

THE PLASTIC BEAST

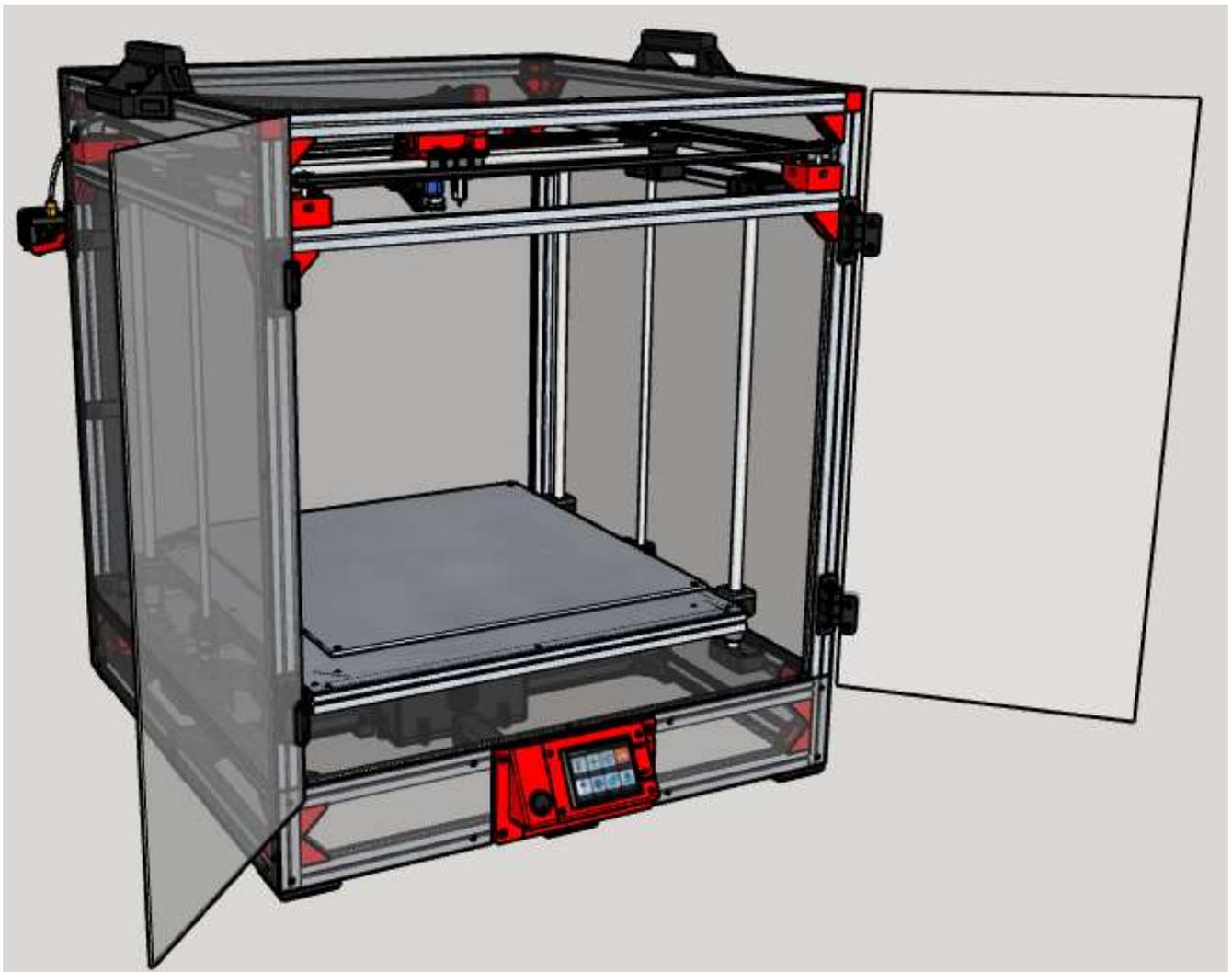


Table of Contents

Step	Description	Location
	Introduction	1
1	Frame	2
2	XY Gantry	5
3	Hotbed Assembly	9
4	Rod and Leadscrew installation	10
5	Power Supply and Cable Concealment	11
6	Initial Wiring	12
7	MKS SBase v1.3 Wiring	13
8	Finish Assembly	15
9	Firmware	17

Introduction

When I was getting ready to start this build a little over a year ago I had seen Vulcaman and Aldricnegrier versions on Instructables.com, I knew this was the printer I wanted to build. The first thing I did was buy a Prusa i3 clone from eBay and start printing the plastics for my version of the Vulcanus Max 40, "The Plastic Beast". Thanks to Vulcaman especially for loading his Sketchup drawing. I used this as a starting point and used or edited several of his parts.

In my Sketchup design I made sure that any part you click on will be 3D printable by stl export without error. I wanted others to have a completely editable design so they could change anything they want. Almost every part on my version has been edited to fit the electronics that I wanted to use. I also used layers for every category of parts on the design so you can turn things off to get a better look at it. The one thing I would warn people new to Sketchup is to make sure you have selected the right layer when editing a part otherwise the layers will not work correctly.

The reason it took so long is because I knew nothing when I started and even though it is open source, getting straight answers about the electronics due to the competition between the original and clone manufactures made it a little more difficult for a novice.

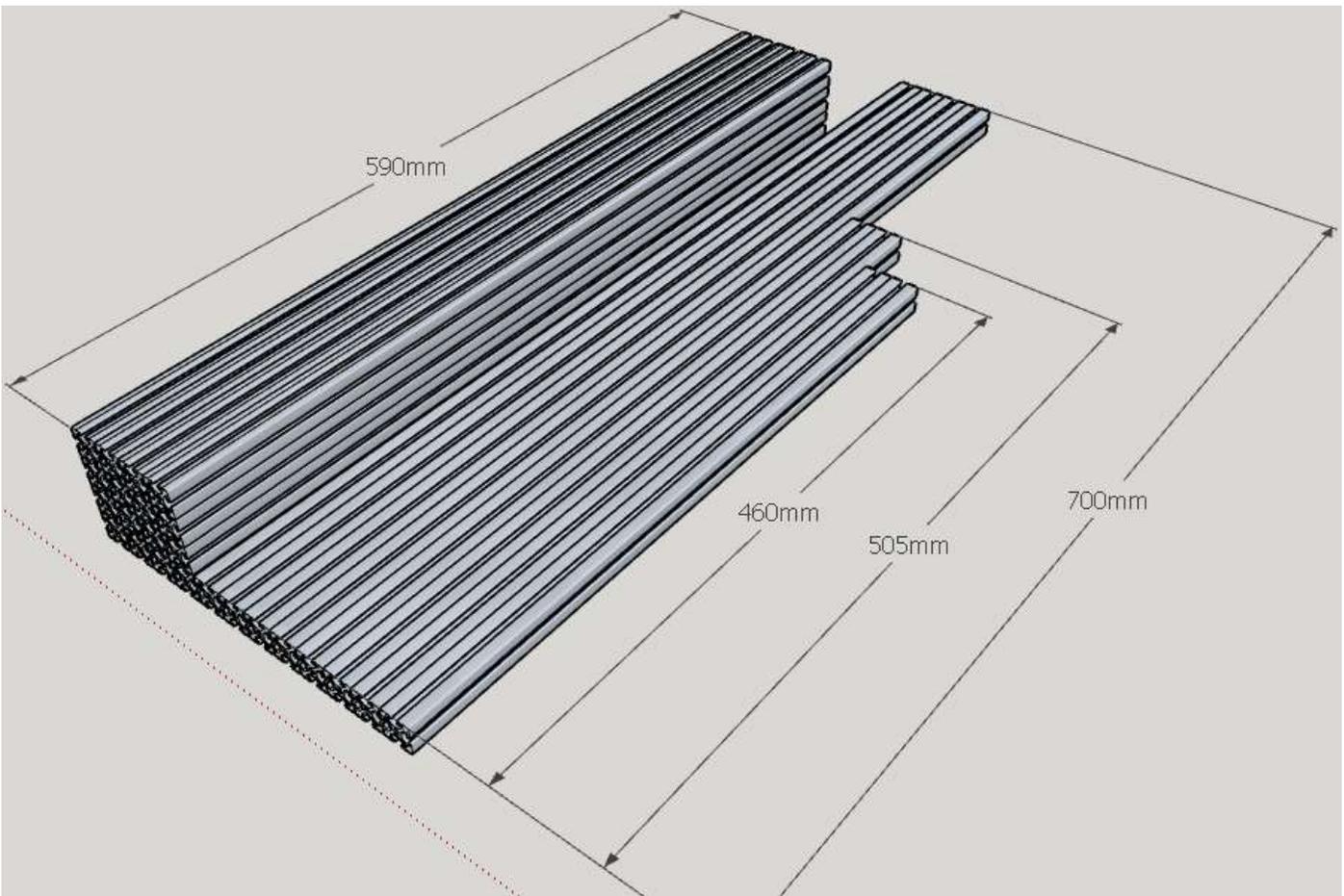
After many prints, reprints, and reprints again, I designed the parts to fit my needs using a variety of variations on Thingiverse.com and from scratch. Also since I put the main frame together over a year ago I saw some parts that cracked due to thicknesses and fixed the effected parts. There are some changes that are not on my printer in the real pictures, but they have been fixed. Also, due to funds, I have not installed the Plexiglas yet, but it is coming soon and I will update the build once the Plexiglas is on.

