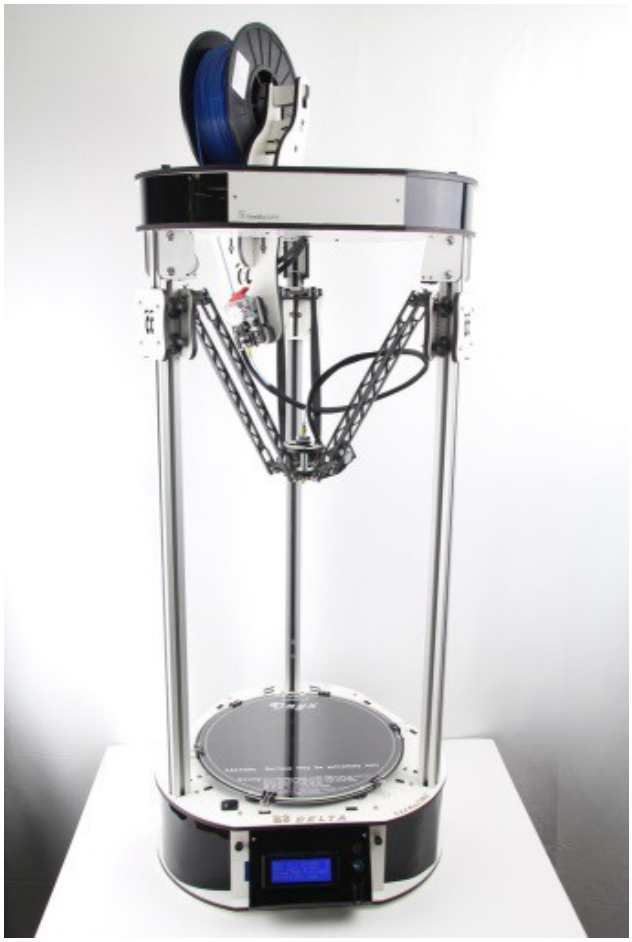
Rostock MAX v2 Assembly Guide

SeeMeCNC™
3D Printers & More

Welcome to the Assembly Guide for the Rostock MAX v2.0 3D printer.
Version 0.08, March 2nd, 2014

Questions or corrections should be emailed to geneb@deltasoft.com

Disclaimer text provided by LulzBot



READ ME FIRST!

READ THIS MANUAL COMPLETELY BEFORE ASSEMBLING AND POWERING UP YOUR PRINTER!

Hazards and Warnings

The SeeMeCNC Rostock MAX 3D printer has motorized and heated parts. When the printer is in operation always be aware of possible hazards.

Electric Shock Hazard

Never open the electronics bay of the printer while the printer is powered on. Before removing the access door, always power down the printer and unplug the AC line cord.

Burn Hazard

Never touch the extruder nozzle or heater block without first turning off the hot end and allowing it to completely cool down. The hot end can take up to twenty minutes to completely cool. Also, never touch recently extruded plastic. The plastic can stick to your skin and cause burns.
Also before of the heated bed which can reach high temperatures capable of causing burns.

Fire Hazard

Never place flammable materials or liquids on or near the printer when powered on or in operation. Liquid acetone and vapors are extremely flammable.

Pinch Hazard

When the printer is in operation, take care to never put your fingers in the moving parts, including the belts, pulleys or gears. Also, tie back long hair or clothing that can get caught in the moving parts of the printer.

Static Charge

Make sure to ground yourself before touching the printer, especially the electronics. Electrostatic charges can damage electronic components. To ground yourself, touch a grounded source.

Age Warning

For users under the age of 18, adult supervision is recommended. Beware of choking hazards around small children.

Table of Contents

0 – Introduction and Acknowledgments

I’d like to welcome you to the Rostock MAX v2 assembly guide!

Even if you've built an original Rostock MAX v1 3D printer, you'll want to read this manual carefully. There are no original Melamine parts left from the original design. The construction has been greatly streamlined and should prove to be a shorter build. The design changes made will ensure that you've got a long lasting, easy to calibrate, delta configuration 3D printer.

Please read this entire guide before you begin assembly of your new Rostock MAX v2! It will help you avoid any unpleasant surprises and will ensure that you’ve got everything you need BEFORE you need it! Understand that the photographs in this assembly guide do NOT tell the whole story of each step! Make sure you read and understand the accompanying text for each step!

A quick note on the RAMBo, the controller for your Rostock MAX. The RAMBo is static sensitive, so please don't take it out of the static bag it ships in until you're ready to use it.

The box containing the RAMBo and its wiring should also contain a printed, black & white sheet that looks like this:

http://www.reprap.org/wiki/File:Rambo-conn-all.jpg

Please refer to this sheet when you reach xxxxxx. This is a valuable guide to wiring the RAMBo up to your Rostock MAX. Note that the connector polarity is clearly marked on the board for the “MOSFET Outputs”.

Acknowledgments

I'd like to thank LulzBot for the use of their images in the Troubleshooting Section and safety disclaimer as well as the gentleman that runs http://minow.blogspot.com.au/ for his excellent guide on calibrating delta configuration 3D printers.

I'd also like to thank the whole gang over at the SeeMeCNC forums for providing excellent feedback. This would be a much lesser creation without their contributions and insights.

1 – Required and Optional Tools And Materials

Before you begin assembly of your Rostock MAX v2, please make sure you've got everything on the following list of tools and additional materials.

- P1 & P2 sized Phillips screwdrivers
- Standard flat head screwdriver
- 3/32" Allen (hex) wrench. A ball-end, T-handle version is a good choice for this and the other sizes of Allen wrenches used
- 5/32" Allen (hex) wrench.
- 7/16" Allen (hex) wrench.
- Needle nose pliers
- Forceps – these will come in handy when routing the belts and reaching for small, hard to reach parts. They can be purchased from Amazon for as little as $3.50 for a set of two.

- Wire strippers
- Wire cutters
- 5/16" open-ended wrench (Used primarily on the nuts that hold the Cheapskates together)
- 2 7/16" open end wrenches. (used to adjust Cheapskate Bearings)
- 11/16" open-ended wrench (used for hot-end mount)
- PermaTex Ultra Copper High Temp RTV

- A small razor knife like an X-Acto knife. This will be handy for cleaning the flashing off the injection molded parts.
- 1/2” wide roll of Kapton tape
- Uninsulated crimp on connectors, sized for 22-18ga wire.

  Radio Shack P/N 640-3036 is an excellent choice.
- A digital caliper. These can be purchased from Harbor Freight tools for around $10.

- A small squeeze clamp that can open at least 2”
- Crimping tool (Jameco P/N 159266 is a good choice)

- Battery powered screwdriver. If you ever needed an excuse to buy one of these, THIS IS IT.
- Pencil.
- 40W Soldering Iron.
- Blue thread locking compound (Loctite or Permatex Threadlocker Blue)
- A small file.

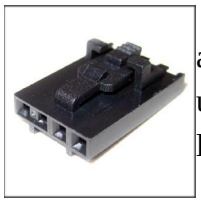
The following is a list of optional things that can make your life easier in the long run.

- Electrician's tape.
- Waxed lacing cord. You can use this in place of wire ties in pretty much any application. You can find it here: http://www.skygeek.com/wht-string.html. While expensive, you'll never really need to buy a wire tie again and it'll likely last you the rest of your life. :)
- .100” (2.54mm) Latching Polarized Male Housing (1x4) and matching crimp pins. This is used to add a connector to the end of the EZStruder extension cable and makes life a lot easier. You can purchase 2 of these connectors and their associated crimp pins from Hansen Hobbies (http://www.hansenhobbies.com/products/connectors/pt1inlpconnectors/pt1in_lp_1x4/) very inexpensively. The link for the pins is shown in the description for the male housing.

If you want to be able to change your hot end easily, I would highly recommend getting quick-disconnect connectors for the hot end as well as the PEEK and layer fans.

For the hot end, I'd recommend these four connectors:

This is a four pin, latching polarized male connector housing. This should be used on the hot-end heating resistor wires and thermistor wires. I'll illustrate the correct installation in the chapter that covers those steps.



This is a four pin, latching polarized female connector housing. This should be attached to the wires coming from the power supply. The female connector is used here in order to prevent accidental shorting of the power and thermistor leads.

This is a female JST connector. These are very nice connectors for both the PEEK and layer fans. These would be fitted to the power leads of the fans.

This is a male JST connector. Just as with the male hot end connector, these would be attached to the power wires coming up from the RAMBo.

The use of these connectors is entirely optional! This is how *I* like to rig my printers and it's entirely okay to not do this. The pre-built printers from SeeMeCNC don't include these connectors, so don't feel obligated to use them. Now that being said, having a quick-disconnect hot end is just *cool.* :)

The JST connectors can be purchased from Hansen Hobbies as well – just make sure you order the right pins! Read the description pages carefully.

The JST connectors can be found here:
http://www.hansenhobbies.com/products/connectors/miscconnectors/

The Latching Polarized connectors can be found here:

http://www.hansenhobbies.com/products/connectors/pt1inconnectors/

If you don't already have a crimping tool, the one shown above will do the job, but the best choice would be a ratcheting crimp tool like this one from Pololu: http://www.pololu.com/product/1928

That's the tool that I use on my projects. It's reasonably priced at $34.95.

There was a great discussion on the SeeMeCNC forums recently on how to properly use this kind of crimping tool. I recommend you check it out if you haven't used this kind of tool before.

http://forum.seemecnc.com/viewtopic.php?f=36&t=4342

As an additional resource, Hansen Hobbies has produced an excellent wire crimping tutorial here: http://www.hansenhobbies.com/products/connectors/Connectors.pdf

2 – Visual Bill of Materials

Your Rostock MAX v2 kit should contain three large laser cut Melamine sheets, a large box containing hardware, injection molded parts, the RAMBo controller and the required wiring. The box will also contain a 450W ATX style power supply.

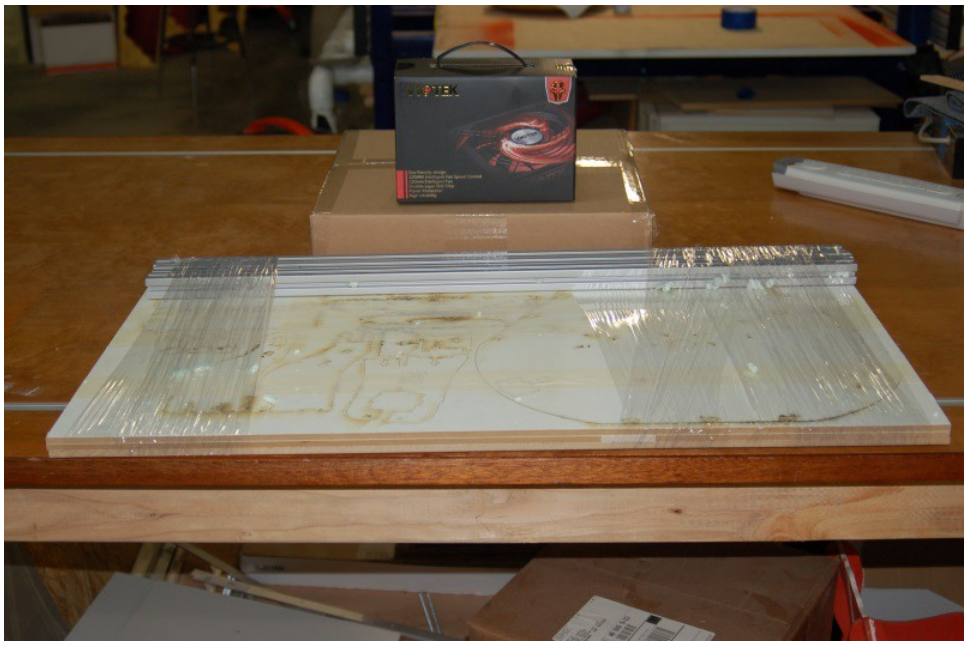


Fig. 1-1: Shipping box contents.

The Melamine parts are held in place with masking tape in order to protect them during shipping. The parts are also covered with a special cutting mask that prevents the laser cutting operation from depositing cutting residue on the Melamine surface. You'll need to remove all of this material before beginning construction.

Included in the three laser cut sheets is an additional smaller sheet that contains a component that's part of the printer's upper section, as seen in Fig. 1-2.

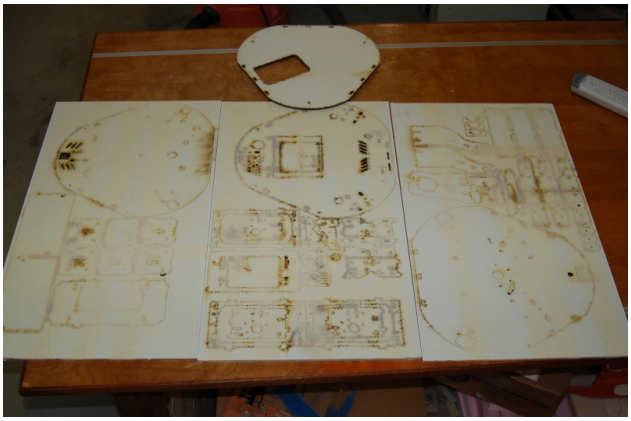


Fig. 1-2: Laser cut parts.

Take special care when removing the laser cut parts from the sheets. Sometimes the laser doesn't quite cut all the way through. If you find a part like this, you'll want to gently score the back side of the sheet along the faint cut line and then press the part out from the front of the sheet. The front and back of the sheet is easily identifiable – the front of the sheet will have very dark laser cut lines with “flash” deposits to either side of the laser cut line. The back of the sheet will have much fainter marks.

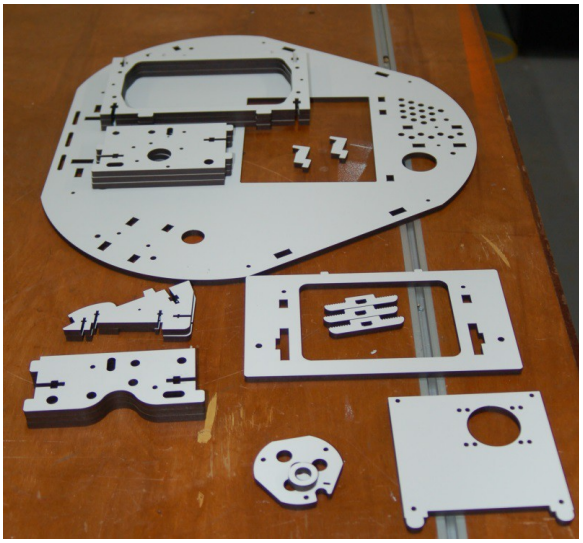


Fig. 1-3: Sheet #1 parts.

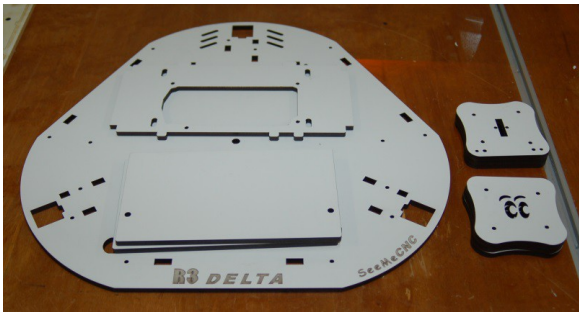


Fig. 1-4: Sheet #2 parts.

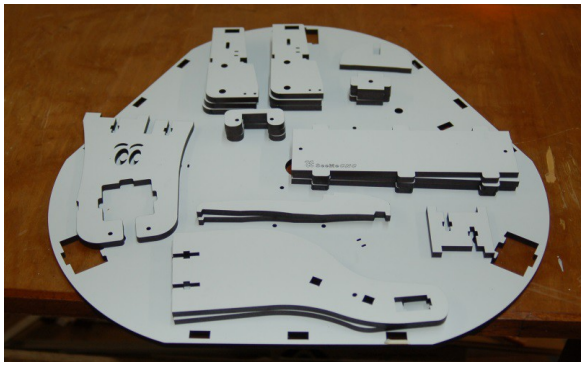


Fig. 1-5: Sheet #3 parts.

The cardboard box contains all the non-melamine components required to build the Rostock MAX v2. Many are in individual baggies, some are in heat-sealed bag "packs". As you go through the following Bill of Materials, please count and check off each item. This is important as you don't want to be short a vital part during the build. It's better to find out before hand than being forced to stop the assembly process due to a missing part. If you are missing any parts, please contact support@seemecnc.com with the subject line of "Missing Parts!". *Note that the quantities shown in the photographs may not necessarily match the quantity listed to the right. When it doubt, follow the quantities listed in the text!*

For those that aren't sure how to identify the various screw types, Bolt Depot has made available some *excellent* references. I would recommend Fastener Basics (http://www.boltdepot.com/fastener-information/Printable-Tools/Fastener-Basics.pdf) and their Fastener Type Chart (http://www.boltdepot.com/fastener-information/Type-Chart.aspx).

Rubber foot pack. Contains 6 each of the following components:

#10-32 x 5/8" Nylon Pan Head Screws

#10-32 Nylon Finish Nuts

Injection molded legs (black)

Soft rubber feet

9 each, #10-32 x 3/4" Knurled Nylon Thumb Screws.

These are for the right & left base covers as well as the LCD panel.

4 each, #6-32 x 1/2" Slotted Pan Head Screws (Nylon).

These are used to mount the 450W ATX power supply

10 each, Plastic Bearing Rollers. 4 are used for mounting the RAMBo and six are used for the belt clamps.

31 each, #6-32 x 1” Phillips Pan Head Screws. Used for general assembly.

6 each, #6-32 x 5/8” Socket Head Cap Screws. Used for mounting the U-Joint plates to the Cheapskate plates.

12 each, #6-32 x 1-3/4” Phillips Pan Head Stainless Steel screws. Used for 608 idlers in the motor mounts as well as the hot end standoffs.

63 each, #6-32 Stainless Steel Nylon Lock Nut – covers all #6-32 screws.

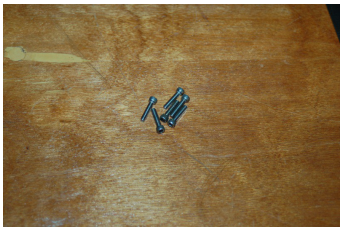
14 each, #6-12 x 1” Phillips Pan Head Stainless Steel screws. Used for Cheapskate plates and EZStruder mount.

15 each, #6-32 x 1/2” 18-8 Stainless Steel Flathead screw. Used inside of base and top side plates, to retain acrylic panels and the three end-stop triggering screws installed in the Cheapskate U-Joint mounts.

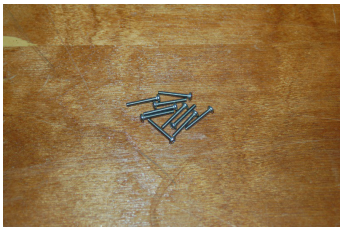
25 each, #¼-20 x 1/2” Stainless Steel Button Head Cap Screws. Used for T-Slot mounting.

25 each, #¼-20 nut plates. Used for T-Slot mounting.

4 each, #4-40 x 3/4” Phillips Flat Head Machine screws. Used for mounting the RAMBo Controller.



6 each, #4-40 x 1/2” Stainless Steel Socket Head Cap screws. Used for the belt clamps.



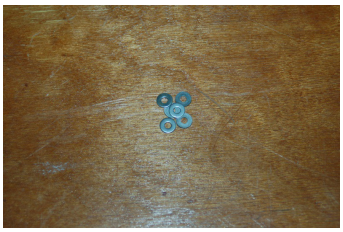
10 each, #2-56 x 5/8” Pan Head Phillips Machine screws. Used for LCD mounting and end-stop switch mounting.

10 each, 2-56 Finish Nuts. Used for LCD mounting and end-stop switch mounting.

8 each, #4 x 3/8” Phillips Pan Head Sheet Metal screws. Used for LCD sides and tower alignment guides.

12 each, M3x.5 x 10mm Pan Head Machine screws. Used for mounting the stepper motors.

18 each, #6 Stainless Steel Flat washers. Used on the 608 bearings that go in the top & bottom t-slot rails.



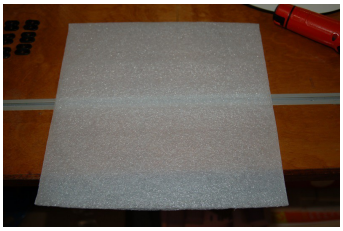
6 each, #4 Stainless Steel Flat washers. Used with the belt clamp screws.

21 each, 608ZZ Ball Bearings. Used in the Cheapskates and belt idlers.

1 each, RAMBo Electronic Control Board with screw terminals and end stop wires.

1 each, USB Cable.

1 each, Onyx Heated Bed Kit.



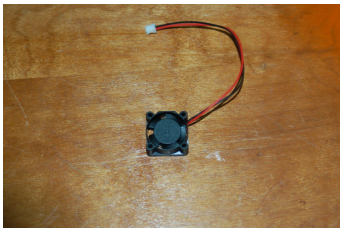
1 each, 300mm x 3mm Borosilicate Glass Build Plate. Used with Onyx Heated Bed. (Yes, there's a big glass disc inside that foam sleeve!)

1 each, LCD Smart Controller with SD card, LCD to RAMBo Adapter Kit and 1 Soft Touch 5mm knob.

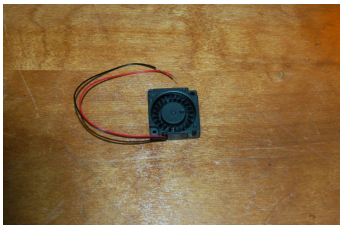
4 each, NEMA 17 Stepper Motors (4800cgm holding torque). Used for three motion axes and extruder drive.

1 each, 450W ATX Power Supply.

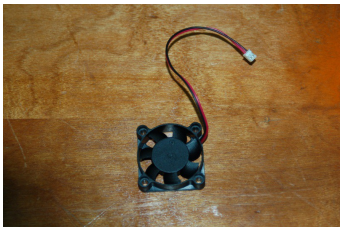
1 each, Rocker switch, including spade lug crimp terminals.



1 each, 25x25x10mm 12VDC fan. Used to cool the PEEK section on the hot end.



1 each, 30x30x10mm 12VDC fan. Used for part cooling.



1 each, 40x40x10mm 12VDC fan. RAMBo cooling fan.

10 feet, 18ga, 4 conductor wire. Used for the hot end power and thermistor.

10 feet, 22ga, 4 conductor wire. Used to extend wiring for extruder motor.

15 feet, 26ga, Black & Red wire. Used for hot end PEEK and part fans.

4 feet, 3/8” diameter Expandable Mesh Wire Loom (black). Used to cover wiring & bowden tube from the top to the hot end platform.

Includes 3” of 5/16” heat shrink tubing.

3 each, 76” GT2 Timing Belts.

3 each, T-Slot rails, 32” long. [REPLACE WITH CORRECT PHOTO]

1 each, Smoked Acrylic parts pack. Includes, LCD face, LCD sides (left & right), base and top covers.

1 each, GT2 2mm pitch belt pulley pack. Includes six grub screws and allen wrench.

18 each, 608 Cheapskate Idler Bearing Spacer. Used for belt idlers.

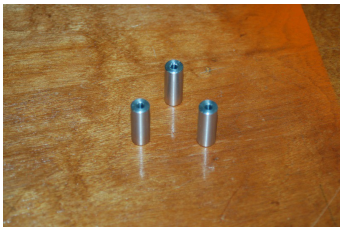
24 each, Bearing Sleeves. Used to cover 608ZZ bearings.

12 each, 608 Cheapskate Carriage Bearing Spacers (black).

12 each, 608 Cheapskate Eccentric Bearing Spacers (gray).

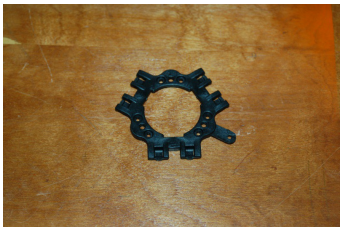
12 each, Universal Joints (machined aluminum).

6 each, 3-1/8” Steel Universal Joint axle shafts.



3 each, 1” long machined aluminum hot end platform spacers.

3 each, Cheapskate U-Joint mounts. Outer tabs have been removed to allow for spring clips.



1 each, Effector Platform (spring clip style).

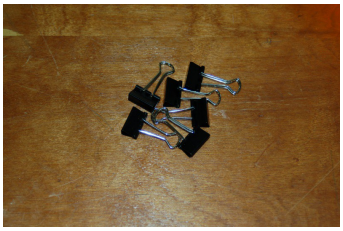
6 each, U-Joint Spring Clips.

6 each, Rostock MAX Delta Arms.

1 each, EZStruder Cold End Kit. Includes stepper motor mounting hardware.

1 each, 15 Tooth Gear. Used for manually operating extruder motor.

1 each, Hot End Kit. Includes hot end, heating resistors, thermistor, PTFE sleeve for thermistor, PTC fittings and PTFE bowden tube.



6 each, Binder Clips. Used to hold the Borosilicate glass build plate to the Onyx heated bed.

12 each, Wire ties. Used for wire management or Barbie Handcuffs. Your call.

3 – Prepping the Hot End and Power Supply

Preparing the Hot End

The hot end for your Rostock MAX v2 3D printer uses Permatex Ultra Copper RTV to hold both the heating resistors and the temperature sensor (the thermistor) in place. Because it takes a few hours for the RTV to set completely (I recommend letting it cure over night), it's a good idea to get that started now. You'll also want to find something ahead of time that you can use to hold the hot end nozzle up that won't be disturbed while the RTV cures.

For this step, you'll need the parts out of the hot end pack. This includes the hot end itself, the two heating resistors and the tiny pack with the thermistor and it's ptfe tubing.

You'll start by coating each heating resistor with RTV as shown in Fig. 3-2.

You'll want to try to keep the resistor leads free of RTV, but don't skimp on the RTV application.

Fig. 3-1: RTV & heating resistor.

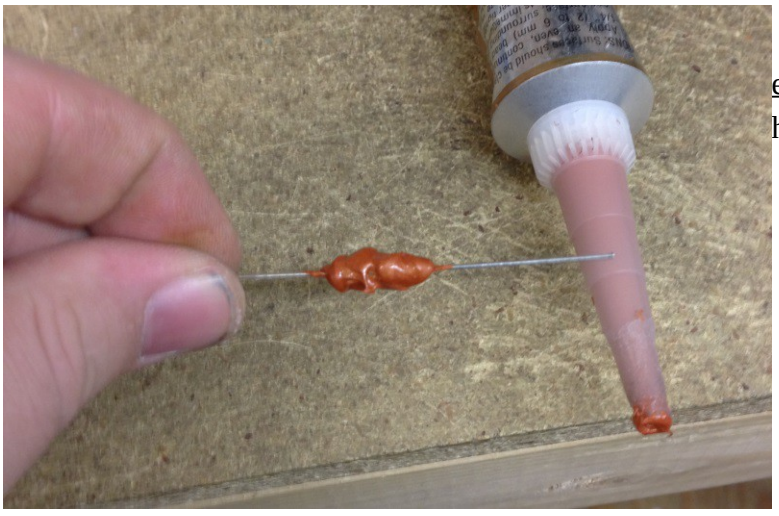


Fig. 3-2: Coating the heating resistor with RTV.

This stuff is goopy and sticks to everything! Keep a paper towel or ten handy.

Carefully insert both heating resistors into the pockets in the hot end as shown in Fig. 3-3.

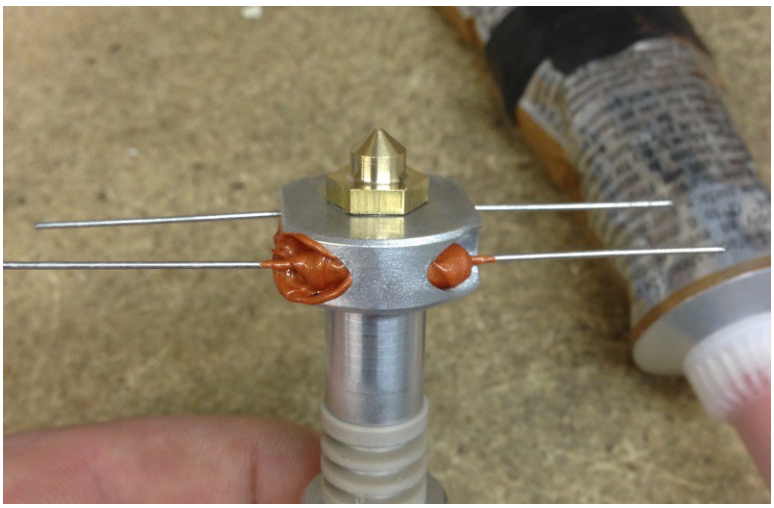


Fig. 3-3: Resistors installed in the hot end.

You'll need to add a little more RTV to both ends of the resistor in order to fully fill the cavity that the resistors sit in.

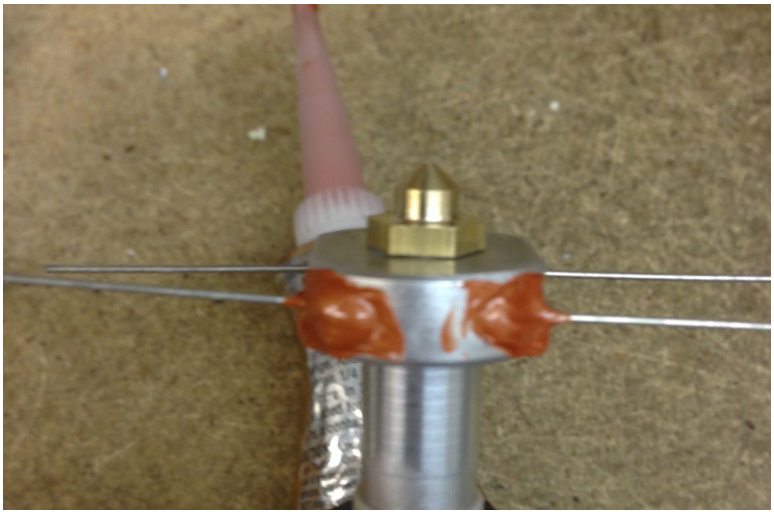


Fig. 3-4: Resistor cavities filled with RTV.

Don't be surprised if your application of RTV is not nearly as neat as shown above. These hot end assembly photos were shot by Andy Oprisko, a SeeMeCNC employee. He's literally built hundreds of hot ends and is very, very good at it.

Set the hot end aside, with the nozzle pointing up. We're going to prep the thermistor for installation next.

Take the short length of PTFE tubing from the thermistor package and cut it in half. Remove the thermistor from the paper protector (aka The Post-It! Of Shielding) and slide the a PTFE tube on to each of the thermistor leads as shown below.

Fig. 3-5: Thermistor with PTFE sleeves installed.

Using a pair of needle nosed pliers, bend a 90 degree angle in the thermistor and PTFE tubing as shown below. Take special care to not damage the thermistor head! It's made of glass and is very delicate.

Fig. 3-6: Bending the thermistor.

Take the nozzle off the Permatex Ultra Copper RTV tube and dip the end of the thermistor into the RTV as shown below.

Fig. 3-7: Coating the thermistor with RTV.

The thermistor should now be installed in the thermistor port on the flatted side of the hot end as shown. Set it aside in a safe place to allow the RTV to cure.

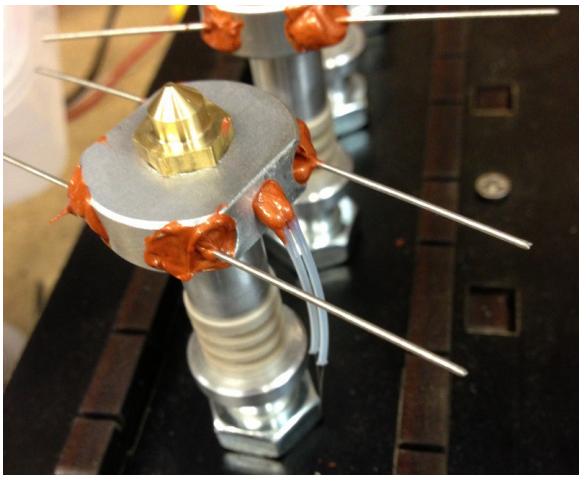


Fig. 3-8: Thermistor installed.

Preparing the Power Supply

Your Rostock MAX v2 uses a standard, 450 Watt ATX computer power supply to provide power to the RAMBo controller, the Onyx heated bed and the hot-end. All of these components require 12V DC. The 12V wires on an ATX power supply are yellow. You'll need four of these for the heated bed power, and one each for the hot-end and motors.

Start by locating the six longest yellow wires in the power supply. You want the most reach possible. Clip the yellow wires and the six longest black wires from the connectors they're attached to. You'll then want to locate one black wire and the green wire on the large ATX connector and cut those free as well. The green wire will turn on the power supply when it's connected to the black wire.

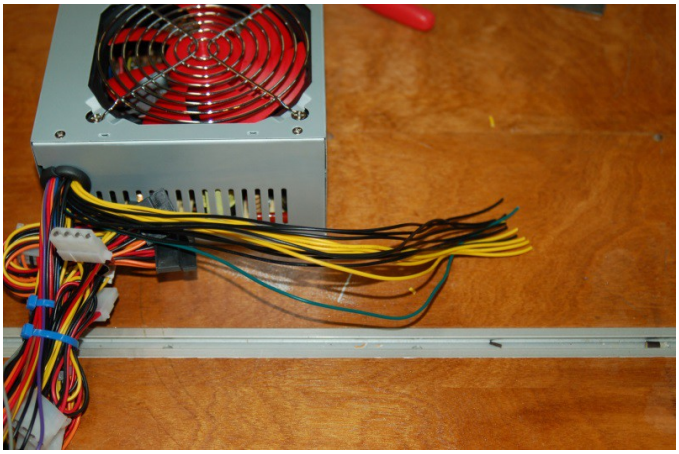


Fig. 3-9: Prepping the power wires.

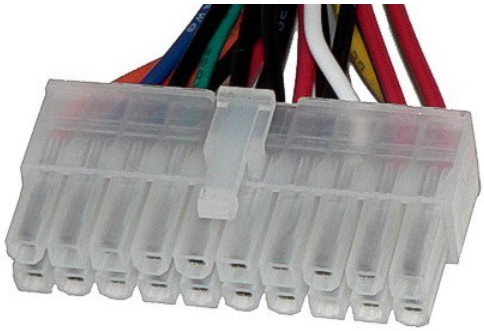


Fig. 3-9A: Typical ATX connector.

Once you've got the needed wires cut free from their connectors, you'll want to get the two crimp-on spade lug connectors out of the power switch package.

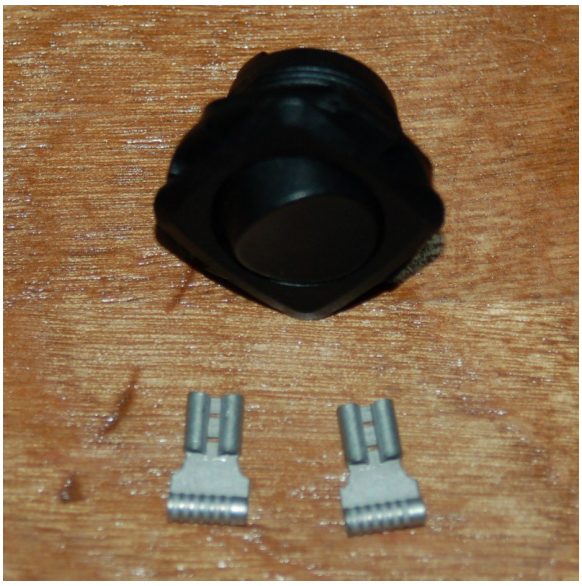


Fig. 3-10: Power switch and crimp-on spade lugs.

Strip off about 3/8” of insulation from the black & green wires that you cut from the big ATX connector and crimp the spade lug connector to each as shown in Fig. 3-10.

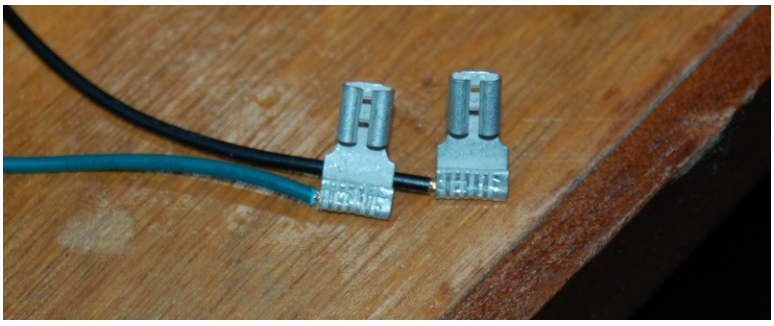


Fig. 3-11: Power switch connectors installed.

Now take the four long black wires from the bundle and strip about 3/4” of insulation from each. Tightly twist them together as shown below. Do the same for the four long yellow wires.

Fig. 3-13: Twisted Wires!

The remaining two yellow and two black wires only need about 3/8” of insulation stripped from them. Next, you'll need to get the RAMBo power connector and install the wires into it. The connector is found in the little bag marked “RAMBo v1.2 Kit” (the version number may be different) inside the white RAMBo controller box.

Install the four bundled black and yellow wires into the far left of the connector as shown in Fig. 4-13 on the next page and then insert the remaining power wires into the connector as shown. Please pay careful attention to the order of installation! If you reverse the yellow and black locations, you'll destroy the RAMBo when you turn on the power.

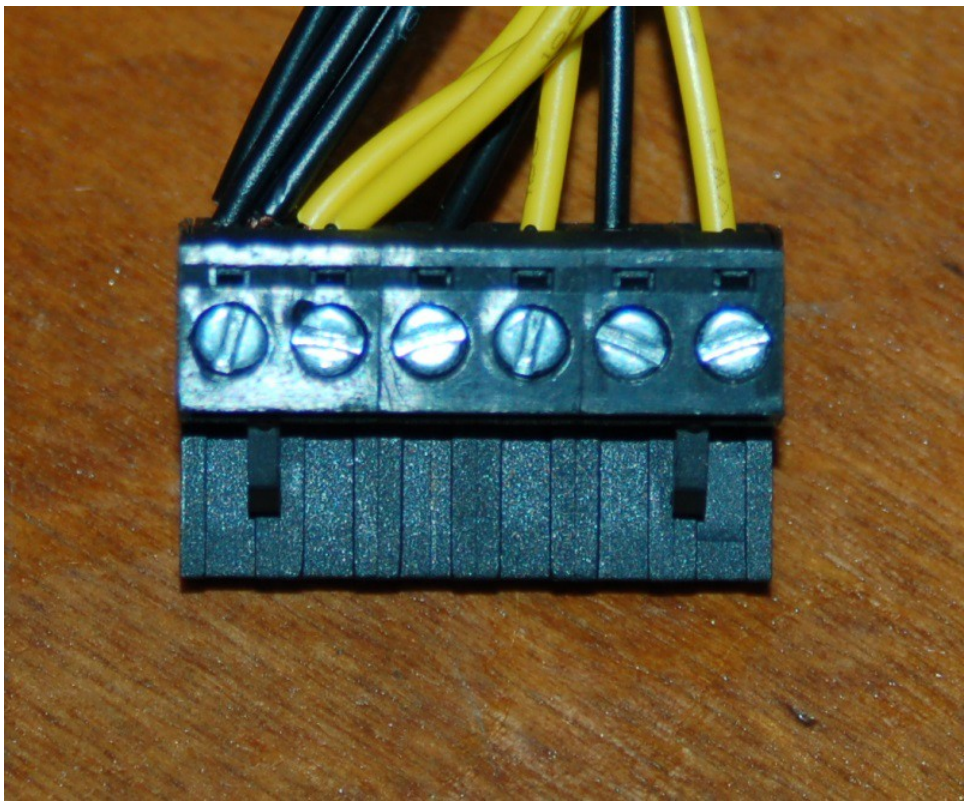


Fig. 3-13: Wires installed in the RAMBo power connector.

I made Fig. 3-13 pretty big so you can see exactly how it is supposed to be wired up.

Once you have the connector installed, grab a couple of the wire ties (or lacing cord!) and bind up the black & yellow wires that go to the connector. It's not strictly required, but it makes for a neat appearance. You can do the same with the black and green wires that will eventually be connected to the power switch. (If you're gonna brag about your baby, she's gotta look *nice!)*

4 – Building the Base

In order to build the base, you'll need the following parts:

1. Base Plate Bottom, Base Plate Top (Not Shown)
2. Vertical Supports (3)
3. RAMBo Mounting Legs (2)
4. Foot Assemblies (6)
5. #6-32 Nylon Lock Nuts (12)
6. #6-32 1/2” Stainless Steel Flat Head Screws (6)
7. #6-32 1” Stainless Steel Pan Head Screws (6) (Not shown.)
8. #6-32 1/2” Nylon pan head screws (4) (Not shown.)
9. Power Supply and Onyx Heated Bed Pack (Not shown.)

