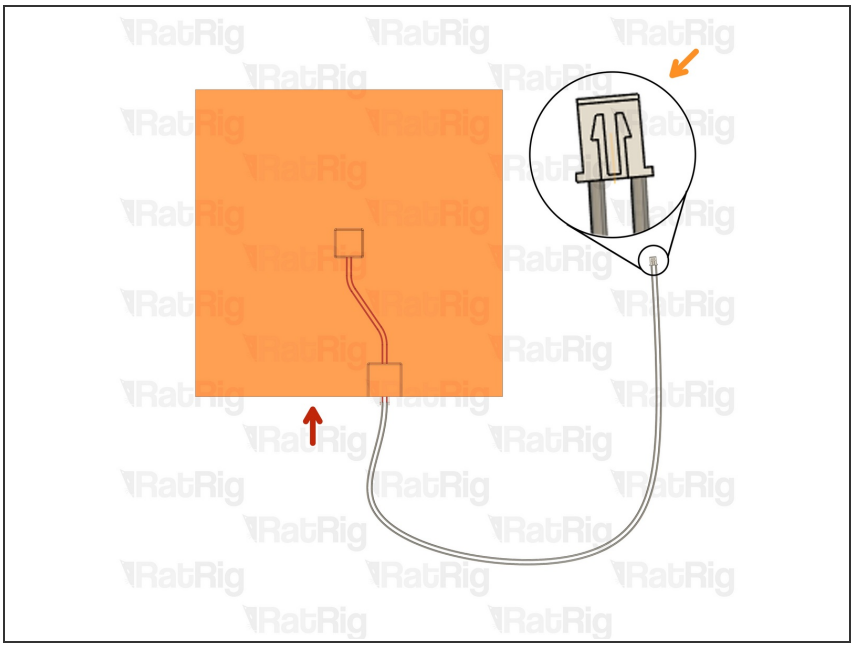
- Probe Cable Sequence

⚠ Pay attention to the wire colours as a mistake in the sequence will damage the probe.

- Route the cable accordingly.

⚠ If you are building a different V-Core 3.1 size please refer to **STEP 1** for the cable length.

