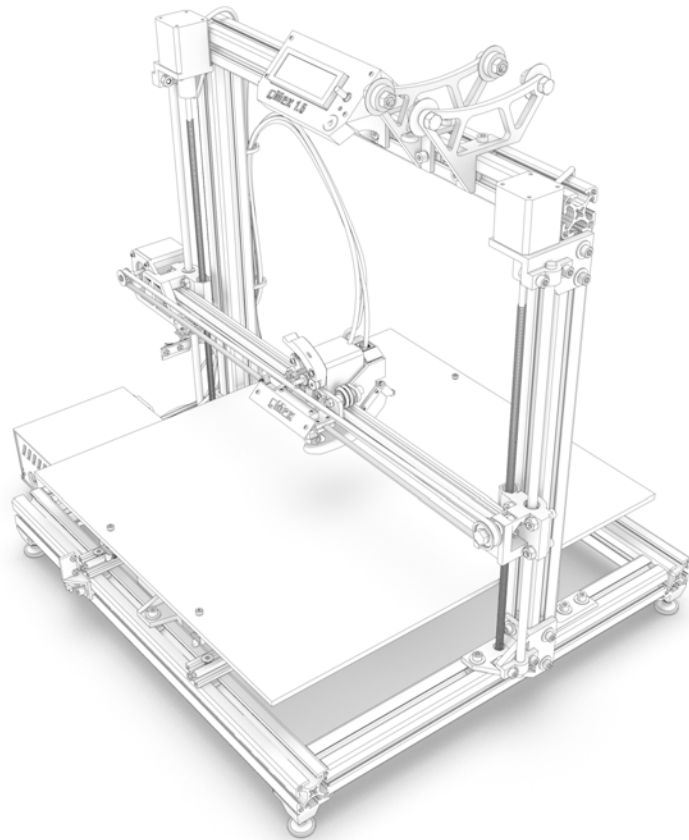


gMax 1.5

3D Printer Build Manual

v 1.2 Updated 12.5.14



Tips for Build

1. Read all the instructions for each step before starting work and feel free to report any incorrect information or typos.
2. The manual lists all the hardware per part, but note that some parts are pre-installed. In the manual, parts in **black** text mean the part needs to be installed, while **grey** text indicates the parts are pre-installed and its just informational.
3. The manual doesn't always list the order to install parts. Look at the image to determine which should be installed first. Refer to the bottom instructions for the general order of operation.
4. Build at your own risk and feel free to modify as you please. Always exercise safety when building since some components are sharp.
5. We recommend using high-quality filament. Poor quality filament results in nozzle clogs and may even damage the hotend. Better filament usually means better prints, less waste and less problems.
6. When doing any electrical modifications always exercise proper caution and unplug all components before beginning work.

Things Needed for Build



Fine Philips Head
Screwdriver



Measuring
Tape



Hex Key Set
(SAE and
Metric)
Included in
Set

Software and Firmware

Recommended software to use

3D Modeling Programs

Many 3D modeling programs can be used to export 3D models to your slicing program. The modeling program you choose must work with the slicer you choose so check the specs of each program.

We recommend using a program which exports clean .stl files such as Sketchup, 3ds Max (which has a built in STL checker) or AutoCad. The .stl file format is widely used in 3D modeling in conjunction with 3D printing but the .stl file must be a solid "watertight" object without errors. Search Google for more information about how to make "clean" .stl files. Note many new slicing programs have .stl repair tools built in.

STL files can be exported from Sketchup using an extension. At the time of writing it can be found here:

<http://extensions.sketchup.com/en/content/sketchup-stl>

Printer Control Via Computer

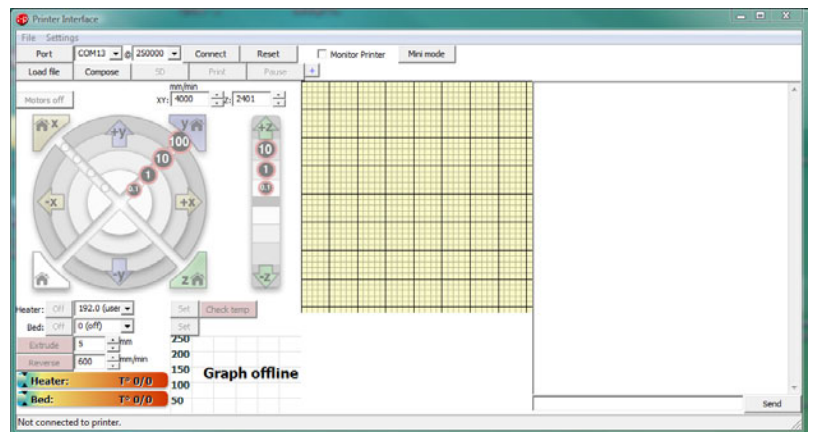
While printing from the LCD screen is preferred, each printer can still be controlled from an attached computer via a USB cord.

Download and install Prinrun software

<http://koti.kapsi.fi/~kliment/prinrun/>

Make sure to select the proper COM port (refer to the section below for information) and set the speed to 250000.

More information will be available on our forum as we post it.



kilment Prinrun

Printer Firmware (Installed in Printer)

Each printer comes pre-installed with our latest version of firmware. We use a slightly modified version of Marlin Firmware for our printer and the changes to the firmware ensure it works with our hardware. As the printer evolves, new versions of firmware may become available and they must be uploaded to your printer. Uploading can be accomplished several ways but the most effective is to upload it using the Arduinio software.

You need to install the Arduinio software, install the Arduinio drivers, open the new firmware, and upload to the board.

Refer to this tutorial (<http://arduino.cc/en/guide/windows>) for information on installing the arduino software and drivers.

Note our printer uses the: **ARDUINO MEGA 2560 chipset**

To install our latest firmware:

1. Download it from our website in the "Downloads" section.
2. Extract the zip file to a location on your computer.
3. Plug in printer and open the arduino software. A blank "Sketch" should come up.
4. Go to "File > Open" and open the "Marlin.ino" file in the extracted folder from step #2.
5. Select "Tools > Board > Arduino Mega 2560 or Mega ADK"
6. Determine which Serial port your arduino is connected to by using the Windows Device Manager. To do this, click Windows > Run and type in %device manager%. Under "Ports (Com and LPT)" you should see the Arduino board and a COM port (see Fig1).
7. Select "Tools > Serial Port > (Select serial port from previous step)"
8. Go to "File > Upload" and wait for upload to finish (usually around a minute).

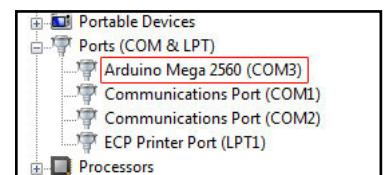


Fig1

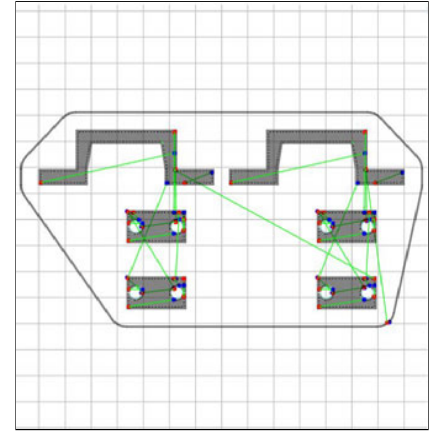
Slicing software

Recommended software to use

Slicing Program

For your printer to know where to print, each 3D model must be sliced into many layers. Several slicing programs are available to produce the required gcode files. We suggest using Slic3r (<http://slic3r.org/>) due to its speed, ease of use, and regular updates but you can also use Cura (may cause fast head movements which could prove difficult for this printer type), Kis Slicer, skeinforge or other slicers that work with "RepRap" type printers.

When using slic3r you can download our config files from the "Downloads" section of our website. Remember the key with slicing your model is the orientation of the model and its design. Open Slic3r and review all the settings to get an idea of the capabilities. Mousing over each setting provides a detailed description of what it does.



sliced model viewed in gcode viewer www.gcode.ws

slic3r Setup

You can either ignore the setup and load our default config files instead, or use the values below:

When configuring slic3r use the following information:

1. Firmware type: [RepRap \(Marlin/Sprinter\)](#)
2. Bed size: [x: 410 y:410](#)
3. Nozzle diameter: Depends on what was ordered with your printer. Most likely [0.5mm](#)
4. Filament diameter: [1.75mm](#)
5. Extrusion temperature: [200C](#)
6. Bed temperature: [0C](#)



slic3r Tips

3D printing with FFF is an art and it can work very well if set up properly. Below are a few key ideas and tricks to keep in mind while designing and slicing your models.

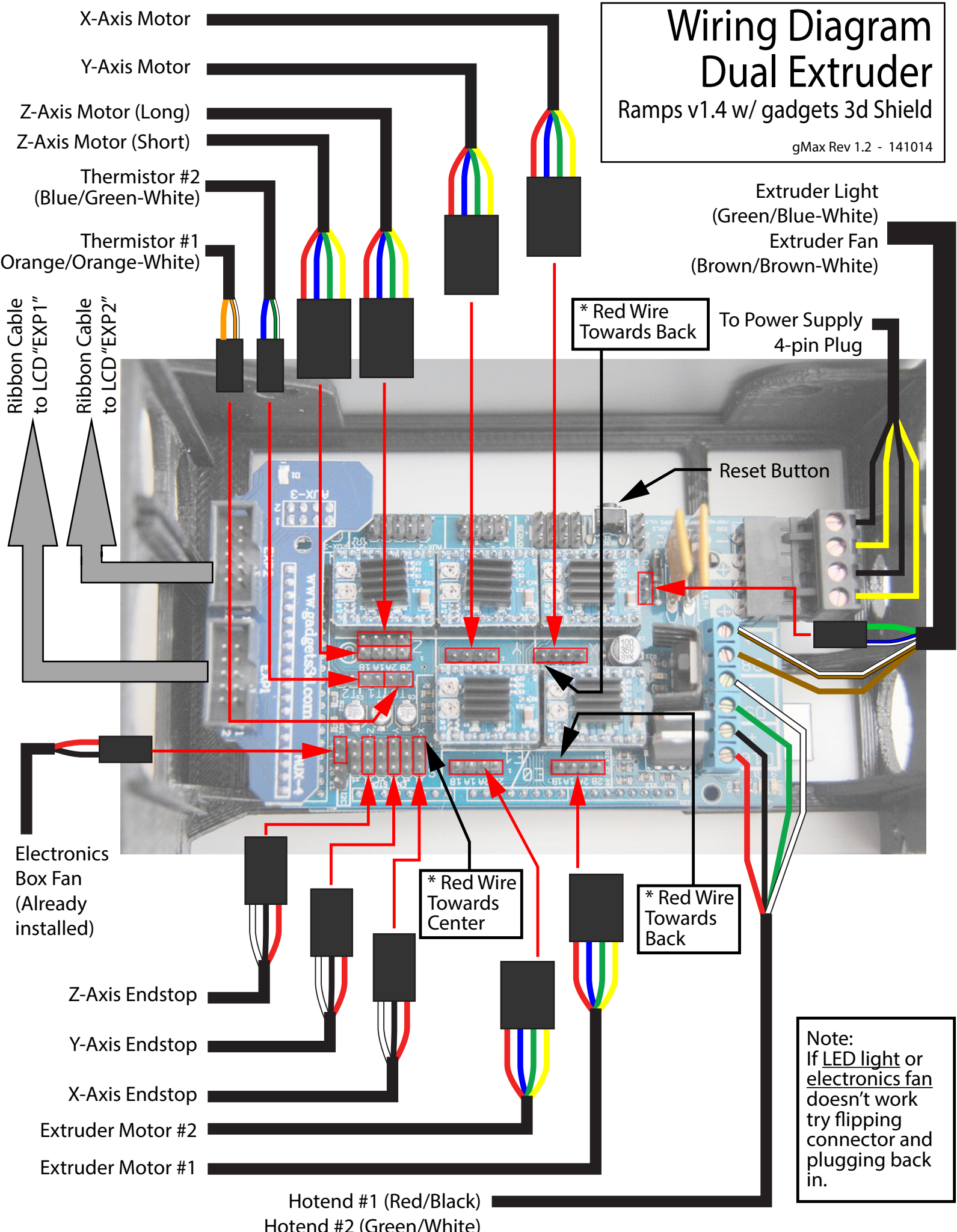
Be sure to read the very detailed slic3r manual at: <http://manual.slic3r.org/Intro.html>

1. Your 3D models may require support material (built into slic3r) if they have extreme overhangs. The gMax can print up to around a 60 degree overhang or a 0.5" bridge without support material. When using dual extrusion you can use a water soluble material, such as PVA, as the support material.
2. Due to the design of the gMax, it prints large models with sweeping curves great but it must be slowed down to handle many small movements. When printing a model with many small complex features you can set the "[Gap Fill](#)" speed to zero to ignore gap fill. This can greatly increase printing speed. It can be found in "[Print Settings > Speed > Gap Fill](#)". Also use the acceleration settings (500 by default) to ensure the printer slows down at corners.
3. By default the gMax is set up to use colorfabb PLA. We have found printing with a 1st layer temp of 196 degrees C will provide adequate adhesion that is still easy to remove when the print is complete. For better adhesion increase the 1st layer temperature. Subsequent layers can have higher temperatures (default 208 C) to allow for easier extrusion.
4. Temperature settings should be adjusted per filament type. Experiment and save settings.
5. Generally the gMax does not require a "raft" below the model for adhesion due to the acrylic bed. If your model has very little points of contact with the bed, a "raft" may be required. The raft settings can be found in "[Print Settings > Support Material > Raft](#)".
6. As mentioned above, slicing your model takes practice and patience. Models must be correctly oriented on the bed for best slicing. Remember to think outside the box too.

Wiring Diagram Dual Extruder

Ramps v1.4 w/ gadgets 3d Shield

gMax Rev 1.2 - 141014



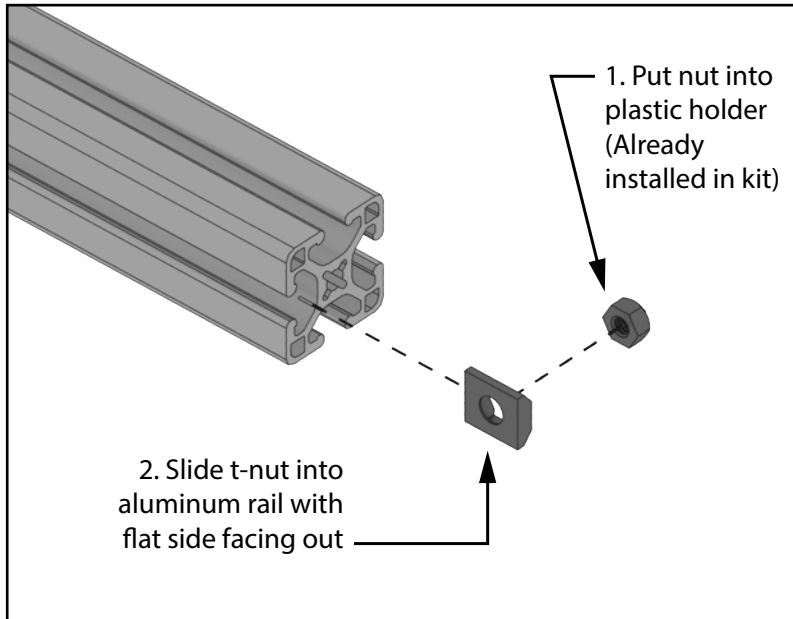
Hotend #1 (Red/Black)
Hotend #2 (Green/White)

Note:
If LED light or electronics fan
doesn't work
try flipping
connector and
plugging back
in.

