000 - TOOLS REQUIRED FOR BUILDING THE K8200

- COMBINATION SNAP RING PLIERS **(VTSRP)**

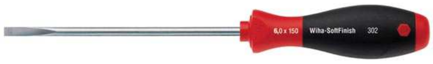
- ALLEN KEYS 1.5-6 mm - RING WITH 8 PCS **(1620-8)**

- WRENCH SET - OPEN END - 6 – 22 mm - 8PCS **(1420-R8)**

- CERAMIC SOLDERING IRON 30W / 230V **(STC30N)**

- SOLDER 60/40 1 mm 100g **(SOLD100G)**

- WIHA - SOFTFINISH CABINET SCREWDRIVER - SLOTTED 3 x 100 mm **(WH00687)**



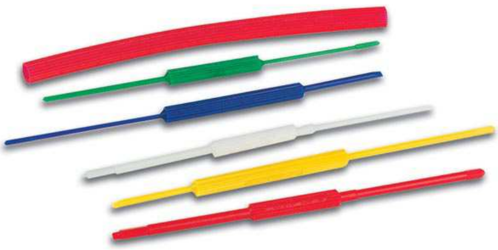
- 5" ELECTRICAL CUTTER & STRIPPER **(VT109 or VT109N)**

- 3 ½-DIGIT DIGITAL MULTIMETER **(DVM840)**

- DIGITAL CALLIPER – 150 mm / 6" - 0.01 mm **(DCA150)**

- TAPE RULE 3m **(HRUT3PRO)**

- 6-PC PLASTIC TUNING NEEDLE SET **(VTPT)**



- 5-PC DIAMOND FILE SET **(VTDF2)**

001 – ASSEMBLING THE COIL SUPPORT

Take the bag labelled with a 1 out of the box, you should have these parts:

Starting from the left of the threaded rod, put the parts together in this order:

- 1 x M6 locking nut
- 1 x M6 small washer
- The mounting bracket oriented as in the picture below
- 1 x M6 small washer
- 2 x M6 nut
- 1 x M6 small washer
- 1 x M6 large washer
- 1 x M6 small washer
- 2 x M6 nut
- 2 x M6 nut
- 1 x M6 small washer
- 1 x M6 large washer
- 1 x M6 small washer
- 1 x M6 locking nut

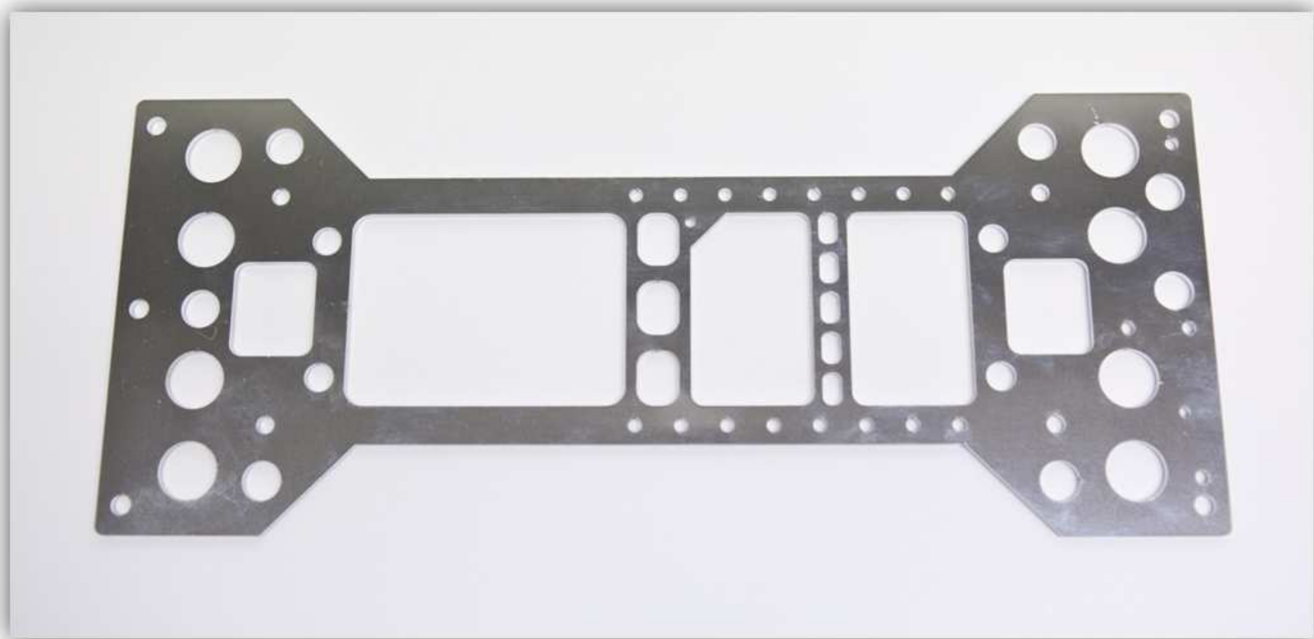
Leave some extra thread on the left (around 10 mm or 0.39"):

Then tighten all the nuts, the result should look like this:

Put this part aside, you will need it later in the build.

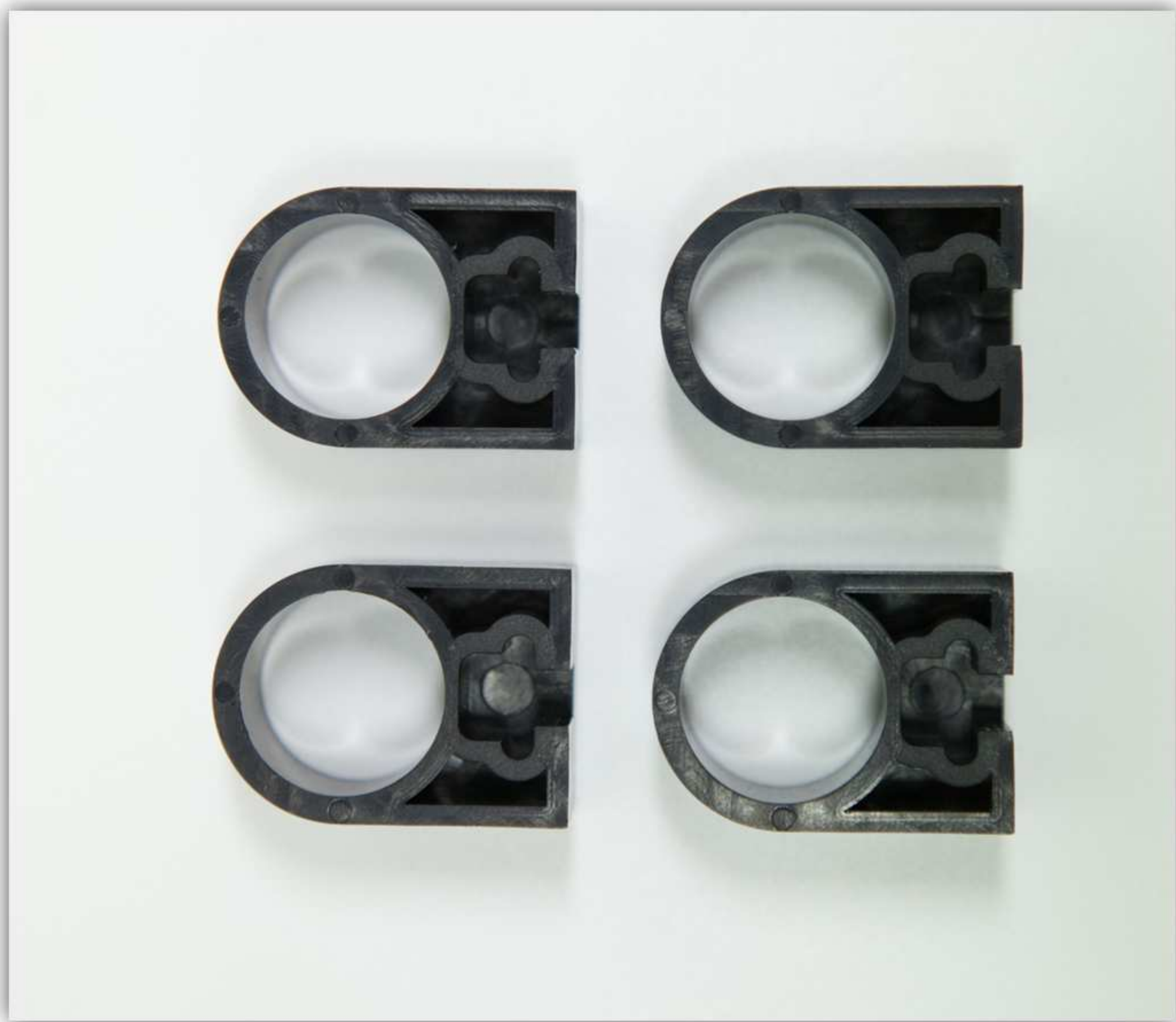
002 – ASSEMBLING THE X CARRIAGE

Take the X CARRIAGE out of the box.



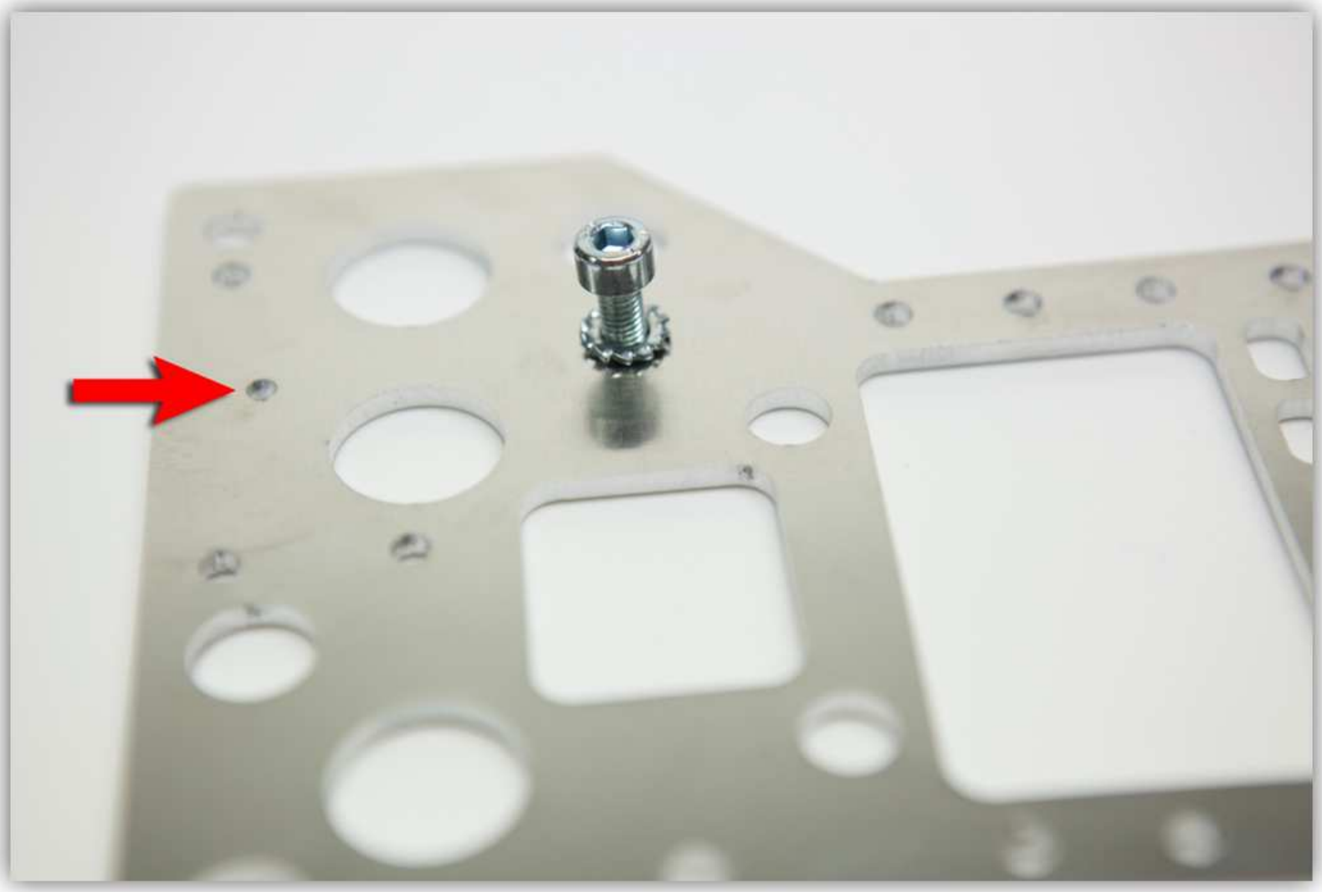
Take the bag labelled with 3 out of the box, you should have these parts:

Now take 4 pieces as shown in the picture below out of the bag containing the plastic parts (BEARING CLAMP X):

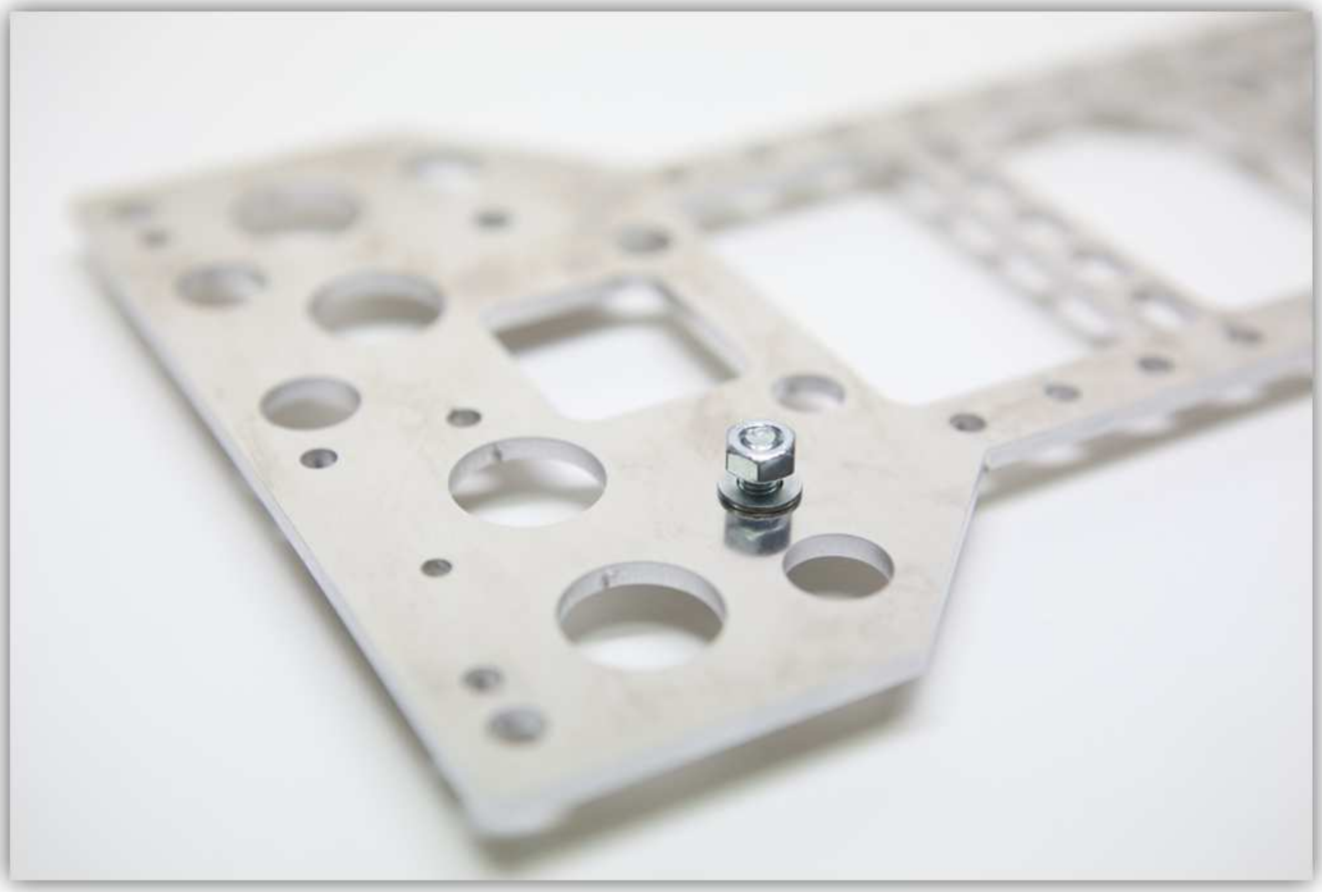


Put an M5 bolt and an M5 toothed washer through the X CARRIAGE as shown in the picture. **Take notice of the orientation of the aluminium plate. The red arrow shows a little hole, make sure this hole lines up as in the picture**

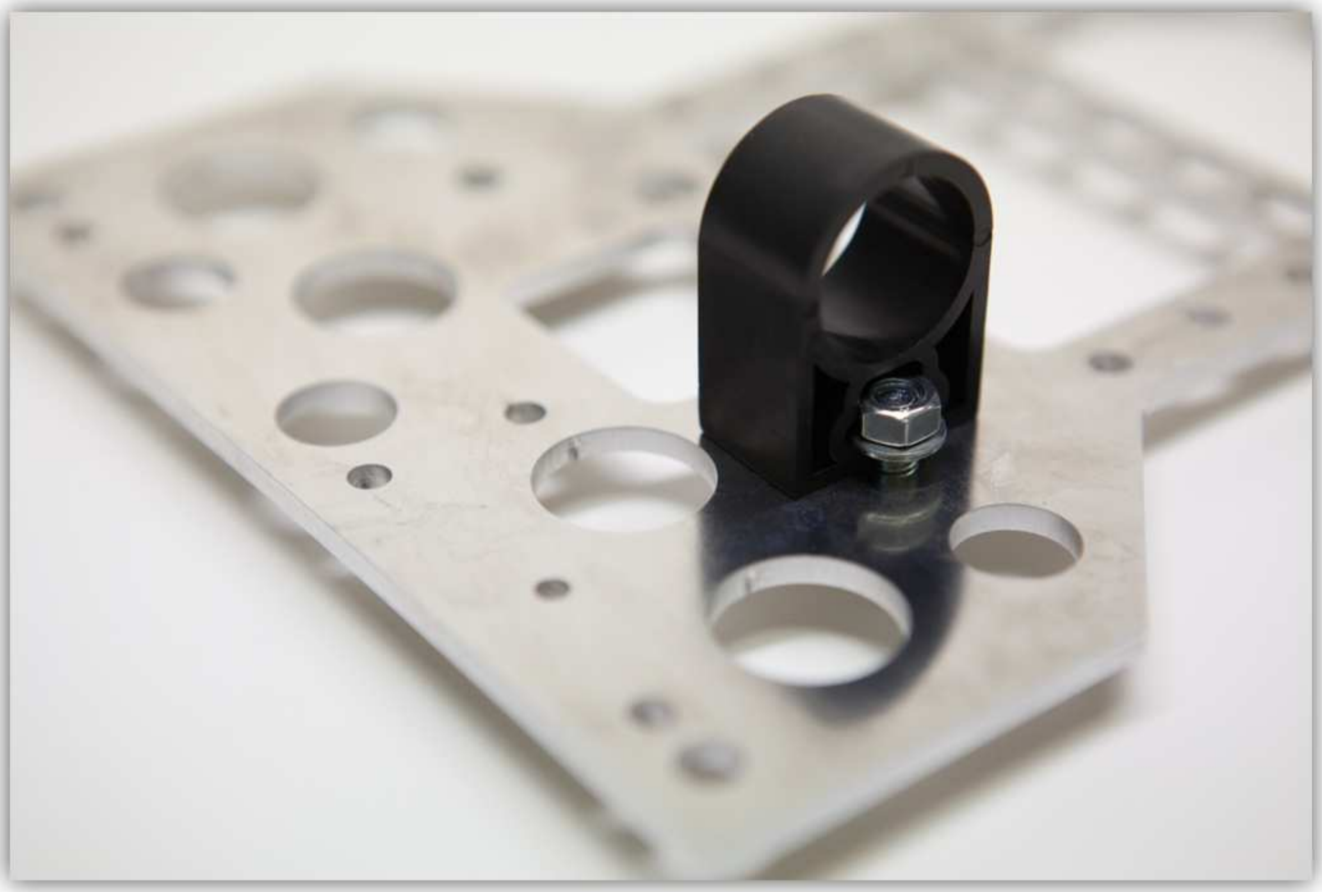
below:

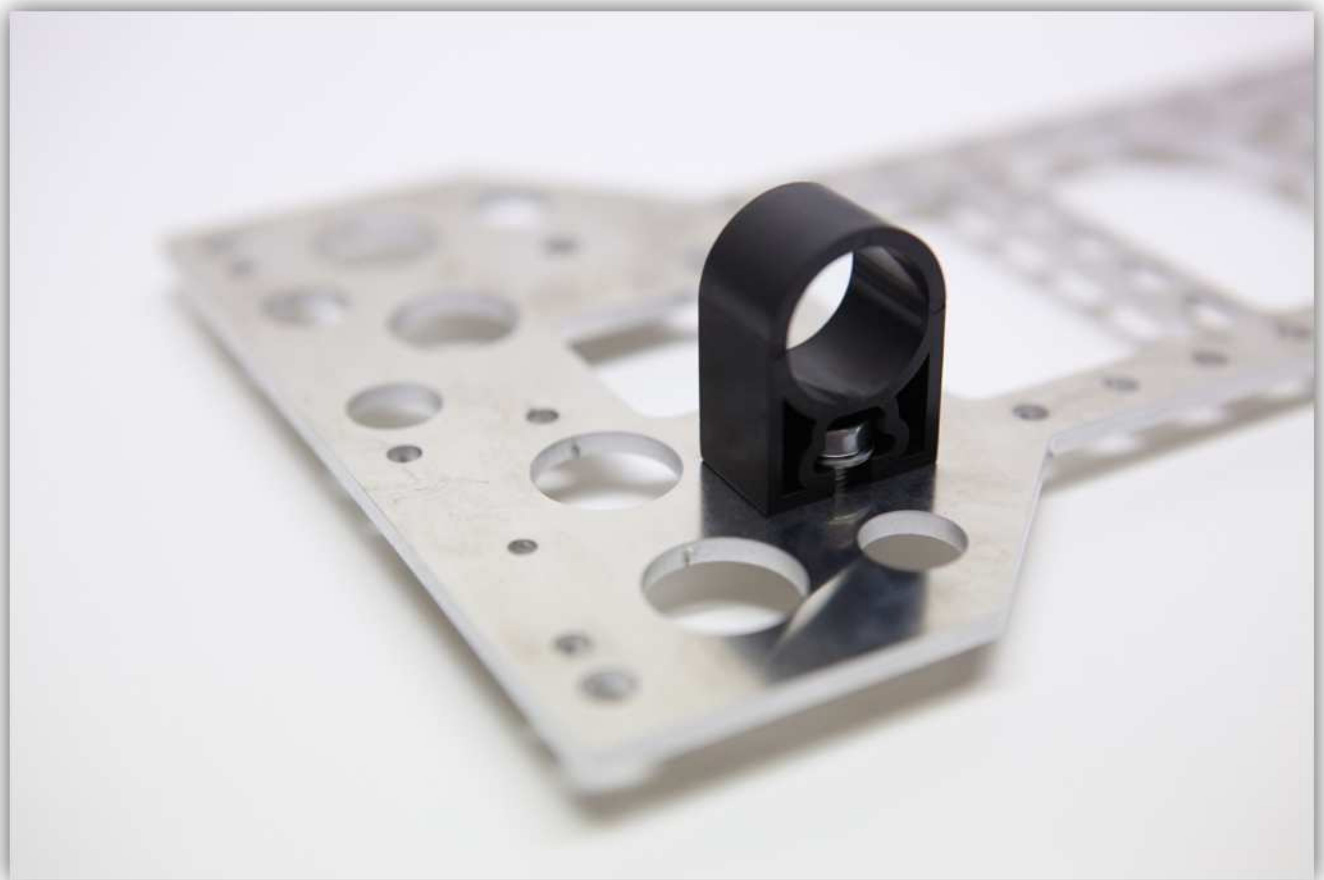


Flip the X CARRIAGE and put a M5 flat washer and an M5 nut on the M5 bolt as in the picture. **Do not tighten this nut.**



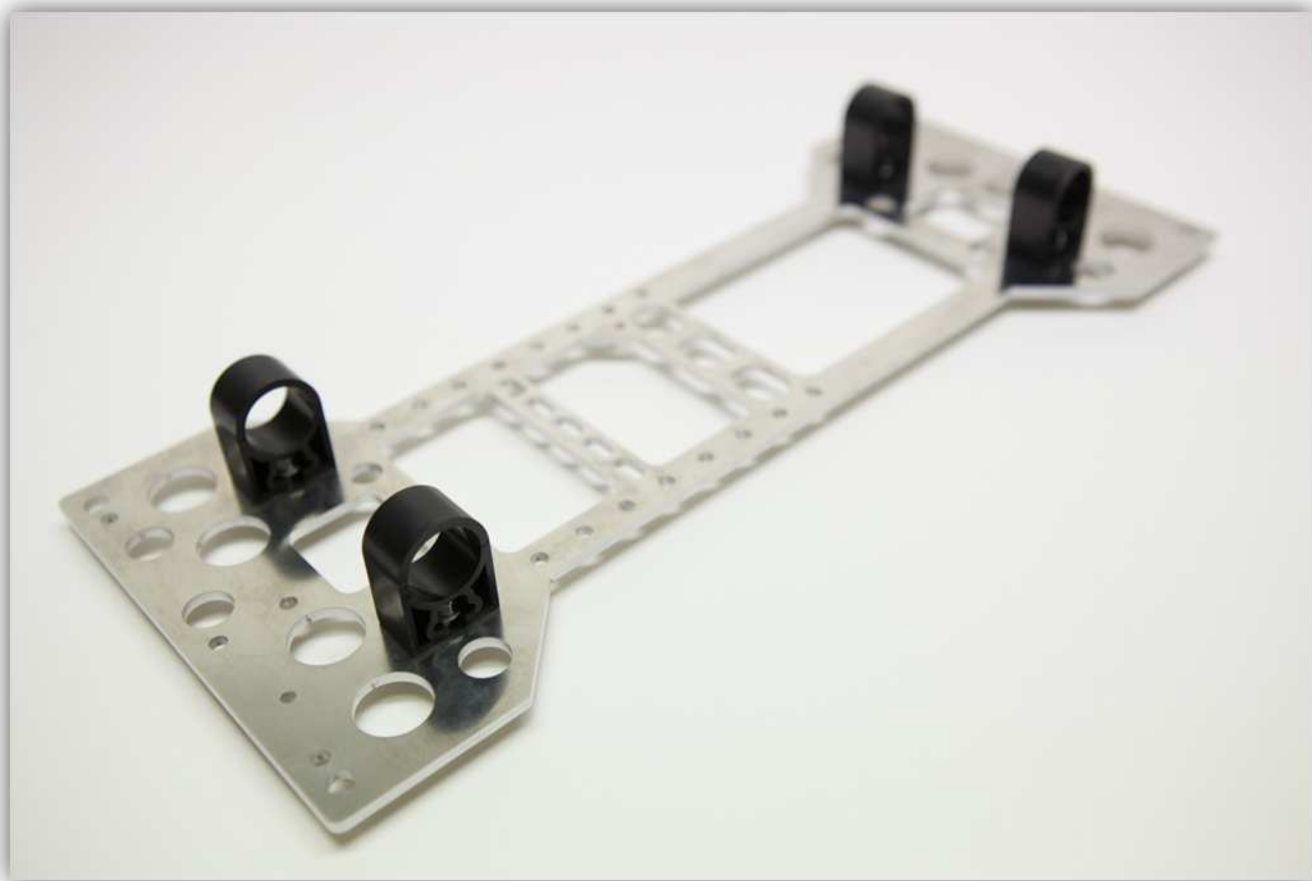
Slide 1 of the BEARING CLAMP X pieces over the washer and nut as shown in the pictures below. **Hand tighten this assembly. This part should be able to move freely but not fall off, later in the build we will tighten this piece.**

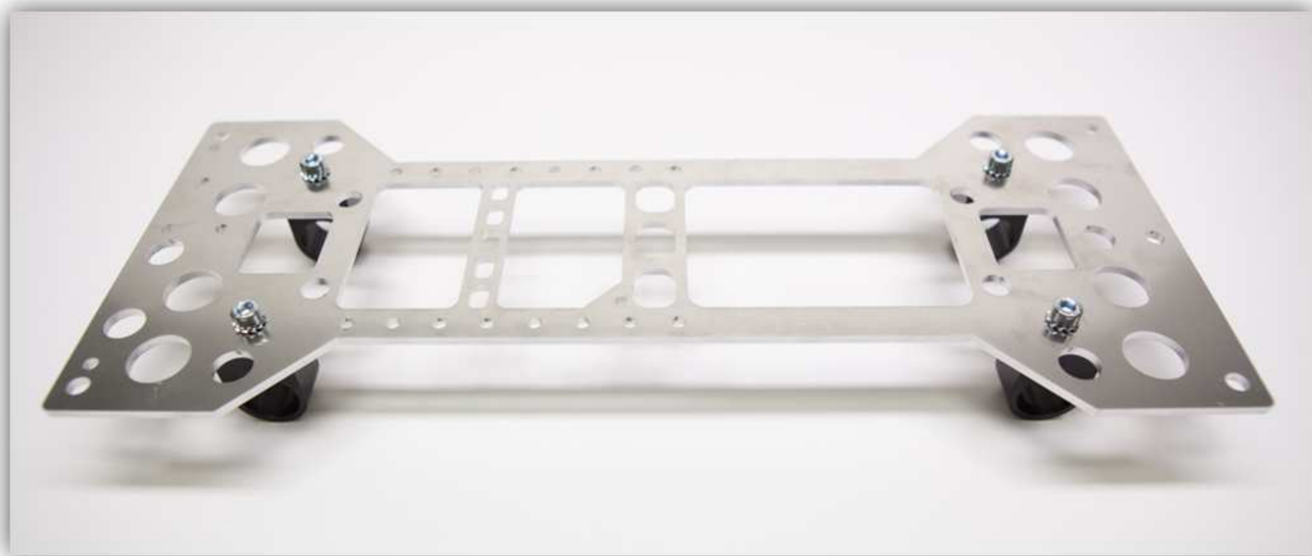




The assembly should look like this:

Repeat this 3 times in the positions shown on the pictures. **Remember, do not fully tighten these bolts. Just hand tighten them.**

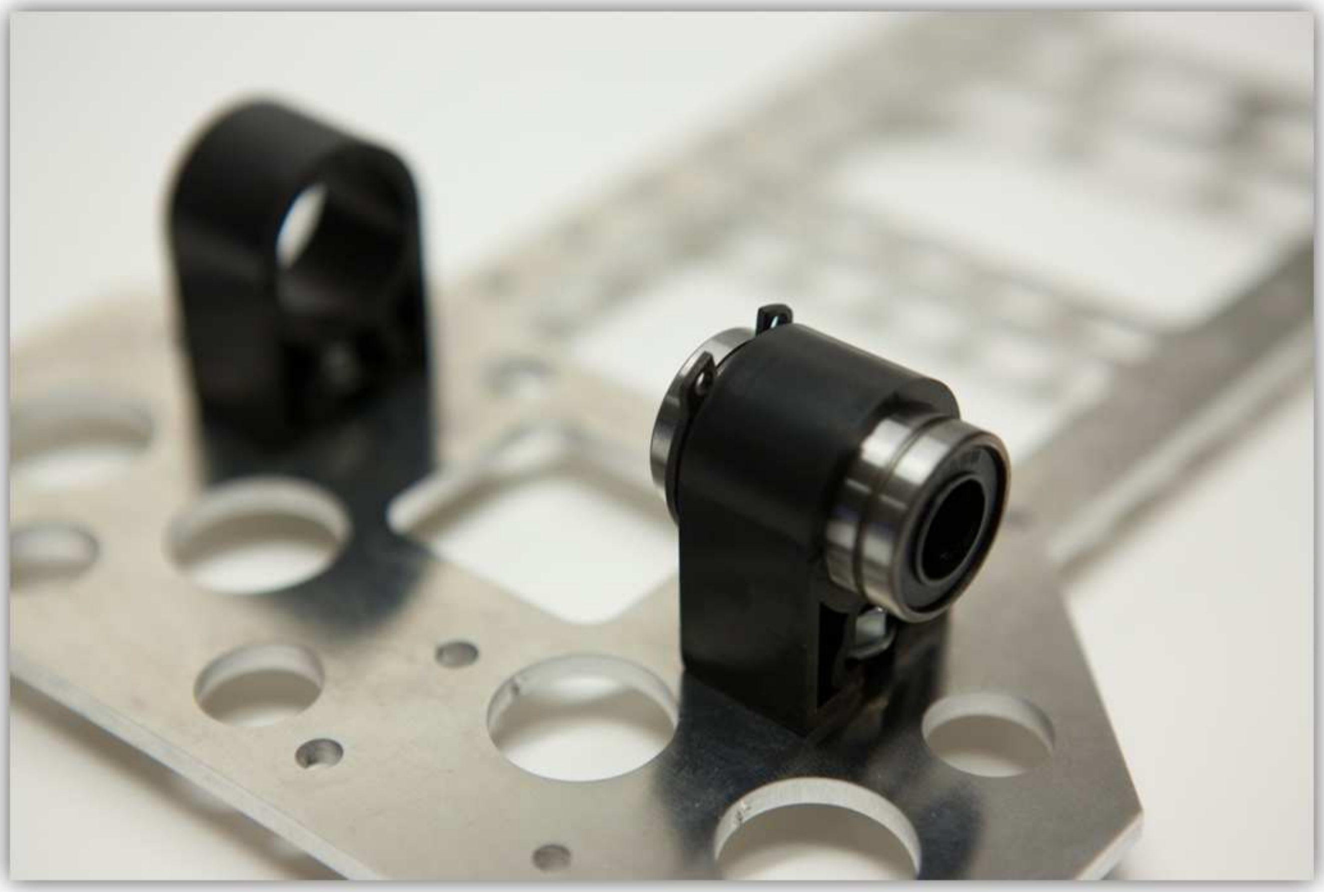




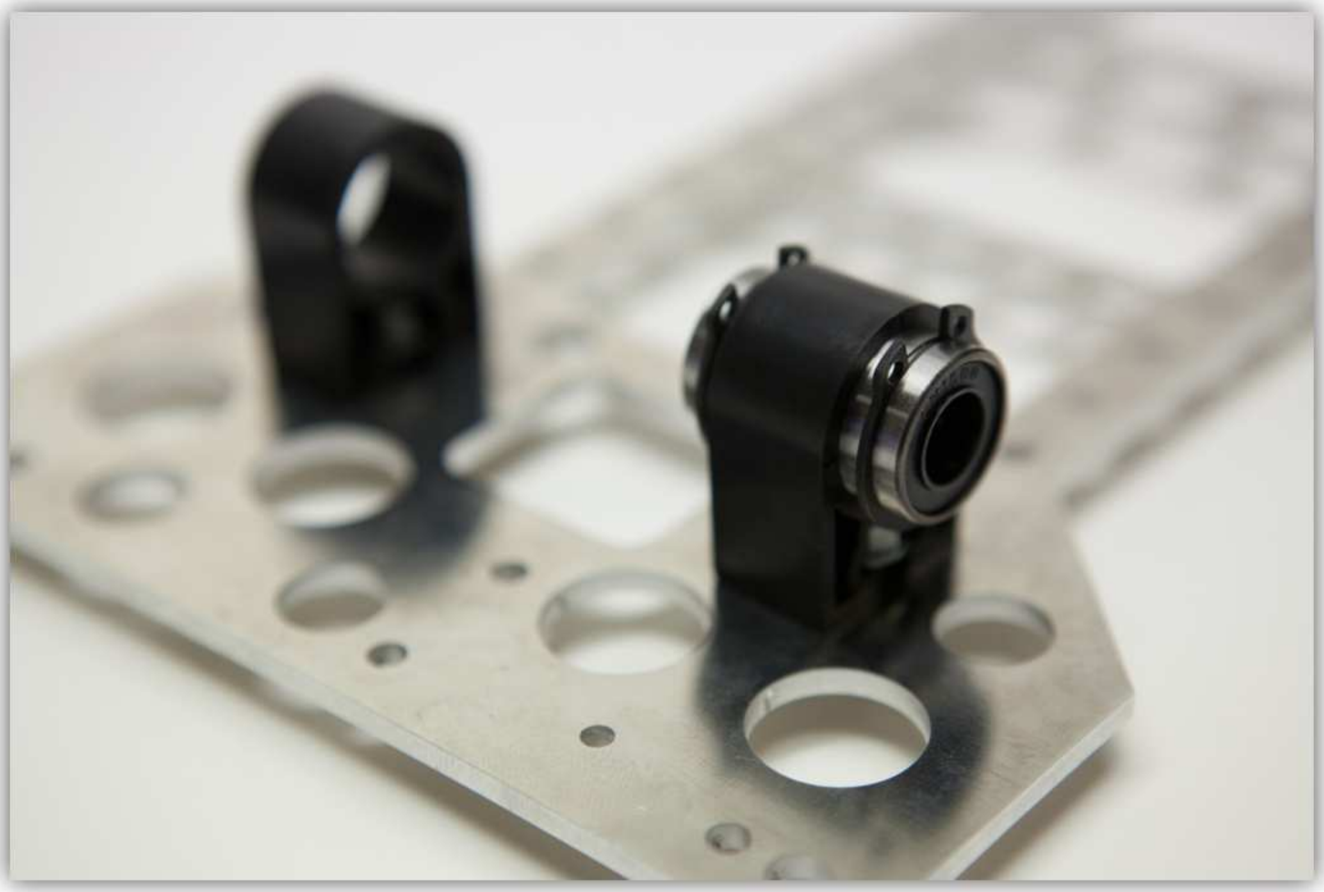
Now take the circlip pliers, a circlip and an LM10UU linear bearing:

Use the circlip pliers to carefully fit the circlip around the LM10UU linear bearing.

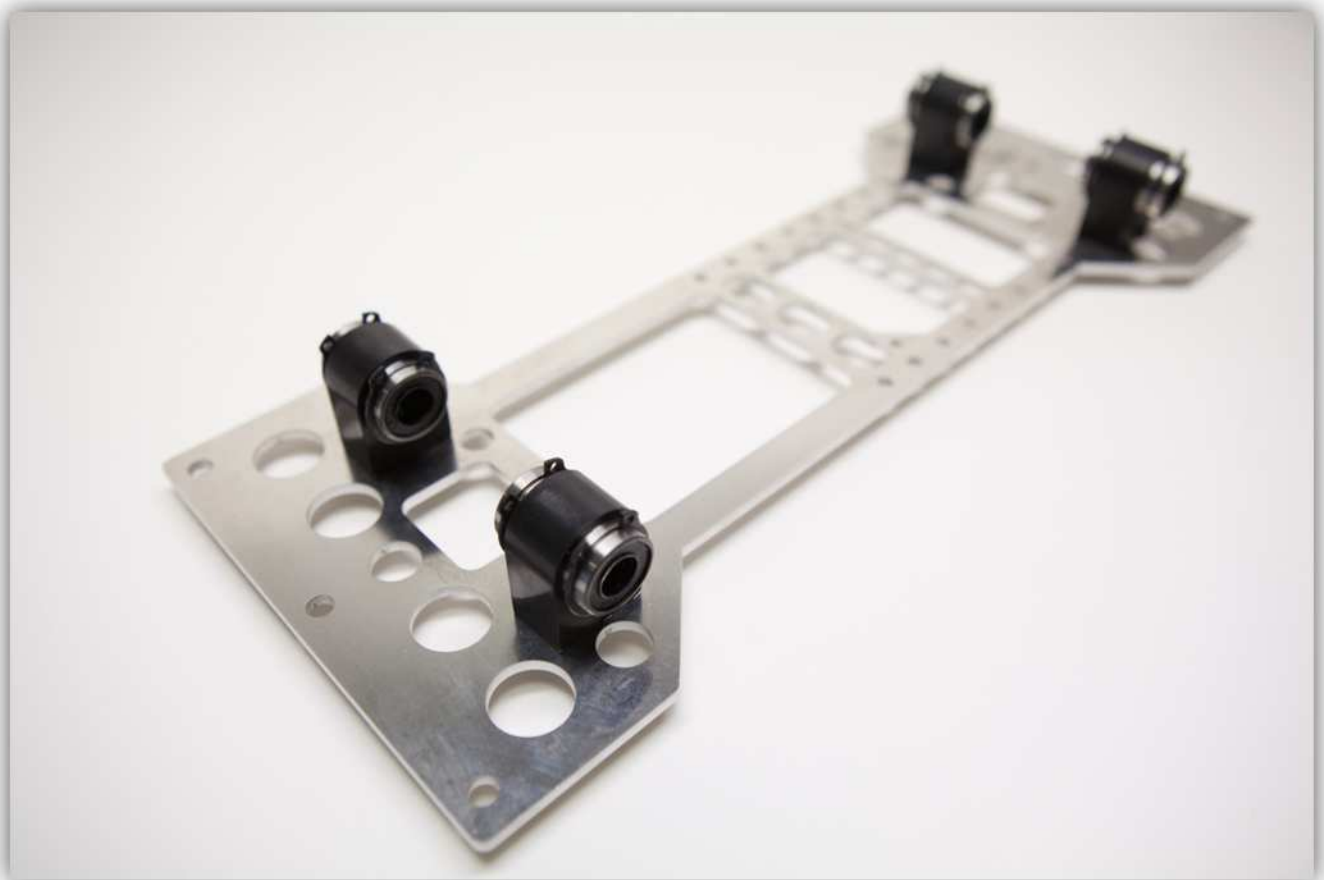
Slide the bearing with one circlip inside one of the BEARING CLAMP X pieces:



Use the circlip pliers to carefully fit the circlip around the LM10UU linear bearing and lock it in the BEARING CLAMP X piece:



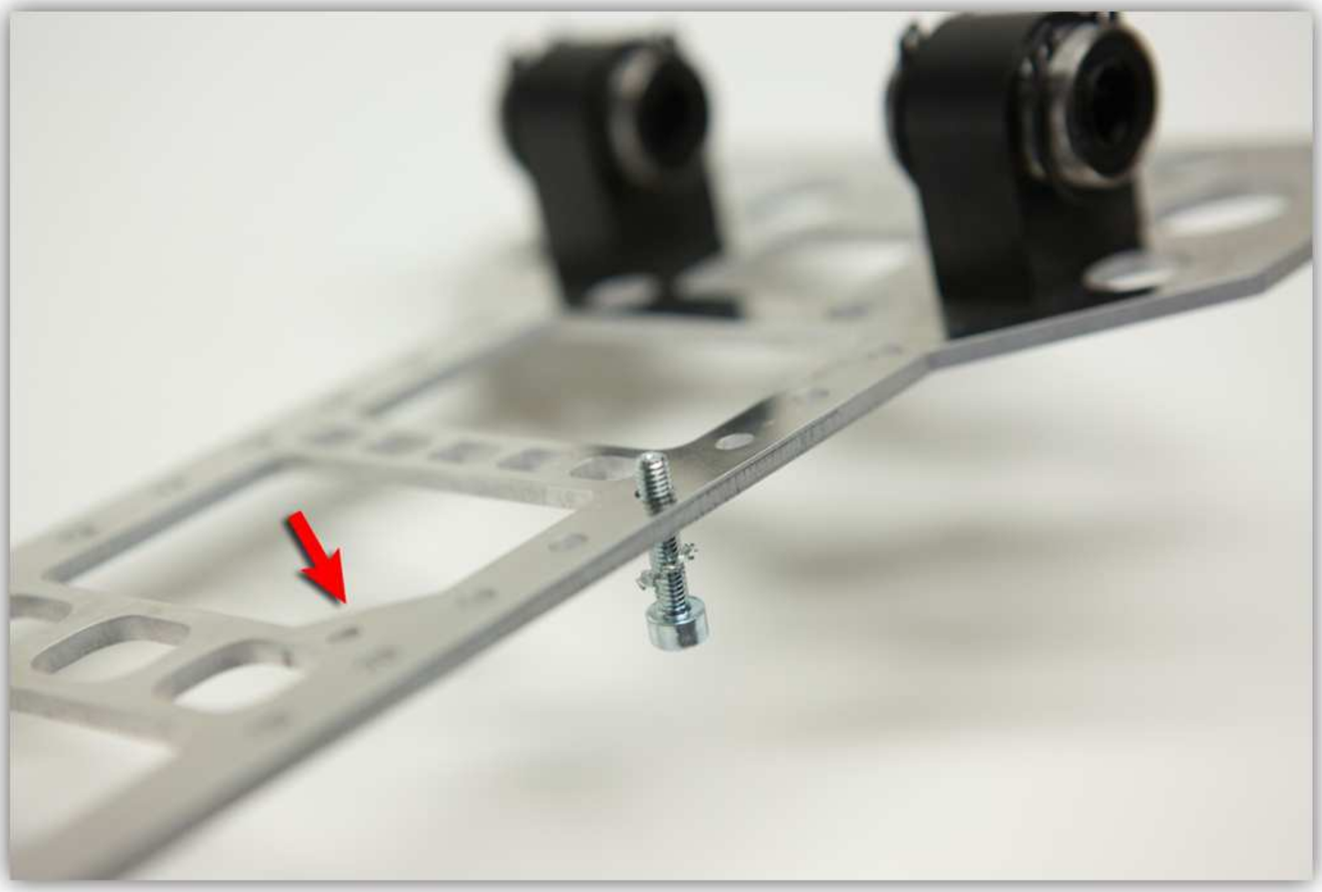
Repeat this process 3 more times so all the BEARING CLAMP X pieces have a bearing with circlips:



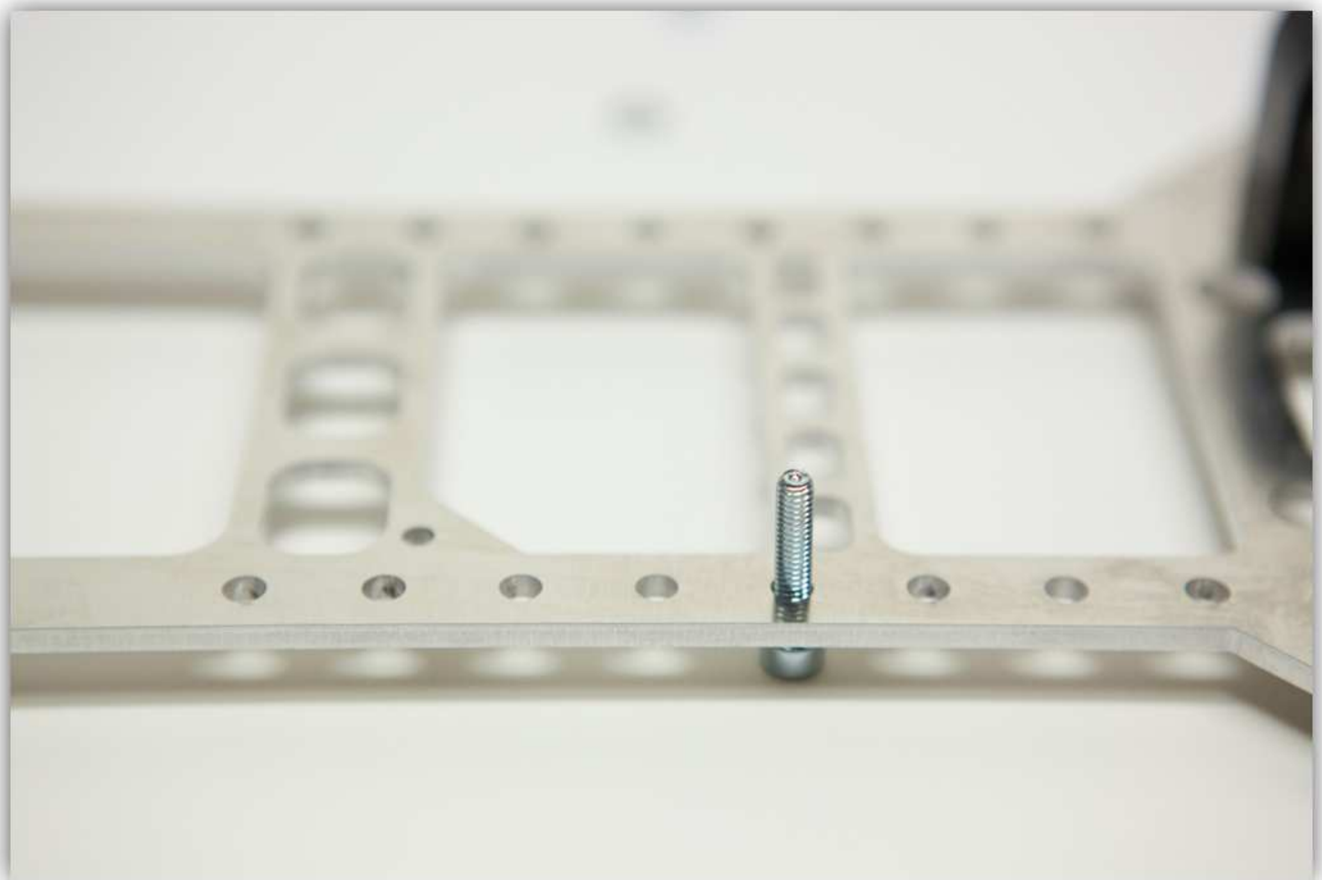
Take the bag labelled with 4 out of the box, you should have these parts. Notice the plastic piece (ADJUST SCREW BRACKET), you can find this in the bag containing the plastic parts.

Insert a small M3 nut in the ADJUST SCREW BRACKET as shown in the picture:

Insert the M4 bolt with a toothed washer as in the picture. **Notice the red arrow, it shows a detail that is only on one side of the X CARRIAGE. You need to insert the bolt on this side.**

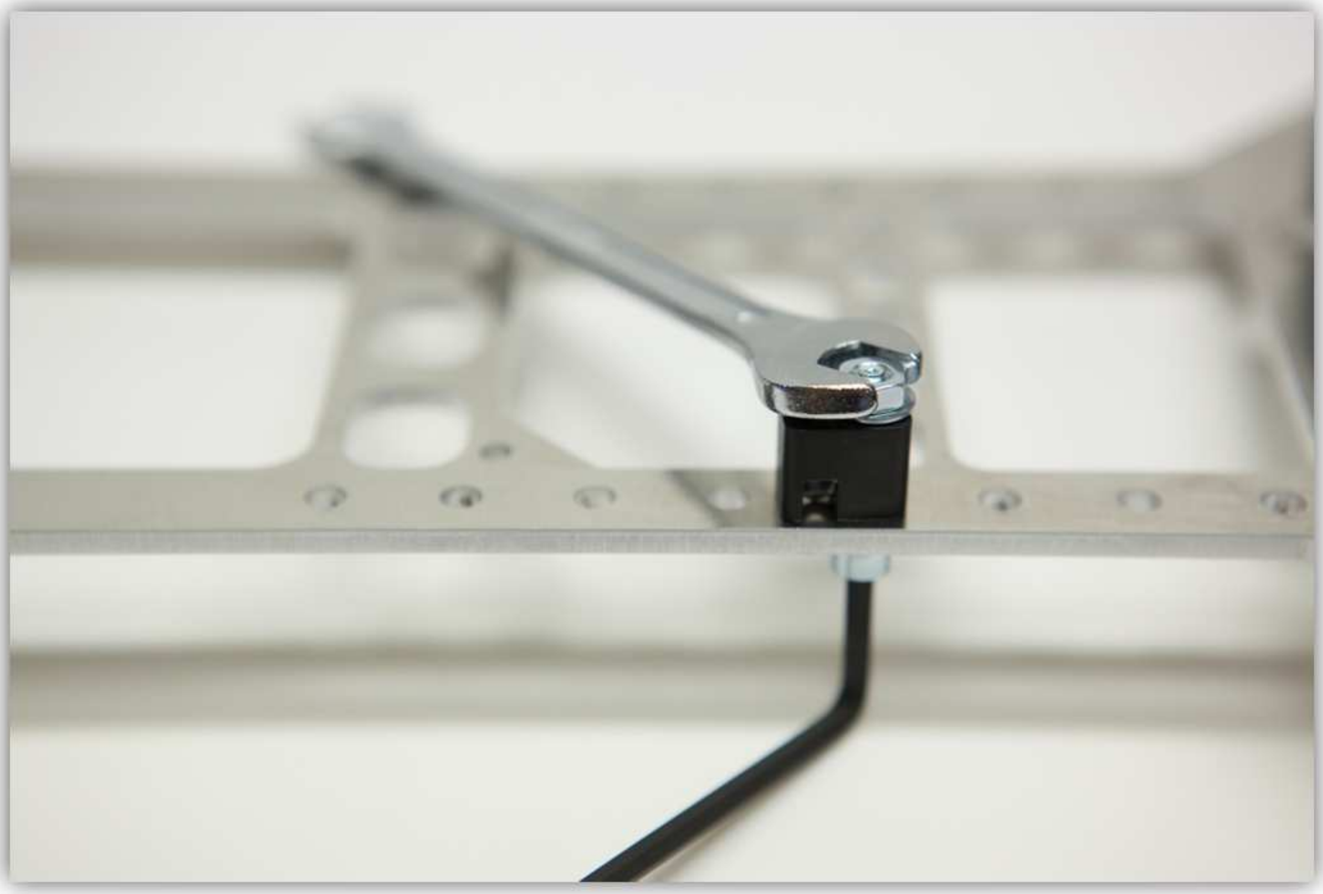


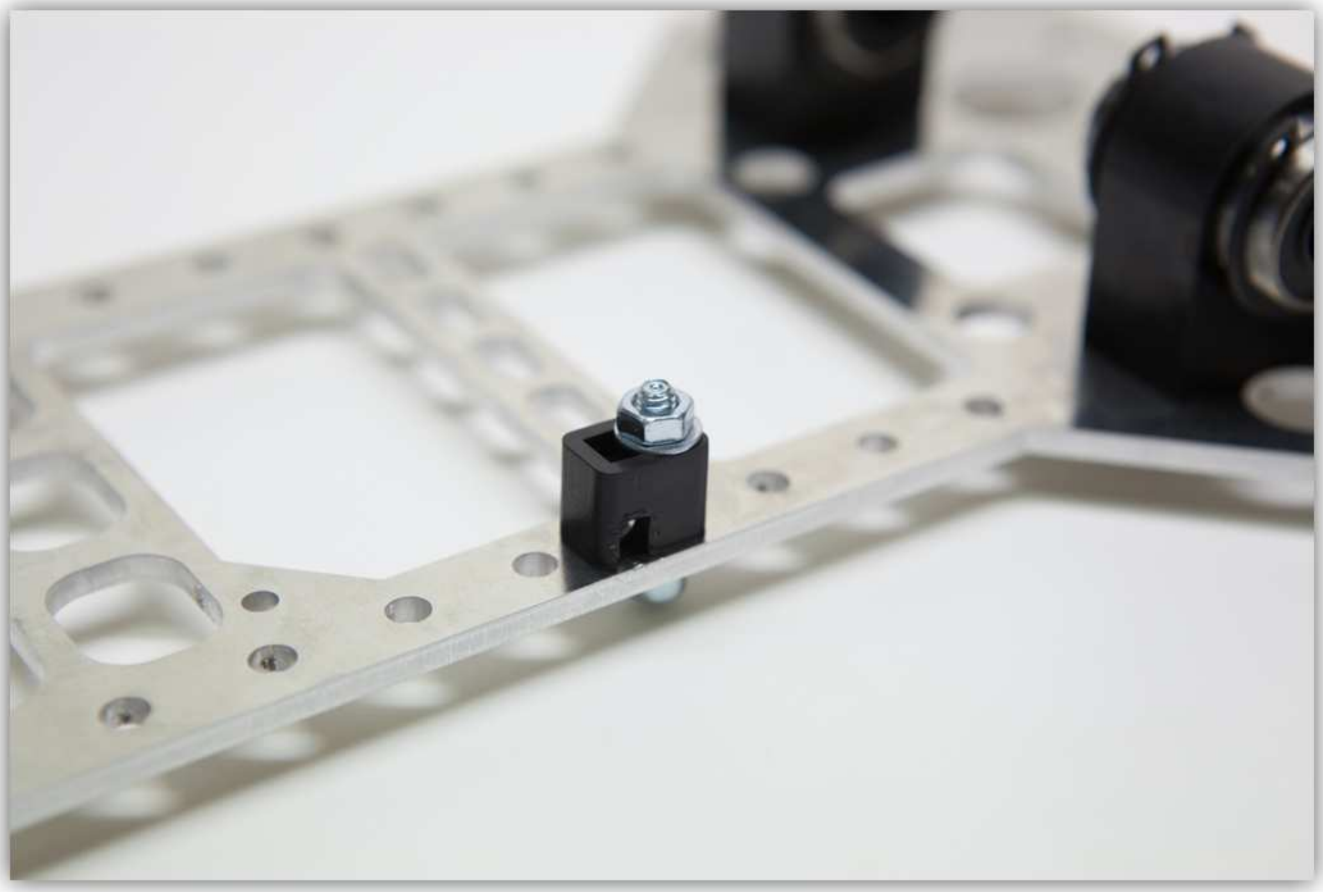
It should look like this:



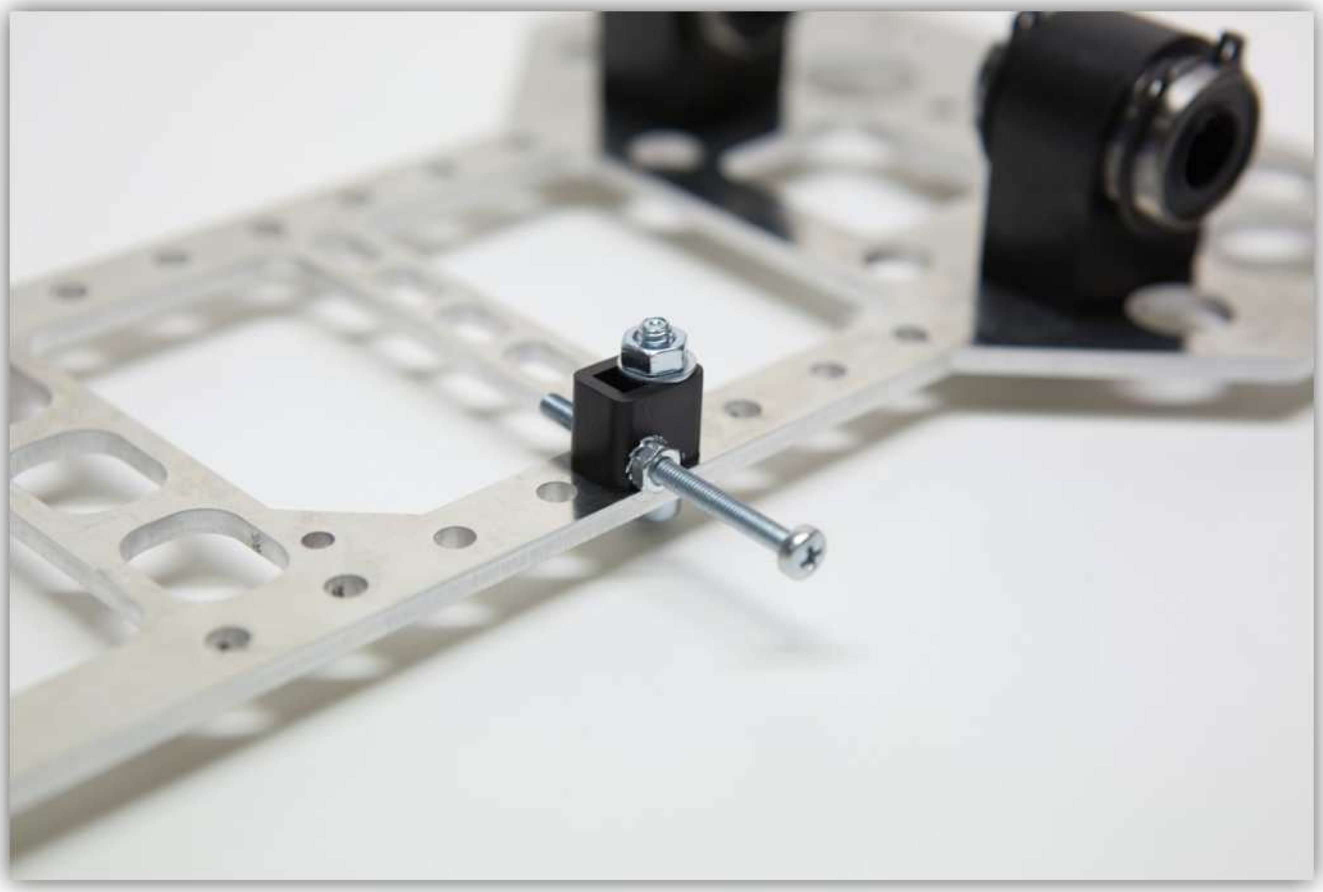
Place the ADJUST SCREW BRACKET with the small M3 nut inside over this bolt as in the picture:

Put an M4 washer and M4 nut on this bolt and tighten everything:

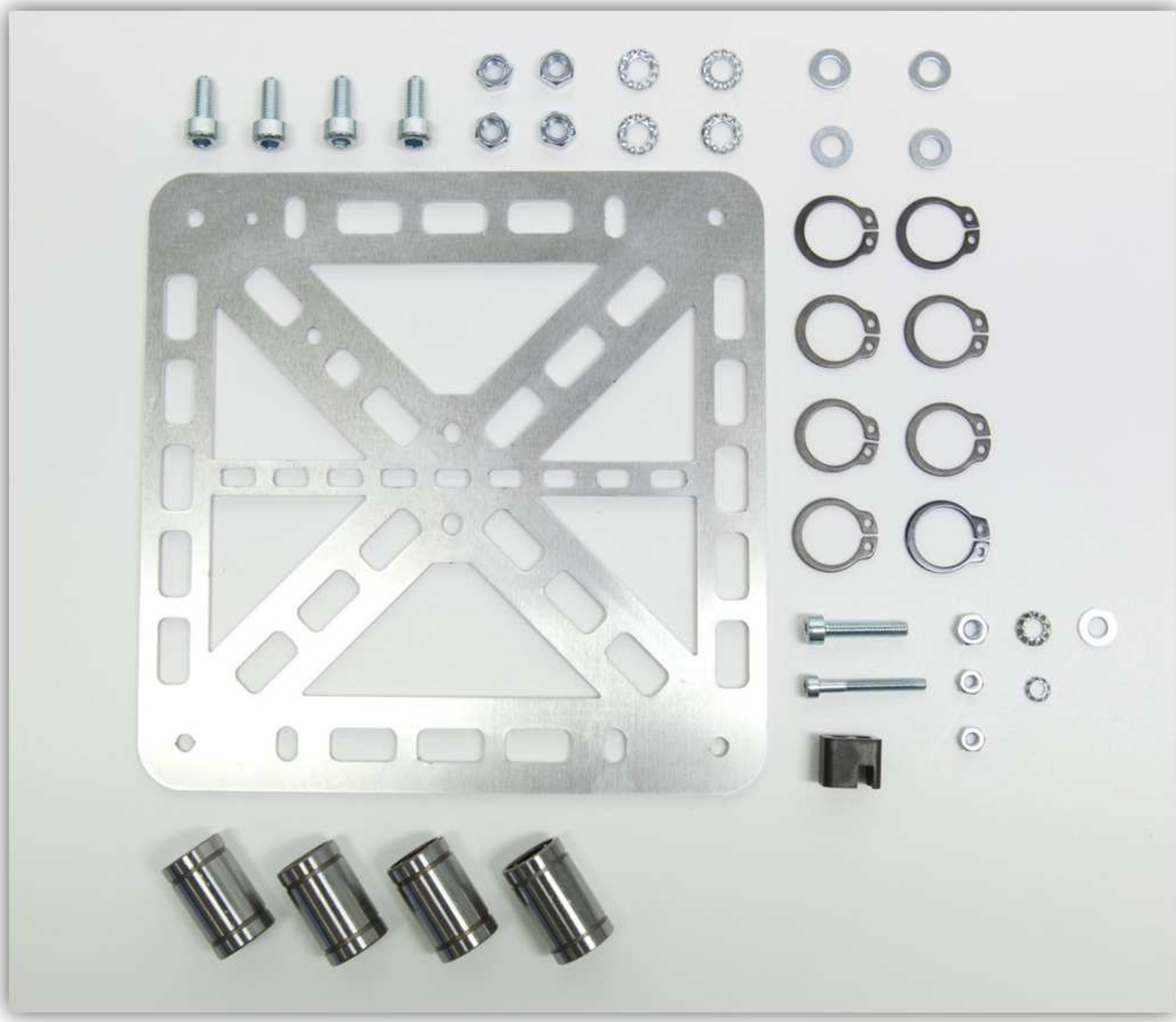




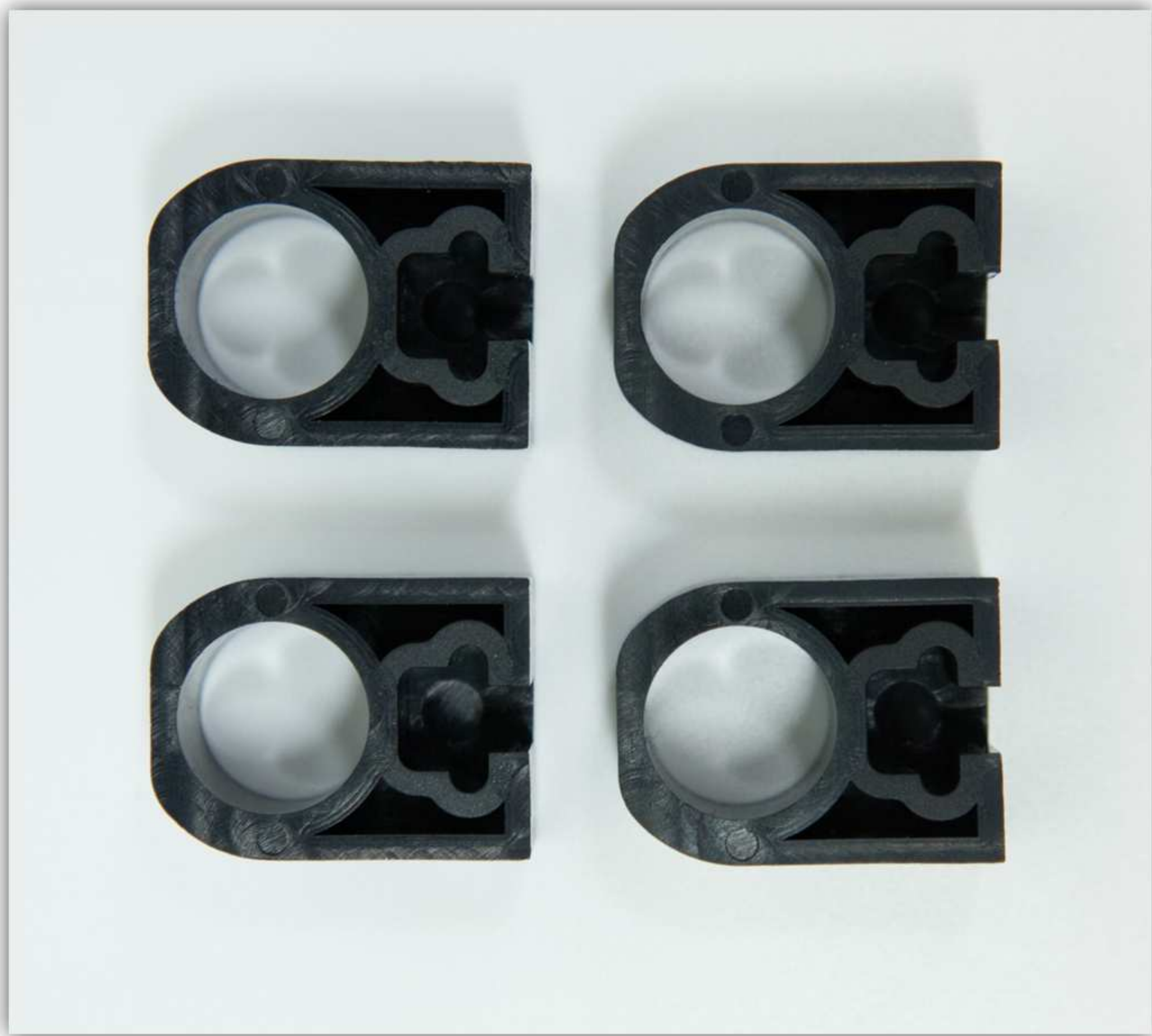
Put an M3 nut and M3 toothed washer over the long bolt and screw it in the M3 nut that is inside the plastic piece:



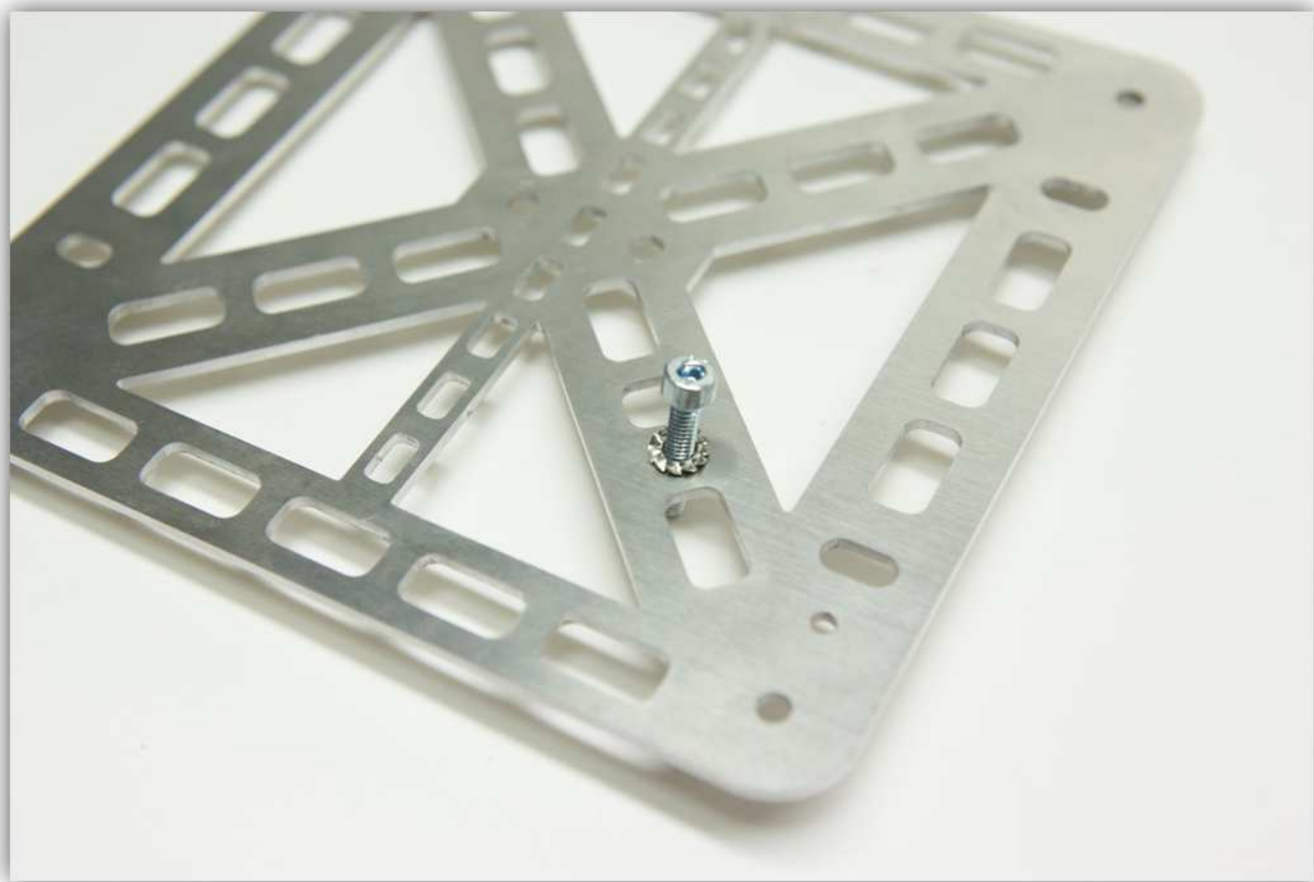
Take the bag labelled with 5 out of the box, you should have these parts. Notice the plastic piece (ADJUST SCREW BRACKET), you can find this in the bag containing the plastic parts.



Also take 4 pieces (BEARING CLAMP Y) as shown in the picture below out of the bag containing the plastic parts:

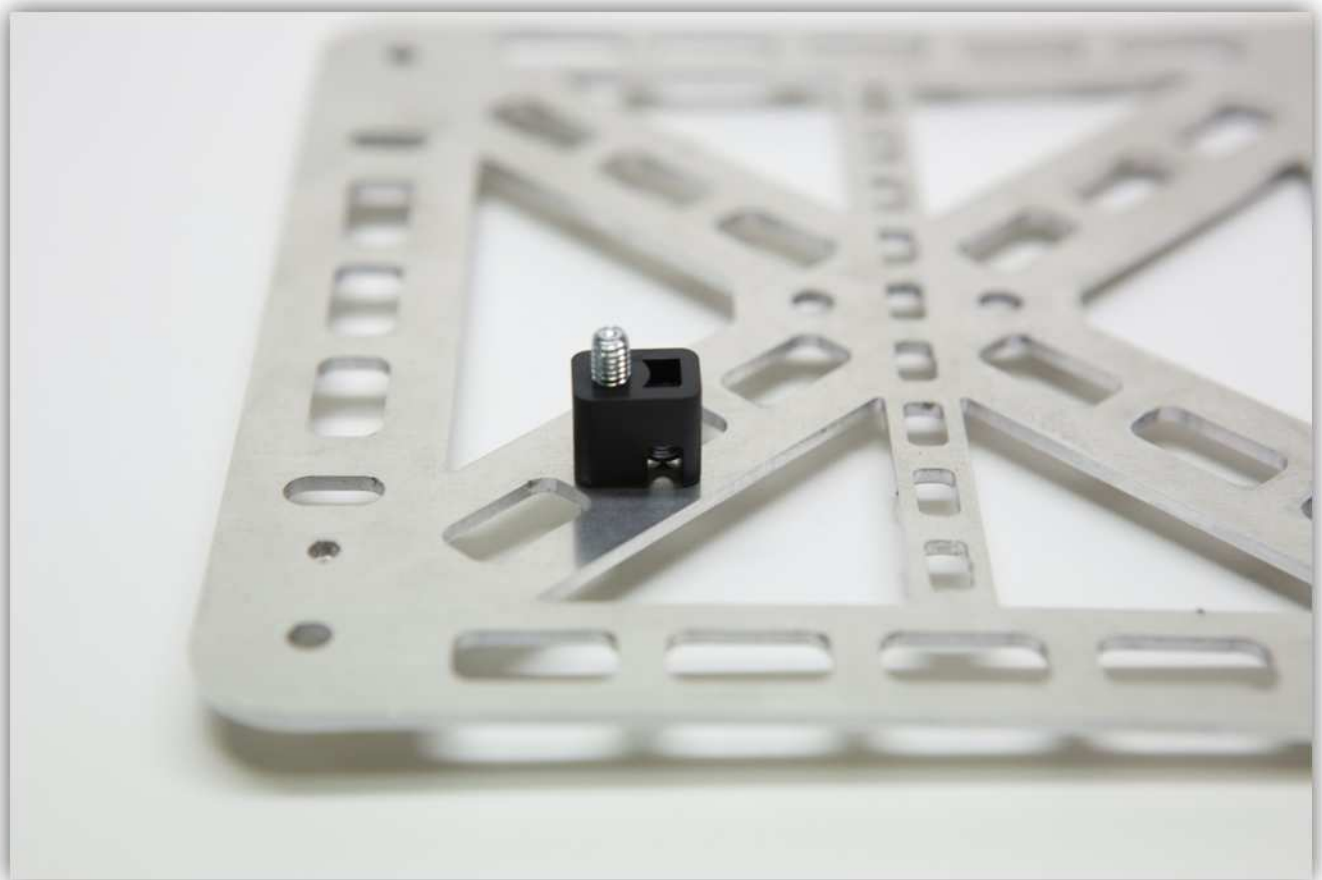


Insert the M4 bolt with an M4 toothed washer as shown in the BED SUPPORT plate (smaller aluminium plate). **Notice the orientation of the aluminium plate. Make sure it is exactly as in the picture.**

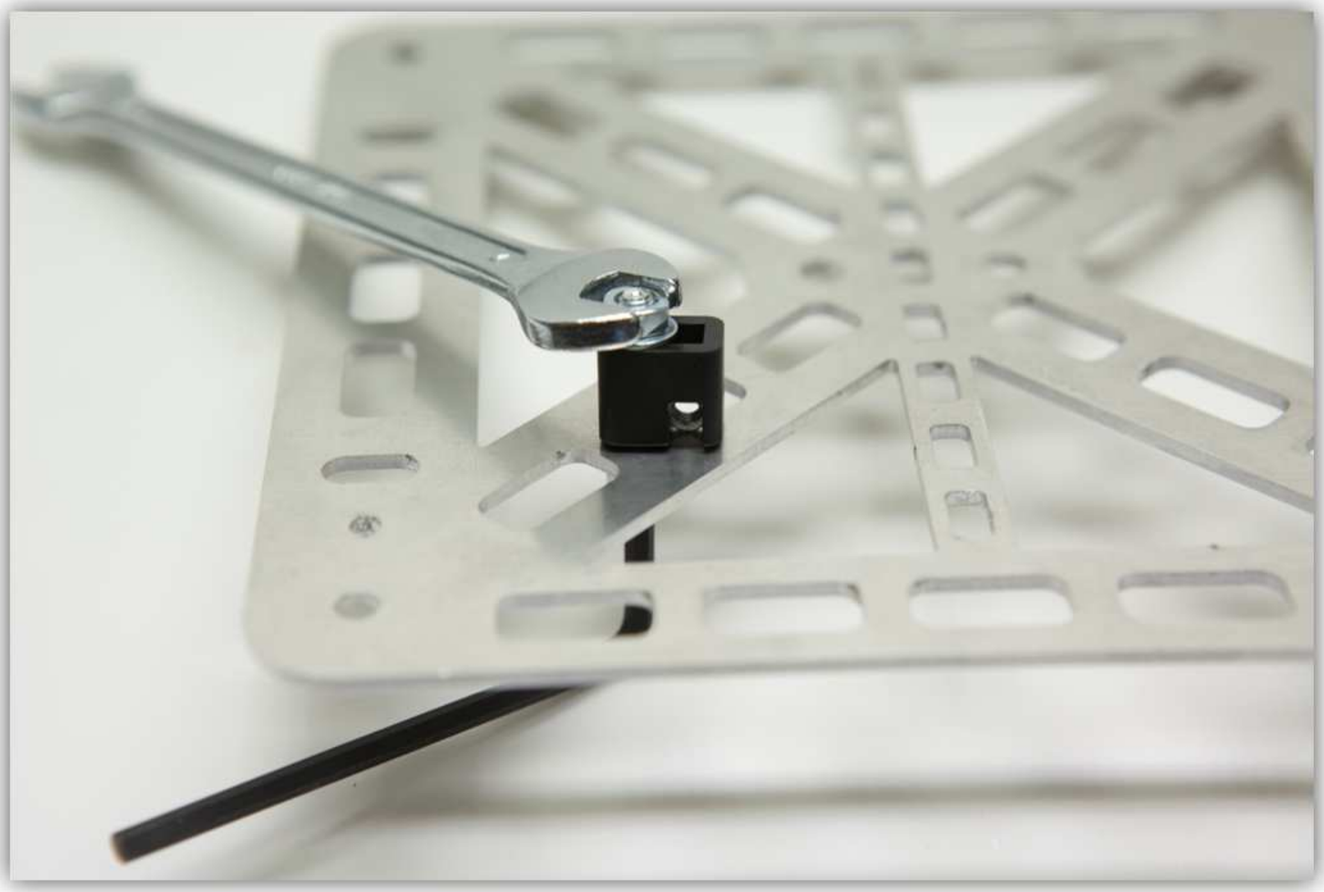


Insert a small M3 nut inside the ADJUST SCREW BRACKET:

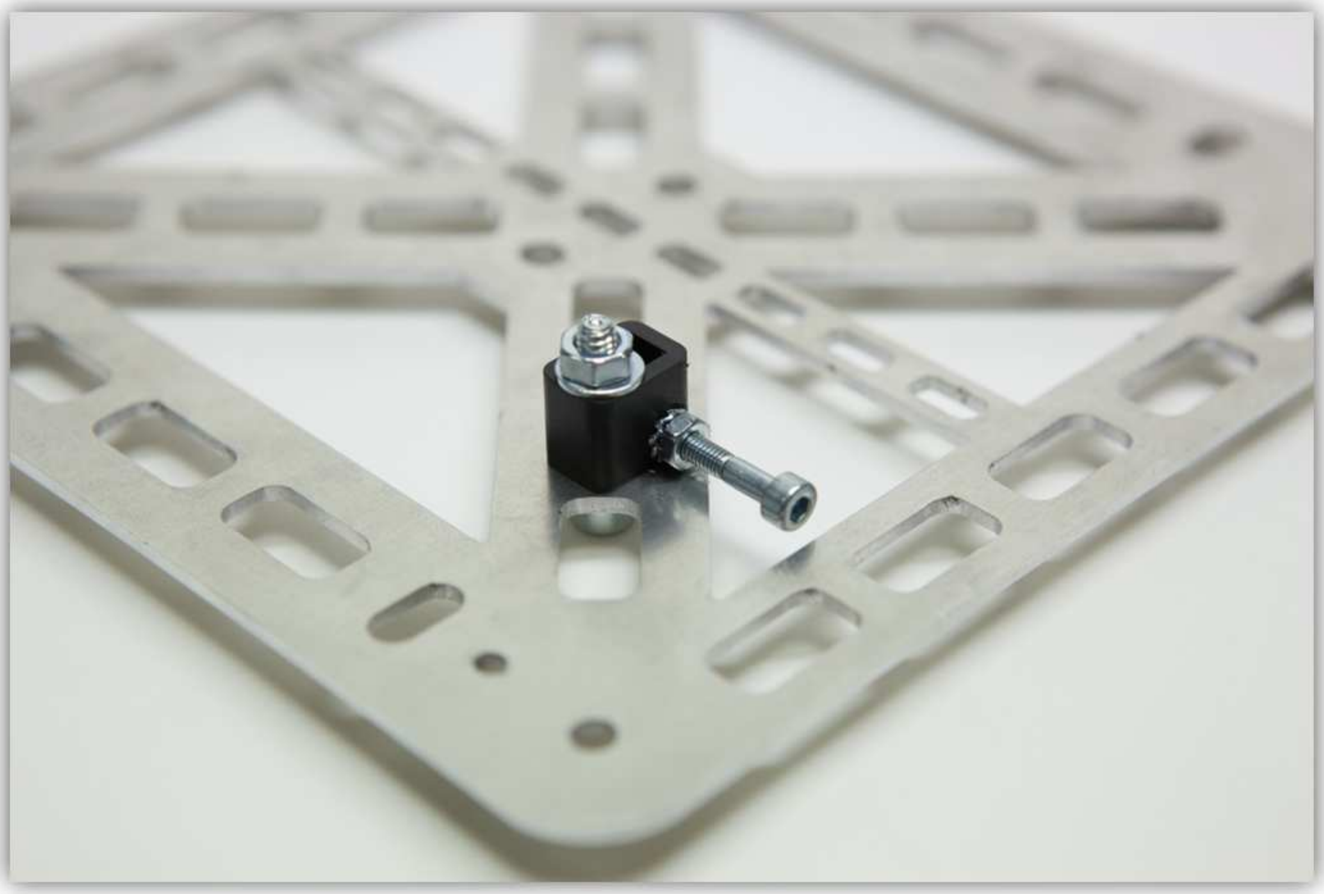
Place this over the M4 bolt. **Notice the orientation of the BED SUPPORT plate. Make sure it is exactly as in the picture.**



Place a M4 washer and an M4 nut on the bolt and tighten everything.



Screw the long M3 bolt with an M3 toothed washer and an M3 nut in the ADJUST SCREW BRACKET as shown in the picture:

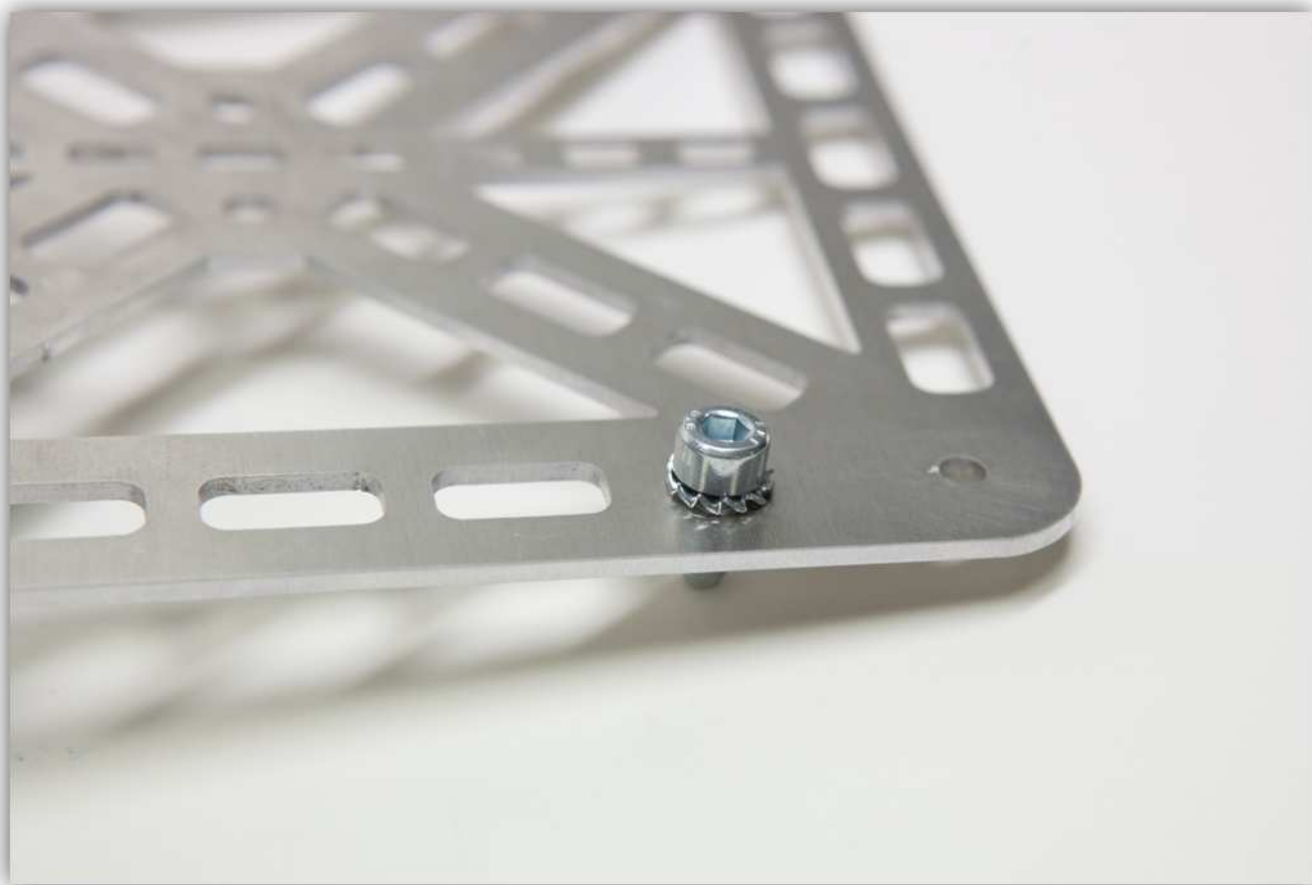


Slide an LM8UU linear bearing in the BEARING CLAMP Y piece as shown in the picture

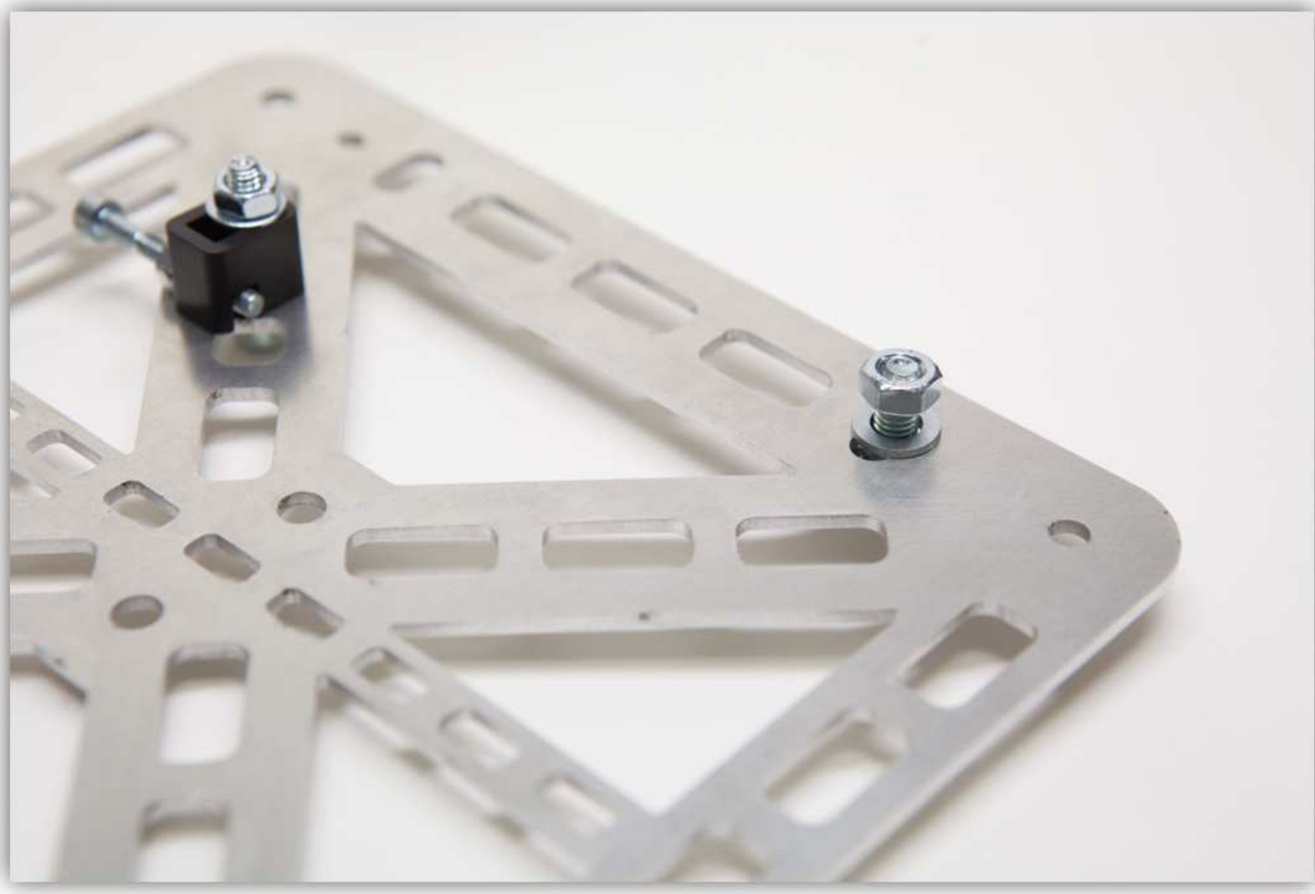
Repeat this 3 more times:

Use the circlip pliers to carefully fit the circlip around the LM8UU linear bearing.

Take an M5 bolt and an M5 toothed washer and insert them in the BED SUPPORT plate as follows:

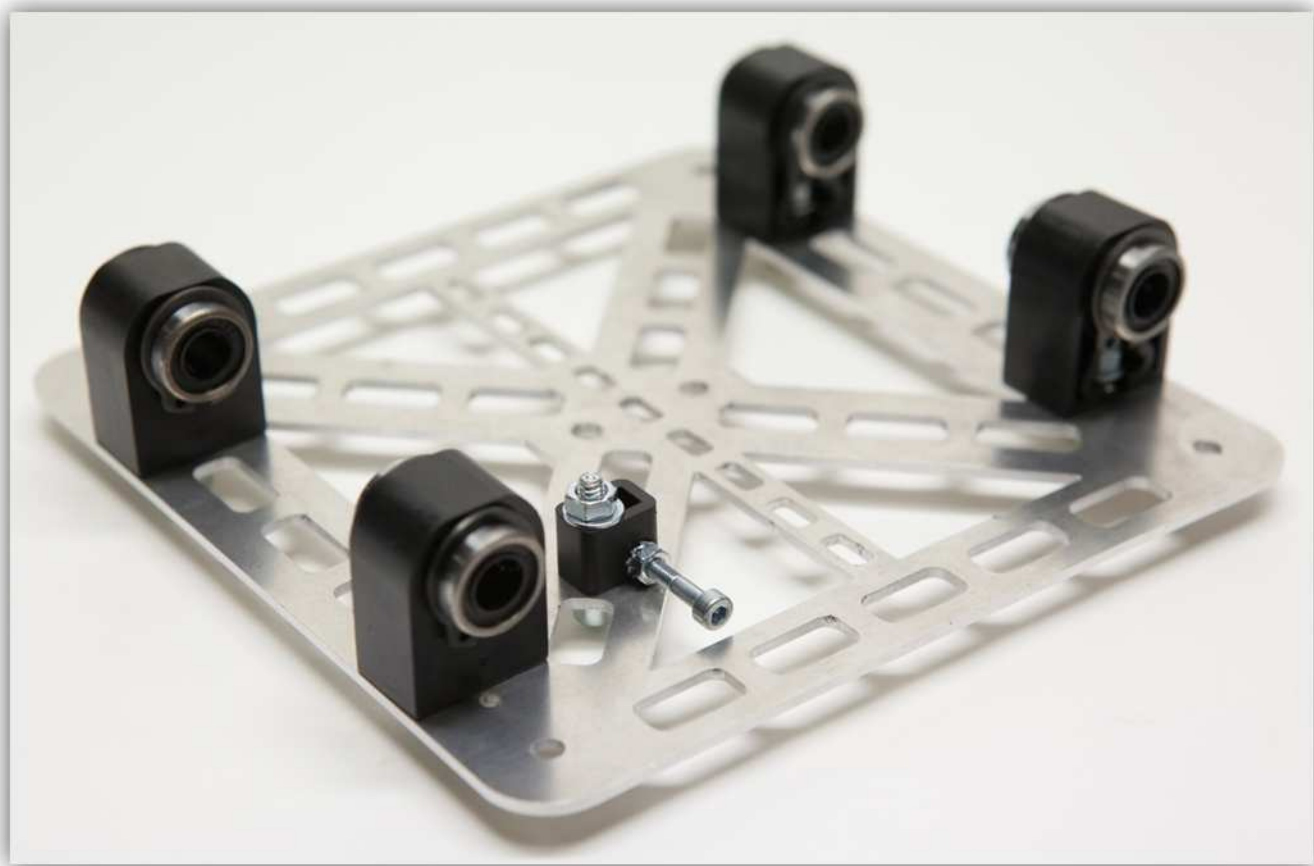


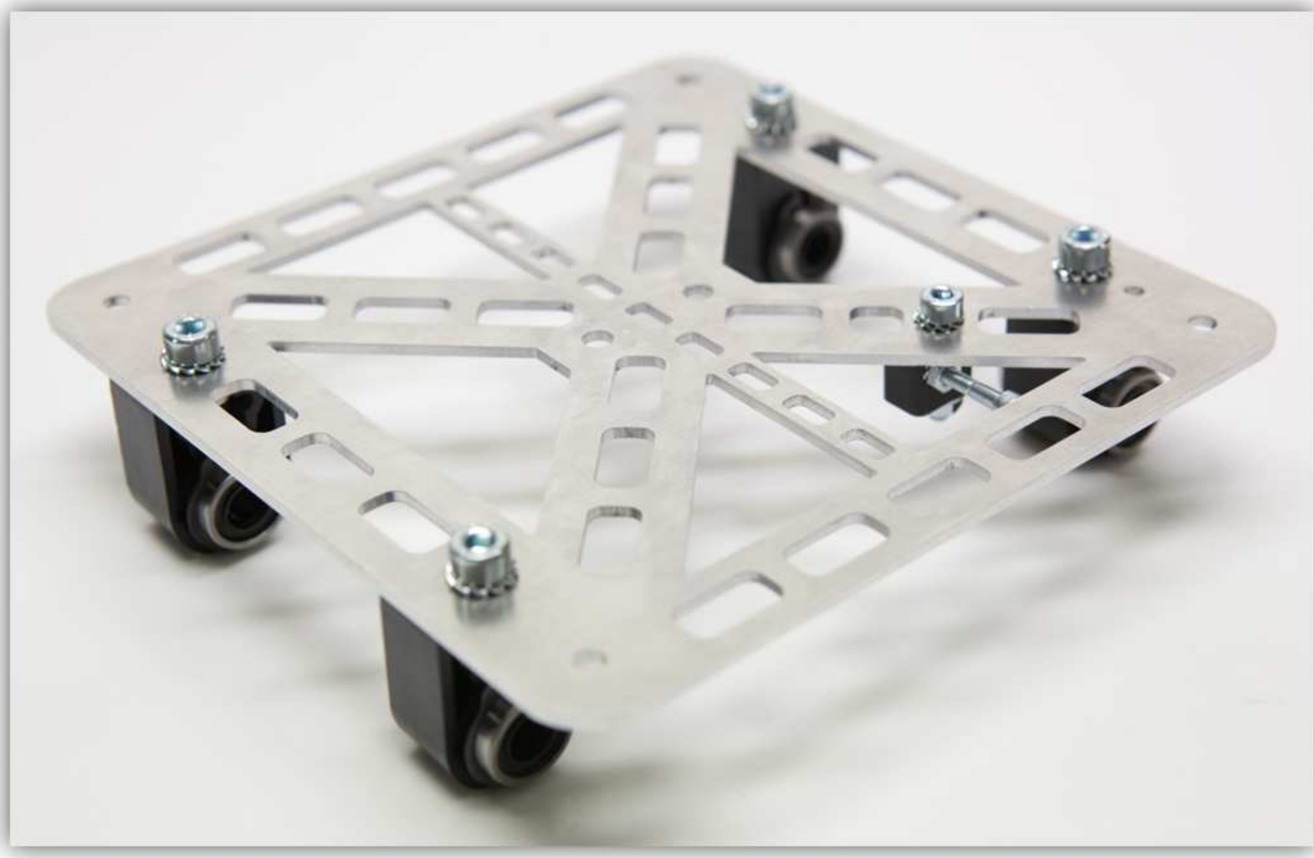
Flip the plate and use an M5 washer and an M5 bolt. **Do not tighten this nut.**



Slide a BEARING CLAMP Y piece over the washer and bolt as follows.

Repeat this process 3 more times, the assembly should look like this:



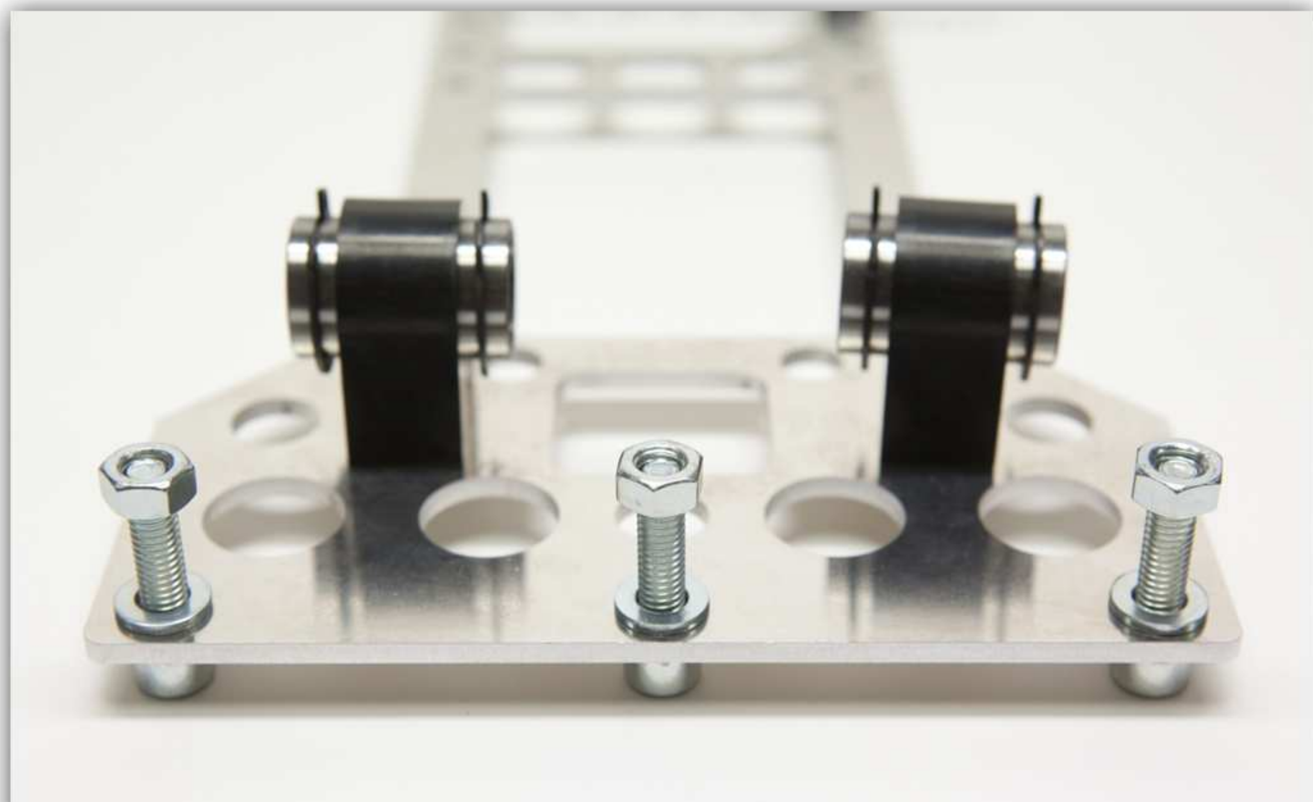


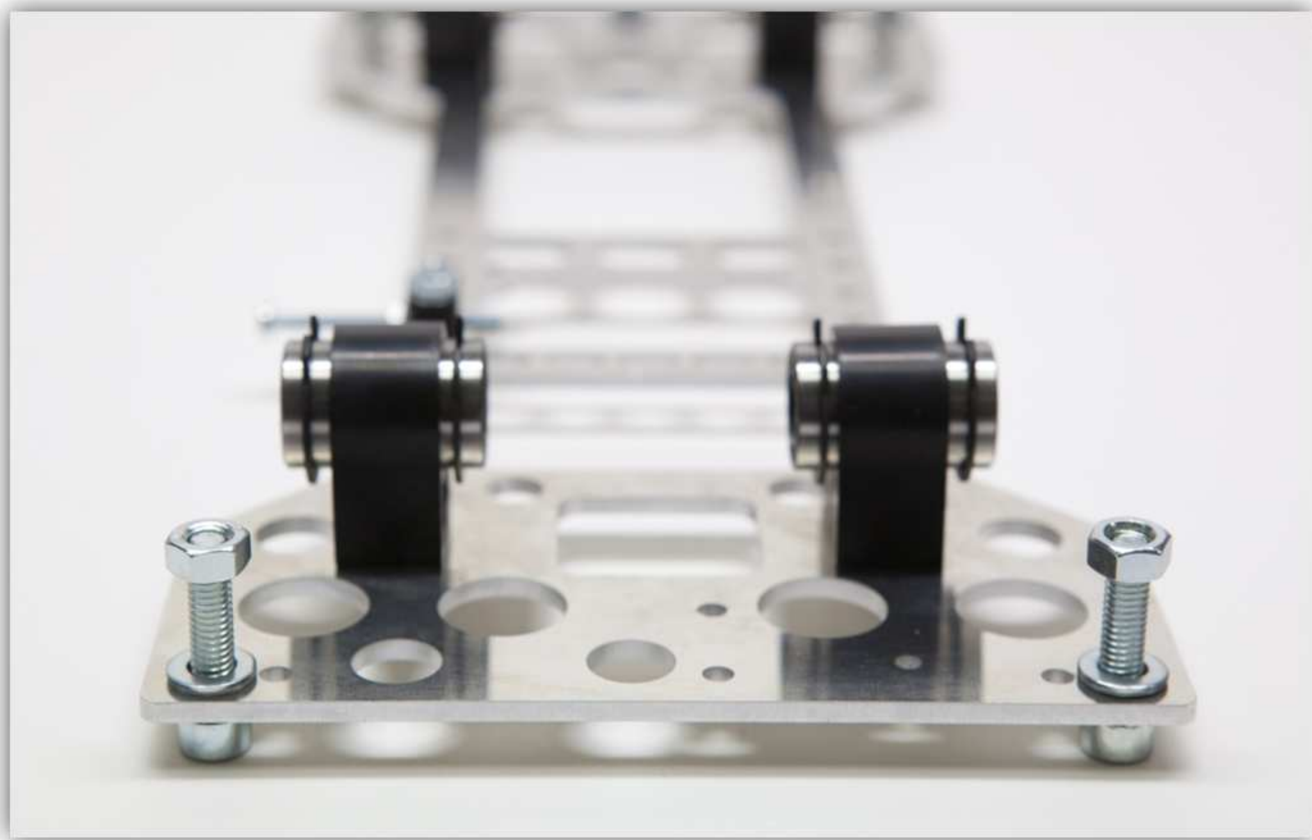
This piece will be referred as the BED SUPPORT CARRIAGE later in the manual.

Take these pieces (BIG Y ROD CLAMP, Y ROD CLAMP RIGHT and Y ROD CLAMP LEFT) as shown in the picture below out of the bag containing the plastic parts:

Take the bag labelled with 6 out of the box, you should have these parts:

Use the long M6 bolts with M6 toothed washers as follows:



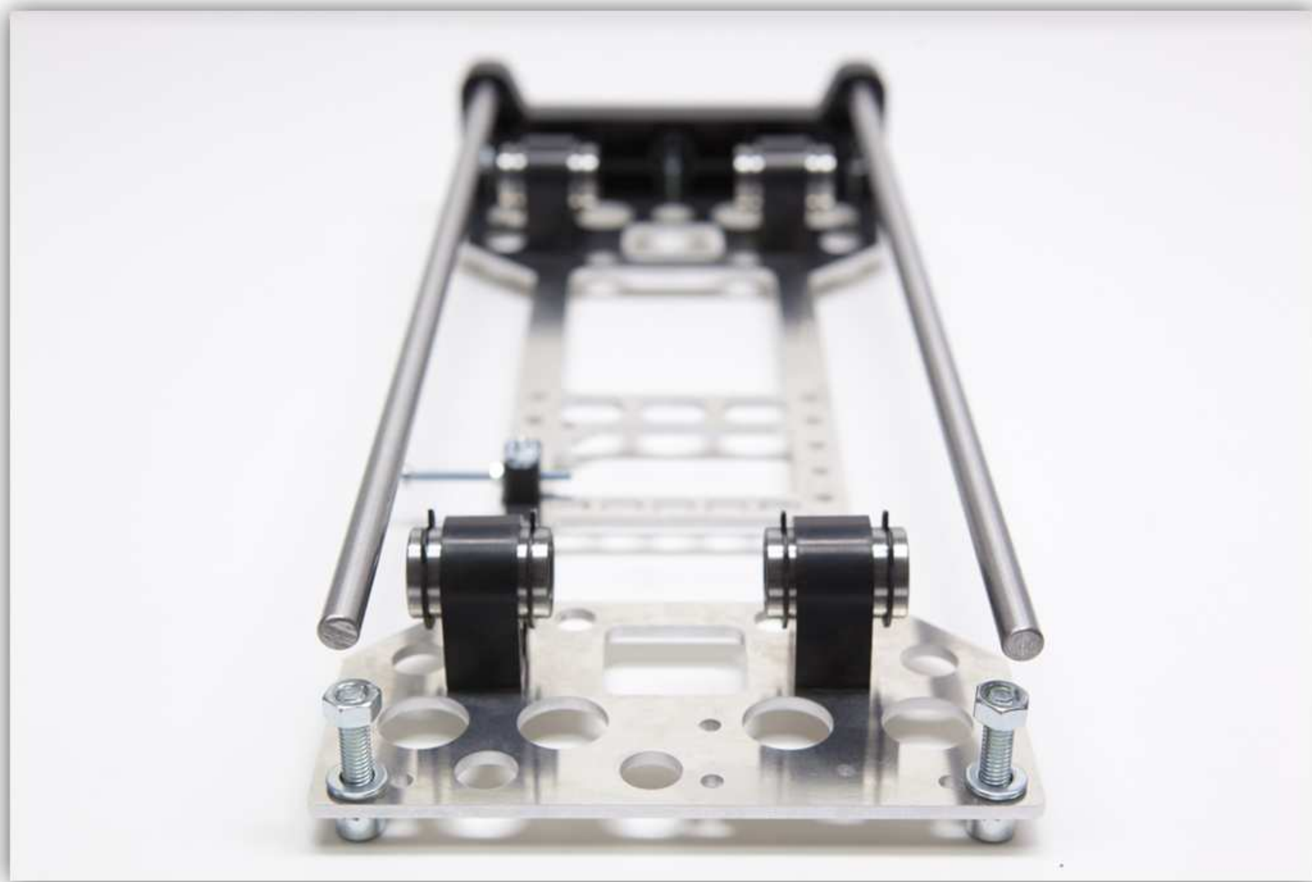


Slide the BIG Y ROD CLAMP part over the bolts and washer on the side with the 3 M6 bolts:

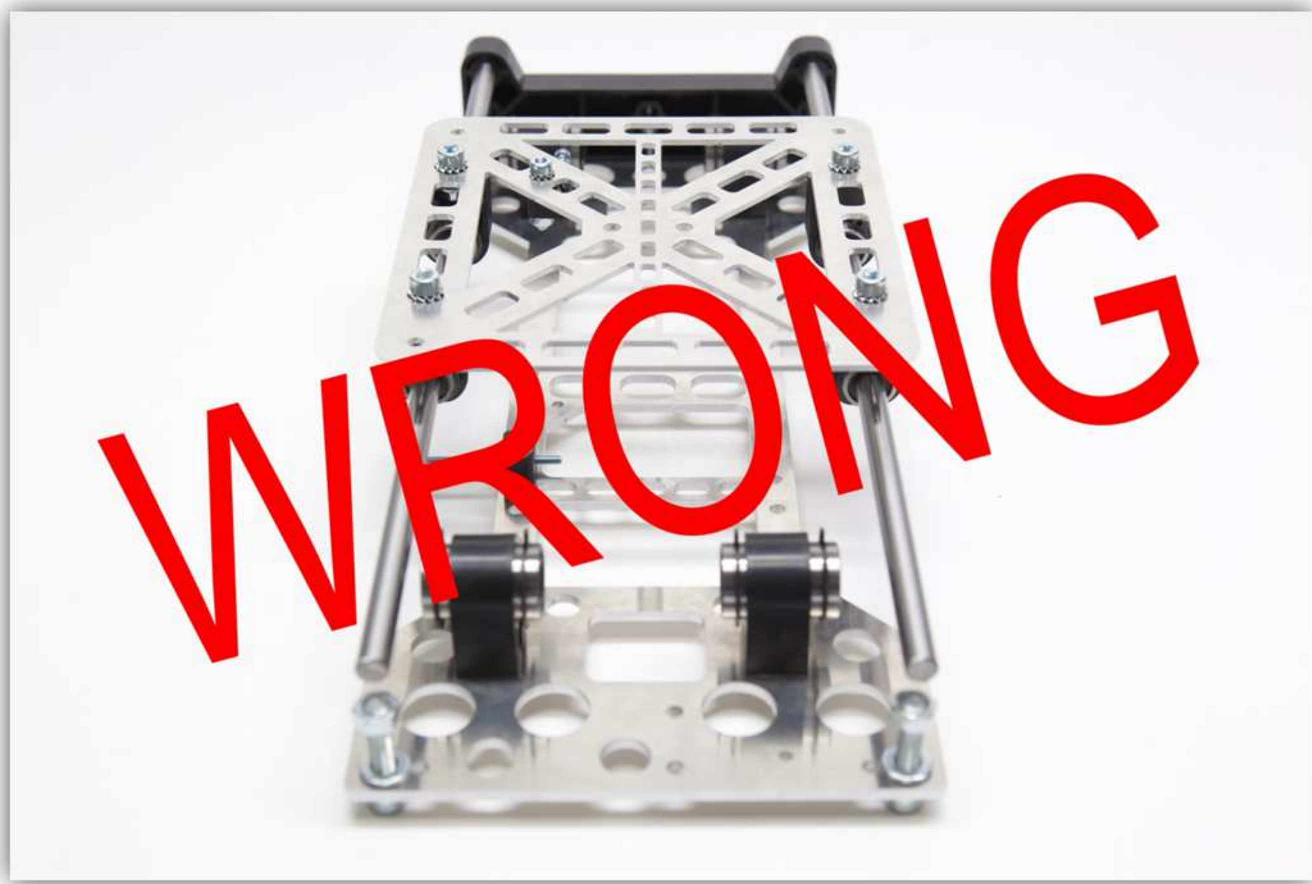
Tighten the 3 M6 bolts.

Out of the bag labelled with 7 get two smooth rods with a diameter of 8 mm (0.31") and a length of 32.5 cm (12.8").

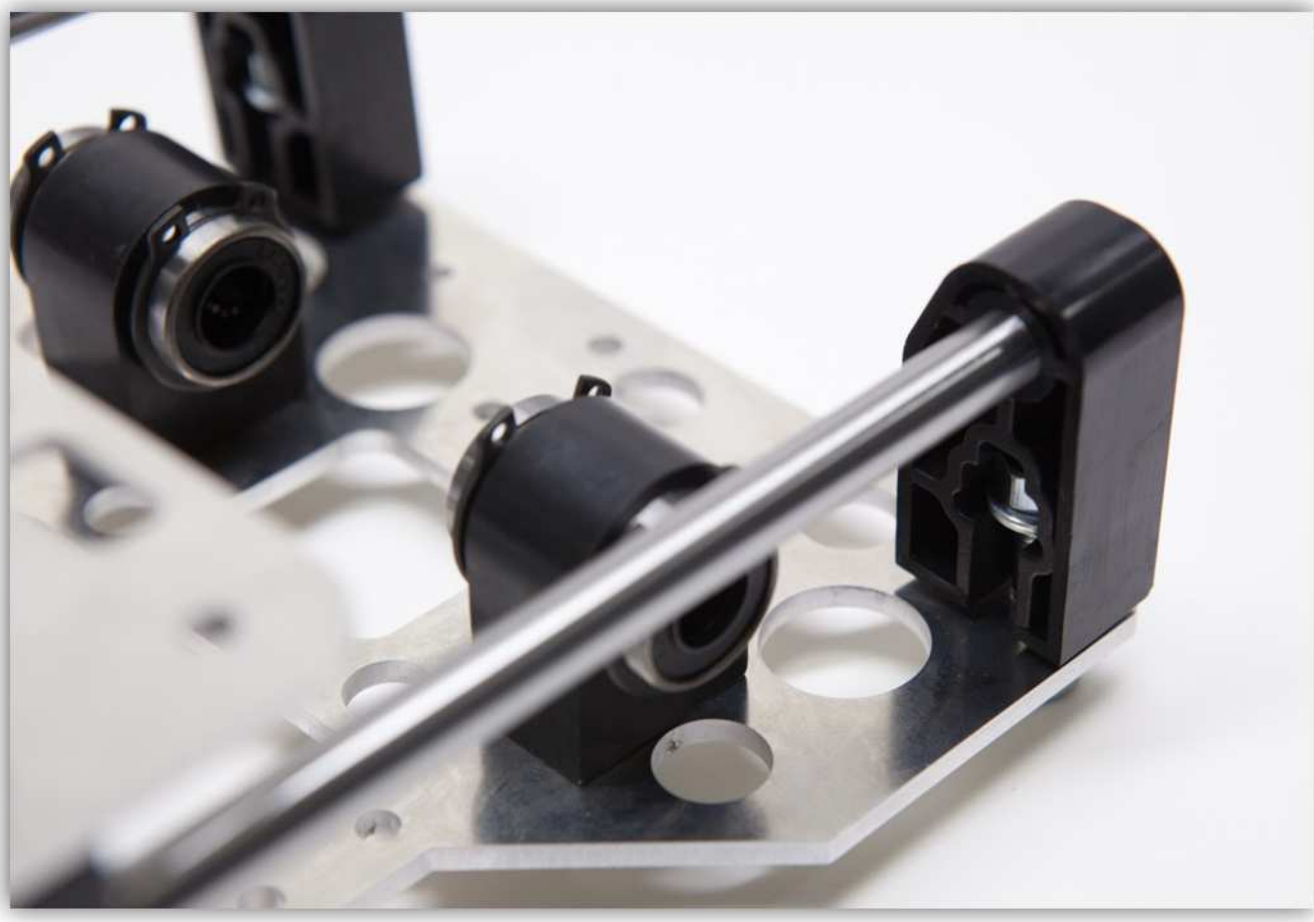
Slot the two rods in the BIG Y ROD CLAMP part.



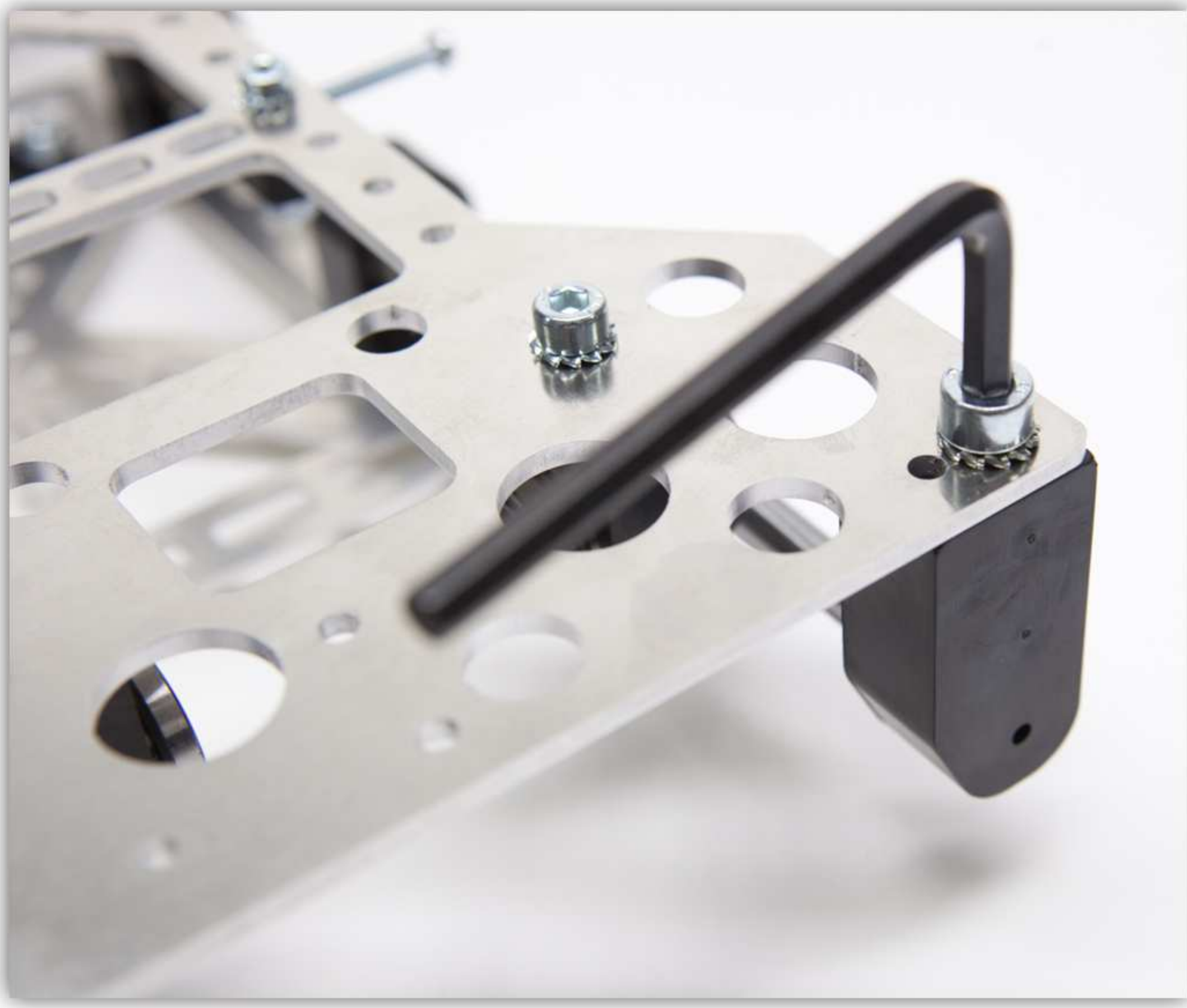
Slide the BED SUPPORT CARRIAGE over these two rods. **Notice the orientation.**



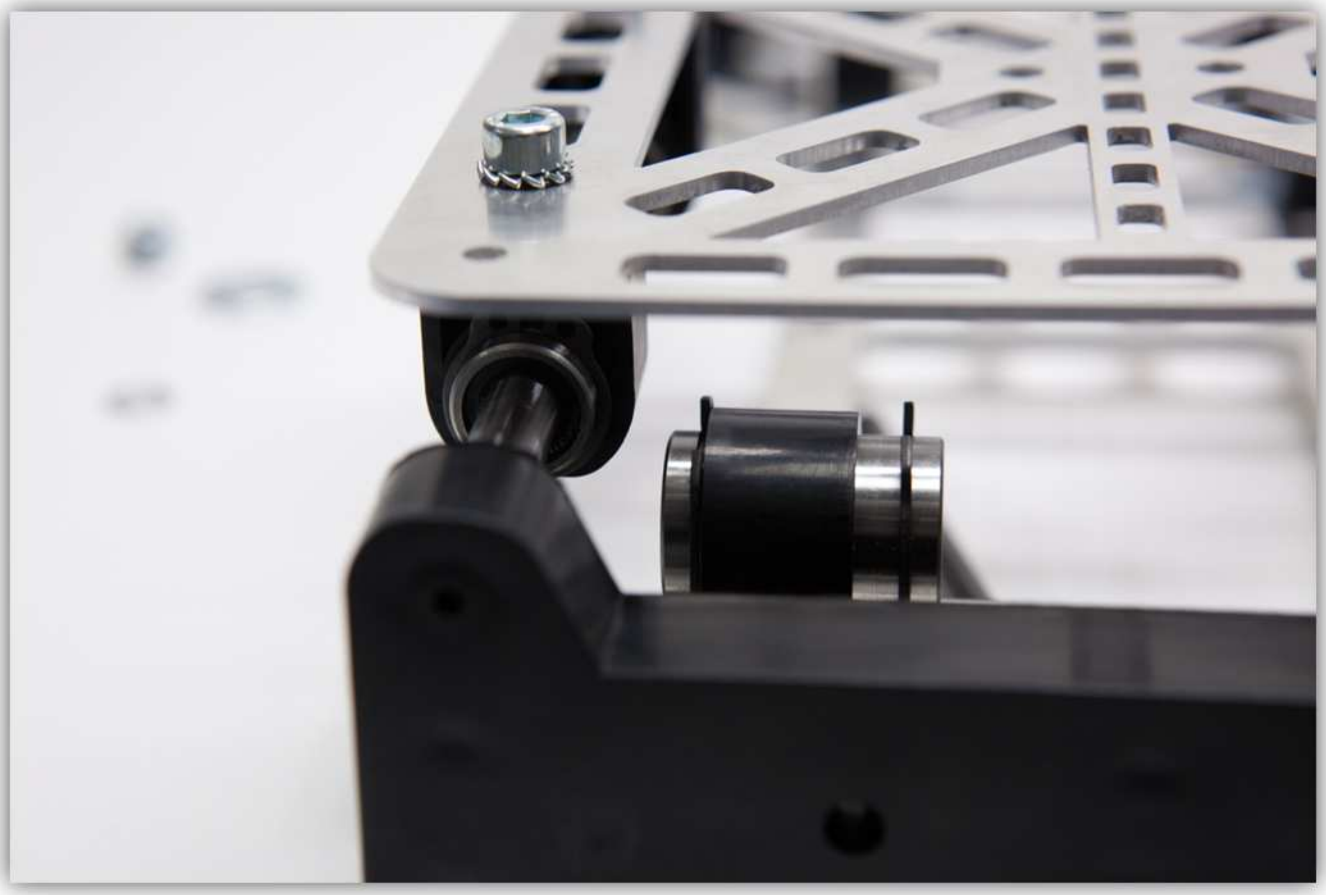
Slide the two smaller plastic pieces (Y ROD CLAMP LEFT and Y ROD CLAMP RIGHT) over the bolt and washer and make sure that the rods slot nicely in these parts.

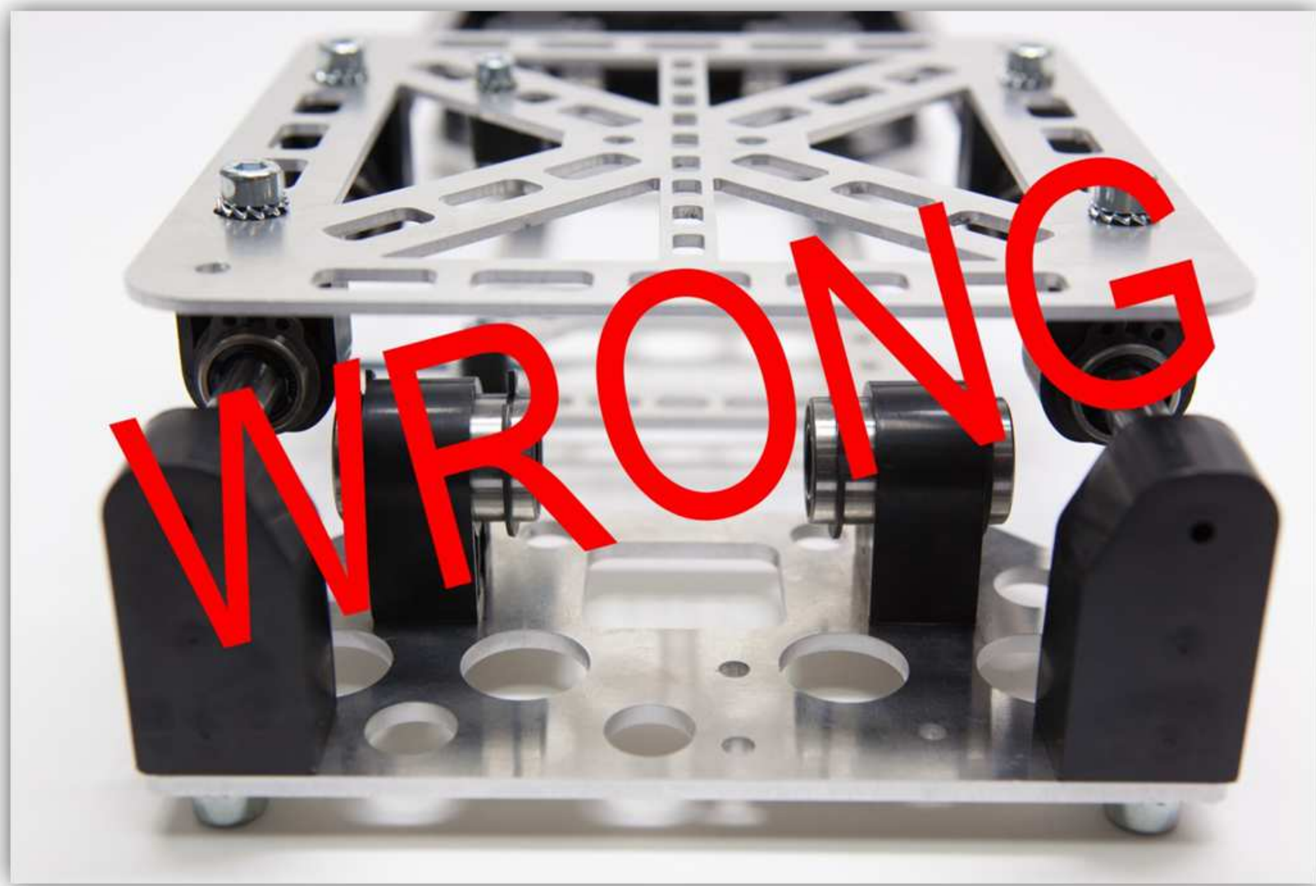


Tighten these bolts firmly.



Make sure there is enough clearance between the points marked with a red arrow.

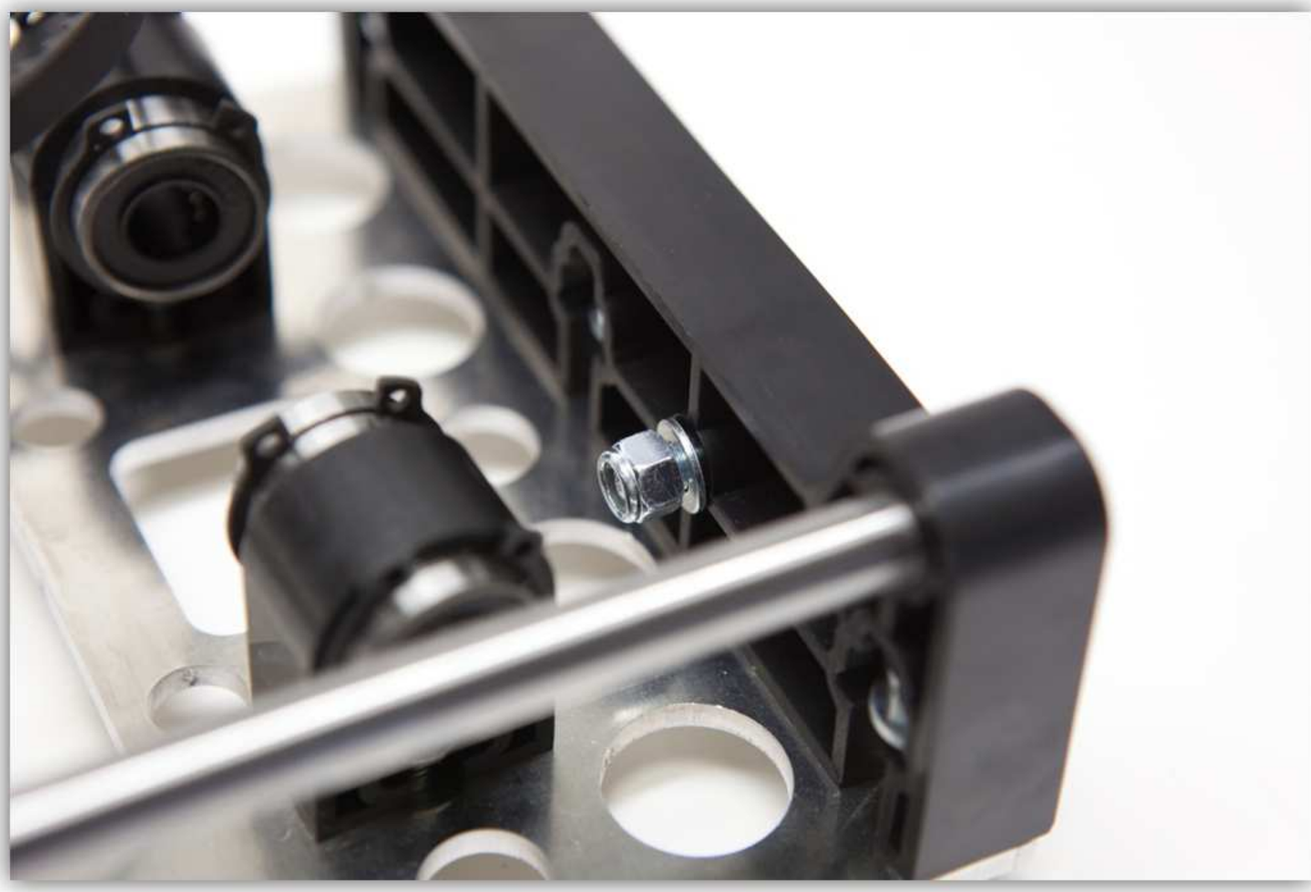



WRONG

Now while moving the BED PLATE SUPPORT CARRIAGE left and right you can tighten the bolts that keep the LM8UU linear bearings in place. Ensure a smooth motion while tensioning these bolts. When the motion is not fluid, loosen the bolts and start over tensioning them.

Use the M5 bolt and the large M5 washer as follows:

And the small M5 washer and an M5 locking nut on the other end. **Do not tighten the locking nut. Just put it on so it won't fall off. We will come back to this part in a few steps.**



Take the bag labelled with 8 out of the box, you should have these parts:

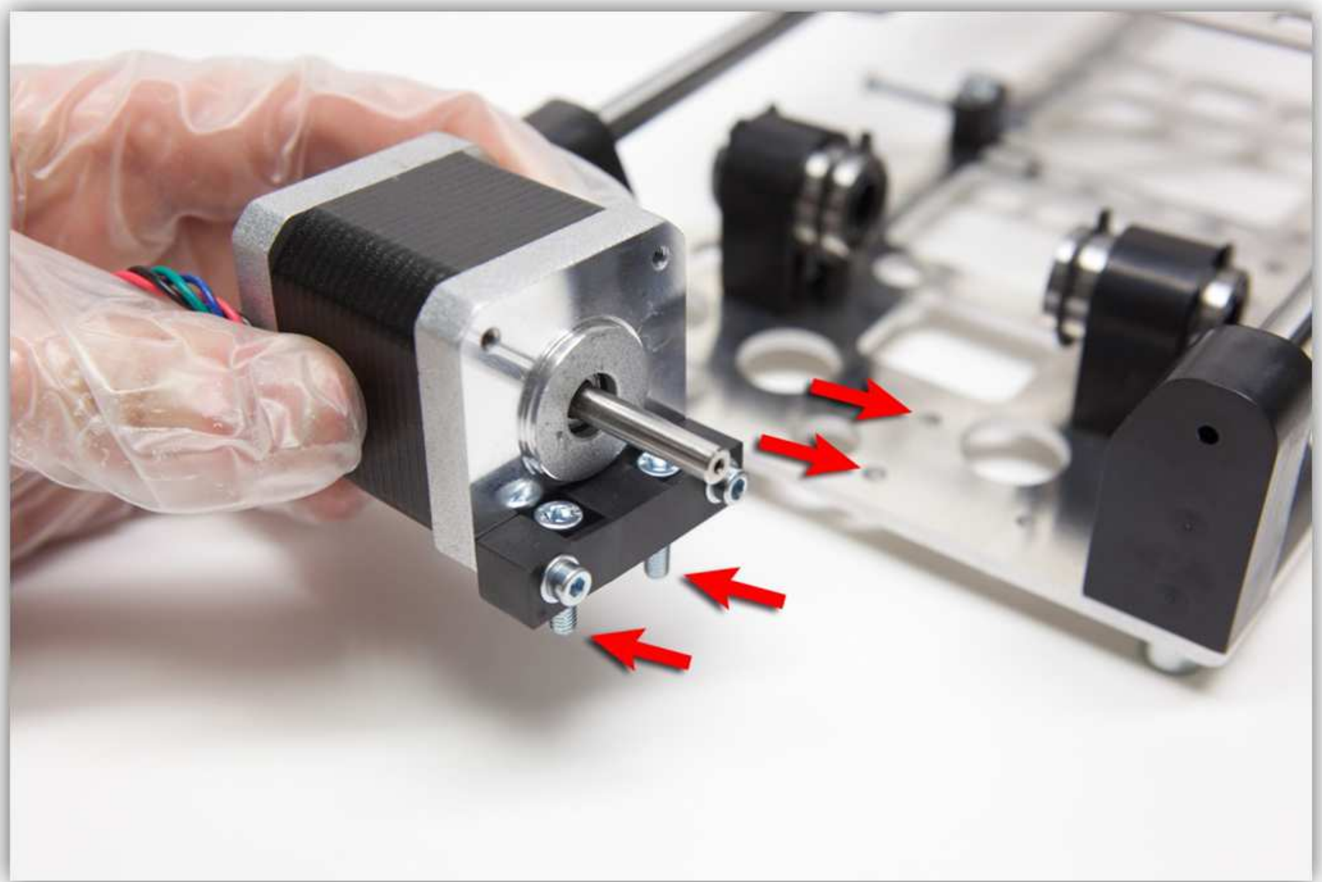
Search the piece (MOTOR MOUNT) as shown in the picture below out of the bag containing the plastic parts:

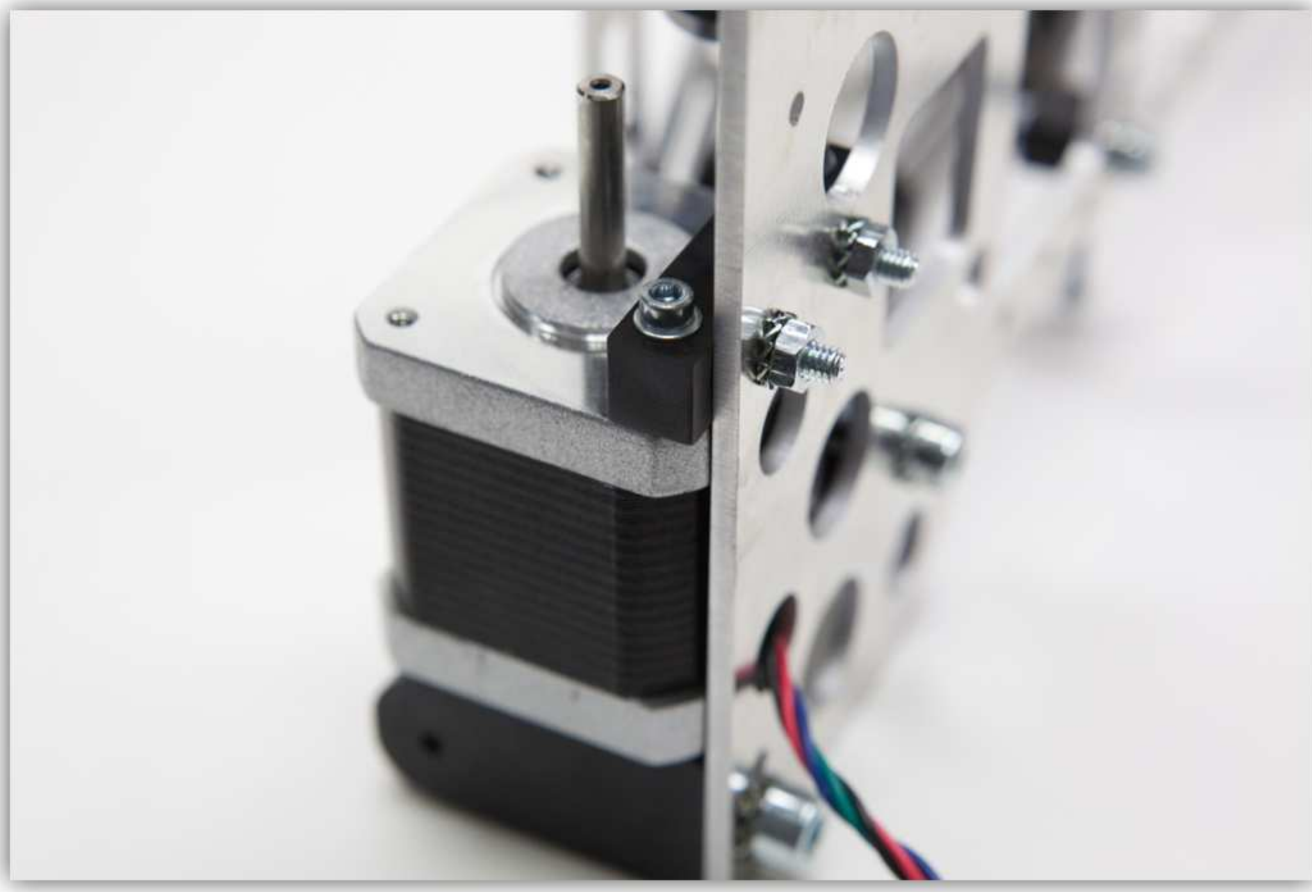
Take 1 motor out of the package labelled 9.

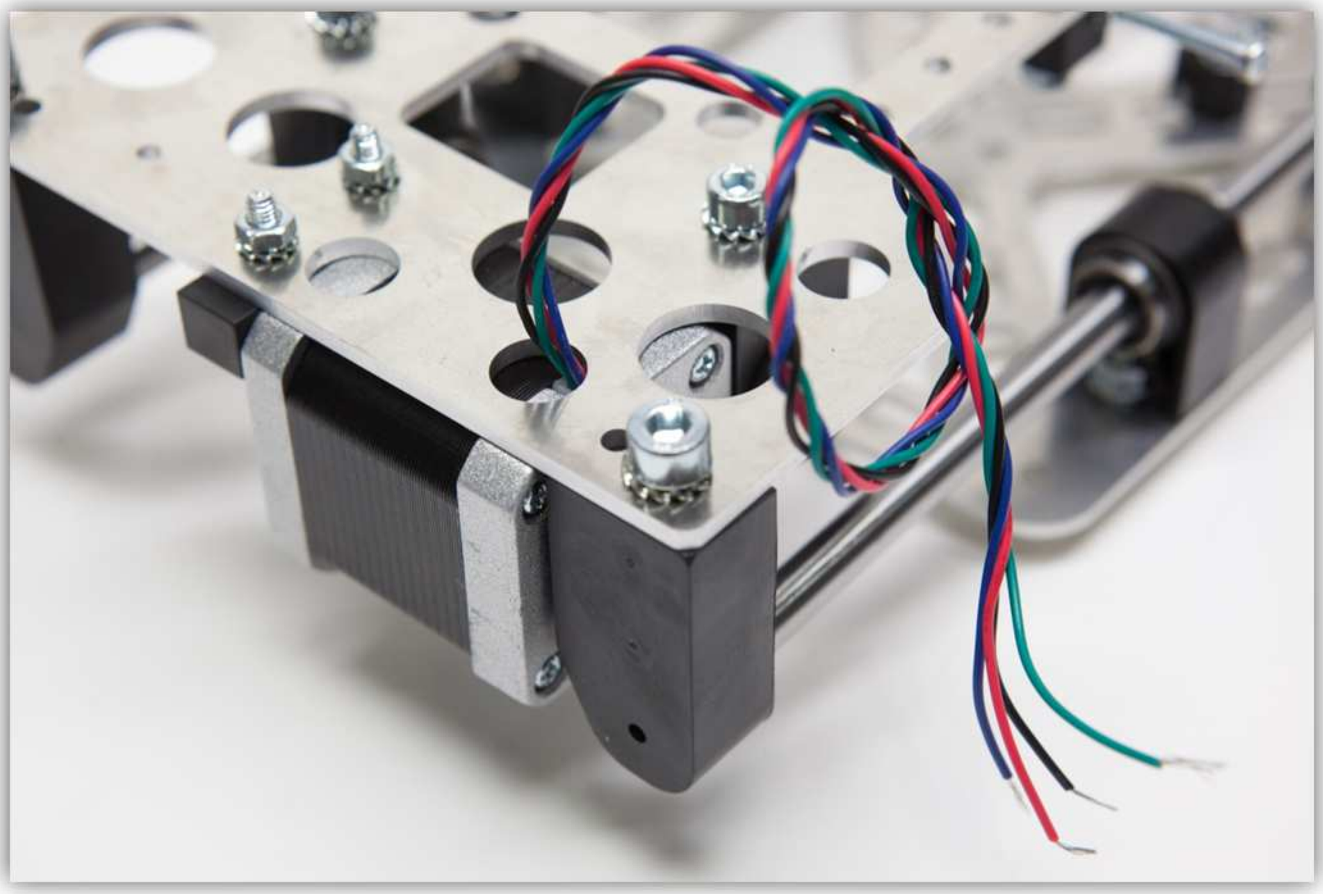
Use the 2 M3 bolts with an M3 washer to bolt the MOTOR MOUNT to the motor. **Notice the orientation of the wires.**

Insert the 2 M4 bolts as follows:

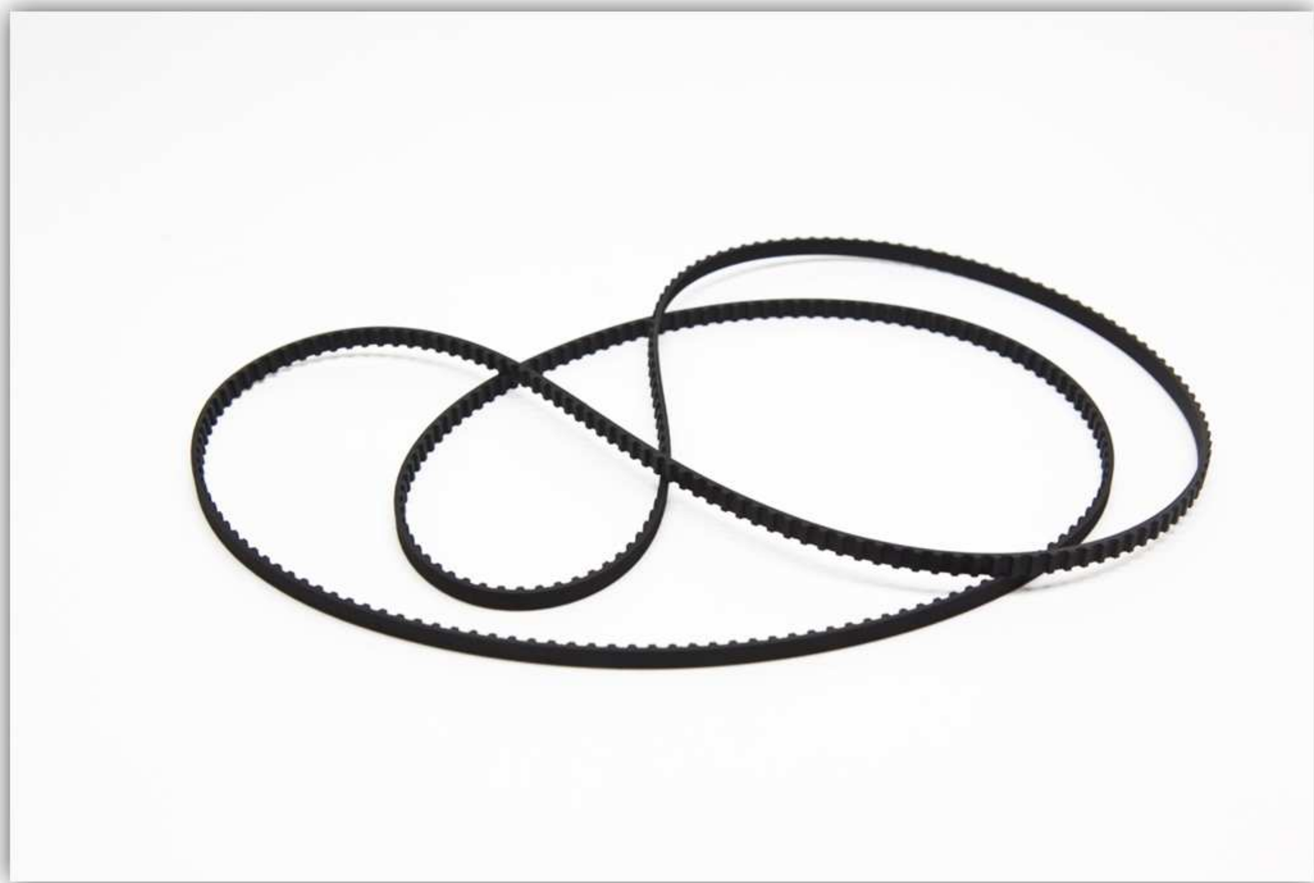
Place the assembly as follows on the X CARRIAGE and use 2 M4 toothed washers and M4 bolts to secure the motor. Make sure that the motor is mounted level and on a 90° angle with the rods and that the wires are through the large hole of the X CARRIAGE.



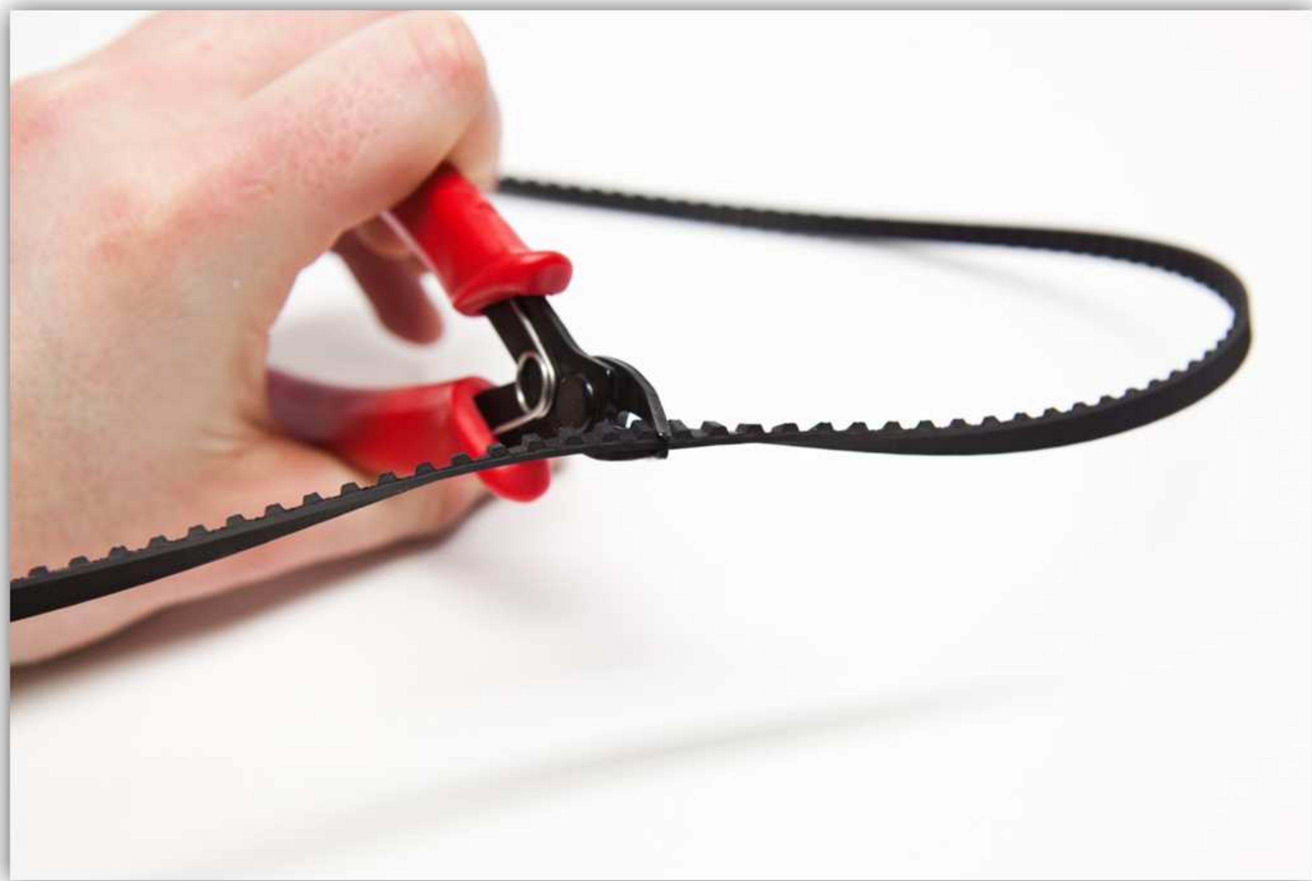


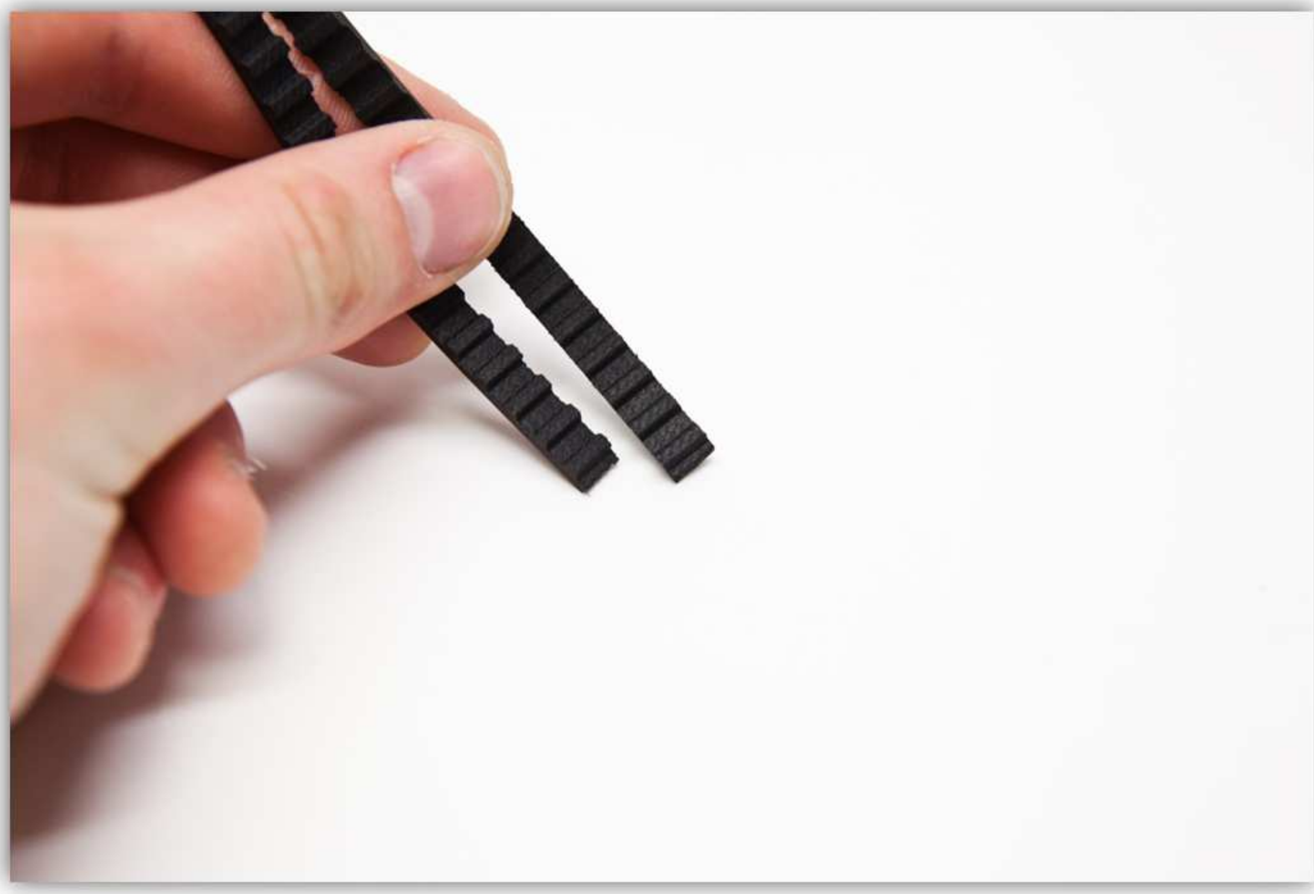


Take the bag labelled with 10 out of the box, you should have these parts:



Cut the belt once.





Now from the end you just cut, measure the belt for **63.5 cm (25") or 127 teeth. This measurement is critical. We advise to count the teeth and also measure the distance before cutting.**

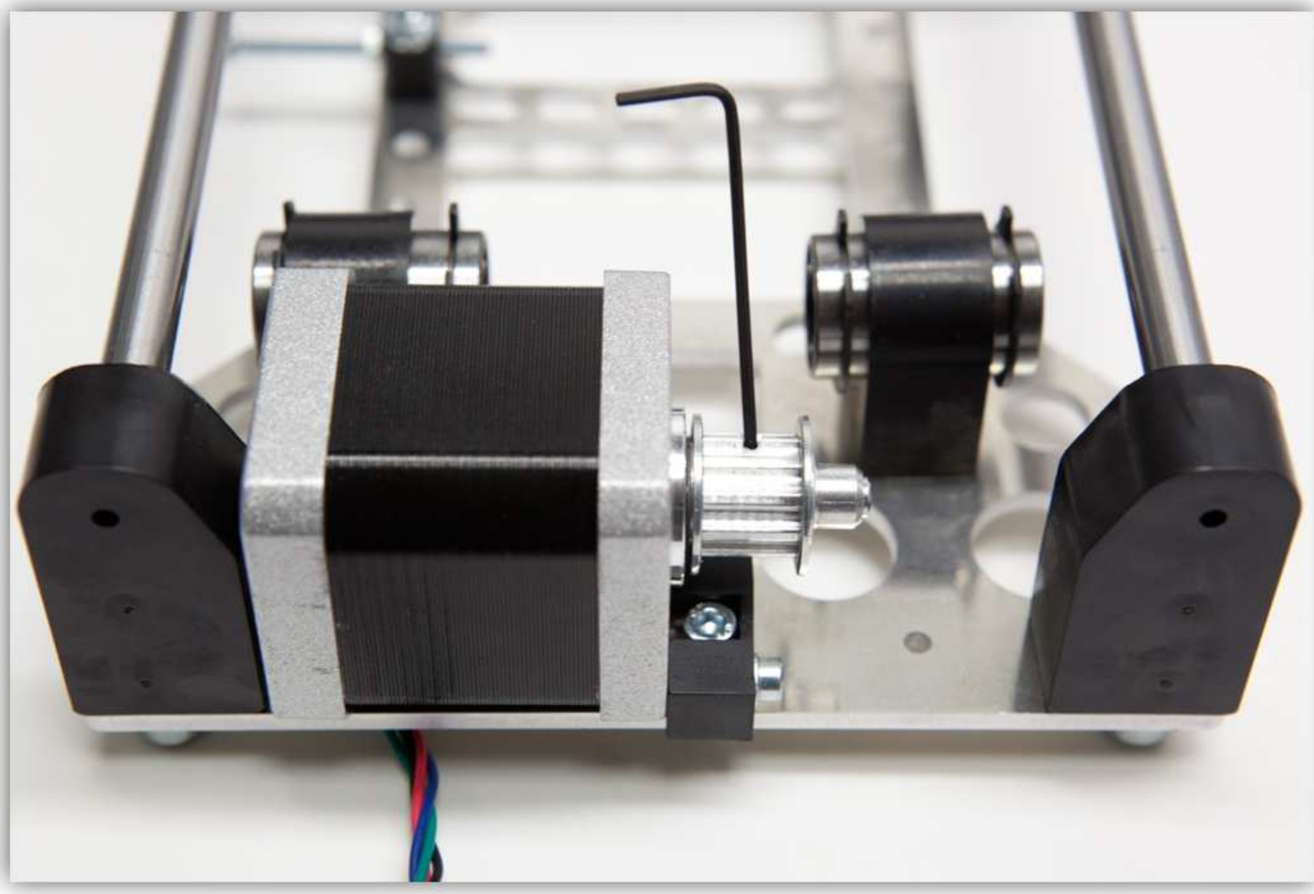
The other half should be approx. 86 cm (33.9"). For this stage in the build we shall need the piece of 63.5 cm (25"). Store the piece of 86 cm (33.9") for later use**.**

Take these pieces (BELT CLAMP A and BELT CLAMP B) as shown in the picture below out of the bag containing the plastic parts:

Take the pulley and the small M3 locking bolt.

Screw the bolt into the pulley.

Slide the pulley over the motor shaft as shown and tighten the small locking bolt.

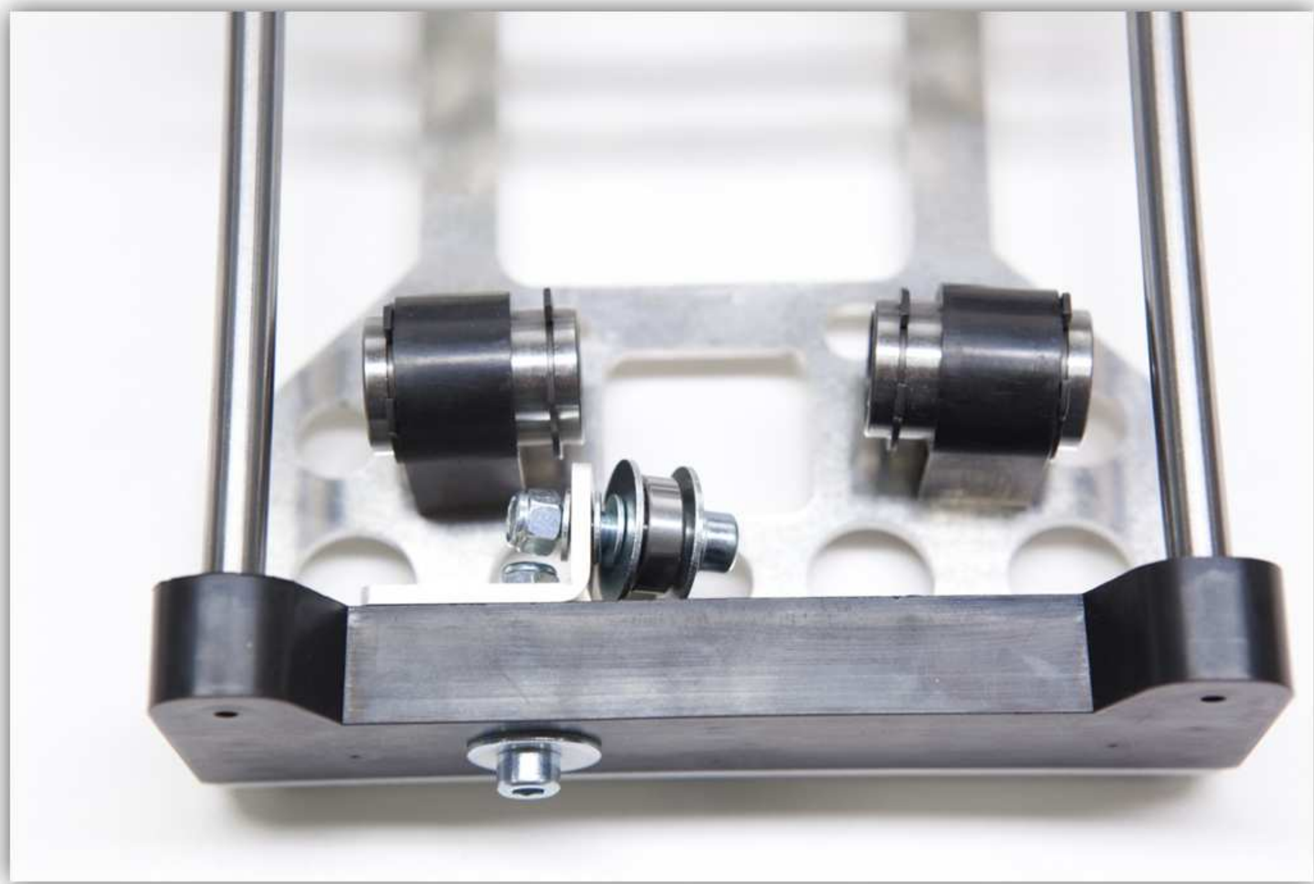


Loosen the bolt and washer on the BIG Y ROD CLAMP you mounted earlier.

Place the small aluminium bracket as shown in the picture and tighten the assembly.

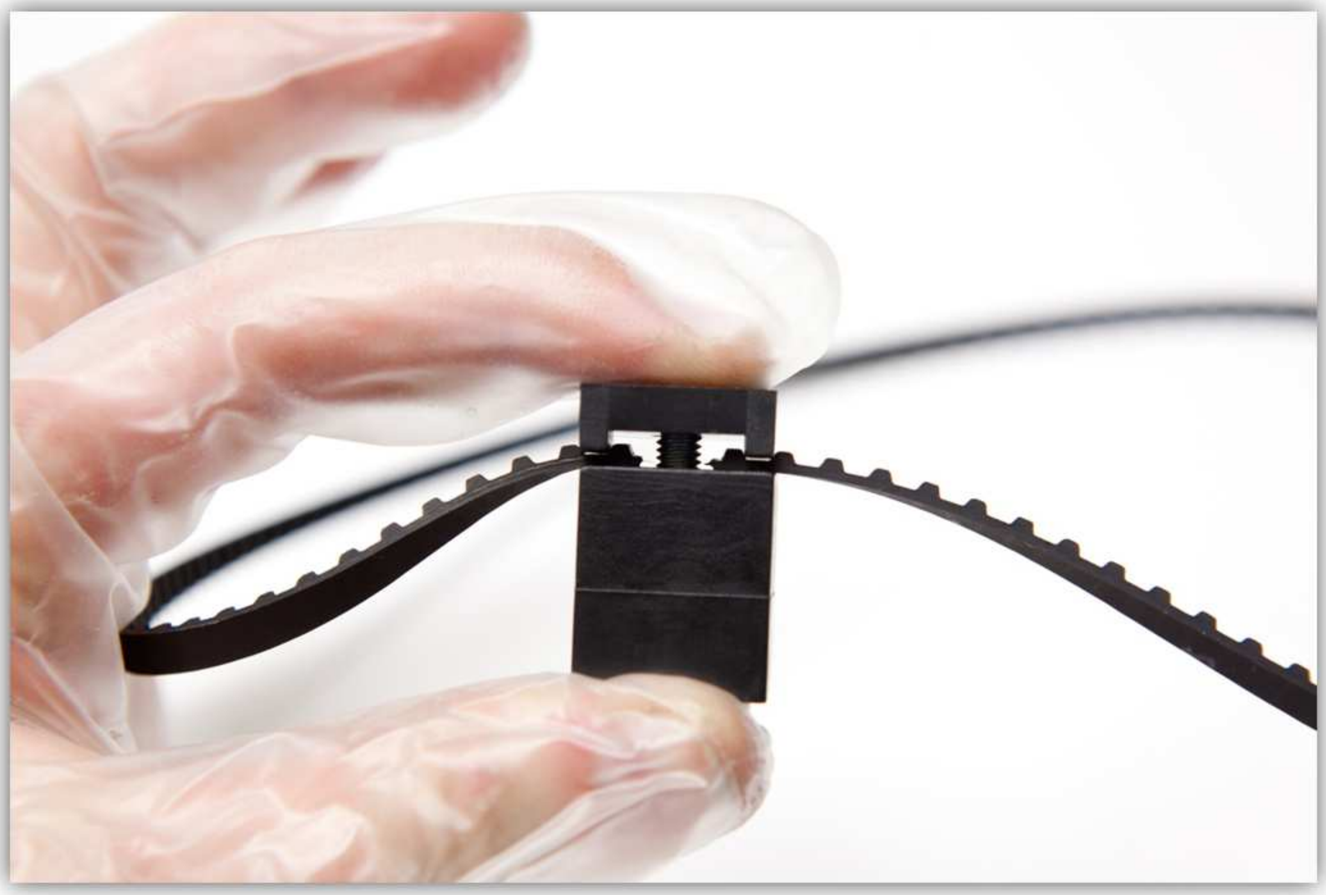
Use the M5 bolt, the 625 bearing, 6 M5 washers and 2 large M5 washers to assemble the following:

Use an M5 locking nut and an M5 washer and mount the assembly as shown in the picture. **Do not tighten this assembly.**

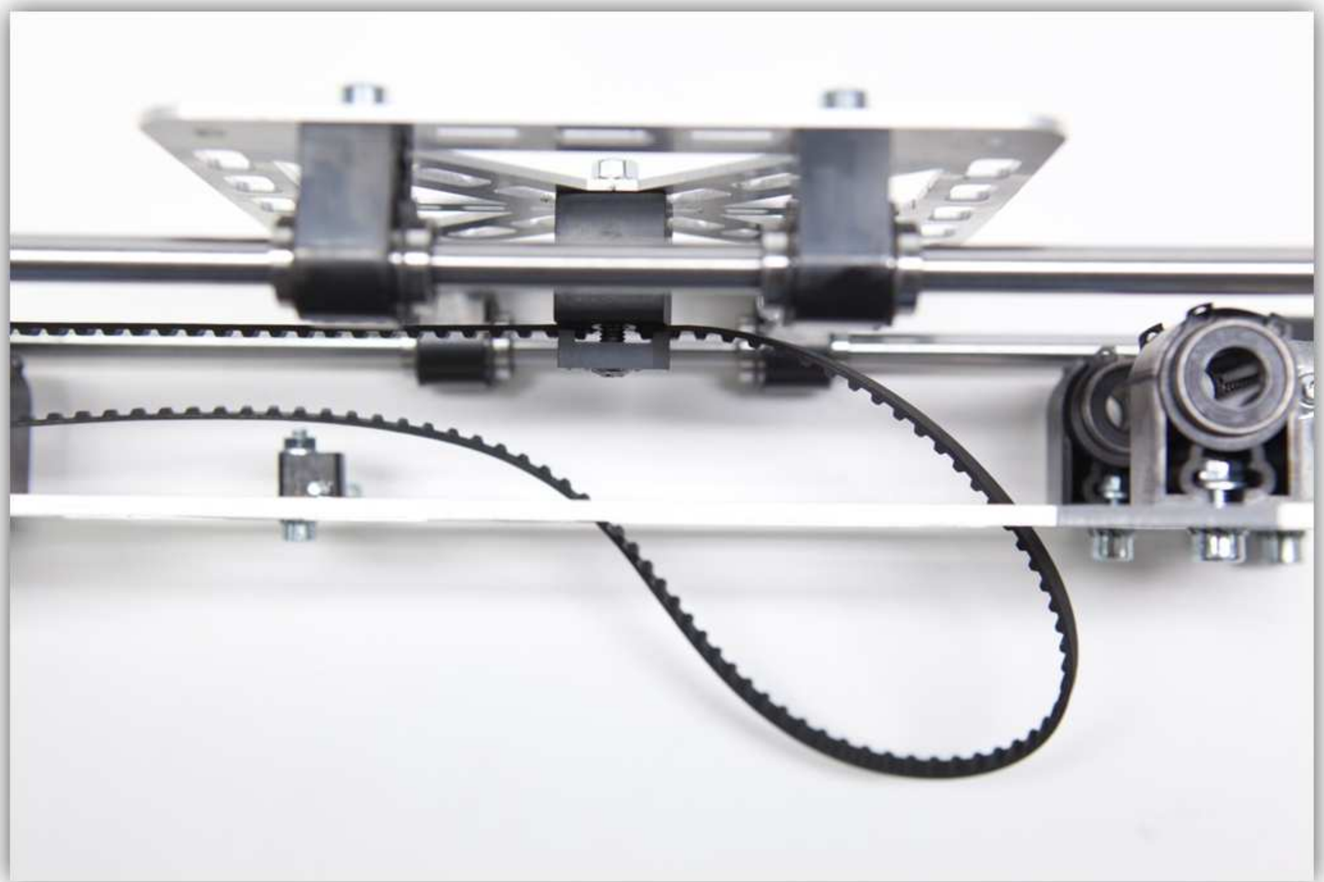


Take the long M5 bolt, the belt and the 2 plastic pieces (BELT CLAMP A and BELT CLAMP B).

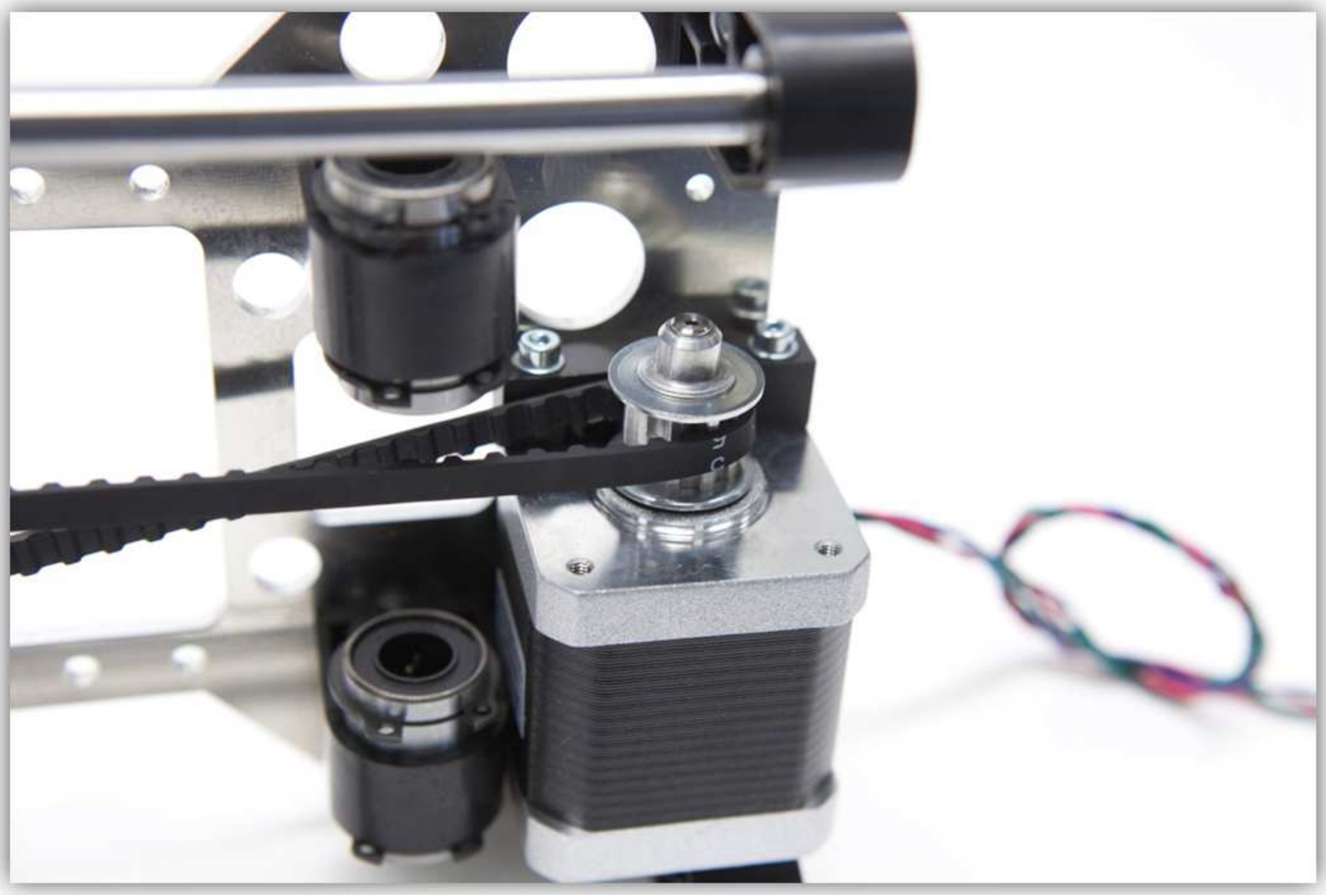
Assemble them as shown in the picture. **Take notice that the belt sits between the clamps exactly as in the picture.**

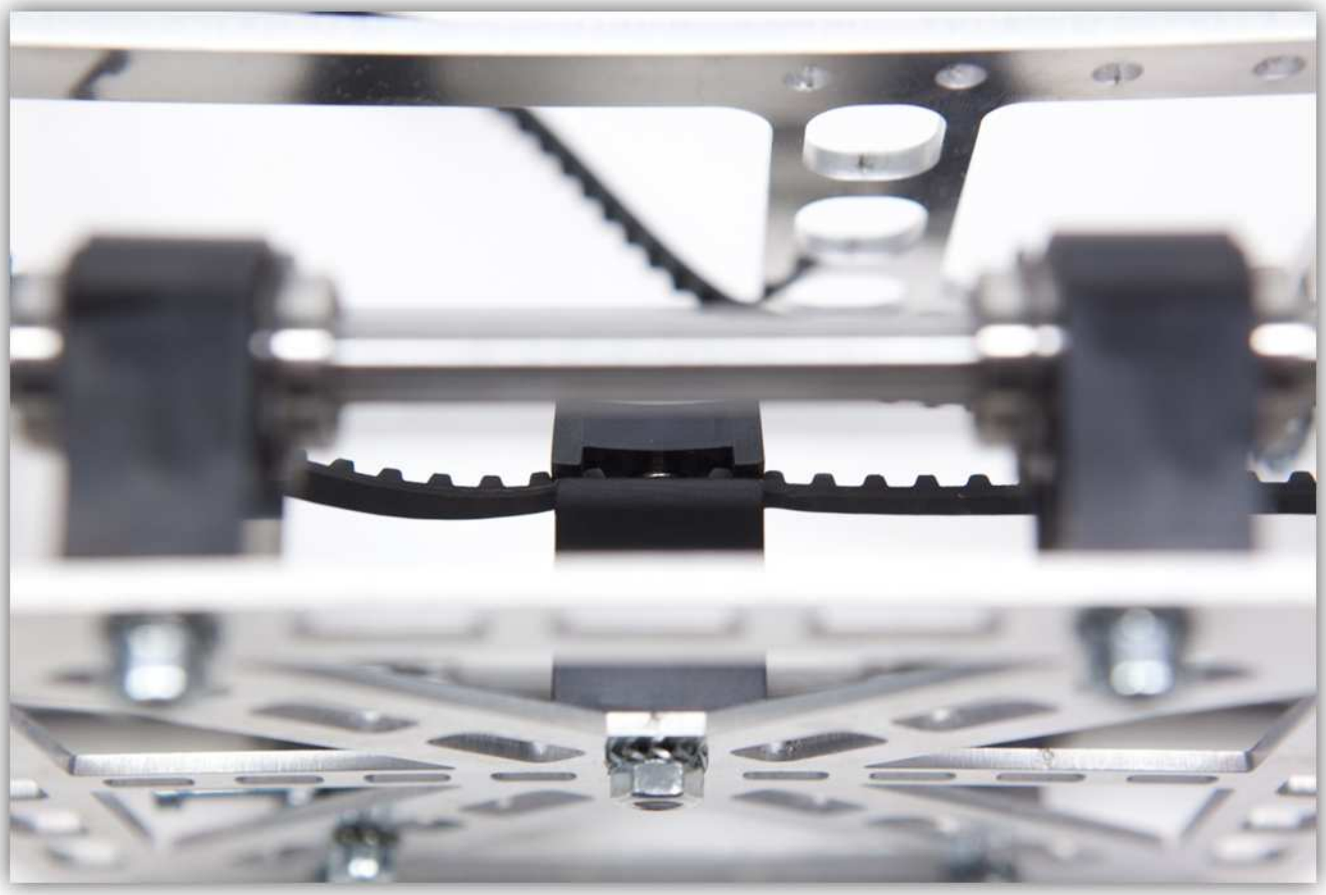


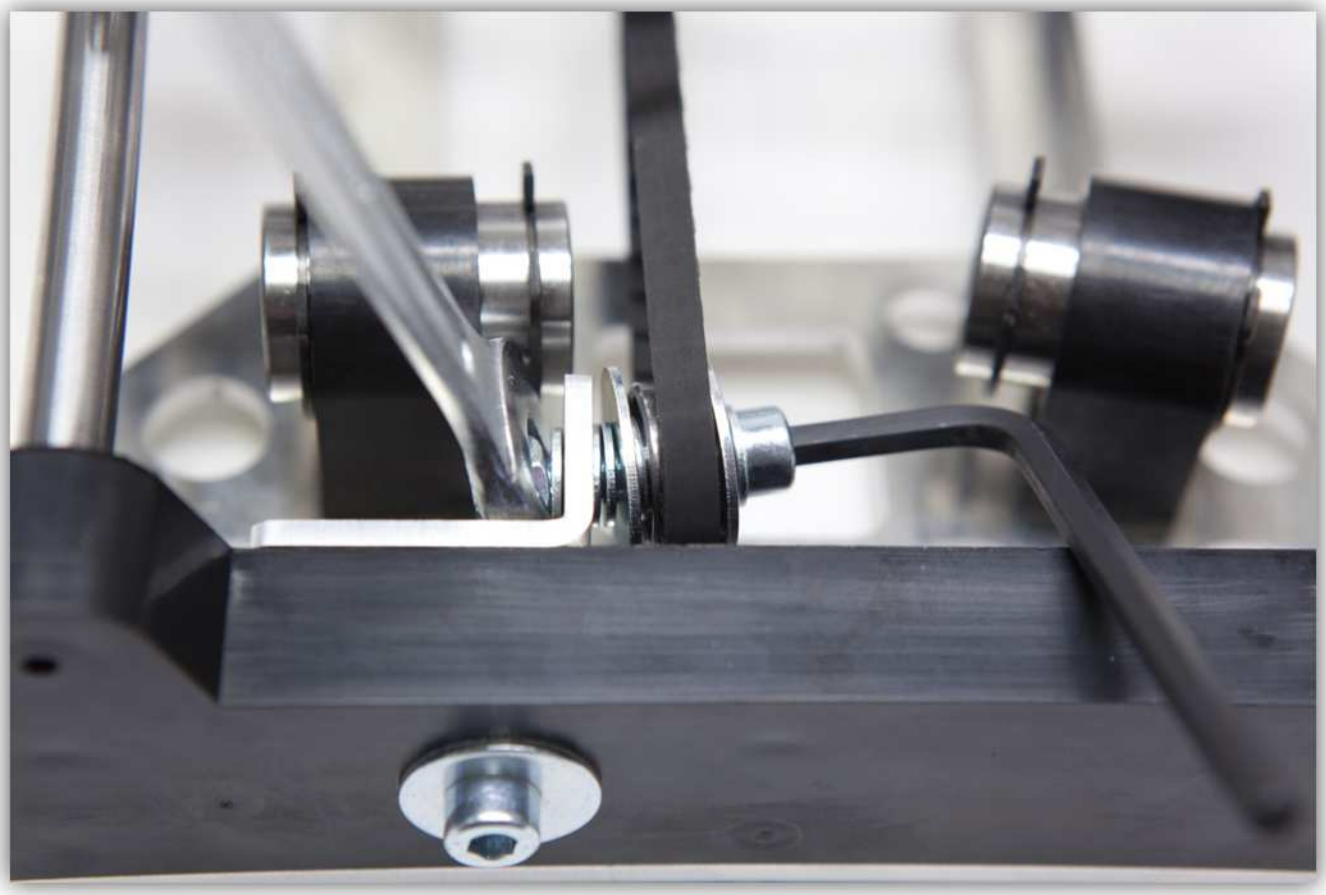
Use an M5 washer and bolt to secure this assembly to the BED SUPPORT CARRIAGE as shown in the pictures:

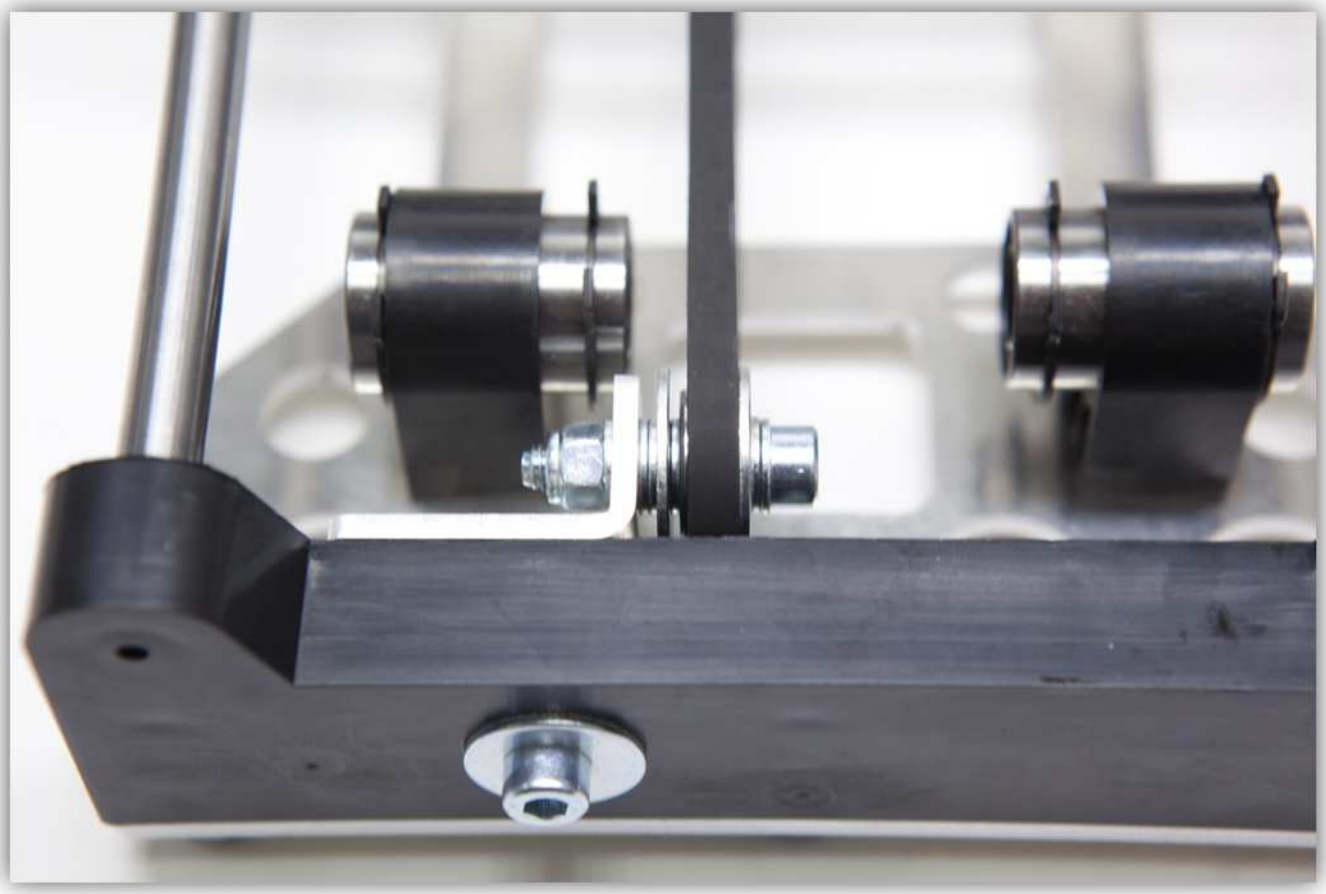


Loop the belt around the pulley and around the 625 BEARING. Now tighten the bolt with the 625 BEARING as shown in the pictures to put tension on the belt.

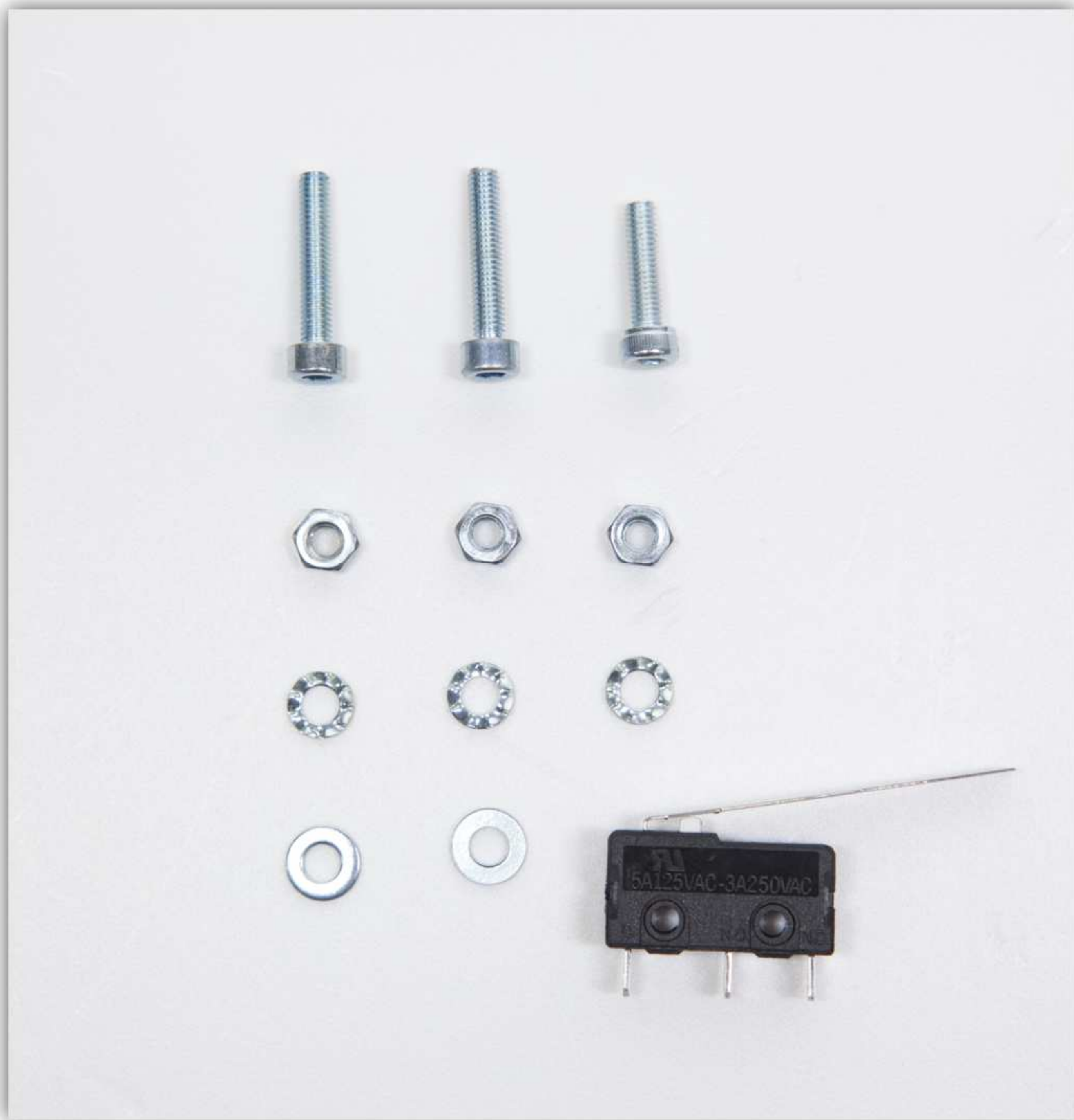








Take the bag labelled with 11 out of the box, you should have these parts:

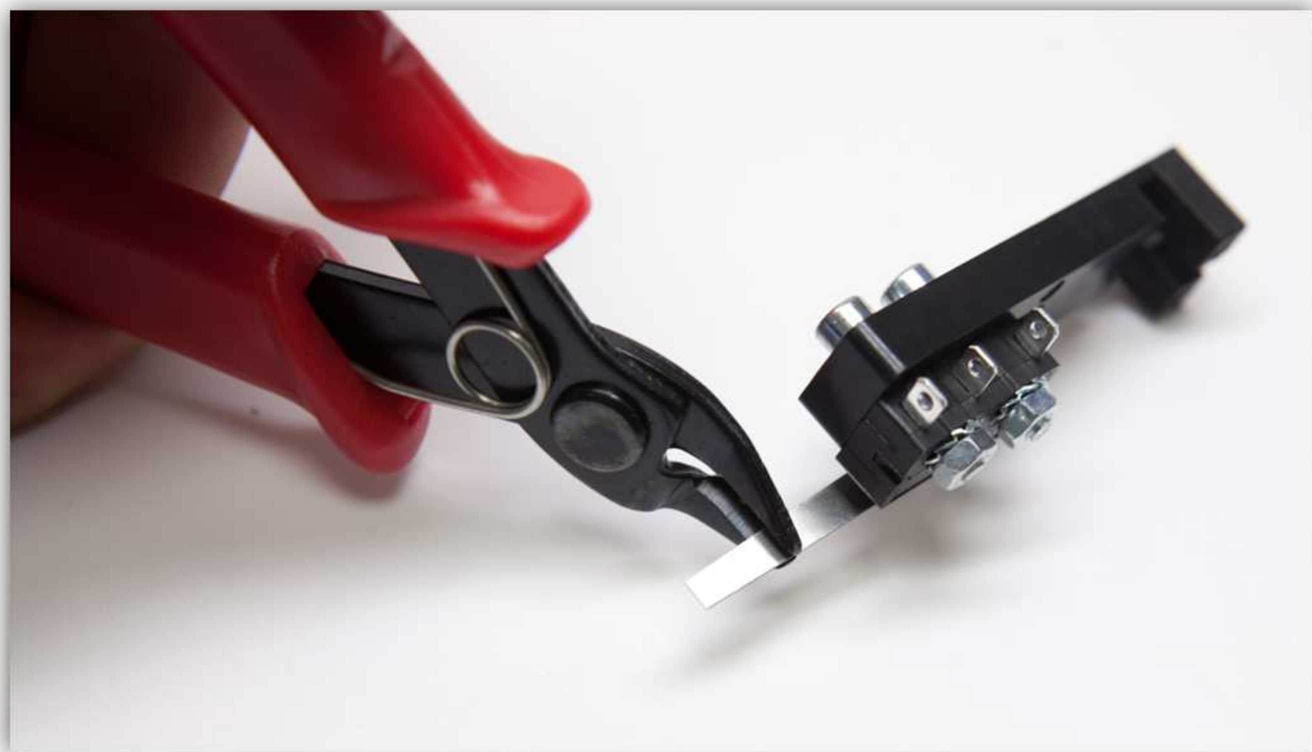


Search the piece (MICROSWITCH MOUNT) as shown in the picture below out of the bag containing the plastic parts:

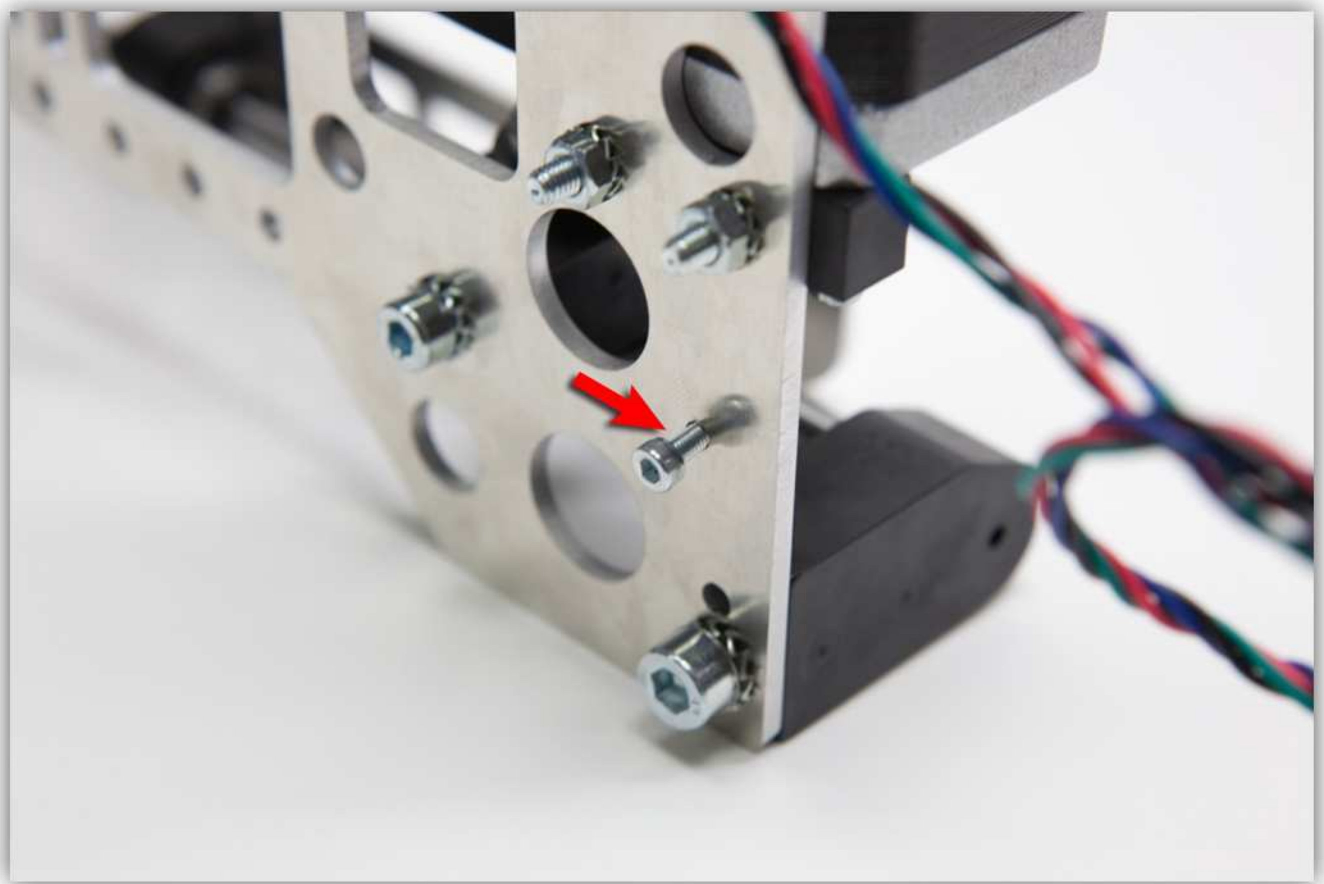
Insert 2 M3 bolts with M3 washers as shown:

Add a micro switch and 2 M3 toothed washer and 2 M3 bolts. Tighten these bolts.

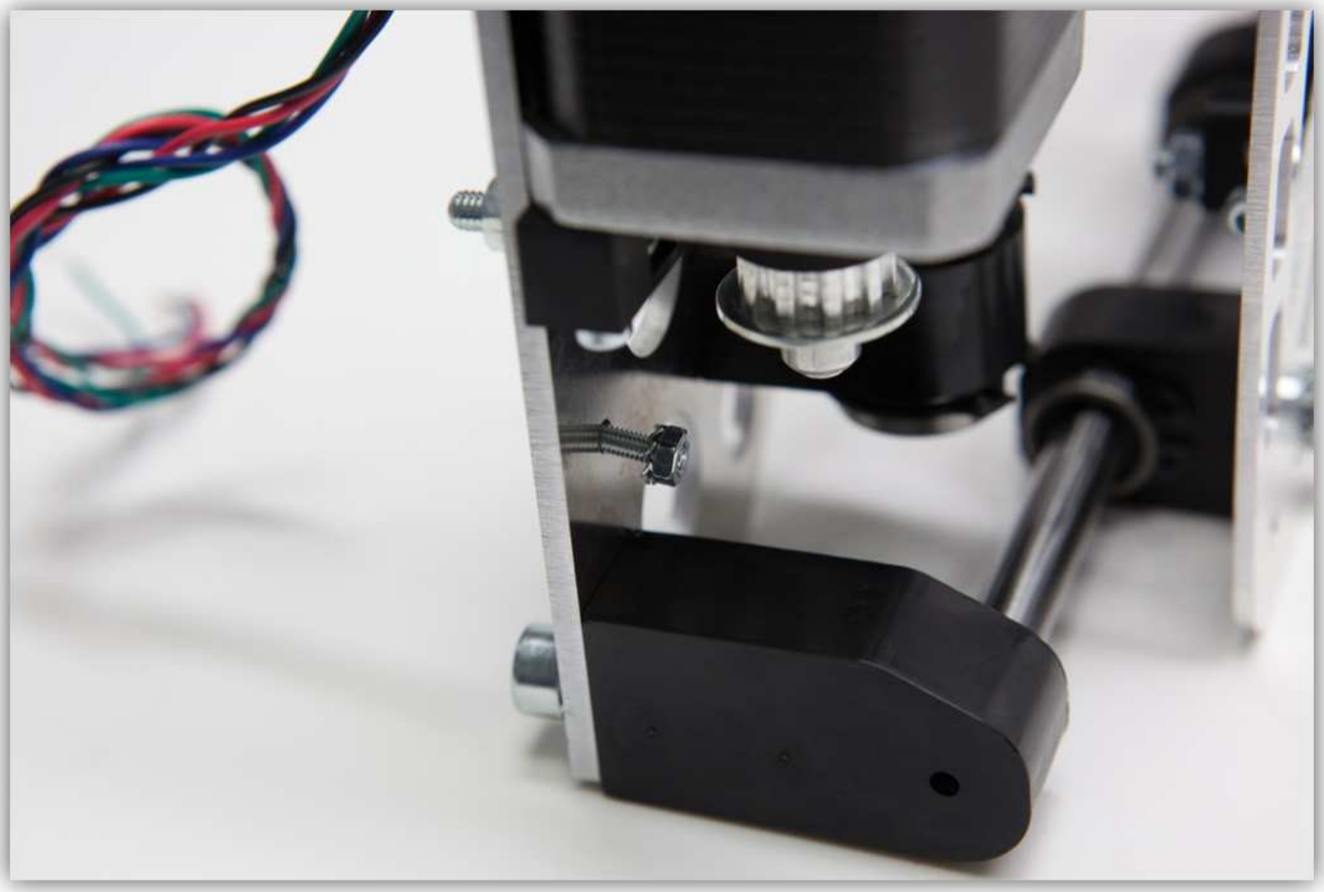
Cut 10 mm (0.39") of the lever of the micro switch, be careful not to cut too much.



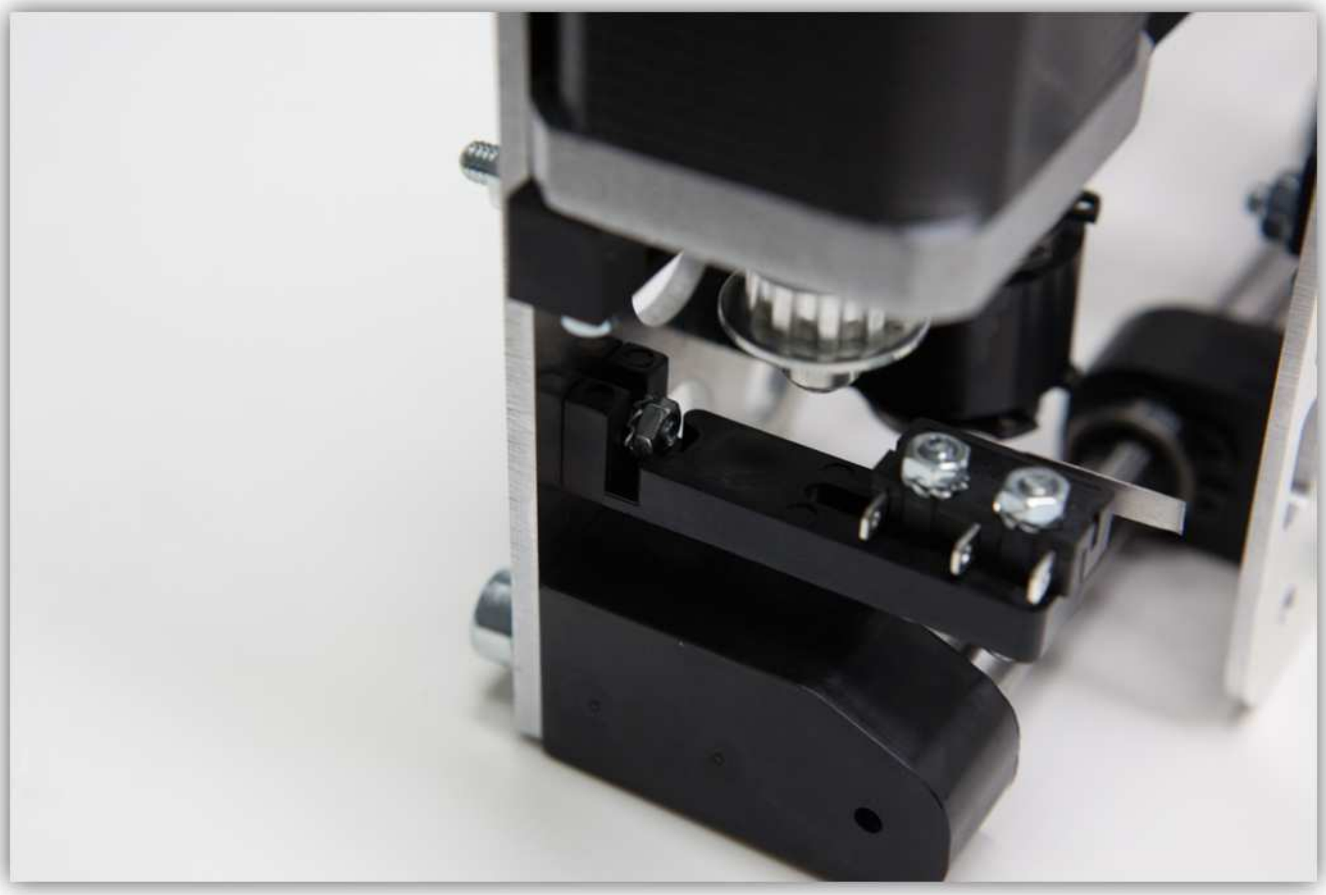
Slot the remaining M3 bolt in the X CARRIAGE as in the picture:



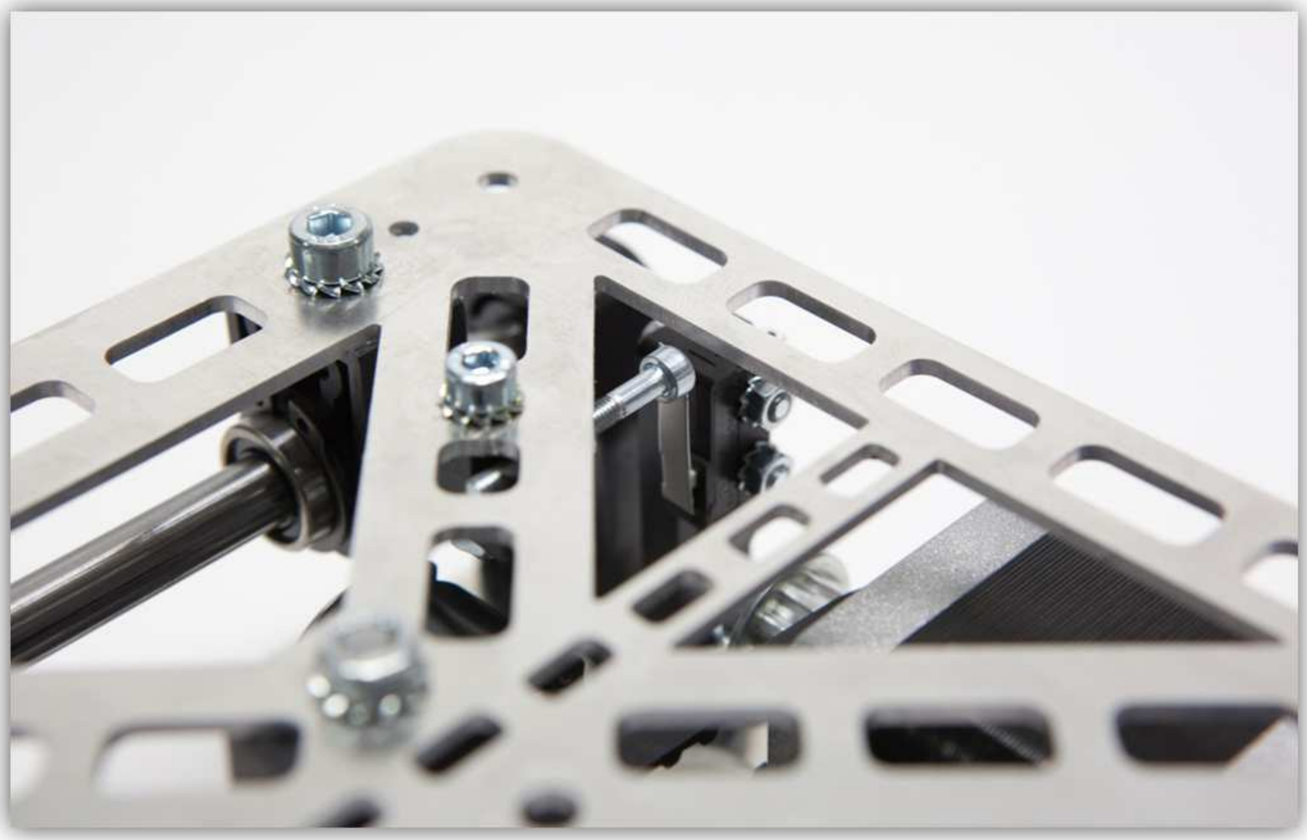
Use an M3 toothed washer and an M3 bolt to hold it in place. **Do not tighten this bolt.**

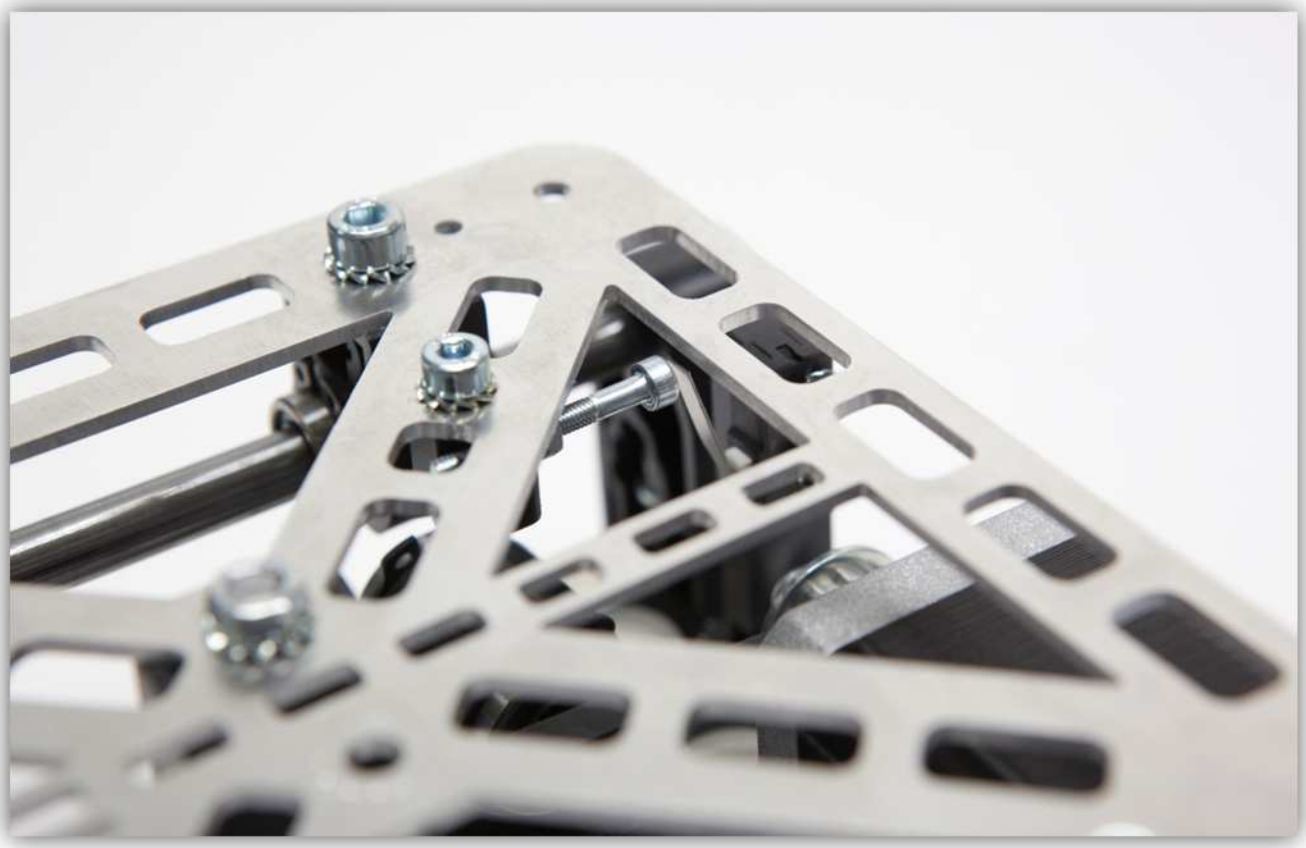


Slide the MICROSWITCH MOUNT under the washer and nut as shown. Hand tighten this nut.

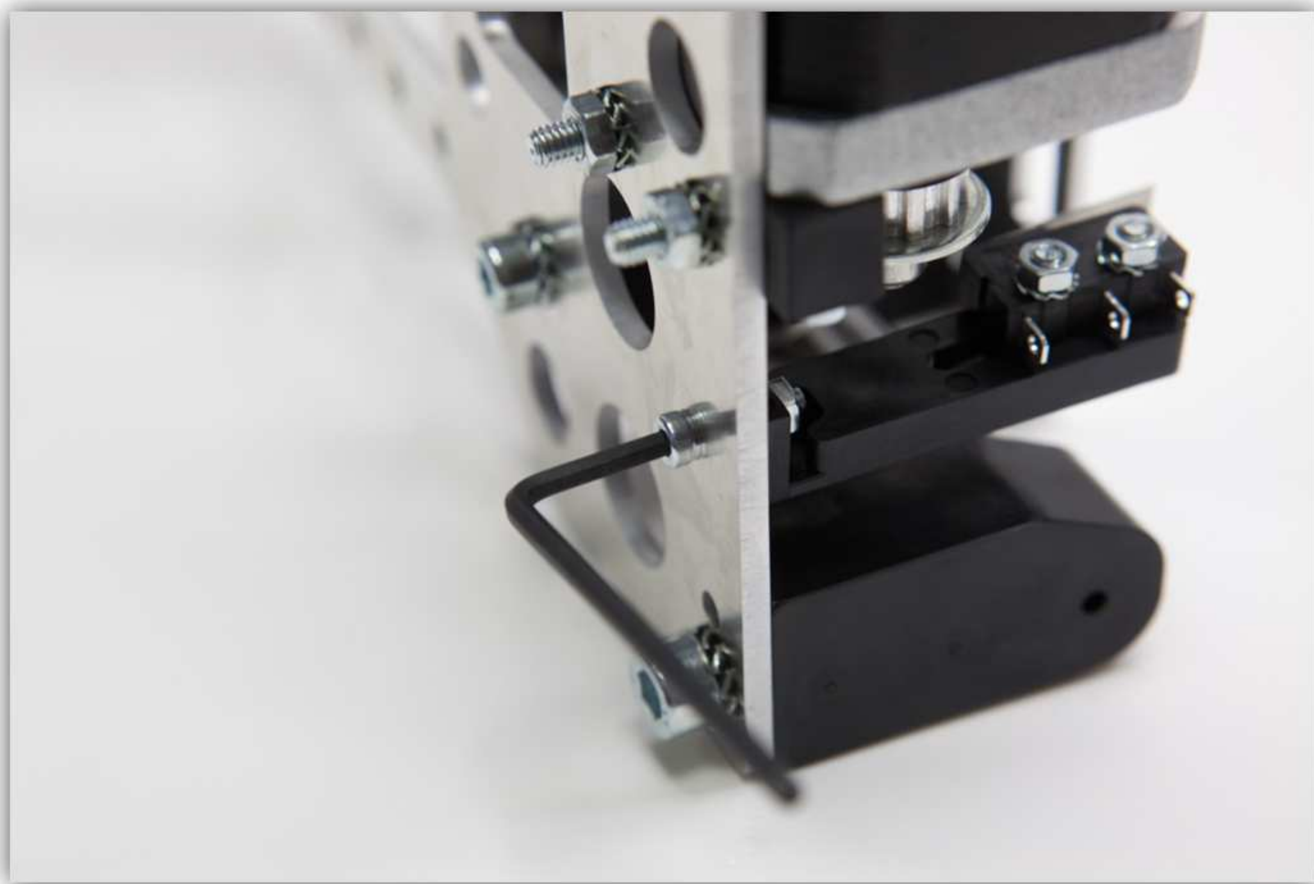


Make sure that the screw on the BED support carriage actuates the micro switch as shown in the pictures below. If this is not the case you can loosen the 4 bolts that hold the BEARING CLAMP Y pieces in place, move the BED SUPPORT PLATE left or right and tighten the bolts again, ensuring a fluid motion.

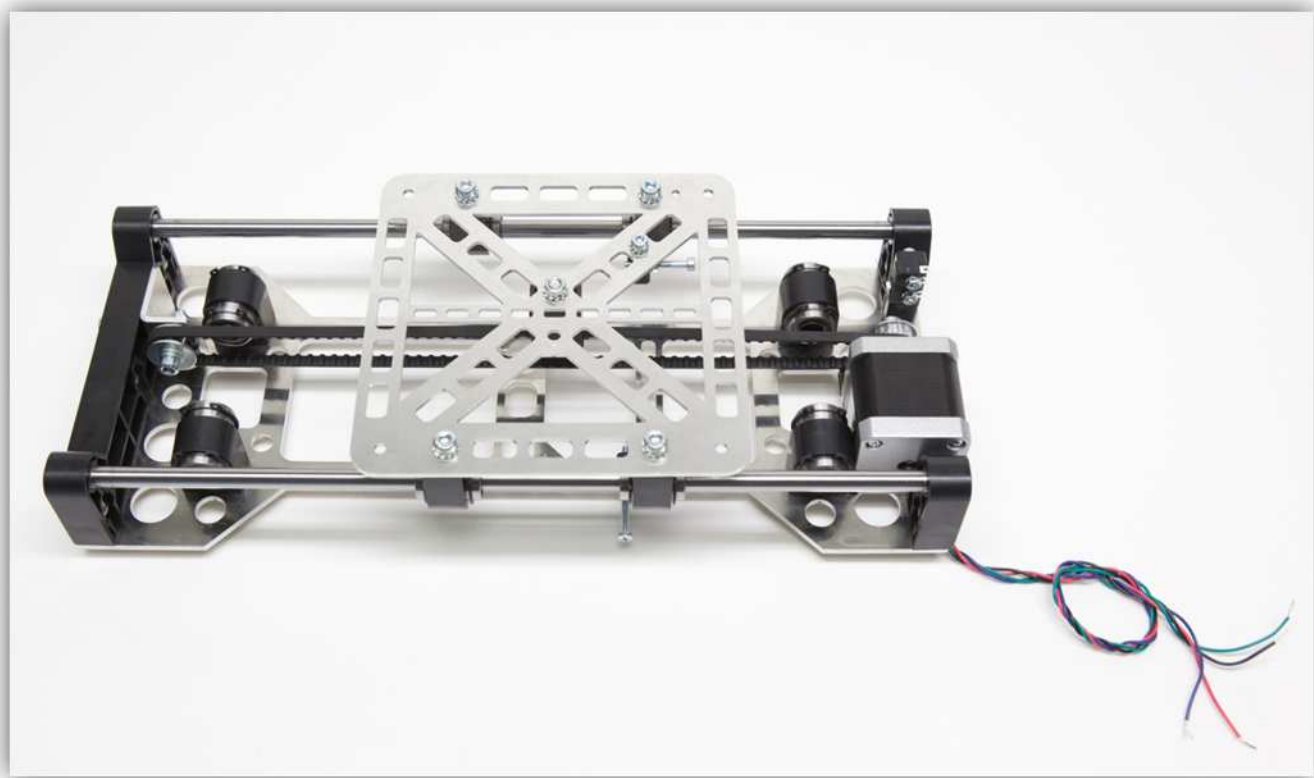




Tighten the bolt that holds the MICROSWITCH MOUNT in place.



You have now finished the second chapter of your build. You should have a completed X CARRIAGE as shown in the picture below:



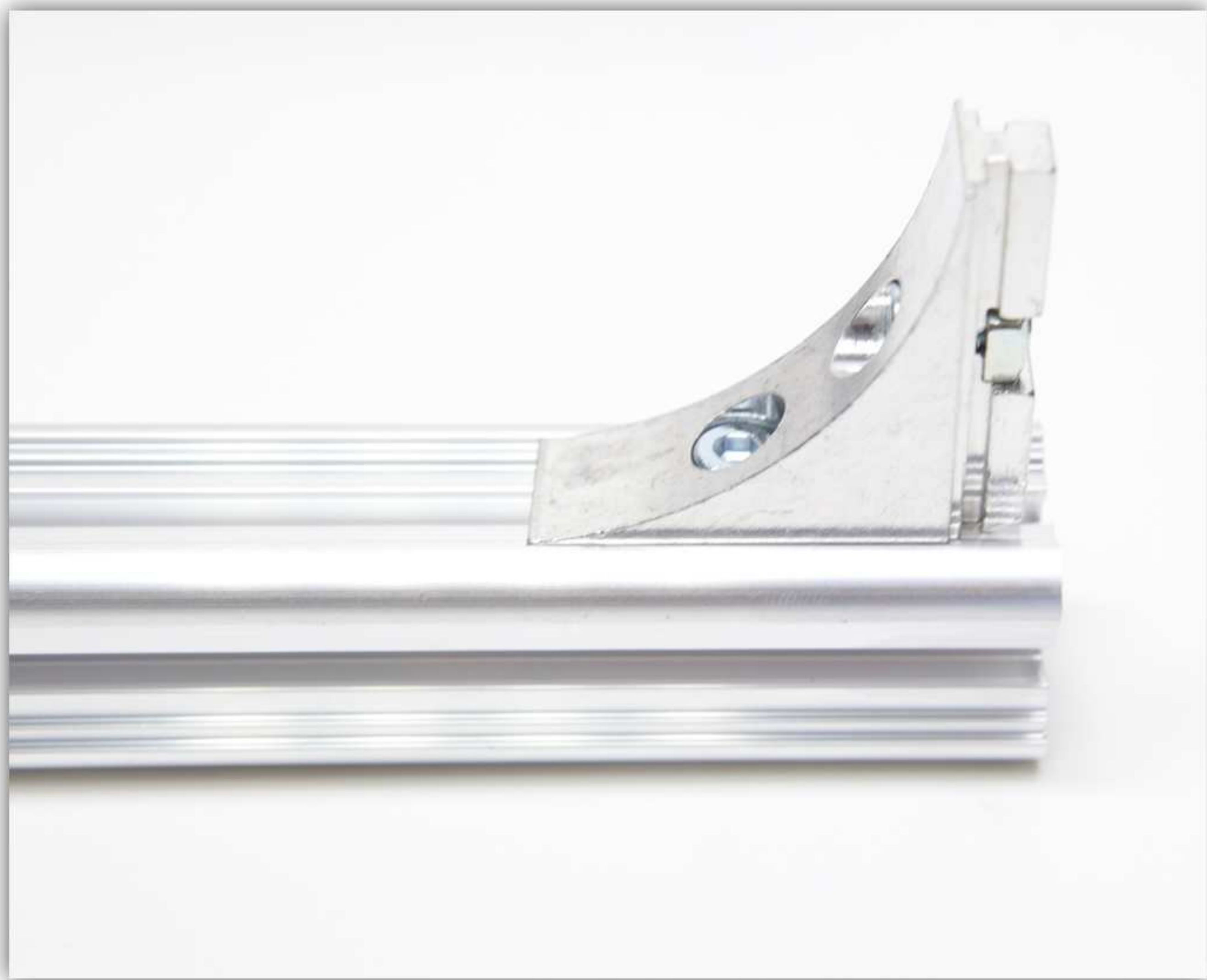
003 – ASSEMBLING BASE FRAME

Take one ALUMINIUM PROFILE of 450 mm (17.7") out of the box.

Take two ALUMINIUM PROFILES of 416 mm (16.4") out of the box.

Take the bag labelled with 14 out of the box. You should have 14 ANGULAR MOUNTS:

Slide 2 of these ANGULAR MOUNTS in each side of the ALUMINIUM PROFILE of 450 mm (17.7").



Slide an ALUMINIUM PROFILE of 416 mm (16.4") on each side of the ALUMINIUM PROFILE of 450 mm (17.7").

Tighten all the bolts firmly and make sure all angles are 90° and all ALUMINIUM PROFILES are flush.

You should have this:

Take the bag labelled with 15 out of the box. You should have these parts:

Take the bag labelled with 16 out of the box. You should have a bag with 34 square nuts:

There should already be an M5 nut on the bolt. Screw a regular M5 nut, an M5 flat washer and a square M5 nut on the foot. Repeat this 4 times. **Do not tighten these nuts.**

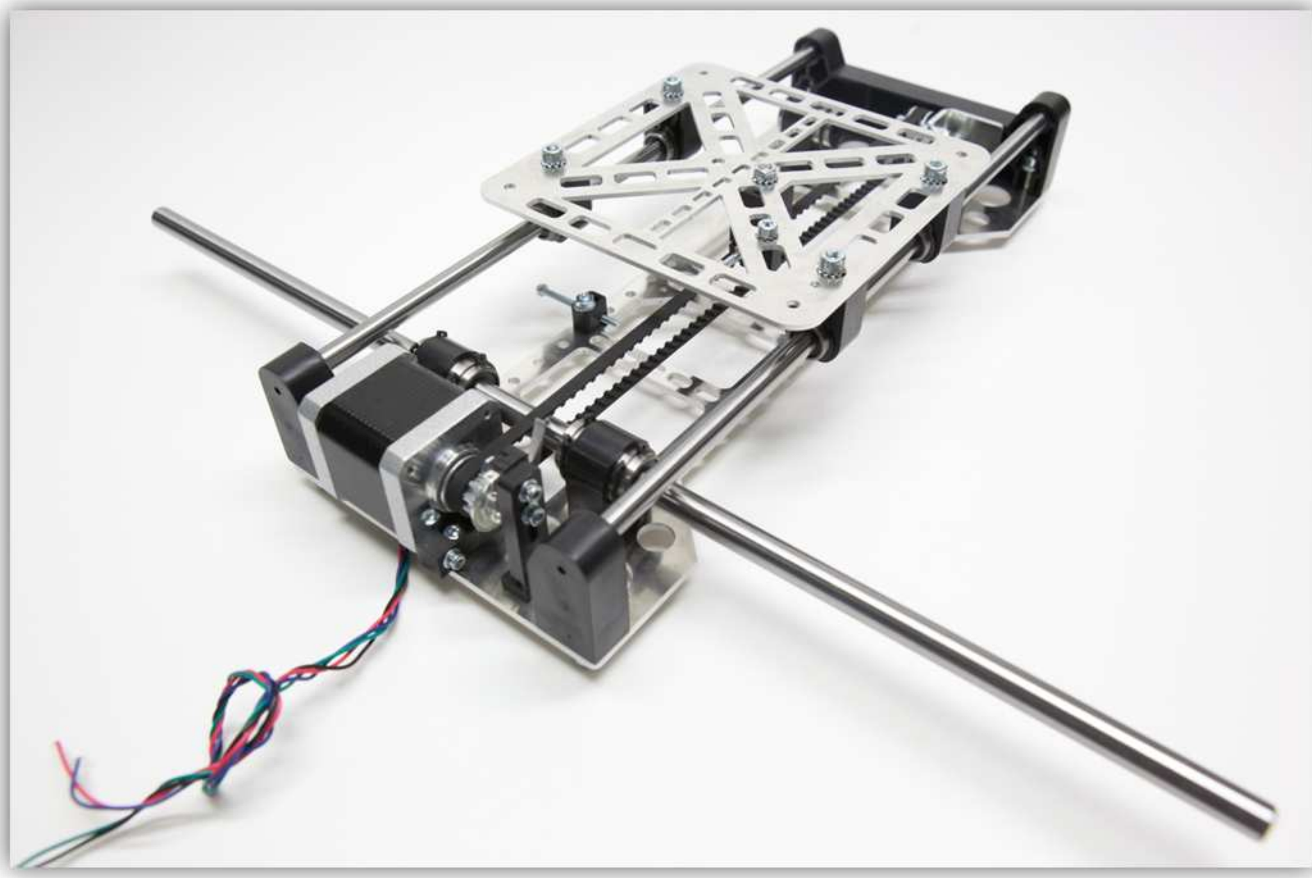
Slide these assemblies into the ends of each 416 mm (16.4") ALUMINIUM PROFILE.

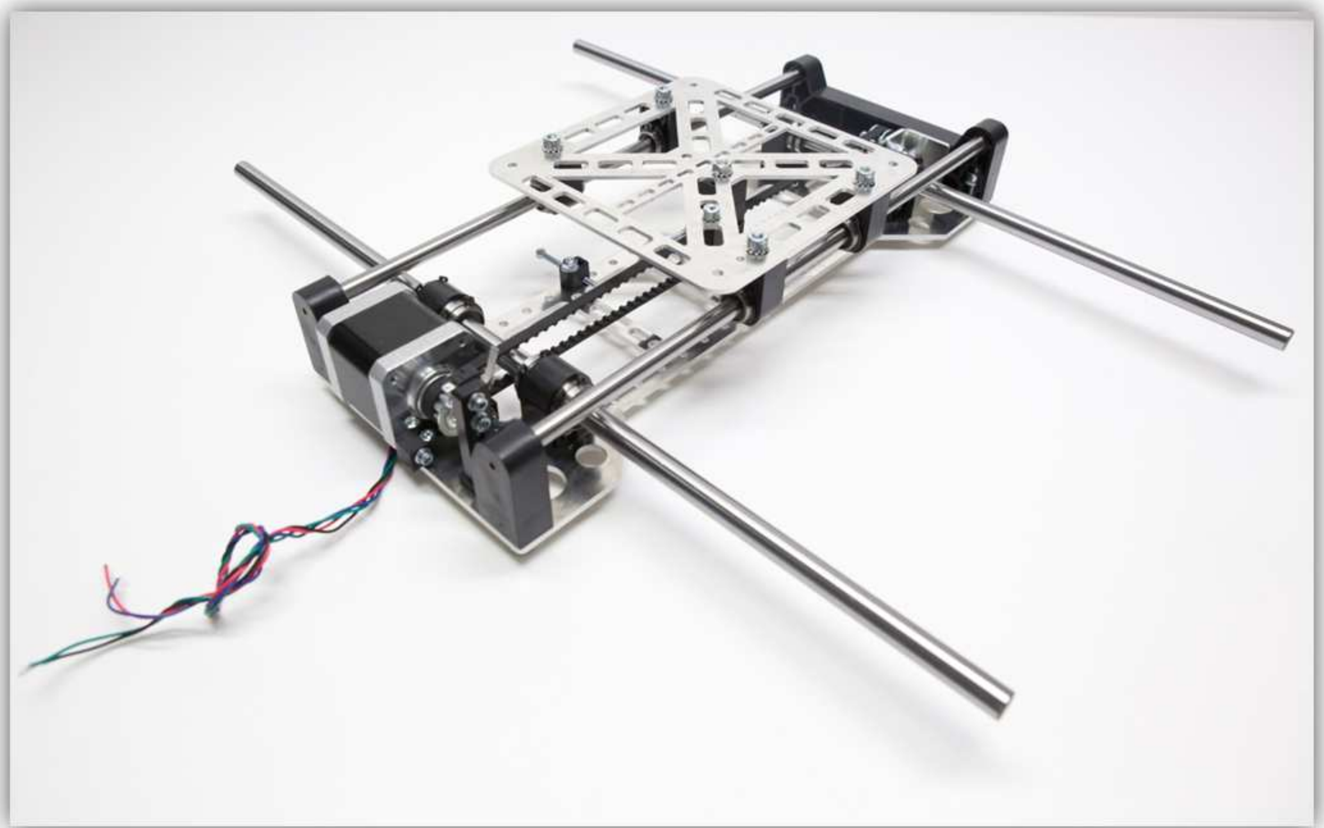
Tighten the nuts firmly as in the picture below:

The frame should look like this:

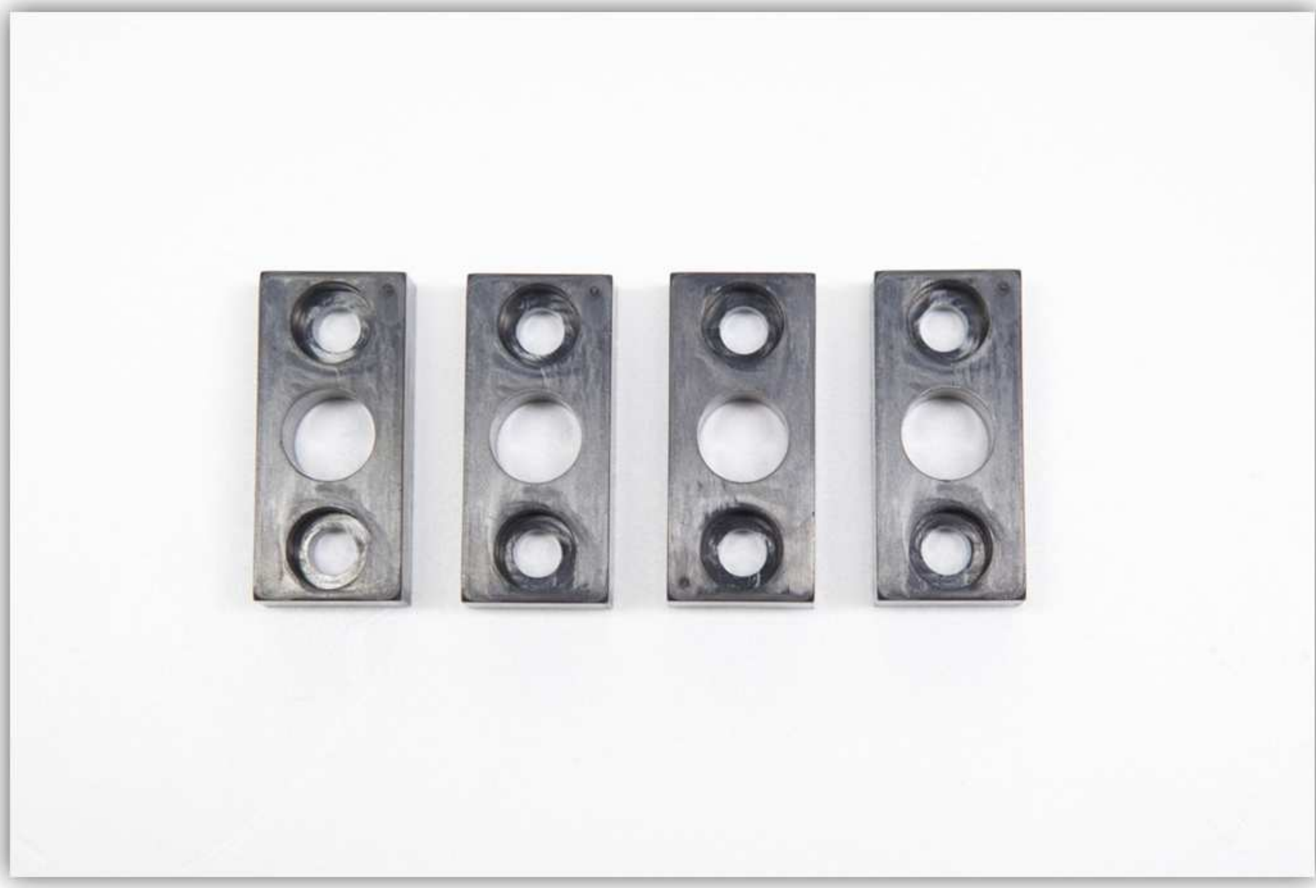
Take two rods out of the bag labelled with 7. These rods should have a diameter of 10 mm (0.39") and a length of 450 mm (17.7").

Slide the two rods into the linear bearings as shown in the pictures below:

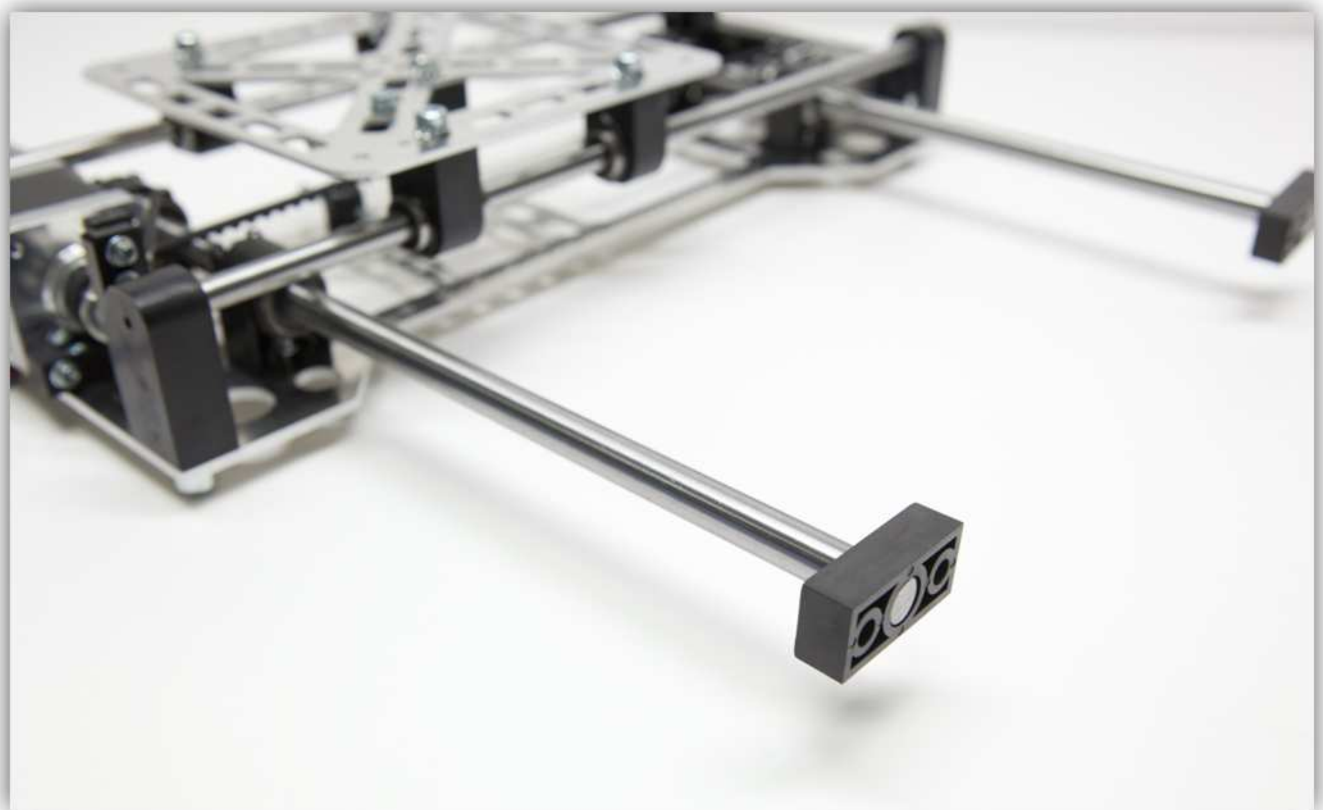


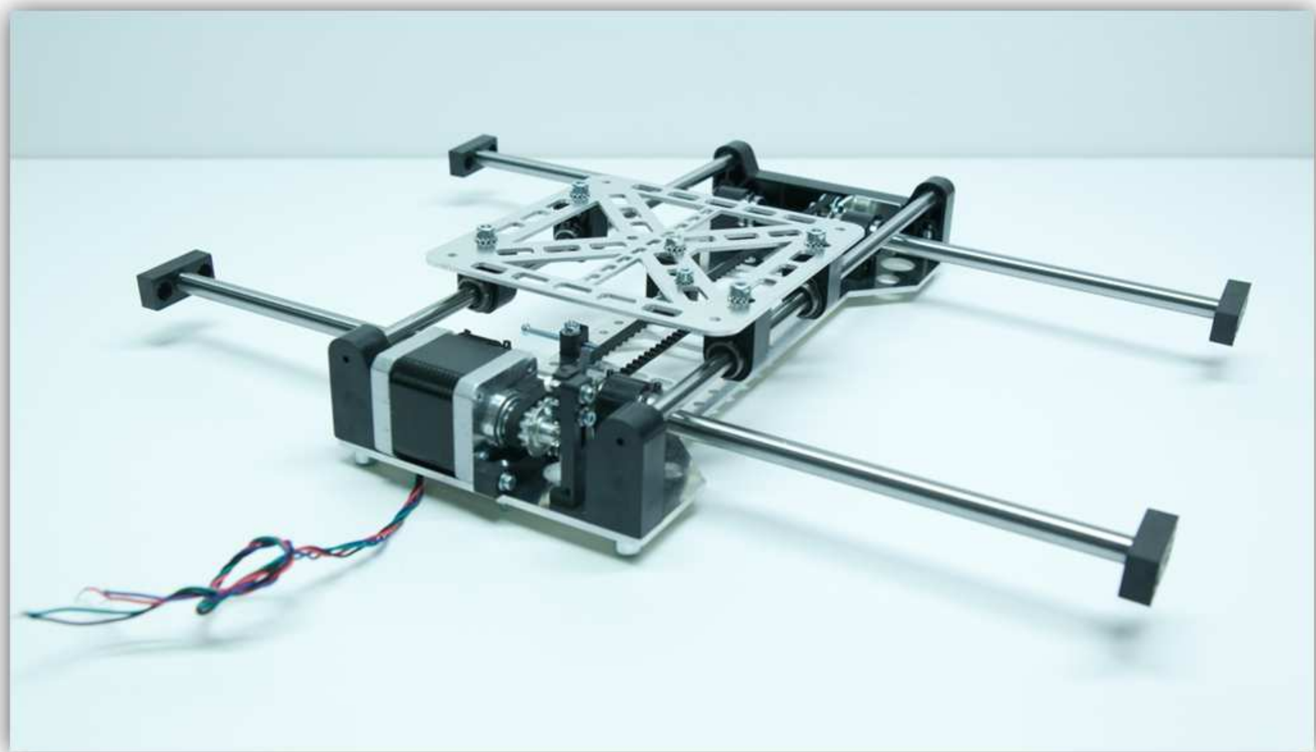


Now take 4 pieces as shown in the picture below out of the bag containing the plastic parts (ROD CLAMP X):



Slide the 4 ROD CLAMP X pieces over the ends of each rod.



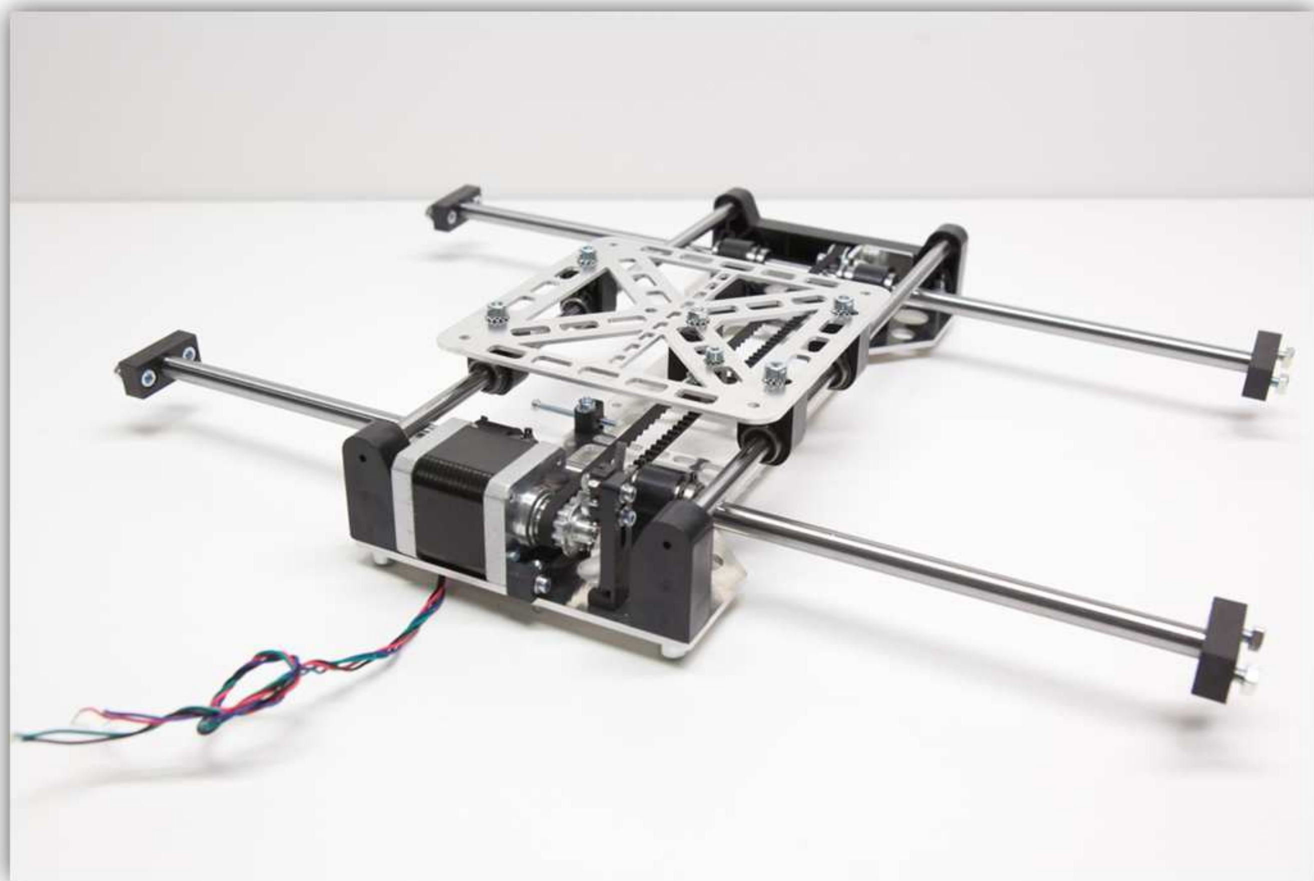


Take all the M5 bolts out of the bag labelled with 17.

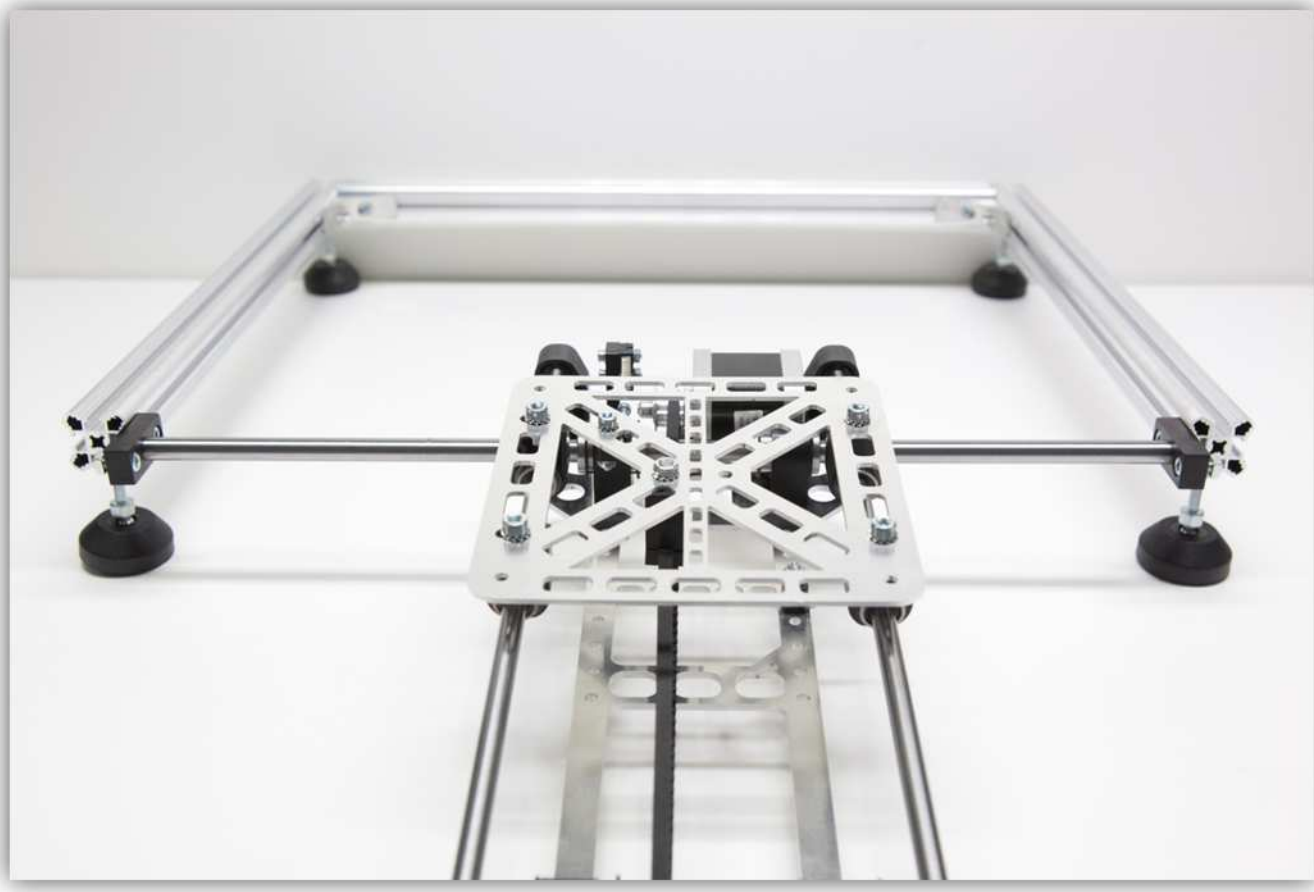
Insert these bolts in each of the ROD CLAMP X pieces as follows:

Screw an M5 square nut on each of the bolts. **Do not tighten these nuts.**

The X CARRIAGE should look like this:



Now slide the X CARRIAGE into the frame as shown in the pictures below. Do this with the side of the motor first.



Now slide 2 square M5 nuts into the right ALUMINIUM PROFILE as shown:

Slide one square M5 nut into the left ALUMINIUM PROFILE as shown:

Slide the X carriage further until there is approx. 4 mm (0.16") between the first ROD CLAMP X piece and the ANGULAR MOUNT on the end of the frame. Make sure the X CARRIAGE is level and parallel inside the frame. Also check if the BEARING CLAMP X pieces are still in the right place. The bolts holding these pieces in place should still be just hand tightened.

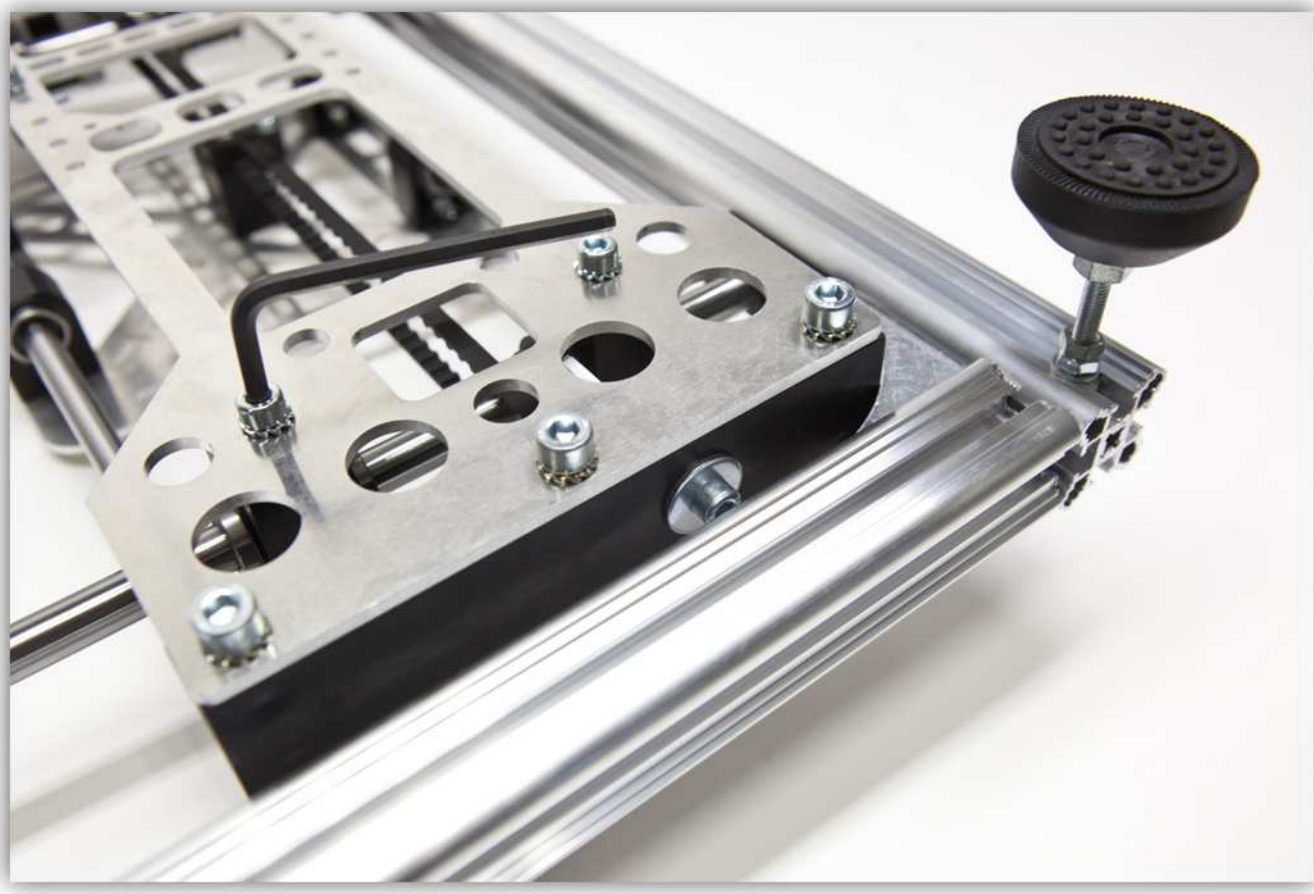
Now slide an ANGULAR MOUNT on each ALUMINIUM bar on the open side of the frame.

Take one ALUMINIUM PROFILE of 450 mm (17.7") out of the box and slide it down the two ANGULAR MOUNTS.

Now slide the ALUMINIUM PROFILE and the 2 ANGULAR MOUNTS inside the frame.

If the ALUMINIUM PROFILE is flush with the rest of the frame you can tighten all the bolts of the ANGULAR MOUNTS.

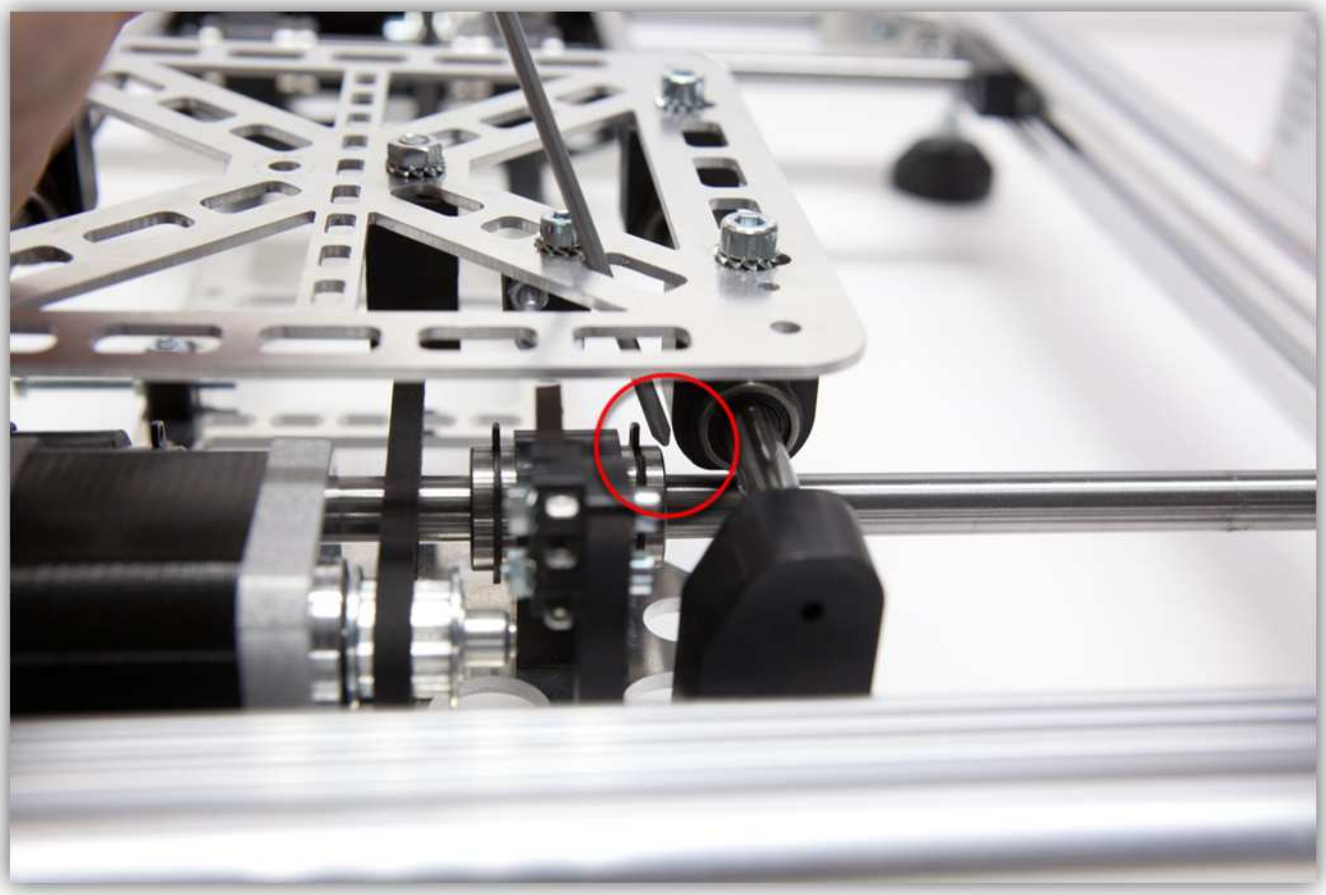
Now after making sure that the BEARING CLAMP X pieces are still in the right place, you can tighten these bolts holding them in place. Make sure the X CARRIAGE can move freely.

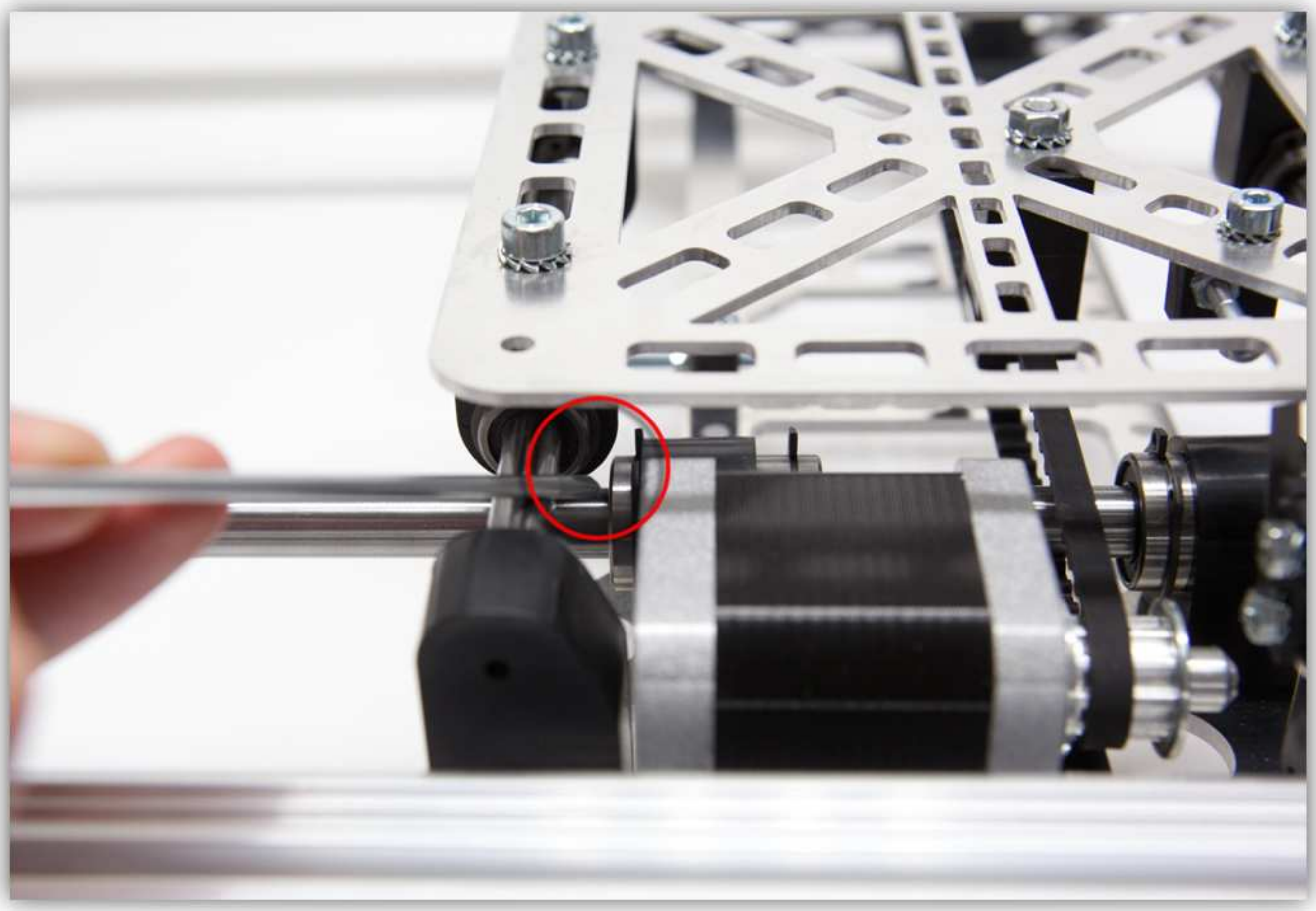


Check if the X CARRIAGE is centred, you should measure approx. 93.50 mm (3.68") on each side.

Now tighten the bolts on de ROD CLAMP X pieces securing the X carriage in place.

Make sure you have enough clearance between the BEARING CLAMP Y pieces and the LINEAR BEARINGS in the BEARING CLAMP X pieces. You can slide these bearings a few millimetres out of the way when there is not enough clearance. The 2 carriages should now move freely along the full length of all the rods.





004 – ASSEMBLING THE LEFT UPRIGHT OF THE FRAME

Take one ALUMINIUM PROFILE of 500 mm (19.7") out of the box.

Slide two ANGULAR MOUNTS (from the box) in the end of the ALUMINIUM PROFILE of 500 mm (19.7").

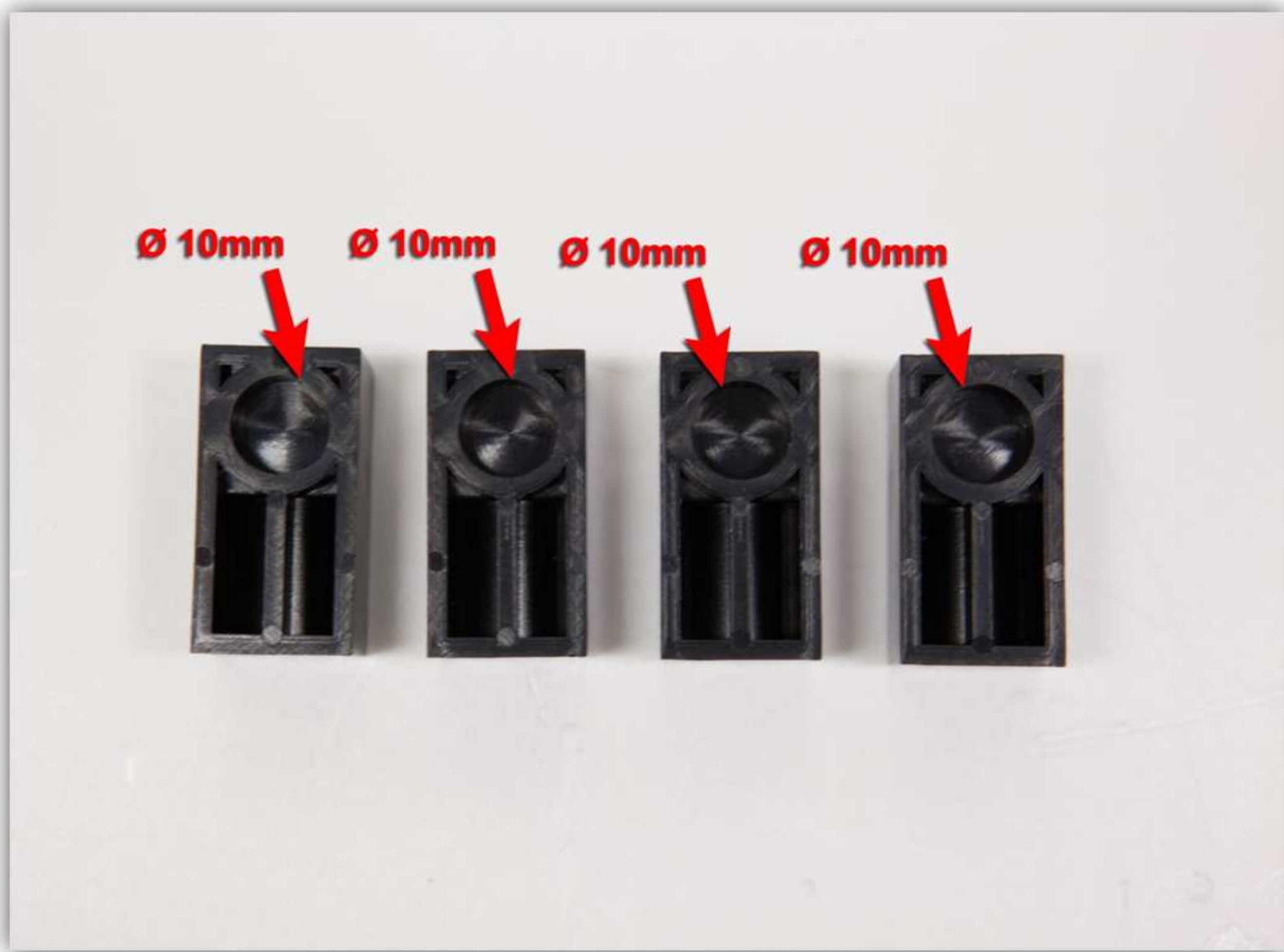
Slide this assembly in the left profile of the BASE FRAME.

Slide it further down the profile until its centre is at 16 cm (6.3") from the edge of the base frame.

Tighten the bolts on the ANGULAR MOUNTS.

Take all the parts out of the bag labelled with 21.

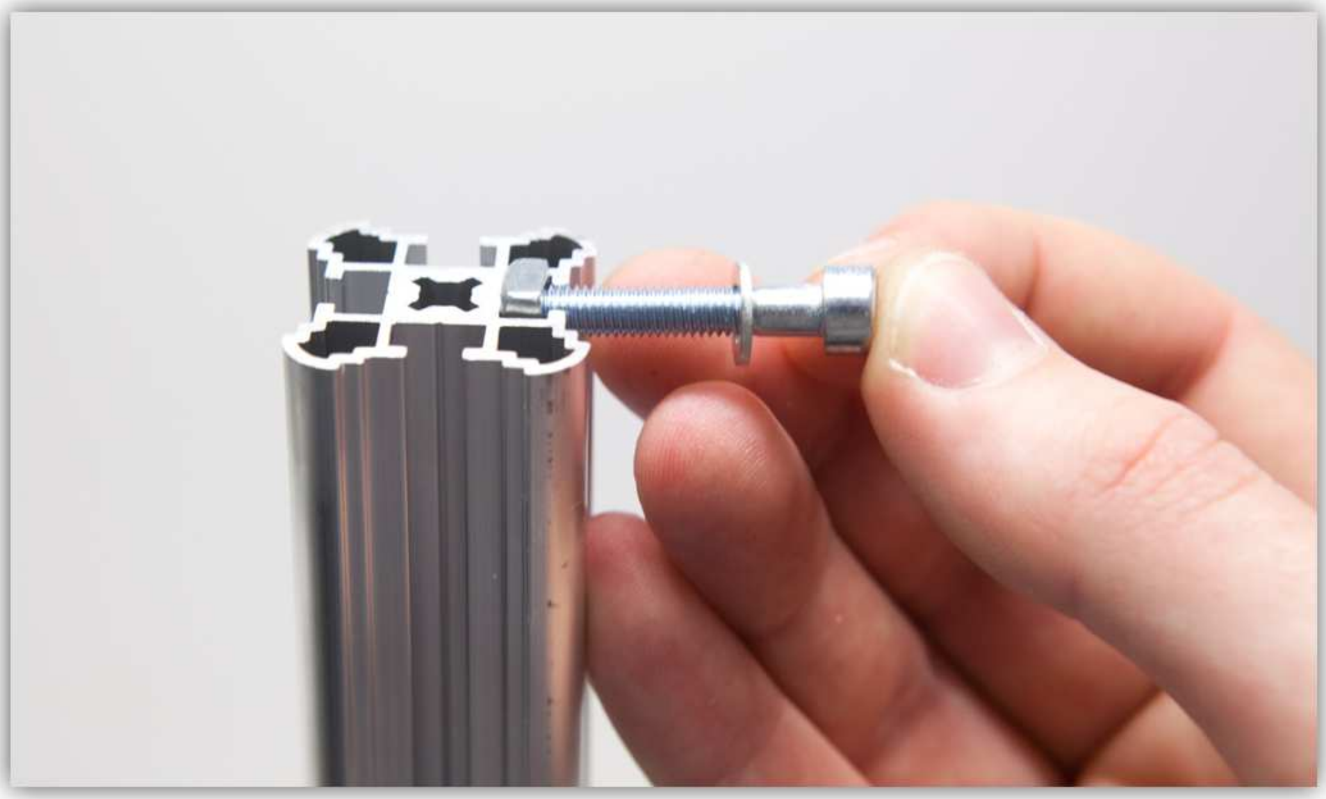
Now take 4 pieces as shown in the picture below out of the bag containing the plastic parts (ROD CLAMP Z BIG). Notice how the round hole must be 10 mm (0.39") in diameter.

