

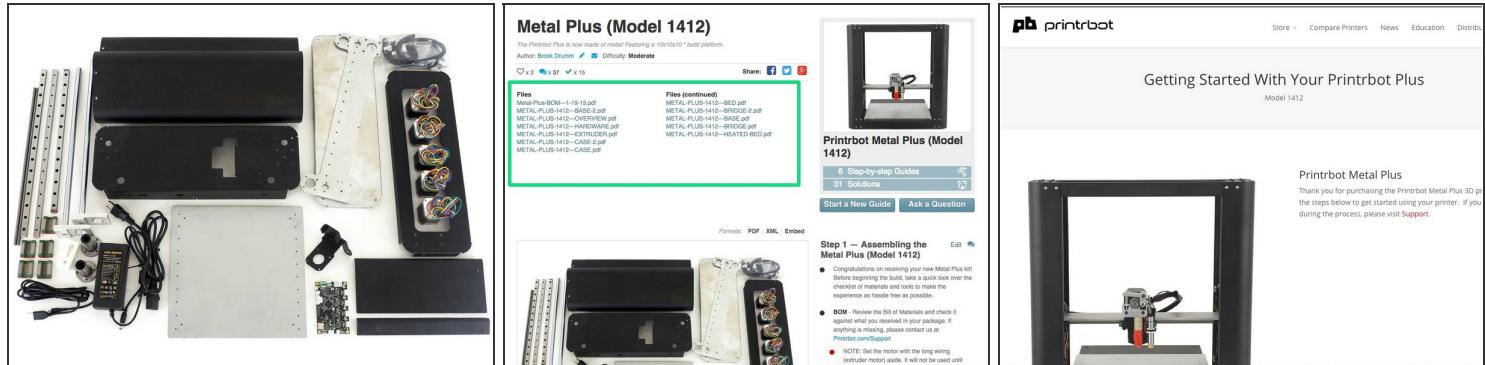


# Assembling the Printrbot Plus Kit (Model 1412)

The Printrbot Plus is now made of metal! Featuring a 10x10x10 " build platform.

Written By: Brook Drumm

## Step 1 — Assembling the Printrbot Plus Kit (Model 1412)



- Congratulations on receiving your new Metal Plus kit! Before beginning the build, take a quick look over the checklist of materials and tools to make the experience as hassle free as possible.
- **BOM** - Review the Bill of Materials and check it against what you received in your package. If anything is missing, please contact us at [Printrbot.com/Support](http://Printrbot.com/Support)
  - NOTE: Set the motor with the long wiring (extruder motor) aside. It will not be used until step 20.
- **Docs** - If you are having a hard time with any of the example photos in the steps, you may prefer the exploded view docs attached to the top of this guide.
- **More** - Find build videos, configuration files, and additional information at [Printrbot.com](http://Printrbot.com).

## Step 2 — Y axis linear rails, carts & bed



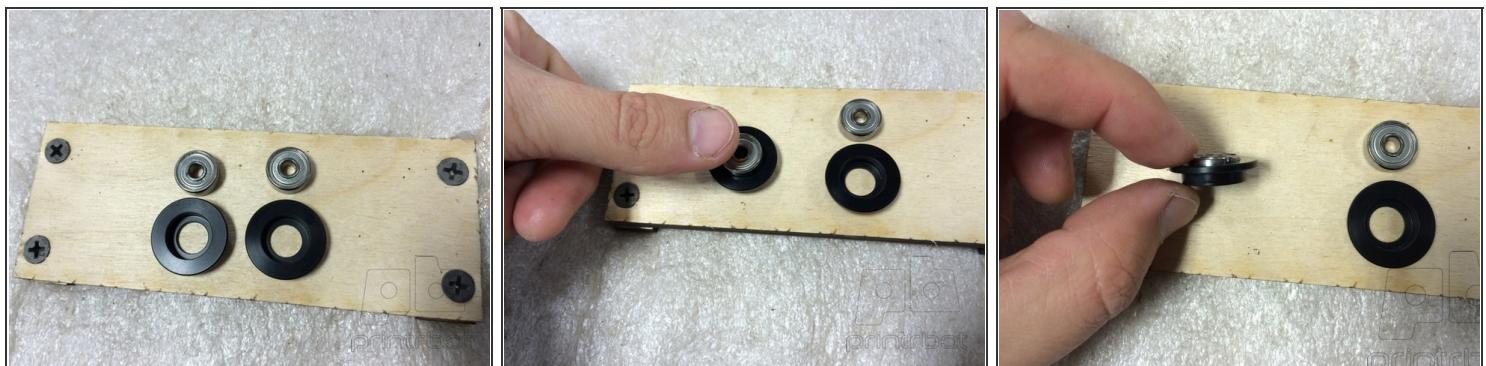
- Lets jump in and put together the build platform. This is the Y axis.
- Gently... SLOWLY slide two carriages on one bar and one carriage on the other.
- M3 8mm screws (26x)
- M3 screws (13 per side) attach the linear rails to the print bed and the two black end plates. Make sure pocket for heated bed wires are toward back.
- DO NOT OVER TIGHTEN... we want everything loose so it all goes together well. Once the Y axis is all mounted and moves really smoothly, come back and tighten these screws up.
- If bearings do pop out, they can easily be put back in by hand. Just be careful to do this in an area that you won't lose any escaped bearings. :)

### Step 3 — Y belt clip



- 20" GT2 Belt
- Make sure your belt teeth lock together when you zip tie the metal tensioner together.
- The nut inserts should face the long belt length, not away from the belt.
- M3 16mm (x2)
- The belt, with clip and screws, can be set aside for now.

### Step 4



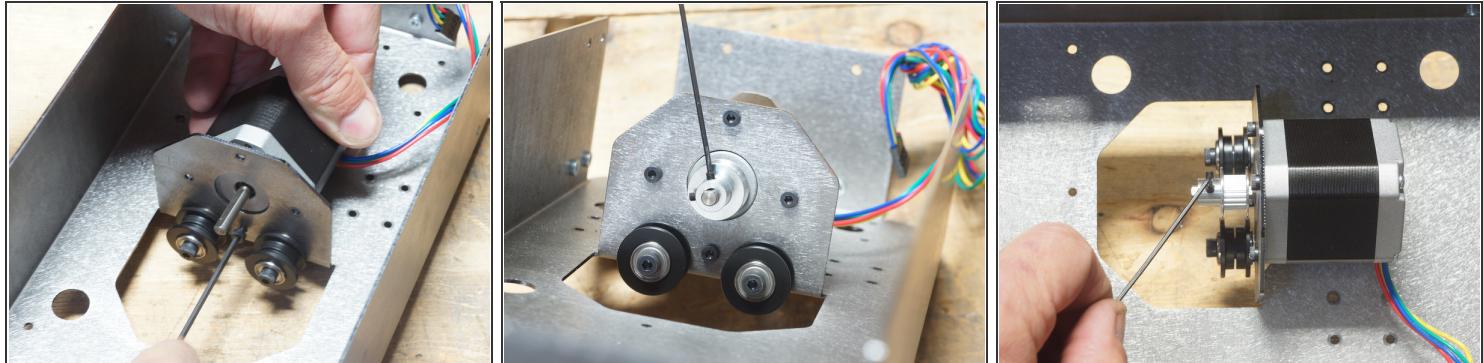
- Each Delrin pulley set has two 624 bearings and two Delrin pulley halves.
- Place 624 bearing into Delrin pulley half and press down.
- When fully seated, the 624 bearing will be 3/4 into the Delrin pulley.

## Step 5 — Y Axis Idler Belt Pulleys



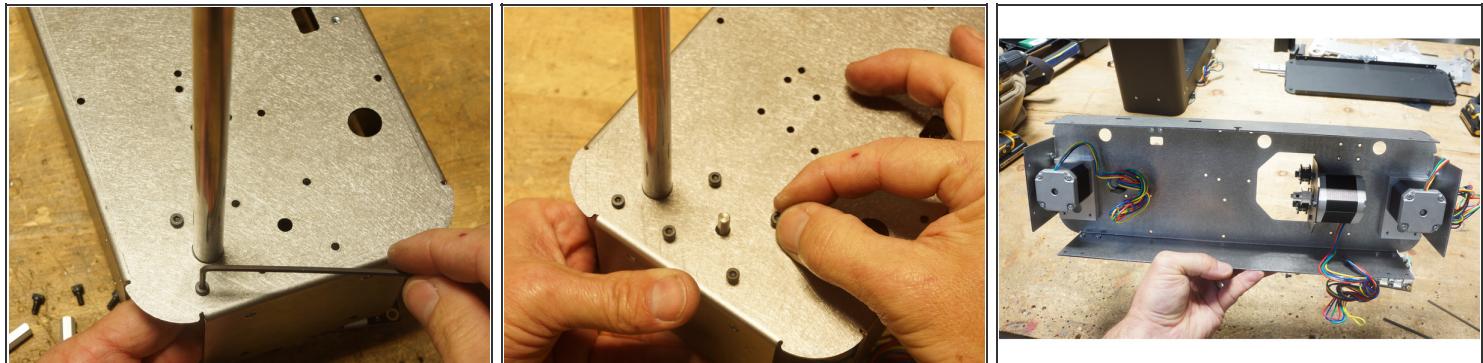
- M4 18mm (2x)
- 624 bearing pressed into pulley half (4x)
- 1/8" #8 Nylon Spacer (2x)
- M4 washer (2x)
- Don't over-tighten to the point of crushing the spacer.
- Pulleys should spin nicely once installed.