Step 44 — Bed Thermistor

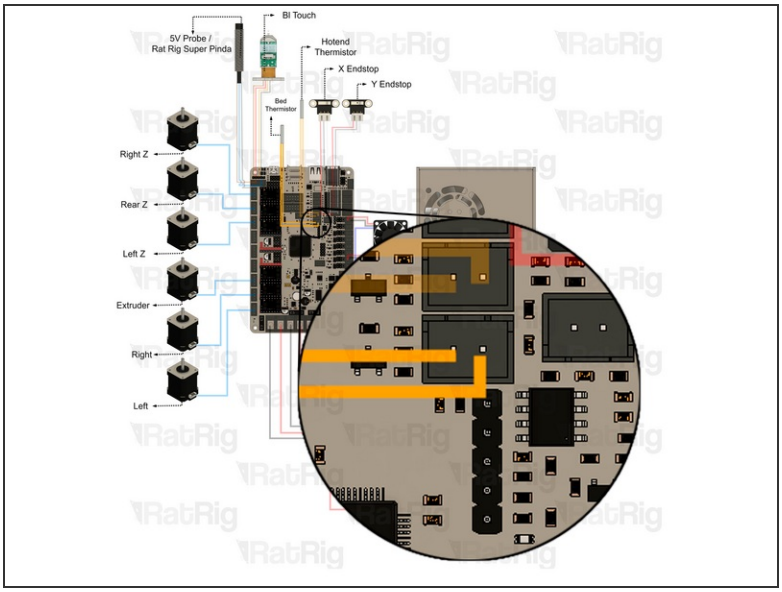


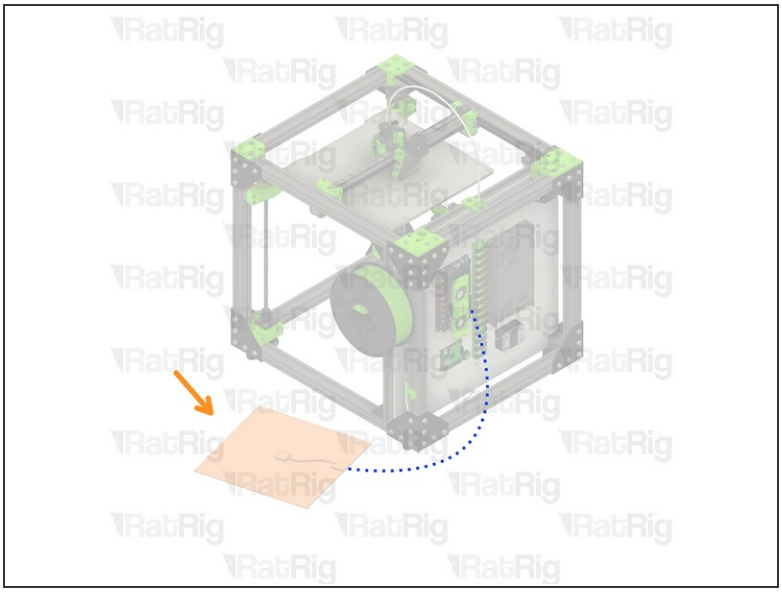
- Bed Heater with the incorporated Thermistor.
- Do not mistake the bed heater wires for the bed thermistor wires. The thermistor wires are the ones with the JST 2 wire connector.

ⓘ The thermistor is a resistor that strongly varies with temperature. When connecting a resistor you don't have to worry about cable order as resistors don't have polarity.

⚠ The magnetic sheet and heater pad will be installed later during the commissioning guide. Do not install them now.

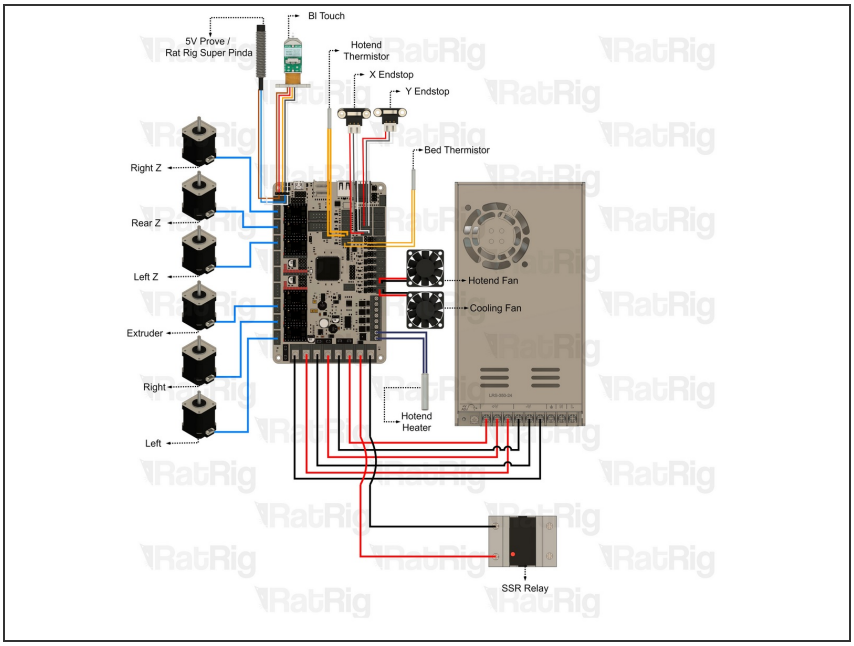
Step 45 — Bed Thermistor Install





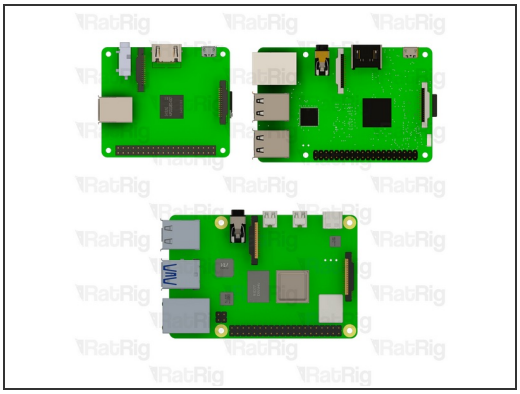
- Connect the Bed Thermistor to the slot right bellow the Hot End Thermistor.
- Place the heater pad next to the machine and connect only the thermistor
  - ⓘ This is required to follow the guide and perform a sanity check

