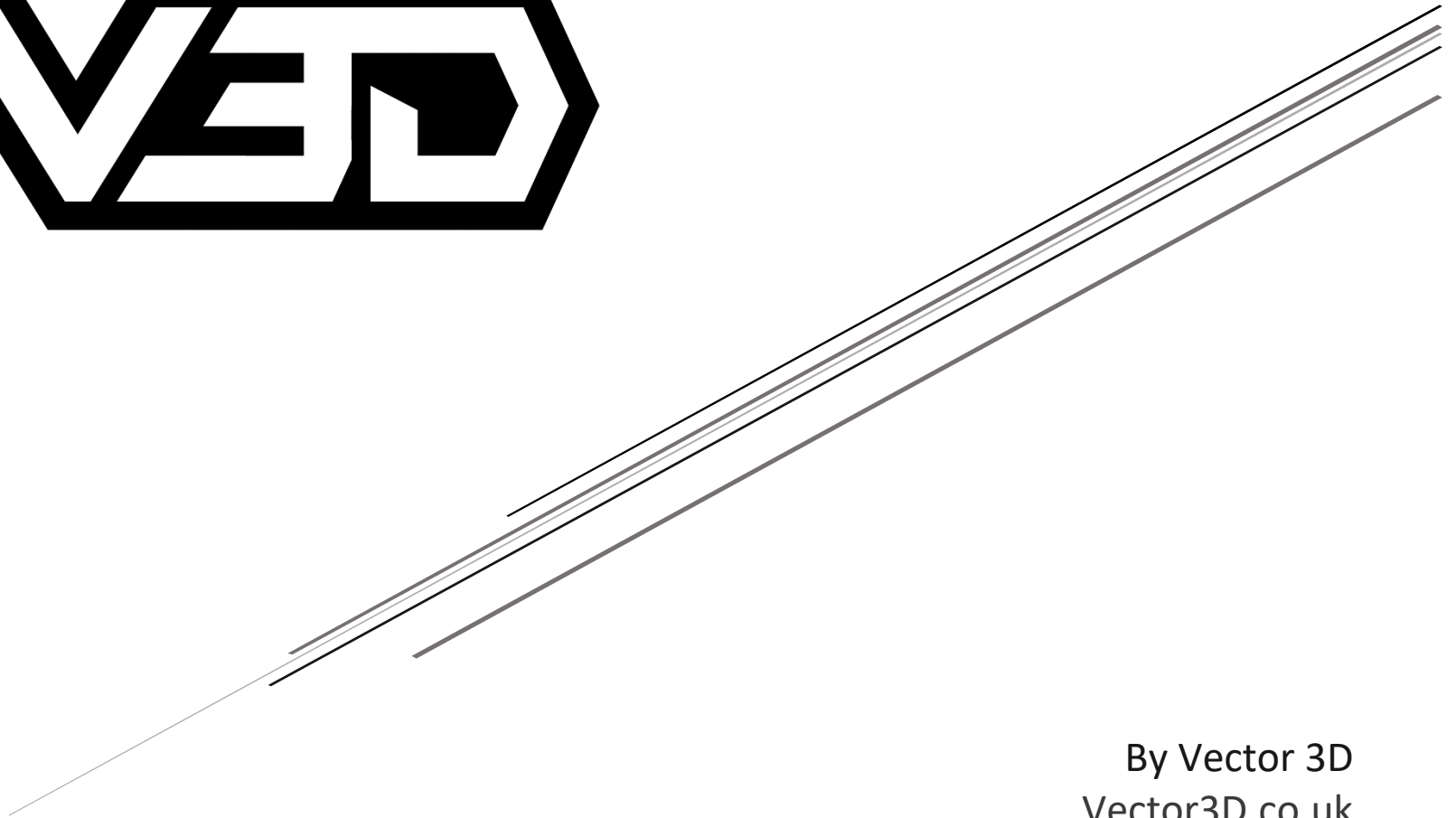


VECTOR 3D DIVIDER PCB

Assembly Manual V1.2 (this version uses a prototype of the PCB for the images)



By Vector 3D
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Introduction

Congratulations on getting started with your purchase of the Vector 3D V-minion PCB Mod (purchase [here](#)). This documentation exists to help you with understanding the assembly, wiring, and connection process to get everything up and running. Even if you're not quite ready to get started yet, it can be helpful to read through as it will give you some context for how everything fits together.

Where to Buy

My website, Vector3D.co.uk will normally have the first stock when a new batch comes in.

[Buy from Vector3D directly](#)

I am also working with resellers to help distribute to those in other parts of the world. Resellers will be selling at the same price as Vector3D but can also offer assembled/soldered versions to help with accessibility.

UK

Buy from [PrintyPlease.uk](#)

US:

Buy from [Squishworx](#)

Warnings

While I have done what I can to ensure the safety of this PCB in its design, you remain responsible for its safe assembly and usage. This documentation is intended as a guide to help give you the best chances of success but neither the author(s) nor Vector 3D Limited will be liable for any harm caused in the assembly or use of this product.

Never disconnect the 16 pin micro-fit connector when the printer is powered on. Don't disconnect anything while the printer is powered on, but in particular, do not disconnect the motors as this will very likely cause damage to your MCU.

Printing This Manual

If you need to print this assembly guide out onto real paper, then you can do it. However, I would strongly recommend against printing the manual out for two reasons. Environmental impact, and the latest information. The first is probably self-explanatory, and secondly, if the manual is updated but you printed it out, you'd then need to print another for the latest information. Please don't print it unless you absolutely must, even then consider printing part of it, and not the whole thing.

Getting Help

You can ask on the Vector 3D discord in the #divider-pcb channel, we're here to help so come and join us using this link: <https://discord.gg/xXmuUpJhxc>



What's Included

This PCB kit is available in three variations: “Some of It”, “Most of it”, and “All of It”. The list of included parts in each kit is shown at the end of this document. “Some of it” is just the PCB so you will need to source all other parts yourself. “Most of it” is the PCB and everything that gets soldered to it plus mechanical mounting hardware, this is ideal for those that may want to acquire a full harness separately which will have all the connectors already attached to it. “All of it” includes everything needed to add the divider PCB to your V-minion with the exception of solder and electrical wires which are not included in any kit.

What you need

This is a full list of what you need for the PCB assembly

- Soldering iron
- Solder
- 1 x PCB
- 2 x 10k Resistors
- 1x BAT85 Diode (optional)
- 4 x 4 Pin JST XH Header
- 6 x 3 Pin JST XH Header
- 2 x 2 Pin JST XH Header
- 2 x 4 Pin Terminal Block (or 4 x 2 pin, they join together)
- 1 x 18 Pin Micro-fit 3.0 right angle header
- 1 x 16 Pin Micro-fit 3.0 right angle header
- 3D Printed Jig (optional)
- Blu-Tak or similar (optional)

This is what you need for mounting to the printer

- 3D Printed enclosure
- 3D Printed Y End stop Mod
- Six M3 Hex Nut
- Four M3 x 6mm Screw
- Four M3 x 12mm Screw
- Two M3 3030 Hammer Nut
- Zip Ties (cable ties)

Printed Parts

To assemble the PCB in the standard position, two 3D printed parts are needed; the enclosure, and the modified Y end stop mod. The modified end stop uses the same screw and nut as the original design but fixes to the top of the extrusion rather than the side, this gives a little more room for the enclosure.