## Step 6 — Y axis motor & GT2 pulley



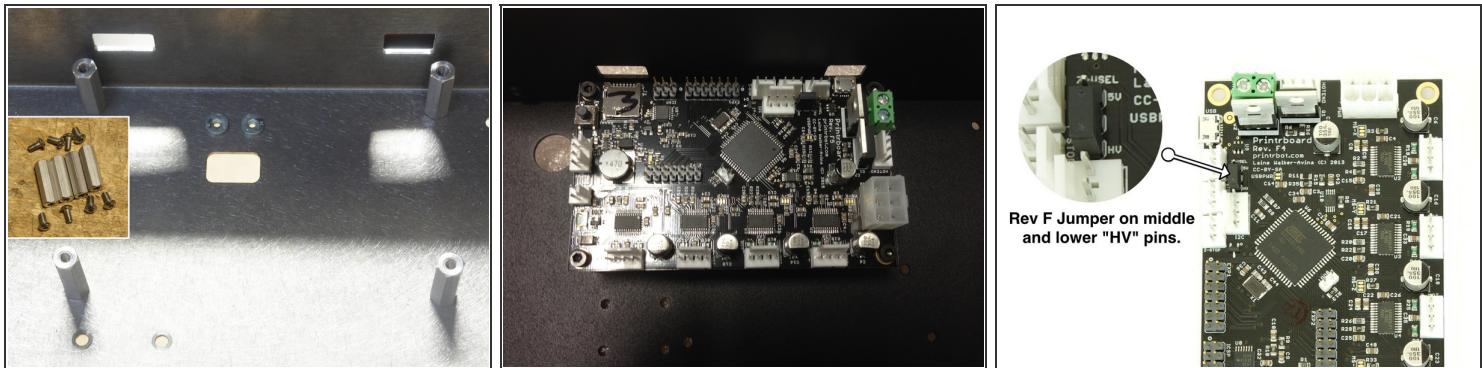
- Nema 17 Stepper motor
- M3 6mm screws (4x)
- Put GT2 toothed belt pulley on motor shaft with set screws facing out
- Align GT2 pulley with the other two belt pulleys
- Tighten one set screw into the flat of the motor shaft, then tighten other set screw. You will find M3 set screws for this kit in the universal bag and the hardware bag.

## Step 7 — Z bars, blocks and motors



- Z bars come pressed into Z blocks
- Slide bars up through bottom of "Base A" & secure first with two screws in front.
- M3 10mm (4x)
- Slide motor shaft through bottom of Z block, orienting wires to come out towards the back side. 4 screws will secure each motor.
- M3 16mm (8x)

## Step 8 — Printrboard Mounts



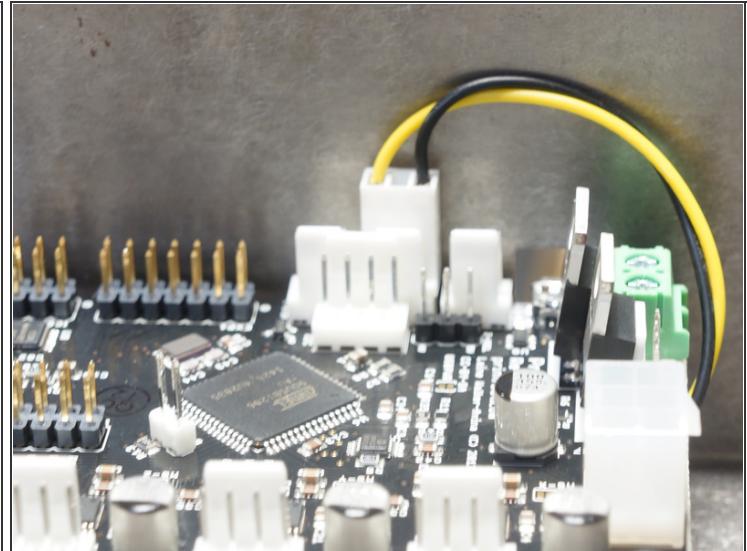
- M3 6mm Button Heads (8x)
- 20mm Hex standoffs (4x)
- Be sure you align the micro SD card slot and USB with the holes provided in the base.
- Take a quick look at your Printrboard. Rev F boards should have a jumper connecting the "HV" voltage selector pins.

## Step 9



- 12" End Stop (shorter wire length)
- Bend the metal tongue on the end stop a little under 90 degrees.

## Step 10 — Y endstop



- Y endstop wires tuck into base through square hole. Fish the wire out from under the Printrboard to plug it into Y endstop plug.
- M2 10mm Screws (2x)

## Step 11 — Y axis mounting & belt routing



- Stand base up on its side so Y motor faces up. Bring your Y bed and Y belt over, paying attention to what is the back and what is the front. Hint: the belt tensioning clip and screws are on back. On the bed, there are two carts on one side and one on the other - these will align with 12 holes in base to attach.
- You may want to route your belt in the pulleys now, but you can fish the belt in after the bed is mounted too, although its a little tight.
- M3 6mm Socket Head Screws (12x) attach carts to base (do not use the 6mm button head)
- Remove the screws from the belt clip and attach the belt clip to the back of the bed with those same screws. TEETH FACE UP. Just catch a few threads, don't tighten yet.
- Now thread belt through bottom front belt slot and back through top slot. PULL TIGHT. Teeth should mesh while you zip tie the belt.
- Now you can tighten the belt until it is quite tight. You should hear a low tone when plucking - like a guitar string.

## Step 12 — X axis plate, rail & carts



- Place X plate down with single threaded hole in lower left corner. Lower right corner will be where you mount the Y motor with 4 screws and large hole for pulley. This orientation ensures you are looking at the bottom of the X plate
- Slide your two linear carts onto the bar. Gently now, don't rush. Don't force. You can replace bearings if they pop out.
- Mount the bar with one screw on each end first, then mount a screw in each available spot.
- M3 8mm screws (13x)
- Tighten finger tight, then a little tug. Aluminum threads can strip, so don't get carried away.

## Step 13 — X Endstop



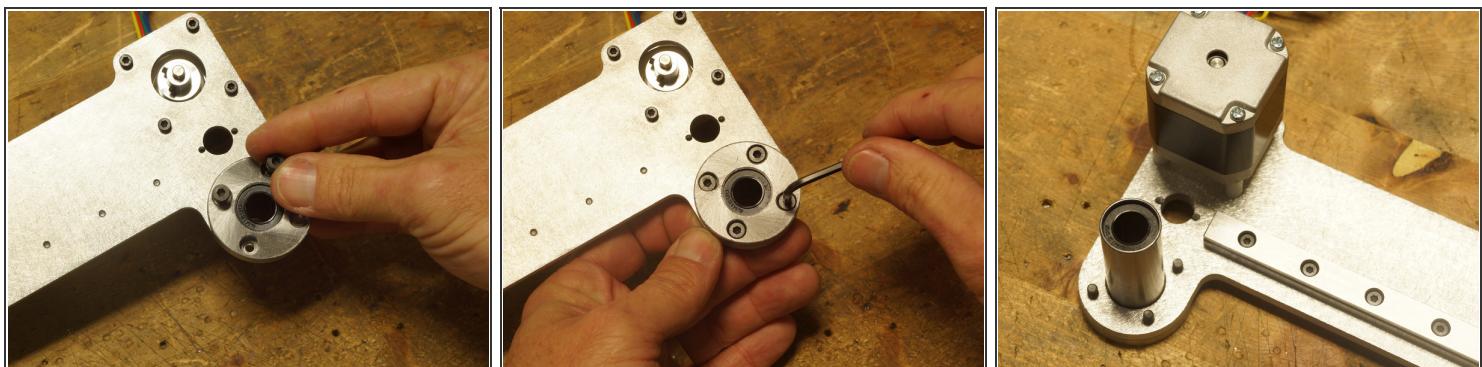
- M2.5 10mm (2x)
- End Stop - 28" Length
- Open mouth of endstop faces the rail.
- TIP: you may want to gently bend back the the wire that sits close to the pulley. Just to avoid any issues.

## Step 14 — X Motor & GT2 Pulley



- You must mount pulley and tighten set screws on pulley BEFORE mounting motor. allow about .5mm of gap between motor top and GT2 pulley. Don't stress over gap, just don't want it dragging. You will find M3 set screws for this kit in the universal bag and the hardware bag.
- M3 22mm (4x)
- 1/2" #6 Nylon Spacers (4x)
- Before moving on, double check the GT2 pulley location after mounting the motor. Compare the Idler pulley to the GT2 pulley and make sure it looks ok. Adjust GT2 pulley as needed, but, yes, you have to remove motor to adjust.

