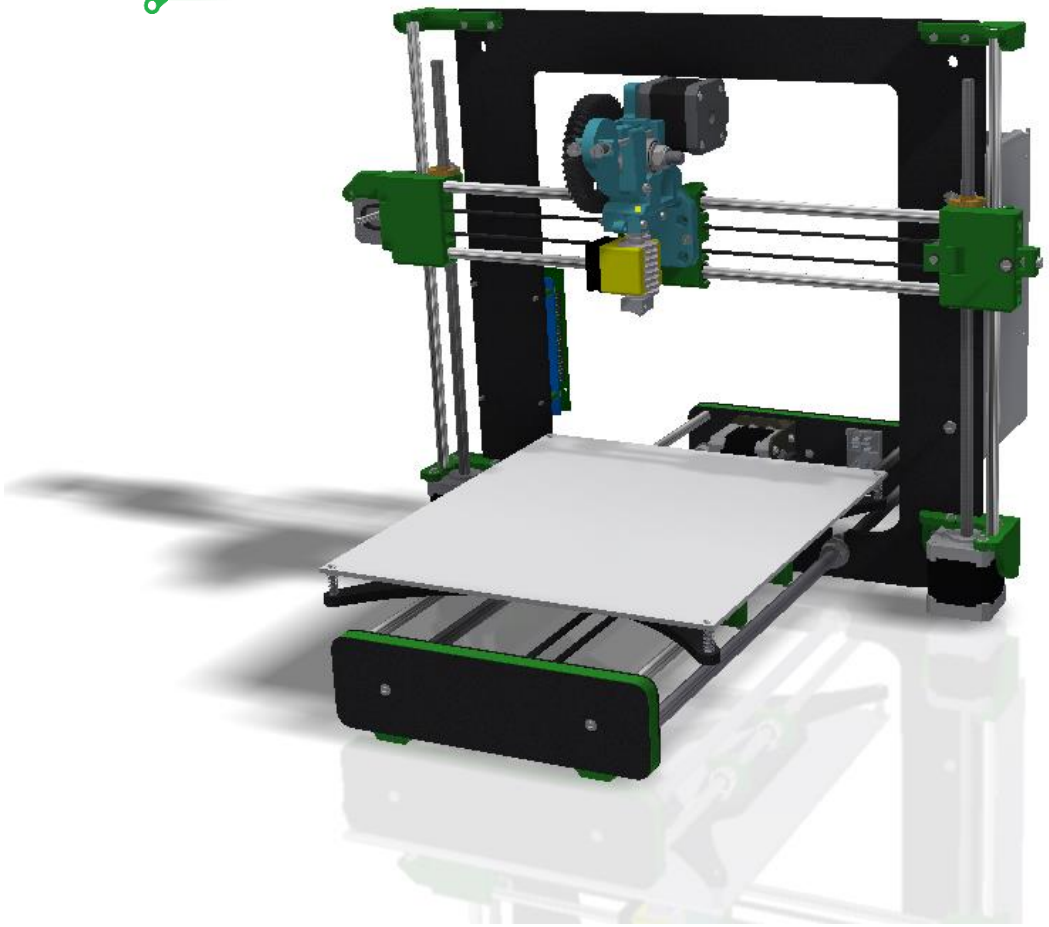
V4 Standard Kit

diyelectronics

Prusa i3 Build Guide



Hi! Congratulations on your purchase of the DIYElectronics.co.za Prusa I3 kit, the best South African 3D Printer Kit! Hopefully this should serve as complete guide to get your printer setup and printing!

This guide will start with a step by step mechanical assembly, and then onto electronic wiring and calibration.

Please take note of the following points before continuing with this this guide ☺ !!!

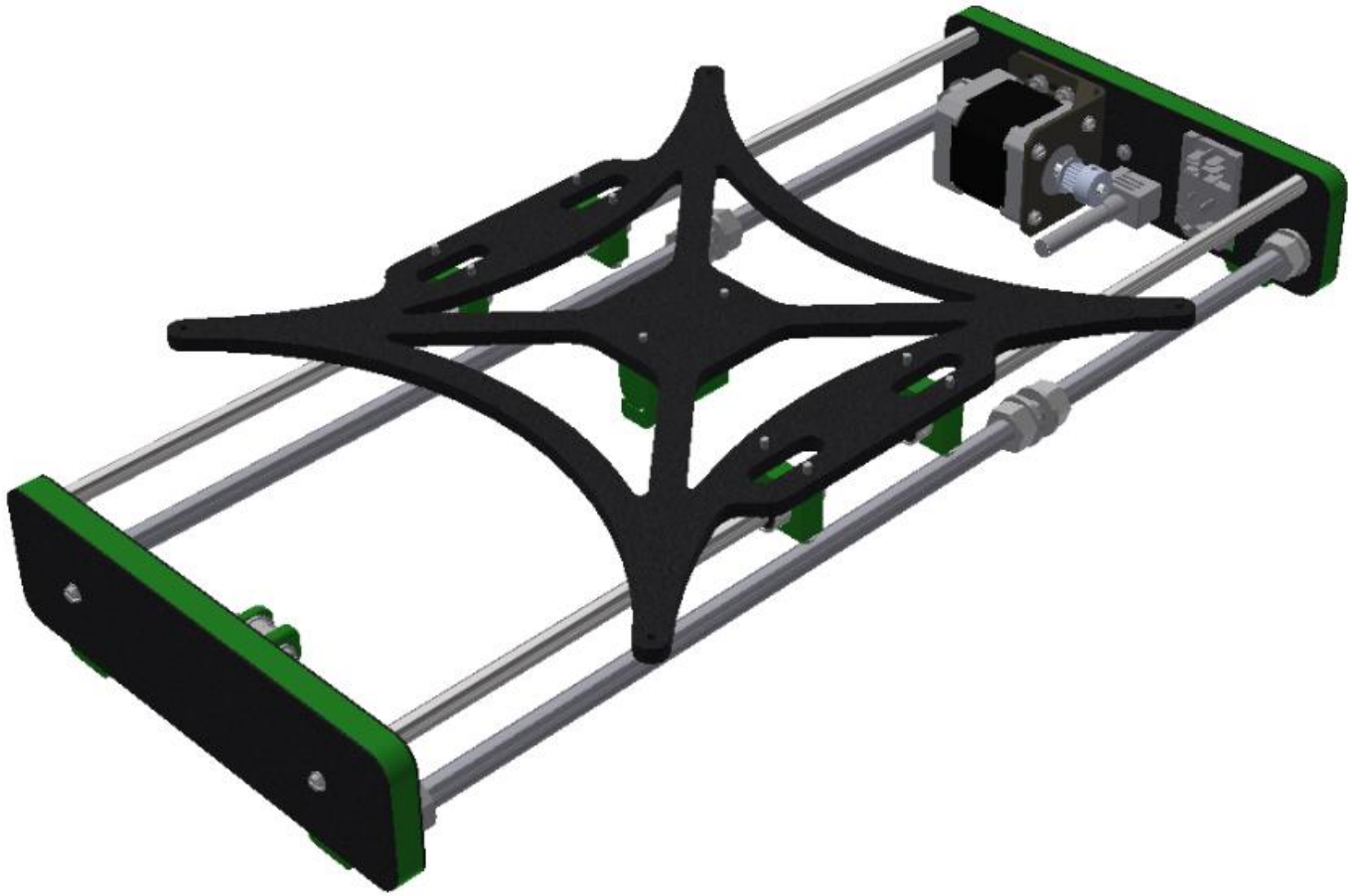
- This is a new and upgraded build guide so in the case of errors or mistakes please kindly let us know at **support@diyelectronics.co.za**. We want to constantly upgrade this for to make this build as easy and seamless as possible. Don't be shy. But make sure you read everything before you email ;)

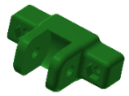
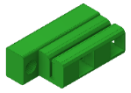
- Due to the nature of Rapid Prototype 3D printed parts, cleaning-up, drilling, filing, cutting of the plastic parts may be necessary. This is important. If you want your build to go smoothly you **MUST** read all of the *Notes and *Tips along the way. Most of the holes need to be drilled out for precision. You don't want to force anything and break your plastic components.

- Be patient and thorough. Take time to make sure you put things together properly. Believe us when we say it will save you LOTS of time if you do it right first.

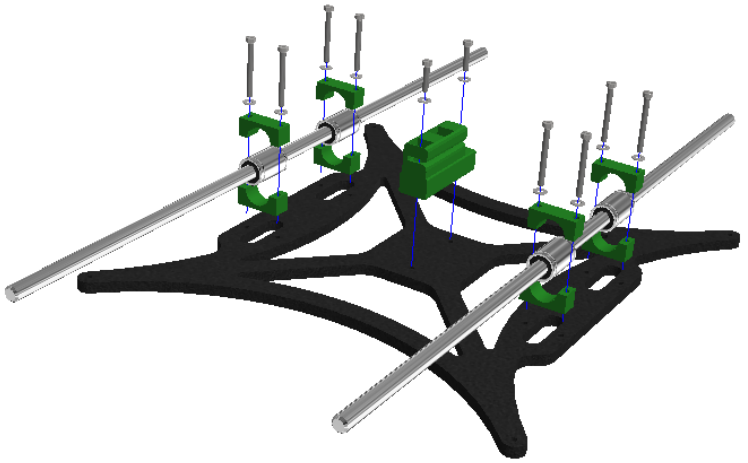
Contents

[1] Y-Axis



Front gasket	1		y-bed carriage	1		624f flanged bearing	2	
Rear gasket	1		y-axis motor mount	1		LM8UU linear bearing	4	
M10x380 threaded rod	2		Bearing holder	8		Nema 17 stepper motor	1	
M8x375 smooth linear rod	2		y-belt tensioner	1		M10 Nut	12	
front outer plate	1		y-belt holder	1		M10 Washer	8	
Front inner plate	1		IEC mains and switch	1		M3 machine screws, washers, nuts		
Back inner plate	1		USB extender	1		M4 machine screws, washers, nuts		
Back outer plate	1		GT2 20tooth pulley	1				

[1.1] Y Carriage – Sub Assembly:



Parts needed:

- 1x aluminum carriage
- 2x M8x375 mm smooth stainless steel rod
- 4x LM8UU linear bearings
- 8x printed bearing holders
- 1x printed y-belt holder
- 2x M3x10 mm ch screws
- 8x M3x25 mm ch screws
- 10x M3 washers

Drill out all the holes of the printed parts with a 3mm drill bit.

Slide two LM8UU linear bearings onto each smooth 375 mm rod.

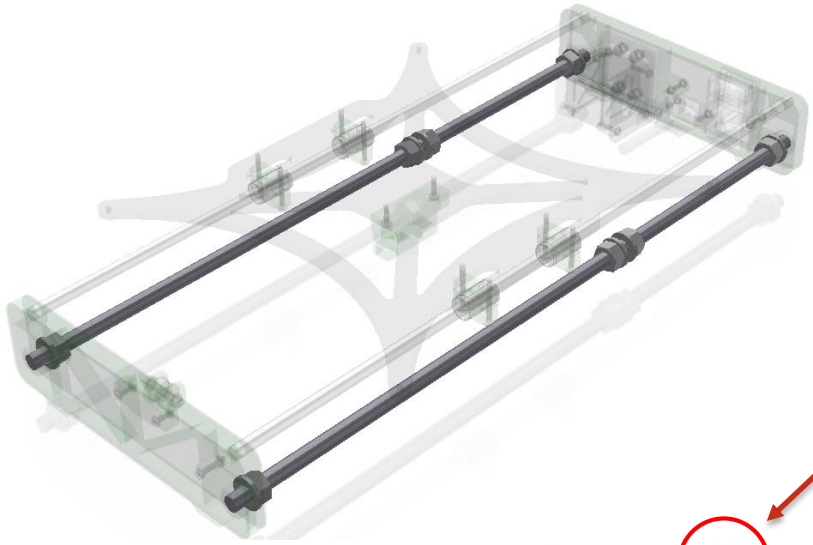
Fix the printed Y-belt to the carriage with the use of two M3x10 machine screws

Line the bearings, rods, and printed bearing holders with the holes in the Y-carriage as shown in the top diagram.

Fasten it all down with eight M3x25 screws (don't forget the washers)

NOTE* Make sure the linear rods slide smoothly within the bearings. Overtightening the bearing holders will restrict movement.

[1.2] Y-Bed Undercarriage Sub-assembly



Parts needed:

- 2x M10x380 threaded rod
- 8x M10 nuts
- 8x M10 washers

Thread M10 nuts and washers onto the two M10 threaded rods as seen in the image above.

Make sure that the distance between the outer washer on one side and the nearest inner washer is **85 mm**. This is important.