It is recommended to print these parts using the same material as the rest of the printer, or with a material of higher temperature resistance. For example, if your printer uses PETG for the parts, do not use PLA, but you could use ABS.

2 Perimeters, 20% infill as per the rest of the parts, should be sufficient for strength.

Mod Compatibility

Due to the positioning of the Divider enclosure at the rear of the printer, the original drag chain modification by Squirrelbrain will not fit, fortunately, there is a modified version for use with this PCB mod.

You can find the files for that here: <https://www.prusaprinters.org/prints/155232-ratrig-v-minion-y-axis-drag-chain-compatible-with->

If you are installing a drag chain modification like this one, I strongly recommend implementing suitable wiring for this, low strand count wires should not be used in drag chains. Drag chains should also not be densely stuffed full of wires as they need space to slip and slide inside. I hope to offer high-quality harnesses

Assembly Steps

Step 1: PCB Orientation

- The Vector 3D logo (V3D) is on the top side of the PCB. ALL components are placed on the top side and soldered on the bottom side.
- We'll assemble ALL the components to the PCB or jig before doing any soldering, this will make sure everything fits and can be located with the jig.

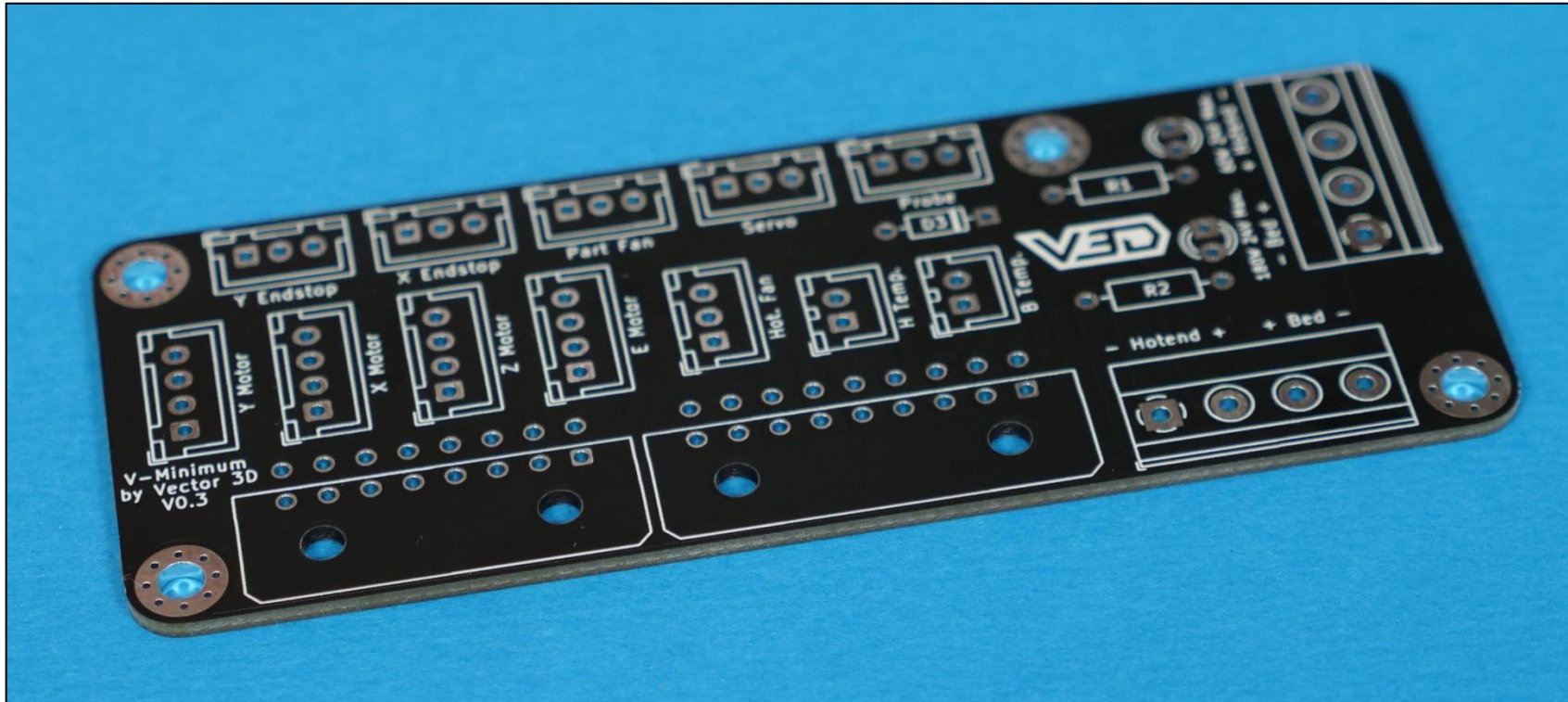


Figure 1: Top of the PCB, components assemble this side.

Step 2: BAT85 Diode

- The BAT85 Diode location is marked as D3.
- The diode is only needed if you need to power the bed probe with 24v. Using the diode prevents high voltage to the MCU. Low voltage inductive probes like the standard one from RR do not need this diode.
- If you do not need or want the diode, cut one of the legs off and use that to bridge the traces in place of the diode. This diode is wired in series so there must be something connecting these two solder pads for the probe to function.
- The orientation is important, it will not work in the incorrect orientation.
- To assemble, bend both pins to be parallel and match the spacing on the PCB. The 3D printed jig tool can be used to help with this process. Align the black end of the diode to the marked end on the PCB. Push the legs through the holes and spread on the other side so it does not fall back out.
- Do not solder yet.