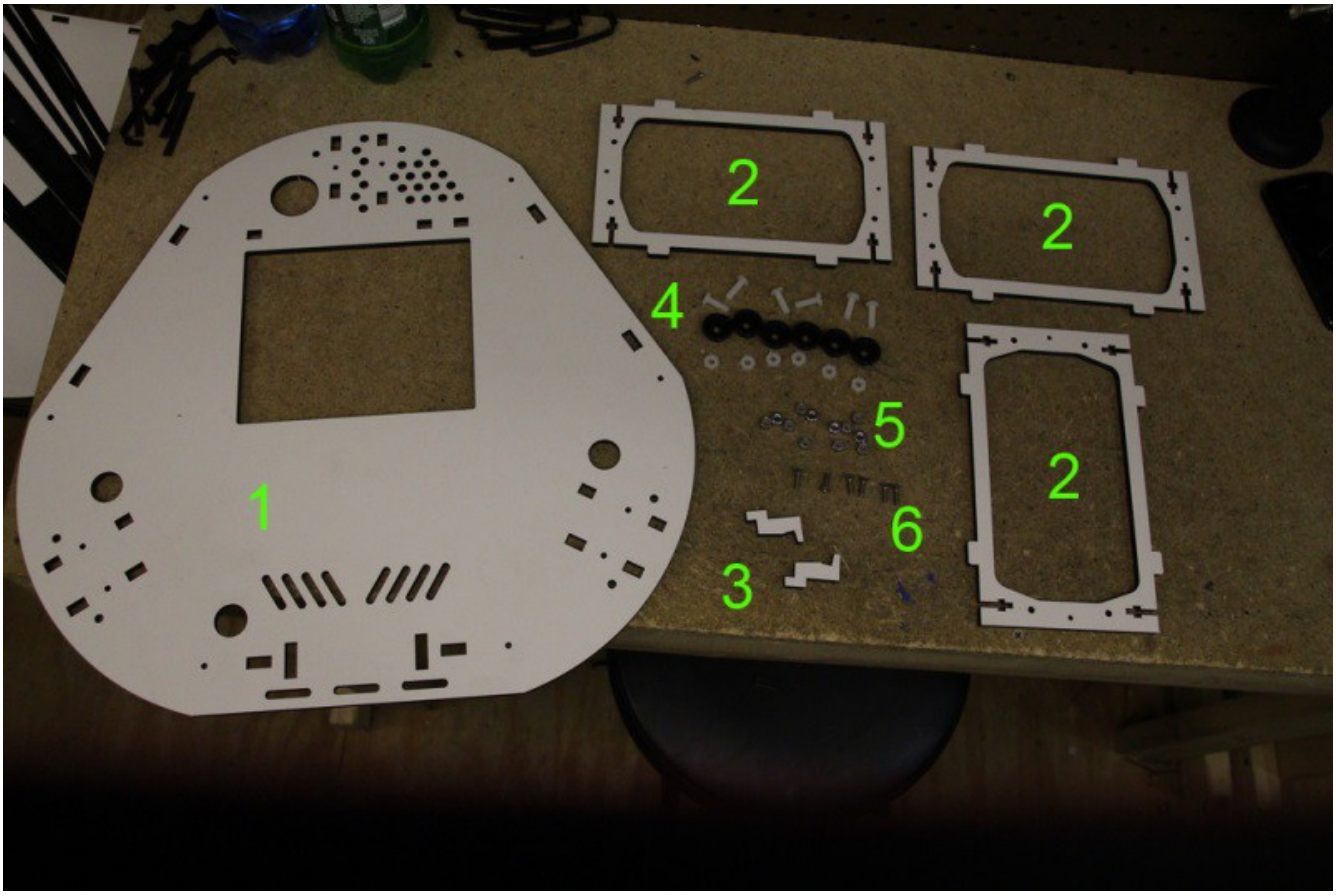


Fig. 4-1: Required base parts.

In addition to the parts listed above, you'll also need the power supply mounting plate, shown below.

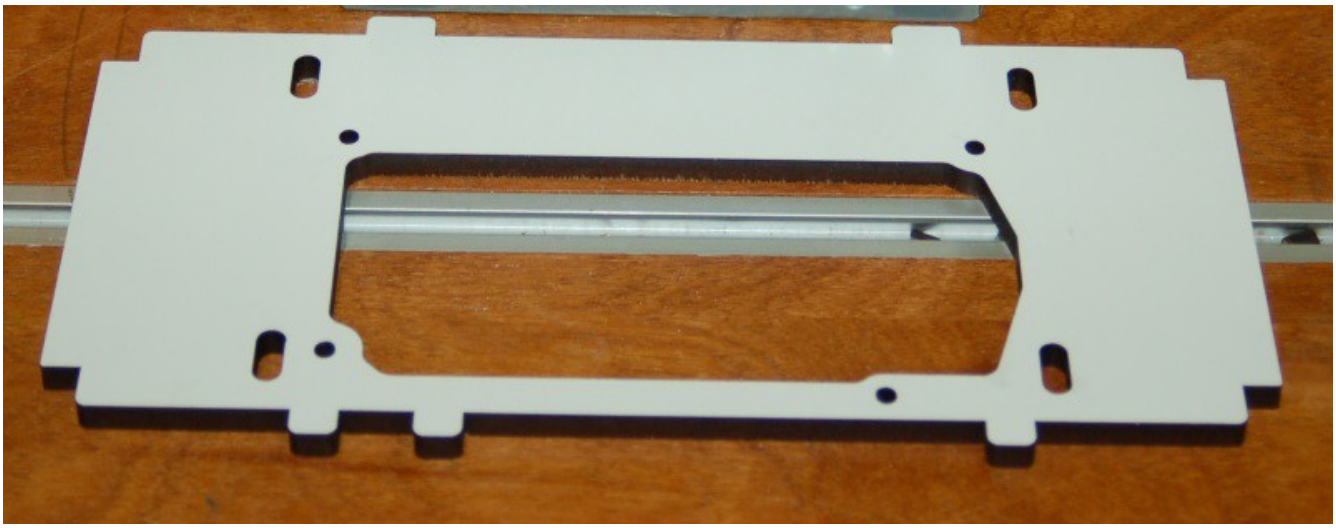


Fig. 4-2: Power Supply Mounting Plate.

Installing The Feet

Set the base plate upside down on your build table and install the six feet as shown below. You won't be installing the rubber “shoes” until the end of the build. The shoes are high-friction parts and it will hamper your ability to spin the machine around on your table while building it.

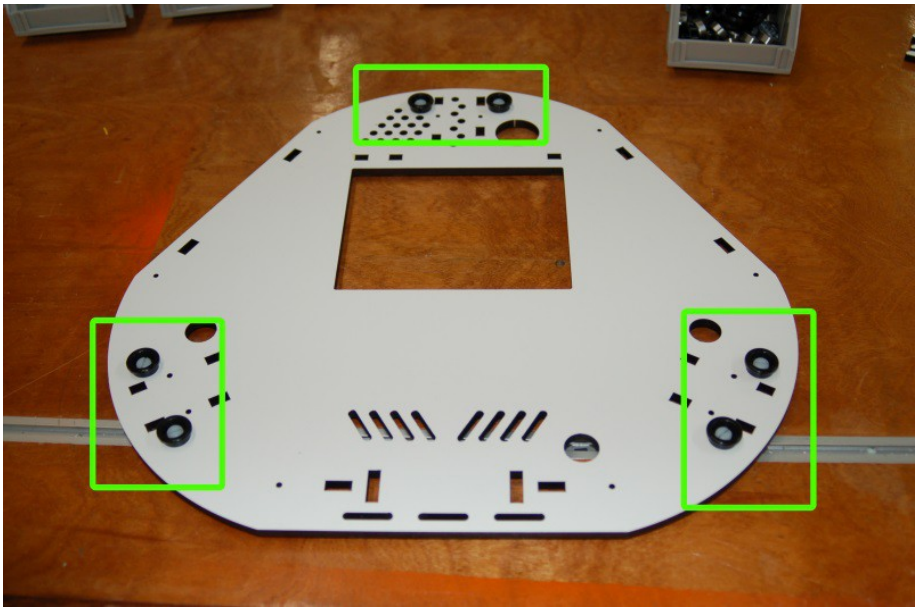


Fig. 4-3: Installing the foot assemblies.

Make sure you've got the base plate oriented exactly as shown, with the angled vent holes closest to you and the two medium sized holes to your right.

Preparing the Vertical Supports

The vertical supports need to have four #6-32 Nylon lock nuts and two #6-32 x 1/2” Stainless Steel flat head screws installed in each one.

The simplest way to install the lock nuts is to use a pair of needle nosed pliers and grip the nut as shown in Fig. 4-4.

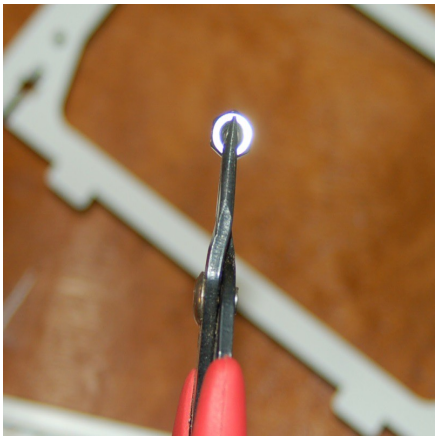


Fig. 4-4:Gripping a nut. (Quit snickering!)

Install each nut in the nut pockets laser cut in the vertical supports as shown below.

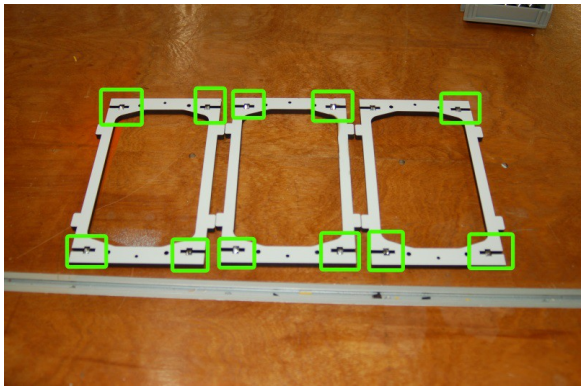


Fig. 4-5: Nut installation points.

The lock nuts need to be oriented such that their flat face is facing the channel leading to the edge of the part as shown in Fig. 4-6.

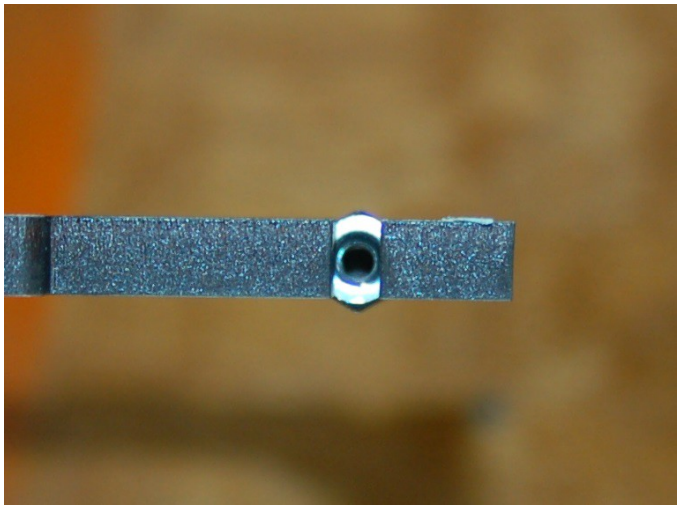


Fig. 4-6: Nut orientation.

The pockets the nuts fit into are tight, but the nuts will fit. If you're having trouble getting the nut to fit, try inserting it from the other side of the part. The laser kerf results in a slight cut angle that makes one side of a cut area a tiny bit wider than the other. This will help get the nuts inserted. If they're too lose, you can use a small tab of Scotch tape to hold them in until you've put screws in the problem nuts.

Next, you need to install two #6-32 x 1/2” Stainless Steel flat head screws into each vertical support as shown in Fig. 4-7.

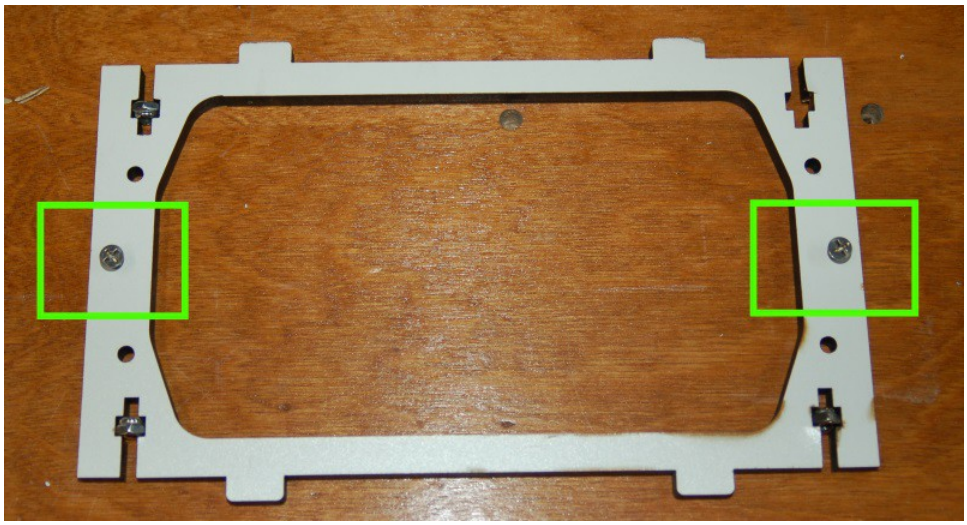


Fig. 4-7: Flat head screw locations.

This is the point where having an electric screwdriver comes in VERY handy. The simplest way to install the flat head screws is to lay the vertical support flat on the table and drive the screws in like in Fig. 4-8. You only want to drive the screw until the tip of the screw is even with the opposite face of the vertical support as shown in Fig. 4-9.

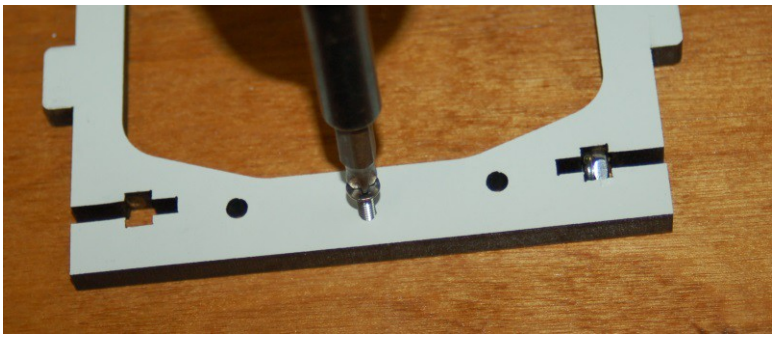


Fig. 4-8: Installing the screw.

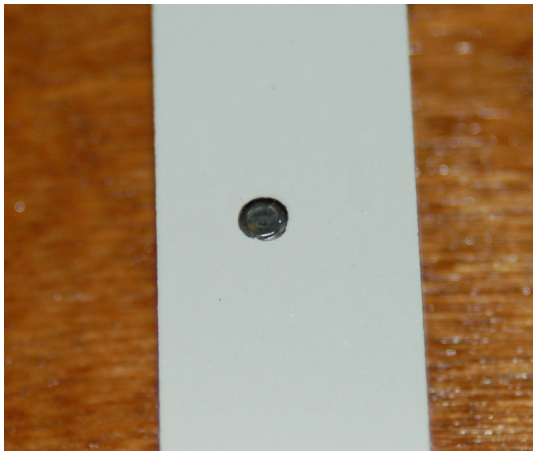


Fig. 4-9: Correct screw depth.

Installing the Vertical Supports and Power Supply

Before the two back vertical supports can be installed, we need to install the power supply on the power supply mounting plate with the four #6-32 x 1/2” Nylon pan head screws.

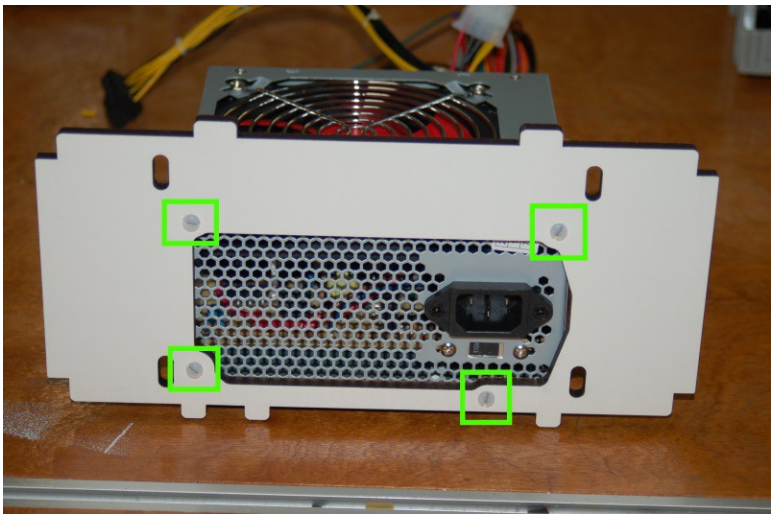


Fig. 4-10: Power supply attached to its mount.

Pay careful attention to the orientation of the mount. As you can see in Fig. 4-10 above, the mount has the two closely spaced tabs on the lower left of the mount. The green squares indicate the locations of the four Nylon screws.

The power supply base is held in place with the vertical supports that are installed to either side of it. You'll install all three parts at the same time – the fit tolerance is loose enough that they just drop in.

Fig. 4-11: Power supply mount and vertical supports.

Figs. 4-12 and 4-13 are provided to give you a bit of additional detail as to how the mount rests on the vertical supports.

Fig. 4-12: Detail of power supply bracket, right side.

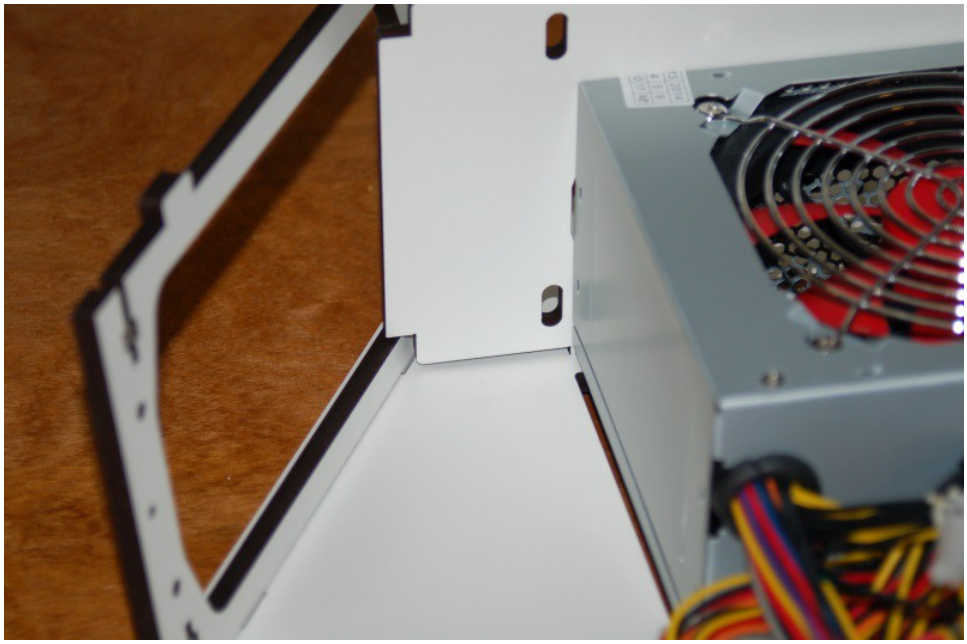


Fig. 4-13: Detail of power supply bracket, left side.

Get four #6-32 x 1” Stainless Steel pan head screws and attach them to the two vertical supports you just installed. See the image below for an example.

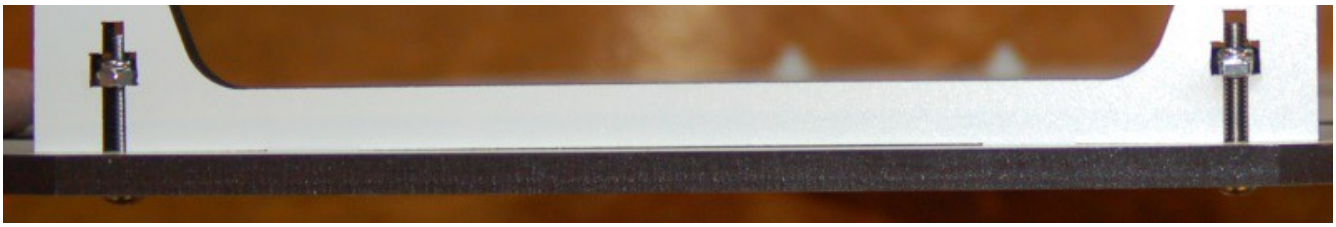


Fig. 4-14: Screws installed in vertical support

Make sure you leave the screws a bit loose – you'll need a bit of “slop” to help you align the tabs when you install the top plate on the base.

Before you can install the last of the three vertical supports, you'll need to install the two RAMBo support panel legs to the front of the base.

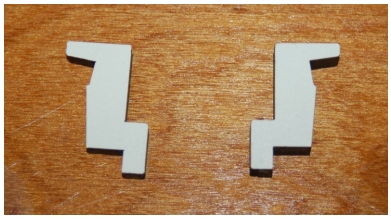


Fig. 4-15: Support Legs.

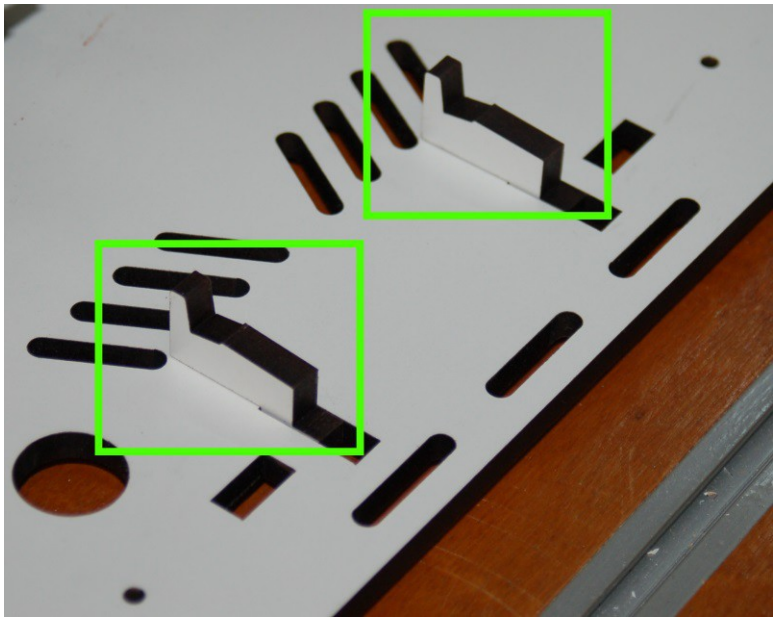


Fig. 4-16: Support legs installed.

The support legs just rest in place – they're held firmly when the support plate is installed over the top of them.

Use two #6-32 x 1” Stainless Steel pan head screws to attach the front vertical support over the two RAMBo legs as shown below. Like the two back supports, leave this a bit loose in order to assist with fitting the top.

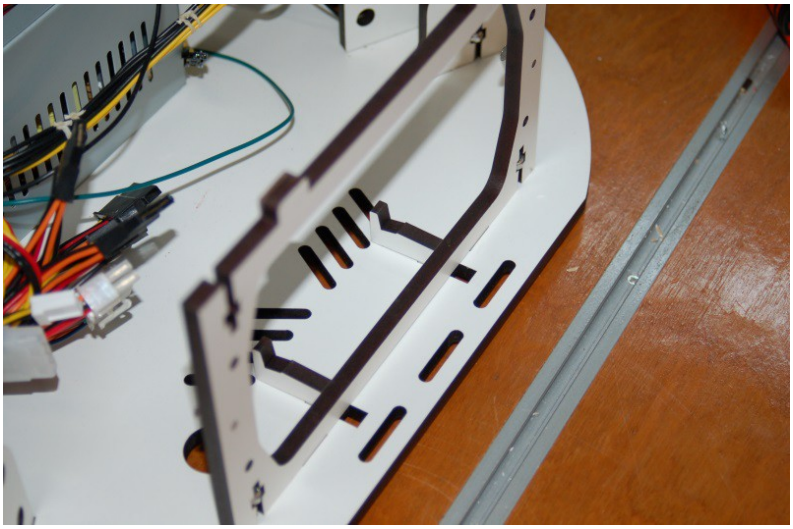


Fig. 4-17: Front vertical support and RAMBo legs installed.

Installing the Drive Gears on the Stepper Motors

For this step you'll need three of the four stepper motors, the drive gear wheel pack and some blue thread locking compound.

Fig. 4-18: Setting up the first stepper.

When you attach the drive gears to the stepper motor, you should start off by putting a bit of thread locker on the first grub screw and install it as shown in Fig. 4-19.

The green arrow points to the “flat” in the stepper motor shaft. You want your first grub screw to press against that flat spot. This will ensure that the drive gear doesn't rotate on the shaft over time. When you slide the drive gear over the shaft, make sure that the outside face of the gear is even with the face of the stepper motor's output shaft. Place a small amount of thread locker and install the second grub screw. Repeat this task for the other two stepper motors.

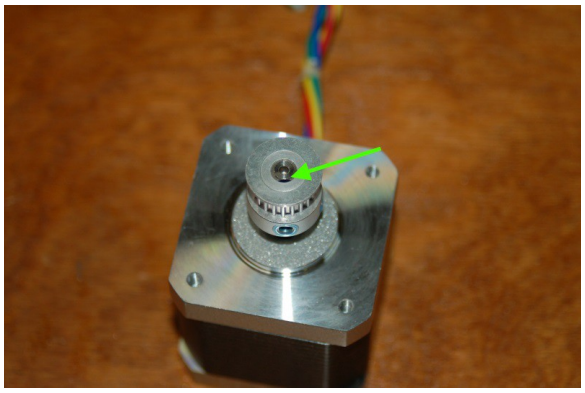


Fig. 4-19: Installing the first grub screw.

Fig. 4-20 shows the correct orientation and alignment of the drive gear. The green line indicates that the gear face and shaft face should be even.

I highly recommend taking the time to put a slight twist in the stepper motor wires and bind them up with some wire ties or lacing cord.

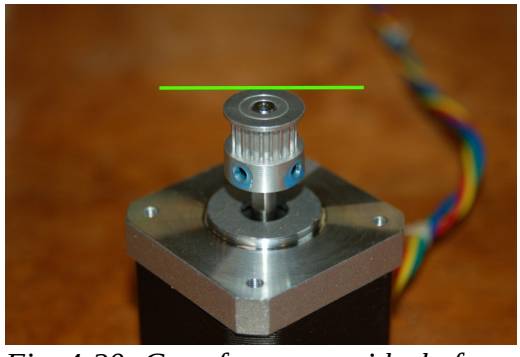


Fig. 4-20: Gear face even with shaft.

Assembling the Tower Supports

For this step, you'll need the following materials:

1. Stepper Motor Support Plates (3)
2. Tower Support Plates (3)
3. Cheapskate Idler Bearing Spacers (12)
4. 608ZZ Roller Bearings (6)
5. ¼-20 1/2” Button Head Cap Screws (12)
6. ¼-20 T-Slot nut plates (12)
7. #6-32 Nylon Lock Nuts (12)
8. #6-32 1” Stainless Steel Pan Head Screws (6)
9. M3 10mm Stainless Steel Pan Head Screws (12)
10. #6-32 1-3/4” Stainless Steel Pan Head Screws (6)
11. Stepper Motors (3)
12. #4 5/8” Stainless Steel Pan Head Machine Screws (3)
13. #6-32 Stainless Steel Flat Washers (6)

First up, you'll need to put together the six belt support bearings by sandwiching each 608ZZ bearing between a pair of the black idler bearing spacers.

Fig. 4-22: Idler bearing parts.

Fig. 4-23: Assembled idler bearing.

Set those aside and grab a stepper motor and a stepper motor support plate. Align the stepper motor as shown in Fig. 4-24 and install it using four of the M3 10mm screws. Apply a little bit of thread locker to each one before installing.

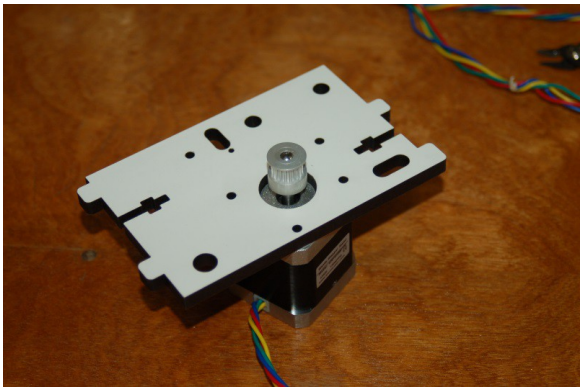


Fig. 4-24: Correct mounting plate alignment.

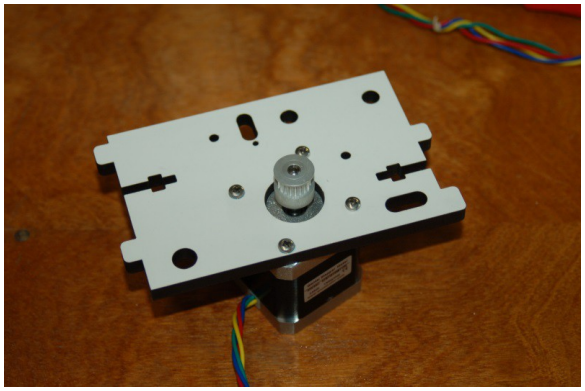


Fig. 4-25: Stepper motor screws installed.

Now you need to install a #4 5/8” machine screw where indicated in Fig. 4-26.

This screw is used as a stop in order to set the correct T-Slot tower depth.

Assemble ***TWO*** stepper motor support plates like you have here. The third is mirrored and will not install properly any other way.

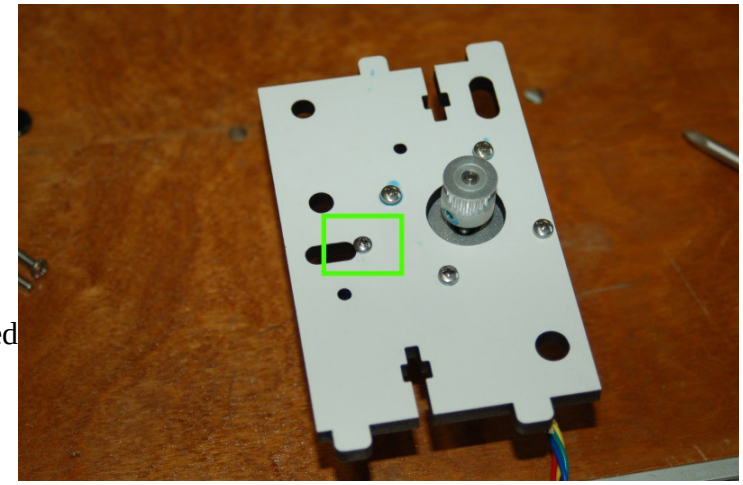


Fig. 4-26: T-Slot stop screw.

Make sure you build the third stepper motor support shown exactly as shown in Fig. 4-27.

When you're finished, you should have three stepper motor support assemblies that look exactly like the three shown in Fig. 4-28.

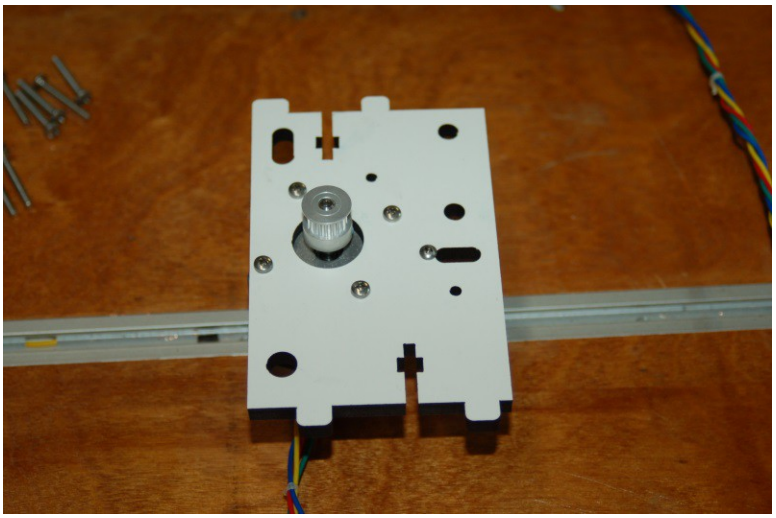


Fig. 4-27: Mirrored stepper motor plate.

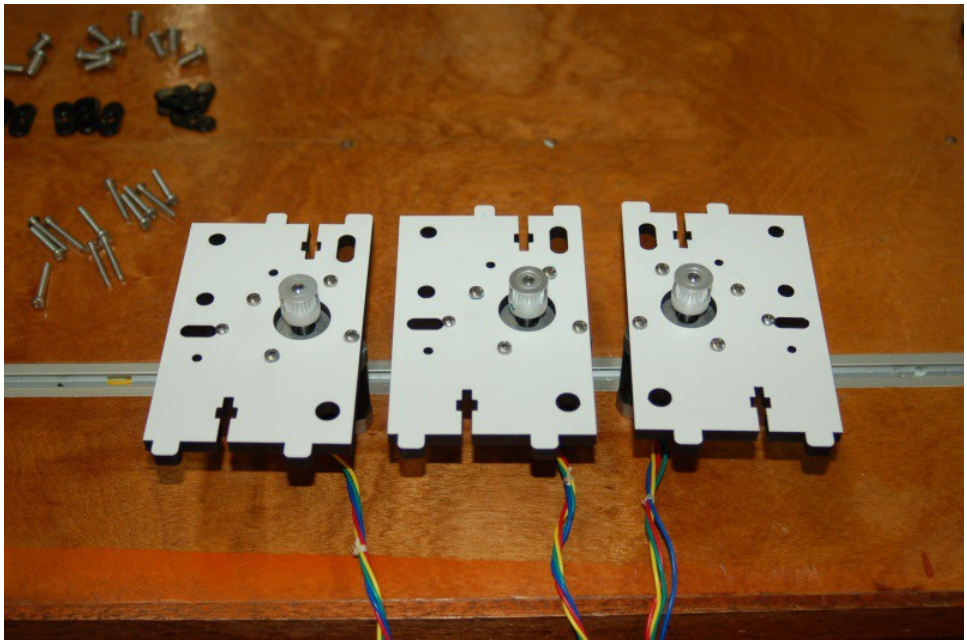


Fig. 4-28: Correctly assembled stepper mount plates.

Now install the 12 #6-32 Nylon lock nuts in the locations shown in Fig. 4-29. Make sure the flat faces of the nuts are facing “out” towards the edge of the part, just like you did for the three vertical supports.

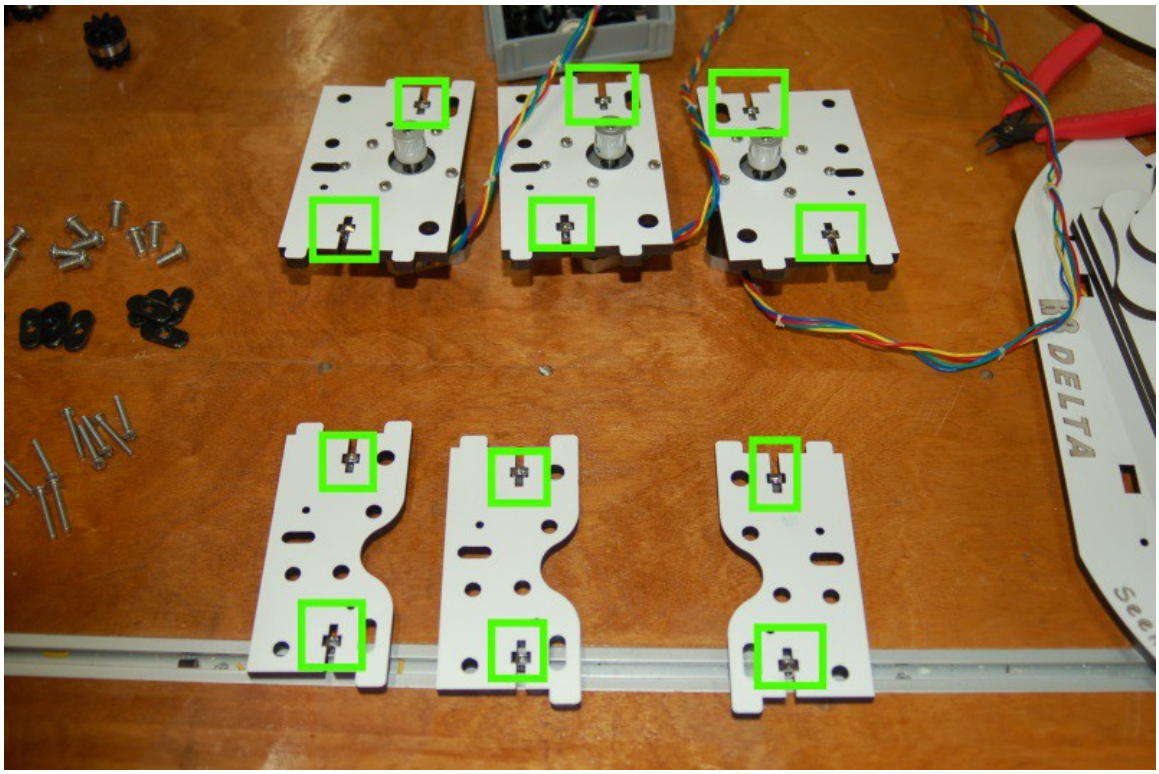


Fig. 4-29: Installation of the Nylon lock nuts.

Each tower support holds the idler bearing assemblies that you put together. In order to install them, you'll need to add a #6-32 washer to two of the #6-32 x 1-3/4” Stainless Steel flat head screws and insert them into the back of each stepper motor mounting plate as shown below:

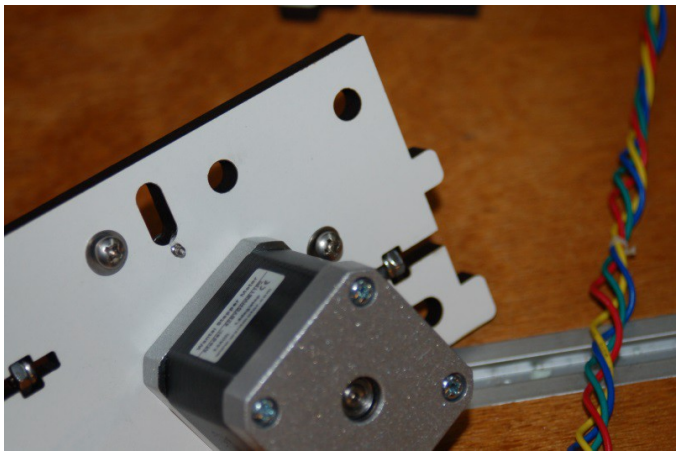


Fig. 4-30: Idler bearing screws installed.

Install two of the idler bearing assemblies on the two screws you just inserted and add the tower support plate on top. Add two #6-32 flat washers and two #6-32 Nylon lock nuts and tighten them down only enough to start engaging the Nylon. The looseness will help install it in the bottom plate and assist in fitting the top plate.

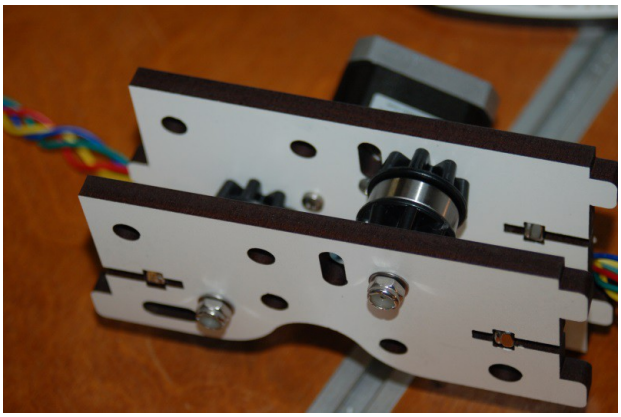


Fig. 4-31: Assembled Tower Support.