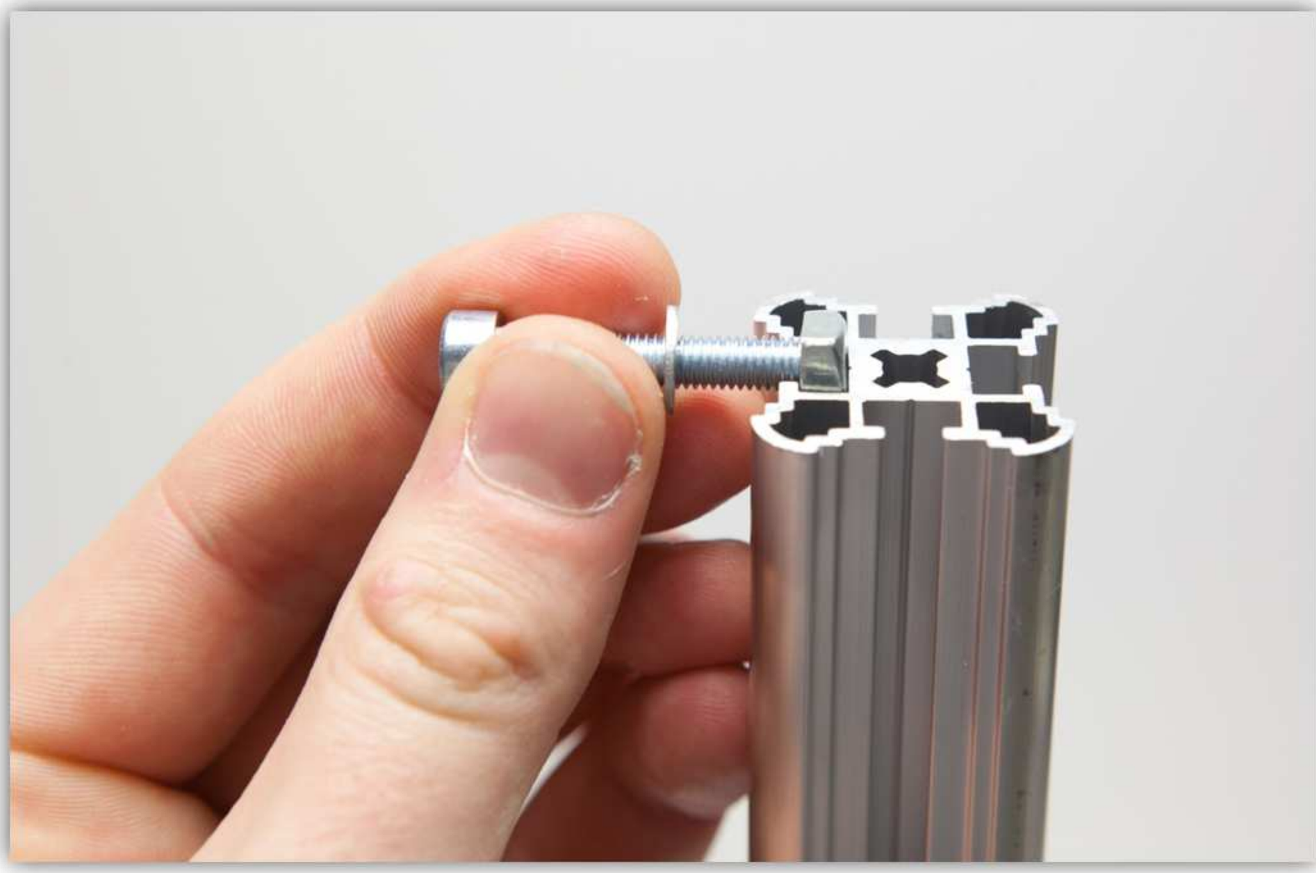


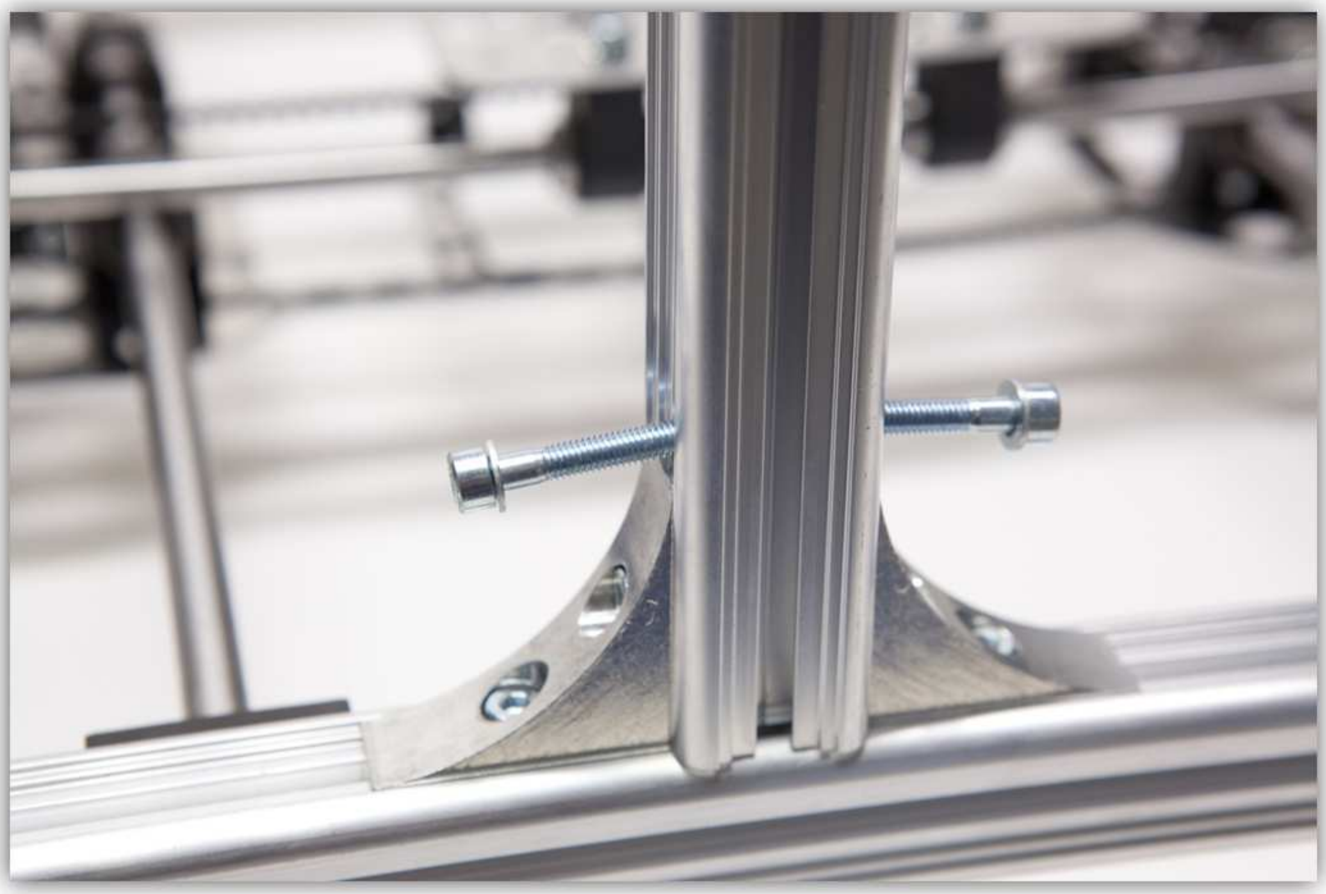
Take two rods out of the bag labelled with 7. These rods should have a diameter of 10 mm (0.39") and a length of 345 mm (13.6").

Use 4 square M5 nuts to assemble the following:

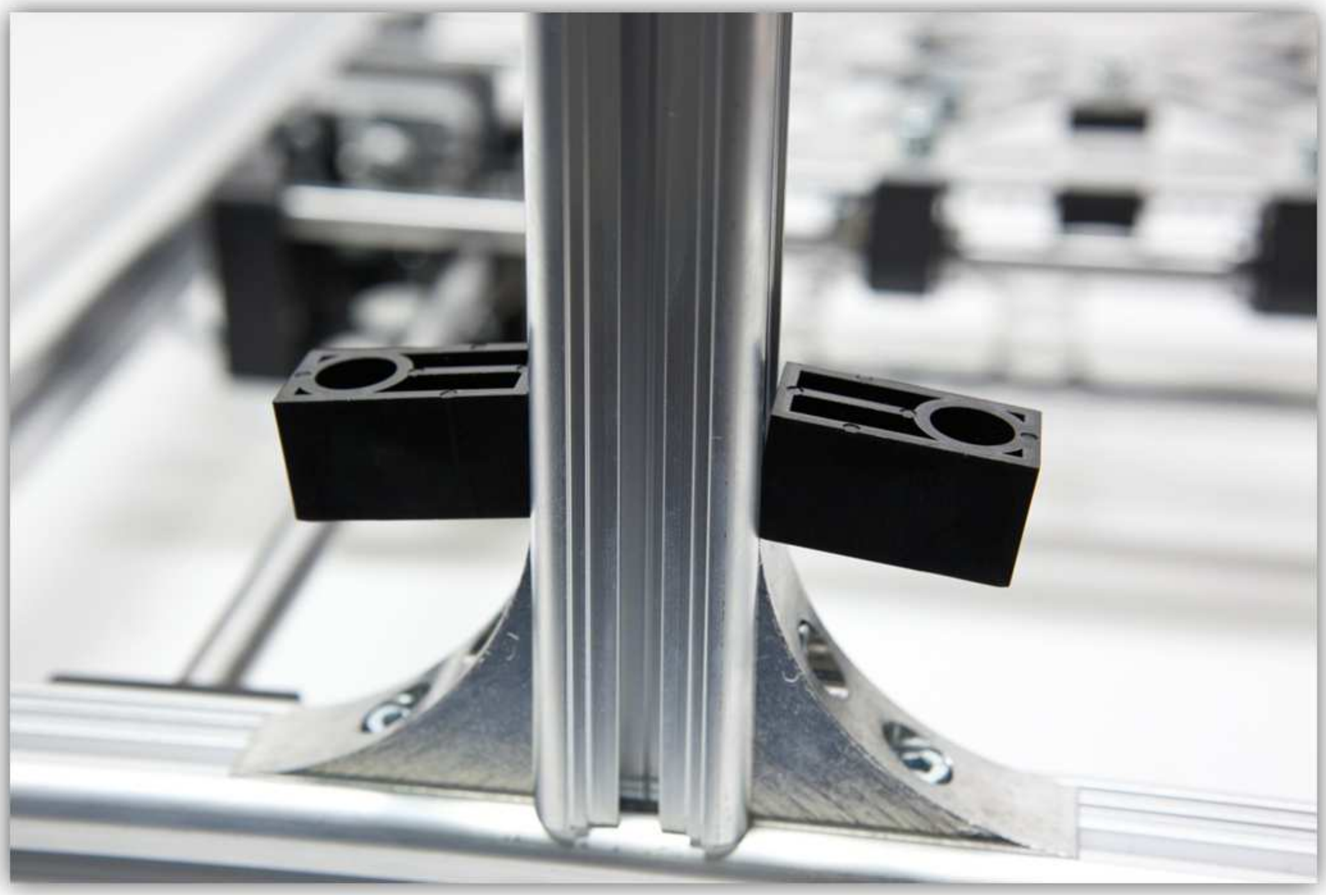
Slide 2 of these down the left upright ALUMINIUM PROFILE as shown in the pictures below:





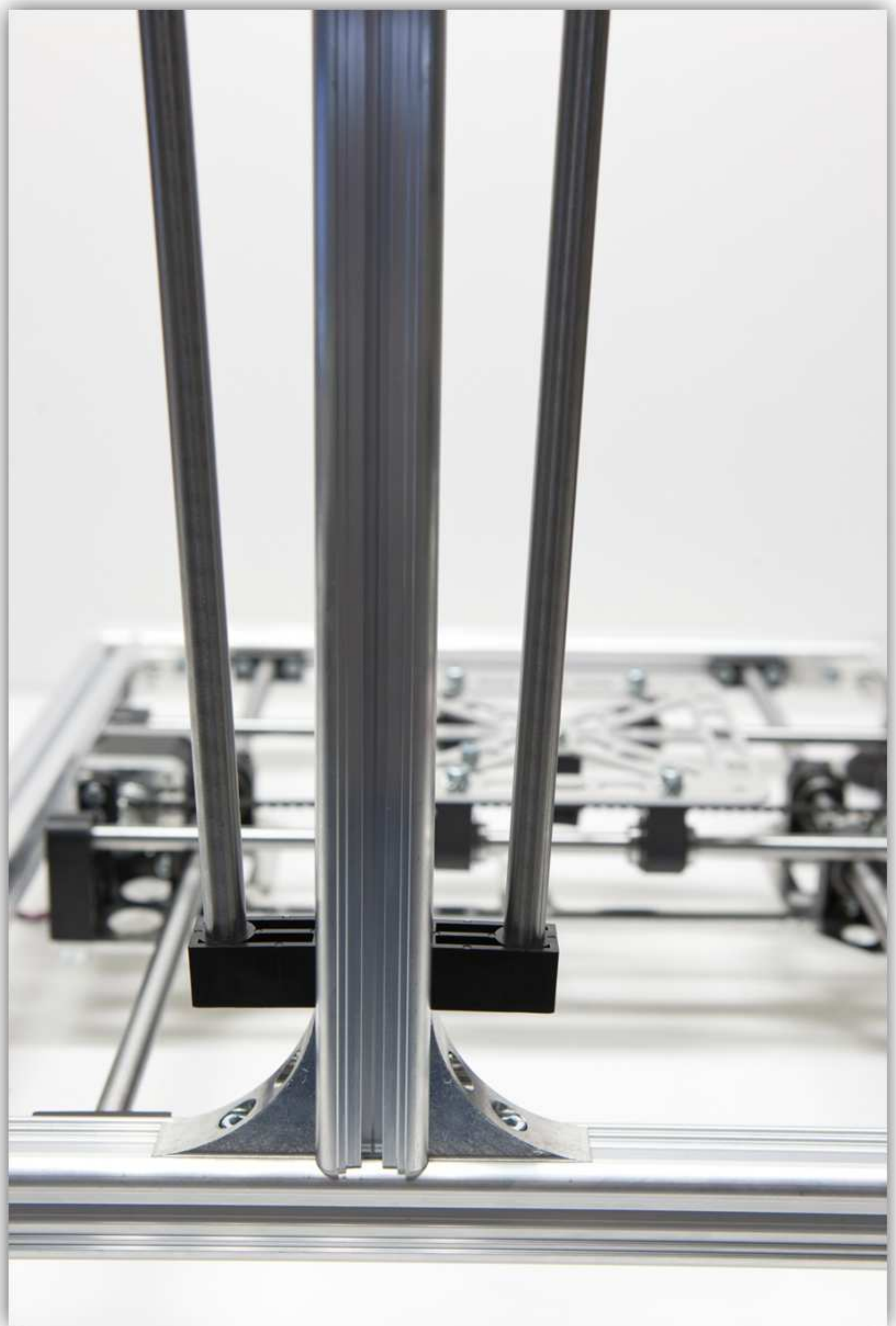


Now slide two ROD CLAMP Z BIG pieces over the bolts as shown in the pictures below.

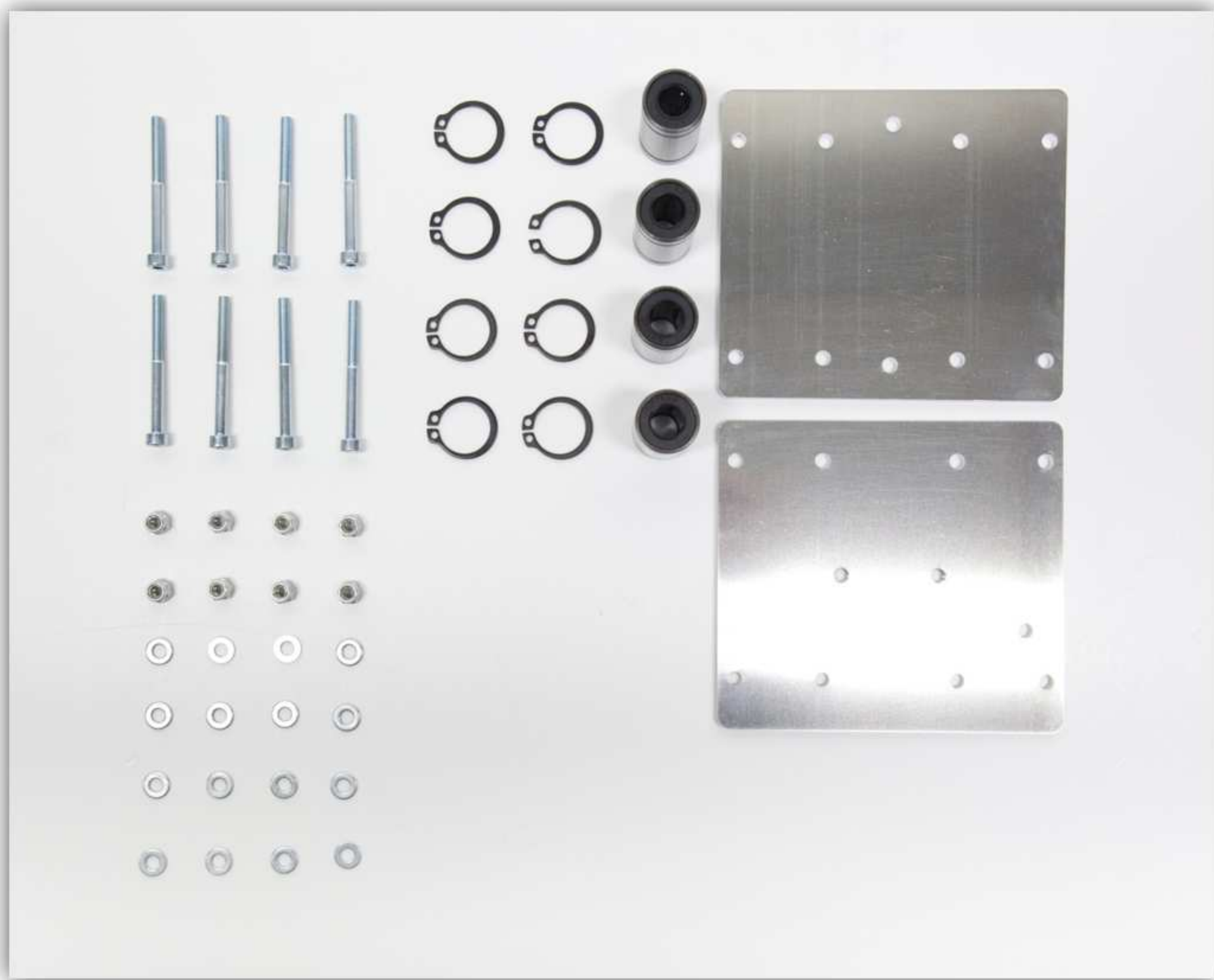


Make sure that the ROD CLAMP Z BIG pieces are as far down as possible and then tighten the bolt. **Do not over tighten this bolt.**

Put the two rods in the ROD CLAMP Z BIG pieces.



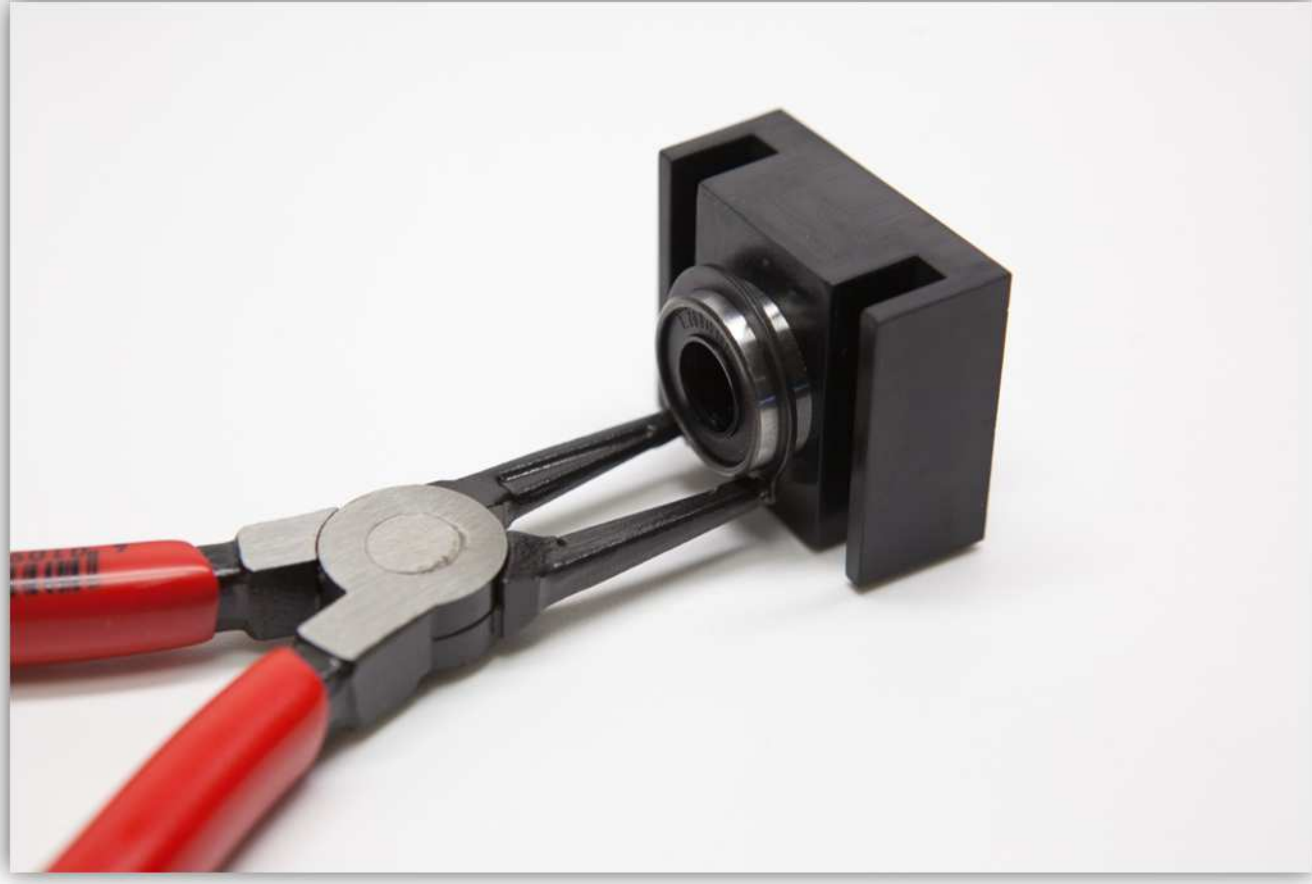
Take all the parts out of the bag labelled with 19.



Now take 4 pieces as shown in the picture below out of the bag containing the plastic parts (BEARING CLAMP Z BIG).

Slide 4 linear bearings into the 4 BEARING CLAMP Z BIG pieces.

Use the circlip pliers to carefully fit the circlips around the both sides of the 4 LM10UU LINEAR BEARINGS.



Take all the parts out of the bag labelled with 20.

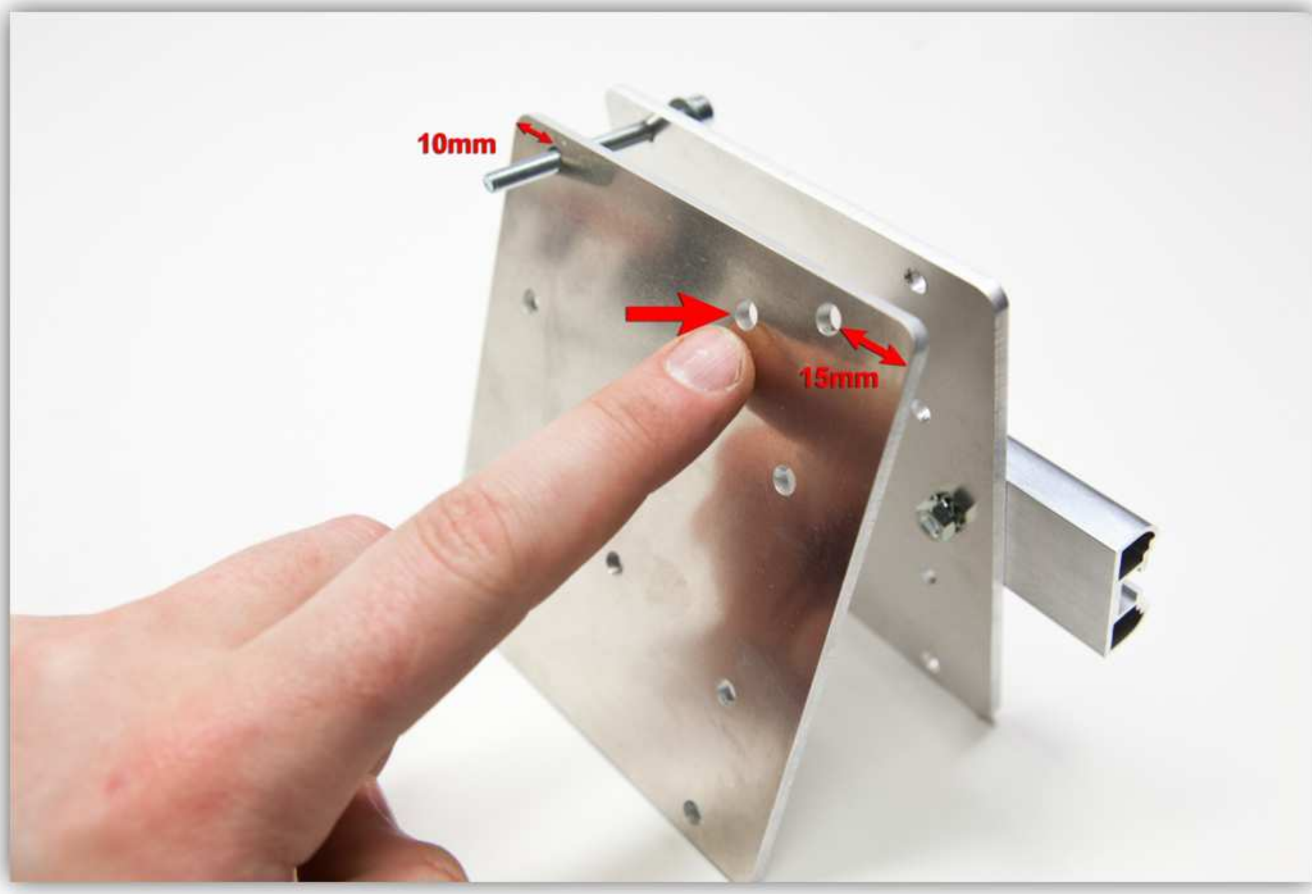
Use the 2 M4 countersunk screws to attach the small ALUMINIUM PROFILE to the Z CARRIAGE FRONT piece.

Note the red markings. Make sure the orientation is correct.

Use the M4 nuts and M4 toothed washers as shown in the picture below:

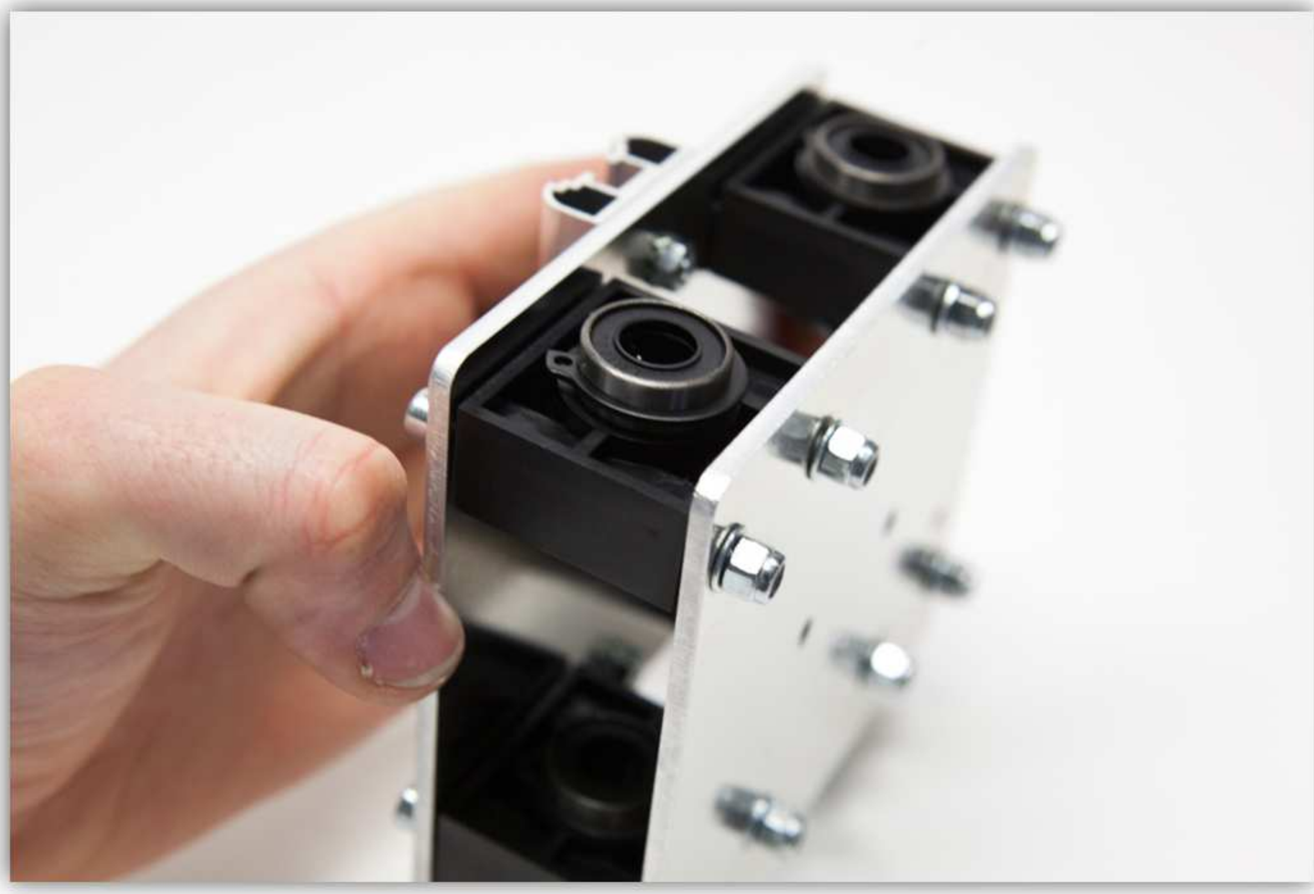
Slide an M4 washer over the long M4 bolt. Repeat this 8 times.

Slide the bolt with washer through then Z CARRIAGE FRONT piece and the Z CARRIAGE back piece. **Make sure that the orientation of the pieces is exactly as in the picture (watch the red arrows carefully).**



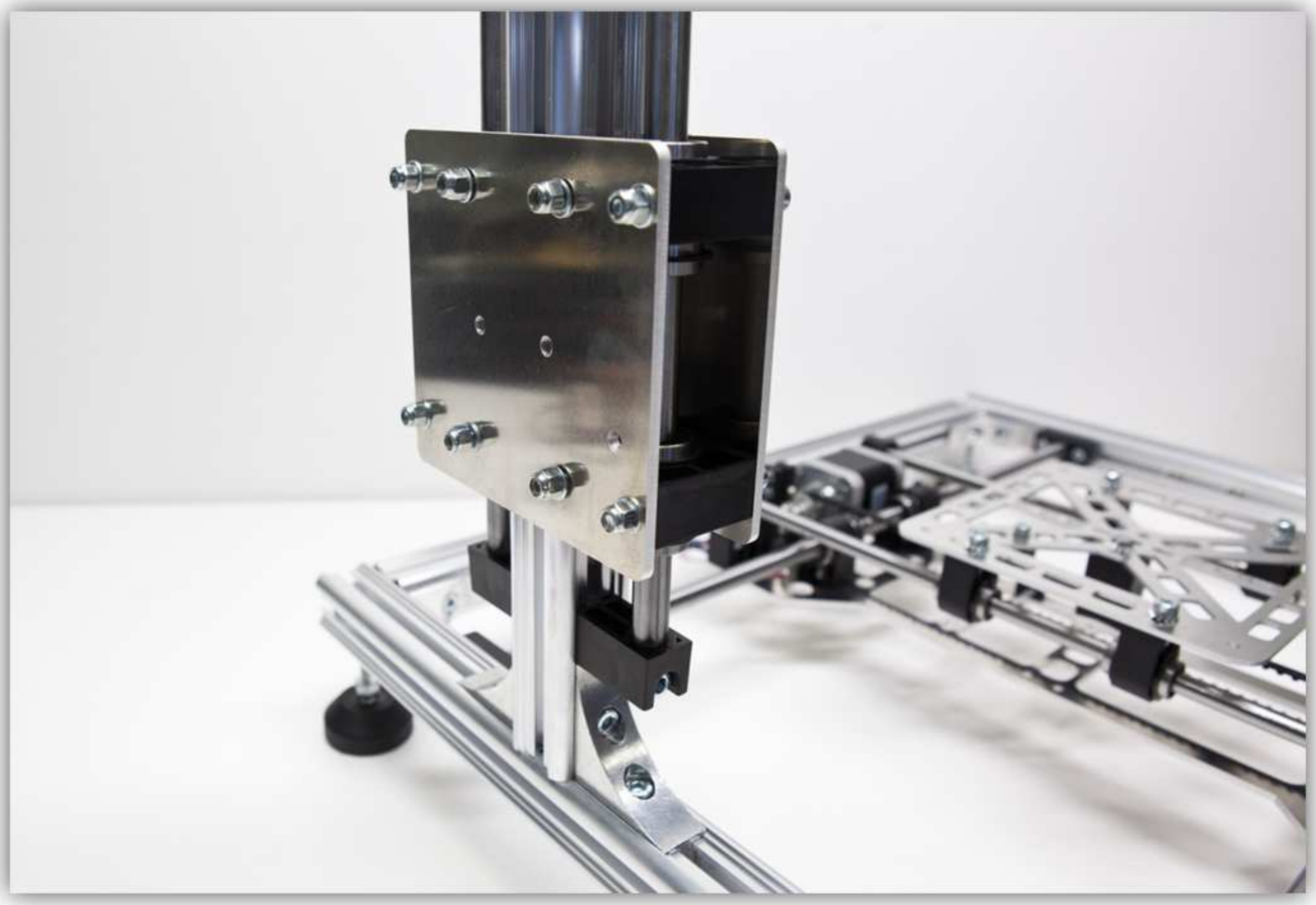
Put the remaining bolts in place and use an M4 washer and an M4 locking nut on each bolt. **Do not tighten the bolts.**

Slide the 4 BEARING CLAMP Z BIG pieces between the 2 aluminium plates and over the bolts.



Slightly tighten the bolts. We will fully tighten these bolts at a later step in the building process.

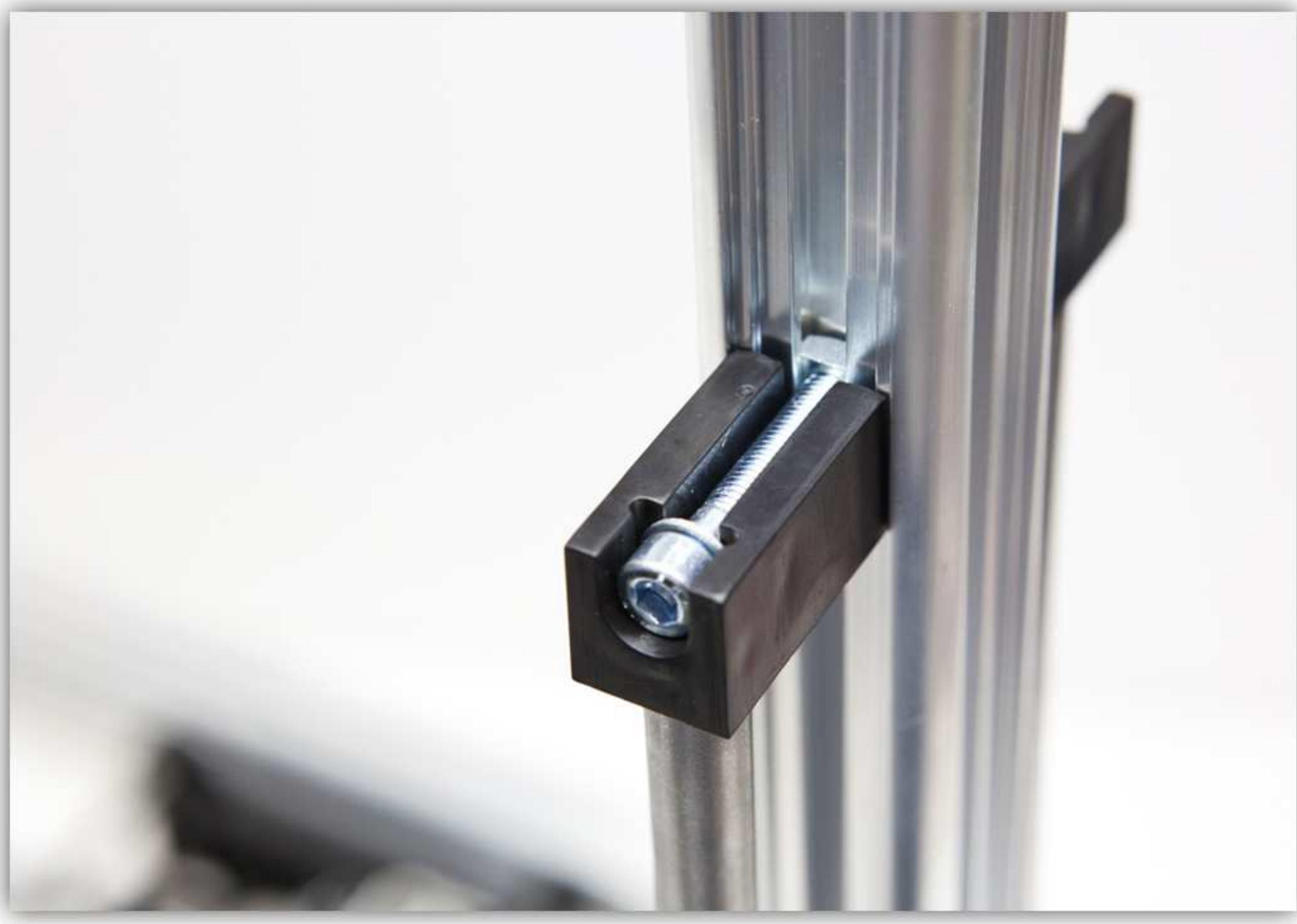
Slide this assembly over the upright 2 rods. **Pay attention to the orientation.**



Now slide the two remaining ROD CLAMP Z BIG pieces over the rods.

Take two of these bolts you assembled earlier:

Slide these bolts in the upright profile so they fit in the ROD CLAMP Z BIG pieces.



Tighten these bolts. **Do not over tighten.**

Making sure that this Z CARRIAGE can move freely up and down, you can firmly tighten all the bolts that were previously only slightly tightened.

005 - ASSEMBLING THE RIGHT UPRIGHT OF THE FRAME

Take one ALUMINIUM PROFILE of 500 mm (19.7") out of the box.

Slide two ANGULAR MOUNTS (from the box) in the end of the ALUMINIUM PROFILE of 500 mm (19.7").

Slide this assembly in the right profile of the BASE FRAME. Slide it down the profile until its centre is at 16 cm (6.3") from the edge of the base frame.


UK/0126/0019
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
NYLON COAT

Tighten the bolts on the ANGULAR MOUNTS.

Take all the parts out of the bag labelled with 22.

Now take the piece as shown in the picture below out of the bag containing the plastic parts (BEARING CLAMP Z SMALL).

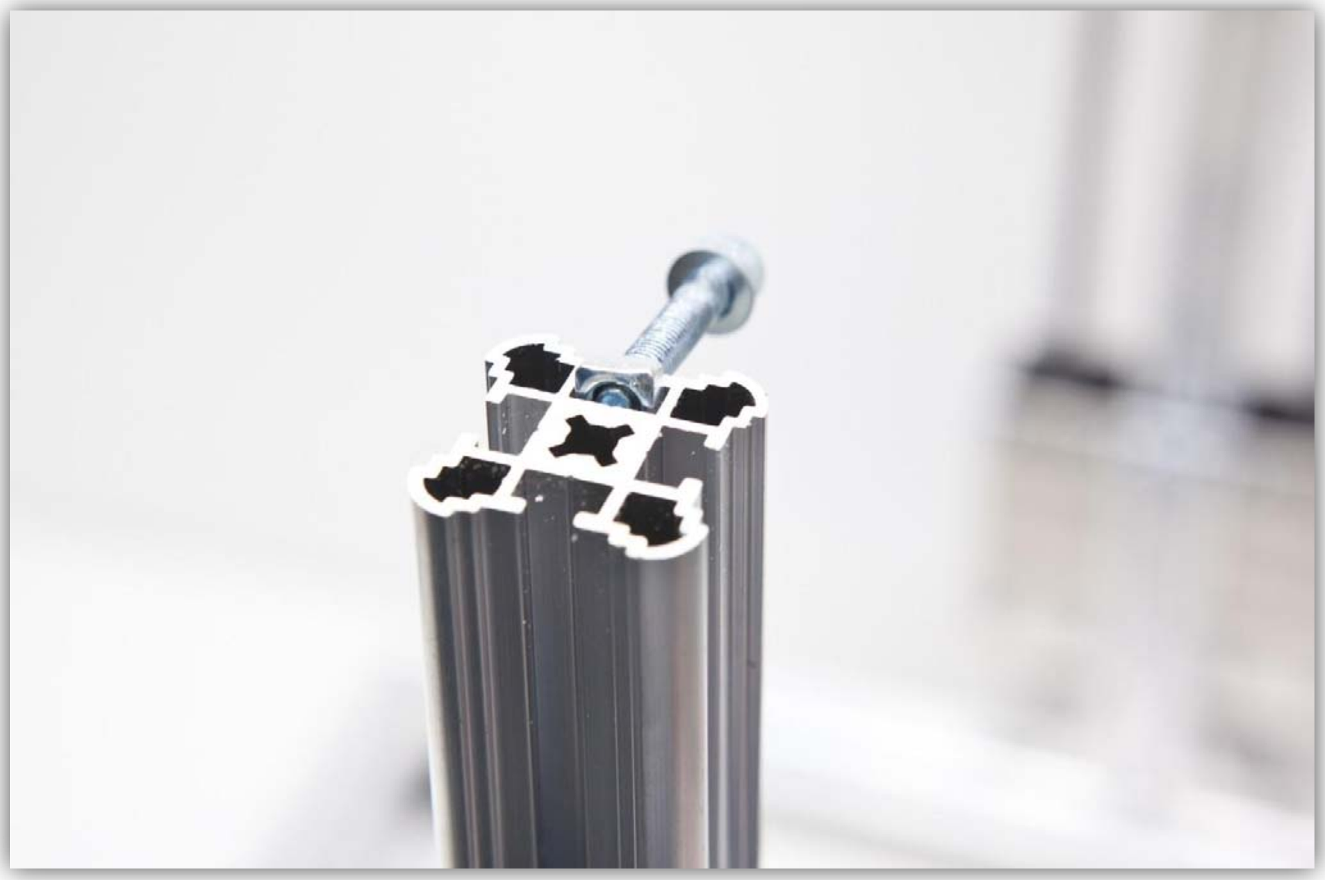
Take all the parts out of the bag labelled with 23.

Take a rod out of the bag labelled with 7. This rod should have a diameter of 8 mm (0.39") and a length of 300 mm (11.8").

Now take the 2 pieces as shown in the picture below out of the bag containing the plastic parts (ROD CLAMP Z SMALL).

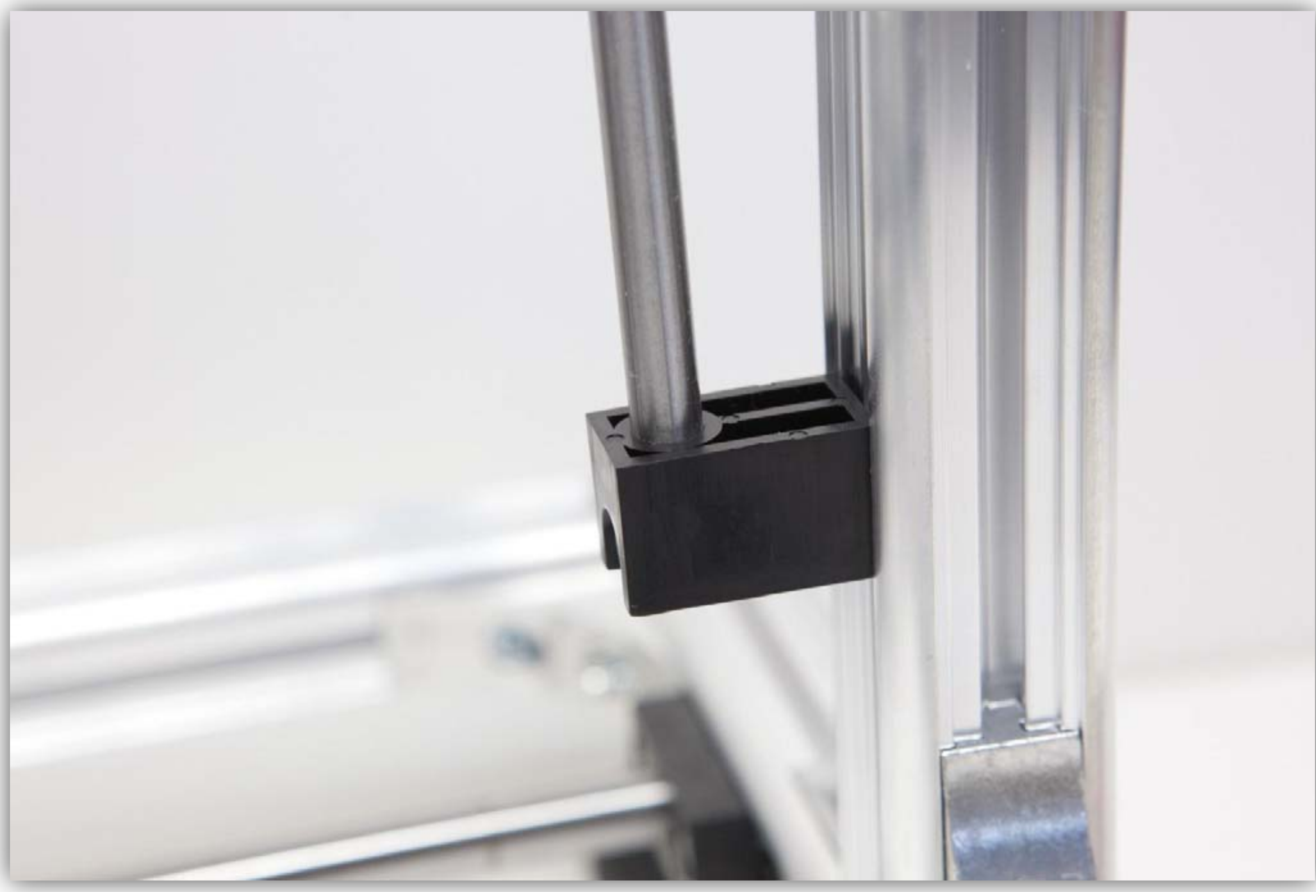
Slide an M5 washer over the M5 bolt and screw a square M5 nut on. Repeat this 2 times.

Slide one of these bolts in the right upright ALUMINIUM PROFILE.



Slide one of the ROD CLAMP Z SMALL pieces over this bolt and make sure you tighten this bolt so that this piece sits at about 6 cm (2.36") of the base frame.

Insert the rod into the ROD CLAMP Z SMALL piece.



Slide an LM8UU LINEAR BEARING into the BEARING CLAMP Z SMALL piece.

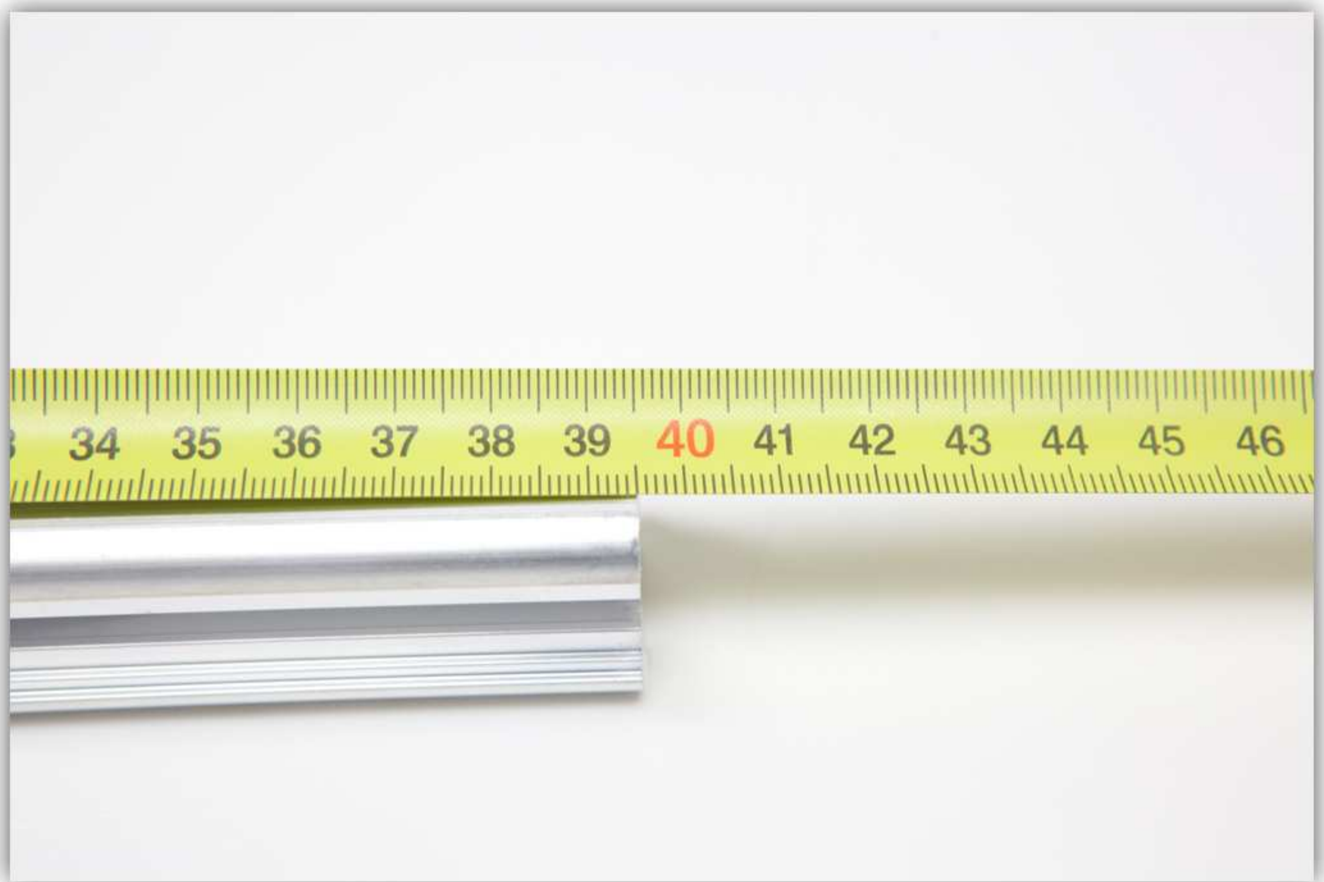
Use the circlip pliers to carefully fit the circlips around the both sides of the LM8UU LINEAR BEARING.

Slide this piece over the rod as shown in the picture below.

Slide one of the M5 bolts (with washer and square nut) and slide it down the ALUMINIUM PROFILE and slide a ROD CLAMP Z SMALL over this bolt. It should fit over the rod.


006 – ASSEMBLING THE EXTRUDER ARM

Take one ALUMINIUM PROFILE of 395 mm (15.6") out of the box.



Take the FAN HOLDER BRACKET out of the bag labelled with 25, also take 4 square M5 nuts (bag 16) and 2 ANGULAR MOUNTS (bag 14).

Slide the 2 ANGULAR MOUNTS into one end of the ALUMINIUM PROFILE of 395 mm (15.6").

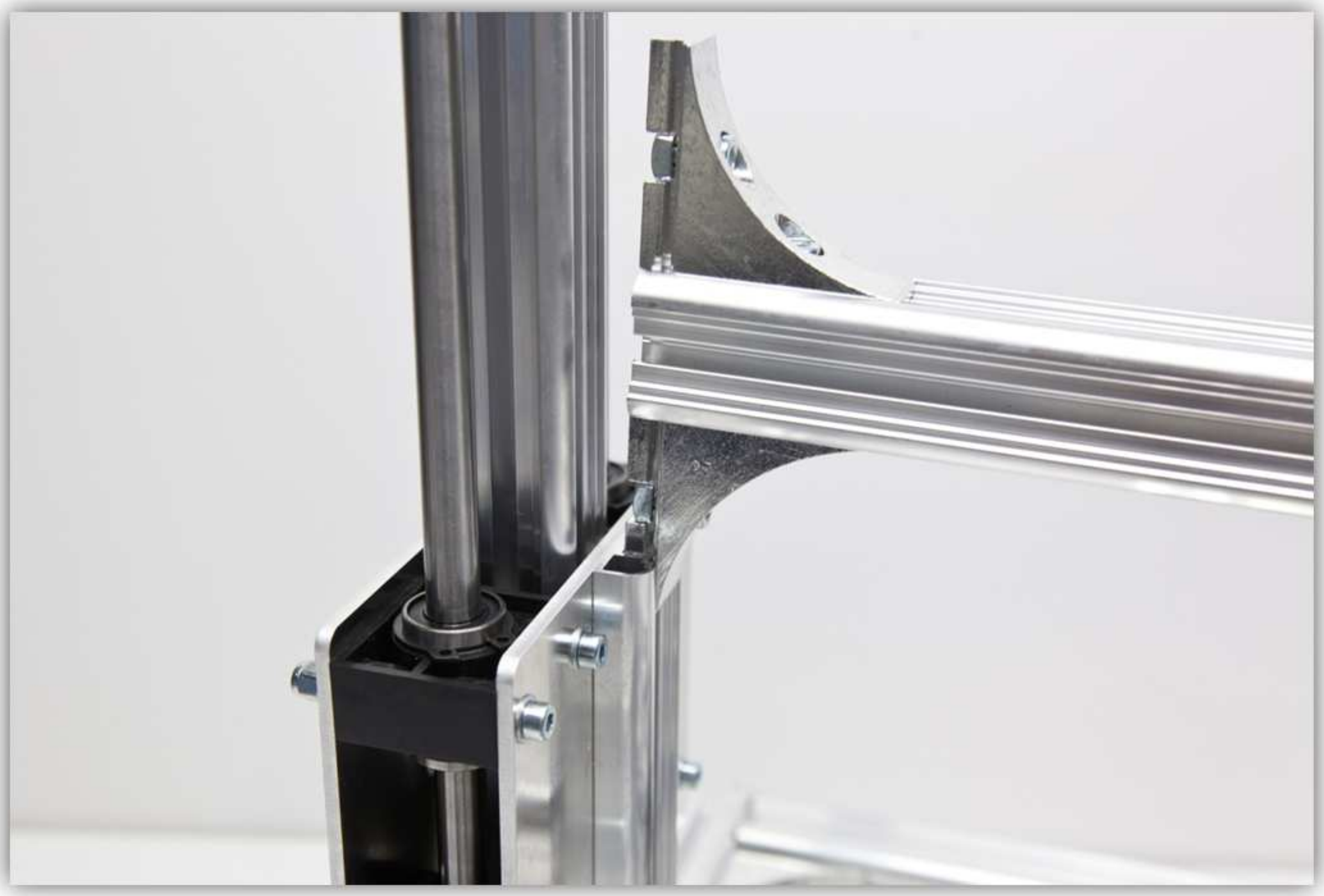
Slide 2 square M5 nuts into the ALUMINIUM PROFILE as shown in the picture below.

Slide the FAN HOLDER BRACKET and 1 square M5 nut into the ALUMINIUM PROFILE. **Notice the orientation of each part.**

Now insert another square M5 nut on the opposite side of the fan holder bracket. **Notice the orientation.**

Now slide the ALUMINIUM PROFILE into the BEARING CLAMP Z SMALL piece.

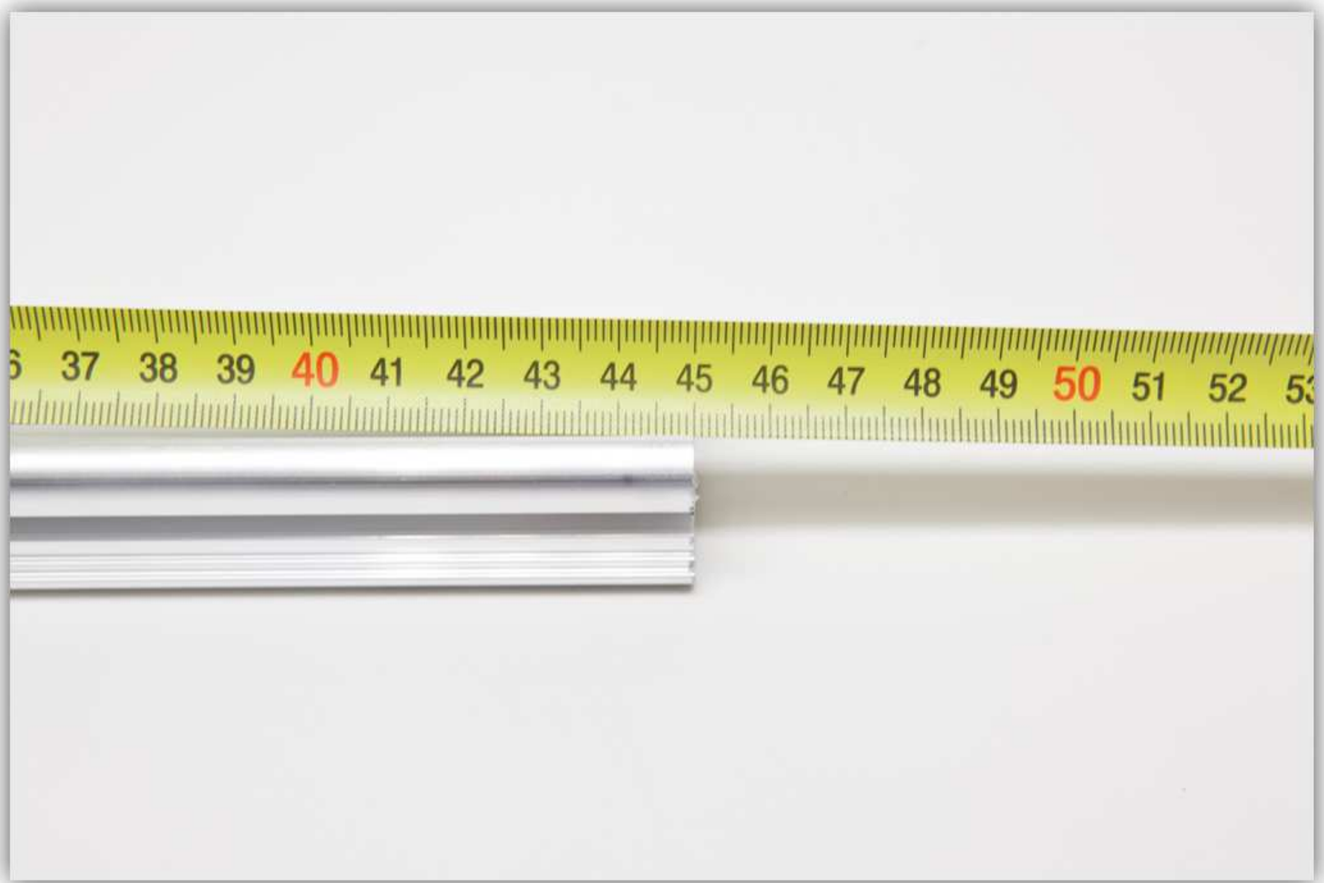
Now slide the two ANGULAR MOUNTS into the Z CARRIAGE. Be careful that while doing this, none of the square M5 nuts slide out of the angular profile.



Make sure there is about 5 mm of a gap from the top of the Z CARRIAGE and the top of the ANGULAR MOUNT.

Tighten all the bolts on the ANGULAR MOUNTS.

Now take the last ALUMINIUM PROFILE it should be one of 450 mm (17.7").



Take 4 ANGULAR MOUNTS out of bag 14.

Slide 2 ANGULAR MOUNTS on each end of the ALUMINIUM PROFILE.

Slide this assembly in the top of the frame.

Slide the ALUMINIUM PROFILE down until the tops of the ANGULAR MOUNTS are flush with the tops of the frame.

Tighten all the bolts on the angular mounts.

Slide the two square nuts on the opposite of each other in the extruder arm towards the BEARING CLAMP Z SMALL piece.

Use the 2 M5 bolts and 2 M5 washers to screw the BEARING CLAMP Z SMALL piece to the EXTRUDER ARM.

Tighten these bolts while making sure the Z CARRIAGE and the EXTRUDER ARM move freely.

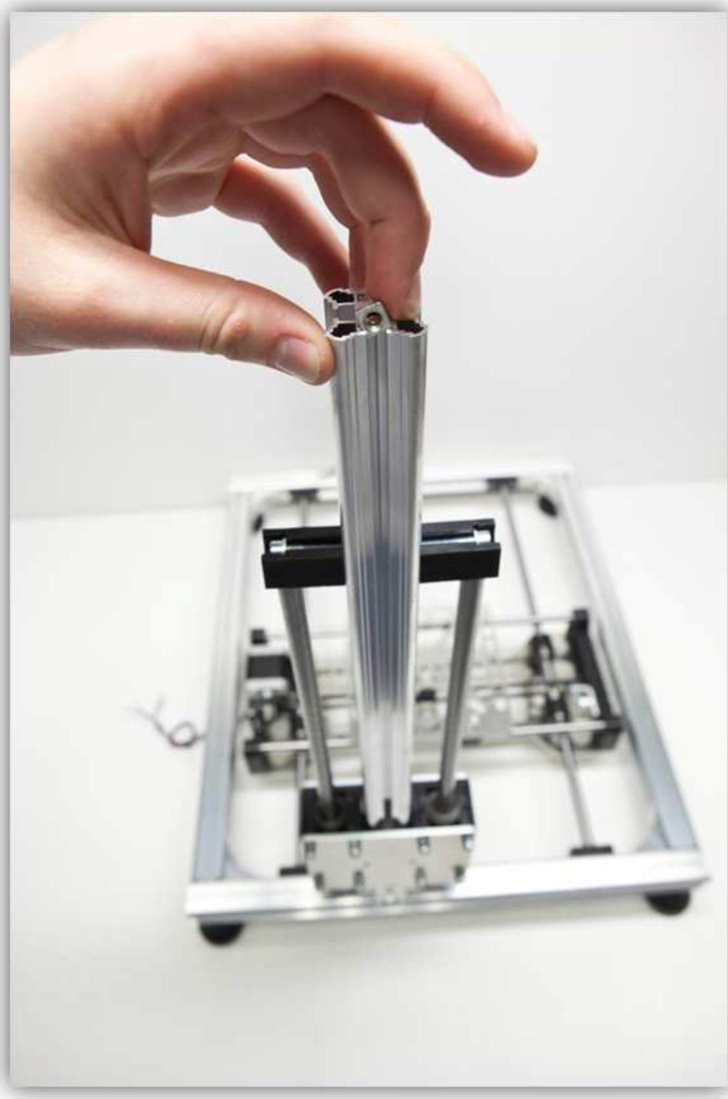
007 – ASSEMBLING THE Z MOTOR AND THREADED ROD

Take a motor out of the package labelled with 9.

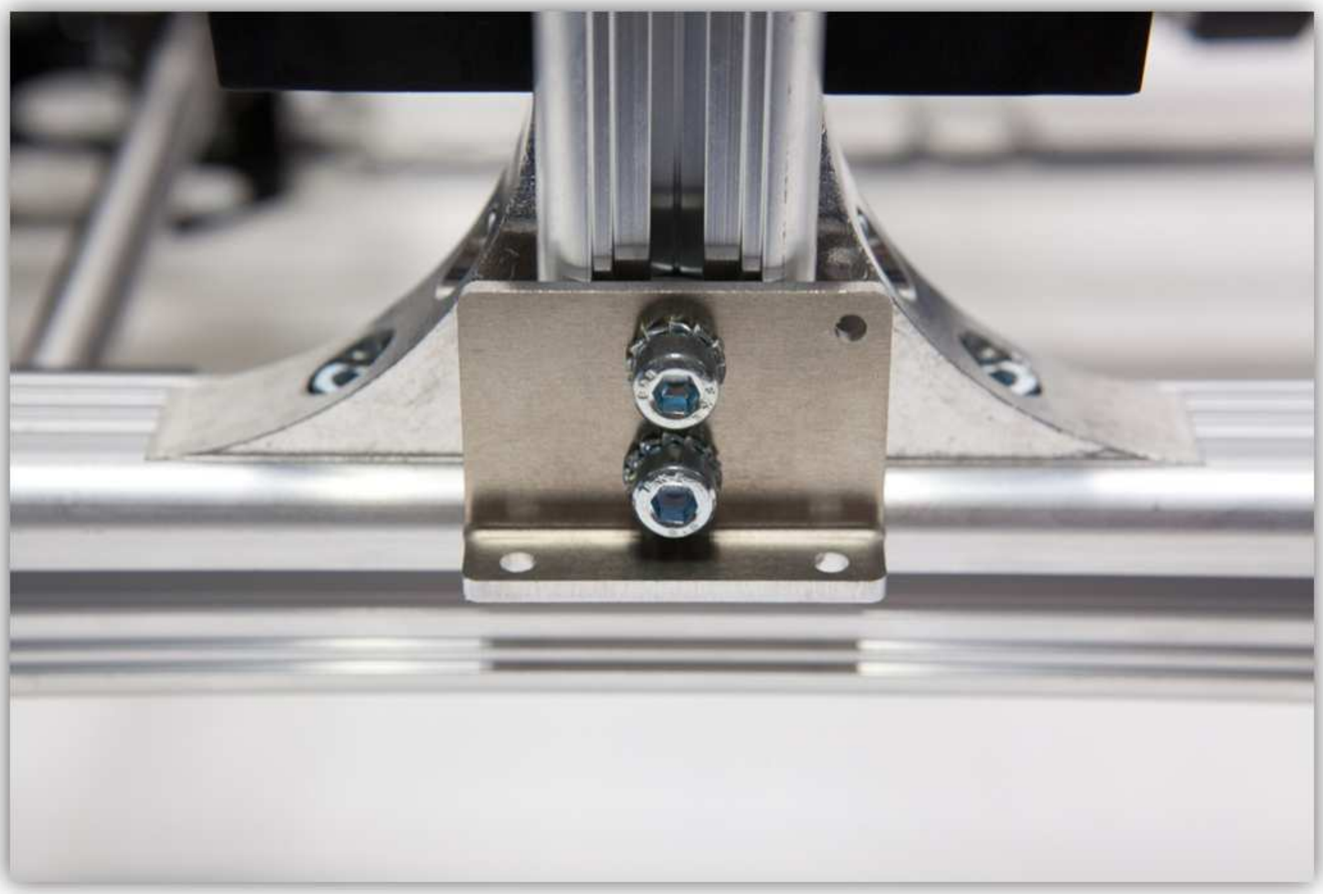
Take the parts out of the bag labelled with 26.

Now take the piece as shown in the picture below out of the bag containing the plastic parts (Z ROD GUIDE).

Slide **2** square M5 nut into the left upright ALUMINIUM PROFILE as shown in the pictures below.

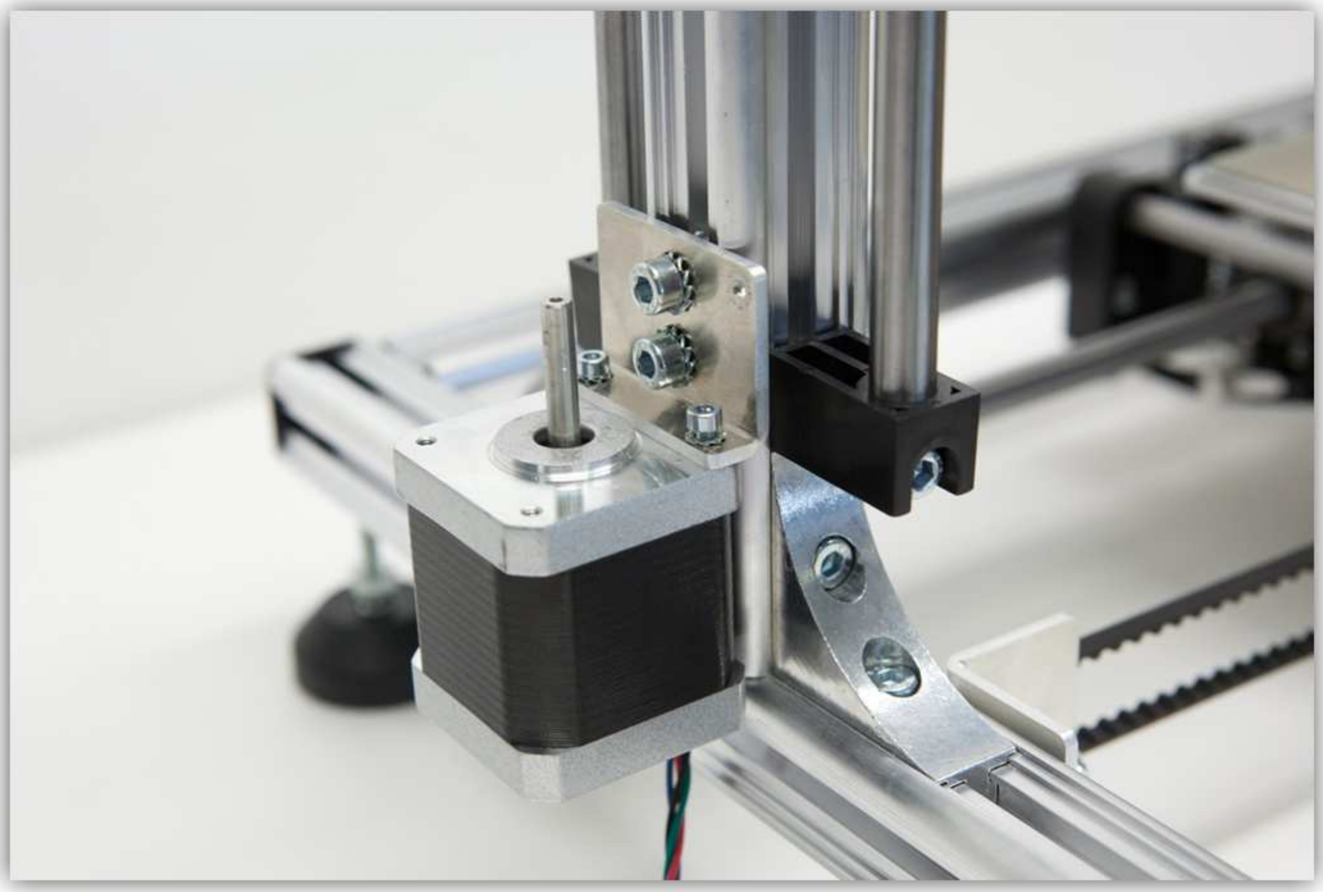


Use 2 M5 bolts and 2 M5 toothed washers to bolt the Z MOTOR BRACKET to the frame.

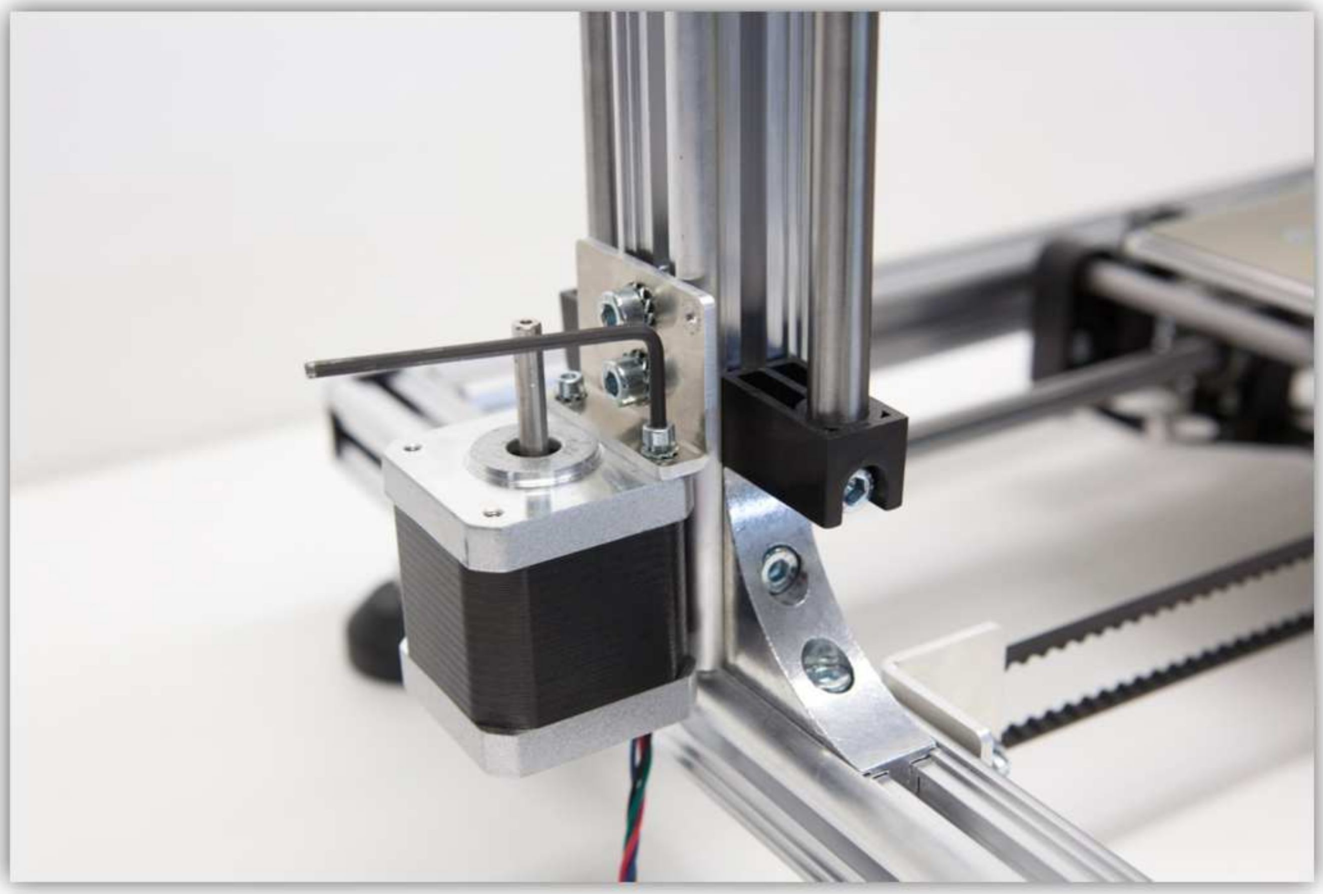


Make sure the bracket bottom is at **MAXIMUM** 4.5 cm (1.77") from the bottom frame. It should be between 4 cm (1.57") and 4.5 cm (1.77"). Tighten the 2 bolts and **make sure that the bracket is perfectly horizontal.**

Take the 2 M3 bolts and 2 M3 toothed washers and bolt the motor to the bracket.



Tighten these bolts firmly.



Screw an M8 bolt followed by an M8 washer, an M8 toothed washer, an M8 washer and the MOTOR CONNECTOR as shown in the picture below.

Tighten everything firmly.

Take the small locking bolt.

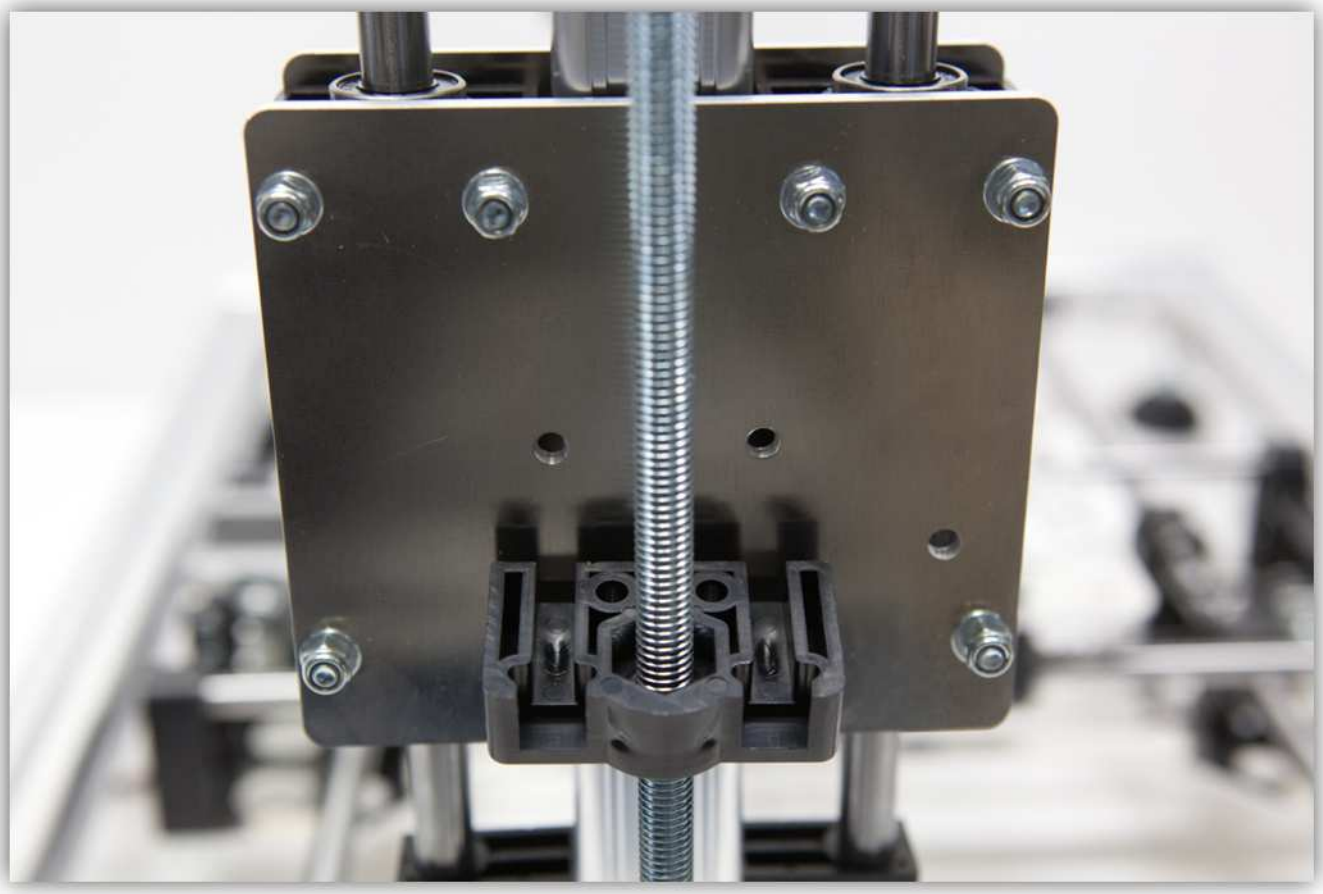
Screw it in the MOTOR CONNECTOR. **Do not screw this bolt in completely.**

Place the MOTOR CONNECTOR over the motor shaft. Make sure that the shaft goes as far as it can. Now tighten the small locking bolt.

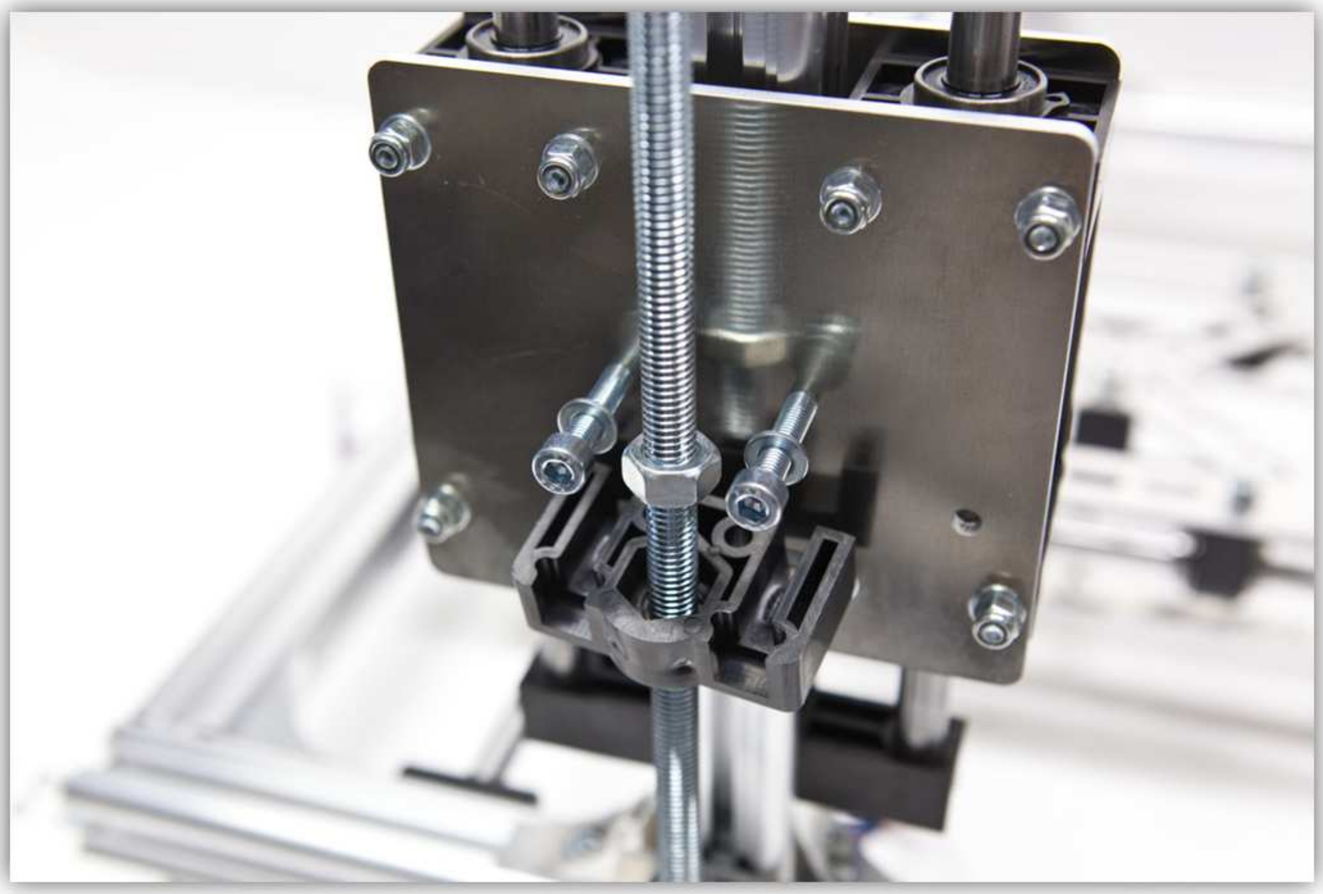
Now take these pieces as shown in the picture below out of the bag containing the plastic parts (Z FOLLOWER A and Z FOLLOWER B).

Take the parts out of the bag labelled with 27.

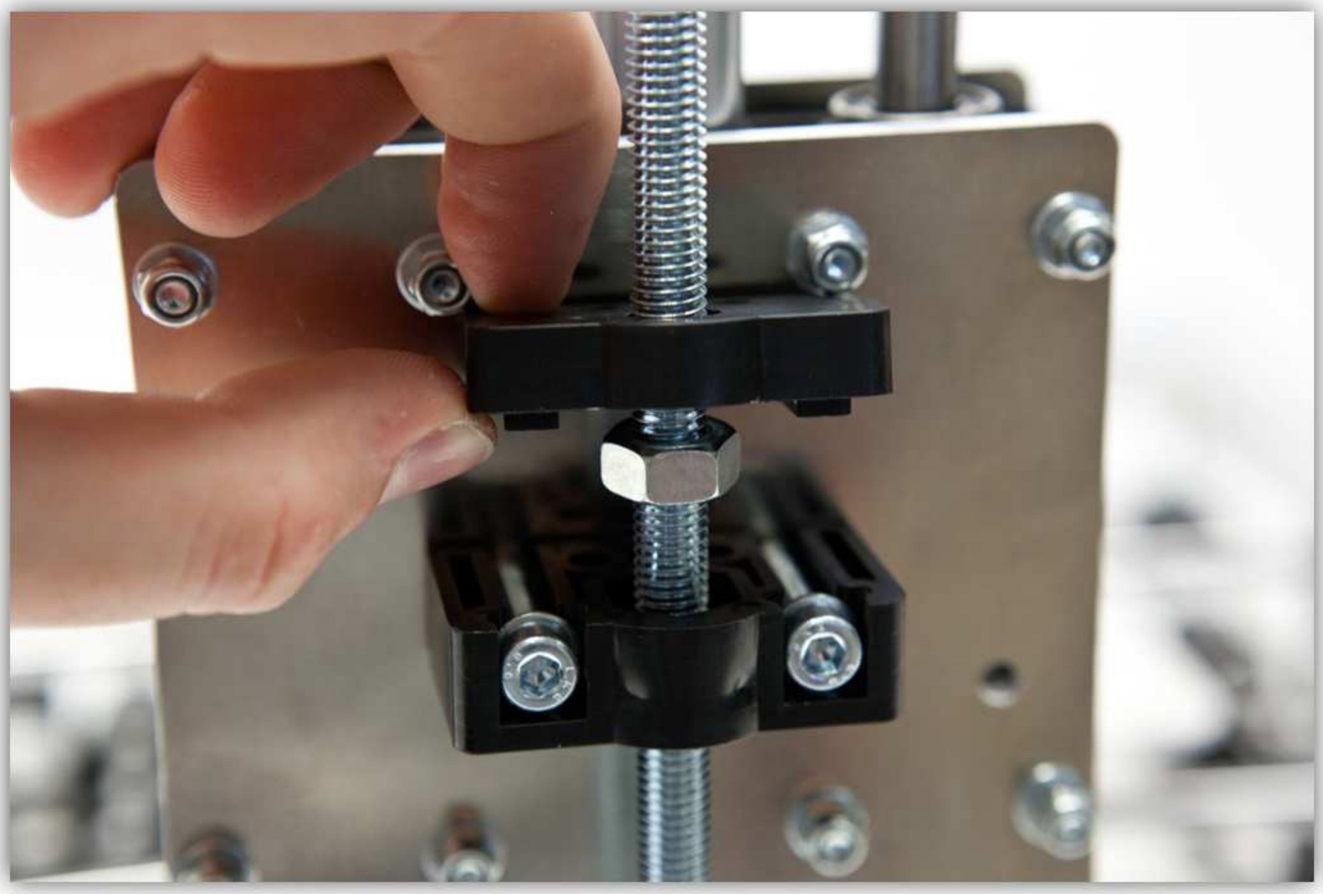
Slide the Z FOLLOWER A piece over the rod as shown in the picture. **Watch the orientation.**



Screw the M8 nut over the rod and take the 2 M5 bolts and 2 M5 washers and screw them into the Z CARRIAGE.

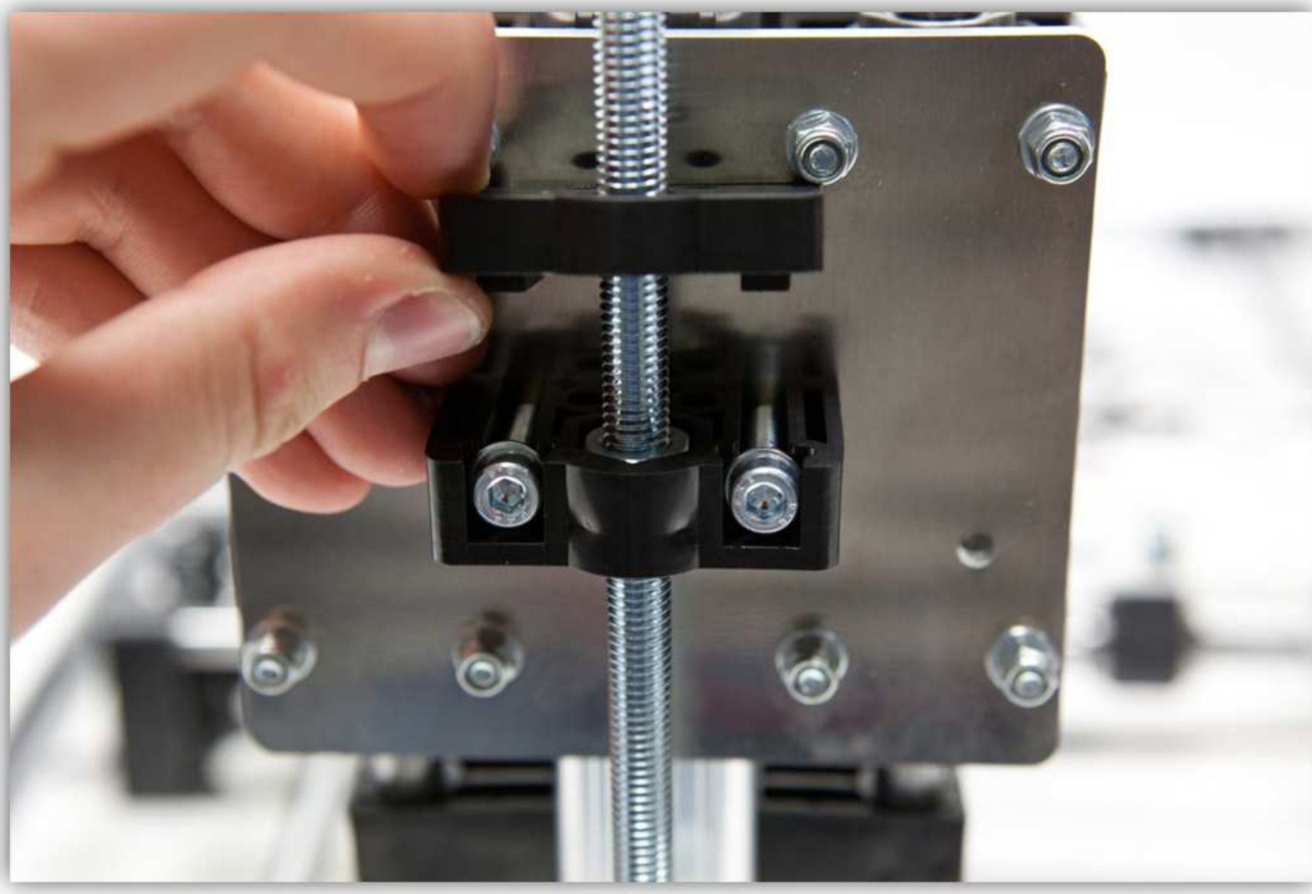


Slide the Z FOLLOWER B piece over the rod as shown in the picture. **Watch the orientation.**

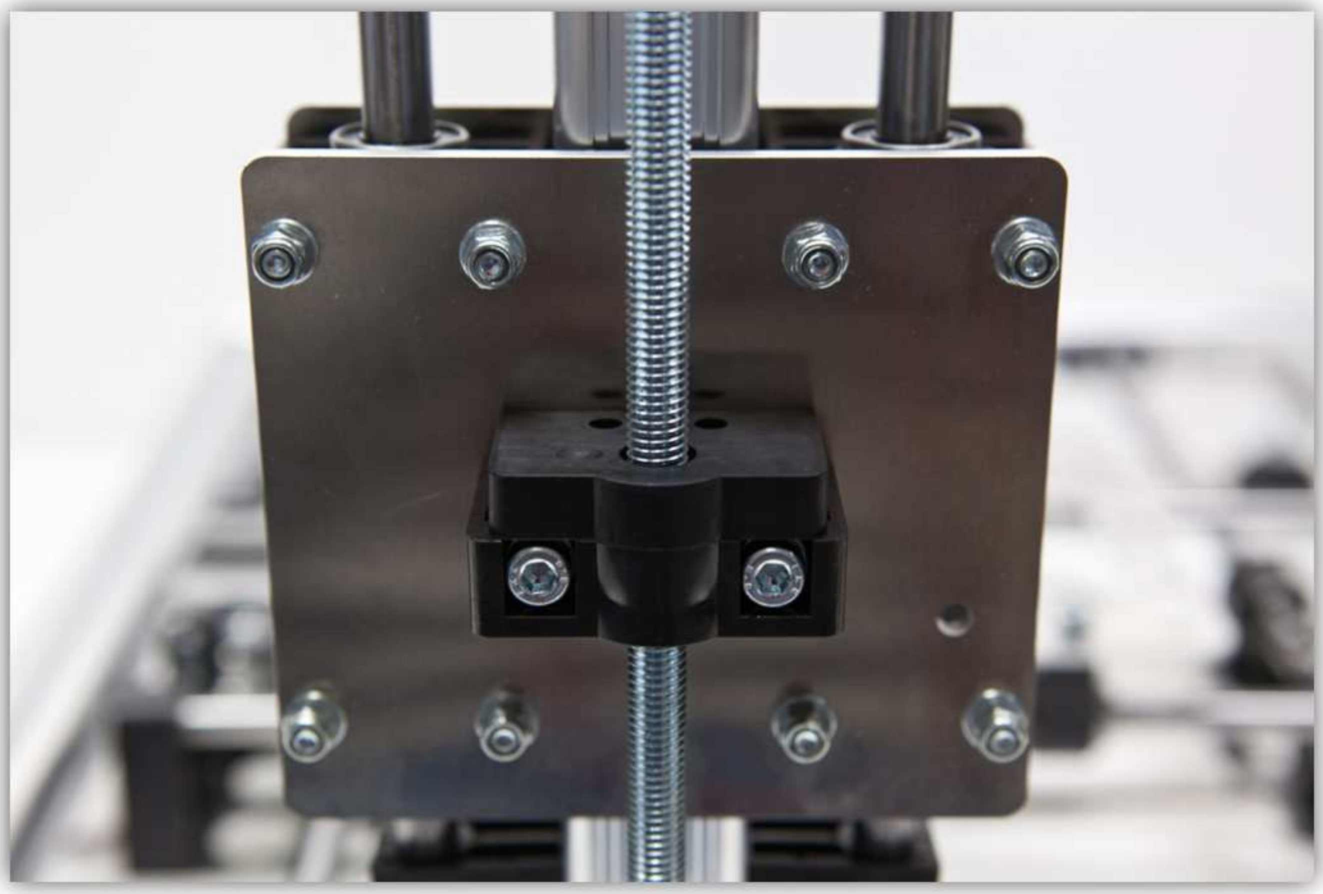


Tighten the MOTOR CONNECTOR to make sure there is no play.

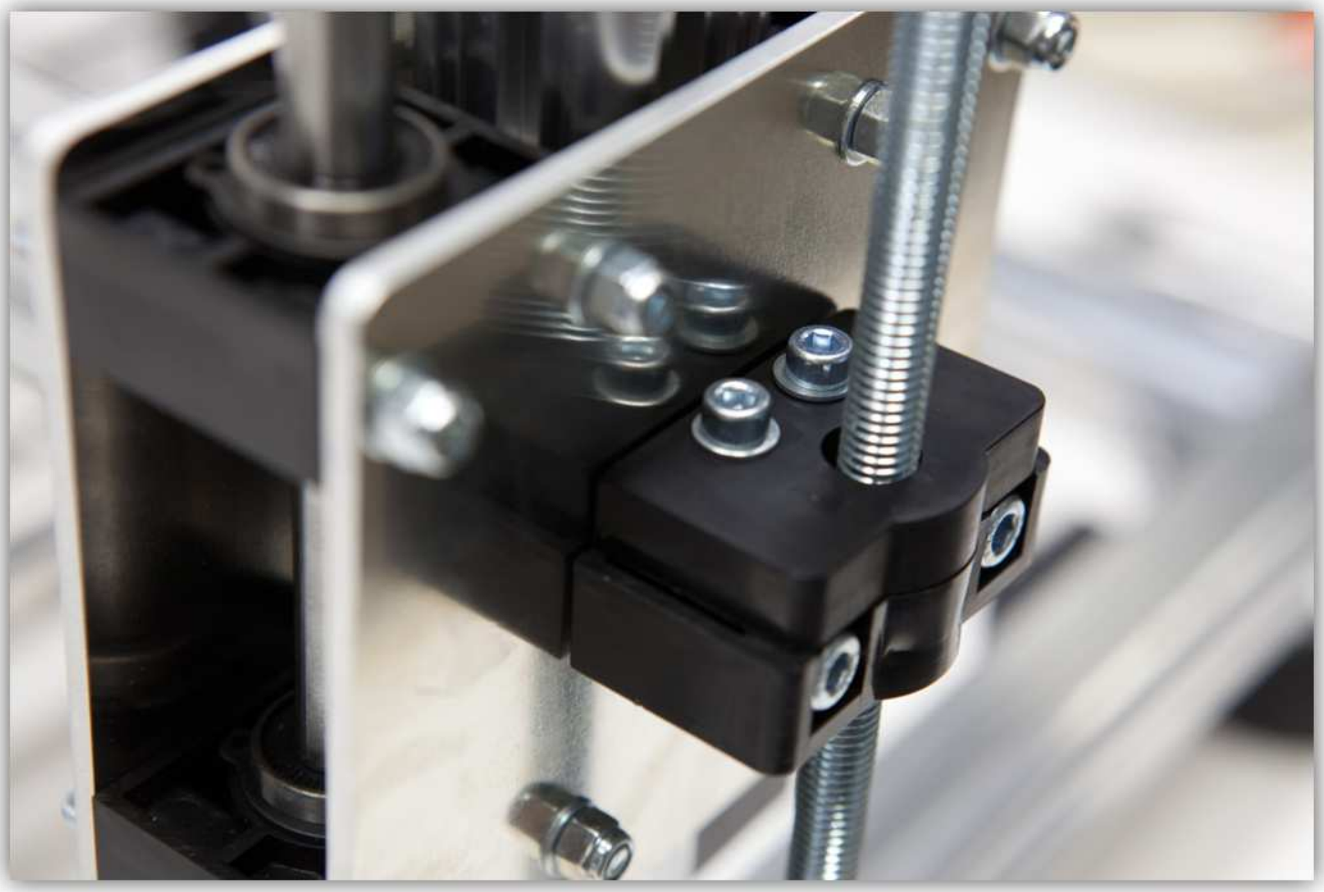
Attach the Z FOLLOWER A piece to the CARRIAGE. **Do not fully tighten these bolts.** Turn the rod until the M8 bolt sits snugly into the Z FOLLOWER A piece.



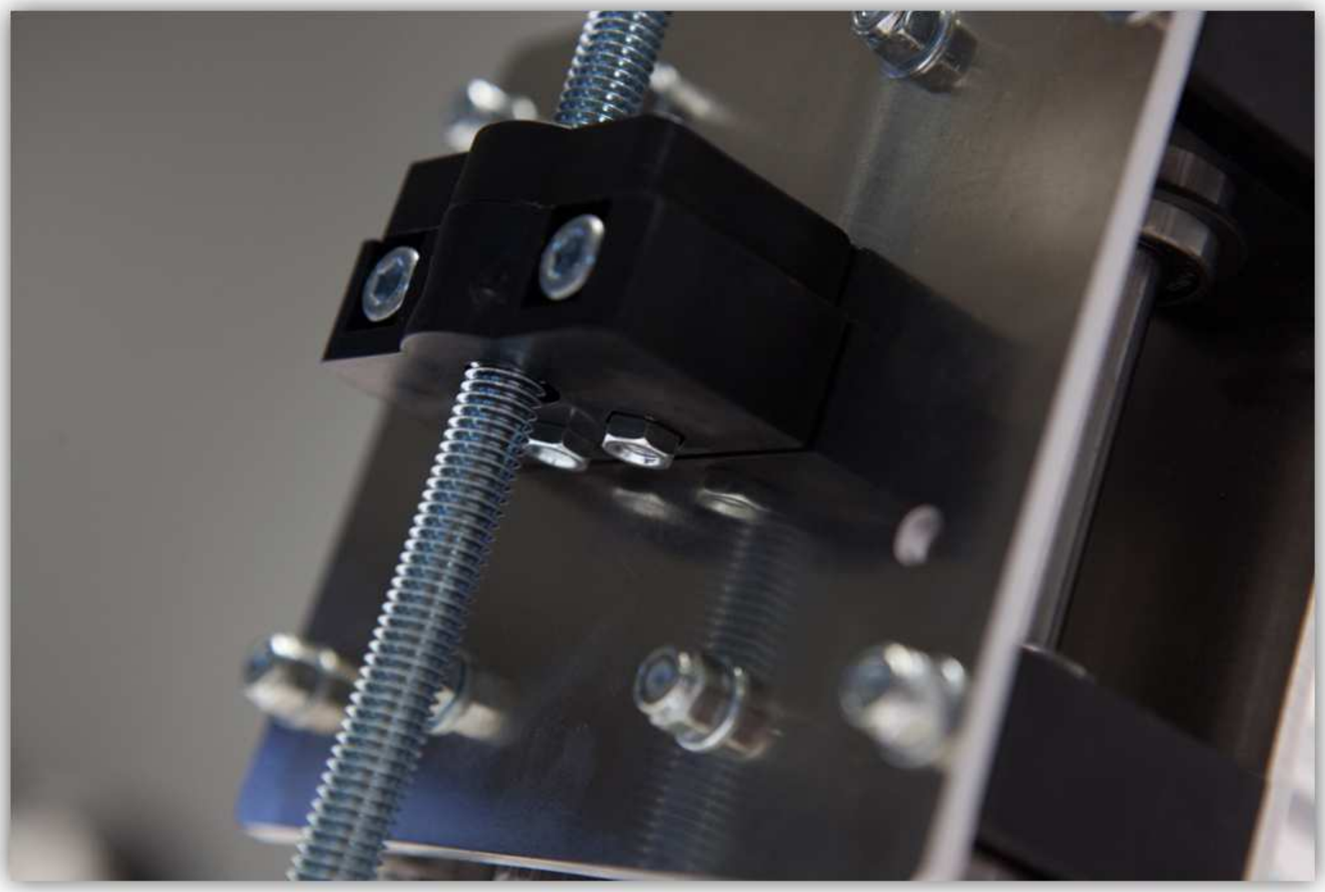
Snap the Z FOLLOWER B piece into the Z FOLLOWER A piece.



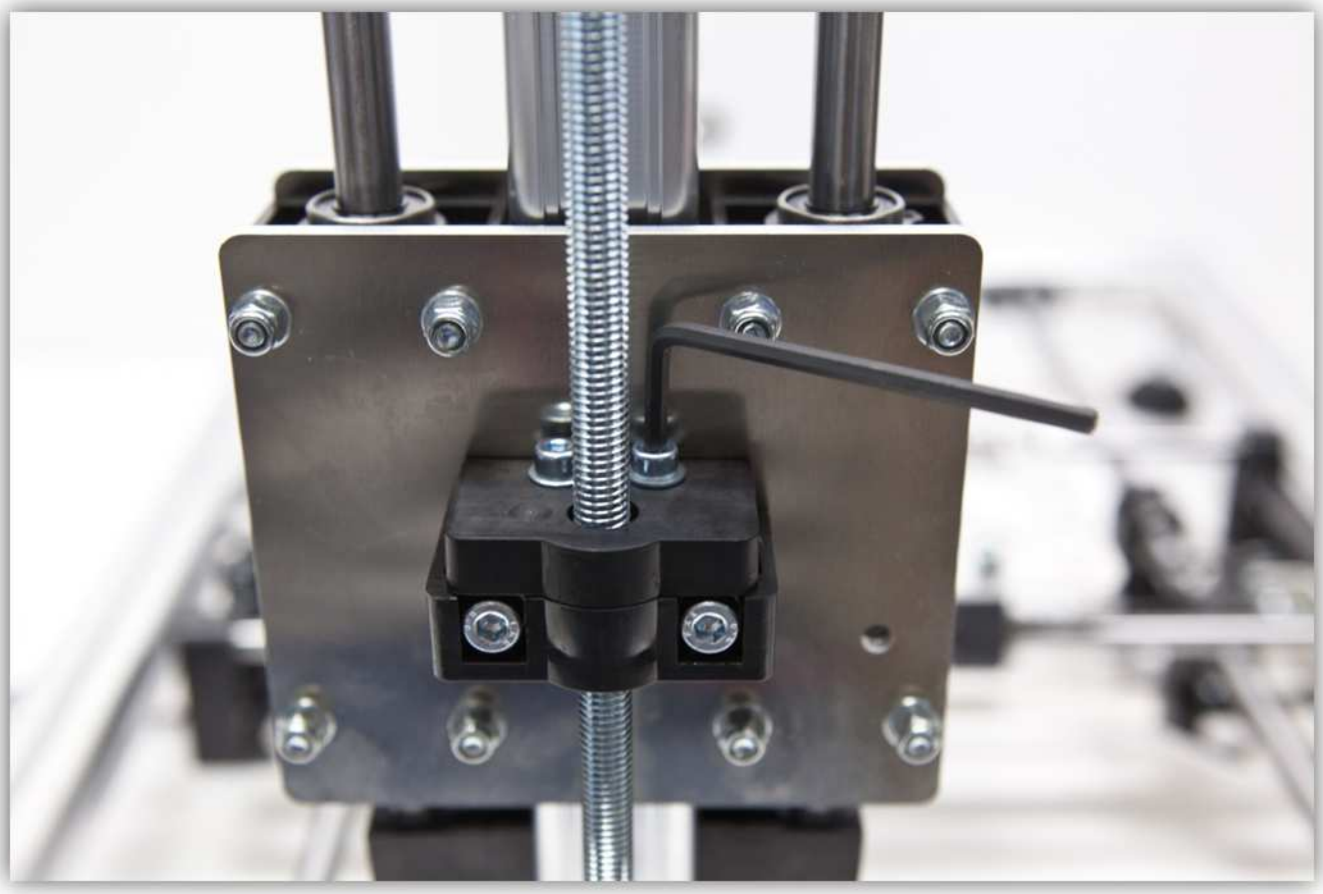
Take the 2 M4 bolts and 2 M4 washers and screw them into the top of the Z FOLLOWER assembly as shown in the picture below.



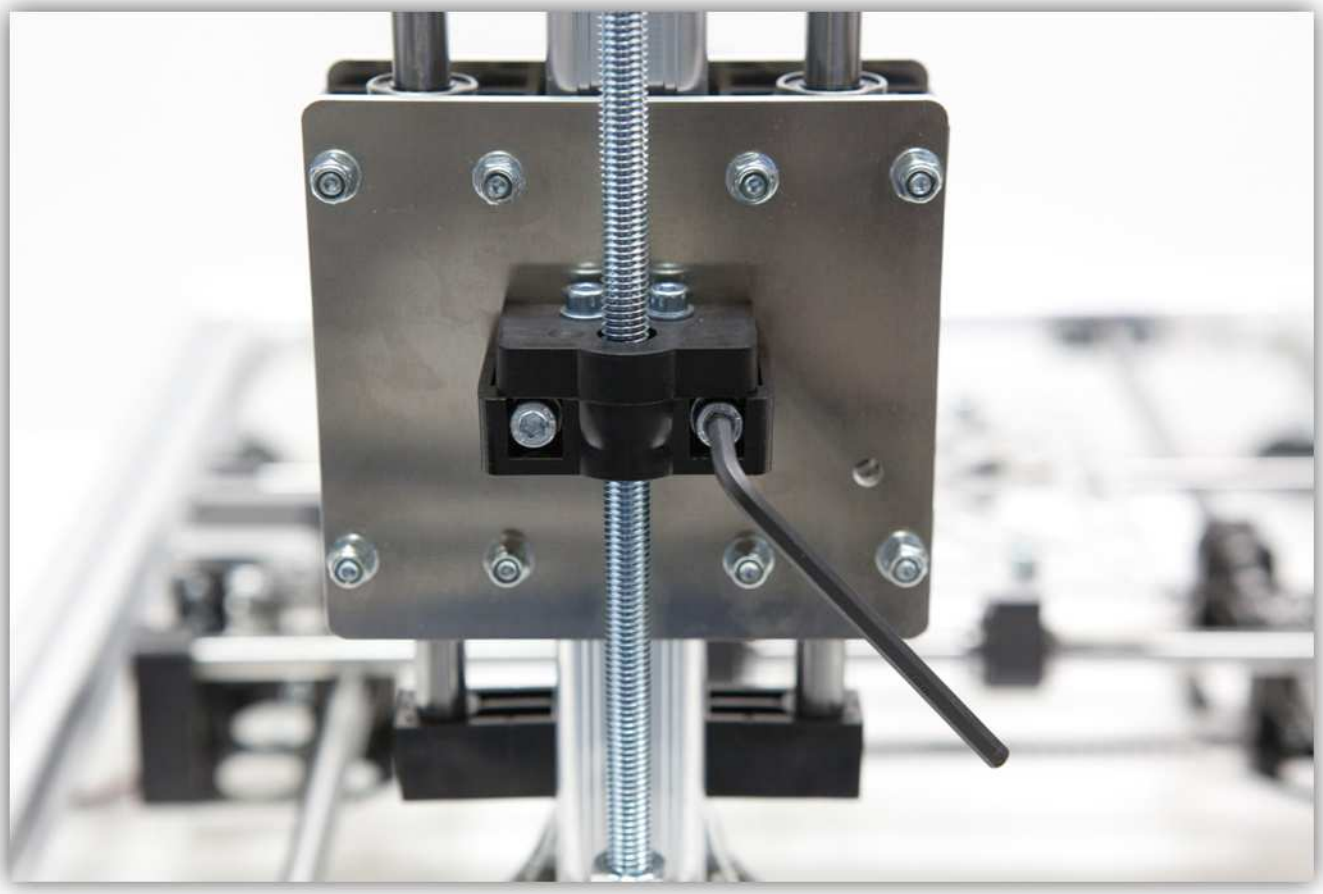
Use 2 M4 nuts to keep the two Z FOLLOWER pieces together.



Tighten these bolts.



Now fully tighten the bolts that attach the Z FOLLOWER assembly to Z CARRIAGE assembly.



Screw an M8 locking bolt on the rod followed by an M8 washer.

Slide a 608 bearing into the Z ROD GUIDE piece.

Slide this assembly over the rod.

Take an M5 bolt, an M5 washer and a square M5 nut.

Slide this assembly into the left upright ALUMINIUM PROFILE as shown in the picture below.

Slide the assembly over the Z ROD GUIDE and tighten the bolt so that it is fixed but still possible to slide up and down.

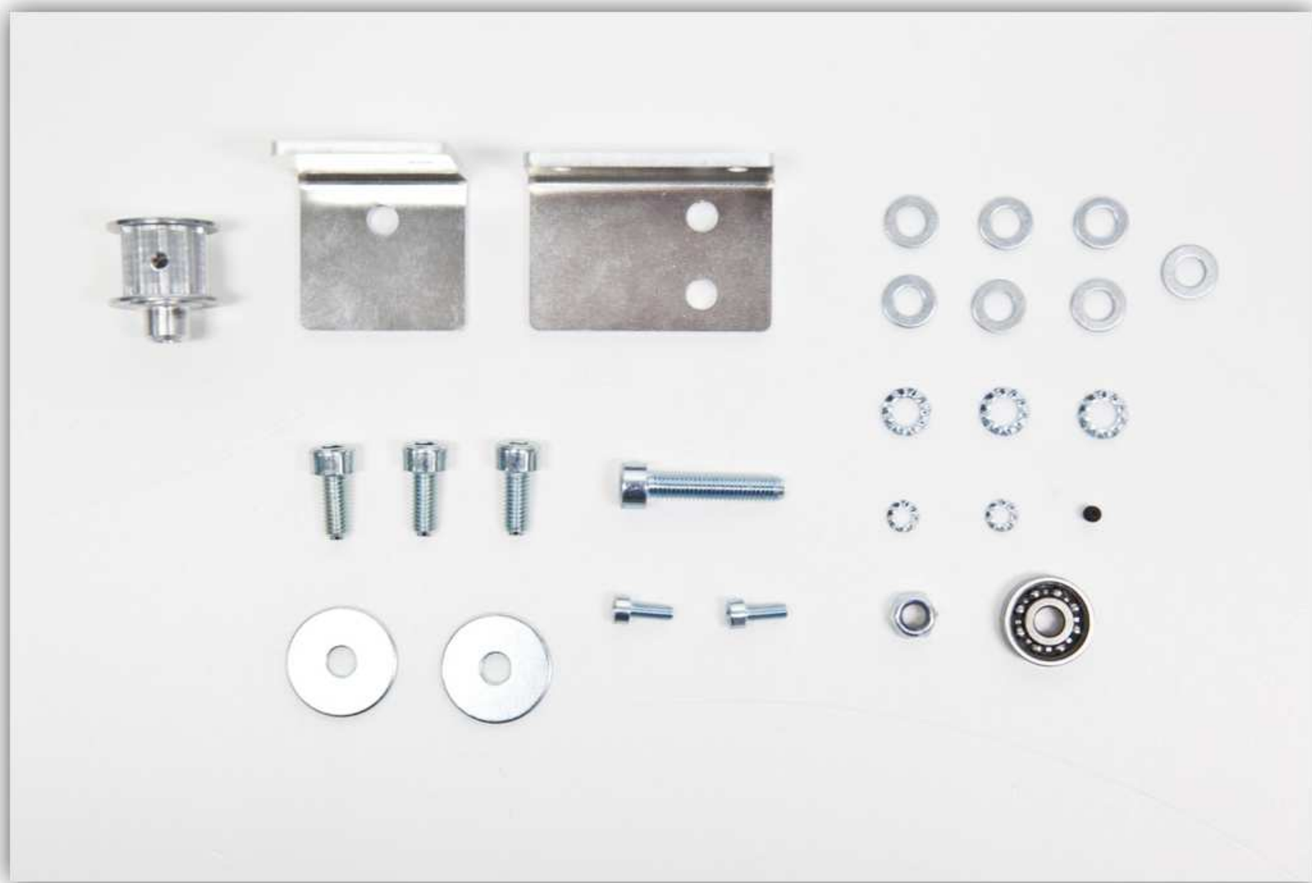
Slide this bolt and Z ROD GUIDE down until the 608 bearing meets the M8 washer.

Screw an M8 locking nut over the rod as shown in the picture.

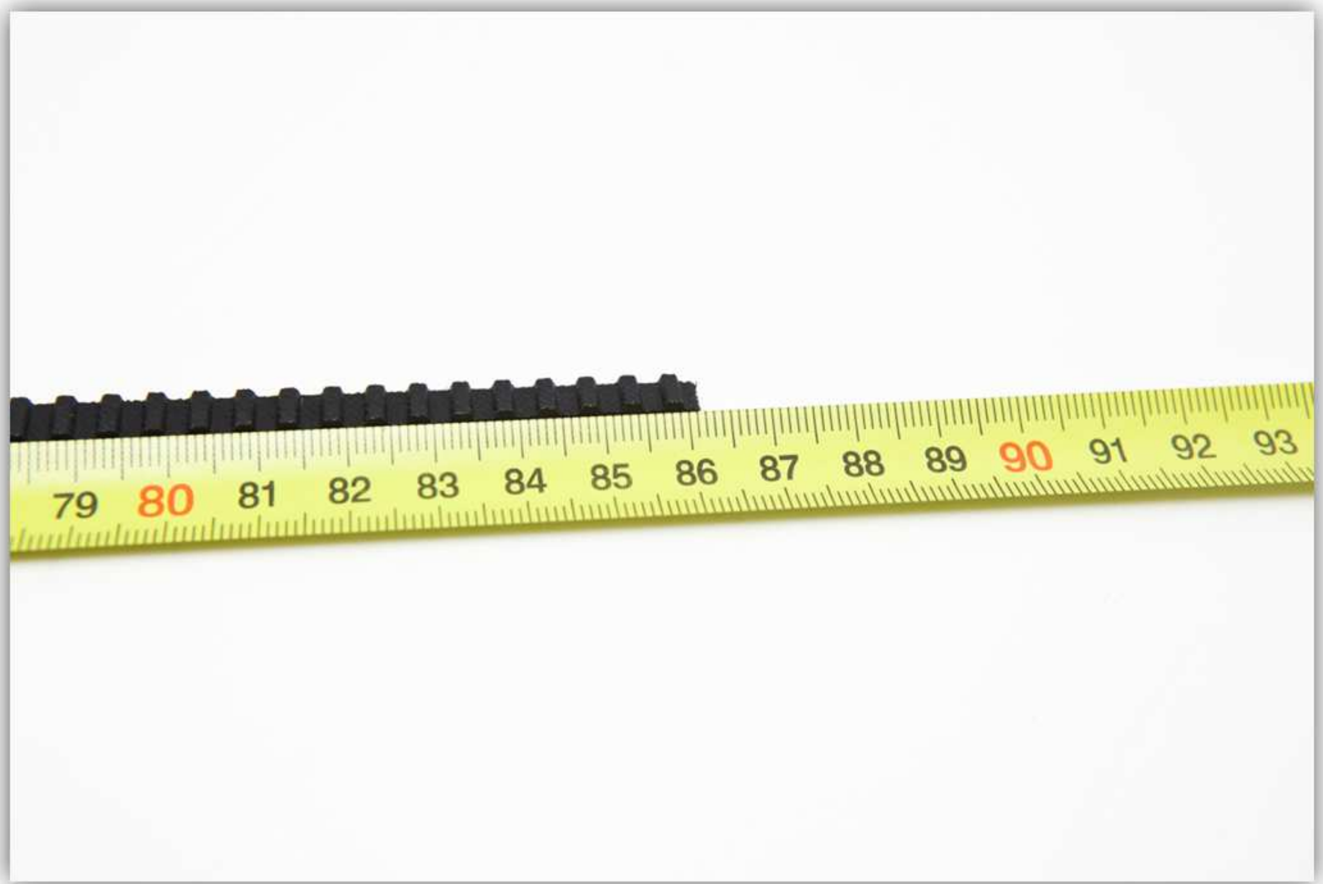
The build should now look like this:

008 – ASSEMBLING THE X DRIVETRAIN

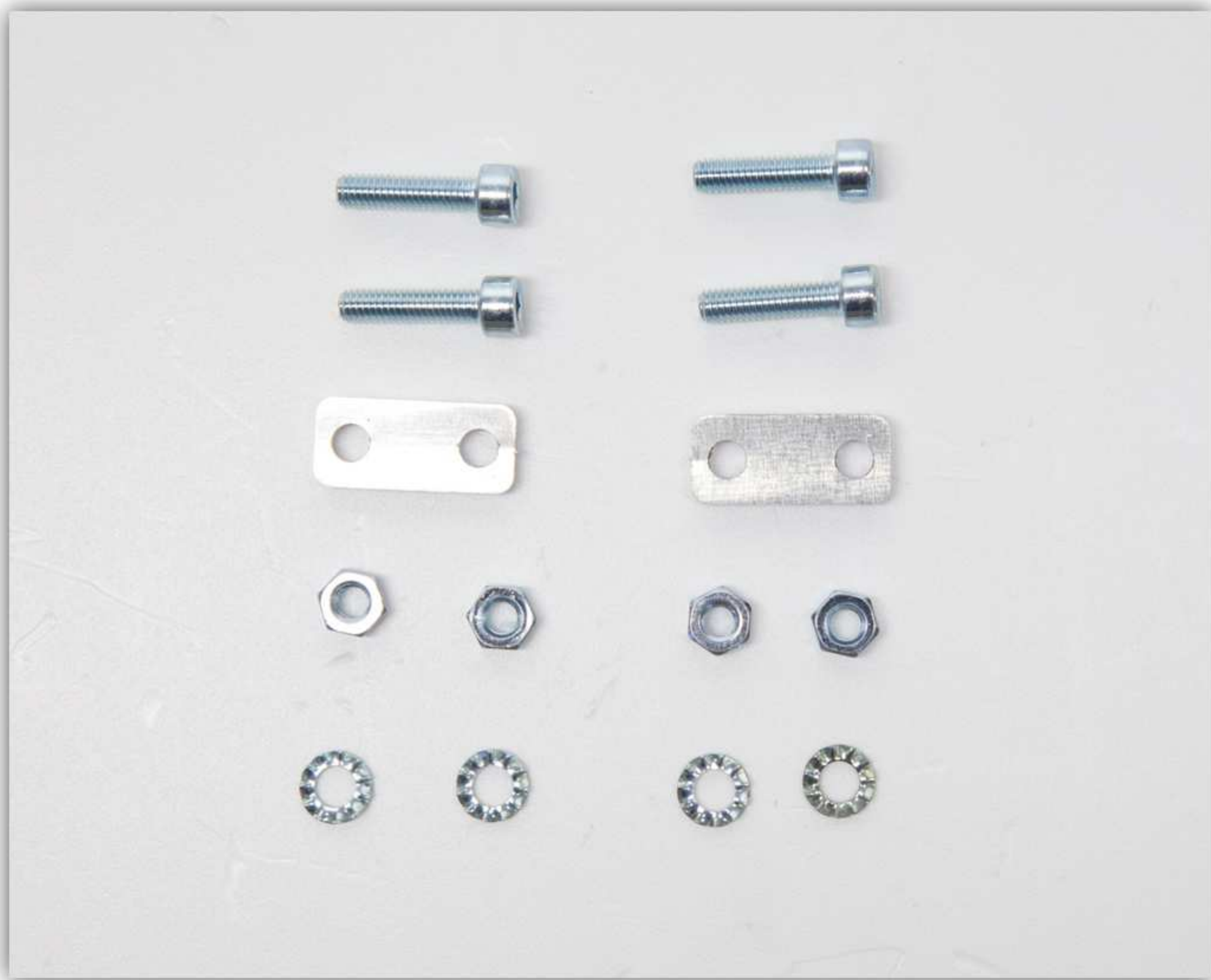
Take the parts out of the bag labelled with 28.



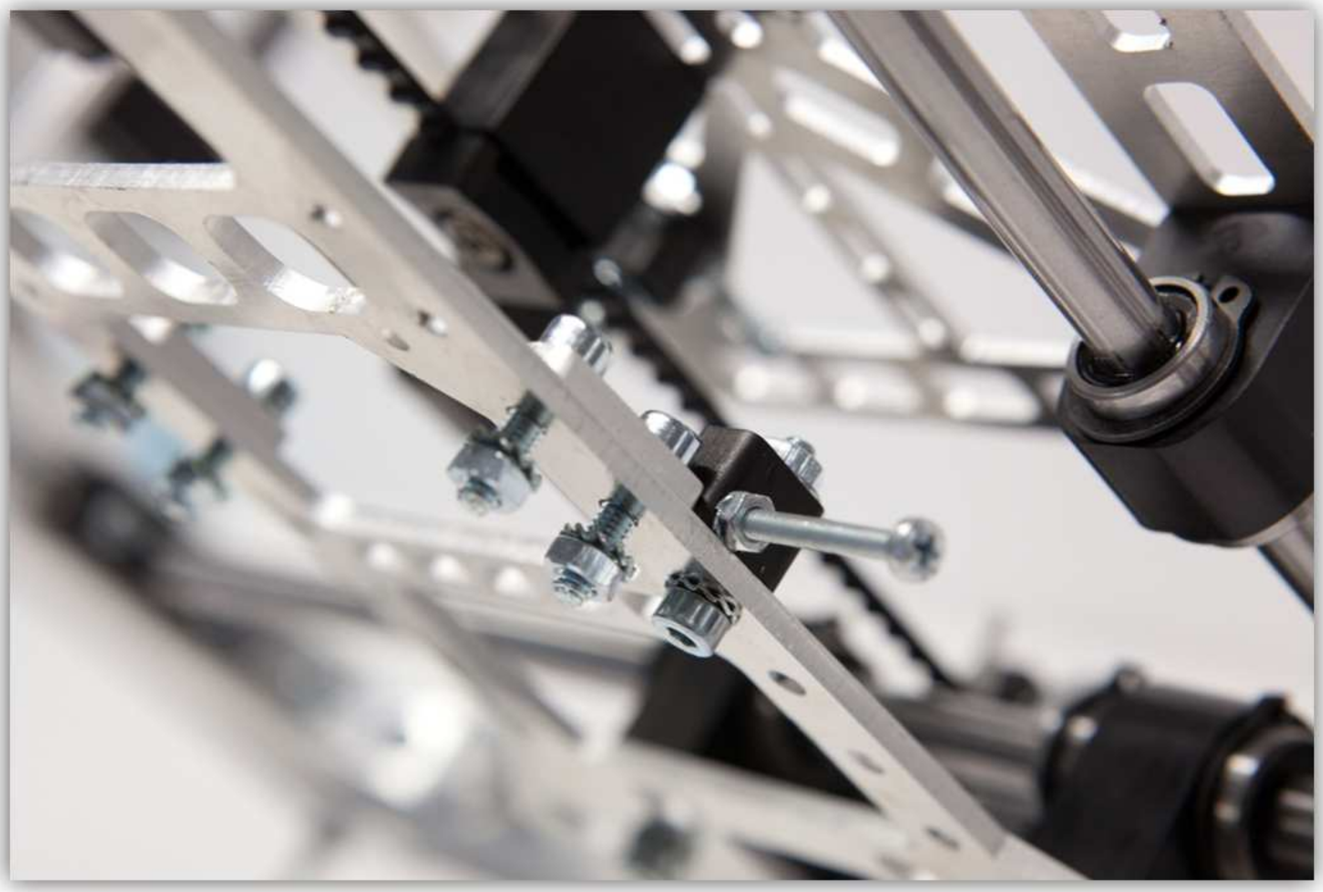
Take the piece of 86 cm (3.39") belt you cut earlier.

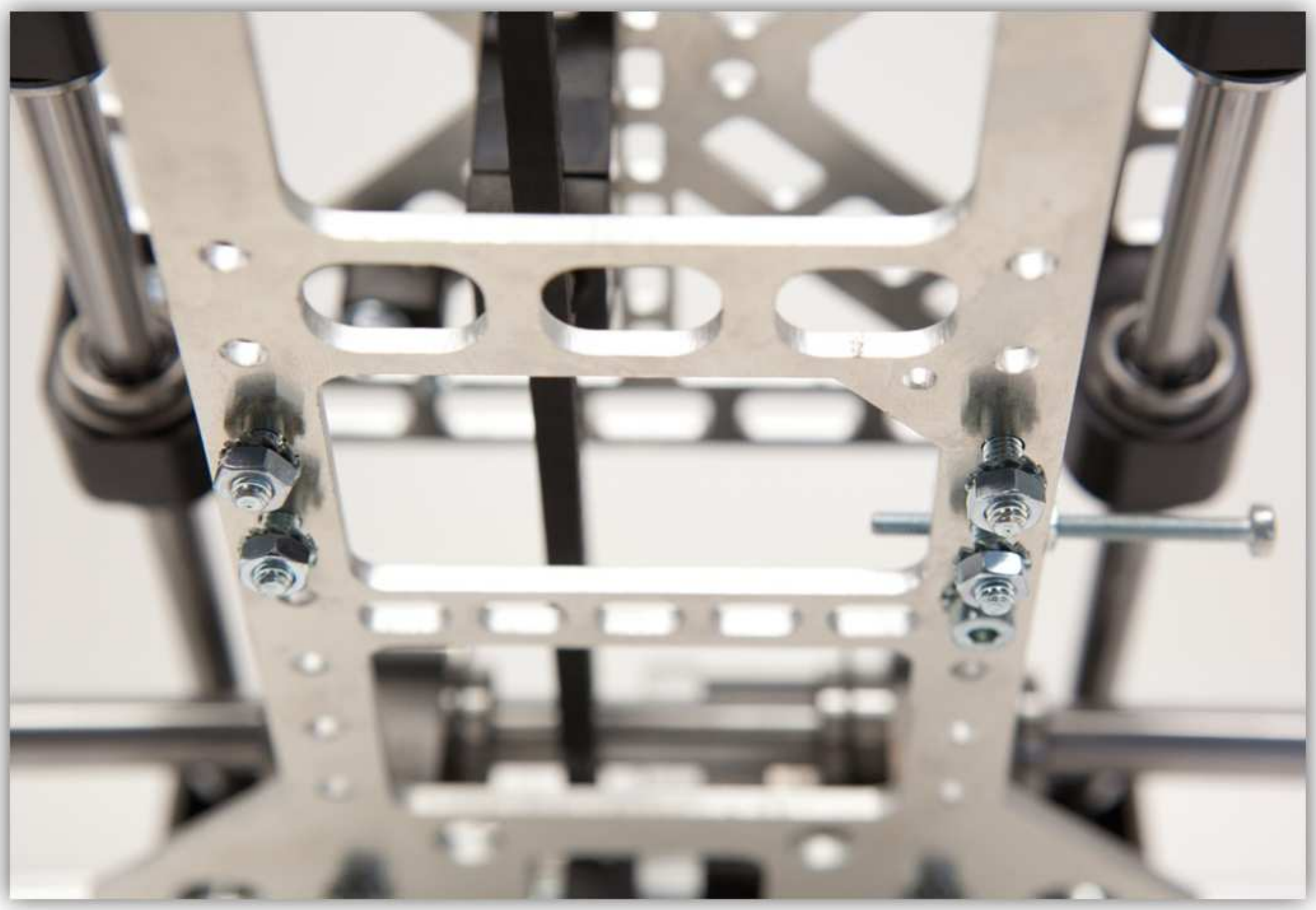


Take the parts out of the bag labelled with 29.

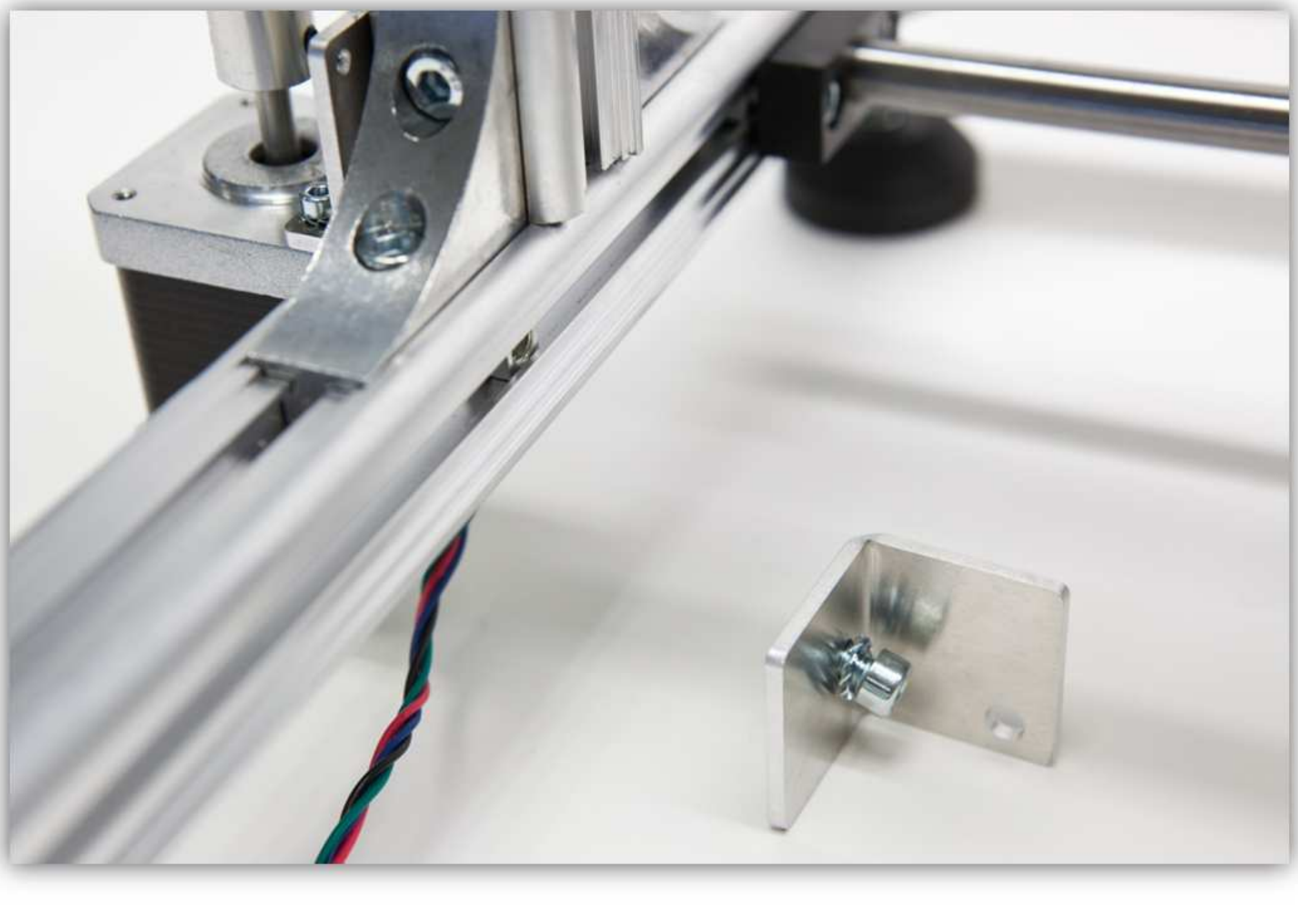


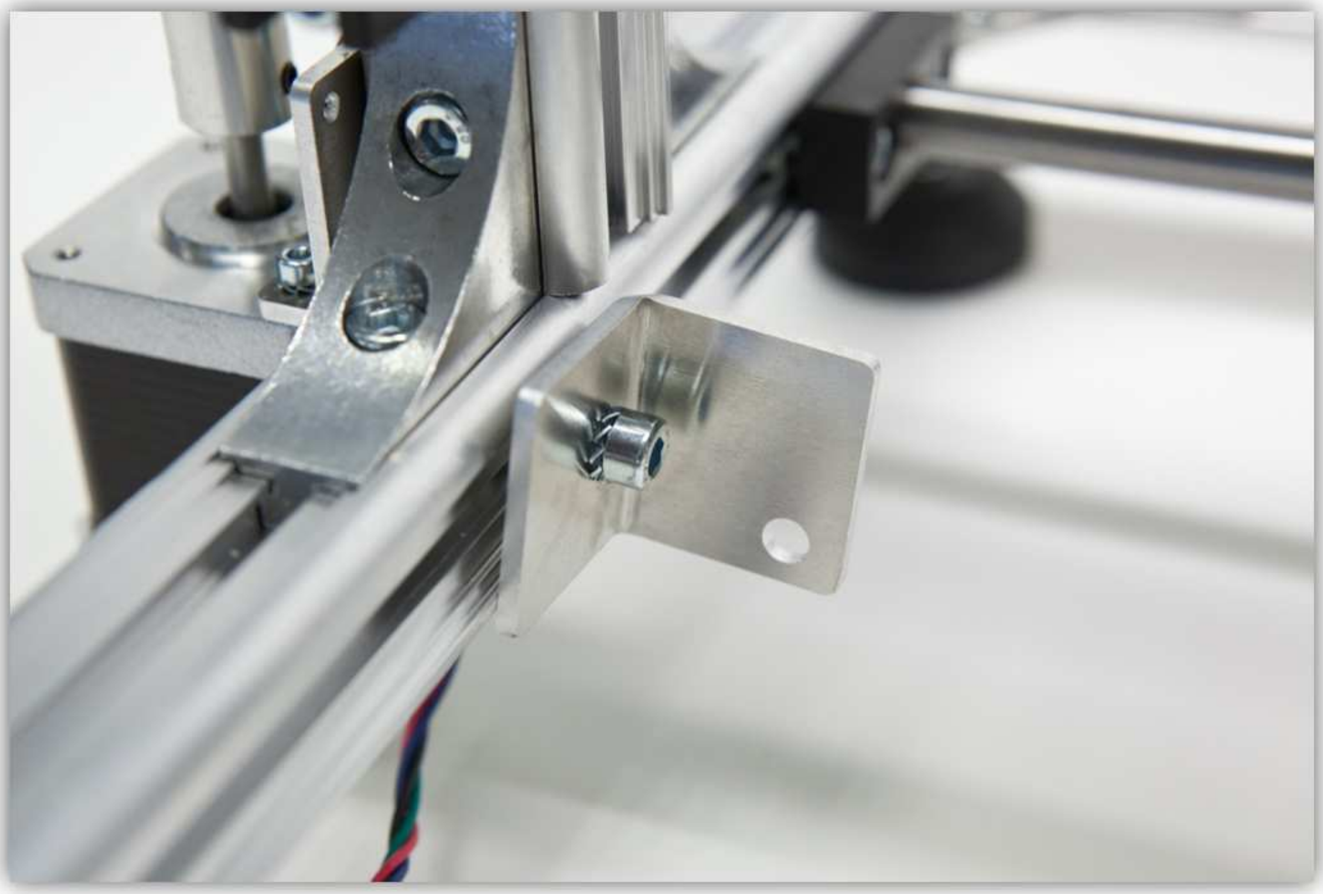
Take the two X BELT CLAMPS, 4 M4 bolts, 4 M4 toothed washers and 4 M4 nuts. Bolt the X BELT CLAMPS as shown to the X CARRIAGE. **Notice the orientation of all the components.**





Take the short M5 bolt and an M5 toothed washer and screw the X PULLEY BRACKET to the square nut on the left side of the base frame you put there earlier. **Do not fully tighten the bolt.**

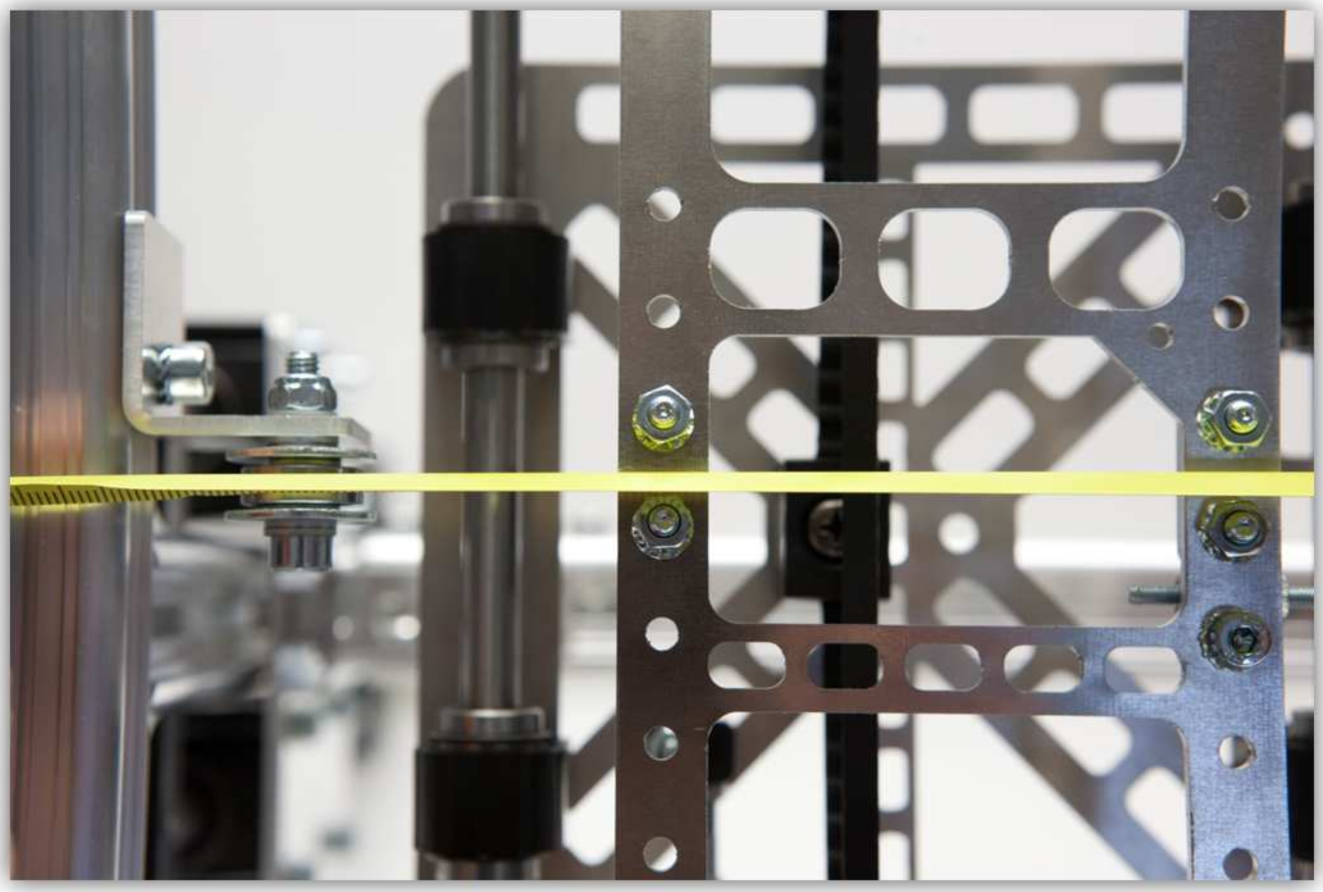




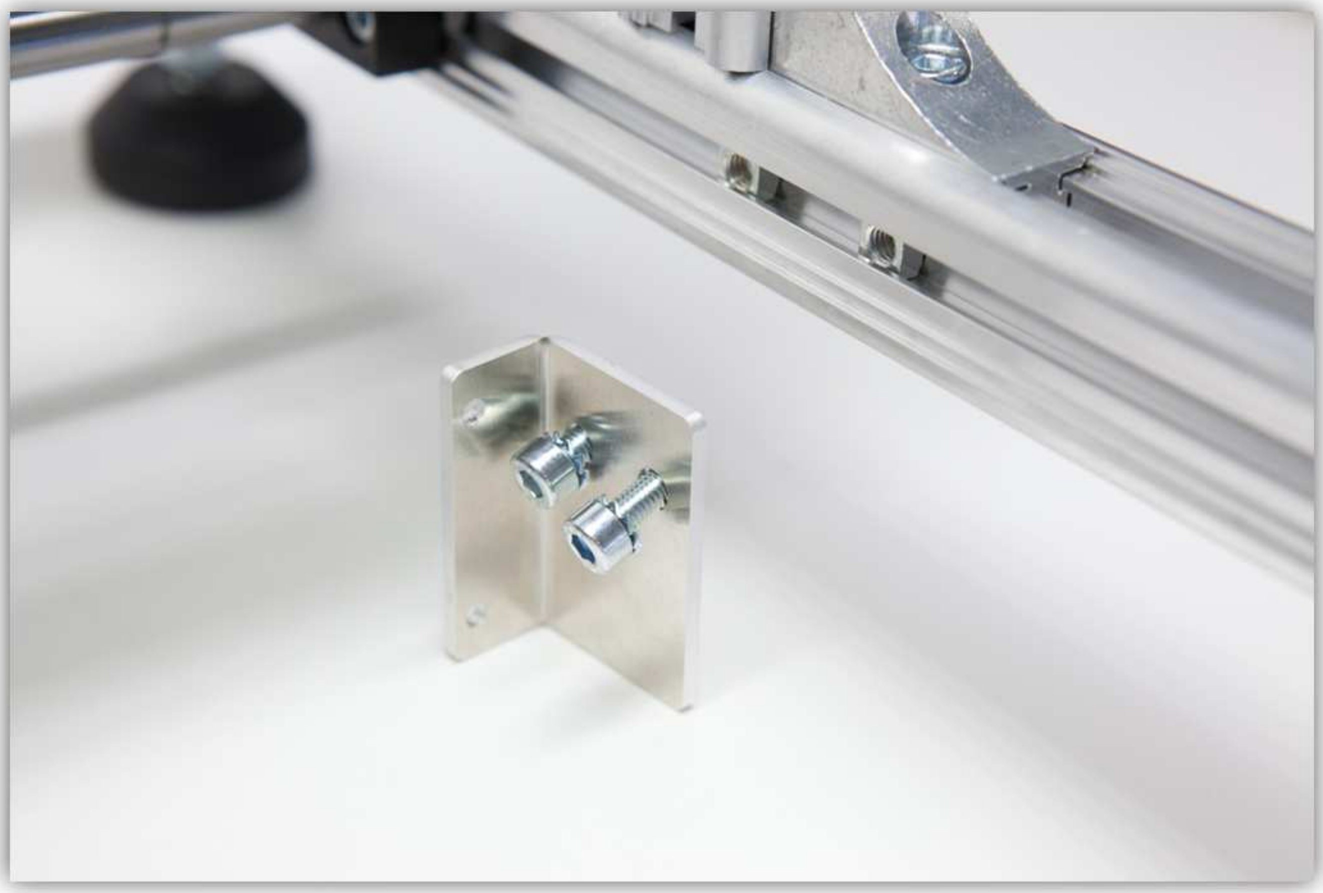
Take the large M5 bolt, 6 small M5 washers, 2 large M5 washers and 1 625 bearing. And assemble the following:

Use an M5 locking nut and an M5 washer to bolt this assembly to the X PULLEY BRACKET as shown in the picture below.

As you look from the bottom, the X BELT CLAMPS and the X pulley should be in one line. Slide the X PULLEY BRACKET until it is in one line with the two X BELT CLAMPS and then tighten the bolt holding it to the base frame. **Make sure it is perfectly horizontal.**



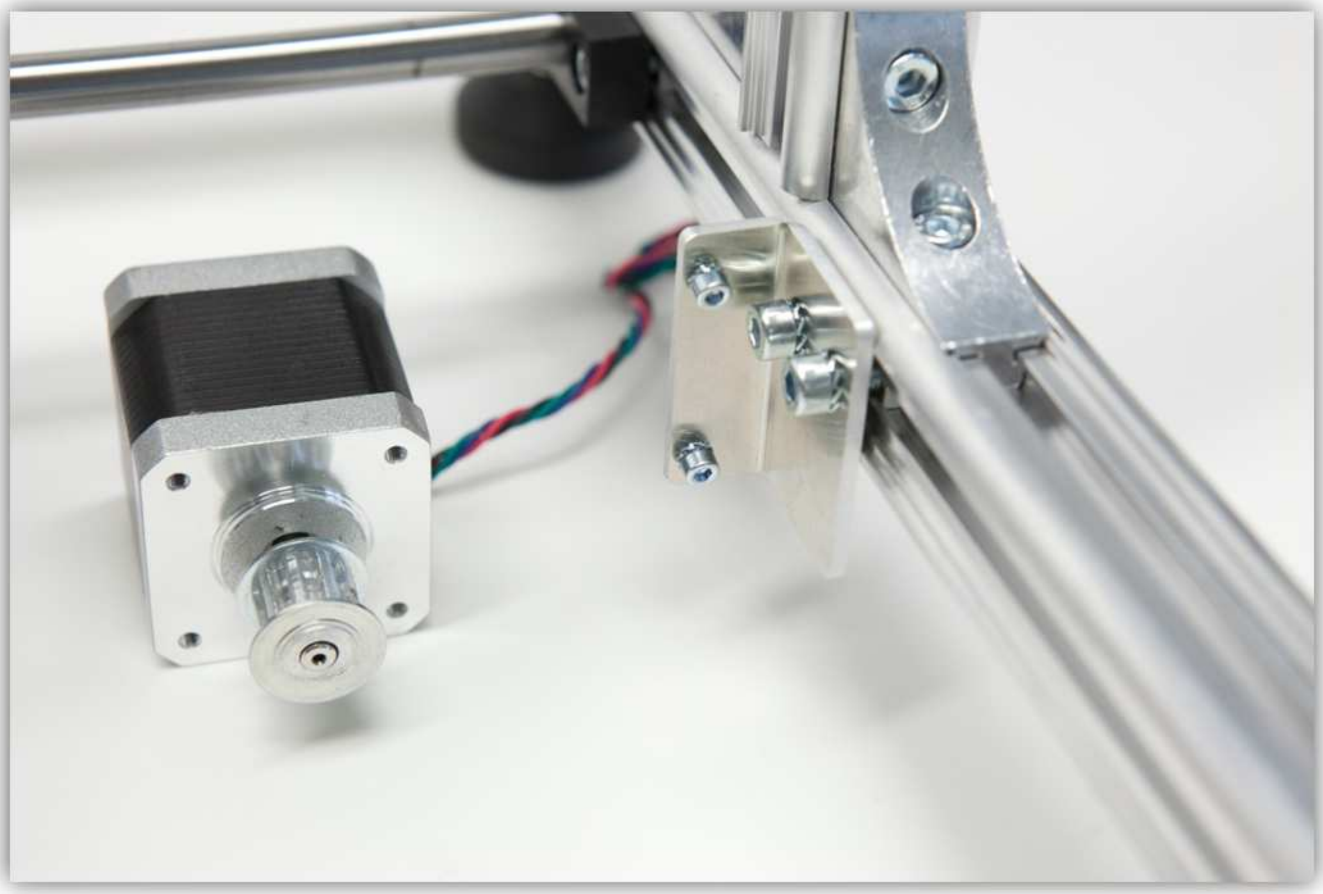
Take two short M5 bolts and two M5 toothed washers and screw the X MOTOR BRACKET to the 2 square nuts on the right side of the base frame you put there earlier. **Do not fully tighten the bolts.**



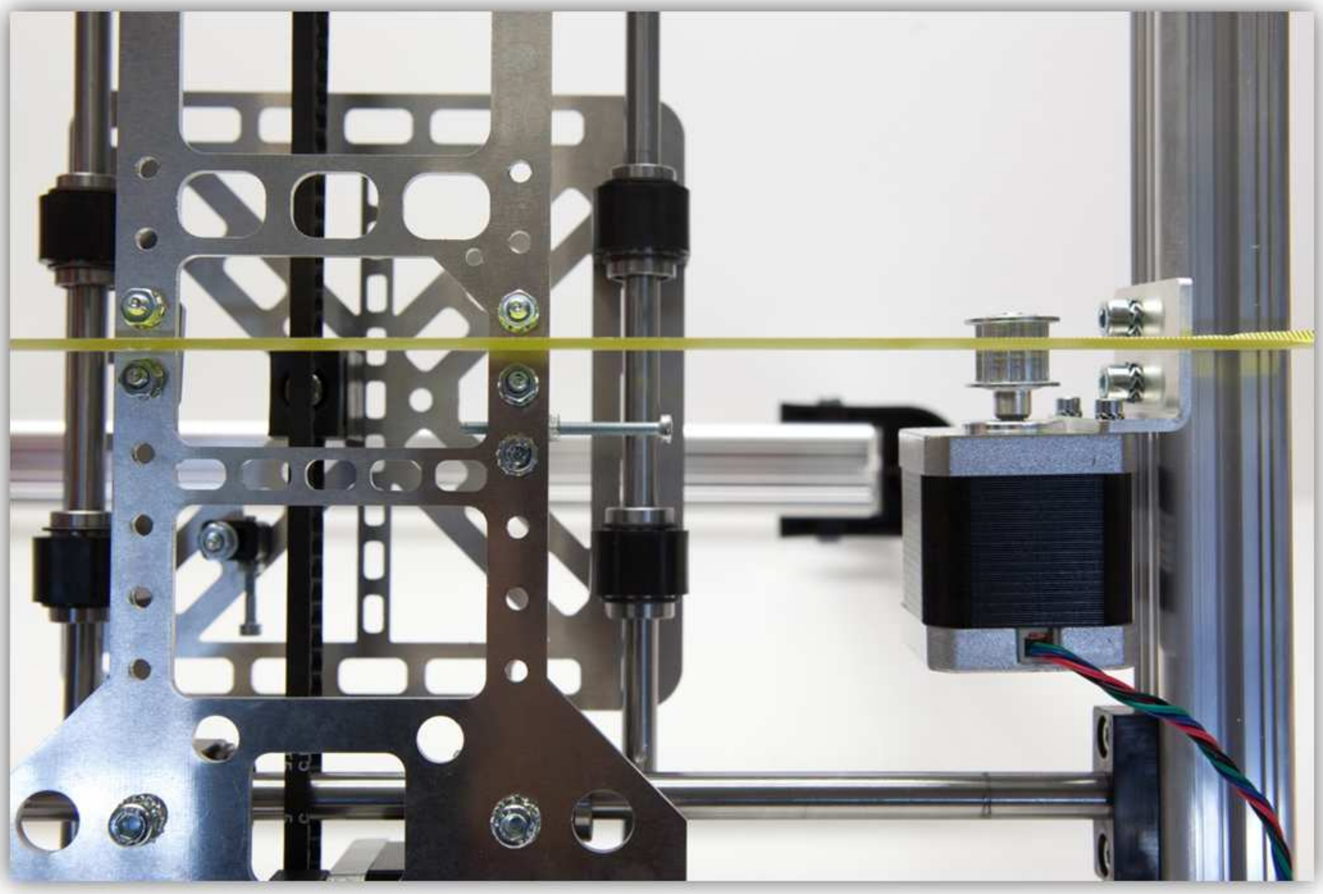
Take the small M3 locking bolt and screw it into the X TOOTHED PULLEY. Do not screw it in completely.

Slide the toothed pulley over the shaft of the motor and tighten the small M3 bolt. **Watch the orientation of the pulley closely and make sure it is flush at the top.**

Take the 2 M3 bolts and the M3 toothed washers and use them to bolt the motor in place.

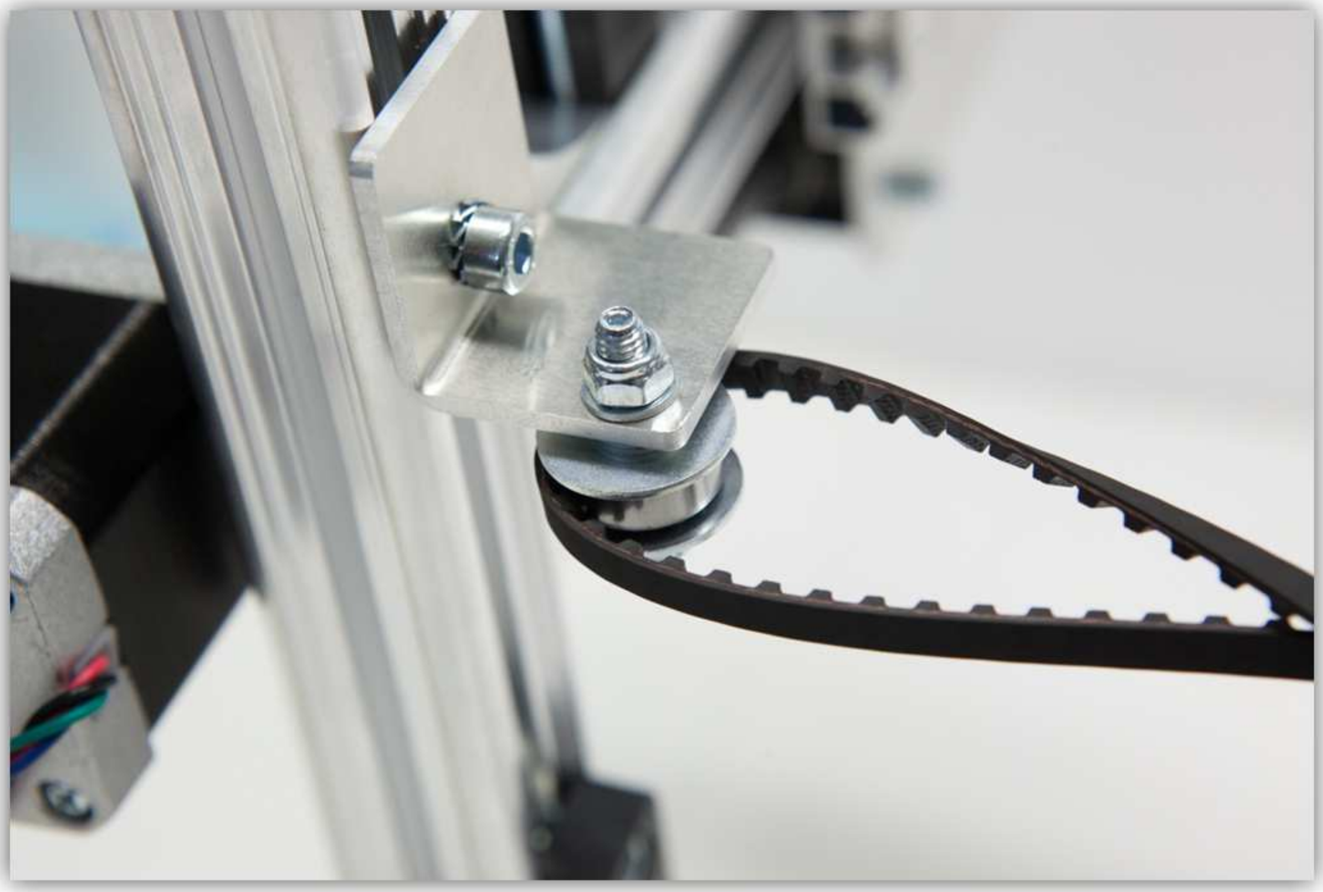


The pulley of the motor should be in line with the 2 X BELT CLAMP pieces. Slide it in place and tighten the bolts.
Make sure it is completely level.

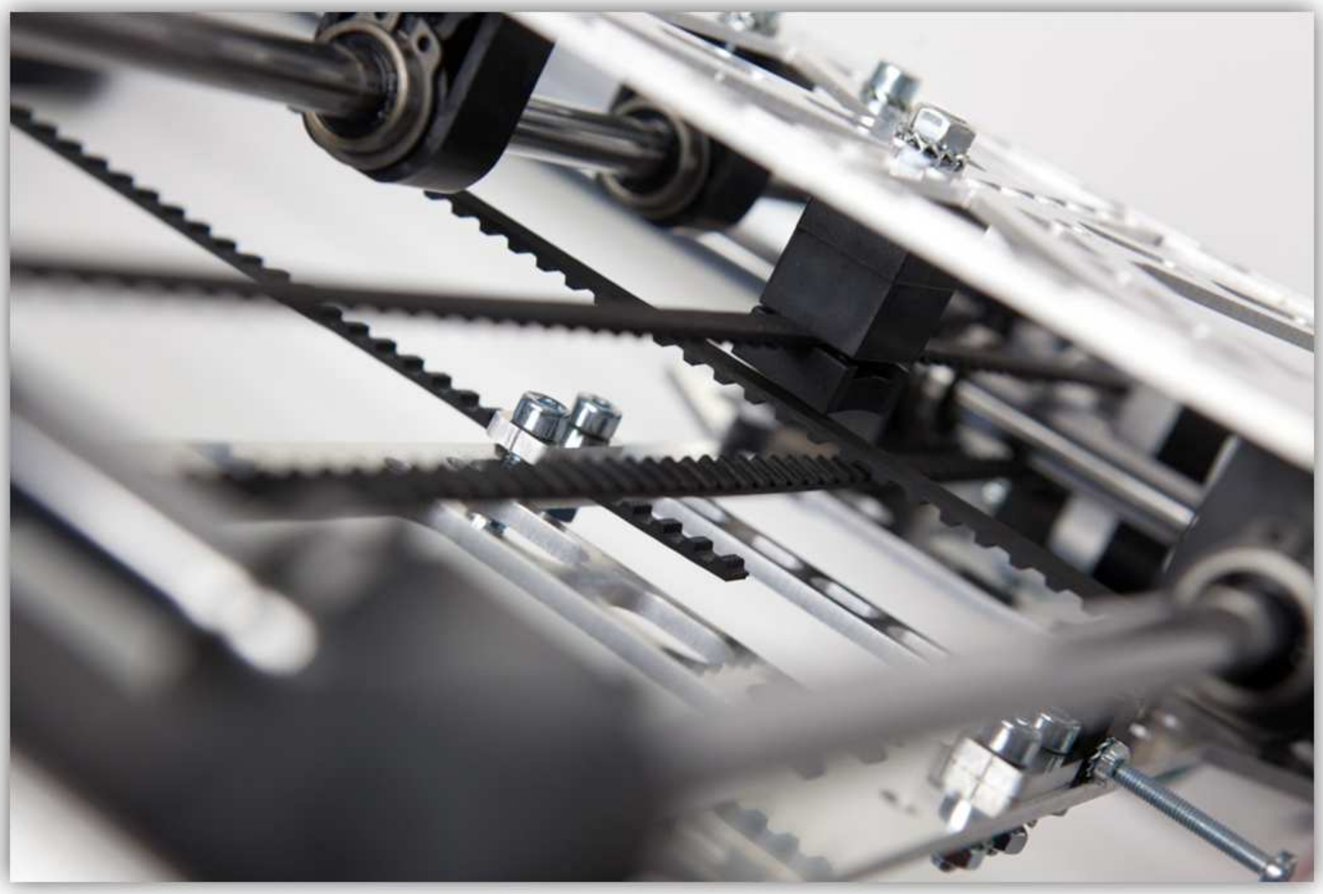


Now clamp the end of the belt into the leftmost X BELT CLAMP. Tighten the nuts.

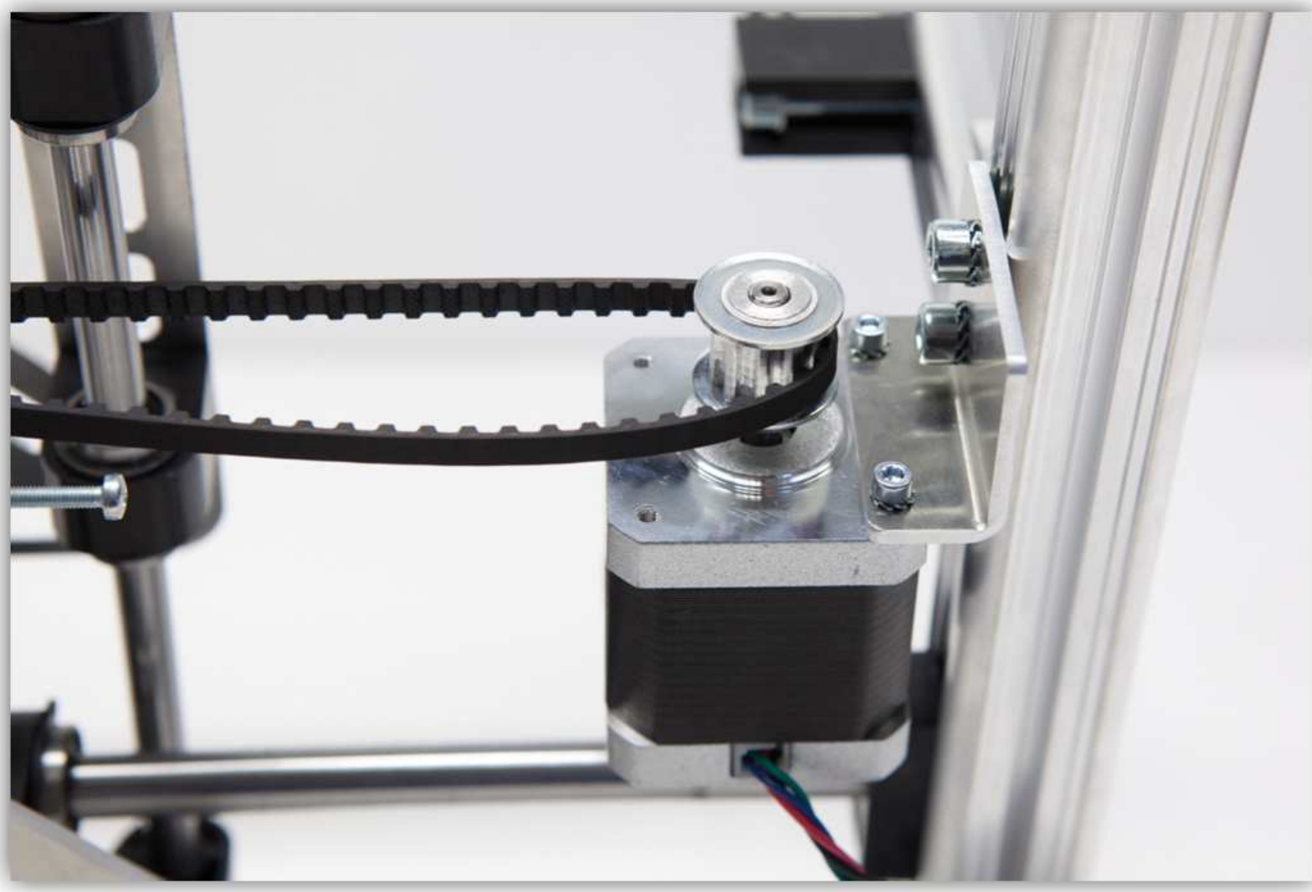
Thread the belt around the pulley.



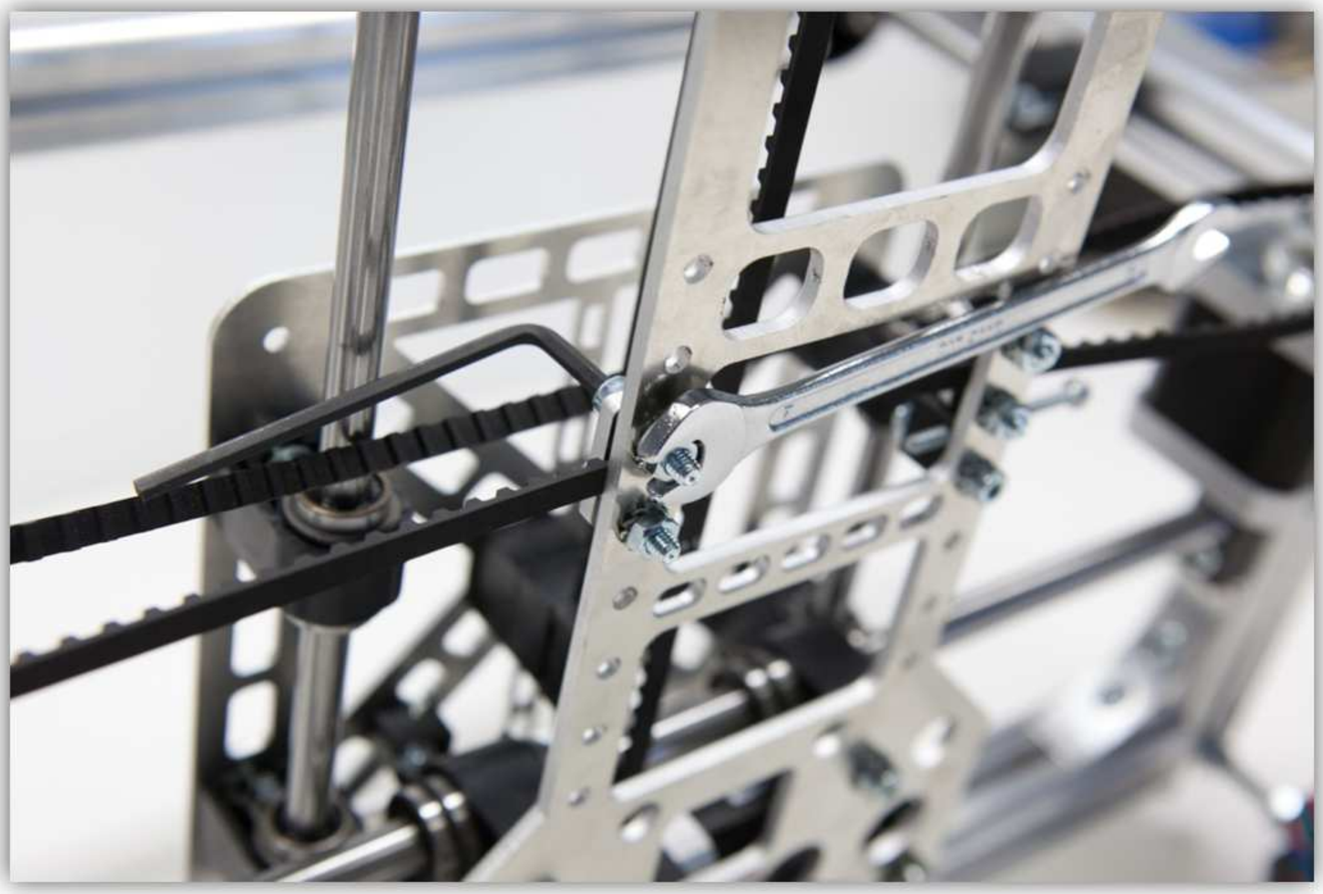
Loop the belt through the Y belt,

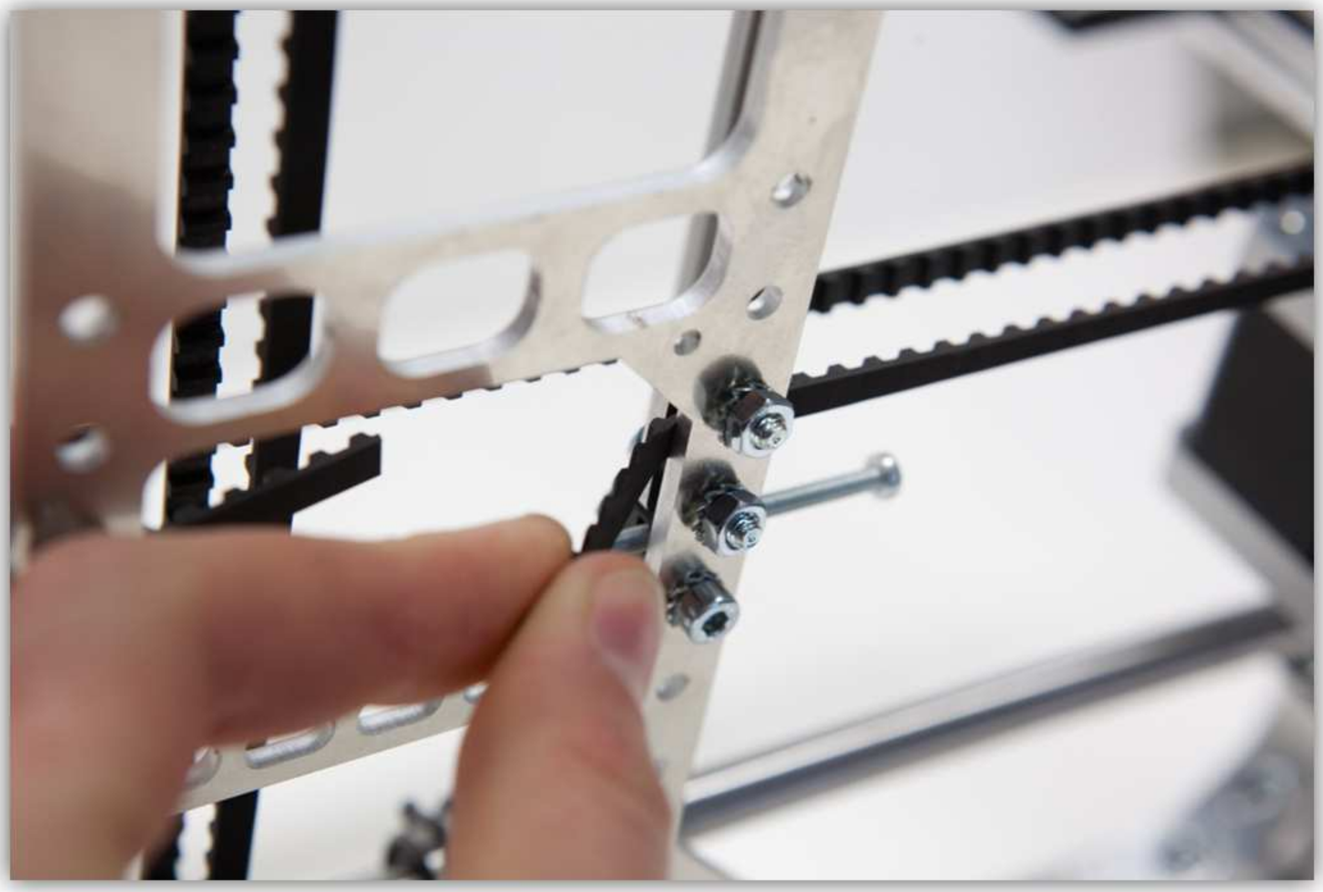


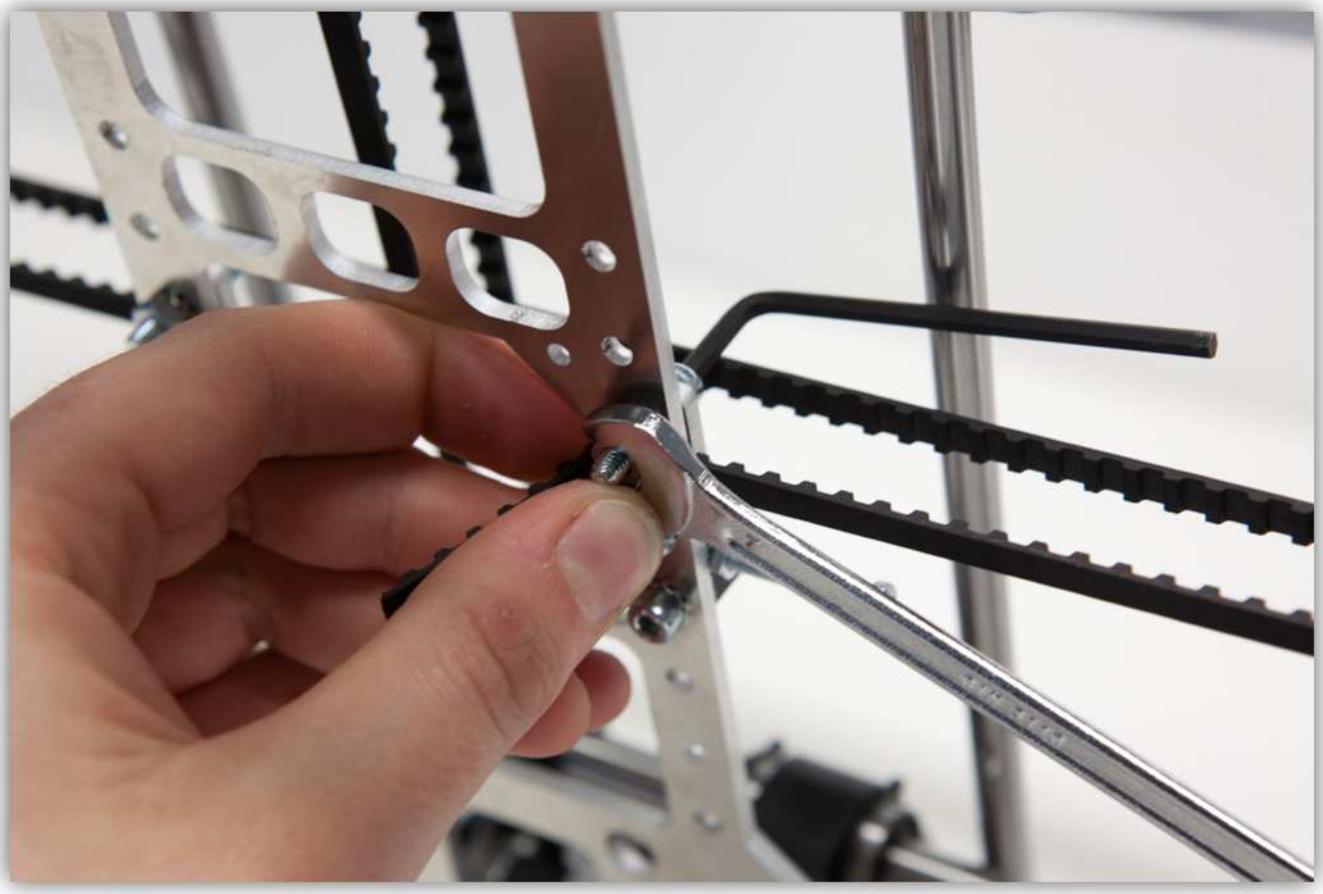
and around the motor pulley.

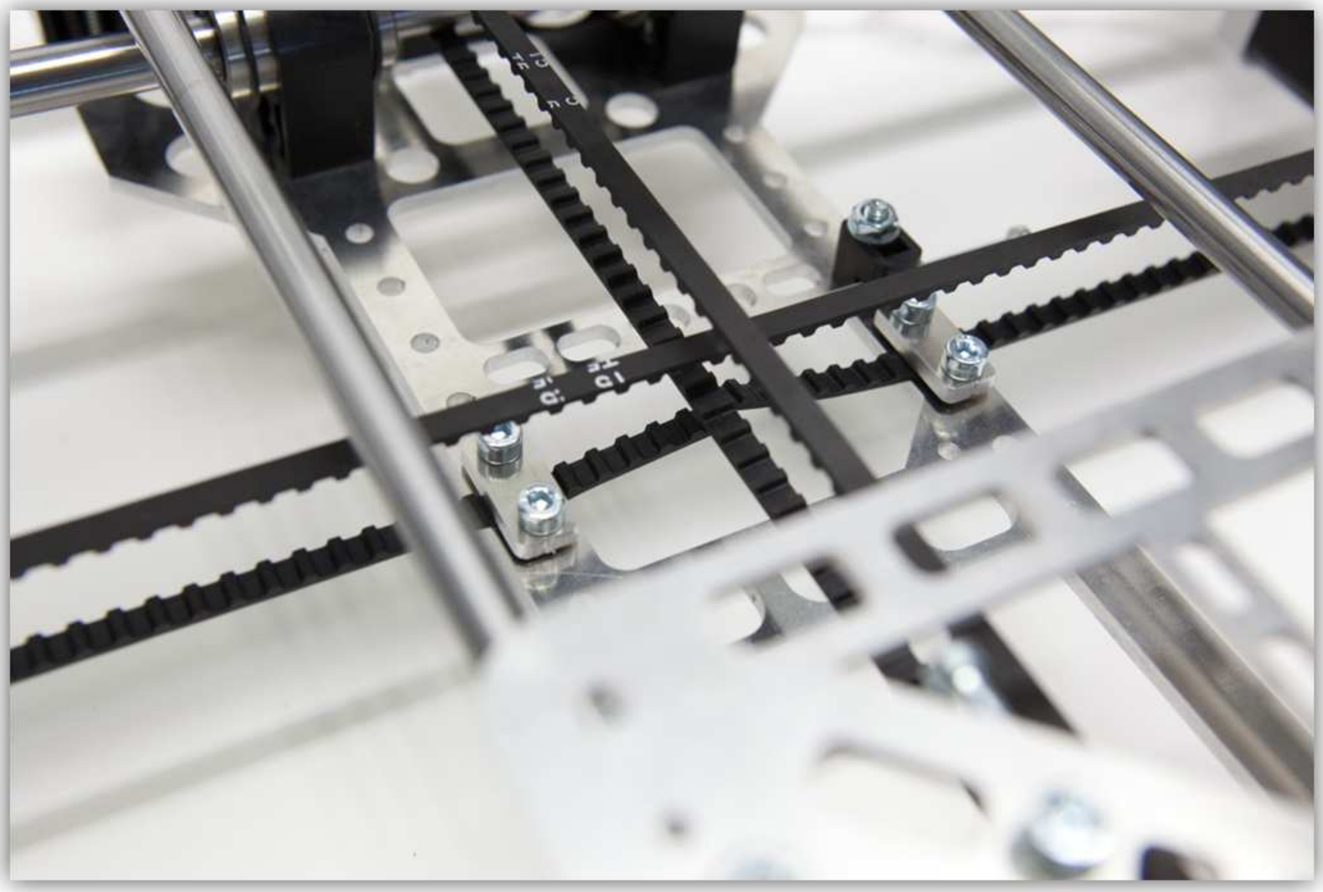


Clamp the end of the belt between the X BELT CLAMP on the right. Pull tension on the belt before tightening the nuts on the X BELT CLAMP.









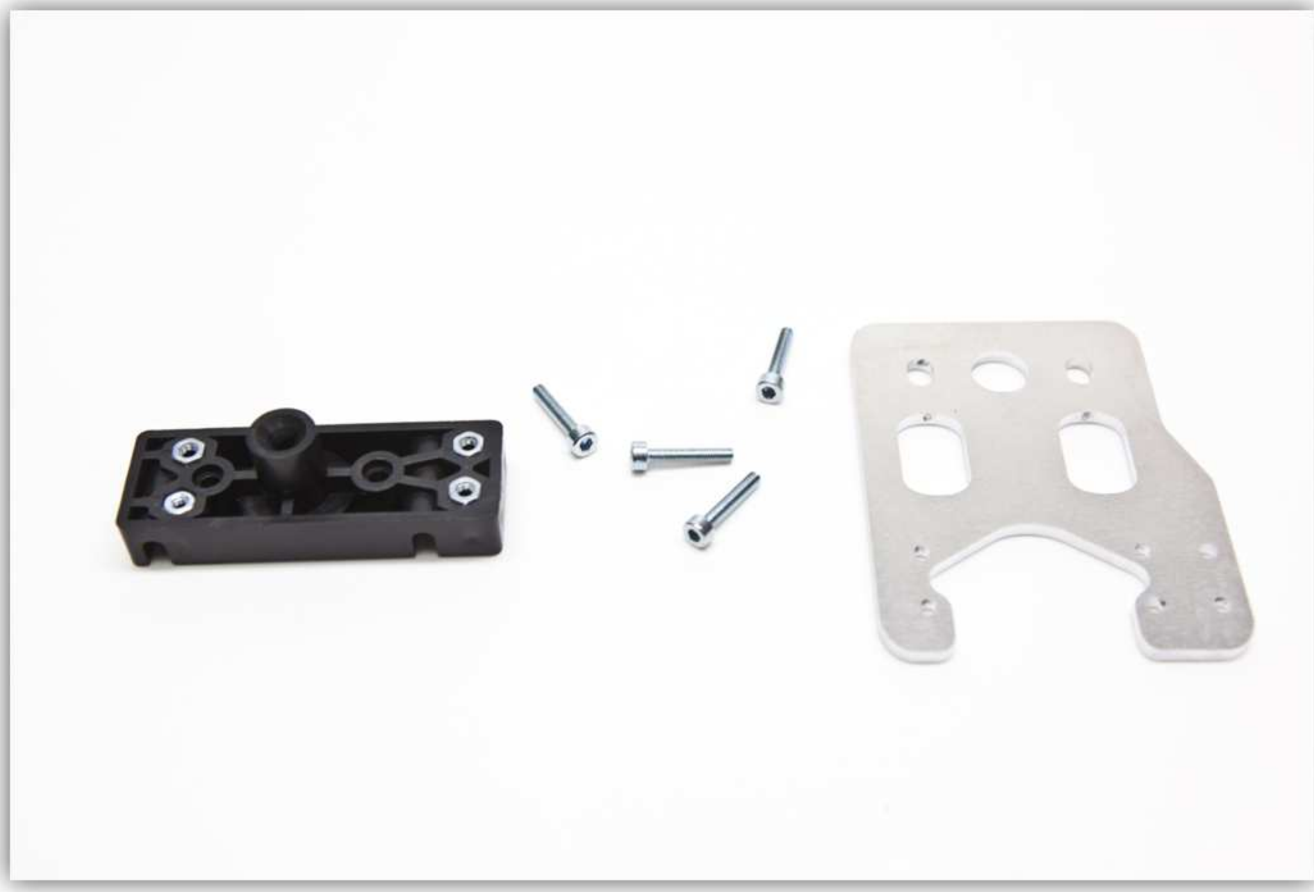
009 – ASSEMBLING THE EXTRUDER

Take the parts out of the bag labelled with 30.

Now take the pieces as shown in the picture below out of the bag containing the plastic parts (LARGE GEAR, SMALL GEAR, EXTRUDER BASE, EXTRUDER SPRING MOUNT, FILAMENT GUIDER, EXTRUDER BEARING CLAMP A, EXTRUDER BEARING CLAMP B). **Attention: there is one SMALL GEAR with a small threaded hole on the side this is the one you need, there are also 3 SMALL GEARS in a separate bag without the small threaded hole on the side, these are spare parts. Do not use one of these 3).**

Take 4 M3 nuts and push them into the EXTRUDER BASE as shown below.

Take the EXTRUDER MOUNT PLATE and 4 M3x16 bolts.

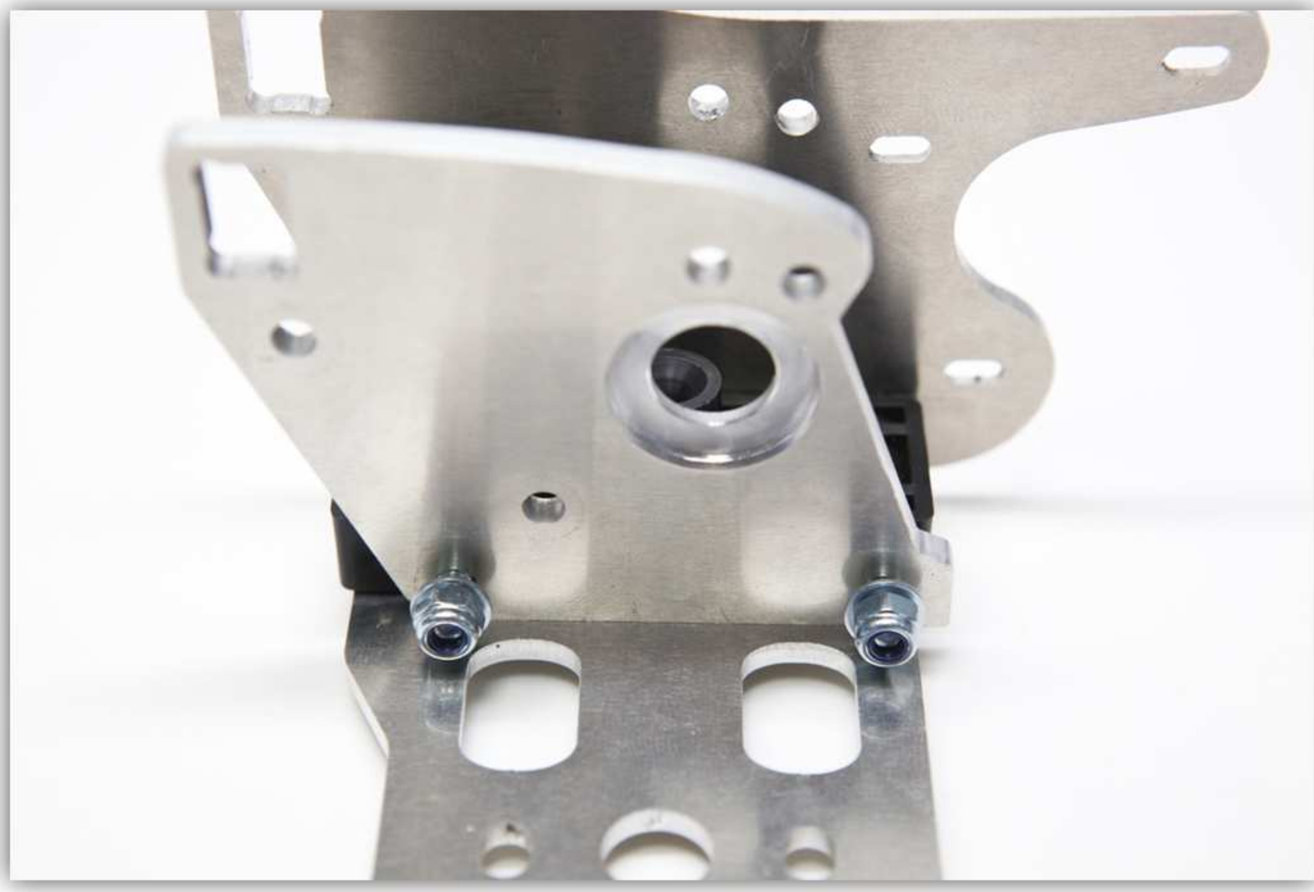


Bolt the EXTRUDER MOUNT PLATE to the EXTRUDER BASE. **Watch the orientation of the pieces closely. Do not fully tighten these bolts.**

Take 2 M4 bolts and 2 M4 washers.

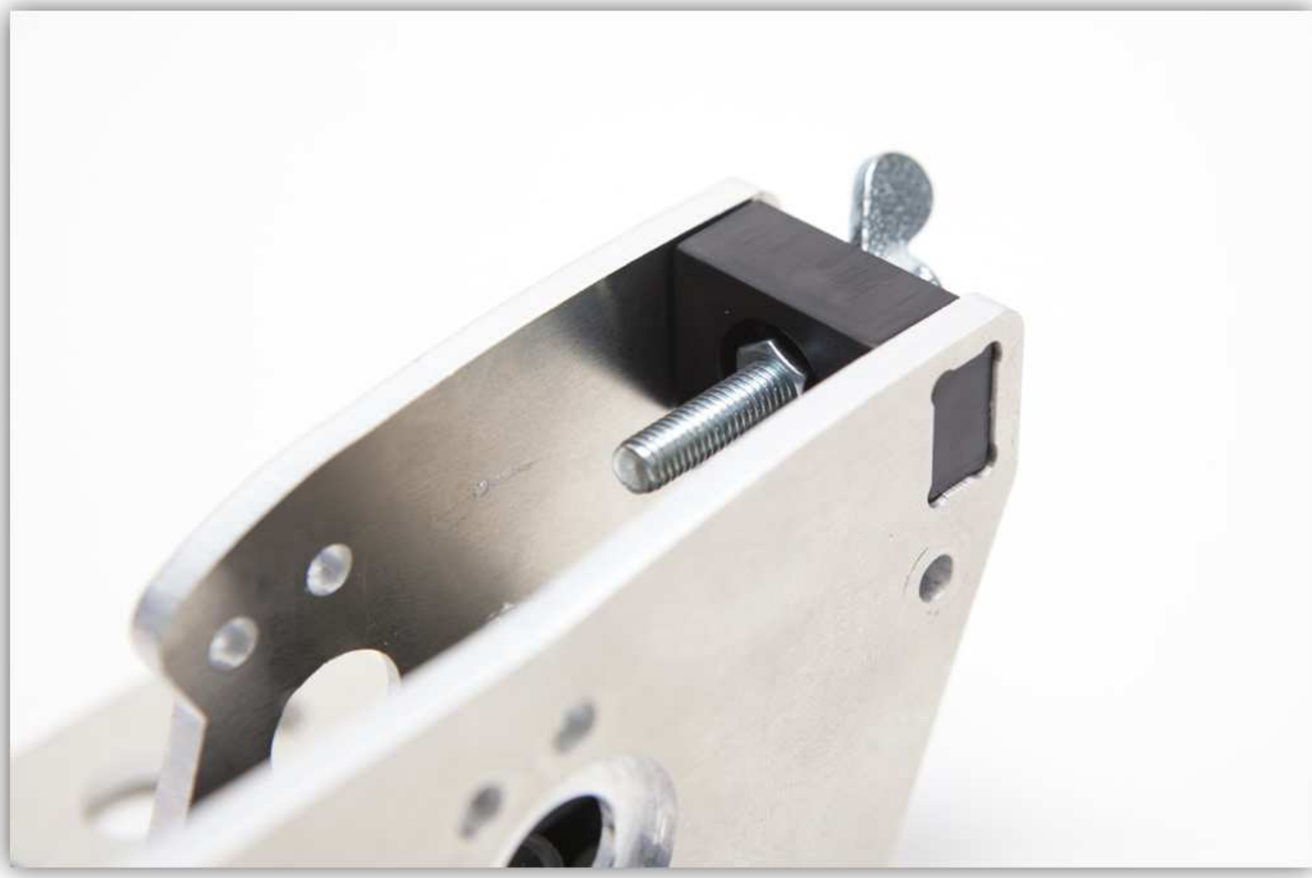
Bolt the FRONT AND BACK EXTRUDER PLATE to the EXTRUDER BASE. **Watch the orientation of the parts closely.**

Use 2 M4 locking nuts and 2 M4 washers. **Do not tighten the nuts.**



Use the M5 butterfly bolt and an M5 nut as shown in the picture below together with the EXTRUDER SPRING MOUNT.

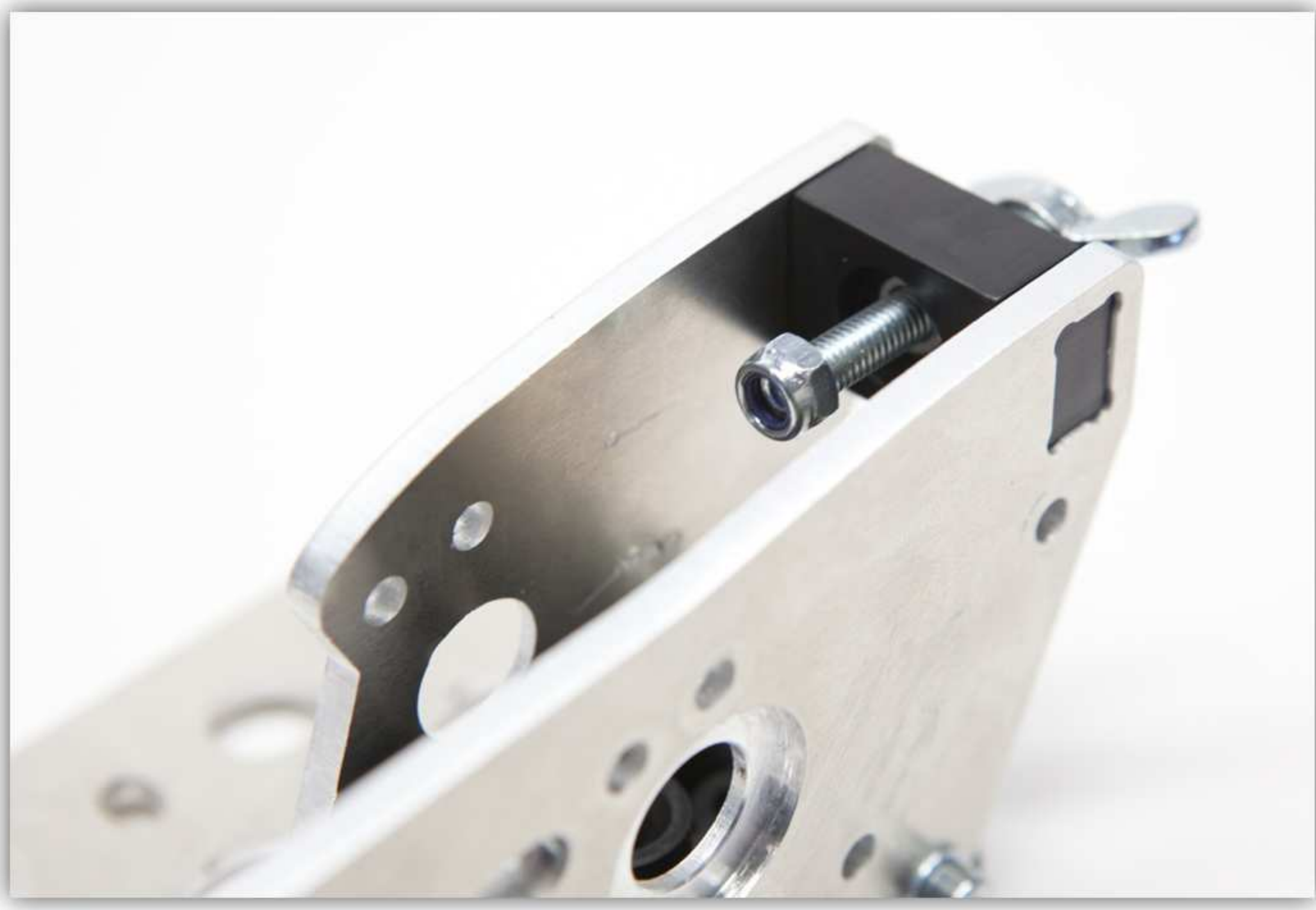
Slide this assembly into the FRONT AND BACK EXTRUDER PLATE.



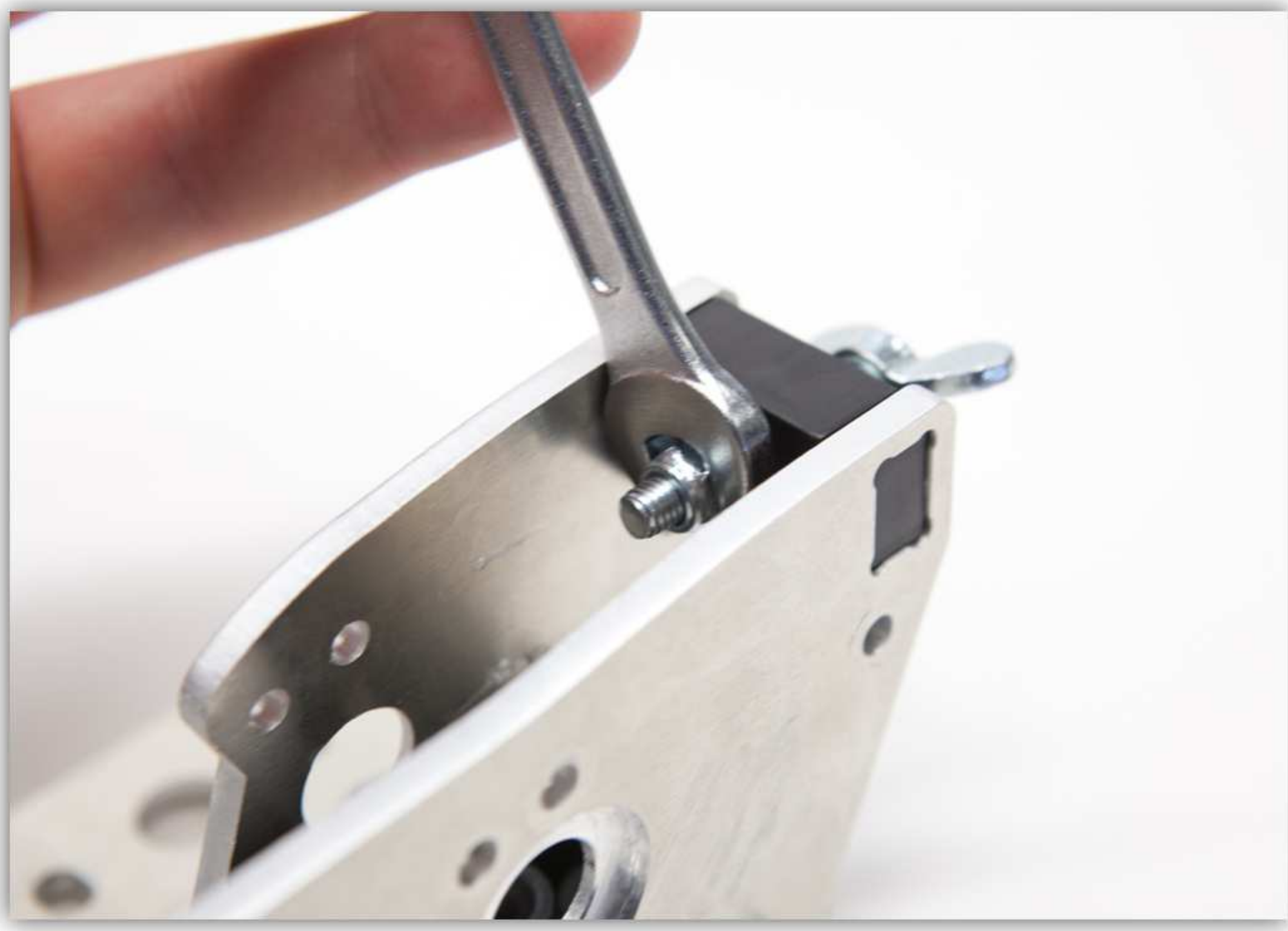
Tighten the bolts that hold the FRONT AND BACK EXTRUDER PLATE together.

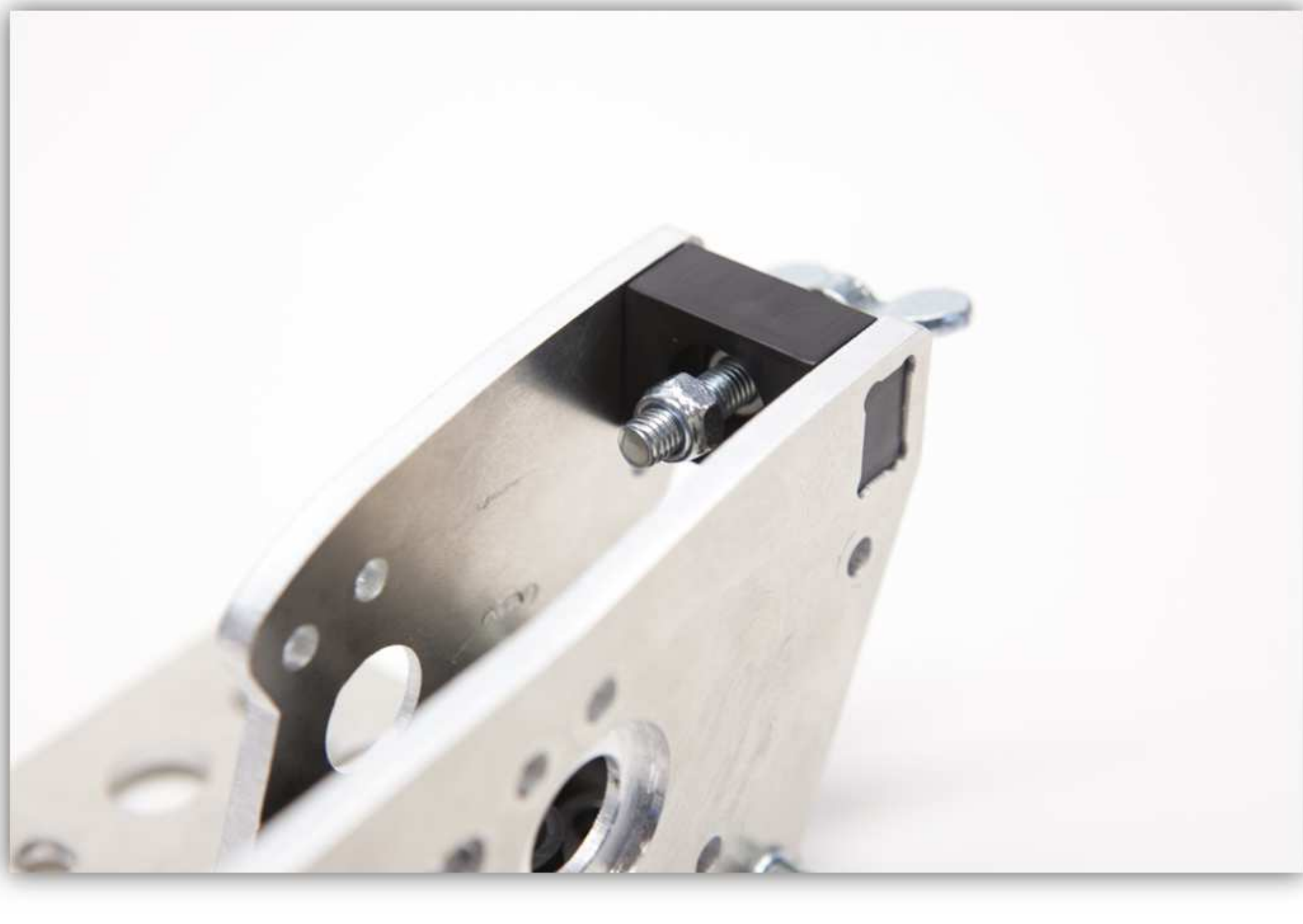
Tighten the bolts that hold the EXTRUDER MOUNT PLATE to THE EXTRUDER BASE.

Use an M5 locking nut and screw it on the end of the butterfly bolt.



Screw this bolt further down so there is about 3 to 5 mm (0.12" to 0.2") of thread from the butterfly bolt visible.



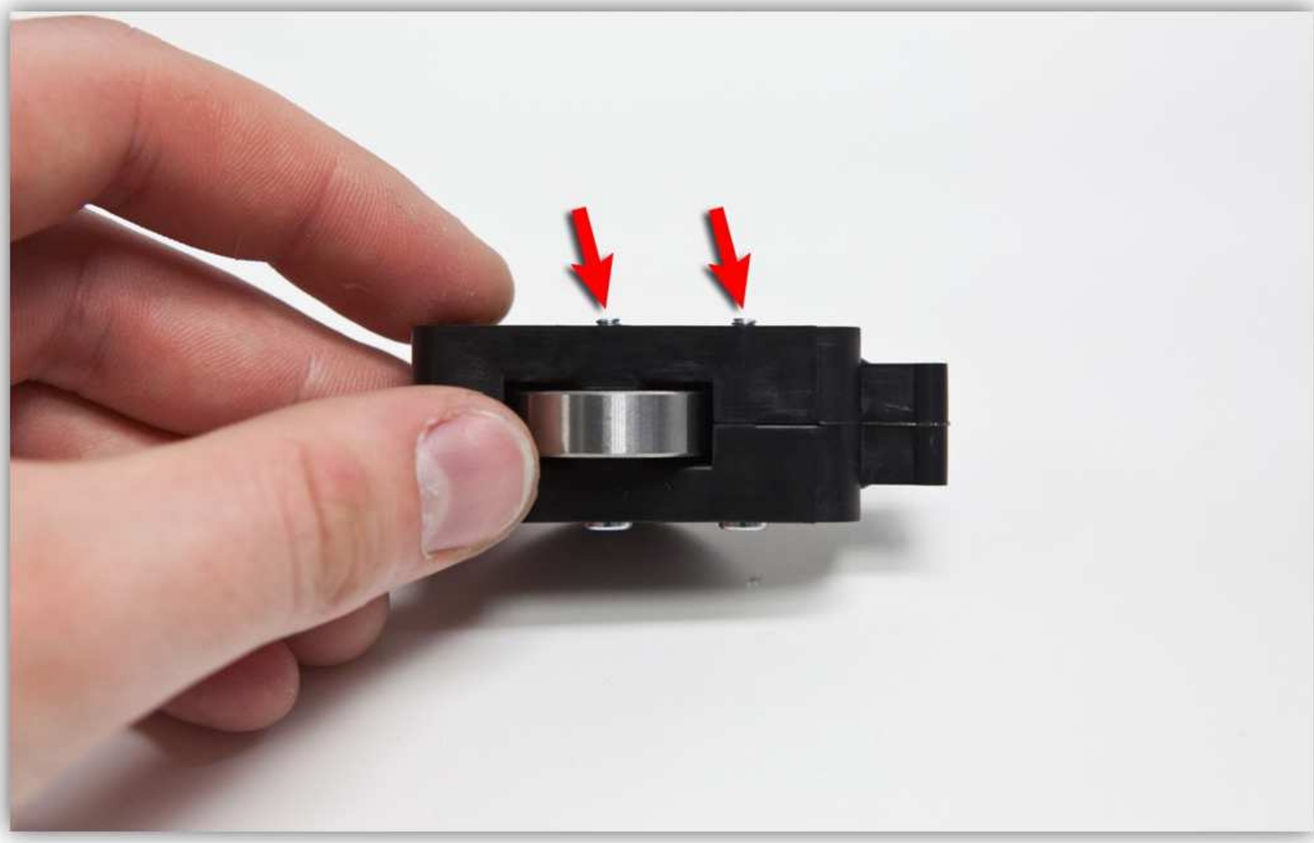


Push 2 M3 nuts into the EXTRUDER BEARING CLAMP A piece.

Take a 608 bearing out of the bag with 3 bearings and put it between the EXTRUDER BEARING CLAMP A and the EXTRUDER BEARING CLAMP B.

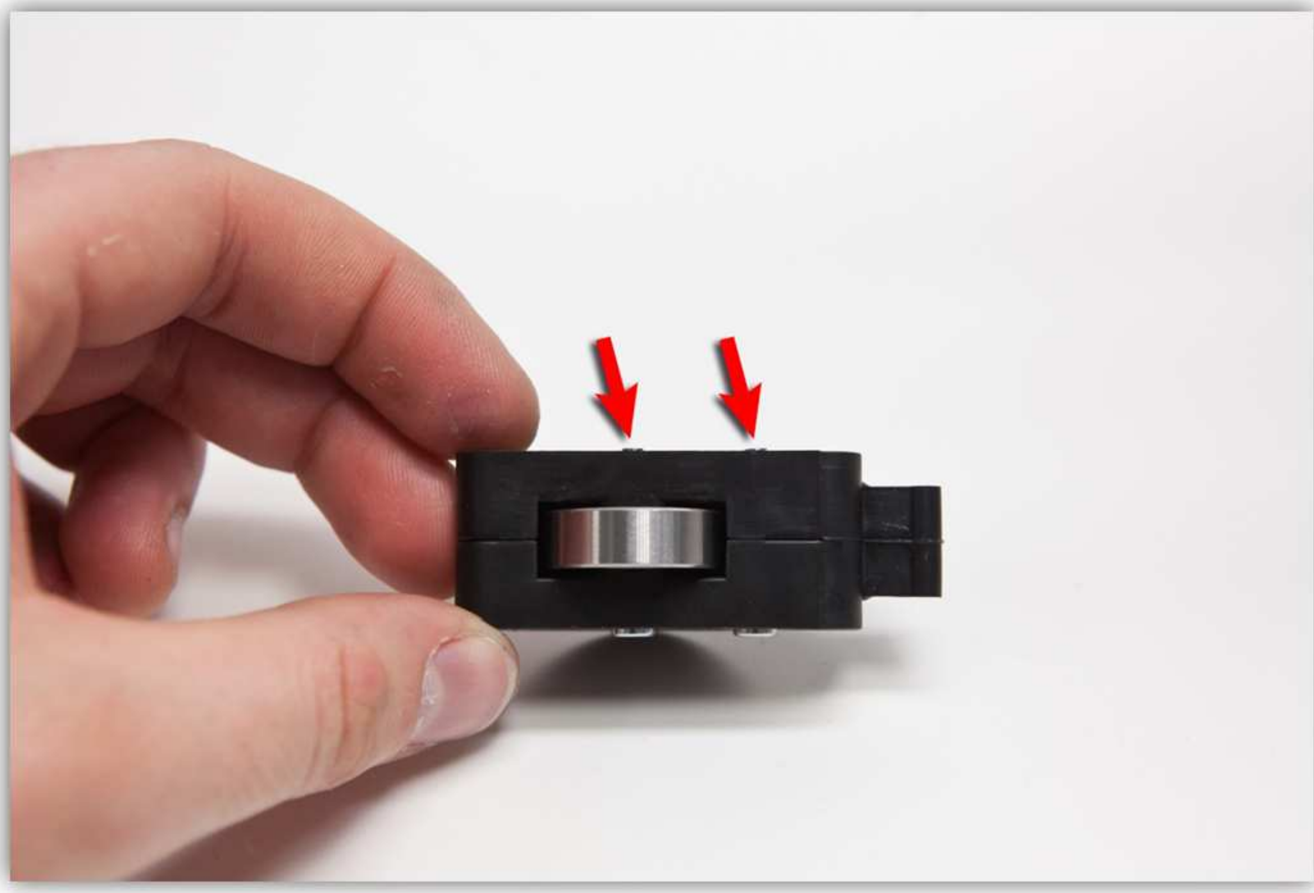
Take the 2 M3x20 bolts and bolt the two halves together.

If the bolts stick out a bit you should grind them down.



Use a small file and grind the bolts down. Make sure that none of the grindings end up in the 608 BEARING.

If the bolts are almost flush with the plastic they will be ok.

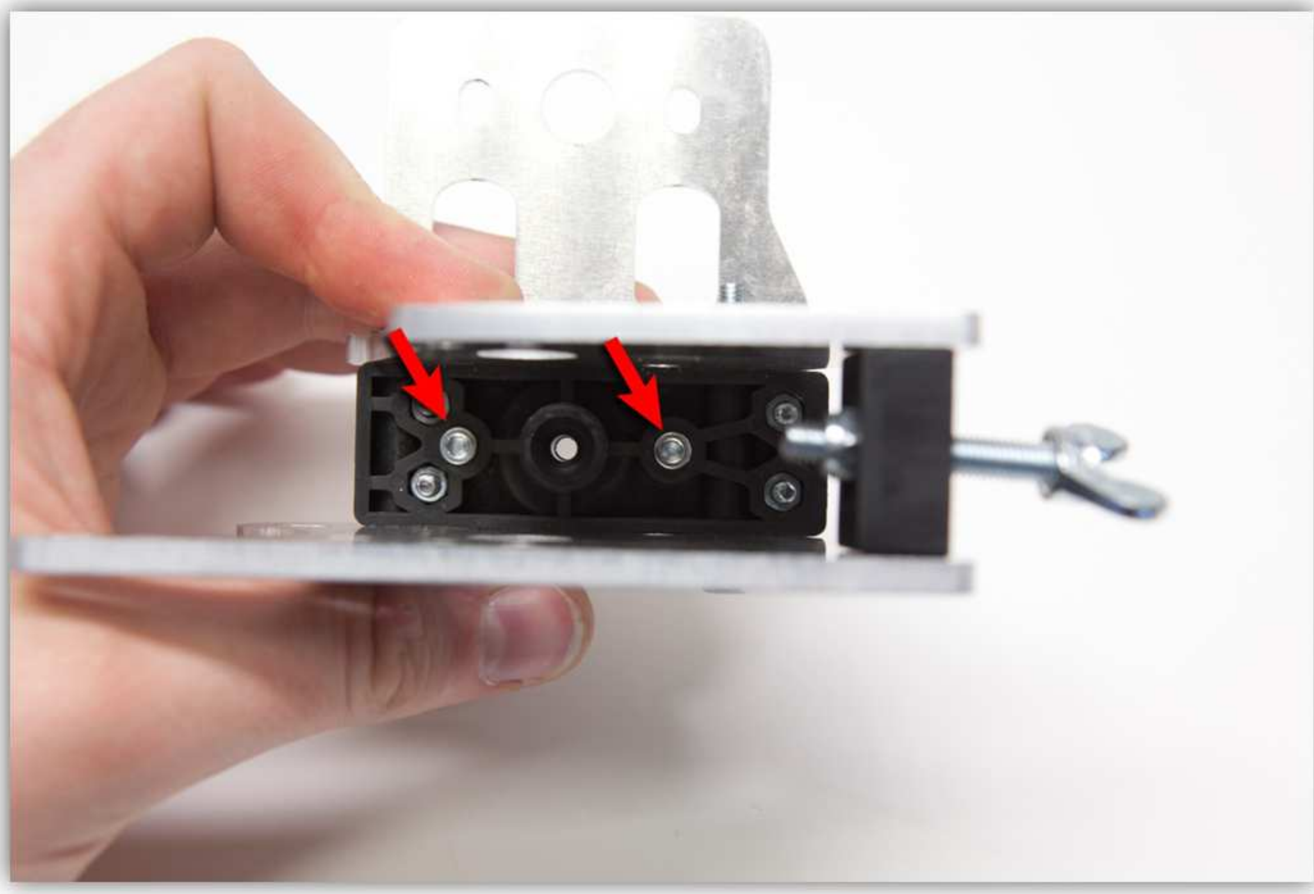


Now screw the small locking bolt (M4 x 5) in the small gear. **Do not screw it in completely.**

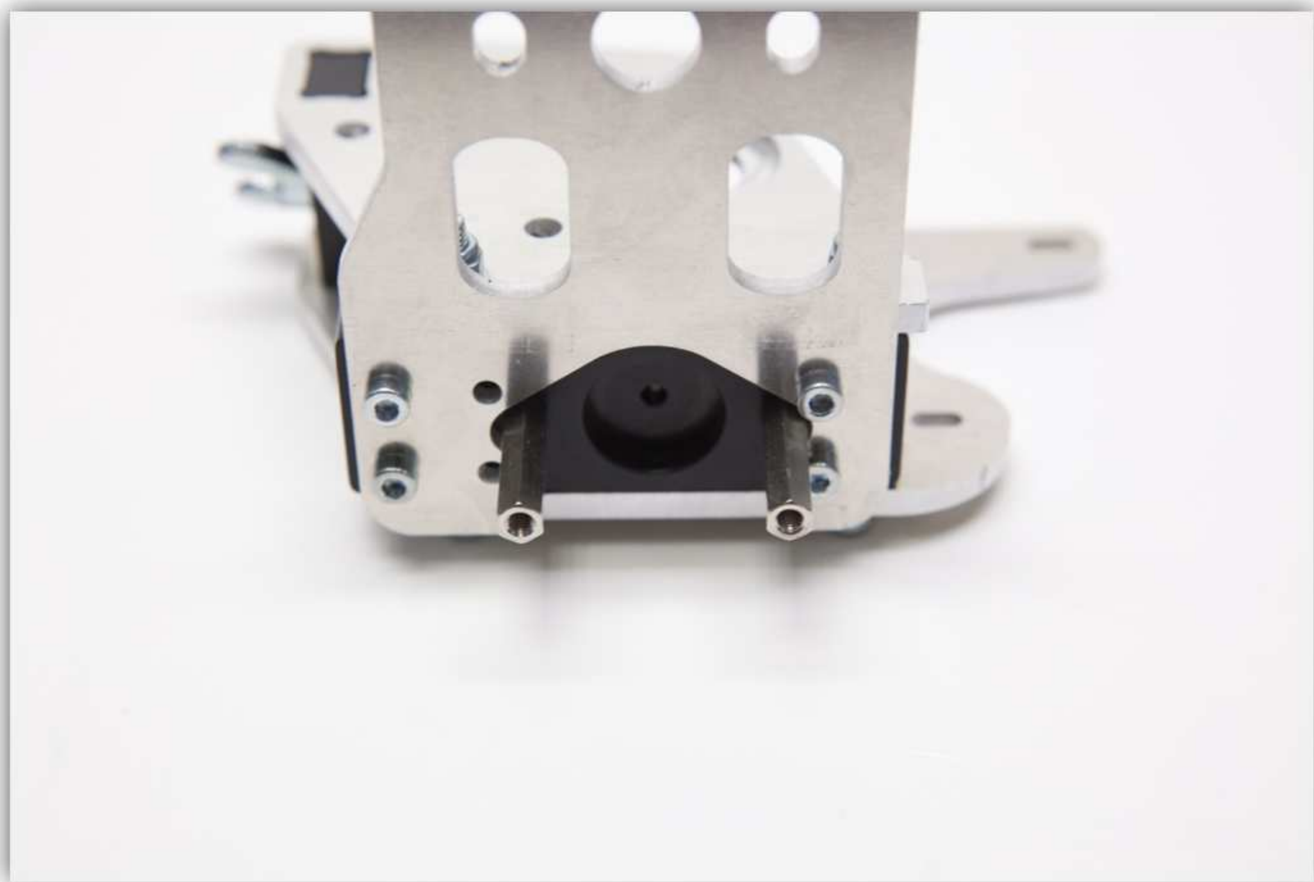
Now take a motor out of the package labelled with 9 and slide the small gear over the shaft. **Slide it down until there is just place for a piece of paper between the motor and the small gear.** Then tighten the small locking bolt.

Now take the 2 metal spacers and two M3 x 16 bolts.

Slide the two bolts into the EXTRUDER BASE piece as shown in the picture below.

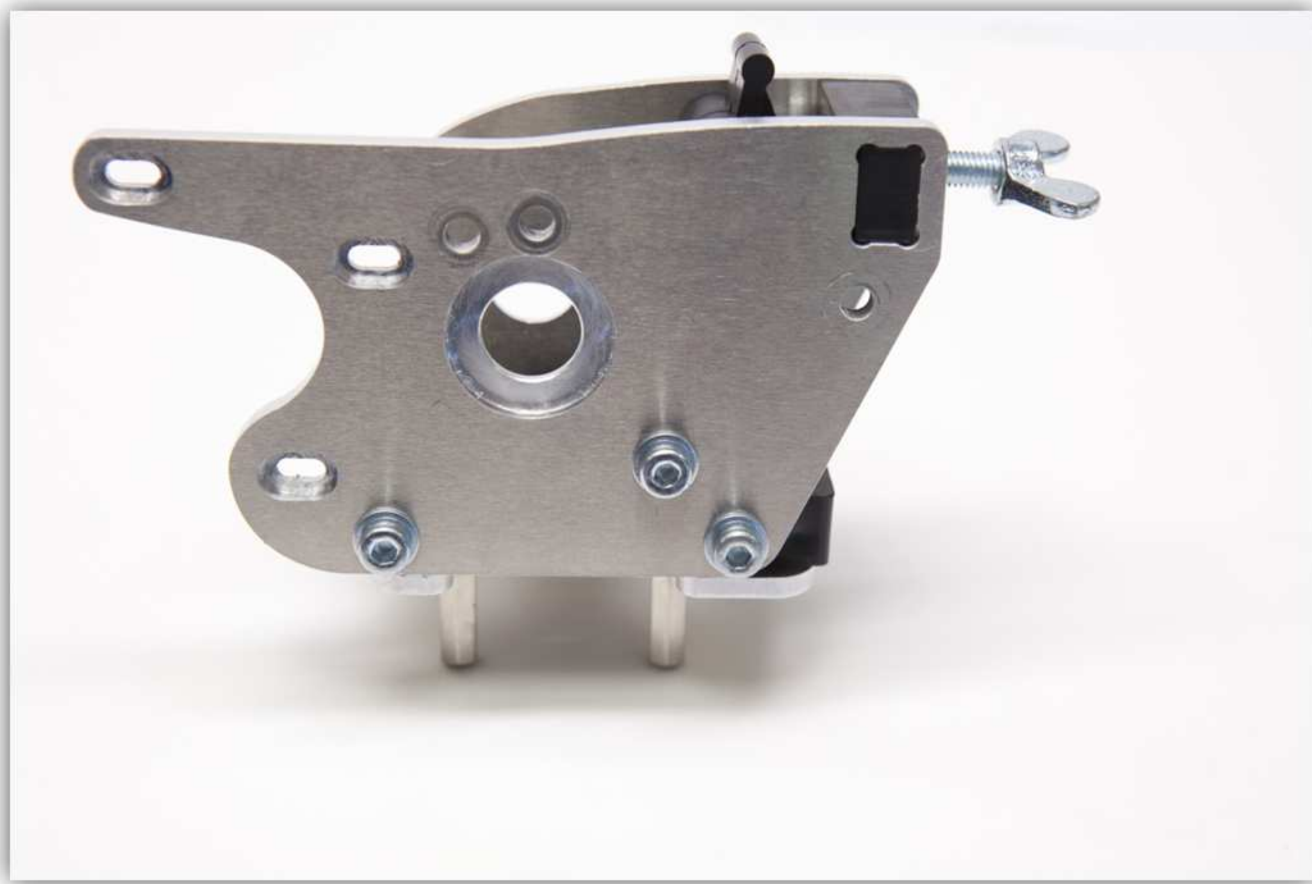


Tightly screw the metal spacers on these bolts.

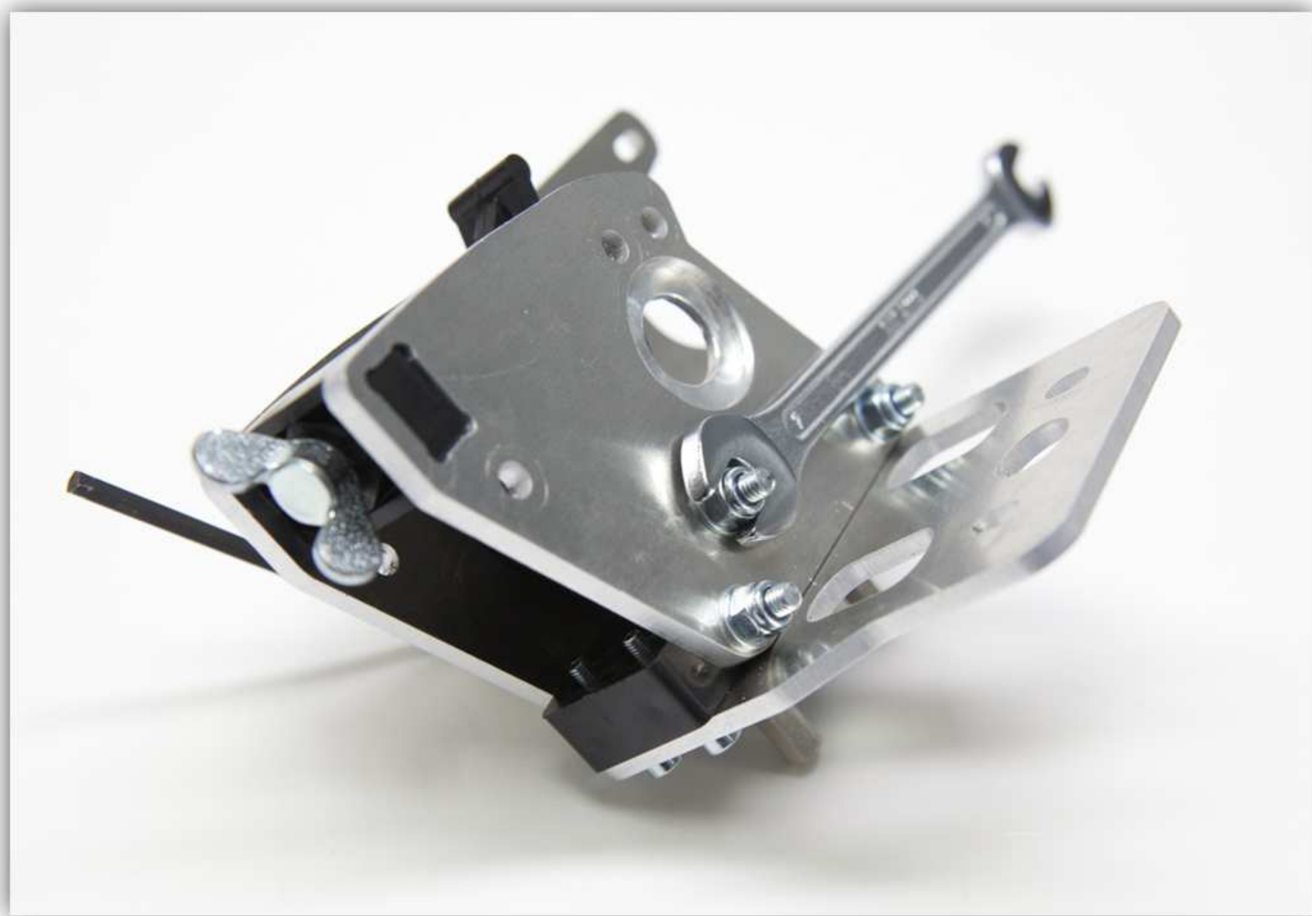


Slide the BEARING CLAMP assembly into the extruder assembly.

Use a long M4 bolt and an M4 washer to lock the BEARING CLAMP assembly in place.



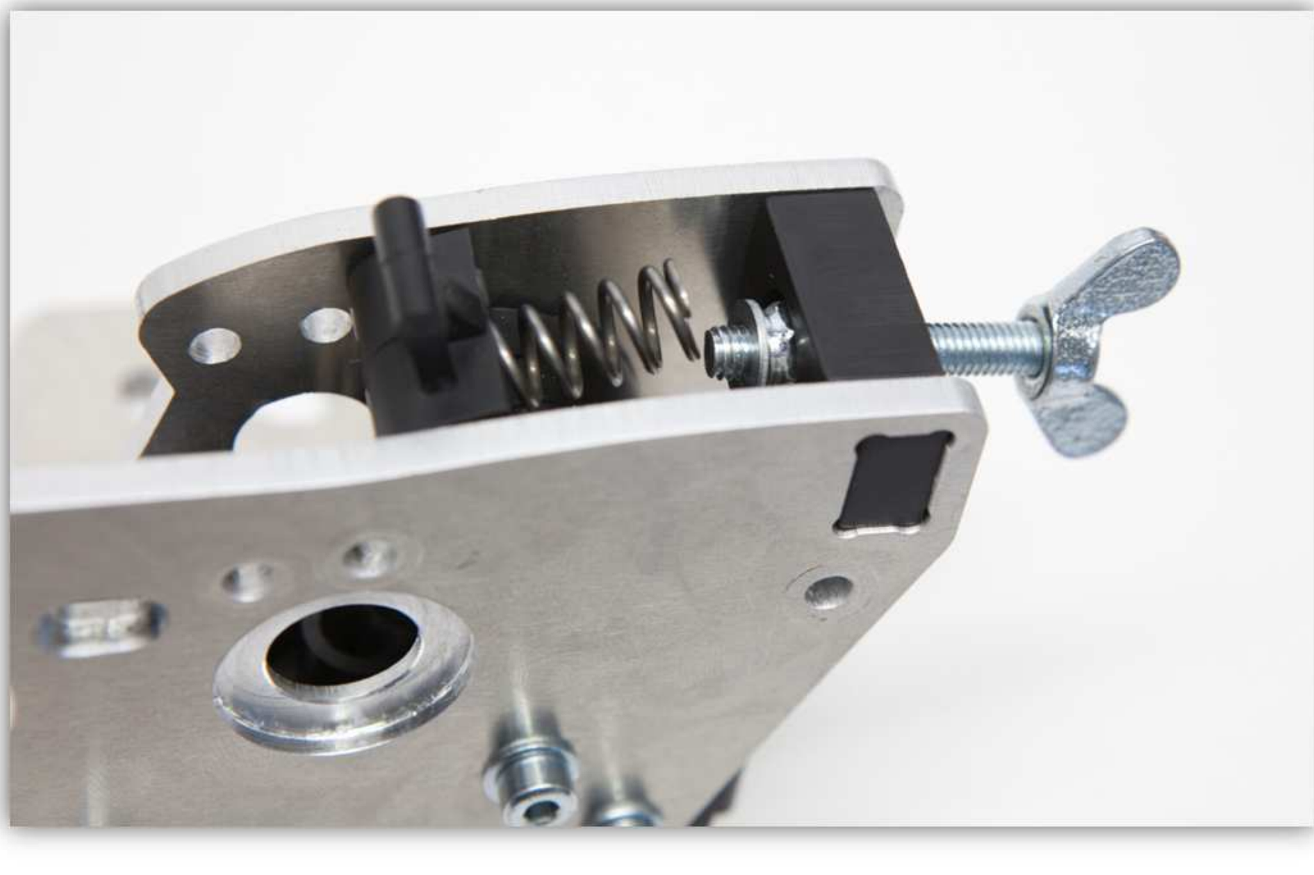
Use an M4 washer and an M4 bolt to **slightly (!)** tighten this bolt.



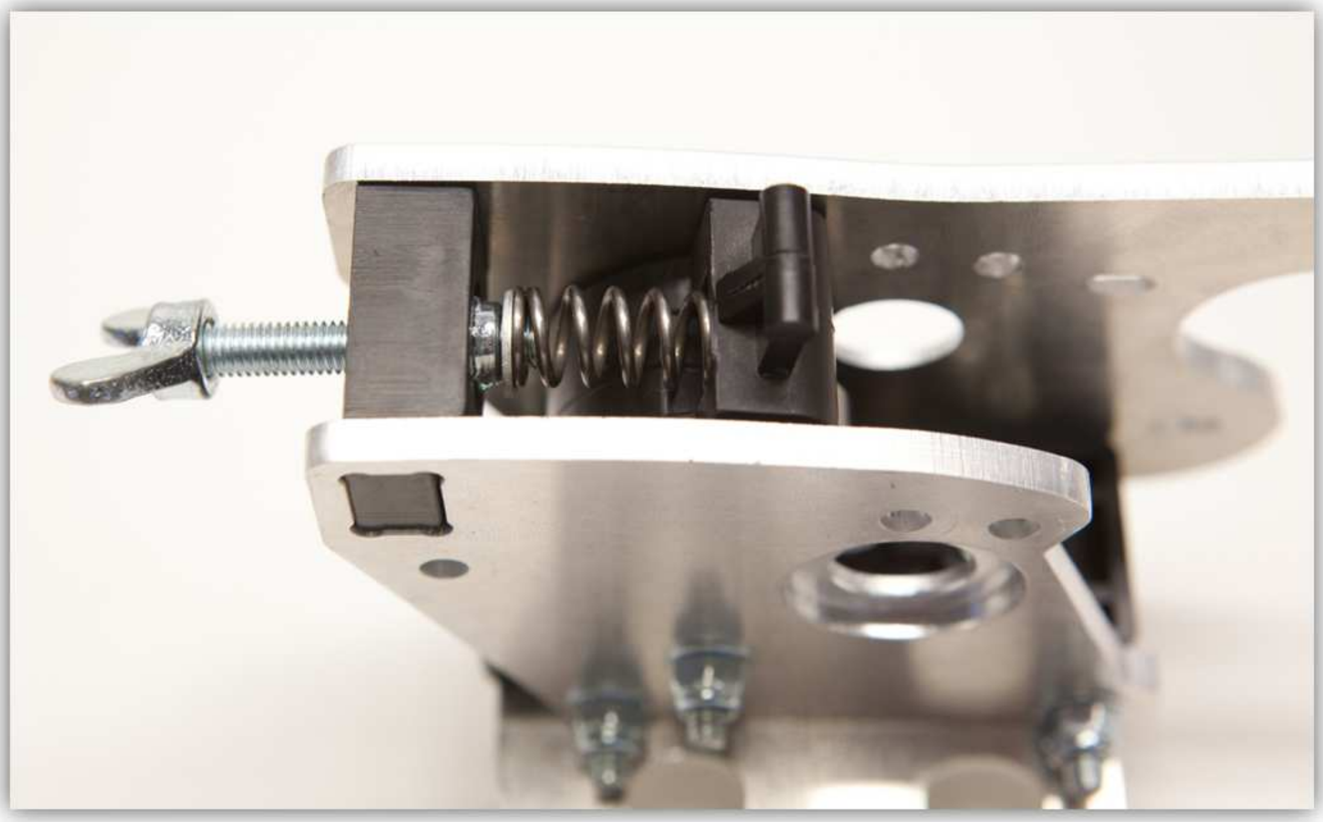
Take the **small** M5 washer and the spring.

Place the spring into the cavity of the BEARING CLAMP assembly.

Slide the washer over the butterfly bolt.

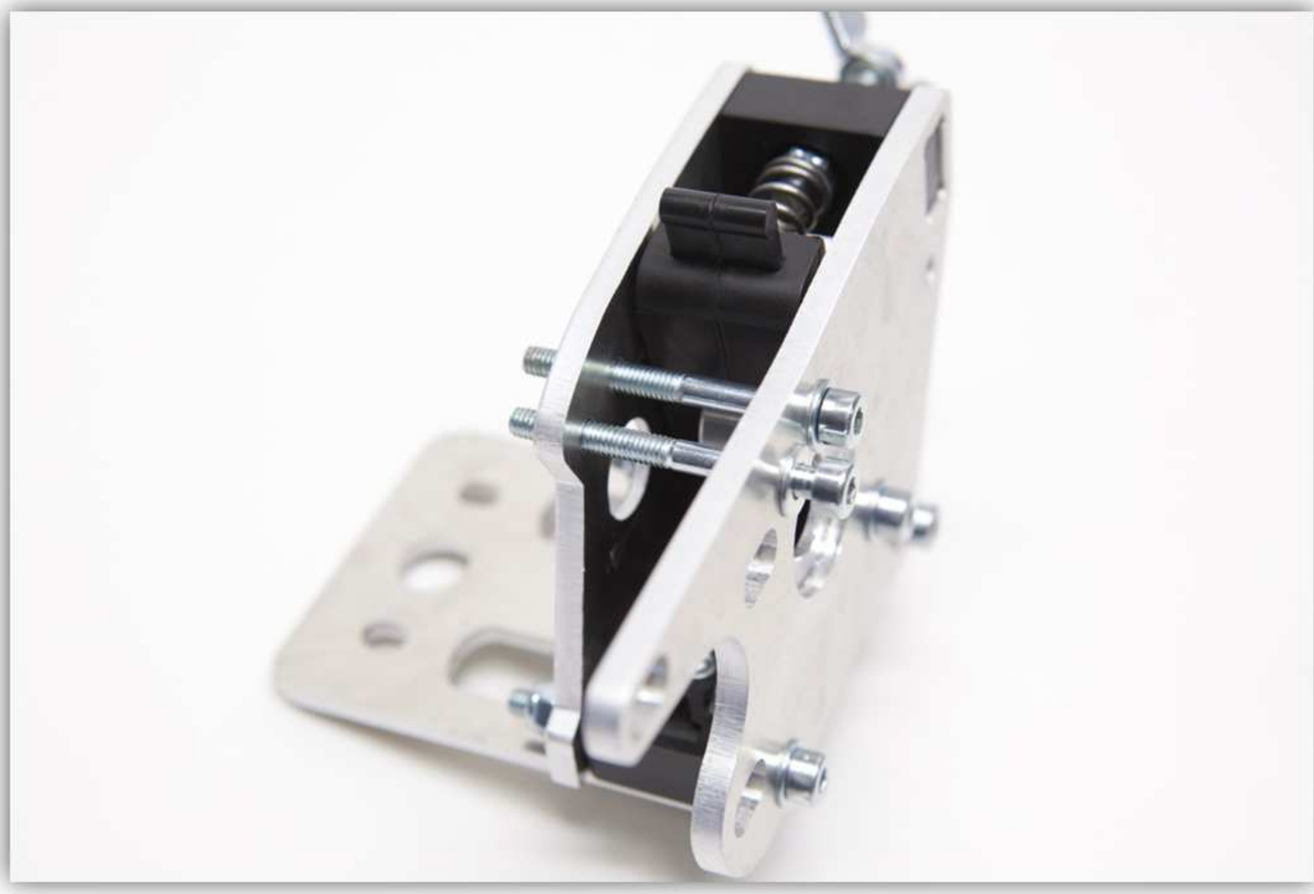


Carefully force the spring over the butterfly bolt.

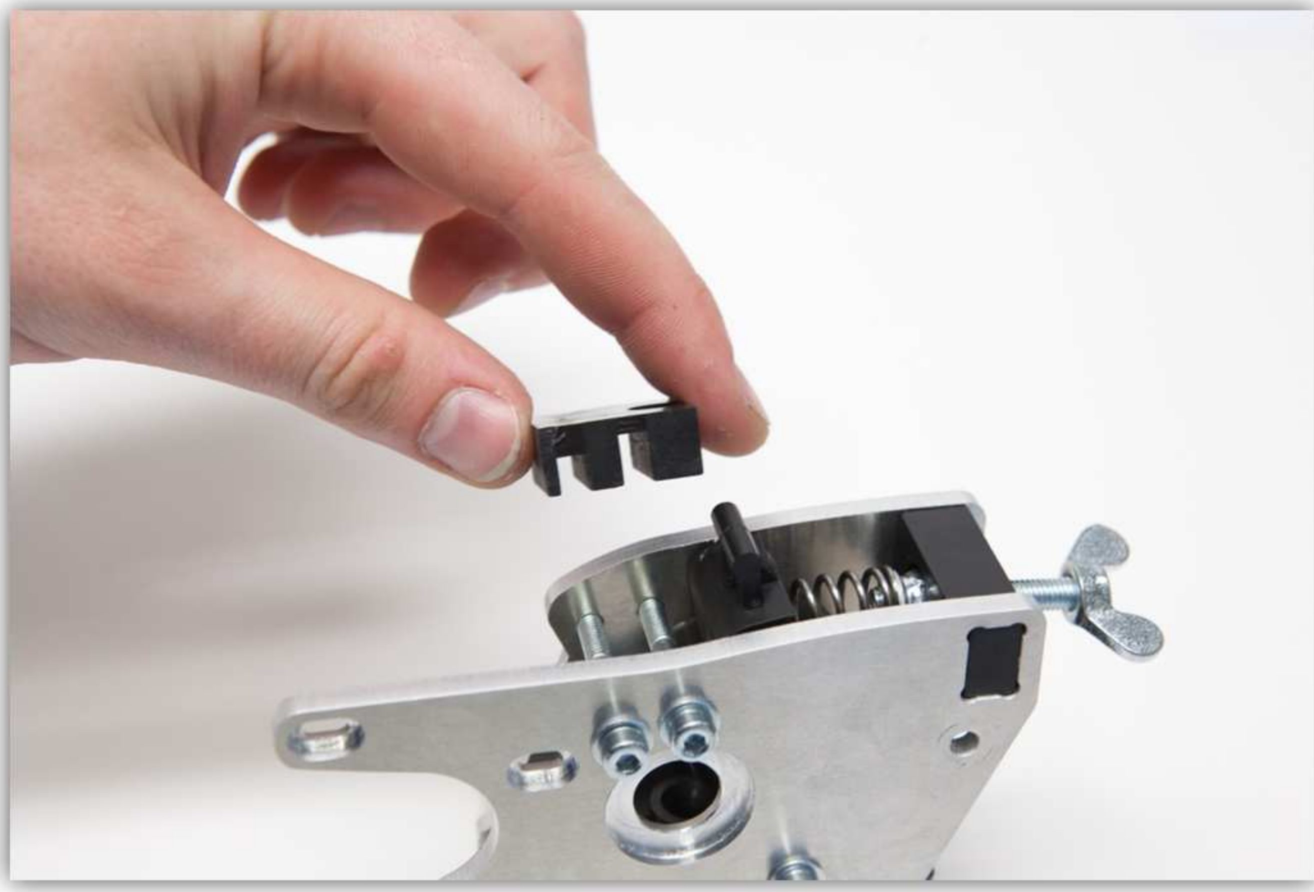


Take 2 long M4 bolts and 2 M4 washers.

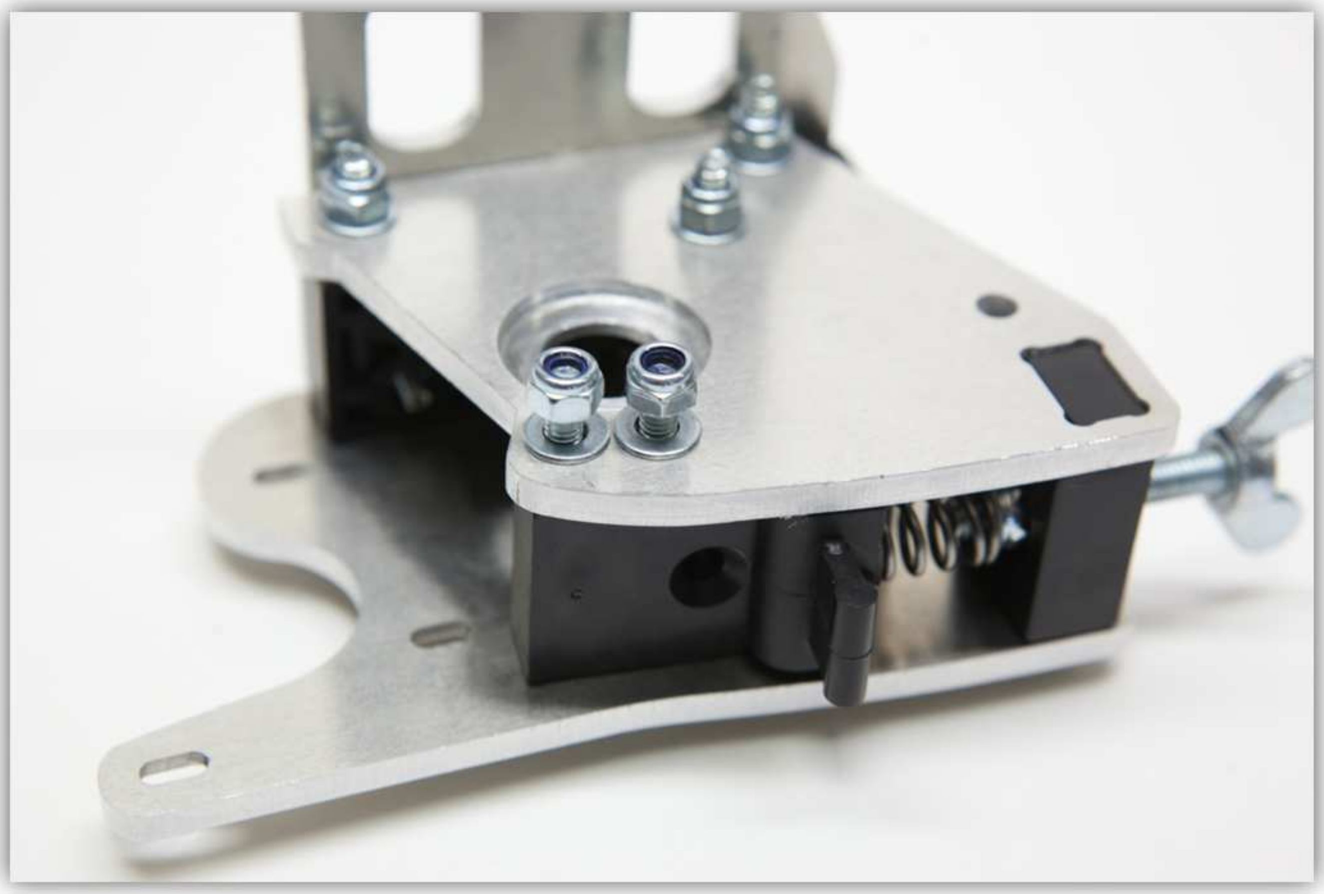
Slide these two bolts in the two holes at the top of the extruder housing.

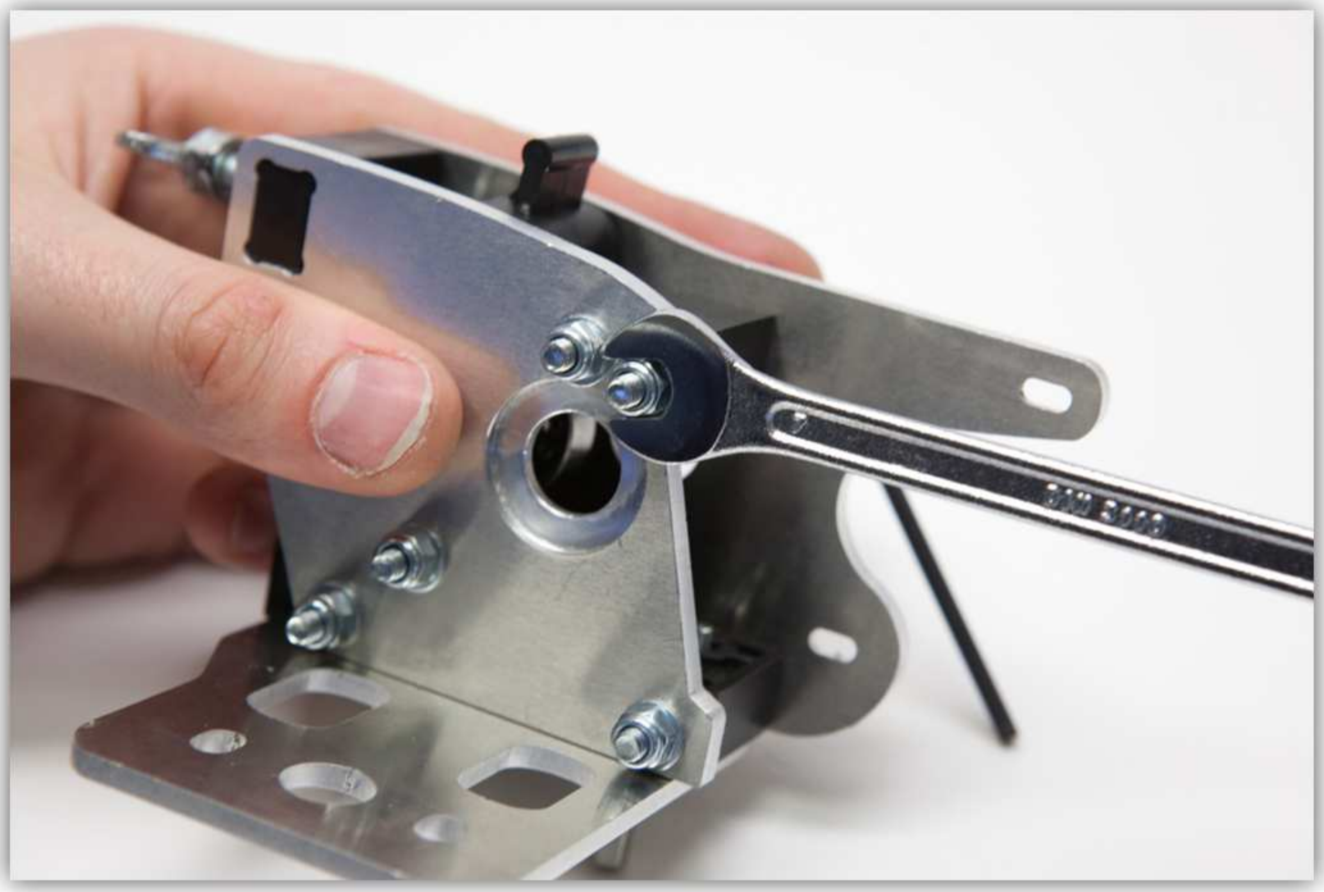


Take the filament guide piece and slide it over these bolts. **Watch the orientation of this piece.**



Take 2 M4 washers and 2 M4 locking bolts to **slightly (!)** tighten these bolts.





Next you will need the LARGE GEAR, 2 608 BEARINGS, 2 M8 washers and the HOBBED BOLT.

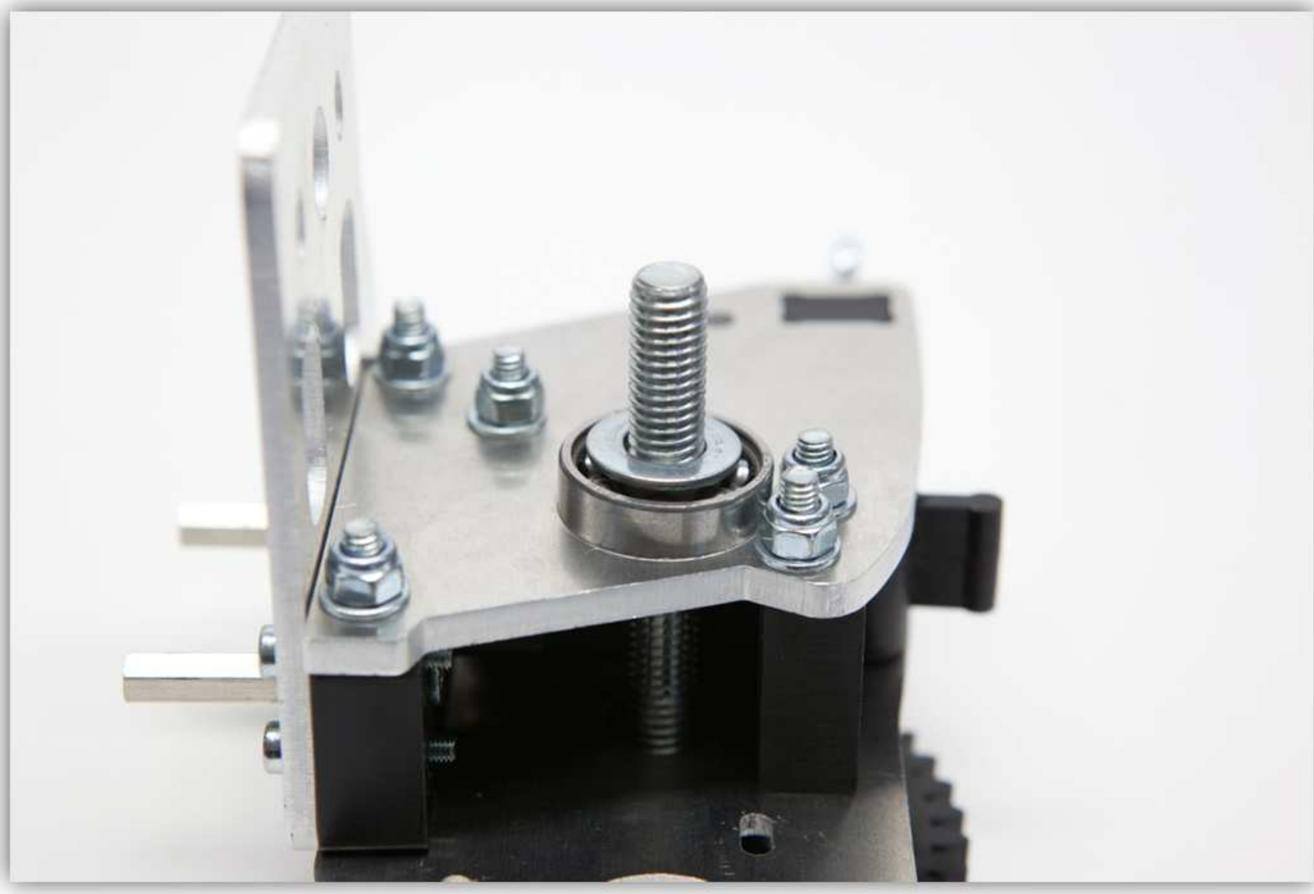
Slide the HOBBED BOLT into the LARGE GEAR so that the head of the HOBBED BOLT fits snugly in the cavity of the LARGE GEAR.

Slide the 3 M8 washers over the bolt followed by a 608 BEARING.

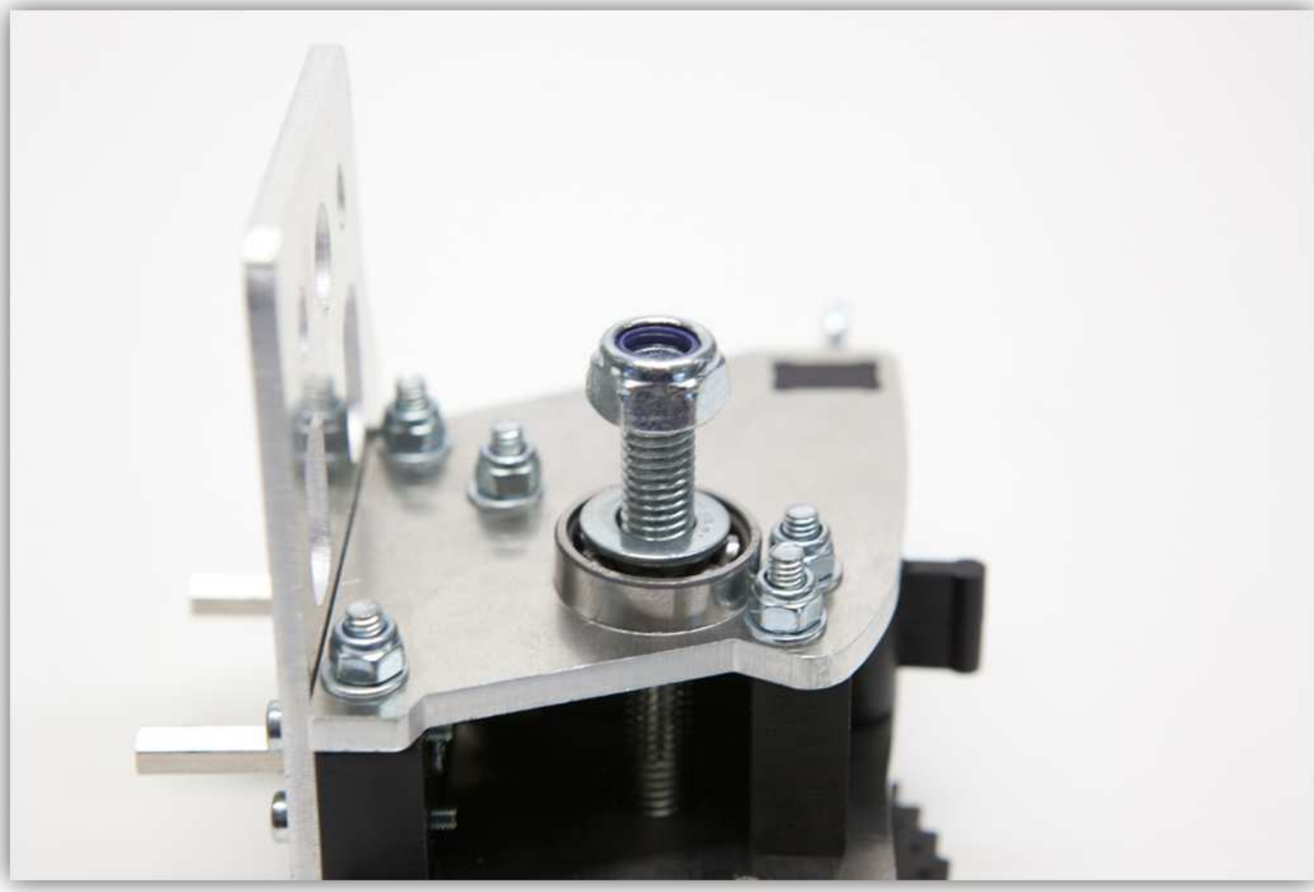
Slide this assembly into the extruder housing. **Watch the orientation carefully.**

Slide a 608 BEARING over the other end of the HOBBED BOLT.

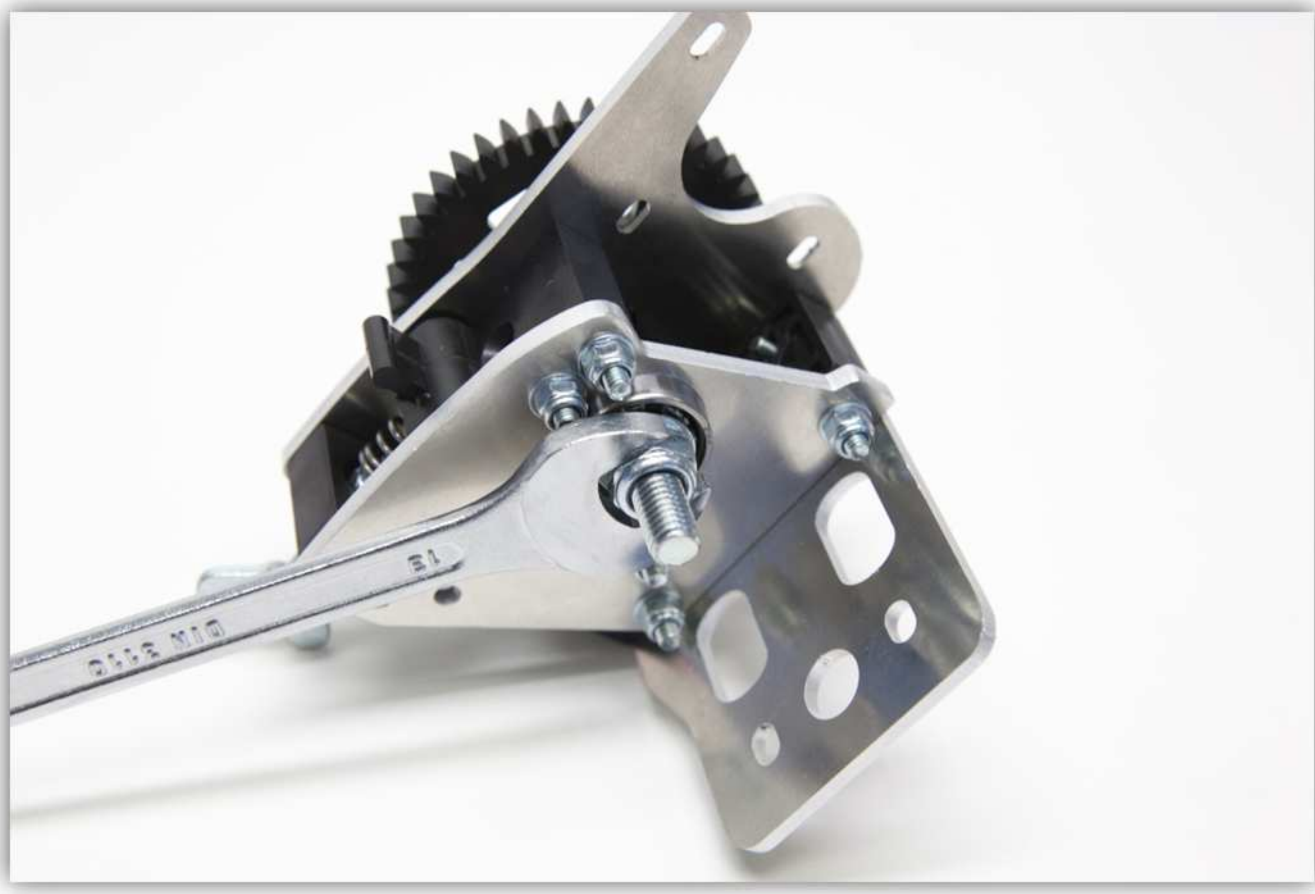
Slide an M8 washer to cover the 608 BEARING.



Screw an M8 locking nut on the HOBBED BOLT.



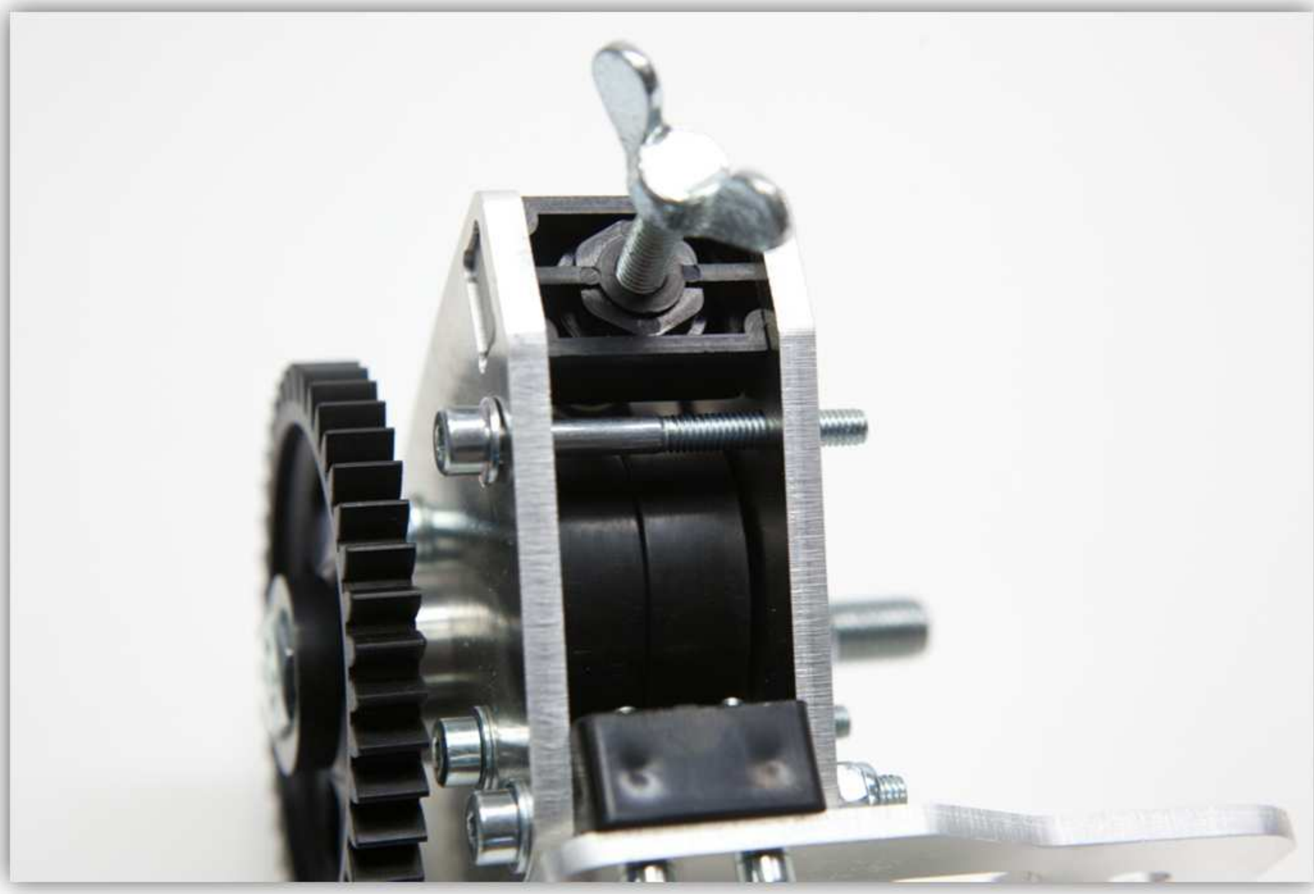
Tighten this bolt but make sure that the large gear turns smoothly.



The extruder housing should look like this.

Take a long M4 bolt and an M4 washer.

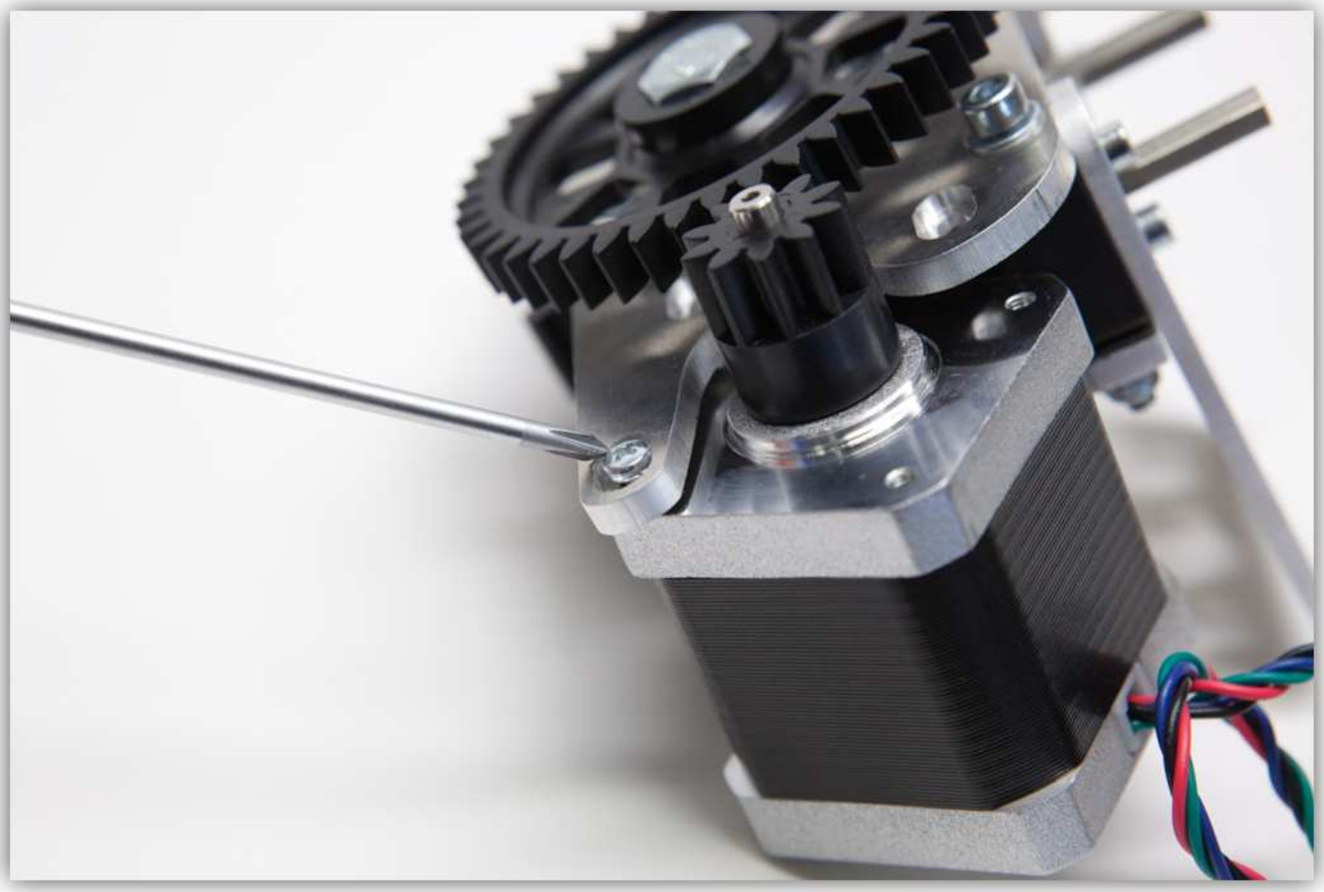
Place it as shown in the picture below.

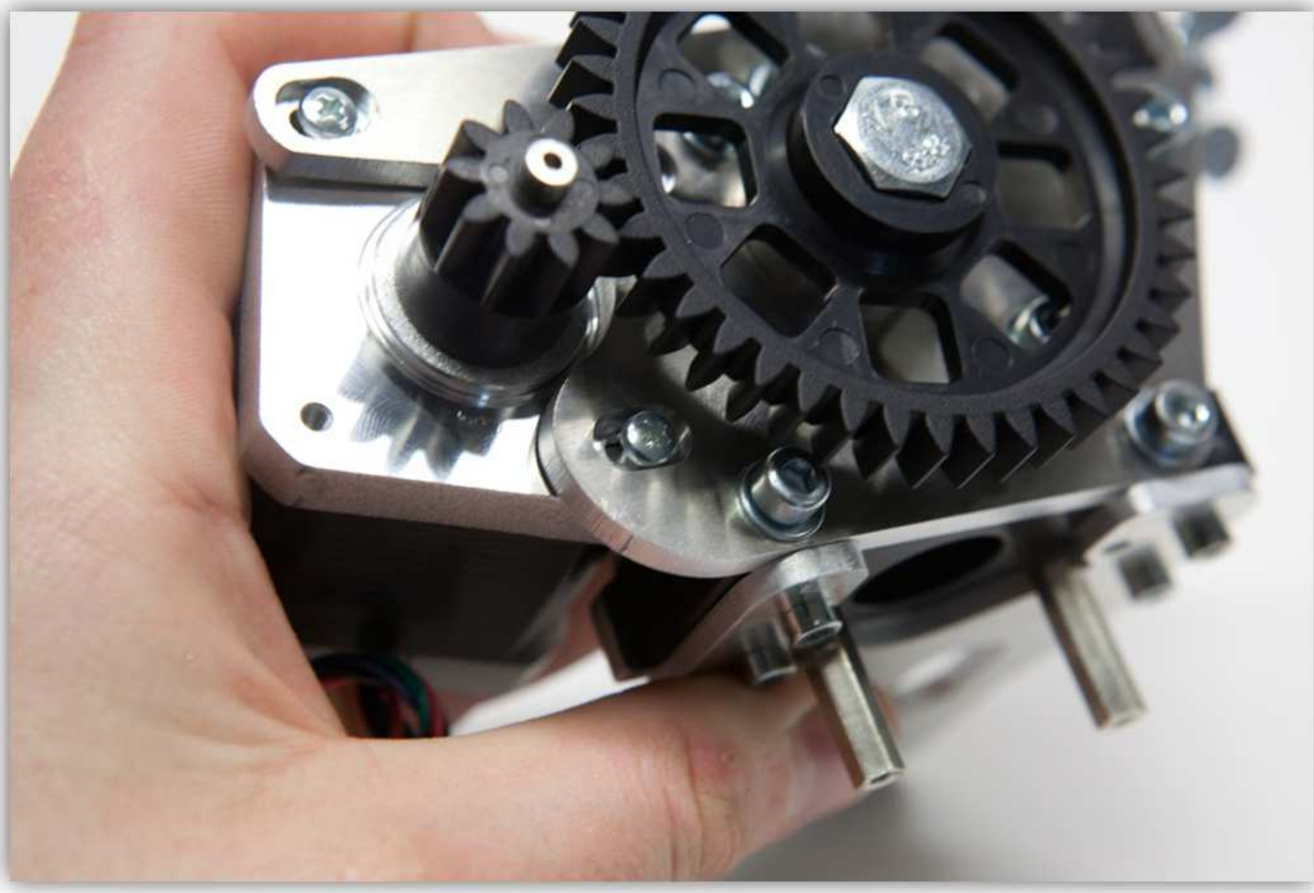


Tighten this bolt **slightly (!)**

Take the 3 M3 x 6 bolts.

