MakerTrack.com
XL Build Instructions - Electronics
RAMBo controller
V. 6

Questions?

Email us at makertrack.com@gmail.com

Dropbox

https://www.dropbox.com/sh/n8lmtovijespx0l/kO2hYADJ_T

Note: Your controller already has the firmware installed. No need to upload firmware. The firmware is located in the DropBox folder above for your reference.

Use a good quality power strip with breaker:

It is a good idea to use a power strip for both power cables (heated bed and electronics). Some of our bigger printers use as close to 20amps due to the very large heated bed. It is always a good idea to unplug the printer when not in use.

Controller Schematic:
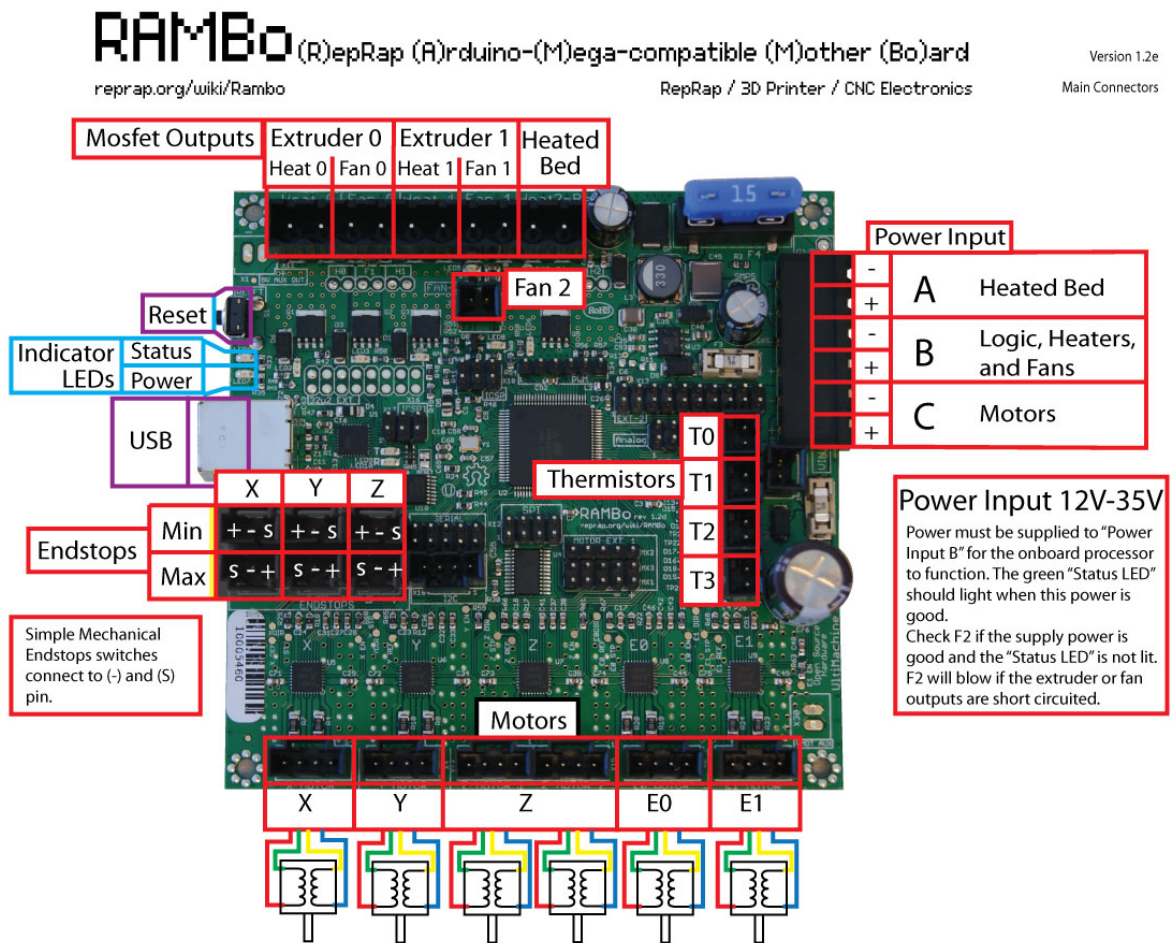
RAMBo includes a set of connectors (bag).

Controller Overview

In this brief overview, I'll cover the basic functions of the controller. In short, you have motor control and heater control.

Motors and End stops

Motors provide movement for X,Y,Z and extruders. There are connections for the motors at the bottom of the schematic via 4 wires.

Motors have limit switches (end stops) that tell them where the boundaries of the machine are. Only MIN end stops are used for X,Y,Z axis. You will find their connections on the left side of the controller.
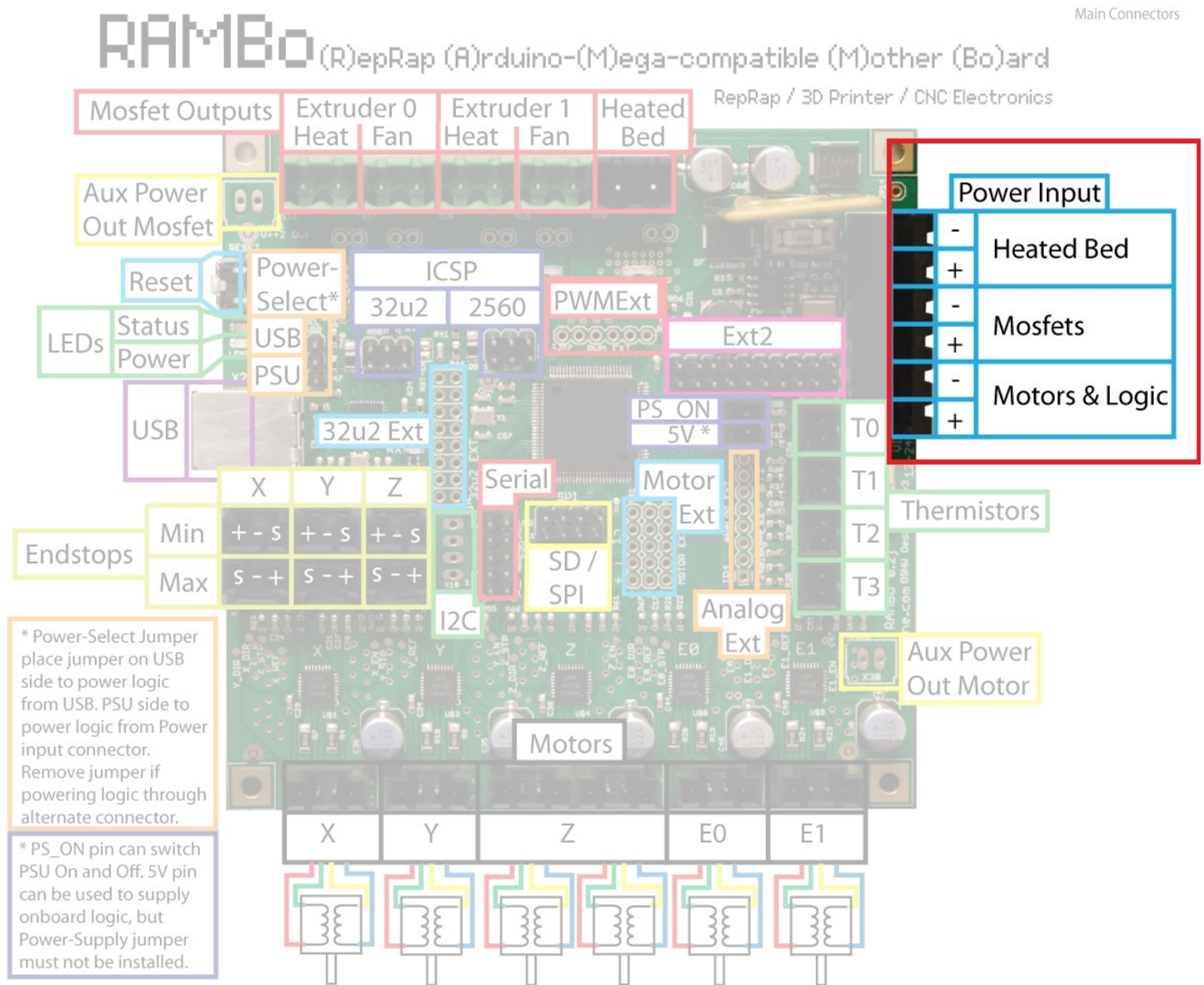
Heaters and Thermistors