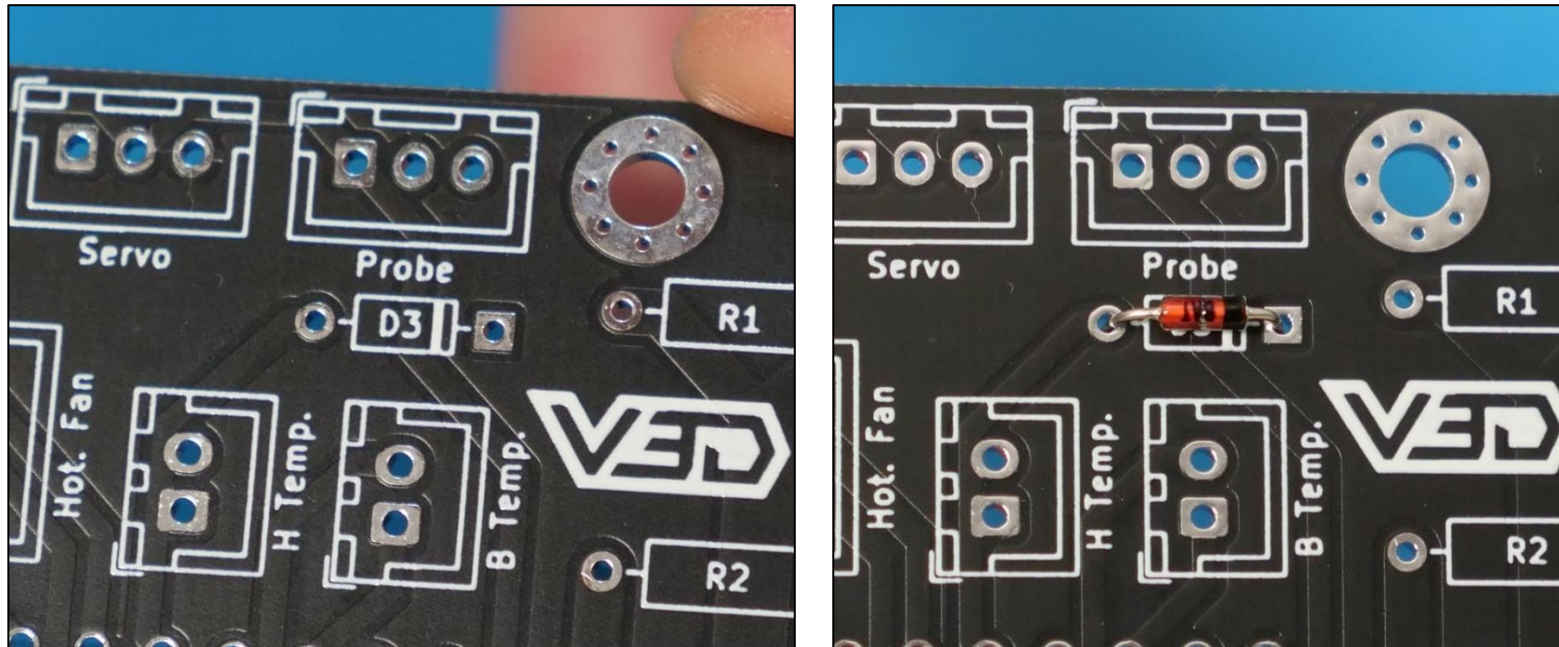


Figure 2: Diode location marked as D3.

Step 3: Resistors (optional)

- The resistor locations are marked as R1 and R2. Both resistors are the same value, 10k ohm.
- The purpose of the LEDs is a visual indicator used in diagnosis to check if power is passing to the Hotend and/or bed.
- If you don't want lights for hotend and bed power functions, you do not need install these resistors, leave these pads unpopulated.
- Both resistors are the same values, so they are interchangeable.
- Resistors are non-polar, so the orientation doesn't matter. However, it looks best if they both face the same way.
- Bend the legs of the resistors to be parallel and push through the holes, spreading on the other side.
- Do not solder these yet.

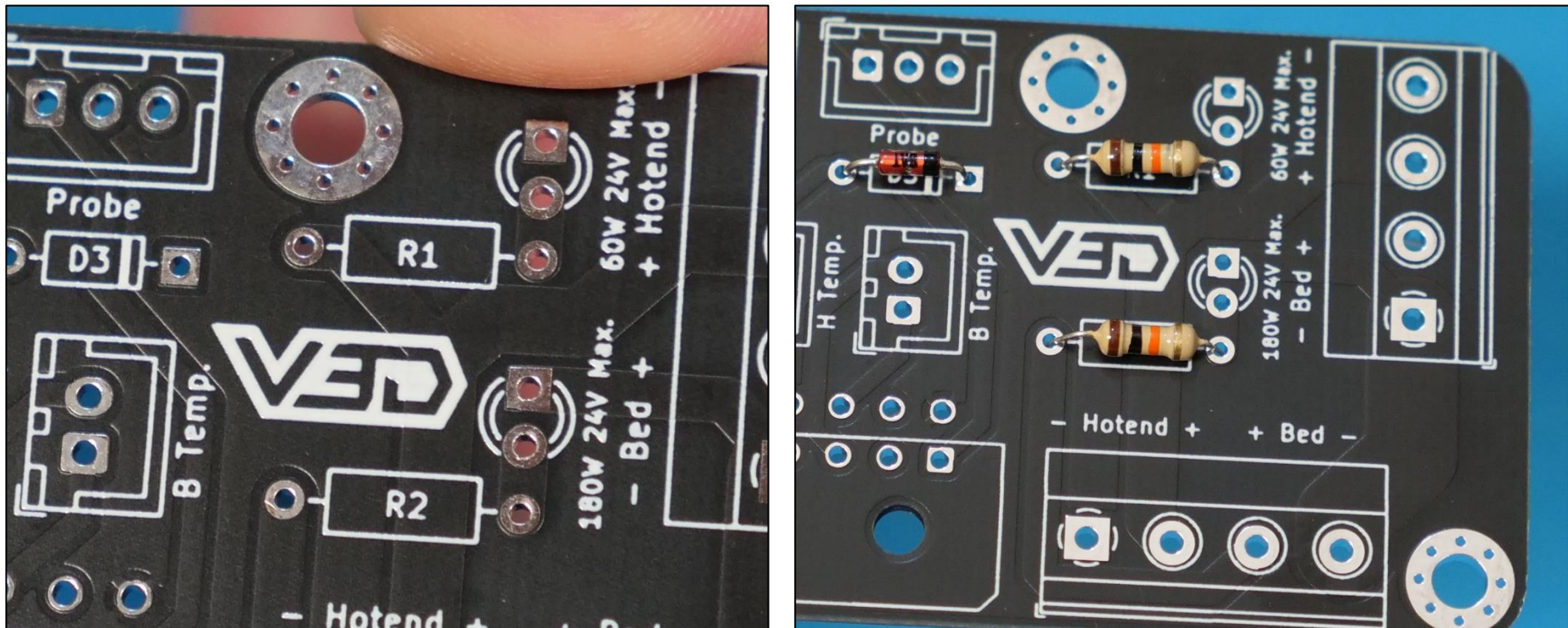


Figure 3: Resistor locations R1 and R2

Step 4: LEDs (optional)

- The LED locations are not numbered, but they are marked with a double circle.
- If you don't want lights for hotend and bed power, you do not need install these LEDs, you can leave these pads unpopulated.
- LEDs have a positive side and negative side. The cathode (negative) side is marked by a flat portion on the side of the LED and the leg is shorter.
- Place the short leg (cathode) of the LED through the hole with a square pad and the long leg through the hole with the circular pad.
- Spread the legs on the rear side of the board just so it doesn't fall out.
- Do not solder these yet.