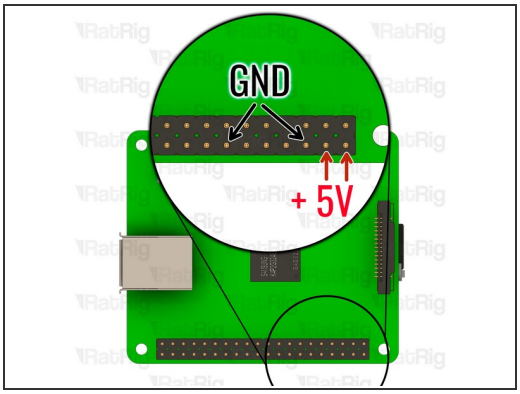
Step 46 — Completed Diagram

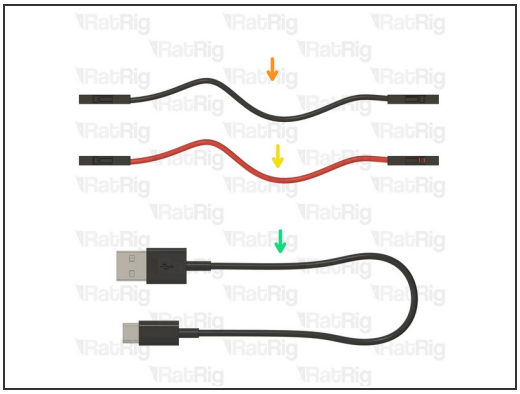


- ☑ Check all the cables. The connections must look like the picture. Take your time to ensure all steps are correct before powering the machine on, any mistakes may cause component malfunction or failure.