Bolt the motor to the extruder housing. **Do not fully tighten these bolts.**

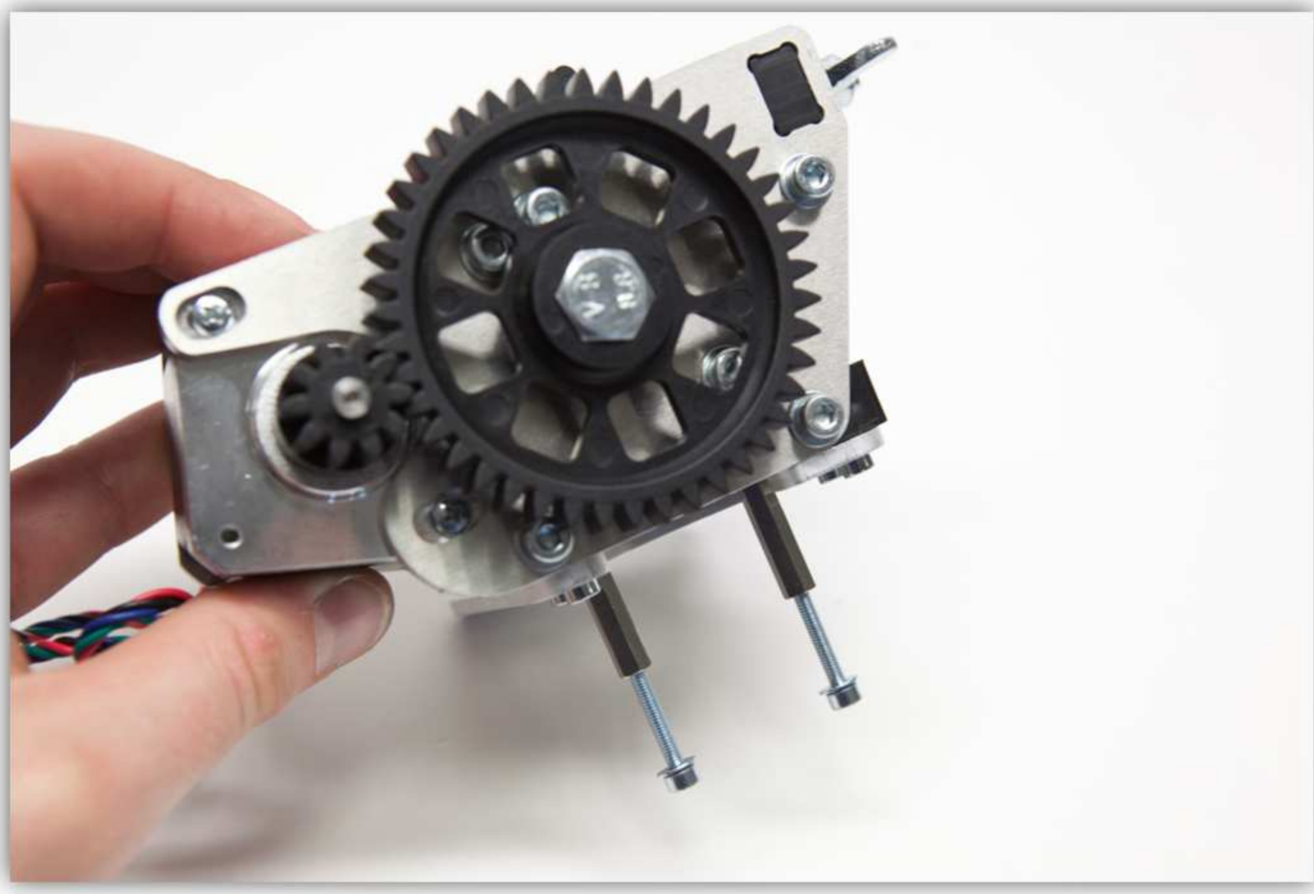




Position the motor so the teeth of the gears interlock as shown in the picture below. **Then you can fully tighten the bolts.**

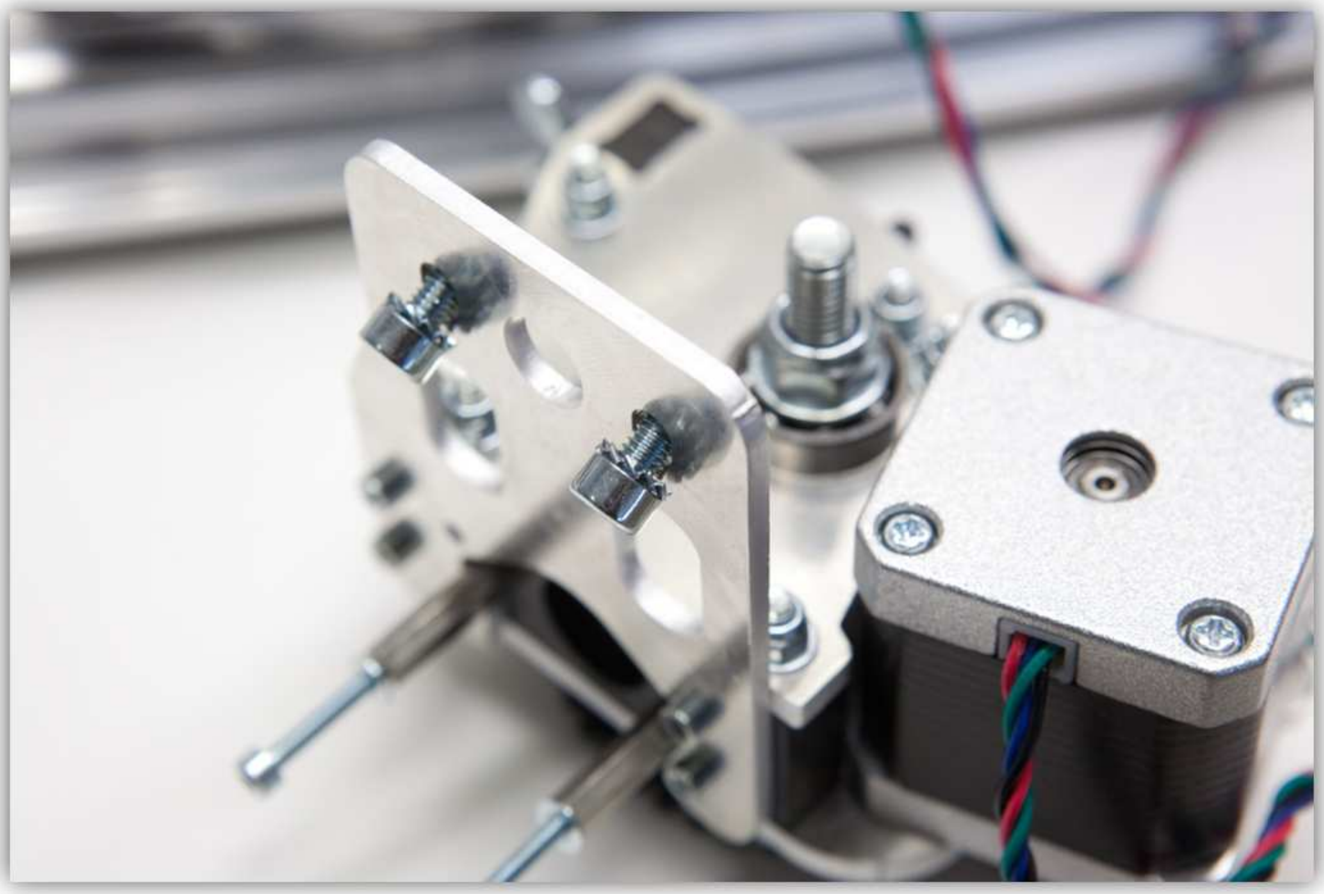
Take 2 M3 x 25 bolts and 2 M3 washers.

Screw these into the spacers for later use (the extruder itself will be mounted with these bolts.)

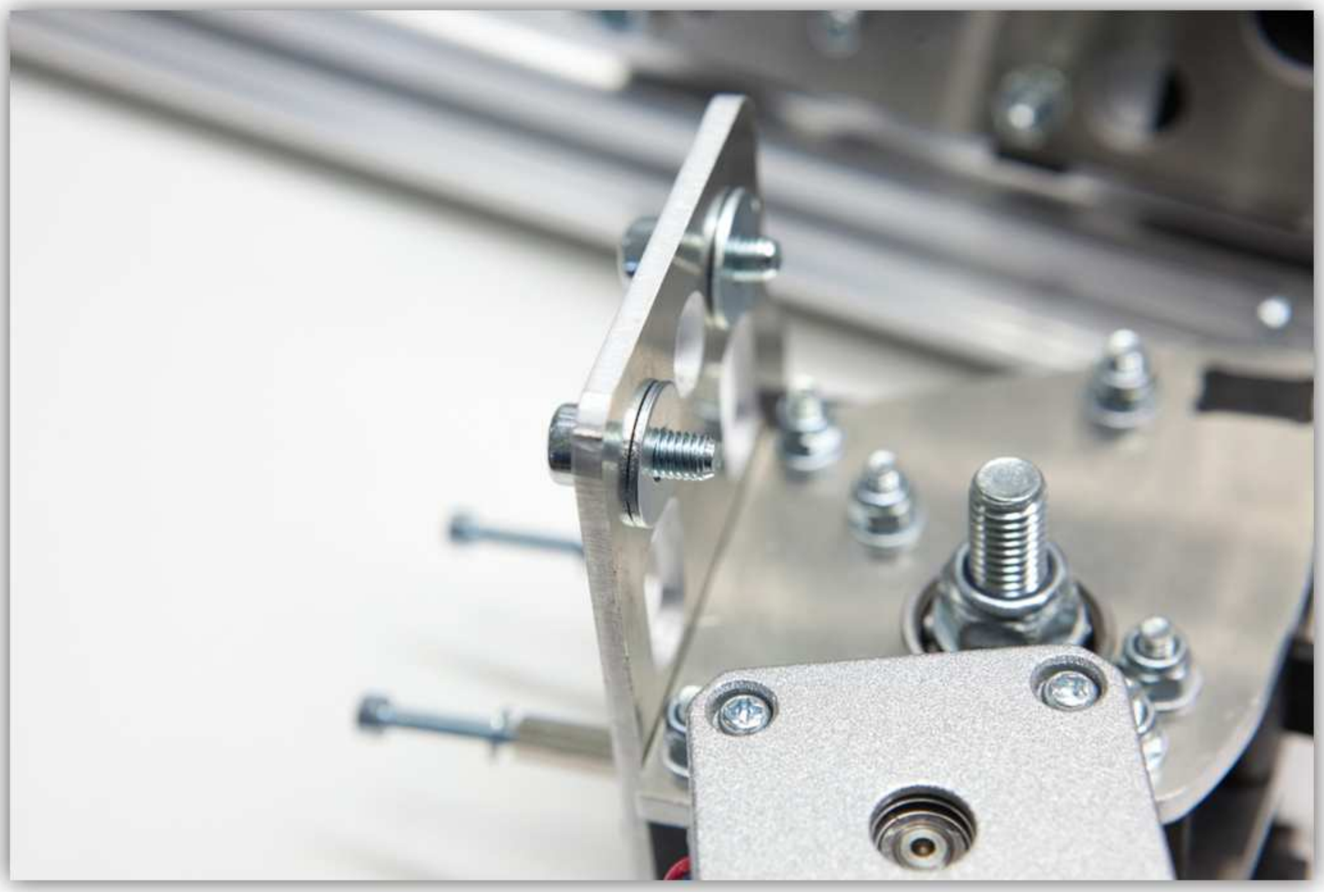


Take the 2 M5 bolts, the two large M5 washers and 2 M5 toothed washers

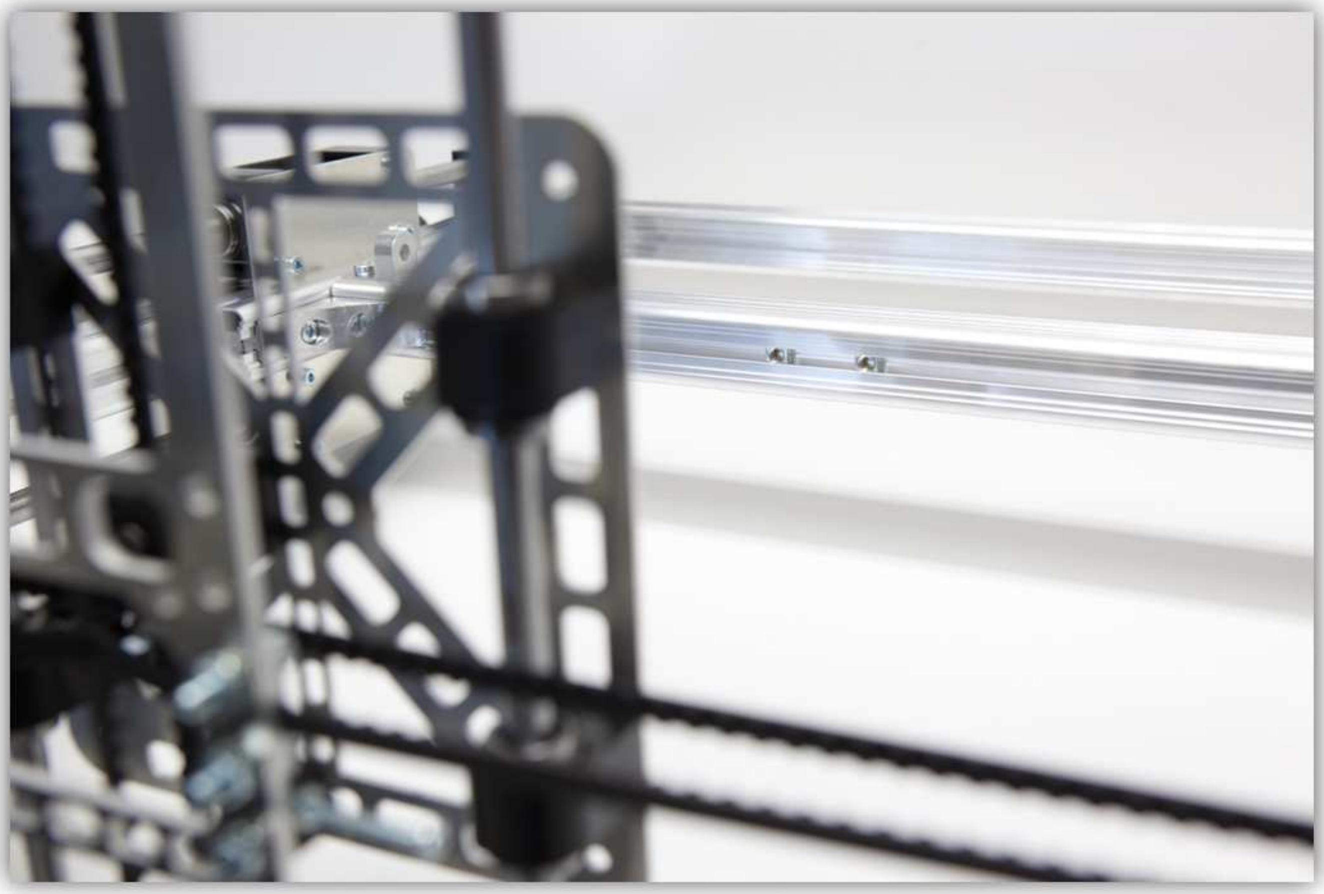
Place these bolts and washers as shown in the pictures below.



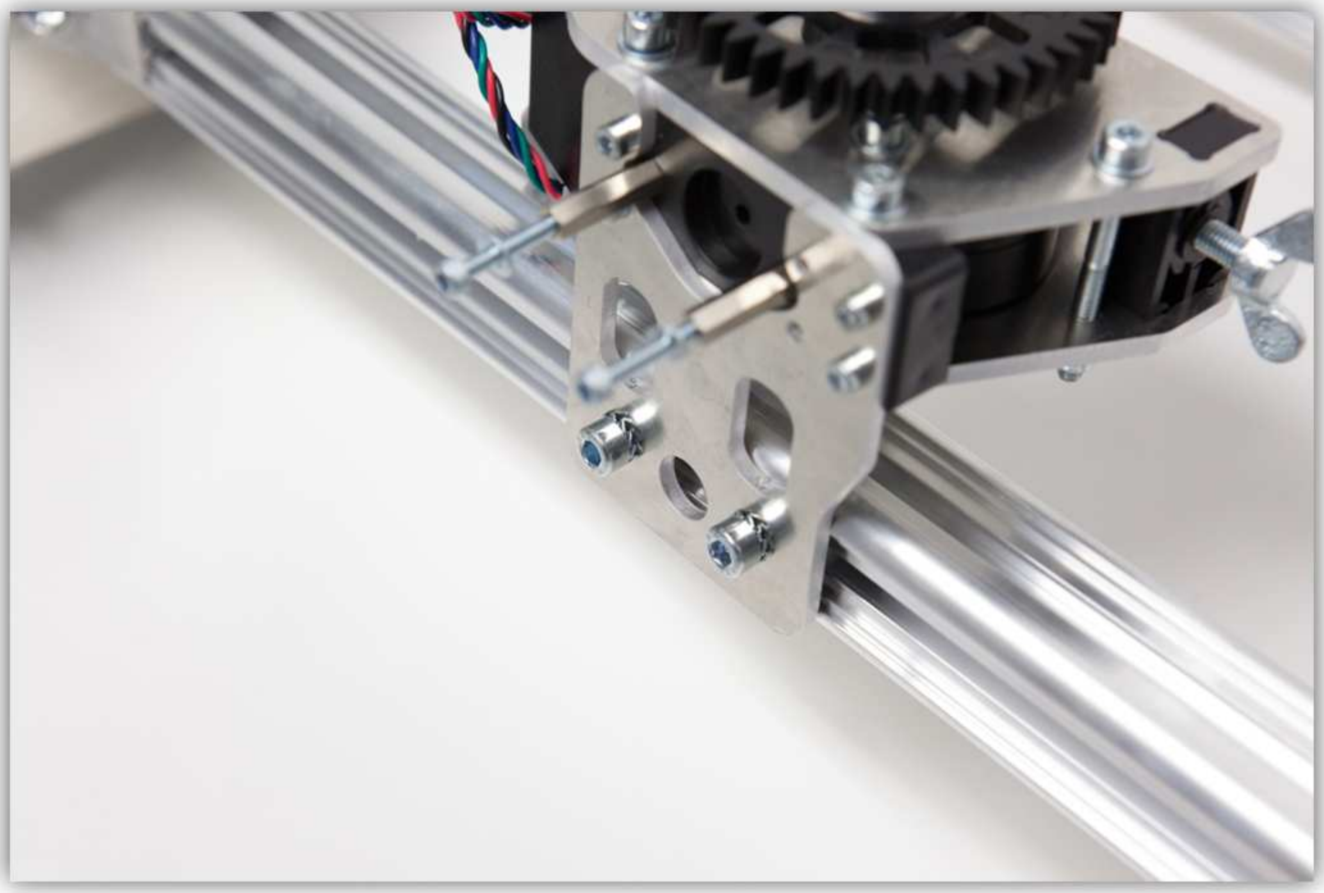
Notice the 2 large M5 washers.

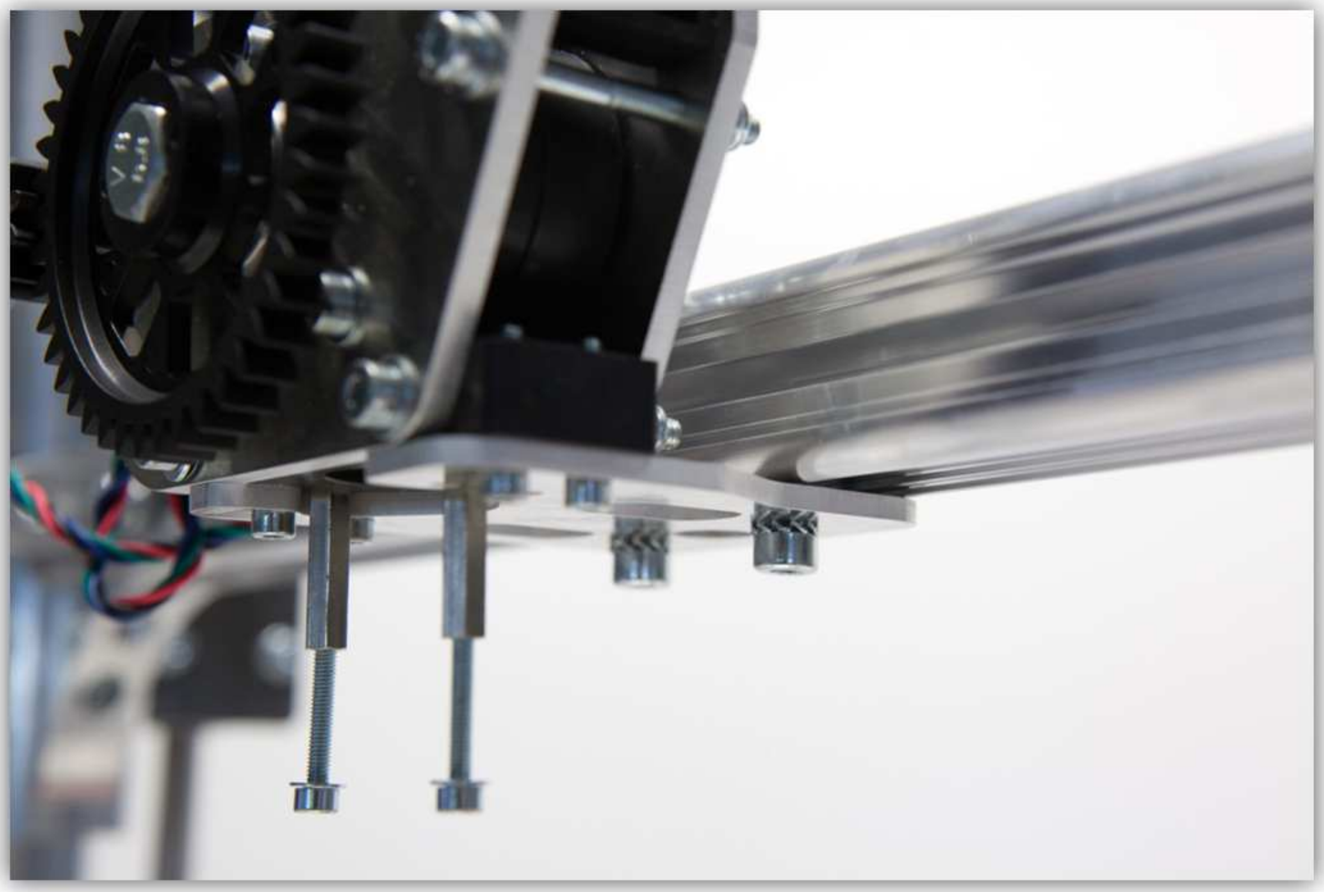


Locate the 2 square M5 nuts in the bottom of the extruder arm profile you put there before.

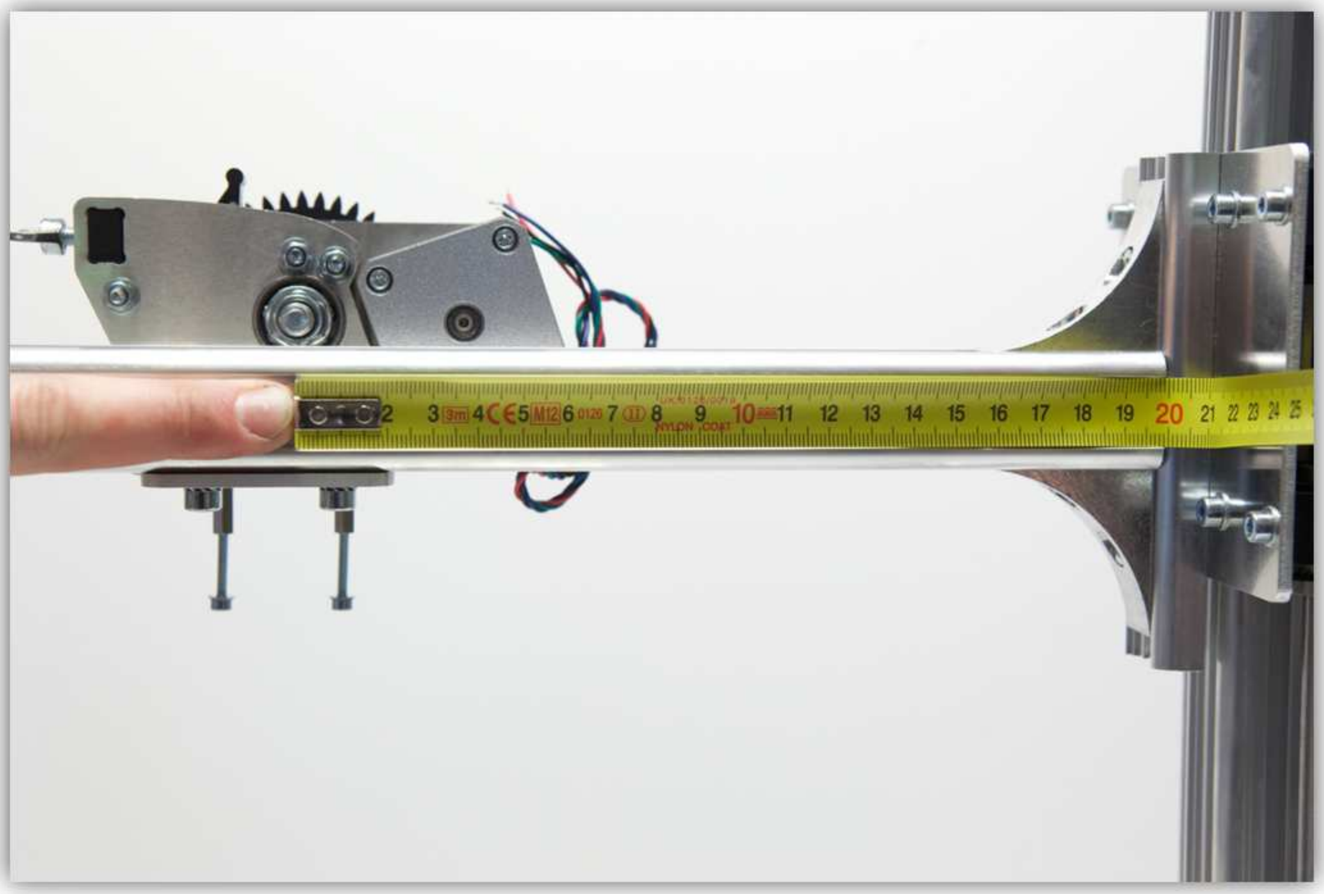


Bolt the extruder to these two nuts. **Do not tighten these bolts fully. Notice the orientation, the extruder housing should be facing forward.**

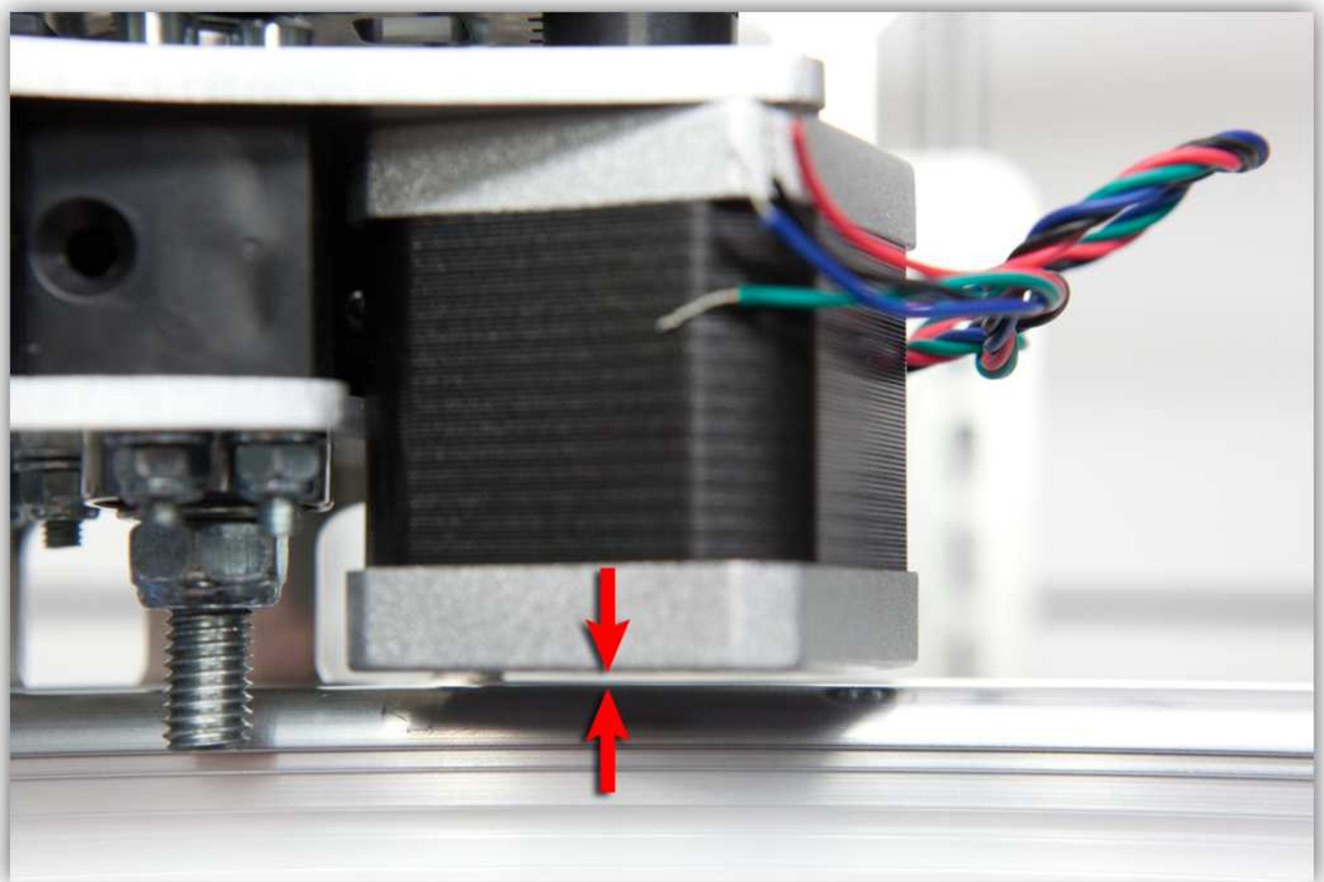




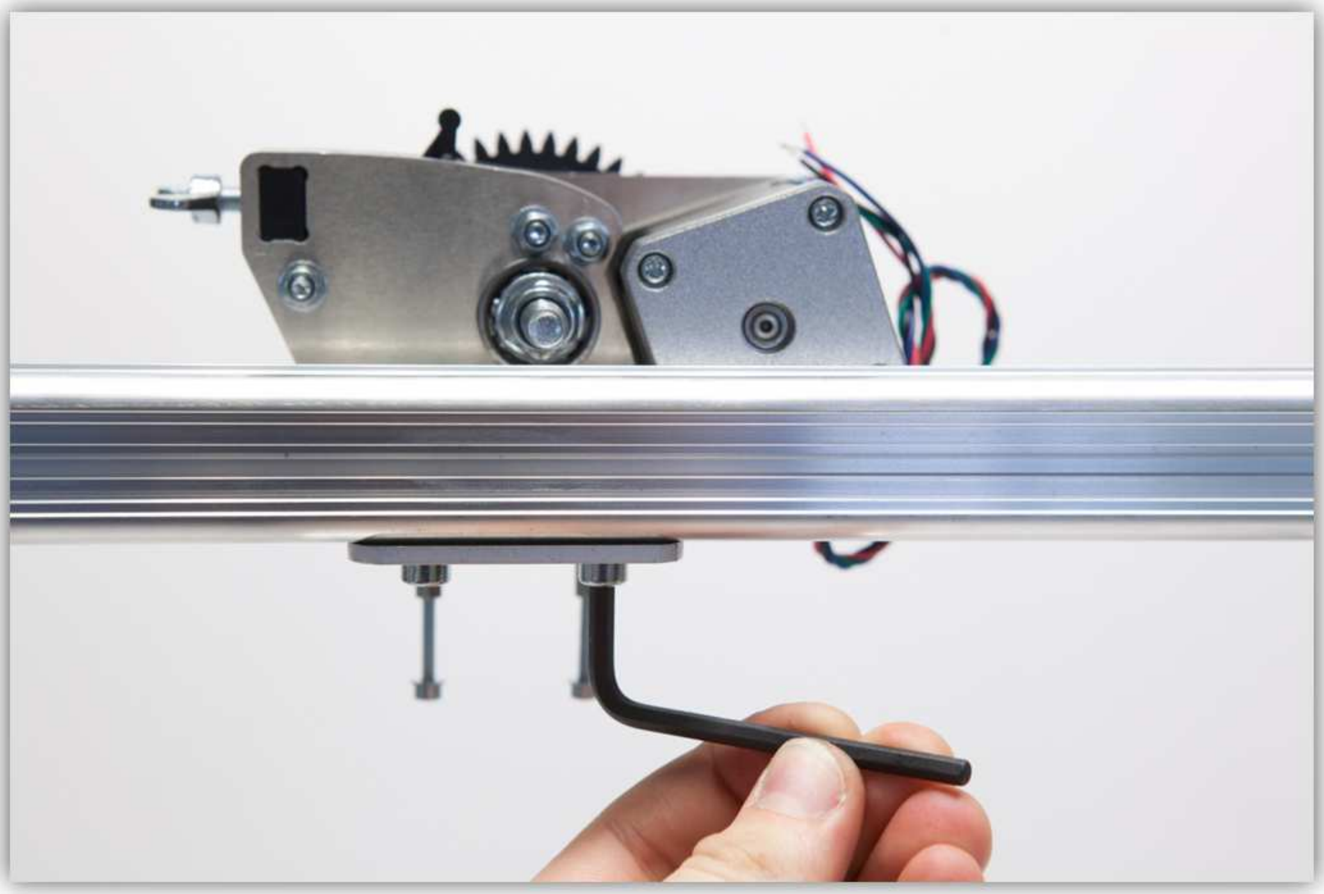
Slide the housing so the centre of the HOBBED BOLT sits at 20 cm (0.79") of the Z CARRIAGE.



Now make sure the extruder housing sits level and there is about a 1 mm (0.04") gap between the extruder arm profile and the back of the motor.

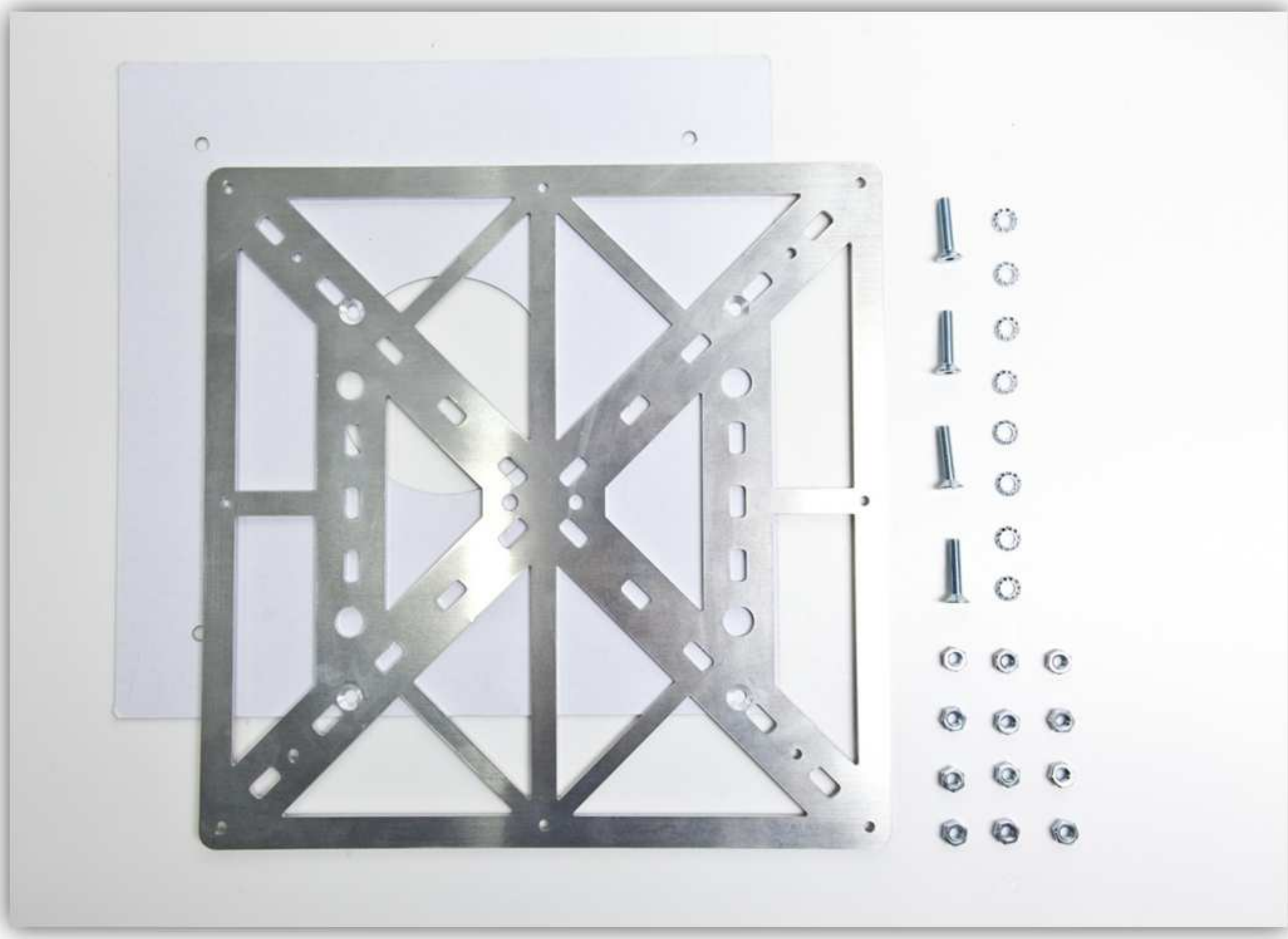


Now you can tighten the bolts that hold the extruder in place.

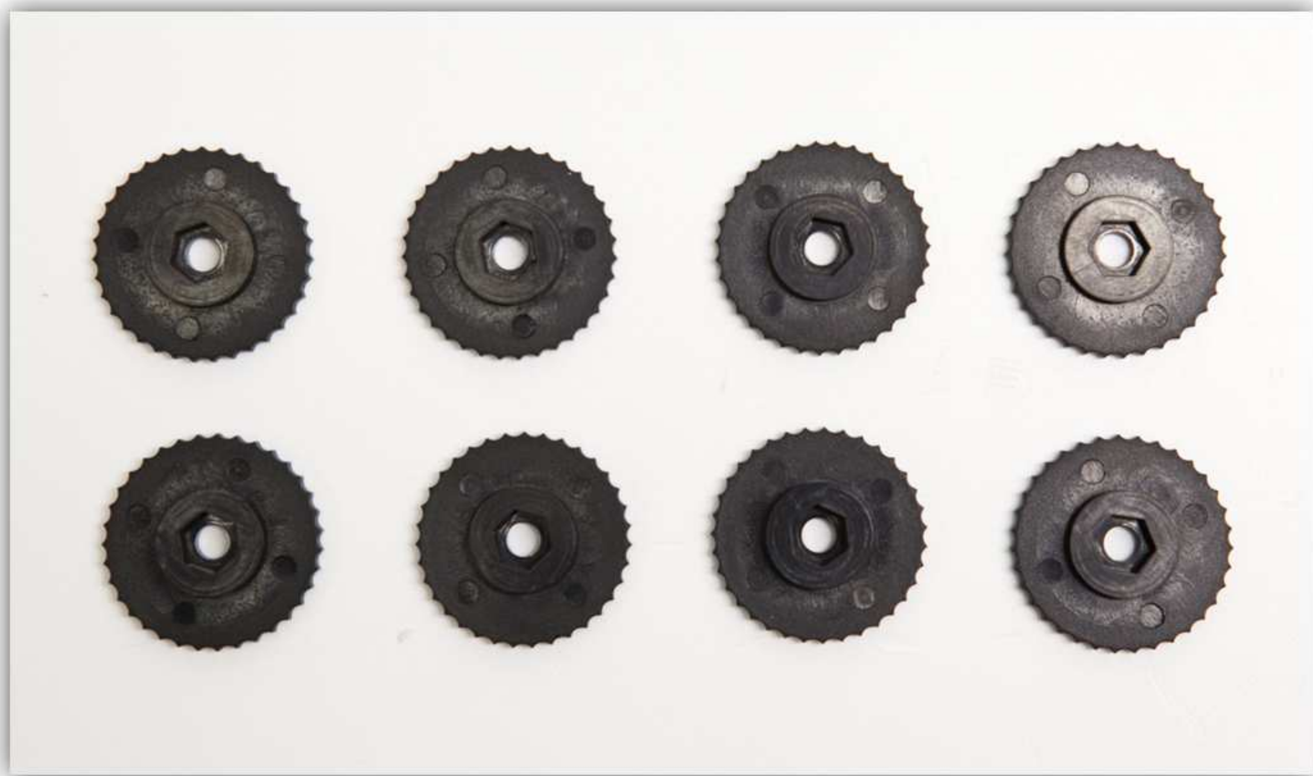


010 – ASSEMBLING THE HEATED BED

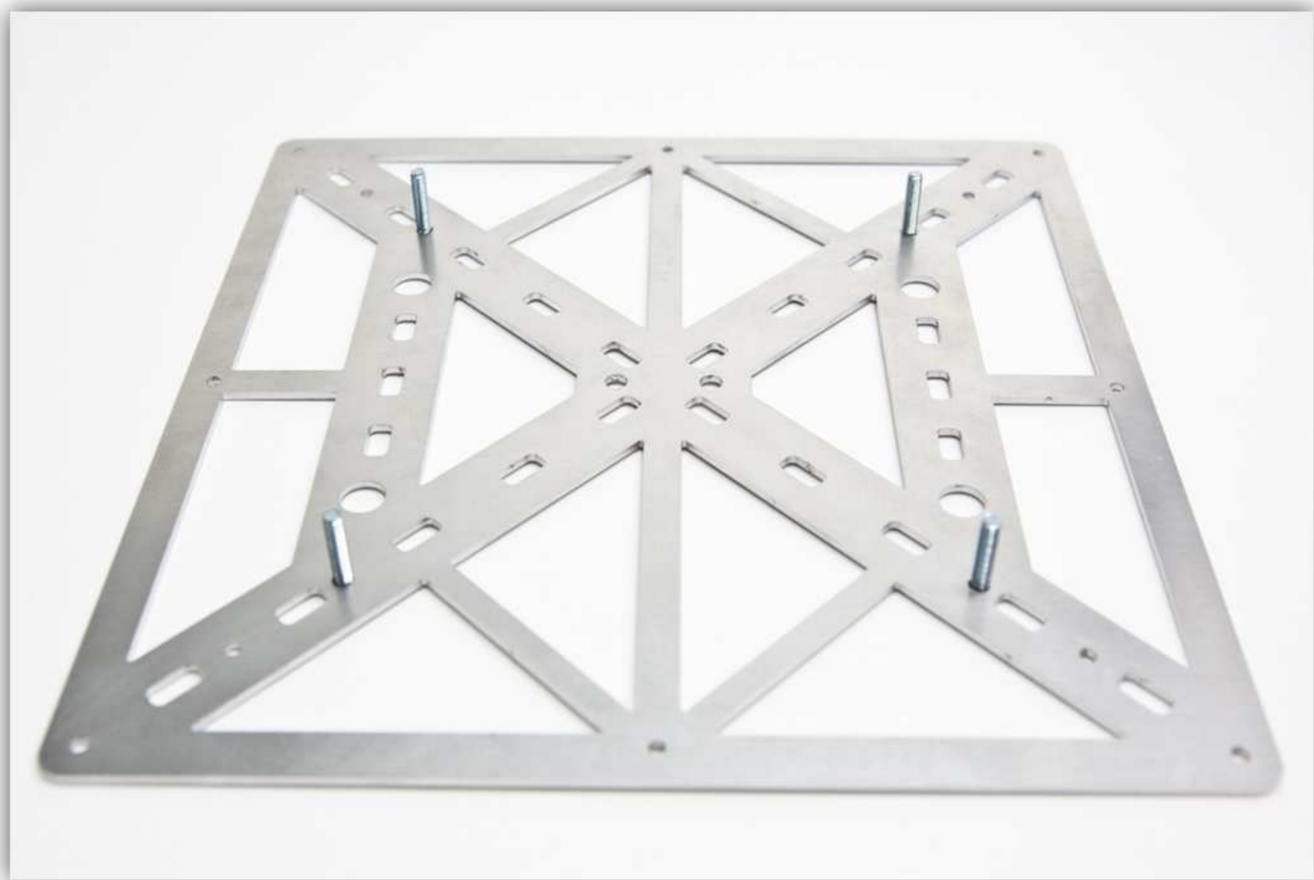
Take all the parts out of the bag labelled with 32.



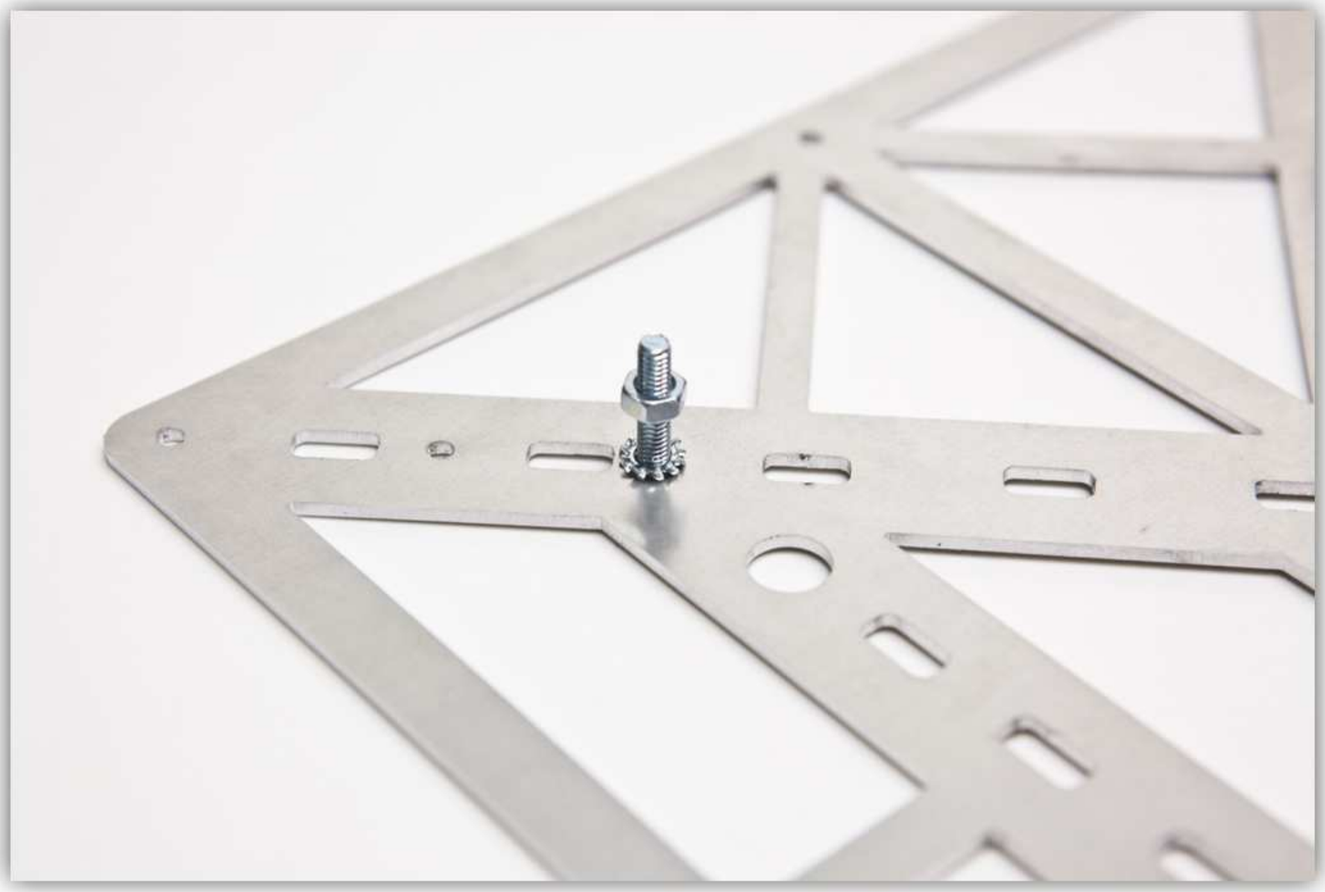
Now take the pieces as shown in the picture below out of the bag with all the plastic parts (THUMB SCREWS)



Take the 4 countersunk M4 bolts and put them through the BED PLATE.

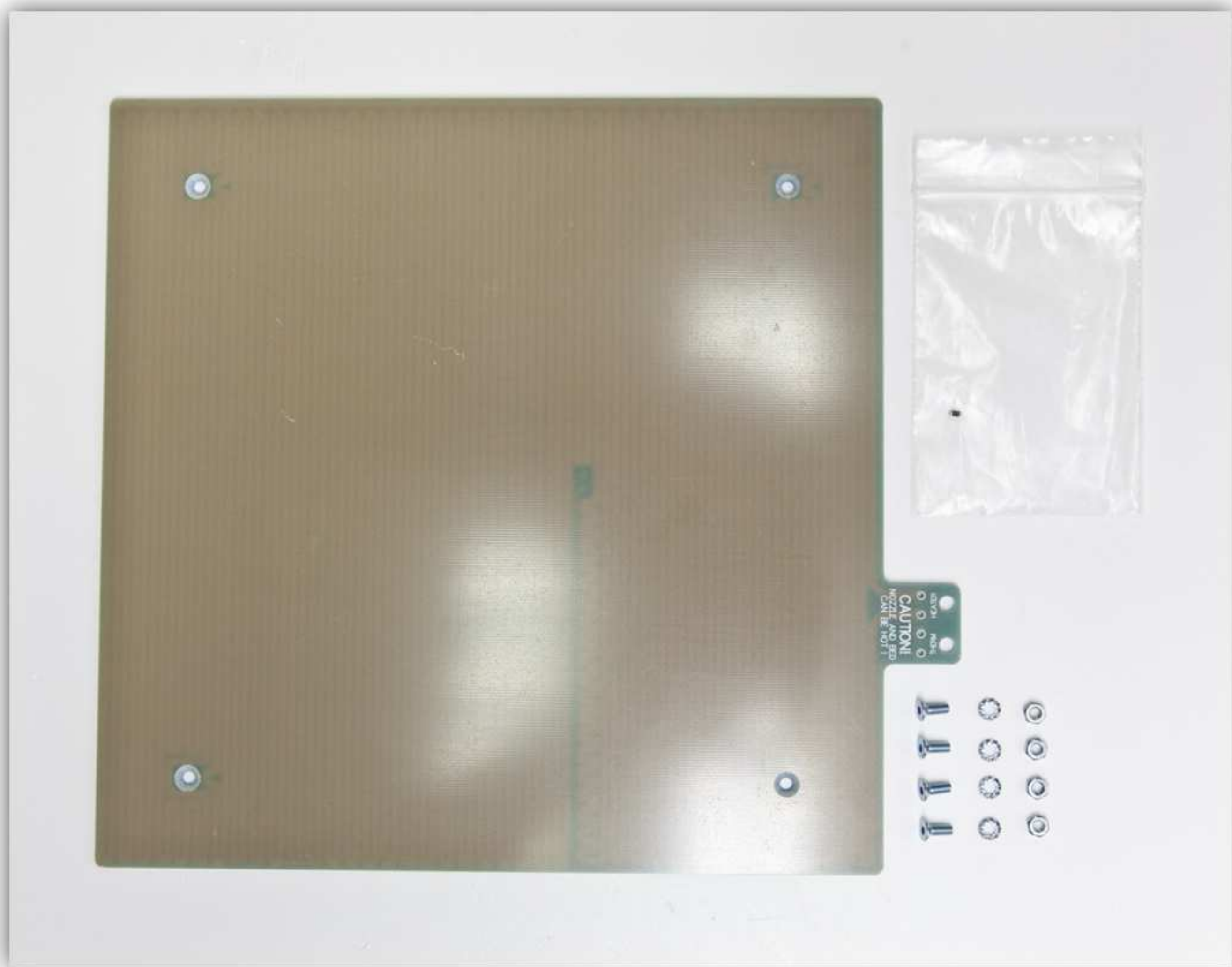


Use 4 M4 toothed washers and 4 M4 nuts.

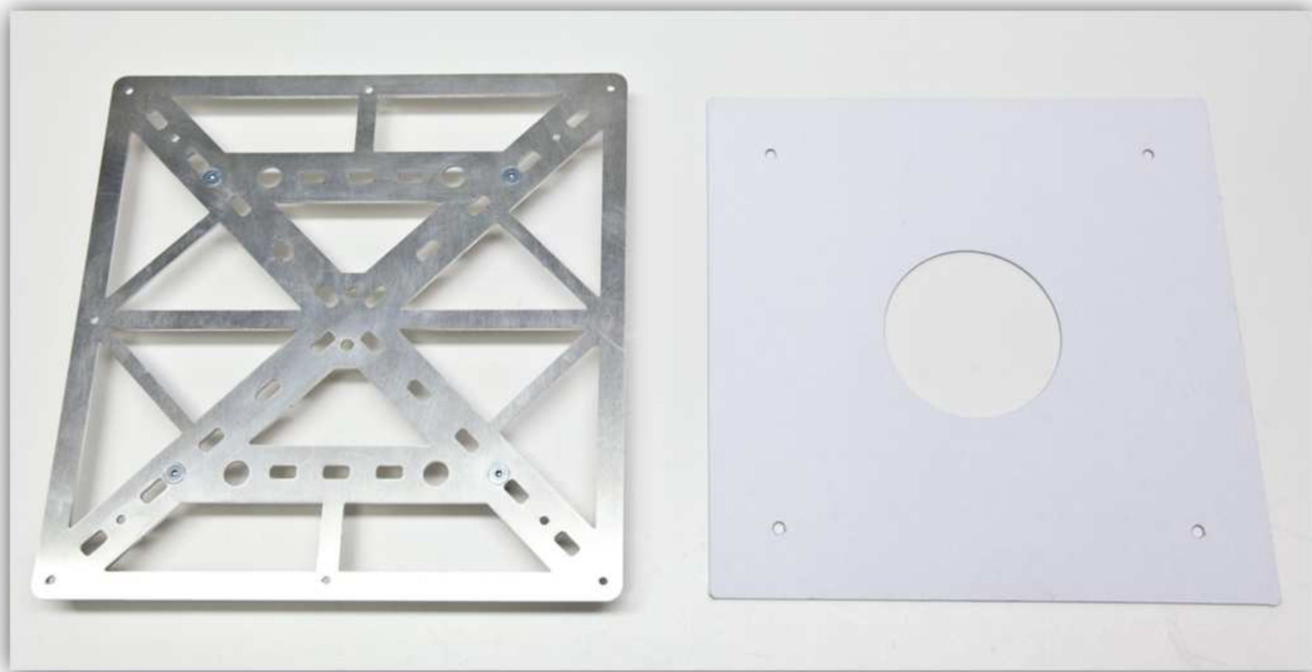


Tighten all these bolts firmly.

Take all the parts out of the bag labelled with 33. **Take extra care with the bag with the small NTC thermistor.**

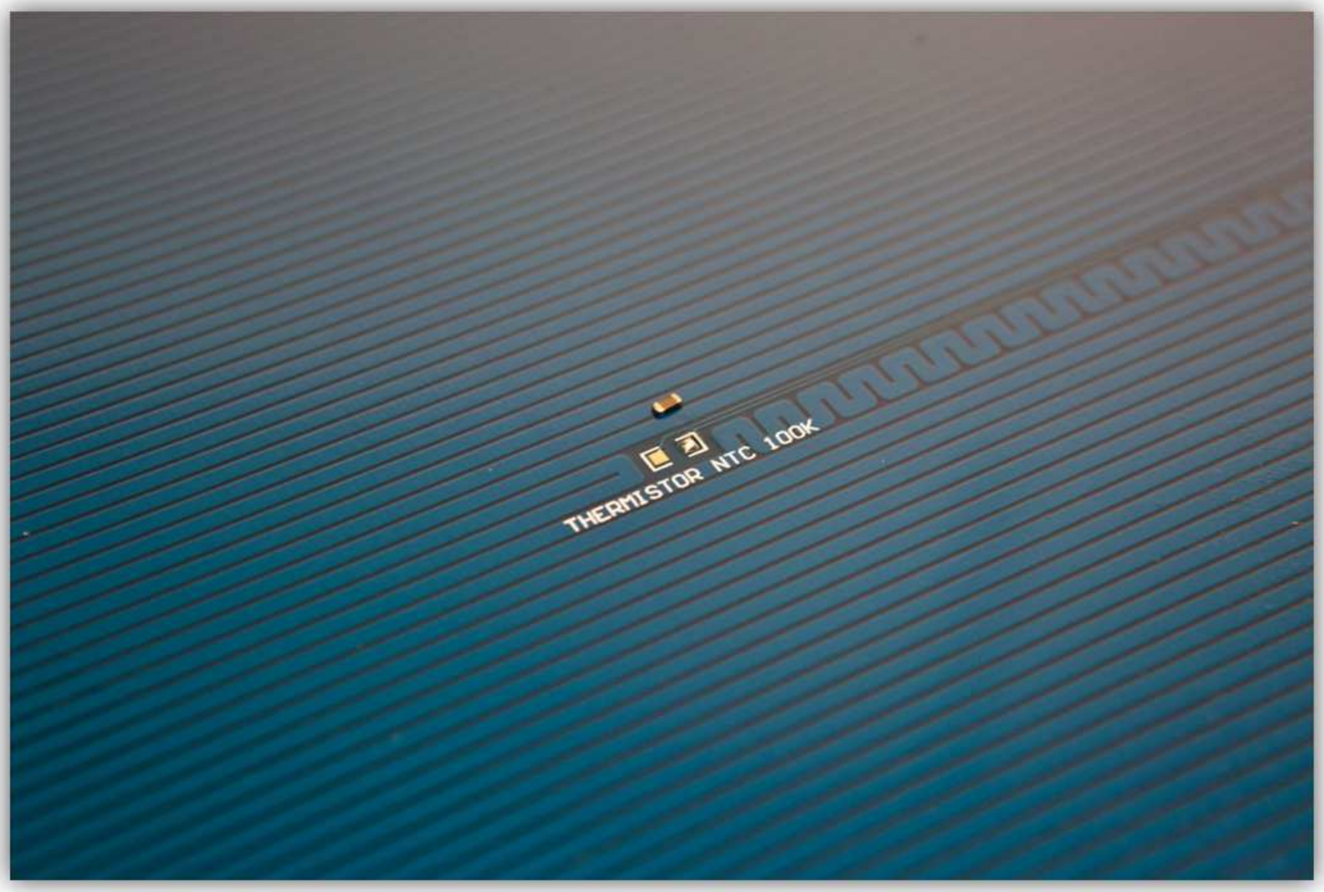


Lay the CARDBOARD ISOLATOR on top of the BED PLATE and align the holes. **Watch the orientation of the bedplate carefully.**

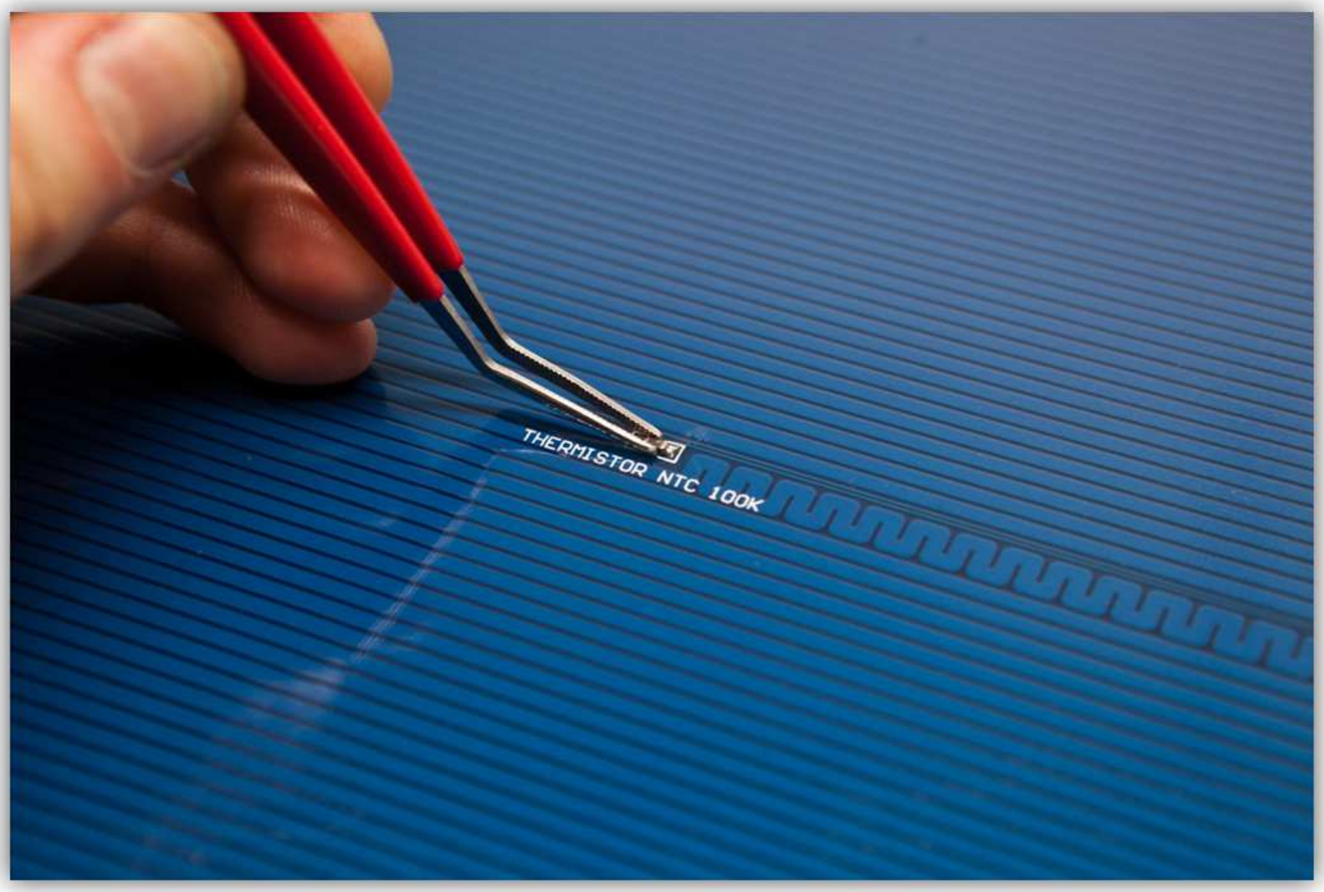


Now take the HEATED BED PCB and the NTC THERMISTOR.

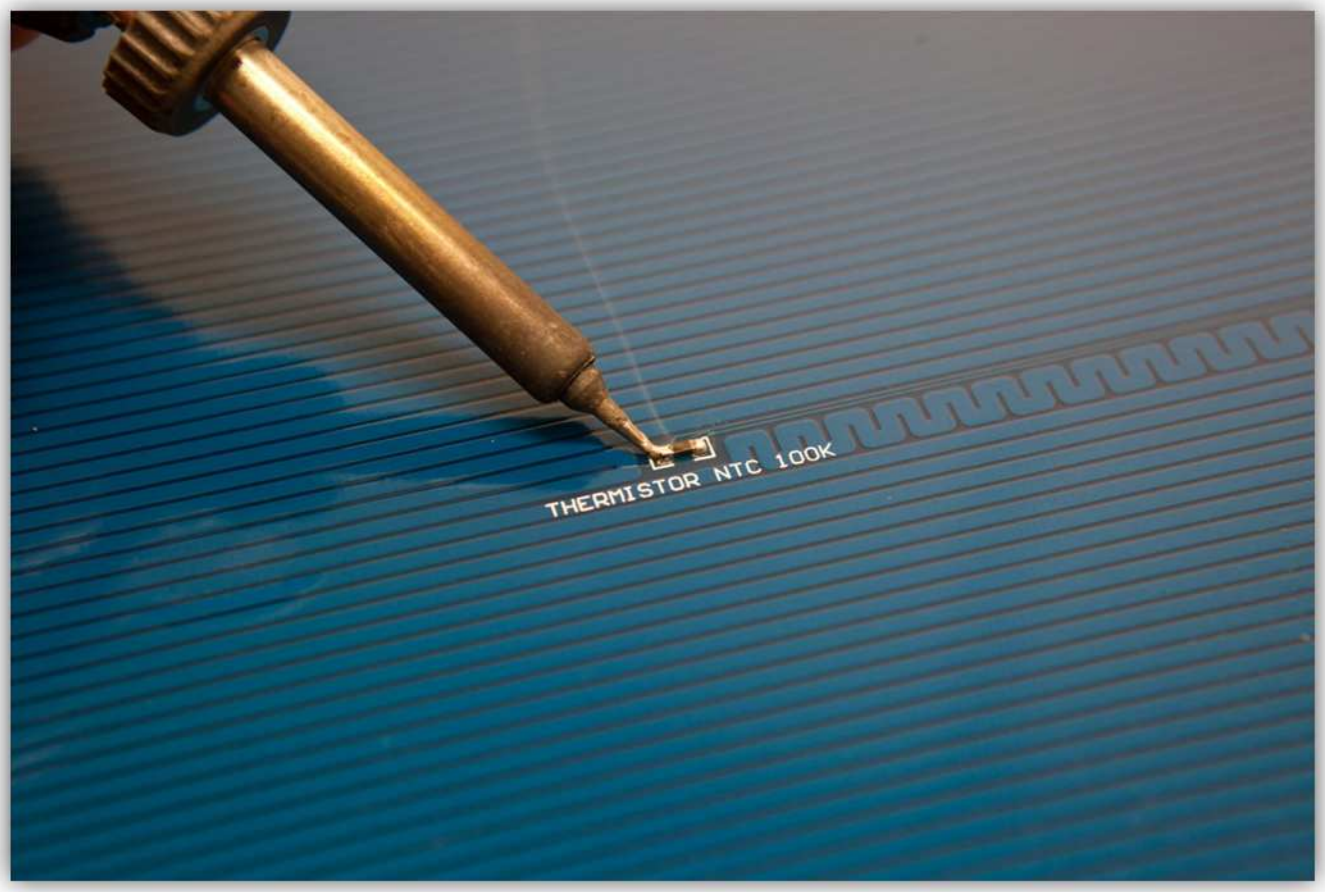
Tin one pad.



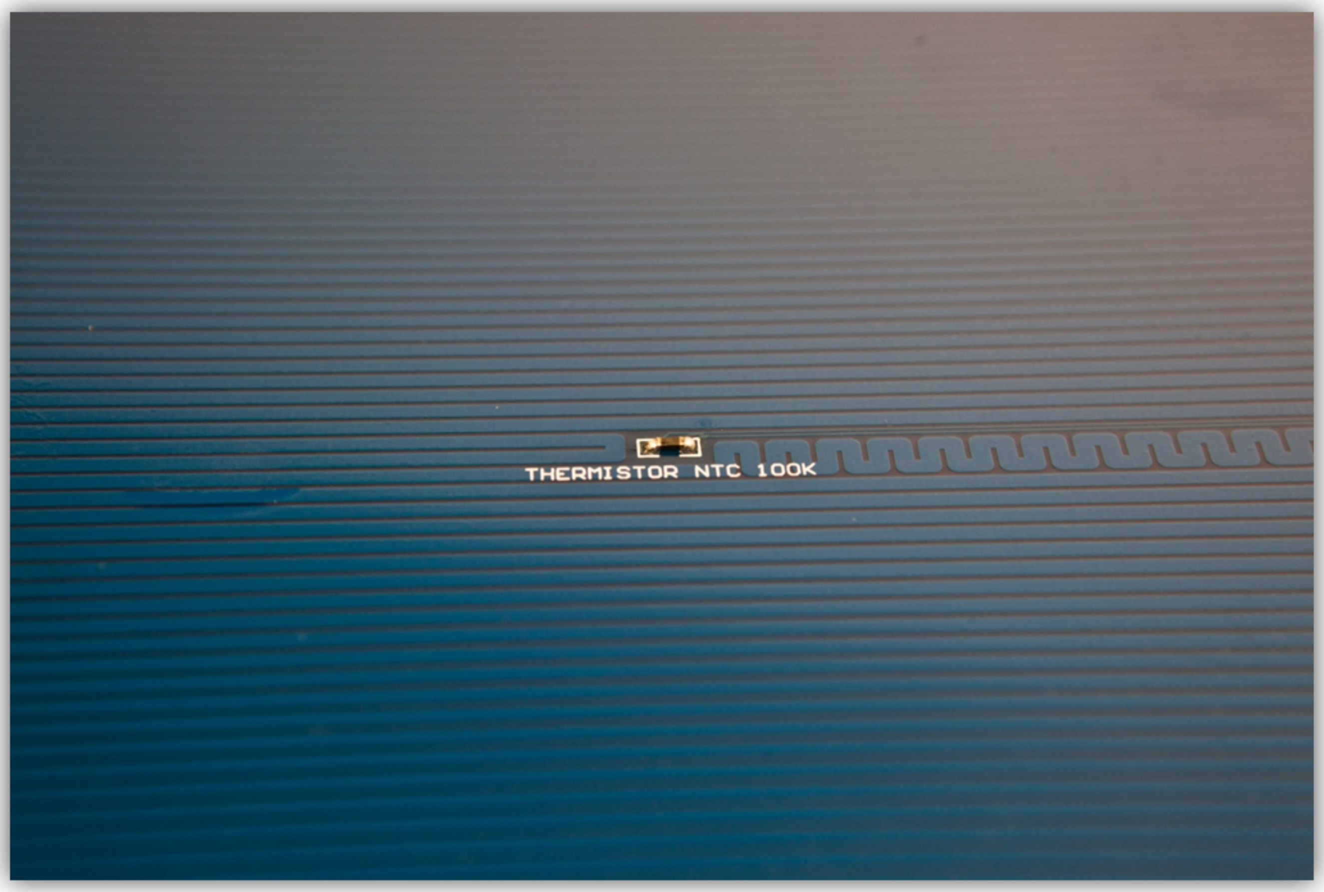
Place the NTC THERMISTOR with one side on the pad while you apply heat, it does not matter which side, a thermistor is not polarized. **Make sure you do not heat the thermistor for too long.**



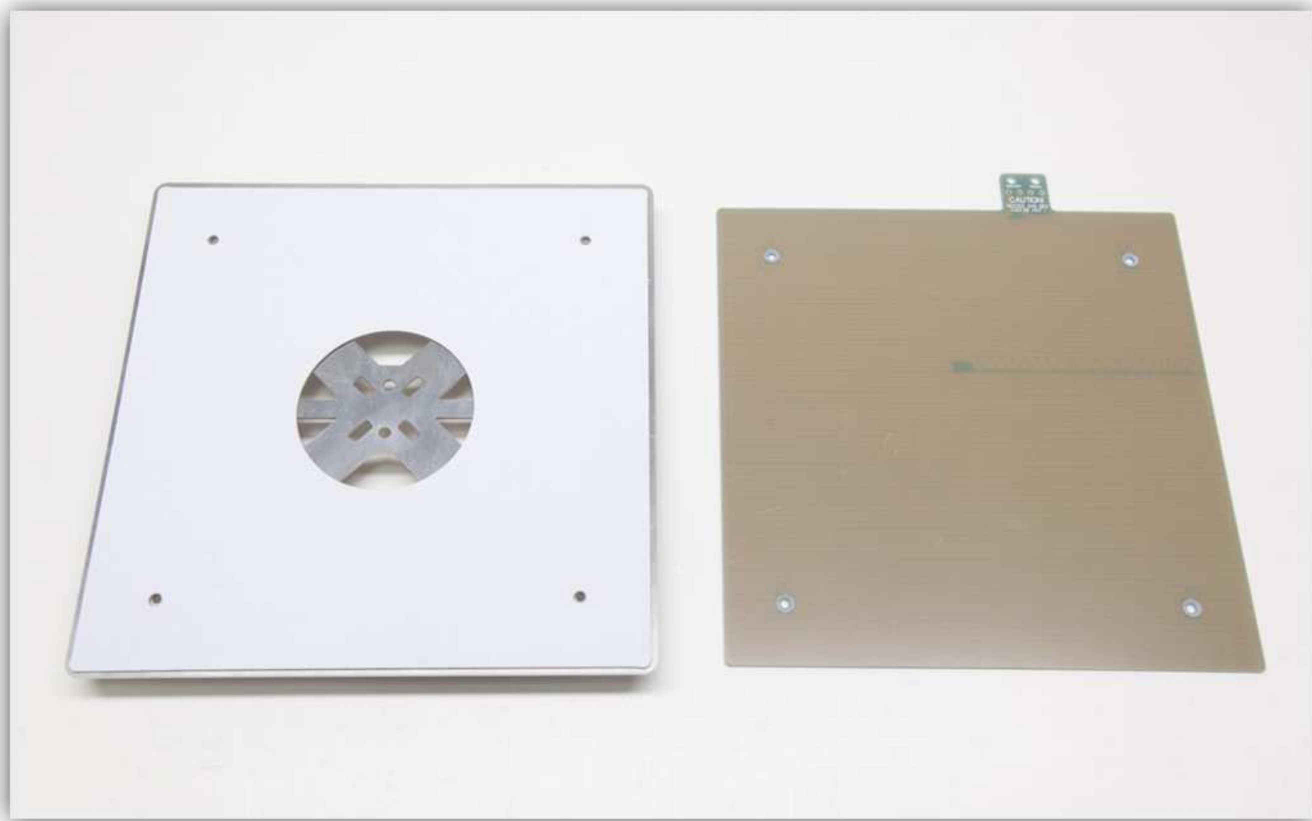
Now tin the other pad and other side of the NTC THERMISTOR.

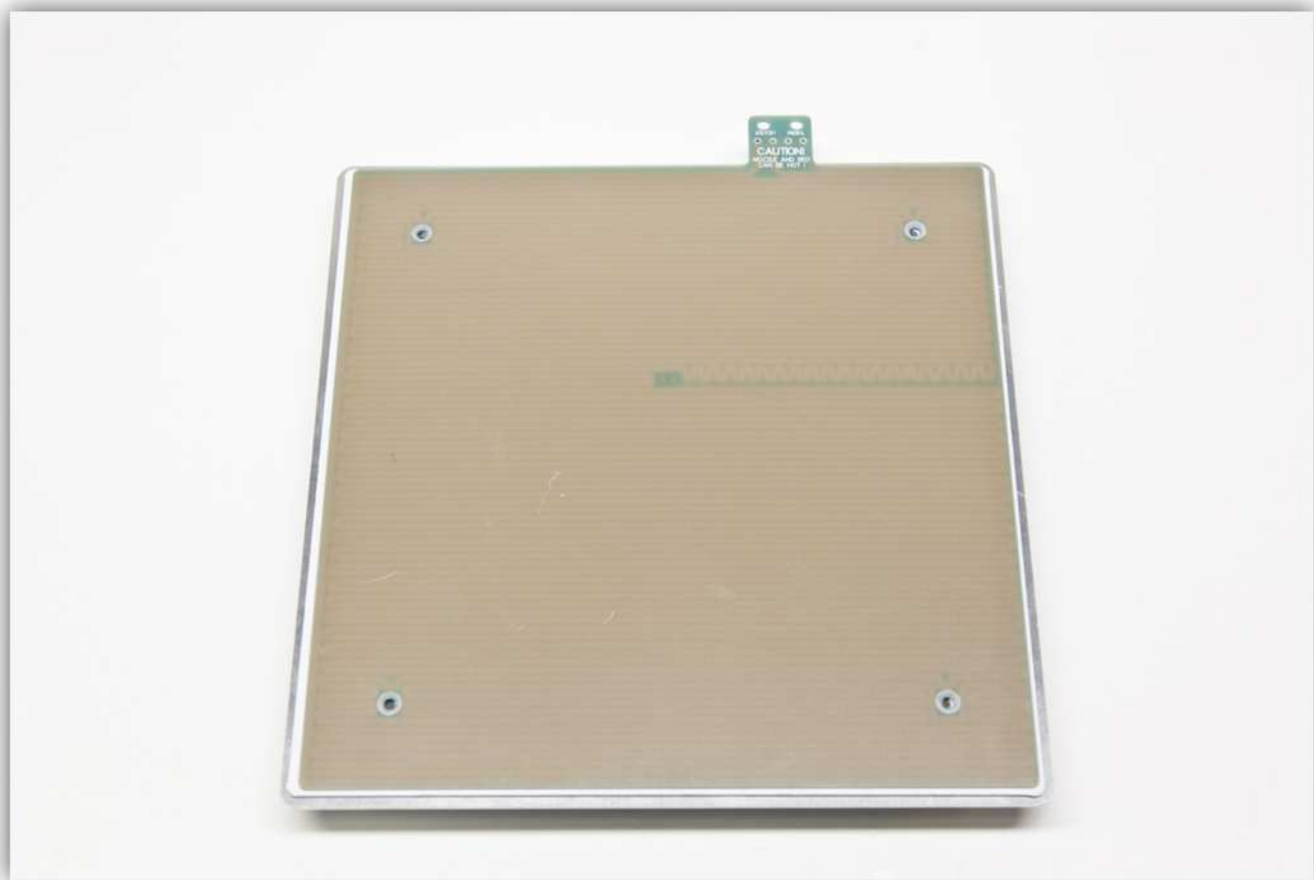


A soldered NTC THERMISTOR should look like this.



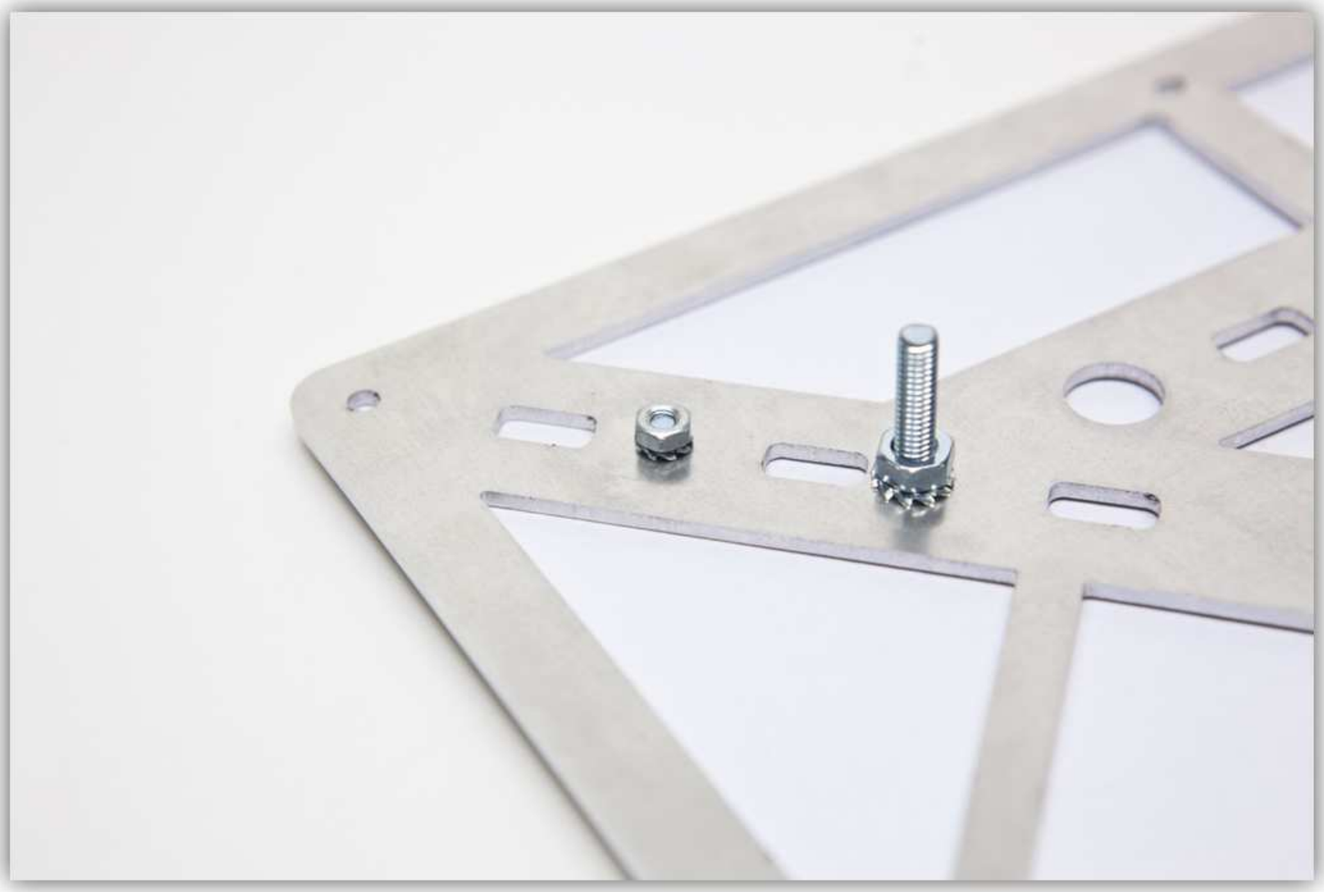
Place the HEATED BED PCB on the BED PLATE. **Watch the orientation carefully.**



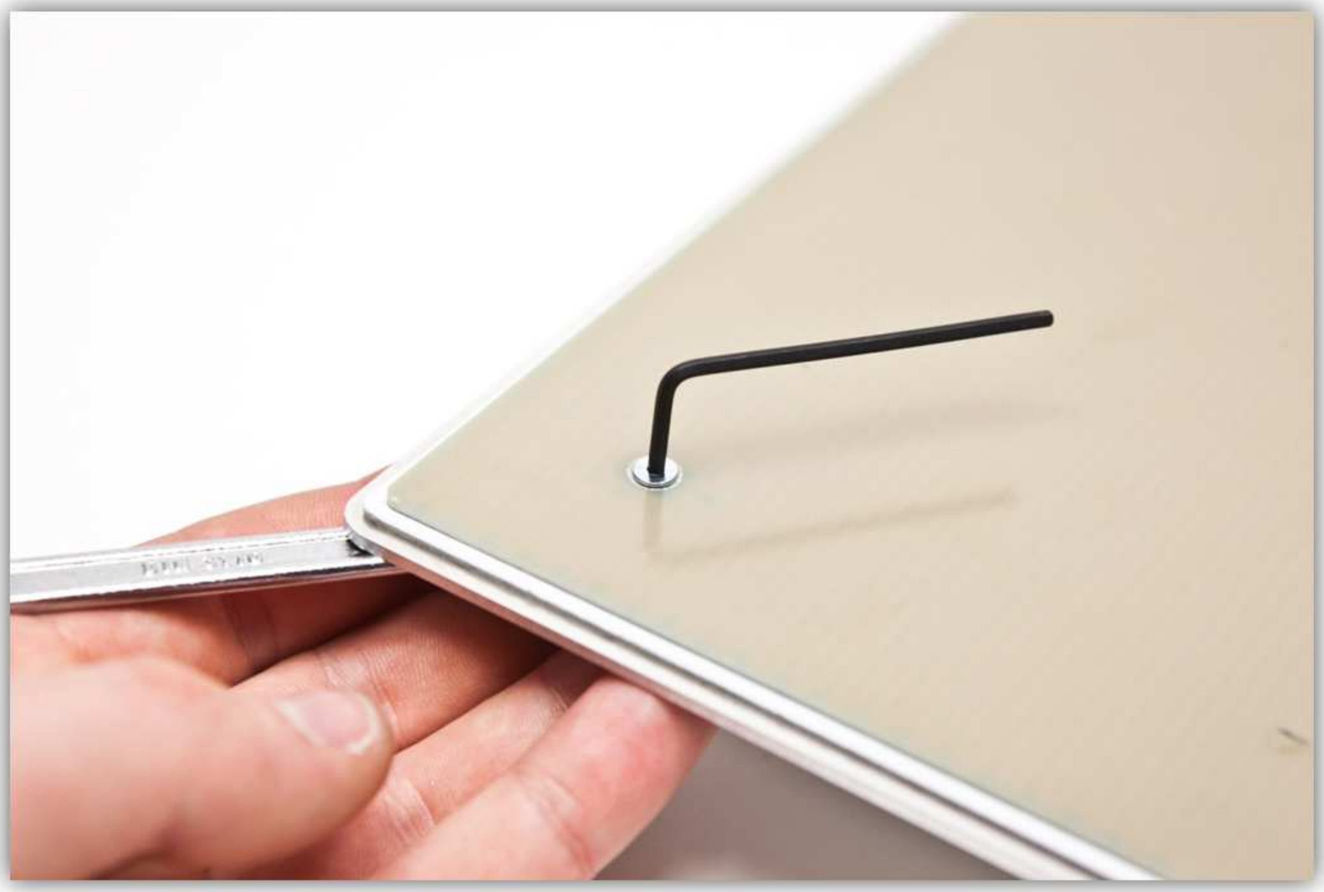


Insert the 4 countersunk M3 bolts in the 4 holes.

Use 4 M3 washers and 4 M3 nuts to secure the HEATED BED PCB to the BED PLATE.

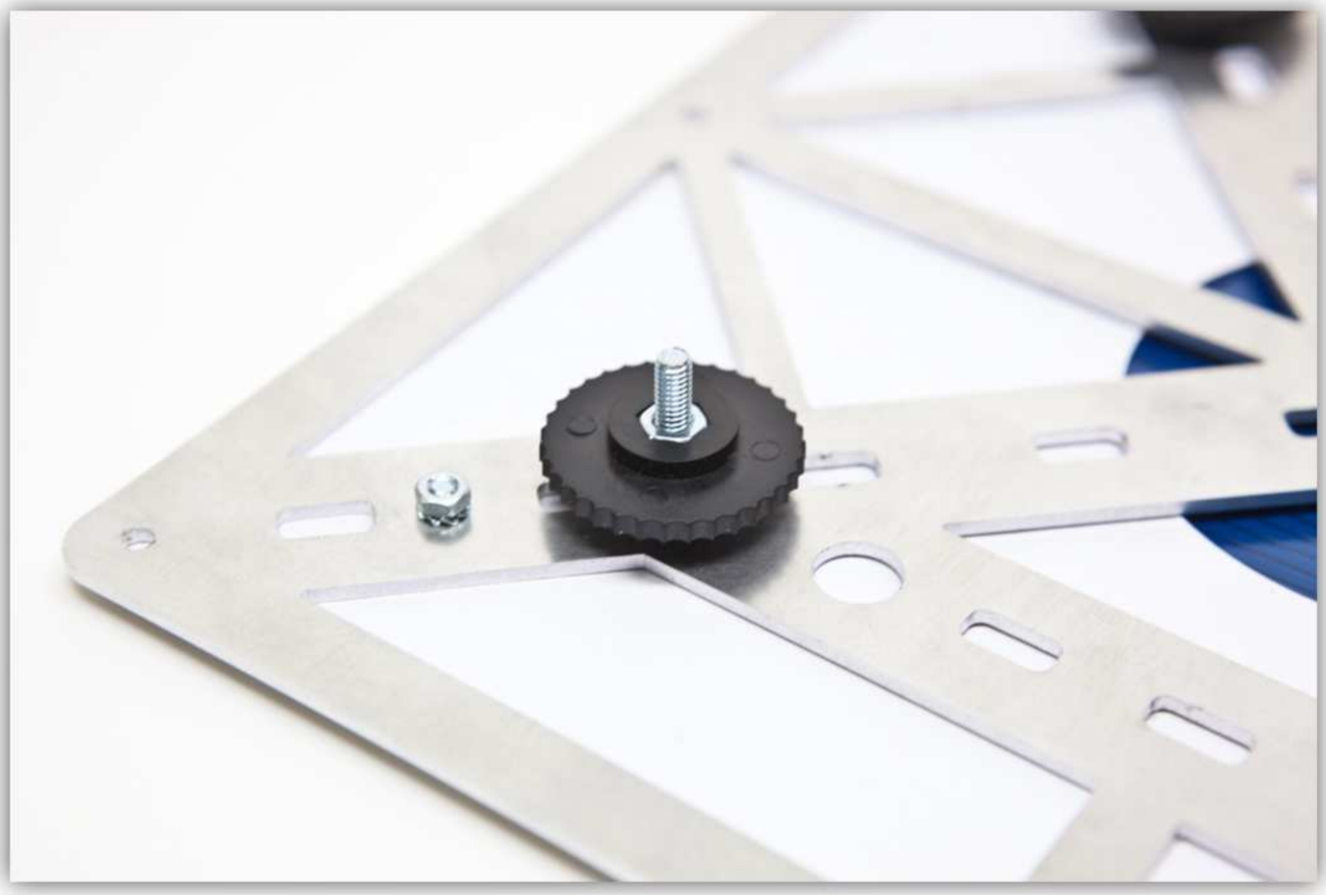


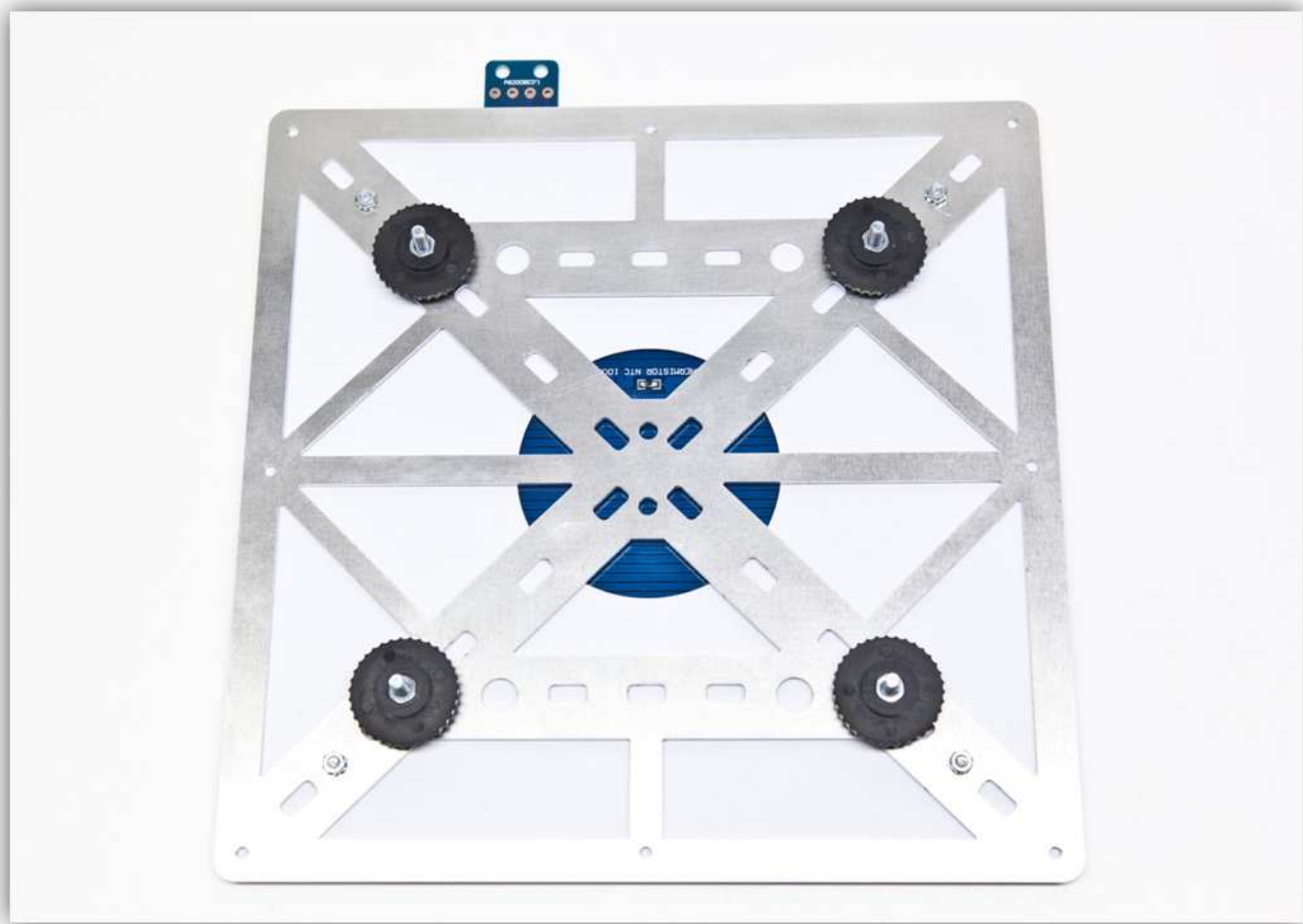
Tighten these 4 bolts firmly.



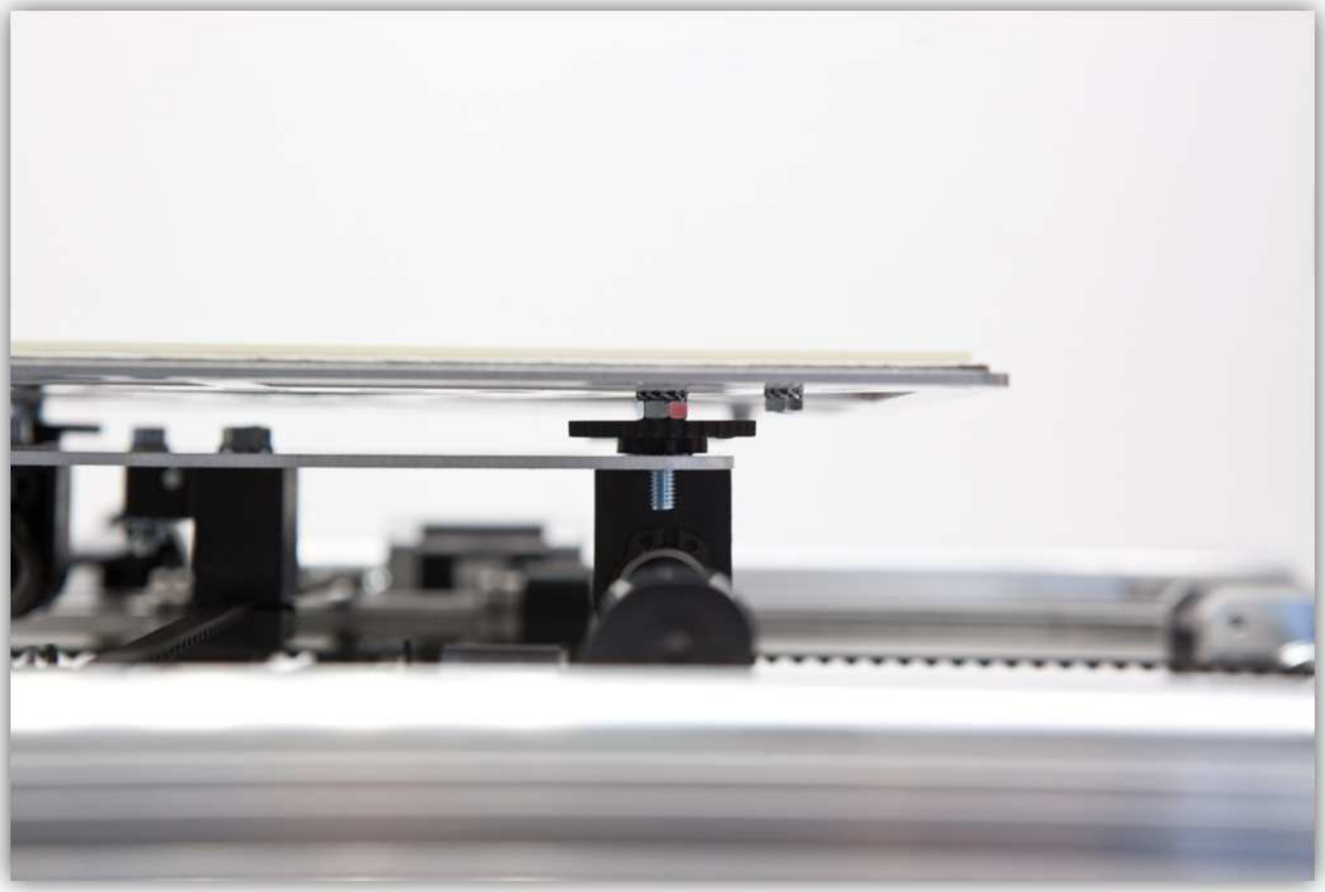
Insert an M4 nut into 4 THUMB SCREWS.

Screw these THUMB SCREWS onto the 4 BED PLATE bolts (all the way down).

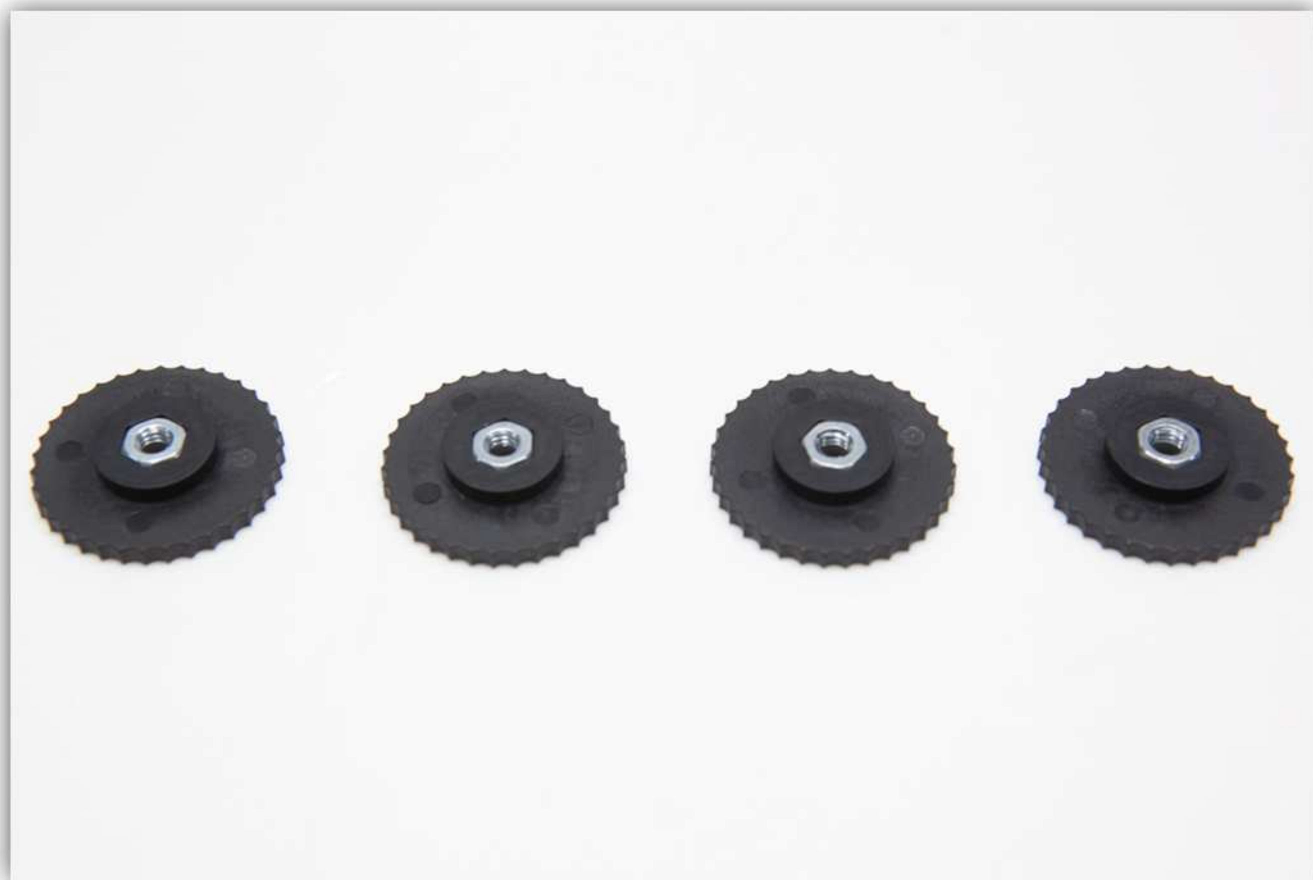




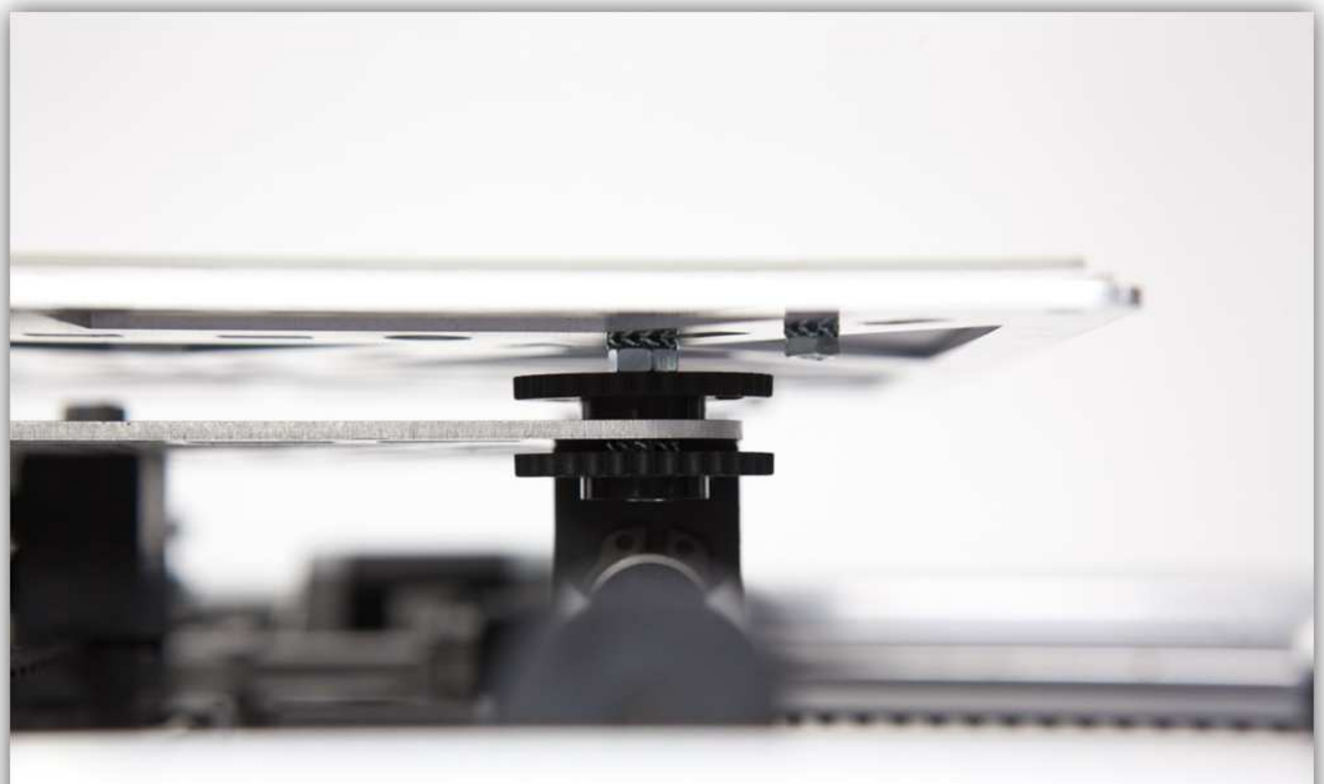
Now place the bed onto the X CARRIAGE. Make sure all the 4 bolts slide through the BED SUPPORT PLATE. **Notice the orientation.**



Insert an M4 nut into 4 THUMB SCREWS.



Put an M3 toothed washer on each of the THUMB SCREWS and screw these on each of the BED PLATE bolts as shown in the pictures below.



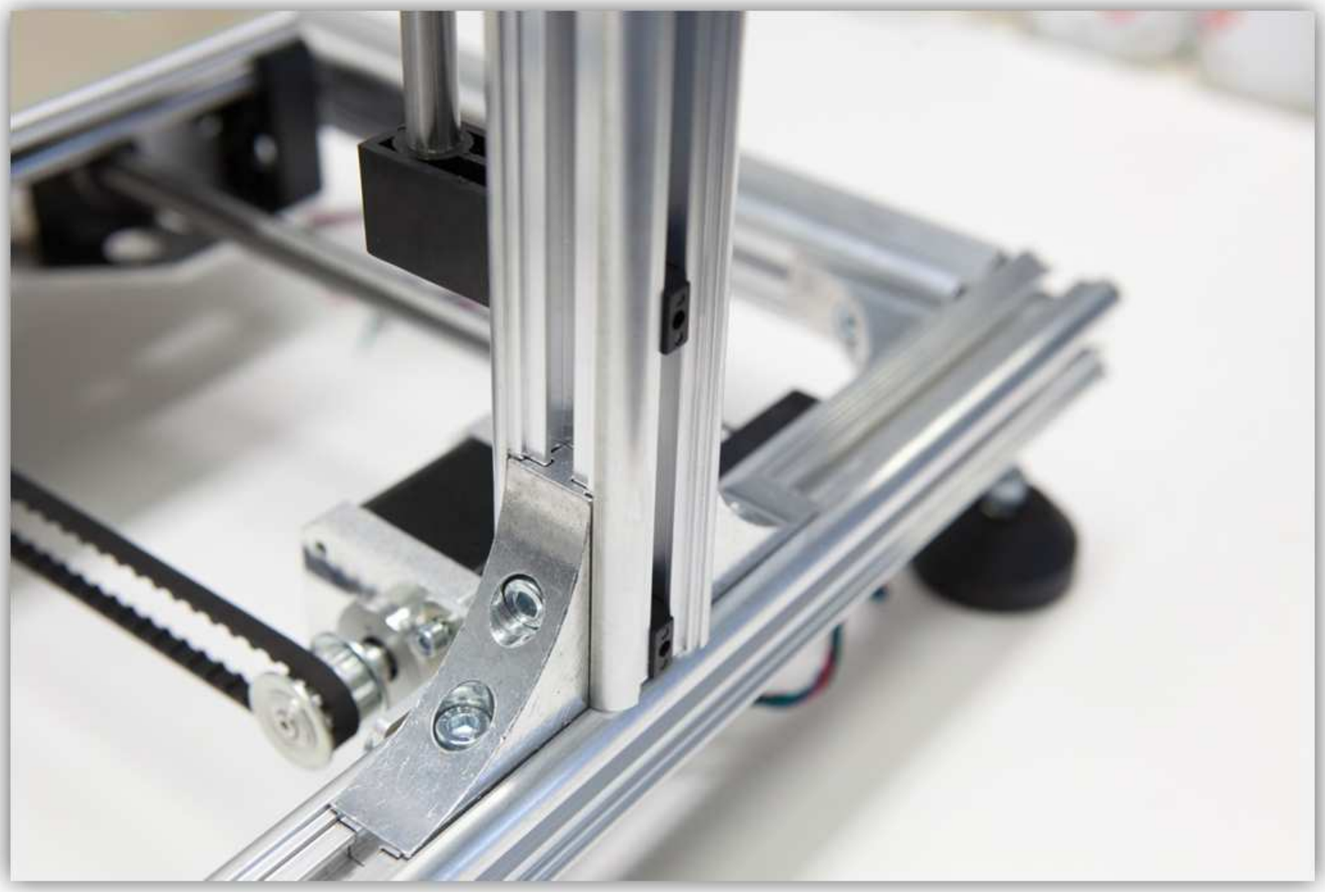
011 – FINISHING THE FRAME

Take all the parts out of the bag labelled with 35.

You will also need the COIL SUPPORT you assembled earlier.

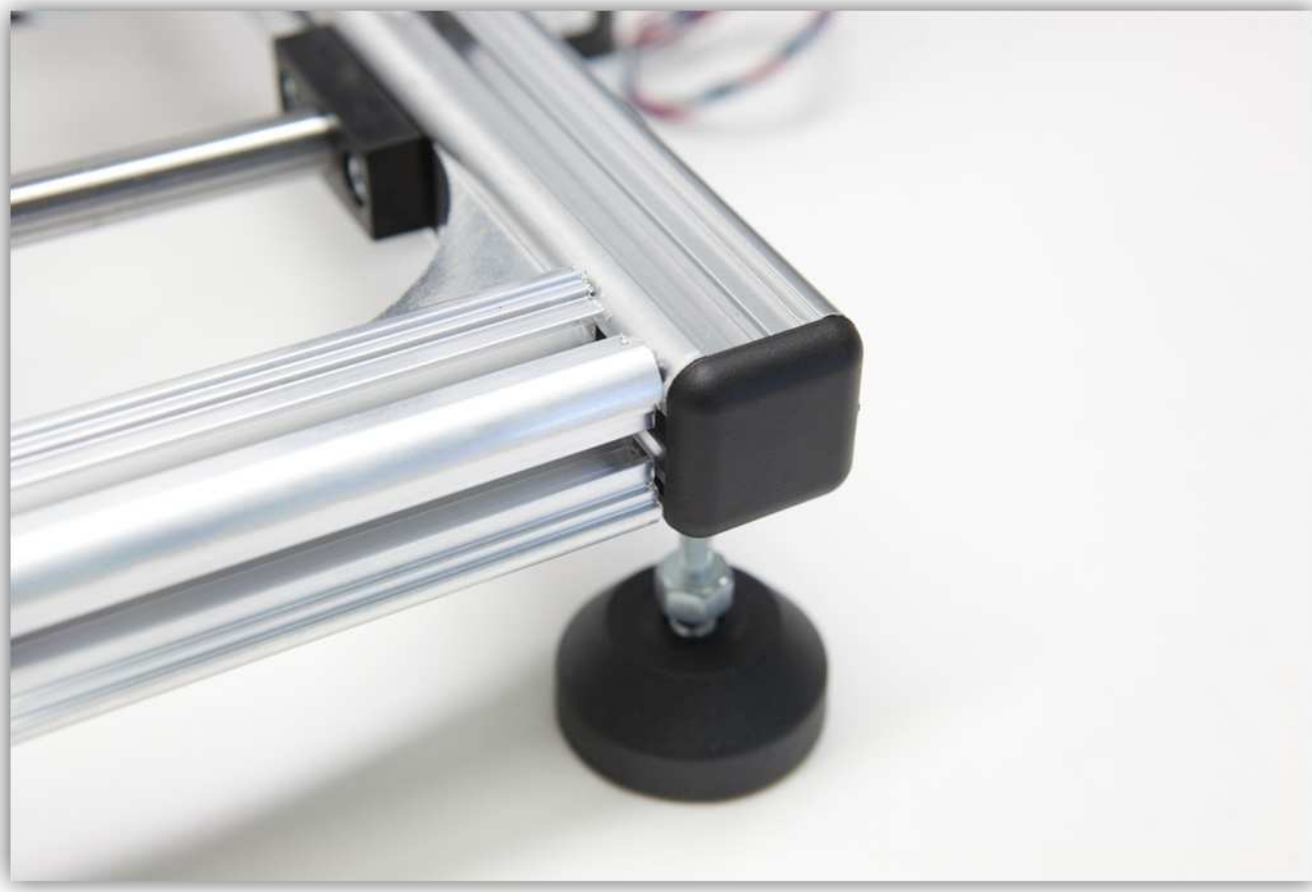
Now take 2 pieces as shown in the picture below out of the bag containing the plastic parts (PROFILE MOUNTS)

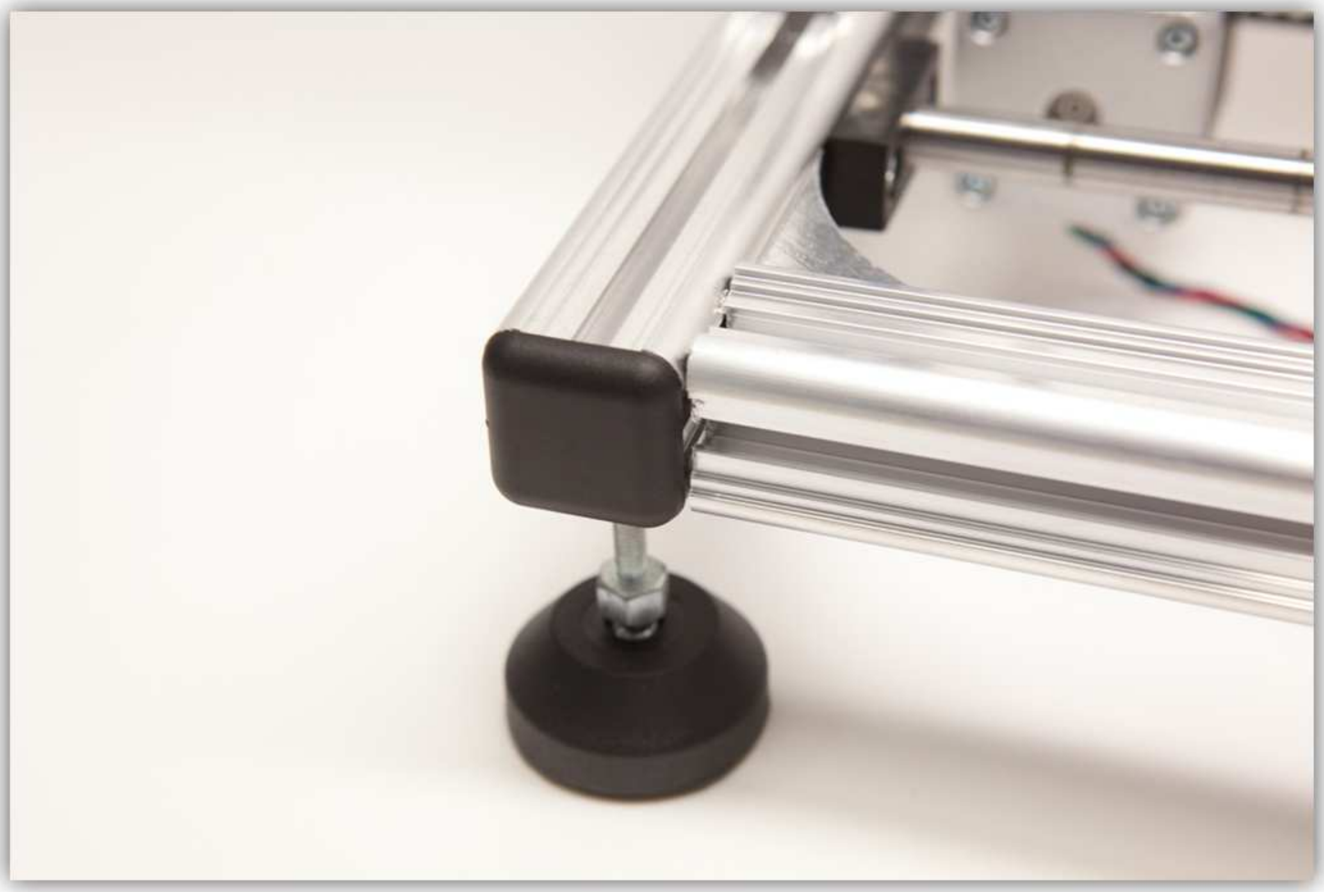
Slide these PROFILE MOUNTS in the right upright ALUMINIUM PROFILE as shown in the pictures below.

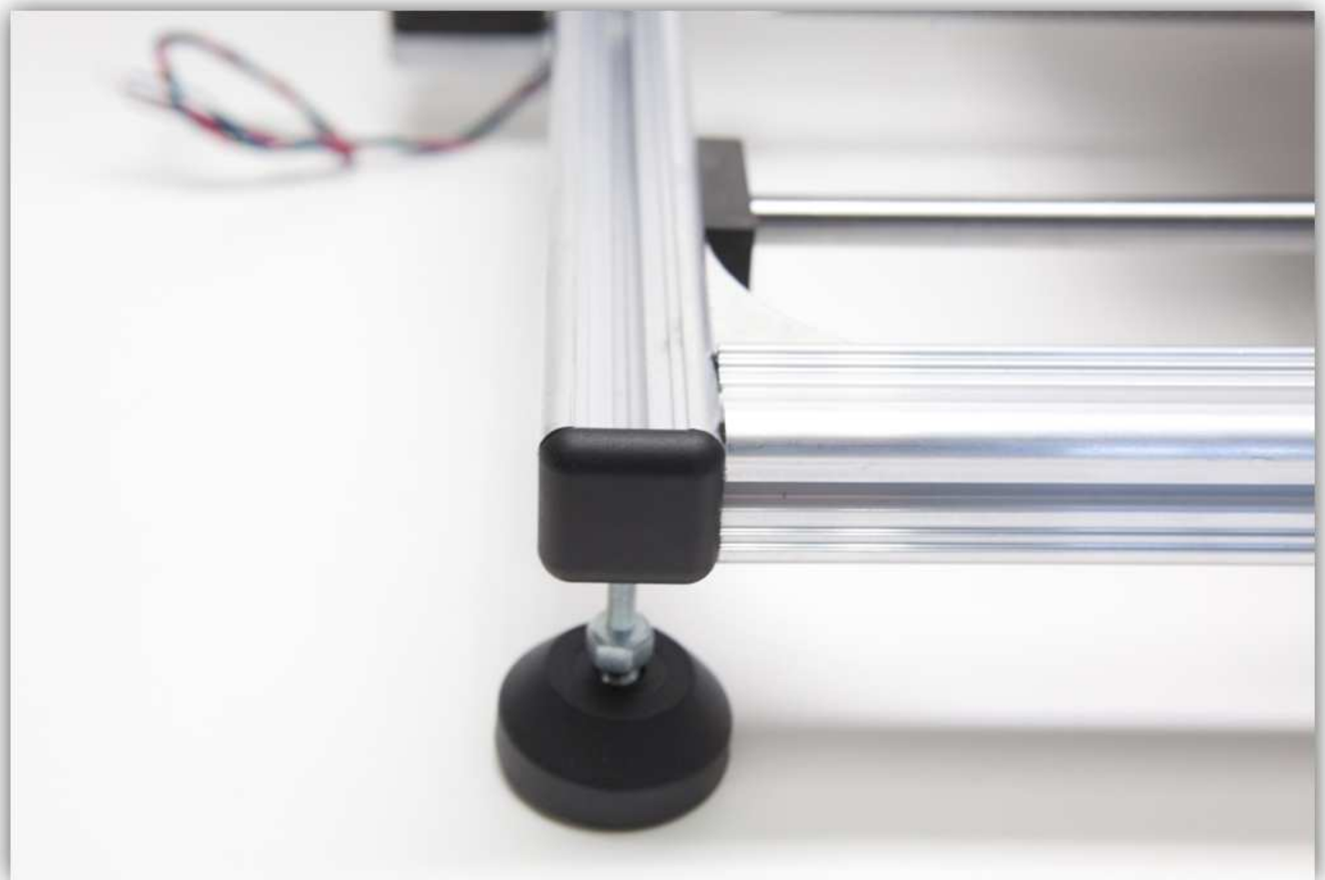


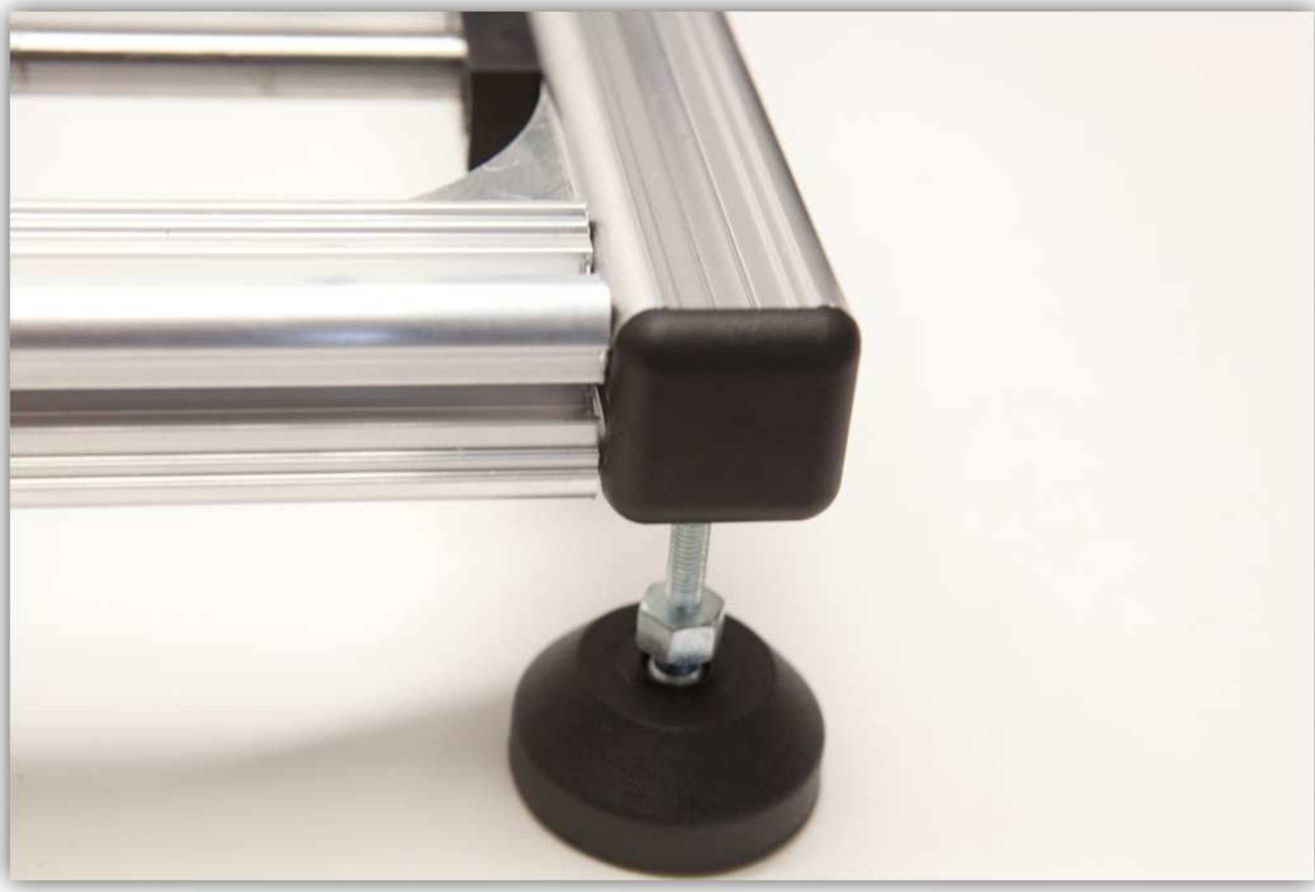
Next slide the COIL SUPPORT in the same profile and align it with the horizontal ALUMINIUM PROFILE. Tighten it firmly.

Place an END CAP on every open ALUMINIUM PROFILE end.









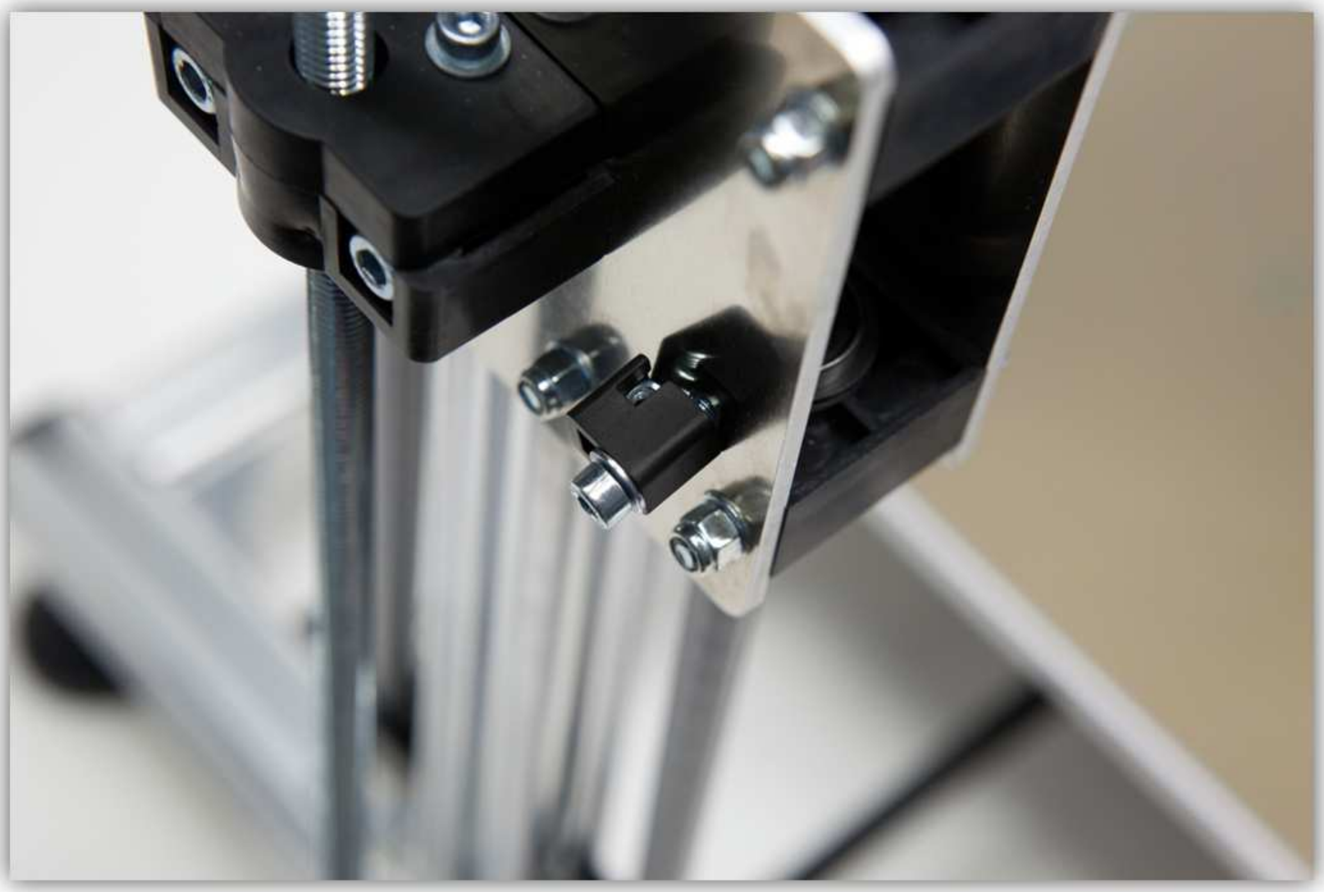
012 – MOUNTING THE Z & X END STOPS

Take all the parts out of the bag labelled with 39.

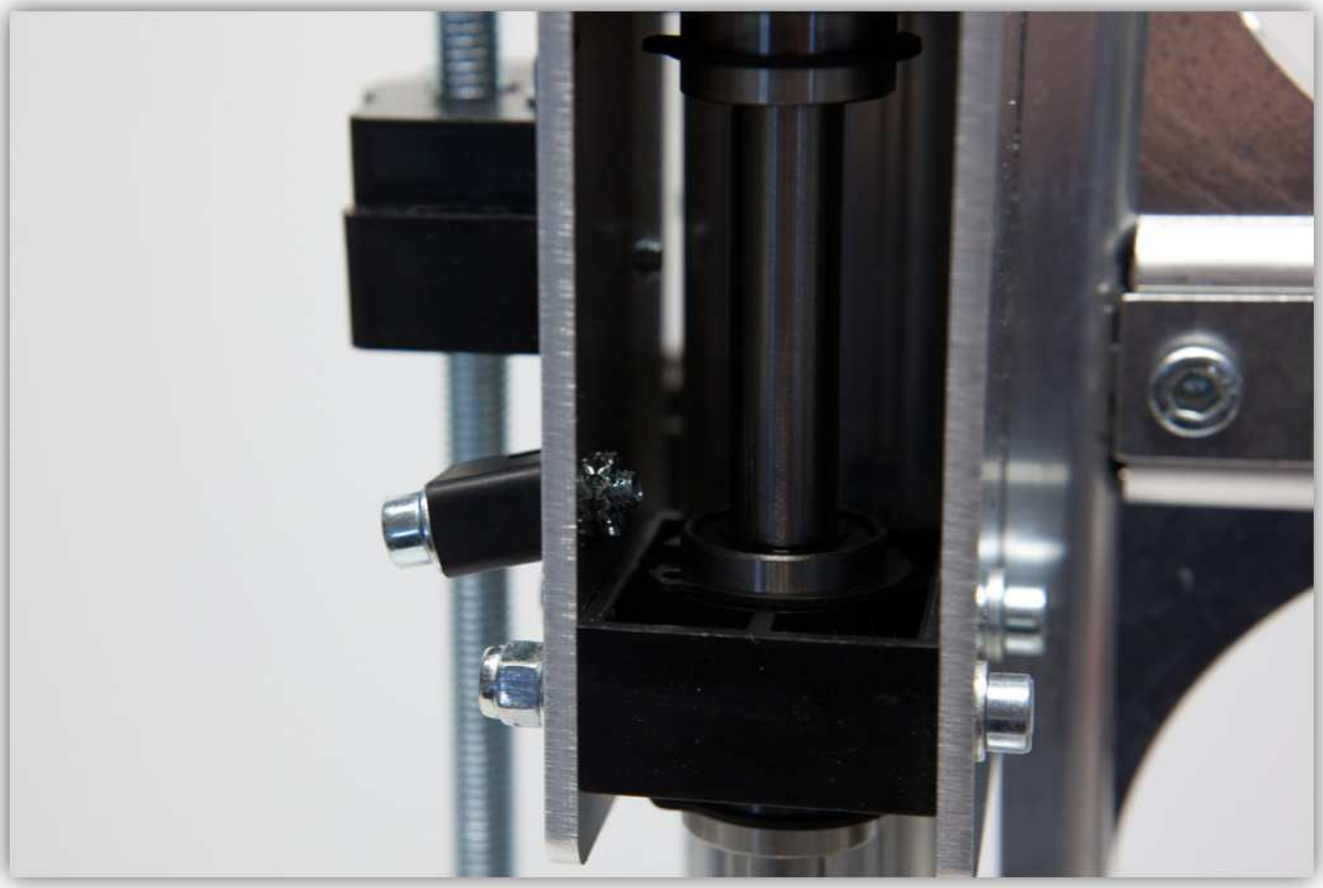
Now take the piece as shown in the picture below out of the bag containing the plastic parts (ADJUST SCREW BRACKET).

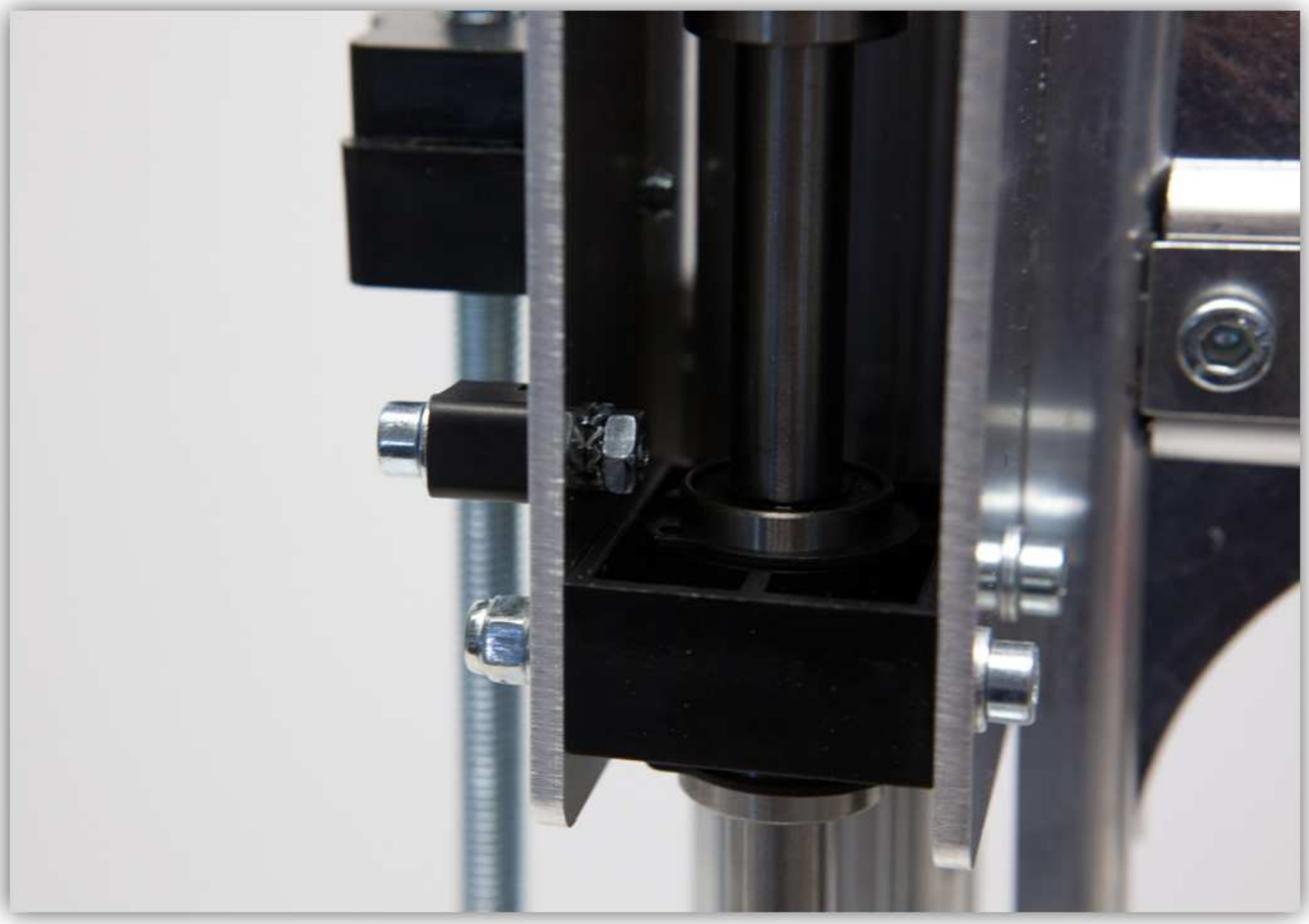
Slide an M3 nut into the ADJUST SCREW BRACKET piece as shown below.

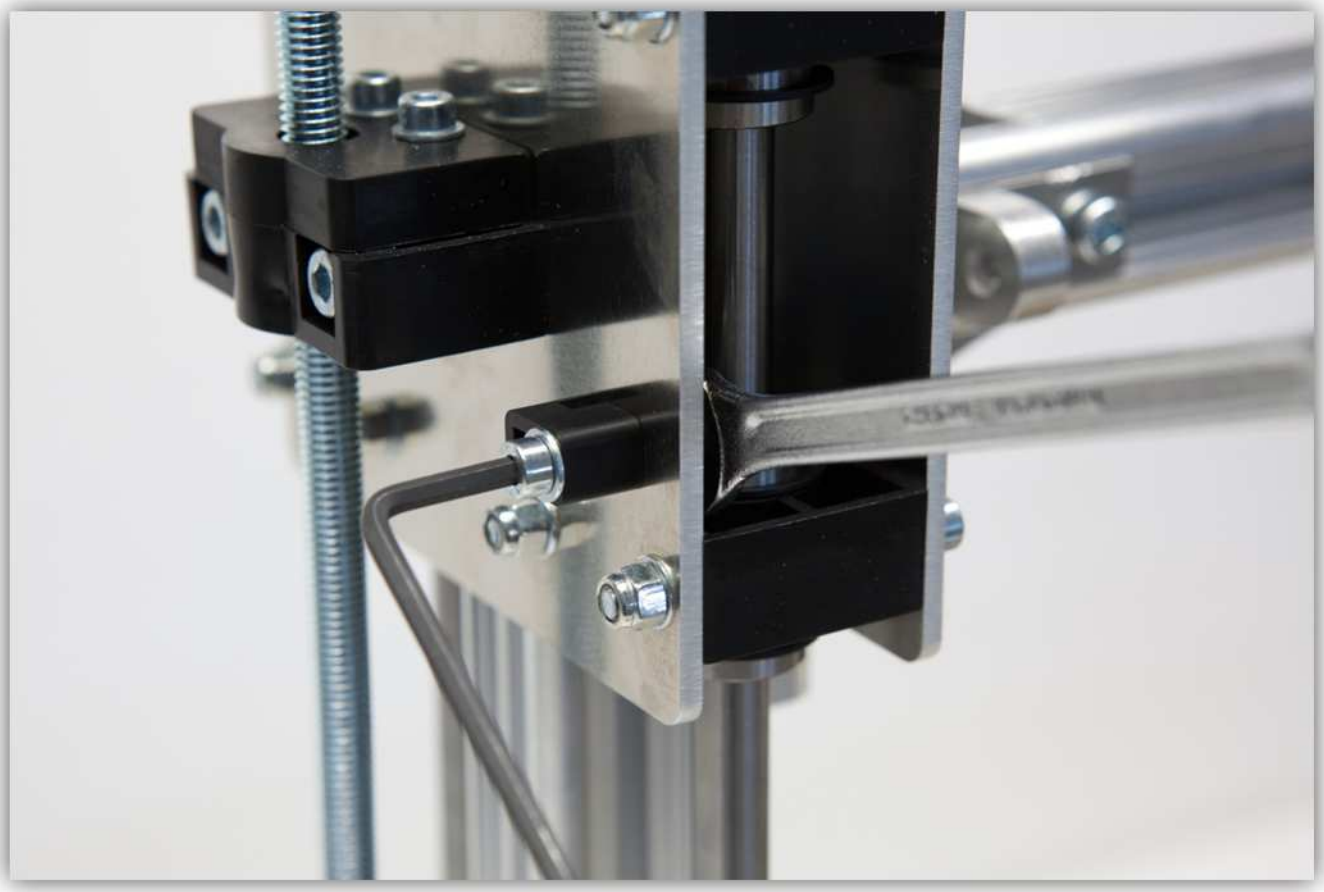
Take the M4 bolt and an M4 washer and bolt the ADJUST SCREW BRACKET piece to the Z CARRIAGE as shown in the pictures.



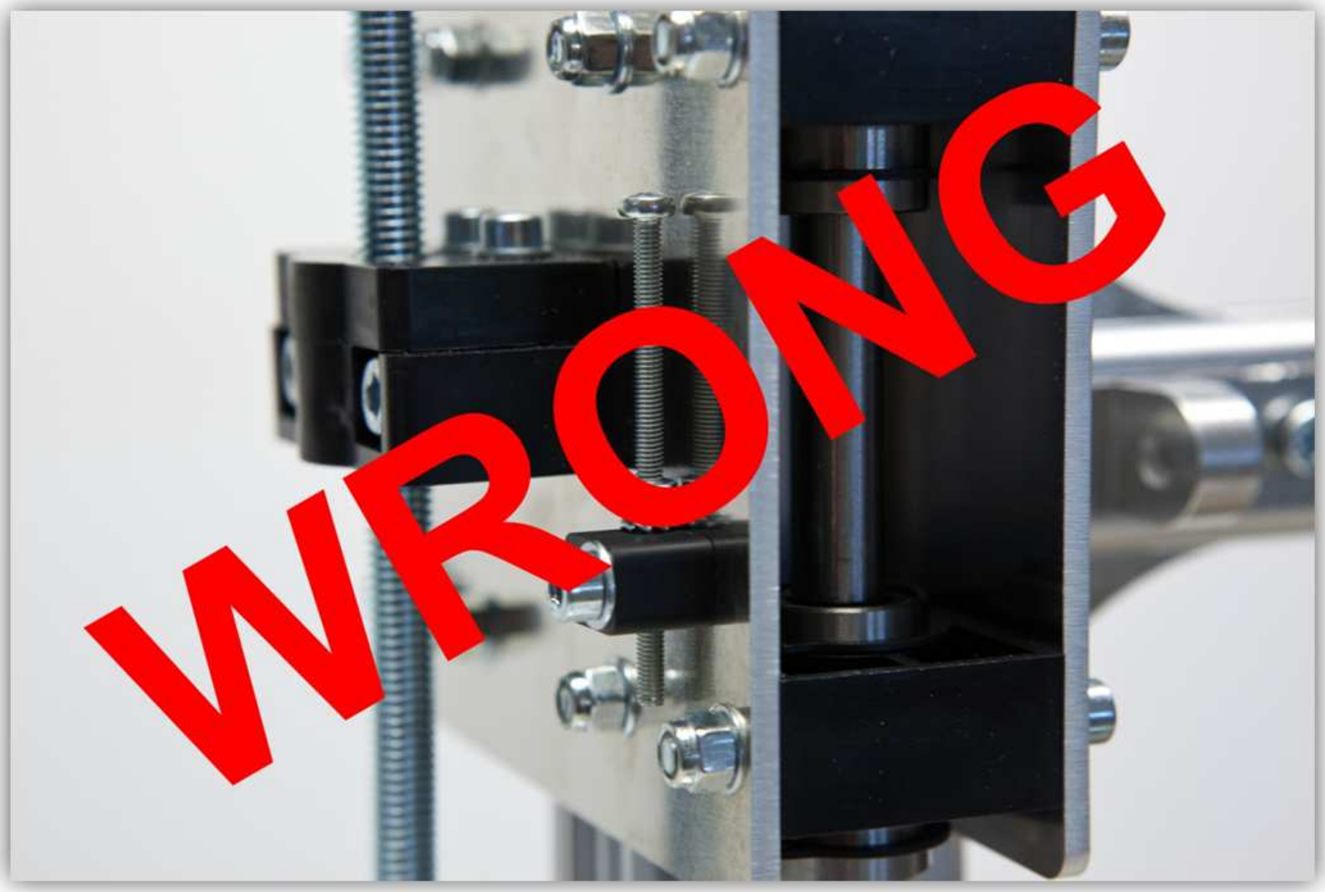
Use an M4 toothed washer and an M4 nut to bolt everything together firmly.



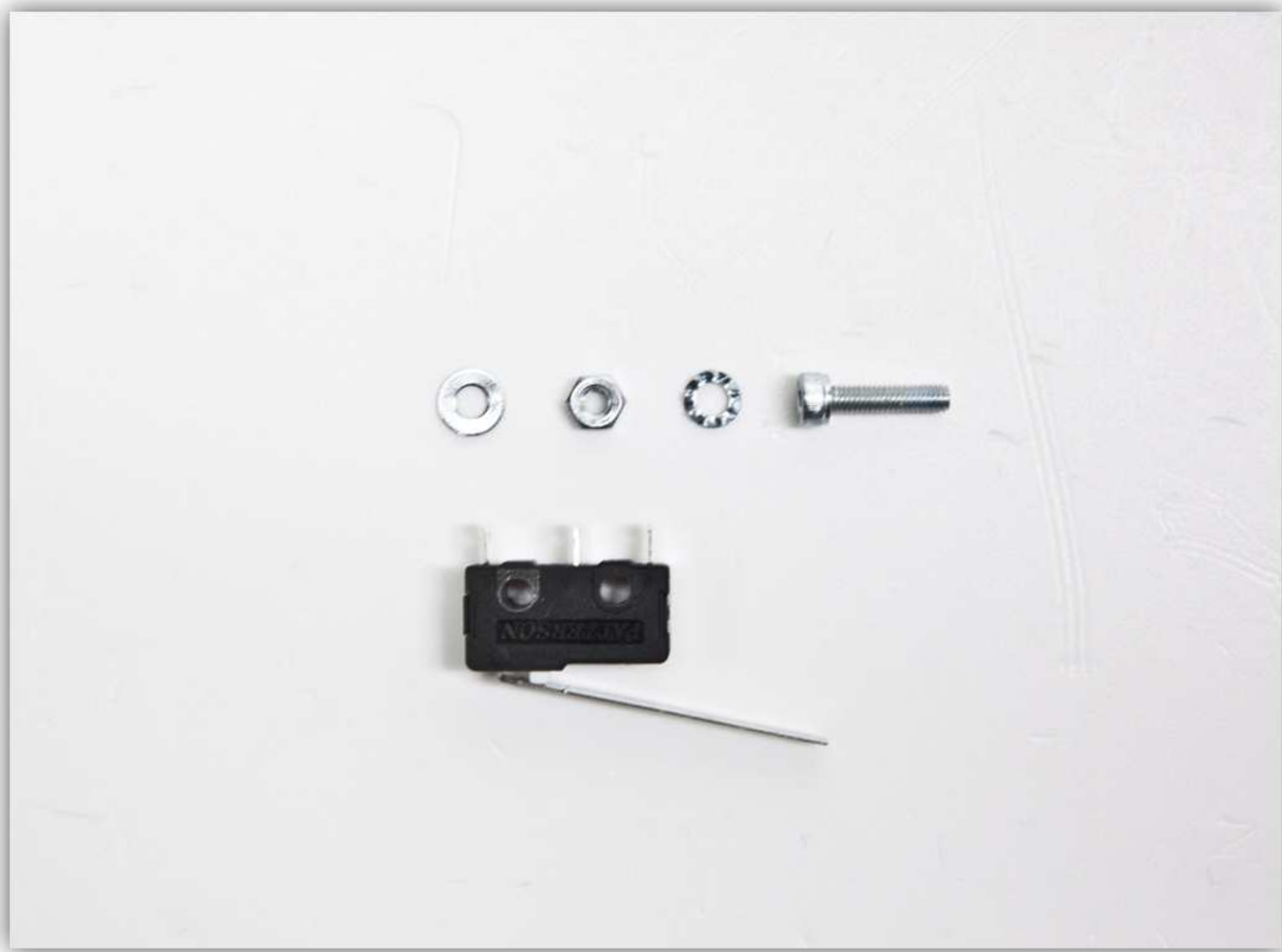




Use the long M3 screw with an M3 nut and an M3 toothed washer as shown in the picture.

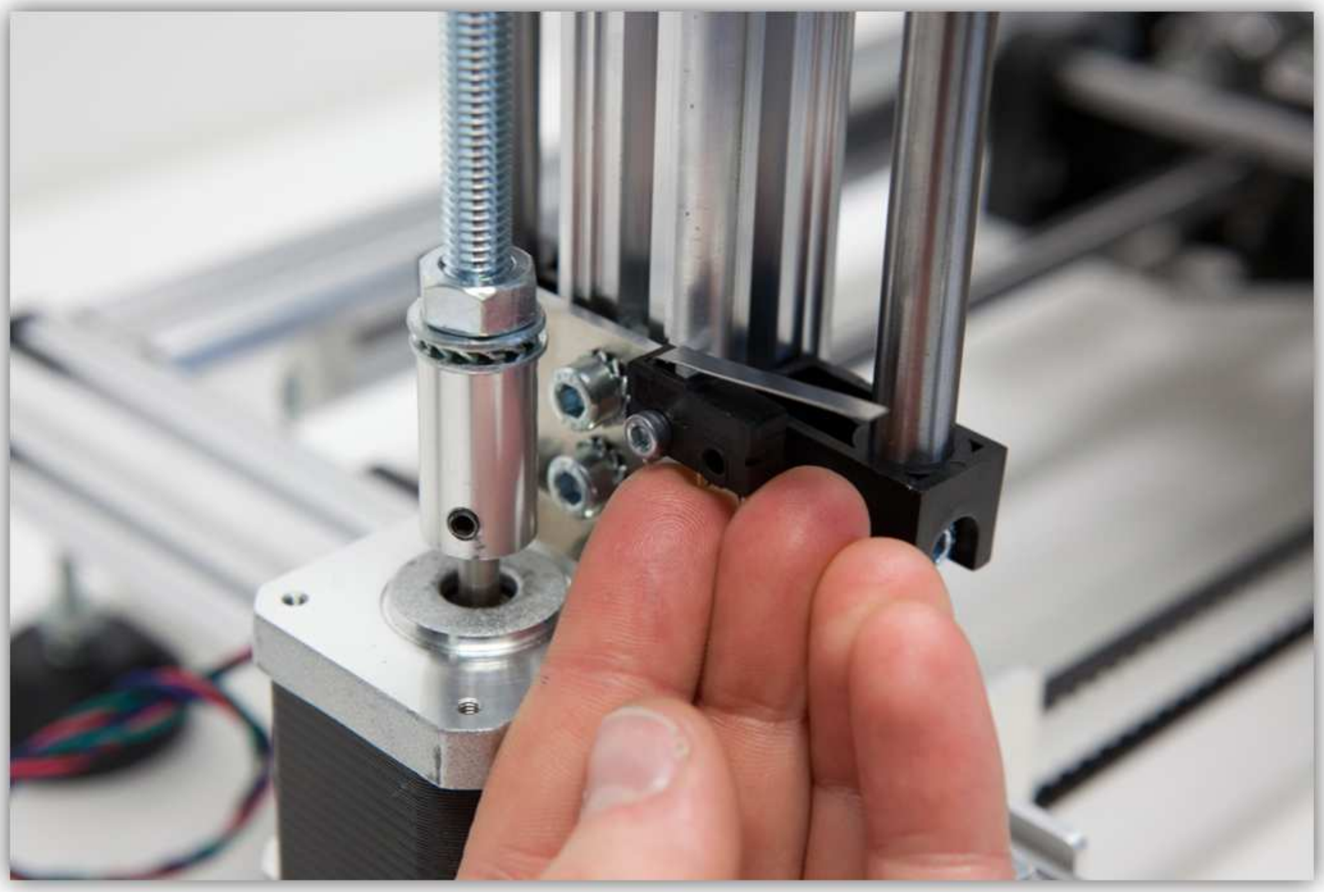


Take all the parts out of the bag labelled with 38.

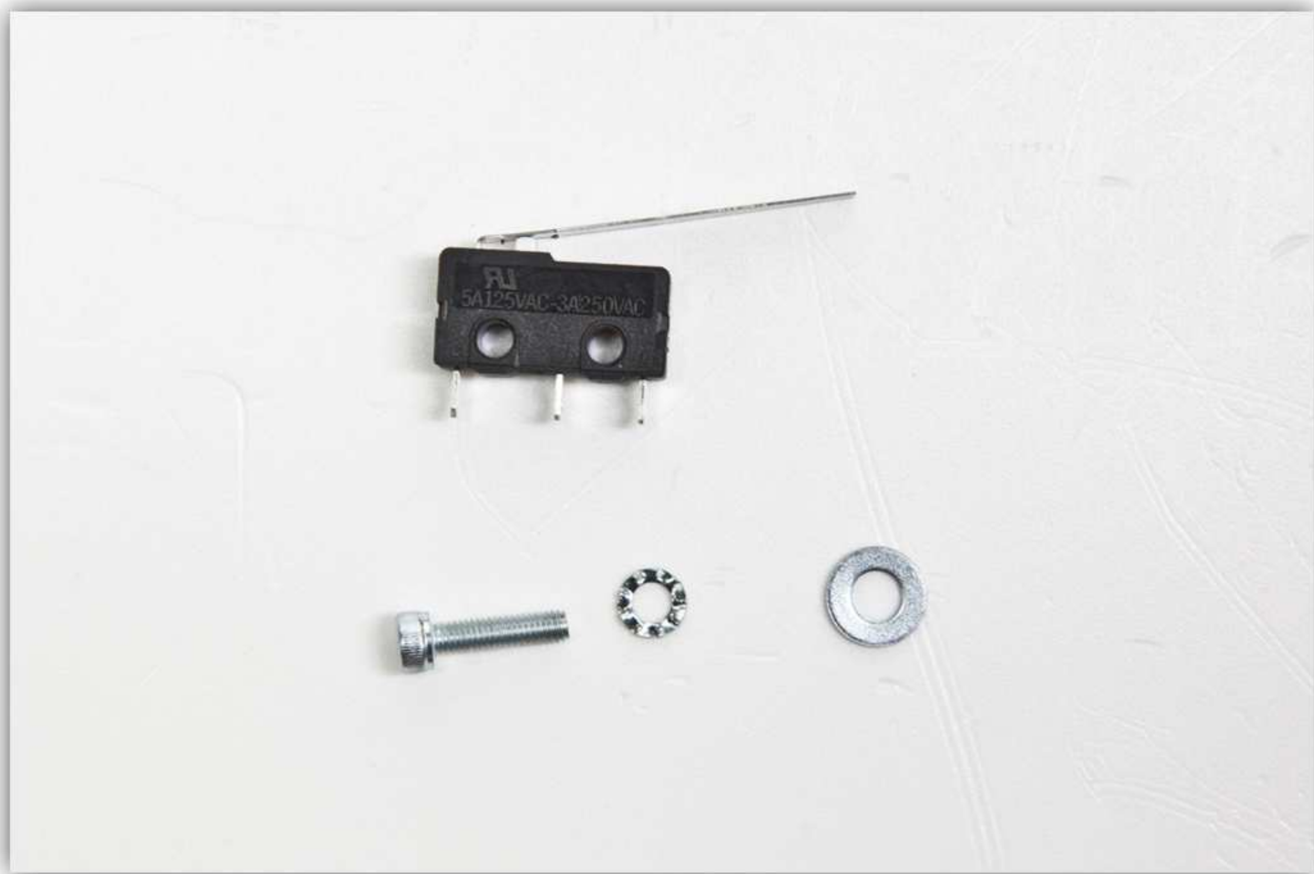


Slide the M3 bolt with an M3 washer and an M3 toothed washer through the micro switch as shown in the pictures.

Bolt the micro switch to the Z MOTOR BRACKET, use an M3 bolt. **Make sure it is level.**



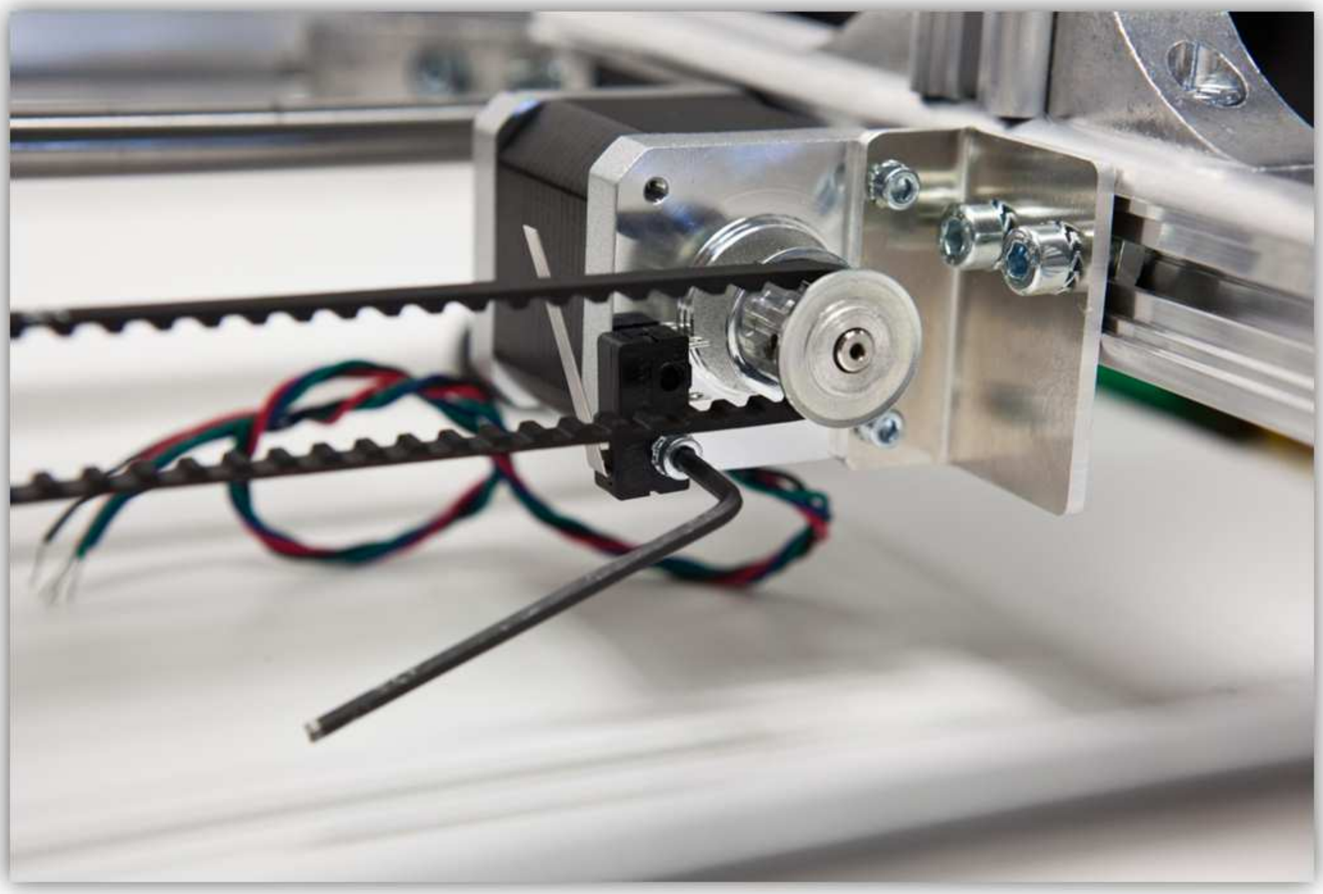
Take all the parts out of the bag labelled with 41.

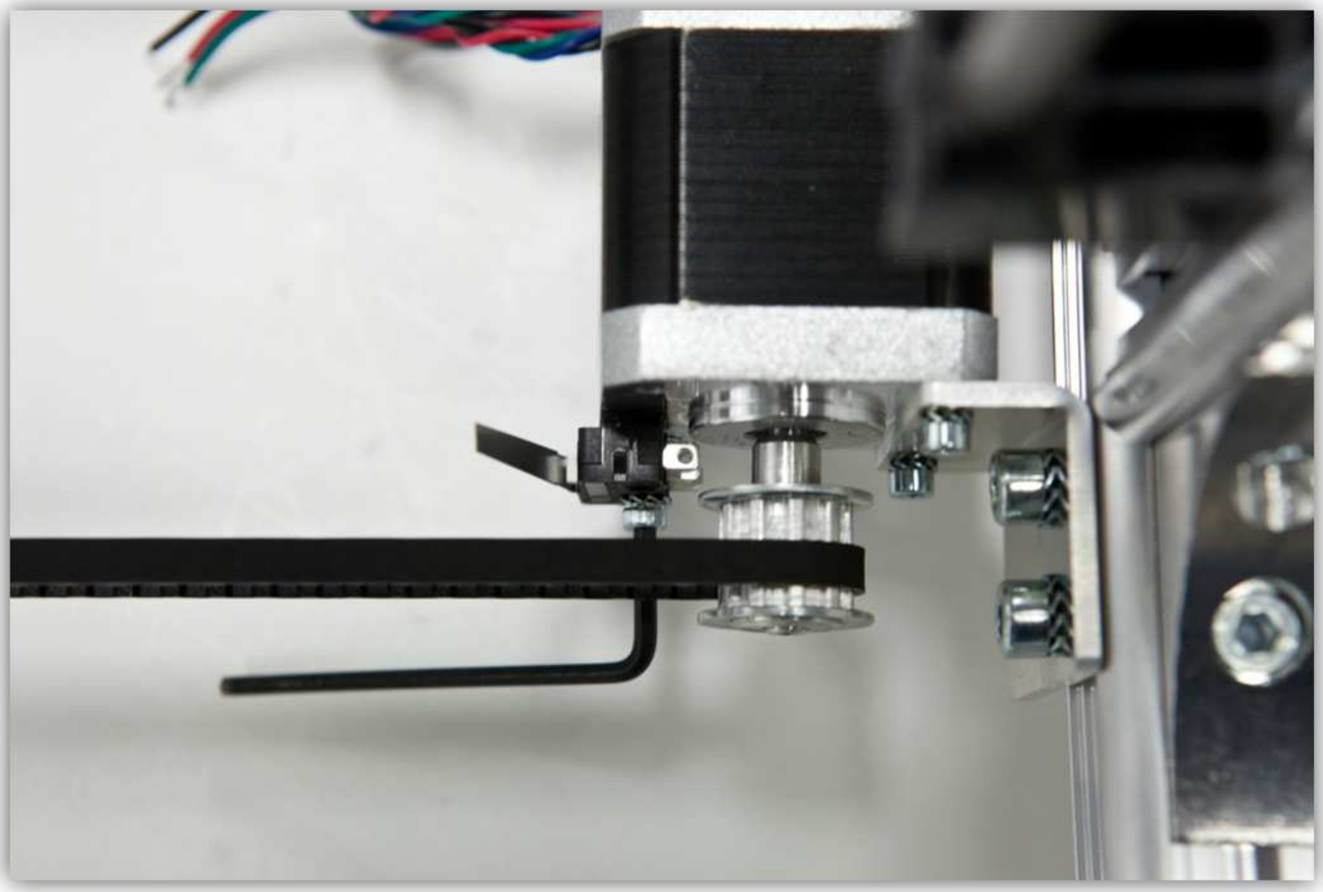


Slide the M3 bolt with an M3 toothed washer through the micro switch.

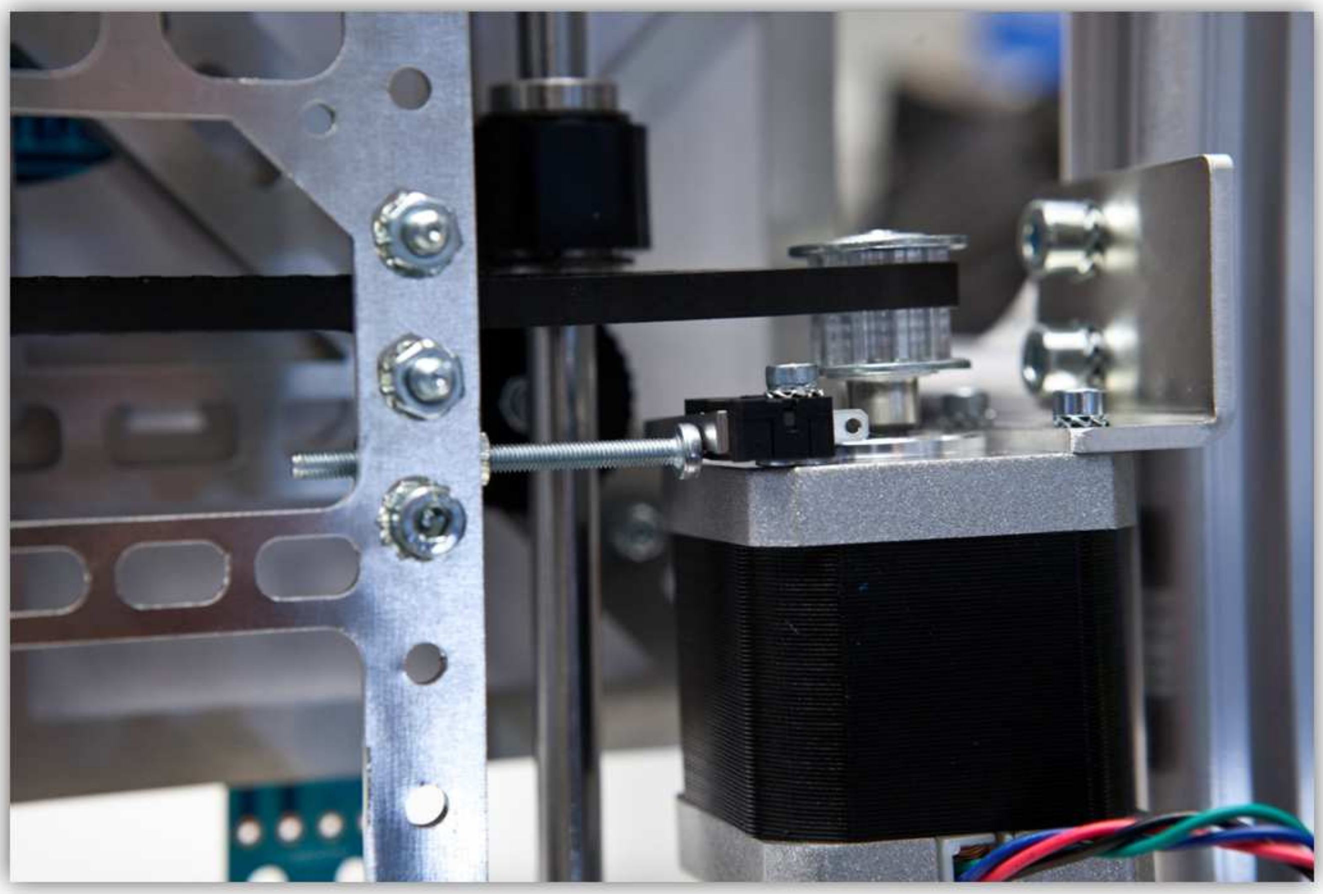
Put the M4 washer on the other end.

Bolt the micro switch to the X motor as shown in the pictures below.





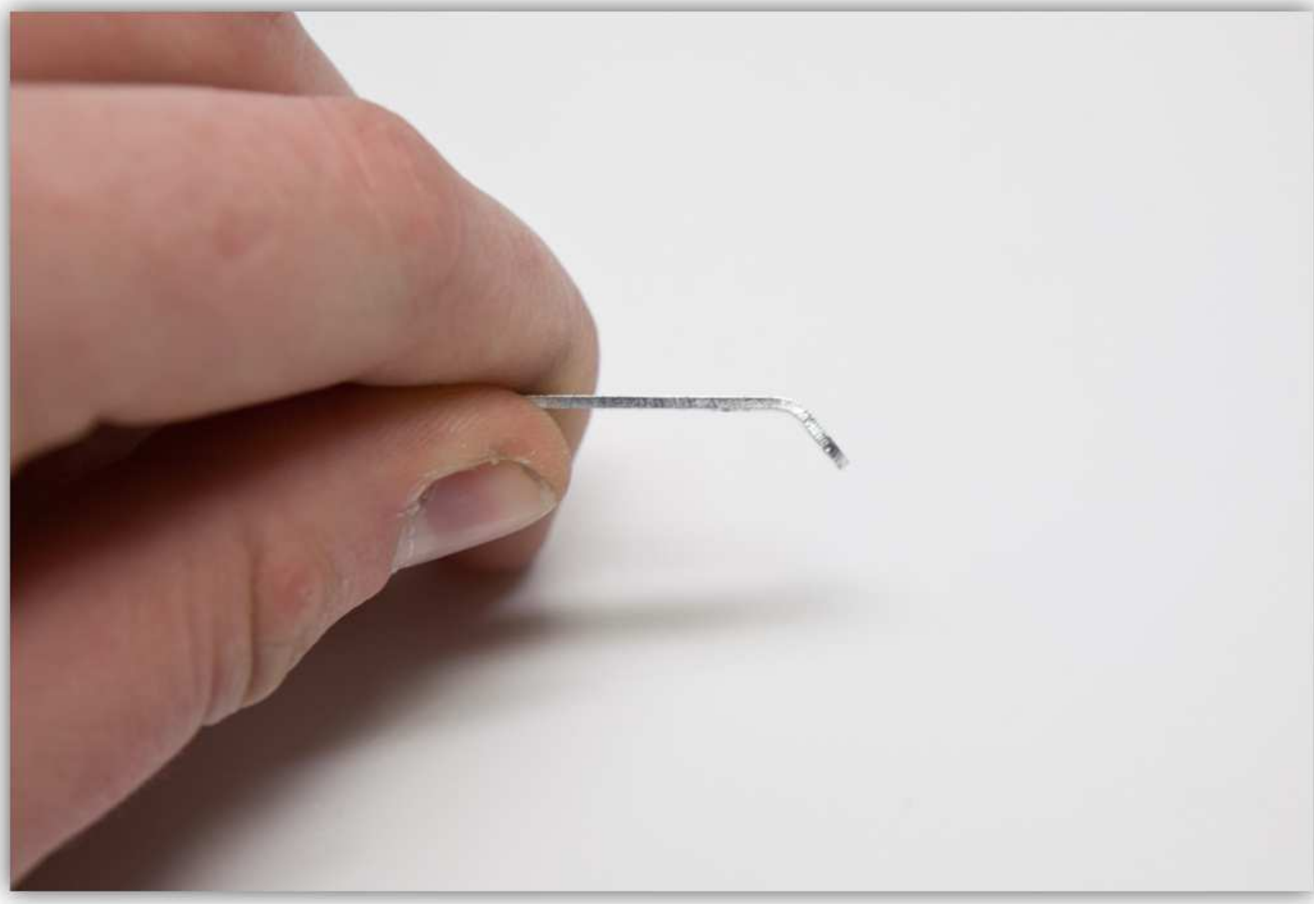
Make sure that the micro switch is in line with the screw on the X CARRIAGE. If not you will have to reposition both X PULLEY BRACKET and X MOTOR BRACKET.

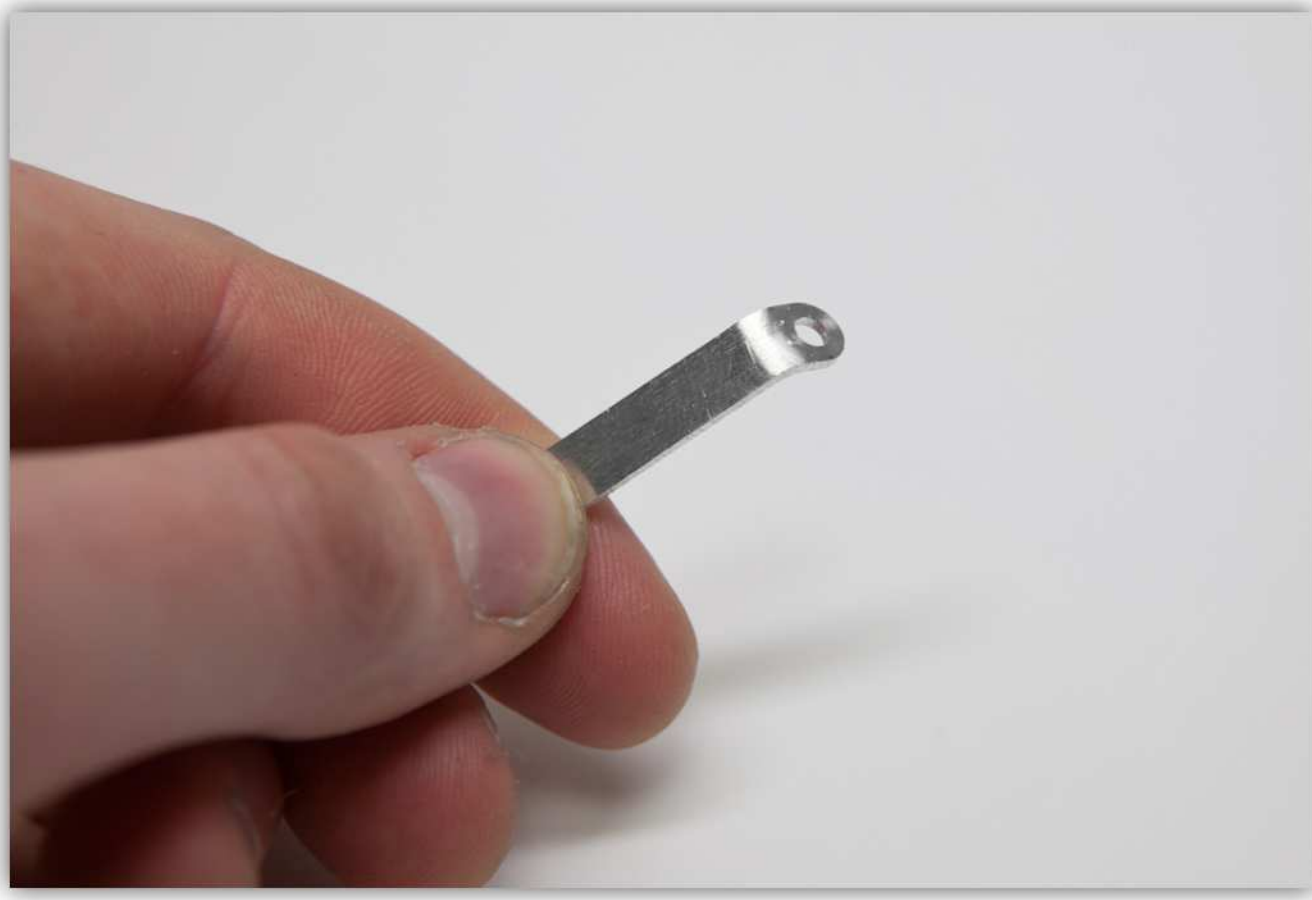


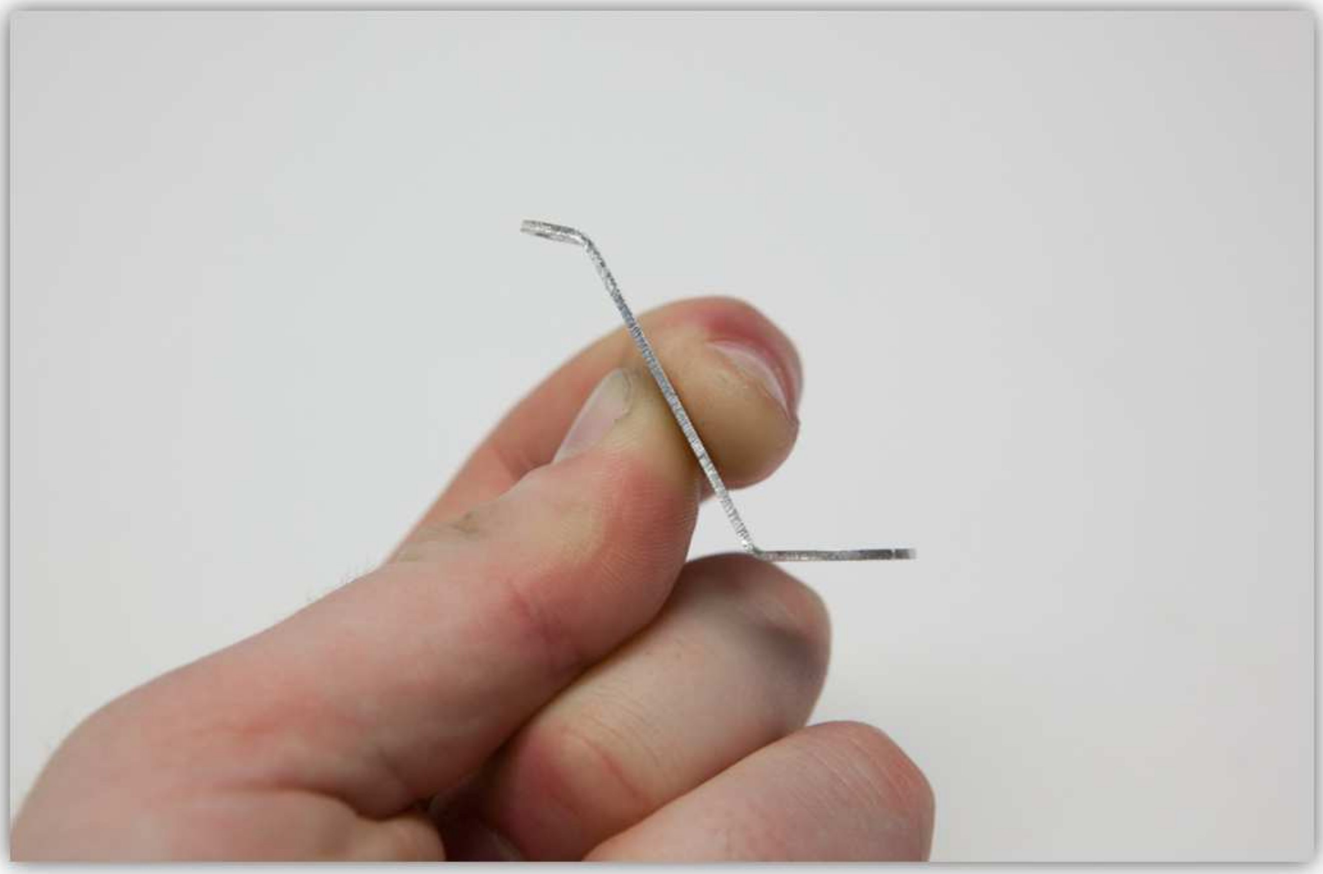
013 – MOUNTING THE FAN

Take all the parts out of the bag labelled with 36.

Bend the FAN HOLDER as in the pictures below. The angles should be roughly the same.

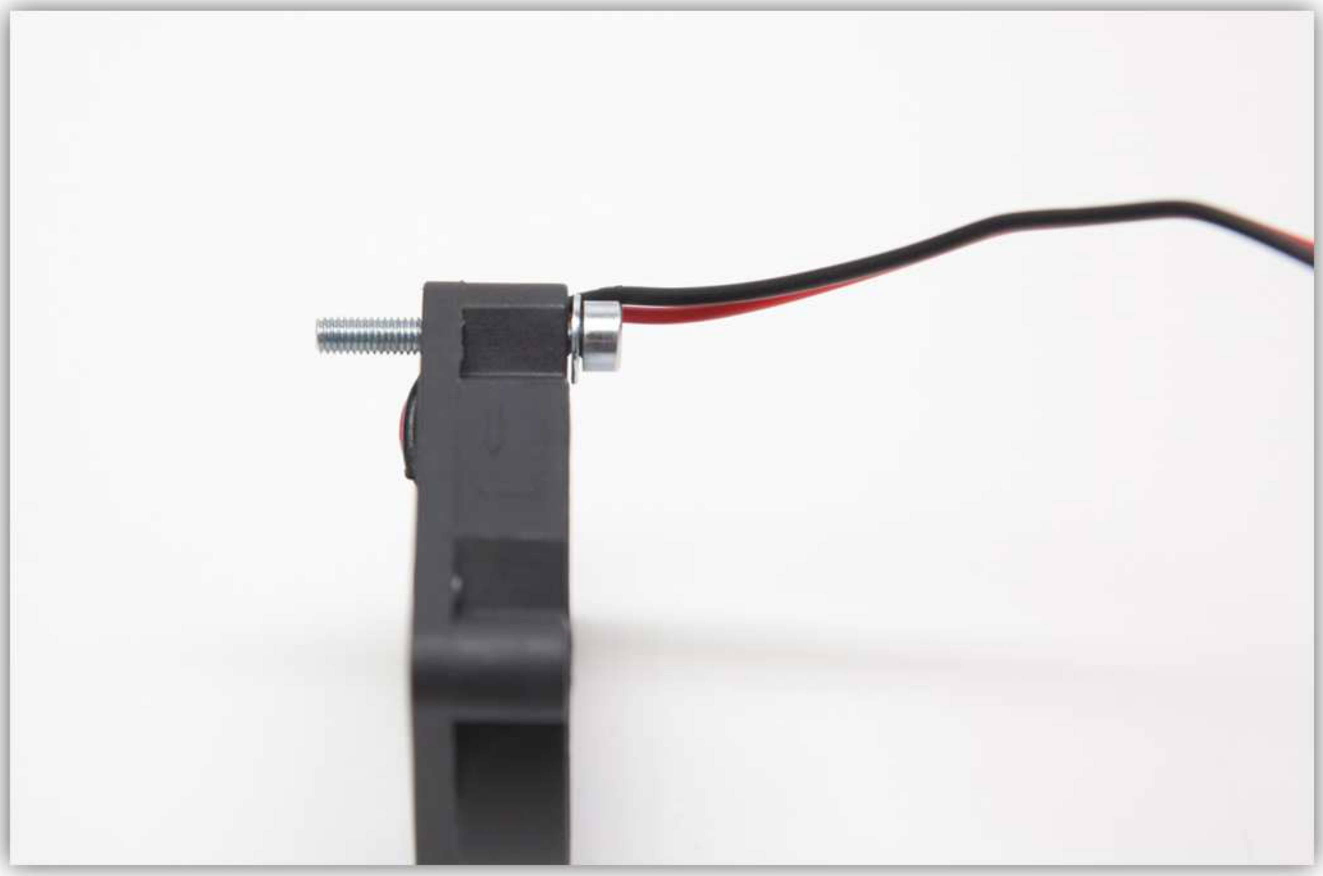




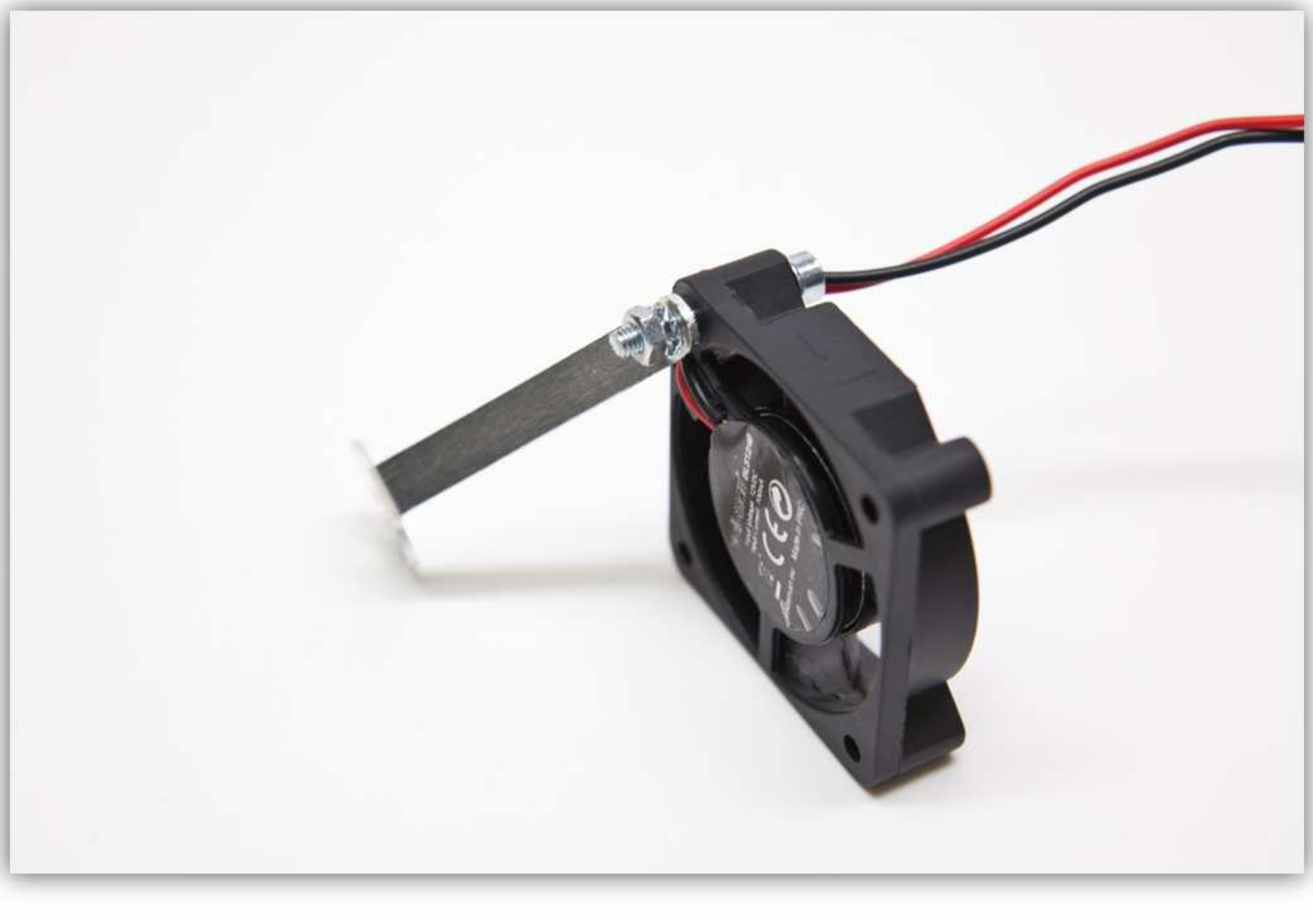


Take the M3 bolt with an M3 washer.

Slide it through the fan and add the FAN HOLDER.

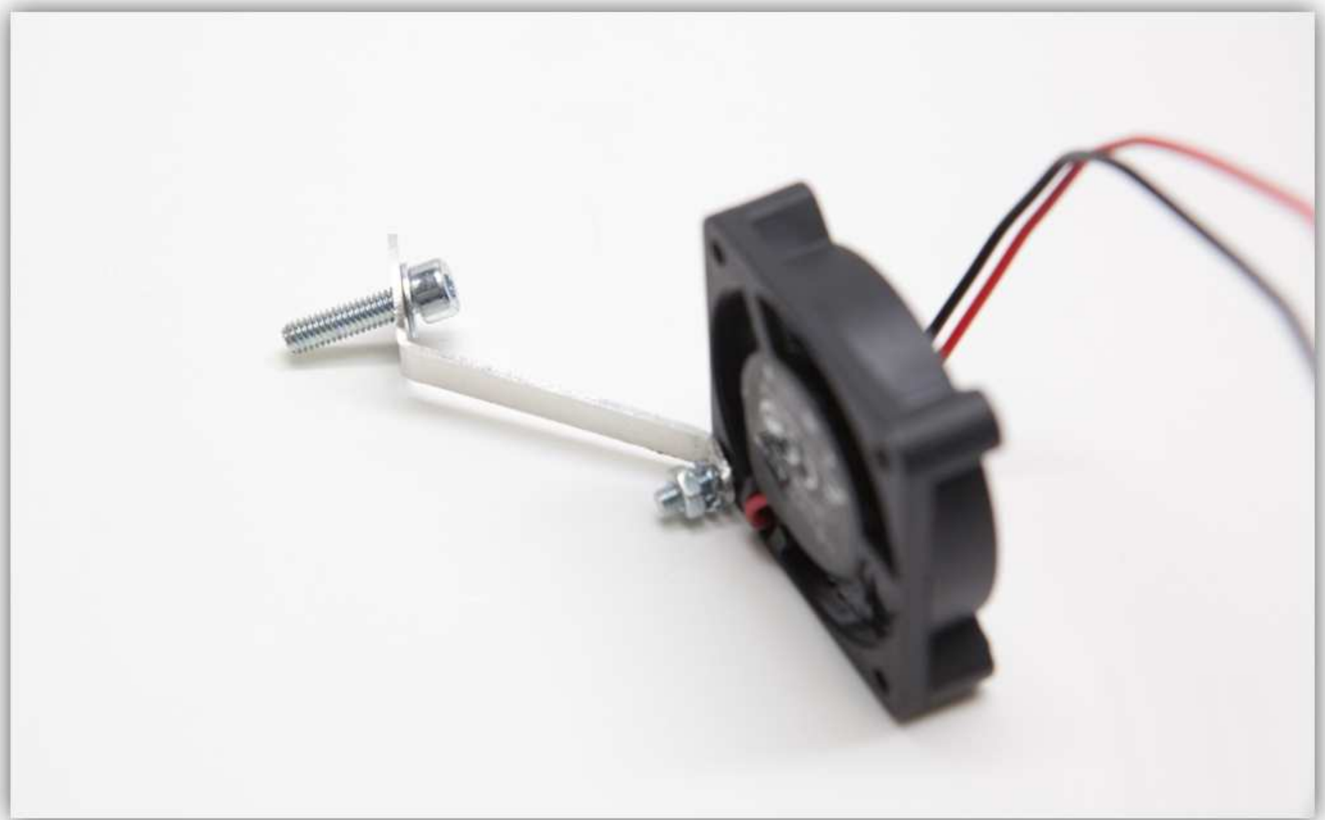


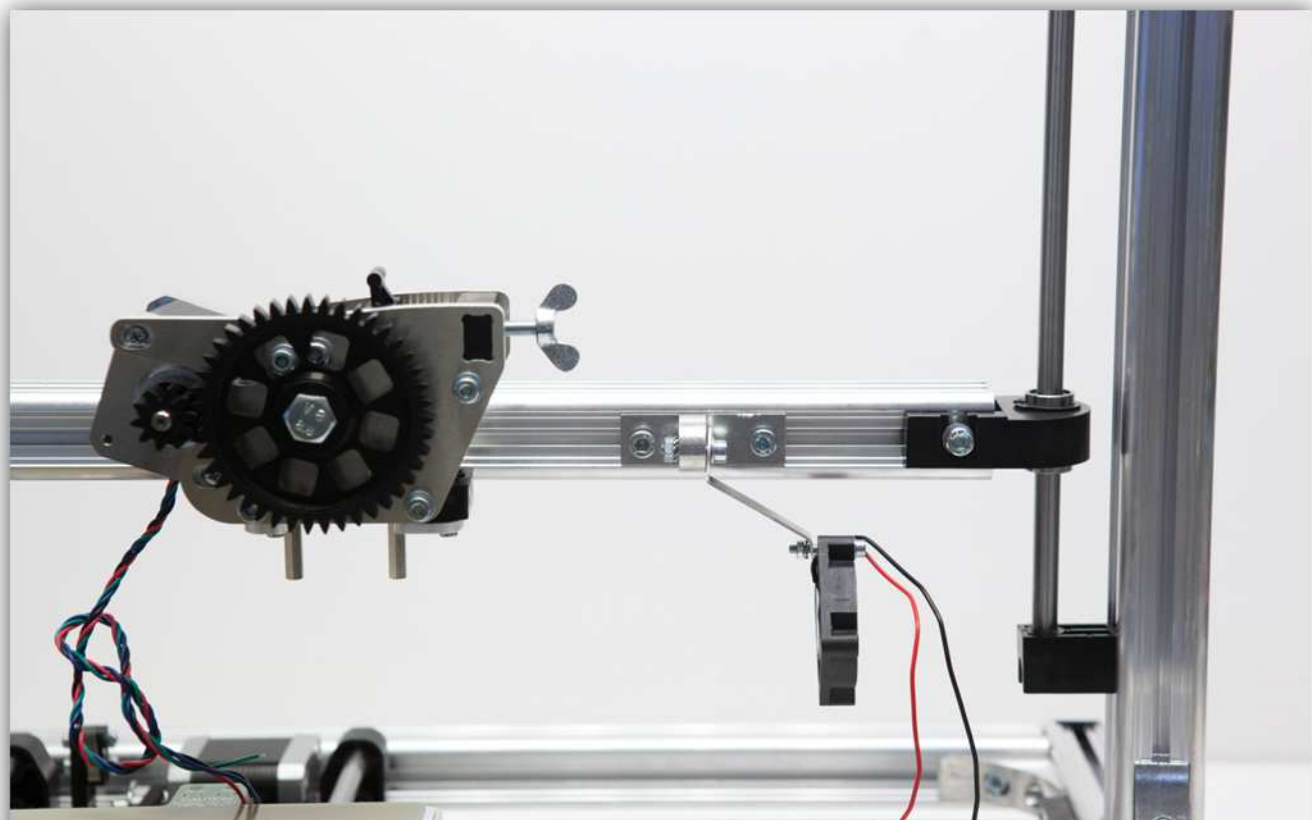
Add an M3 toothed washer and an M3 nut.



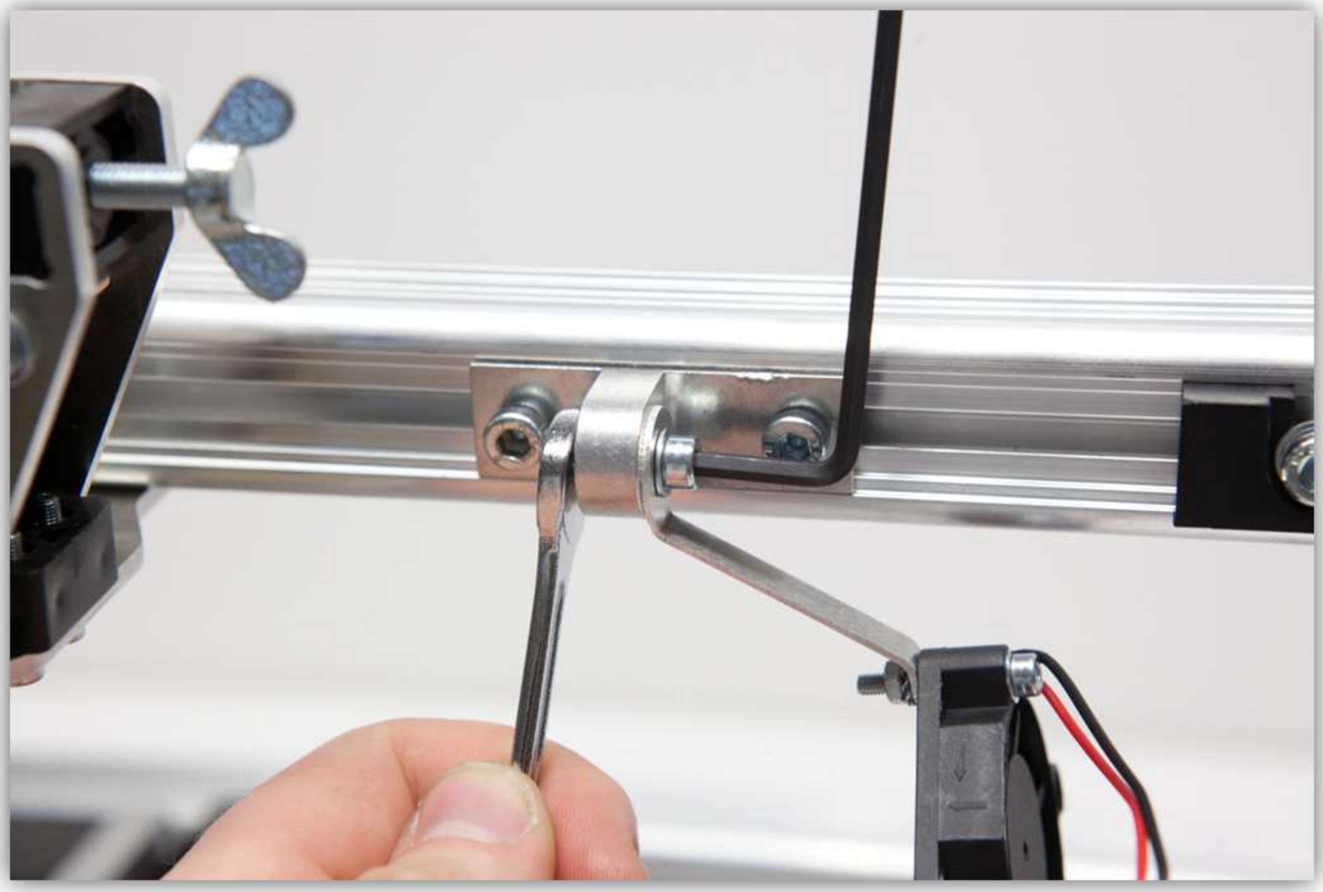
Take the M4 bolt and an M4 washer.

Slide it through the FAN HOLDER and mount it to the FAN HOLDER BRACKET you put earlier on the extruder arm with an M4 nut and an M4 toothed washer.



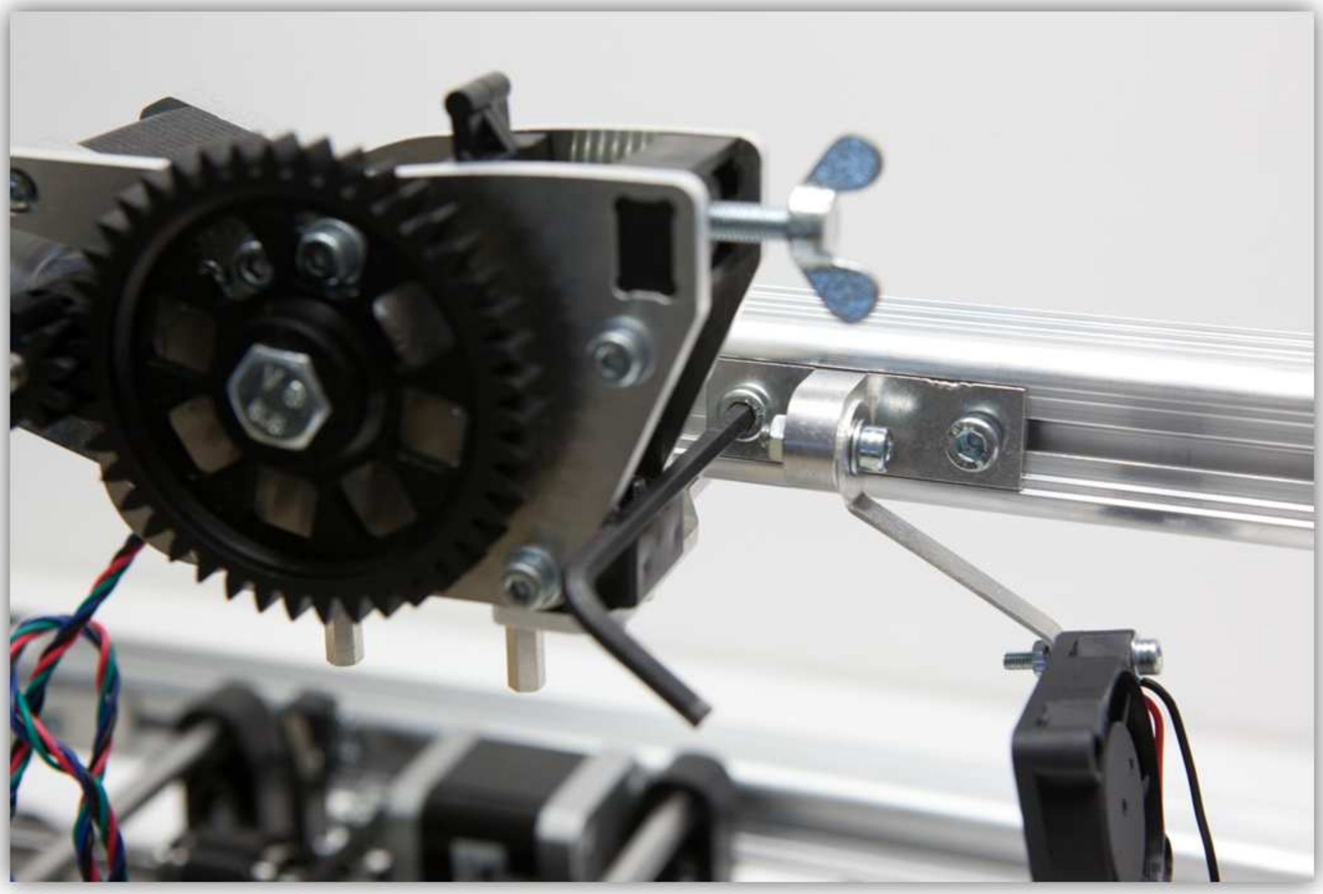


Tighten this bolt, make sure that the FAN HOLDER is vertical.

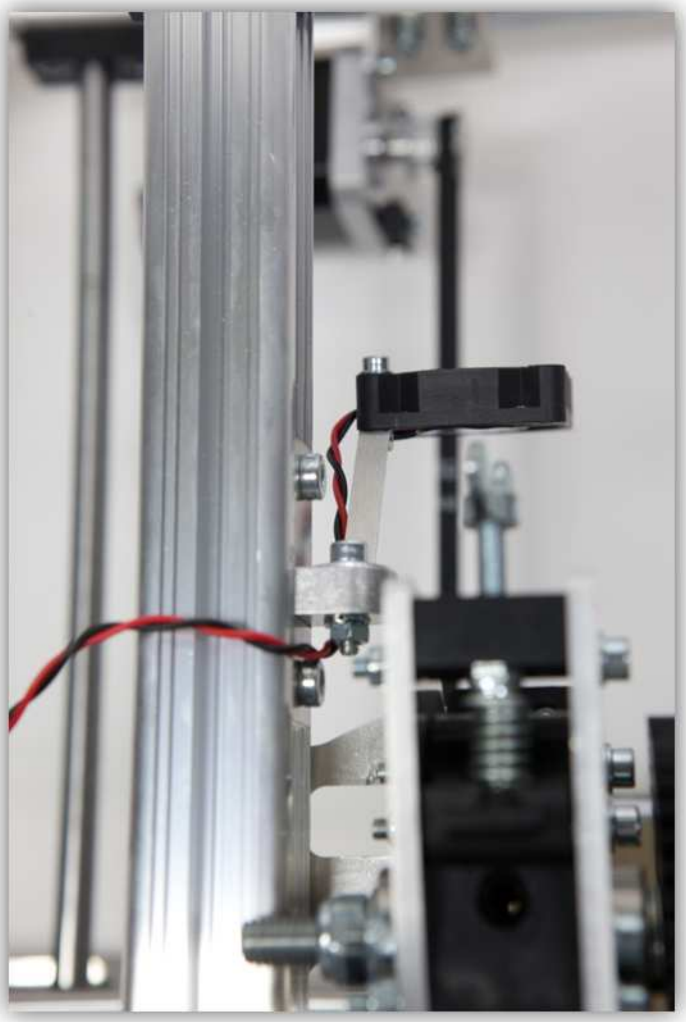


Tighten the bolt on the fan, make sure that the fan is level.

Slide the FAN HOLDER BRACKET closer to the extruder and tighten it firmly.



Place the wire as follows.

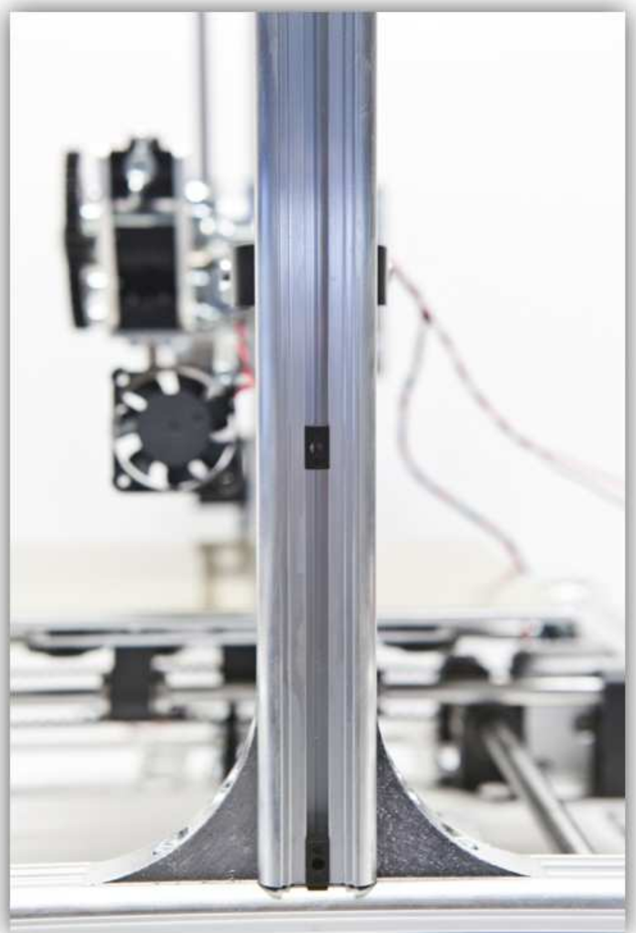


014 – MOUNTING THE CONTROLLER BOARD

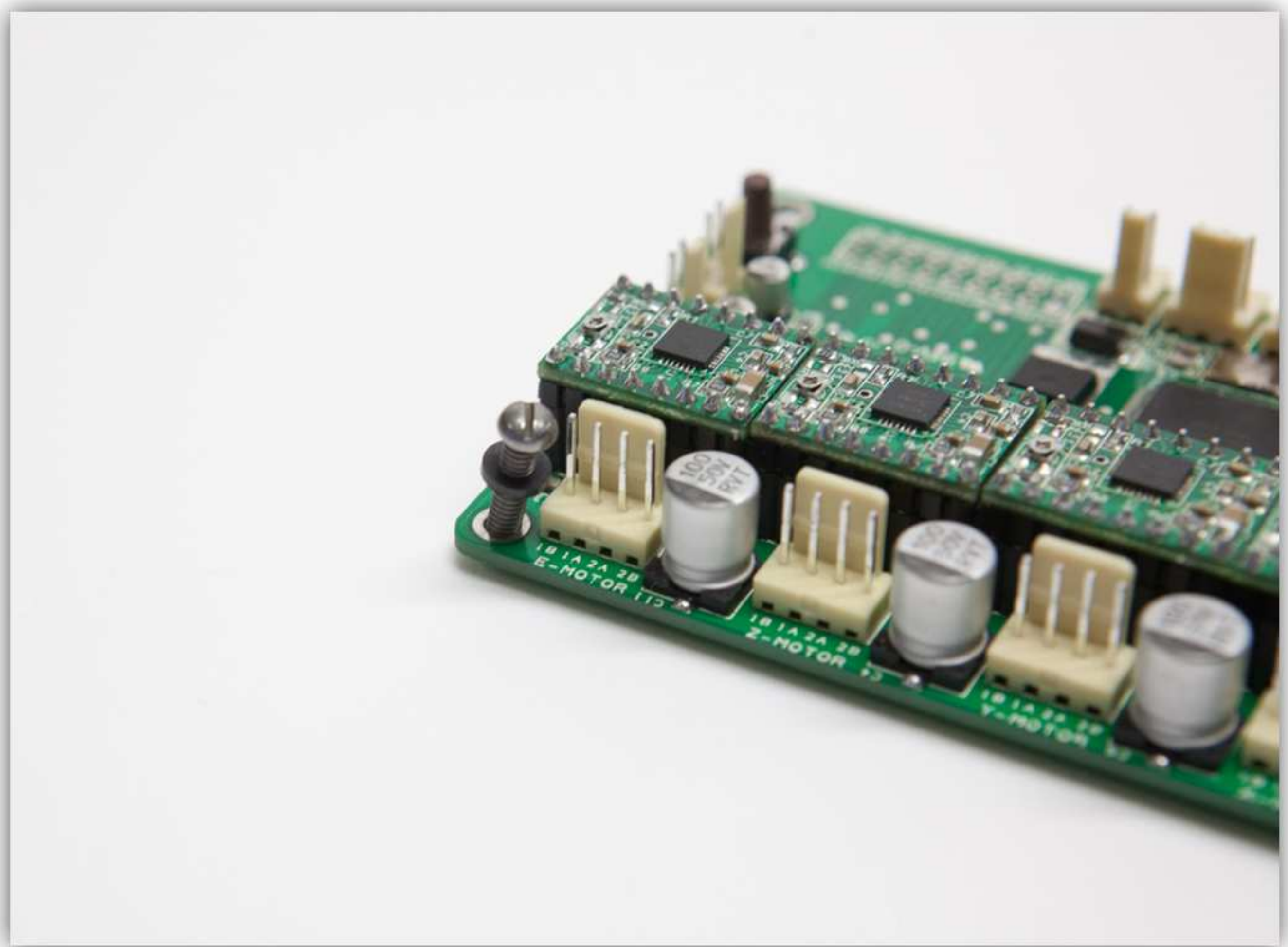
Take all the parts out of the bag labelled with 34 and 37.

Slide 2 of the small plastic rings over the bolts. **Watch the orientation of the plastic rings.**

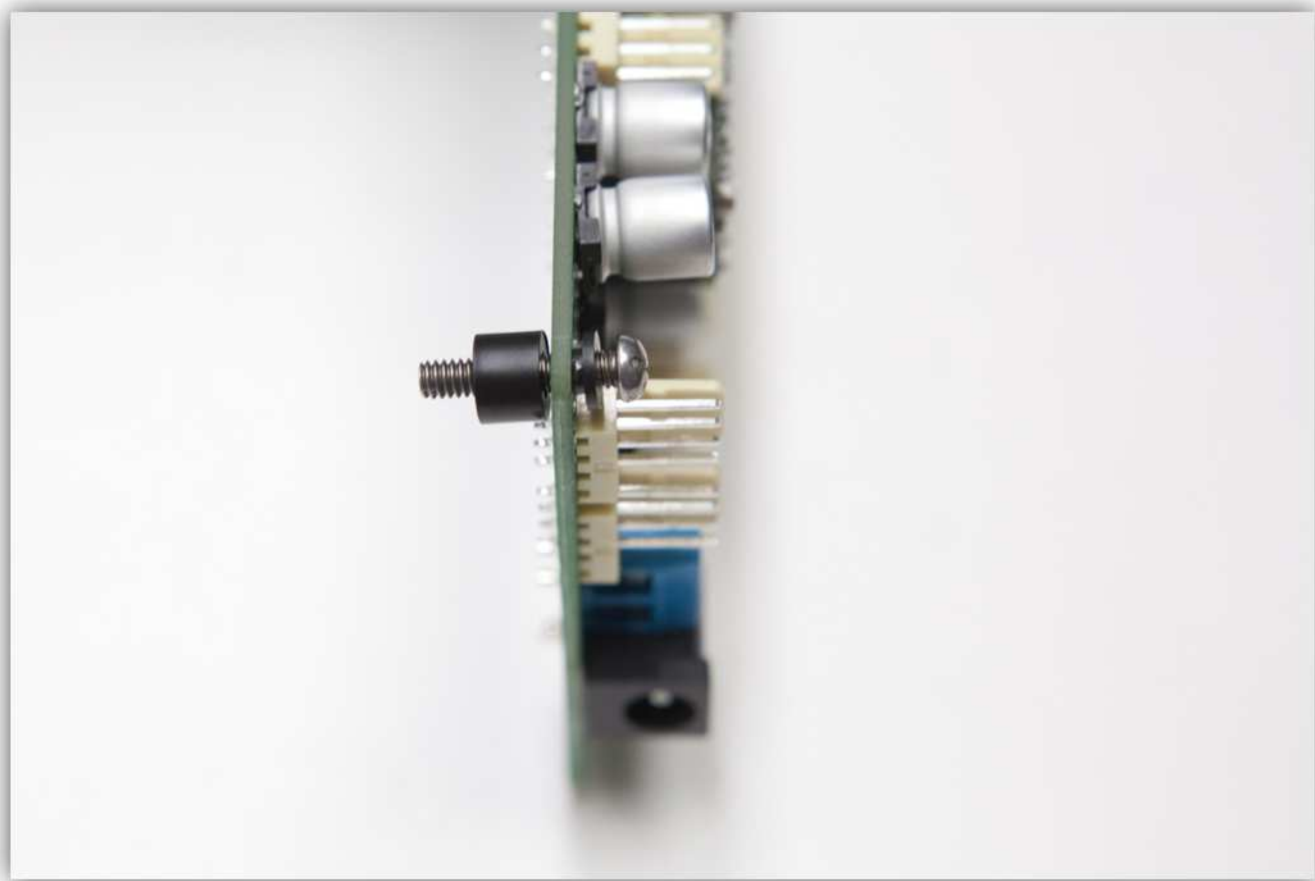
Make sure that the plastic PROFILE MOUNTS are approx. 105 mm (4.13") apart.



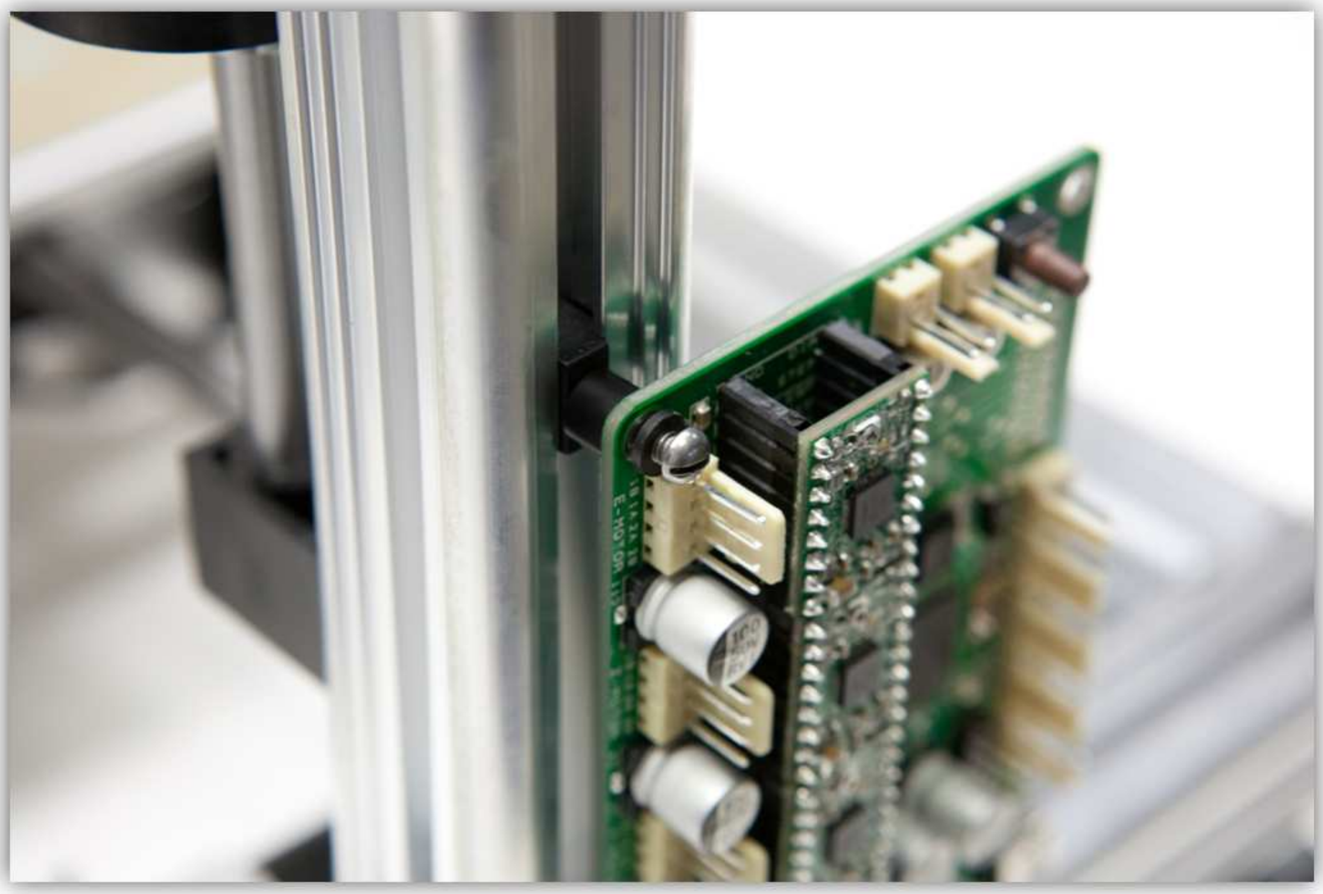
Slide the bolts through the controller board as shown in the pictures below. **Watch the orientation of the controller board closely.**

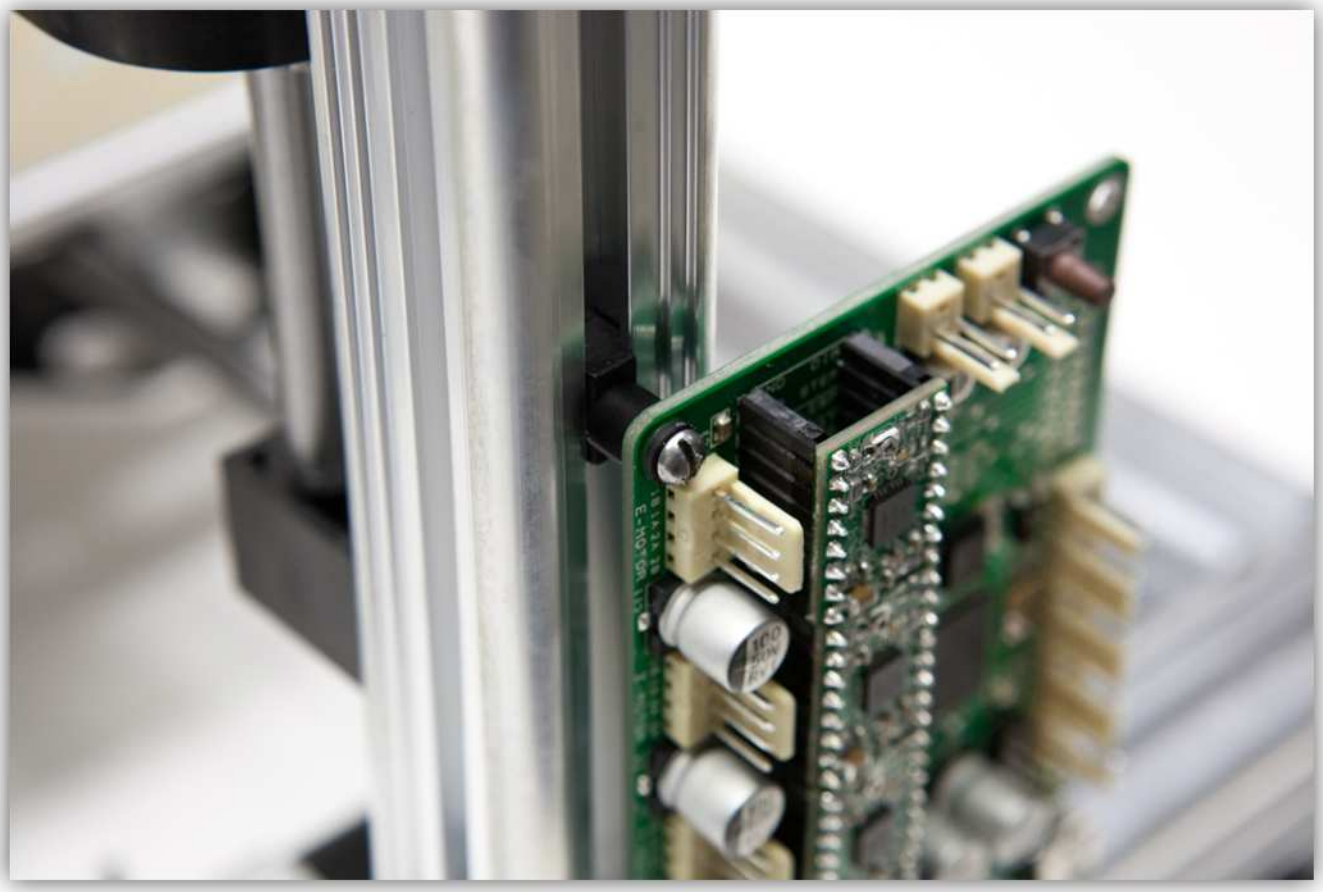


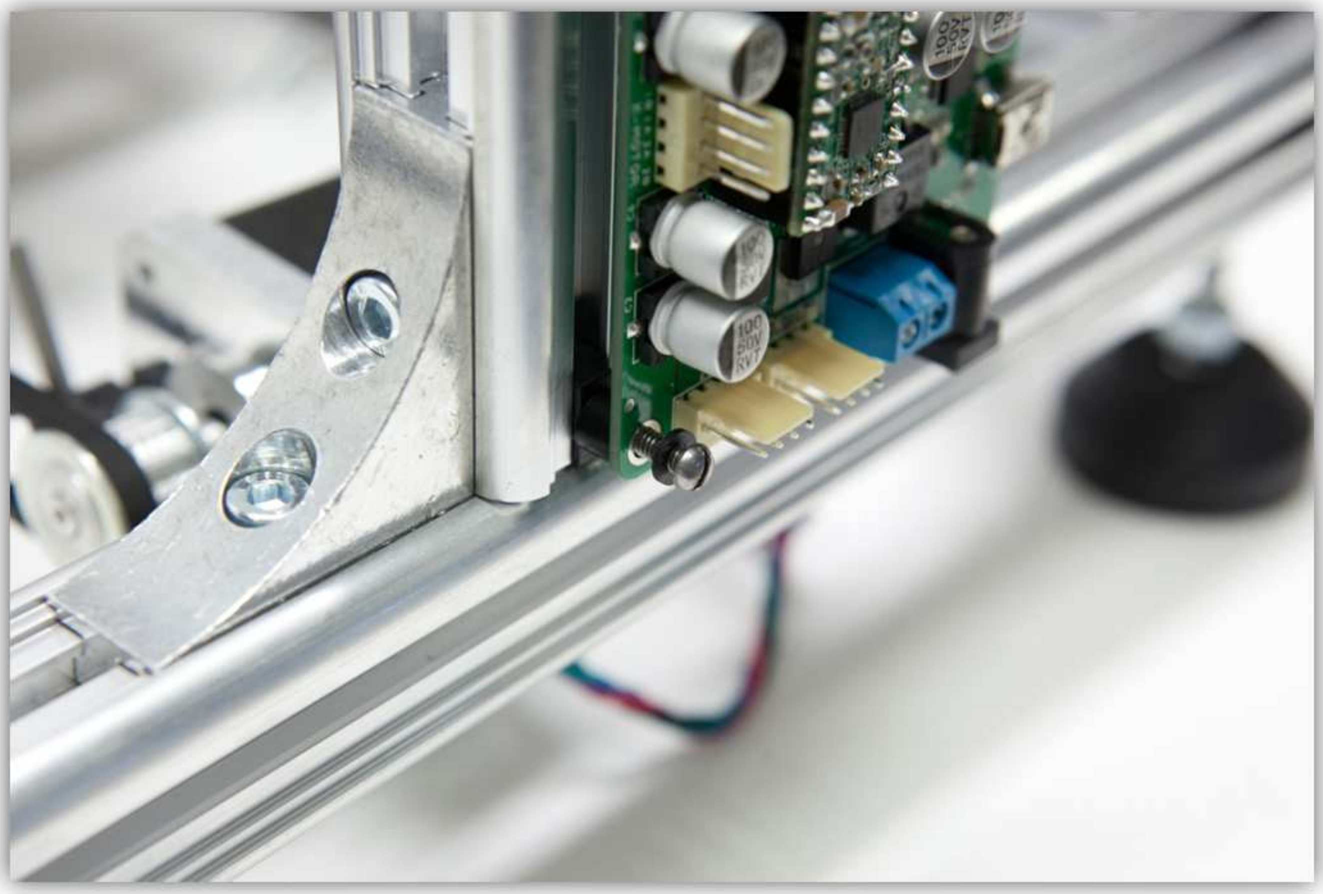
Slide a spacer over each bolt.

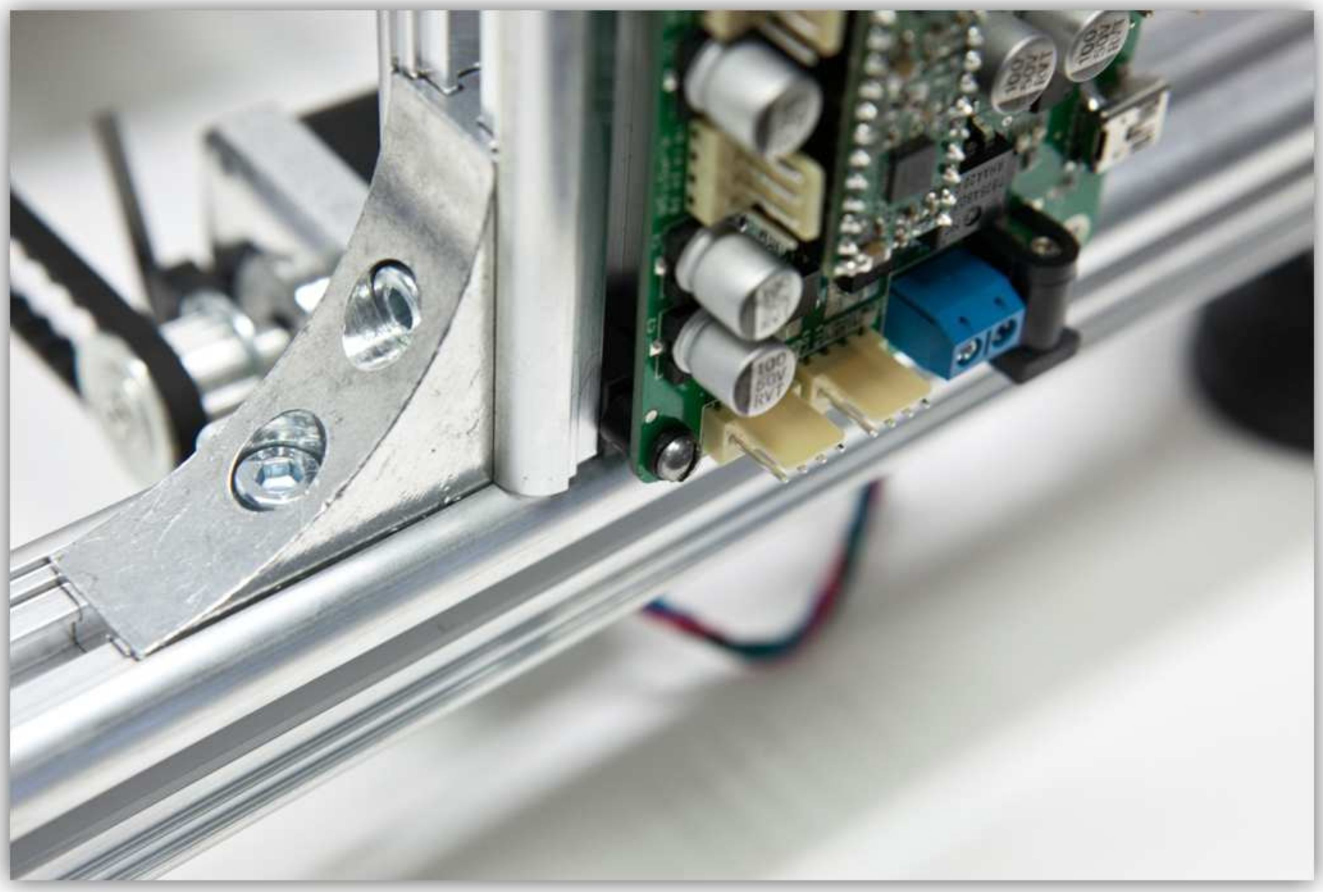


Screw the bolts into the PROFILE MOUNTS.

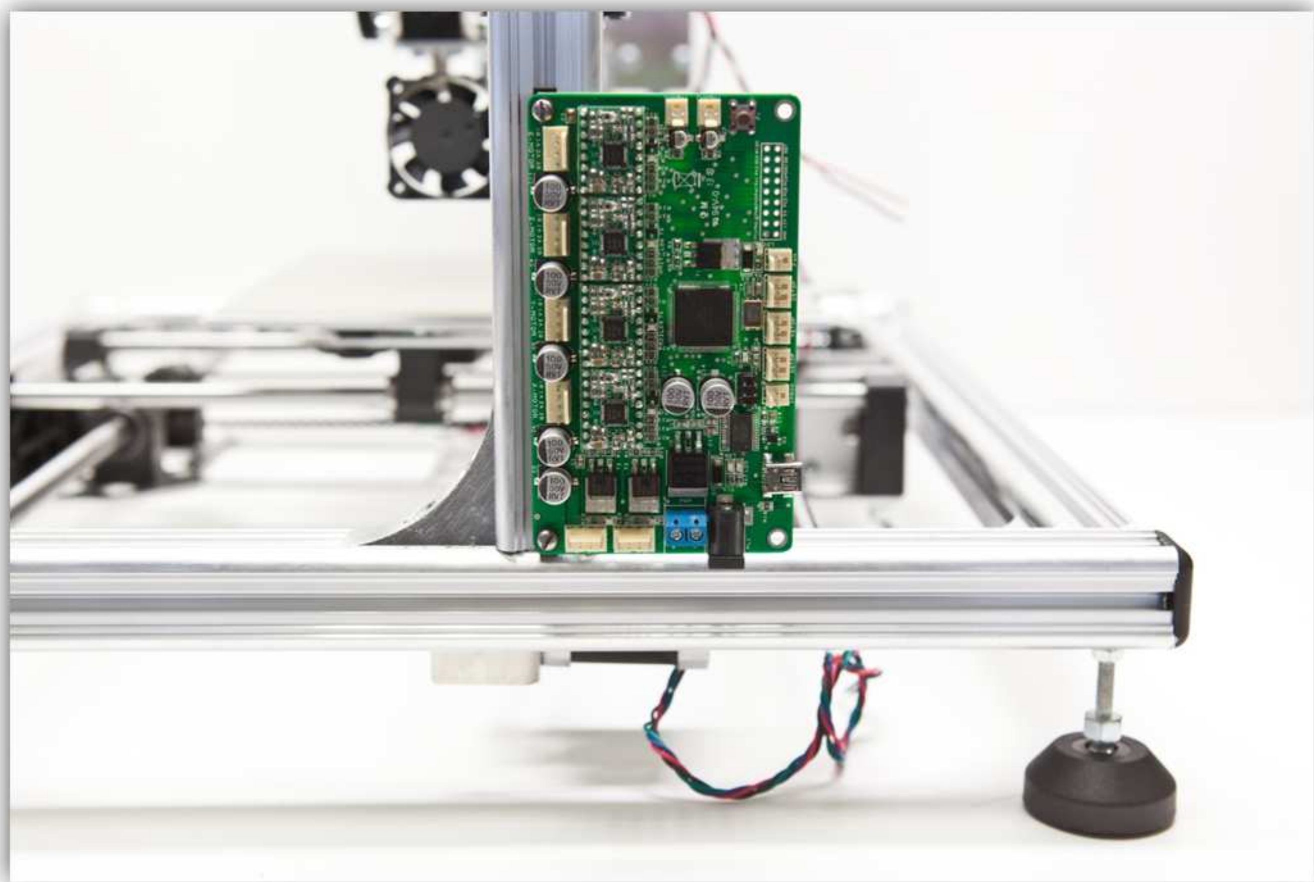






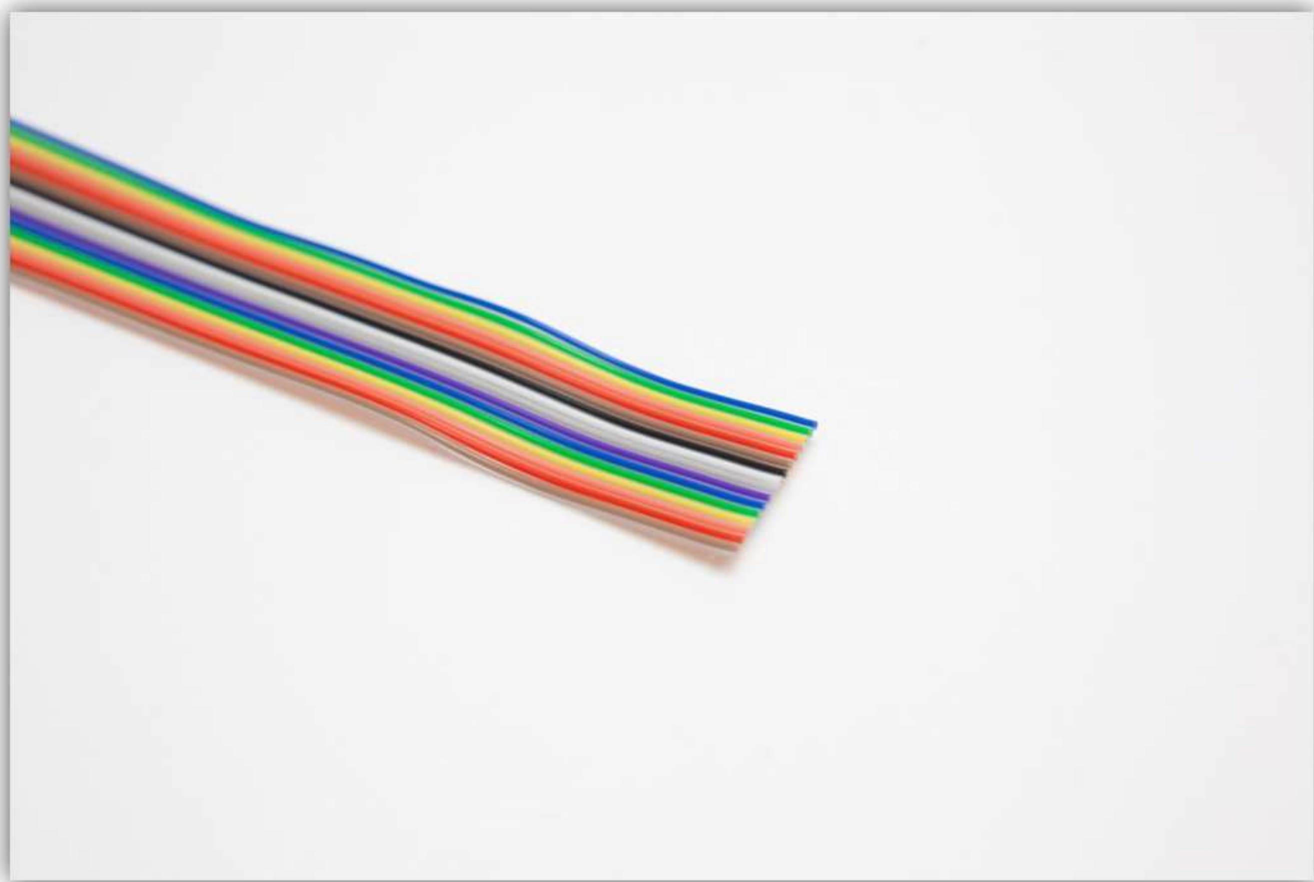


The board should be oriented as follows.

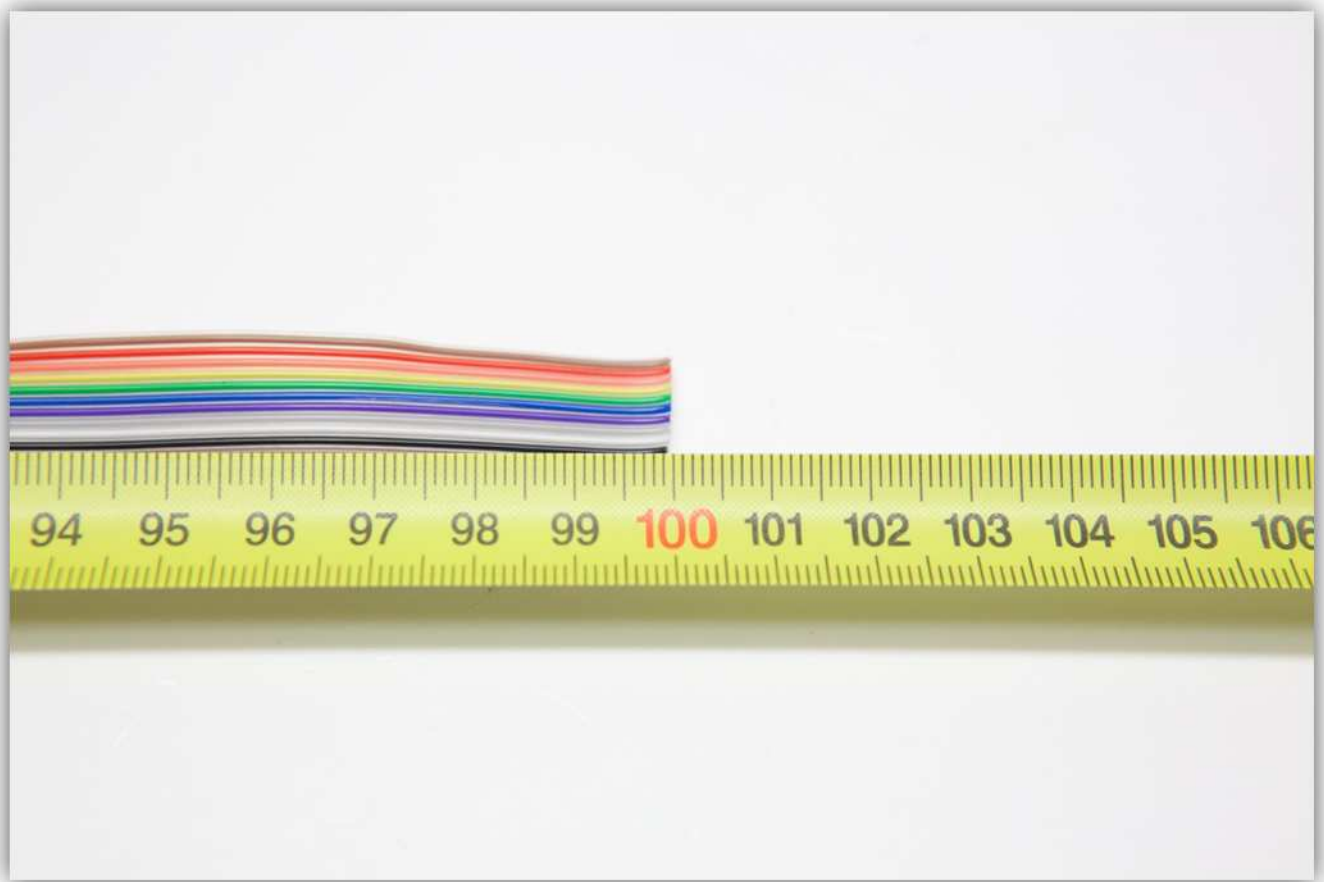


015 – WIRING THE EXTRUDER MOTOR AND FAN

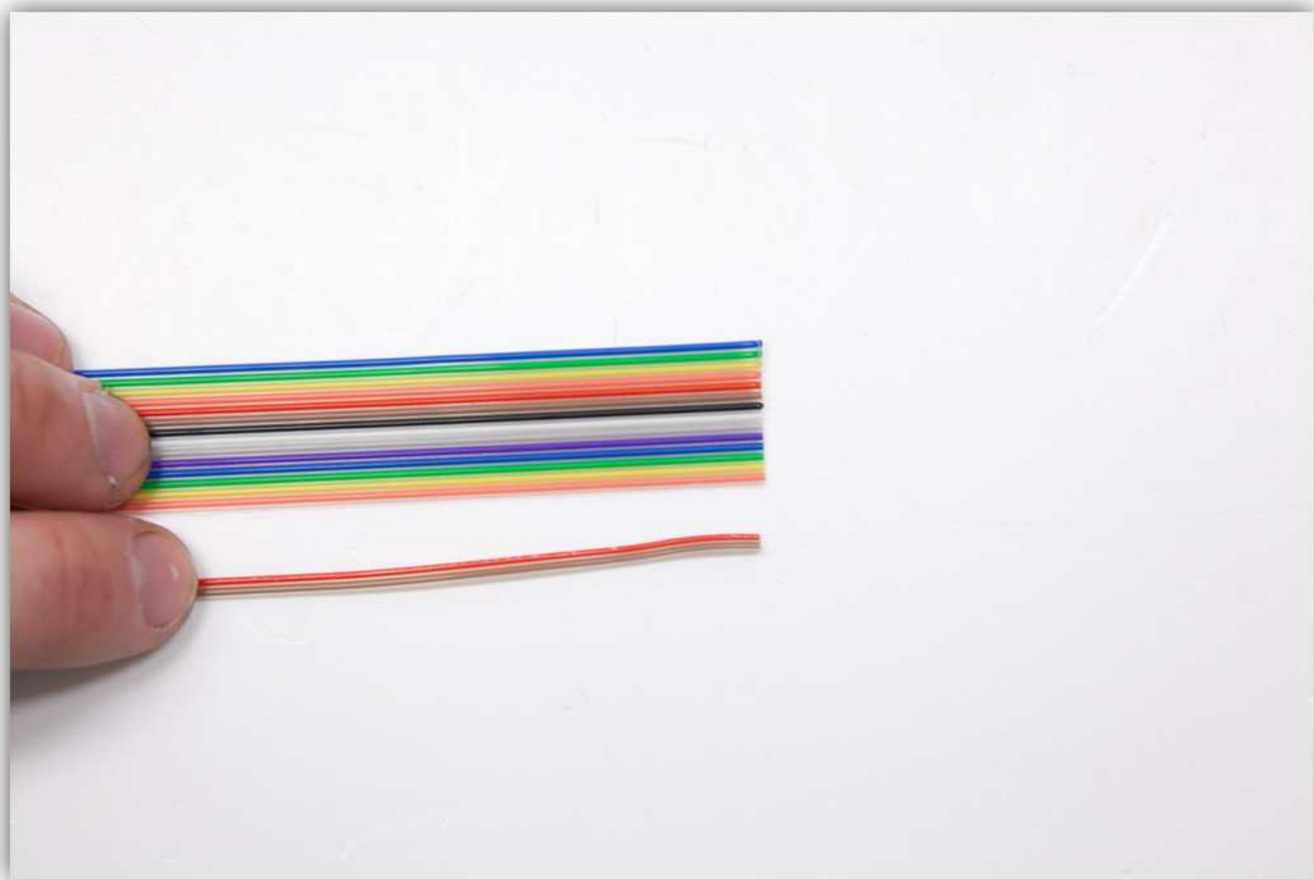
Take the MULTI-COLOURED FLATCABLE out of the bag labelled with 40.



Cut a piece of 100 cm (39.4"). **This length is critical, measure twice before cutting.**

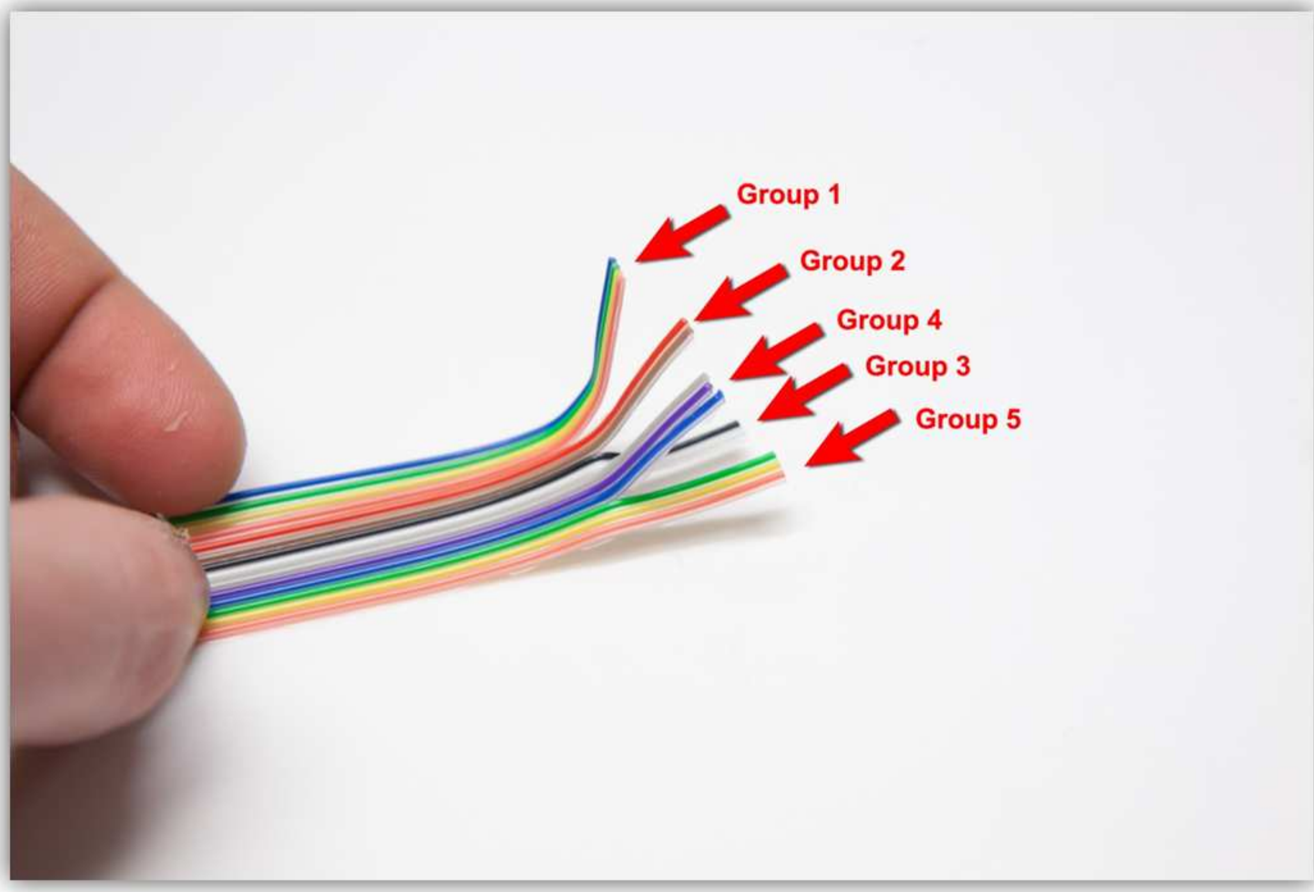


Detach (rip them of) the outer **Brown** and **Red** coloured wires from the pack over the whole length. Keep these apart, you will need these later.

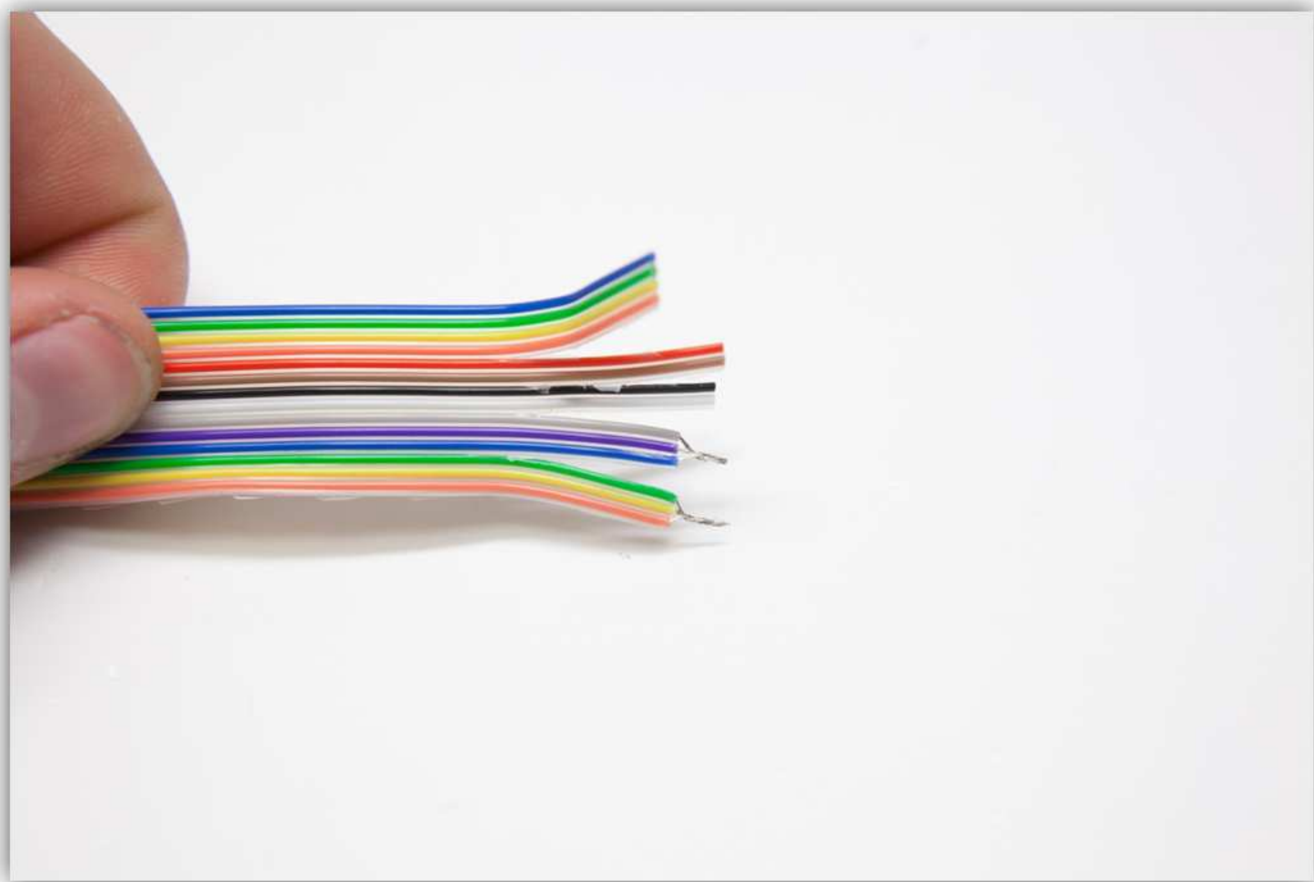


Detach the following groups for about 2 cm (0.79"):

- Group 1 : **Blue, Green, Yellow, Orange**
- Group 2: **Red, Brown**
- Group 3: **Black, White**
- Group 4: **Grey, Violet, Blue**
- Group 5: **Green, Yellow, Orange**

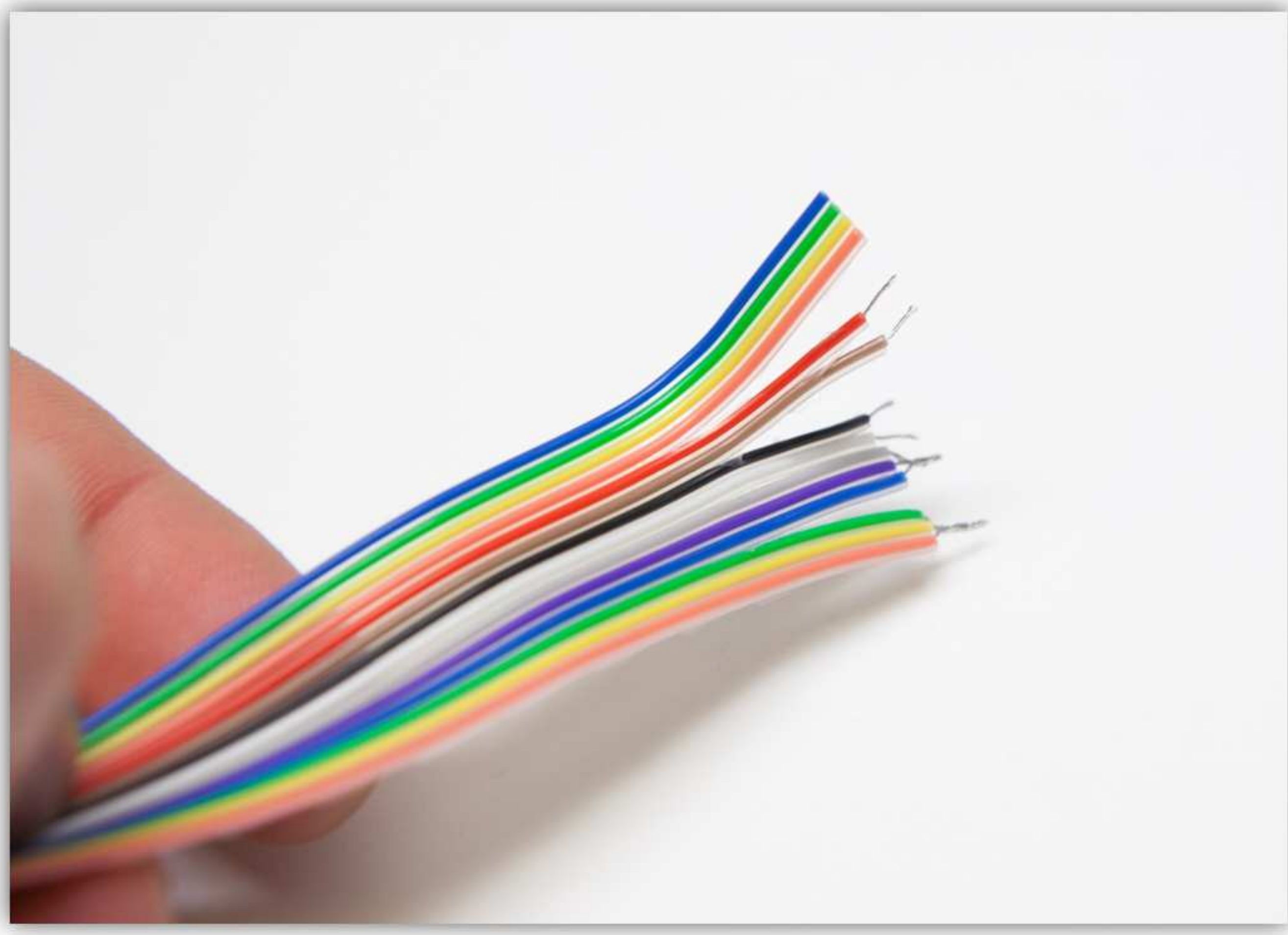


Strip the wires from group 4 and group 5 (5 mm) and twist the wires in a group together as shown in the picture.

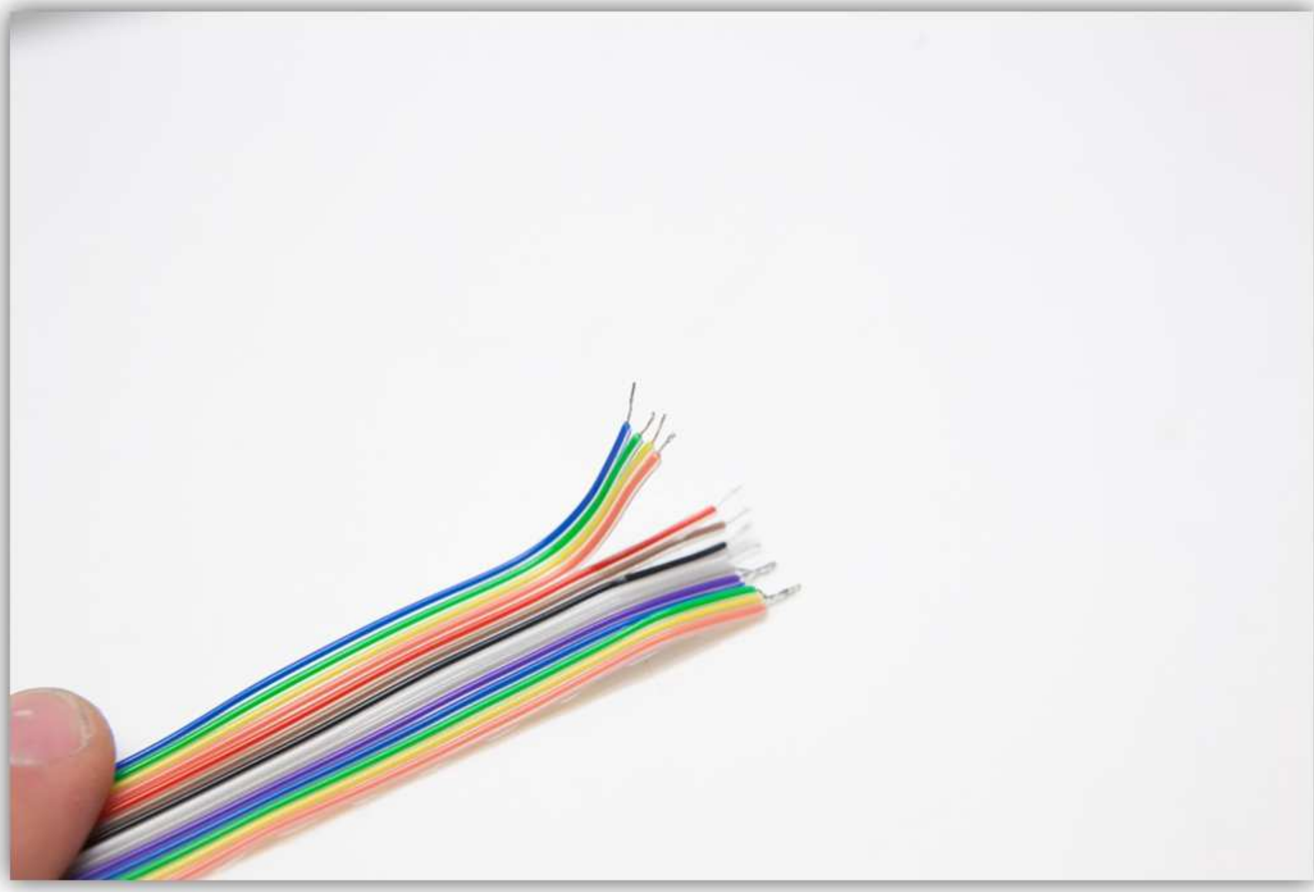


Strip the wires from group 3 (5 mm) (0.2"). **Do not twist these together.**

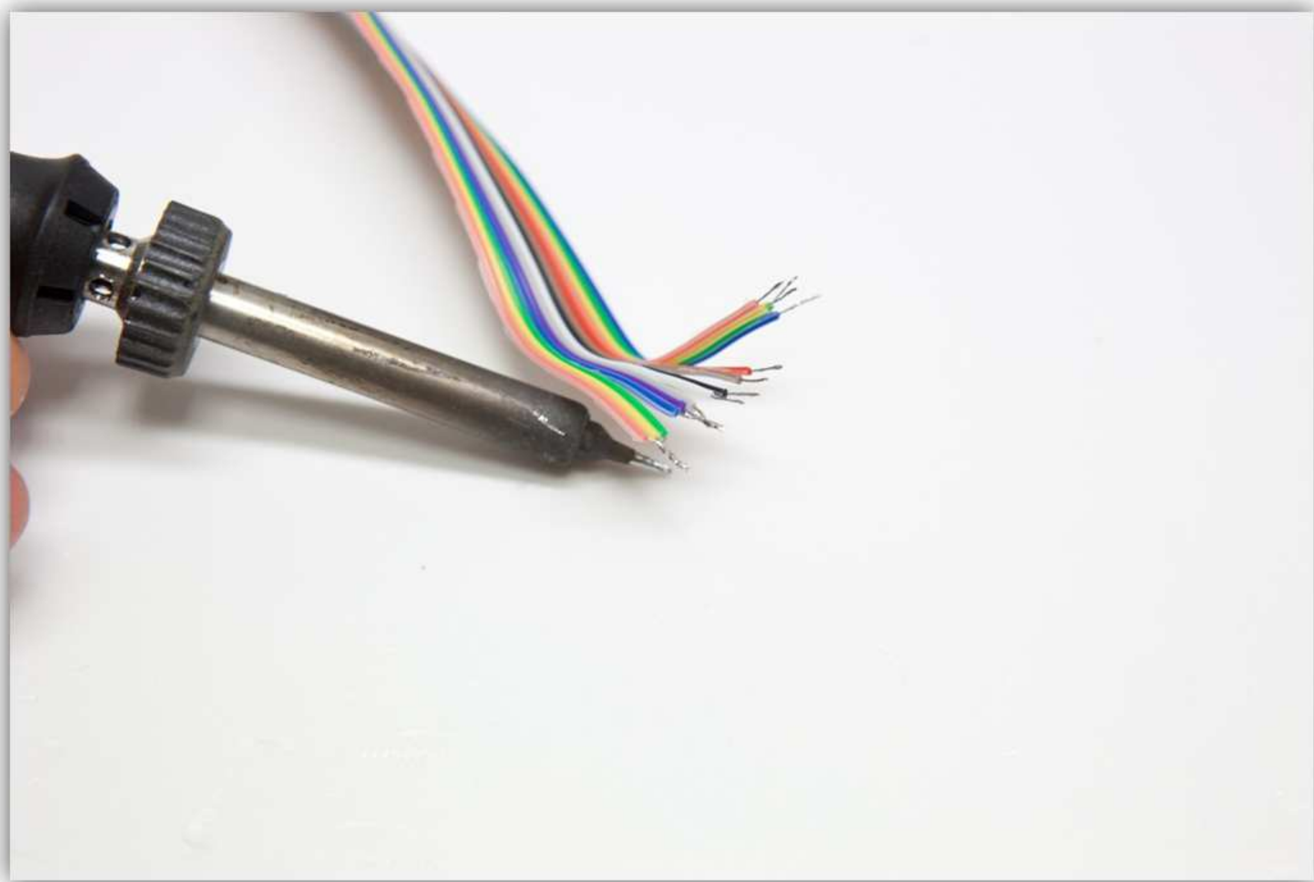
Strip the wires from group 2 (5 mm) (0.2"). **Do not twist these together.**



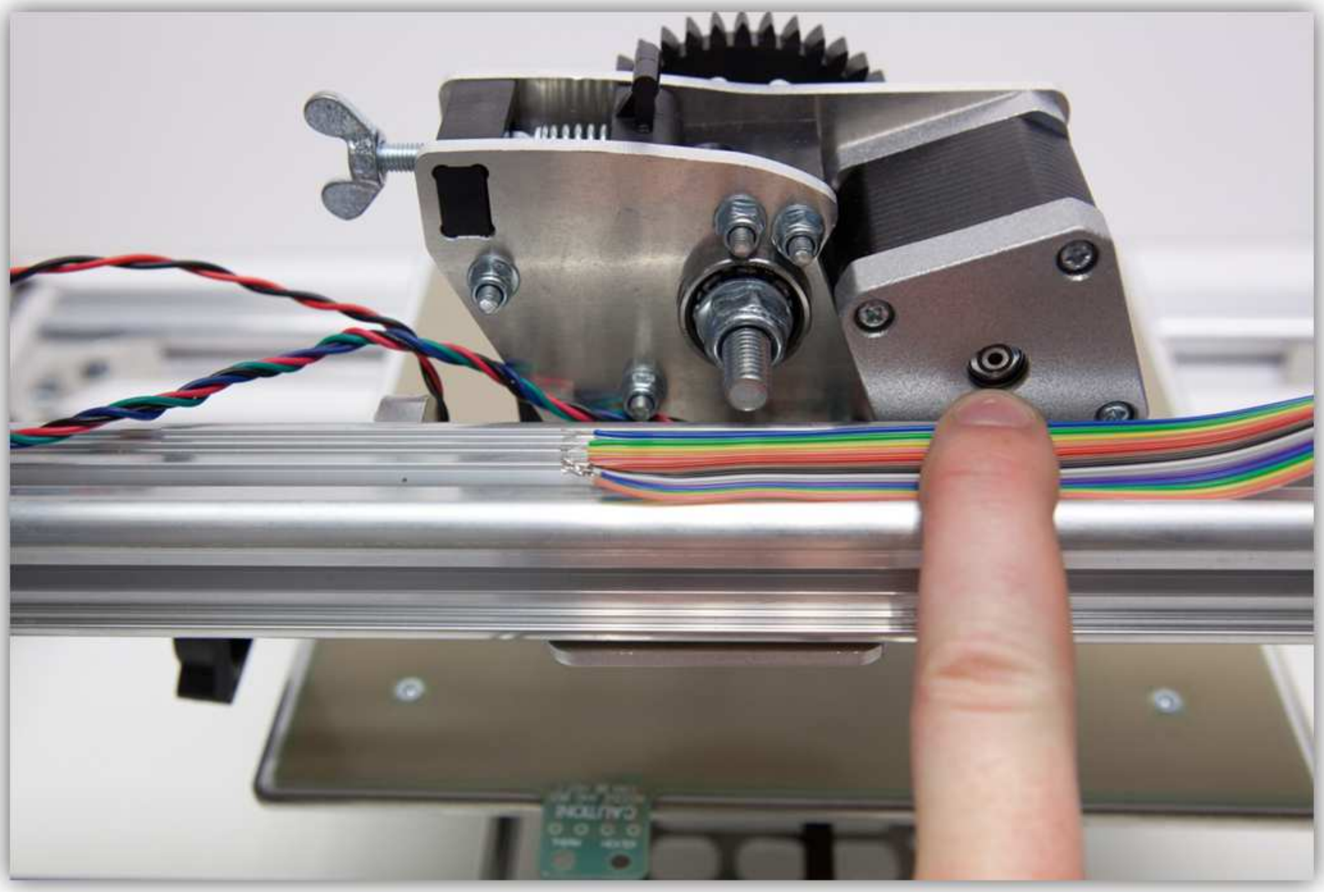
Strip the wires from group 1 (5 mm) (0.2"). **Do not twist these together.**



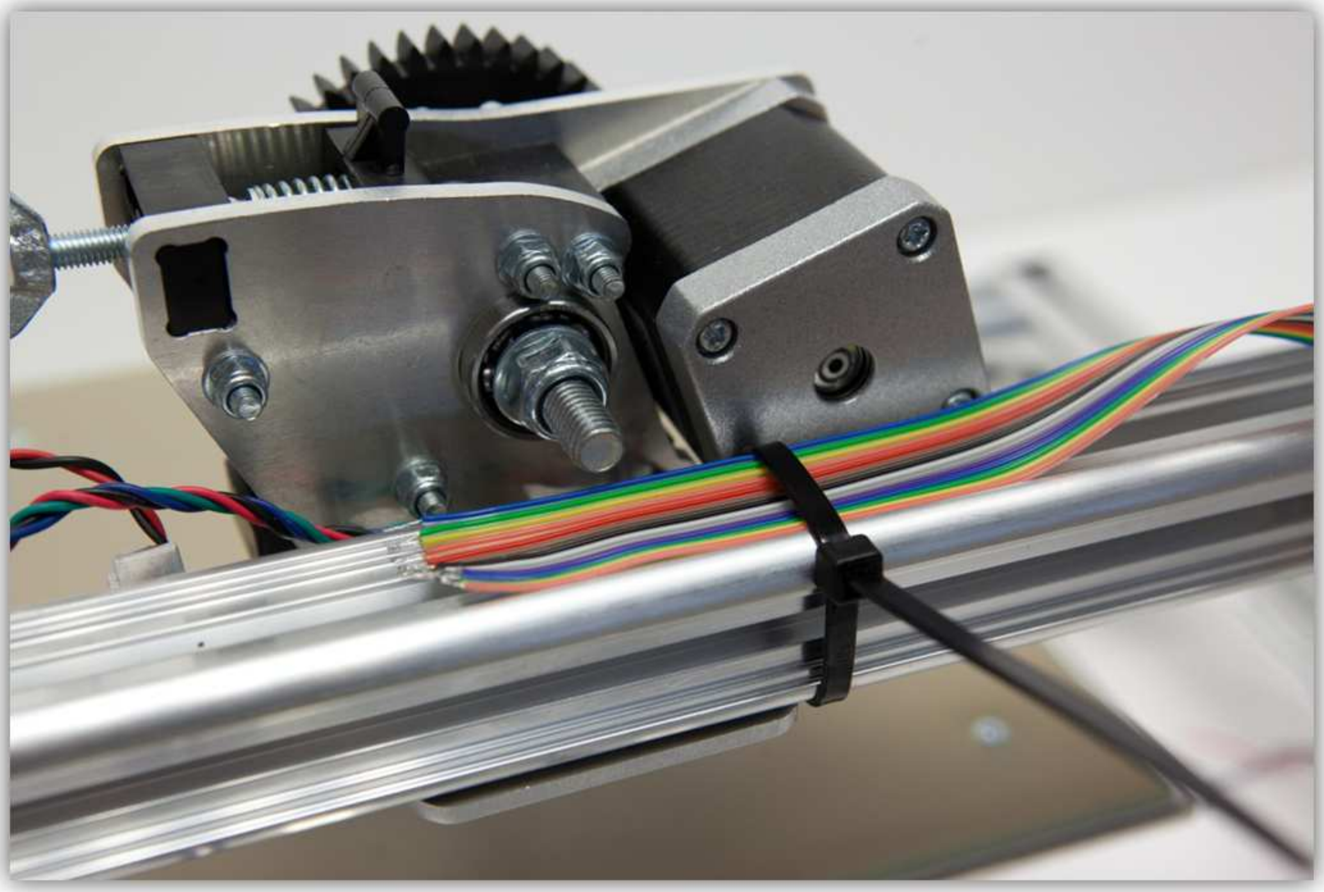
Tin all the wires. Take extra care when tinning the wires from group 4 and 5 since these are twisted together they need a bit more tin to make sure they all stay together.



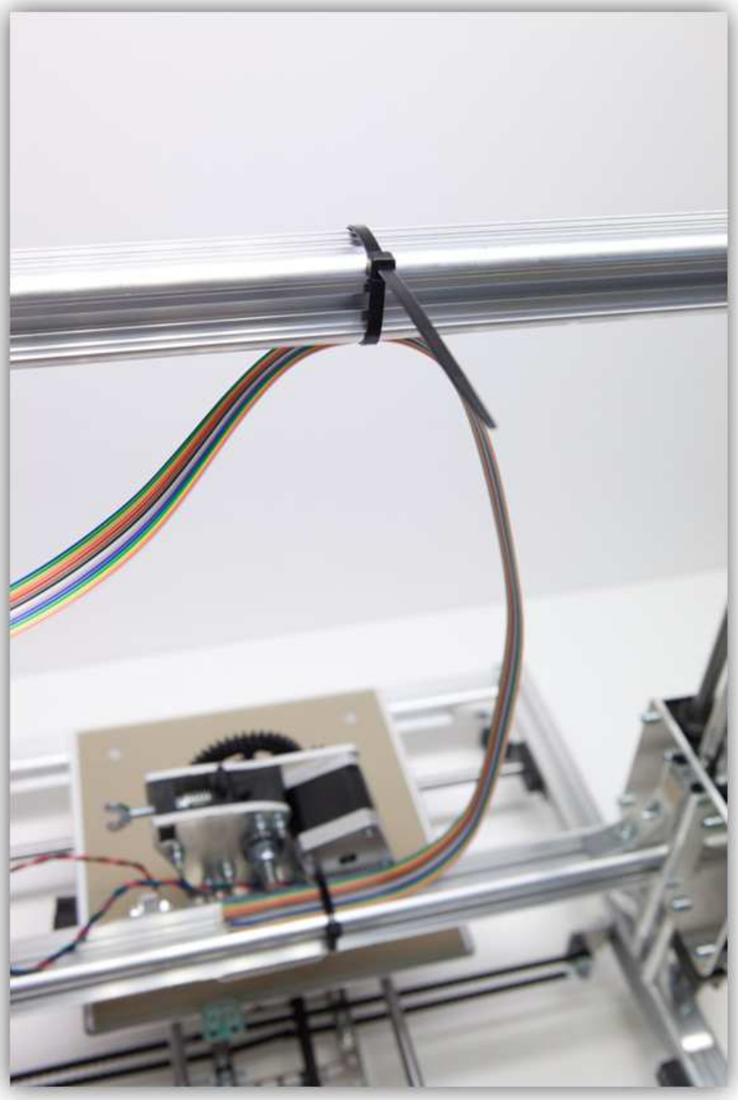
Place this end of the cable next to the extruder with group 1 closest to the extruder housing.