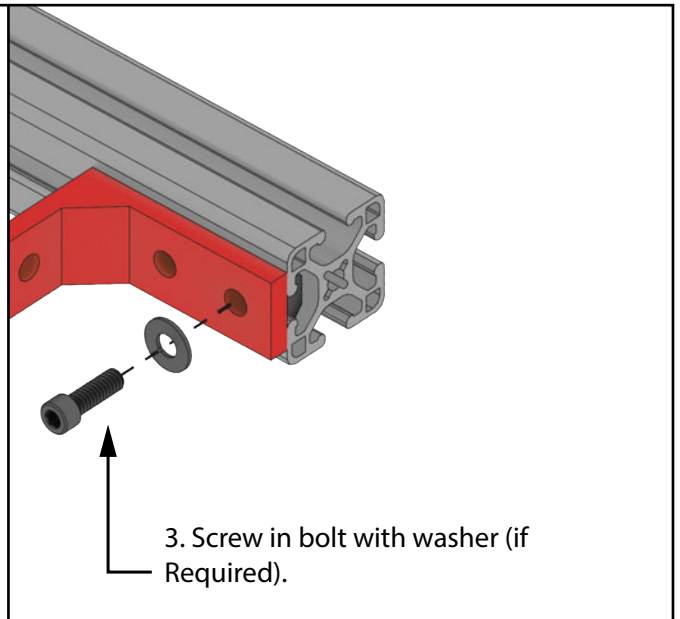
How to install bolts and t-nuts

Option #1

Step 1

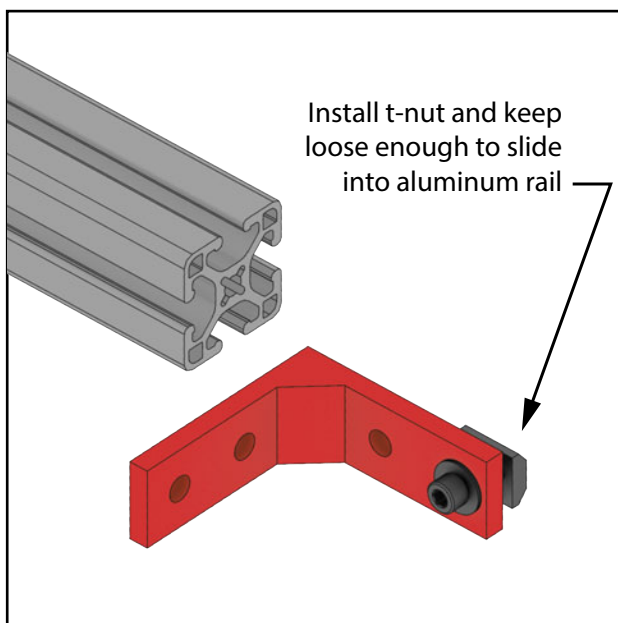


Step 2

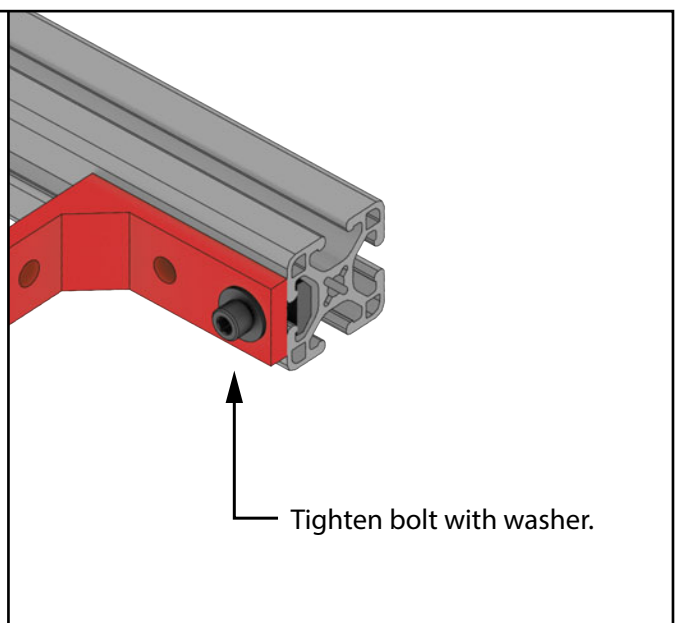


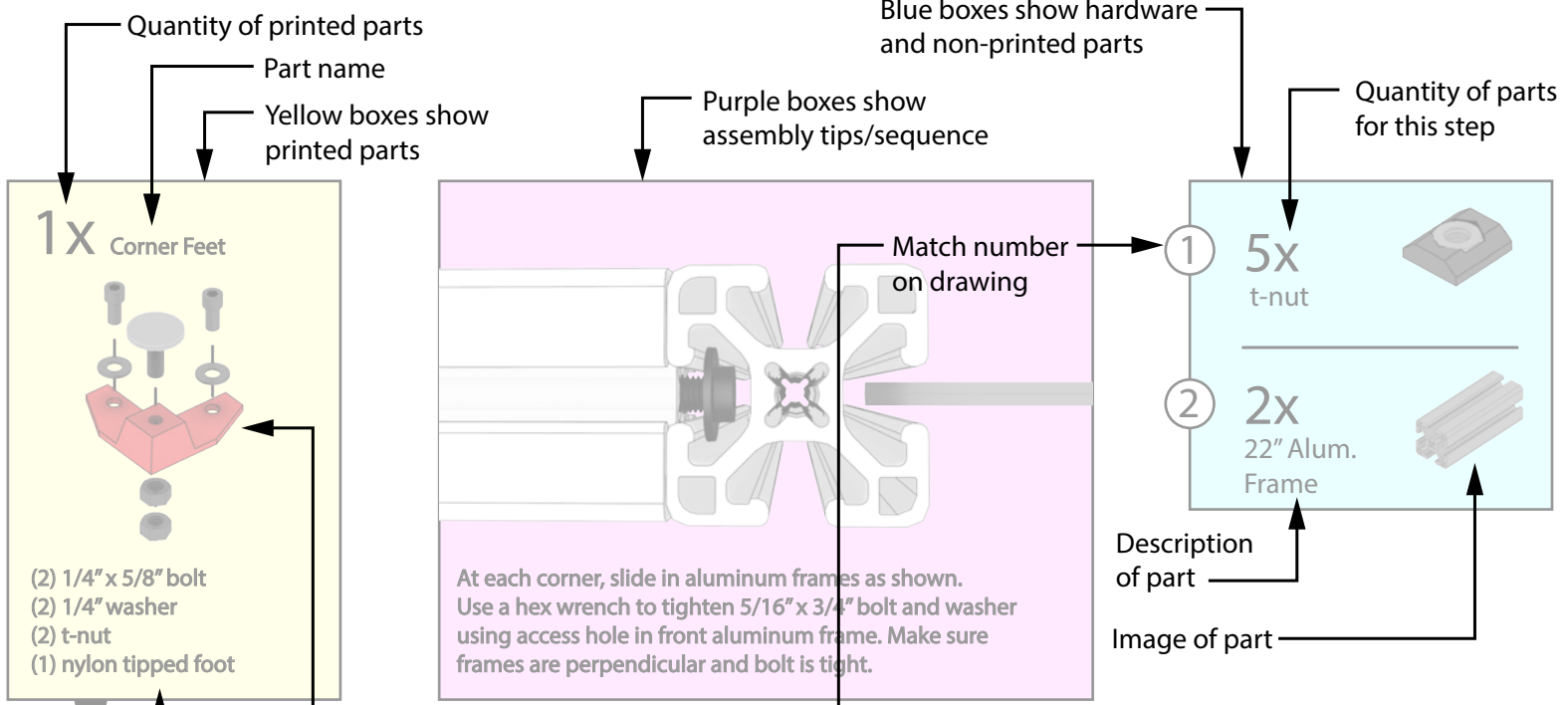
Option #2

Step 1



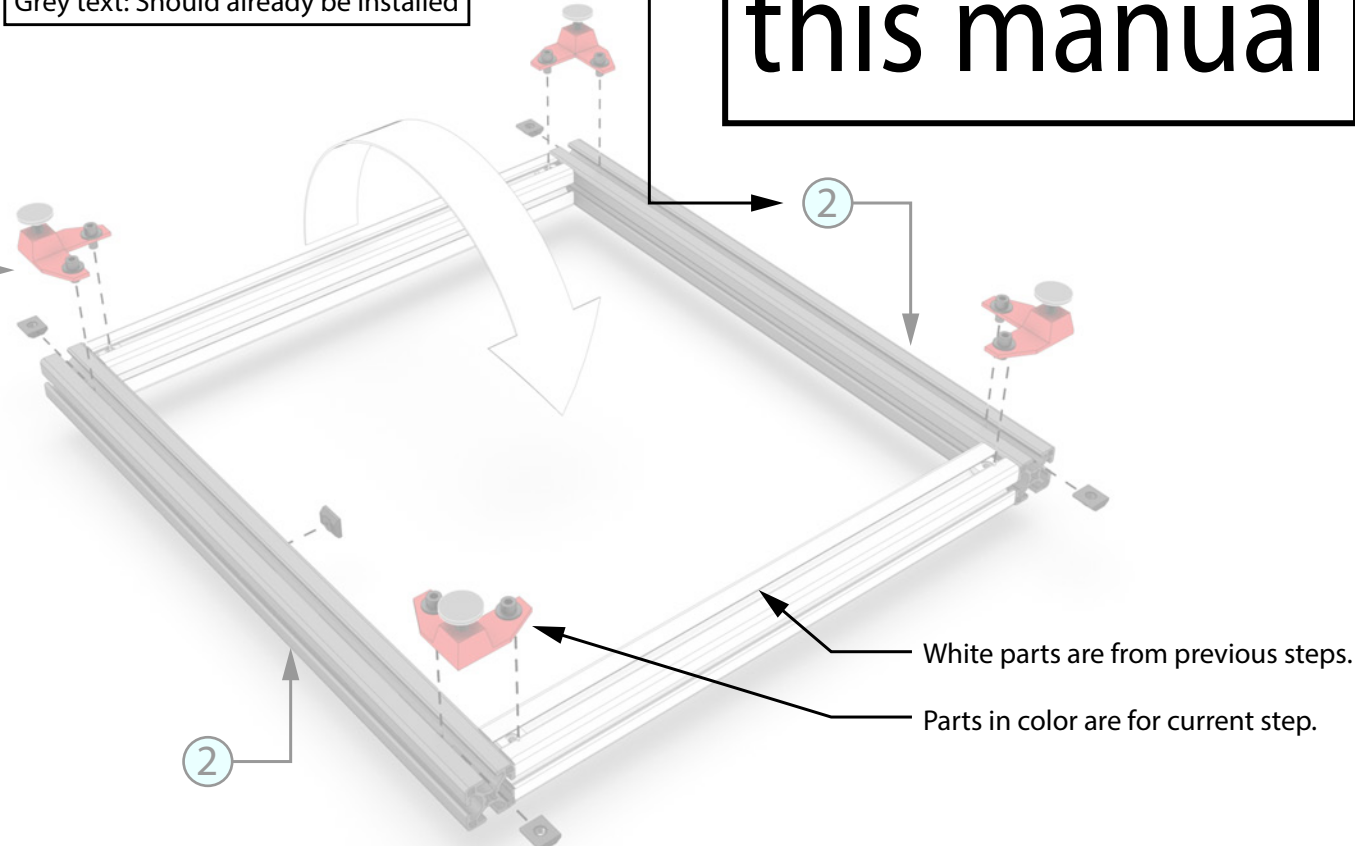
Step 2



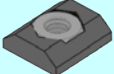


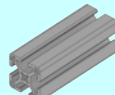
How to use this manual

Note:
Black text: Needs to be installed
 Grey text: Should already be installed




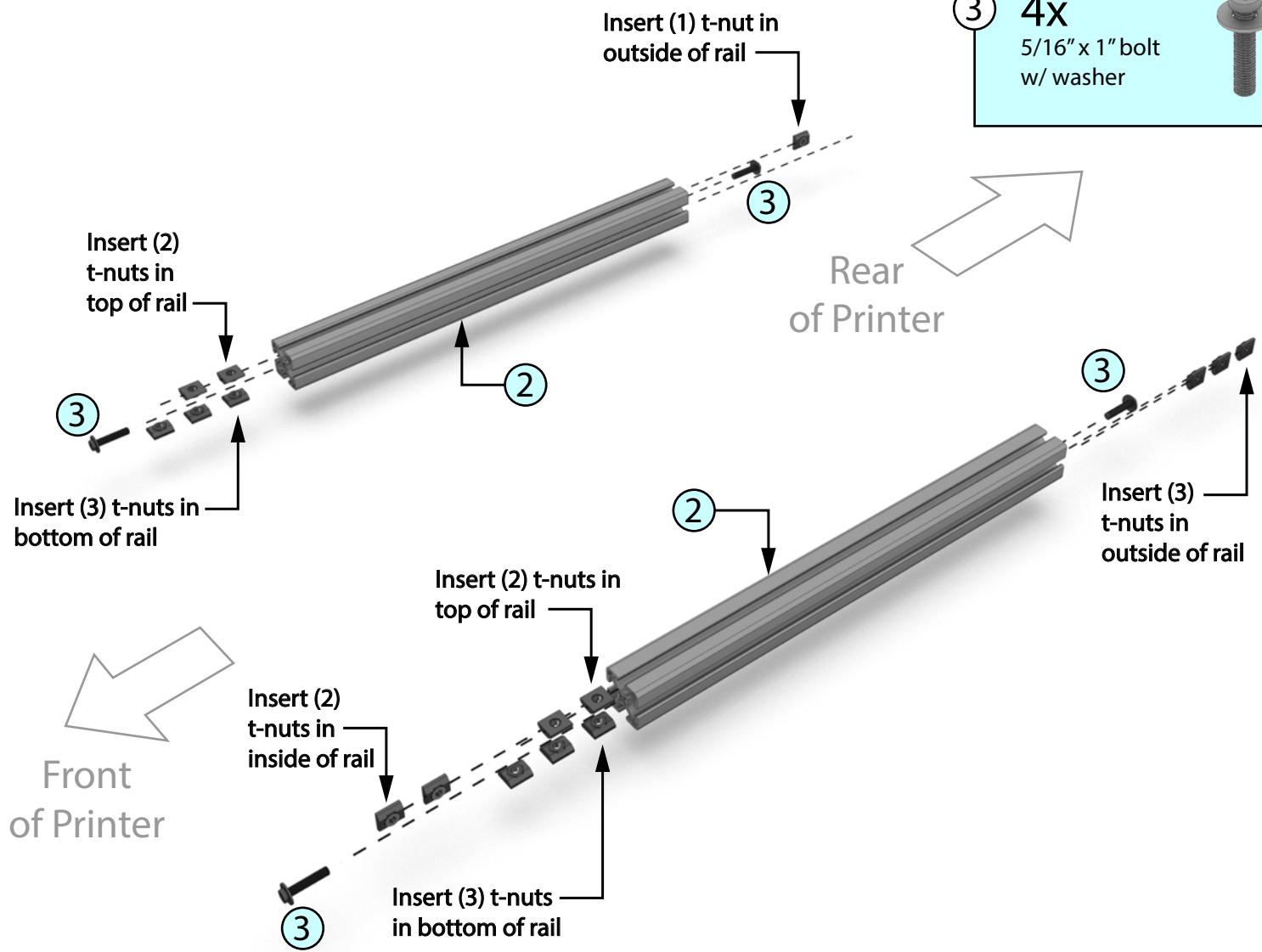
- General sequence of parts for this step
1. Install front and rear aluminum rails w/ t-nuts shown
 2. Install adjustable corner feet
 3. Flip entire assembly over after tightening
- Current step number
- ## Step #

- ① 16x t-nut 

- ② 2x 18" Alum. Frame 

Important Note. Use 18" frames that have threaded holes on BOTH ends

- ③ 4x 5/16" x 1" bolt w/ washer 



Place (2) frames on a flat surface and install the items shown

Step 1

4x Corner Feet

(2) 1/4" x 5/8" bolt
 (2) 1/4" washer
 (2) t-nut
 (1) nylon tipped foot
 (2) 5/16" nuts

5/16" x 3/4" bolt with washer. Make sure washer is next to head of bolt as shown here

Hex wrench

At each corner, slide in aluminum frames as shown. Use a hex wrench to tighten 5/16" x 1" bolt and washer using access hole in front aluminum frame. Make sure frames are perpendicular and bolt is tight.