## Step 15 — Z Bearing - Right Side



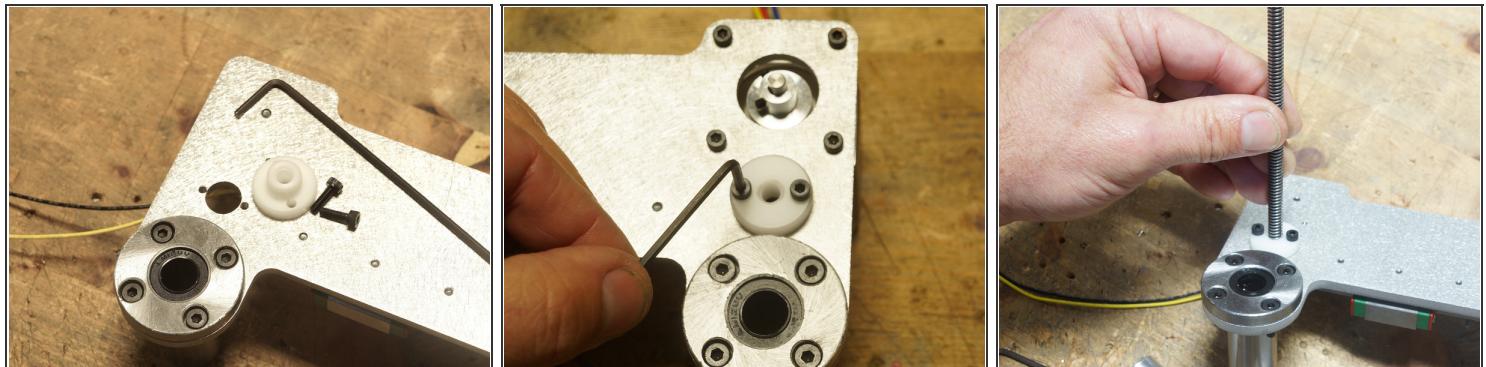
- Two Z axis linear bearings
- M4 8mm (8x)

## Step 16 — Z Bearing - Left Side



- Just a detailed view so you can see what it all should look like.
- Note: There are 2 linear rail carts on X, but only one is shown in the bottom view picture.

## Step 17 — Z Acme Nuts



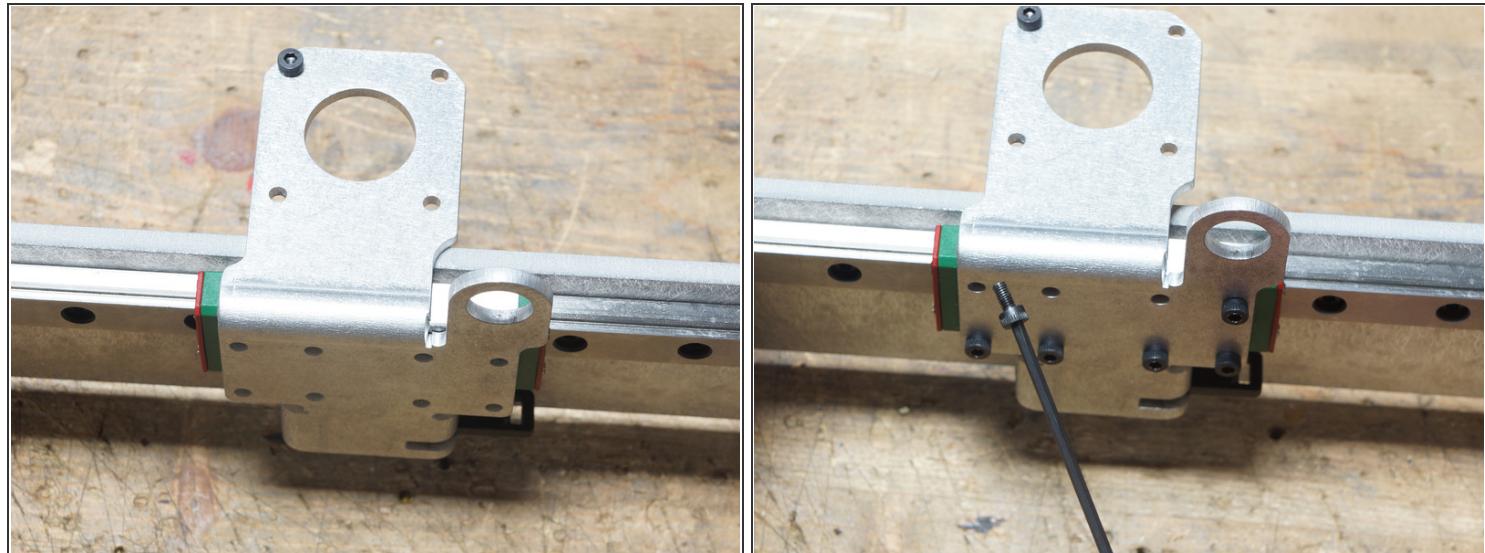
- Z acme nuts key into the holes provided
- M3 10mm (4x)

## Step 18 — X Carriage



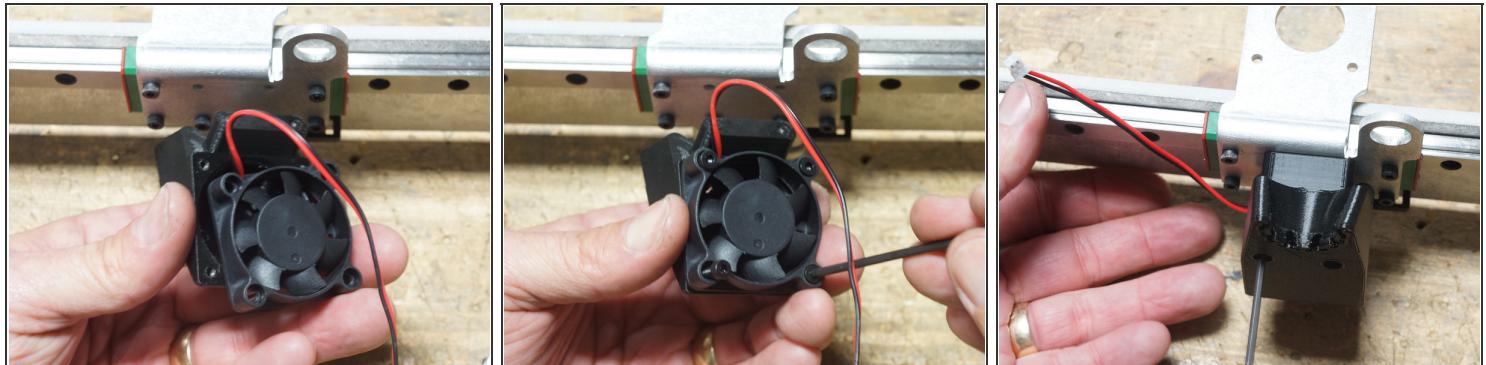
- X belt tensioner must be inserted into cart first. Then the bolt can pass through hole in the side of the carriage and thread into the tensioning arm. Just catch the first few threads - leaving room to tighten and tension belt later.
- M3 22mm screw (1x)

## Step 19 — X Carriage Mount



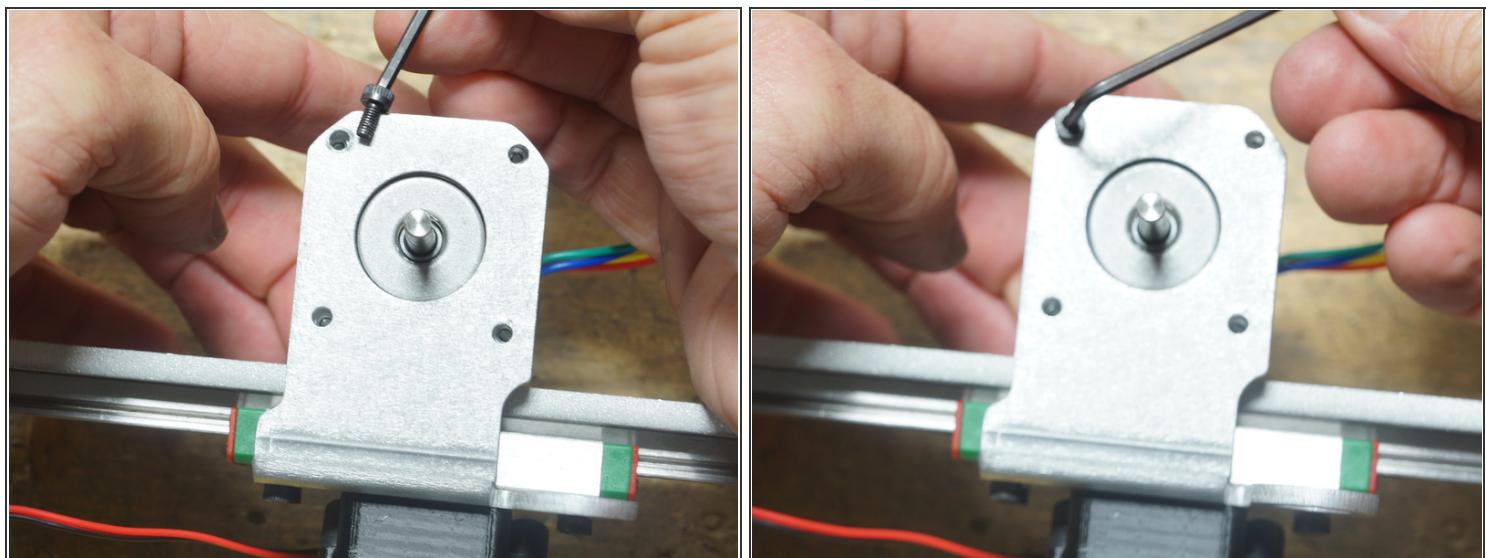
- M3 6mm screws (6x)
- The two front and center holes will be used to mount the fan shroud.
- Don't over-tighten! These carriages are important :) Hand tighten, then a little nudge to snug up each screw.
- If you tighten the screws and it binds the carriage - making movement difficult, you may need to loosen screws again and be more gentle when tightening them. You don't want the carts to "Rack" in opposite directions where they fight each other.
- Note: Just ignore that lonely screw at top left... I'll get to that soon.