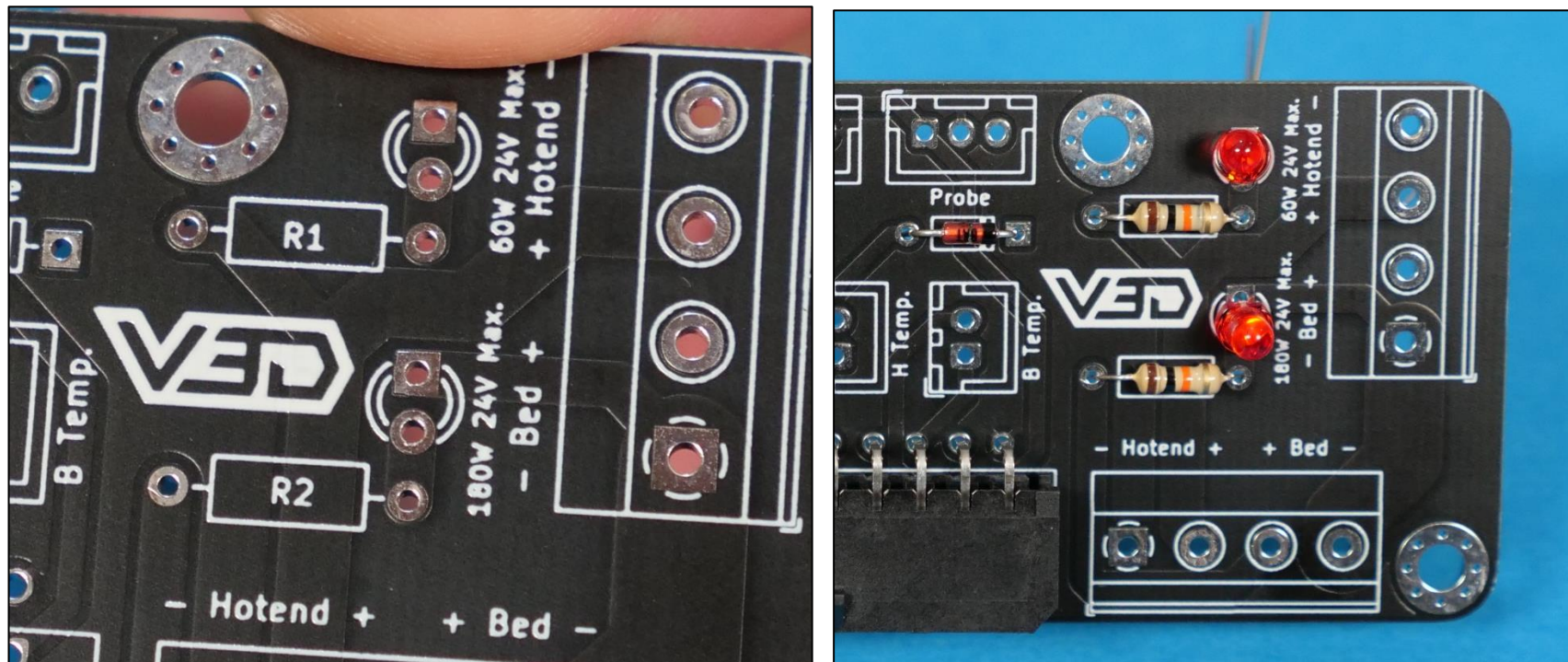


Figure 4: LED locations (round) and with LEDs installed

Step 5: Micro-Fit 3.0 Connectors

- There are two large micro-fit connectors to be fitted to the PCB. They look similar but one of them has two additional pins. They cannot fit in the wrong position, so do not force them.
- Carefully position one of the micro-fit connectors on the top side of the PCB, aligning the legs with the holes, ensuring that there is one leg for each hole, and every hole is populated.
- There are two plastic pins which engage into the PCB so push down firmly until the click, and the connector is held securely in place.
- Check the underside of the PCB to see if the connector clips are correctly secured to the un-plated holes in the PCB.
- Do not solder these yet.

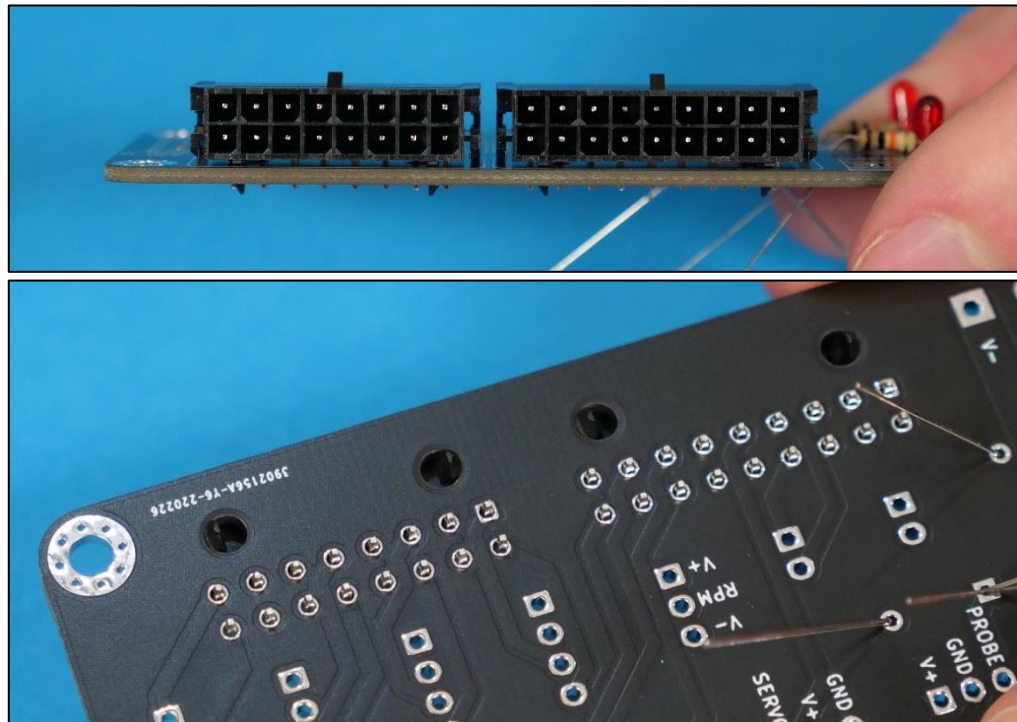


Figure 5: Micro-Fit 3.0 connectors fitted

Step 6: Populating the Jig

- While optional, the 3D printed jig will really help with assembly and soldering of the PCB.
- If your solder does not have flux in the core, then you may want to add flux to the PCB pads before assembling into the jig.
- Optionally, secure the jig to your worksurface near your soldering station using Blu-Tak or something similar. This will stop it moving around when you solder.
- There are 14 positions on the Printed Jig to be populated with JST headers and screw terminal blocks.
- They are designed such that they cannot be placed incorrectly. No force is required.
- Populate all 14 positions ensuring that the legs for soldering point upwards.
- Once done correctly, all the connector bodies should sit flush with the top of the jig.

