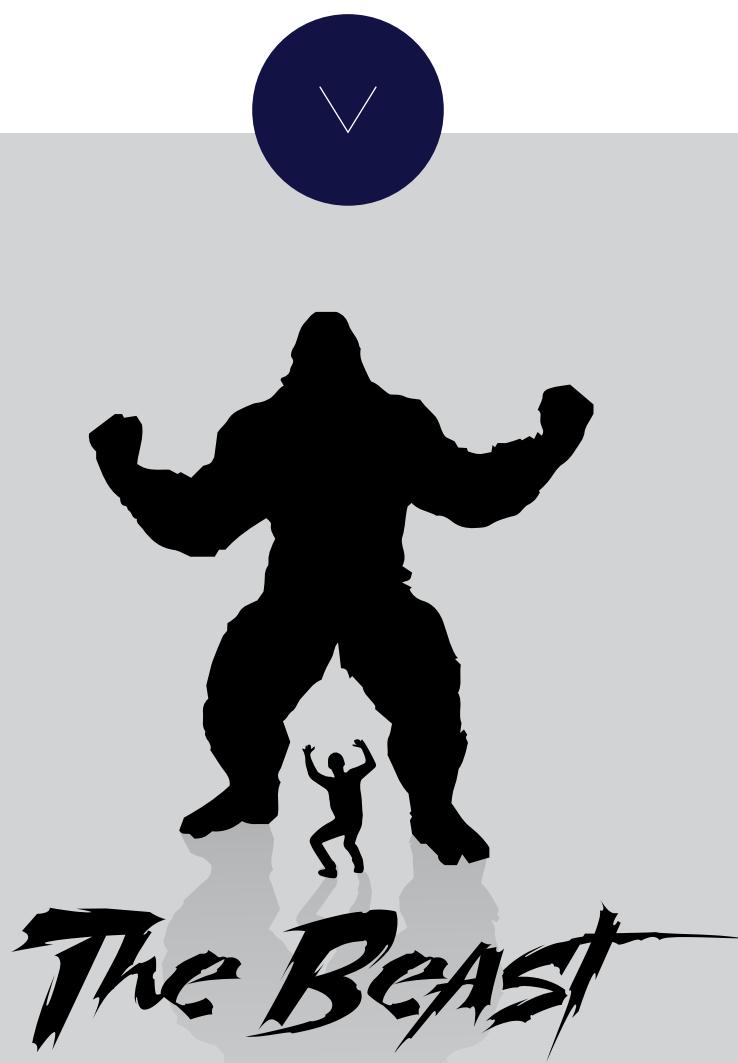




CULTIVATE3D.COM

THE BEAST

KIT BUILD MANUAL



Cultivate3d

The Beast

CREDITS

"The Beast" would not be possible without the relentless efforts of the Open Source 3D Printer Community.

Particular respect to:

Josh Mamo : Cultivate3d

Dan Herlihy : Cultivate3d

Repetier : 3D Printer Firmware and Software

Makerslide : Barton Dring

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Reference Photos for this build are available from
<http://cultivate3d.com/beastphotos>

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about this build

Building a 3D Printer can be an incredibly satisfying endeavor, made more so by the knowledge "The Beast" is one of, if not the most versatile production FDM (Fused Deposition Modeling) machines on the market. With your printer, you will be able to achieve 4x the production rate of standard FDM 3D Printers while maintaining very high quality print output.

Buying a ready made 3D Printer is simple. Learning how to use it effectively is something which can only occur if you truly understand the underlying technology. This build process will give you the tools and understanding to command the printing process and therefore get the most of out all 3D Printers, not just "The Beast".

Don't be afraid of the apparent complexity of all the wires, tubes and electronics. Building a 3D Printer looks a lot more complex than it is. The Beast has 4x this apparent complexity. Getting it to work well will require dedication and an aptitude to learn. The theory is simple, feed plastic filament into a heater block, it melts and electronics control how much to melt, and where to put it down. We're sharing with you the sum of our knowledge about this technology however this build manual can only provide some of the answers, the rest will be best answered through your own experimentation and ability to think outside of the box.

We know "The Beast" will prove to be a solid production workhorse. If you follow these instructions, you'll be left in a perfect position to truly understand the FDM printing process and what makes these machines work for *you* to produce reliable, perfect prints.

Cultivate3d: Imagine Your Future.

DAN HERLIHY

General Manager



how to use this manual



This manual is intended to be used a visual reference. Many of the concepts herein are difficult to explain without images. Pay particular attention to "notes" depicted by the symbol above. These notes should not be ignored as they are critical to the construction and or function of the final product.



Look for part names and important information in **BOLD**.

All references to "Captive Nuts" will be documented, **but not instructed**. These nuts MUST be pressed into their respective holes with pliers. You may need to clean printing artifacts from these holes in order to press the nut into its captive space.

Some printed parts may need to be "Finished" before use. This may involve cleaning printed artifacts from the part or drilling out holes to size prior to use in your printer.



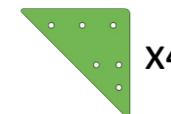
tools required

- Hex Socket driver set to suit M3 and M5 Socket Screws
- Small and Medium Phillips and Flat head screw driver
- Scalpel or craft knife
- Electric Drill with 3mm and 5mm drill bits, Phillips and Hex driver-bits
- Small and Large Long Nose Pliers
- Wrench and Socket set to suit M3 and M5 nuts
- Small Side Cutters
- Soldering Iron (Optional)
- Cigarette Lighter
- Set Square



x2

Look for icons similar to the ones on the left on the top of pages which have a "Parts required" List. These icons represent printed plastic and acrylic parts. Next to the icon is a number which indicates the **total number of parts required including repeats (see above)**.



x4

Black icons are Printed.
Green Icons are 3mm Laser Cut Acrylic



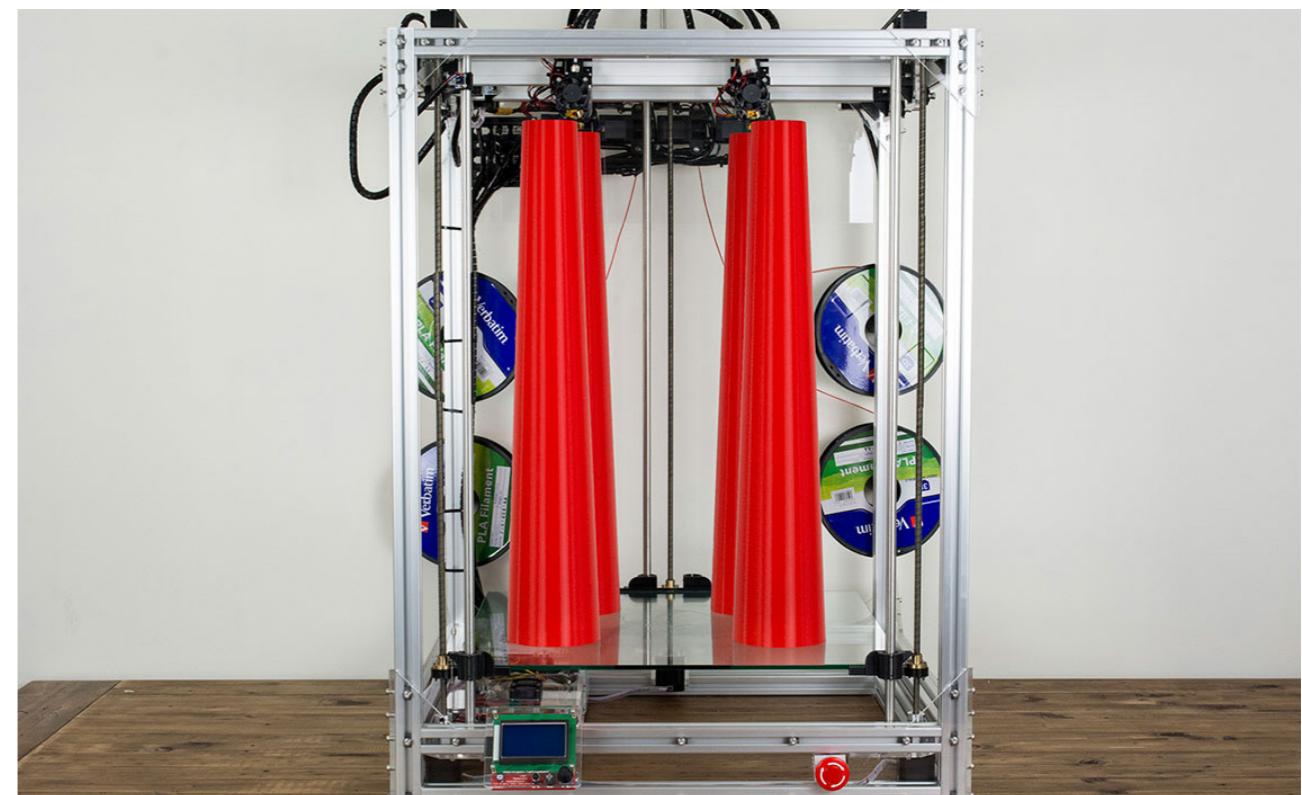
x2

Blue Icons are 6mm Laser Cut Acrylic



Parts Required

- M5 x 35mm Screws
- M5 Hex Nuts
- 1x Lead Screw Idler
- 1x Acrylic Side Braces
- 1x Z Motor Brace



Space to work

Ensure you have enough space to complete the Build. "The Beast" is a very large printer. We estimate you will need **at least 2 cubic meters** to build and store your printer. Bear in mind, you may want to access the rear of the printer on a regular basis. You may also need extra space to be able to remove and clean your print bed or to change filament.

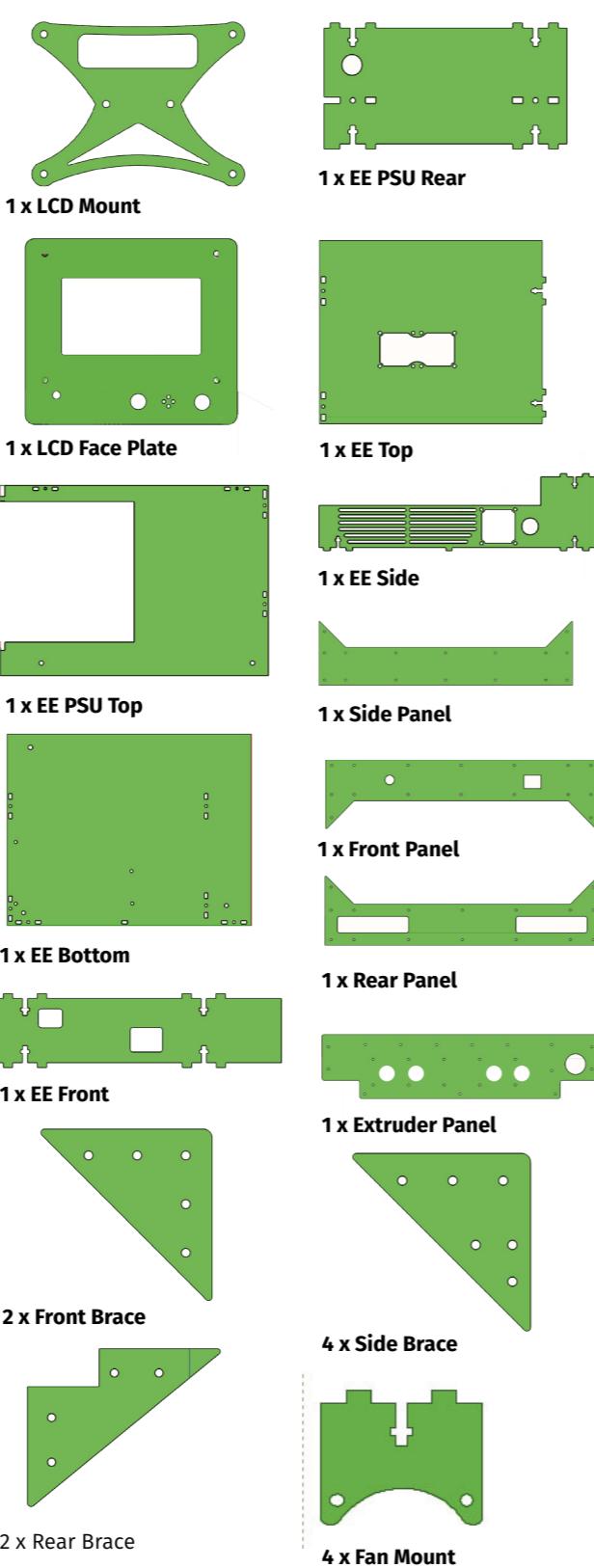
Build Time

Building a 3D Printer is simple, as long as you have time, patience and the ability to learn. Although this build can be completed in less than 48 hours, we recommend first timers give themselves plenty more time to complete their first build. It is far better to take your time with the knowledge everything is done right, than to rush the job and regret the painful prospect of having to partially disassemble the printer to fix something you missed.

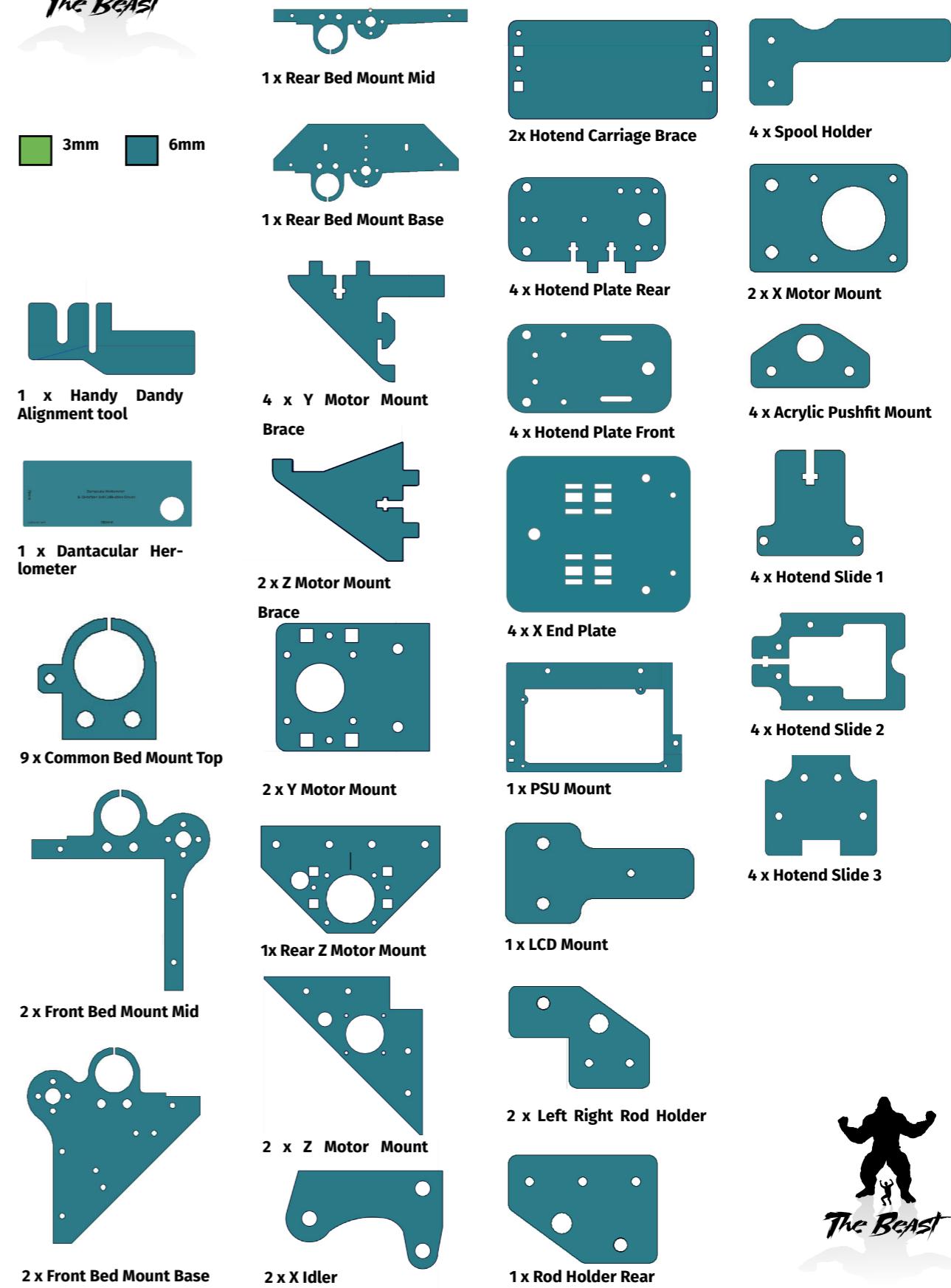
Plastic Parts Reference



Laser Cut Parts Reference



Laser Cut Parts (Cont.)





x2

25mm Spacer



The Beast

The Beast

Construct 2x Y-Idler assemblies as shown and set aside for later use.