Extruders require heat to melt the plastic filament and heated beds heat to bond filament to the bed. This is done with a small heater cartridge on the hotend (on extruder) and a sheet heater for the heated bed. Connections are at the top of the controller.

Thermistors are the temperature regulators. This device monitors the temp of the hotend and heated bed. The controller will turn on and off to keep the heaters within a specified range. Thermistors connections are on the right side of the controller.

In the following pages, where to install wires for the items above is described.

Power Input to controller

RAMBo (R)epRap (A)rduino-(M)ega-compatible (M)other (Bo)ard
RepRap / 3D Printer / CNC Electronics
Main Connectors

Mosfet Outputs | Extruder 0 Heat | Fan | Extruder 1 Heat | Fan | Heated Bed

Aux Power Out Mosfet

Reset

LEDs | Status | Power

Power-Select* | ICSP | 32u2 | 2560 | PWMExt
USB | PSU | Ext2

USB | 32u2 Ext | PS_ON 5V * | T0

Endstops | Min | X +-S | Y +-S | Z +-S | Serial | Motor Ext | T1
Max | X S-+ | Y S-+ | Z S-+ | SD / SPI | T2
I2C | Analog Ext | T3

Thermistors

Aux Power Out Motor

Power Input
- Heated Bed
+
- Mosfets
+
- Motors & Logic
+

Motors
X | Y | Z | E0 | E1

* Power-Select Jumper place jumper on USB side to power logic from USB. PSU side to power logic from Power input connector. Remove jumper if powering logic through alternate connector.

* PS_ON pin can switch PSU On and Off. 5V pin can be used to supply onboard logic, but Power-Supply jumper must not be installed.

CAUTION: Be sure to wire to the correct polarity (positive/negative) or you will damage the board.

The controller requires 3 pairs (6 wires) from the power supply. Use the supplied RED/BLACK 18awg wire to connect 3 pairs RED/ + and BLACK/ - .

Always turn power off to any electronic device before working on it.
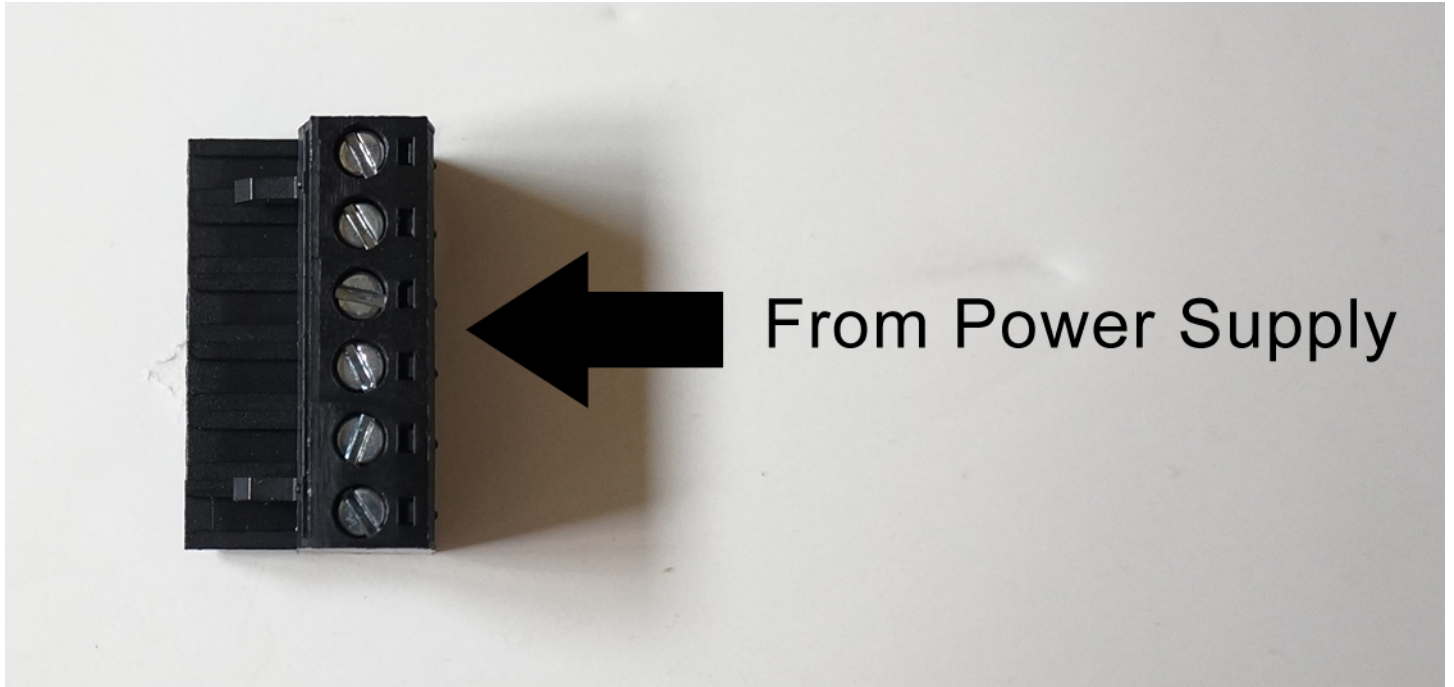
From Power Supply

The screw terminal connector above is part of your controller kit (in a bag). Note that it is keyed and will only insert one way.

