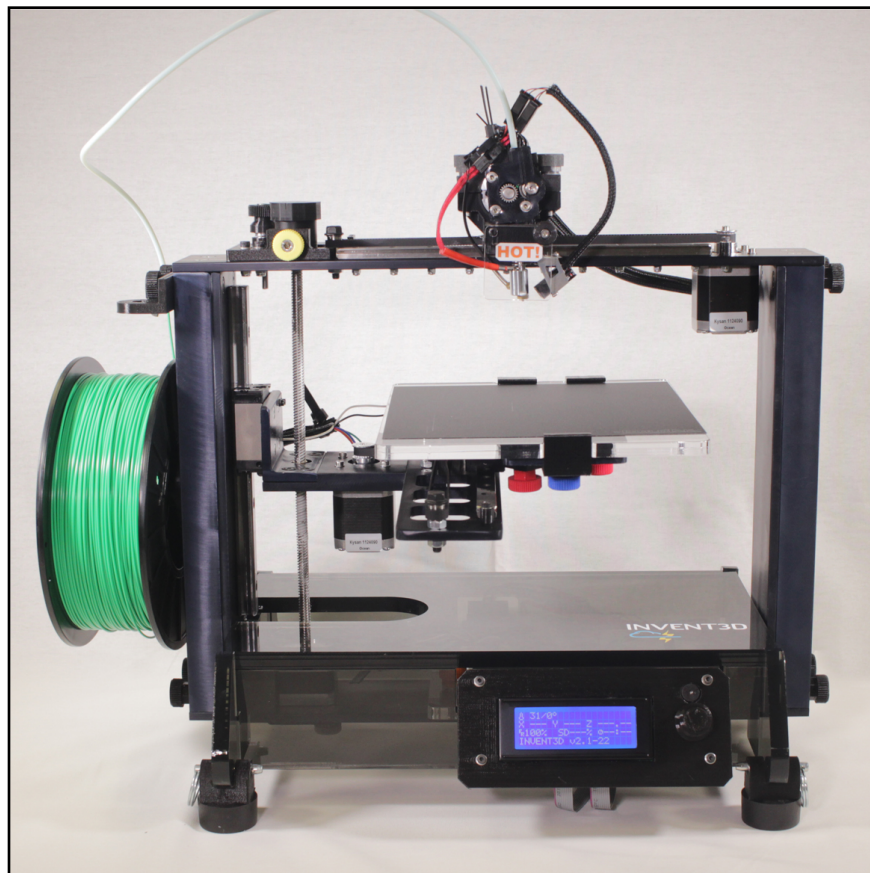


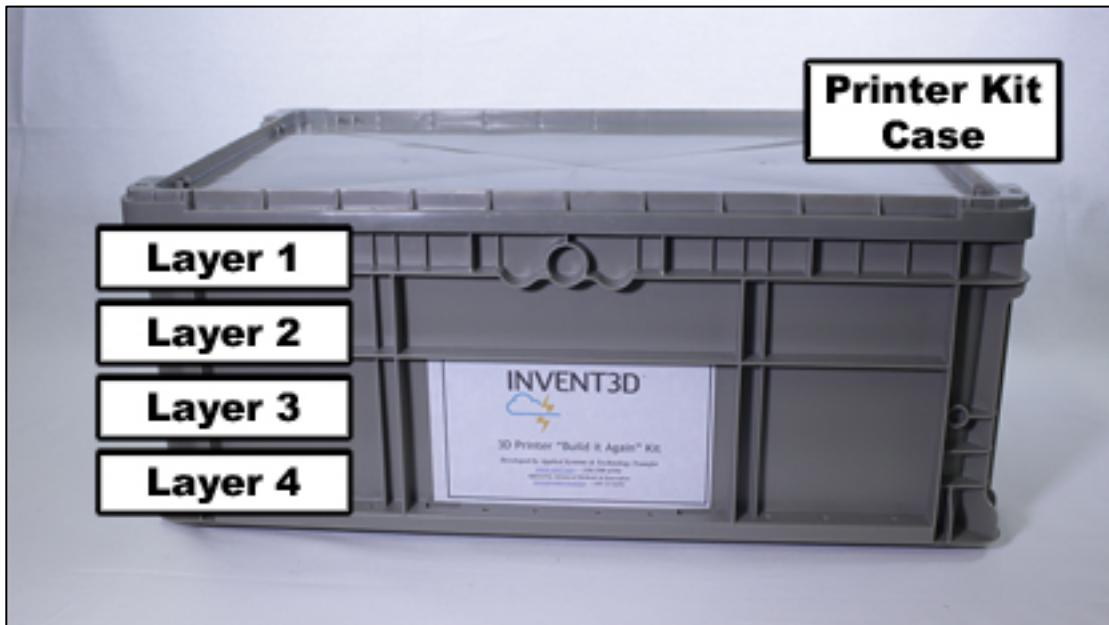
INVENT3D Printer Kit Assembly Instructions



Version 6

I. Printer Kit Case Layout

The printer kit components are organized in four layers in the printer kit case. The custom-cut foam layers allow components and subassemblies to be re-packed in the same manner when disassembled. These layers are labeled from the top down within the case, meaning Layer 1 is the top layer and Layer 4 is the bottom layer. A detailed drawing and photo(s) of each layer is included below to ensure that all pieces are accounted for and for ease of subsequent assemblies.

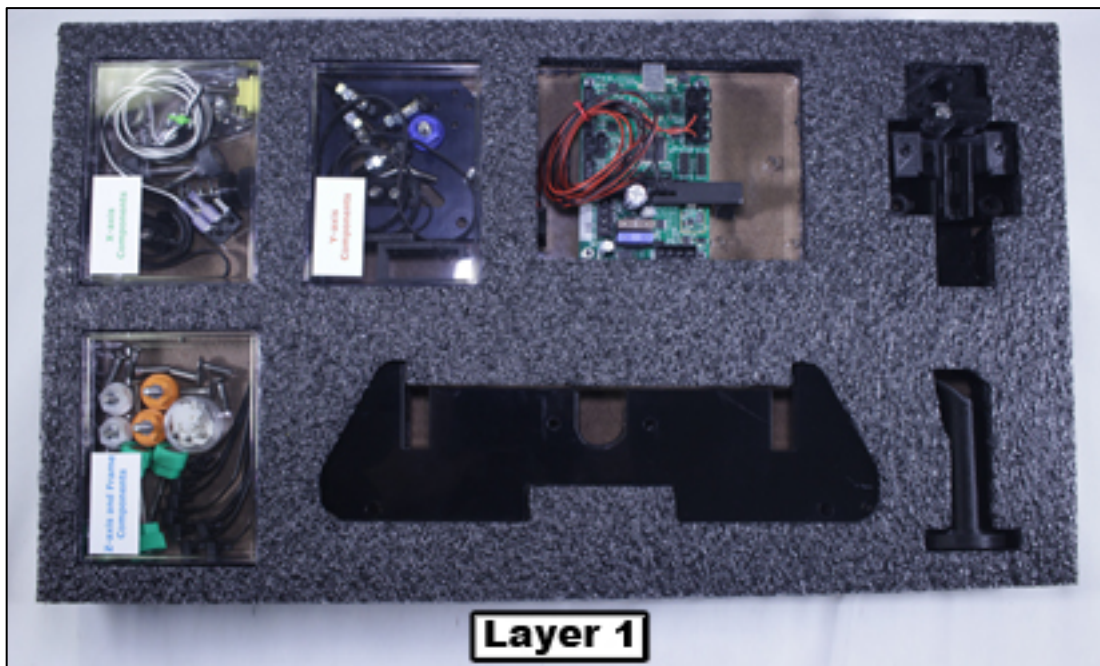
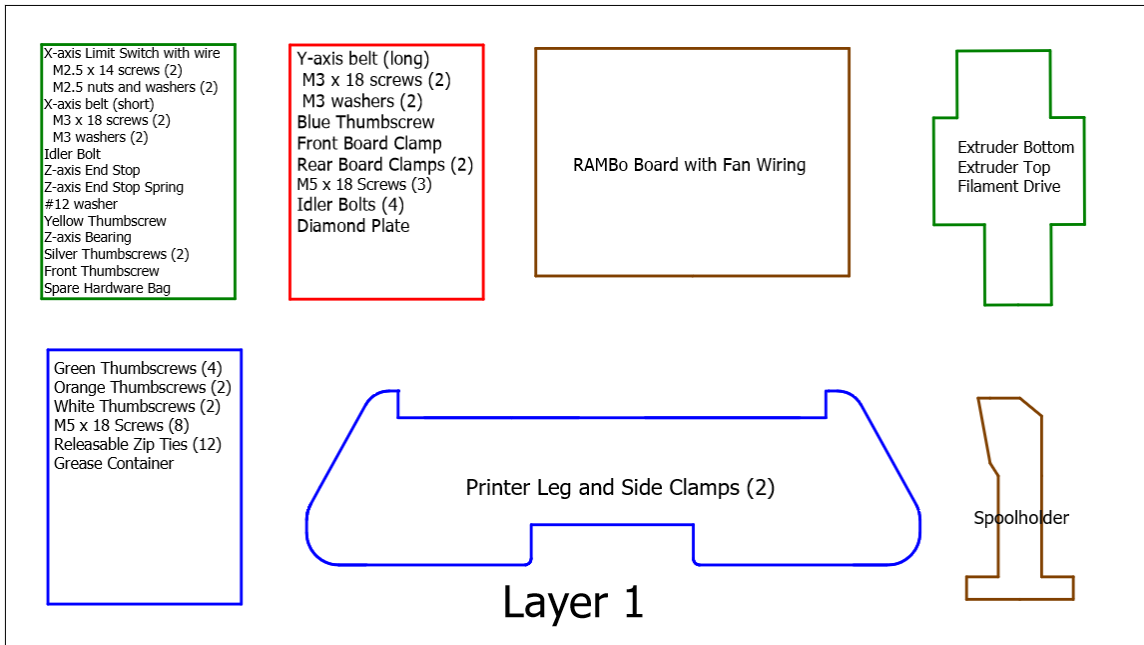


Layer 1





- X-axis Components
- Y-axis Components
- Frame/ Z-axis Components
- Finishing Components

3D Printer Kit

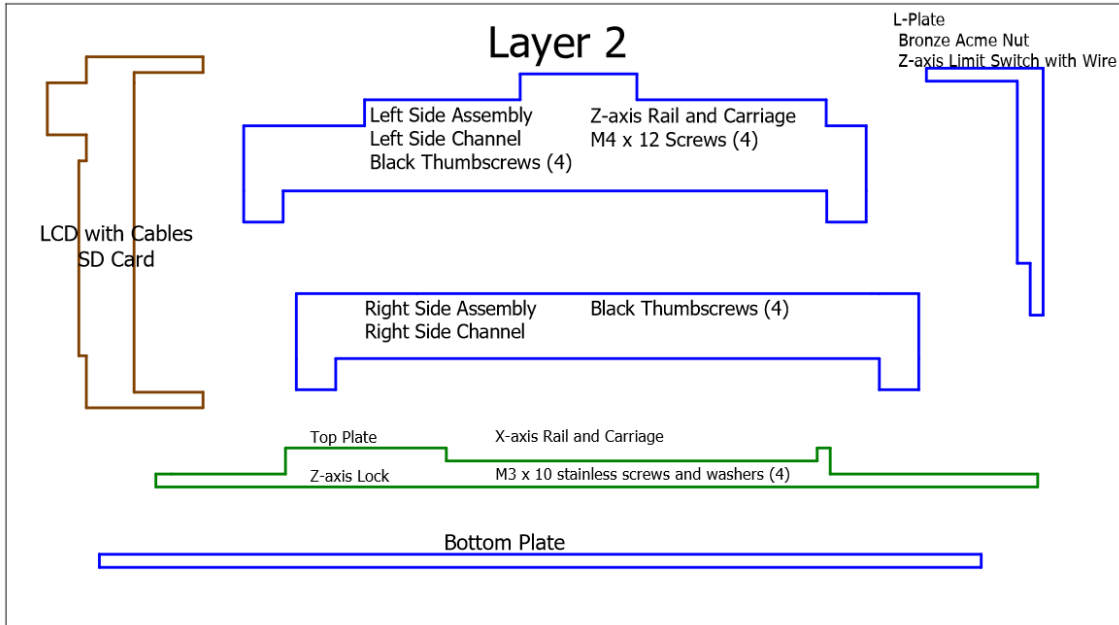
Case Layer Drawing



Layer 2

-  X-axis Components
-  Y-axis Components
-  Frame/ Z-axis Components
-  Finishing Components

3D Printer Kit Case Layer Drawing

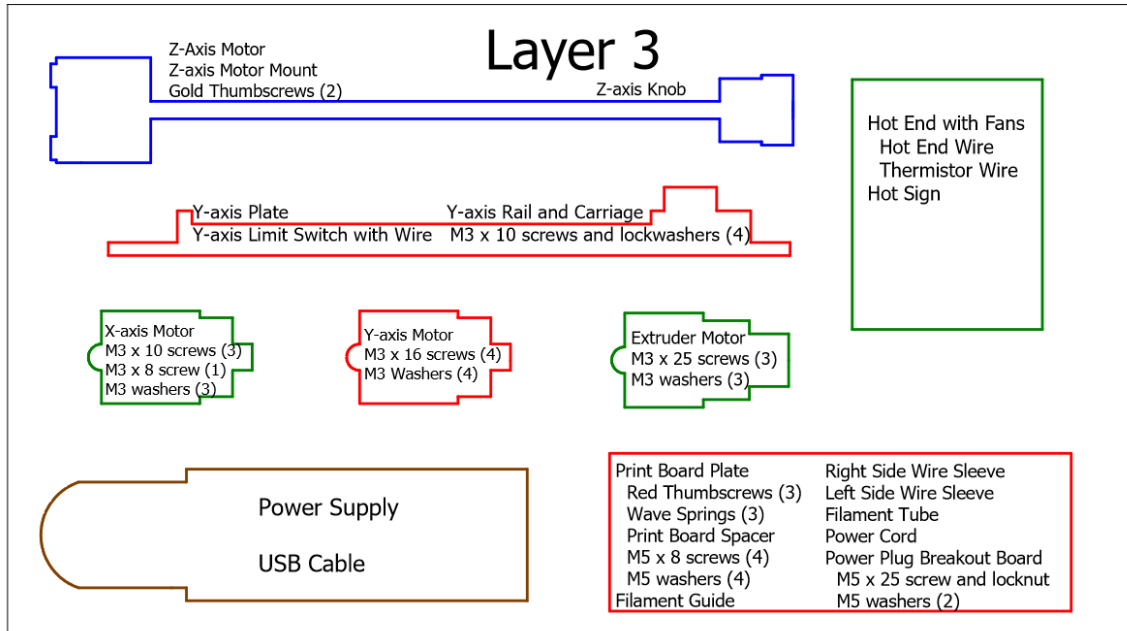


Layer 3





- X-axis Components
- Y-axis Components
- Frame/ Z-axis Components
- Finishing Components