Parts Required (Per Assembly)

- 1x M5 50mm Screws
- 2x M5 Hex Nuts
- 2x F605ZZ Flanged Bearing
- 1x 25mm Spacer
- 1x M5 T-Slot Nut



Completed Y-Idler Assembly



M5 Nut

M5 x 50mm Screw

F605ZZ Flanged Bearings

25mm Spacer

M5 T-Slot Nut

ASSEMBLY NAME ▶

Y-Idler

The Y Idler will eventually fix to the top of the printer and acts as a pulley for the 2x Y Belts.



x2

Front Rod Holder



x1

Rear Rod Holder



The Beast

ASSEMBLY NAME ▶

Rod Holders

Parts Required

- M5 x 12mm Screws
- M5 T-Slot Nuts

1x Rear Rod Holder
(Acrylic Part)

2x Front Rod Holders
(Acrylic Parts)

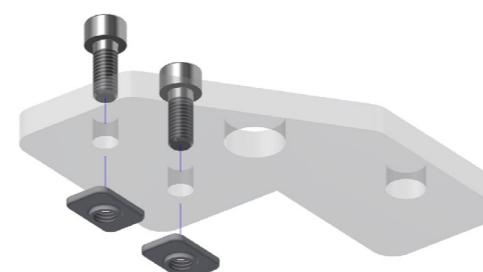
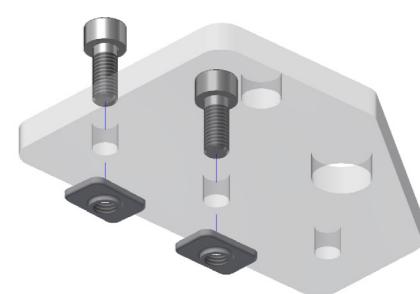
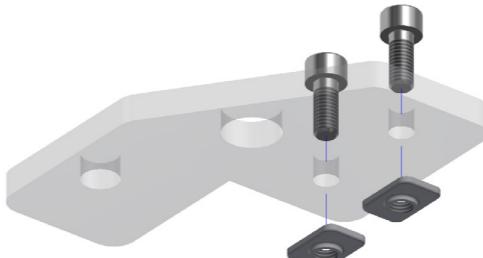


Completed Rear Rod Holder Assembly



Completed Front Rod Holder Assemblies

Construct 2x mirrored Front Rod Holder Assemblies as shown and 1x Rear Rod Holder Assembly as shown below.



PART / SUB ASSEMBLY NAME ▶

Y-IDLER / Rod Holders



x3

12mm Rod Holder



ASSEMBLY NAME ▶

12mm Rod Clamp

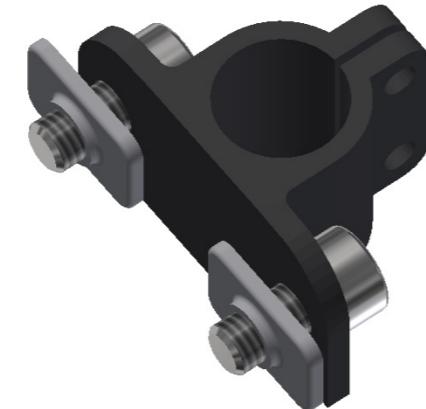


Parts Required (Per Assembly)

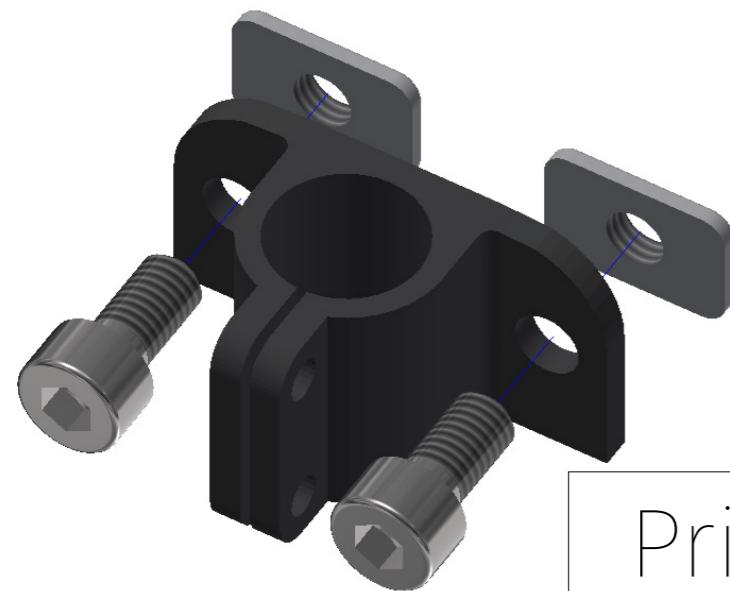
M5 10mm Screws

T-Slot Nuts

1x 12mm Rod Clamp

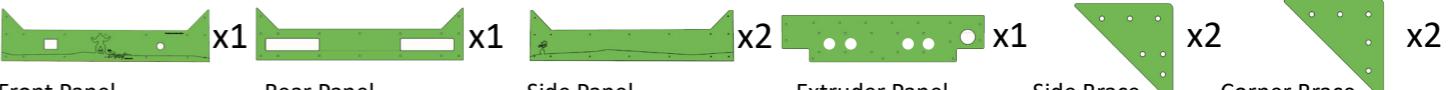
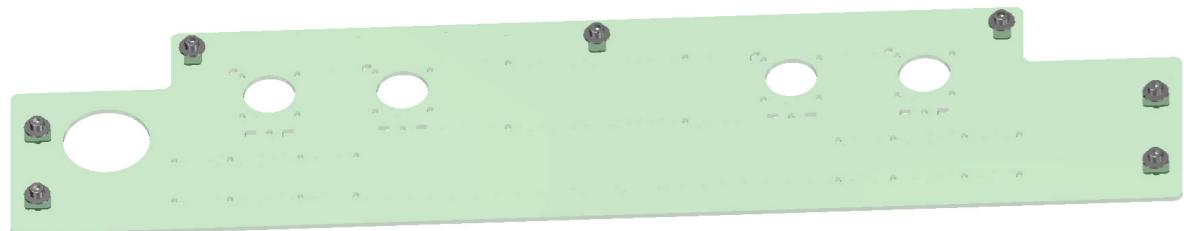


Construct 3x 12mm Rod Holders as shown below and set aside for later use.



Printer Frame

Insert an M5 12mm screw and washer into each hole in the Front, Rear, Side, Extruder Panels as shown, as well as each Corner Brace and Side Brace. Take note, the side braces and corner braces are in mirrored pairs.



Front Panel

Rear Panel

Side Panel

Extruder Panel

Side Brace

Corner Brace



Parts Required

M5 10mm screws

M5 T-Slot Nuts

M5 Washers

1x Front Panel

1x Rear Panel

2x Side Panel

1x Extruder Panel

4x Side Braces

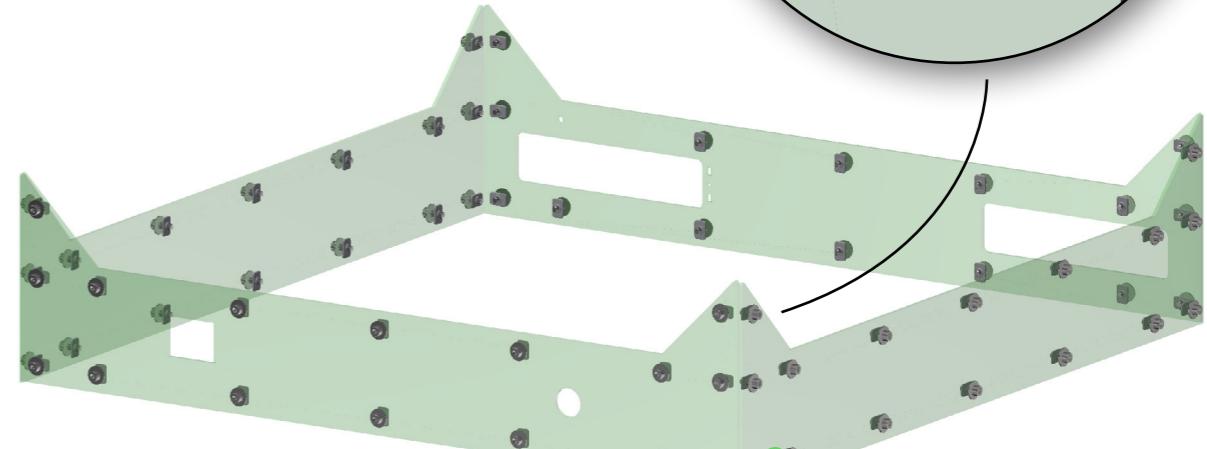
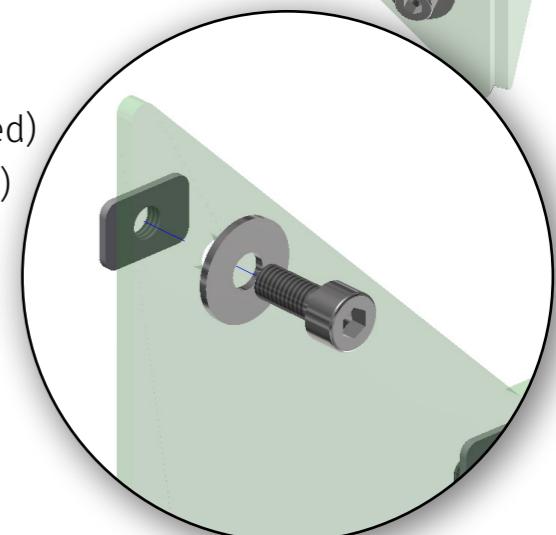
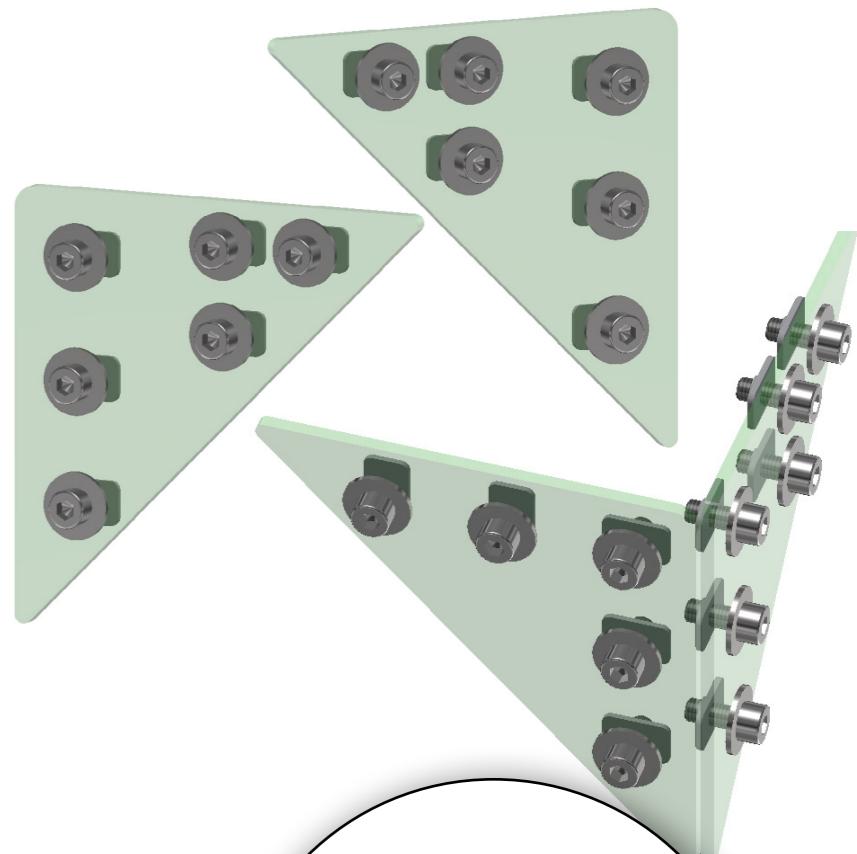
2x Corner Braces

2x Front Rod Holder Asml. (pre assembled)

1x Rear Rod Holder Asml.(pre assembled)

4x 897mm 3030 Extrusion

10x 600mm 3030 Extrusion



PART / SUB ASSEMBLY NAME ▾

Populate M5 Screws





x2

Rear Z Motor Mount Brace



x1

Rear Z Motor Mount

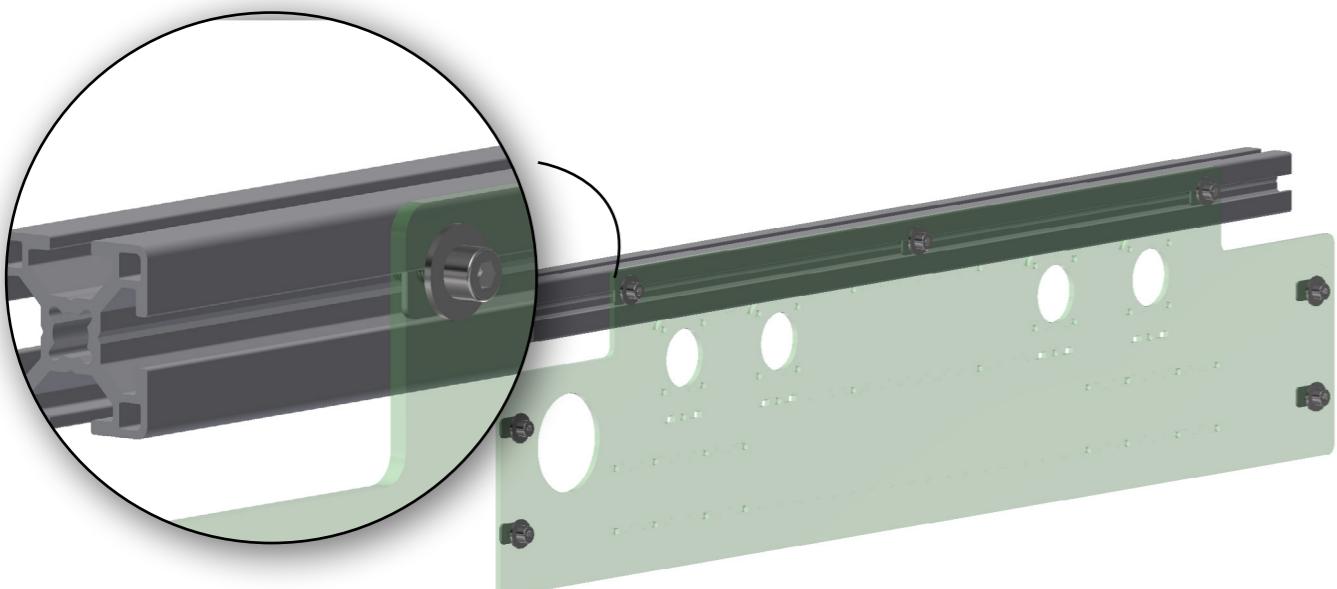
ASSEMBLY NAME▶

Printer Frame



Take note of the orientation of the screw head – all T-Slot **nuts should be on the etching side of the acrylic (if etched).**

Slide 1x 600mm 3030 extrusion onto the top row of T-Slot nuts of the extruder panel and set aside for later use. Finger tighten nuts for later adjustment. See picture.



Extruder Panel with 3030 extrusion attached

Parts Required

M3 16mm Screws

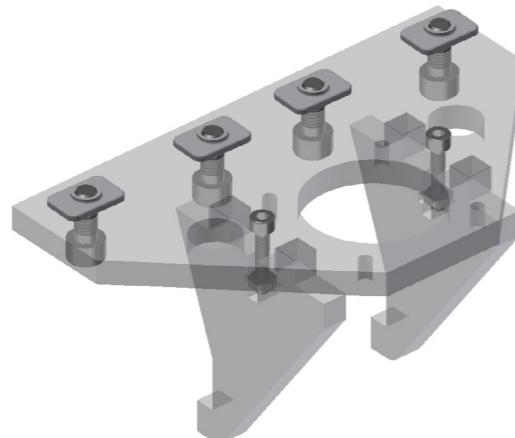
M5 12mm Screws

M3 Nuts

T-Slot Nuts

2x Rear Z Motor Mount Braces

1x Rear Z Motor Mount



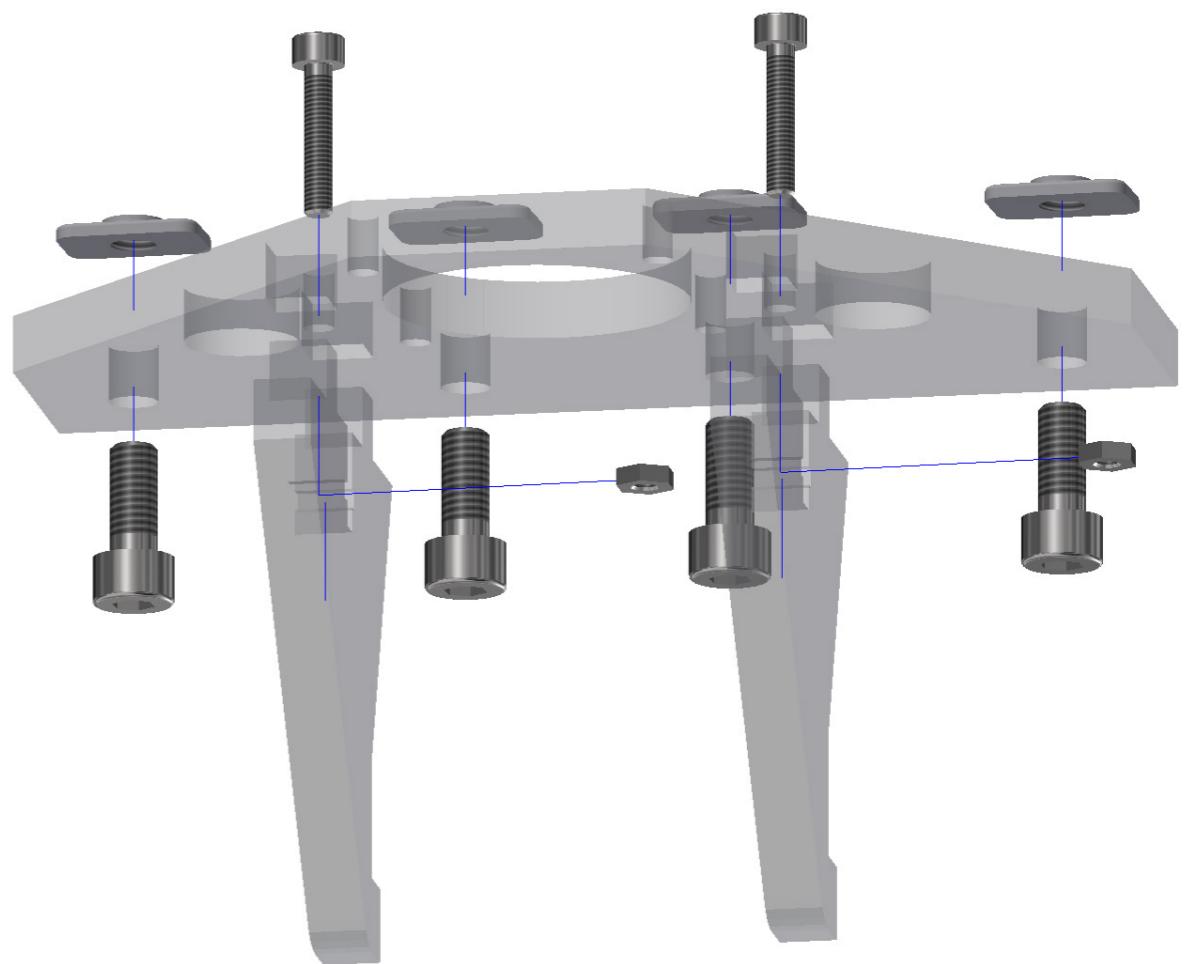
Completed Z Motor Mount Assembly



ASSEMBLY NAME▶

Rear Z Motor Mount

Pre assemble the Z Motor Mount as shown. If need be, press the M3 Nuts into their captive spaces with a pair of long nose pliers.