Again, be mindful of the polarity of the input wiring so you do not damage your controller.
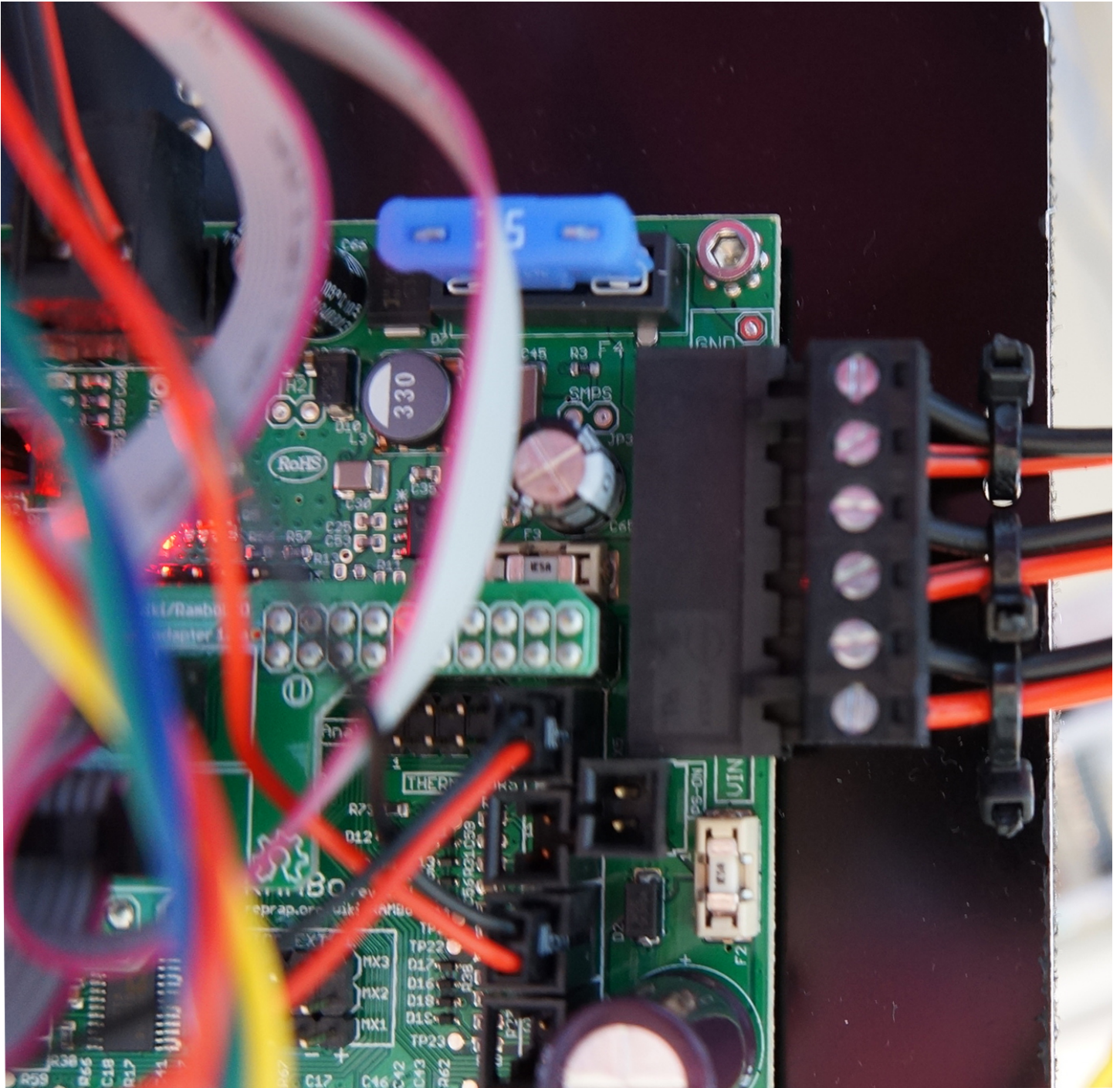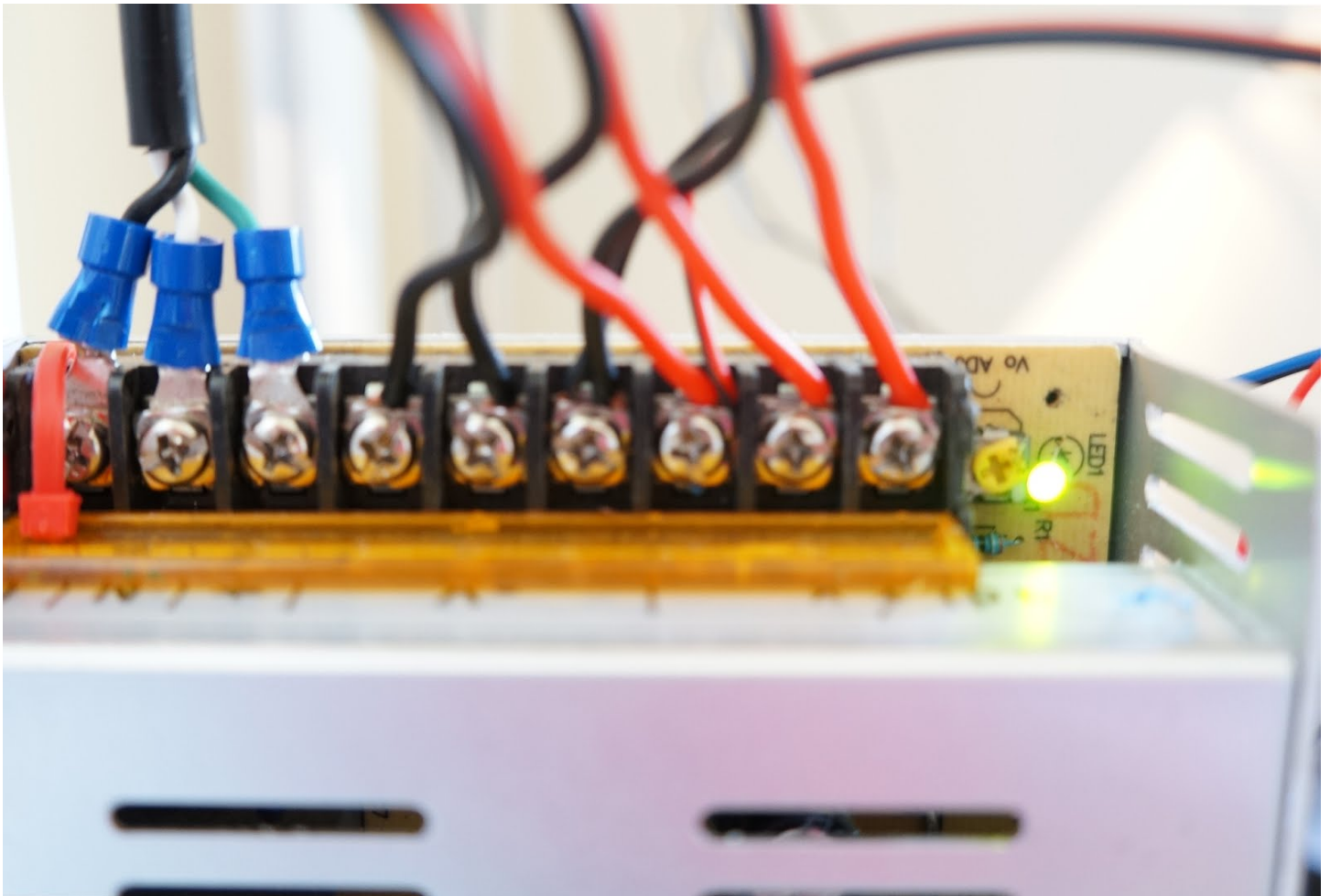
Power Supply

3 prong plug wiring plugs into:

- Black - Load
- White - Neutral
- Greed - Ground

Positive (+) and Negative (-) leads go from power supply to controller.

⚠ Your power supply may differ. Check polarity on each connection first.

Motor Connections / Extensions

Due to the size of the printer, motors leads may need to be extended. Only 1 type of motor is used for all axis and extruder. Use the supplied shielded 4 conductor wire to extend the motor leads by stripping, soldering and then protecting each wire with a section of the supplied shrink tube.

All bare wires need to attach to the controller using the the supplied 4 conductor locking molex connector.

The motor wires and the extension wires are not the same color. So, please use the chart below for reference.