[1.3] Y-Axis assembly

Parts needed:

- Y Carriage Sub-Assembly
- Y Bed Undercarriage sub-assembly
- Inner front plate
- Inner back plate
- Front printed gasket
- Back printed gasket
- 4x M10 nuts

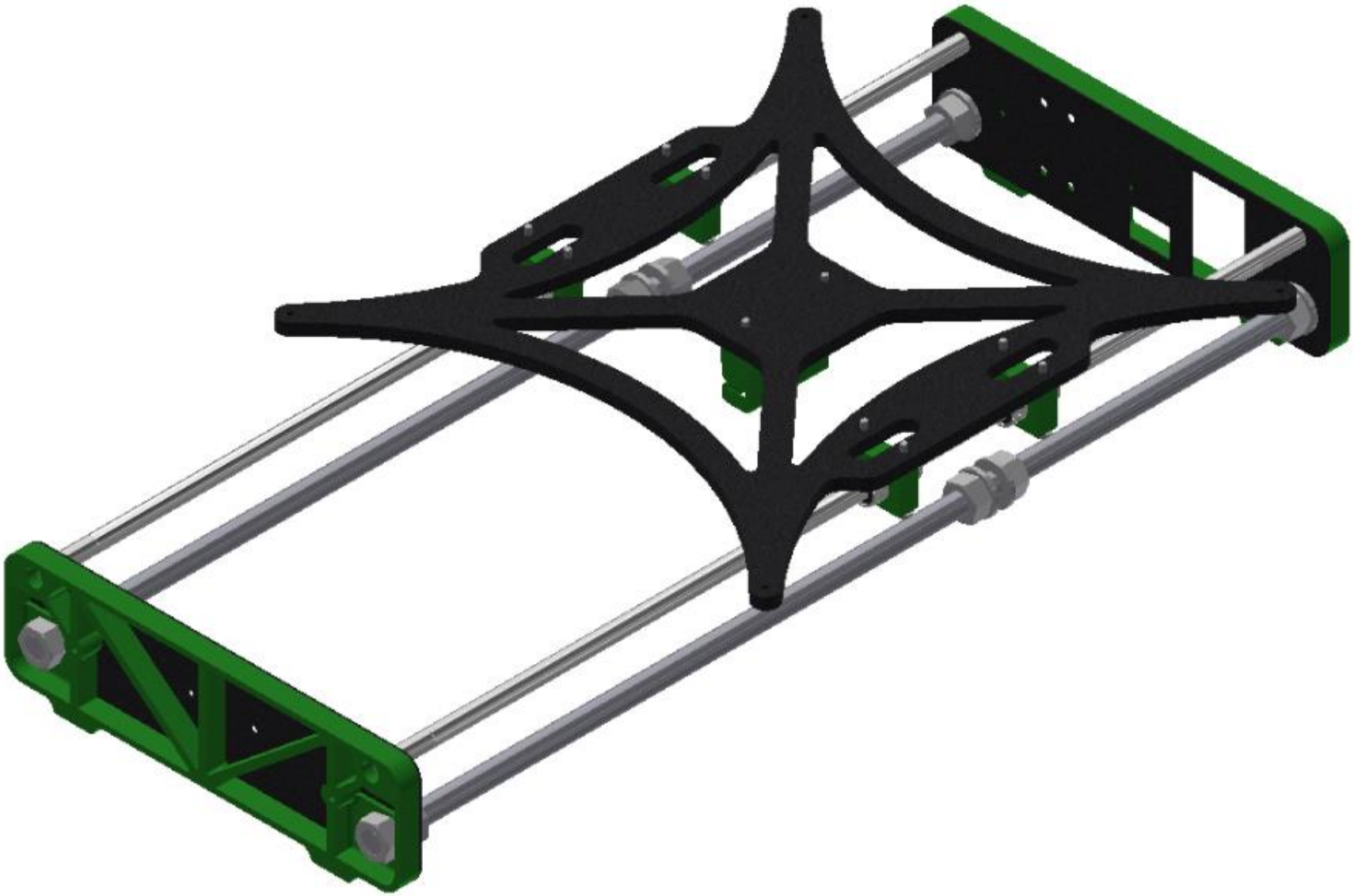
Drill out the holes of the printed gaskets. You will need a size 3, 8 and 10 size drill bit

Assemble the Y-Axis by sliding the plates and gaskets onto the ends of the smooth and threaded rods. The M8 smooth rods should fit snugly into the printed gasket holes.

There should be exactly enough threaded rod protruding from the printed gaskets to fit M10 nuts onto.

Tighten these four M10 nuts with a size 17 spanner.

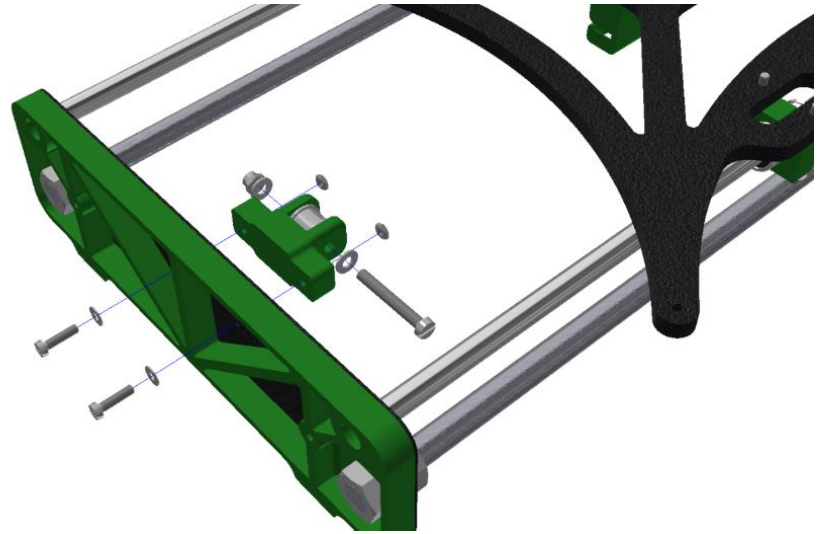
NOTE: Make sure that you tighten the 4 M10 nuts on a flat surface to ensure a flat Y-Axis assembly.



[1.4] Y-Belt Idler pulley sub-assembly

Parts needed:

- 1x printed Y-belt idler
- 2x 624 flanged bearings
- 1x M4x25 machine screw
- 2x M4 washers
- 1x M4 nyloc nut
- 2x M3x20 machine screws
- 2x M3 washers
- 2x M3 nuts



First fasten the printed Y-Belt idler bracket to the front inner end plate. Use M3x20 machine screws and fasten into M3 nuts which are to be held captive in the printed bracket.

Feed an M4x25 screw though the bracket and TWO 624 flanged bearings butted up against each other. Don't forget about the washers on either side.

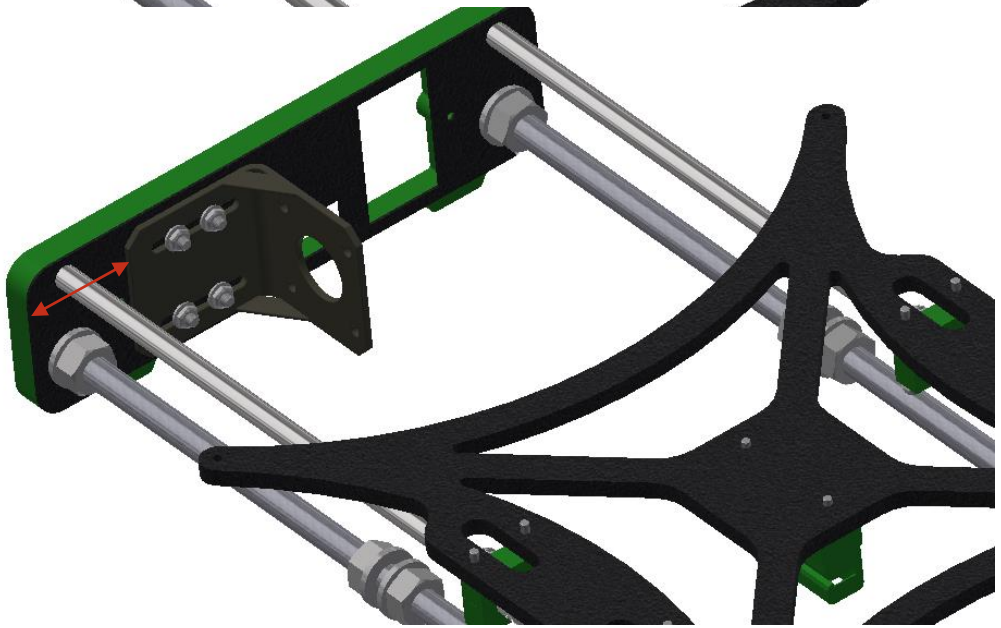
Tighten with an M4 nyloc nut. You want the bearings to rotate smoothly so don't overtighten.

[1.5] Y-motor mount Sub-assembly

Parts needed:

- 1x motor mount
- 4x M4x10 machine screws
- 8x M4 washers
- 4x M4 nuts

Fix the Y-motor mount to the rear inner end plate using 4x M4x10 screws, washers, and nuts as shown in the image. Make sure that the mount is straight and parallel to the top of the end plate.

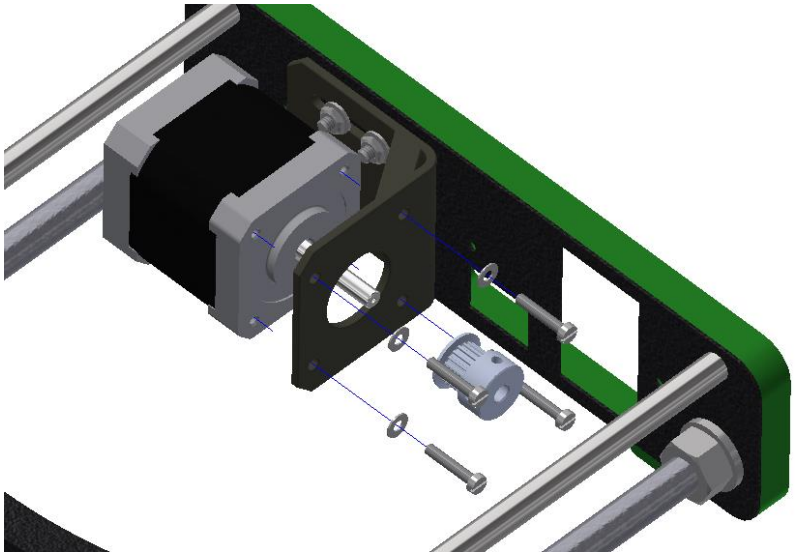


NOTE* The distance from the edge of the motor mount to the edge of the end plate needs to be about **40 mm**

[1.6] Y Motor sub-assembly

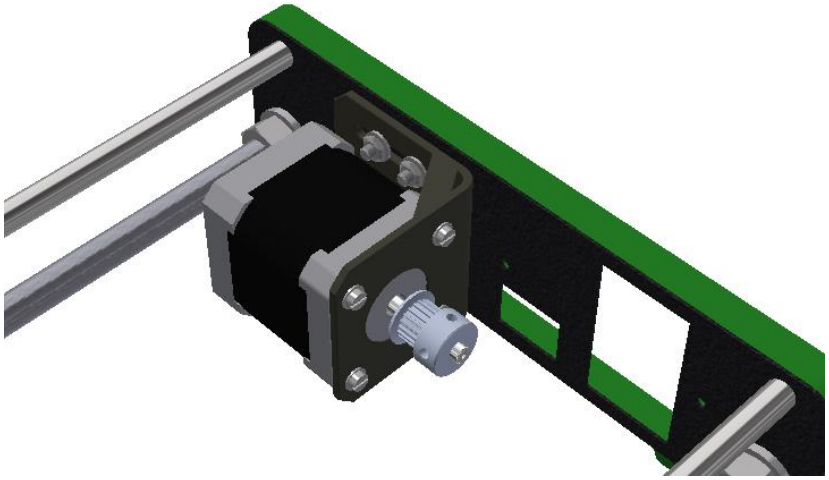
Parts needed:

- 1x Nema 17 stepper motor
- 1x GT2 20t pulley (with 2 M3 grub screws)
- 4x M3x8 machine screws
- 4x M3 washers



Fix the Y axis Nema 17 stepper motor to the motor mount using four M3x10 machine screws with washers as seen in the picture above. Tighten well, but not enough to strip the thread of the stepper motor.

Then slide the GT 2 pulley onto the stepper motor shaft. Position the pulley so that the center of the teeth line up with the center of the idler bearing on the other side of the axis (see the next section)