PART / SUB ASSEMBLY NAME ▶

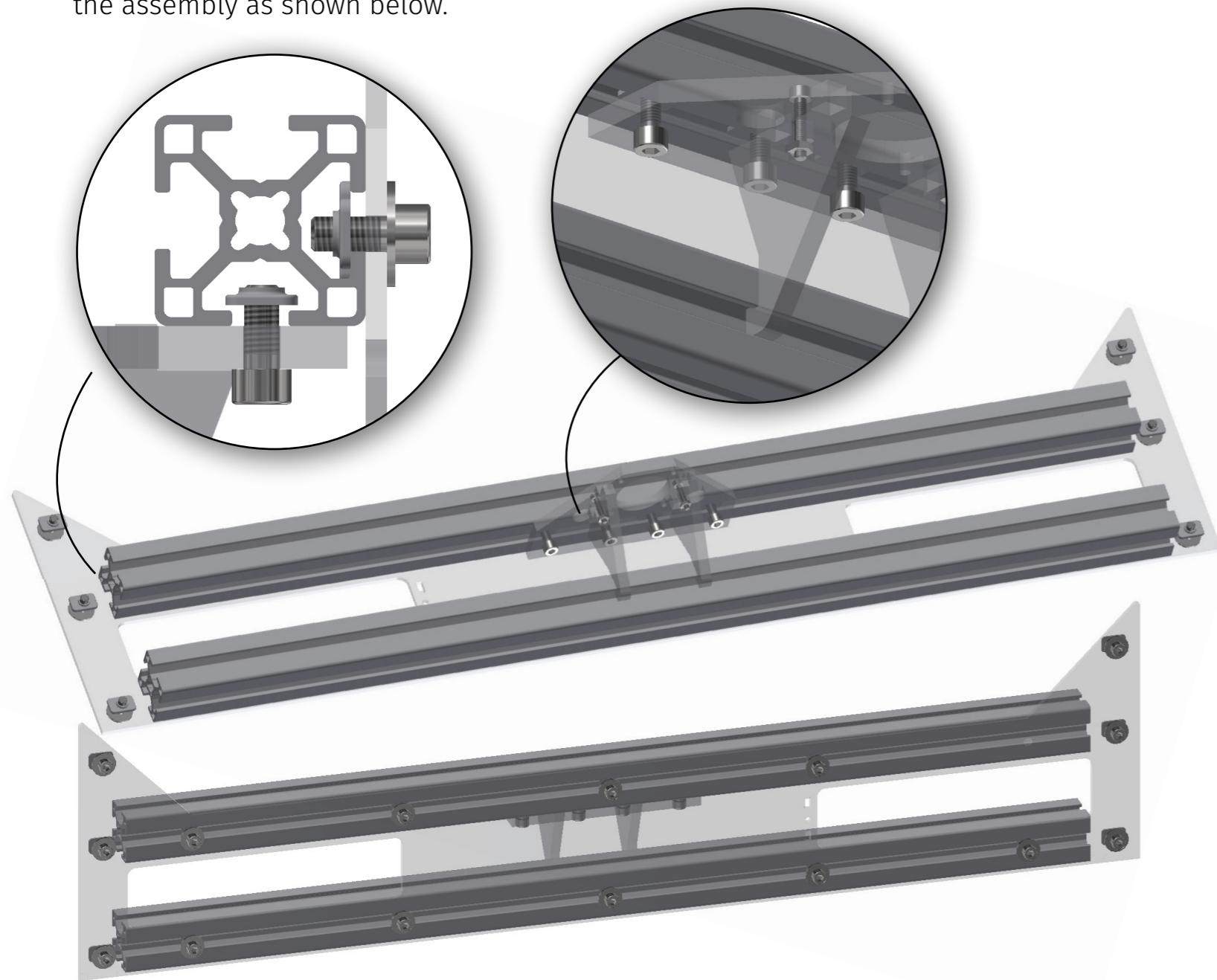
Rear Z Motor Mount



Printer Frame (Cont.)

ASSEMBLY NAME ▾

Insert, center and firmly secure the Z Motor Mount Assembly onto a 600mm 3030 extrusion as shown, then use it and another 3030 extrusion to complete the assembly as shown below.



PART / SUB ASSEMBLY NAME ▾

Printer Frame - Rear Z Motor Mount



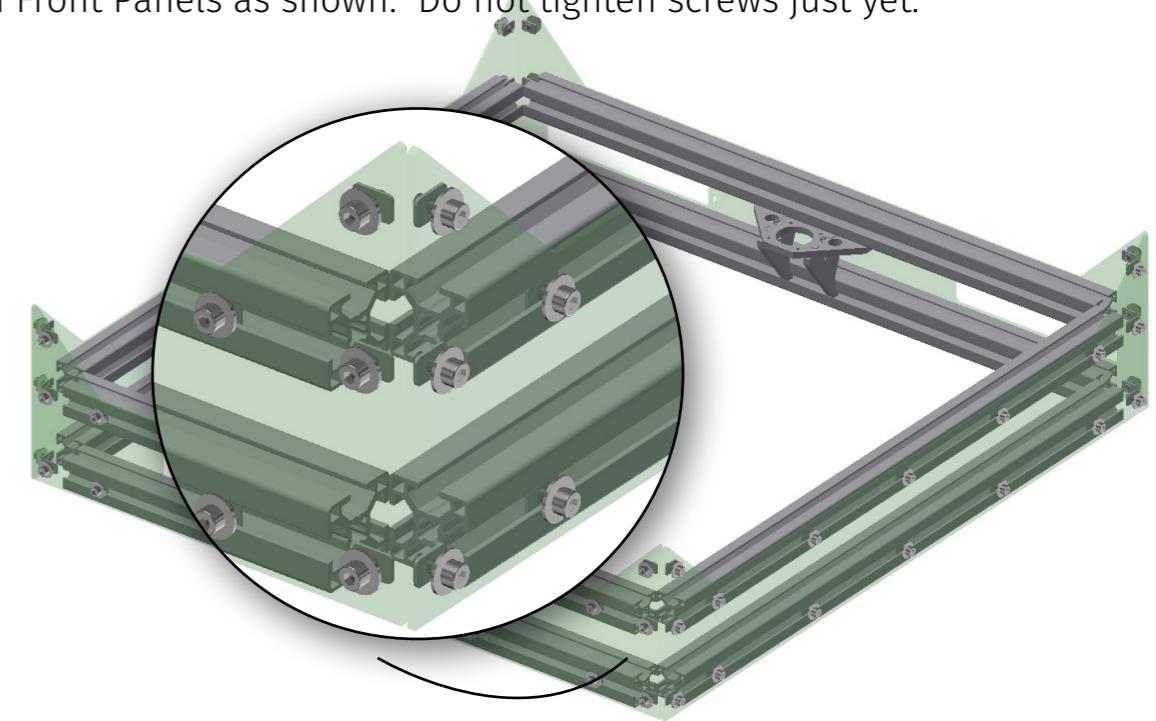
cultivate3d



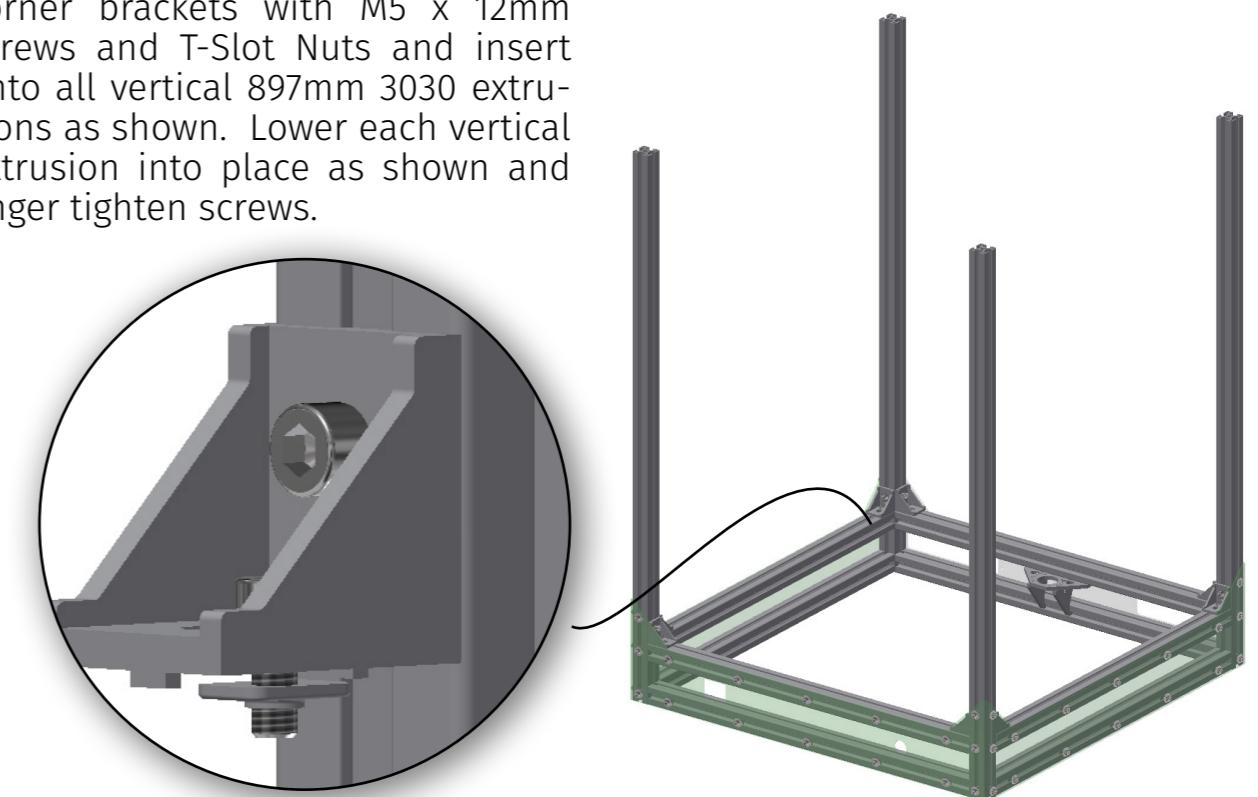
ASSEMBLY NAME ▾

Printer Frame

Insert 6 x 3030 Extrusions to onto the T-Slot Nuts as shown with the remaining Side and Front Panels as shown. Do not tighten screws just yet.



Pre assemble 8x 3030 Aluminium corner brackets with M5 x 12mm screws and T-Slot Nuts and insert onto all vertical 897mm 3030 extrusions as shown. Lower each vertical extrusion into place as shown and finger tighten screws.





x4

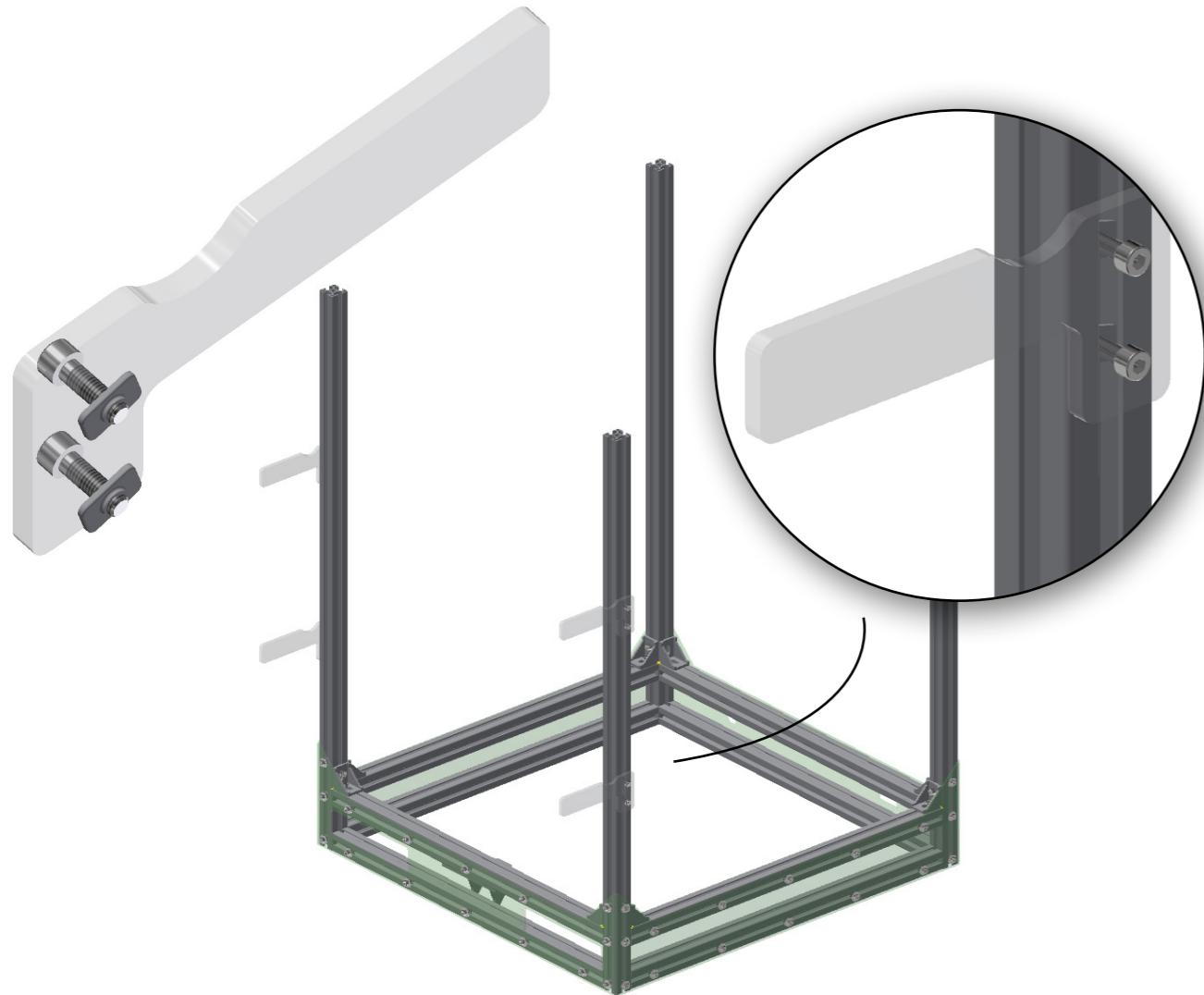
Spool Holder

Parts Required

M5 12mm Screws
T-Slot Nuts

4x Spool Holders

Pre assemble 4x spool holders with M5 12mm screws and T-Slot nuts as shown. Attach 2 of each to each of the rear vertical 3030 extrusions as shown and secure roughly 1/3rd and 2/3rds the way up the extrusion.



PART / SUB ASSEMBLY NAME ▾

Printer Frame - Spool Holders

ASSEMBLY NAME ▾

Spool Holders



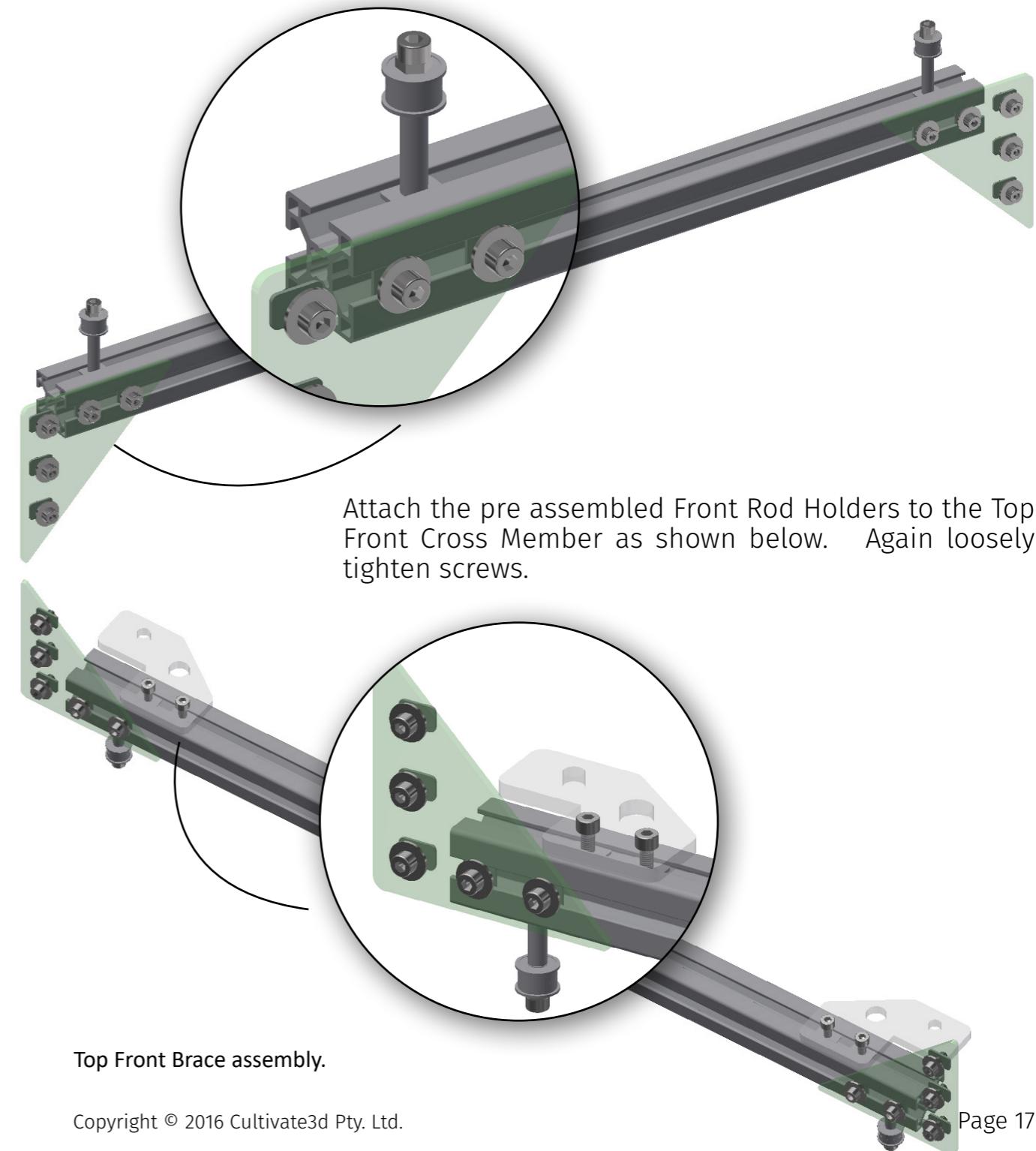
REPEAT x4



ASSEMBLY NAME ▾

Printer Frame (Cont.)