Check diagram for wire order and sequence. If using extension wire, substitute colors using chart below.

Standing in front of the printer (top motors in front of you), the X motor on right side, Y motor is on left. The Z motors at the bottom of the printer are both connected to the same Z terminal in parallel on the controller.

Motor Wire	Connection	Extension Wire
black / blue		black
yellow		white
green		green
red		red
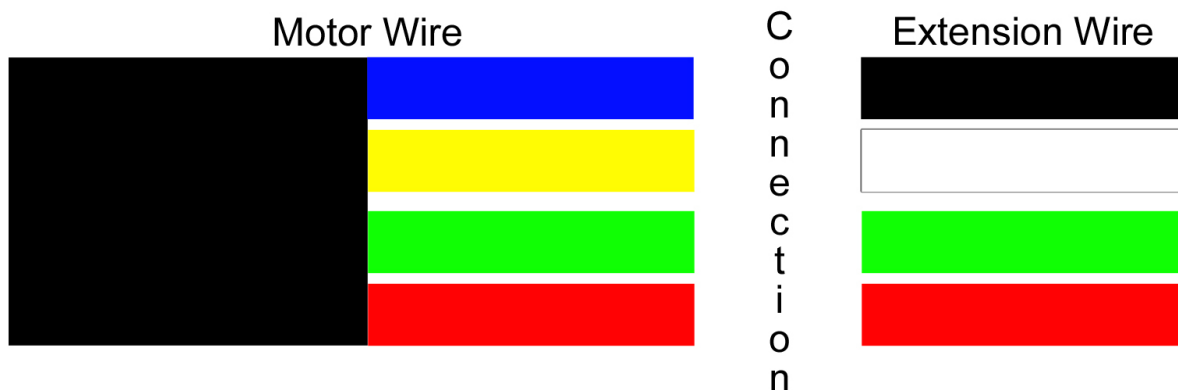
Since the wire colors of the motor and the shielded cable do not match, use the conversion above.

End Stops:

⚠ Do not connect to "+". Connecting to "+" may damage your controller.

There are 3 end stops on the each printer axis - X,Y,Z. See diagram.

Similar to the motors, you will have to extend the end stop wires with the included 24awg 2 conductor red/black wire. Solder the connections to the end stops. Only two connections need to be wired - middle + the side on the hinge (not the open side of the hinge). See controller diagram (previous page). Connect 2 wires to "S" and "-" ONLY. Do not connect to "+". Connecting to "+" may damage your controller. Wires can go to either spot, since their orientation does not matter.

Mcode - M119 checks end stop status. Enter this code in your controller software Gcode window to get status.

The Z end-stop and adjustments shown below.

Thermistors:

There are 2 thermistors - heated bed, hotend.

Use supplied 2 conductor 24awg wire to extend as needed. Wire orientation/polarity does not matter. Wires can plug into any of the 2 required spots on the controller.

Connect to controller with supplied keyed connectors.

Look for T0 and T2 on the controller board.

T0 - hotend thermistor
T2 - heated bed thermistor

The heated bed has 2 black wires that are connected to the thermistor.
The hotend thermistor is usually black and red.

Extruder Hotend Power:

The hotend is heated by a ceramic cartridge heater which has a 2 conductor connection. On the diagram, it is marked " Extruder 0 Heat".   Orientation of wires does not matter. Use supplied keyed connector with a screw terminal.

If you need to extend the wire, be sure to use the supplied 18awg wire.

Heated Bed Power:

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CAUTION: While the 115VAC connection has already been made, it is important that you safely handle the heater wiring. Stop using the heater if you smell something burning, see damage to wire or see smoke. That indicates damage to the device and should not be used.

Your heated bed is an industrial style 115VAC silicone heater. Since your controller only provides DC power, another power plug is dedicated just for the heater. Control happens via a relay DC signal from the controller that switches the relay on and off. When the relay is on, 115VAC is sent to the heated bed.

Your AC side is already connected. You do need to connect the controller to the relay (see diagram below).

Use the 2 conductor wire 24awg wire provided to connect. RED is "+" and BLACK is "-" on both the controller and the relay.

Troubleshooting:

You can test the relay by connecting a 9 volt battery to the DC side. Mind the polarity of your connections. When the relay switches on, a red light turns on and 115VAC is sent to the heater.
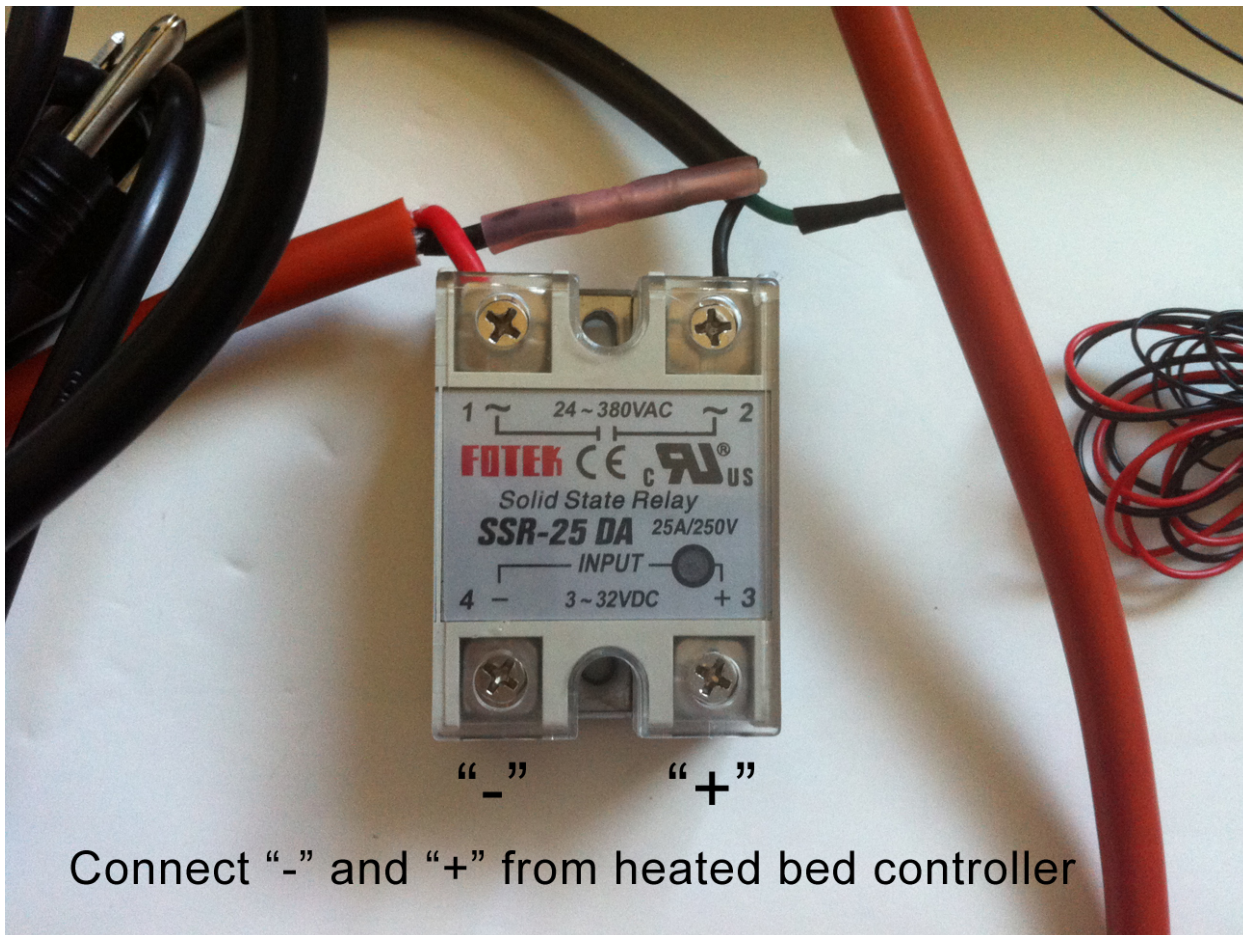
Connect "-" and "+" from heated bed controller

Extruder fan:

CAUTION: The fan on the hotend must be on at all times. If not, the filament may jam.

