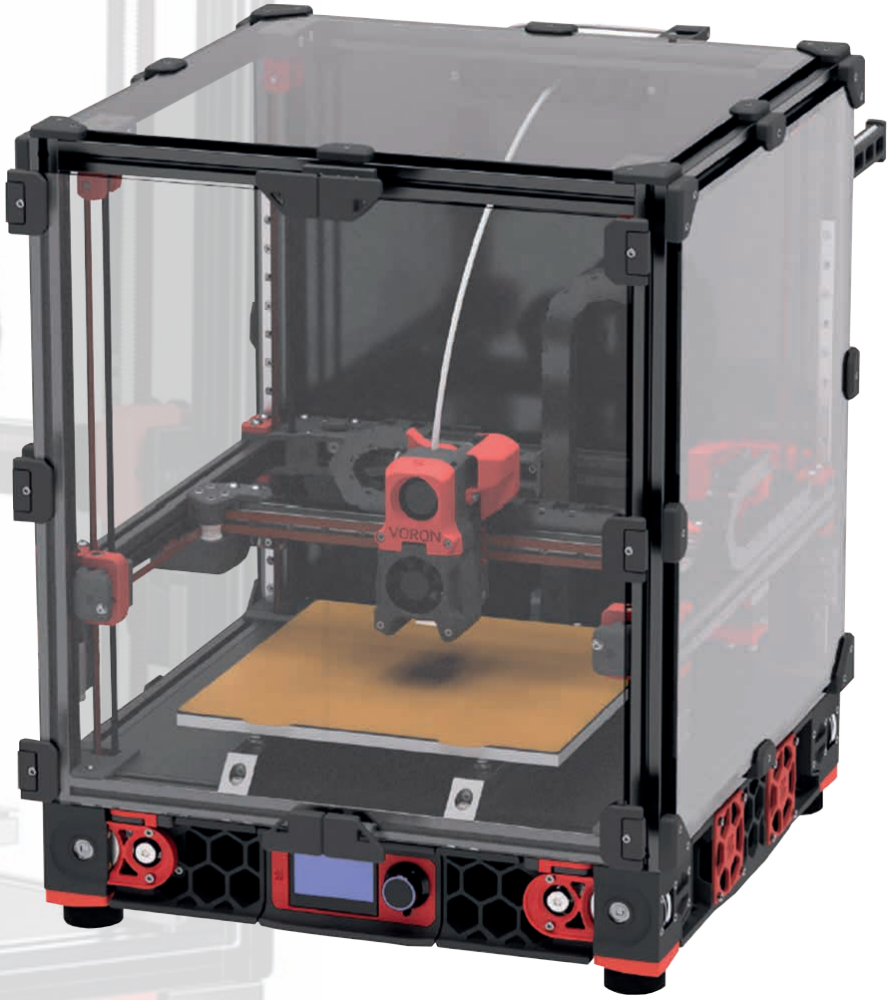
VORON 2.4

KIT 8

- CONTROL PANEL
- WIRING



VERSION B

Mini 5+ DUET 3D + RASPBERRY (optional)

Before you begin on your journey, a word of caution.

In the comfort of your own home you are about to assemble a robot. This machine can maim, burn, and electrocute you if you are not careful. Please do not become the first VORON fatality. There is no special Reddit flair for that.

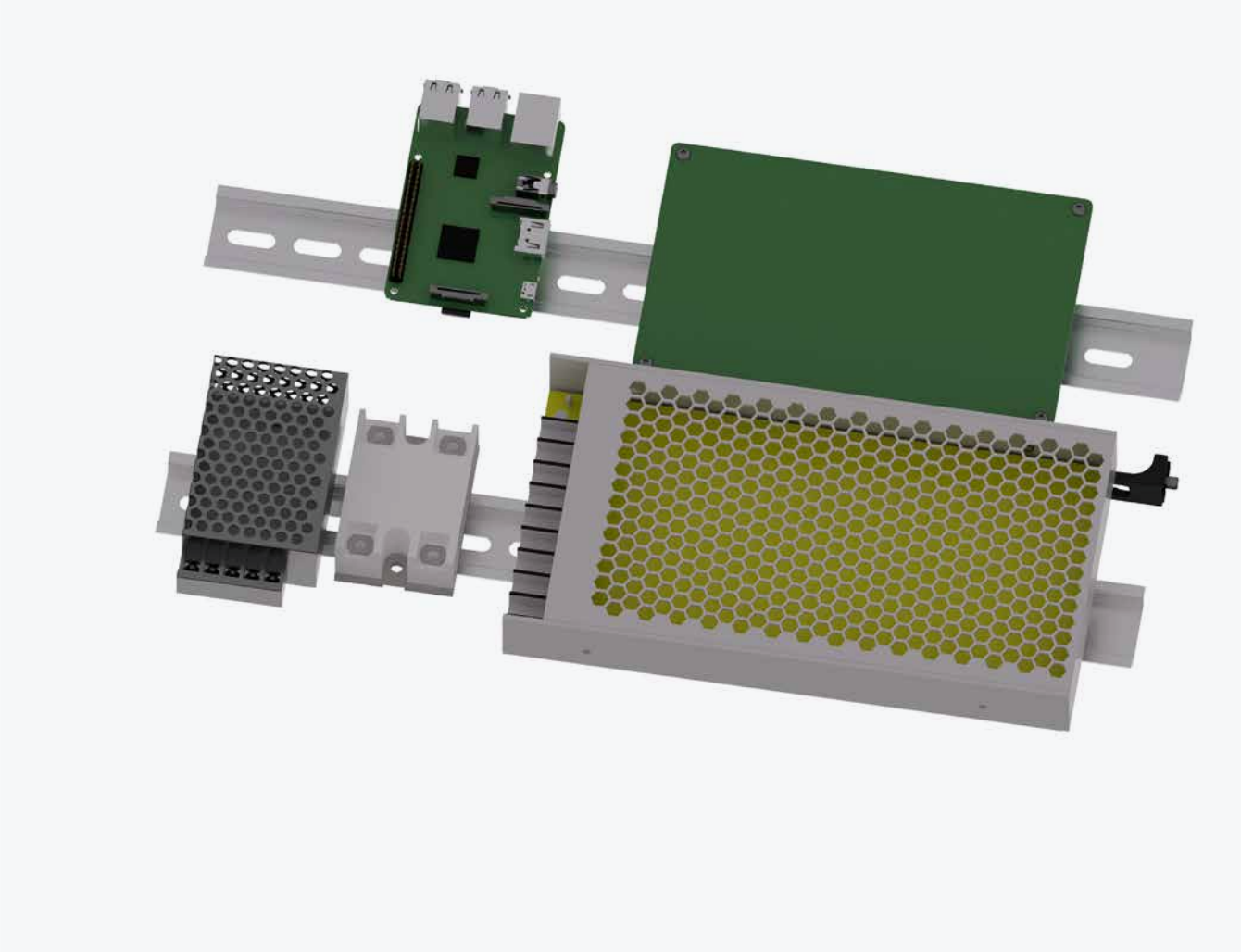
Please, read the entire manual before you start assembly. As you begin wrenching, please check our Discord channels for any tips and questions that may halt your progress.

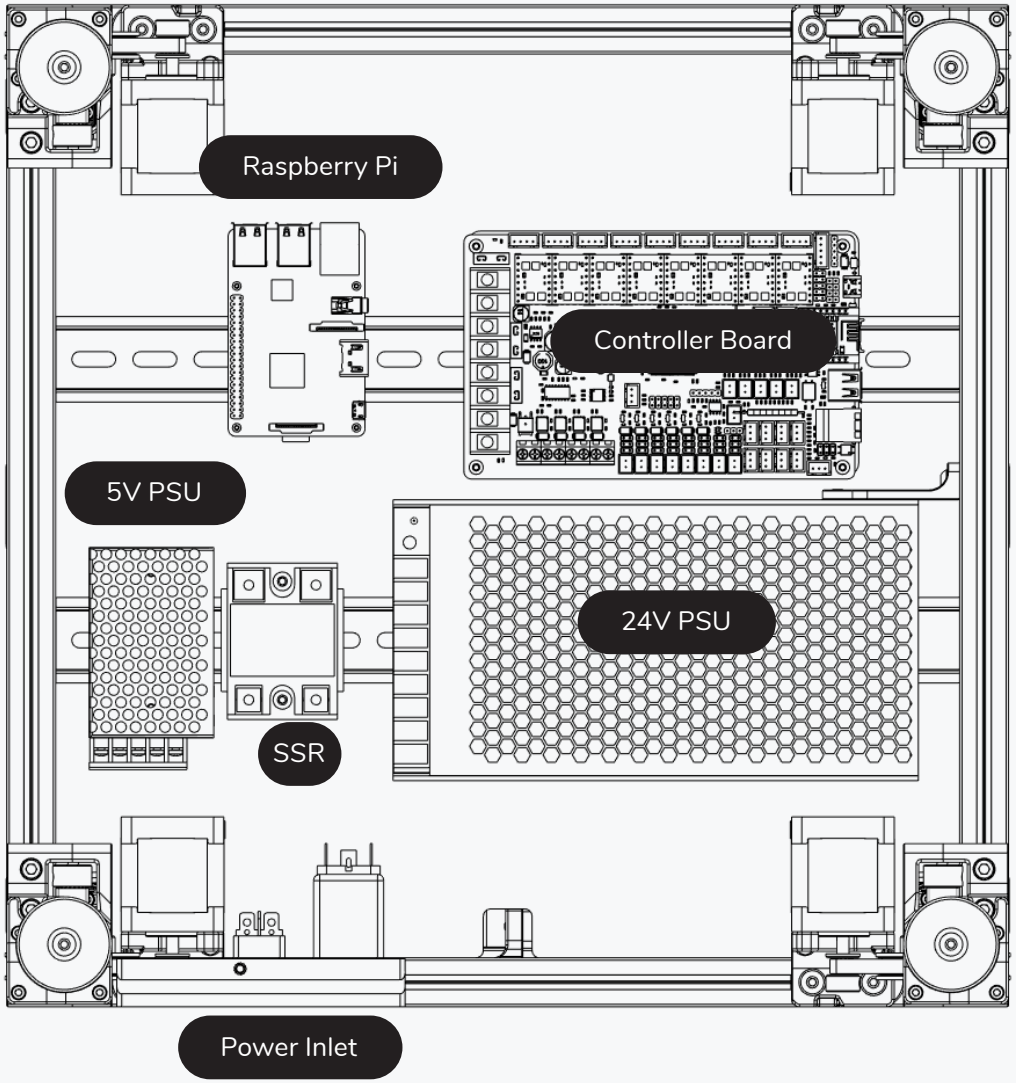
Most of all, good luck!

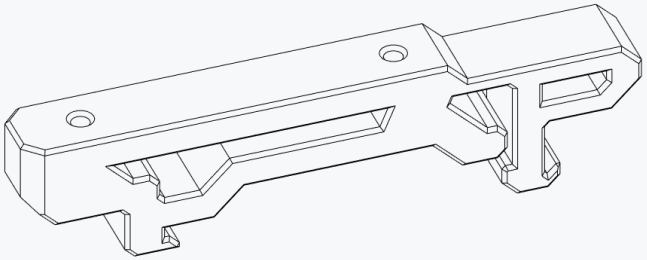
THE VORON TEAM

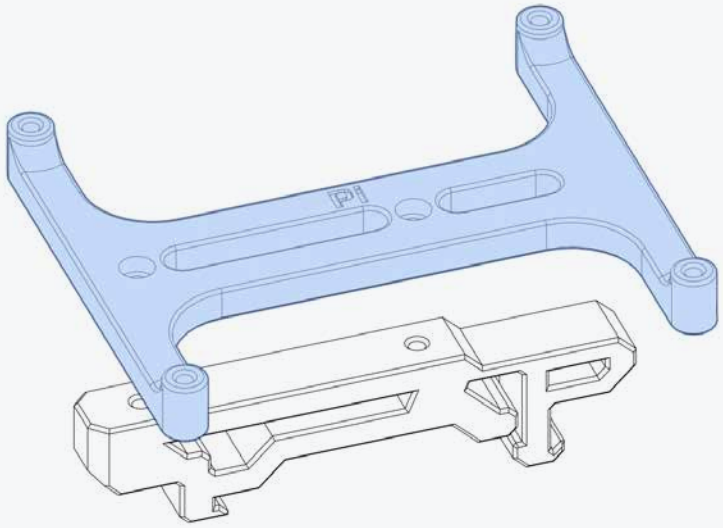
NOTE:
Inside this manual you will find photos of various Duet products. These are only indicative images. We always advise you to check the version of the Boards in use and consult the documentation for the version to be wired on the official DUET 3D platform.

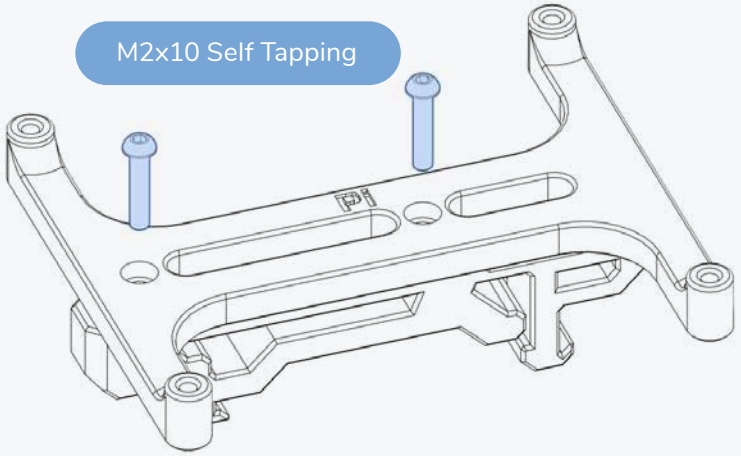
https://docs.duet3d.com

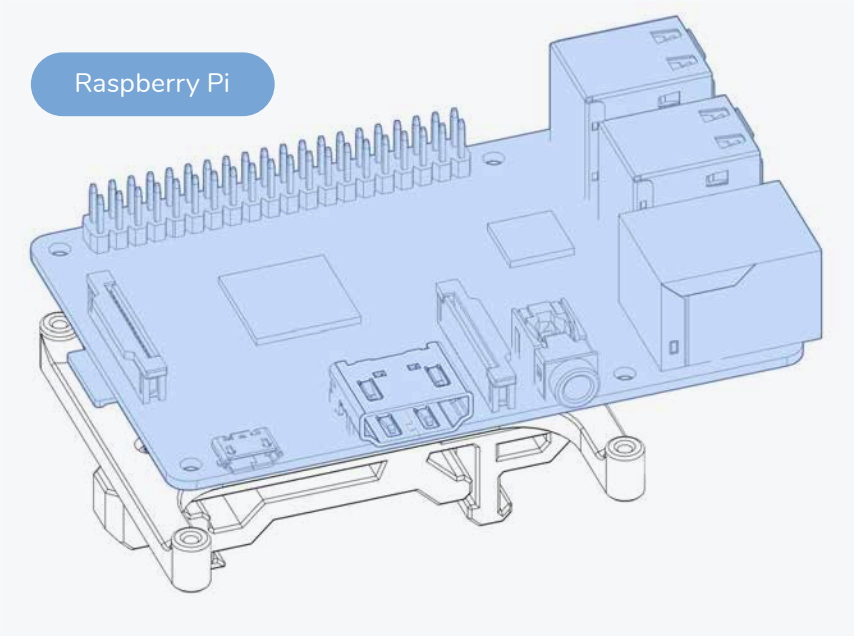


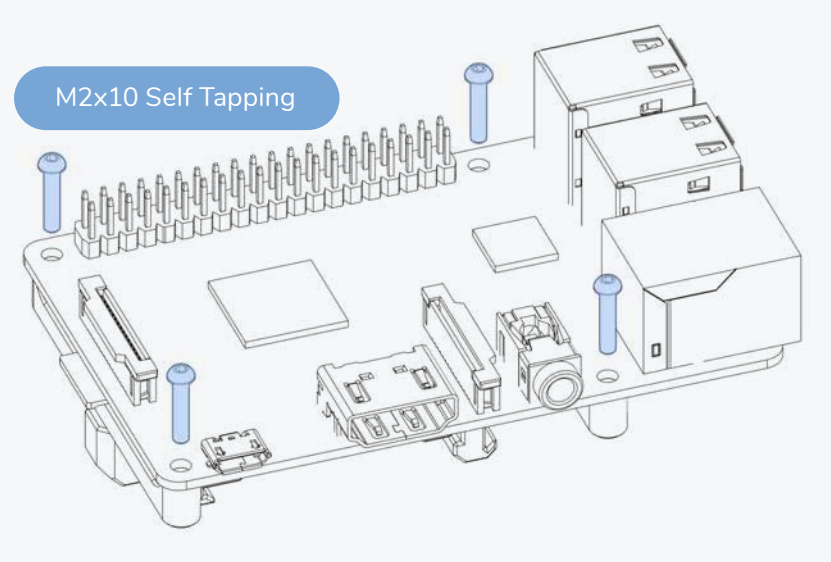

Raspberry Pi
Controller Board
5V PSU
24V PSU
SSR
Power Inlet

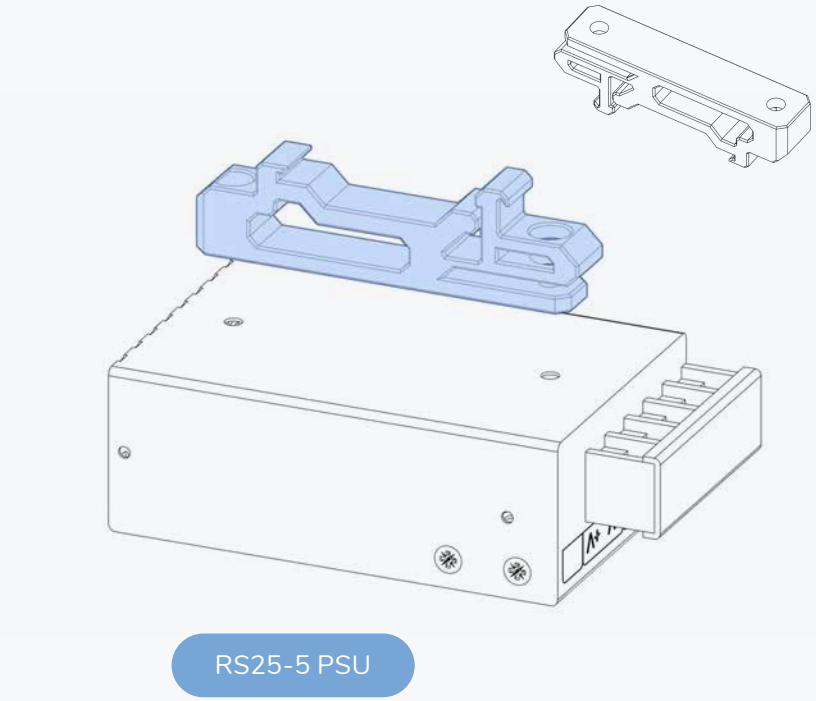




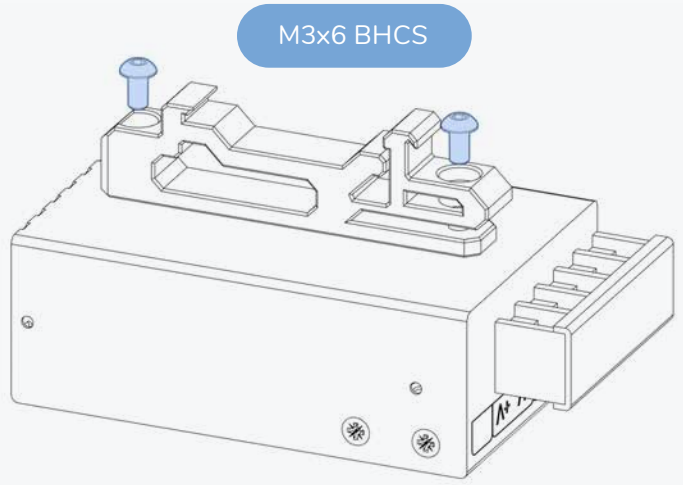

M2x10 Self Tapping

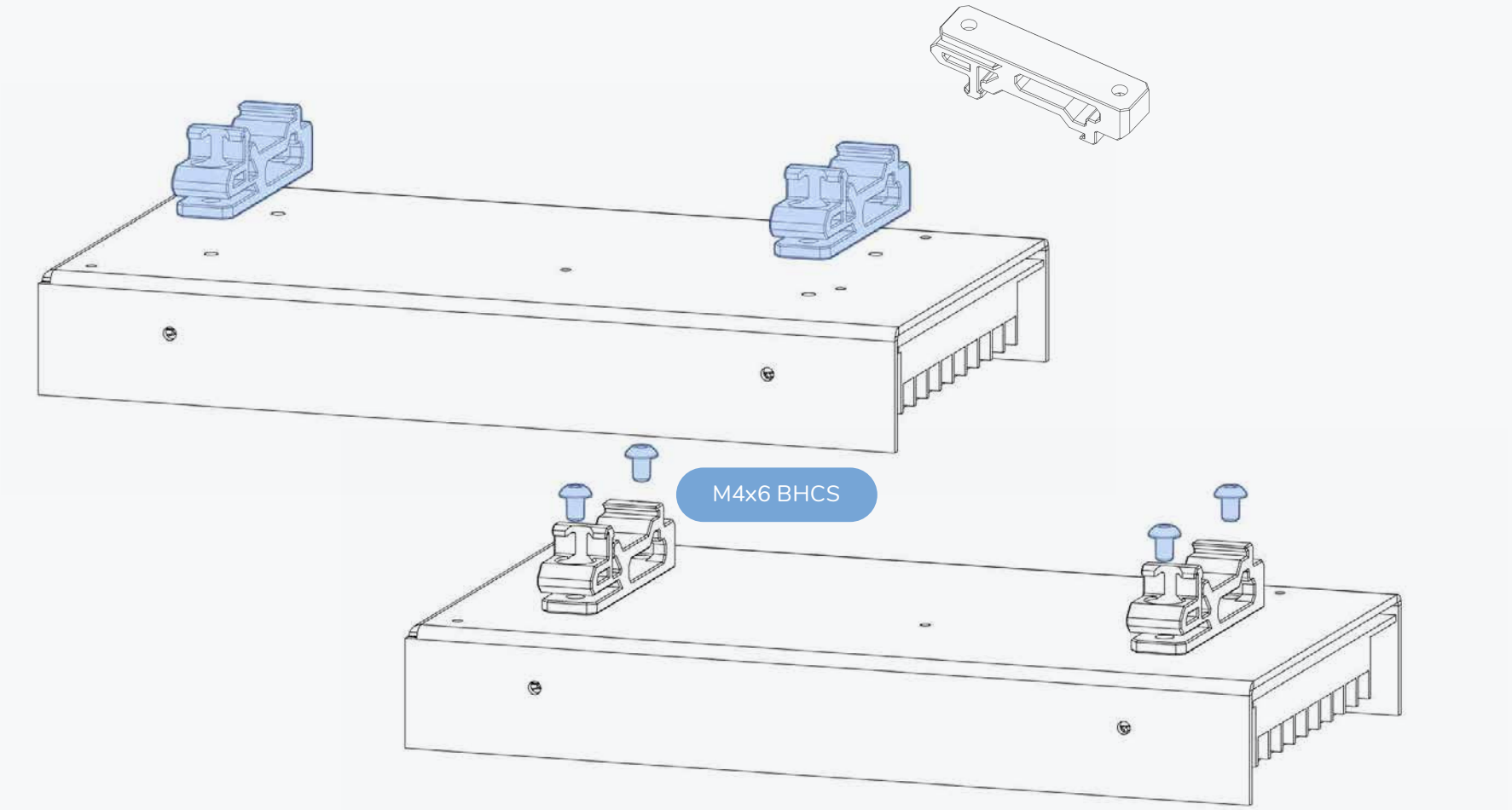

Raspberry Pi

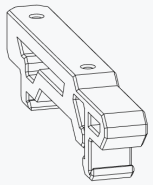

M2x10 Self Tapping

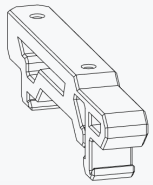


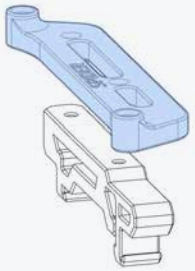
RS25-5 PSU

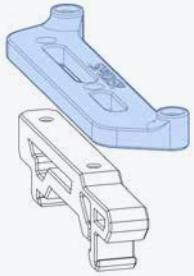



M4x6 BHCS



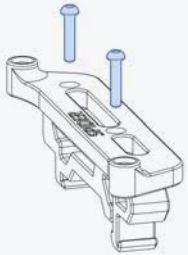




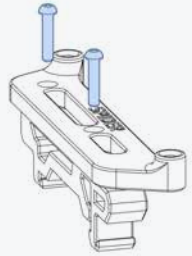


AVAILABLE MOUNTS

We also provide mounts for other controller boards. They are assembled in a similar manner.



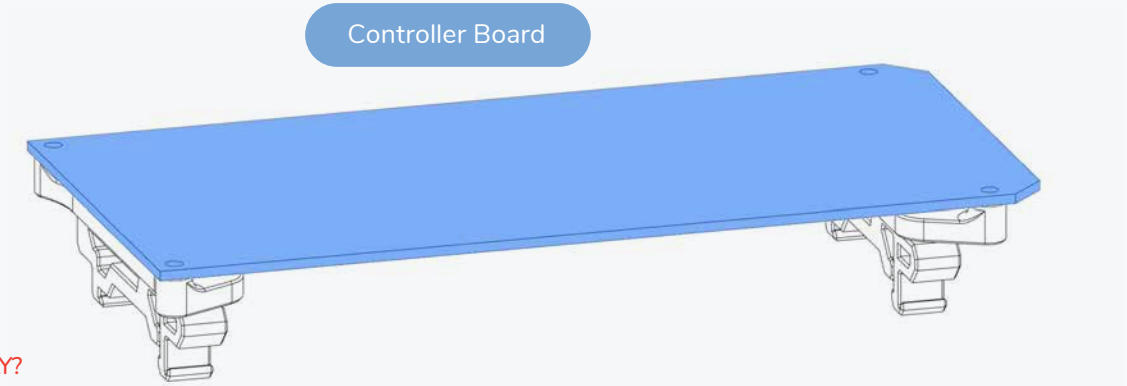
M2x10 Self Tapping



NOTE:

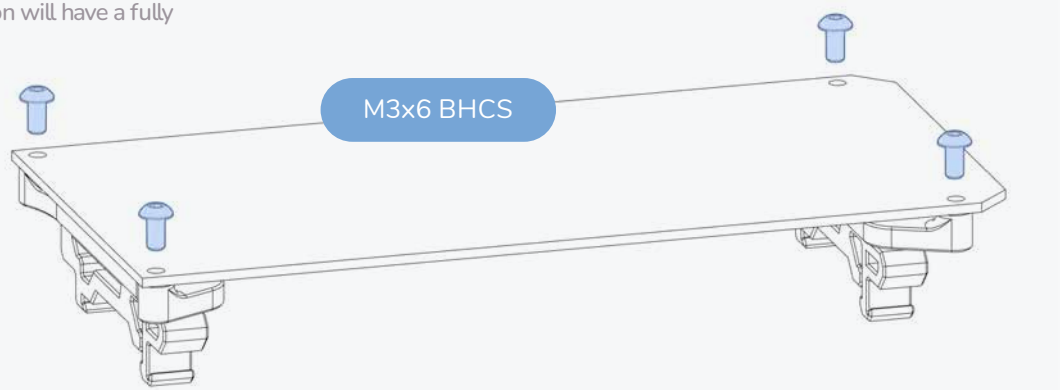
If you use the 1LC DUET toolboard, take care to download and print the dedicated supports.