Use the pre assembled corner braces and Y-Idlers to construct the top front cross member as shown, do not tighten screws yet. Secure the Y Idlers roughly 30mm from the edge of the 3030 extrusion. (You will position these precisely later).

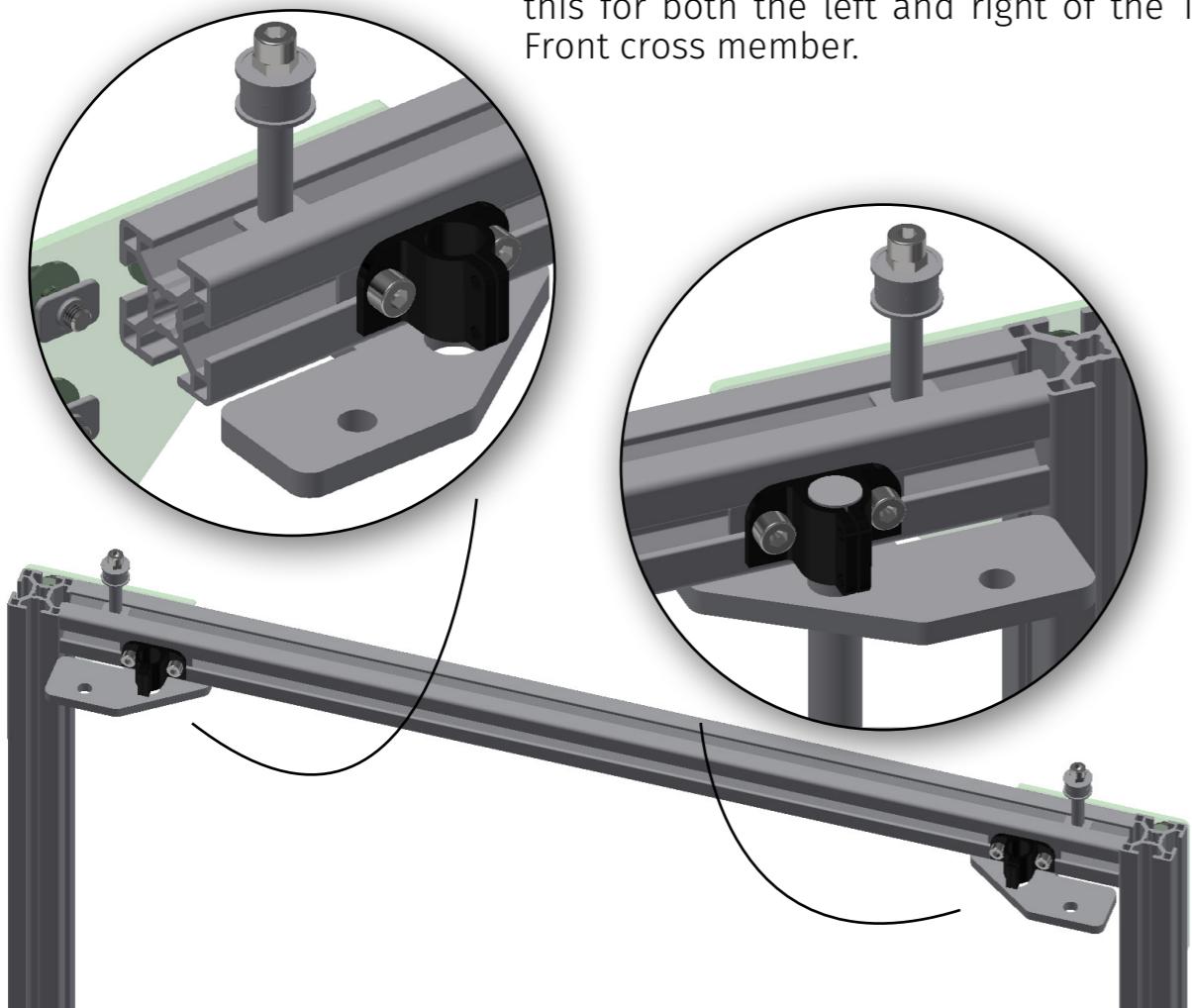




ASSEMBLY NAME▶

Printer Frame

Attach a pre assembled 12mm Rod Clamp directly above each Acrylic Rod Holder, in line with the 12mm Hole as shown. Repeat this for both the left and right of the Top Front cross member.



Slide the Completed Top Front Brace assembly onto the Front of the Printer frame by lining up each of the vertical rows of T-Slot nuts and corner brackets with the 3030 vertical slots as shown.

Lightly tighten the 4 horizontal screws on the Top Front Brace assembly and 3 vertical screws either side and adjust the height of the Top brace assembly to make flush with the top of the vertical 3030 extrusions.



It is important not to fully tighten any of the Printer frame screws at this stage as you will need to square everything up later in the process. Screws should be tightened just enough to prevent the vertically mounted parts from falling out of place.

x4
Y Motor Mount Bracex2
Y Motor Mount

ASSEMBLY NAME▶

Y Motor Mounts



Parts Required (Per assembly)

M3 16mm Screws

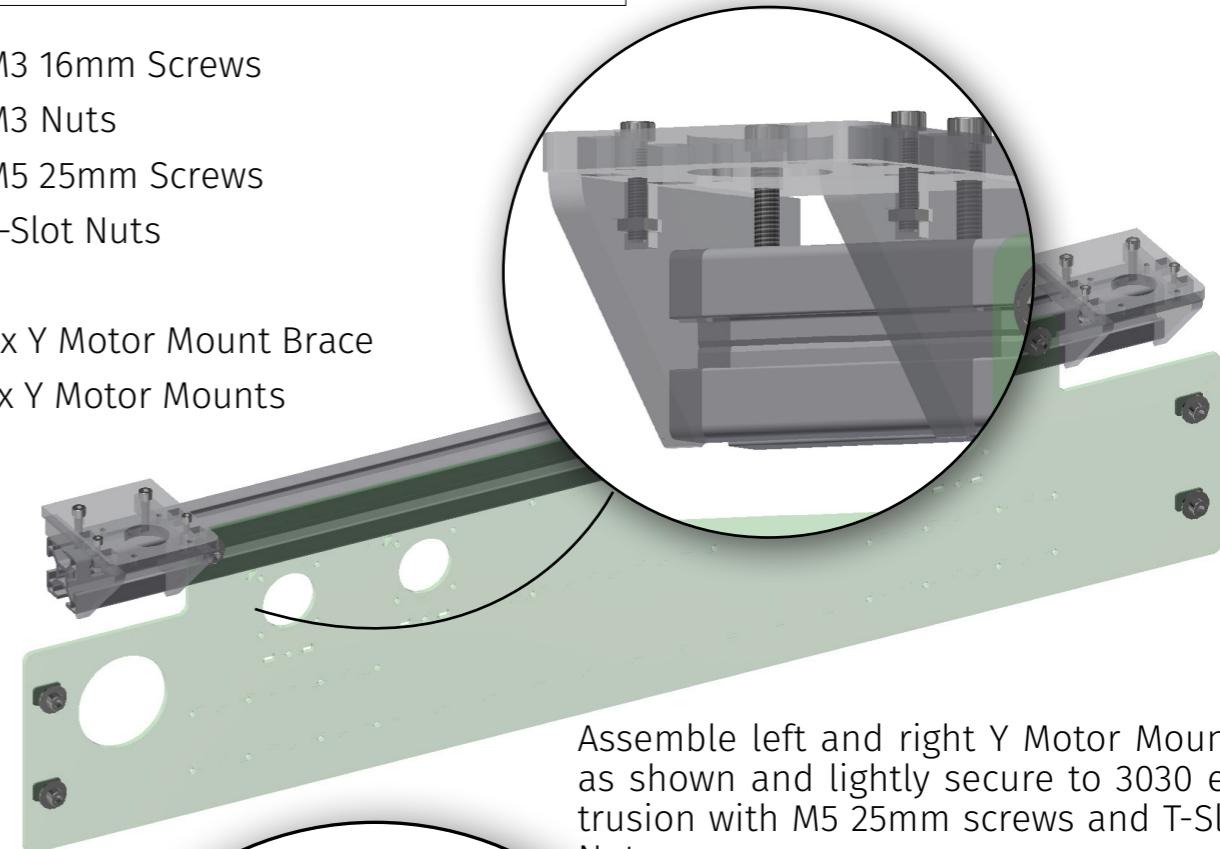
M3 Nuts

M5 25mm Screws

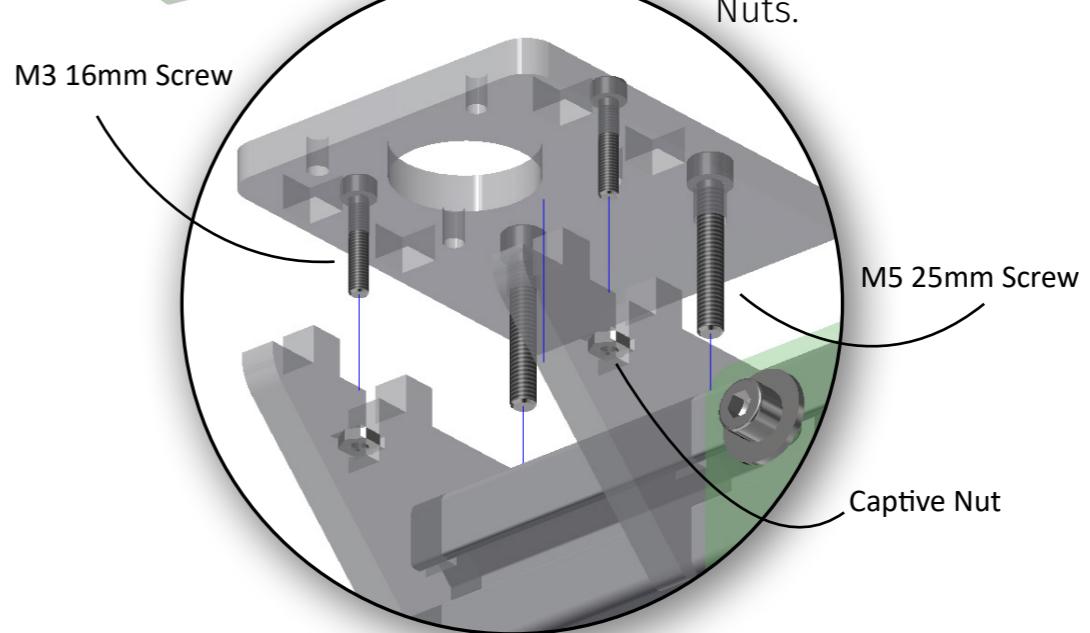
T-Slot Nuts

2x Y Motor Mount Brace

1x Y Motor Mounts



Assemble left and right Y Motor Mounts as shown and lightly secure to 3030 extrusion with M5 25mm screws and T-Slot Nuts.

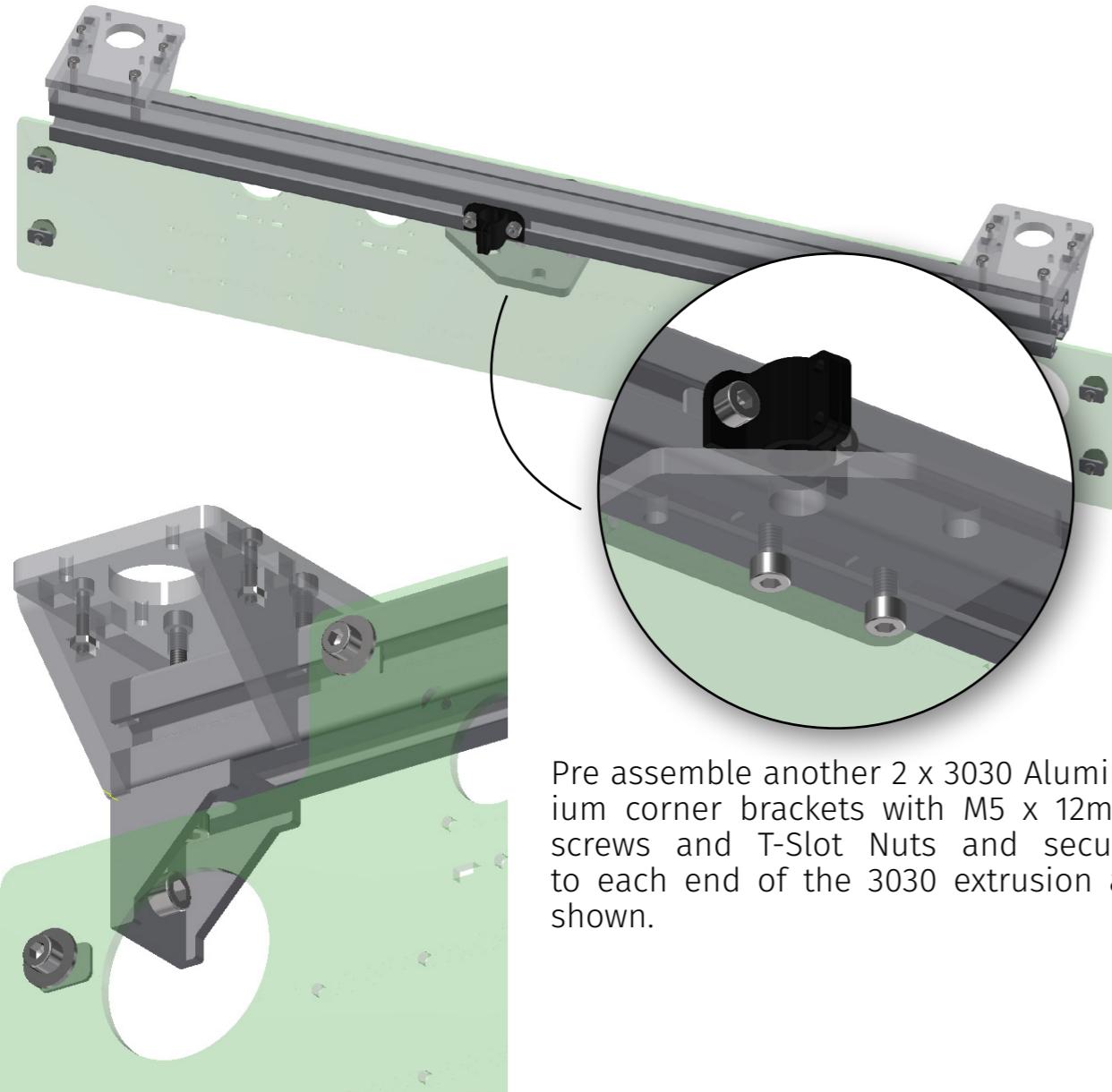




ASSEMBLY NAME▶

Printer Frame

Slide the Rear Rod Holder onto the under slot of the 3030 extrusion on the Extruder Panel Assembly using 3 x M5 16mm screws with washers & T-slot nuts. Centre the middle of the smaller rod holes with the very center of the extrusion then tighten screws. Also secure the remaining 12mm Rod Clamp above the 12mm hole in the Rod Holder.