3D Printer Kit

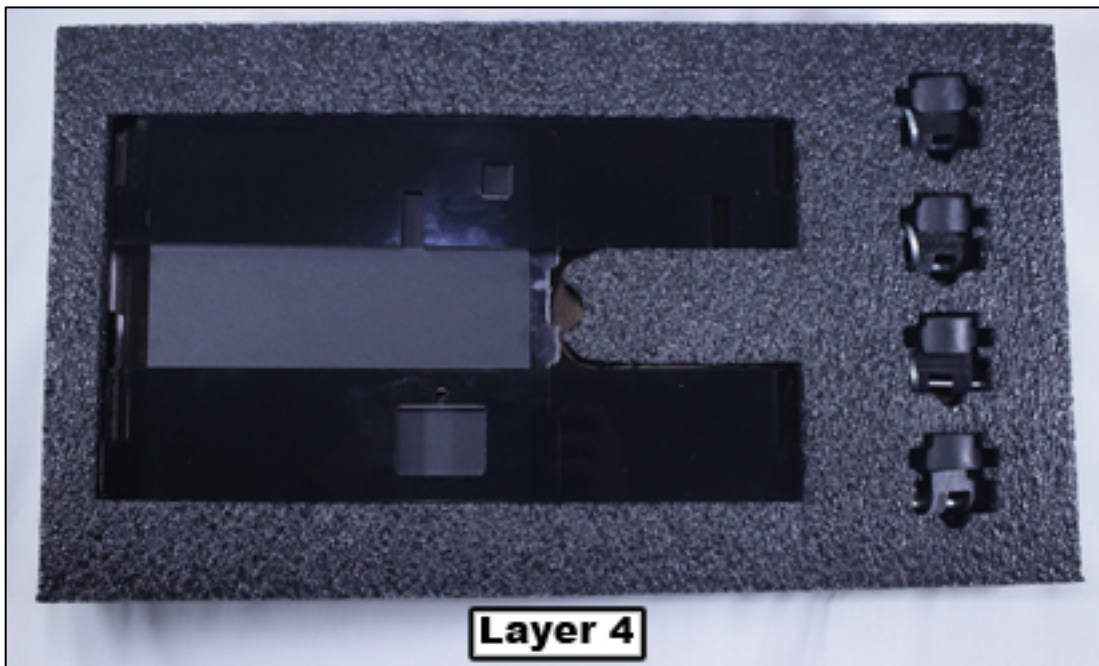
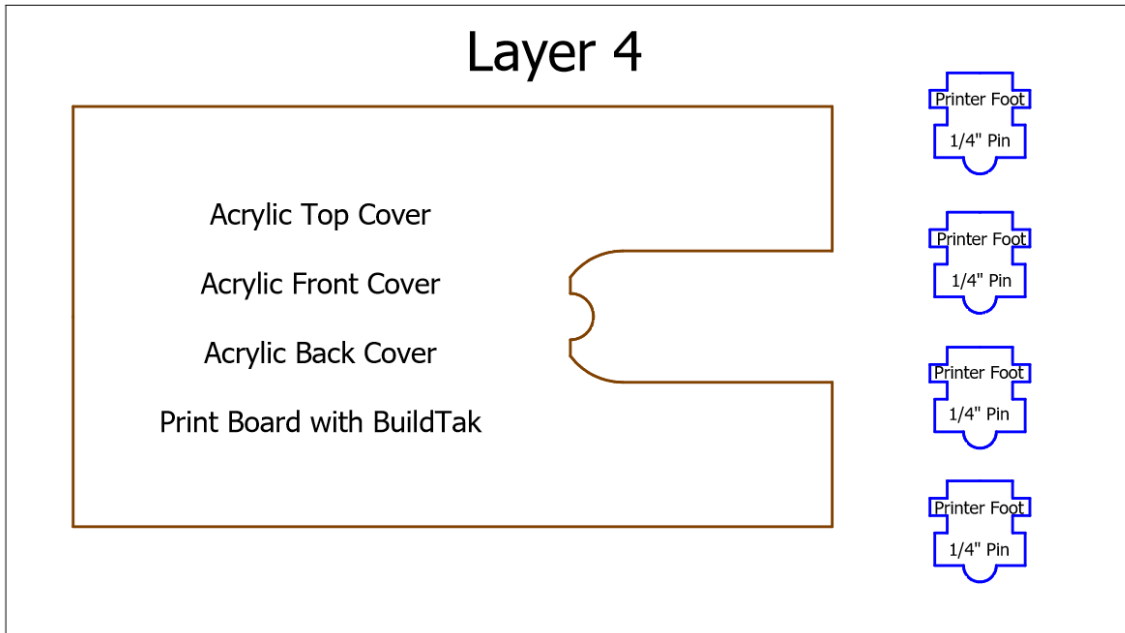
Case Layer Drawing



Layer 4

-  X-axis Components
-  Y-axis Components
-  Frame/ Z-axis Components
-  Finishing Components

3D Printer Kit Case Layer Drawing



II. General Assembly Instructions

The INVENT3D Printer is a sophisticated, electro-mechanical system. It is imperative that all procedures are read and followed exactly to avoid damage that would prevent full and correct assembly and/or operation of the printer. AST2 is not responsible for damage resulting from failure to follow procedures.

The procedures will provide detailed information about each printer assembly and printer component that will be used to build a functioning INVENT3D Printer. Procedures are also provided for disassembly of the printer for storage and reassembly by subsequent users.

It is imperative to implement the following general guidance when assembling the INVENT3D printer kit:

- Unless otherwise noted, printer kit components and subassemblies are not to be disassembled; disassembly should return the printer kit to the same condition in which it arrived.
- Screws that are black anodized should not be removed.
- Always hand tighten screws first to ensure that the screw is threaded properly and avoid cross-threading.
- Screws do NOT need excessive force to tighten.
- Thumbscrews generally do not require a wrench
- If a screw is hard to turn, make sure that the correct screw is being used in the correct location.

Contact Applied Systems & Technology Transfer, LLC (AST2) if any parts are missing or not functioning properly. Leave a note in the kit so that the other users are aware of the missing/malfunctioning parts to ensure that corrective actions are completed prior to its assembly. AST2 welcomes and appreciates any comments on the printer, assembly or operation as feedback is used in its continuous improvement process.

info@inventorcloud.net

Support via on-line ticket (recommended)

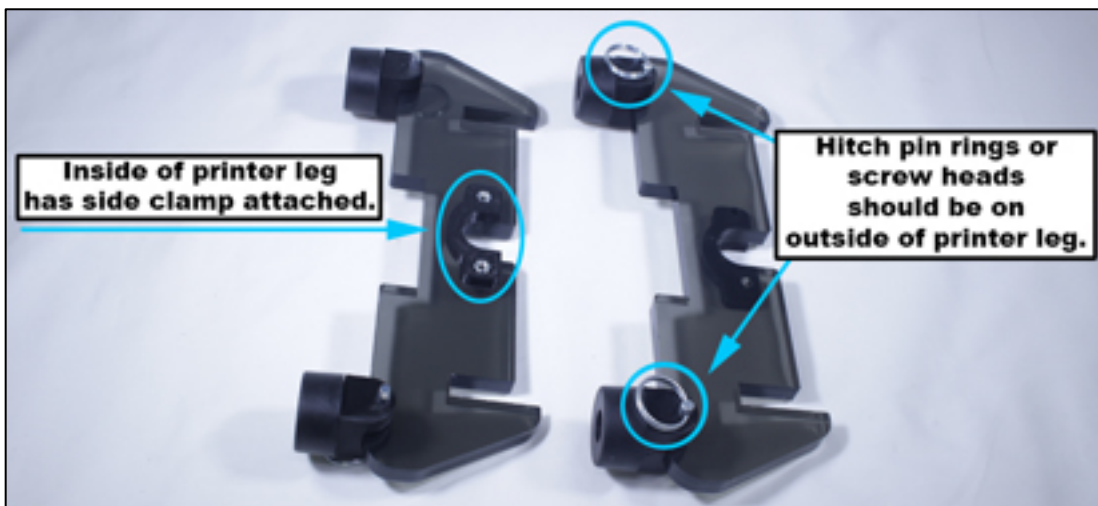
III. Detailed Assembly Instructions

**NOTE: Refer to Case Layer Drawings and Alphabetical Parts Listing to find parts referenced
Use tools in tool kit to assemble.**

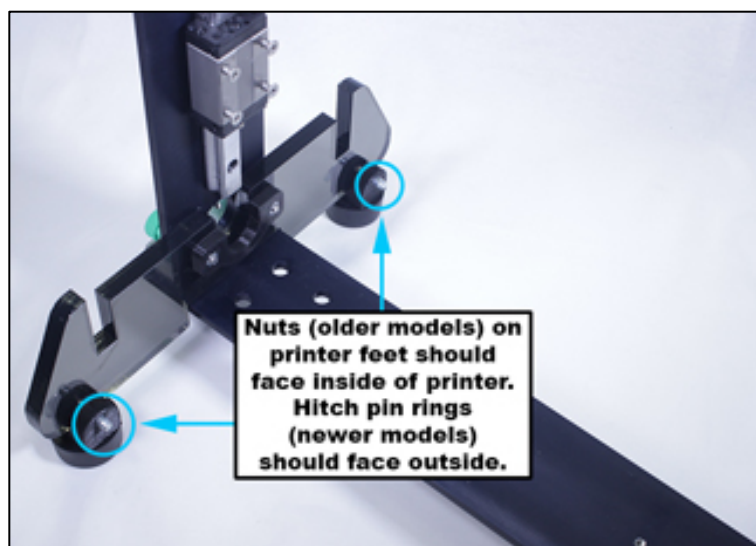
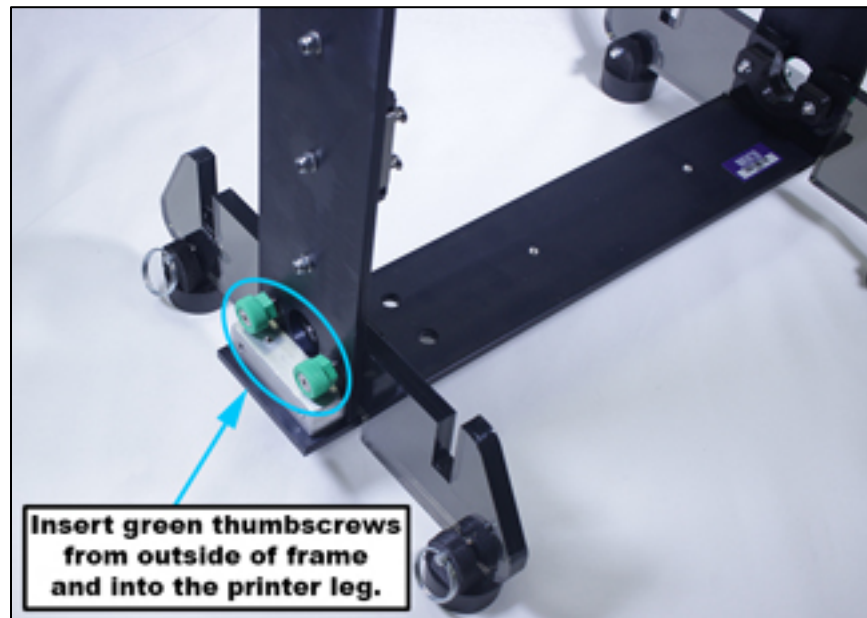
1. Connect the left side assembly and the right side assembly with the bottom plate using four M5 x 18 flat head screws from the z-axis plastic box



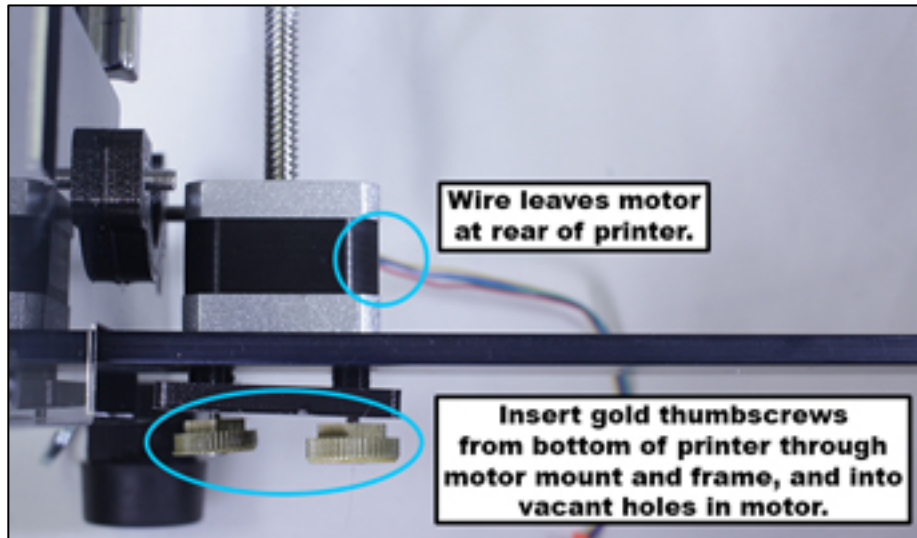
2. Connect printer feet to the printer legs. There are currently two variations of printer foot mounting hardware: hitch pins (newer models) or screws with lock nuts (older models).



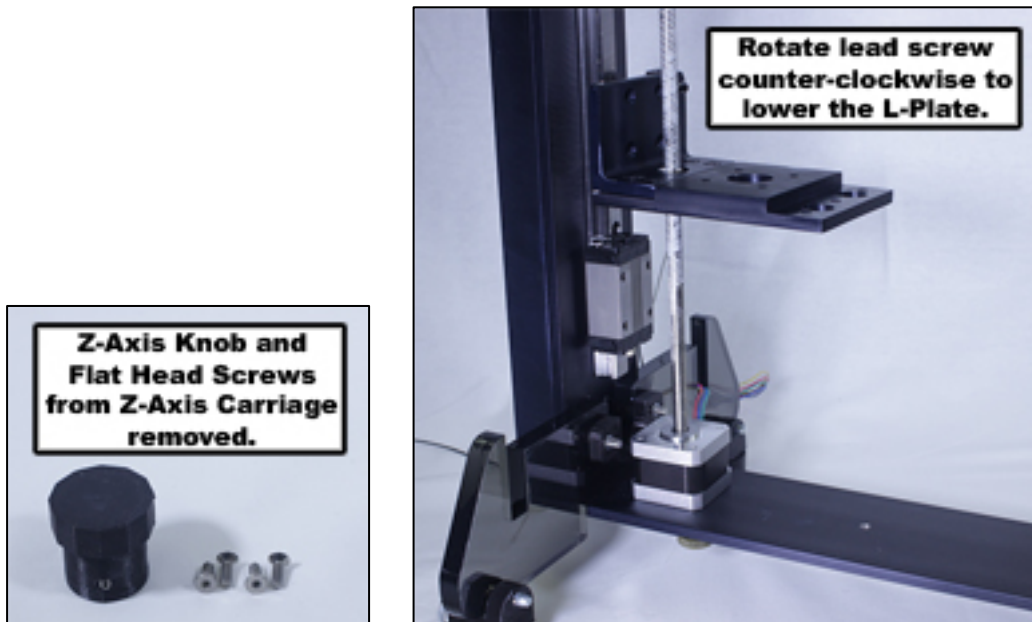
3. Remove left side channel by unscrewing the four black thumbscrews.
Screw the two green thumbscrews through the left side frame and into the printer leg until tight.
Re-attach the left side channel with the four black thumbscrews.
4. Repeat for right side channel.



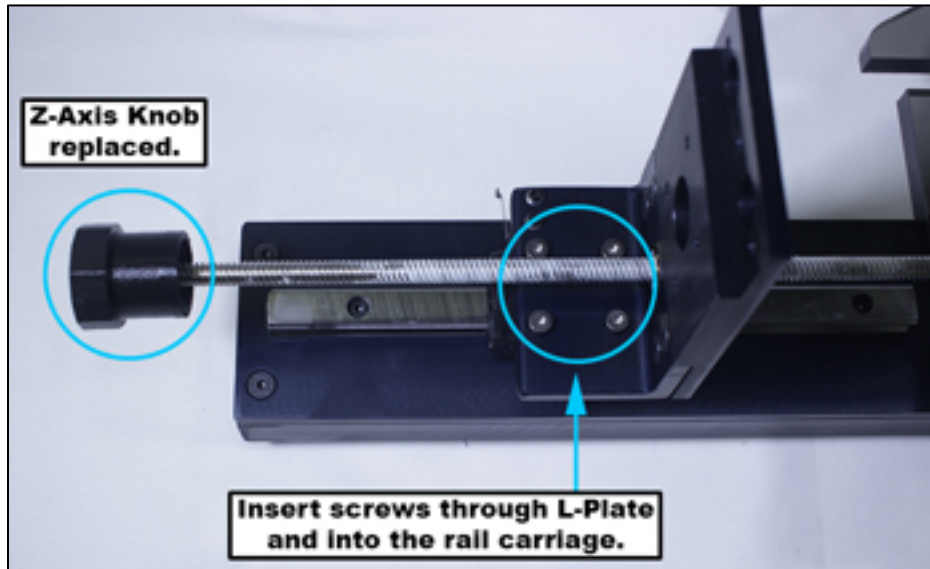
5. Mount the z-axis motor to the bottom plate using the two gold thumbscrews and the z-axis motor mount. **NOTE:** wire placement below! Wires leave motor from rear of printer.