I think that I have done a very thorough tutorial, I tried to make sure that I did not miss anything because I know that every expertise level will be looking at this. I just wanted to make sure that the novice could figure this out faster than I did. When ordering screws, it is a good idea to order about 10 percent extra screws just in case. A lot of the screws drop in price by half or more when you order 100, so it is more cost effective to order the larger numbers. Mrmetric.com has any type of metric screw you can think of, and I wanted mine all black, but they have others too if you want a different look. The Plastic Beast was designed for Socket Head Cap Screws.

Step 1

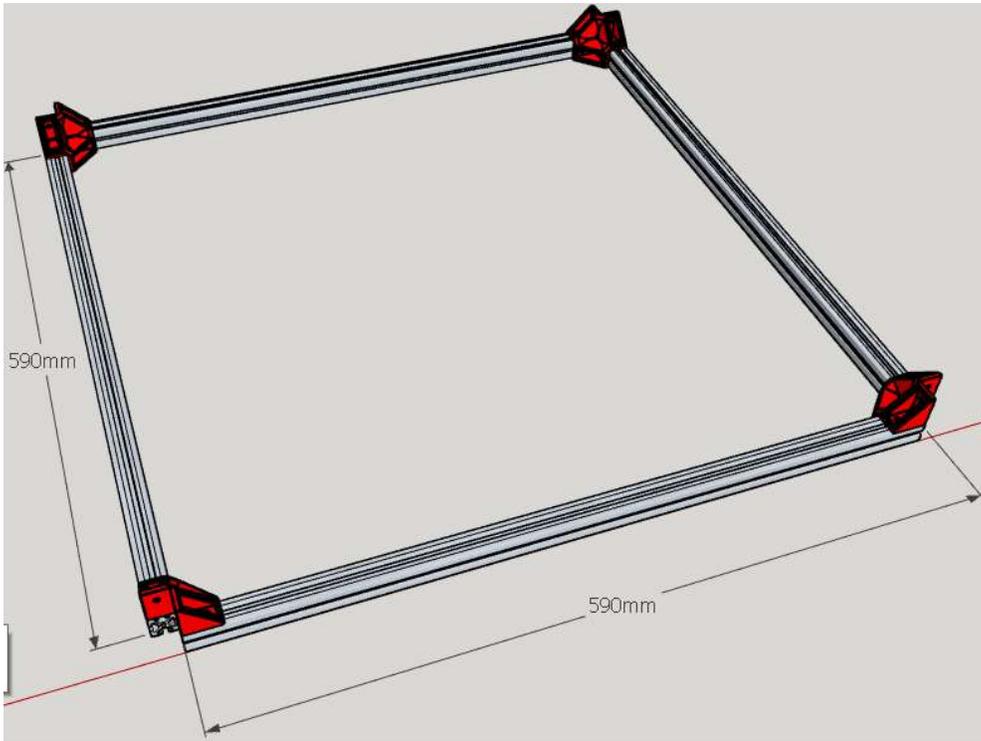
Frame

<u>Item</u>	<u>Quantity</u>	<u>Item</u>	<u>Quantity</u>
2020_3_Way_Corner	12	590mm 2020 Aluminum Extrusion	16
2020_2_Way_Corner	4	700mm 2020 Aluminum Extrusion	4
2020_Corner_Blanks	4	M5 x 10mm Socket head cap screw	122
Z_Motor_Bracket	2	M5 Drop In Extrusion T Nuts	92
Z_12mm_Rod_Holder	8	M5 Extrusion T Nuts	30
Z_Top_Lead_Screw_Bracket	2		

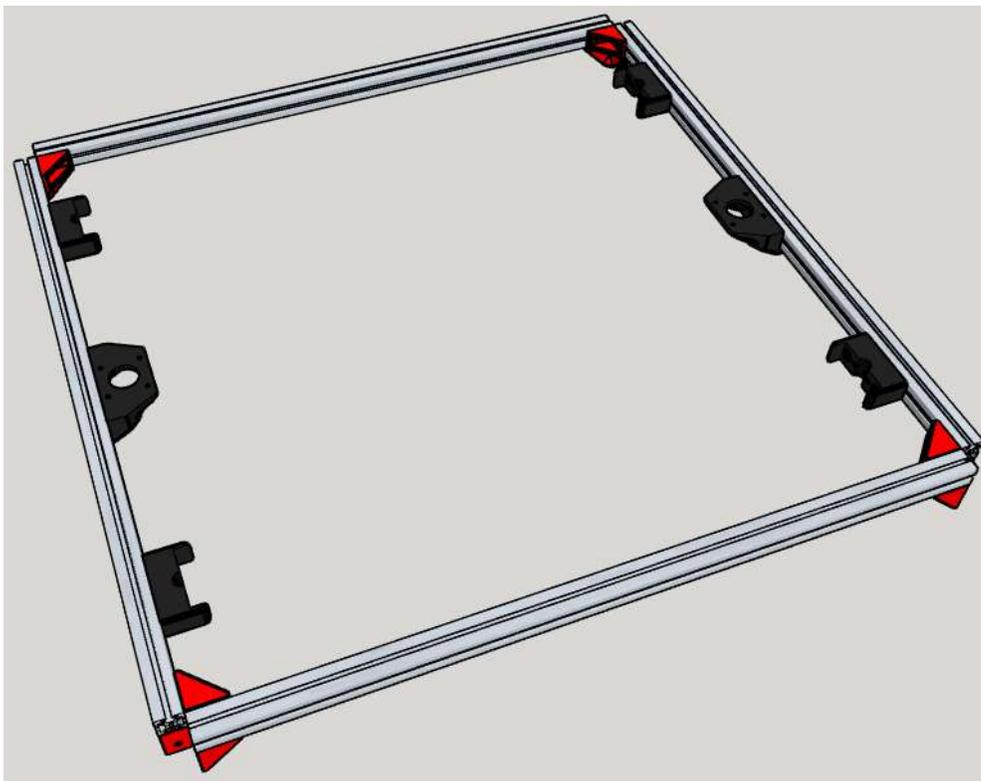


1. The first step assembling the frame is to make each of the 4 square sections at each level. When assembling each one, pay attention to the direction of corners. See the pictures below for reference. When tightening the screws, just get them snug at first because you'll want to make sure the whole frame is square before you tighten them for good.