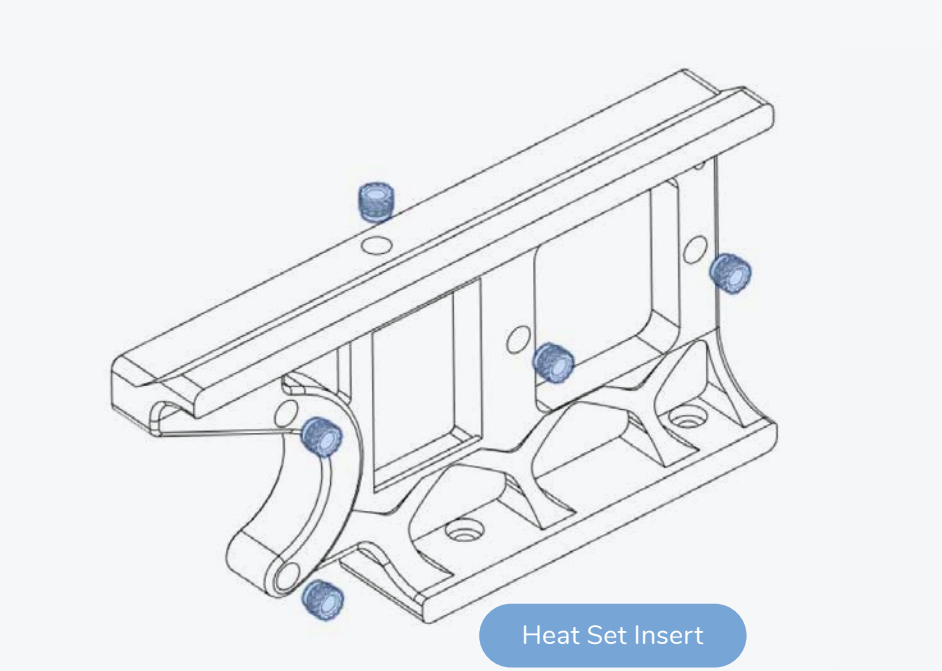
optional - CONTROLLER BOARD

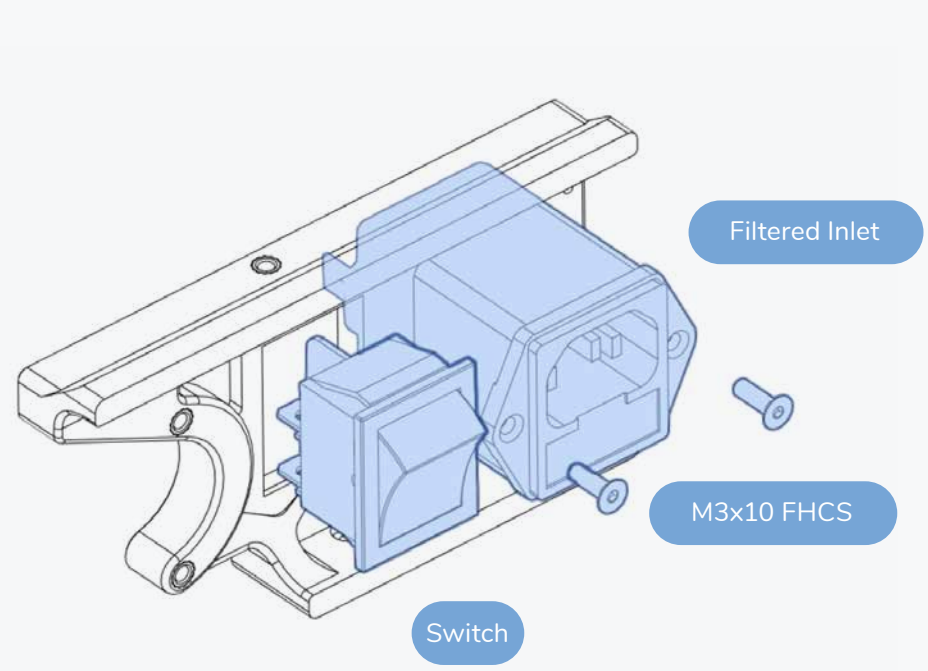


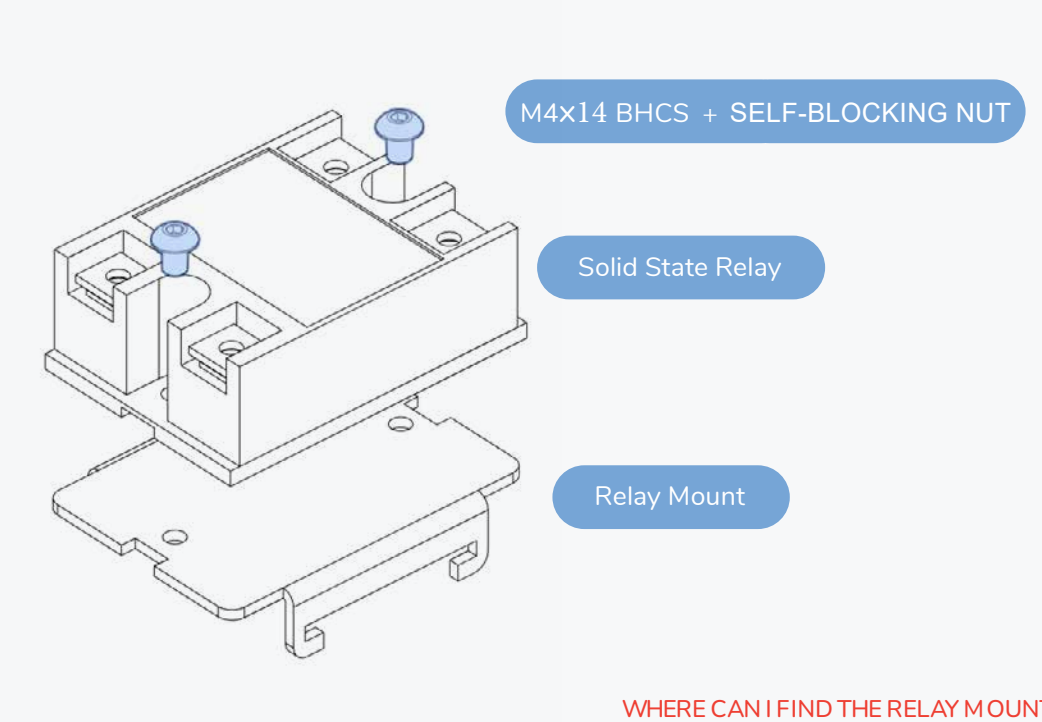
WHY DOES IT LOOK THAT WAY?

We used a dummy to keep the file size of the printers cad manageable. The wiring section will have a fully featured image.




Heat Set Insert


Filtered Inlet
M3x10 FHCS
Switch

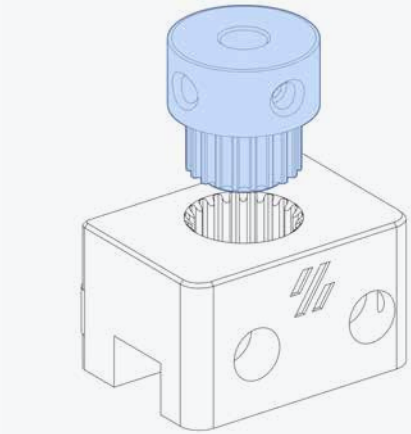


WHERE CAN I FIND THE RELAY MOUNT?

The SSR mount is an off the shelf part. Look for a metal bracket in your pile of parts.
There is no printed mount.

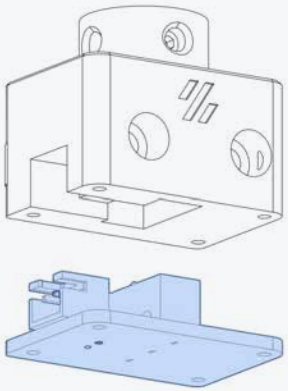
OPTION: Z ENDSTOP BOARD

GT2 20 Tooth Pulley

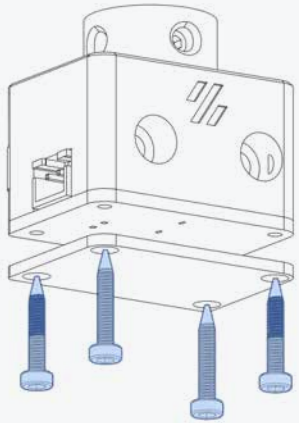


PRESS FIT

Apply the required force to fully seat the pulley in the printed part.

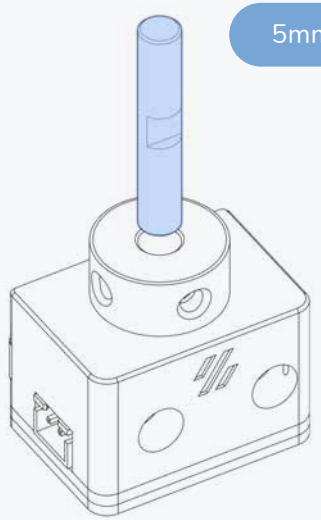


Microswitch Z Endstop Board



M2x10 Self Tapping

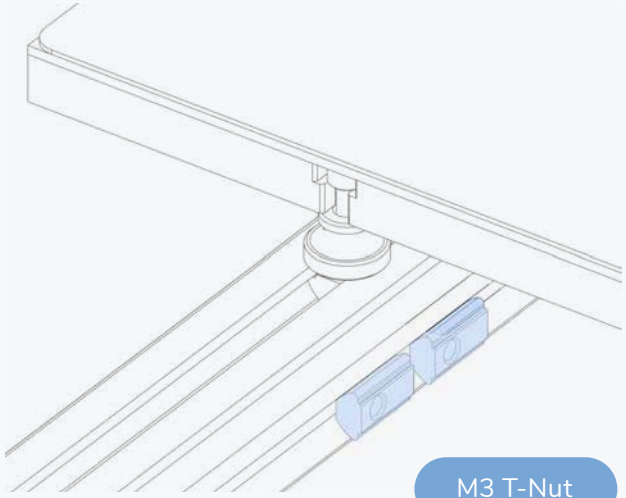
5mm Shaft



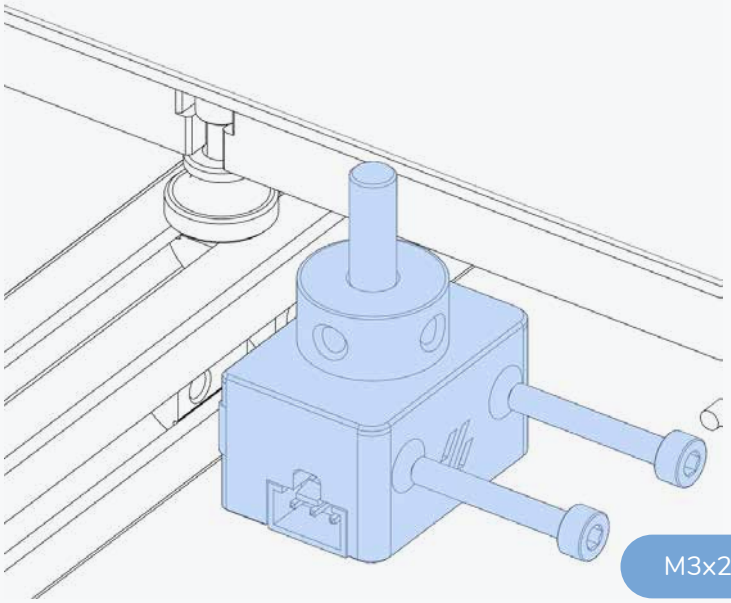
ADDITIONAL INFORMATION

Visit voron.link/3bwwnqy for design files and BOM.

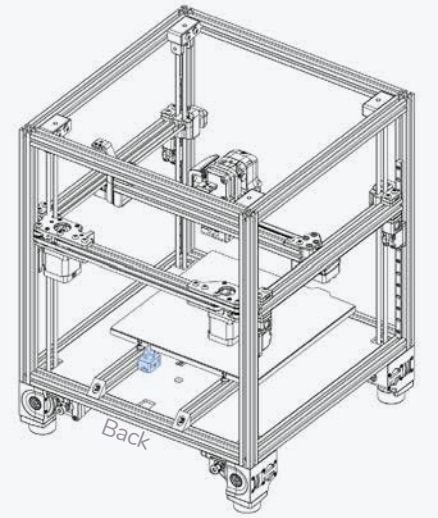
Z ENDSTOP



M3 T-Nut

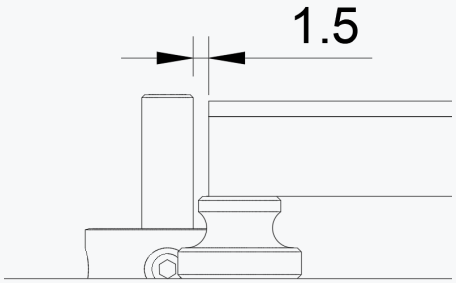


M3x20 SHCS



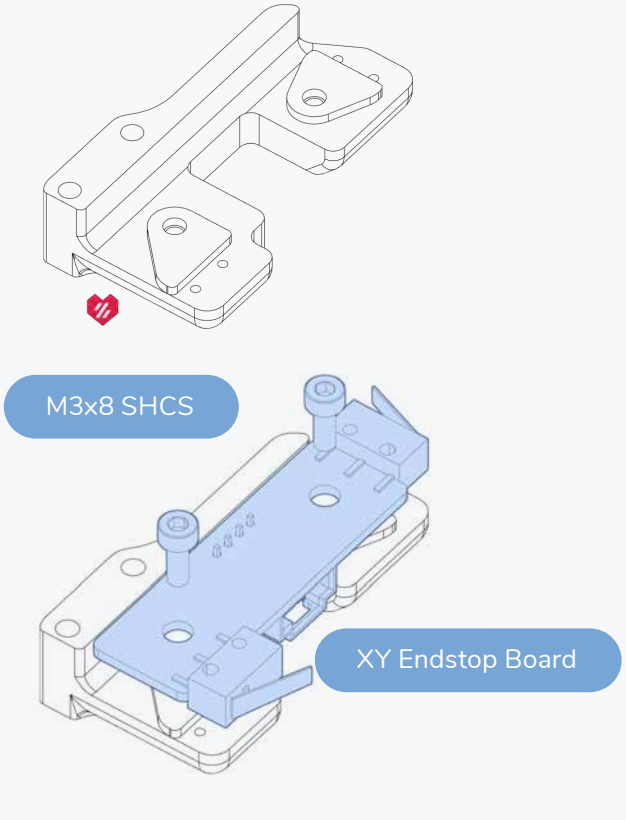
ADJUST Z ENDSTOP POSITION

The shaft of the Z Endstop must not touch the print bed.
Adjust the position if required.

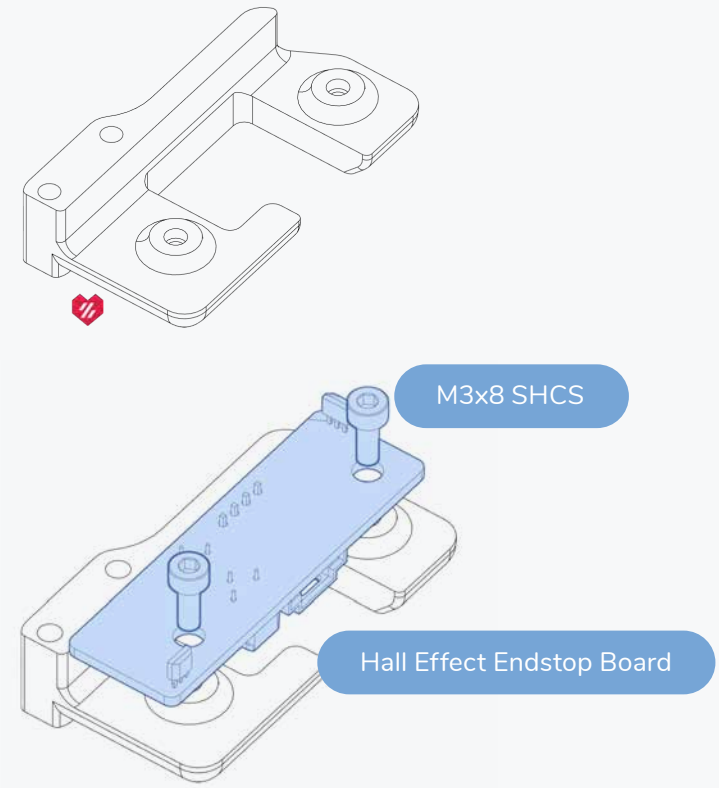


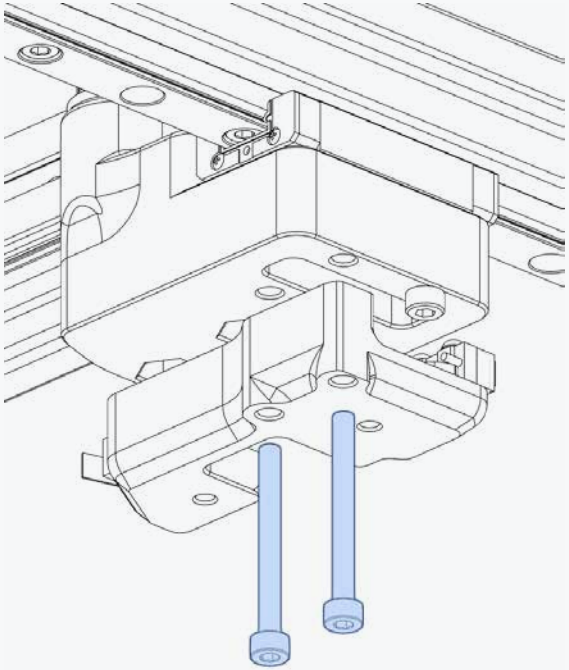
ALTERNATE X/Y ENDSTOPS

OPTION: XY ENDSTOP BOARD

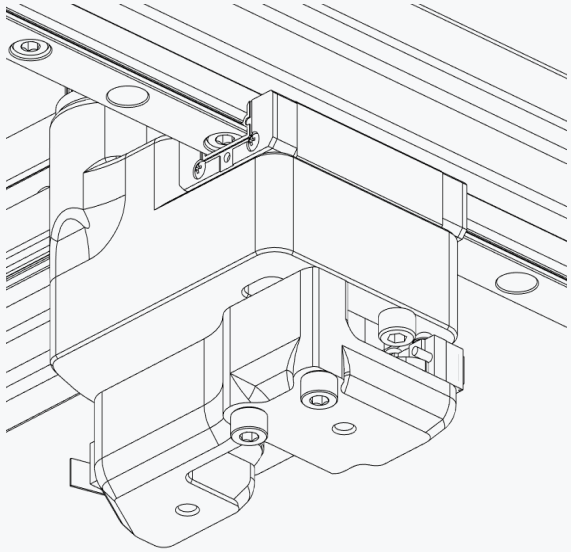


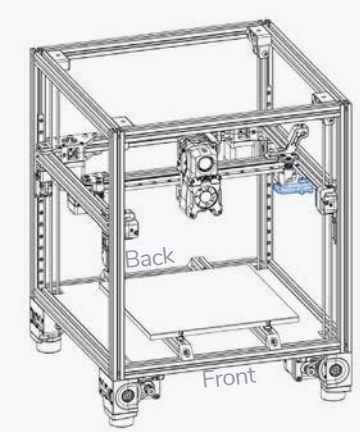
OPTION: HALL EFFECT ENDSTOP BOARD





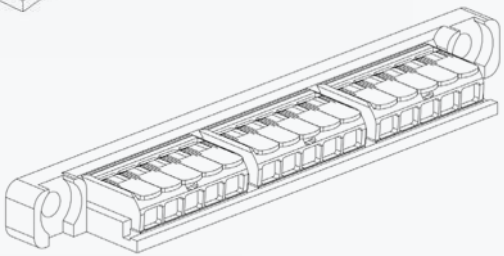
M3x30 SHCS

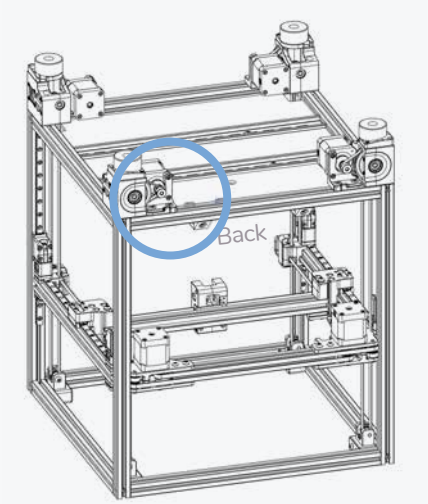


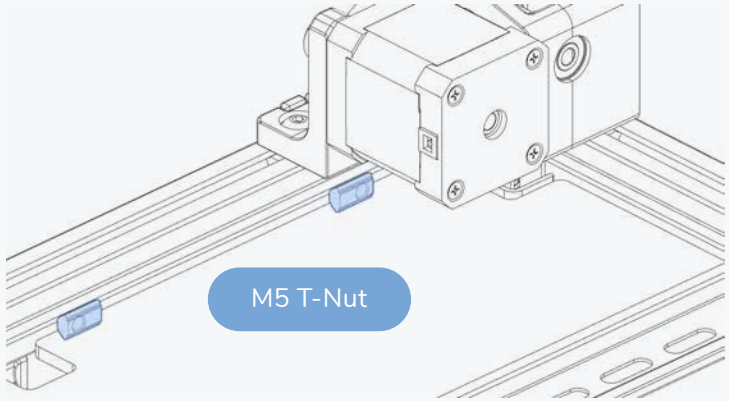


MAINS DISTRIBUTION - WAGO

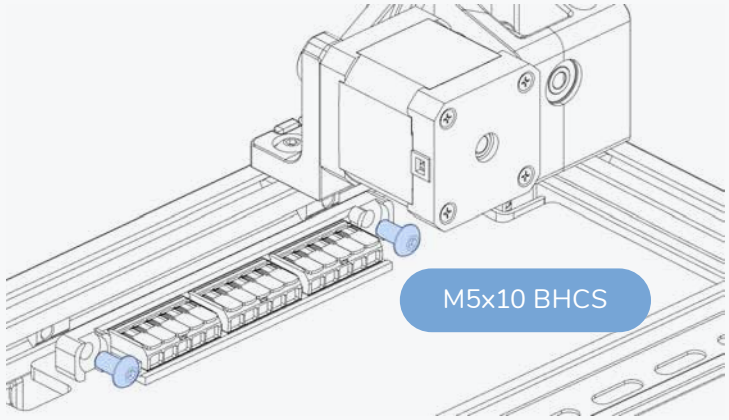
WAGO 221 415 Clamps







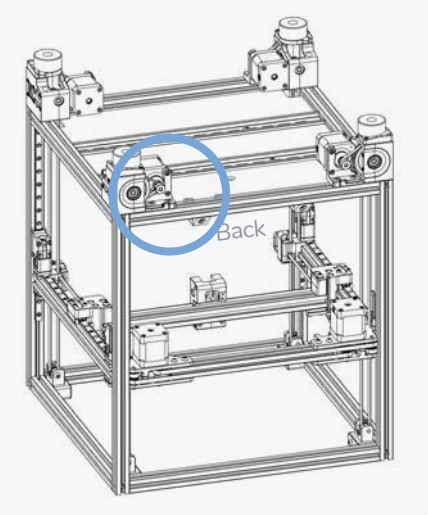
M5 T-Nut

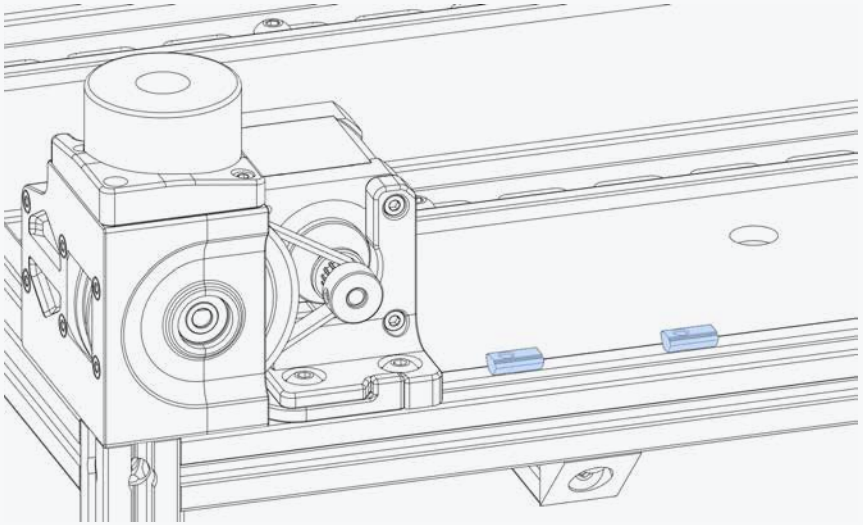


M5x10 BHCS

UPSIDE DOWN ASSEMBLY

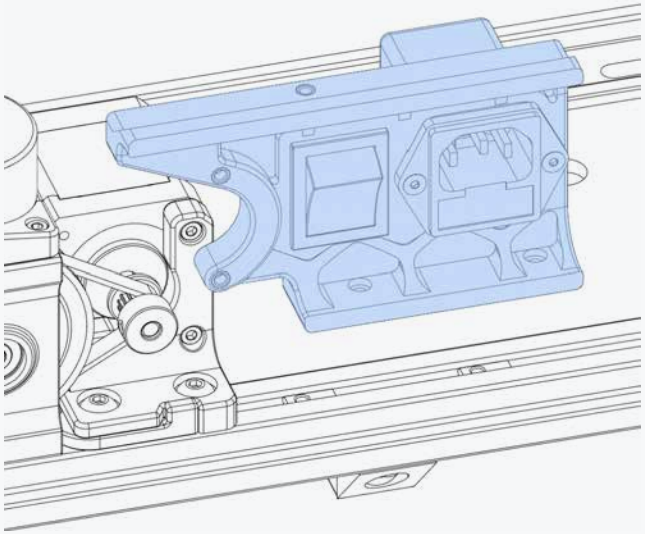
For ease of assembly we recommend to flip the printer on its head for the next steps. Hope you don't regret building a 350.