## Step 20 — Fan & Shroud



- Fan mounts to shroud. Don't over-tighten. You don't want that fan twisting or cracking.
- M3 10mm (4x)
- M3 22mm (2x)
- the long screws go through the remaining holes in the X carriage into the carts

## Step 21 — Extruder Motor



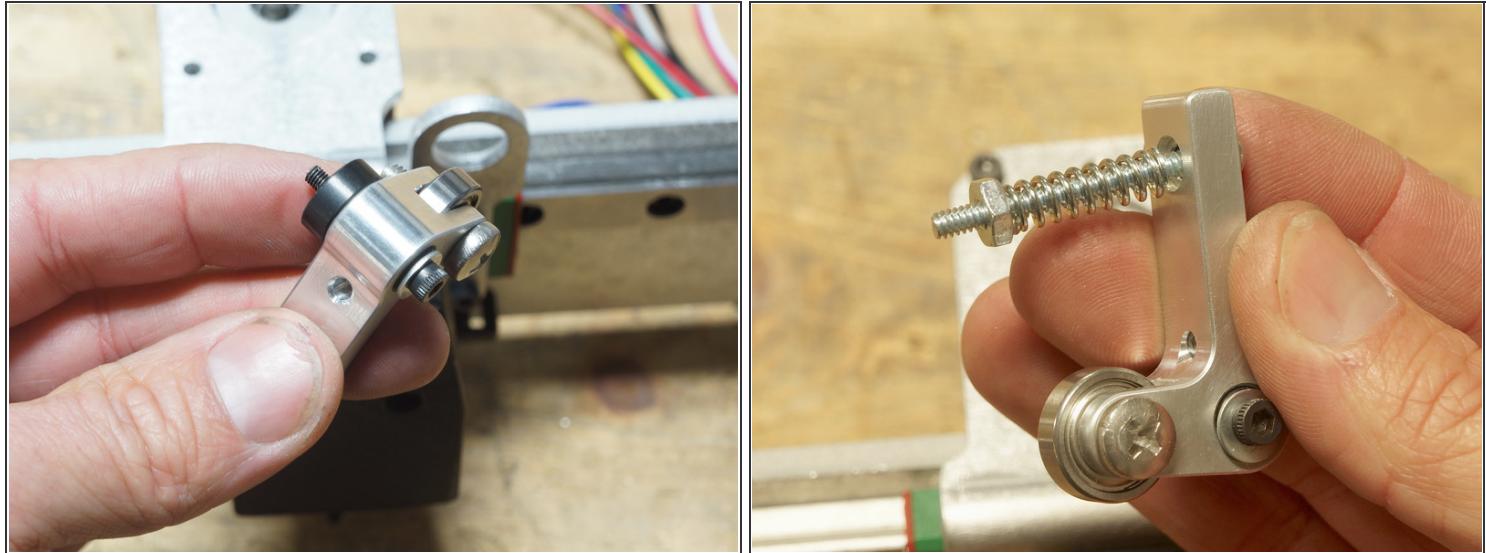
- Mount the extruder motor (the motor with the long extension wiring) by using one little screw in the top left to hold it in position.
- Wires on the motor point to right side
- M3 6mm (1x)

## Step 22 — Extruder Idler Arm



- 625 bearing
- M5 16mm Pan Screw - Phillips style
- Black Delrin spacer slides in from back. This will mount to upper right hole on motor

## Step 23 — Extruder Idler Assembly



- M3 25mm (1x)
- M4 washer
- 6-32 1.5" screw - Phillips type (1x)
- 6-32 Hex Nut (1x)
- Extruder Spring
- The 6-32 screw, spring and nut work together to provide tension on the bearing to press the filament into the teeth of the drive gear.

## Step 24



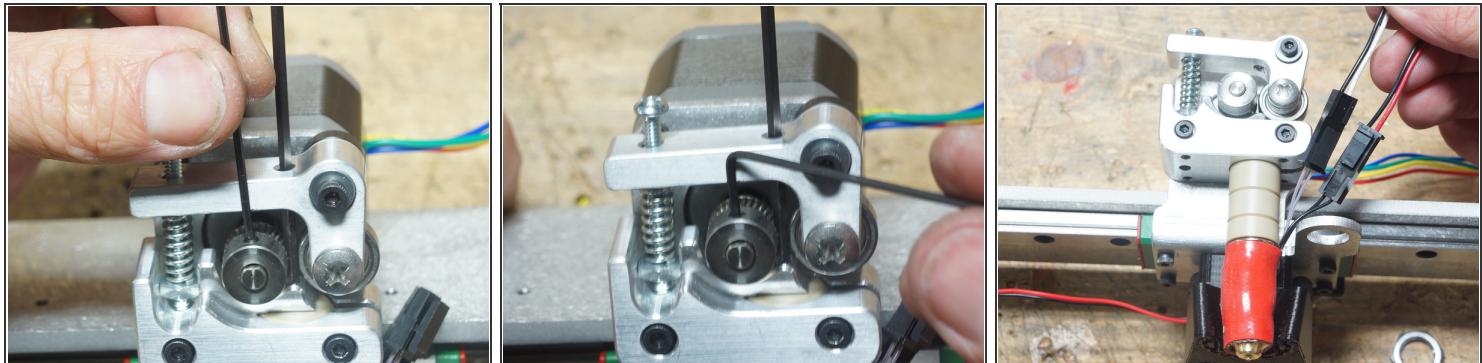
- M3 25mm (2x)
- #4 Flat Washer (4x)
- Aluminum Extruder Base
- 1.75mm Ubis Ceramic Hot End
- Place two #4 flat washers onto each M3 25mm screw. This preventing the screw from bottoming out in motor. If it bottoms out, it won't hold assembly tight on X carriage.
- Insert Ubis Hot End into the extruder base before you tighten right M3 25mm screw. Make sure the hotend is pushed all the way to the top of its mounting hole for best results.
- Make sure wires on hotend are routing out behind the sensor mount (off to right)

## Step 25 — Hot End and Drive Gear



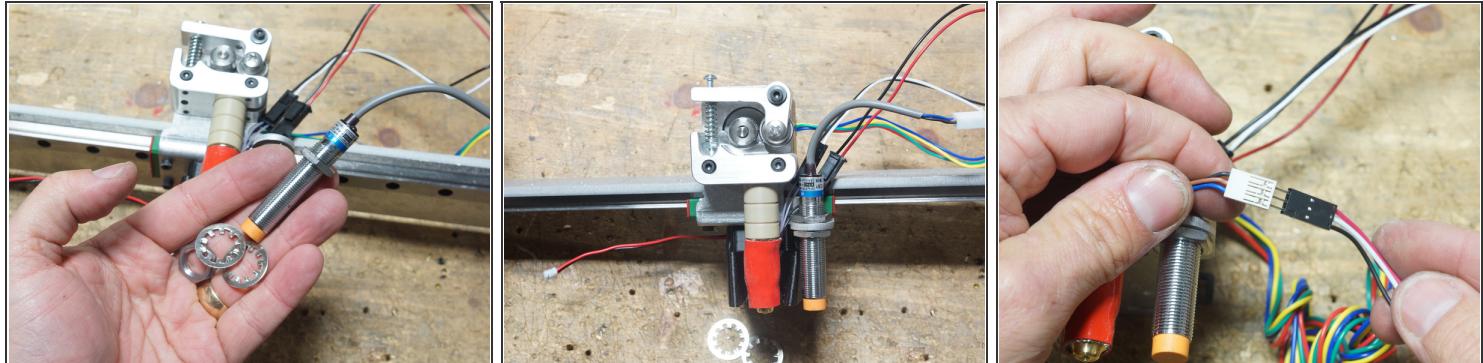
- Mount the Arm to the top right screw hole in the motor, tighten the M3 25mm screw.
- Slide on the drive gear with set screw facing out
- You will find M3 set screws for this kit in the universal bag and the hardware bag.