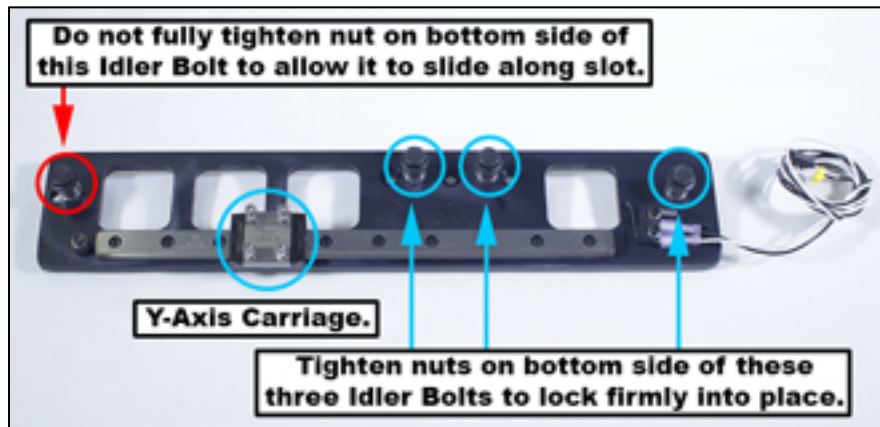
6. Remove the Z-axis knob by loosening the small set screw.
Remove the four screws from the z-axis carriage.
Thread the L-plate subassembly onto the z-axis lead screw and replace the z-axis knob.



7. Rest the printer assembly on its left side.
Align the L-plate with the holes on the carriage and insert the four screws removed in the previous step and tighten.



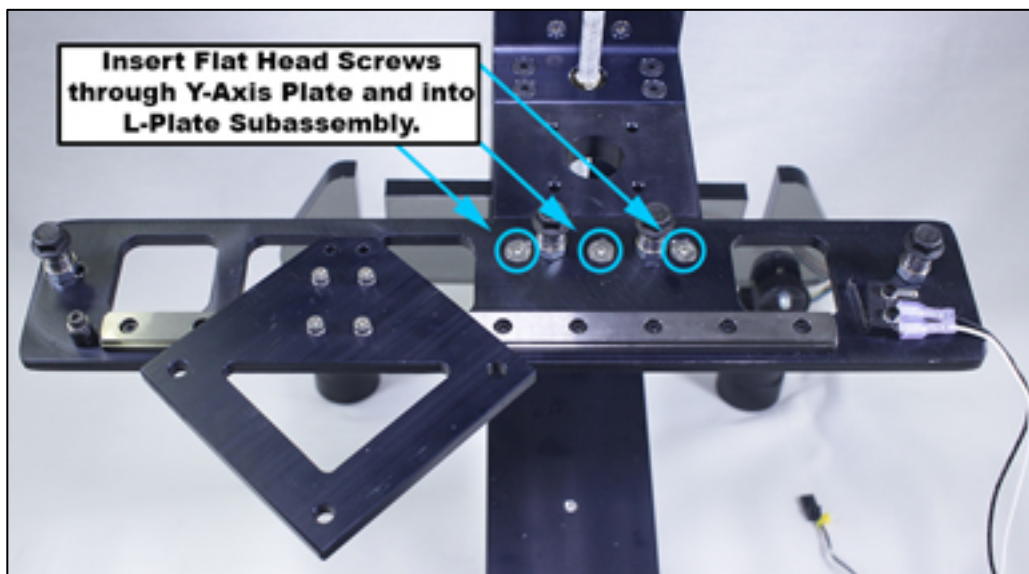
8. Attach the four idler bolts to the y-axis plate. **NOTE:** one nut is on each side of plate.



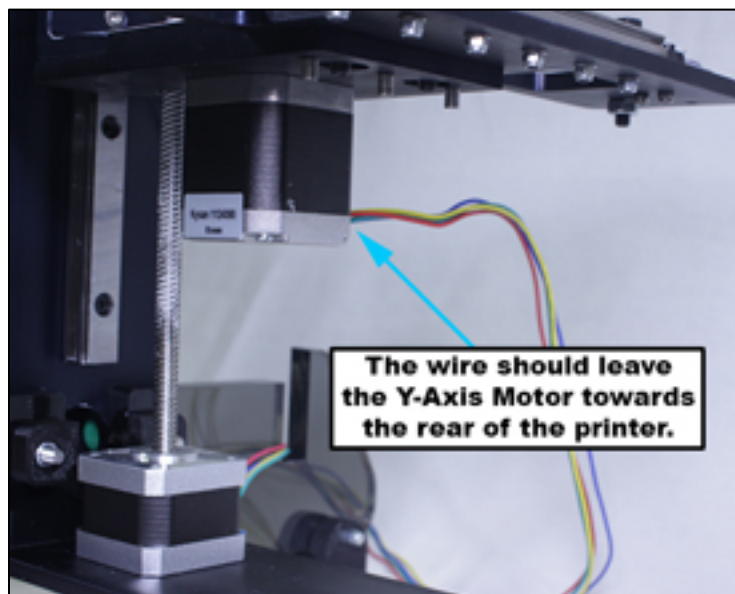
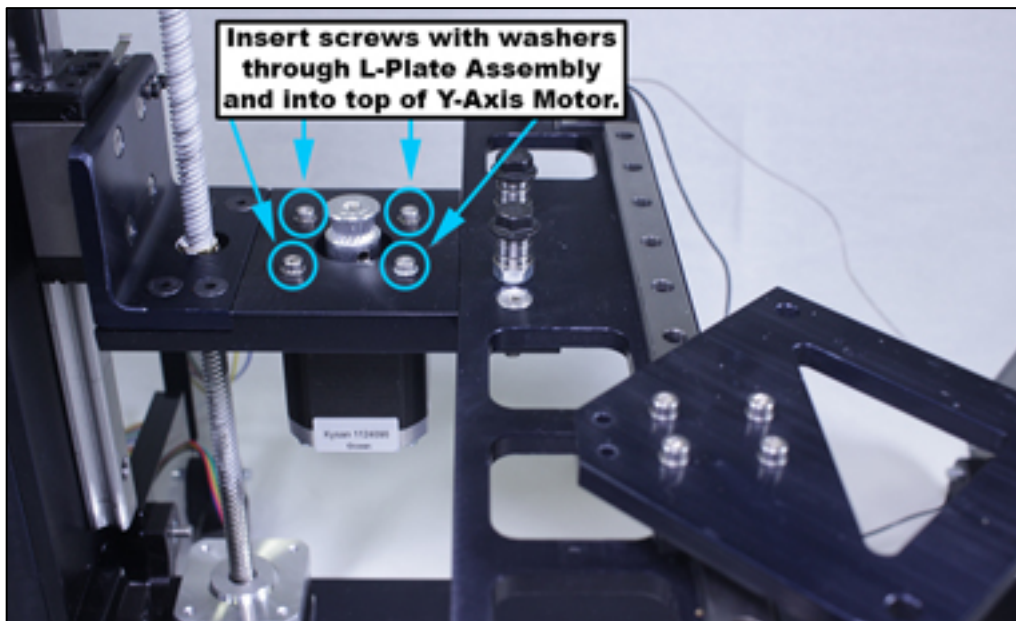
9. Remove four screws and lock washers from Y-axis carriage.
Align the diamond plate and attach to the carriage with the four screws.
NOTE: washers go on top of plate.



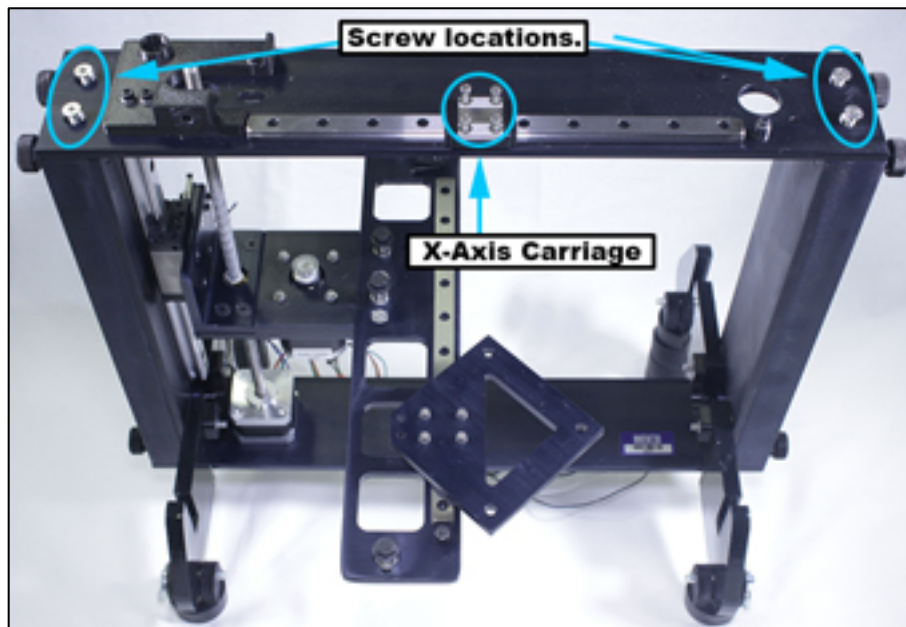
10. Attach the Y-axis plate to the L-plate using three M5 flat head screws from the Y-axis plastic box.



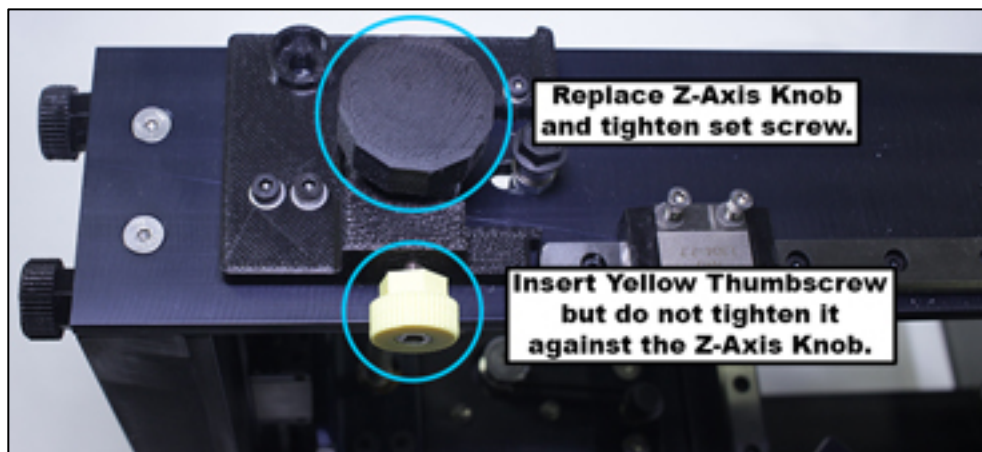
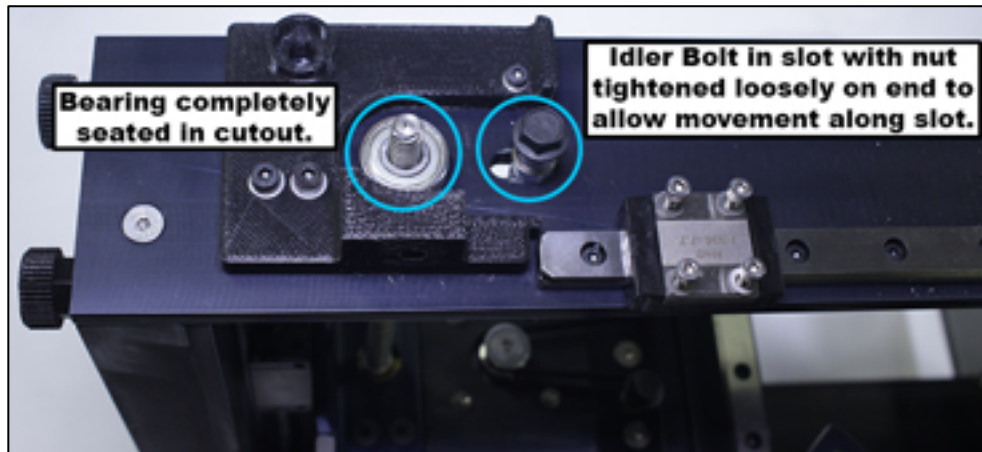
11. Attach the Y-axis motor to the L-plate assembly using screws found in Y-axis motor.



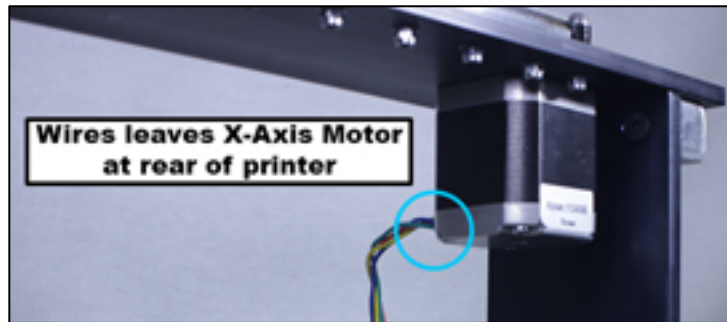
12. Remove the Z-axis knob and align the top plate. Connect the top plate to the left and right sides using M5 flat head screws found in the Z-axis plastic box.



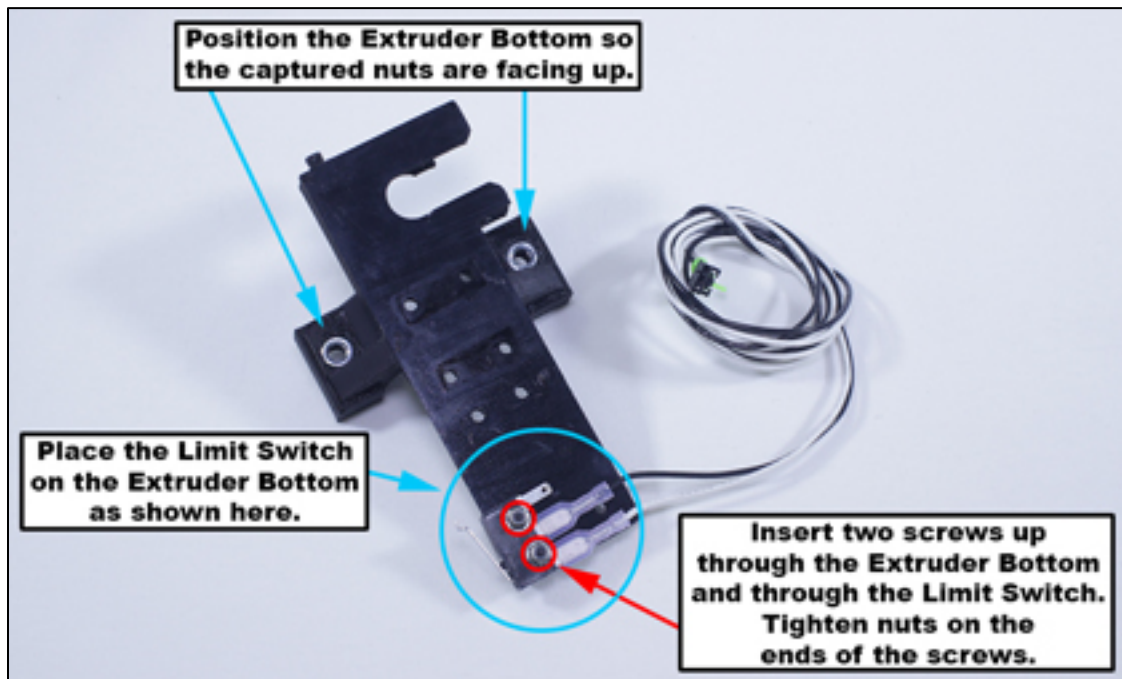
13. Take bearing from X-axis box and slide the bearing on the Z-axis lead screw.
Replace the Z-axis knob.
Insert the yellow thumb screw into the front to the Z-axis plate near the Z-axis knob.
Attach the idler bolt to the top plate.