The fan on the hotend extruder should be on full time to keep the hotend from overheating and causing filament to jam.

Extend and connect directly to the positive and negative terminals on the power supply unit using supplied 24awg wire.

Windows Driver

Windows requires a driver to communicate with RAMBo. Download this file [File:RAMBo USBdriver.zip](#) and unzip it into a known location on your computer. In windows 7, plug in your RAMBo board, and let windows fail to find the driver. Then, go to the start menu, right click on computer and click properties. On the left, click on Device Manager. Scroll down to Unknown Devices, and right click on RAMBo. Choose Update driver. CLick on "Browse my computer for driver software", then click on "Let me pick from a list of device drivers on my computer", then click the button for "Have Disk" and then click browse and point it to the file you downloaded above.

Link to driver: [RAMBo USB driver for Windows](#)

Pronterface

Pronterface is your 3d printer controller. It is what you use to control the movement and temp as well as submit Gcode files to the 3d printer.

A ZIP file with the program is available here:

http://koti.kapsi.fi/~kliment/printrun/

Settings:

- Rambo controller - 2500000 baud rate
- Port - Click on this button to find your controller port.

Connecting to your 3d printer:

- Press the connect/disconnect button

LCD controller:

The RAMBo controller has a separate daughter board for the controller.

The LCD controller has 2 short ribbon cables that transmit 5v power and data.   They are short since radio noise/cross talk will cause errors in the controller. It is important not have the ribbon cables by any motor wiring or any other wiring that can produce radio noise.

The connectors on the controller are located in the center of the controller. Each cable and connection is keyed.

Troubleshooting: If the LCD does not light up, switch position.

End Stops:

NOTE: It is important that you make sure that the end stops are aligned and actually hit their mark when you start using the printer.

ONLY connect to the **MIN** side of the end stop connections.

X and Y axis - with the motors off, you can gently push them towards the end stop and verify they engage in the right location. That location should be on the glass at the extreme limits of the build platform. Adjust end stop locations if needed.

Z axis - with the motors off, you can turn the Z threaded rods until the reach the end stops. You can do this by hand, but it may take a while. Adjust end stop. The hotend and end stop should be very close to the bed, but not run into it. We will make final height adjustment with the bed screws during bed leveling.

You can engage the endstop with your finger to stop the axis from moving. This is helpful if you find your carriage going in the wrong direction. If your axis crashes in to the printer and you can't get it to stop, you can press the CONNECT/DISCONNECT button in pronterface to stop the printer.

Endstop locations:

When you hit "HOME" for each axis, with will travel towards it's endstop.

X - travels front to back. endstop is located left/rear.
Y - travels left and right. endstop on left side (next to extruder)
Z - travels up and down. endstop located on left side printer
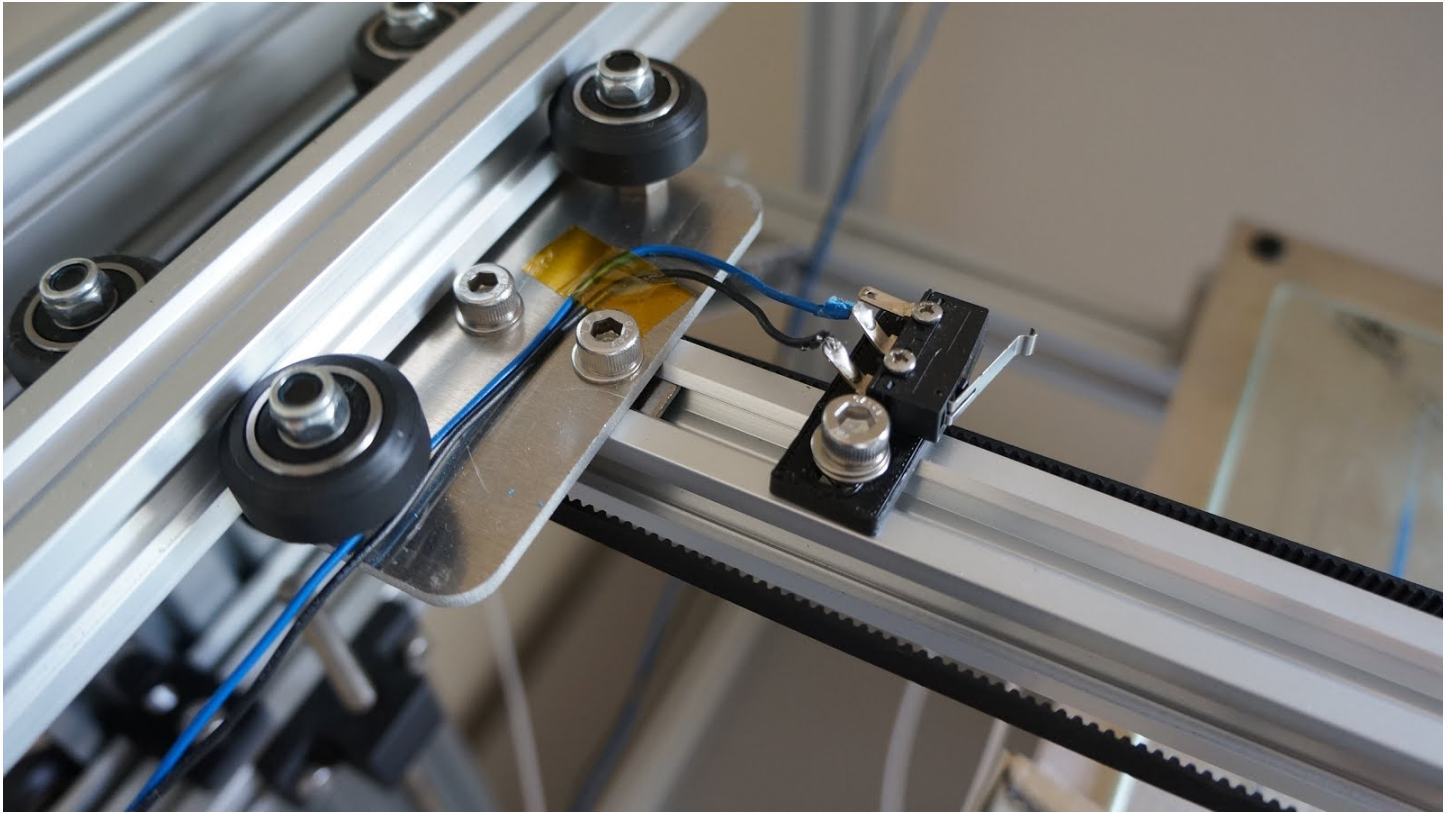
Testing end-stops -

> In proterface, you can check each enstop by entering m119 in the gcode window. Press each end-stop (close it) and then enter m119