① 5x t-nut

② 2x 22" Alum. Frame

③ 8x 1/4" x 5/8" bolt

④ 8x 1/4" washer

Flip printer left-to-right after installing parts

Rear of Printer

Front of Printer

② Slide 22" aluminum rails into place making sure access holes are facing out. Refer to diagram above for information on how to tighten corners.

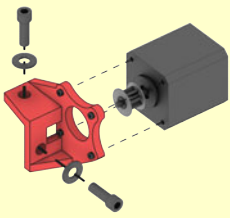
② Use t-nuts already in rail from step #1

① Important Slide in (1) t-nut on inside with aluminum rail

1. Install front and rear aluminum rails w/ t-nuts shown
 2. Install adjustable corner feet
 3. Flip entire assembly over after tightening

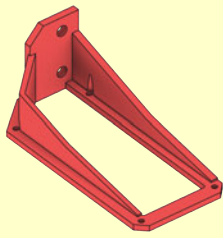
Step 2

1X Y-Axis Motor Bracket



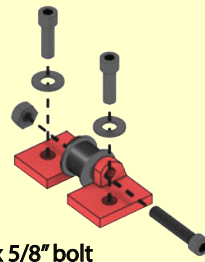
- (2) 1/4" x 3/4" bolt
- (2) 1/4" washer
- (2) t-nut
- (1) motor
- (1) geared pulley

1X Power Supply Bracket



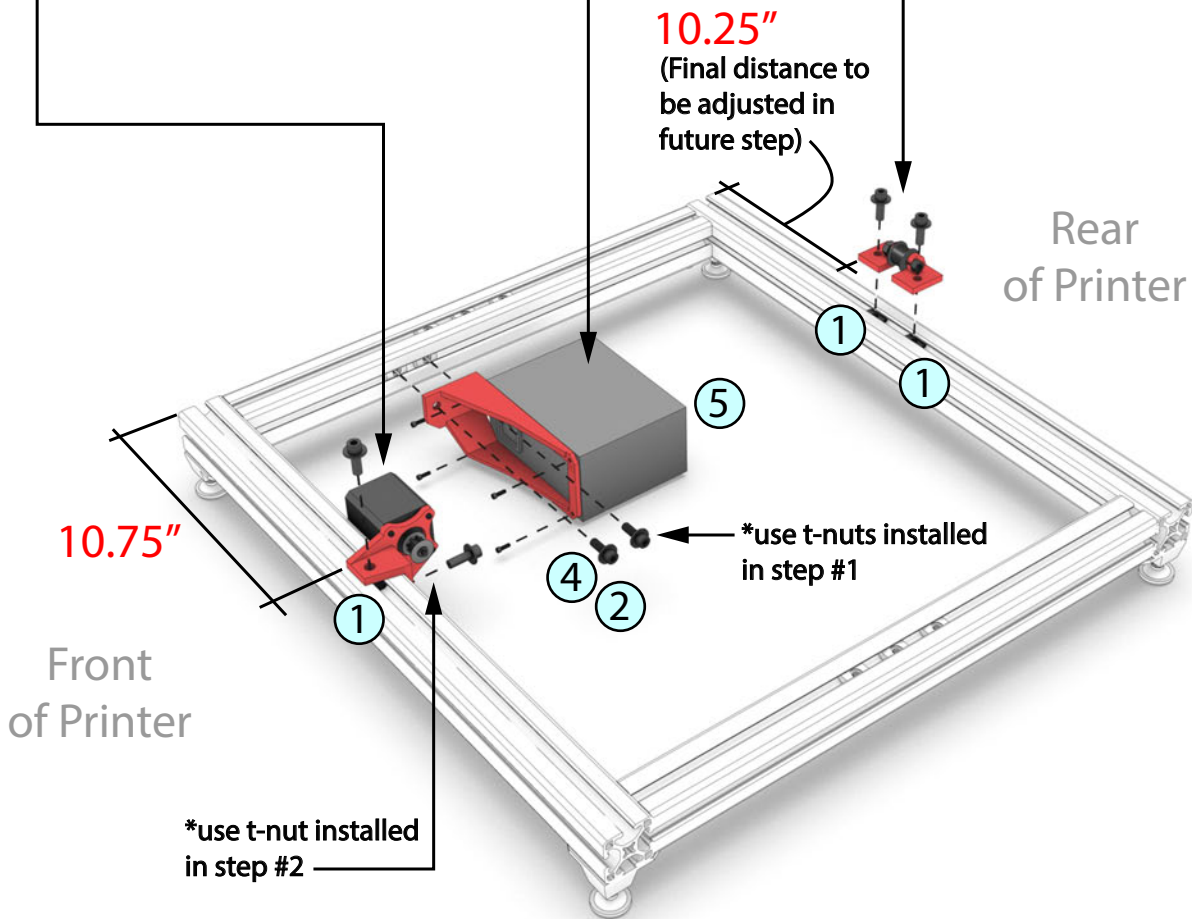
- (4) 5-40 x 3/8" bolts
- (2) 1/4" x 5/8" bolt
- (2) 1/4" washer
- (2) t-nut

1X Y-Axis Rear Bearing Bracket



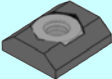


- (2) 1/4" x 5/8" bolt
- (2) 1/4" washer
- (2) t-nut
- (1) M4 x 30mm bolt
- (1) M4 nut
- (1) pulley kit

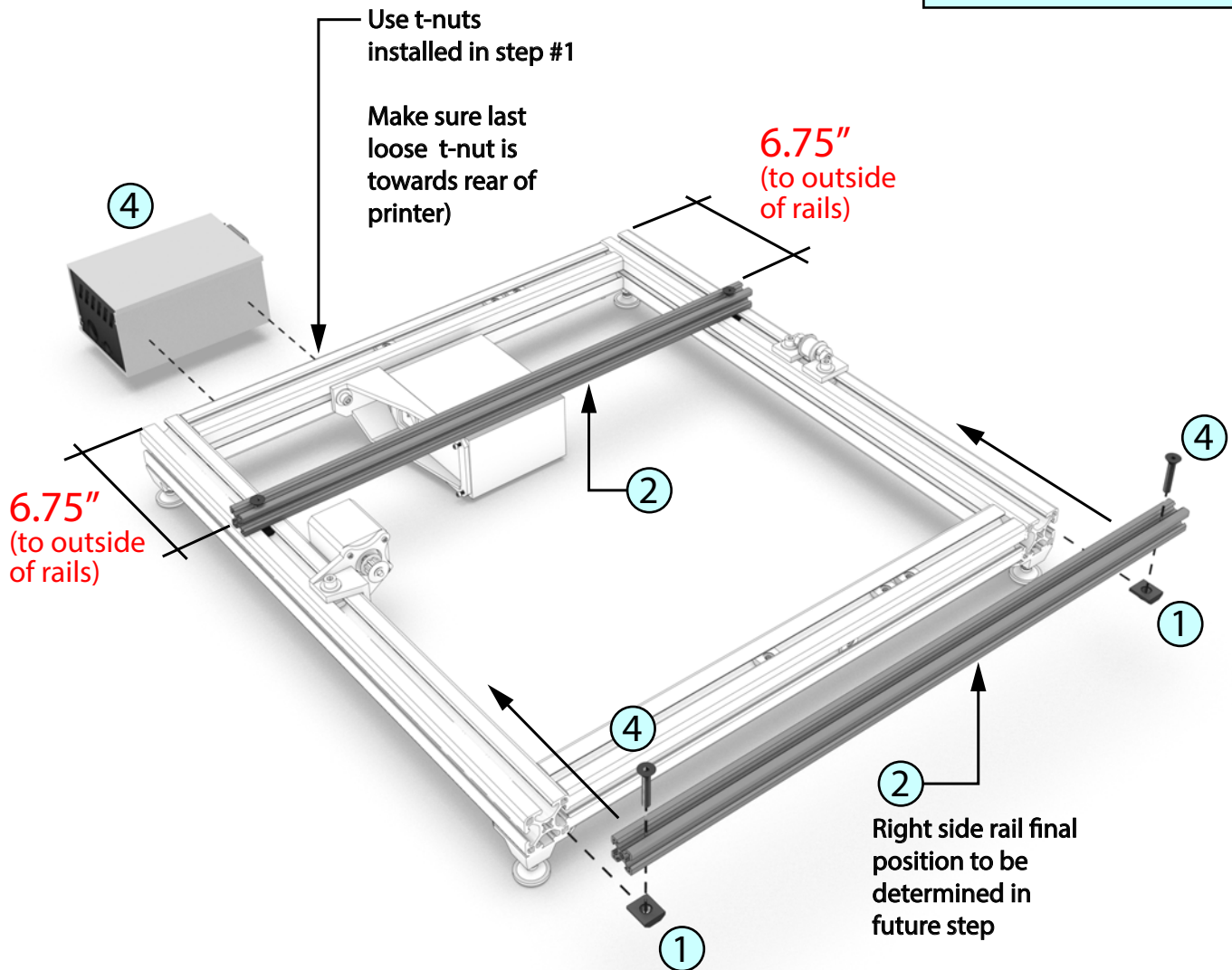
- ① 3x t-nut
- ② 4x 1/4" x 5/8" bolt
- ③ 2x 1/4" x 3/4" bolt
- ④ 6x 1/4" washer
- ⑤ 1x Power Supply



1. Install front motor bracket and rear bearing bracket
 2. Install power supply and bracket

Step 3

- | | | |
|---|---------------------------------------|---|
| 1 | 4x
t-nut |  |
| 2 | 2x
21" thin
aluminum rails |  |
| 3 | 4x
1/4" x 1-1/4"
flat head bolt |  |
| 4 | 1x
Electronics box | |



1. Install Aluminum rails
 2. Install electronics box using bolts pre-installed in box

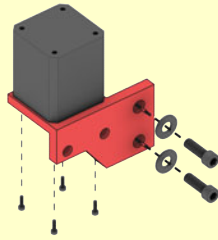
Step 4

1x LCD Screen



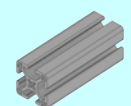
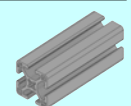

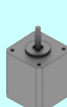
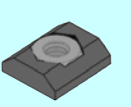


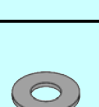
(2) 1/4" x 5/8" bolt
(2) t-nut

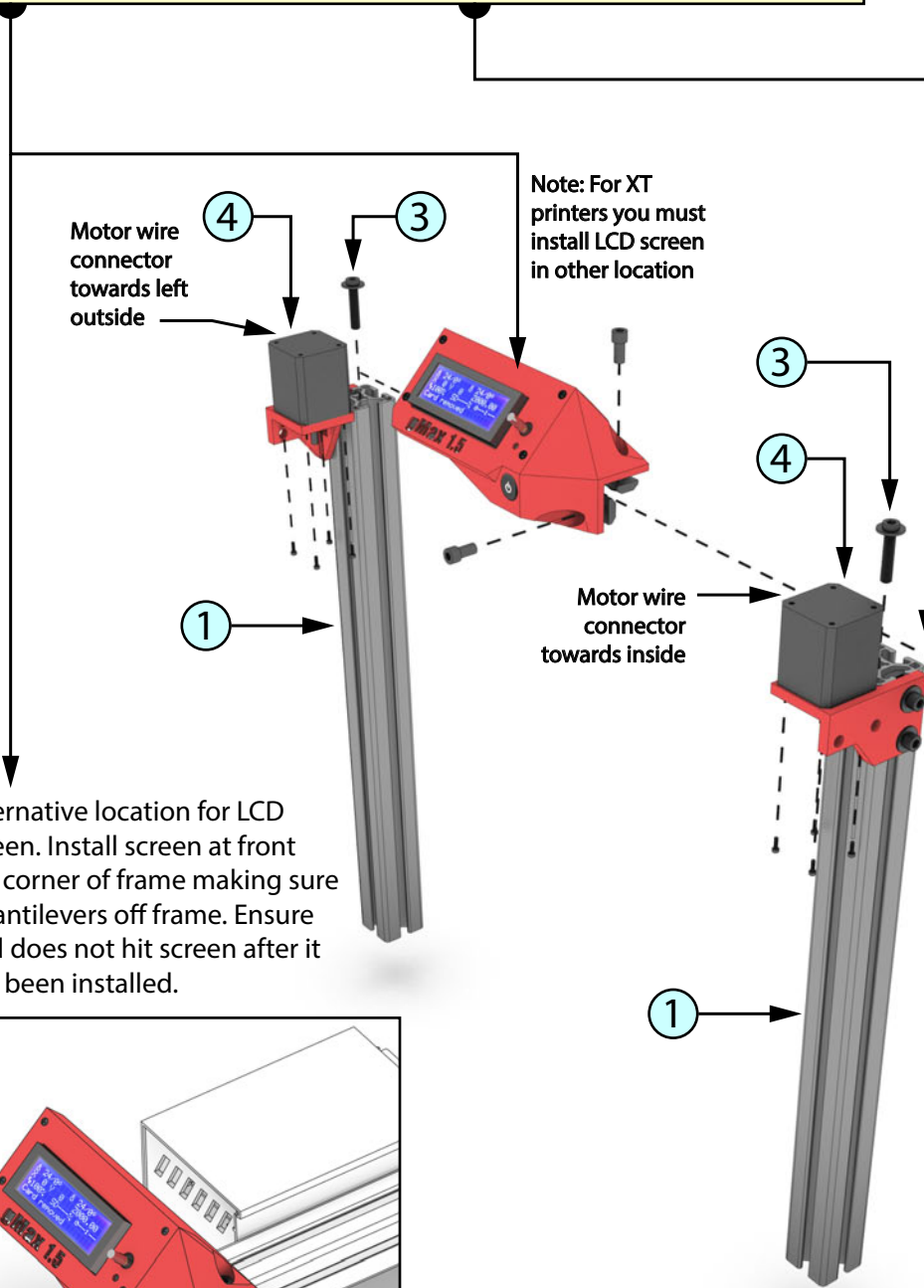
2x Z-Axis Motor Brackets



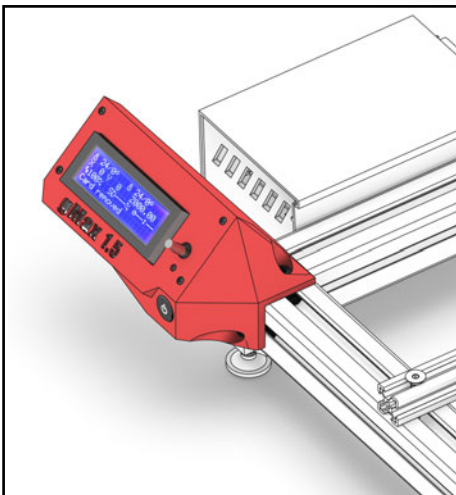
*Parts are mirrored (only right side is shown)

(2) 1/4" x 3/4" bolt each
(2) 1/4" washer each
(2) t-nut each
(1) motor
(4) 4-48 x 3/8" bolts (In stepper motor bag)

- 1 2x 17" Alum. Frame 26" (For XT Printers) 
- 2 1x 22" Alum. Frame 
- 3 2x 5/16" x 1" bolt w/ washers 
- 4 2x 1 stepper motor w/ (4) 4-48 x 3/8" bolts 
- 5 6x t-nut 
- 6 2x 1/4" x 5/8" bolt 
- 7 4x 1/4" x 3/4" bolt 
- 8 4x 1/4" washer 



Alternative location for LCD screen. Install screen at front left corner of frame making sure it cantilevers off frame. Ensure bed does not hit screen after it has been installed.