14. Attach x-axis motor, making sure that the short screw is in the front left corner.

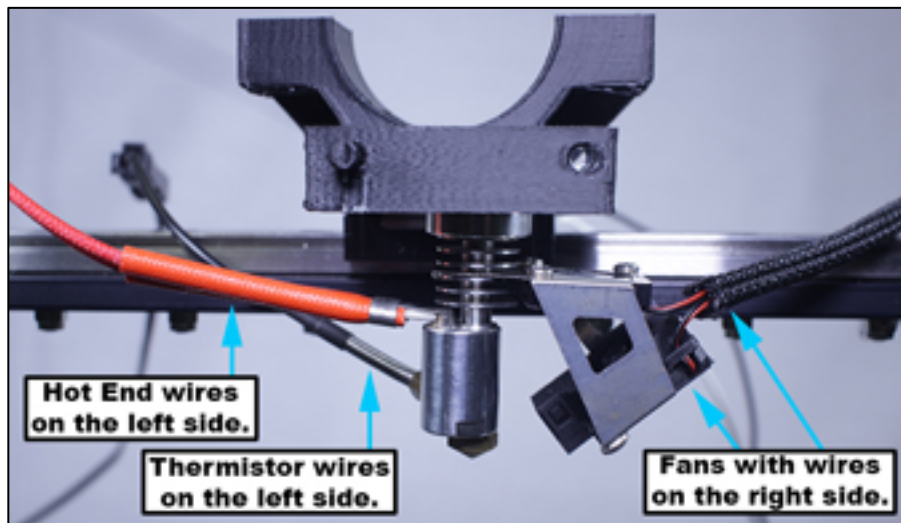
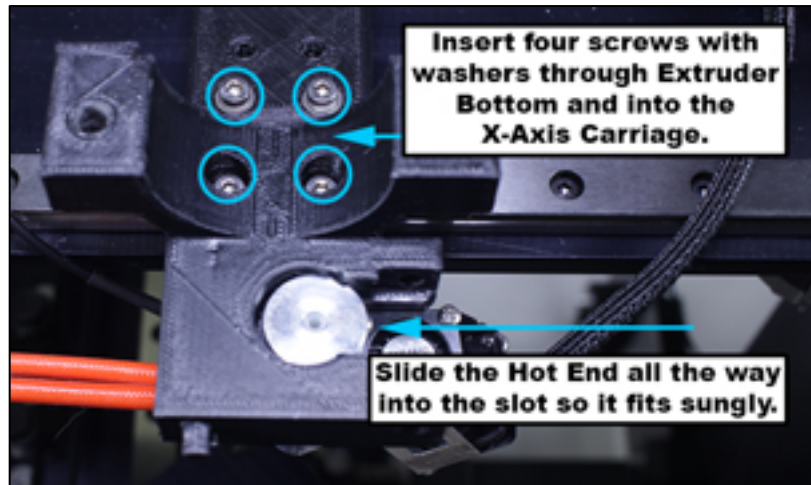


15. Attach X-axis limit switch to the extruder bottom. **NOTE:** Use pliers to tighten if needed.

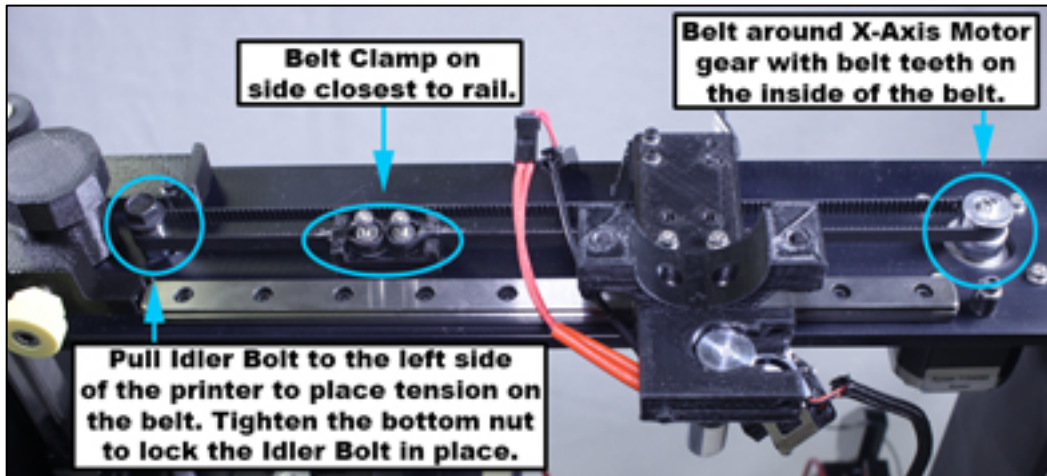


16. Attach the extruder bottom to the X-axis carriage using the four screws found in the X-axis carriage. (Refer to top of photo in first image under Step 17).

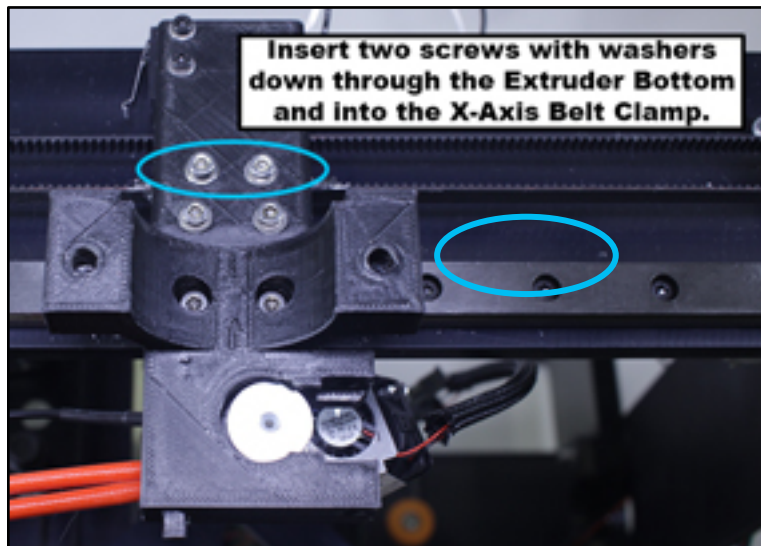
17. Slide hot end into the slot on the extruder bottom until it seats flush with the end of the slot. Refer to both photos below.



18. Connect X-axis belt to the X-axis motor and idler bolt. **NOTE:** belt teeth face inwards. Tighten the belt by sliding the idler bolt back and tighten with wrench. Check tension on the belt – there should be some resistance with squeezing the belt together with your fingers.



19. Remove the screws from the belt clamp. Align the holes in the belt clamp with those in the extruder bottom. Reconnect the extruder bottom to the belt clamp with screws previously removed.



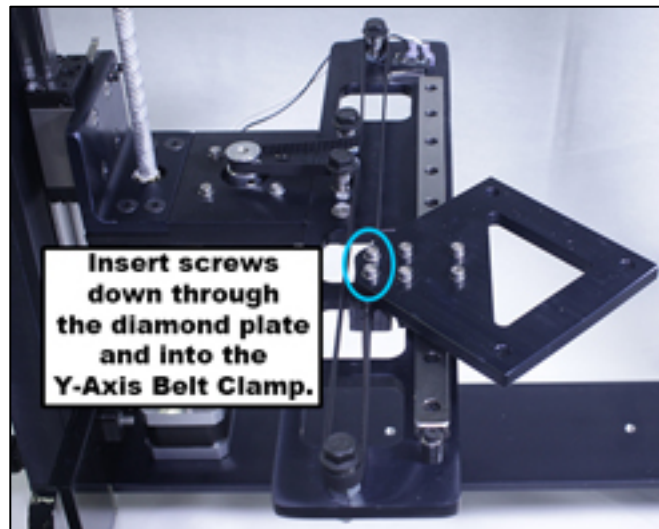
20. Connect the Y-axis belt to the Y-axis motor and idler bolts. NOTE: belt goes around all FOUR idler bolts and Y-axis motor.
Tighten the belt by sliding the slotted idler bolt back and tighten.

Tighten the belt by sliding the slotted idler bolt back and tighten.

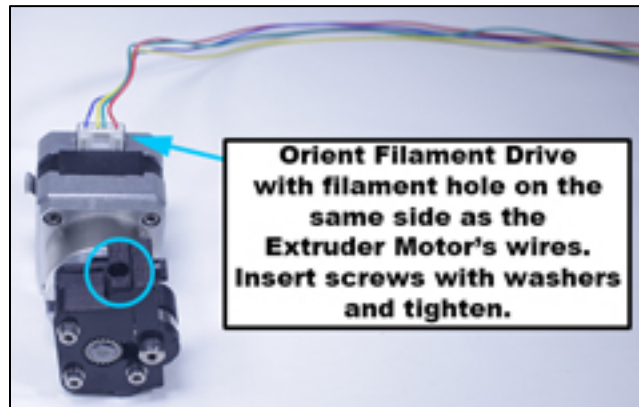
Check tension on the belt – there should be some resistance with squeezing the belt together with your fingers.



21. Remove the screws from the Y-axis belt clamp.
Align the diamond plate with the holes in the belt clamp.
Replace the screws and tighten.

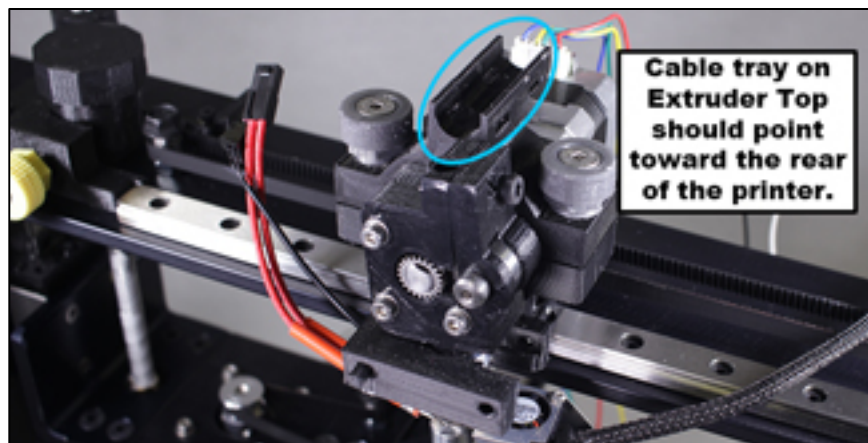


22. Attach the filament drive to the extruder motor.

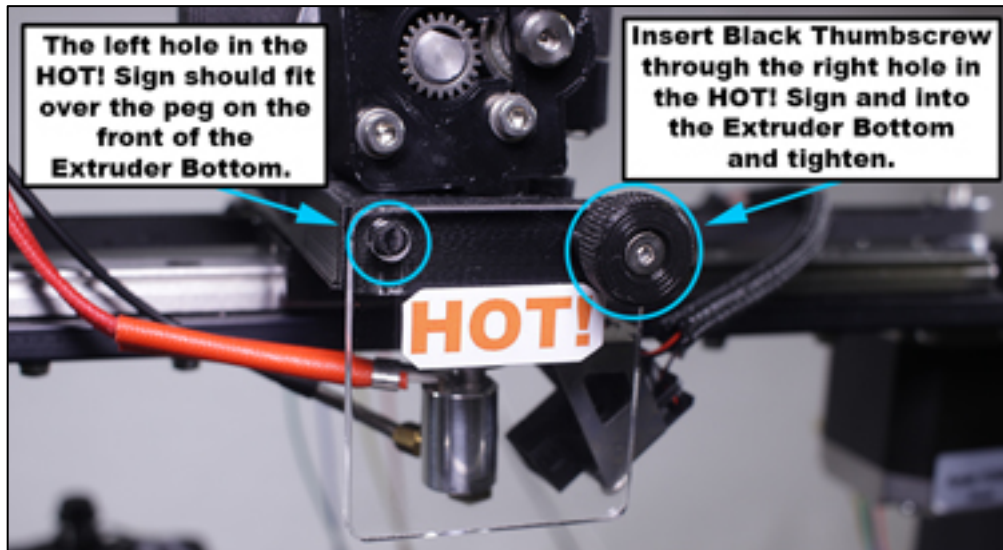


23. Place the extruder motor onto the extruder bottom.

Secure the extruder top over the extruder motor using the two silver thumbscrews found in the X-axis box.



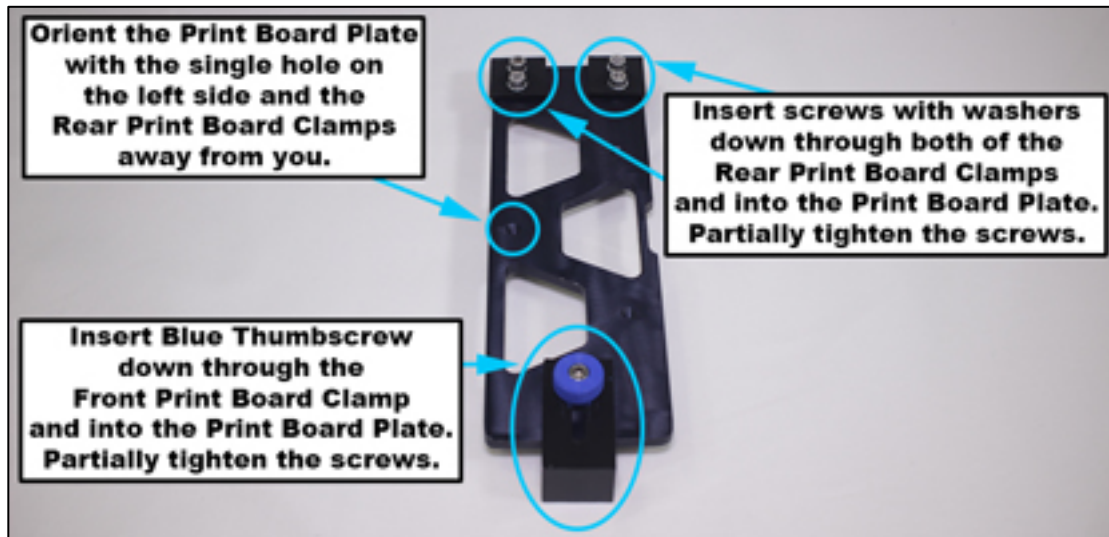
24. Attach the HOT! sign using the long black thumbscrew found in the X-axis box.



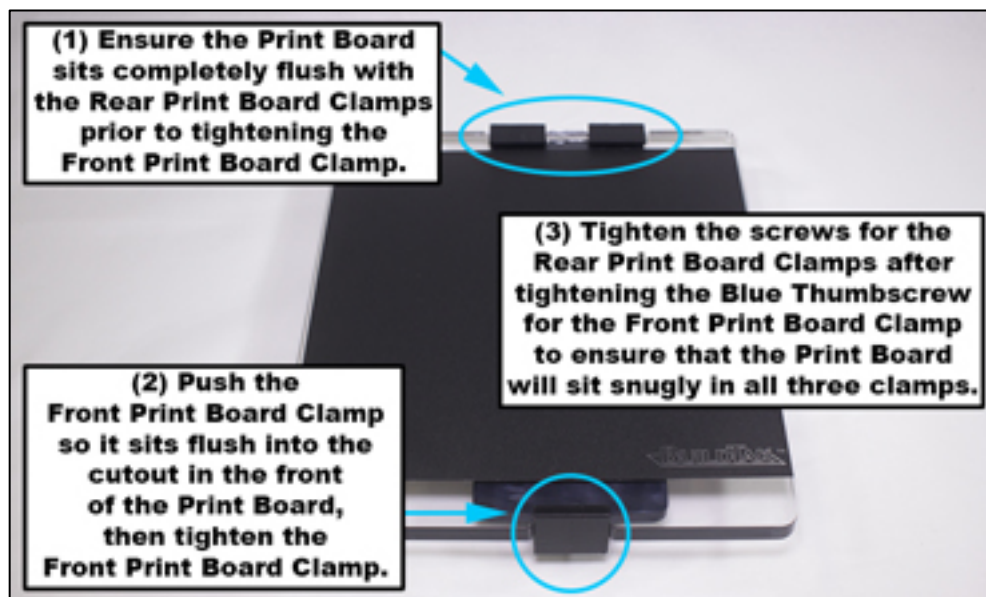
25. Remove the three red thumbscrews, three wave springs, and print board spacer from the print board plate, taking note of their orientation and how they fit together.