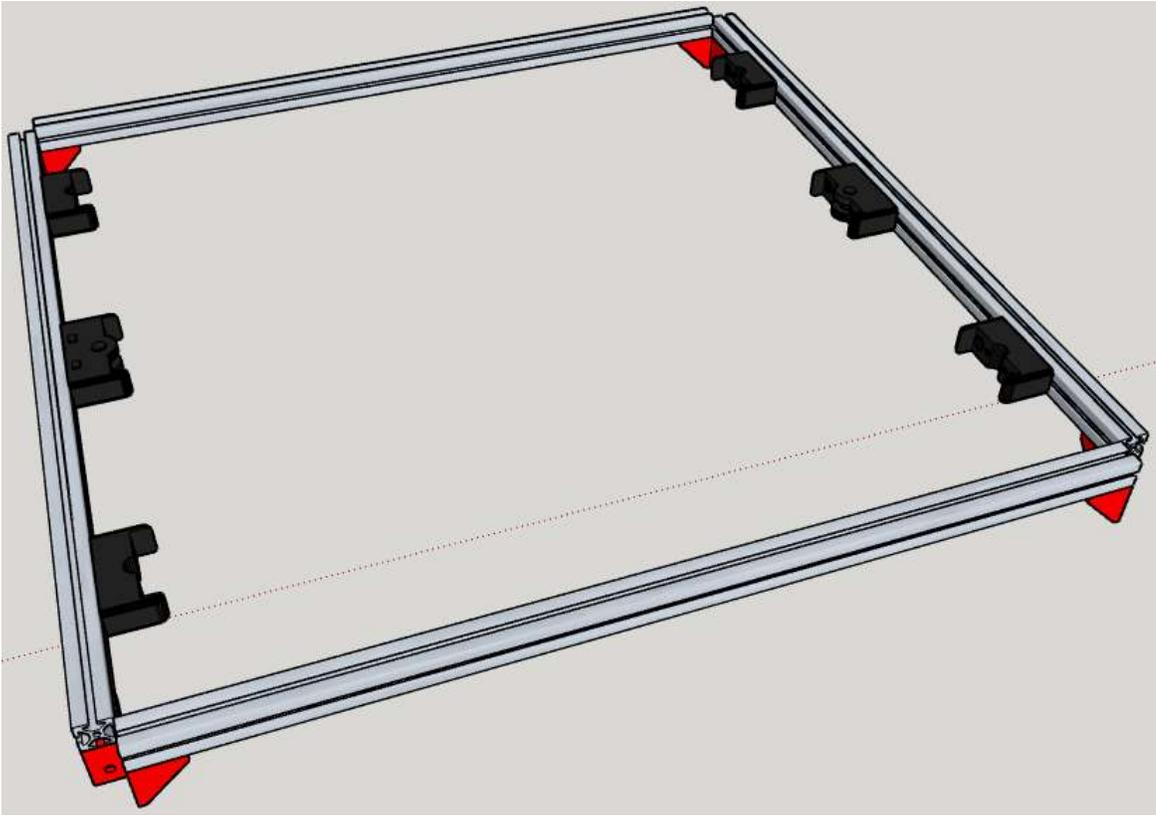
Bottom Level



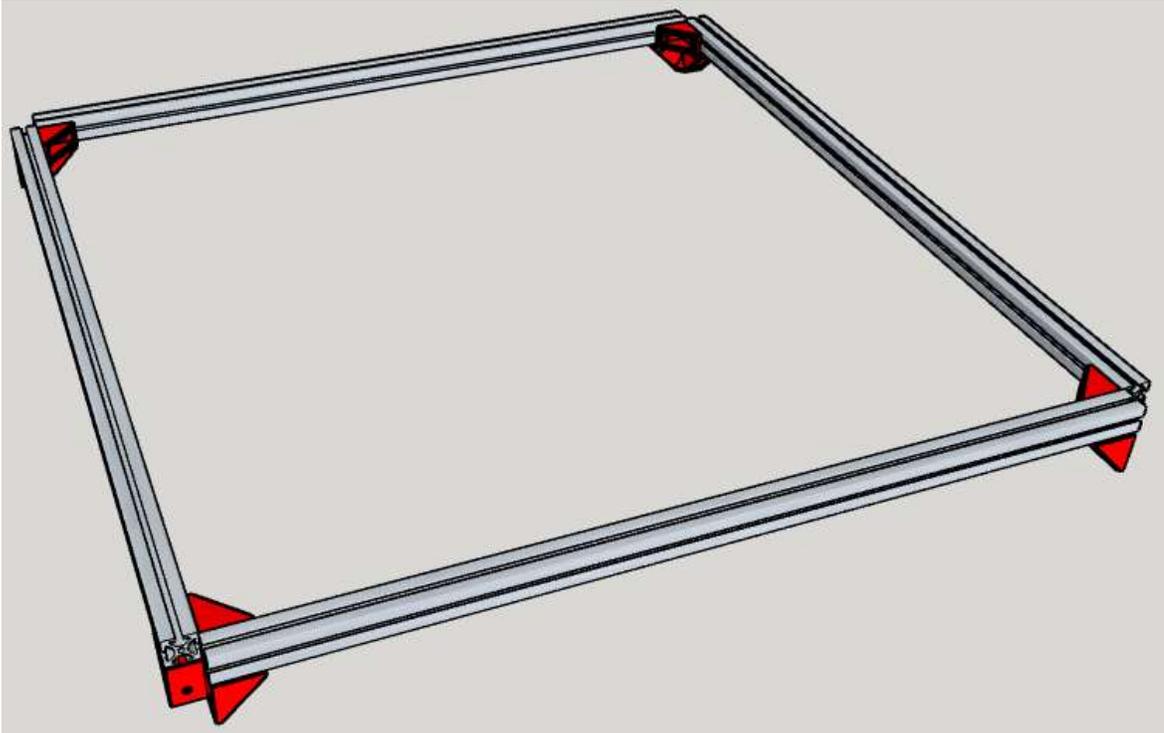
Second Level



Third Level



Top Level



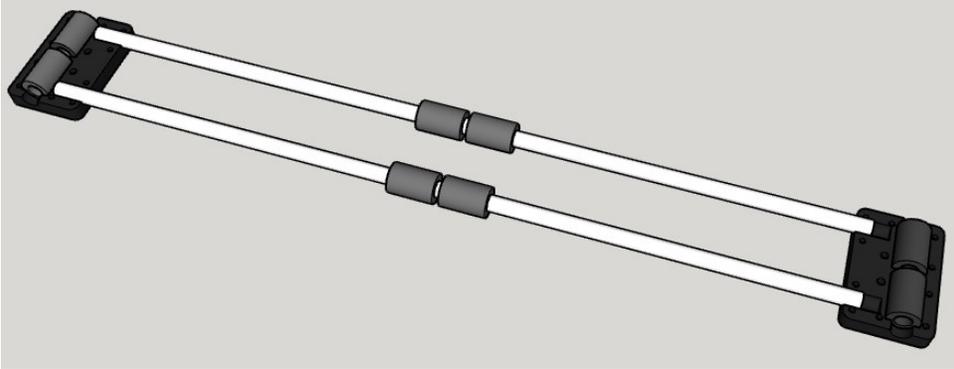
Step 2

XY Gantry

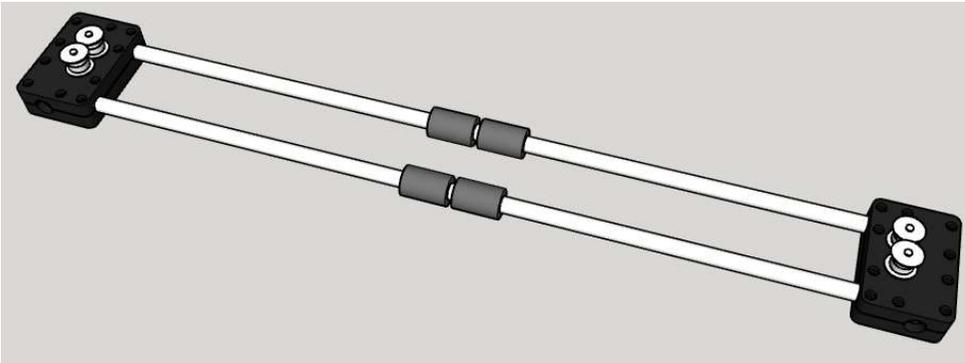
Item	Quantity	Item	Quantity
XY_Idler_Right	1	M5 Extrusion T Nuts	14
XY_Idler_Left	1	M3 x 10mm Socket head cap screw	10
XY_Motor_Right	1	M3 x 20mm Socket head cap screw	24
XY_Motor_Left	1	M3 x 30mm Socket head cap screw	2
XY_Carriage_E3D_V6_Bracket1	1	M3 Hex nuts	28
XY_Carriage_E3D_V6_Bracket2	1	LM10UU for XY	8
XY_Carriage_E3D_V6_Lower	1	GT2 Toothless Pulley 4mm Bore	8
XY_Carriage_E3D_V6_Upper	1	GT2 Belts 5m & 2 Gt2 Pulleys	1
GT2_Belt_Tensioner_Left	1	E3D v6 HotEnd, 1.75mm, Bowden add-on, 12v	1
GT2_Belt_Tensioner_Right	1	BLTouch	1
HE_Duct_Fan	1	4010 Fan for Hotend Duct	1
X_Endstop_Bracket	1	End Stops (Only 2 are needed)	2
Y_Endstop_Bracket	1	Nema 17 59 n-cm torque 2A 200 steps	2
X_Bracket_Left_Down	1	M4 x 25mm Socket head cap screw	2
X_Bracket_Right_Down	1	M4 x 30mm Socket head cap screw	2
X_Bracket_Left_Up	1	M4 x 35mm Socket head cap screw	4
X_Bracket_Right_Up	1	M4 Hex nut	8
537mm 10mm dia Y-Axis Smooth Rod	2	2020_Center_Feet	4
511mm 10mm dia X-Axis Smooth Rod	2	2020_Corner_Blanks	4
M5 x 10mm Socket head cap screw	14	2020_Corner_Feet	4

1. Take the Left and Right X Upper Brackets and put 3 or 4 M3 x 20mm Socket head cap screws through the holes and place upside down.

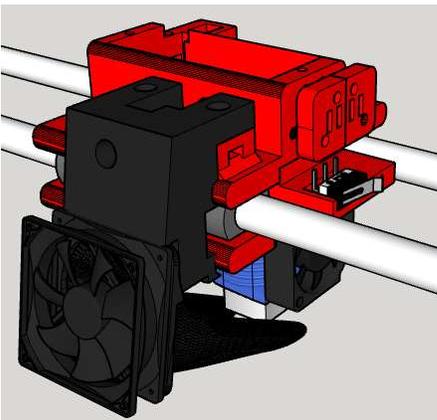
- Place the 2 511mm 10mm dia. X-Axis Smooth Rod on the brackets with the 8 LM10UU bearings as shown.