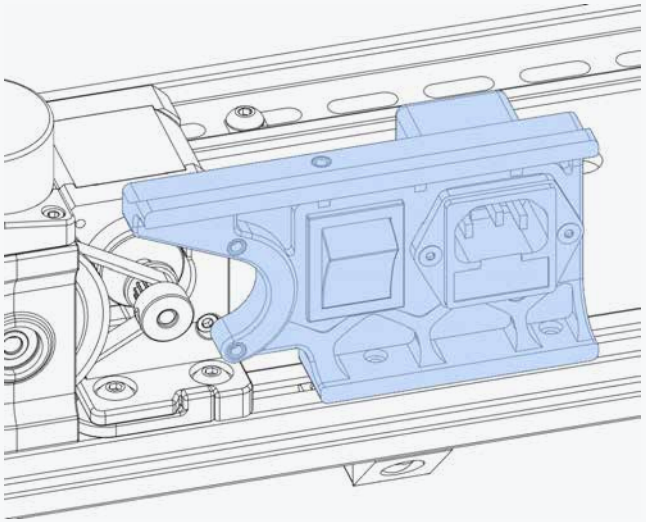


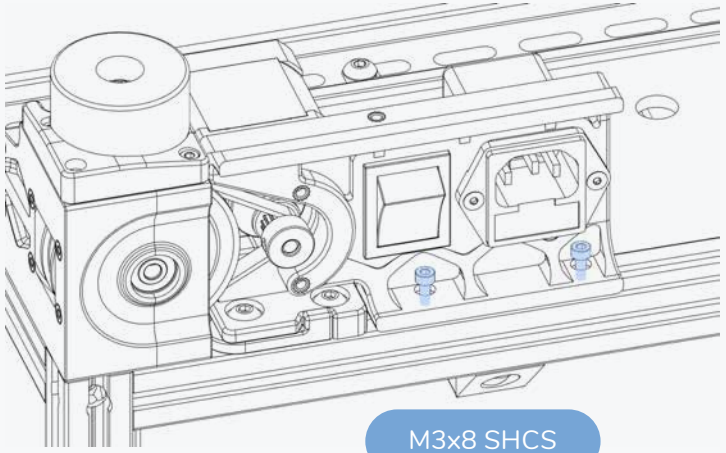


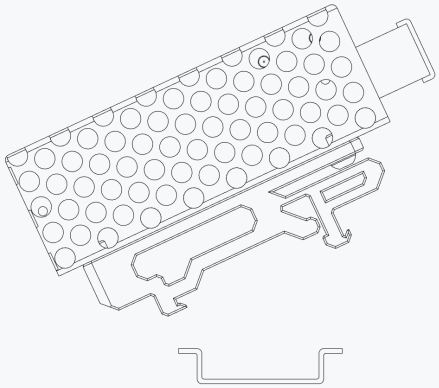
M3 T-Nut

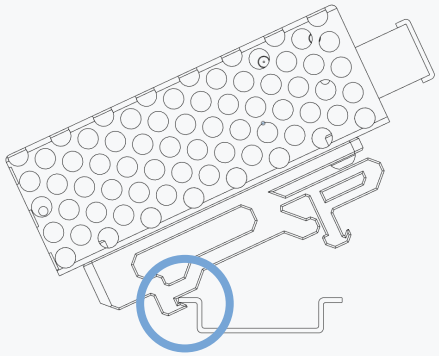
POWER INLET





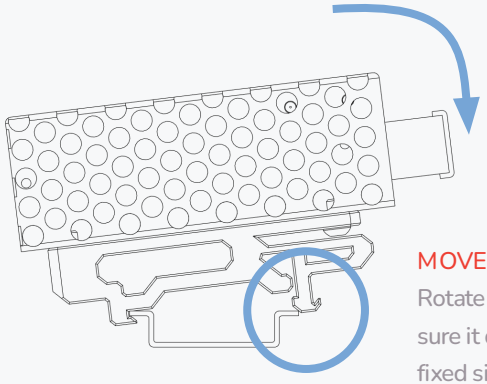






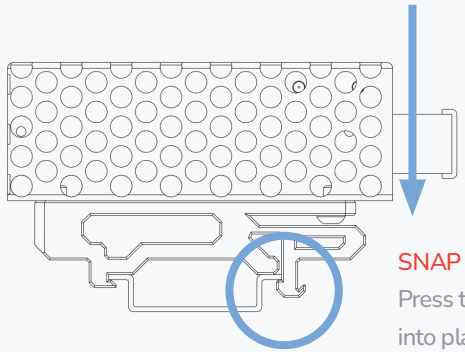
HOOK FIXED SIDE

Hook the fixed side of the printed mount on side of DIN rail.



MOVE INTO POSITION

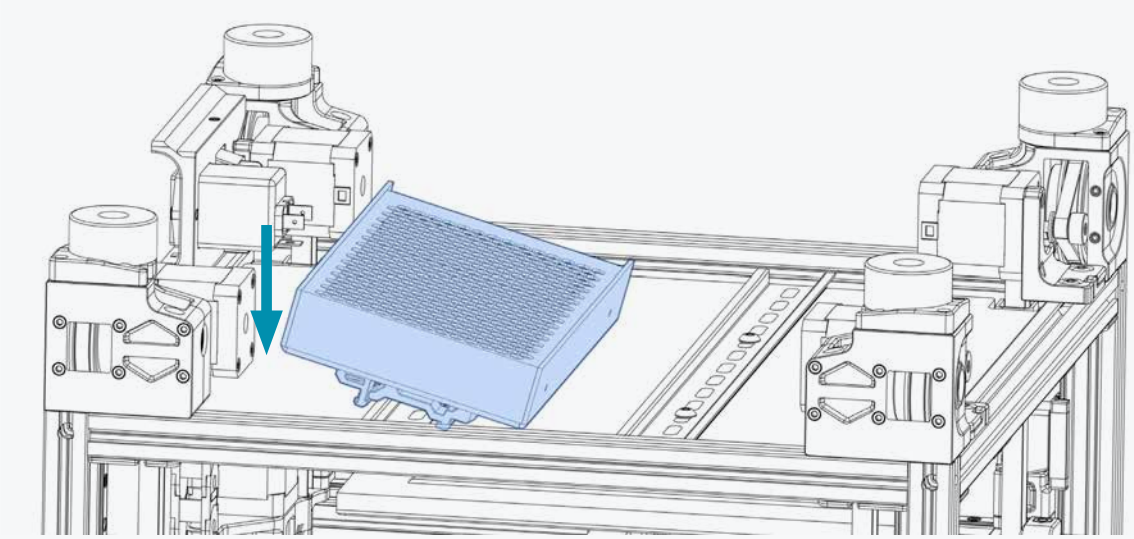
Rotate the part into place, m ake sure it does not unhook from the fixed side.

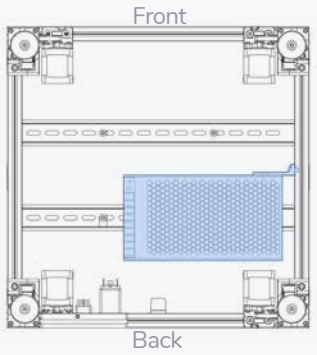


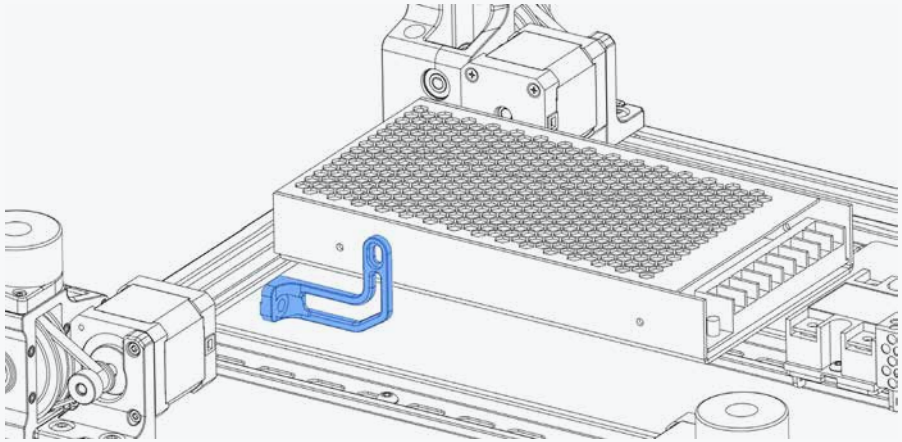
SNAP INTO PLACE

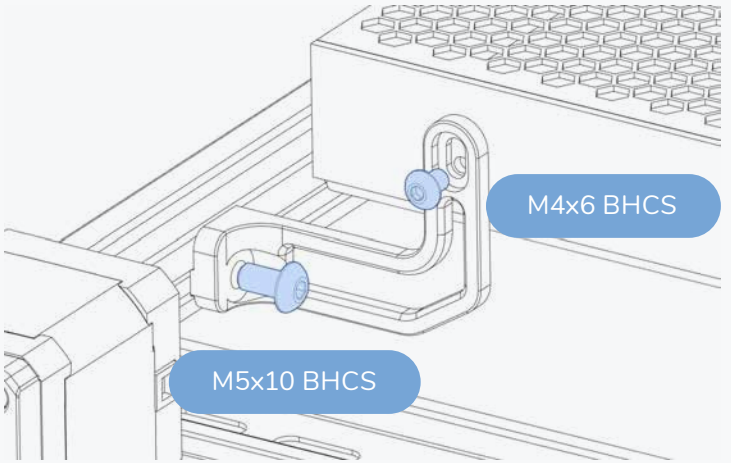
Press to snap the free side into place. The part should now sit securely on the DIN rail.

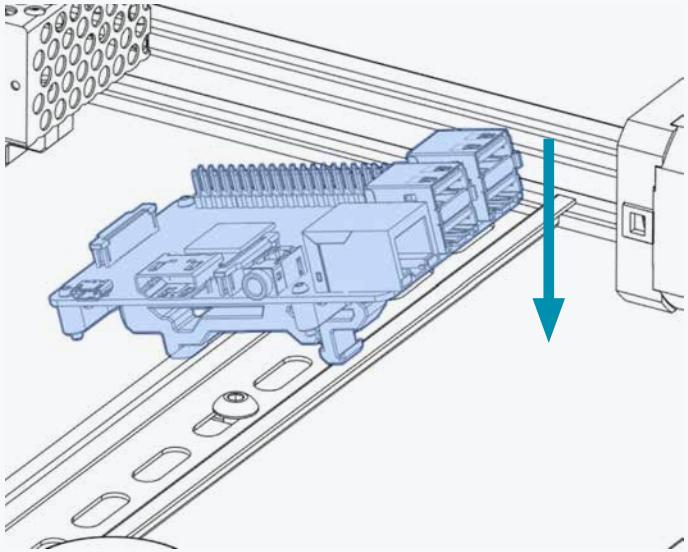
24V PSU

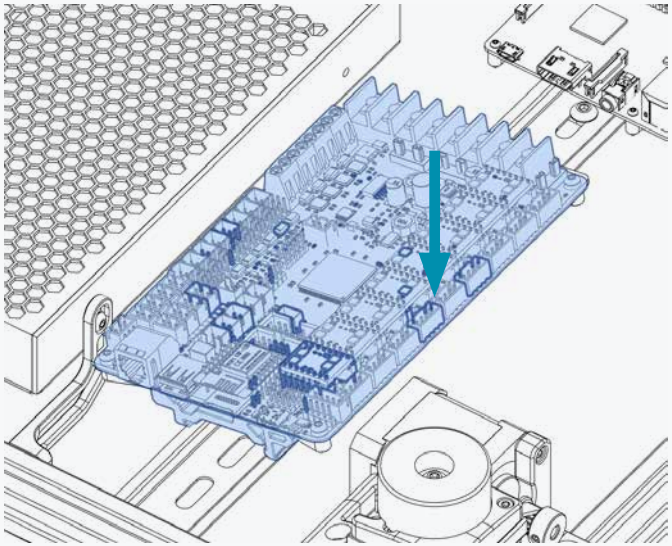


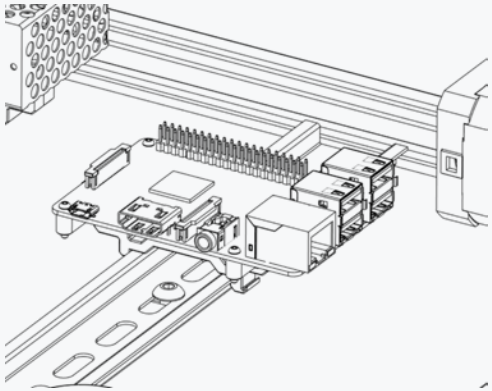


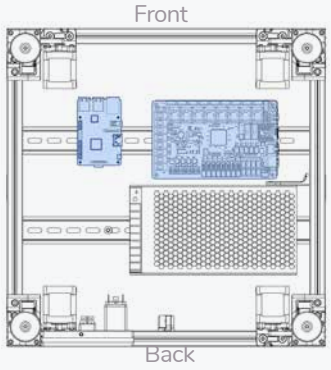


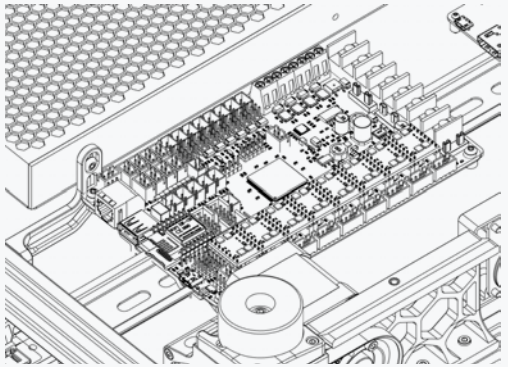




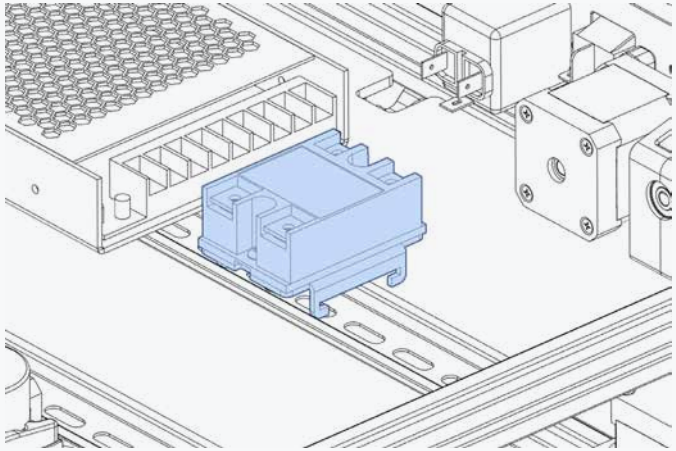


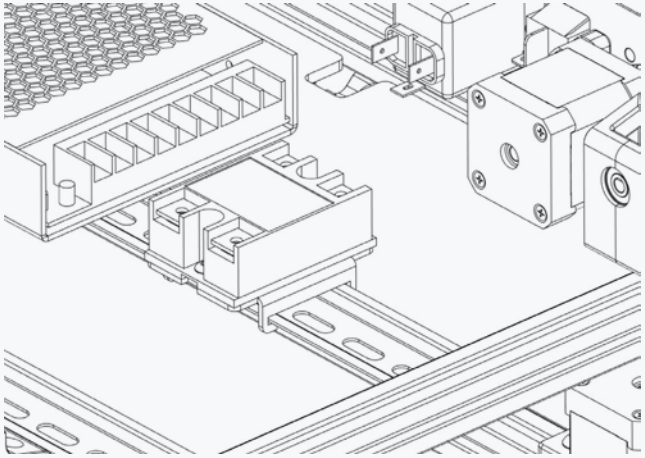


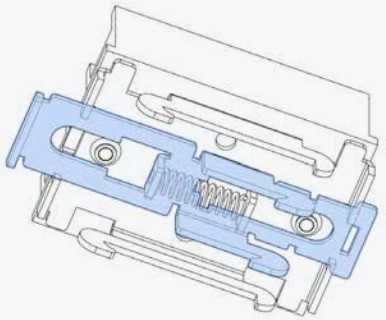

Front
Back

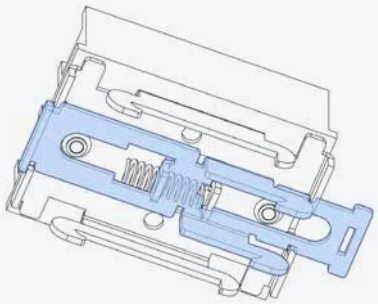


SOLID STATE REALY







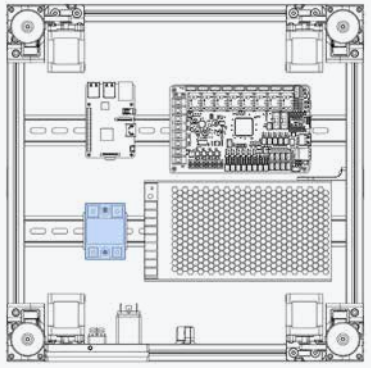


SPRING LOADED

Use a flat head screw driver to pull the latch open. It will lock open.

Be careful when releasing the latch, it will snap back into place. Mind your fingers.

Front



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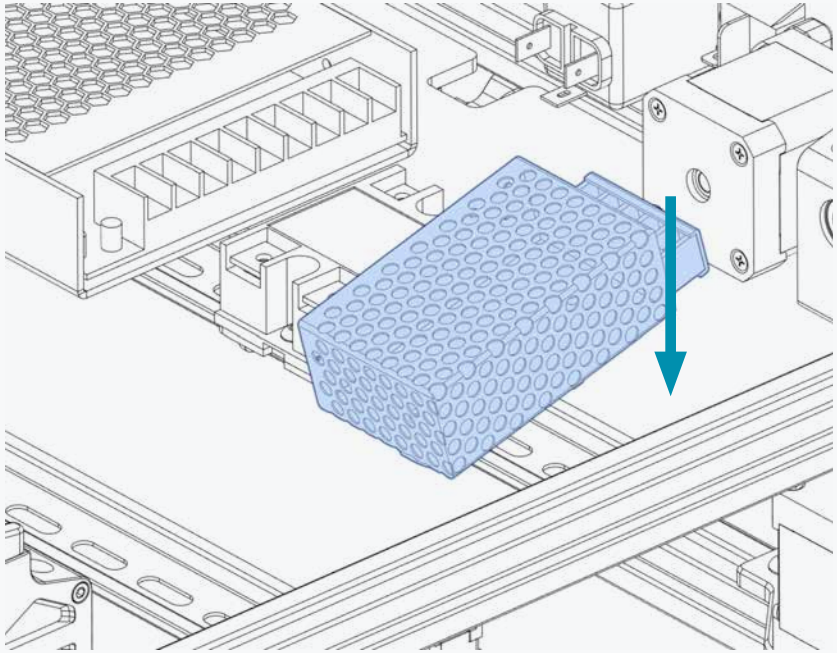
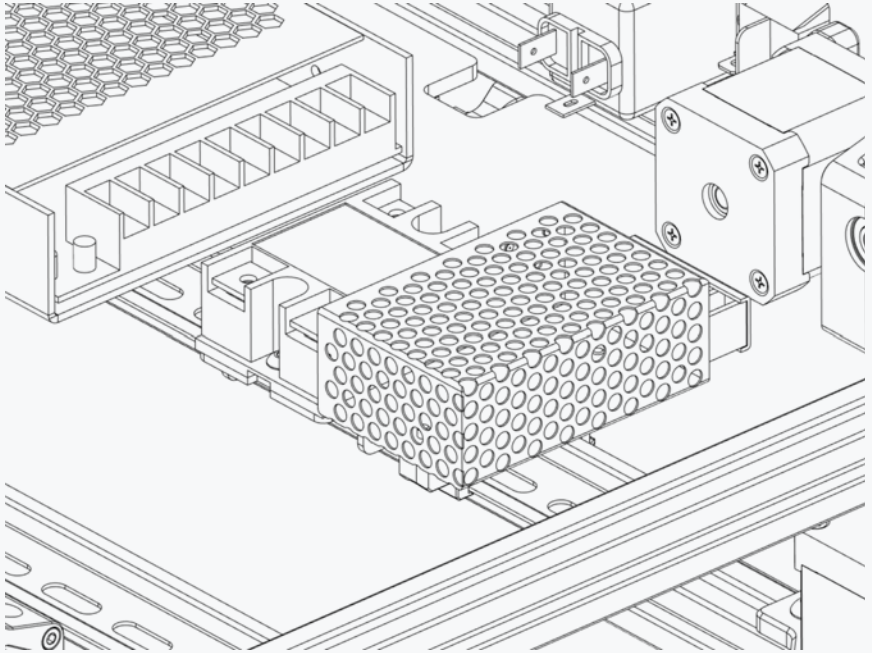
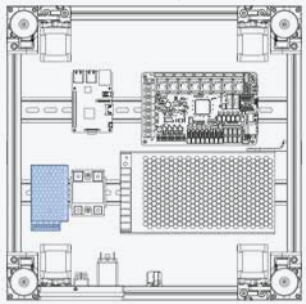
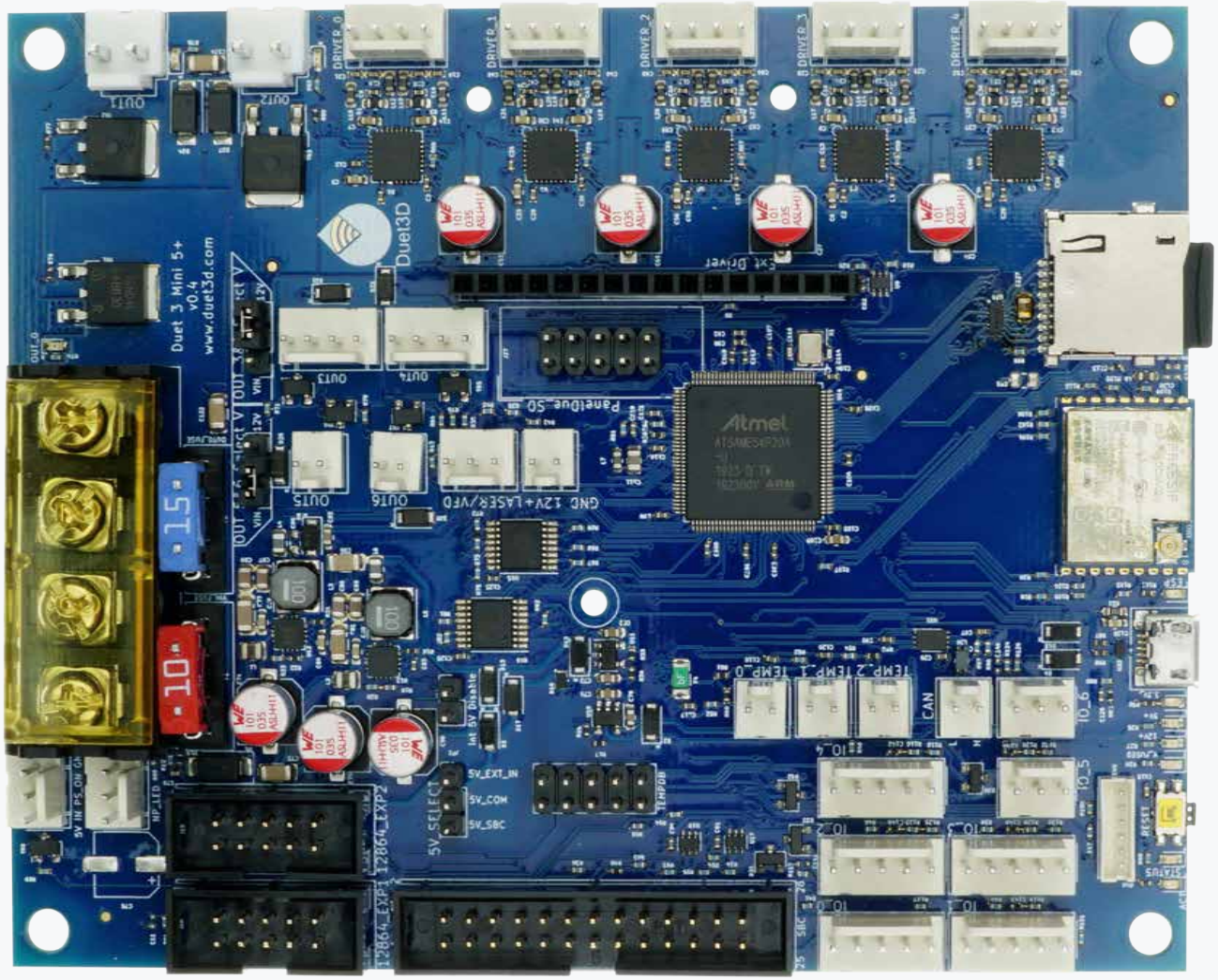





Front
Back



MINI 5+ DUET 3D

The Duet 3 Mini 5+ balances value and performance, focused on small and medium size machines that do not need the high power output of the Duet 3 Mainboard 1LC. It provides 5 on board drivers and the normal complement of heaters, fans, IO, LCD etc. There are Wifi and Ethernet variants, with the option of using an SBC (Single Board Computer, e.g. Raspberry Pi) for control in the same manner as other Duet 3 mainboards. It has a header for a two driver expansion board and a CAN-FD port for connecting Duet 3 expansion and tool boards.

Except where otherwise stated, the following applies to both the WiFi and Ethernet versions.