26. Attach the rear board clamps to the print board plate and hand tighten.
Attach the front board clamp using the blue thumbscrew.

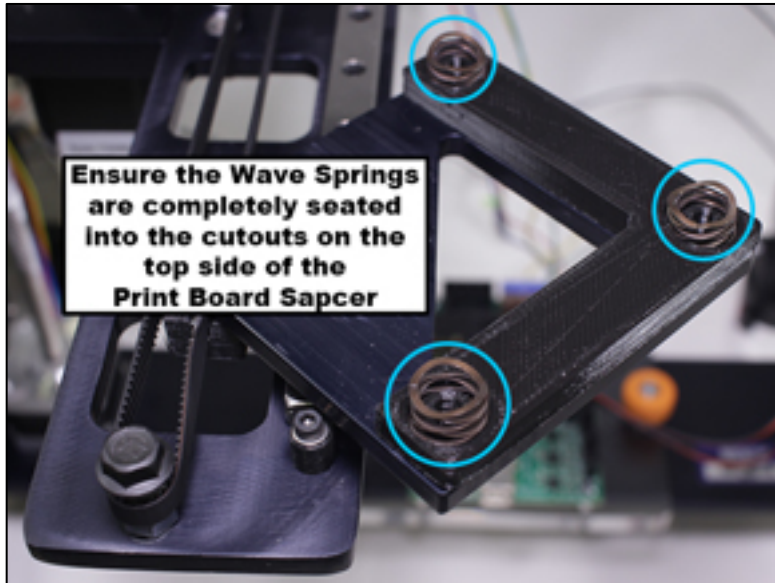


27. Slide the print board into the rear clamps on the print board plate until the print board is completely seated into the rear clamps.
Slide the front clamp into the notch on the front of the print board and tighten.
Tighten screws in rear clamps to lock clamps into place.
Loosen the blue thumbscrew and remove the print board.



28. Place the print board spacer onto the diamond plate and align the three holes. Insert the three wave springs into the print board spacer.

NOTE: Wave springs fit in recessed areas on print board spacer.



29. Place print board plate over the three wave springs; ensure they remain seated.
Insert and tighten all three right red thumbscrews so their ends are about flush with the top of the print board plate.

PHOTO TAKEN FROM ABOVE PRINTER, LOOKING DOWN

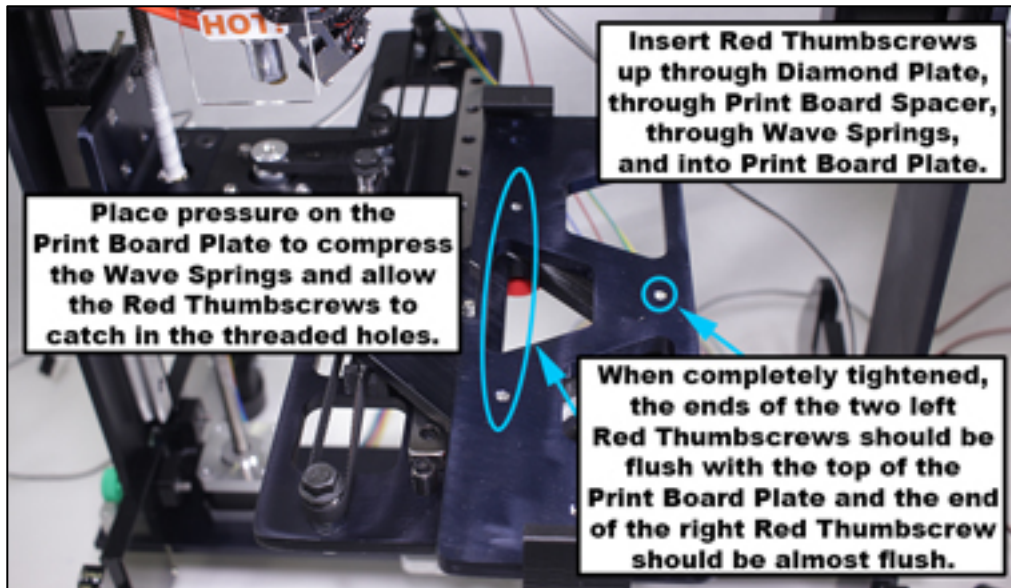
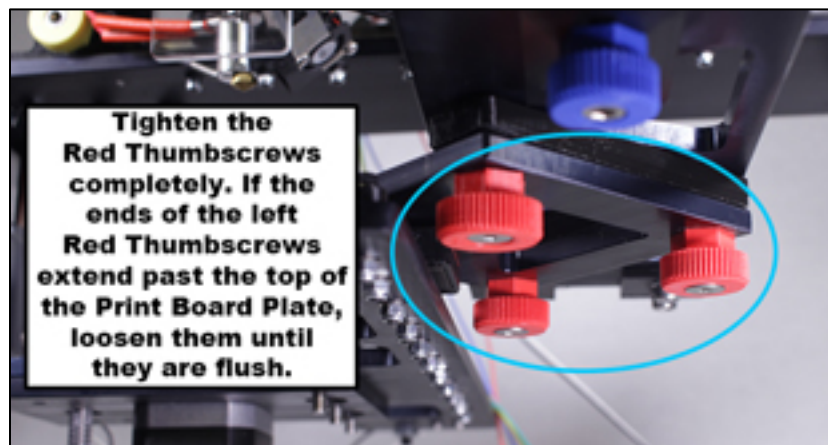
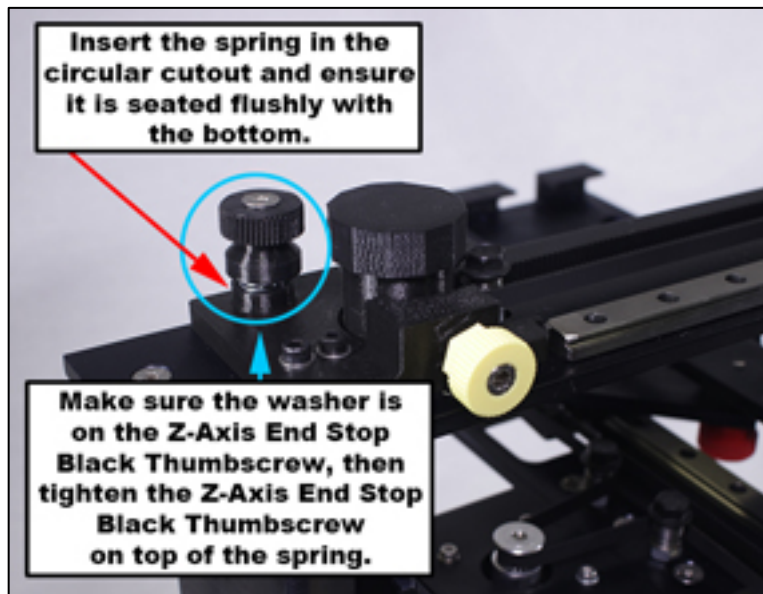


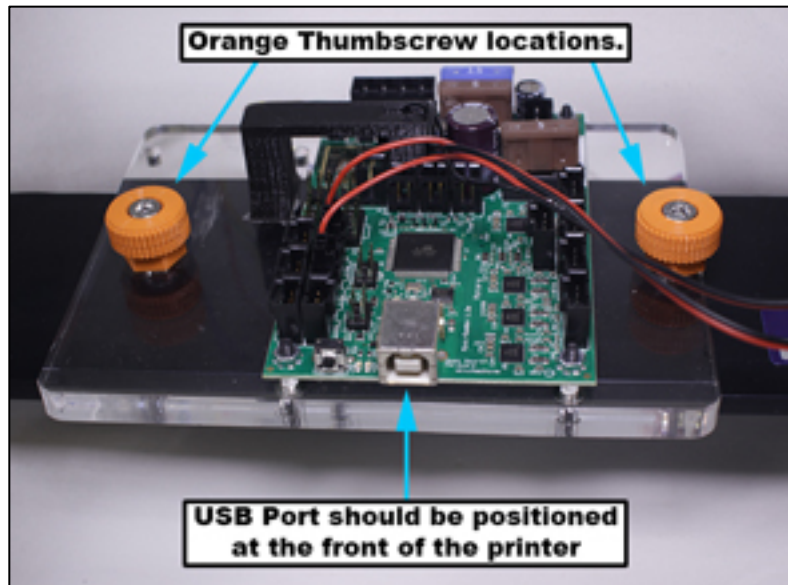
PHOTO TAKEN FROM BELOW PRINTER, LOOKING UP



30. Insert the z-axis end stop into the top plate and tighten it until about 1" extends below the top plate.

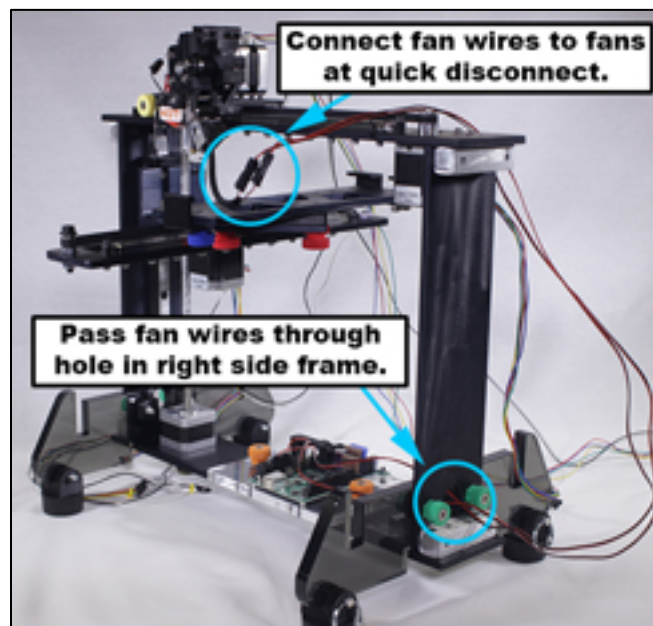


31. Attach the RAMBo board with using the two orange thumbscrews.



32. Untangle all wires. Remove the right channel. Pass the fan wires from the RAMBo board, through the hole in the right side frame, and connect to the hot end fans.

NOTE: Fan wires may be black or red and black.



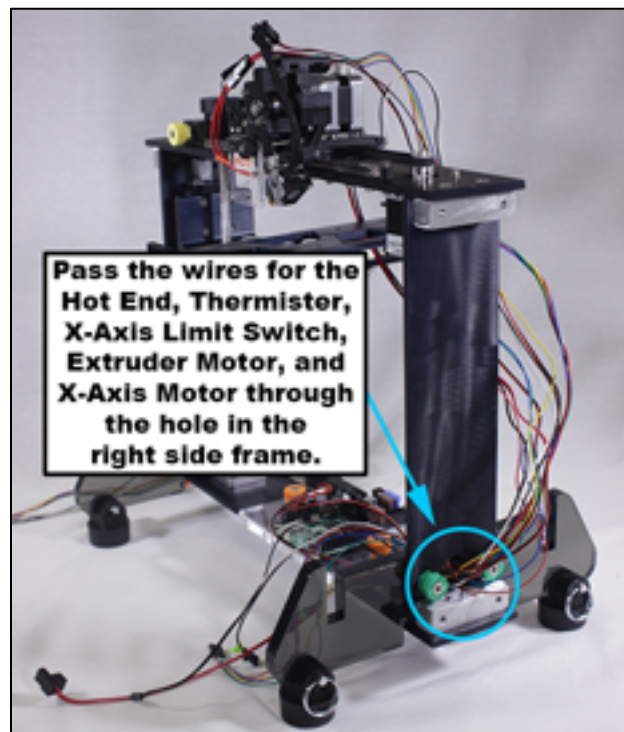
Pass right side wires (hot end wire, thermistor wire, fan wires, extruder motor wire, x-axis limit switch wire, x-axis motor wire) through the hole in the right side frame.

NOTE:

Limit Switch wires are black and white, Motor wires are red, green, yellow, and blue.

The source of the wires can be identified by the color of the zip tie near the plug.

- | | |
|--------------------------|----------------|
| X Limit Switch and Motor | green zip tie |
| Y Limit Switch and Motor | yellow zip tie |
| Z Limit Switch and Motor | orange zip tie |
| Extruder Motor | white zip tie |



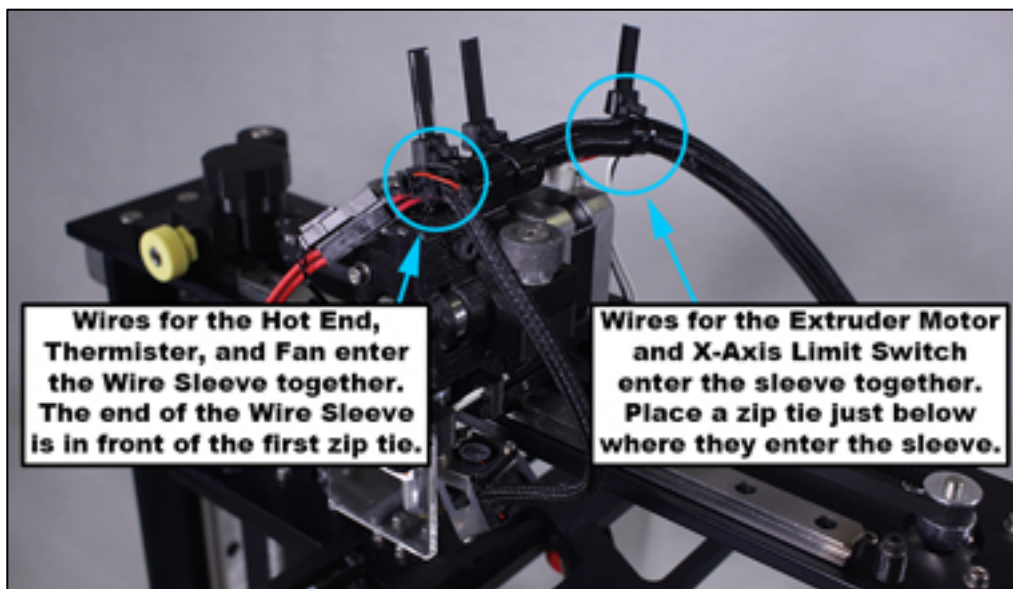
Group hot end wires together and insert into the longer wire sleeve (it is sliced lengthwise) just past the quick disconnects until approximately 3" of wire are inserted.

Pass zip ties through slots in extruder top and tighten to fasten wire sleeve in place.

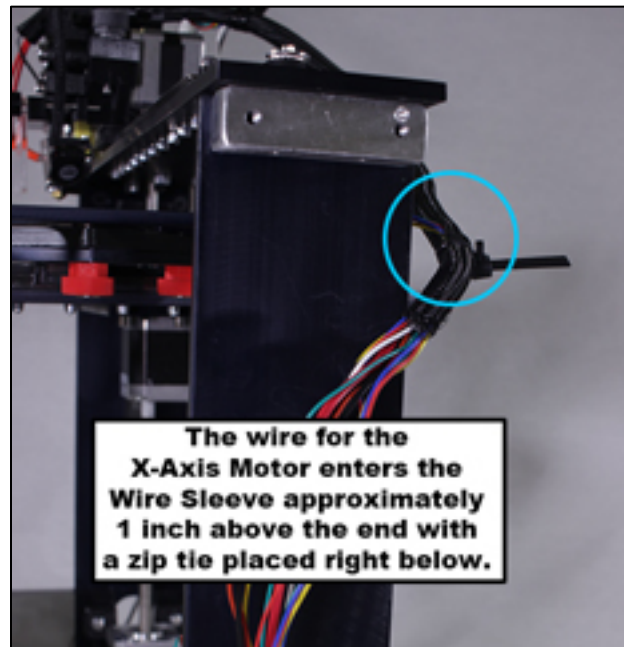
Insert the extruder motor wire and x-axis limit switch wire into the wire sleeve until approximately 3" of wire are inserted.