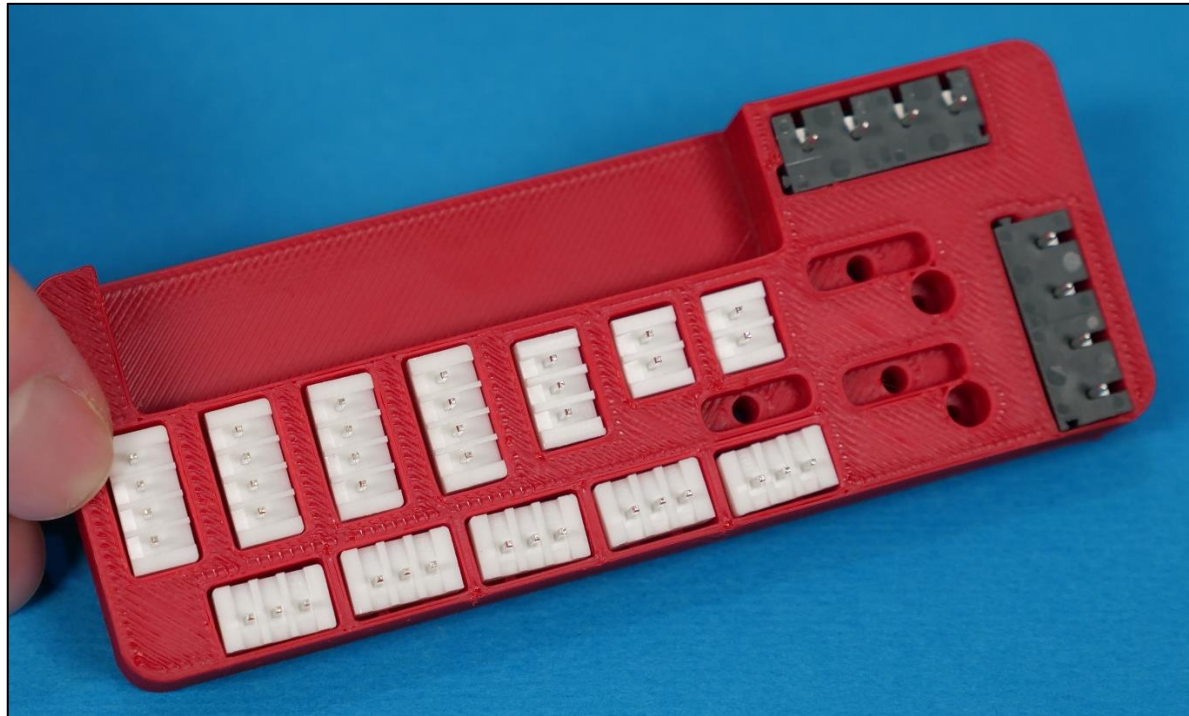


Figure 6: Assembly jig fully populated with connector components

Step 7: Soldering

- With the partially assembled PCB and populated jig, turn the PCB face down and gently place it on top of the jig. Jiggle it around a bit and all the connector legs should comfortably stick through the PCB. The top surface of the PCB should sit very close, or flush, with the top of the jig.
- Being careful not to join any two pads together and ensuring a good connection between the pad and leg, solder all the components to the PCB.
- If you are not experienced with soldering, or have not done it in a while, here is a short video to give you some help. This is a Collins Lab video on the Adafruit Industries channel on YouTube. <https://www.youtube.com/watch?v=QKbJxytERvg>
- Use side cutters to trim the long legs of the resistors, LEDs and diode.
- The solder I use is SC-SO-AU-63 37 which has a 2% Flux core. If your solder does not have flux in it, then you may need to add flux before assembling it into the jig.
- Once soldered, double-check all eight hotend and bed pads to ensure the pads are fully soldered and make good contact. Its good practice to look over all your solder joints, but these high current ones are particularly important.

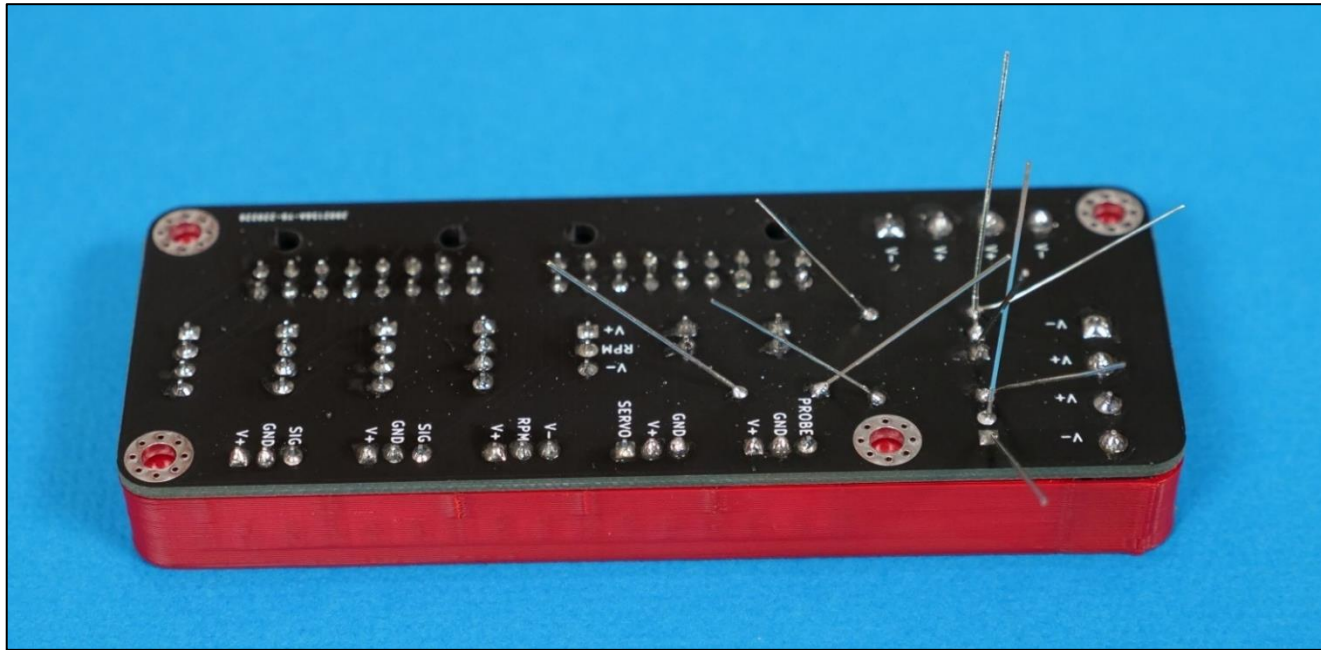


Figure 7: Fully soldered PCB

Step 8: Remove the PCB from the Jig.

- Depending on the tolerance of the print and heat used in soldering, the PCB may become quite stiff to remove.
- Using the holes in the underside of the jig if necessary to push on the components, gently remove the PCB from the jig.
- Avoid the use of sharp or metal tools to do this as you could slip and damage the PCB traces or components.
- You may wish to use the tabs protruding from the ends of the jig to prop up the assembly while gently pushing through the holes to release.
- PCB Assembly complete, congratulations.



Figure 8: Removal of the completed PCB from the jig and completed PCB.

Wiring Guide

Tips and advice for getting good wiring for your divider PCB and V-minion in general.

1. Take your time
2. You can always cut a wire shorter, but never longer.
3. Always crimp wires with a crimping tool, not pliers.
4. There are a few spare crimp terminals provided in the kit so that a few mistakes can be corrected but if you need lots of practice, you may wish to acquire some additional crimp terminals.
5. Check the pin diagrams section to understand where each pin connects.
6. Check the section on mechanical assembly for mounting the PCB to the printer. Knowing the final location of the PCB will help with getting the wire lengths just right.
7. There is only one +V wire for end-stops, this is used for both endstops.
8. The GND, or ground, wire is shared between multiple components. Generally, this is best wired to the power supply GND.

Motors

1. NEVER disconnect the 02x08 16 pin micro fit connector when the printer is powered on. This would disconnect all the stepper motors and will very likely cause damage to your MCU if removed when powered on.
2. The motor connectors are all in the same orientation, get the colours all matched up and you're good to go.
3. The extruder motors from Bondtech have different wire colours.
4. If you self-sourced your motors the wire colours may be different. For this part of the build, it doesn't matter, you can wire them up just the same because the PCB is just a passthrough. Just remember when connecting the Divider PCB to the main control board to observe the pin numbering.