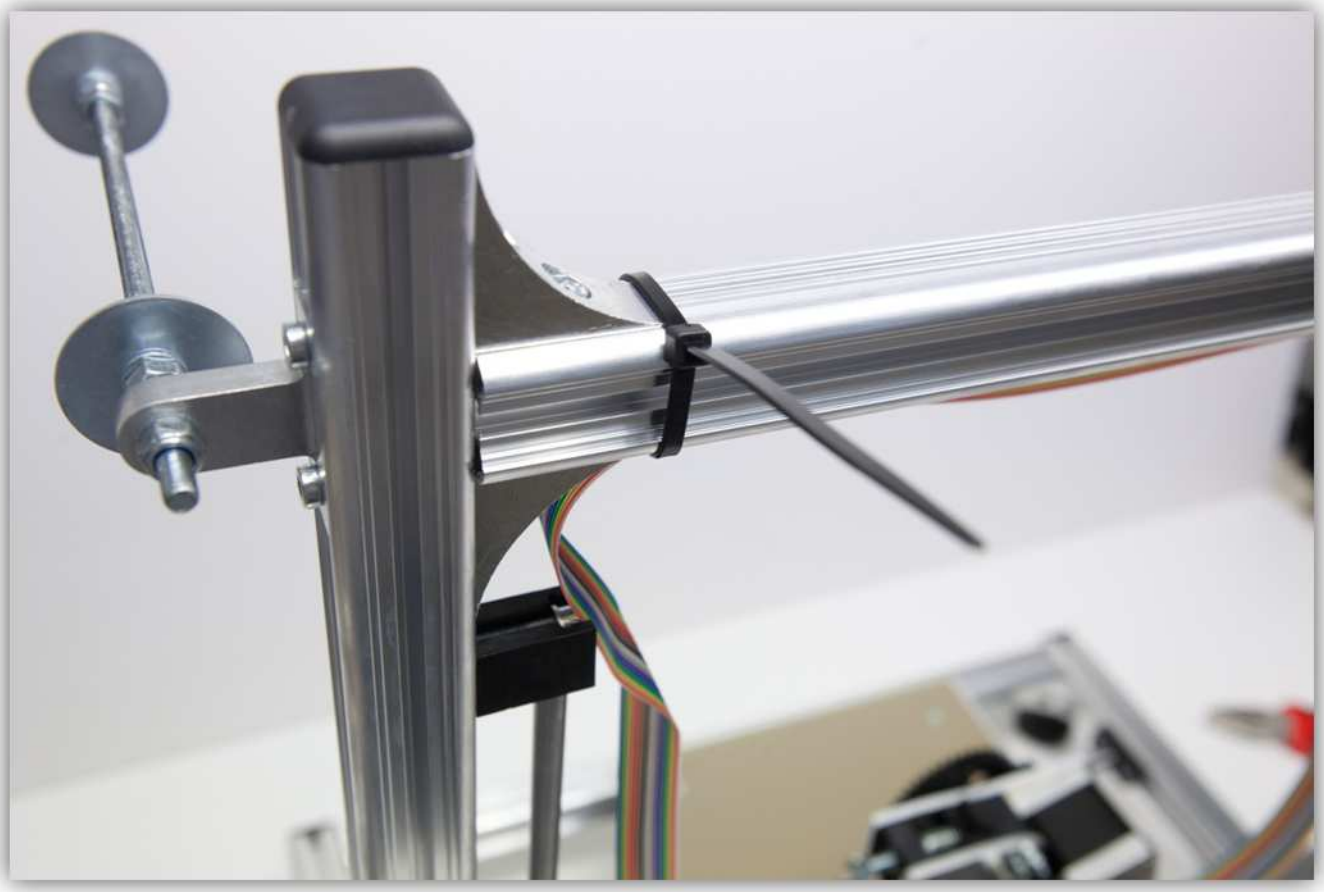
Secure the cable with a large tie strip (from the bag labelled with 40).



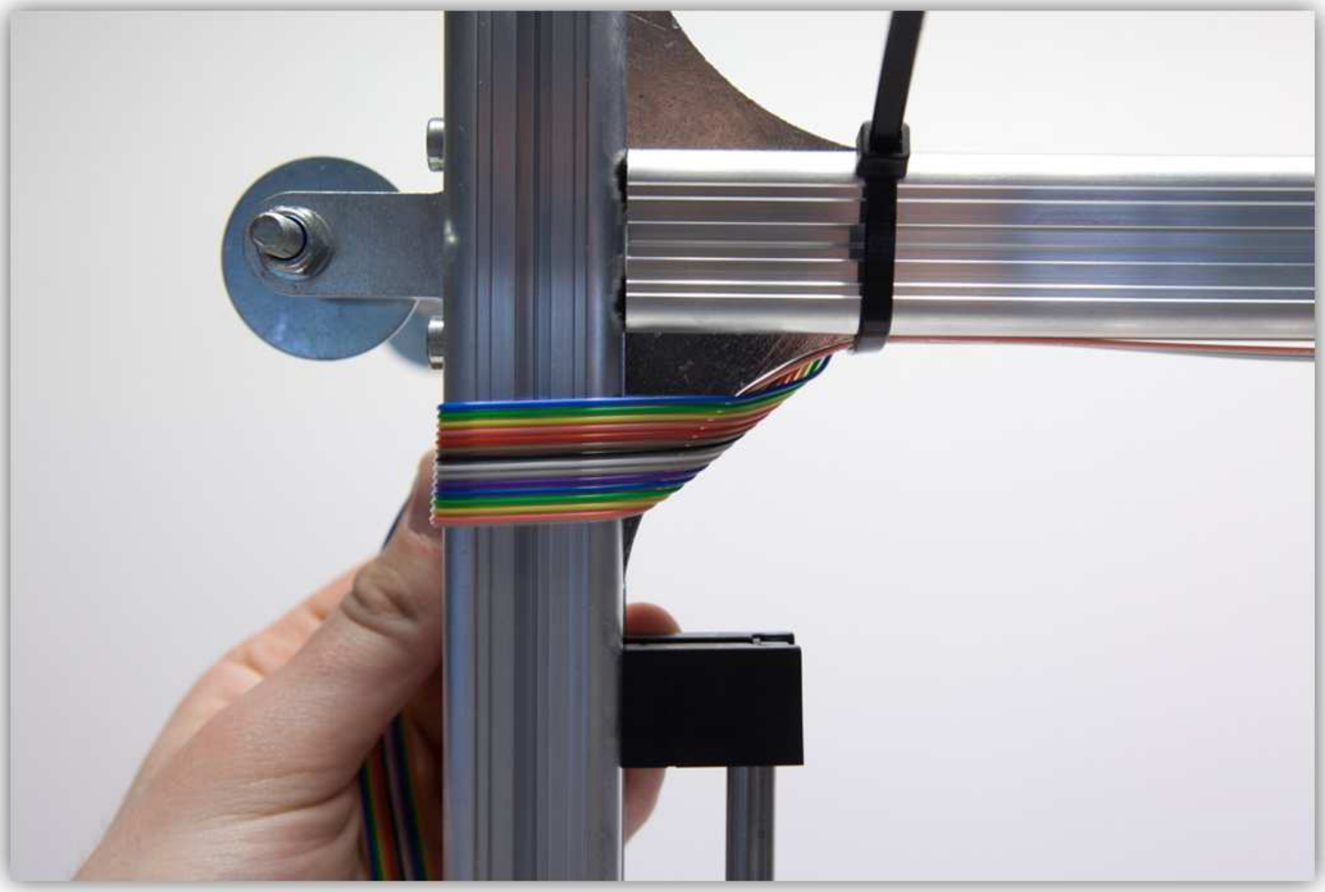
Make sure that the extruder arm is at its lowest point an then secure the cable to the horizontal profile at the top with a large tie-strip as shown in the picture. **Use only the length of cable needed, not more.**

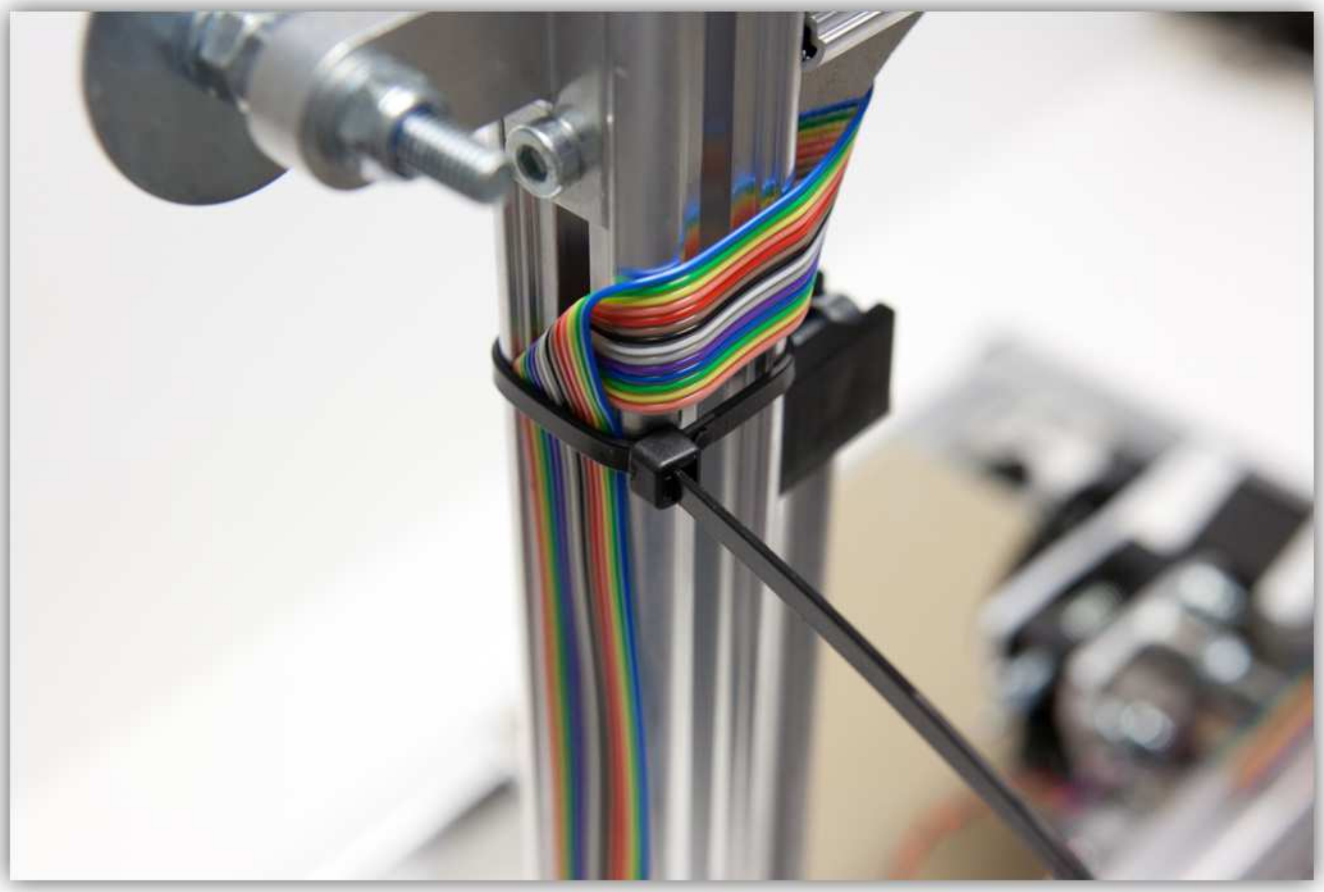


Next secure the cable with a large tie-strip next to the right upright profile.

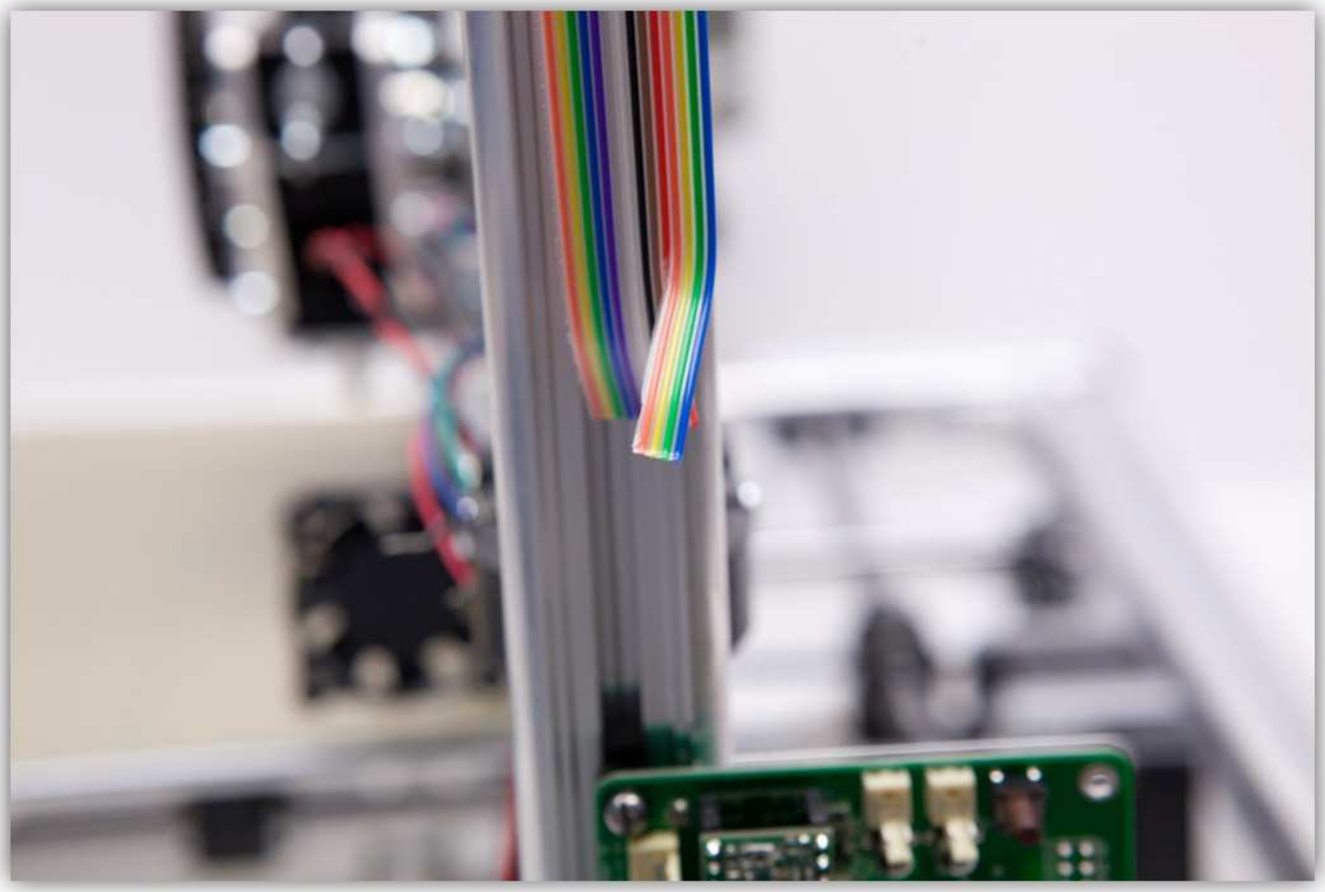


Fold the cable as shown in the pictures below and secure the cable with a large tie strip.

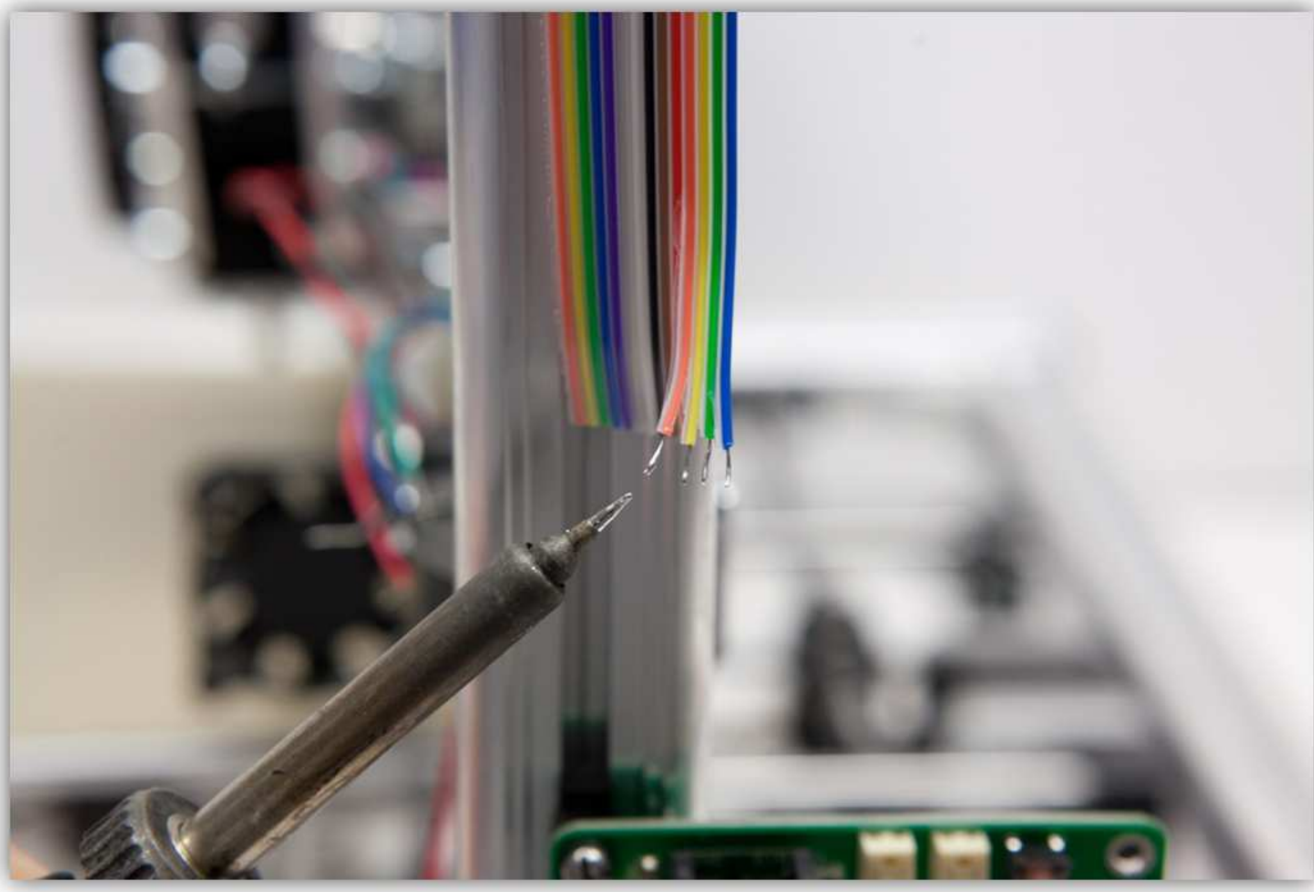




On this end of the cable detach (2 cm) (0.79") the **Blue, Green, Yellow, Orange** wires as a group.

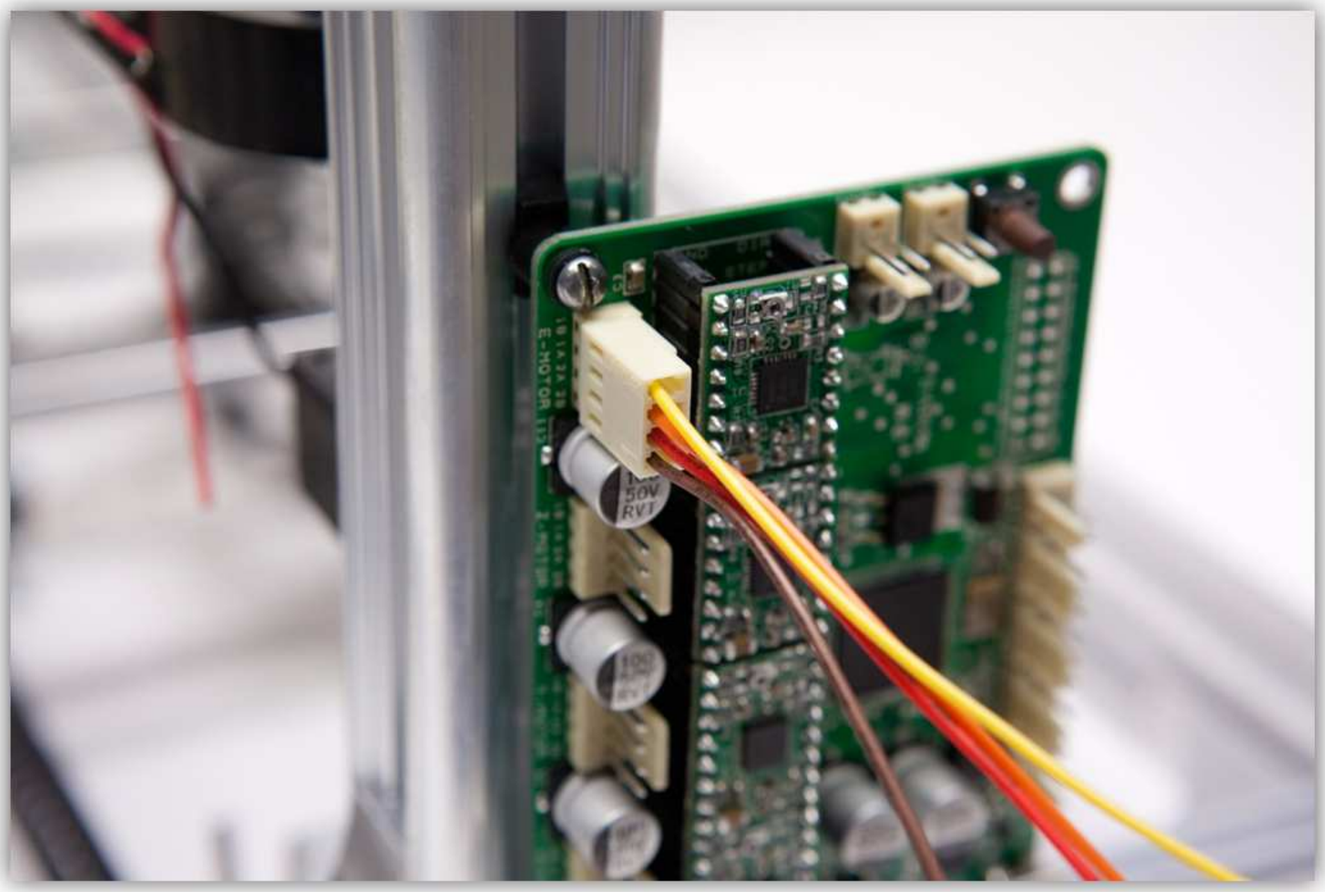


Strip the 4 wires (5 mm) (0.2") and tin them.



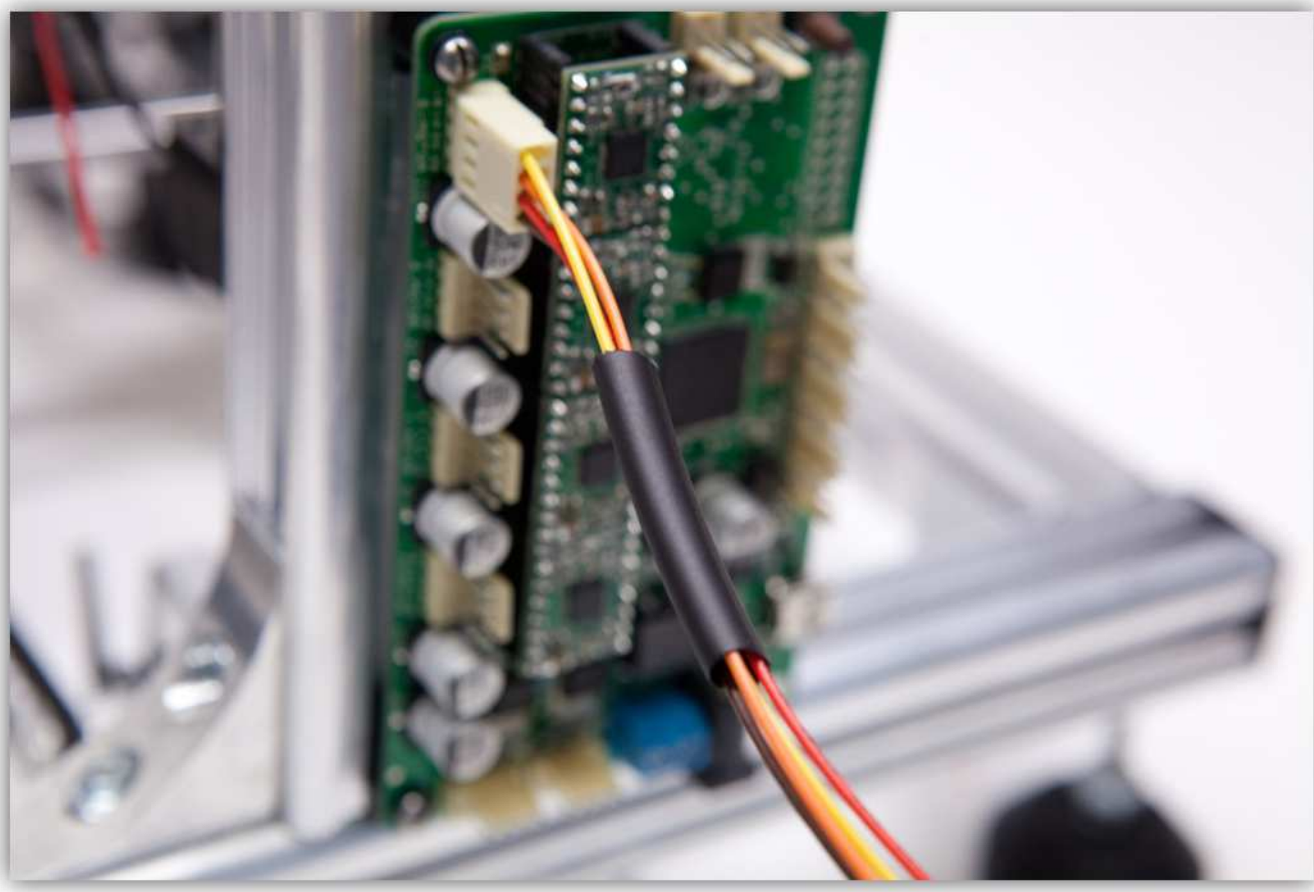
Take a board to wire connector with 4 wires out of the bag labelled with 40.

Plug the female connector in the male connector labelled with E-MOTOR on the controller board.

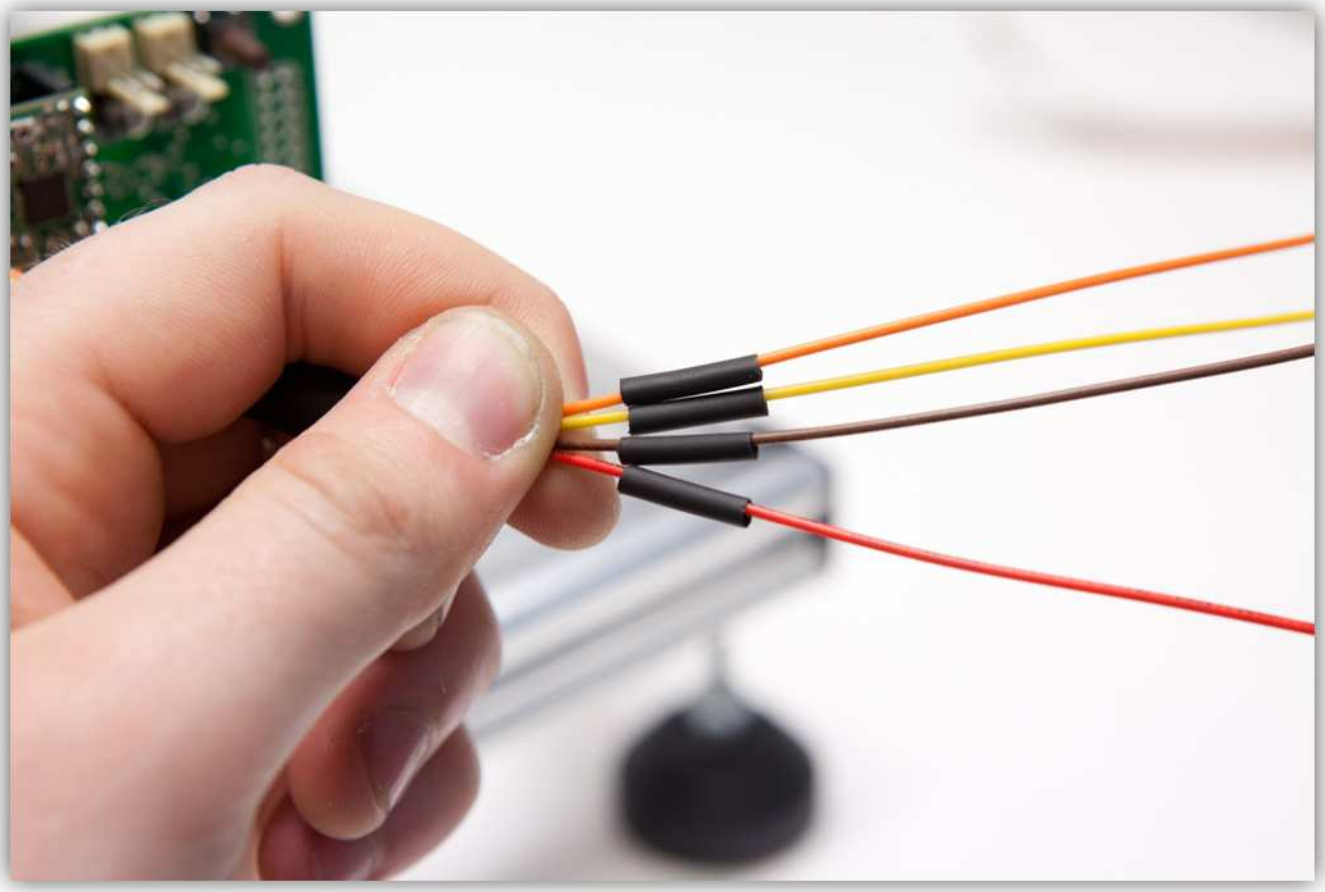


Cut 4 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the biggest piece of heat shrink tubing over the 4 wires from the connector.

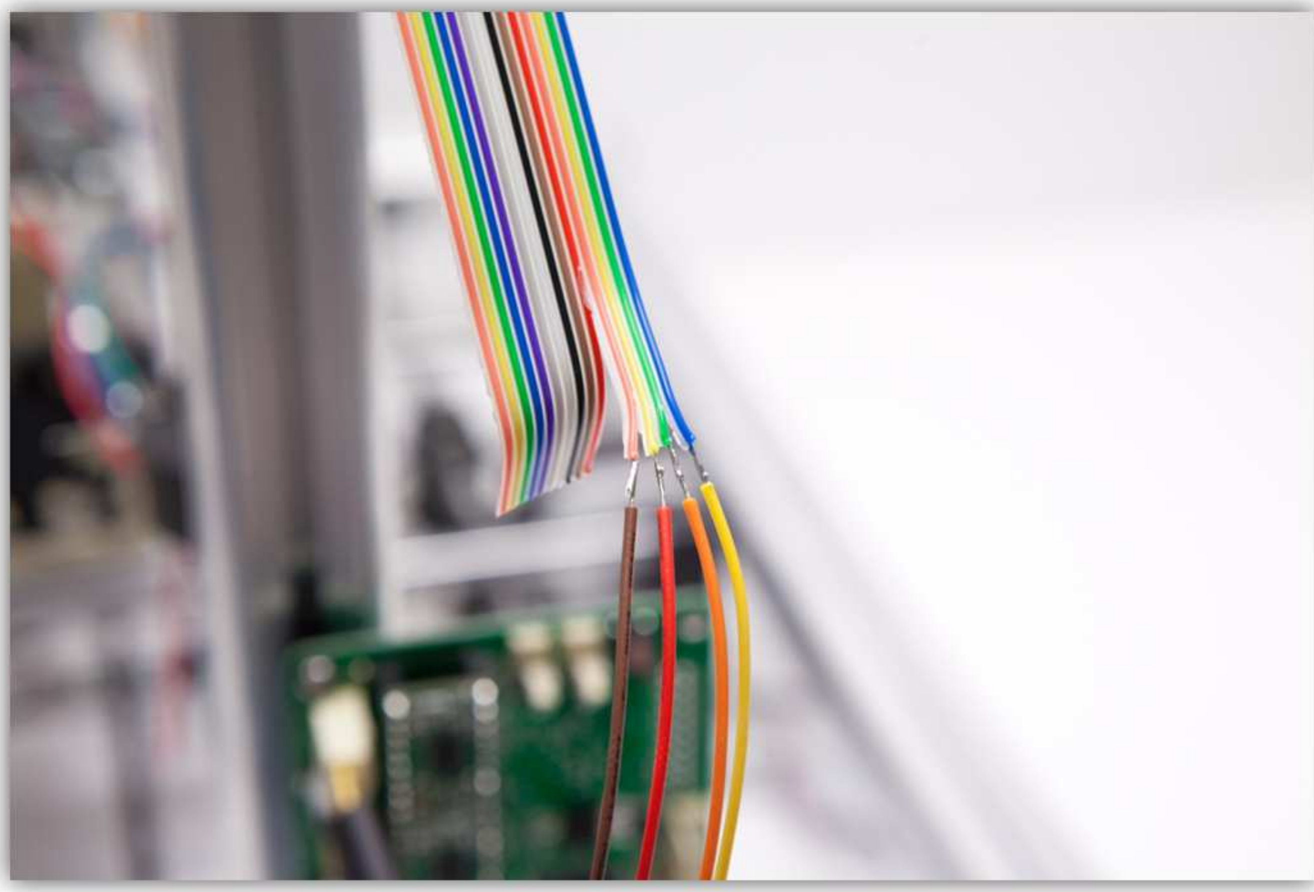


Slide the 4 small pieces of heat shrink tubing over the 4 wires of the connector.

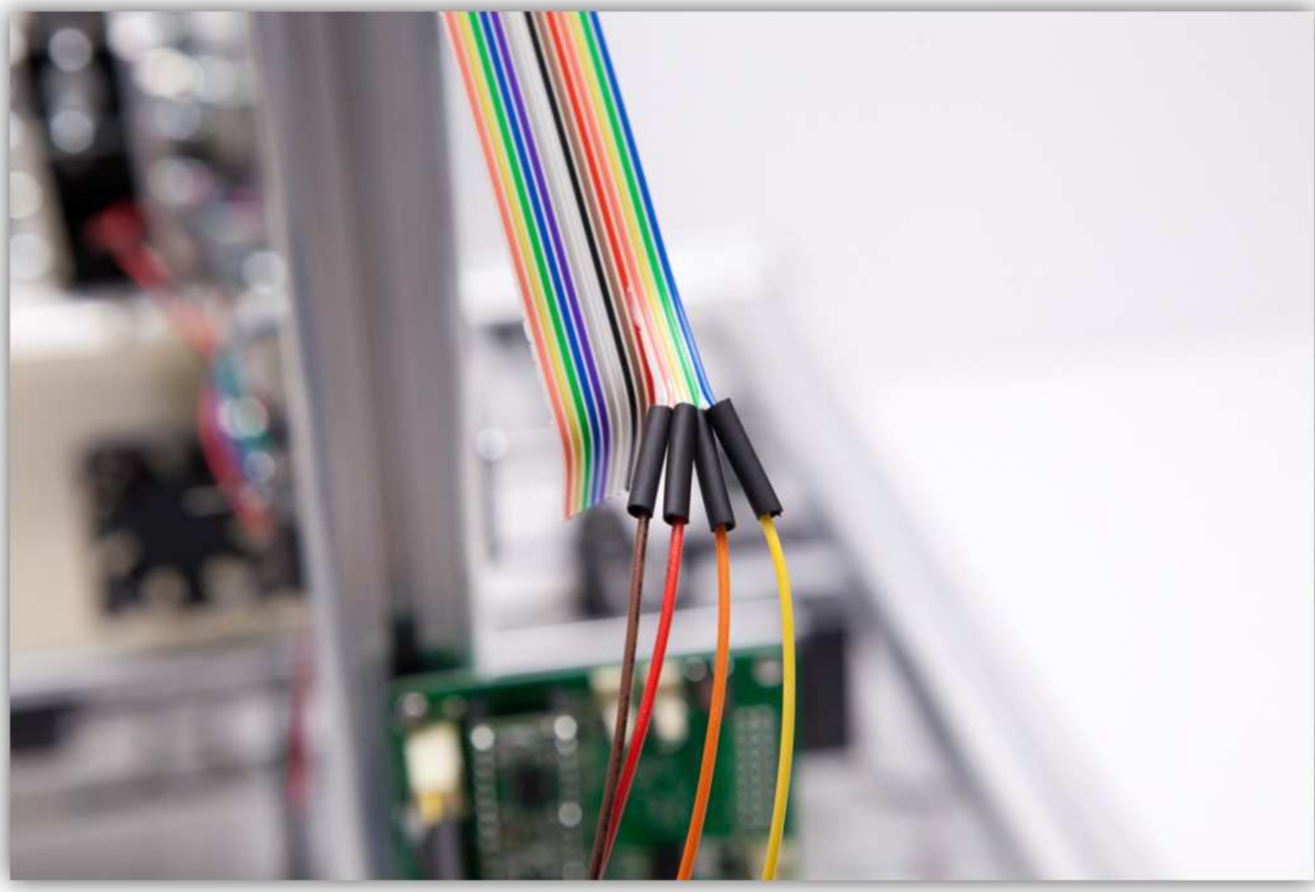


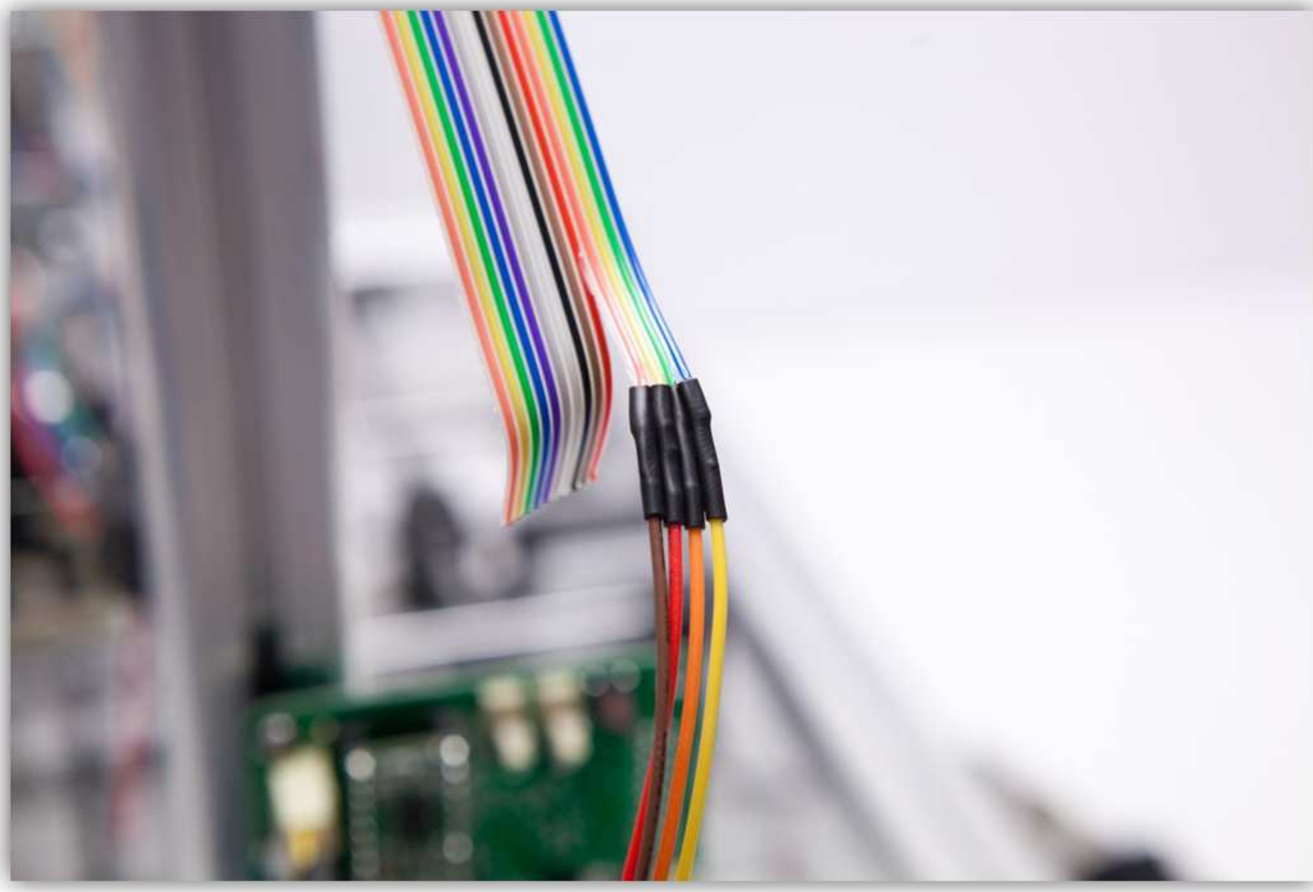
Solder the 4 wires from the connector to the 4 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	->	Connector wires
Blue	->	Yellow
Green	->	Orange
Yellow	->	Red
Orange	->	Brown

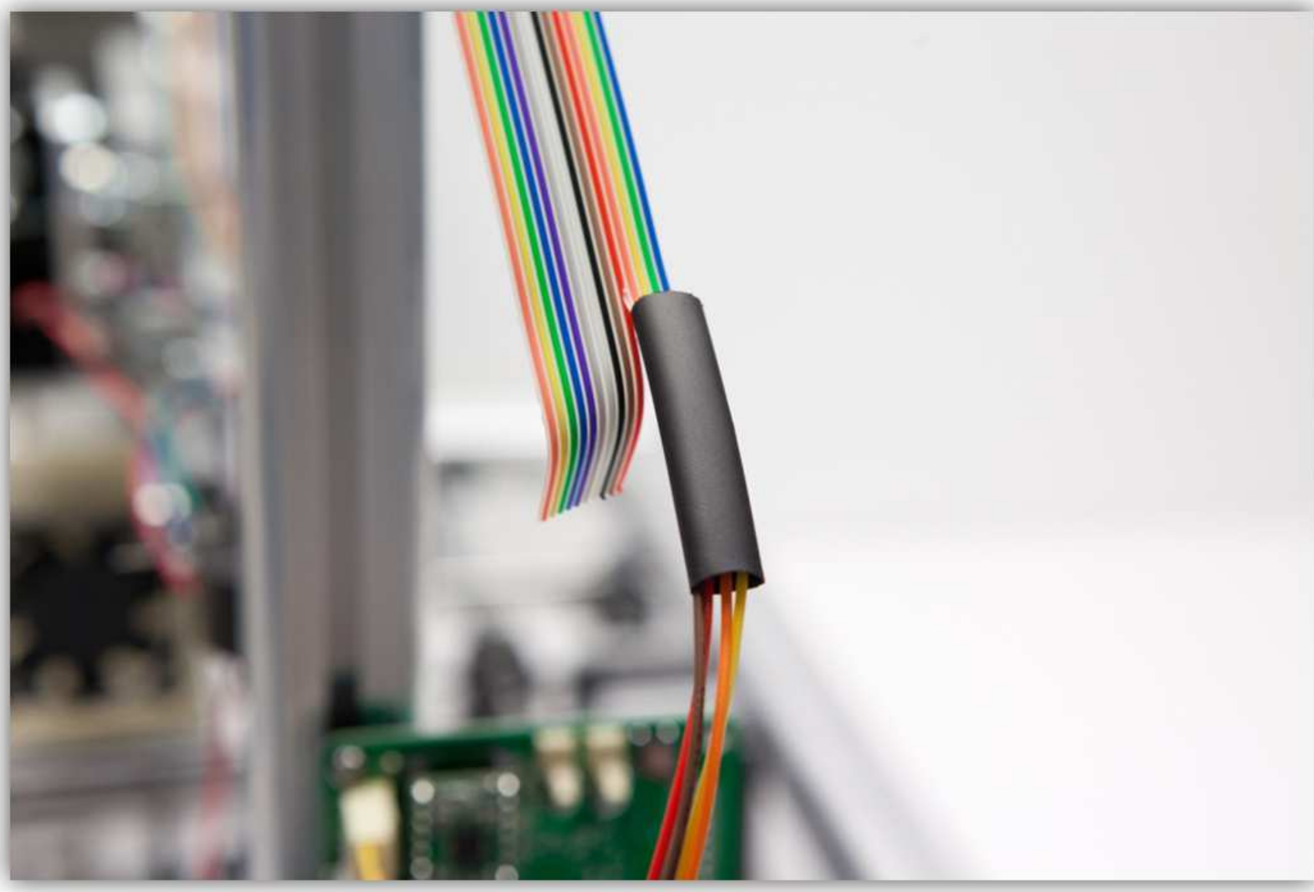


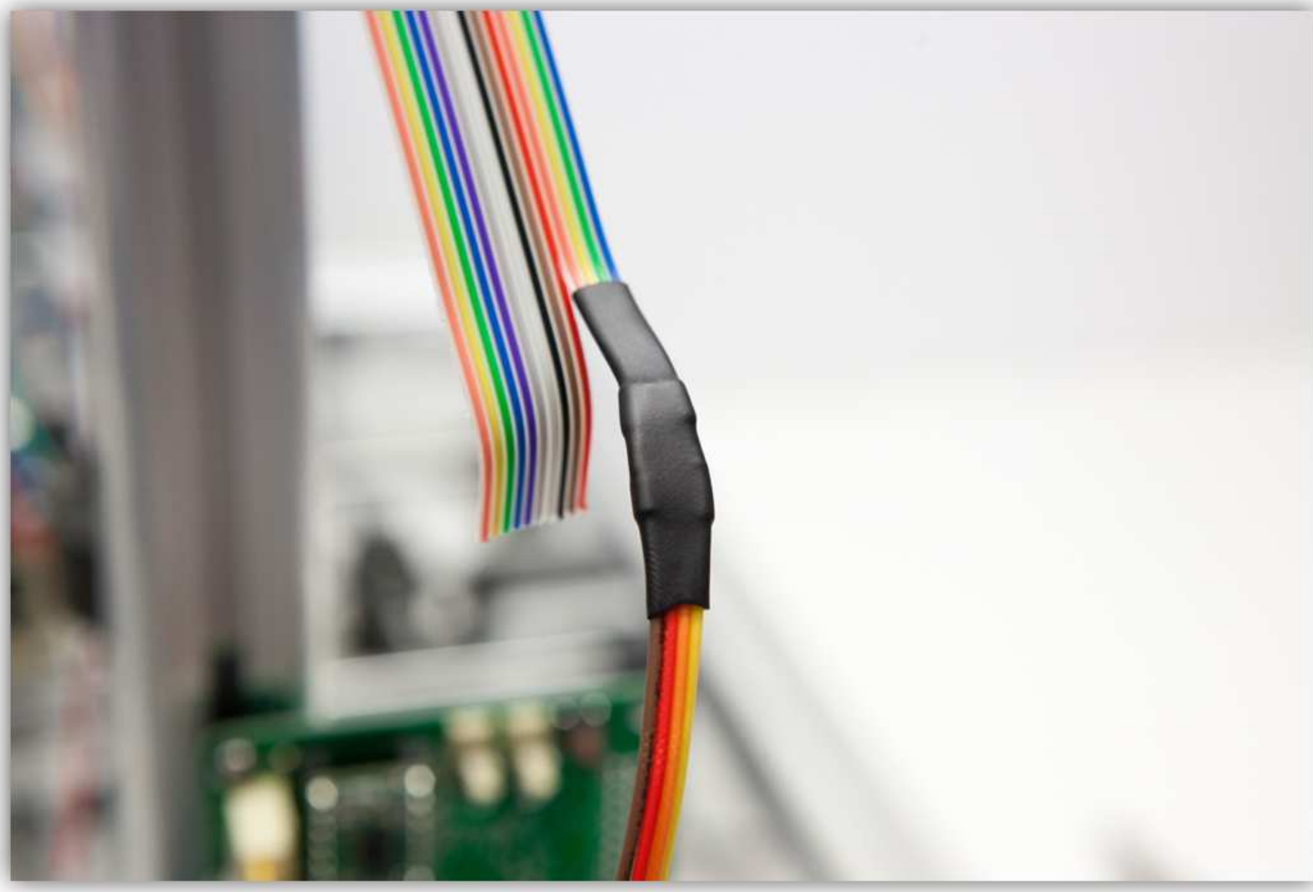
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.





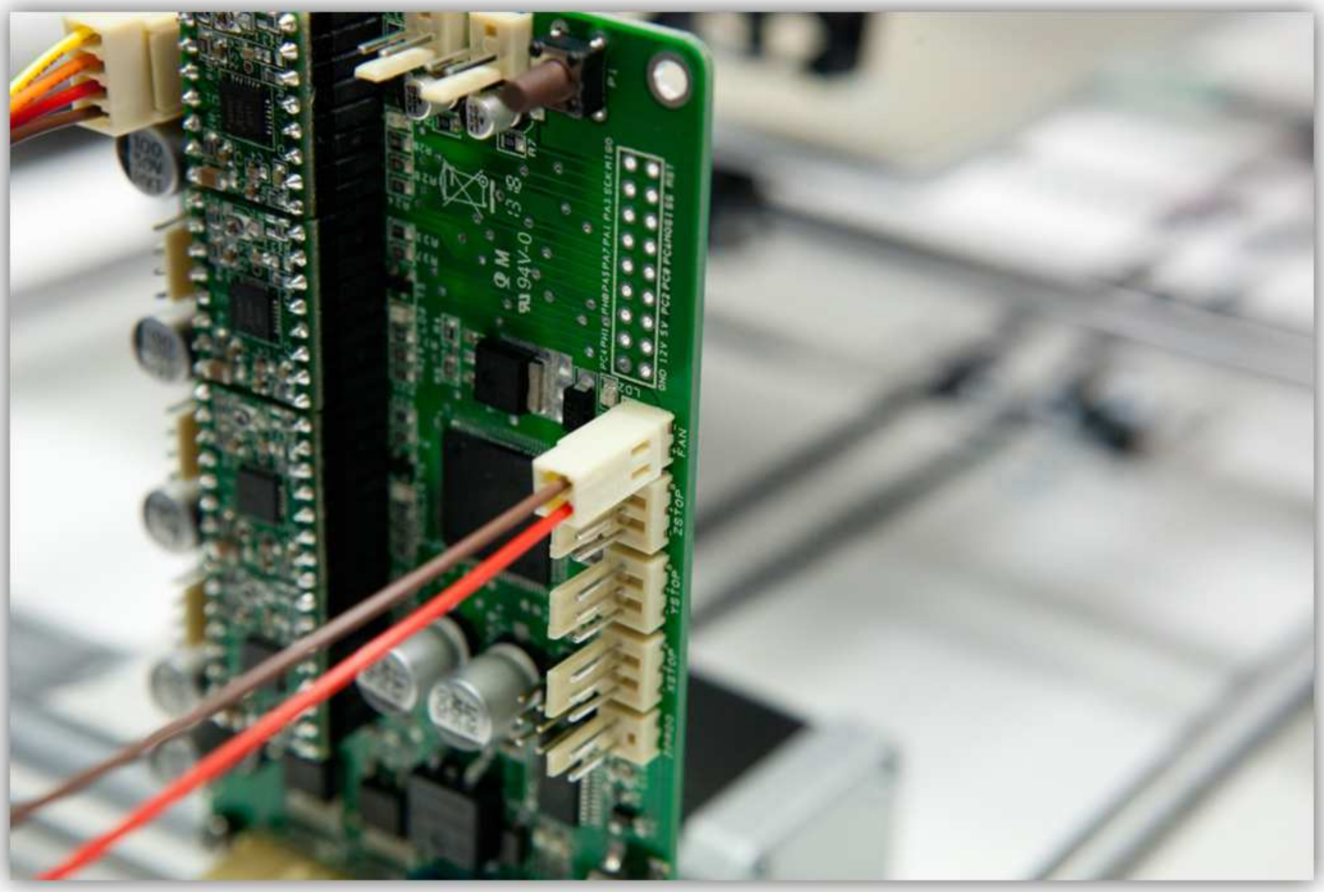
Now slide the big piece of heat shrink tubing over the 4 small pieces, heat the big piece so it covers and protects the 4 heat shrunk joints.



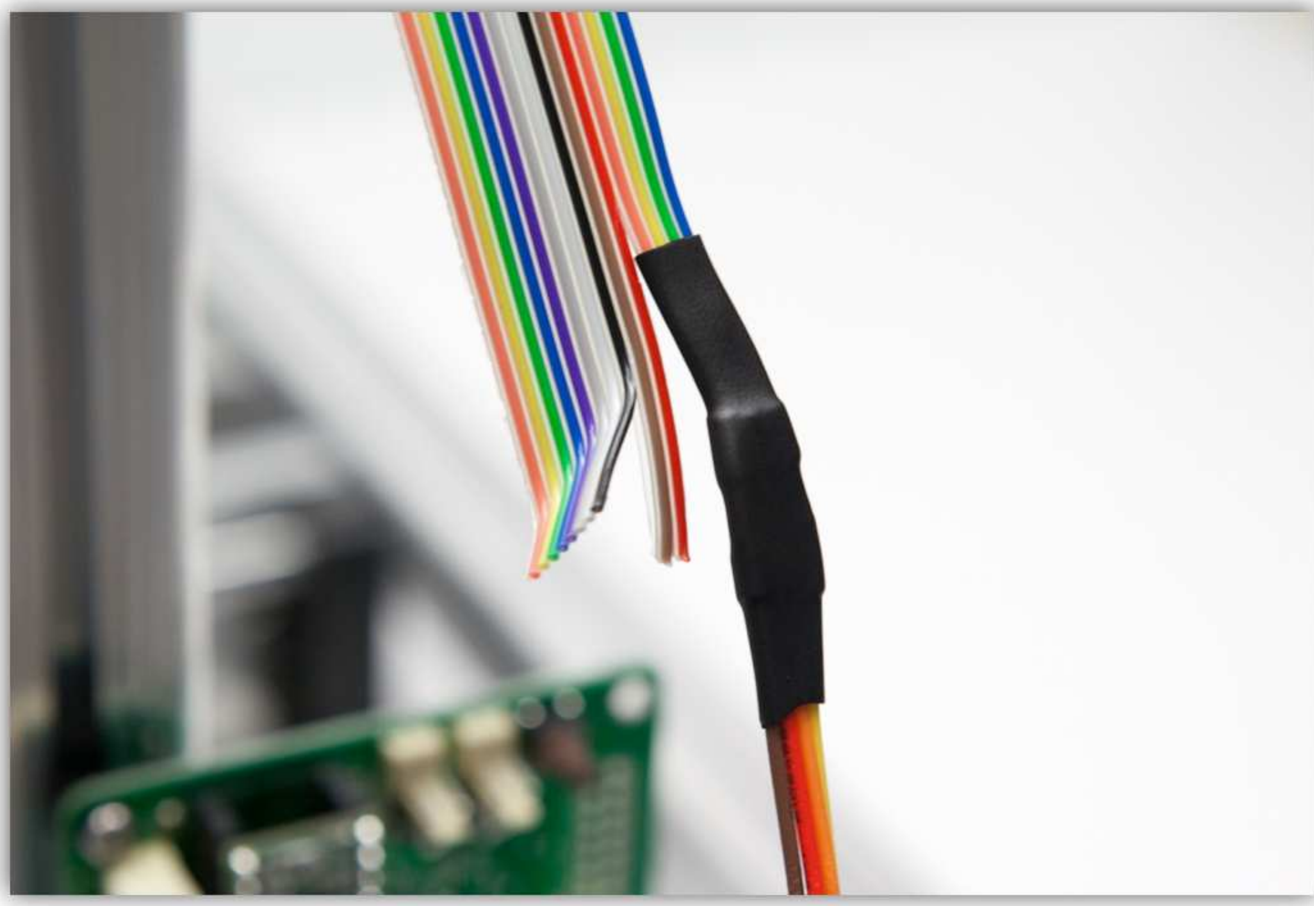


Take a board to wire connector with 2 wires out of the bag labelled with 40.

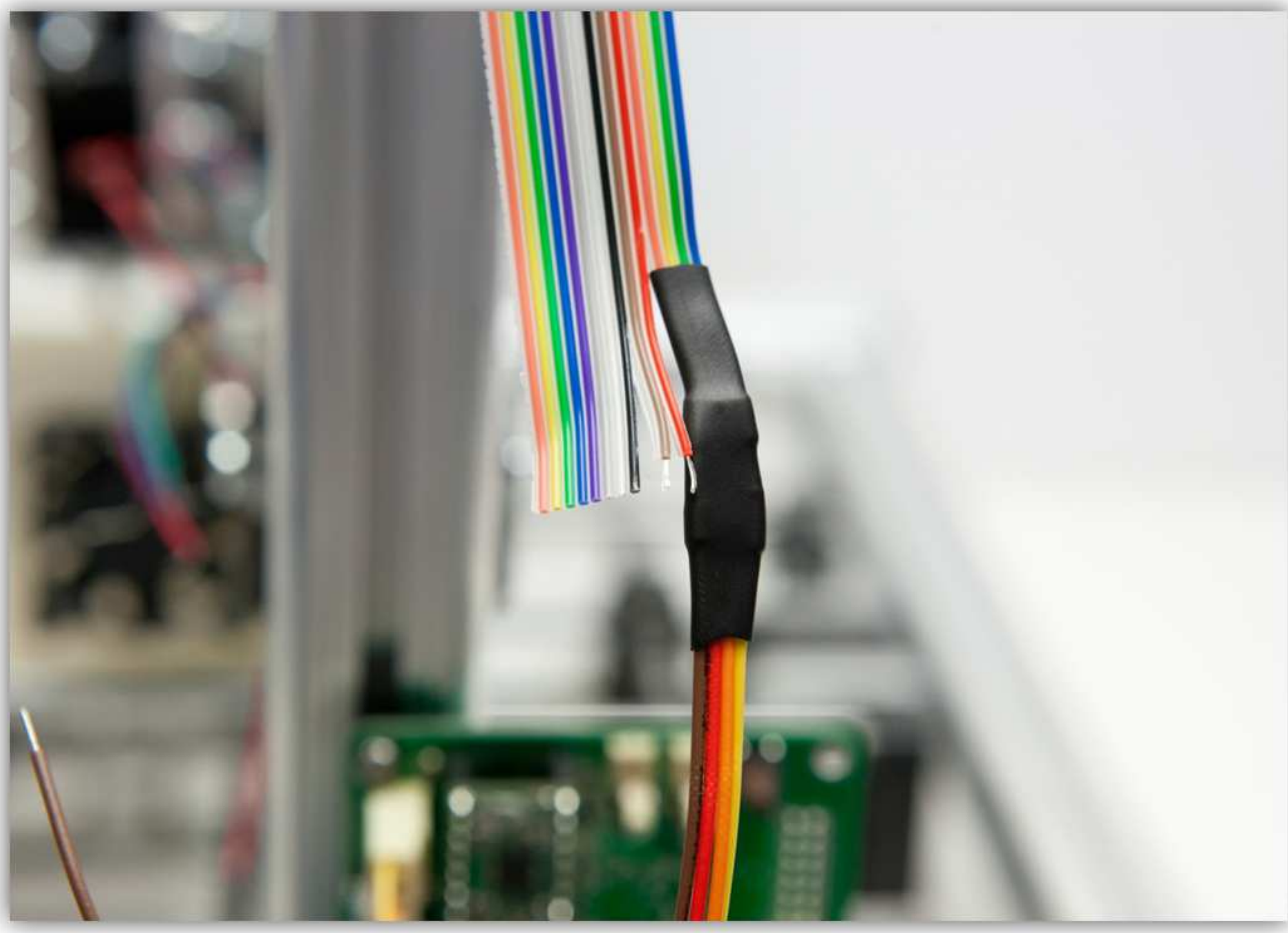
Plug the female connector in the male connector labelled with FAN on the controller board.

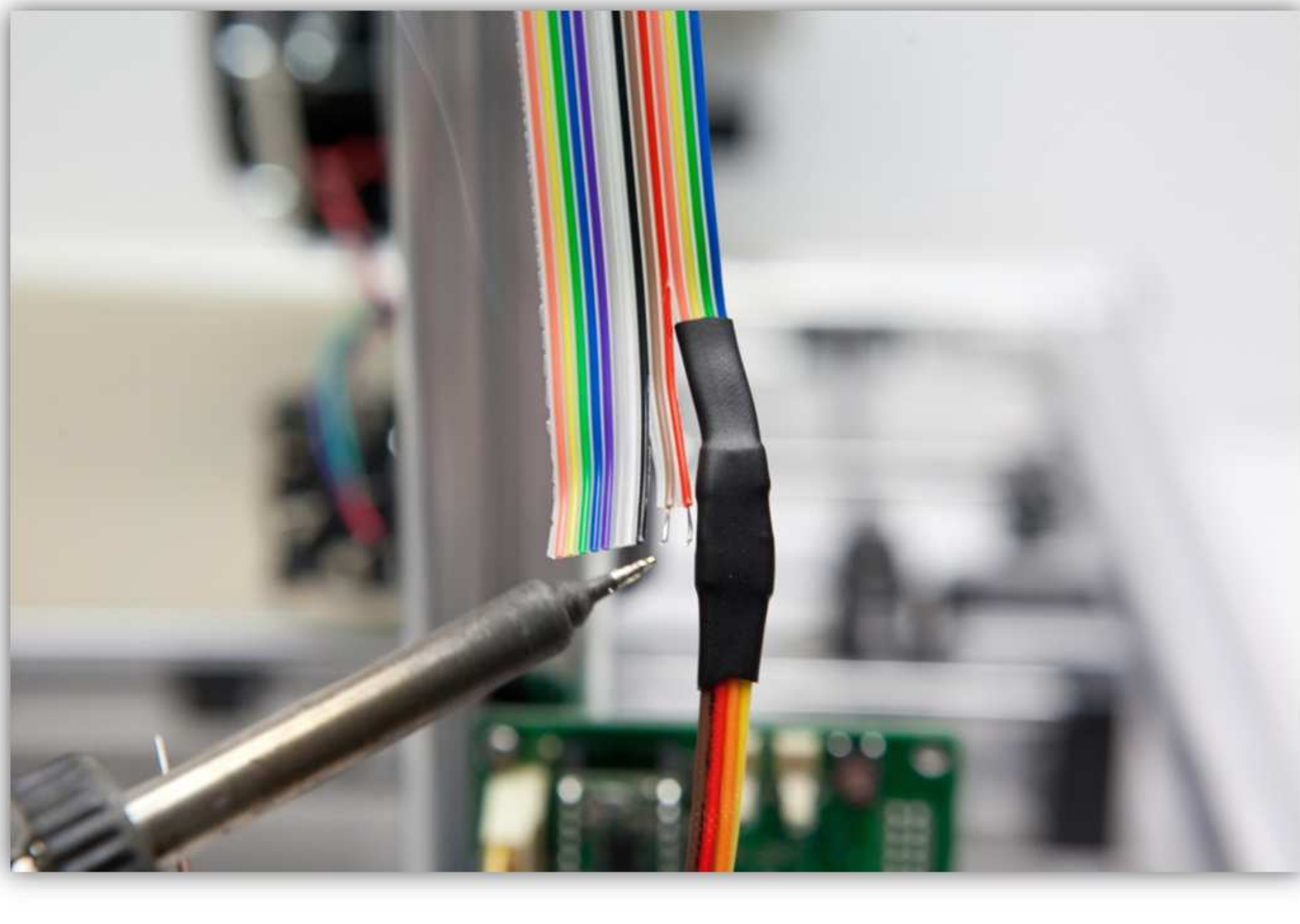


Detach (2 cm) the **Red** and **Brown** wires from the flat cable as a group.



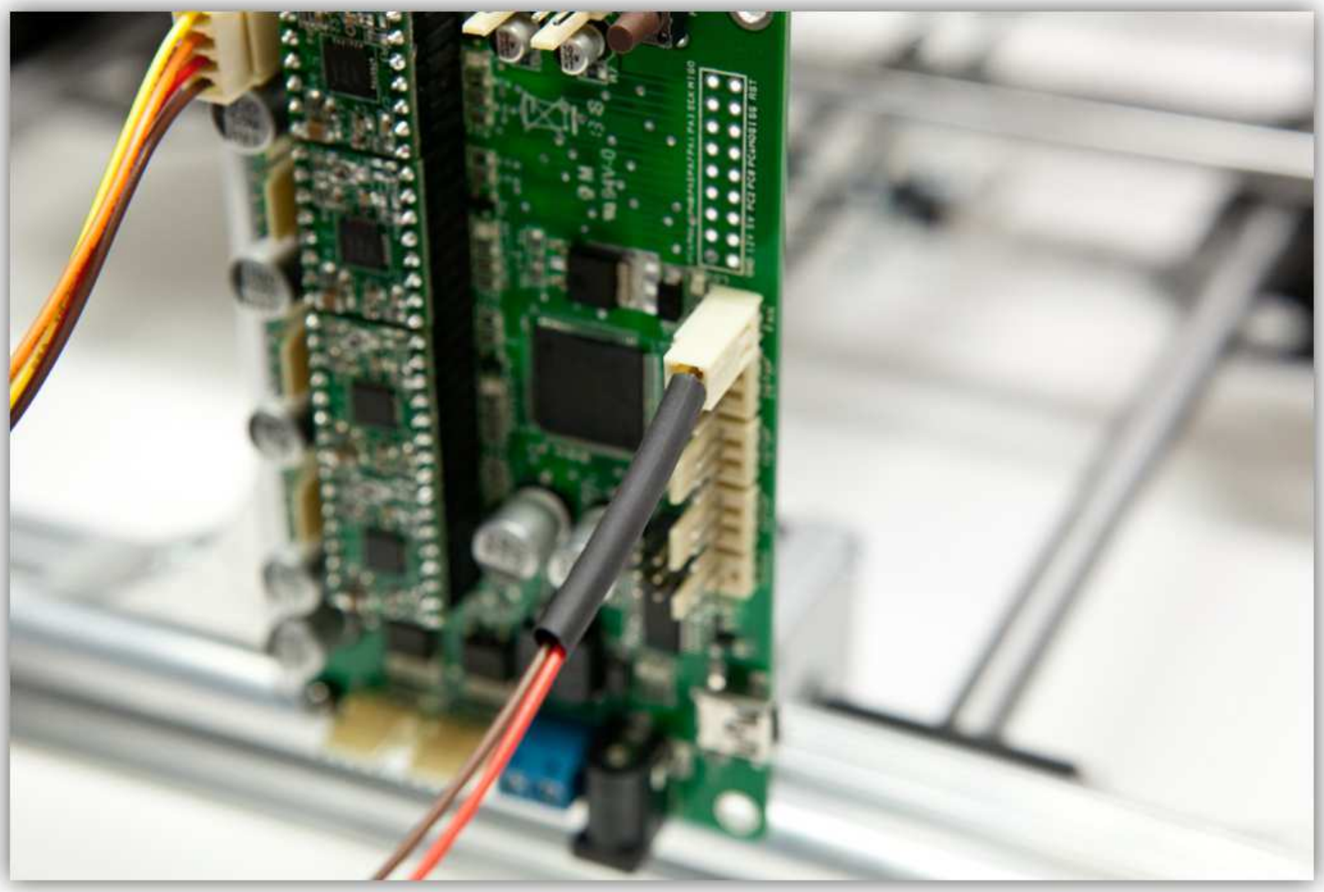
Strip and tin these two wires.



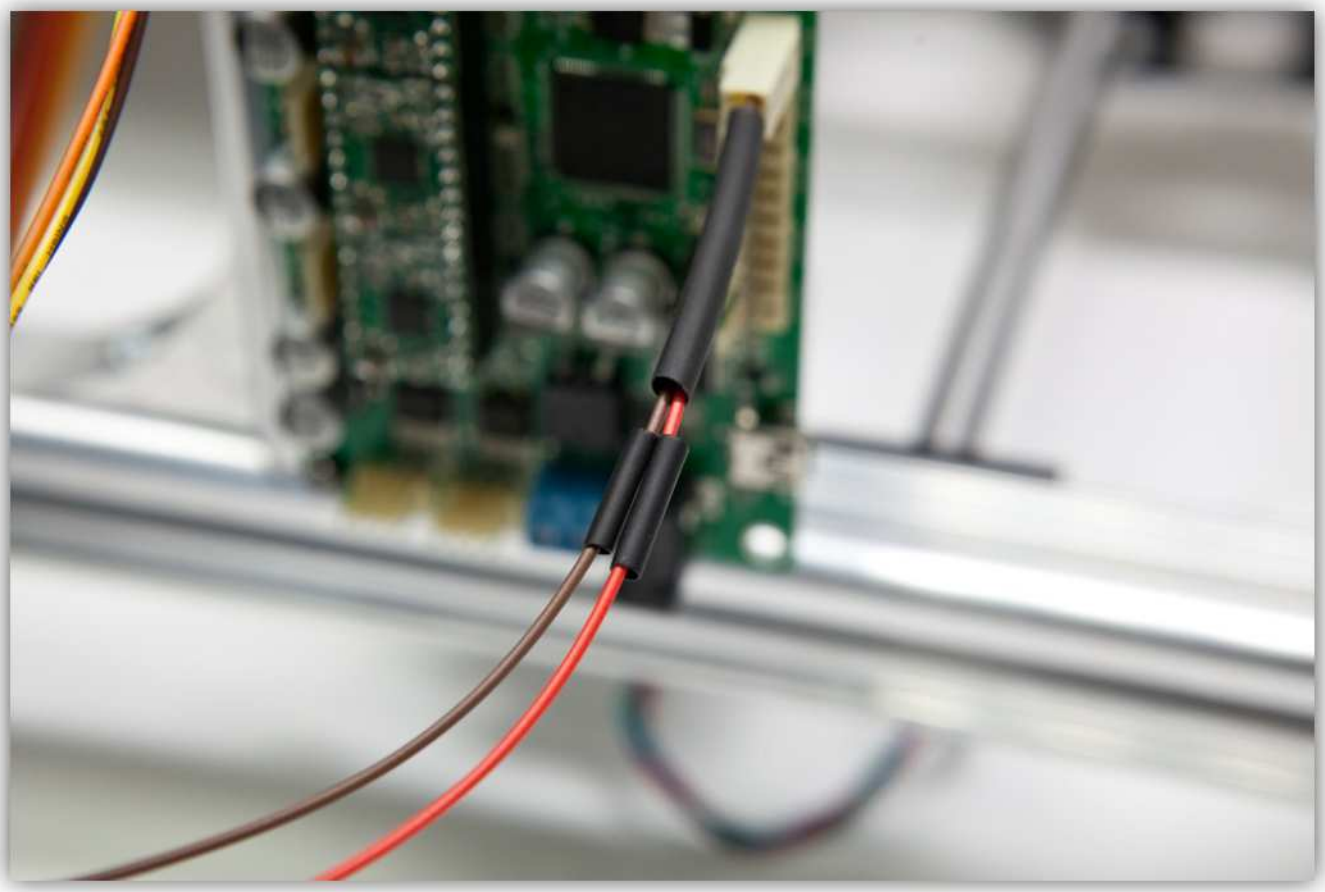


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the medium size heat shrink tubes over the 2 wires of the connector.



Slide the 2 small heat shrink tubes over the 2 wires of the connector.

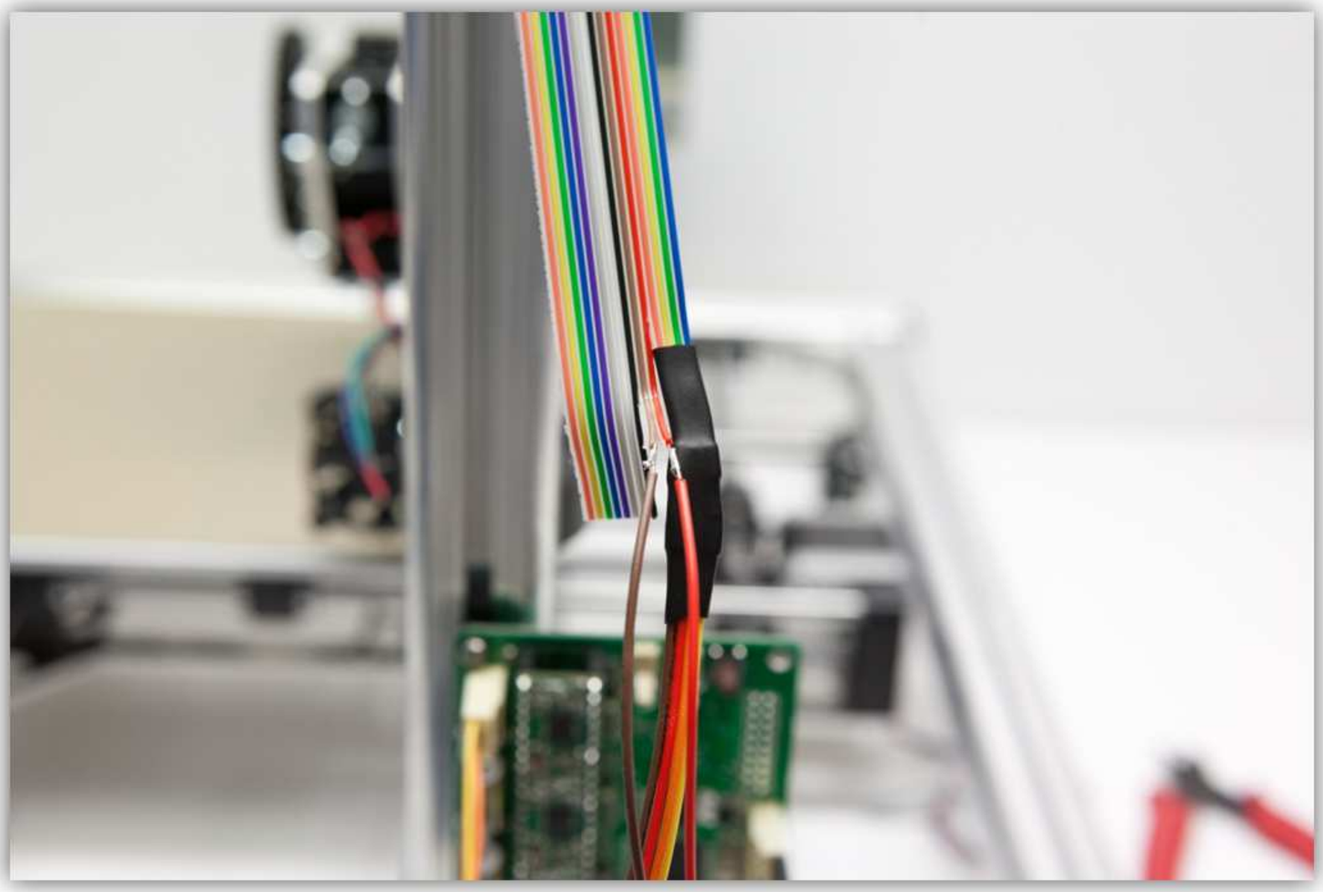


Solder the 2 wires from the connector to the 2 wires of the flat cable you tinned earlier. **Watch the colours closely.**

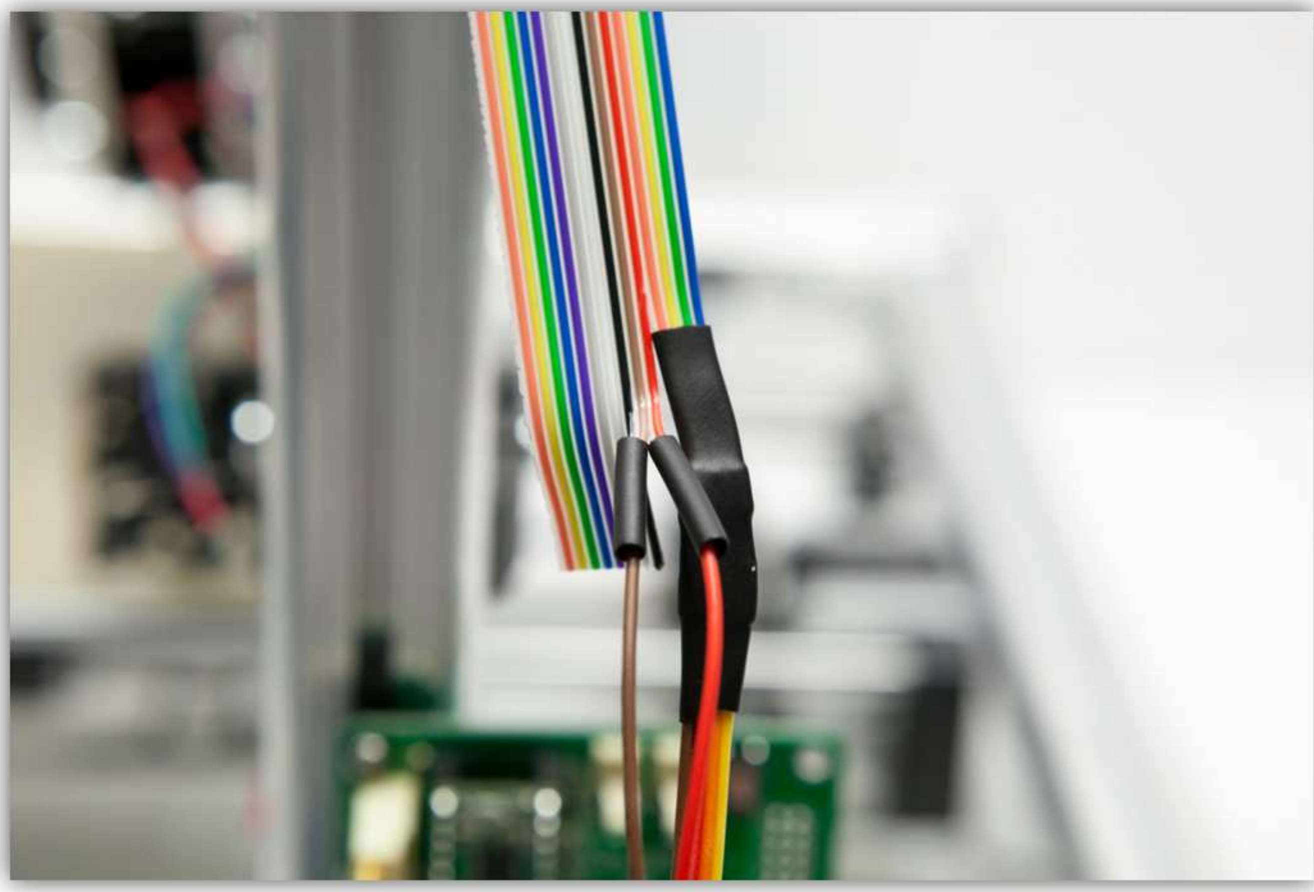
Flat cable -> Connector wires

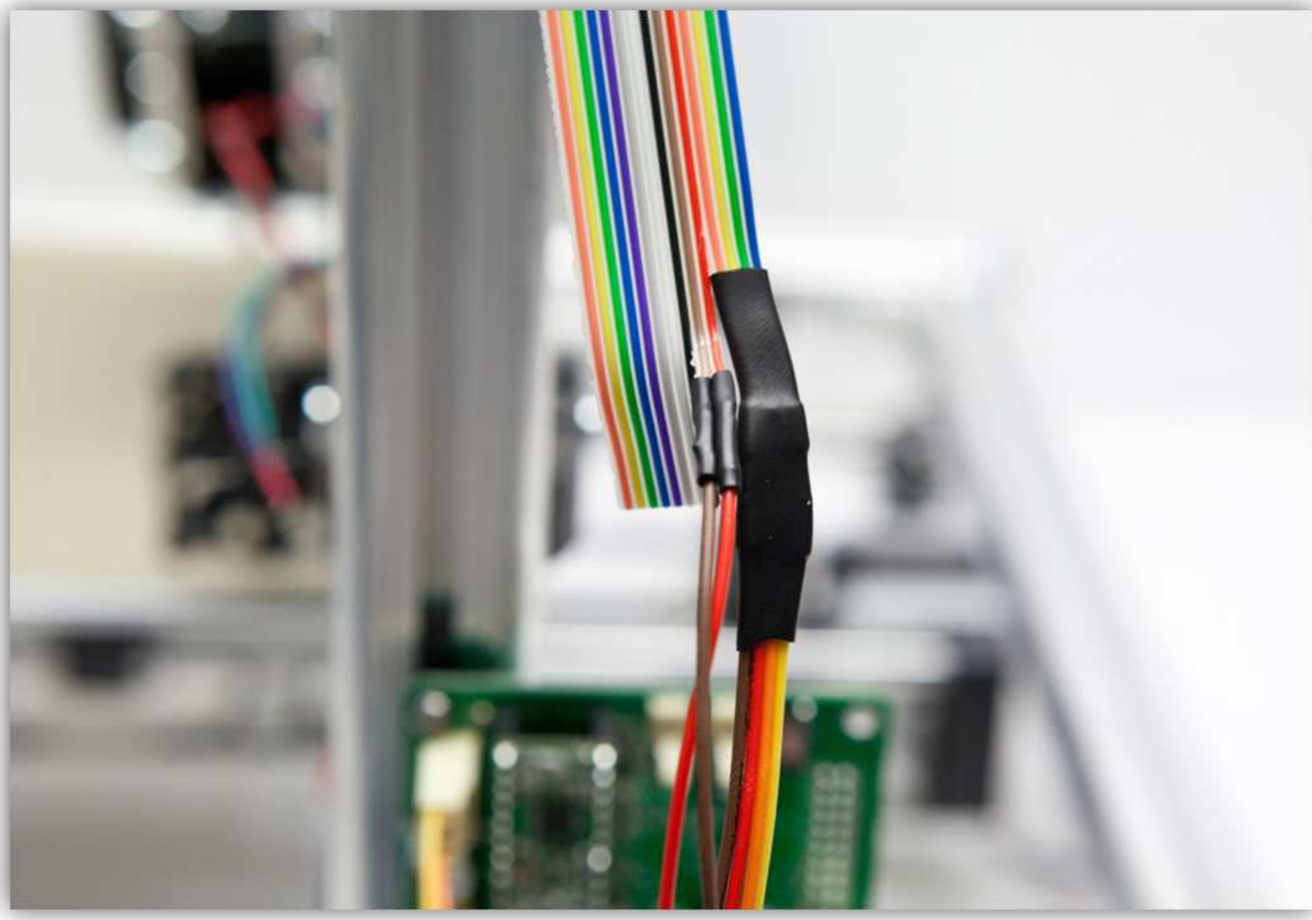
Red -> Red

Brown -> Brown

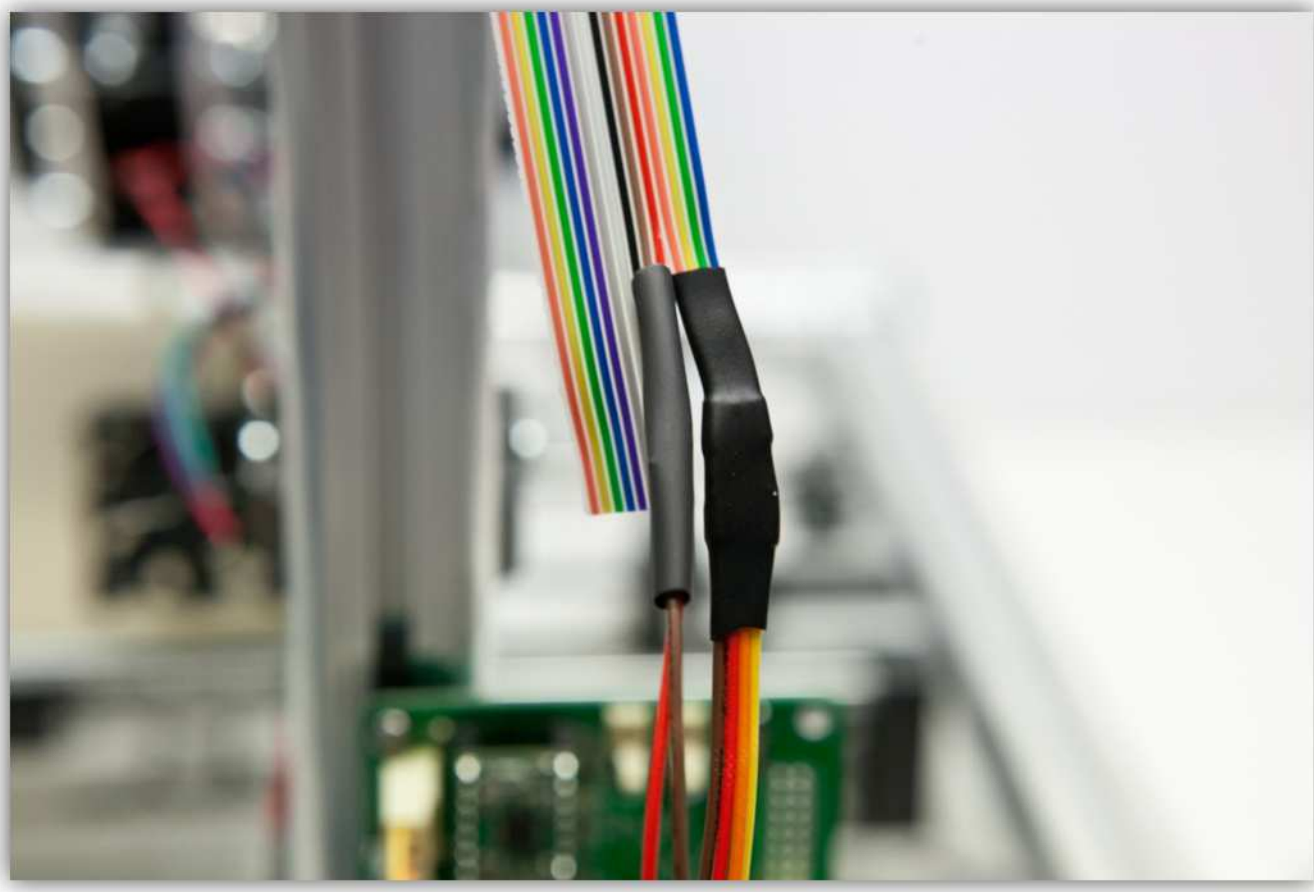


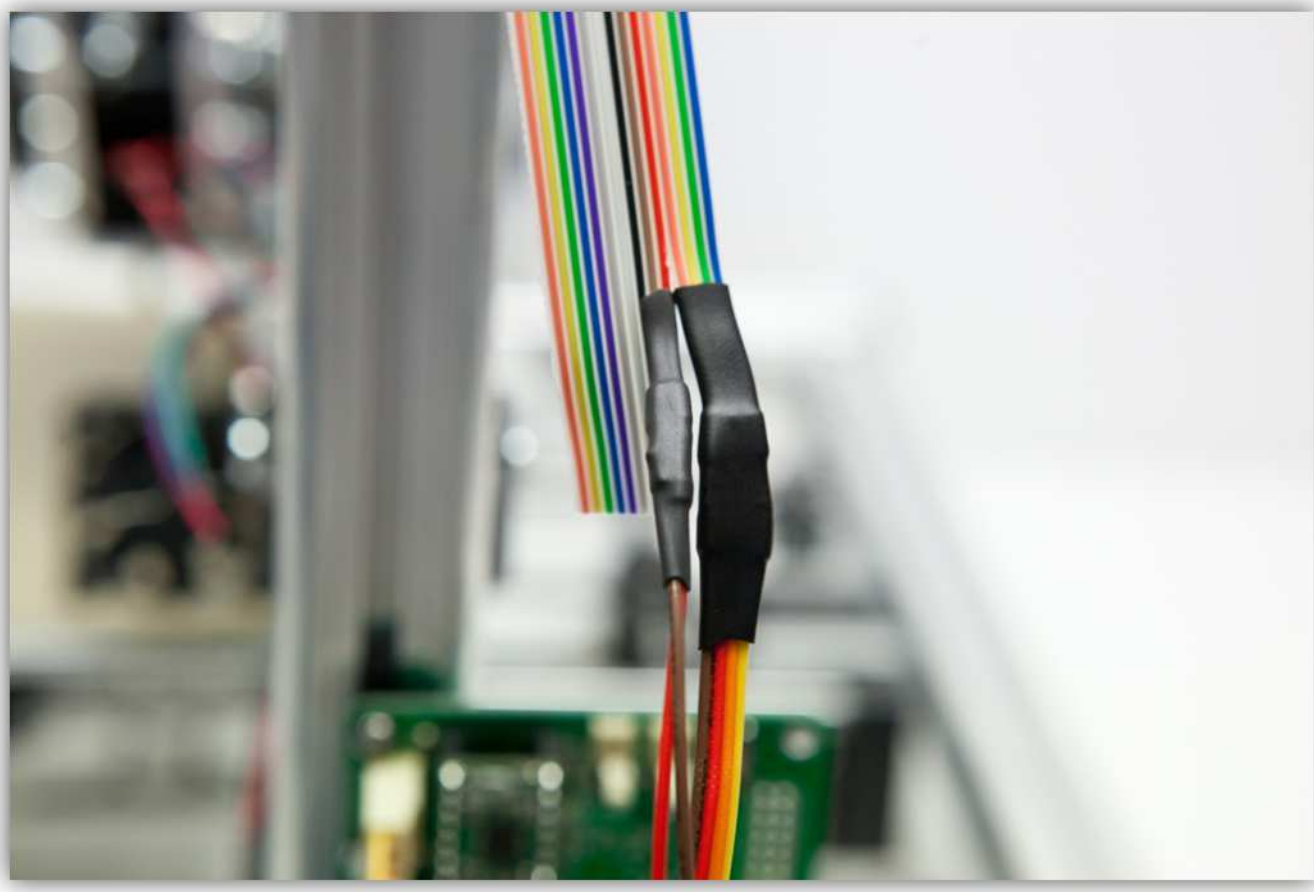
Slide the 2 small heat shrink tubes over the solder joints and heat them up.



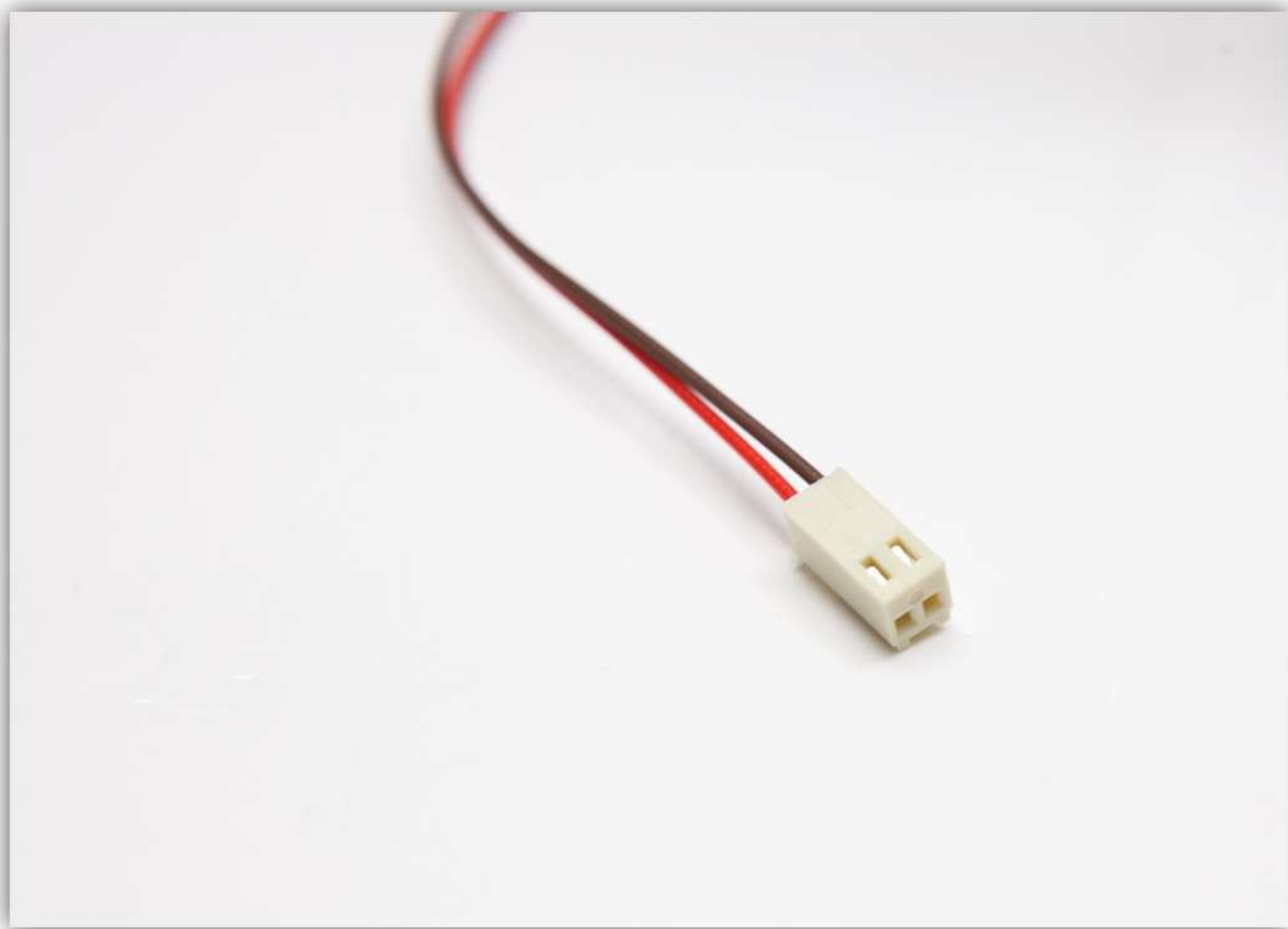


Now slide the medium size piece of heat shrink tubing over the 2 small pieces, heat the medium size piece so it covers and protects the 2 heat shrunk joints.

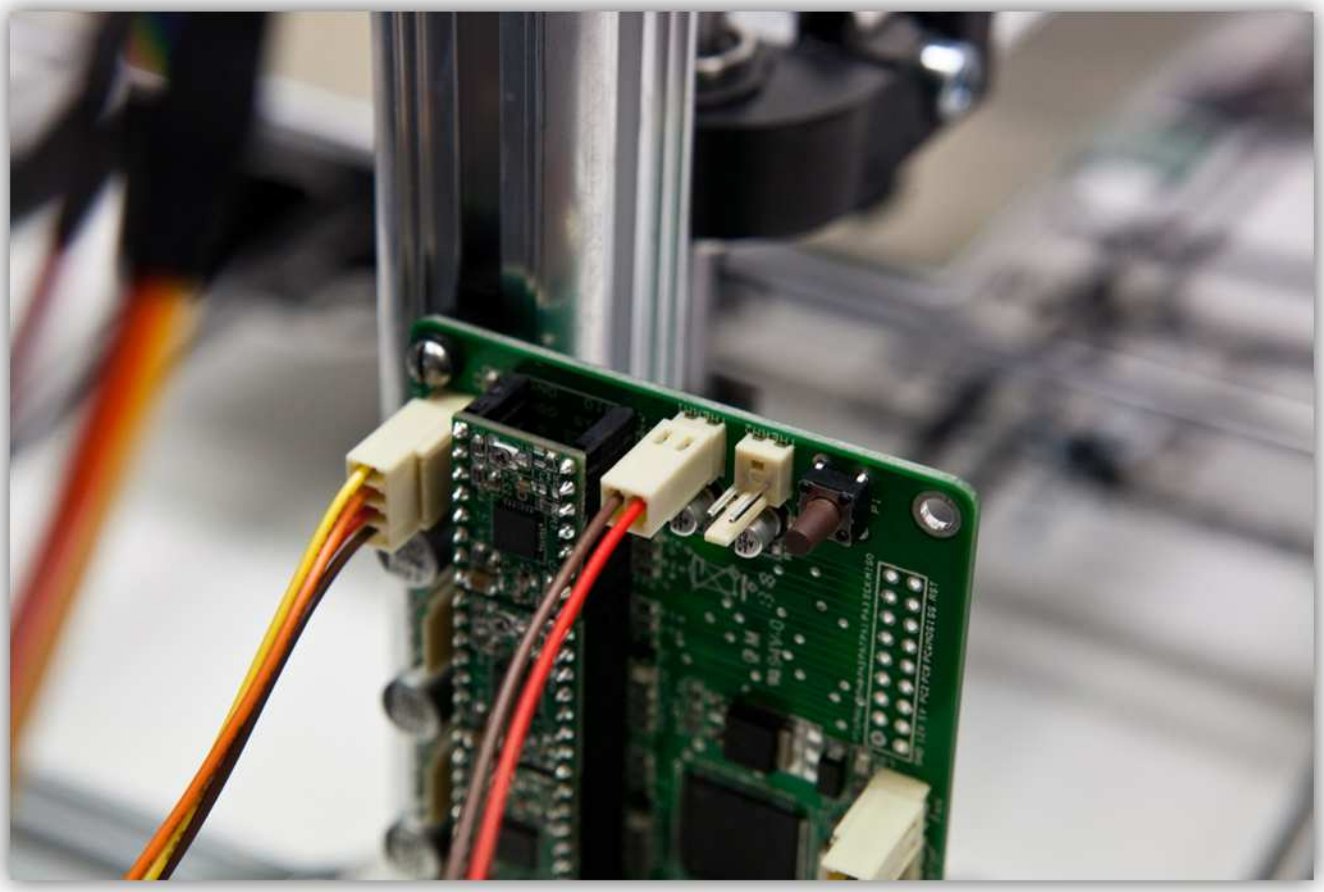




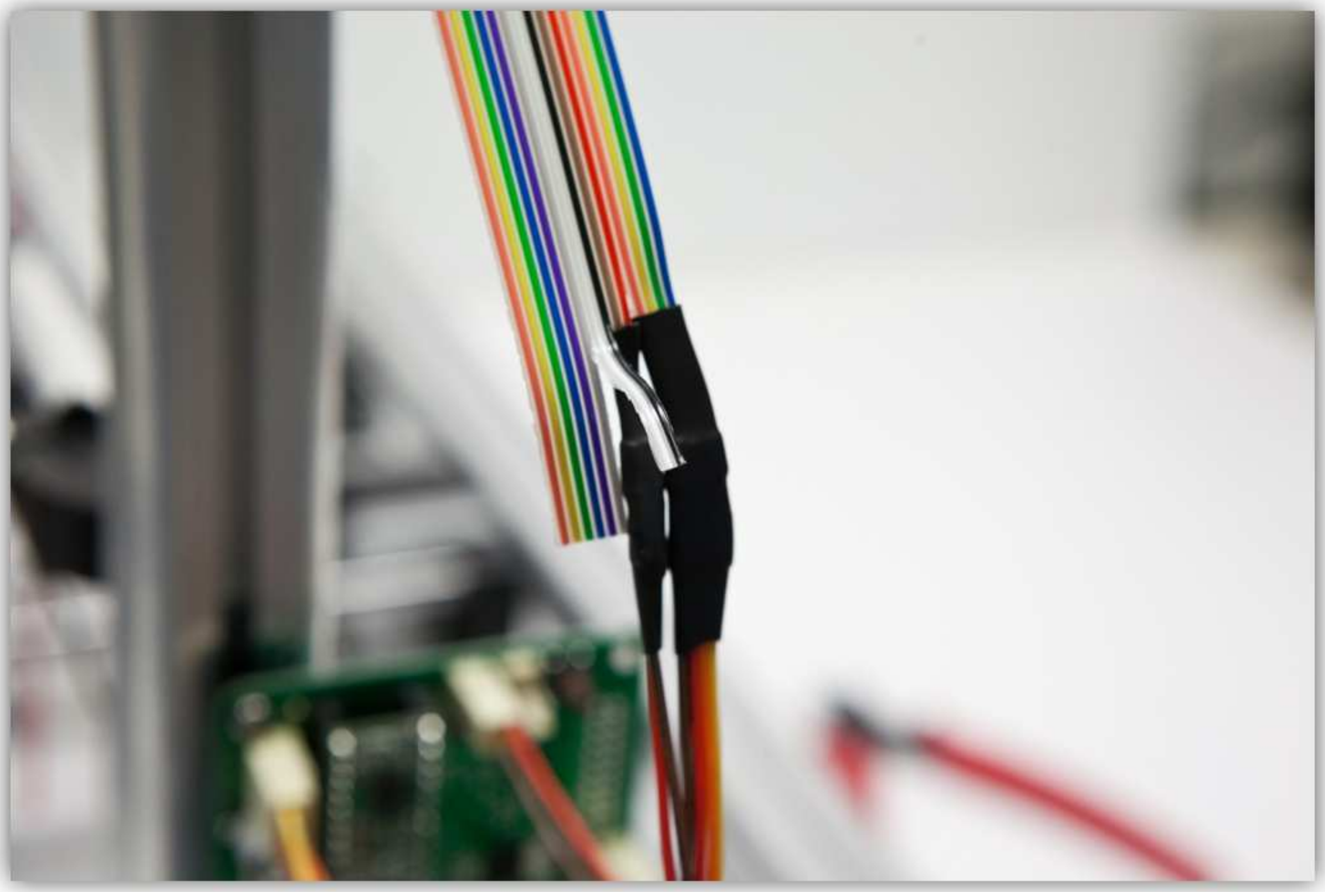
Take a board to wire connector with 2 wires out of the bag labelled with 40.



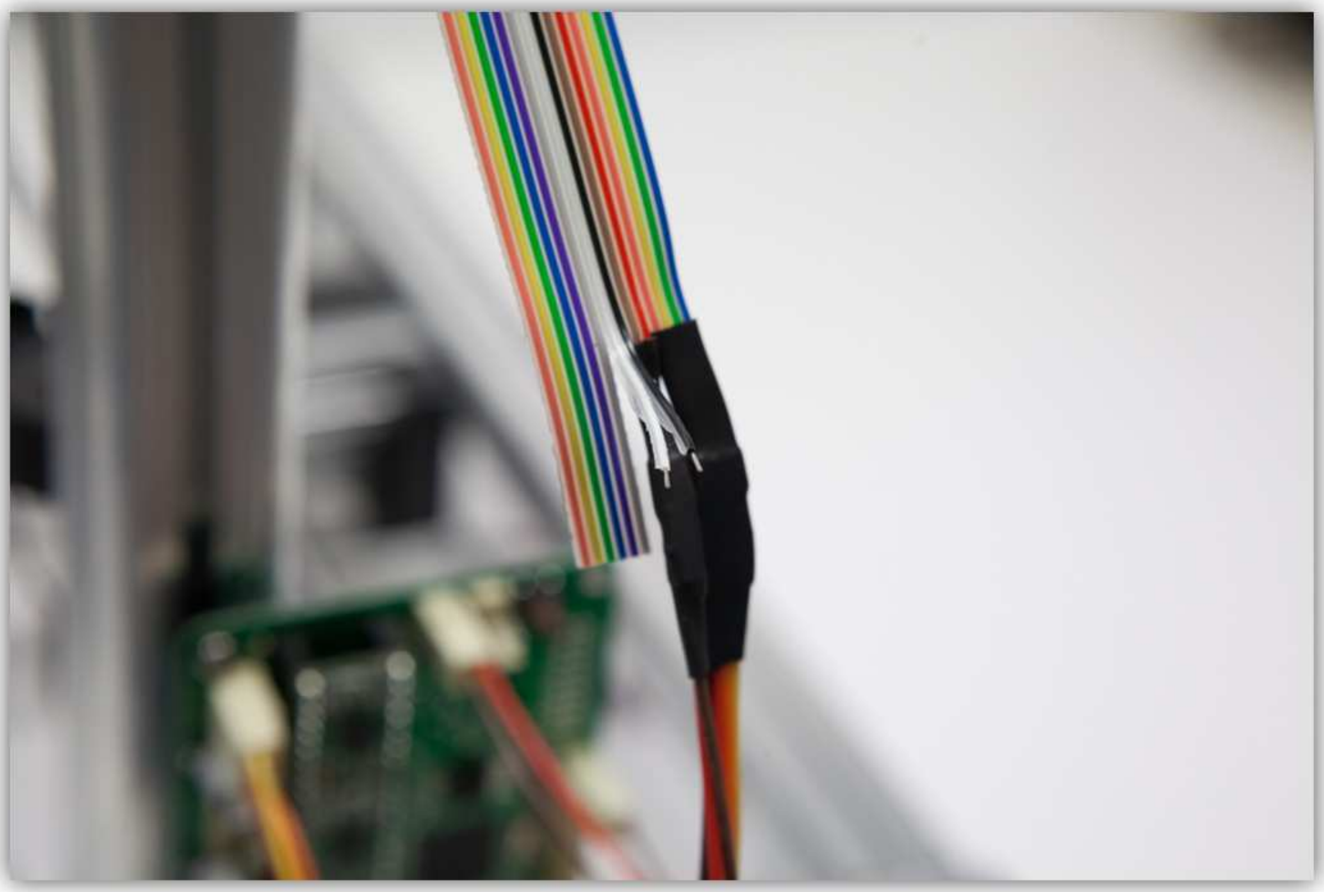
Plug the female connector in the male connector labelled with THERM1 on the controller board.

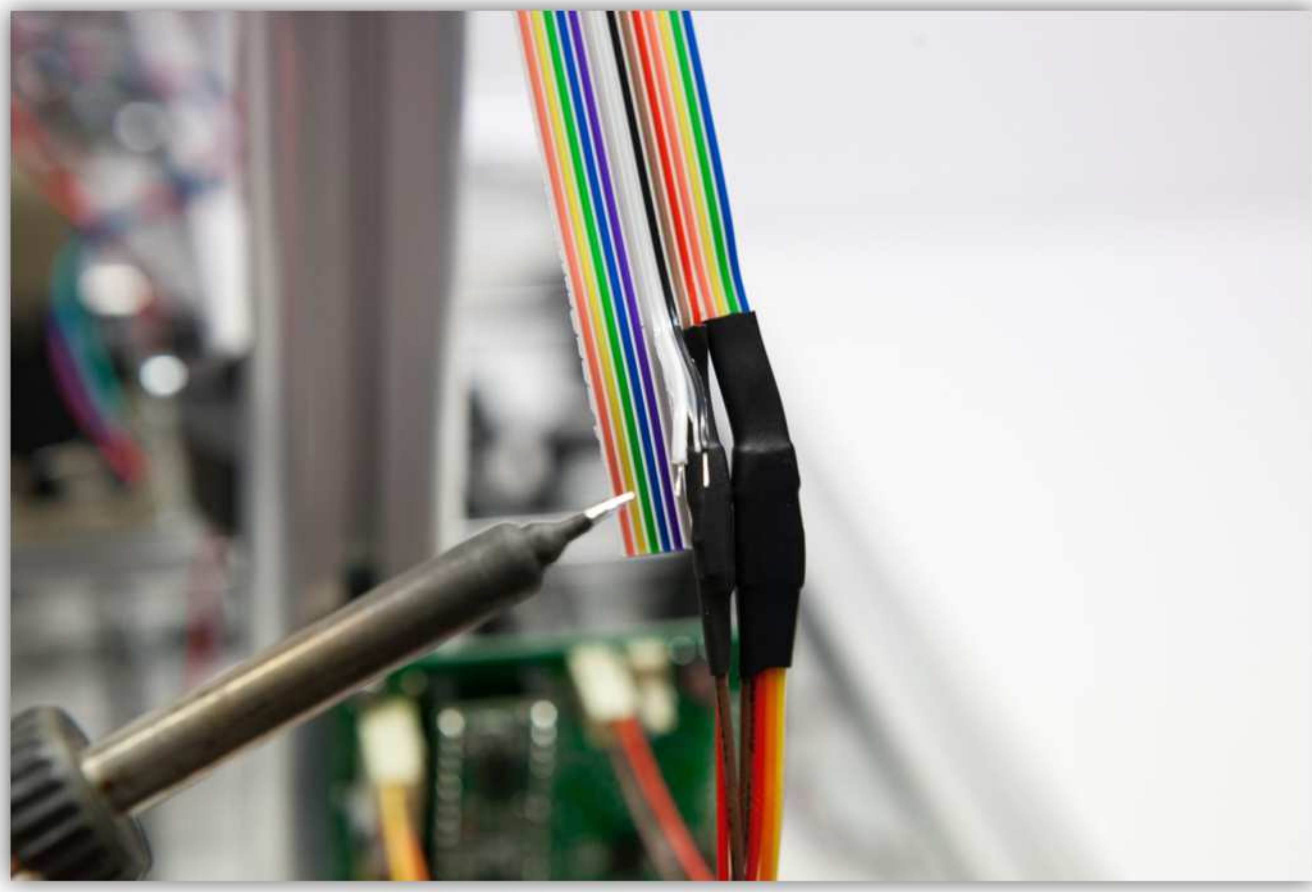


Detach (2 cm) (0.79") the **Black** and **White** wires from the flat cable as a group.



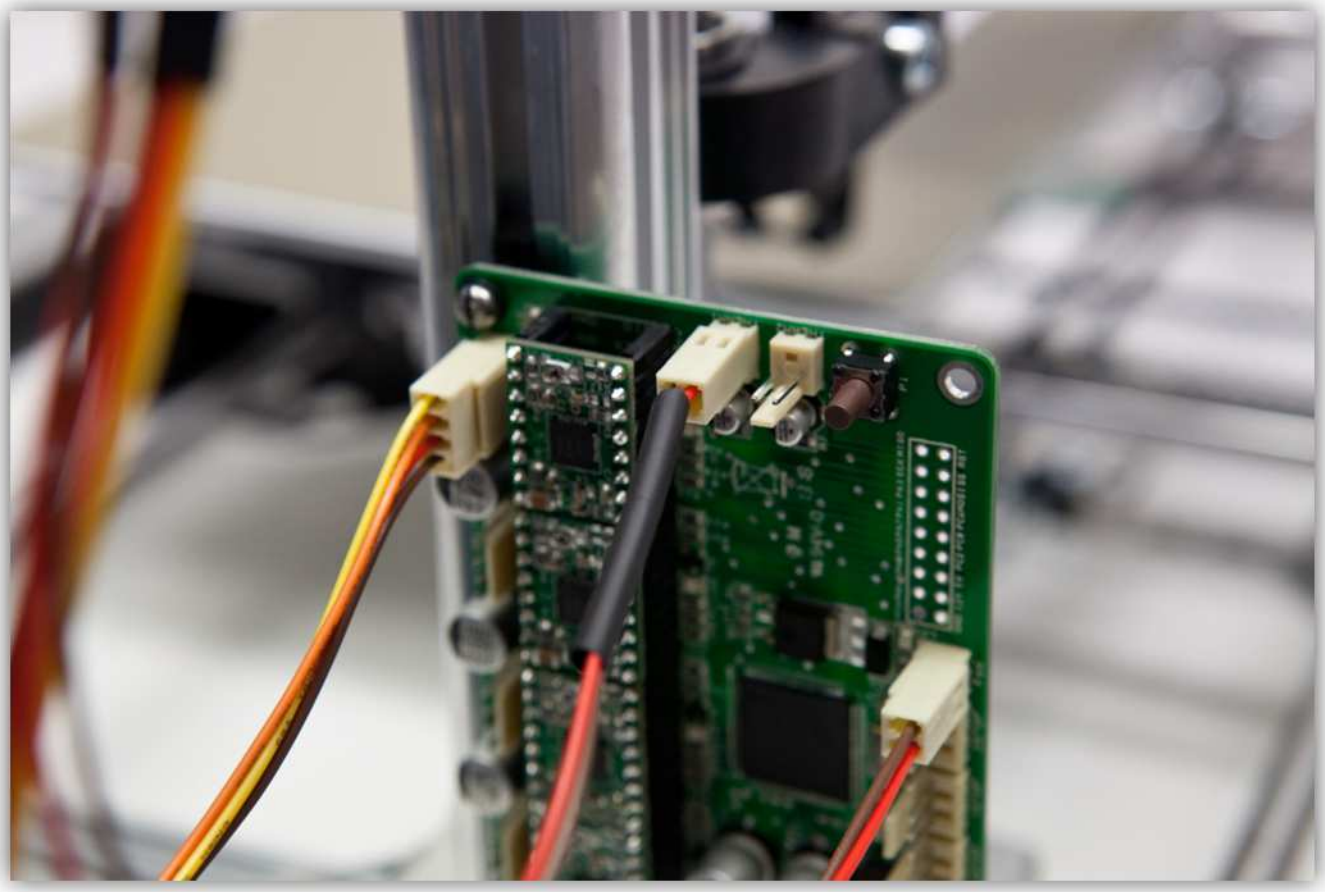
Strip the two wires (5 mm) (0.2") and tin them.



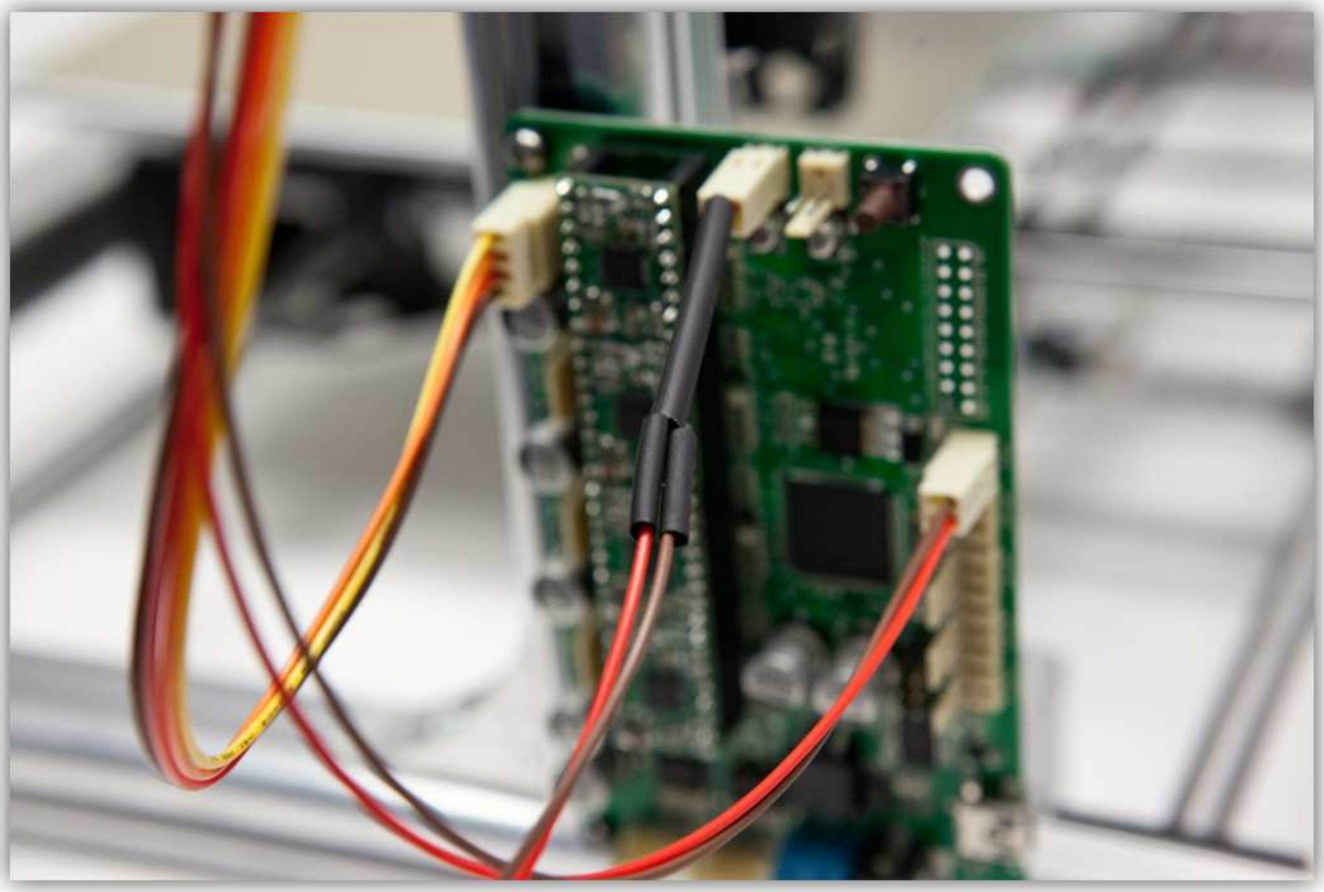


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the medium size heat shrink tubes over the 2 wires of the connector.

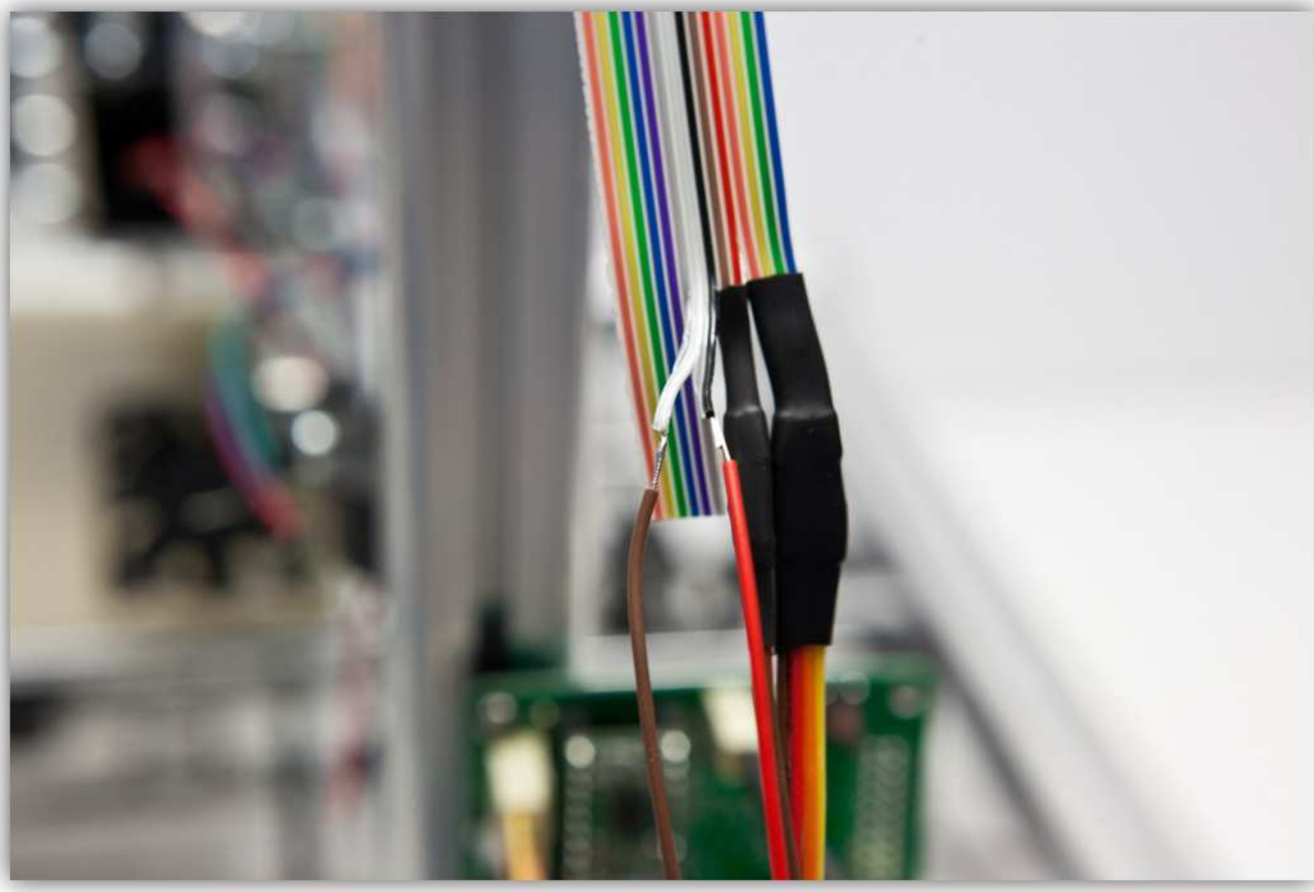


Slide the 2 small heat shrink tubes over the 2 wires of the connector.

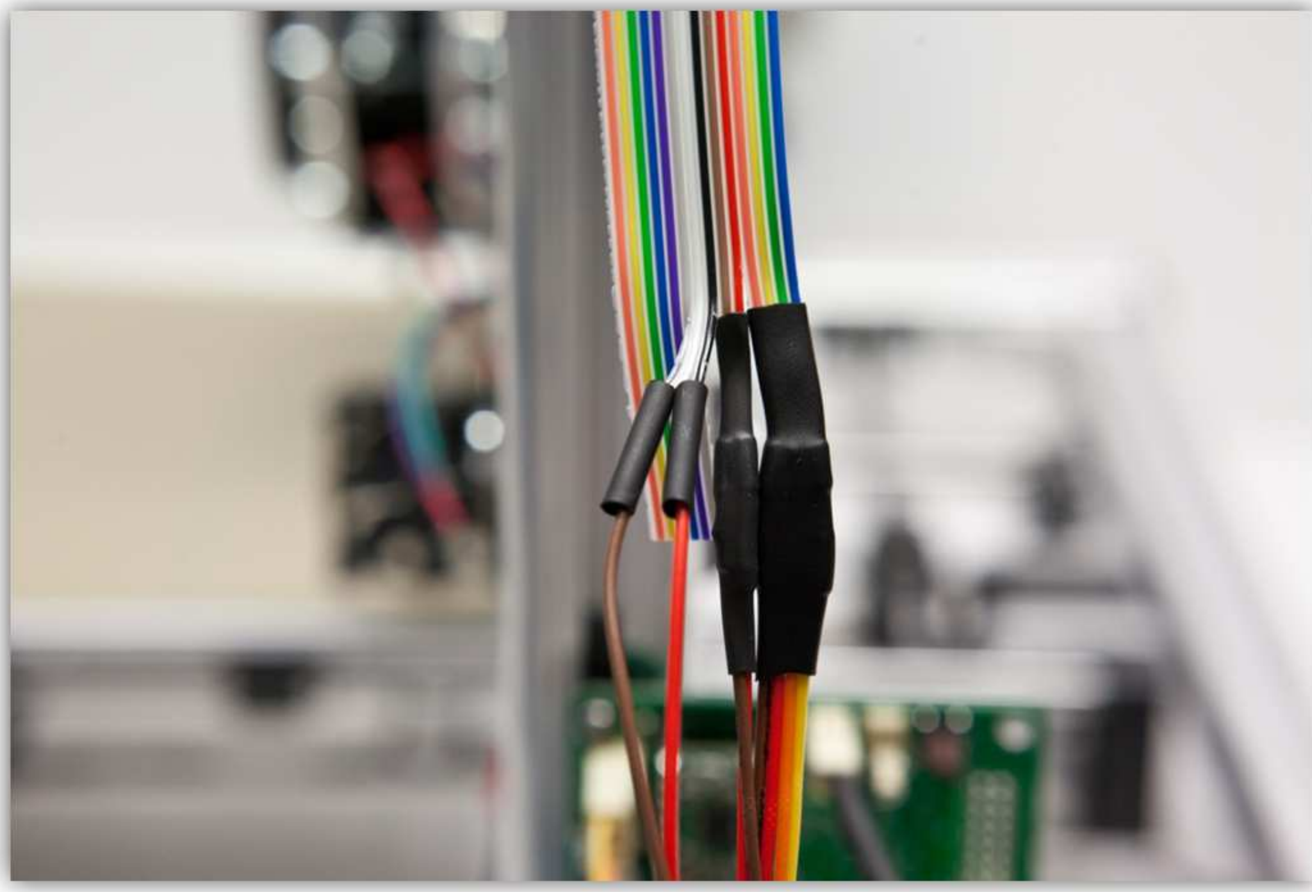


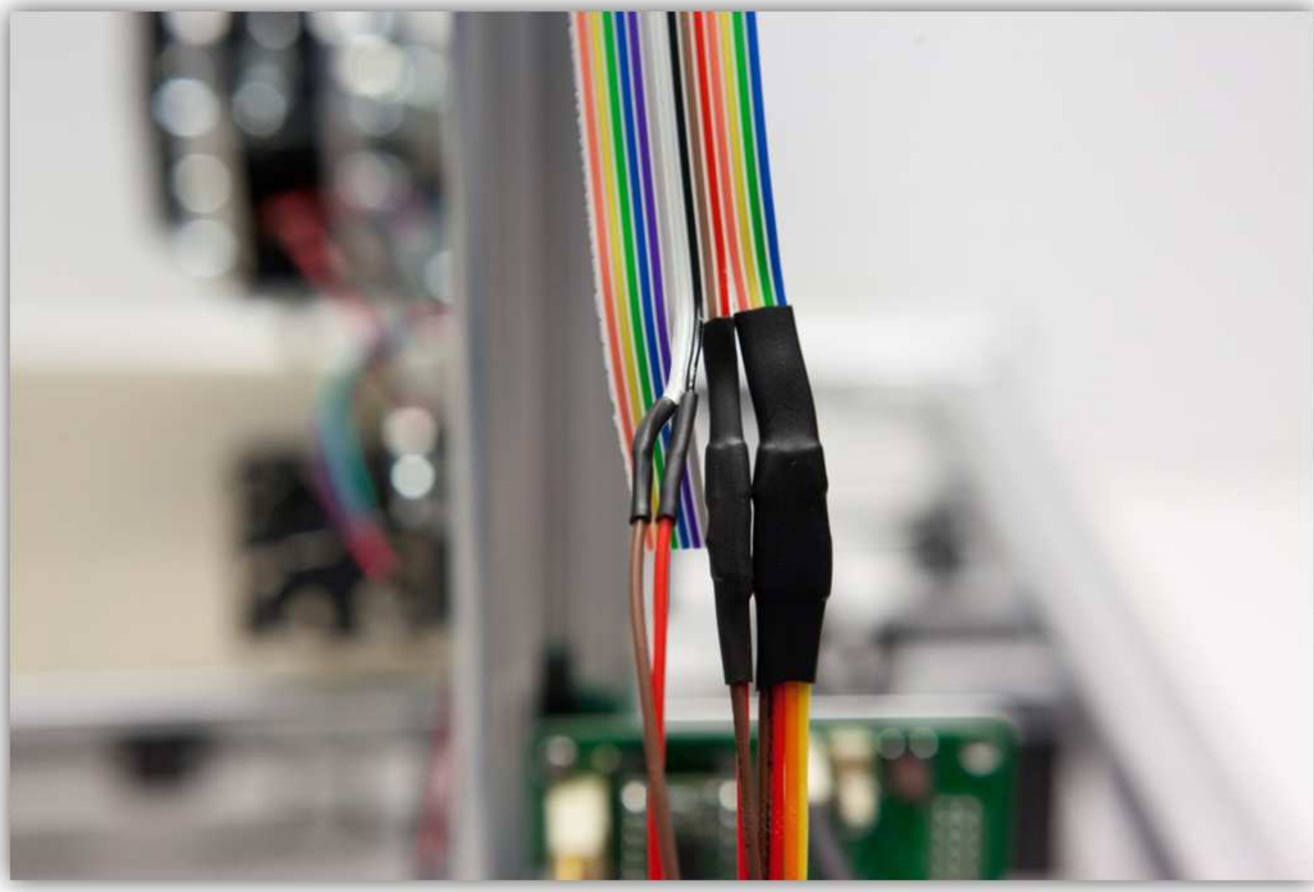
Solder the 2 wires from the connector to the 2 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	**->**	**Connector wires**
Black	**->**	**Red**
White	**->**	**Brown**

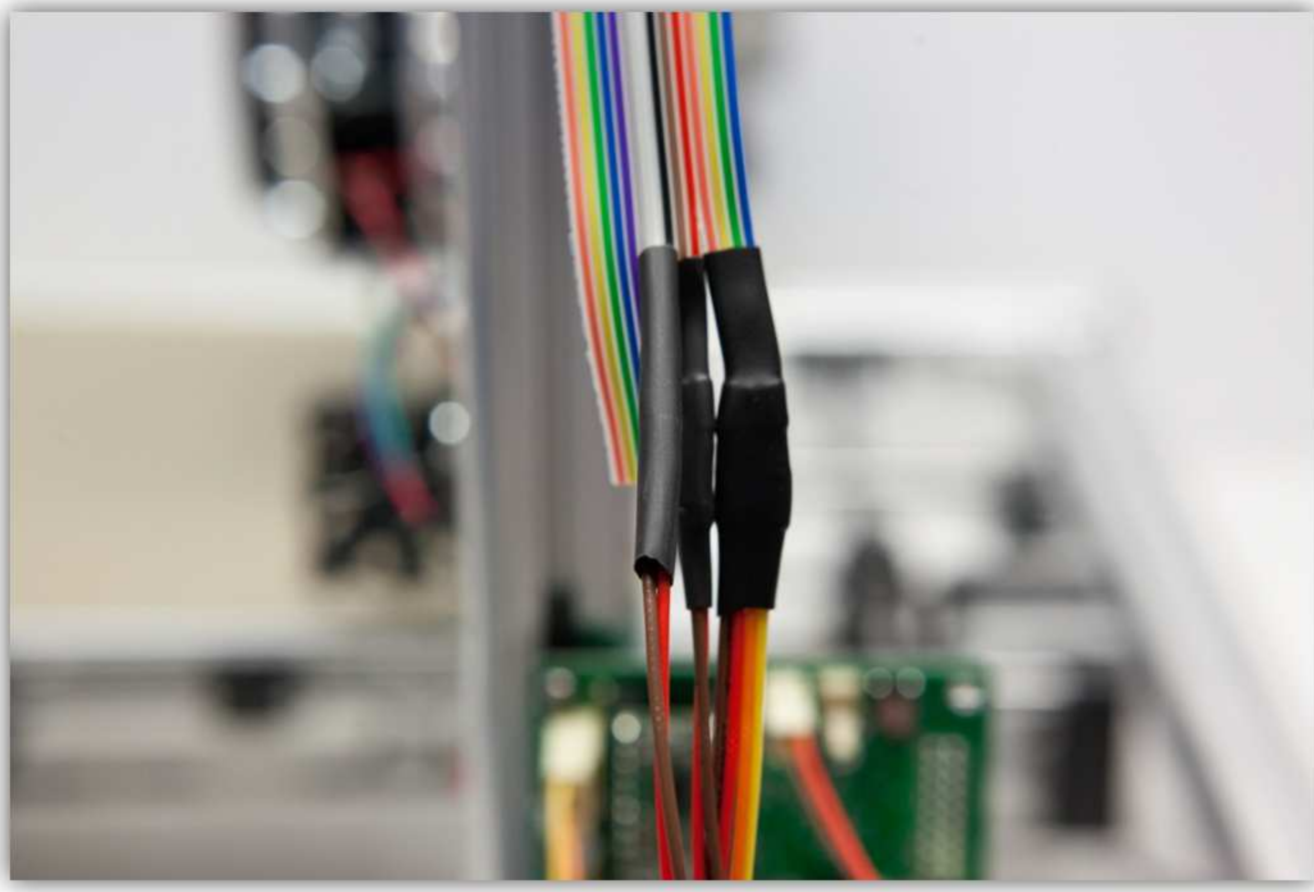


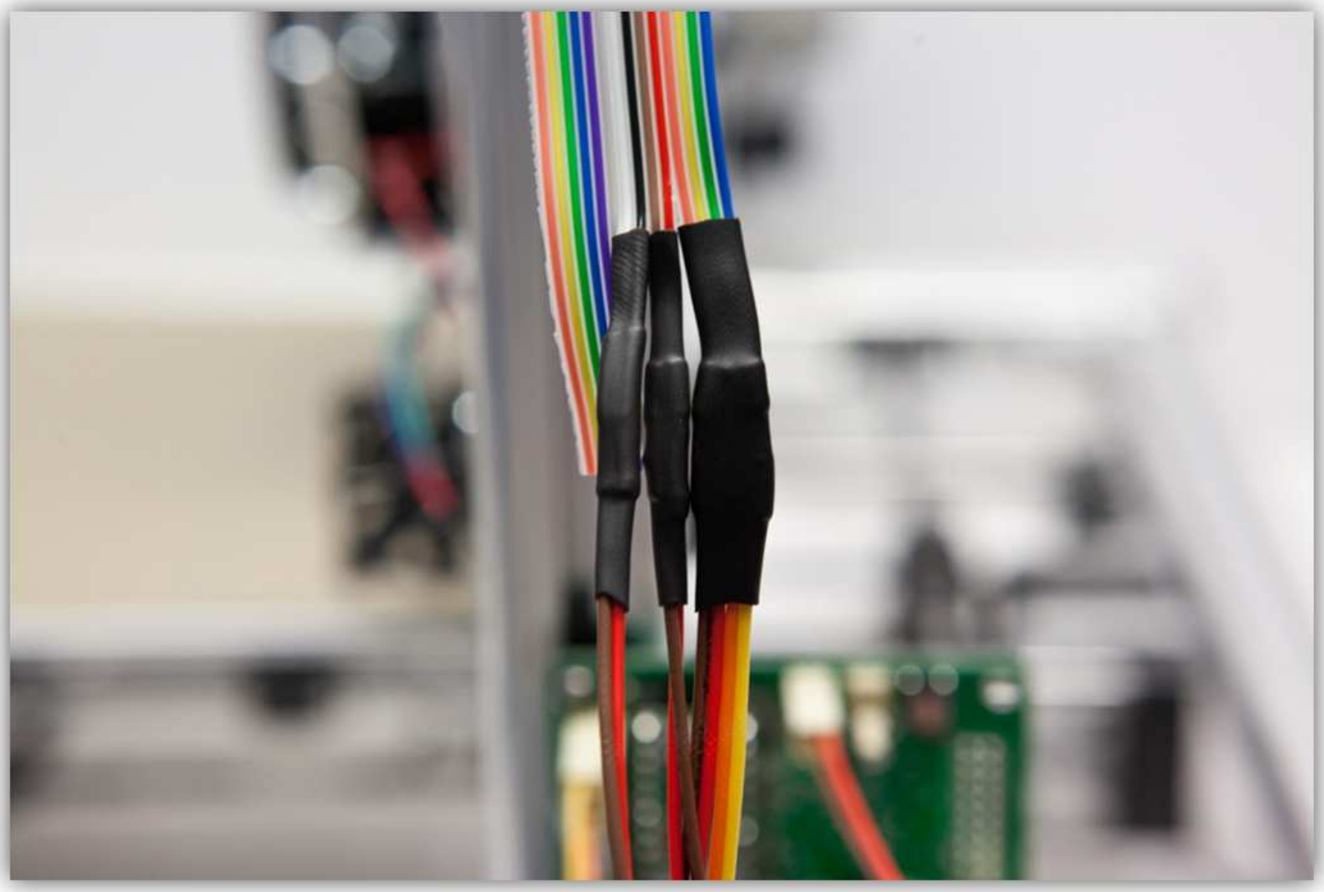
Slide the 2 small heat shrink tubes over the solder joints and heat them up.



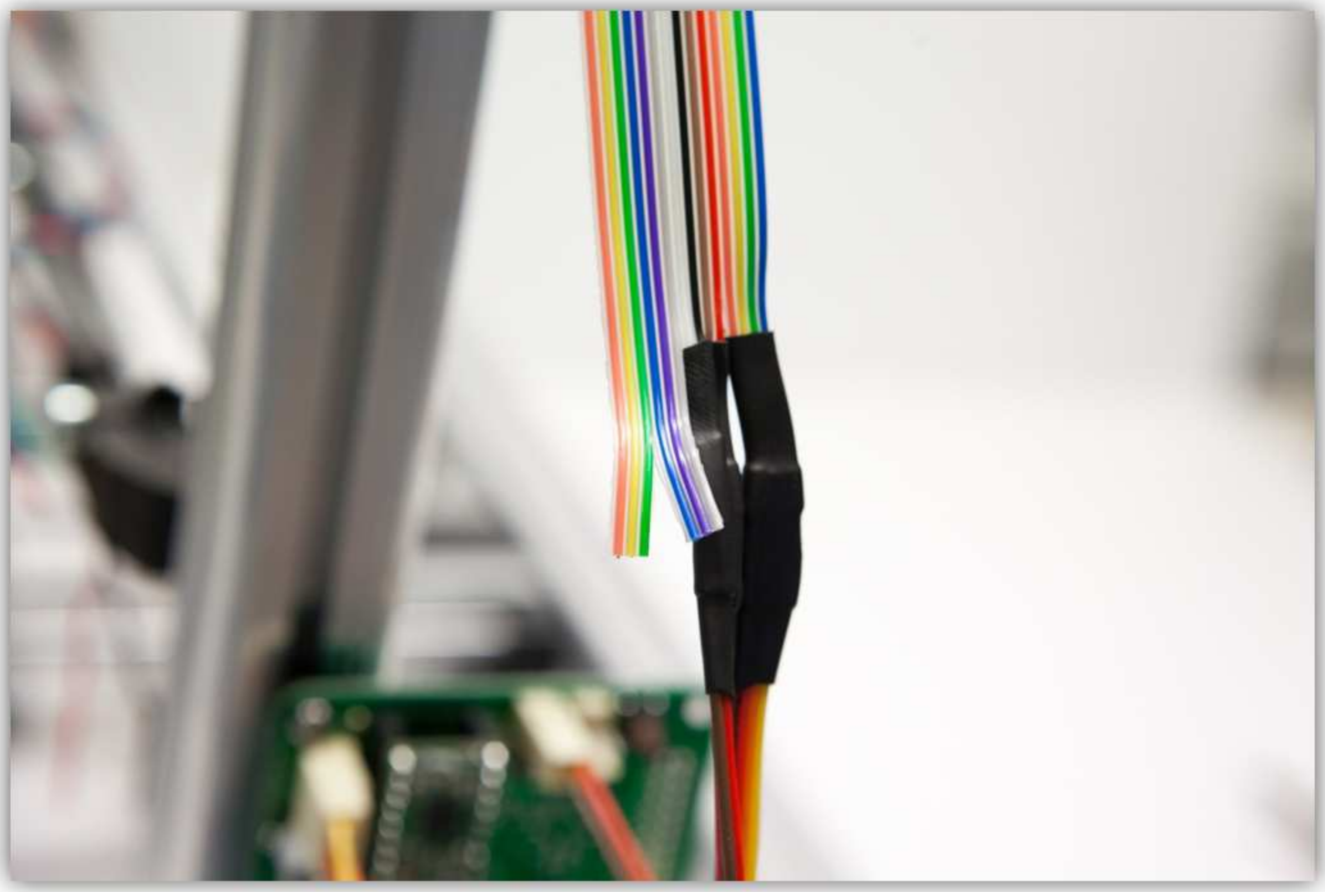


Now slide the medium size piece of heat shrink tubing over the 2 small pieces, heat the medium size piece so it covers and protects the 2 heat shrunk joints.

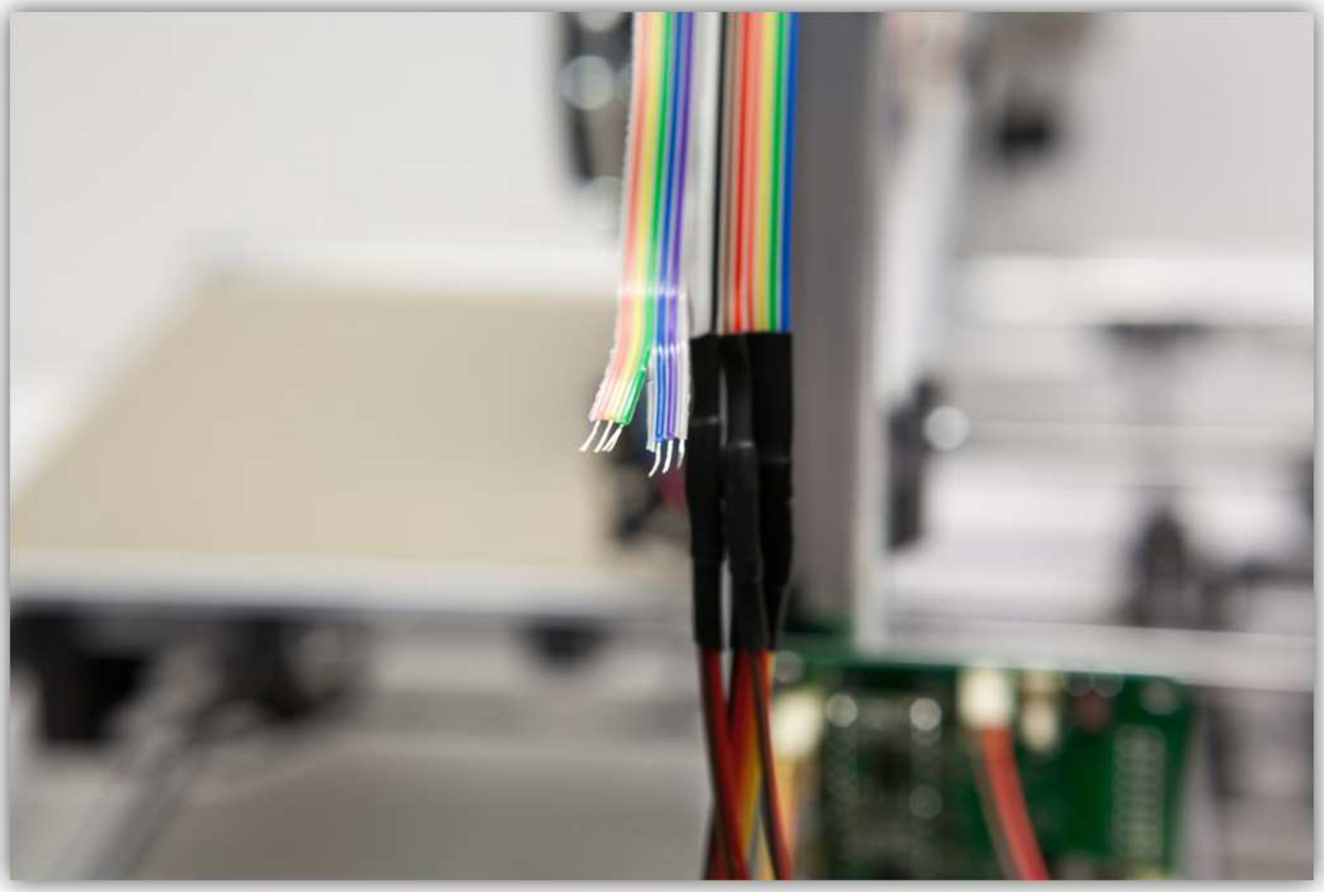


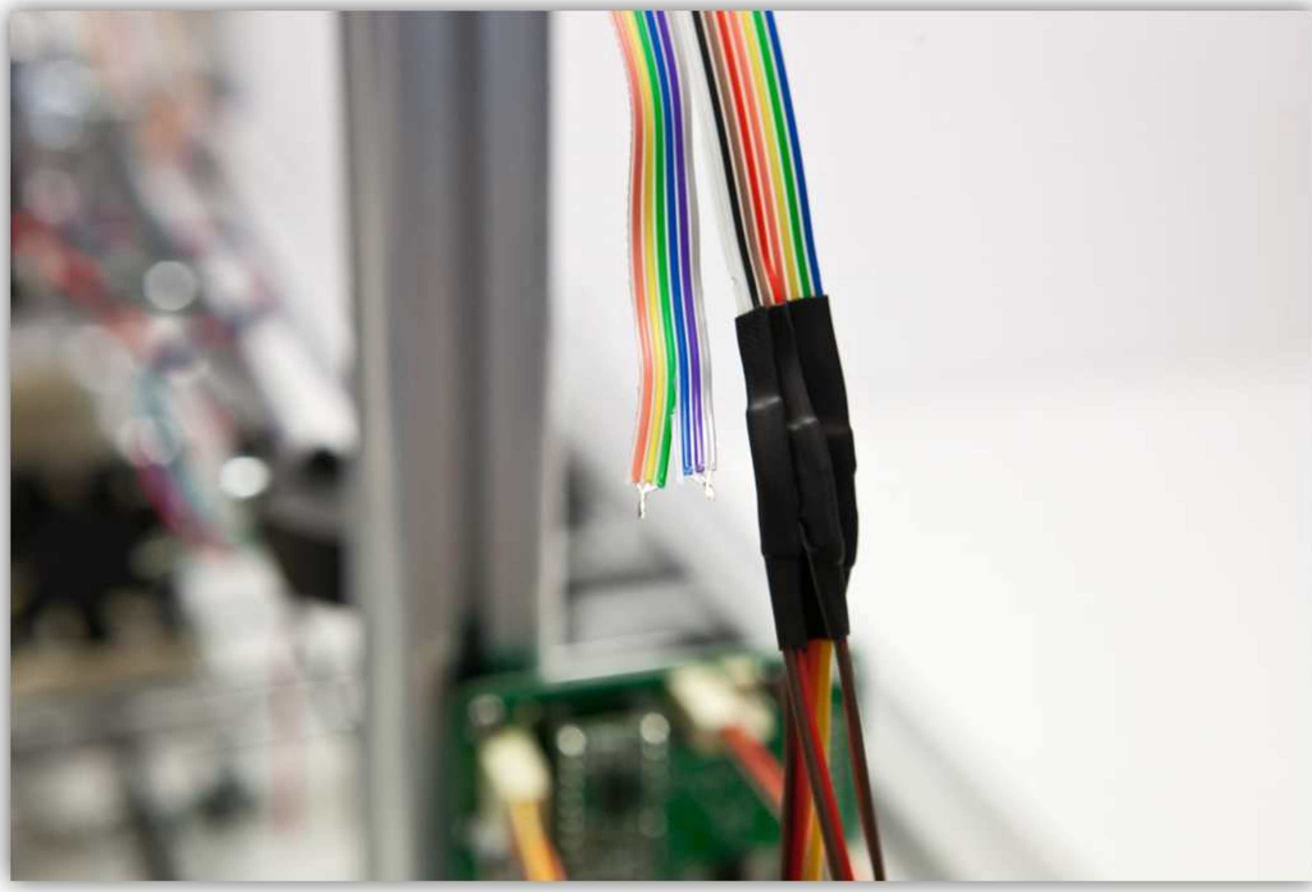


Next detach 2 cm (0.79") the **Orange, Yellow, Green,** and **Blue, Violet, Grey** as groups.

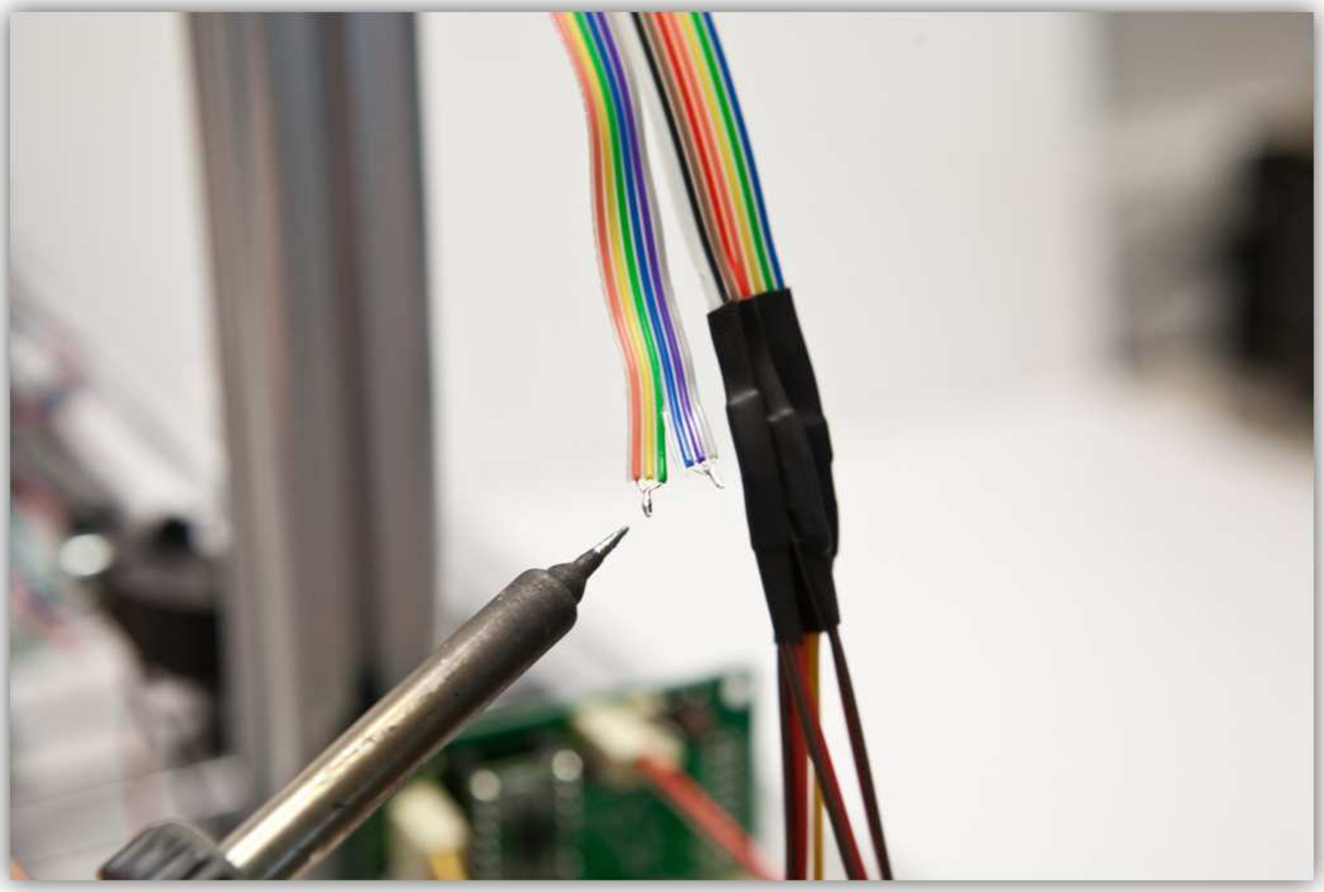


Strip the wires (5 mm) (0.2") and twist them together per group.



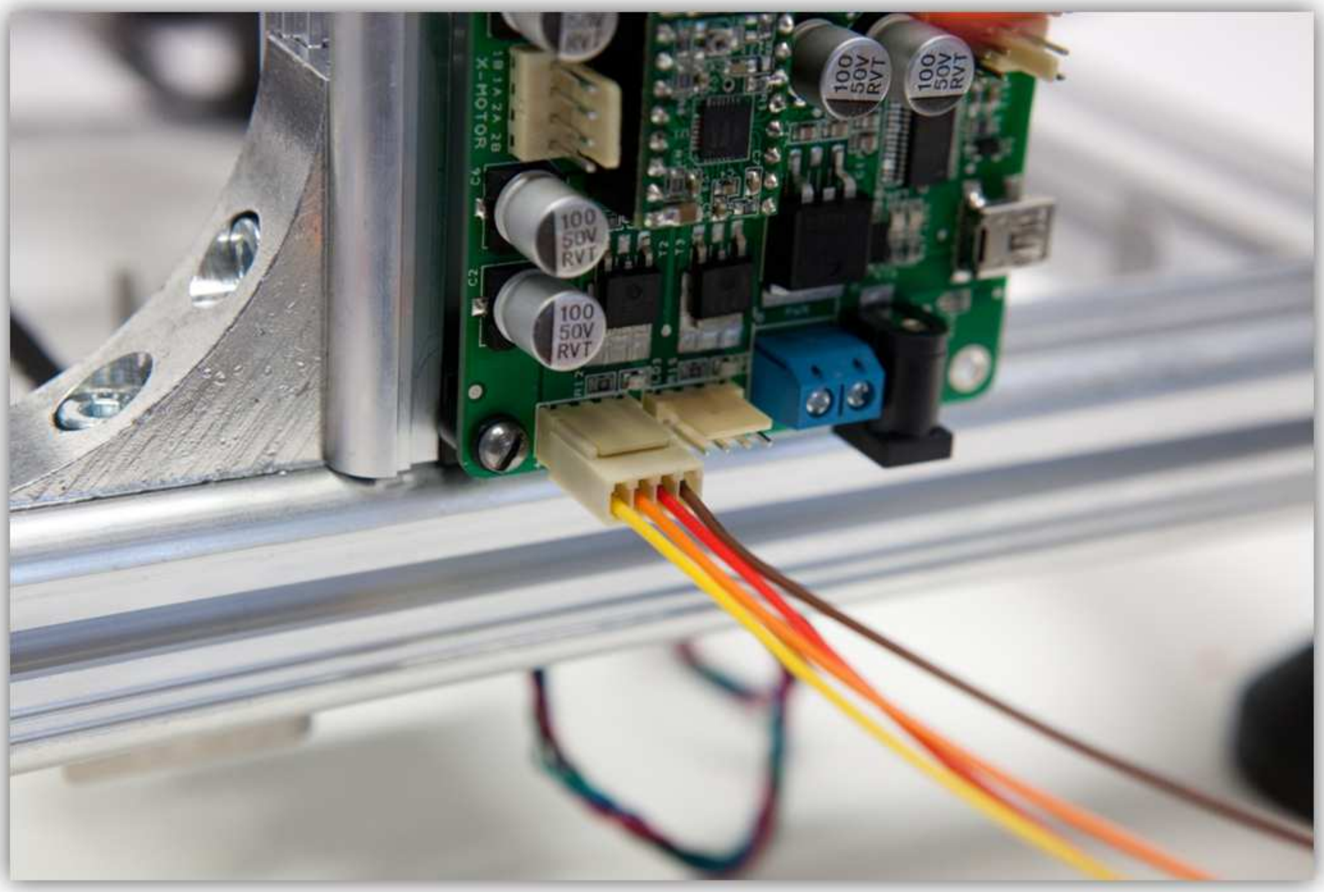


Tin the wires together per group.



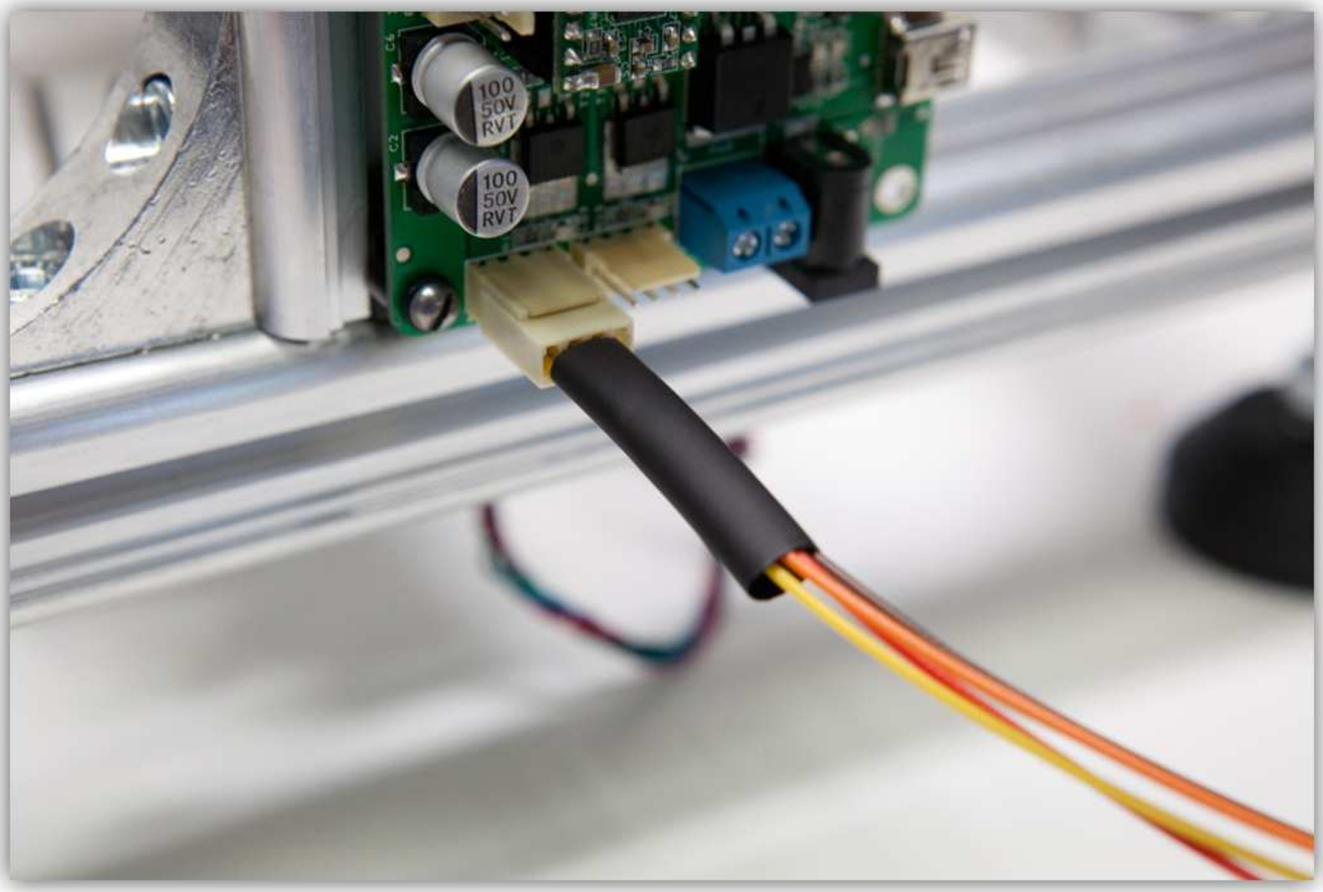
Take a board to wire connector with 4 wires out of the bag labelled with 40.

Plug the female connector in the male connector labelled with HEATER1 on the controller board.

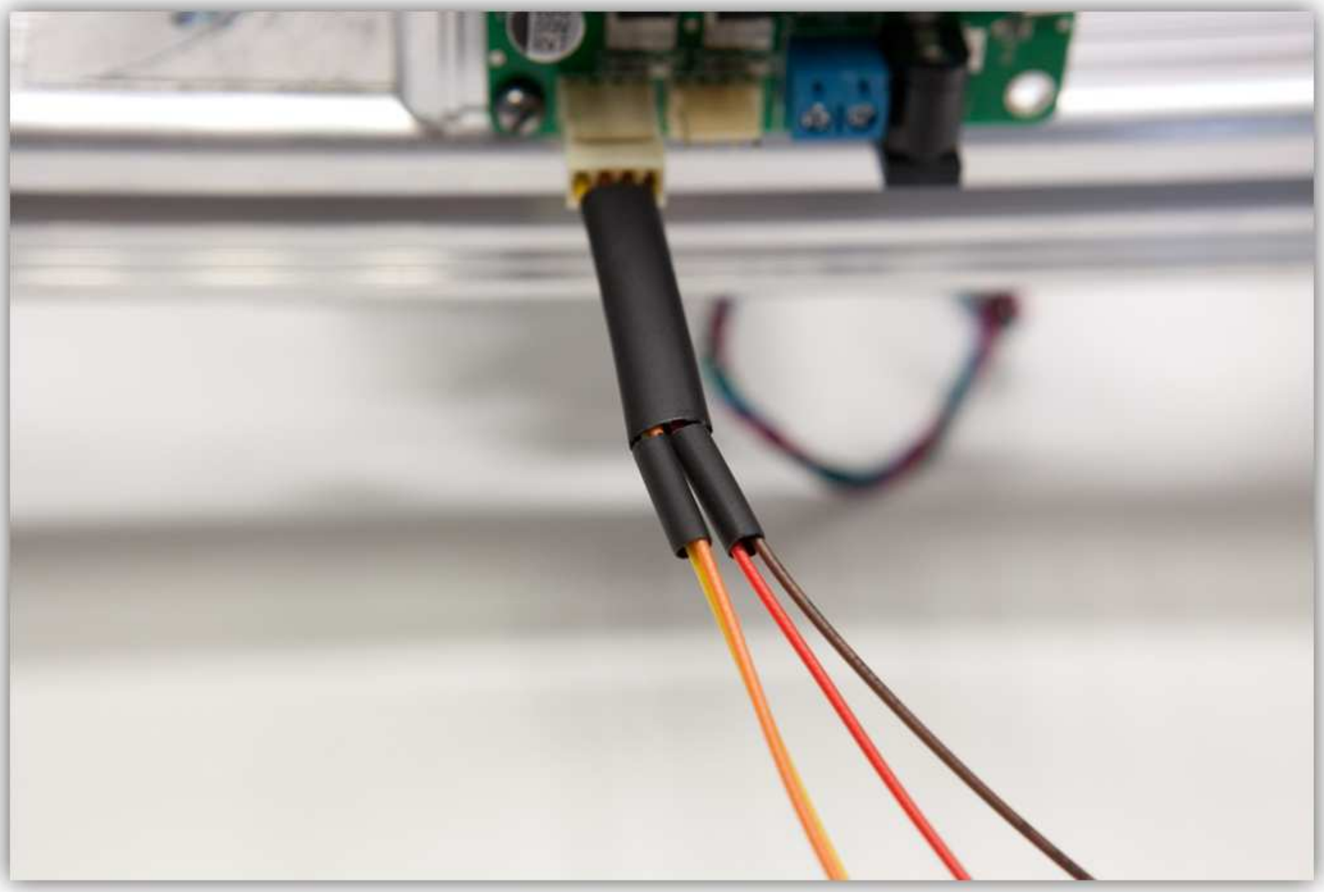


Cut 2 small pieces of the medium size heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

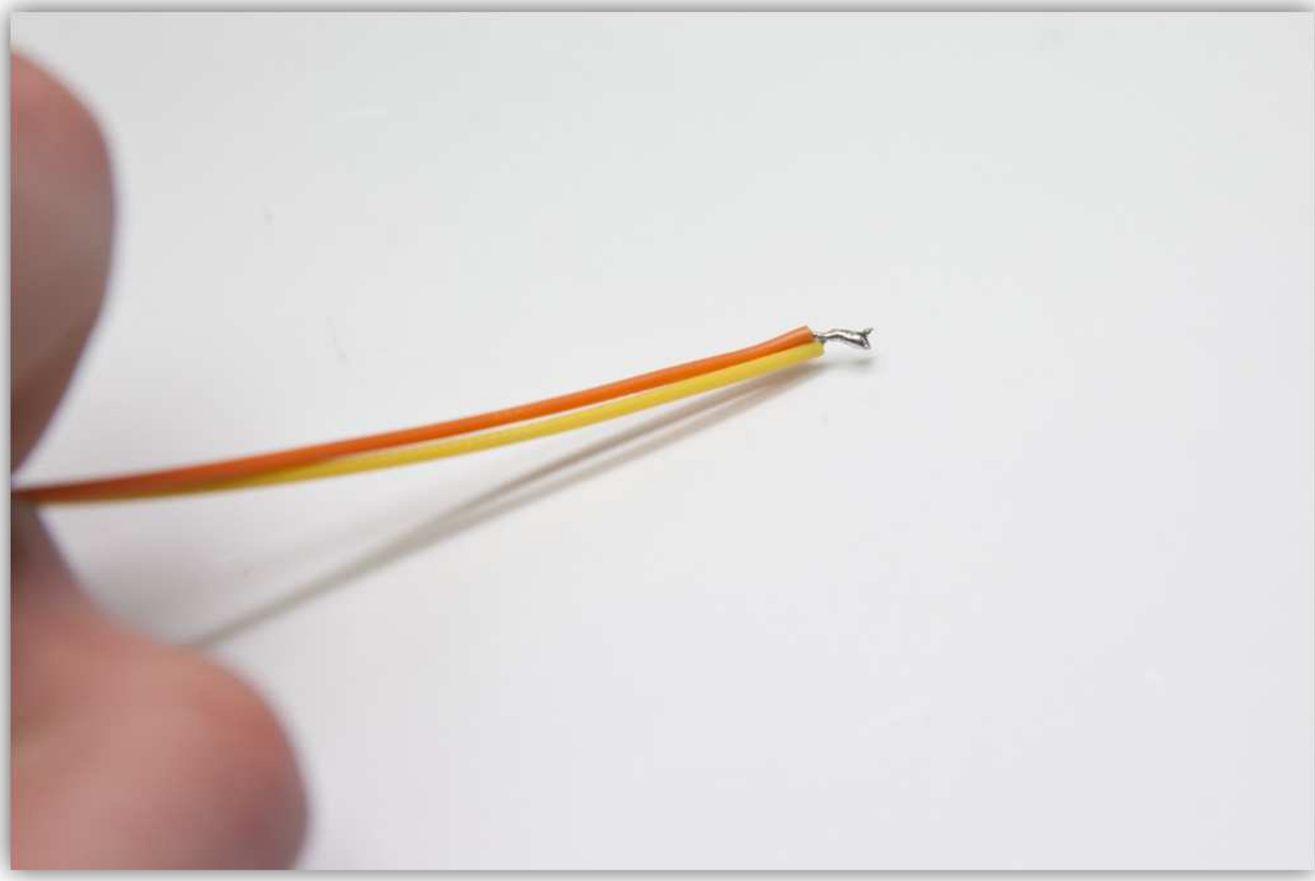
Slide the big heat shrink tubes over the 4 wires of the connector.



Slide 1 medium size heat shrink tubes over the **Yellow** and **Orange** wire and 1 medium size heat shrink tube over the **Red** and **Brown** wire.



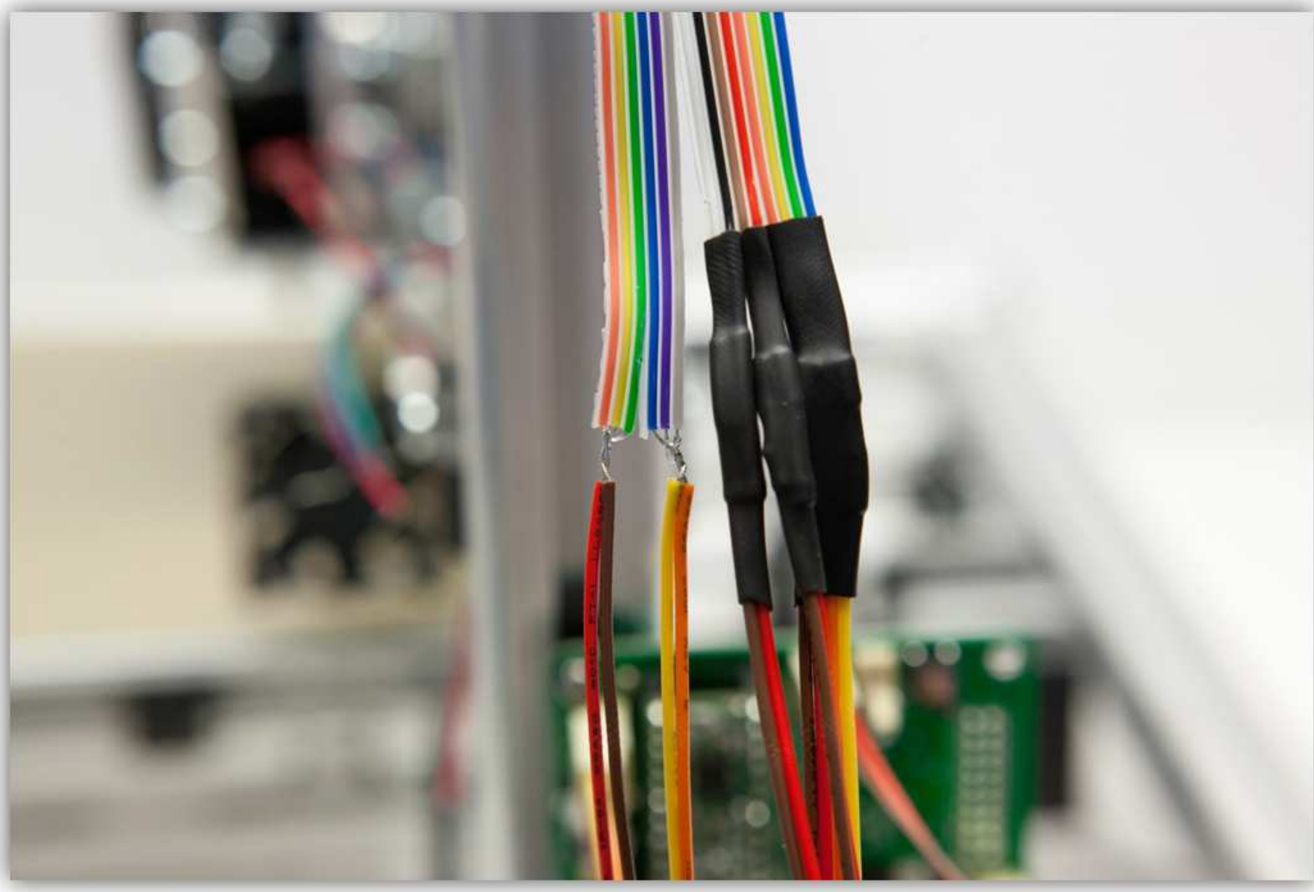
Next twist and tin the ends of the **Yellow** and **Orange** wires together.



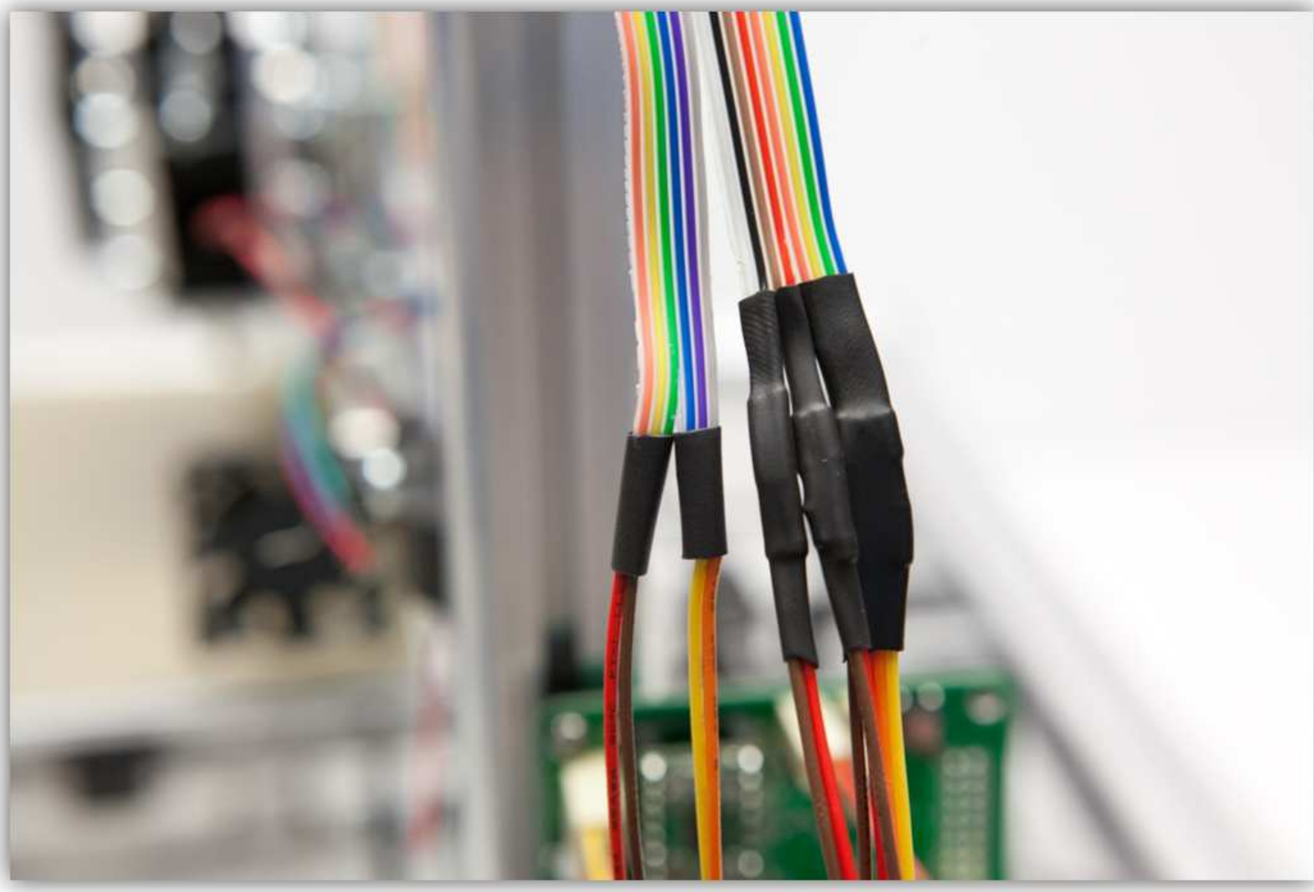
Also twist and tin the ends of the **Red** and **Brown** wires together.

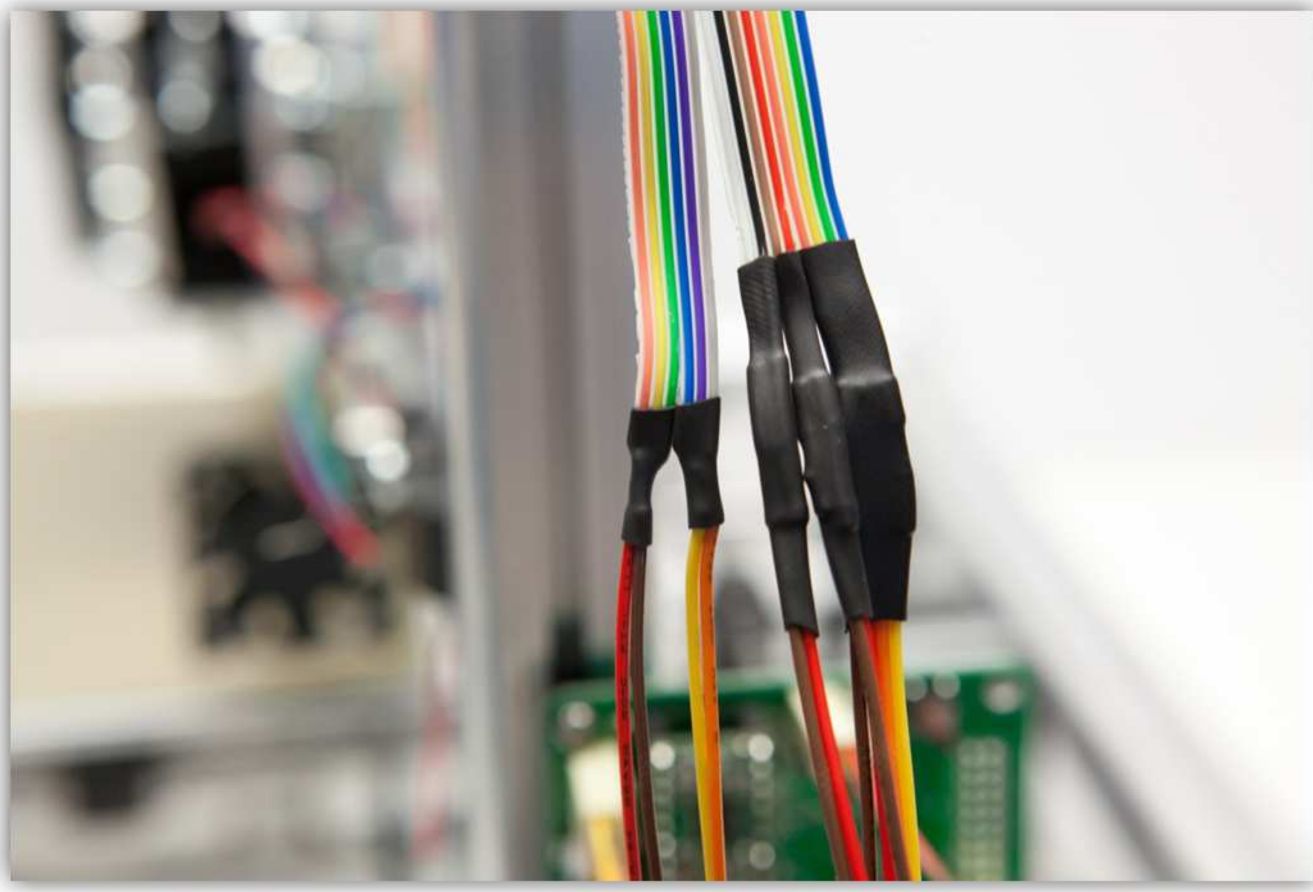
Solder the 6 wires from the connector to the 4 wires of the flat cable you tinned earlier. **Watch the colours closely and respect the groups.**

Flat cable	->	Connector wires
Orange, Yellow, Green	**->**	**Red** and **Brown**
Blue, Violet, Grey	**->**	**Yellow** and **Orange**

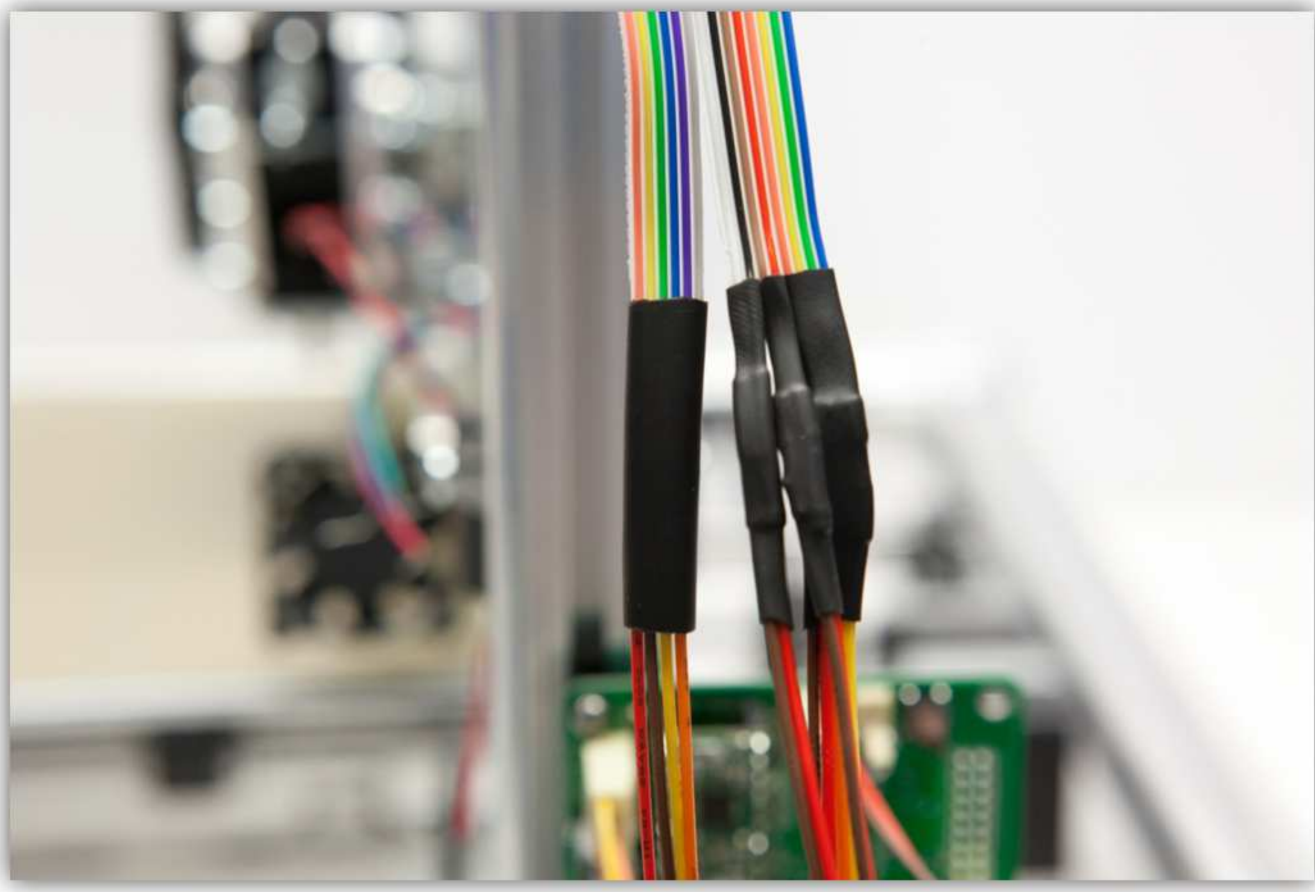


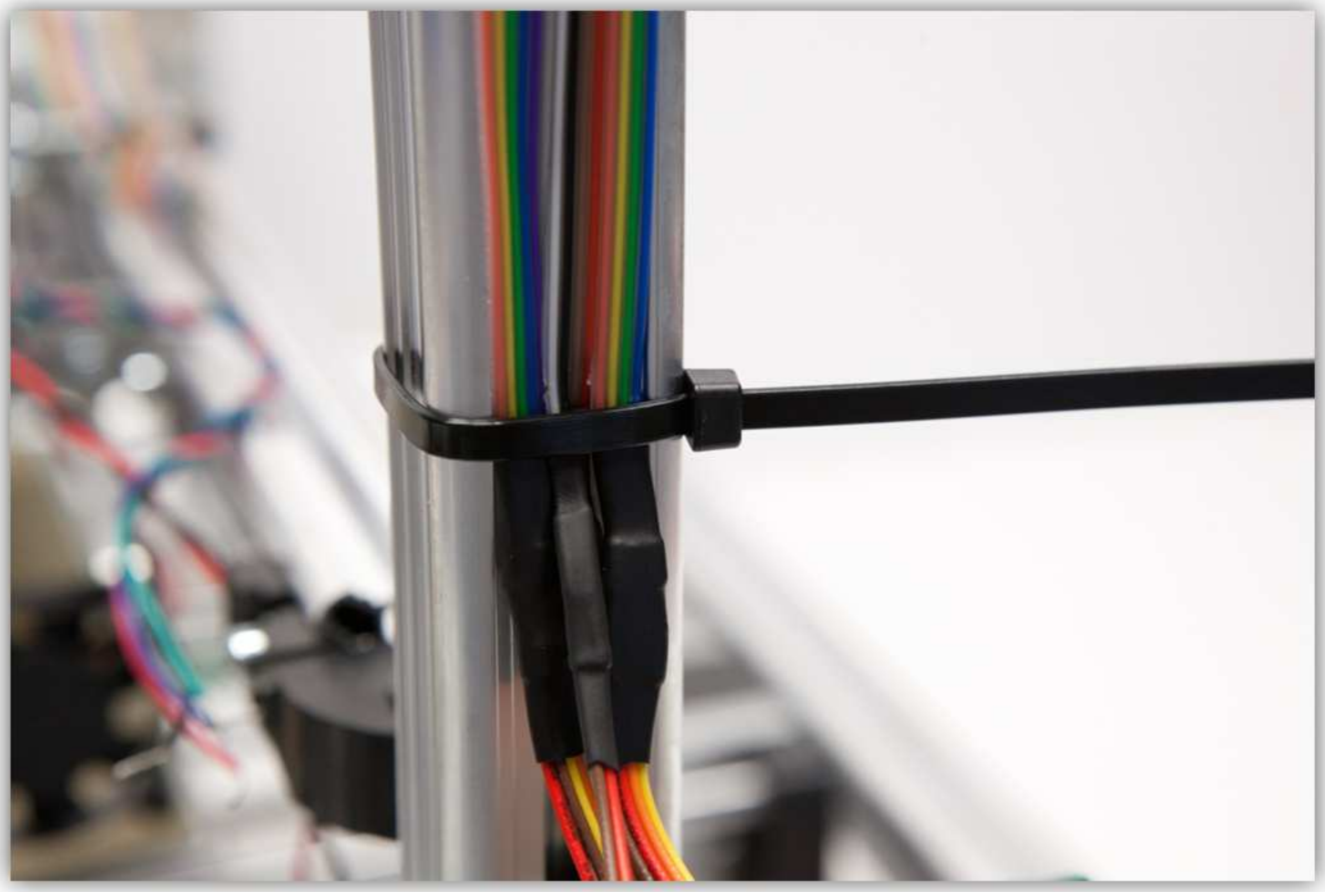
Slide the medium size heat shrink tubes over the solder joints and heat them up so they shrink.

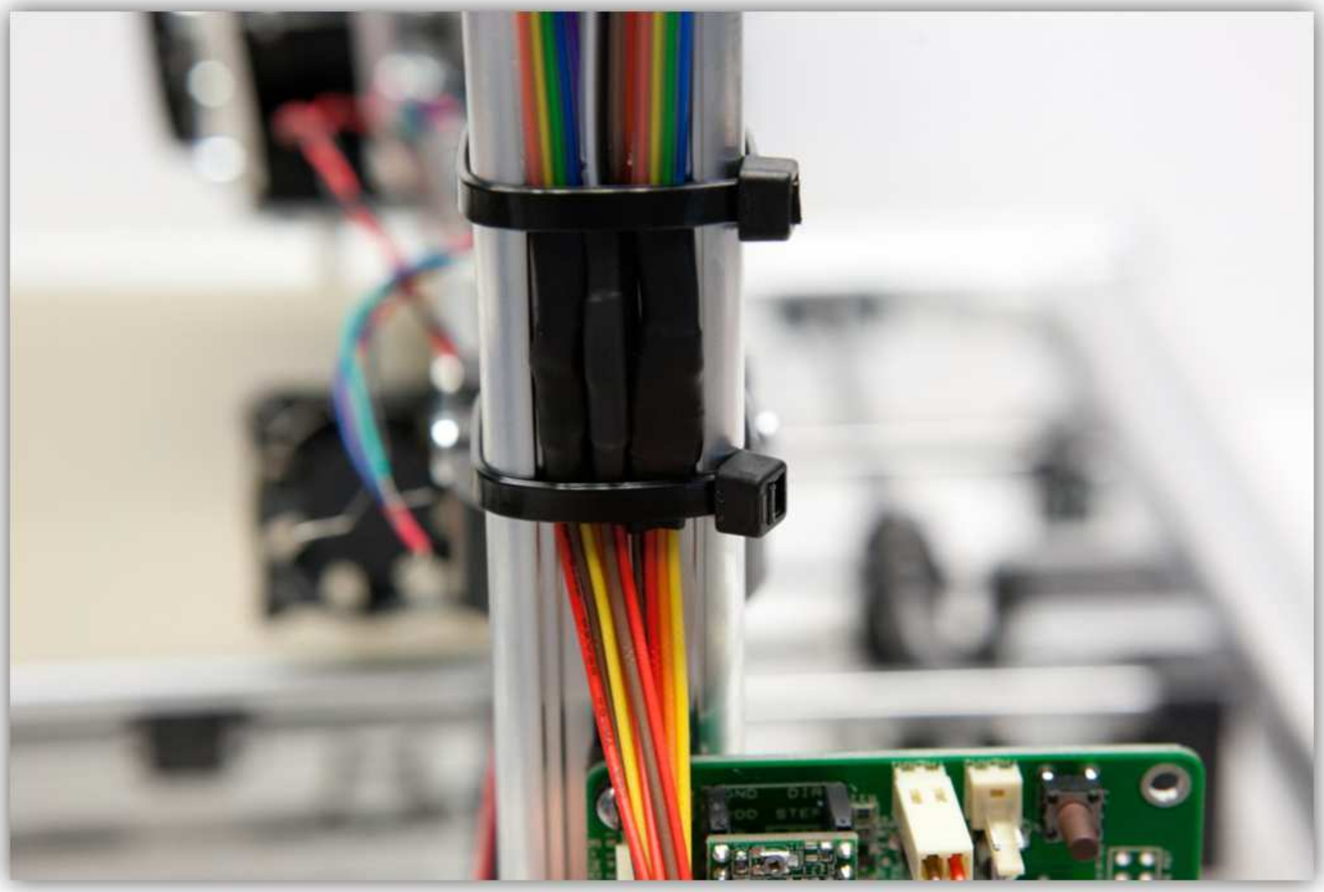




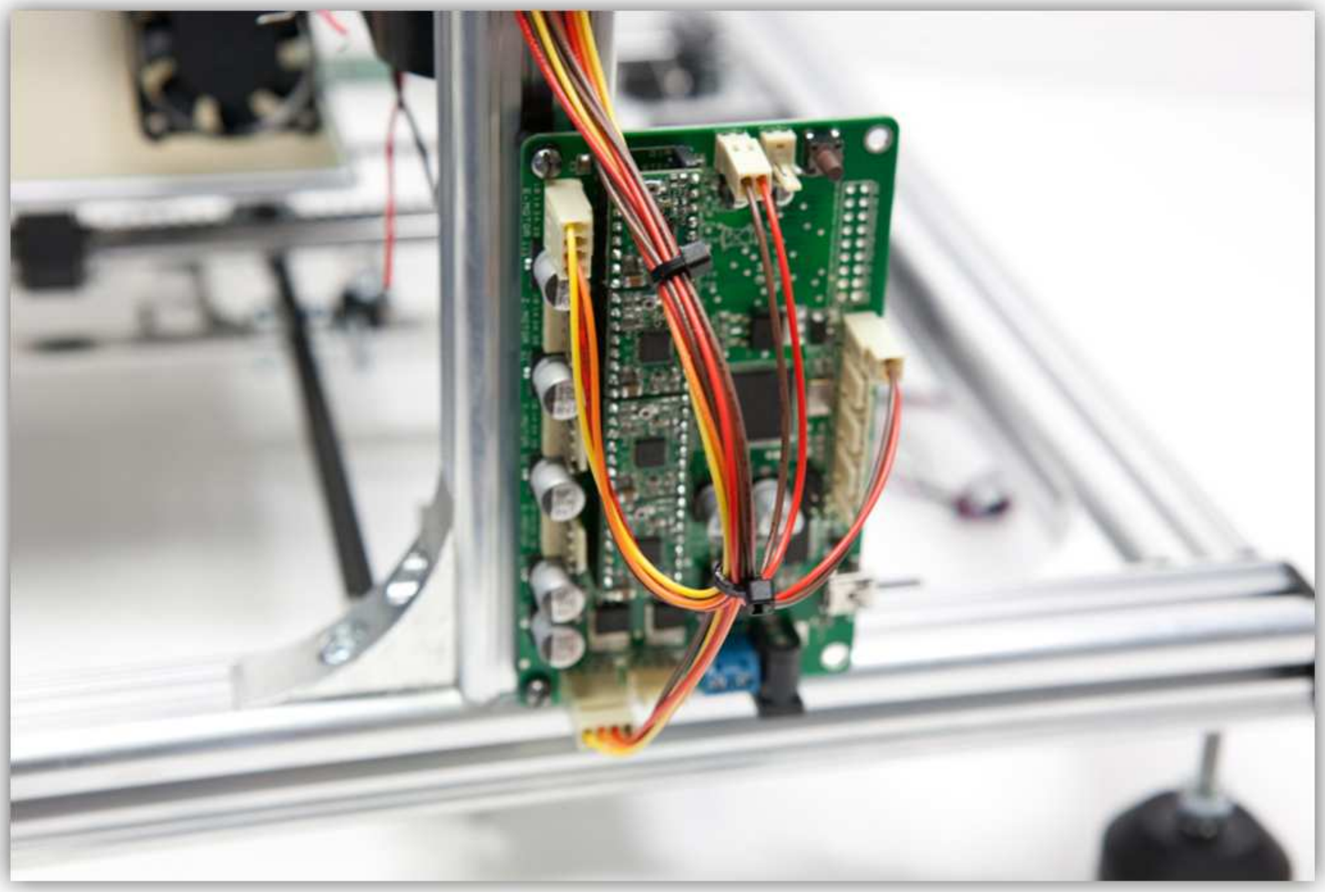
Now slide the big piece of heat shrink tubing over the 2 medium size pieces, heat the big piece so it covers and protects the 2 heat shrunk joints. Secure all the joints with 2 large tie-strips to the profile.



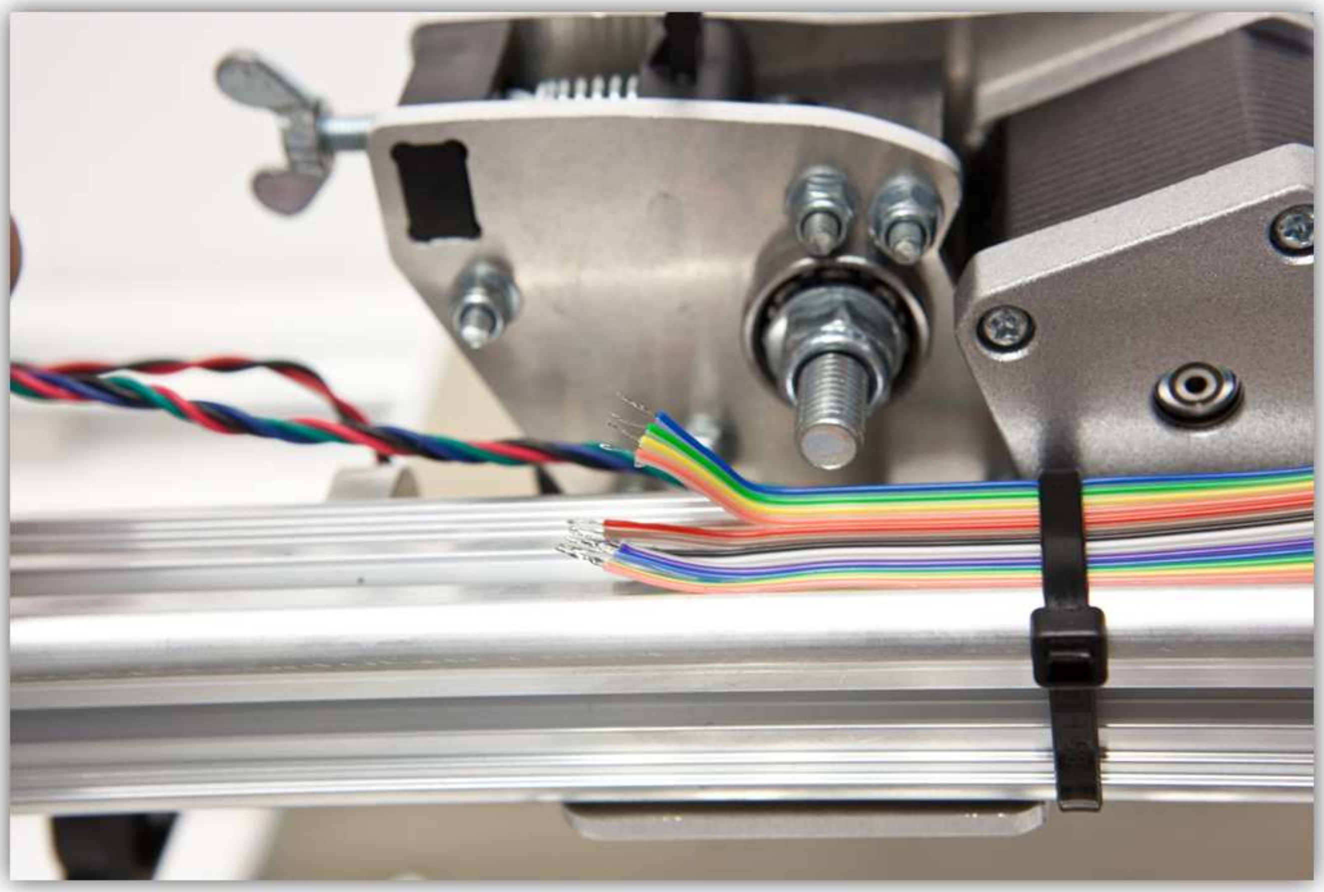




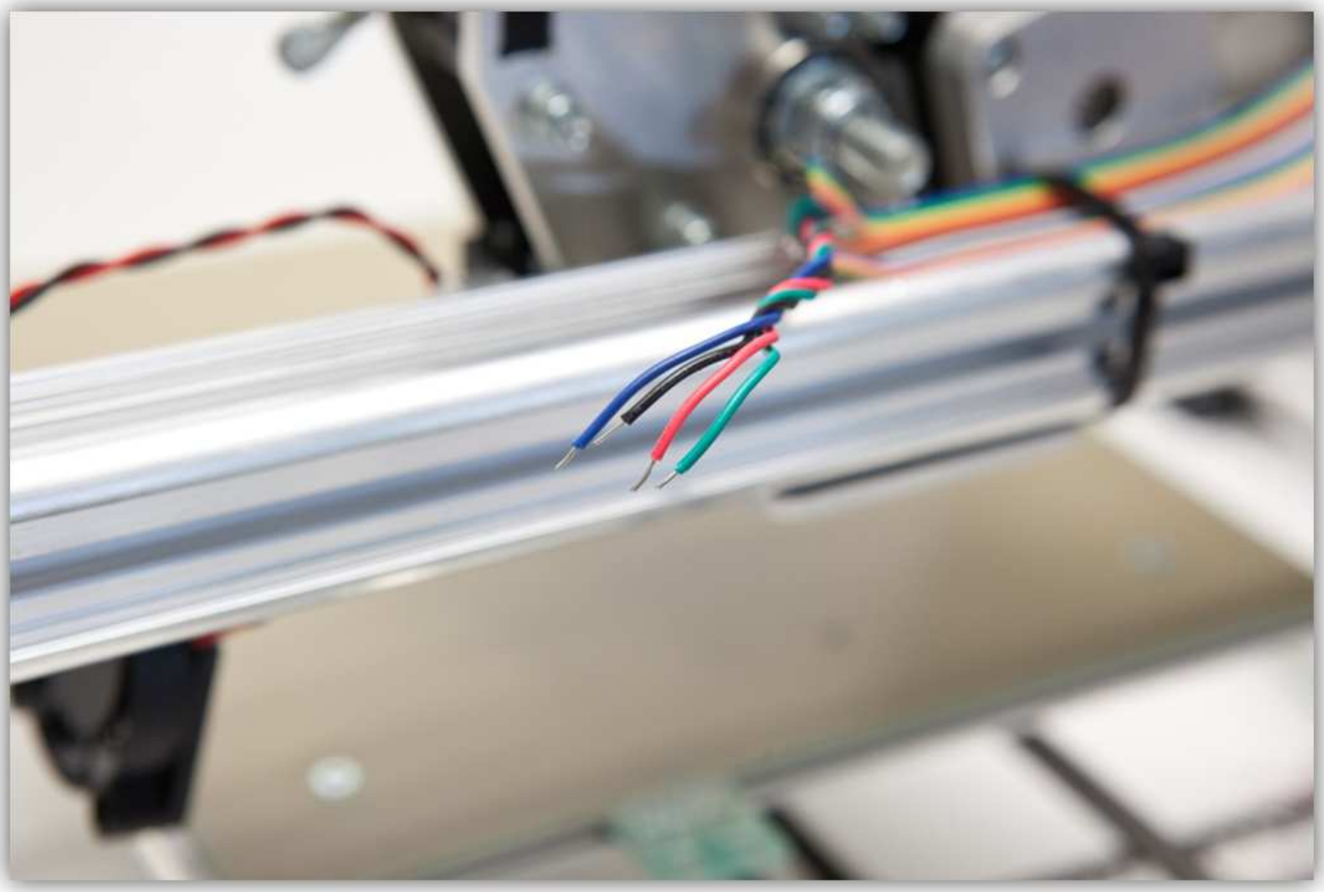
Use some small tie-strips (bag 40) to group the wires together.



Turn you attention to the other end of the flat cable again.

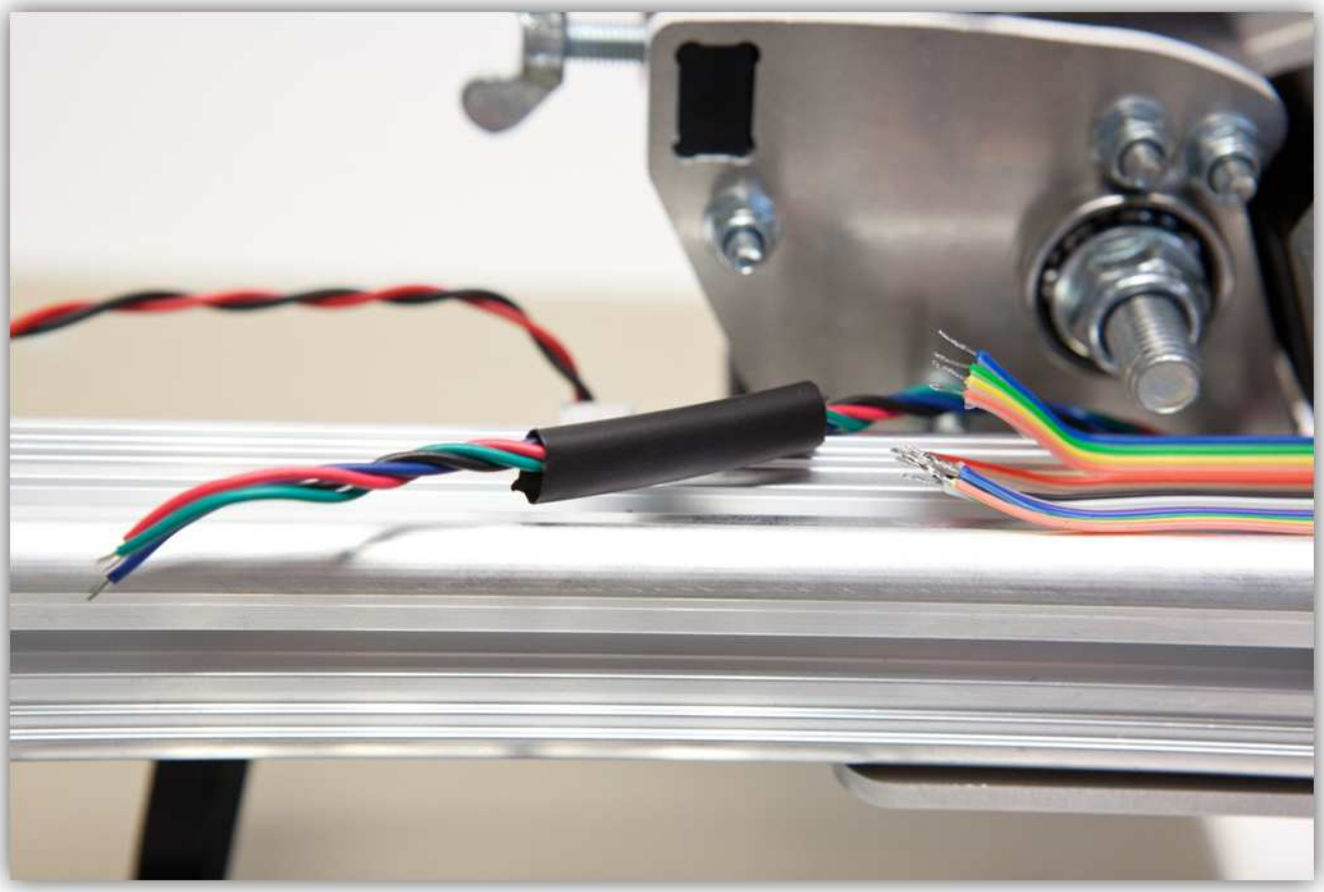


Take the wires of the extruder motor and tin them.

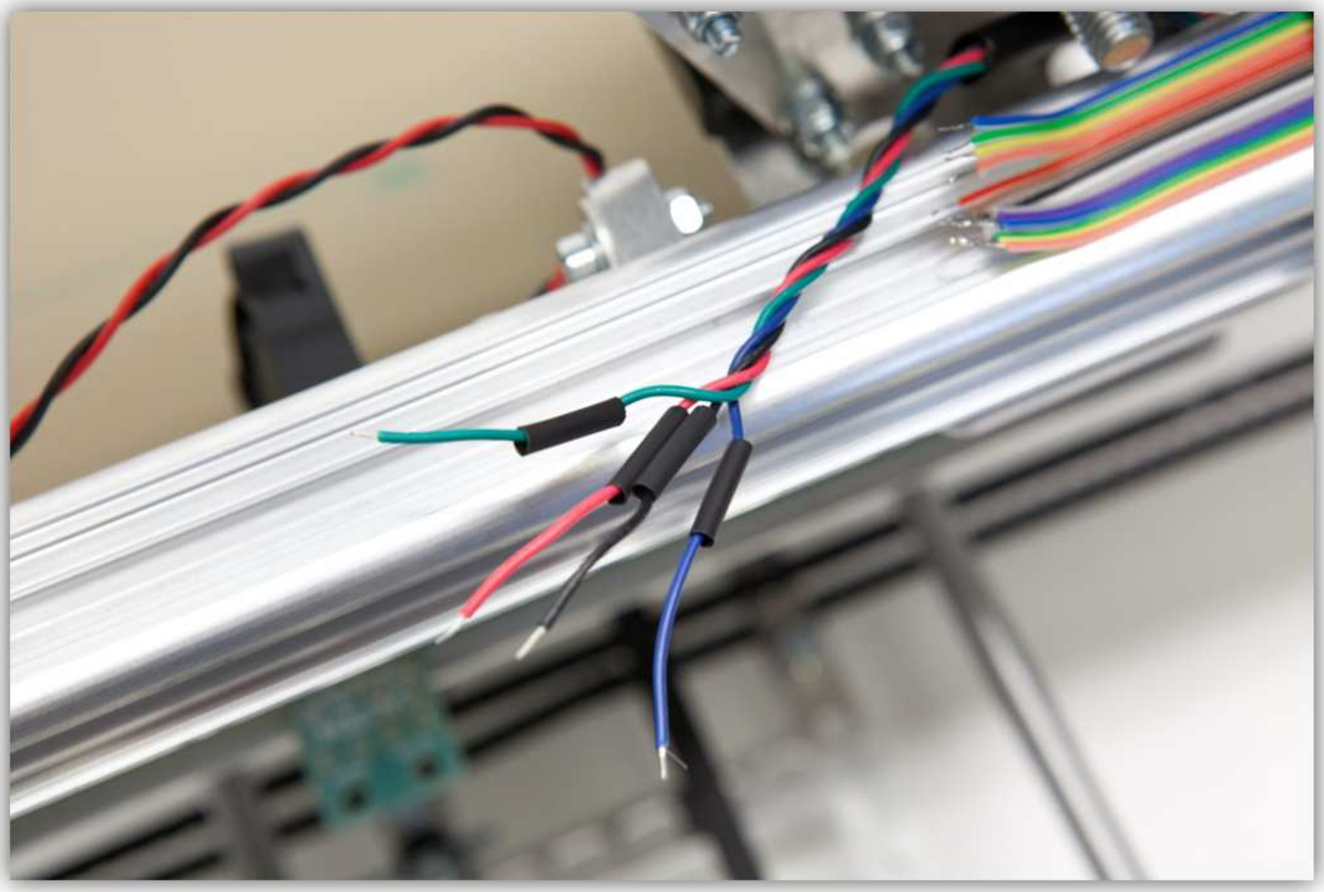


Cut 4 small pieces of the small heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

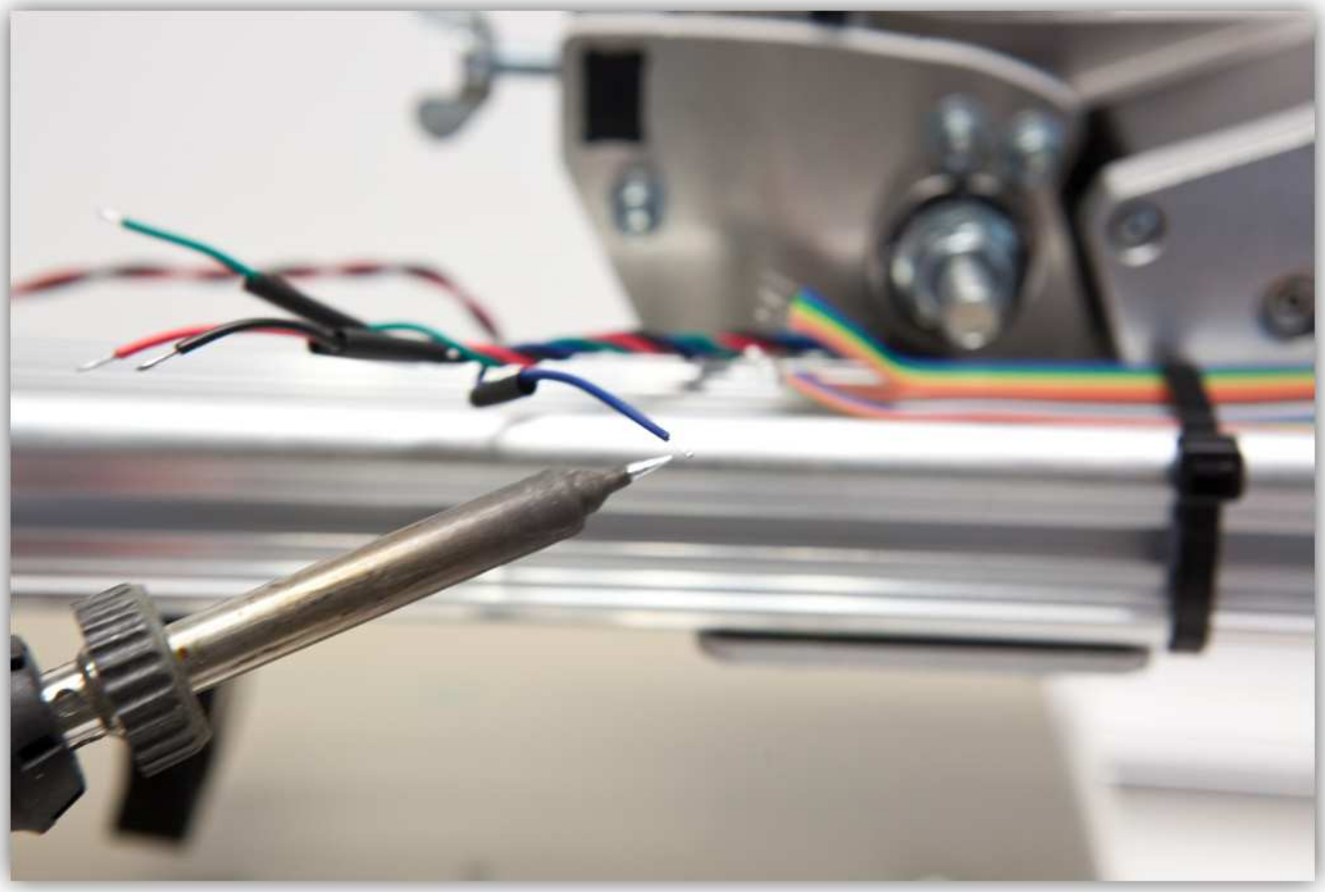
Slide the big heat shrink tube over the 4 wires of the motor.



Slide the 4 small heat shrink tubes over the 4 wires of the motor.

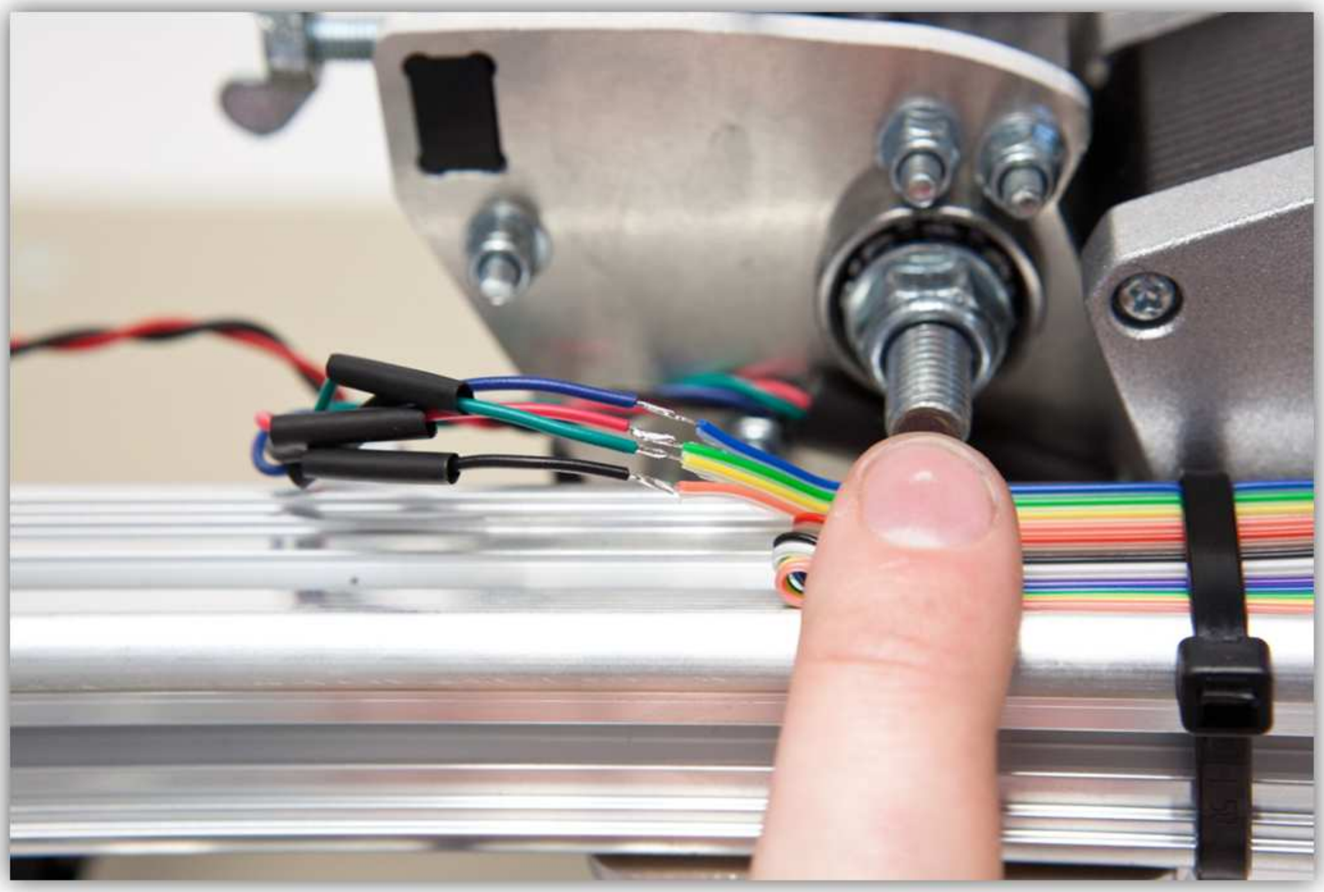


Tin all the wires.

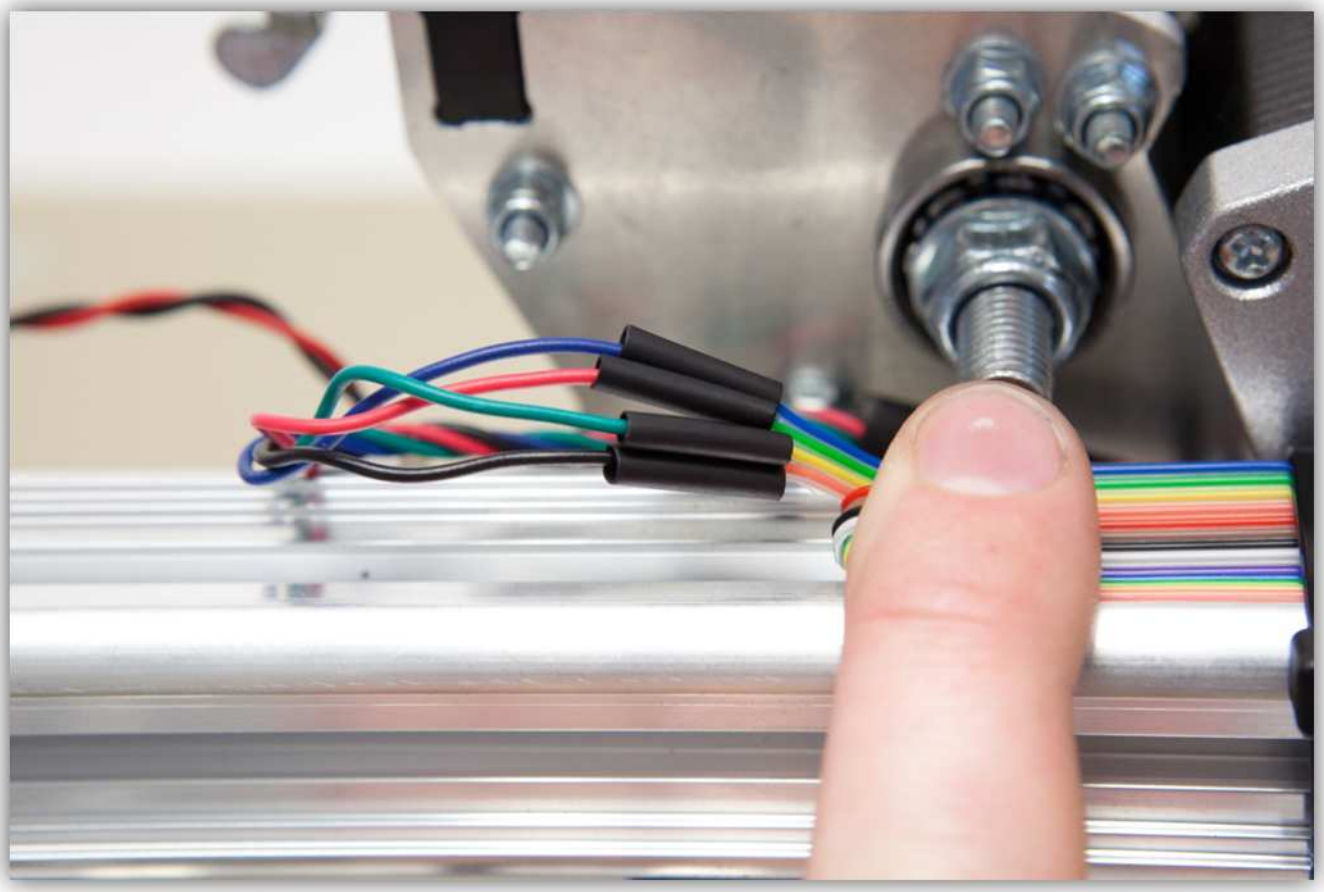


Solder the 4 wires from the motor to the 4 wires of the flat cable you tinned earlier. **Watch the colours closely.**

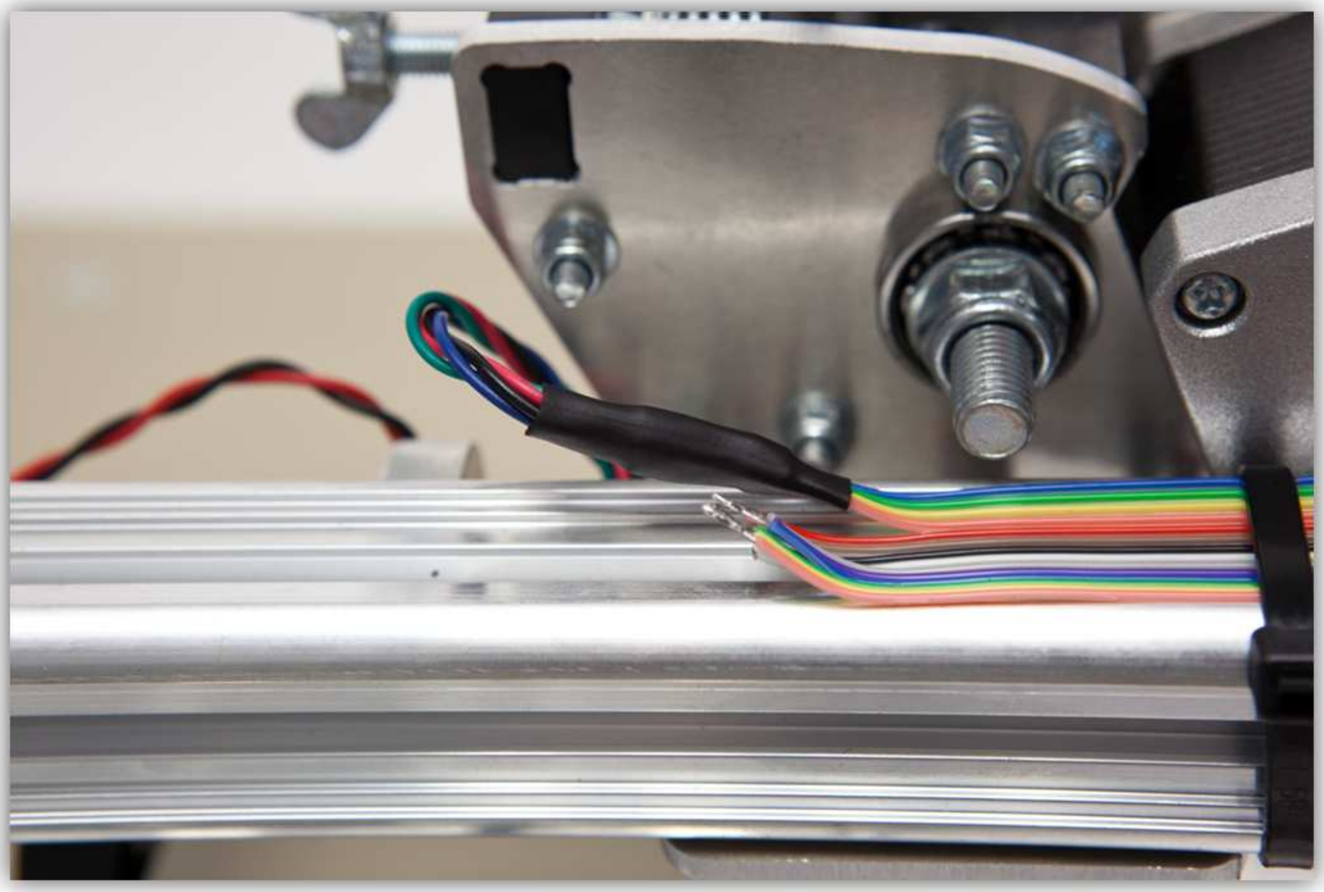
Flat cable	->	Motor wires
Blue	->	Blue
Green	->	Red
Yellow	->	Green
Orange	->	Black



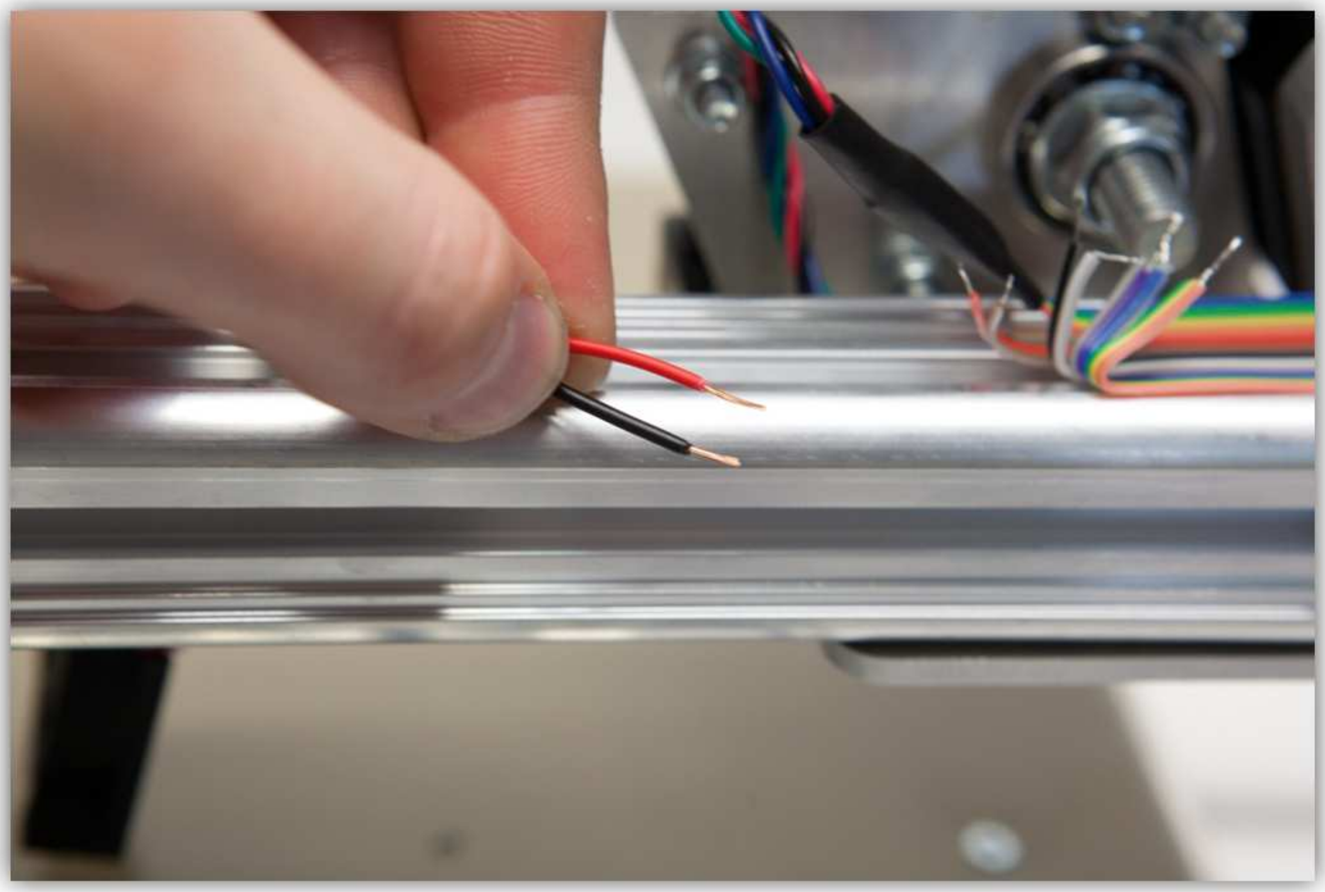
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.

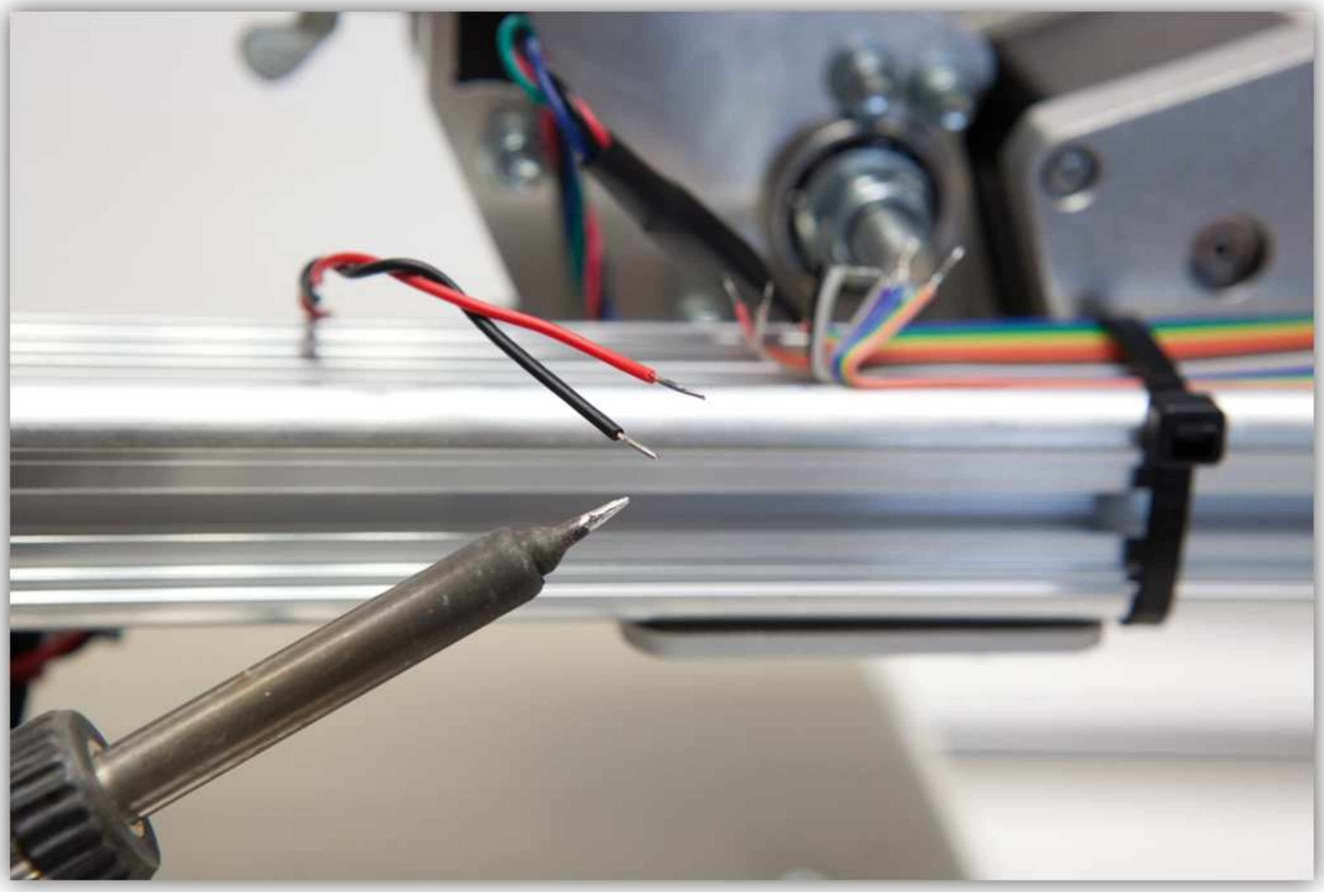


Now slide the big piece of heat shrink tubing over the 4 small pieces, heat the big piece so it covers and protects the 4 heat shrunk joints.



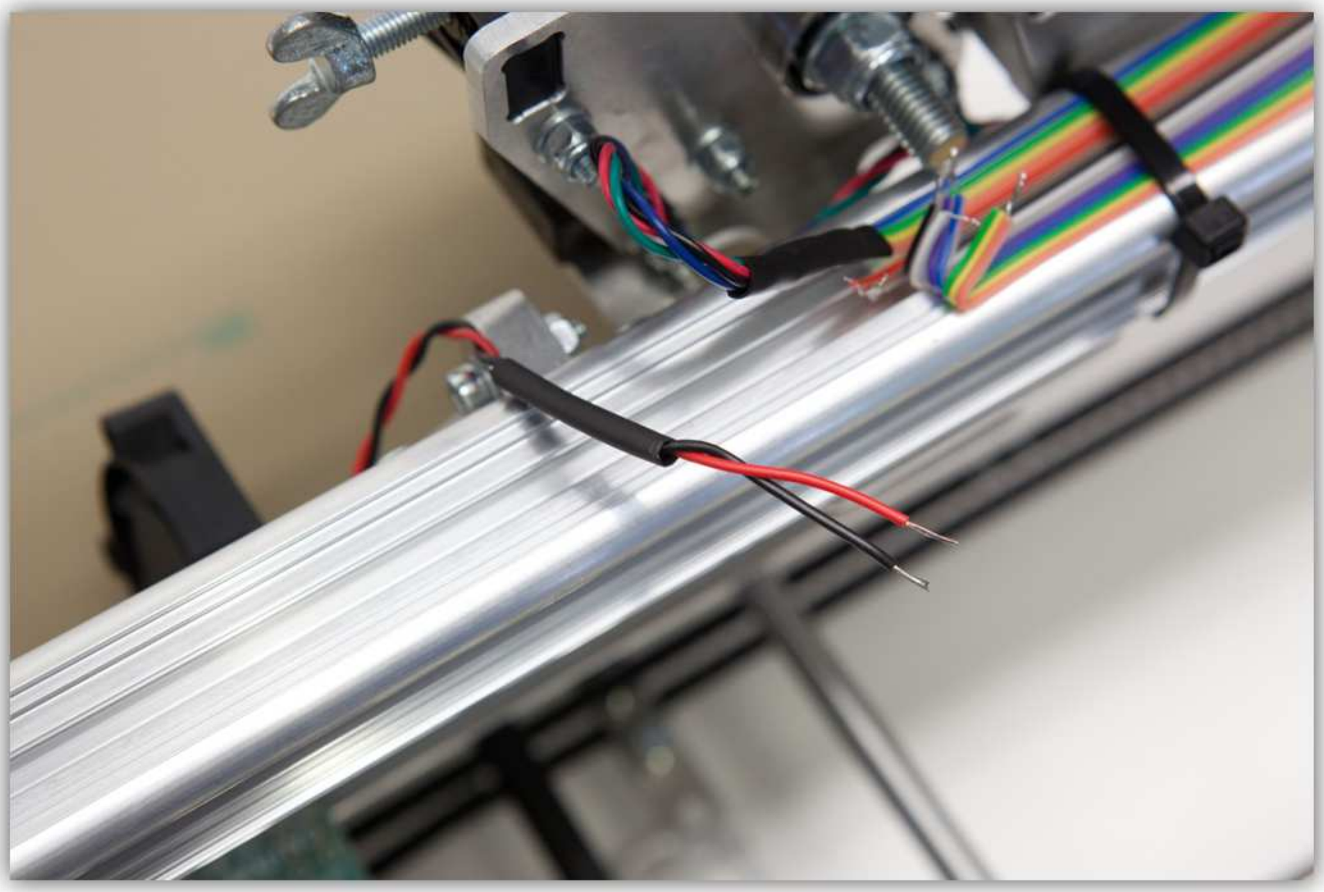
Now take the 2 wires of the fan and tin them.



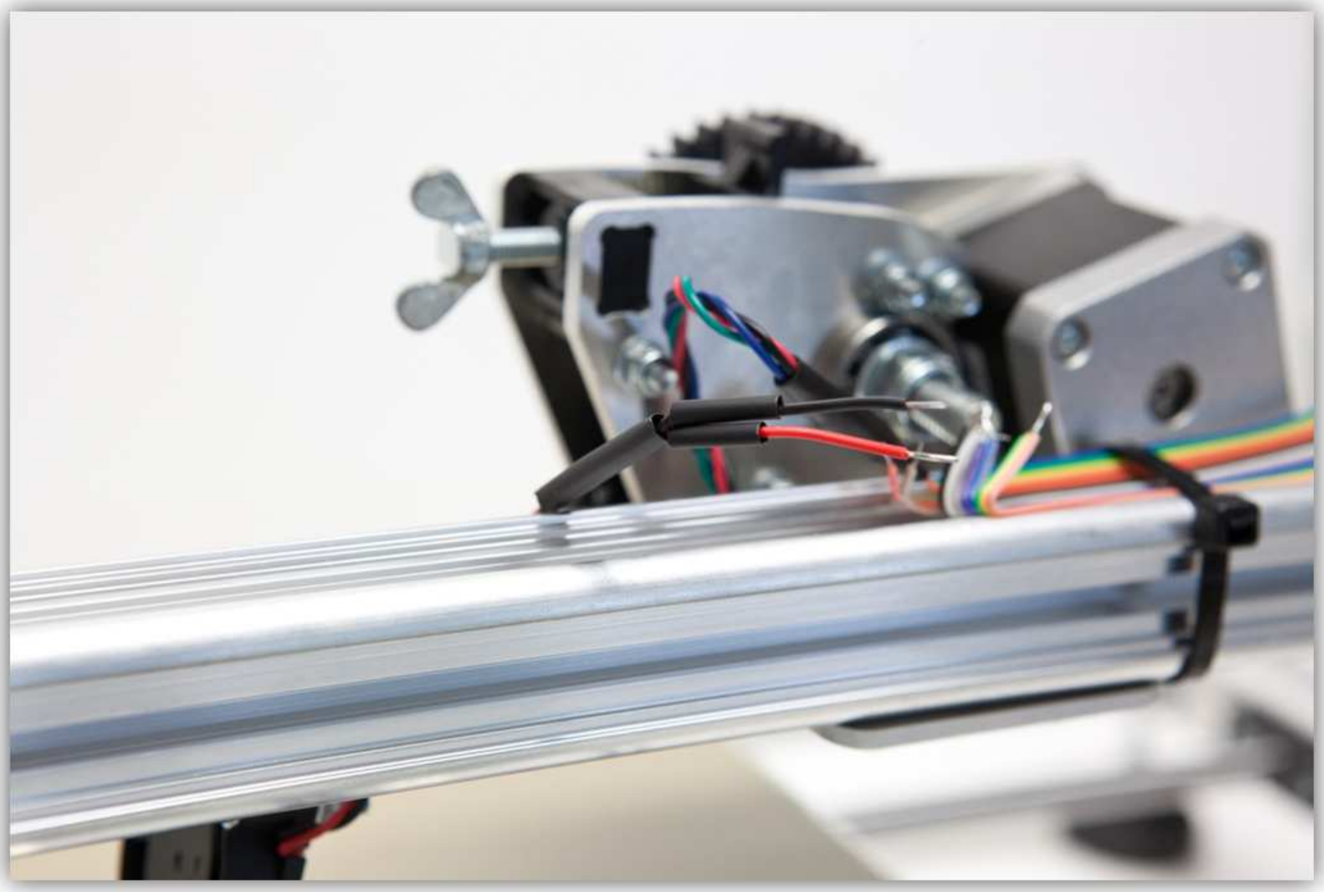


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the medium size heat shrink tube over the 2 wires of the fan.

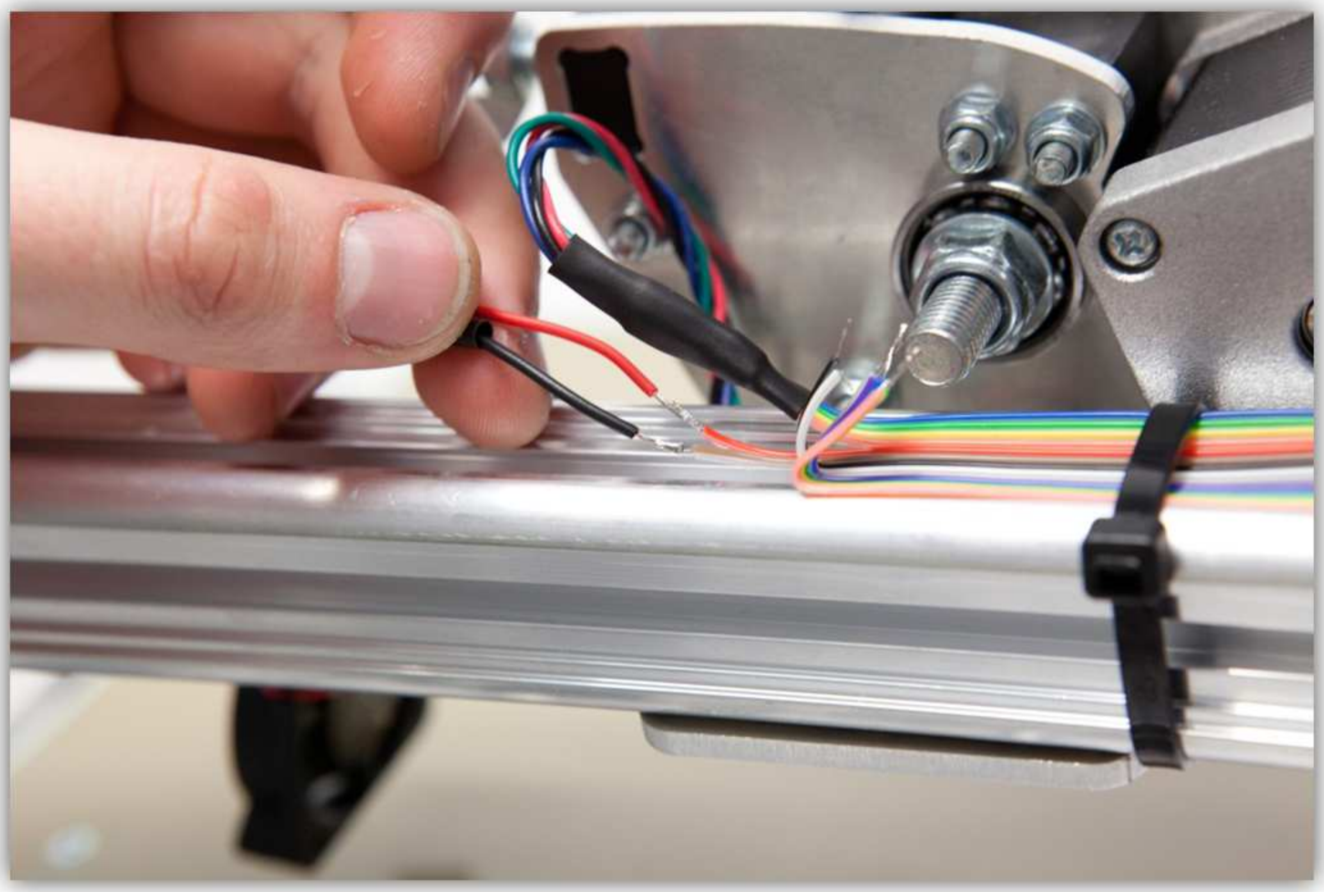


Slide the 2 small heat shrink tubes over the 2 wires of the connector.

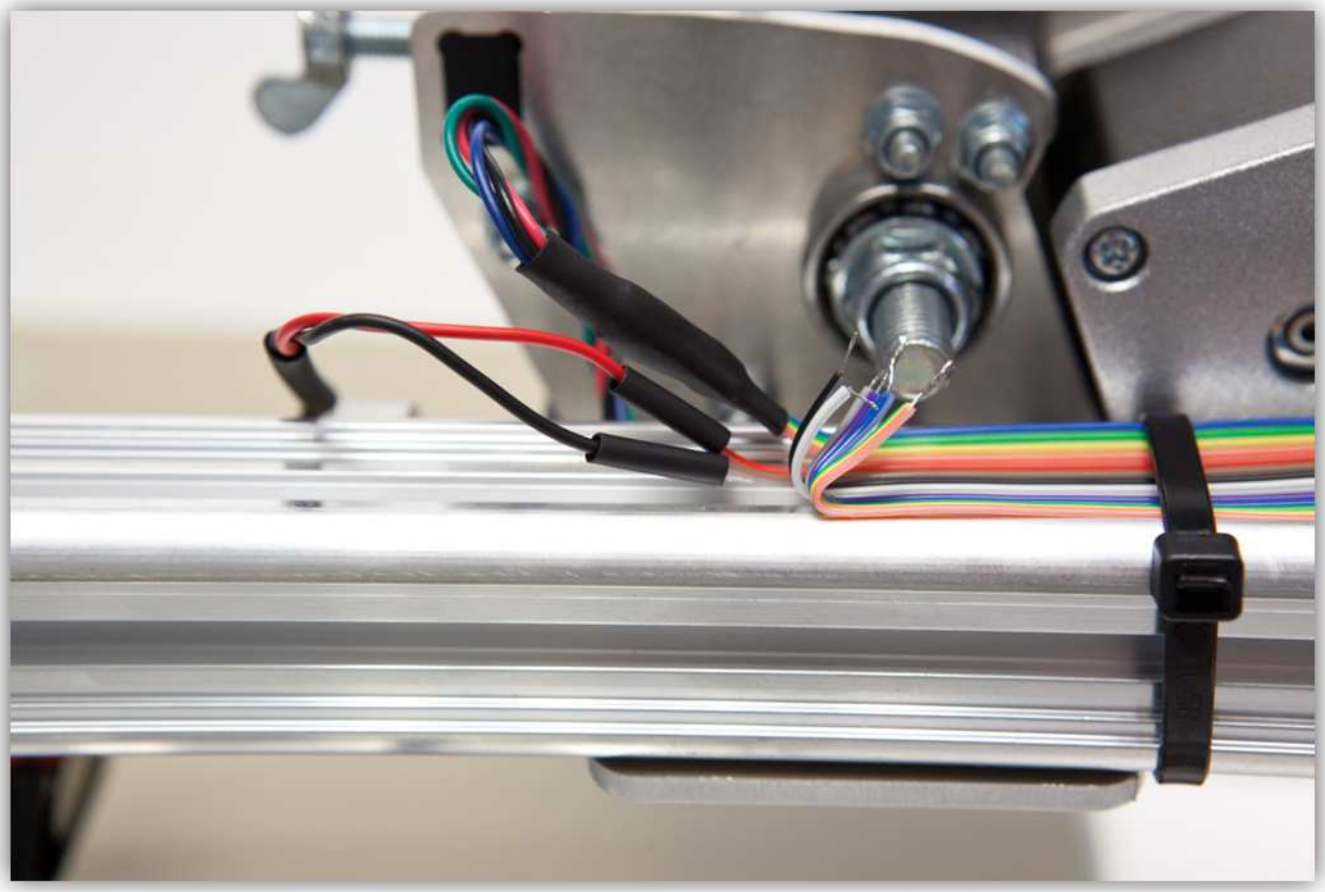


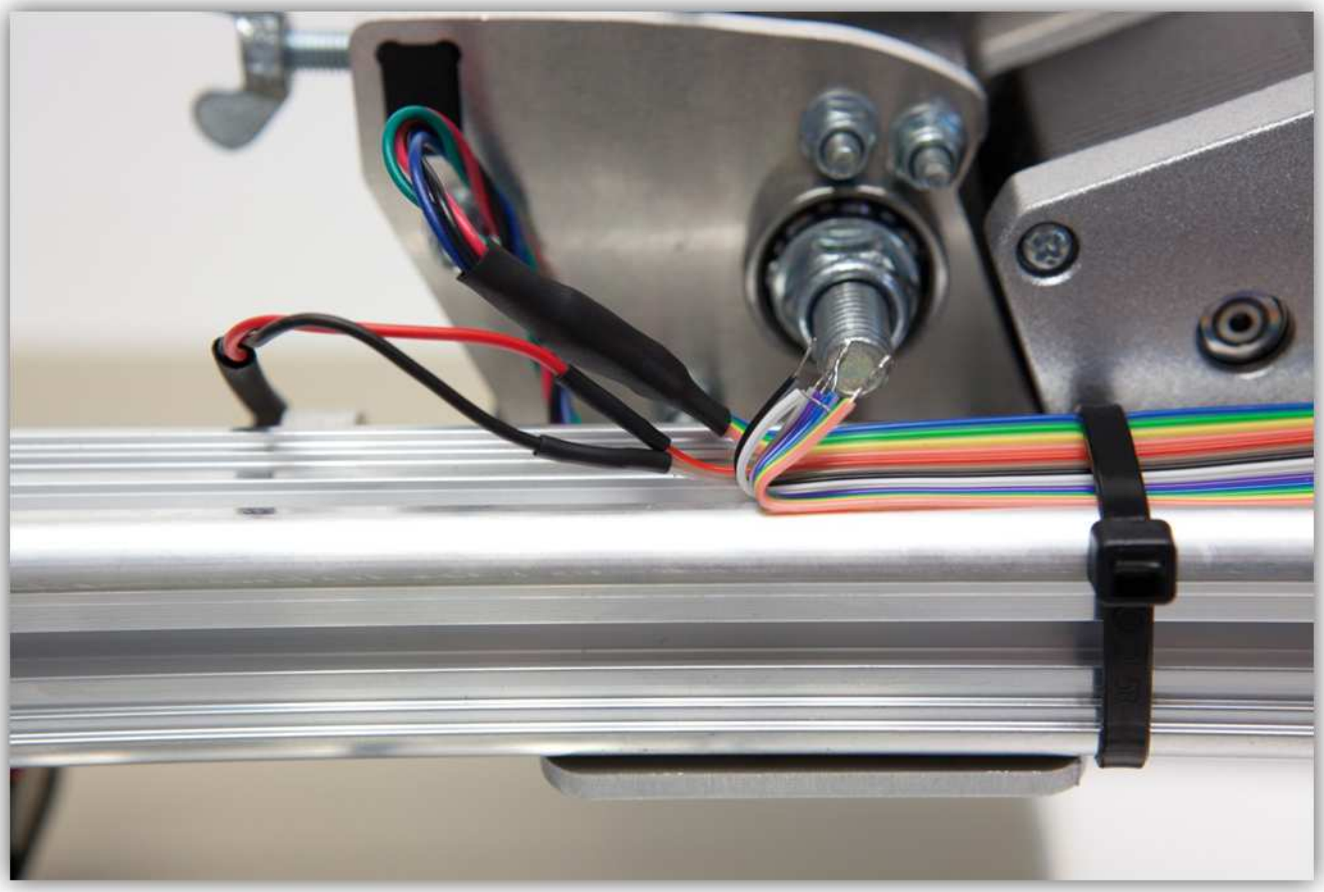
Solder the 2 wires from the fan to the 2 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	**->**	**Fan wires**
Red	**->**	**Red**
Brown	**->**	**Black**

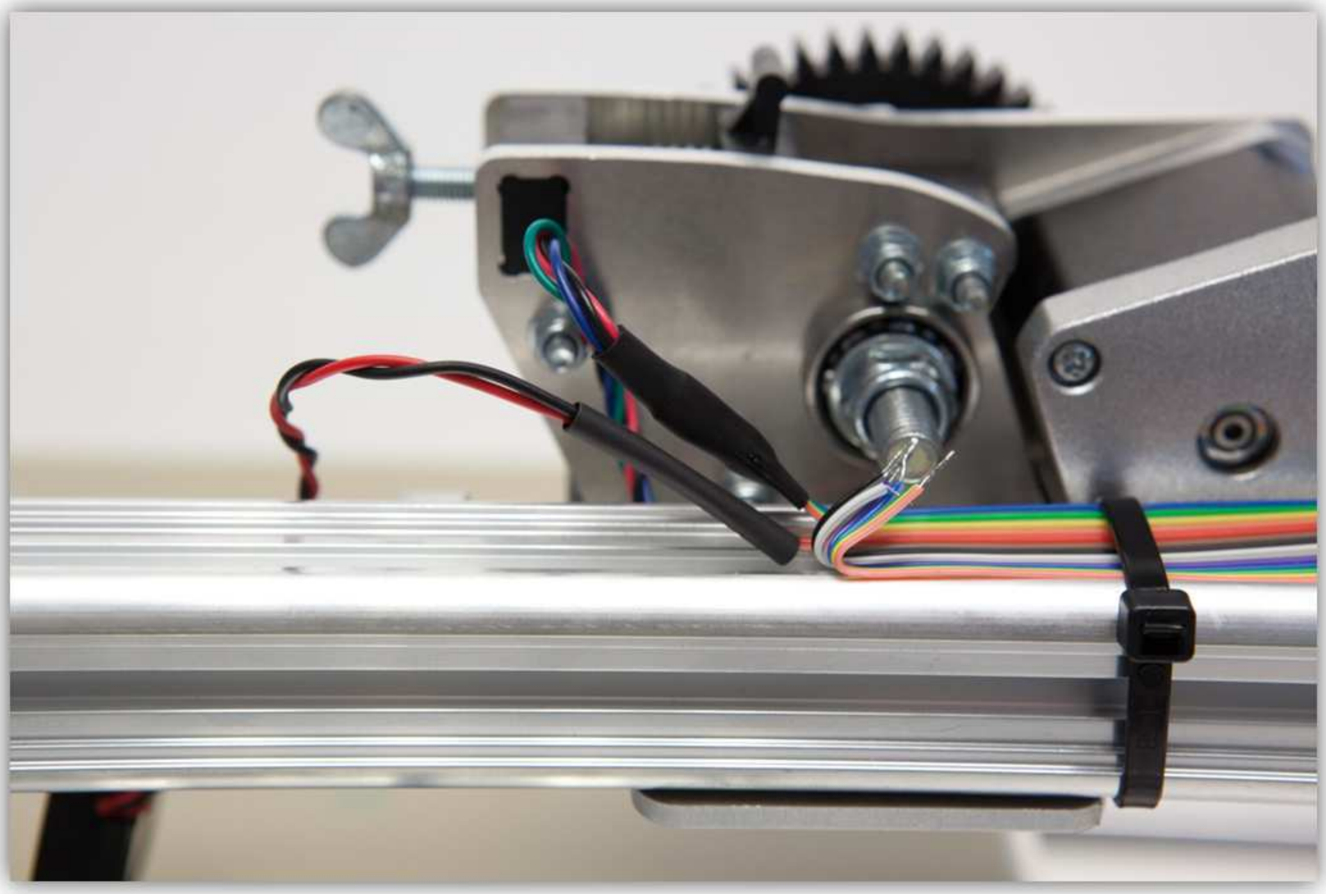


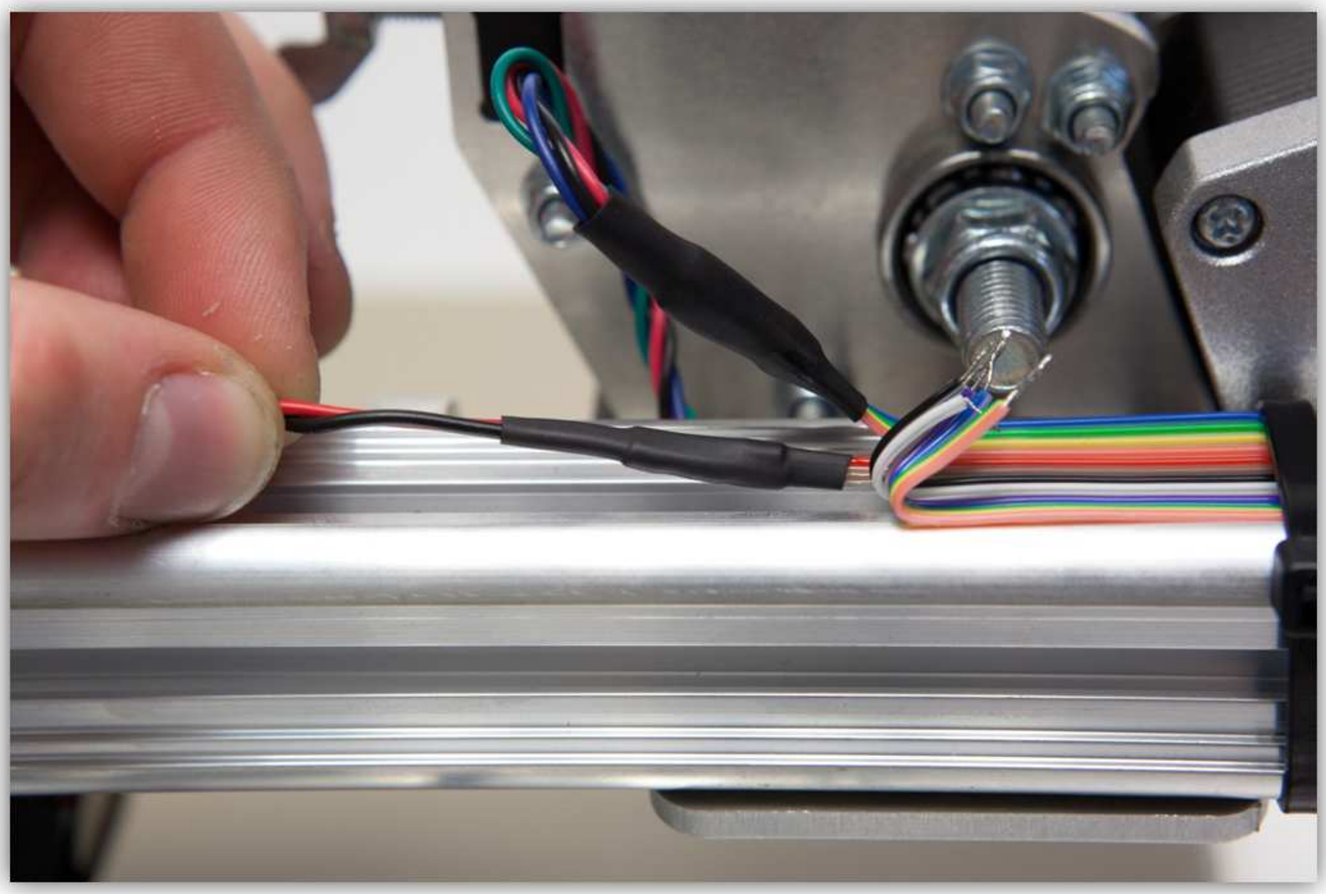
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.



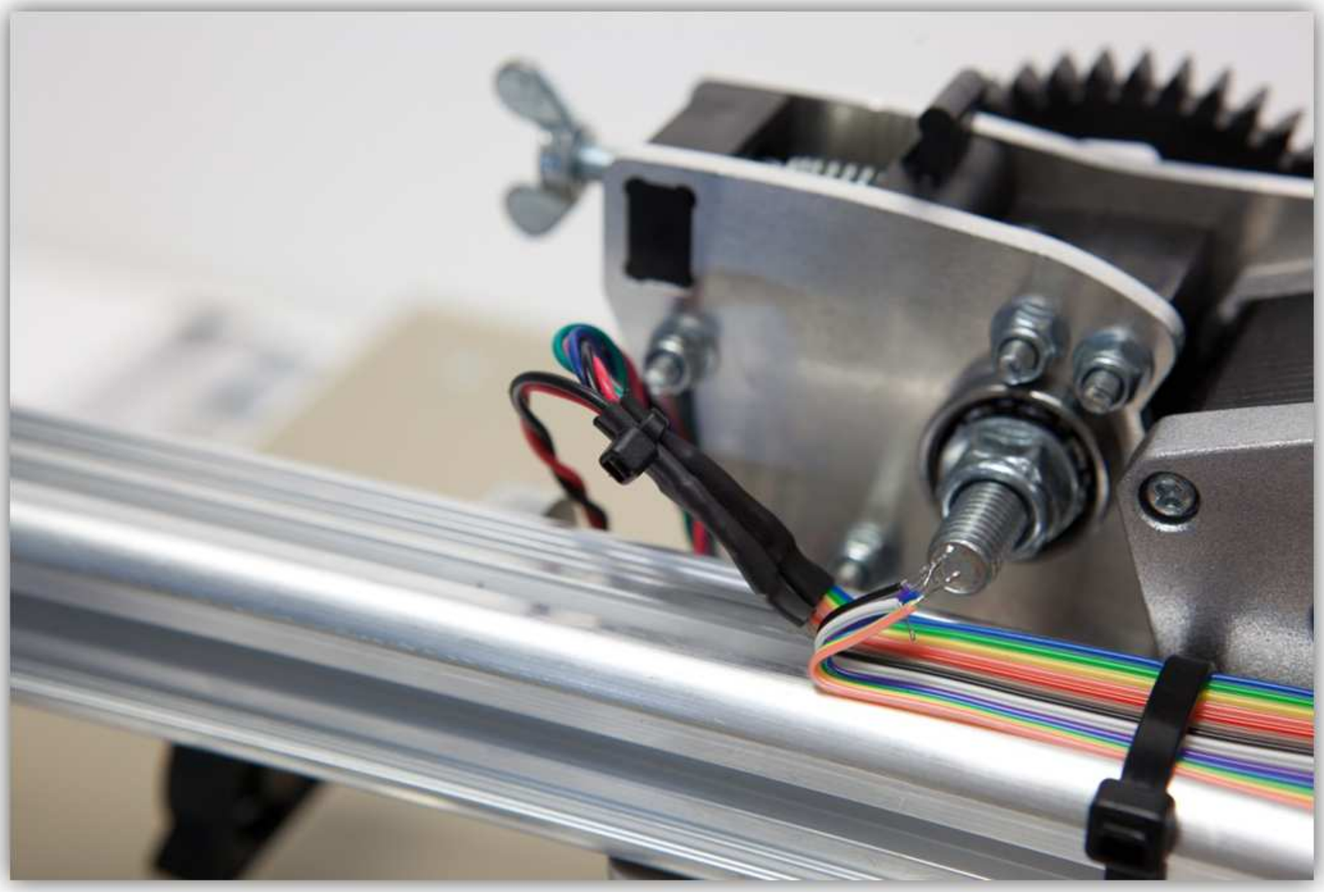


Now slide the big piece of heat shrink tubing over the 2 small pieces, heat the big piece so it covers and protects the 2 heat shrunk joints.





Use a small tie-strip to keep the cables together.

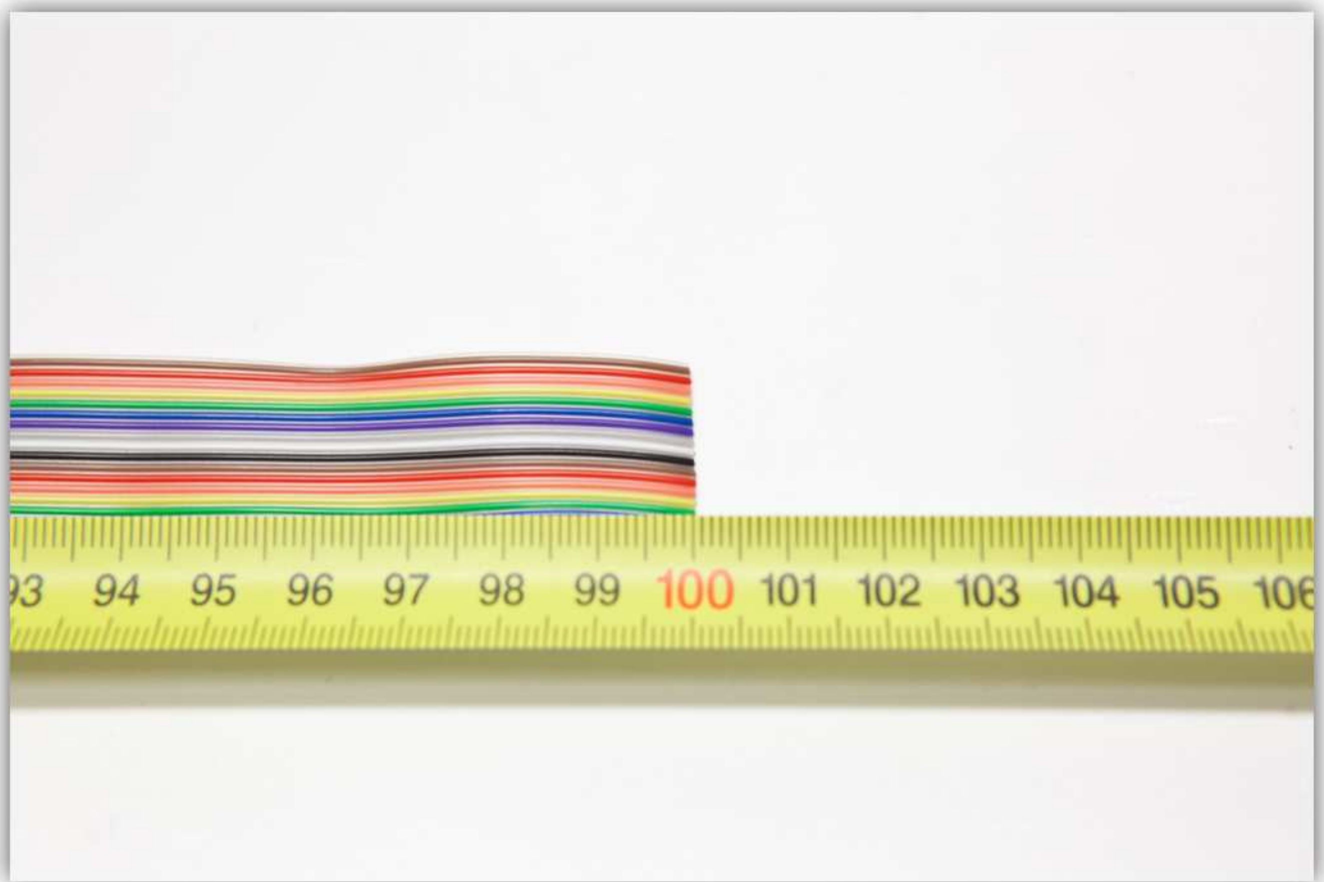


Use a small tie-strip to guide the cable of the fan.

We will return to this flat cable again in a later chapter to hook up the extruder itself.

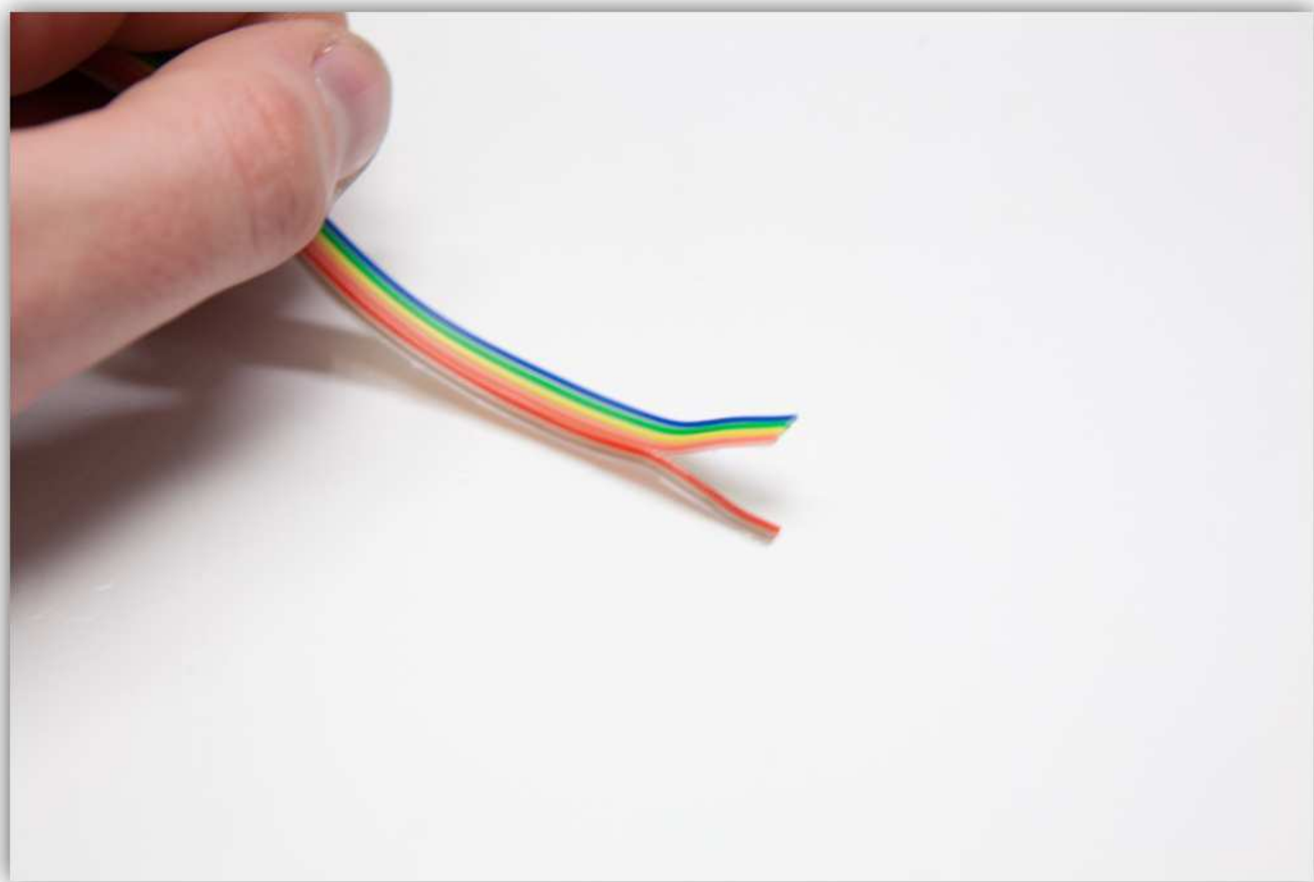
016 – WIRING THE Z AXIS MOTOR AND MICRO SWITCH

Take the MULTI-COLOURED FLATCABLE out of the bag labelled with 40. Cut a piece of 100 cm (3.94"). **This length is critical, measure twice before cutting.**

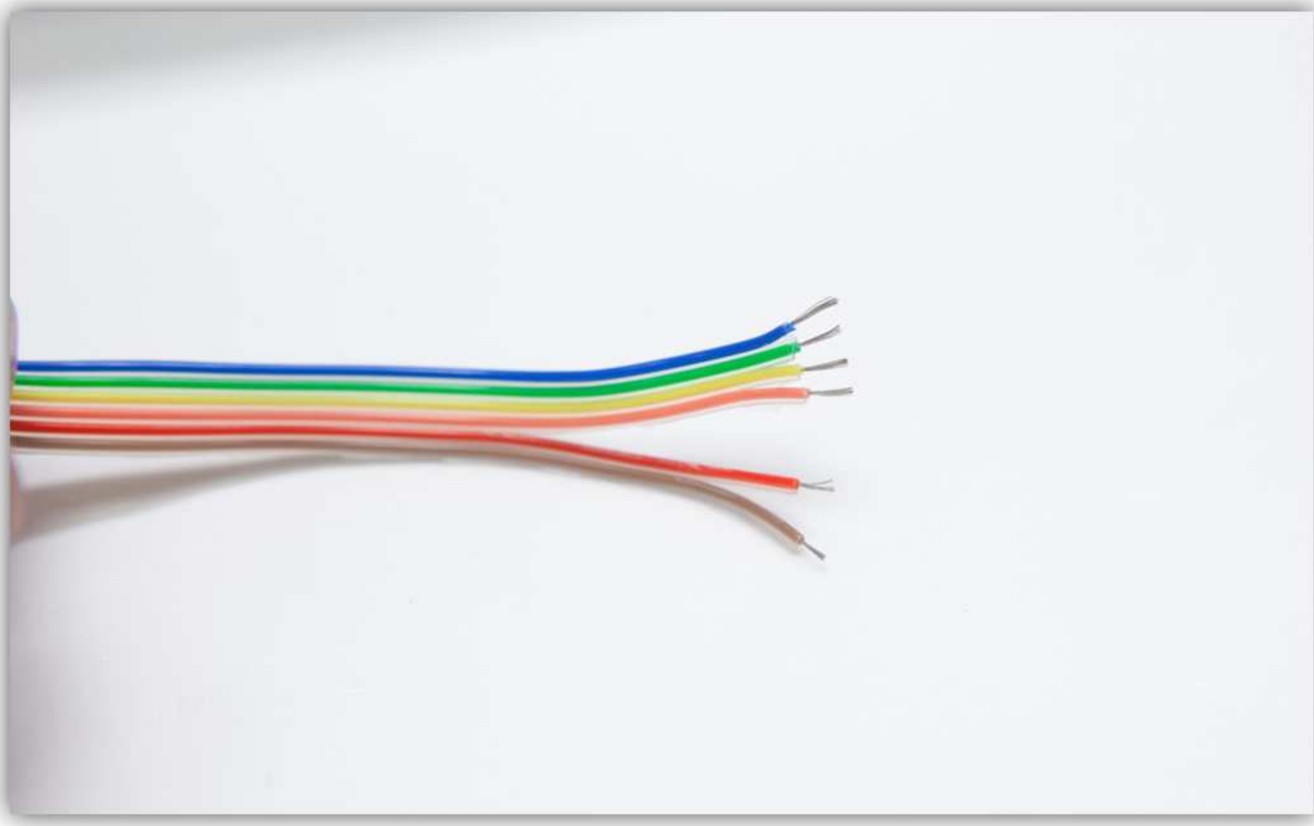


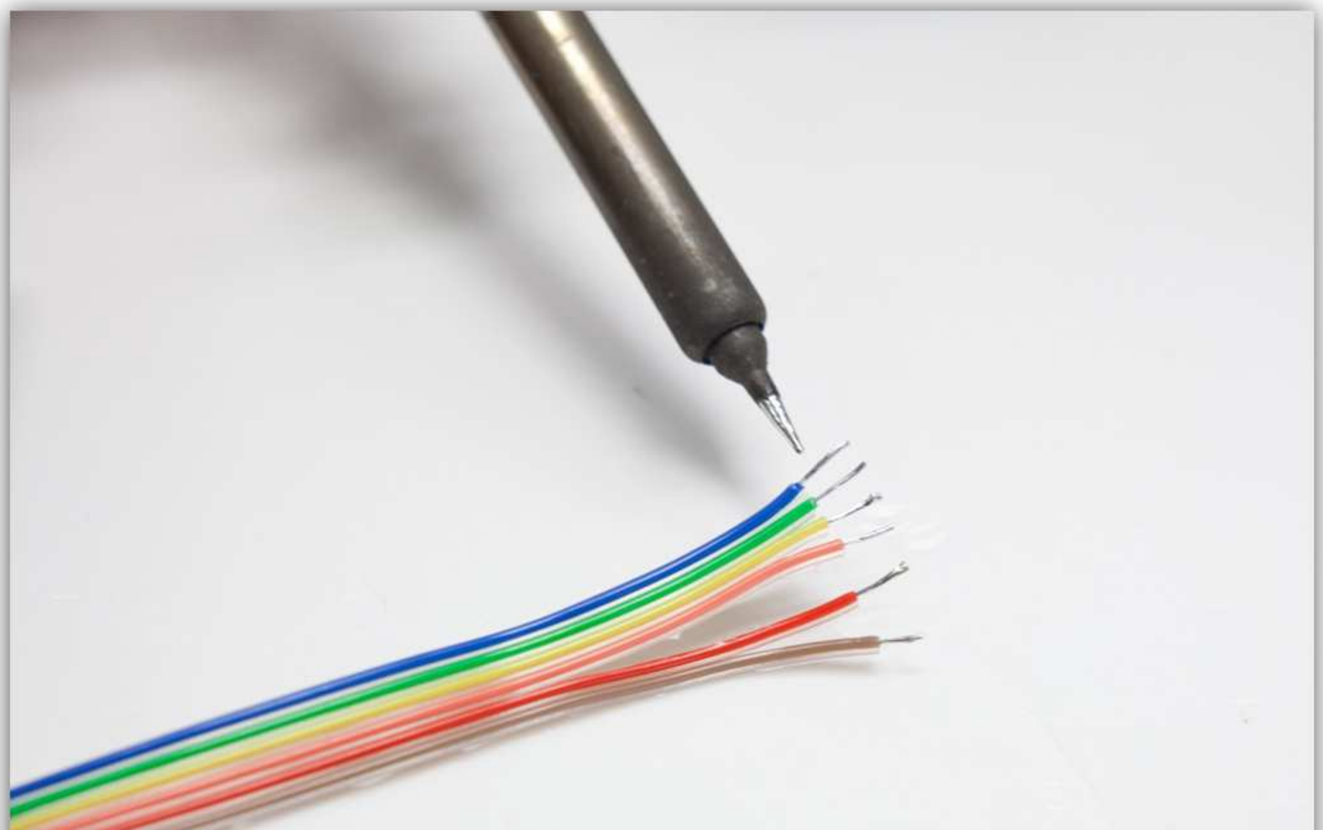
Detach (rip them of) the outer **Blue, Green, Yellow, Orange, Red** and **Brown** colour wires from the pack over the whole length. We will use these colours for this chapter.