Step 47 — Raspberry Pi

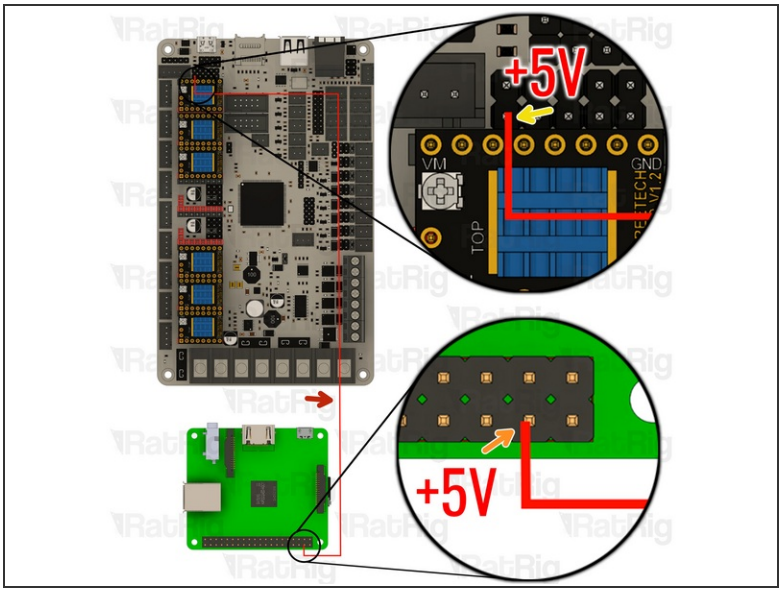


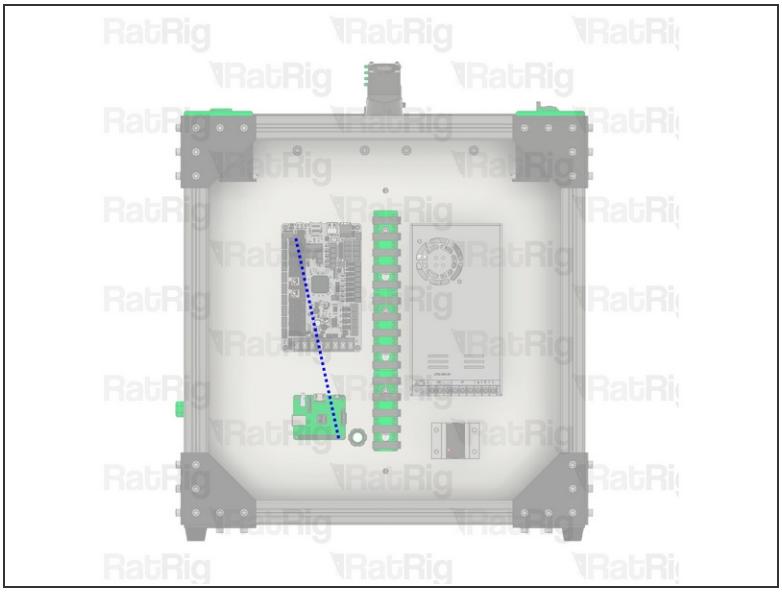




- The Raspberry Pi wiring is the same regardless of the Raspberry Pi model used. Please note that all GPIOs are in the same place as well as the USB ports.
- Power Input +5V
- Power Input GND
- 2x Black Jumper Wire (Length: 250mm)
- 2x Red Jumper Wire (Length: 250mm)
- USB A to USB C Wire (Length: 350mm)
- The Raspberry Pi can be powered in many ways, using an external 5V power supply, via USB (power input) and via the GPIOS pins. The V-Core chooses to power the PI via the GPIOS pins as this simplifies the wiring.

Step 48 — Raspberry Pi +5V

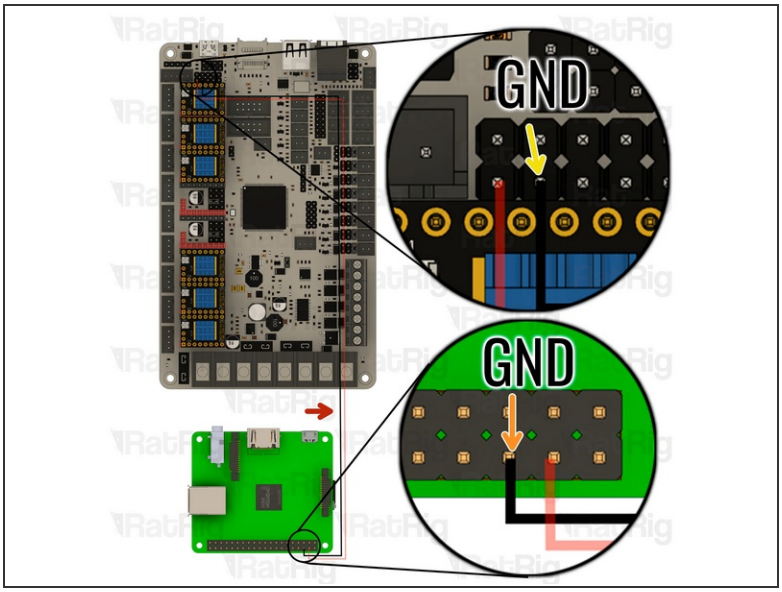


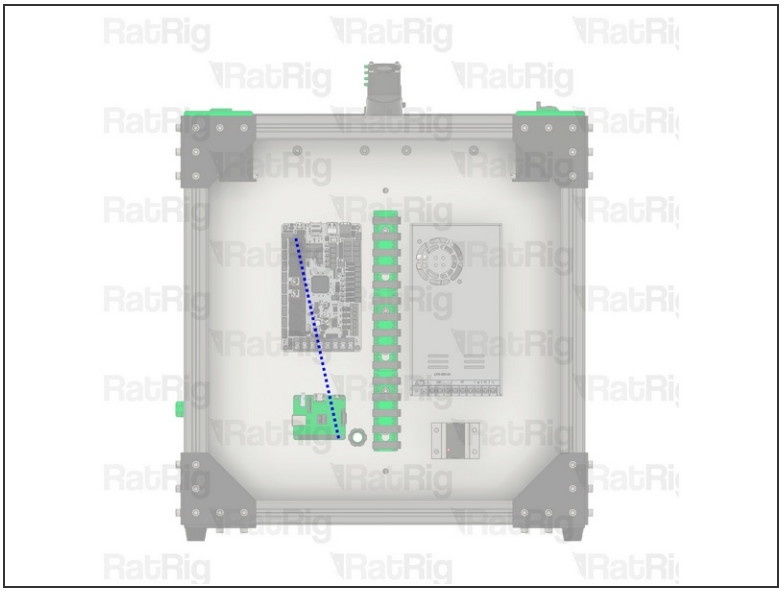


- Red Jumper Wire (Length: 250mm)
- Power Input +5V on the Raspberry Pi
- Power Output +5V on the Octopus V1.1
- Route the cable accordingly.