Attach zip tie where extruder motor and x-axis limit switch wires enter the wire sleeve.

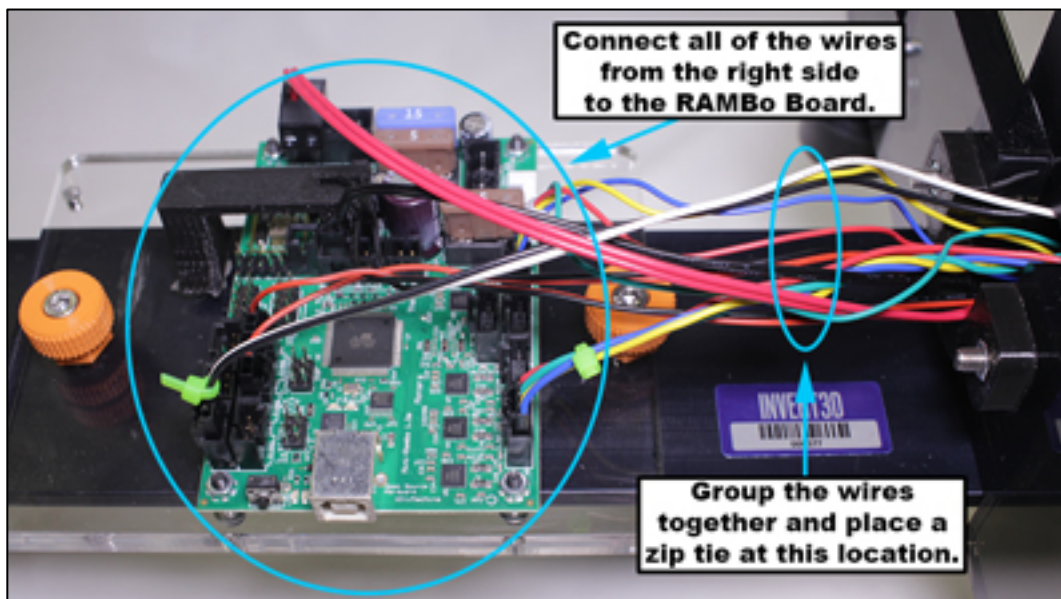
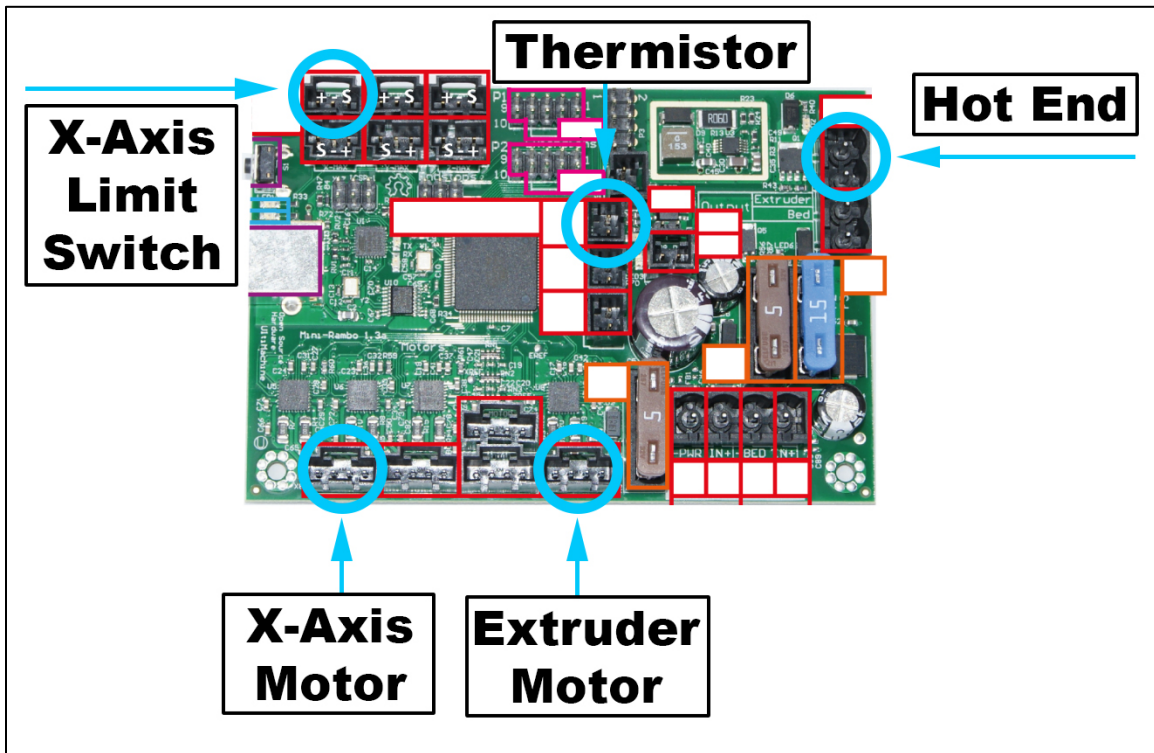
Insert all wires for the remaining distance of the sleeve.



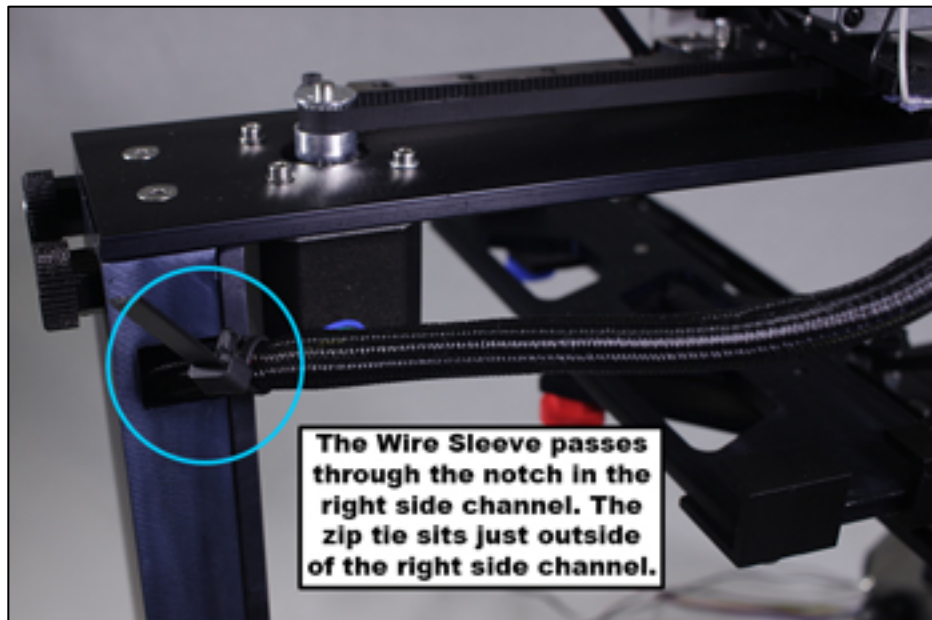
Insert the X-axis motor wire for the last 1" of the sleeve and secure with a zip tie.



Plug all wires into appropriate places on the RAMBo board. Place a zip tie around the right side wires near the RAMBo board.



Replace the right side channel ensuring that the wires pass through the notch at the top.



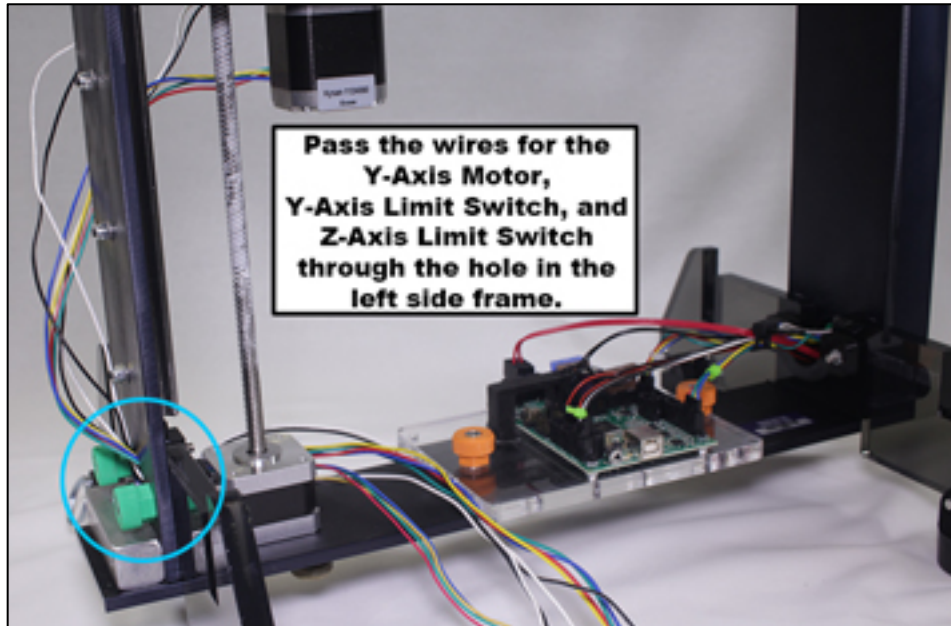
33. Remove left side channel.

Pass left side wires (y-axis motor, y-axis limit switch, z-axis limit switch) through the hole in the left side frame.

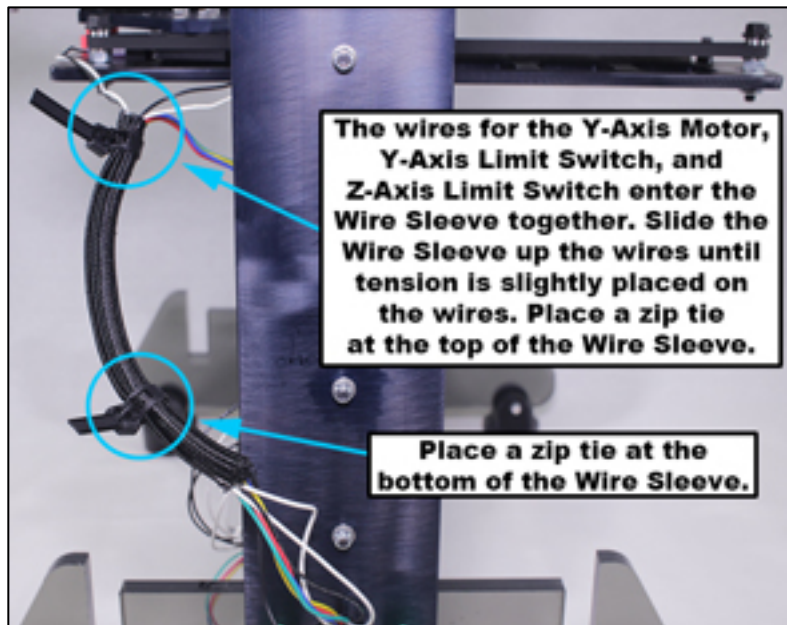
NOTE:

Limit Switch wires are black and white, Motor wires are red, green, yellow, and blue. The source of the wires can be identified by the color of the zip tie near the plug.

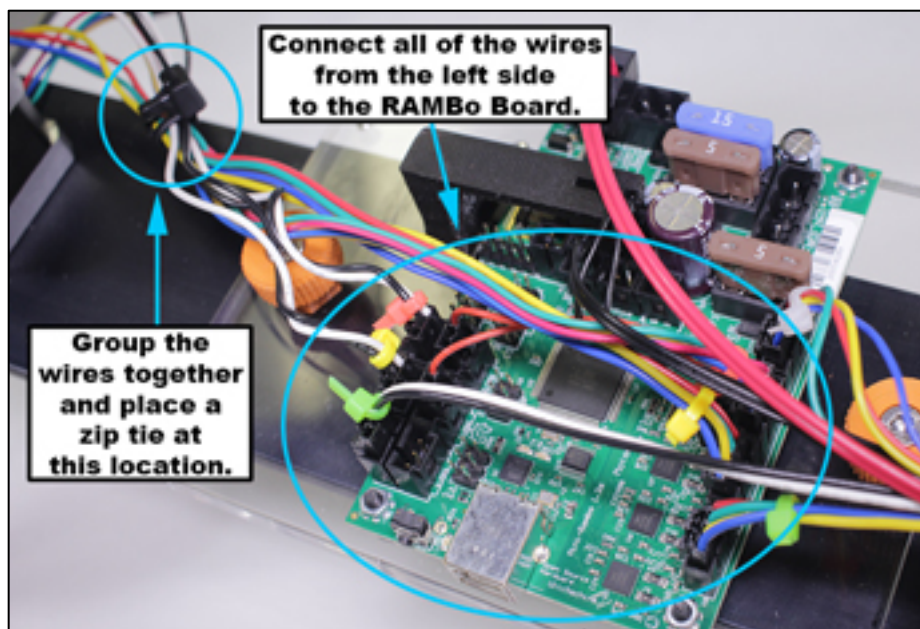
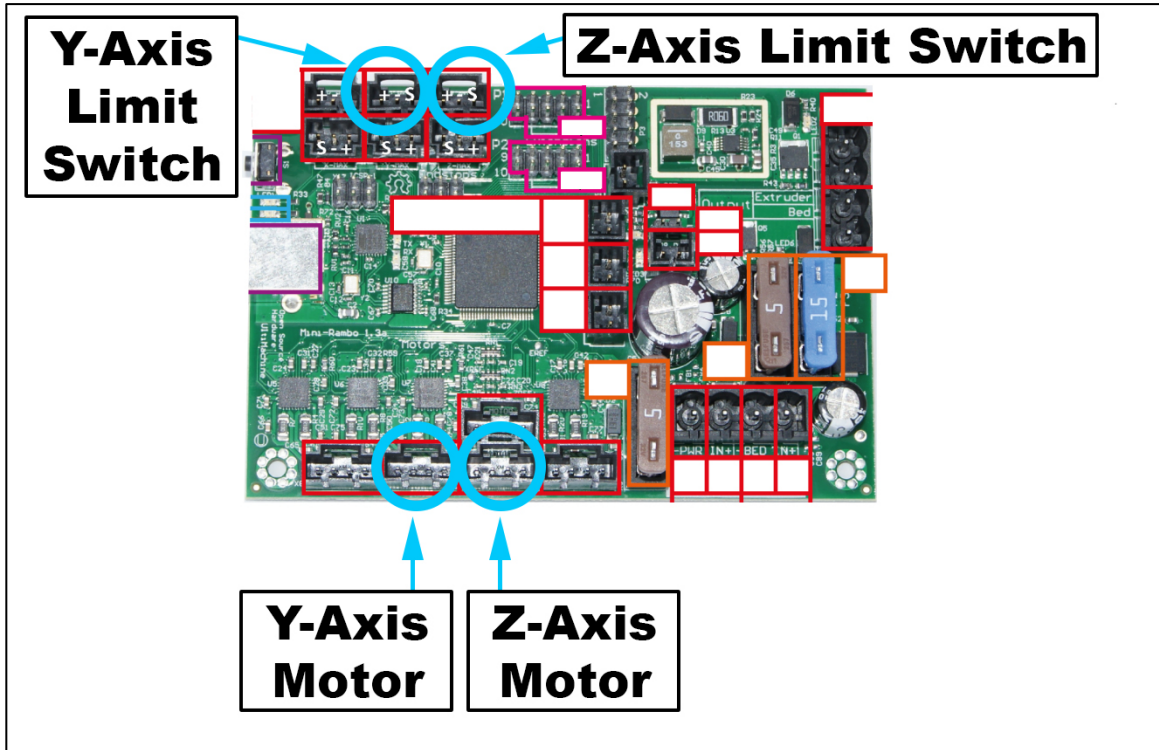
- X Limit Switch and Motor green zip tie
- Y Limit Switch and Motor yellow zip tie
- Z Limit Switch and Motor orange zip tie



Insert the three wires into the shorter wire sleeve (sliced lengthwise). Attach a zip tie on each end of the sleeve.