PART / SUB ASSEMBLY NAME ▾

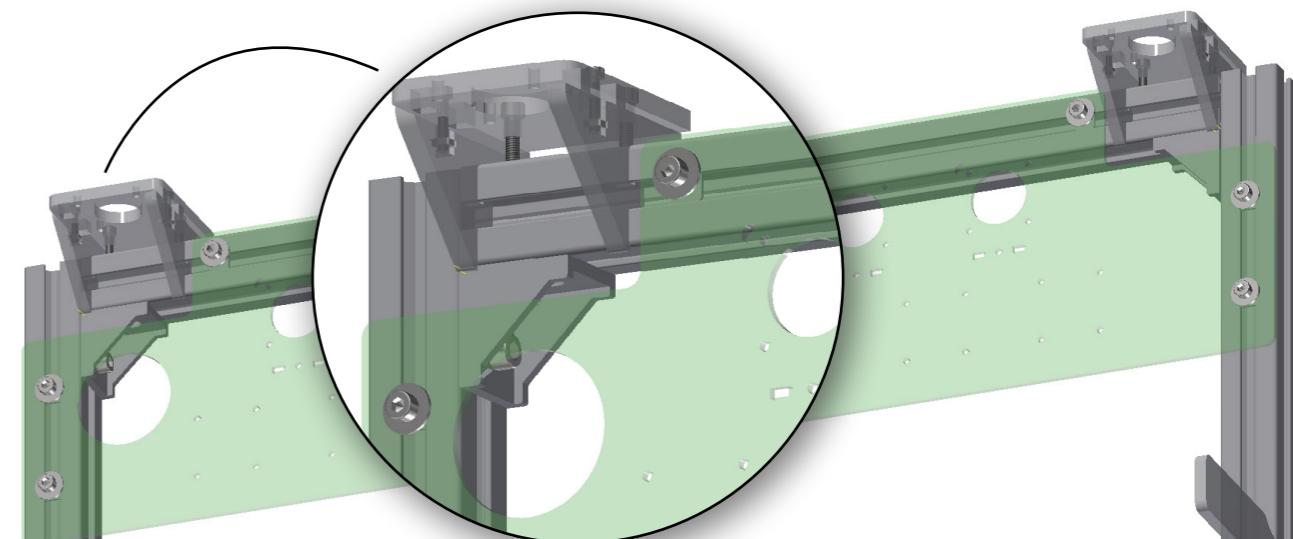
Printer Frame - Rear Rod Holder

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ASSEMBLY NAME▶

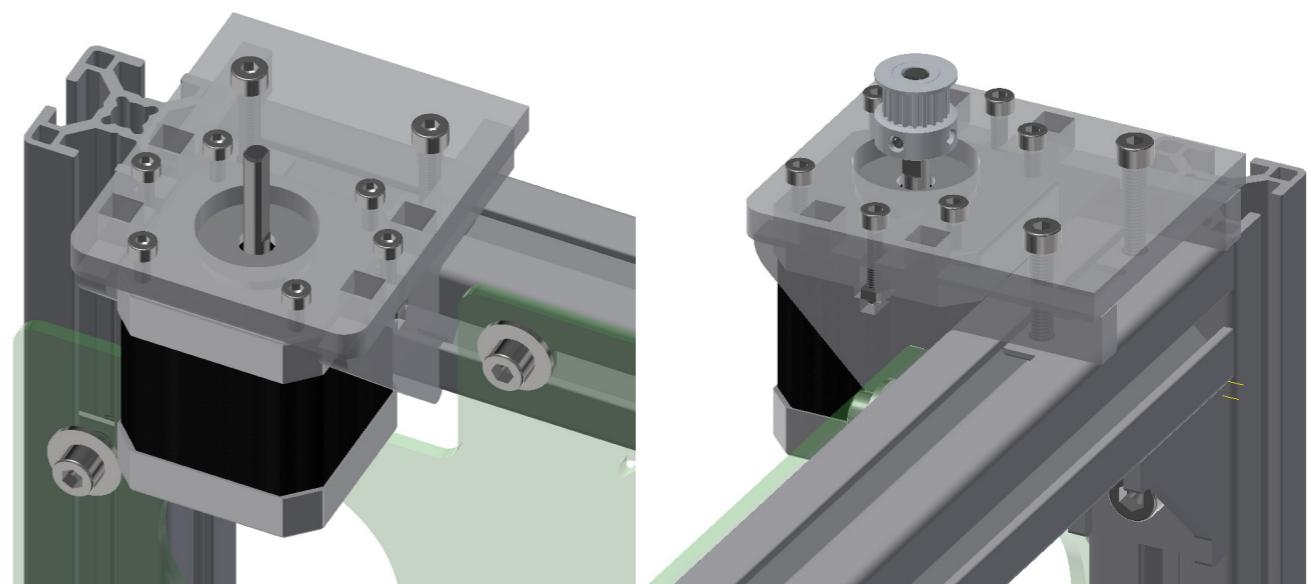
Printer Frame

Slide extruder panel assembly into position on the printer frame as shown. Once in position, align the horizontal extrusion with the top of the vertical extrusion and lightly tighten all the screws to secure the extruder panel in place.



Y Motor Mounts (Cont).

Attach a Nema 17 (Y Motors) to each of the Y motor mounts, securing with 4x M3 10mm screws & washers on each motor. Position motor wires facing towards opposing motor. Attach a GT2 Pulley to each of the Y motor shafts with 2x grub screws ensuring one of the grub screws is tightened onto the flat of the motor shaft.





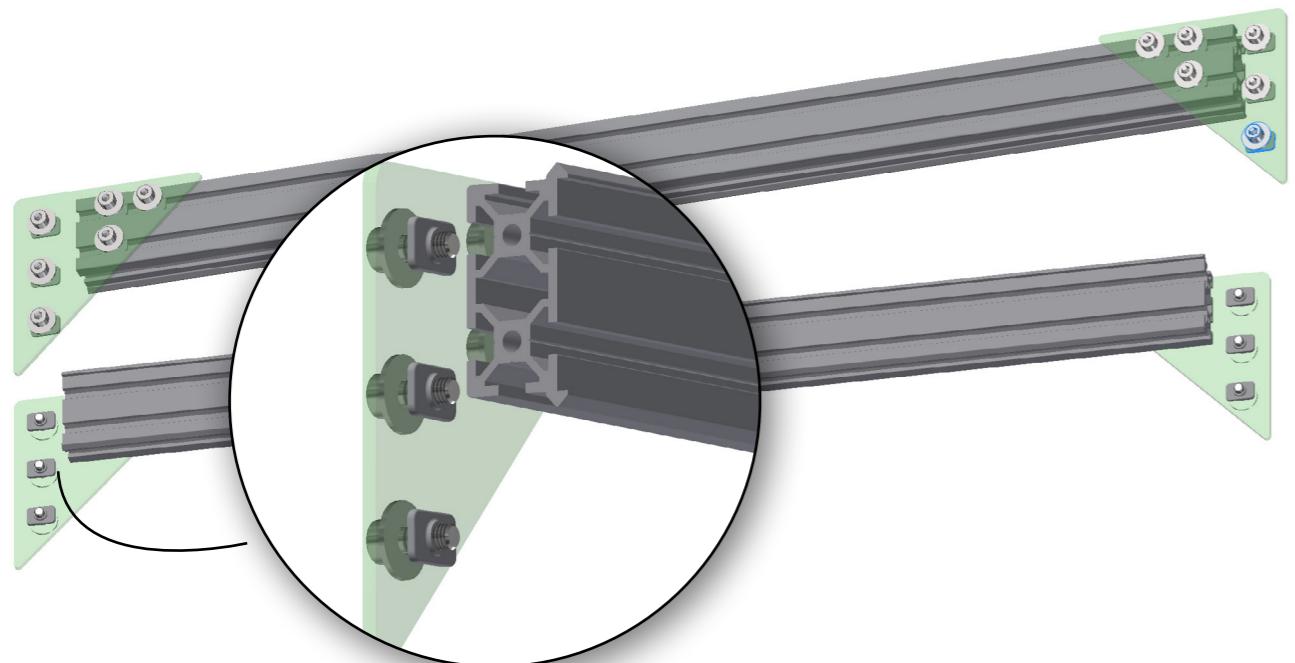
ASSEMBLY NAME▶

Side Y Rails

Parts Required

- 4 x Side Braces (Assembled Earlier)
- 2x 597mm Extruded Rail (Make sure these are the longer of the extruded rails).

Identify and slide each pre assembled Side Braces into the 597mm Extruded rail t-Slots as pictured. Be mindful of the orientation during assembly. If in doubt, refer to the pictures. Finger tighten the screws to hold the side braces in position, leaving space at each end to slide the Side braces onto the vertical 3030 extrusions. Make sure the braces are on the non-lipped side of the extruded rail.



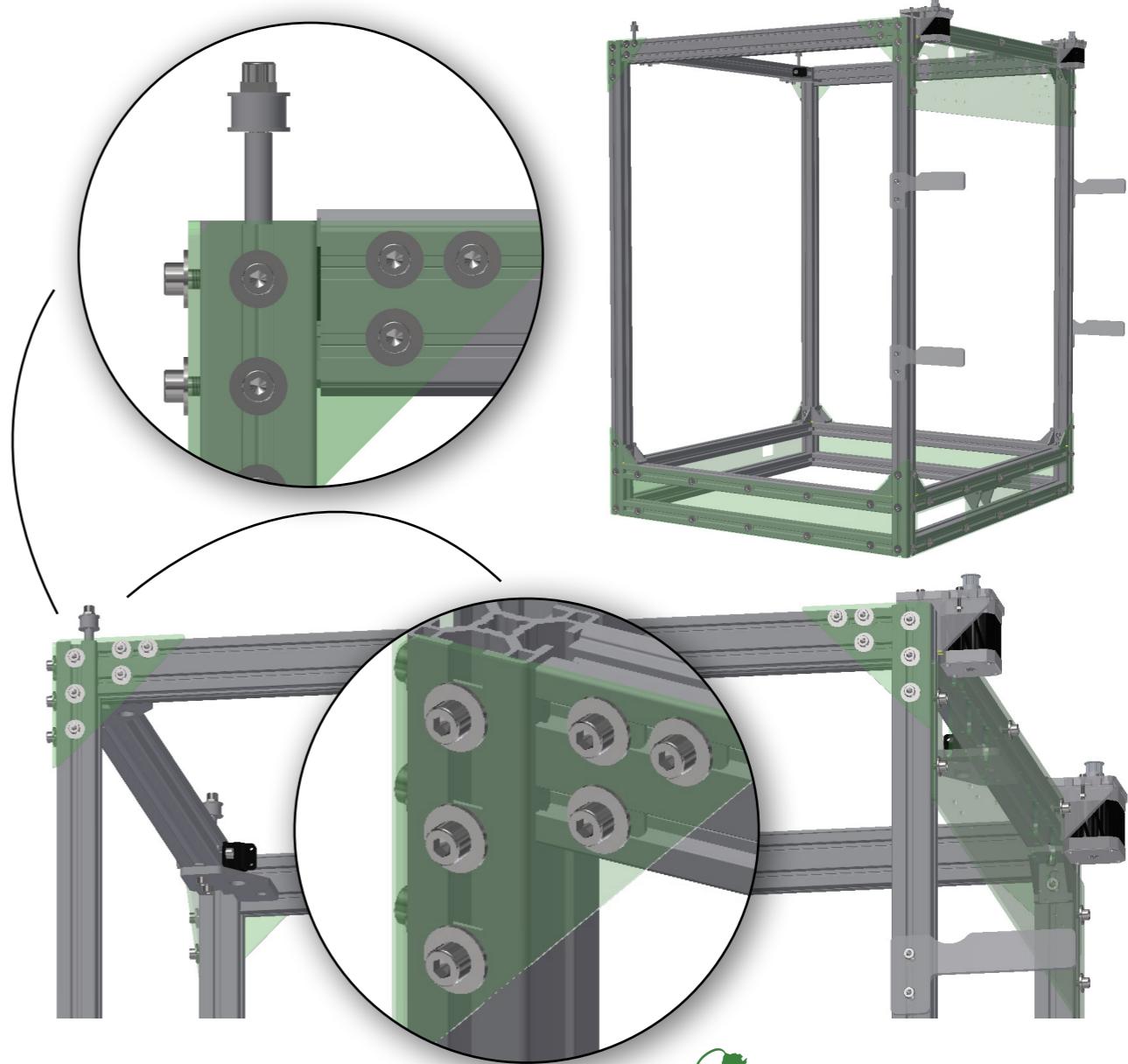
PART / SUB ASSEMBLY NAME ▾
Side Y Rails



ASSEMBLY NAME▶

Printer Frame (Cont).

Take the 2x completed Side Extruded rail assemblies and slide onto the Printer Frame's vertical 3030 extrusions, each Extruded Rail Assembly spanning front to back, with the Acrylic side on the outside of the printer to complete the frame. Flush the flat of the Extruded rail assembly with the top of the vertical 3030 extrusions ensuring the peak of the rail itself sits above the printer frame as shown and lightly tighten the screws to hold in place.



PART / SUB ASSEMBLY NAME ▾
Printer Frame (Cont.).



x2
Front Z Motor Mounts



Parts Required

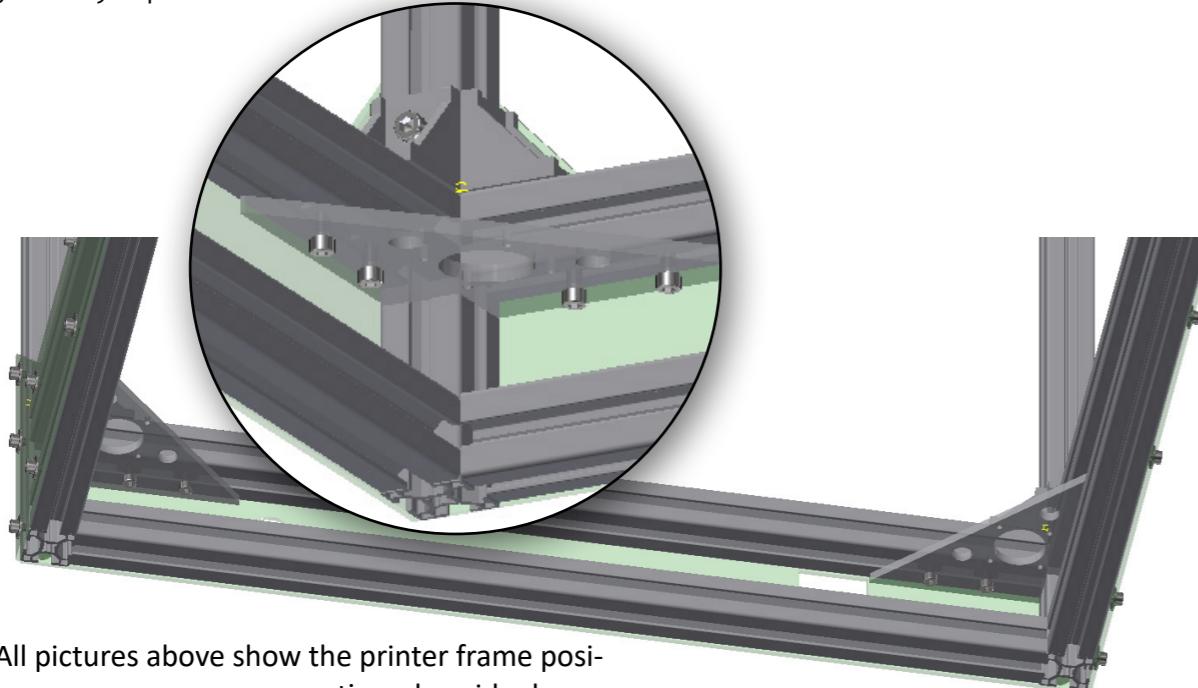
T-Slot Nuts
M5 16mm Screws
M5 Washers

1x Left Front Z Motor Mount
1x Right Front Z Motor Mount

Gently flip the Printer frame upside down, exposing the bottom slots of the lower part of the frame as shown. Identify the 2 Front Z Motor Mounts.

For each front Z Motor Mount, slide 4x M5 T-Slot nuts into place in the top slot of the extrusion (2 for each front and 2 for each side of the extrusion as shown).

Take special note of the position of the extra large holes in the Z motor mounts. Position these holes on the front side of the printer under the corresponding holes in the rod holders. Use 4x M5 16mm screws with washers to secure each Front Z-Motor Mount to the T-Slot Nuts in the front corners of the printer frame as shown. If need be, position the T-Slot nuts with a flexible poking tool like a cable tie. Ensure the Front Z-Motor Mounts butt up firmly against the vertical extrusions and tighten each screw firmly. Once tightened flip printer right way up.



All pictures above show the printer frame positioned upside down.

PART / SUB ASSEMBLY NAME ▾

Front Z Motors



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x1
Front Bed Mount Base
x1
Front Bed Mount Mid
x3
Bed Mount Top



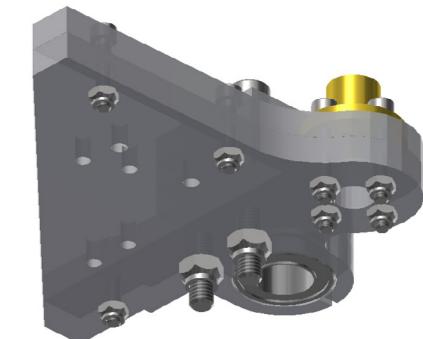
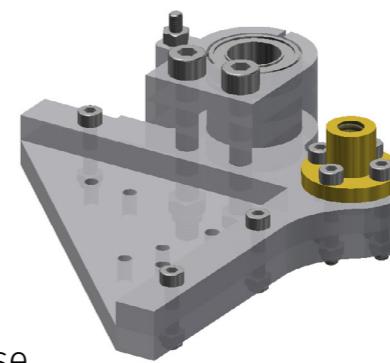
Parts Required

M3 16mm Screws
M3 20mm Screws
M5 35mm Screws
M3 Nyloc Nuts
M5 Nyloc Nuts
M3 Nut

1x LM12UU Bearing
1 x Brass TR8 Nut
1 x Front bed Mount Base
1 x Front bed Mount Mid
3 x Bed Mount Top

Front Bed Mounts

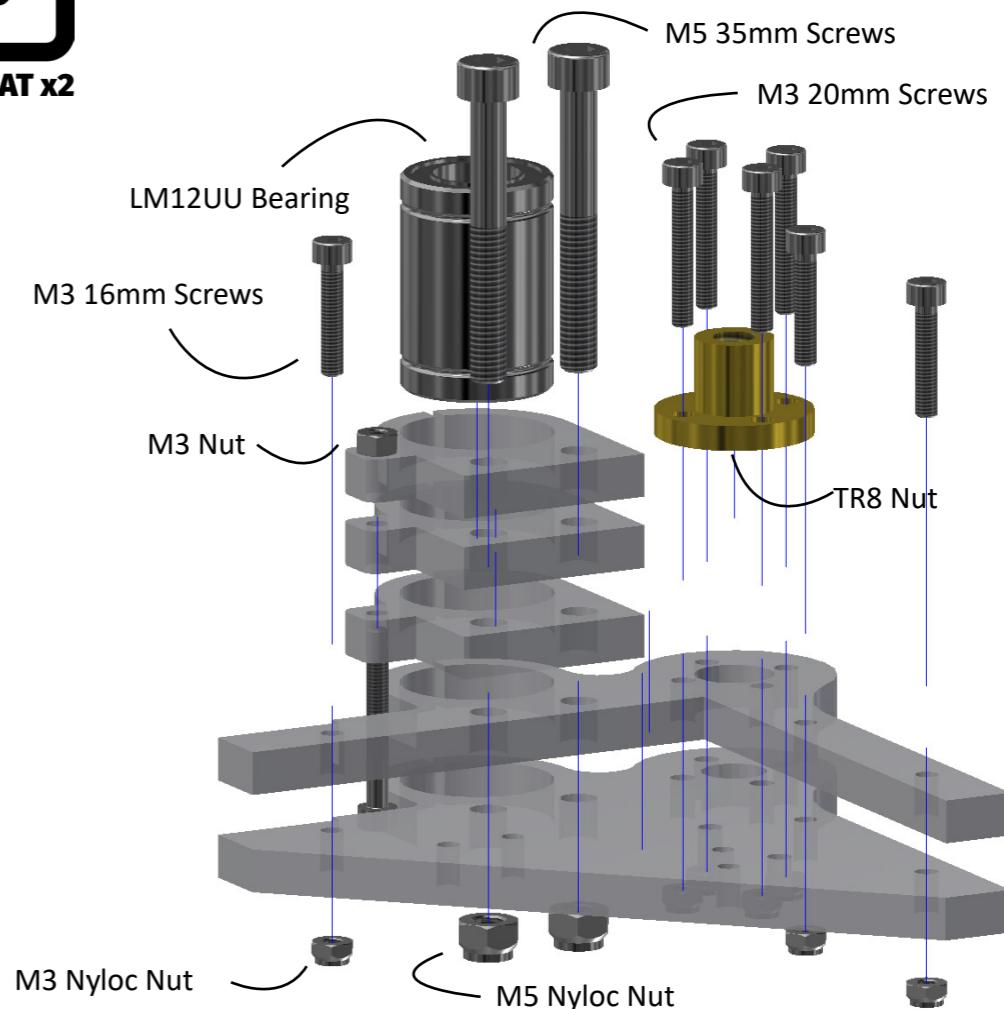
Assemble the Front Left and Right Bed Mounts as per the diagrams below and tighten all screws firmly. Mirror the assembly for the right Bed Mount.