Detach the **Brown** and **Red** wire for 2 cm (0.79").



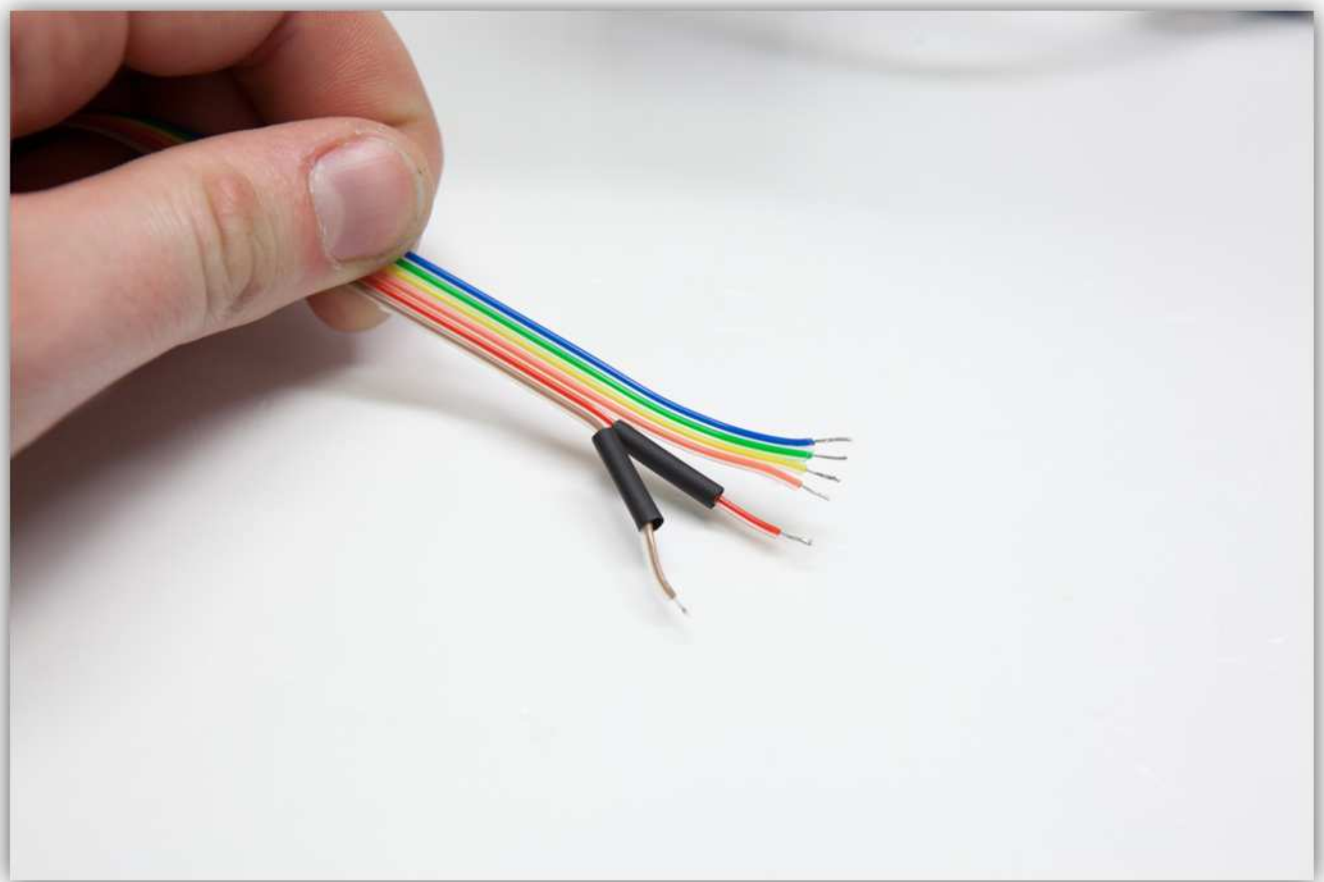
Strip and tin the wires.



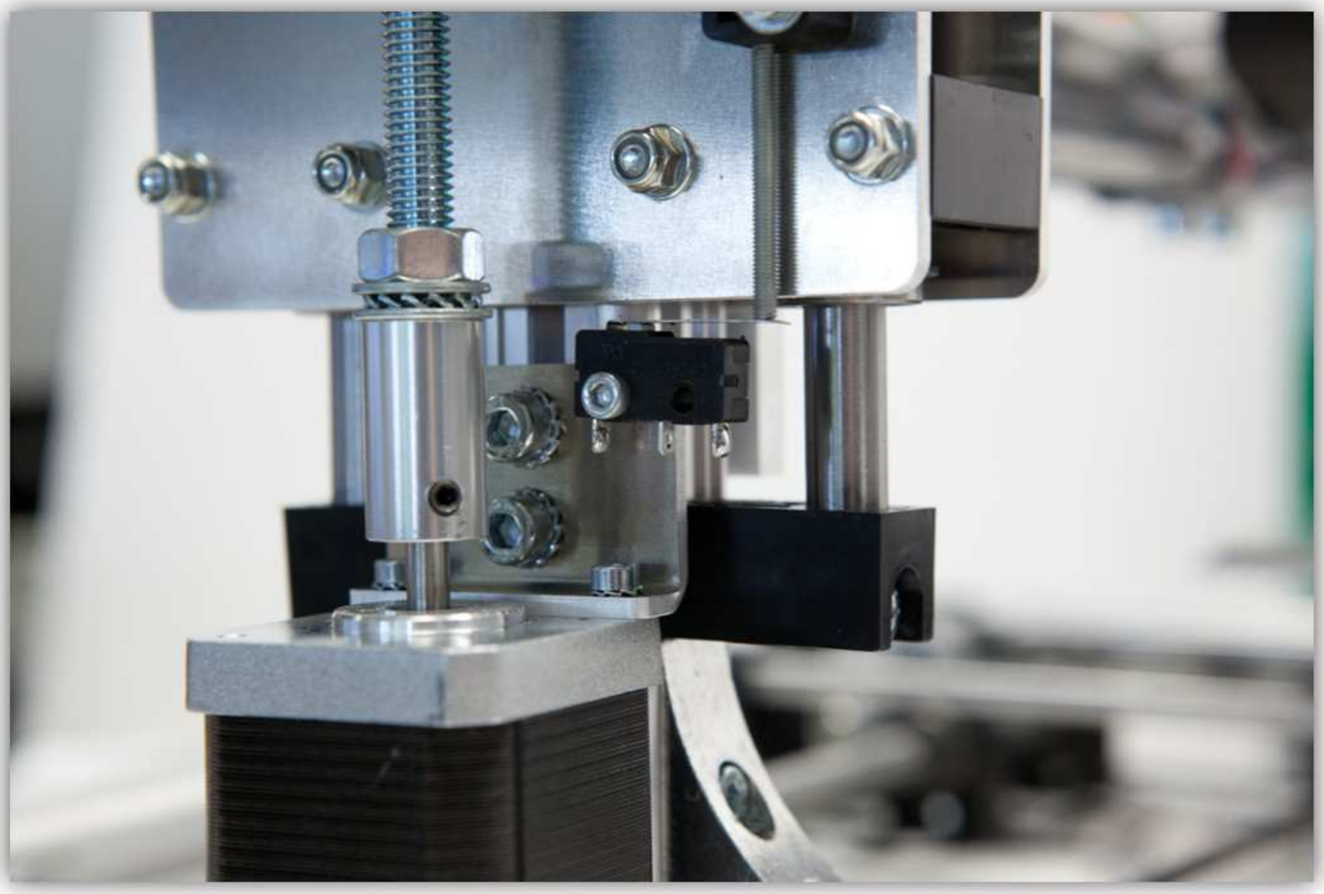


Cut 4 medium size pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long

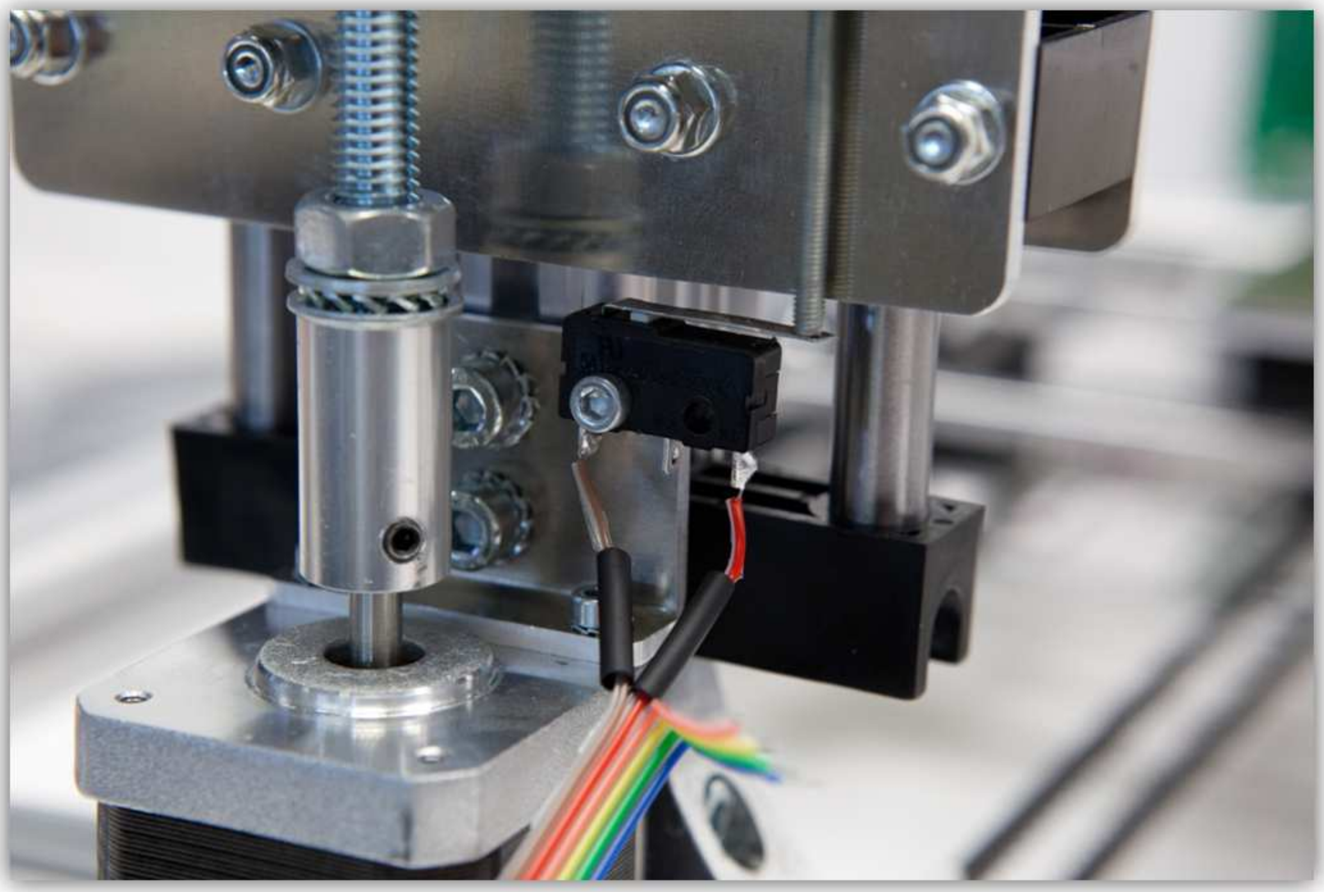
Slide the 2 medium size pieces of heat shrink tubing over the **Red** and **Brown** wires of the flat cable.



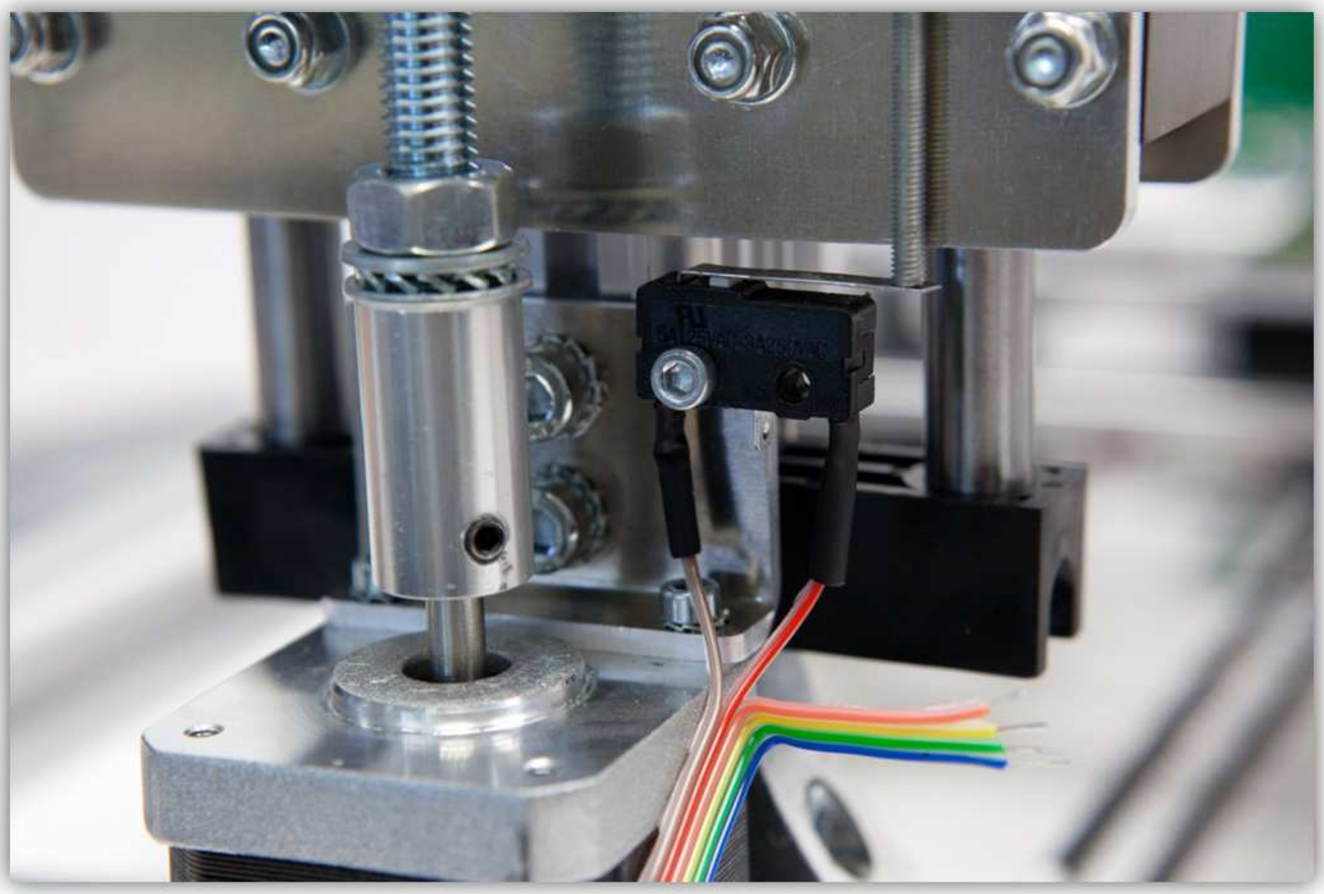
Tin the two outer contacts of the Z micro switch.

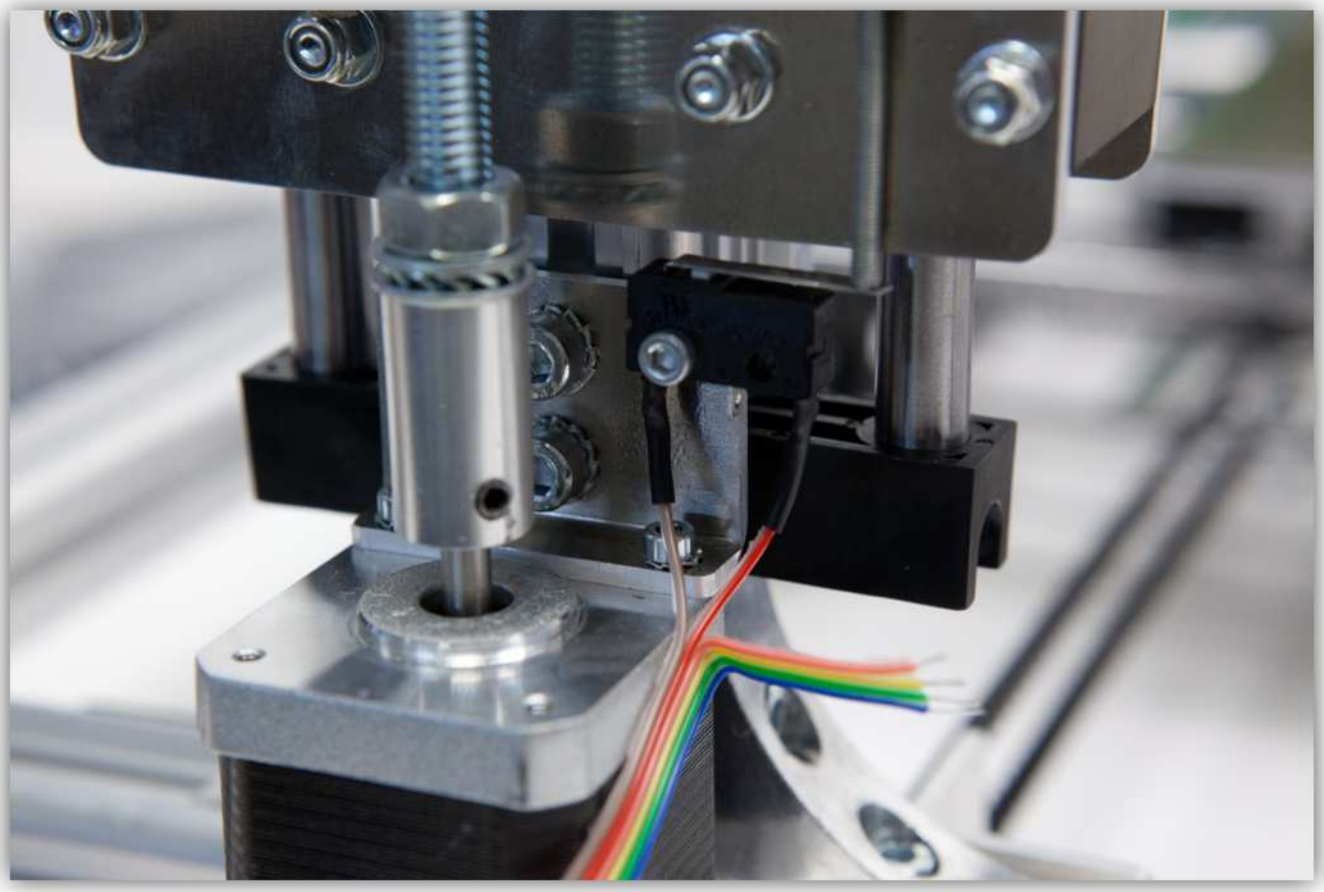


Solder the **Red** and **Brown** wires to the contacts.

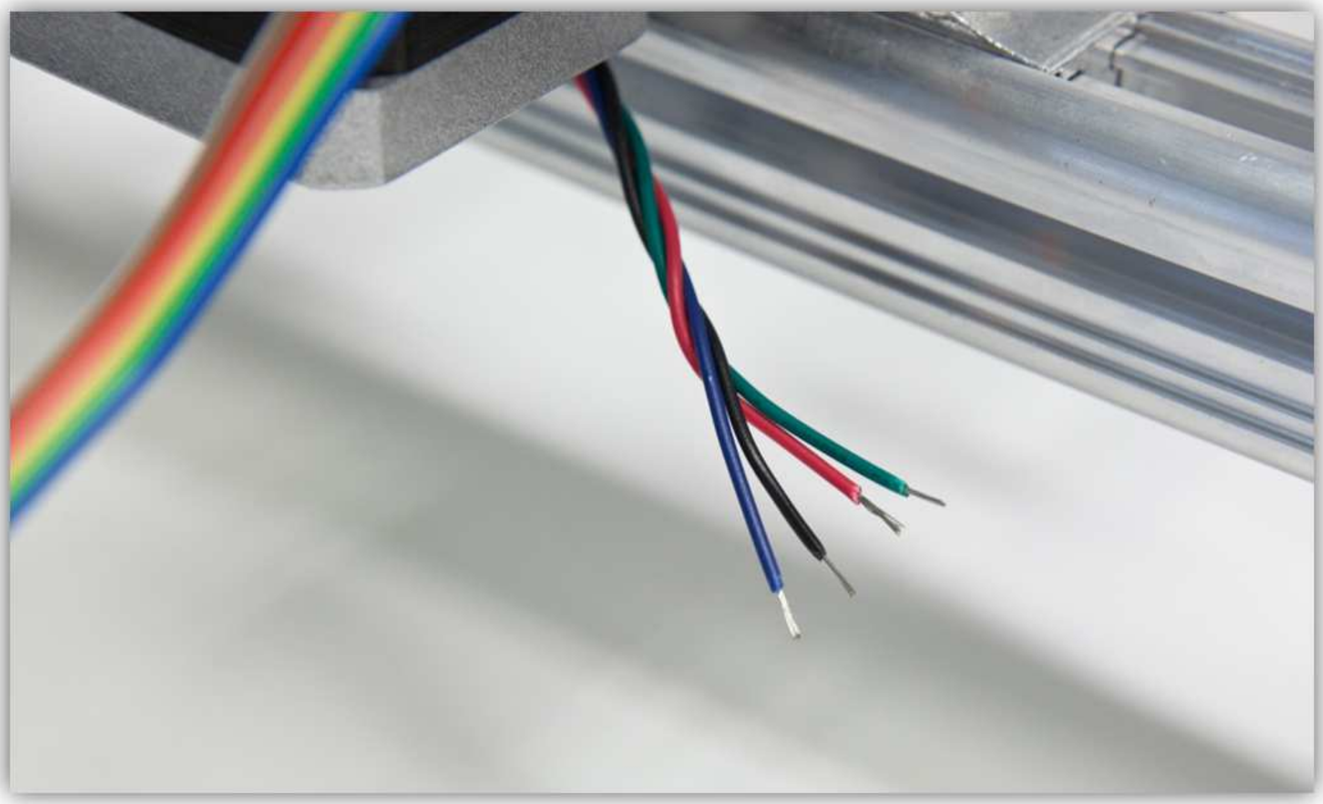


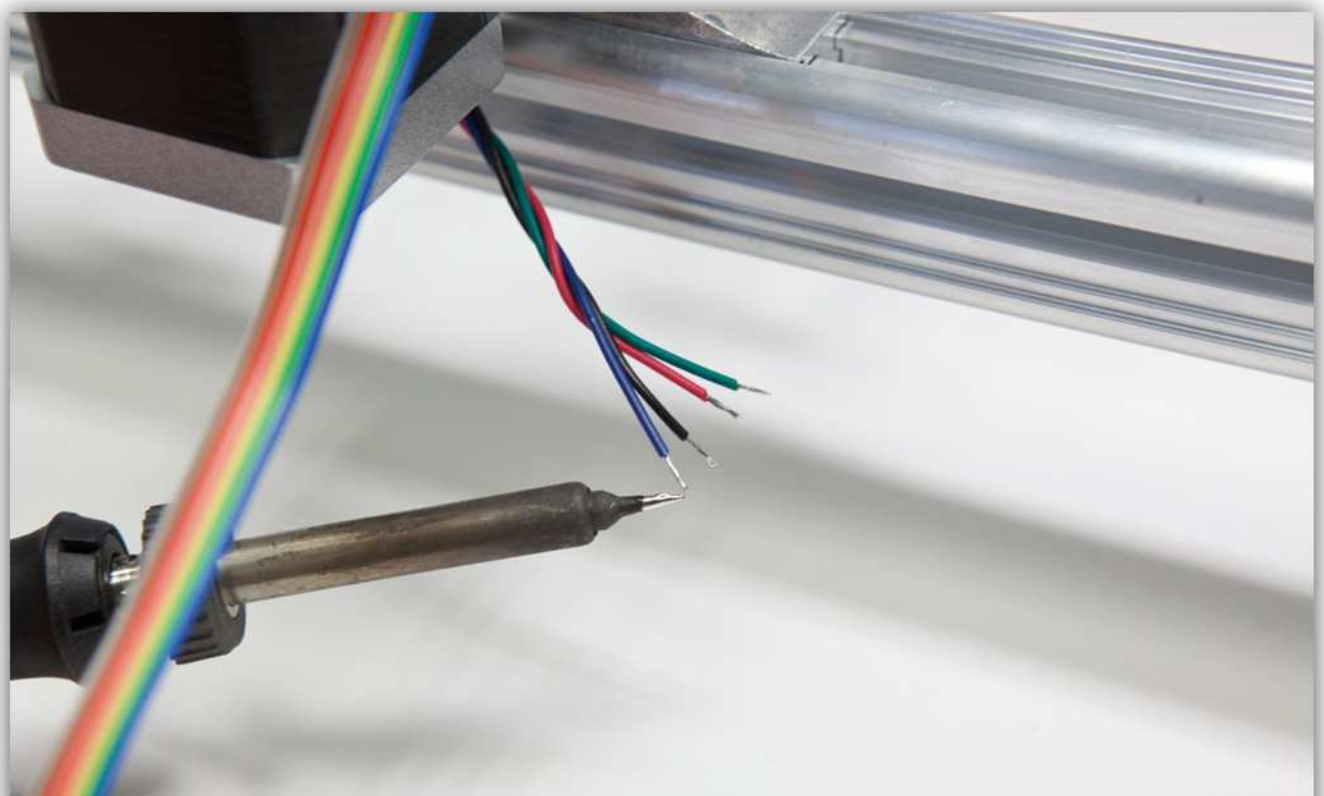
Slide the heat shrink tubes over the contacts and heat them up.





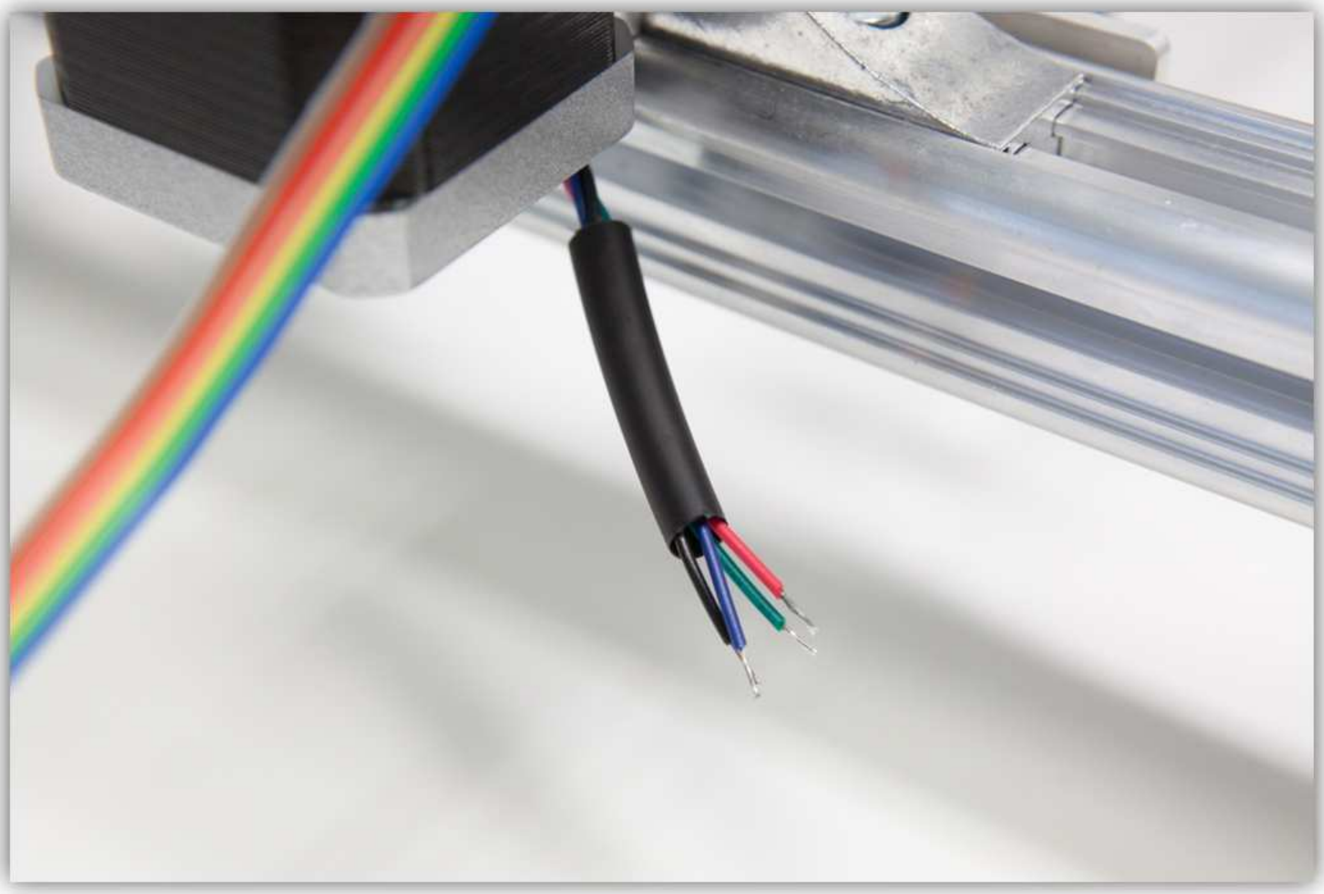
Shorten the wires of the Z motor a bit and thin them.



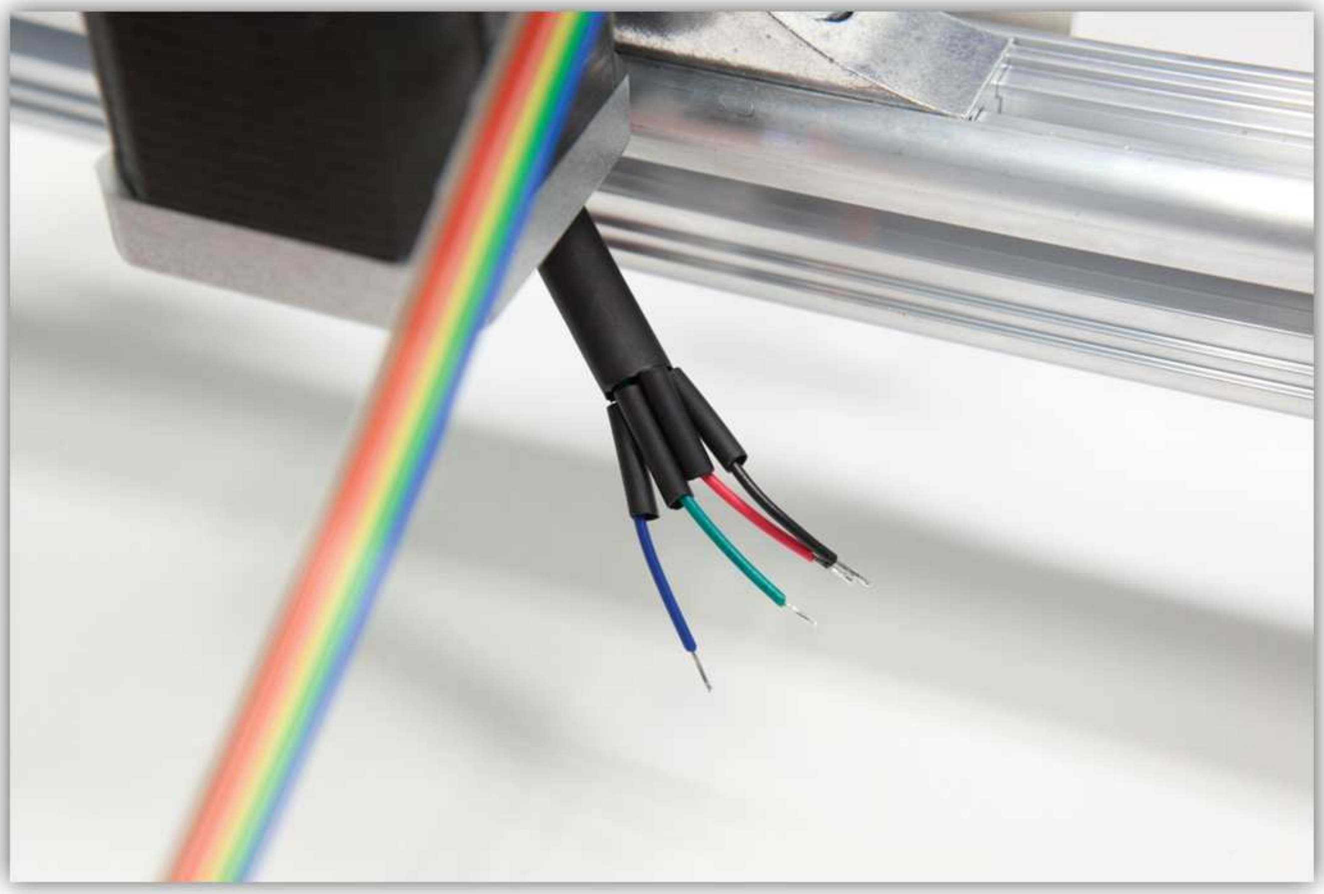


Cut 4 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the biggest piece of heat shrink tubing over the 4 wires from the motor.

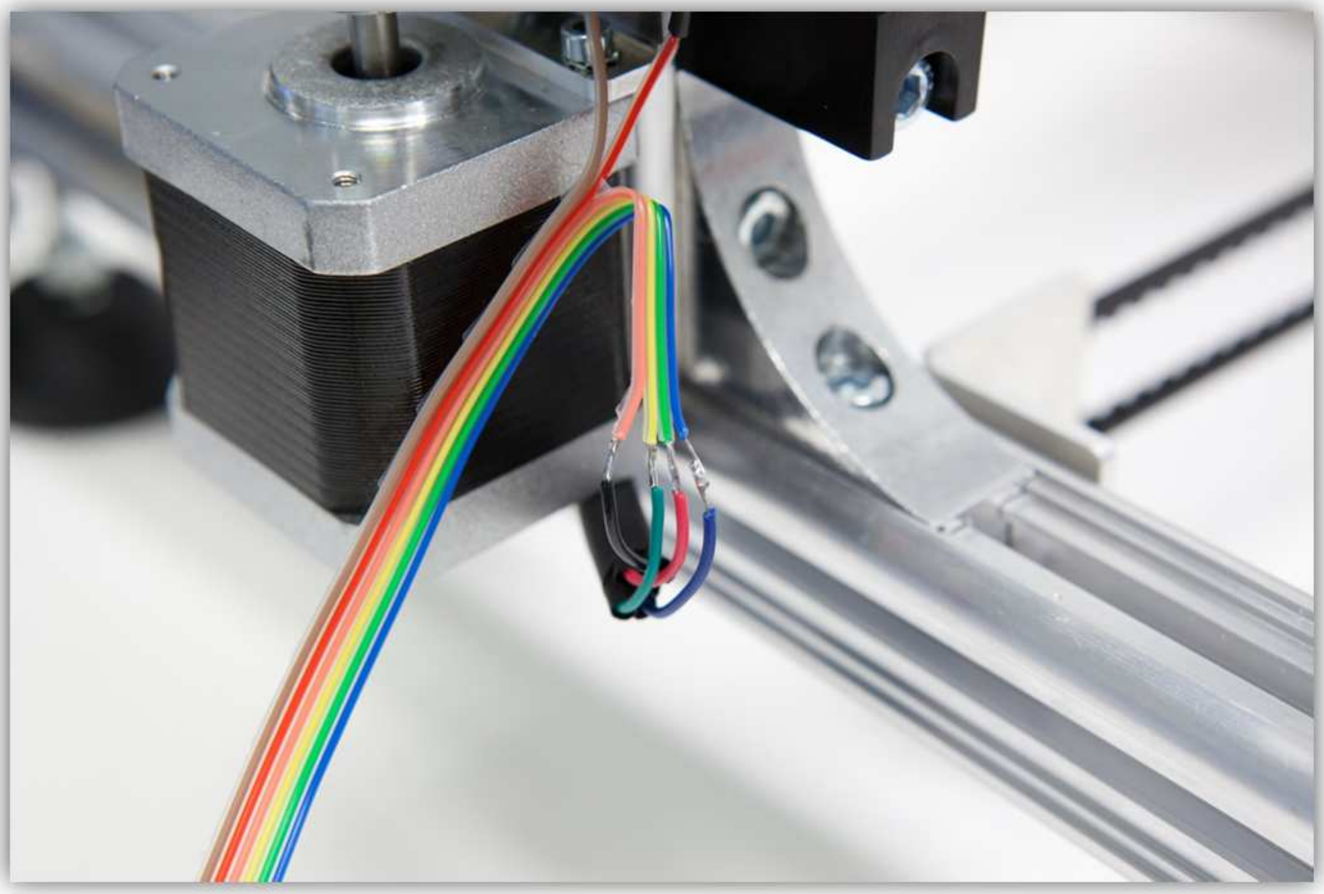


Slide the 4 small pieces of heat shrink tubing over the 4 wires of the motor.

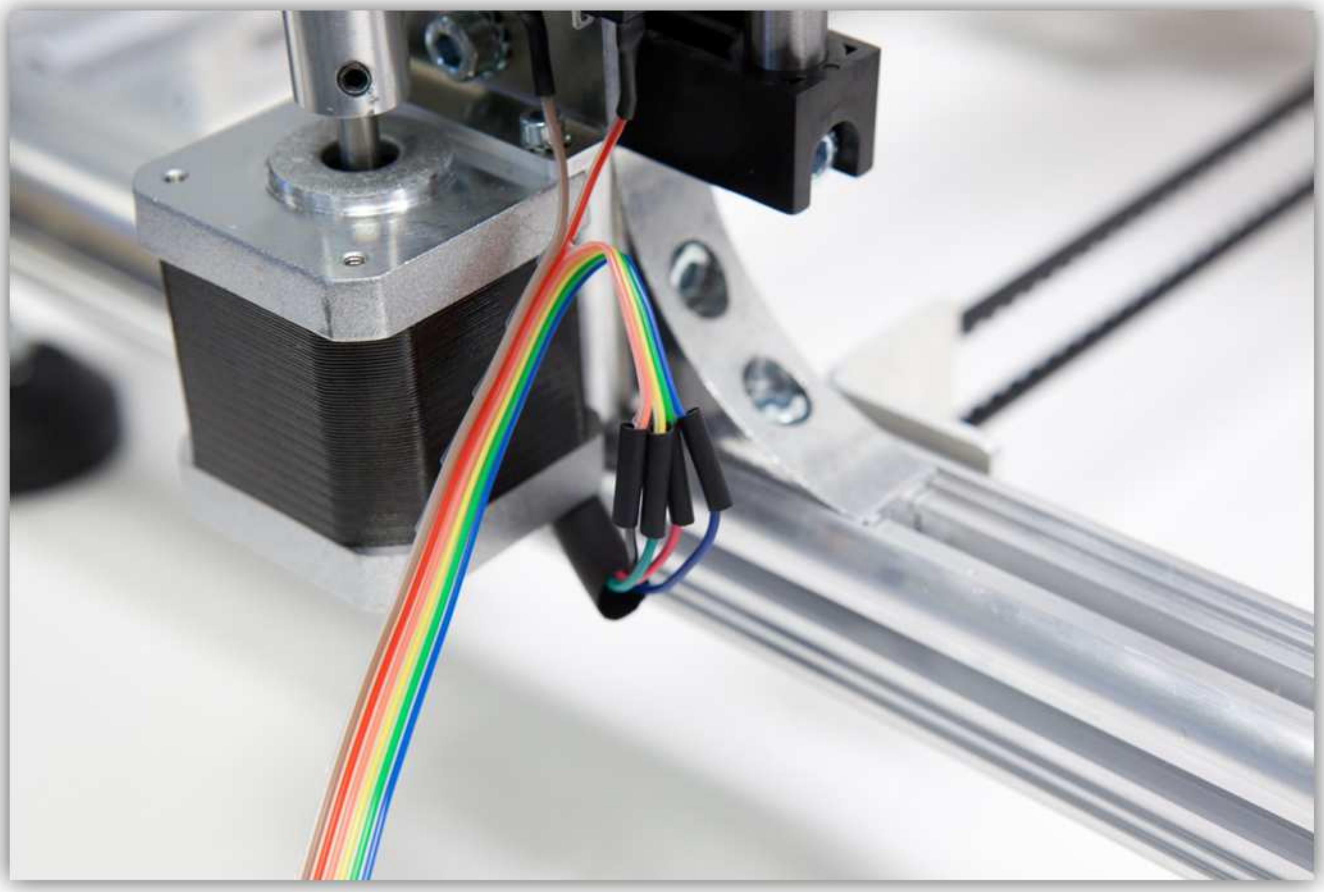


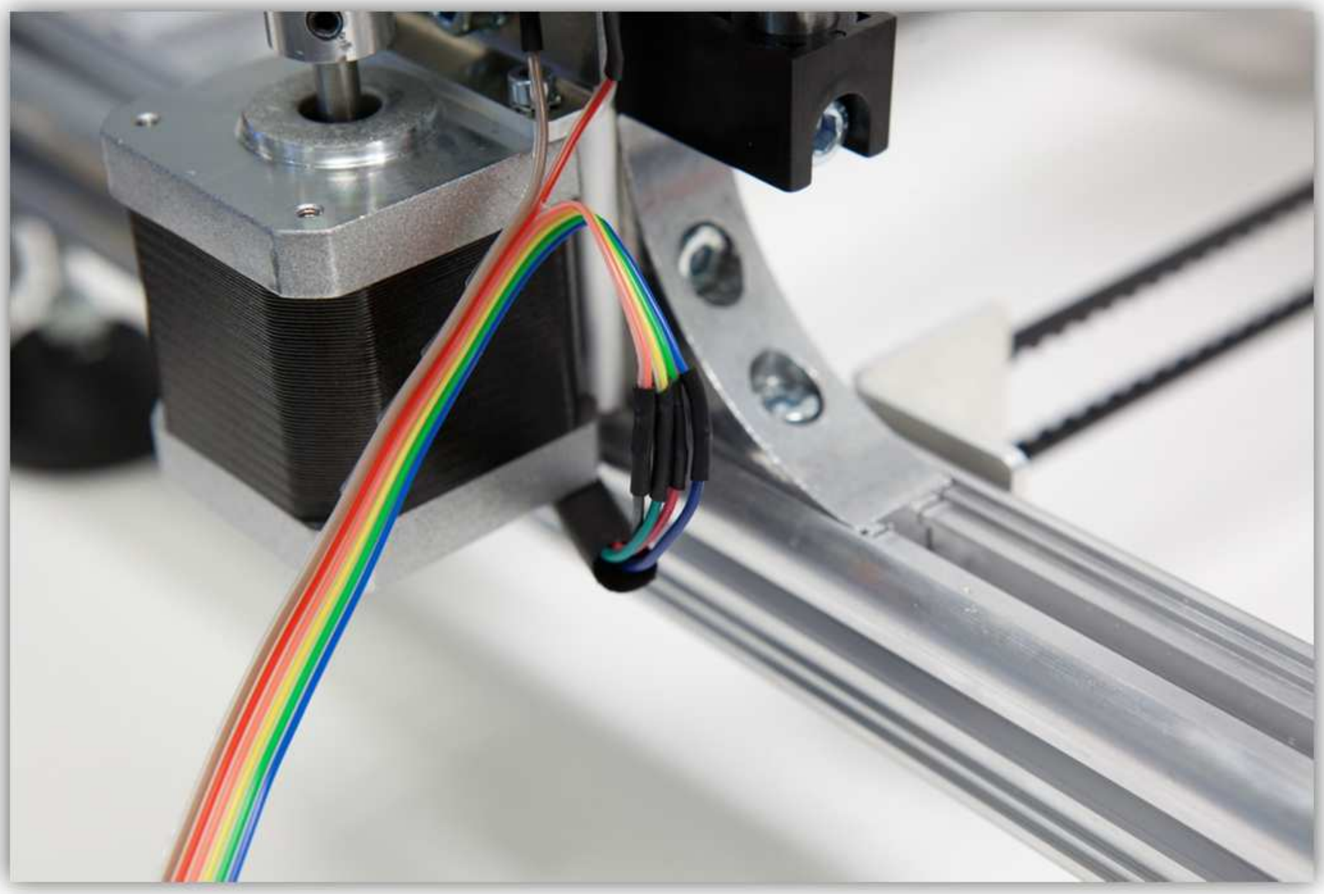
Solder the 4 wires from the motor to the 4 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	**->**	**Motor wires**
Blue	**->**	**Blue**
Green	**->**	**Red**
Yellow	**->**	**Green**
Orange	**->**	**Black**

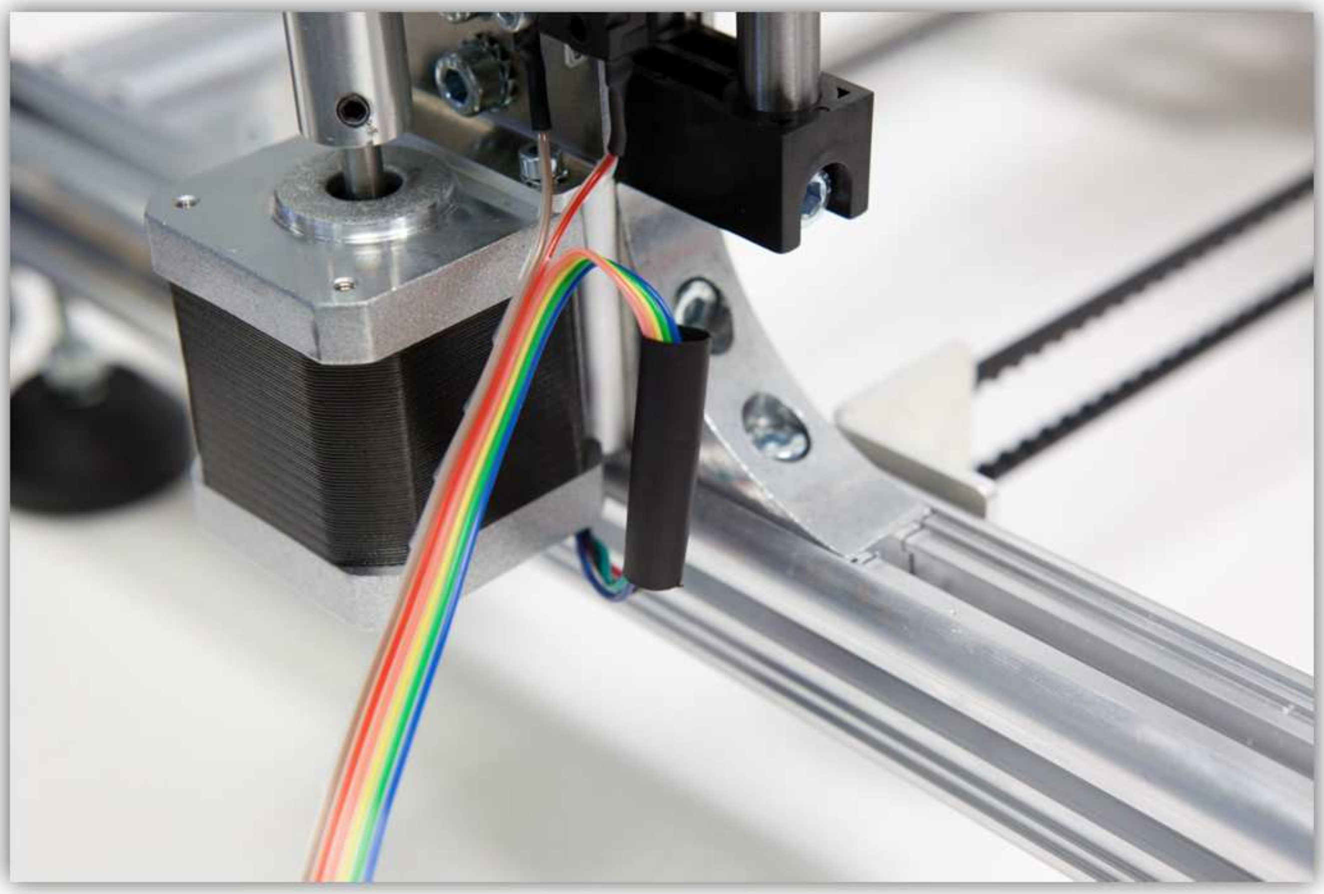


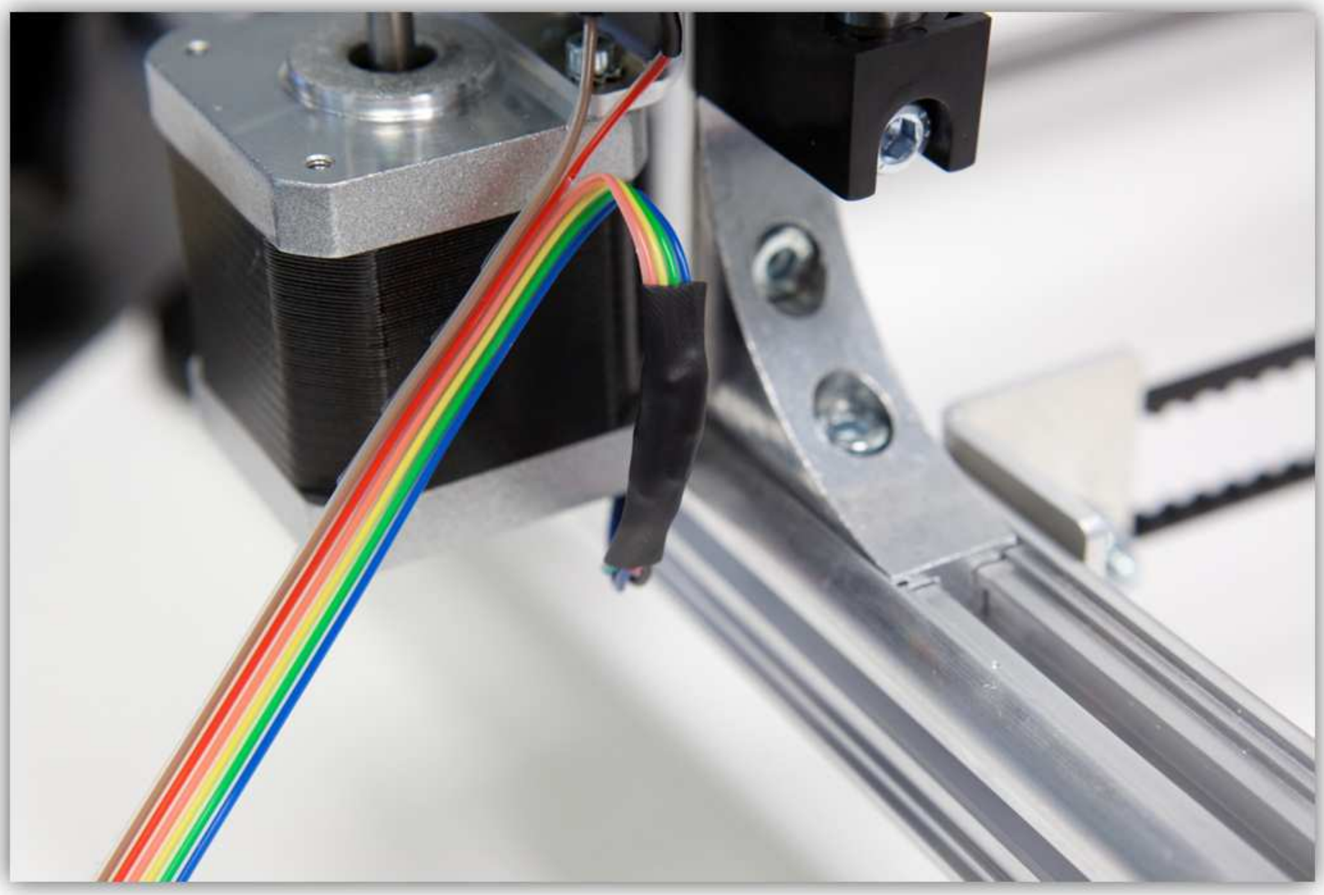
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.



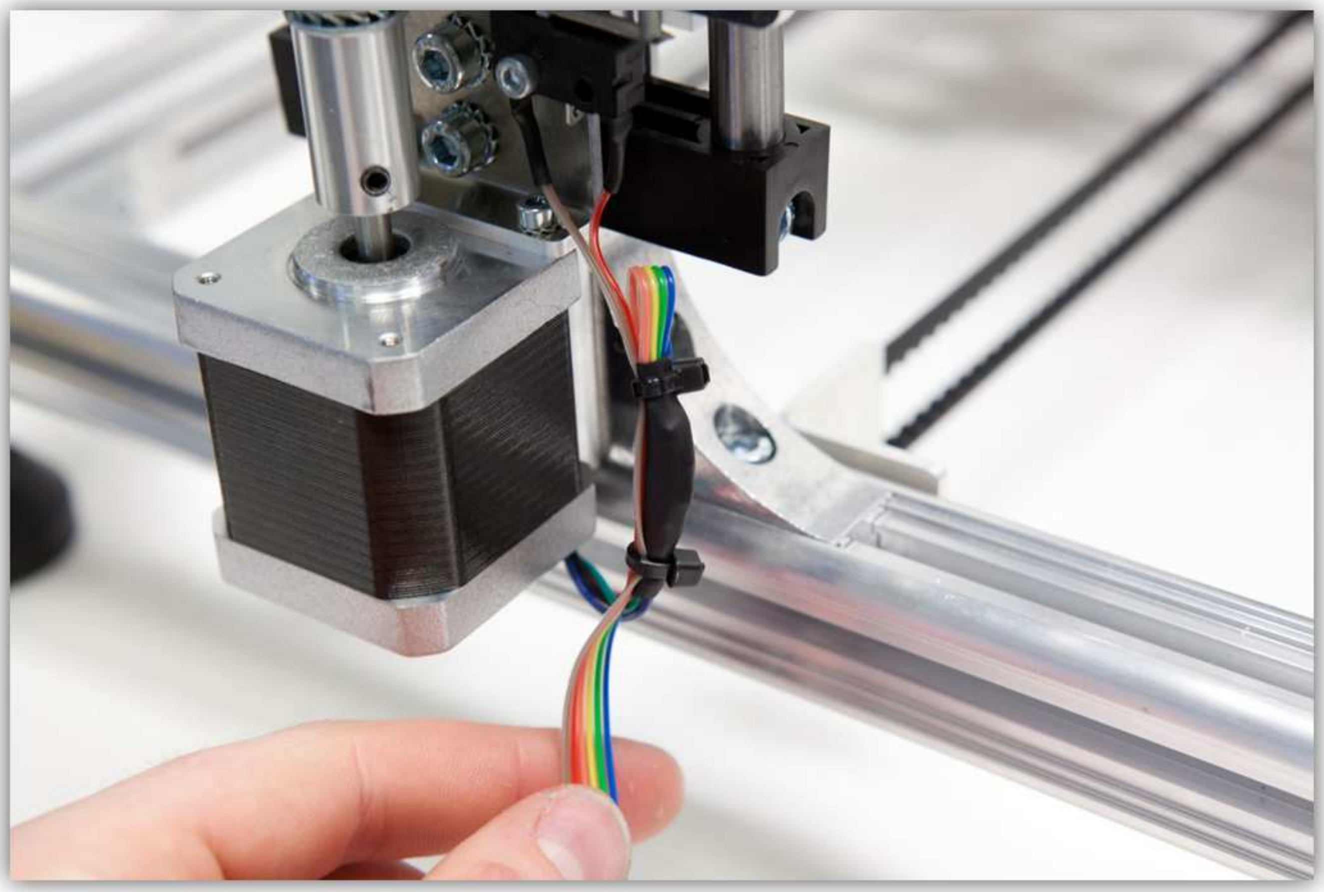


Now slide the big piece of heat shrink tubing over the 4 small pieces, heat the big piece so it covers and protects the 4 heat shrunk joints.

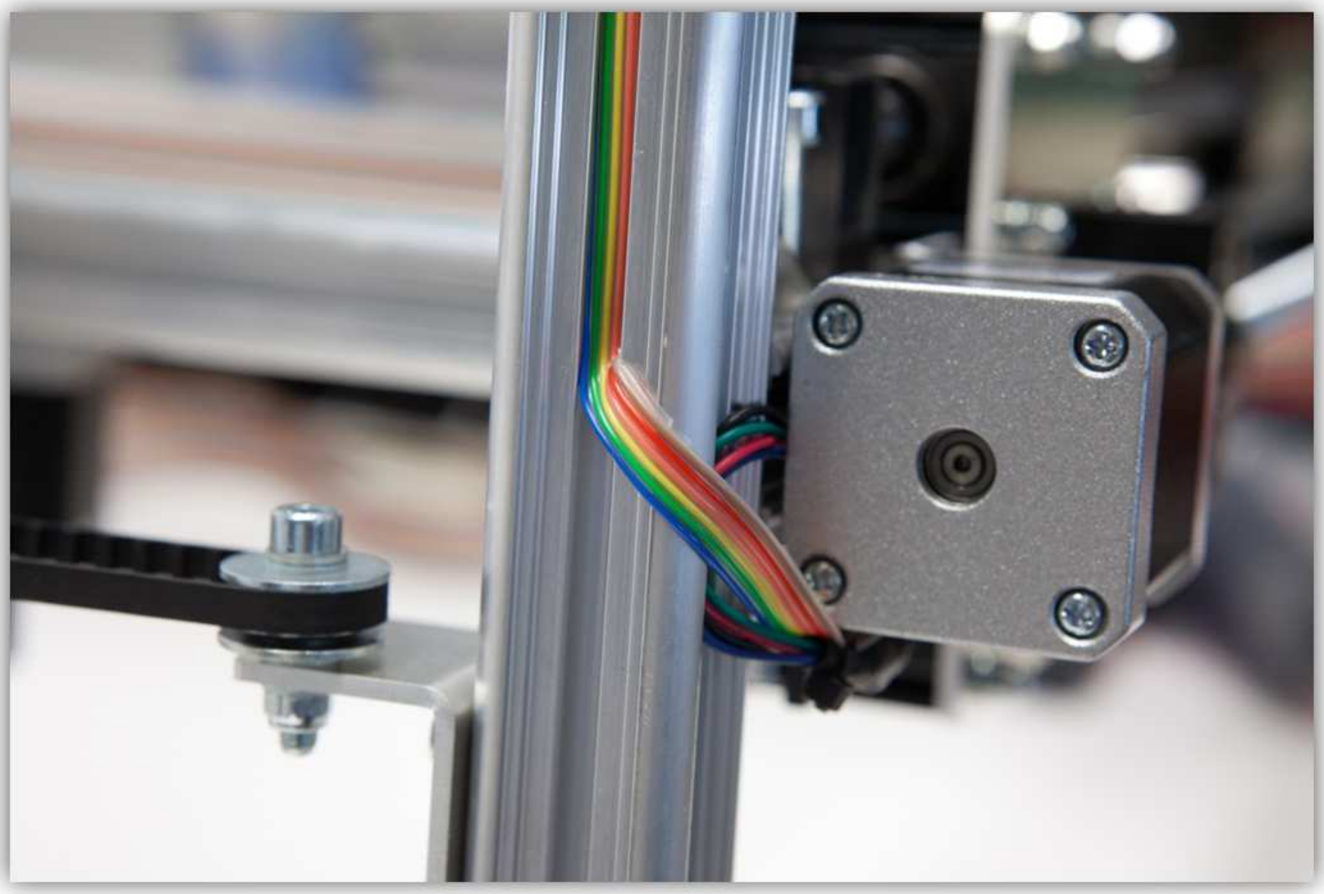


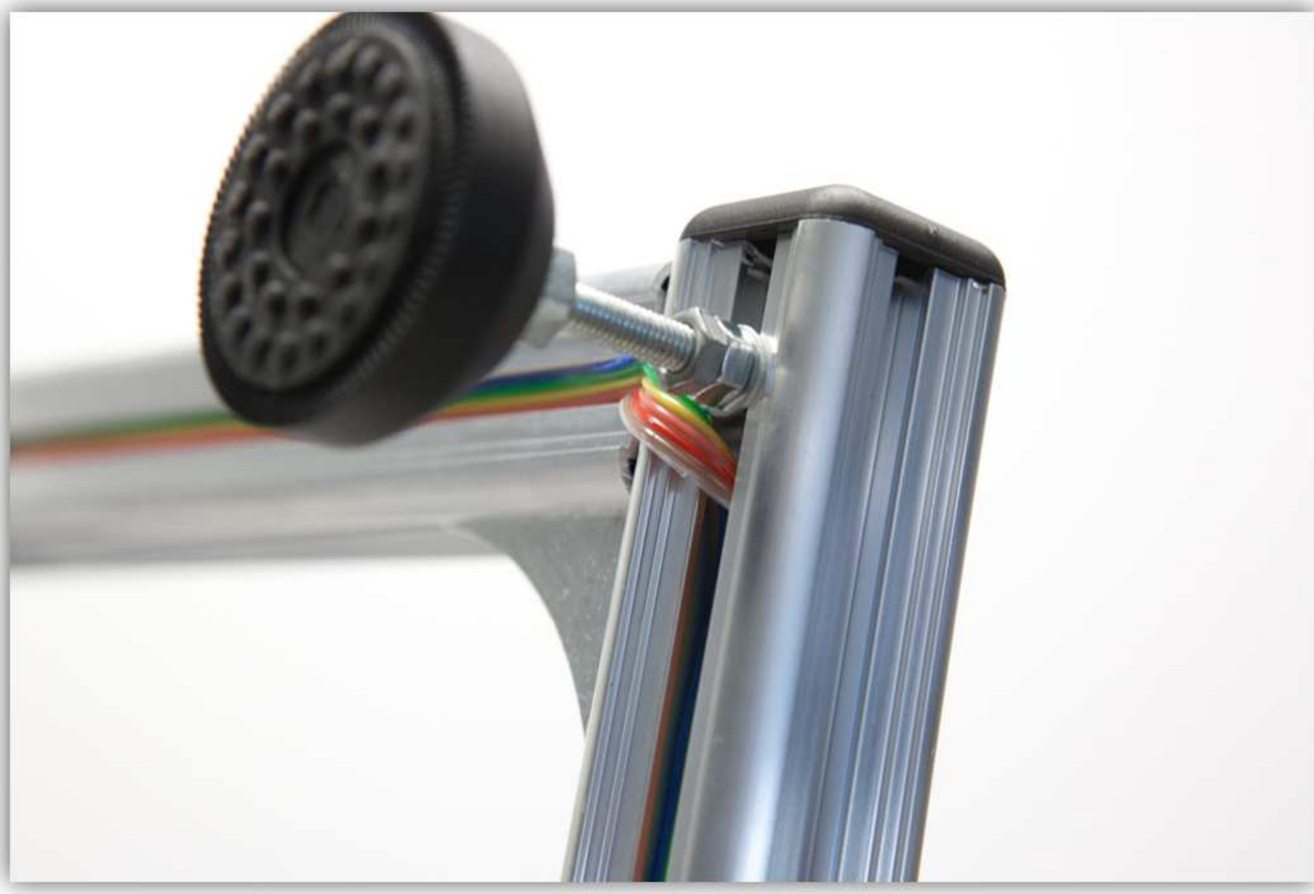


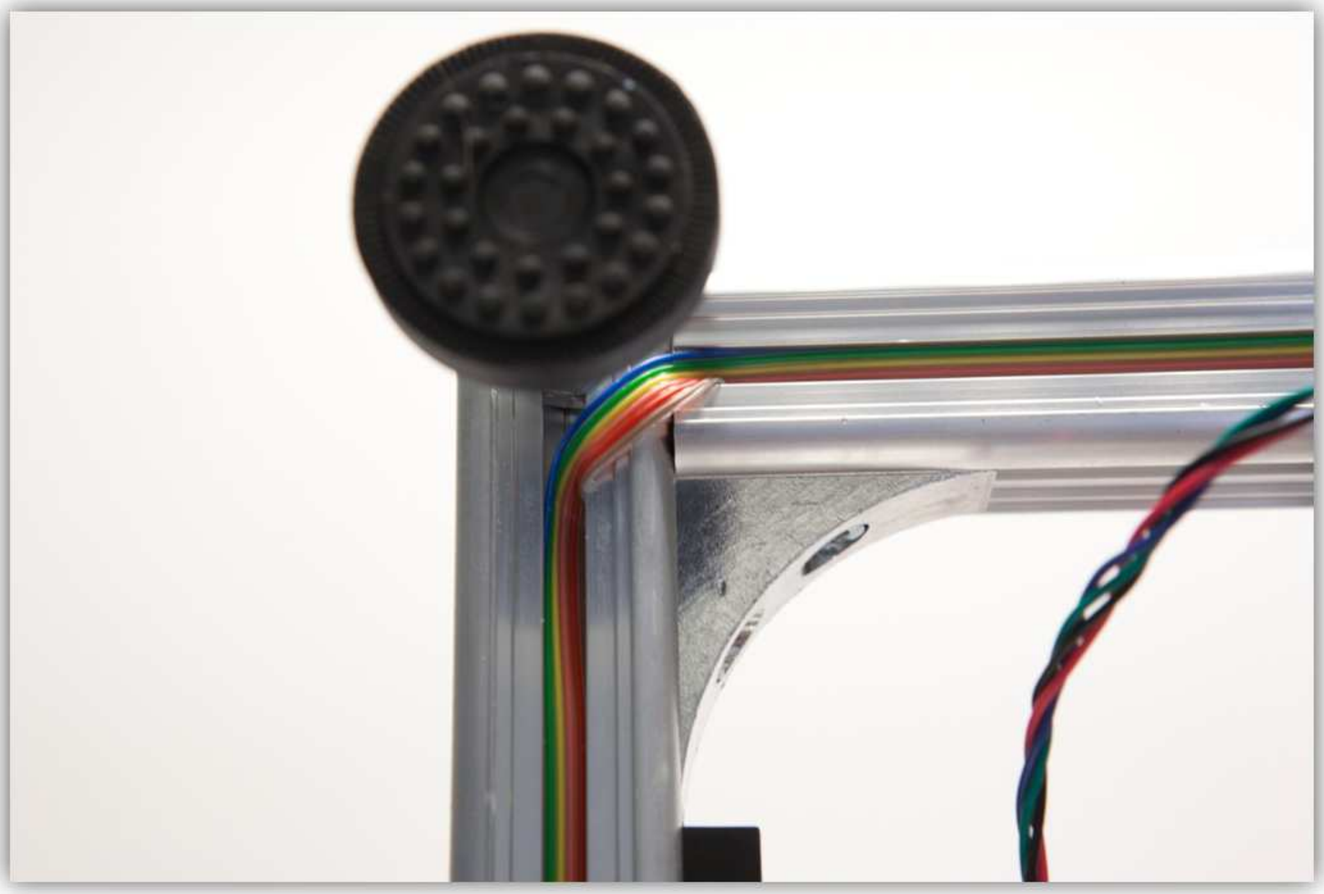
Use two small tie-strips to hold the wires in place as shown in the picture below.

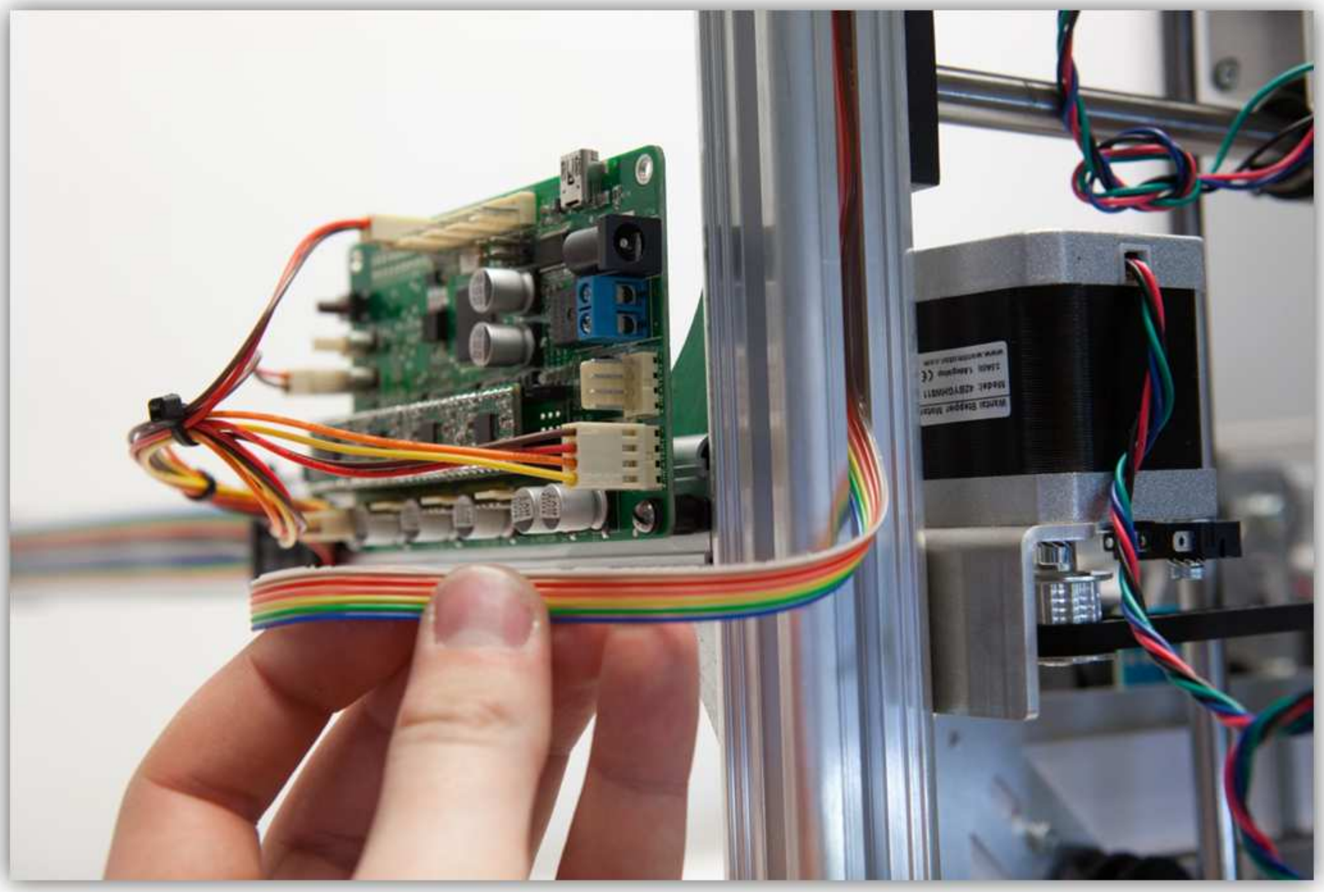


Slide the flat cable in the hollow space of the profile, run it through the back of the printer as shown in the picture below.

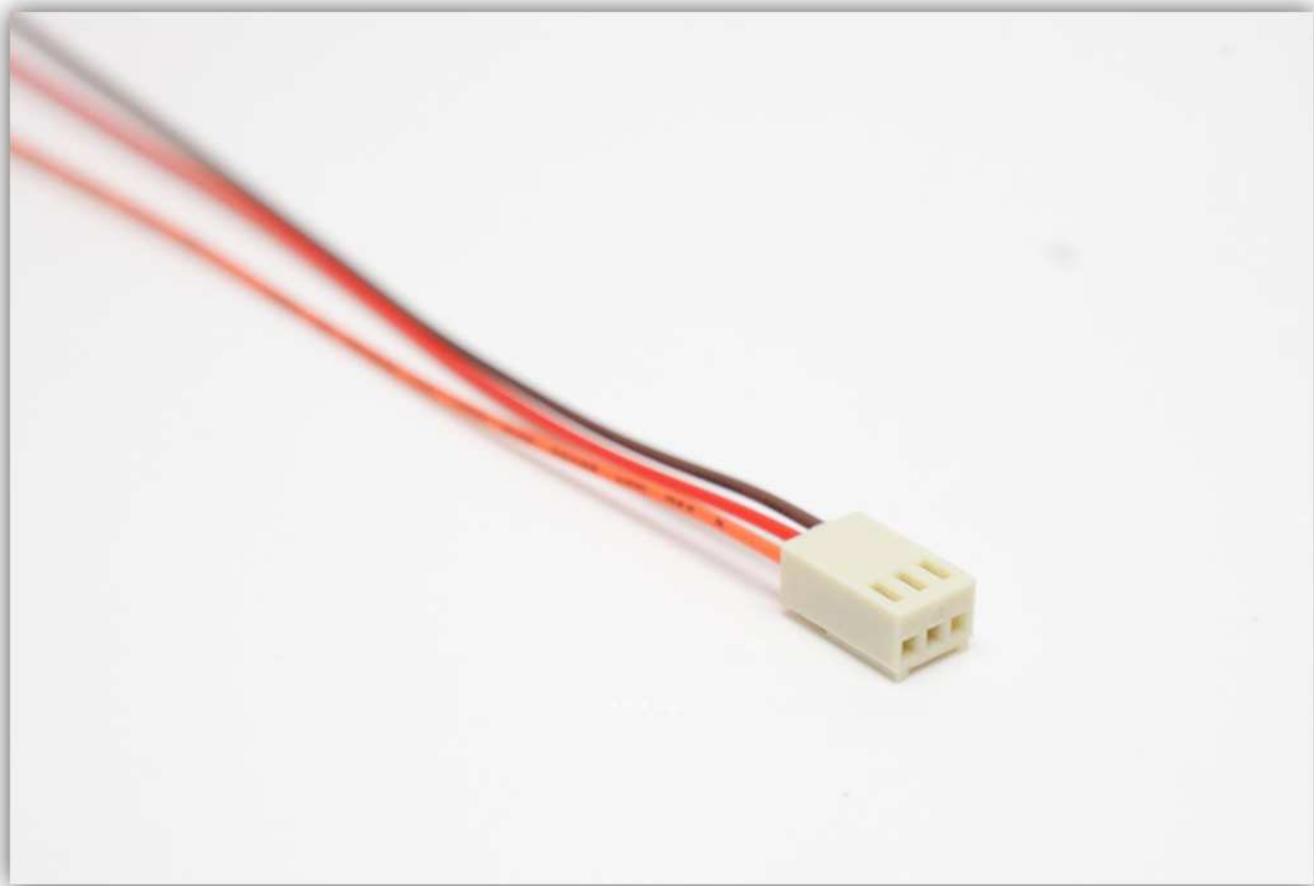




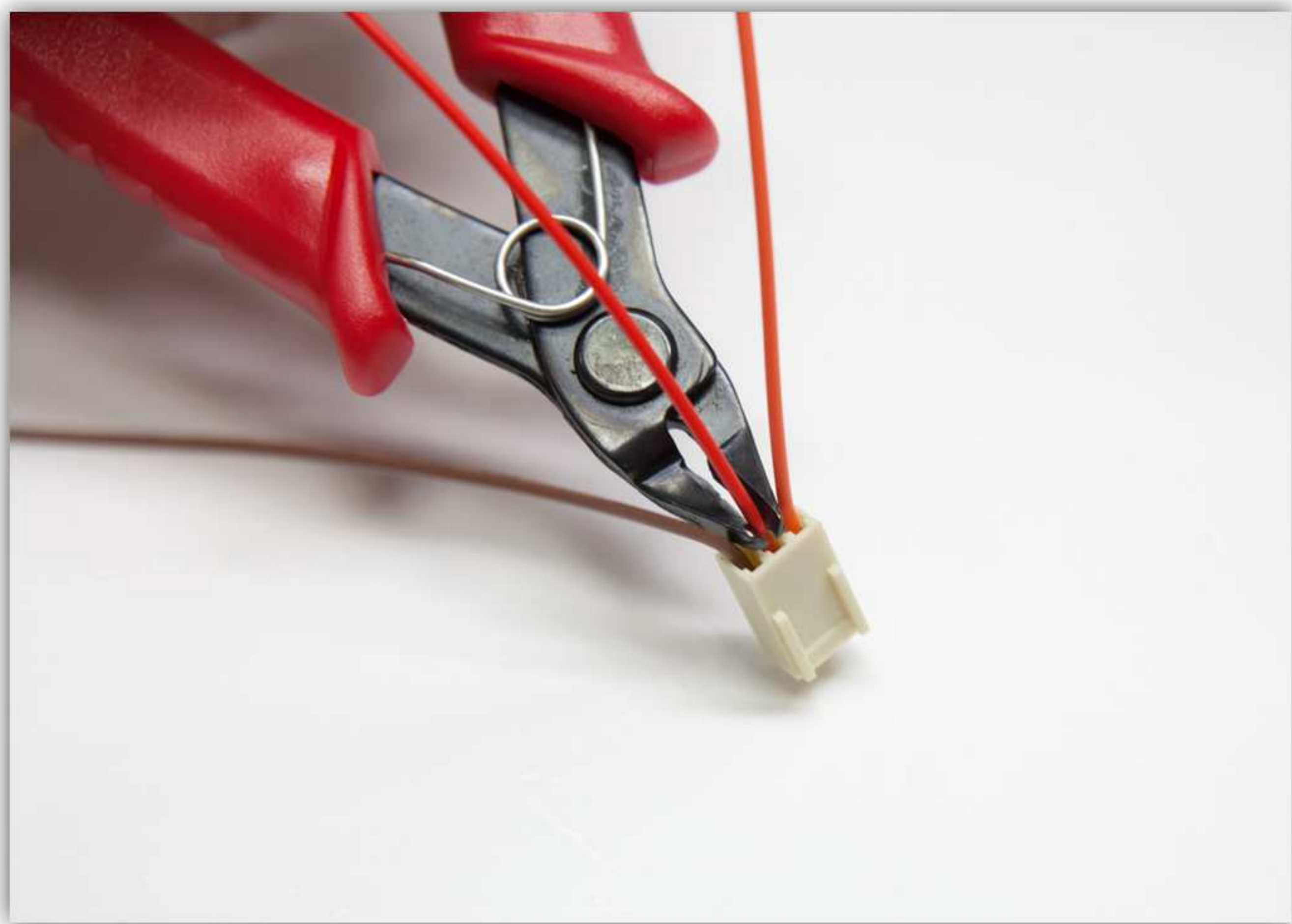


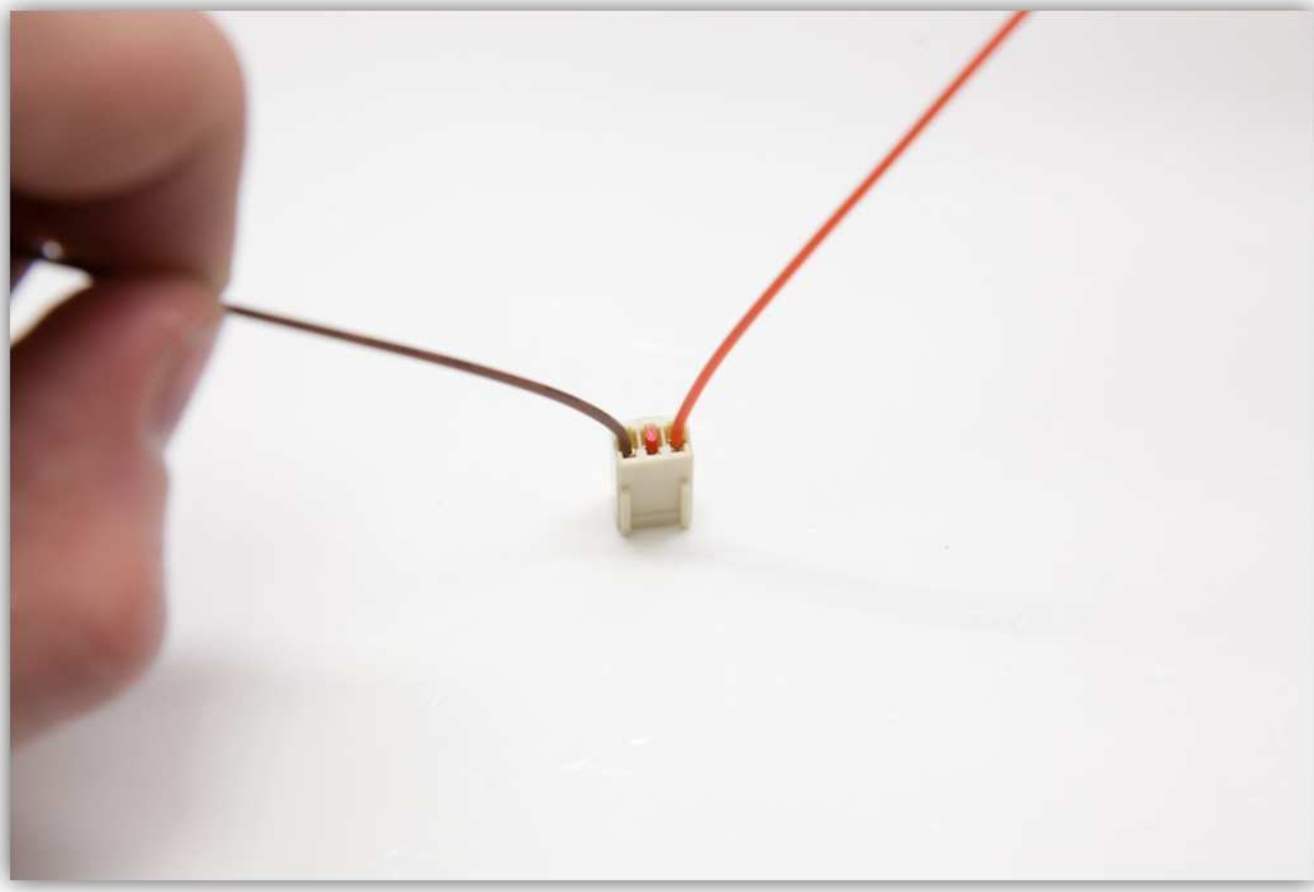


Take a board to wire connector with 3 wires out of the bag labelled with 40.

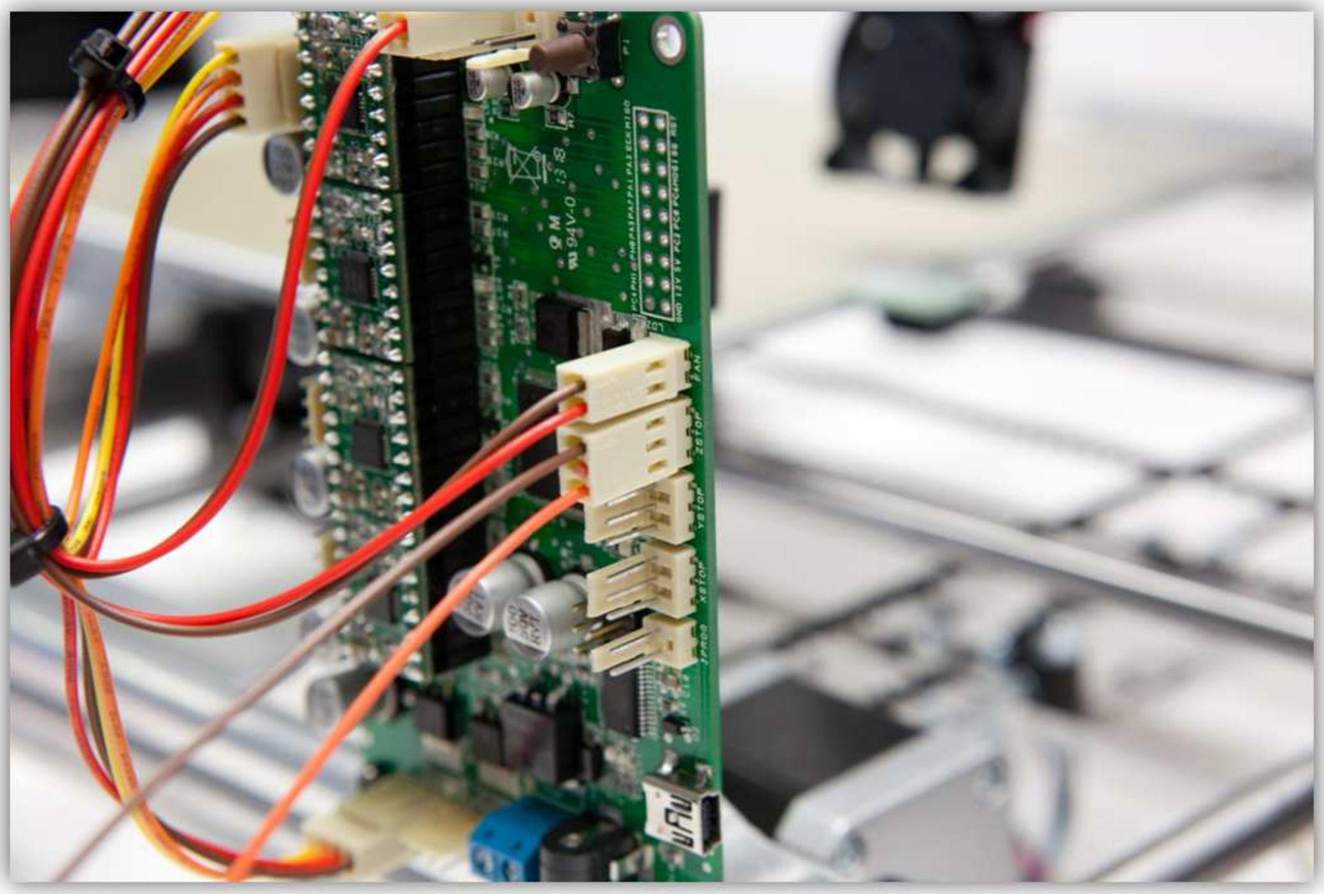


Cut the middle wire away at the connector.

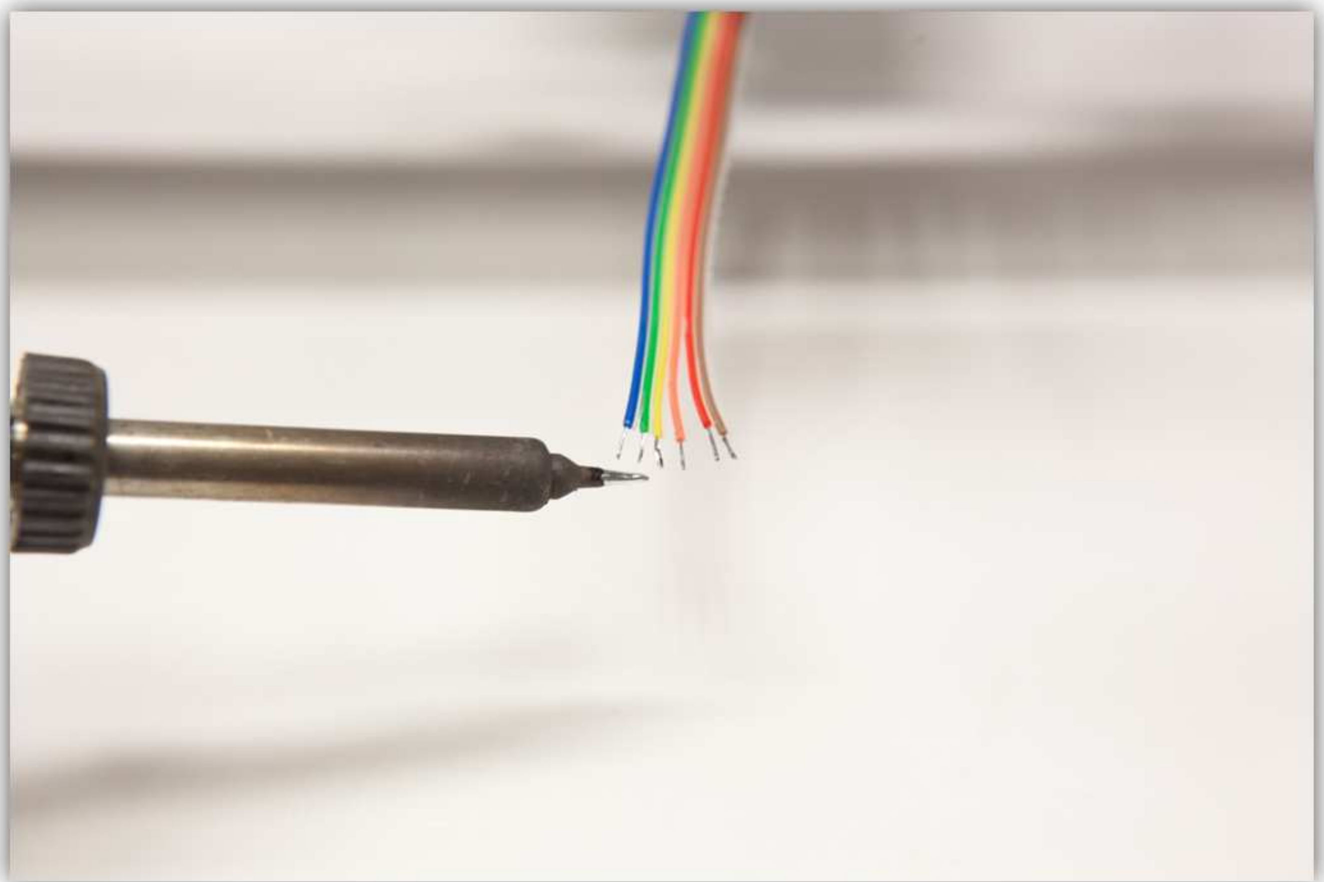




Plug the female connector in the male connector labelled with ZSTOP on the controller board.

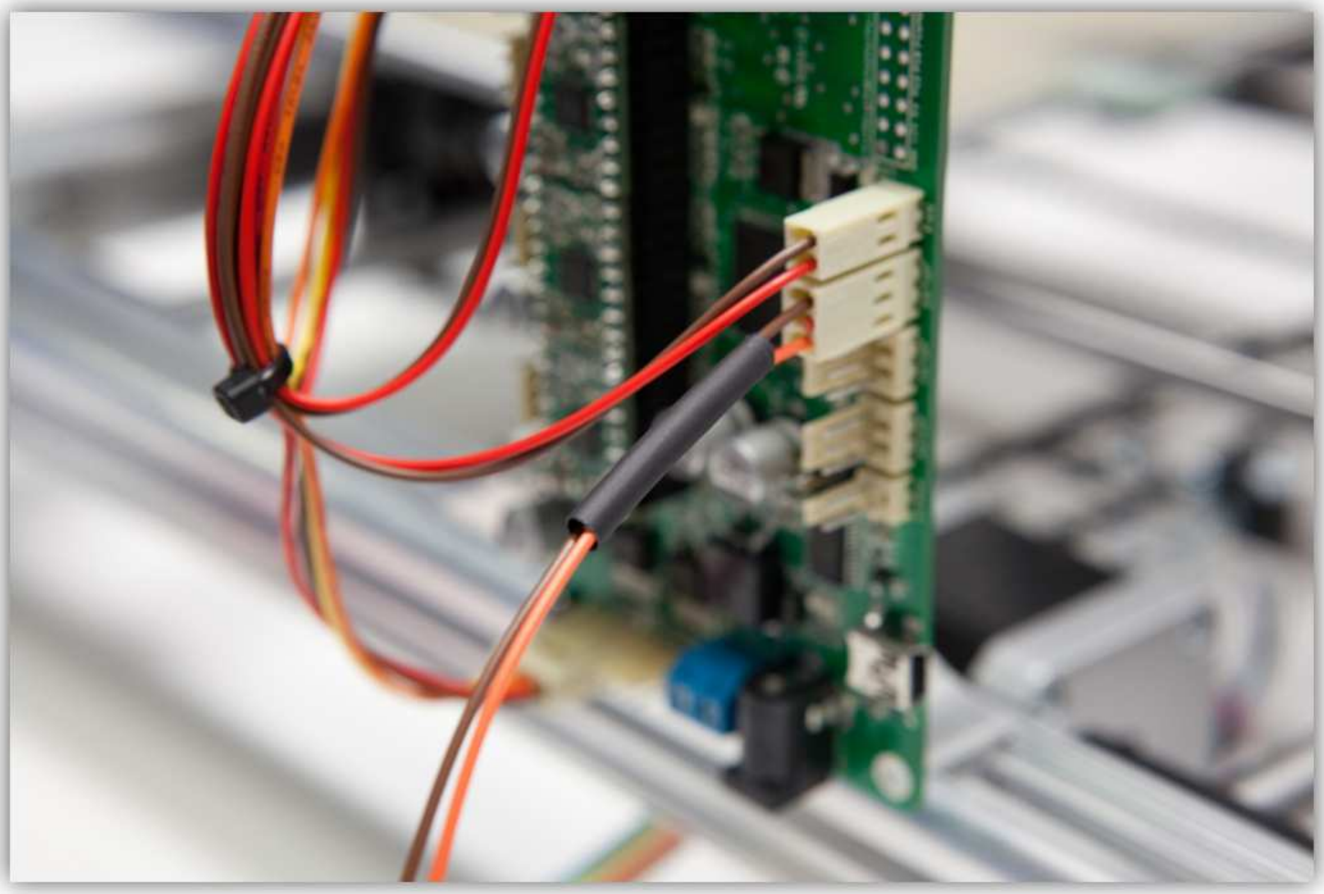


Strip all the wires from the flat cable that comes from the Z motor.

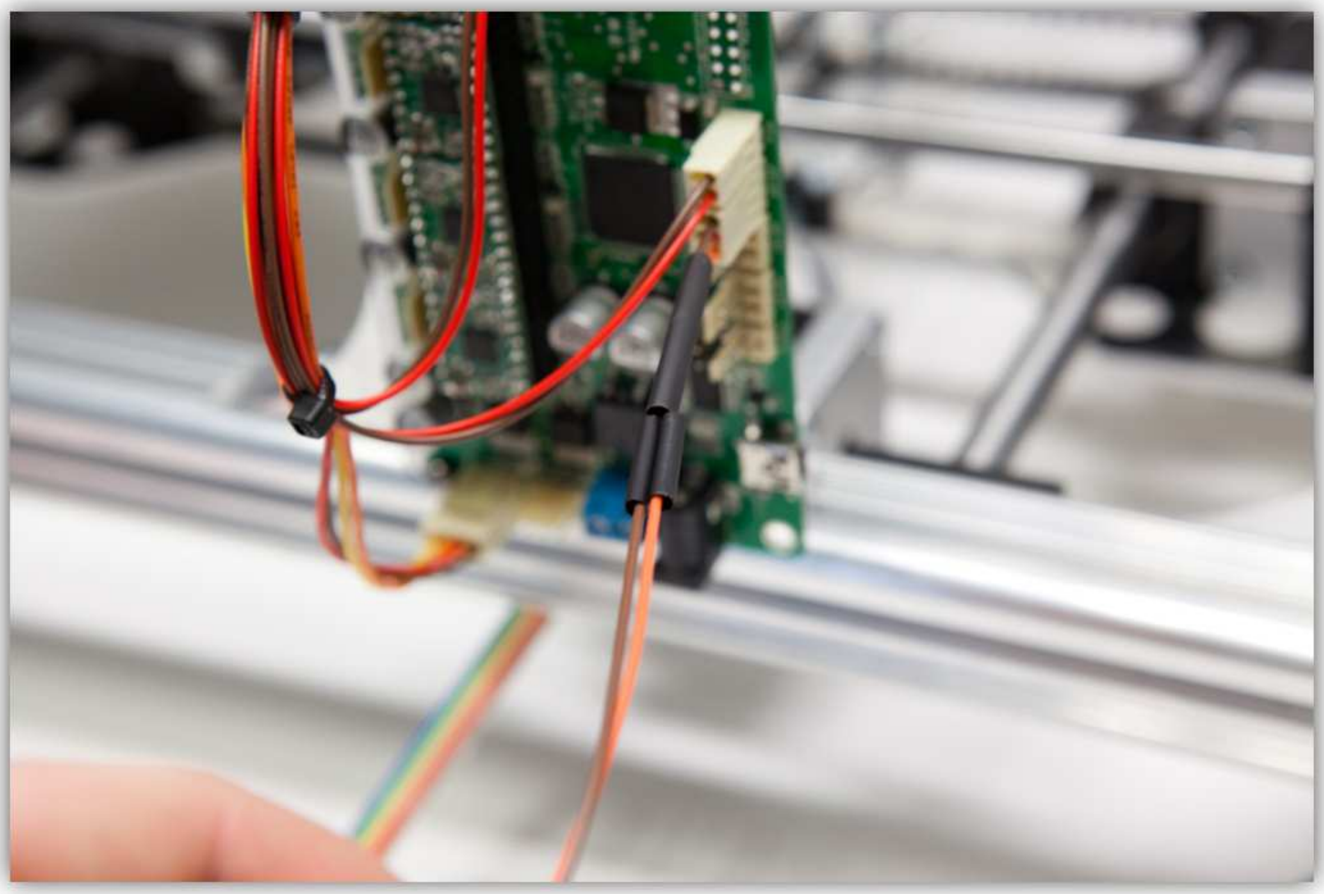


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the medium size heat shrink tubes over the 2 wires of the connector.

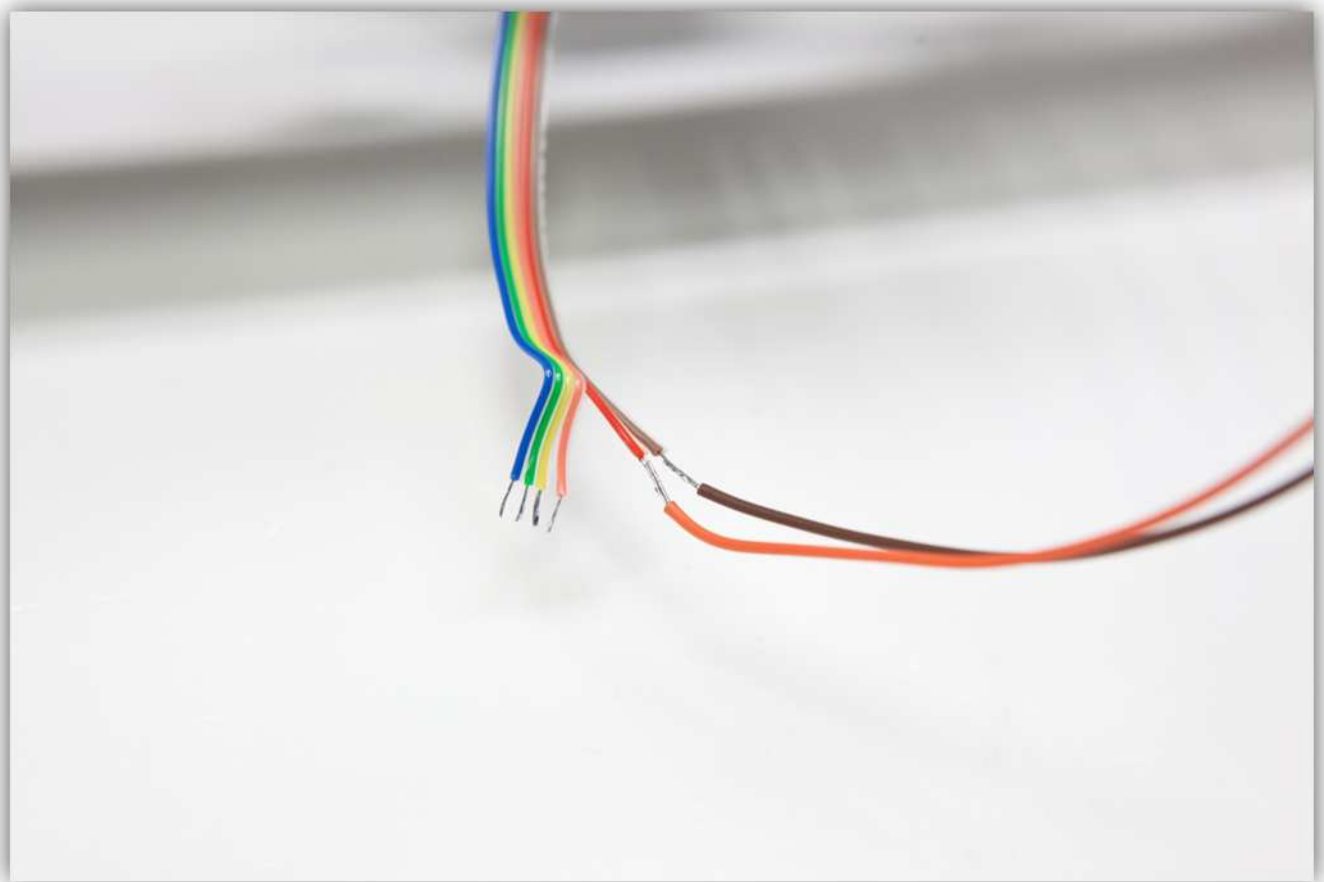


Slide the 2 small heat shrink tubes over the 2 wires of the connector.

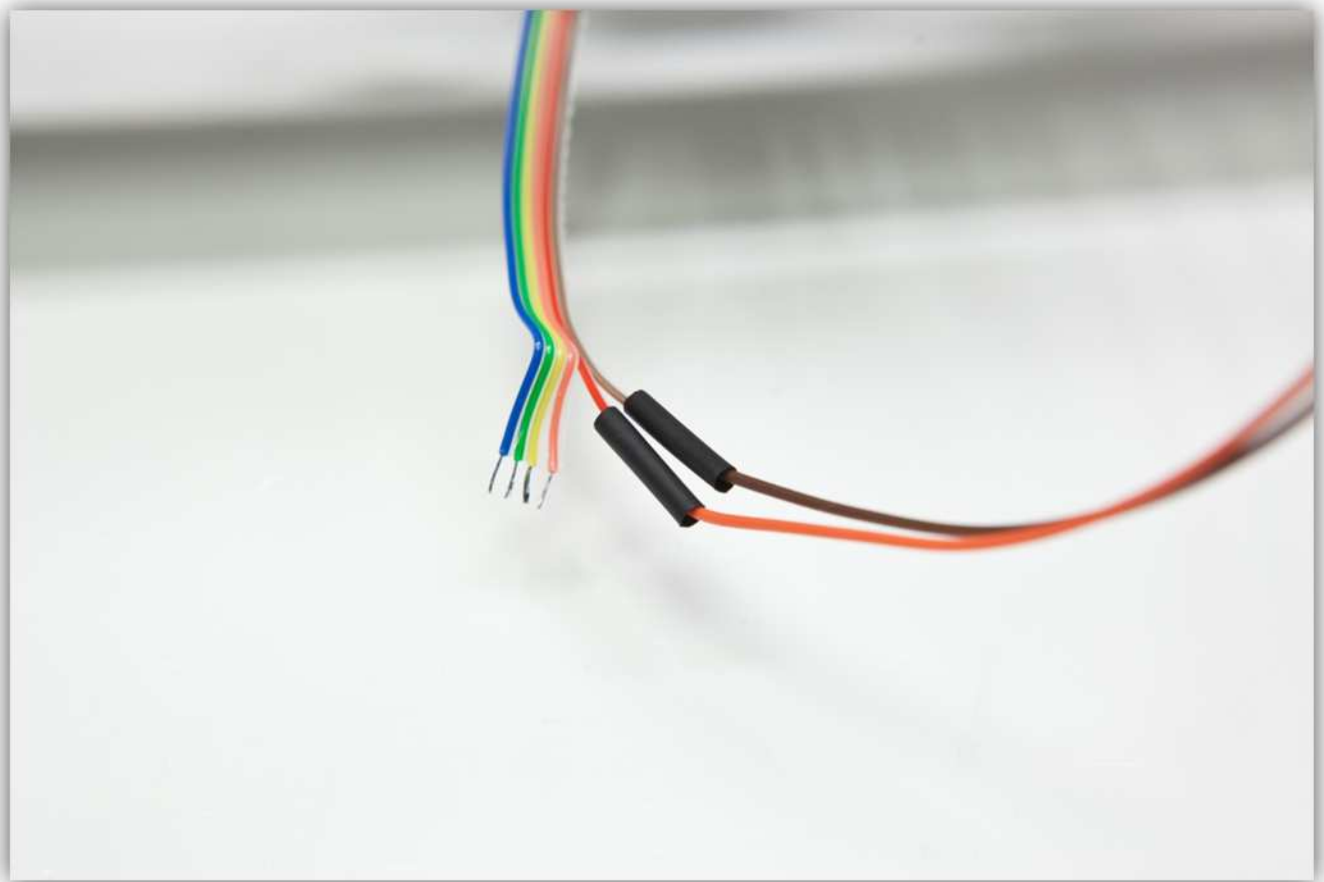


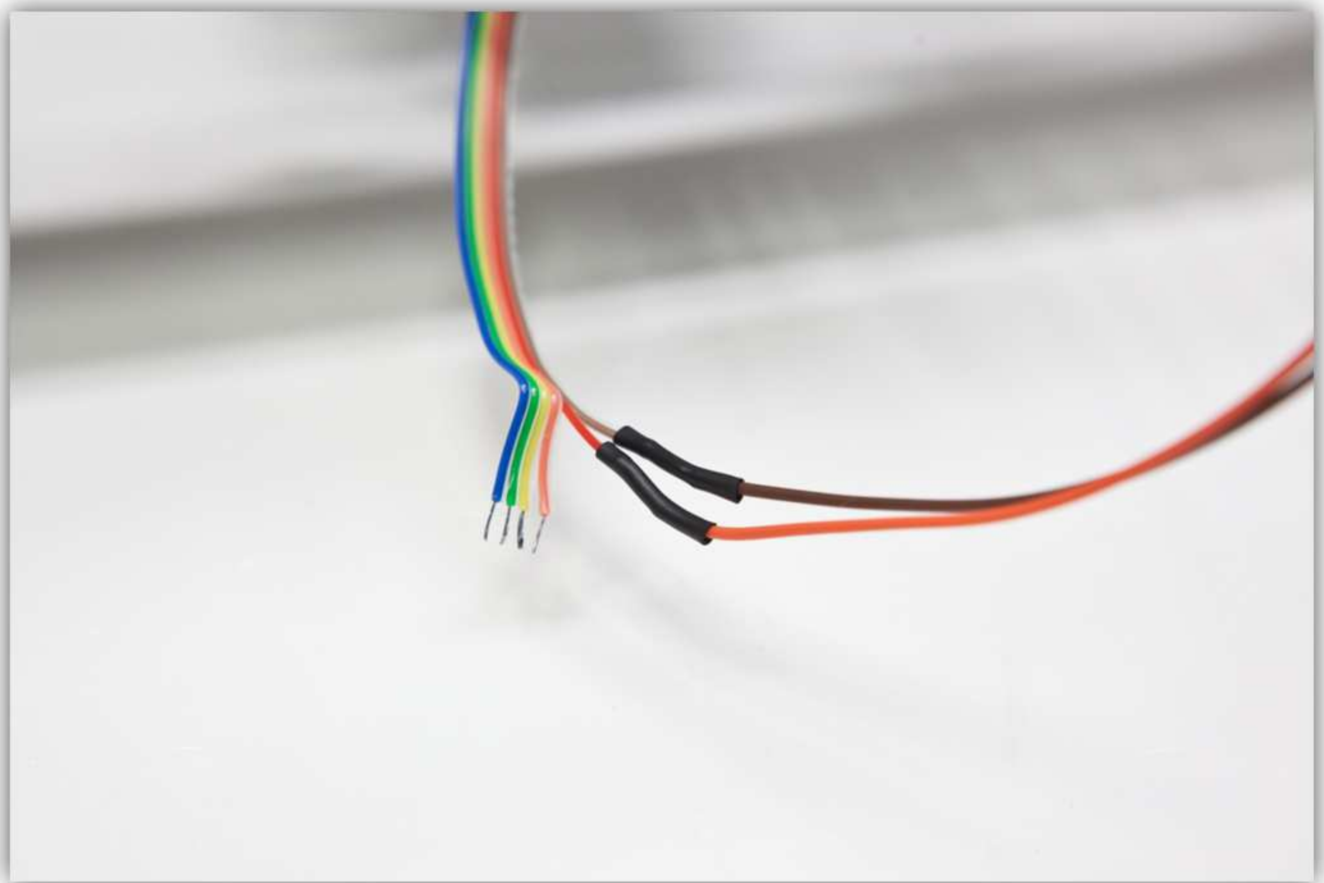
Solder the 2 wires from the connector to the 2 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	**->**	**Connector wires**
Red	**->**	**Red**
Brown	**->**	**Brown**

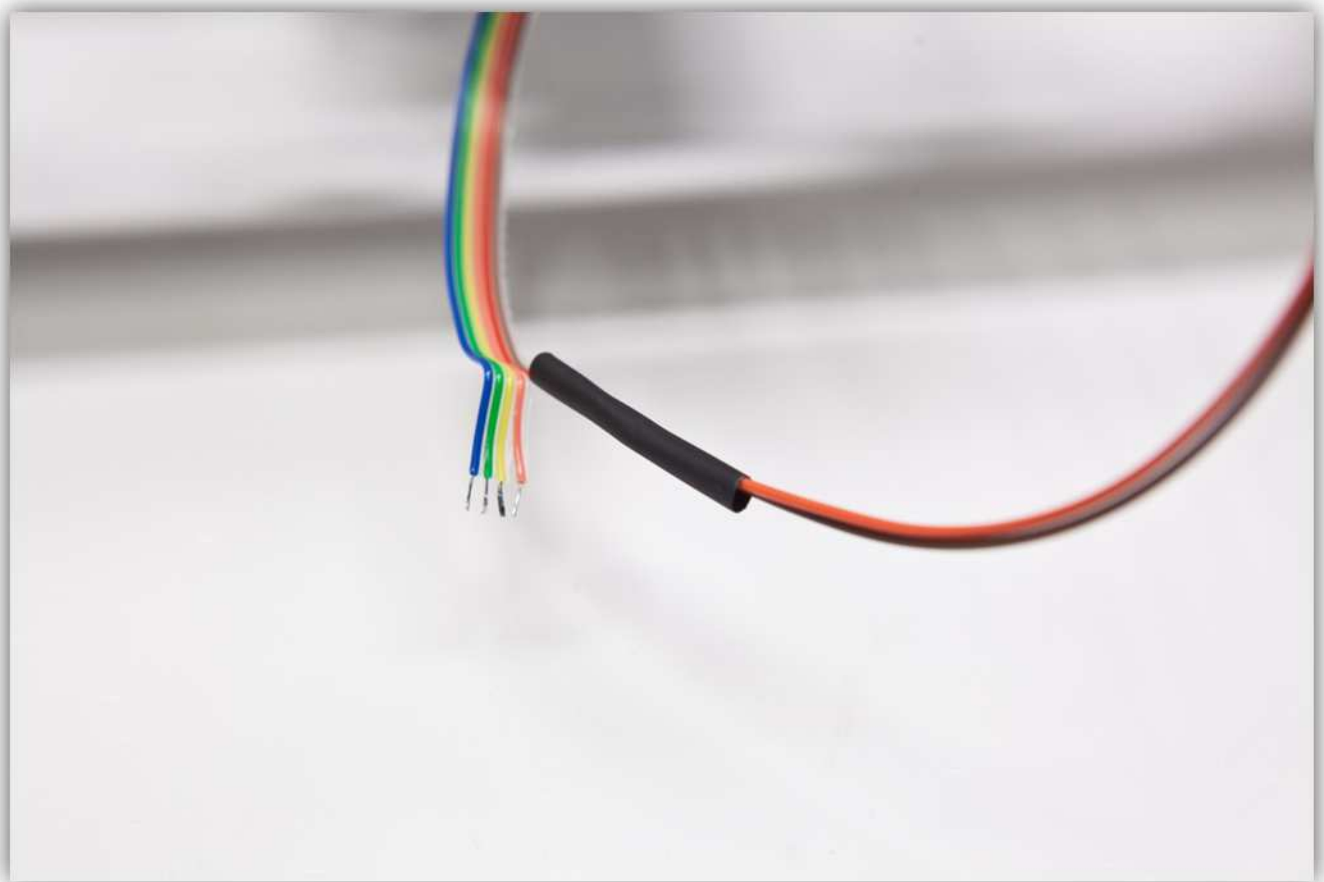


Slide the 2 small heat shrink tubes over the solder joints and heat them up.



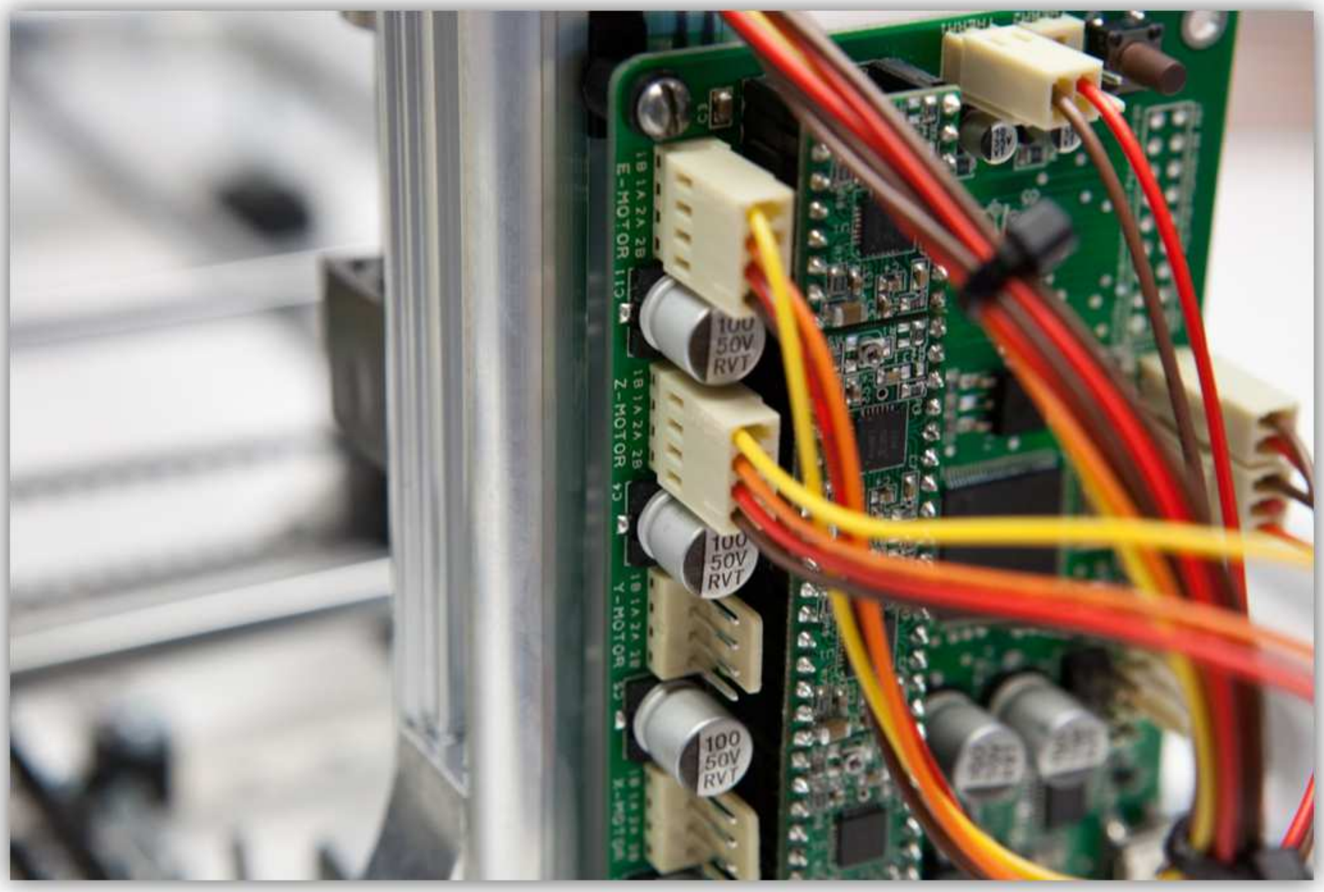


Now slide the medium size piece of heat shrink tubing over the 2 small pieces, heat the medium size piece so it covers and protects the 2 heat shrunk joints.



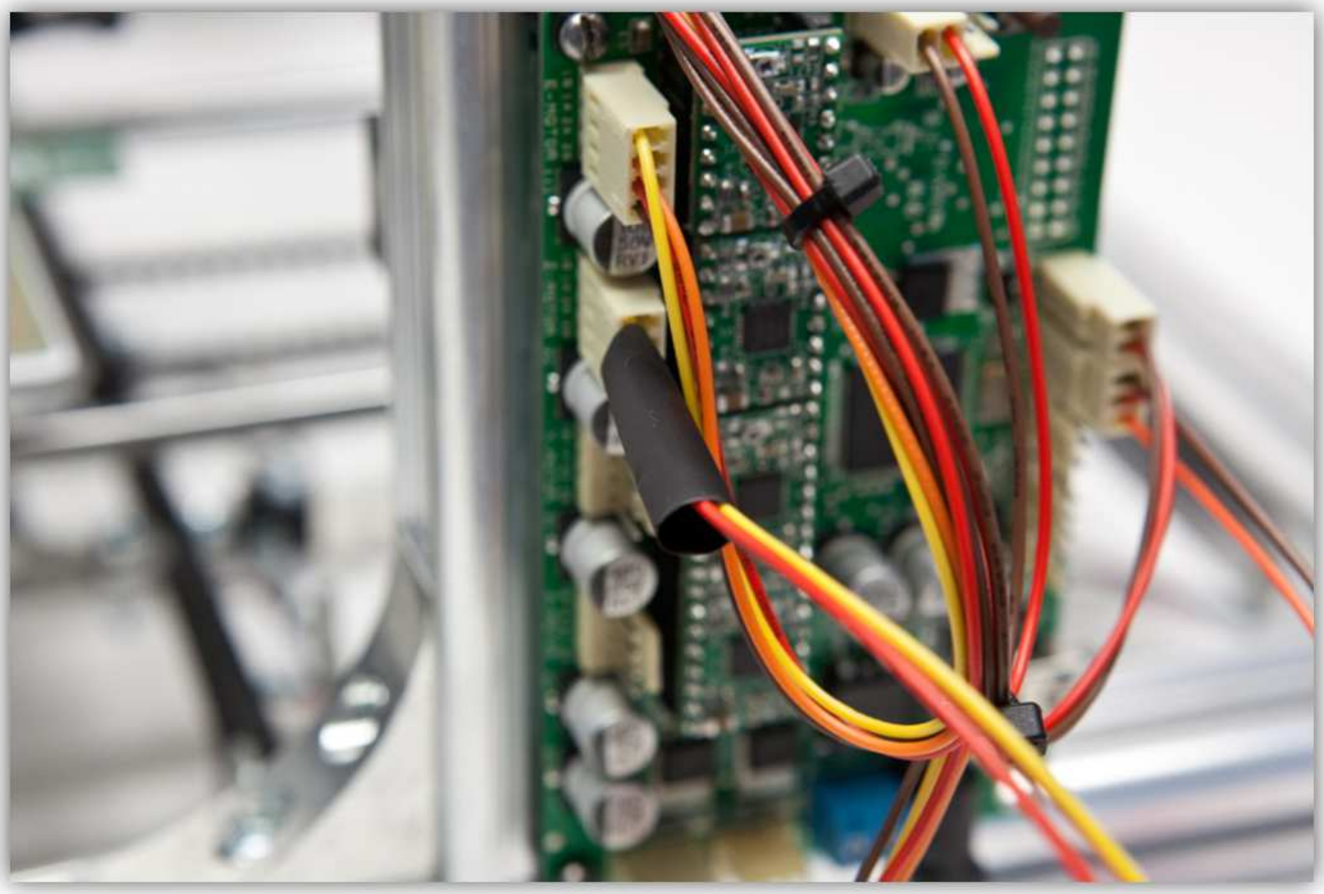
Take a board to wire connector with 4 wires out of the bag labelled with 40.

Plug the female connector in the male connector labelled with Z-MOTOR on the controller board.



Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the big heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

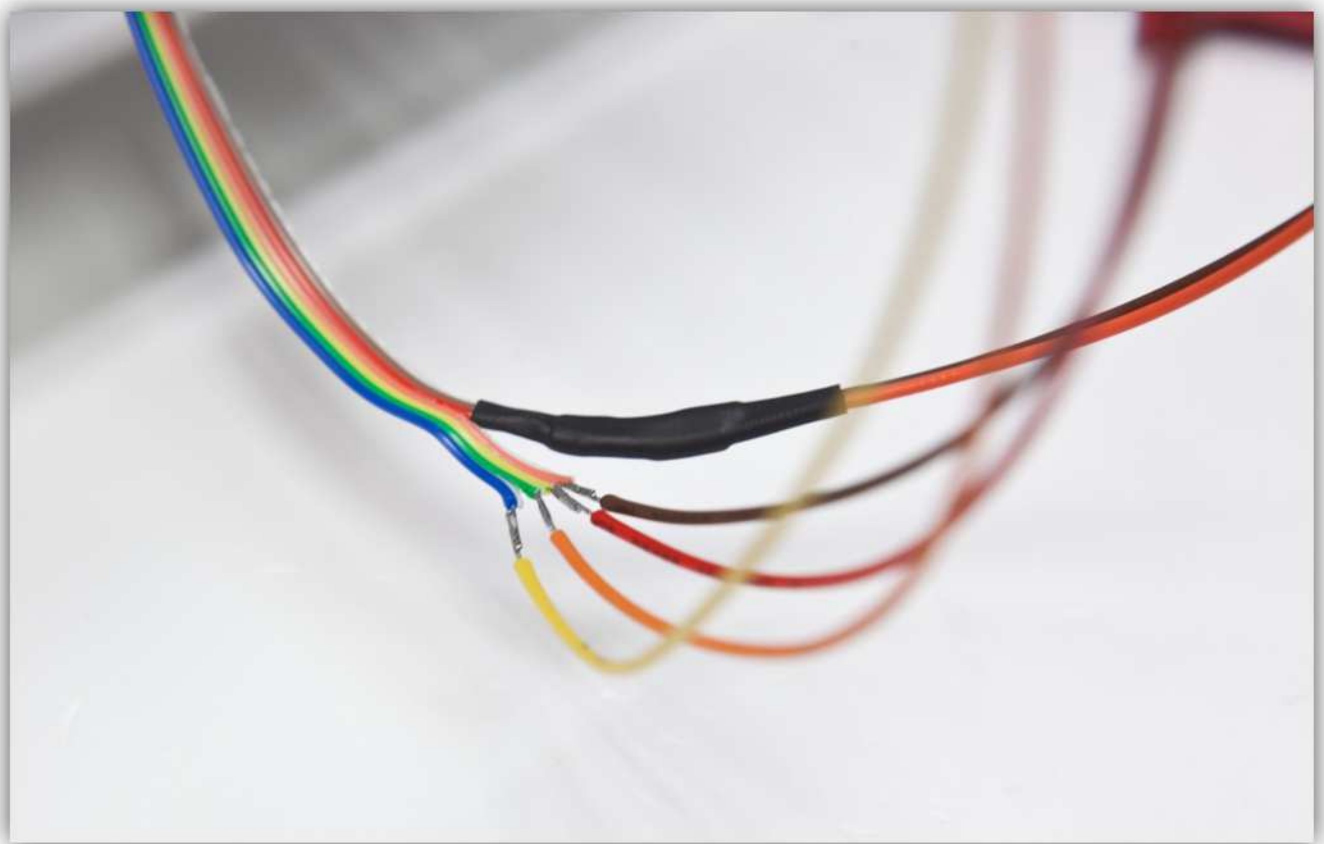
Slide the big heat shrink tubes over the 4 wires of the connector.



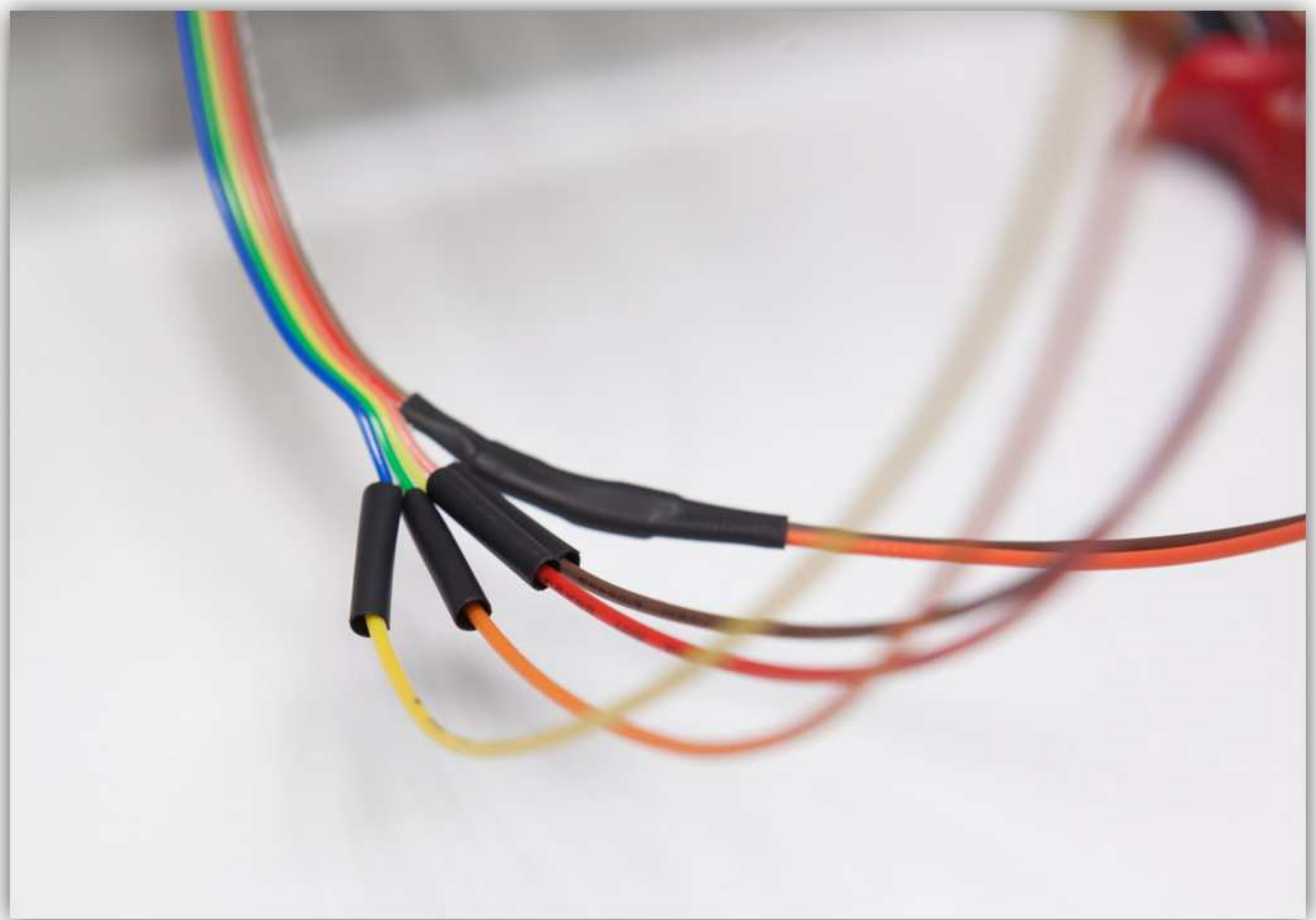
Slide the 4 small heat shrink tubes over the 4 wires of the connector.

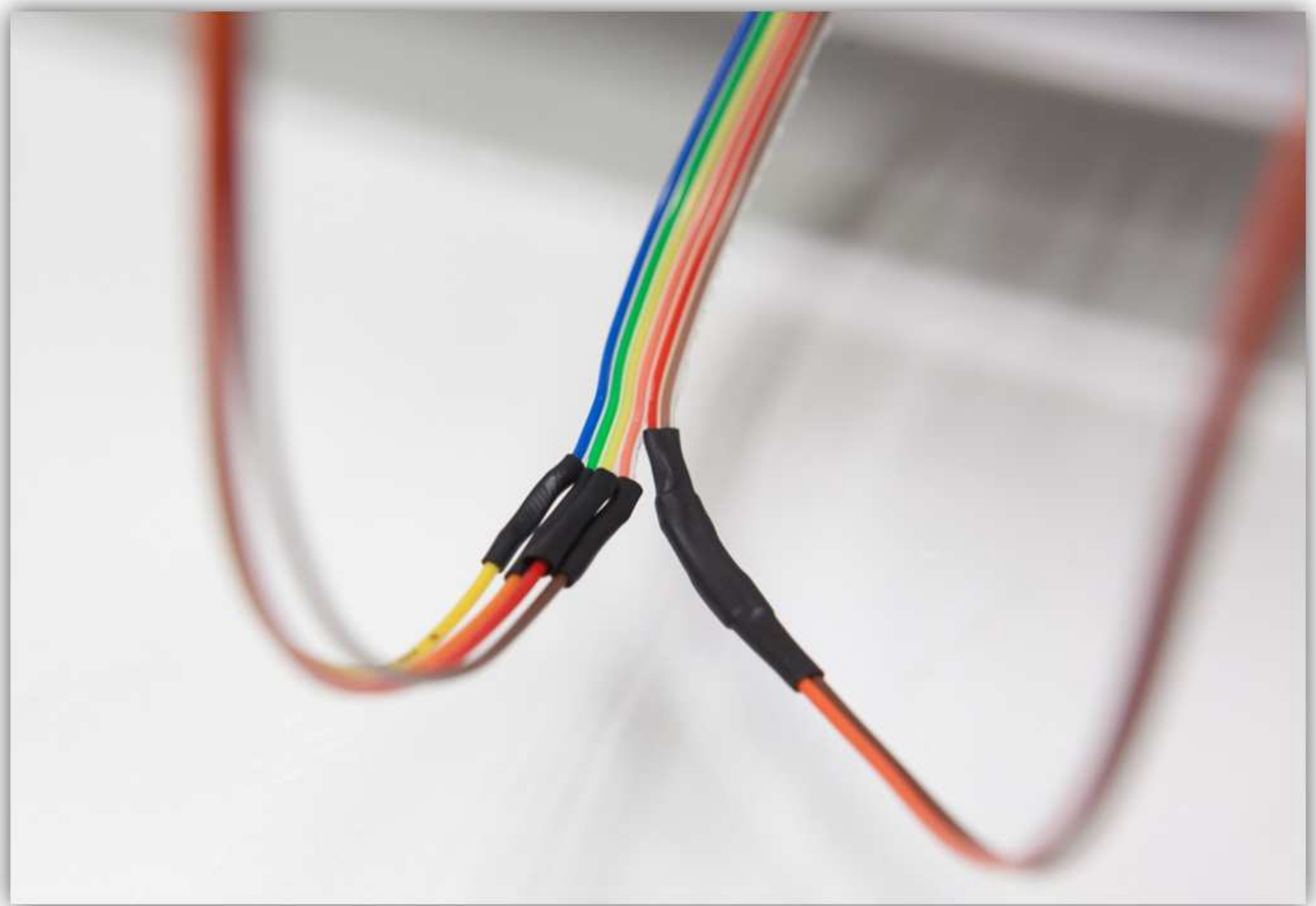
Solder the 4 wires from the connector to the 4 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	**->**	**Connector wires**
Blue	**->**	**Yellow**
Green	**->**	**Orange**
Yellow	**->**	**Red**
Orange	**->**	**Brown**

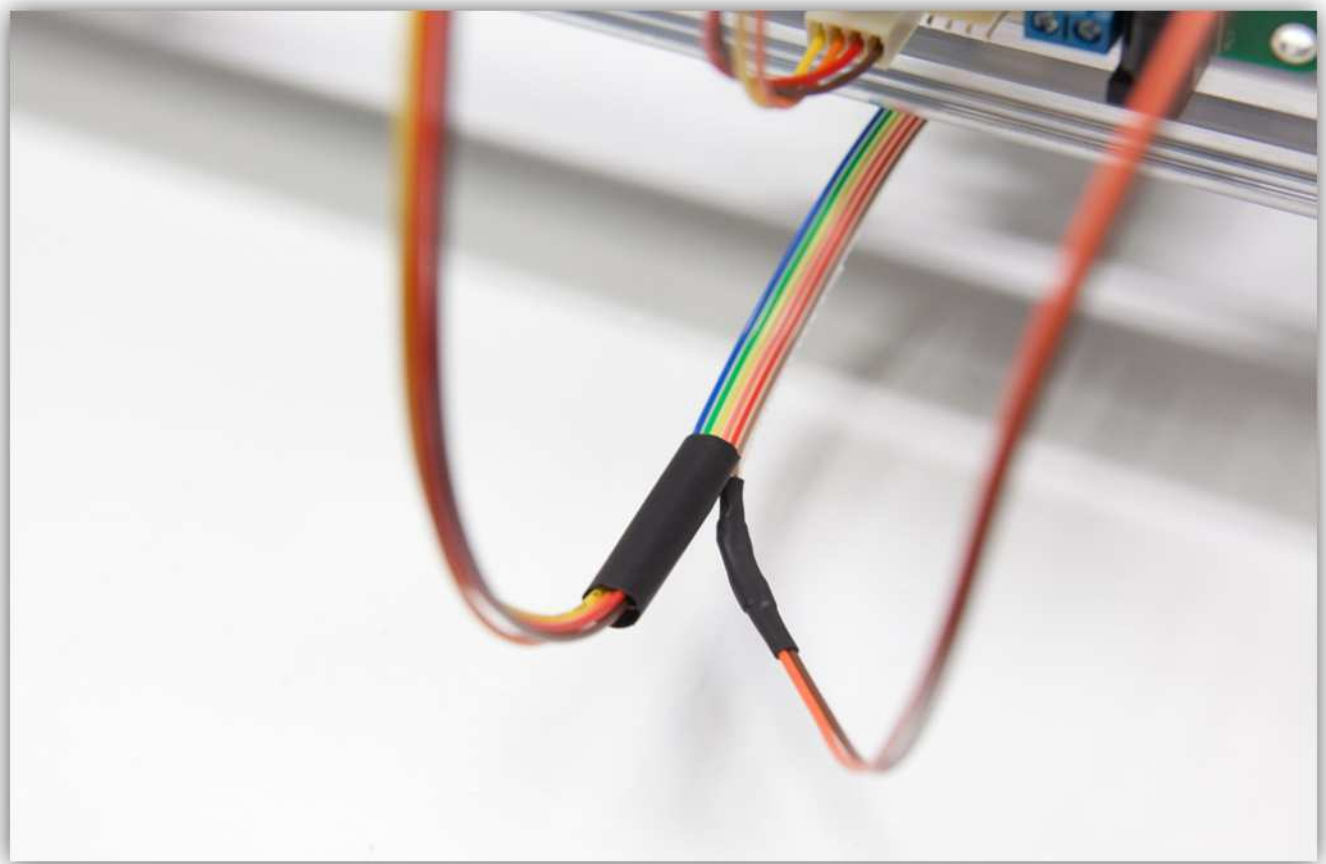


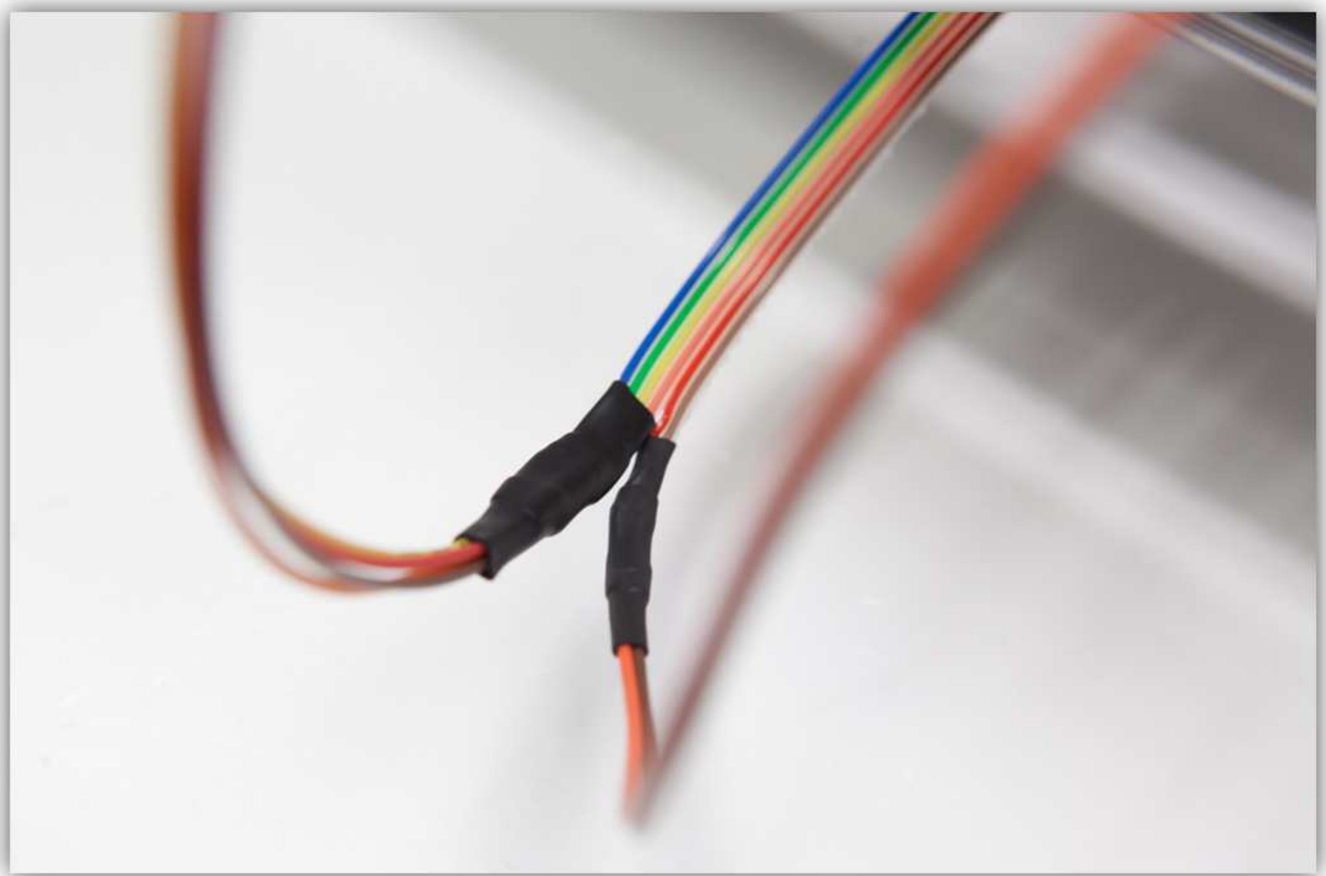
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.



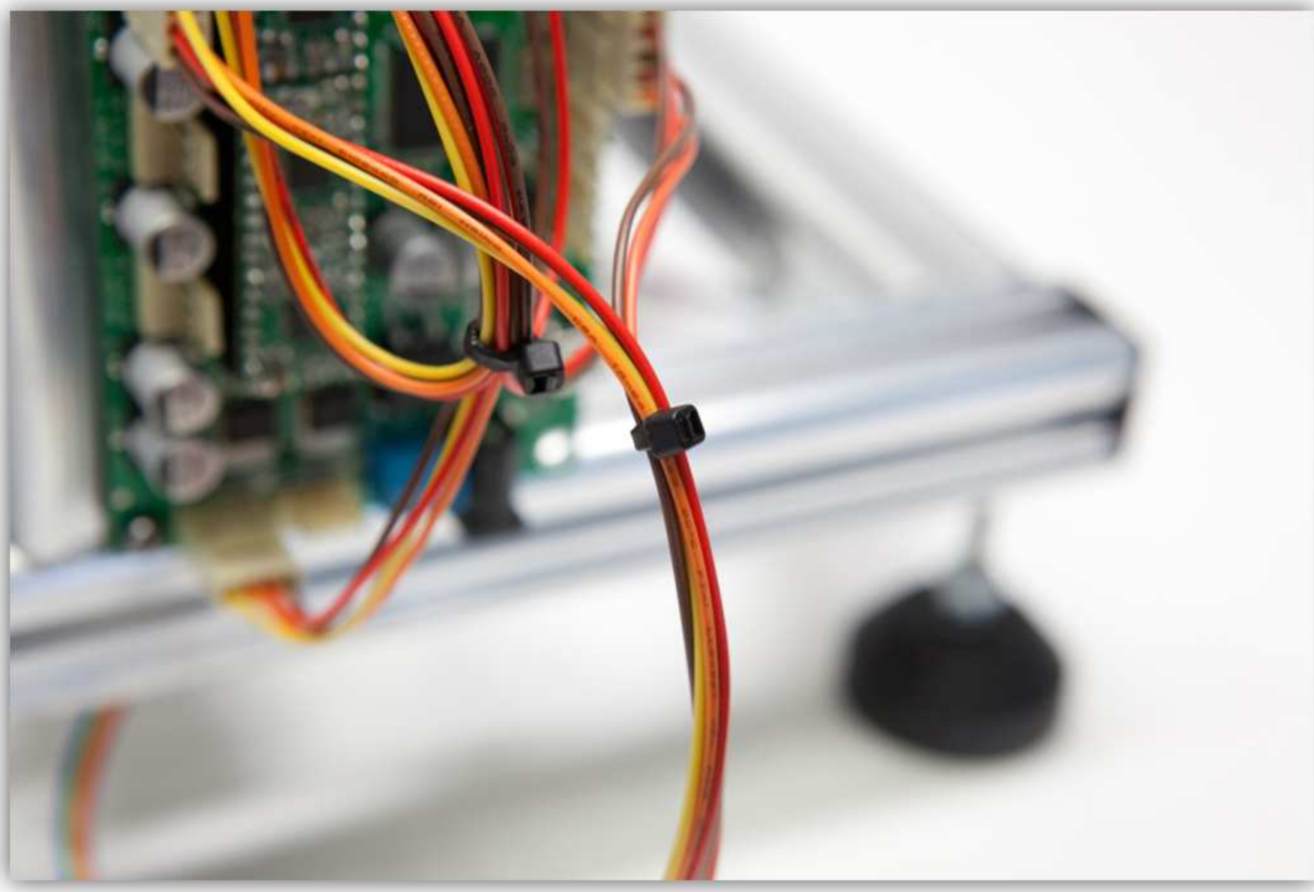


Now slide the big piece of heat shrink tubing over the 4 small pieces, heat the big piece so it covers and protects the 4 heat shrunk joints.



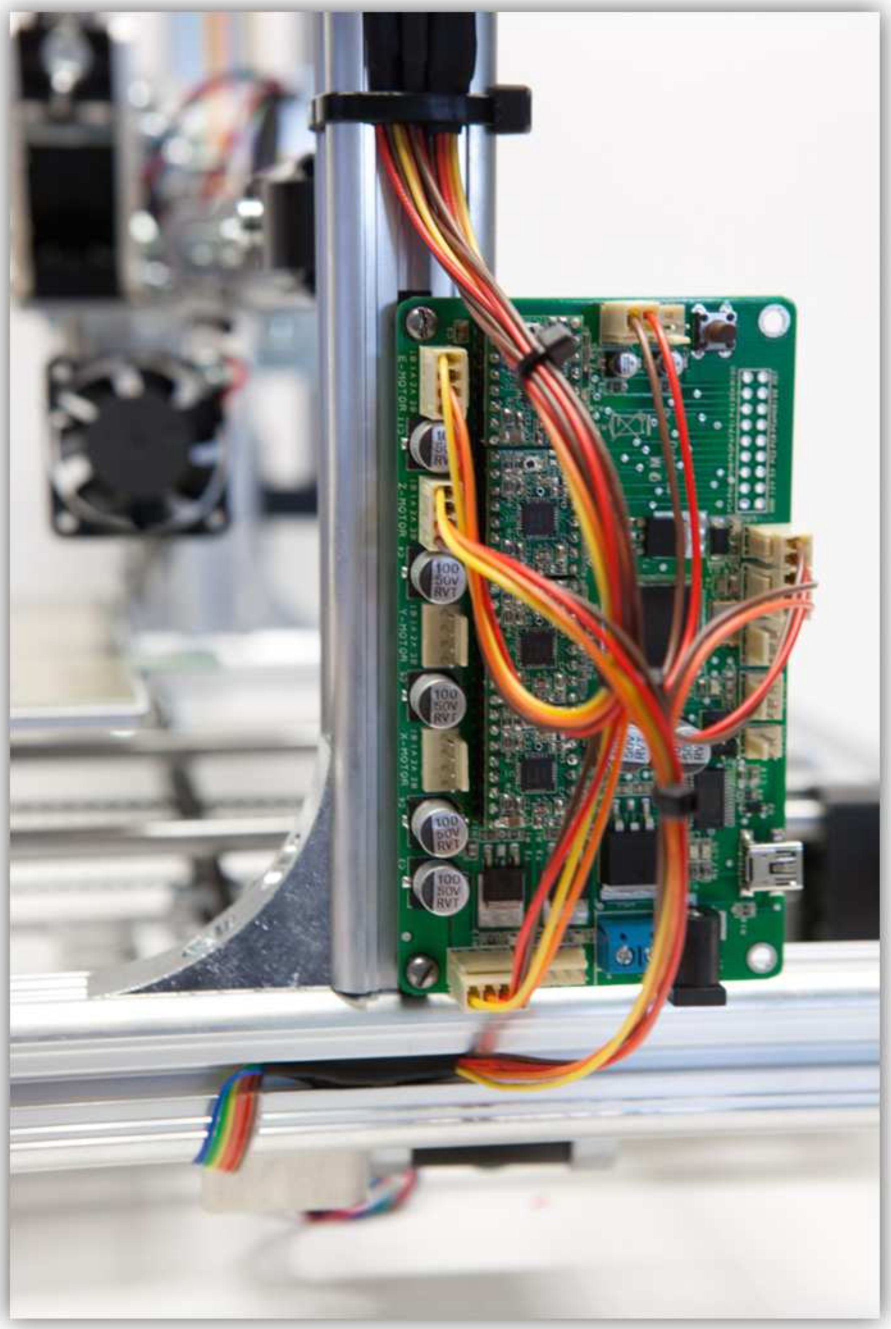


Use small tie-strips to group the cables together.



Tuck the excess cable into the void in the profiles.

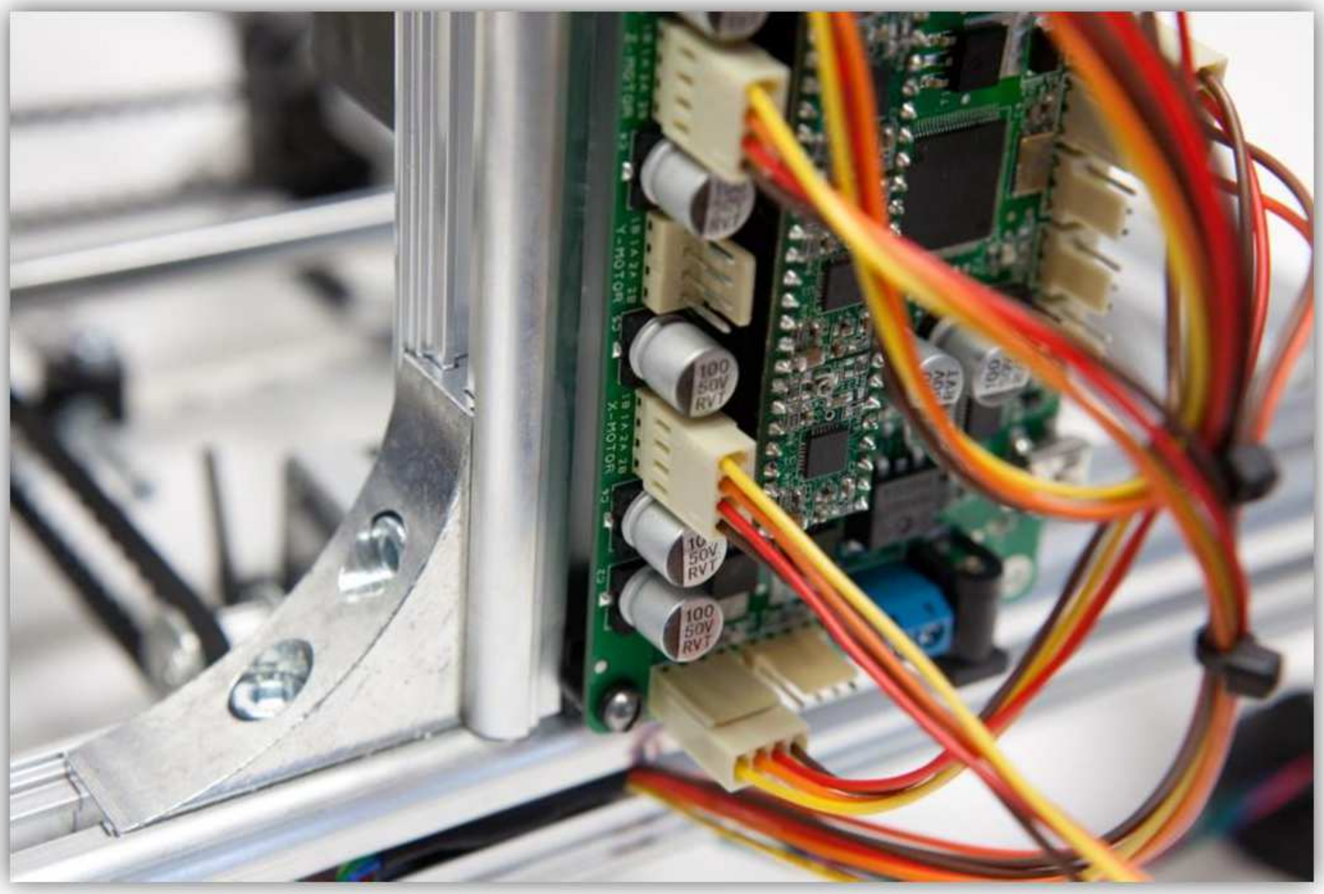
The controller board should now look like this.



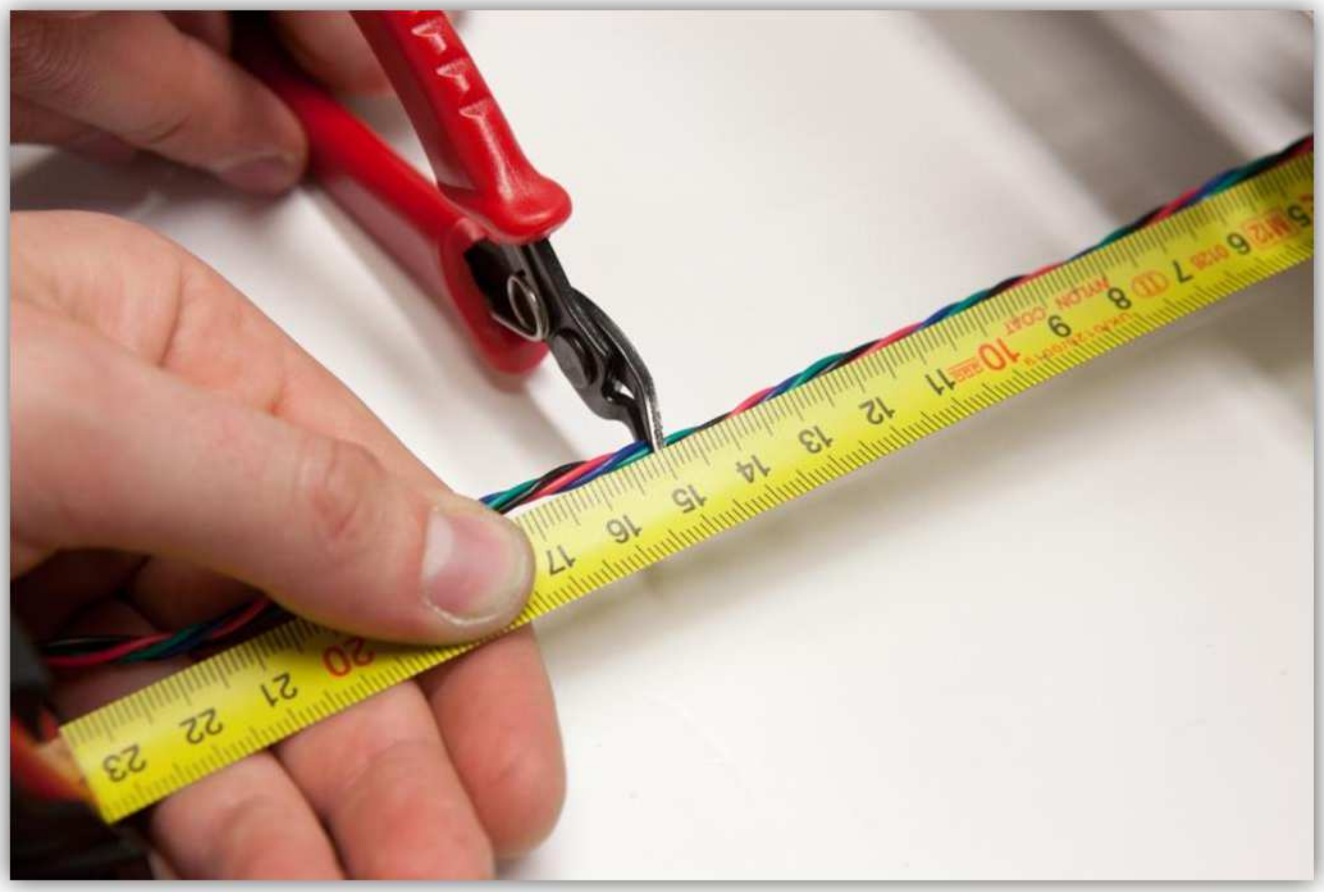
017 – WIRING THE X AXIS MOTOR AND MICRO SWITCH

Take a board to wire connector with 4 wires out of the bag labelled with 40.

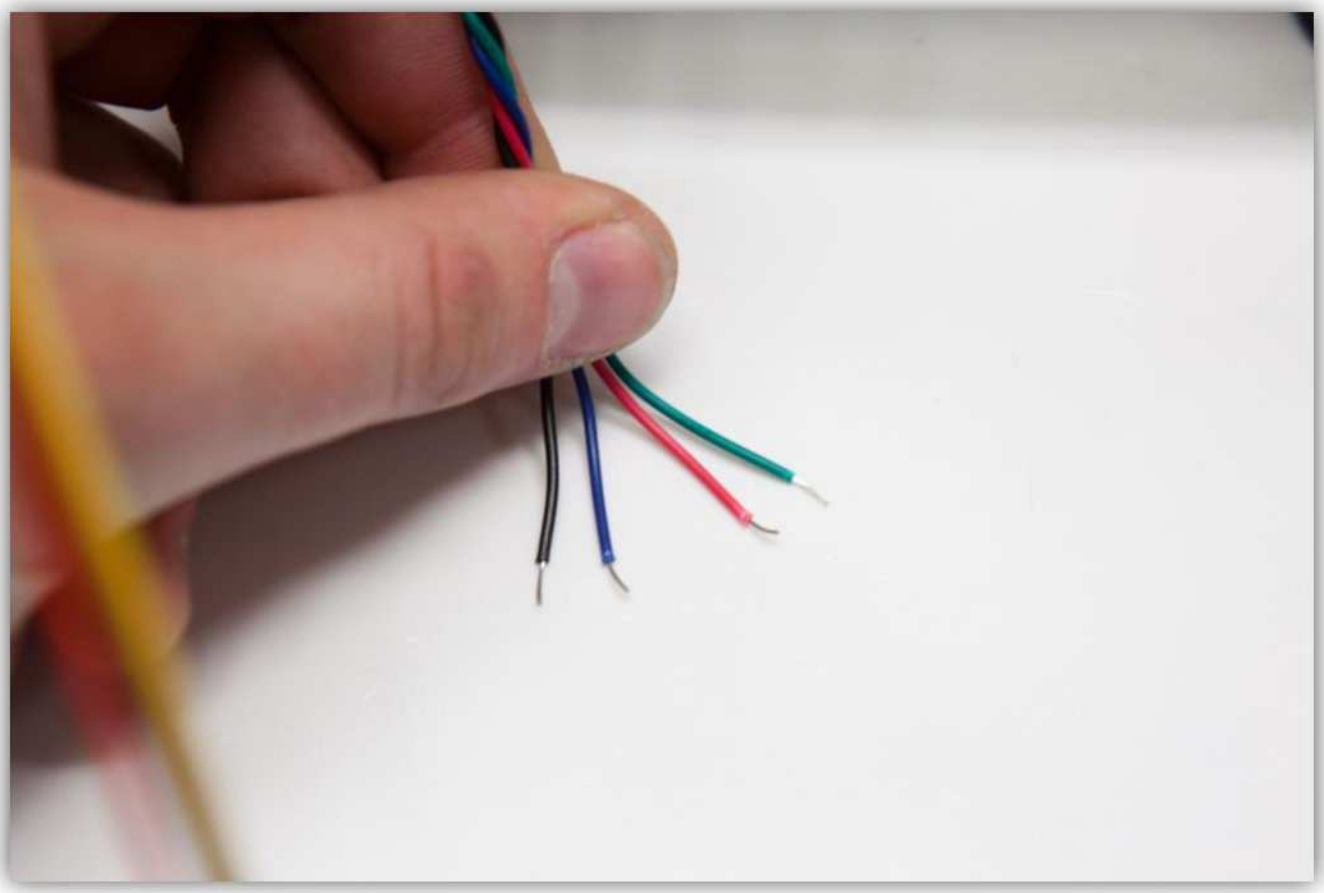
Plug the female connector in the male connector labelled with X-MOTOR on the controller board.



Cut the wires of the X axis motor down to about 15 cm (5,9").

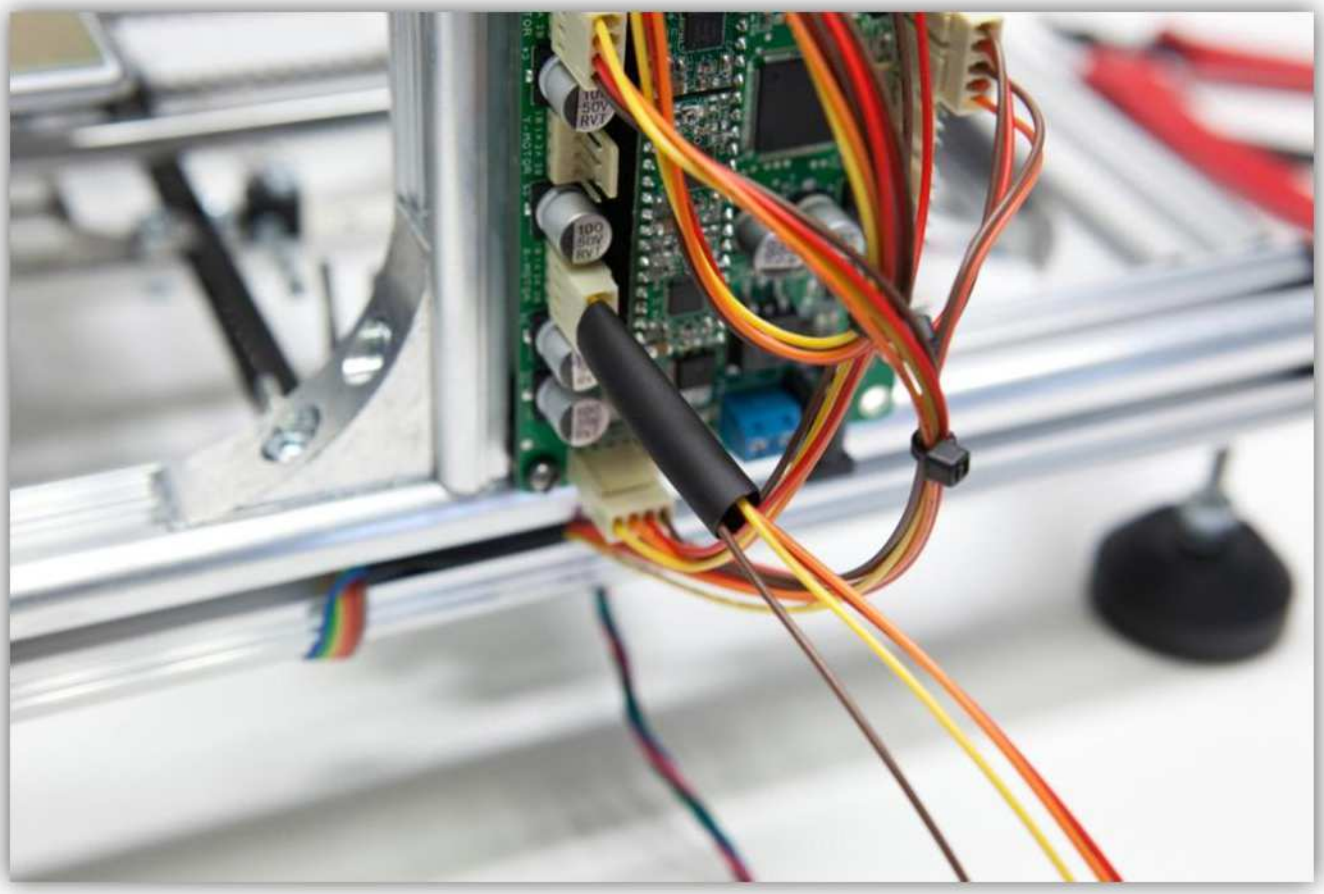


Strip the wires 5 mm (0.2") and tin them.



Cut 4 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

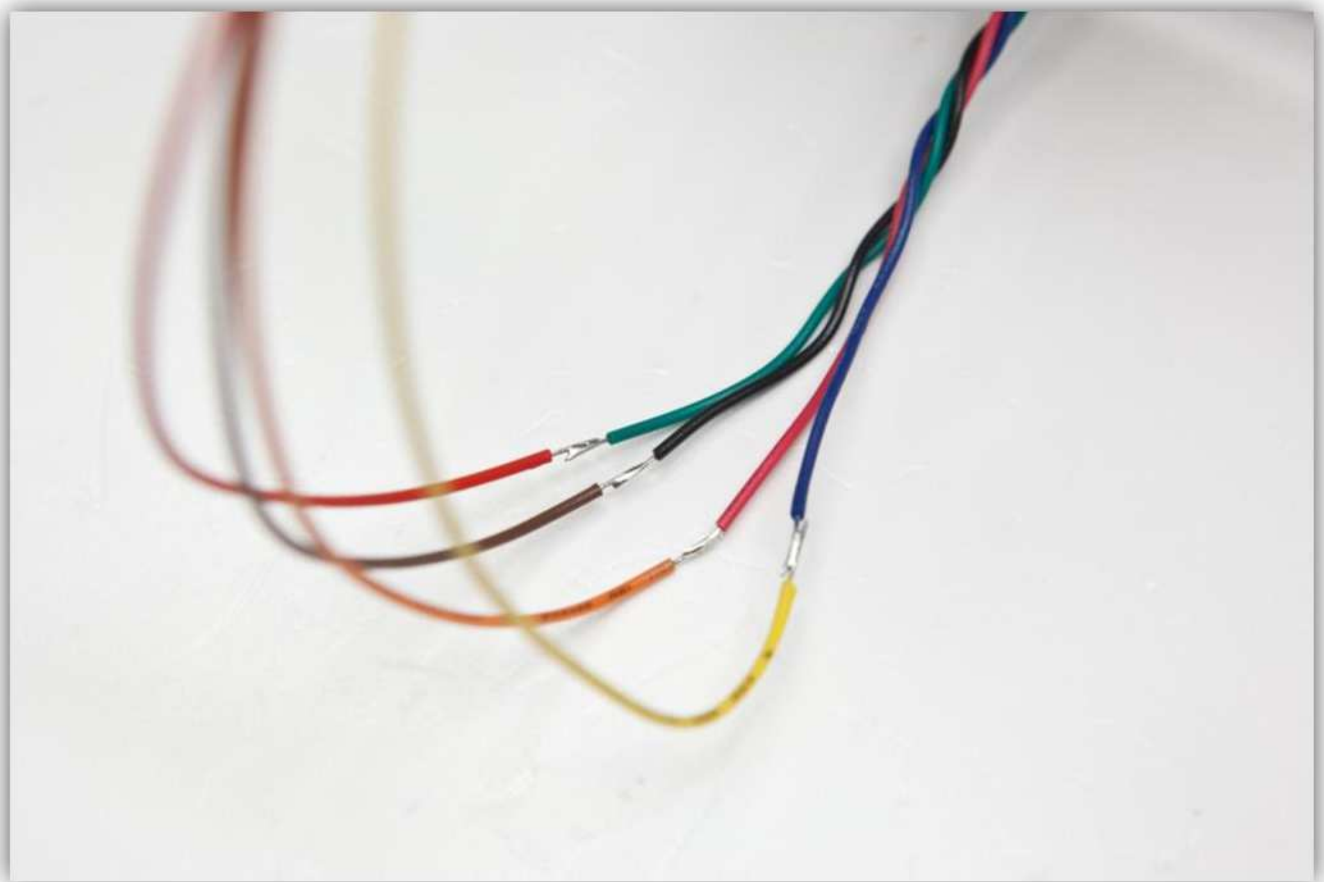
Slide the big heat shrink tube over the 4 wires of the connector.



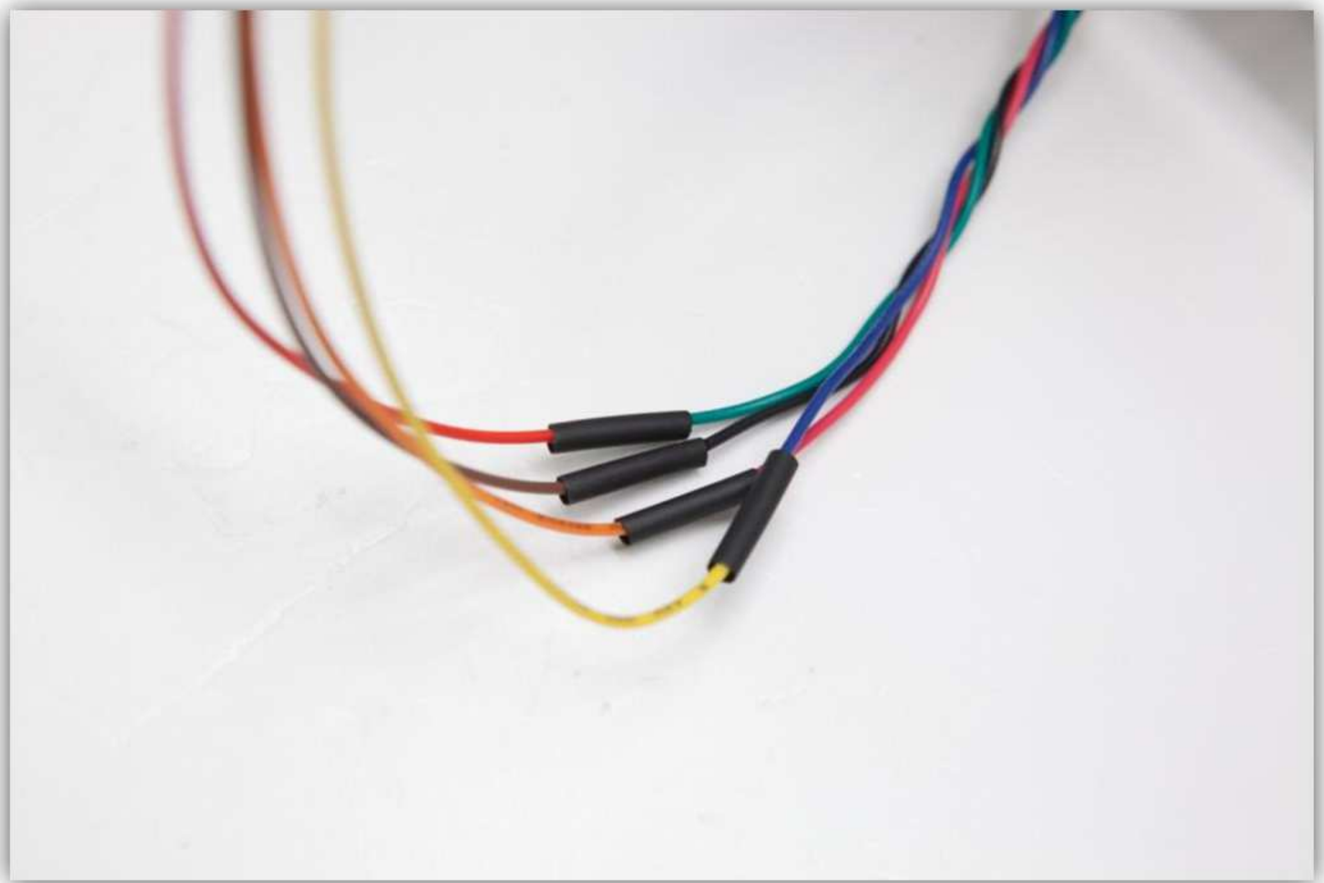
Slide the 4 small heat shrink tubes over the 4 wires of the connector.

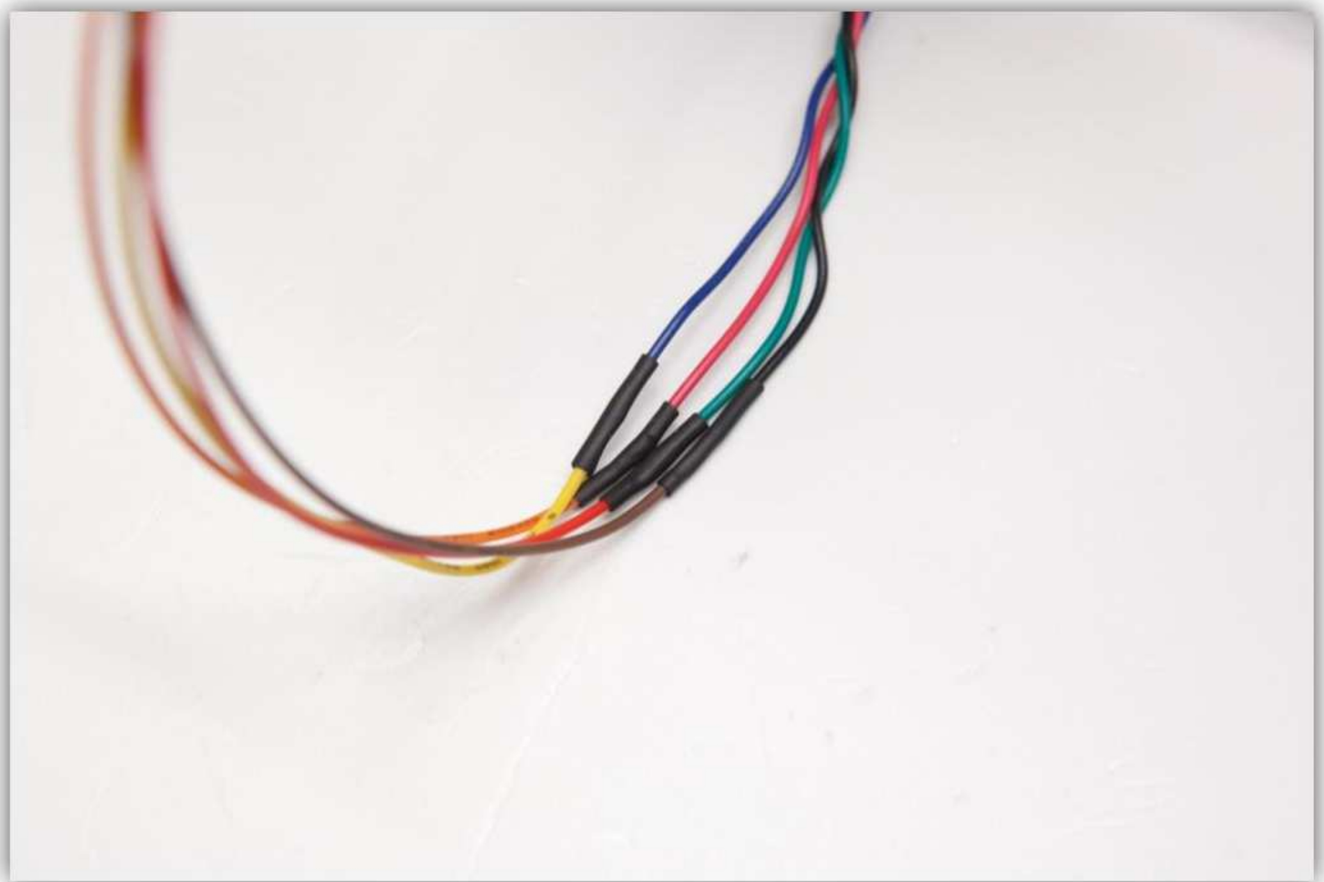
Solder the 4 wires from the motor to the 4 wires of the connector you tinned earlier. **Watch the colours closely.**

Connector cable	**->**	**Motor wires**
Yellow	**->**	**Blue**
Orange	**->**	**Red**
Red	**->**	**Green**
Brown	**->**	**Black**

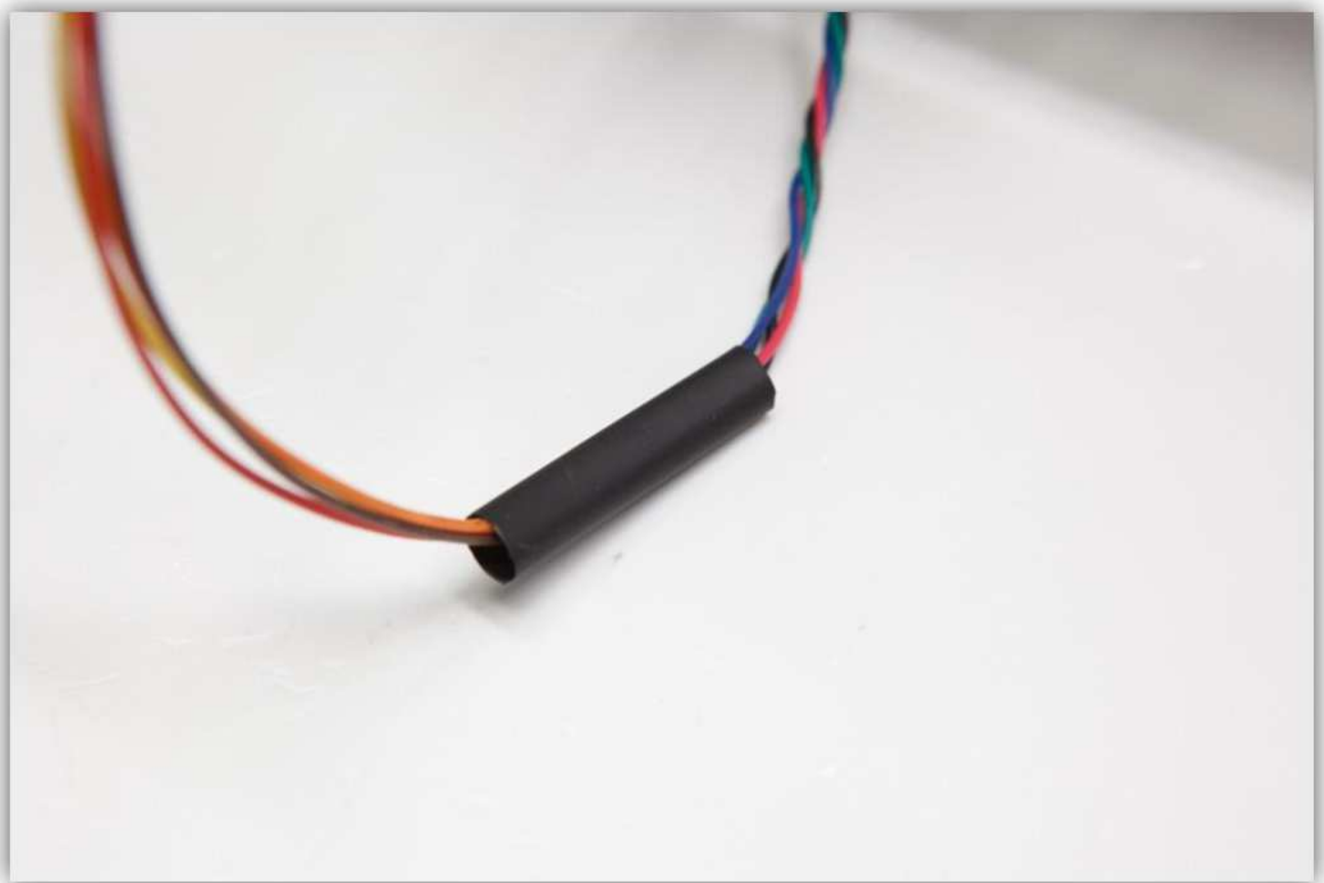


Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.

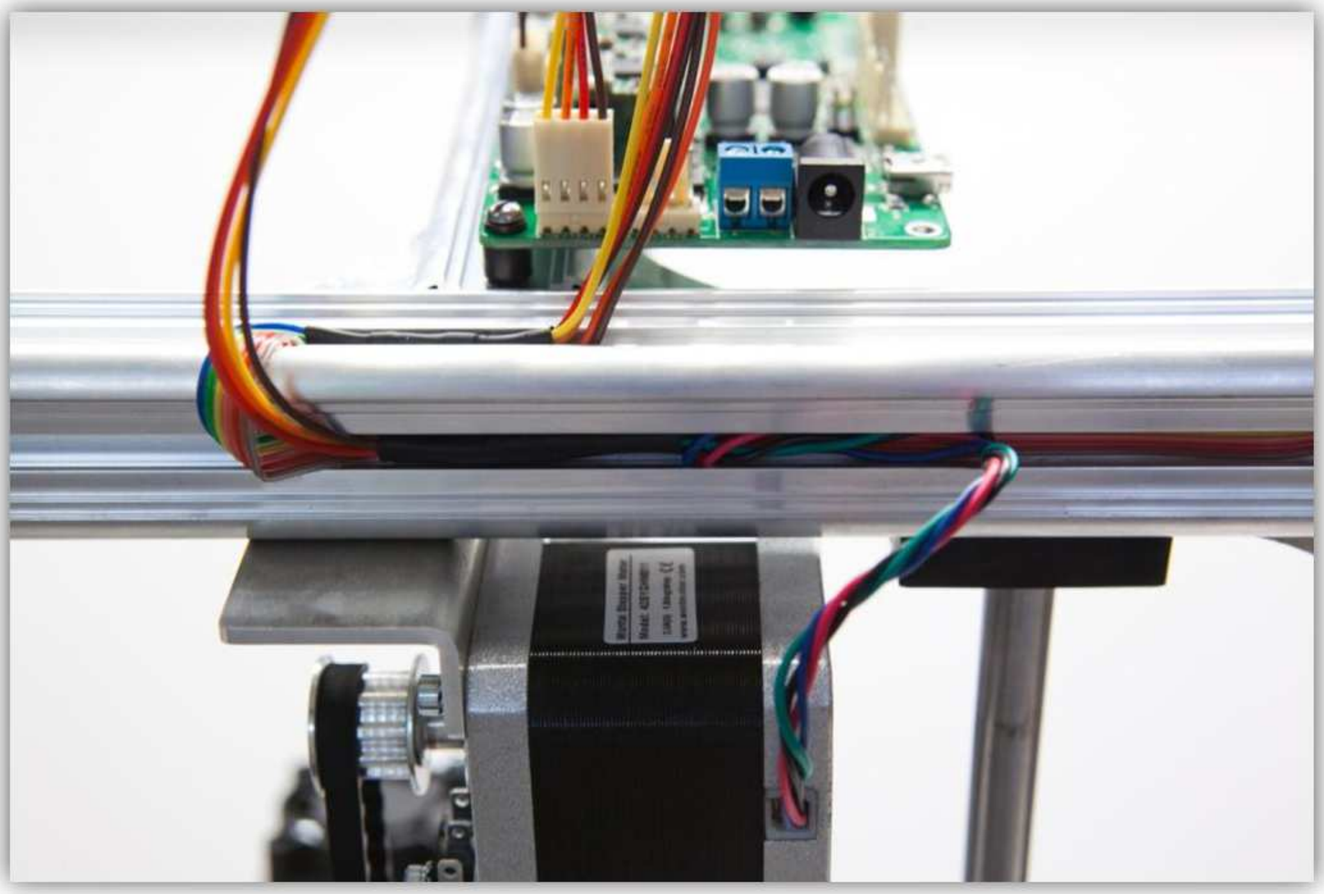




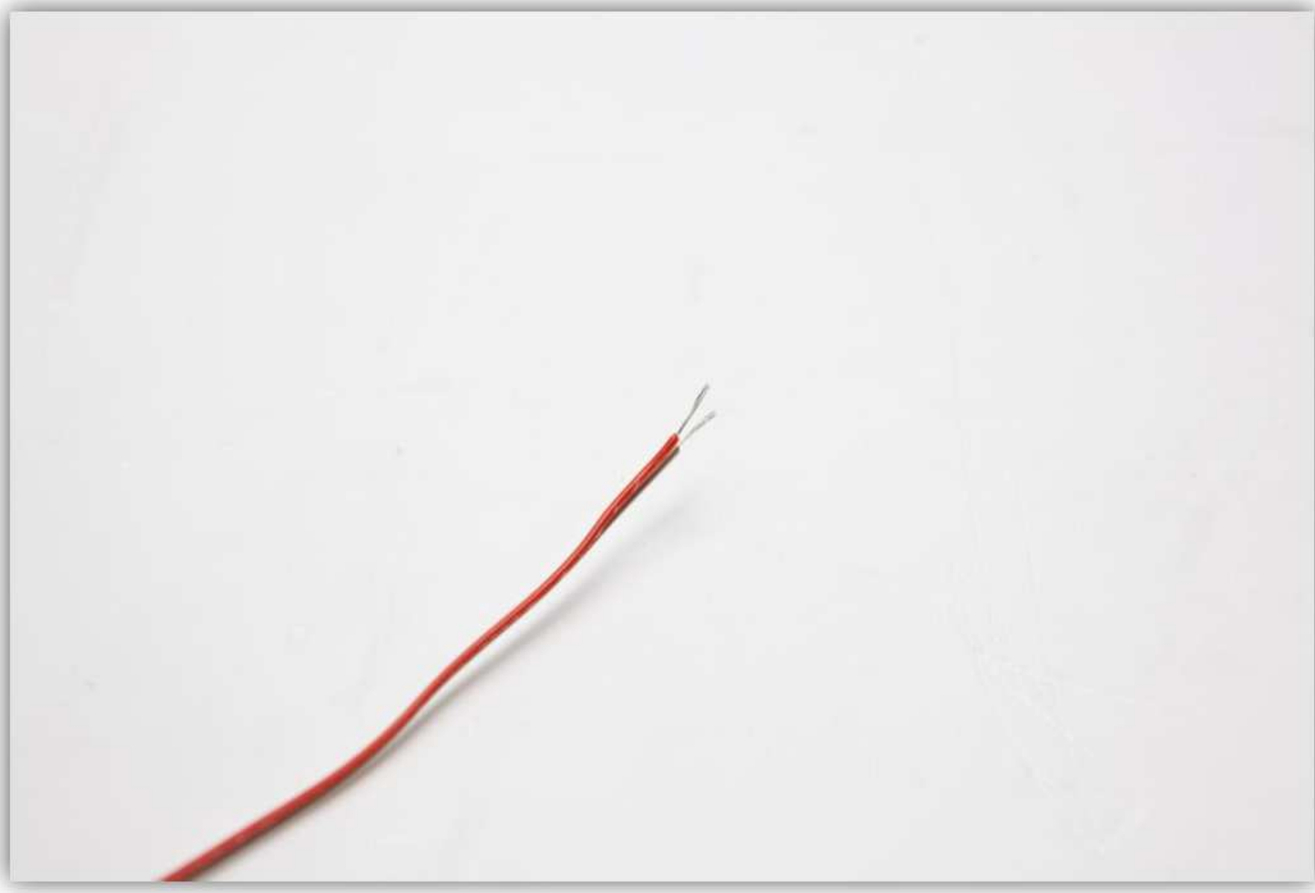
Now slide the big piece of heat shrink tubing over the 4 small pieces, heat the big piece so it covers and protects the 4 heat shrunk joints.



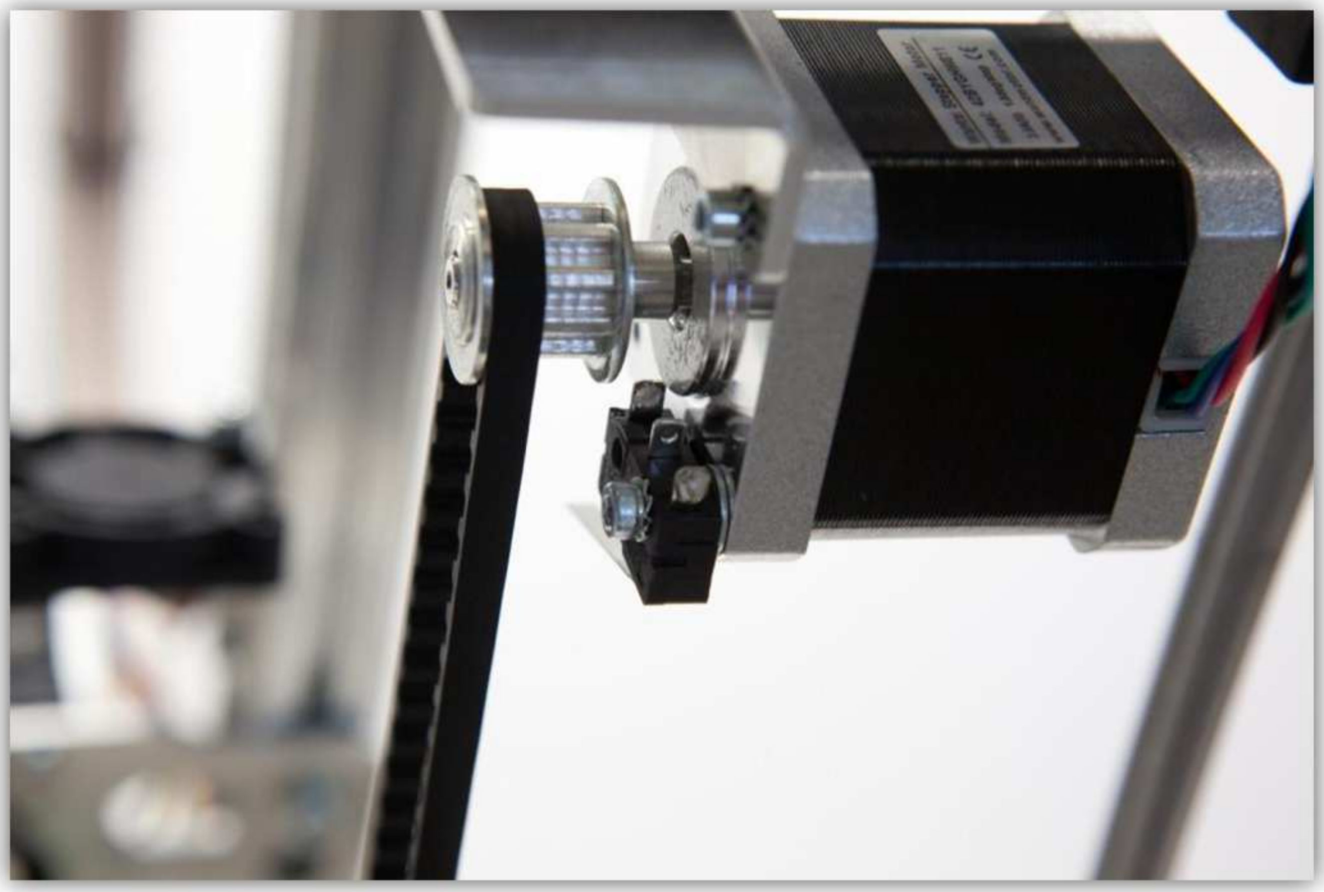
Tuck the excess cable into the void in the profiles.



Take a piece of **Red** and **Brown** wire that you detached from the flat cable earlier. Strip the ends 5 mm (0.2") and tin them.



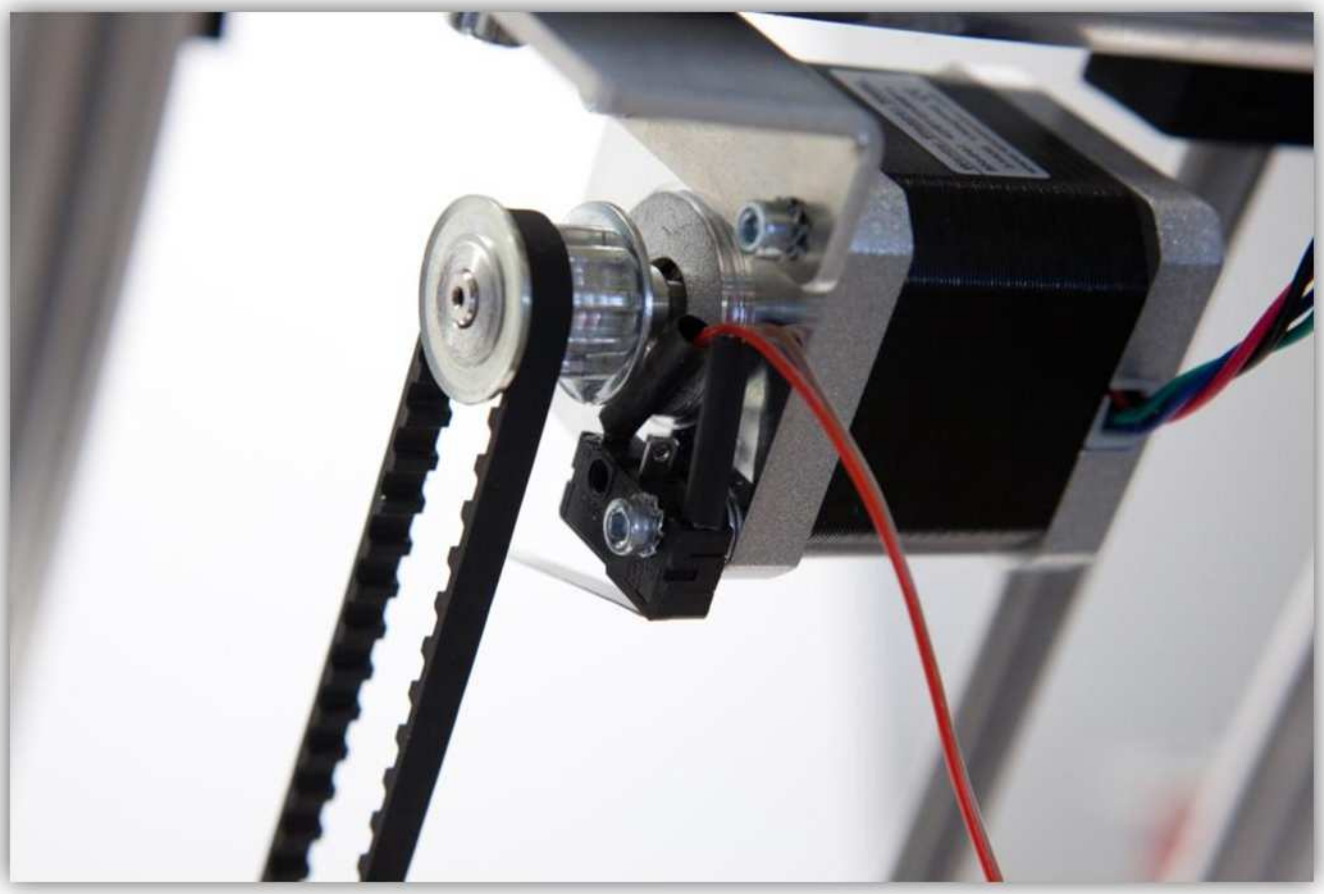
Tin the contact points of the X micro switch. **Be careful and don't touch the belt with the hot soldering iron.**



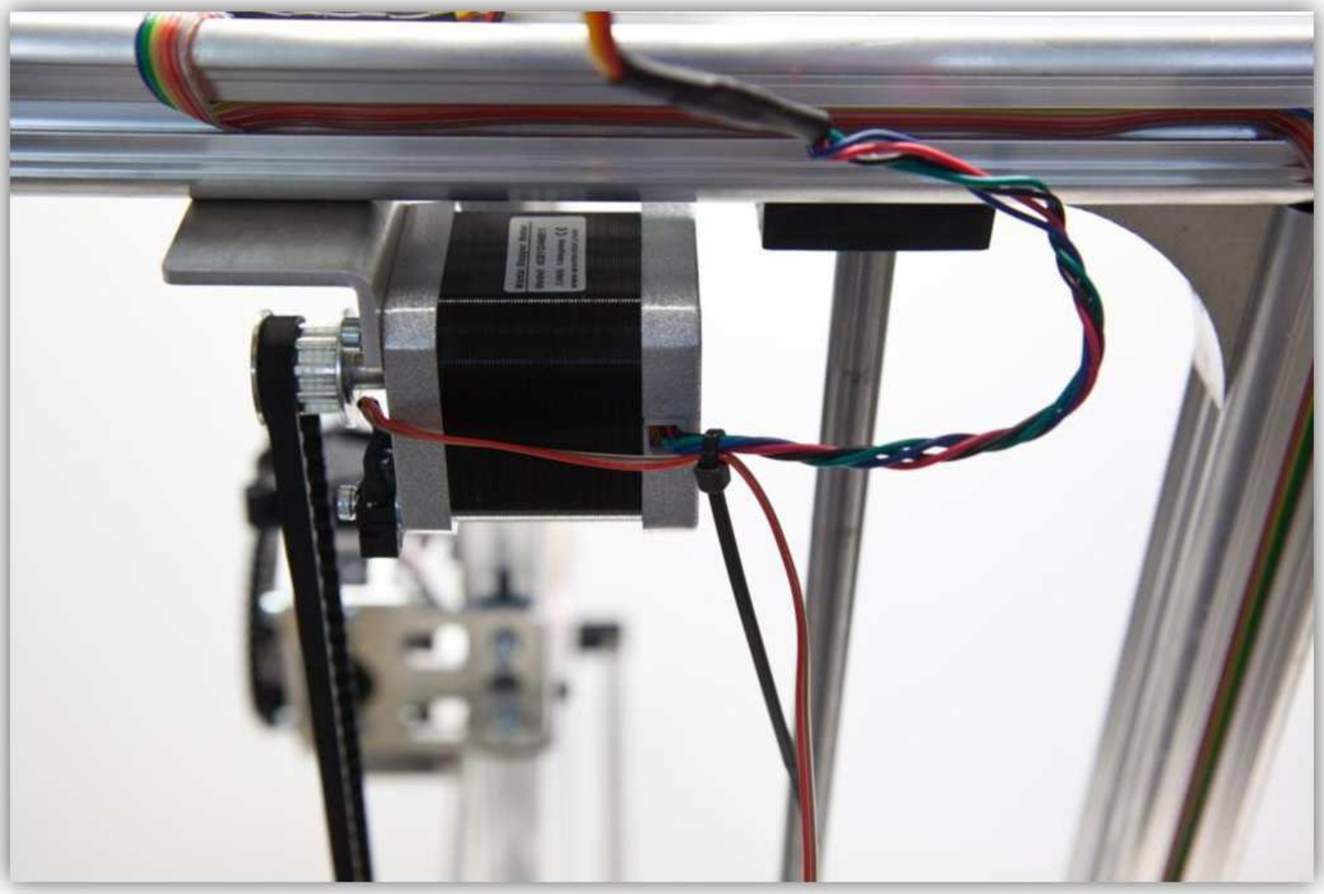
Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long.

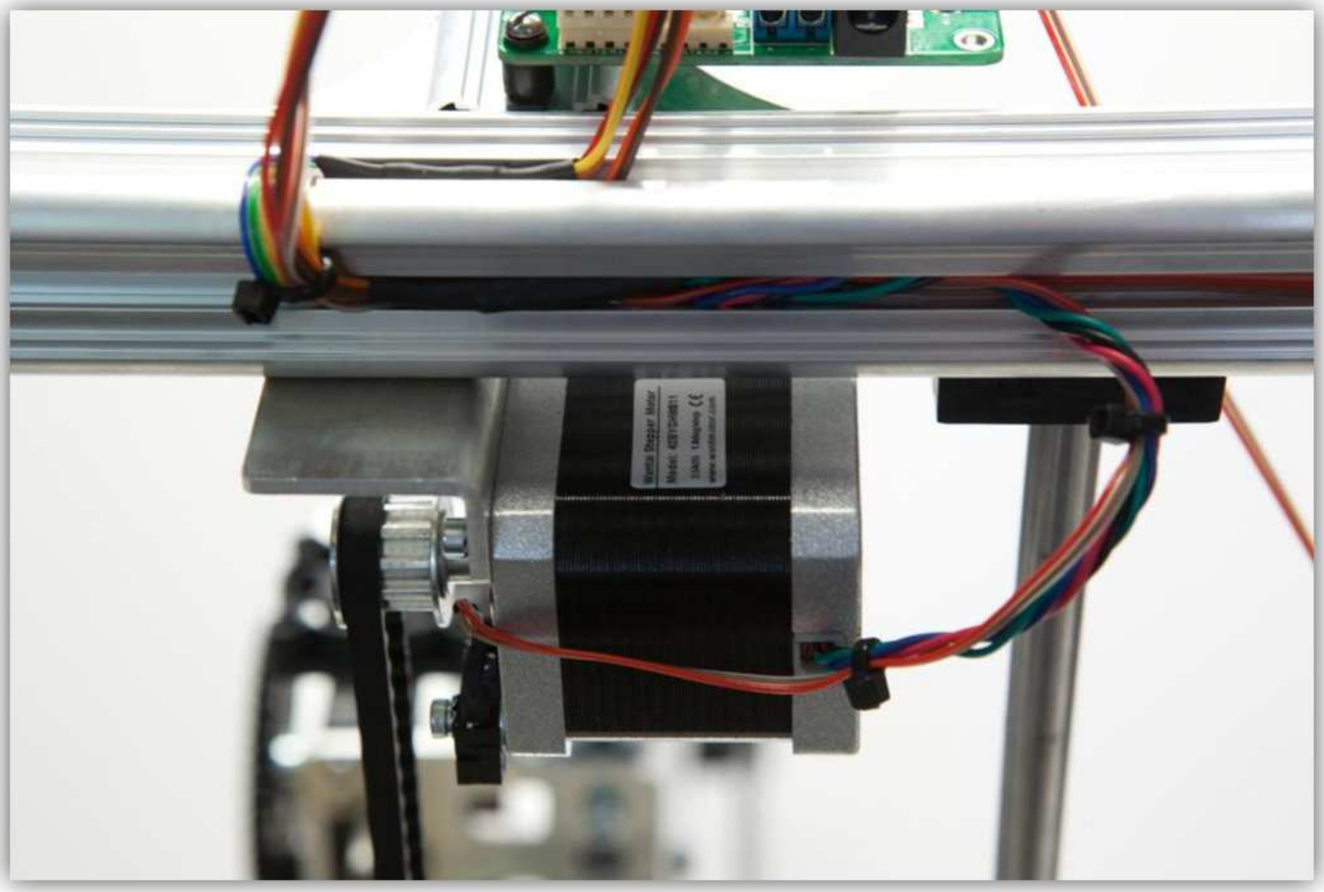
Slide them over the ends of the **Red** and **Brown** wire you tinned earlier.

Solder the wires to the contact points of the micro switch, slide the heat shrink tubes over the contacts and shrink them.



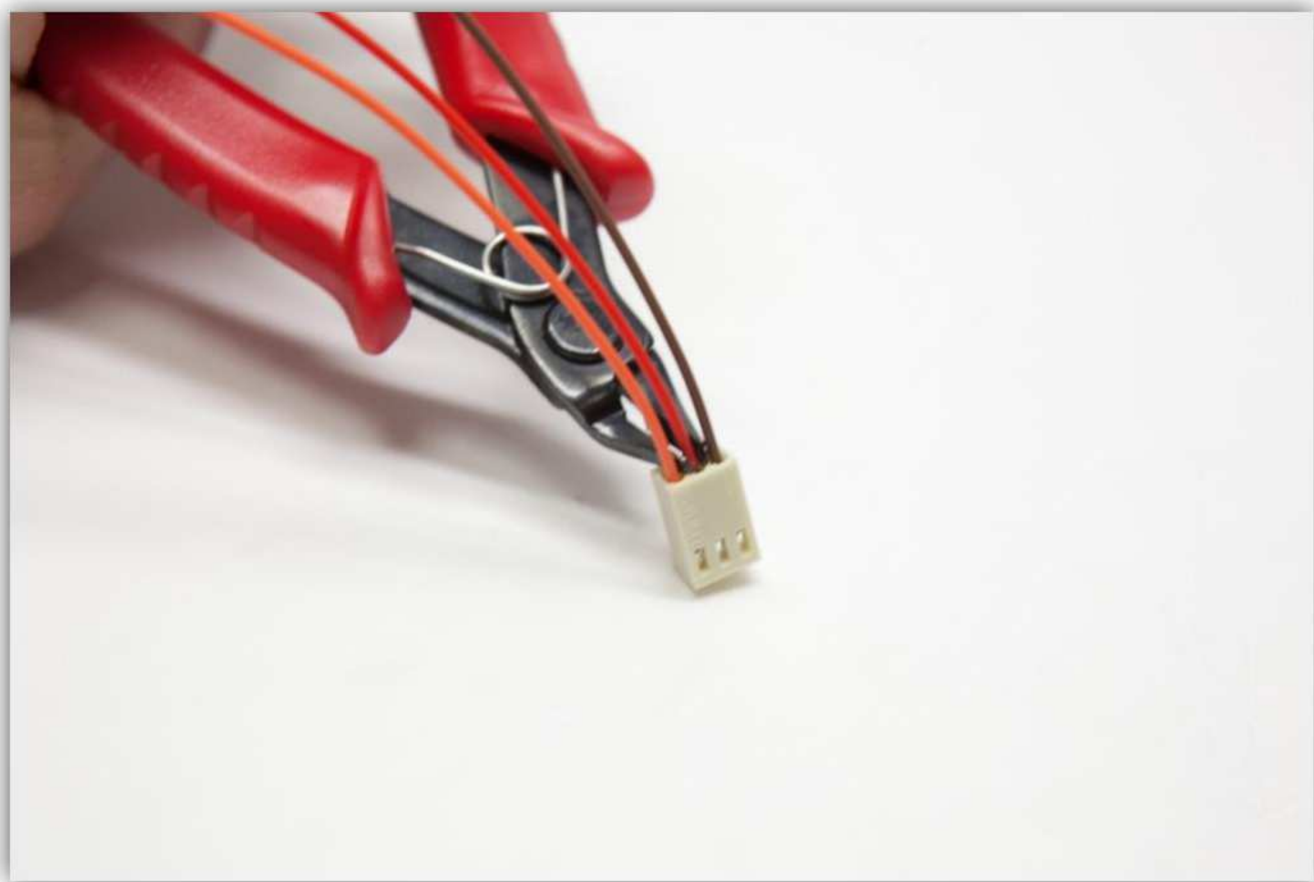
Use small tie-strips to hold the **Red** and **Brown** wire in place.

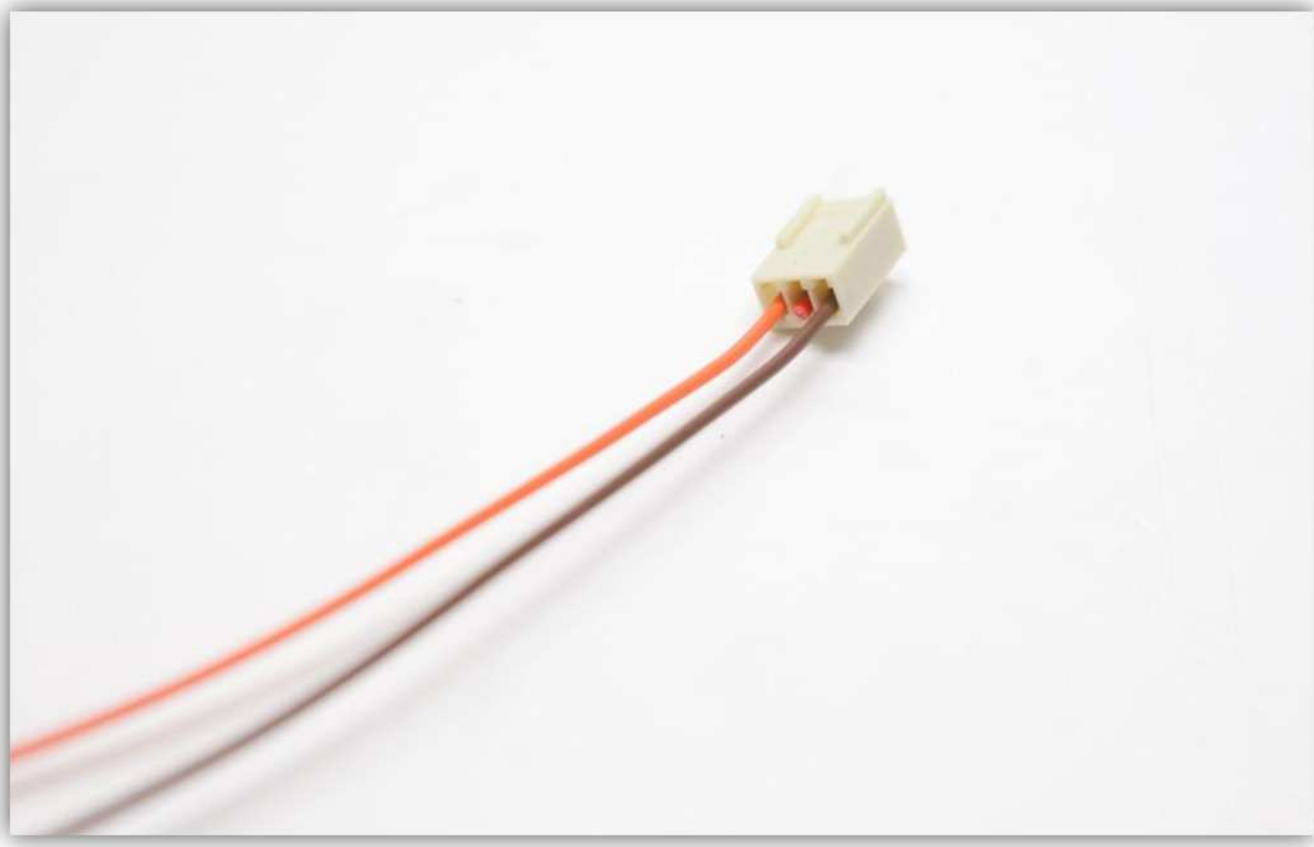




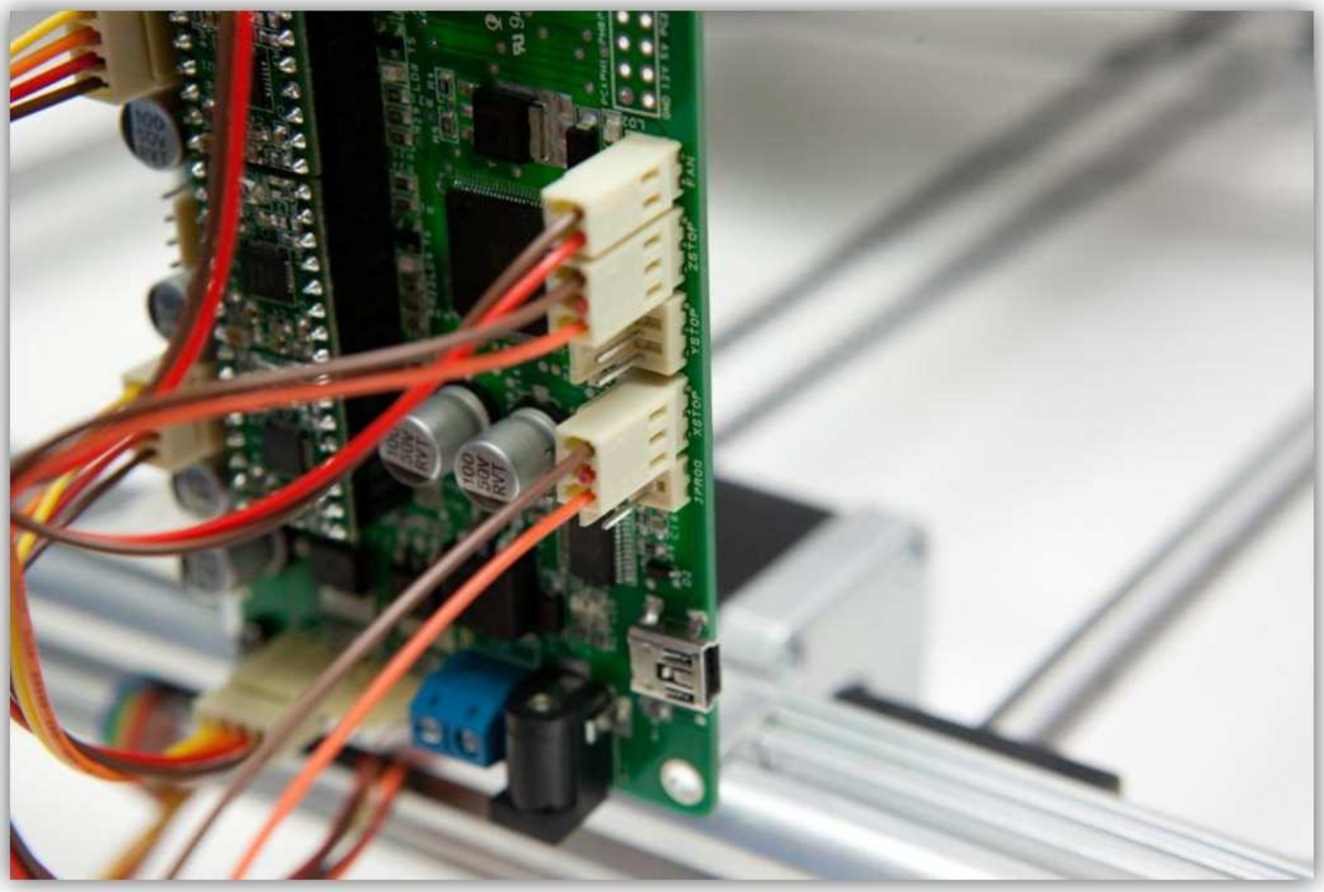
Take a board to wire connector with 3 wires out of the bag labelled with 40.

Cut the middle wire away at the connector.

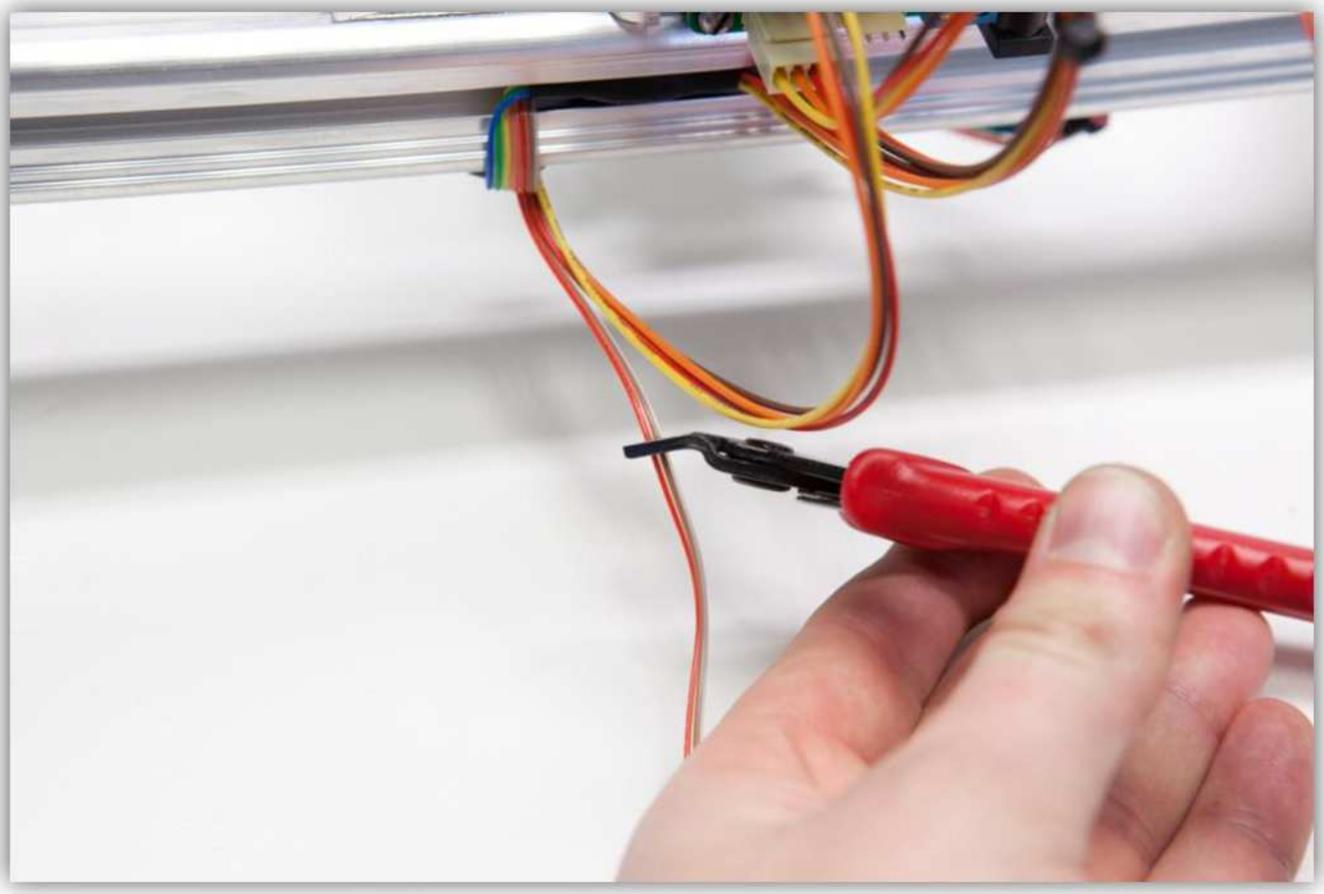




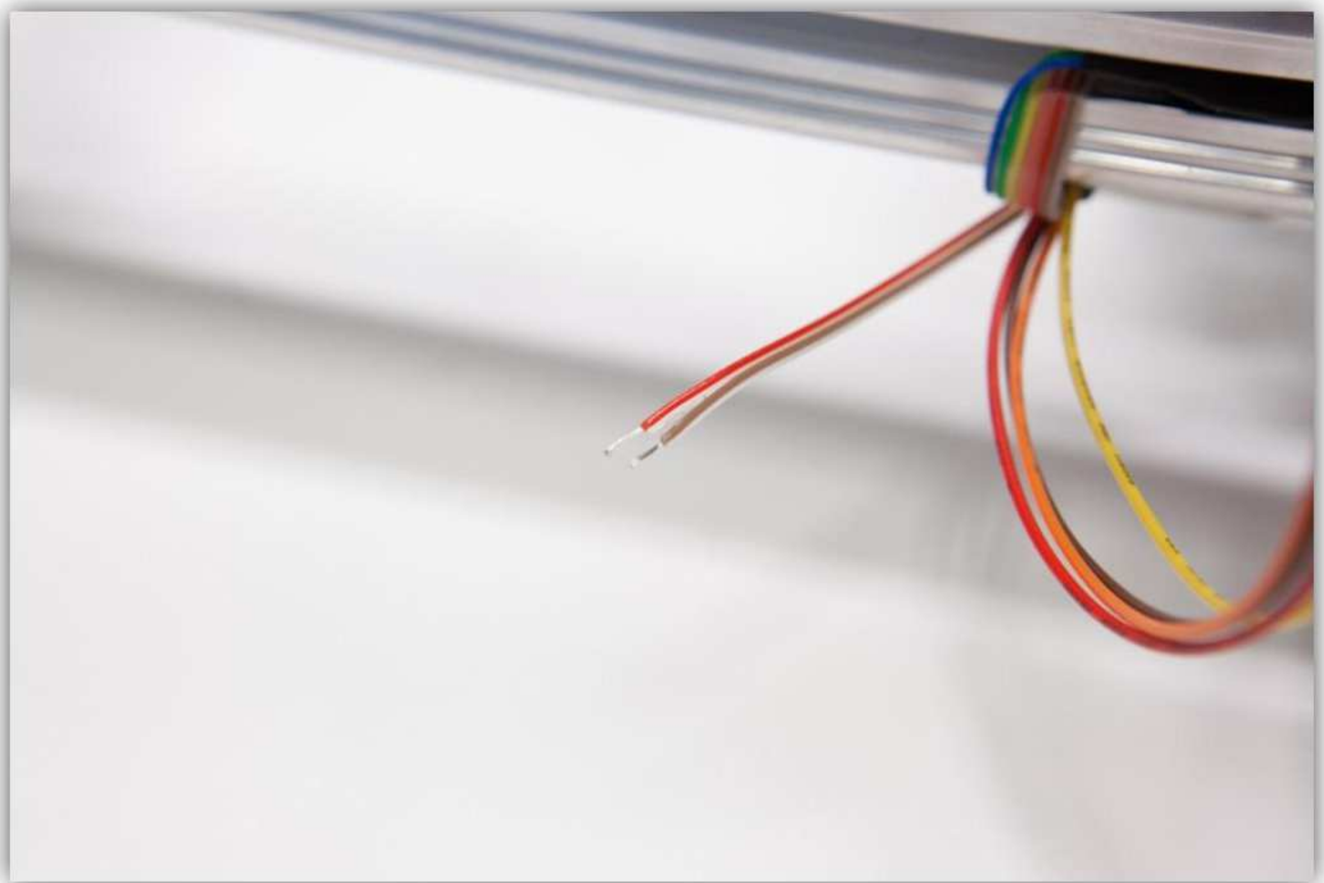
Plug the female connector in the male connector labelled with XSTOP on the controller board.

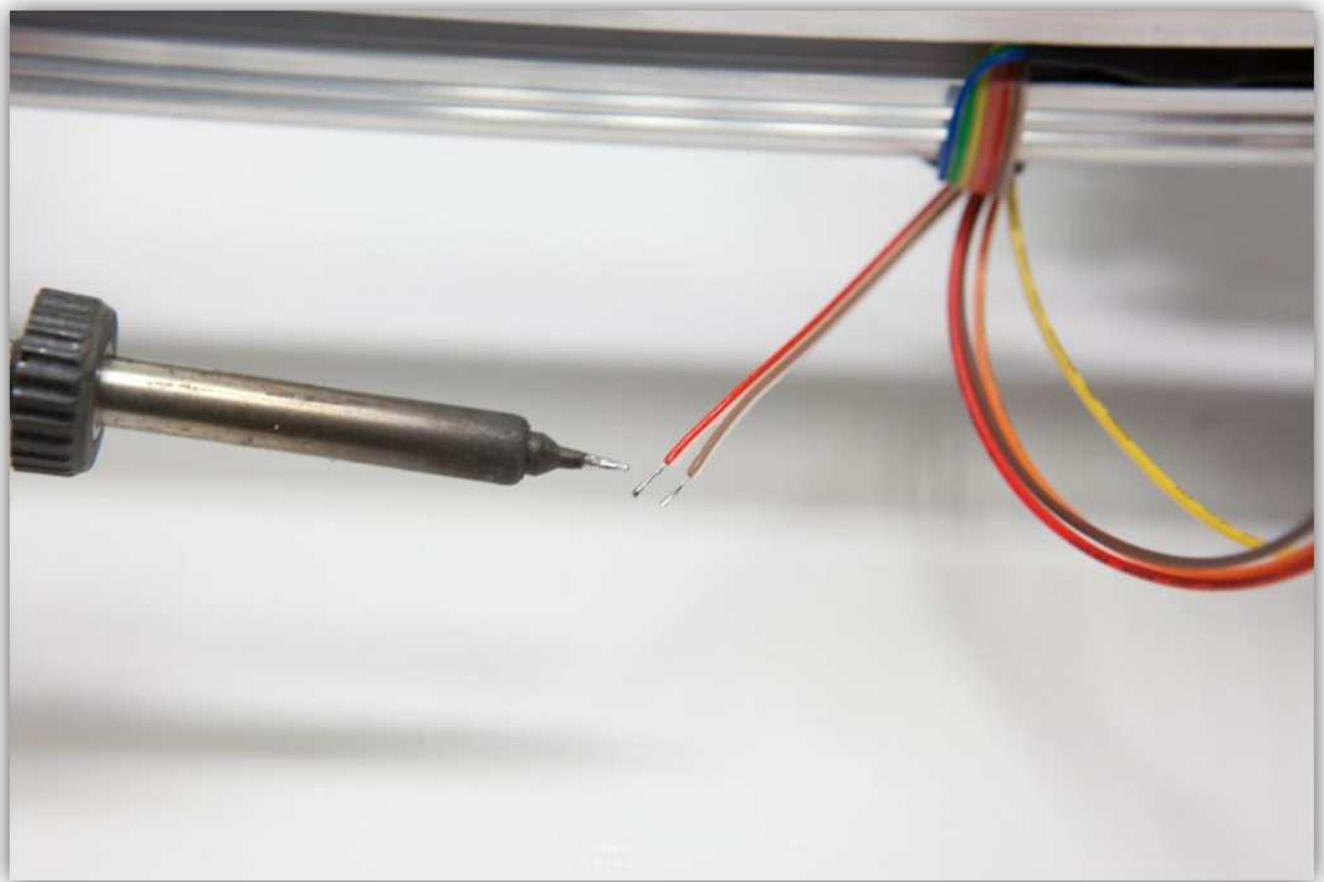


Cut the **Red** and **Brown** wire from the X micro switch so that it can connect to the wires of the connector you just plugged in.



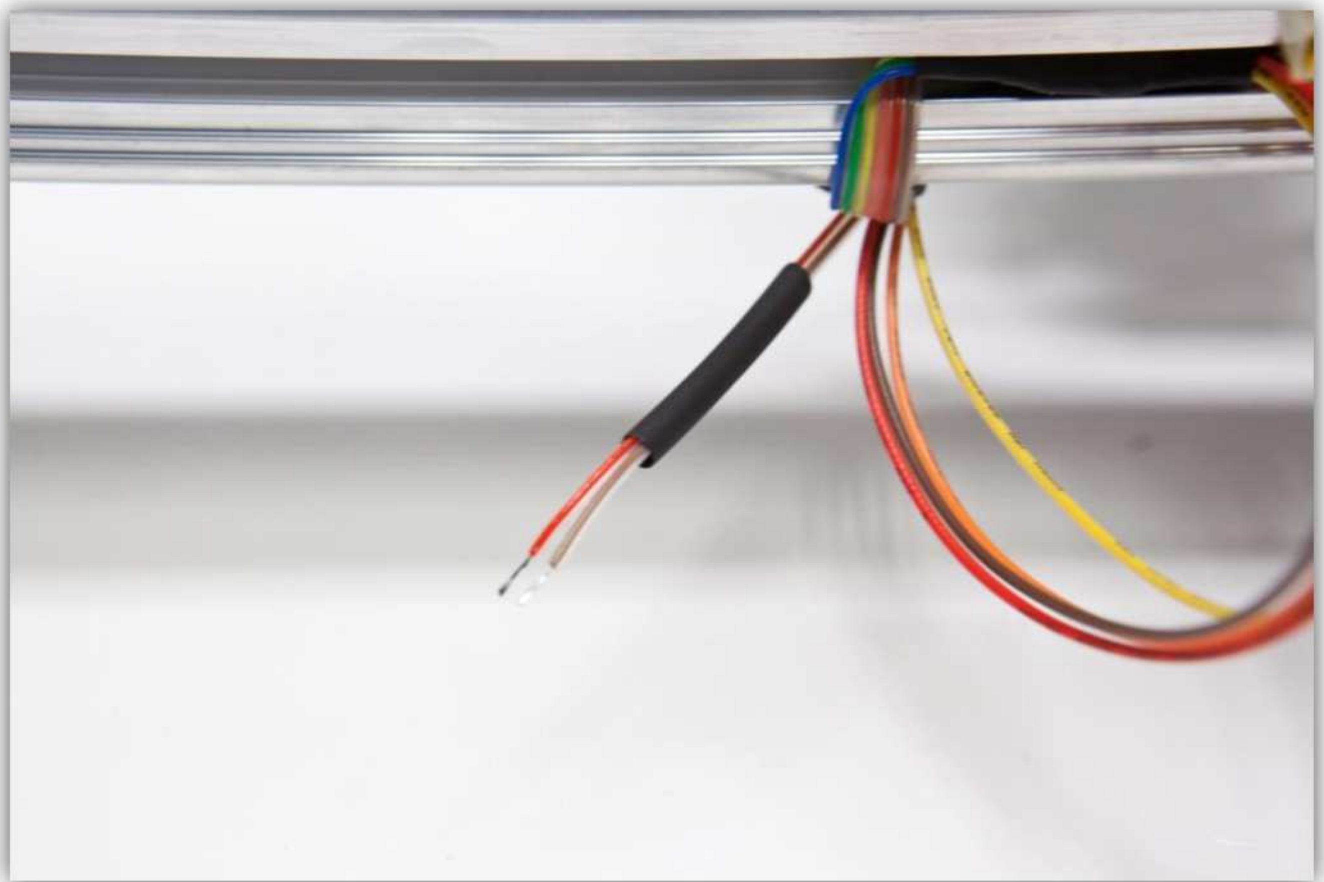
Strip 5 mm (0.2") and tin the ends of these wires.



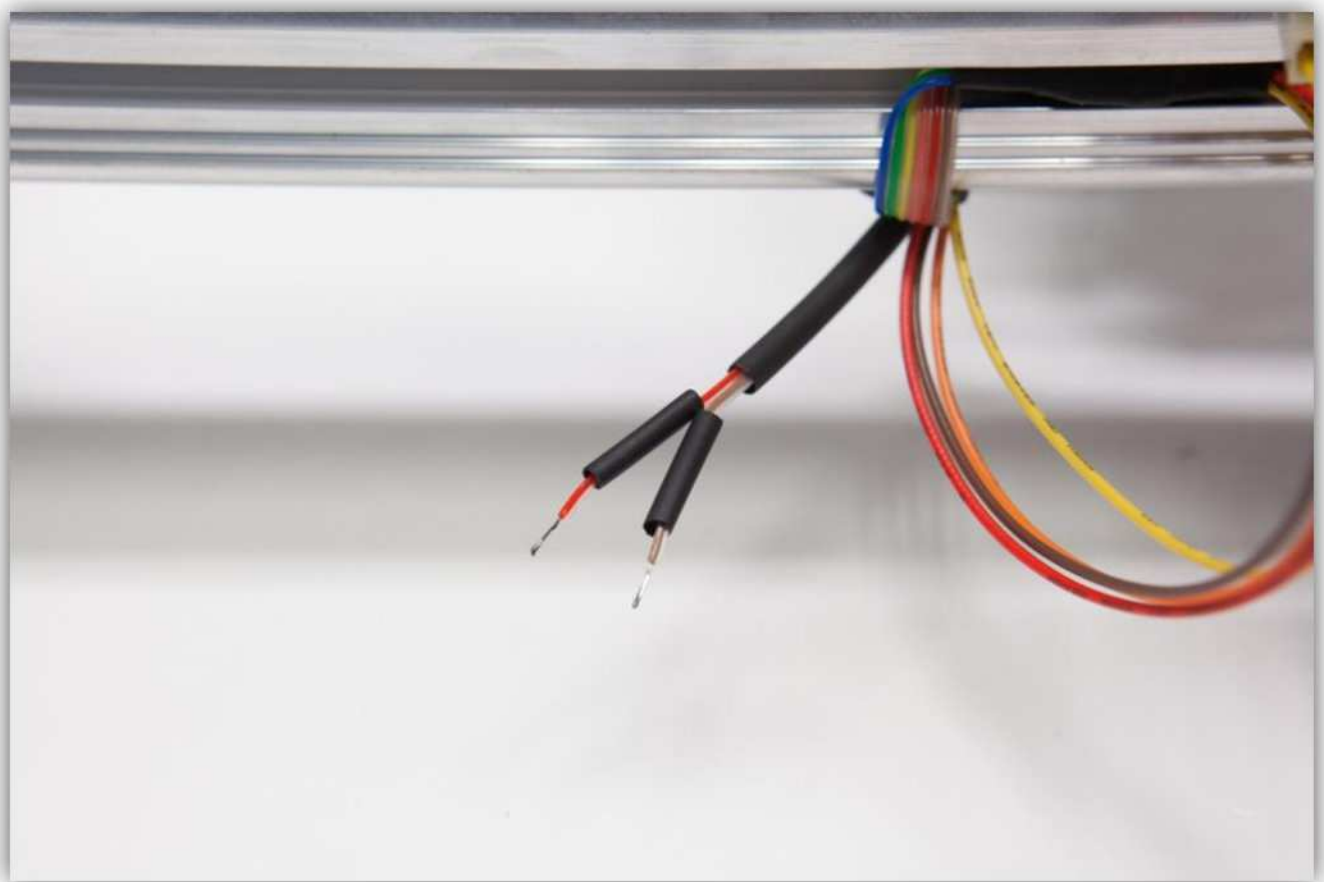


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the medium size heat shrink tubes over the 2 wires of the connector.

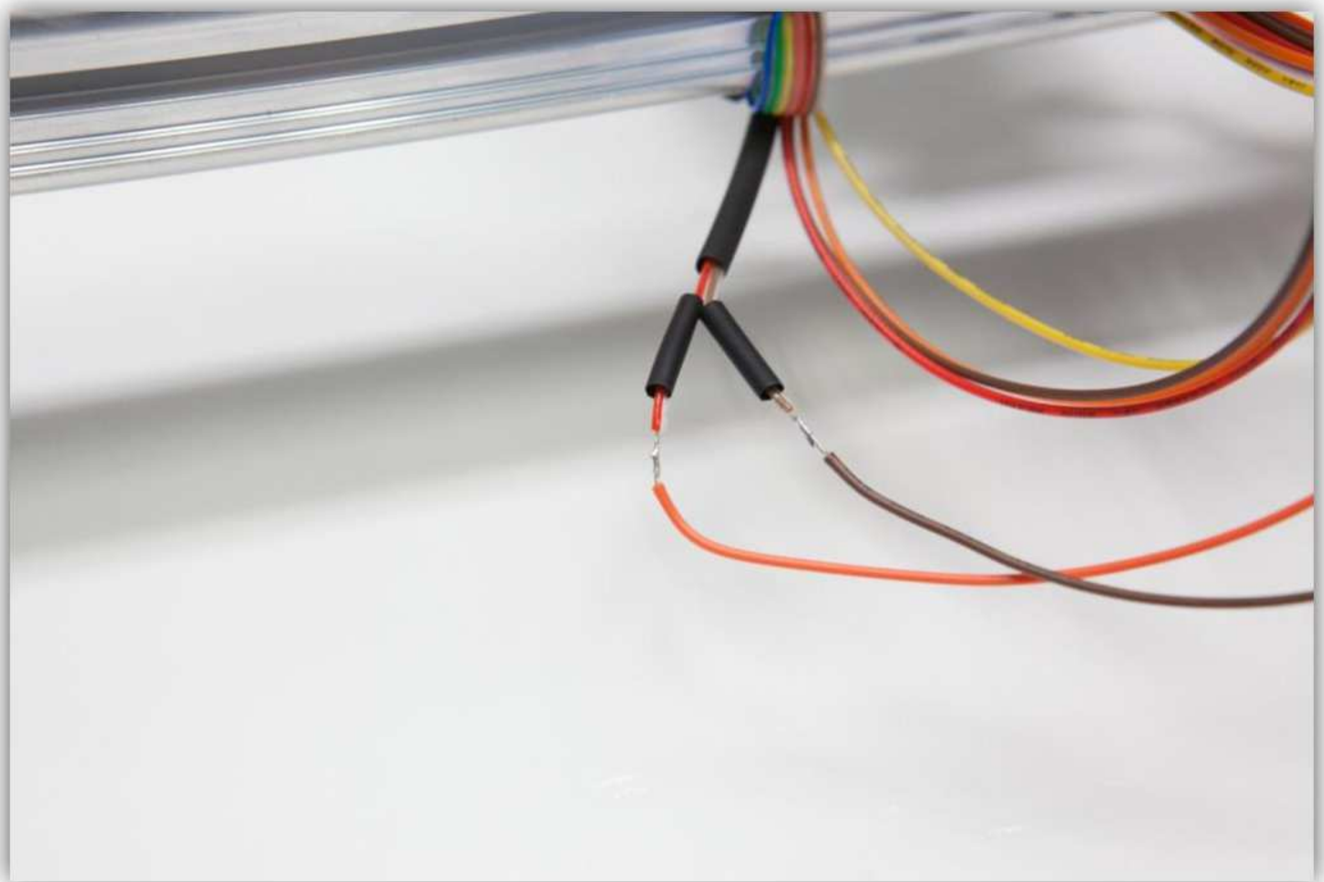


Slide the 2 small heat shrink tubes over the 2 wires of the connector.

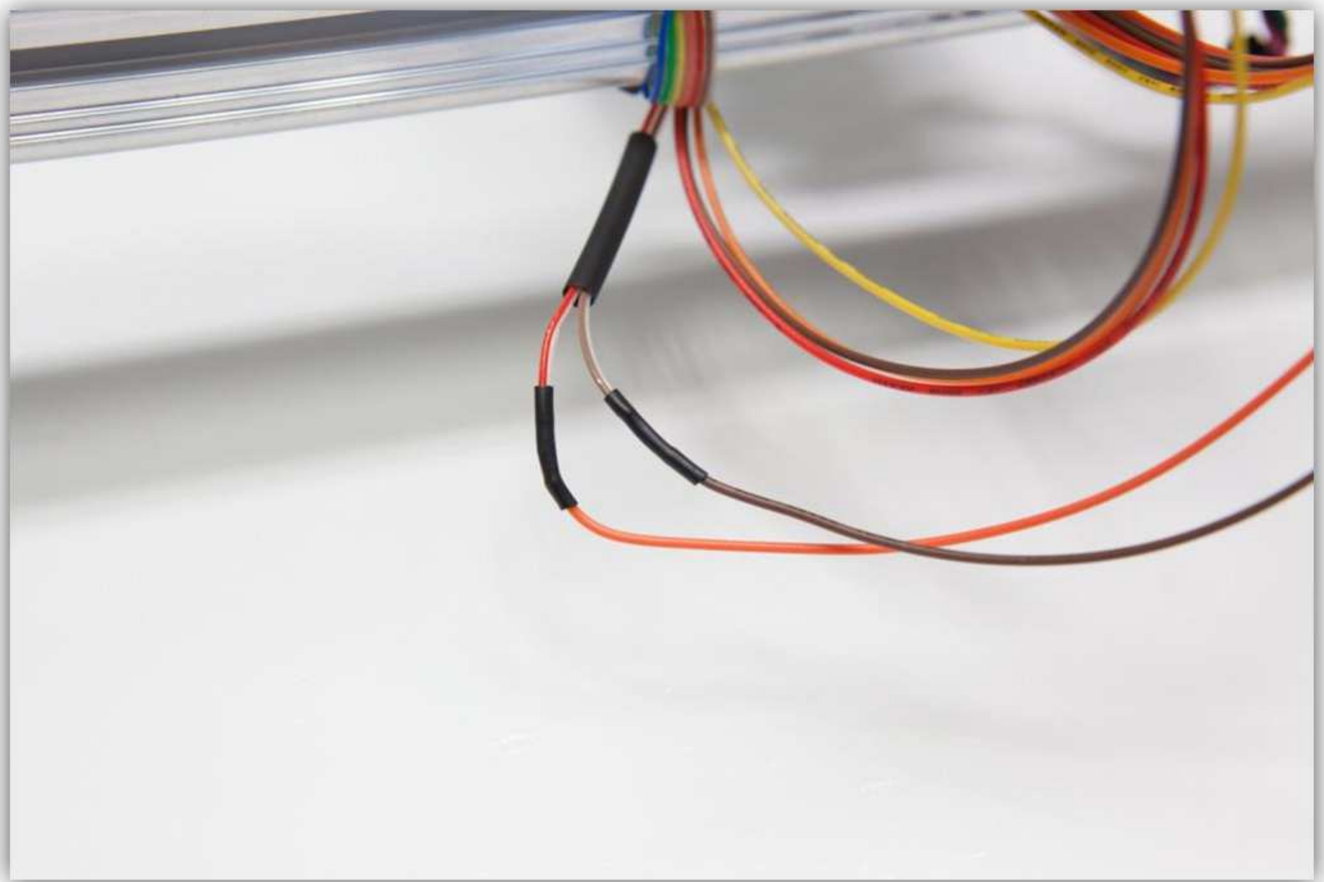


Solder the 2 wires from the **Red** and **Brown** wire to the 2 wires of the flat connector you tinned earlier. **Watch the colours closely.**

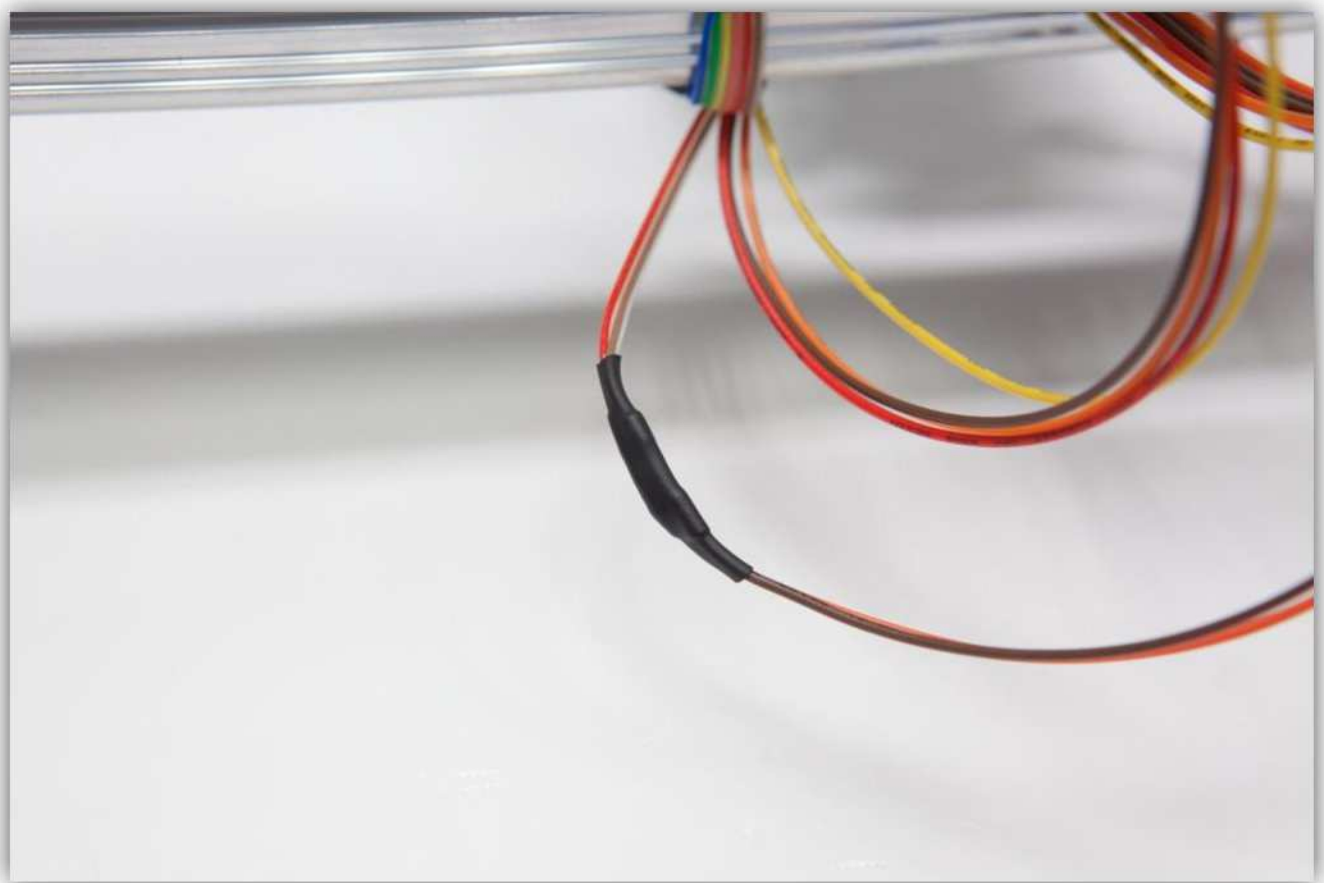
Flat cable	**->**	**Connector wires**
Red	**->**	**Red**
Brown	**->**	**Brown**



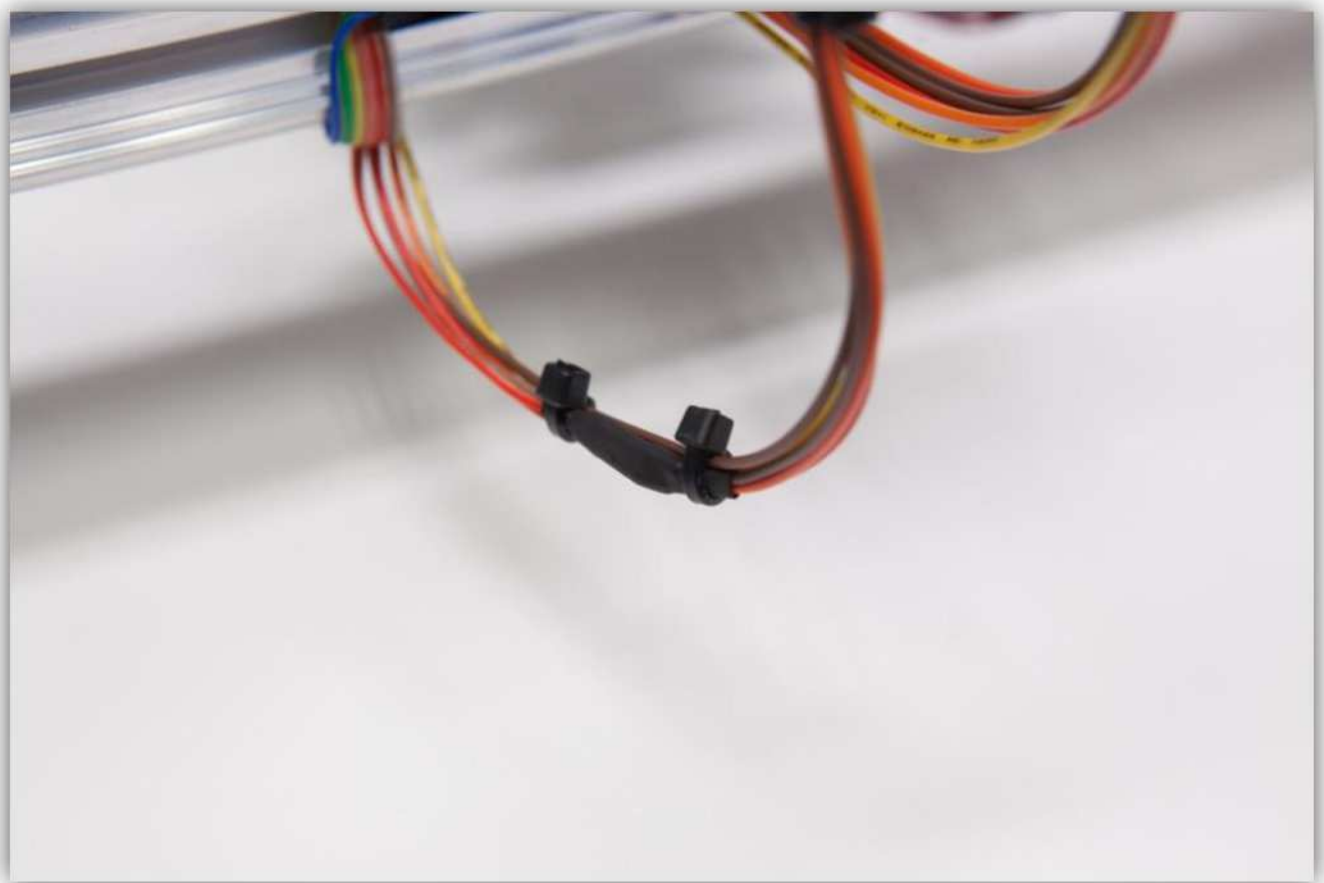
Slide the 2 small heat shrink tubes over the solder joints and heat them up.

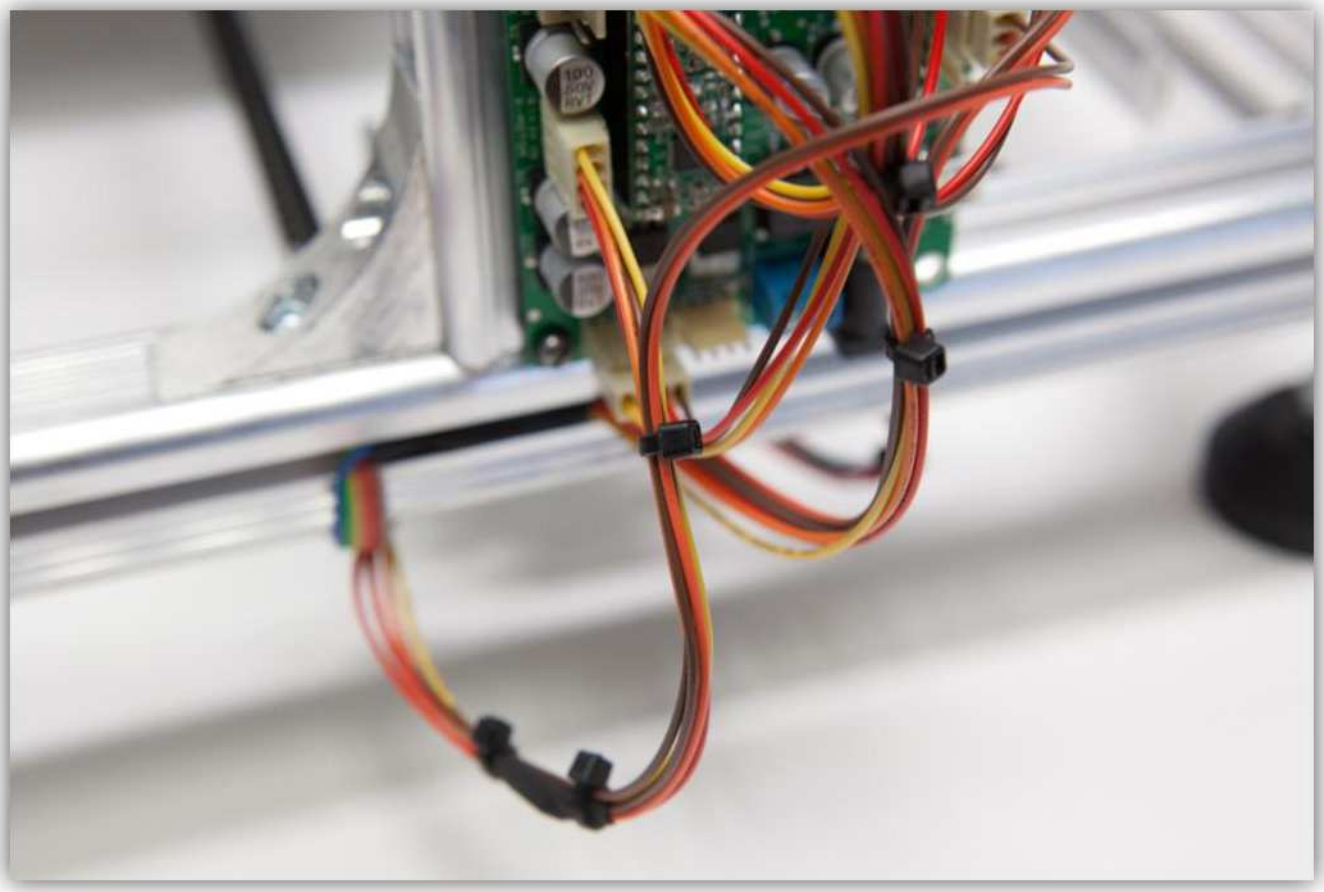


Now slide the medium size piece of heat shrink tubing over the 2 small pieces, heat the medium size piece so it covers and protects the 2 heat shrunk joints.



Use a few small tie-strips to hold the wires together.



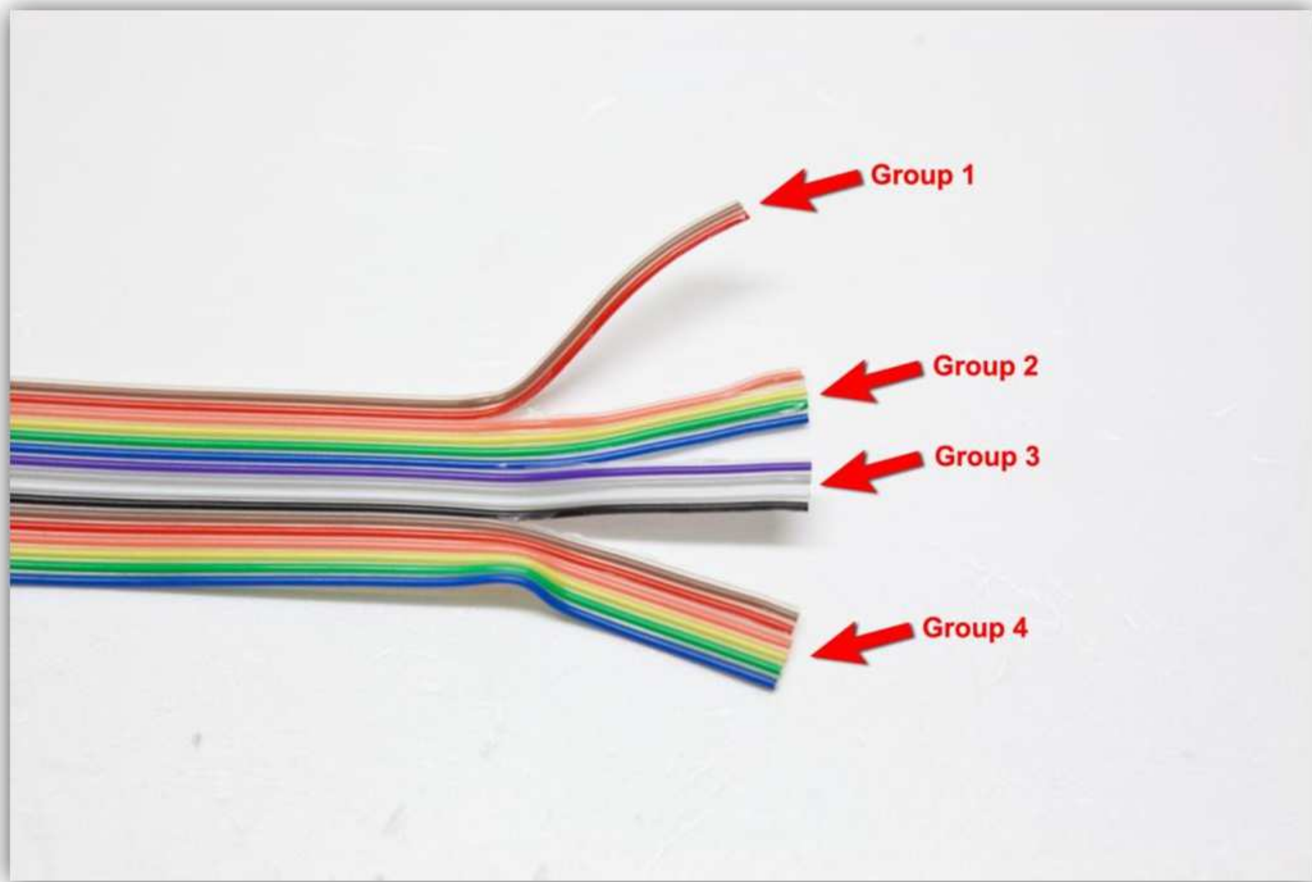


018 – WIRING THE Y AXIS MOTOR AND MICRO SWITCH

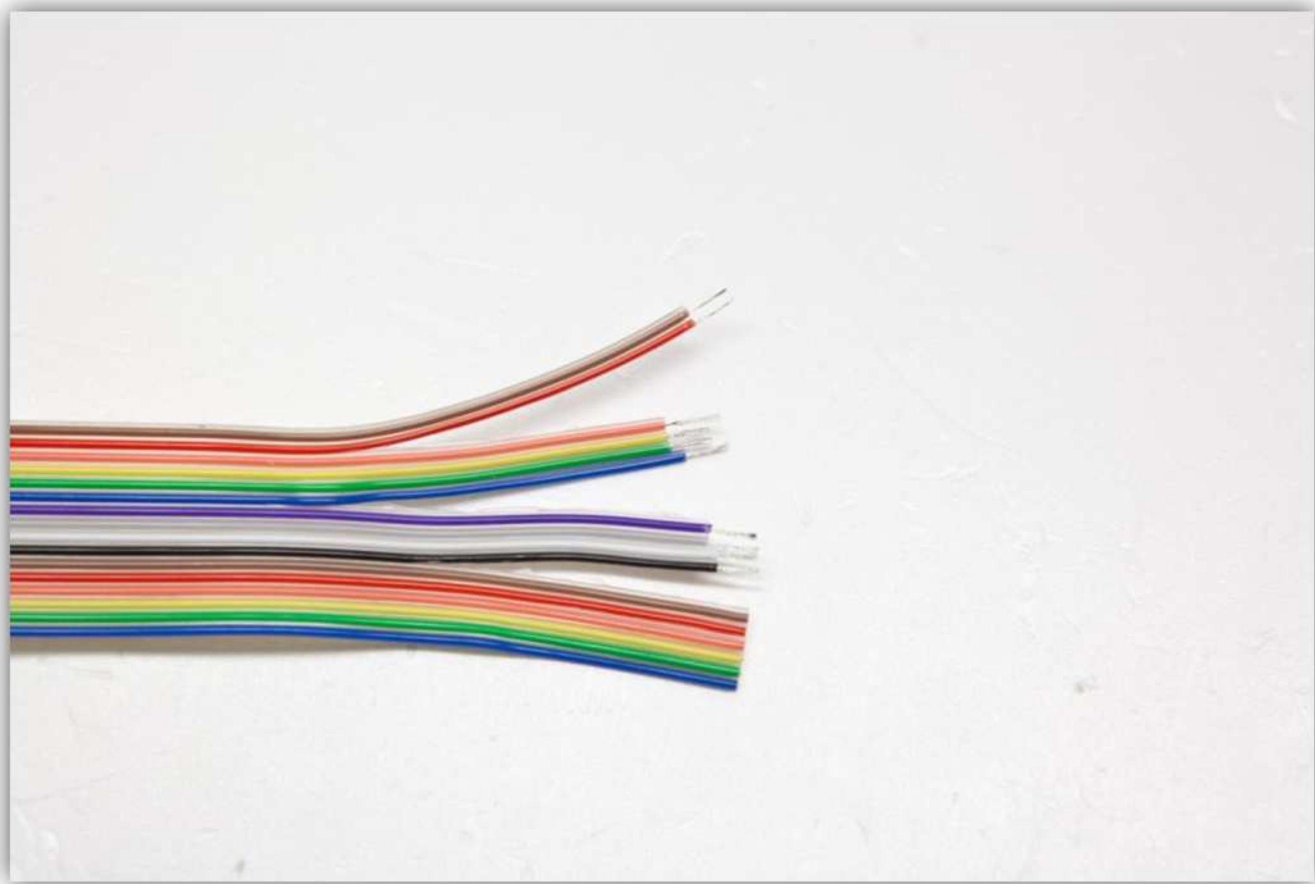
Take the rest of the flat cable, it should be 1 meter (39.4") long.

Detach the following groups for about 2 cm (0.79"):

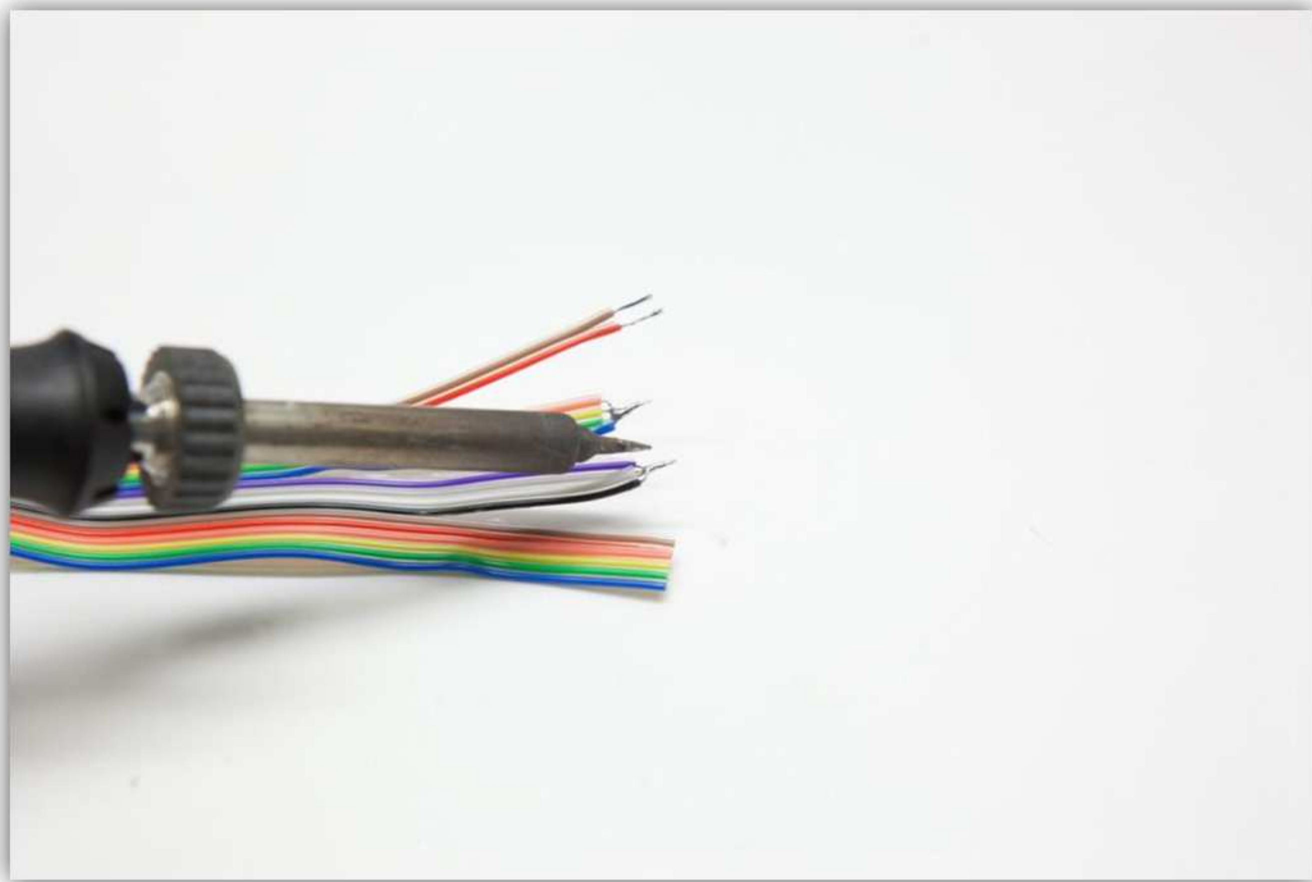
- Group 1: **Brown, Red**
- Group 2: **Orange, Yellow, Green, Blue**
- Group 3: **Violet, Grey, White, Black**
- Group 4: **Brown, Red, Orange, Yellow, Green, Blue**



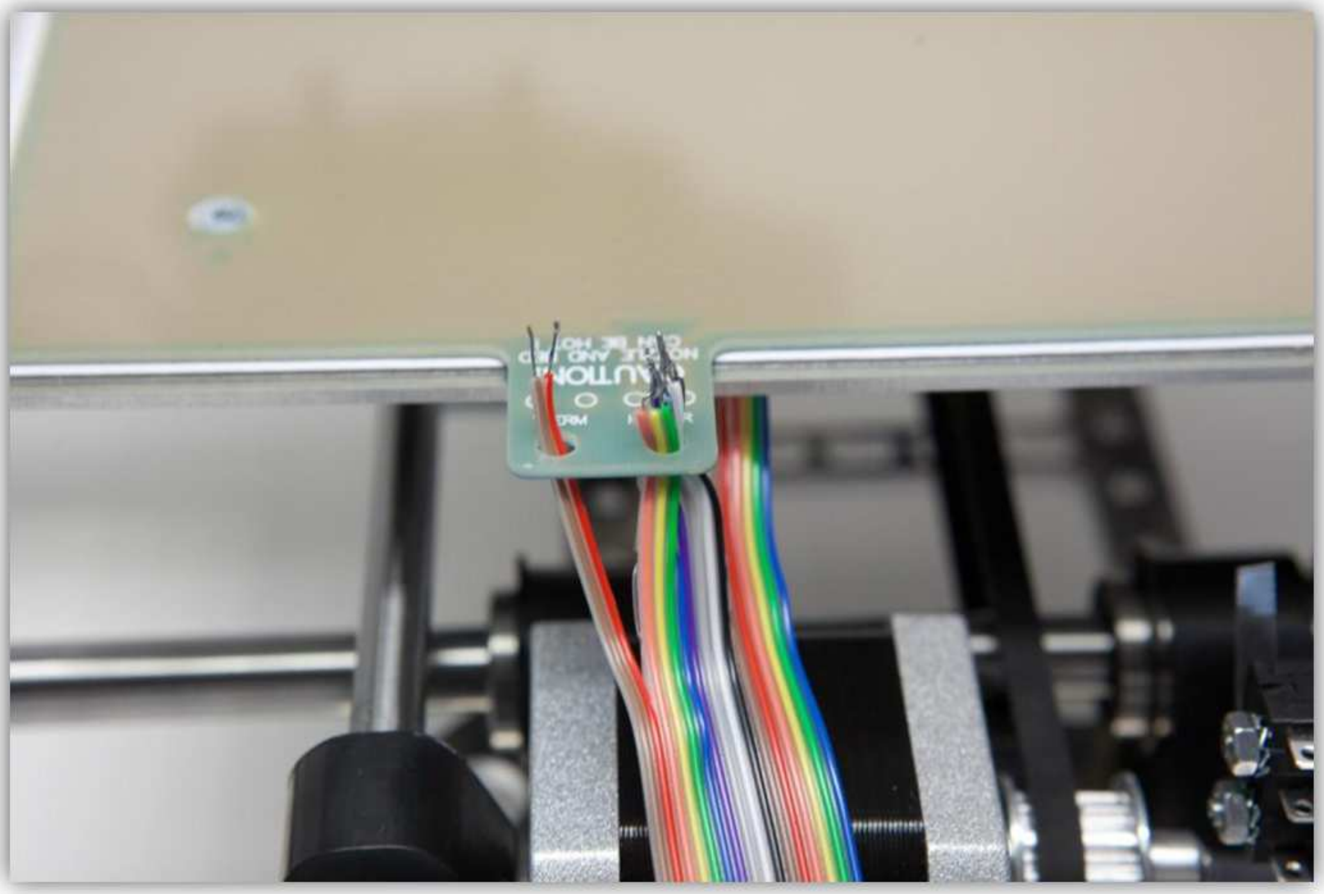
Strip and thin the first 3 groups. **Make sure you twist the wires from group 2 and 3 together.**



Twist the wires from group 2 and 3 together before soldering them together.

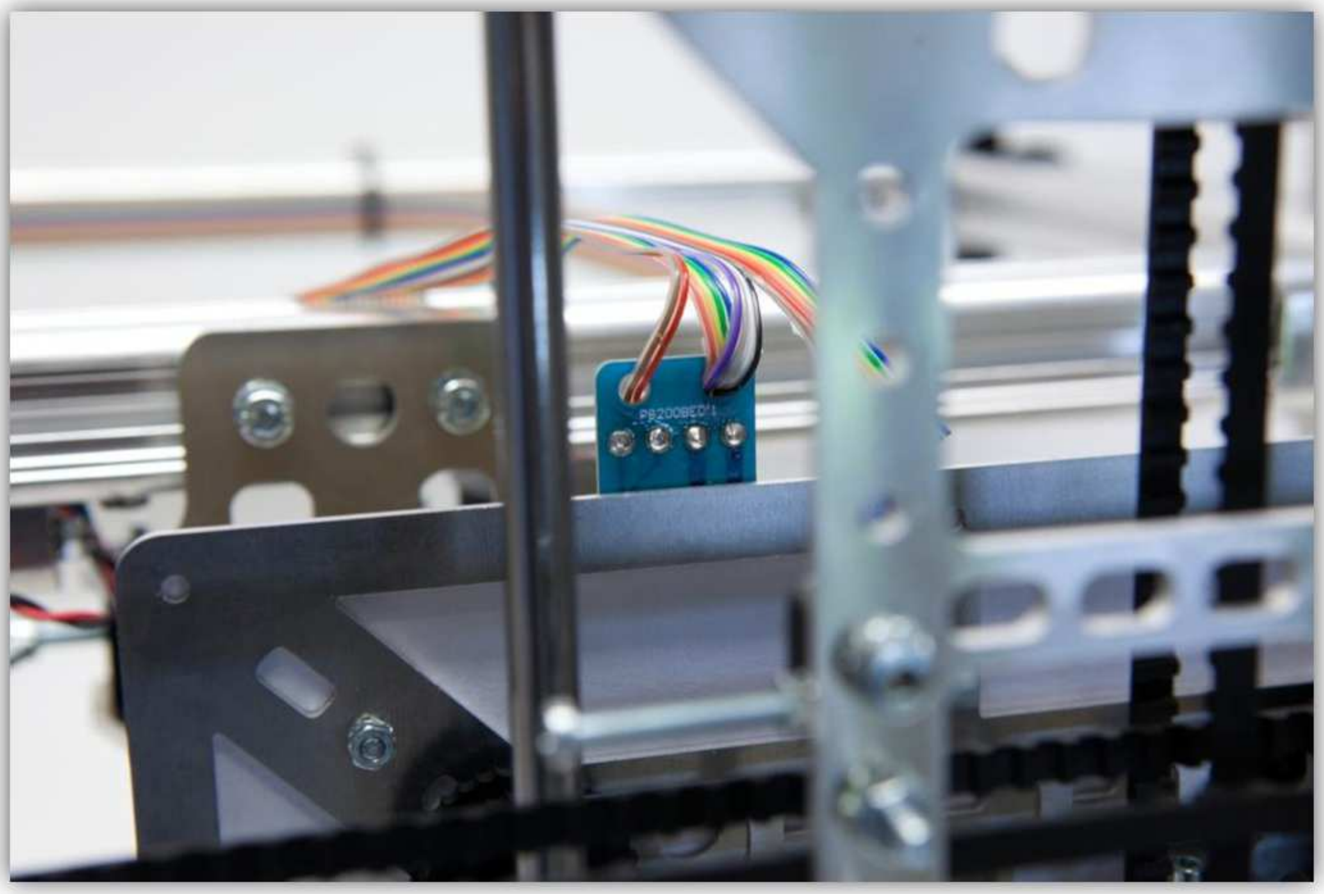


Guide the wires 1 cm through the holes of the heated bed. **Group 1** should go through the hole marked with THERM. **Group 2 and 3** should go through the hole marked with HEATER.