⚠ Make sure the wires don't touch the TMC2209 heat sinks as they get hot and can damage the wires, leading to component failure.

Step 49 — Raspberry Pi GND

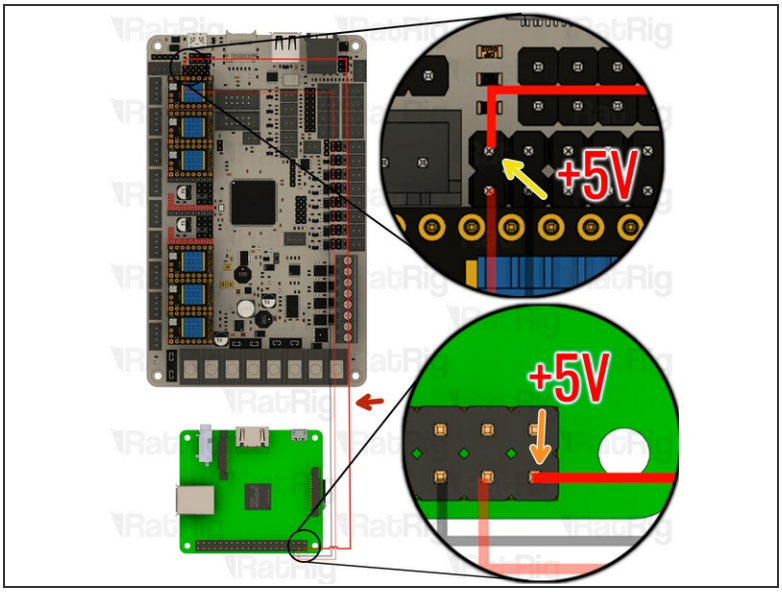


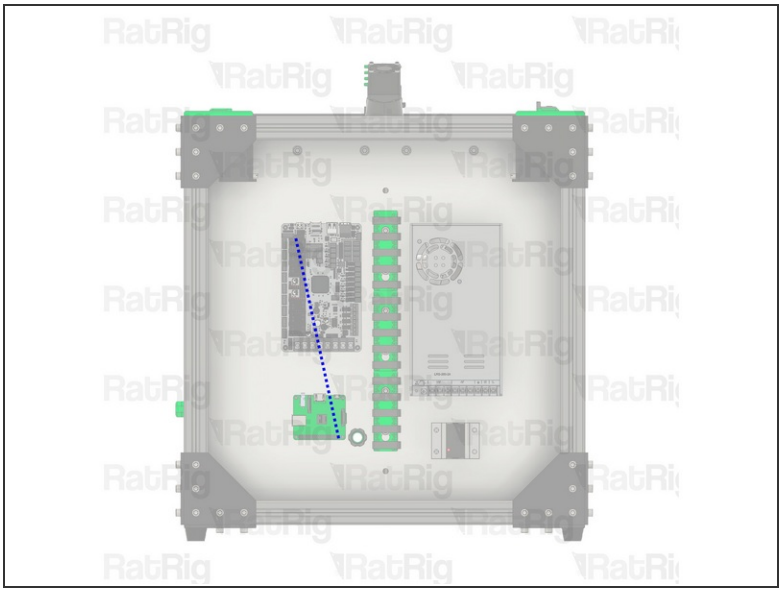


- Black Jumper Wire (Length: 250mm)
- Power Input GND on the Raspberry Pi
- Power Output GND on the Octopus V1.1
- Route the cable accordingly.

⚠ Make sure the wires don't touch the TMC2209 heat sinks as they get hot and can damage the wires, leading to component failure.