Belt Guide

x axis

Top View

y axis

Y motor

X motor

FRONT

Belt Guide
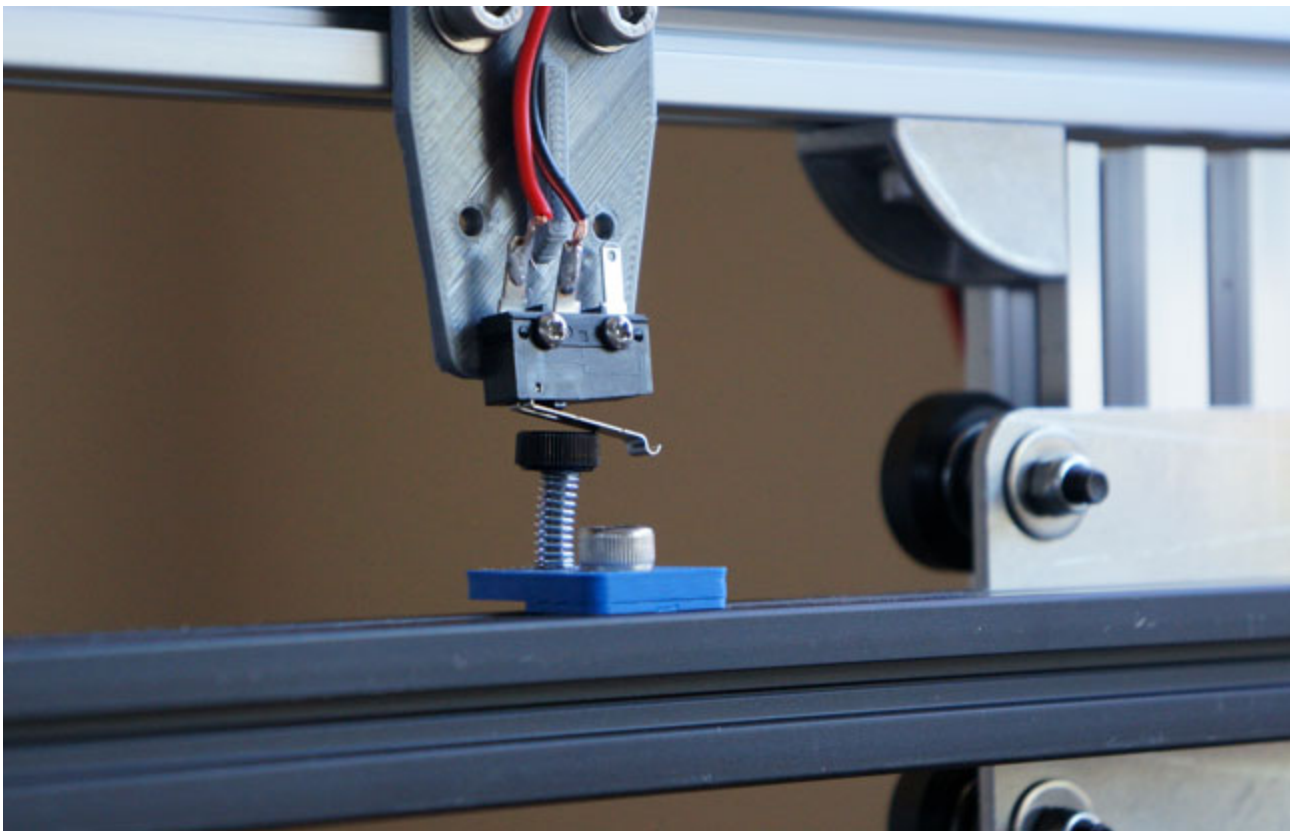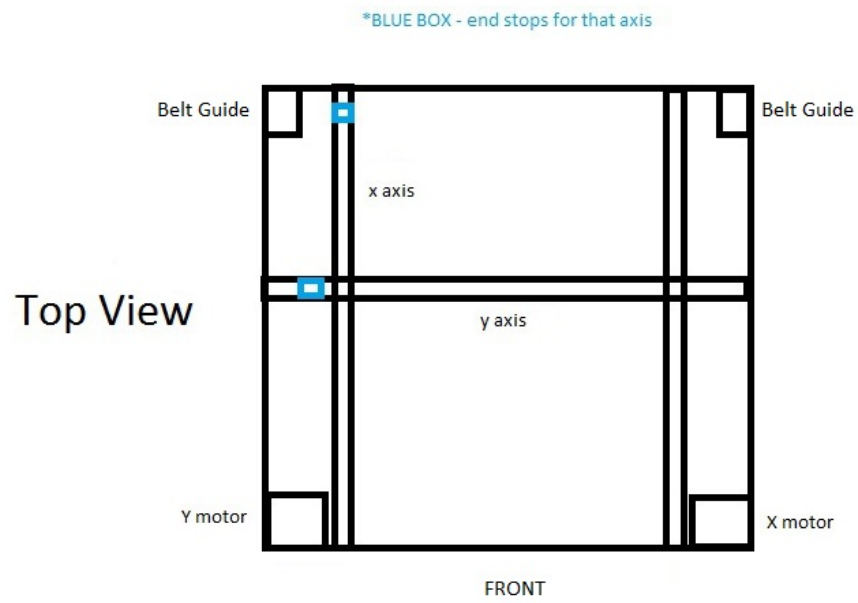
The Z end stop components include the end stop switch assembly and the adjustable end stop.
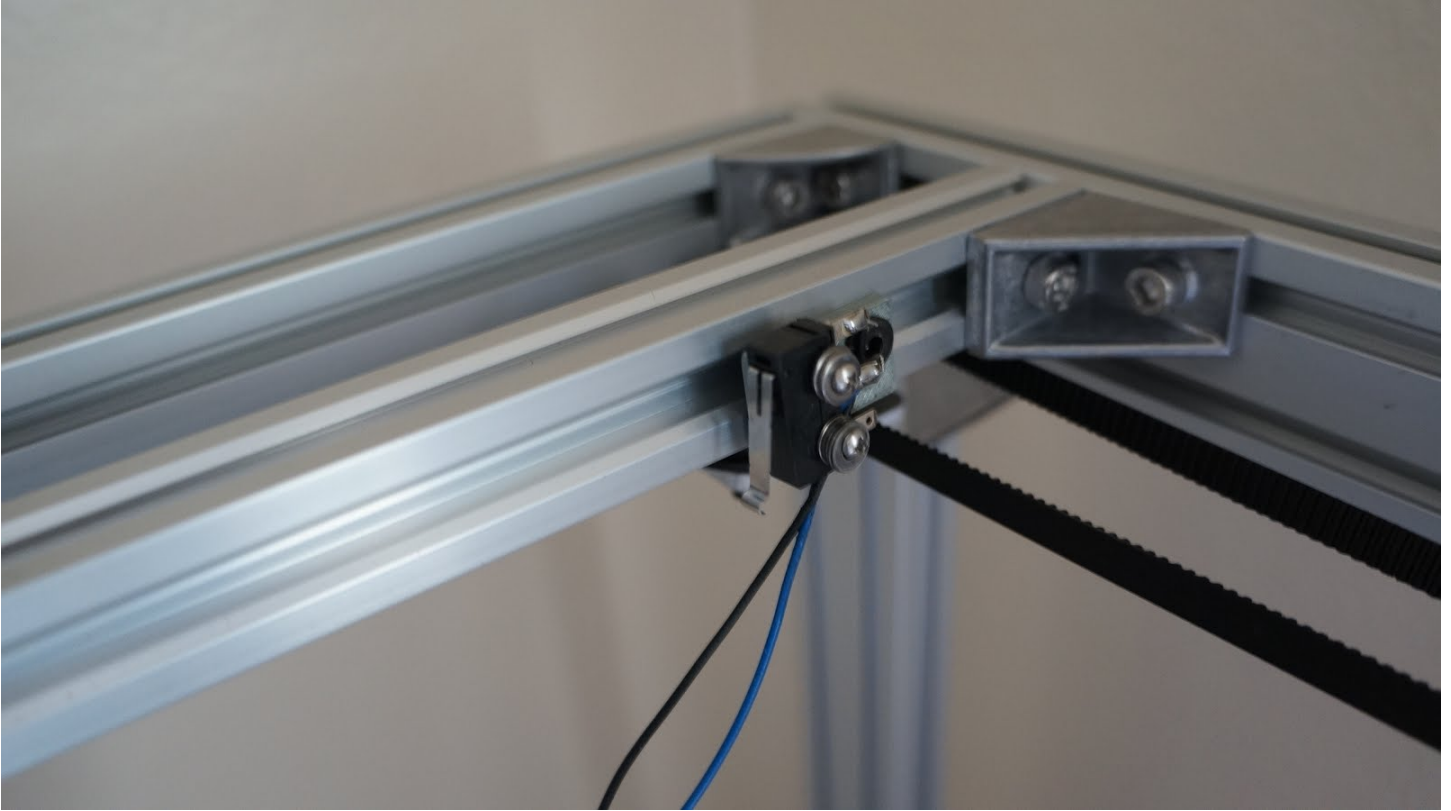
The X endstop is located at the back right corner of the printer.