## Step 26 — Drive Gear Alignment



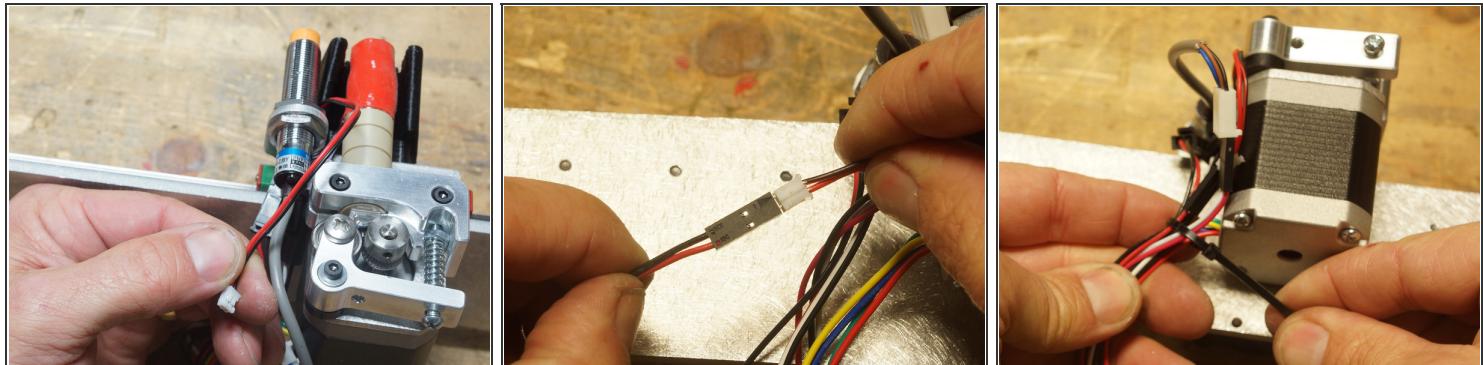
- Align the set screw with the flat on the motor
- I show an allen wrench put through the top filament hole in the arm AND through the filament hole on the tongue of the base of the extruder. This allows me to perfectly center the deepest part of the groove with the teeth on the drive gear.
- Tighten the set screw once you are certain it is all aligned. Double check.
- You MAY want to use Loctite or a dab of glue to keep the set screw from slipping.
- The 6-32 tensioning screw can be tensioned until the nut raises up so the top of the nut is flush with the two sides in the pocket that keeps the nut from turning.
- Attach hotend power and thermistor extension wires.

## Step 27 — Z Sensor



- The bottom of the sensor should be about 1mm above the tip, so it doesn't drag across the printed plastic when it is running.
- Z sensor is held in place by tightening the two large nuts against the metal. You can use the wooden wrenches or pliers to tighten.
- Final adjustment of the Z sensor height is covered later... DO NOT turn on and try to use without carefully reviewing [calibration instructions](#). You could scratch your print bed.
- Attach Sensor wire extension. We generally ship these with extension in place and shrink wrapped. But I wanted to show the correct scheme for matching wire colors on the two.  
**DO THIS WRONG AND YOU MAY DAMAGE YOUR ELECTRONICS**
- Sensor BLACK wire to Extension RED
- Sensor BROWN to Extension WHITE
- Sensor BLUE to Extension BLACK
- Recommended - Once you connect the Sensor Extension to the Sensor, use heat shrink tubing or electrical tape to keep connection firmly in place.

## Step 28 — Fan Extension and wiring



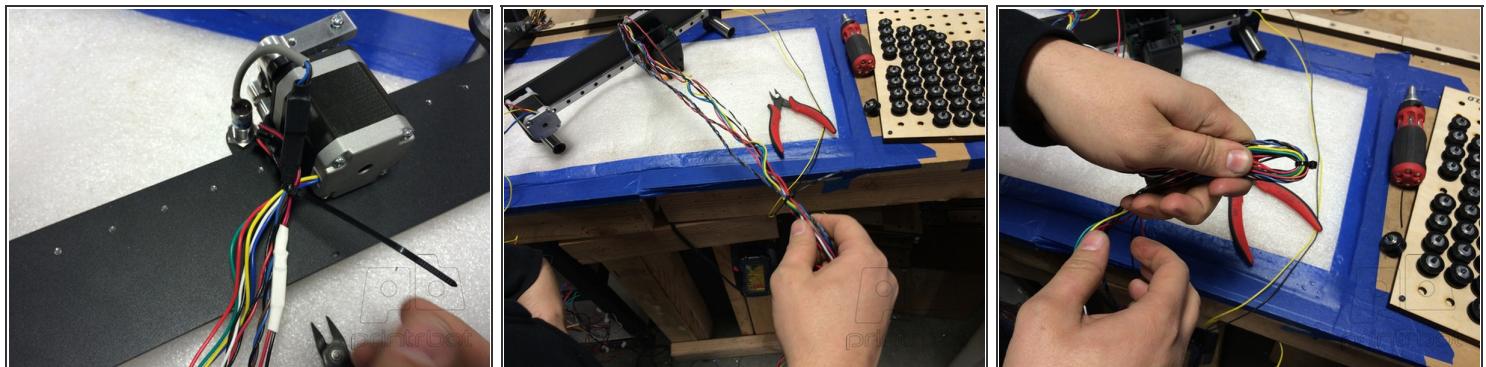
- The fan that can cool your prints may come with the cable extension attached, but we wanted to show what it looks like here.
- Red to red. Black to Black.
- If you connect this wrong, it MAY damage your electronics.
- The connectors are a little hard to connect at times... hang in there.
- Now that all Extruder wires are in place, zip tie to where the motor wires come out of the motor.
- BE SURE you are NOT straining the hot end wires - allow slack. If the carriage movement strains the hotend wires, it could pull the crimped ends off and ruin your hotend.
- BE SURE your sensor extension wire and fan extension wire connectors are not tucked out front before zip tie... you want only wires in that zip tie bundle - no connectors.

## Step 29



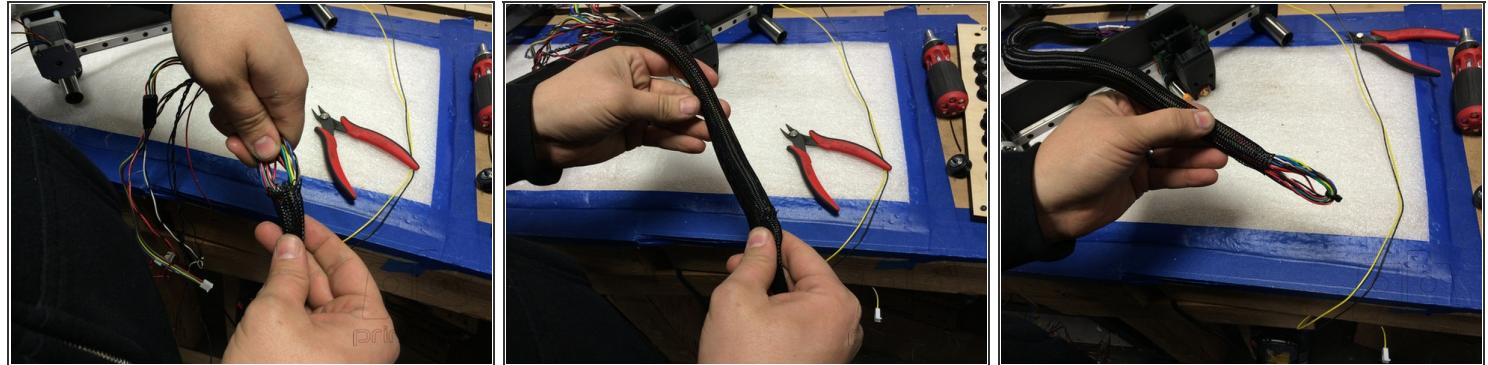
- 34" Braided Wire Wrap
- Notice there is a cut in the 34" Braided Wire Wrap. This is the entry point for the X axis End Stop.
- You will want to begin feeding wiring into the shorter side of the 34" wrap (red box).

## Step 30



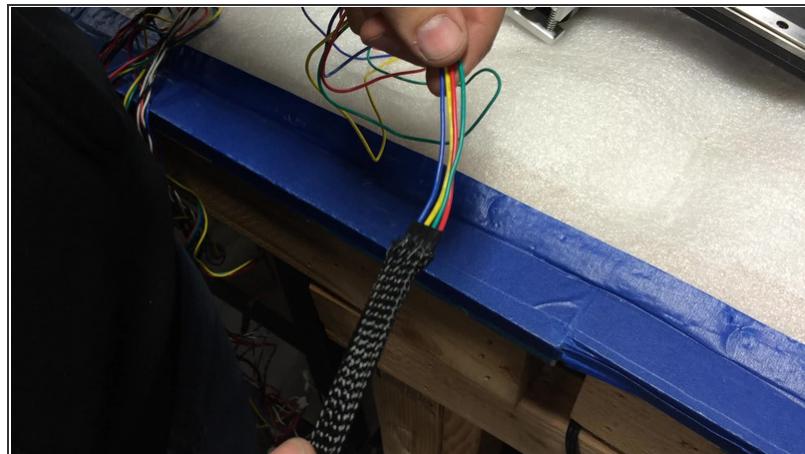
- First zip tie the wiring at the base of the extruder motor (photo #1).
- Then zip tie about 18" down the bundle of wires from the extruder.
- Fold the wiring onto itself at the point of that zip tie.