Endstops

1. Wiring endstops incorrectly can cause problems for your printer so be sure to double-check the wiring before powering on, particularly the +V and Signal wires as these are likely to be the wrong way around if you did it wrong.
2. The pin layout for the Divider PCB is slightly different to the BTT SKR 2 control board, so don't just transfer across, it won't be ok.
3. Both endstops share the same power input so they both need to use the same voltage. Basically, just use the same design of end stop for X and Y.

Inductive Probe

1. Be warned that some inductive probs seem to be using different colour wires for different functions so just double check that you are wiring to the correct pin.
2. The pin diagram shows two possible wiring configurations depending on if you are using the standard stock inductive probe, or a BL Touch. Pick one or the other, you cannot use both.
3. The diode for the probe is only needed if you are going to use a 24V probe but wiring the “Probe +V” pin to 24V. Threaded inductive probes like the stock one from RR, the PINDA, and many variations of this, all use 5v so there is no need for the diode in these cases. Just beware that if you do opt for a different probe in the future, you check its operational and signal voltages so that you do not damage the MCU.

Fans

1. While the standard fans that come with the RR V-minion only utilise 2 pins I have seen a trend that I'd like to encourage: fans with RPM sense. For this reason, I have added a third pin to the fan connectors that allow the use of three-pin fans.
2. If you want to use 2 pin fans, you'll still need to use a 3 pin JST XH Connector, but you only need to wire up the +V and -V pins.
3. If you want to use 3 pin fans, you'll need to wire all three pins (obviously) and then identify a pin on your control board to use for RPM sense as most controllers also use 2 pin fan connectors currently.
4. The two fan connectors are wired independently so you can use different voltages for the hotend and part cooling fans if needed. Simply wire to the appropriate voltage at the control board end.

GND

1. The GND, or ground, on the micro fit connectors, is a combined ground from several devices like end-stops, servo and probe.
2. Connect this to ground on the power supply.

Bed and Hotend Thermistors

1. Probably the easiest thing to deal with because it doesn't matter which way around you connect the pins. Just make sure they're connected, and then it “just works”.

Servo

1. If you're wondering why there is a servo connection then you're not the only one, I've had a few questions on this. The movement of the BL Touch probe pin is controlled as a servo, so when you attach a BL Touch, you need to connect the pins to the servo connectors, for pin control, and probe, for sensing, as shown in the pin diagram.

2. The servo has its own voltage pin so you can power from any voltage but for BL Touch, wire to the control board as normal.

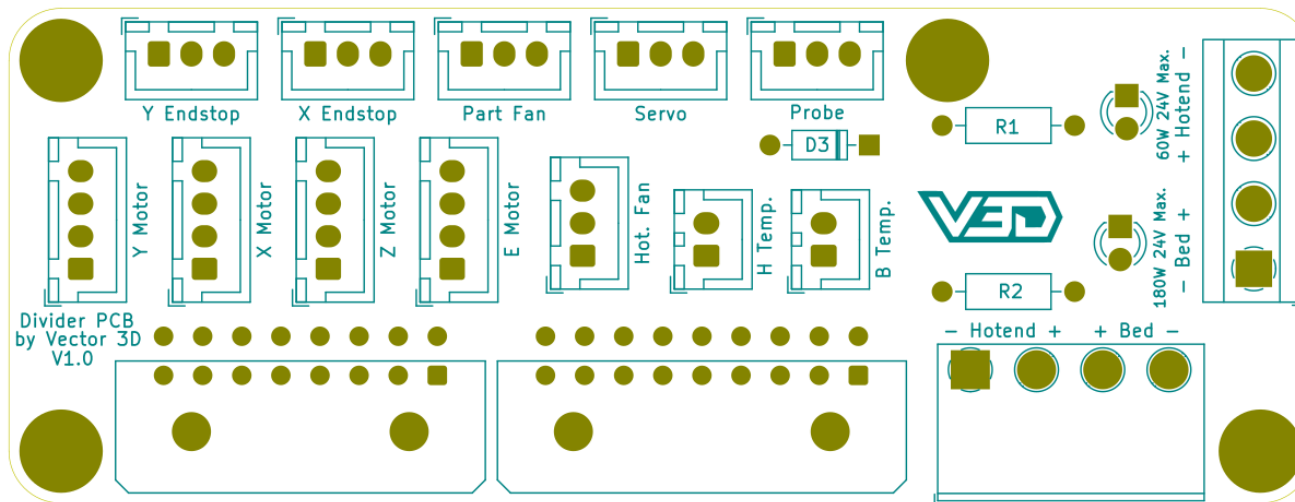
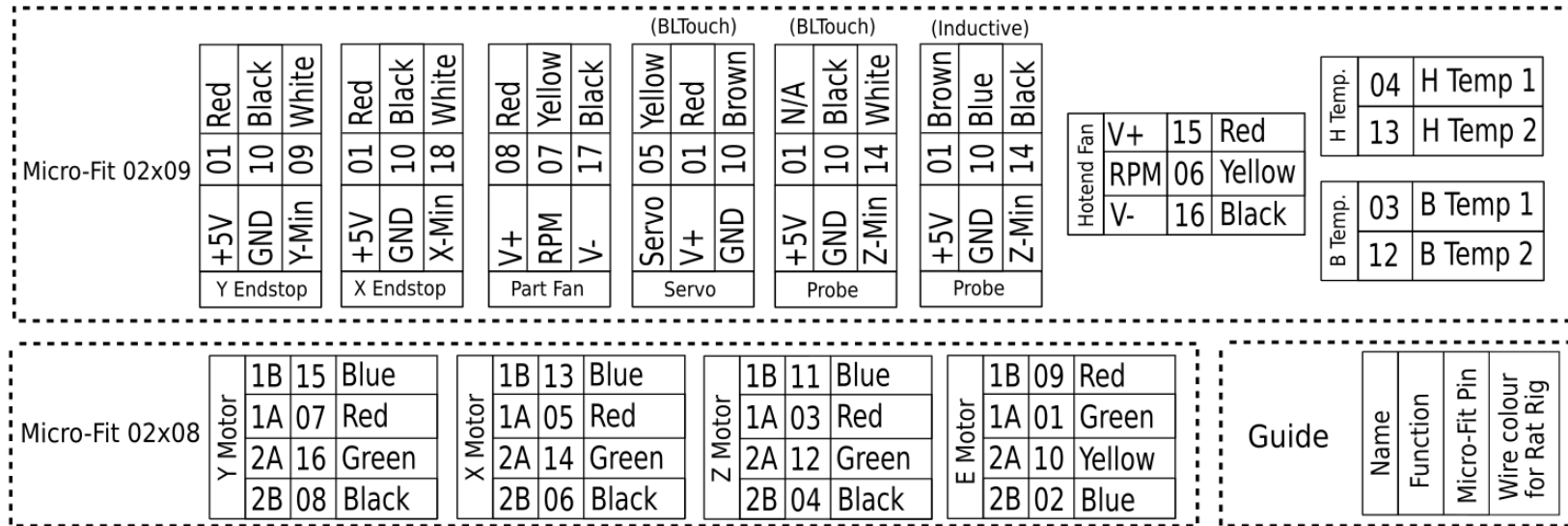
Hotend and Bed

1. Wiring of these two is very similar so I'm grouping them together. The PCB is marked with + and – locations, corresponding to positive and negative respectively, which you need to match coming from the control board to ensure that the LEDs light as intended. Typically, Red (or accent colour) for positive, and black for negative.
2. The LEDs are mainly intended for diagnosis if something stops working at a later time so they won't be very visible during a normal print but they could come in useful down the road so it's worth checking they work correctly now so that there are no surprises.
3. The thick white power wires from the heated bed only just fit in the ferrule terminals provided. For the best fit, you'll need to remove the woven fabric that covers the insulation to allow the plastic part of the ferrule to cover the wire.