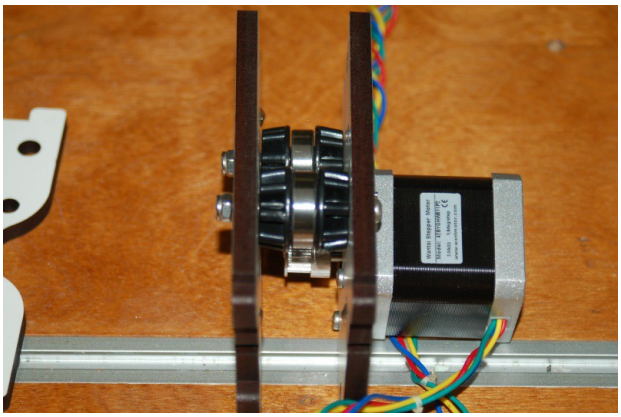


Fig. 4-32: Assembled Tower Support.

Now you need to install four of the ¼-20 cap head screws and four T-Slot nut plates into each tower support assembly. Only thread the T-Slot nut plates enough to feel the end of the screw catch all the threads in the plate – the space is needed to make the tower installation easier.

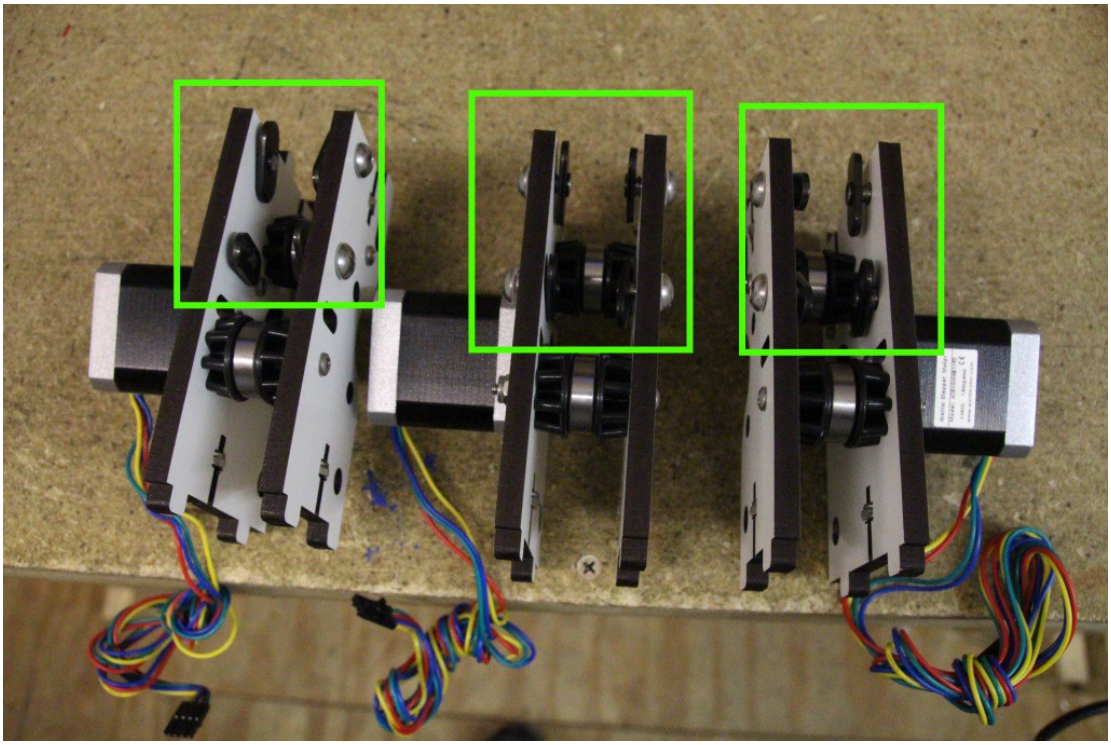


Fig. 4-35: Tower mounting hardware installed.

Finish assembling the other two tower supports. Install the three tower supports as shown in Figs. 4-34 and 4-35. The X (on the left) and Y (on the right) axis tower supports are opposites of one another as you can see in Fig. 4-34. Use six of the #6-32 x 1” Stainless Steel pan head screws to attach the tower supports to the base. Leave them a bit loose as you did with the other base plate mounted parts. You should label each stepper motor wire with the name of the axis you're installing it on. This will make it easier to identify when it comes time to plug them into the RAMBo controller.

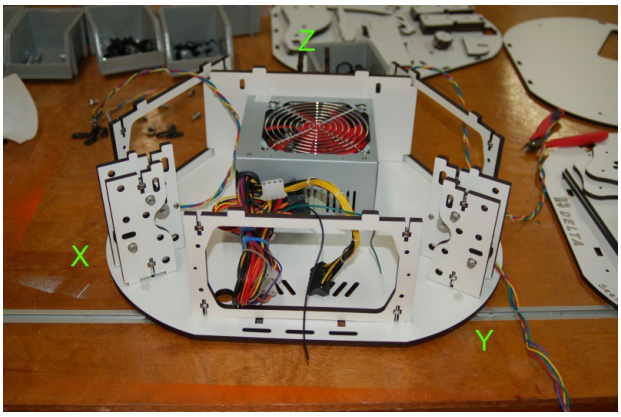


Fig. 4-34: X and Y tower supports installed.

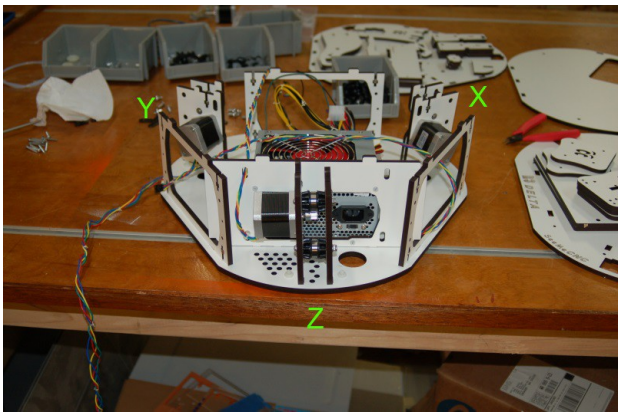


Fig. 4-35: Z axis tower support installed.

Now route the Z axis stepper motor wires through the hole in the power supply mounting plate as shown in Fig. 4-36.

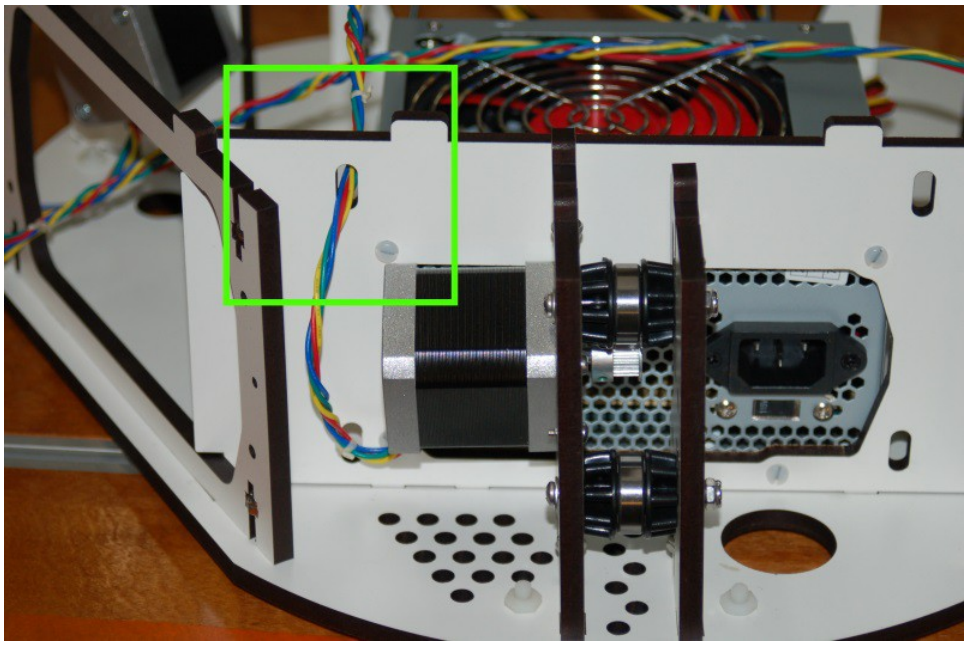


Fig. 4-36: Routing the stepper wiring.

Installing the Top Plate

The next step requires that you open up the Onyx Heated Bed package and remove the included #4-40 T-Nuts. These will be installed on the underside of the top plate as indicated by the green squares in Fig. 4-37. You'll also need 12 #6-32 1” Stainless Steel pan head screws in order to affix the top plate to the base.

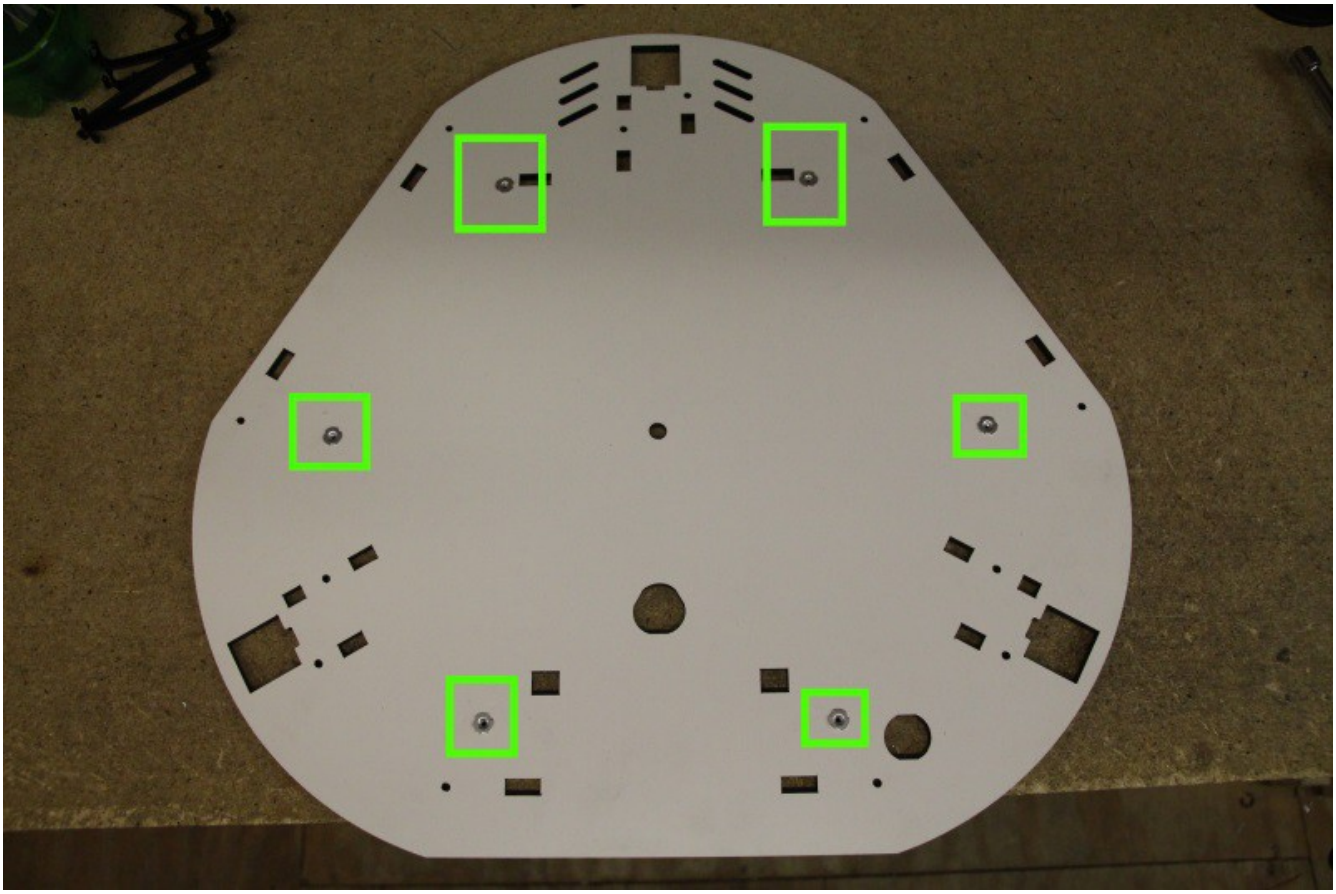


Fig. 4-37: T-Nut locations.

Please ensure that you've oriented the top plate as shown above so you'll be installing the T-Nuts on the underside of the top plate. The T-Nuts can be installed by lightly tapping them in with the back of a screwdriver, or by “drawing” them in using one of the #4-40 flat head screws that are included in the Onyx package. Make sure you use a small washer under the flat head screw if you do this, otherwise you could damage the holes in the top plate.

You may want to cover the T-Nuts with Scotch tape in order to make sure that they don't accidentally get driven out of the holes when you begin installing the Onyx Heated Bed.

In order to install the top plate on the base you've assembled, you'll need to carefully begin to align the tabs in the three vertical supports and the three tower supports with the notches in the top plate. As you work one section down on to the tabs, install a #6-32 1” screw at a near hole to keep that section from popping out while you're working your way around the top. It takes a little patience to get done, but it's *vastly* easier than installing the original Rostock MAX top plate.

Fig. 4-38: Top Plate Installed.

Once you've gotten the top fully seated, fully tighten all of the #6-32 1” screws. Tighten the three vertical supports both top and bottom and then tighten down the three tower supports.

You don't want to over-tighten them however. If you do, you'll collapse the laser cut nut pockets.

5 – Installing the Onyx Heated Bed

For this task you'll need the remaining parts in the Onyx Heated Bed package:

1. Thermistor Pack. Includes a red LED, PTFE insulation tubing, a thermistor and a small resistor.
2. Onyx Heated Bed
3. Star Mounting Plate (Not Shown)
4. Nylon Spacers (6) (Not Shown)
5. #4-40 3/4” Stainless Steel Flat Head Screws (6) (Not Shown)

Fig. 5-1: Onyx heated bed parts.

Installing the Thermistor, LED and Power Wires

Before you begin wiring up the Onyx, please take a few minutes to cover up the copper “vias” on the top surface of the Onyx. This is done to prevent accidental short circuits should you decided to use a metal “heat spreader” plate in the future.

Even if you never expect to use such an accessory (not sold by SeeMeCNC!), you still need to cover the center hole where the thermistor is installed from the bottom. This will prevent the RTV used in the process from raising above the top surface of the Onyx.

Fig. 5-2: Via locations that need to be covered.

Once you've got the Kapton applied, open up the small package that contains the thermistor and the PTFE tubing. Cut two 1/4” tubes from the PTFE tubing and slide them on to the thermistor leads. You'll then bend the thermistor the same way you did when prepping the hot end.

See Fig. 5-3 for an example of what you need to do.

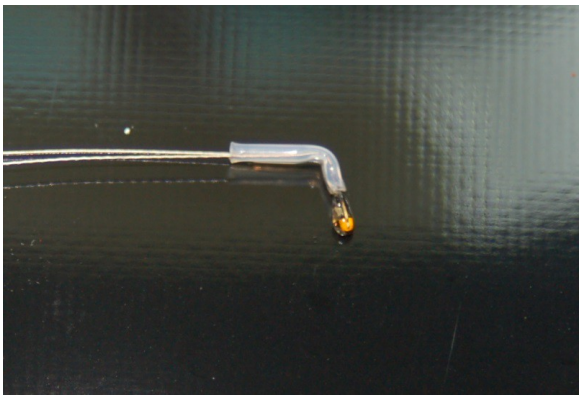


Fig. 5-3: Thermistor properly bent.

As you did with the hot end thermistor, dip the end of the heated bed thermistor into some RTV and insert it in the center hole in the Onyx as shown below. Make sure you've got your thermistor oriented the way I show it.

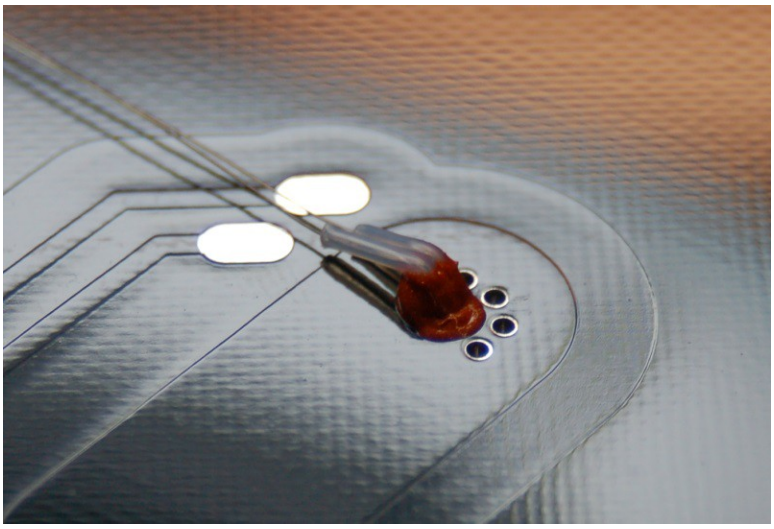


Fig. 5-4: Thermistor inserted in the Onyx heated bed.

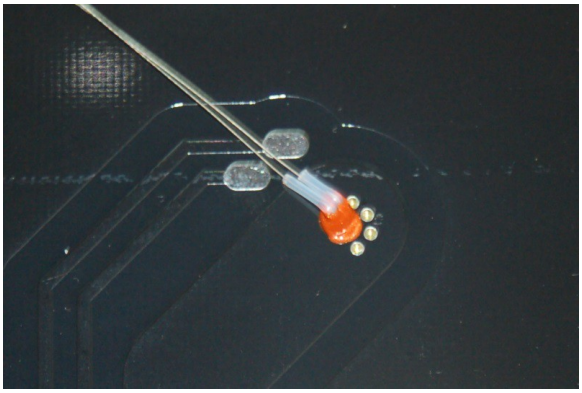


Fig. 5-5: Same thing, different view.

Once you've got the thermistor in the Onyx, I want you to spread the thermistor leads apart such that each one crosses the center of a solder pad and then tape the thermistor in place using a short strip of Kapton tape. This will keep the thermistor in place while you're soldering the leads to the pads.

Next, solder down the leads to the solder pads. Make sure you don't create a solder bridge between the two pads. Use only enough solder to do the job. When you're done, clip off the excess leads.

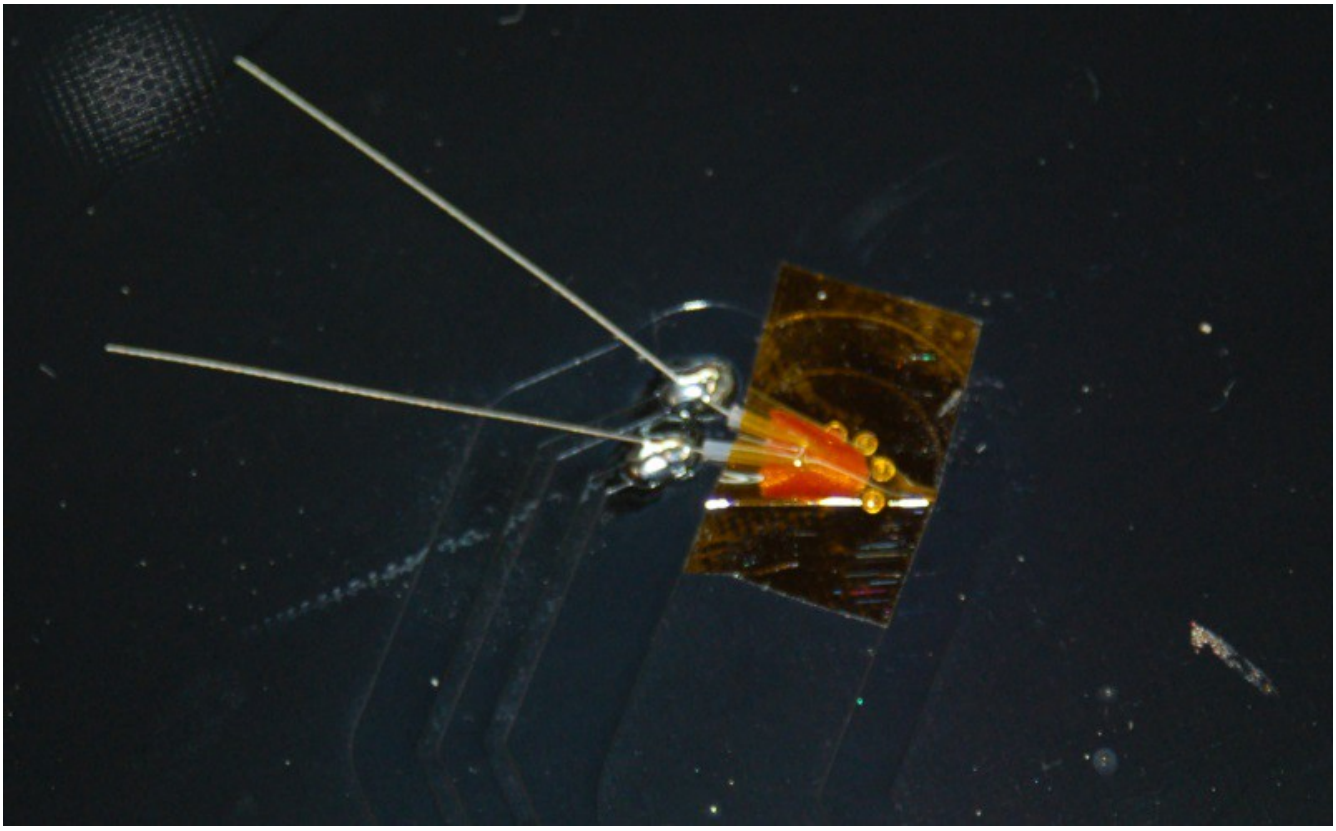


Fig. 5-6: Thermistor taped in place and soldered.

With the Onyx still upside down, I want you to install the resistor as shown in Fig. 5-7. The resistor is soldered from the side of the Onyx facing you, not the opposite side as you'd normally do when soldering in parts. After you finish soldering it in, clip the leads flush to the opposite side of the Onyx and using a small file, ***carefully*** file away the remaining tips of the resistor leads that stand proud of the surface. The 300mm Borosilicate build plate covers this area and you don't want to scratch it or cause it to lift up.

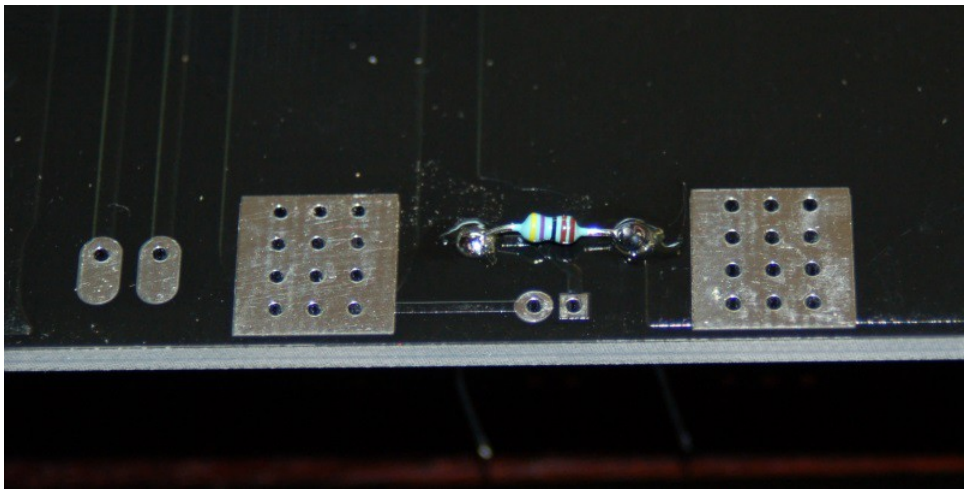


Fig. 5-7: Resistor soldered to the bottom of the Onyx.

Once you've got the clipped leads cleaned up, install the red power LED as shown:

The LED is oriented with its Cathode (- side) facing to the right as indicated by the arrow. If you install it backwards it won't come on when the power is applied to the Onyx. The LED is bent “down” in order to be viewed easily from the top of the Onyx. (Remember, in this photo the Onyx is upside down.) As you did with the resistor, clip the excess leads and carefully file away any remaining part that sticks above the surface of the “top” face of the Onyx.

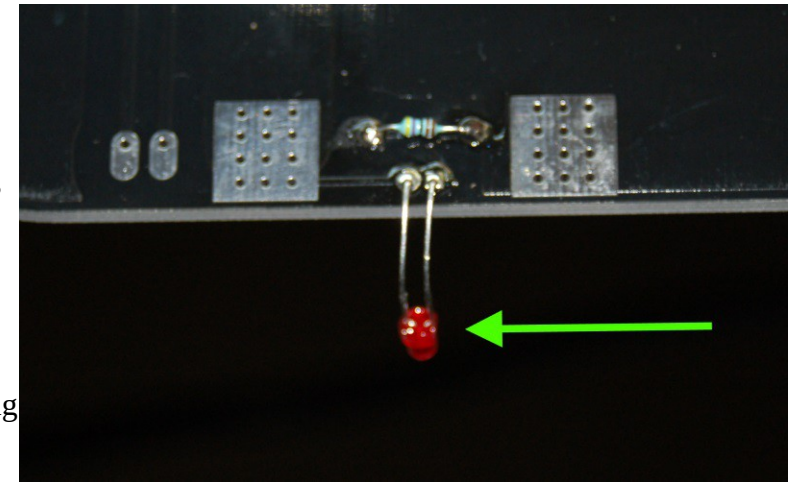


Fig. 5-8: LED installed.

Cut 21” off the 18ga, four conductor cable included with your kit and remove the black & red wires from it. These are the power wires that need to be soldered to the power pads on the bottom of the Onyx.

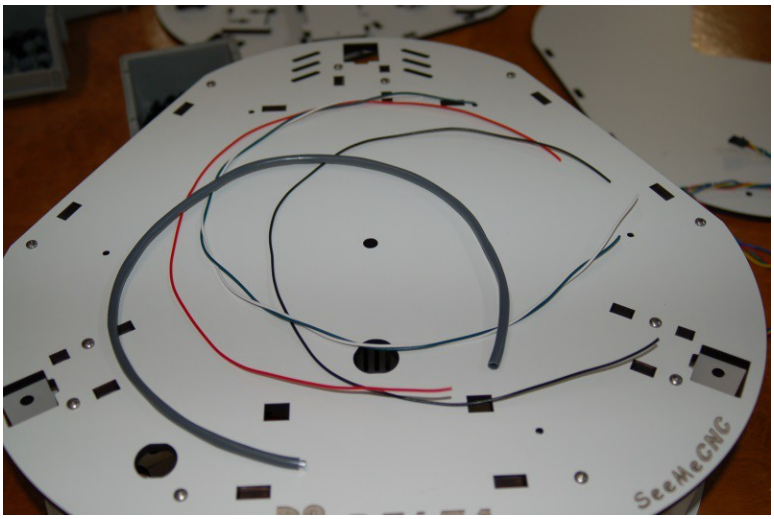


Fig. 5-9: Wire stripped out of the 4 conductor. cable.

Flatten the end of the black wire and lay it on the pad as shown below. Solder in place.

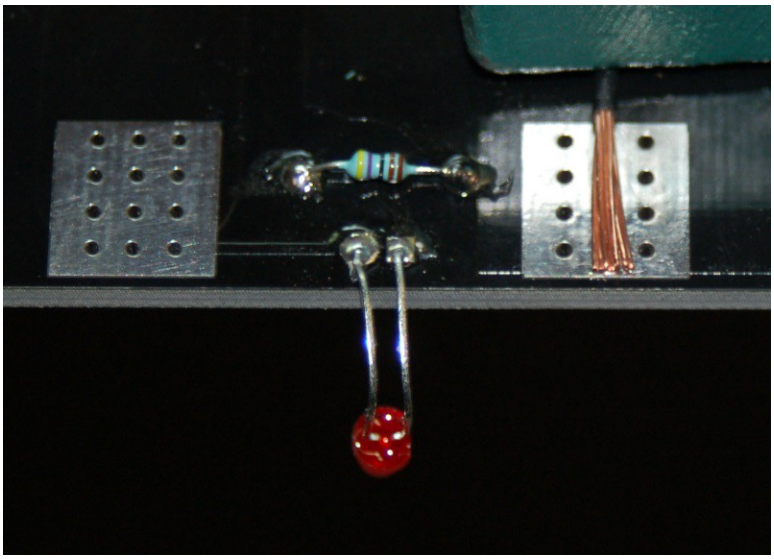


Fig. 5-10: Ground lead ready to be soldered down.

Repeat the process with the red wire as shown in Fig. 5-11.

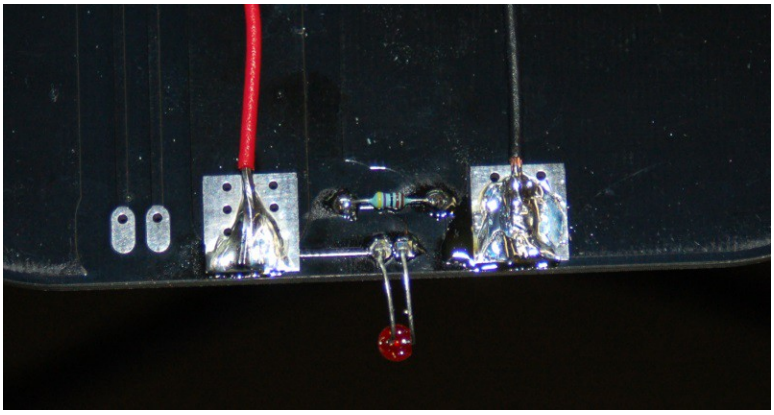


Fig. 5-11: Power wires soldered down.

Now you need to attach the thermistor signal leads. You'll find them in the box that the RAMBo came in. It's a long, two wire (both white) cable with a connector fitted to one end.

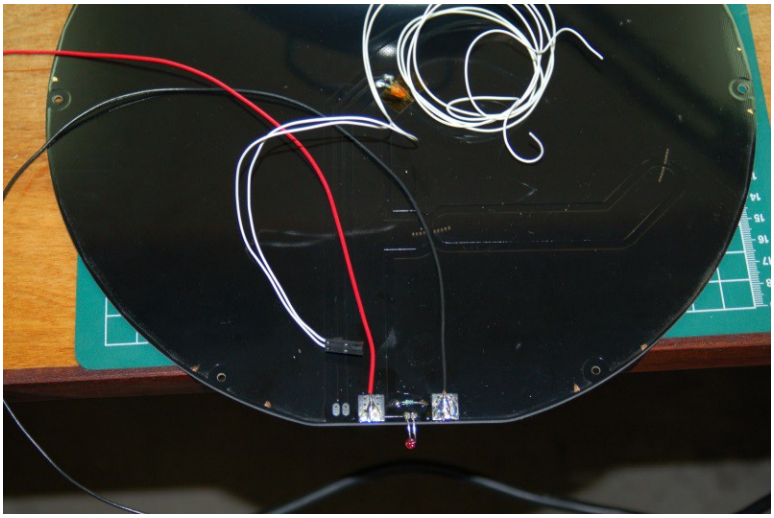


Fig. 5-12: Thermistor signal wires.

Strip about 1/8” of the insulation of the bare ends of the thermistor wires and solder them on top of the solder pads that are located to the red wire. One wire per pad and take care to avoid solder bridges. When you're finished, cover the thermistor signal wire pads and the two power wire pads with Kapton tape to guard against a short circuit.

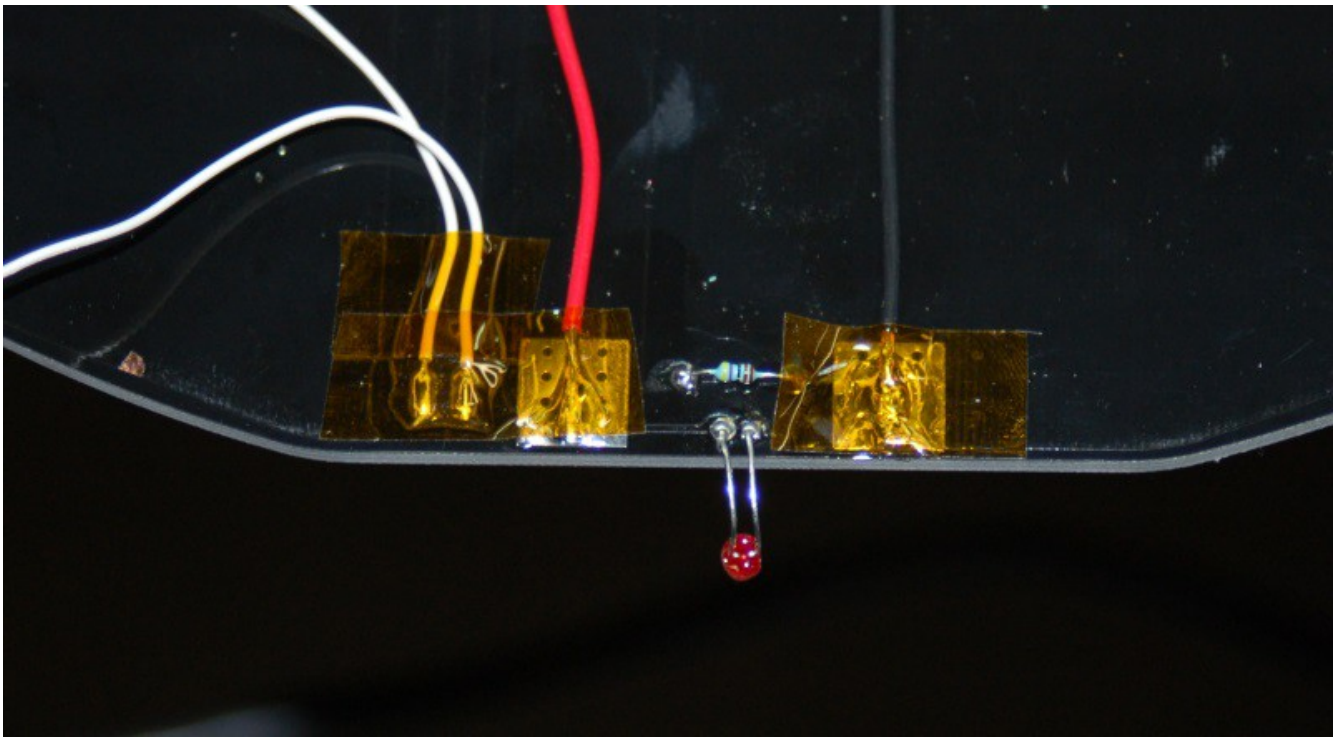


Fig. 5-13:Thermistor wires installed and covered with Kapton tape.

Mounting the Onyx Heated Bed to the Base

In order to mount the Onyx on the base, you'll need to route the power and thermistor signal wires through the center of the base as shown below.

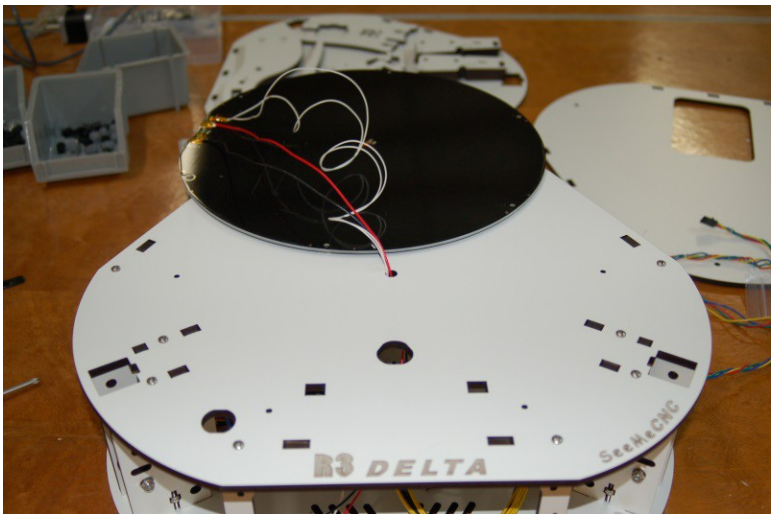


Fig. 5-14:Routing the Onyx wiring.

Pull the wiring forward through the opening in the front facing vertical support in order to get them out of your way. Next, you'll need to lay down the Onyx support plate – it's the star-shaped Melamine part that came in the Onyx Heated Bed package.

Lay the mounting plate on the bed and then lay the Onyx heated bed on top of it.

Fig. 5-15: Orienting the Onyx on the mounting plate.

Now it's time to attach the Onyx and its mounting plate to the base – grab the round nylon spacers and the six #4-40 flat head screws that were included with the Onyx. Adjust the position of the printer so that the Z axis is farthest away from you.

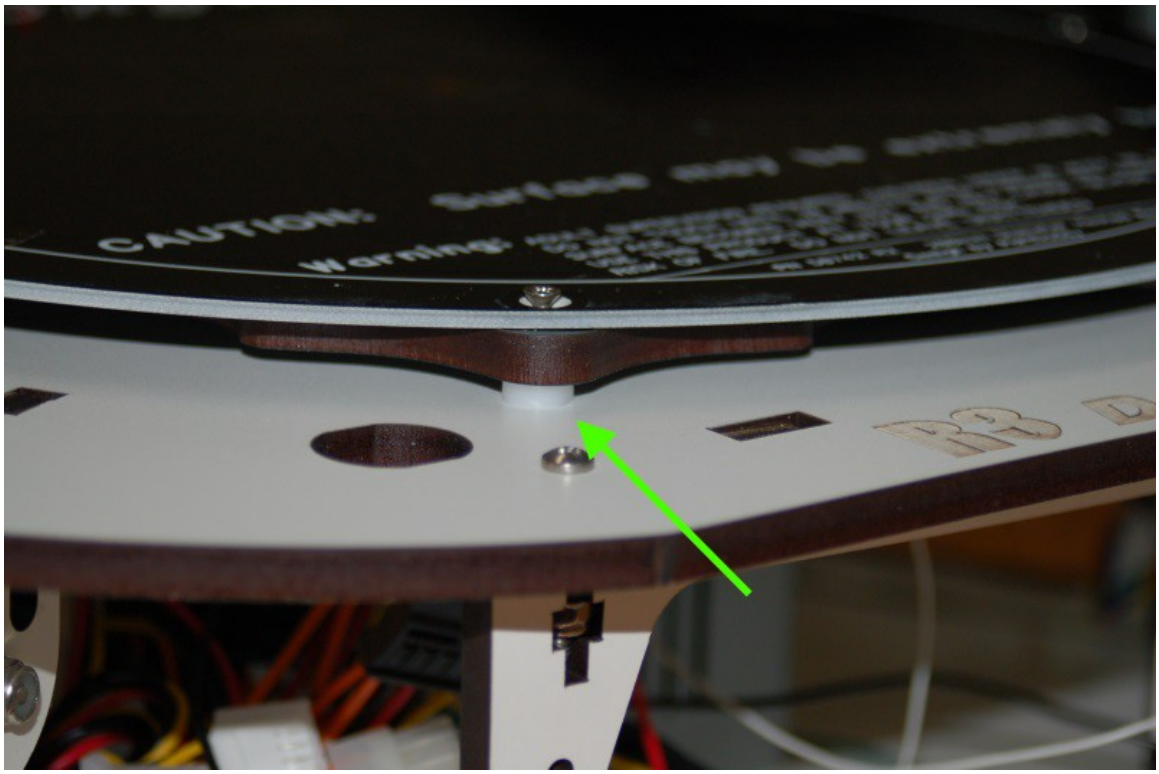


Fig. 5-16:Attaching the Onyx & mounting plate.

Orient the Oynx heated bed such that the LED is farthest away from you and near the Z axis. You can refer to Fig. 5-17 on the following page for clarification if needed.

Make sure that the Onyx and its mounting plate holes are roughly aligned with the mounting holes in the top of the base. Slide a nylon spacer under the mounting plate so that it aligns with both the Onyx and mounting plate holes. Insert a #4-40 flat head screw and tighten it only a turn or two. You want to leave the screws loose until you've got all six installed.