## Step 31



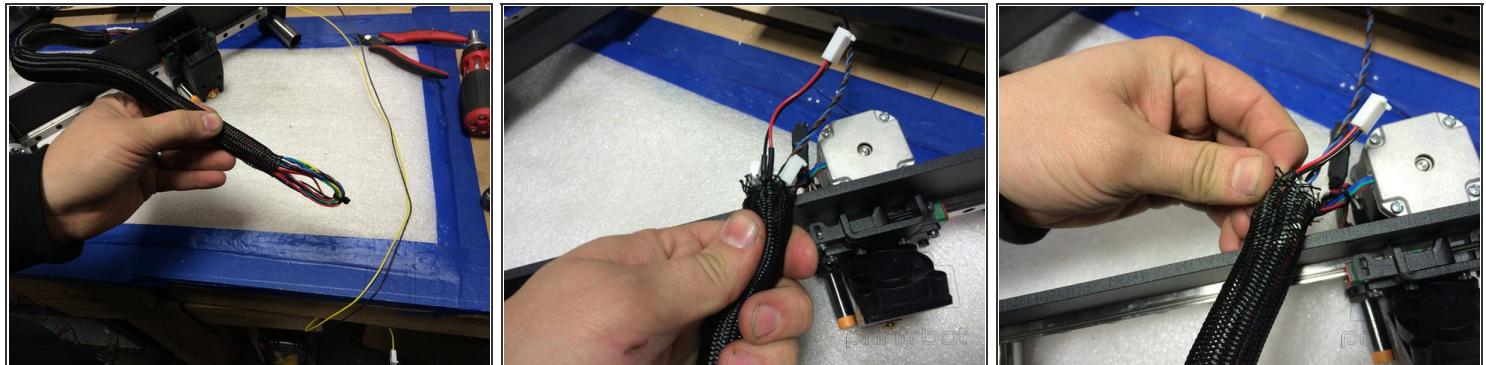
- Feed the doubled up wiring through all 34 inches of the braided wire wrap.
- See next step for technique on getting wiring through wire wrap.

## Step 32



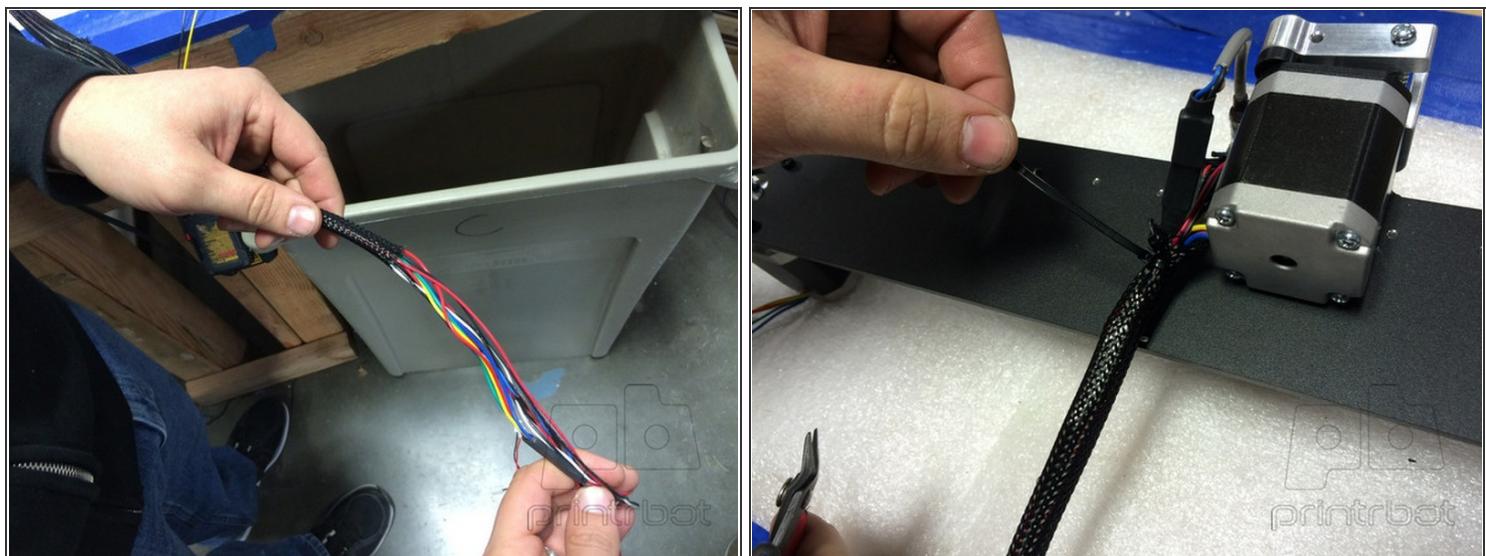
- See video for technique on feeding wiring.
- Bunch the braided wire wrap together in order to create a wider diameter by which to feed wires through.

## Step 33



- As you're feeding through the bundle of wires be aware of the connectors on the other end.
- Feed the connectors through so they do not snag.

## Step 34



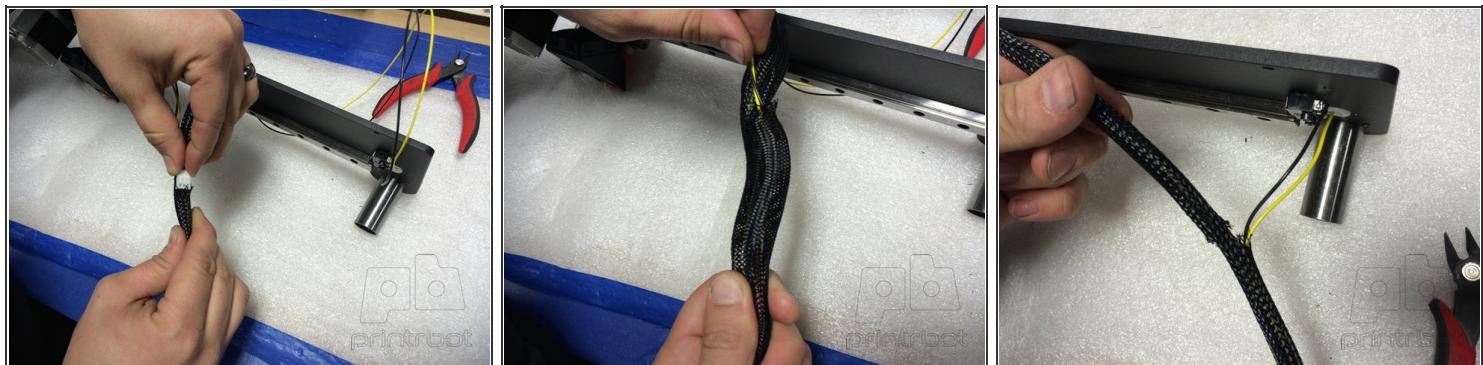
- Once all the way through, zip tie the braided wire wrap onto the wiring at the base of the extruder motor.

## Step 35 — X Carriage Wire Bundle Management



- Move X Cart with Extruder all the way to the right while facing it.
- Stretch all cables to left to see that the cut in the braided wrap lines up with the other side of the Z-X platform.
- Zip tie the wiring to the center hole on the Z-X platform.

## Step 36



- Insert the X axis end stop connector into the cut in the braided wire wrap.
- Feed the end stop wiring through the wrap.
- Only leave about 3 inches of length between the end stop and the wrap (photo #3).

## Step 37



- M4 22mm screw (1x)
- 3/8" P Clip
- M4 Flat Washer (2x)
- 1/8" #8 Nylon Spacer
- 624 bearing w/ Delrin pulley set
- Feed M4 22mm screw into P Clip. Then place M4 flat washer onto screw.
- Place first half of the Delrin pulley onto the M4 flat washer.
- Then place 1/8" #8 nylon spacer onto 624 bearing.

## Step 38



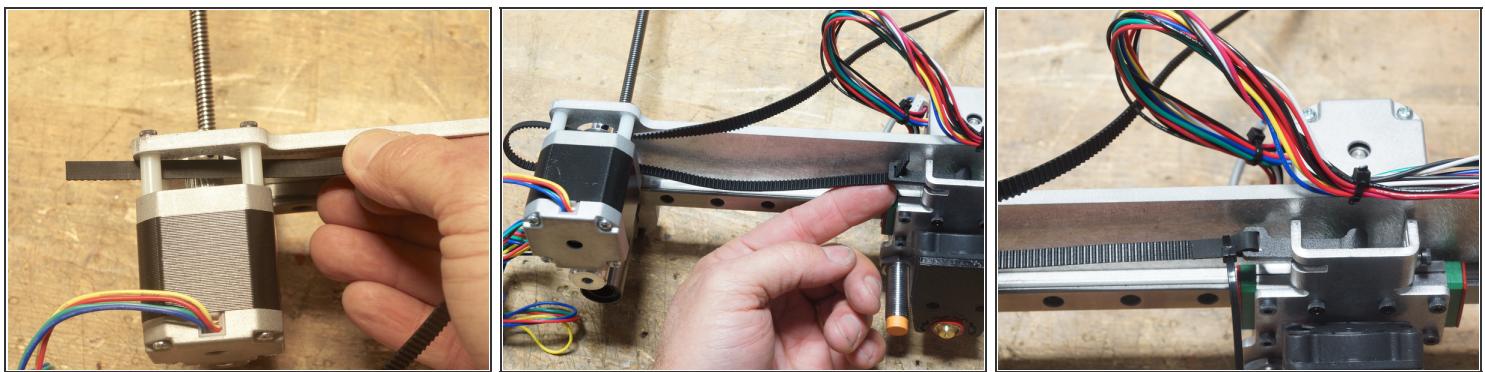
- Place other half of the Delrin pulley onto the 1/8" #8 nylon spacer.
- Attach onto Z-X platform next to the X axis end stop.