Step 50 — Raspberry Pi +5V



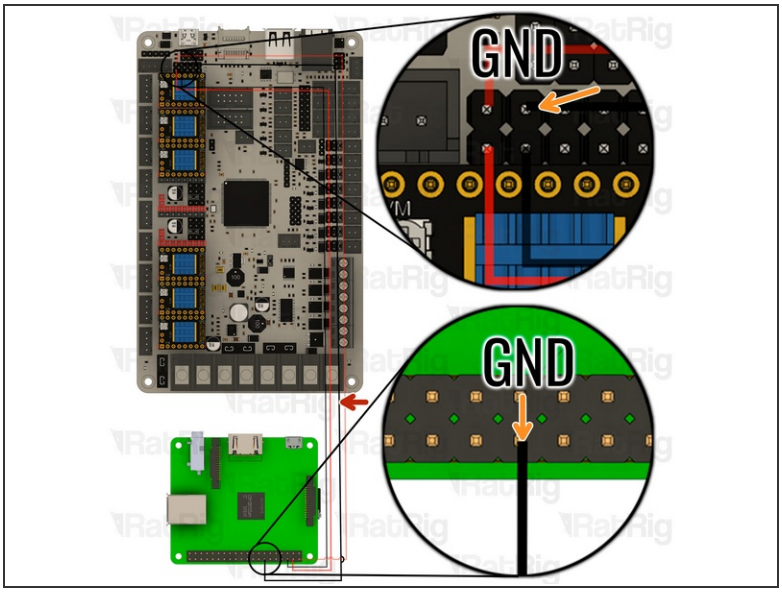


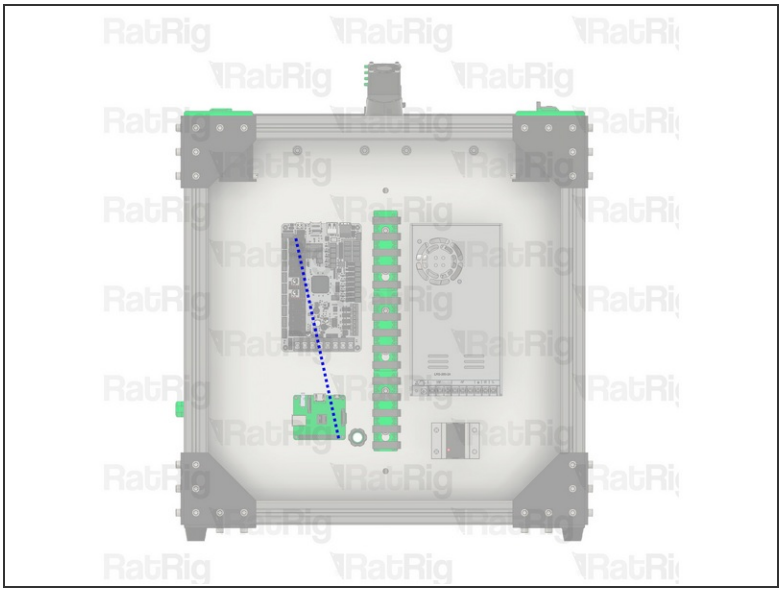
ⓘ The Raspberry Pi is very sensitive to voltage variations. It's advised to run 4 power cables in order to keep the supplied power more consistent.

- Red Jumper Wire (Length: 250mm)
- Power Input +5V on the Raspberry Pi
- Power Output +5V on the Octopus V1.1
- Route the cable accordingly.

⚠ Make sure the wires don't touch the TMC2209 heat sinks as they get hot and can damage the wires, leading to component failure.

Step 51 — Raspberry Pi GND



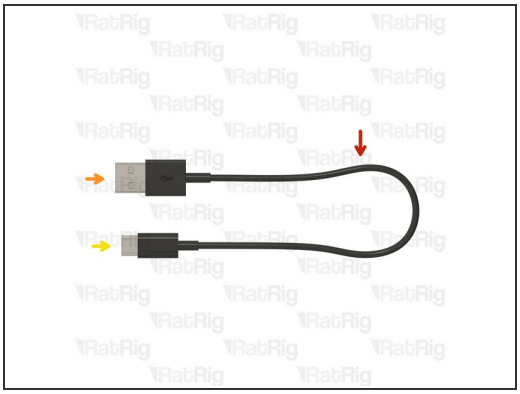
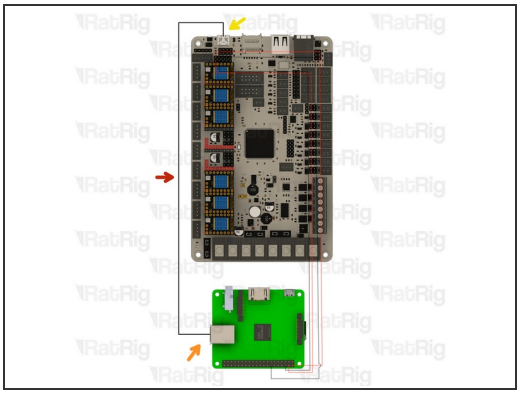
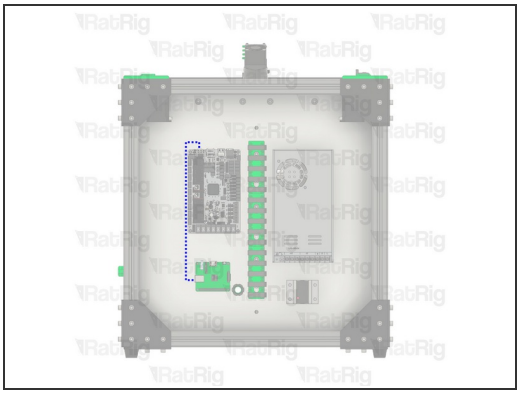