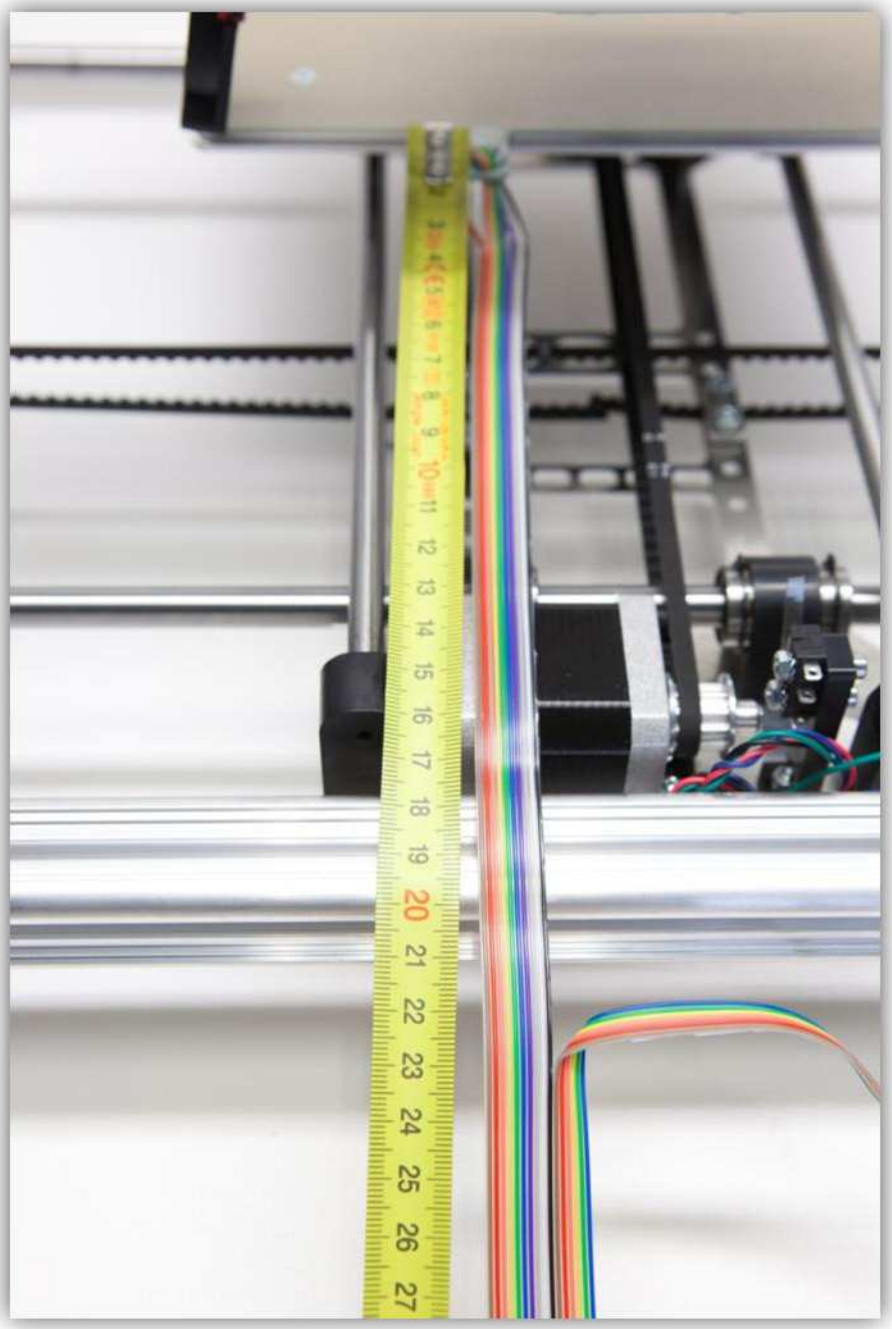


Now insert the tinned pieces of the wires into the small holes, the wires from **Group 1** go into the holes that correspond with THERM (not polarized) and the wires from **Group 2 and 3** go into the holes that correspond with HEATER (not polarized).

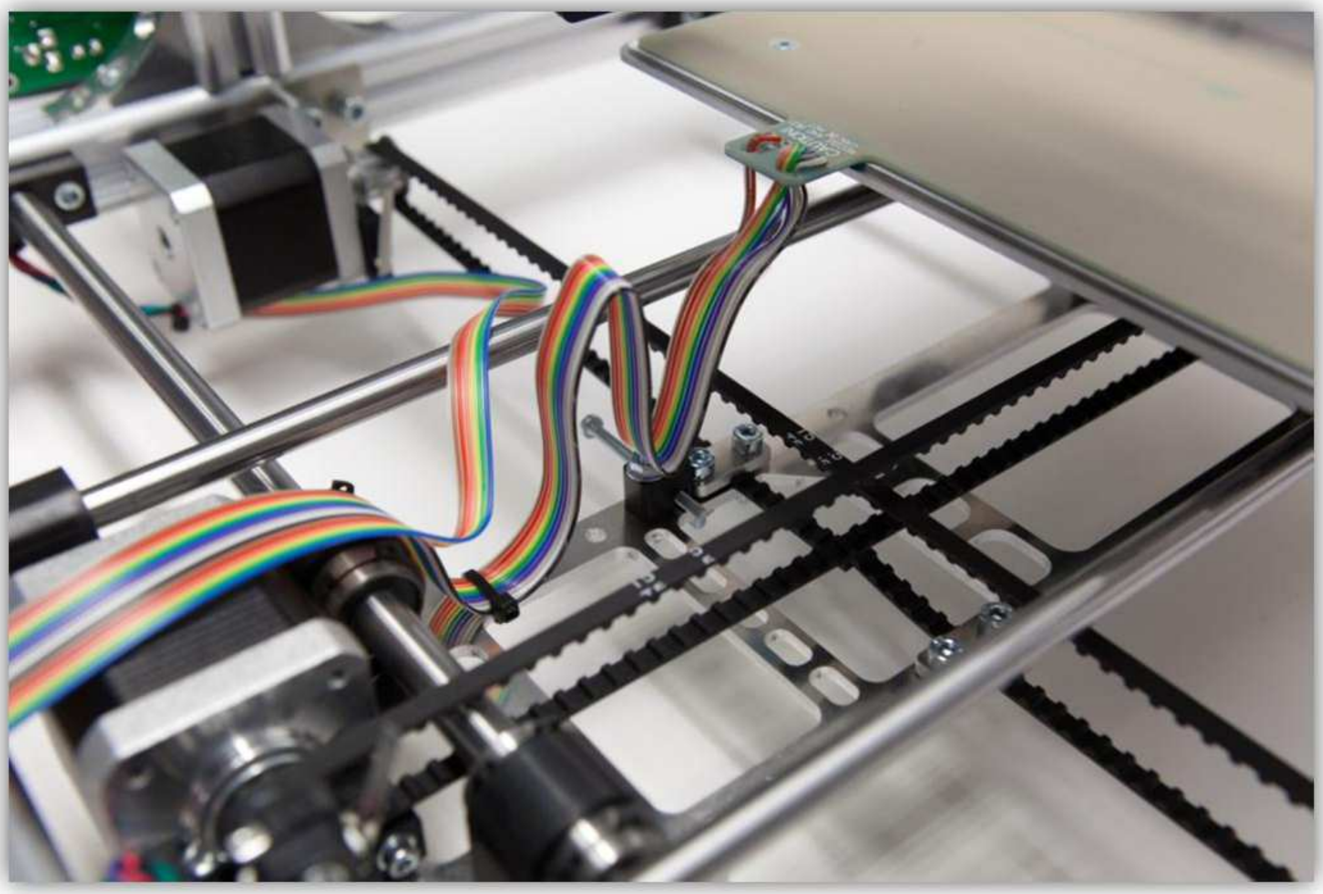
Solder the end of the wires to the bottom of the board. **Take extra care when soldering these points to not damage a part of the printer with the hot soldering iron.**



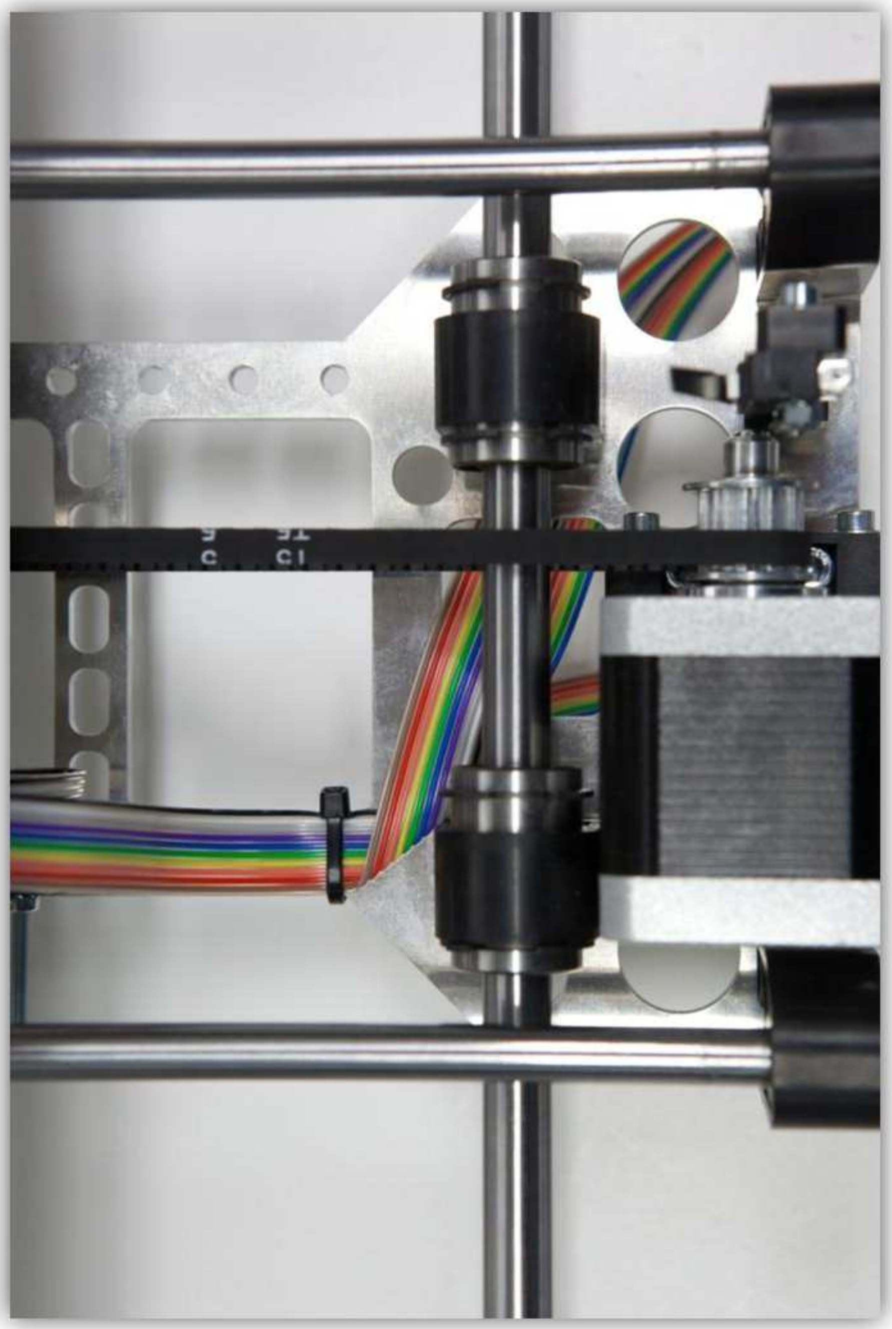
Detach **Group 4** 23 cm (9.06") from the wires that are now connected to the HEATED BED PCB.



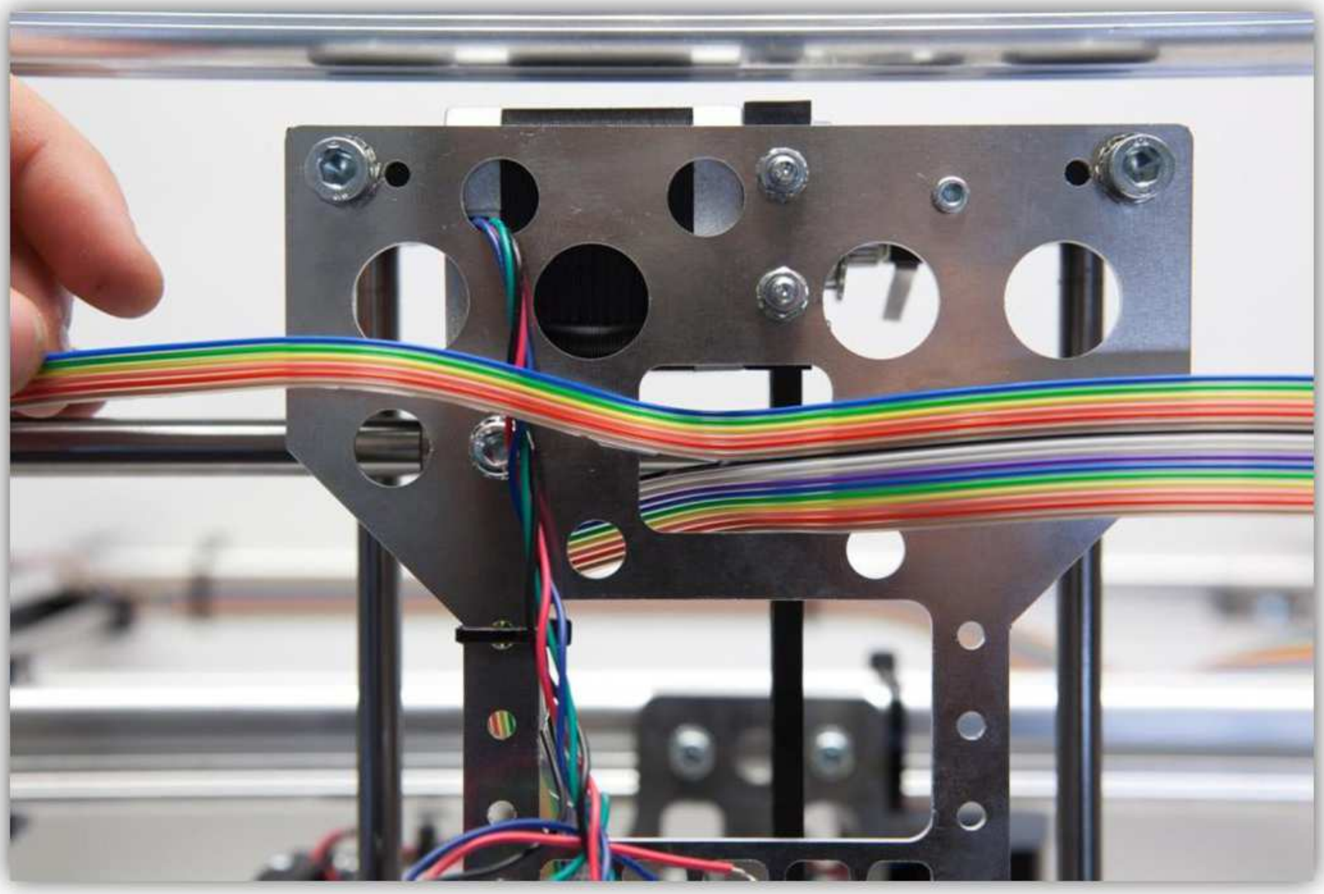
Use a small tie-strip to fasten the wires of **Group 1, 2** and **3.** Make sure the bed can move to its full extent without the wire catching or stretching. It’s good practice to give it some bends as shown in the picture so that it folds nicely when the bed is moving.



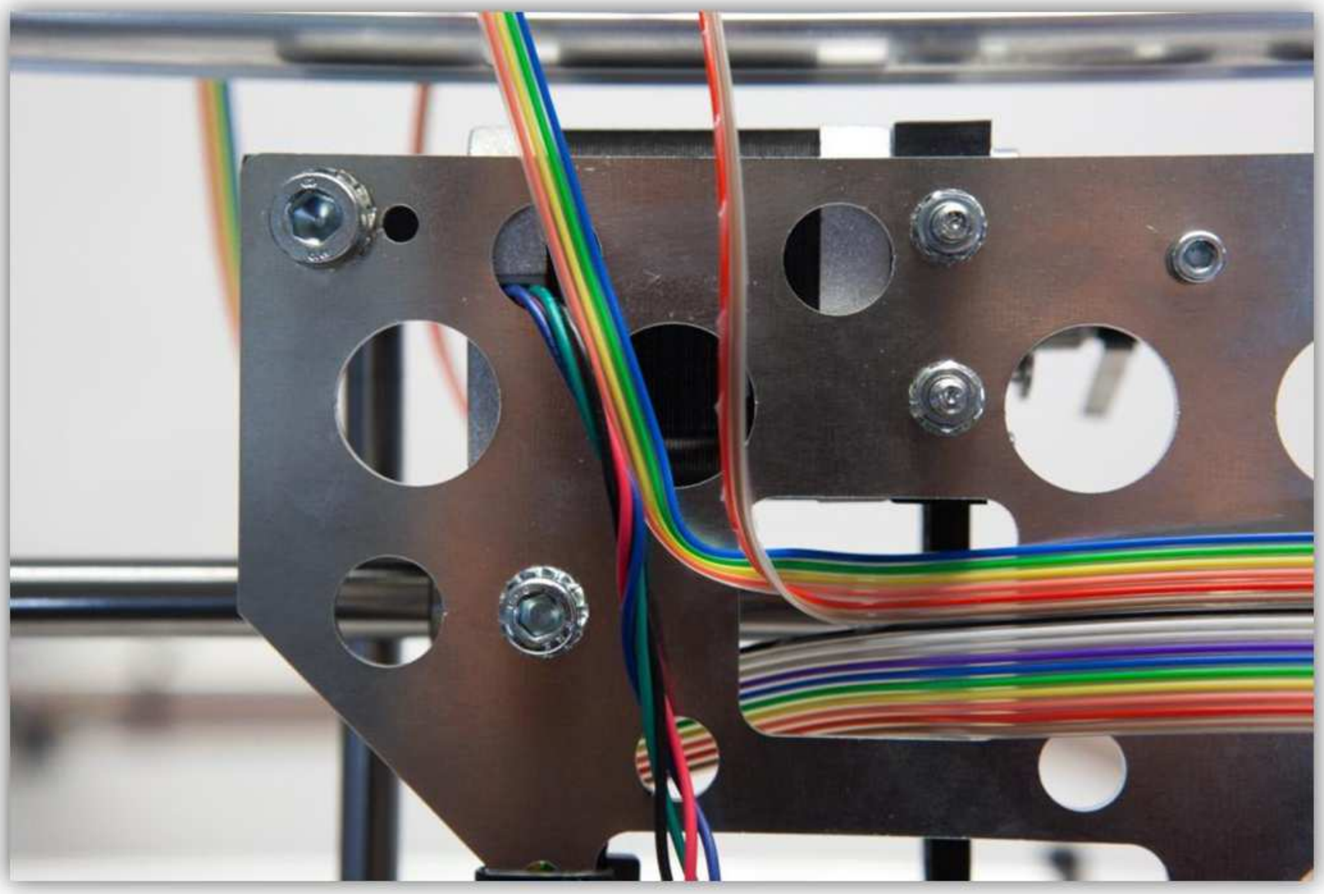
Fold the cable as shown in the picture below. Thread the cable through the hole.



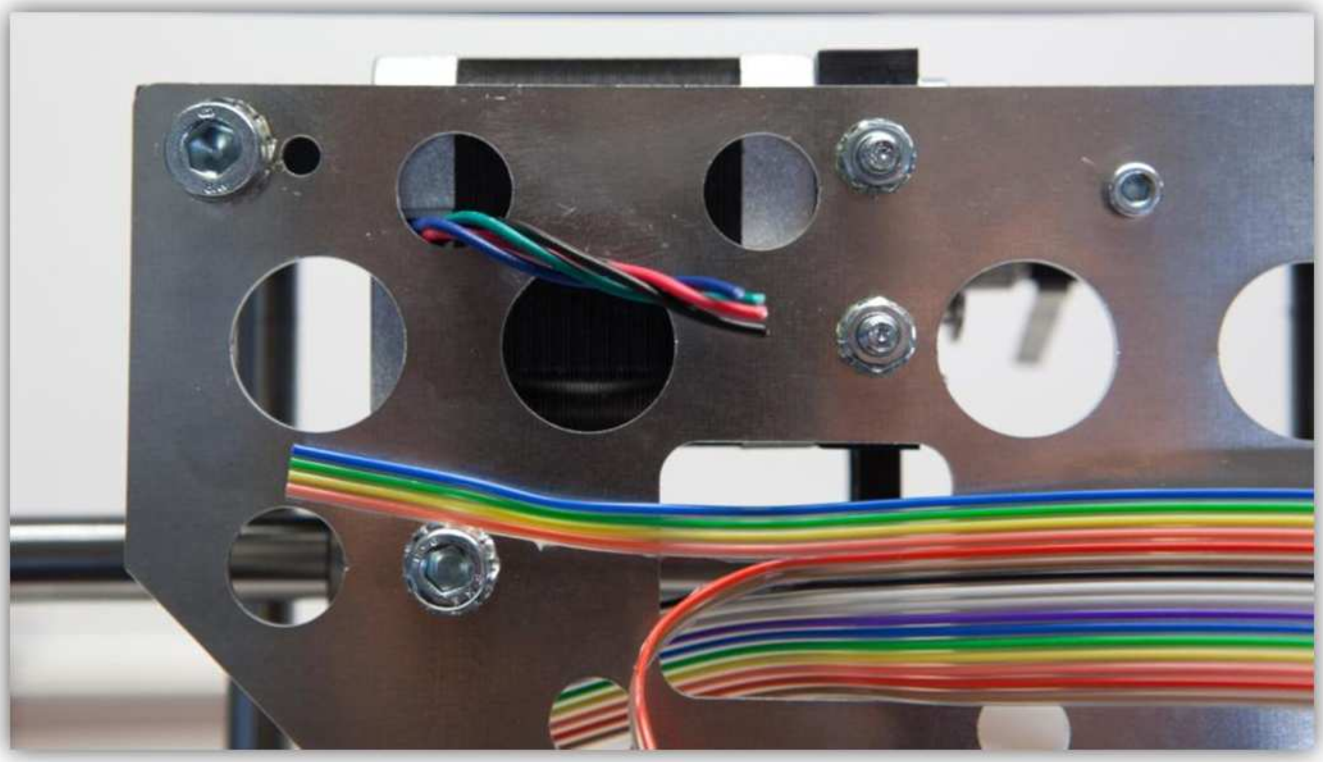
Notice where the cable splits.



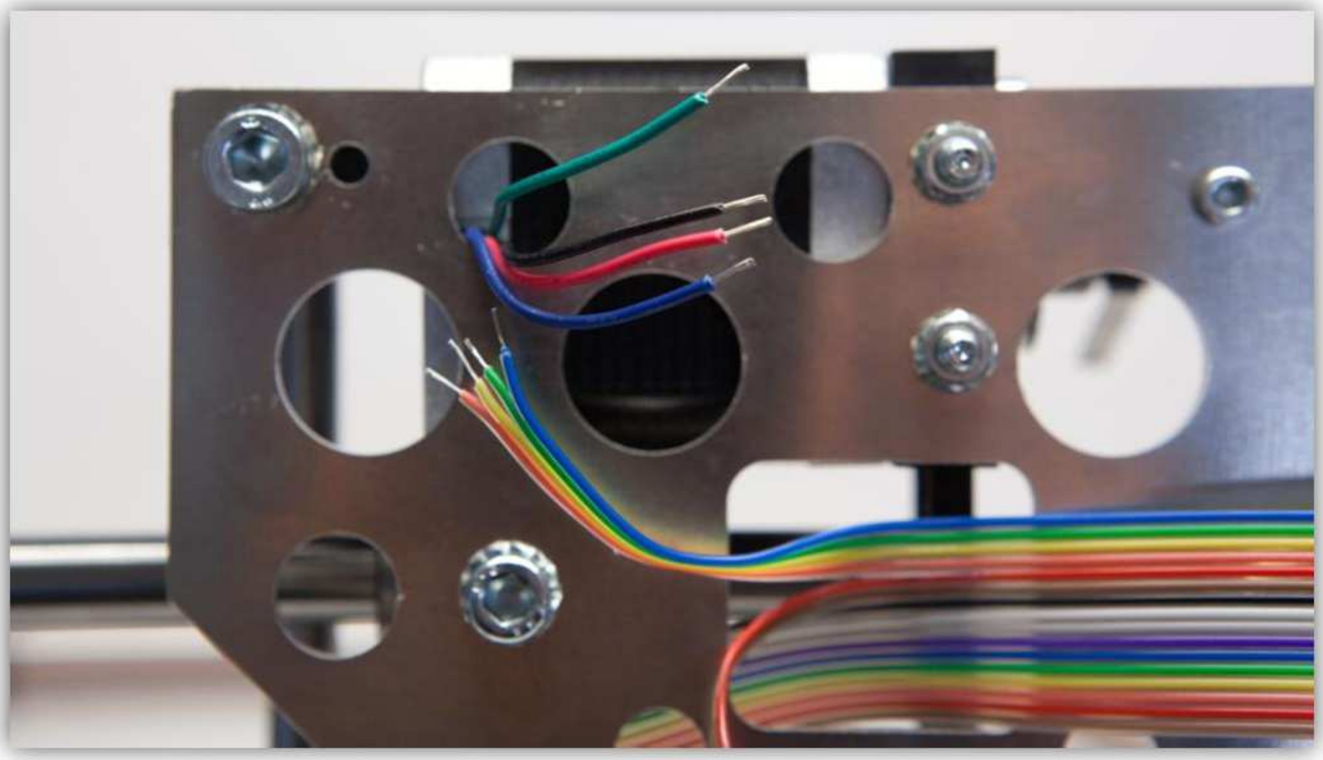
Split the wires as shown in the picture. You should have a group with the following wires: **Blue, Green, Yellow, Orange** and a group with the following: **Red, Brown.**

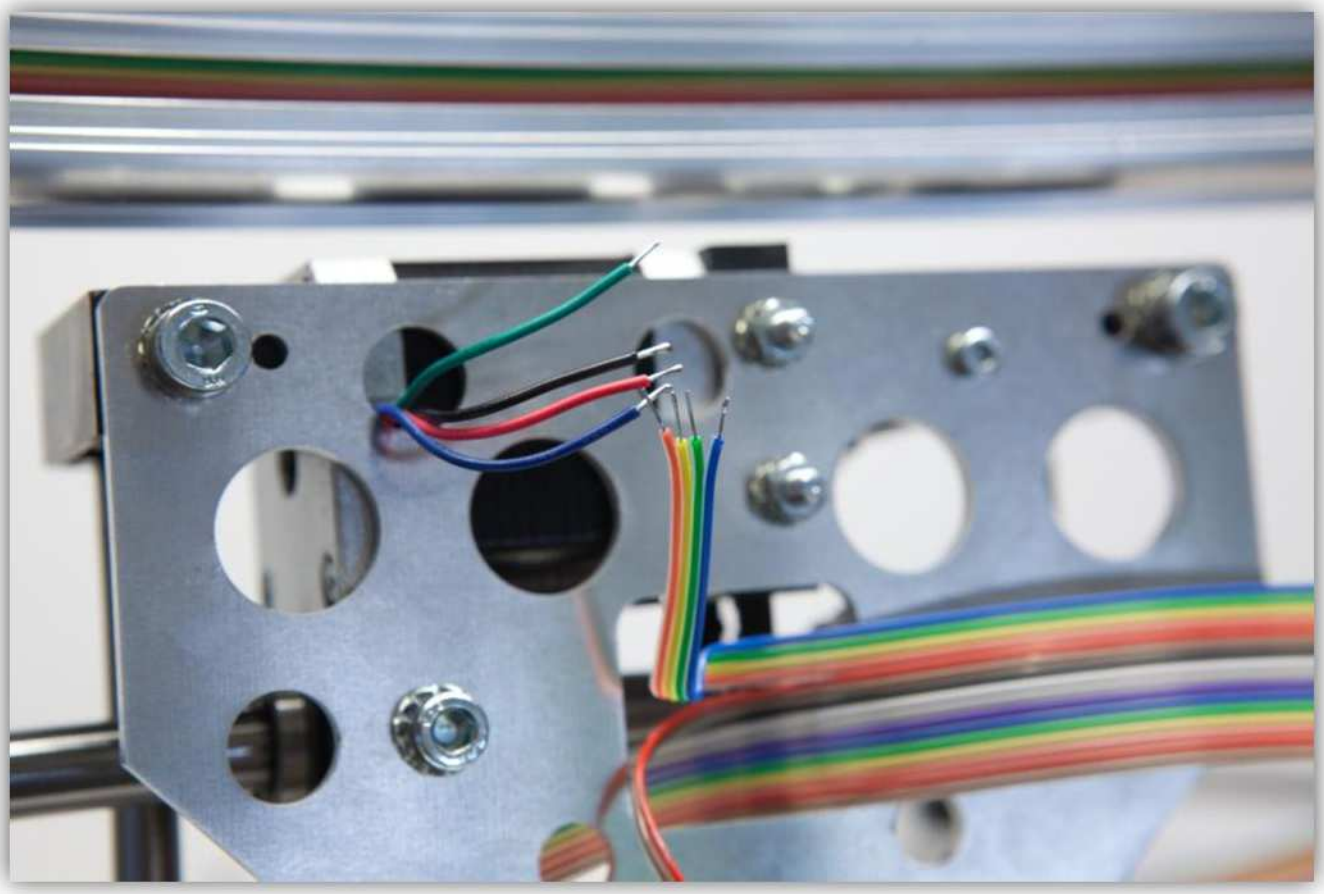


Cut the group with the following wires **Blue, Green, Yellow, Orange** and the wires of the motors so they can connect. Look at the picture below for guidance.

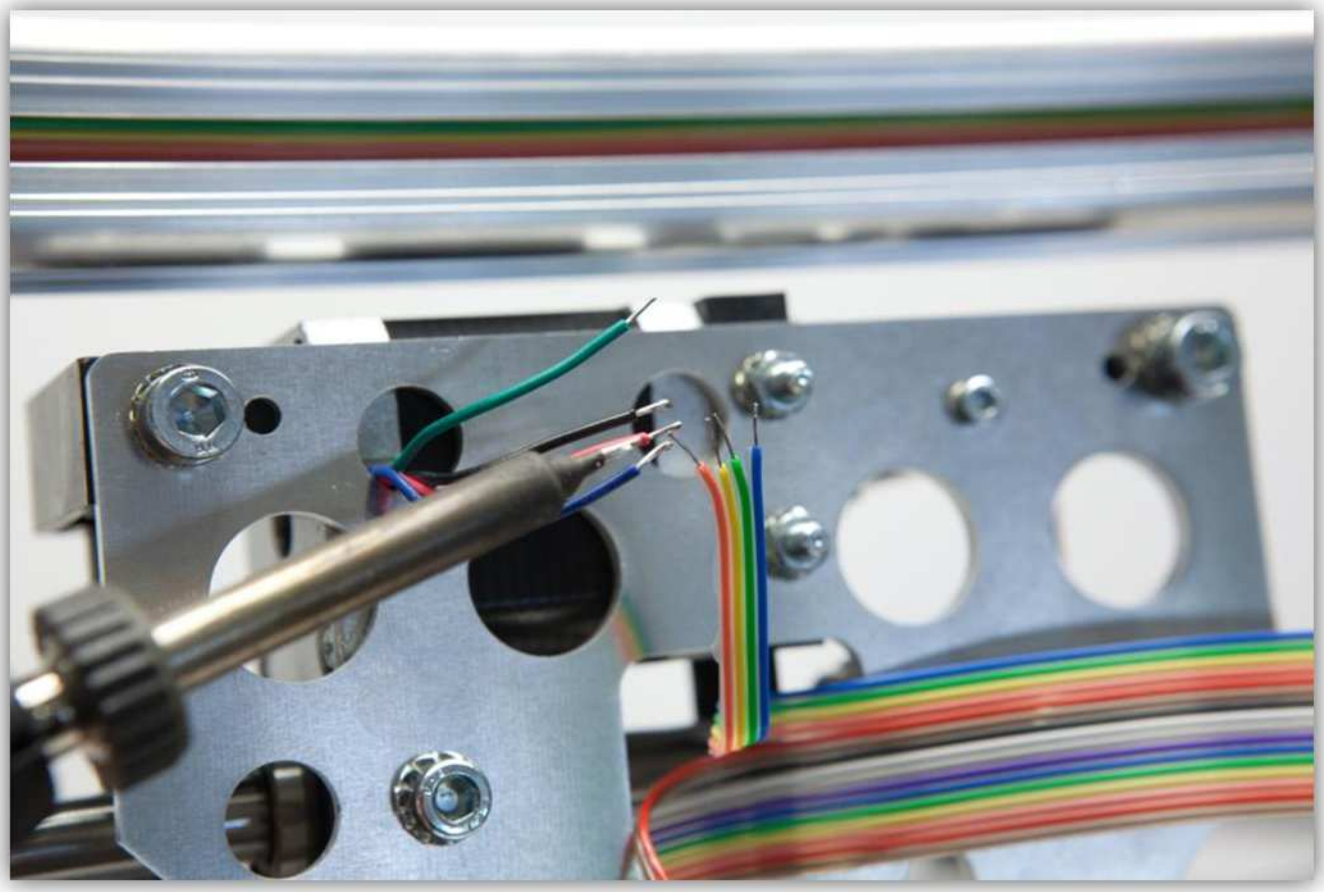


Strip 5 mm (0.2") the wires as shown in the pictures below.



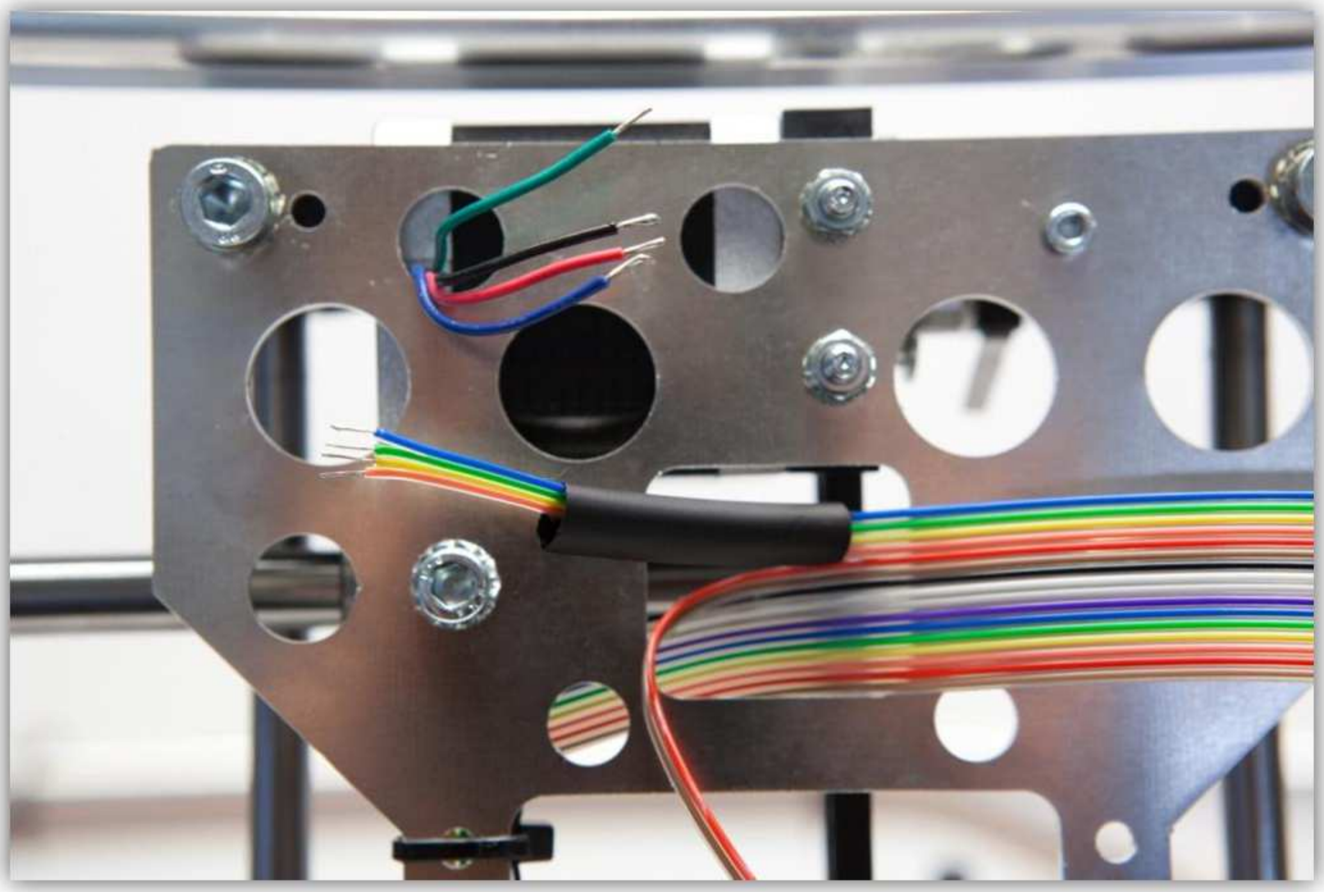


Tin the wires.

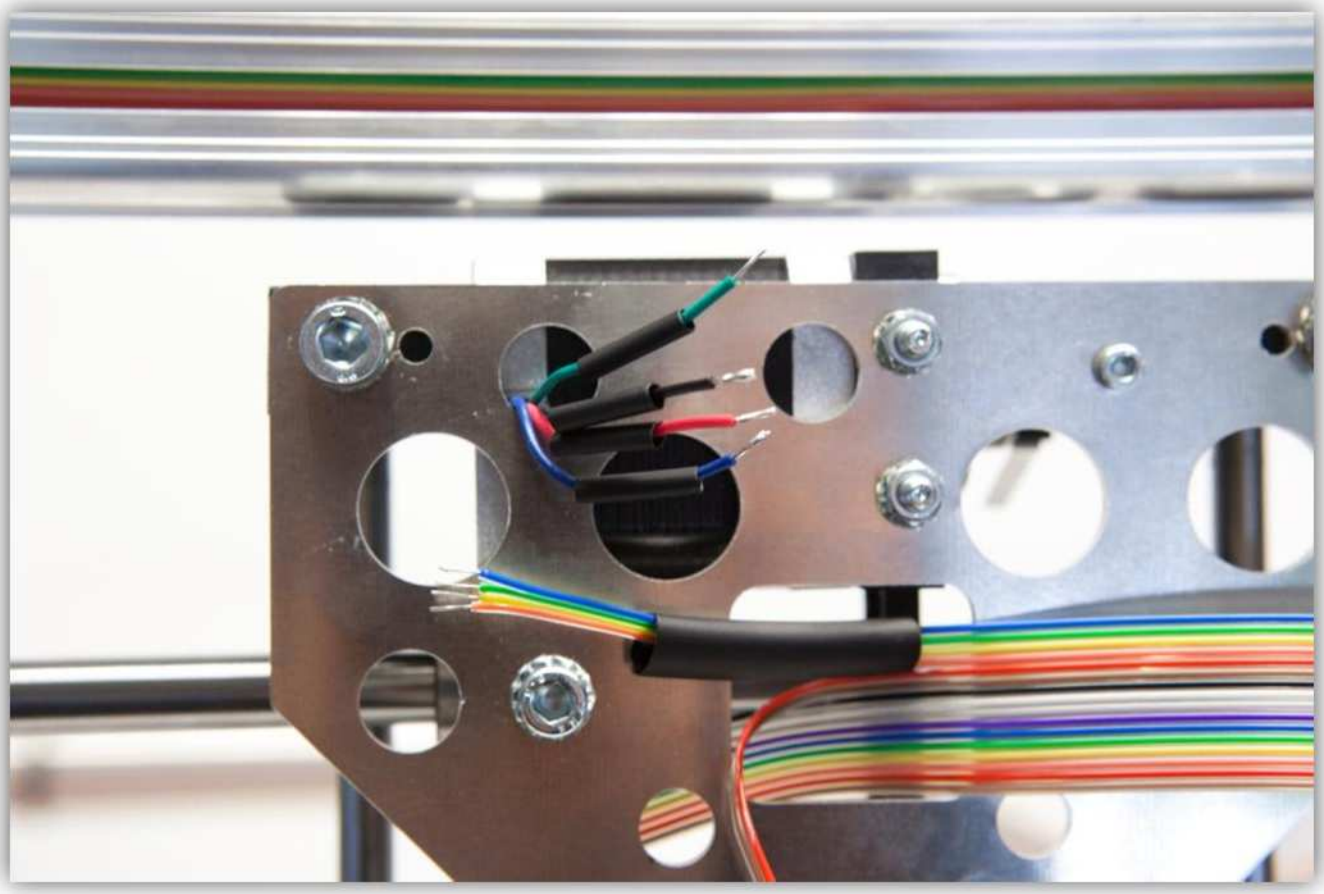


Cut 4 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the biggest piece of heat shrink tubing over the 4 wires from the flat cable.



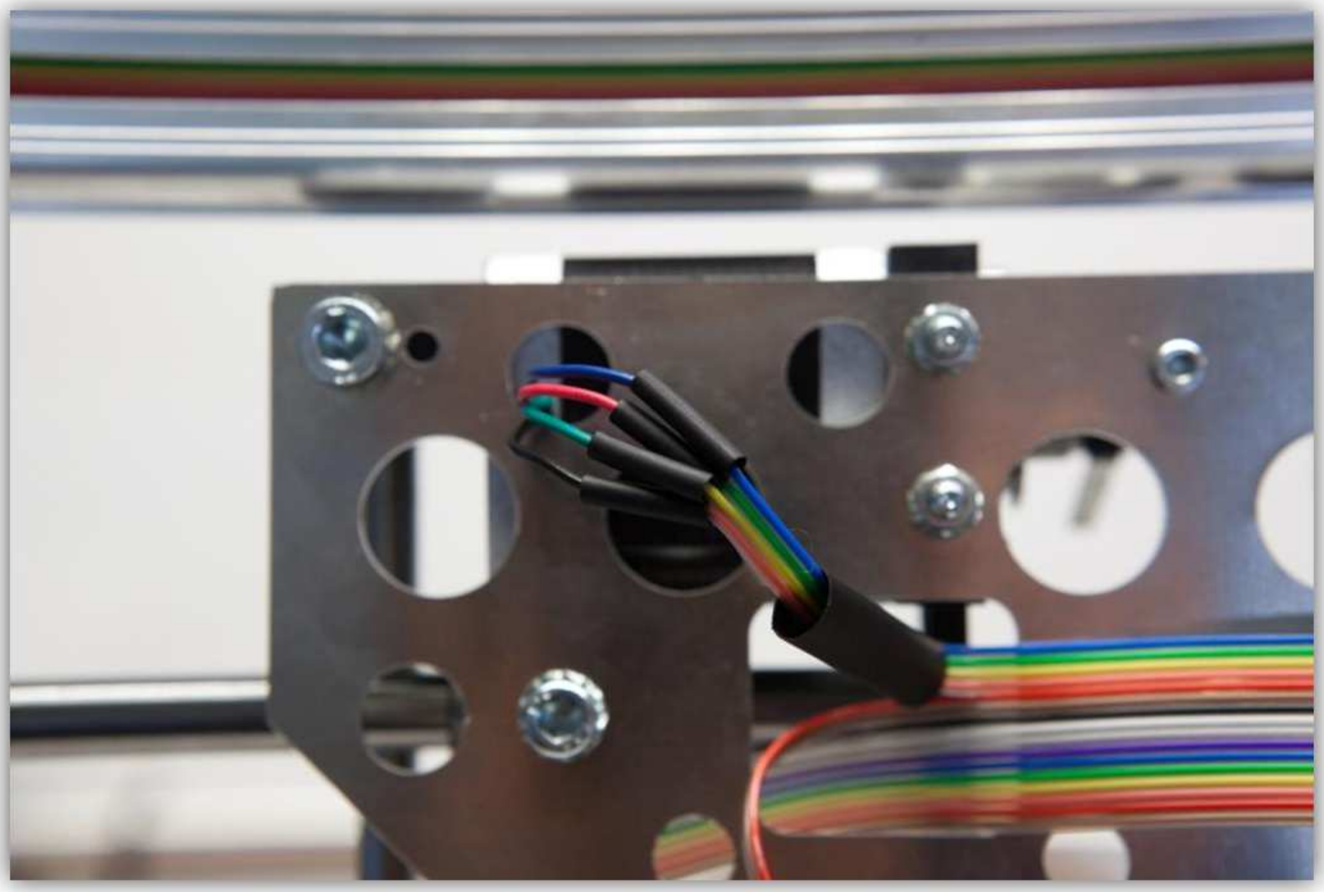
Slide the 4 small pieces of heat shrink tubing over the 4 wires of the motor.

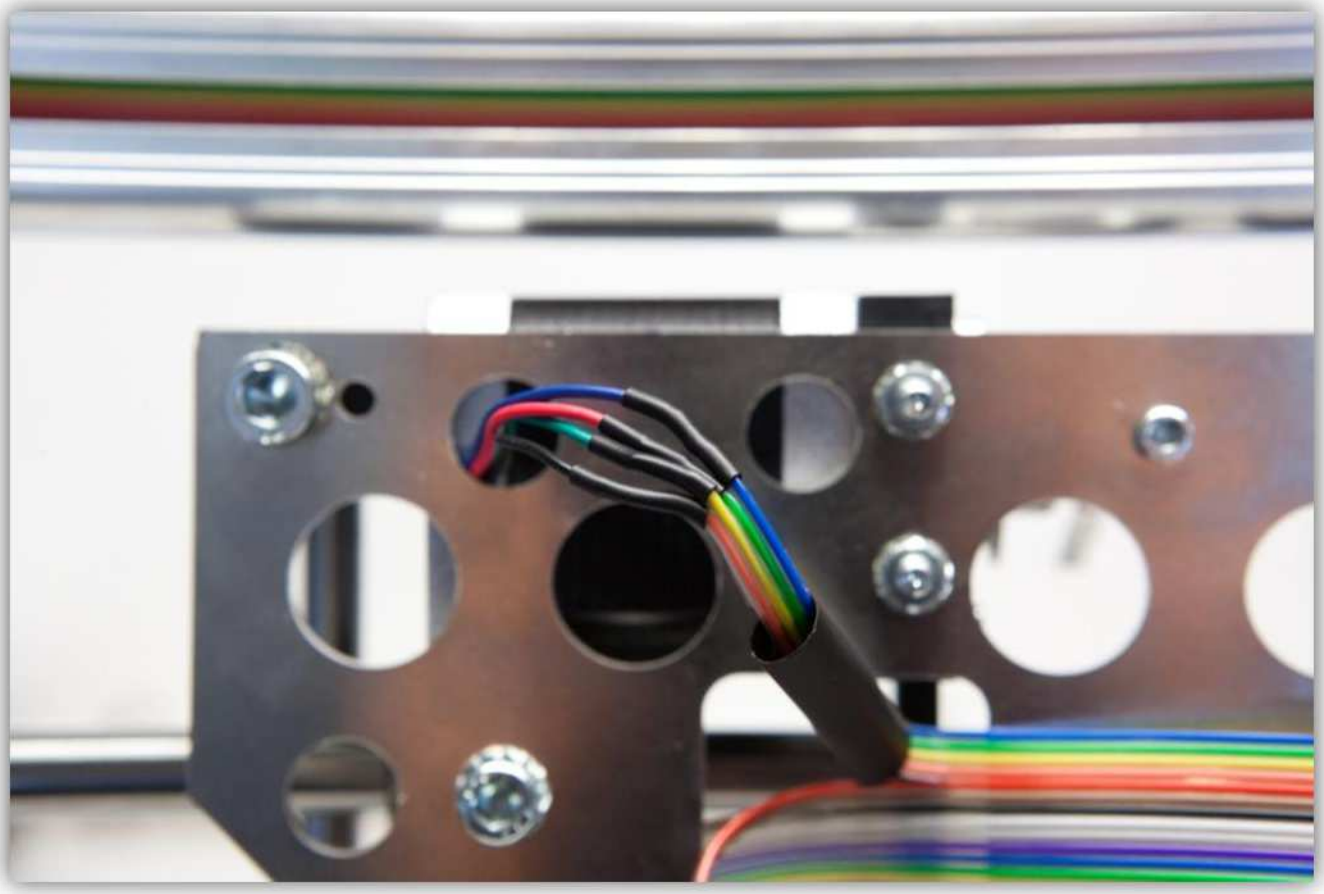


Solder the 4 wires from the motor to the 4 wires of the flat cable. **Watch the colours closely.**

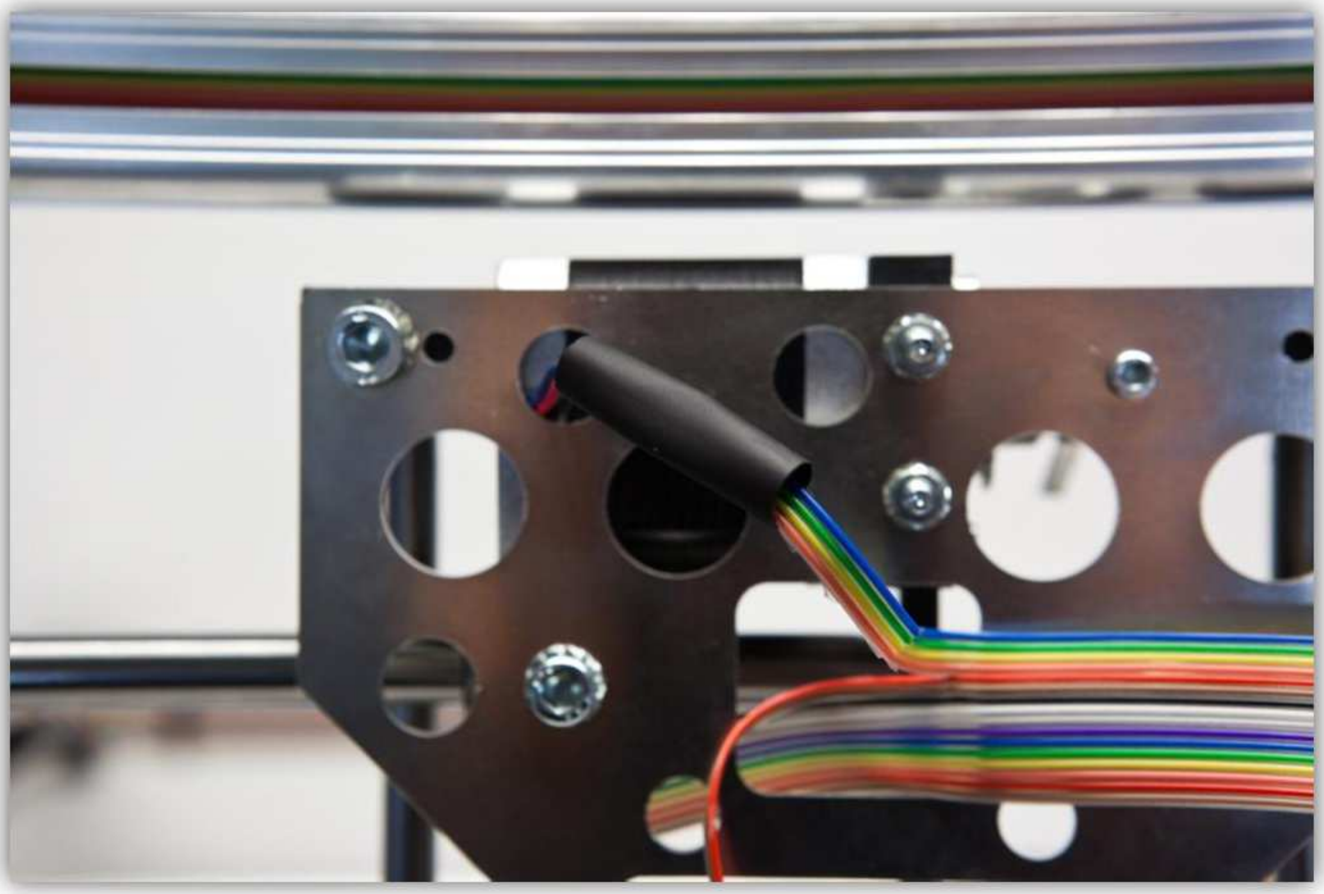
Flat cable	->	Motor wires
Blue	->	Blue
Green	->	Red
Yellow	->	Green
Orange	->	Black

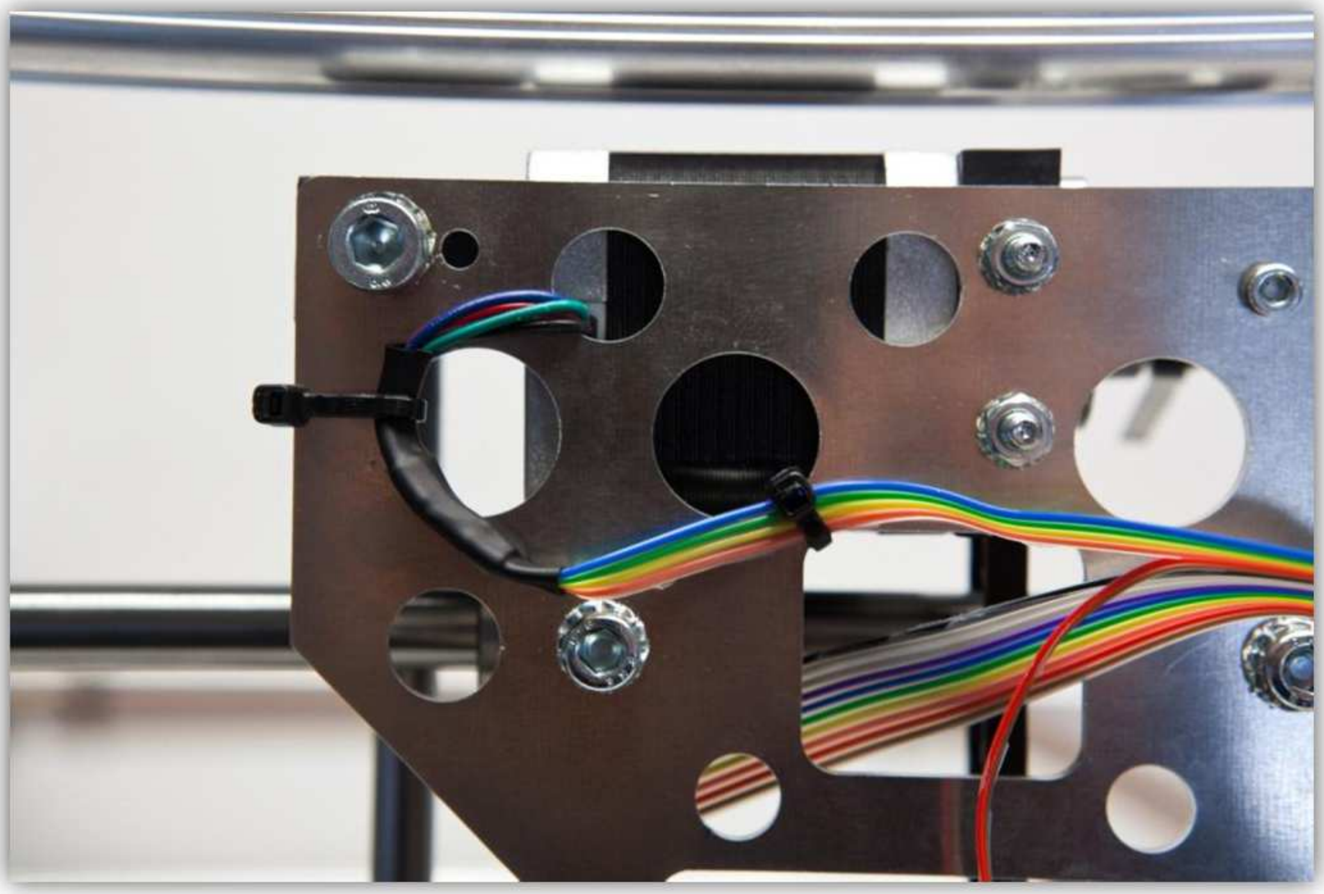
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.



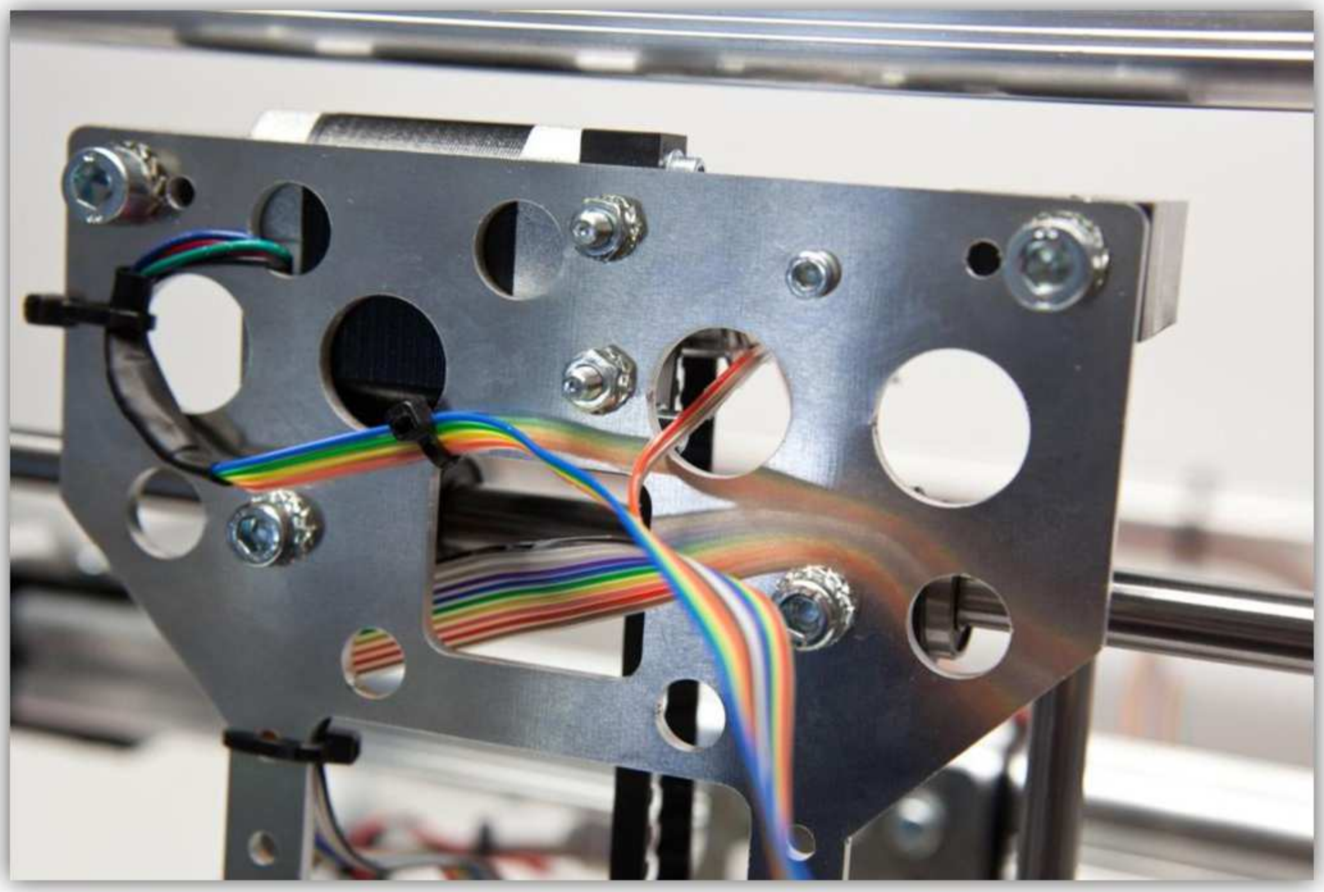


Now slide the big piece of heat shrink tubing over the 4 small pieces, heat the big piece so it covers and protects the 4 heat shrunk joints. Then use a small tie-strip to keep the wires in place as shown in the picture.

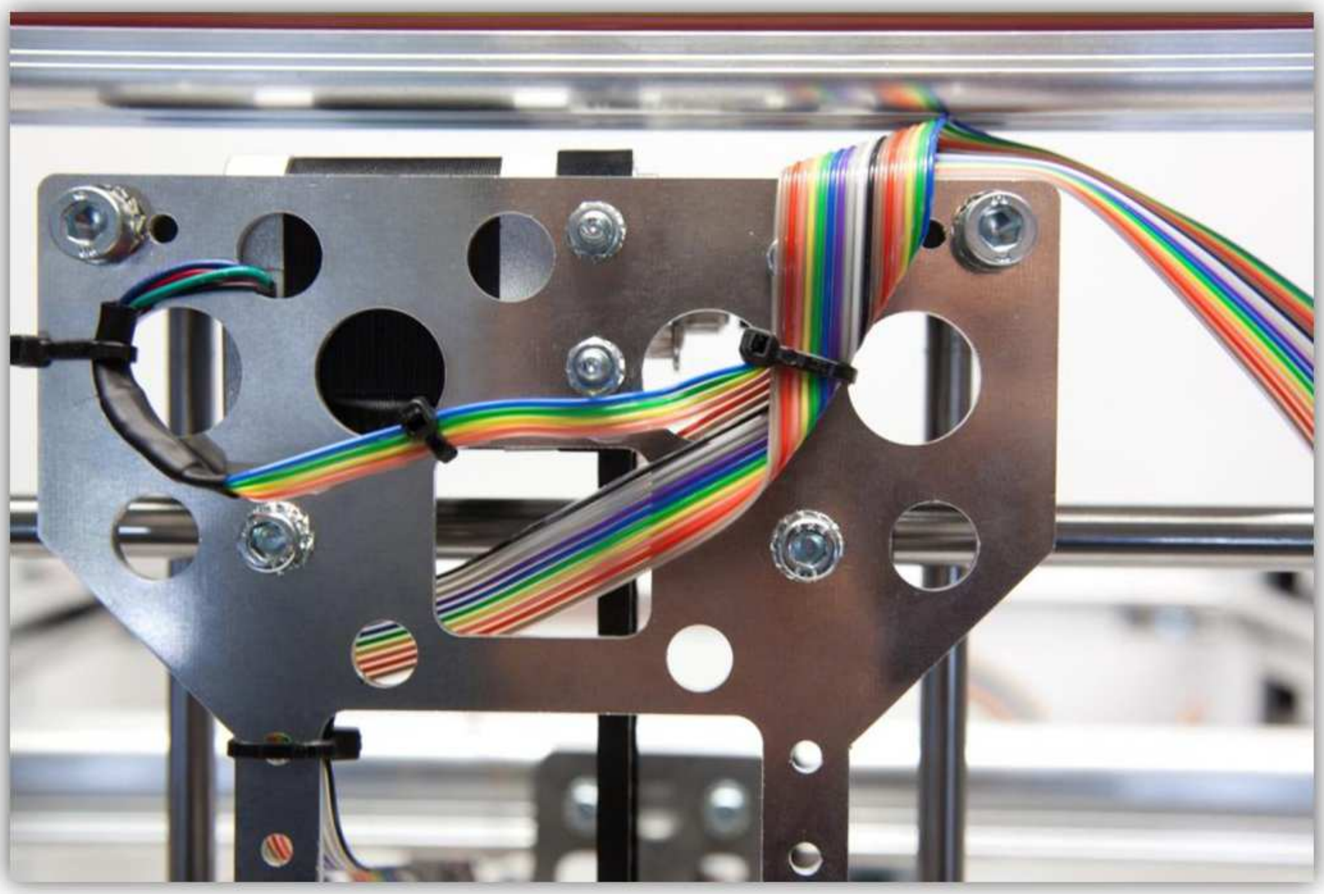




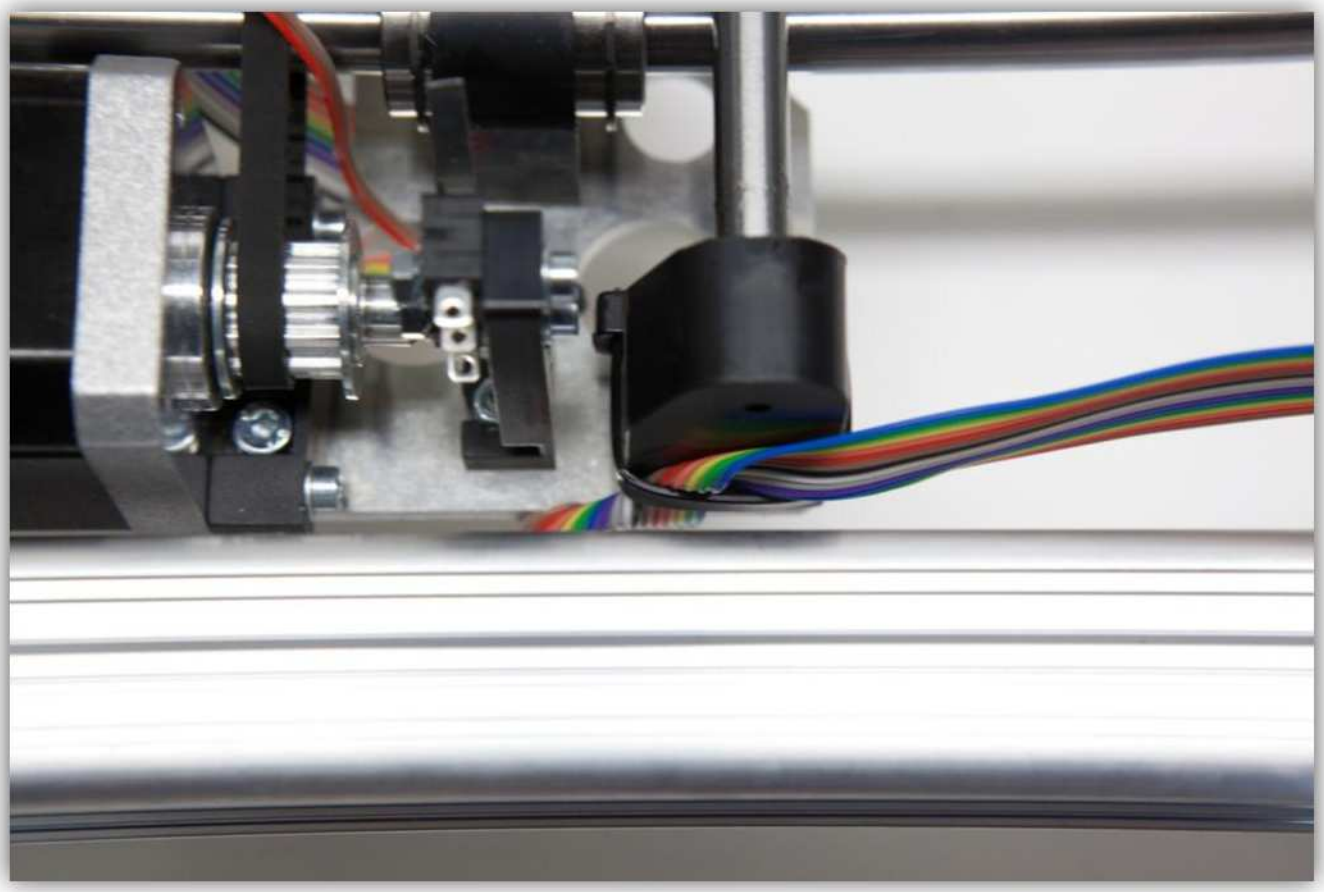
Slide the **Red** and **Brown** wire through the hole as shown in the picture below.

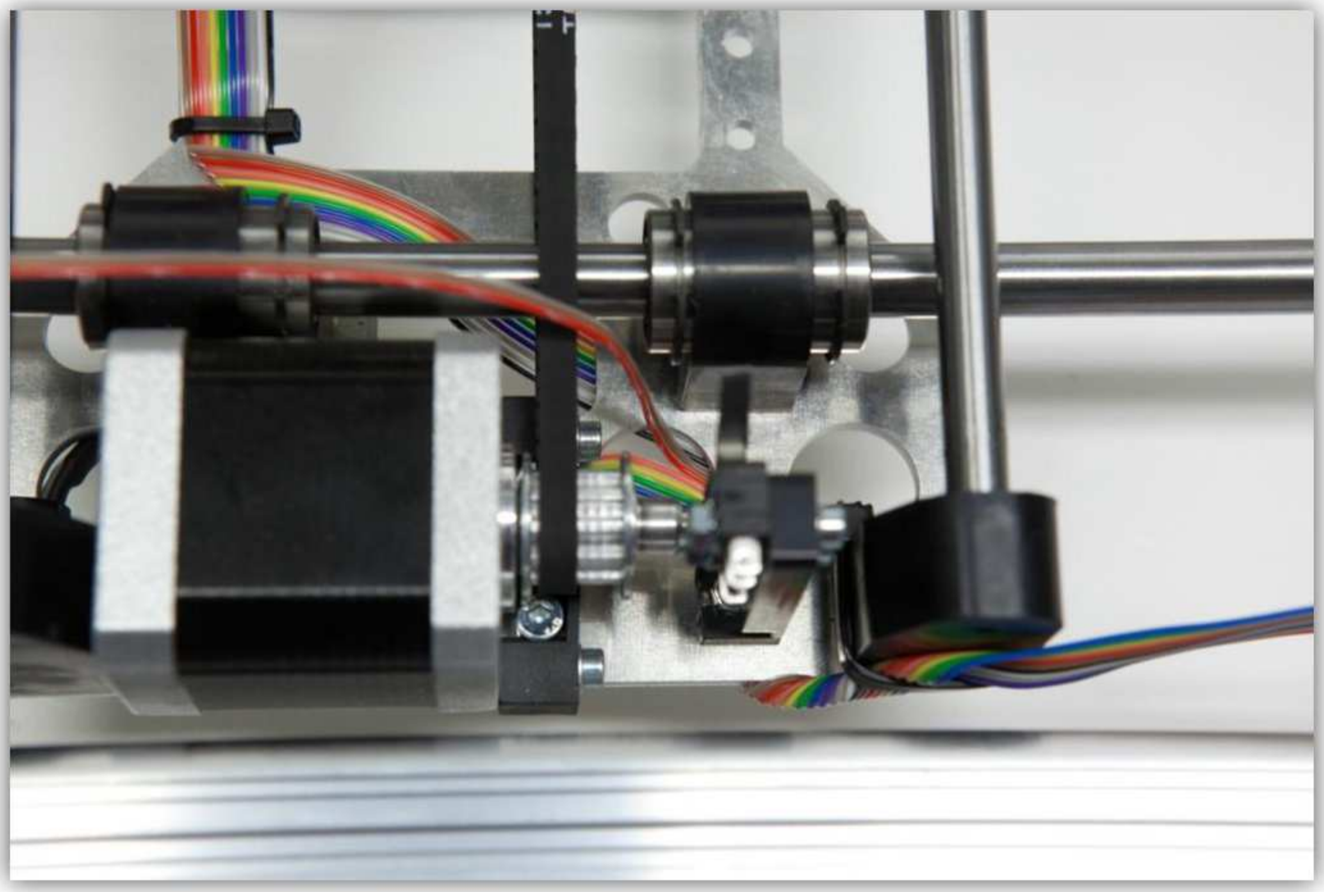


Fold the cable as shown in the pictures below and secure it with small tie-strips.

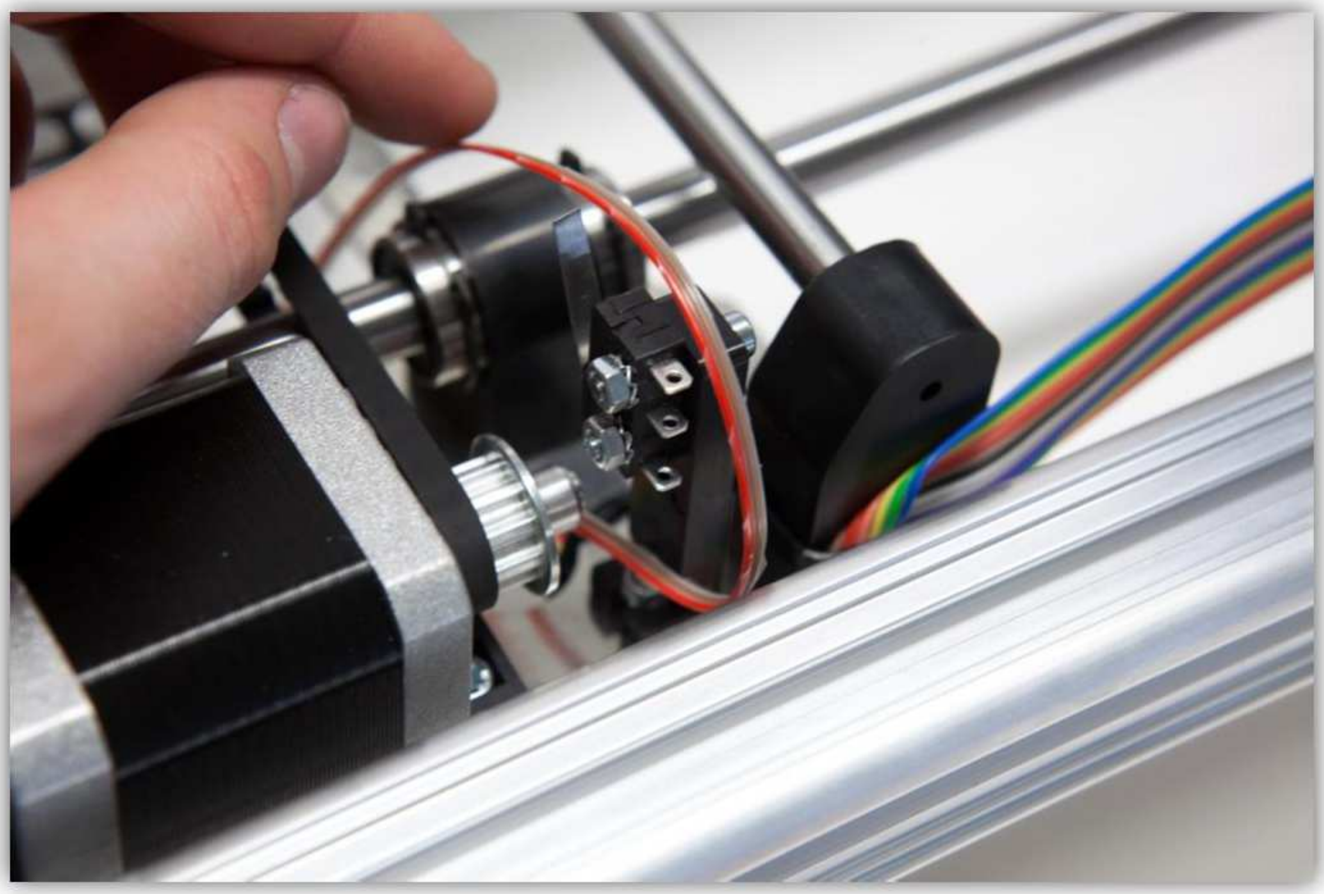


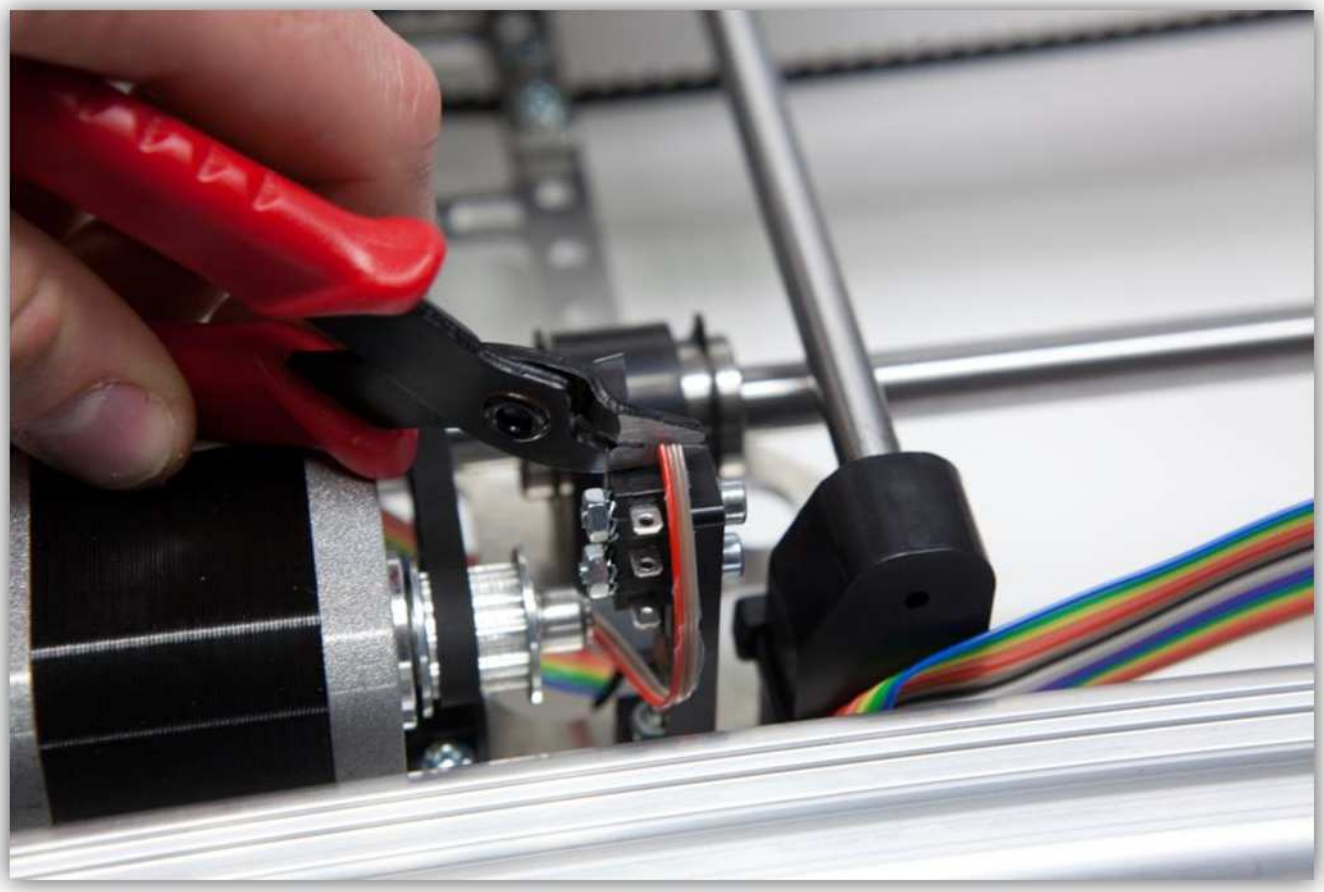
Secure the cable firmly so it is parallel to the frame.



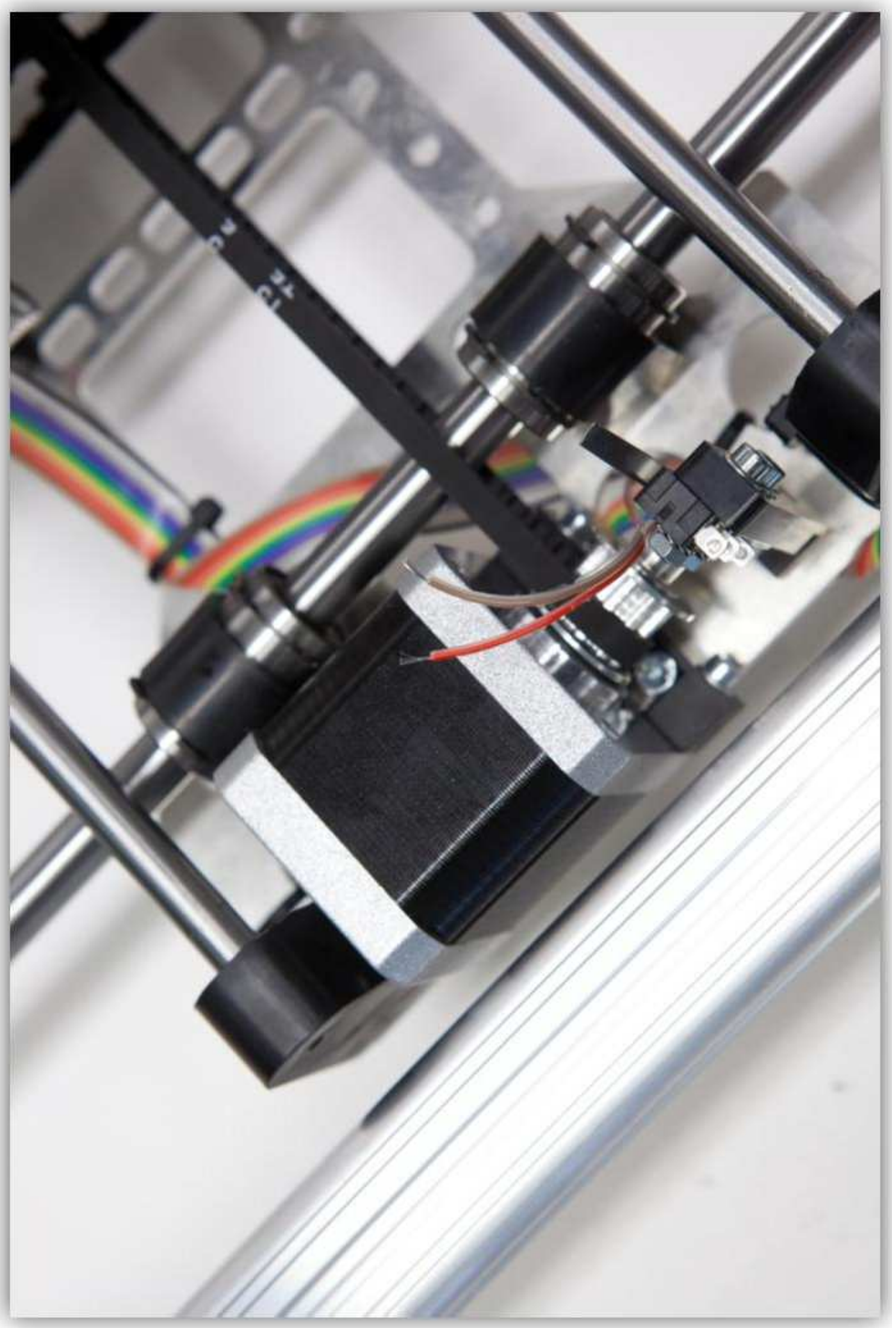


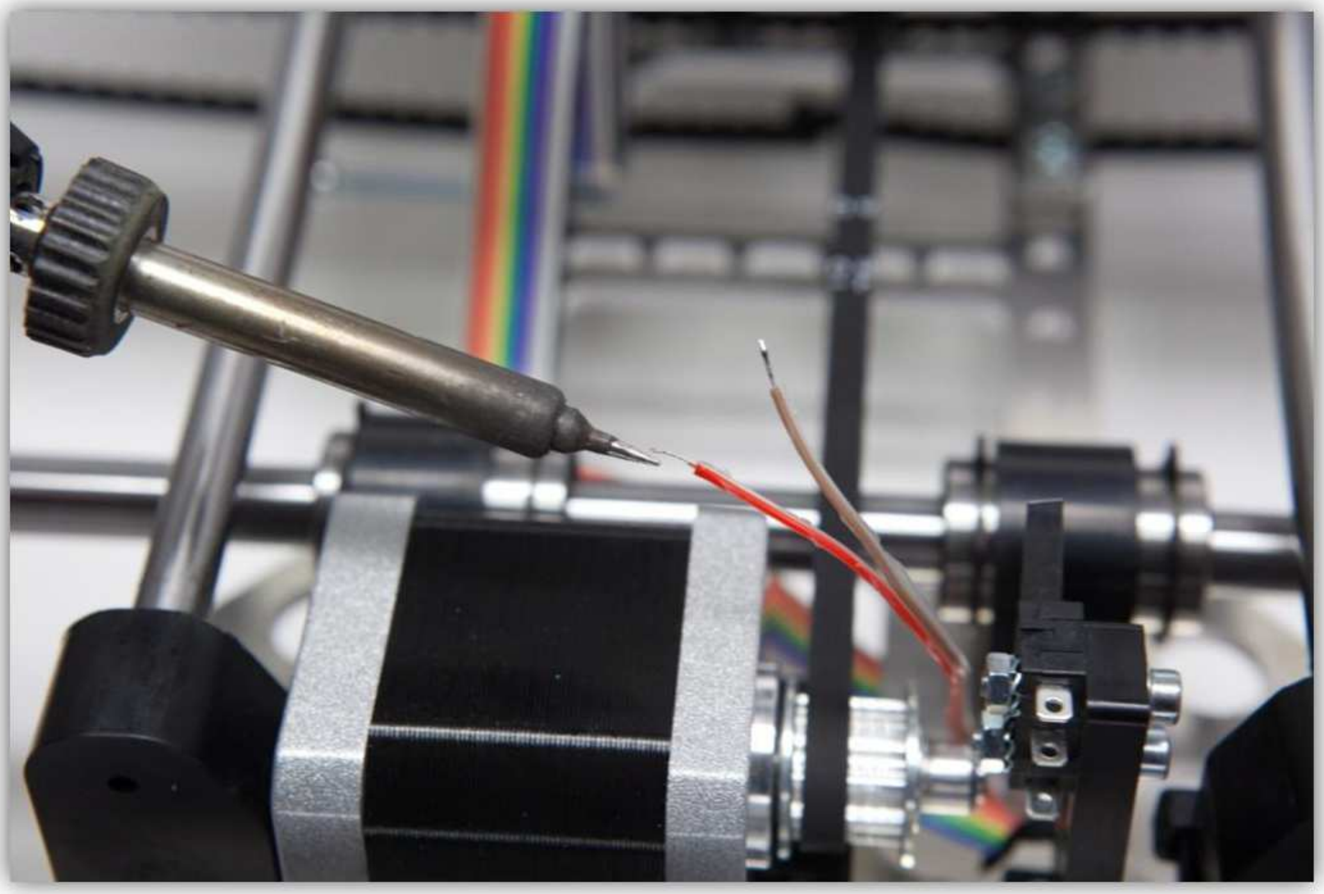
Cut the **Red** and **Brown** wire as shown in the pictures below.





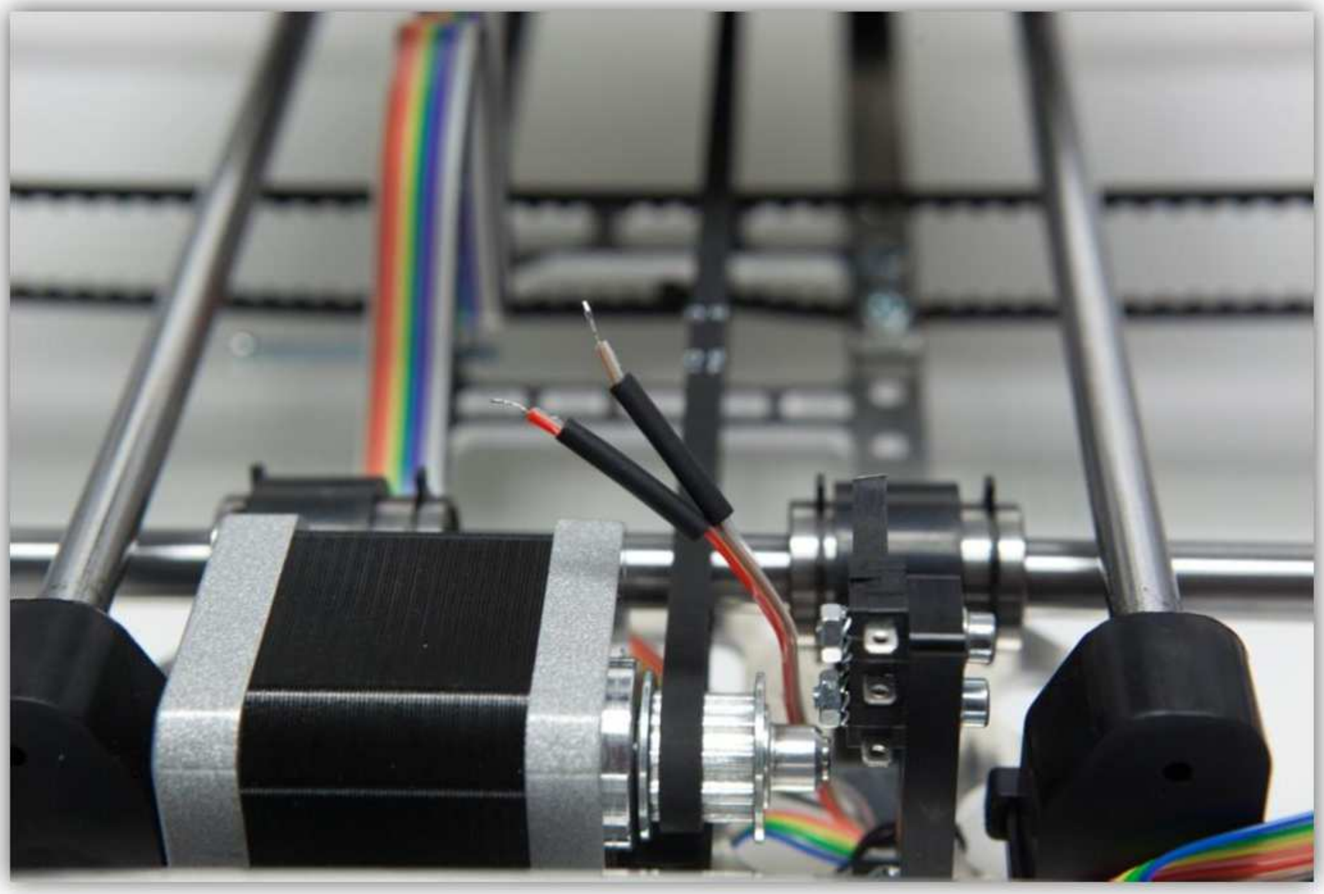
Strip 5 mm (0.2")) and tin the wires.



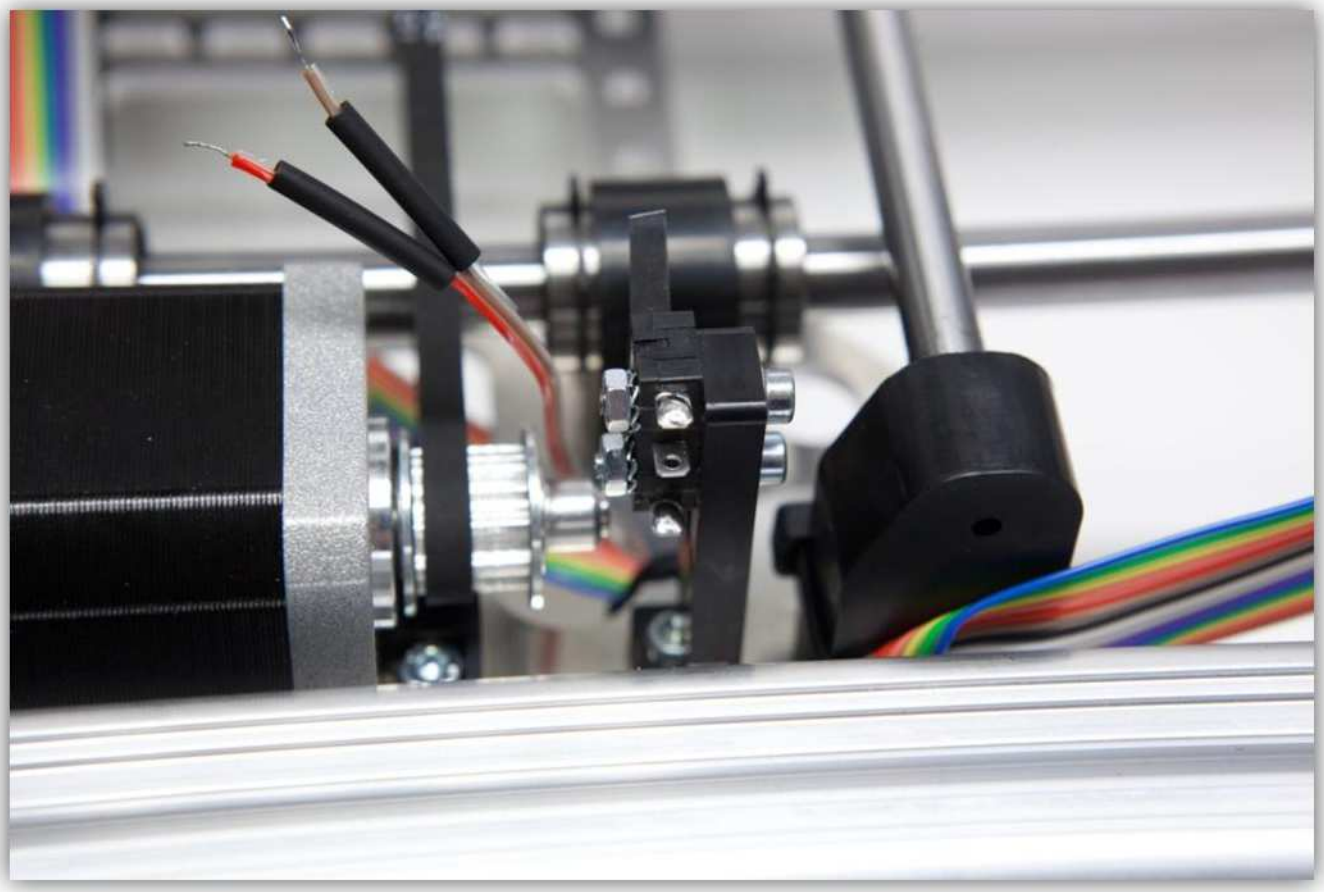


Cut 4 medium size pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long.

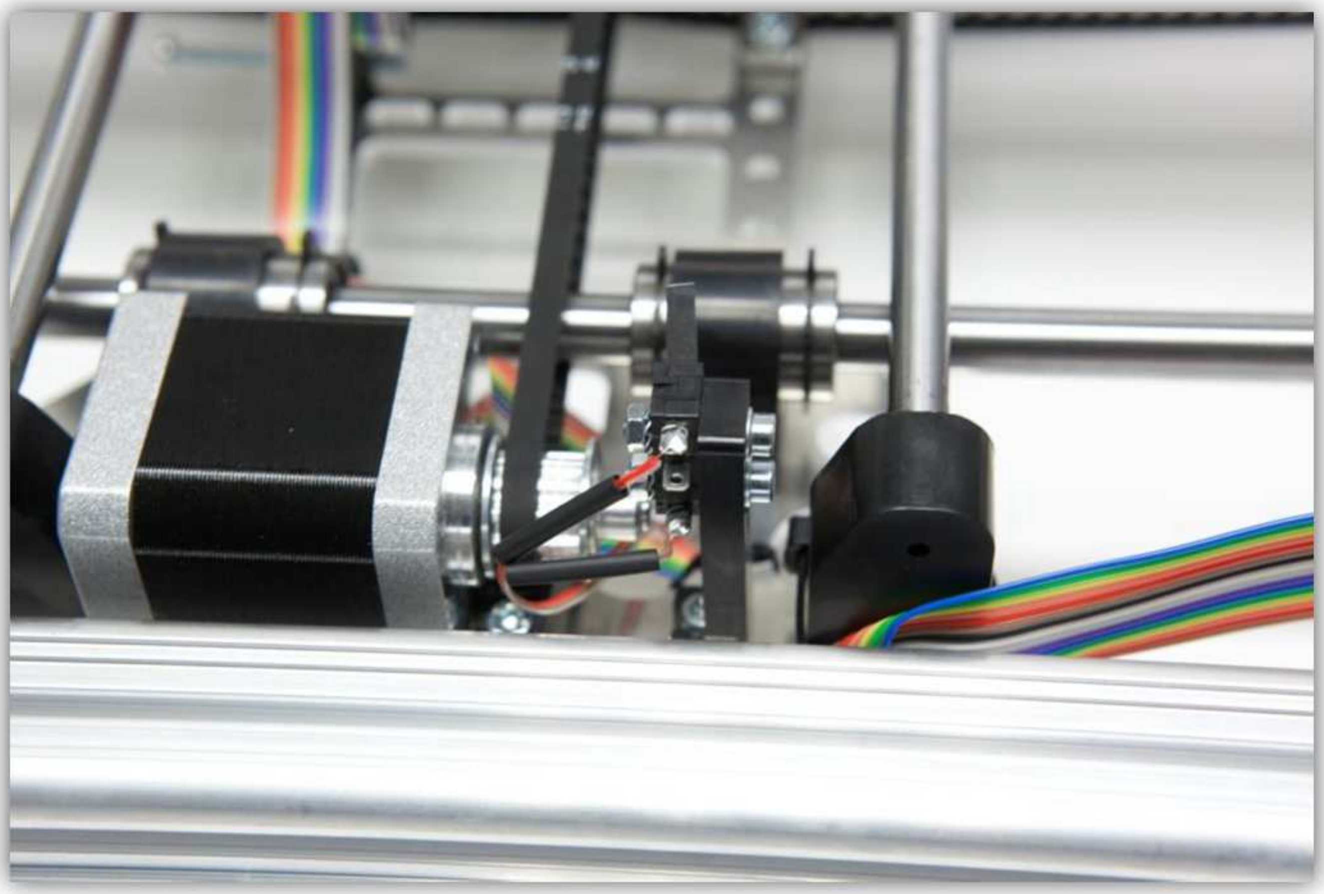
Slide the 2 medium size pieces of heat shrink tubing over the **Red** and **Brown** wires of the flat cable.



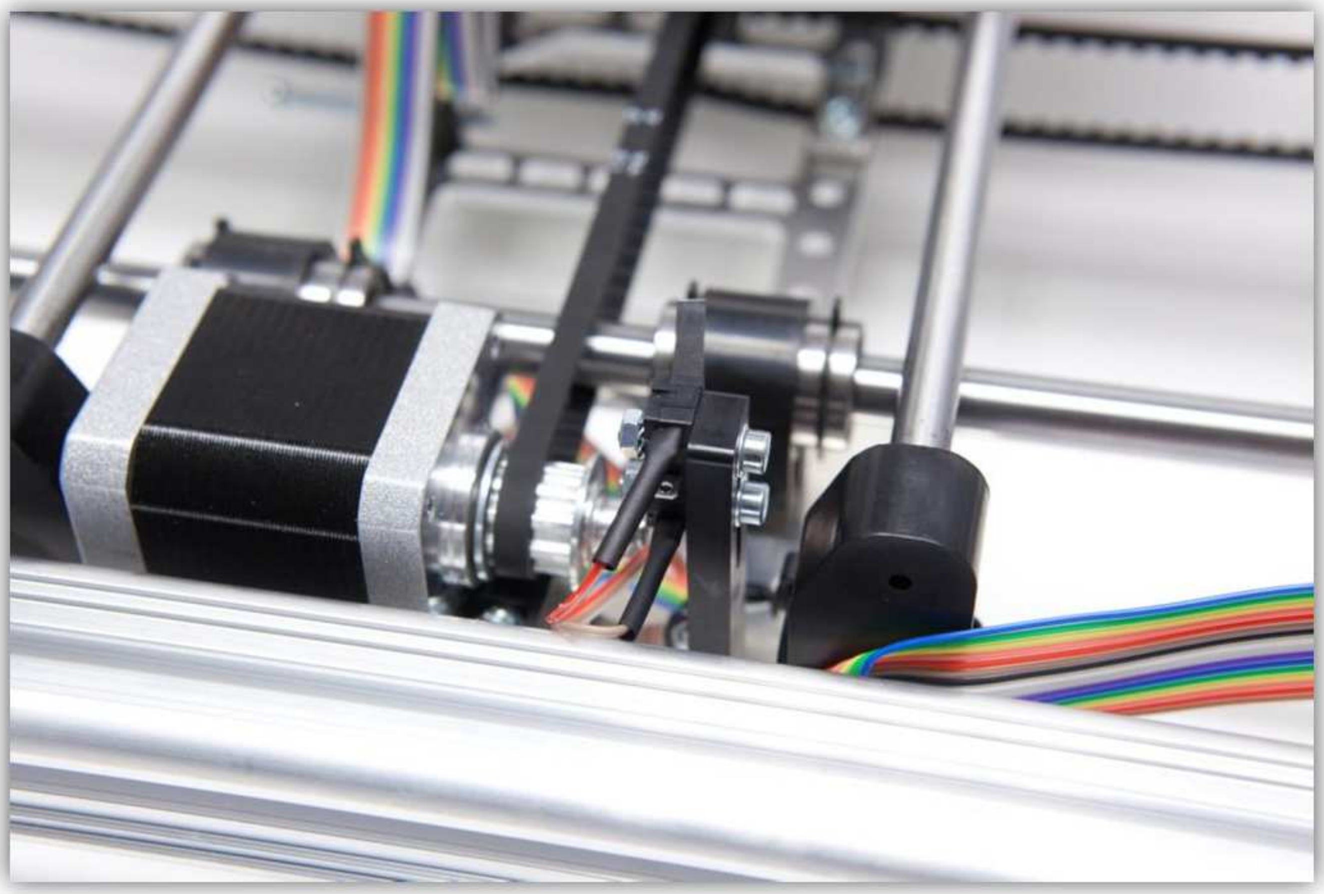
Tin the two outer contacts of the Y micro switch.

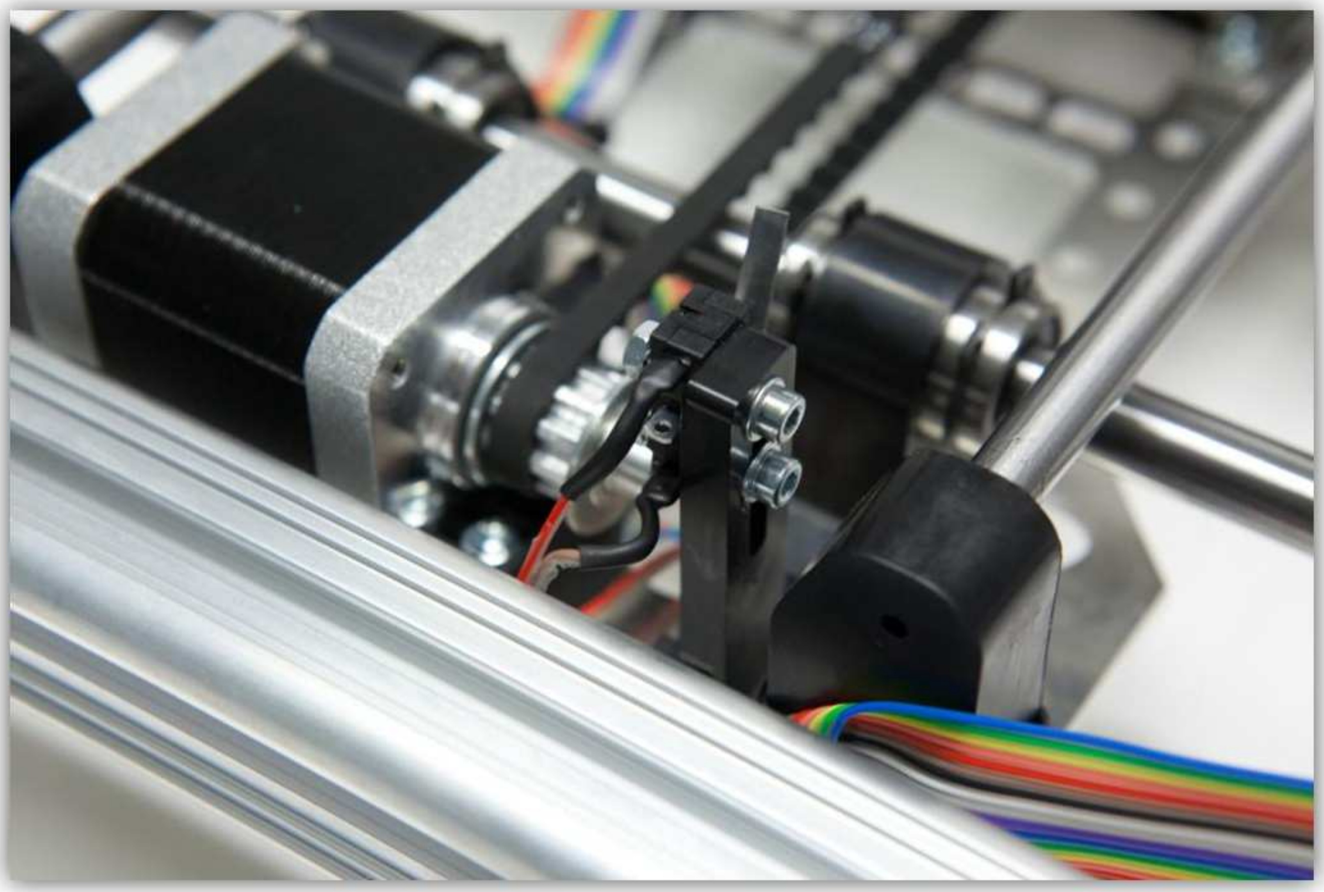


Solder the **Red** and **Brown** wires to the contacts.

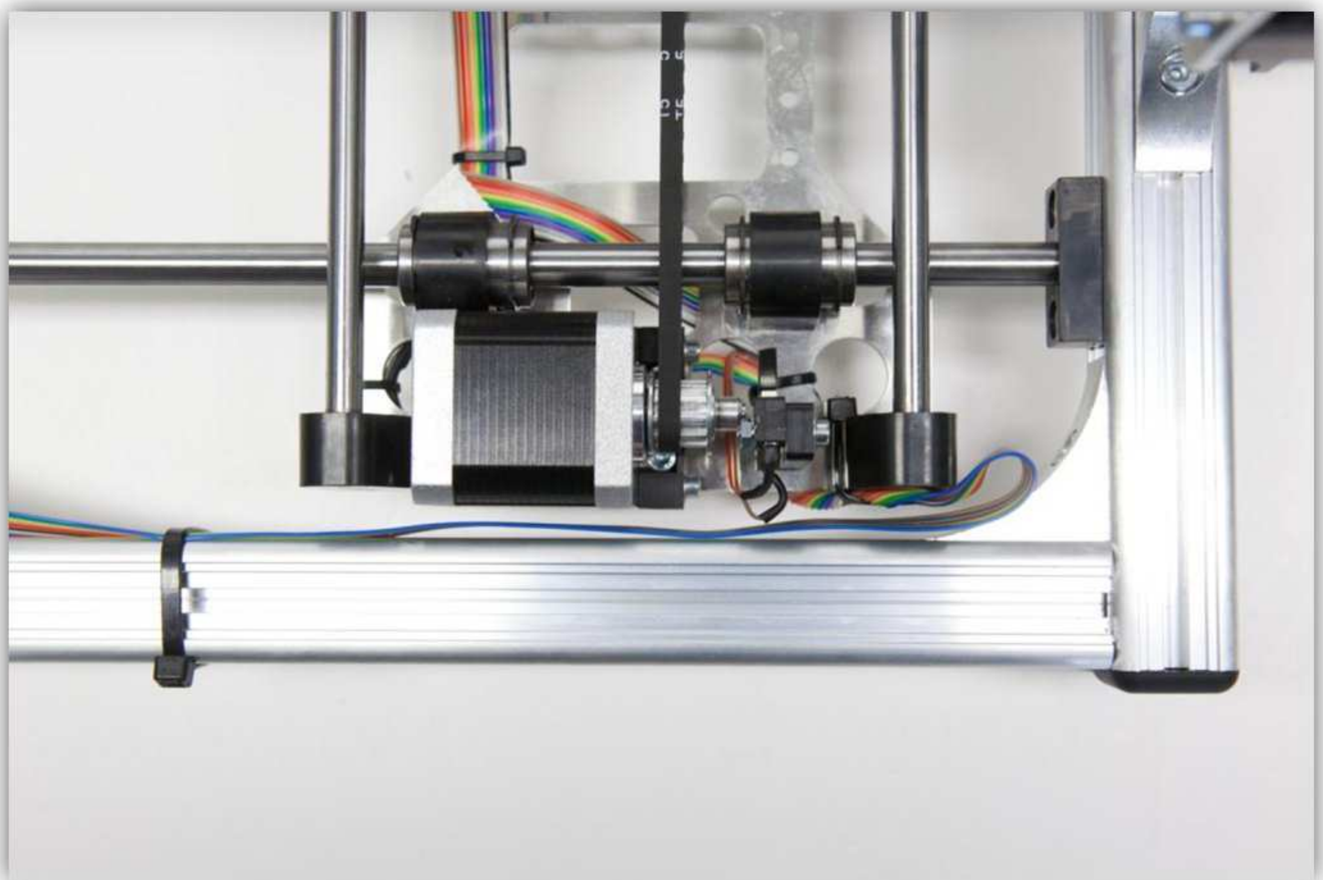


Slide the heat shrink tubes over the contacts and heat them up.



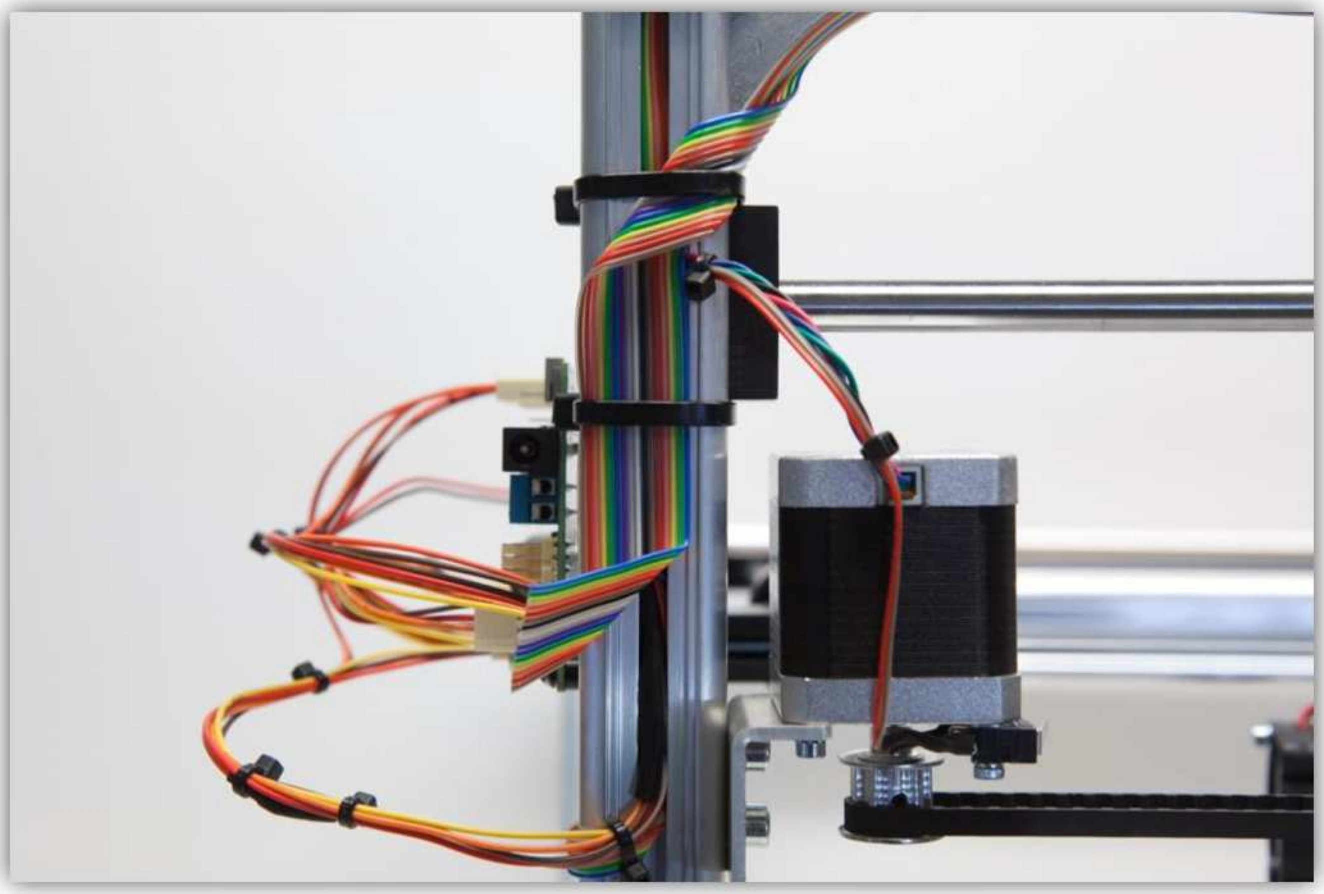


Now move the X CARRIAGE as far away as possible from the controller board. Lead the flat cable as shown in the picture and secure it with a large tie-strip.



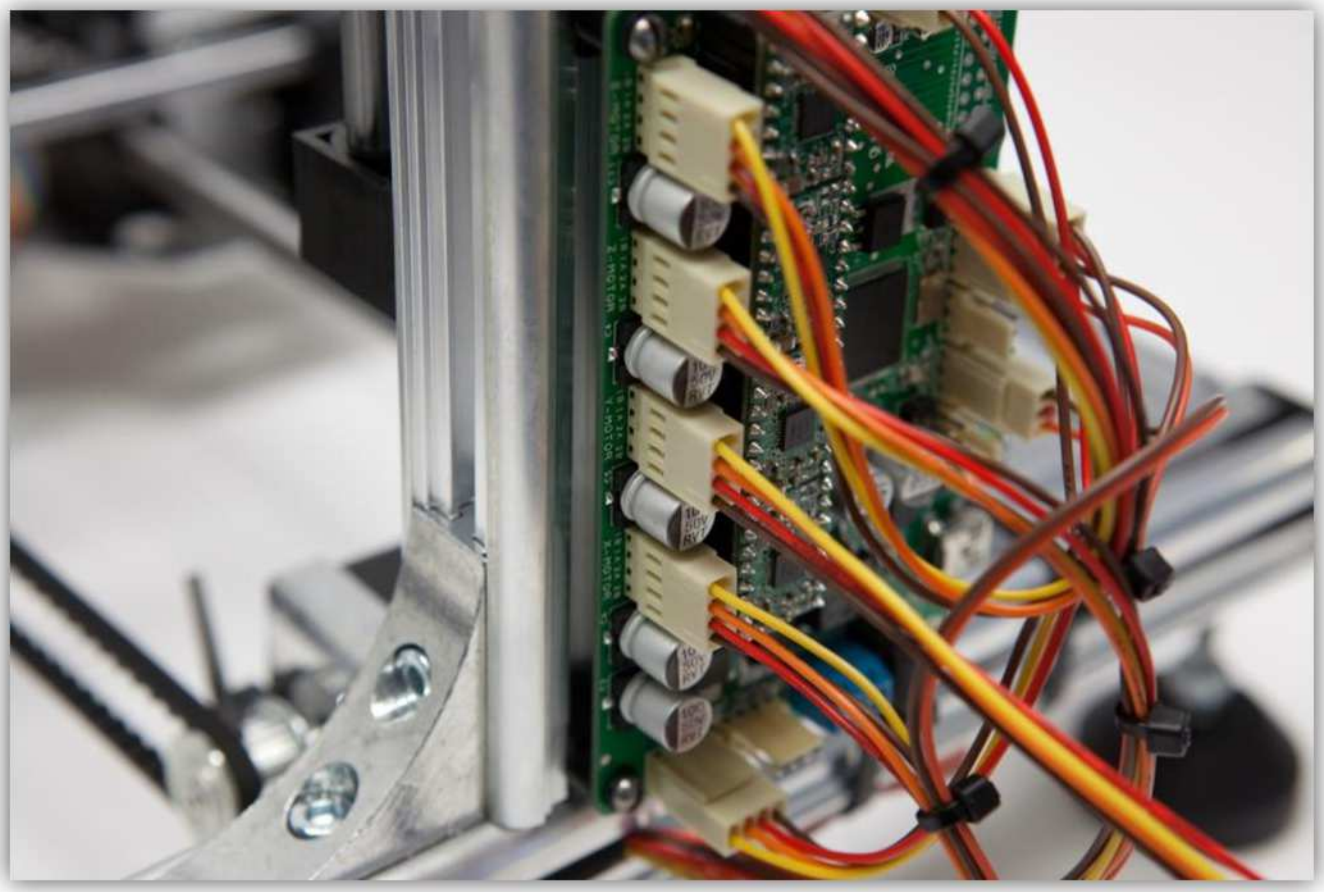
Lead the flat cable further along the ALUMINIUM PROFILES while securing it with large tie-strips. **Notice how the cable folds in the corner and disappears under the ALUMINIUM PROFILE.**

Fold and secure the cable as shown in the picture below.

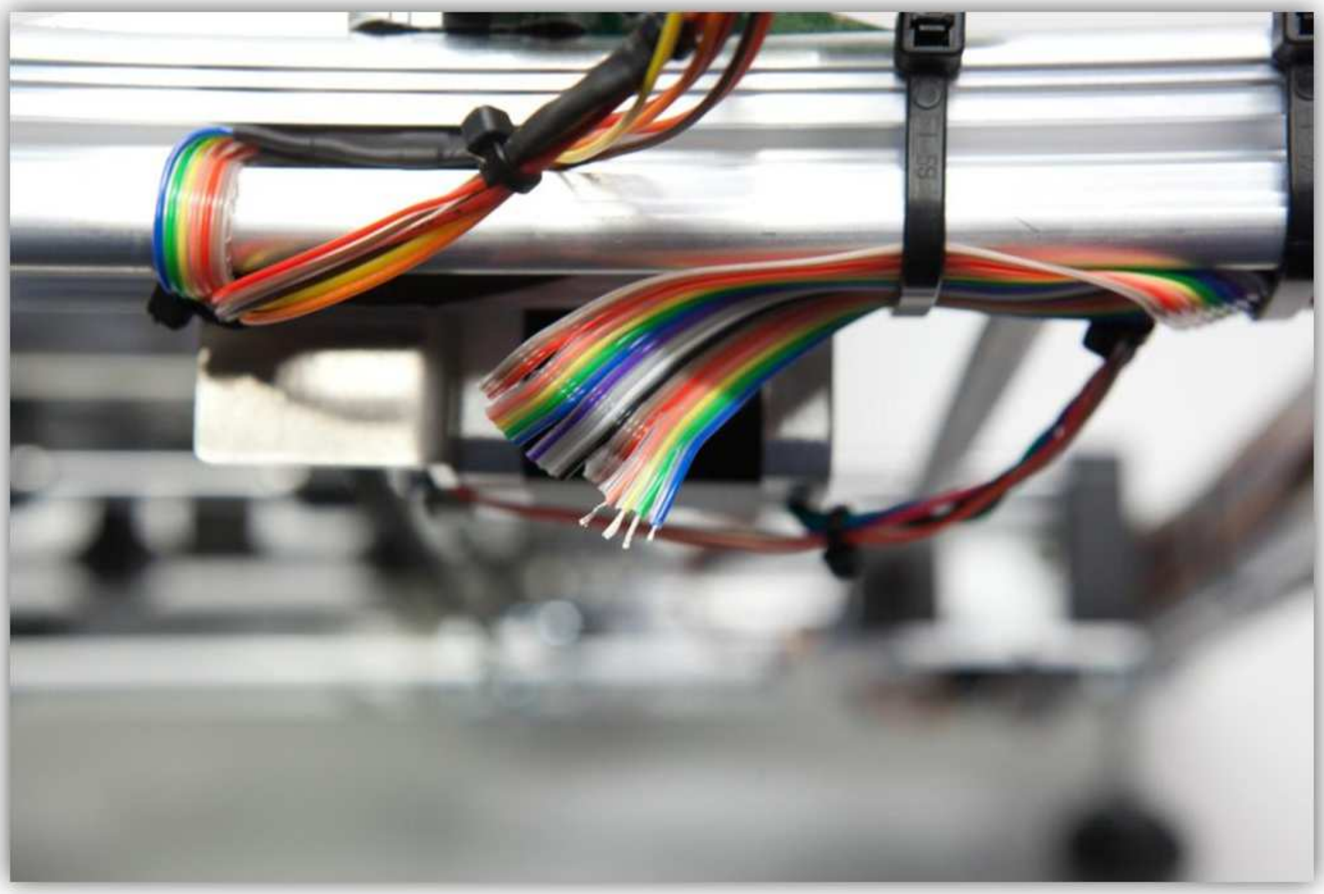


Take a board to wire connector with 4 wires out of the bag labelled with 40.

Plug the female connector in the male connector labelled with Y-MOTOR on the controller board.

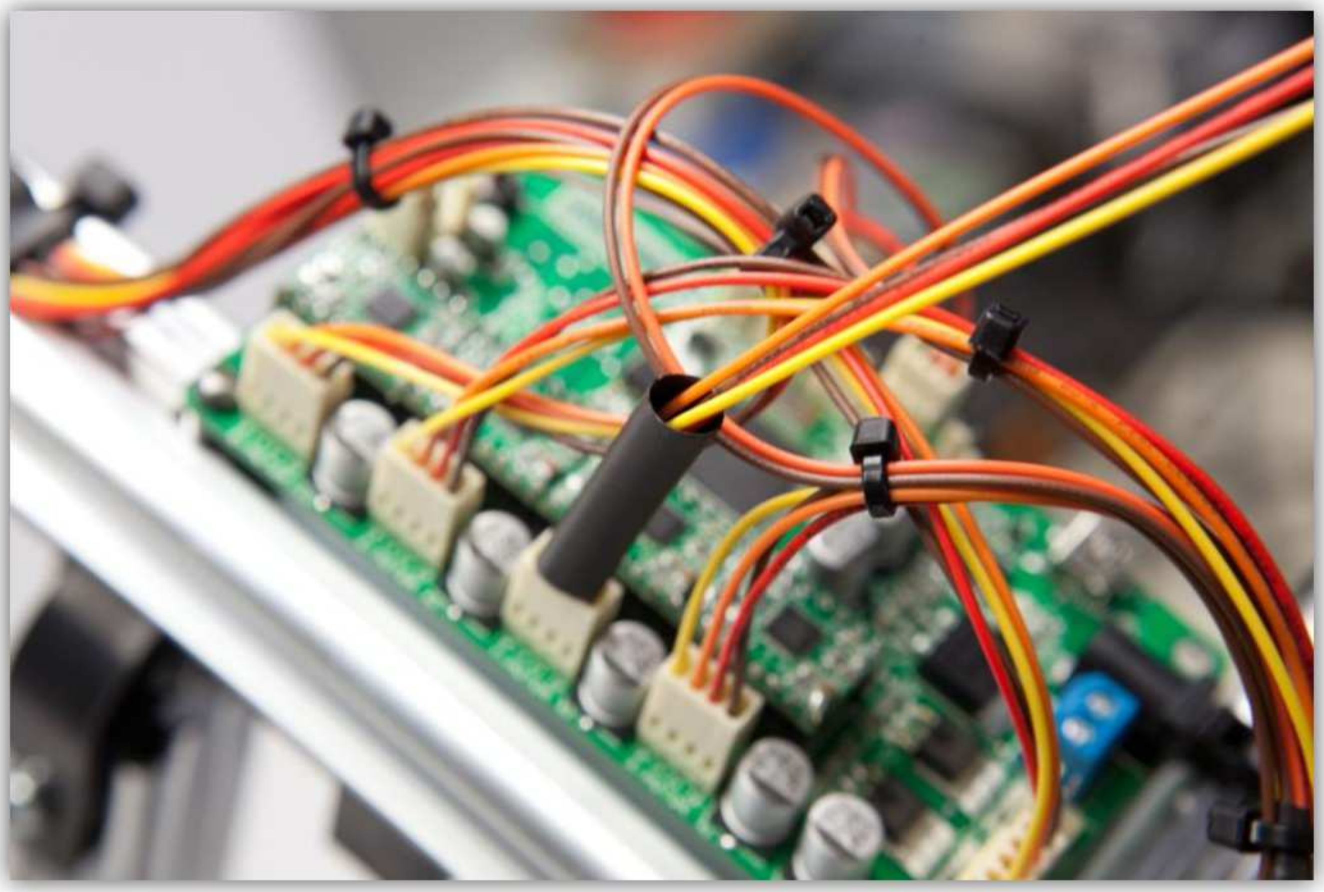


Strip 5 mm (0.2") the following wires: **Blue, Green, Yellow, Orange** and tin them.

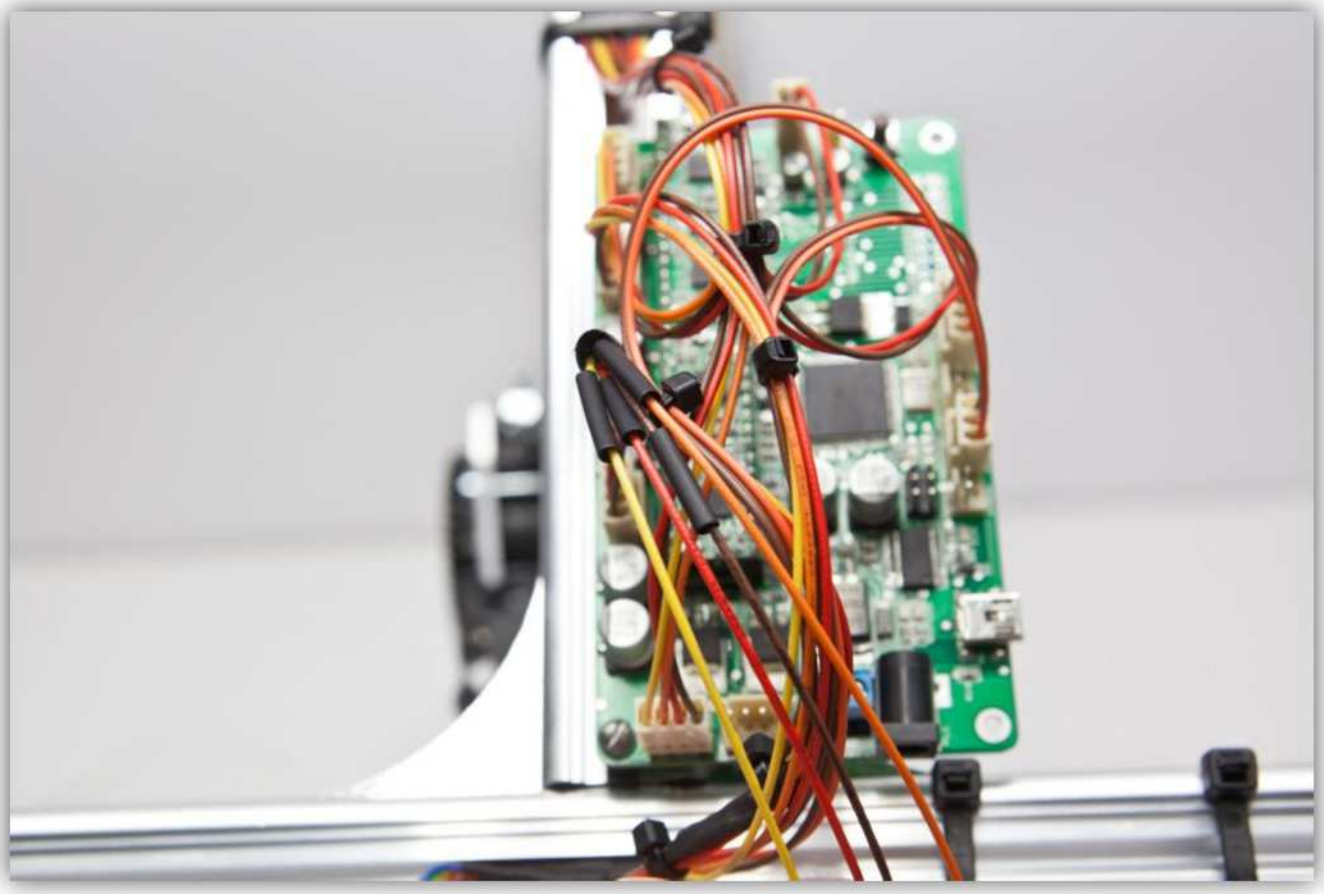


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the big heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the big heat shrink tubes over the 4 wires of the connector.

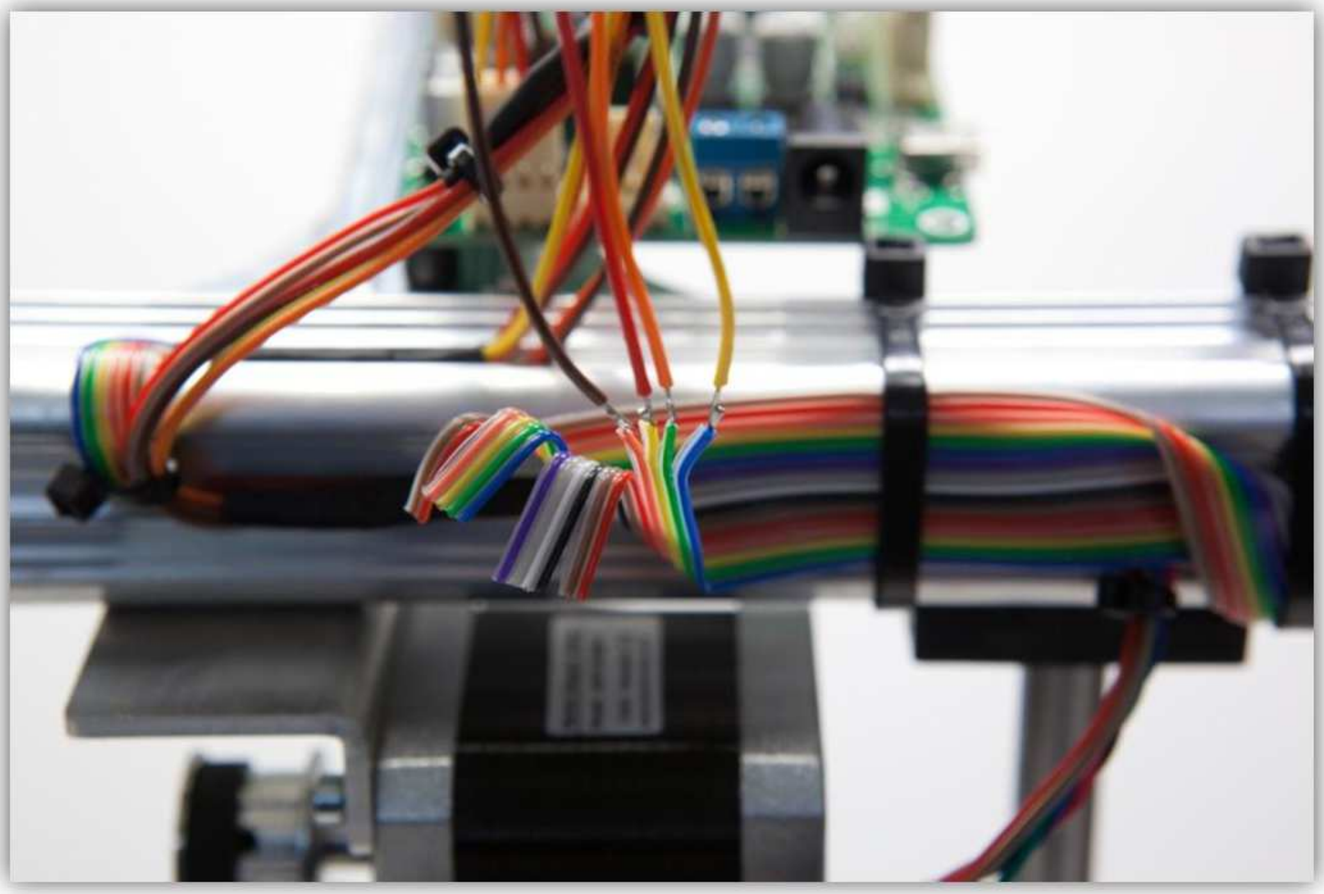


Slide the 4 small heat shrink tubes over the 4 wires of the connector.

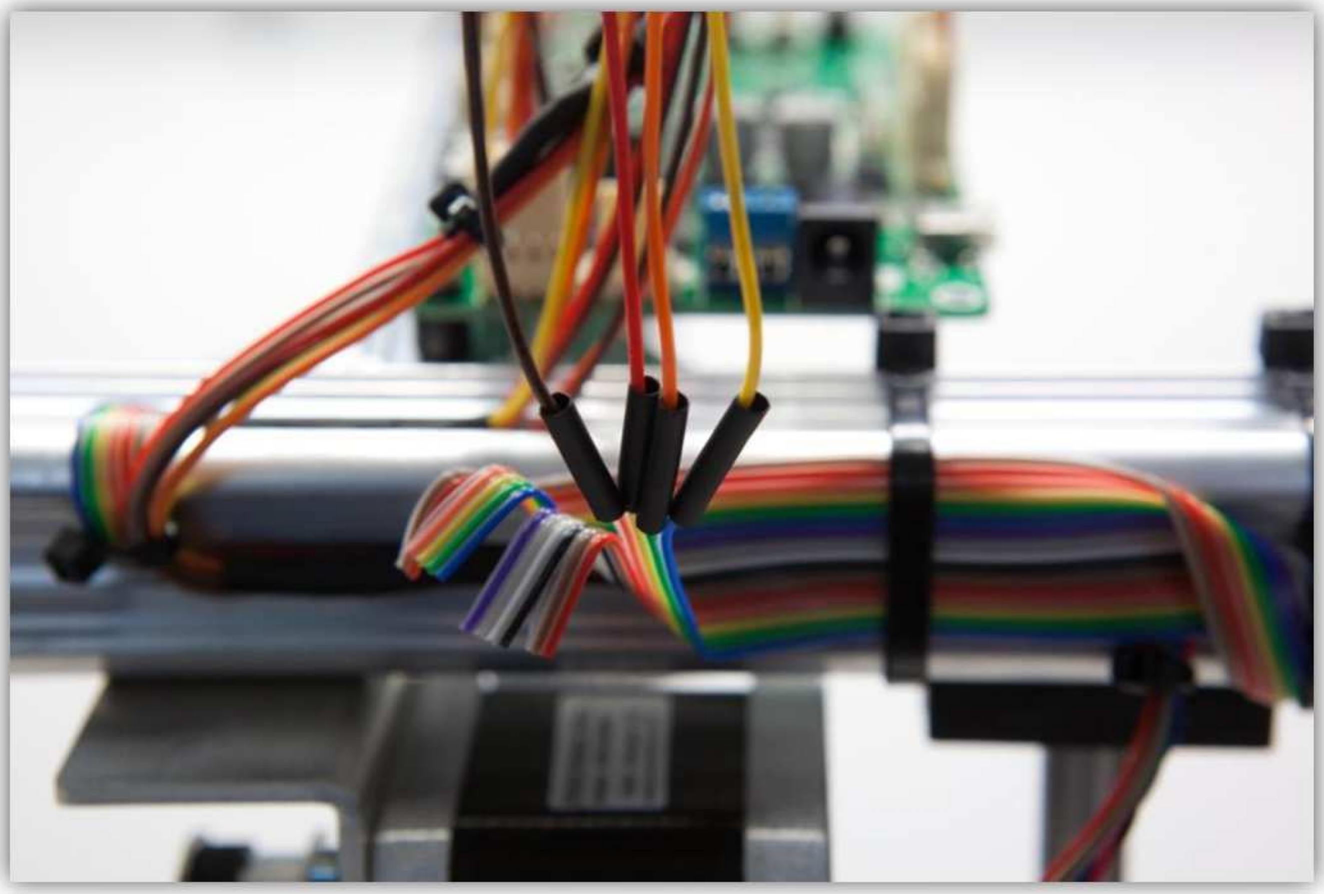


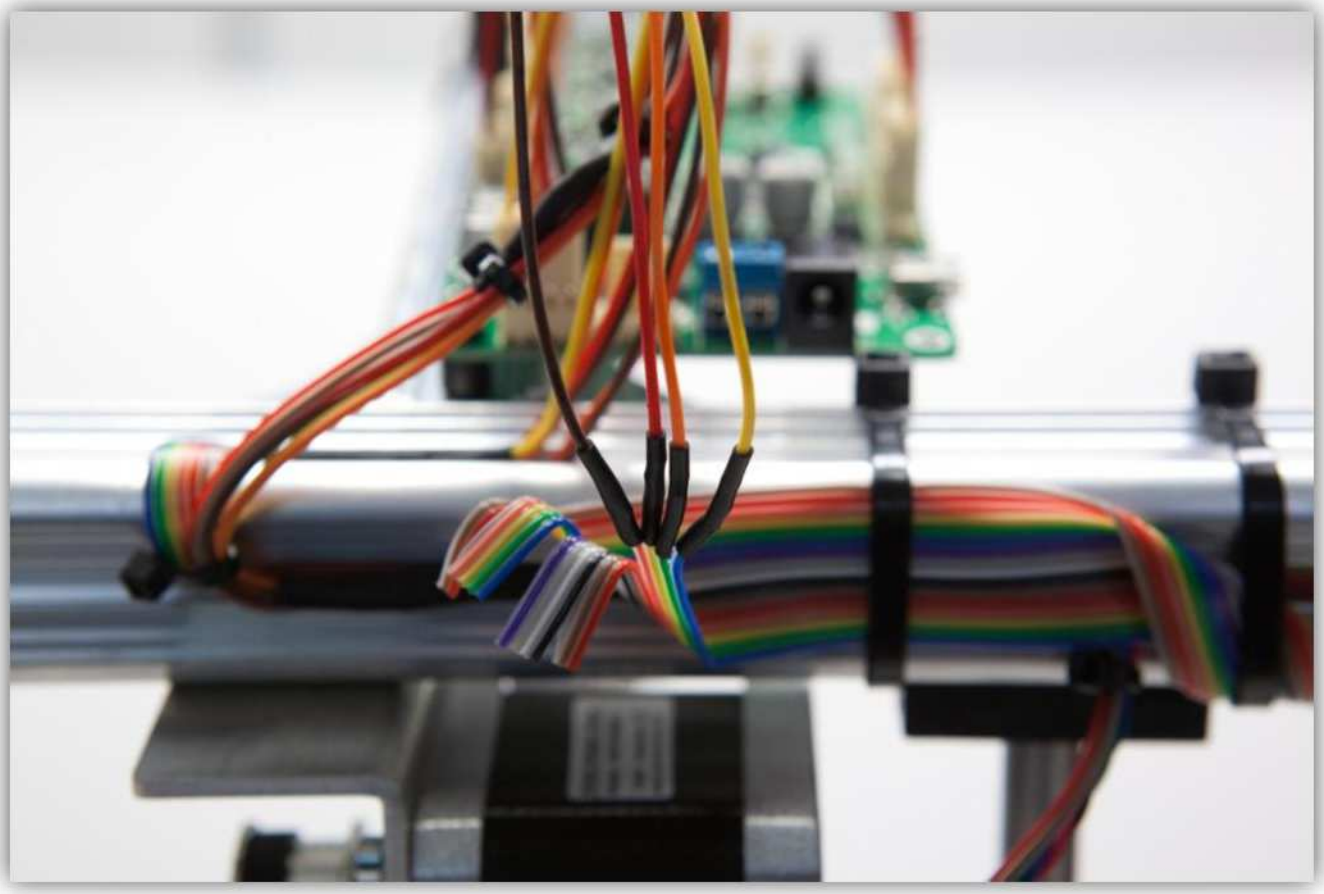
Solder the 4 wires from the connector to the 4 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	->	Connector wires
Blue	**->**	**Yellow**
Green	**->**	**Orange**
Yellow	**->**	**Red**
Orange	**->**	**Brown**

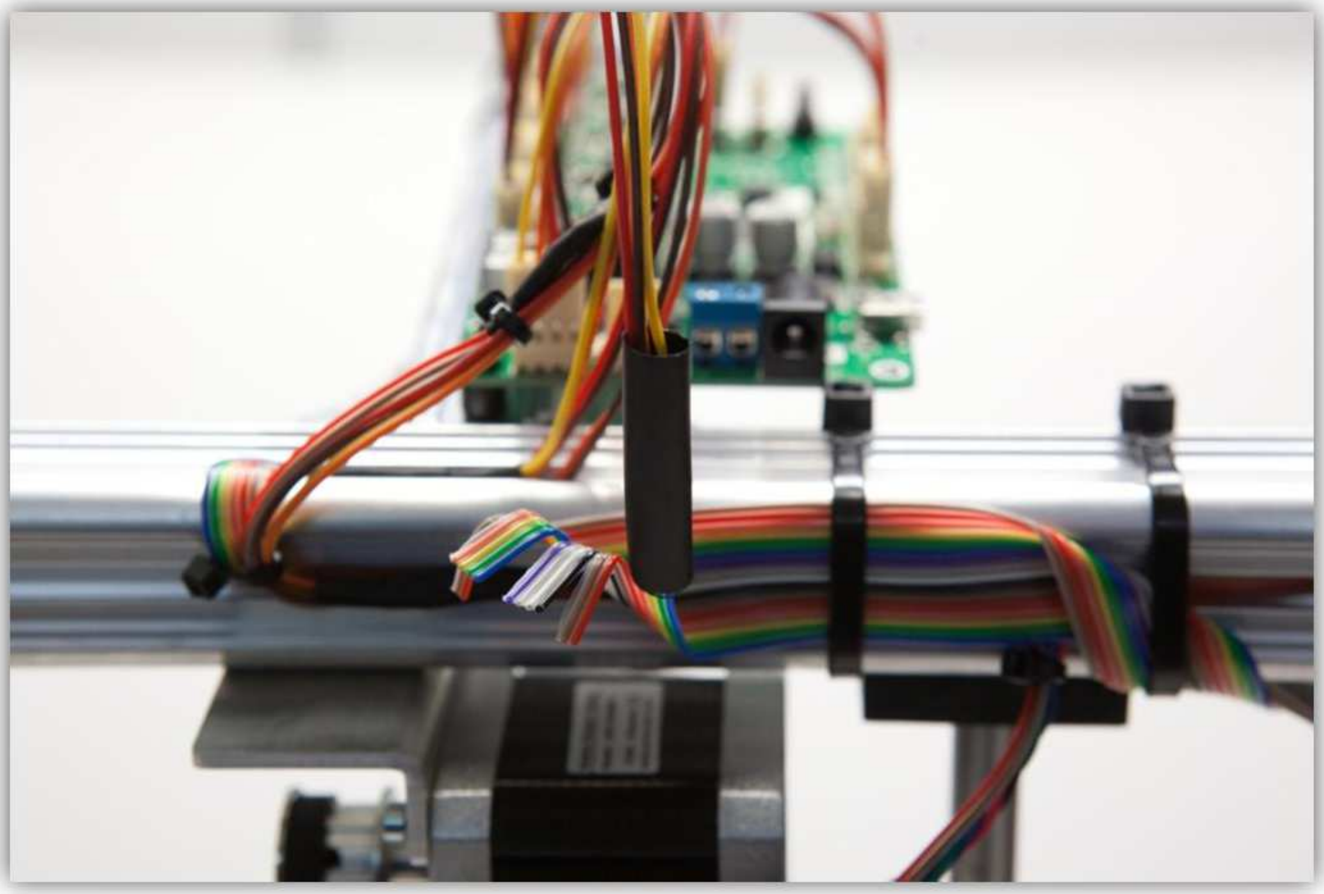


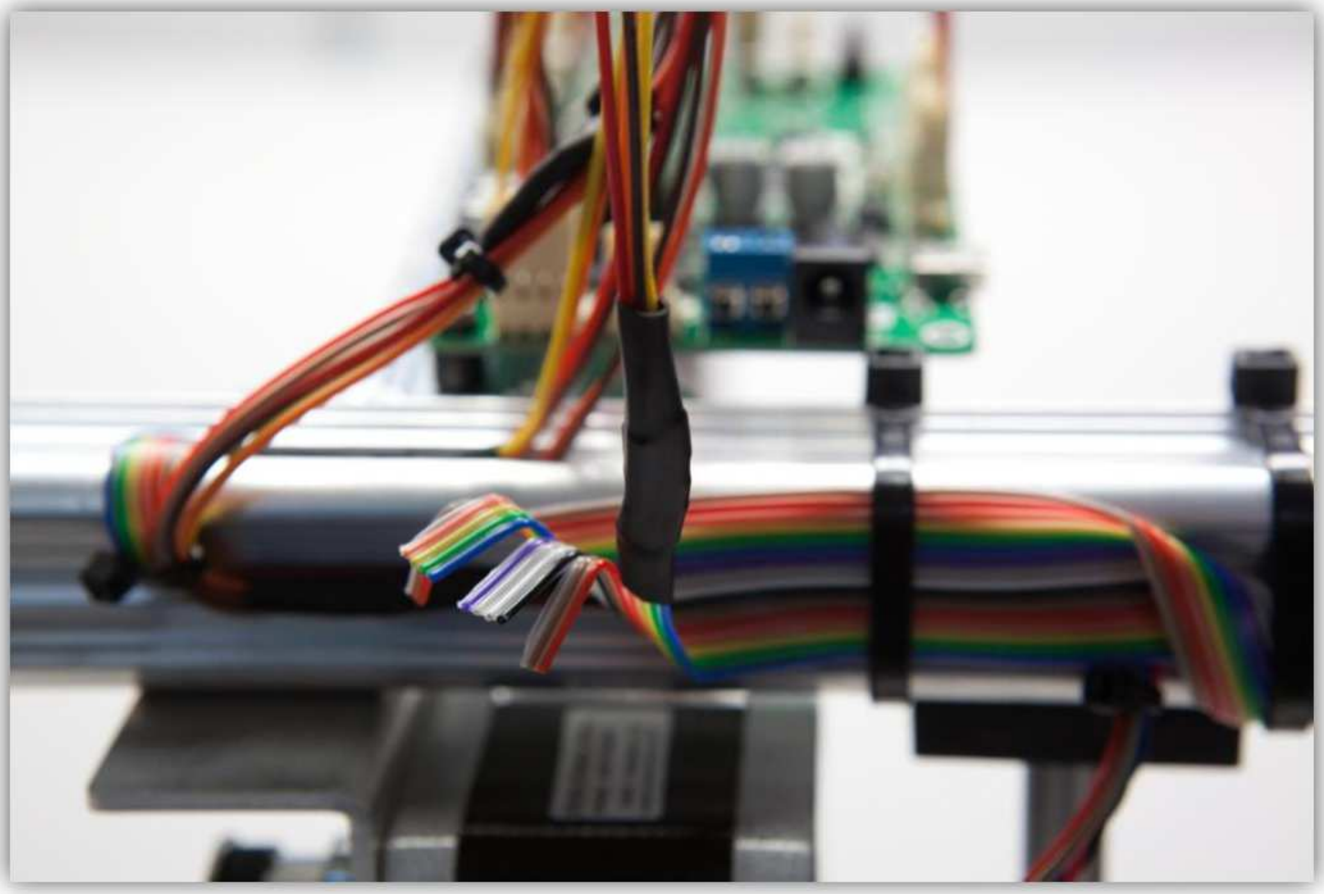
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.



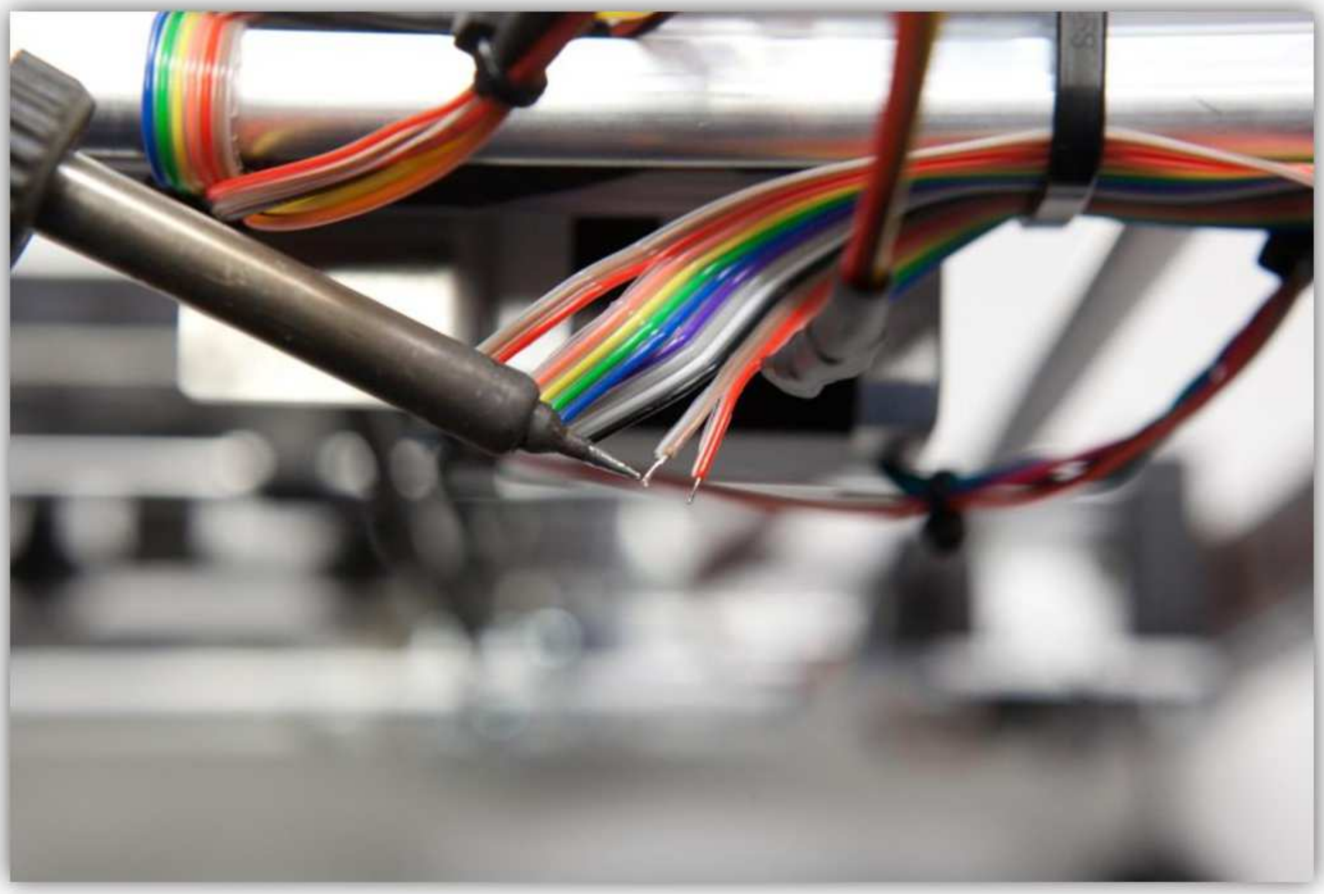


Now slide the big piece of heat shrink tubing over the 4 small pieces, heat the big piece so it covers and protects the 4 heat shrunk joints.



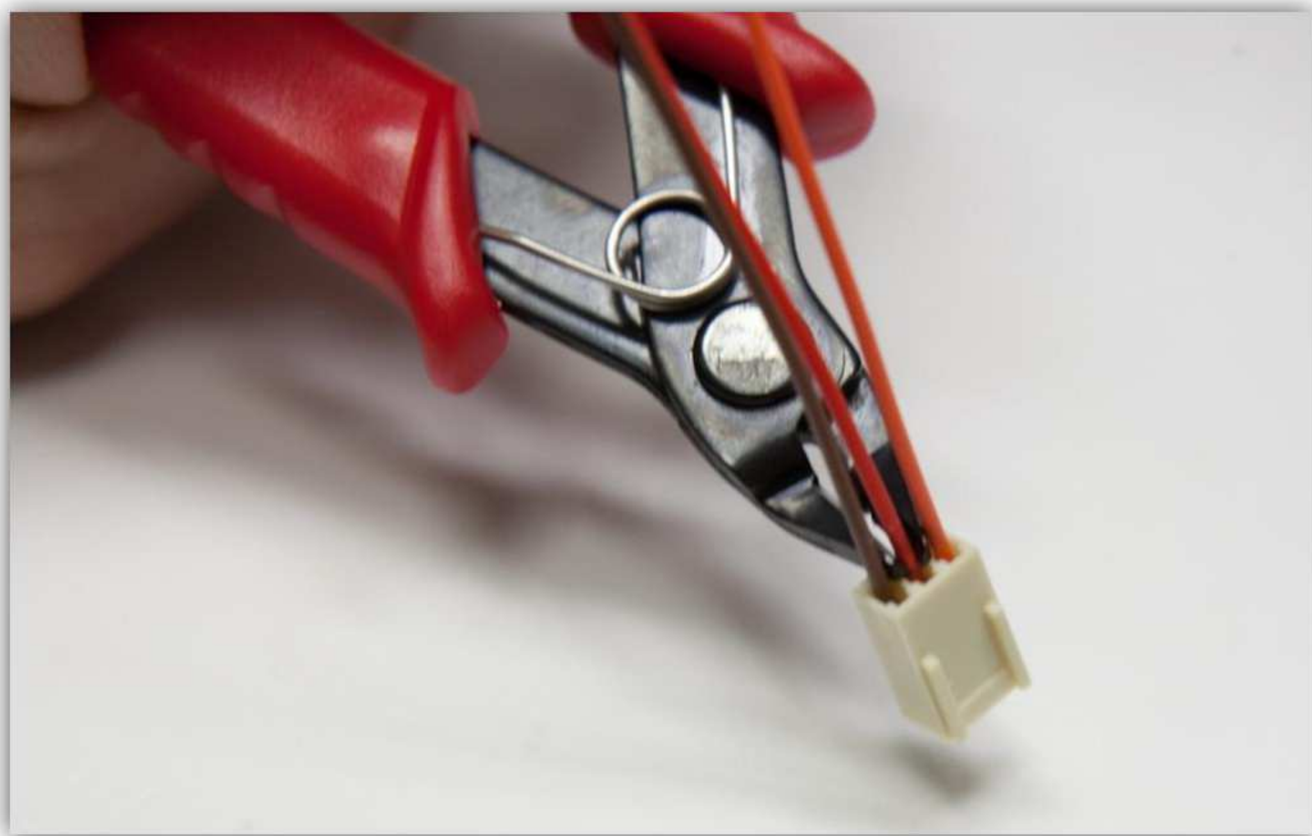


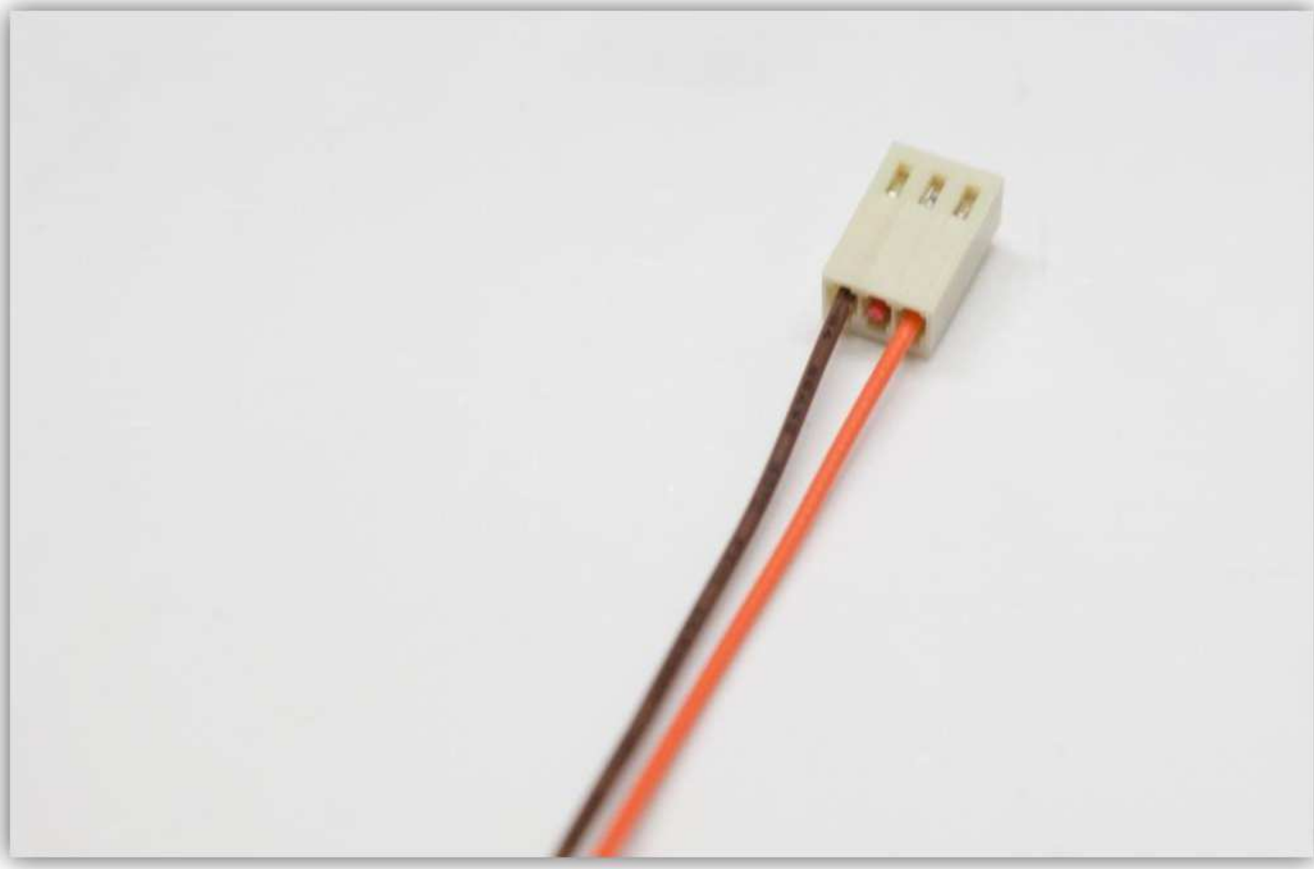
Strip 5 mm (0.2") the **Red** and **Brown** wire from the flat cable and tin the ends.



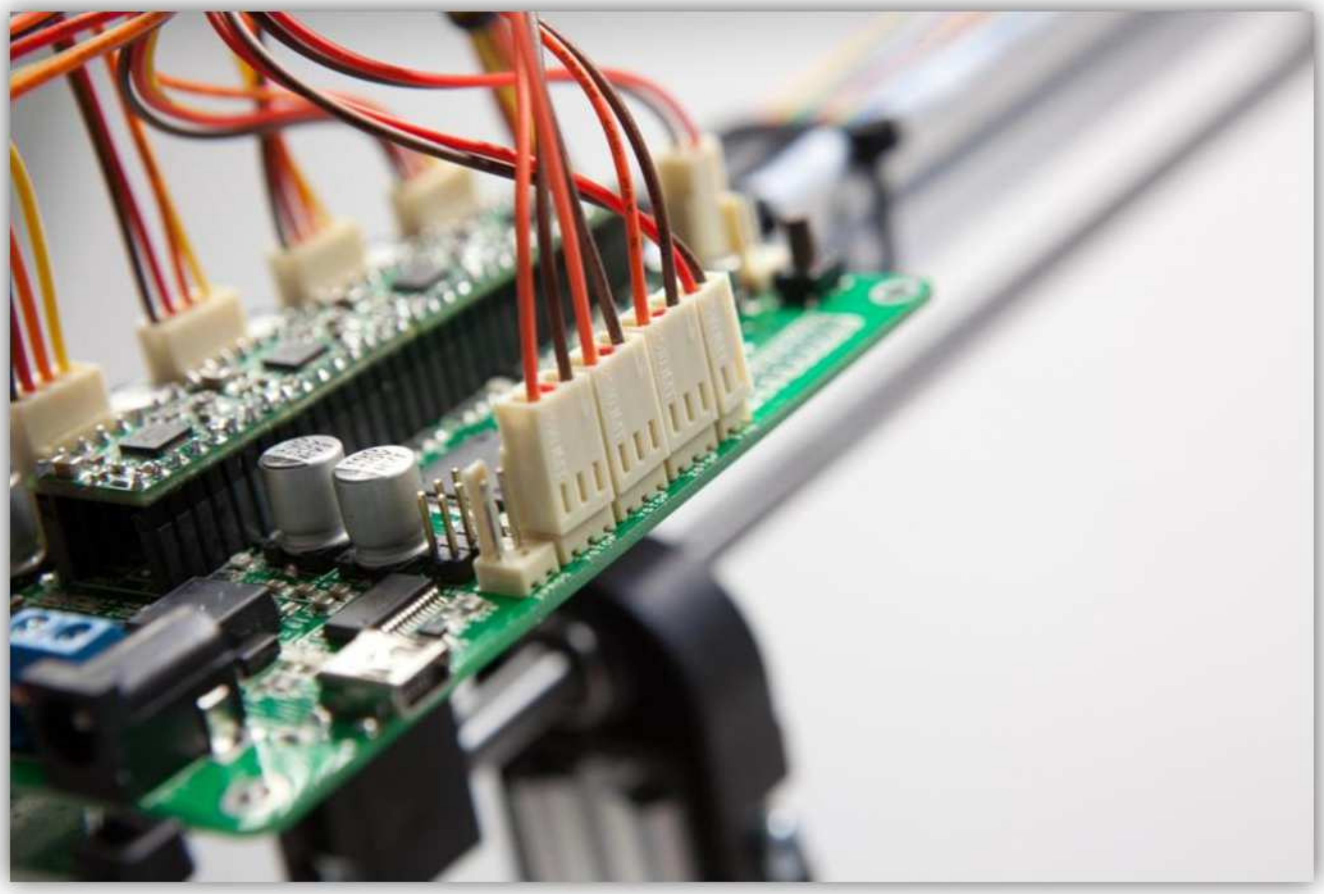
Take a board to wire connector with 3 wires out of the bag labelled with 40.

Cut the middle wire away at the connector.



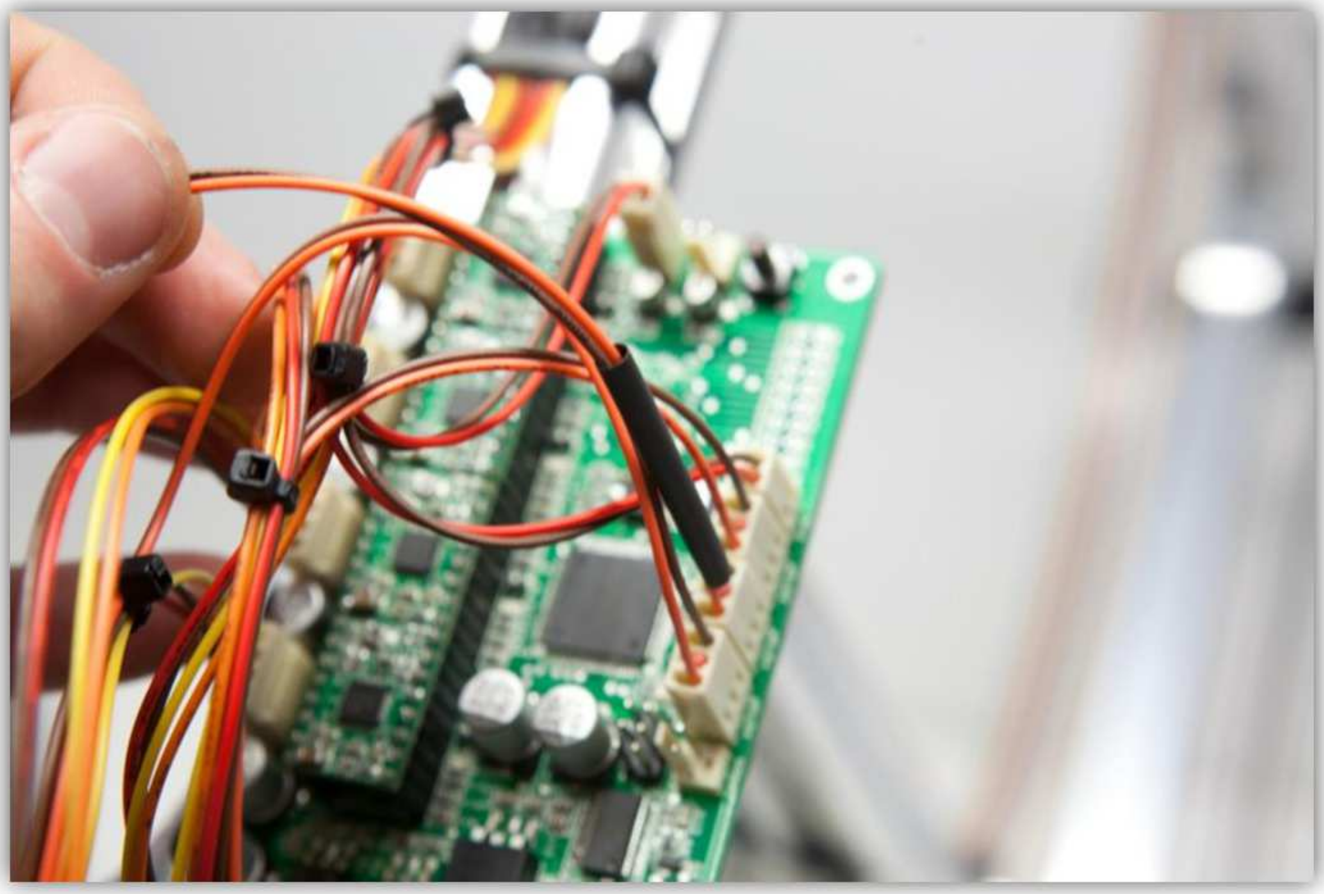


Plug the female connector in the male connector labelled with YSTOP on the controller board.

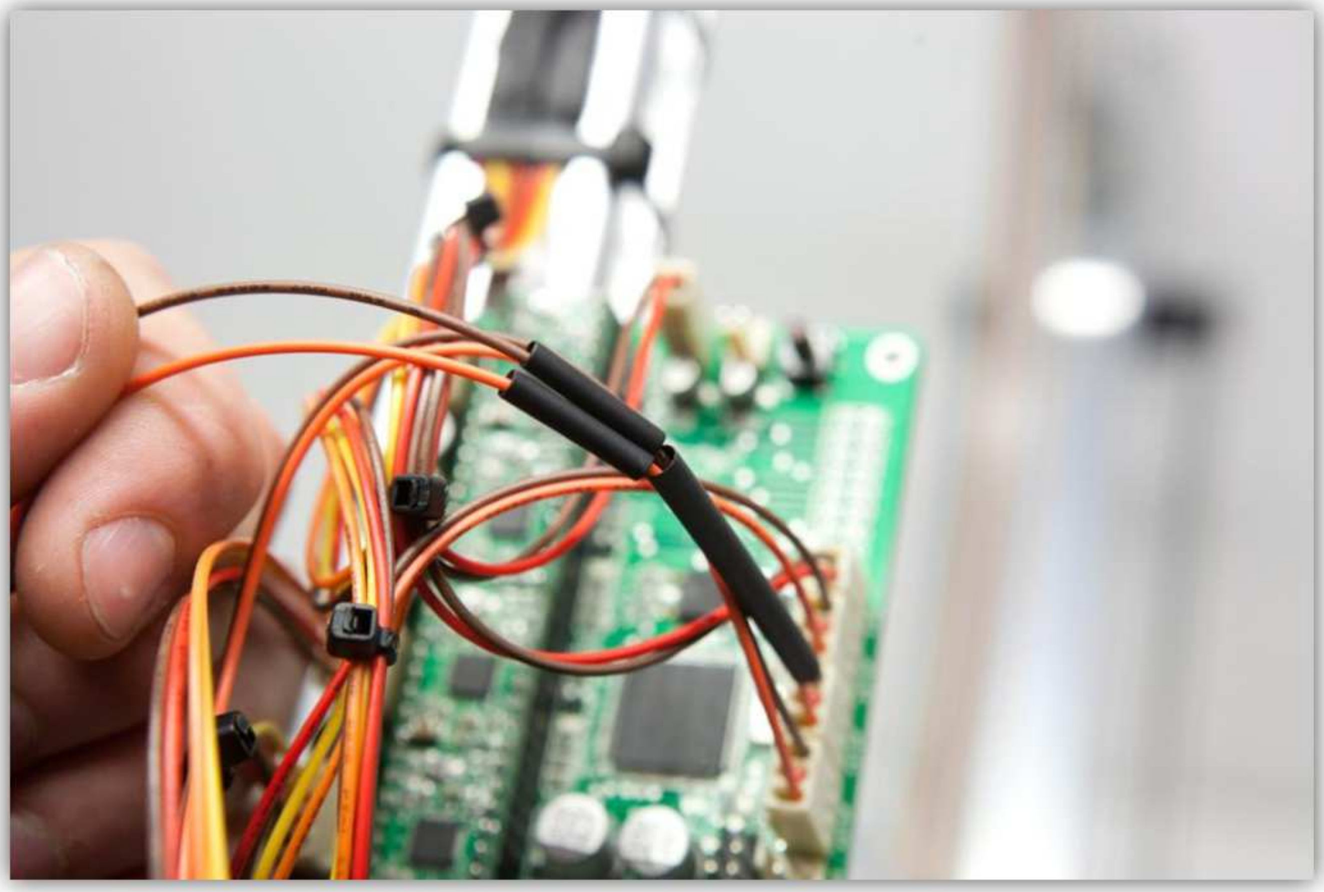


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the medium size heat shrink tubes over the 2 wires of the connector.



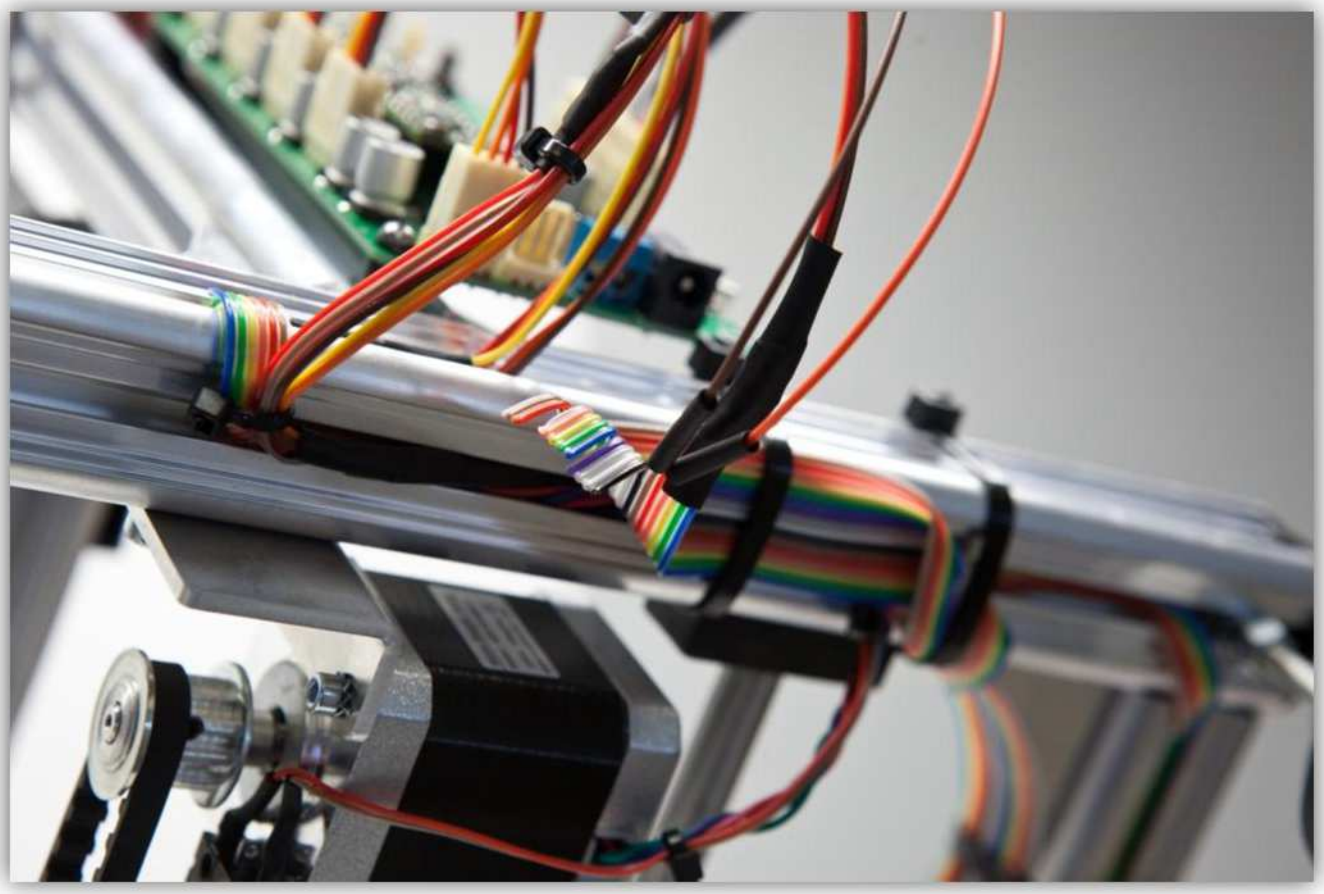
Slide the 2 small heat shrink tubes over the 2 wires of the connector.

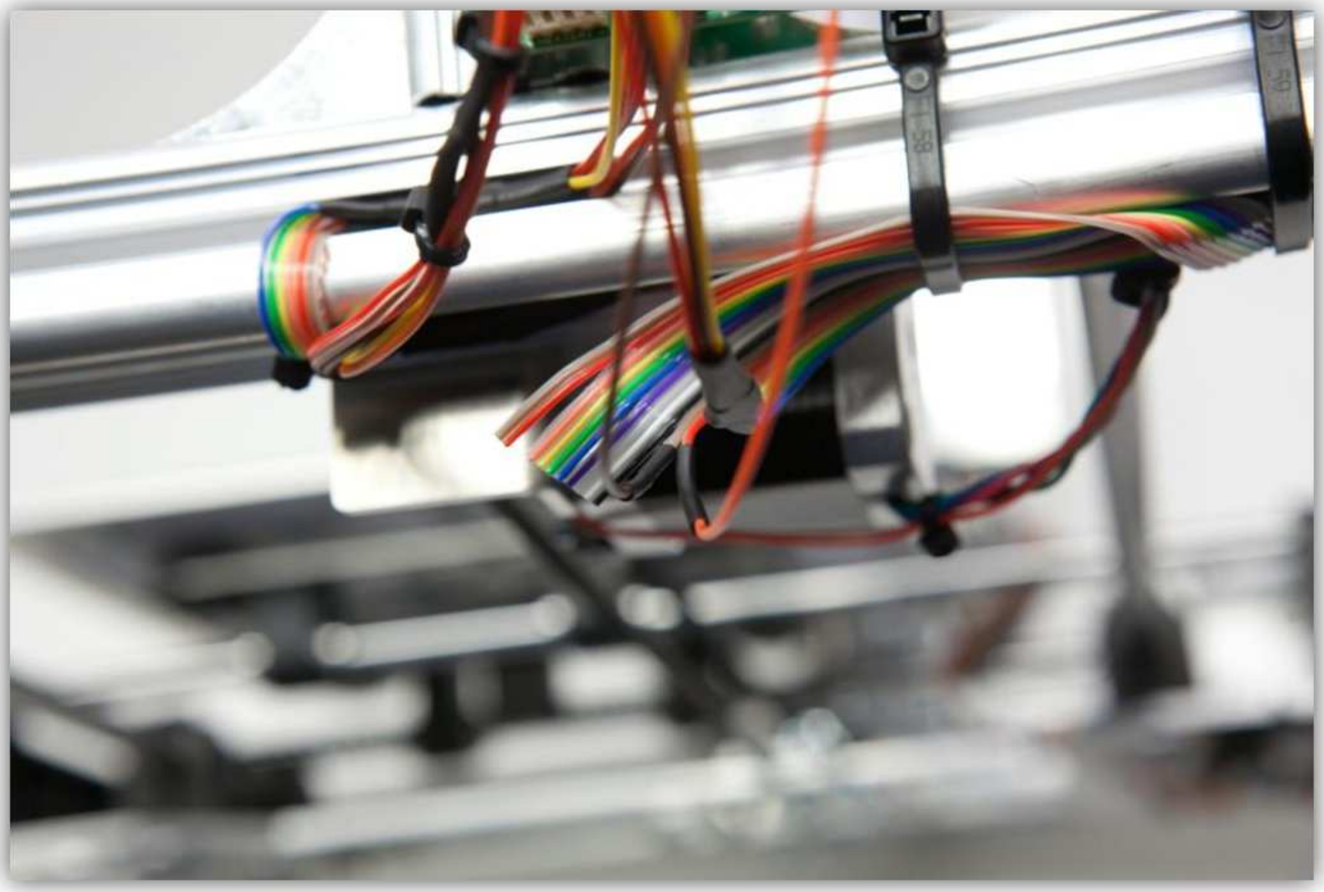


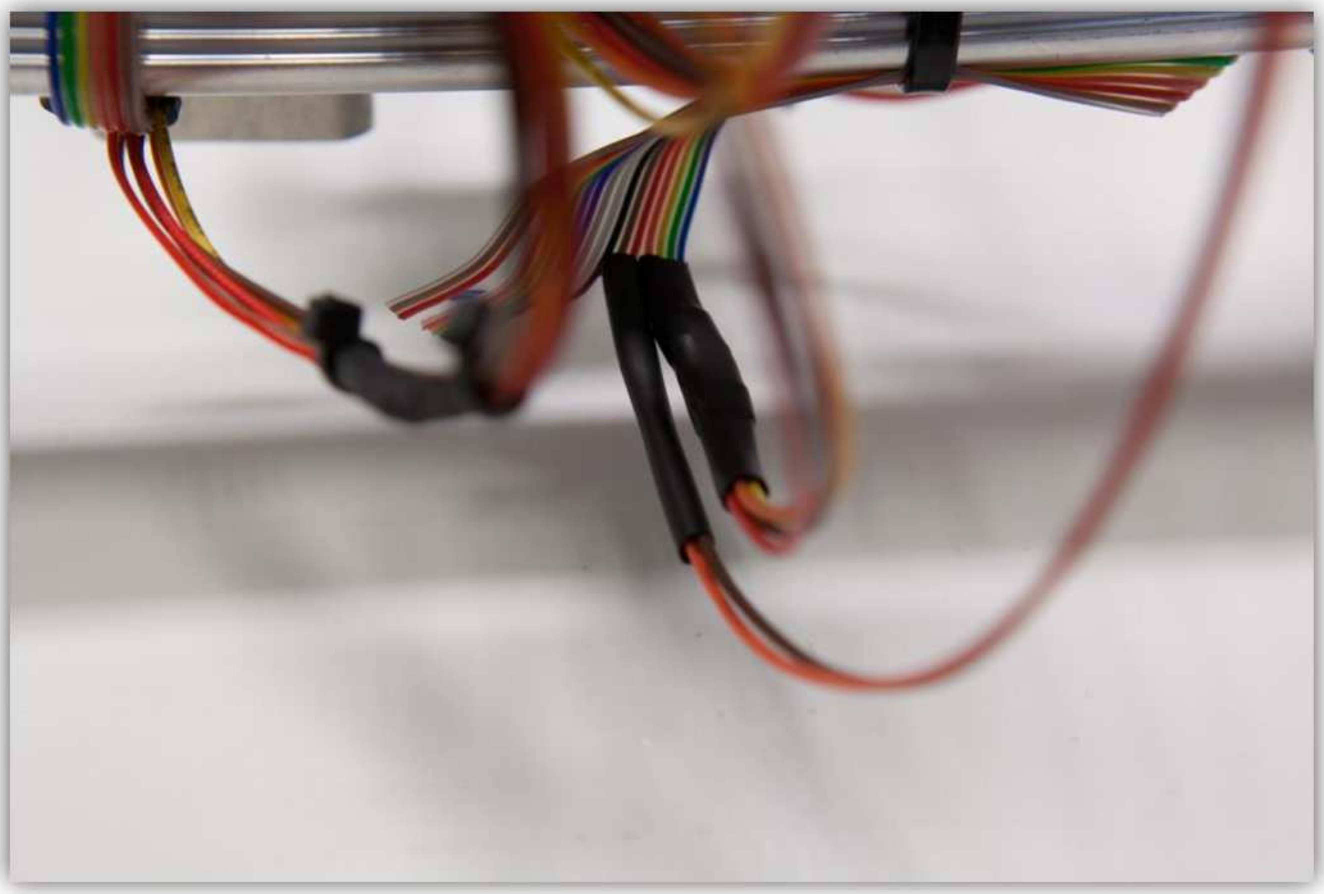
Solder the 2 wires from the connector to the 2 wires of the flat cable you tinned earlier. **Watch the colours closely.**

Flat cable	**->**	**Connector wires**
Red	**->**	**Red**
Brown	**->**	**Brown**

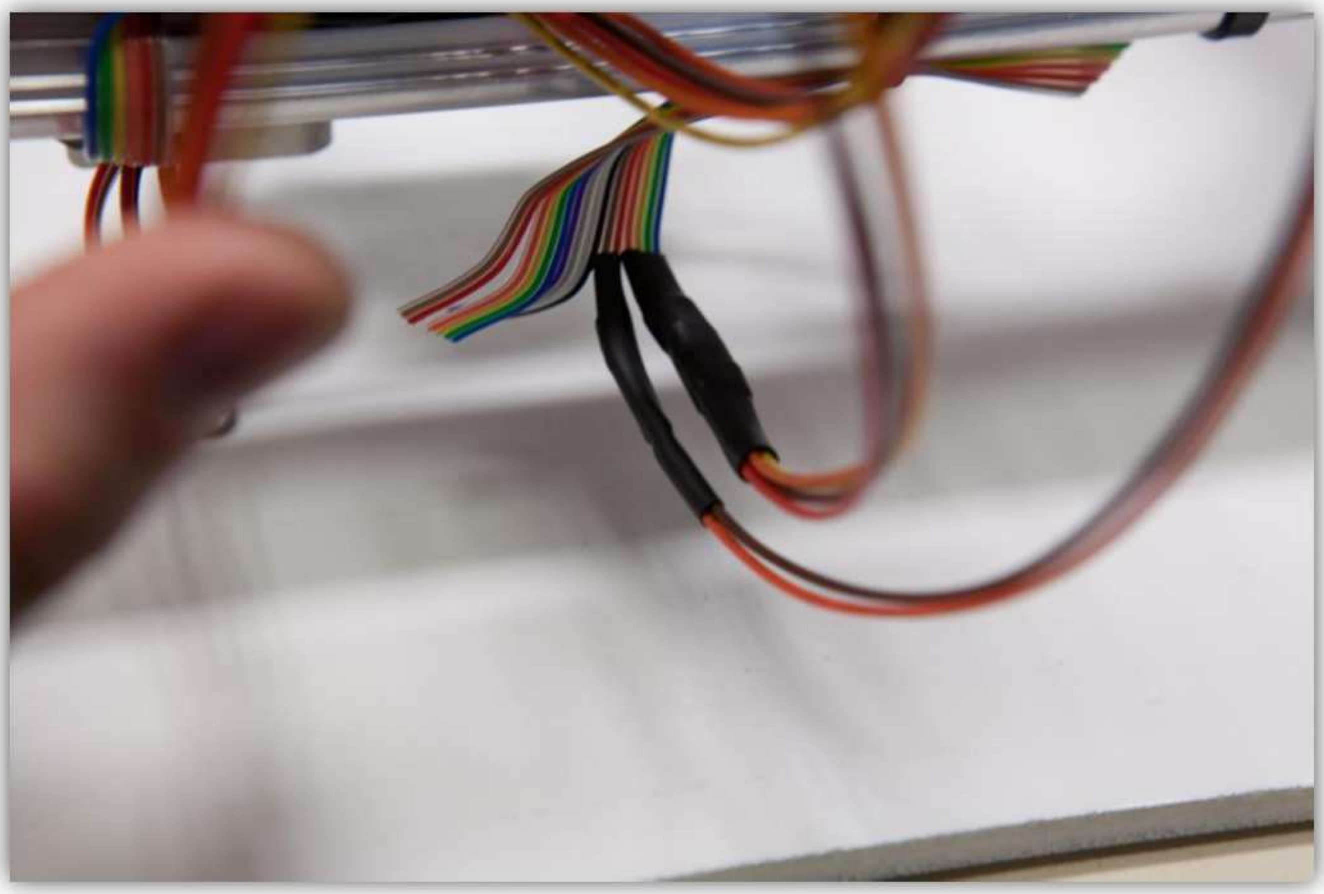
Slide the 2 small heat shrink tubes over the solder joints and heat them up.





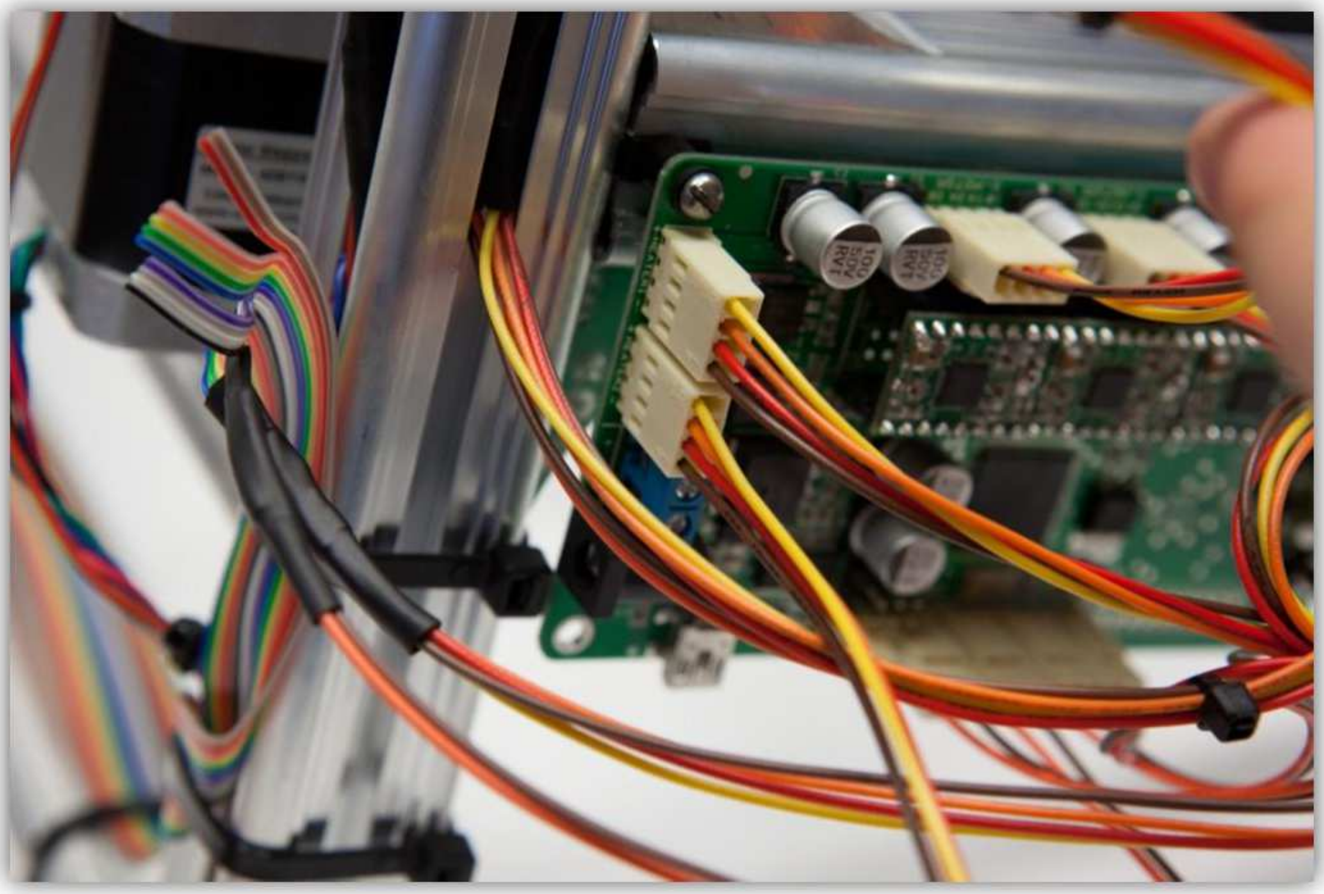


Now slide the medium size piece of heat shrink tubing over the 2 small pieces, heat the medium size piece so it covers and protects the 2 heat shrunk joints.

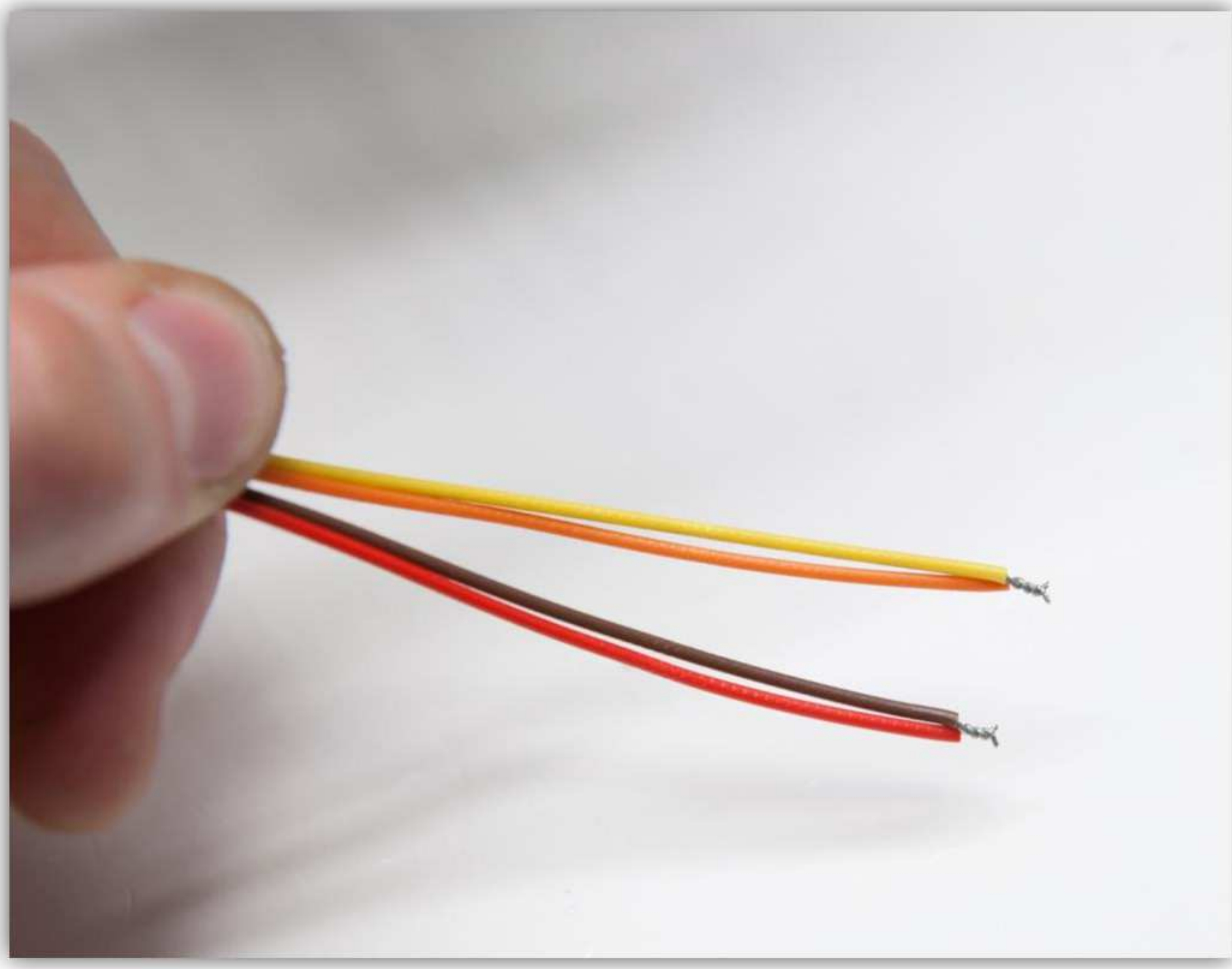


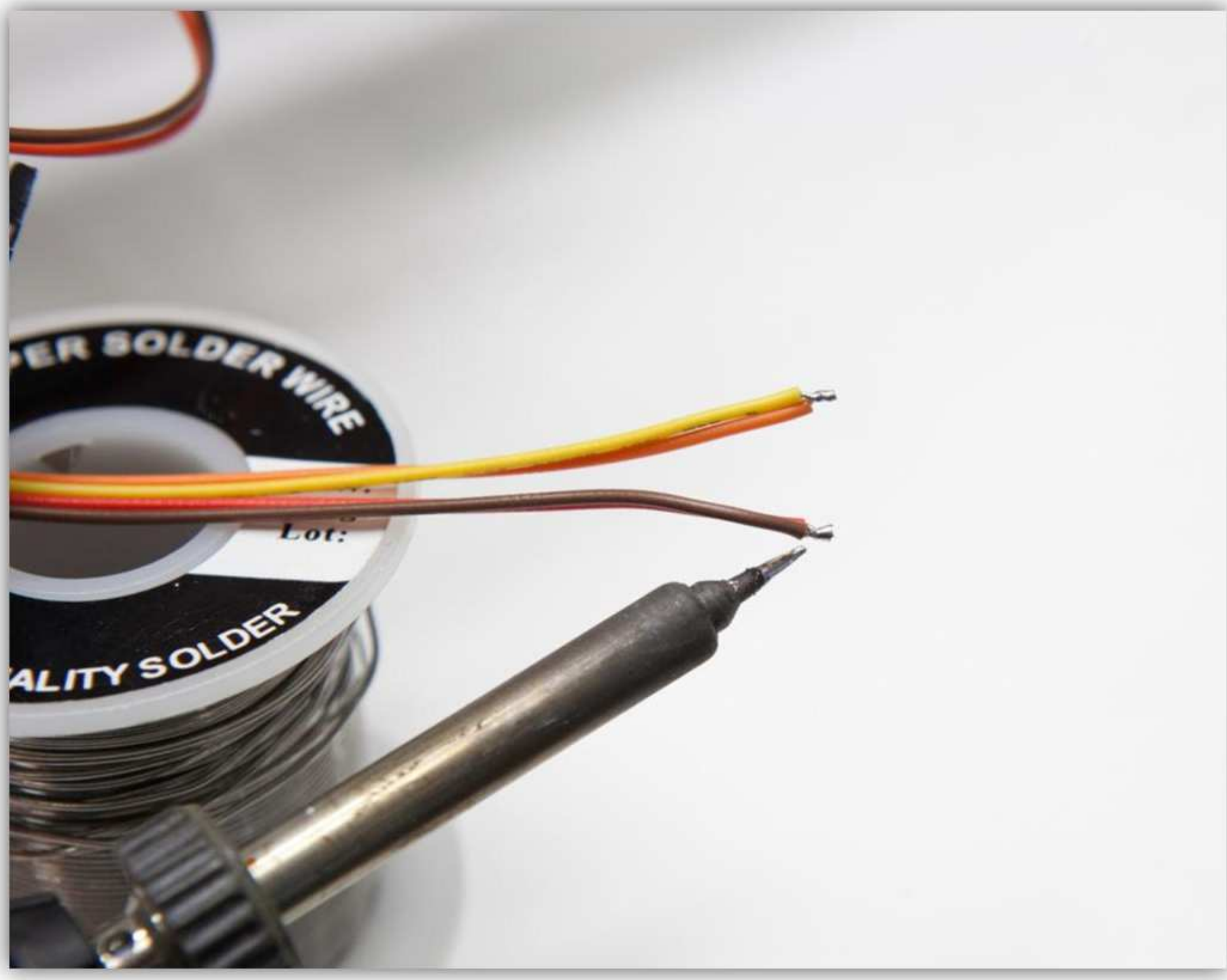
Take a board to wire connector with 4 wires out of the bag labelled with 40.

Plug the female connector in the male connector labelled with HEATER2 on the controller board.

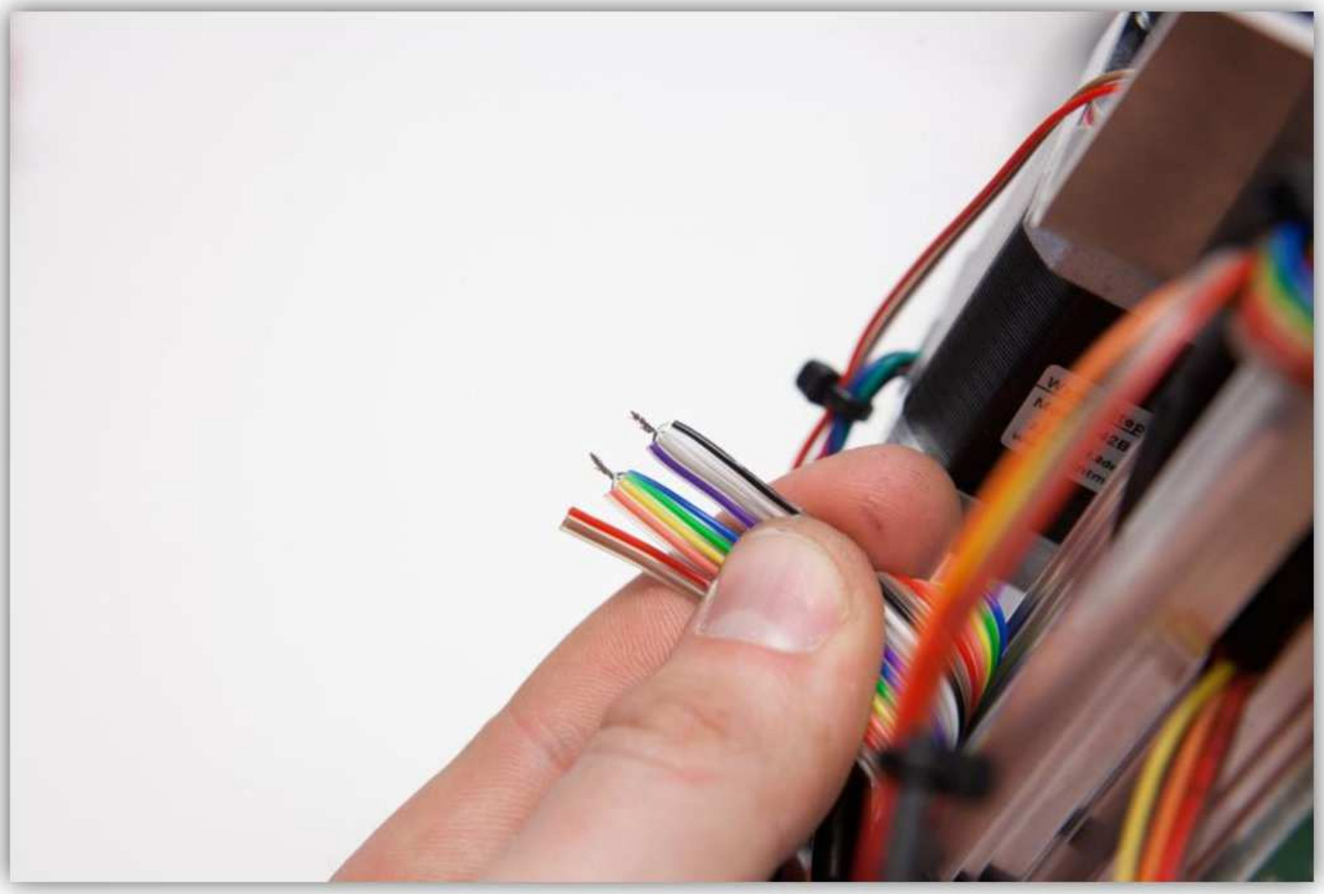


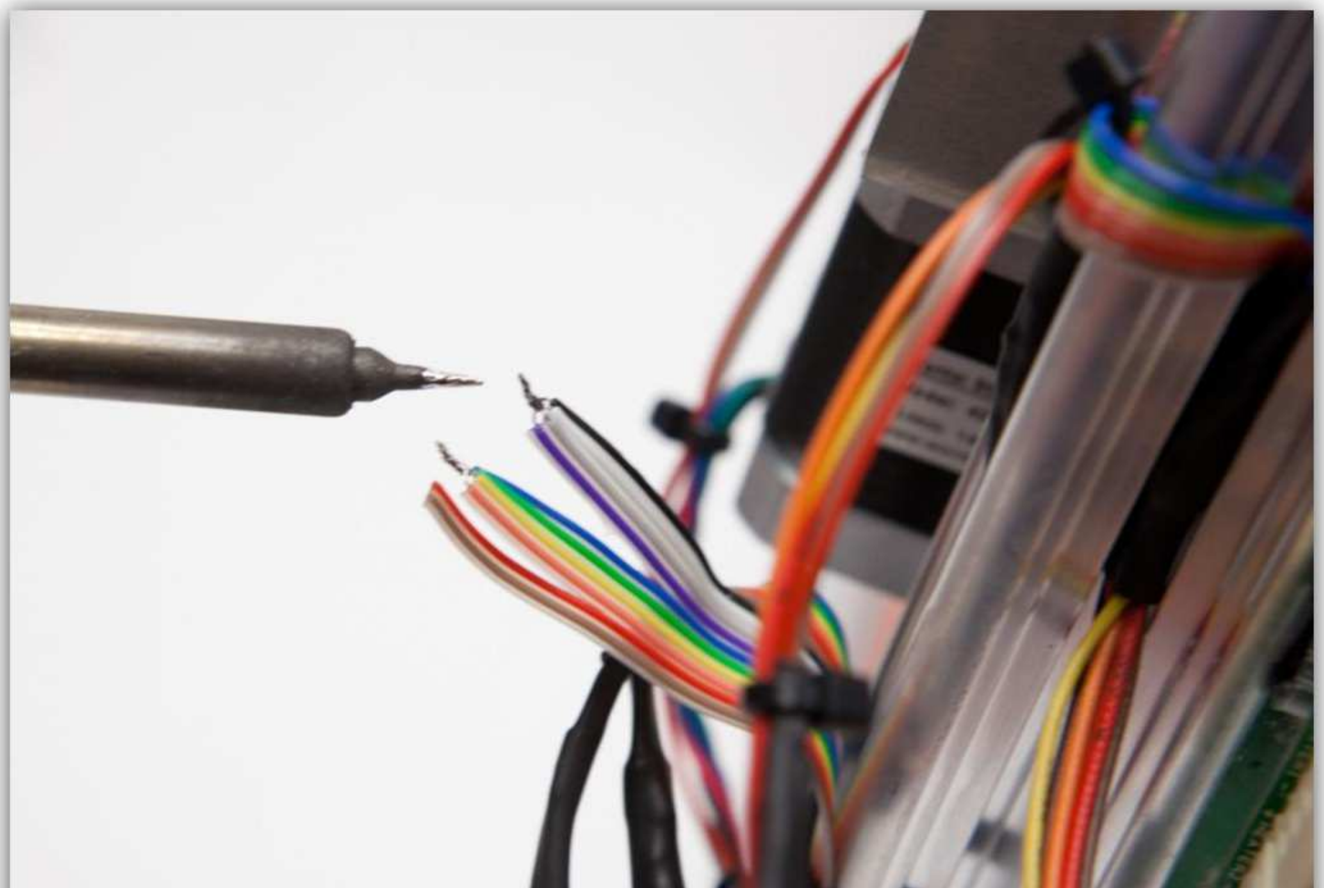
Twist and tin the ends of the **Yellow** and **Orange** wires together and twist and tin the ends of the **Red** and **Brown** wires together.





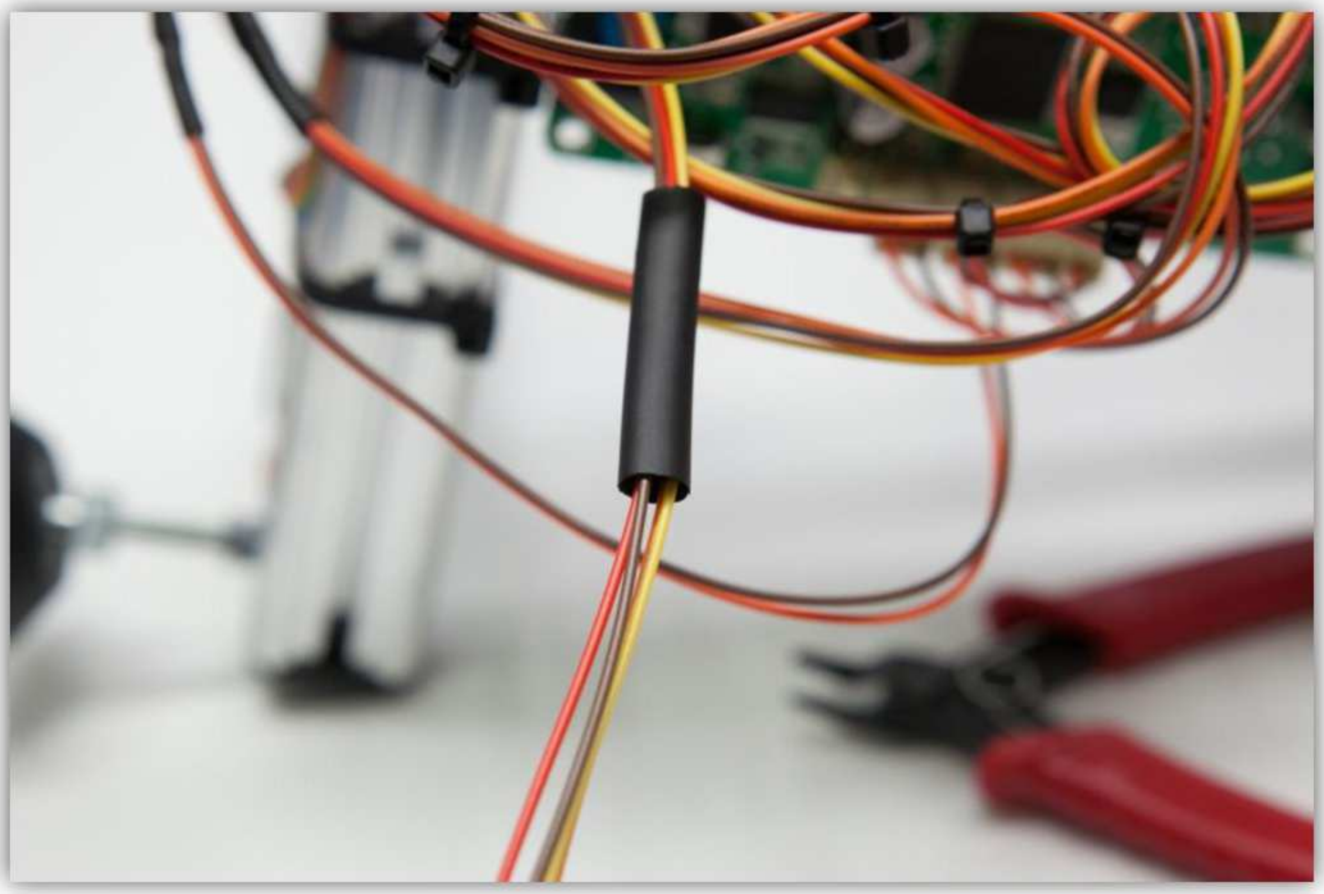
Next detach 2 cm (0.79") the **Orange, Yellow, Green, Blue** and **Violet, Grey, White, Black** as groups. Strip 5 mm (0.2") the ends, twist them together per group and tin the ends together per group.



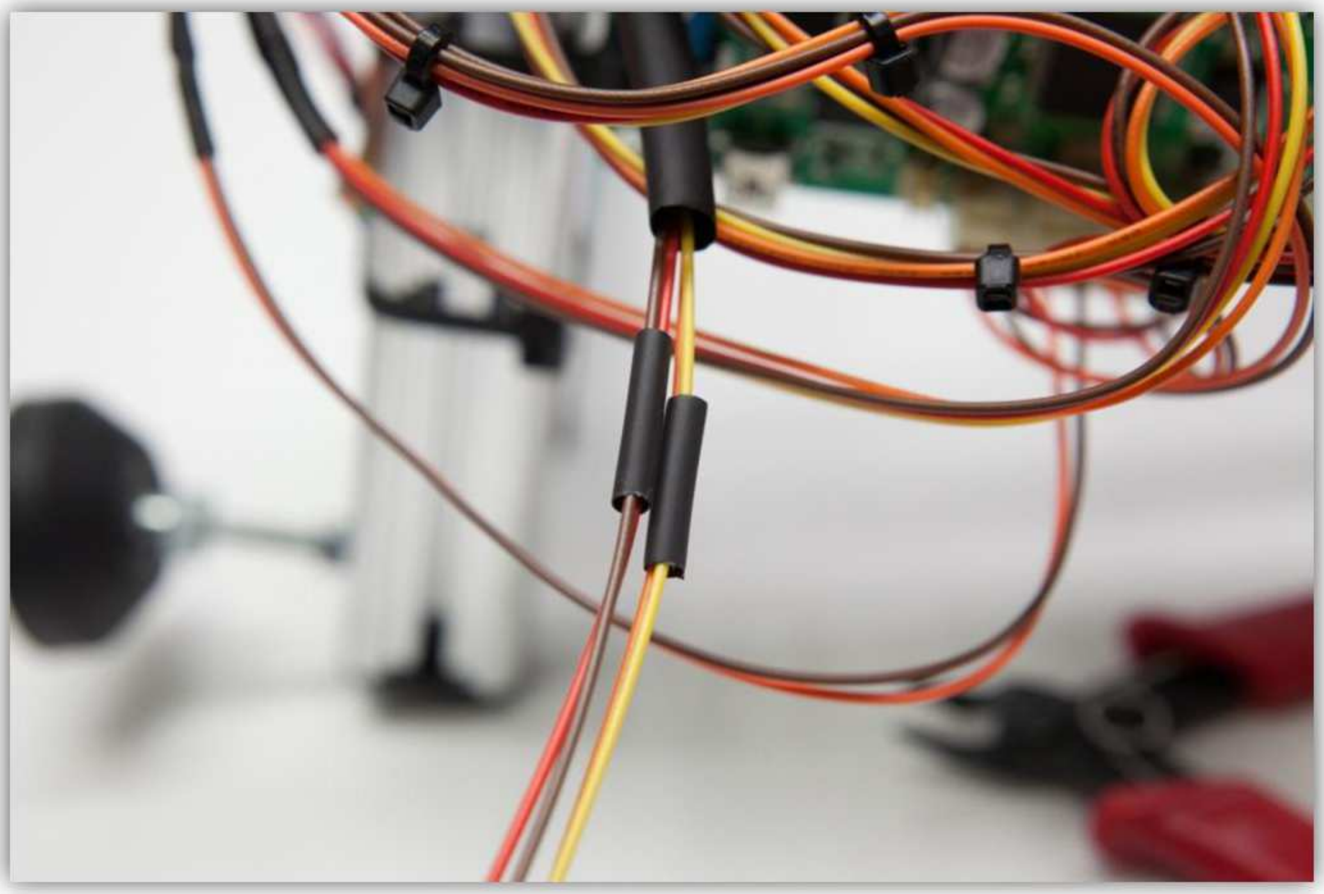


Cut 2 small pieces of the medium size heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

Slide the big heat shrink tubes over the 4 wires of the connector.

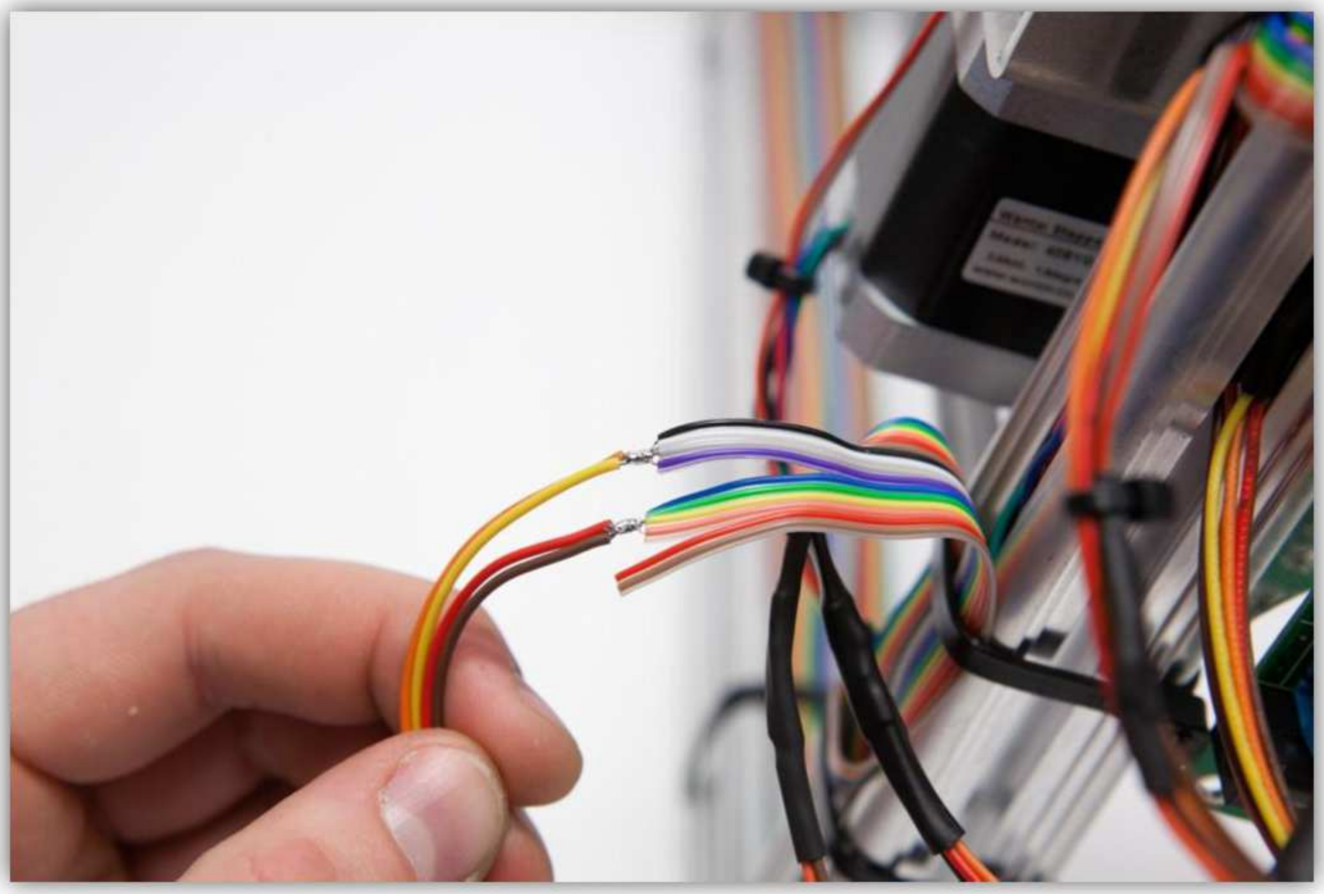


Slide 1 medium size heat shrink tubes over the **Yellow** and **Orange** wire and 1 medium size heat shrink tube over the **Red** and **Brown** wire.

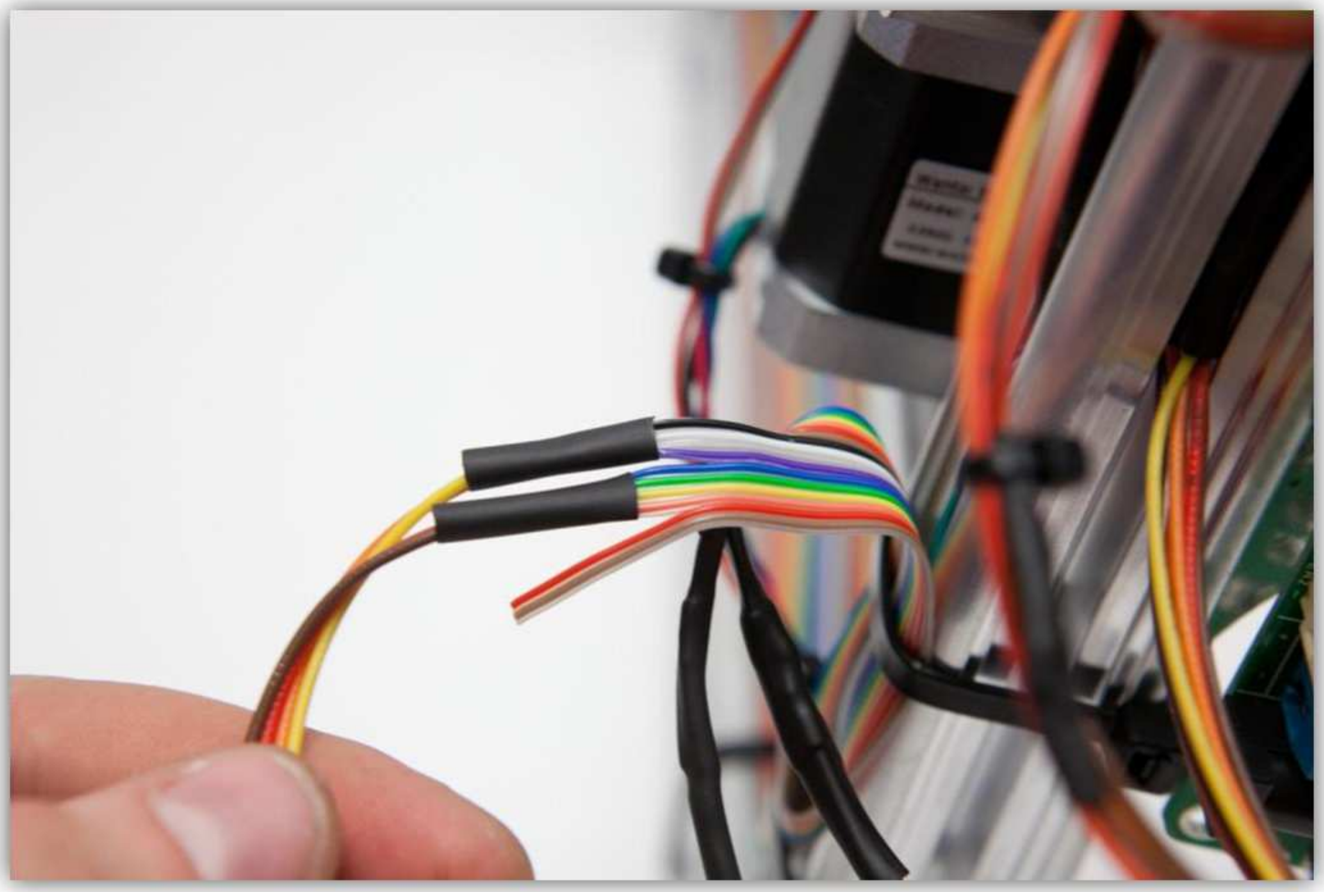


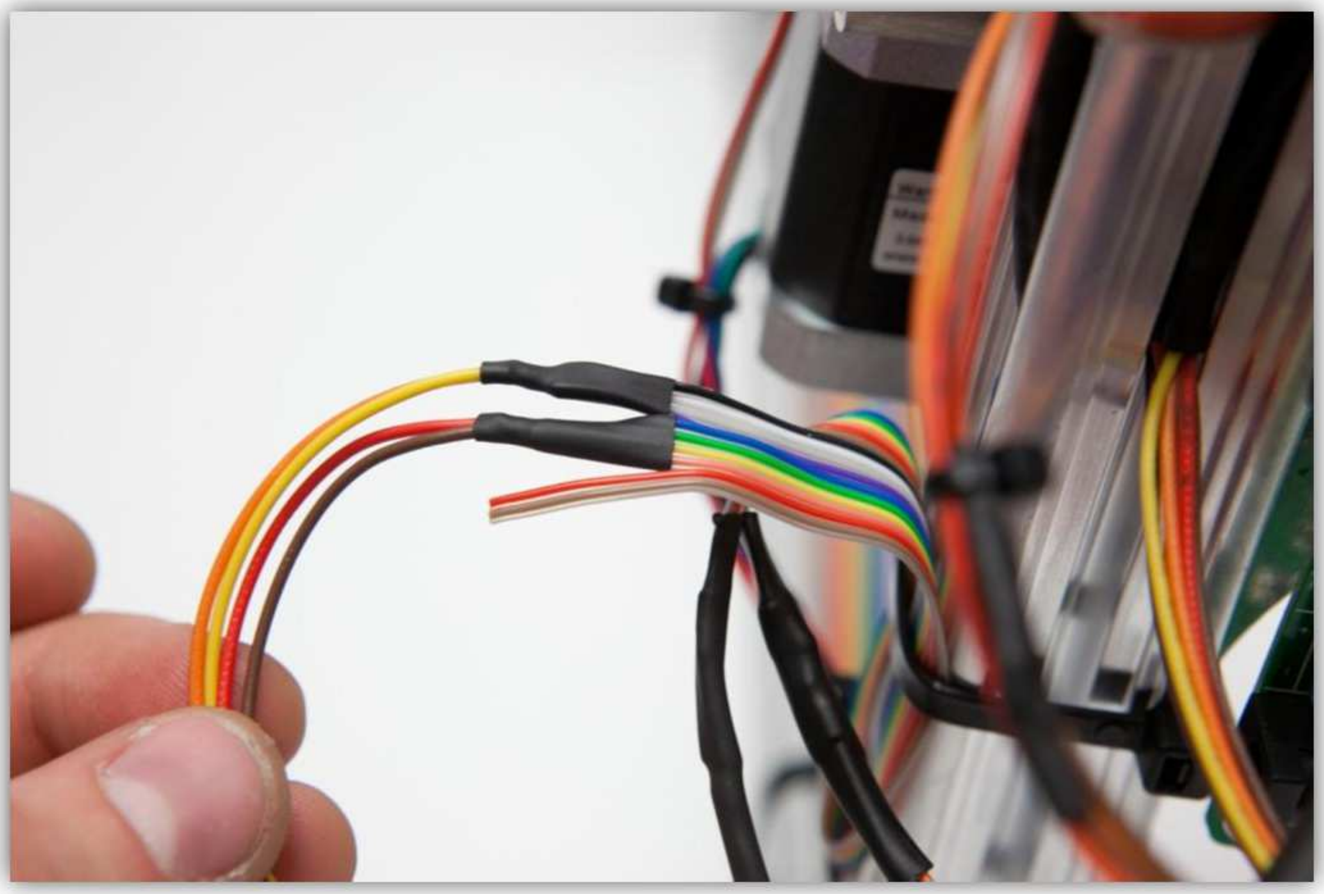
Solder the 6 wires from the connector to the 4 wires of the flat cable you tinned earlier. **Watch the colours closely and respect the groups.**

Flat cable	**->**	**Connector wires**
Orange, Yellow, Green, Blue	**->**	**Red** and **Brown**
Violet, Grey, White, Black	**->**	**Yellow** and **Orange**

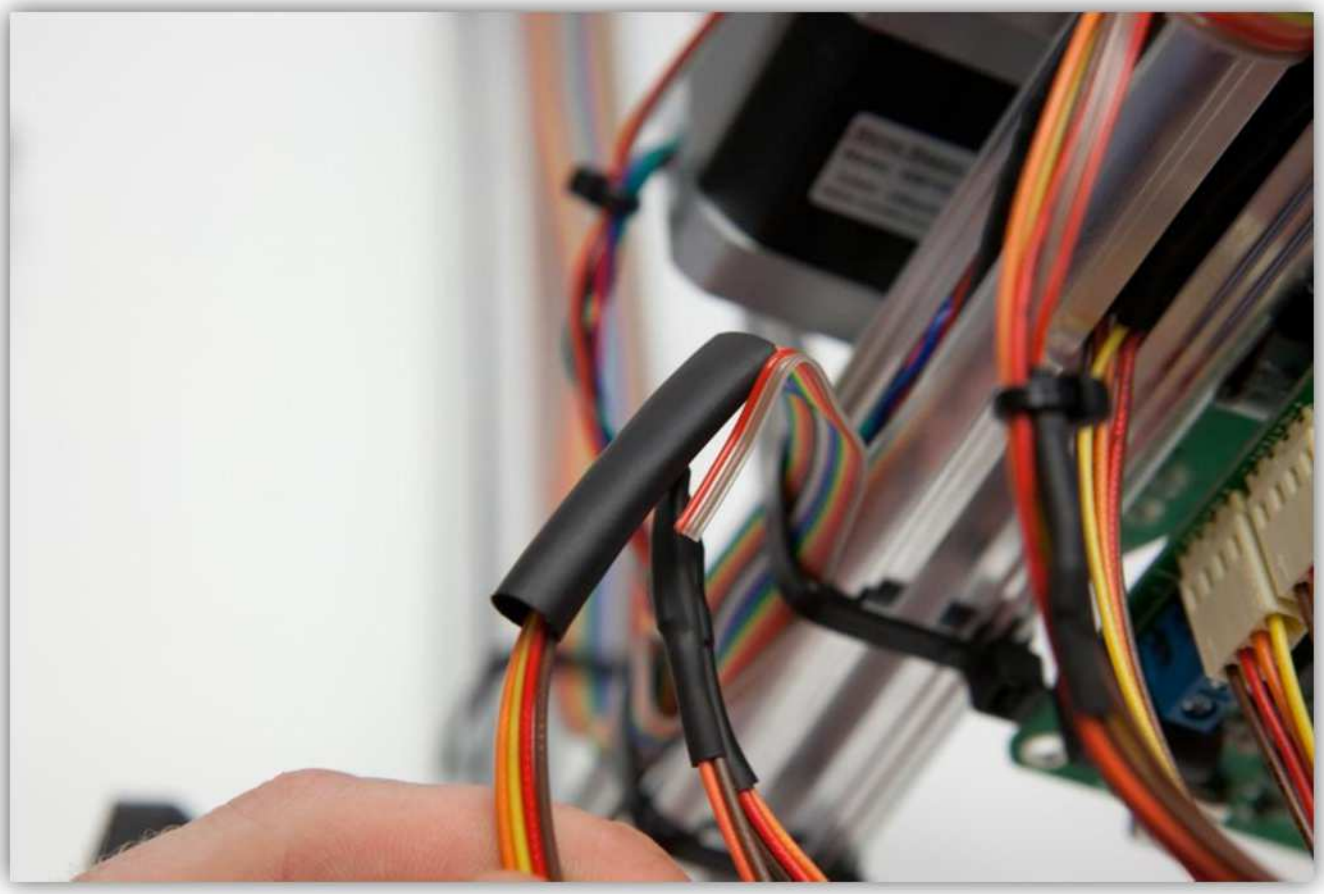


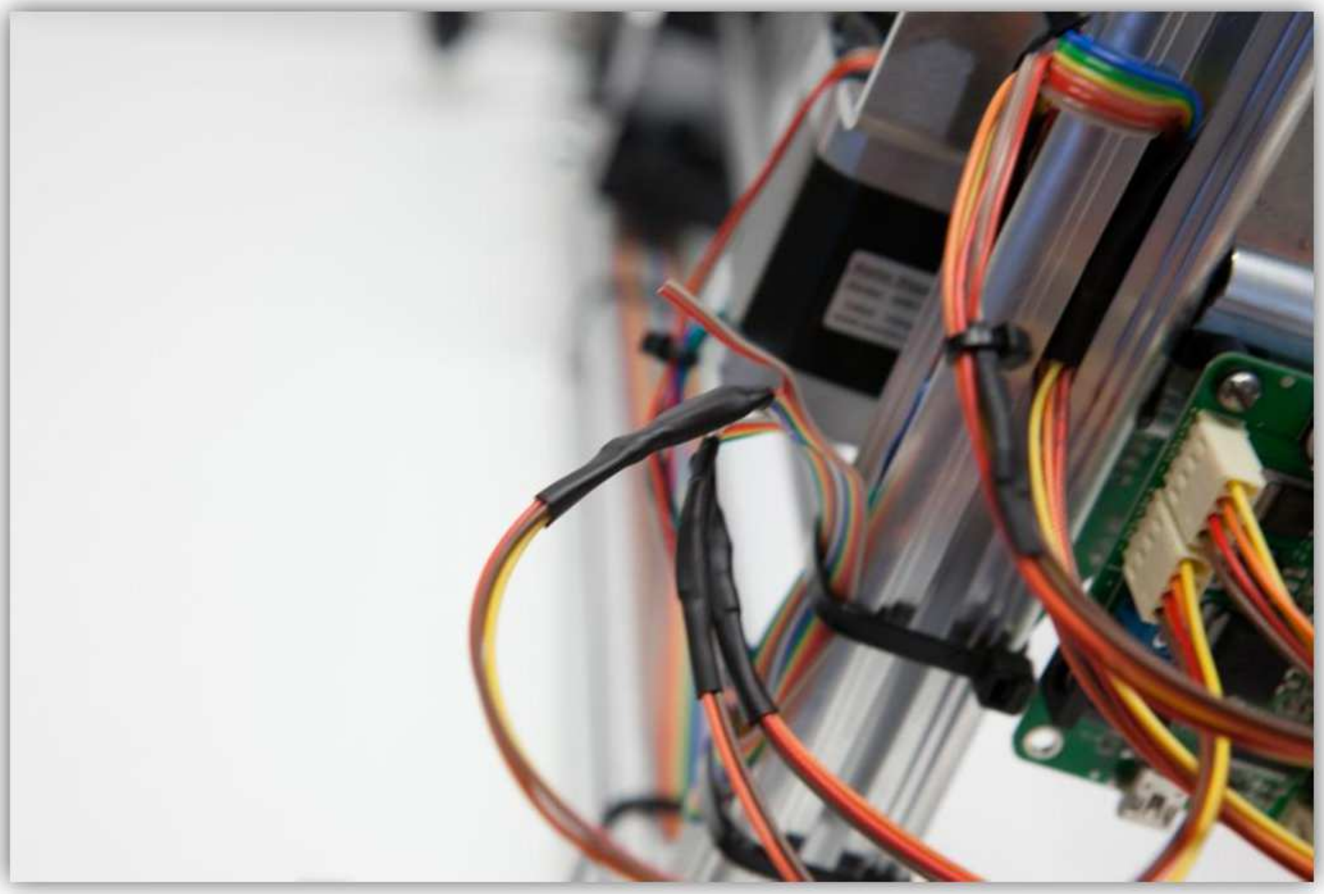
Slide the medium size heat shrink tubes over the solder joints and heat them up so they shrink.



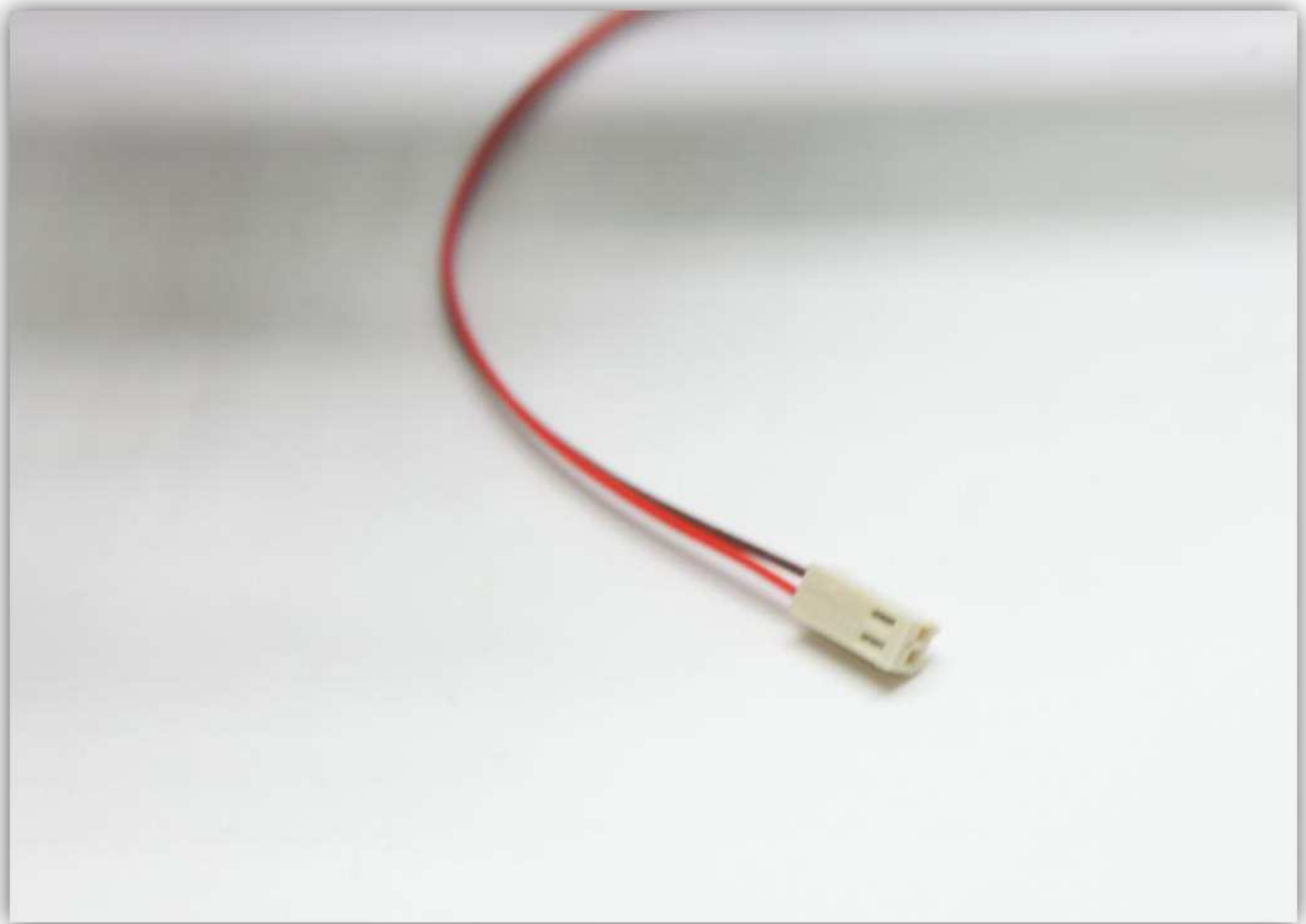


Now slide the big piece of heat shrink tubing over the 2 medium size pieces, heat the big piece so it covers and protects the 2 heat shrunk joints. Secure all the joints with 2 large tie-strips to the profile.

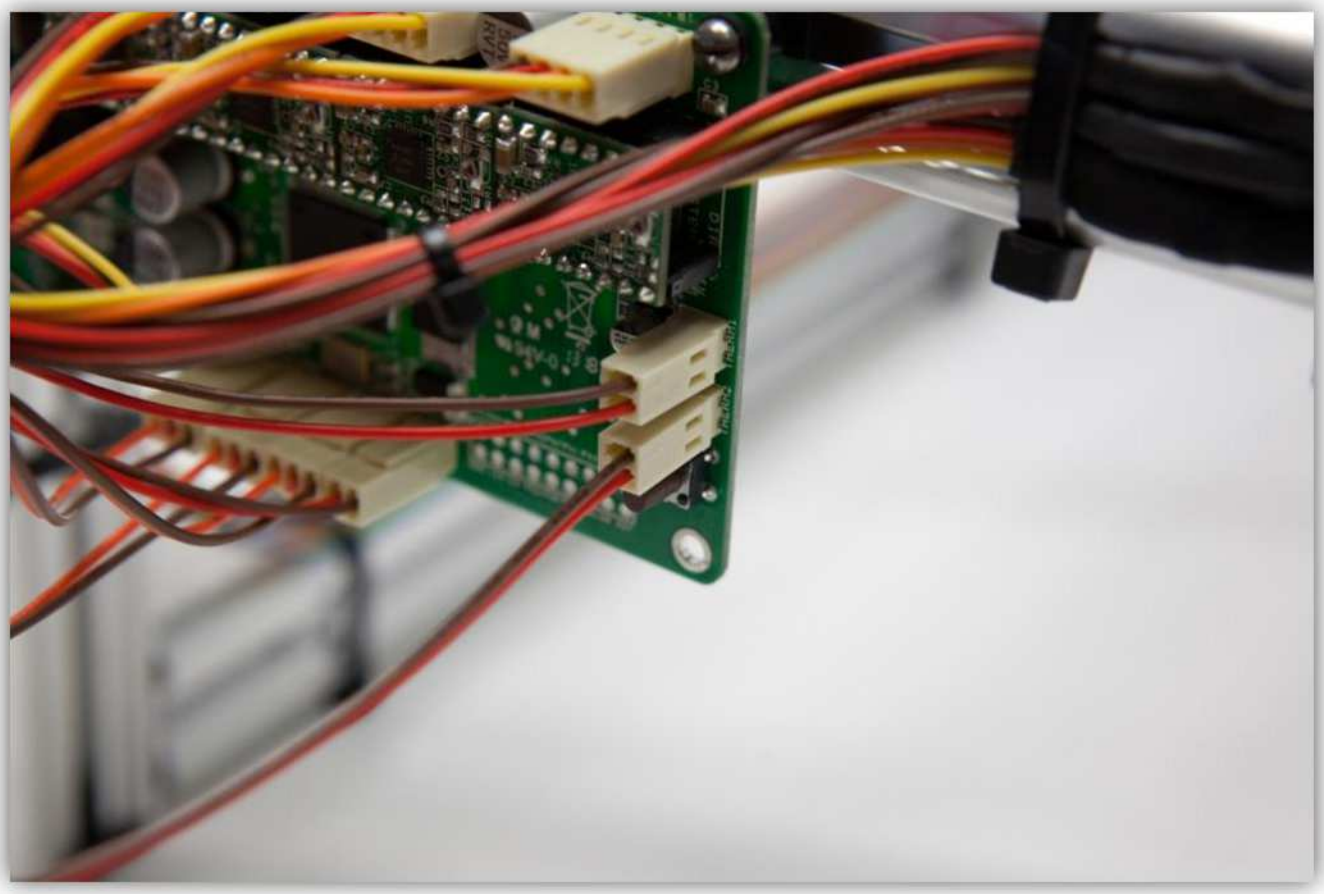




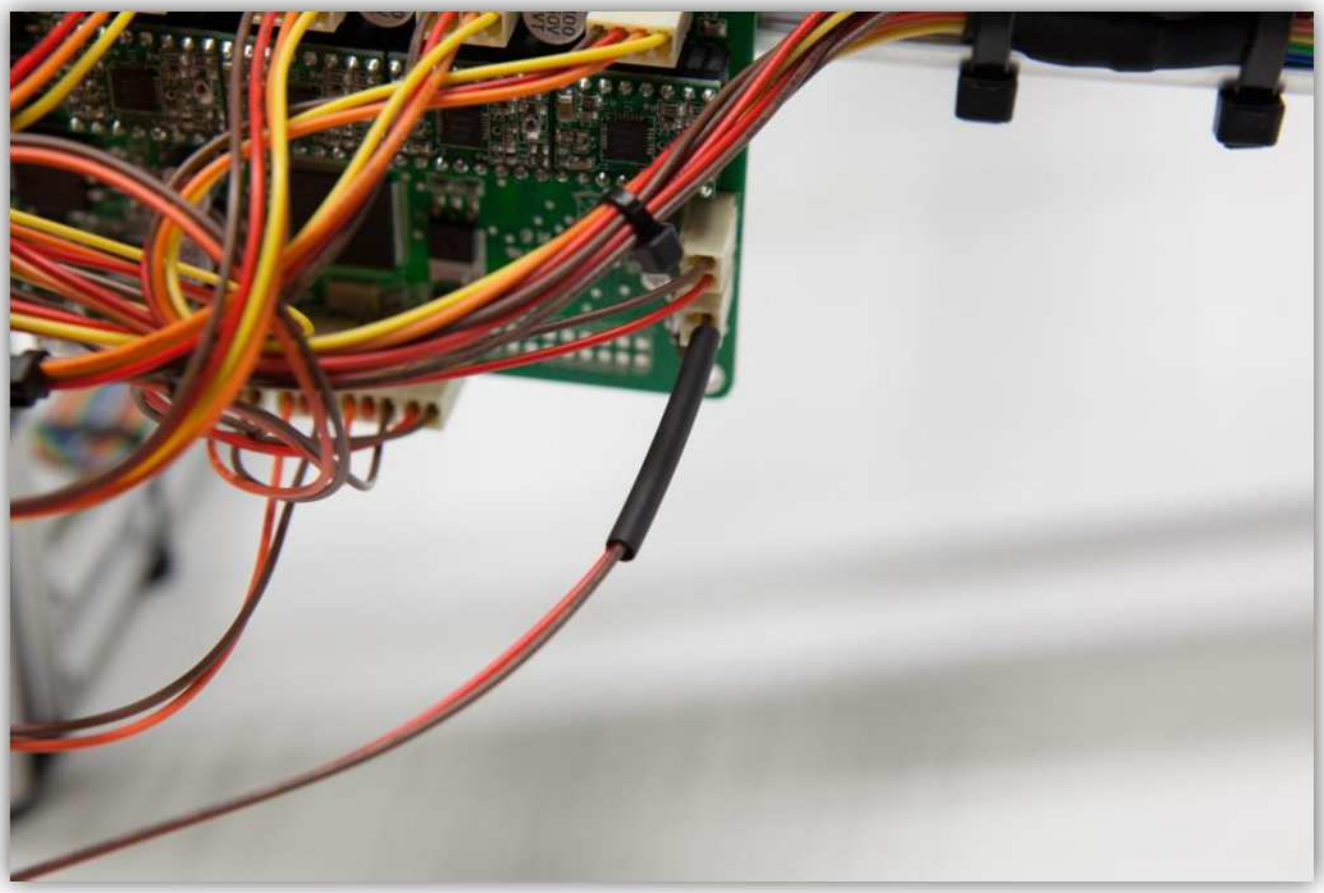
Take a board to wire connector with 2 wires out of the bag labelled with 40.



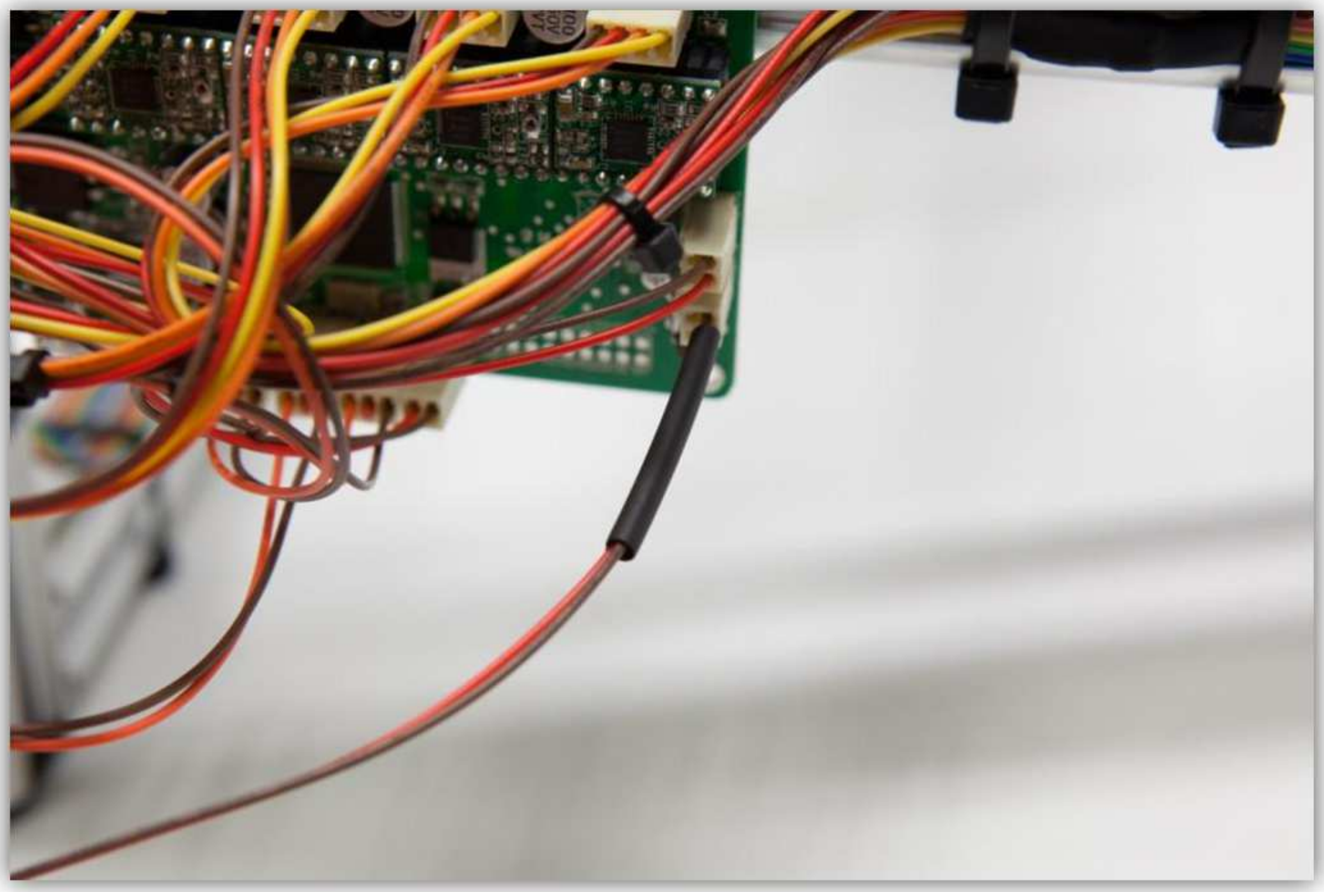
Plug the female connector in the male connector labelled with THERM2 on the controller board.



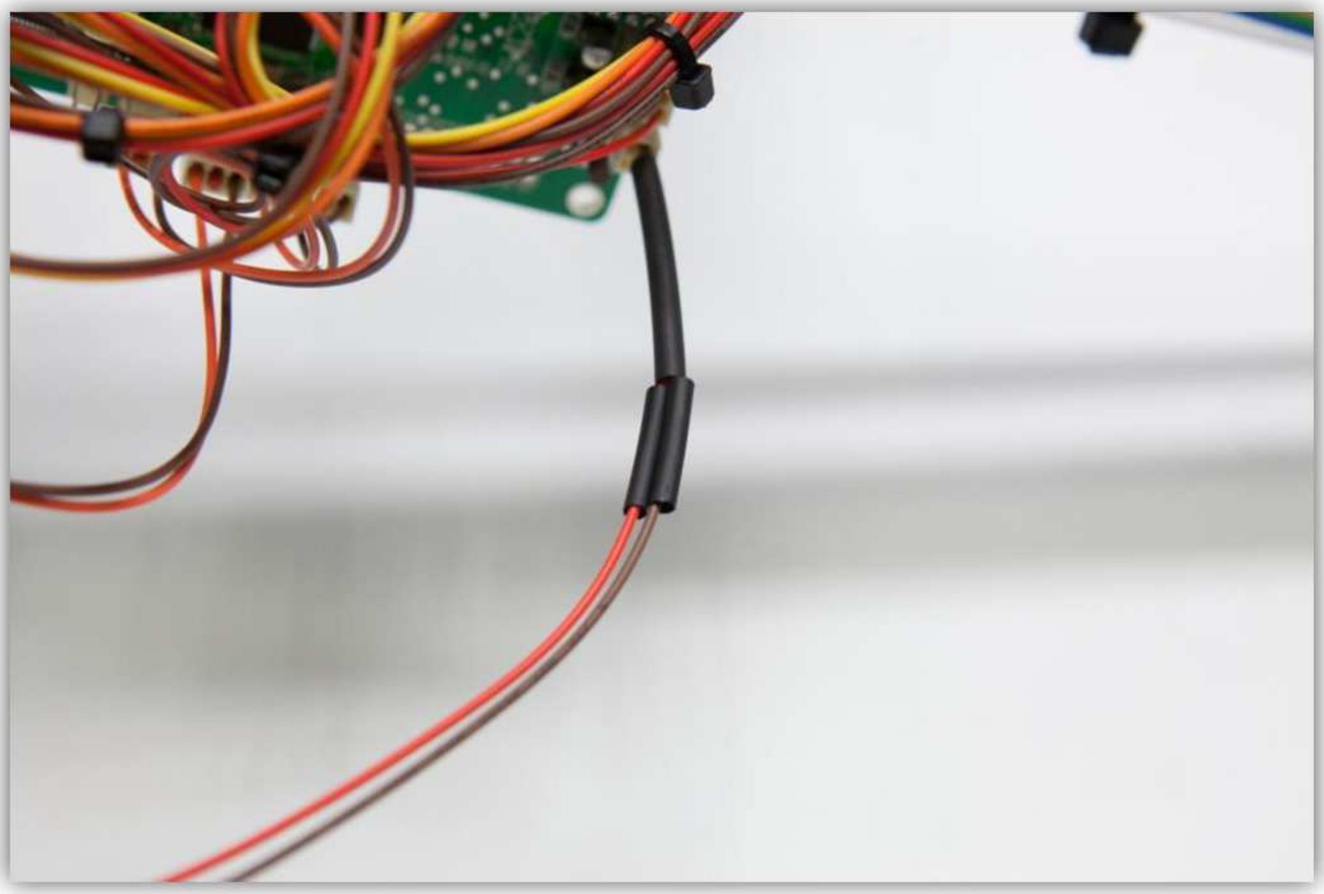
Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.



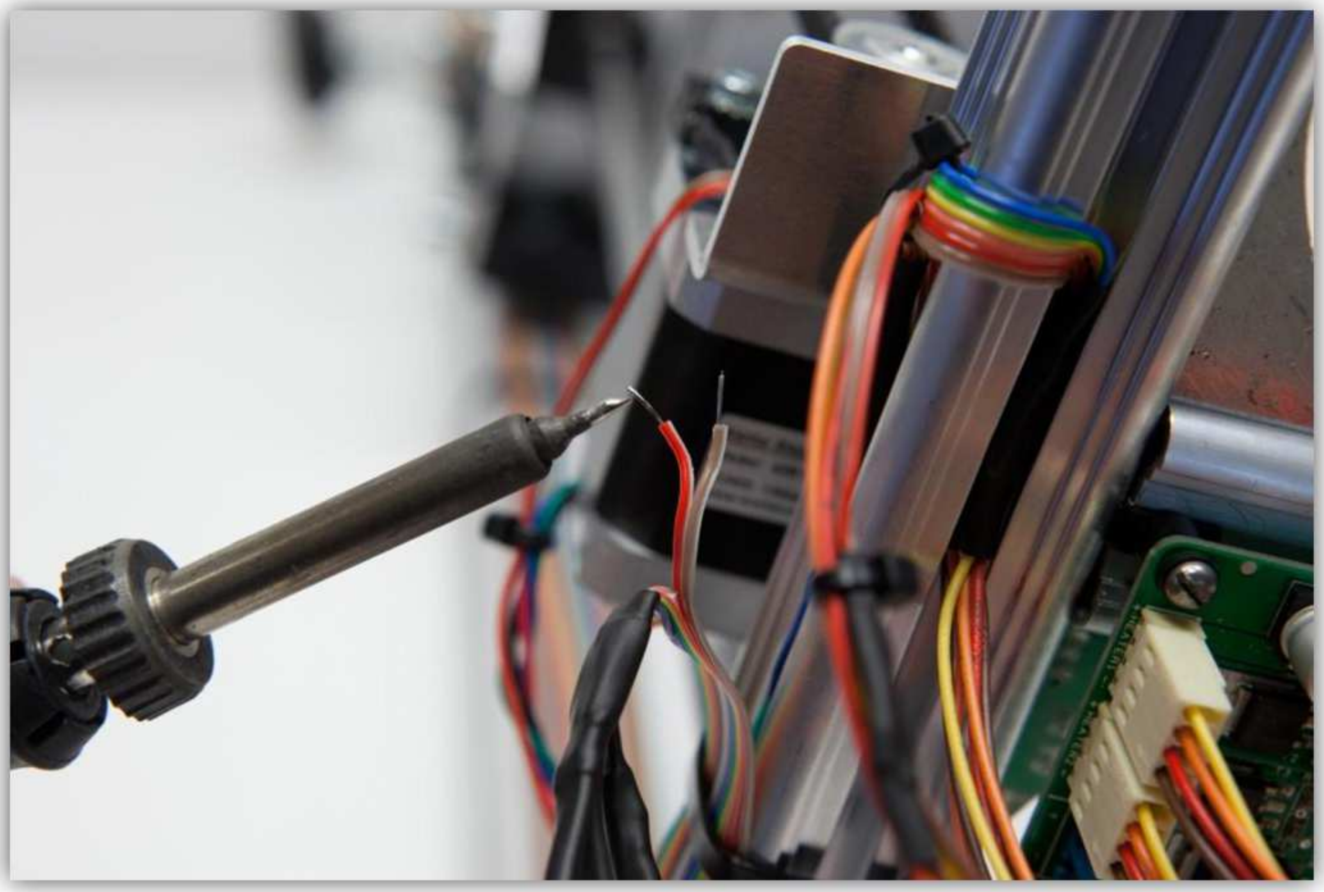
Slide the medium size heat shrink tubes over the 2 wires of the connector.



Slide the 2 small heat shrink tubes over the 2 wires of the connector.

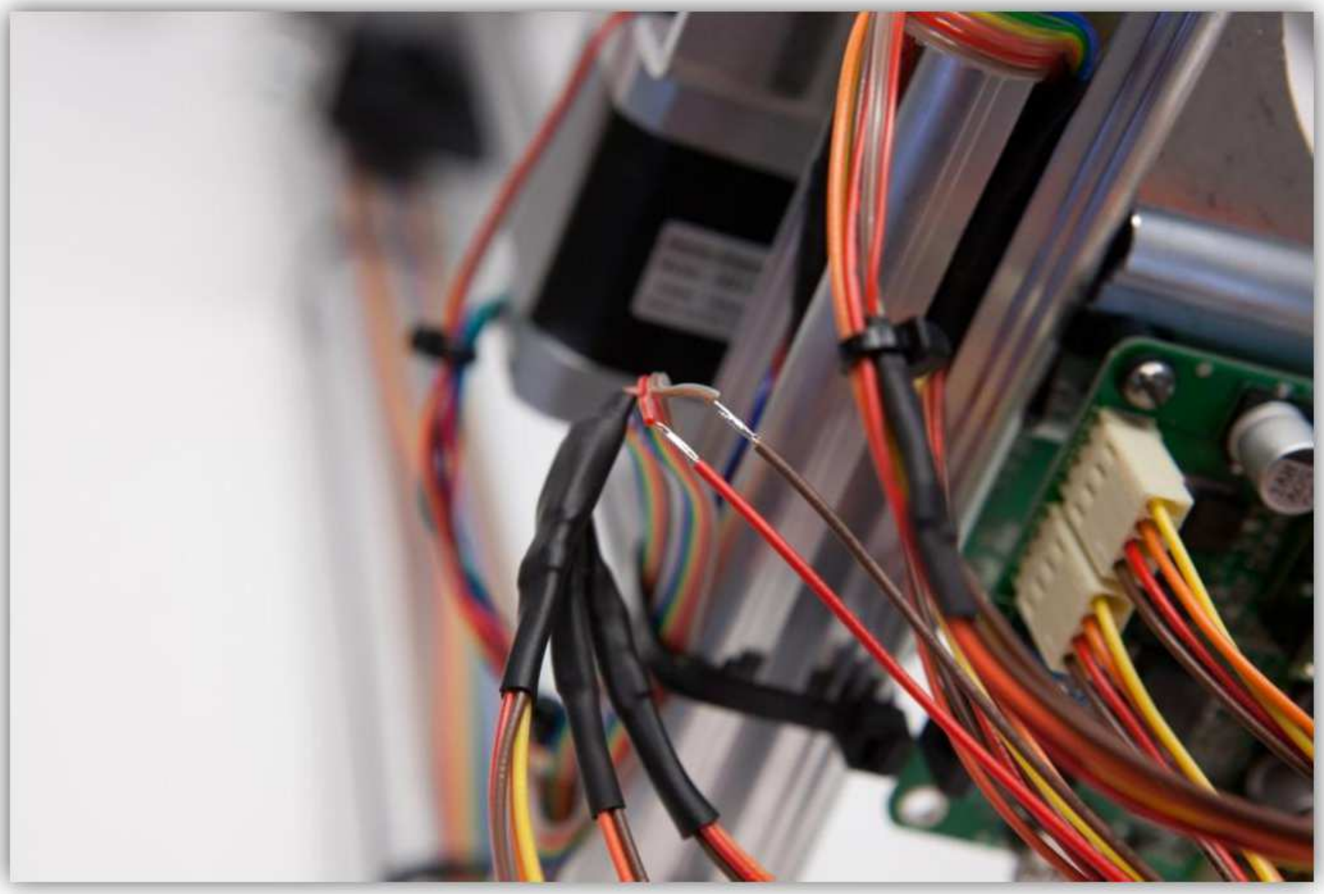


Strip the two wires 5 mm (0.2") that are left over (**Red** and **Brown**) and tin them.

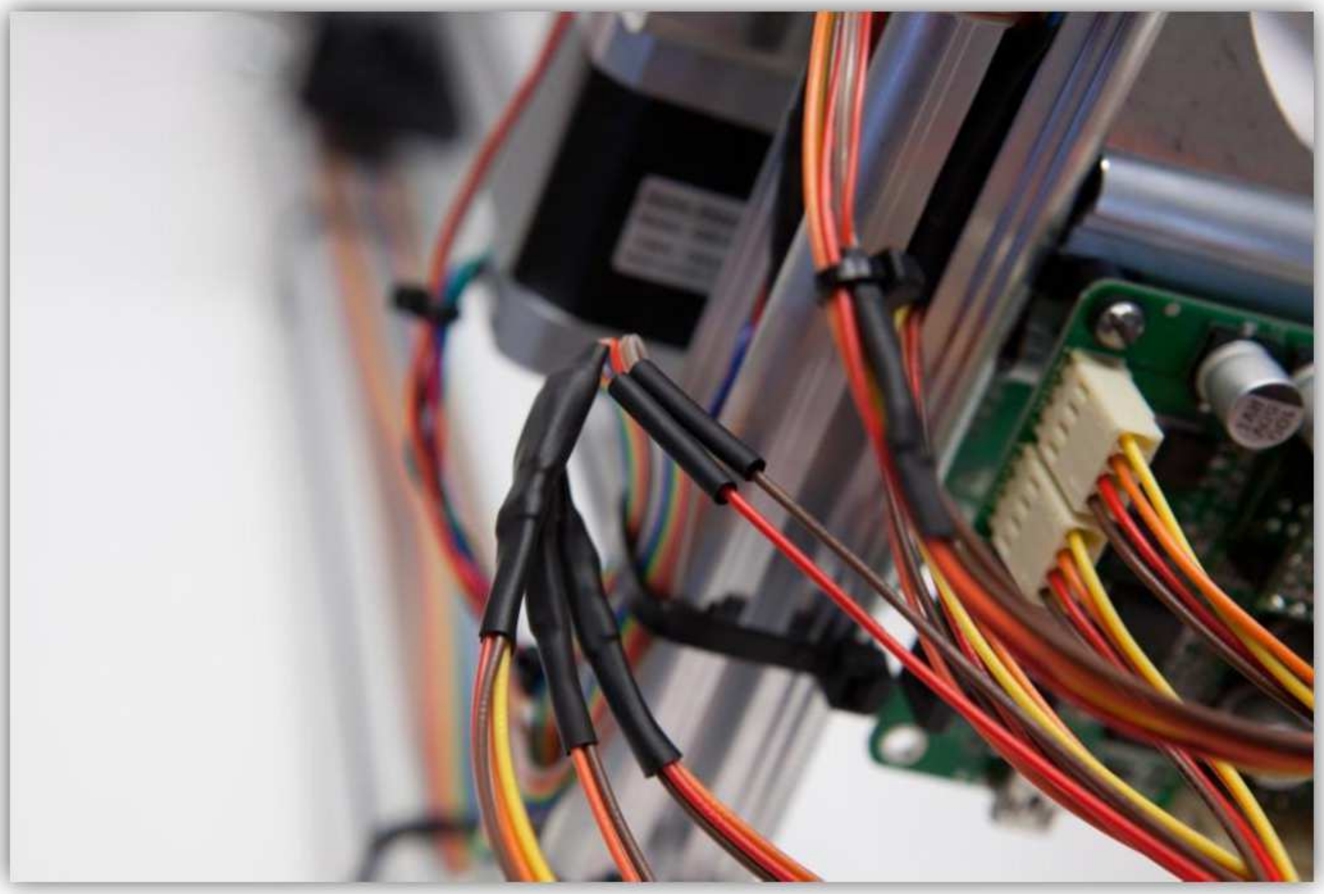


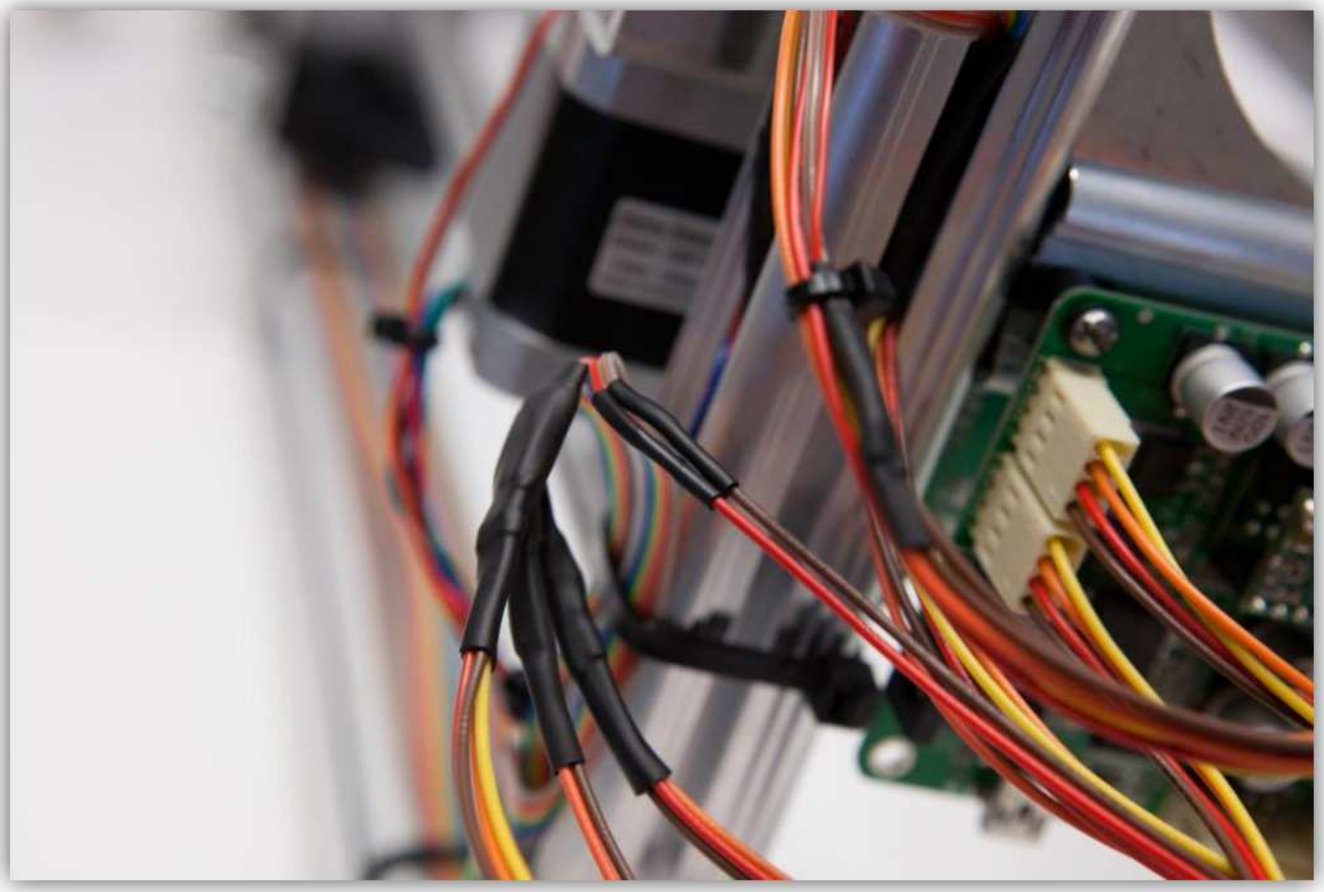
Solder the 2 wires from the connector to the 2 wires of the flat cable. **Watch the colours closely.**

Flat cable	->	Connector wires
Red	->	Red
Brown	->	Brown

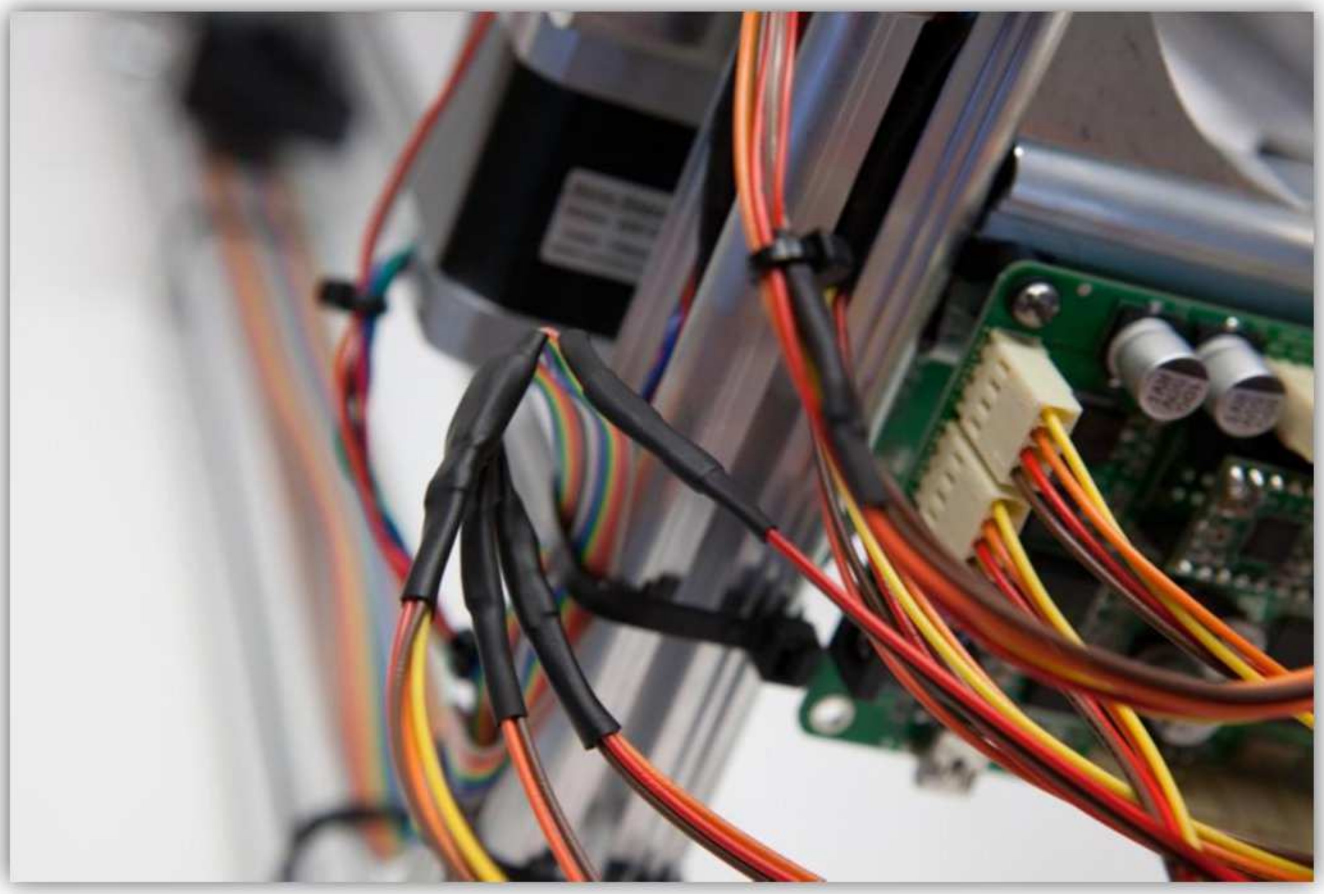


Slide the 2 small heat shrink tubes over the solder joints and heat them up.