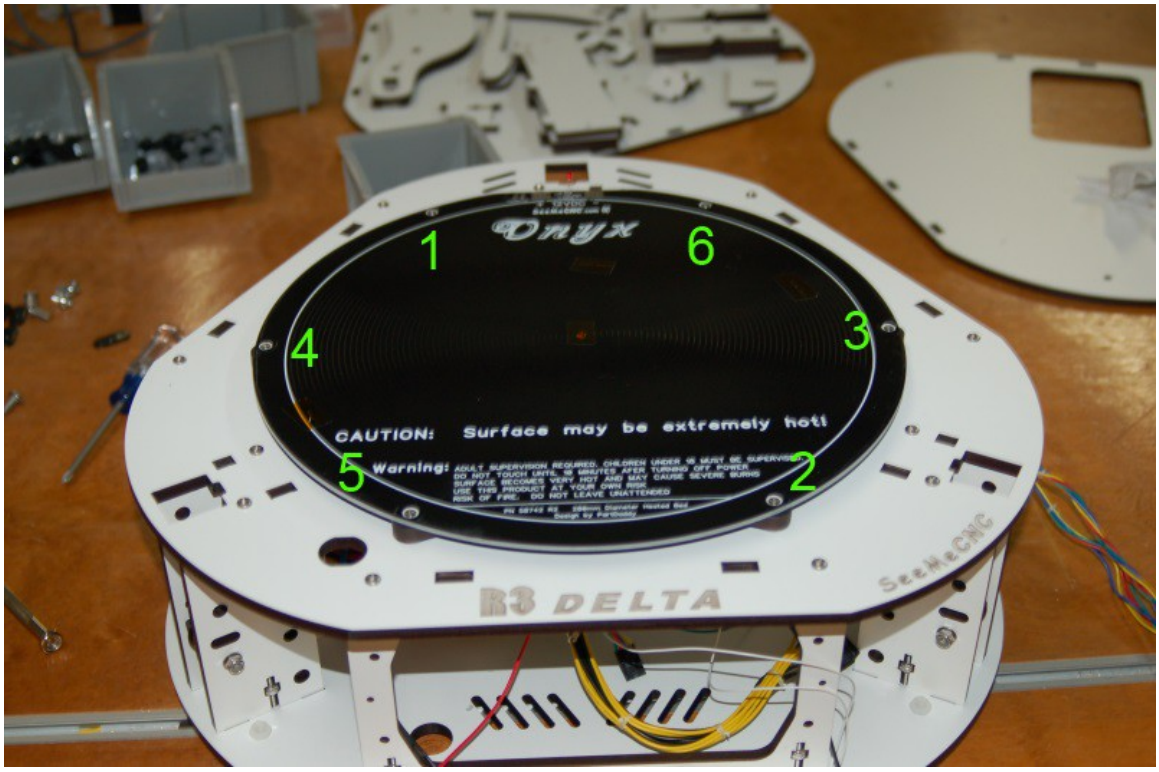


Fig. 5-17:Screw tightening order.

When you've got all six screws loosely installed, carefully take up any extra slack in the Onyx wiring by carefully pulling any extra through the center hole in the base. Tighten the six screws using the order shown in Fig. 5-17 above. This will help ensure that the Onyx remains as flat as possible when it heats. As you tighten each screw, make sure you only turn it a bit more than finger tight – if you apply too much force, the screw head will damage the Onyx.

6 – Installing the Towers & Tower Wiring

For this task you'll need the following items:

1. Aluminum Tower Extrusions (3)
2. 18ga, four conductor cable
3. 22ga, four conductor cable
4. End Stop Wires (3)
5. 26ga black & red wire

Threading the Towers

In the Rostock MAX v2, you'll be routing the hot end, extruder stepper and end-stop wiring through the center of the three towers.

In order to do this, you're going to have to strip the outer jacket from both four conductor cables. This is very easy to do, but there IS a bit of a trick to it. :)

Inside each cable is a very thin, very strong Nylon string. You're going to use this string to split the gray outer jacket of the cable along its full length.

Start by carefully removing about 6” worth of the outer jacket by using an X-Acto knife to score the jacket all the way around. When you've got it scored, pull the end away from the rest of the cable and the jacket should come off at the score line.

You'll be left with four colored wires, a bare wire, a very thin foil wrap and that magic little Nylon string. Wrap the string around your fingers to get a good grip on it and holding the exposed wires in one hand, pull the Nylon string away from you, along the length of the cable. Continue doing this until it's split the whole gray outer jacket. The only part we're interested in is the four colored wires.

The Z axis tower will get the 18ga hot end wires, the X axis tower will get the end-stop wires and the Y axis tower will get the 22ga wires for the extruder as well as two pair of 26ga wires for the PEEK fan and the layer fan.

The 18ga wire is the largest in diameter, followed by the 22ga wire and the 26ga wire is the thinnest.

The 18ga, four conductor cable is the first one we're going to use. When you're done stripping it, you should have something like this:

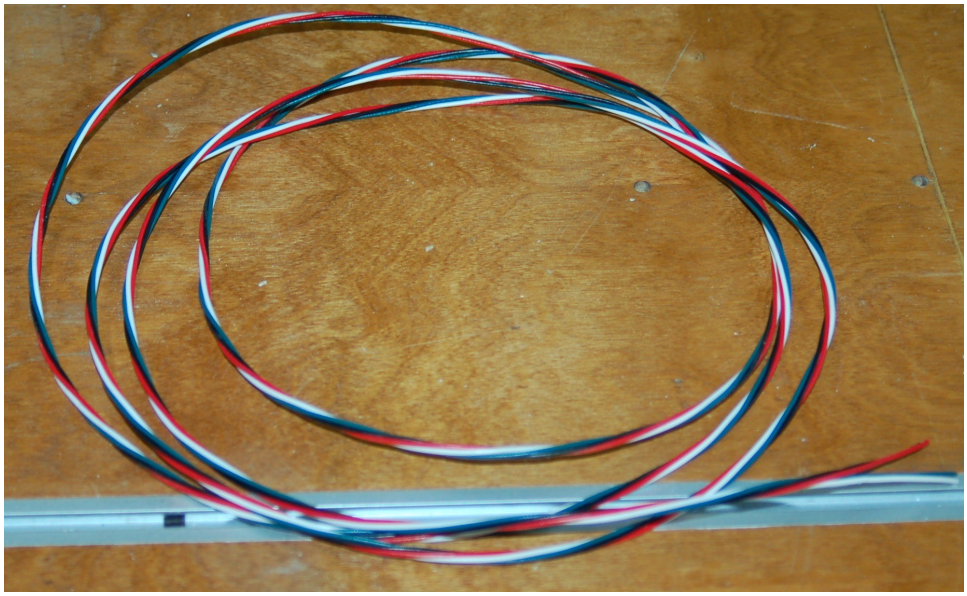


Fig. 6-1: 18ga, four conductor hot end cabling.

Take one of the aluminum extrusions and thread this wire right through the small hole in the center of the channel.

When you're done, it should look like the image shown below.

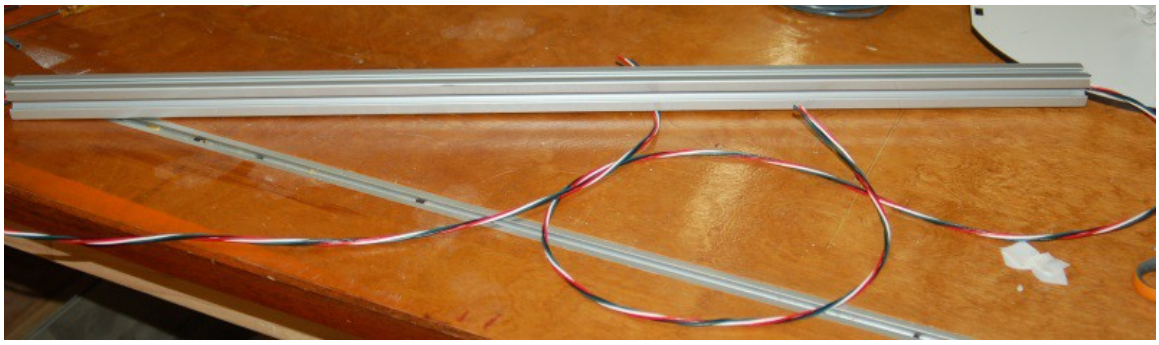


Fig. 6-2: 18ga wires in the Z axis tower.

Now grab the 22ga, four conductor cable and strip the jacket off of it if you haven't already.

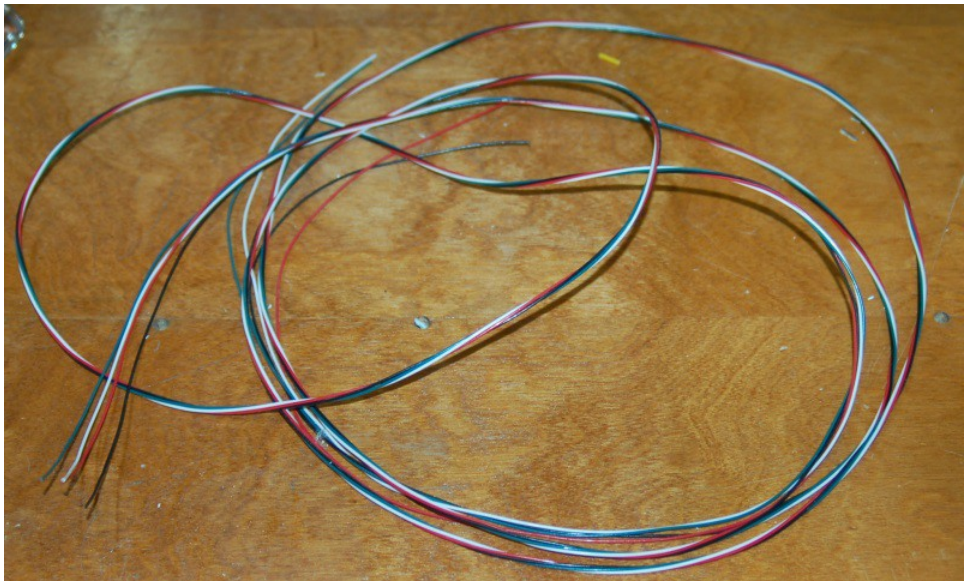


Fig. 6-3: 22ga wire with the jacket removed.

Next, grab the little bag that the 26ga wires are in. You'll want to un-spool all of it and cut it in half so that you've got two equal lengths of black wire and two of red wire.

After you've cut the black & red wires in half, pair one black & one red together and tie a knot at the end. This will help you identify the pair later.

Fig. 6-4: 26ga wire for fans.

You'll need to pair up a black and red wire and then spindle the end as shown:

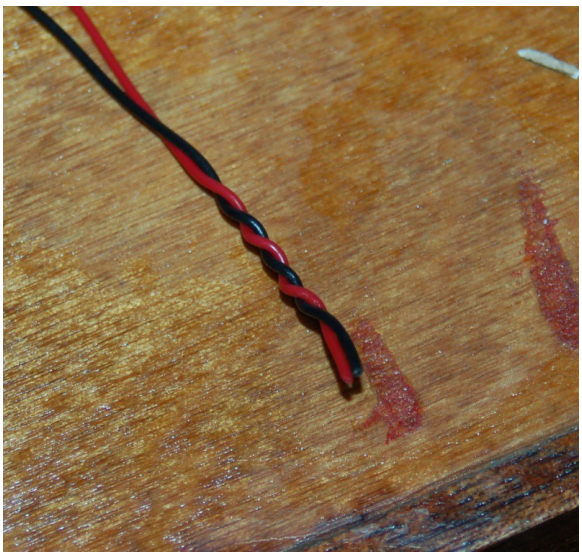


Fig. 6-5: Twisted fan wires.

Do this for the other black & red pair and then using a short length of Scotch tape, bundle them together with the 22ga wire. This whole bundle will go down the center of the next aluminum tower extrusion. The tape will help make sure that all six wires make it without any problems.

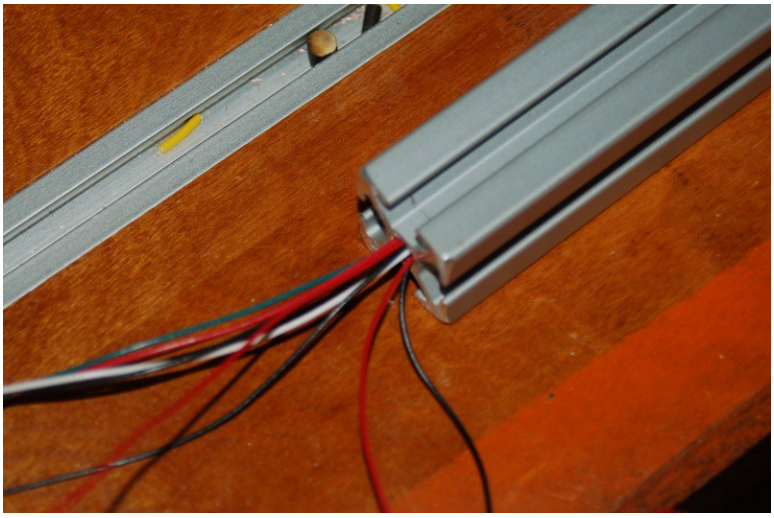


Fig. 6-6: Threading the Extruder & Fan wires.

When you've pulled the bundle through the tower, identify the black & red pair that you tied the knot in and tie a knot at this end as well.

Now you'll need to grab the end-stop wire bundle from the box the RAMBo was shipped in.

When you unspool the wires, you should end up with three pairs of wires, one black and one white. They'll have a female crimp-on connector on one end and a shielded, crimp-on spade lug connector on the other.

Fig. 6-7: End stop wires.

Take the first pair and using a Sharpie or other fine tip, permanent marker, write an “X” on the flat face of the two spade lug connectors.

Carefully spindle the ends of the wire with the female crimp connectors as shown in Fig. 6-8.

When you're done, thread the wire through the center of the next aluminum extrusion and label the pair with an “X” using Scotch tape or other label.

Fig. 6-8: Spindled wire ends.

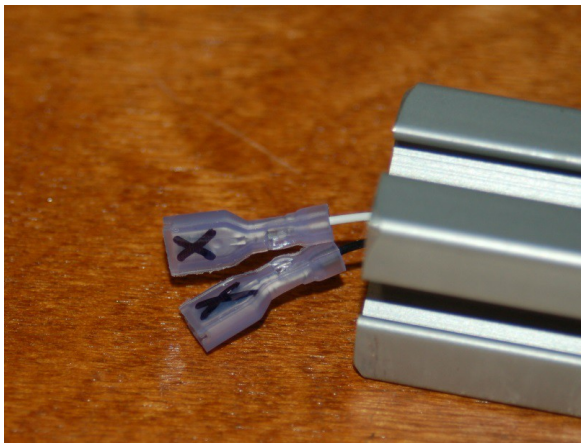


Fig. 6-9: Labeled end-stop wires.

Repeat the process for the next remaining pairs of wires – label them “Y” and “Z”. You'll need to know which one is which and it's a lot easier to do it now than to figure it out once everything is all assembled.

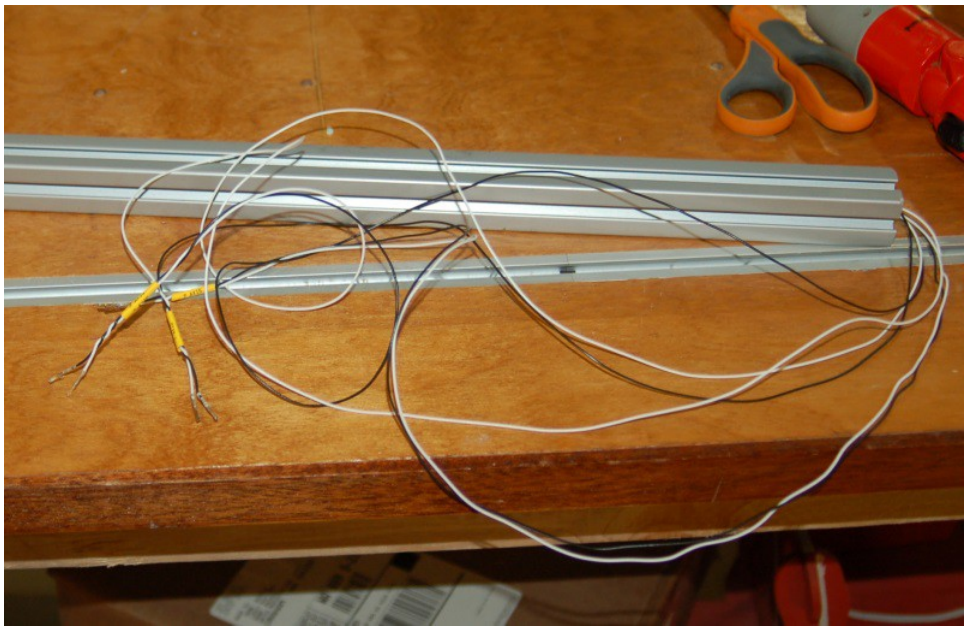


Fig. 6-10: End-stop wires pulled and labeled.

Setting the Towers

Now it's time to set each tower in its respective tower support assembly.

We're going to start with the Z axis – remember, it's the one right behind the power supply.

In order to set the Z axis tower (the one with the 18ga wires!), you'll need to turn the T-Slot nut plates such that they're oriented vertically as shown below.

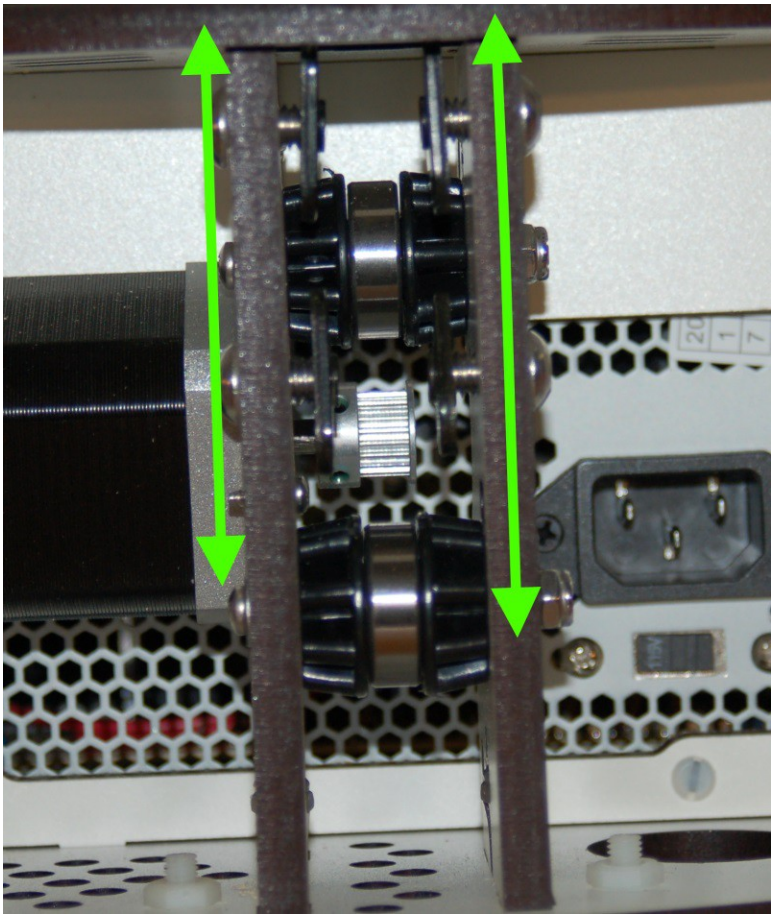


Fig. 6-11: T-Slot nut plate orientation.

Don't tilt your head, the picture is leaning a little bit. :)

Next, you're going to thread the wires coming out of the Z axis tower through the “post” hole in the top of the base that's right over the T-Slot nut plates.

Now carefully set the end of the tower in the post hole and slide it in. It's a VERY tight fit but do not wiggle it! You want to drive the tower straight down. If you wiggle it front to back too much, you can break the area where it's thin at the corners of the hole.

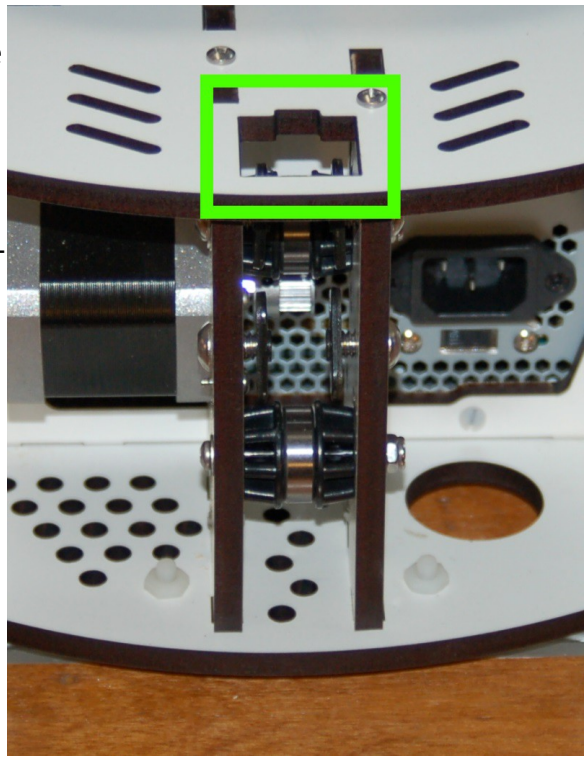


Fig. 6-12: Z-Axis post hole.

As you drive the tower down, make sure that the T-Slot nut plates are sliding into the t-slots on both sides of the tower. You'll want to drive it down until it comes into contact with the #4 leveling screw that you installed in the tower assembly. After the tower is set, use a 5/32 Allen (hex) wrench to tightend the ¼-20 cap screws only finger tight. You'll tighten them up after the top as been mounted.

Now that the tower is set, route the wires out the wire guide slot as shown in Fig. 6-13.

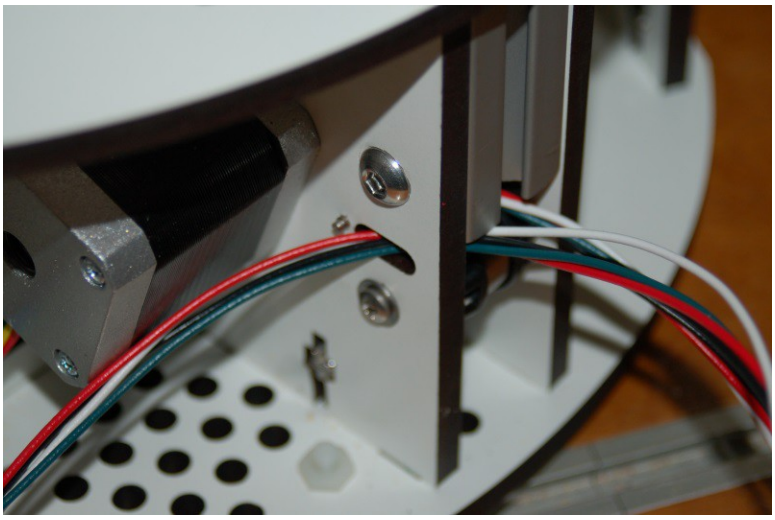


Fig. 6-13: Wire guide slot.

Now repeat the tower setting operation for the X axis.

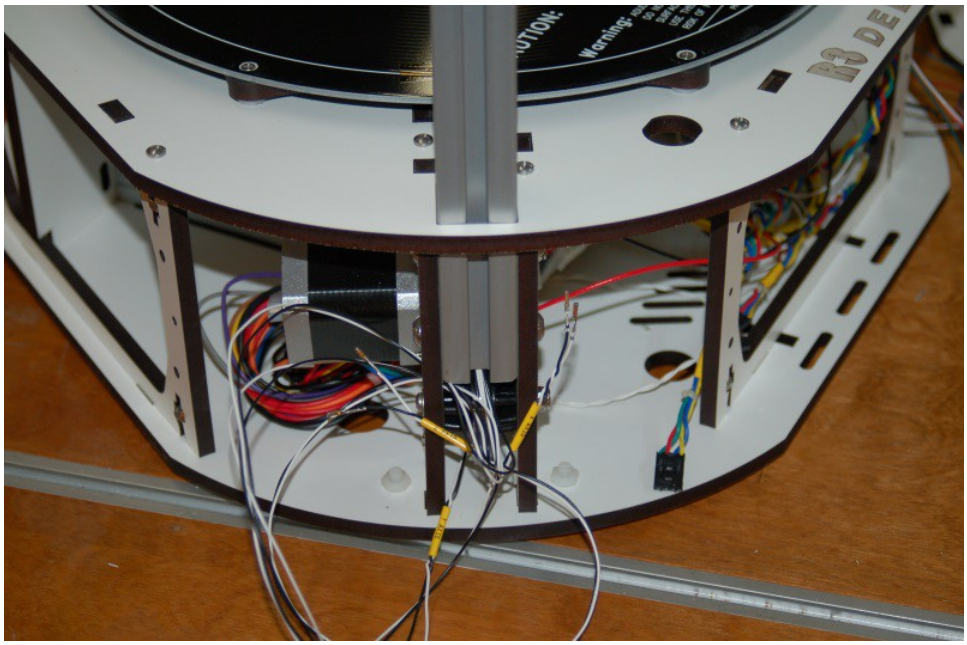


Fig. 6-14: X axis tower set and wire routed.

And again for the Y axis tower.

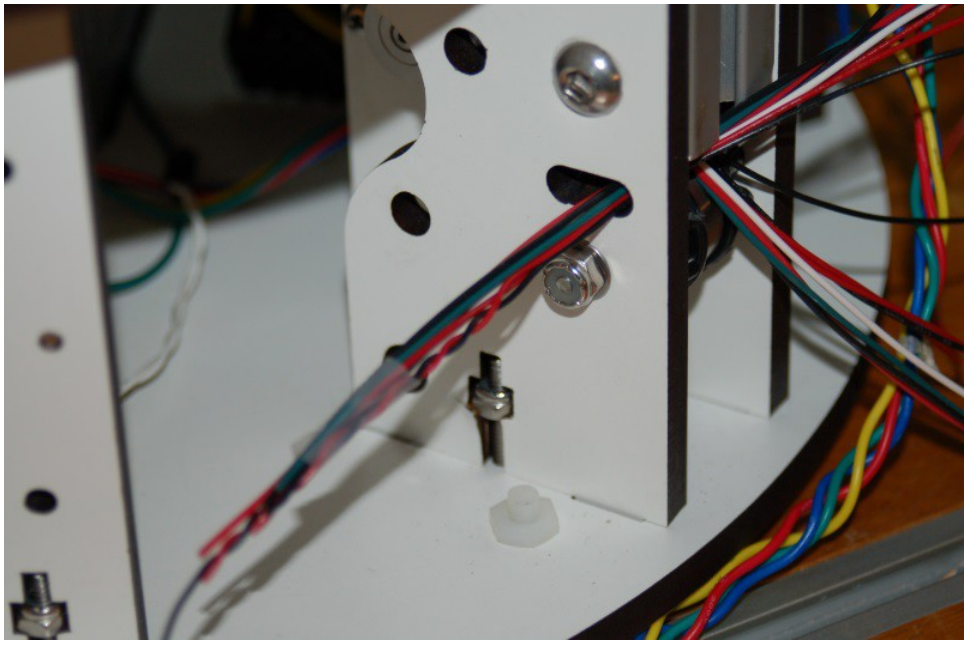


Fig. 6-15: Y axis tower set and wire routed.

7 – Assembling the Top Section

In order to assemble the top section of the Rostock MAX v2, you're going to need the following components:

1. Top Section Base Plate
2. Tower Spacers (3)
3. #4 3/8” Pan Head Philips Screws (3)
4. Upper Tower Mounts (6)
5. End Stop Switches (3) (Not Shown.)
6. #2-56 x 5/8” Pan Head Machine Screws (6) (Not Shown.)
7. #2-56 Finish Nuts (6) (Not Shown.)
8. ¼-20 x 1/2” Stainless Steel Button Head Cap Screws (12) (Not Shown.)
9. T-Slot Nut Plates (12) (Not Shown.)

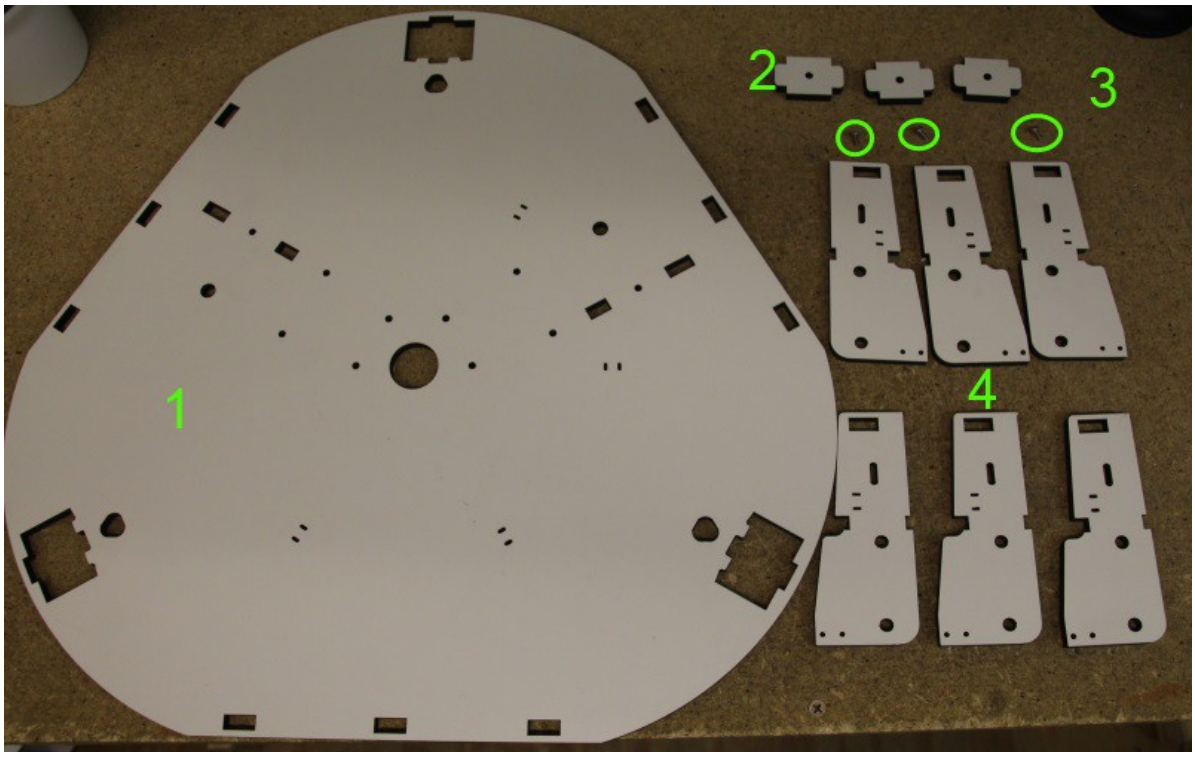
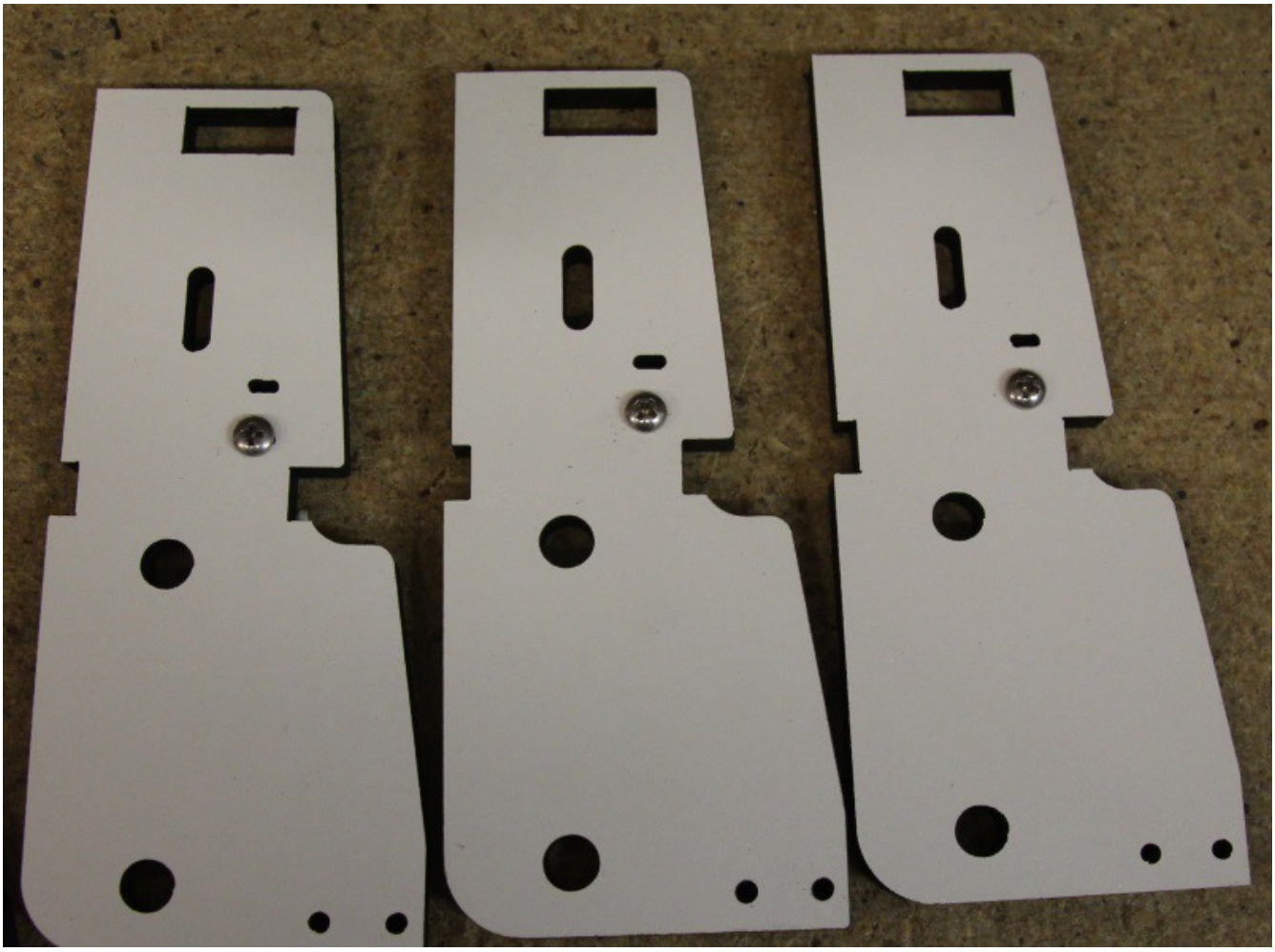


Fig. 7-1: Top Section Components.

Prepping the Upper Tower Mounts

Before you can install the upper tower mounts, three tower depth stop screws need to be installed as shown below.



These screws perform the same function as the ones previously installed in the lower tower mounts. This helps guarantee that the top section will be at the correct height on all three towers.

Installing the Upper Tower Mounts

The upper tower mounts don't fit in the tower sockets without being a bit clever in the installation process.

Take two upper tower mounts (make sure the one on your left has a tower depth stop screw installed!) and set them into the tower socket as shown in Fig. 7-3.

Now you want to adjust the mount on the right side so it's at the same angle as the one shown in Fig. 7-4 below.

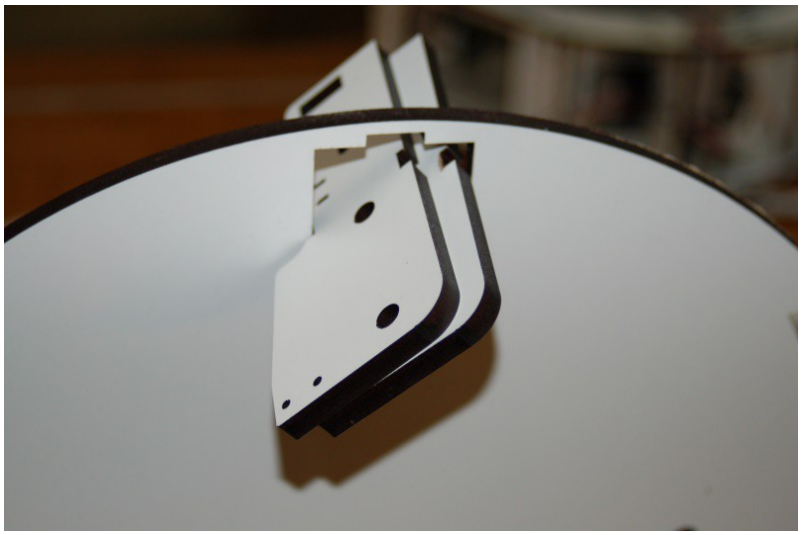


Fig. 7-3: Inserting the upper tower supports in the top plate.

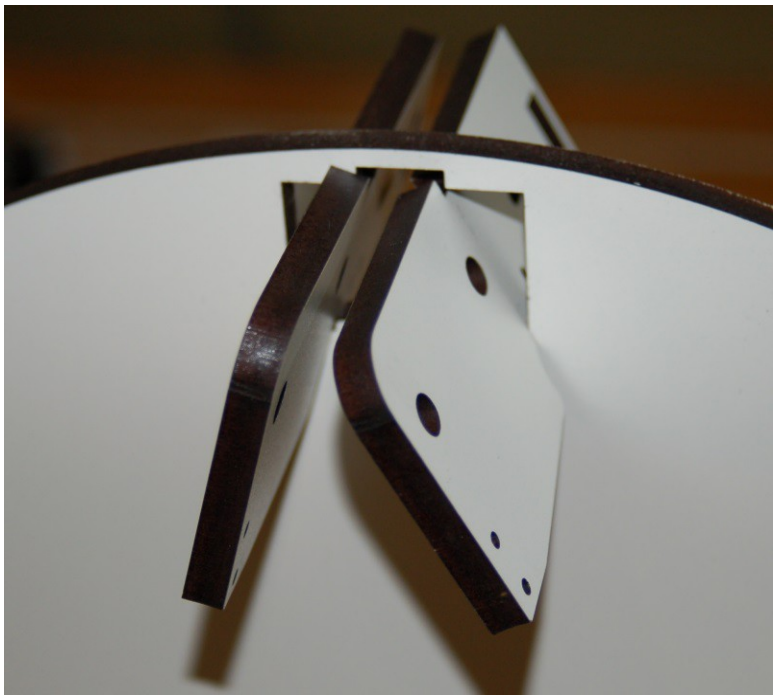


Fig. 7-4: Fitting the tower supports

Now carefully spread them apart so that they're flush with the sides of the tower pocket.

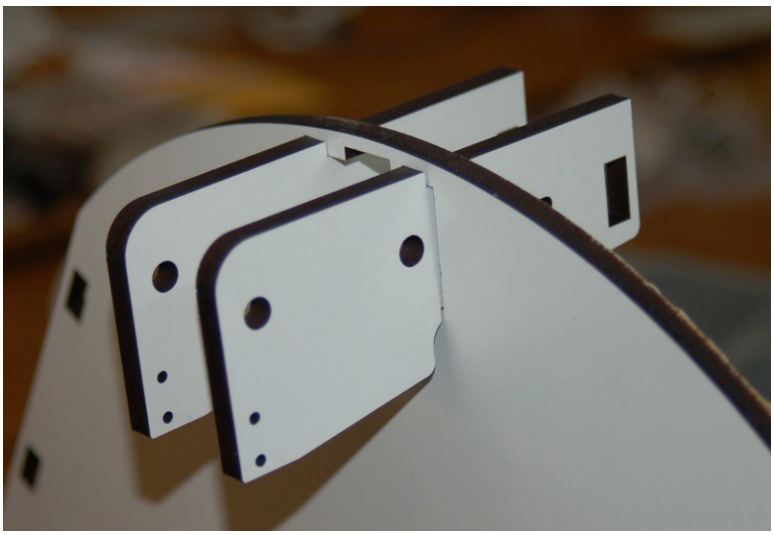
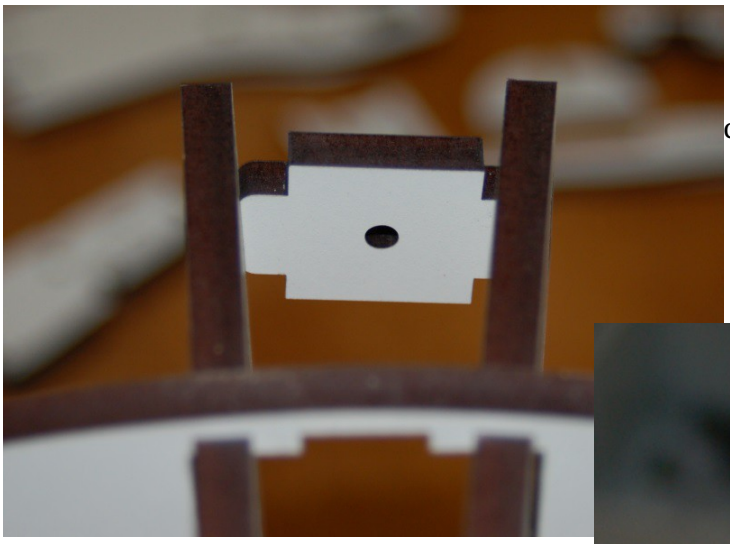
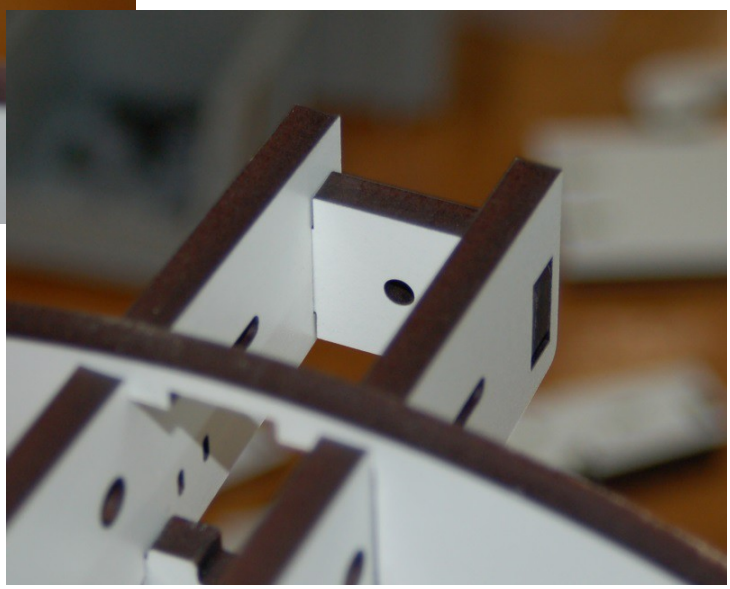


Fig. 7-5: Tower supports fully seated.