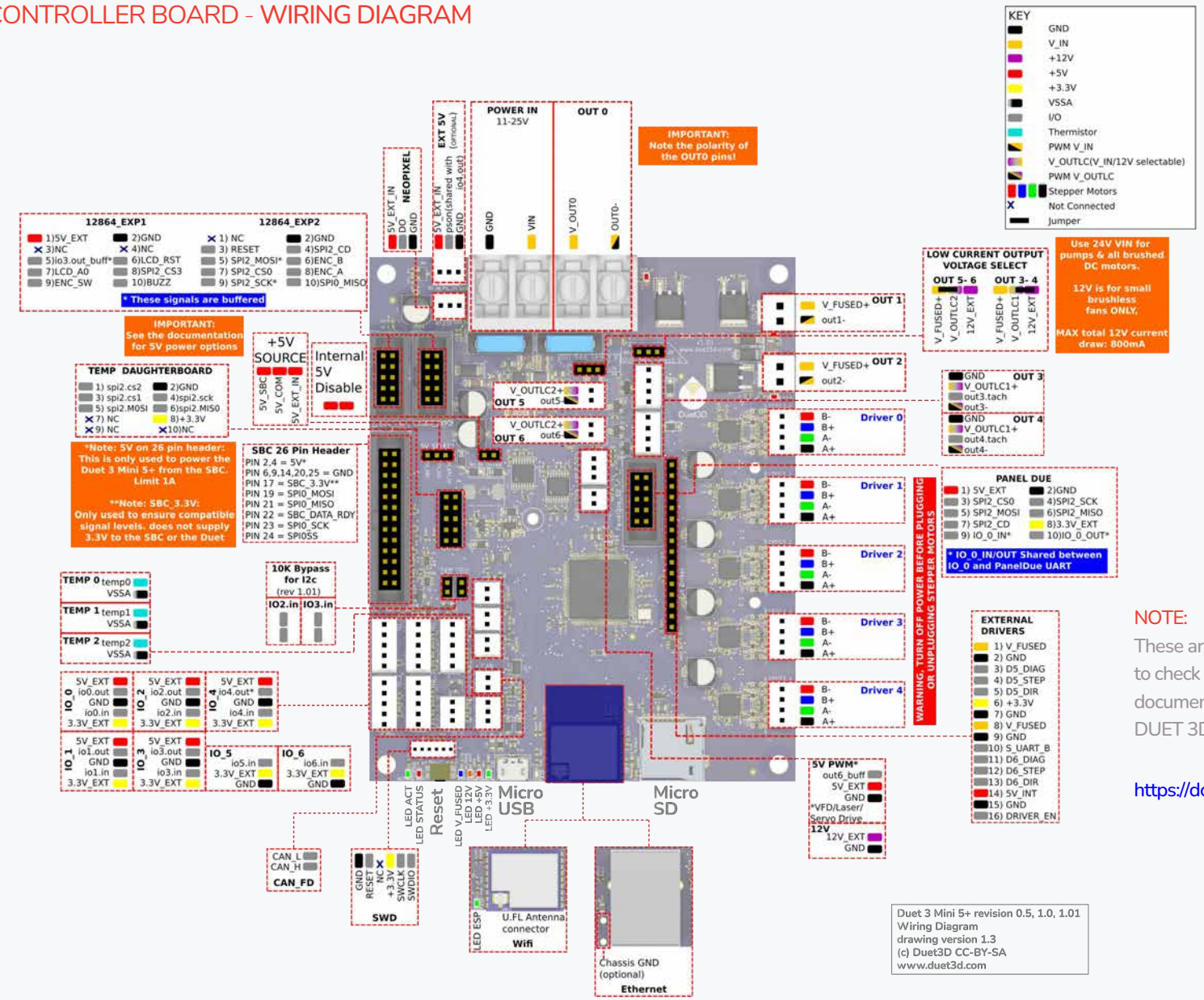
Before mounting it on the din rail, connect it via wifi or ethernet to your PC, update the firmware to the latest version, and upload a configurations (config.g) compatible with the features of the printer you are building.

NOTE:

These are only indicative images. We always advise you to check the version of the Board in use and consult the documentation for the version to be wired on the official DUET 3D platform.

https://docs.duet3d.com

CONTROLLER BOARD - WIRING DIAGRAM



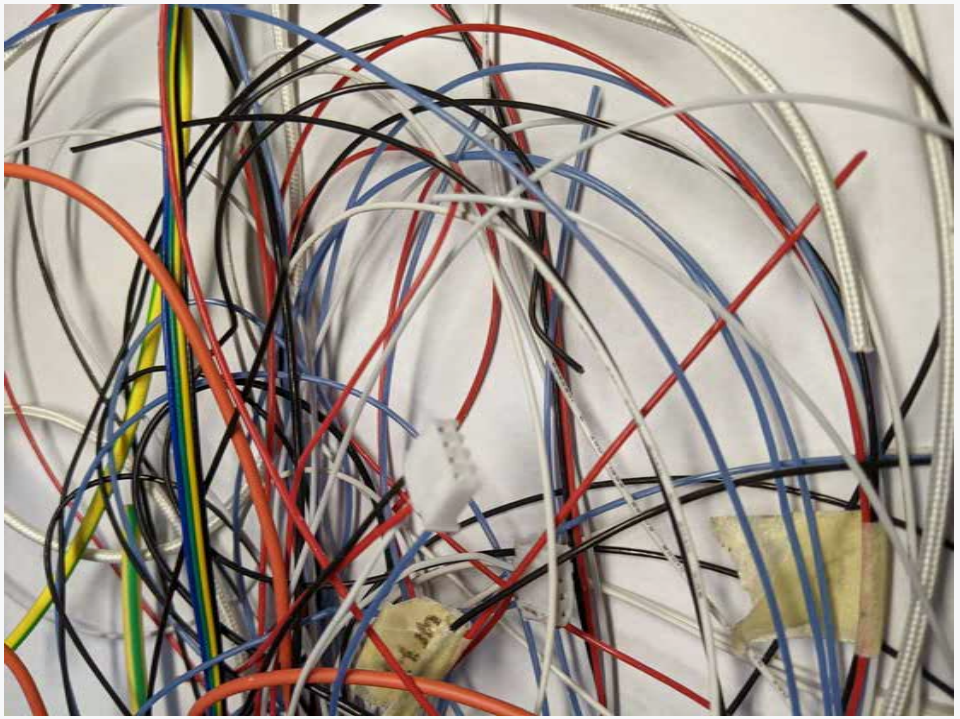
NOTE:

These are only indicative images. We always advise you to check the version of the Board in use and consult the documentation for the version to be wired on the official DUET 3D documentation.

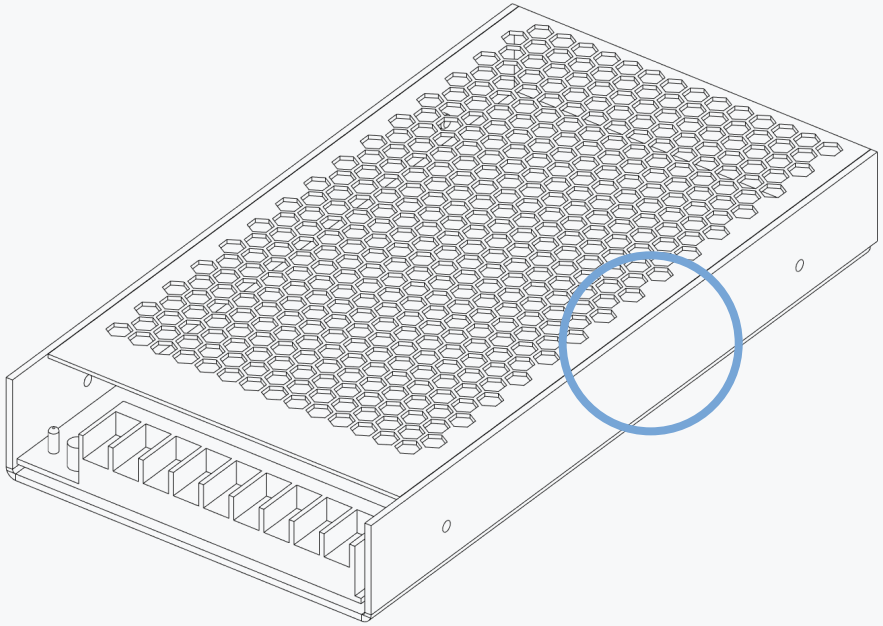
https://docs.duet3d.com

Pin location	RRF3 Pin name	Notes
Heater outputs		
OUT_0	out0	High current output, bed heater
OUT_1	out1	Medium current output, hot ends
OUT_2	out2	
Outputs (4-pin)		
OUT_3	out3	4-wire fans with tacho
	out3.tach	
OUT_4	out4	
	out4.tach	
Outputs (2-pin)		
OUT_5	out5	
OUT_6	out6, laser, vfd	Pin shared with OUT 6 and LASER/VDF connectors
Temperature inputs		
TEMP_0	temp0	
TEMP_1	temp1	
TEMP_2	temp2	
Inputs/Output		
IO_0	io0.in	PanelDue, endstops, Z probes, filament monitors etc. Shares io0.out and io0.in pins with PanelDue_SD connector.
	io0.out	
IO_1	io1.in	endstops, Z probes, filament monitors etc
	io1.out	
IO_2	io2.in	
	io2.out	
IO_3	io3.in	
	io3.out	
IO_4	io4.in	
	io4.out, pson	
IO_5	io5.in	Input only
IO_6	io6.in	
SPI CS		
TEMPDB	spi.cs0	Thermocouple or PT100 daughterboard
	spi.cs1	
	spi.cs2	
	spi.cs3	
Miscellaneous		
LASER/VDF	laser, vdf, out6	Pin shared with OUT 6 and LASER/VFD connectors
EXT 5V	pson, io4.out	For controlling an external PSU or SSR, shared with io4.out

For more details https://docs.duet3d.com/Duet3D_hardware/Duet_3_family/Duet_3_Mini_5+_Hardware_Overview



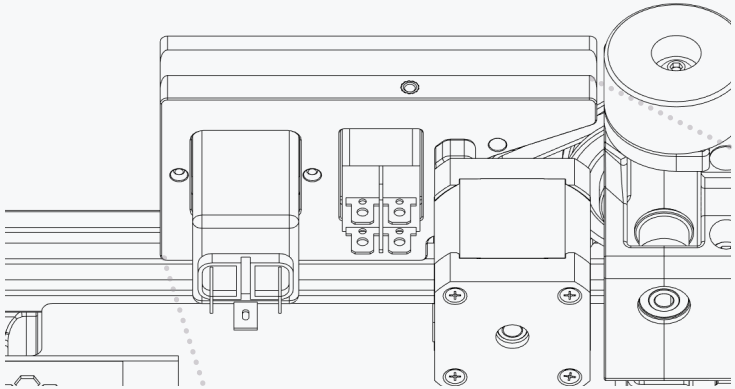
PSU VOLTAGE CHECK



INPUT VOLTAGE SWITCH

Check the input voltage switch of the power supply. It is located in the highlighted area.

Make sure the selection matches your local mains voltage. Refer to the Mean Well LRS-200 datasheet for possible settings (voron.link/e0szdyh).



ATTACH 250MM OF WIRE

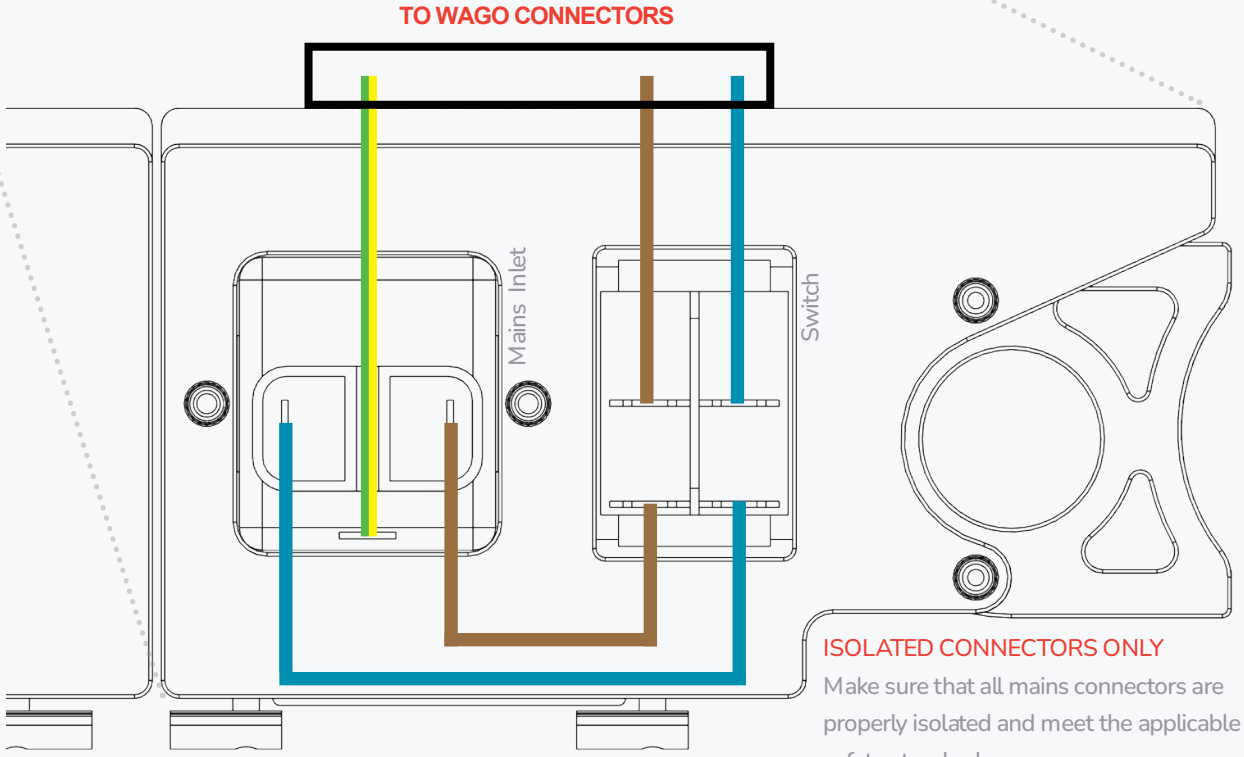
Cables should be at least 1mm² (AWG18) or thicker depending on local regulations.

MAINS INLET WIRING

We show the wiring in the IEC colour scheme. Depending on your region the colour scheme and wiring standards will differ.

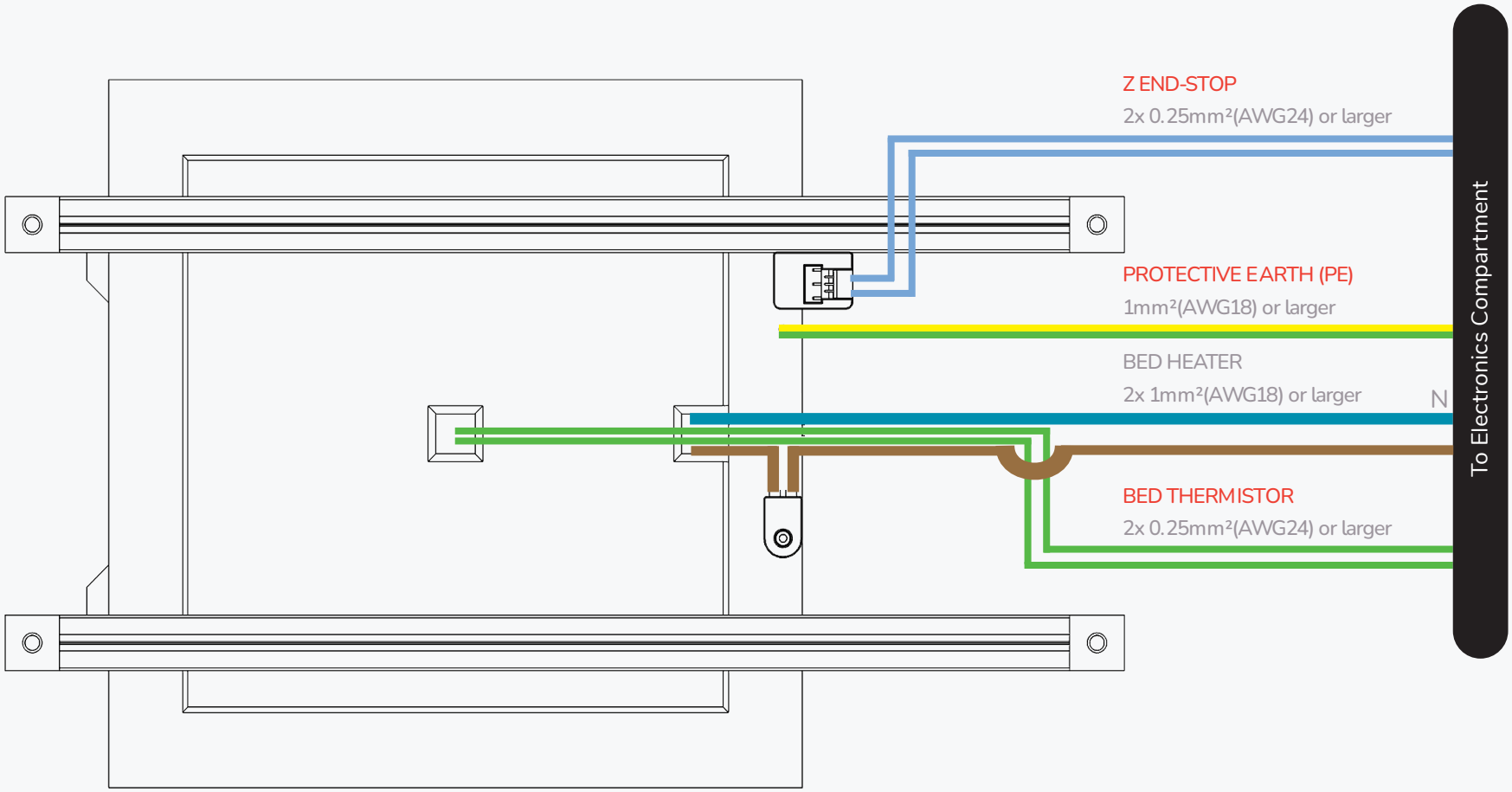
Mains wiring should only be done by qualified personnel trained in local regulations and safety standards. Depending on your local regulations you may be forbidden from wiring the mains side and/or putting the printer into operation; seek professional assistance.

Failure to observe those could result in bodily harm.

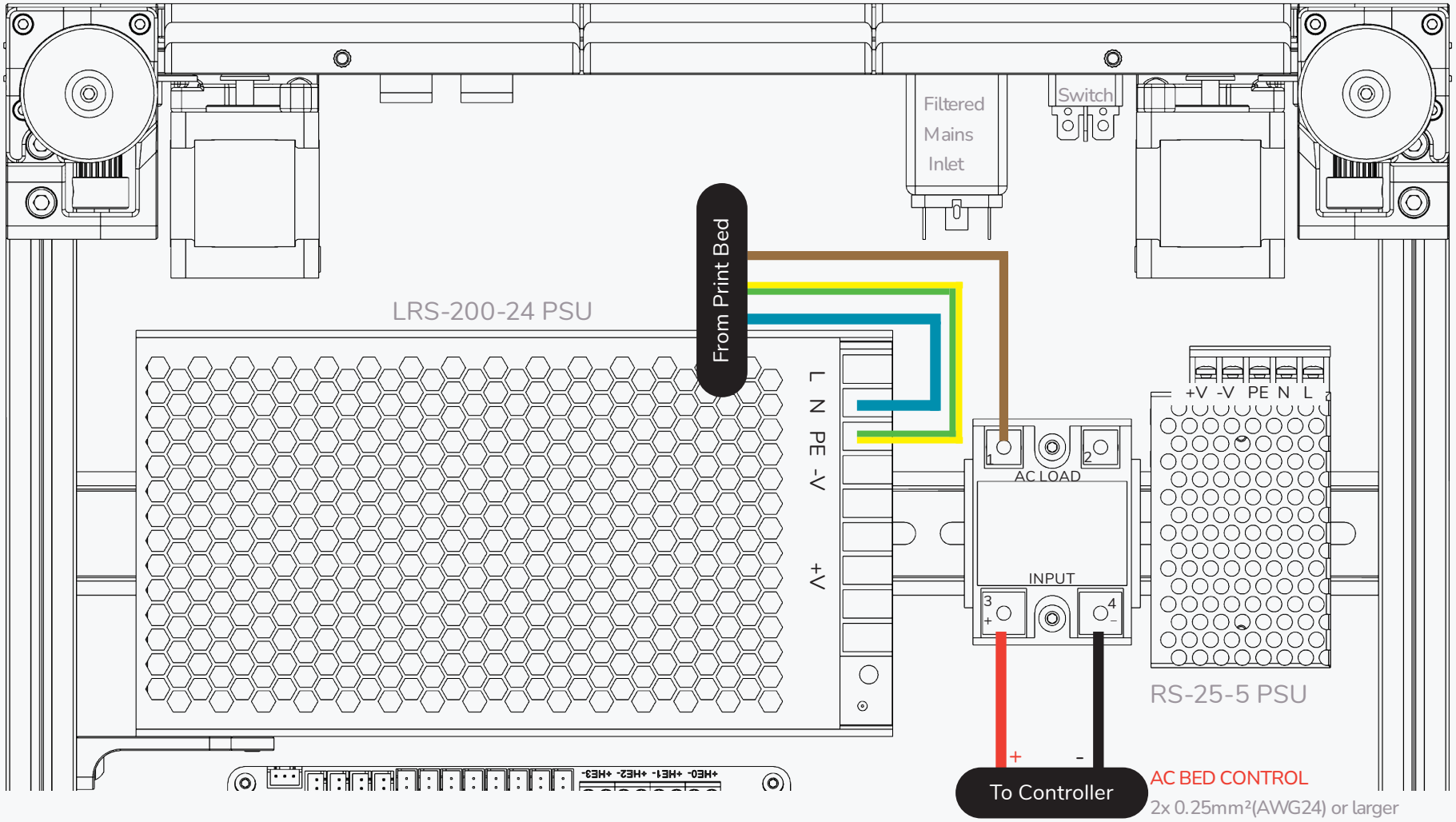


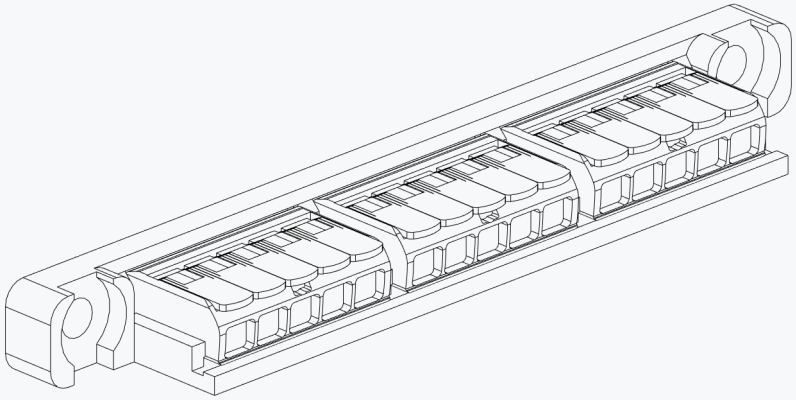
ISOLATED CONNECTORS ONLY

Make sure that all mains connectors are properly isolated and meet the applicable safety standards.


Z END-STOP
2x 0.25mm²(AWG24) or larger
PROTECTIVE EARTH (PE)
1mm²(AWG18) or larger
BED HEATER
2x 1mm²(AWG18) or larger
N
BED THERMISTOR
2x 0.25mm²(AWG24) or larger
To Electronics Compartment

MAINS WIRING

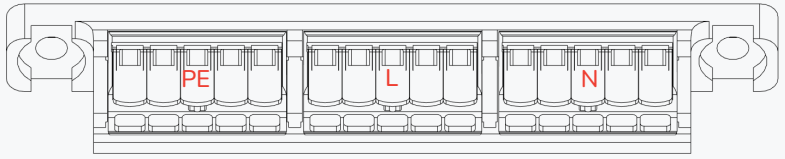




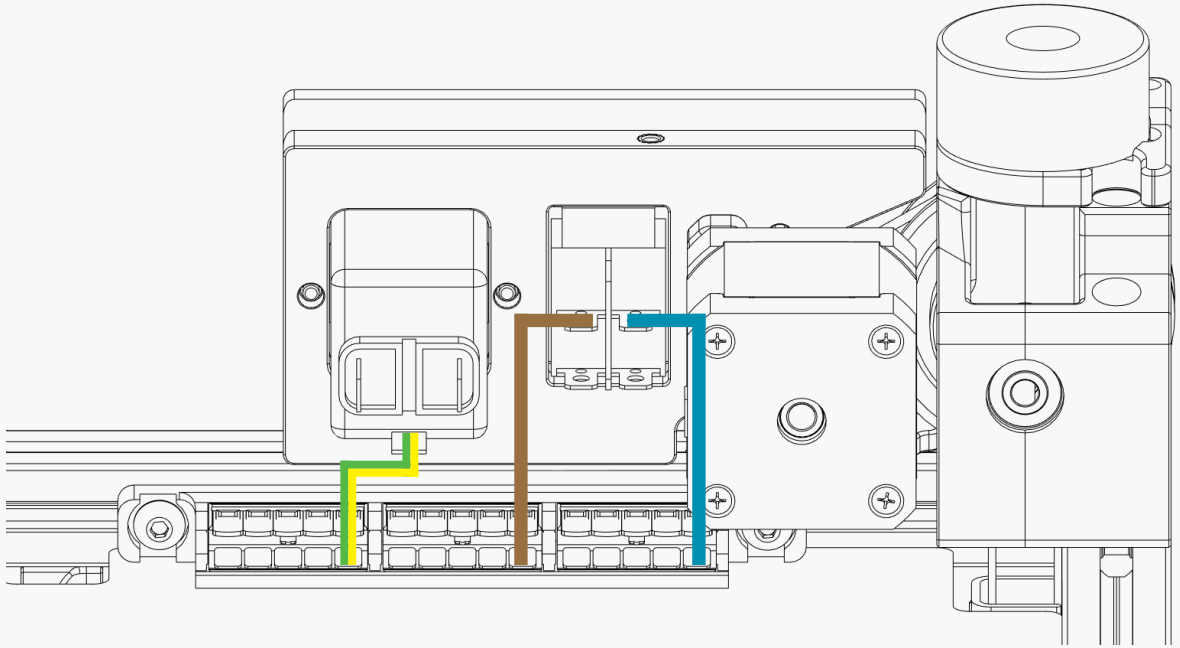
WAGO CLAMPS FOR MAINS

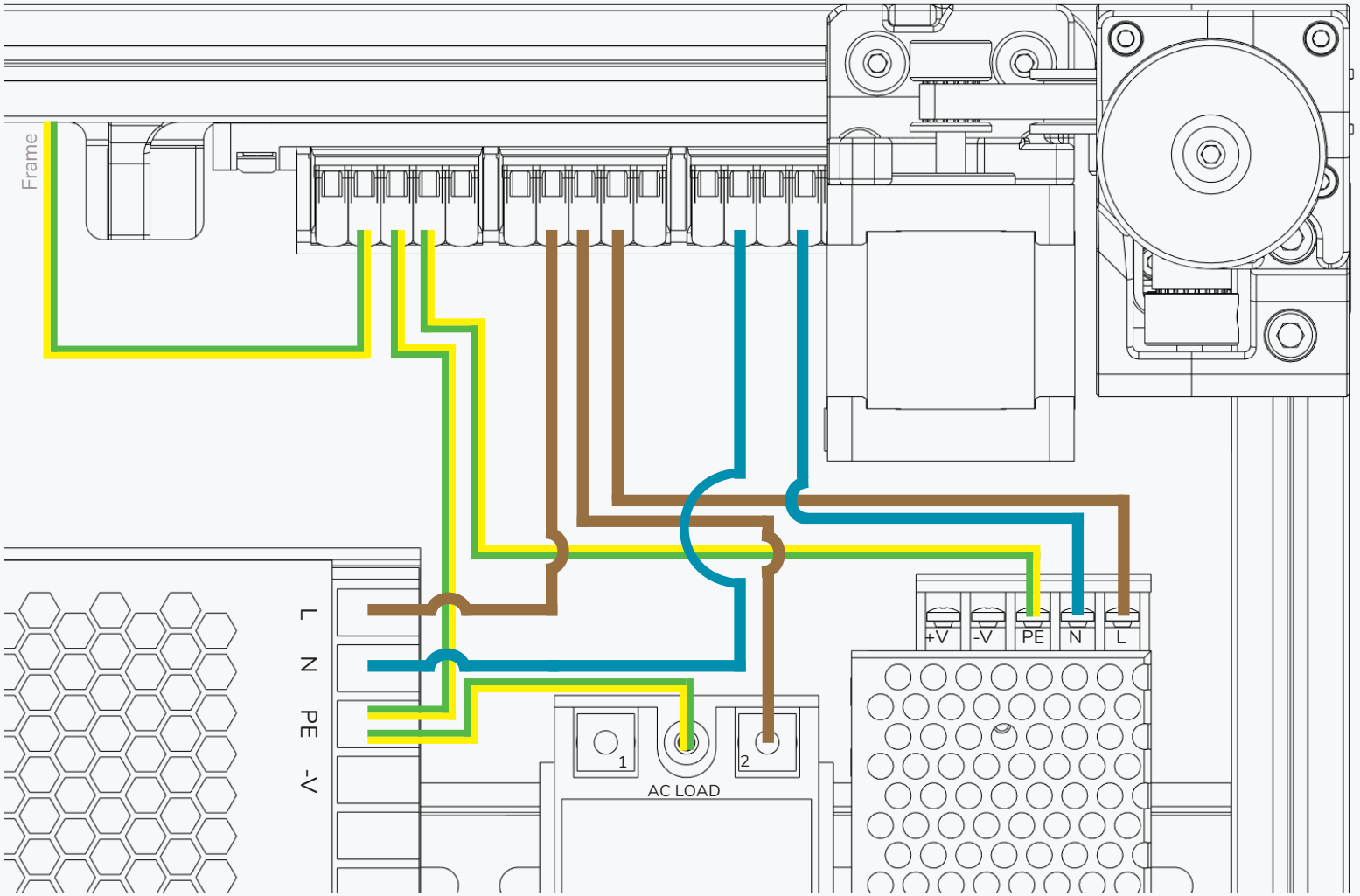
WAGO wire clamps allow for a clean and easy wiring of the mains side.