Assembled Front Left Bed Mount.



REPEAT x2





Rear Bed Mount Base x1 Rear Bed Mount Mid x1 Bed Mount Top x3



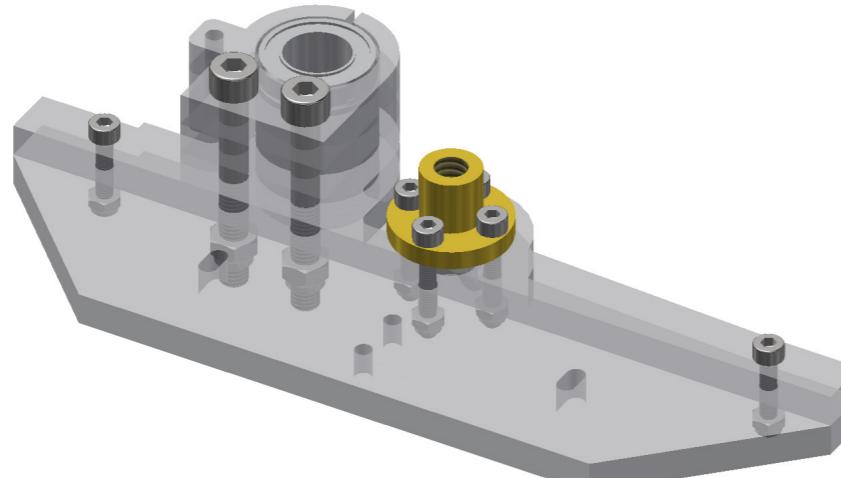
ASSEMBLY NAME▶

Rear Bed Mount

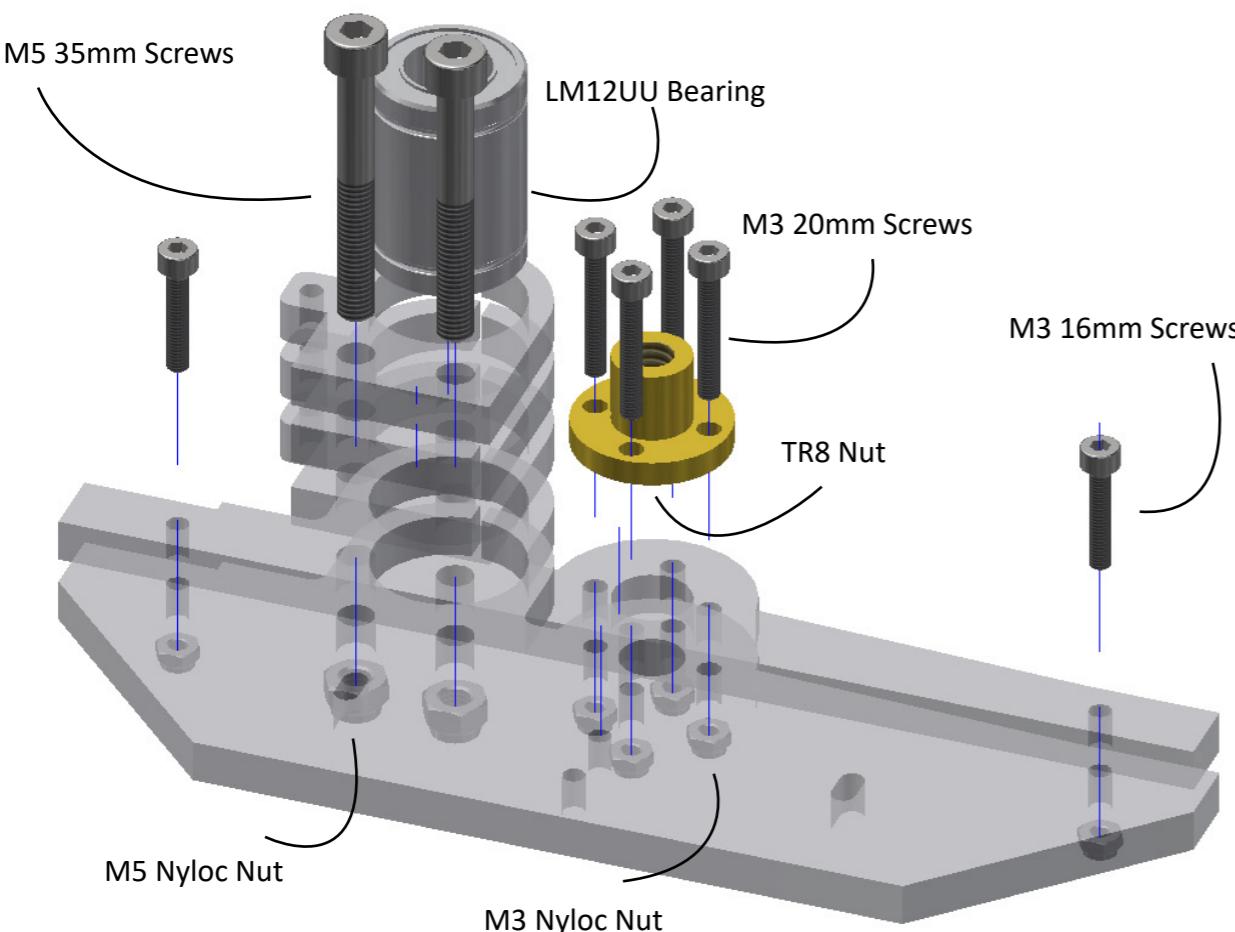
Parts Required

M3 16mm Screws
M3 20mm Screws
M5 35mm Screws
M3 Nyloc Nuts
M5 Nyloc Nuts

1x LM12UU Bearing
1 x Brass TR8 Nut
1 x Rear Bed Mount Base
1 x Rear Bed Mount Mid
3 x Bed Mount Top



Assembled Front Rear Bed Mount.



ASSEMBLY NAME▶

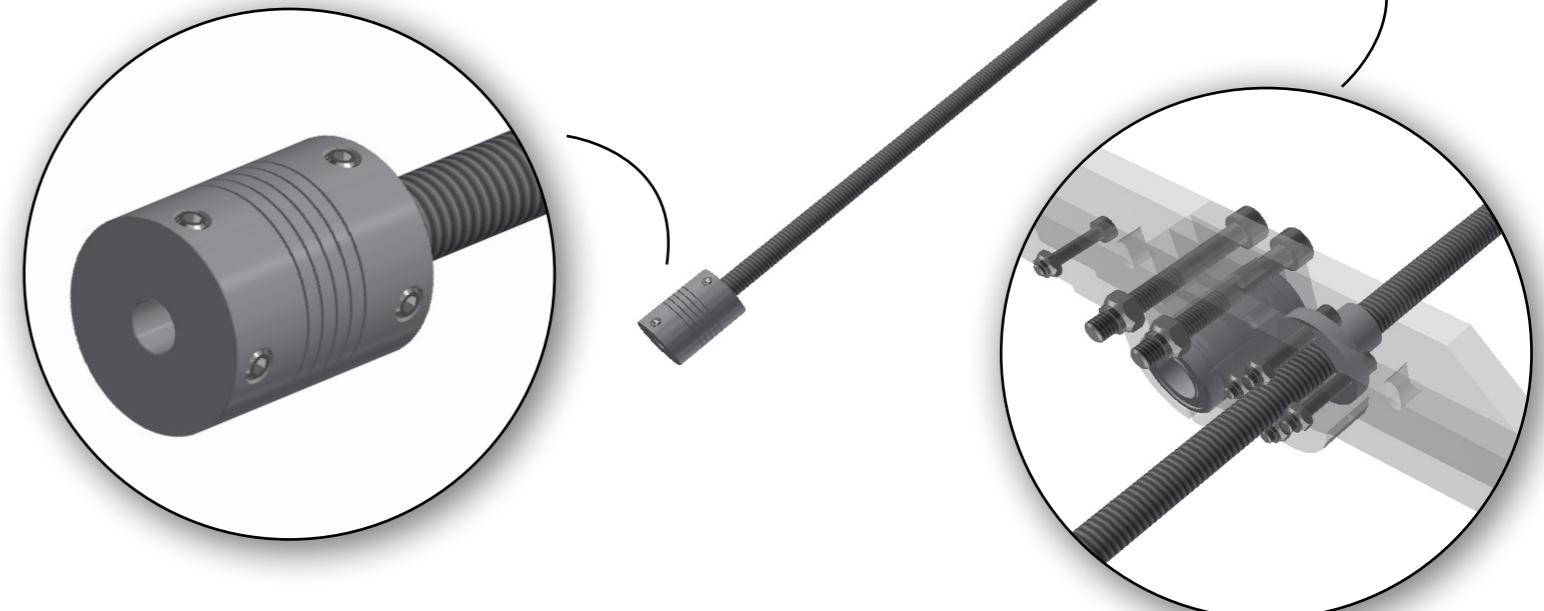
Couple Lead Screw

The Lead Screw Couplers are used to attach the lead screws to the motor shafts.



Parts Required

3x Lead Screws
3x Aluminum Coupling



Insert the M8-M5 Flexible coupling onto each lead screw as far as it goes. Tighten the 2x different sized grub screws closest to the Lead screw to attach the coupling firmly in place.

Screw the Left, Right and Rear Bed Mounts onto each Leadscrew as shown at least 200mm down the rod. Make sure the Brass Nut is pointed towards to open end of the lead screw.

PART / SUB ASSEMBLY NAME ▶

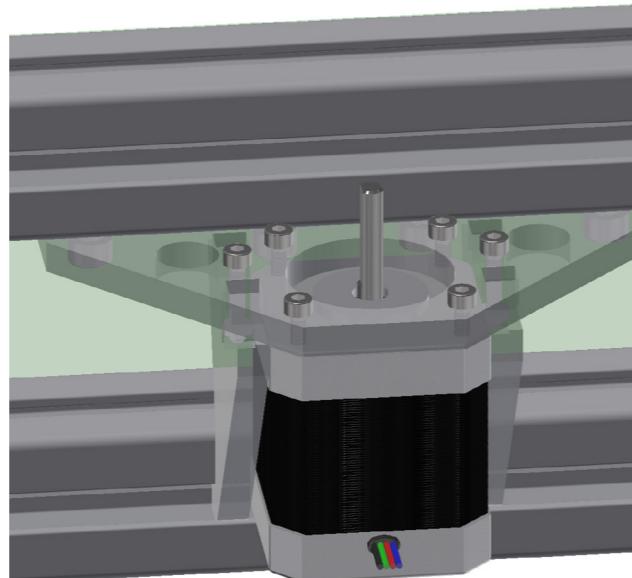
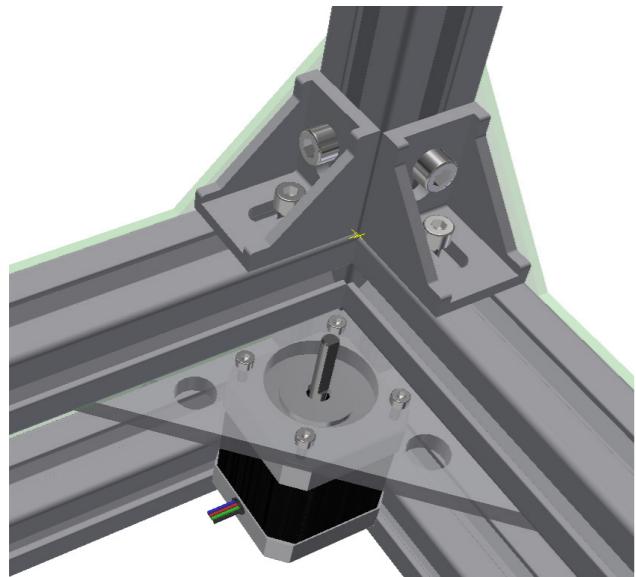
Couple Lead Screw



ASSEMBLY NAME ▶

Z Motors

Install 3 Z Stepper Motors; 2 at the front into the corner mounts and 1 at the back into the rear Z Motor Mount. Use M3 10mm screws. Refer to pictures below.



ASSEMBLY NAME ▶

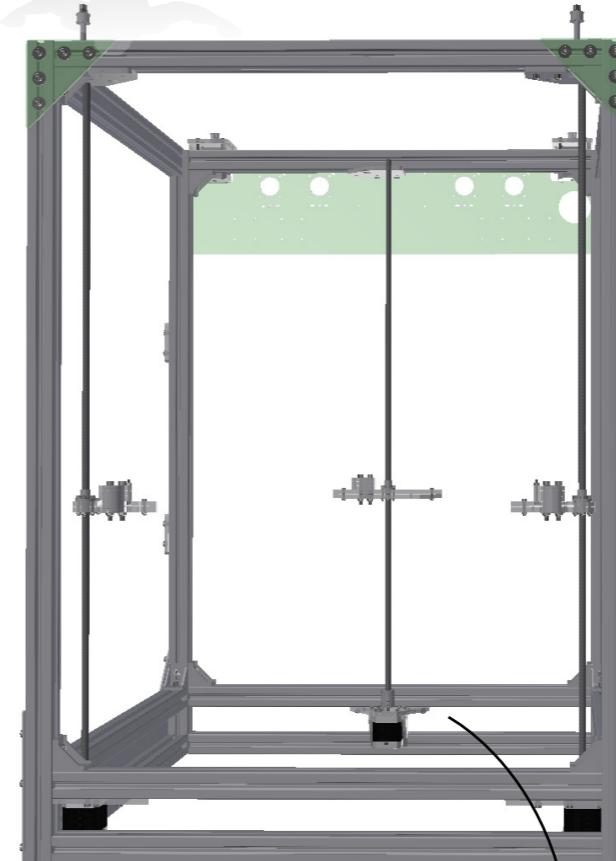
Couple Lead Screw



Check picture to ensure the correct orientation of each of the Left, Right and Rear Bed Mounts before beginning.

Ensure the remaining (lower) grub screws on each of the M8-M5 Couplings are loose enough to facilitate insertion onto the motor shaft.

Slide the Leadscrew up through the Rod Holders and then the coupling down back over the Motor Shaft ensuring the flat on the shaft lines up with one of the grub screws on the coupling.



ASSEMBLY NAME ▶

Top Front 3030 Corner Brackets

Assemble and install the 2 top, front 3030 corner brackets in the position shown.



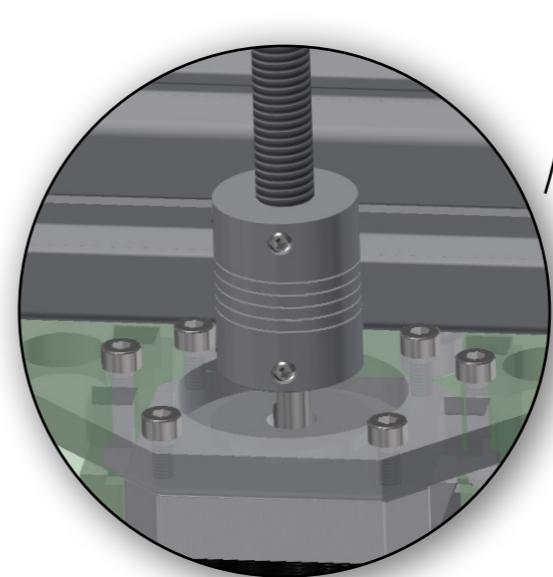
PART / SUB ASSEMBLY NAME ▼

Z Motors



PART / SUB ASSEMBLY NAME ▼

Couple Lead Screw to Z Motors



Lubricate each lead screw along the full length with grease to ensure the TR8 Nut can move freely.