Plug left side wires and Z-axis motor wire, into appropriate locations on RAMBo board. Neatly arrange the wires and secure with zip tie near their connection to RAMBo board. Pull excess wire though left side frame and slide wires in the slot between the Z-axis motor and left frame.

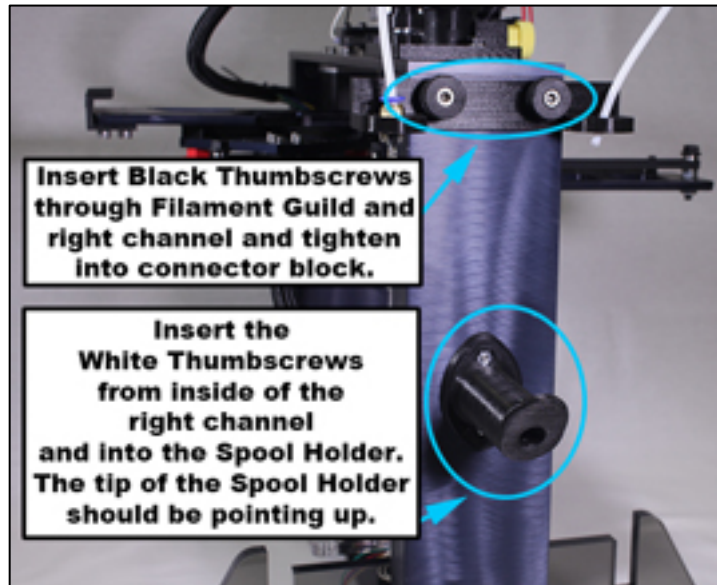


34. Attach the spool holder to the left side channel using the white thumbscrews.

Replace the left side channel and attach filament guide on top at same time.

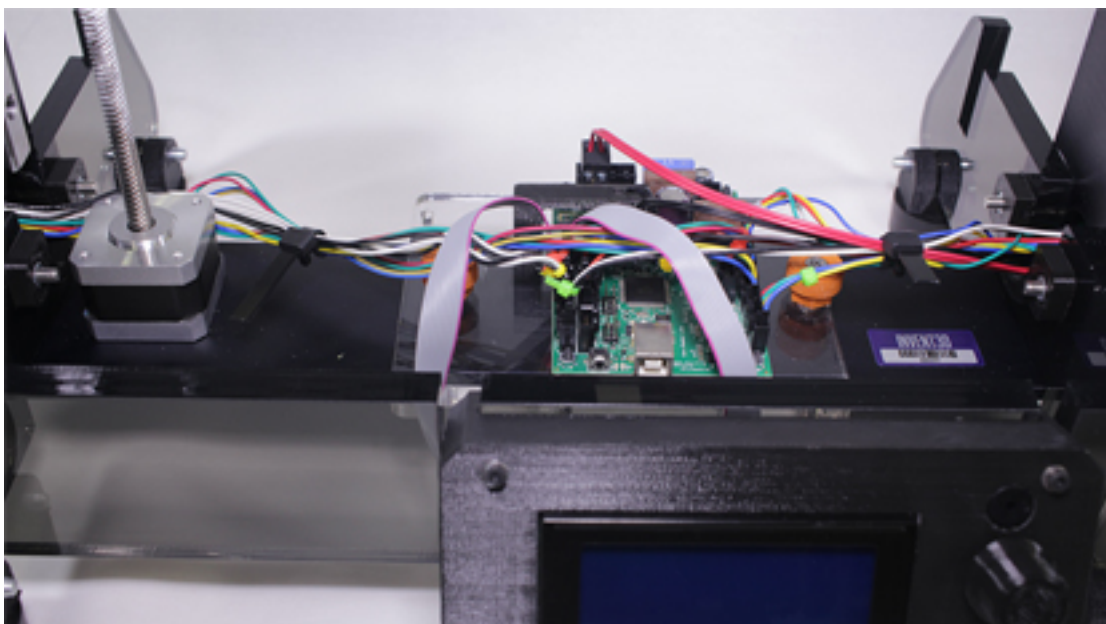
Ensure that wires cleanly pass through the notch in the channel without pinching.

The zip ties should be on the outside.

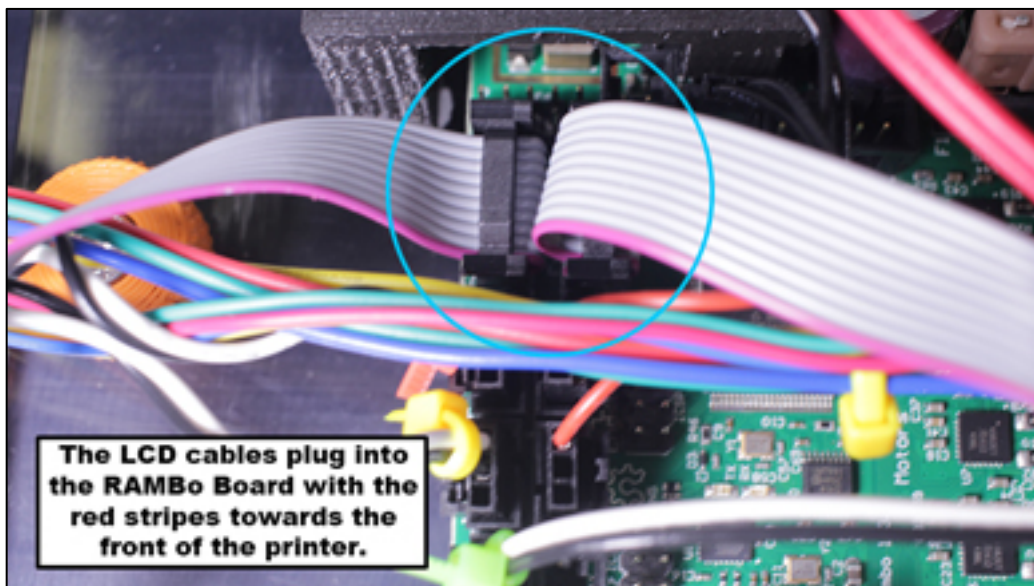
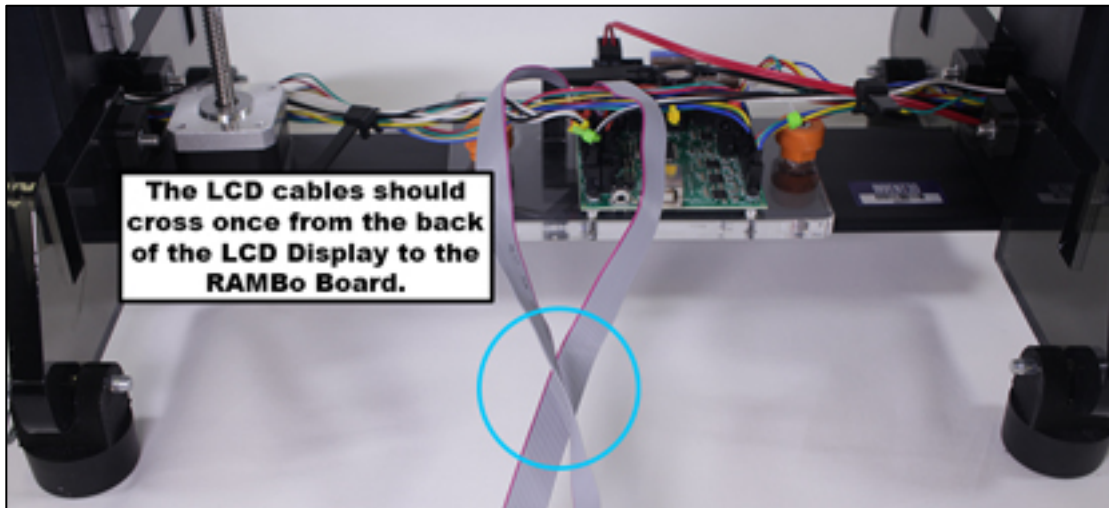
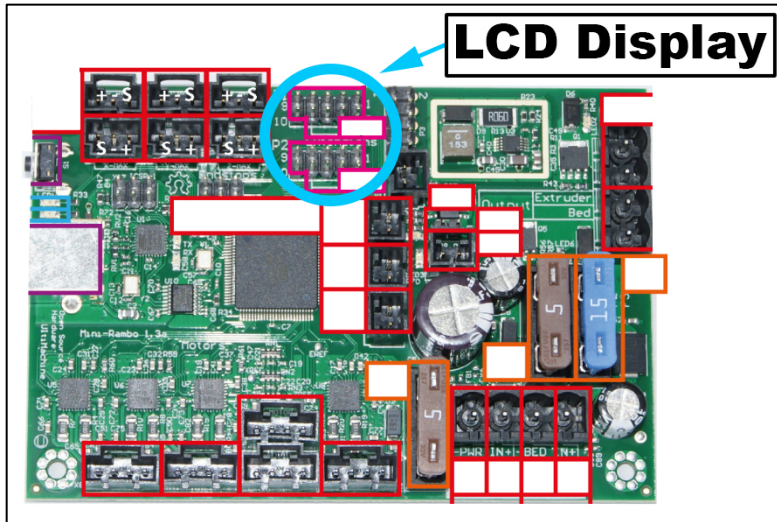


35. Place front acrylic cover into the slots on the printer legs.

Place LCD into the slots on the front cover.



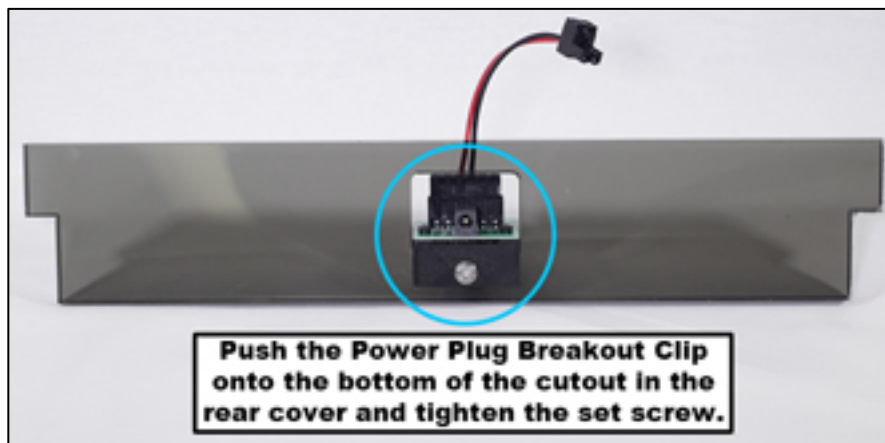
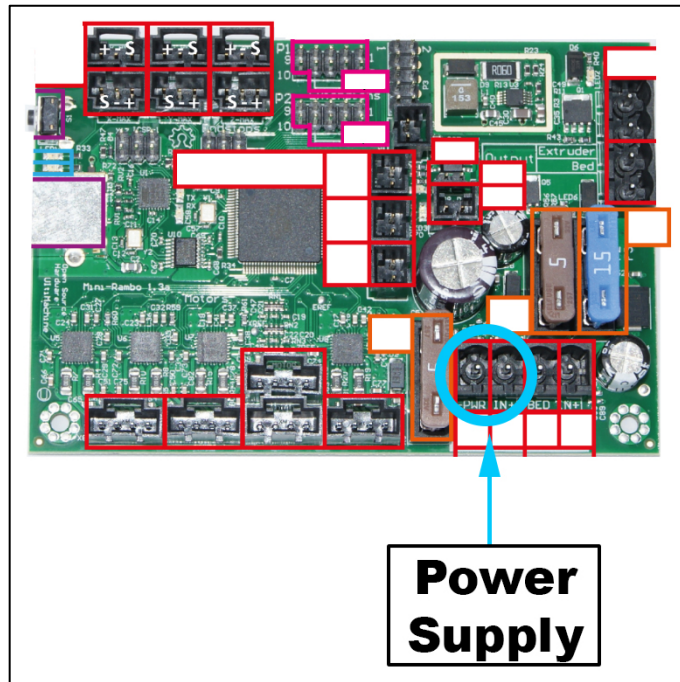
36. Cross the LCD gray wires (bottom picture).
Plug the LCD gray wires into the RAMBo board (diagram and picture on next page).



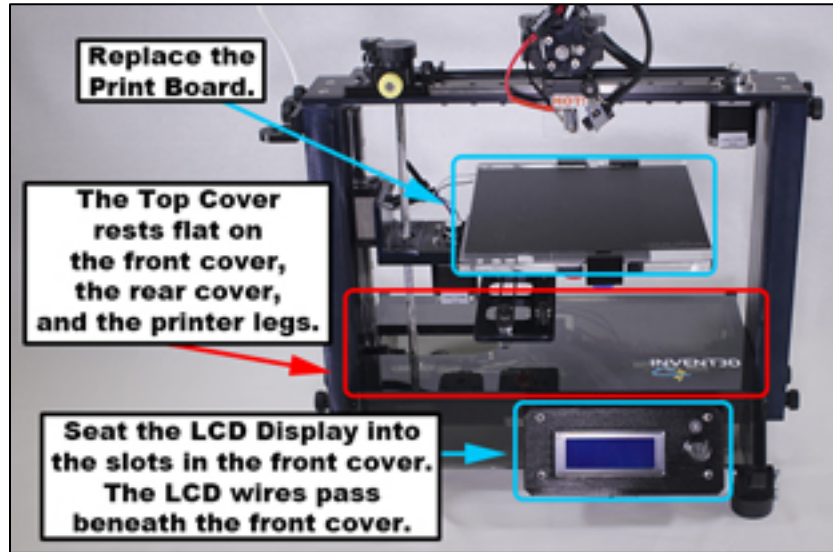
37. Attach the power plug breakout board to the rear cover.

Insert the rear cover into the slots on the printer legs.

Plug the power plug breakout board wire into the RAMBo board.



38. Replace the print board onto the print board plate by inserting it completely into the rear clamps, then press the front board clamp tightly against the print board and tighten the blue front board clamp thumbscrew.
39. Place top cover onto the printer legs.