Notes

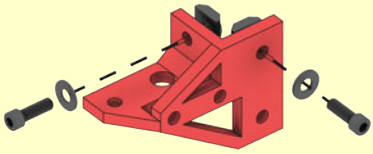
Aluminum frame rails should be square and outside corner of rails should be flush.

Refer to Step #2 for information on how to tighten 5/16" bolts.

1. Insert 5/16" bolt and washers in ends of vertical frame
2. Install motors onto brackets
3. Install motor brackets on top of aluminum frame
4. Slide in top 22" aluminum frame w/ LCD bracket

Step 5

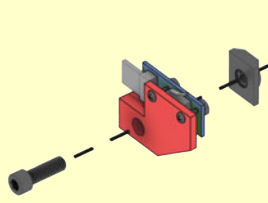
2x Z-axis lower bracket



*Parts are mirrored (only right side is shown)

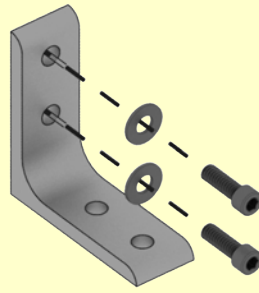
- (2) 1/4" x 3/4" bolts each side
- (2) 1/4" washer each each side
- (2) t-nut each side

1x Z-Axis Endstop



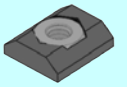
- (1) 1/4" x 1" bolt
- (1) t-nut

2x Aluminum Angle



- (2) 1/4" x 3/4" bolts each side
- (2) 1/4" washer each each side
- (2) t-nut each side

1 9x t-nut



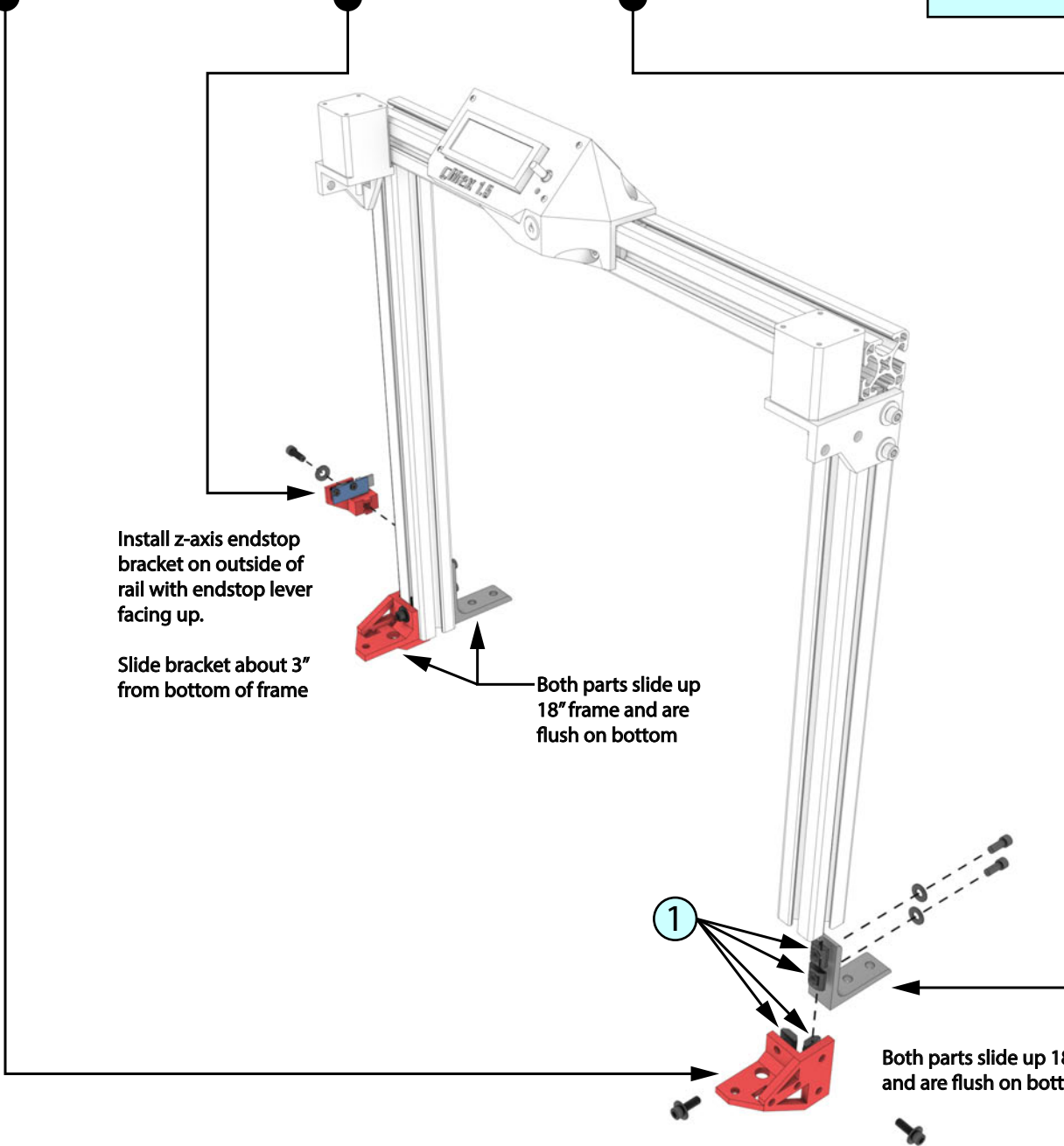
2 1x 1/4" x 5/8" bolt



3 8x 1/4" x 3/4" bolt



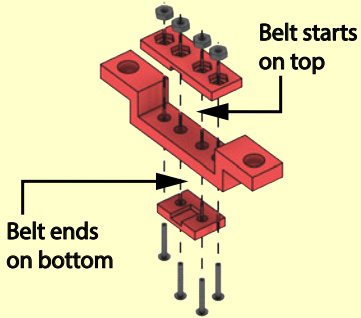
4 9x 1/4" washer



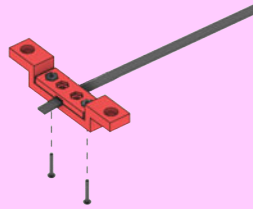
1. Install z-axis endstop bracket
2. Install lower Z-axis printed bracket and aluminum angle on bottom of 17" frame

Step 6

1x Y-Axis Belt Clamp

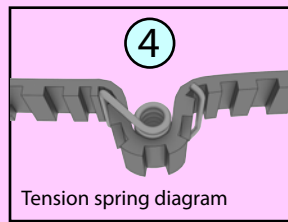


- (2) 4-40 x 1/2" bolts (outside)
- (2) 4-40 x 3/4" bolts (inside)
- (4) 4-40 nuts



1. Loosen 4-40 x 1/2" screws on outside and insert belt in top then tighten clamp

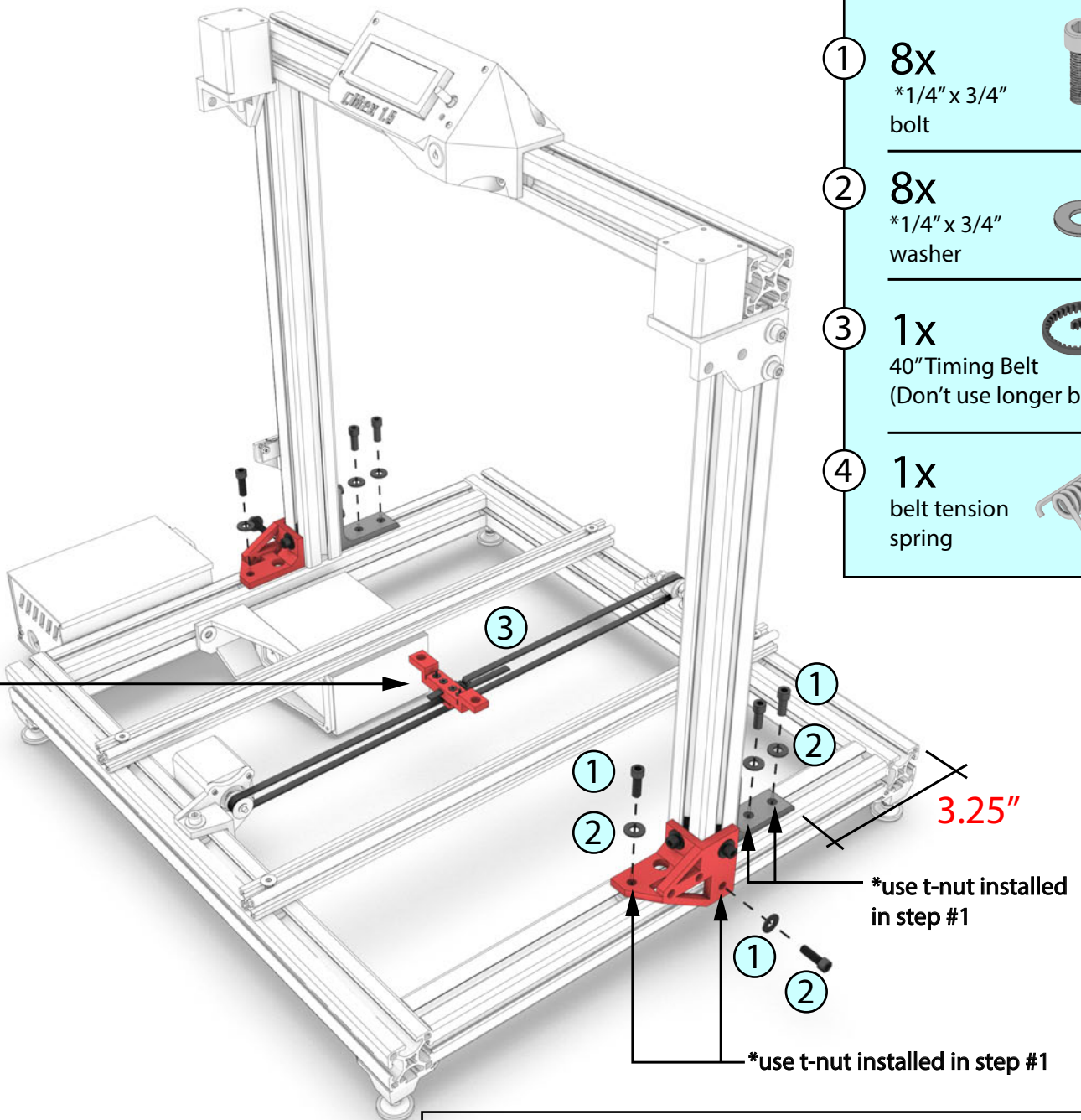
2. Make sure smooth side of belt faces up