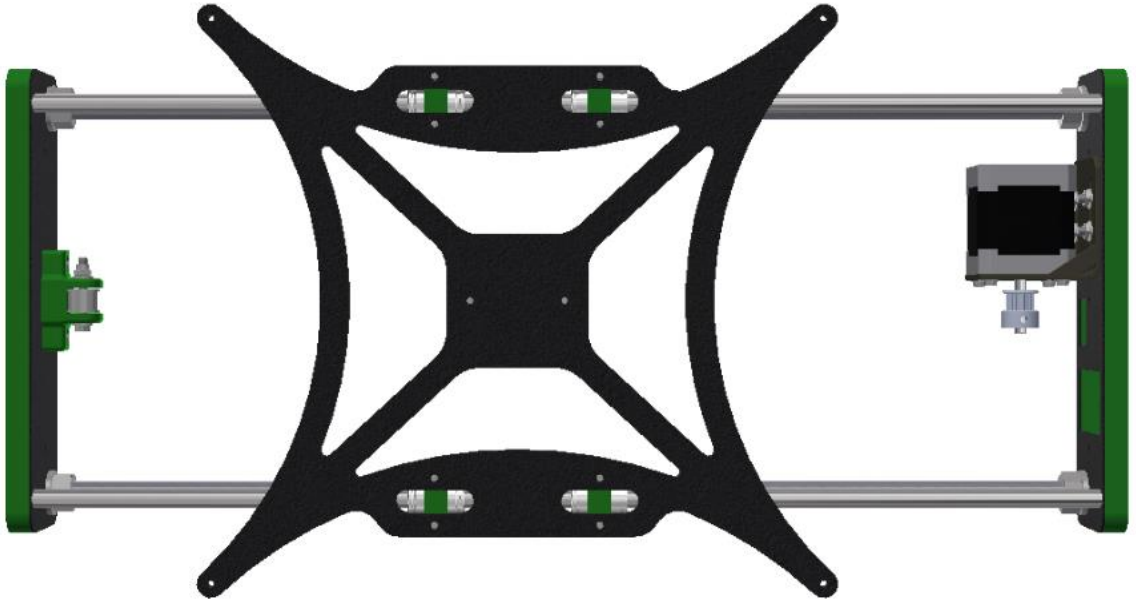
[1.7] Y-Axis timing belt

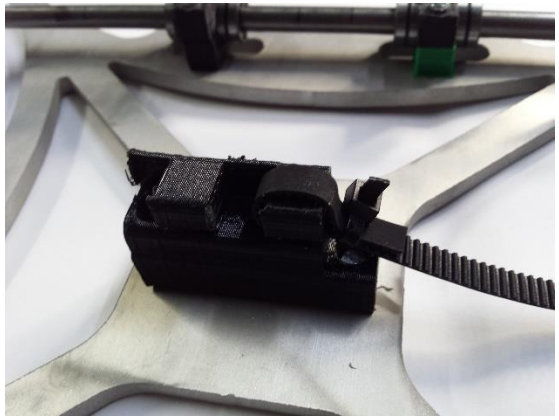
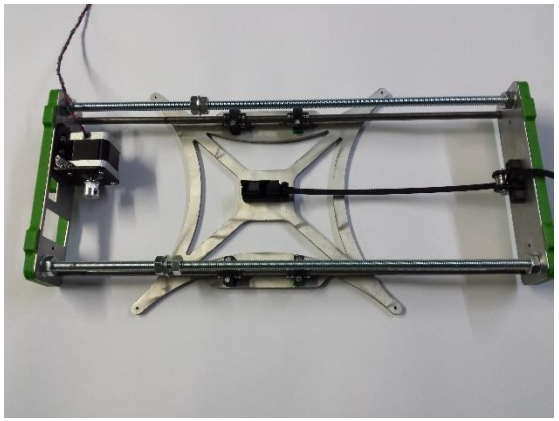
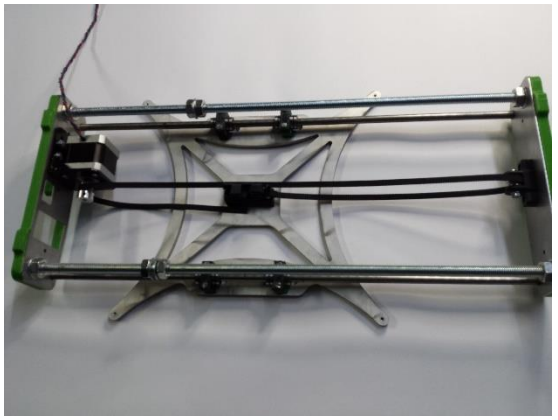
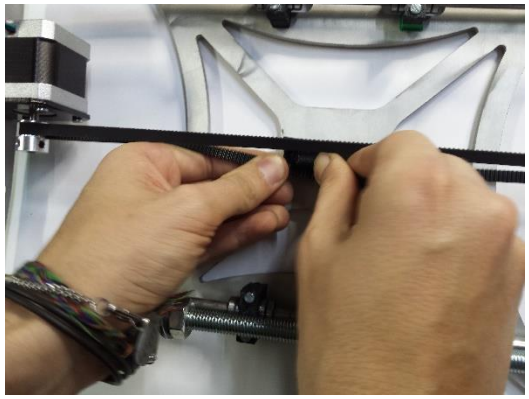
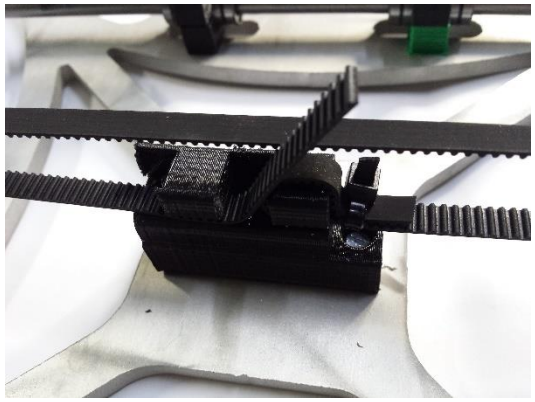
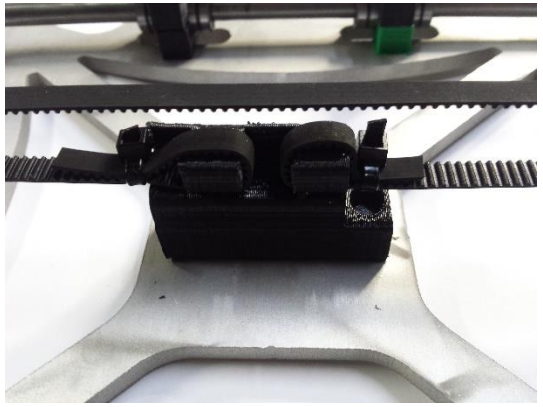
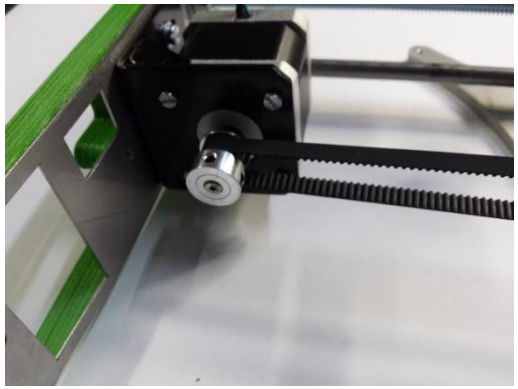
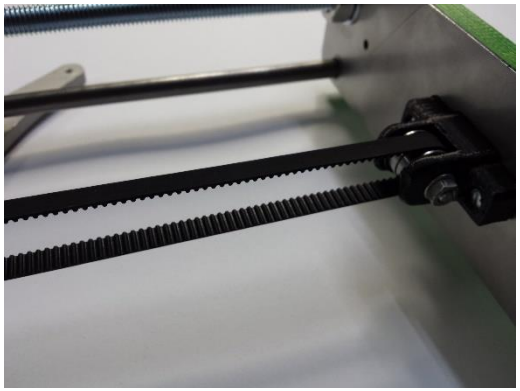
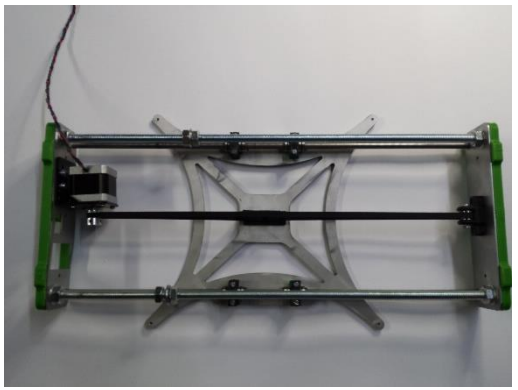
Parts needed:

- 1x timing belt
- 1x spring tensioner
- 4x cable ties

Make sure that the center of the GT2 pulley, center of the Y-Belt holder, and the center of the Y-belt idler bearing are all in line with each other. If they are not, you will need to loosen the pulley grub screws and position the pulley (possibly flip it around). If this still doesn't work you will need to loosen the Y-motor mount M4 screws and reposition the mount.

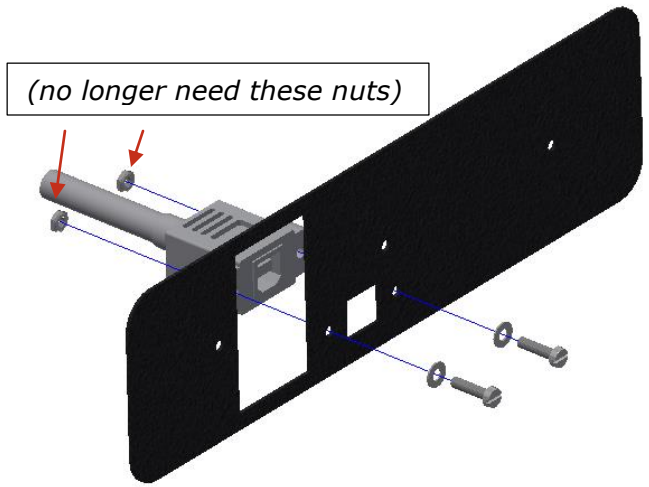
Next you have to flip the entire Y-axis around and attach the timing belt.



[1.8] Outer end plates

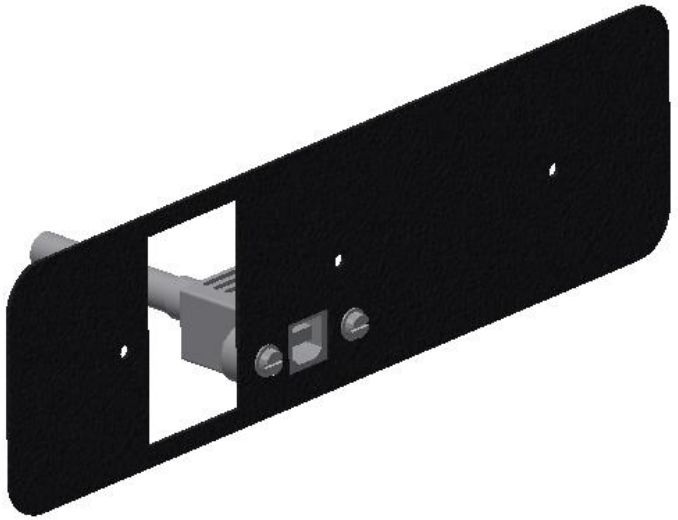
NOTE The cutout for the IEC connecter is no longer present on the rear outer plate. The IEC connecter now is included in the PSU kit



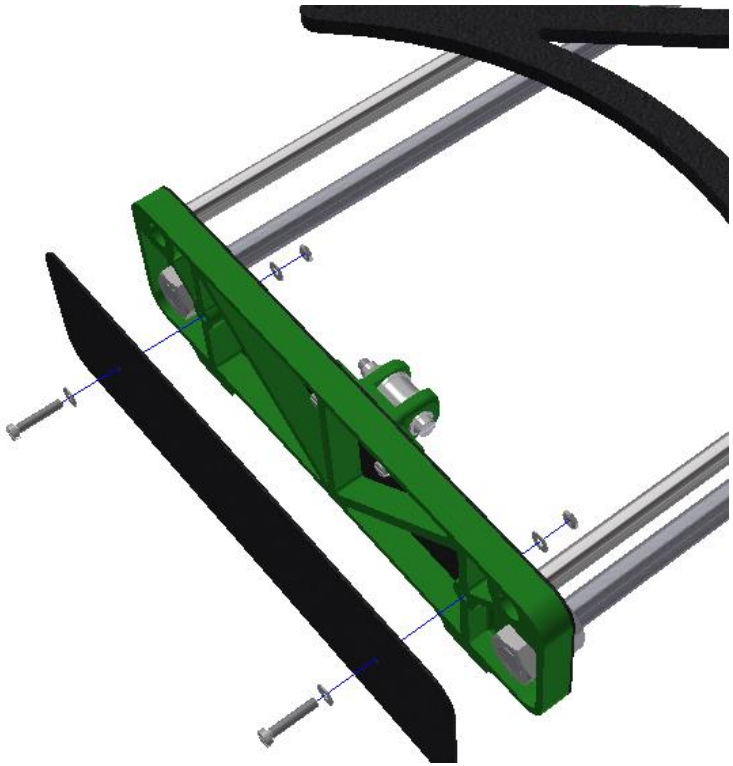
Parts needed:

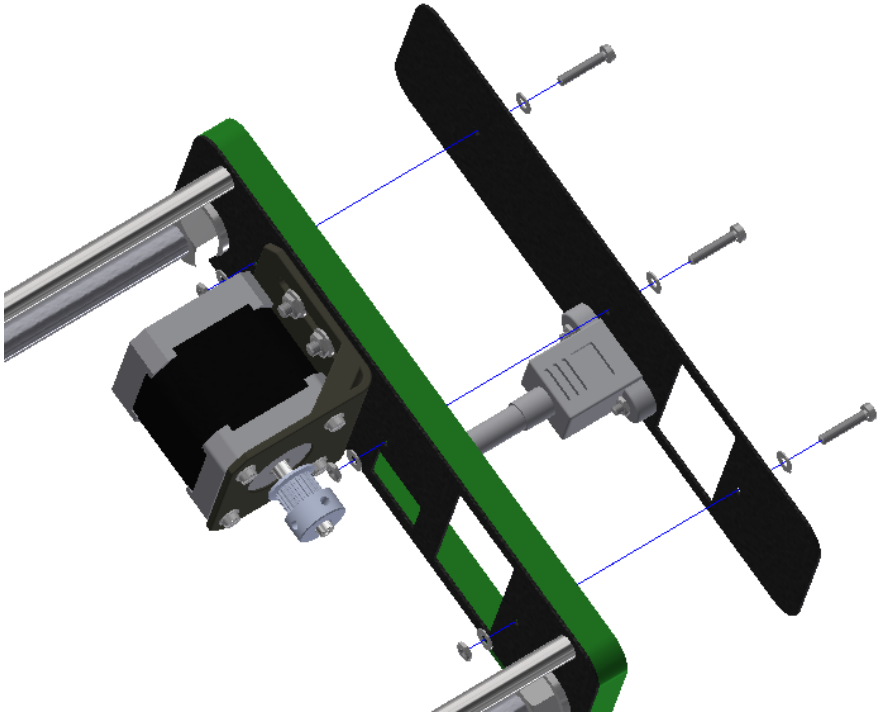
- 1x rear outer end plate
- 1x USB male to USB female adapter
- 2x M3x10 machine screws
- 2x M3 washers
- 5x M3x20 machine screws
- 10x M3 washers
- 5x M3 nuts