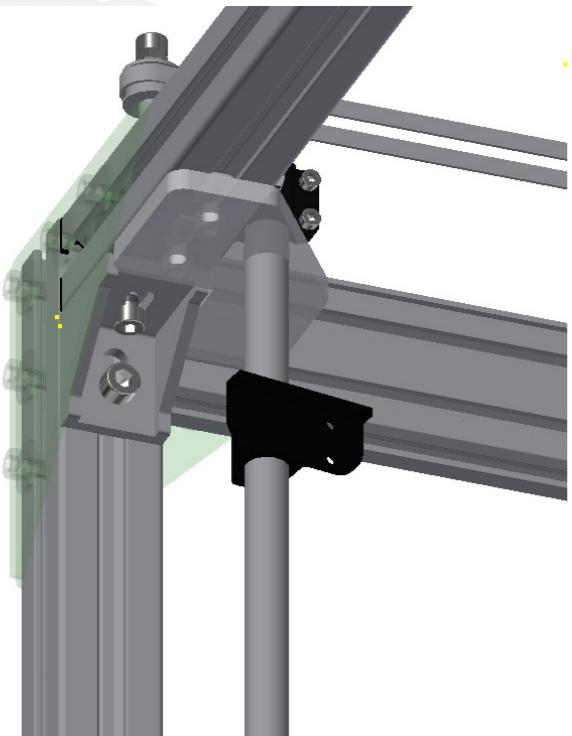
x1

Z Endstop Holder



ASSEMBLY NAME ▾

Insert Smooth Rods

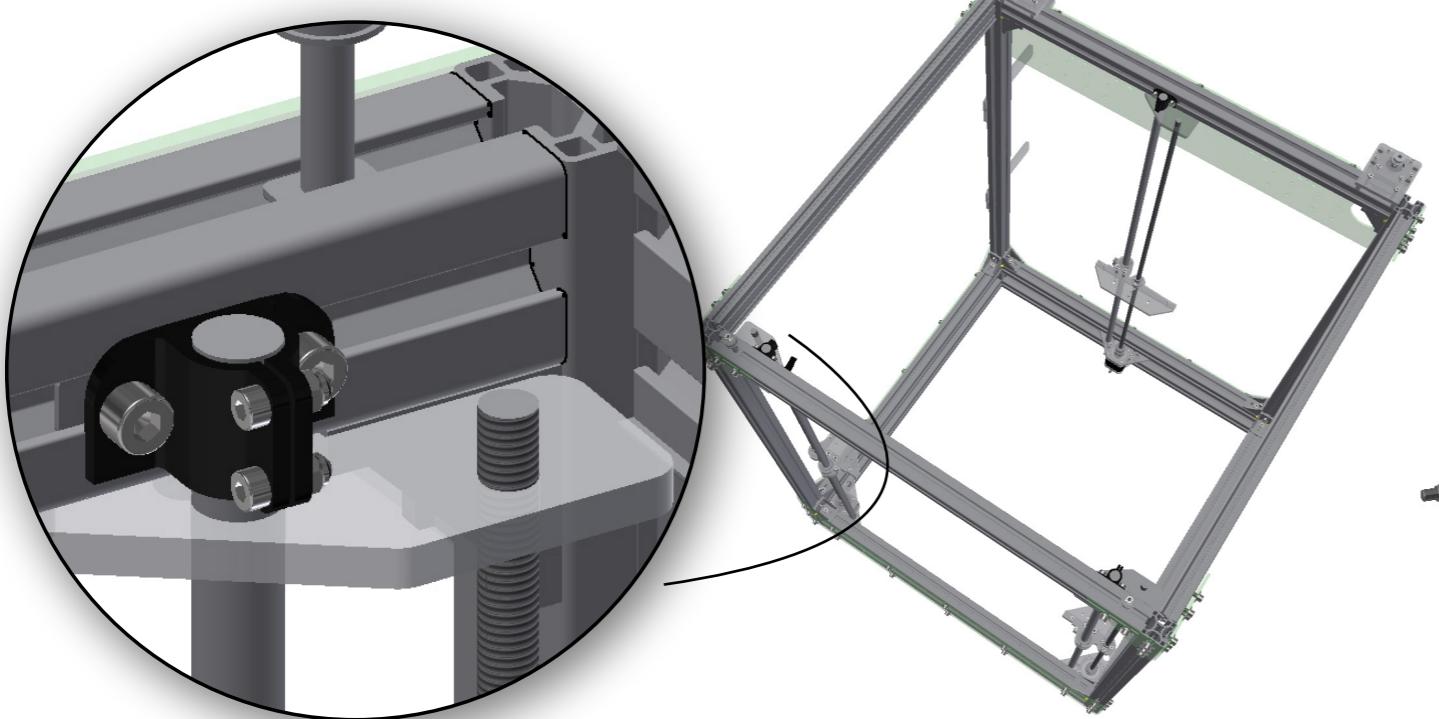


Parts Required

- 3 x Smooth Rods
- 1 x Z Endstop Holder

Install the front left Rod holder as shown, ensuring you insert the Z End Stop Holder (check alignment) before pushing the 12mm Rod all the way down through to the Z Motor Mount Below. Once in place, secure the vertical position of the Rod with the Smooth Rod Clamp as shown.

Repeat this for the right and rear smooth rods and take note, only the front left smooth rod requires a Z End Stop Holder.



PART / SUB ASSEMBLY NAME ▾

Insert Smooth Rods



x4



x2



x2



x2

ASSEMBLY NAME ▾



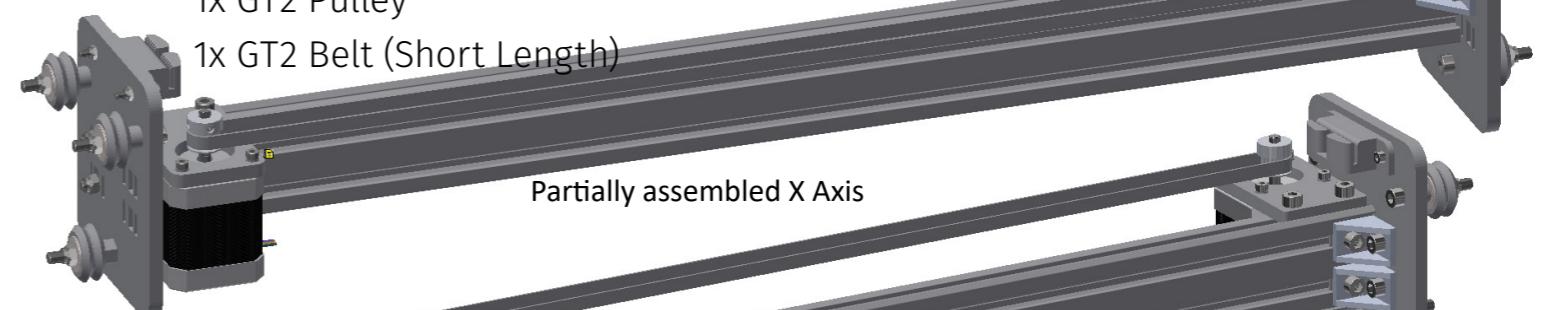
X Axis Assembly

Parts Required (Per Assembly)

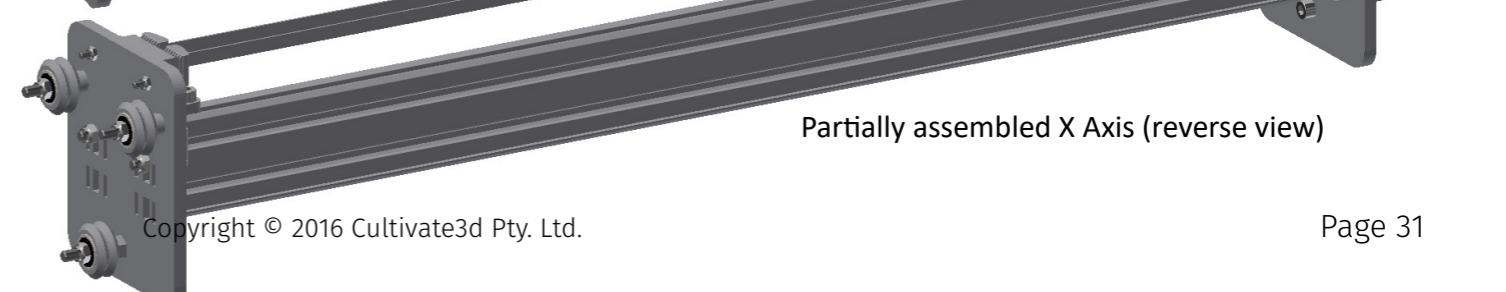
- M5 35mm Screws
- M5 16mm screws
- M5 8mm Screws
- M3 16mm Screws
- M5 Nuts
- T-Slot Nuts
- 4 x 20mm Brackets
- 2 x Y Belt Clamp
- 1 x X Motor Mount
- 2 x X End Plate
- 1 x X Idler
- 1 x X Axis Extruded Rail (580mm)
- 3x 2020 Corner Bracket
- 2x F605ZZ Bearings
- 24x 625-2RS bearings
- 12x V-Wheel Shim
- 12x Delrin V-Groove Wheel
- 4x Aluminum M5 Short V Wheel Spacer
- 2x Eccentric V Wheel Spacer
- 1x Nema 17 Motor
- 1x GT2 Pulley
- 1x GT2 Belt (Short Length)



Completed mirrored X Axes



Partially assembled X Axis



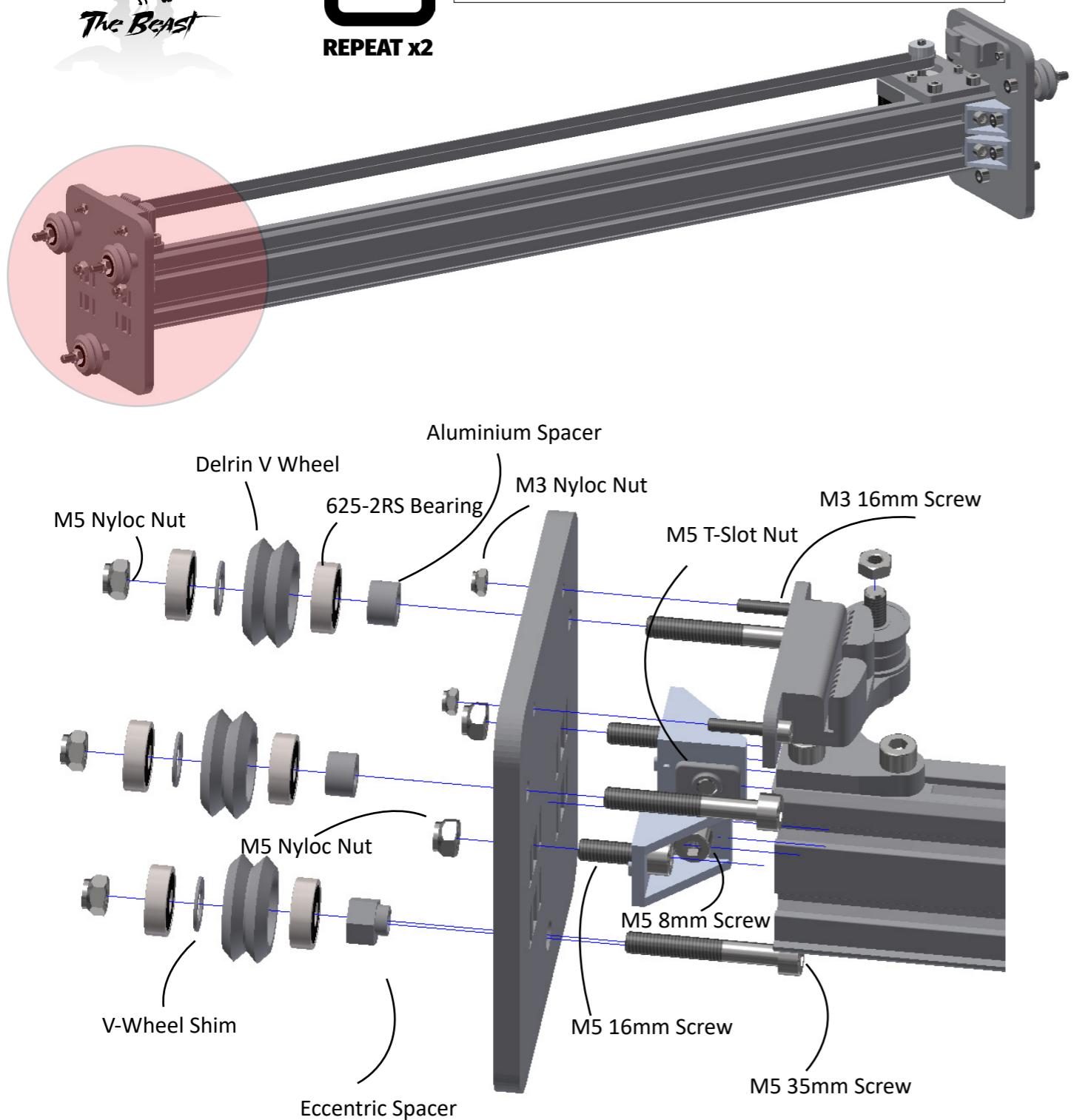
Partially assembled X Axis (reverse view)



ASSEMBLY NAME ▾

REPEAT x2

X Axis Assembly



PART / SUB ASSEMBLY NAME ▾

X Axis Assembly

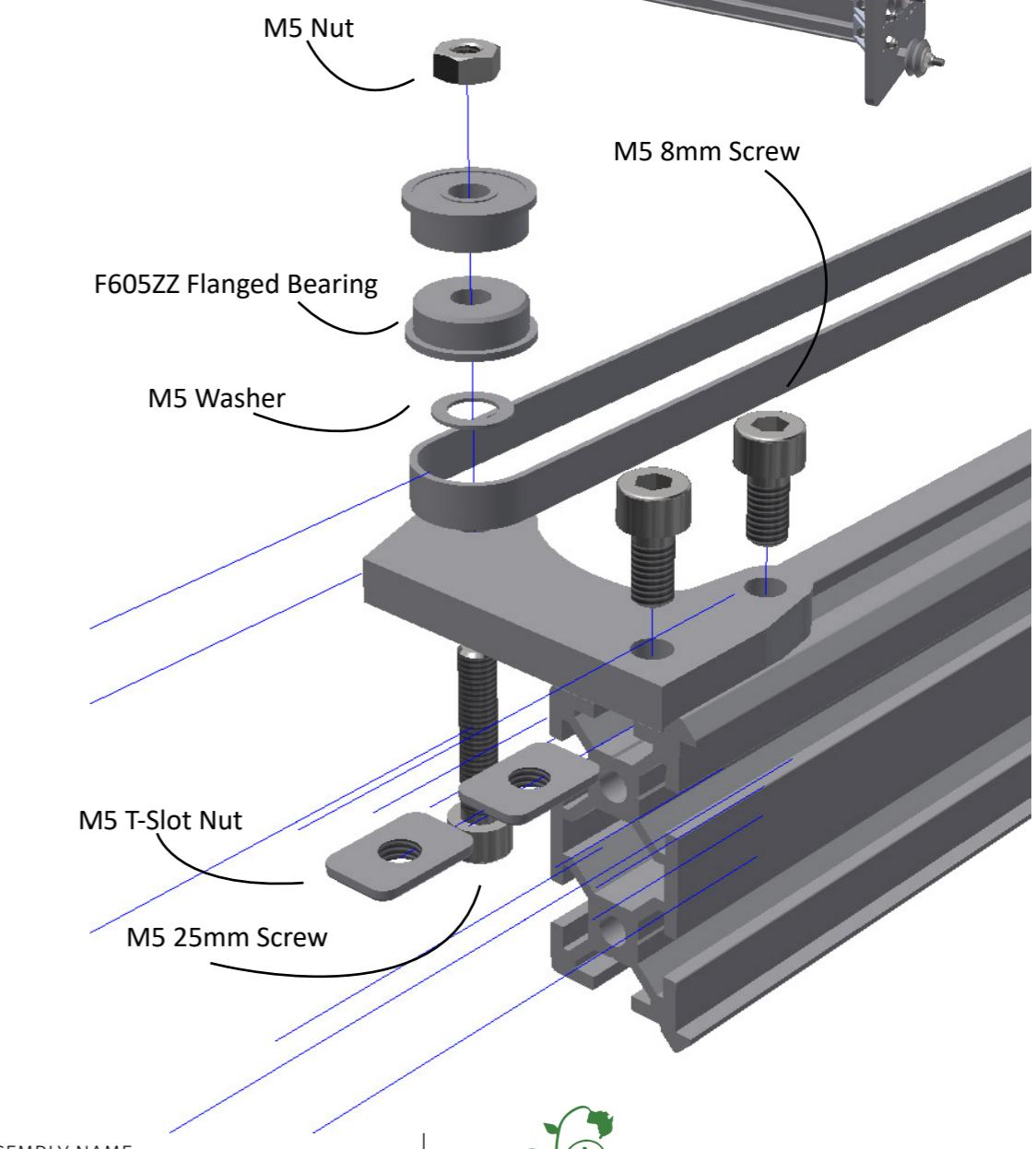
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ASSEMBLY NAME ▾