ⓘ The Raspberry Pi is very sensitive to voltage variations. It's advised to run 4 power cables in order to keep the supplied power more consistent.

- Black Jumper Wire (Length: 250mm)
- Power Input GND on the Raspberry Pi
- Power Output GND on the Octopus V1.1
- Route the cable accordingly.

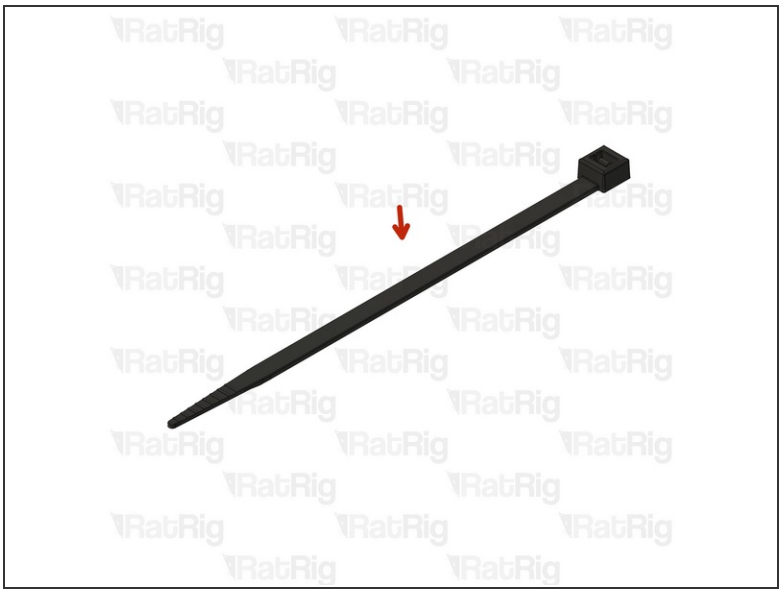
⚠ Make sure the wires don't touch the TMC2209 heat sinks as they get hot and can damage the wires, leading to component failure.

Step 52 — Raspberry Pi USB

- USB A to USB C Cable [Length: 350mm]
- USB A Port on the Raspberry Pi
- USB C Port on the Octopus V1.1
- Route the cable accordingly.

Step 53 — Cable Management



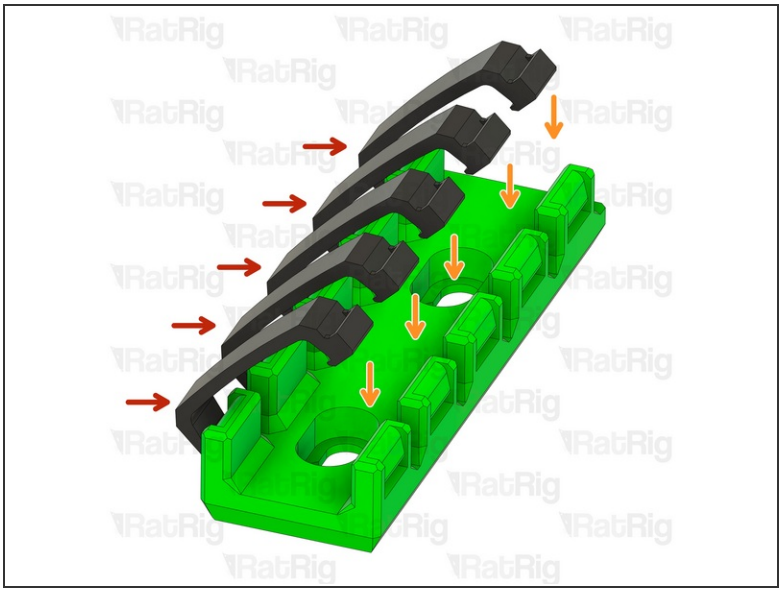
- Zip Ties

ⓘ Harness all the cable groups with the Zip Ties.