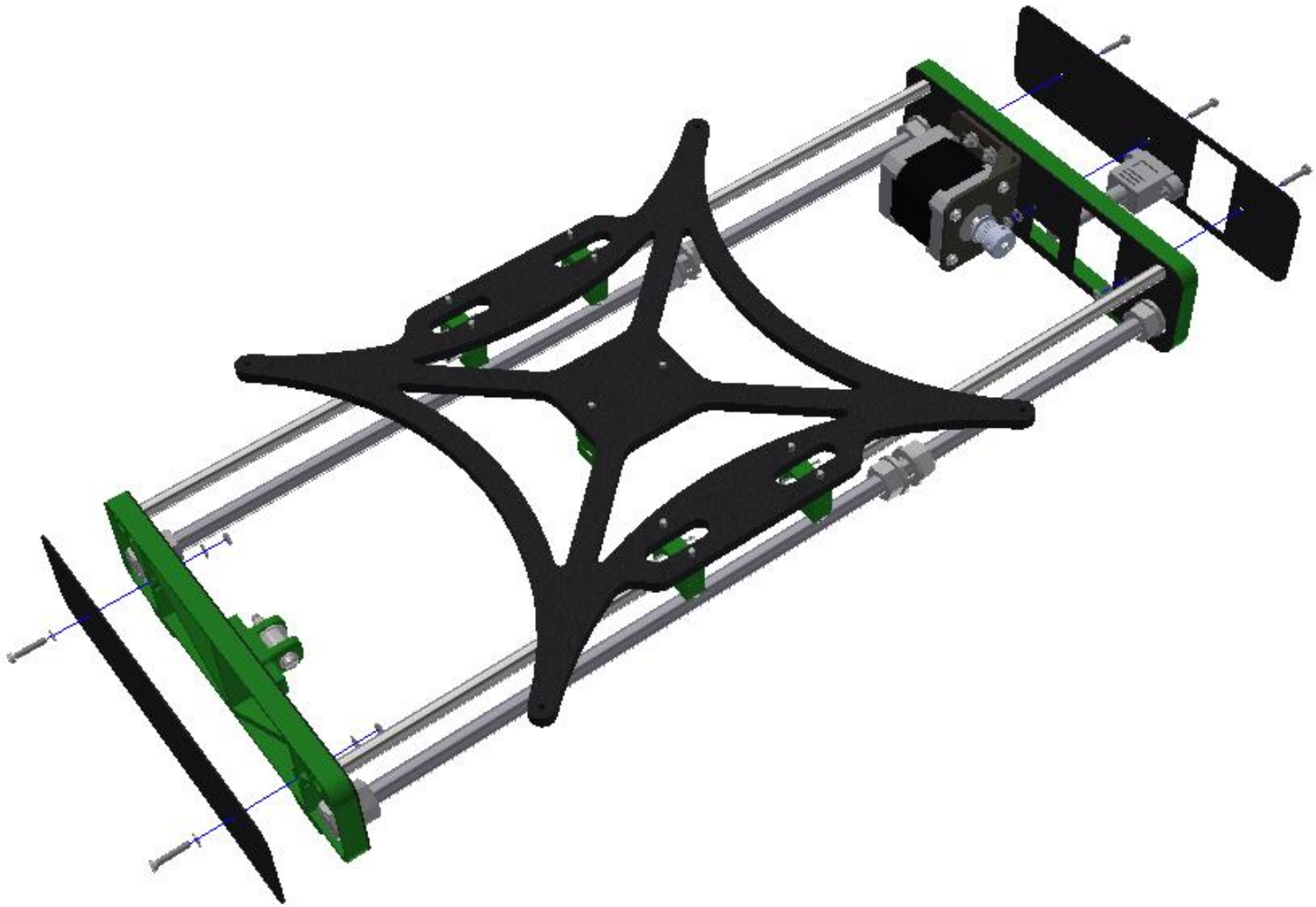
Fix the female end of the USB adapter to the rear outer end plate as seen in the images.



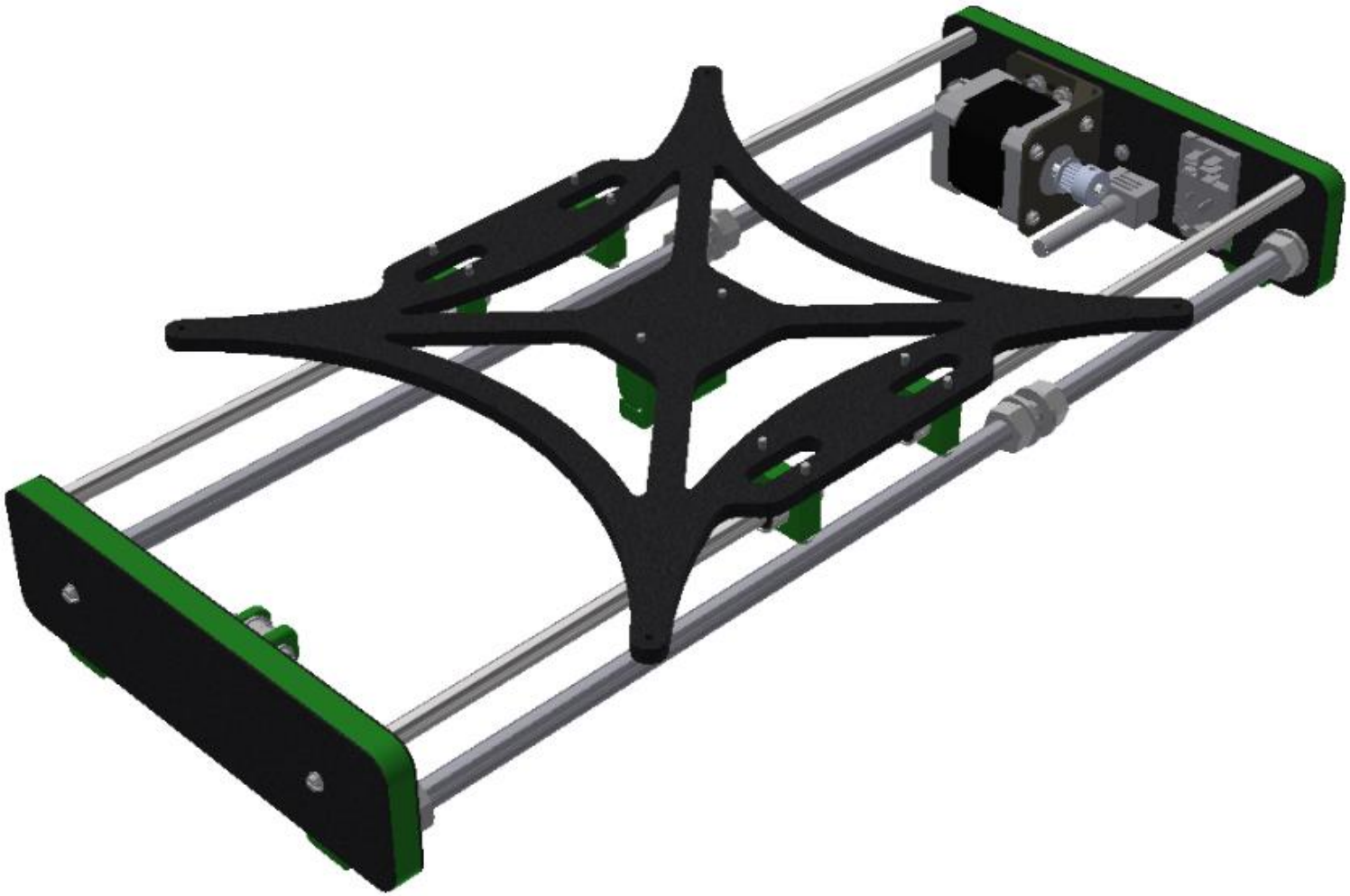
Next up is fixing the outer end plates to the front and rear gaskets. Do this by inserting three M3x20 screws with washers through the read outer end plate – through the gasket and rear inner end plate. Place washers on the protruding ends of the screws and tighten with M3 nuts.



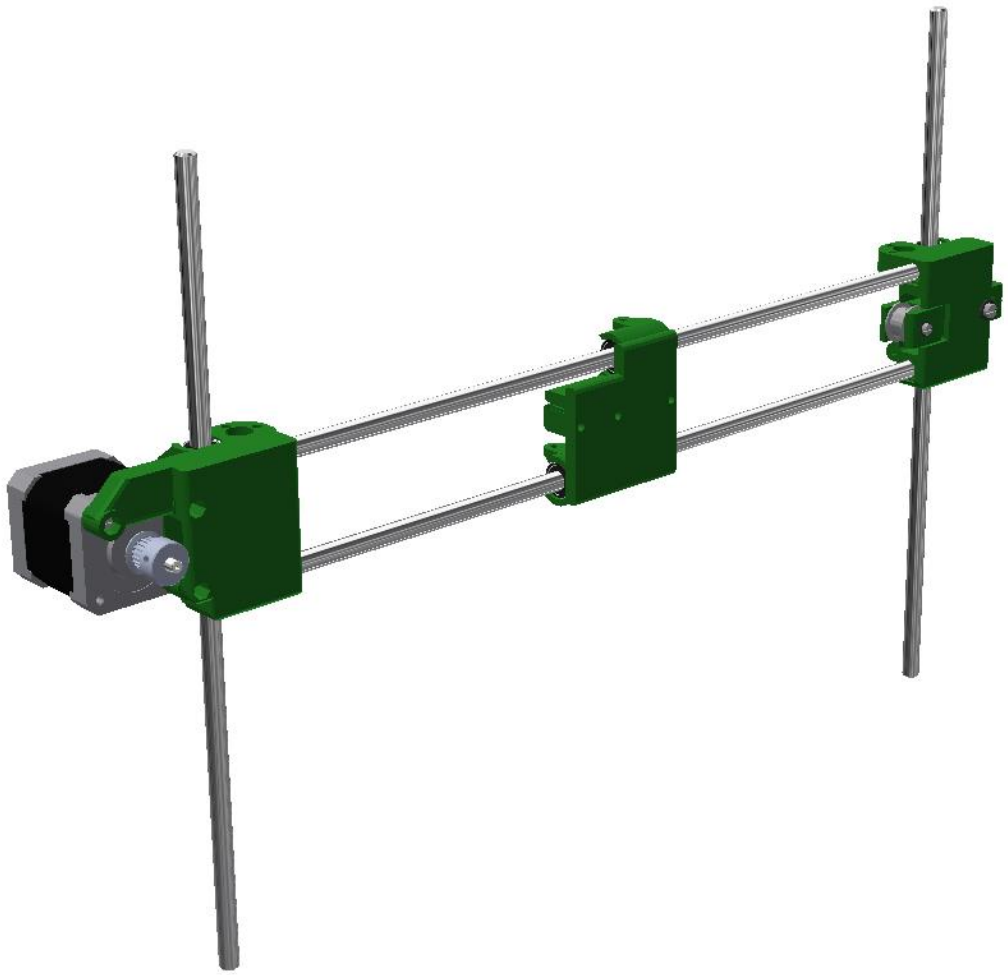




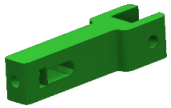
Well done! Your printer’s Y-Axis assembly is now complete :D



[2] X-Axis

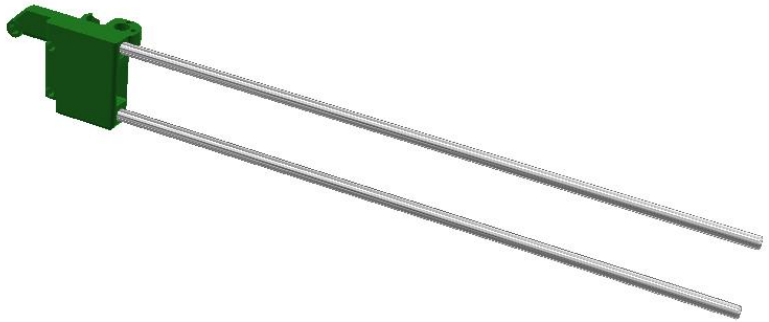


Parts needed:

370mm smooth linear rods (x-axis)	2x		LM8UU linear bearings	7x	
320mm smooth linear rods (z-axis)	2x		Nema 17 stepper motor	1x	
Printed x-end	1x		GT2 pulley (with grub screws)	1x	
Printed x-end motor	1x		M3x10mm machine screw	3x	
Printed x-axis carriage	1x		M4x25 machine screw	1x	
Y-axis tensioner	1x		M4x20 machine screw	2x	
F624 idler bearing	2x		M4 washer	3x	
M4 nyloc nut	1x		M4 nut	2x	

STEP 1

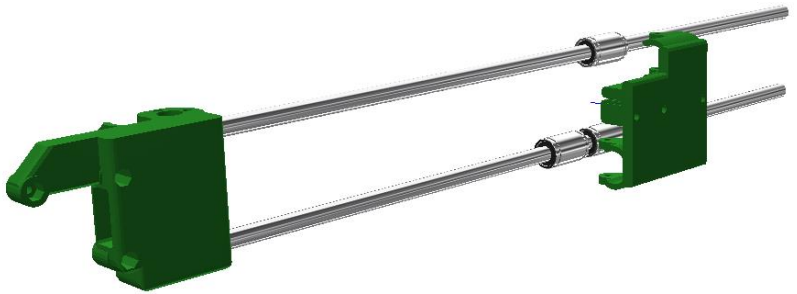
- Insert two M8x370 linear rods into the printed x-end motor bracket



Note: will probably need to drill out the holes on both x-end parts with an 8 mm drill bit.

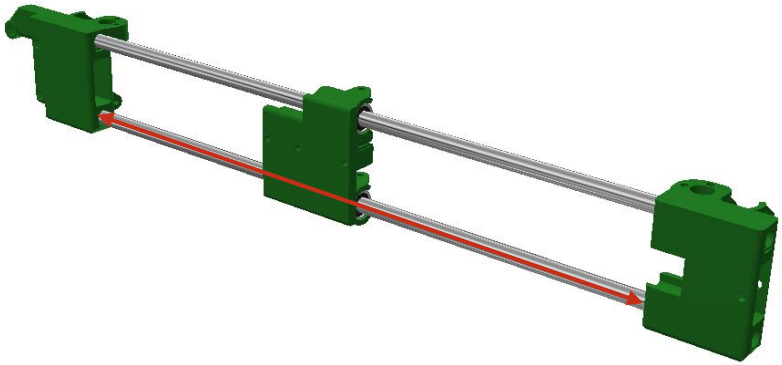
STEP 2

- Slide on two LM8UU linear bearings onto the bottom rod and one on the top
- Snap the printed x-axis carriage onto the bearings.
- Make sure that the bearings line up perfectly with their mounting cavities!