Y end stop is located on the left side of the extruder beam.

UPDATE: The Y end stop switch is now located on the extruder carriage. Photos to come

Extruder Carriage cable bundle

With quite a few wires going to it and it constantly moving, the extruder carriage requires some support to keep the wires in orderly.

We have supplied a beam mount and tubing that you'll zip tie your wires to.
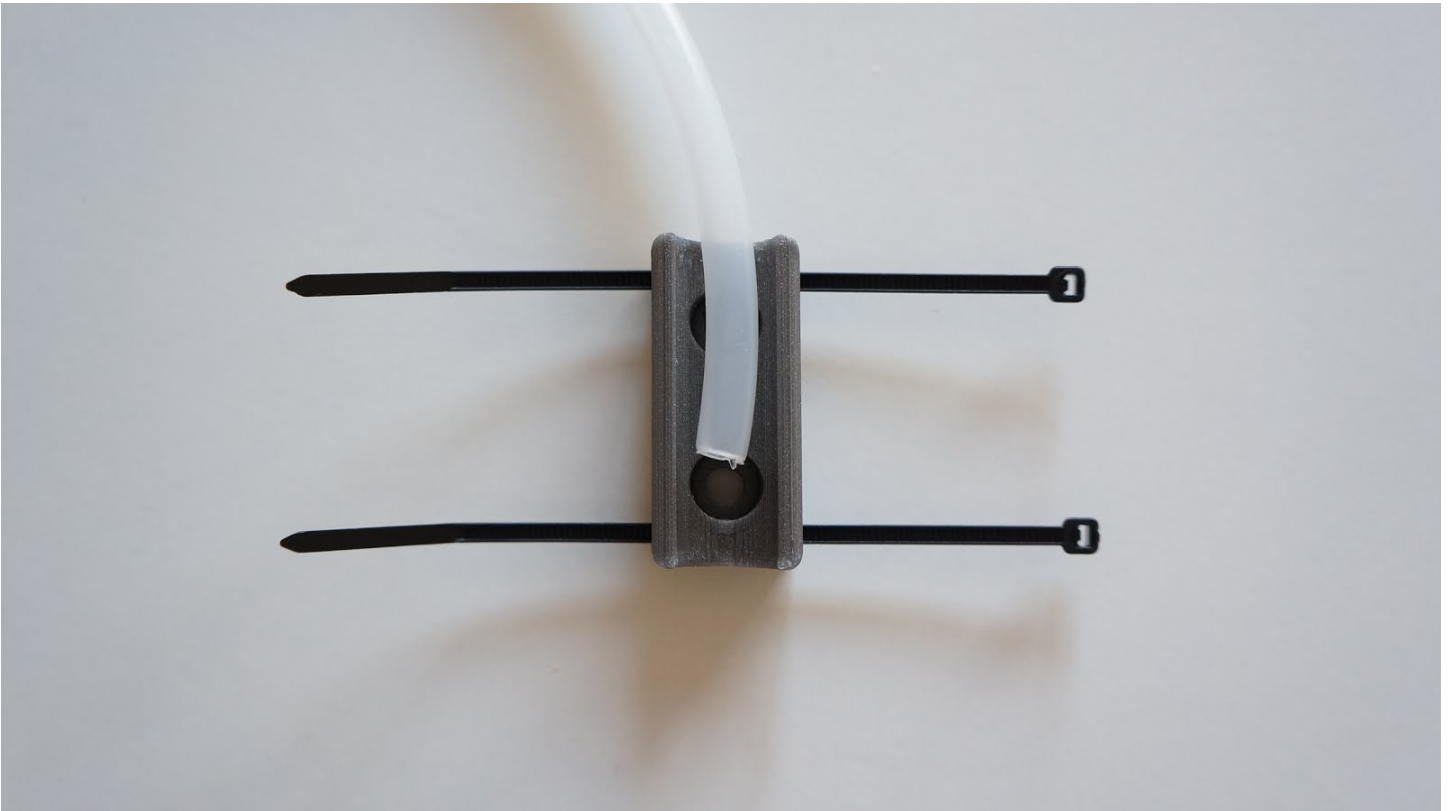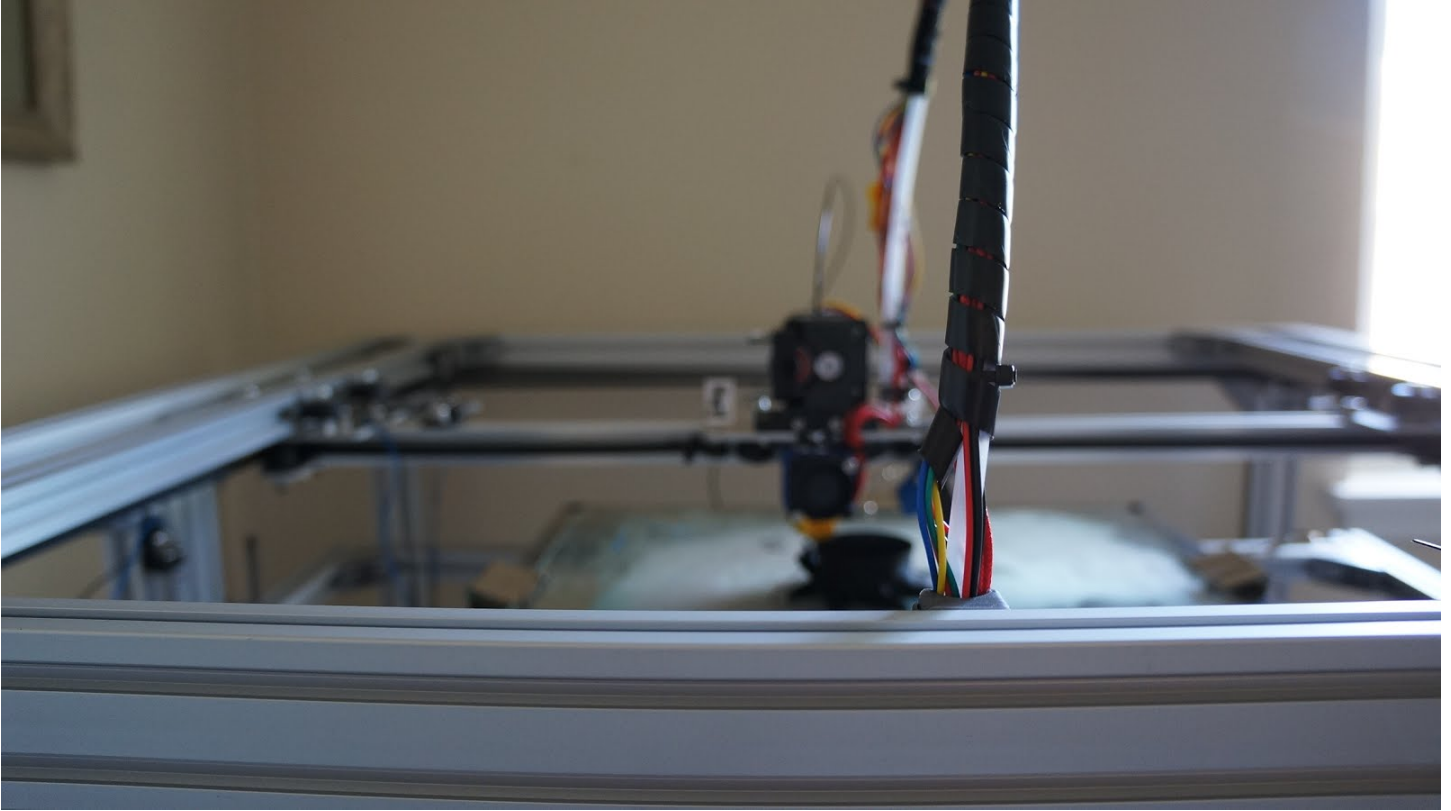
The umbilical cord will likely lay down, but that doesn't seem to be an issue. It is important that you make sure there is enough tubing so you don't constrain the extruder carriage.