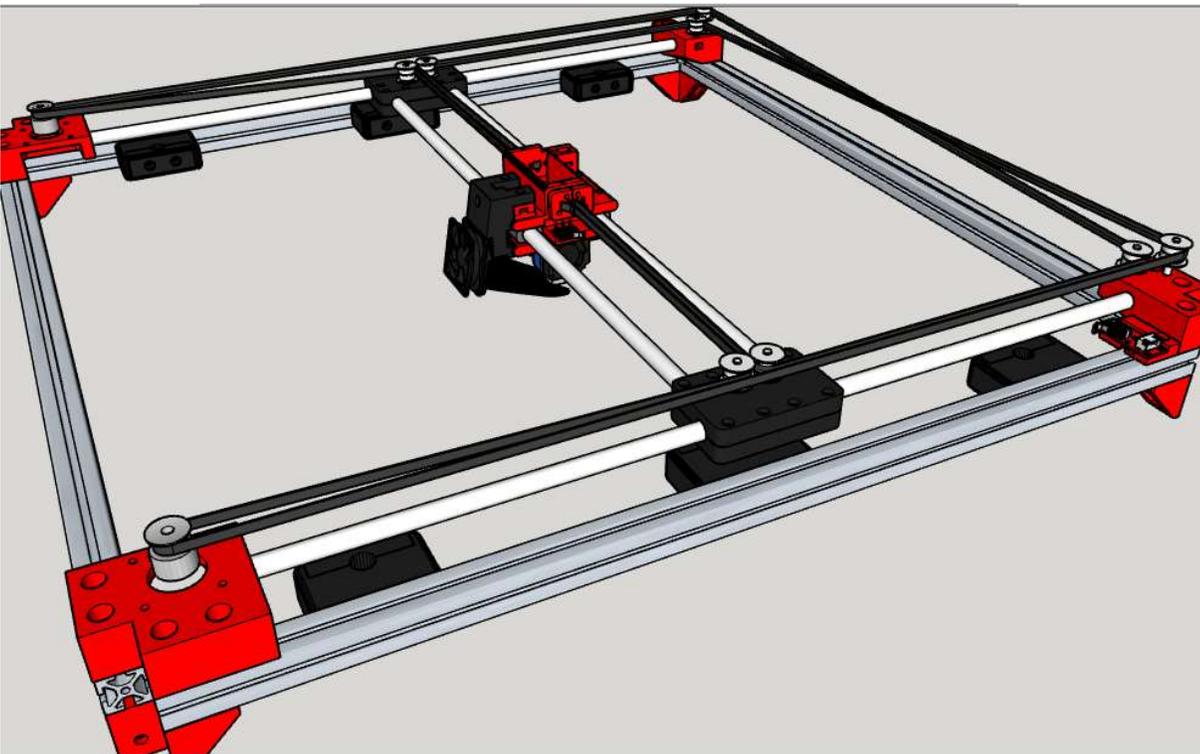
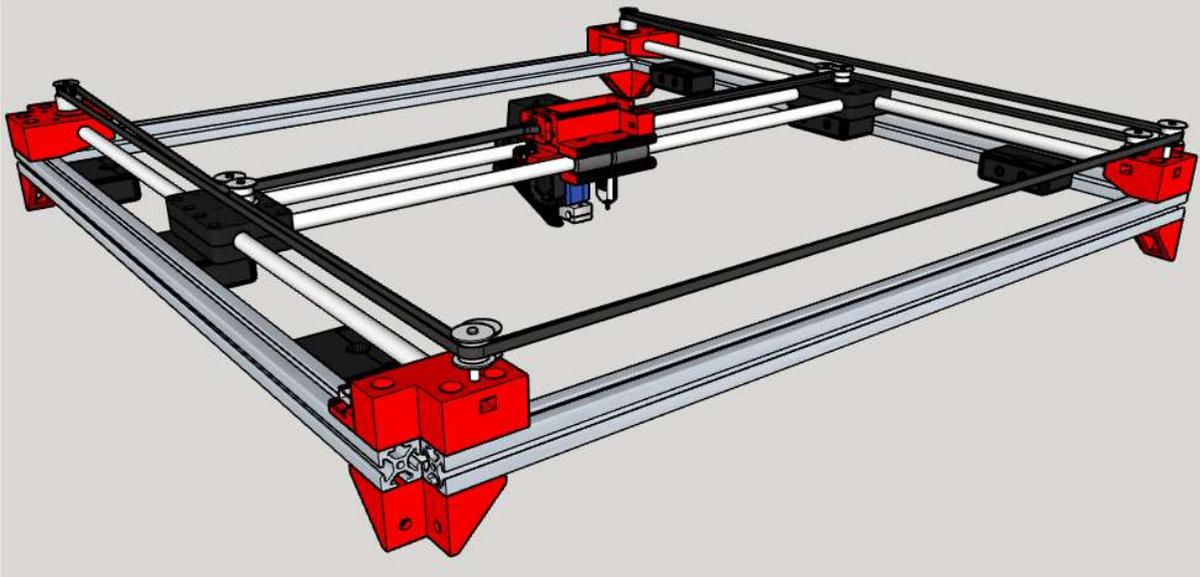
- Now place the Lower Left and Right X brackets on and secure with M3 hex nuts.
- Install the rest of the screws and hex nuts and flip back over.
- Install 4 4mm toothless GT2 pulleys with the 4 4mm x 30mm socket head cap screws, 4 M4 washers and 4 M4 hex nuts. You may need more washers for belt alignment.



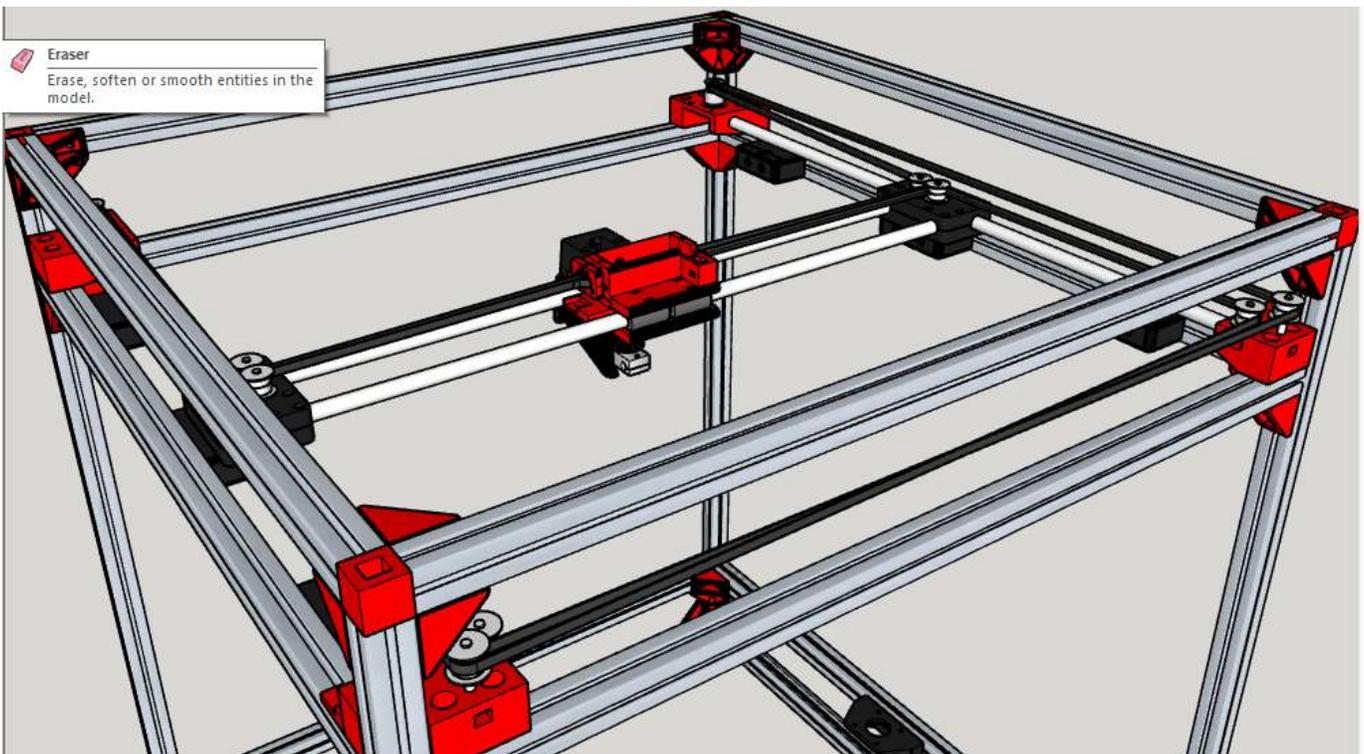
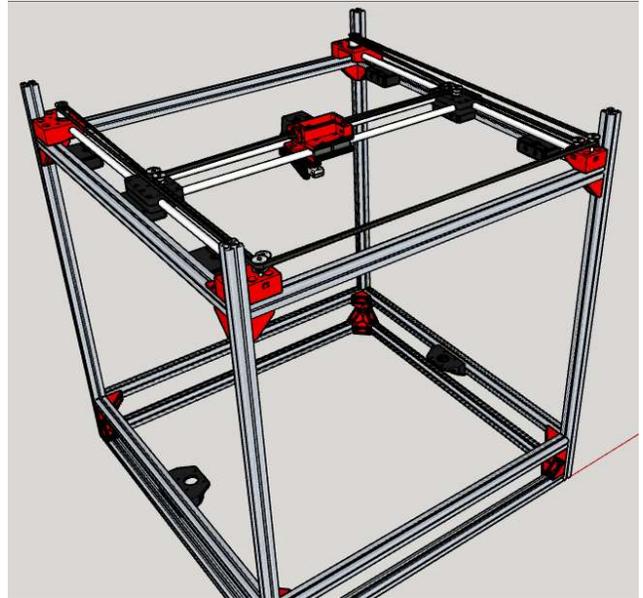
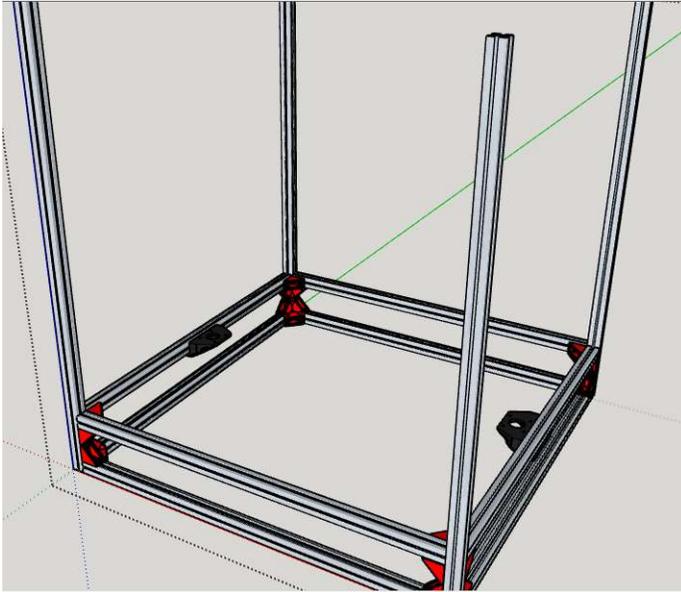
- Install 2 E3D brackets around the E3D Hotend and secure with 2 M3 x 30mm socket head cap screws and hex nuts through brackets.
- Install E3D and X endstop bracket to the upper XY Carriage with 3 M3 x 20mm socket head cap screws and hex nuts
- Install BLTouch with 2 M3 x 10mm socket head cap screws and hex nuts into lower XY Carriage
- Secure upper and lower XY Carriage brackets over the 4 bearings with 4 zip ties.
- Install HE Duct fan with 2 M3 x 10mm socket head cap screws, and nuts.
- Install 4010 Fan for Hotend Duct with 4 M3 x 20mm socket head cap screws and hex nuts.