STEP 3

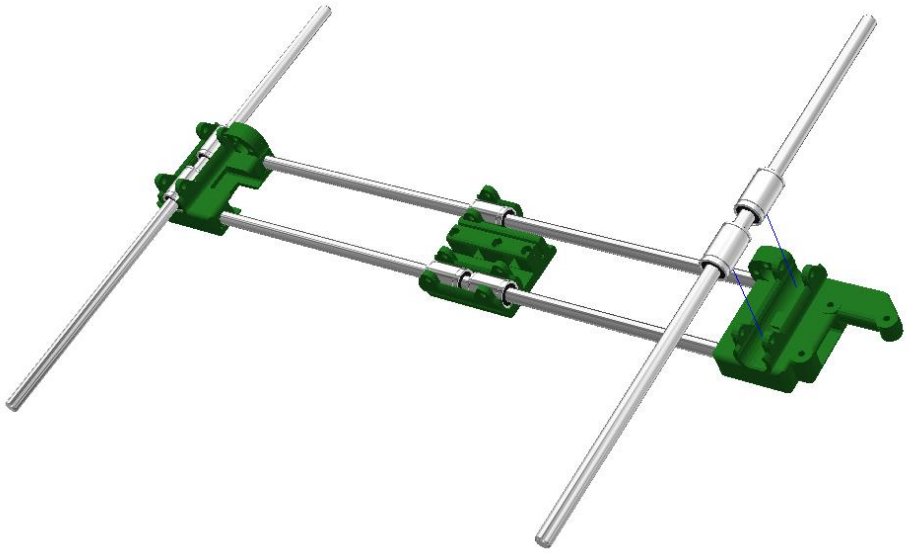
- Press fit the other printed x-end part onto the two linear rods.
- The distance between the two inner faces of the x-end parts (or the length of exposed linear rod) needs to be **307 mm**.



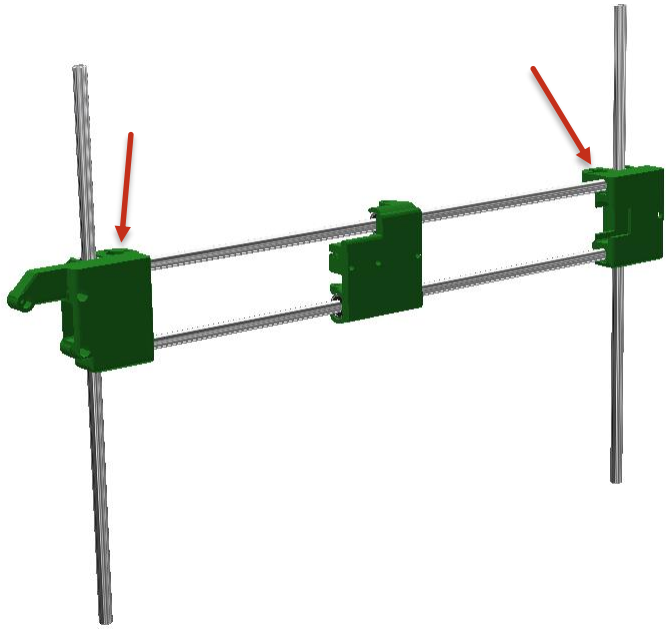
STEP 4

- Slide two LM8UU linear bearings onto each M8x320mm z-axis linear rods

- Press fit the bearings (with rods inserted) into their cavity slots. Once again, it is VERY important that the bearings seat perfectly into their slots.



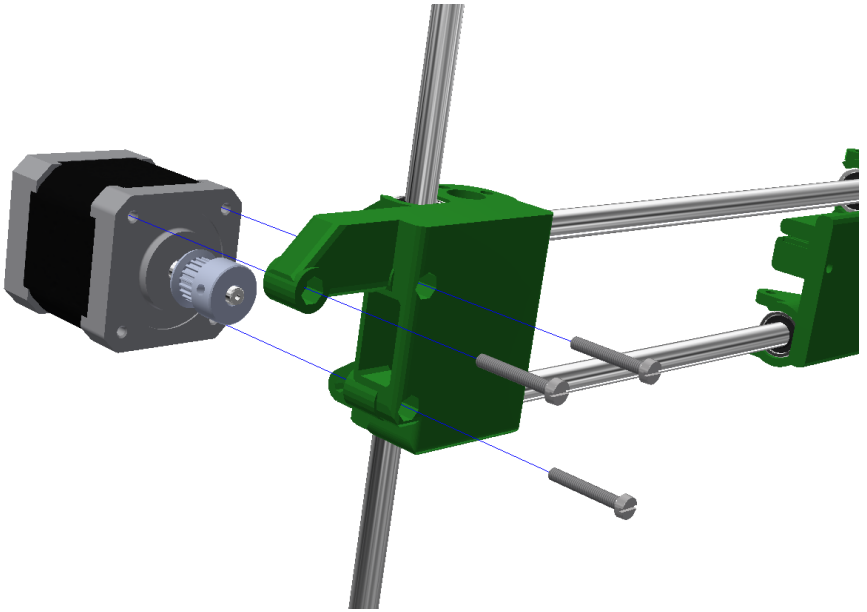
- Check that the x-axis runs smoothly up and down the bearings. If there is excess friction this would indicate improper seating or alignment of the bearings



STEP 5

- Slide the 20tooth GT2 pulley onto the shaft of the Nema 17.

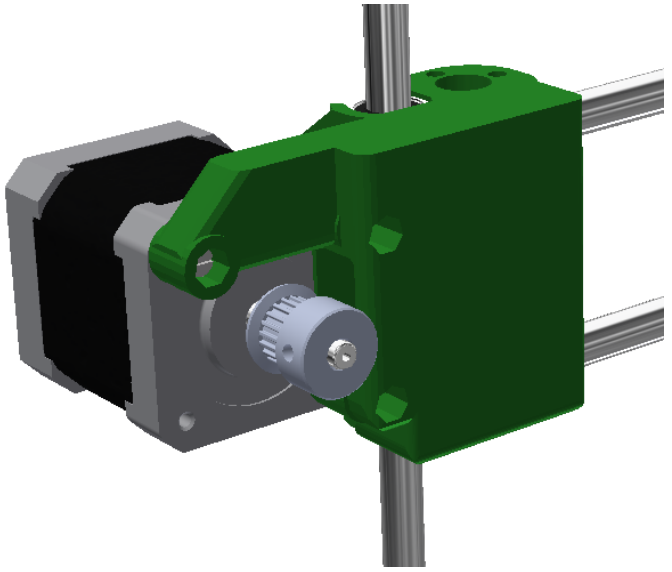
- Tighten the two grubscrews with a suitable allen key – thereby fixing the pulley to the motor shaft



STEP 6

- Fix the Nema 17 stepper motor to the printed x-end bracket using three M3x10 machine screws

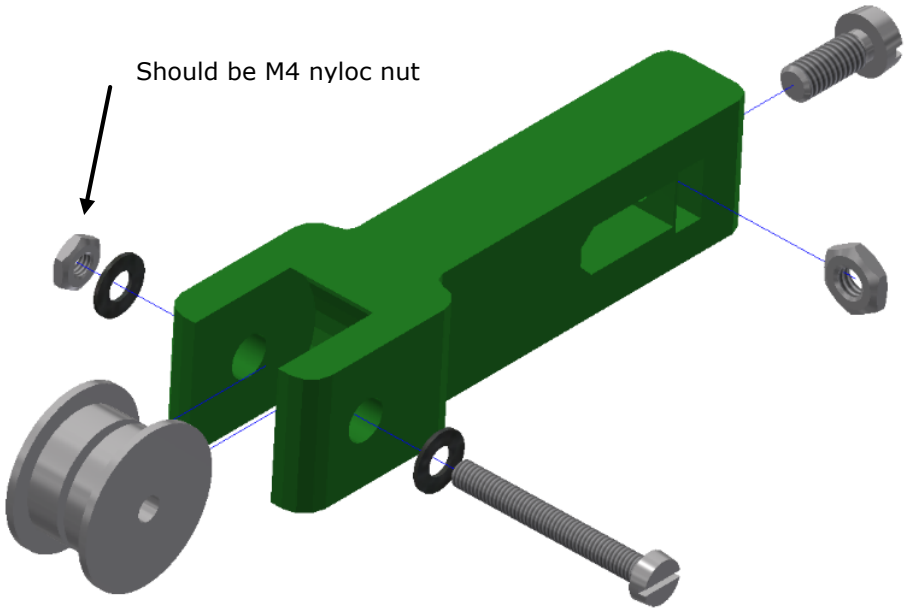
- Make sure that the center of the pulley's teeth are aligned with the centre of the slot of the printed x-end



[2.1] X-Axis Tensioner Sub-Assembly

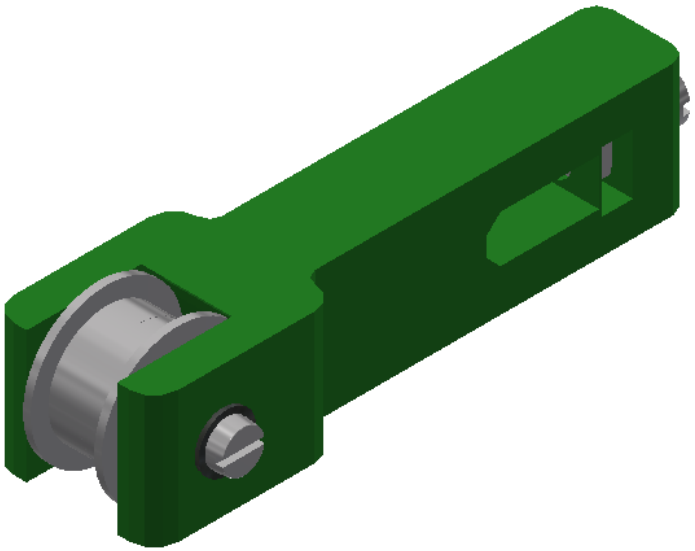
STEP 7

- Fix the two 624f bearings to the printed x-axis tensioner with an M4x25 machine screw, two M4 washers, and an M4 nyloc nut.



STEP 8

- Slide an M4 nut into the rear captive slot
- Screw an M4x20 machine screw into the nut

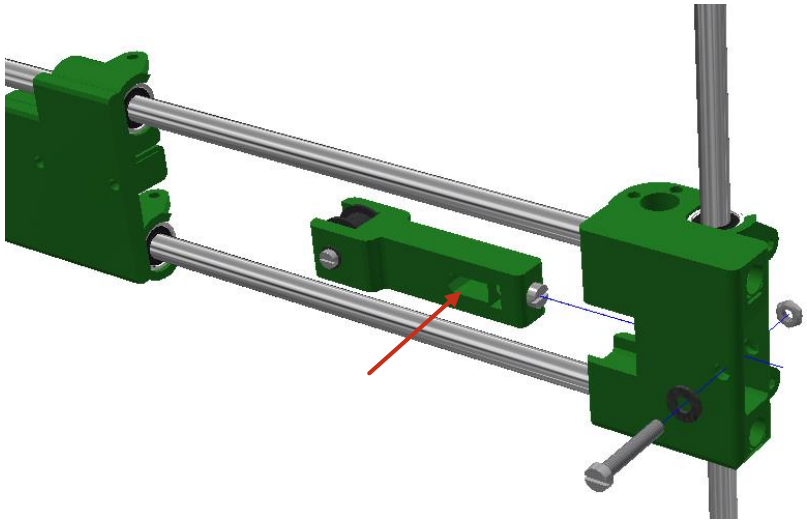


NOTE: Do not overtighten the screw which houses the two bearings. The bearings should be able to rotate freely on the screw's axis

STEP 9

- Slide the x-axis tensioner sub-assembly though the printed right side x-end

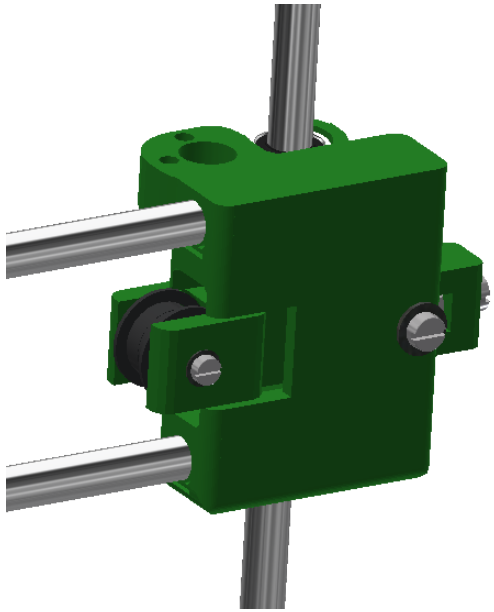
NOTE** This can sometimes be a tight fit. You don't want to break the x-end so sanding or filing of the sides of the tensioner may be required.



STEP 10

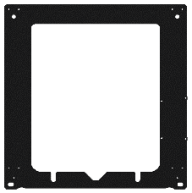
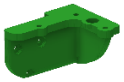
- Once the tensioner is in, insert an M4x20 machine screw with washer and nut through the tensioner's slot (indicated by the red arrow). This screw acts as a backstop which the M4 screw in the rear of the tensioner sits against.