You may want to label your clamps as shown below.

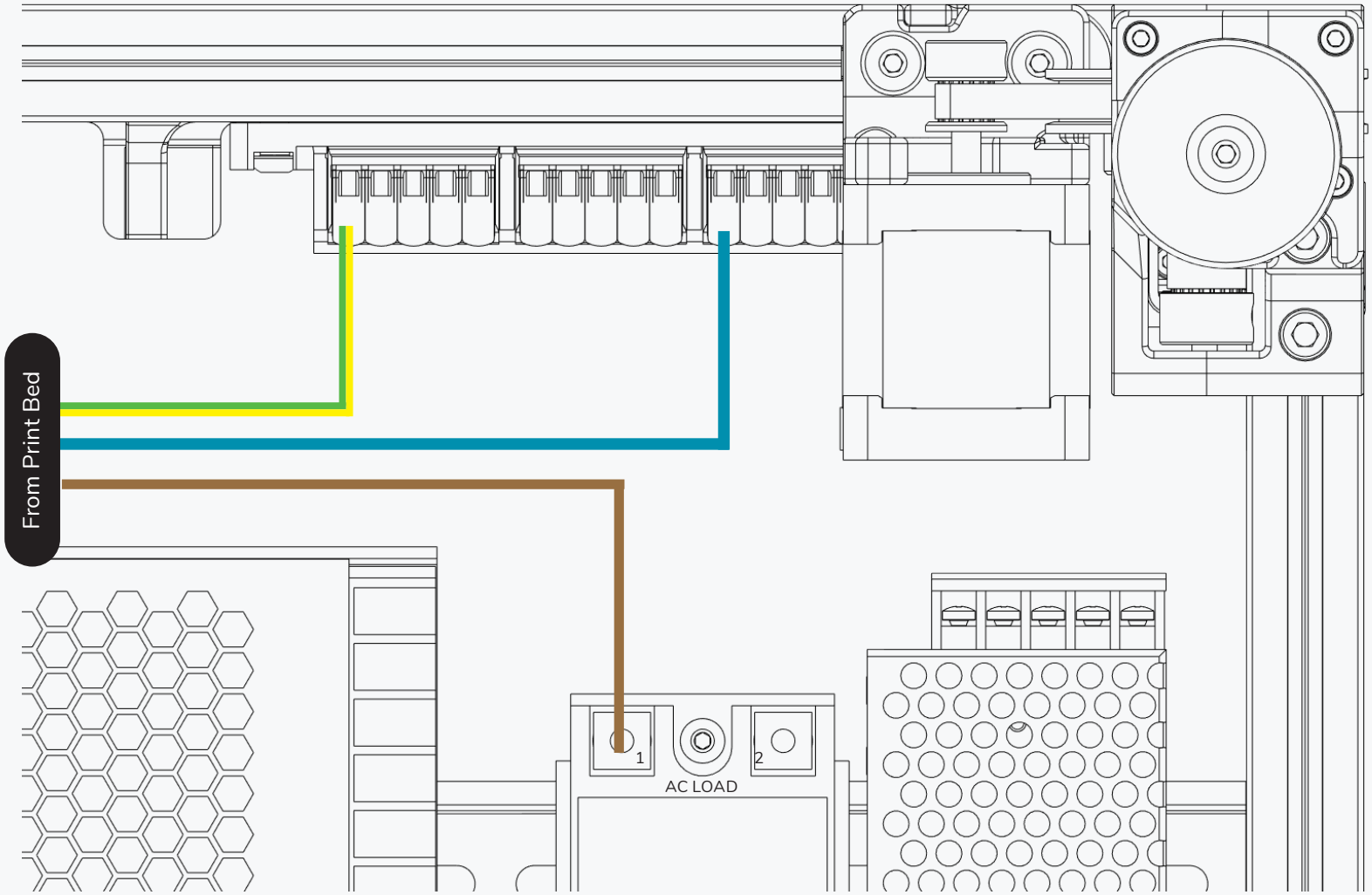


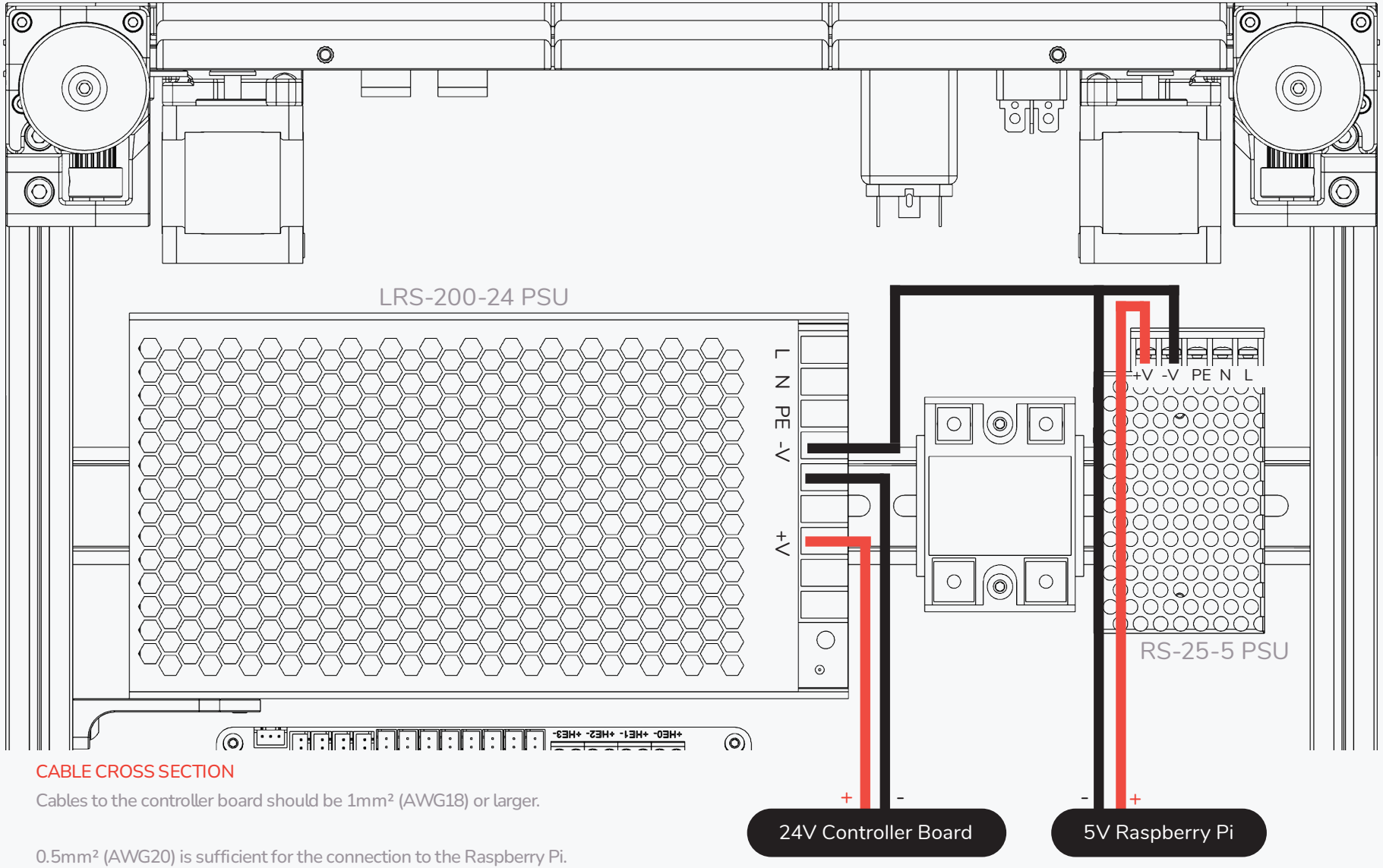
MAINS WIRING - WAGO CLAMPS




Frame
L
N
PE
-V
1
2
AC LOAD
+V
-V
PE
N
L

MAINS WIRING - WAGO CLAMPS



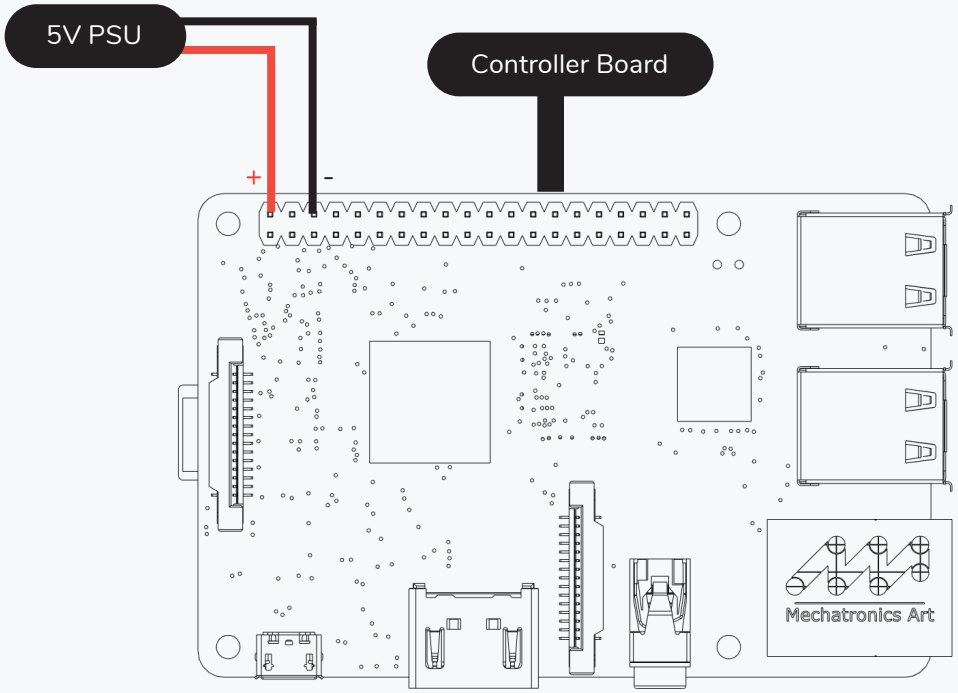


CABLE CROSS SECTION

Cables to the controller board should be 1mm² (AWG18) or larger.

0.5mm² (AWG20) is sufficient for the connection to the Raspberry Pi.

RASPBERRY PI - OPTIONAL

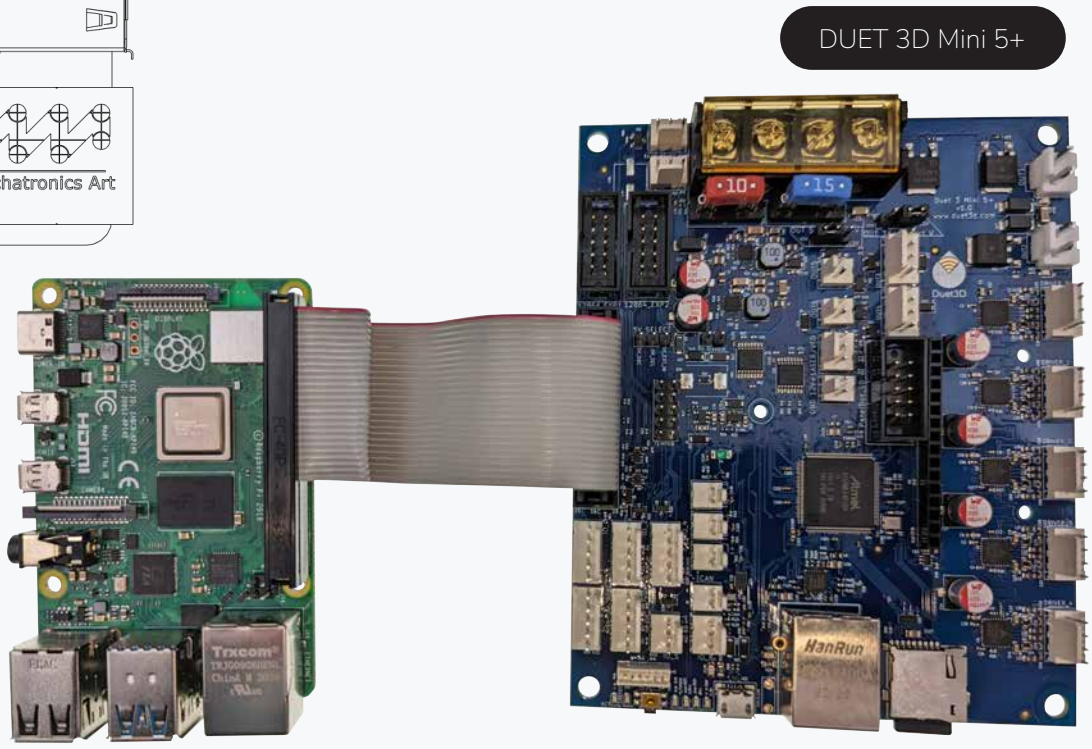


RASPBERRY PI POWER

While we suggest that you power the Raspberry Pi via the GPIO pins you may also power it using the "Power-In" USB port.

Cut a suitable USB cable and wire the + and ground lines to the 5V DC/DC converter instead.

Attention: if using Duet3D board is not necessary the external power supply for Raspberry Pi. Duet3D boards supply directly 5V DC to Raspberry Pi by BUS.



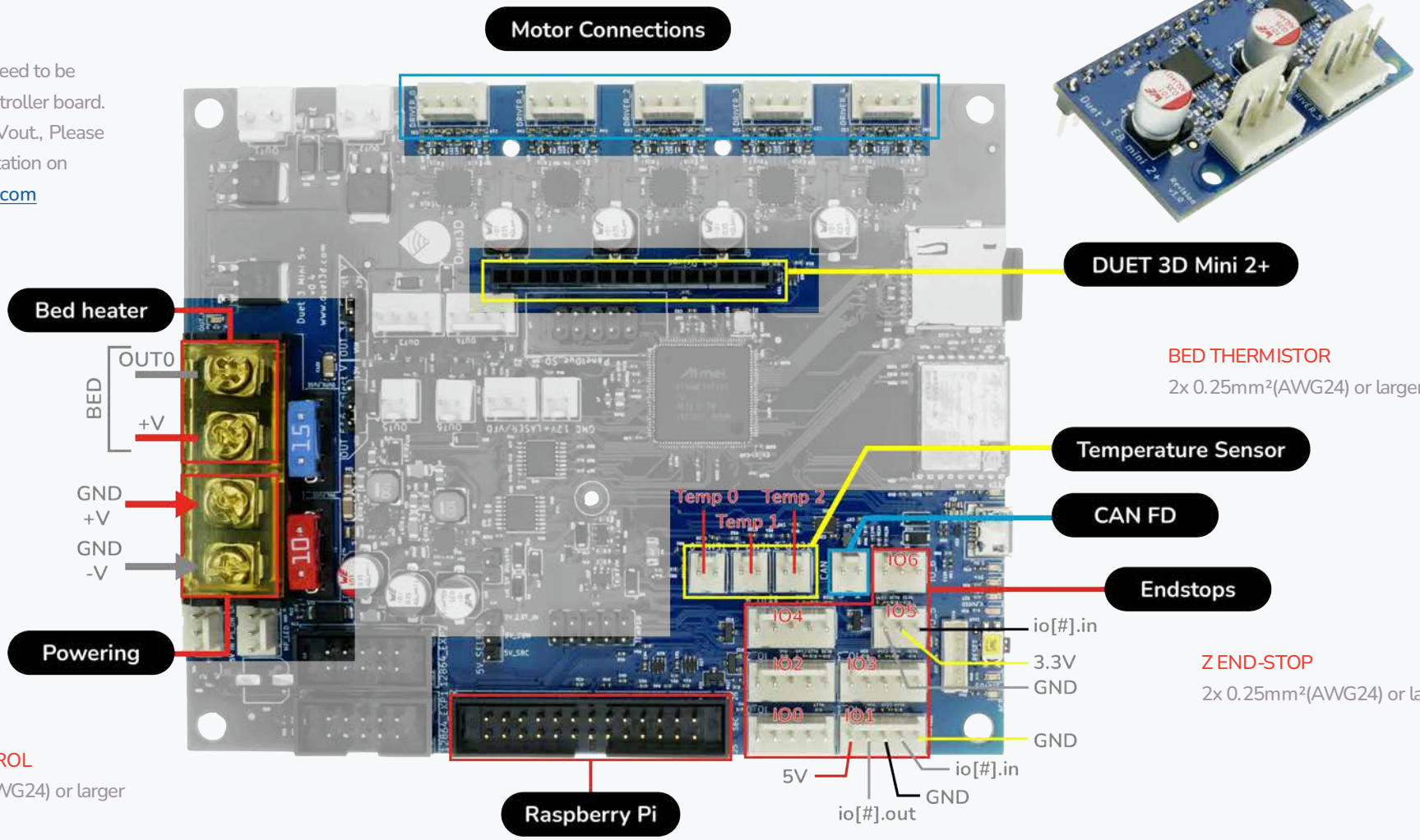
CONTROLLER BOARD

We always advise you to check the version of the Board in use and consult the documentation for the version to be wired on the official DUET 3D documentation.

https://docs.duet3d.com

JUMPERS

Some Jumpers may need to be configured on the controller board. For example, for Fun Vout., Please consult our documentation on https://docs.duet3d.com



BED THERMISTOR

2x 0.25mm²(AWG24) or larger

Z END-STOP

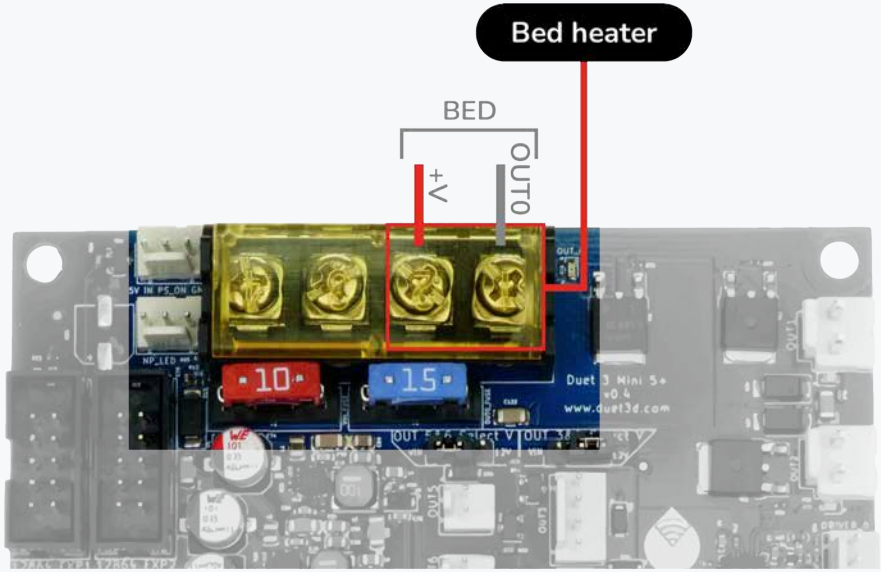
2x 0.25mm²(AWG24) or larger

AC BED CONTROL

2x 0.25mm²(AWG24) or larger

CONTROLLER BOARD :

CONNECTING A BED HEATER



BED HEATER DRIVEN USING A SOLID STATE RELAY

The Bed heater driven using a Solid State Relay

You can use a solid state relay (SSR) to switch the bed heater by connecting the SSR control terminals to the Duet bed heater terminals. This way you can connect a higher power heated bed, and/or use a separate PSU for the bed heater.

Use a low voltage drop DC/DC SSR such as the Auber Instruments MGR-1DD80D100 or Crydom DC100D40. The SSR may need a heatsink, depending on the current. Do not be tempted to use a cheap DC-DC SSR such as the SSR-40DD, which is basically useless for this application because of its high voltage drop.

Make sure that you get the wires from the Duet bed heater terminals to the + and - control terminals of the SSR the right way round. The bed heater terminals will use Duet VIN voltage as the switching voltage. You can connect the SSR to any other PWM pin on the Duet, so long as the signal voltage is high enough to turn the SSR on and off.

Caution: when using a high-powered bed heater, in the event that temperature control fails and the bed heater is turned on at full power for an extended period of time, you should either make sure that the bed heater and bed will not exceed a safe temperature, or else install a thermal cutout to disconnect the bed heater or its power supply before excessive temperatures are reached.

NOTE:
These are only indicative images. We always advise you to check the version of the board in use and consult the documentation for the version to be wired on the official DUET 3D platform.
https://docs.duet3d.com

CONNECTING A BED HEATER

MAIN VOLTAGE AC BED HEATER

Use a zero-crossing DC-AC SSR such as Crydom D2425, Kudom KSI240D25-L or Fotek SSR-25DA (note: many Fotek SSRs on sale are fakes, using triacs rated at lower current than the marked rating of the SSR). For 230V bed heaters, SSR-10DA may be sufficient. If your bed heater draws more than about 1/4 of its rated current then the SSR may need a heatsink.

Take appropriate safety precautions when using a main voltage bed heater. In particular:

• Connect metal parts of the printer to mains ground. This includes the printer frame, the bed plate if it is conductive (e.g. aluminium), and any other metal parts that the bed heater or SSR wiring might come into contact with if wires break.

• Ensure that it is not possible for the user to touch the SSR terminals or any other exposed mains wiring, or for you to touch the mains wiring when you are working on the printer with power applied. If your SSR is not supplied with a clear plastic safety cover, buy one (for the Crydom SSR listed above, the part number is KS101).

• If the bed is moving, use highly-flexible wire or cable with a sufficient voltage rating to connect the moving bed heater to the stationary wiring. Cable intended for use in multimeter tests leads is one possibility.

• If the bed is moving, you must use strain relief at both ends of that cable, to reduce the risk of the cable fracturing with repeated movement.

• If the bed is moving, use a cable chain or similar to make sure that the cable can't get chafed or trapped.

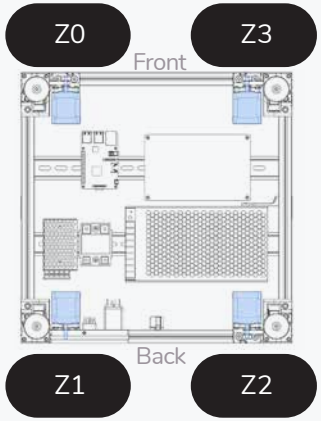
• Provide a fuse for the bed heater circuit or the whole printer appropriate to the current draw and the current rating of the mains lead. One option is to use a panel mount IEC mains inlet connector with a switch, neon indicator and fuse built in. See this Thingiverse thing for an example setup on a delta printer.

• It is highly recommended that you power the printer via a Ground Fault Current Interruptor (GFCI) - more commonly called a RCD (Residual Current Device) in the UK - to protect against electric shock in the event of a fault.

If in doubt, consult a qualified electrician.

For more details: Wiring your Duet 3D: bed heater

CONTROLLER BOARD

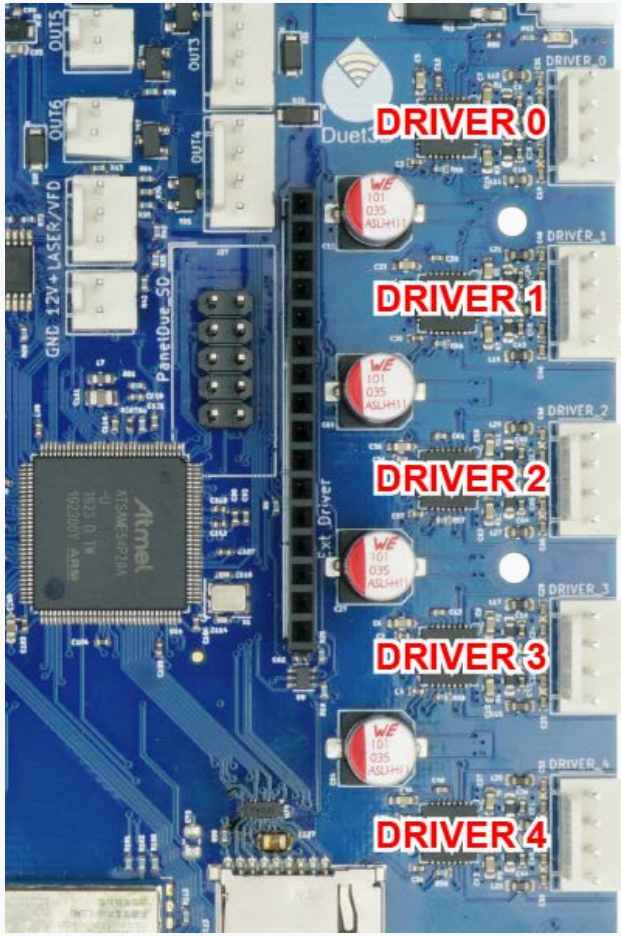


BLACK MOTOR WIRES?