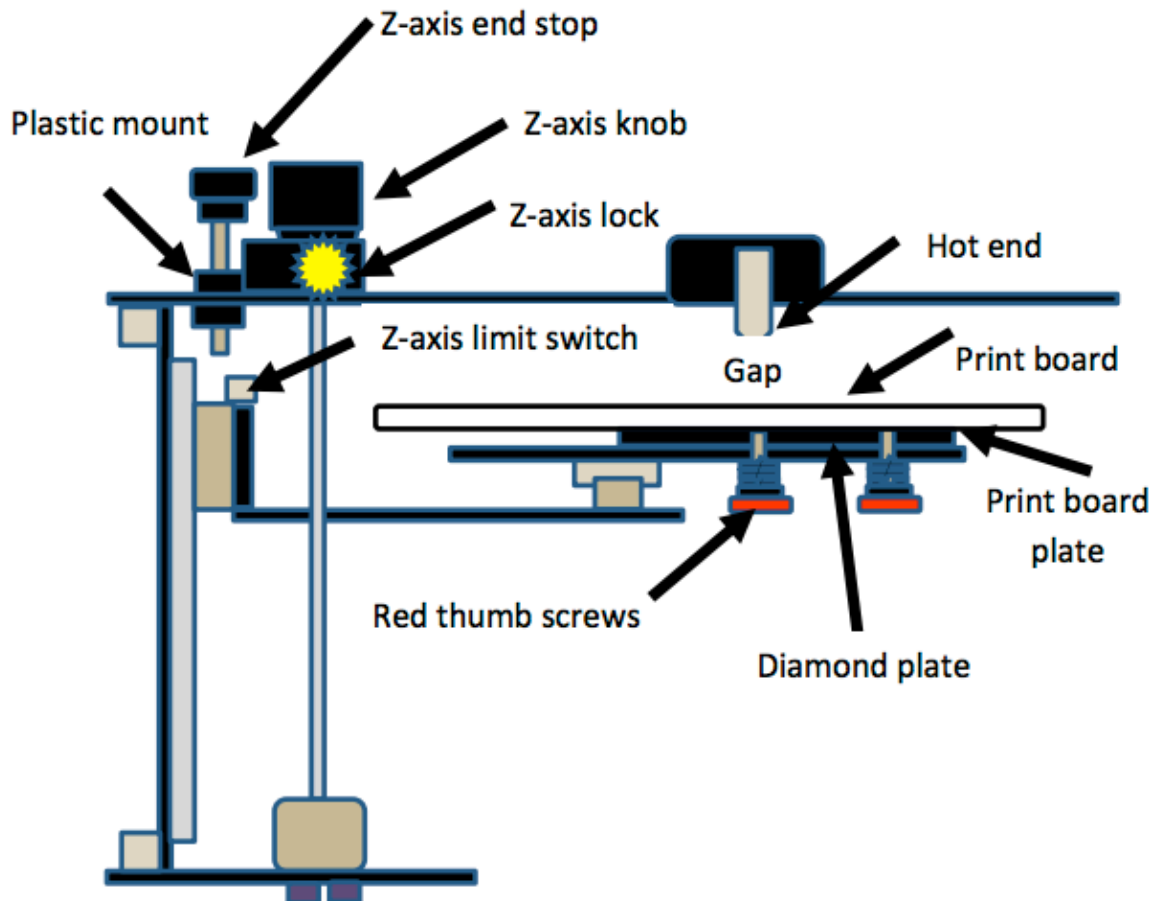


40. Plug AC adapter into the back of the printer.

Printer Board Leveling Process

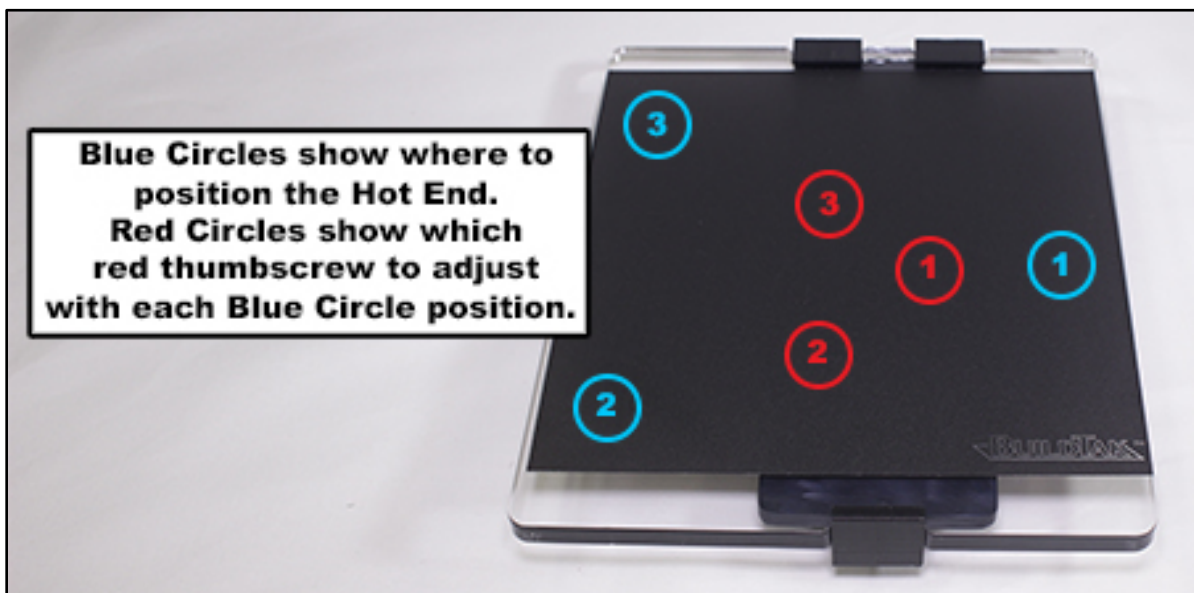
The print board's level is determined by the three red print board leveling thumbscrews located below the print board and the one black Z-axis end stop screw located on the top, at the back left (it is the smaller black screw). The three red print board leveling thumbscrews let you adjust the tilt of the print board side-to-side and front-to-back. The black Z-axis end stop screw lets you adjust how close the print board can get to the hot end. You are calibrating the hot end to be two print layers away from the board (approximately 0.2 mm) which is sufficiently measured by using a normal business card or index card.

NOTE: Be safe – only level the print board when the hot end is cold. Print board leveling should never be performed when the hot end is hot as it can permanently damage the print board.



- a) Remove the print board.
- b) Visually locate the ends of the red thumbscrews in the print board plate.
- c) Tighten all three red thumbscrews until they are flush with top side of the print board plate.
- d) Loosen each red thumbscrew 1 ½ turns. Confirm that each screw is recessed the same amount below the surface of the print board plate. **NOTE:** If you are having difficulty determining how much to turn the red thumbscrews, re-tighten all three red thumbscrews until they are flush with the top of the print board plate, then place a mark on the right side of each red thumbscrew.
- e) Grab the print board plate and gently wiggle it up-and-down and back-and-forth to make sure the wave springs are properly seated in the print board spacer, and to check for any loose screws missed during assembly. Tighten any screws that feel loose.
- f) Install the print board by pressing it firmly into the rear print board clamps, then press the front board clamp firmly against the print board, and finally secure the front print board clamp by tightening the blue thumb screw located below the print board.
- g) Loosen the Z-axis end stop screw so that the end of the screw extends no more than ½” from the bottom side of the top plate.
- h) Place a business card or index card (approximately 0.2mm) on the print board.
- i) Move the hot end and the print board so that the hot end is located directly over the center of the print board. Using the Z-axis knob, lift the print board until the card is just slightly trapped by the hot end. The card should be moveable with only slight resistance. **NOTE:** Try to not press down on the print board when moving the card as this will make the gap between the hot end and the print board appear larger than it is. (If the Z-axis end stop screw prevents you from lifting the print board high enough, go back and redo Step G above.)
- j) While holding the Z-axis knob, hand tighten the yellow Z-axis lock thumbscrew to lock the print board so it can't move up or down along the Z-axis.

- k) Move the hot end and print board to position the hot end at Blue Circle 1 in the picture (approximately 1" from the right side of the print board). Using the card, measure the gap between the hot end and the print board. Adjust only the right red thumbscrew (Red Circle 1) until the card is moveable with only slight resistance.
- l) Repeat Step K above, moving the hot end to Blue Circle 2 in the picture (approximately 1" from the left side of the print board) and adjust only the front red thumbscrew (Red Circle 2).
- m) Repeat Step K above, moving the hot end to Blue Circle 3 in the picture (approximately 1" from the left side of the print board) and adjust only the rear red thumbscrew (Red Circle 3).



- n) Repeat the last three steps with each red thumbscrew to confirm that you have a consistent gap between the hot end and the print board in all three locations.
- o) Gently press and release the Z-axis limit switch and listen for it to click. Now slowly tighten the Z-axis end stop screw until you hear it press the Z-axis limit switch and make it click.
- p) Loosen the yellow Z-axis lock thumbscrew, then use the Z-axis knob to lower the print board a few inches.

q) To check the adjustment of the Z-axis limit switch:

1. Press the LCD button; menu will display.
2. Go to “Prepare” and select; menu will display.
3. Go to “Auto Home” and select.
4. The hot end and print board assembly will move to 0,0,0 position. **NOTE:** If you hear any noise, stop and troubleshoot. Causes may include: belts may not be aligned, yellow thumbscrew not released, may need to apply grease to Z-axis lead screw, end stop switches are not functioning properly, etc.
5. Tighten the yellow Z-axis lock thumbscrew to lock the print board so it can't move up or down along the Z-axis.
6. Press LCD button; menu will display.
7. Go to “Prepare” and select; menu will display.
8. Go to “Disable Steppers” and select. This will allow you to move the hot end and print board to check the gap with the card. The card should be moveable with only slight resistance.
9. If the gap is correct, you're done. If the gap is too tight, turn the Z-axis end stop screw $\frac{1}{4}$ turn clockwise. If the gap is too large, turn the Z-axis end stop screw $\frac{1}{4}$ turn counter-clockwise.
10. Loosen the yellow Z-axis lock thumbscrew, then use the Z-axis knob to lower the print board a few inches.
11. Re-check the adjustment of the Z-axis limit switch by repeating the previous 10 steps until the gap is correct.

NOTE: This full process for print board leveling typically only needs to be done when you are assembling the printer from the kit or if the print board get way out of level. For day-to-day use the print board should stay level. Always remove the print board before attempting to remove a printed part from the print board. Attempting to remove a part from the print board while it is still connected to the printer is a quick way to get your print board way out of level, and very well may damage the printer.

Printer Testing Procedures

It is important to test all components of printer prior to use. This section provides direction to verify that all wires are connected properly, motors are wired properly, and end stop switches are in the correct position. The printer must be plugged in prior to beginning testing.

Checking motors

1. Press LCD button; menu will display. Options are viewed by using button for scrolling and pressing LCD button to “select” item highlighted
2. Go to “Prepare” and select; menu will display.
3. Go to “Move Axis” and select; menu will display.
4. Go to “1 mm” (moves stepper motor by 1 mm) and select; menu will display.
5. Go to “X axis” and select.
6. Rotate the LCD knob slowly. Rotating clockwise, head assembly moves away from the X-axis limit switch. Rotating counter clockwise, head assembly moves toward the X-axis limit switch. This confirms that motor has been wired properly.
7. Repeat steps 1) through 6) with Y-axis and Z-axis. **Note:** press “select” until return to home screen.

Checking Auto Home

1. Press LCD button; menu will display.
2. Go to “Prepare” and select; menu will display.
3. Go to “Auto Home” and select.
4. Head assembly will move to 0,0,0 position.
5. If you hear any noise, trouble shoot. Causes may include: belts may not be aligned, yellow thumbscrew not released, may need to apply grease, end stop switches are not functioning properly, etc.

Always disable motors after testing Auto Home. Otherwise, they will be in a frozen state.

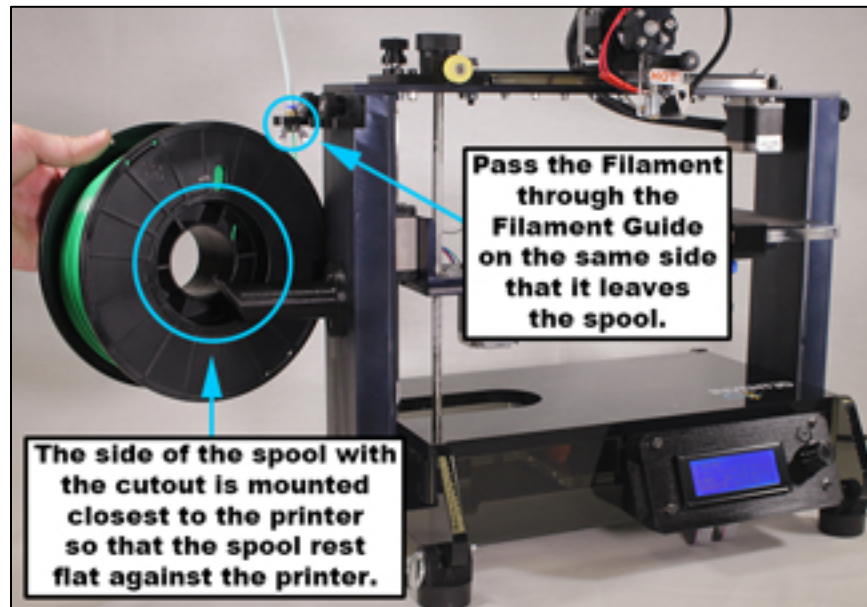
1. Press LCD button; menu will display.
2. Go to “Prepare” and select; menu will display.
3. Go to “Disable Steppers” and select.

Hot End

1. Press LCD button; menu will display. **Note:** Board must be lowered.
2. Go to “Prepare” and select; menu will display.
3. Go to “Heat PLA” and select.
4. Temperature will start to increase (it is set at 225°C for PLA)
5. The fans should come on when the temperature reaches about 50°C (carefully look and listen to verify both fans are on).

Filament Feed/Extruder

Please note that you cannot test Filament Feed or feed filament when hot end is cold.



1. Press LCD button; menu will display.
2. Go to "Prepare" and select; menu will display.
3. Go to "Move Axis" and select; menu will display.
4. Go to "1 mm" and select; menu will display.
5. Go to "Extruder" and select; menu will display.
6. Feed filament into the small hole above the filament feed gear.
7. Hold the filament with one hand, and turn the knob on LCD clockwise.

Filament should be drawn through the gear into the hot end. If it does not, it is not aligned.

Troubleshooting Tips for Filament Feeding

1. Loosen the silver thumbscrews to adjust motor assembly.
2. Manually align the filament so that it is aligned with the gear on the feed.
3. Extrude some filament by turning the LCD knob clockwise to verify working correctly.

Do not leave the filament in the feed if printer will be idle for a week or longer as it will deteriorate, becoming more heat resistant which leads to clogging feed assembly and nozzle.

Cooldown

Please do not leave the hot end heated for long periods when not in use.

1. Press LCD button; menu will display.
2. Go to "Prepare" and select; menu will display.
3. Go to "Cool Down" and select; menu will display.
4. Temperature will go down.
5. Fans will turn off at 50°C and below.

When temperature is below 50°C and if printer will be idle, unplug the power source.

Test Print

A test file has been preloaded on the SD card. Print **test** file to check print. Do **NOT** print any other file until the test file is accurately printed.

1. If not already in LCD, insert SD card fully in the left side of LCD.
2. Press LCD button; menu will display.
3. Go to “Print” and select.
4. Temperature will begin to rise to set point shown on LCD.
5. Print head will move to right front of print board and extrude a small amount of filament.
6. Printing of test part will initiate.
7. If part does not print, refer to Troubleshooting Guide in Operating Instructions.
8. Assess quality of printed part. If it is not good quality, refer to Troubleshooting Guide in Operating Instructions.

Understanding operation and maintenance is key to successful printing. It is very important to read and understand the INVENT3D Operating Instructions and Troubleshooting Guide and view the videos below. **IMPORTANT** - Visit www.inventorcloud.net to check for updates.

The slicer program **must** be downloaded from www.inventorcloud.net . Every printer has unique settings in the slicing program. These settings are **NOT** interchangeable. Use of settings NOT specific to the INVENT3D Printer will cause it to print poorly and may damage the printer.

INVENT3D Printer Videos

Videos are available on YouTube and INVENTORcloud website:

- Installing Slic3r: <https://youtu.be/-kWy8JPh2IQ>
- INVENT3D – Keys to Success: https://youtu.be/4-TP87f_Dtk
- Changing Filament: <https://youtu.be/GkhGFjLo9Y>
- Part Removal: <https://youtu.be/YJ2lwoVA1l4>
- Print Board Leveling: <https://youtu.be/t5xmp9knYew>
- Routine Maintenance: <https://youtu.be/GVPg4gXYw9w>
- Z Axis Calibration: <https://youtu.be/jwzYRii9fM0>

Applying BuildTak

BuildTak is an adhesive for the print board that allows for easy removal of printed items. Other materials can be used (ie: painter's tape, hairspray, etc) but BuildTak provides ease of use. Parts must be removed carefully to remove damaging the BuildTak sheet.

1. Remove print board from printer.
2. Remove old BuildTak and if necessary, clean board if cloudy layer of adhesive remains.
3. Remove the plastic covering over the back of new BuildTak sheet to expose the adhesive.
4. Carefully, slowly and avoiding bubbles, begin laying sheet down and smoothing, from one side of board to other side. If bubbles, pull section back up, press out bubbles and re-lay.
5. Return and secure print board on printer.