1. After installing belt on bearing and motor (shown below), insert it into lower part of clamp

2. Install tension spring very close to bracket

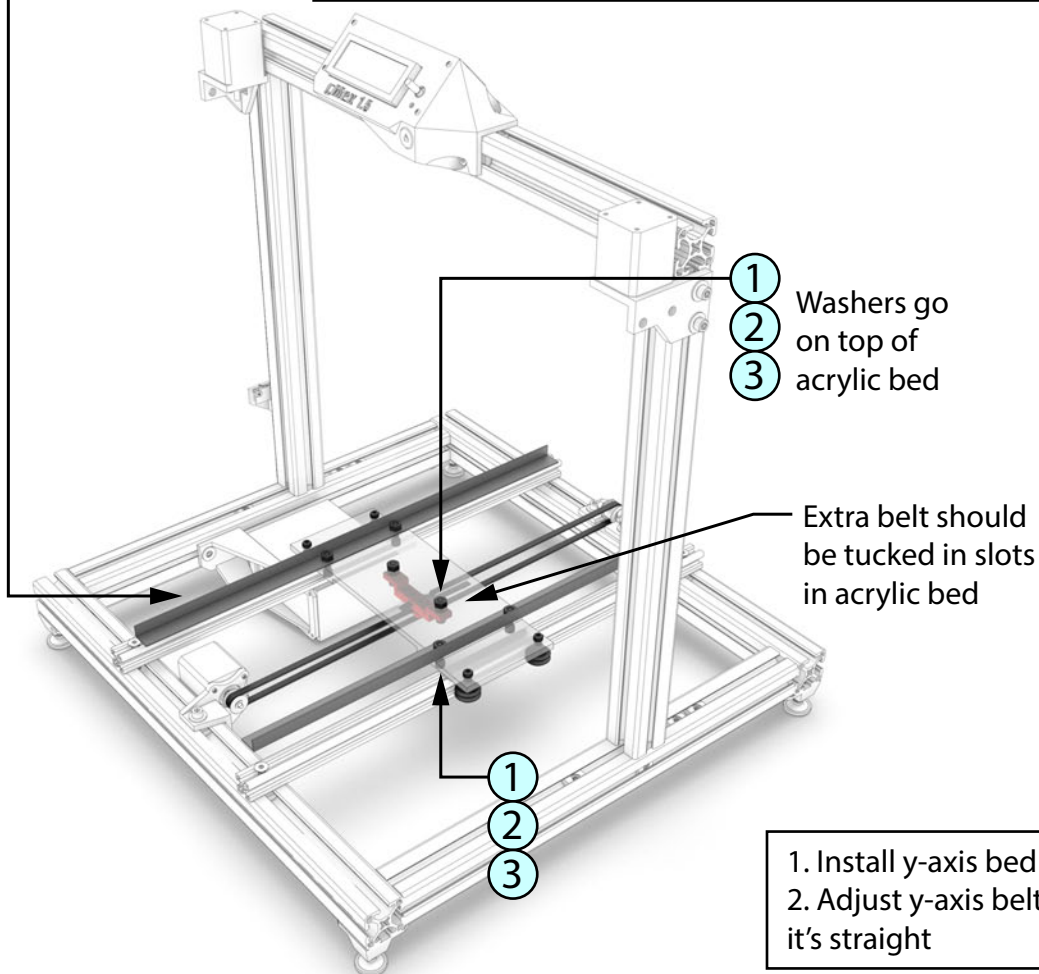
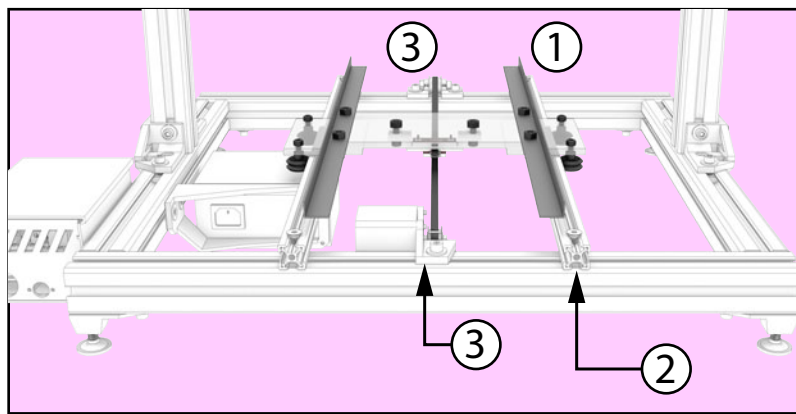
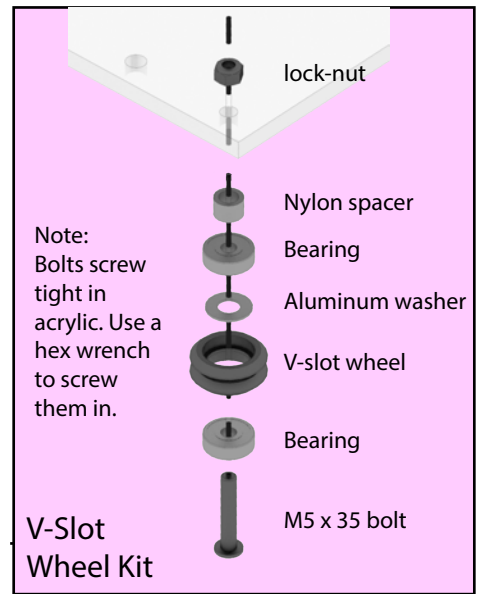
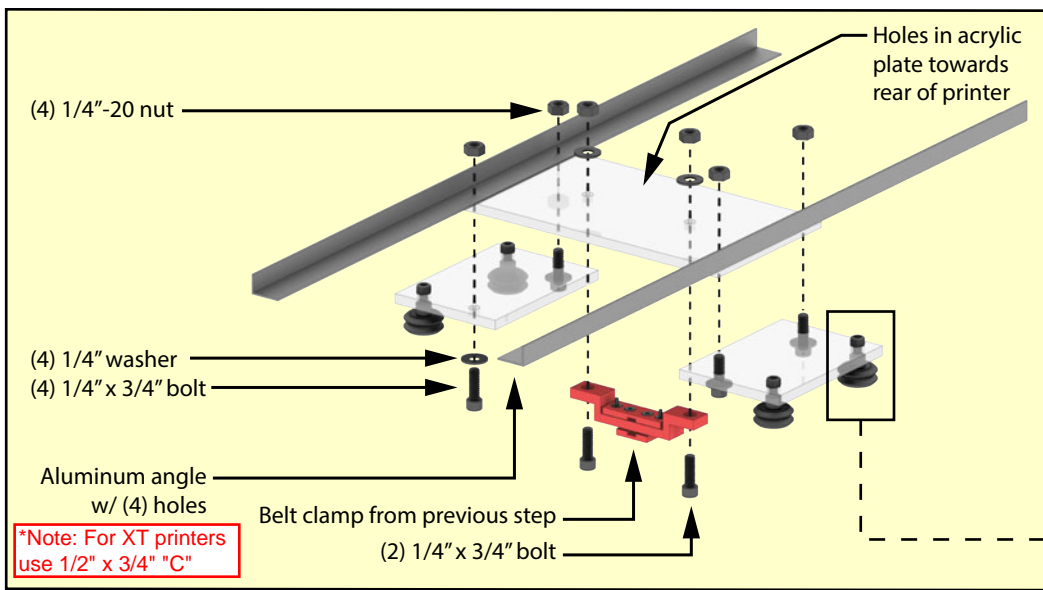
3. Pull belt tight and use 4-40 x 3/4" screws on inside of clamp to secure belt.
*To tighten belt in the future you only need to loosen the inner screws.






- ① 8x *1/4" x 3/4" bolt
- ② 8x *1/4" x 3/4" washer
- ③ 1x 40" Timing Belt (Don't use longer belt)
- ④ 1x belt tension spring

1. Install top frame on bottom frame
2. Install y-axis belt and belt clamp

Step 7

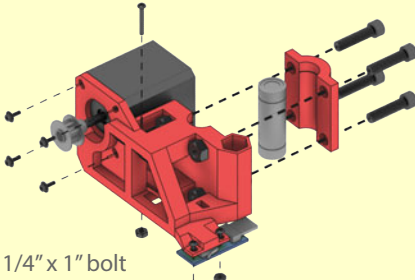


- | | | | |
|---|----|------------------|---|
| 1 | 4x | 1/4" x 3/4" bolt |  |
| 2 | 6x | 1/4" washer |  |
| 3 | 6x | 1/4" nut |  |

1. Install y-axis bed carriage
2. Adjust y-axis belt to ensure it's straight

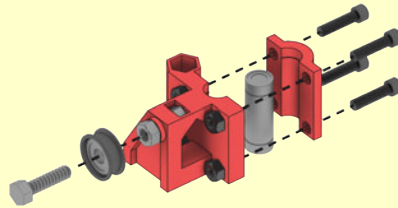
Step 8

1x Y-Axis Belt Clamp



- (4) 1/4" x 1" bolt
- (4) 1/4" nut
- (1) LM8LUU bearing
- (1) motor
- (4) 4-48 cap screws
- (1) pulley
- (1) endstop
- (1) 4-40 x 1-1/2" screw & lock nut
- (2) 4-40 x 1/2" screw
- (3) 4-40 nut

1x Y-Axis Belt Clamp



- (4) 1/4" x 1" bolt
- (4) 1/4" nut
- (1) LM8LUU bearing
- (1) 5/16" x 1" bolt
- (1) 608 bearing
- (2) 5/16" nuts

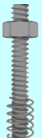
1

2x
*Z-axis coupler



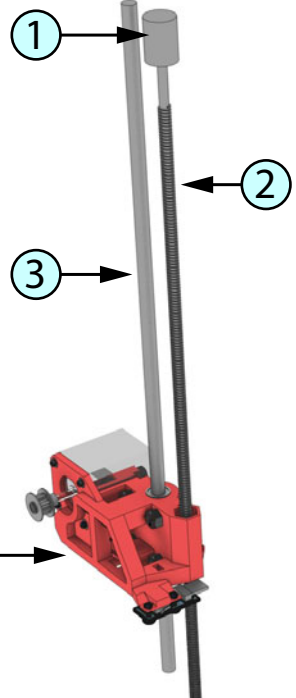
2

2x
16" long 1/4" ACME rod
1/4" ACME nut and spring
Use 25" long rod for XT Printers

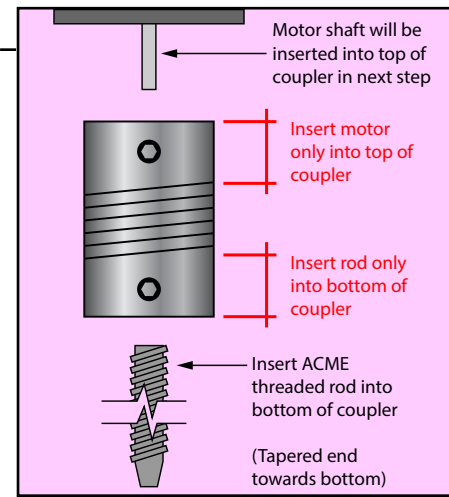


3

2x
18" long smooth rod
Use 26" long rod for XT Printers



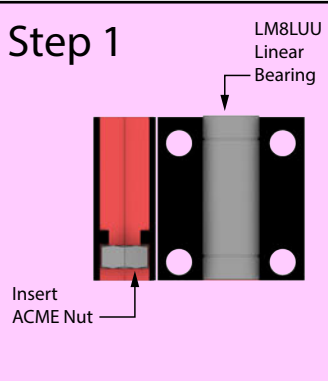
2



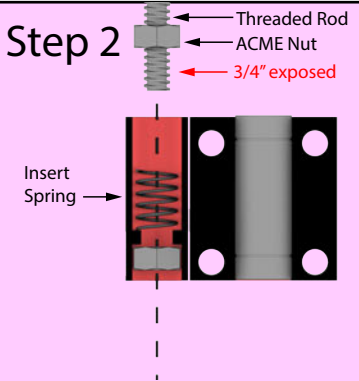
Note
When attaching coupler screw may be hard to turn

3

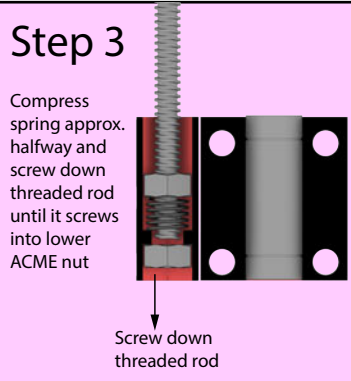
Step 1



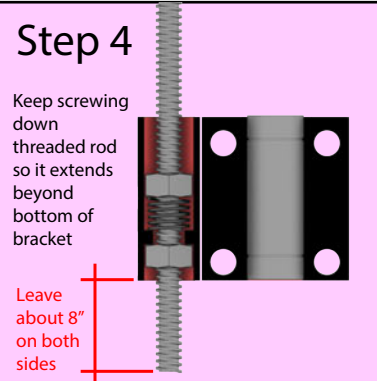
Step 2



Step 3



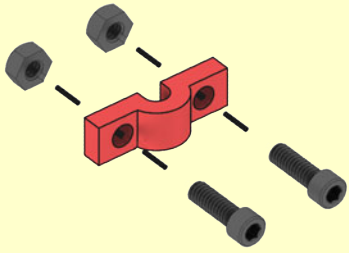
Step 4



1. Install parts on z-axis rods

Step 9

1x Y-Axis Belt Clamp

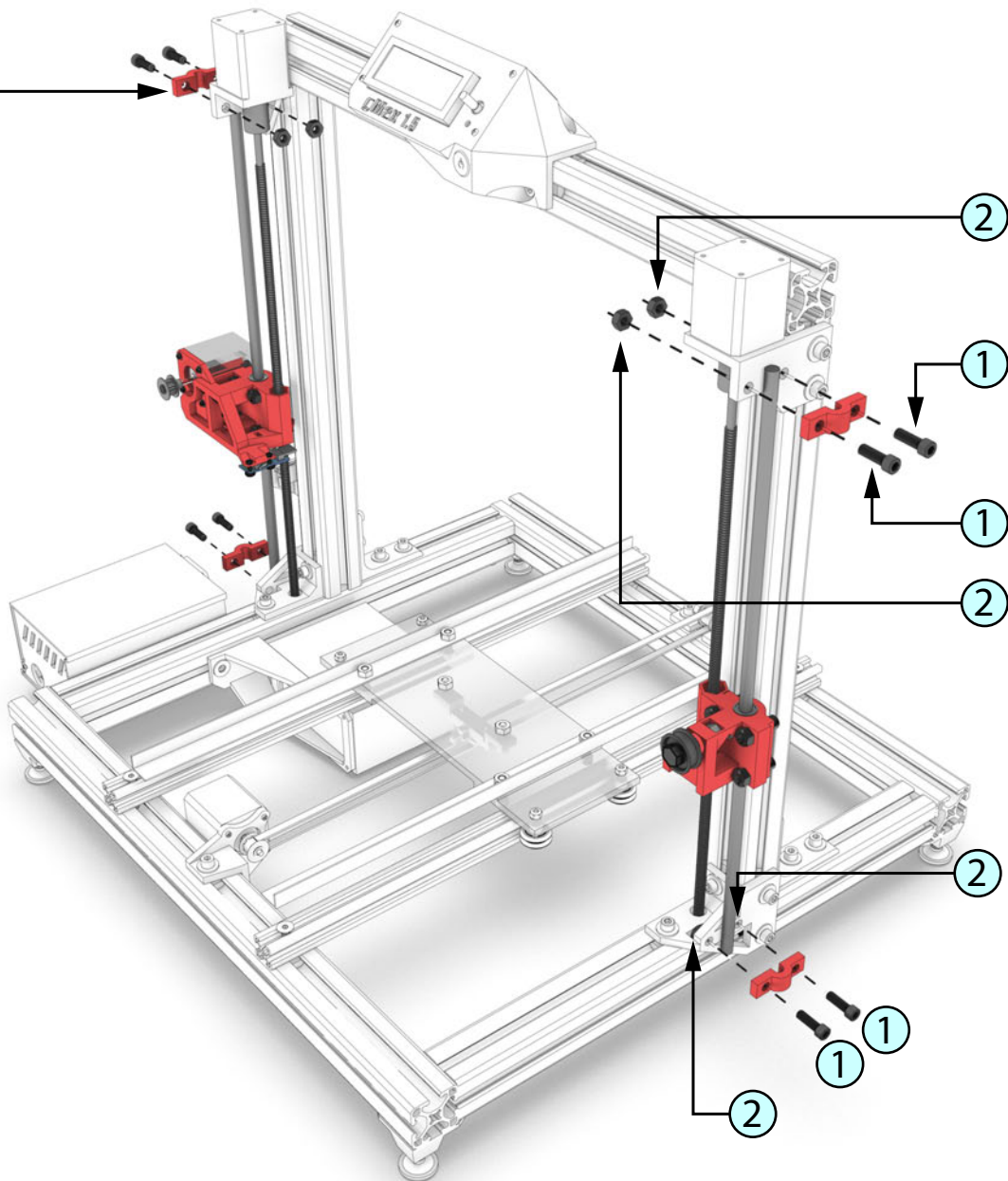


(2) 1/4" x 3/4" bolts each side
(2) 1/4" nuts each side

1 8x
*1/4" x 3/4"
bolt

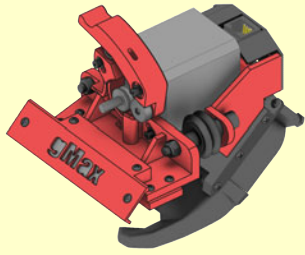


2 8x
*1/4" nut



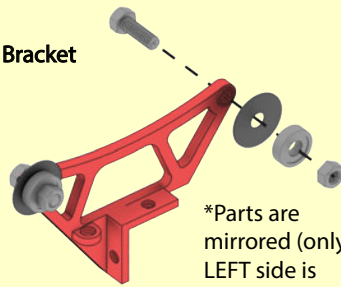
1. Install parts on z-axis rods **Step 10**

1x Extruder



*Extruder comes assembled
(Single extruder shown)

2x Filament Bracket



*Parts are mirrored (only LEFT side is shown)

- (2) 1/4" x 3/4" bolt each side
- (2) 1/4" washer each side
- (2) t-nut each side
- (2) 5/16" x 1" bolts each side
- (2) 1/4" printed washer each side
- (2) 608 bearing each side
- (2) 5/16" nuts each side