There is no standardized stepper wire colouring scheme. Each manufacturer implements their wires colours slightly different.

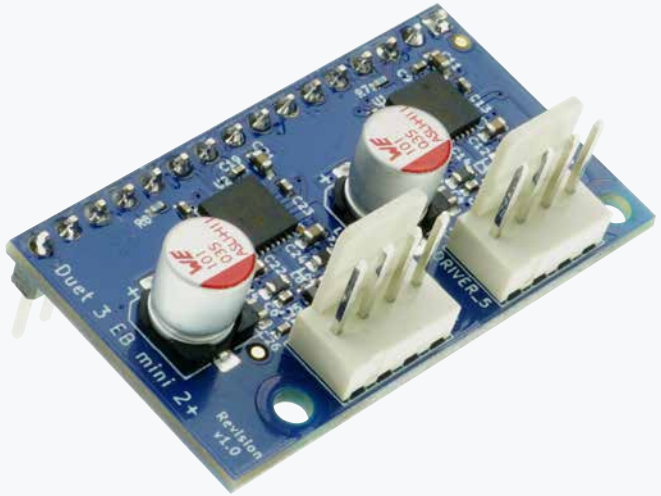
Please consult the datasheet of your stepper motors for the correct order.

If your motors came with plugs it's usually safe to assume that this order is correct, but we recommend to always double check the motor datasheet and compare it with the board diagram.



MOTOR CONNECTIONS

4x 0.25mm²(AWG24) or larger

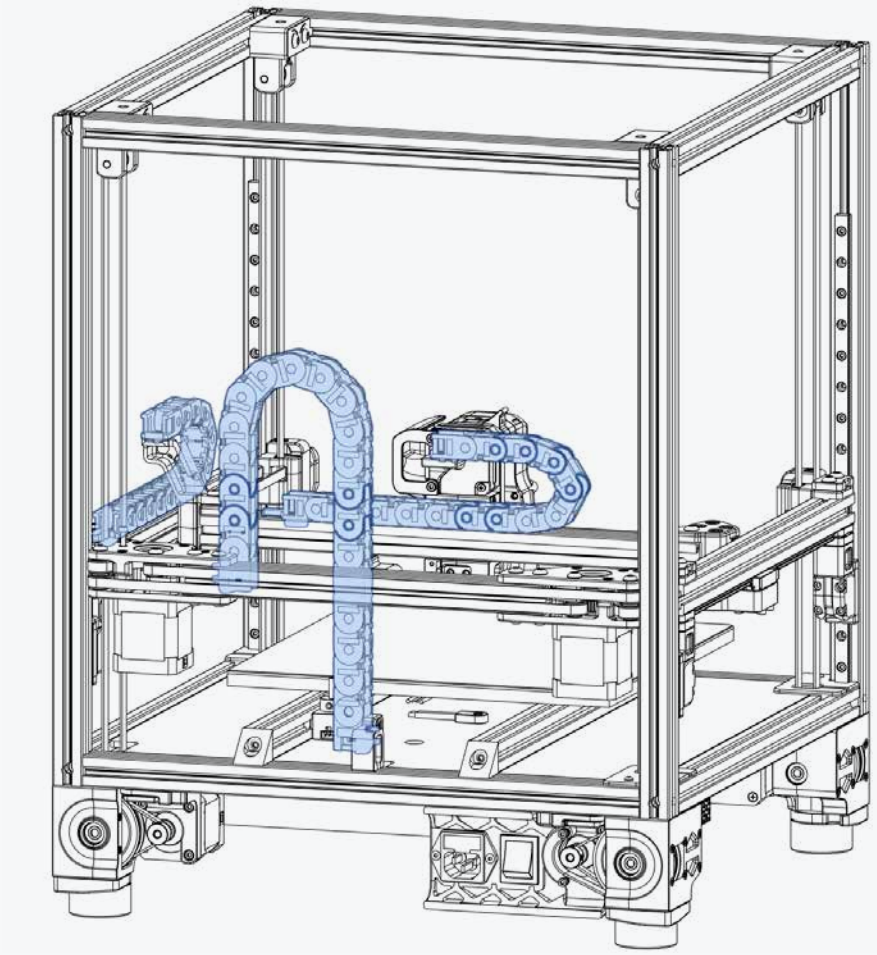


DUET MINI 2+

The Duet 3 Expansion Mini 2+ is specifically designed for the expansion header of the Duet 3 Mini 5+. It may be possible to use it with other mainboards but this is not supported. It provides 2 x TMC 2209 stepper motors drivers with the same configurability as the 5 mounted on the Duet 3 Mini 5+ (i.e. UART control of all supported TMC2209 features, and stall detection signals).

We must add the Mini 2+ expansion because the project requires seven outputs and the Mini 5+ board only has five.

Note: Connectors for the motors are supplied with the board

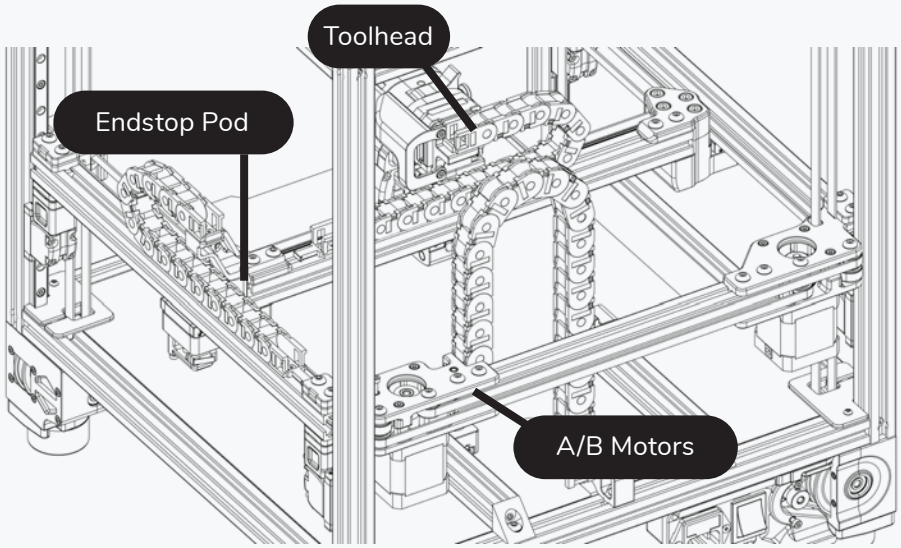


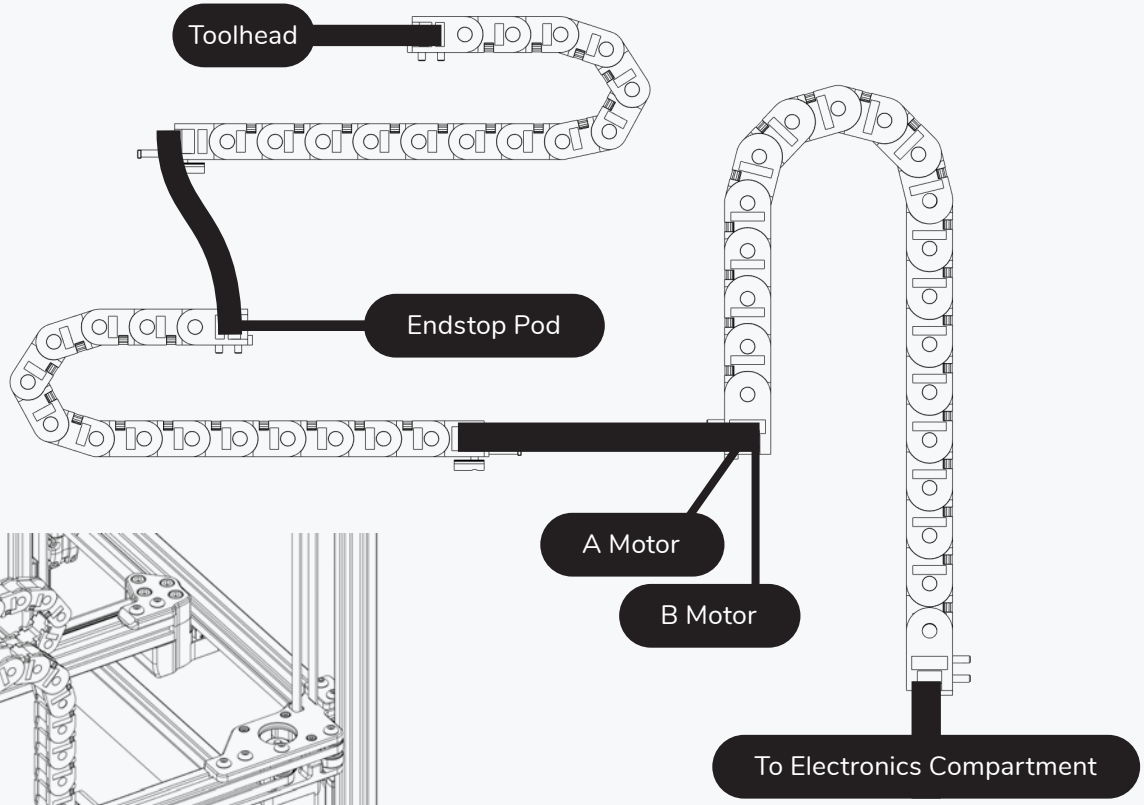
CABLE CHAINS INSTALL

You can opt to install the chains now and fish the wires through the chains or build the complete harness outside of the printer and install it in one go. Either approach does work.

If you sourced a prebuild wire harness completing the harness outside of the printer is recommended.

CABLE CHAINS - OVERVIEW

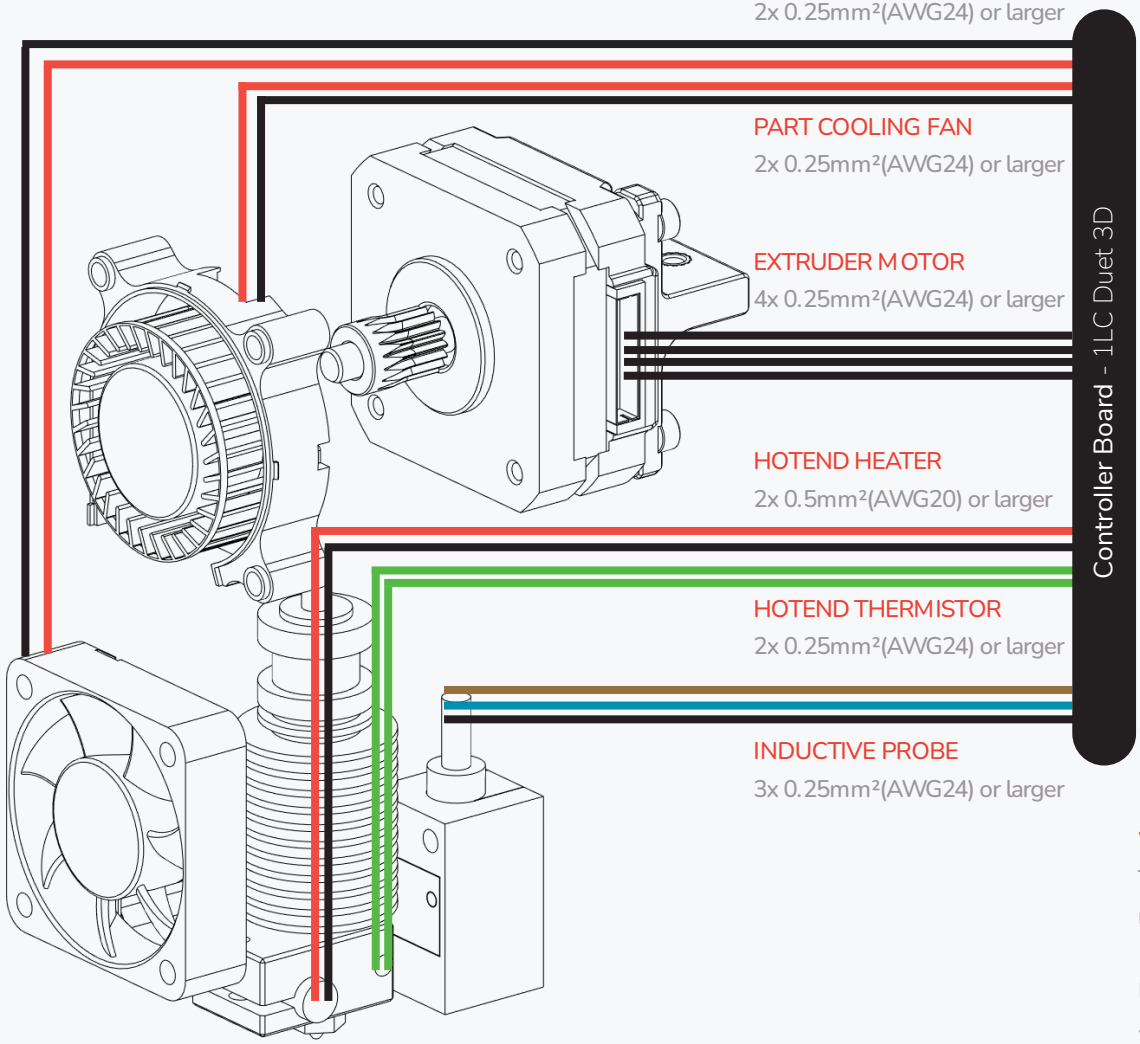


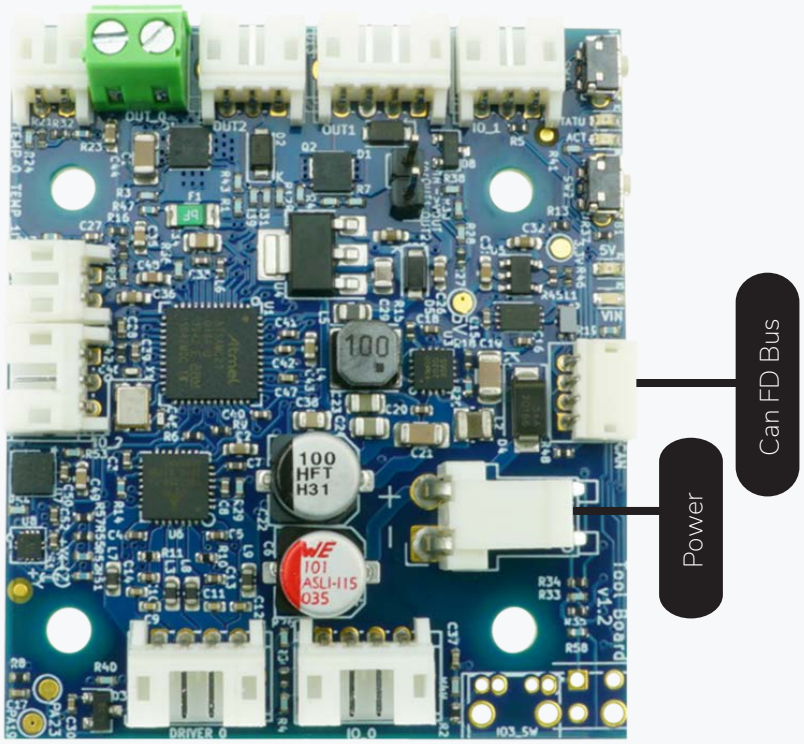


CABLE CHAINS

It can happen that cables of motor B are not able to be incuded in the cable chain 10x15. Don't worry for this: you can fix it with a cable tie in the external part of the cable chain.

Alternatively, a larger chain can be used, but this reduces the usable print area.

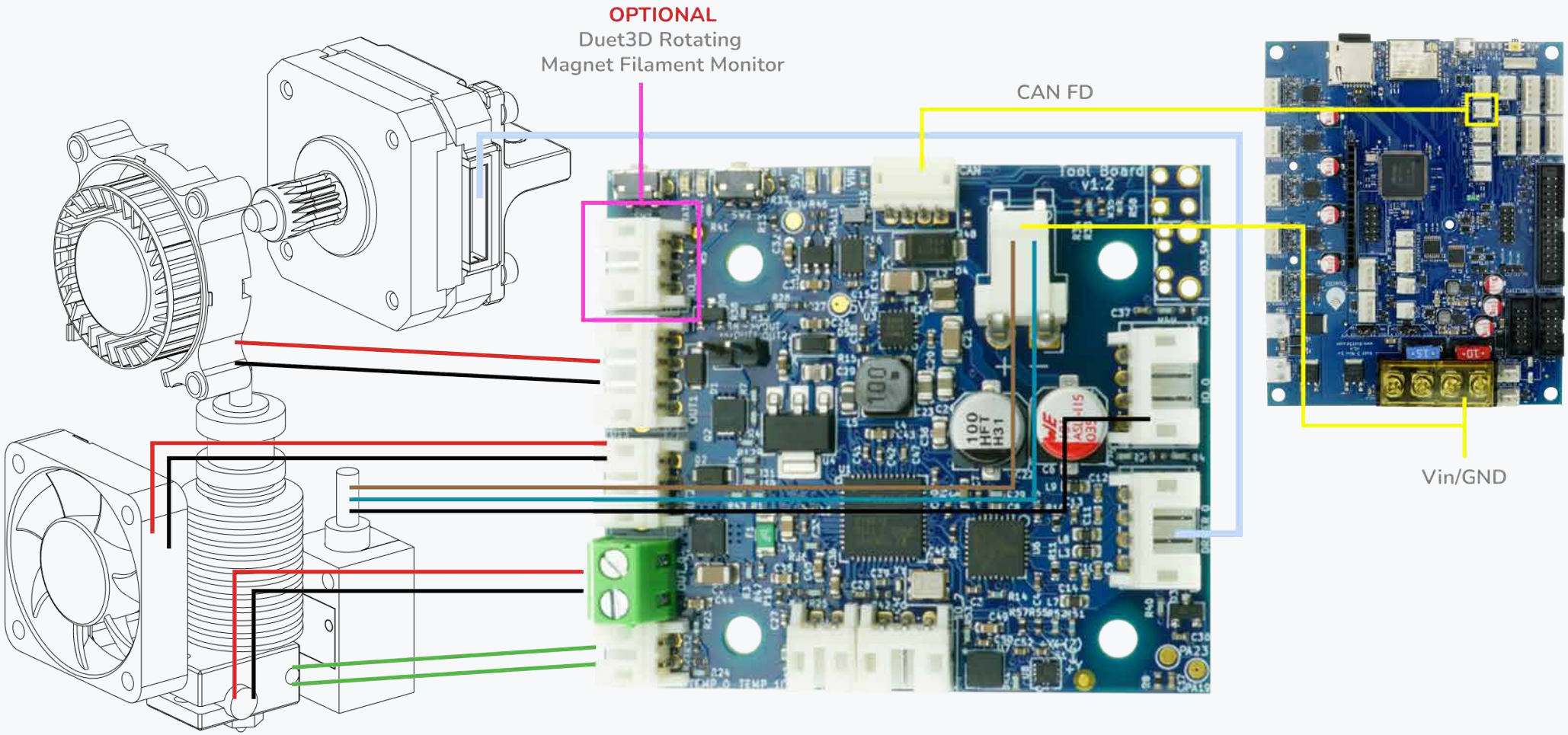




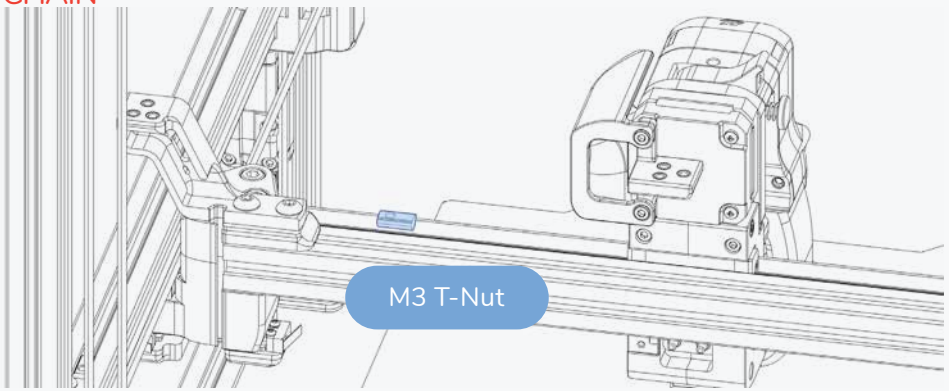
WIRES, DRAG CHAINS AND CRIMPS

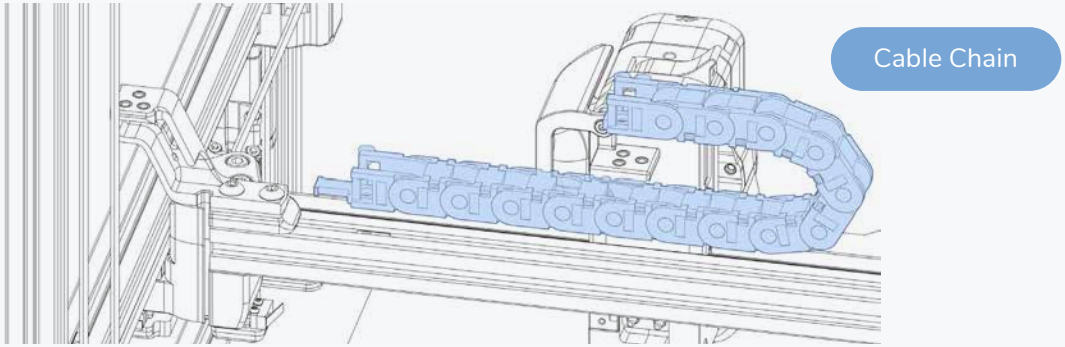
The wires attached to the probe, fans, heater, etc. are usually not rated for use in drag chains.

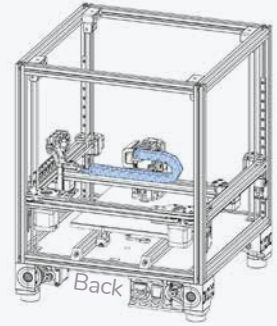
By using the 1LC board the number of cables is reduced to two to 4: two for the power supply and 2 for the CAN FD.

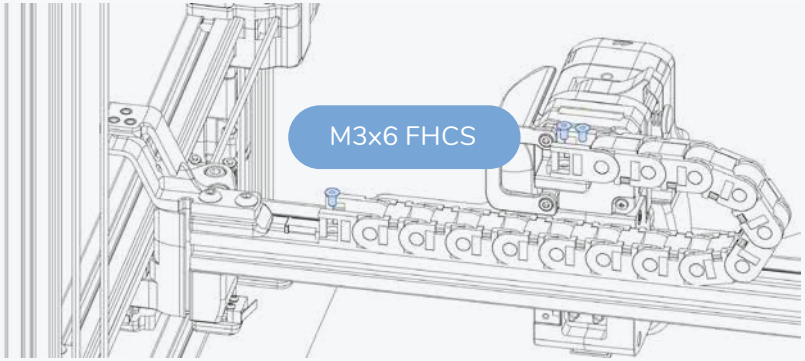

OPTIONAL
Duet3D Rotating
Magnet Filament Monitor
CAN FD
Vin/GND

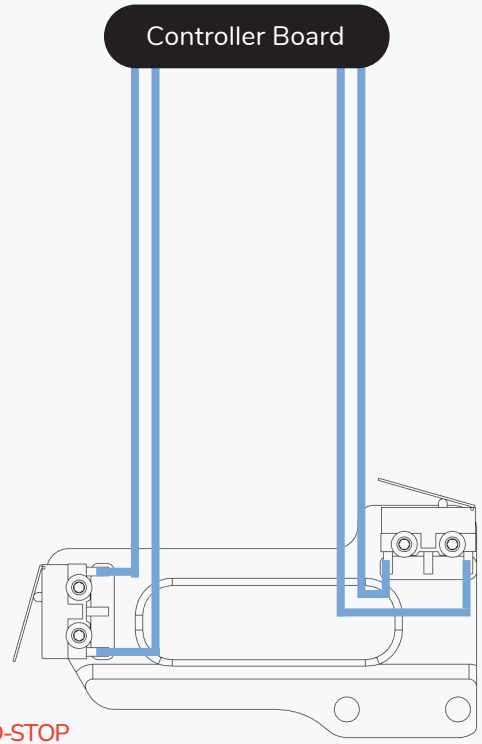
X CABLE CHAIN





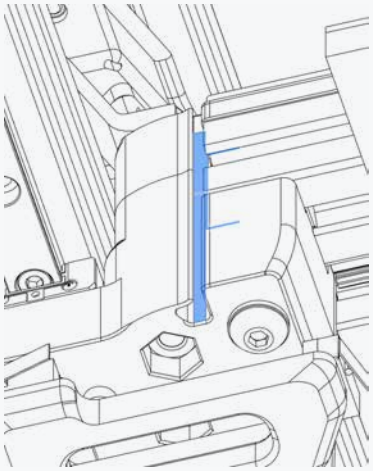






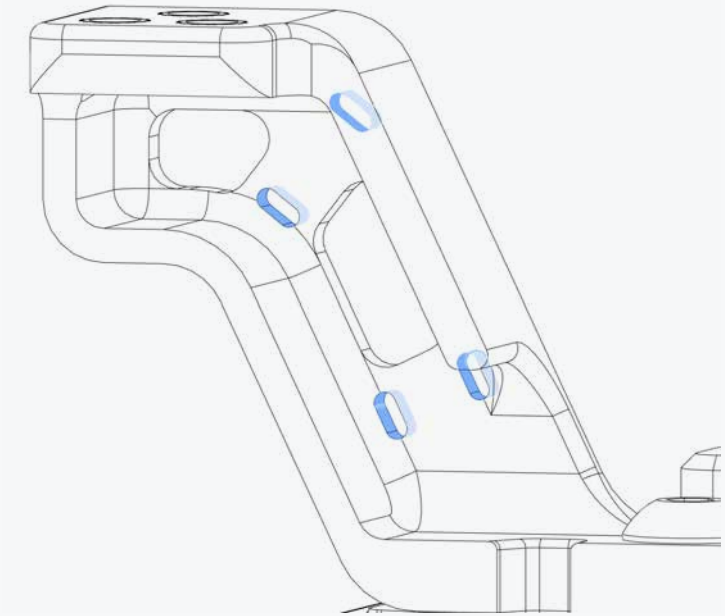
X END-STOP

2x 0.25mm²(AWG24) or larger



Y END-STOP

2x 0.25mm²(AWG24) or larger



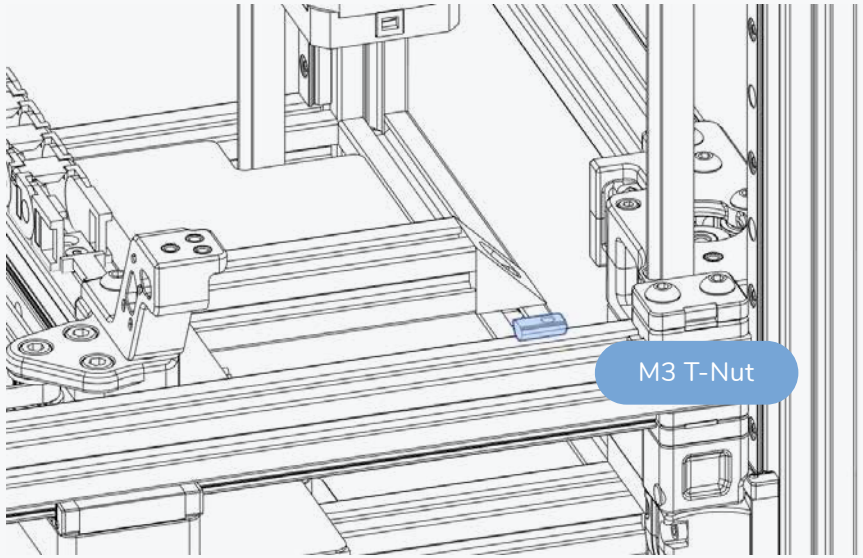
ZIP TIE LOOPS

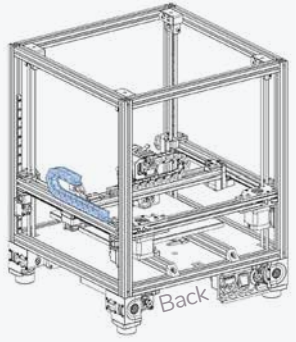
Secure the wire bundle to the strain relief using small zip ties.