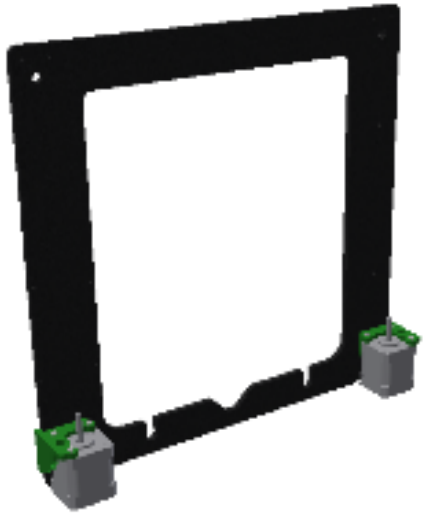
TIP: Make sure to leave the rear tensioning screw as unscrewed as possible (the image is incorrect and shows it fully screwed in and tensioned). You only want to tension it once you have installed the timing belt.



[3] Z–Axis

Parts needed:

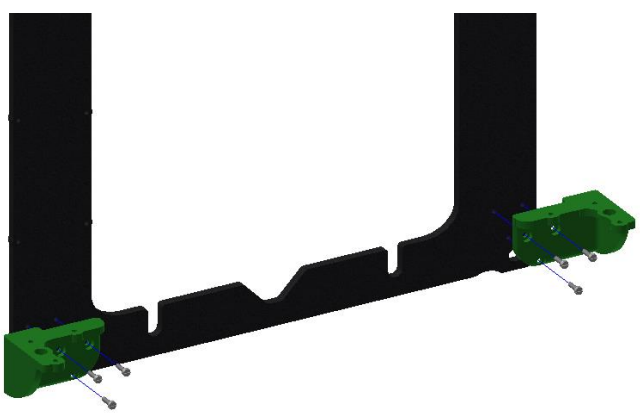
Aluminium 6mm frame	1x	
Nema 17 stepper motor	2x	
Printed z-axis bottom left corner	1x	
Printed z-axis bottom right corner	1x	
M3x10 machine screw	12x	
M3 washer	6x	

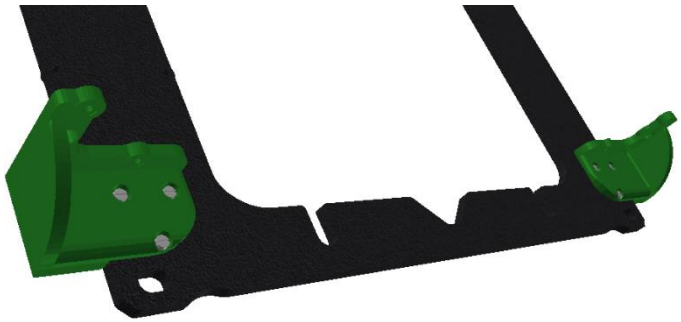


STEP 1

- Fix the printed z-axis bottom left and right corners to the laser cut aluminium frame. Using 6 M3x10 machine screws

NOTE: You need to make sure that the machine screws are screwed tight, but do not over tighten and strip the thread of the laser cut frame

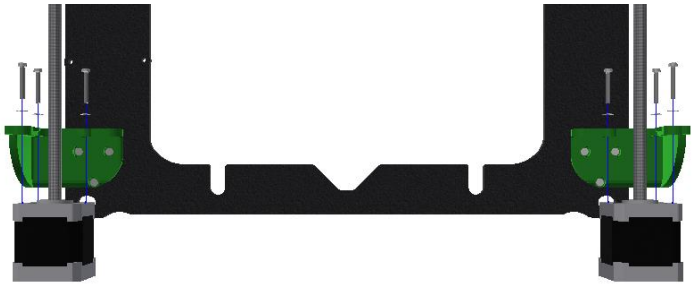


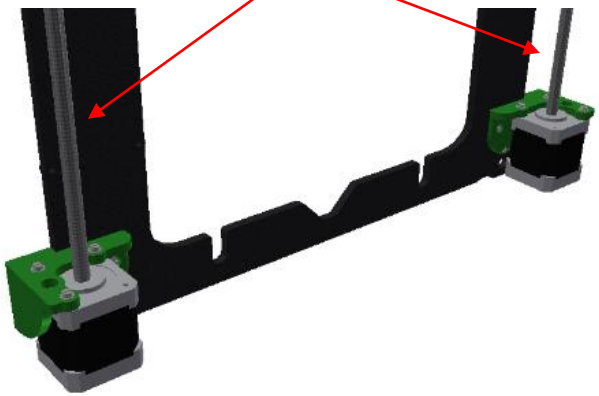


Ignore these rods. You have standard stepper motors and will attached threaded rod in the next section

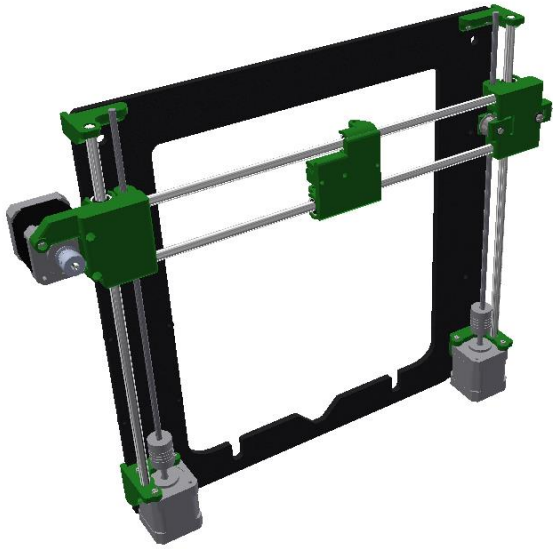
STEP 2

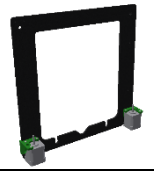
- Fix the Nema 17 stepper motors to the z-axis motor mount corners with M3x10 machine screws and washers





[4] XZ-axis Mate

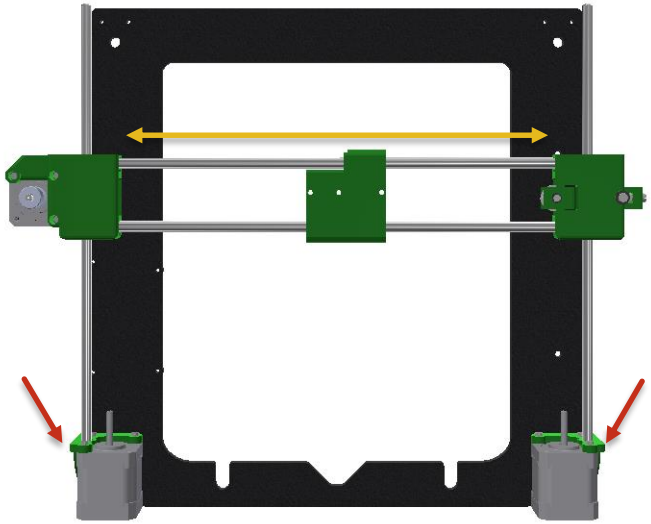


Z-axis subassembly (standard Z motors without leadscrews)	1x	
X-axis subassembly (standard x-ends)	1x	
Printed z-axis top left corner	1x	
Printed z-axis top right corner	1x	
M5 nut	2x	
M3x10 machine screw	4x	
Aluminium Couplers	2x	
M5 x 300mm threaded rod	2x	

STEP 1

- Get your X-axis assembly ready and press fit the two M8x320 smooth rods into the bottom two printed Z-corners (red arrows)

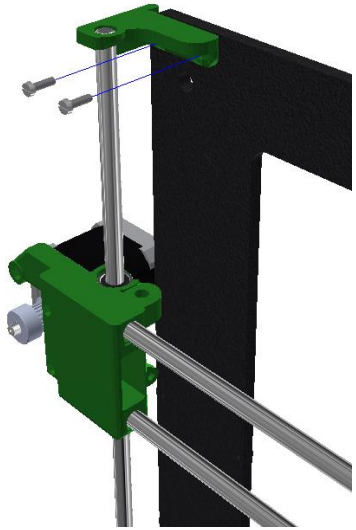
- You need to make sure that the distance between the x-ends 85 mm (orange arrow). And that the M8 smooth rods are parallel to the frame's edge.

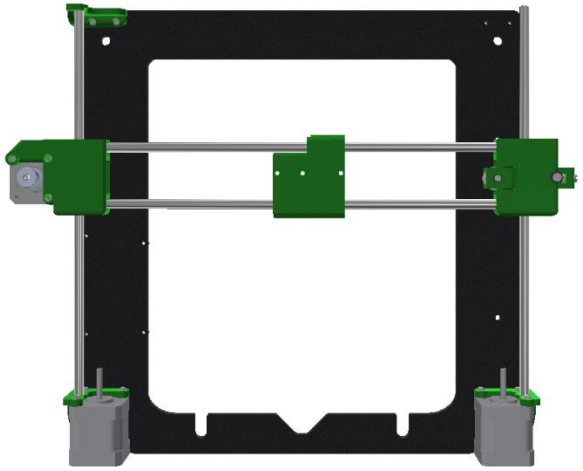


STEP 2

- Drill out the top left and right z-axis corners. Press fit the left top z corner on top of the left 320mm smooth rod.

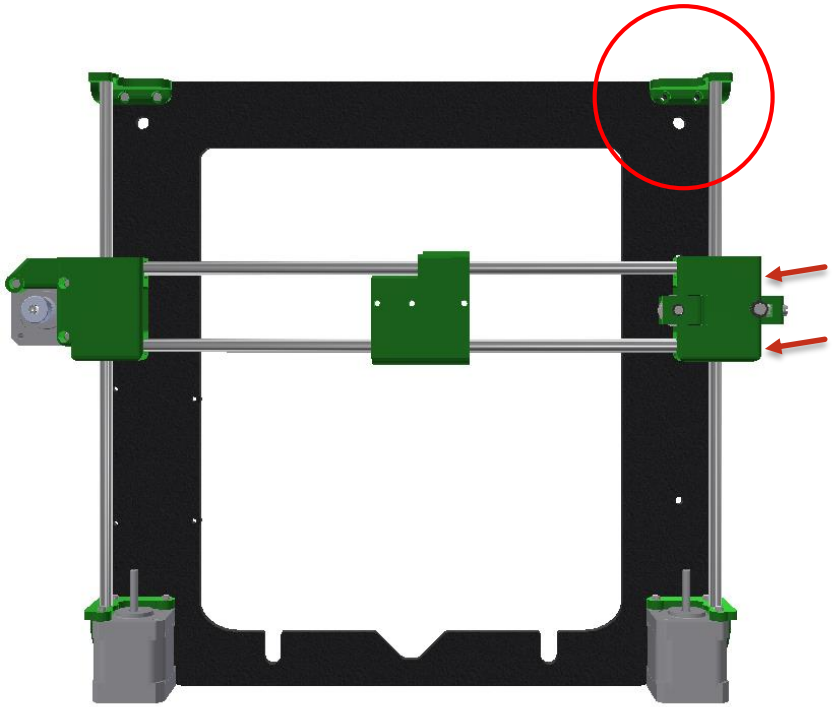
- Fix the left side corner to the aluminium frame with two M3x10 machine screws





STEP 3

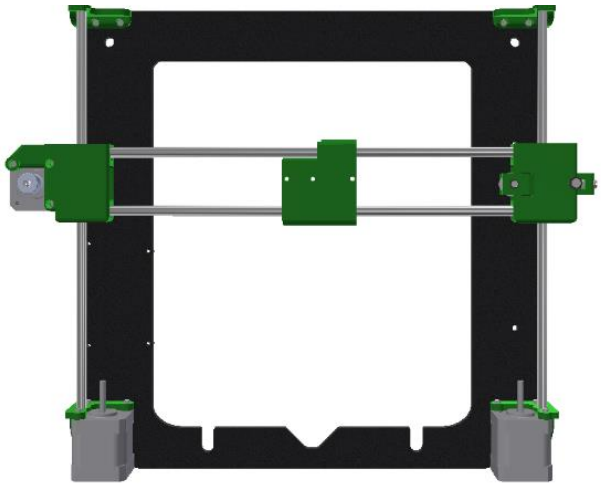
- Press fit the top right z corner onto the M8 smooth rod
- Use a mallet or hammer to lightly tap the x-end (indicated by red arrows) until the **top right** z-axis corner lines up with the aluminium frame holes.



STEP 4

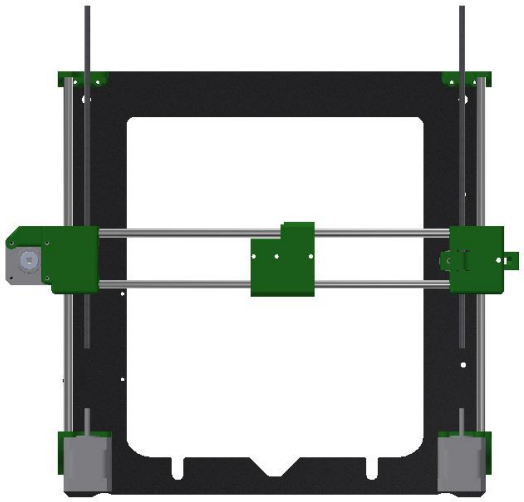
- When you are happy with the alignment, fit the top right corner to the frame using two M3x10 machine screws.
- The X-Axis should traverse up and down the Z-axis smooth rods without any binding.