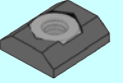
1 2x 24" thin aluminum rail



2 2x 4-40 x 1" screw w/ nut



3 4x t-nut



4 4x 1/4" x 3/4" bolt



5 4x 1/4" washer

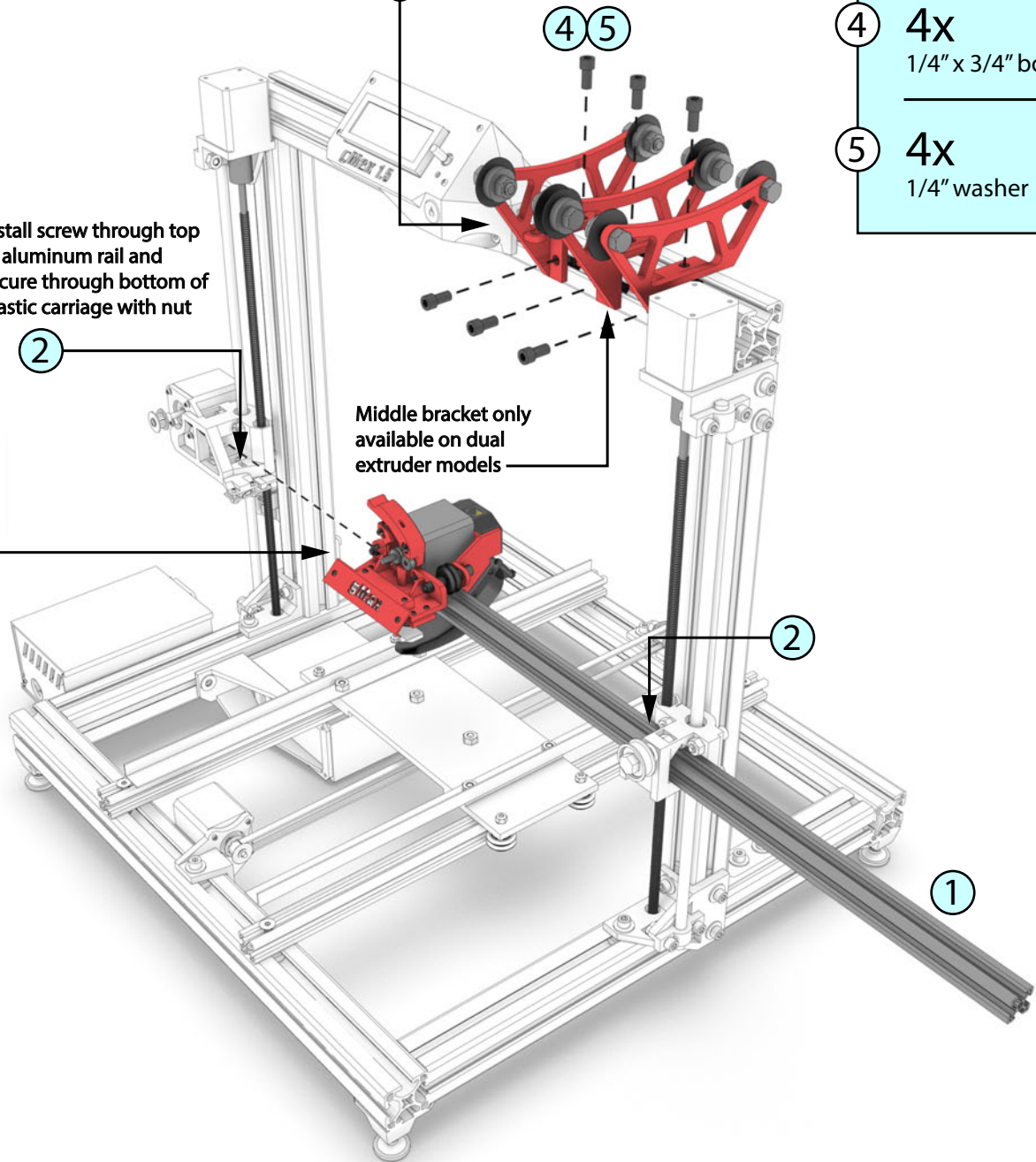


Install screw through top of aluminum rail and secure through bottom of plastic carriage with nut

2

Middle bracket only available on dual extruder models

4 5



1. Install extruder rail w/ extruder
2. Install filament spool brackets
3. Install 4-40 x 1" screws and nuts on rail

Step 11

1x Y-Axis Endstop

(1) 1/4" x 5/8" bolt
 (1) 1/4" washer
 (1) Endstop

Tension spring diagram

Note:
 Install tension spring close to extruder assembly.
 Spring should be extended approx half way.

- 1 **1x** 51" GT2 belt

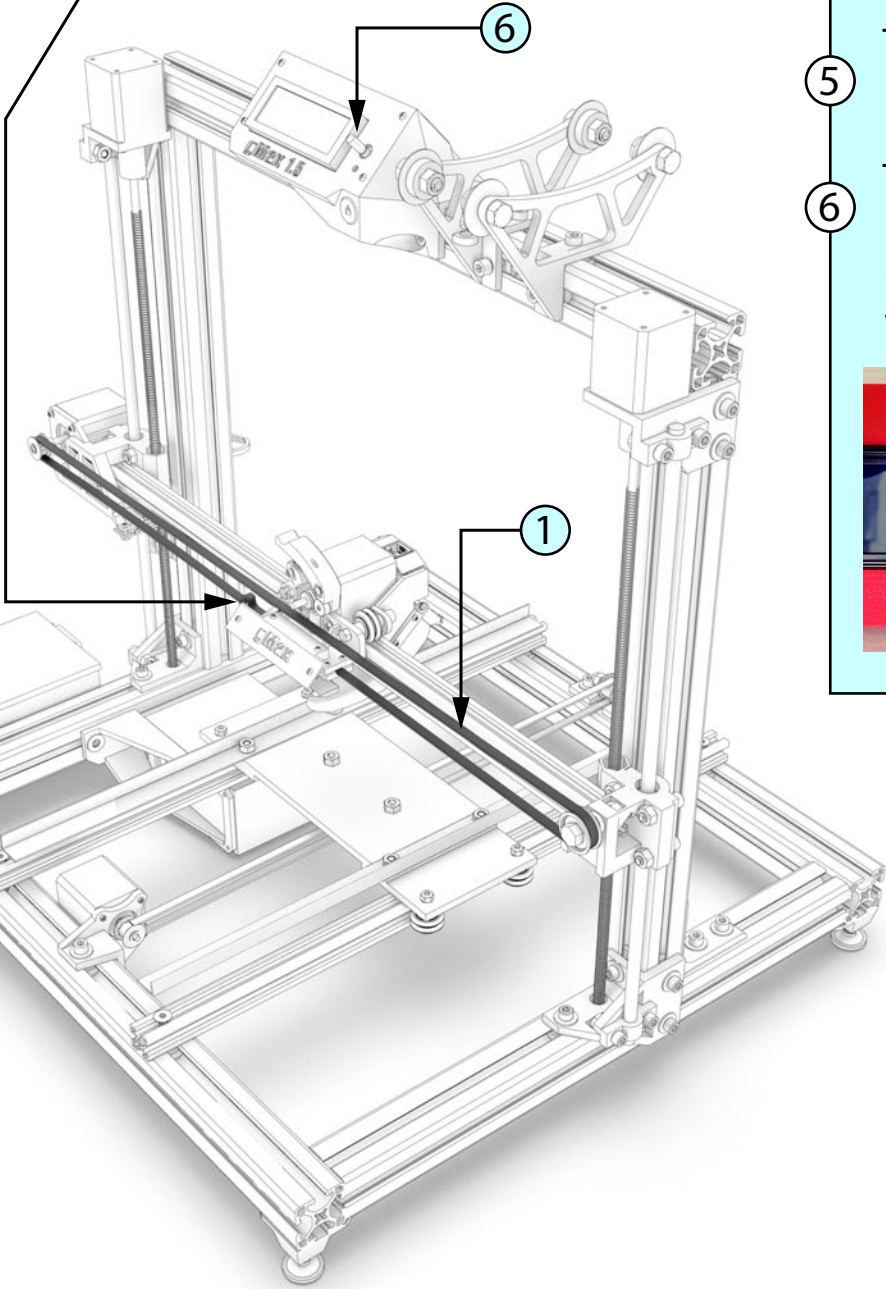
- 2 **1x** Tension spring

- 3 **1x** t-nut

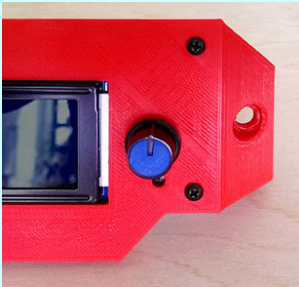
- 4 **1x** 1/4" x 5/8" bolt

- 5 **1x** 1/4" washer

- 6 **1x** LCD screen knob (knob is in plastic box along with SD card)

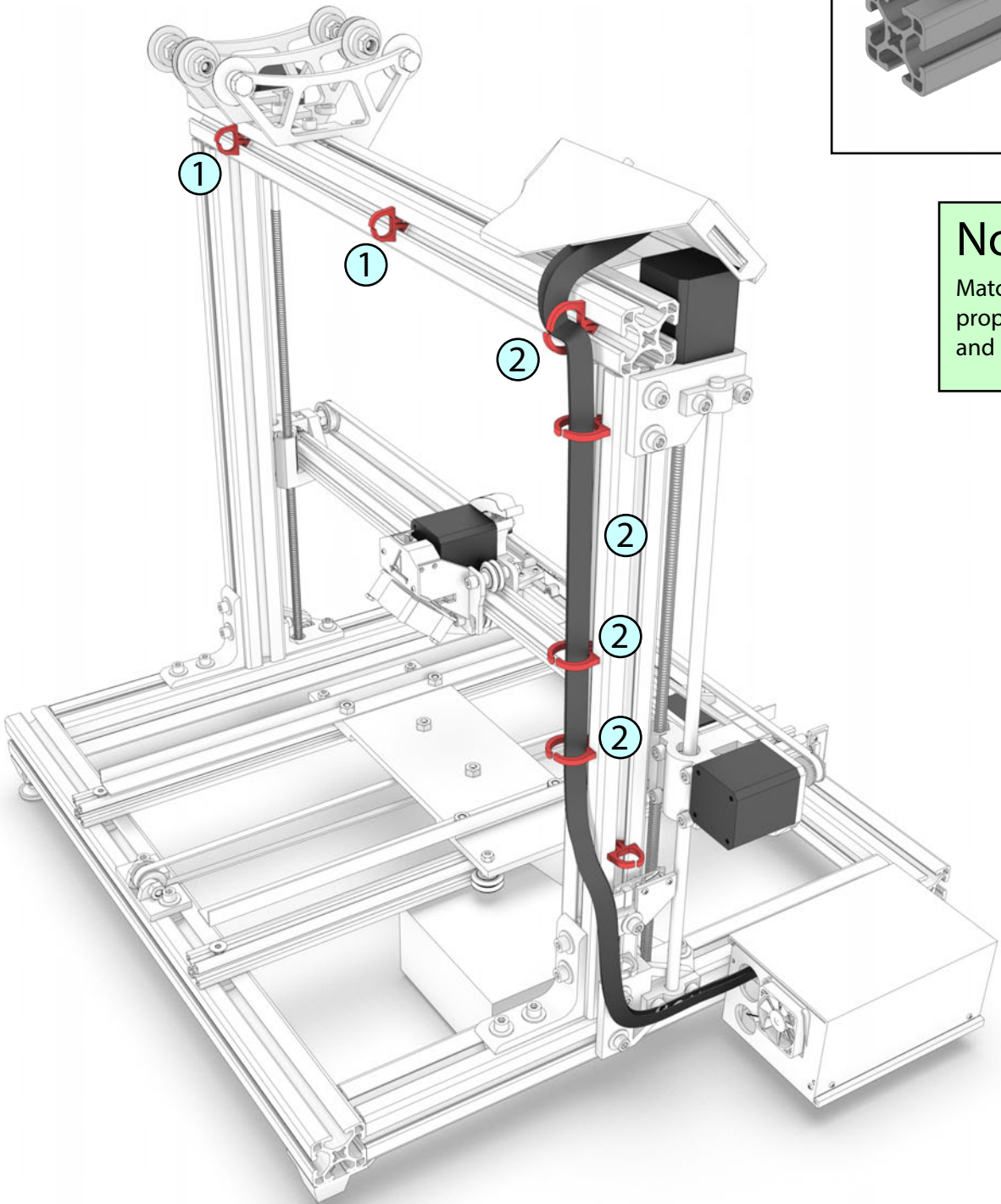
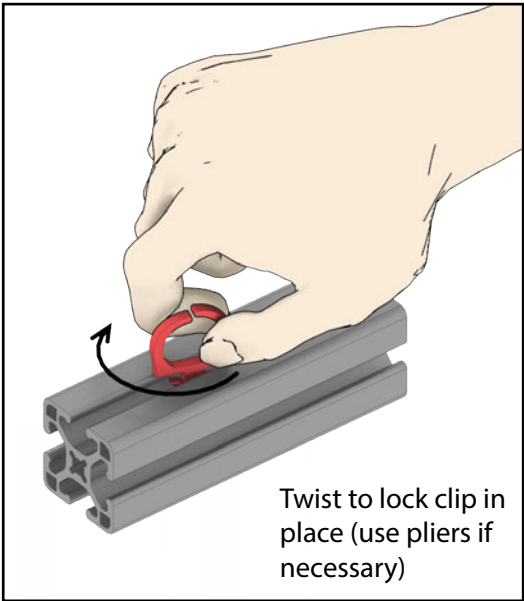
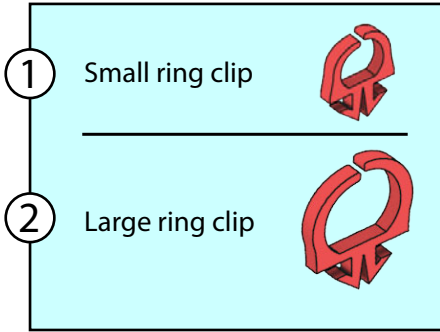


Note:
 V-Slot wheel should trigger endstop when bed is pulled forward



1. Install X-axis GT2 belt
 2. Install Y-axis endstop
 3. Install LCD screen knob

Step 12





Notes

Match tags on wire with proper motors, endstops and LCD position.