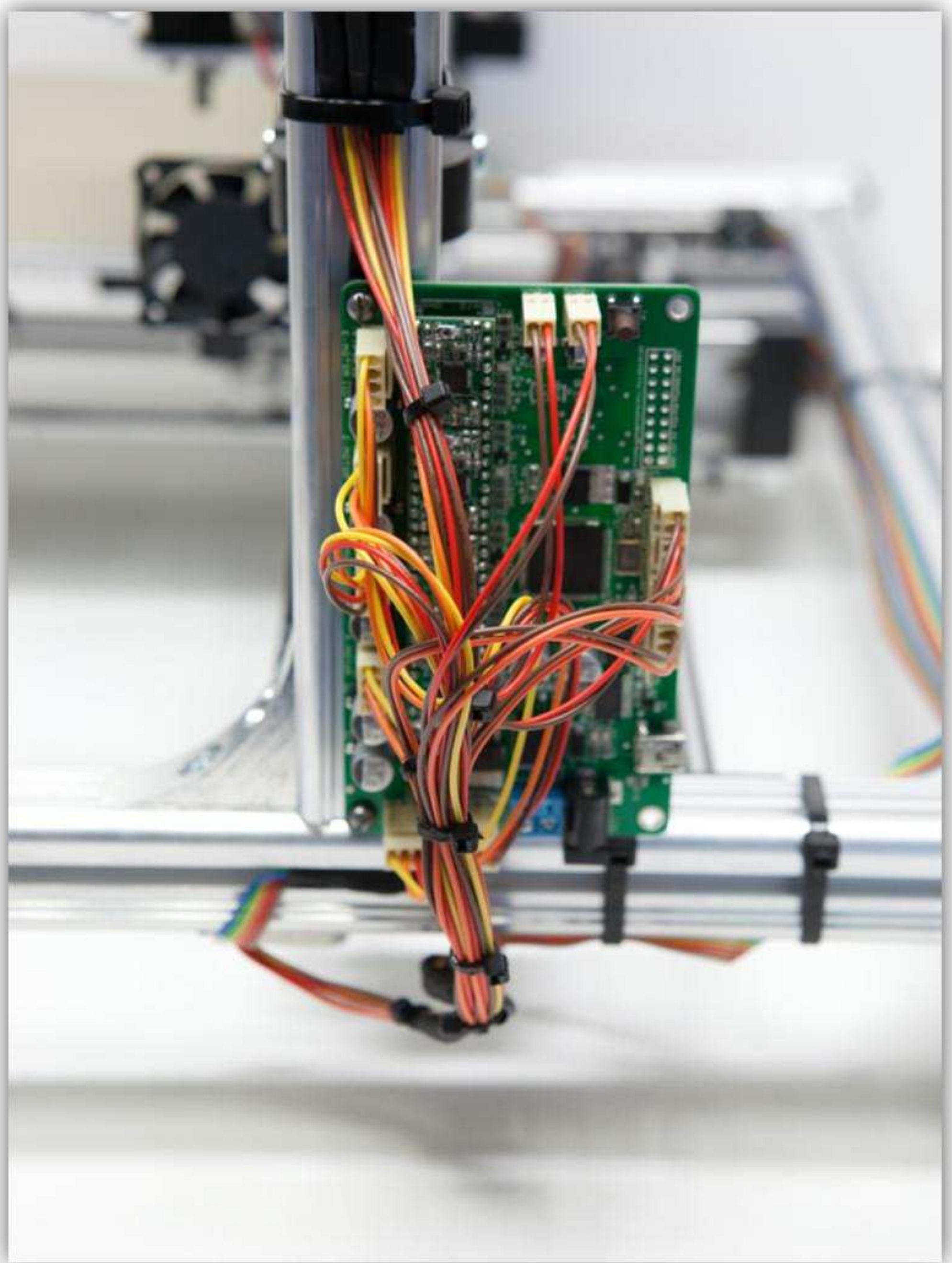


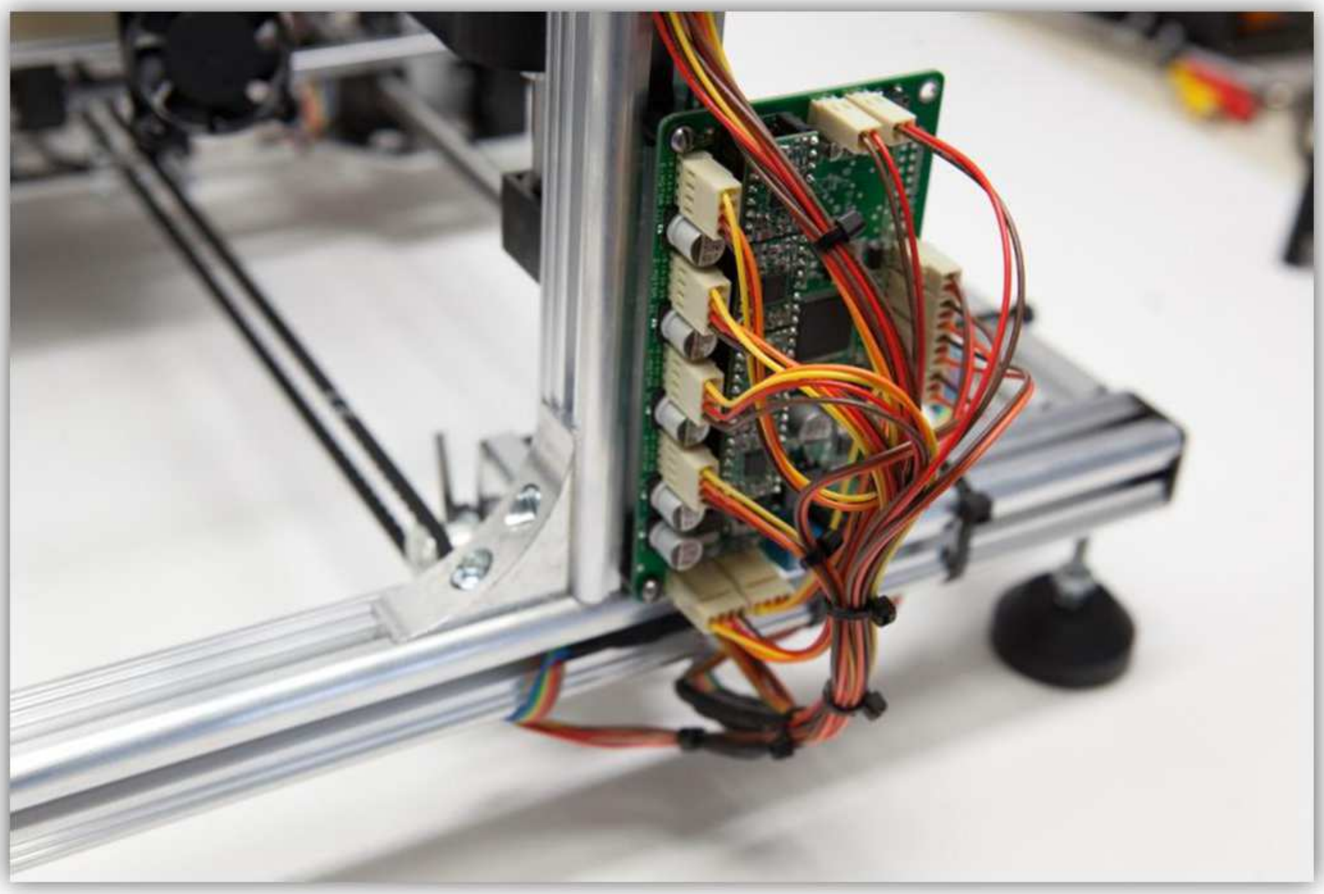


Now slide the medium size piece of heat shrink tubing over the 2 small pieces, heat the medium size piece so it covers and protects the 2 heat shrunk joints.



Use small tie-strips to keep the cables together.





019 – ASSEMBLING THE HOTEND

Take the bag labelled with 31 out of the box. You should have these parts. **Take EXTRA care with the small NTC THERMISTOR! It is very fragile.**

Slide the white plastic spacer into the aluminium bracket.

Slide the copper barrel into the white spacer. **Watch the orientation closely.**

Screw on the white plastic barrel.

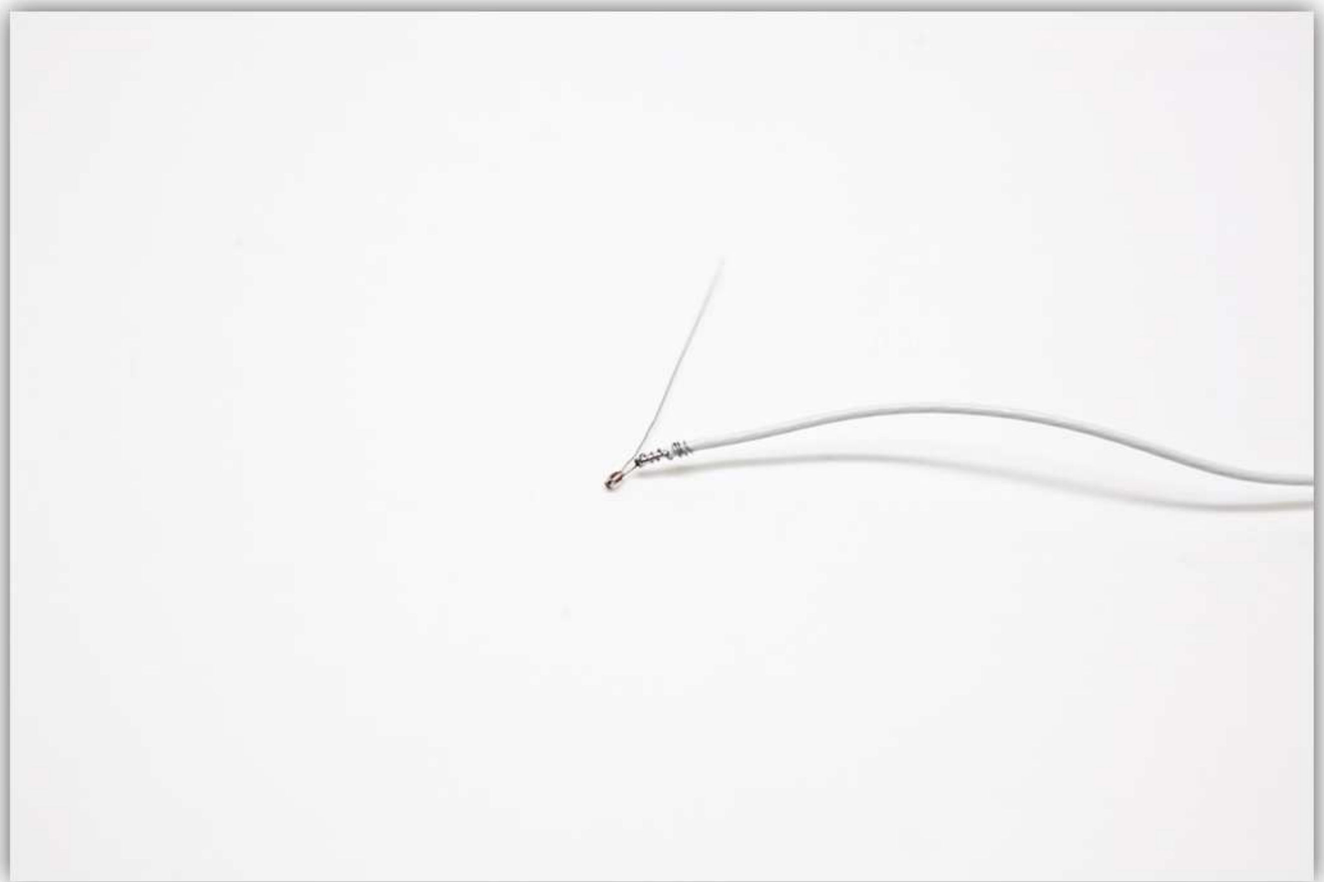
Take the heater block.

Slide the 2 sleeves of the cartridge, cut them in half and slide two of them back onto the heater cartridge.

Cut the wires of the heater cartridge in half.

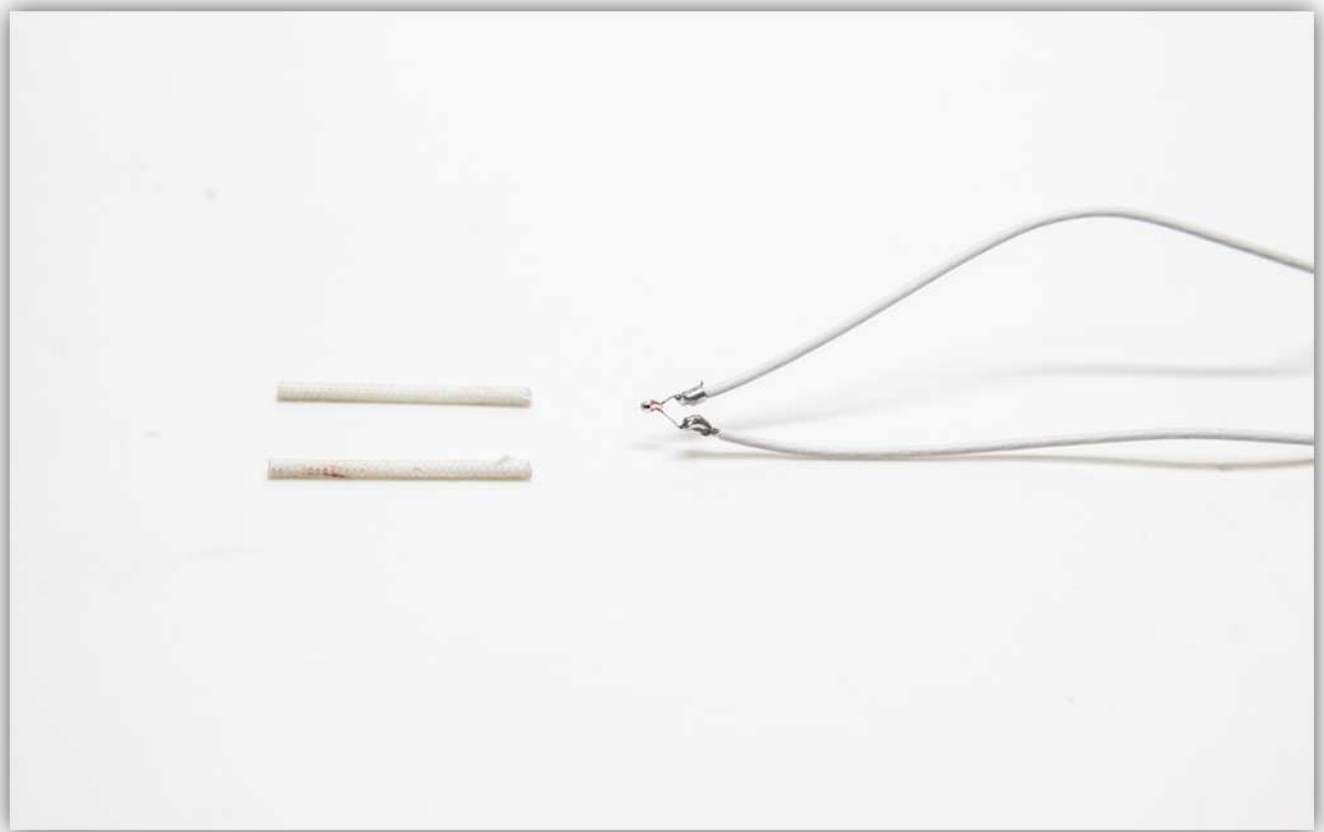
Strip 5 mm (0.2") all the ends of the wires you have cut. Take the two loose wires.

Carefully (!) wrap one leg of the NTC onto the bare wire. Solder it in place.



Carefully (!) wrap the other leg of the NTC onto the second bare wire. Solder it in place.

Slide the 2 remaining sleeves over the connections.



Use the small washer and the small copper screw to **lightly** fasten the wires to the heater block. **Make sure that the glass bead of the NTC fits snugly in the small hole and that you don't over tighten the small screw (this could cause a short circuit between the 2 wires!!**

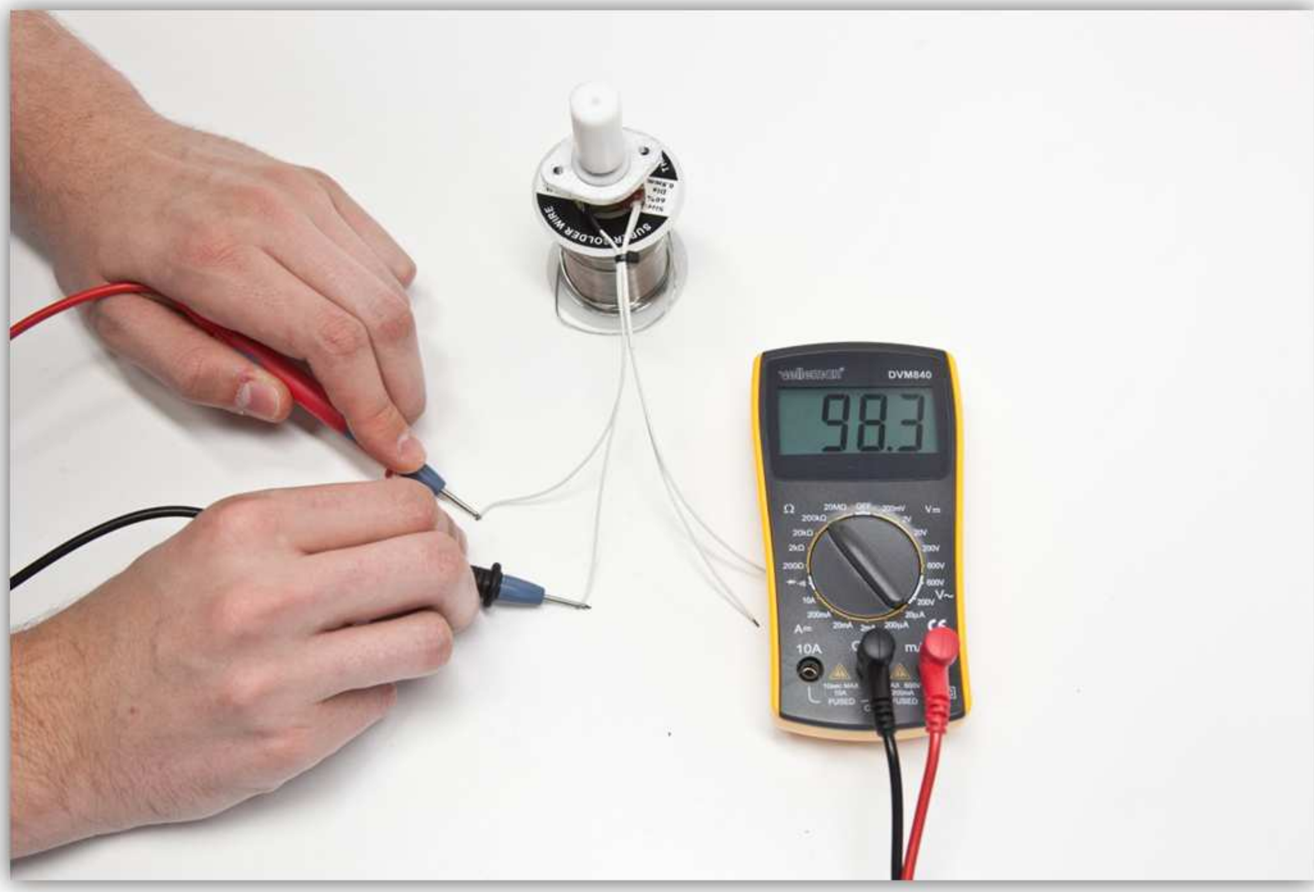
Use a small tie-strip to hold the wires of the NTC and the heater block together.

Slide the big washer over the copper barrel.

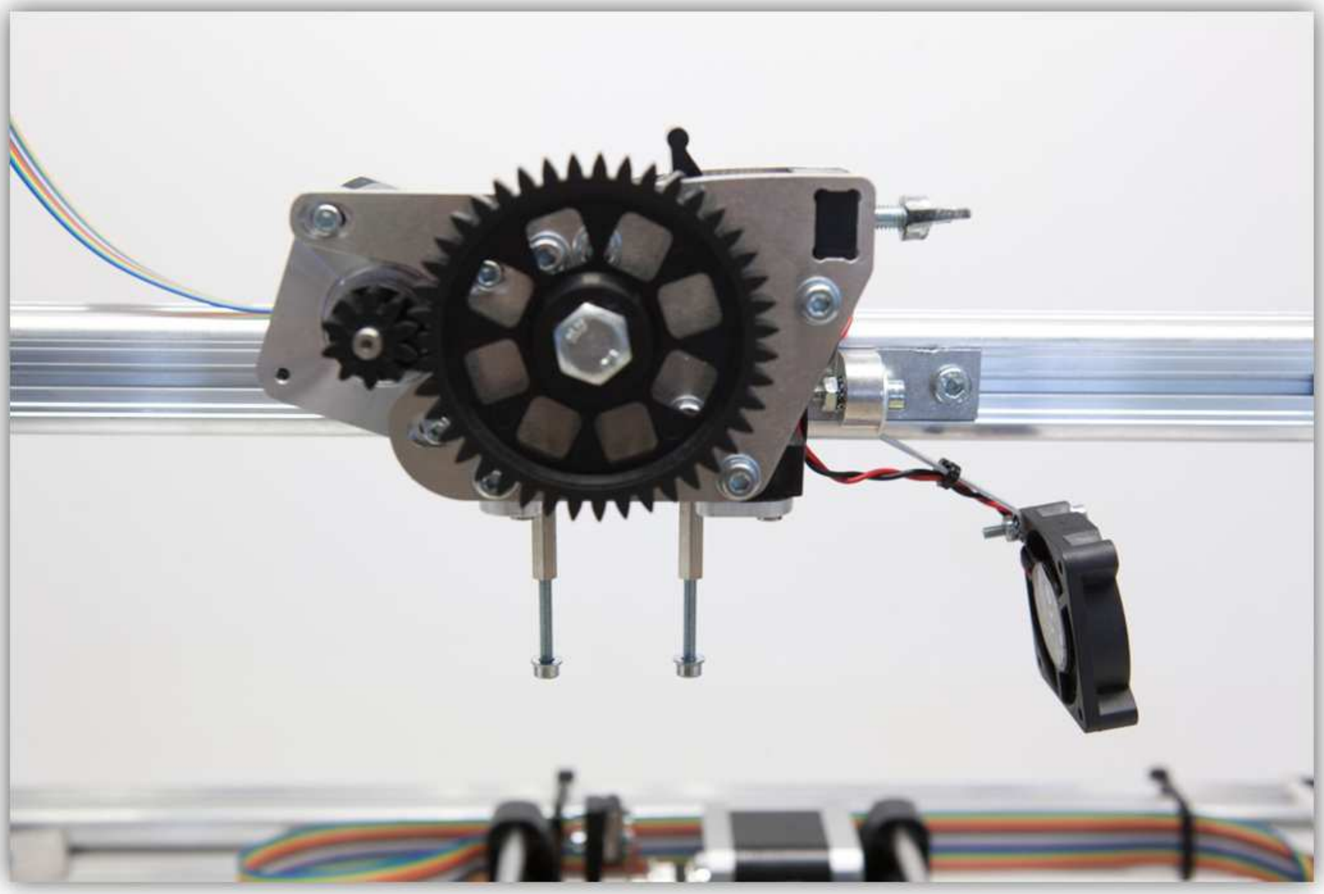
Slide the heater block over the copper barrel. **Watch the orientation!**

Screw the nozzle on the copper barrel. **Tighten it firmly. You can unscrew the white plastic barrel and use another wrench on the copper barrel to tighten the nozzle firmly. Do not forget to screw the white plastic barrel back on firmly afterwards.**

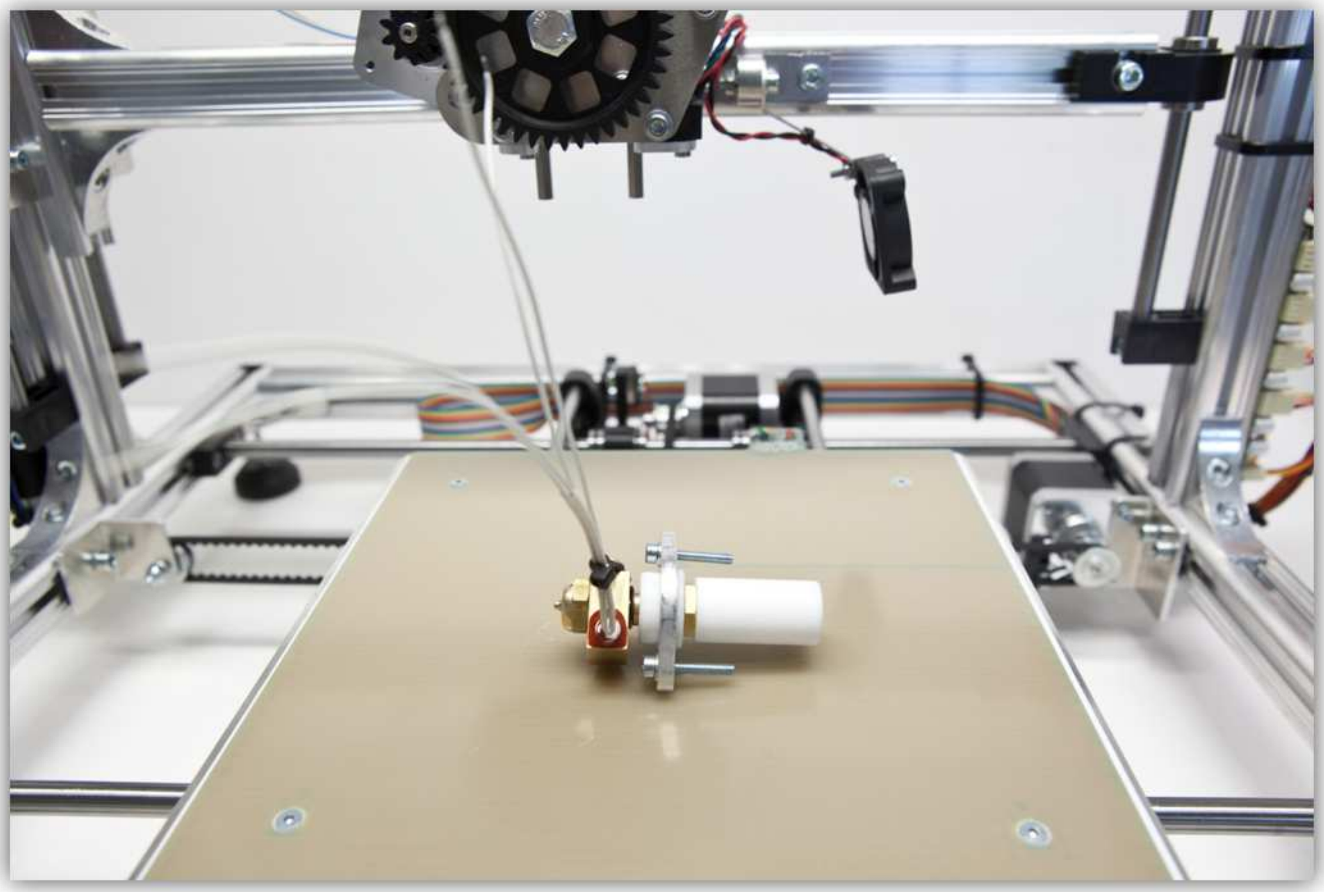
Put your multimeter on **200 kΩ** and measure the leads of the NTC. You should measure something between 70 to 100 KΩ depending how hot the NTC is. If your measurement is way lower than it is possible that the NTC is shorting out. Detach it, check it and attach it again.



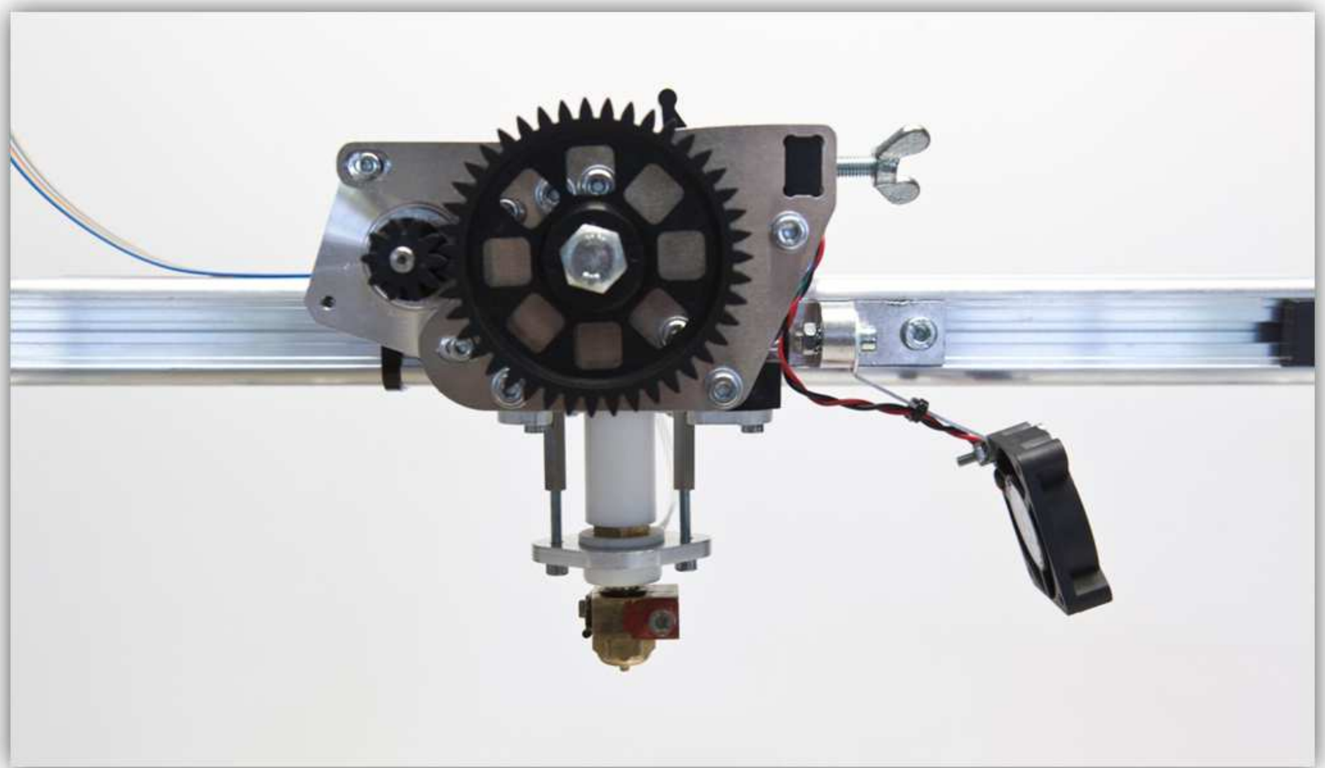
Unscrew the two bolts where the HOTEND needs to be mounted.



Slide these bolts and washer into the aluminum bracket.



Slide the white plastic barrel into the opening in the EXTRUDER BASE. Screw the bolts into the metal spacers. **Notice how the NTC side of the extruder faces away from the fan. Make sure this is correct!**



Cut 2 small pieces of the medium size heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the biggest heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

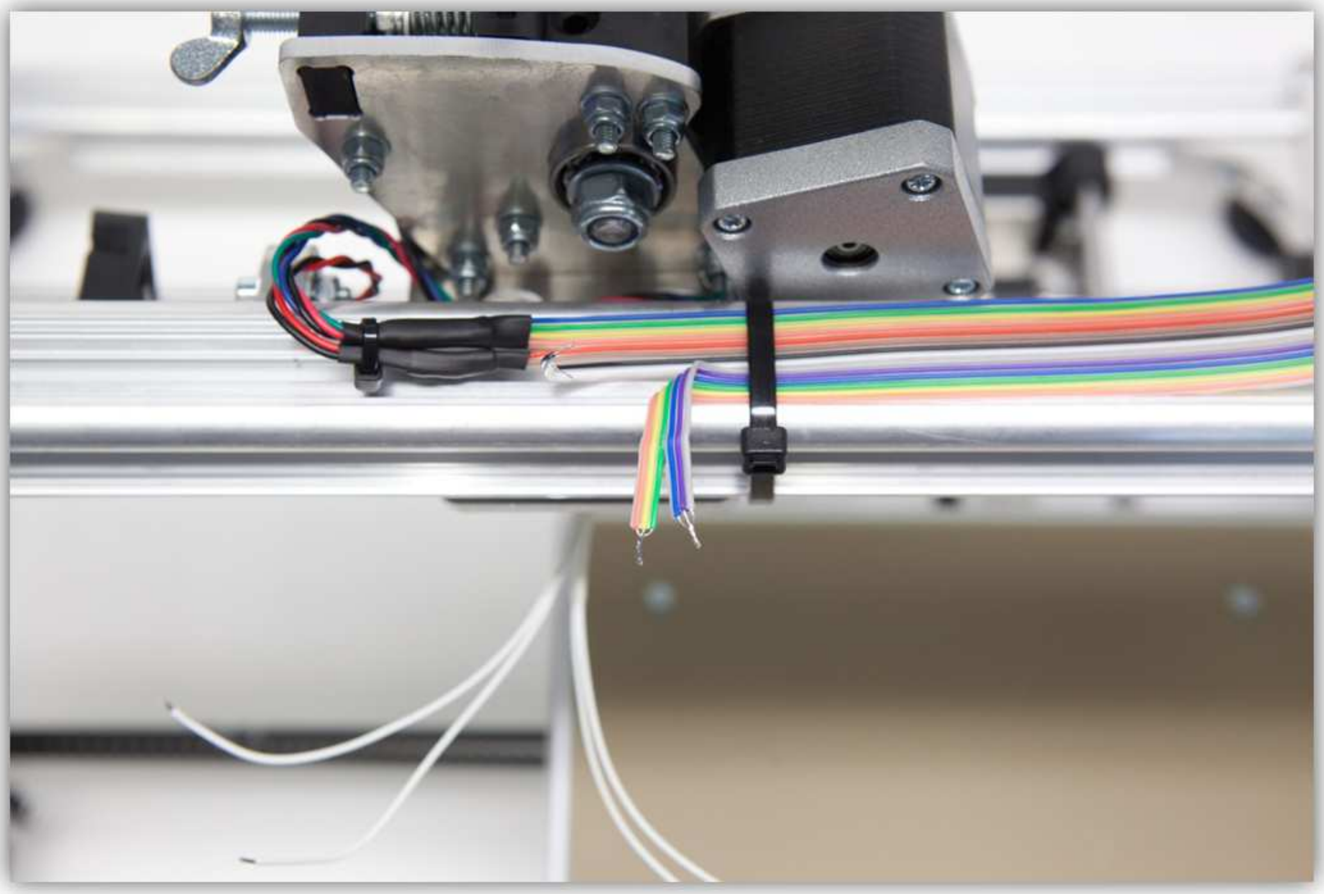
Slide the big heat shrink tubes over the 4 wires of the HOTEND.

Slide the 2 medium size heat shrink tubes over the 2 wires of the heater cartridge. **Make sure these are the wires of the heater cartridge and not the ones of the NTC!**

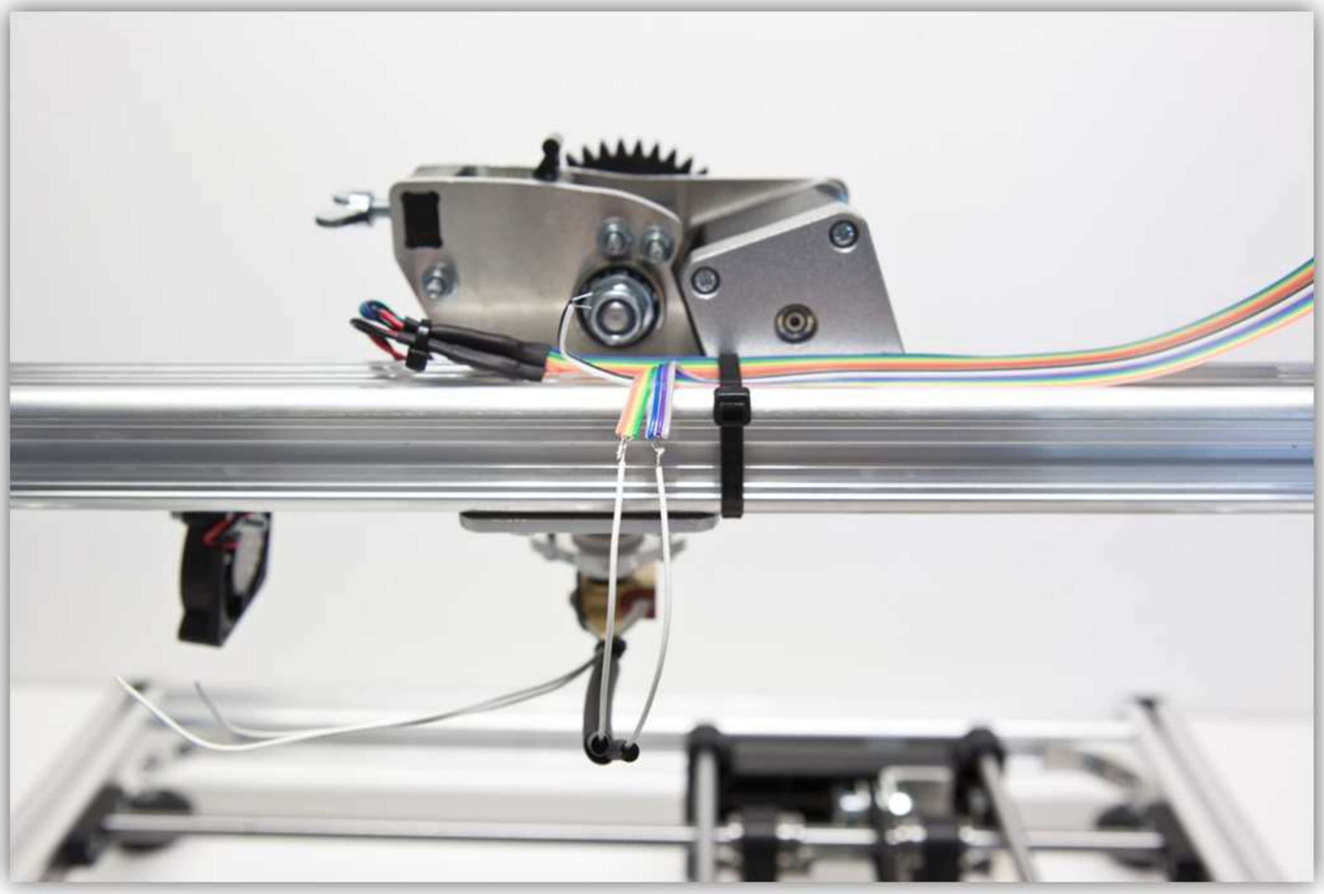
Tin the wires of the heater cartridge.

Take the 2 groups with the following wires:

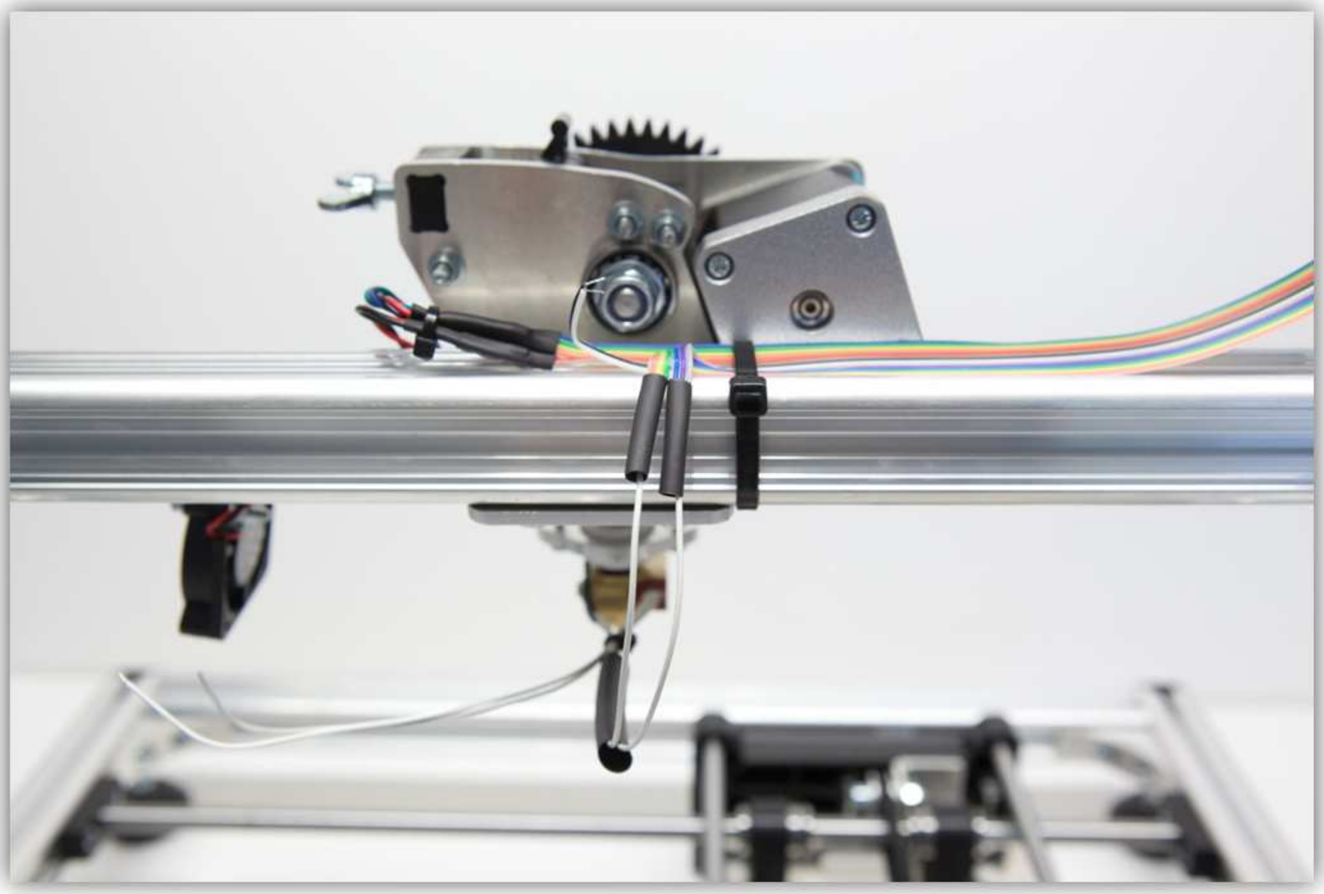
- Group 1: **Grey, Violet, Blue**
- Group 2: **Green, Yellow, Orange**

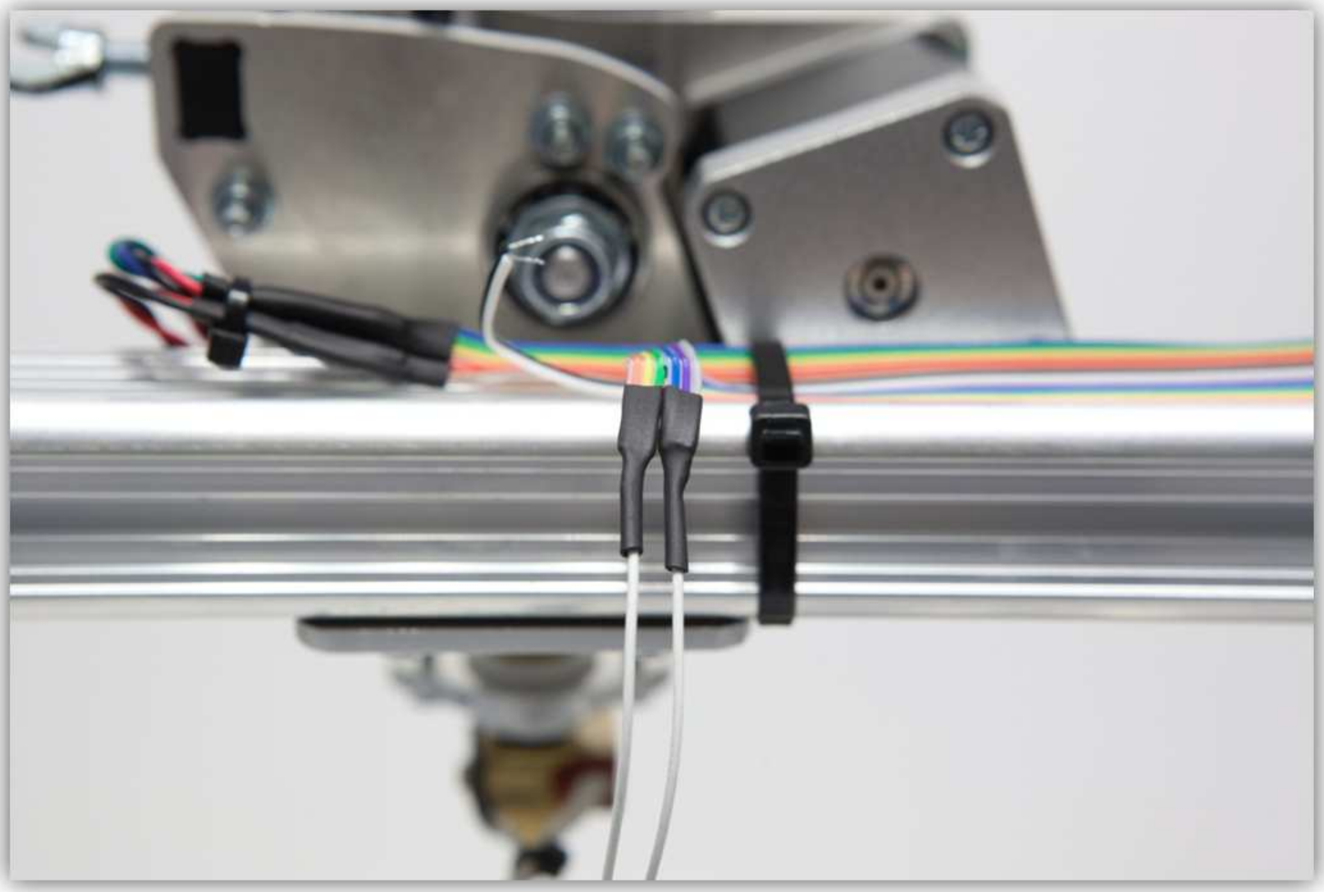


Solder the 2 wires of the heater cartridge to the 2 groups.

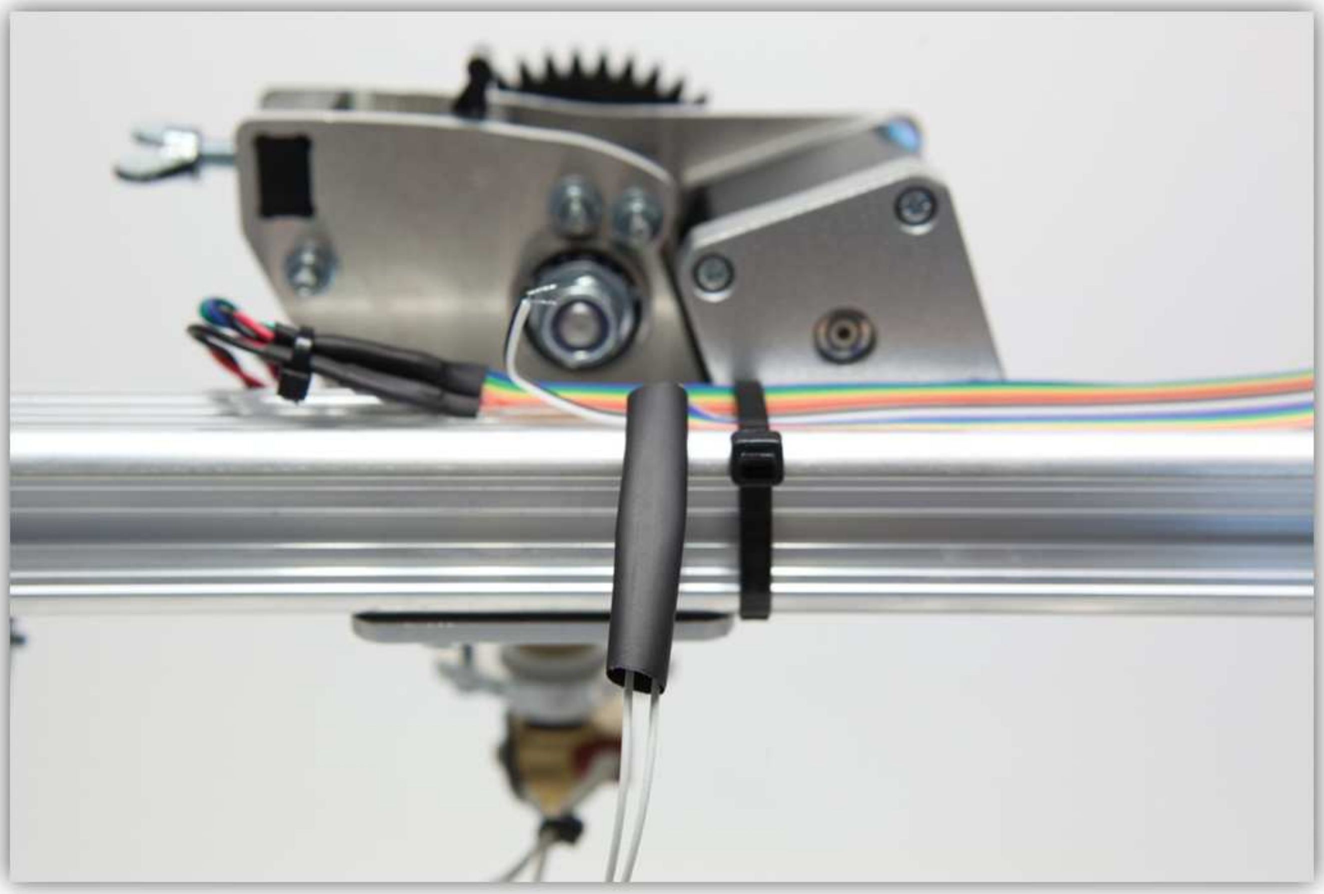


Slide the medium size heat shrink tubes over the solder joints and heat them up so they shrink.





Now slide the big piece of heat shrink tubing over the 2 medium size pieces, heat the big piece so it covers and protects the 2 heat shrinked joints.

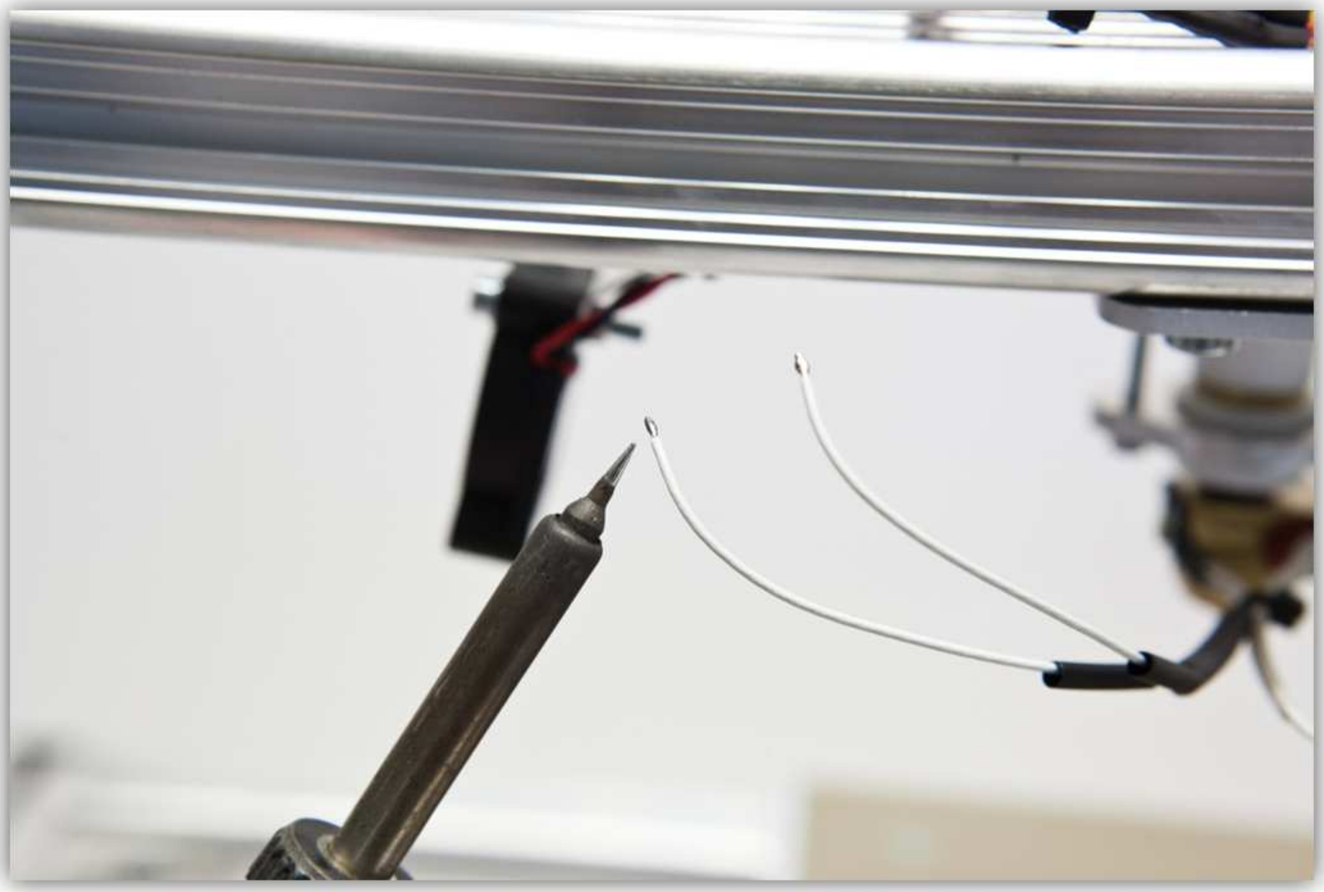


Cut 2 small pieces of the smallest heat shrink tubing of 1.5 cm (0.59") long and 1 large piece of the medium size heat shrink tubing of 4 cm (1.57"). You can find the heat shrink tubing in the bag labelled with 40.

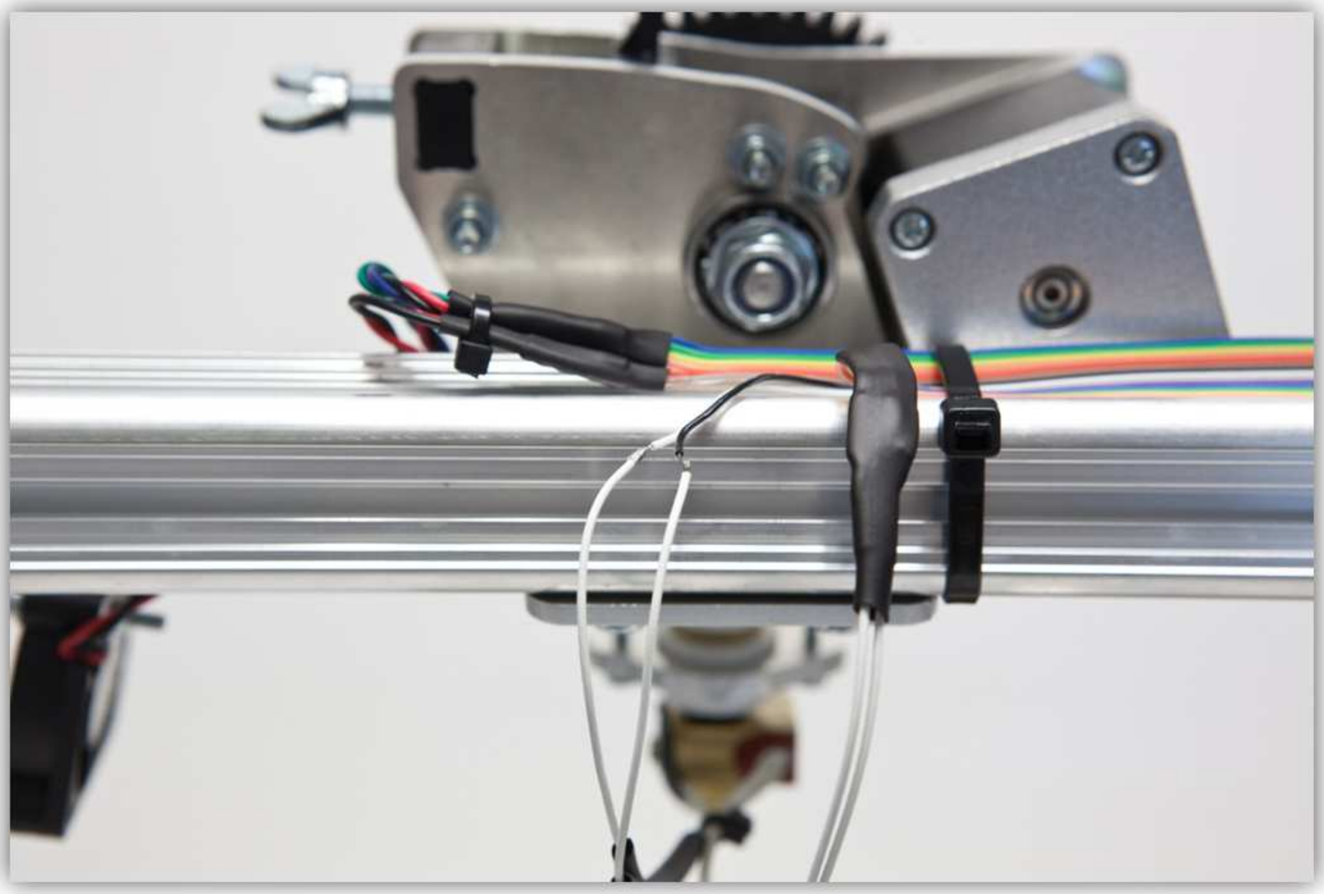
Slide the medium size heat shrink tubes over the 2 wires of the NTC. **Make sure these are the wires of the NTC.**

Slide the 2 medium size heat shrink tubes over the 2 wires of the NTC.

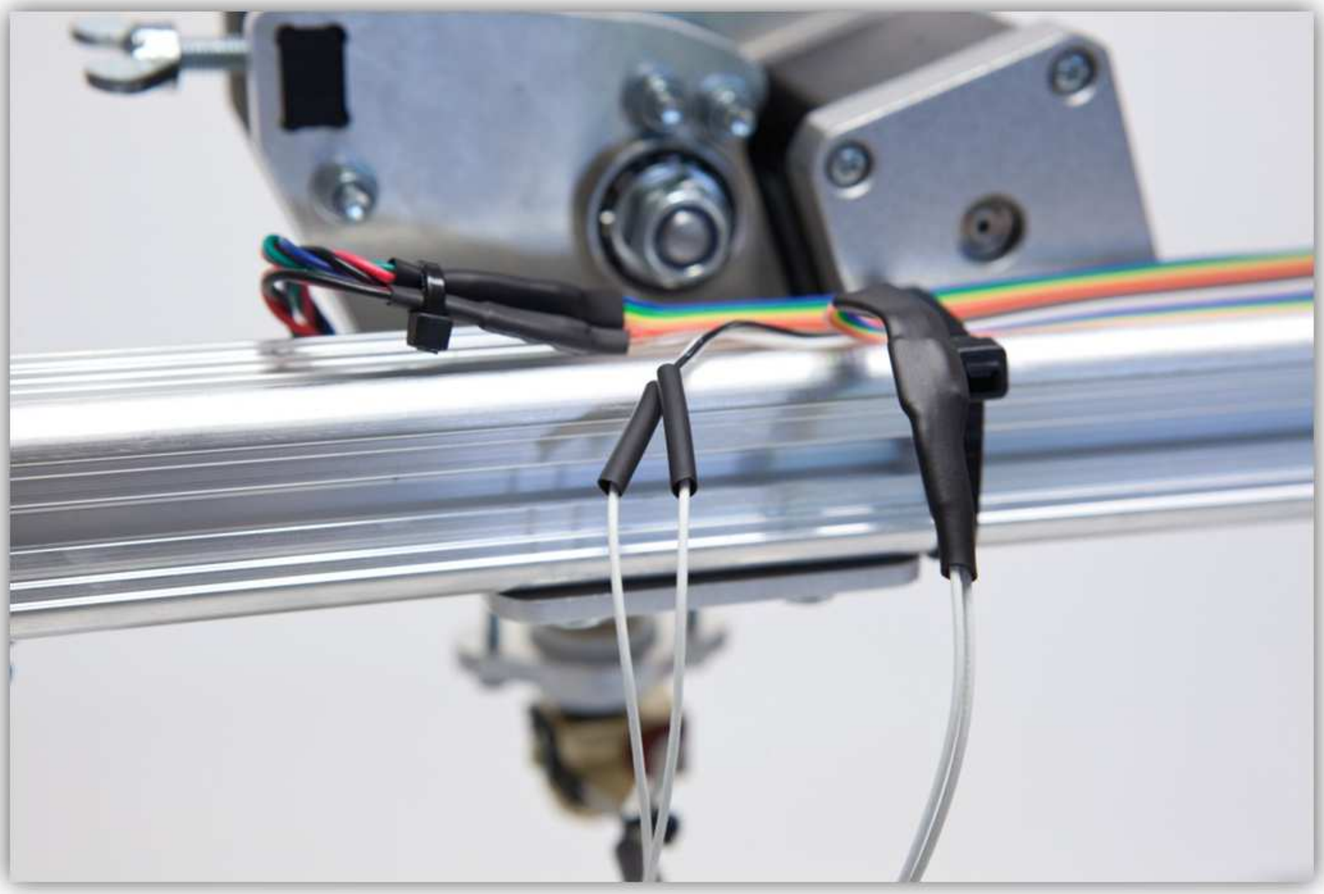
Tin the wires of the NTC.

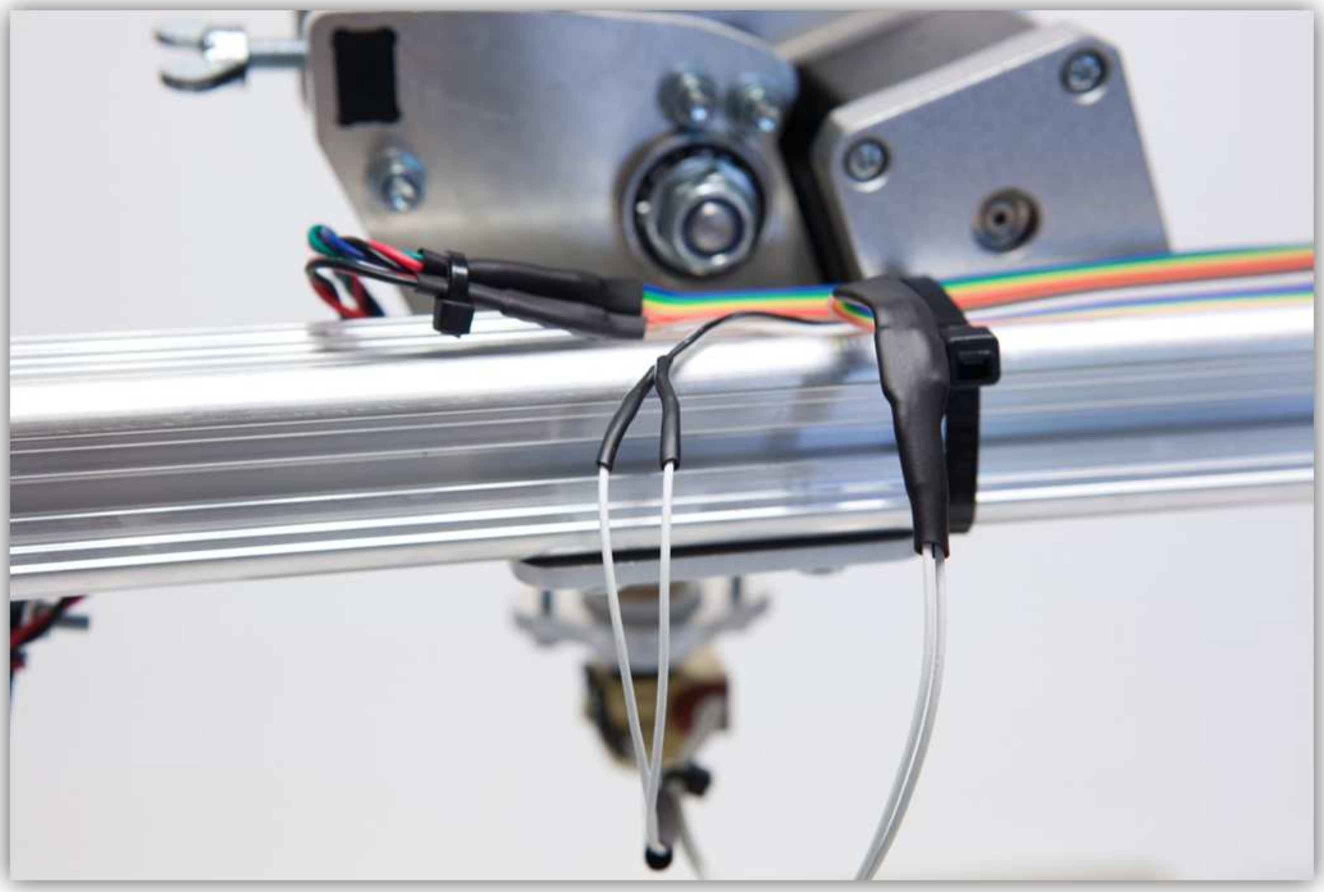


Solder the 2 wires of the NTC to the **Black** and **White** wires of the flat cable.

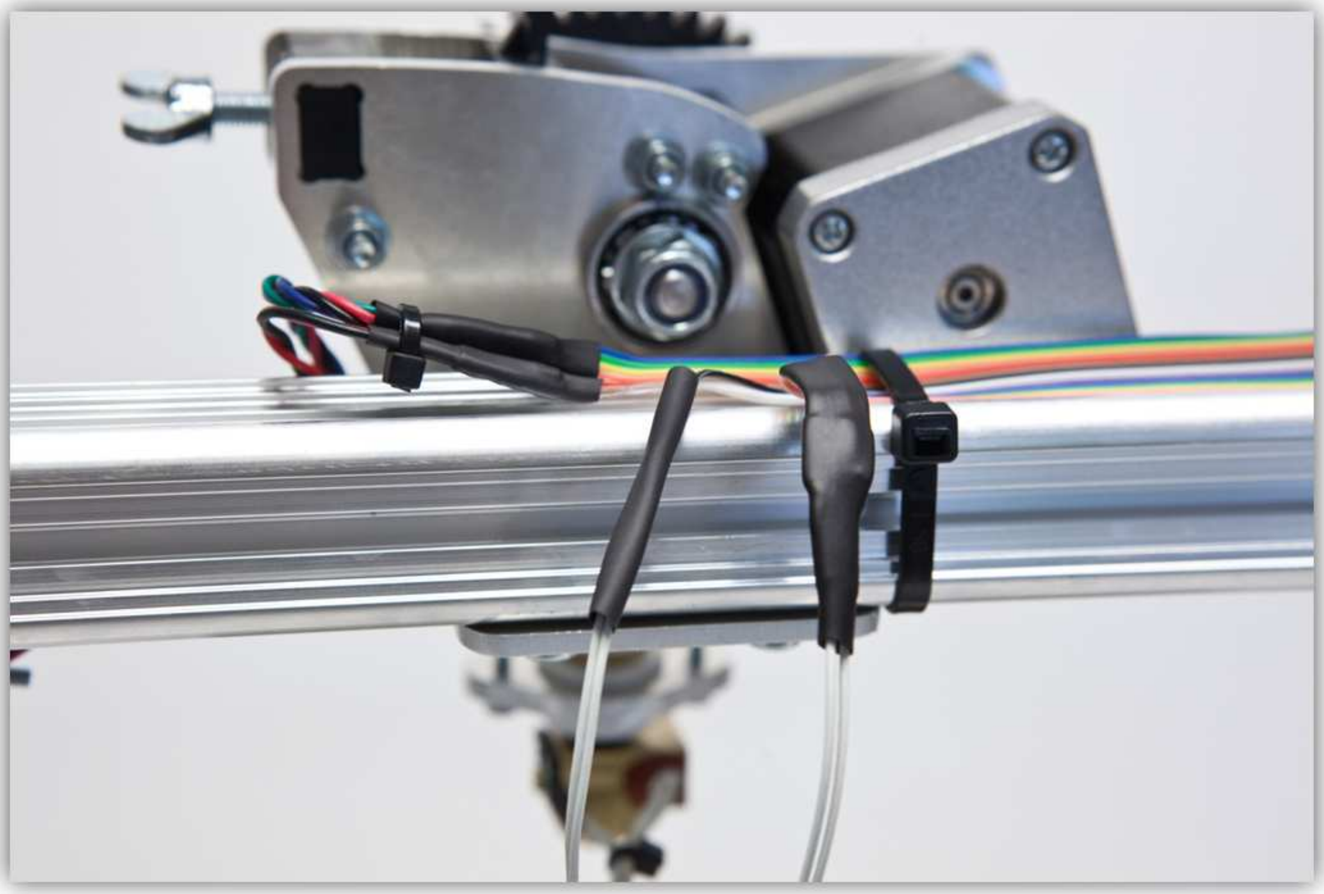


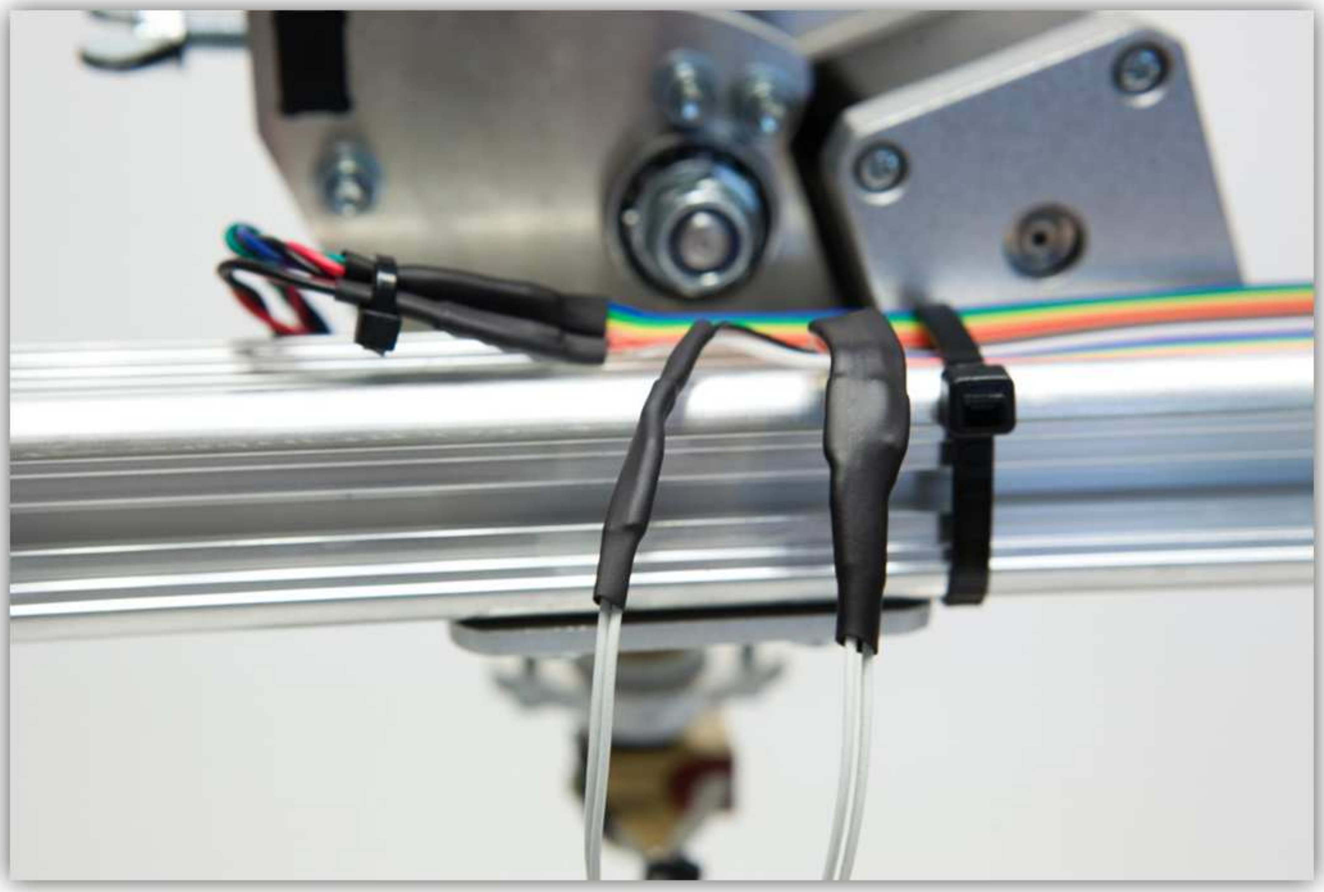
Slide the small heat shrink tubes over the solder joints and heat them up so they shrink.



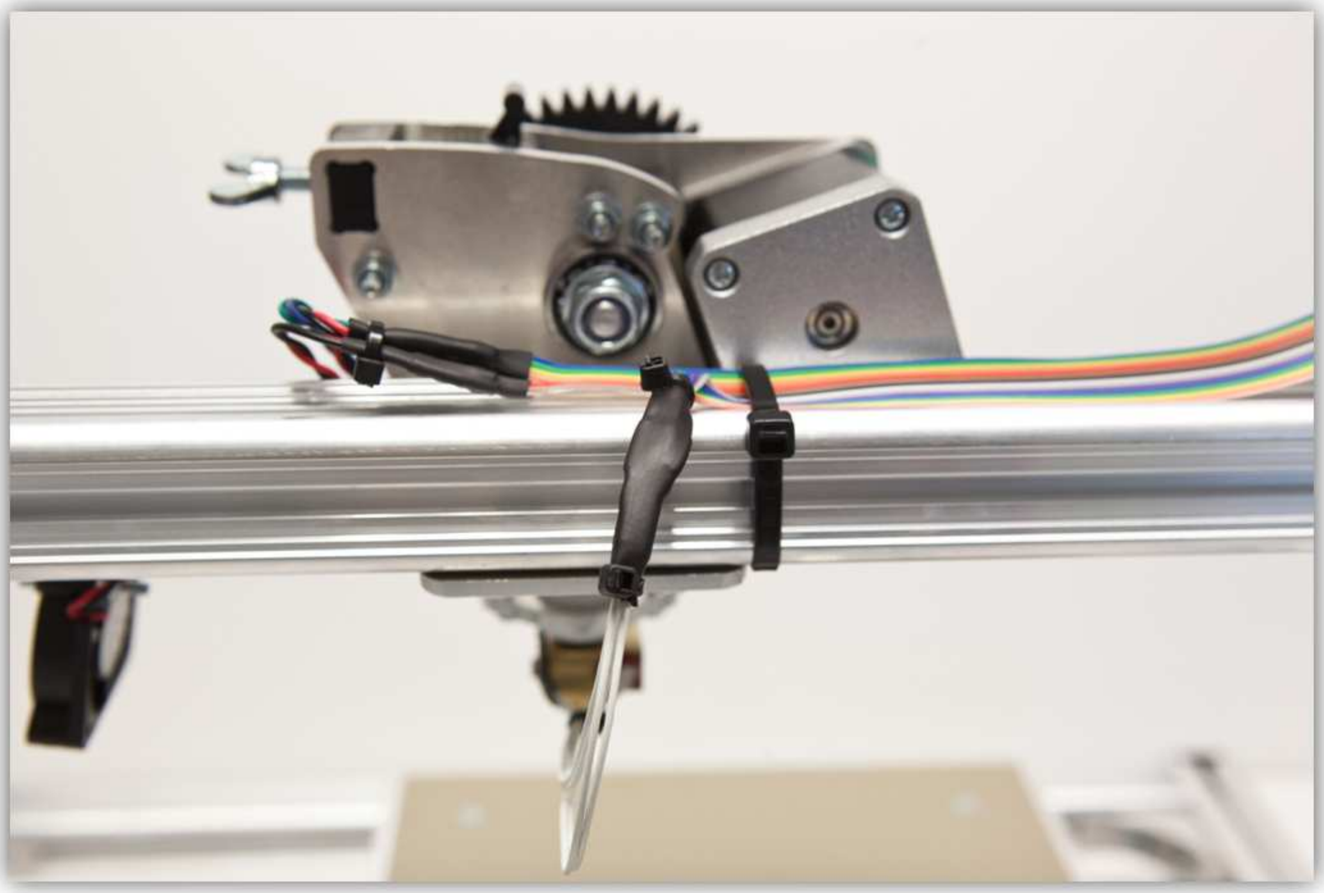


Now slide the medium size piece of heat shrink tubing over the 2 small size pieces, heat is piece so it covers and protects the 2 heat shrinked joints.

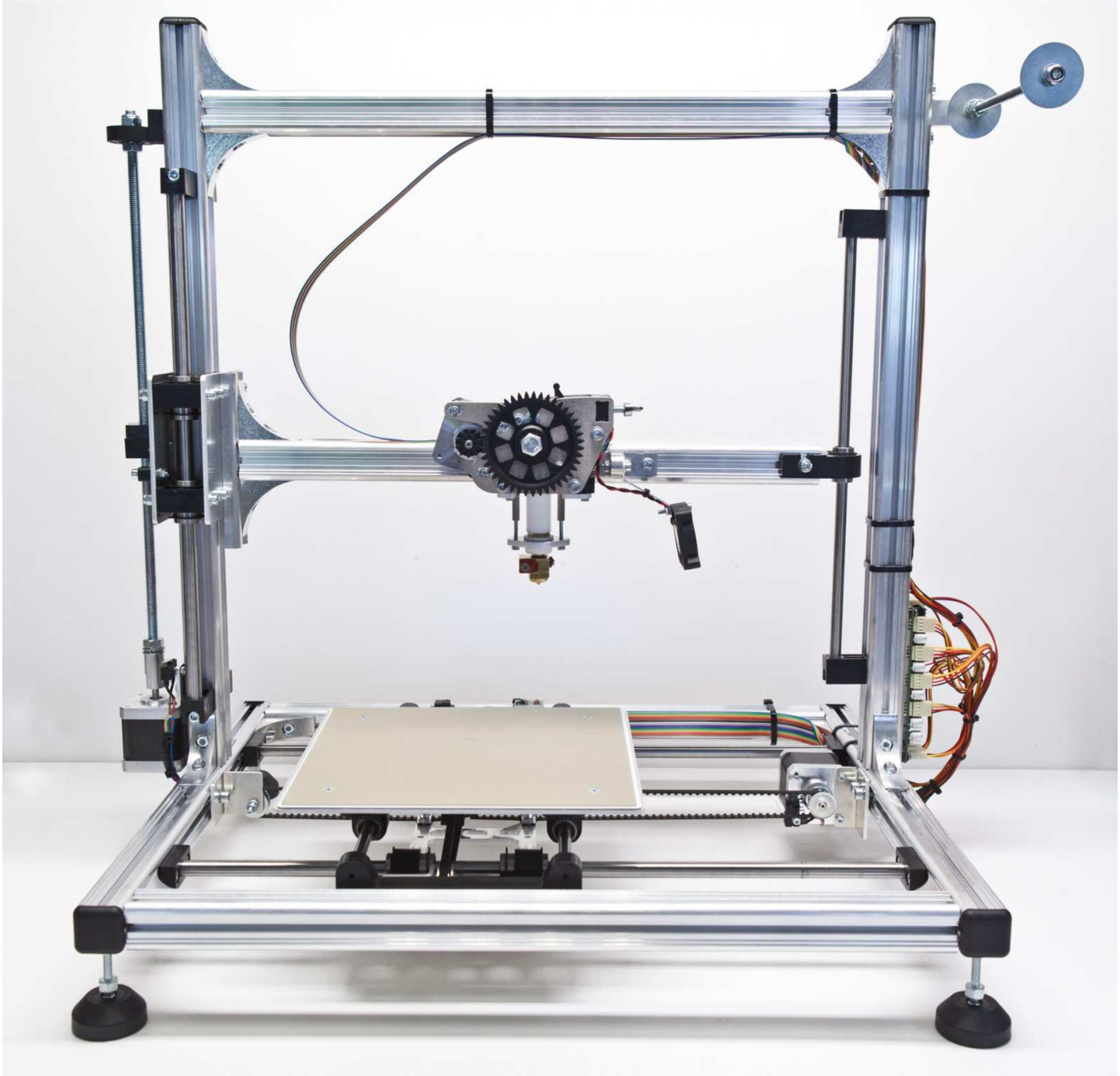




Use 2 small tie strips to keep all the wires together.



Congratulations! The K8200 3D PRINTER is now finished! In the next chapters we will speak about the basics of printing, calibrating your printer, more advanced settings and so on. Make sure to read and understand these next chapters, because they contribute a whole lot to the printing quality of the K8200.



001 - THE BASICS

In this section we will explain the basics about 3D printing. As this section will not go into detail about every aspect you will also have to carefully read the next sections to fully understand the workflow and get the best results out of your printer.

To print a 3D model you need several things:

- 3D model
- Slicer & G-code interpreter software
- 3D printer

3D model

There are several ways to obtain a 3D model, You can draw it yourself using software like:

- Sketchup (free) (WIN/MAC) http://www.sketchup.com/
- Blender (free) (WIN/MAC/LINUX) http://www.blender.org/
- OpenSCAD (free) (WIN/MAC/LINUX) http://www.openscad.org/
- And many more…

Or you can download files from the Thingiverse repository: http://www.thingiverse.com/ in the STL format.

Slicer software & G-code interpreter

The software you will use with the K8200 is freeware and is called:

- Repetier (free) (WIN/MAC/LINUX) http://www.repetier.com/
  V0.84 (WIN)!!
  There are newer versions of this program but we are working on the compatibility for the newer versions. This manual focusses only on this version of the software.

Repetier is bundled with a slicer program (Slic3r) and also acts as a G-code interpreter.

To print a 3D model you will have to "slice" that model. With slicing we mean: translate the 3D model into tool paths that the K8200 understands, and these tool paths are described in code called G-code. It does this by incrementally cutting the virtual model into thin slices (hence "slicing"). So, in general: the slicing program translates the 3D model to a format the 3D printer understands.

Al the variables like: speed, flow rate, layer height, infill, … etc. are calculated in this process so as these parameters are unique to each type of printer. It is not recommended to use G-code files sliced for another type of printer than the K8200.

As this process is a delicate balance between lots of variables it will be thoroughly explained in a later section of this manual.

With the G-code interpreter part of Repetier you will be able to use .gcode files to print objects, and also manually control all the axes (X, Y, Z), the extruder, the fan and the heated bed. G-code is in fact just a string of these manual commands written in a language the printer understands: G-code.

Once an object is successfully sliced or converted into G-code, this code can be loaded and send to the printer line by line, this will tell the printer step by step what it has to do, to print the object.

002 - CONNECTING THE PRINTER

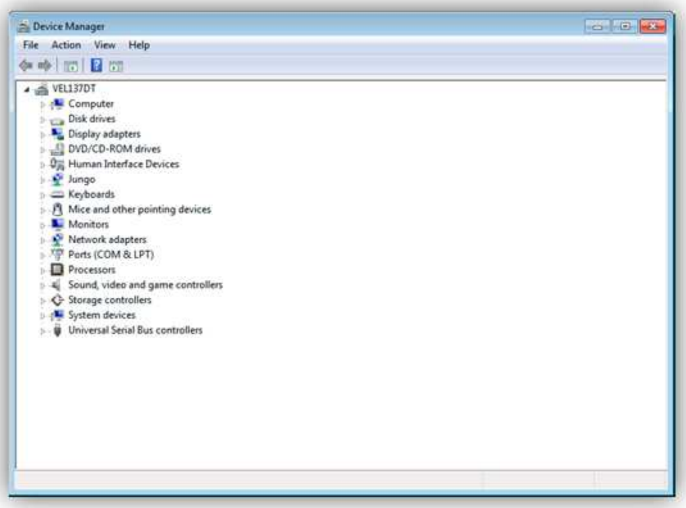
Now that you have an idea what 3D printing entails, we can continue and connect the printer to your computer. First make sure you have a computer with a decent amount of RAM (min. 2-4 GB) as working with 3D print files can be taxing on your system. Secondly you will need an available USB 2.0 port to connect the printer to, but before connecting the printer you should download the driver suitable for your system.

- FTDI VCP DRIVER (free) (WIN/MAC/LINUX) http://www.ftdichip.com/Drivers/VCP.htm

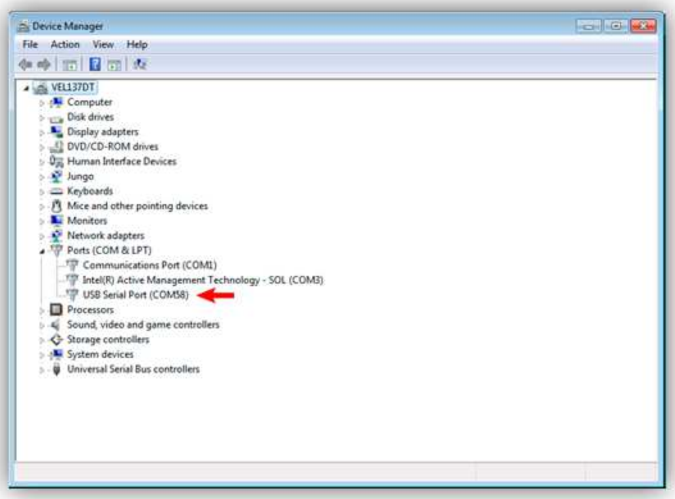
After installing this driver you can connect the USB cable with a free USB port on your computer (do not connect the power cable of the printer, we will do this in a later stadium). And follow the steps for your operating system:

- PC (WIN 7)

The PC will continue and install the driver for the printer and you will have to check the number of the COM port to use in the configuration of Repetier later. To check this number, go to: “Start”, type: “Device Manager” and press Enter. You should see something similar to this:



Under “Ports (COM&LPT)” you should find an entry with the name: USB Serial Port and a COM Port number between brackets. (The number you see on your computer can be totally different from the one you see here.) Remember this number as you will need it later.



- MAC

UNDER CONSTRUCTION

- LINUX

UNDER CONSTRUCTION

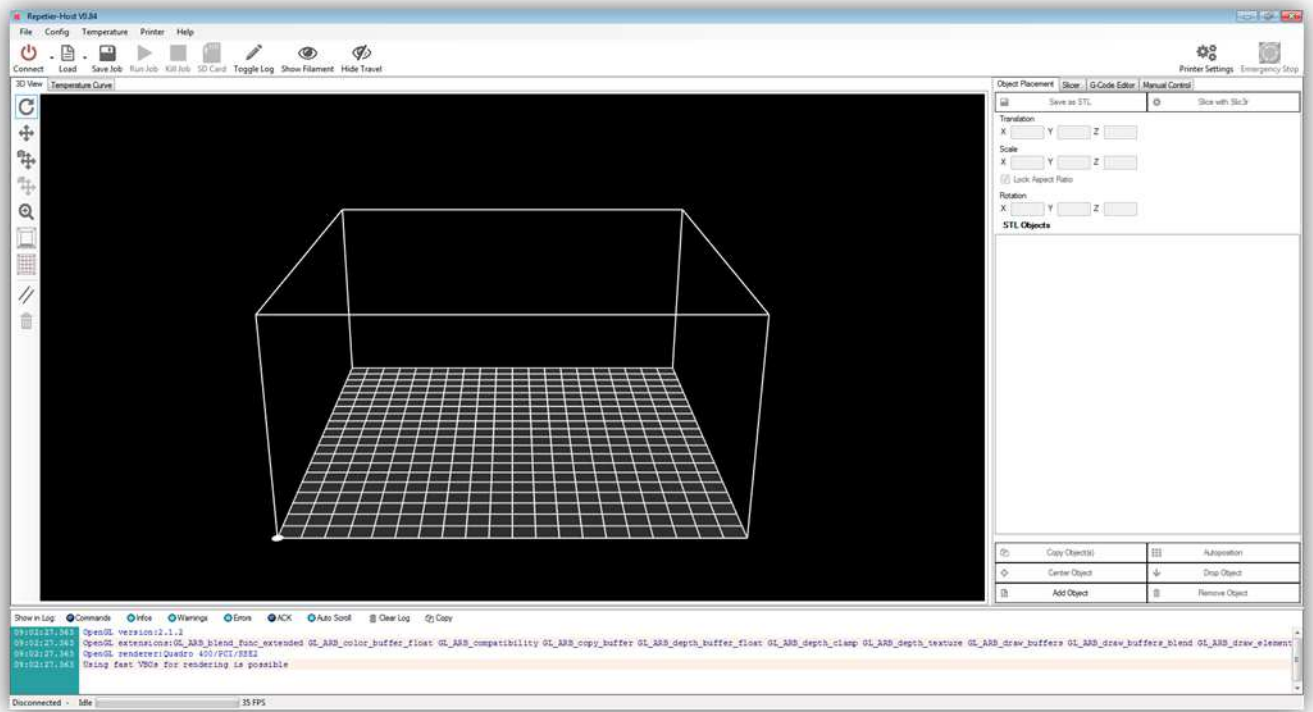
Now we can configure Repetier so it knows what printer it will be talking to. First, if you haven't already downloaded the Repetier software, you can download it here (this explanation will be done with the 0.84 (WIN) version of the software, this version is perfect for the printer for all intends and purposes, newer versions are not yet fully supported and you are recommended to download an equivalent of this version depending on which operating system you are using):

- Repetier (free) (WIN/MAC/LINUX) http://www.repetier.com/

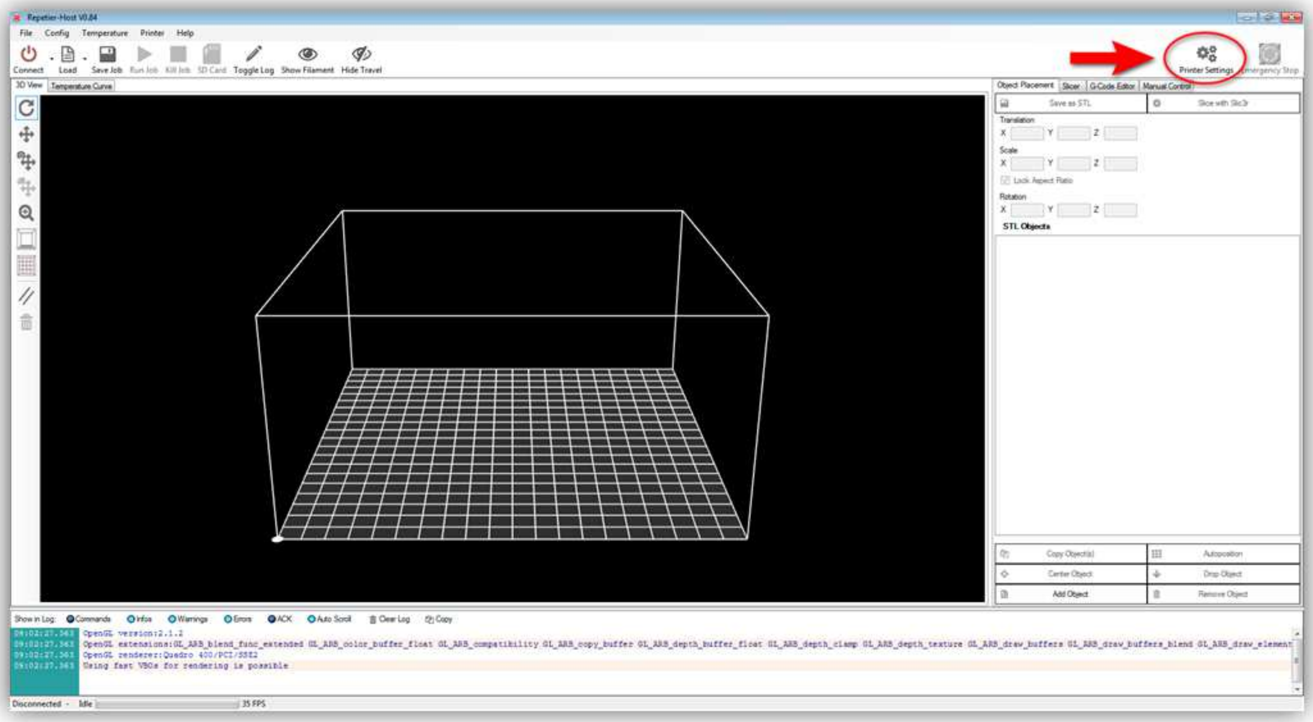
V0.84 (WIN)

There are newer versions of this program but we are working on the compatibility for the newer versions. This manual focusses only on this version of the software.

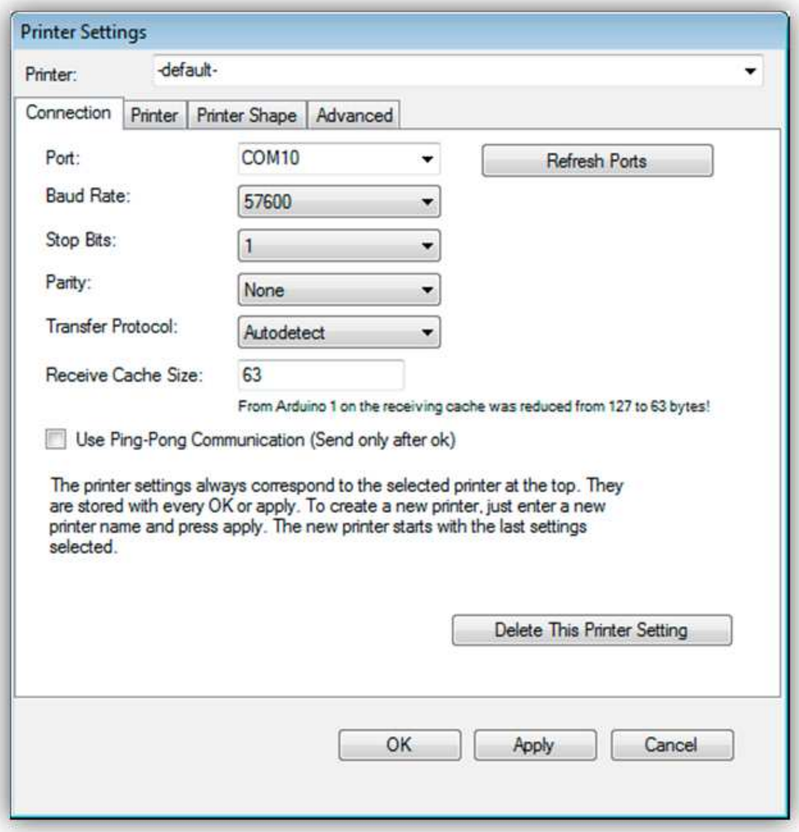
Once installed you can start Repetier and you should see something like this:



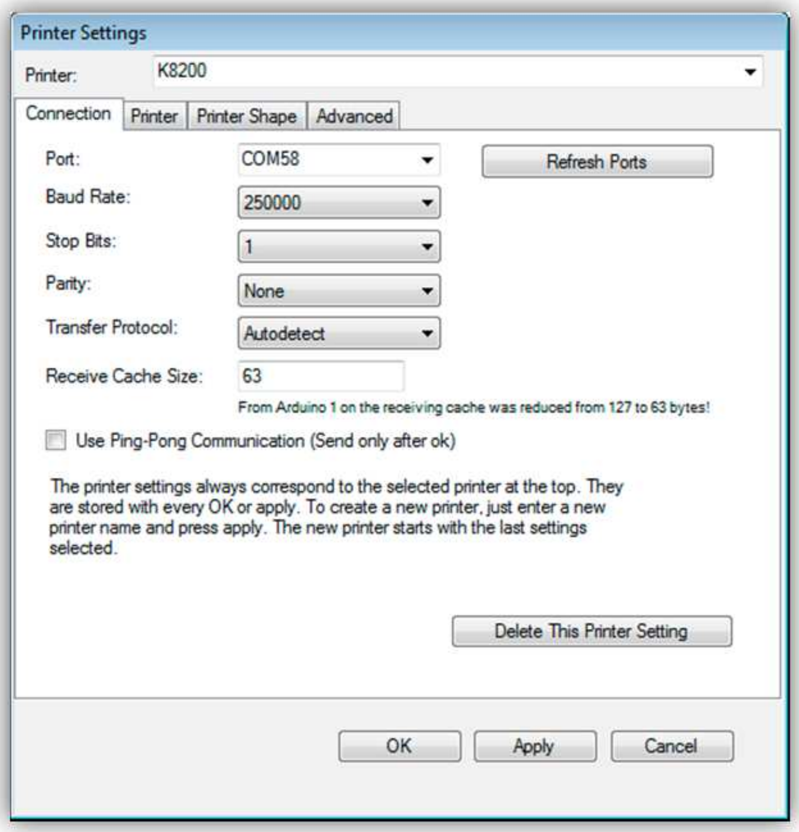
Now click on the "Printer Settings" button:



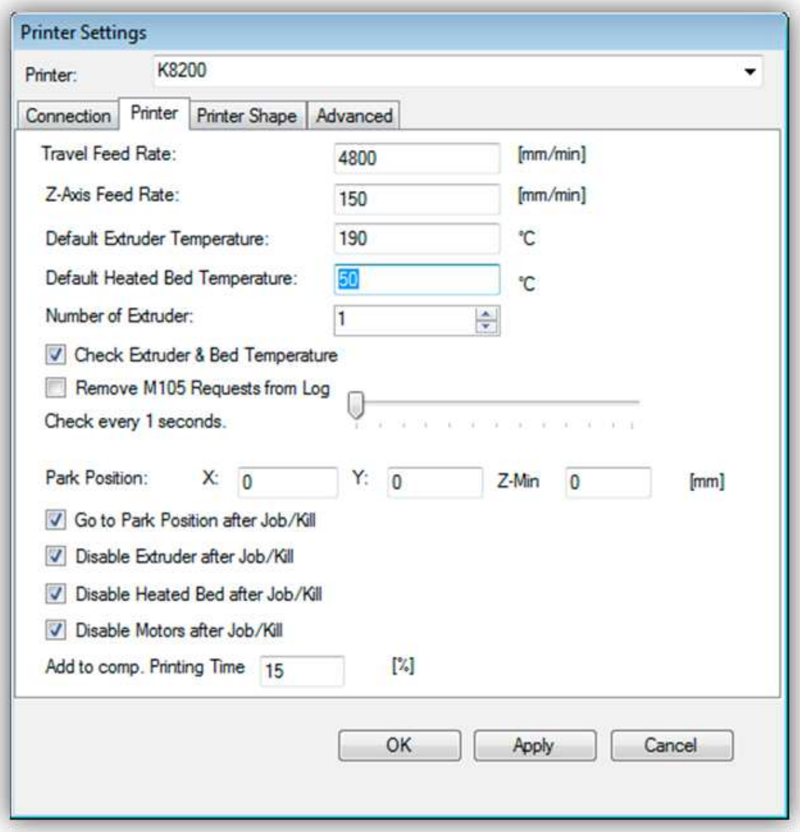
You should see the following dialog window:



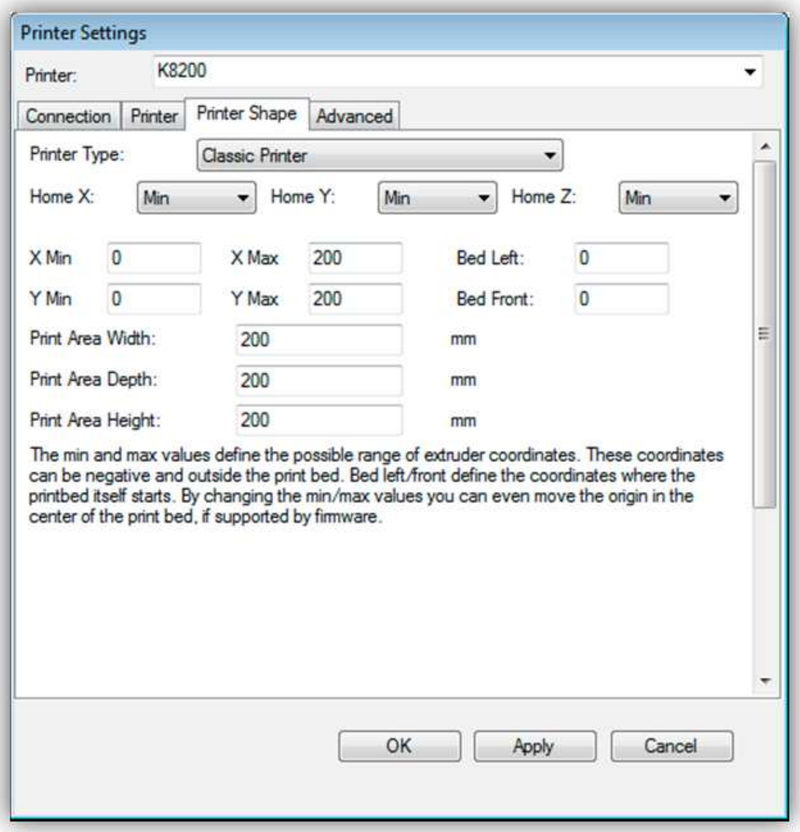
Change the settings on this tab to the ones below (for the "Port" setting you should use the Virtual COM Port on which your computer is communicating with the K8200. See the section about driver installation at the beginning of this chapter for more information.)



For the “Printer” tab you should use the following settings:

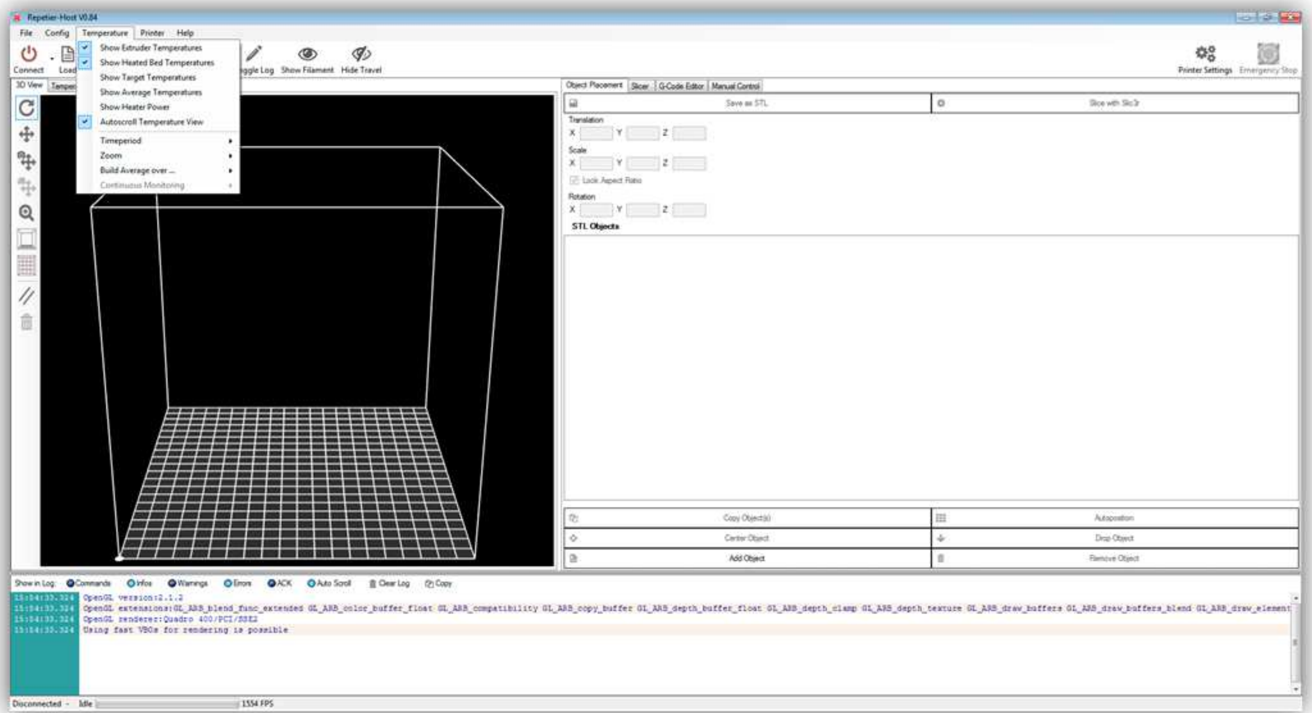


For the “Printer Shape” tab you should use the following settings:



For the “Advanced” tab you shouldn’t change anything. Press “OK” to save your changes.

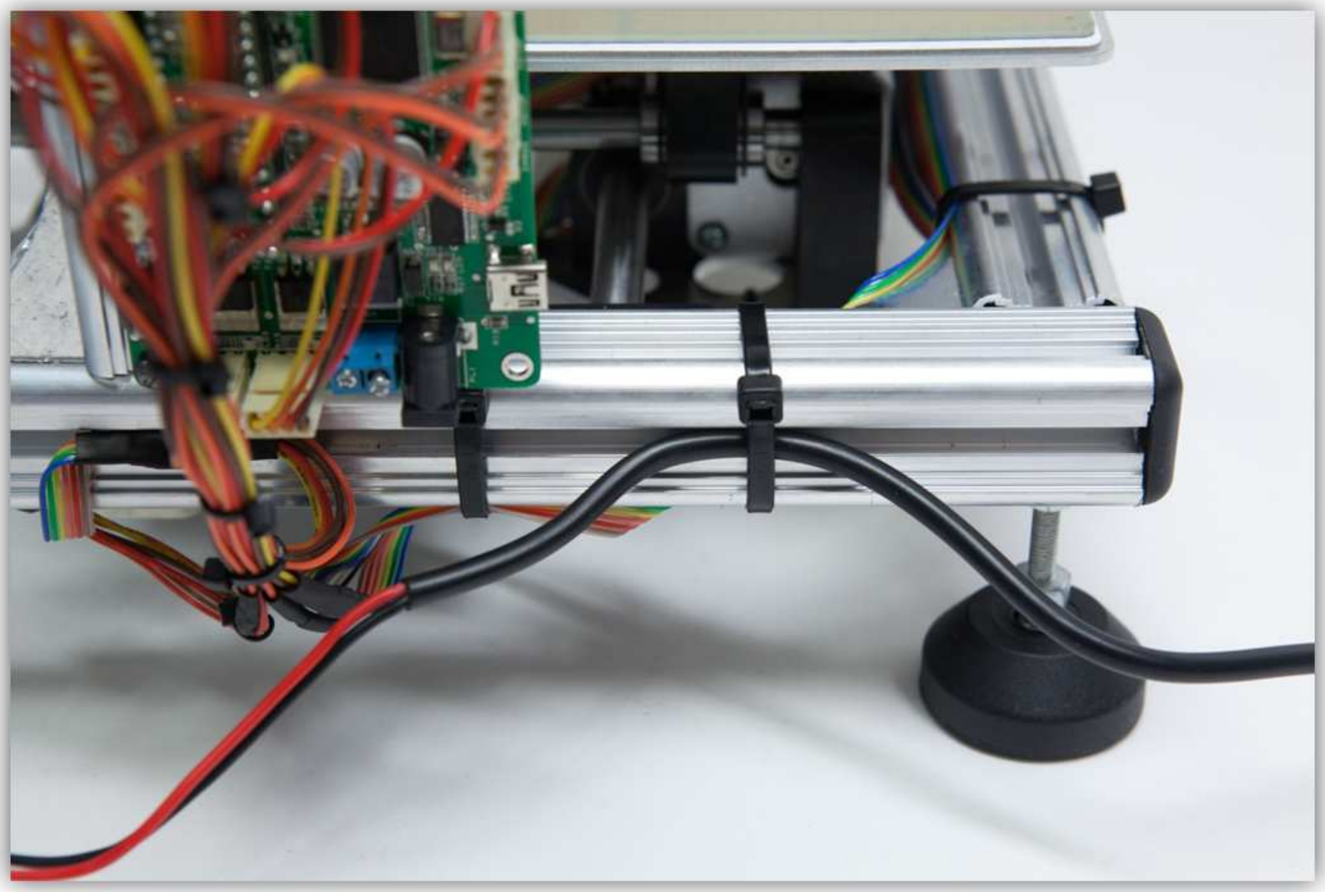
In the main window under “Temperature” you should select the following.



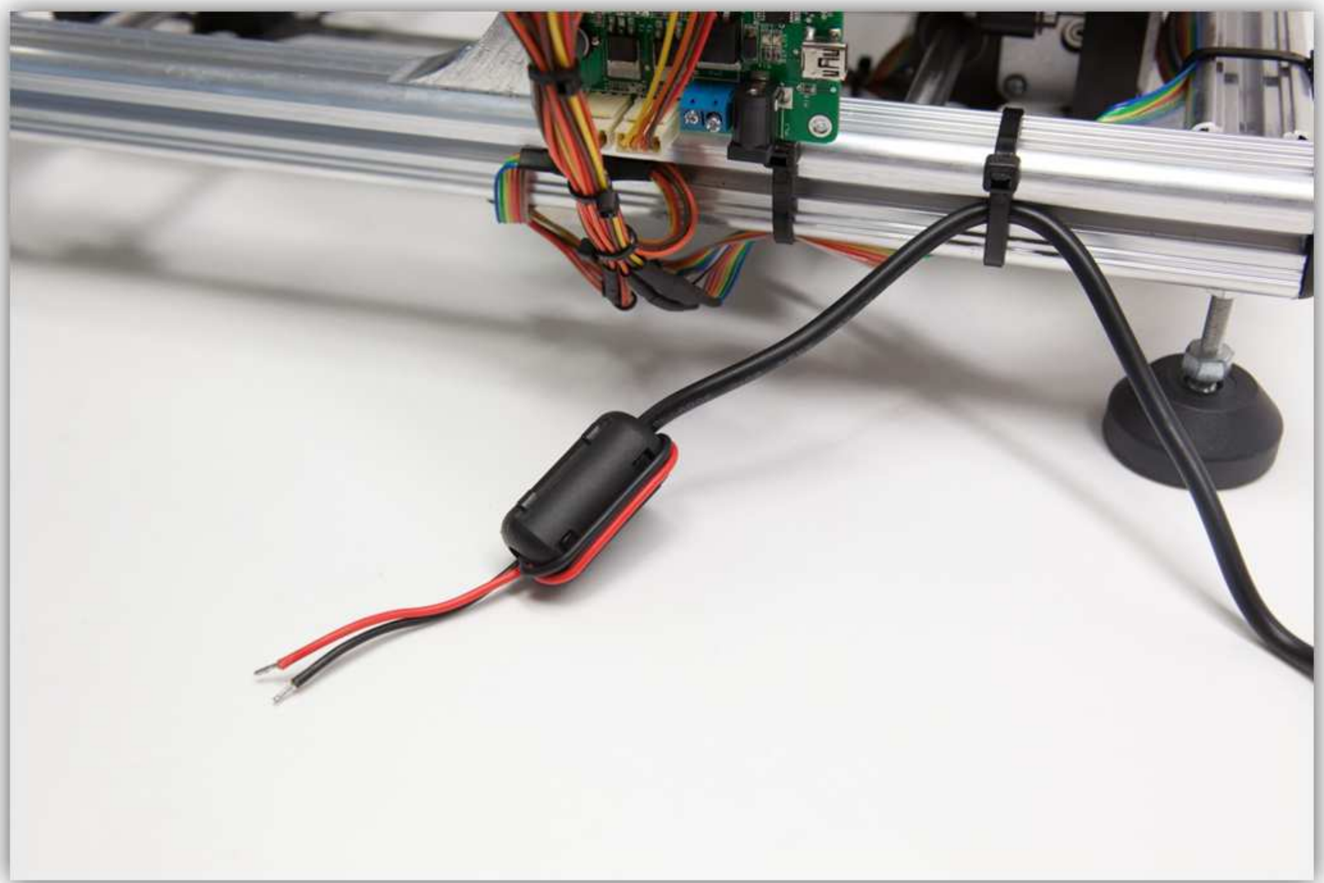
Now we will supply power to the printer. You will need the following items from the box.

First strip the end of the cable so you have 15 cm (5.9") of free wire. **Be careful not to cut too deep while you are stripping the cable.**

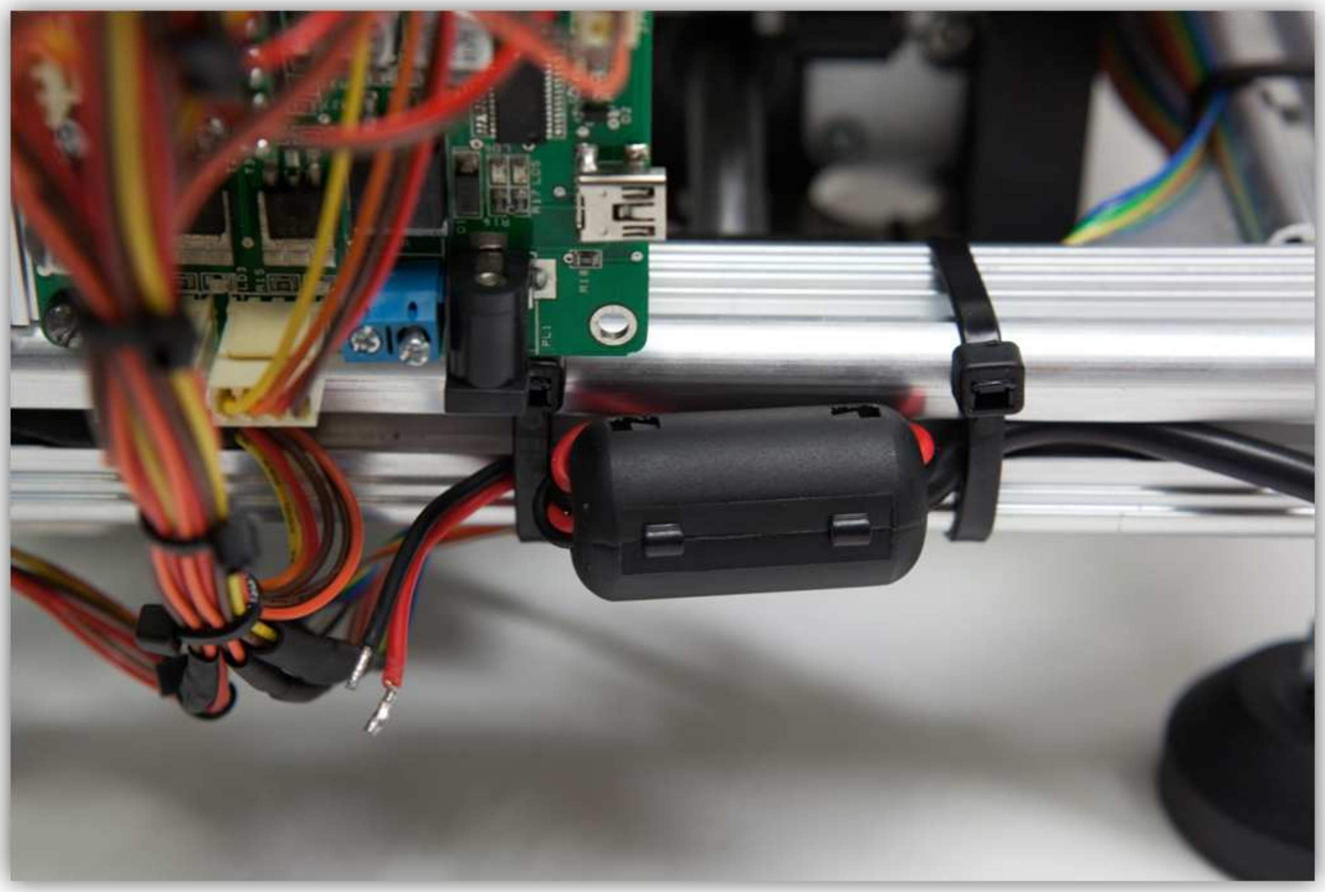
Loop the wire through the first tie wrap as shown in the picture.



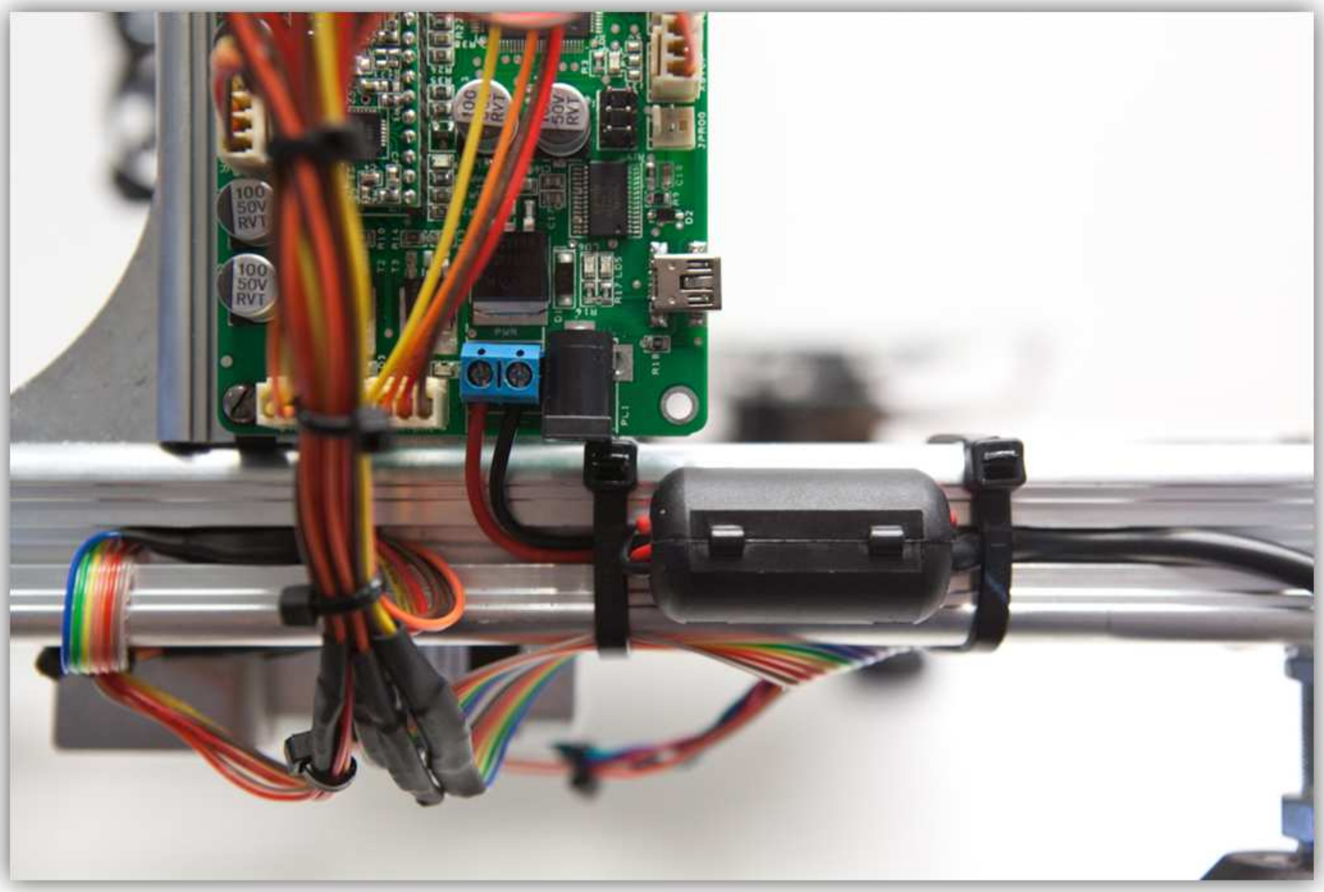
Use the clamp-on filter as shown in the pictures below.



Now loop the wire through the second tie-strip.

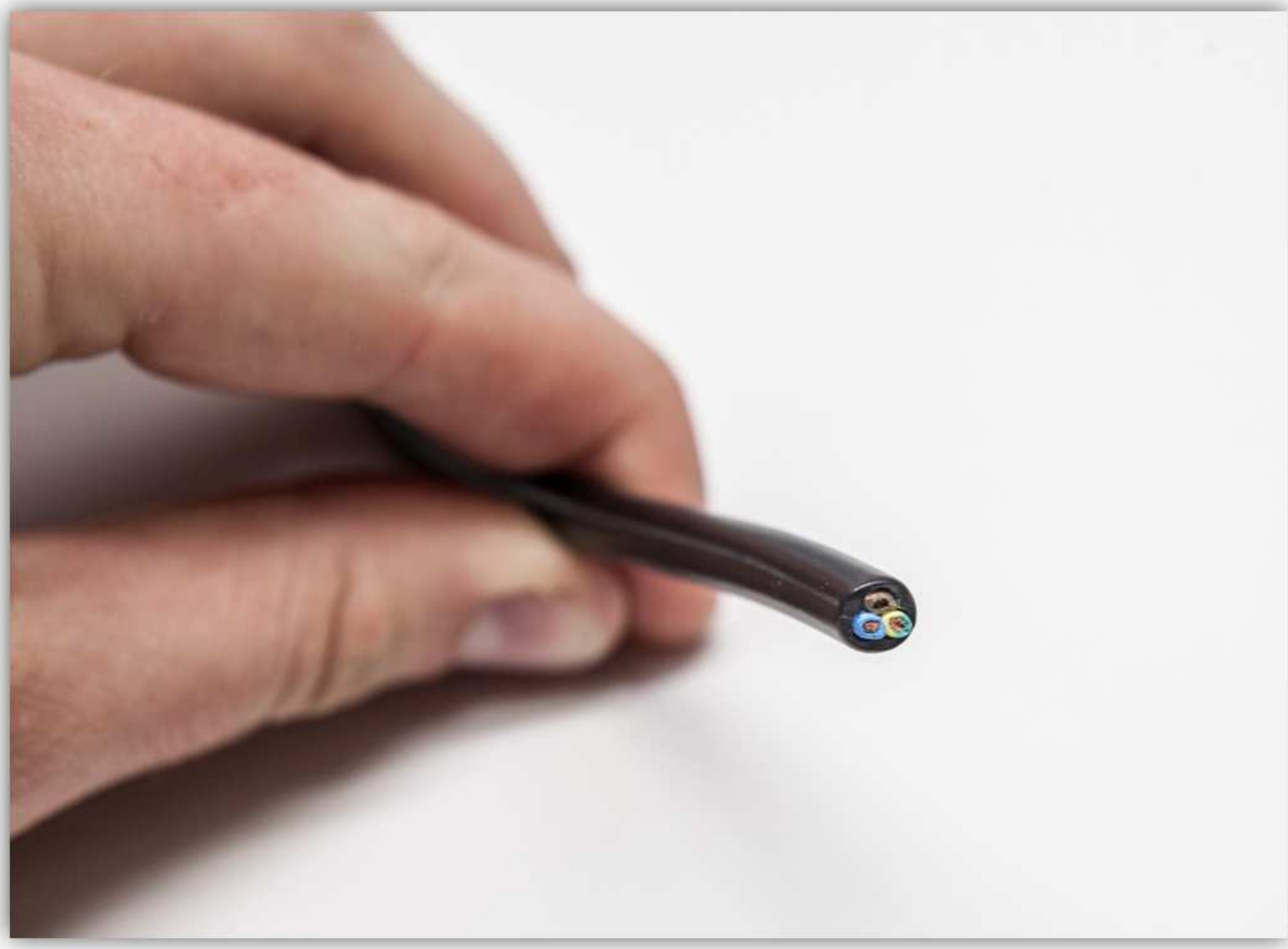


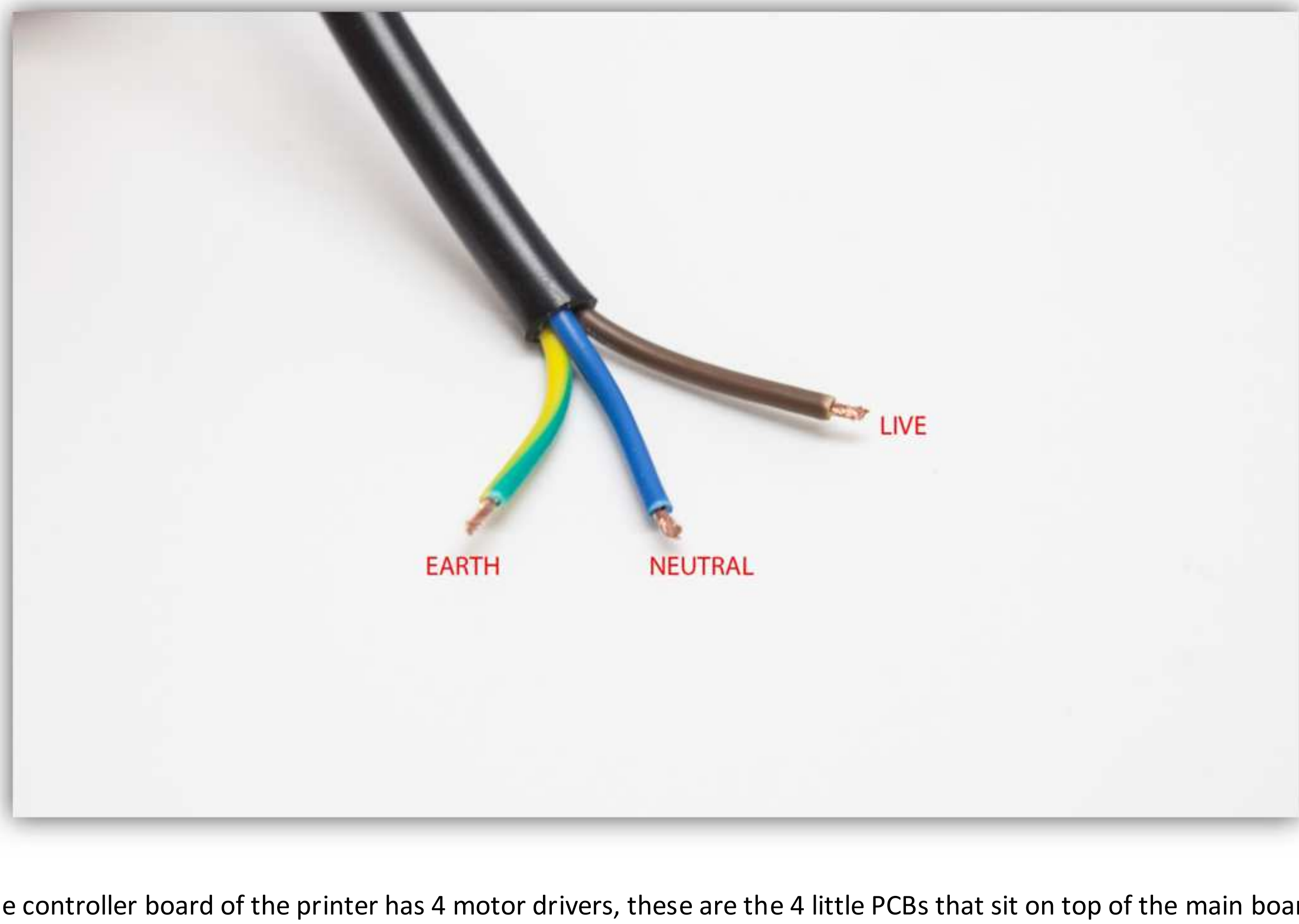
Connect the wires to the blue screw connector. **Notice the polarity. The red wire is positive and the black is negative.**



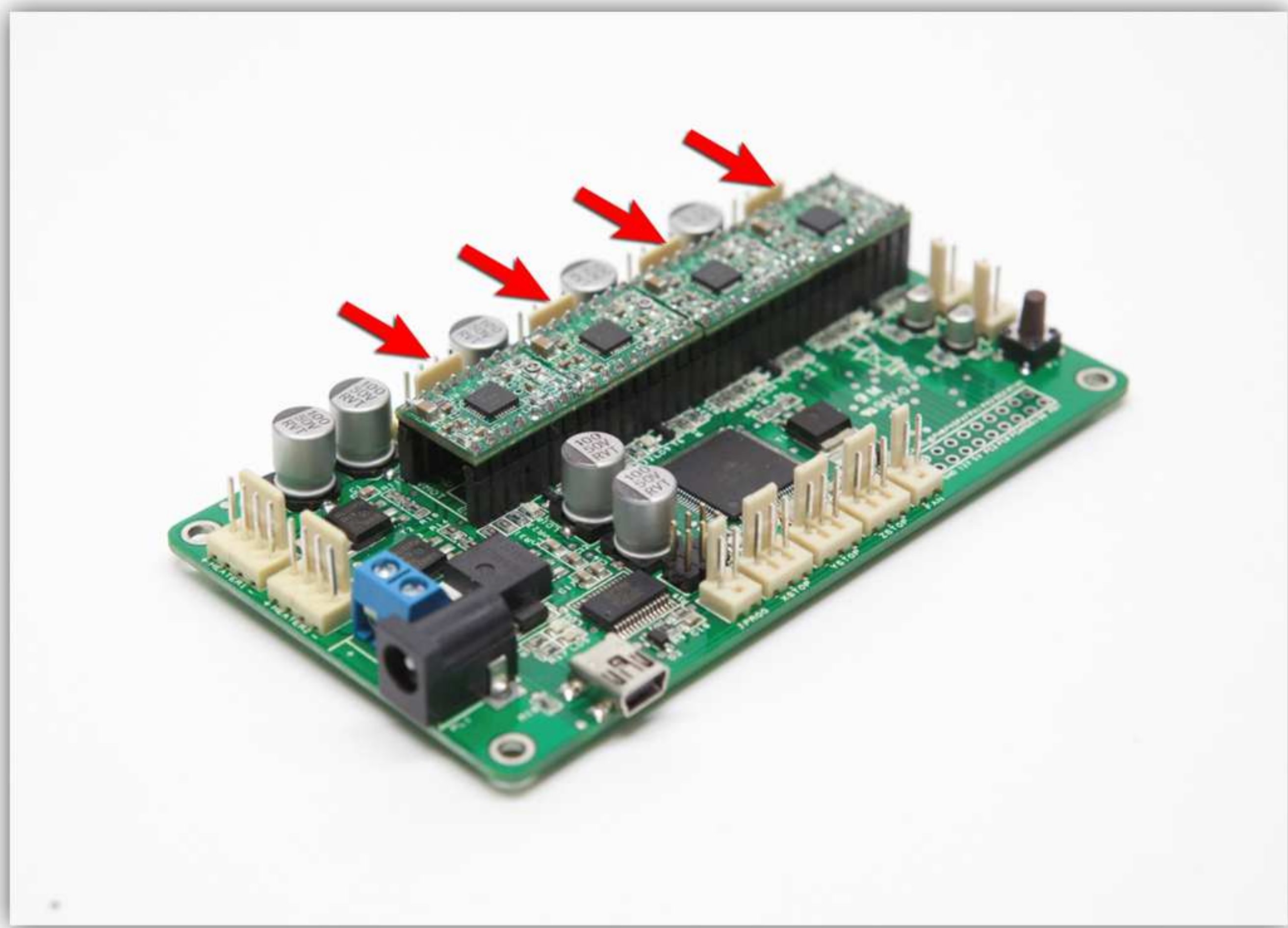
Now connect the adapter to the mains with the supplied cable. **If anything happens when you do this, disconnect the supply immediately. Check everything and correct any fault if necessary before connecting the power supply again.**

Since this is a DIY kit it is possible that the AC plug does not fit the sockets in your country. If this is the case please buy a correct plug at your distributor and use the pictures below to connect it to the power lead. The power block accepts the following voltages: 100-240V 50-60Hz.



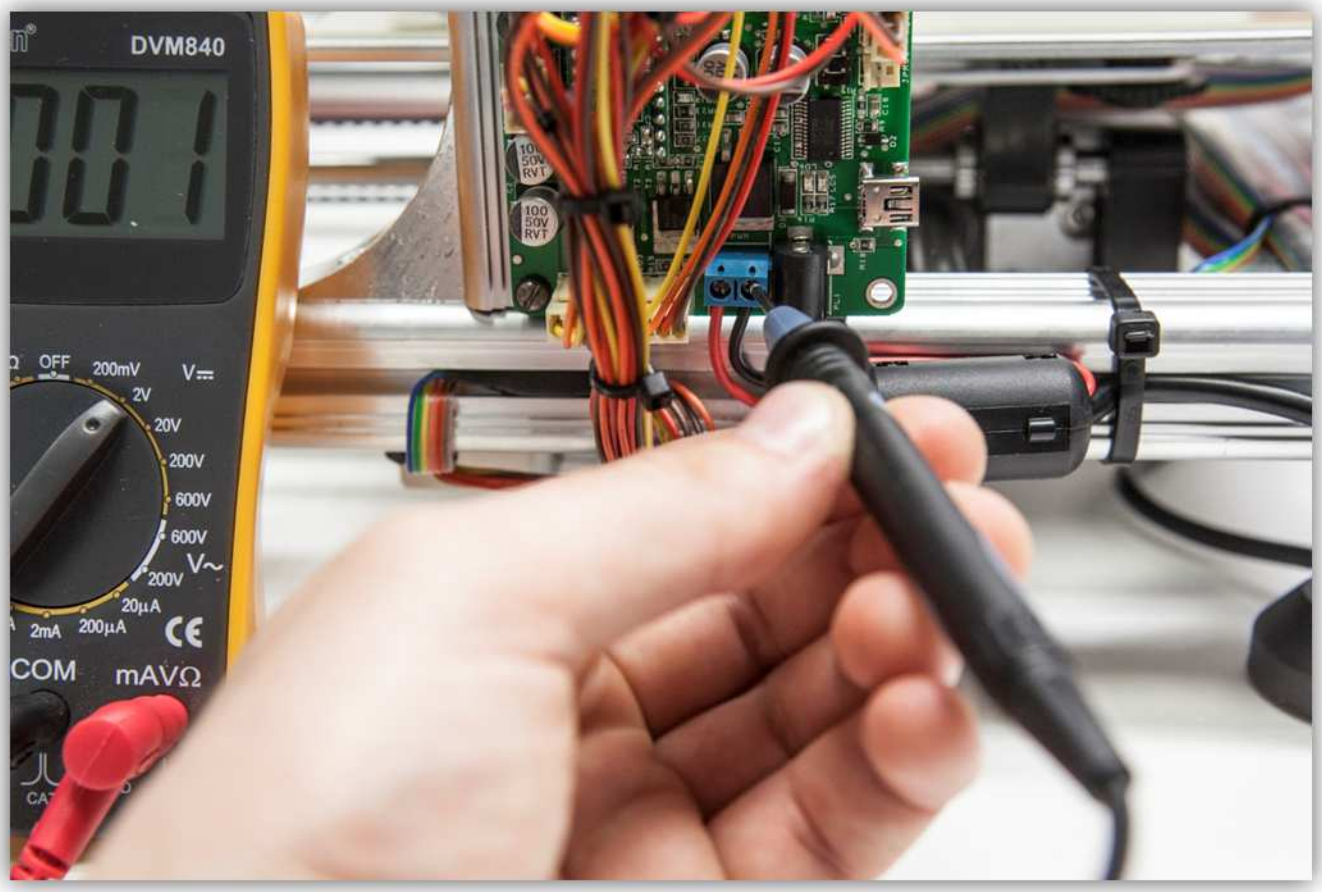


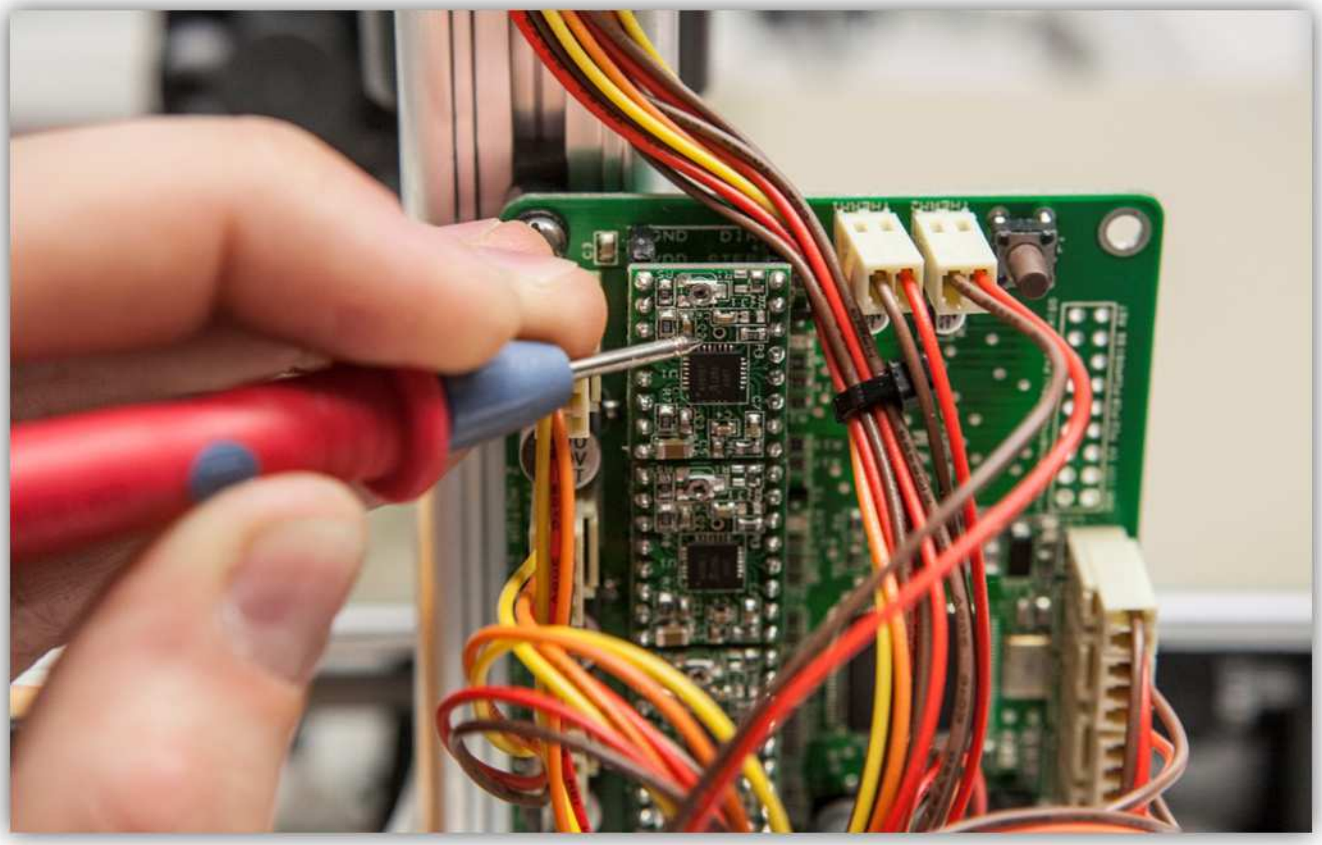
The controller board of the printer has 4 motor drivers, these are the 4 little PCBs that sit on top of the main board.

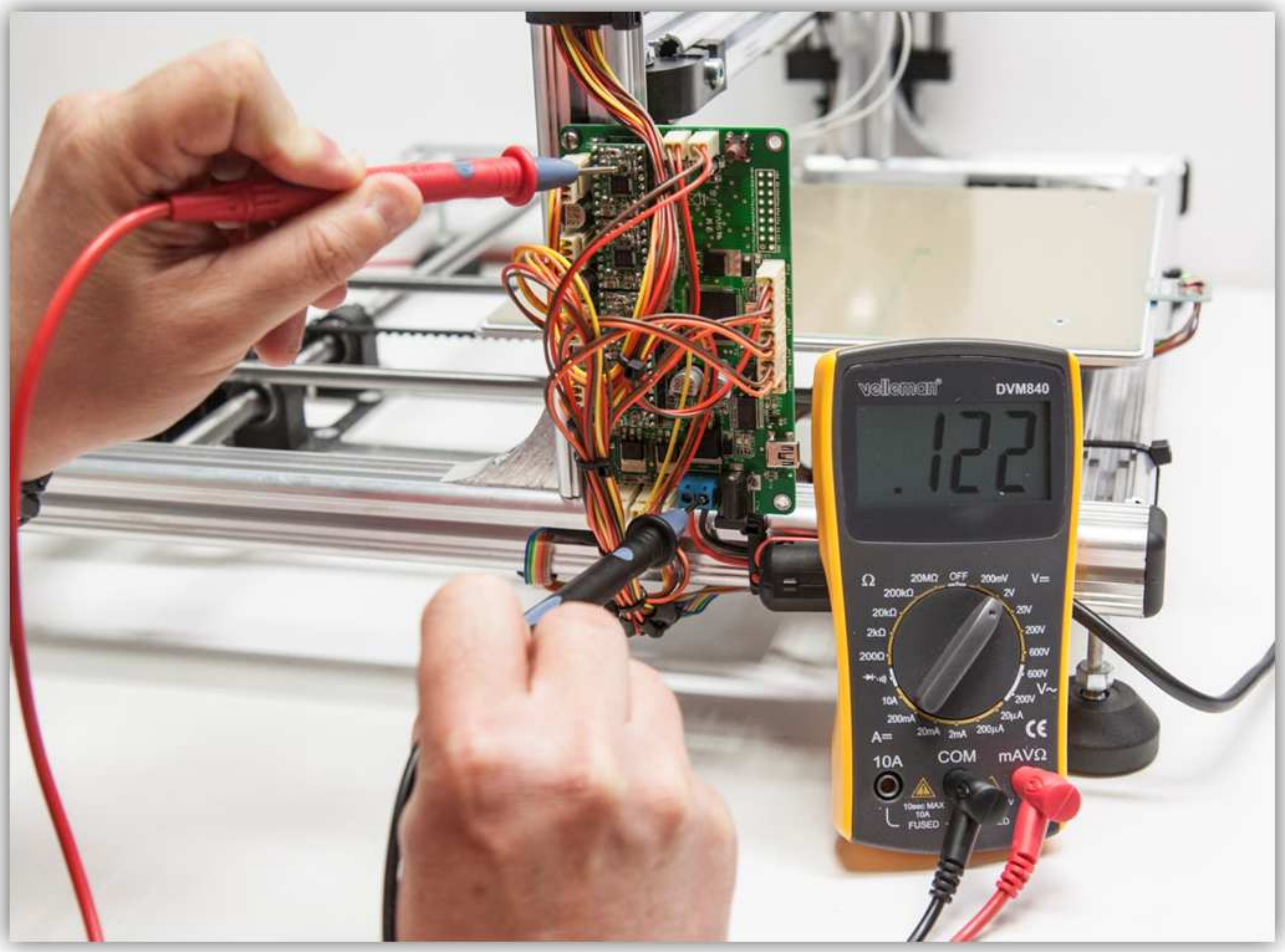


These drivers control the current that flows through each motor. To do that correctly each of them needs to be calibrated. Take your multimeter and a ceramic screwdriver **(a normal screwdriver will also work but be very careful not to touch anything else but the trimmer on the driver boards as you can cause a short circuit).**

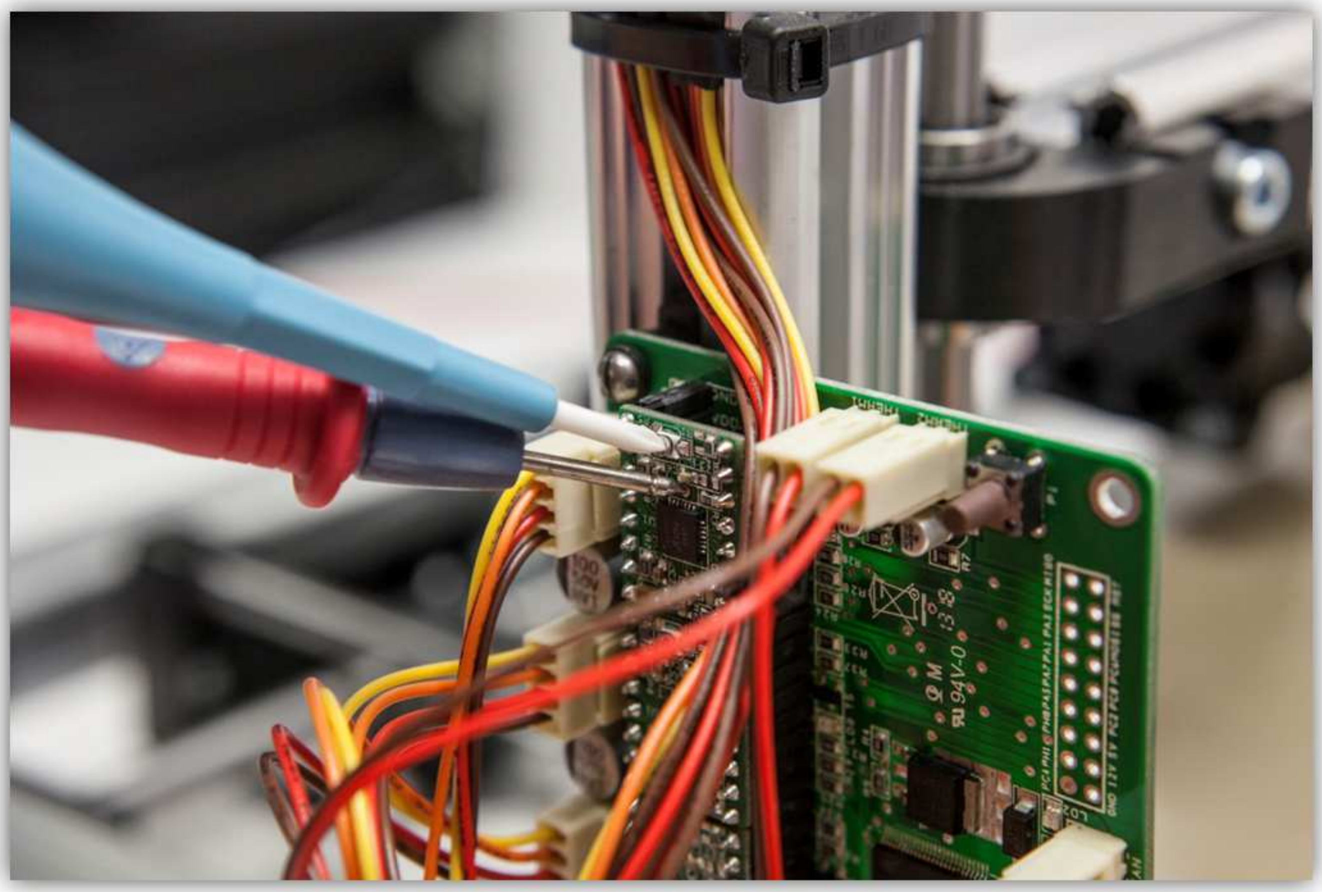
Put your multimeter on 2V DC and put the negative lead on the negative screw of the power connector. Put the positive lead on the large via of the first motor driver (for the extruder motor). **BE VERY CAREFUL NOT TO TOUCH ANYTHING ELSE WITH THE POSITIVE LEAD OF YOUR MULTIMETER.**

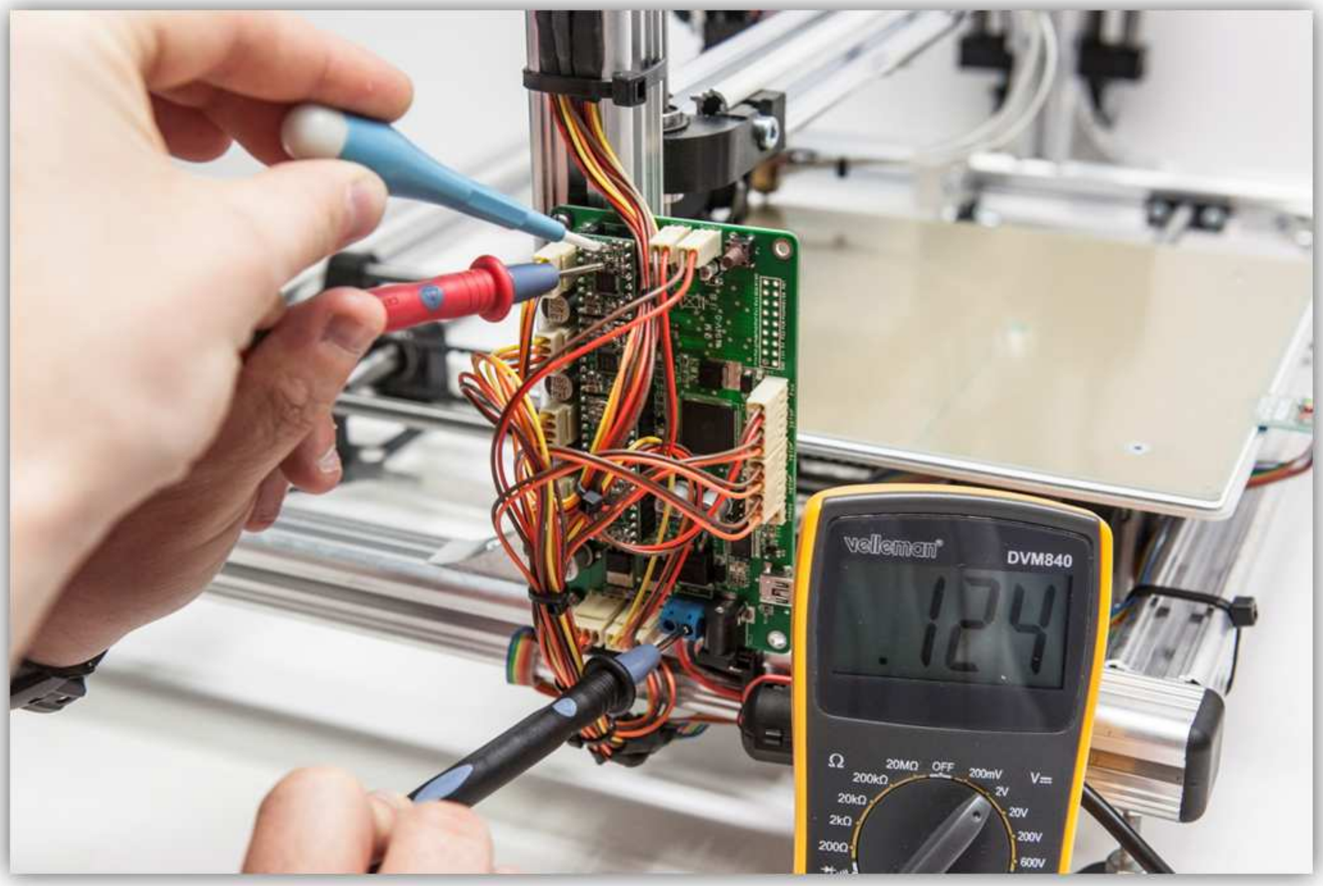

DVM840
001
OFF
200mV
2V
20V
200V
600V
600V
200V
20µA
2mA
200µA
COM
mAVΩ
100
50V
RVT

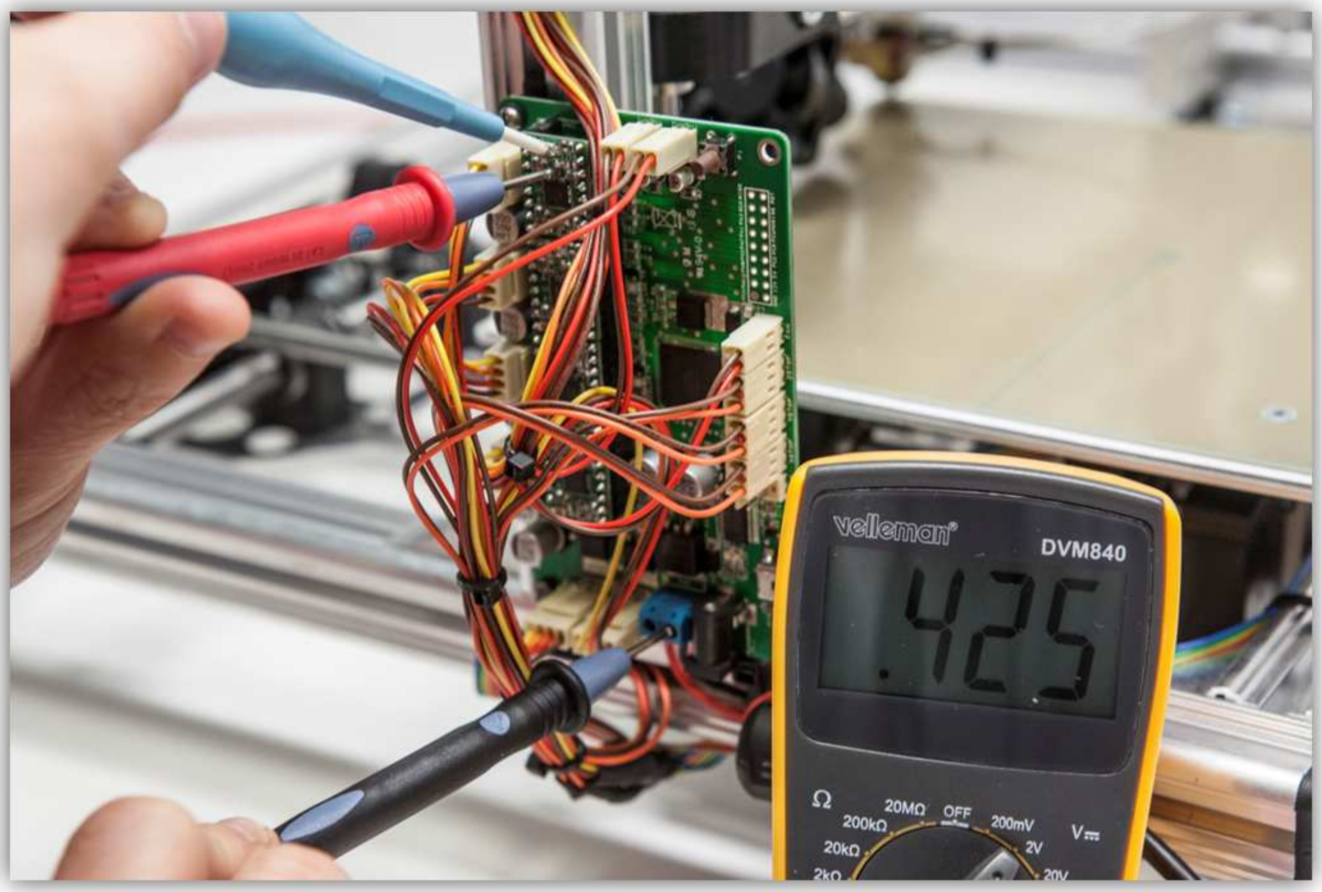




Adjust the little trimmer on the driver with the ceramic screwdriver until you measure **0.425V.**


94V-0


velleman
DVM840
.124
Ω
20MΩ
OFF
200mV
200kΩ
20kΩ
2kΩ
200Ω
2V
20V
200V
600V

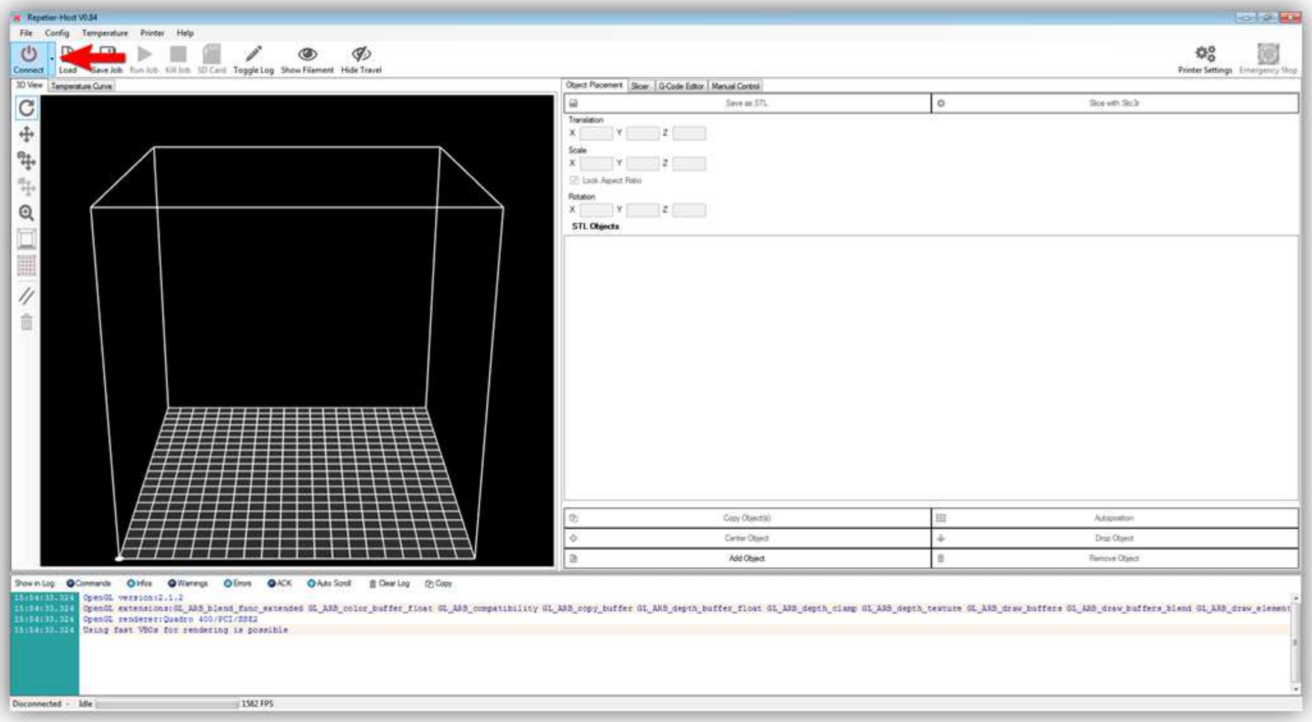


Repeat this process for the other 3 motor drivers.

In the following steps we will test all the motors of the printer, it is possible due to stiff mechanical movement that motors will skip steps (this means that when a motor is driven it wants to turn but the forces on it are too great and it returns to its original position). When this happens it could have several causes. Check for mechanical stiffness and add a bit of lubricant to the threaded rod and the smooth rods. If this does not help and a motor keeps skipping steps you can raise the calibration voltage for that particular motor to 0.55V.

Now we can attempt to control the printer with Repetier. Move the HEATED BED PCB into the middle of the printer by hand and make sure the extruder arm is at about 20 cm (7.87") from the heated bed.

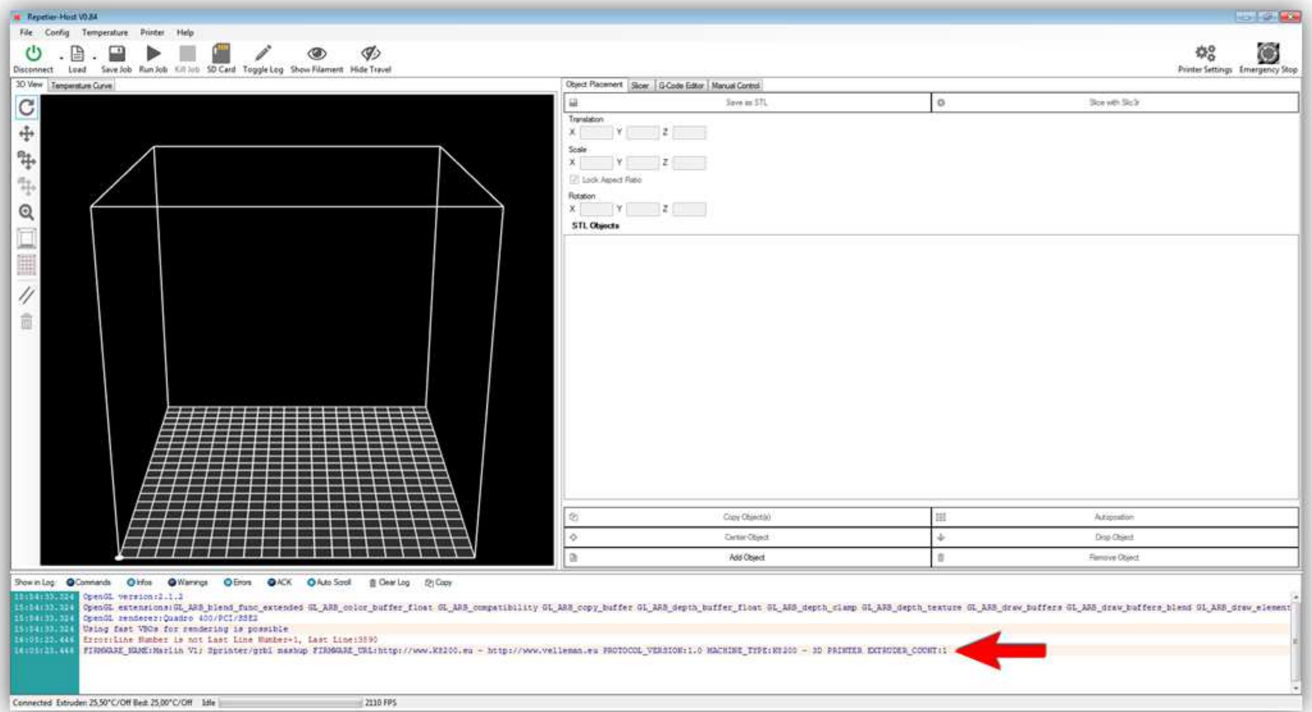
Click this button in the Repetier software:



The text on the button should change from “**Connect**” to “**Disconnect**”.

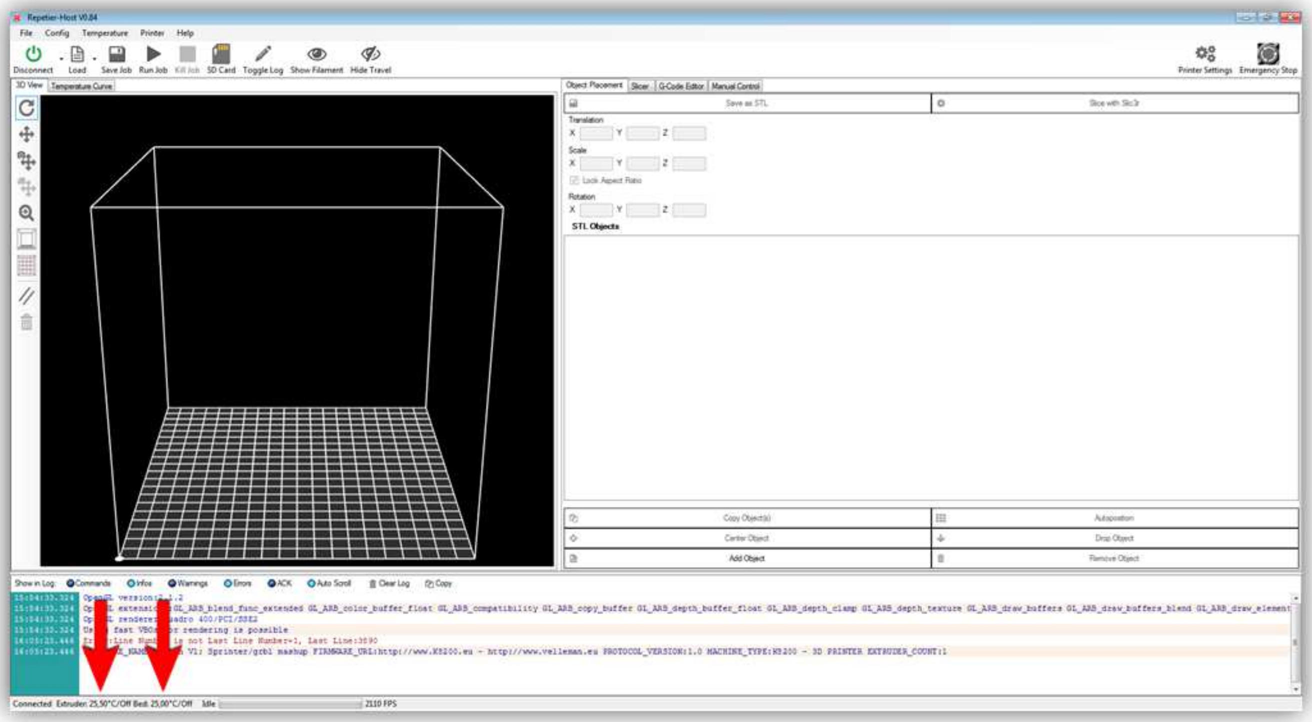
In the log view on the bottom of Repetier you should see the printer showing the following data:

FIRMWARE_NAME:Marlin V1; Sprinter/grbl mashup FIRMWARE_URL:http://www.K8200.eu - http://www.velleman.eu PROTOCOL_VERSION:1.0 MACHINE_TYPE:K8200 - 3D PRINTER EXTRUDER_COUNT:1

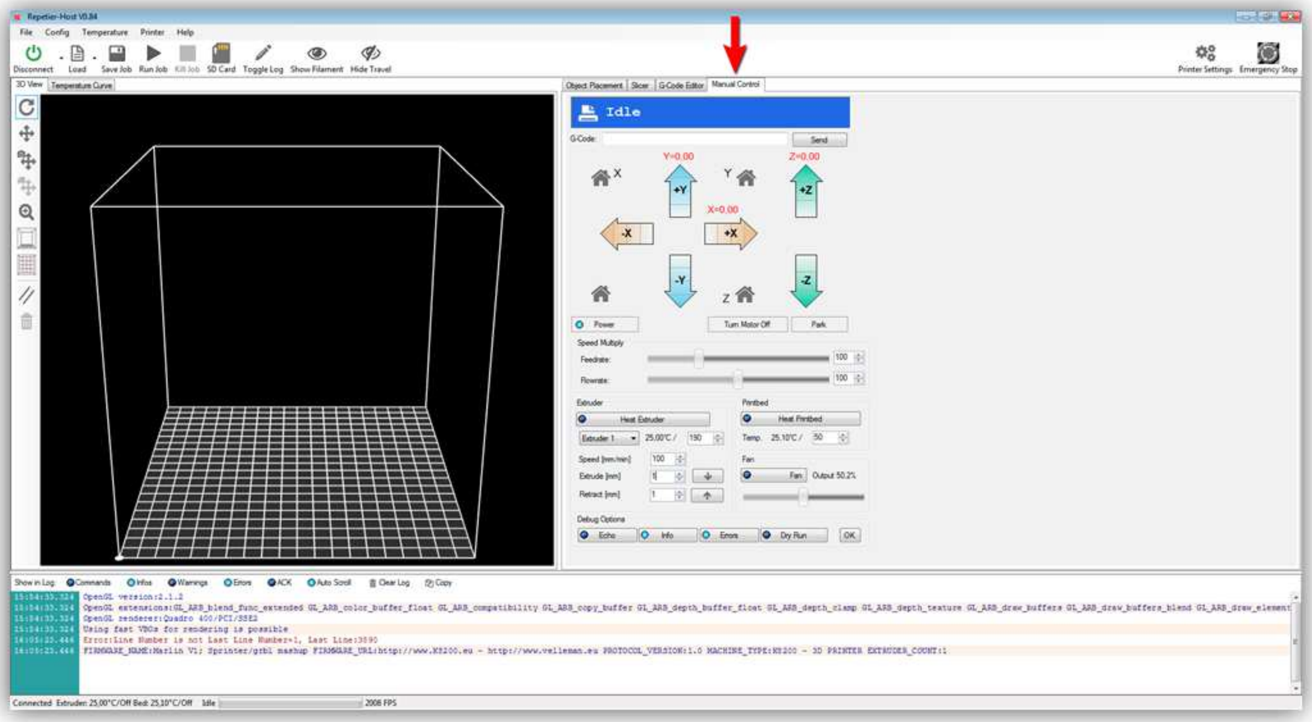


This means that there is a successful connection between the computer and printer.

You should also see the Extruder and Bed temperature. They should show a value close to room temperature.

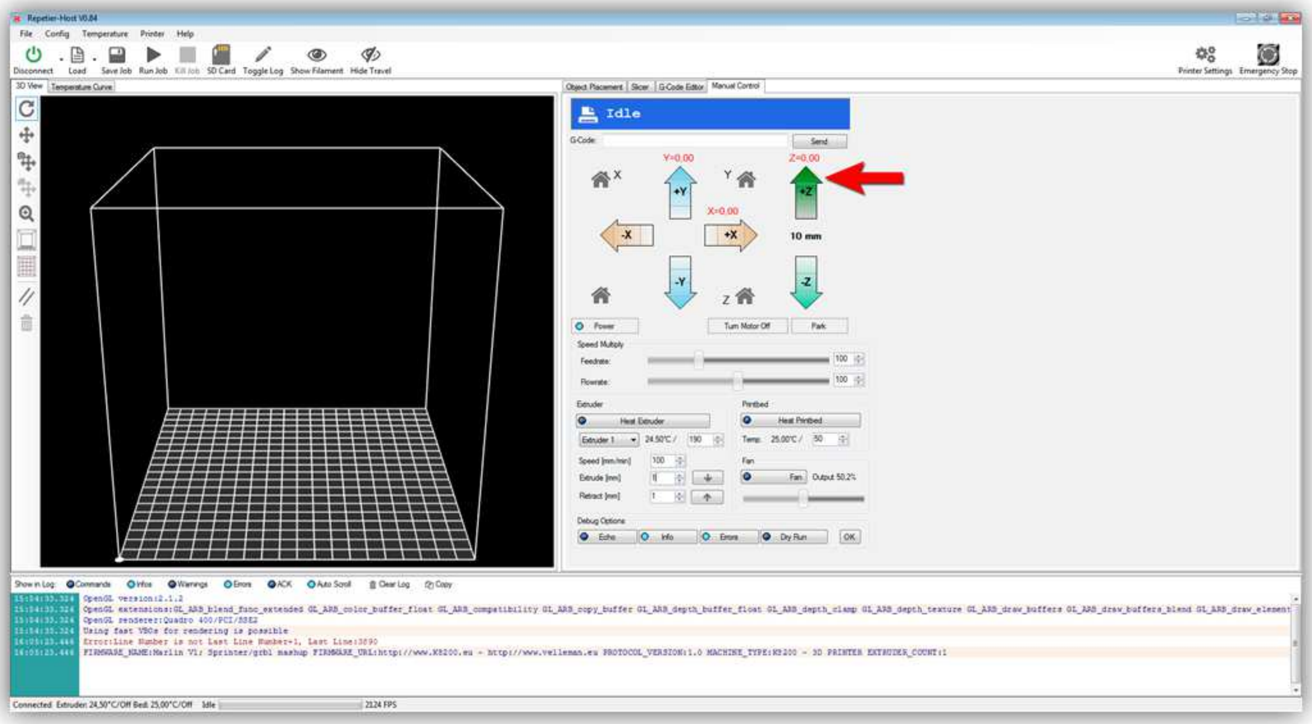


Now select the “Manual Control” tab.

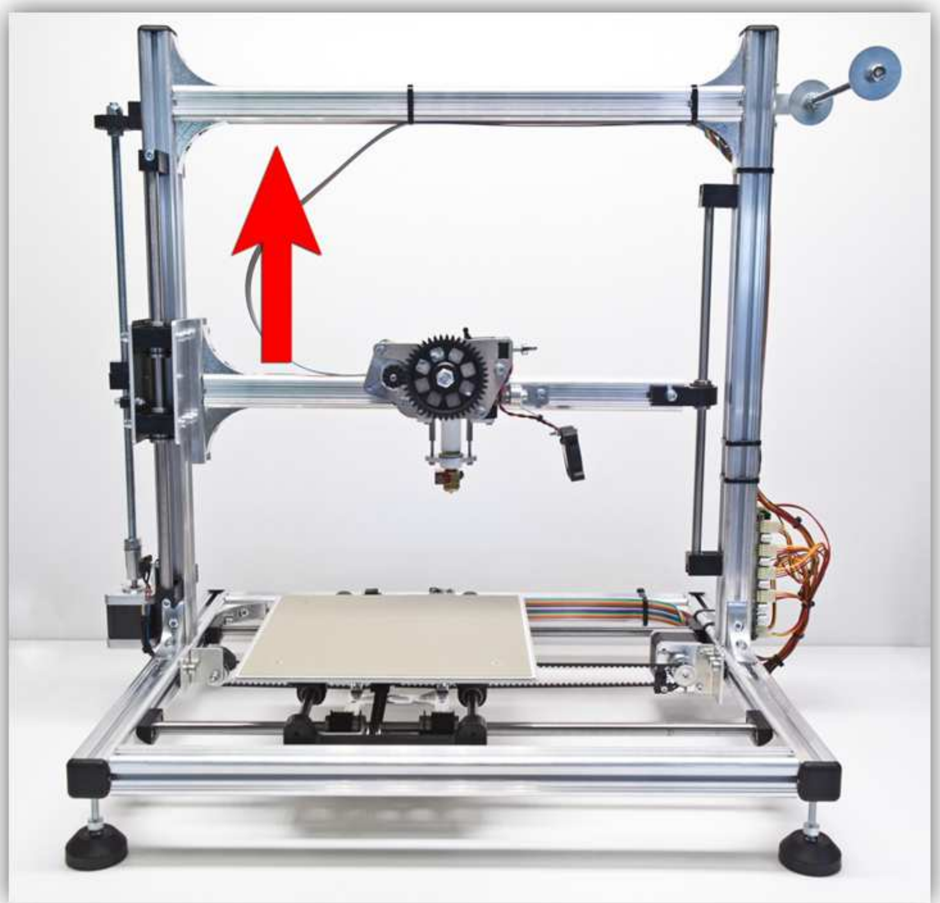


Now we will test each function of the printer separately.

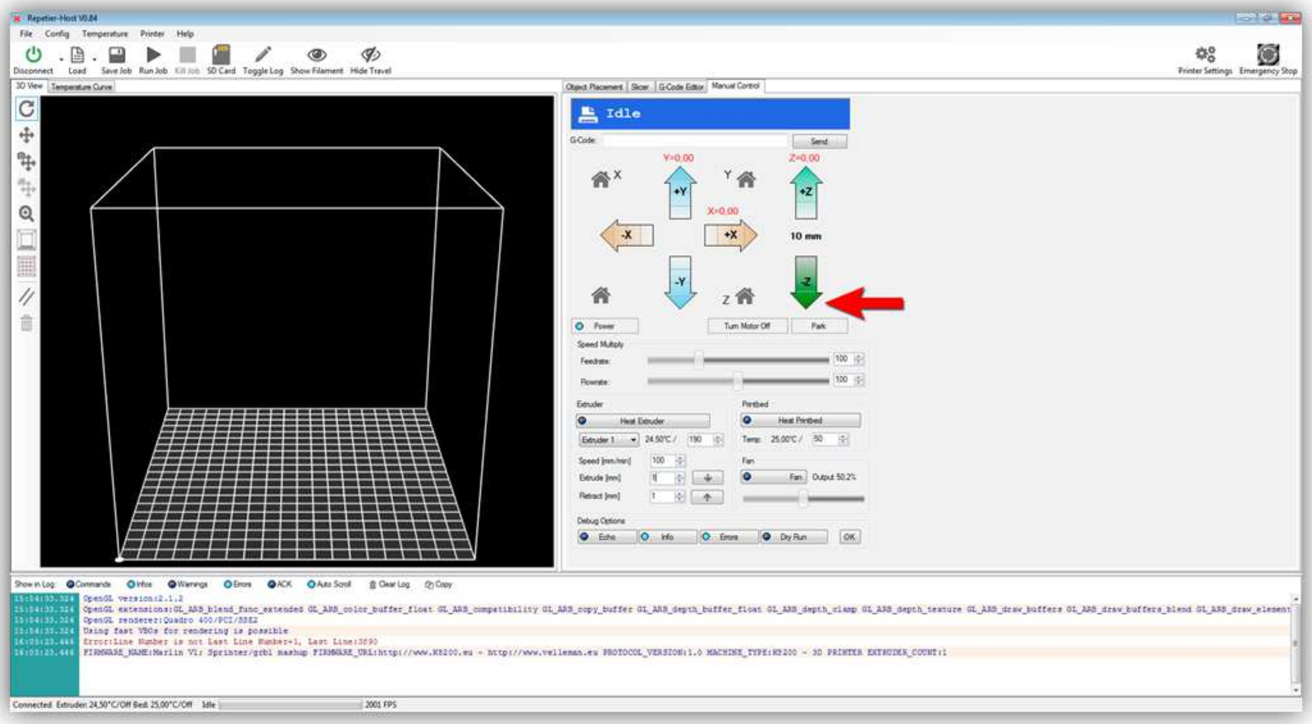
Press the Z + arrow for 10 mm **(The arrow has 3 active areas where you can click, choose the one that shows 10mm).**



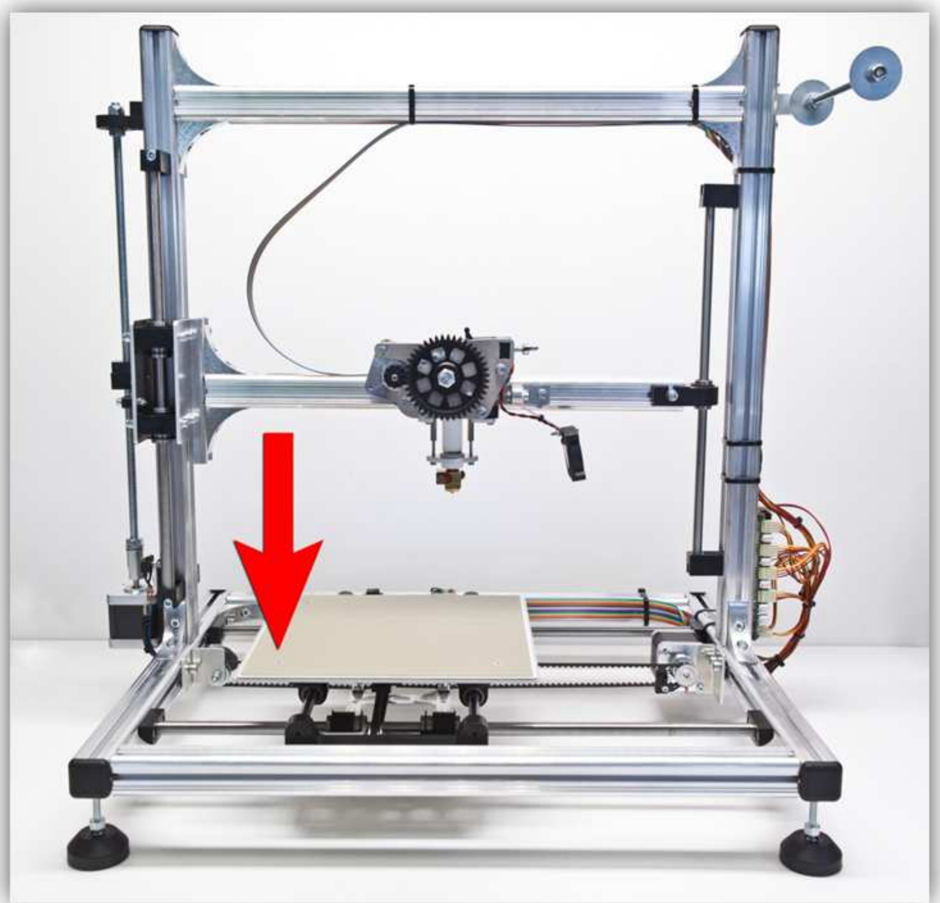
The Z AXIS should go **UP** 10 mm, everything should go smoothly. If the Z AXIS does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing.



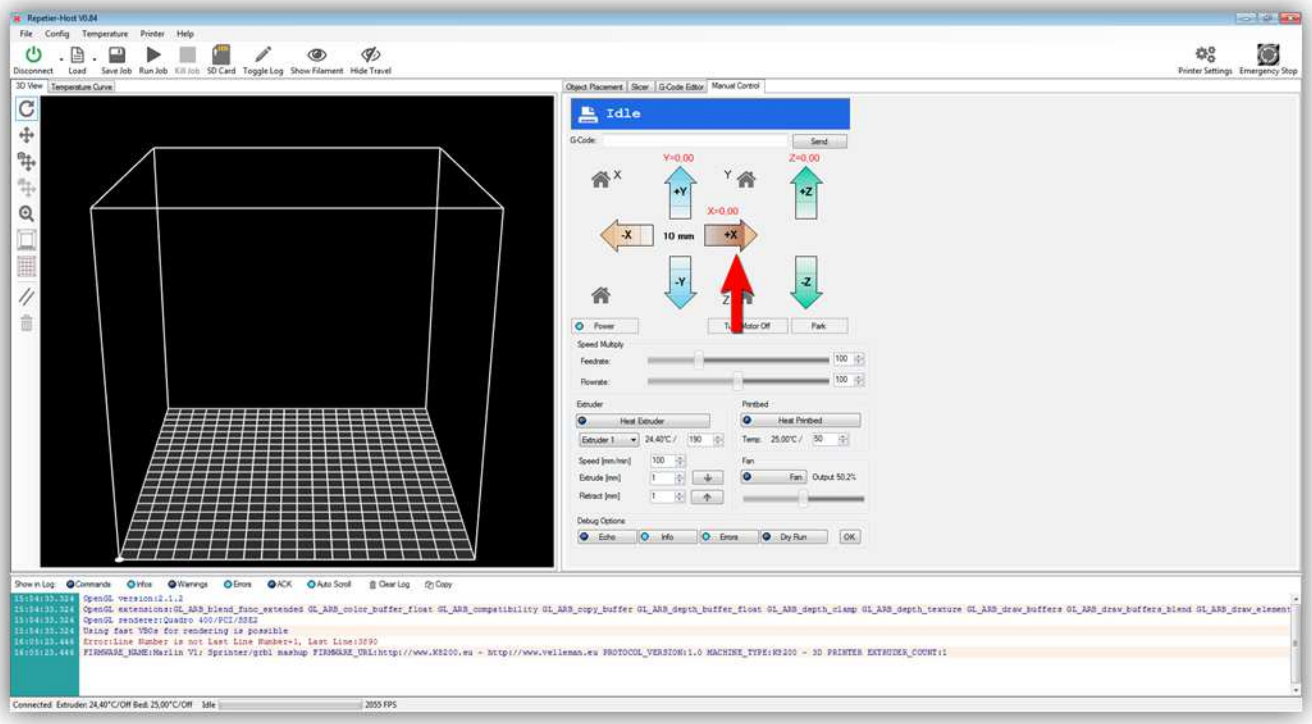
Press the Z - arrow for 10 mm **(The arrow has 3 active areas where you can click, choose the one that shows 10mm).**



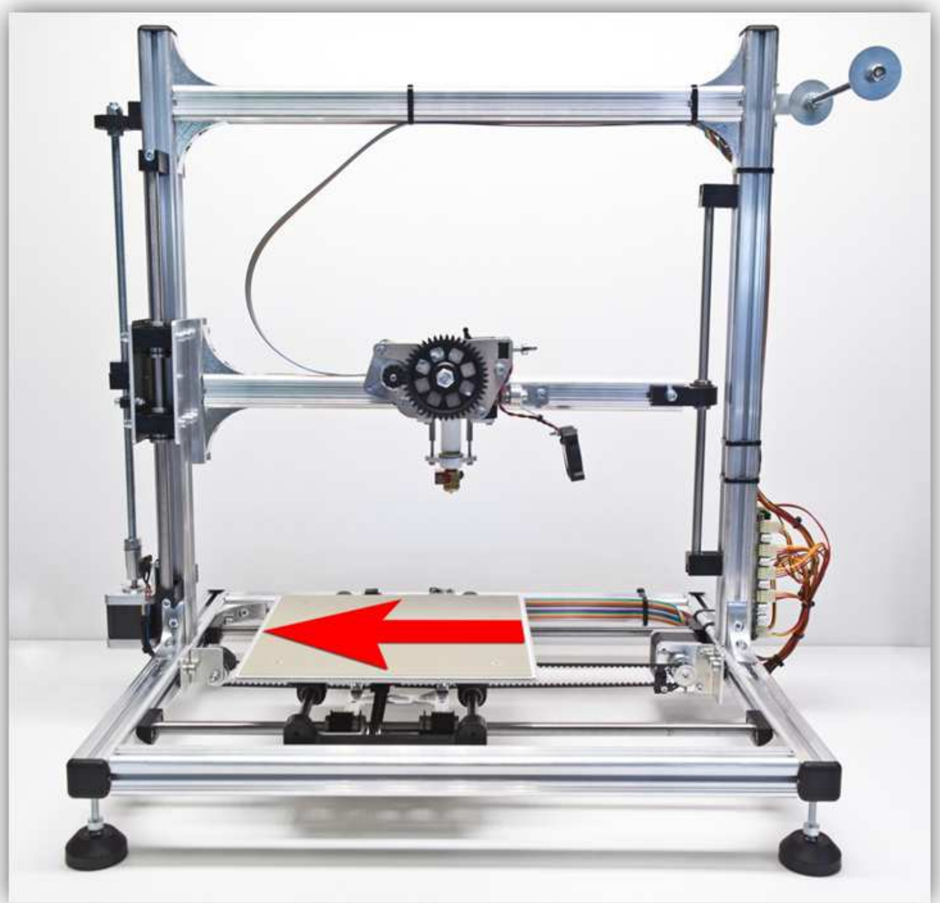
The Z AXIS should go **DOWN** 10 mm, everything should go smoothly. If the Z AXIS does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing.



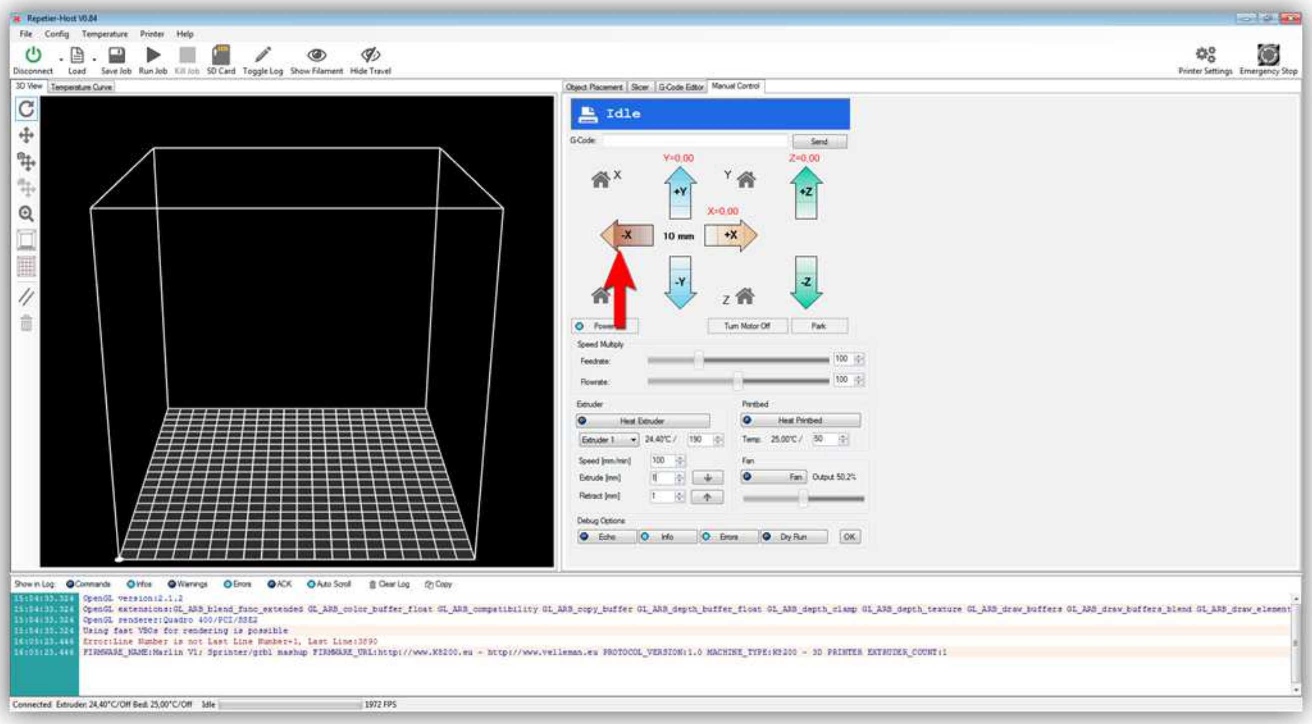
Press the X + arrow for 10 mm **(The arrow has 3 active areas where you can click, choose the one that shows 10mm).**



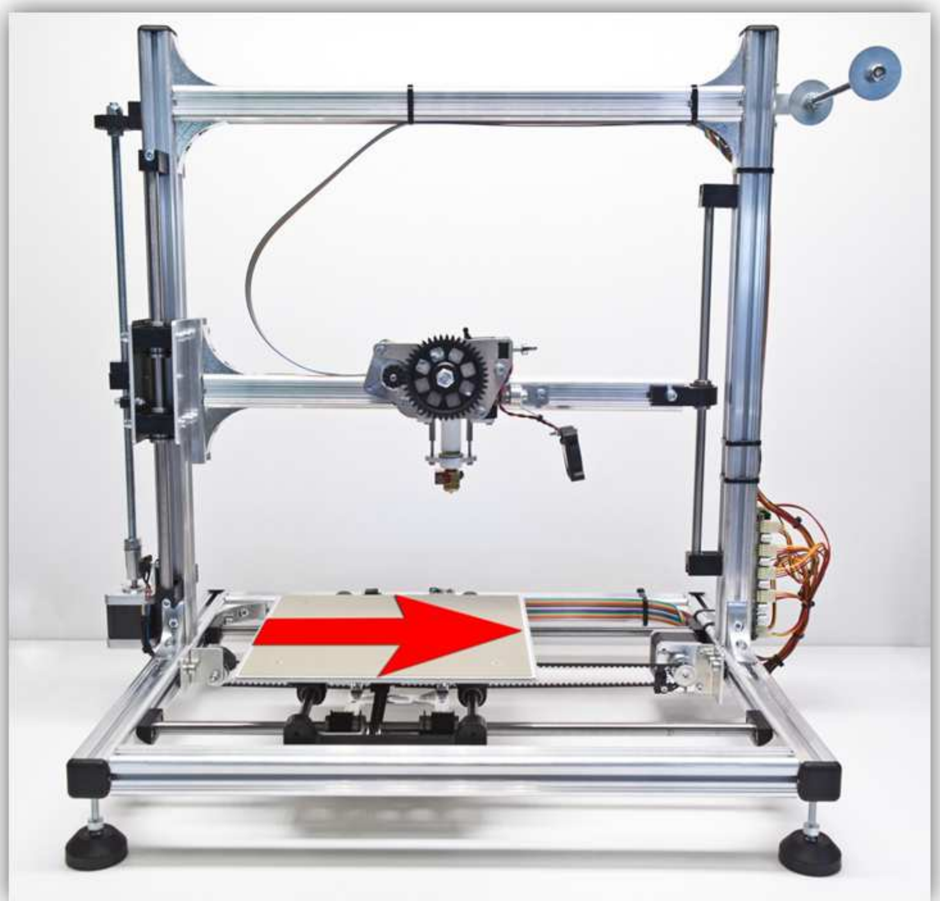
The X AXIS should go **LEFT** 10 mm, everything should go smoothly. If the X AXIS does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing.



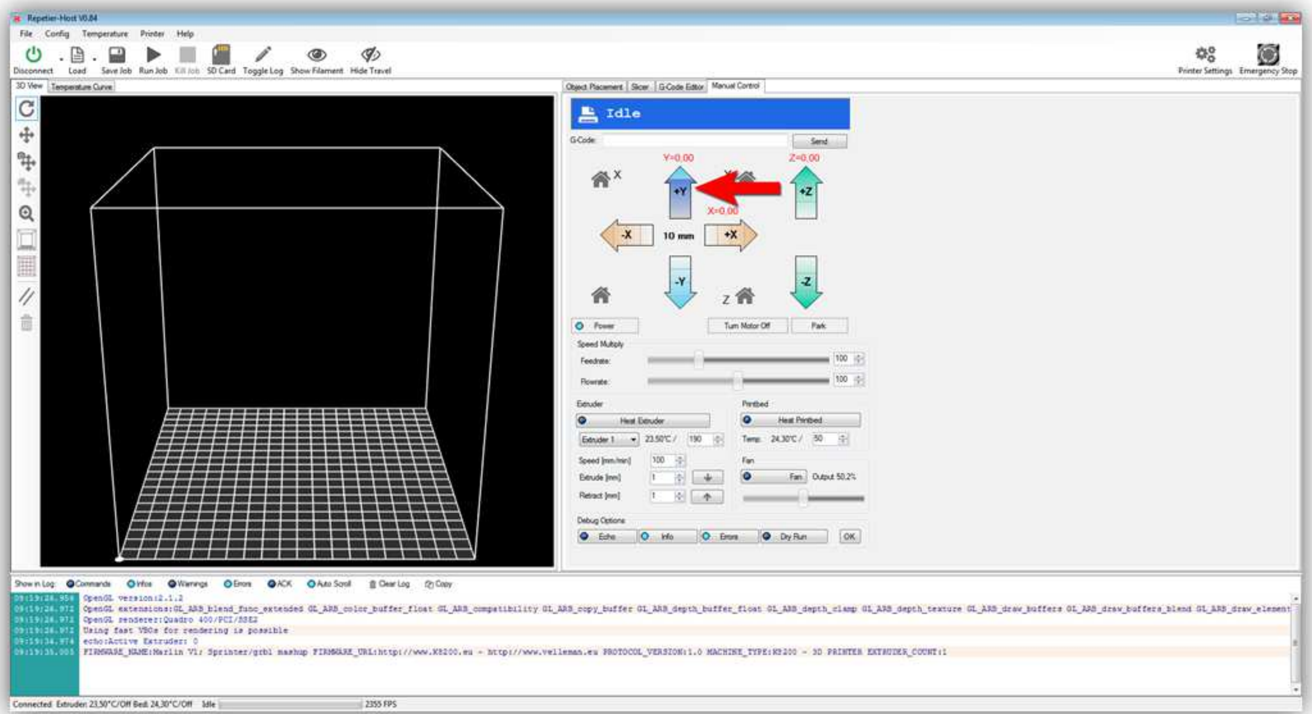
Press the X - arrow for 10 mm **(The arrow has 3 active areas where you can click, choose the one that shows 10mm).**



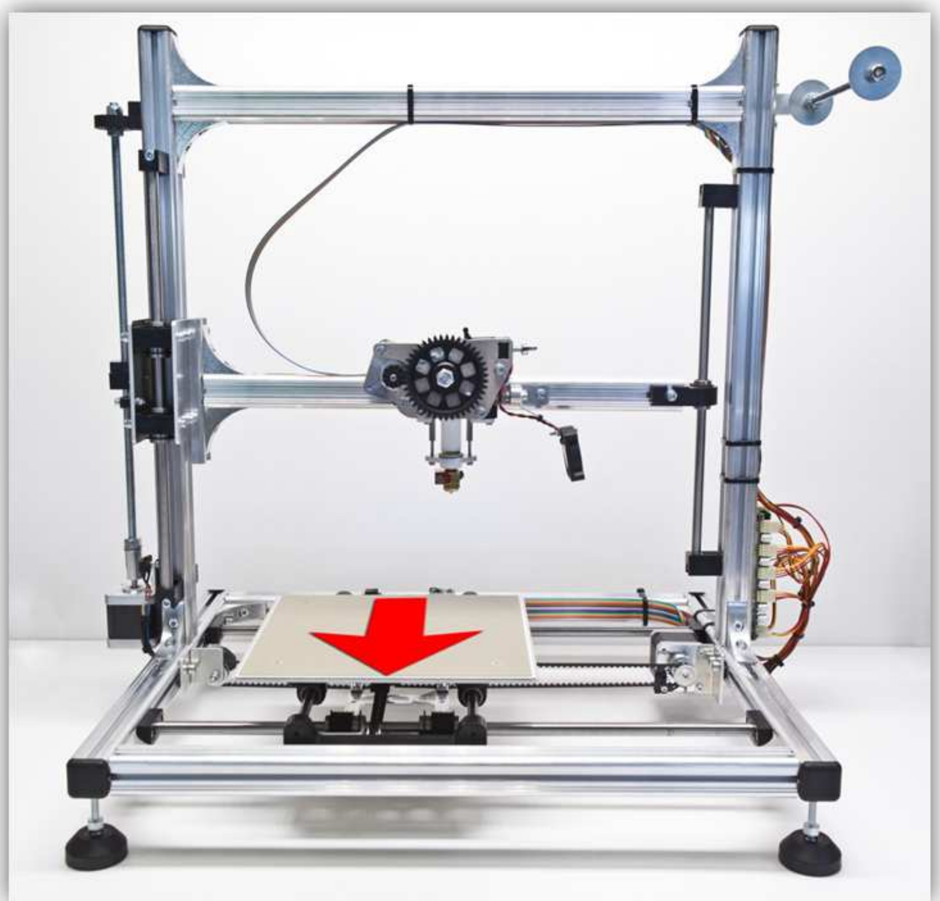
The X AXIS should go **RIGHT** 10 mm, everything should go smoothly. If the X AXIS does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing.



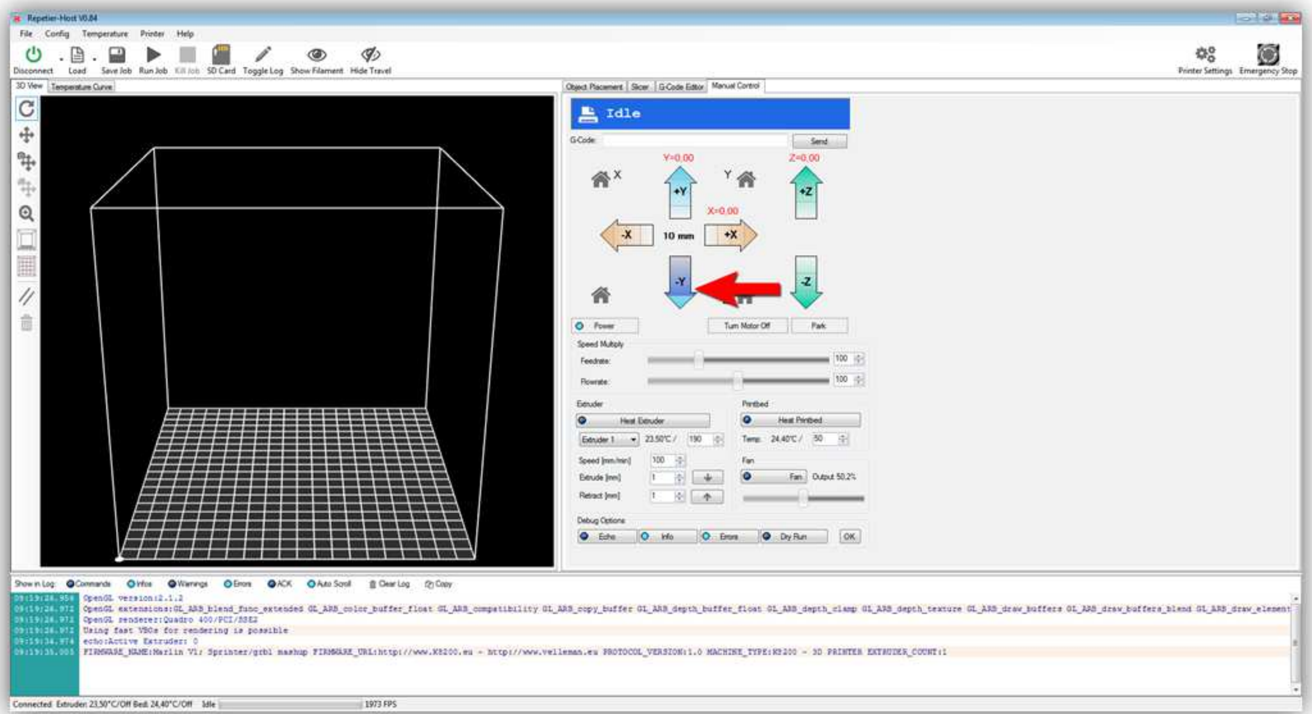
Press the Y + arrow for 10 mm **(The arrow has 3 active areas where you can click, choose the one that shows 10mm).**



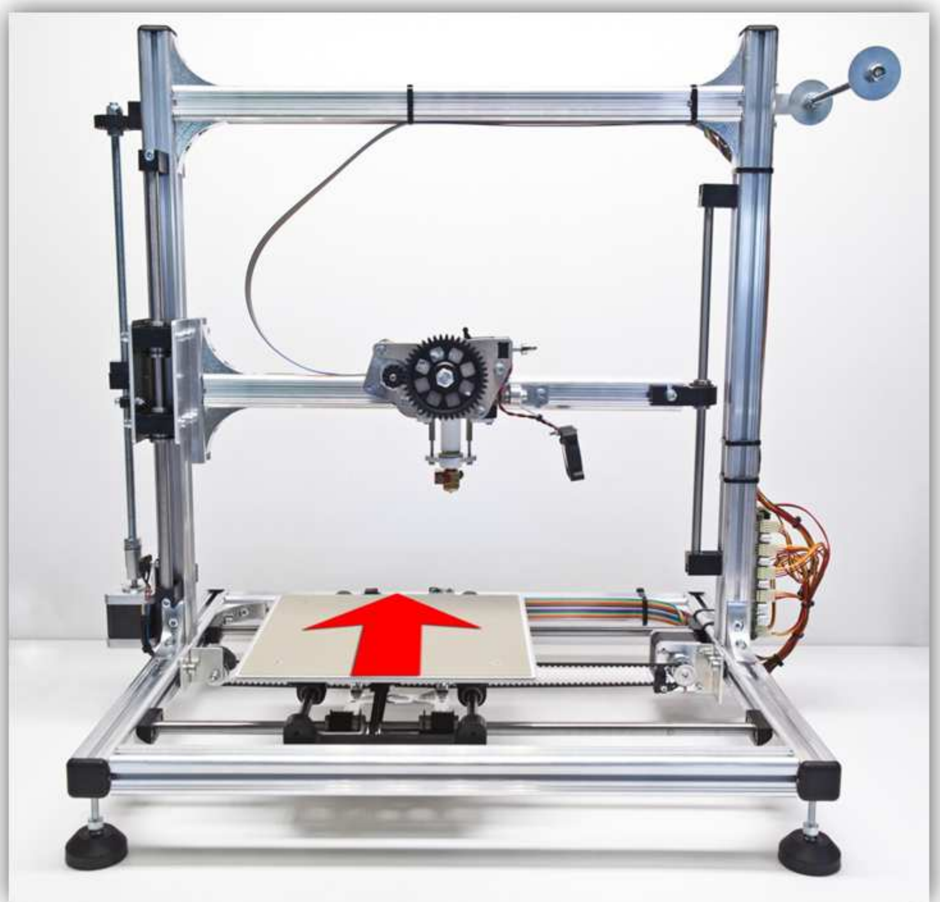
The Y AXIS should go **FORWARD** 10 mm, everything should go smoothly. If the Y AXIS does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing.



Press the Y - arrow for 10 mm **(The arrow has 3 active areas where you can click, choose the one that shows 10mm).**



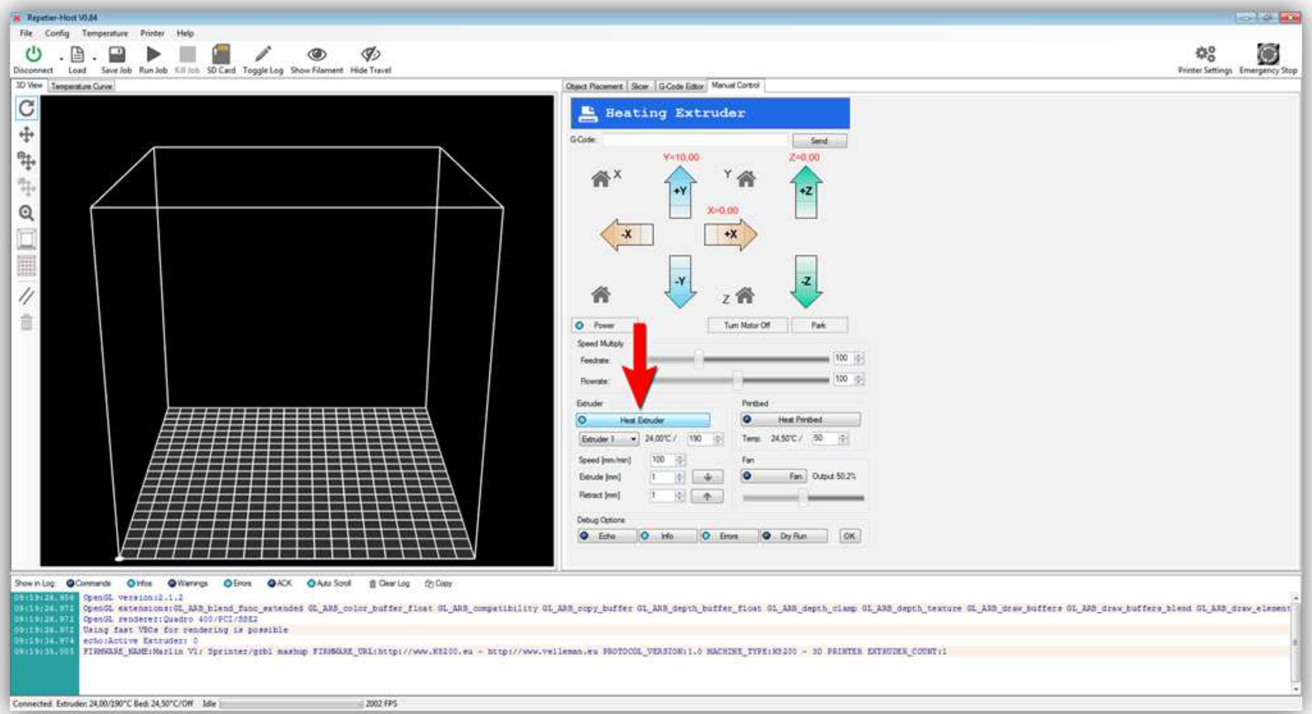
The Y AXIS should go **BACK** 10 mm, everything should go smoothly. If the Y AXIS does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing.



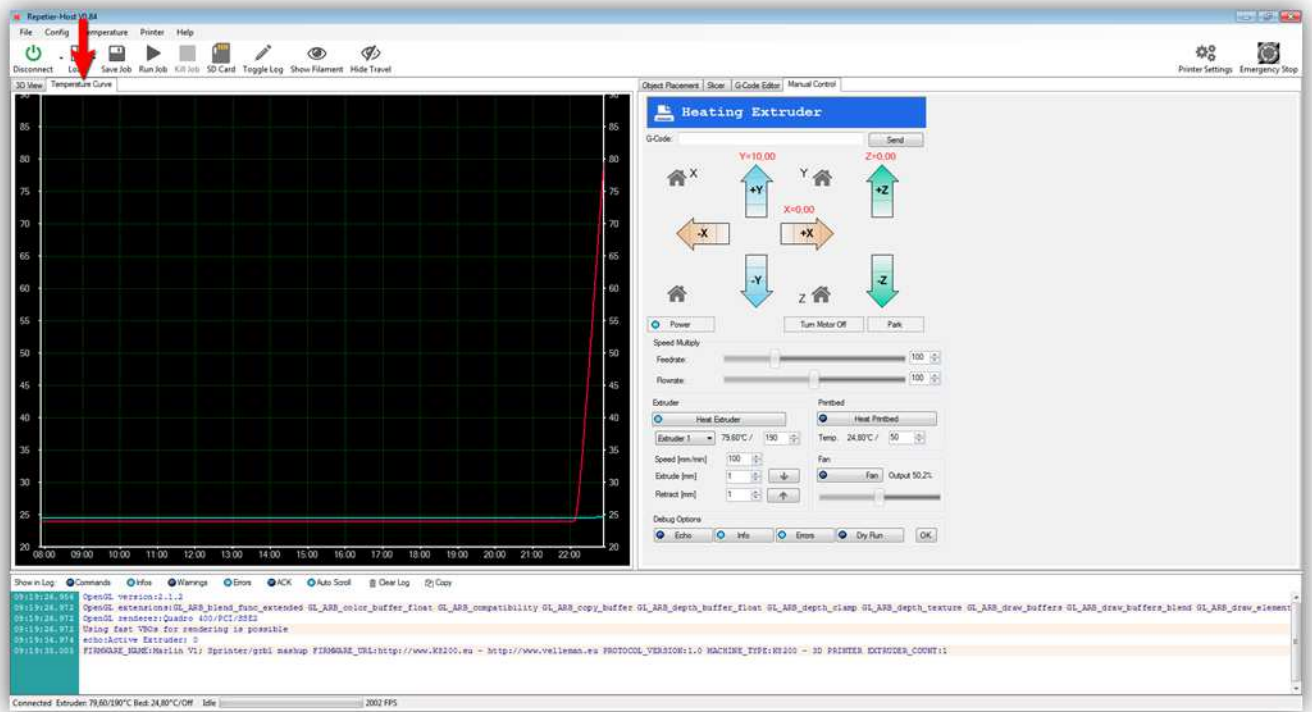
If everything went right so far you know that each motor is wired correctly. Now we will test if the extruder works.

Press on the “Heat Extruder” button. Make sure the value in the box is 190°C.

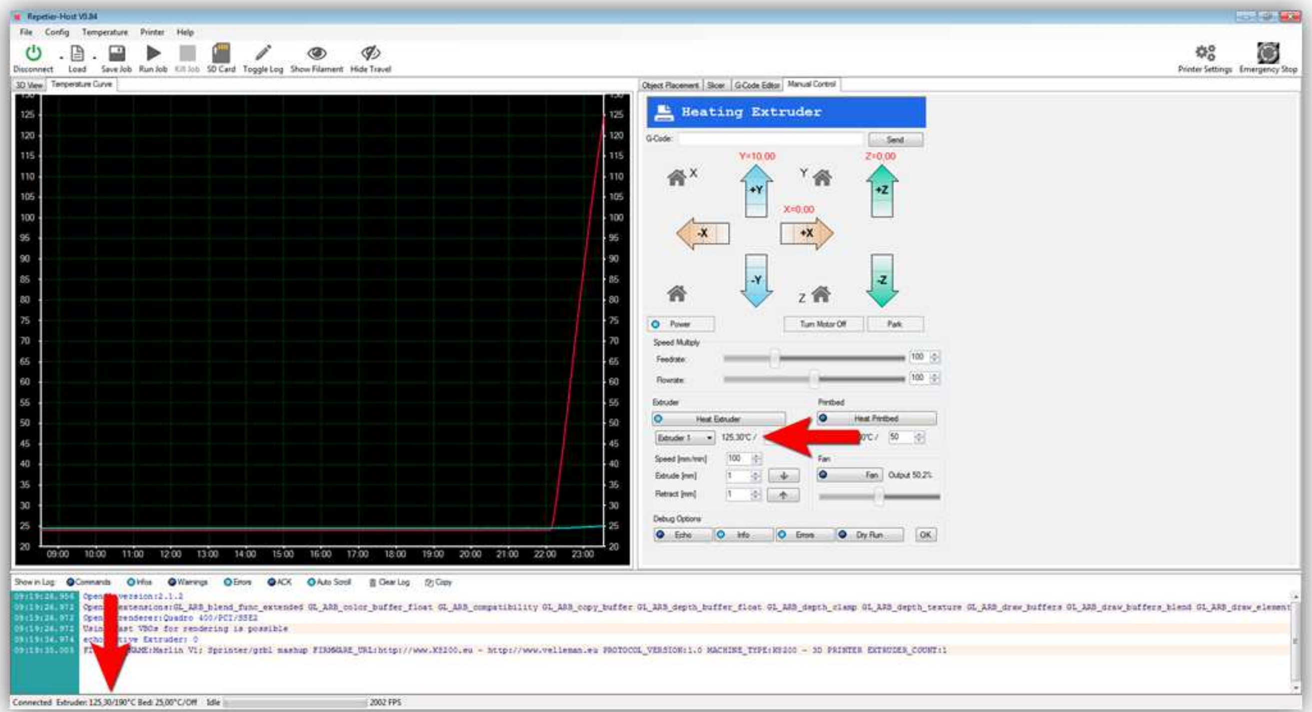
(When you do this you can also see an indicator light on the controller board lighting up, showing that HEATER 1 is powered).



With the “Heat Extruder” button active, press the “Temperature Curve” tab.

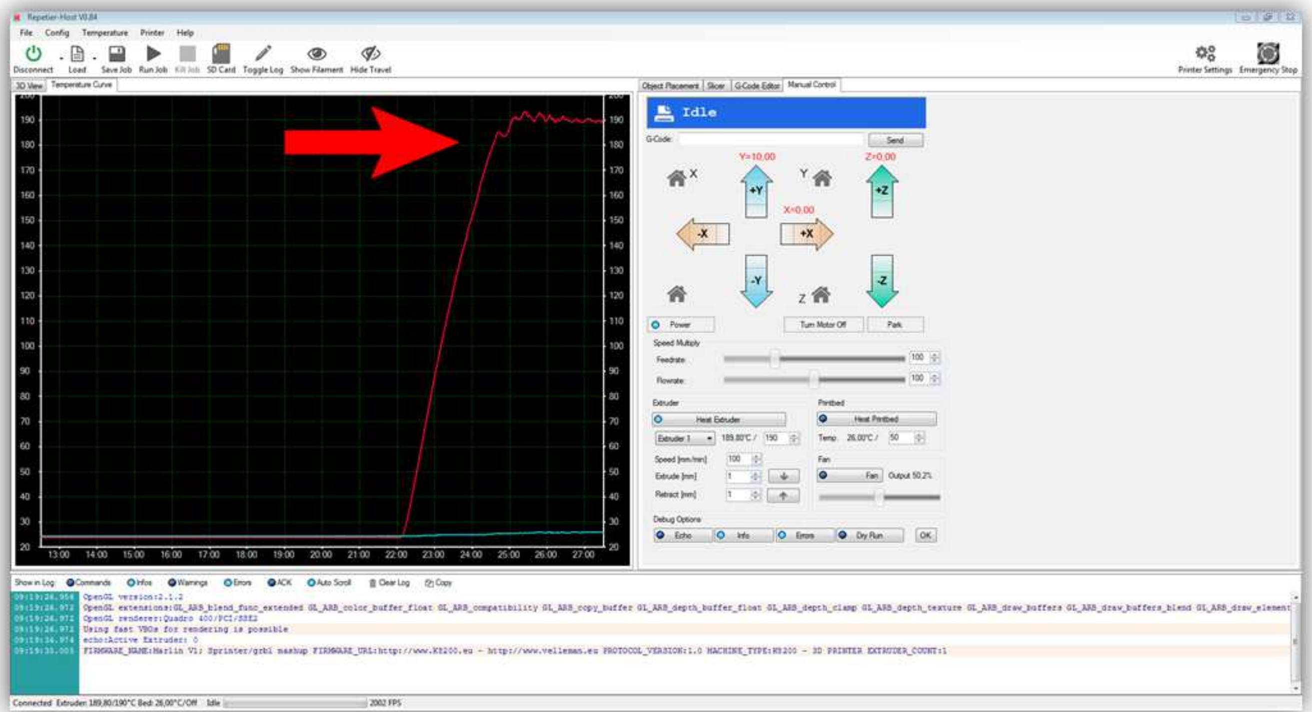


There you should see a graph indicating the temperature of the extruder (RED) and the temperature of the heated bed (BLUE). The red line should rise to the temperature that was specified in the box (190°C). You can also check the current temperature in the following places:



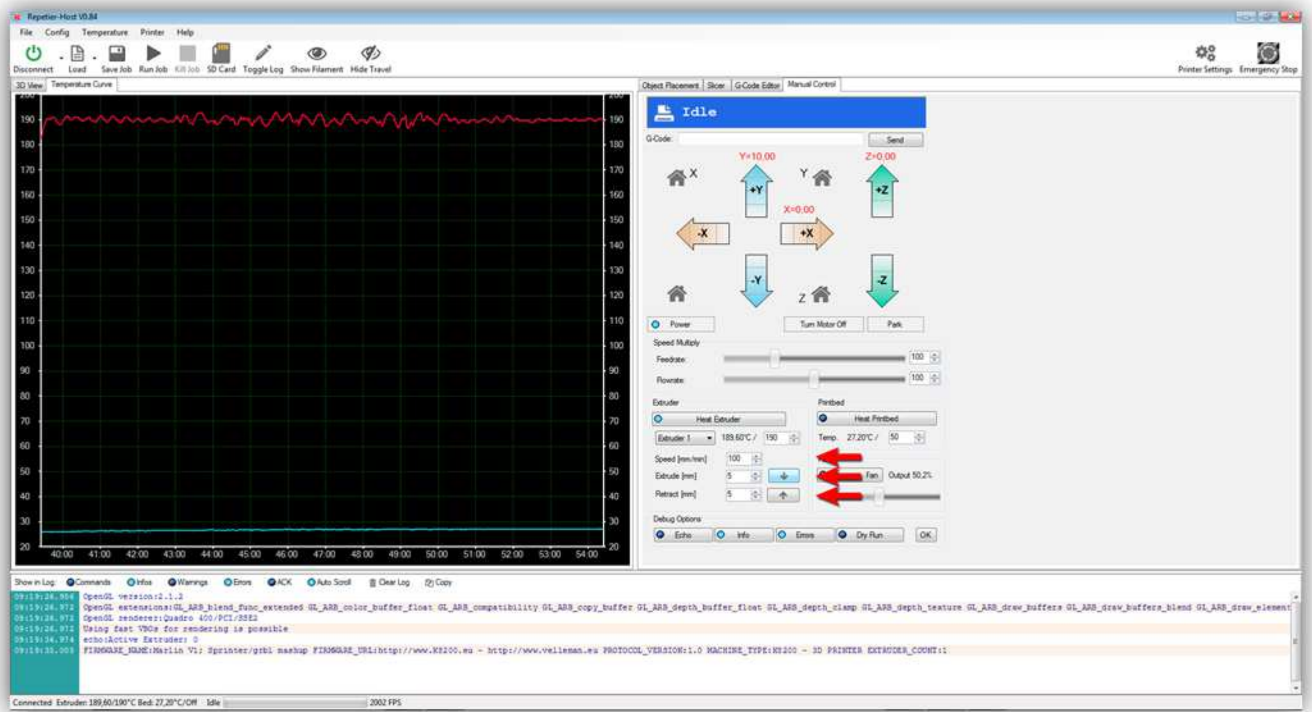
Once the temperature has reached 190°C the graph should start looking like this:

(Be careful because the extruder is now extremely hot. Do not touch it.)

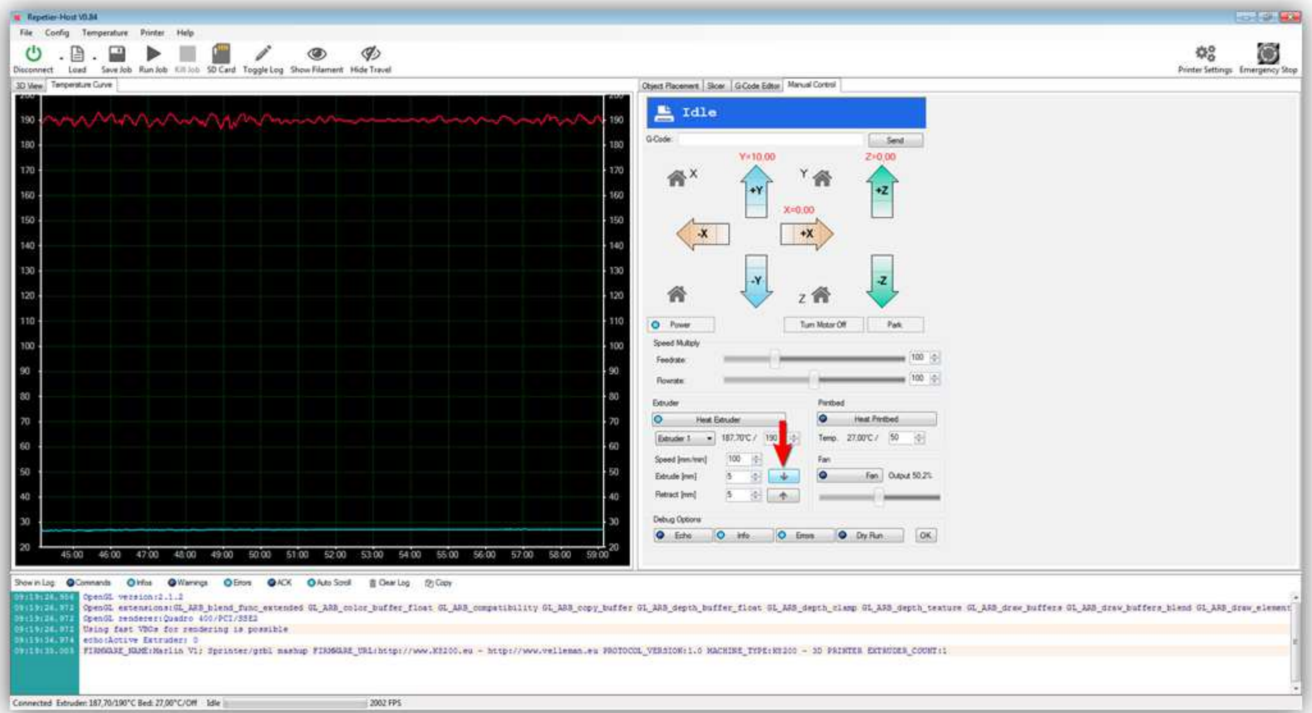


While the extruder is hot we can test the extruder motor. For safety reasons, the motor cannot turn when the extruder is cold. First check the values in the following boxes.

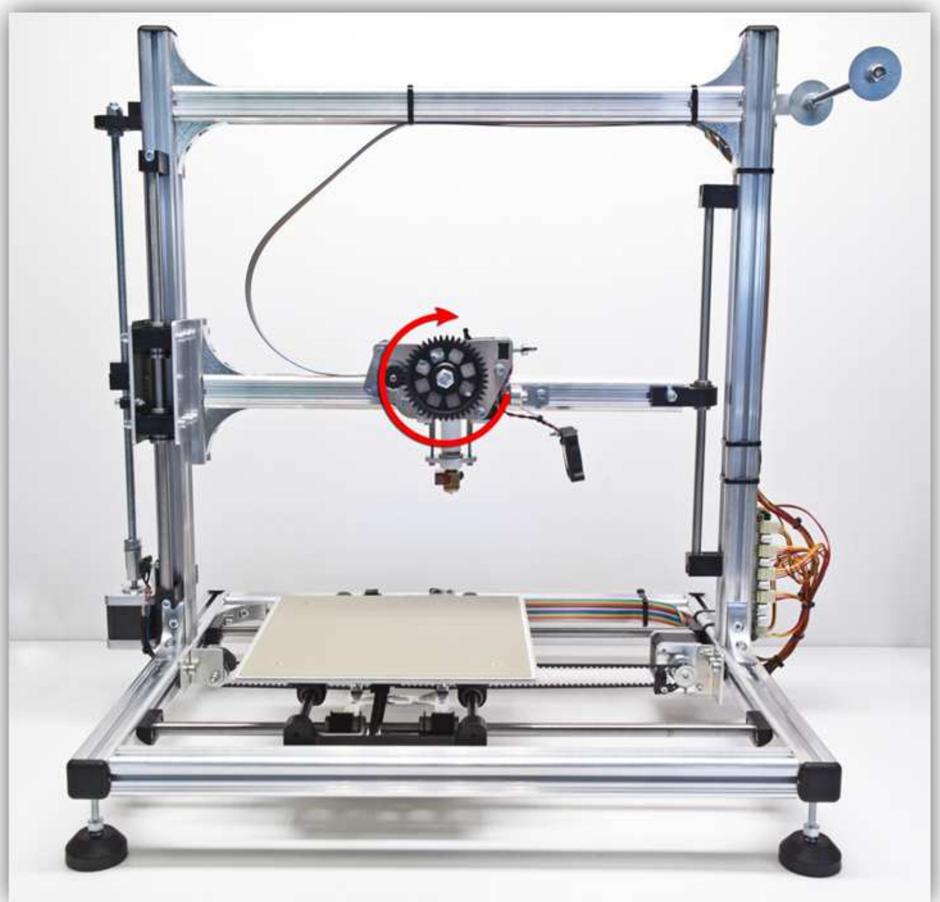
- Speed = 100
- Extract = 5
- Retract = 5



Then press the following button:

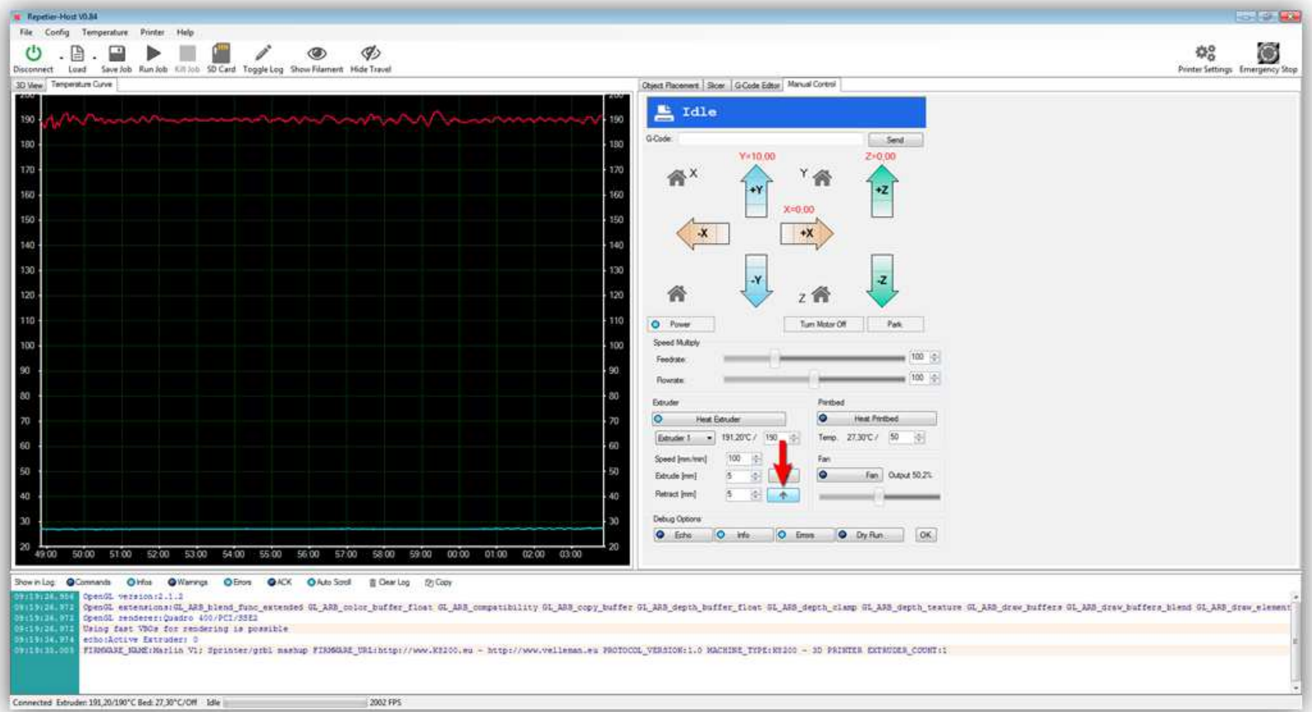


The extruder motor should turn a bit and make the large gear turn to the **RIGHT**.

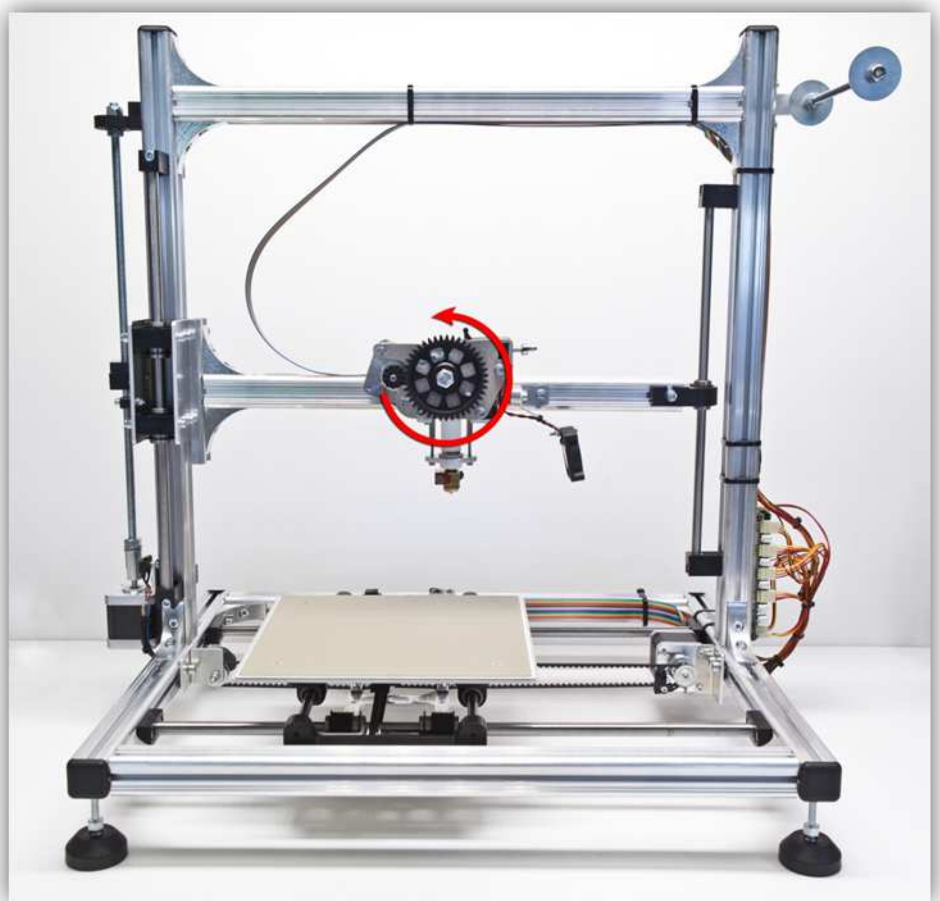


The extruder motor should turn smoothly. If the LARGE GEAR does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing.

Then press the following button:

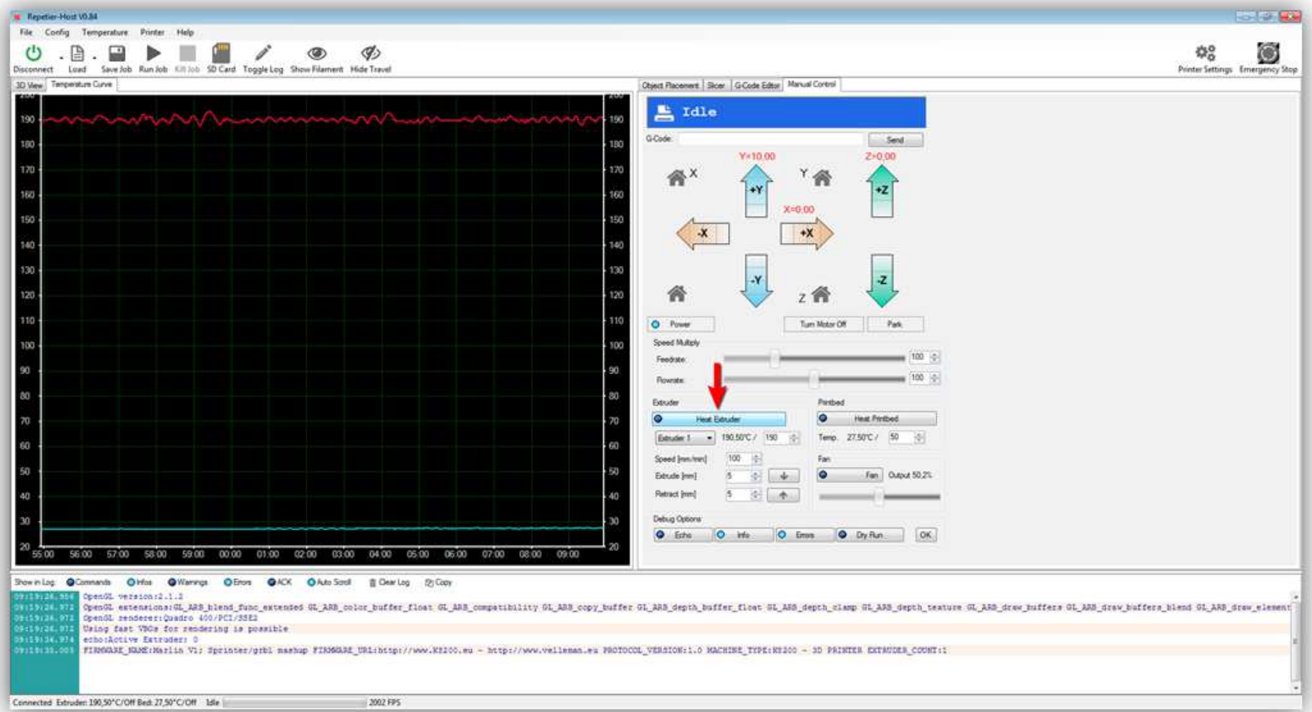


The extruder motor should turn a bit and make the large gear turn to the **LEFT**.

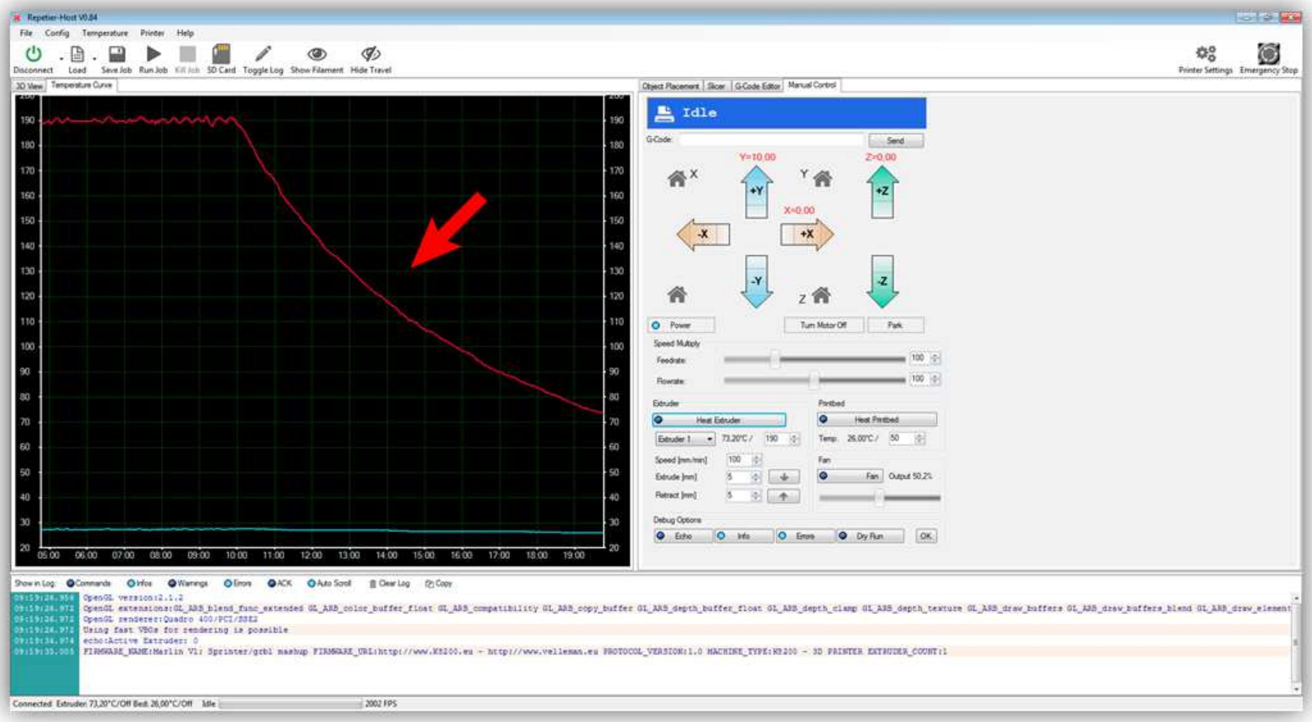


The extruder motor should turn smoothly. If the LARGE GEAR does not move or moves in the opposite direction you wired something wrong. Find and correct the fault before continuing

Now you can shut down the heater of the extruder by pressing the “Heat Extruder” button again.

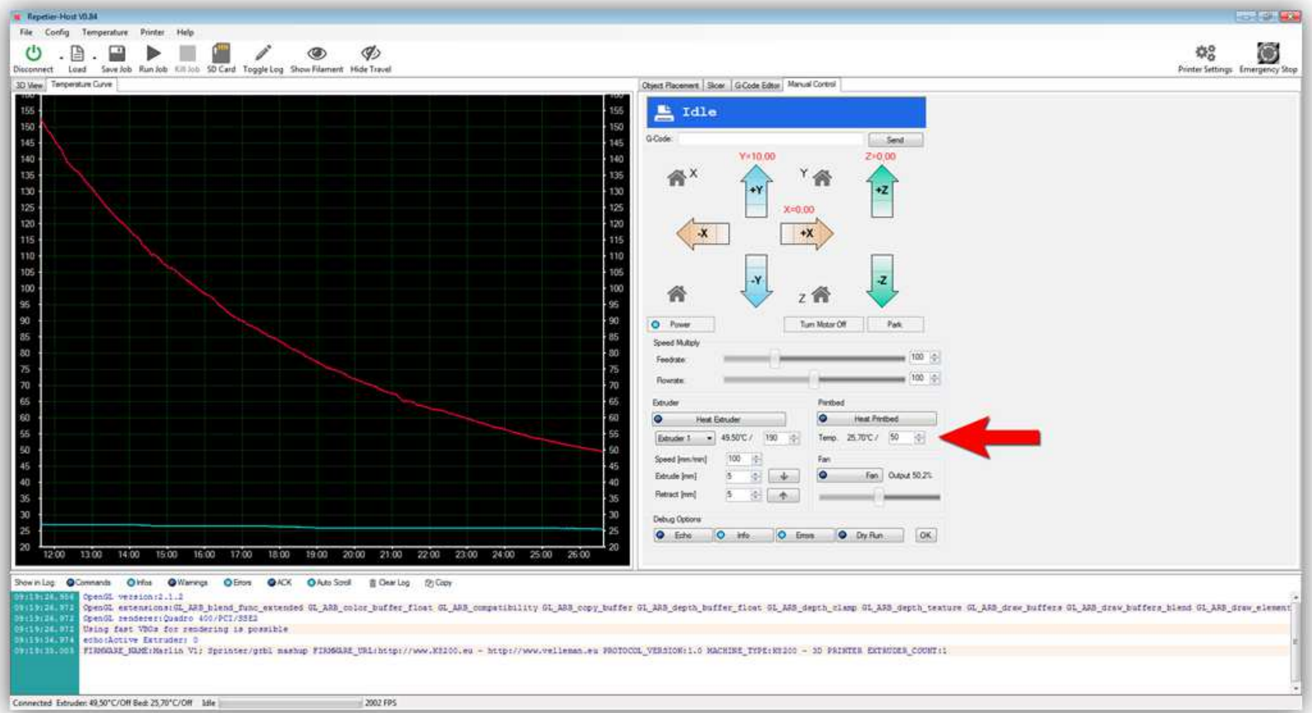


You should see the temperature graph drop to room temperature over time.



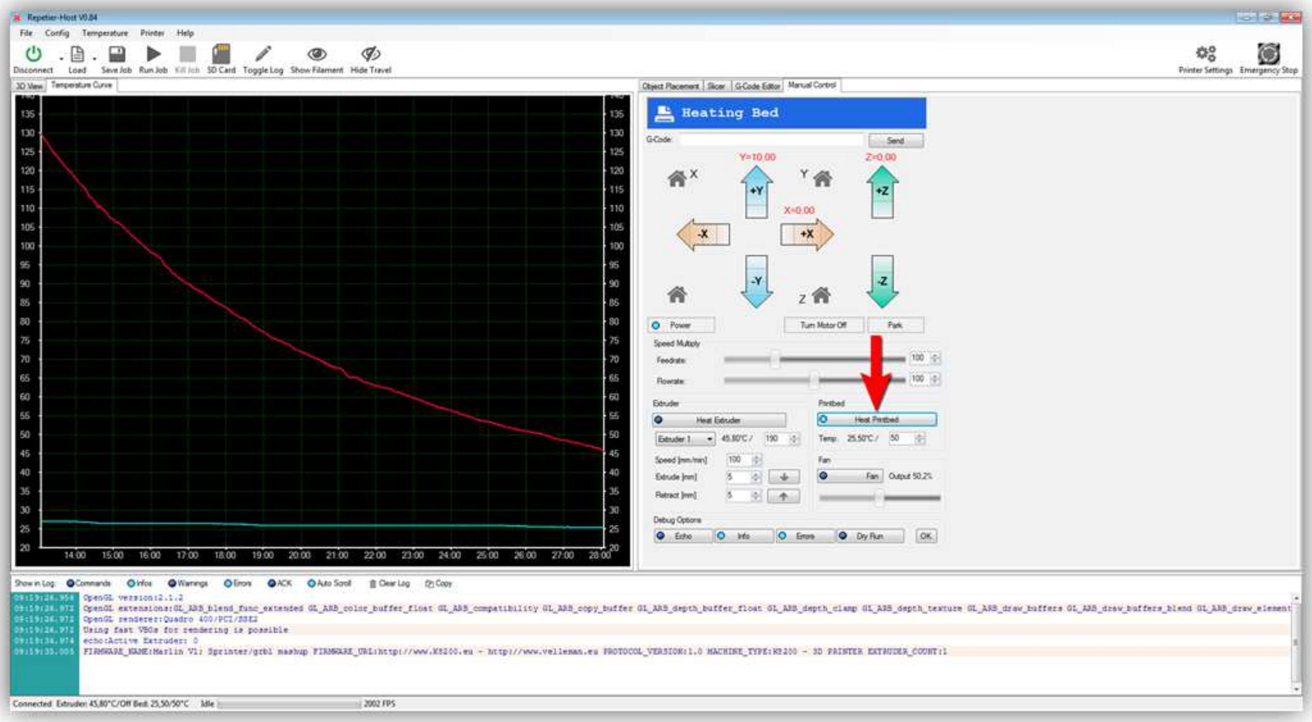
If everything went right so far you know that the extruder will work, now we will test the HEATED BED PCB.

Make sure the temperature for the HEATED BED PCB is set at 50°C.



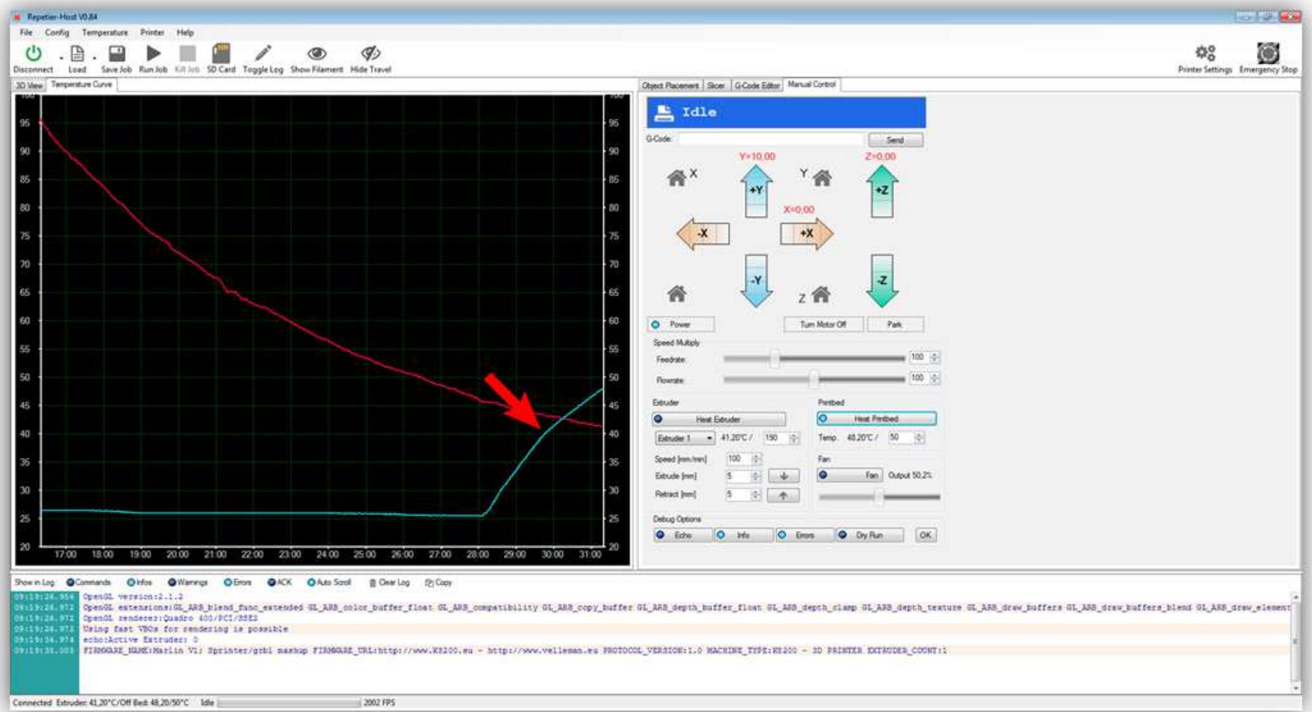
Now press the button “Heat Printbed”.

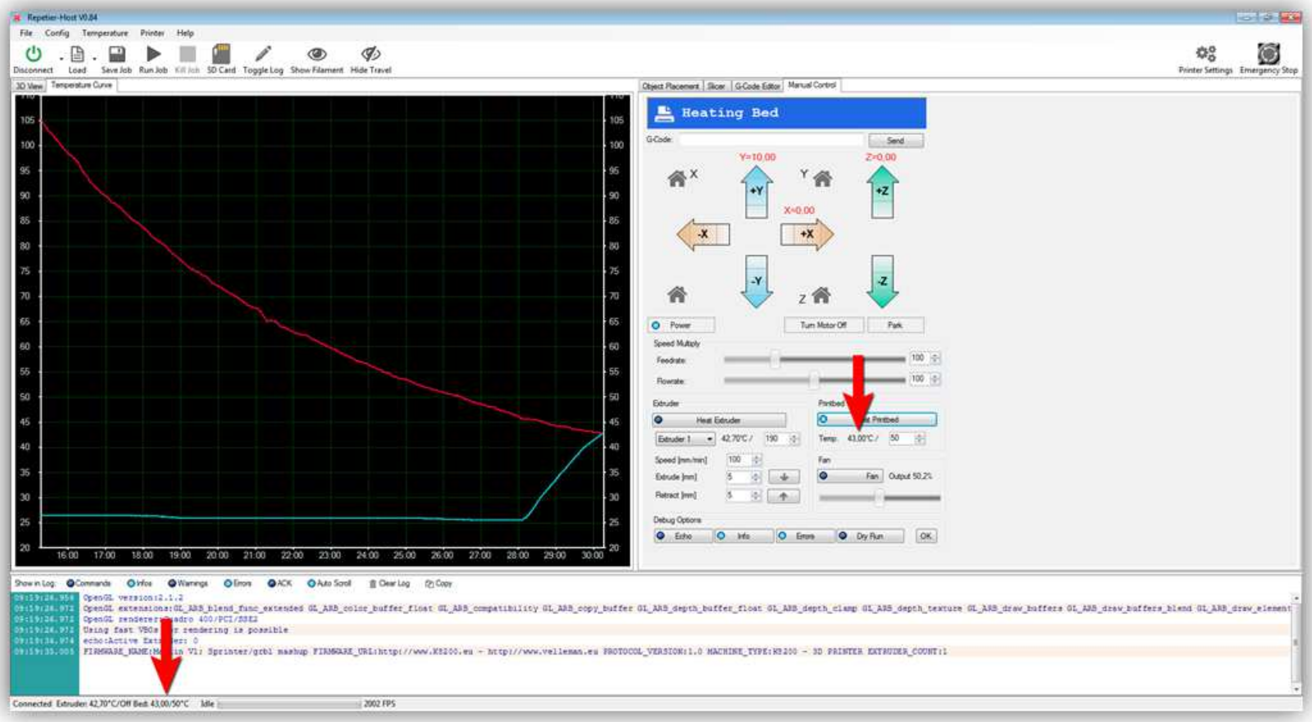
(When you do this you can also see an indicator light on the controller board lighting up, showing that HEATER 2 is powered).



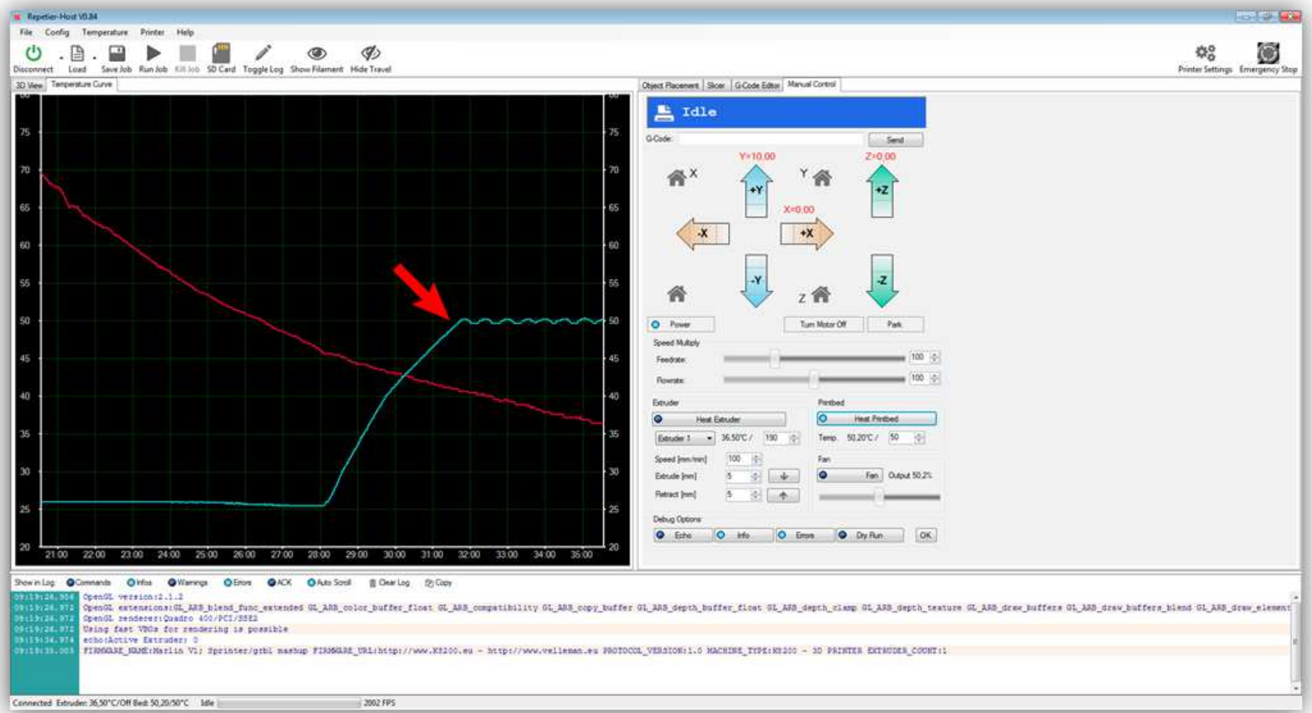
The BLUE line in the temperature graph should start to rise, and you should see the current temperature of the HEATED BED PCB rise.

(Be careful because the HEATED BED PCB is now hot!)

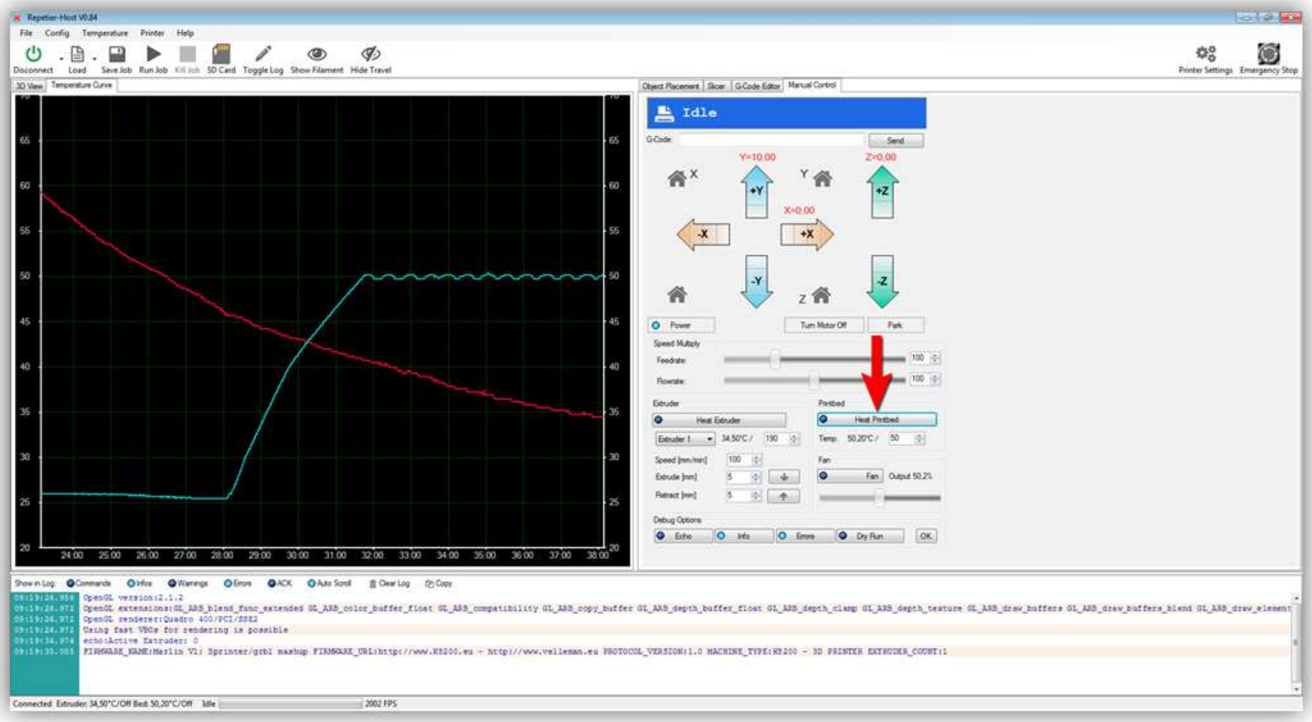




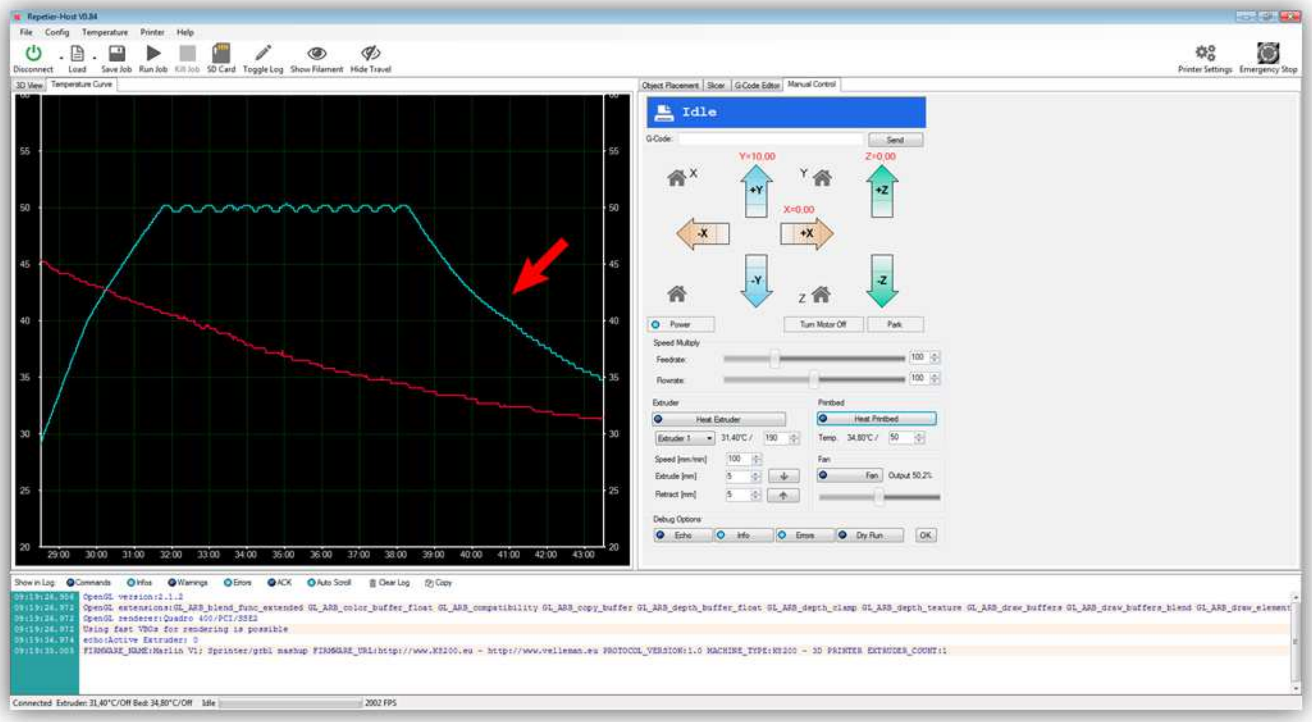
Once it has reached 50 °C the graph should look like this:



Now you can turn of the HEATED BED PCB by clicking on the “Heat Printbed” button again.



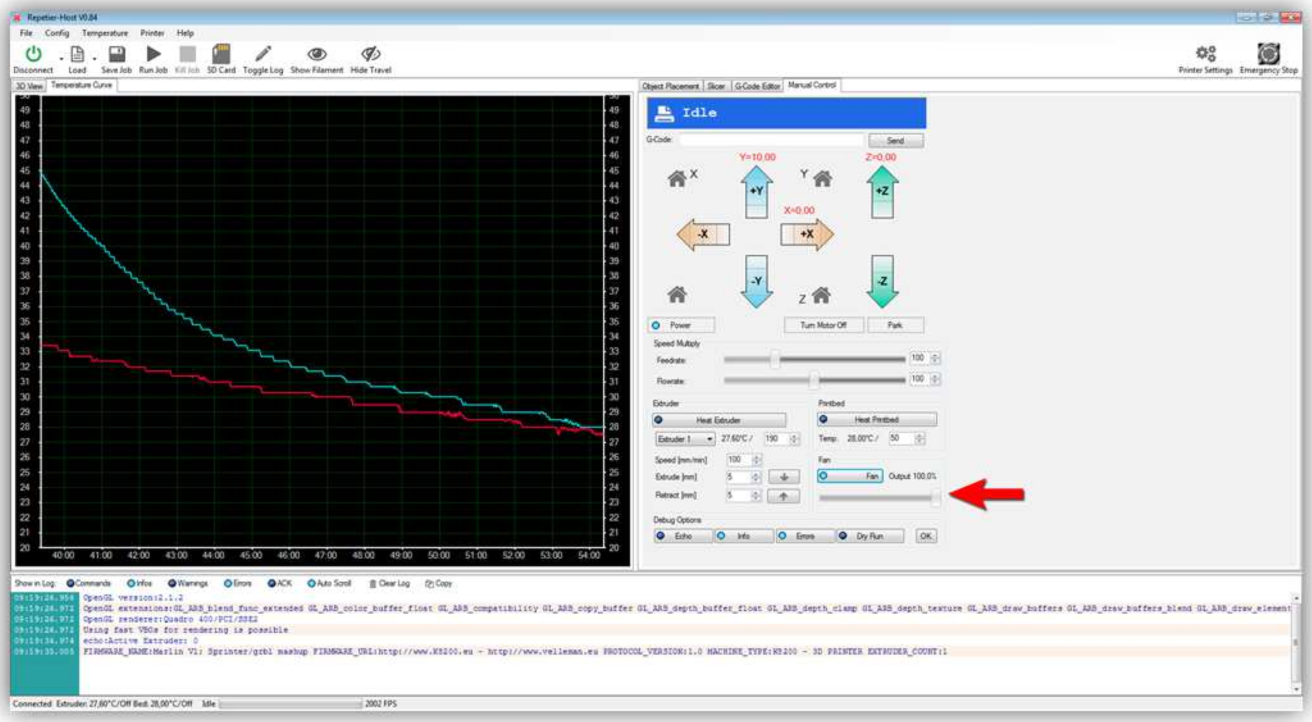
You should see the temperature graph drop to room temperature over time.



Now we will test the fan.

Slide the slider for the fan to 100% and click on the “Fan” button.

(When you do this you can also see an indicator light on the controller board lighting up, showing that FAN is powered).



The fan should begin to blow air in the direction of the extruder.

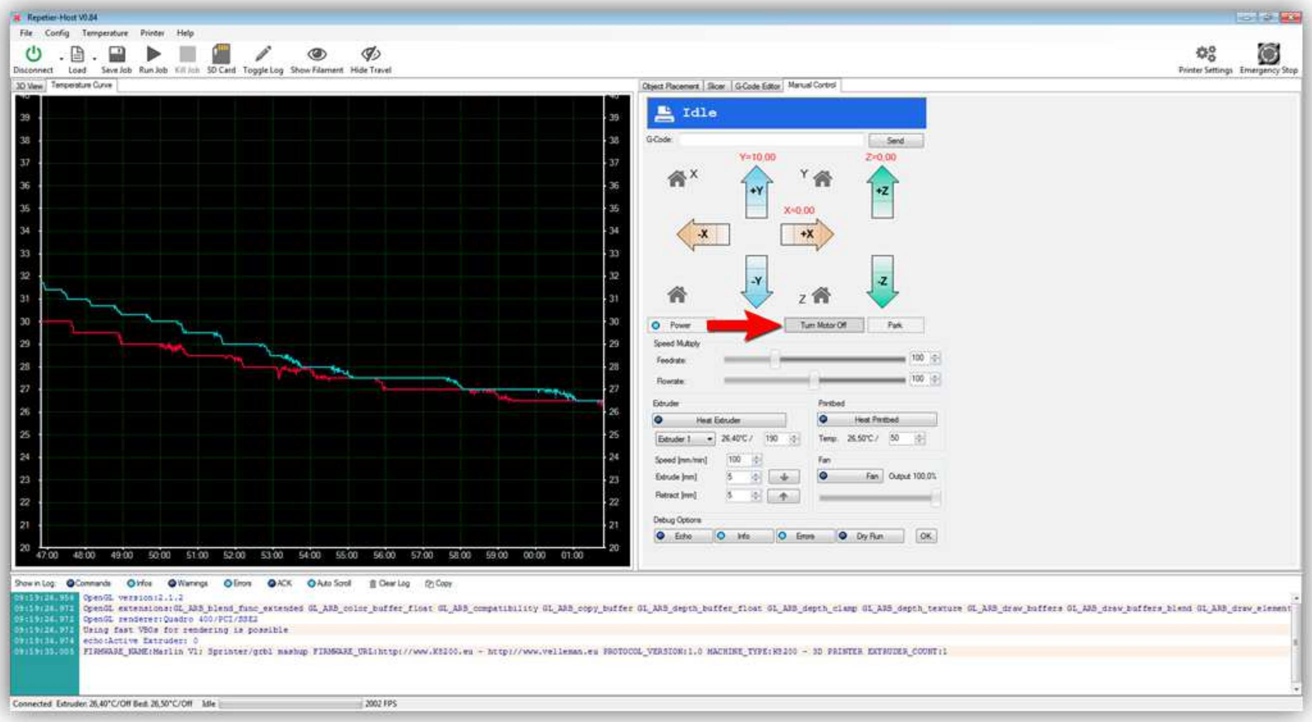
If the fan does not turn, make sure the slider is at 100% and check your wiring. If the fan blows in the wrong direction, mount it the other way around.

Now you can move the slider around, the fan should blow more or less according the position of the slider.

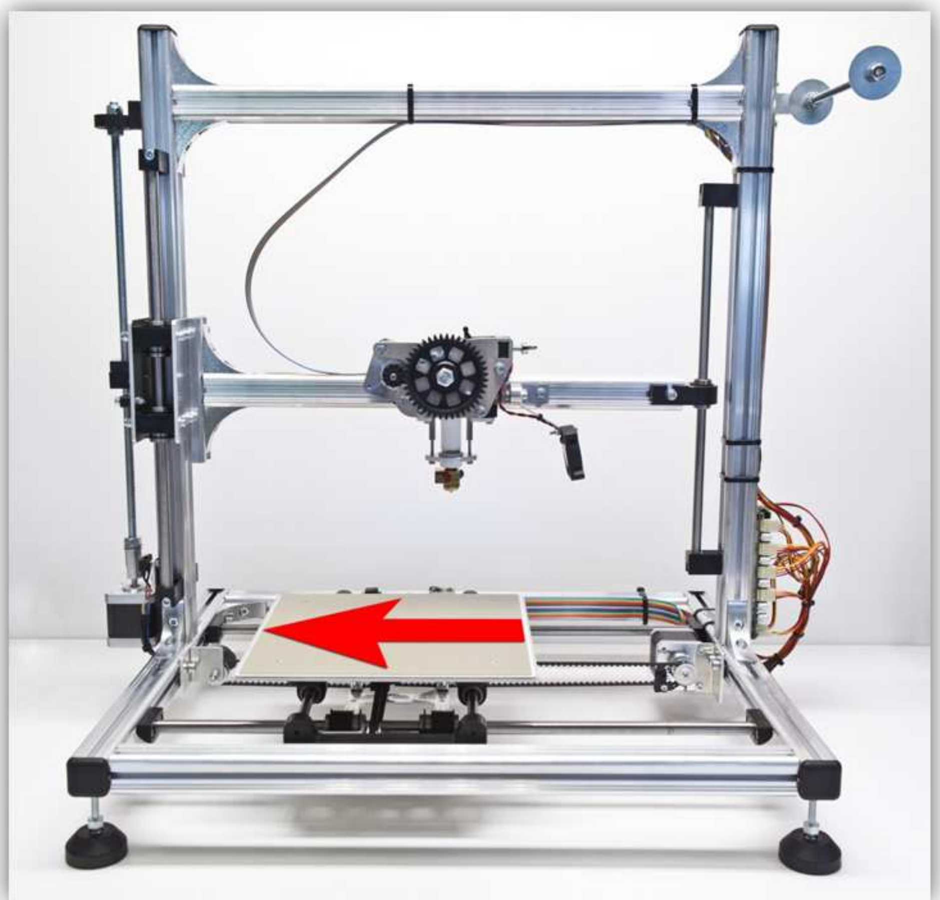
Turn off the fan by clicking on the “Fan” button again.

Now we need to test all the micro switches. These are critical for the machine to find its home position. Each axis has its own micro switch and its corresponding adjust bolt. **Before continuing you must be sure the printer moved in the right directions when you previously tested all the motors.**

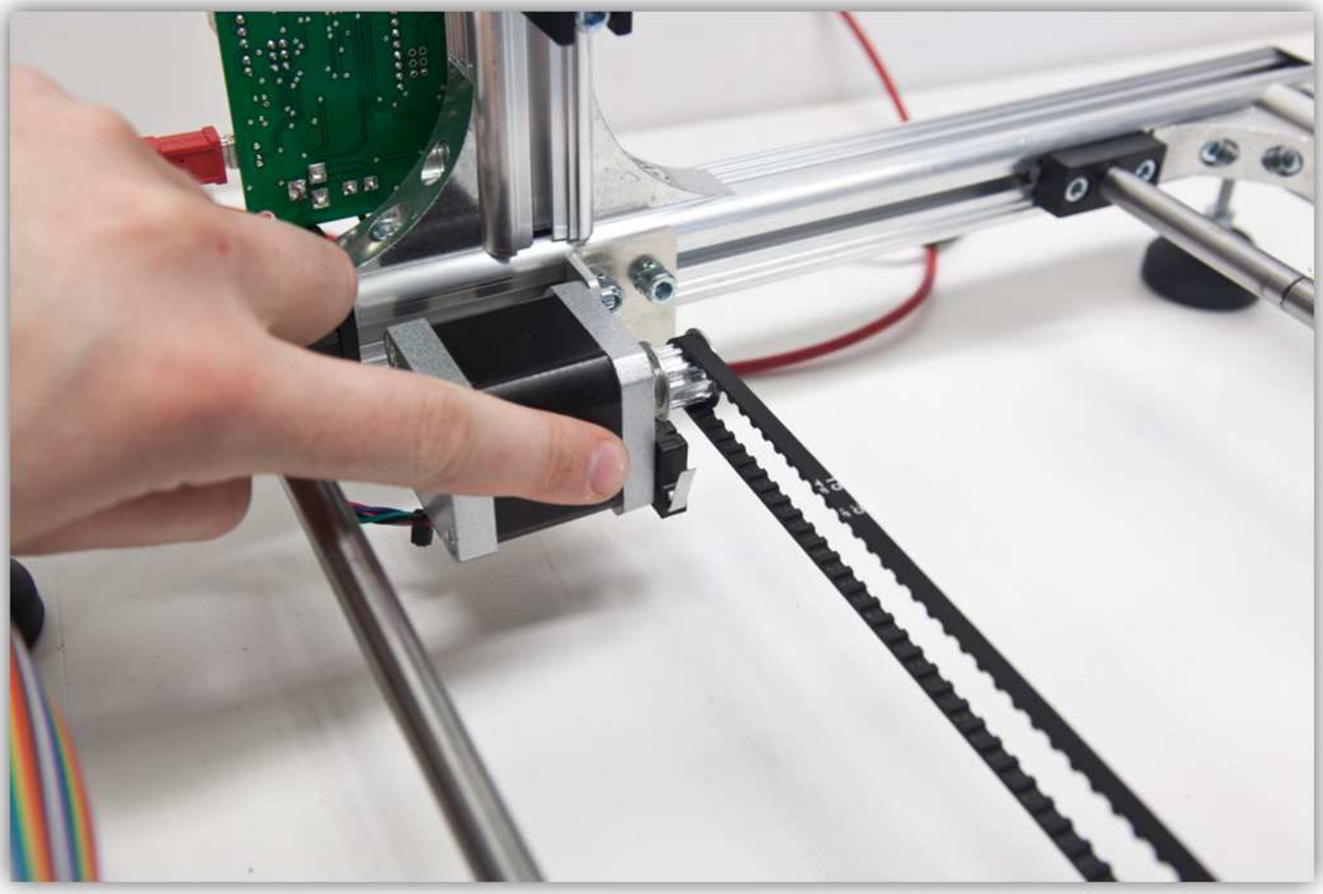
First press the button “Turn Motor Off”. This turns off the hold capability of the motors so you can move the HEATED BED PCB around by hand.

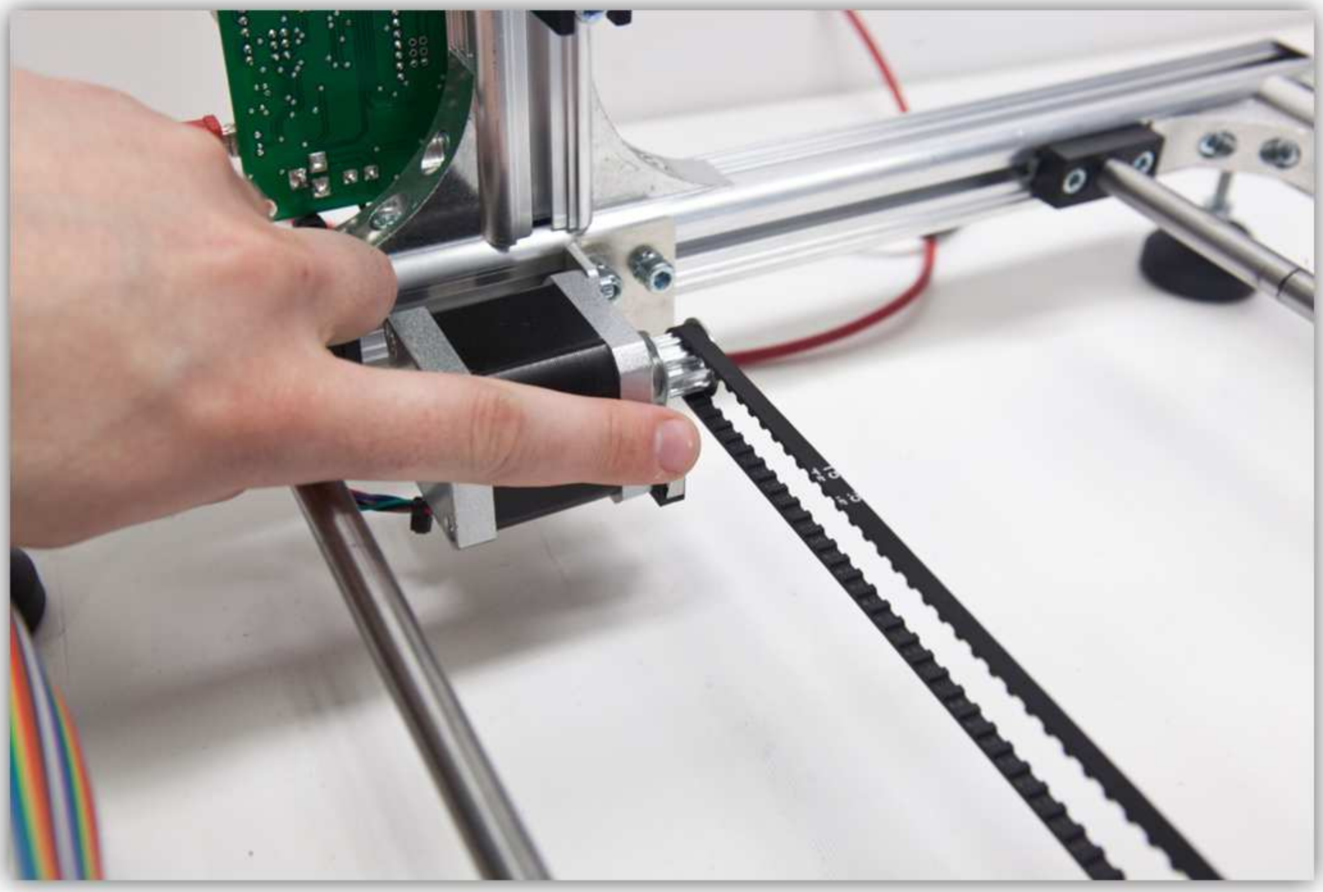


Next move the HEATED BED PCB completely to the **LEFT** by hand.