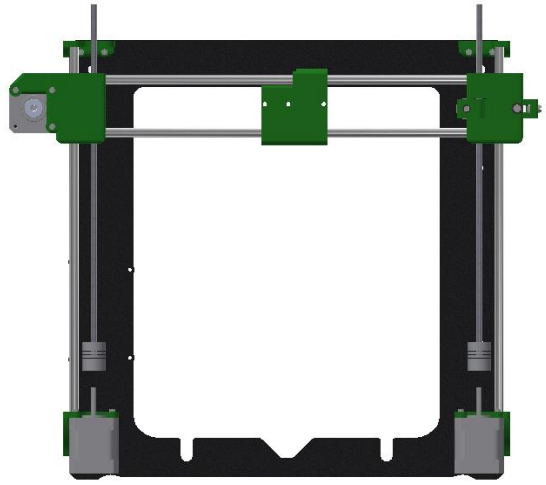
NOTE! It is very important to ensure that there is NO bowing of the smooth rods. This will cause problems with binding



STEP 5

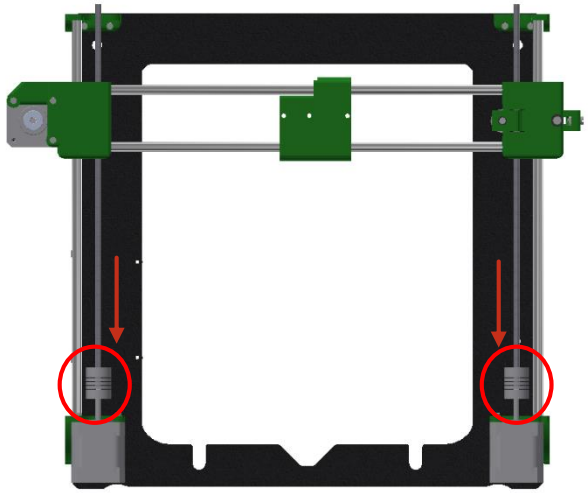
- Thread the two M5x300 thread rod shafts into the M5 nuts already inserted into the two x-ends *(you want to use machine oil to lube this when you are done).*





- Fix the two aluminium couplers to the bottom of each of these rods. Tighten the two upper grub screws on each flex coupler using an allen key.

- Lower the x-axis down, thereby coupling the threaded rod and stepper motor shafts. Make sure that the two rods are perpendicular and everything is true. Tighten the bottom two grub screws onto the stepper motor shafts.

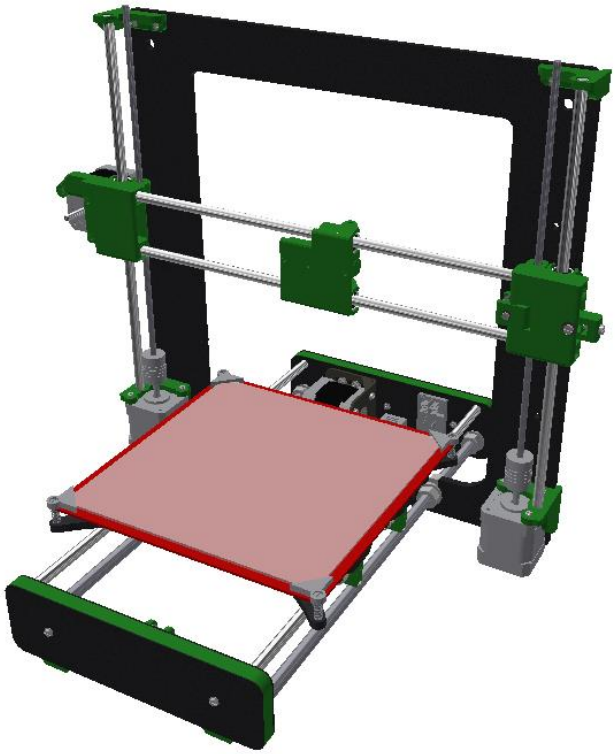


TIP *There should be a gap between the 300mm threaded rod and the stepper motor shaft inside the coupler. These should not be up against each other.*

[5] YZ – axis Mate

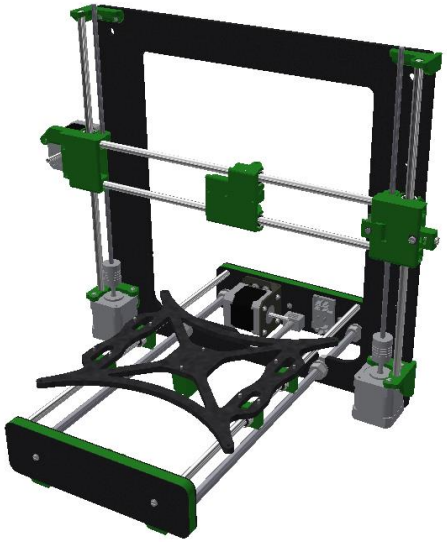
Parts Needed:

Y-Bed carriage	1x	
MK2 heatbed	1x	
200x200 glass print surface *(comes with kapton tape)*	1x	
Printed glass corners	4x	
Springs	4x	
M3x25 countersunk screws	4x	



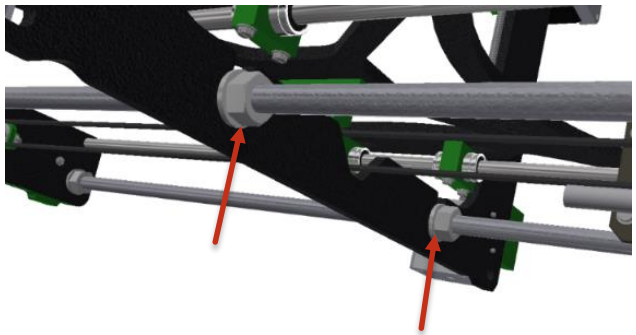
STEP 1

- Slot the Y-axis assembly down into the slots of the aluminium frame
- Keep in mind the 85 mm clearance mentioned in the first section



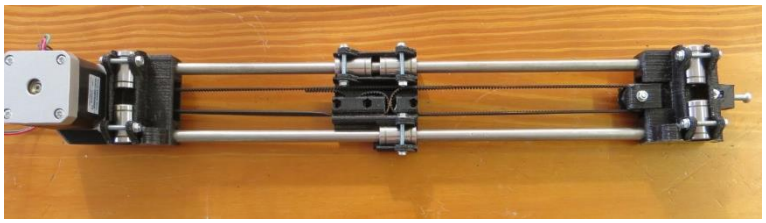
STEP 2

- Tighten the M10 nuts with a size 17 spanner
- Make sure that the feet of the aluminium frame and the printed gaskets are level!



STEP 3

- Install the timing belt similarly to how it was done on the Y-axis. See example picture on the right. Secure ends by x-carriage with cable ties.



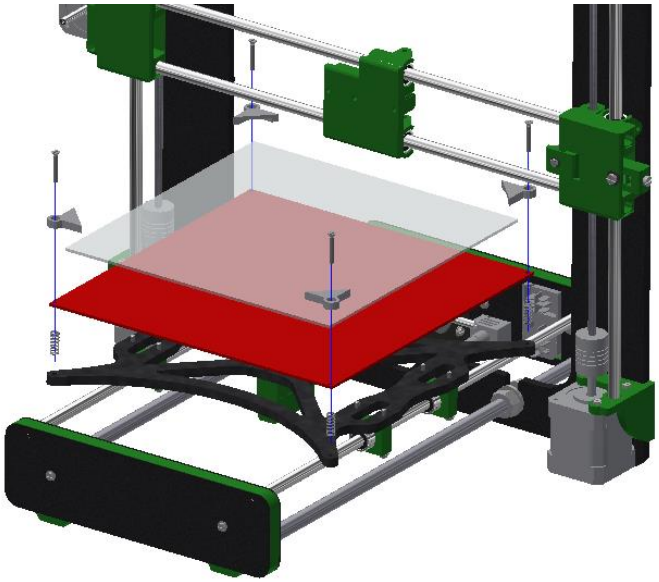
STEP 4

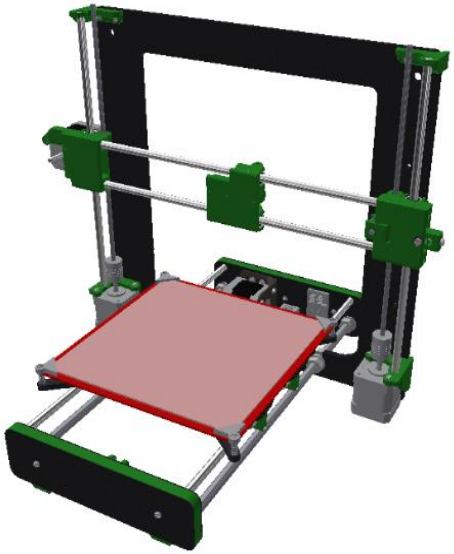
- Time to fix your glass print surface and Mk2 heater pad to the Y-Bed carriage using the four M3x25 countersunk machine screws provided.

- Machine screws -> plastic bed corners -> Glass bed -> Mk2 heater pad -> springs -> aluminium Y-bed carriage

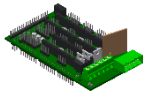
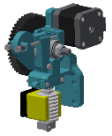
- Tighten all of this down until the springs are compressed to about 1 cm.

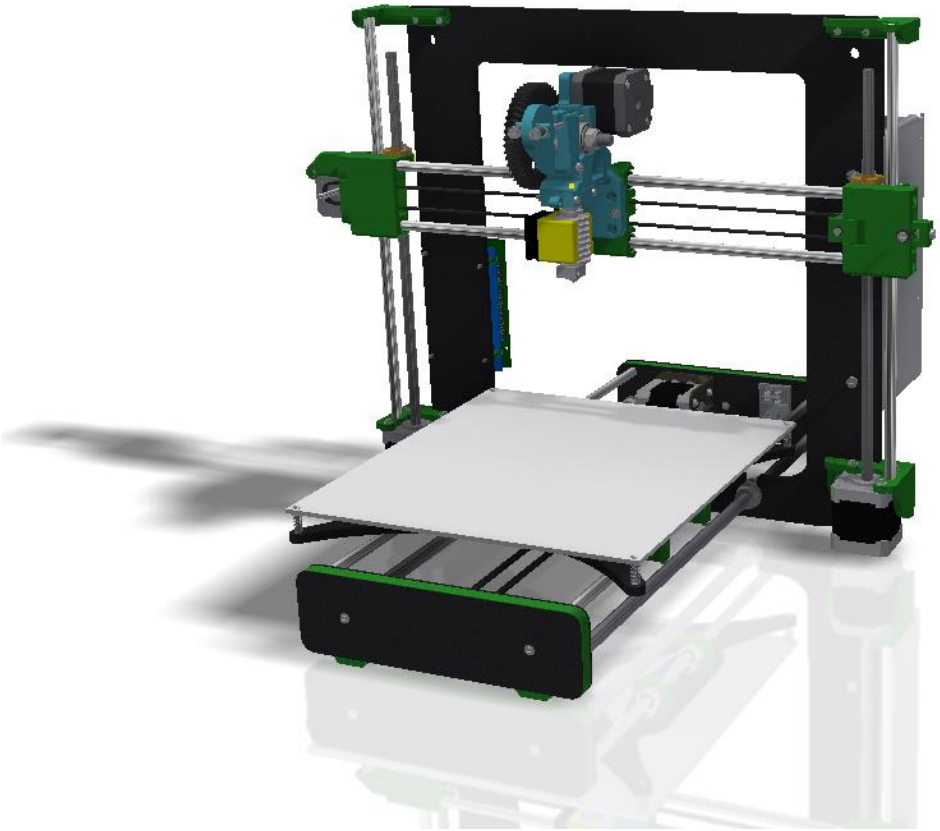
Note: Your Mk2 bed will have thermistor and power wires connected to it. Make sure that these are facing the BACK of the printer. These will plug into your electronics at a later stage.





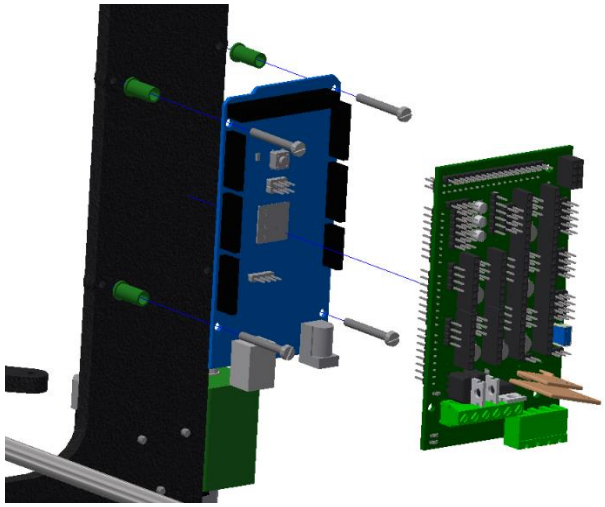
[6] Electronics and Extruder Assembly

Arduino Mega	1x	
Ramps 1.4	1x	
12V power supply *(With cover containing power connector and switch)*	1x	
Printed standoff	4x	
M4x10 machine screw	2x	
M3x20	4x	
M3x30	2x	
Extruder and hotend subassembly		



STEP 1

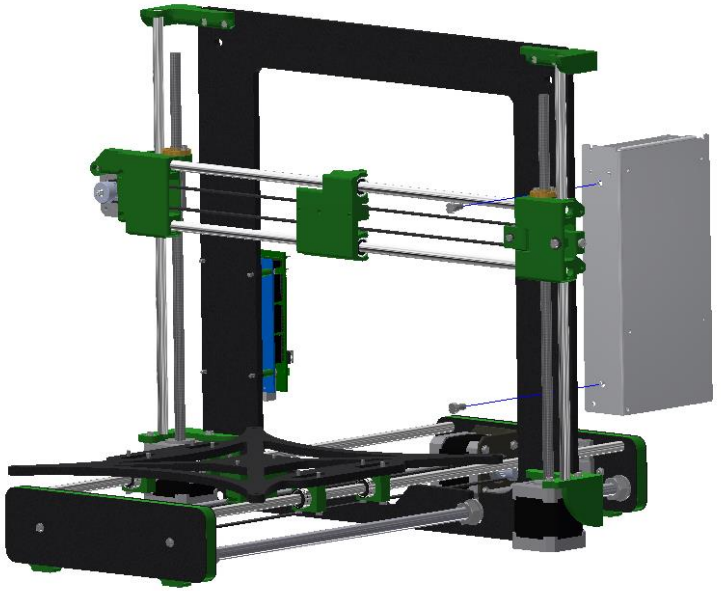
- You will receive both your Arduino Mega and Ramps 1.4 control board assembled and 'mated' together. Evenly apply force to the edges of both boards to pry the two apart
- Fix the Arduino mega to the frame using four M3x20 machine screws and standoffs between the frame and the bottom of the Arduino
- Once it is secure, press the Ramps 1.4 shield back into place (try not bend any pins and make sure that all of the pins are inserted fully)



STEP 2

- Secure the 12V power supply to the frame using two M4x10 machine screws.