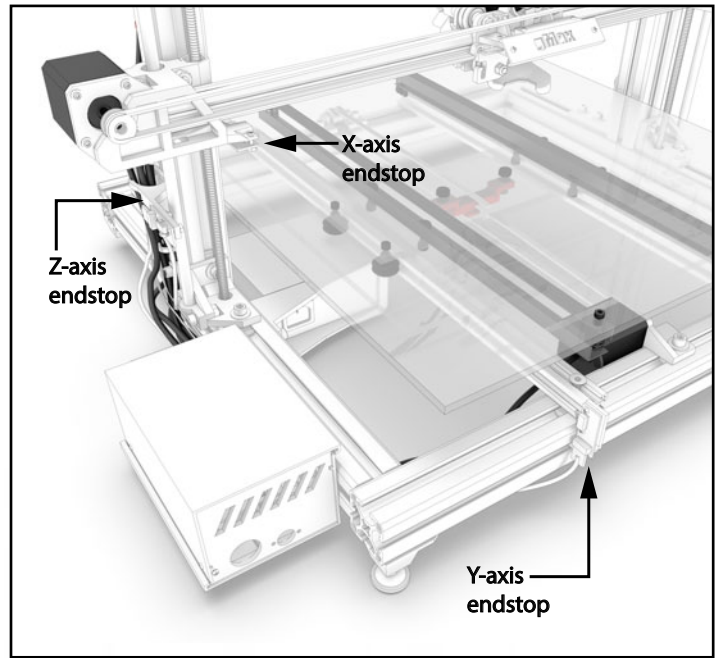
1. Install wire management rings
2. Install ribbon cable

Step 12.1

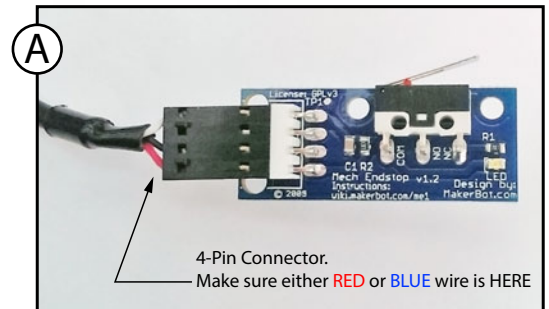
- ① Small ring clip 

- ② Large ring clip 

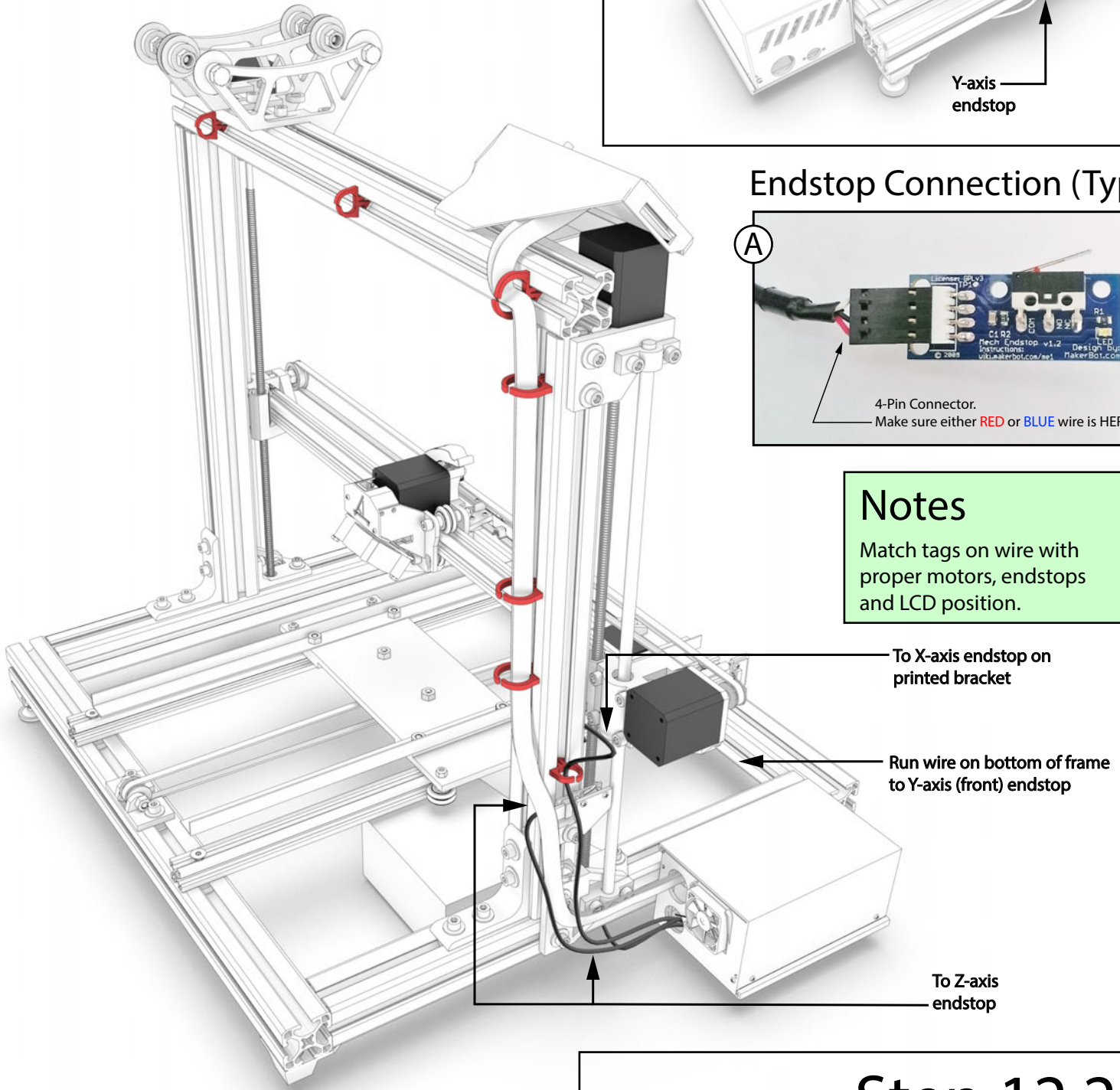
Front view of printer




Endstop Connection (Typ)




Notes
Match tags on wire with proper motors, endstops and LCD position.

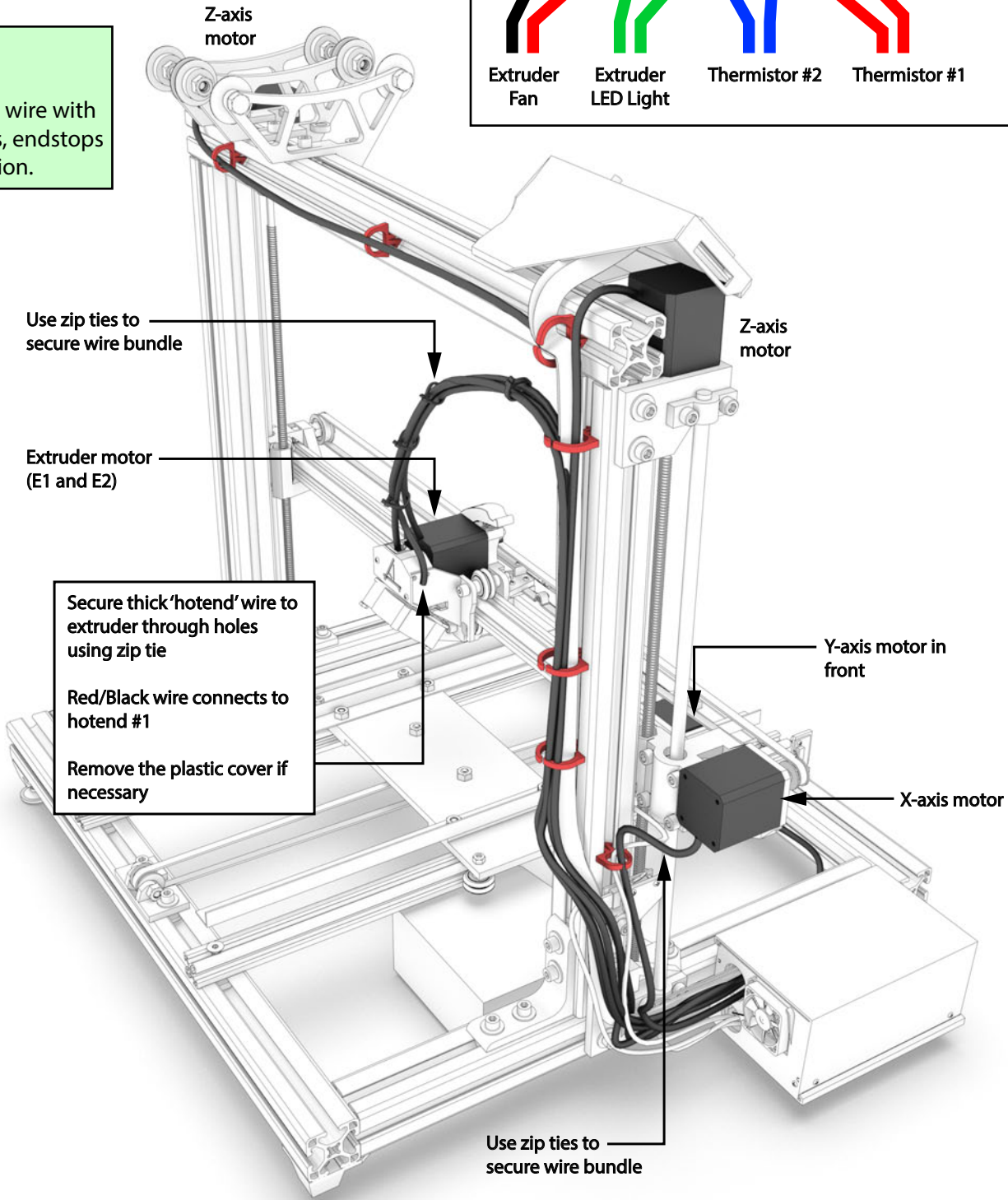
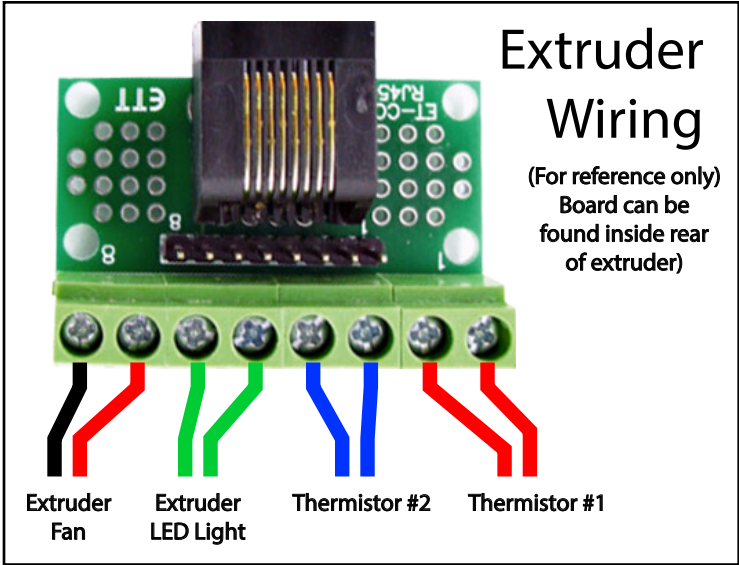


1. Install ribbon cable **Step 12.2**


- 1 Small ring clip 


- 2 Large ring clip 

Notes
 Match tags on wire with proper motors, endstops and LCD position.

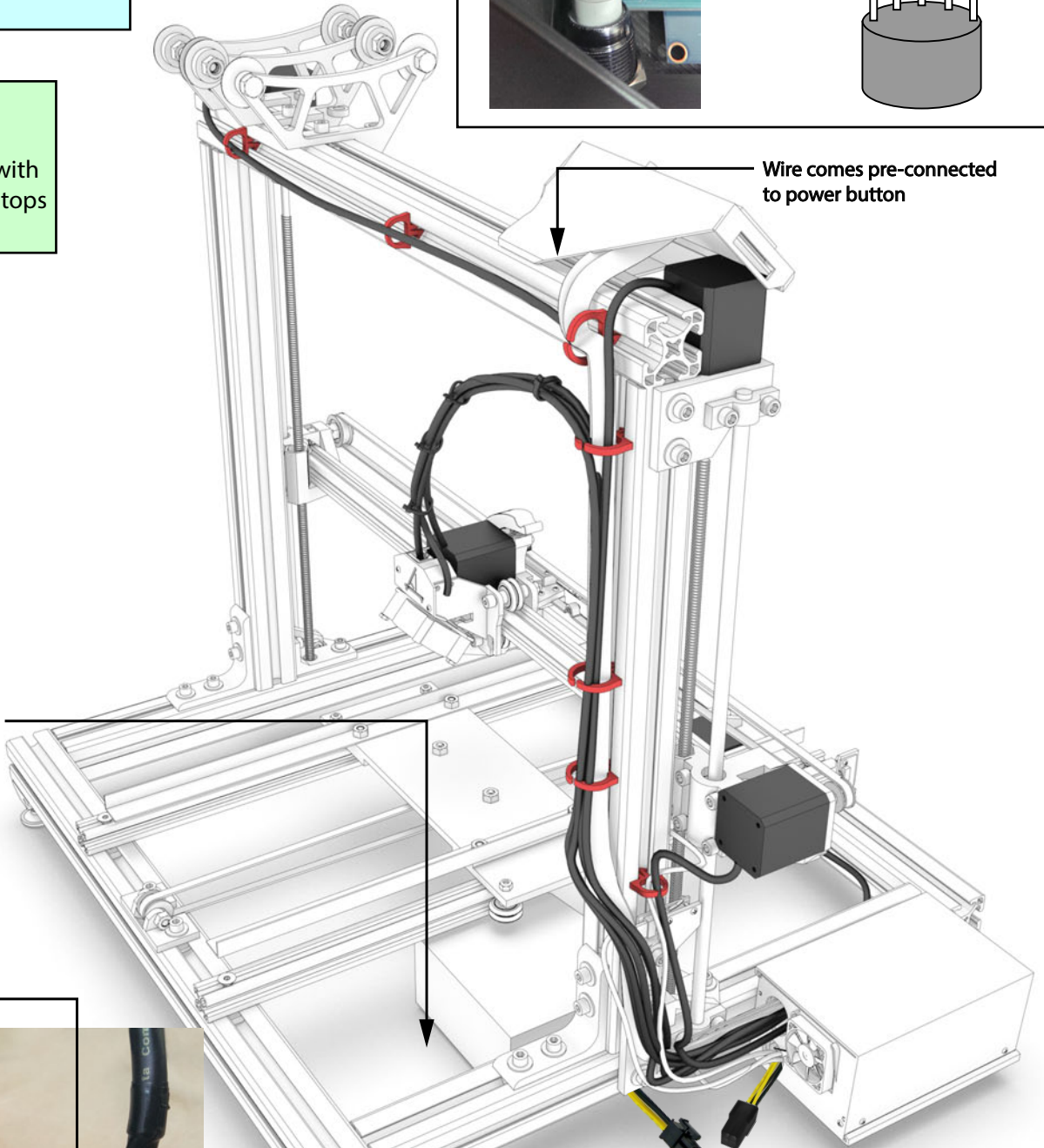
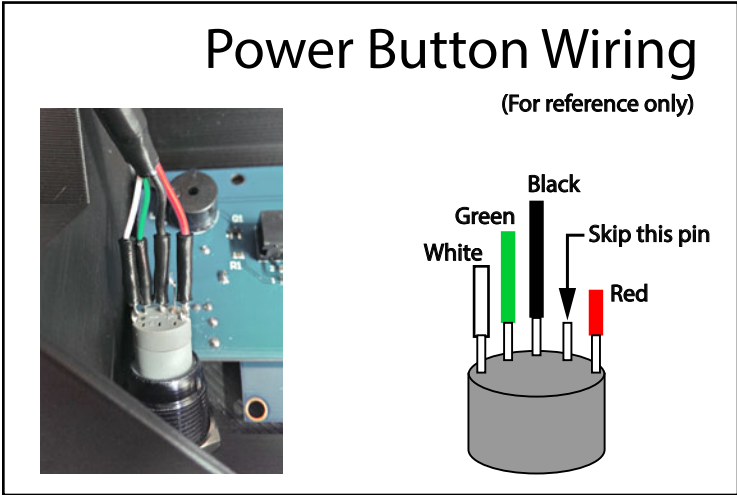


1. Install motor wires
 2. Plug in extruder wire bundle
- # Step 12.3

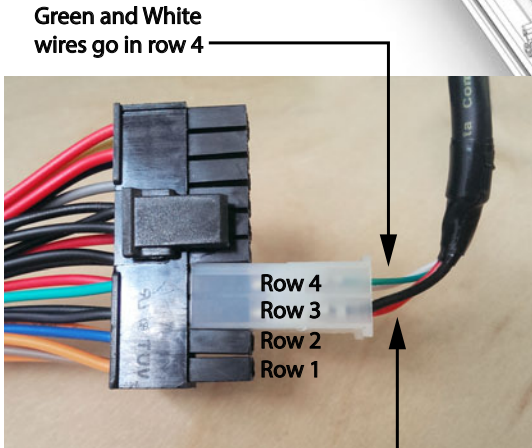
- ① Small ring clip 

- ② Large ring clip 

Notes
Match tags on wire with proper motors, endstops and LCD position.