Control Boards

1. The Divider PCB is wired to the control board using the two micro-fit connectors plus the pluggable screw terminal block.
2. When creating the harness that will connect the MCU and Divider it's recommended that you connect wires one device at a time and bundle them together with a label if available. It may also help to connect the wires to the control board as you wire them up.
3. The JST connectors for wiring the PCB to the MCU are not included since you would need to have these anyway if you did not own this PCB mod. You will need to remove the wires from these connectors so they can be repurposed. Since you may not be able to reuse the same wires, crimp terminals are included in the 'All of it' kit.
4. Most connectors plug in the same place as the original wiring so you can follow the Rat Rig guide. For additional wires such as fan RPM, you will need to determine a suitable position on the control board.
5. Only make the wires as long as you need. Additional wire length causes power loss and voltage drop as well as some signal degradation which can impact the function of more sensitive components. You should be good up to around 700-800mm but this has not yet been tested at the time of writing.
6. At the end of the document is a harness specification which can be used as an example to help with wiring the control board to the Divider PCB.

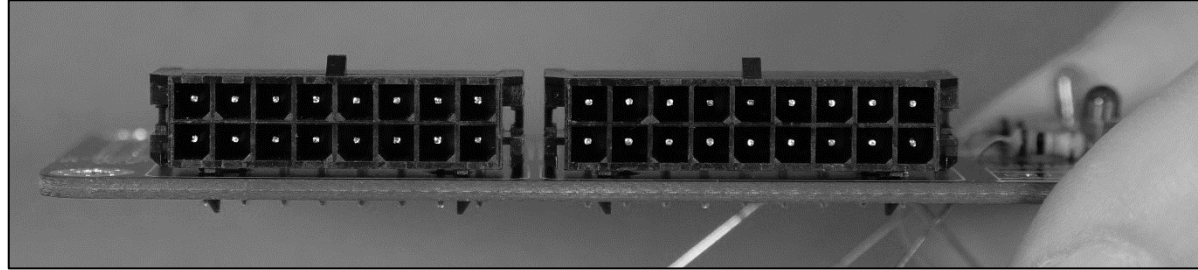
Pin Diagrams



Divider PCB TOP

PCB to Control Board

Micro-fit Connector 02x08



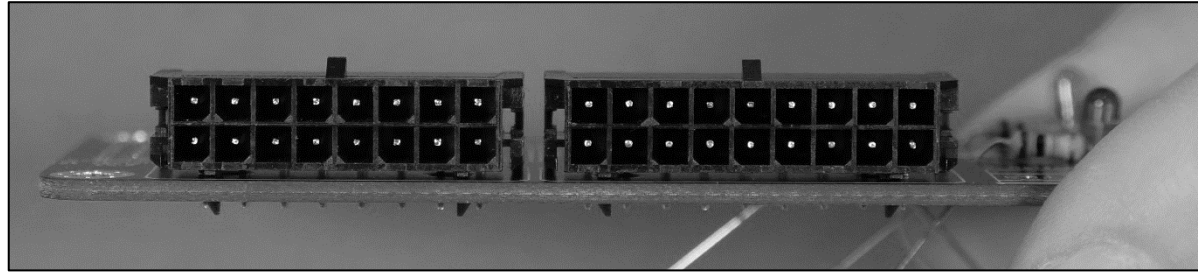
Layout, as per orientation of above image. 02x08 is the connector on the left.

16	15	14	13	12	11	10	9
8	7	6	5	4	3	2	1

Pin connections

Pin	Connection	Pin	Connection
1	Extruder 3 (Green, 1A)	9	Extruder 4 (Red, 1B)
2	Extruder 1 (Blue, 2B)	10	Extruder 2 (Yellow, 2A)
3	Z Motor 3 (Red, 1A)	11	Z Motor 4 (Blue, 1B)
4	Z Motor 1 (Black, 2B)	12	Z Motor 2 (Green, 2A)
5	X Motor 3 (Red, 1A)	13	X Motor 4 (Blue, 1B)
6	X Motor 1 (Black, 2B)	14	X Motor 2 (Green, 2A)
7	Y Motor 3 (Red, 1A)	15	Y Motor 4 (Blue, 1B)
8	Y Motor 1 (Black, 2B)	16	Y Motor 2 (Green, 2A)

Micro-fit Connector 02x09



Layout, as per orientation of above image. 02x09 is the connector on the right.