Now you want to insert one of the tower mount spreader blocks as shown below.



The fit is very tight, but it WILL fit. Just be careful to not break the tower support plates.



Repeat the process for all three upper tower supports.

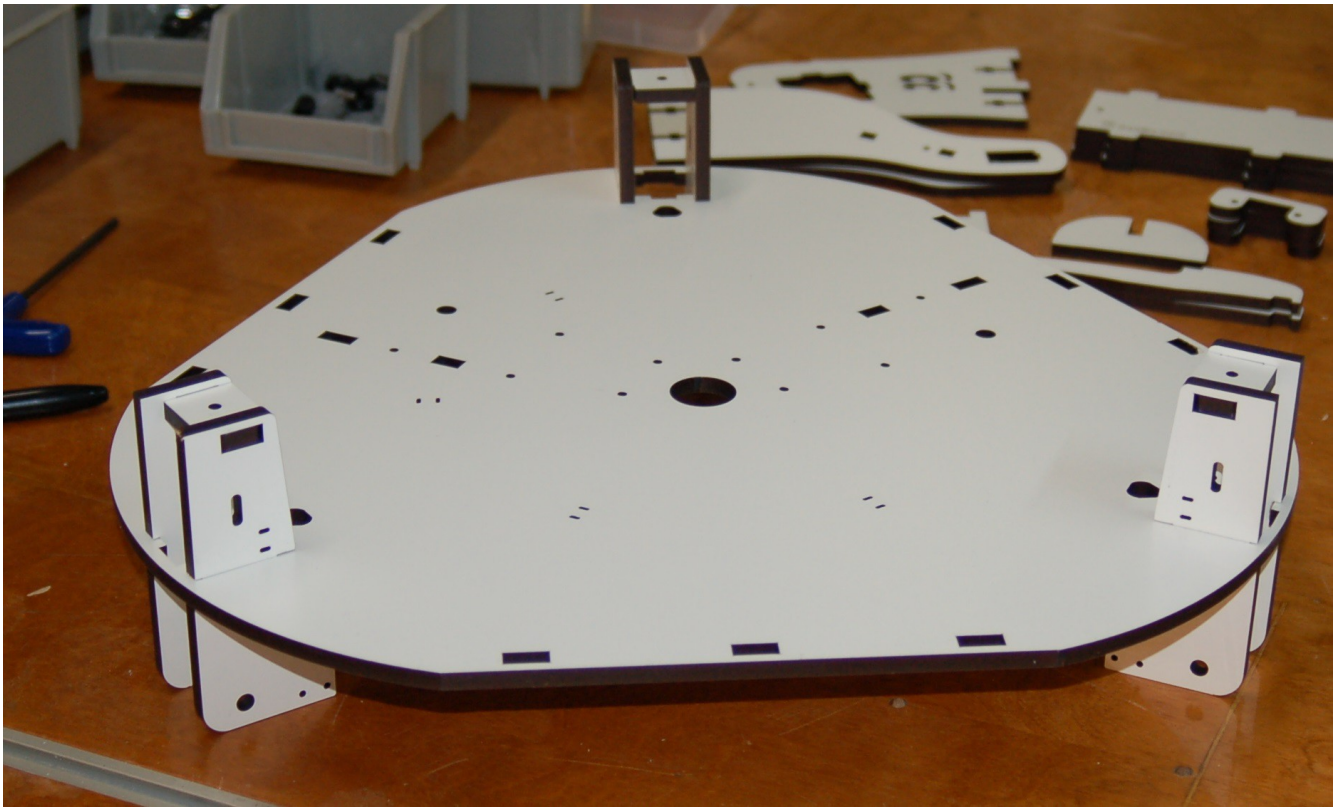


Fig. 7-8: All three upper tower supports installed.

Installing the End Stop Switches

For this step, you'll need the following parts:

1. End Stop Switches (3)
2. #2-56 x 5/8” Pan Head Phillips Machine Screw (6)
3. #2-56 Finish Nuts (6)

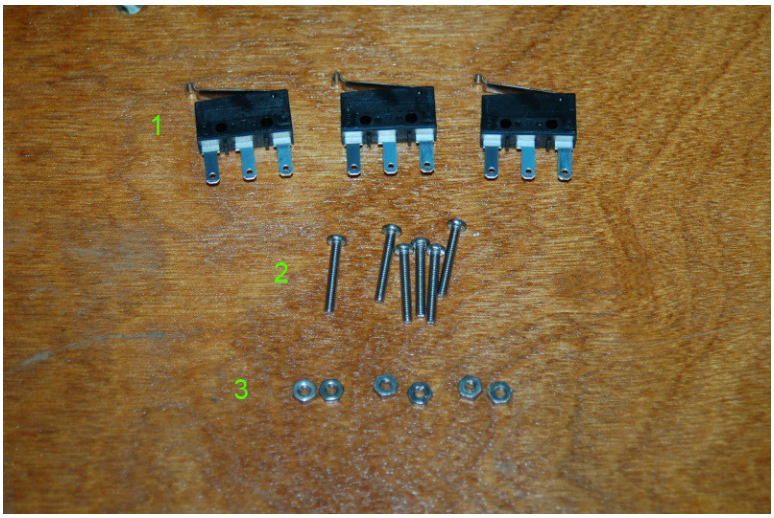


Fig. 7-9: End Stop Parts.

In order to install the end-stop switches, you'll need to bend the leads on the switches to about a 45 degree angle. Using both hands, bend the leads by using the switch body as a lever against a table surface as shown. Please make sure that the switch is oriented exactly as shown!

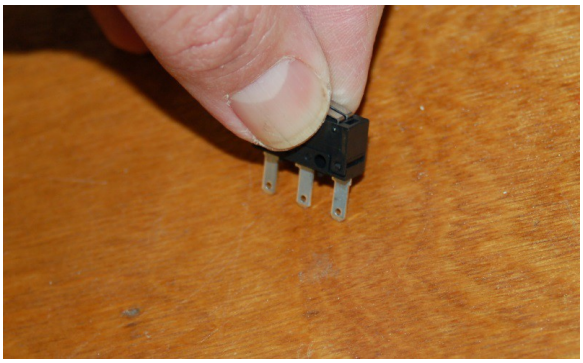


Fig. 7-10: Bending the switch leads.

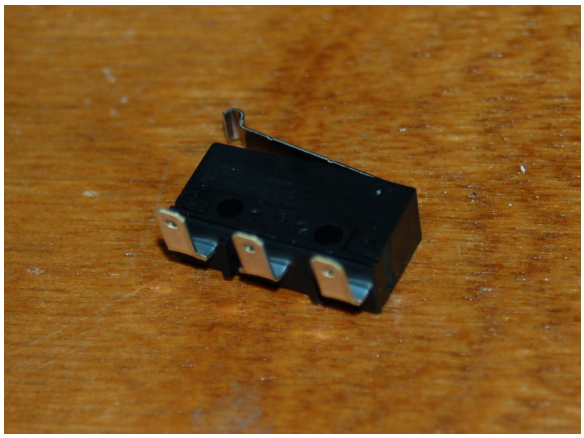


Fig. 7-11: Leads bent!

The tip of the switch lever must be to your left when you bend the leads!

Bend all three switches the same way and then you can install them on to the right side of the upper tower supports. I indicate “right” side as that's the orientation when the top plate is flipped upside down.

Using two #2-56 x 5/8” pan head screws and two #2-56 finish nuts, install the end-stop switches on to the upper tower support as shown. Make sure you don't over tighten the screws, or you'll crack the switch body.

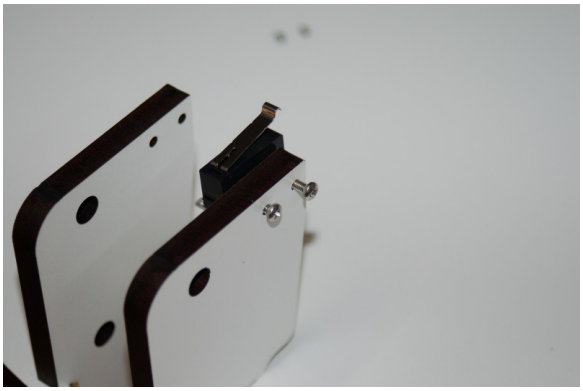


Fig. 7-12: Installing the end-stop switch.

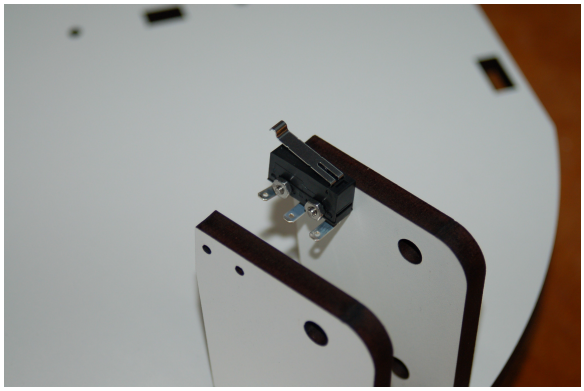


Fig. 7-13: Installing the end-stop switch.

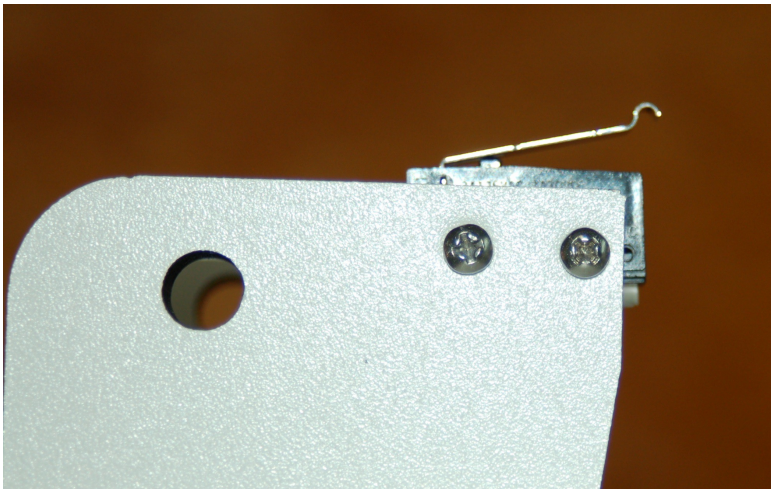


Fig. 7-14: End-stop switch installed.

When you're finished, the underside of the top plate should look like Fig. 7-15 below.

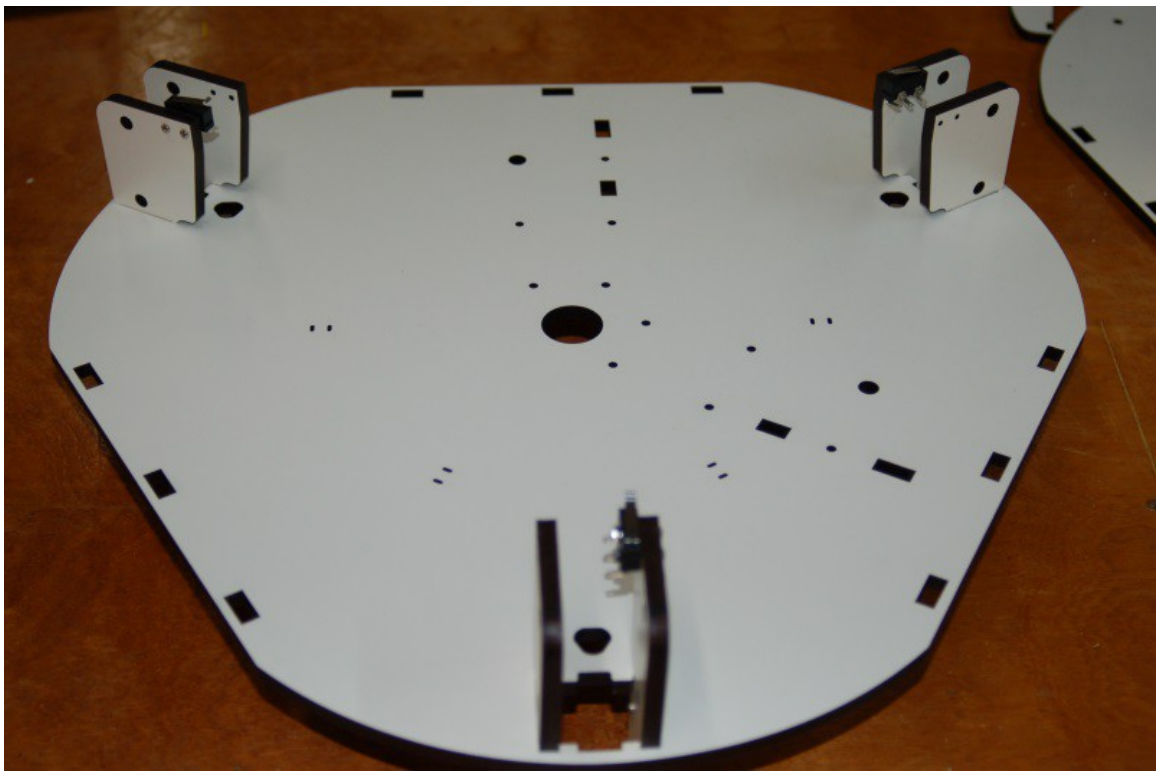


Fig. 7-15: Three end-stop switches installed.

Installing the Upper Tower Mounting Hardware

For this step, you'll need the following parts:

1. ¼-20 x 1/2” Button Head Cap Screws (12)
2. T-Slot Nut Plates (12)

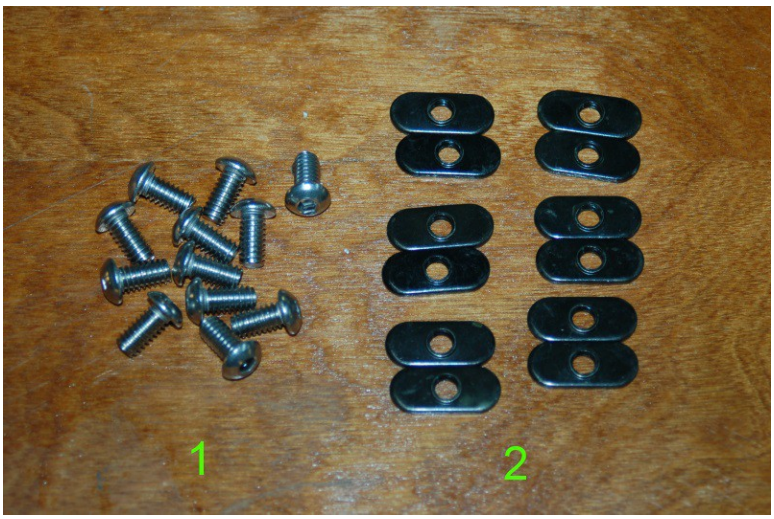


Fig. 7-16: Upper tower mounting hardware.

Install four ¼-20 button head screws and four T-Slot nut plates into each upper tower support as shown in Fig. 7-17.

Thread the nut plates only a couple of turns – they need to be as loose as the lower ones were in order to properly fit the towers.

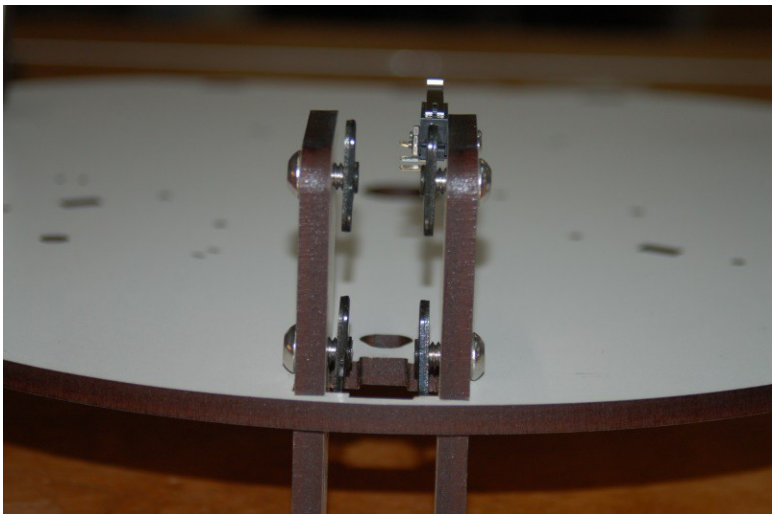


Fig. 7-17: Mounting hardware installed.

8 – Assembling and Installing the Cheapskate Carriages

Assembling the Cheapskate Rollers

For this step, you'll need the following components:

1. Bearing Sleeves (24)
2. 608ZZ Bearings (12)

Fig. 8-1: Bearing Sleeves.

Fig. 8-2: 608ZZ Bearings.

The Cheapskate rollers are made from two bearing sleeves and a single 608ZZ bearing. You'll need to apply sleeves to all 12 bearings used in this step.

Start by laying a sleeve on the table, wide “face” up. Press a 608ZZ bearing into it as shown in Fig. 8-4.

Set the second sleeve on top of the 608ZZ bearing and press down with the palm of your hand until it's fully seated. You may want to use a paper towel or cloth pad to protect your hand – the edges of the sleeve can be sharp.

Repeat this process for the 11 remaining 608ZZ bearings.

Fig. 8-4: Bearing seated in a sleeve half.

Fig. 8-4: Finished Cheapskate rollers.

Assembling the U-Joint Carriers

For this step, you'll need the following components:

1. U-Joint Carriage Base (3)
2. #6-32 x 5/8” Socket Head Cap Screws (6)
3. #6-32 Nylon Lock Nuts (6)
4. Cheapskate Carriage Inside Plate (3) (Not shown.)
5. #6-32 x 1/2” Stainless Steel Flat Head Screws

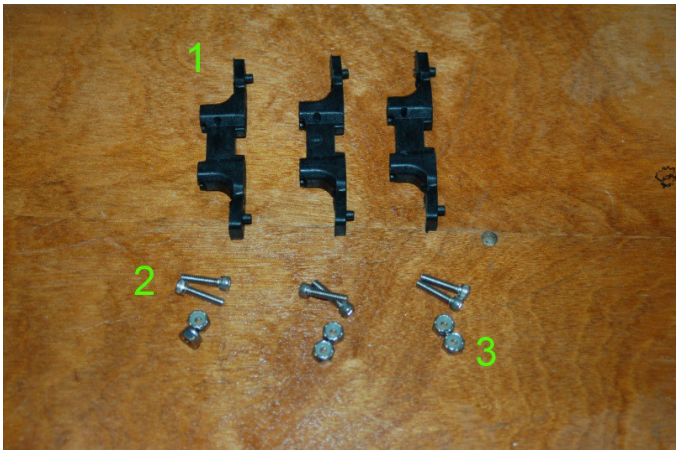


Fig. 8-5: U-Joint Carrier Hardware.

The u-joint carrier bases get installed on the inside carriage plate by pressing their alignment pins into the holes indicated by the arrows in Fig. 8-6.

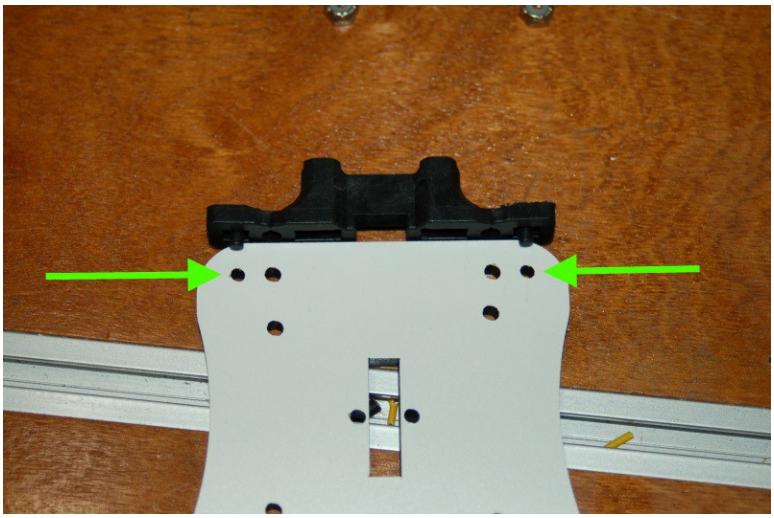


Fig. 8-6:Aligning the u-joint carriage base.

Note that these u-joint carriers are an interim design and are simply the original v1 parts that have had the end posts ground off. You may find that the grinding has removed enough material that the alignment pin is no longer able to remain in place. If you find that happening, just remove that alignment pin and hold it in place until you can get the socket head cap screws installed.

From the front side of the u-joint carrier, insert two #6-32 x 5/8" socket head cap screws through the holes indicated. Install two #6-32 Nylon lock nuts on the back and tighten them down using a 7/16 hex wrench and a 5/16" wrench.

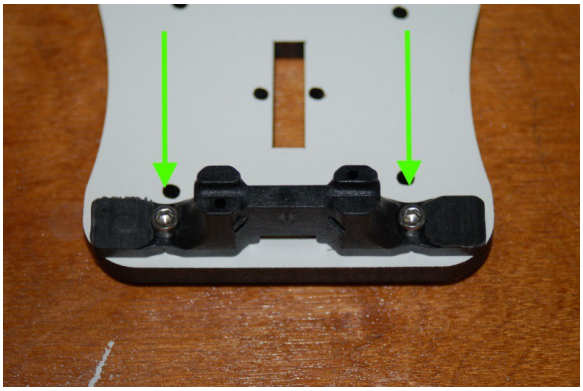


Fig. 8-7: Screw locations.

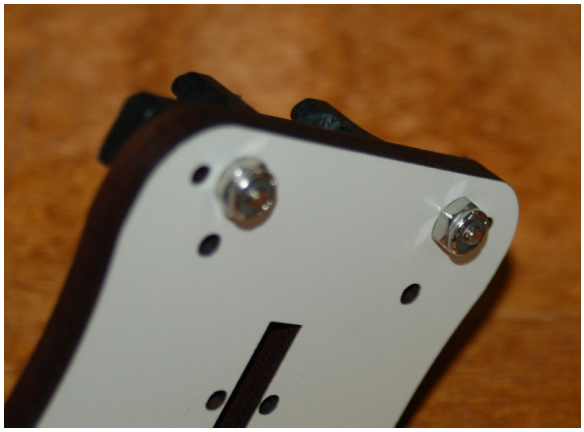


Fig. 8-8: Nylon lock nuts installed.

Next, you'll need to install a #6-32 x 1/2” Stainless Steel flat head screw. This screw is what triggers the end-stops when the printer is commanded to its “home” position.

Install the screw *exactly* as shown in Fig. 8-9. Use the rightmost hole in the u-joint carrier – this hole lines up with where you installed the end-stop switch. When you install the screw, try to leave the bottom of the head even with the top of the inside carriage plate as indicated by the green line in the photo. This will give you a consistent start point when it comes time to calibrate the printer when your build is completed.

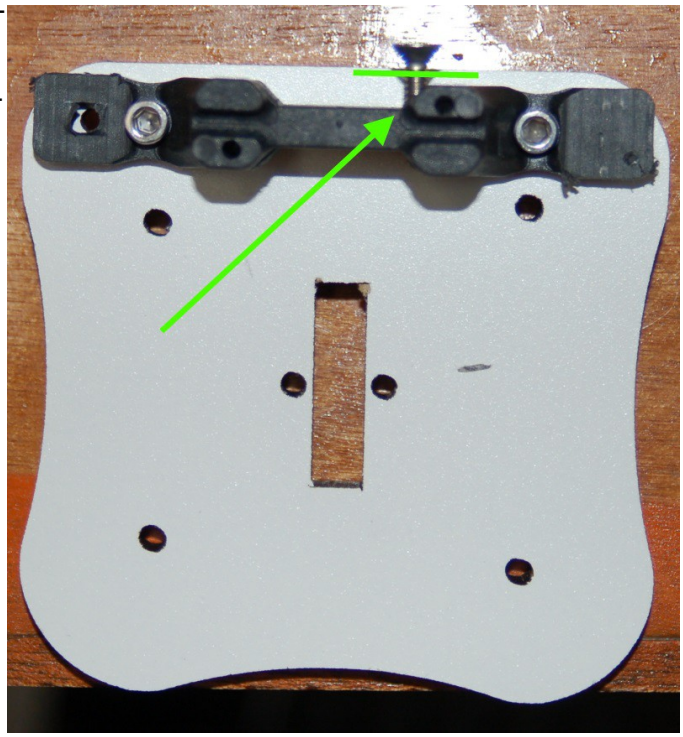


Fig. 8-9:Setting the end-stop triggering screw.

Fig. 8-9A:Screw alignment.

Fig. 8-9A should give you a good idea as to how the bottom of the screw head aligns with the line defined by the top of the Cheapskate inner carriage plate.

Repeat these assembly steps for the other two u-joint carriers.

Installing the U-Joints

For this task, you'll need the following components:

1. U-Joint Spring Clip (3)
2. #4 x 3/8” Pan Head Phillips Machine Screw (6)
3. 3-1/8” U-Joint Axle (3)
4. Machined Aluminum U-Joints (6)

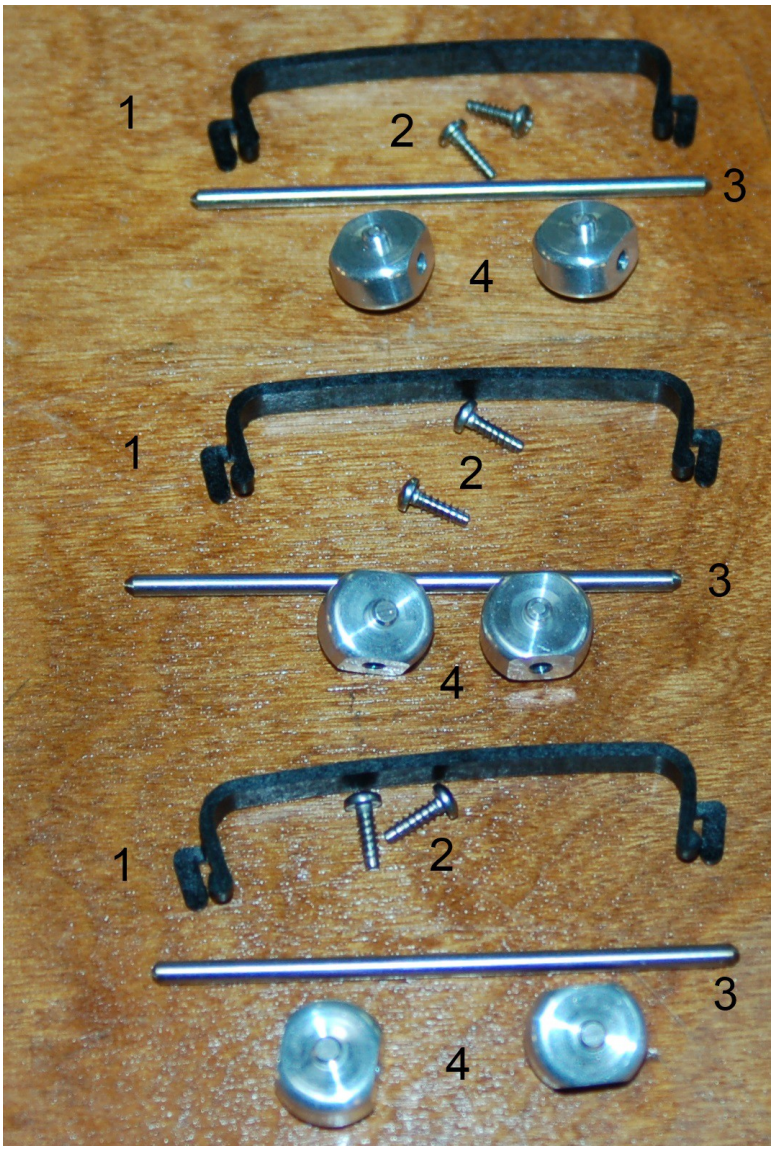


Fig. 8-10:U-Joint Components.

Carefully inspect the u-joint axles. Ensure that they're perfectly straight and are free of any scarring. If the axle is scarred, ***carefully*** clean up the scarred area by using steel wool, emery cloth or a fine cut file. If the axle is bent, contact support@seemecnc.com for a replacement. Test each u-joint by spinning it on the axle. They should all spin freely. If they don't check for burrs on the u-joint and de-burr as needed.

Using two #4 x 3/8” screws, install the 3-1/8” u-joint axle as shown below.

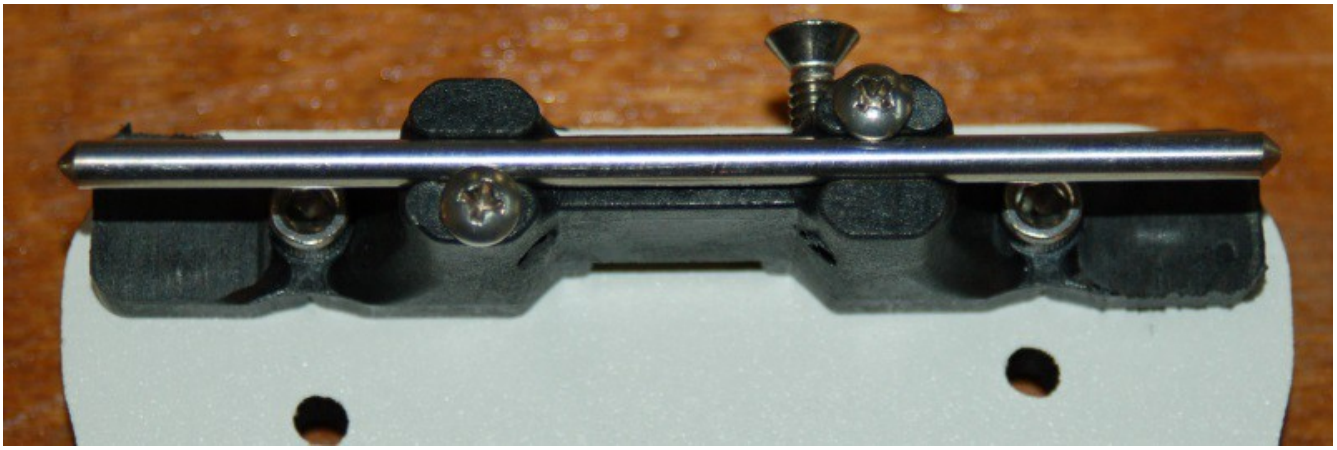


Fig. 8-11:Installing the u-joint axle.

Make sure that you've got the axle centered on the u-joint carrier. Note that the positions of the #4 screws in your build may be flipped from the image shown above. This is perfectly okay as long as the end-stop triggering screw is in the correct location.

Make sure that the axle is fully seated in the channel provided in the u-joint carrier. The #4 screws will be flush with the face of the u-joint carrier when the axle is properly seated.

Slide two u-joints on to the u-joint axle as shown below.

Fig. 8-12:U-Joints installed.

Now you can install the spring clip that retains the u-joints.

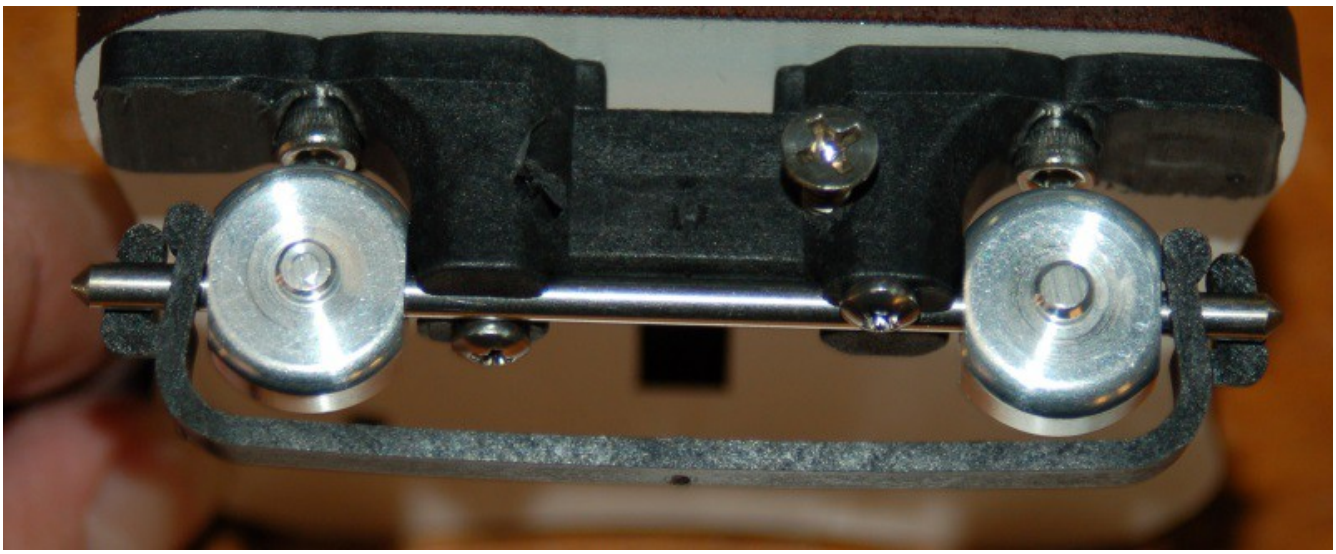


Fig. 8-13:U-Joint spring clip installed.

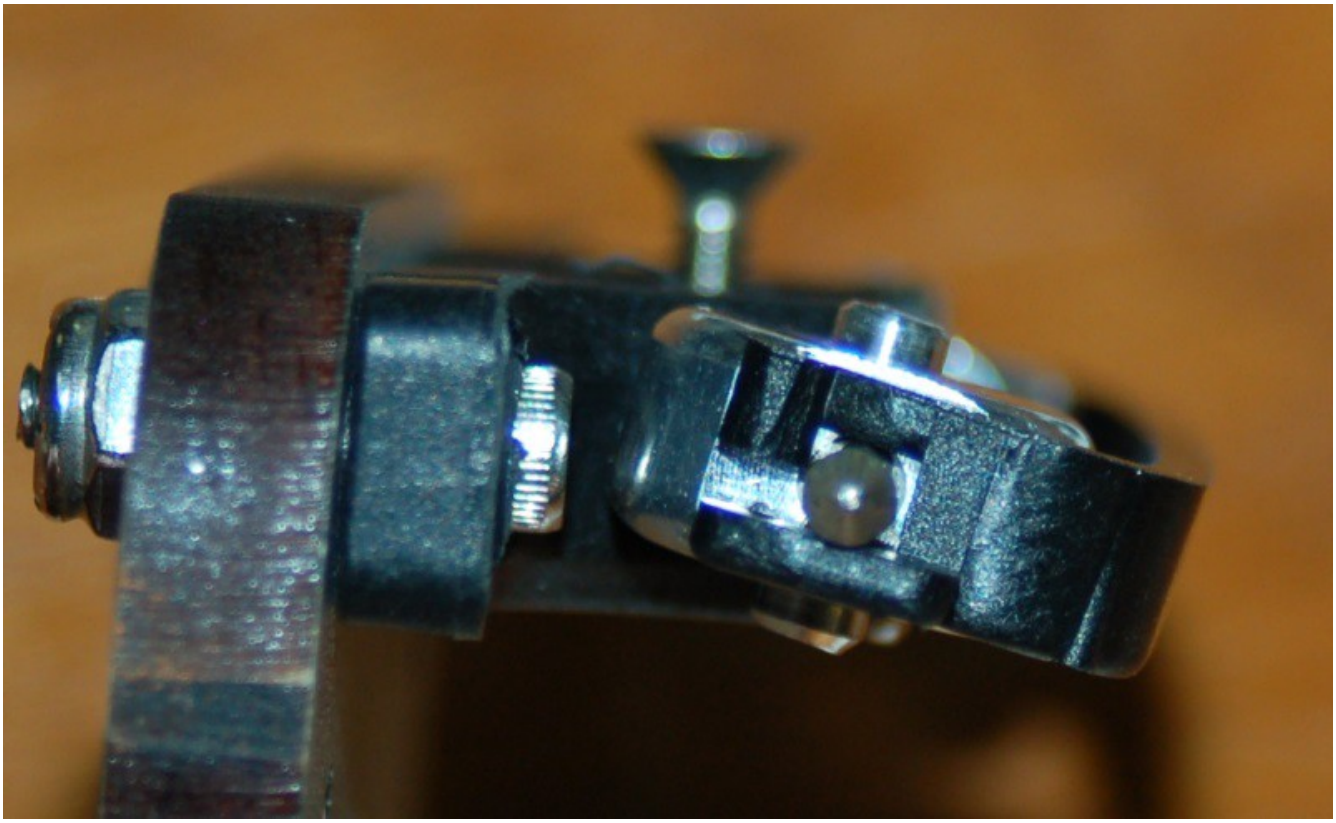


Fig. 8-14:U-Joint spring clip installed.

Repeat this task for all three u-joint carriers.

Installing the Belt Clip T-Nuts

For this step you'll need the following components:

1. #4-40 T-Nuts (6)

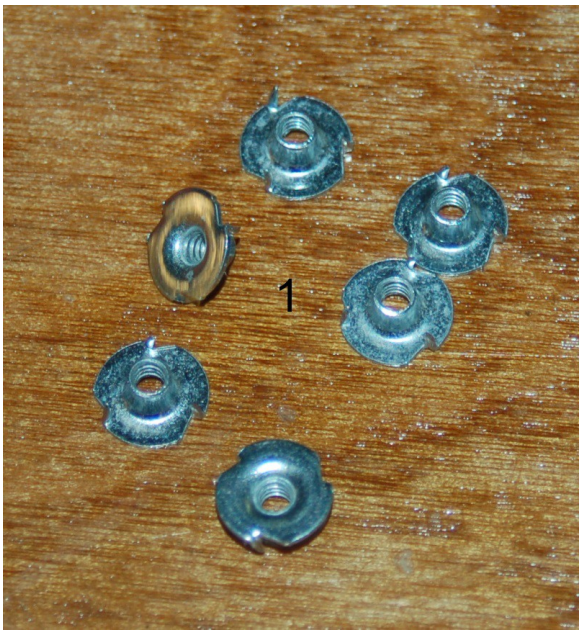


Fig. 8-15: Belt Clip T-Nuts.

Install two #4-40 T-Nuts in the back of all three Cheapskate inner carriage plates as shown.

Make sure the barbs on the t-nuts are fully seated in to the Melamine. If they're a bit loose, you can cover them with a small bit of Scotch tape to hold them in place until the belts are installed.

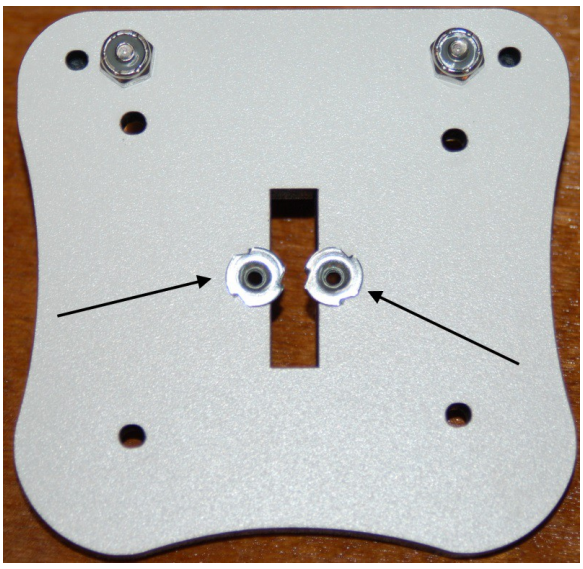


Fig. 8-16:Belt clip t-nuts installed.