12. Now insert the 2 537mm 10mm dia. Y-Axis Smooth Rods into the Idler brackets on the right and left.
13. Slide the entire hotend assembly, rods, and bearings over rods you just inserted into the idler brackets.
14. Slide the other end of the rods into the Left and Right Motor Brackets until they are flush to the inside.
15. Mount the entire assembly to the top of the third level with 14 5mm x 10 socket head cap screw and extrusion T nuts.
16. Mount 2 Nema 17 motors with GT2 Pulleys to the brackets with 4 M3 x 10mm socket head cap screw each.
17. Install 2 GT2 Belts and secure with Belt tensioners and 4 M3 x 20mm socket head cap screws and nuts.



18. Install all four sections of the different levels to the 4 700mm 2020 extrusion pieces starting at the bottom. Once completely assembled, make sure it is squared and true and tighten all of the screws.
19. Flip upside down and install Center and Corner Feet with M5 x 10 socket head cap screws and extrusion T nuts.
20. Upright the assembly and install the Corner Blanks with M5 x 10 socket head cap screws. If you have an M5 tap it will make this easier.

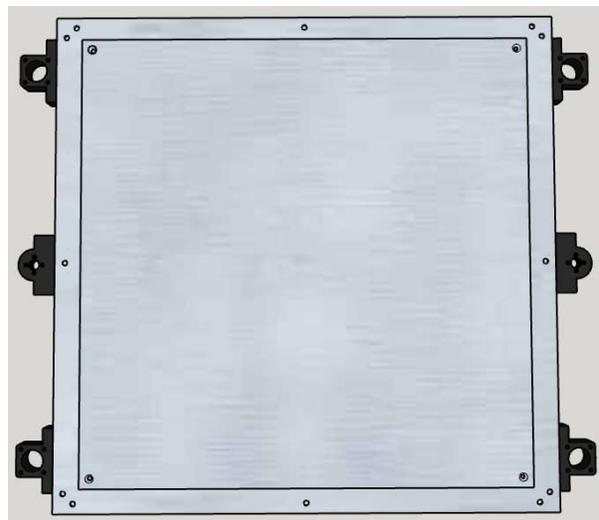
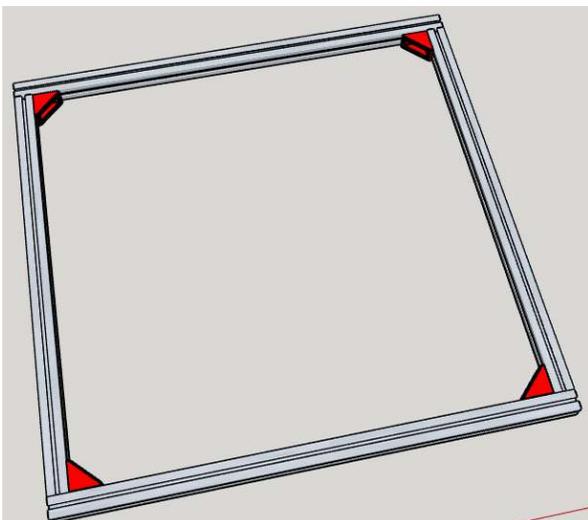


Step 3

Hotbed Assembly

<u>Item</u>	<u>Quantity</u>	<u>Item</u>	<u>Quantity</u>
2020_1_Way_Corner	4	Aluminum Plate 505mm x 505mm x 2mm	1
460mm 2020 Aluminum Extrusion	2	Aluminum Plate 440mm x 440mm x 5mm	1
505mm 2020 Aluminum Extrusion	2	Z_Lead_Screw_Nut_Bracket	2
M5 x 10mm Socket head cap screw	32	Z_LMK12LUU_Bracket	4
M5 Drop In Extrusion T Nuts	8	M4 x 25mm Socket head cap screw	24
M5 Extrusion T Nuts	24	M4 Hex nut	40
400*400mm 110V 600W Heat Bed	1	Copper Nuts	2
LMK12L for Z (LMK12LUU)	4		
M4 x 30mm Flat Head Socket Cap	4		

1. Build heat bed frame by joining the 4 pieces of 2020 extrusion metal that are left to make an even square with 4 2020 1 Way Corners, 8 M5 x 10mm socket head cap screws and 8 extrusion T nuts.
2. Attach the Z Axis Rod and Lead Screw Brackets as shown in the picture with 12 M5 x 10 socket head cap screws and 12 extrusion T nuts.
3. Attach 4 LMK12LUU bearings with 16 M4 x 25 socket head cap screws and 16 hex nuts to the bearing brackets.
4. Attach the 2 lead screw copper nuts with 8 M4 x 25 socket head cap screws and 8 hex nuts.
5. Attach the 3mm aluminum plate to the frame with 12 M5 x 10 socket head cap screws and 12 extrusion T nuts.
6. Mark the corners of the bottom of the 5mm plate at 400 mm square and attach the bed heater to the bottom by removing the paper backing.
7. Attach the 5mm aluminum plate to the 3mm aluminum plate using 4 M4 x 30 flat head socket screws and 16 hex nuts. Make it as level as possible with at least 15mm of clearance.

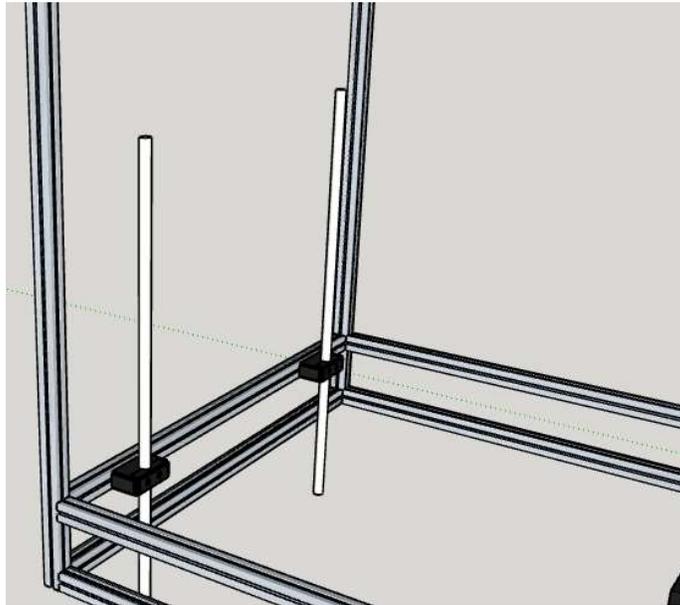


Step 4

Rod and Leadscrew installation

<u>Item</u>	<u>Quantity</u>	<u>Item</u>	<u>Quantity</u>
541mm 12mm dia Z-Axis Smooth Rod	4	M4 Hex nut	20
Z_12mm_Rod_Cap	8	M3 x 10 Socket head cap screws	8
Z_Top_Lead_Screw_Bracket_Cap	2	Axis coupler 5mm to 8mm	2
608zz Bearing	2	Nema 17 59 n-cm torque 2A 200 steps	2
M4 x 25mm Socket head cap screw	16	488mm Lead Screws	2
M4 x 30mm Socket head cap screw	4		

1. Attach 12mm smooth rods to bottom bracket of rod holder with the rod cap and 2 M4 x 25mm socket head cap screws and hex nuts. Allow the bottom of the rod to rest on the table so you can slide the heat bed bearings over the top. Repeat 3 more times.