18	17	16	15	14	13	12	11	10
9	8	7	6	5	4	3	2	1

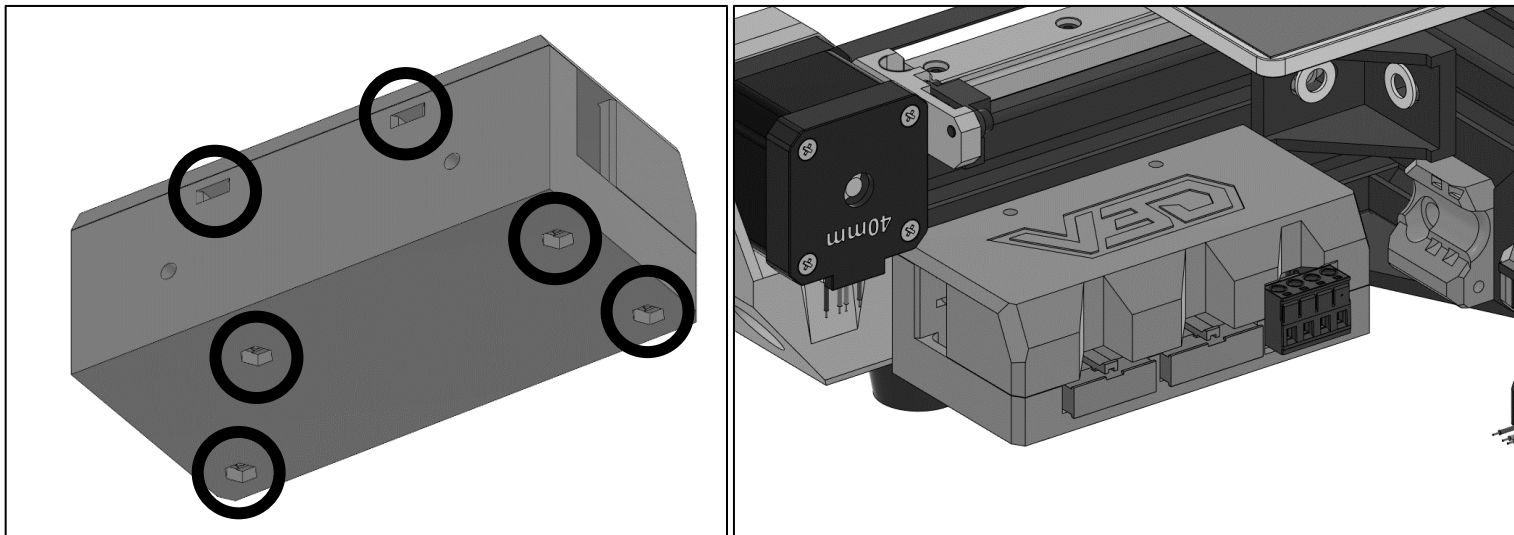
Pin connections

Pin	Connection	Pin	Connection
1	Endstops +V	10	GND
2	Probe +V	11	Servo +V
3	Bed Thermistor 2	12	Bed Thermistor 1
4	Hotend Thermistor 2	13	Hotend Thermistor 1
5	Servo Signal	14	Probe Signal
6	Hotend Fan RPM	15	Hotend Fan -V
7	Part Fan RPM	16	Hotend Fan +V
8	Part Fan +V	17	Part Fan -V
9	Y Min Endstop Signal	18	X Min Endstop Signal

Mechanical Assembly

Mounting the PCB to the enclosure, and enclosure to the printer is simple. Access to the screw heads for mounting the PCB to the enclosure can be difficult after the PCB is installed so it's recommended to mount the enclosure to the printer first, then install the PCB into the enclosure.

1. Replace the Y end stop with the modified one provided to allow space for the enclosure.
2. Prepare the enclosure by installing the 6 M3 Hex Nuts.
 - a. Four secure to the underside, and two go in the back to secure the lid.
3. Fit the enclosure to the printer.
 - a. It secures at the rear of the printer as shown in the image below
 - b. Use two M3 x 12 screws and two M3 3030 hammer nuts to secure it in place.
4. Install the PCB into the enclosure using 4 M3 x 8mm screw.



Bill of Materials Table

Item	Quantity	Some of it	Most of it	All of It
Divider PCB	1	Yes	Yes	Yes
3mm LED	2		Yes	Yes
10k Resistor	2		Yes	Yes
BAT 85 Diode	1		Yes	Yes
JST 4 Pin Header	4		Yes	Yes
JST 4 Pin Plug	4			Yes
JST 3 Pin Header	6		Yes	Yes
JST 3 Pin Plug	6			Yes
JST 2 Pin Header	2		Yes	Yes
JST 2 Pin Plug	2			Yes
JST crimp terminal	90			Yes
Terminal Block 4 pin	1		Yes	Yes
Pluggable Terminal Block 04	1		Yes	Yes
Microfit 02x08 Header	1		Yes	Yes
Microfit 02x08 plug	1			Yes
Microfit 02x09 Header	1		Yes	Yes
Microfit 02x09 plug	1			Yes
Microfit male crimp terminal	40			Yes
Bootlace Ferrule 18AWG RED	4			Yes
Bootlace Ferrule 18AWG BLACK	4			Yes
M3 Hex Nut	6		Yes	Yes
M3x6 Cap Screw	4		Yes	Yes
M3x12 Cap Screw	4		Yes	Yes
M3 3030 Hammer Nut	3		Yes	Yes
Zip Ties	6			Yes

Harness Example Specification

Harness	Pin	Connector	Connector ID	Function	Connector 2	Connector ID2	Pin2
1	1	Micro-fit 3 02x08	1	E Motor	JST XH 4-Pin	A	3
1	2	Micro-fit 3 02x08	1	E Motor	JST XH 4-Pin	A	1
1	3	Micro-fit 3 02x08	1	Z Motor	JST XH 4-Pin	B	3
1	4	Micro-fit 3 02x08	1	Z Motor	JST XH 4-Pin	B	1
1	5	Micro-fit 3 02x08	1	X Motor	JST XH 4-Pin	C	3
1	6	Micro-fit 3 02x08	1	X Motor	JST XH 4-Pin	C	1
1	7	Micro-fit 3 02x08	1	Y Motor	JST XH 4-Pin	D	3
1	8	Micro-fit 3 02x08	1	Y Motor	JST XH 4-Pin	D	1
1	9	Micro-fit 3 02x08	1	E Motor	JST XH 4-Pin	A	4
1	10	Micro-fit 3 02x08	1	E Motor	JST XH 4-Pin	A	2
1	11	Micro-fit 3 02x08	1	Z Motor	JST XH 4-Pin	B	4
1	12	Micro-fit 3 02x08	1	Z Motor	JST XH 4-Pin	B	2
1	13	Micro-fit 3 02x08	1	X Motor	JST XH 4-Pin	C	4
1	14	Micro-fit 3 02x08	1	X Motor	JST XH 4-Pin	C	2
1	15	Micro-fit 3 02x08	1	Y Motor	JST XH 4-Pin	D	4
1	16	Micro-fit 3 02x08	1	Y Motor	JST XH 4-Pin	D	2
2	1	Micro-fit 3 02x09	2	Endstops +V	JST XH 3-Pin	K	1
2	2	Micro-fit 3 02x09	2	Probe +V	Mini-PV (dupont) 1 pin	S	1
2	3	Micro-fit 3 02x09	2	Bed Thermistor	JST XH 2-Pin	E	1
2	4	Micro-fit 3 02x09	2	Hotend Thermistor	JST XH 2-Pin	F	1
2	5	Micro-fit 3 02x09	2	BI Touch Servo	JST XH 3-Pin	I	1
2	6	Micro-fit 3 02x09	2	Hotend Fan RPM	Mini-PV (dupont) 1 pin	T	1
2	7	Micro-fit 3 02x09	2	Part Fan RPM	Mini-PV (dupont) 1 pin	U	1
2	8	Micro-fit 3 02x09	2	Part Fan +	JST XH 2-Pin	G	2
2	9	Micro-fit 3 02x09	2	Y Min	JST XH 3-Pin	K	3
2	10	Micro-fit 3 02x09	2	GND	Fork	N	1
2	11	Micro-fit 3 02x09	2	Servo +V	JST XH 3-Pin	I	2
2	12	Micro-fit 3 02x09	2	Bed Thermistor	JST XH 2-Pin	E	2
2	13	Micro-fit 3 02x09	2	Hotend Thermistor	JST XH 2-Pin	F	2
2	14	Micro-fit 3 02x09	2	Probe Signal	JST XH 2-Pin	M	1
2	15	Micro-fit 3 02x09	2	Hotend Fan -	JST XH 2-Pin	H	1
2	16	Micro-fit 3 02x09	2	Hotend Fan +	JST XH 2-Pin	H	2
2	17	Micro-fit 3 02x09	2	Part Fan -	JST XH 2-Pin	G	1
2	18	Micro-fit 3 02x09	2	X Min	JST XH 3-Pin	L	3
3	1	Ferrule	3	Bed - (180W)	Ferrule	O	1
3	1	Ferrule	4	Bed + (180W)	Ferrule	P	1
3	1	Ferrule	5	Hotend + (60W)	Ferrule	Q	1
3	1	Ferrule	6	Hotend - (60W)	Ferrule	R	1