Assembling and Installing the Cheapskate Carriages

For this step, you'll need the following components:

1. #6-32 x 2” Stainless Steel Pan Head Screws (12)
2. #6-32 Nylon Lock Nuts (12)
3. Cheapskate Bearing Black Plastic Spacer (12)
4. Cheapskate Bearing Gray Plastic Eccentric Spacer (12)
5. Cheapskate Outside Plate (3) (Not Shown.)
6. Cheapskate Inside Plate (3) (Not Shown.)
7. Cheapskate Roller (12) (Not Shown.)

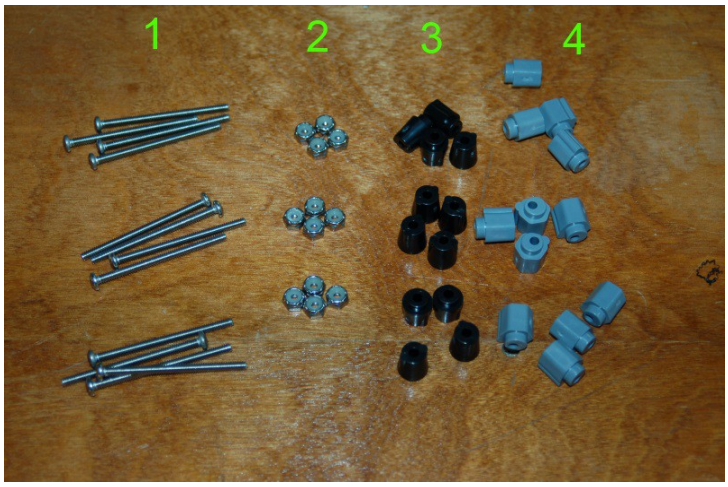


Fig. 8-17: Cheapskate hardware.

Start off by installing the black & gray spacers to each one of the 12 Cheapskate rollers you built previously.

Fig. 8-18:Standard spacers & roller.

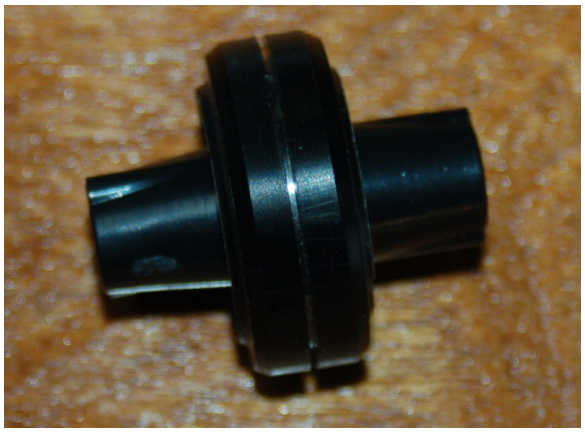


Fig. 8-19:Assembled std. roller.

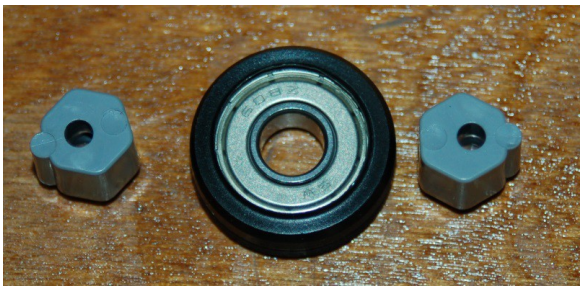


Fig. 8-20:Eccentric spacers & roller.

When you assemble the eccentric rollers, make sure that you've got the eccentric spacers aligned with one another as shown in Fig. 8-21.

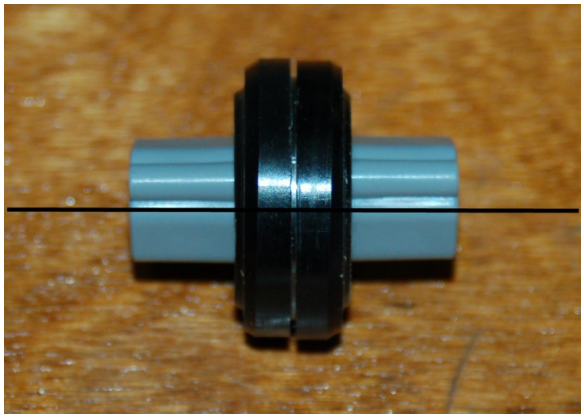


Fig. 8-21:Assembled Eccentric roller.

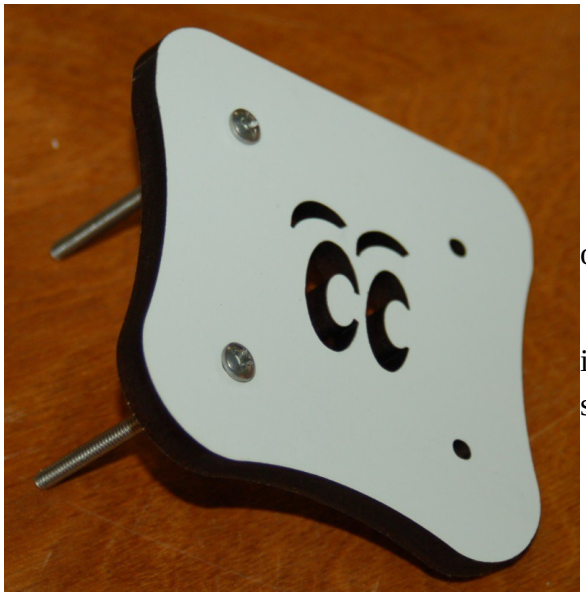


Fig. 8-22:Installing the 2" screws.

Install four #6-32 x 2” flat head screws into the Cheapskate outer plate. Fig. 8-22 shows two of the four installed.

Lay the Cheapskate outer plate flat on your work table and install the roller bearing assemblies you just finished as shown in Fig. 8-23.

Now it's time to install the Cheapskate carriages on to the aluminum towers.

Place the Cheapskate outer carriage you just assembled on the tower and then slide the Cheapskate inner carriage on to the four 2” screws as shown below.

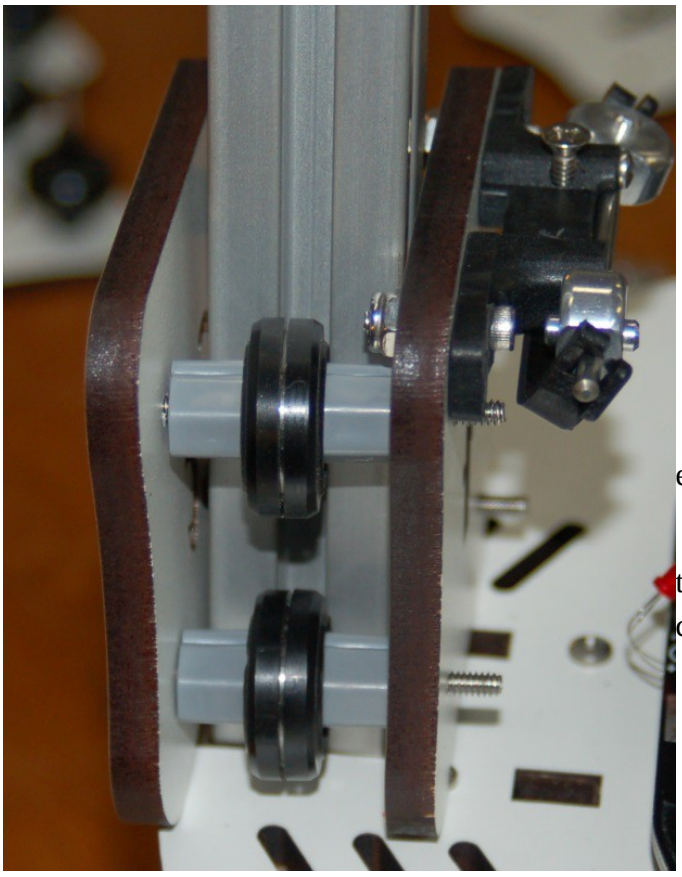


Fig. 8-24:Cheapskate on the tower.

Fig. 8-23:Cheapskate rollers installed.

Note that I've oriented the tiny bulge on the eccentric spacers such that they “point” straight up.

This position puts the roller very close to the tower and will reduce the time needed to set the correct tension on the Cheapskate carriage.

Install the four #6-32 Nylon lock nuts on to the 2” screws and tighten them down.

Fig. 8-25:Installing the #6-32 nuts.

Fig. 8-26:Don't forget to tighten them!

Repeat these steps for the two remaining Cheapskate carriages.

Fig. 8-27:Cheapskate carriages installed!

Adjusting the Cheapskate Carriages

Once you've gotten all three carriages installed, you'll need to adjust the eccentric spacers in order to tighten the grip of the roller bearings on the aluminum tower.

You'll need two 7/16” wrenches in order to make sure that you're adjusting both eccentric spacers at the same time.

You want to tighten the upper and lower rollers such that it grips the tower with no horizontal or vertical rotation – it must roll straight up and down.

I've created a short YouTube video that shows the degree of tightness that you're after with your adjustments.

http://youtu.be/9dUL8VKzc34

Fig. 8-28: Adjusting the eccentric spacers.

Adjust all three Cheapskate carriages so that they're all at as close to the same “grip” as you can get it. A good way to estimate that is to make sure that the little bulges on the eccentric spacers match across all three Cheapskates. Get one set as good as you can and then make the position of the others match. If it doesn't get you dead-on, it won't take much adjustment after that point.

9 – Installing the Top Plate and Idler Bearings

For this task, you'll need the following components:

1. #6-32 x 1-3/4” Stainless Steel Pan Head Screw (3)
2. #6-32 Nylon Lock Nut (3)
3. 608ZZ Roller Bear (3)
4. Black Plastic Bearing Spacer (6)
5. Assembled Top Plate (Not Shown.)

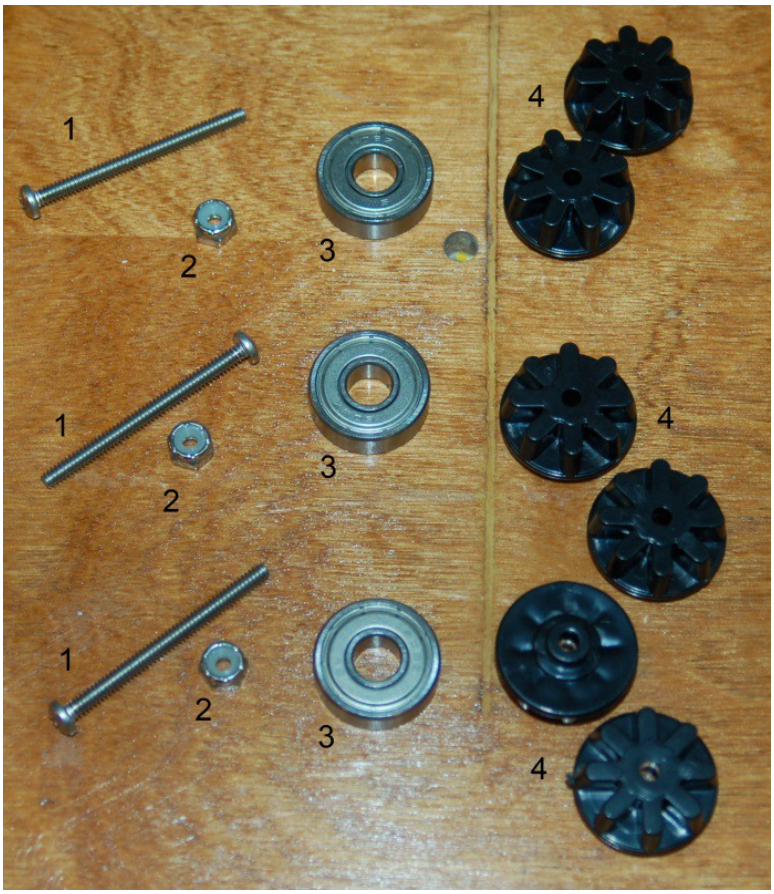


Fig. 9-1:Idler bearing hardware.

While completing this section you'll notice a discrepancy between the photos and the text with regard to the idler bearing installation. Originally, I installed the idler bearings into the top plate before mounting it to the towers. Doing that first increases the difficulty in getting the wiring threaded through the openings in the top plate, so I'm going to have you mount the top plate and THEN install the idler bearings. My apologies for any confusion this creates!

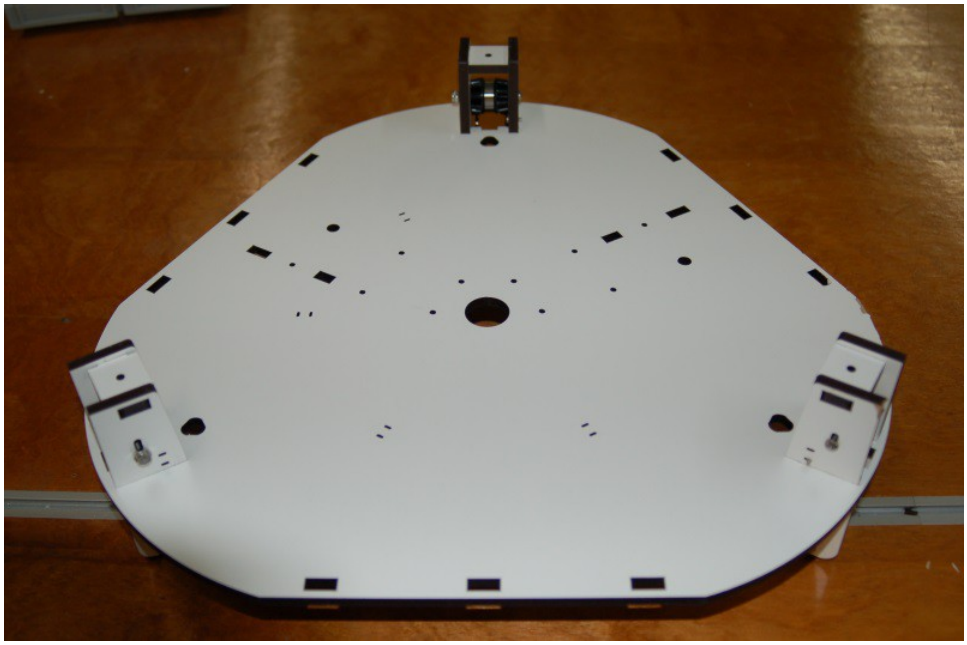
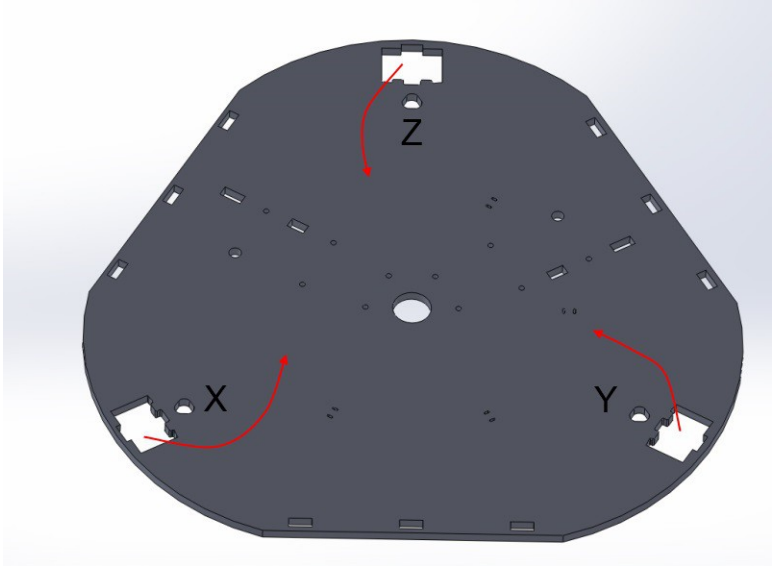


Fig. 9-2:Top Plate ready for installation.

Installing the top plate is pretty easy, it just takes patience. You'll want to orient the top so that the Z tower is farthest away and the X and Y towers are closest to you. See Ill. 9-1.

Carefully thread the wiring in each tower through the tower mounts and toward the center of the top plate as indicated by the red arrows in Ill. 9-1.



Carefully align the upper tower mounts with each tower, ensuring that the T-Slot nut plates are able to slide down the notches in the sides of the towers as shown below.

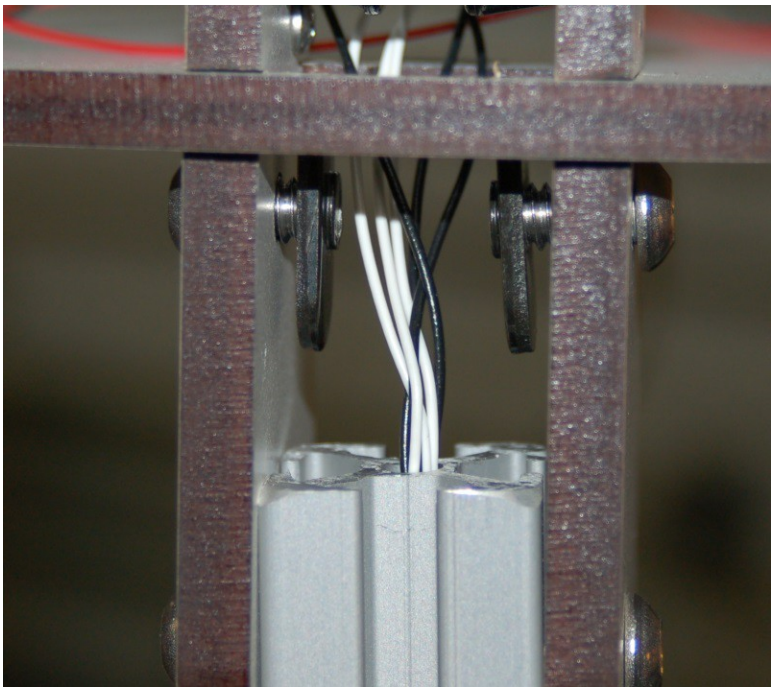


Fig. 9-3:Setting the top plate.

You want to keep the top plate level as any tilt will make it difficult for you to get all three upper tower mounts on the towers properly. The top plate should fit over the towers until the top of each tower comes into solid contact with the depth limiting screws that you installed when you assembled the upper tower mounts into the top plate.

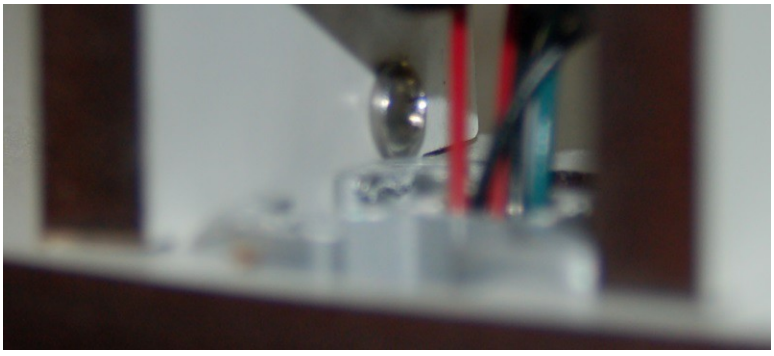


Fig. 9-4:Tower in contact with depth limiting screw.

Tighten each of the tower's button head cap screws only finger tight. We'll come back and tighten them the rest of the way once the top assembly is completed.

Assemble an idler bearing out of two black plastic bearings spacers and a 608ZZ roller bearing. Install it into the upper tower mounting as shown below. Use a #6-32 1-3/4” pan head screw and a #6-32 Nylon lock nut to hold it in place. Don't tighten it – we'll do that after the belts are installed.

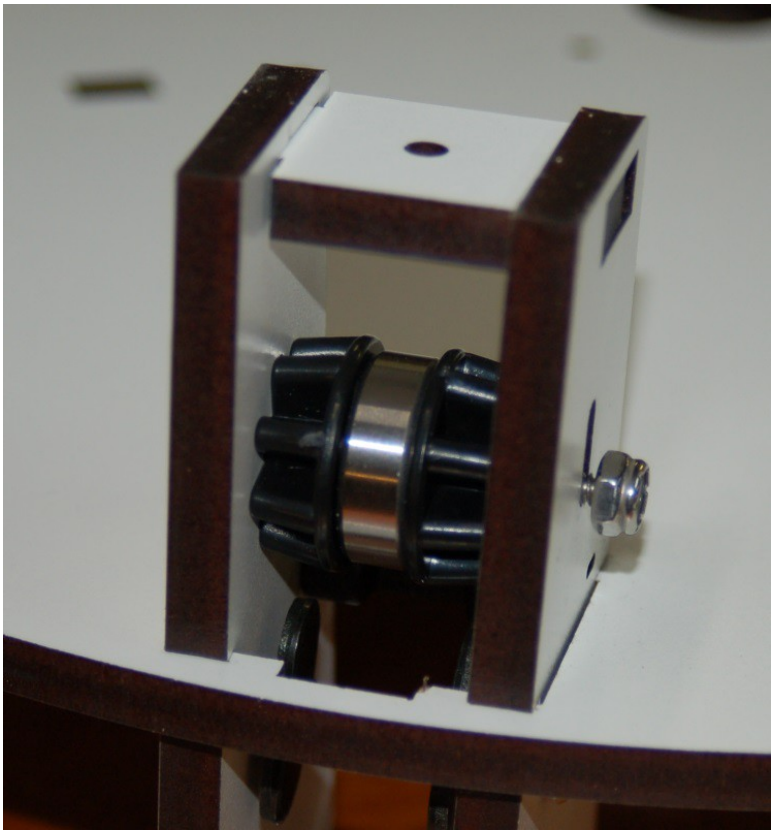


Fig. 9-5:Idler Bearing installed.

Repeat this step for the other two idler bearings.

10 – Wiring the End Stop Switches

For this task, you'll be routing the end-stop wires to the end-stop switches and connecting them up. You'll want to lay the machine flat with the Z axis pointing “up” for this step.

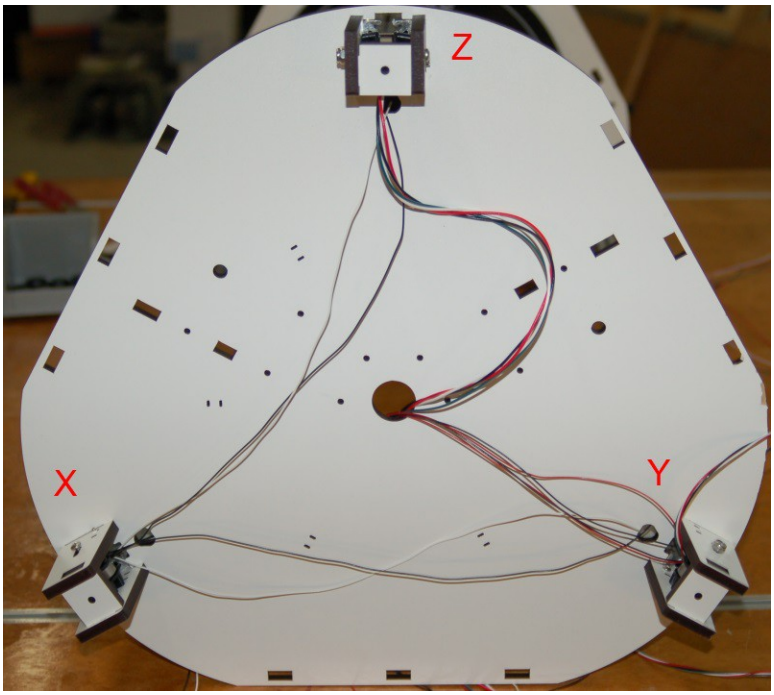
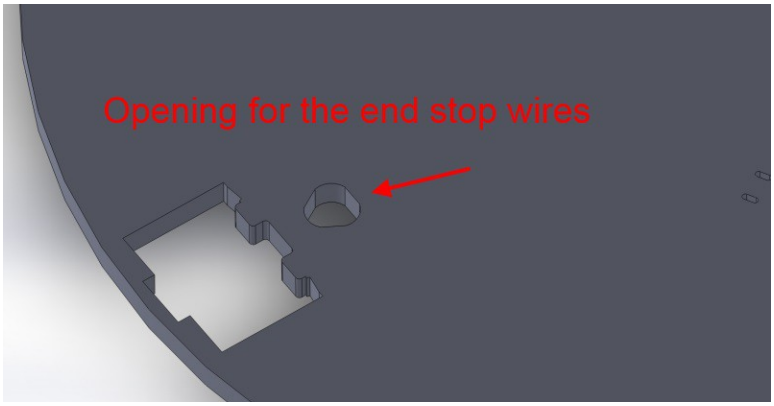


Fig. 10-1:Work orientation.

Next to each tower mounting point, there's a triangular shaped hole that the end-stop wires should pass through in order to reach the end-stop switches. To make this task easier, simply spindle each pair of end-stop wires as shown and then route each pair to the appropriate hole for each axis.

Fig. 10-2:End-stop wires.



Ill. 10-1:End-stop wire routing hole.

Start off with the Z axis end-stop. Thread the Z axis end-stop wires through the opening and attach the spade connectors to the lugs on the switch. You want to connect to the outer two lugs and ignore the center one. It's a tight fit, so please be careful not to damage the switch. A small pair of needle nosed pliers would big a big help here.

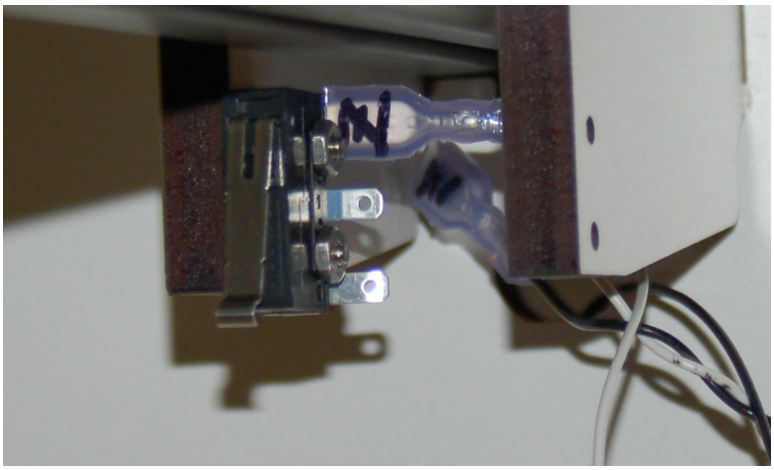
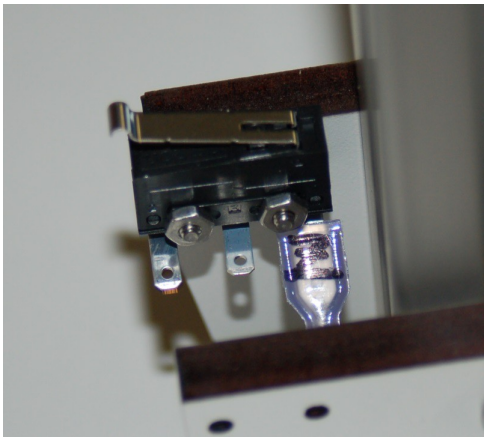
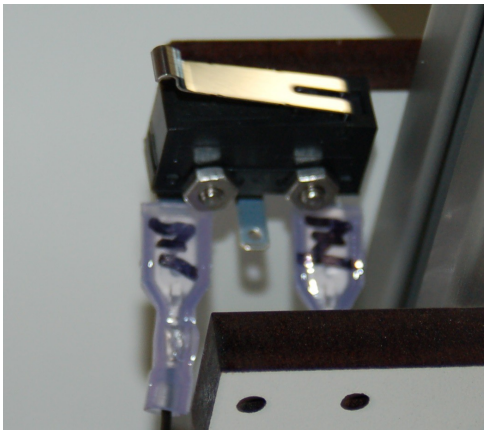


Fig. 10-3:Attaching Z axis end-stop wires.





Now go ahead and wire up the X and Y axis end-stop switches.

Wire Routing

Once all three end-stop switches are wired, carefully pull the slack out of the end-stop wires by ***carefully*** pulling them through from the bottom of the X axis tower.

Next, you want to pull the four 18ga wires from the Z tower and the four 26ga wires from the Y tower through the center hole in the top plate. Carefully feed 30” of wire as measured from the top plate. This will give you plenty of length to work with when it comes time to wire up the hot end.

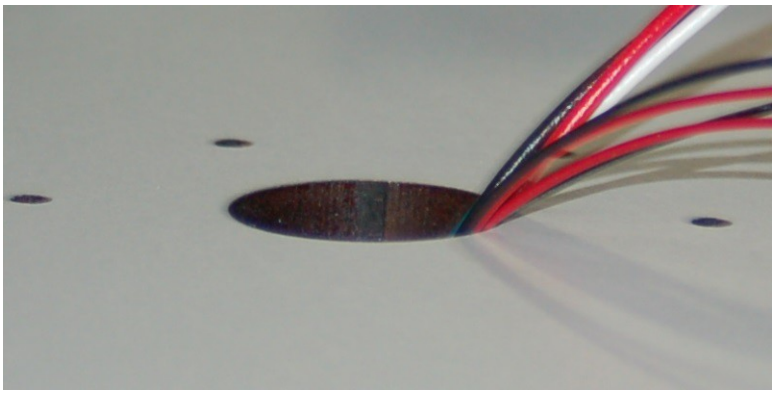


Fig. 10-6:Down the center hole!

Now route the four 22ga extruder motor wires from the Y axis tower till they touch the center hole. That will give you about 8” of wire from where the wires exit the top of the Y tower to the center of the top plate.

Moving to the bottom of each tower, route the wire through the side openings as shown.

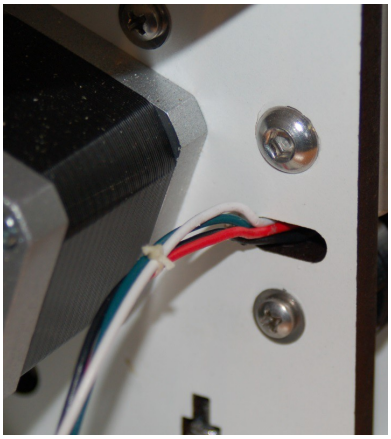


Fig. 10-7:Z Axis.

Fig. 10-8:Y Axis.

Fig. 10-9:X Axis.

Once that's complete, you'll need to tie down the wires using wire ties at the “tie” locations on the right side of each upper mounting bracket.

Before you tie the wires down, you'll want to make sure that the wire exits the center of the tower and comes directly to the inside face of the upper tower support, into a 90 degree bend and then towards its destination. This needs to be done in order to make sure the drive belt will not rub on the wires.

[INSERT ILLUSTRATION OF WIRE ROUTE]

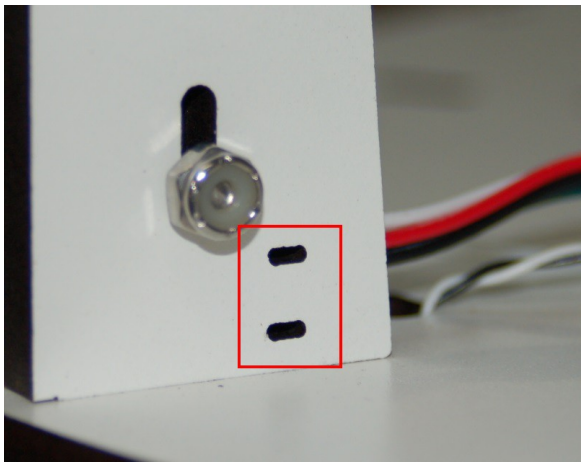


Fig. 10-10:Wire tie-down point.

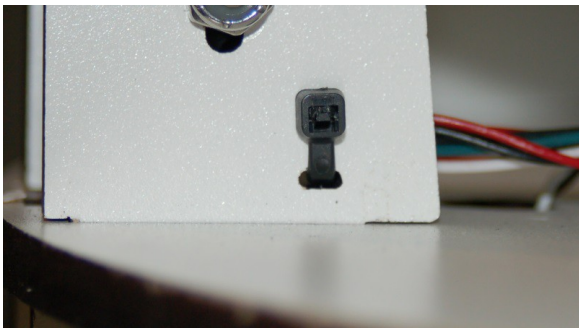


Fig. 10-11:Tie-down point, outside face.

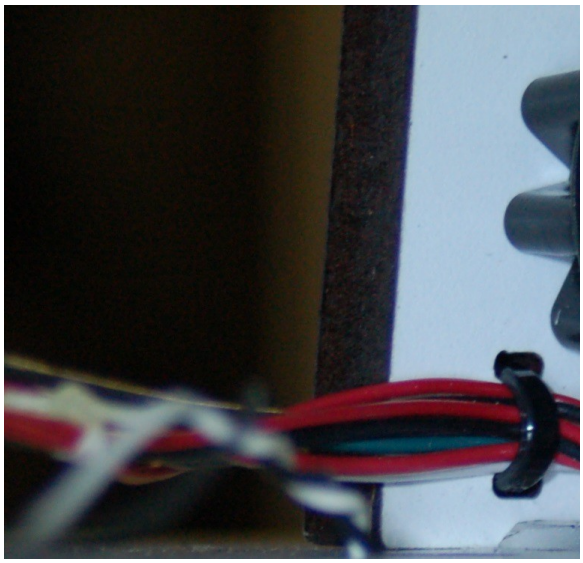


Fig. 10-12:Tie-down point, inside face.

Now you can tie down the end-stop wiring on the top plate.

Tie down the end-stop wires in the areas marked by the red boxes. Do not use the tie point marked by the red “X”. This tie point will be used later, but requires special wire routing that I'll cover later.

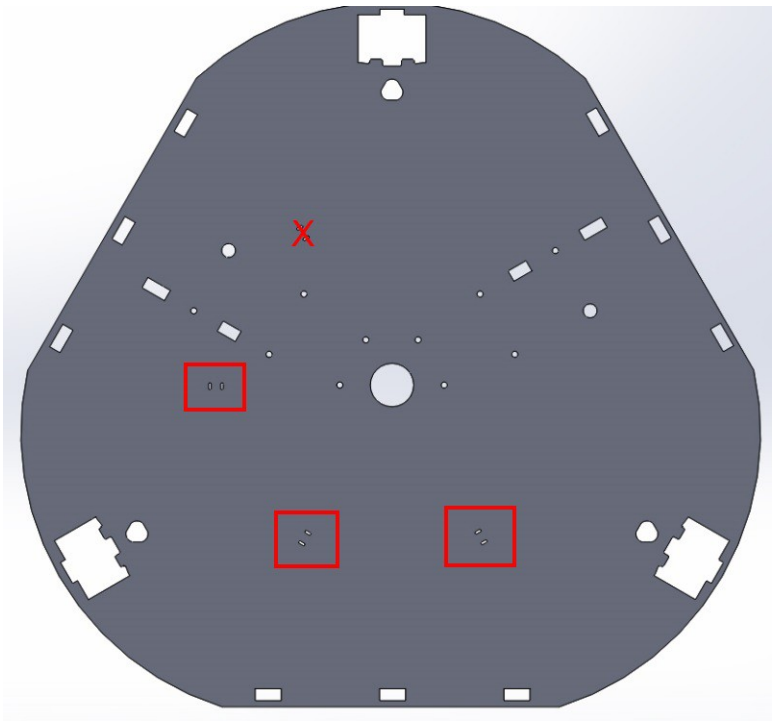


Fig. 10-13:Tie-down locations.

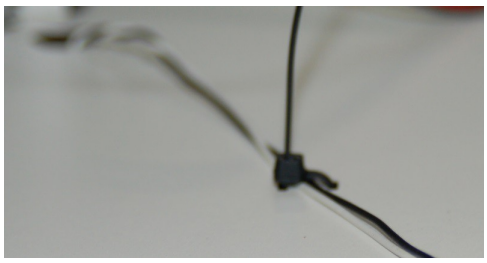


Fig. 10-14:Tied down.

Fig. 10-15:Ready for belts!

11 – Installing the Drive Belts

For this step, you're going to need the following components:

1. GT2 Drive Belts (3)
2. #4 Flat Washers (6)
3. #4-40 x 1/2” Socket Head Cap Screws (6)
4. Laser Cut Belt Clamps (3)
5. Plastic Bearing Rollers (3)

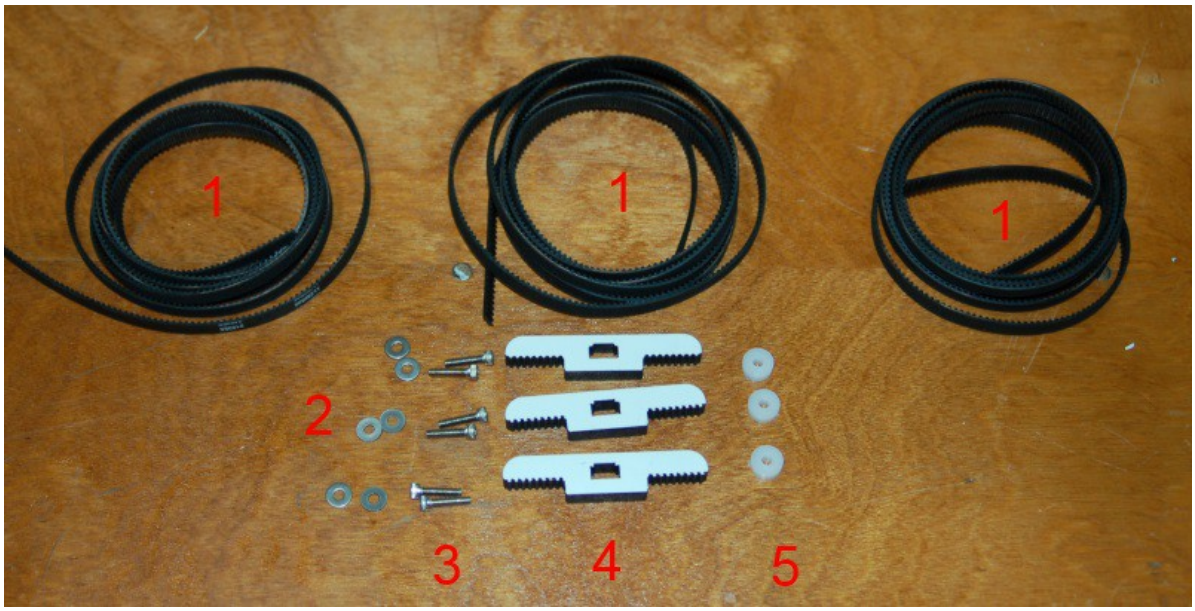


Fig. 11-1:Belt Clamp Components.

Installing the drive belts on the Rostock MAX v2 is a *lot* easier than it was on the Rostock MAX v1 kit. As you can see from the parts list required, the same job is done with fewer parts making for a much simpler installation.

Belt Routing

Take one of the GT2 drive belts and thread it into the notch at the base of the Z tower as shown in Fig. 11-2. Make sure that the belt teeth face ***in*** towards the tower.

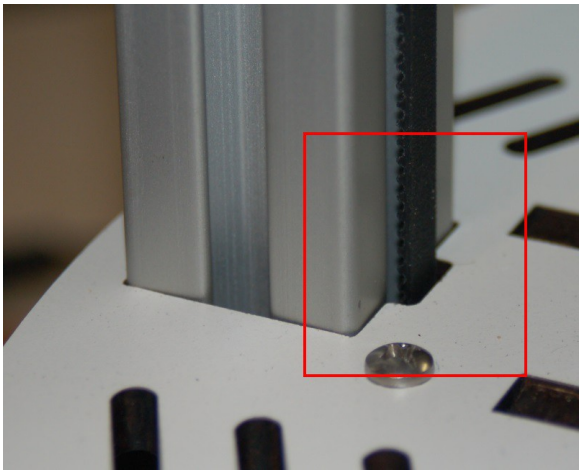


Fig. 11-2:Starting point for the belt route.

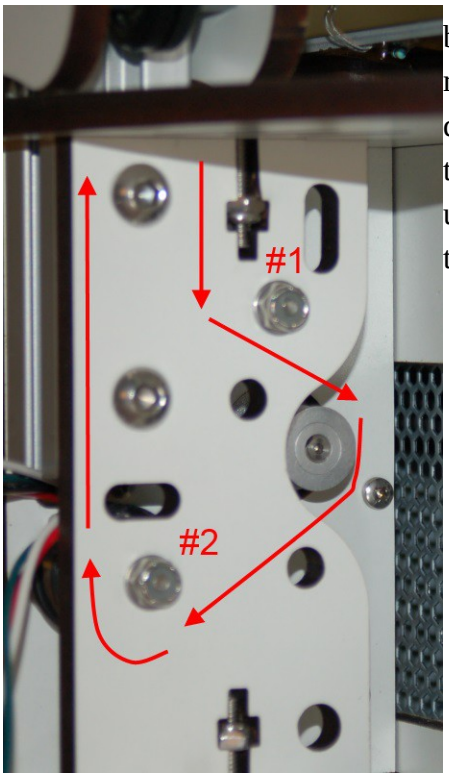


Fig. 11-3:Lower belt path.