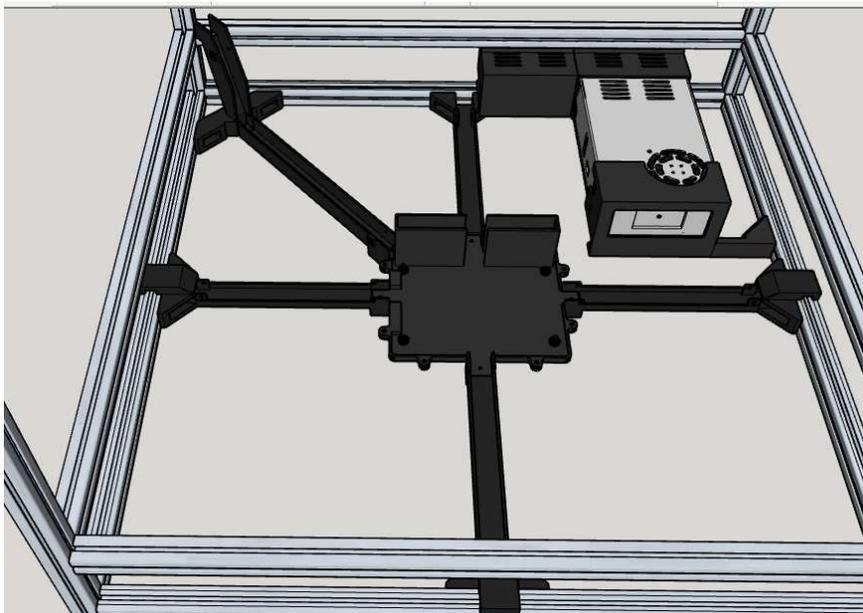
2. Slide heat bed onto smooth rods from the top.
3. Slide 12mm smooth rods up and into top bracket making sure it is even top and bottom and attach the 4 remains rod caps with 2 M4 x 25mm socket head cap screws and hex nuts in each.
4. Install 1 608zz bearing into the top lead screw bracket and install the bracket cap with 2 2 M4 x 30mm socket head cap screws and hex nuts. Repeat on the other side.
5. Install 2 Nema 17 motors into Z axis motor bracket with 8 M3 x 10 socket head cap screws.
6. Install the 2 5mm to 8mm couplers on to the 2 488mm lead screws and tighten. Thread the screws up through the bottom bracket and into the top one. Install bottom of coupler onto the motor making sure one of the small set screws is on the flat part of the motor shaft and tighten. There are many ways to do this process, just do what works for you.
7. Now you can go around and make sure everything is lined up, and moves freely, then tighten everything down checking once in a while to ensure it doesn't get pulled out of alignment.

Step 5

Power Supply and Cable Concealment

<u>Item</u>	<u>Quantity</u>	<u>Item</u>	<u>Quantity</u>
CC_Bottom_Corner_Bracket	1	Solid_State_Box	1
CC_Corner_to_Center	1	360w 30a 12v Power Supply	1
CC_Front_to_Center	1	M5 x 10mm Socket head cap screw	19
CC_Left_to_Center	1	M5 Extrusion T Nuts	19
CC_Rear_to_Center	1	M4 x 6mm Socket head cap screw	8
CC_Right_to_Center	1	M3 x 10mm Socket head cap screw	1
Power_Supply_Bracket_1	1	M3 x 14mm Socket head cap screw	4
Power_Supply_Bracket_2	1	M3 Hex nut	5
MKS_SBASE_v1_3_and_Wiring_Box	1		

1. Attach Power Supply Bracket 1 and 2 to the power supply with 8 M4 x 6mm socket head cap screws.
2. Attach Power Supply Brackets to the frame in back right corner with 5 M5 x 10mm socket head cap screw and 5 M5 extrusion T nuts.
3. Install Solid State Box with 4 M5 x 10mm socket head cap screw and 4 M5 extrusion T nuts.
4. Install Bottom Corner Bracket into left rear corner with 2 M5 x 10mm socket head cap screws and 2 M5 extrusion T nuts.
5. To make things much easier press all of the M3 hex nuts into the bottom of all of the Cable Concealment Brackets and the M4 Hex nuts into the center MKS Sbase box.
6. Set the MKS Sbase Box in the bottom center and start installing the Right, Left, Rear, Front, and Corner Cable Brackets into the 2020 Frame with 2 M5 x 10mm socket head cap screw and extrusion T nuts, and 1 M3 x 14mm socket head cap screw and hex nut per bracket. Attach the Corner to Center Bracket last.

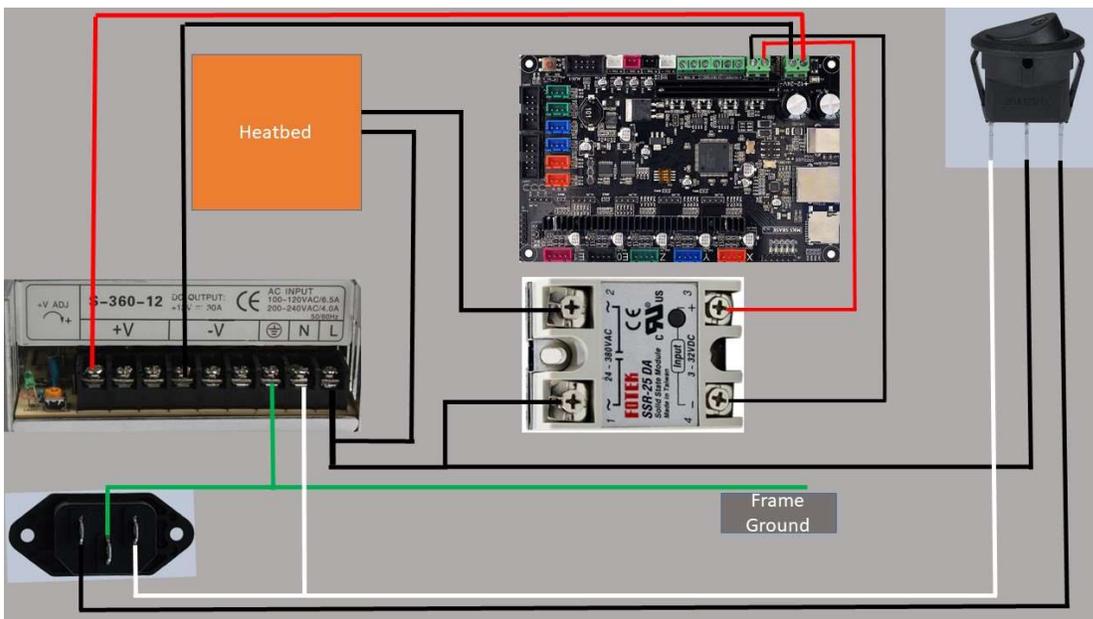
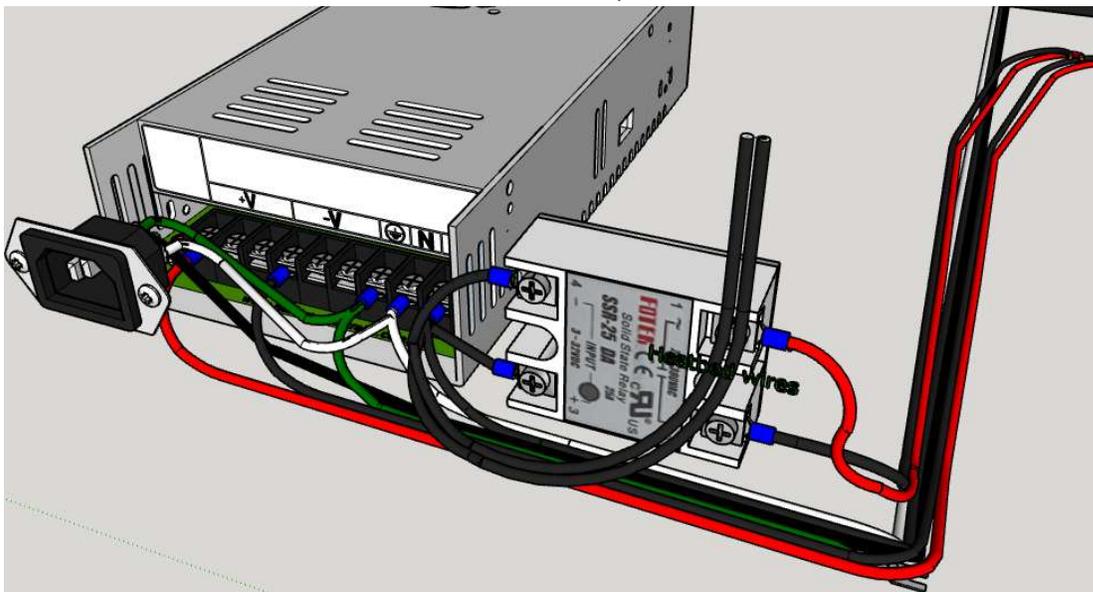


Step 6

Initial Wiring

Item	Quantity	Item	Quantity
Rocker Switch	1	SSR-25 DA Solid State Relay	1
3 Prong Power Socket	1	TFT32_Bracket_with_Switch	1
18 Gauge Wire Assortment	1		

1. Mount the SSR-25 DA into the Solid State Box
2. Wire power supply and relay according to the diagram and picture below using the 18 gauge wire and connectors.
3. Install Rocker Switch into TFT32 Bracket and hook up wires.