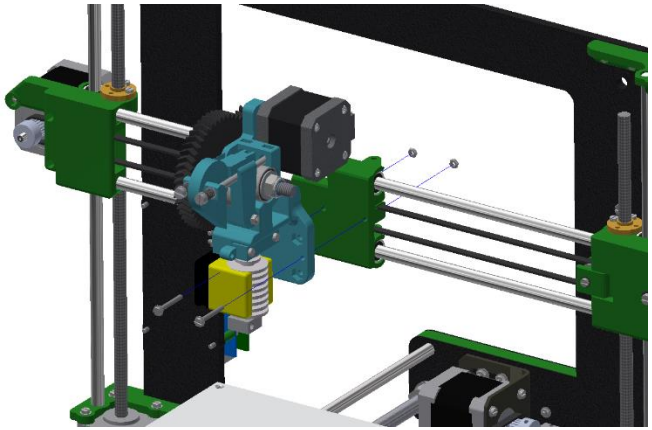
The Power supply comes with a protective cover attached. This cover also houses the IEC power socket and fused on/off switch!



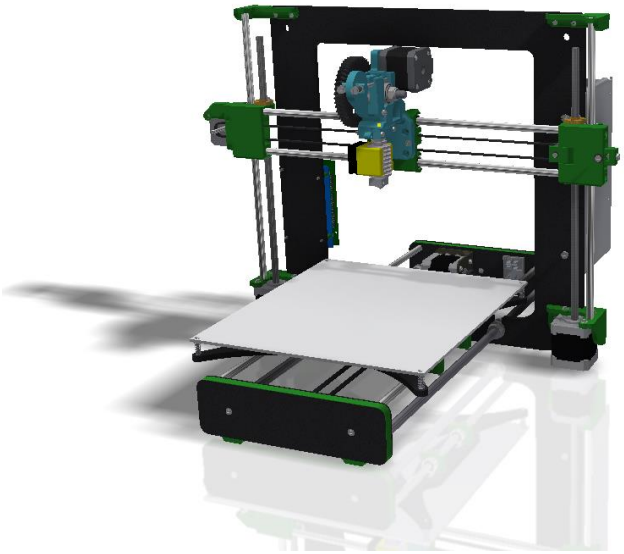
STEP 3 - *REFER TO CHARLSTRUDER INSTRUCTIONS ON HOW TO ASSEMBLE THE EXTRUDER*

STEP 4 – Mounting Extruder

- Fix the completed extruder the to the x-axis carriage using two M3x30 machine screws, M3 washers, and M3 nuts.

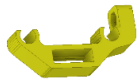
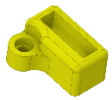


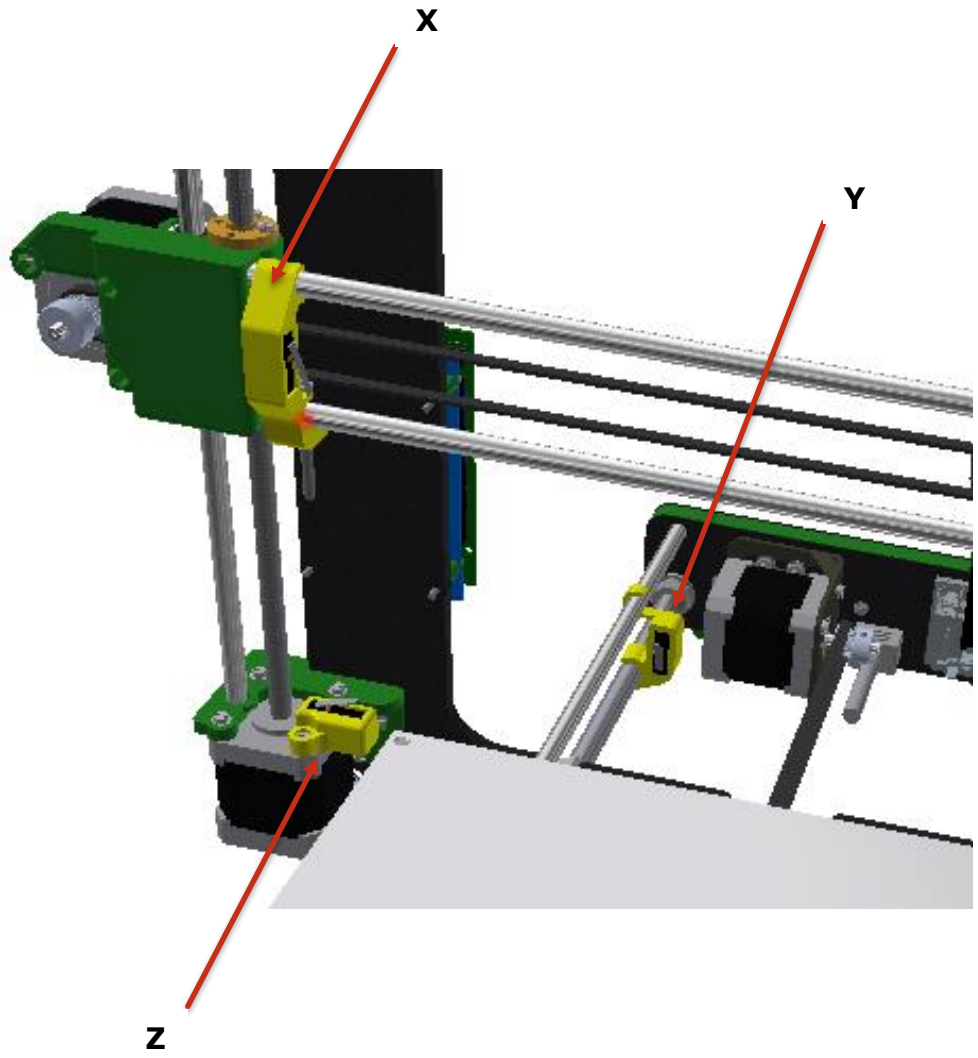
Tip: You might need to remove the hotend from the clamp temporarily if it is in the way and you can't get your screwdriver on either side of the hotend fins.



Your printer should look like this. Nearly there :D !!

[7] Endstops

Printed X-Endstop holder	1x	
Printed X-Endstop holder	1x	
Printed X-Endstop holder	1x	
End switch	3x	
M3x8 machine screw	1x	
M4x60 machine screw	1x	
M4 Nyloc nut	1x	

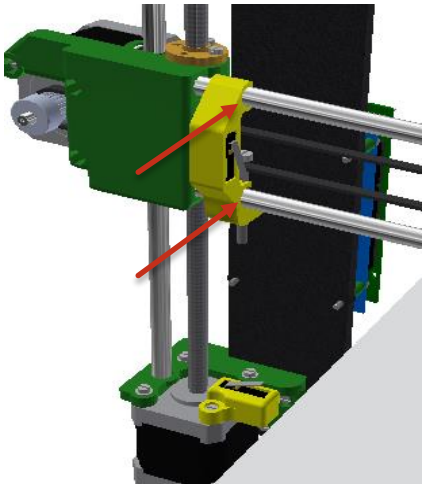


STEP 1

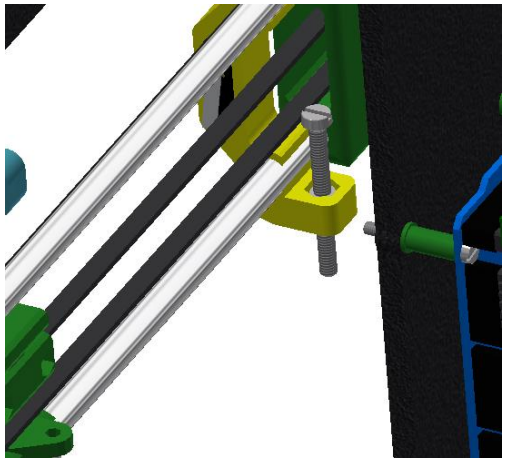
Time to attach your three end stops, one for each axis as seen in the image. First thing you need to do is insert the end switches into the printed parts. These press fit into place and have wires pre-soldered on. Make sure that you feed the connector and wire through the back of the holder before you press them down into place.

STEP 2

- Snap the x-axis end switch holder onto the two M8 smooth rods (left image).

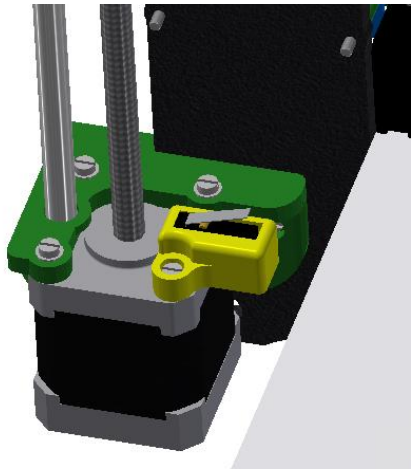


- Press-fit an M4 nyloc nut into the printed part and thread an M4x60 machine screw into this nut.



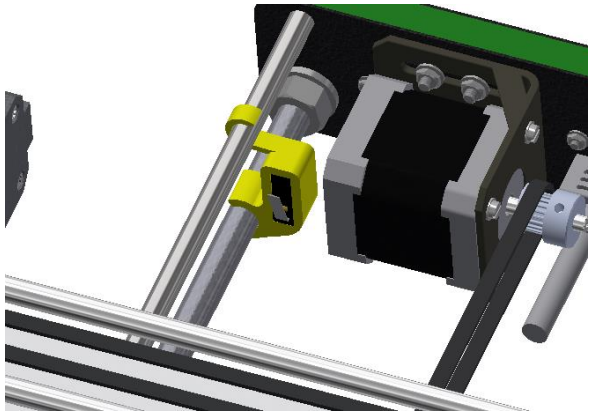
STEP 3

- Use an M3x8 machine screw to fix the z-axis end switch assembly to the corner threaded hole of the LEFT z-axis stepper motor.



STEP 4

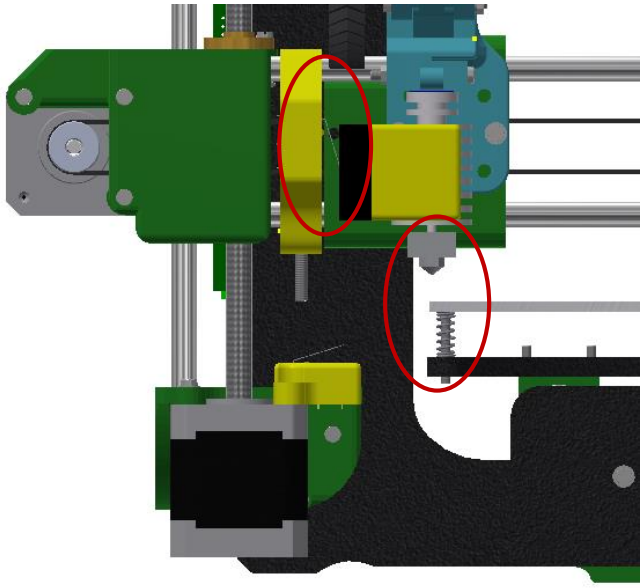
- Snap the y-axis end switch assembly to the M10 threaded rod. The top 'hook' keeps the assembly vertical



STEP 5

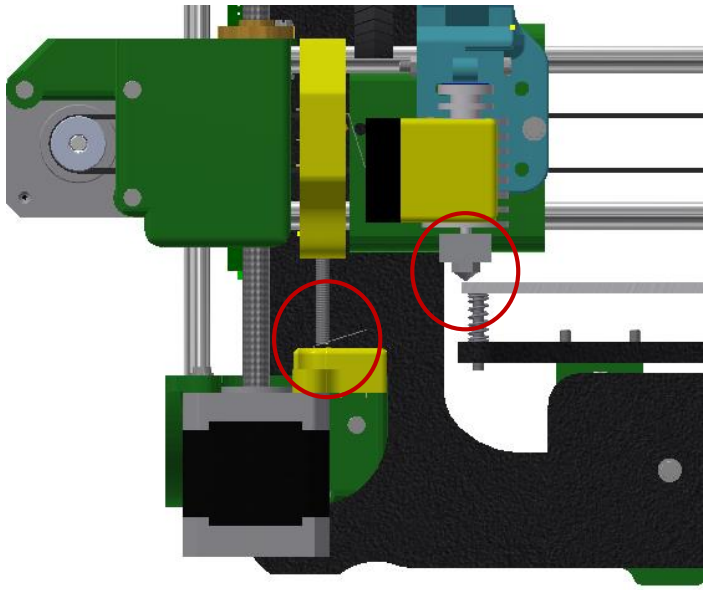
Now it's time to position the three end switch assemblies. The point of this is to ensure the tip of the nozzle 'homes' to the front left corner of the bed.

- First up is the x-axis. Position the X end-switch assembly so that the tip of the nozzle lines up with the left edge of the print bed when the switch makes contact with the x-carriage.



- Next up is the z-axis. Manually rotate the z-axis lead screws or threaded rod to lower the print nozzle to the bed (Just above).

- Use a screwdriver to adjust the M4 screw so that it actuates the end-switch at this height.



- Finally, the y-axis. The Y end switch assembly needs to be positioned so that the tip of the print nozzle lines up with the front edge of the print bed.

  The switch actuates up against the edge of the plastic bearing holder.