Route the belt so that it passes to the outside of the #1 idler bearing, around the GT2 drive gear attached to the stepper motor and round the outside of the #2 idler bearing. At no point should the drive belt come into contact with the wiring – it should pass around the #2 idler cleanly. Route the belt up the tower and around the upper idler as shown in Fig. 11-4. Make sure that the belt passes through the notch as shown by the green rectangle,

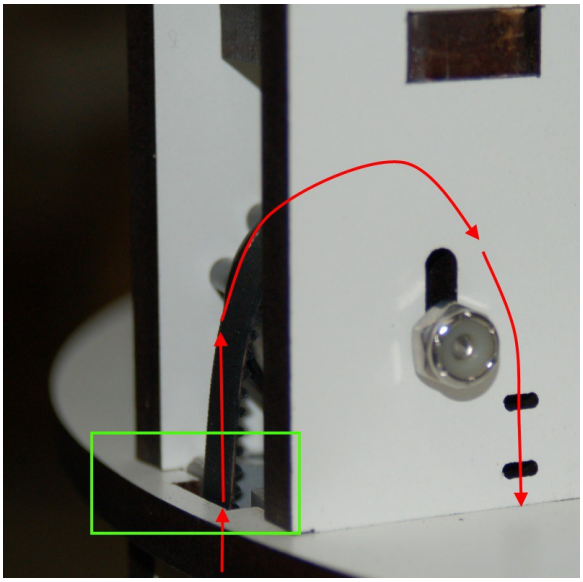


Fig. 11-4:Upper belt path.

As the belt passes over the upper idler, make sure it passes through the notch shown outlined in green.

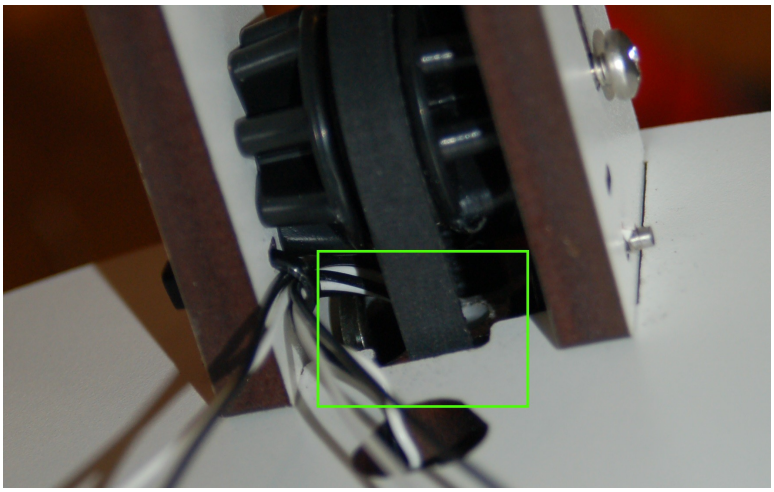


Fig. 11-5:Belt going back down to the Cheapskate.

Installing the Belt Clamps

The simplest way to do this is to clip the Cheapskate in place with a clothespin or other clamp and then pull the upper end of the belt through the belt feed slot in the Cheapskate. Use a small pair of needle nosed pliers to grab the belt end and pull it through the slot.

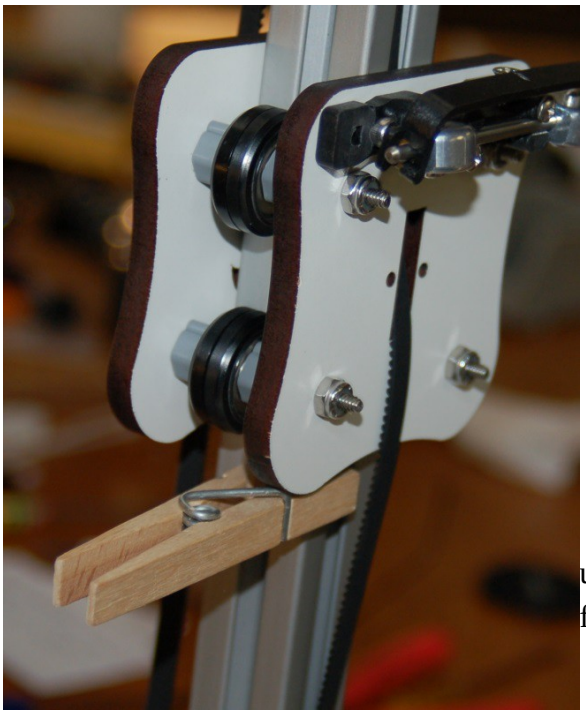


Fig. 11-6:Pulling the upper belt end.

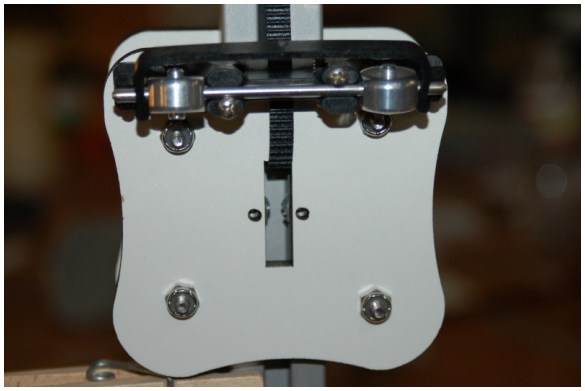


Fig. 11-7:Belt tucked under the u-joint carriage.

Route the end of the belt through the gap under the u-joint carriage as shown above. Tape it in place to keep it from moving while you're threading the lower belt end.

Now lay the machine down on your work table such that the Z axis is near you. This makes the next steps a lot easier!

Thread the lower belt end through the bottom of the Cheapskate as shown.

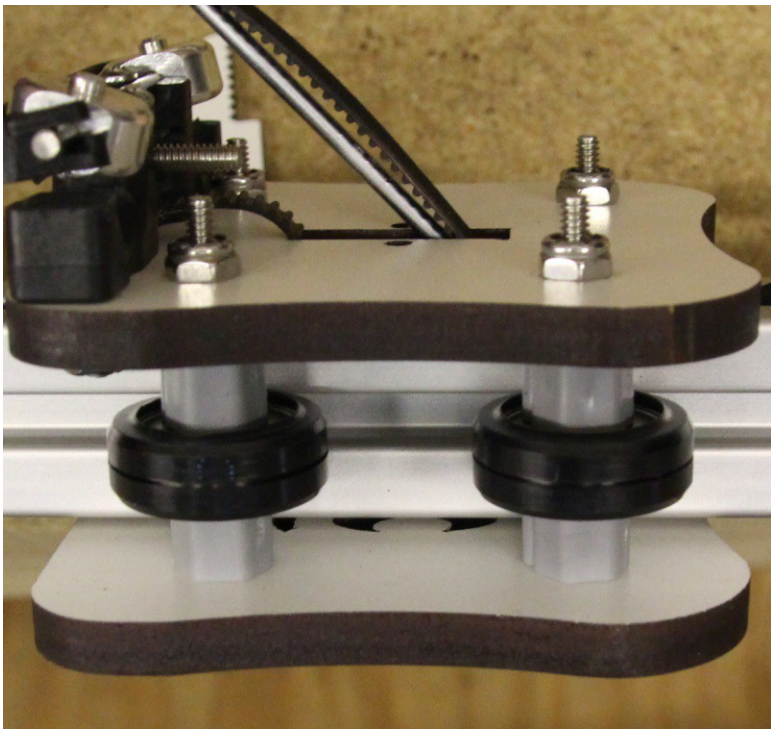


Fig. 11-8:Bottom end threaded into the Cheapskate.

Now pull the lower end of the belt a bit so that it eats up any available slack and starts to draw the upper belt end out of the Cheapskate. You want about 1” of belt above the left or “top” edge of the Cheapskate. Take a laser cut belt clamp and install it into the notch, capturing only the “top” end of the belt. Holding that end of the clamp in place, pull the bottom end of the belt tight and then press the belt clip in place. If you're not feeling especially dexterous today, tape the ends of the belt clamp in place tightly enough for it to keep a hold on the belt ends. (I have an invisible cat that's very handy, so you won't see me using tape. I just ask her nice, and she holds down whatever I need held down.)

(Don't see any cat paws do you? Told ya, invisible cat.)

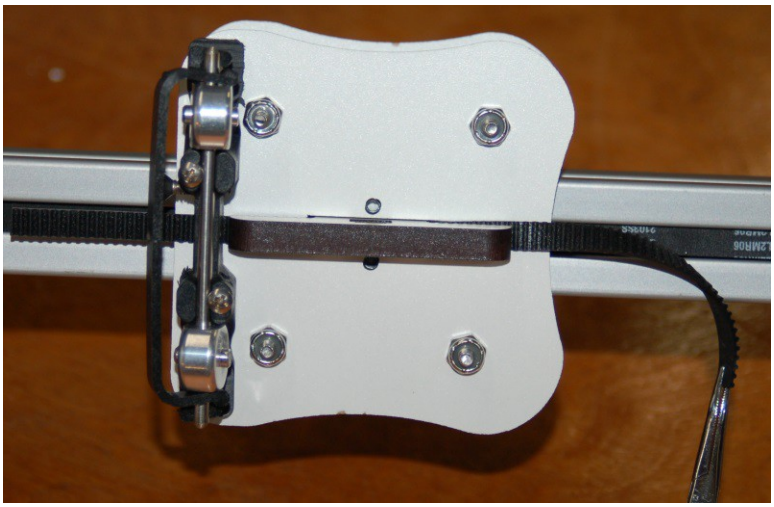


Fig. 11-9:Ready to install clamp fasteners.

Take a plastic roller bearing and a #4 flat washer and set them into place in the exposed notch on the belt clamp.

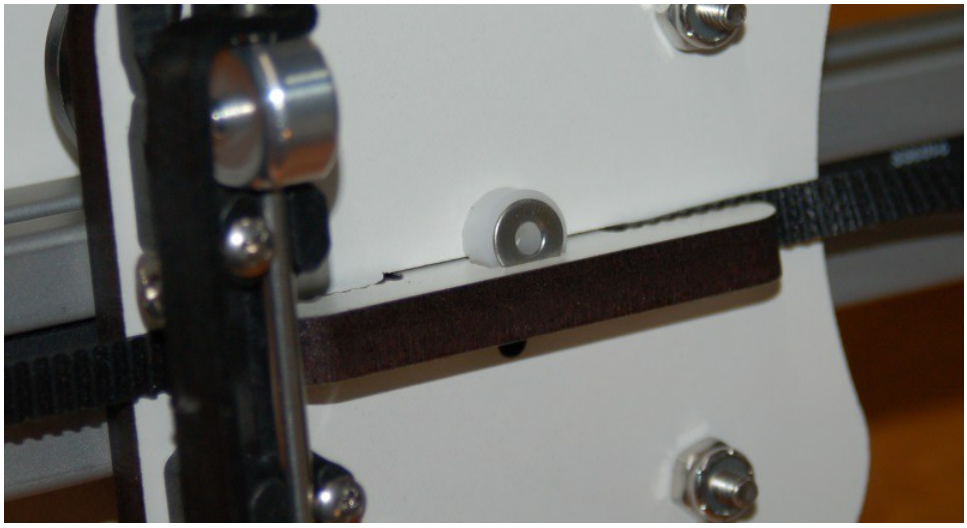


Fig. 11-10:Ready for a screw!

Here's a detail to watch out for when you're installing the belts. Notice in Fig. 11-11 below, the belt teeth on the left are resting on the outside surface of the belt clamp. The belt teeth on the right are correctly engaging the teeth on the clamp. Make sure that the teeth engage on both sides before you tighten down the belt clamp.

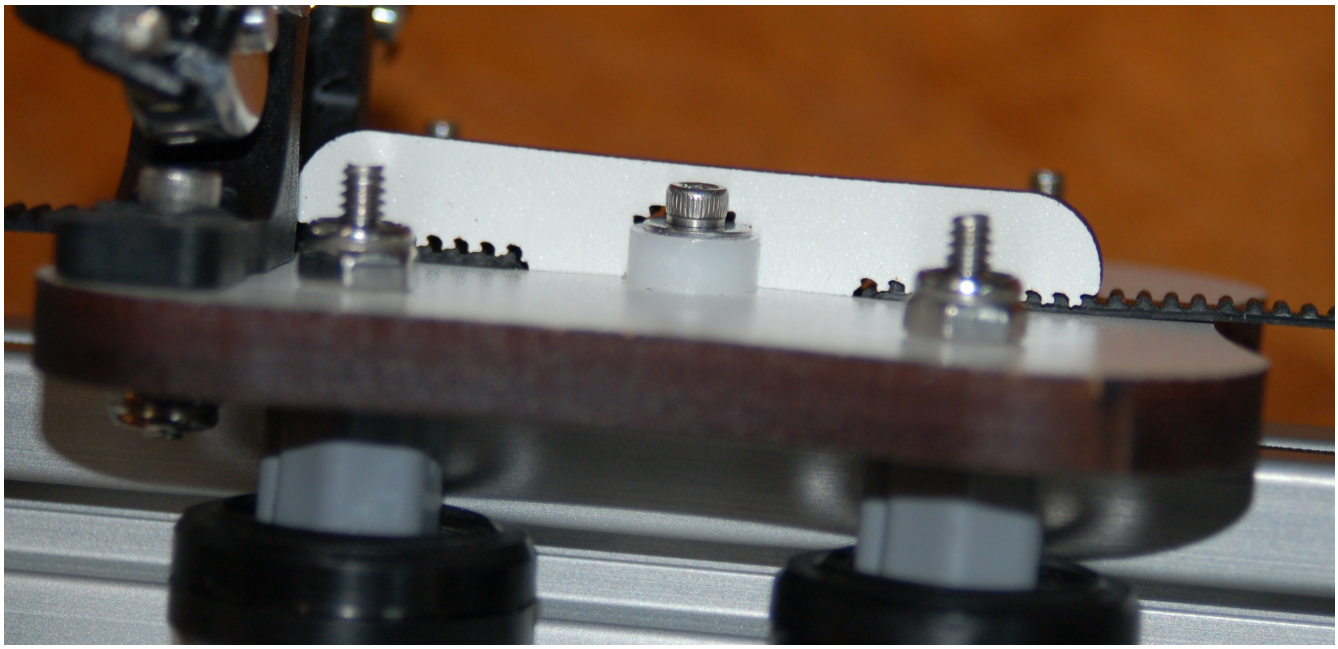


Fig. 11-11:Mis-aligned belt teeth.

Using a 3/32” hex wrench, install the #4-40 x 1/2” socket head cap screw as shown below.

Fig. 11-12:Nearly done with the first belt clamp!

Now carefully roll the printer such that the other side of the belt clamp is face-up and install the other plastic spacer, #4 washer and #6-32 screw.

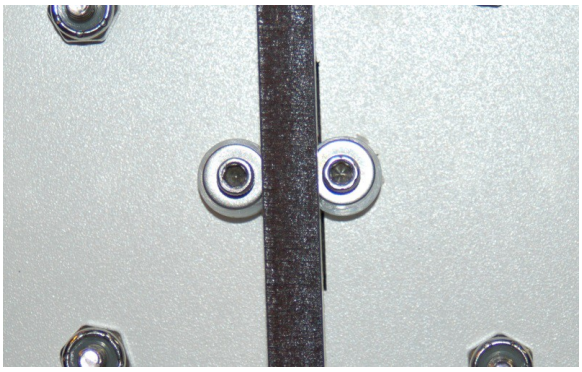


Fig. 11-13:Belt clamp installed!

Repeat this task for the X and Y axes. Make sure that while you're working with the belts that the lower belt doesn't slip off the GT2 drive gear! You're better off catching and correcting it now than having to take things apart to fix it later!

Fig. 11-14:Belt following correct path around GT2 gear.

12 – Assembling the EZStruder and Filament Holder

For this step you'll need the following components:

1. EZStruder Mounting Bracket (1)
2. EZStruder Mounting Bracket Stabilizer (1)
3. EZStruder Mounting Spacers (3)
4. Filament Holder Spacer (1)
5. Filament Holder, Inside (1)
6. Filament Holder, Outside (2)
7. NEMA 17 Stepper Motor (1)
8. EZStruder Hardware Pack (1)
9. #6-32 Nylon Lock Nuts (4) (Not Shown.)
10. #6-32 x 1” Pan Head Screws (2) (Not Shown.)
11. #6-32 x 2” Pan Head Screws (2) (Not Shown.)

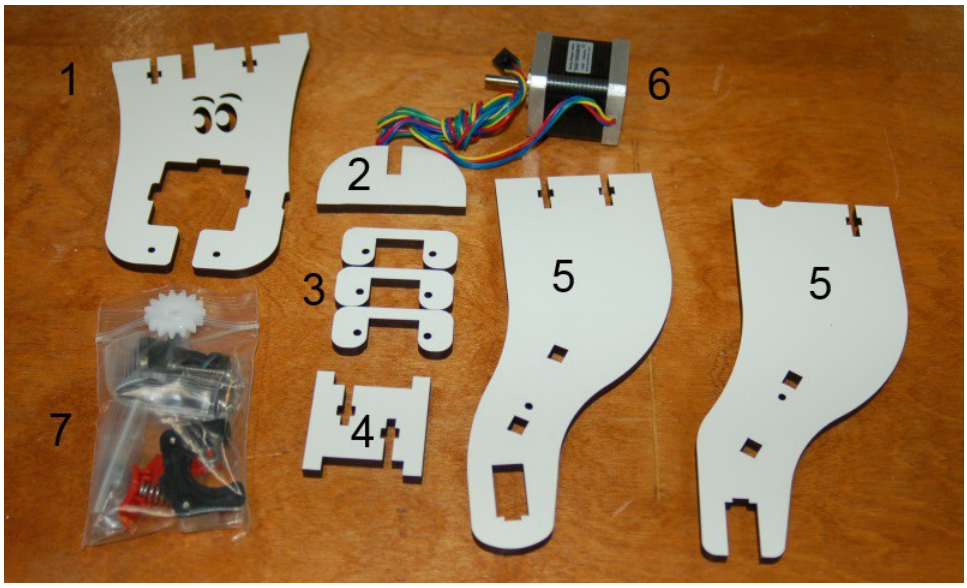


Fig. 12-1:EZStruder & Filament Holder Components.

Preparing the EZStruder

The EZStruder ships un-assembled, so let's take care of that first.

The EZStruder hardware pack consists of the following parts:

1. Filament Tensioner
2. Filament Guide Block and Bowden Tube Mount
3. 1 Short metric screw
4. 1 Long metric screw
5. Hobbed gear, grub screw and a hex wrench.

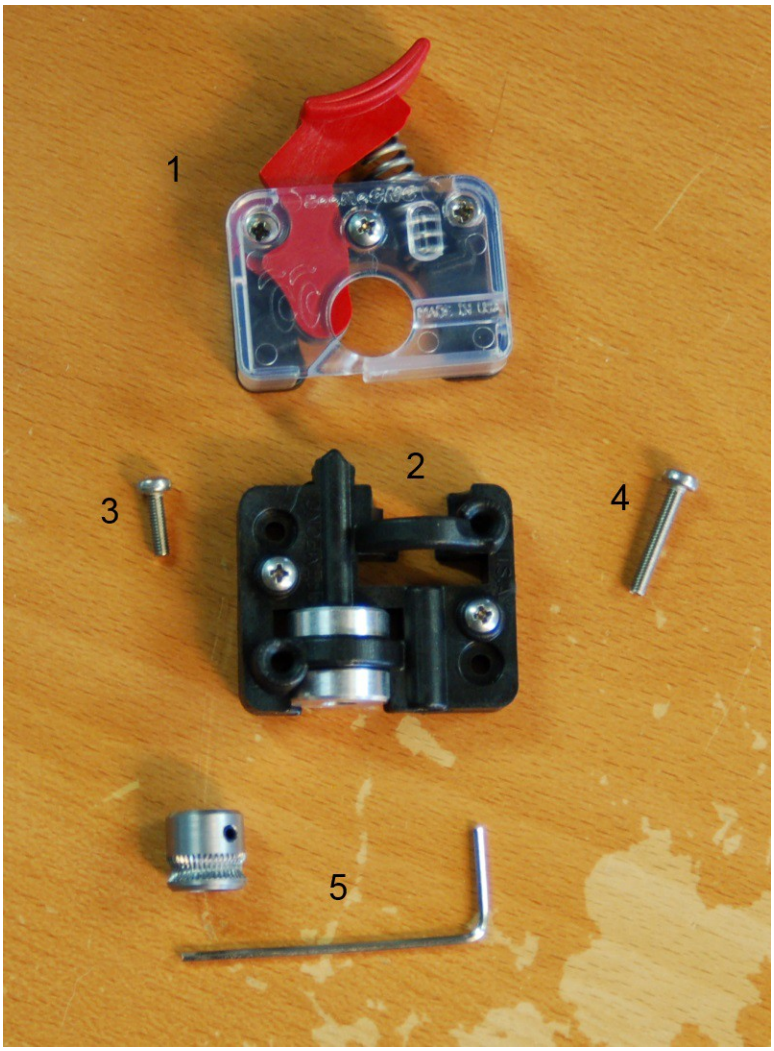


Fig. 12-2:EZStruder Hardware Pack.

The parts kit will also include a push-to-fit connector and that looks like the example in Fig. 12-3 below.

Fig. 12-3: PTF Conn.

In order to correctly align the hobbed gear on the output shaft of the stepper motor, we need to install the Filament Tensioner first. The tensioner has two screws that are “captured” and will be used to install it on to the stepper motor face as below. Make sure you keep the wires exiting the motor facing up as shown.

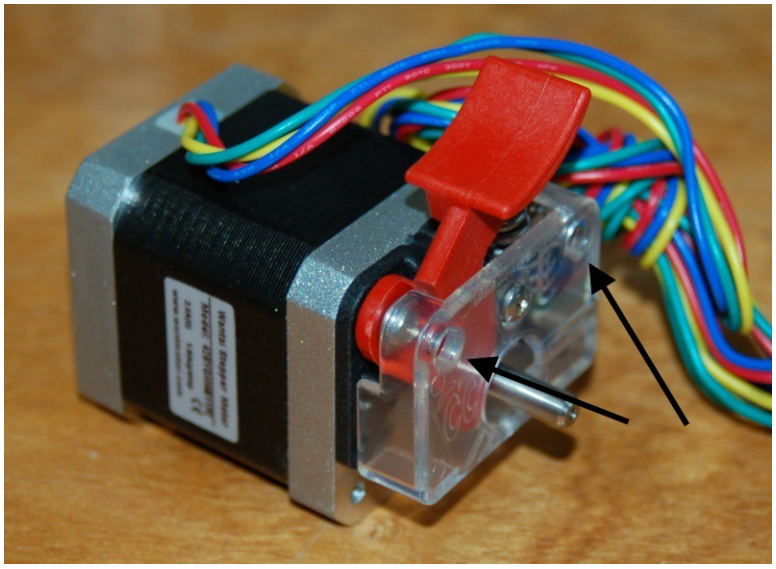


Fig. 12-4:Filament Tensioner installed.

The two black arrows in the figure above point to the two screw holes that have capture screws in them.

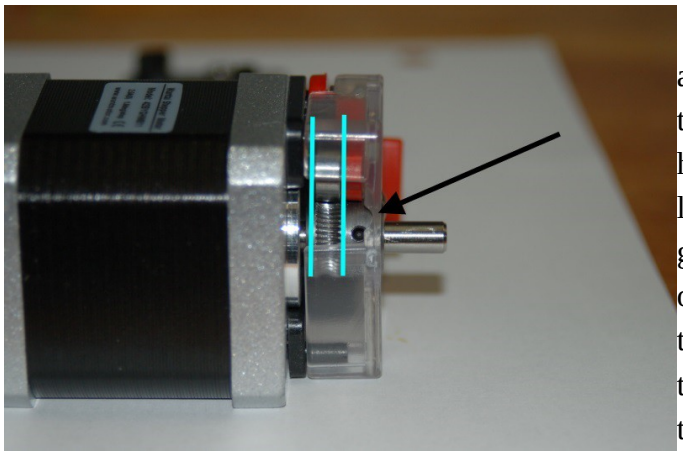


Fig. 12-5:Installing the hobbed gear.

Rotate the stepper shaft until the flat face along the shaft faces the small notch indicated by the arrow. Remove the grub screw from the hobbed bolt (if necessary) and put a dab of thread locker on it before putting it back into the hobbed gear. Slide the hobbed gear on to the stepper shaft, oriented as you see to the left. Make sure that you turn the gear so you can reach the grub screw through the channel pointed to by the arrow. Align the edges of the gear so they match the alignment marks (cyan lines) in the photo above. Tighten down the grub screw, making sure that it's coming into contact with the flat face of the stepper shaft.

Using the two metric screws included in the hardware pack, install the filament guide block on the face of the stepper motor as shown below.

Install the shorter of the two screws into the position marked #1 and the other, longer screw into the position marked #2.

Install the PFT connector (#3) finger tight.

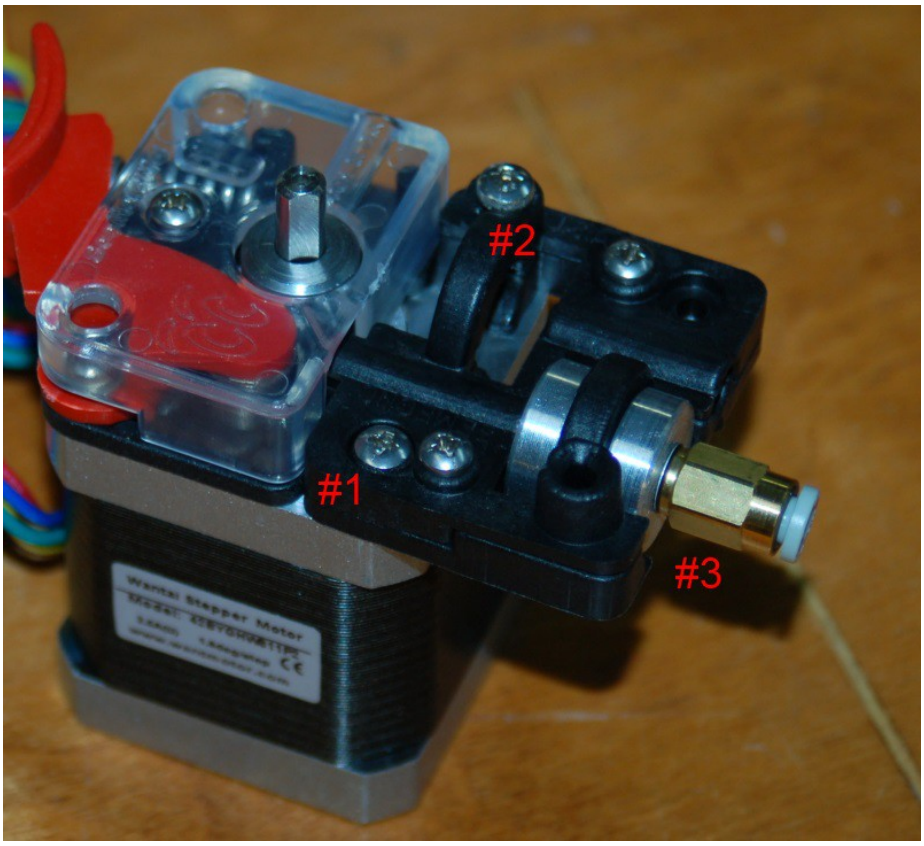


Fig. 12-6:Filament guide block installed.

Mounting the EZStruder

For this step, you'll need the following components:

1. Assembled EZStruder (1)
2. EZStruder Mounting Bracket (1)
3. EZStruder Mounting Spacers (3)
4. #6-32 x 2” Pan Head Screws (2)
5. #6-32 Nylon Lock Nuts (2)

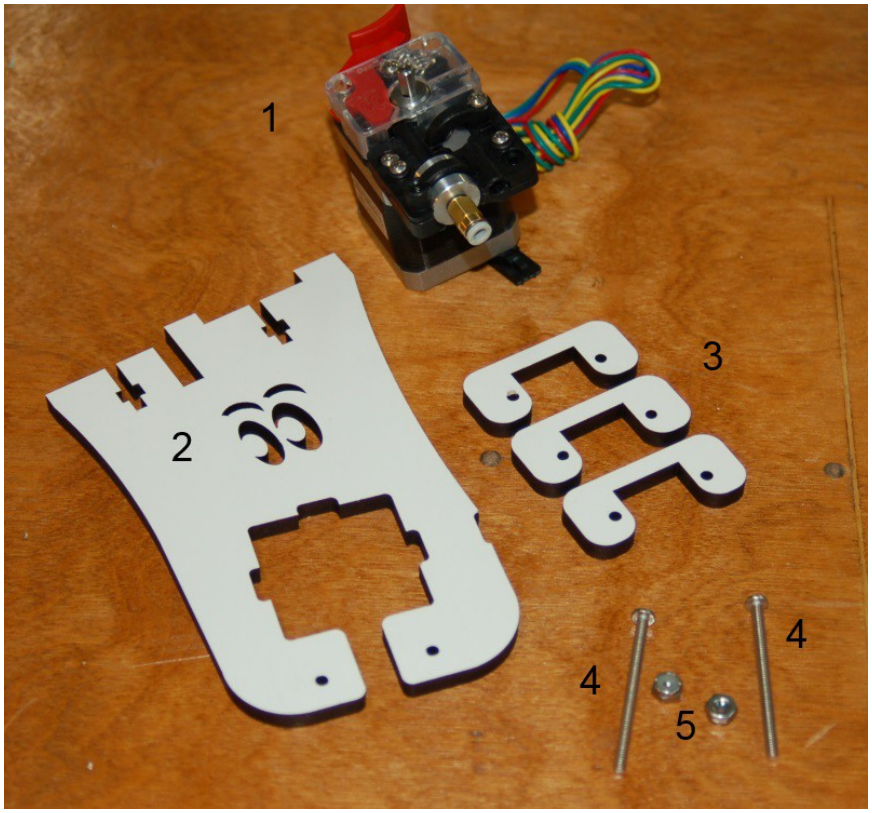


Fig. 12-7:EZStruder Mounting Parts

This assembly is extremely simple. Stack the three mounting spacers as shown below and using both of the #6-32 screws and Nylon lock nuts, install the EZStruder on to the mounting bracket.

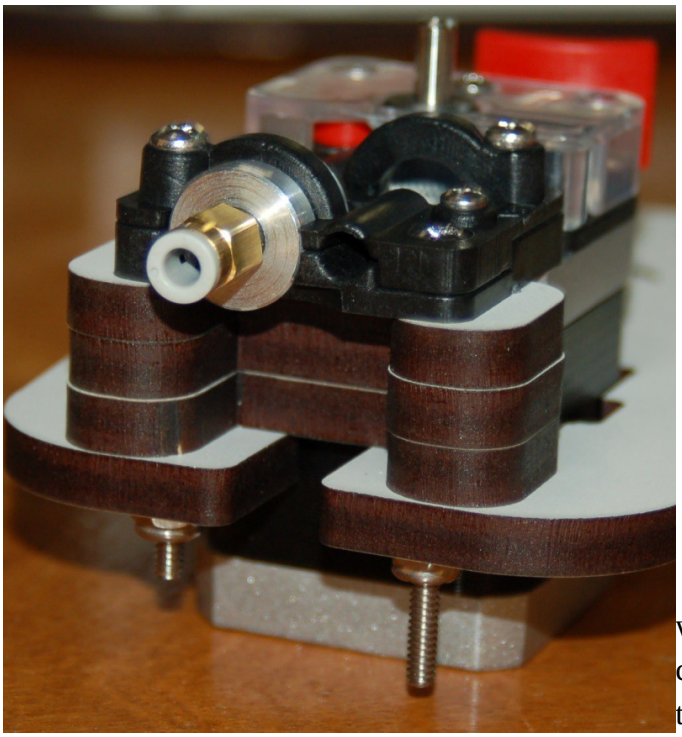


Fig. 12-8:EZStruder Mounted.

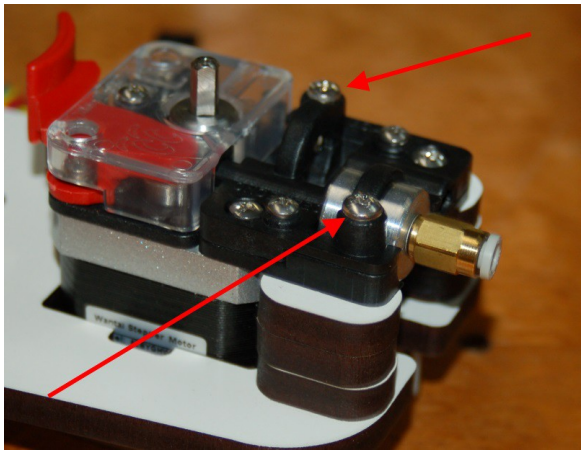


Fig. 12-9:Mounting screw locations.

Finally, locarte the big white plastic gear – it was likely packed along with the other EZStruder components. Press the gear about half-way down the stepper motor shaft as shown below.

This gear will allow you to manually feed filament into the hot end when necessary.

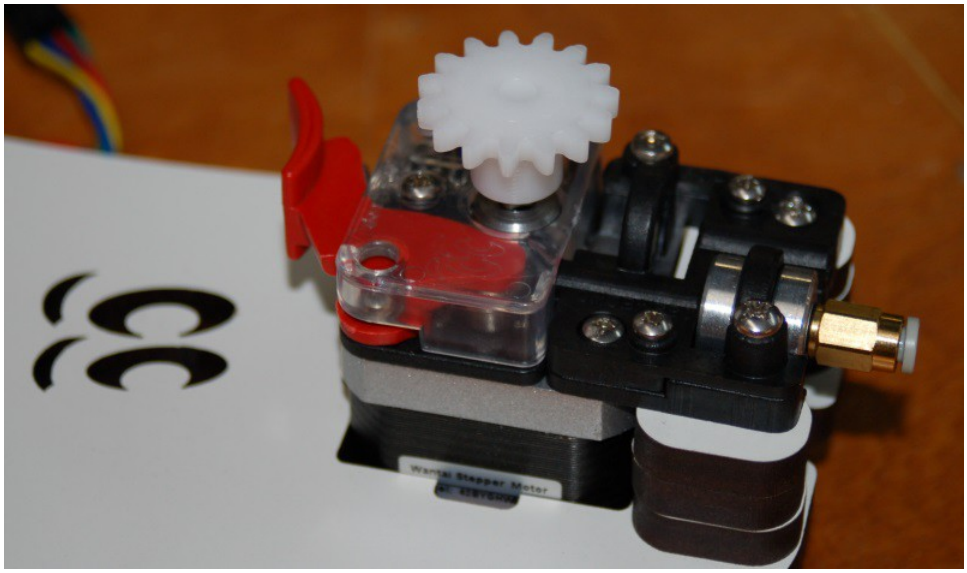


Fig. 12-10:Manual knob installed.

Installing the EZStruder Mount and Filament Holder

For this step, you'll need the recently assembled EZStruder mount, the mount stabilizer, two #6-32 x 1” pan head screws and two #6-32 Nylon lock nuts.

Slide the mount stabilizer on to the stabilizer slot on the EZStruder mount as shown, then install two #6-32 Nylon lock nuts into the nut pockets.

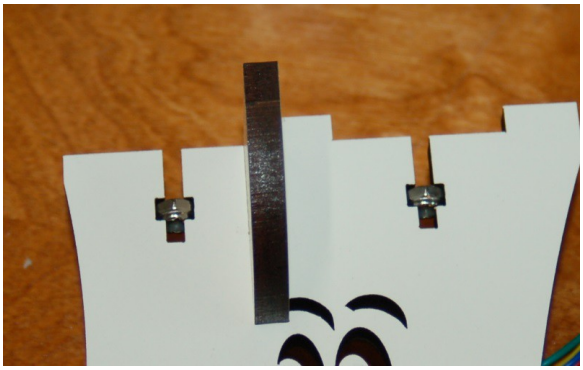


Fig. 12-11:Lock nuts....

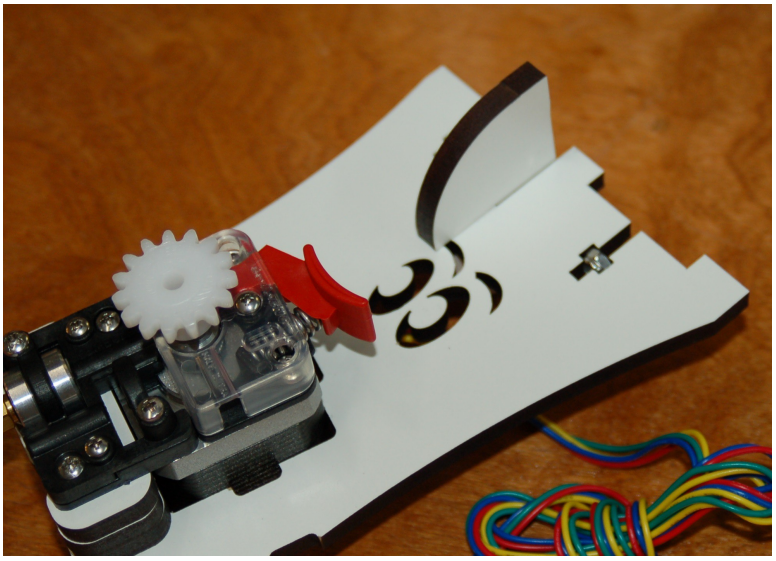
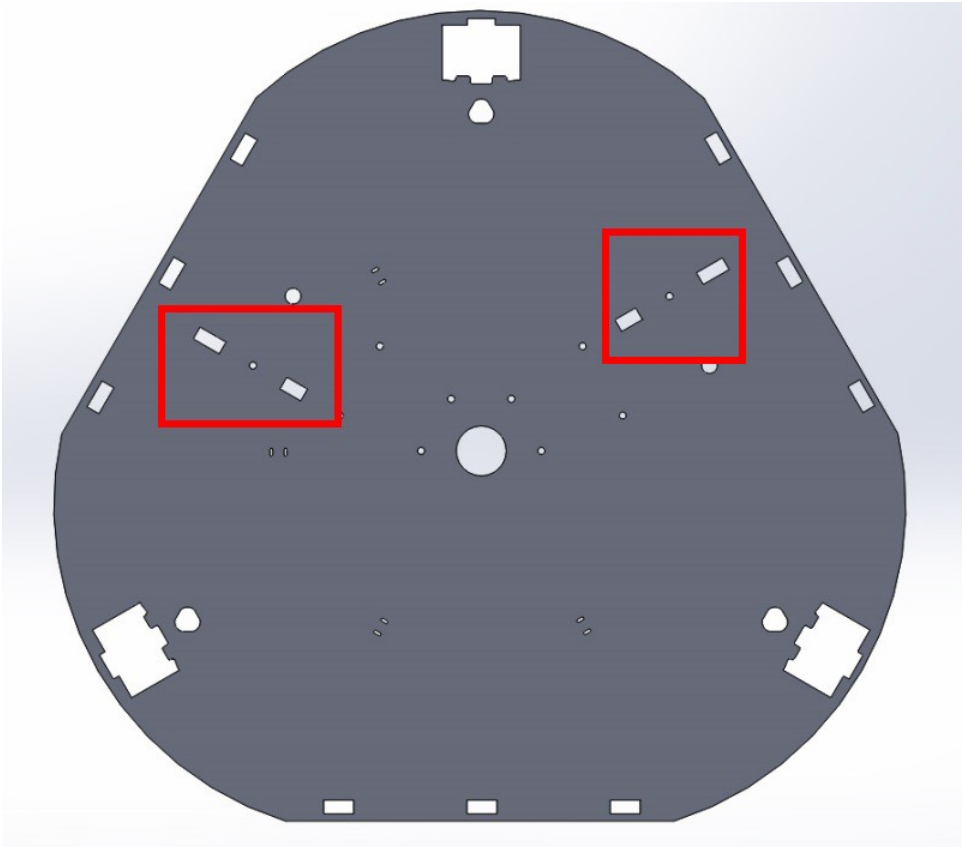


Fig. 12-12:...and mount stabilizer installed!

You've got two choices where you can mount the EZStruder to the top plate, both are shown in Ill. 12-1.



Ill. 12-1:EZStruder mounting points.

You can install your EZStruder mount in either of the positions marked in red. The currently shipping top finish plate for the Rostock MAX v2 will only accommodate a single extruder, but it will allow it to be installed in either position. The location is entirely your choice. No matter where you put it, make sure that it's oriented with the curve going towards the center of the machine and the extruder should be facing the filament guide hole in the top plate as demonstrated in Fig. 12-13. The arrow in the upper right corner is pointing to the filament guide hole. Install the mount to the top plate using two #6-32 1” screws.