Step 7

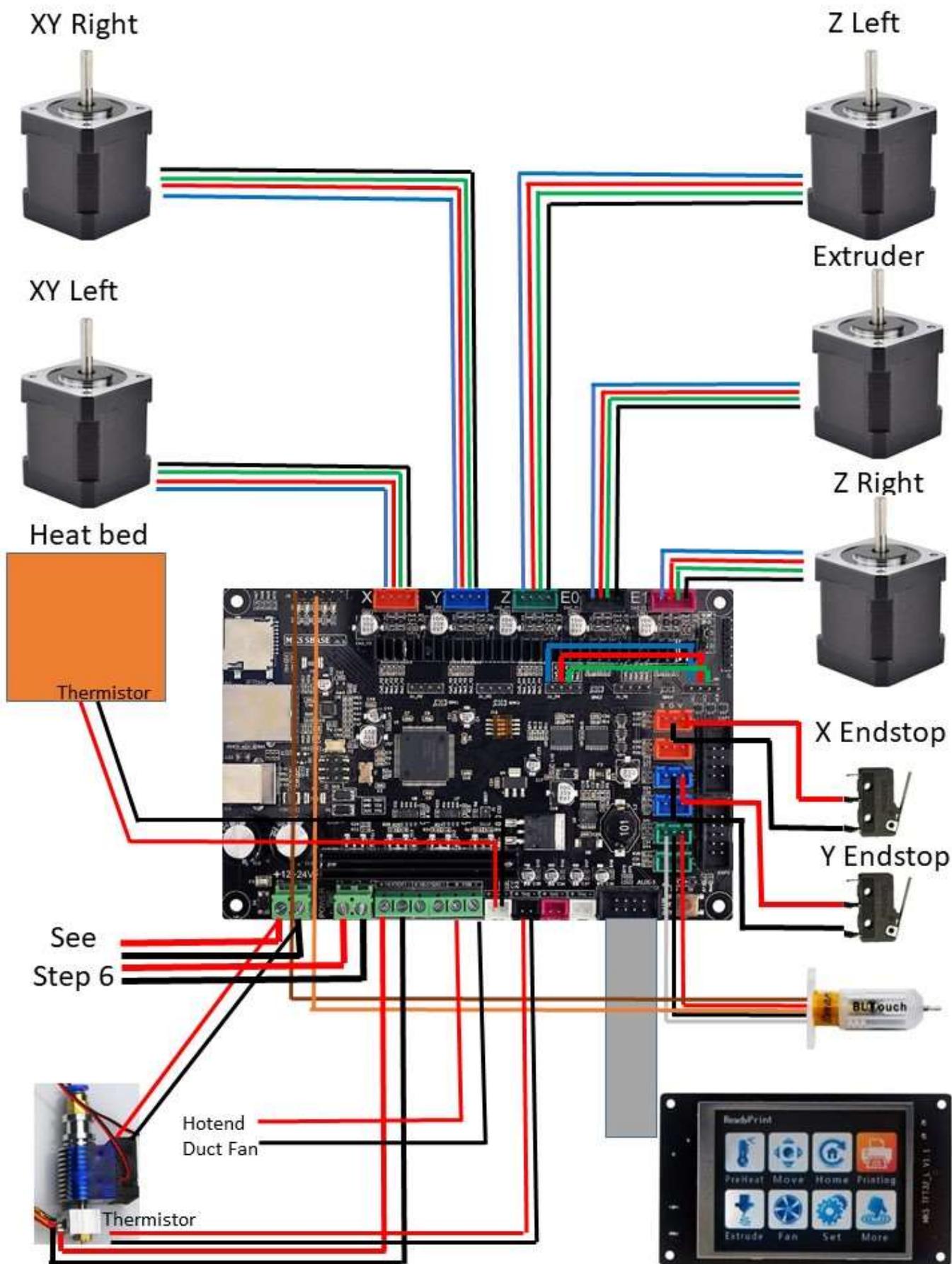
MKS SBase v1.3 Wiring

<u>Item</u>	<u>Quantity</u>	<u>Item</u>	<u>Quantity</u>
22 Gauge Wire Assortment	1	M3 Hex Nut	4
DuPont Crimping Tool	1	Extruder_Motor_Bracket	1
MKS TFT32 V3.0 Smart Touch Screen	1	MK8 Direct Drive Extruder	1
MKS SBASE V1.3 Open Source Smoothieboard	1	M5 x 10mm Socket Head Cap Screw	8
2.54mm DuPont Connectors	1	M3 x 10mm Socket Head Cap Screw	4
TFT32_Bracket_Back	1	M5 Extrusion T Nuts	8
TFT32_Bracket_Main	1	Nema 17 59 n-cm torque 2A 200 steps	1
M3 x 10mm Socket Head Cap Screw	4		

1. Install MKS Sbase V1.3 into its bracket with 2 M3 x 20mm socket head cap screws and hex nuts.
2. Hook up main board power and heat bed wires to the MKS Sbase.
3. Install TFT32 into the TFT Bracket Main with 4 M3 x 10mm socket head cap screws and nuts.
4. Now attach the TFT32 Cable and stick it through the hole in the back plate, then attach the assembly to the frame with 4 M5 x 10mm socket head cap screws and 4 extrusion T nuts.
5. Put power wires through the hole in back plate, hook up to switch, and attach the switch and bracket to the frame with 2 M5 x 10mm socket head cap screws and extrusion T nuts. Slide against TFT32 Bracket.



6. Attach the other end of the TFT32 Cable to the MKS Sbase v1.3.
7. Install Nema 17 motor and MK8 Direct Drive Extruder onto the Extruder Bracket and mount to frame with 2 M5 x 10 socket head cap screws and extrusion T nuts.
8. Install the rest of the wiring following the diagram, some will need to be extended.