Testing extruder and heated bed:

The extruder and heated bed are the HOT items on the printer. Be very careful not to touch them and while you are working around them. You can get burned.

Extruder Test:

Bring your extruder up to temp and run filament through it. A few feet should be enough. The goal is verify that the filament is flowing properly. Filament should not drip or smoke (excessively). If it does, the temp is too high. If it struggles to extrude, you can raise the temp 2 degrees at at time.   It should be a smooth and consistent operation.

NOTE: The fan on the extruder must be on full time.

(Youtube Video needed)
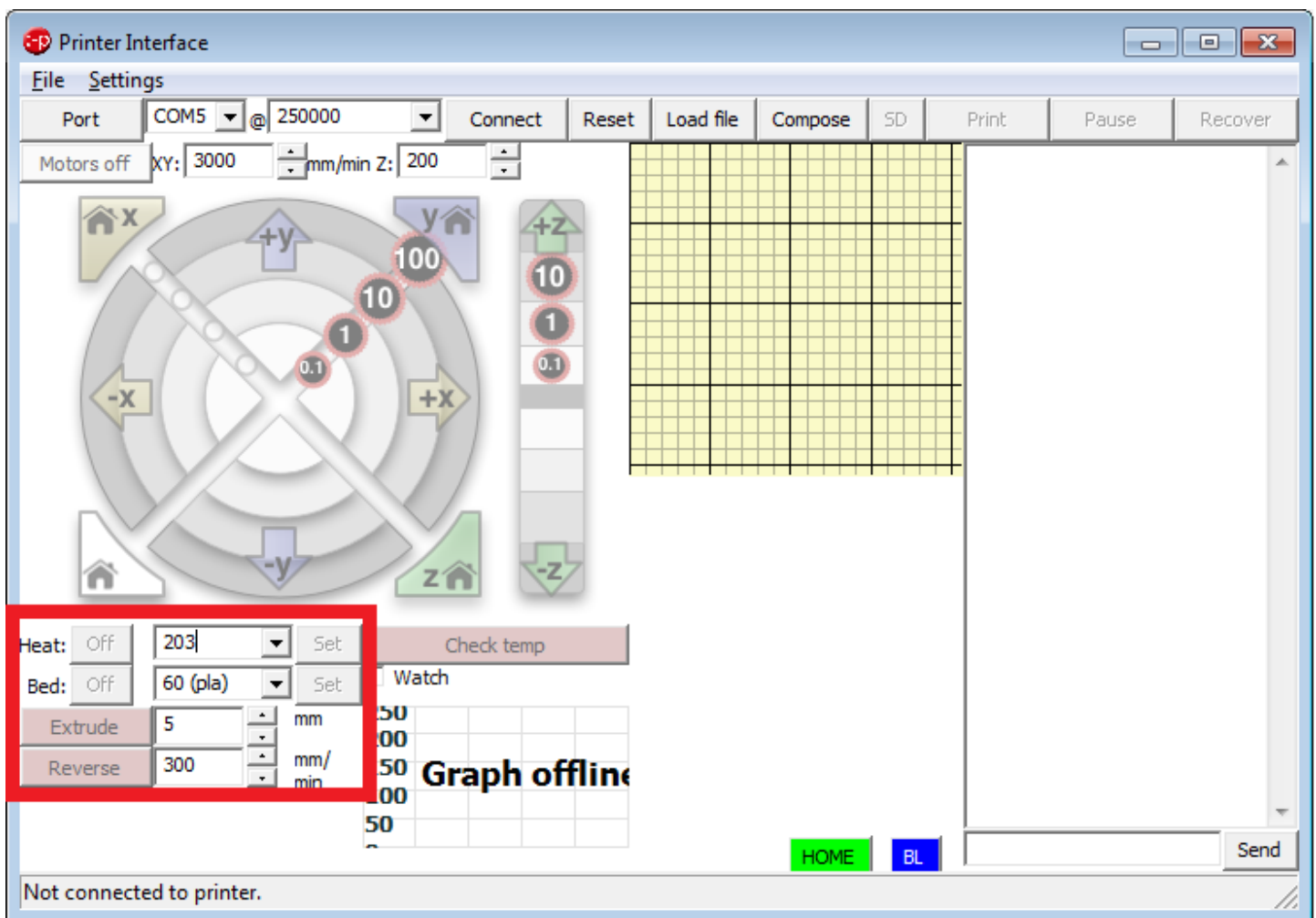
Heated Bed Test:

The heated bed should be tested for at least 15 minutes. Stop if you see or smell anything out of the ordinary (smoke/smells).   60C is for PLA and 110C is for ABS.

Arduino IDE

If you are going to update or modify your firmware, you'll need to use the Arduino IDE located in the DropBox link on the first page of the document. You'll find Marlin firmware and the Arduino IDE pre-packaged for the Rambo. Pre-packaged means that the Add-On for the Rambo controller board and LCD are already installed. Without the add ons, Rambo will not be seen as a board type in Arduino IDE and the LCD will not work (blank)

NOTE: It is critical that Rambo be chosen as the board type. If not, the board will not work properly.