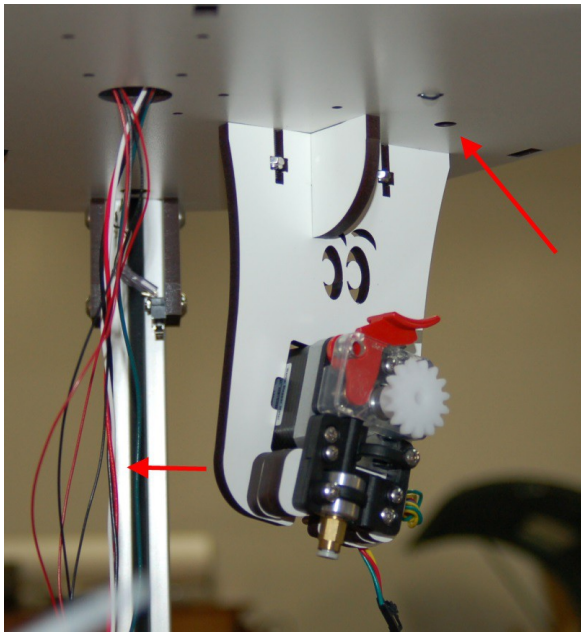


Fig. 12-13:EZStruder mount installed.

Wiring the EZStruder's Stepper Motor

After you've neatened up the stepper motor wires (ahem), tie the wires to the side of the EZStruder mount using a wire tie and route the wires up through the center hole in the top plate.

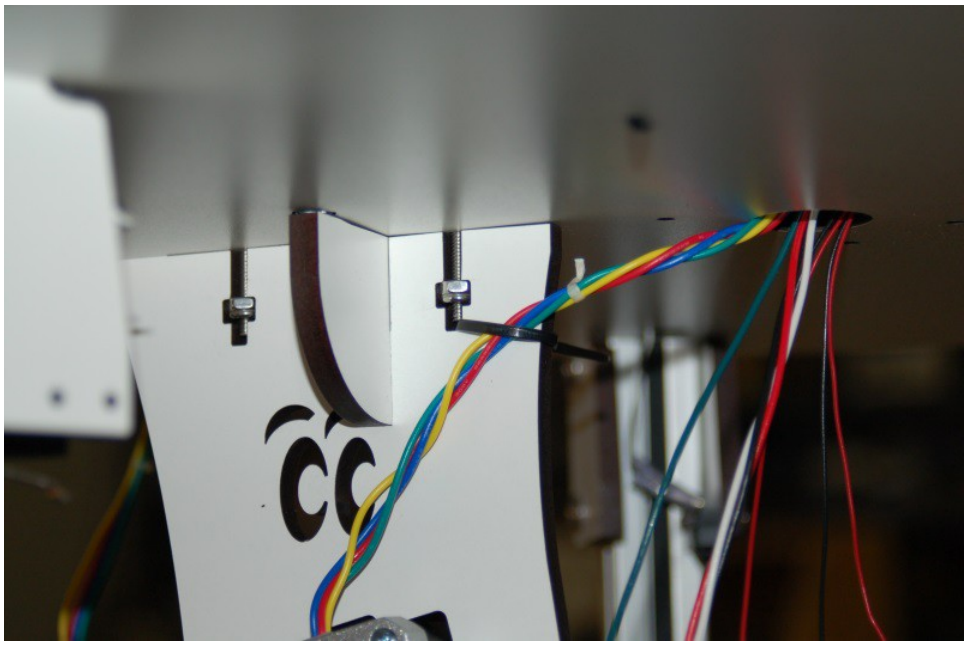


Fig. 12-14:Routing the extruder wires.

At this point you have a decision to make on whether or not you want to install a latching polarized connector to the stepper motor wires in the tower or not. If you do want to go that route, please jump ahead to Appendix A: Quick Disconnects in your Rostock MAX v2.

Cut the connector off of the EZStruder stepper motor and strip 1/2” of insulation off each stepper motor wire and each one of the 22ga wires that you routed up the Y tower.

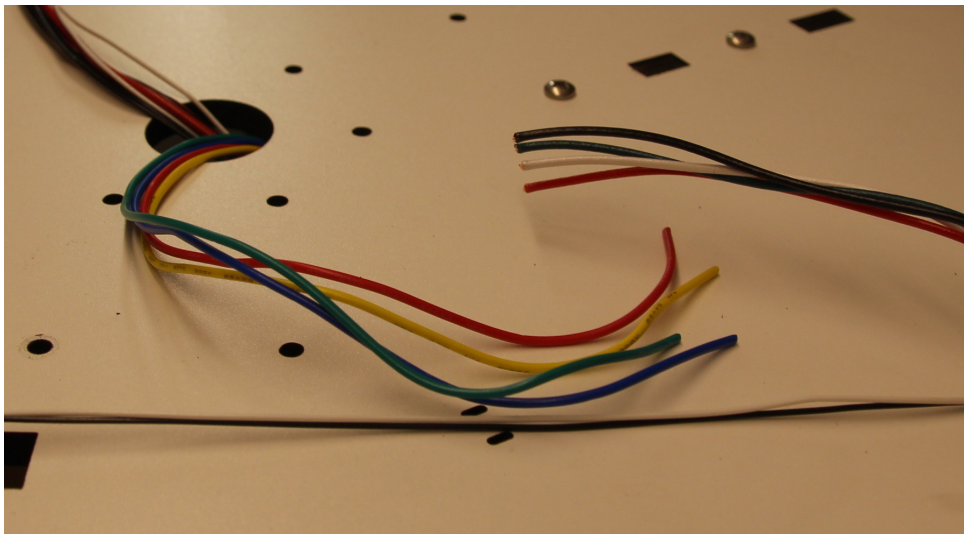


Fig. 12-15:Wires ready for splicing.

If you've never spliced wire before, I'd recommend using a simple splice called a Western Union Splice. You can see how it's done below in Ill. 12-2.

Below is an example of what the splice looks like.

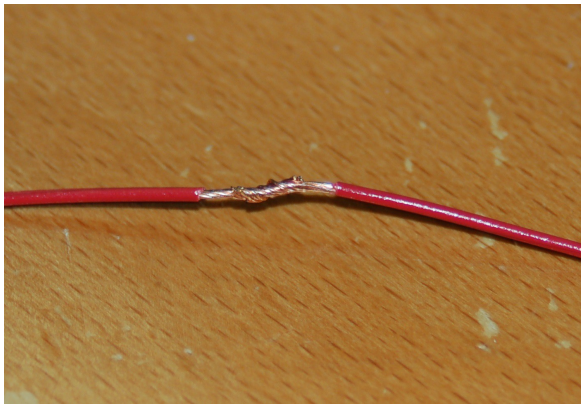
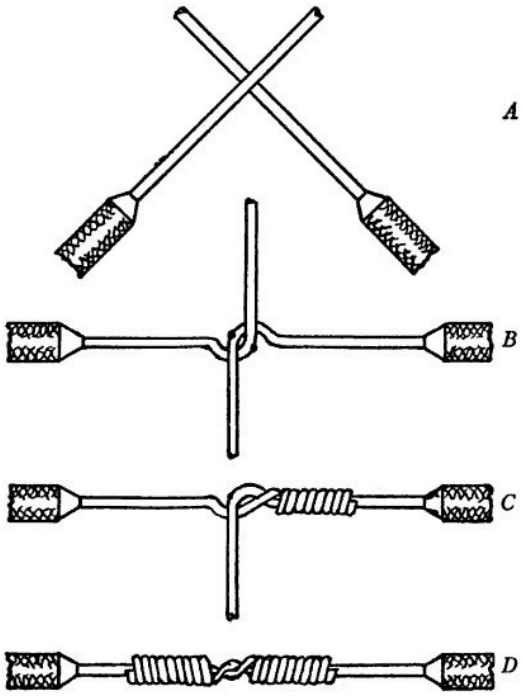


Fig. 12-16:Splice example.

I would recommend that if you use this splice, you solder the joint before covering it with Electrician's tape.



Ill. 12-2:A Western Union Splice.

When splicing the wires together, please follow the chart below. This is important in order to get the pin assignments correct when you add the connector to the other end of the extension cable. (The connector & pins are supplied as part of the RAMBo parts kit.)

If you're color-blind, please get some assistance with this step. Getting the wires backwards will make you crazy. :)

Pin	Stepper Color	Extension Color
1	Green	Green
2	Red	Red
3	Blue	Black
4	Yellow	White

Table 12-1:Wiring Color Chart.

When you're done with the splicing, use a few short lengths of Kapton tape to hold the wire along the path shown by the red arrow in Fig. 12-17.

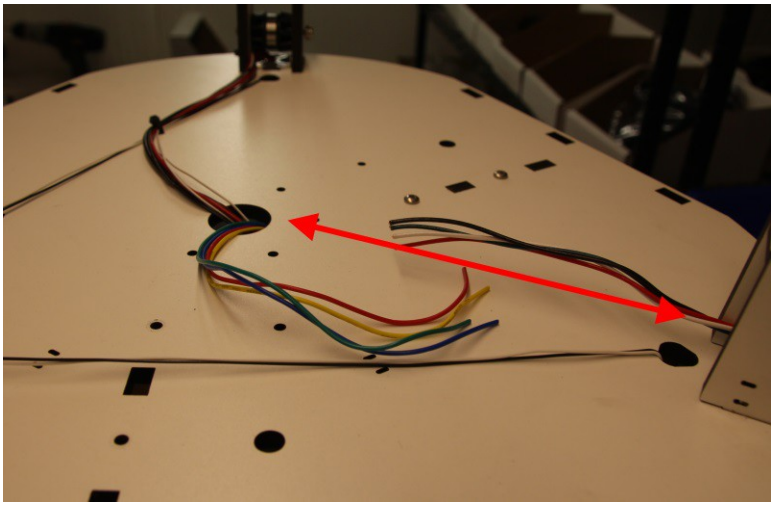


Fig. 12-17:Stepper motor wire path.

This is done in order to keep the motor wires way from the two small end-stop wires. If they're run in close parallel with one another, they can pick up current from the stepper motor and cause false end-stop triggers to be reported. If that happens, the printer does very, very odd things.

13 – Wiring and Installing the Hot End

Preparing the Hot End Wiring

For this task, you'll need the short length of heat shrink tubing and the 3/8” Expandable Black Mesh Loom.

Fig. 13-1:Expandable Mesh Loom and Heat Shrink Tubing.

Before we begin the task of installing the wire loom, I want to you take a second and tie down the hot end wires. This is an earlier step that was delayed until this point.

In order to avoid electrical interference of the X axis end-stop, you need to tie down the hot end wires coming out of the Z axis tower such that they cross the end stop wires exactly as shown in Fig. 13-2. By crossing the end-stop wires perpendicularly, interference can be avoided.

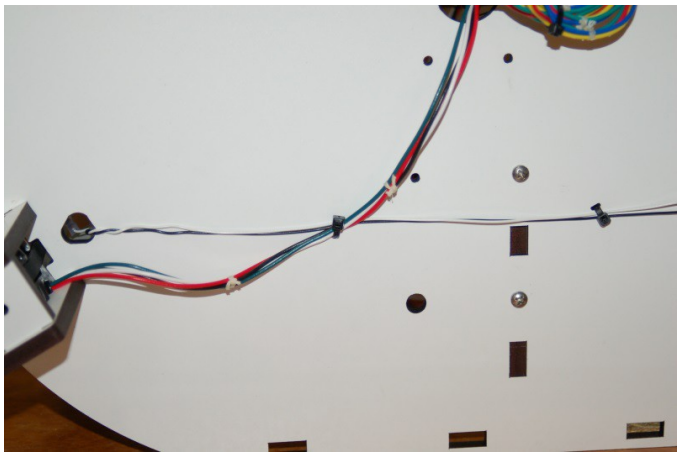
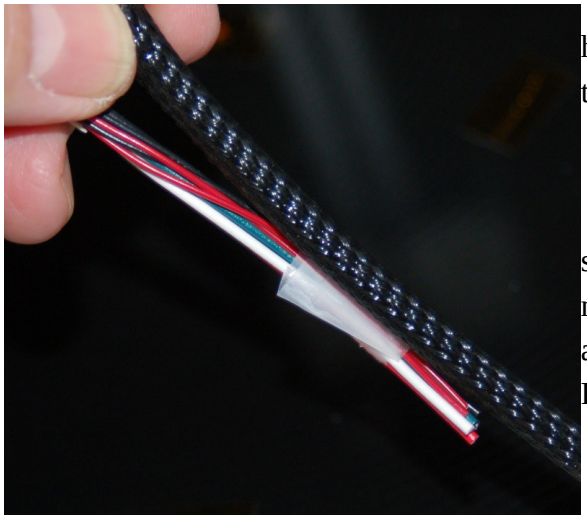


Fig. 13-2:Hot end wires crossing the end stop wires.

Cut a length of mesh loom that will cover the hot end wires from the top plate to a point about 2.5” short of the end of the wires. Tape the hot end wires together and slide the mesh loom section you just cut over them.



Make sure that when you slide the loom over the hot end wires that it reaches up to the center hole in the top, plus a little bit more.

Now, I want you to cut a 7/8” length of the heat shrink tubing and slide it over the bare-wire end of the mesh loom. Adjust it such that half is covering the mesh and half is covering the wire as indicated by the line in Fig. 13-4.

Fig. 13-3:Wires and mesh loom.

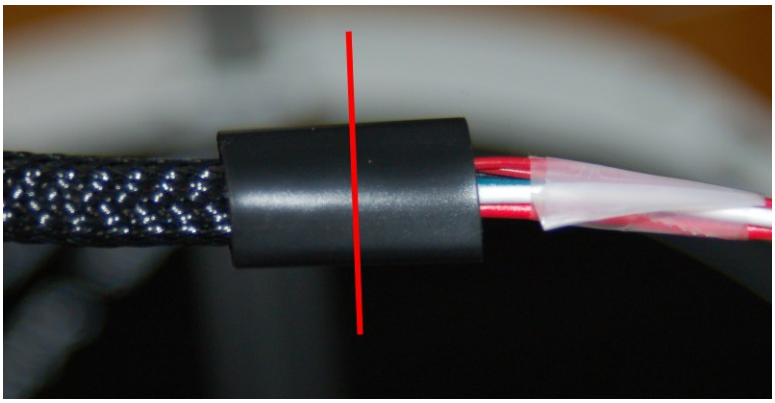


Fig. 13-4:Correct heat shrink location.

Using a hair dryer or heat gun, heat the tubing until it conforms to the loom & wires as shown in Fig. 13-5. Keep the heat source moving around the tubing as it shrinks to get an even shrink all the way around.

Cut another 7/8” length of heat shrink tubing and apply it to the other end of the mesh loom.

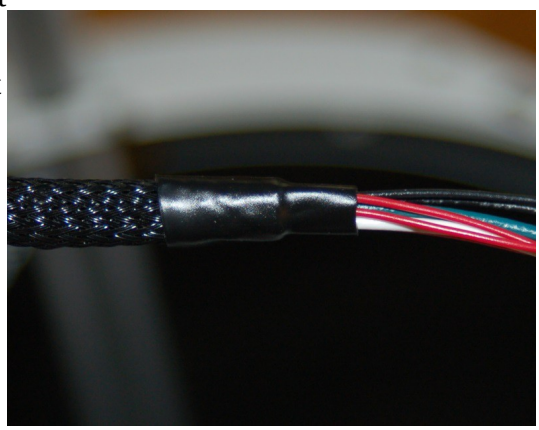


Fig. 13-5:Properly applied heat shrink.

Now it's time to prepare the hot end for mounting. By this time, the RTV in your hot end should be fully cured (make sure you've let it cure for at least 24 hours) and it should look like this:

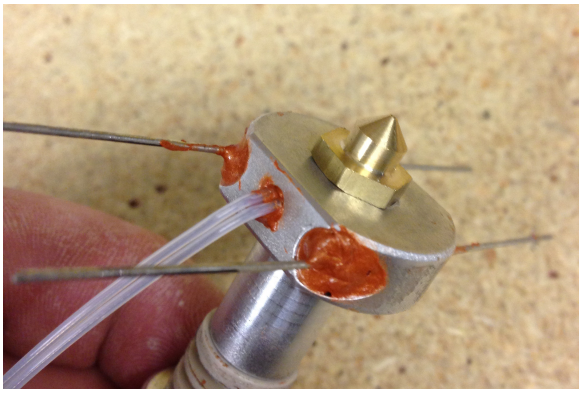


Fig. 13-6:Completed Hot End.

Using a pair of needle nosed pliers, bend the resistor leads as shown in the following photos.

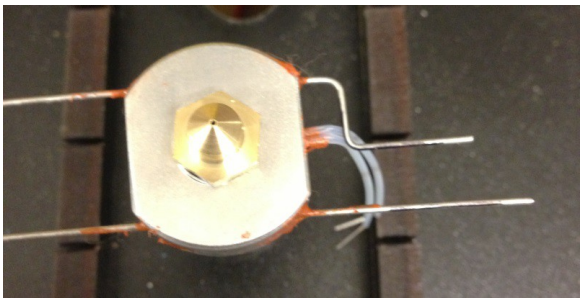


Fig. 13-7: Step #1.

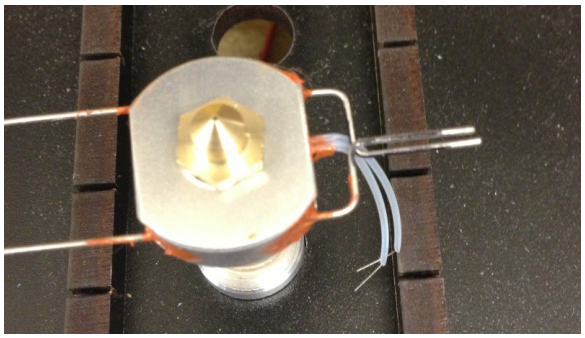


Fig. 13-8: Step #2.

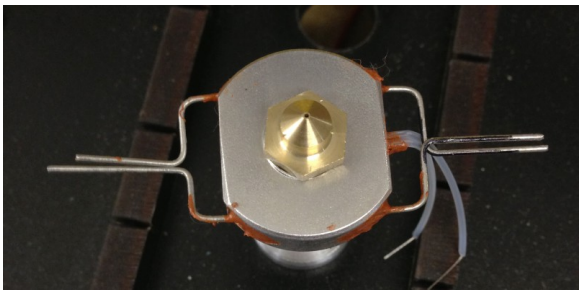


Fig. 13-9: Step #3.

Install two 22-18ga uninsulated barrel crimp connectors as shown in Fig. 13-10.

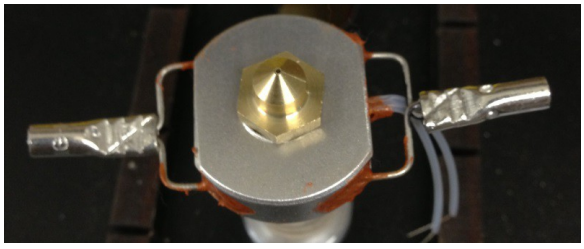


Fig. 13-10: Step #4.

Strip off 3/8” of insulation from the 18ga black & red wires coming from the hot end loom and crimp them into the connectors as shown.

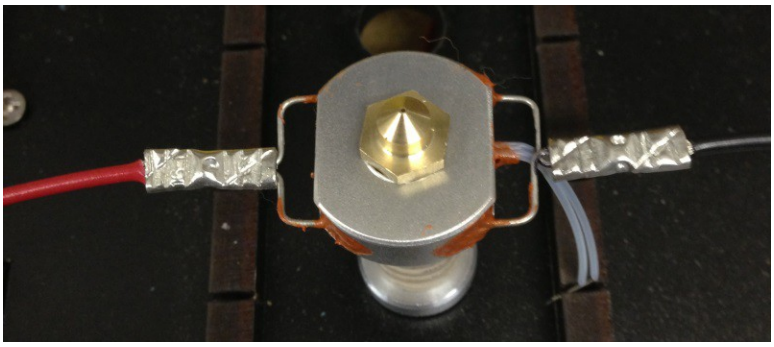


Fig. 13-11:Power wires connected.

At this point, I want you to cover the crimp connectors with a bit of Kapton tape – this will help prevent accidental shorts. The photos of the crimp connectors from this point forward have omitted the Kapton tape for clarity.

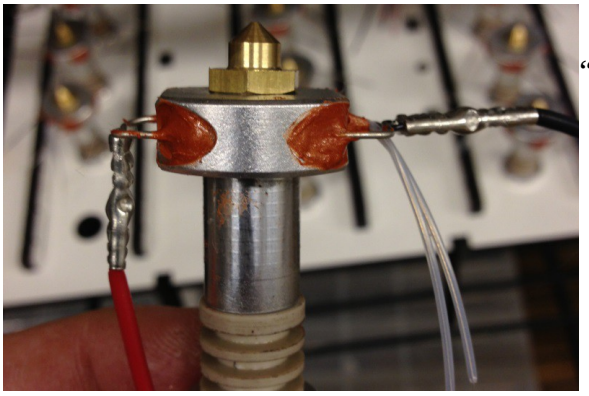


Fig. 13-12:Positive lead bent "up".

Bend the resistor legs connected to the red wire “up” as shown in Fig. 13-12.

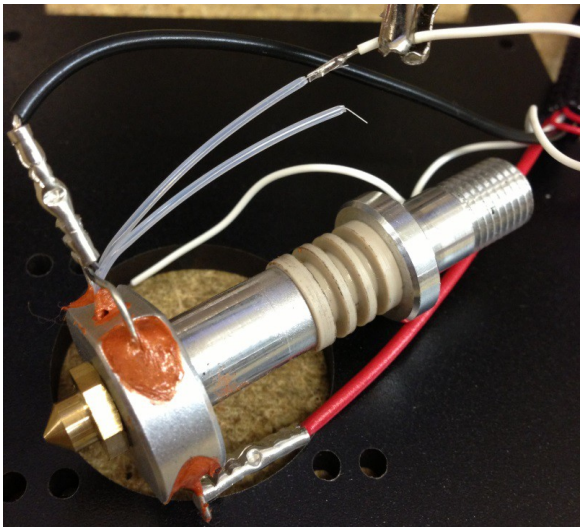


Fig. 13-13:Attaching thermistor leads.

Carefully solder the white wire to one thermistor lead and the green wire to the other. You may notice that the thermistor wires shown are different than the ones you're working with. This is okay and was a change made after the photographs were originally taken.

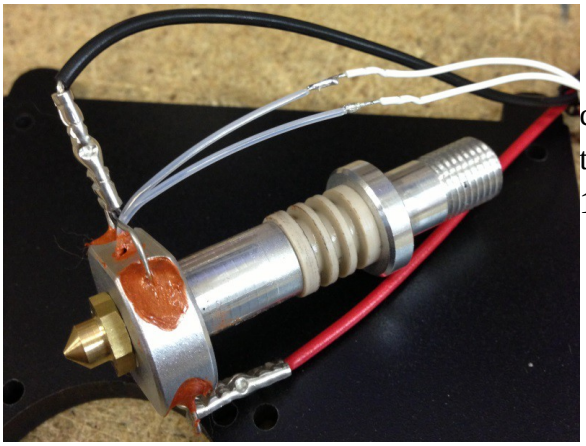


Fig. 13-14:Both thermistor leads connected.

Once you've got both thermistor leads connected, cover each connection with Kapton tape (individually) and then bind them together with Kapton as shown in Fig. 13-15.

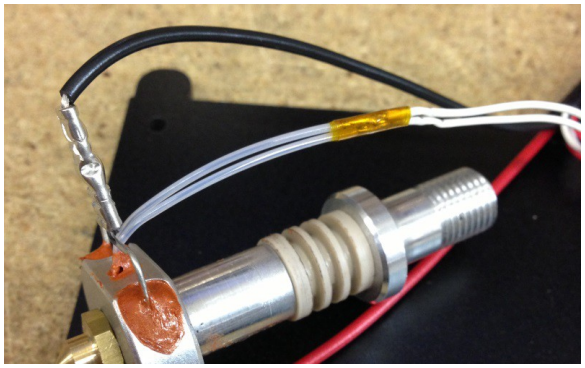


Fig. 13-15:Kapton covered leads.

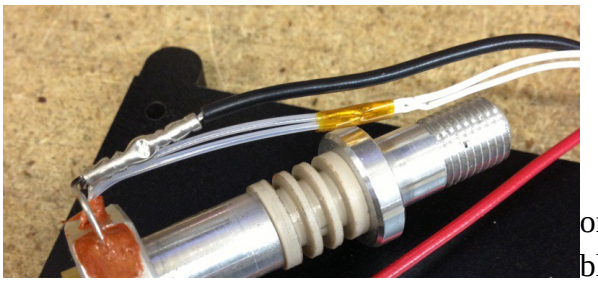


Fig. 13-16:Thermistor lead routing.

Bend the black wire “up” as you did with the red one and carefully line up the thermistor wires next to the black lead as shown to the left.

Bind the thermistor leads to the black wire with Kapton tape as shown in Fig. 13-17. This is an important step as it acts as a strain-relief to help prevent the thermistor from pulling out of the hot end. If the thermistor is pulled out during a print, the hot end will overheat and destroy the PEEK (the tan section) barrel.

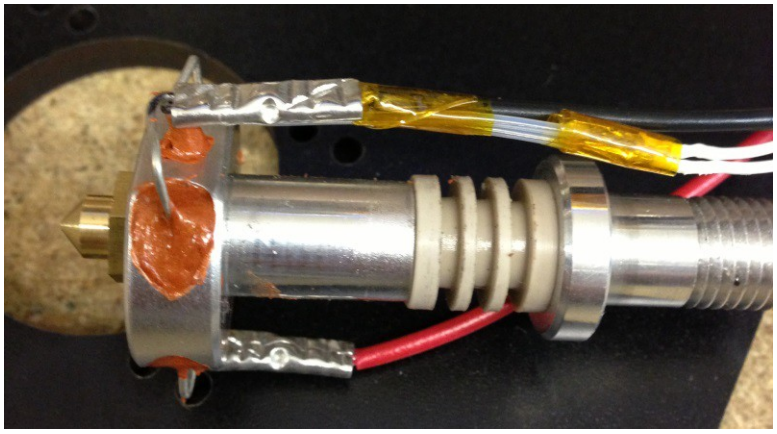


Fig. 13-17:Completed thermistor wiring.

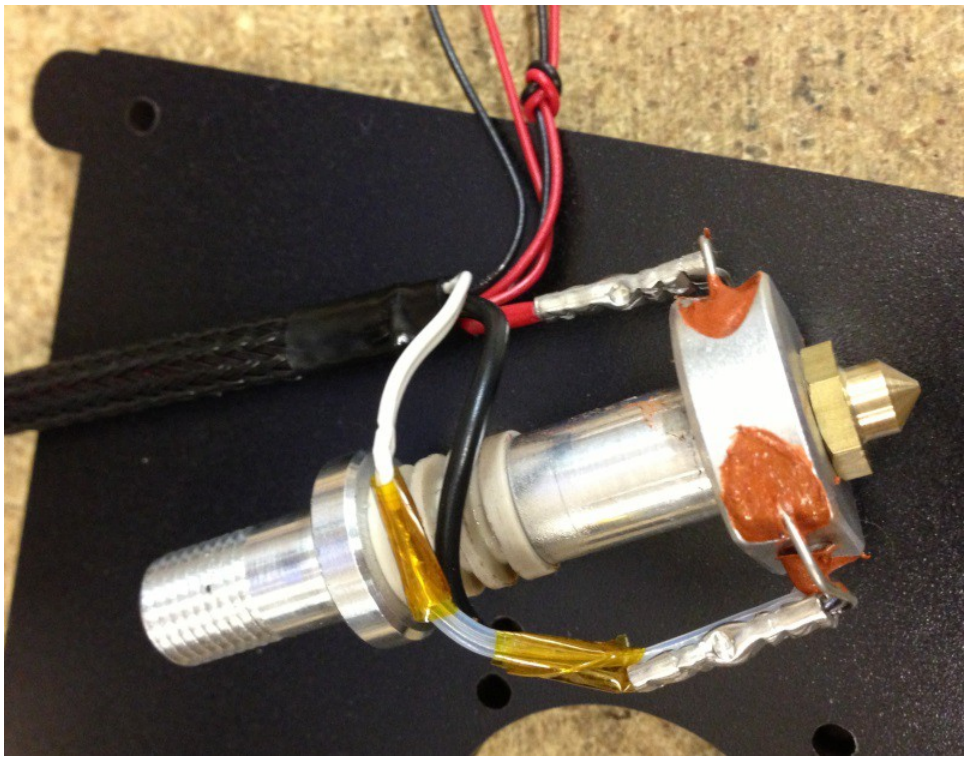


Fig. 13-18:Hot end wiring completed.

Attaching the Hot End to the Hot End Mounting Plate

Appendix A: Quick Disconnects in Your Rostock MAX v2

If you're reading this appendix, chances are pretty good that you want to use the quick disconnect connectors that I mentioned at the beginning of this assembly guide. Let's get to it, shall we? If you've never installed crimp pins before, I can't recommend this excellent tutorial over at

Hansen Hobbies enough. http://www.hansenhobbies.com/products/connectors/Connectors.pdf

The tutorial covers connectors that are mostly R/C oriented, but the lessons still apply to the connectors we'll be using here.

Wiring the EZStruder's Stepper Motor

For this step, you'll need a four pin male latching polarized connector and four male crimp pins.

Strip about 3/16” of insulation from each of the four 22ga stepper motor extension wires coming from the Y axis tower. Crimp each pin as shown below:

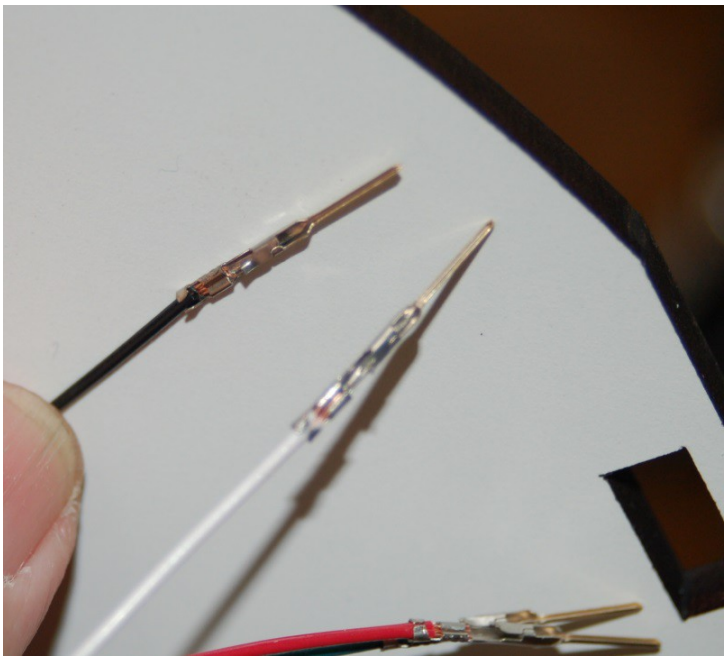


Fig. A-1:Male crimp pins installed.

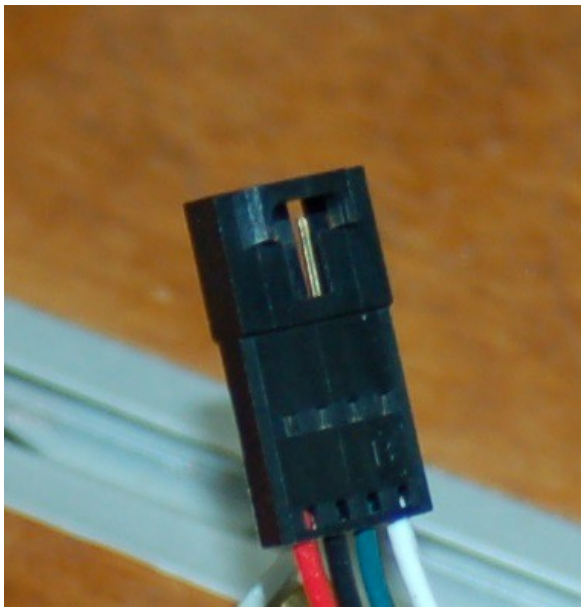


Fig. A-2:LP Connector installed.

Now loop the stepper motor wires and extension wires as shown and then join the connectors.

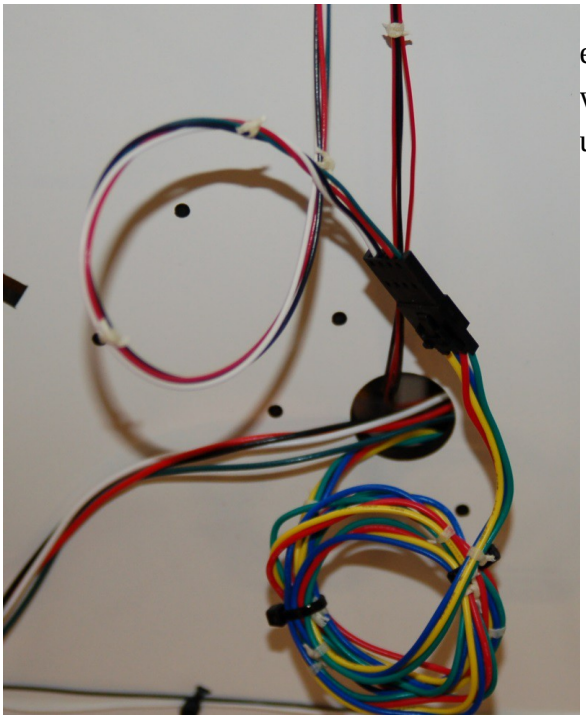


Fig. A-3:Looped & Connected!

I'm a bit of a wiring geek, so I tend to go to extremes when I'm cleaning things up. You can tape your wires down in the positions shown using Kapton tape. I use a stick-on wire tie pad. :)

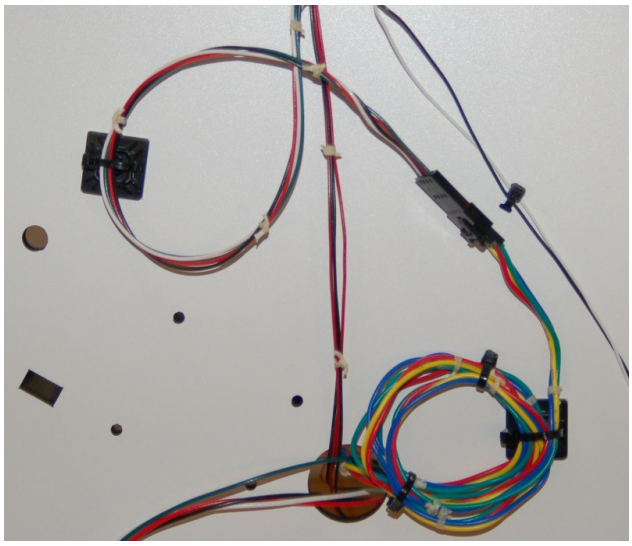


Fig. A-4:Extruder wiring done!

Wiring the Hot End, Thermistor and Fan Connectors

First, we're going to mount the JST connectors to the PEEK and Layer fan leads (the two pair of 26ga wires).

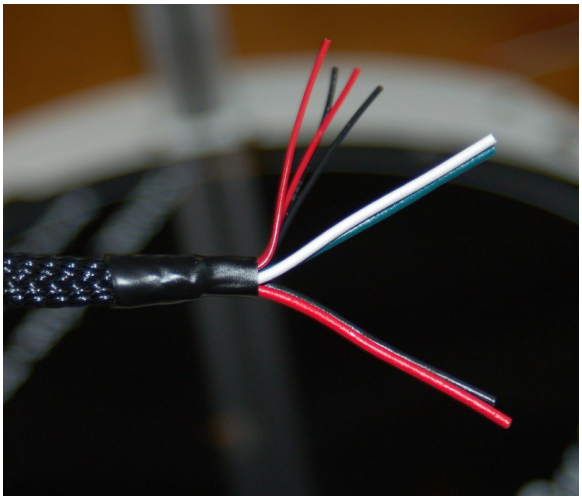


Fig. A-5: Hot end wires (knot not shown.)

The pair of wires that you tied a knot in are going to be the PEEK fan wires. Strip about 3/16” from the ends of the wires and crimp on a female crimp pin to each wire. Fold the PEEK fan wires back and add female crimp pins to the other pair. Take two female JST connector shells and mark them as shown below.

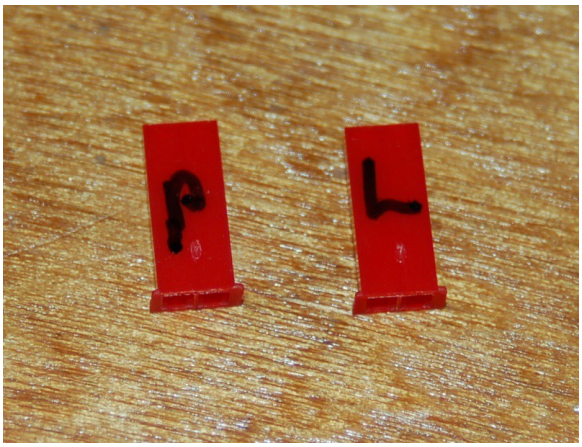


Fig. A-6:Marked fan connectors.

This will help identify the PEEK (“P”) and Layer (“L”) layer fans. The JST connectors have pin numbers molded into the lower face of each connector. Insert the black (-) wire into the pin #1 position and insert the red (+) into the pin #2 position.

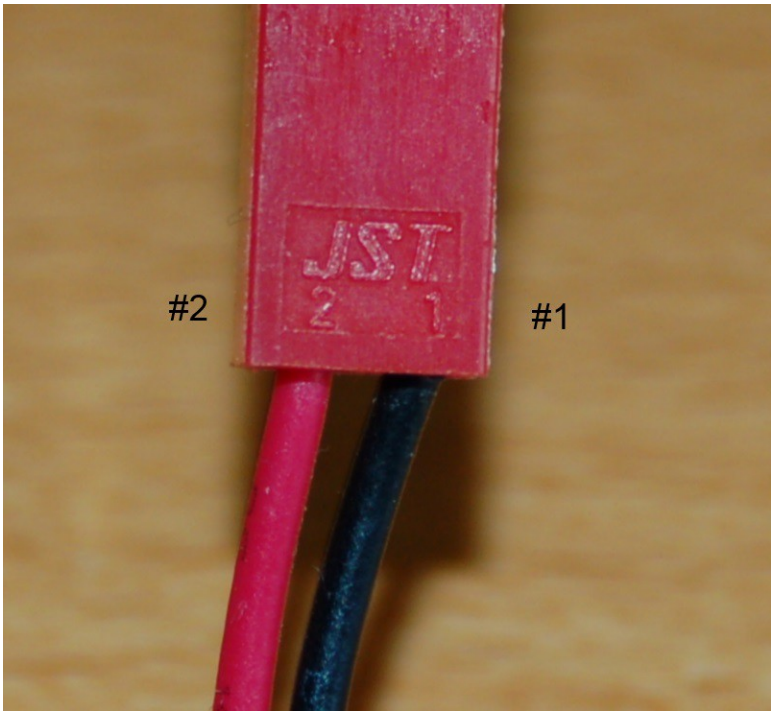


Fig. A-7:JST connector pin identification.

Now you need to strip off about 3/16” of insulation from the four 18ga wires coming out of the hot end loom. Crimp on a female crimp pin to each one and insert them into the four pin, locking poliarized connector. Follow the wiring chart below.

Pin	Color
1	Green
2	Red
3	Black
4	White

The pin #1 location is indicated on the connector face by the white arrow in Fig. A-8.

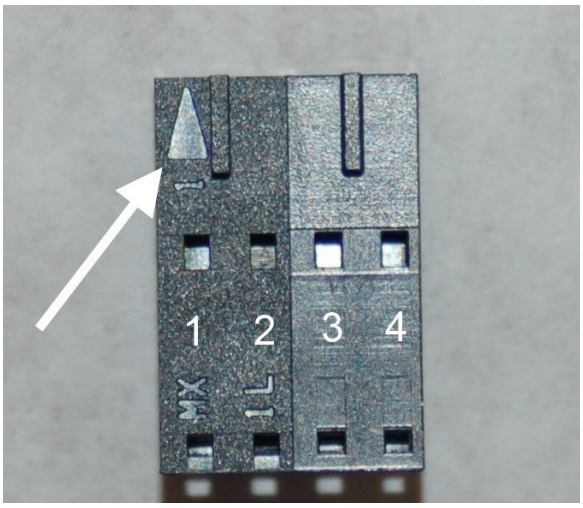


Fig. A-8:Connector pin identification.