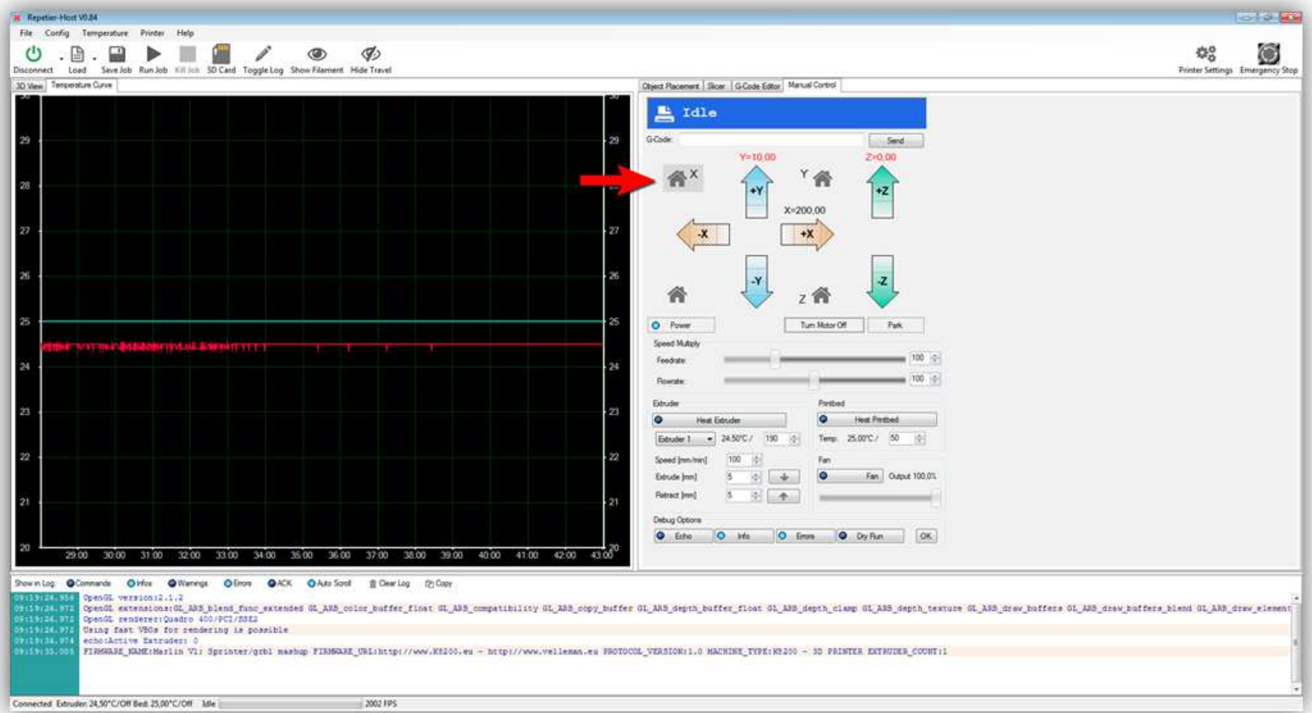


Put your finger on the micro switch of the X AXIS, do not press it.





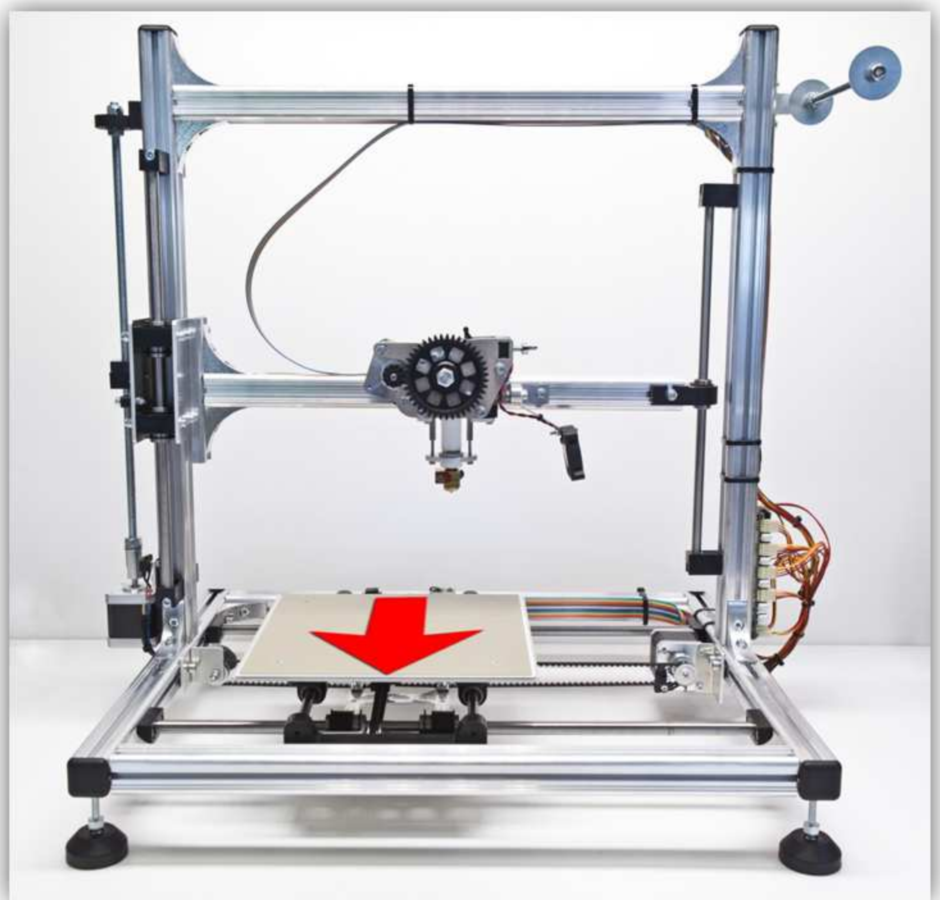
Now press the “Home X AXIS" button.



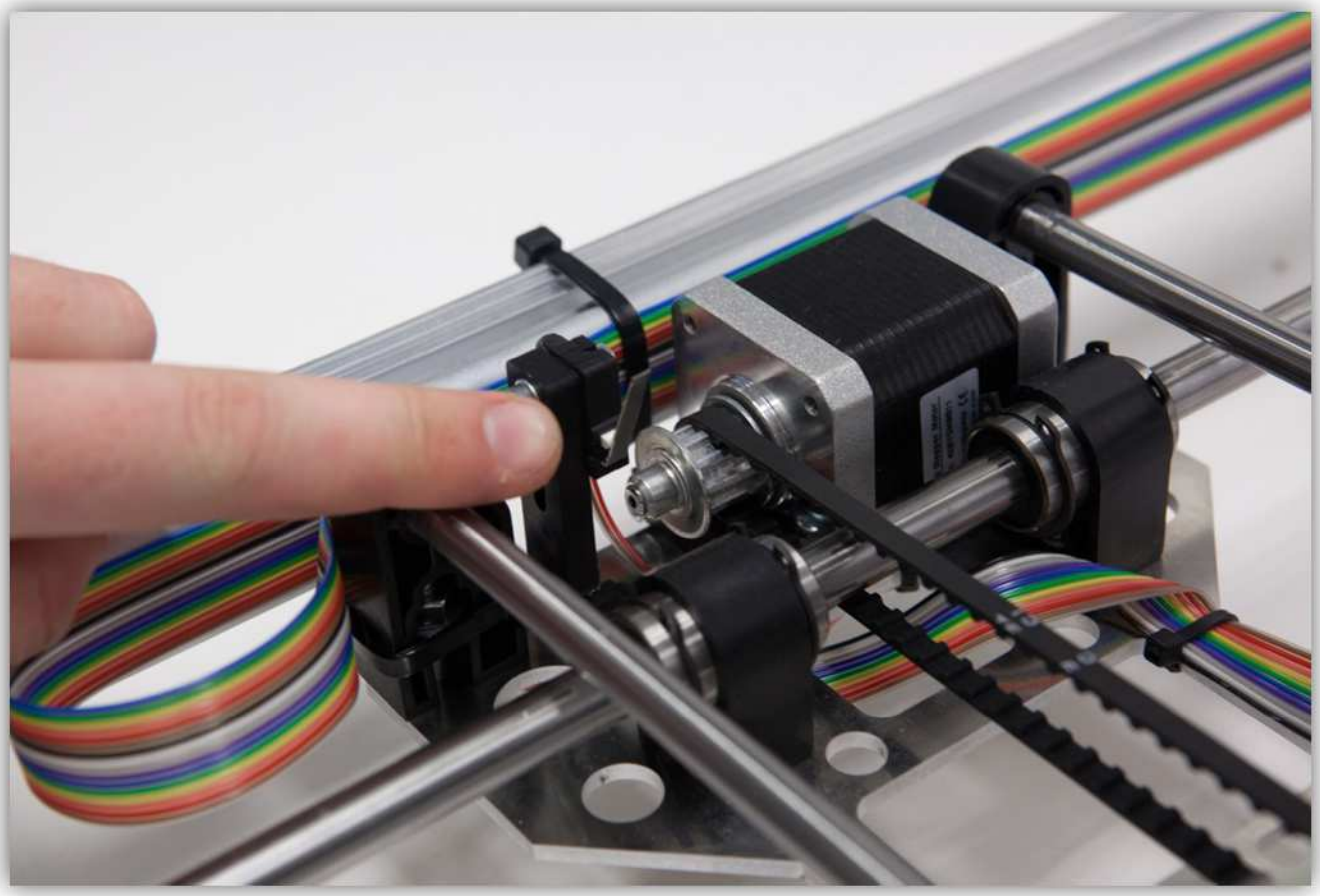
As soon as you have pressed this button the print bed will move towards the micro switch that your finger is resting on. Quickly press the micro switch. If the micro switch is working correctly the bed will stop.

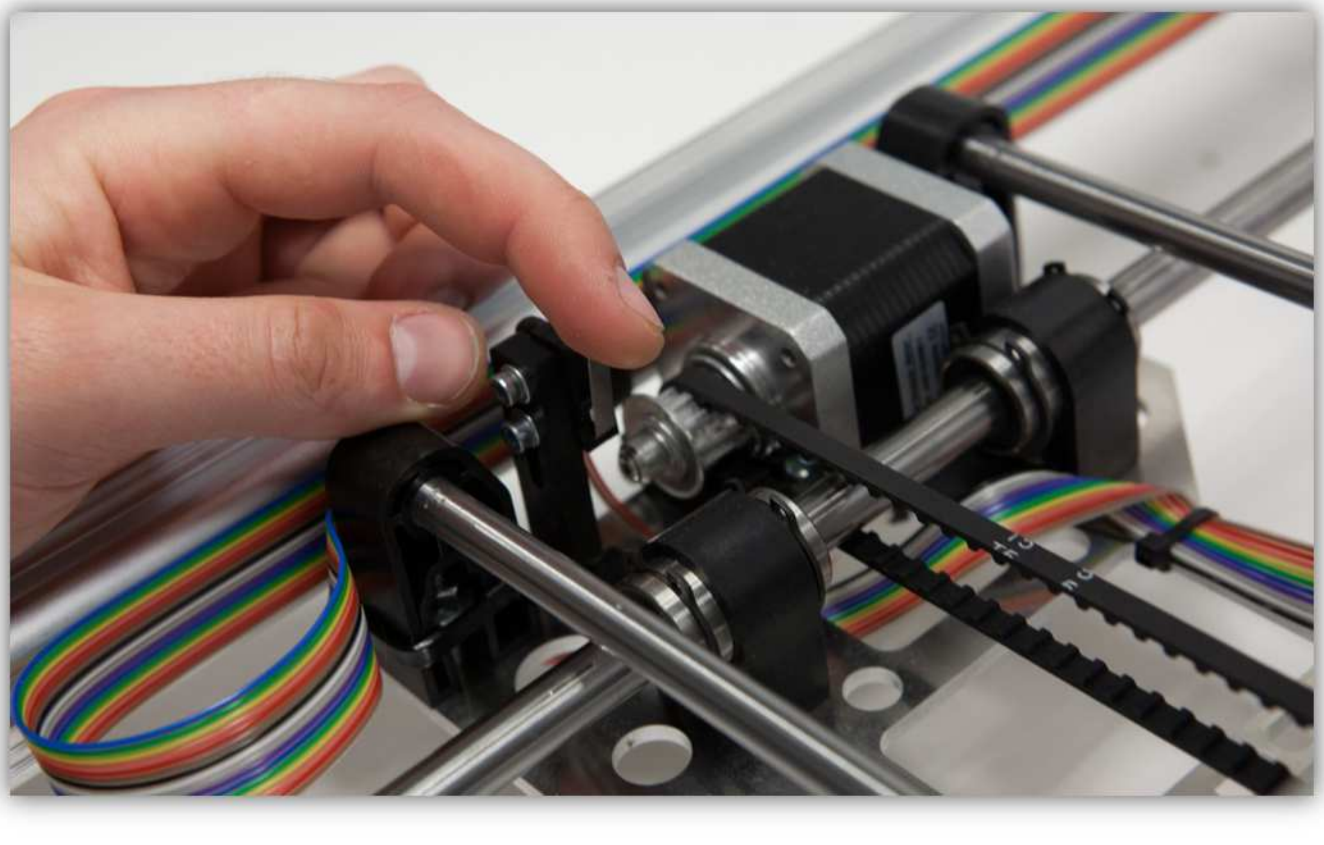
If the bed has stopped the micro switch wiring for the X AXIS is correct.

Next move the HEATED BED PCB completely **FORWARD** by hand.

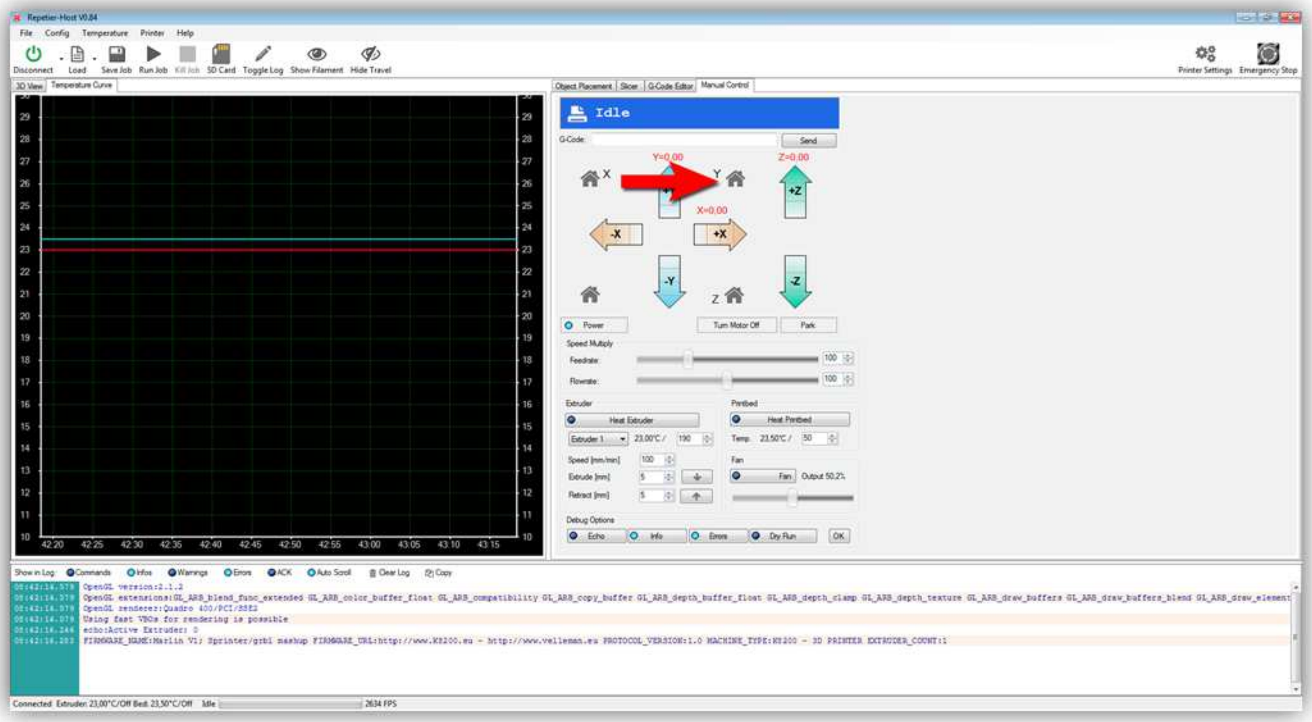


Put your finger on the micro switch of the Y AXIS, do not press it.





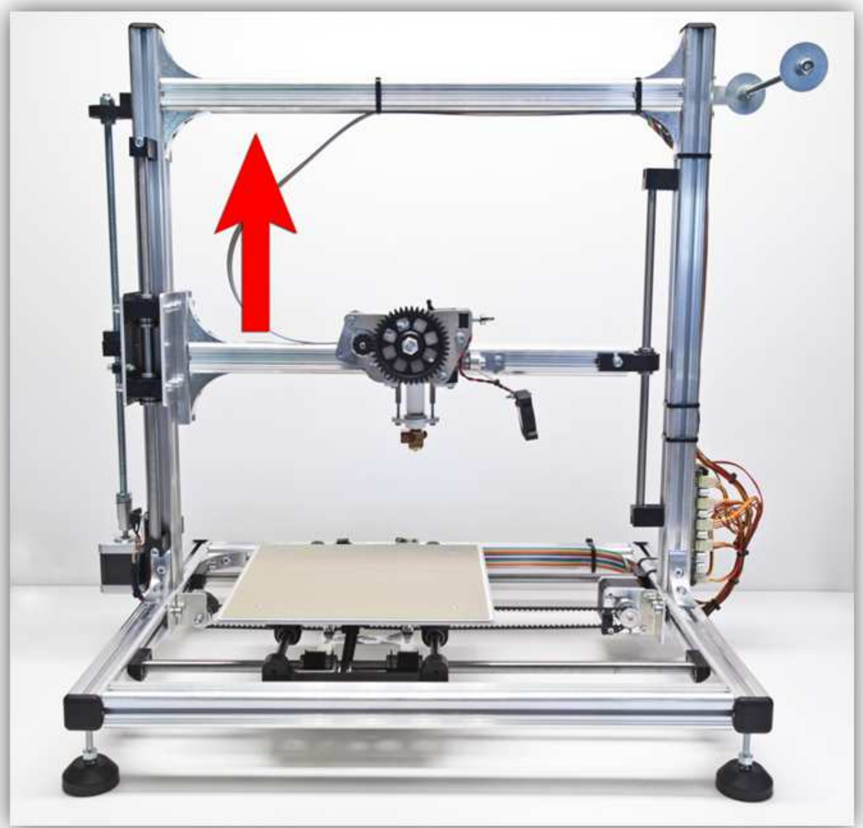
Now press the “Home Y AXIS" button.



As soon as you have pressed this button the print bed will move towards the micro switch that your finger is resting on. Quickly press the micro switch. If the micro switch is working correctly the bed will stop.

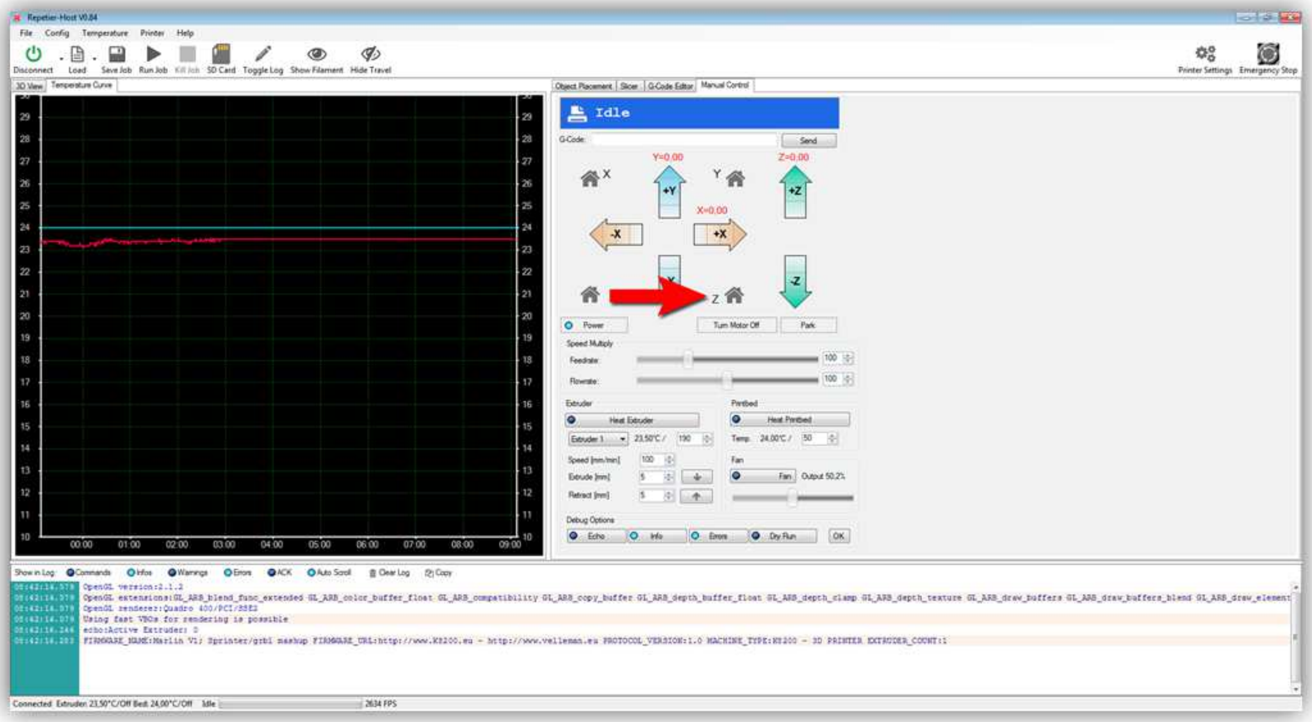
If the bed has stopped the micro switch wiring for the Y AXIS is correct.

Next move the Z CARRIAGE about 20 cm (7.87") **UP** by turning the motor for the Z AXIS by hand. **Do not use the UP button in the manual control panel.**



Put your finger on the micro switch of the Z AXIS, do not press it.

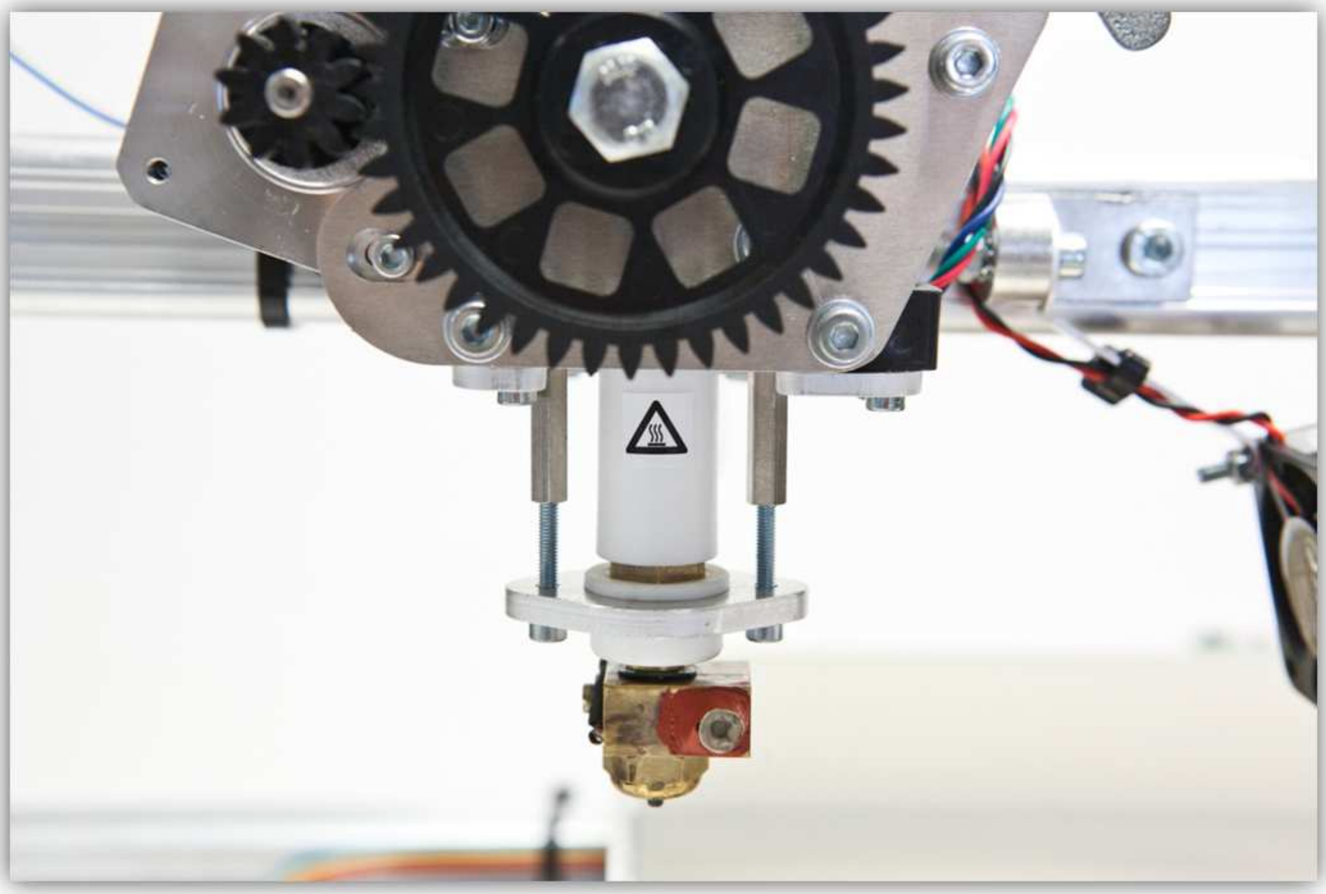
Now press the “Home Z AXIS" button.

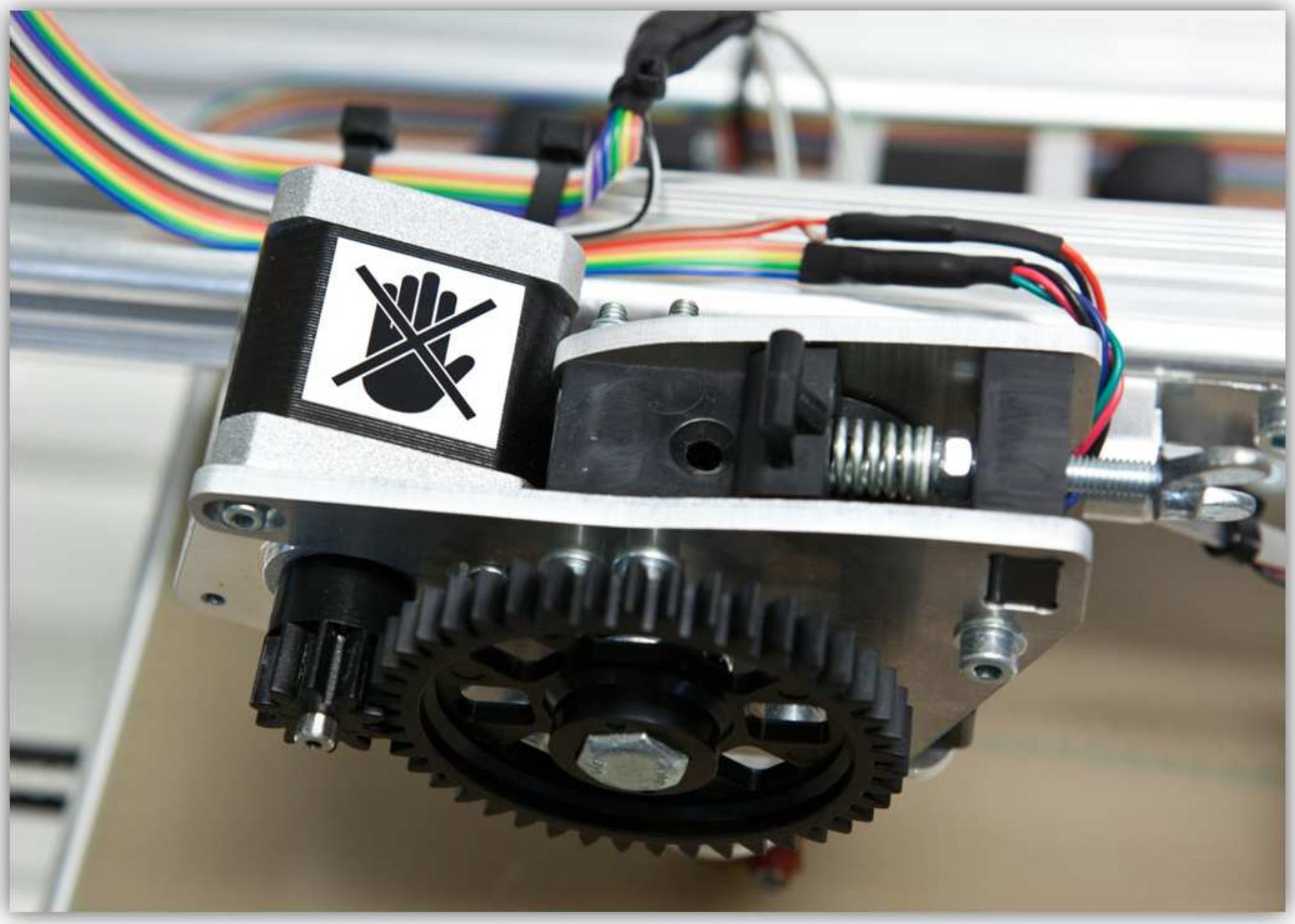


As soon as you have pressed this button the Z CARRIAGE will move towards the micro switch that your finger is resting on. Quickly press the micro switch. If the micro switch is working correctly the Z CARRIAGE will stop.

If the bed has stopped the micro switch wiring for the Z AXIS is correct.

If everything is working apply the stickers found in bag 30 as follows.





Now we have tested all the functions of the printer. We can now start the calibration process. This will be explained in the next chapter.

003 - CALIBRATING THE PRINTER

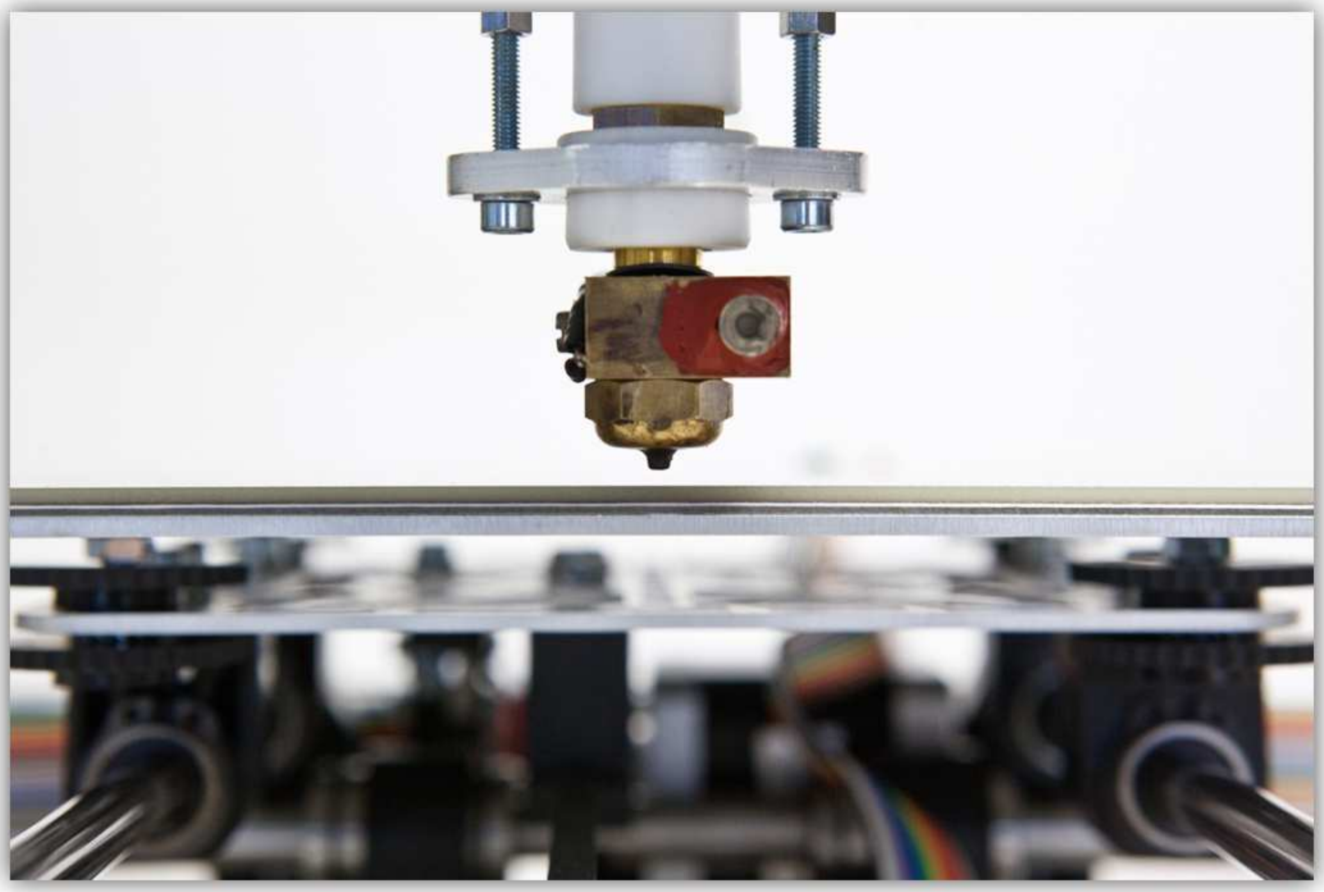
First we will calibrate the Z AXIS, this is the most critical AXIS. The correct calibration of this AXIS has a great influence on printing quality and a poorly calibrated Z AXIS can result in damage to the HEATED BED or the EXTRUDER.

The process of calibrating the Z AXIS is twofold: making sure the distance of the EXTRUDER NOZZLE to the HEATED BED is correct and levelling the bed. We can only level the bed after we calibrated the X and Y AXIS so this will be done at a later stage.

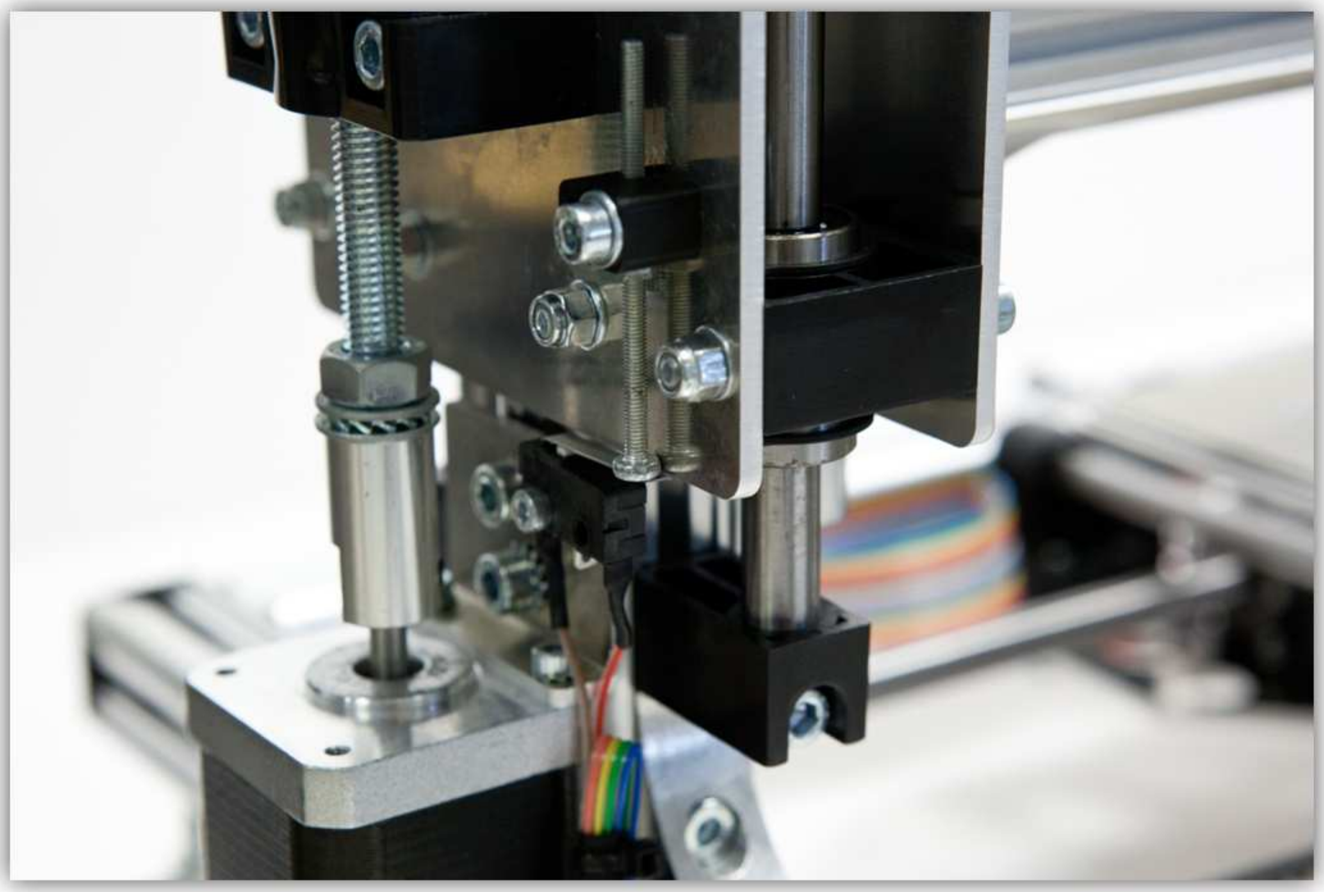
First make sure you have completed chapter 2 and your printer is functioning correctly!

Move the heated bed so that the EXTRUDER NOZZLE sits in the middle of the HEATED BED.

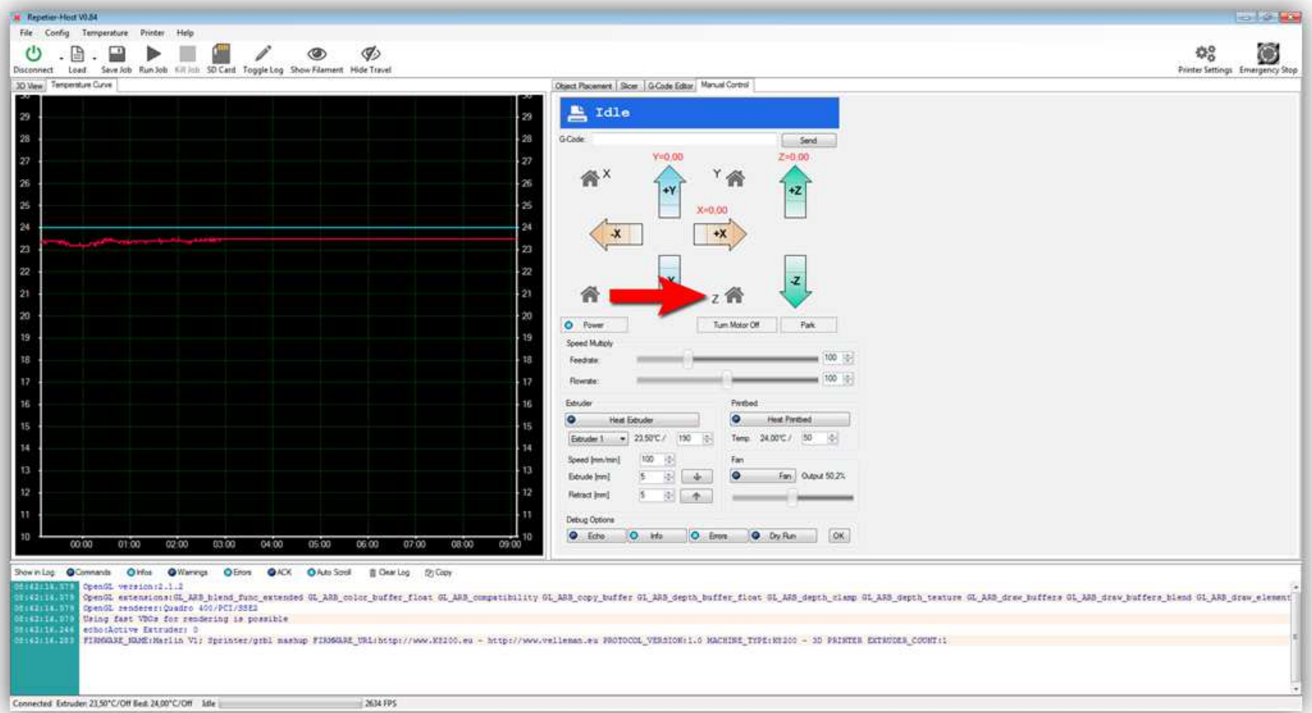
Now move the Z CARRIAGE down **by hand (turn the Z AXIS motor)** until the nozzle sits about 1 mm (0.04") from the HEATED BED. **Be careful that the ADJUSTMENT BOLT for the Z AXIS does not engage the micro switch!**



Now turn the ADJUSTMENT BOLT for the Z AXIS until you hear a click sound of the micro switch engaging.

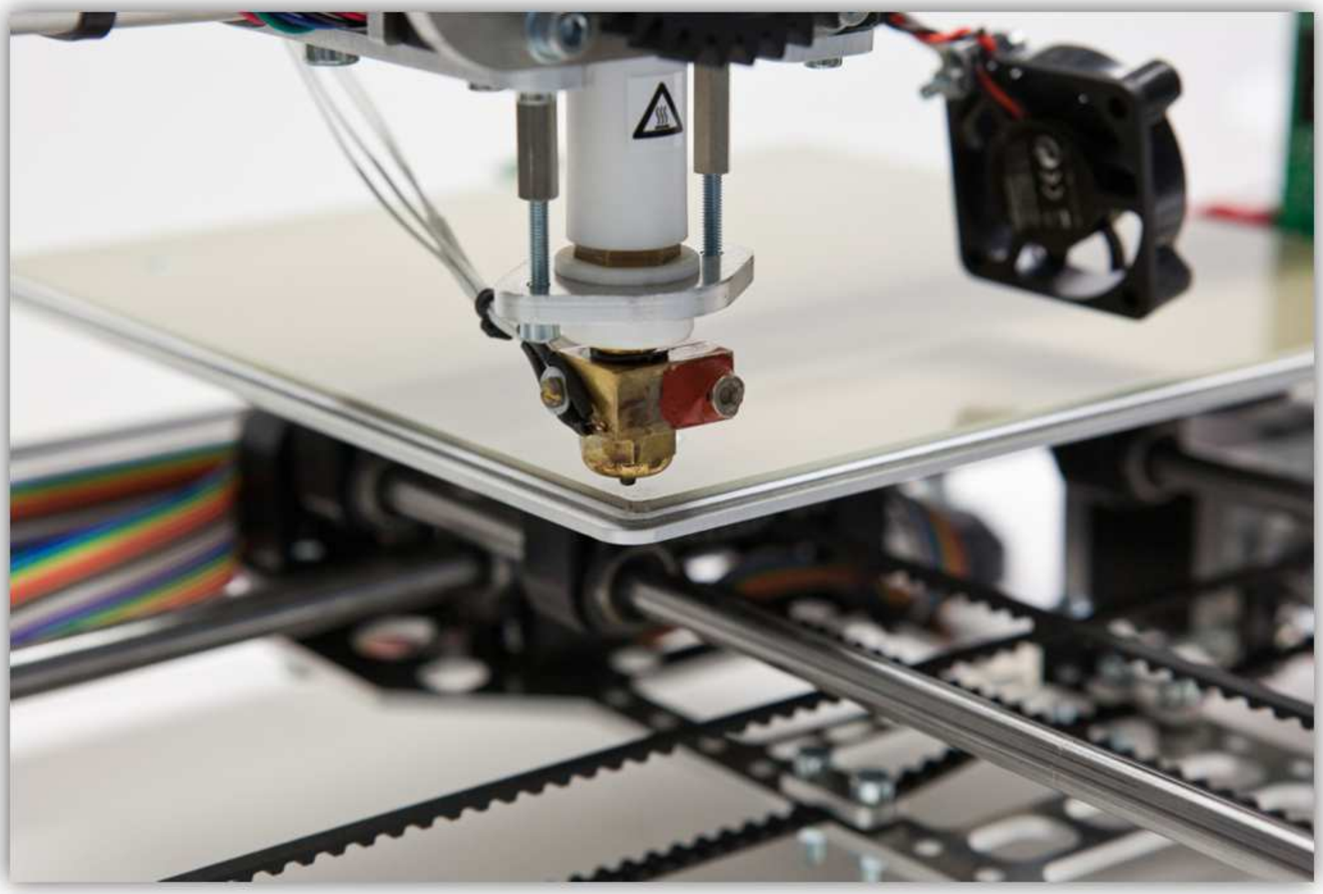


Now if you press the “Z AXIS homing” button the Z CARRIAGE should move UP a bit and then return to the position where the EXTRUDER NOZZLE sits 1 mm (0.04") from the HEATED BED.

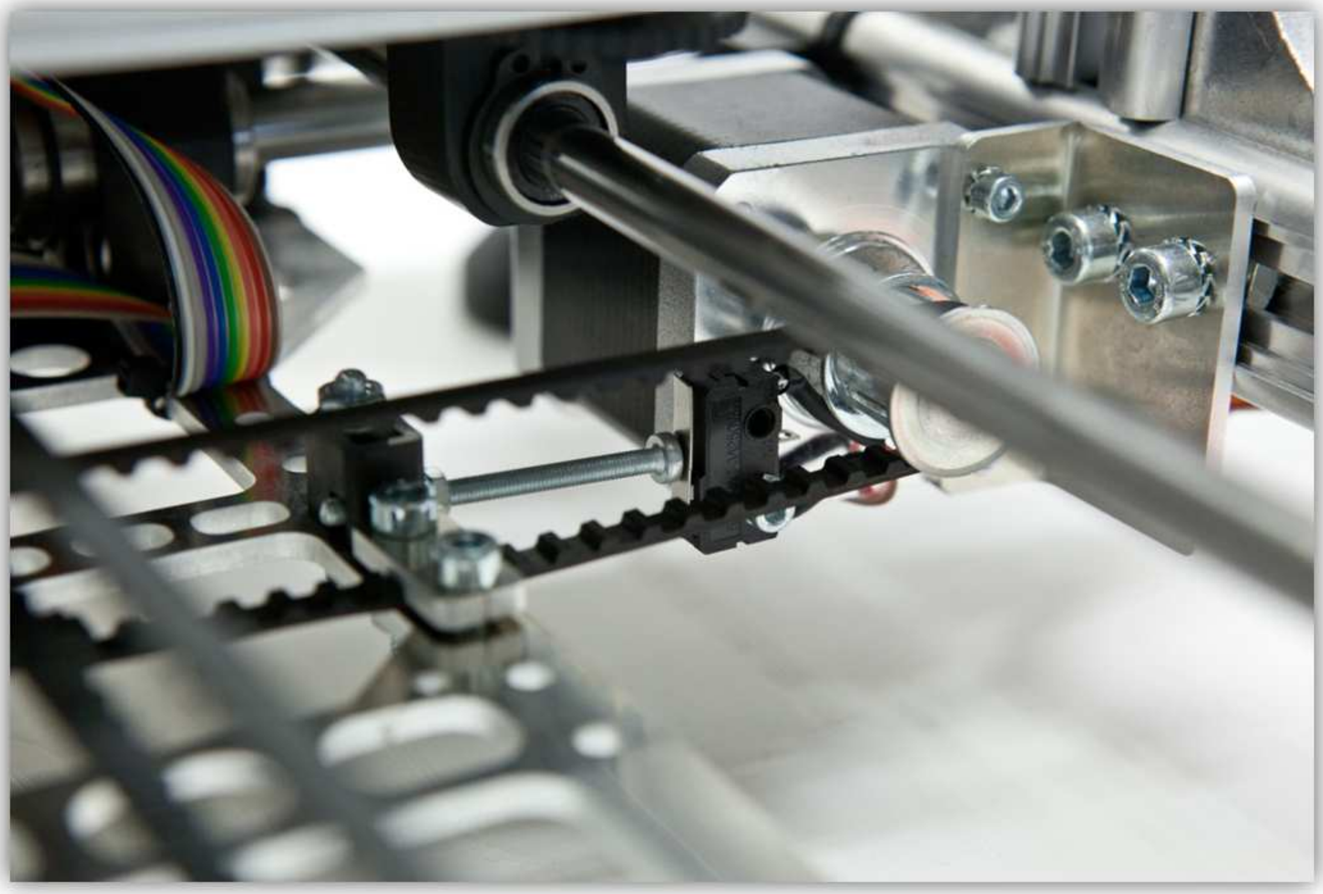


Now the Z AXIS is roughly calibrated (it is still a bit too high from the HEATED BED to print but in order to continue we first have to calibrate the X and Y AXIS).

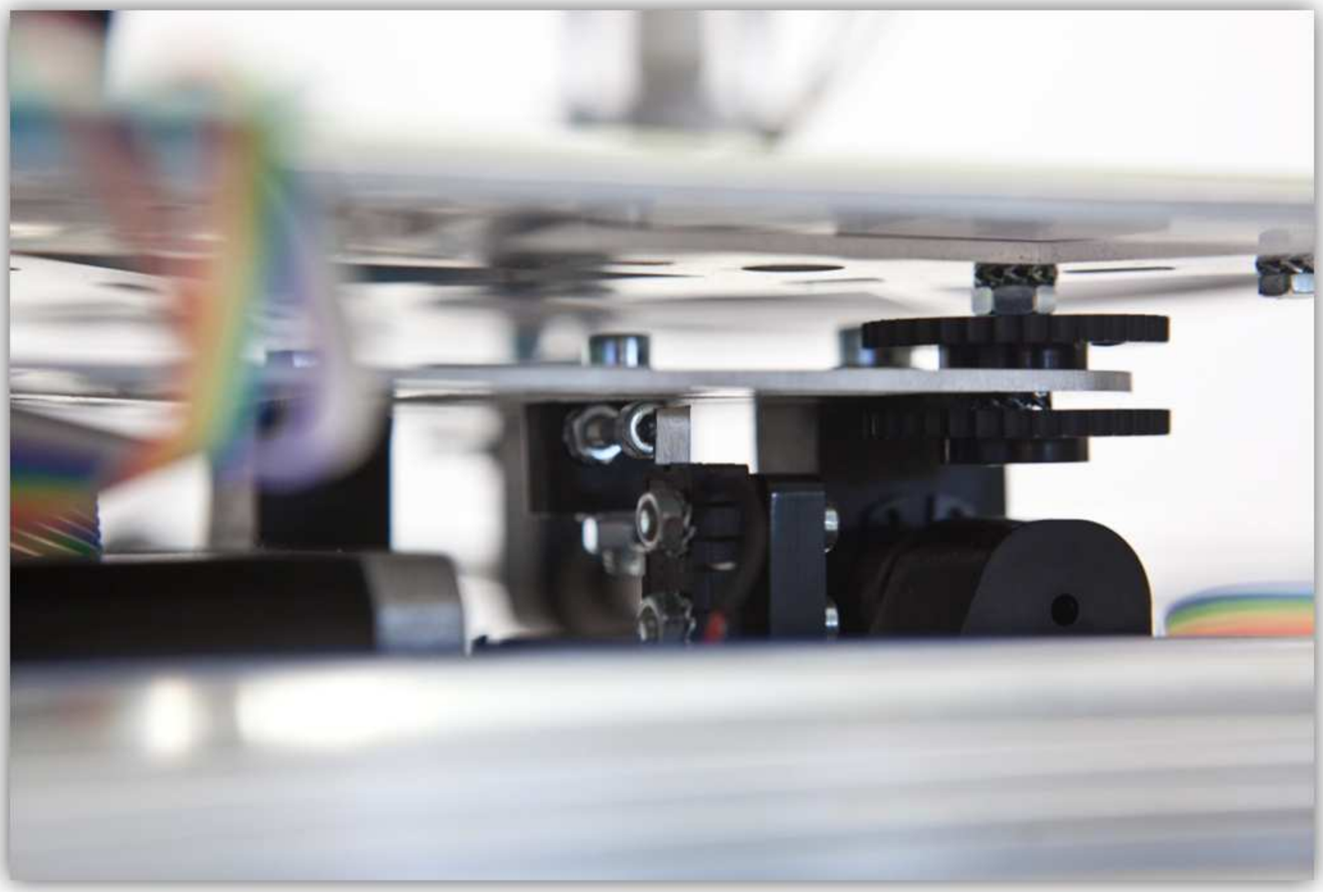
Move the bed so that the EXTRUDER NOZZLE sits in the bottom left corner of the HEATED BED, about 3 mm (0.12").
Make sure none of the X and Y micro switches are engaged!



Now, adjust the X ADJUSTMENT SCREW until you hear the micro switch engage.

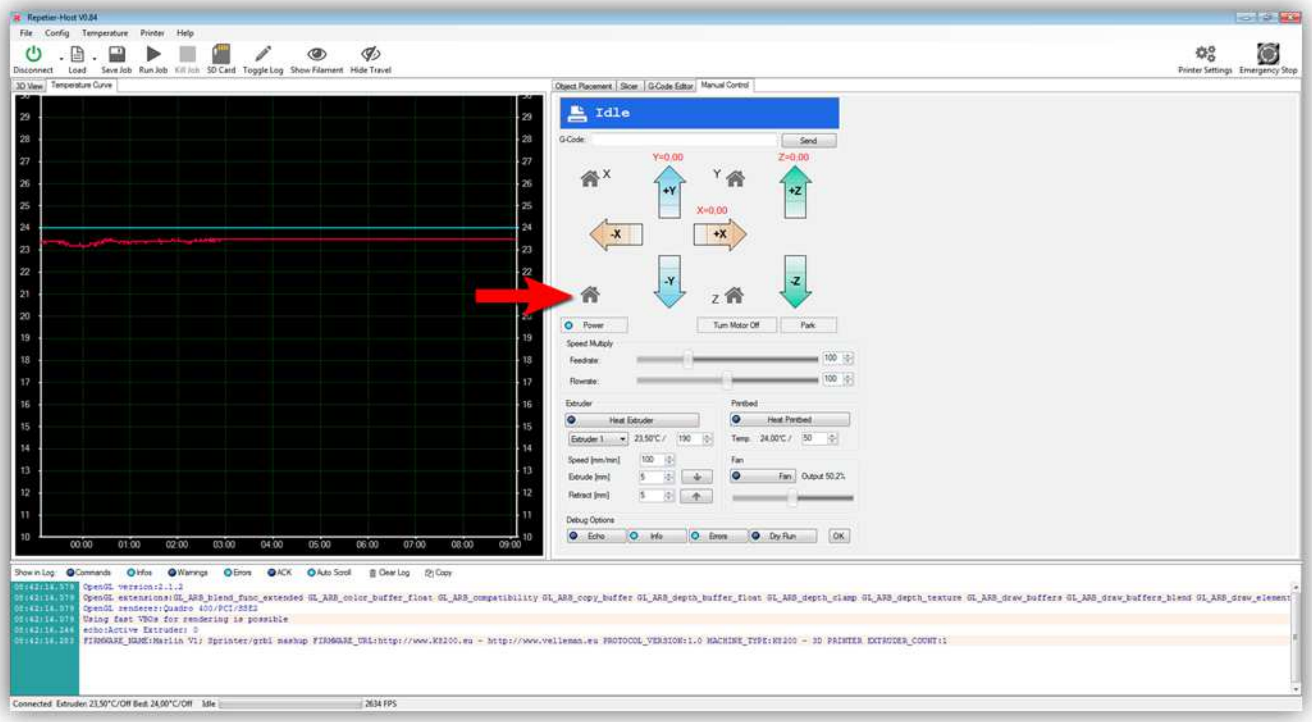


Now, adjust the Y ADJUSTMENT SCREW until you hear the micro switch engage.



Now all the AXES are calibrated, just the Z AXIS needs some fine adjustment.

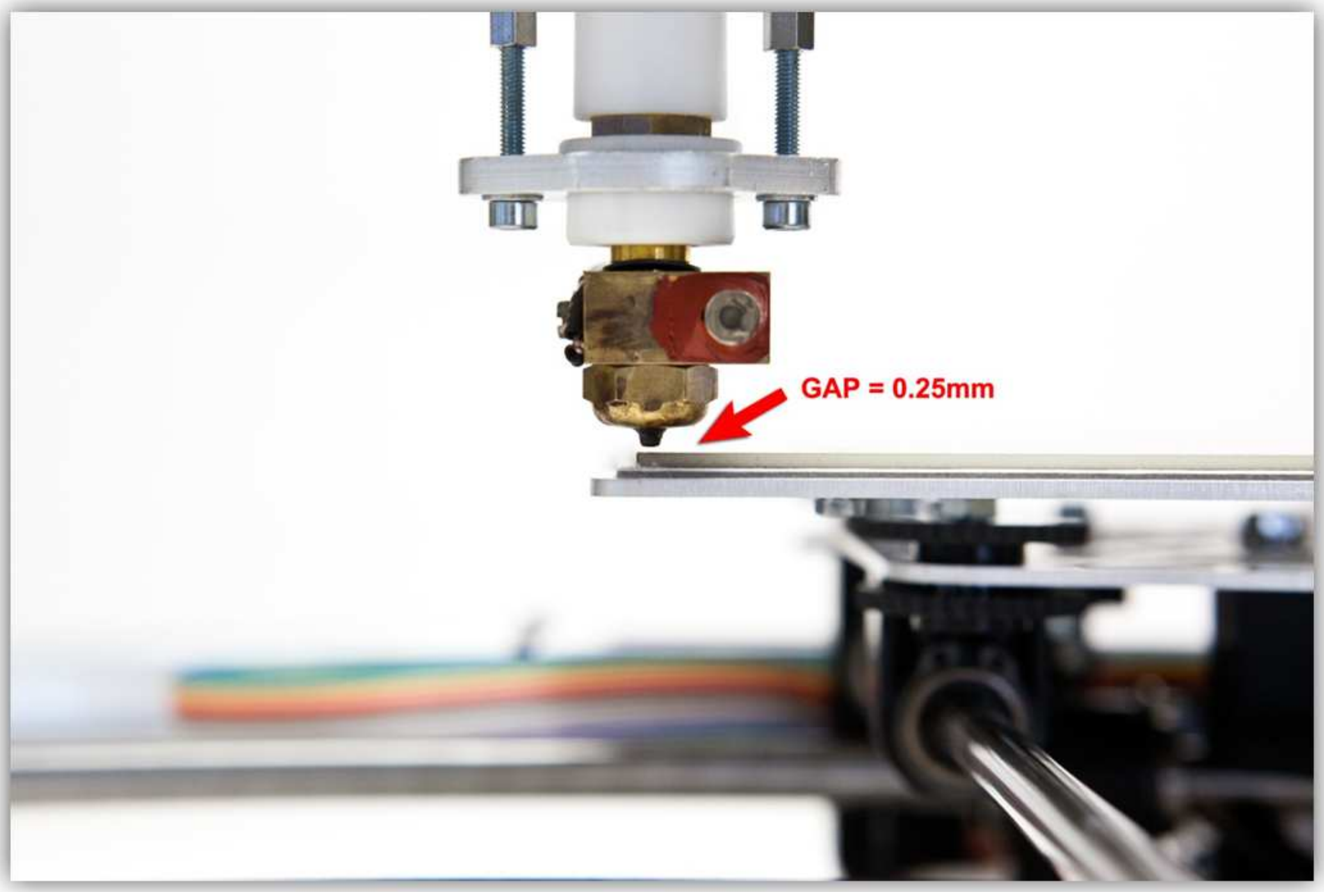
First press the “HOME ALL AXES” button.



The printer will now search its home position by moving the HEATED BED and the Z CARRIAGE until the EXTRUDER NOZZLE is situated in the bottom left corner of the HEATED BED. This is its 0, 0, 0 position.

The distance between the HEATED BED and the EXTRUDER NOZZLE is now just slightly too high to print properly. This distance should be around 0.25 mm (0.01").

Adjust de Z ADJUSTMENT SCREW slightly to make sure that the distance between the HEATED BED and the EXTRUDER NOZZLE is not more than 0.25 mm (0.01") when you press the “HOME ALL AXES” button.



Now move the HEATED BED 20 cm (7.87") to the **left** using the **corresponding manual control button**. The distance between the HEATED BED and the EXTRUDER NOZZLE should still be exactly 0.25 mm (0.01") in this corner. If not, adjust this corner of the bed using the 2 THUMB SCREW under the bed.

Now move the HEATED BED 20 cm (7.87") **forward** using the **corresponding manual control button**. The distance between the HEATED BED and the EXTRUDER NOZZLE should still be exactly 0.25 mm (0.01") in this corner. If not, adjust this corner of the bed using the 2 THUMB SCREW under the bed.

Now move the HEATED BED 20 cm (7.87") to the **right** using the **corresponding manual control button**. The distance between the HEATED BED and the EXTRUDER NOZZLE should still be exactly 0.25 mm (0.01") in this corner. If not, adjust this corner of the bed using the 2 THUMB SCREW under the bed.

Now move the HEATED BED 20 cm (7.87") **back** using the **corresponding manual control button**. The HEATED BED should be at its starting position again. The distance between the HEATED BED and the EXTRUDER NOZZLE should still be exactly 0.25 mm (0.01") in this corner. If not, adjust this corner of the bed using the 2 THUMB SCREW under the bed.

Now move the HEATED BED 10 cm (3.94") to the **left** and 10 cm (3.94") to the **front** by using the **corresponding manual control buttons**. The nozzle should be in the middle of the HEATED BED. The distance between the HEATED BED and the EXTRUDER NOZZLE should still be exactly 0.25 mm (0.01") in the middle of the heated bed. If the bed is a bit too high here press it down slightly. The HEATED BED, CARDBOARD ISOLATOR and ALUMINIUM BED PLATE can be forced a little bit until the bulge in the middle is gone.

Repeat these steps until you are sure the bed is completely flat and the EXTRUDER NOZZLE is at 0.25 mm (0.01") on all points.

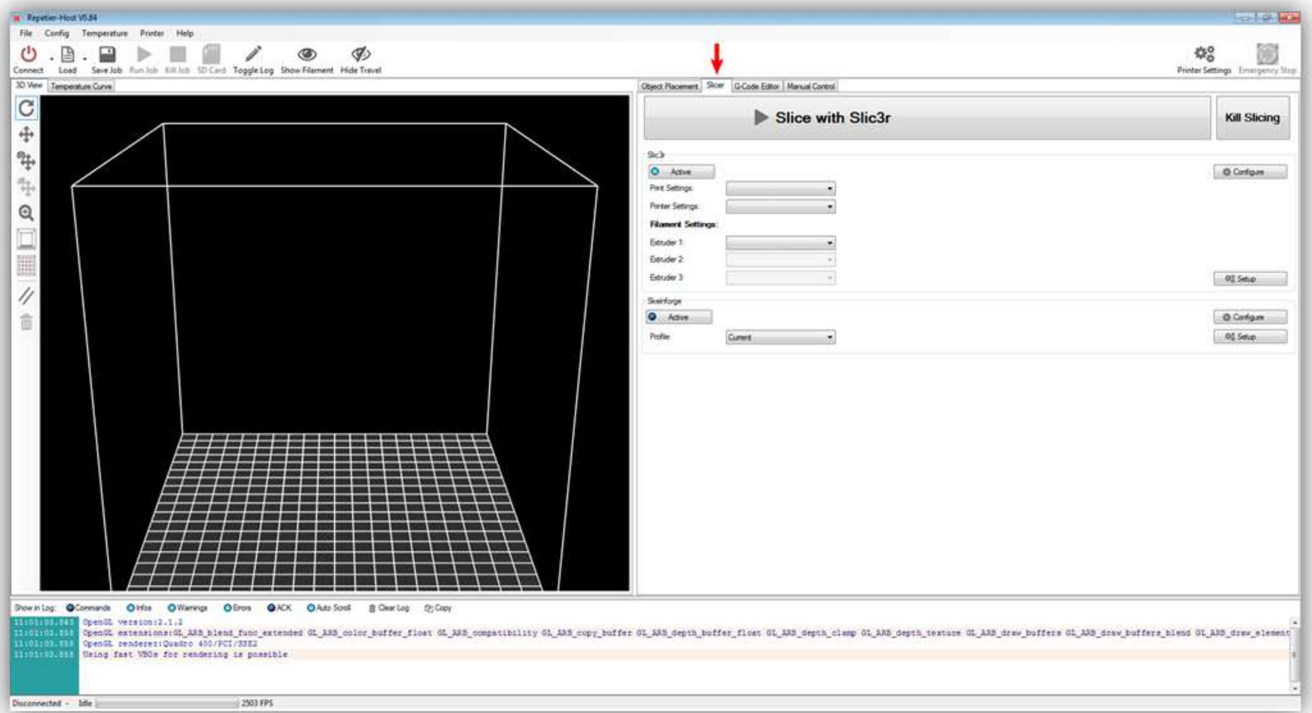
Now the printer is completely calibrated and ready to print, in the next chapter we will configure the Slic3r program to make your first print!

004 - CONFIGURING SLIC3R

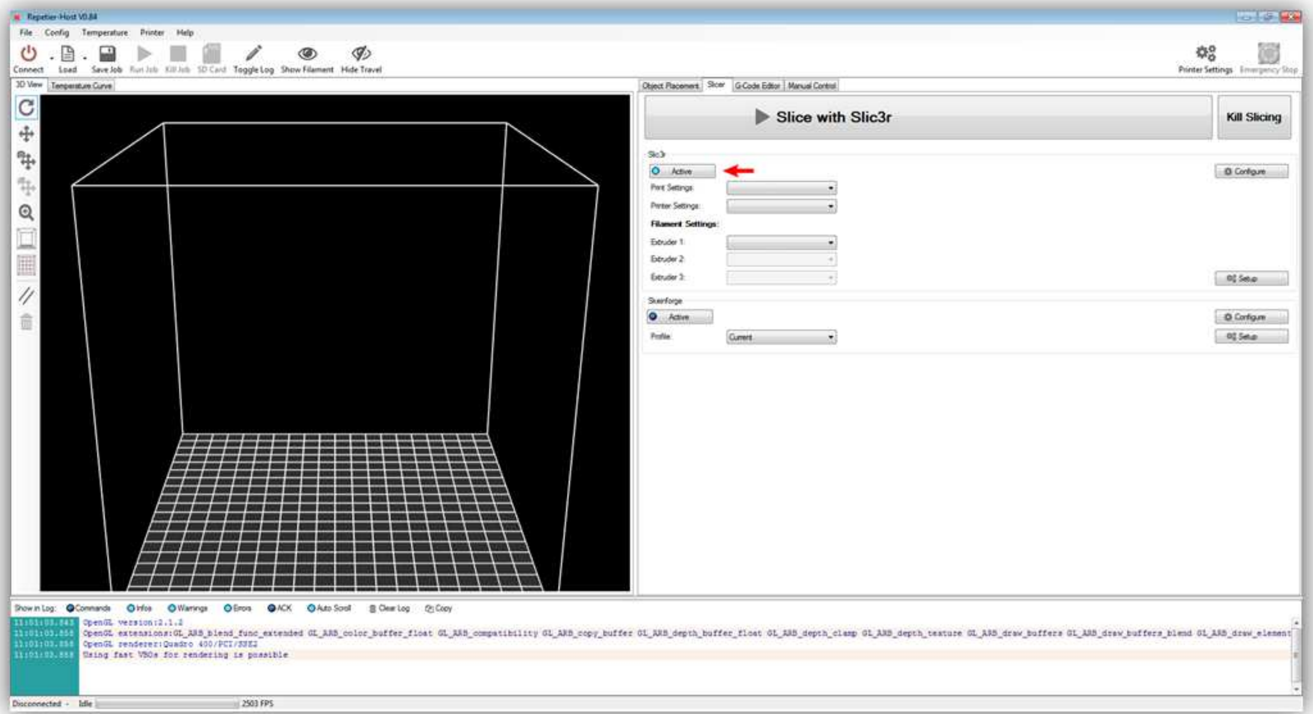
After you have calibrated your printer and printed we can configure the slicer portion of Repetier. First you will have to download a configuration file from the download section. Or choose the link below:

K8200-PLA-STANDARD "download"

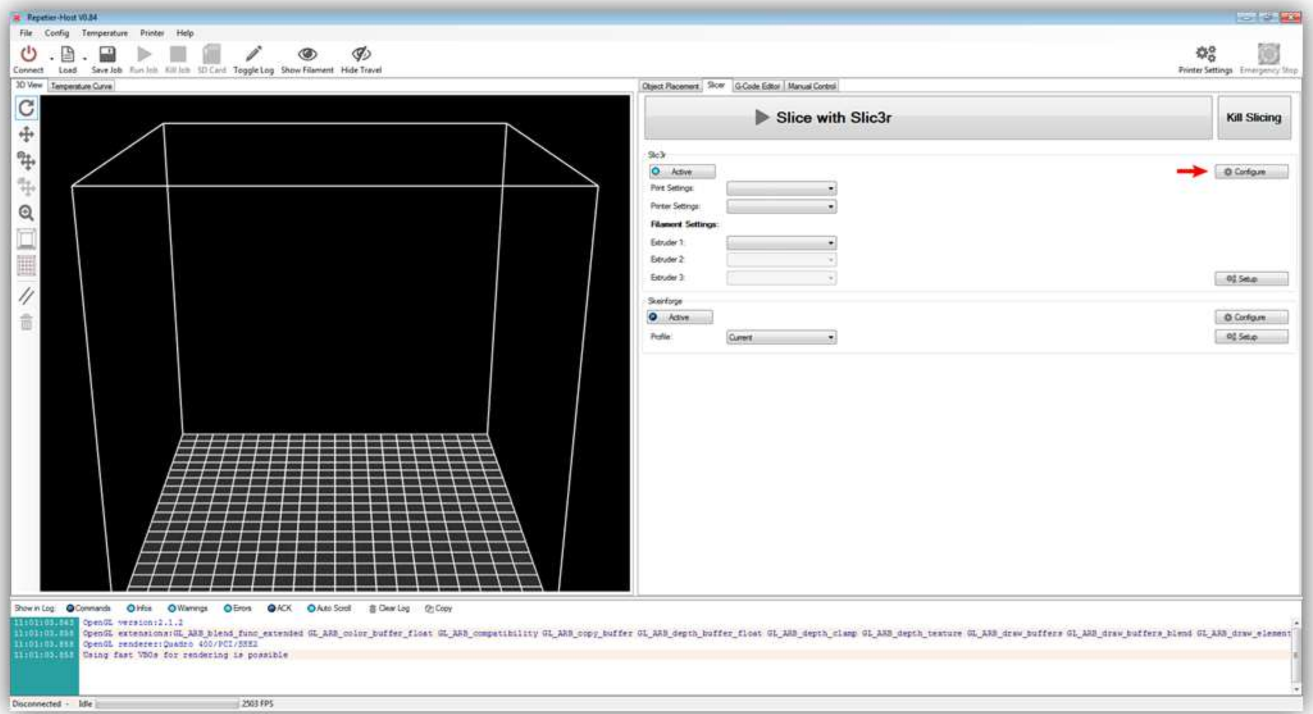
Next start the software and go to the "Slicer" tab:



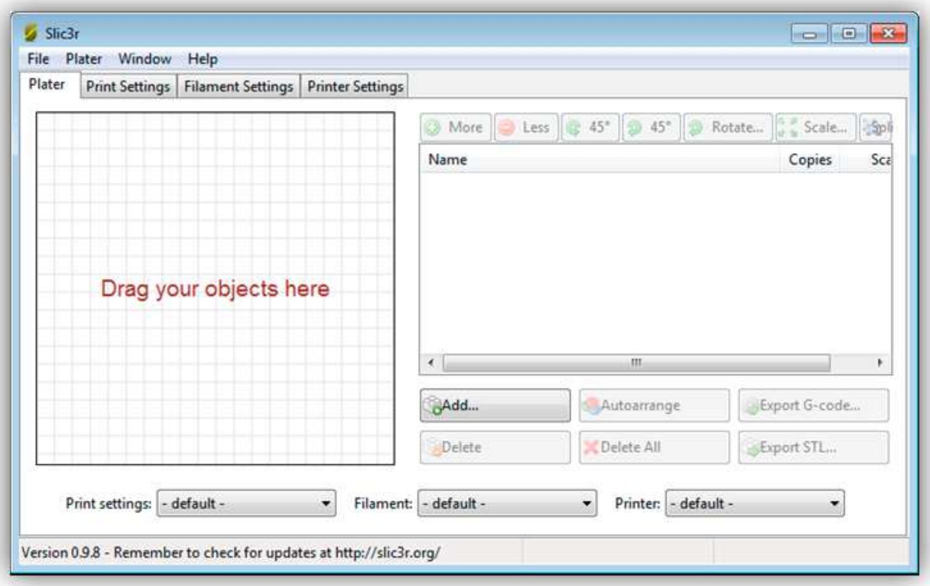
Next, click on the Slic3r "Active" button:



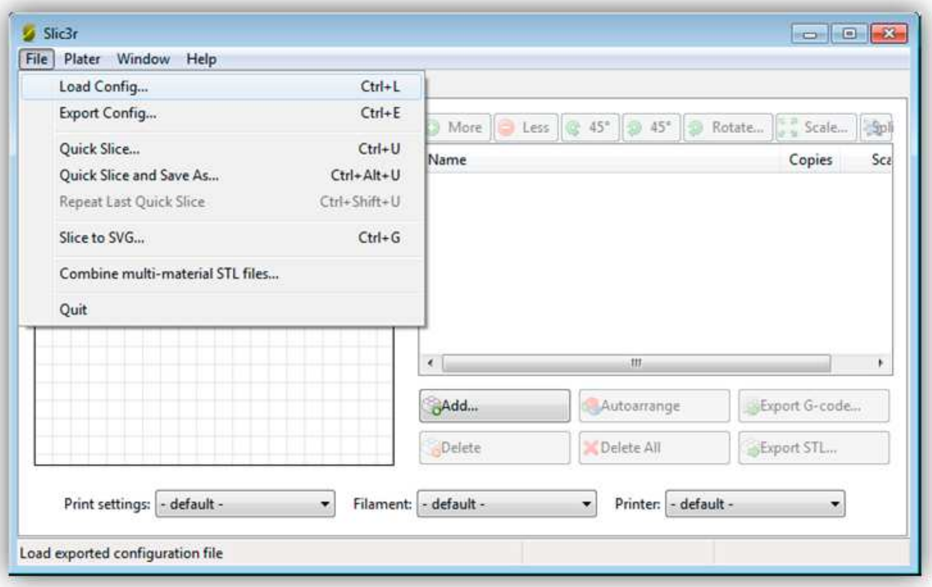
Then click on the Configure button as shown below:



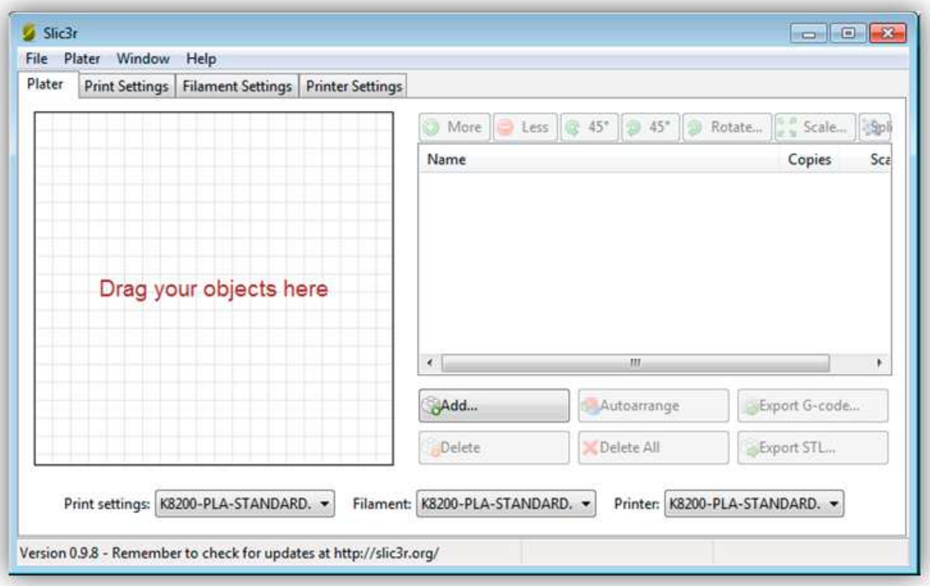
After a while the Slic3r program will start and if you started it for the first time it will prompt you with a wizard. We will not use the wizard so you can close this window. Then you should see something like this:



Then choose: “File” > “Load Config”:



In the dialog box choose the configuration file you just downloaded, you should see the following, note the changes on the bottom:

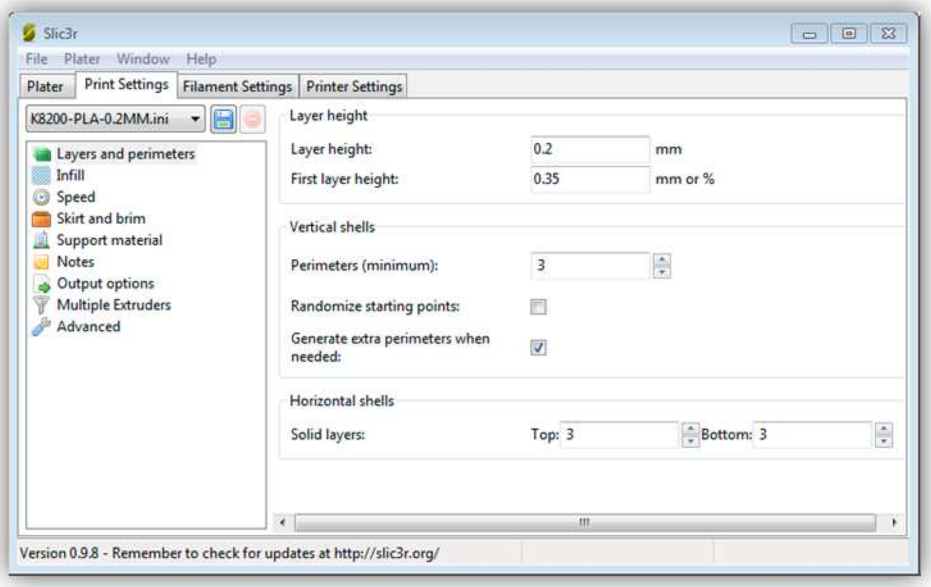


Now the profile is loaded but not saved! You should save each aspect of the profile, including

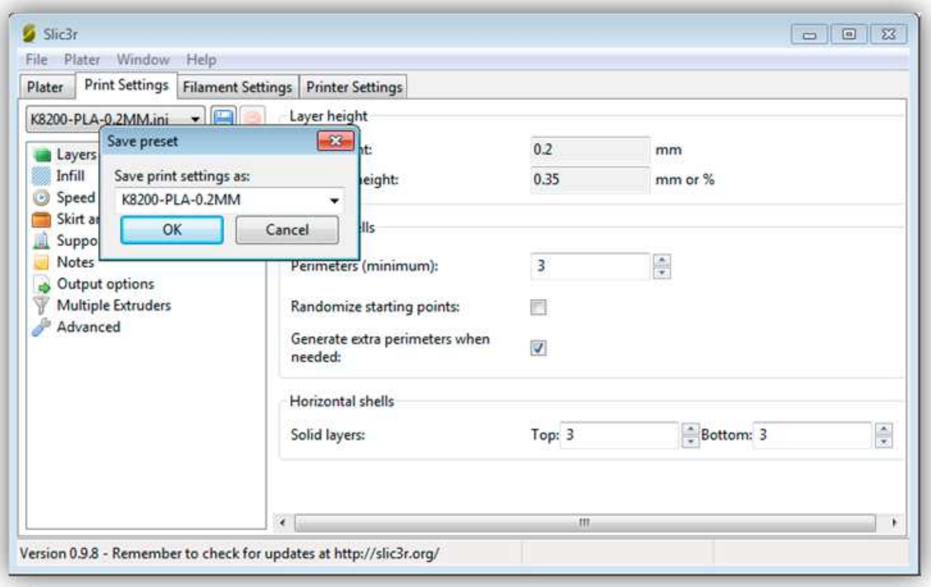
- Print Settings
- Filament Settings
- Printer Settings

Once these settings have been saved they will be accessible from Repetier without opening the slicer plugin.

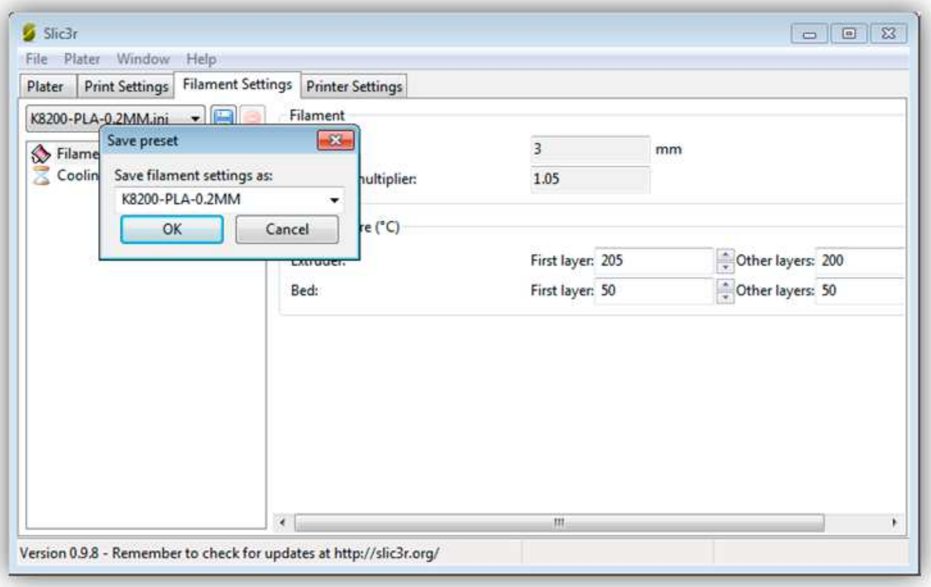
To save the settings go to the Print Settings Tab:



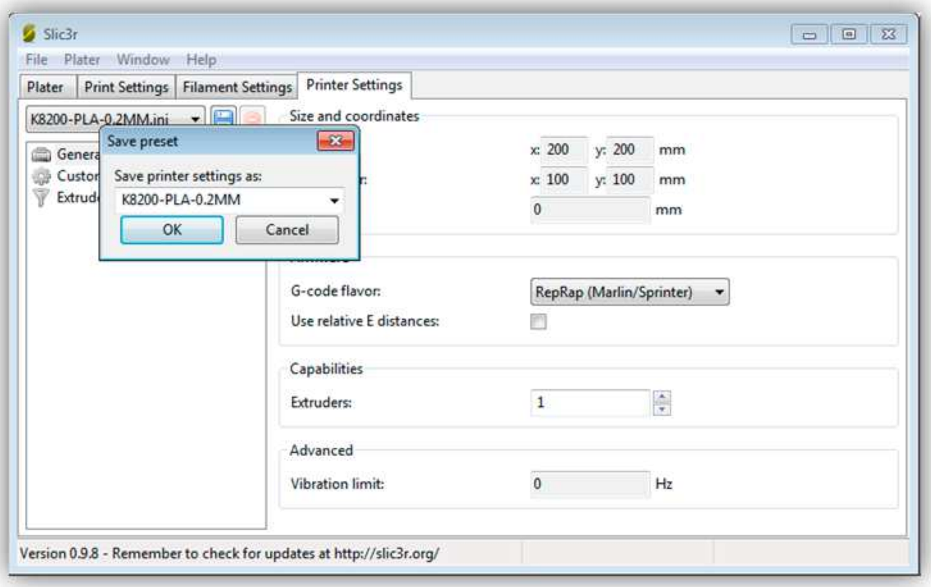
Click on the little floppy disk icon to save the Print Settings, and click OK when prompted:



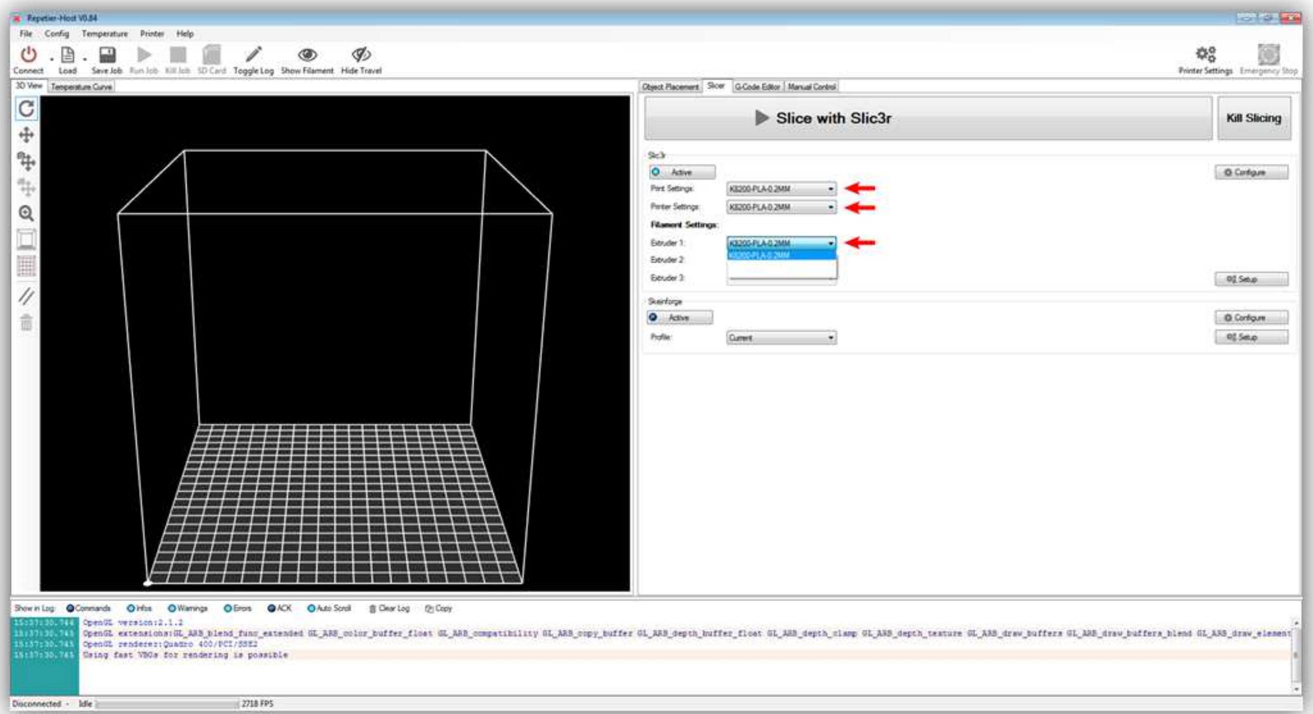
Do the same for the Filament Settings:



And finally for the Printer Settings:

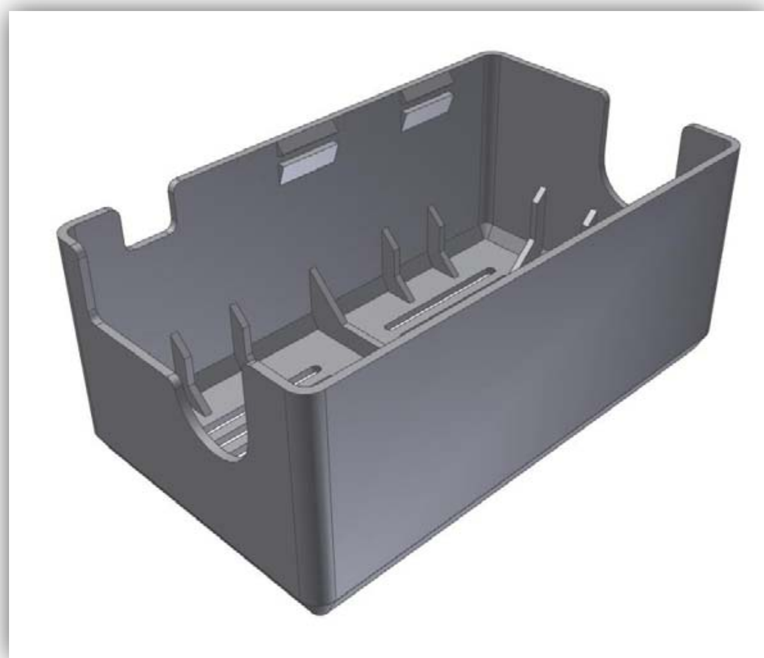


Now you may close the Slic3r window and you will be able to select Slic3r profiles from Repetier directly as shown below:



005 - THE FIRST PRINT

The print we will make will be a housing for the controller board so it is a bit protected. It looks like this:



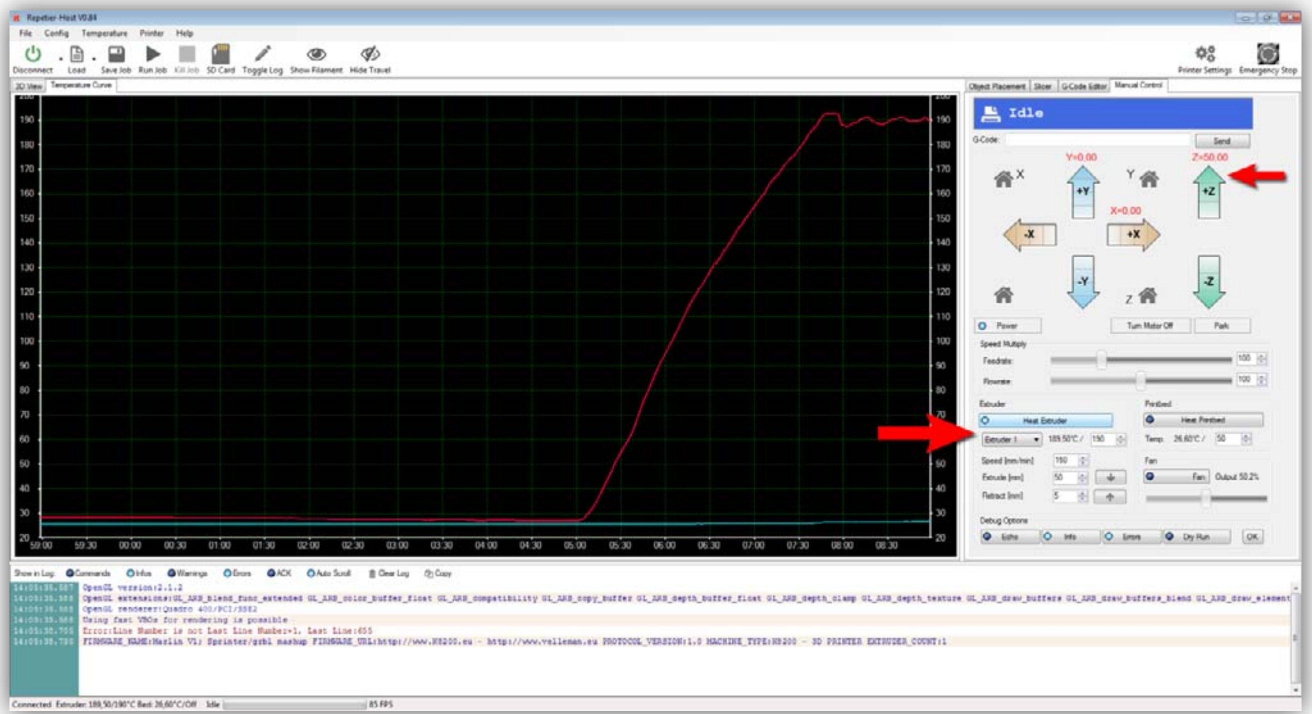
IMPORTANT: Before reading any further make sure the HEATED BED is COMPLETELY grease free (use some rubbing alcohol or isopropyl alcohol to clean it). If you are experiencing problems with the PLA sticking to the board later on you can use a small piece of light grit sandpaper (400) to roughen up the surface of the heated bed.

We need to load the printer with plastic before we can print. We will use PLA plastic, this needs low temperatures and is easy to print. (When you are using ABS we advise that you place the printer where there is enough ventilation.)

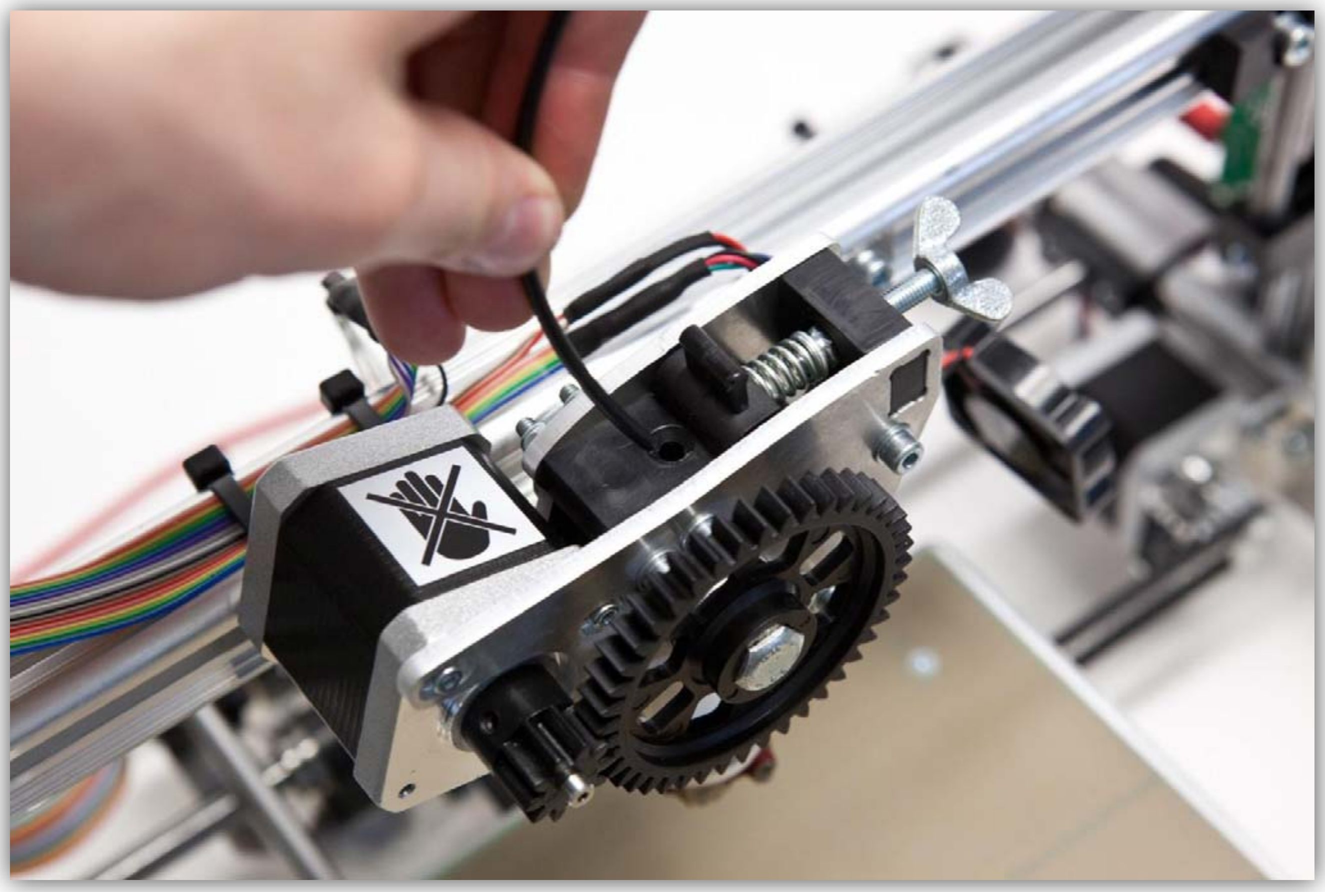
Take the 5 meter PLA sample out of the box and place it on the spool holder.

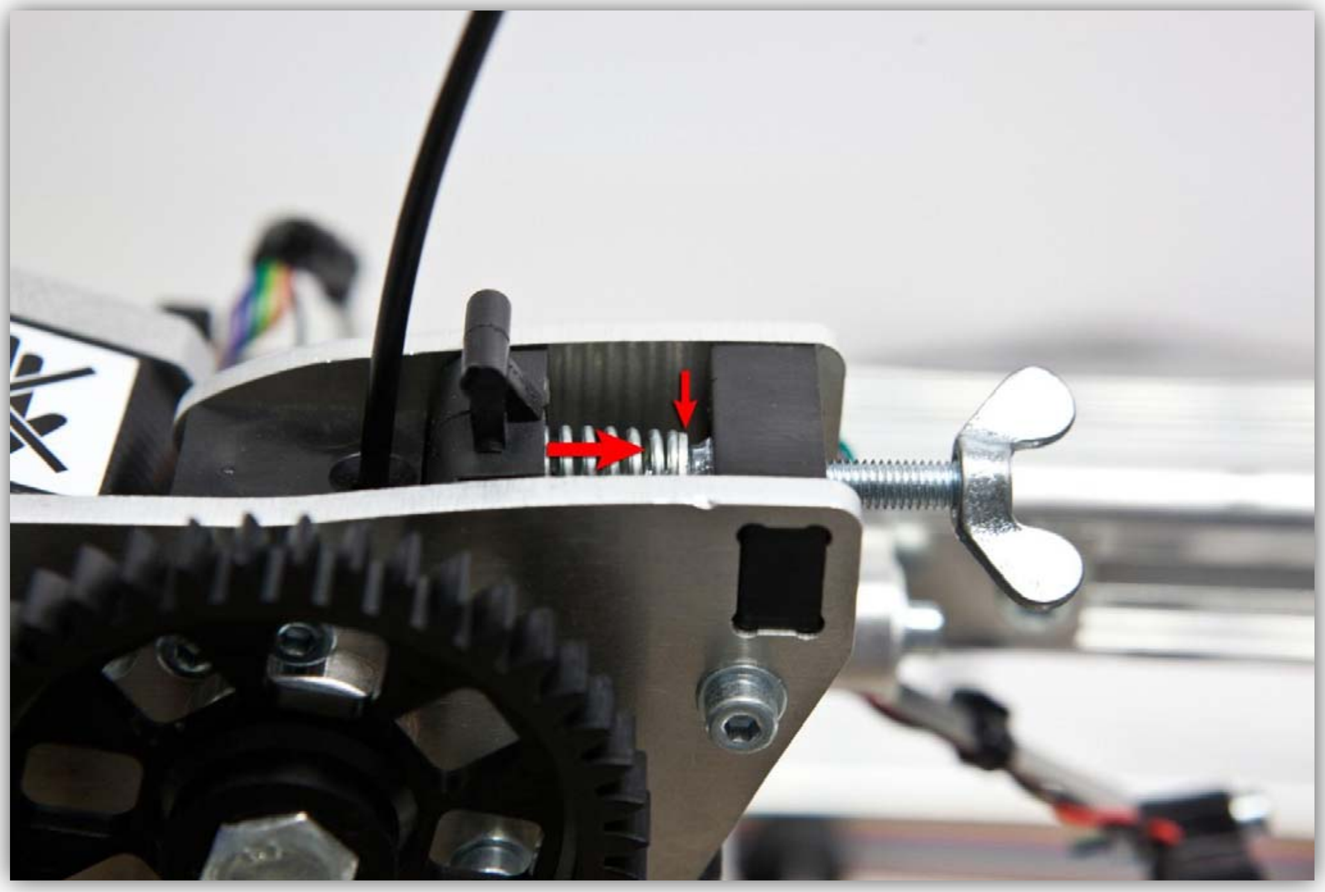
The part we shall make needs more than the 5 meter sample PLA (it needs around 7 meter)! So you won't be able to complete the part with only this amount. This piece of sample PLA is to experiment and to make sure everything is working before you use a regular spool. Keep a spool ready when you are printing this part to switch while it is printing.

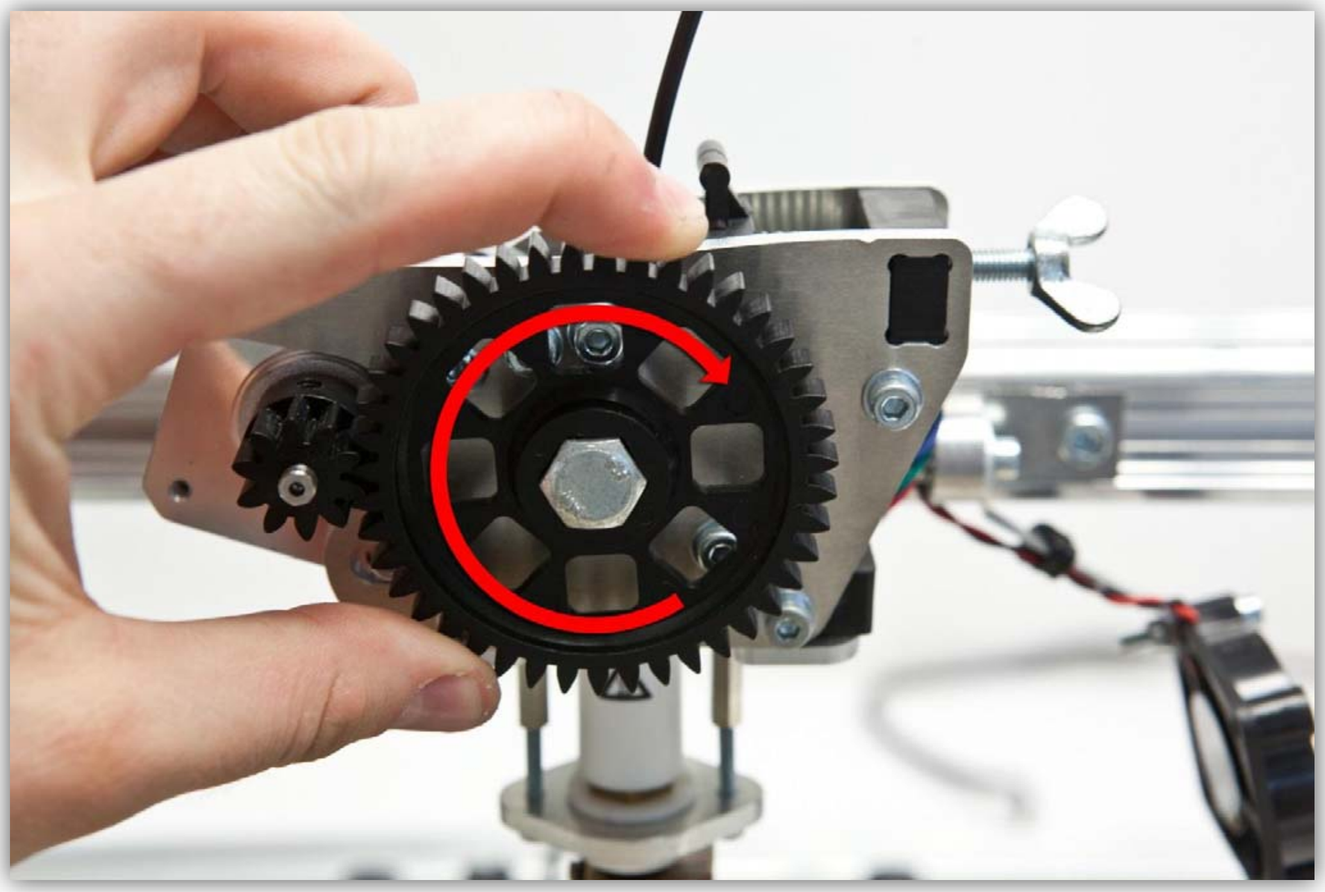
Move the EXTRUDER **UP** 5cm (1.97") and heat the EXTRUDER to 190°.

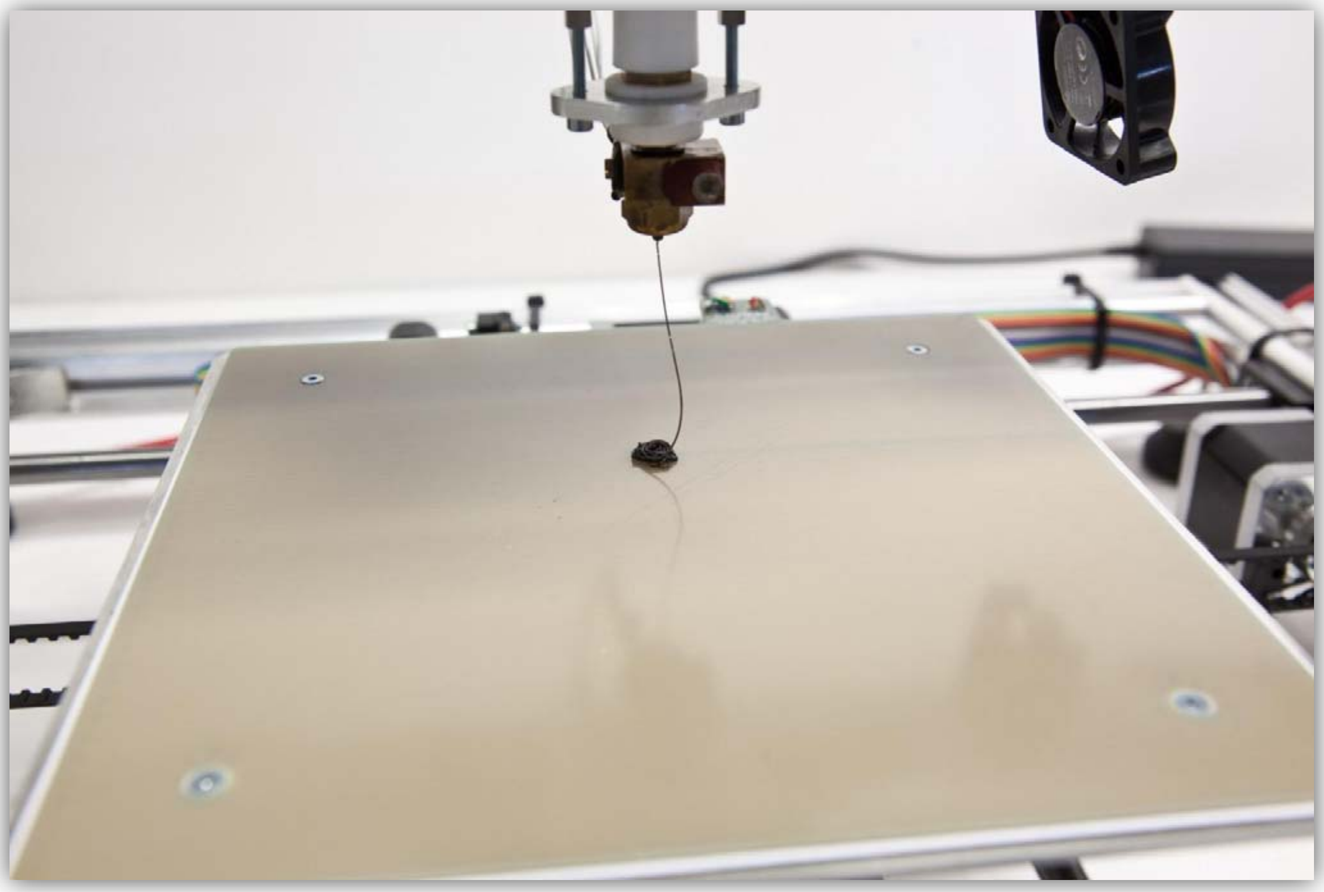


Once the EXTRUDER has reached its temperature feed the filament through the EXTRUDER. Make sure that the spring is not compressed using the BUTTERFLY BOLT. Turn the LARGE GEAR **clockwise** by **hand**. You will feel the PLA filament being pulled into the extruder. Continue turning the LARGE GEAR until some plastic starts to flow out of the EXTRUDER NOZZLE.



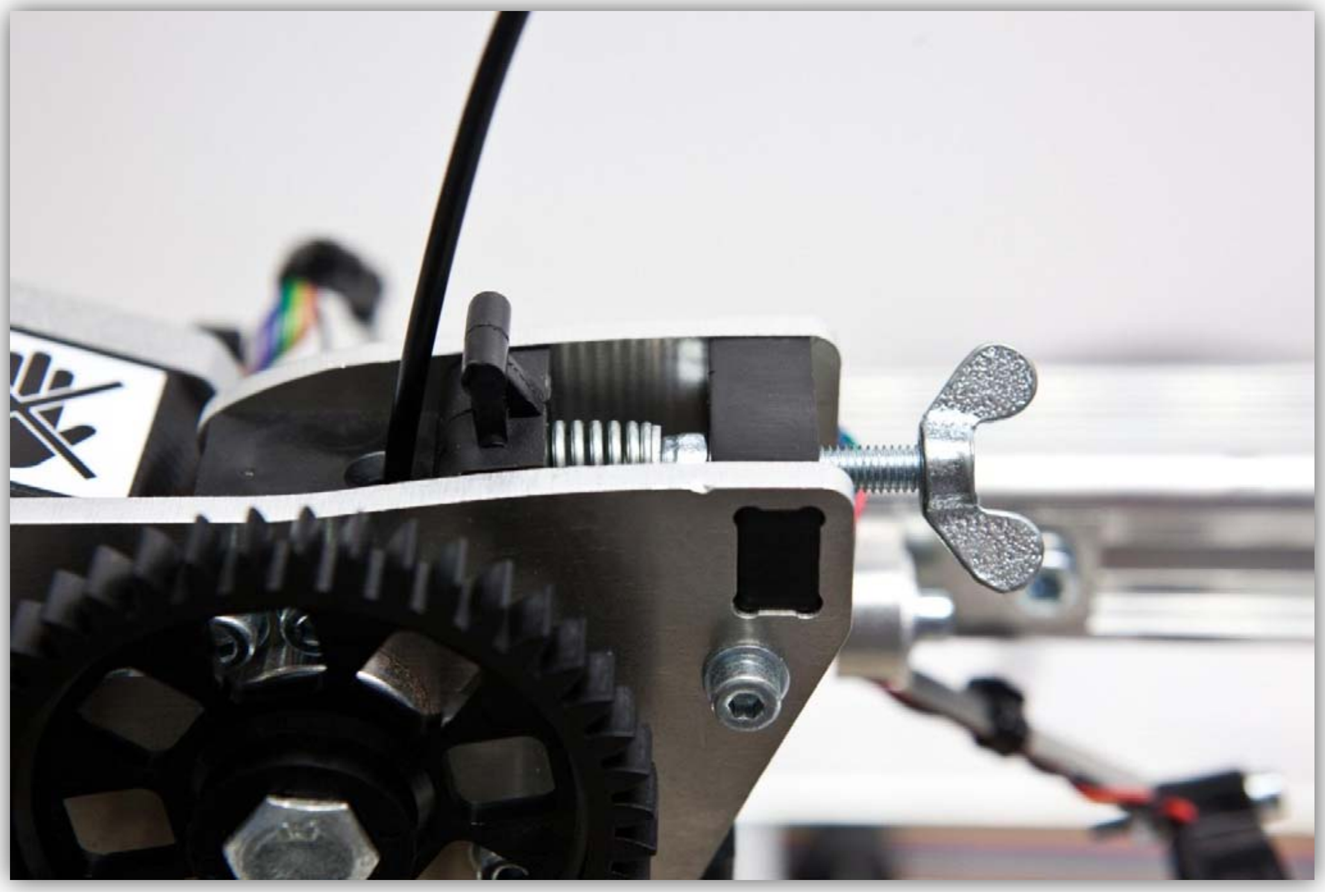




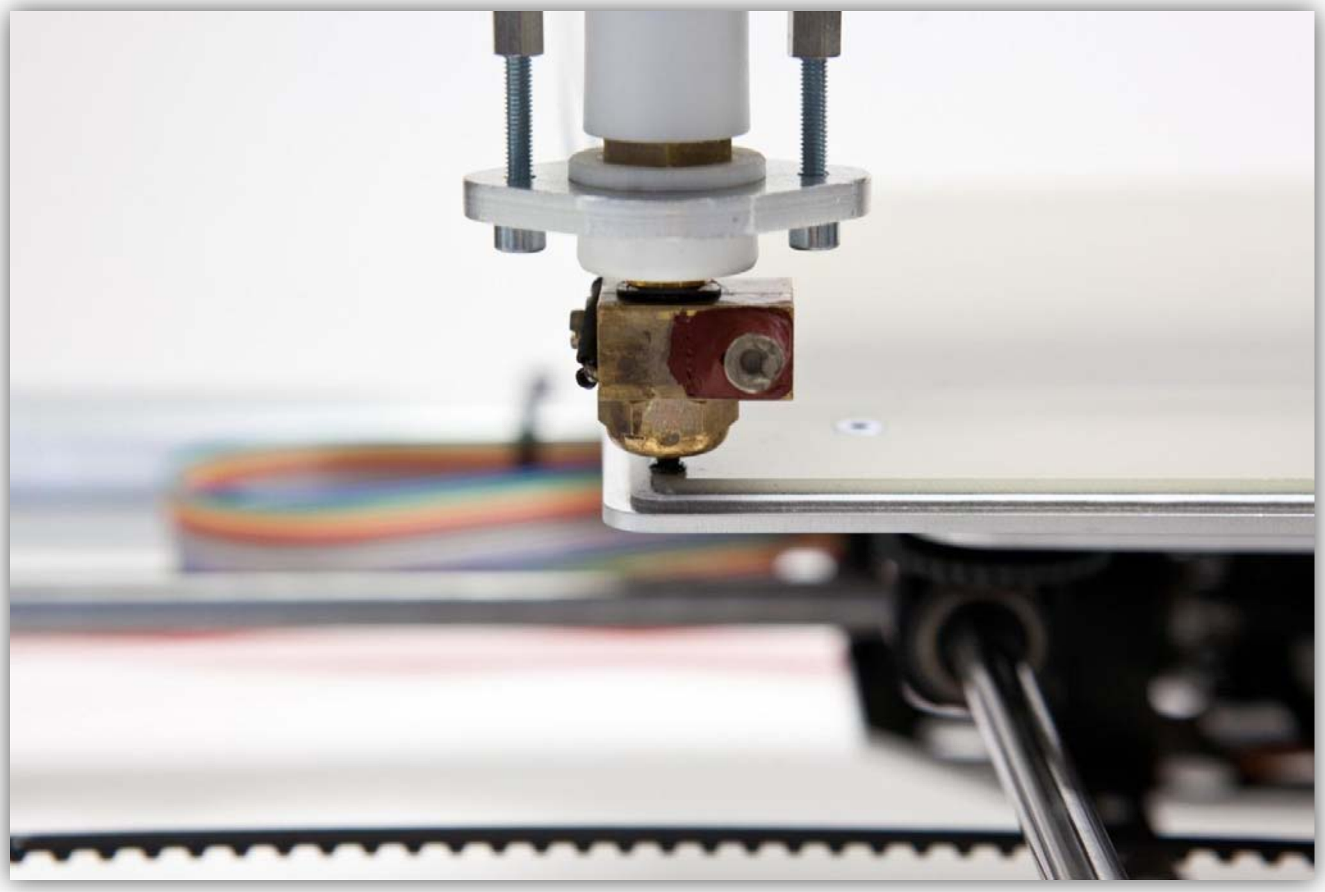


(The nozzle will drip when hot and become “unprimed”. To prevent this, always move the EXTRUDER to the 0, 0, 0 position so it doesn’t drip as much. Use small tweezers to clean the EXTRUDER NOZZLE now and then and take blobs of plastic from the heated bed.)

Use the BUTTERFLY BOLT to put some tension on the spring.

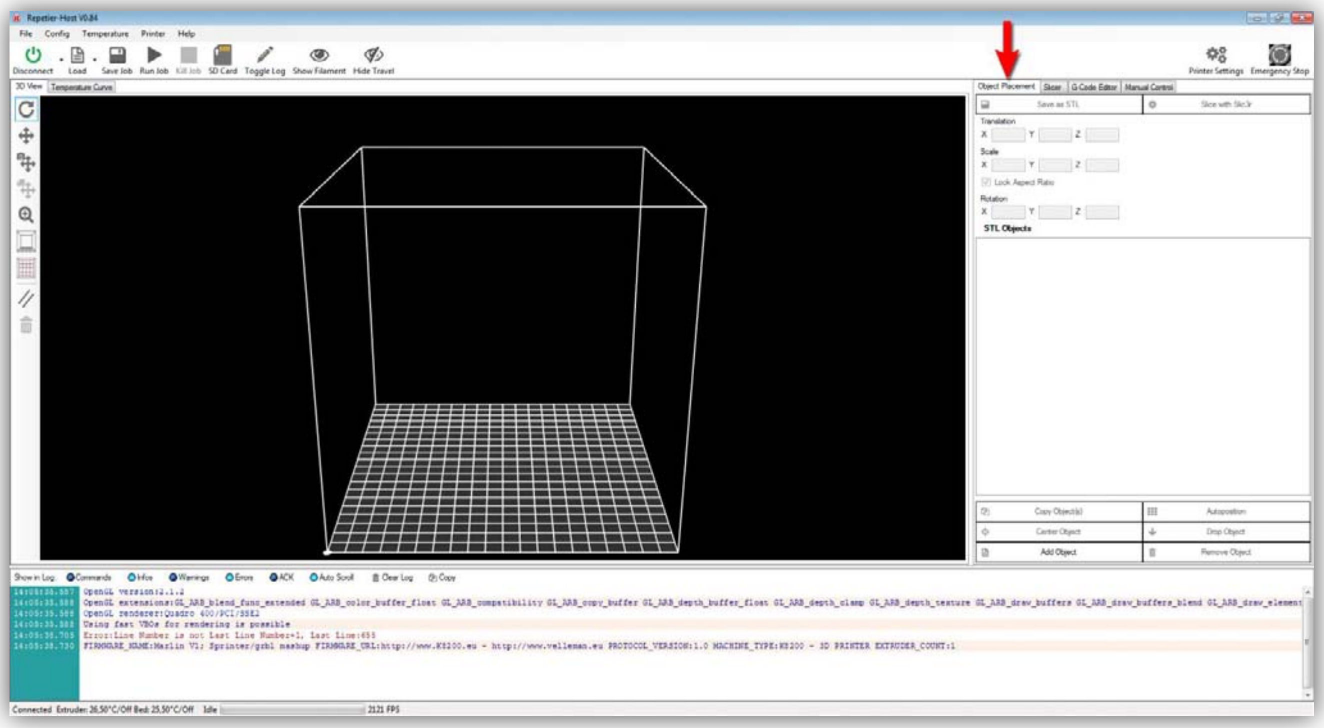


Press the “HOME ALL AXES” button and shut down the EXTRUDER HEATER. Clean up all the excess plastic with small tweezers.

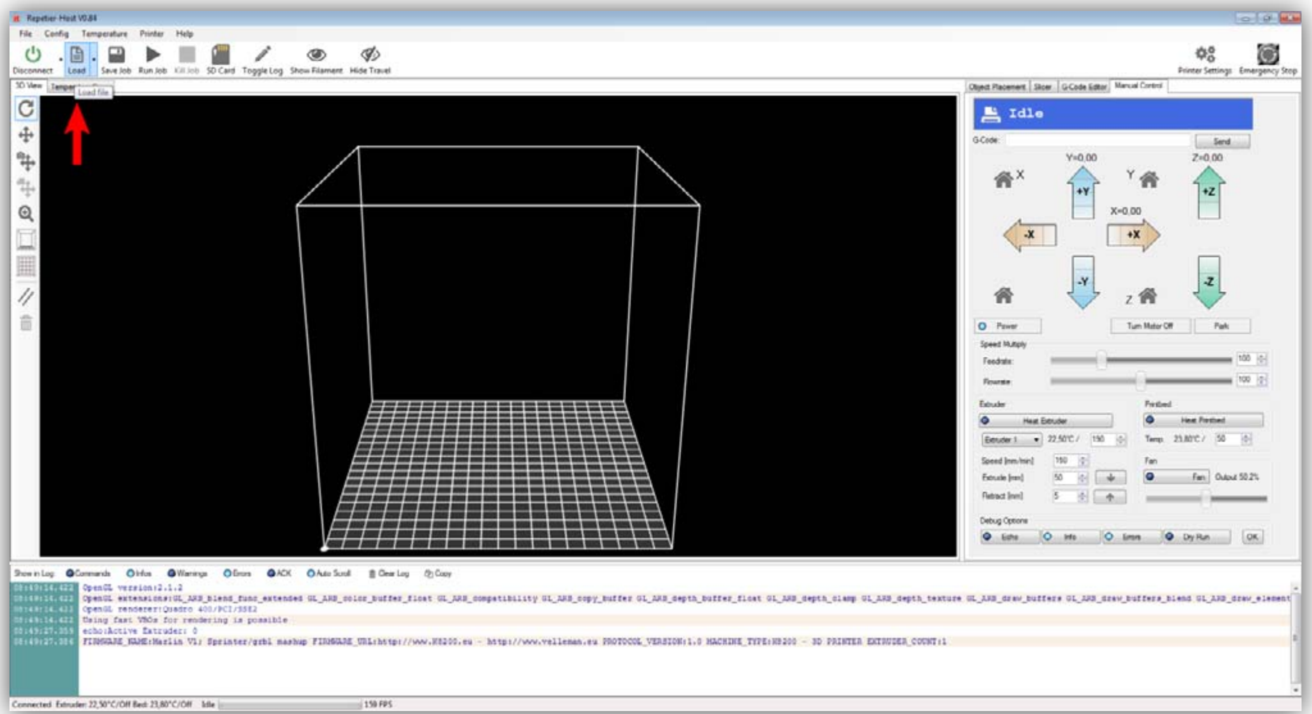


Download the *K8200BOARDCOVER.STL* file. This is the 3D file we shall print. Save it somewhere on your computer.

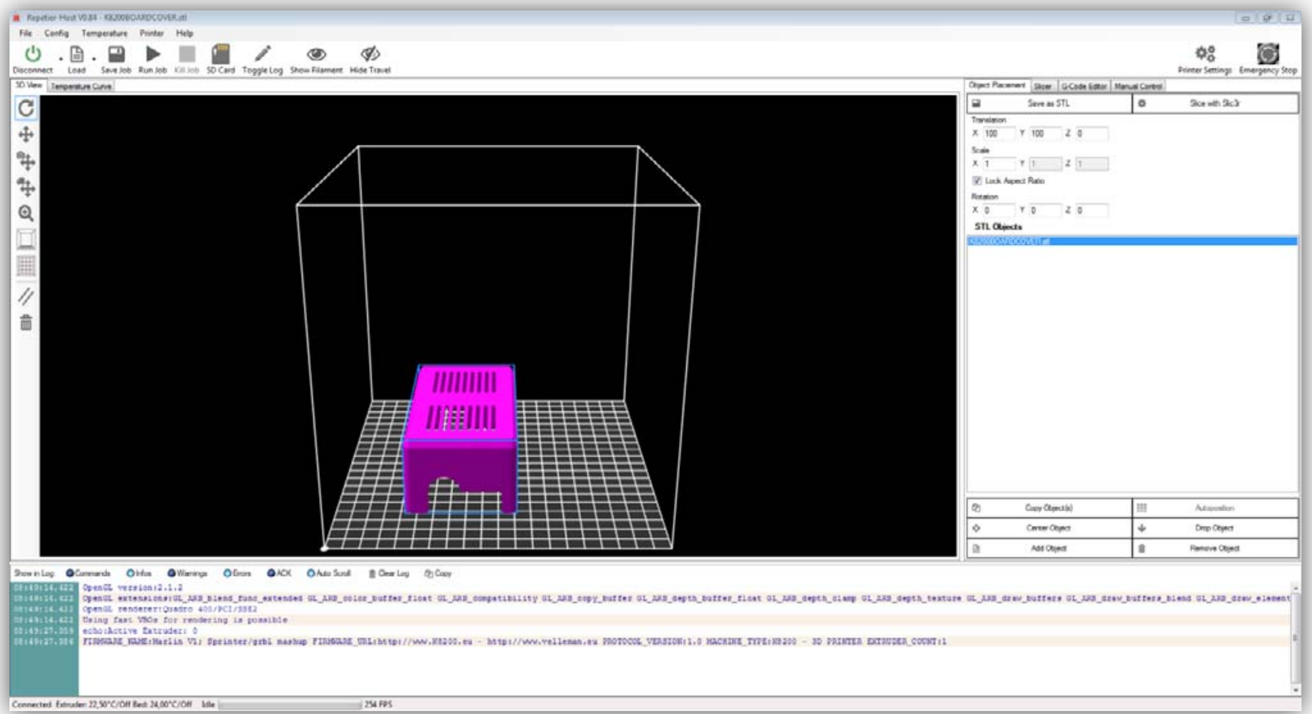
Select the Object Placement tab.



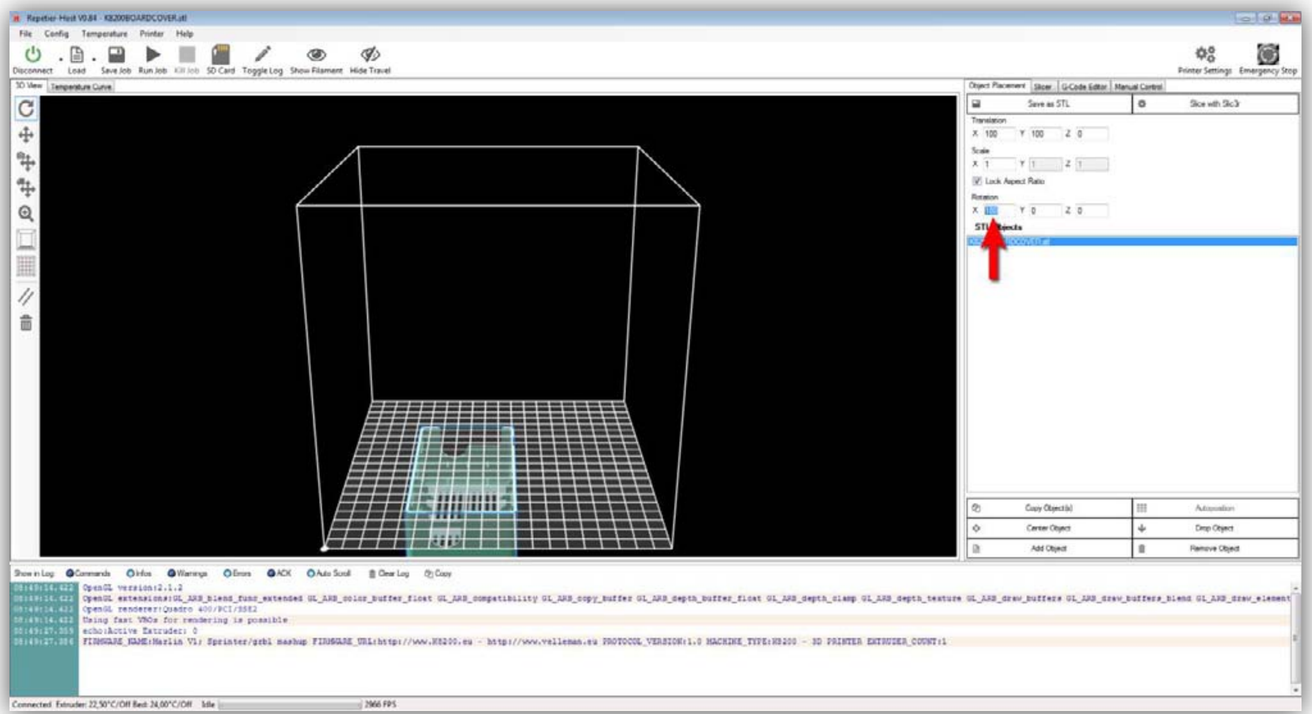
Press the load button.



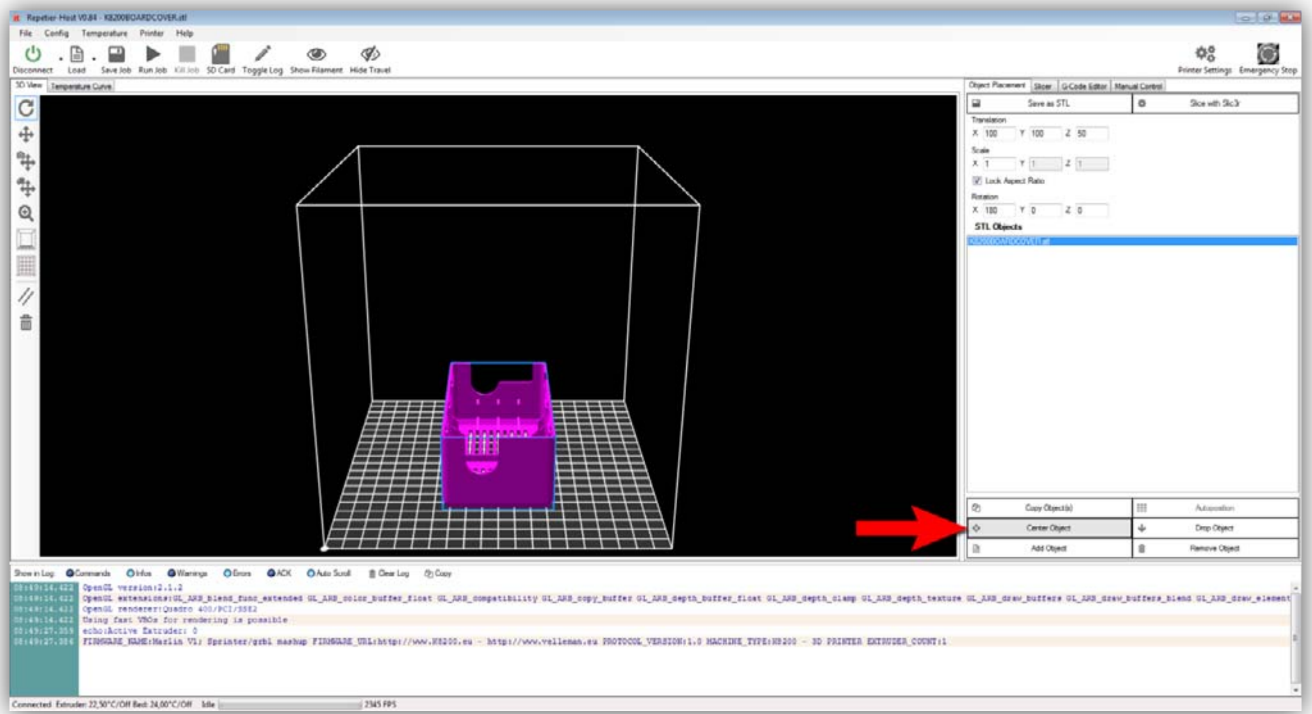
In the dialog window search and select the file *K8200BOARDCOVER.STL* you just downloaded. The window should now look like this.



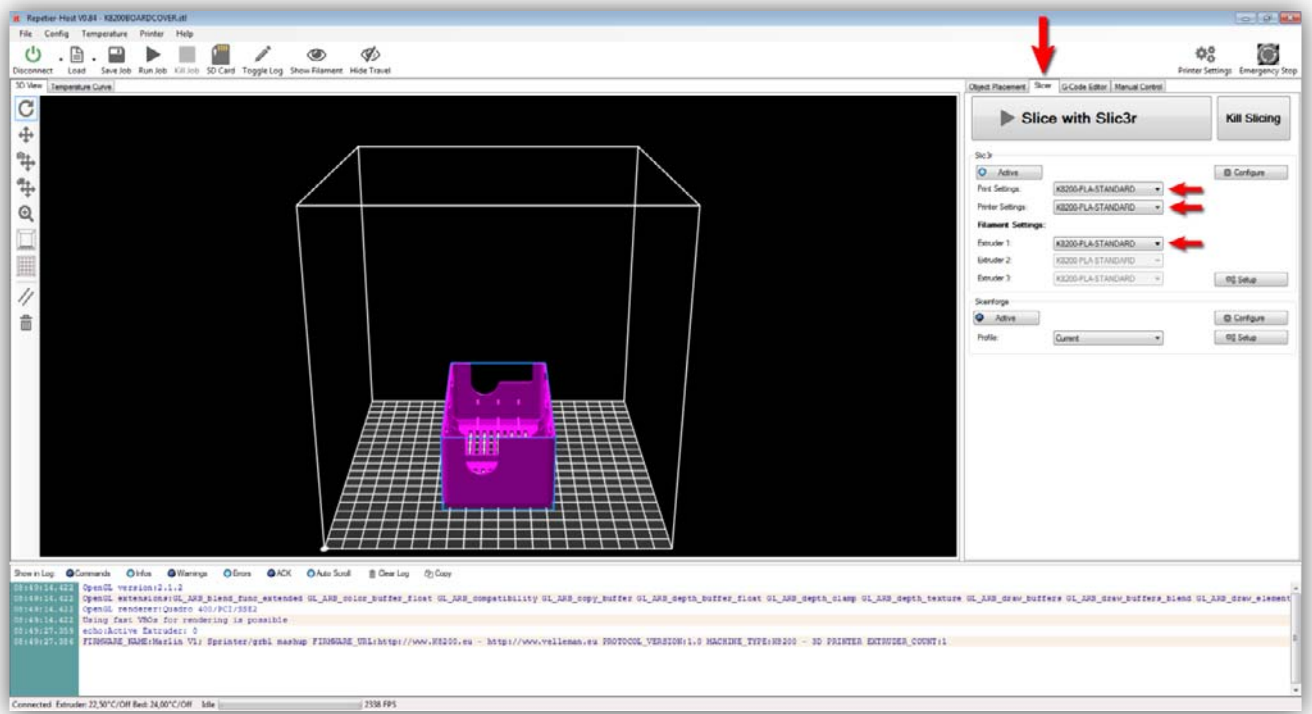
The part must be rotated 180° before we can print it successfully. You can rotate it by entering “180” in the X rotation.



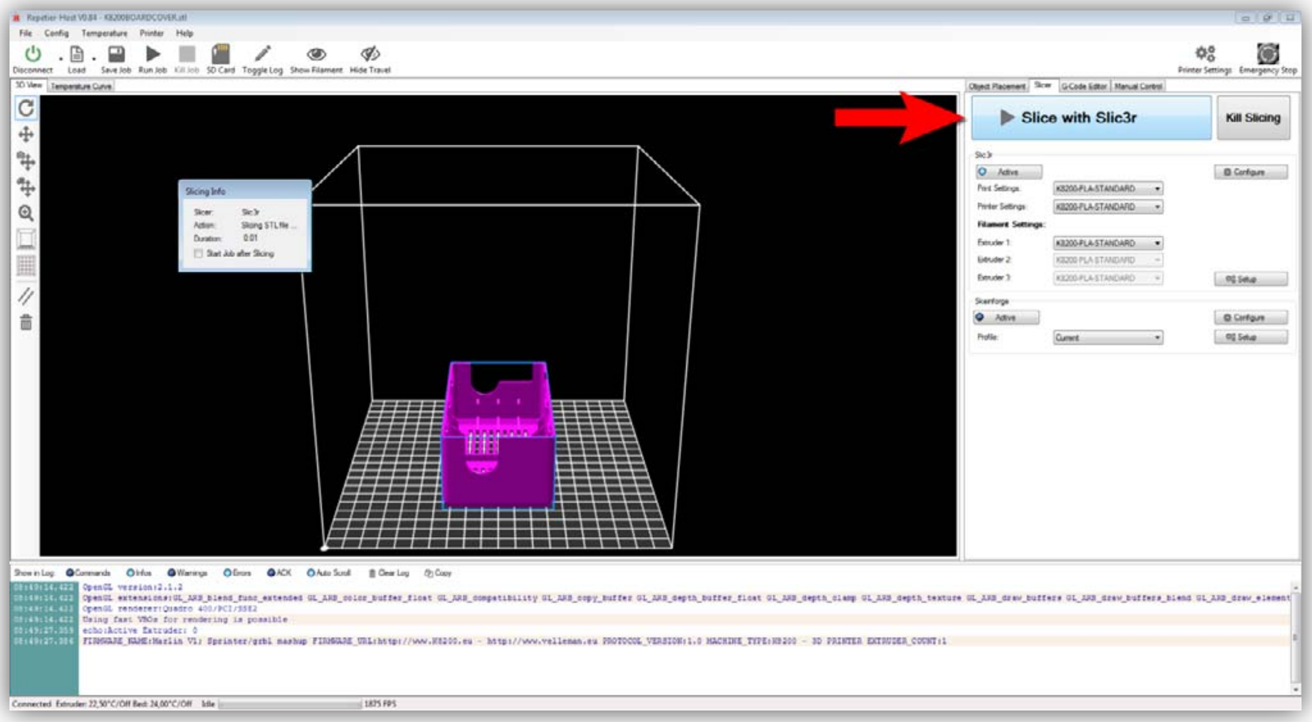
As you can see the part has now been rotated. But it sits under the print area. To fix this press the “Center Object” button.



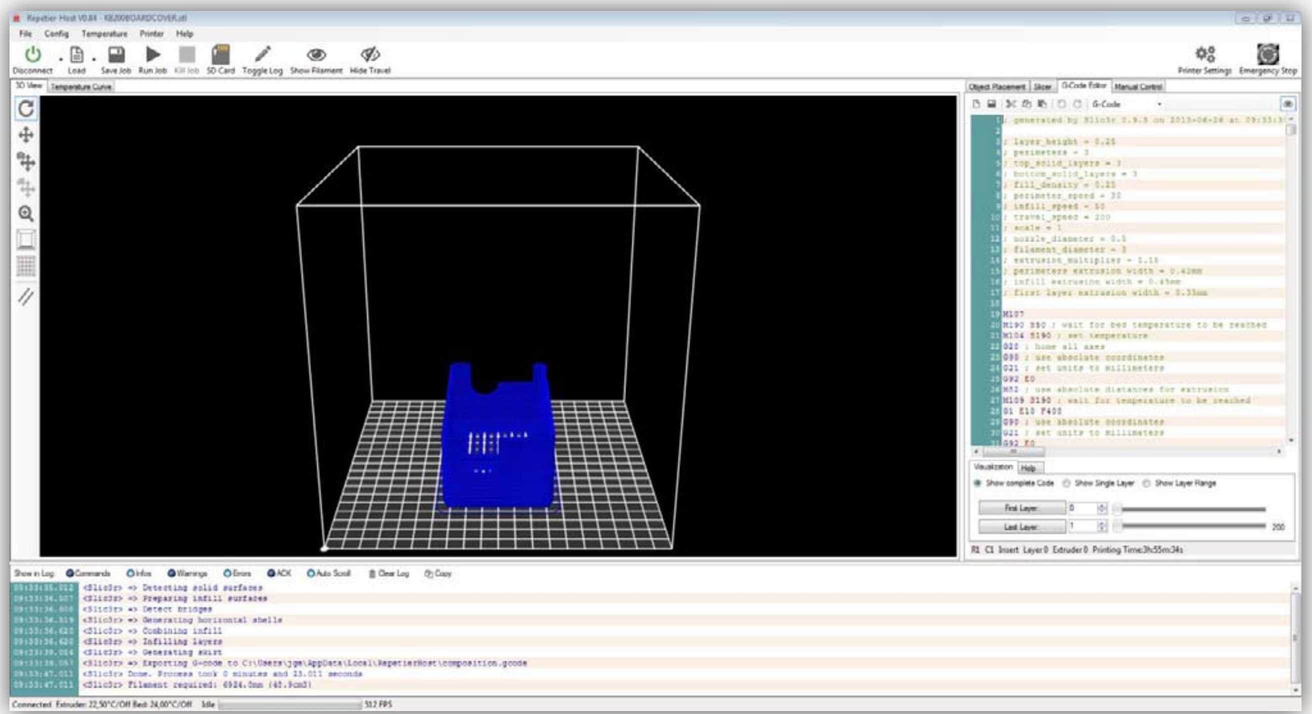
The part is orientated correctly now and ready to be sliced. Press the Slicer tab. Make sure you followed every step in chapter 4 and all the Slic3r profiles are K8200-PLA-STANDARD.



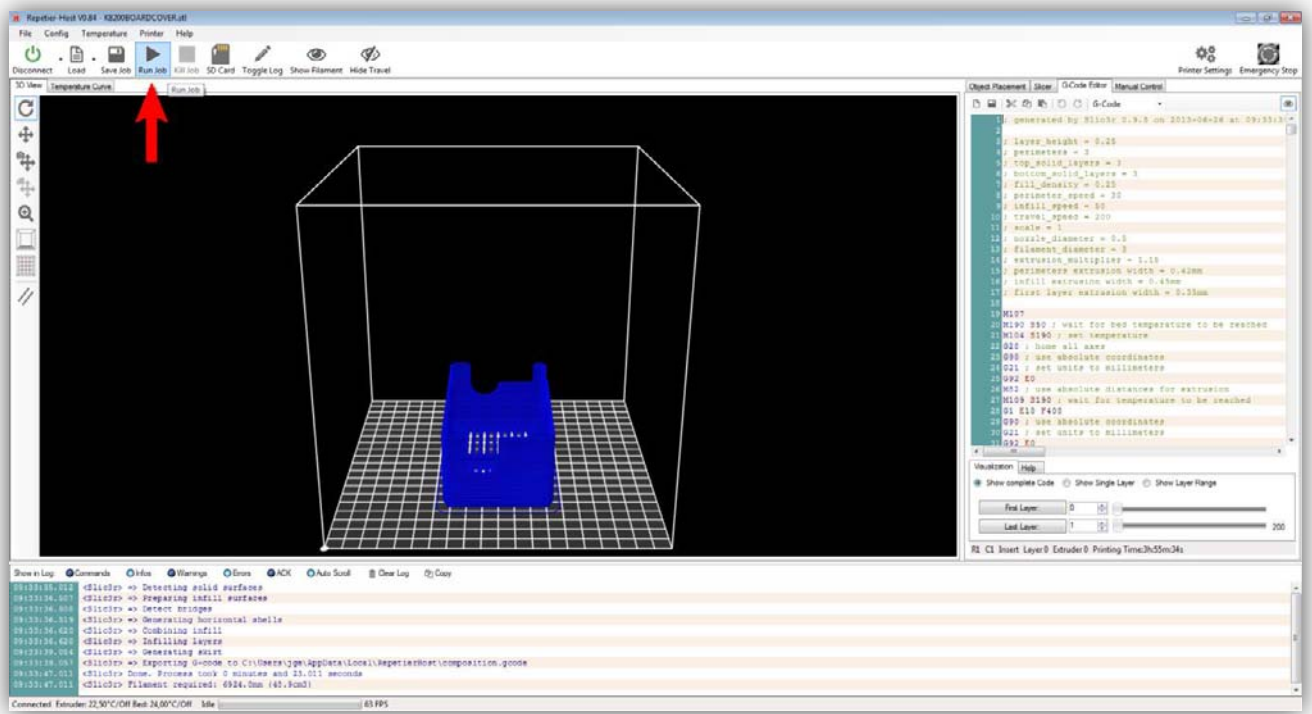
Press the big “SLICE WITH SLIC3R” button.



A small window will pop up and you will be able to see the progression in the log window. Once the slicer is done the view will switch to the G-code Editor tab, where you can see the generated G-code and a 3D representation of this code. Note the entry's in the log window.

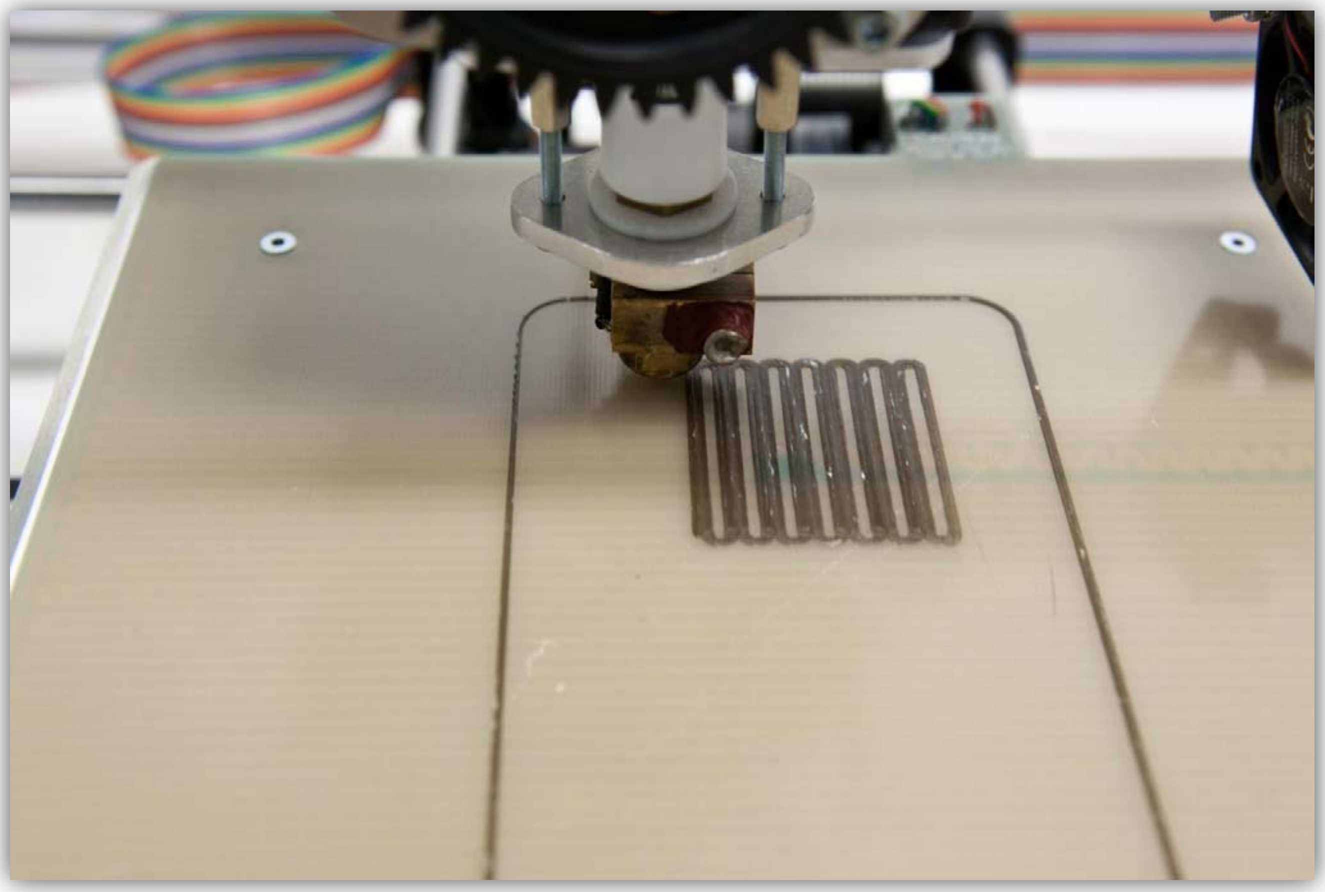


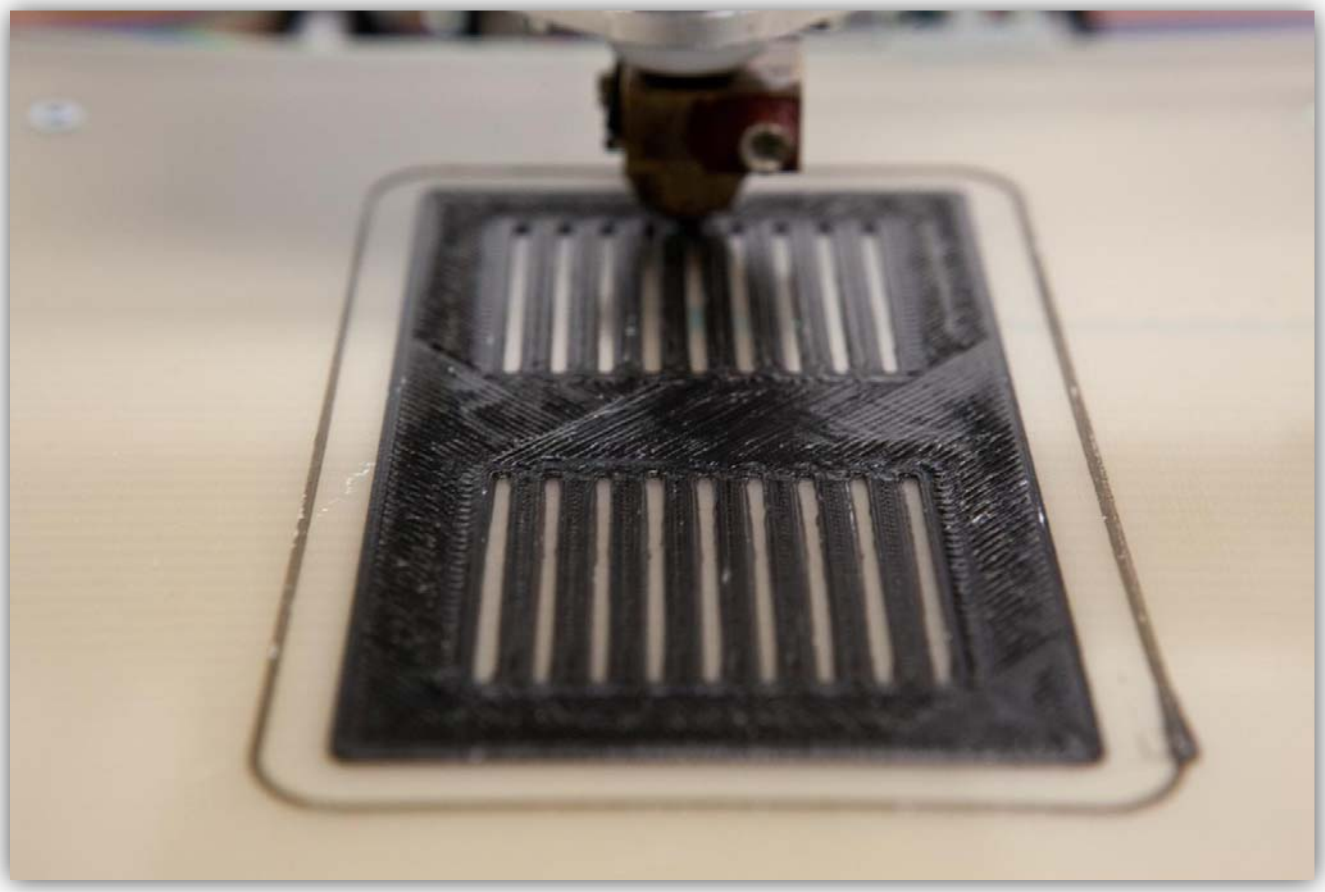
Now press the "Run Job" button. This will start the printing process. At first not a lot will happen as the HEATED BED has to heat up. Once this is done the EXTRUDER will heat up. This can take a few minutes, you can monitor the progress of these temperatures in the Temperature curve window.

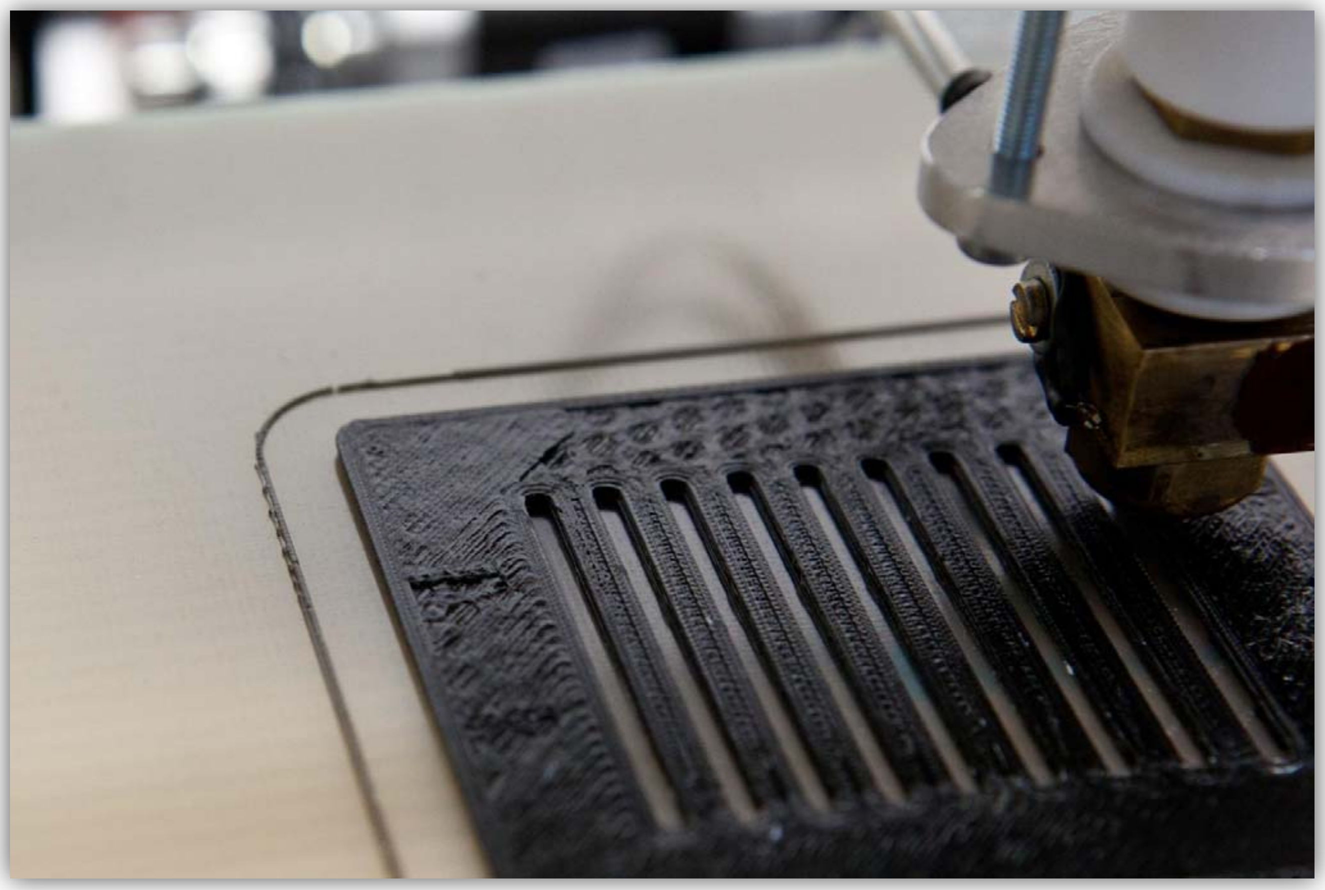


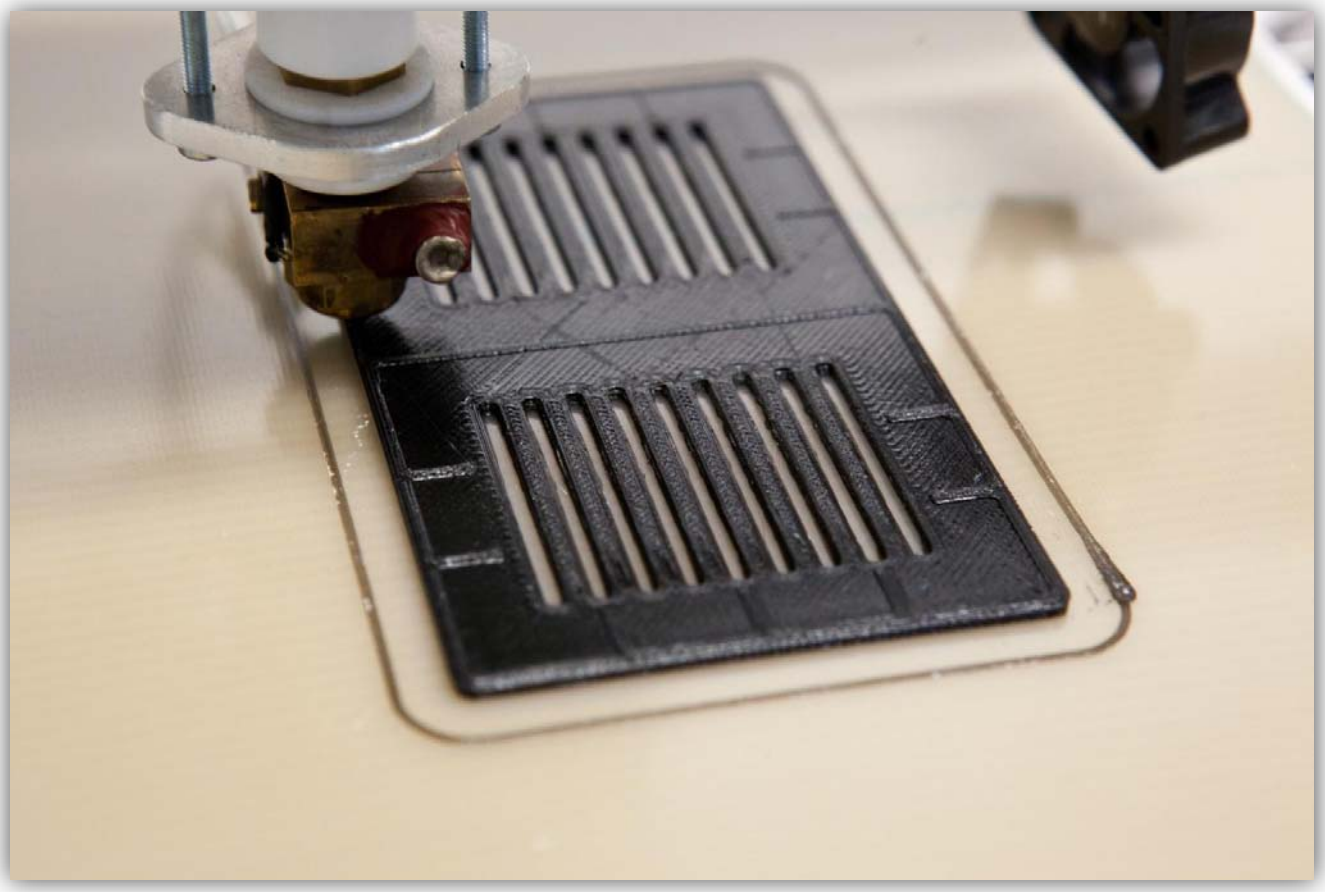
Once the bed has reached its temperature (50°C) the printer will home all the axes by itself. This behaviour is normal. When the extruder temperature has stabilized (190°C) the printer will begin printing. It will first prime the nozzle a bit leaving a little blob of plastic on the 0, 0, 0 point. You can remove this.

While the printer is printing make sure that for the first layer the plastic gets squished onto the HEATED BED. If your Z axis calibration is good this should be OK. It is no problem if the first layer seems a like it is printed with too much plastic, by the third layer this should be smoothed out and the print surface should look uniform.



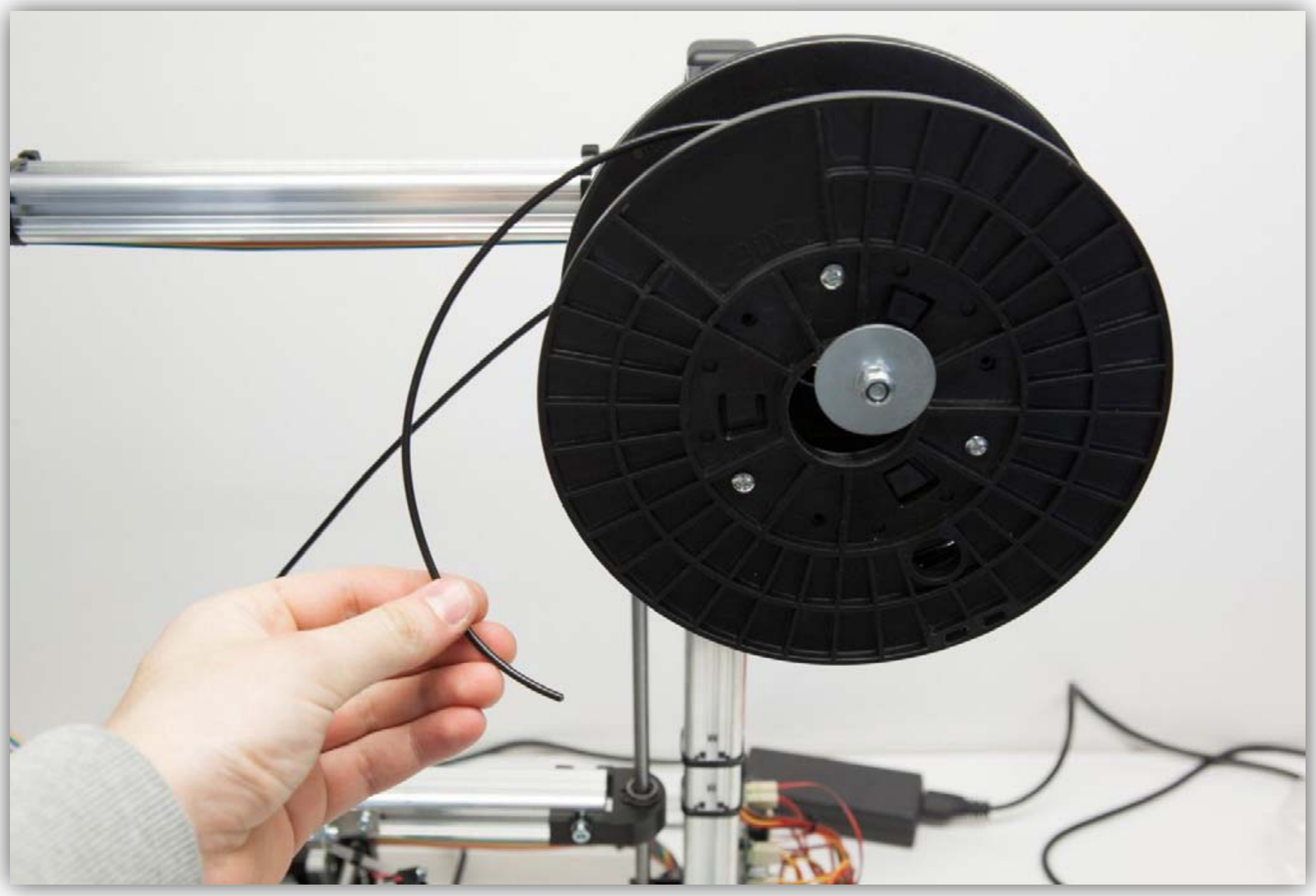






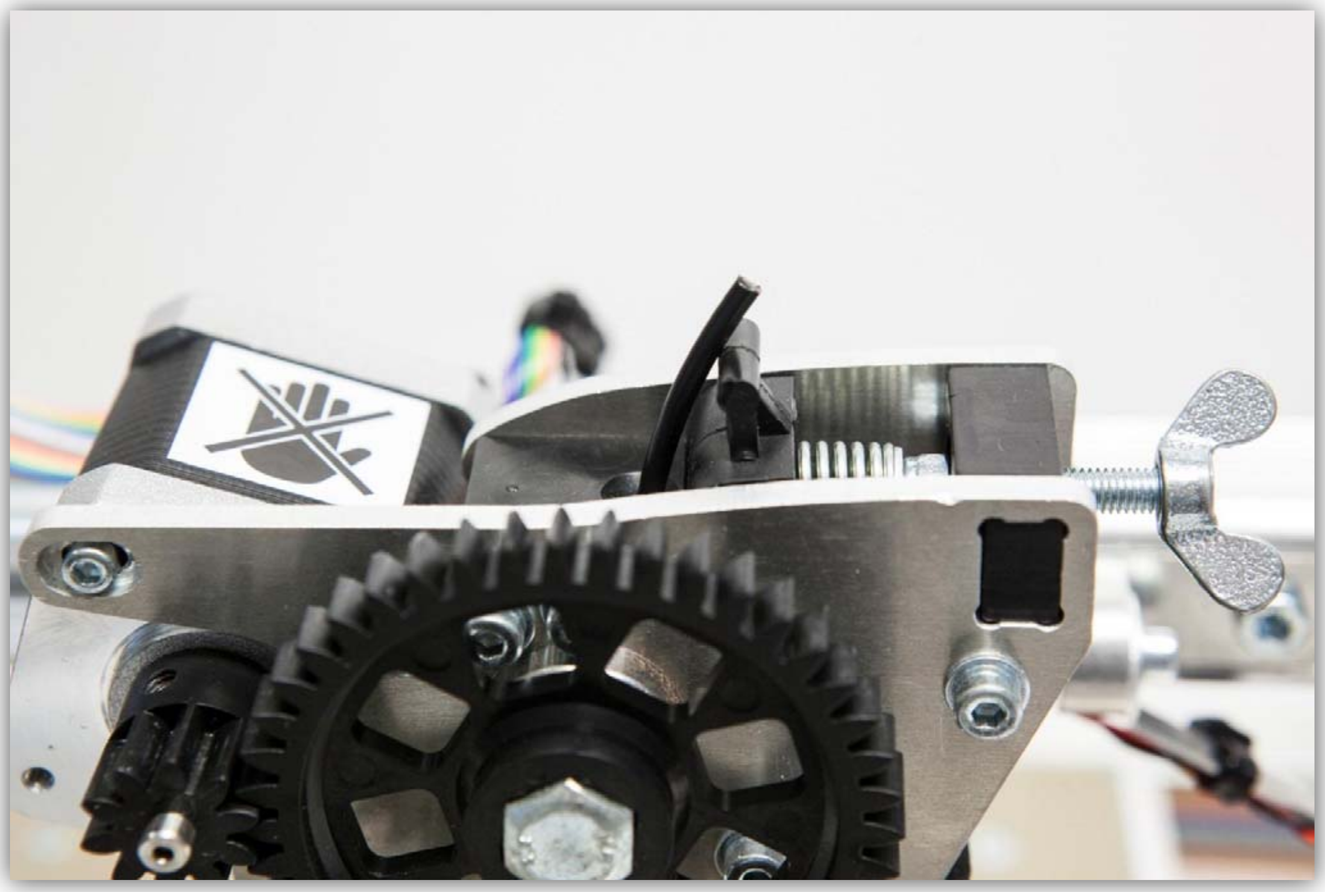
Take notice of the filament usage! By now almost all the sample filament will be used. Make sure you have a regular spool ready to change. This works as follows **(you can do this while the printer is printing)**.

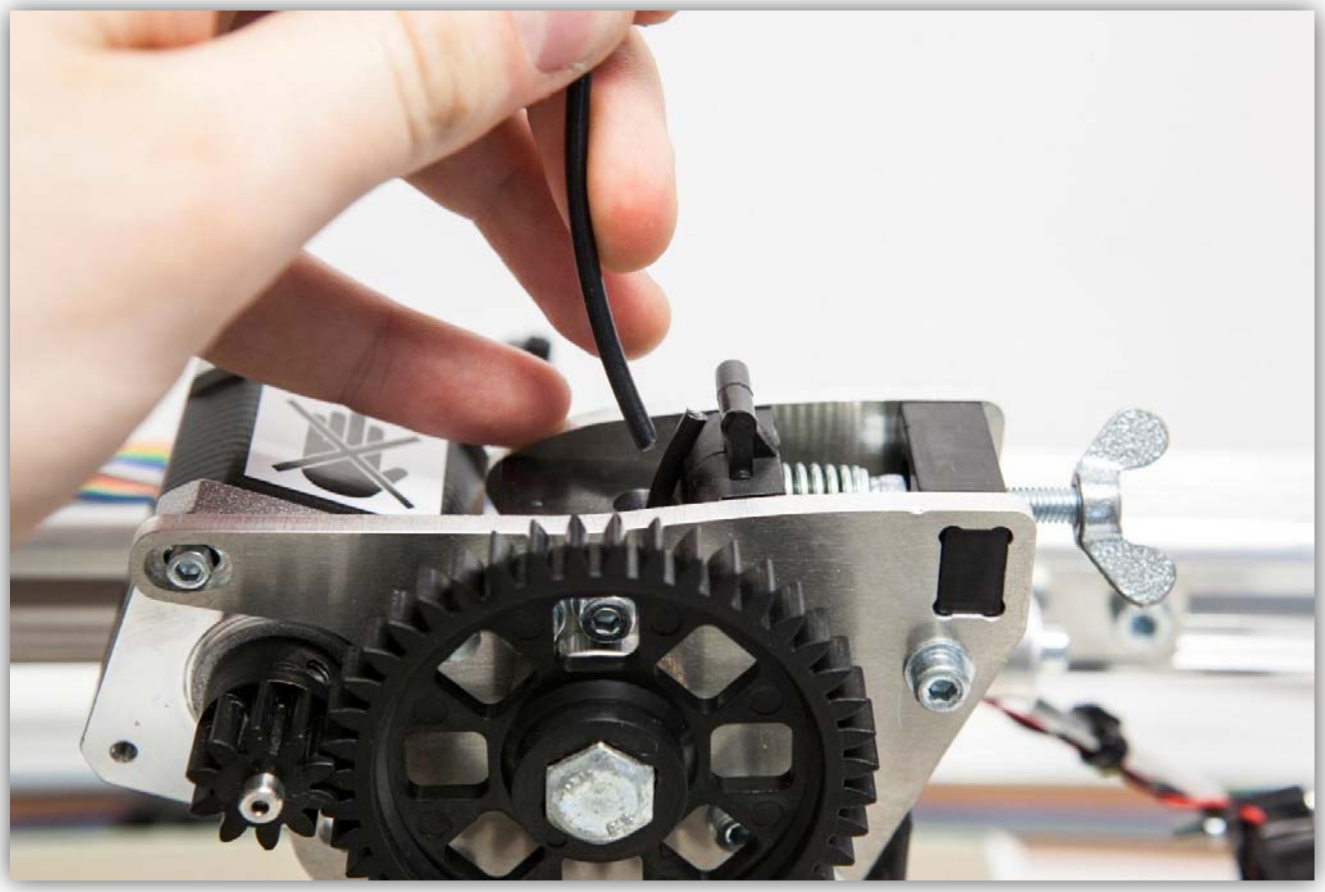
Load the spool on the holder.

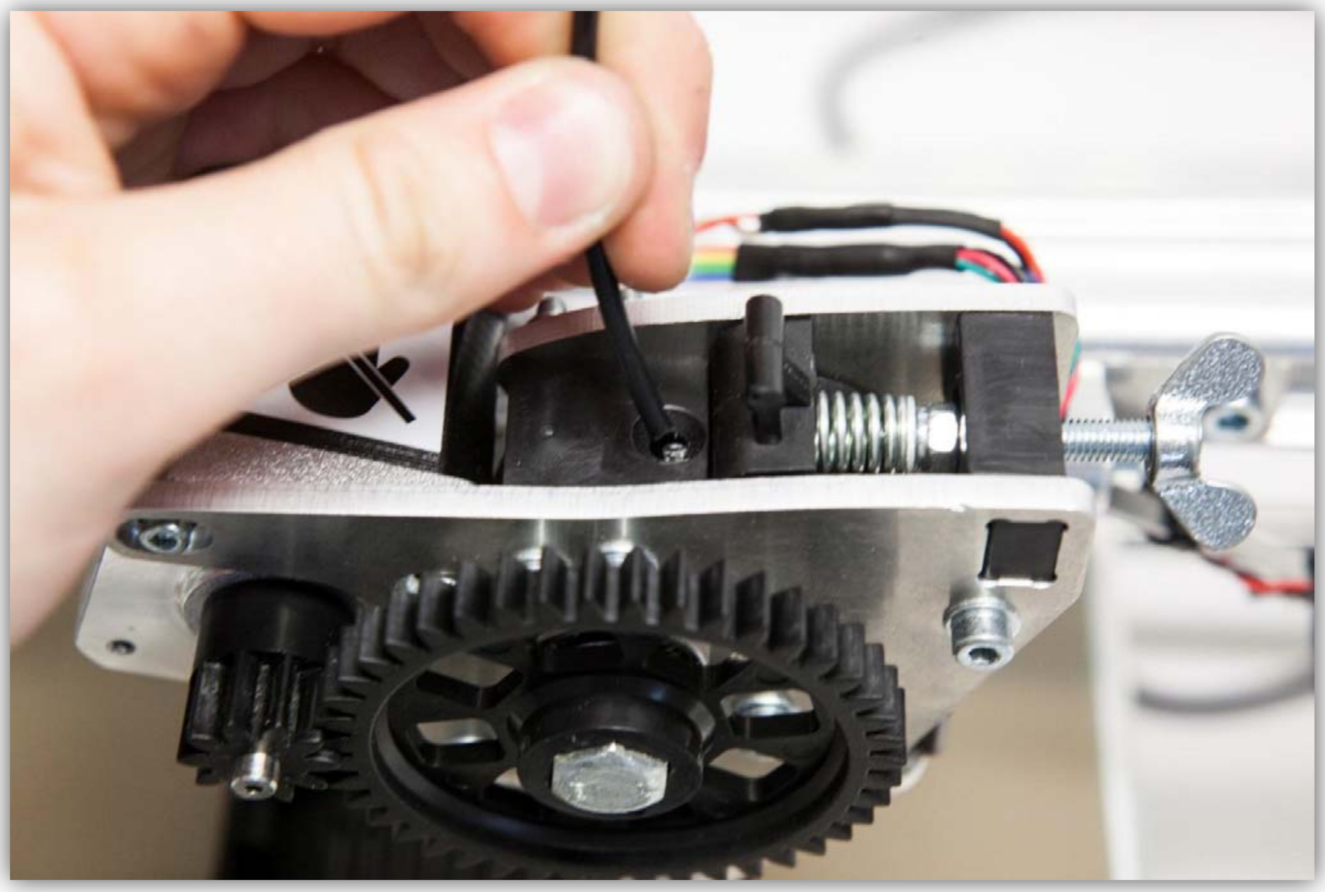


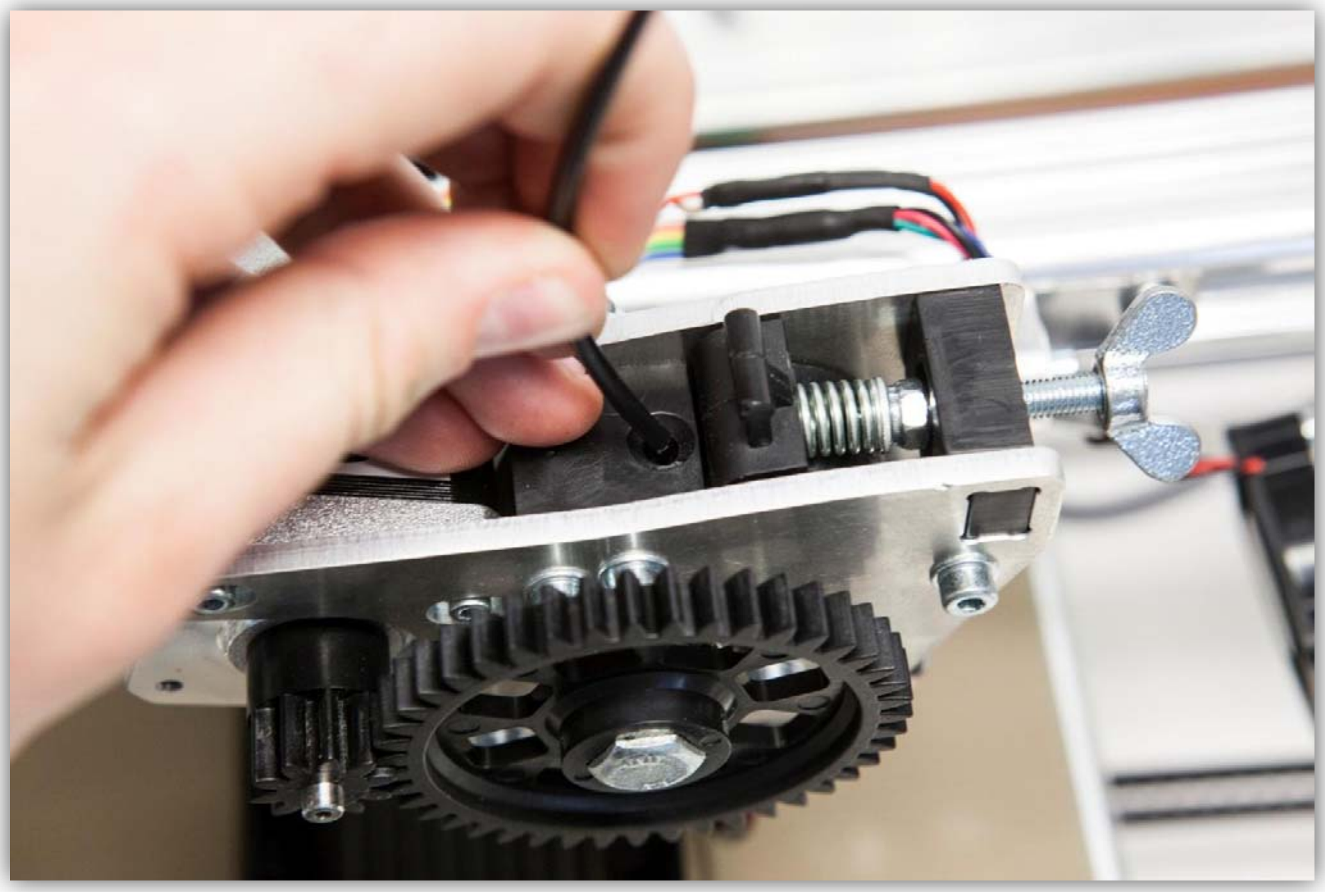
Make sure the end of the wire is clear and straight.

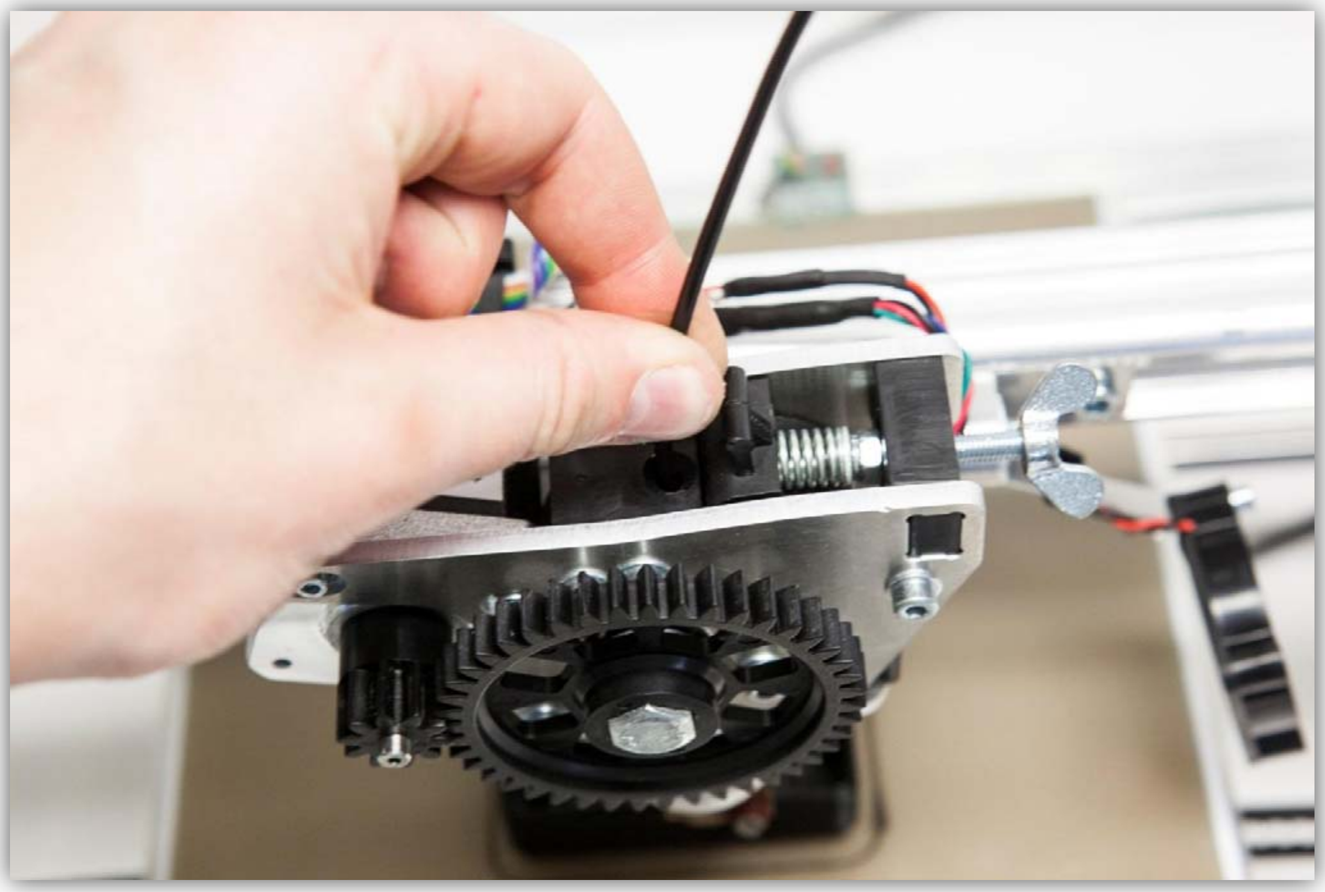
When the last of the filament disappears into the EXTRUDER feed the new filament in. Apply **gentle** pressure, until you feel the HOBBED BOLT grab the filament and starts pulling it in. Take notice of the filament so it moves down fluidly. Once 5 cm (1.97") of new filament has disappeared into the extruder you can be sure the change has been successful.











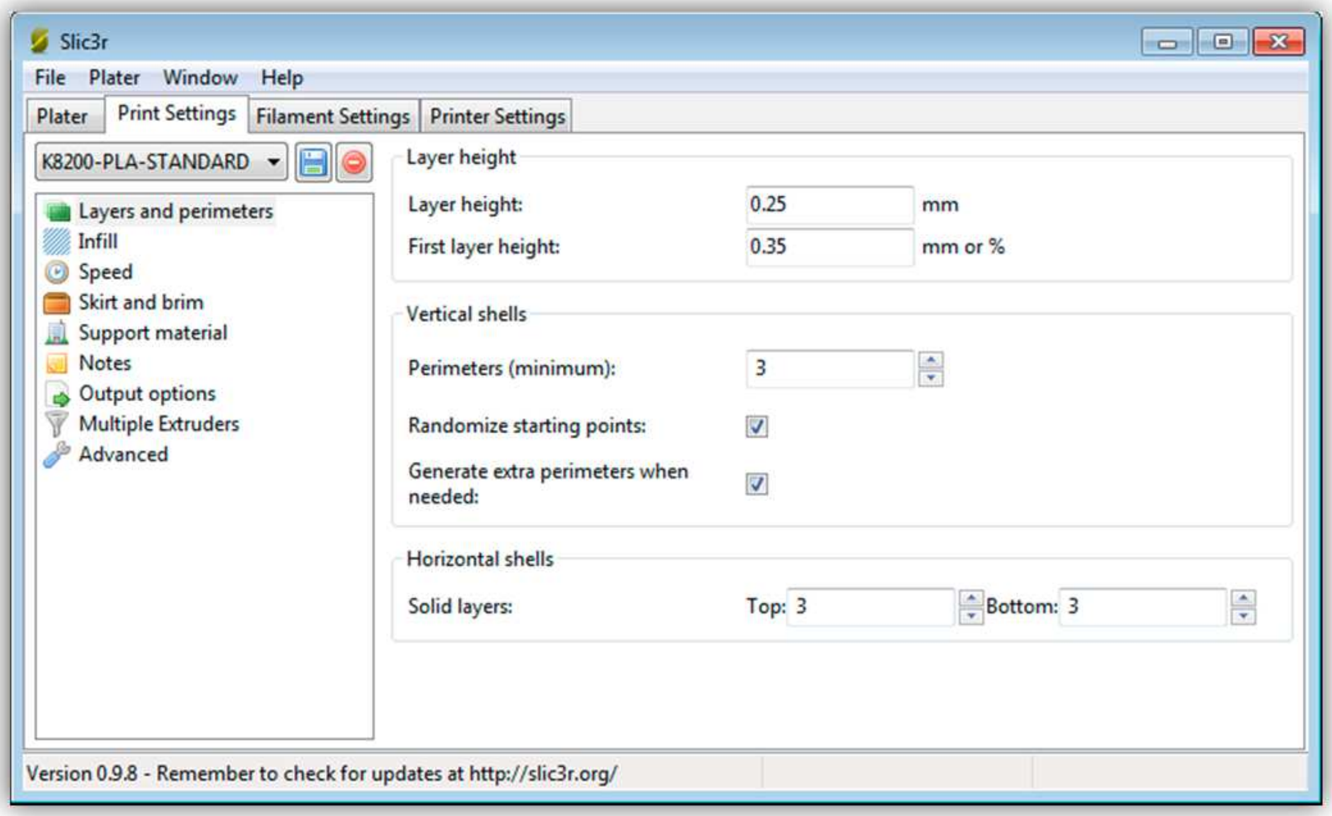
When the printer is finished let everything cool down for about 1 minute, the piece should pop of the HEATED BED when it had cooled. Once the file is printed it should look like this:

006 - ADVANCED SETTINGS

Now you have printed your first part using the supplied Slic3r configuration file, for most prints this configuration file will do fine but sometimes you will want to manually adjust some Slic3r settings and make your own profiles. In this chapter each setting will be explained in detail so you know how to have total control of the printing process.

First you will have to open up the Slic3r configuration window, you can find instructions on how to do that in the chapter CONFIGURING SLIC3R.

Then go to the “Print Settings” tab and choose “Layers and perimeters”. This tab defines all the parameters about perimeters and the layer height. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Layer Height: This is the general layer height expressed in millimeters. This is the main setting for print resolution. 0.5mm = rough, 0.2mm = fine.

First layer Height: The first layer is usually printed a bit thicker to accommodate for Z AXIS calibration fault and make the print stick to the bed better.

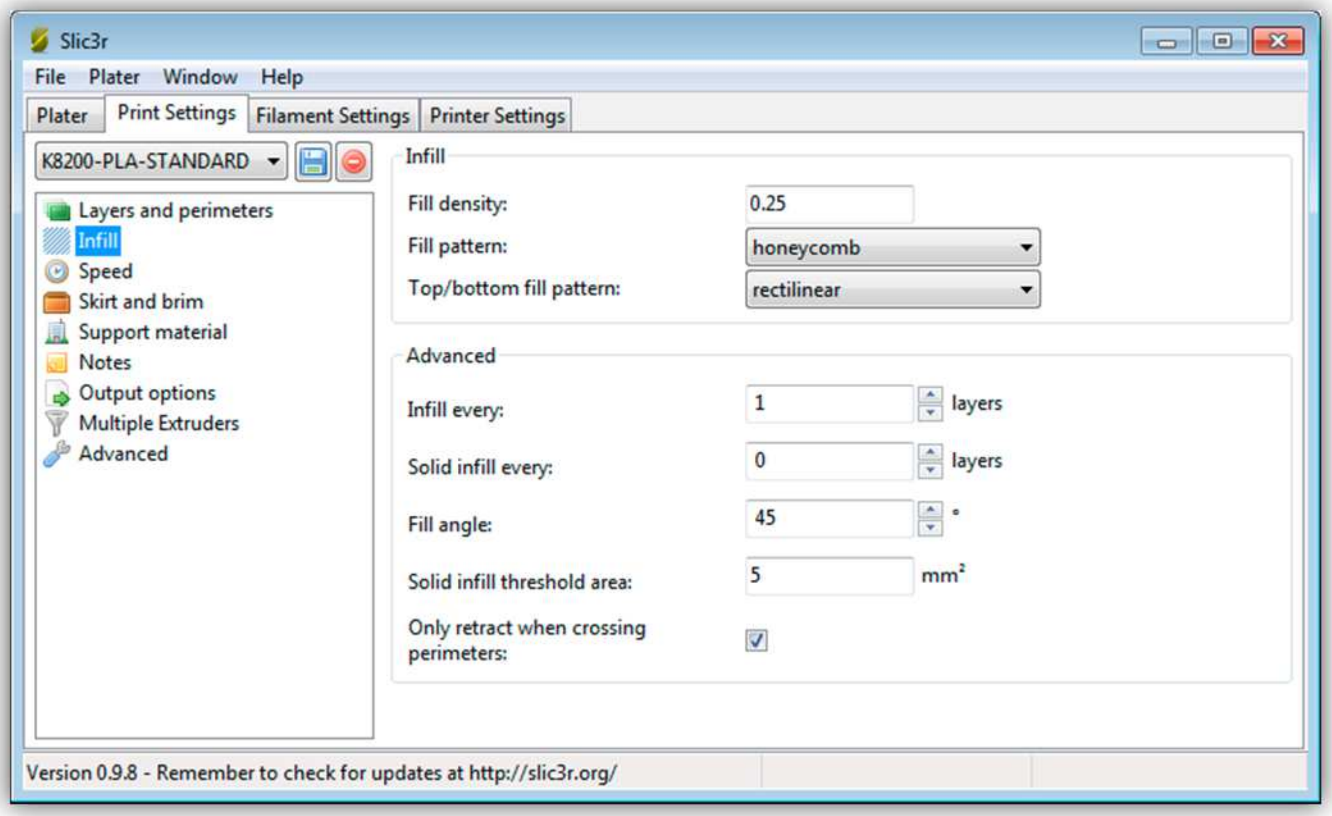
Perimeters (minimum): This number represents the number of loops the slicer will make to create an outer wall. The minimum is one but to be safe and have stronger walls 3 is a good option. If you have thin walls Slic3r will automatically decrease this number.

Randomize starting points: To prevent “starting blobs” (points where the printer starts a new layer) forming a vertical row you can enable this option. It scatters the starting points of every layer over the object.

Generate extra perimeters when needed: When an overhang in the object is detected sometimes it is necessary to create more perimeters to create a more solid and faultless print. When this option is enabled Slic3r will do this.

Solid layers: A solid layer is a layer with 100% infill. You can choose the number of solid layers on the top and bottom of a print. For a vase choose 3 solid layers on the bottom and 3 on the top, also use 0 for infill.

Still in the “Print Settings” tab choose “Infill” this tab defines all the parameters about perimeters and the layer height. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Fill Density: This number represents the amount of infill. max = 1 (solid infill) min = 0 (no infill)

Fill Pattern: This is the pattern used as internal infill.

Top/bottom fill pattern: This is the pattern used as top and bottom infill

Infill every: Print infill every … layer.

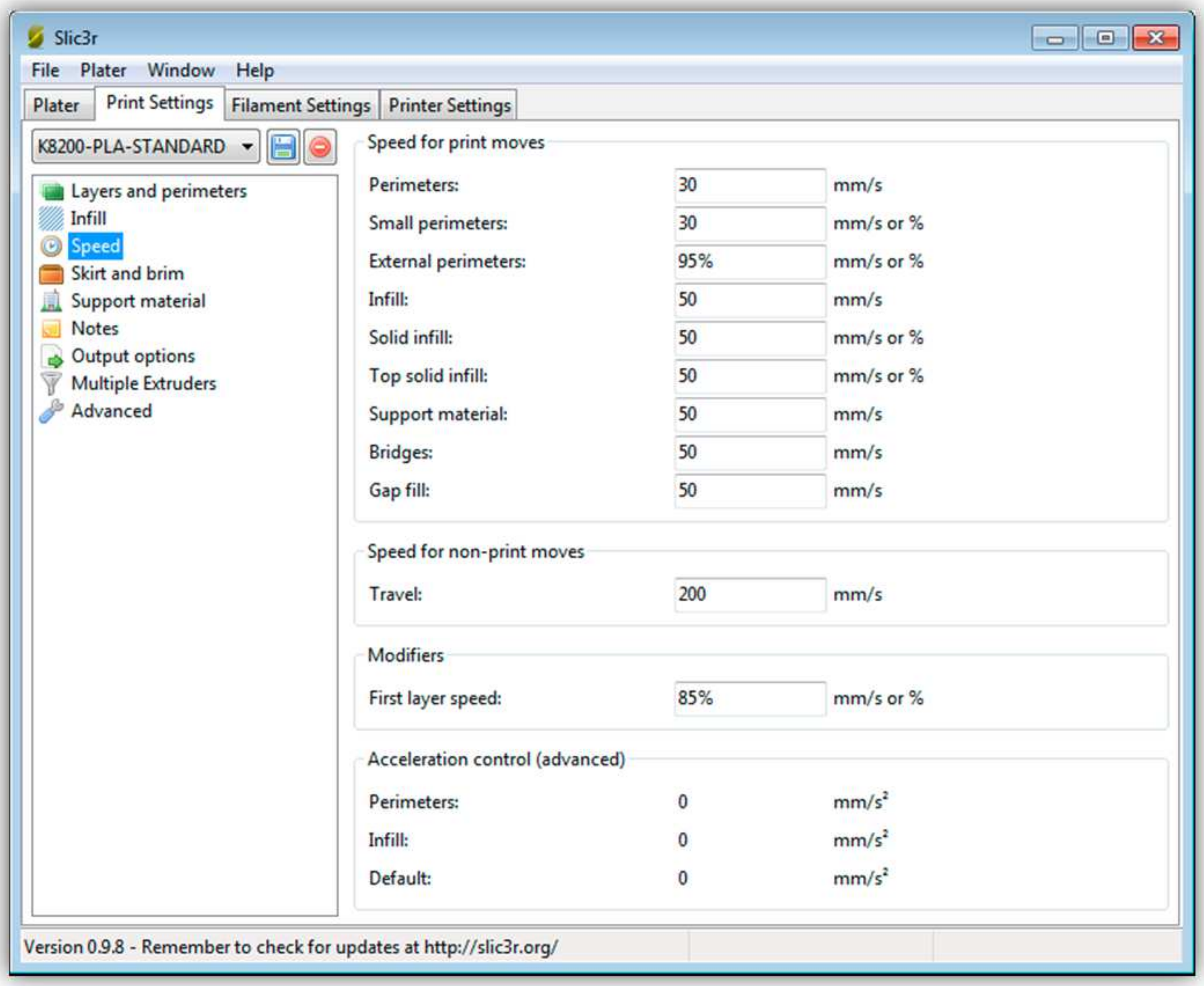
Solid infill every: Print solid infill every … layer.

Fill angle: The direction of the infill.

Solid infill threshold area: When during internal infill an area is encountered that is smaller than the amount specified, a solid infill will be used to ensure structural rigidity.

Only retract when crossing perimeters: To prevent blobs that are created when the nozzle is traveling (not printing but moving to a new print area) it can retract the filament. Retraction is not always good since it is hard to control so we want to minimize the use of retraction. Keep this option enabled.

Still in the “Print Settings” tab choose “Speed” this tab defines all the parameters about Speed. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Perimeters: The speed of the nozzle when printing perimeters.

Small perimeters: The speed of the nozzle when printing small perimeters.

External perimeters: The speed of the nozzle when printing the outer perimeters. (Slower is better.)

Infill: The speed of the nozzle when printing the internal infill.

Solid infill: The speed of the nozzle when printing the solid infill.

Top solid infill: The speed of the nozzle when printing the solid infill on the top layer. (Slower is better.)

Support material: The speed of the nozzle when printing the support material.

Bridges: The speed of the nozzle when printing the bridges.

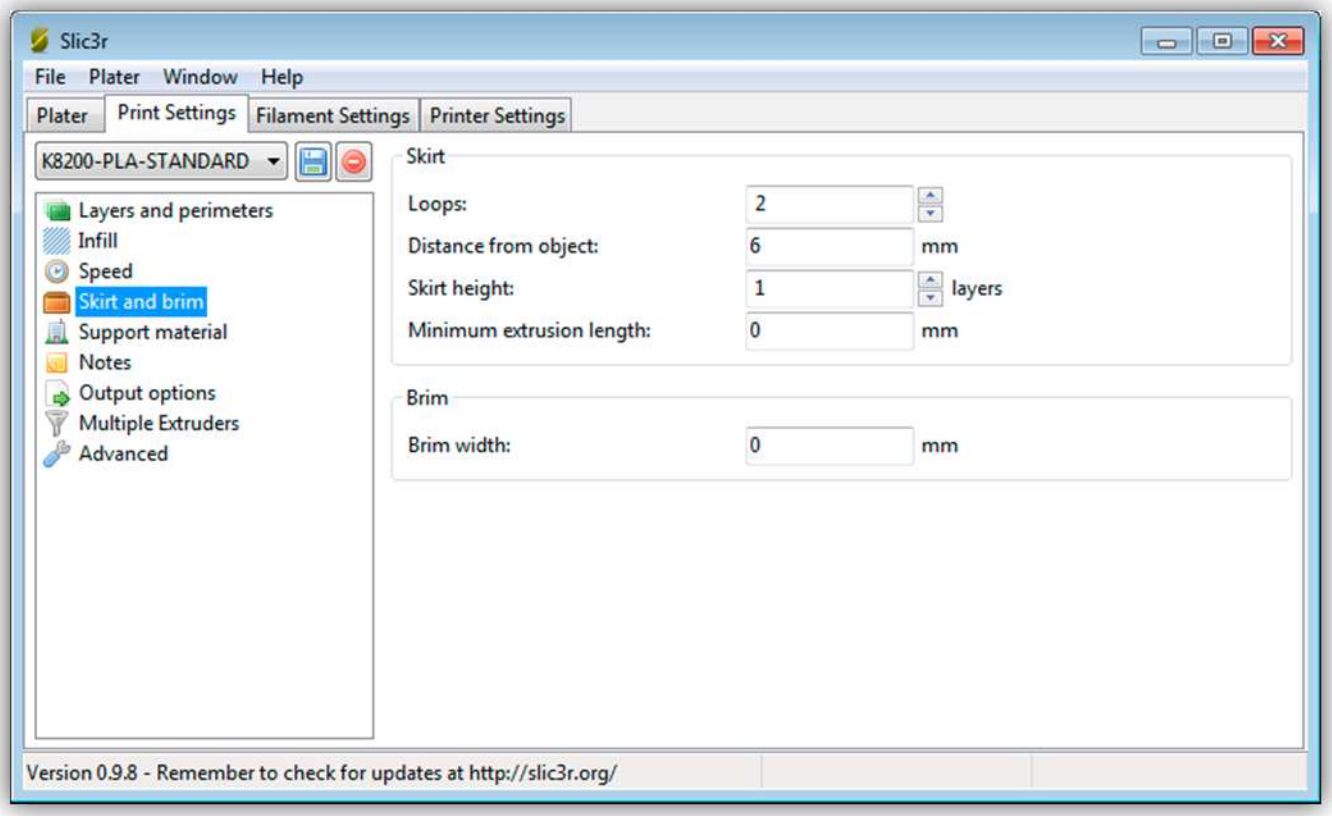
Gap fill: The speed of the nozzle when filling gaps.

Travel: The speed of the nozzle for non-printing moves. (Faster is better.)

First layer speed: The speed of the nozzle when printing the first layer. (Slower is better.)

Acceleration control: DO NOT CHANGE THESE SETTINGS!

Still in the “Print Settings” tab choose “Skirt and brim” this tab defines all the parameters about the skirt and brim. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Skirt: A skirt is the first few loops around an object, usually used for priming a nozzle.

Loops: How many times the nozzle loops around an object.

Distance from object: How far the loops are from the object.

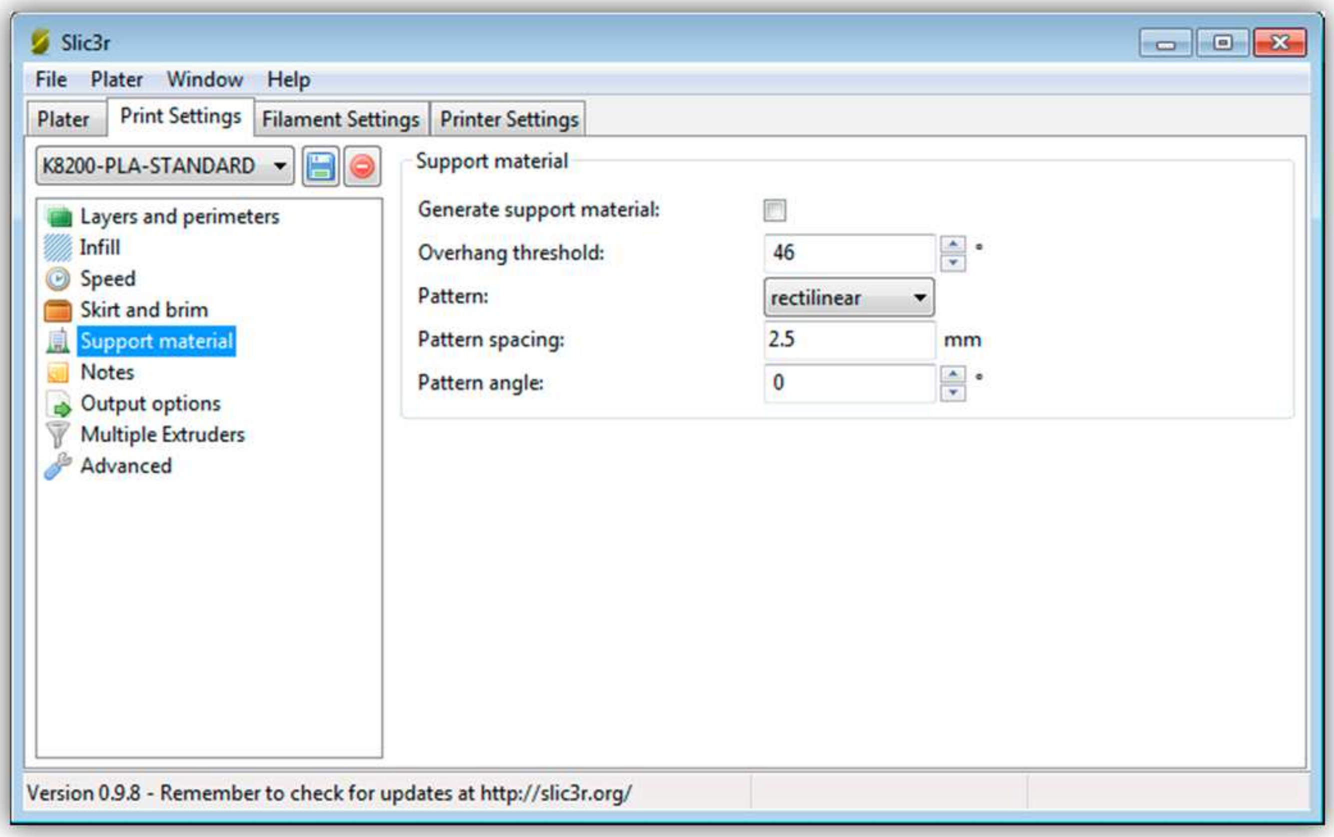
Skirt height: How many layers of the skirt will be built.

Minimum extrusion length: The skirt must use more than … mm before it will be printed.

Brim: A brim is a feature that widens the first layer to enhance the adherence of the printed object to the HEATED BED and to counteract warping. Enable this for prints with a small HEATED BED footprint.

Brim width: This number specifies how much the bottom layer gets widened.

Still in the “Print Settings” tab choose “Support material” this tab defines all the parameters about the Support material. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Support material: Support material is used to support overhangs in an object. These need to be cut away afterwards.

Generate support material: Enable this checkbox if you need support material (not needed in normal prints).

Overhang threshold: Angle of overhang which must be present before the slicer will calculate support material.

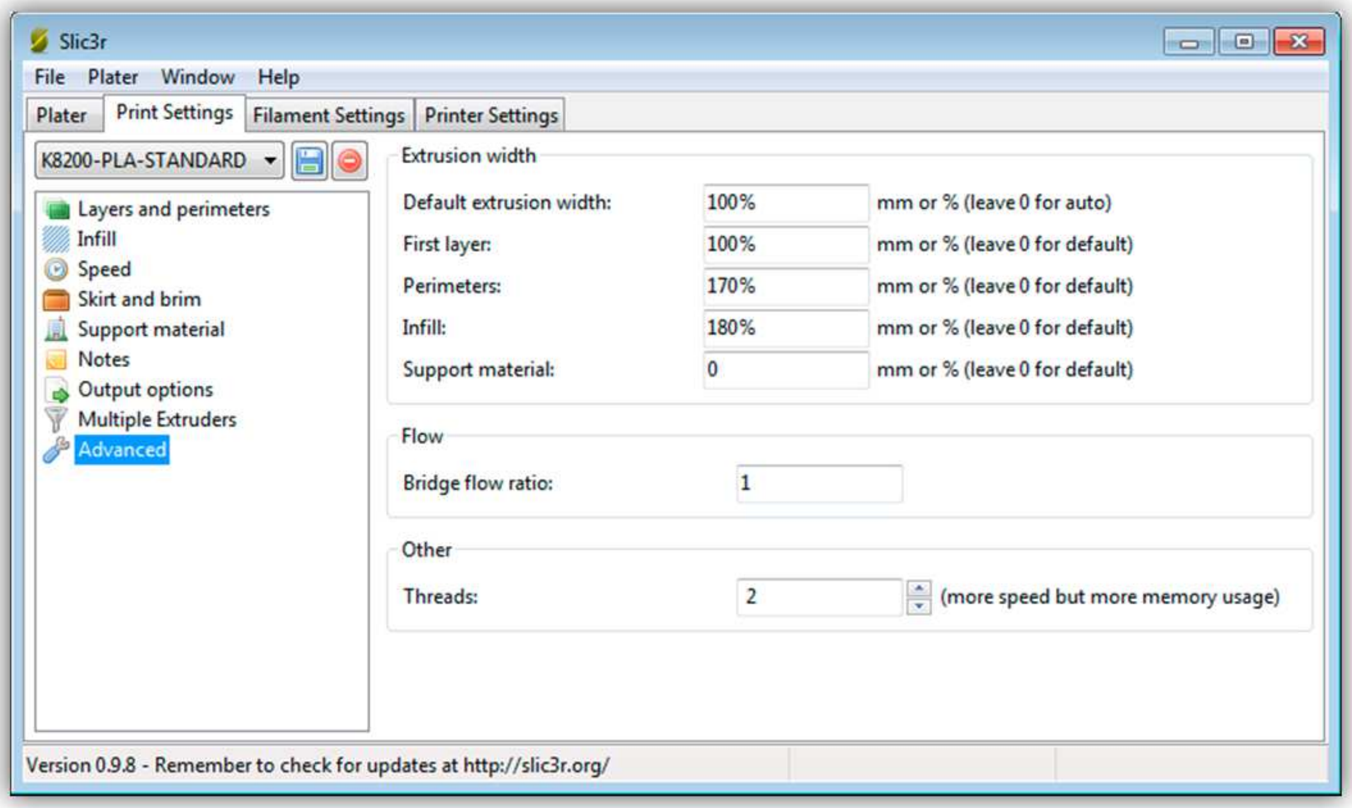
Pattern: The pattern that will be used as support material.

Patterns spacing: The spacing of the pattern.

Pattern angle: The angle of the pattern.

Notes, Output options and Multiple extruders are not used.

Still in the “Print Settings” tab the “Advanced” this tab defines all the advanced parameters. **Use caution when changing these parameters!** You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Extrusion width: The extruder can extrude a thinner or thicker string of plastic by varying the extrude force. The parameters below control this feature.

Default extrusion width: The standard extrusion width.

First layer: The extrusion width of the first layer.

Perimeters: The extrusion width of the perimeters.

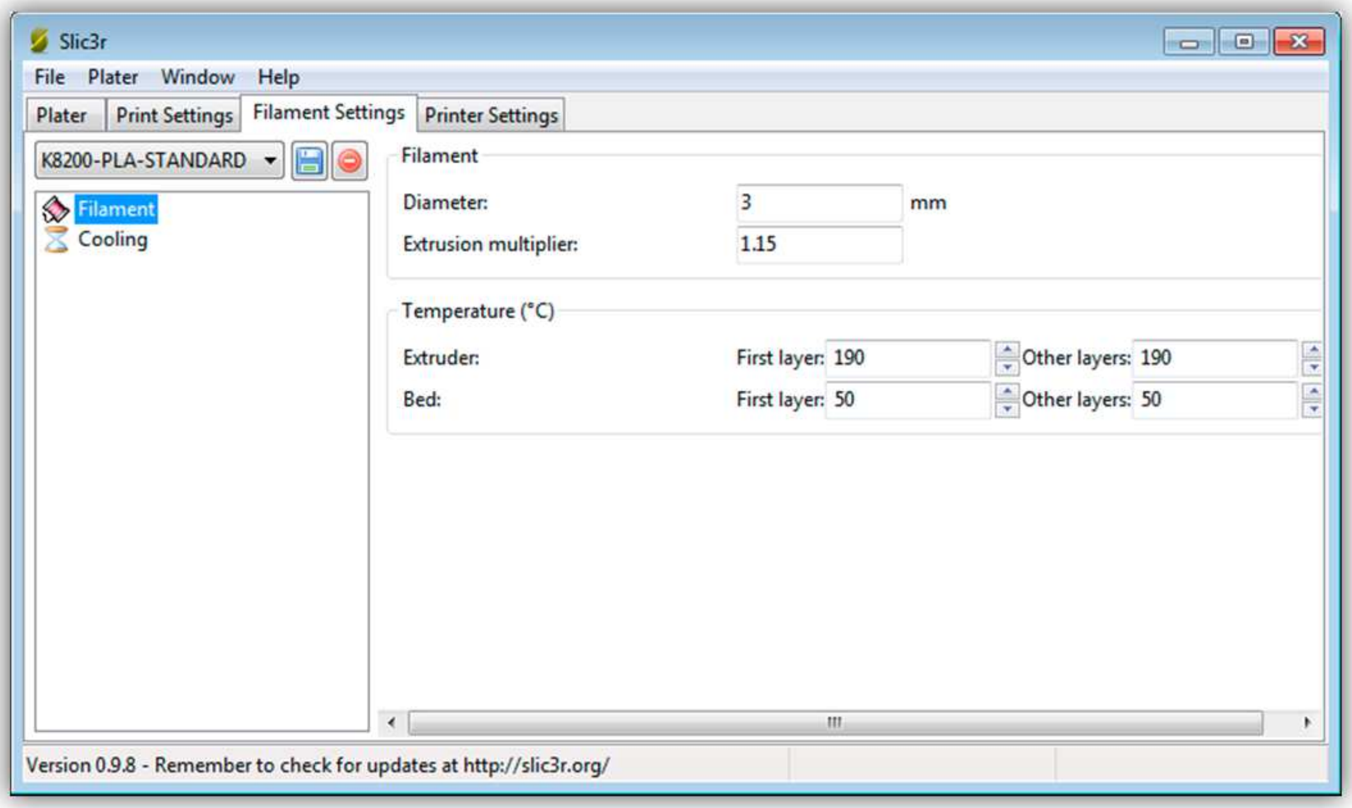
Infill: The extrusion width of the infill.

Support material: The extrusion width of the support material.

Bridge flow ratio: To make bridges (spans in the air between walls) the flow ratio can be individually set.

Threads: You can change the amount threads Slic3r uses to calculate tool paths. This depends on how many cores your processor has and the amount of RAM that is available in your computer.

Now in the "Filament Settings" tab choose "Filament" this tab defines all the parameters about the Filament. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



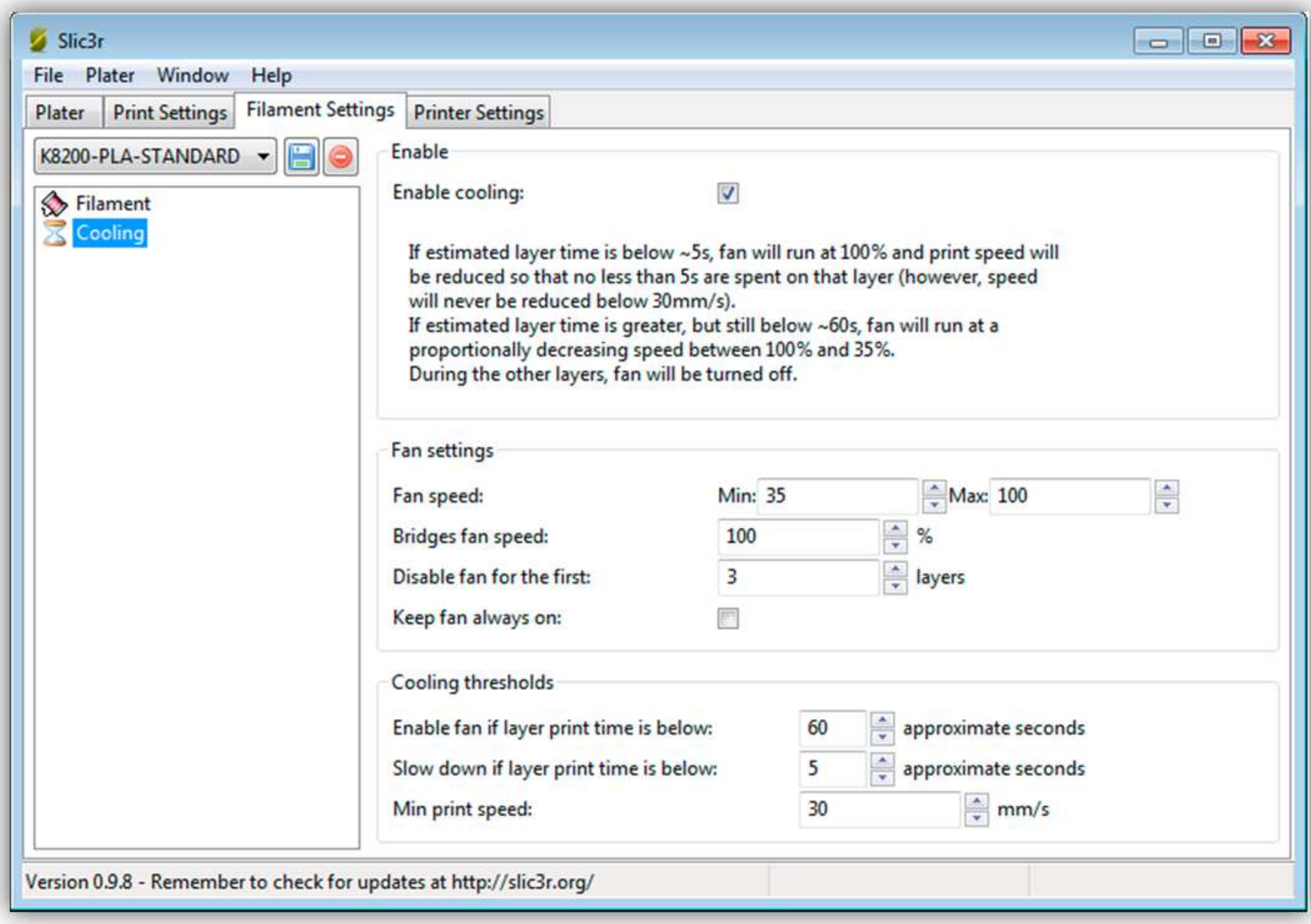
Diameter: This is the diameter of the filament that you are using. This should always be 3mm.

Extrusion multiplier: Here you can enter a multiplier number if you see that your printer is printing lean or too fat. Only use small increments or decrements!

Extruder temperature: Here you can enter the extruder temperature, the first layer can be entered separately. Be sure to read the part about **Custom G-code** below when you are changing the temperature here!

Bed temperature: Here you can enter the bed temperature, the first layer can be entered separately. Be sure to read the part about **Custom G-code** below when you are changing the temperature here!

Still in the “Filament Settings” tab choose “Cooling” this tab defines all the parameters about cooling. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Enable cooling: Enable this checkbox if you want the fan to be controlled by the G-code

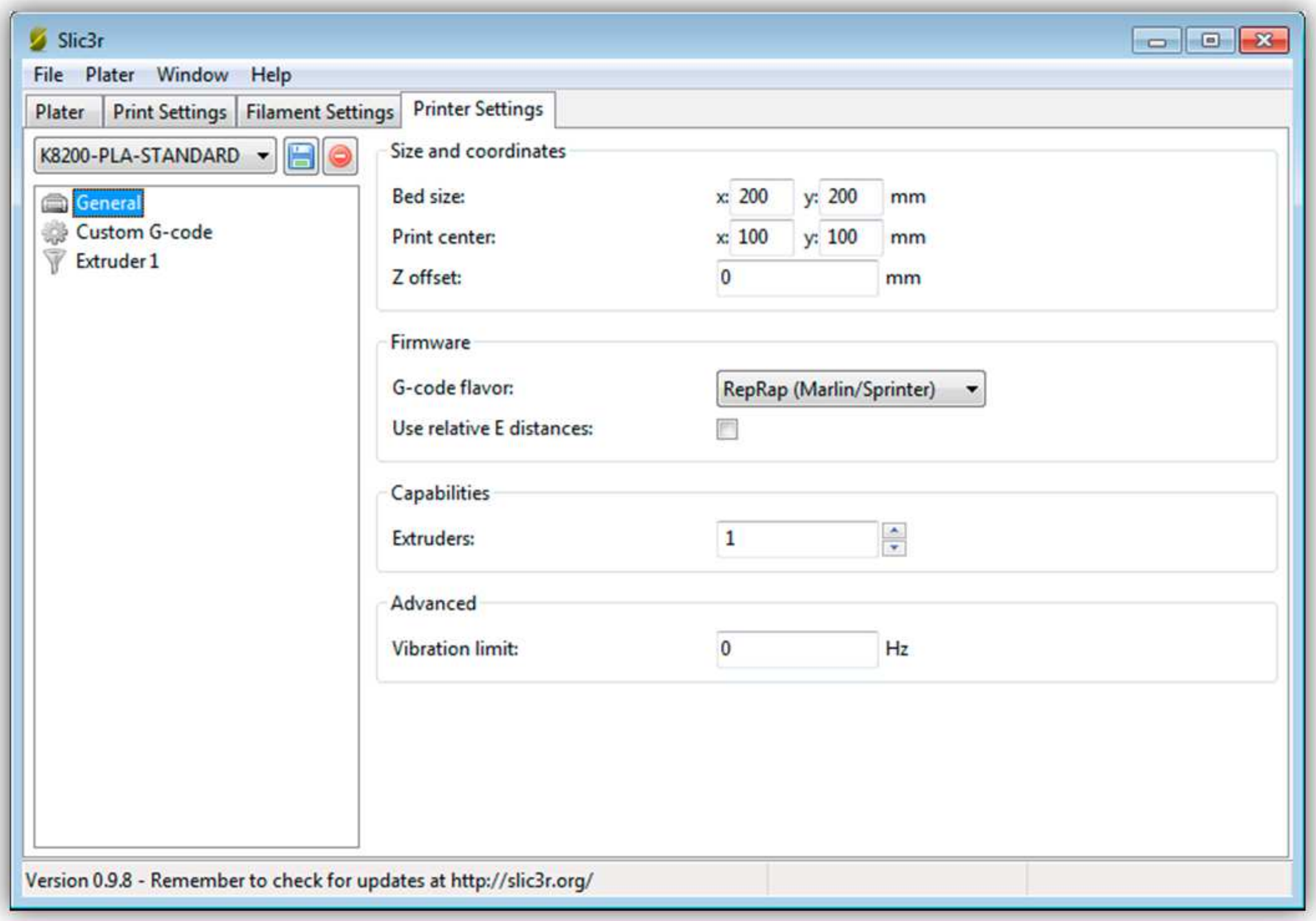
Fan speed: These are the min and max values (%) for the fan speed.

Bridges fan speed: Speed of the fan when making bridges.

Disable fan for the first … layers: Disables the fan for the first … layers.

Keep fan always on: If you enable this checkbox the fan will ben continuously on.

Now in the "Printer Settings" tab choose "General" this tab defines all the parameters about the general. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Bed size: The size of the HEATED BED.

Print center: The center of the HEATED BED

Z offset: You can give the Z AXIS an offset, use with caution!

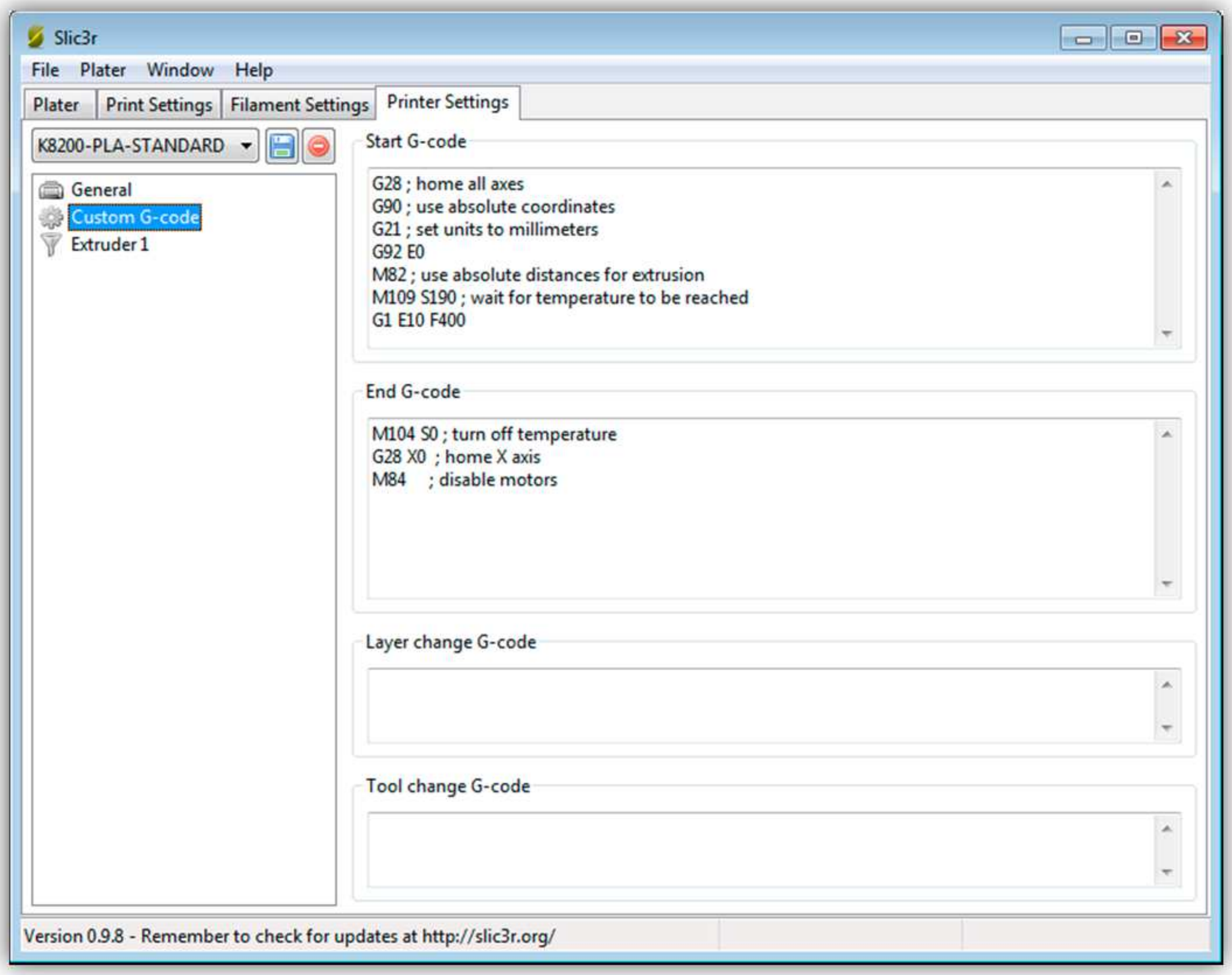
G-code flavor: Do not change this setting!

Use relative E distances: Do not change this setting!

Extruders: How many extruders the printer has. **Do not change this setting!**

Vibration limit: When infilling tight spaces the machine can vibrate violently. You can set a vibration limit here in Hz.

Still in the "Printer Settings" tab choose "Custom G-code". You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Start G-Code: Here you can put G-code that the printer will perform on the start of a print.

G28 ; home all axes
G90 ; use absolute coordinates
G21 ; set units to millimeters
G92 E0
M82 ; use absolute distances for extrusion
M109 S190 ; wait for temperature to be reached ***CHANGE THE S190 VALUE IF YOU CHANGED THE EXTRUDER TEMPERATURE!!!***
G1 E10 F400 ; prime the nozzle

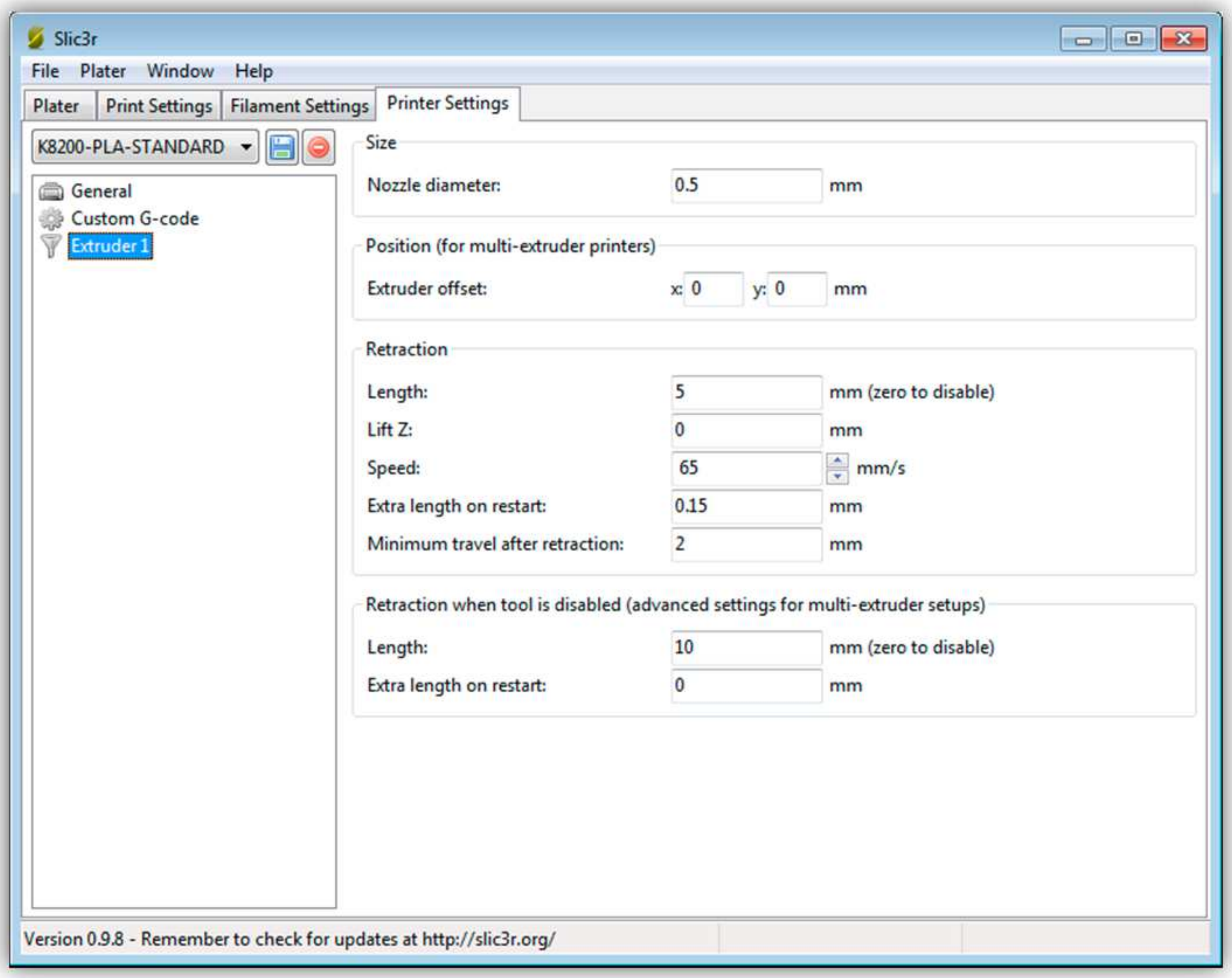
End G-code: Here you can put G-code that the printer will perform on the end of a print.

M104 S0 ; turn off temperature
G28 X0 ; home X axis
M84 ; disable motors

Layer change G-code: Here you can put G-code that the printer will perform on a layer change.

Tool change G-code: Not used.

Still in the “Printer Settings” tab choose “Extruder 1”. You should see something like this (NOTE: the values you see in these screenshot are not necessarily correct, these are just for illustrative purposes.):



Nozzle diameter: The diameter of the nozzle hole.

Extruder offset: Not used.

Retraction: When the extruder travels (non-print move) it will retract a bit of plastic to prevent a blob forming on the nozzle so it won't potentially damage or soil the printed object with this blob.

Length: Specifies how much the extruder will retract plastic.

Lift Z: You can move the nozzle up and down an amount when a travel occurs.

Speed: The speed of retraction.

Extra length on restart: After a retraction it can be necessary to push a little more plastic in the beginning.

Minimum travel after retraction: Only retract if the travels are longer than … mm.

007 - UPDATING FIRMWARE

The firmware that runs on the controller board of the printer is open source. This means everybody who wants can download, change, compile and upload changed code to the printer.

(Velleman will only give support to the stock firmware and to updates of the firmware that Velleman issues. You will NOT void your warranty if you change your firmware. You can always revert back to the stock firmware following the instructions below.)

To view, change, compile and upload the firmware to the controller board you will need the Arduino software.

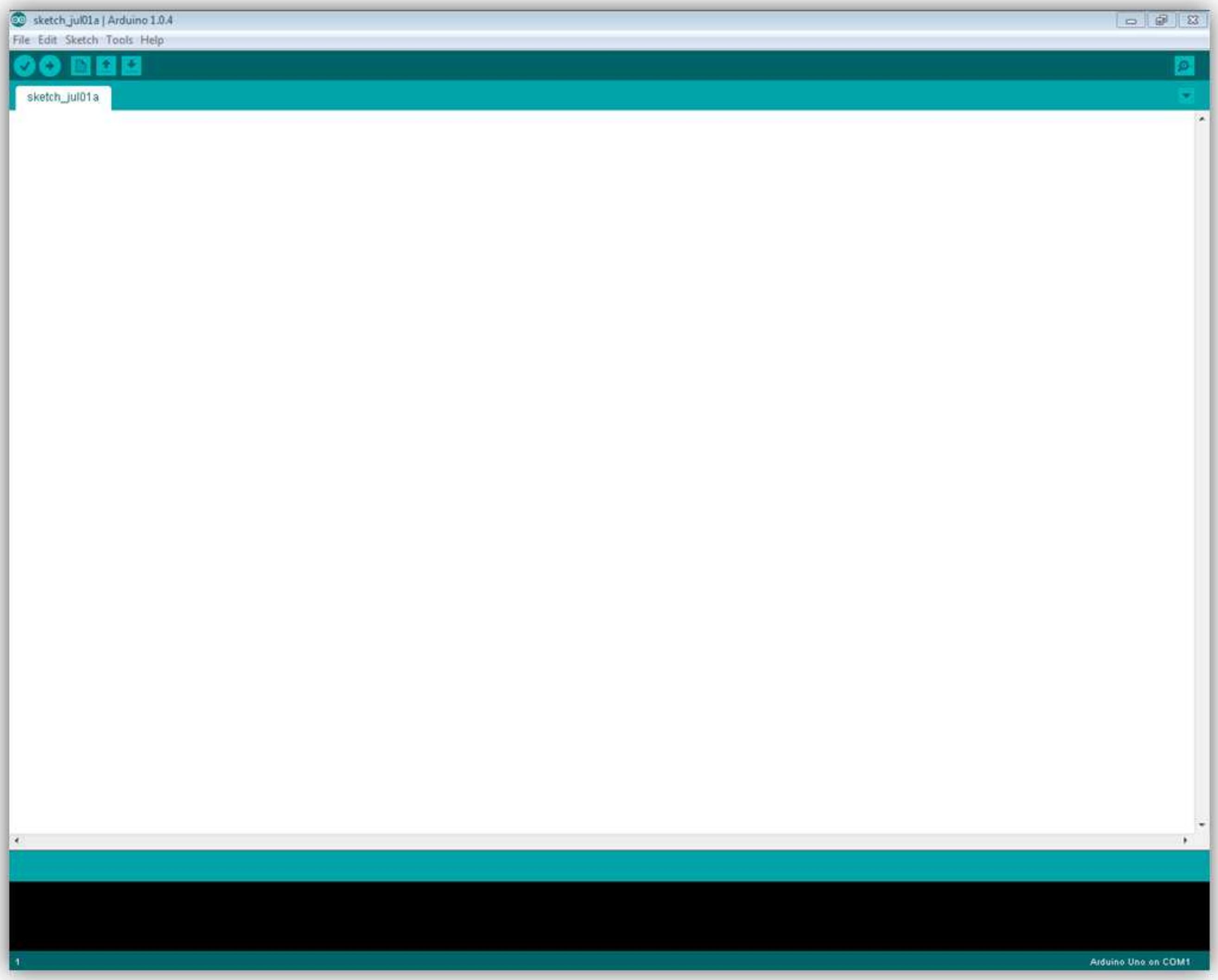
You can find the download link and install instructions on this page:

http://arduino.cc/en/Main/Software

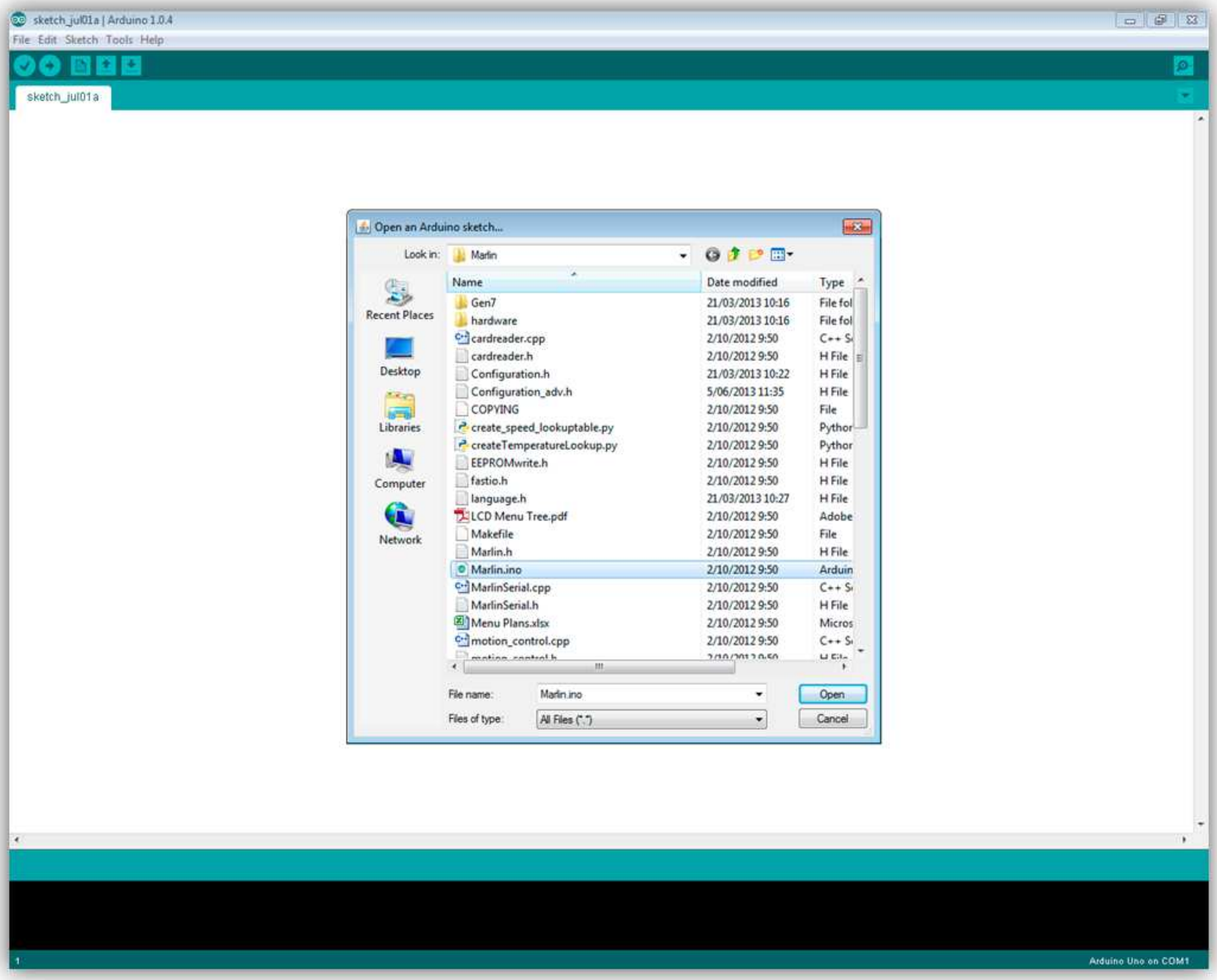
You will also need the source code of the firmware, you can download it in the download sections of this website.

When you start the Arduino software make sure the board is powered and connected to the computer **(driver must be installed)** and that the Repetier software is closed.

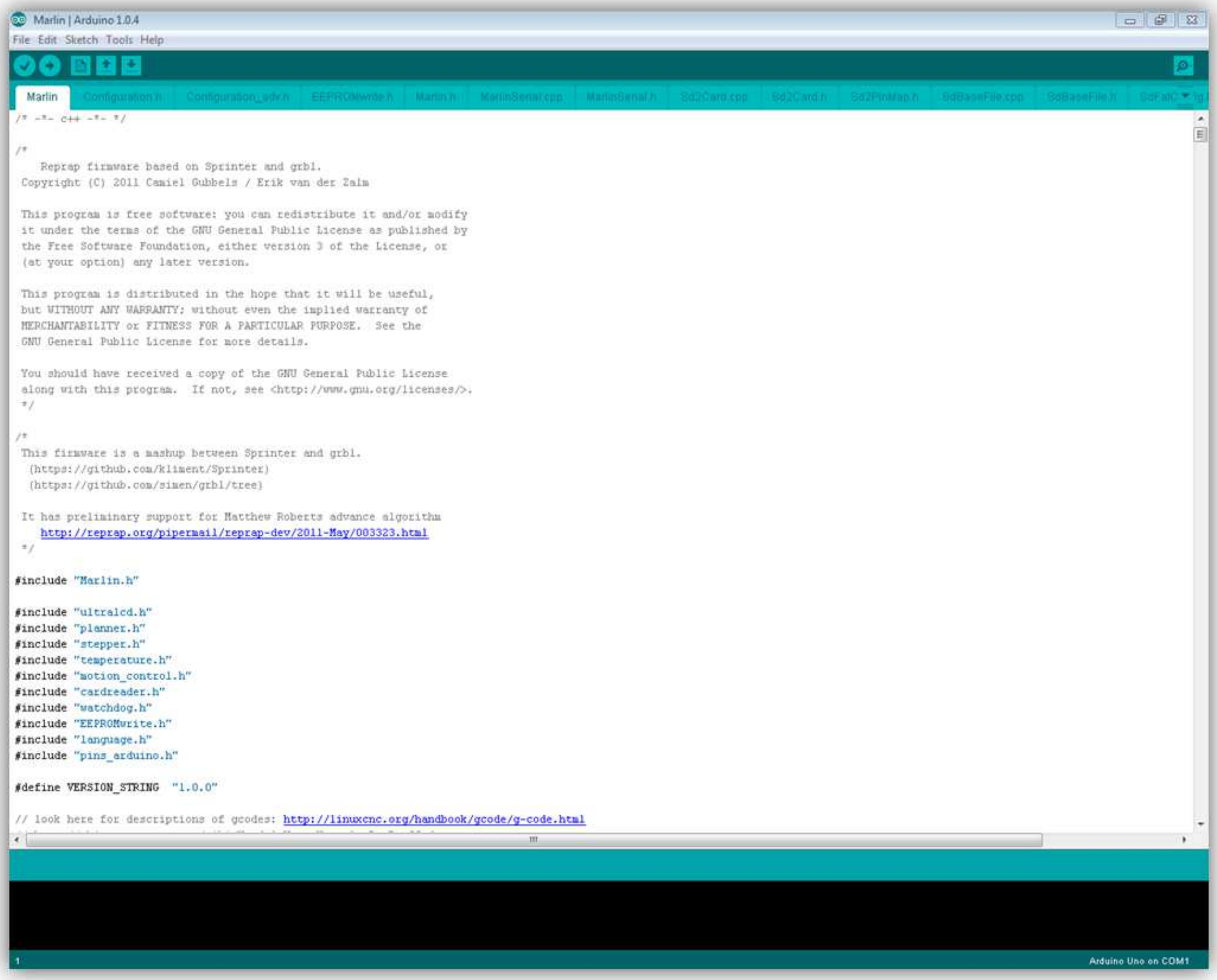
You should see something like this:



Click **File -> Open** and in the firmware folder you downloaded select the **"Marlin.ino"** file.

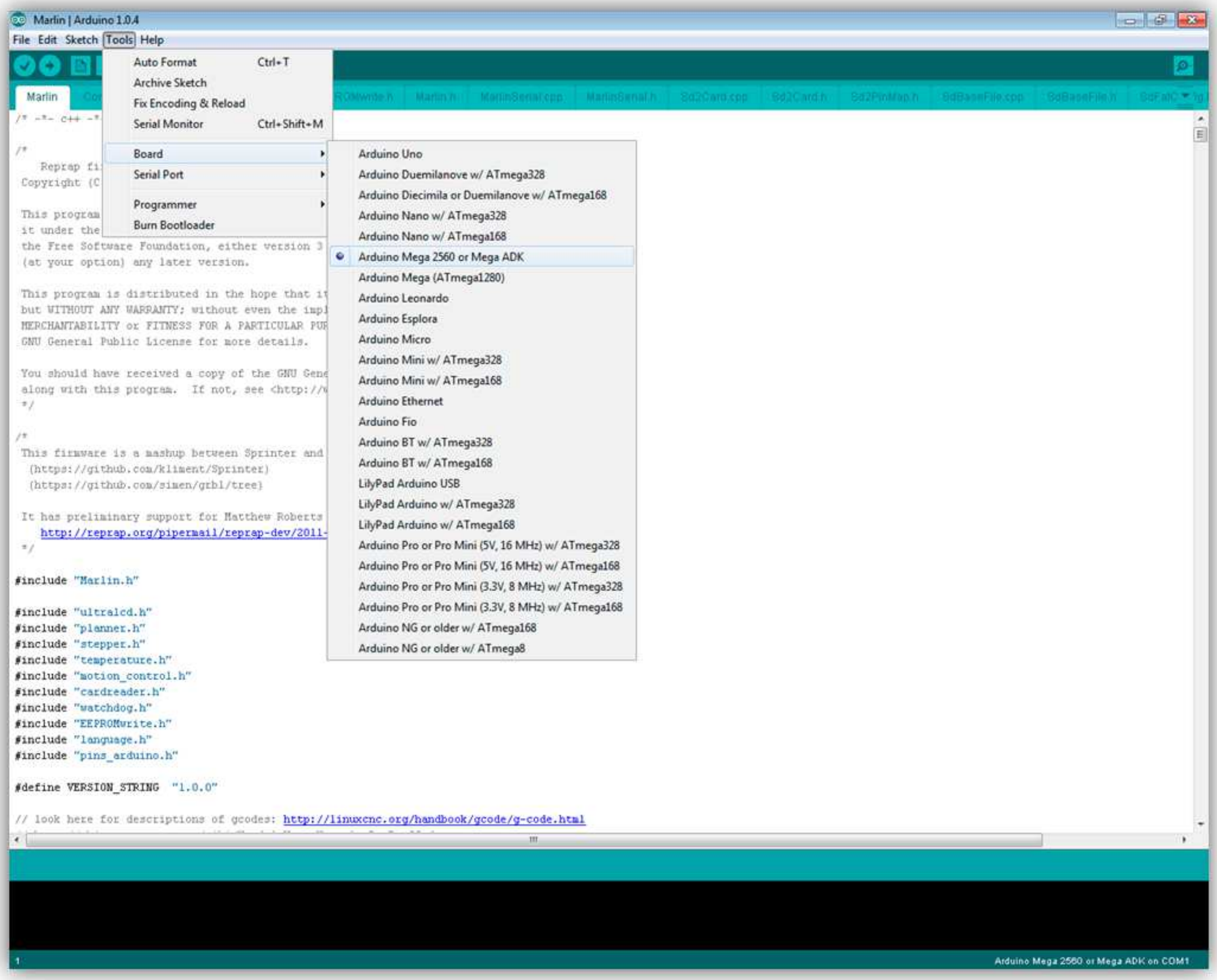


sketch_jul01a | Arduino 1.0.4
File Edit Sketch Tools Help
sketch_jul01a
Open an Arduino sketch...
Look in: Marlin
Recent Places
Desktop
Libraries
Computer
Network
Name
Date modified
Type
Gen7
hardware
cardreader.cpp
cardreader.h
Configuration.h
Configuration_adv.h
COPYING
create_speed_lookuptable.py
createTemperatureLookup.py
EEPROMwrite.h
fastio.h
language.h
LCD Menu Tree.pdf
Makefile
Marlin.h
Marlin.ino
MarlinSerial.cpp
MarlinSerial.h
Menu Plans.xlsx
motion_control.cpp
File name: Marlin.ino
Files of type: All Files (*.*)
Open
Cancel
Arduino Uno on COM1

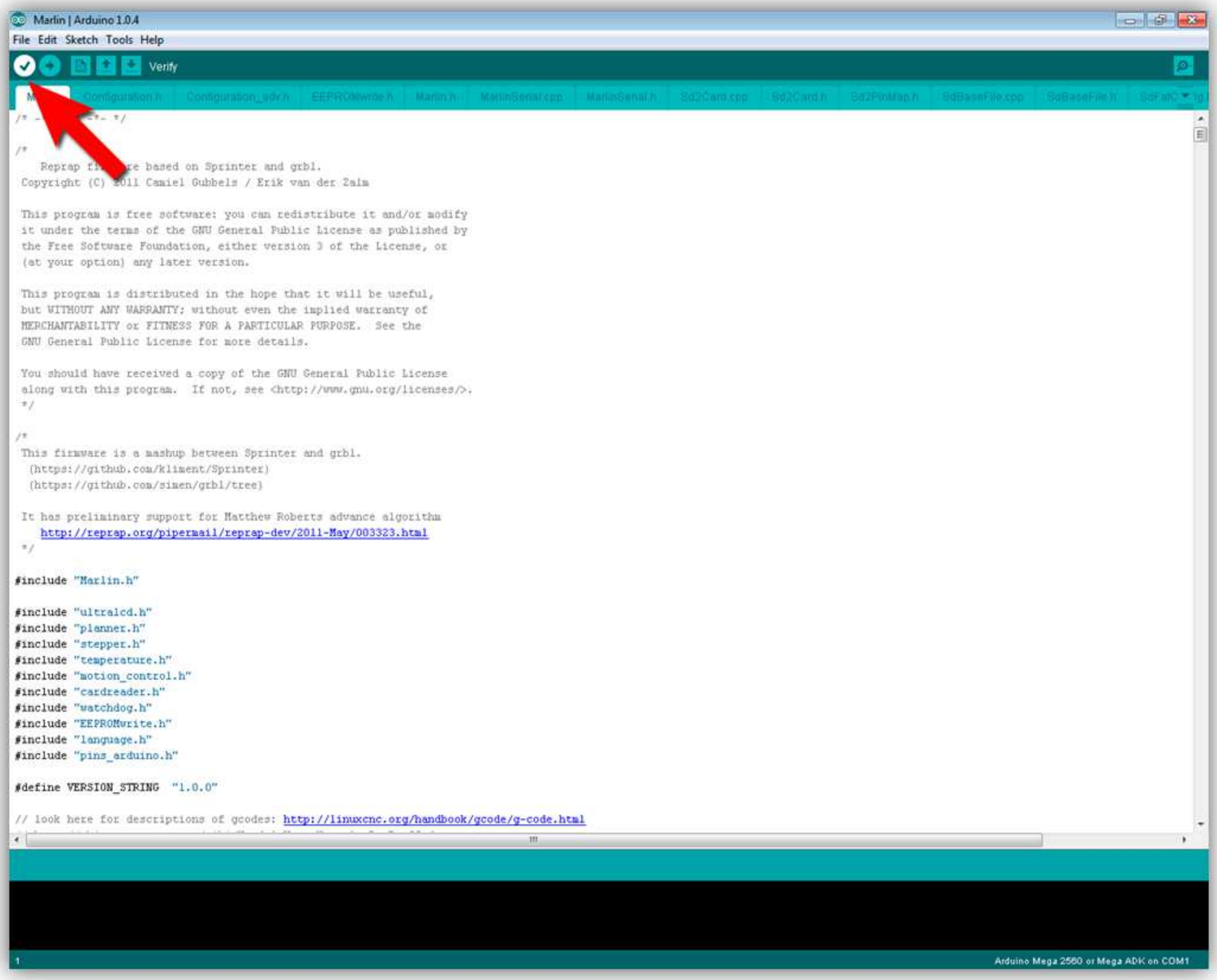


Before making any changes make sure that you selected the right board. This setting can be found under:

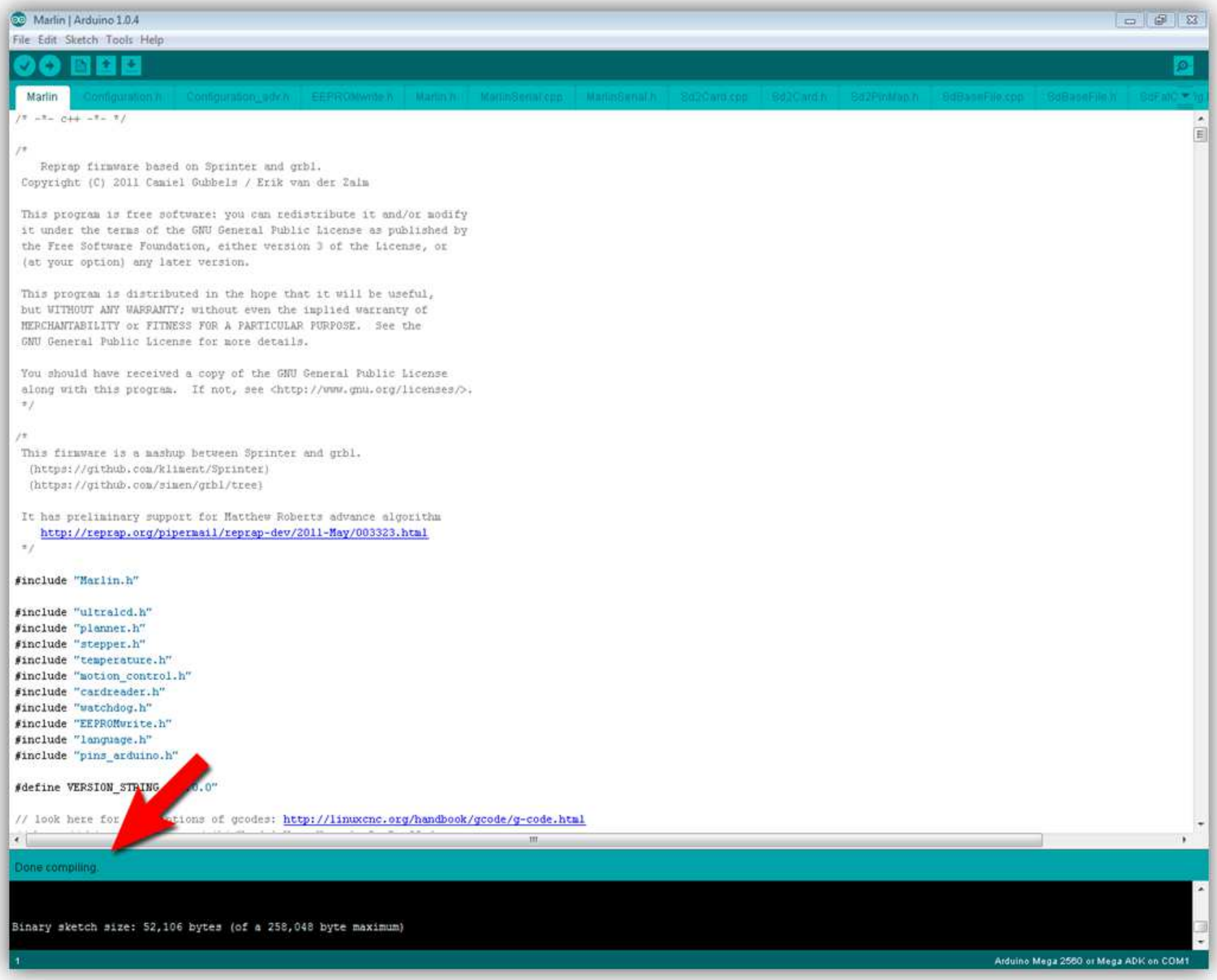
Tools - > Board -> Arduino Mega 2560 or Mega ADK



Now you can check if the source code compiles correctly, press the “Verify” button.

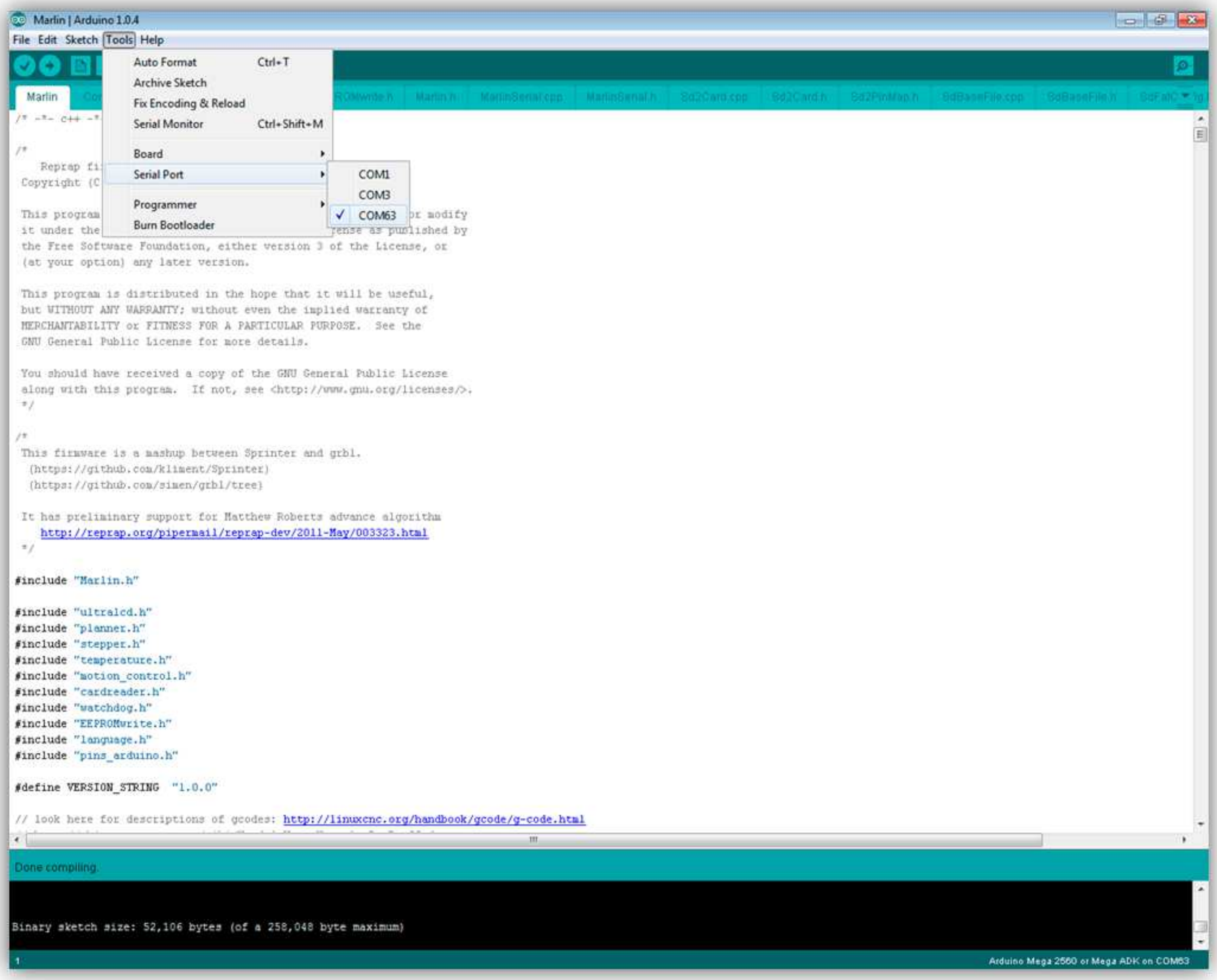


If everything went correct you should see a “Done compiling” message at the bottom of the window.

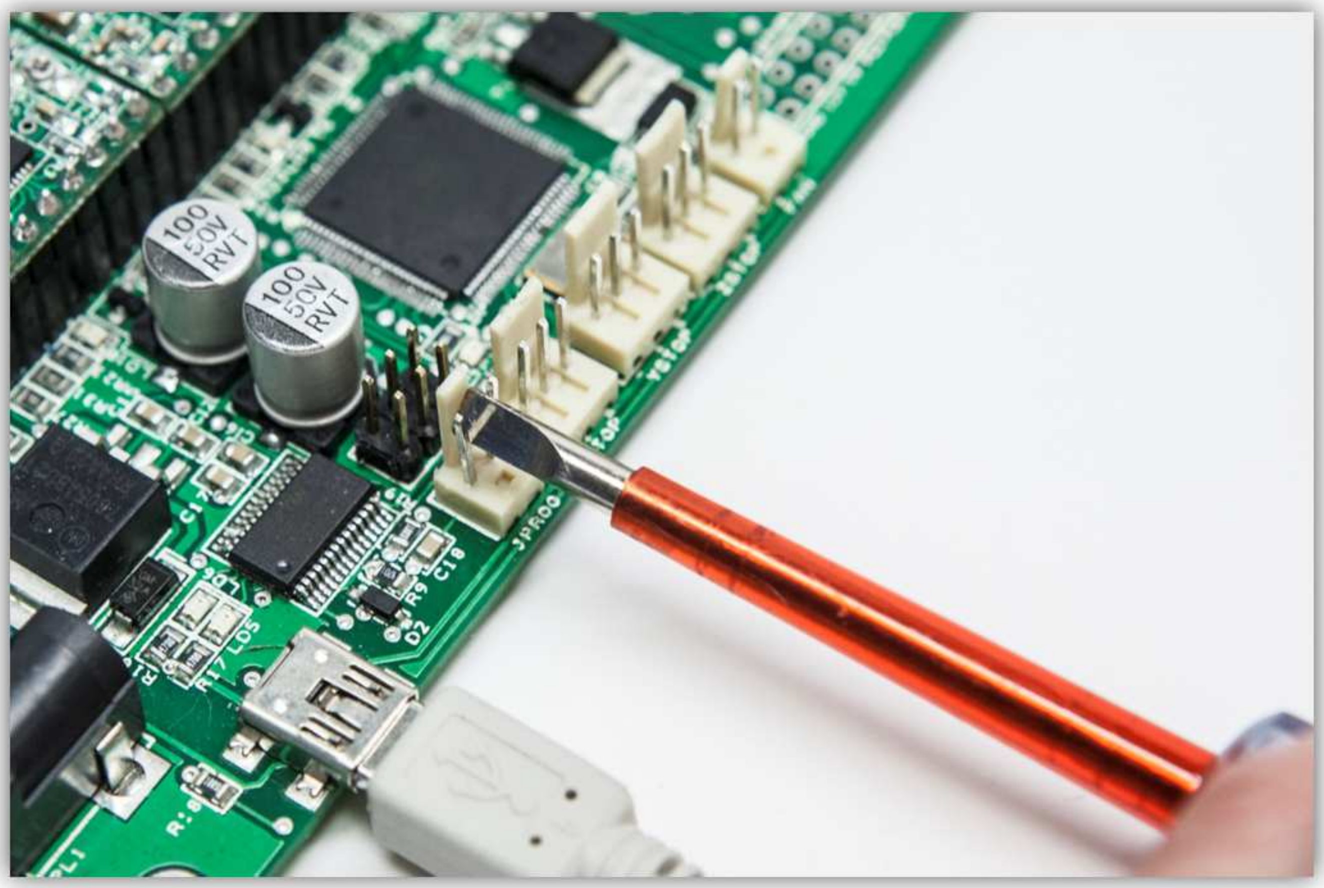


Now select the correct COM port your board is on. This setting can be found under:

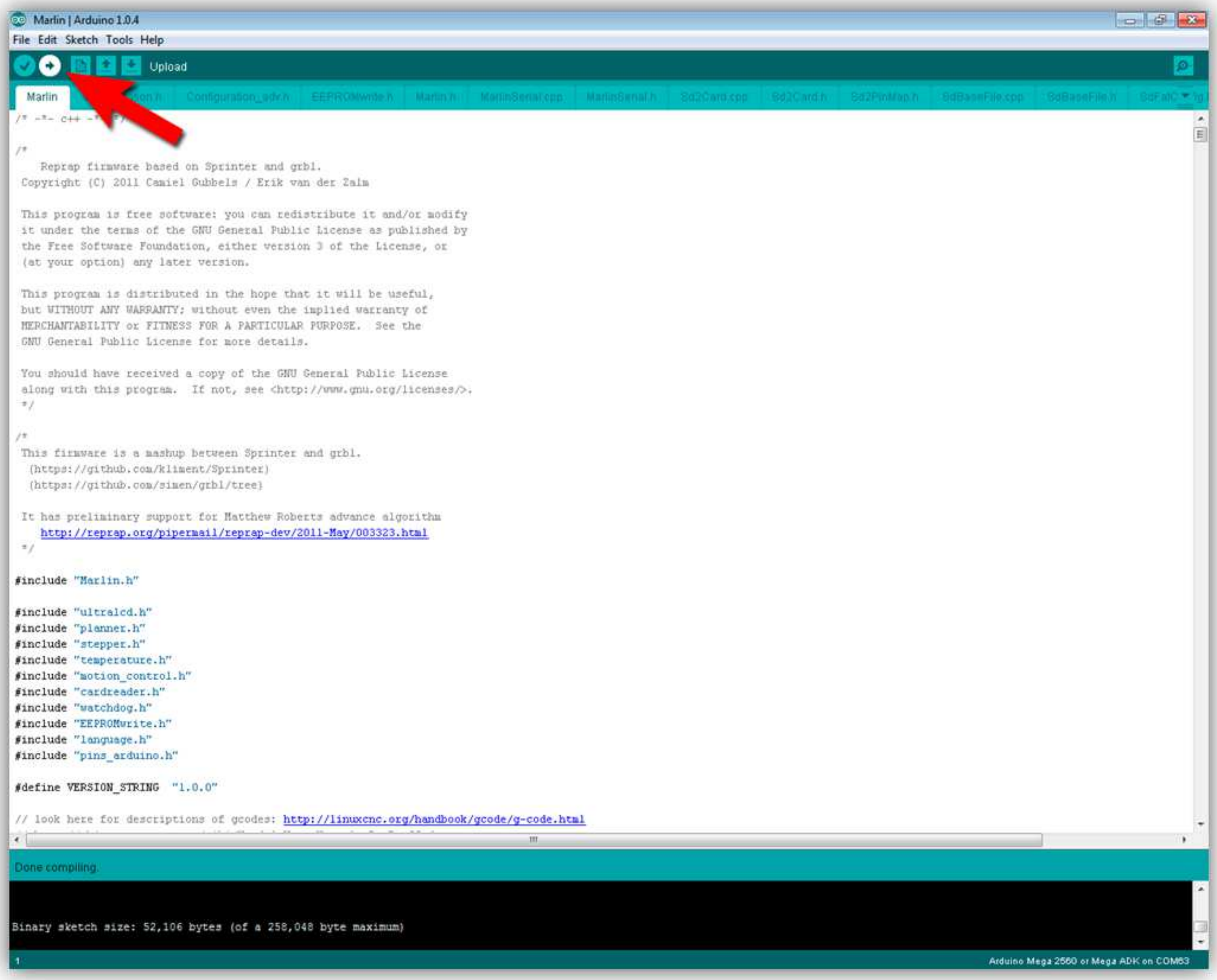
Tools -> Serial Port



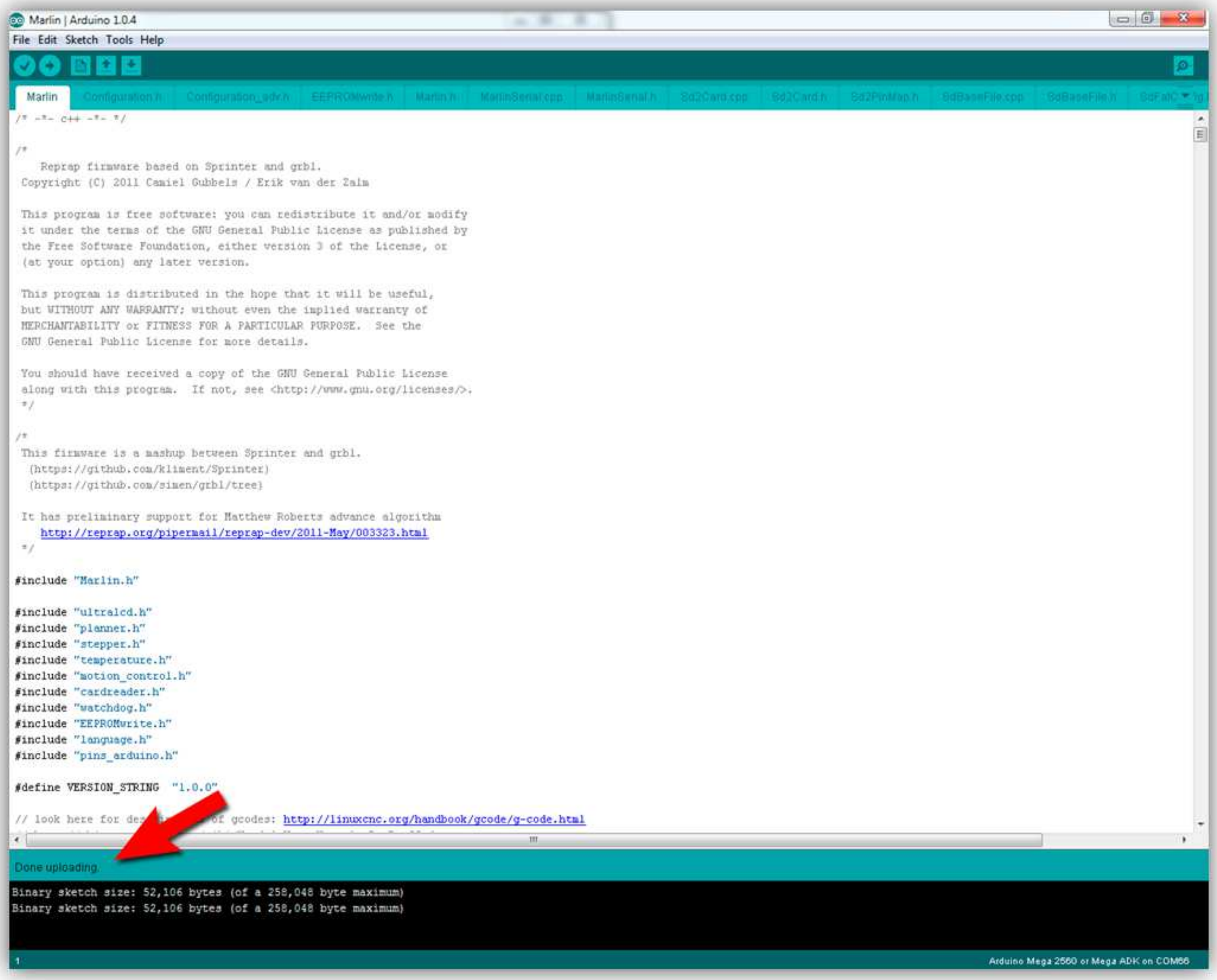
Before we can flash the board we need to short the pins on the JPROG connector. You can do this by putting a screwdriver between the pins. **Be sure to do this continually while the Arduino software is programming the board.**



Press the “Upload” button to program the board via USB.



You should see the LEDs flash for a while and when it’s all done the Arduino software should show “Done uploading”


Marlin | Arduino 1.0.4
File Edit Sketch Tools Help
Marlin
/* -*- c++ -*- */
/*
Reprap firmware based on Sprinter and grbl.
Copyright (C) 2011 Camiel Gubbels / Erik van der Zalm
This program is free software: you can redistribute it and/or modify
it under the terms of the GNU General Public License as published by
the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.
This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.
You should have received a copy of the GNU General Public License
along with this program. If not, see <http://www.gnu.org/licenses/>.
*/
/*
This firmware is a mashup between Sprinter and grbl.
(https://github.com/kliment/Sprinter)
(https://github.com/simen/grbl/tree)
It has preliminary support for Matthew Roberts advance algorithm
http://reprap.org/pipermail/reprap-dev/2011-May/003323.html
*/
#include "Marlin.h"
#include "ultralcd.h"
#include "planner.h"
#include "stepper.h"
#include "temperature.h"
#include "motion_control.h"
#include "cardreader.h"
#include "watchdog.h"
#include "EEPROMwrite.h"
#include "language.h"
#include "pins_arduino.h"
#define VERSION_STRING "1.0.0"
// look here for de of gcodes: http://linuxcnc.org/handbook/gcode/g-code.html
Done uploading.
Binary sketch size: 52,106 bytes (of a 258,048 byte maximum)
Binary sketch size: 52,106 bytes (of a 258,048 byte maximum)
1
Arduino Mega 2560 or Mega ADK on COM66