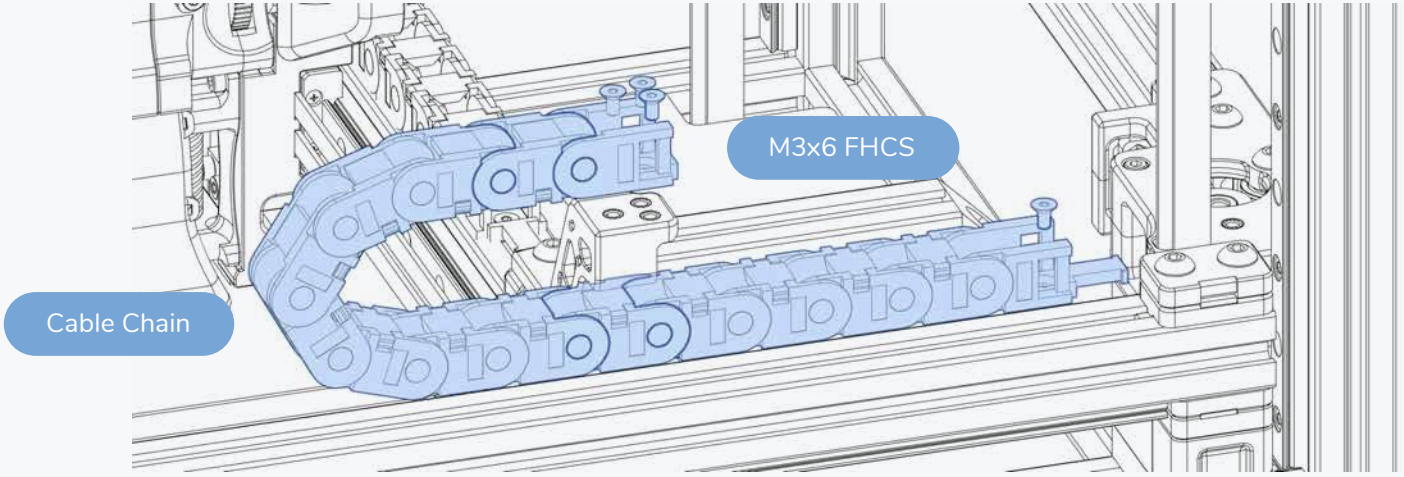
OPTION: ENDSTOP BOARD/HALL EFFECT BOARD

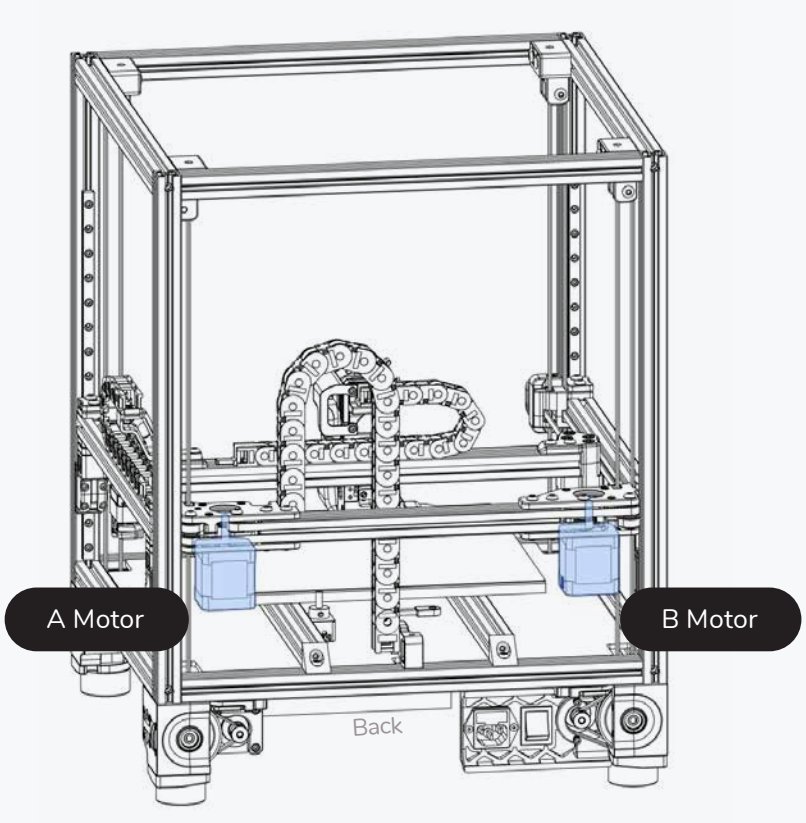
Those boards utilize a 4 pin connector instead. Please refer to https://voron.link/djhyygu and https://voron.link/d6qb7o6 for details.

Y CABLE CHAIN





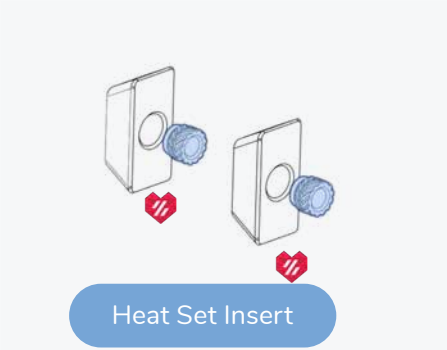


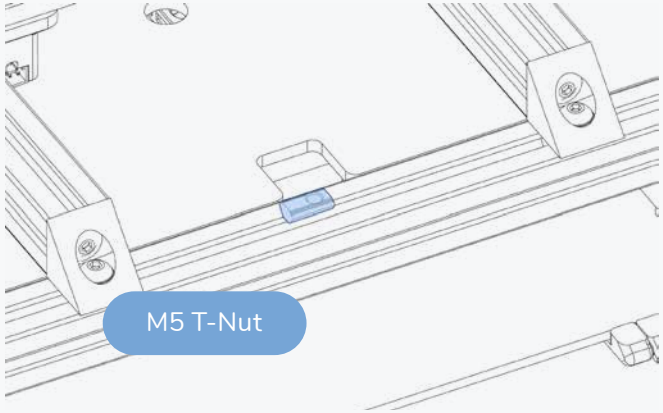


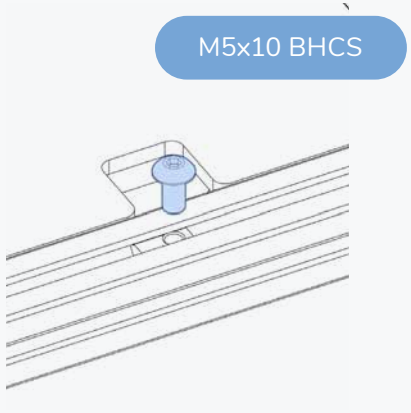
SECURING MOTOR CABLES

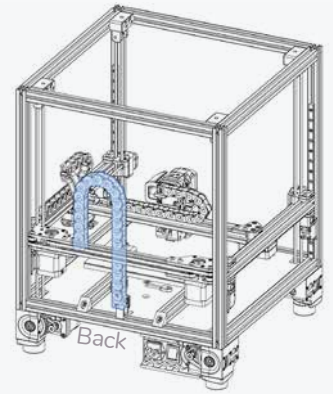
Secure the wire bundles along the small extrusion that sits between the drives with small zip ties.

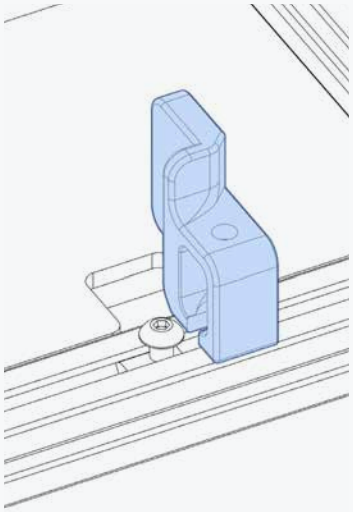
Z CABLE CHAIN

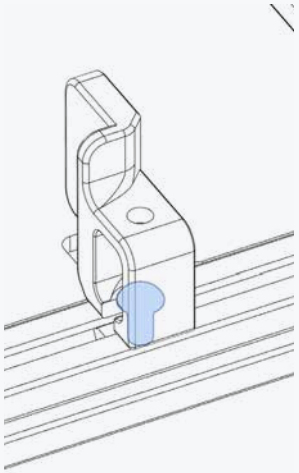


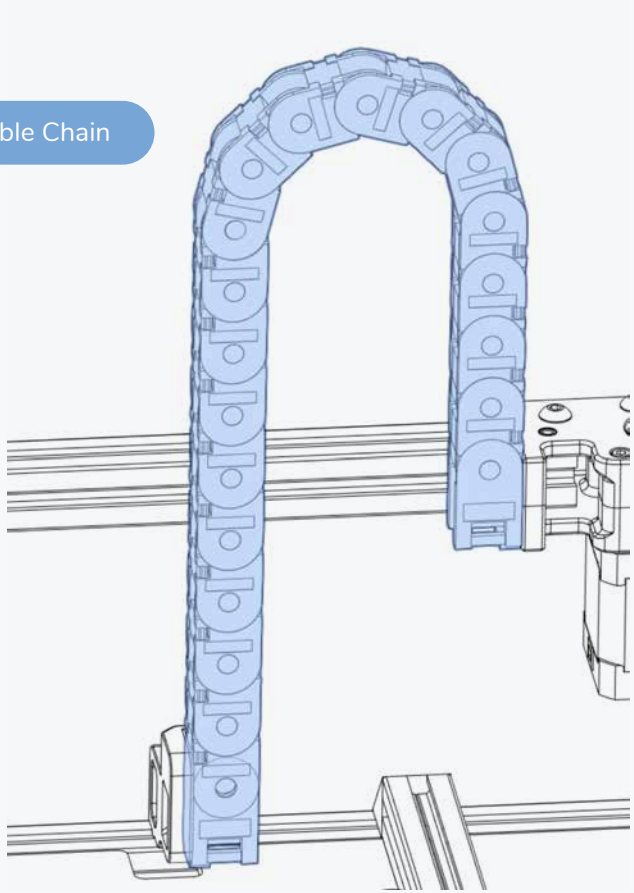


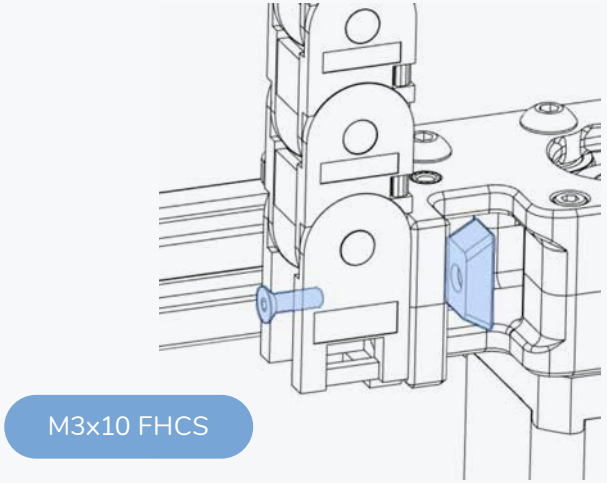


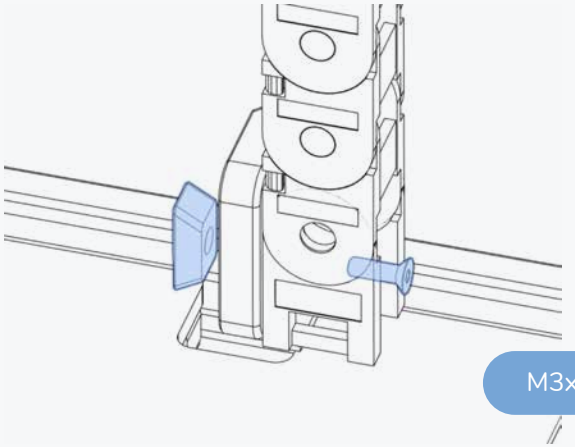




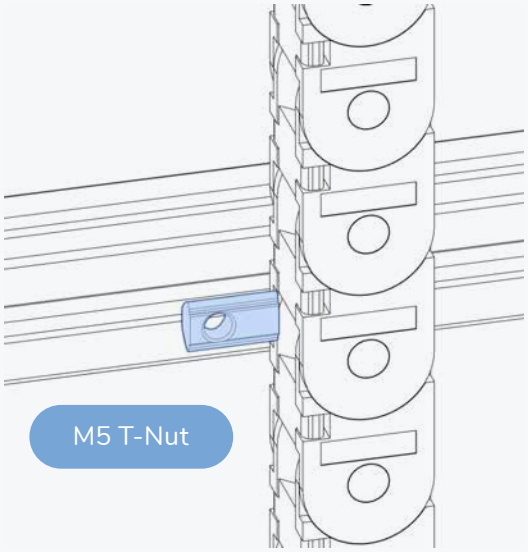


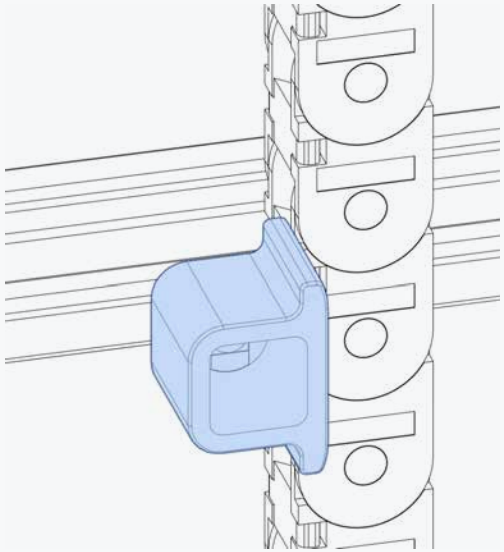

Cable Chain

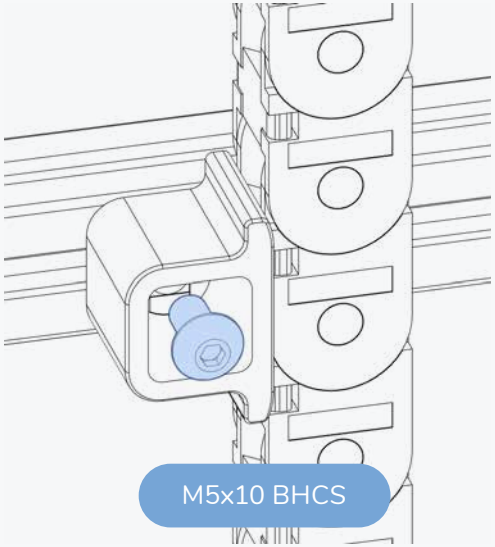

M3x10 FHCS

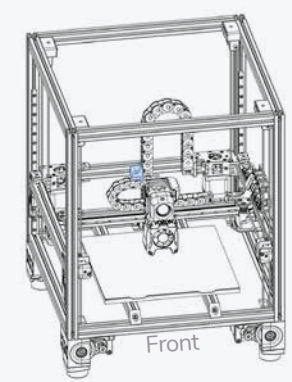

M3x10 FHCS

Z CABLE CHAIN



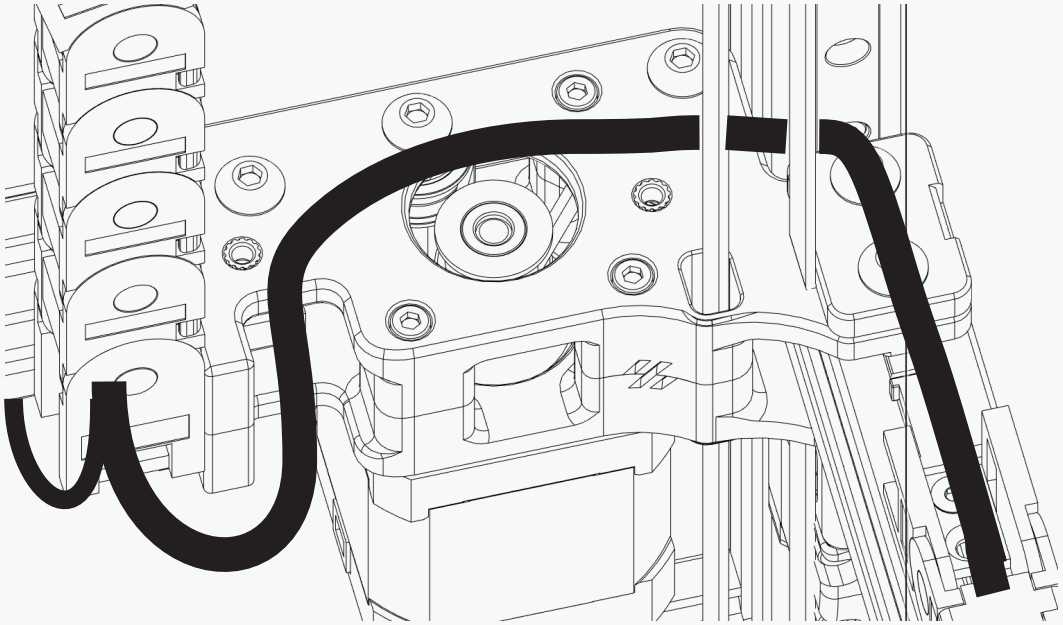


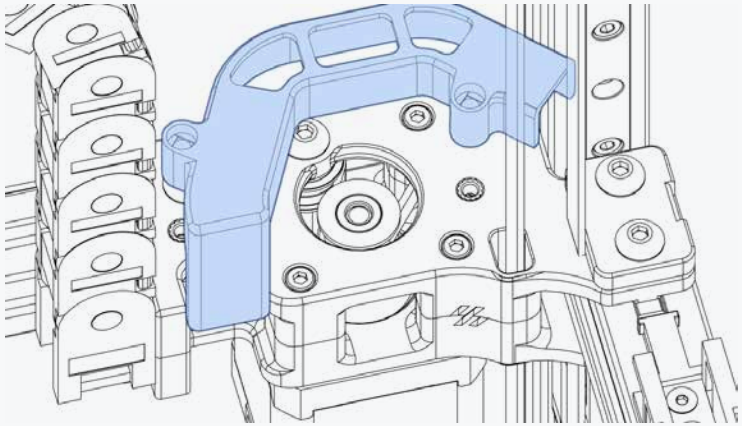


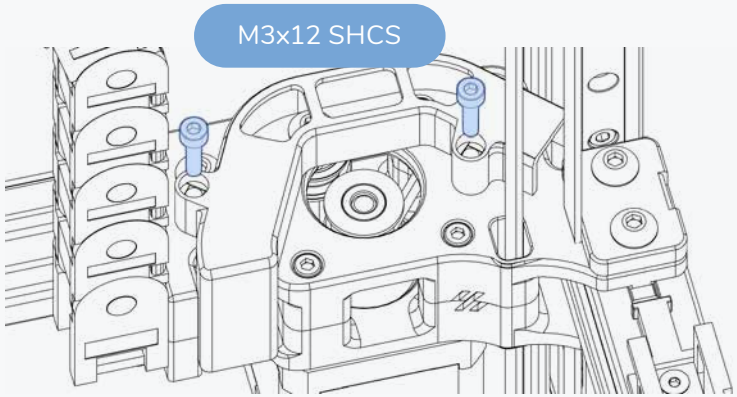


WIRE PATH

Guide the wire bundle behind the Z belt and over the A drive as shown above. Secure it with zip ties on the strain relief of the cable chains.



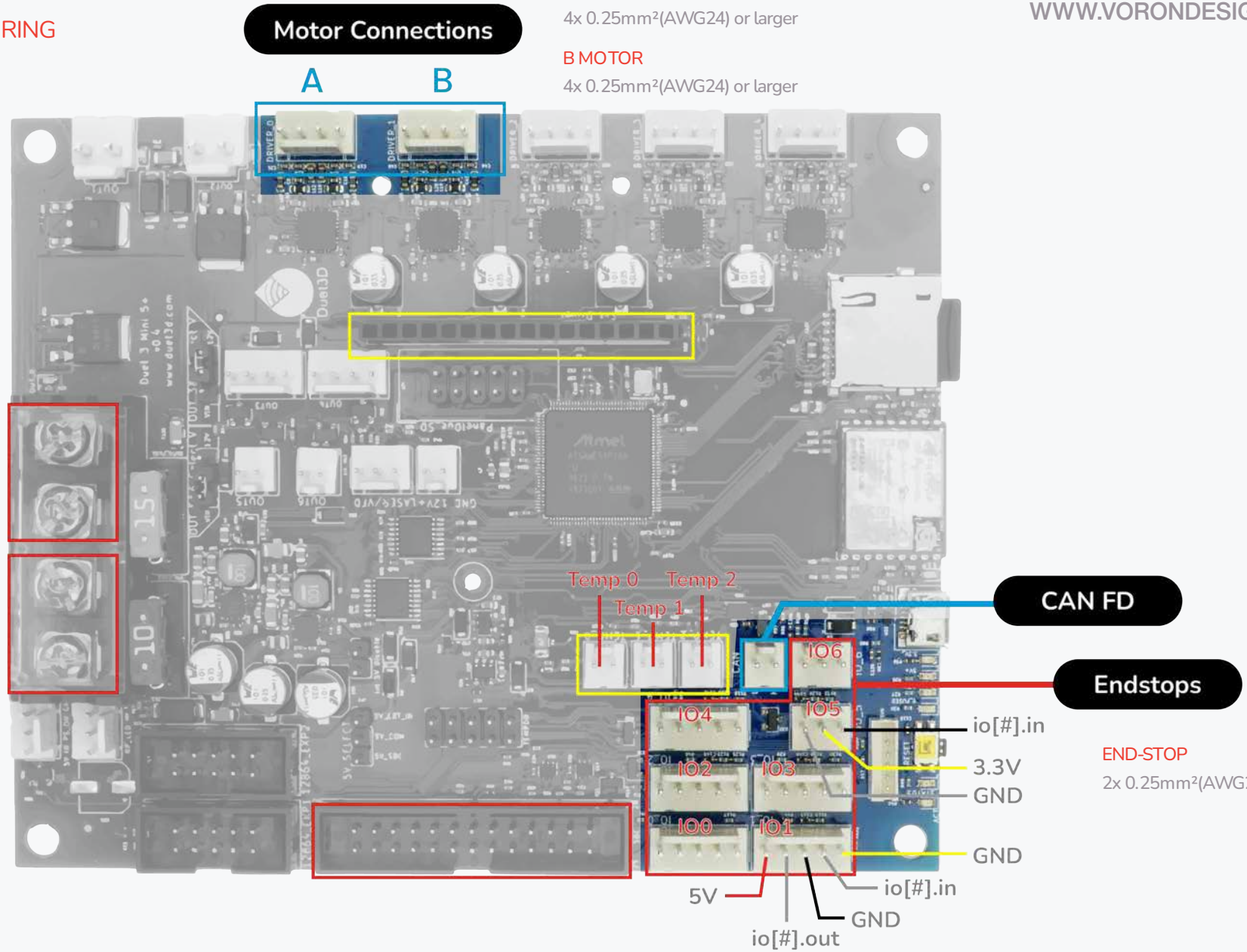




OPTION

If you use high quality cables they can be bigger than usual ones. This can cause the plastic cable cover not to be fixed properly with the M3x12 screws. We therefore recommend using slightly longer screws to avoid straining the plastic. M3x16 SHCS are sufficient.