⚠ Tighten all zip ties carefully as you might pinch/break the cables.

- Rat Rig recommends using a Cable Sleeve to wrap the Tool Head wiring harness, you can get it here.

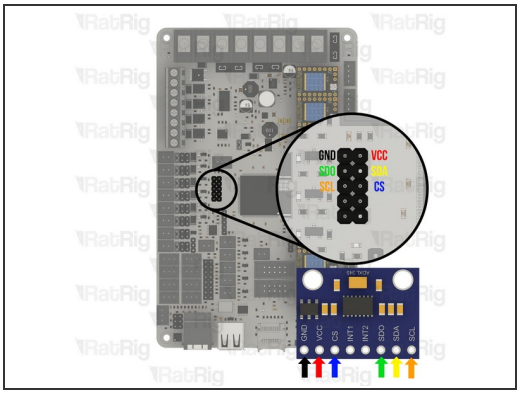
Step 54 — Close The Electronics Wire Guides

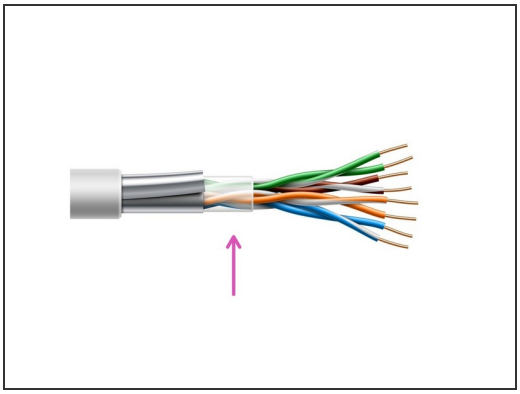
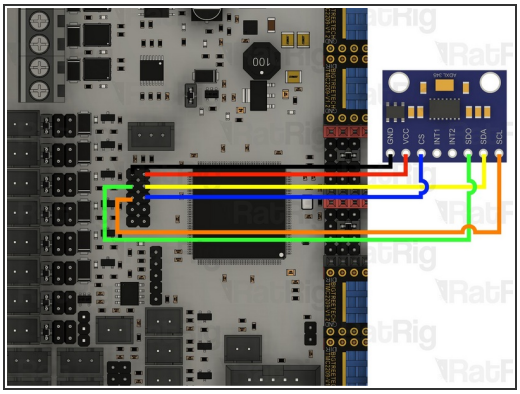


- Electronics Wire Guide Clip set aside on **STEP 9**
- Click them into place once all the cables are routed inside of the Electronics Wire Guides.

⚠ Close the clips carefully as you might pinch/break the cables.

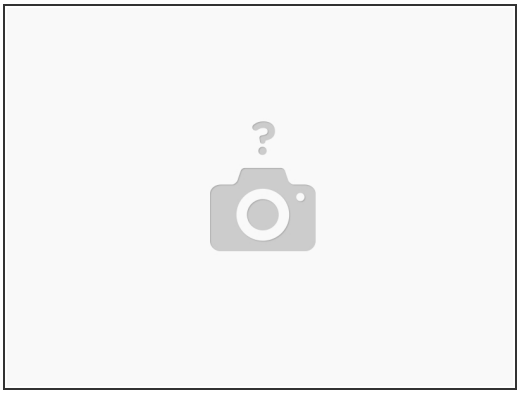
Step 55 — Accelerometer



- The ADXL is now included in the optional electronics kit.
- The most commonly used accelerometer is the ADXL 345, RatOS has a built-in configuration.
- [Buy the ADXL 345]
- Ethernet cable, CAT6 or superior, is recommended to improve signal stability.
- Wire the ADXL with the ethernet cable, it's required to solder the wires to the sensor and crimp dupont connectors on the other end.
- Make sure to follow the wiring diagram carefully as switching a wire will damage the sensor.

Step 56 — Firmware & RatOS



- The firmware guides are available at: https://v-core.ratrig.com/firmware/