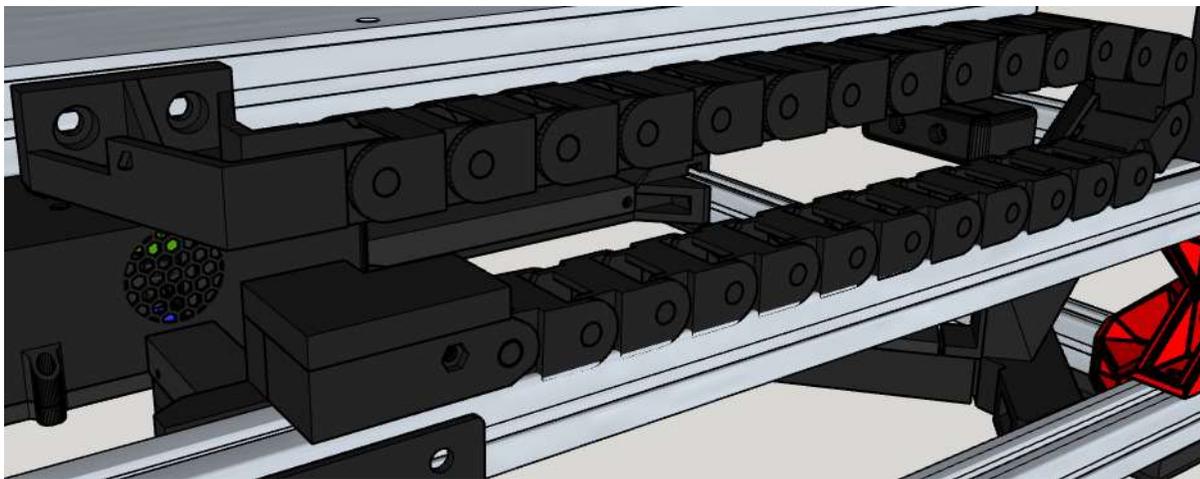


Step 8

Finish Assembly

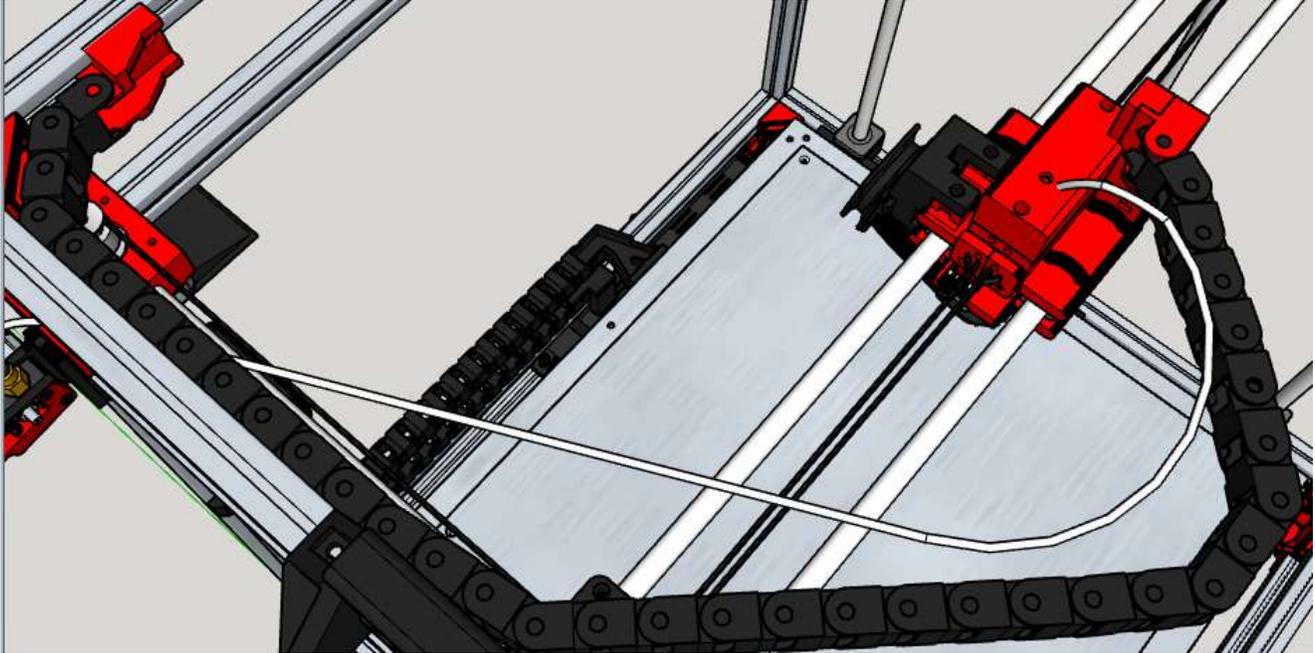
<u>Item</u>	<u>Quantity</u>	<u>Item</u>	<u>Quantity</u>
Solid_State_Box_Cover	1	Drag_Chain_Bracket_HB_2	1
XY_Carriage_Wiring_Cover	1	Drag_Chain_Bracket_HB_Cover	1
2020_Handle	2	Drag_Chain_Guide	1
CC_Bottom_Corner_Bracket_Cover	1	Drag_Chain_HE_Bracket	1
CC_Rear_to_Center_Cover2	1	Drag_Chain_Link	60
CC_Corner_to_Center_Cover	1	HB_Drag_Chain_Bracket	1
CC_Front_to_Center_Cover	1	HE_Rear_Drag_Chain_Bracket	1
CC_Left_to_Center_Cover	1	M5 x 10mm Socket Head Cap Screw	17
CC_Lower__Bracket	1	M5 Extrusion T Nut	17
CC_Rear_to_Center_Cover	1	M4 x 12mm Socket Head Cap Screw	8
CC_Right_to_Center_Cover	1	M4 x 25mm Socket Head Cap Screw	10
CC_Upper_Bracket	1	M4 Hex Nuts	18
Drag_Chain_Bracket_HB	1	PTFE Tube	1

1. Install Drag Chain Brackets using 2 M5 x 10mm socket head cap screws and 2 extrusion T nuts in each bracket.
2. Connect 26 Drag Chain links for the heat bed and 34 for the hot end assembly and thread the wires through the drag chains.
3. Connect drag chains to drag chain brackets

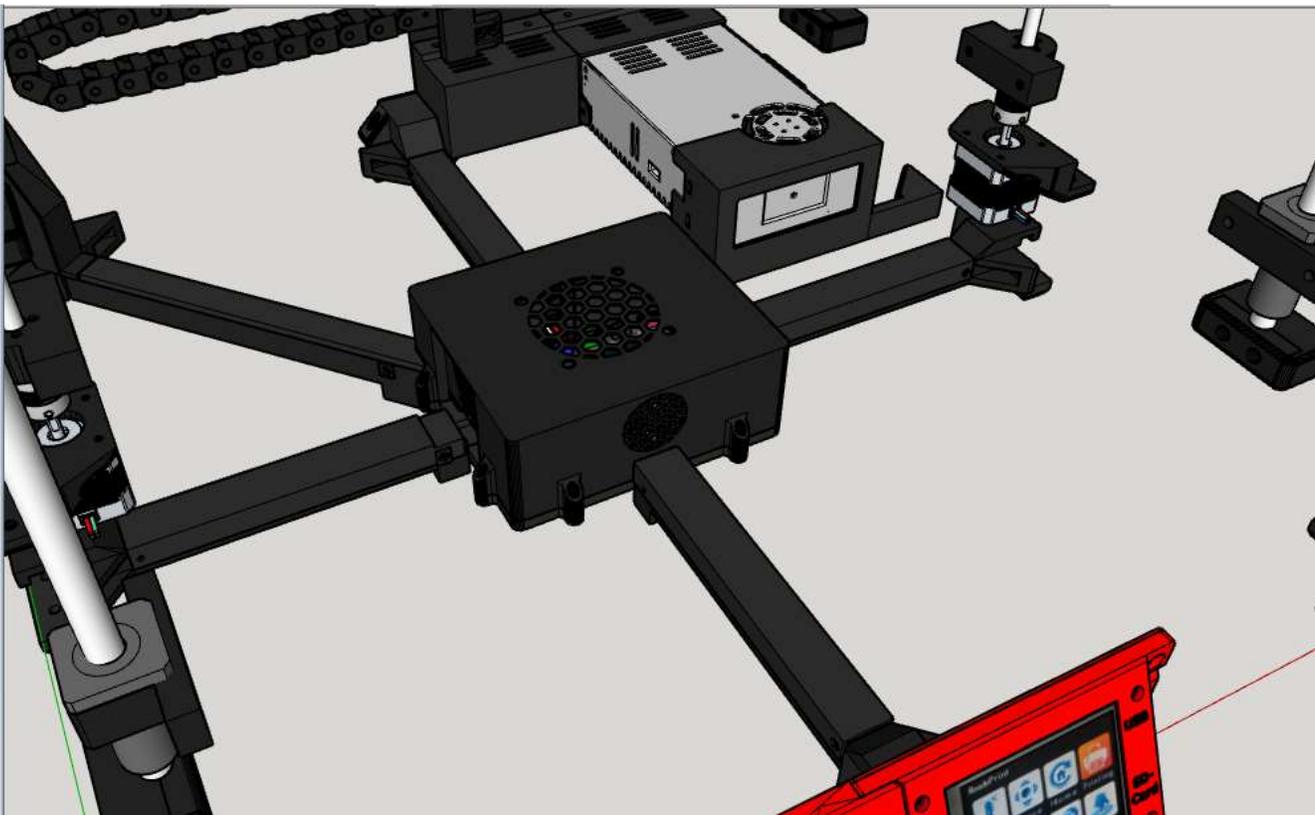


4. Install PTFE tube into E3D V6 and up through the XY Hot end Cable Cover.

5. Install XY Hot end Cable Cover with 2 M3 x 10mm socket head cap screws.



6. Once all wires are connected install all of the cable covers with M3 x 25mm socket head cap screws and M3 hex nuts.



7. Install power supply and SSR covers using 8 M5 x 10mm socket head cap screws and 8 M5 extrusion T nuts.

Step 9

Firmware Setup

1. Install drivers and firmware in accordance with MKS-SBASE Datasheet or visit the following website for more information. <https://github.com/makerbase-mks>
2. Put the following information in your Gcode script for the BLTouch.
G91
G1 Z007
G90
M280 S10.6
M280 S7.0
G28
M280 S3.0
G32
G1 X225 Y200 F6000
G30 Z1.55 (This line could change due to your bed to BLTouch distance.
M280 S7
3. Load Filament and print a test cube.

Links

<https://github.com/makerbase-mks>

Makerbase Github page

<https://www.instructables.com/>

How to information site

<https://plus.google.com/communities/109126963511513081214>

BLTouch information

<https://www.thingiverse.com/>

3D Models you can download

<https://www.myminifactory.com/>

3D Models you can download

<http://smoothieware.org/>

Firmware and Smoothieboard discussion

<https://e3d-online.com/>

E3D Hotend Information

<http://reprap.org/>

All things site for 3D printing

<http://3dprintingforbeginners.com/>

3D Newcomer's Forum

<https://www.3dprintingforum.org/>

3D Printing Forum

<https://www.sketchup.com/>

Design Software that's easy to use

And of Course

<https://openbuilds.com/>

Open Source site "Dream it, Build it, Share it"