CONTROLLER WIRING



A MOTOR

4x 0.25mm²(AWG24) or larger

B MOTOR

4x 0.25mm²(AWG24) or larger

END-STOP

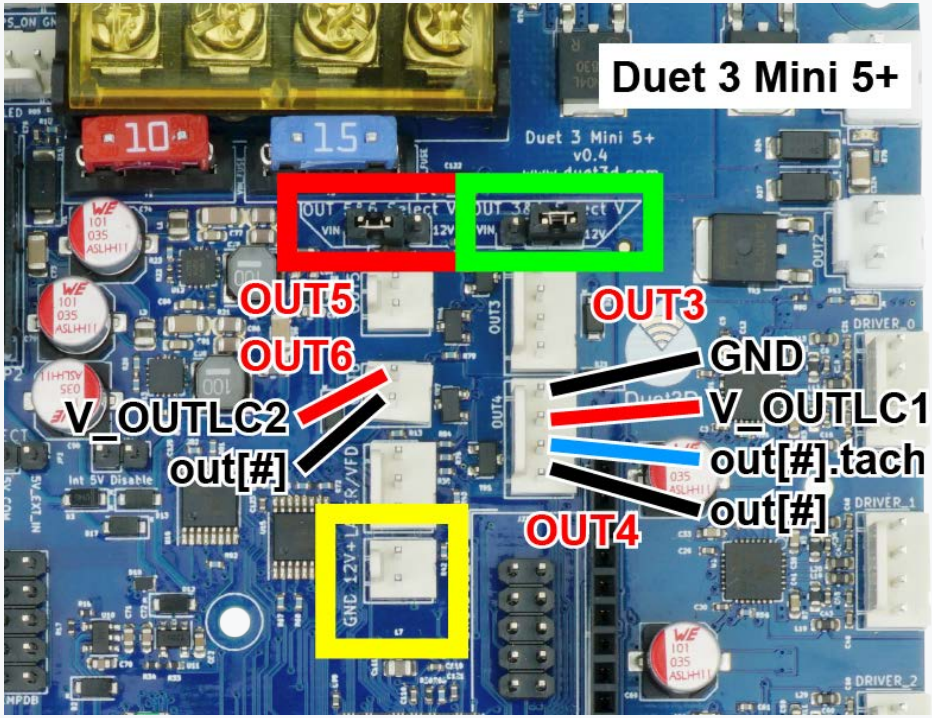
2x 0.25mm²(AWG24) or larger

FAN CONNECTION

The Mini 5+ provides:

- 2 x 4-wire PWM-controlled outputs with tacho input: OUT3 and OUT4.
- Voltage is selectable between VIN / 12V / external power (provide required voltage to centre pin), using the OUT3&4 Select V jumper.
- 3 x 2-wire PWM-controlled outputs: OUT5 and OUT6.
- Voltage is selectable between VIN / 12V / external power (provide required voltage to centre pin), using the OUT5&6 Select V jumper.
- 1 x 12V, always-on ouput
- A PWM (Pulse Width Modulation) fan connection is for fans you wish to control the speed of, for example a print cooling fan.
- An always on fan is for something like an electronics fan - always on when the printer is on.
- Some fans are more compatible with PWM control than others. If you have trouble varying the speed of a fan, check the documentation for changing PWM frequency.
- The polarity of the fans is important - don't connect them backwards, or you may damage the Duet board.
- When using the onboard 12V regulator (i.e. 12V has been selected and/or using 12V always on ouput), the TOTAL 12V current draw must not exceed 800mA.

For more details, see "User manual: Connecting and configuring fans"



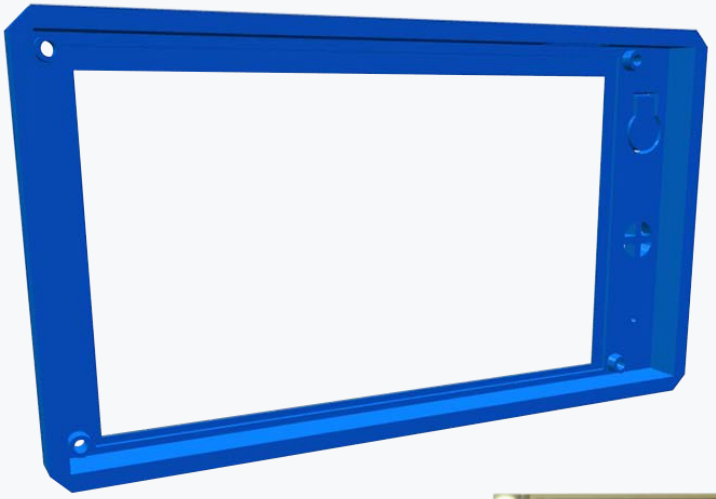
COOLING FAN

2x 0.25mm²(AWG24) or larger

PREPARATION

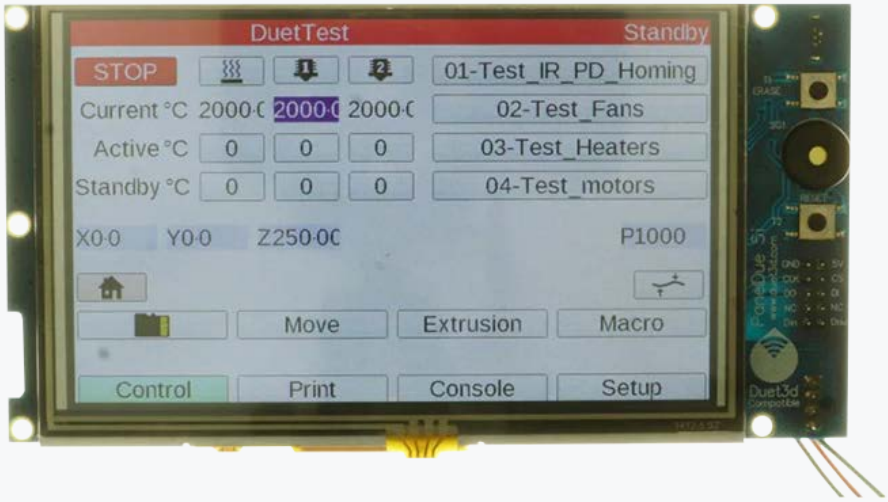
COVER PANELDUE i7

- Support for using a geniune PanelDue I7
- Access to the SD-Card Slot on the Panel



Front

Back



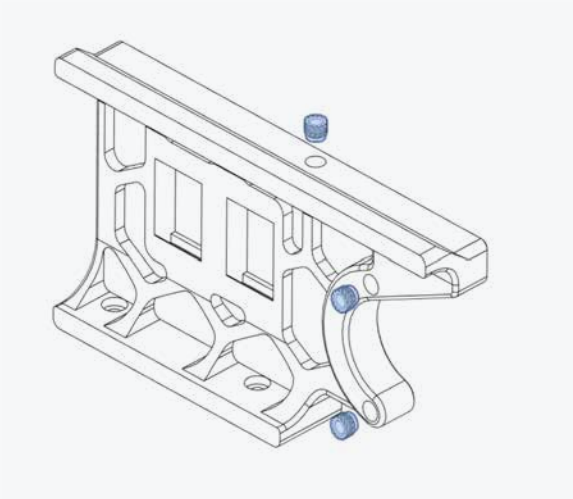
Paneldue i7 Duet3D

SOURCE

Thingiverse

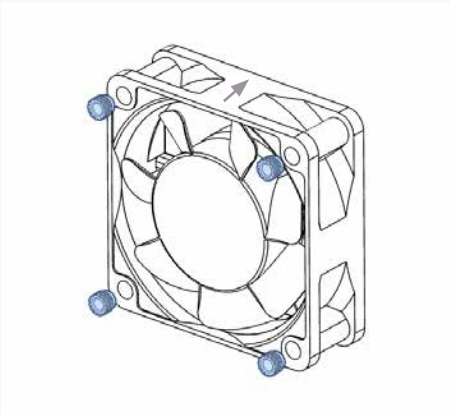
https://www.thingiverse.com/thing:4970553

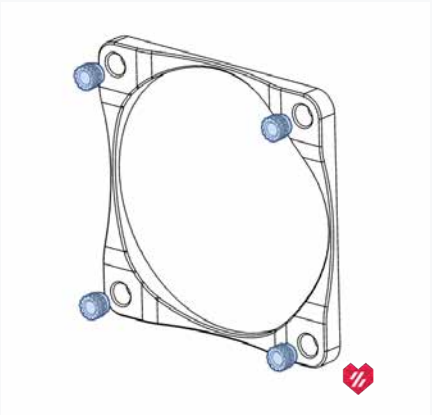
Author: MacNite

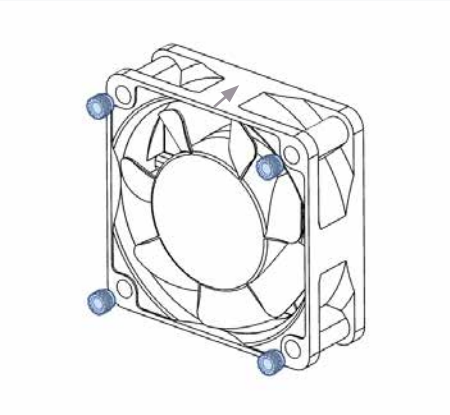


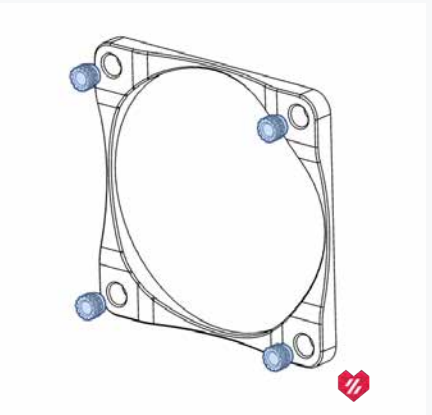
Heat Set Insert

60x20 Fan









M3x16 BHCS

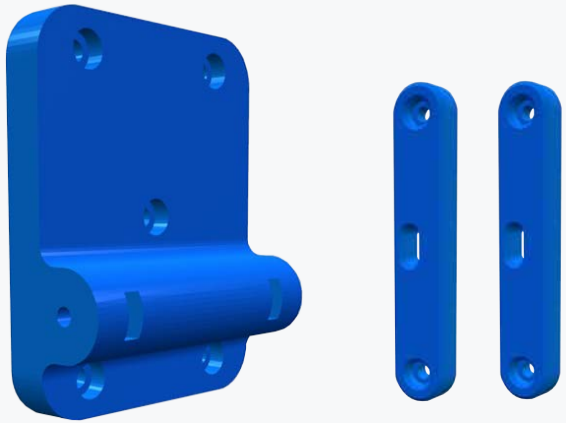
M3 Nut

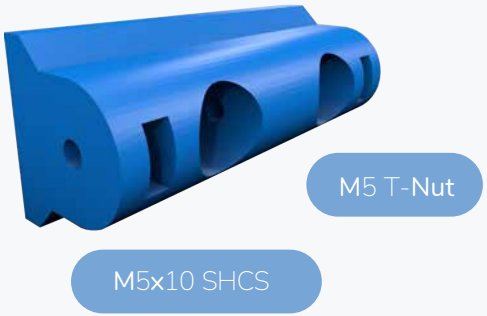
SOURCE

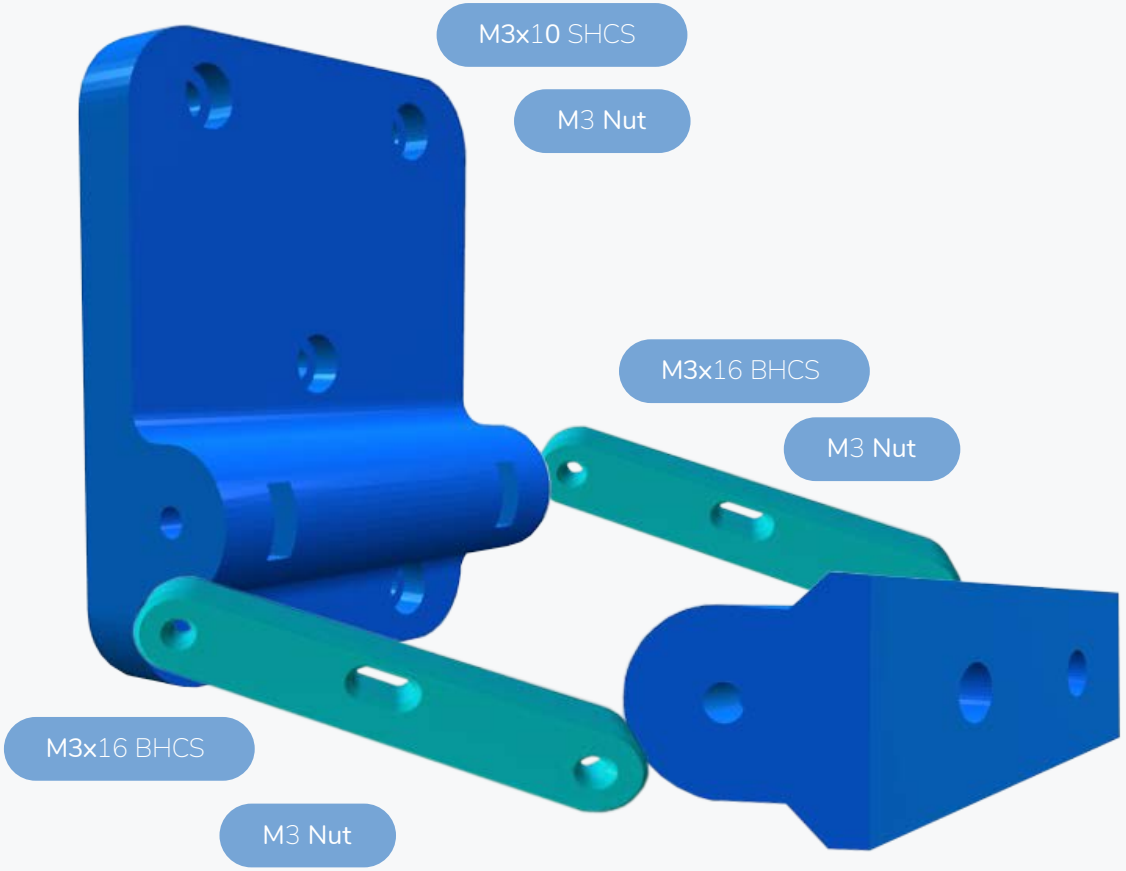
Thingiverse

https://www.thingiverse.com/thing:4970553

Author: MacNite







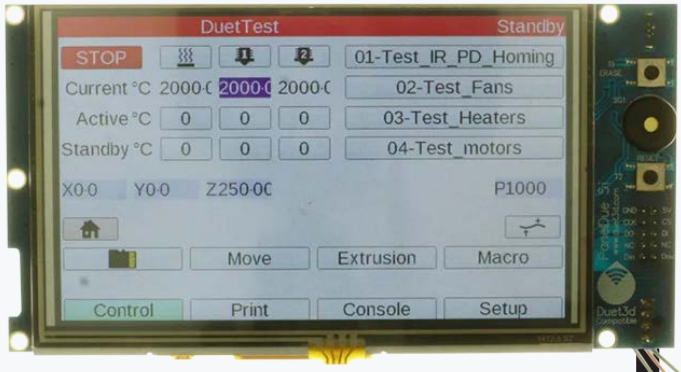
SOURCE

Thingiverse

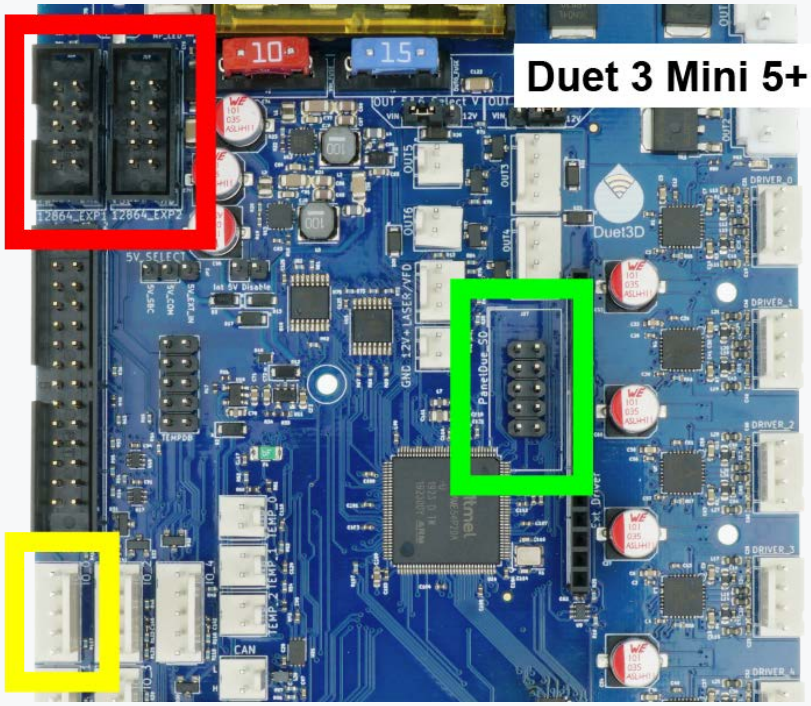
https://www.thingiverse.com/thing:4970553

Author: MacNite

LCD HOOKUP



NOTE: Cables are included in the display package



CONNECTING A PANELDUE

Duet 3 Mini 5+ supports PanelDue connected via IO_0 or 10-pin PanelDue_SD connector

- The PanelDue, an optional accessory sold separately, is a touchscreen display which gives a user the ability to control the Duet with an intuitive interface directly at the printer.
- The PanelDue can be connected in two ways (both cables are supplied with the PanelDue), depending on Duet board:
- A 4-wire cable that contains power and serial signals. This has a maximum recommended length of 1 meter. It plugs into the 5-pin IO_0 header. The supplied 4-wire cable may need to be rewired using the supplied 5-way connector shell; see "User manual: Connecting a PanelDue" for details
- A 10-way flat cable with a maximum recommended length of 400mm. It plugs into the 10-pin PanelDue_SD header. It has extra pins that allow the Duet to access the PanelDue's SD card reader. The IO_0 connector cannot be used for other purposes when using the PanelDue_SD header because they share connections.

For more details, including using the PanelDue_SD header to connect an external SD card reader, see "User manual: Connecting a PanelDue"

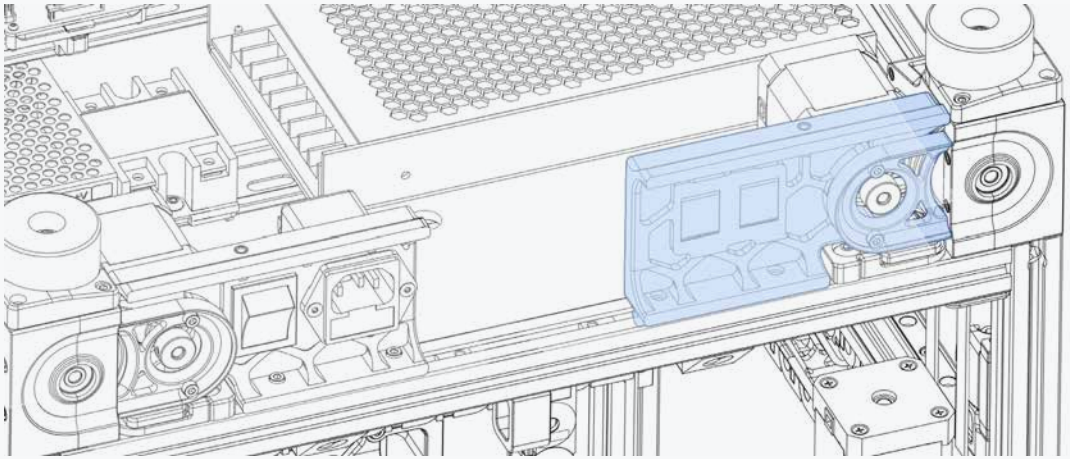
CONNECTING A 12864 DISPLAY

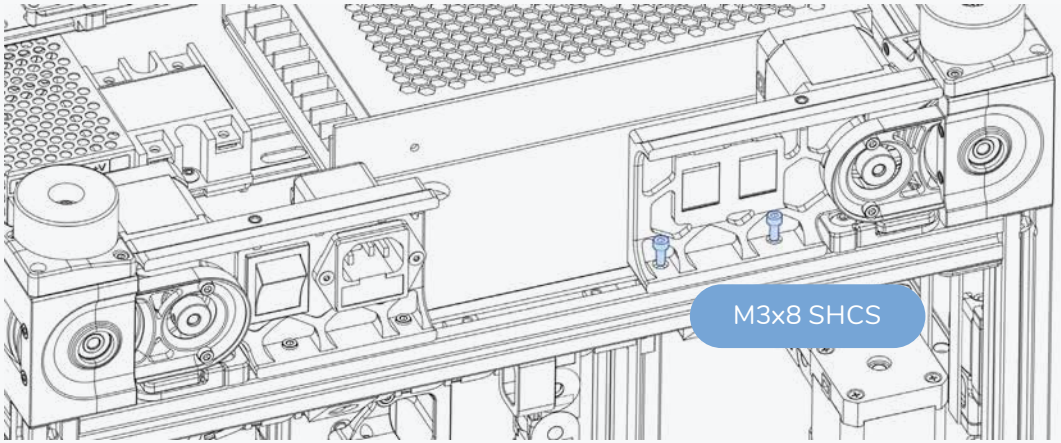
Duet 3 Mini 5+ boards support 12864 mono graphics LCD displays with a rotary encoder. Other Duet 3 boards do not support 12864 displays.

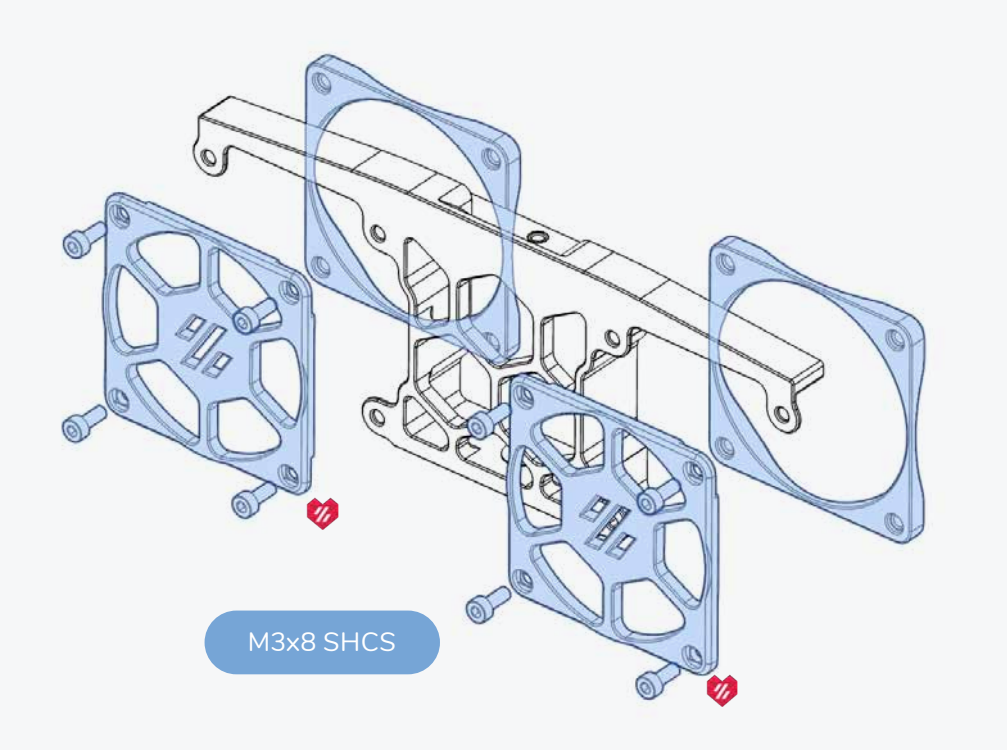
- Duet 3 only supports 12864 displays with the ST7567 controller chip.
- The 12864_EXP1 and 12864_EXP2 connectors are used to connect a 12864 display.

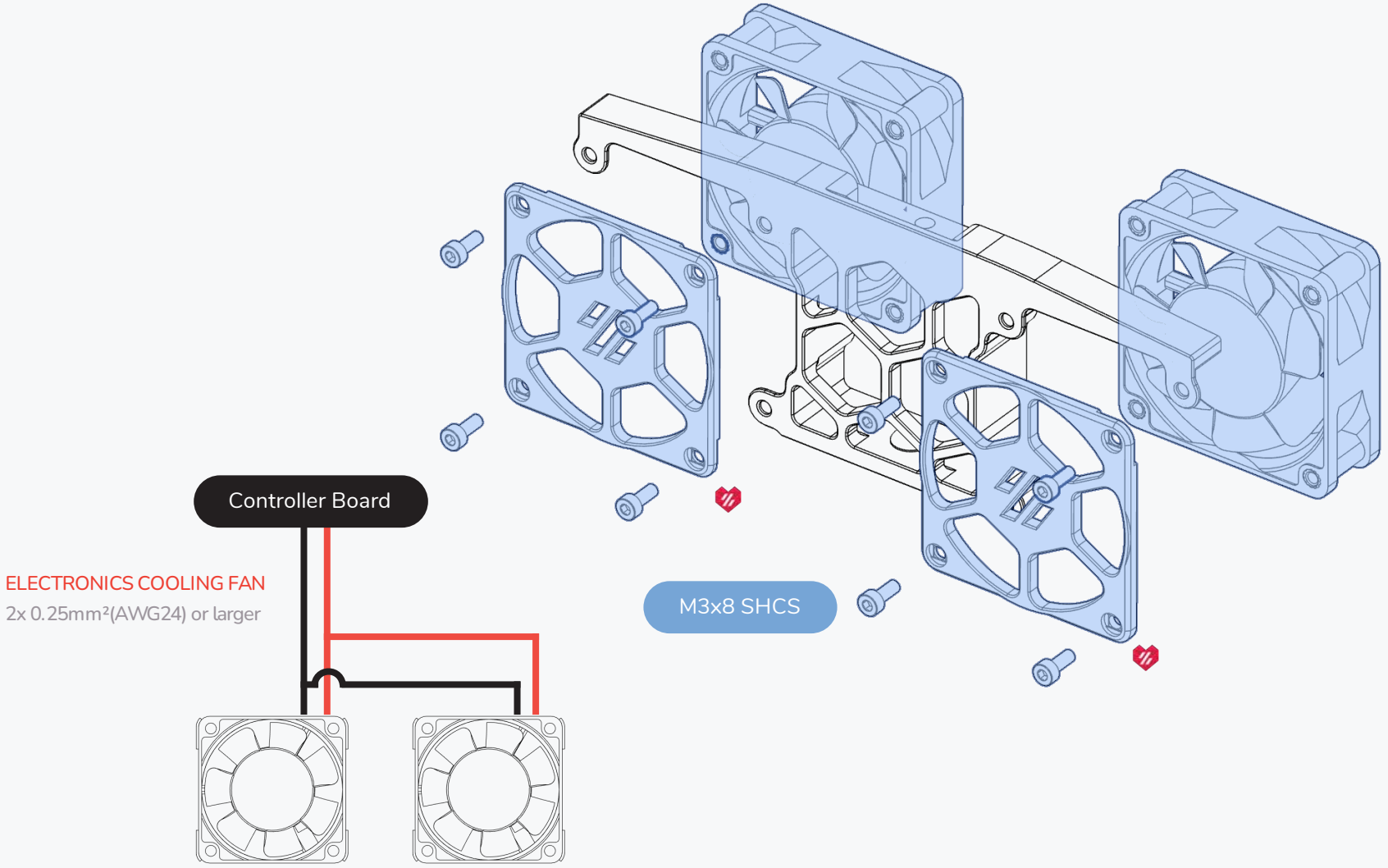
For details, see "User manual: Connecting 12864 displays."

SKIRTS






M3x8 SHCS


Controller Board
ELECTRONICS COOLING FAN
2x 0.25mm²(AWG24) or larger
M3x8 SHCS

FANS