1. Connect wire from power button to 20-pin connector on power supply in columns 3 and 4
2. Slide connector all the way down

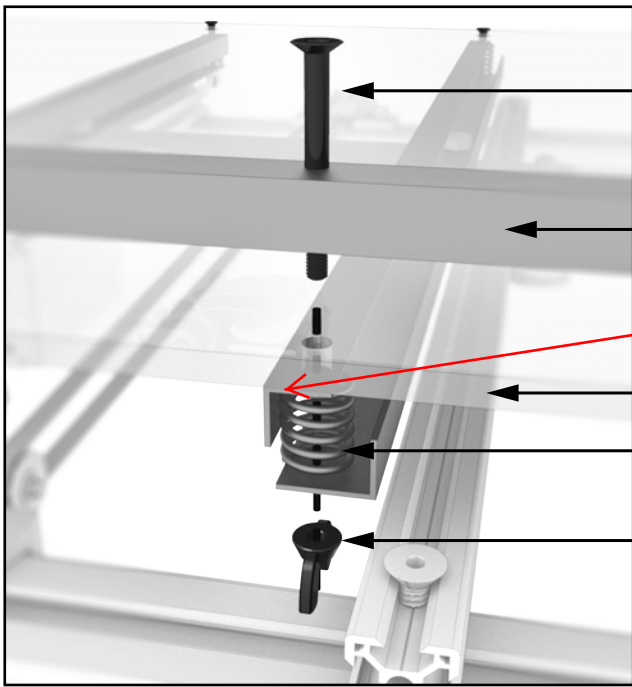


Green and White wires go in row 4

Black and Red wires go in row 3 (towards bottom in this image)

Connect 4-Pin wire from power supply to electronics (2) Black Wires, (2) Yellow Wires

1. Plug in power from power supply
 2. Plug in power button from LCD screen
- # Step 12.4



M4-35 flat head bolt

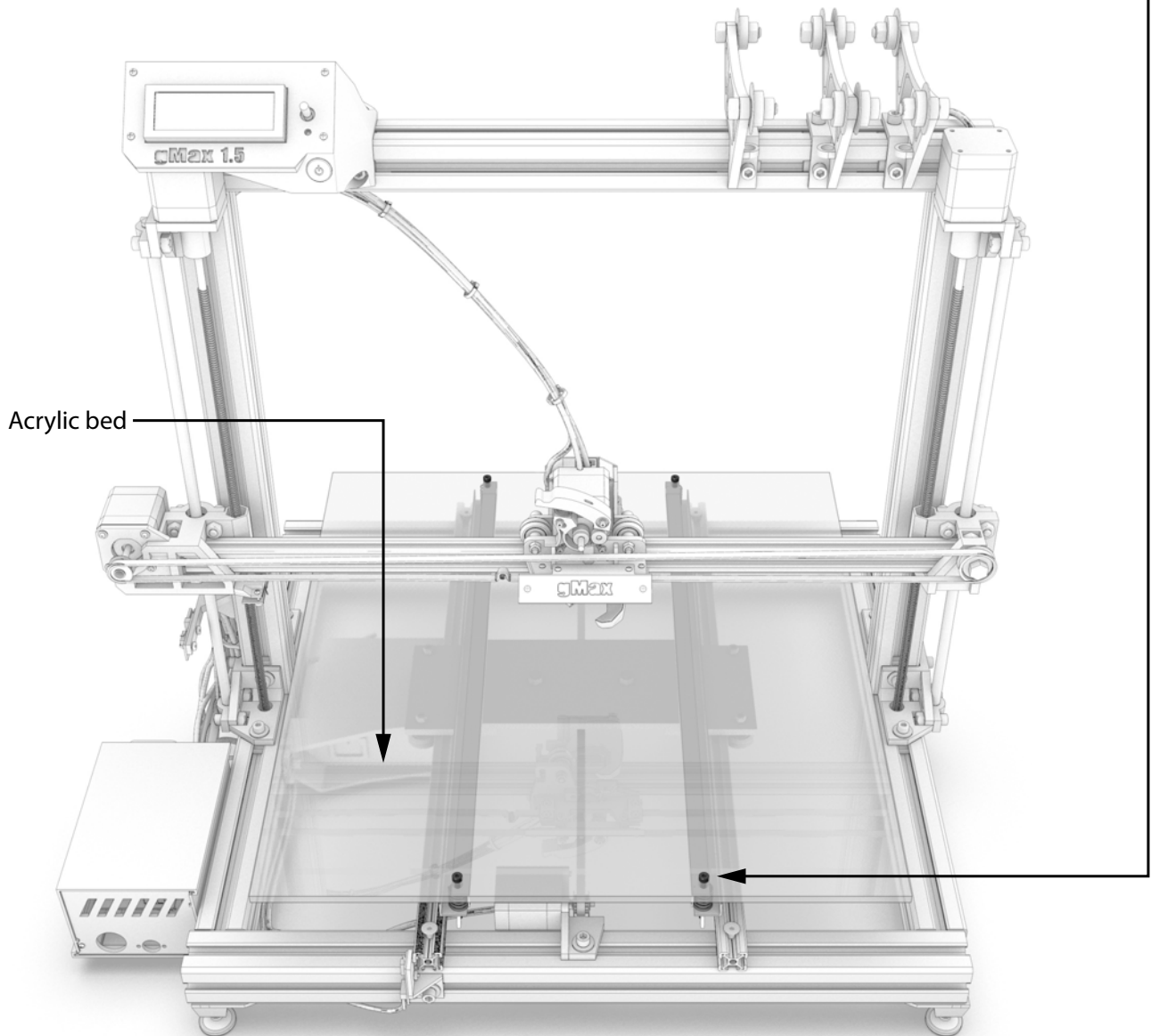
Aluminum angle
(attached to bed)

*Note: For XT printers use
1/2" x 3/4" aluminum angle

Acrylic bed

Bed leveling spring

Nylon wing nut



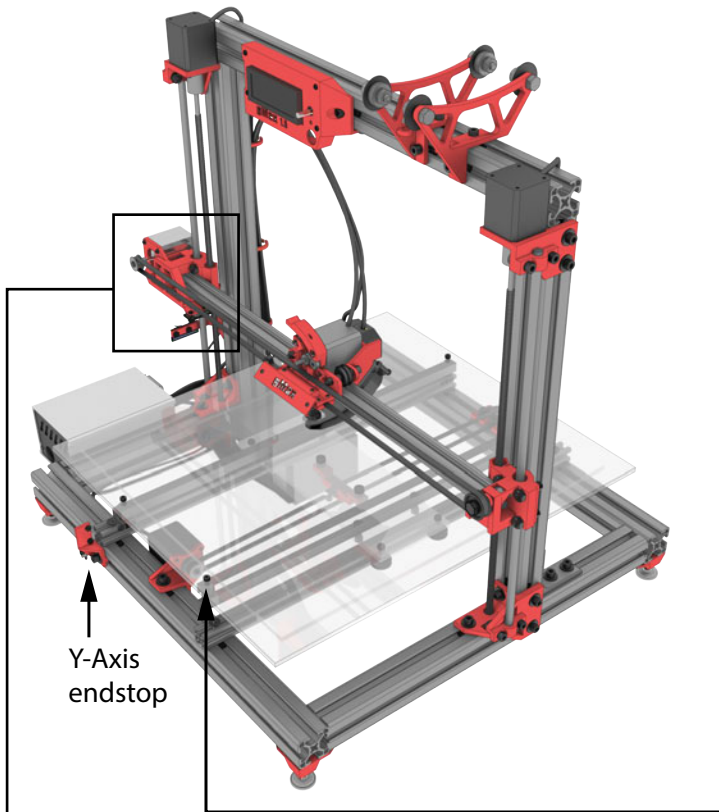
Acrylic bed

1. Install acrylic bed and hardware

Step 13

Calibrating Your Printer

You must complete these steps before turning on the printer for the first time



Level Printer Bed

1. With printer turned off, slide extruder to far left and put a piece of paper below. Lower extruder, by manually turning BOTH Z-Axis motors at top, until the piece of paper just barely pulls out from under extruder.

2. Move the extruder to the far right and repeat same actions as previous step this time only turning the right motor.

3. Repeat steps 1 and 2 a few times to ensure extruder is level left to right.

4. Next move extruder to left and slide bed to rear. Adjust the bed height by turning the wingnuts while holding the bolt. For larger movements you can loosen bed rails and raise or lower the rail. Adjust height until a piece of paper barely fits below.

5. Repeat step 4 for all 4 corners and ensure the nozzle is level across the full bed.

*Note:

After you begin a print, can should manually adjust the height of the extruder by turning each z-axis motor coupler which connects the motor to the threaded rod. The motors are disabled when not in use and should turn easily. Once the height is set you should adjust the z-axis endstop screw in the next step.

Adjust Endstop Locations

1. After extruder is leveled with bed, turn on printer.

2. Move extruder to far left and it should trigger the X-Axis endstop. When it hits the endstop (seen in step 10) a blue light should come on. If no light appears check wiring and make sure lever, on endstop, is being triggered.

3. Pull bed forward and ensure Y-Axis endstop is triggered.

4. Adjust height of Z-Axis endstop so it is triggered when extruder is just touching bed (refer to Fig 13.1). For fine adjustment turn the screw.

Note:

Make sure to check the endstops during routine maintenance to ensure everything lines up. If printer is started and it doesn't hit an endstop the **printer may be damaged!**

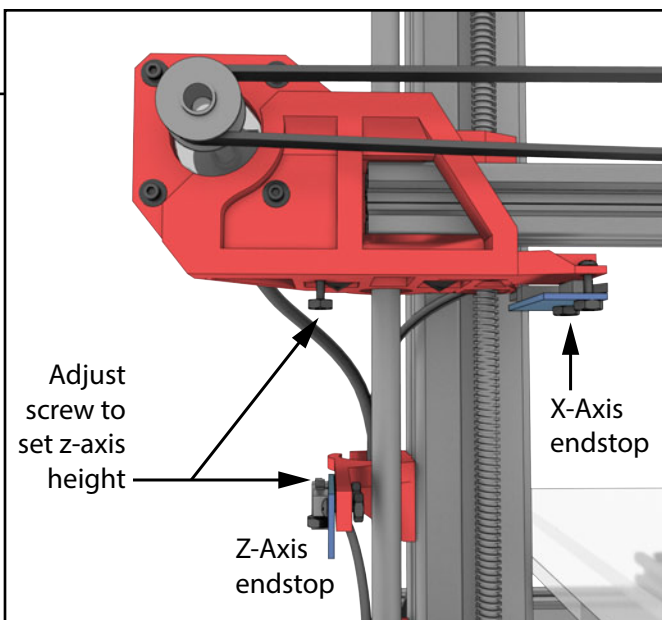
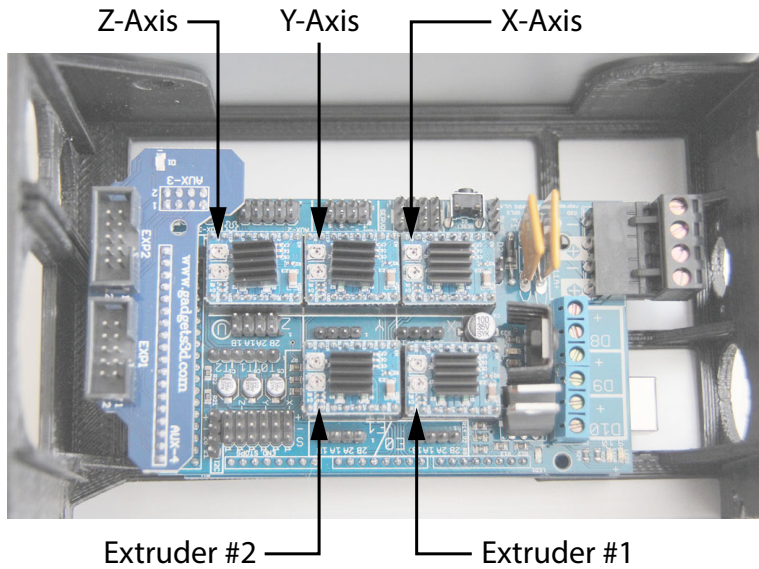


Fig13.1

Calibrating your Printer Part 2

Additional calibration and tweaking tips

*Note stepper drivers come pre-set and only small adjustments are necessary



Adjust power for motors (Stepper Drivers)

1. Turn the printer on and use LCD screen (or computer software) to test X, Y and Z movement. If using LCD screen menu go to "Prepare > Auto Home" to send extruder to home position. Alternately use "Prepare > Move Axis > 1.0mm > Axis" to move independantly

*Note extruder motor won't turn if extruder is too cold as a safety measure.

2. If motors don't turn but skipping is heard, motors may be receiving too much or too little power.

3. Adjust how much power is sent to each motor by turning the lower potentiometer, using the supplied ceramic screwdriver, as seen in Fig 14.1. Turn screw in 5 degree increments until motor makes a light hum and doesnt skip. It's better to slightly overpower motor as too little power can cause skipping in prints with rapid movement.

4. Top potentiometer is used as a temperature cut-off safety but isn't needed. Make sure this potentiometer is turned to the position shown in Fig 14.1

* Make sure not to overturn potentiometers as they may turn past the limits.

5. After adjusting motors, refer to the quickstart guide to start a print. After 5-10 minutes, feel the back of each motor to ensure they aren't getting very hot (warm is ok). If too hot, they may be receiving too much power. Also check heatsink as seen in Fig 14.1. Be careful since it may be very hot. If too hot turn down the potentiometer slightly.

Temperature shutoff
Make sure flat spot is turned to position shown in red. No further adjustment required

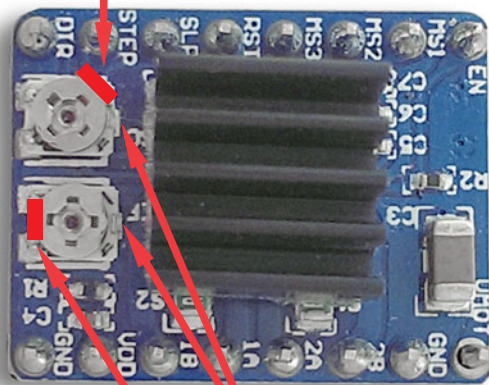


Fig14.1

Turn potentiometer clockwise to increase power or turn counter-clockwise to reduce power to motor.

Small metal tabs located here are used to stop potentiometer from spinning continuously.

Tips:

Look closely at the potentiometer and the flat spot on the screw should be close to the position represented as a red bar in this image.