## Step 39



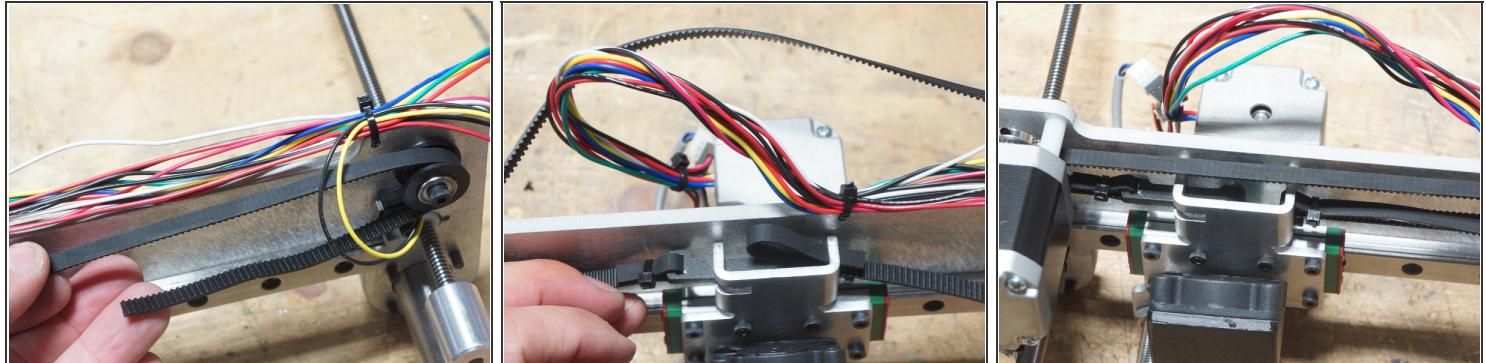
- Now take the 14" braided wire sleeve and feed the wiring from the X axis motor through in the same way you did the opposite side of the Z-X plate.
- This side will be much easier to feed since you are only feeding one set of wires.
- Once the wiring is all the way through the sleeve, zip tie the end of both the 14" and the 34" sleeve to make sure it doesn't move or slip.

## Step 40 — X Belt



- These next two steps will help you install the X axis GT2 belt. They will look a little different from the previous steps but installation is the same.
- Zip tie belt to belt tensioning arm in the back of the X carriage. TEETH MESH.
- Your belt goes around the GT2 pulley on the motor, engaging with the teeth, of course.

## Step 41 — X Belt Tensioning



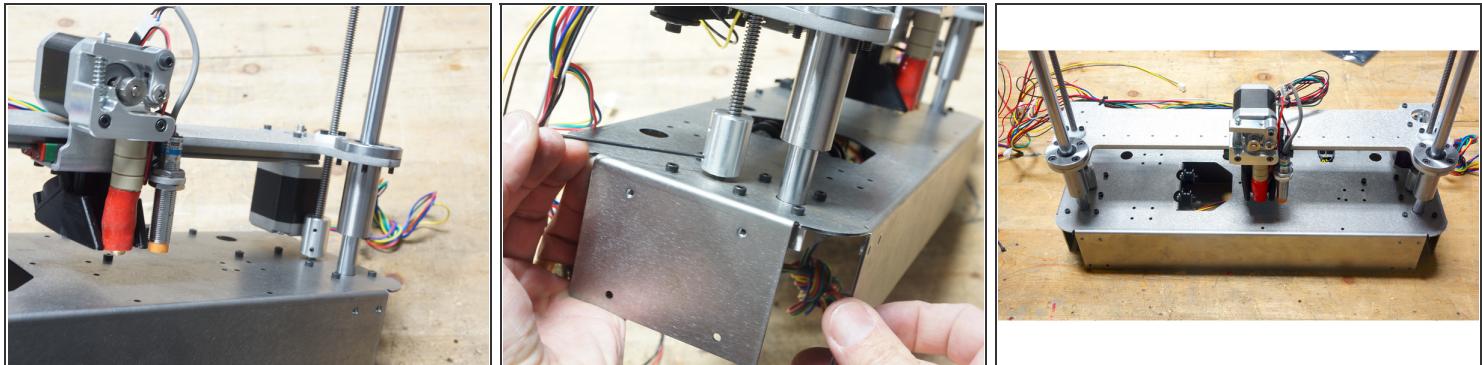
- Please disregard the fact that the braided wire wrap isn't in these photos and that the Delrin pulley does not have the P Clip on it. you installed it correctly in the previous steps.
- The belt passes behind the carriage and around the idler pulley on the other side.
- Beware of X endstop wires.
- Belt will thread through slot nearest the rail first, then back through rear slot. TEETH MESH
- Pull very tight. MESH TEETH as you pinch and hold while you get the zip tie on tight.
- Now, tension belt with the M3 screw that will pull the belt tight with the tensioning arm as you tighten the screw.
- Yes, I know the screw is hard to reach. It really works well though.
- Belt should be adequately tight, you should hear a low tone when plucking - like a guitar string.

## Step 42 — Acme Rods and Z couplers



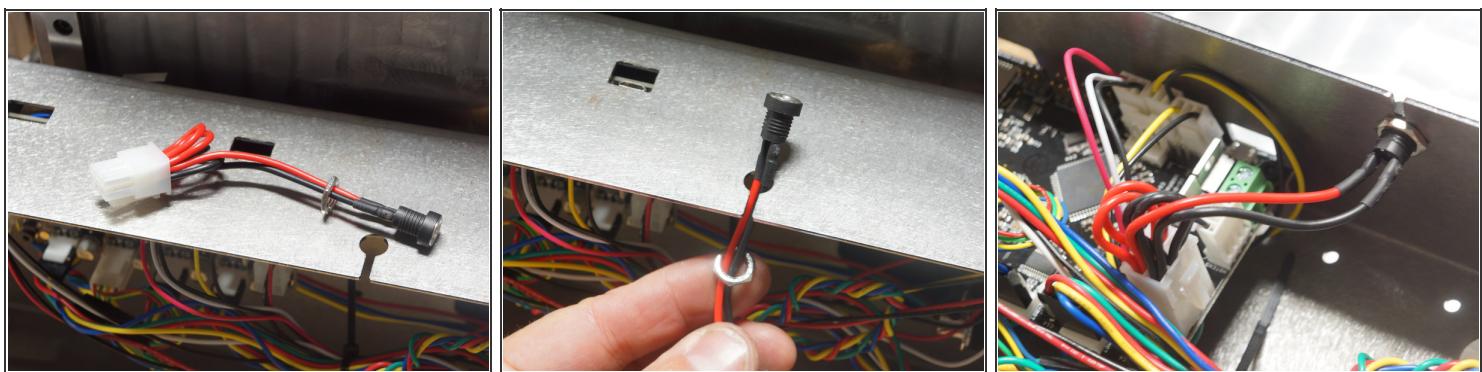
- Insert your Acme rods into the acme nuts before you slide the X plate assembly onto the 12mm Z bars.
- You don't want the hotend tip hitting the metal base, so screw the acme rods down to extend beyond the x motor bottom plane.
- Add your Z couplers to the acme rod and tighten the set screws. You MAY want Loctite here or a dab of glue to make sure your set screws don't back out and cause problems.

## Step 43 — X Plate Assembly Meets Base



- Slide X plate assembly onto Z bars GENTLY. make sure acme rods have equal amounts and that the Z couplers meet the motor shaft at same time.
- You want the X plate parallel with the base as you are tightening the set screws.
- When you slide your Z couplers over the Z motors, make sure your set screws align with the flat on the motor shaft. Tighten Z coupler set screws securely to motor shaft.
- Measure X plate height on left and right to ensure parallel with base.
- If you wave to adjust one side, hold opposite acme with hand so it doesn't turn. When electrically coupled, they want to move in unison.

## Step 44 — Power Dongle



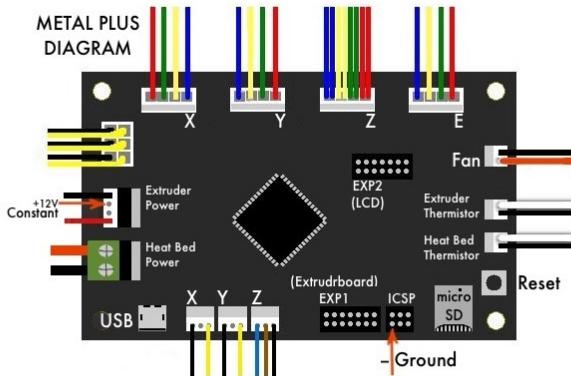
- Loosen nut and back off until it is past heat shrink.
- Pass wire into slot, then set the threaded barrel in place.
- Tighten nut by hand, then nudge slightly tighter with pliers.
- Plug power connector into Printrboard.

## Step 45 — Z Bar Top



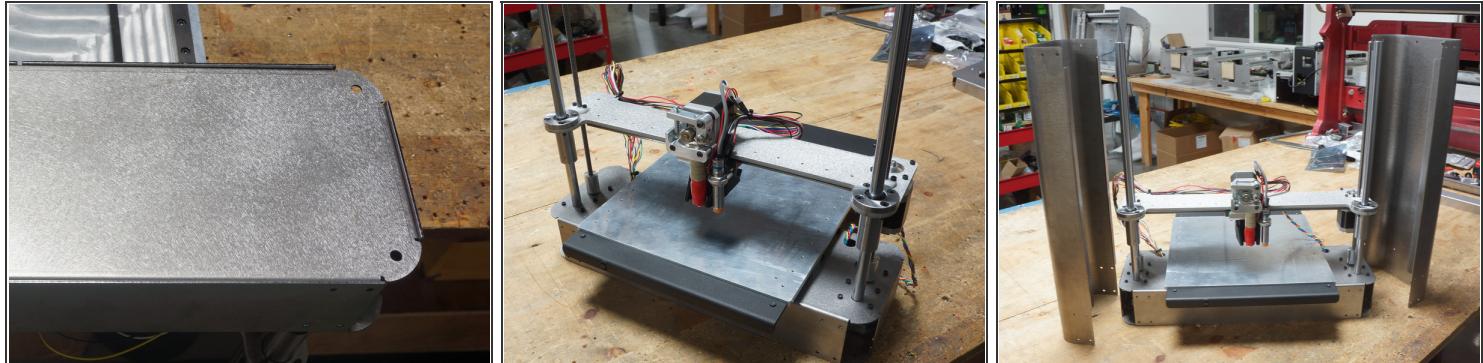
- M3 10mm Button Head Screws (8x)
- Four screws (per side) attach the blocks to the top plate.
- The thinner metal edge is the front of the top metal part for the case.
- In the Z block, the smaller hole is for the acme rod - it lands roughly in the middle of the metal plate. The large 12mm hole in the Z block faces front.

## Step 46 — Printrboard Wiring



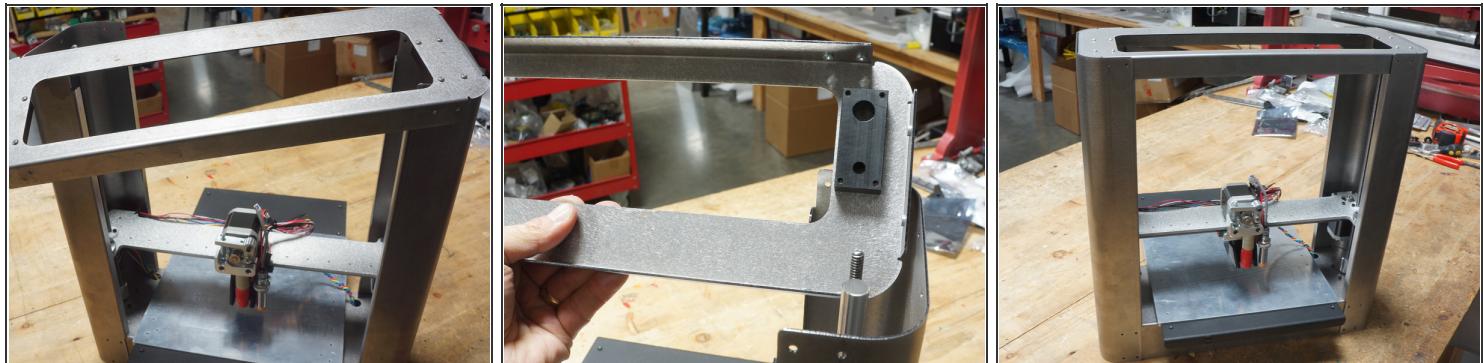
- Wiring Management should not be overlooked.
- Bad wire management MAY damage your printer and render it useless.
- DOUBLE and TRIPLE check all connections before connecting power. If you are wrong and hastily connect power.... you could fry the board. I cannot overstate this point.
- EXTRA NOTE: The Ground and +12V constant that are marked with red arrows are mentioned here to show you how you WOULD connect a Metal Ubis hotend FAN, if you decide to buy one and give it a go. You can remove the red wire prong from the fan connector housing and just plug the 3-hole connector into the ICSP so the black wire connects with ground.

## Step 47 — Base B - for Bottom.



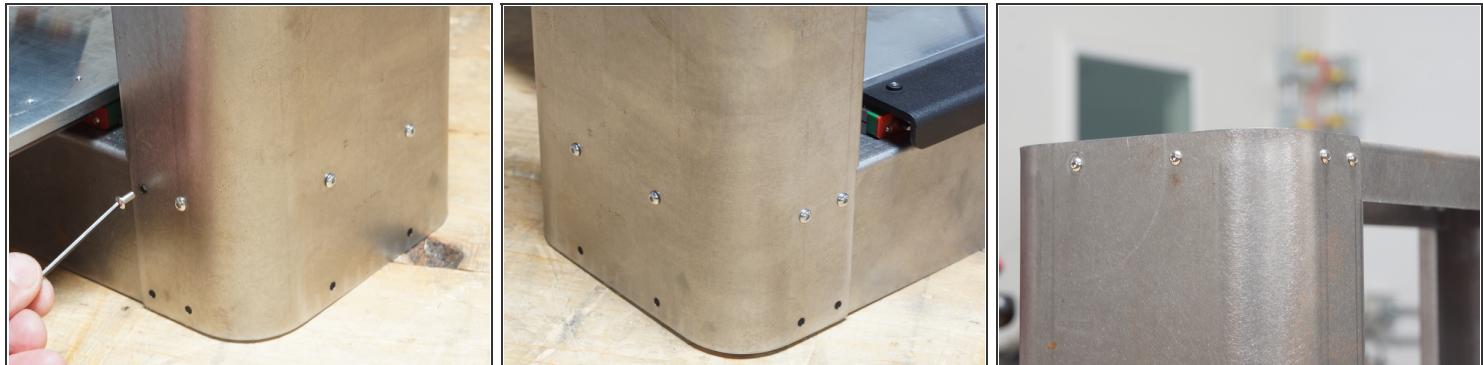
- Base B is the bottom of your bot and nestles INSIDE the Base A sheet metal. You may need to politely coax it in, as it is quite snug.
- Be careful not to use a metal edge to pry against the black powder coating.... it could chip the paint.
- Now that the bottom of the case is in place, the sides can attach. You are ready to screw together the case!!

## Step 48 — Case in Place



- Sides are in place. Note they only work one way - with two rows of screw holes on bottom and one row on top. The two sides are identical.
- Top can now be put in place. Careful to gently slide 12mm bar and acme rod into their respective hole in the Z blocks.

## Step 49 — Side Screws



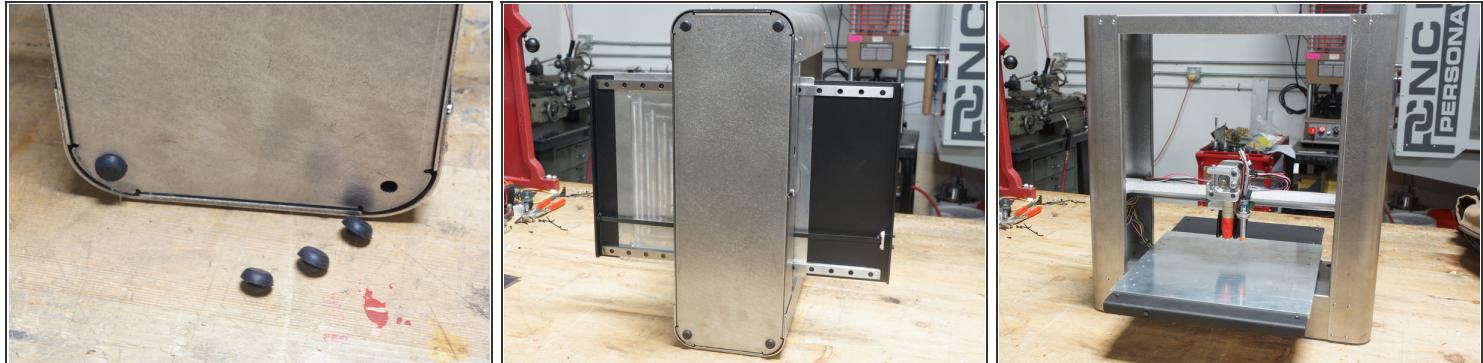
- M3 6mm button Head Screws (24x)
- The top row and middle row of each side have 6 screws each (12 per side, 24 total). The bottom row is actually 10mm length.

## Step 50 — Case Side Bottom



- M3 10mm Button Head Screw (12x)
- Yes, they are longer, because they go through three sheets of metal, not just two.
- LOOK at that Beauty. Well done.

## Step 51 — Rubber Boots



- Put the 4 rubber feet on so you don't scratch up your table. Like I have. You sort of twist them into place. It's quite hard.
- OK, NOW, step back and admire your work!!
- Well done.
- Now move on to the calibration steps. Don't get impatient.... these are important steps that ensure you will get good prints!
- To maintain your Printrbot Plus, we recommend greasing the Y axis rails every 1-2 months. [Tri-Flow Superior Lubricant](#) is a satisfactory product for this. We also recommend [WD-40 silicone lubricant](#).
- Happy printing. - Brook
- **NEXT STEPS**
- [\*\*Click here\*\*](#) to go through our guide on guide on [Getting Started with Cura on Your Printrbot Plus.](#)

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