X Axis Assembly


REPEAT x2



PART / SUB ASSEMBLY NAME ▾

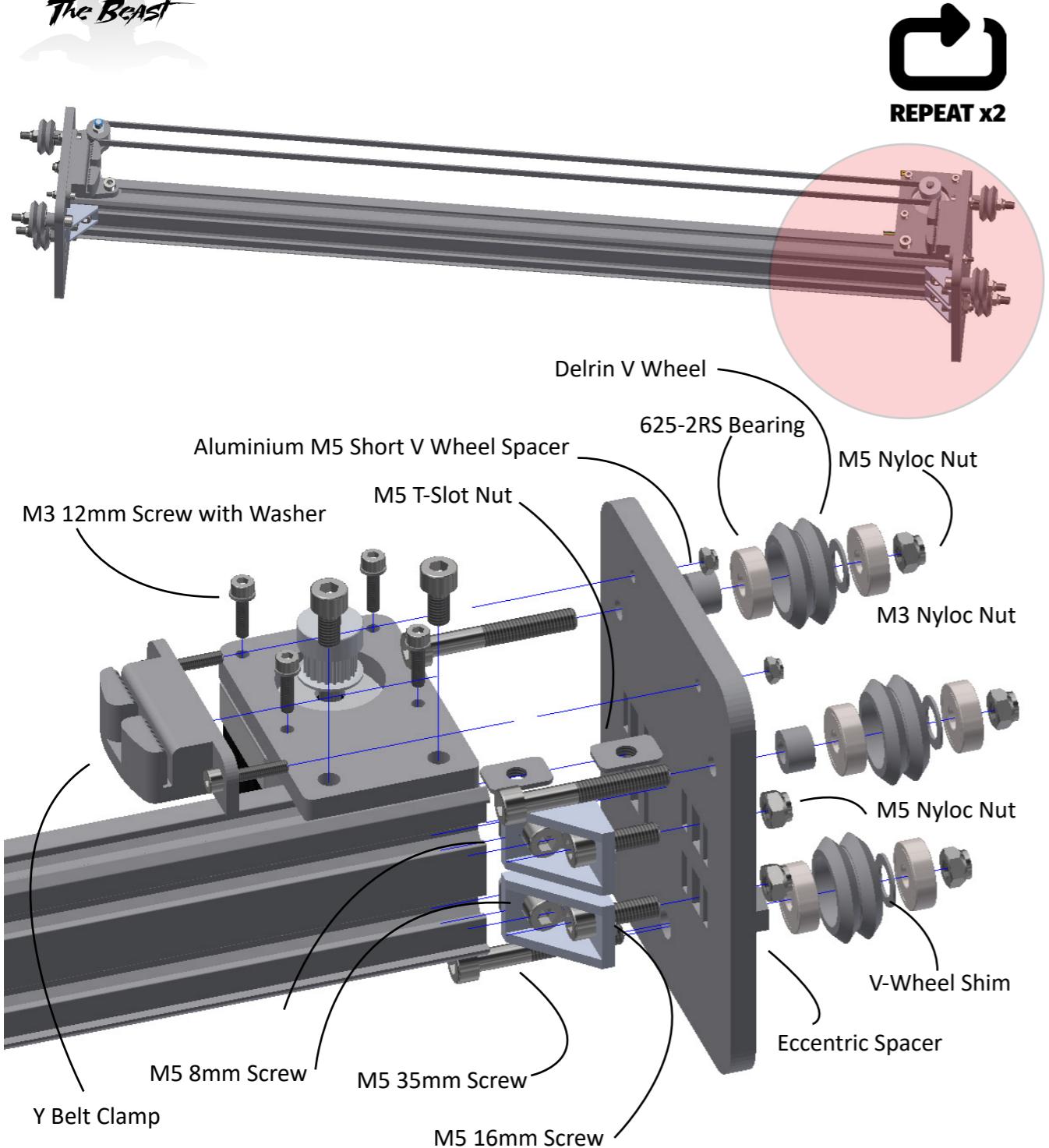
X Axis Assembly

 cultivate3d



ASSEMBLY NAME ▾

X Axis Assembly



PART / SUB ASSEMBLY NAME ▾

X Axis Assembly

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ASSEMBLY NAME ▾

X Axis Assembly

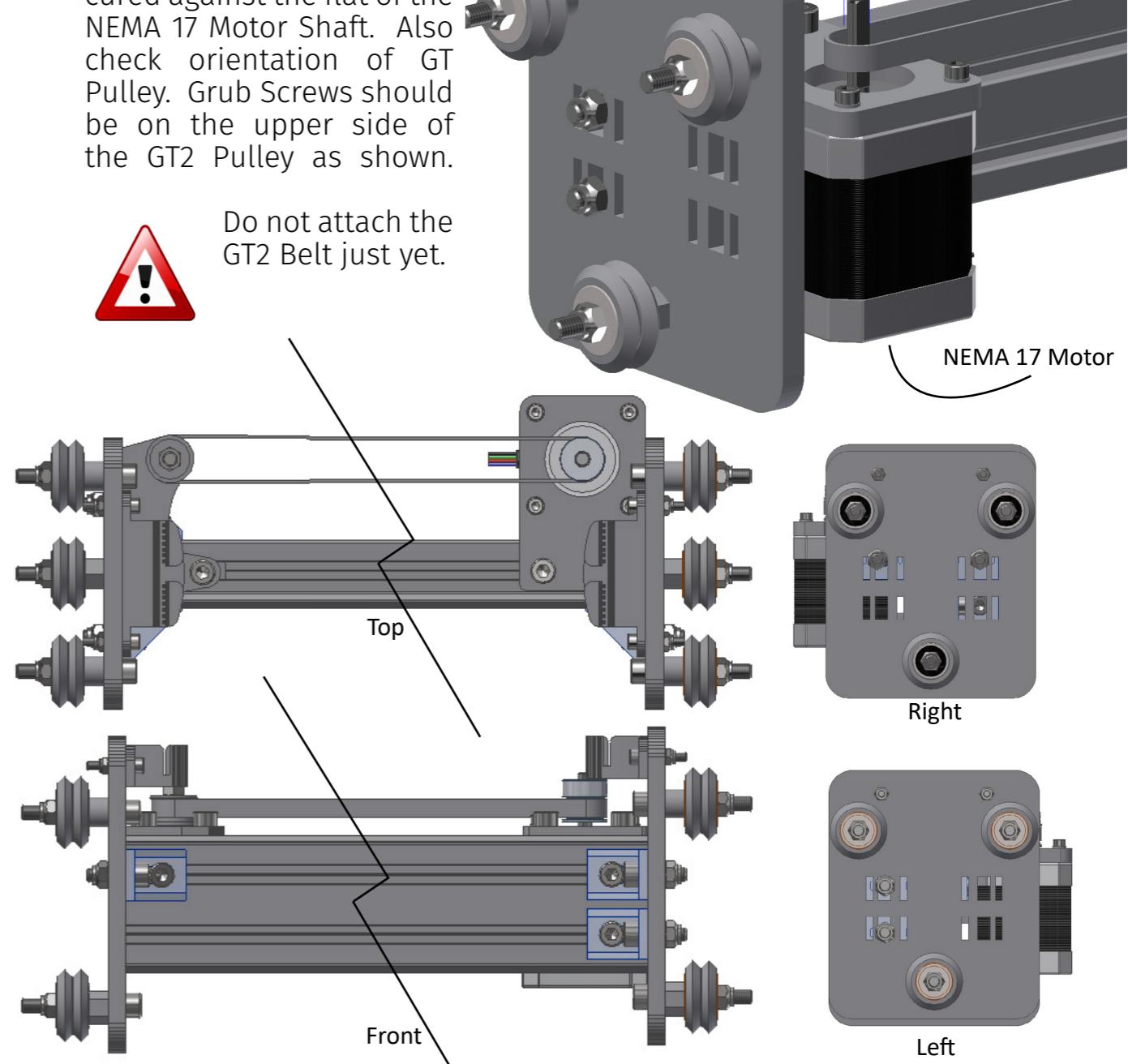


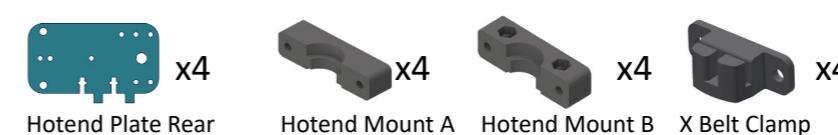
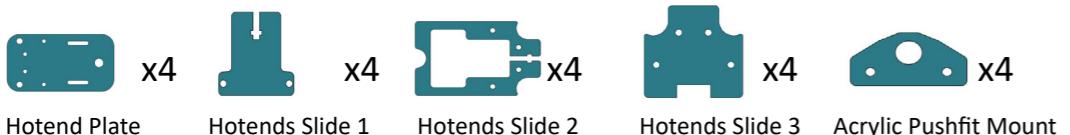
REPEAT x2

Ensure Grub Screws are secured against the flat of the NEMA 17 Motor Shaft. Also check orientation of GT Pulley. Grub Screws should be on the upper side of the GT2 Pulley as shown.



Do not attach the GT2 Belt just yet.





Hotend Carriage Assembly

ASSEMBLY NAME▶

The Hotend Carriage is designed to make it easy to make small independent adjustments to each hotend nozzle height.

Assemble 4x Hotend Carriage assemblies as per the following diagrams.

Parts Required (Per Assembly)

M3 x 20mm Screws

M3 x 25mm Screws

M3 x 50mm Screws

M5 x 60mm Screws

M3 Nyloc Nuts

M3 Nuts

Square Nuts

1 x Hotend Mount A

1 x Hotend Mount B

3 x Delrin V-Groove Wheel

2 x M5 Short V Wheel Spacers

3 x M5 Long V Wheel Spacers

1 x Eccentric V Wheel Spacer

1 x Hotend Plate Front

1 x Hotend Slide 1

1 x Hotend Slide 2

1 x Hotend Slide 3

1 x Acrylic Pushfit Mount

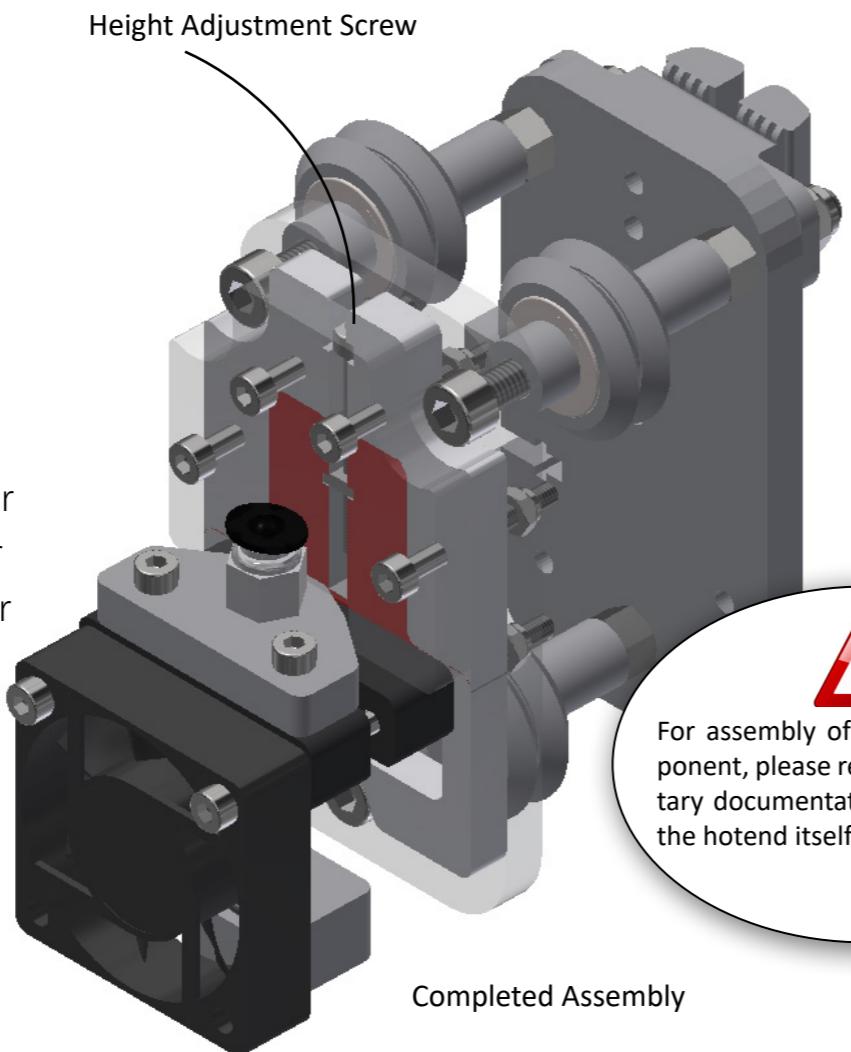
1 x Pushfit Mounts

1 x 40mm Fan

1x Hotend

PART / SUB ASSEMBLY NAME ▶

Hotend Carriage Assembly



! For assembly of the Hotend component, please refer to supplementary documentation provided with the hotend itself.

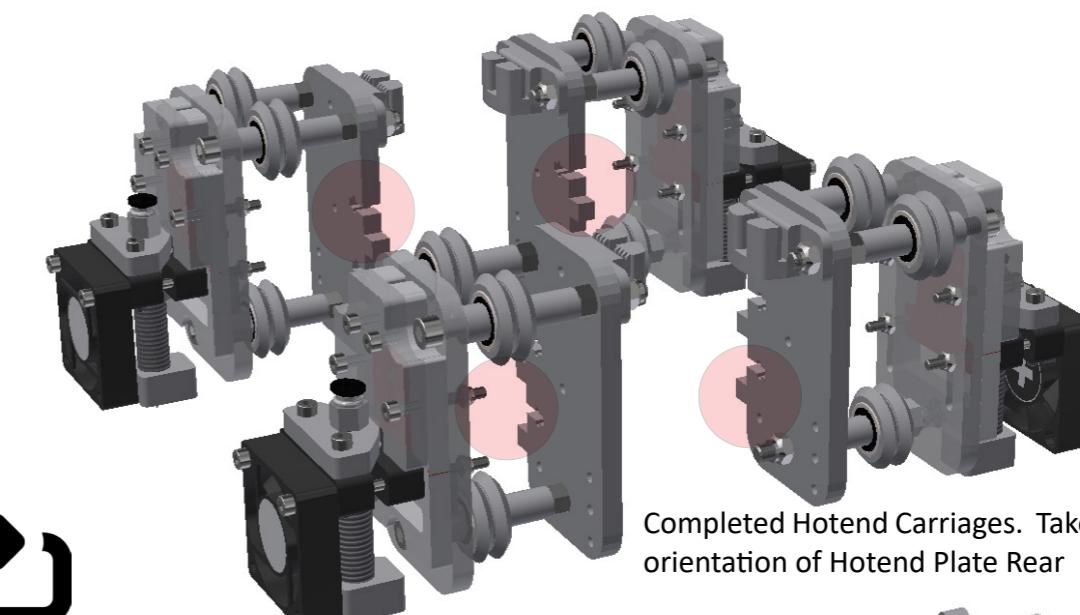
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Hotend Carriage Assembly

ASSEMBLY NAME▶

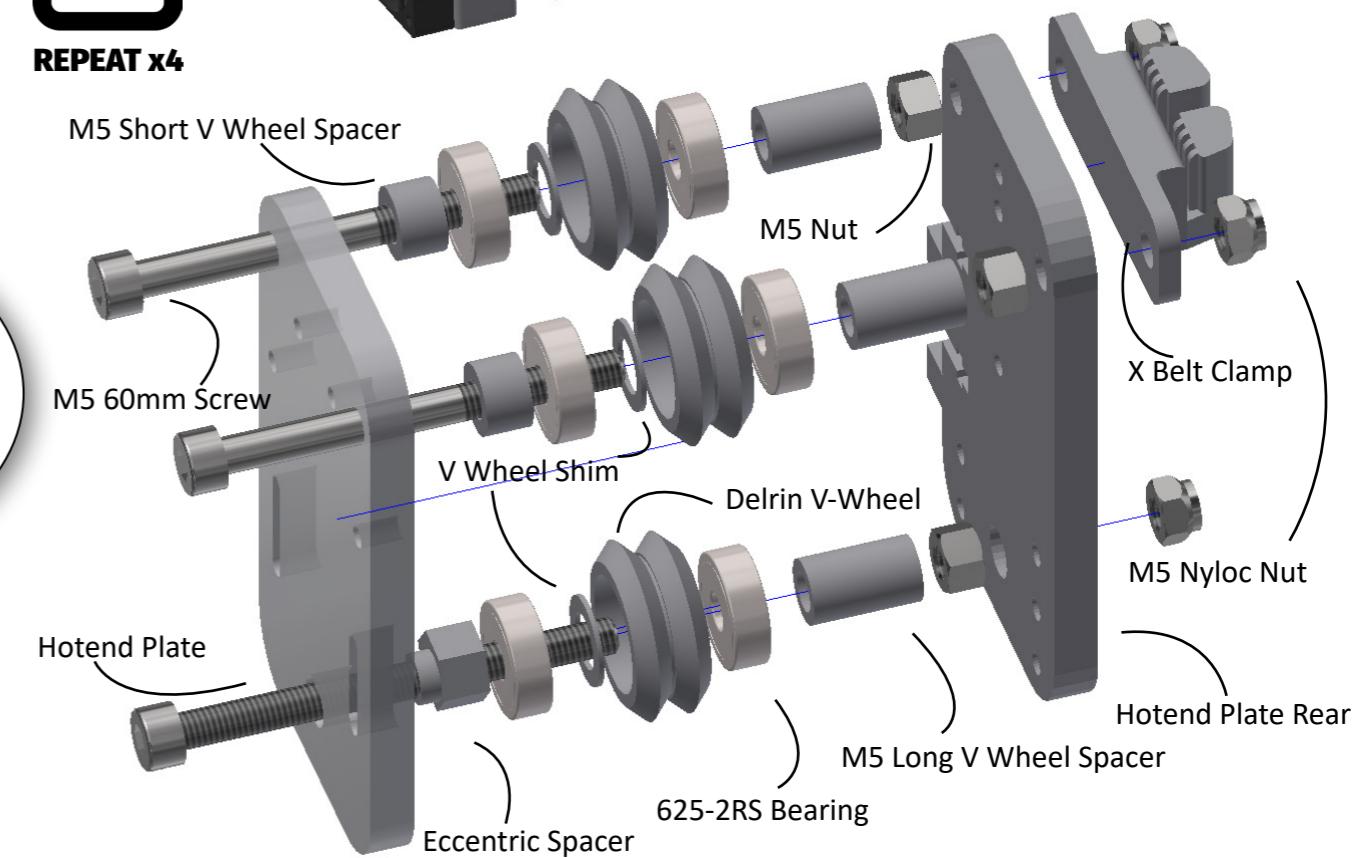


Hotend Carriage assemblies should be assembled in 2x Mirrored Pairs with the notches on the Hotend Plate Rear facing left on one pair and right on the other. Secure firmly, but **do not over tighten** screws. Once assembled, upon turning the height adjustment screw, the carriage should move up and down easily with no lateral movement.



REPEAT x4

Completed Hotend Carriages. Take note of orientation of Hotend Plate Rear



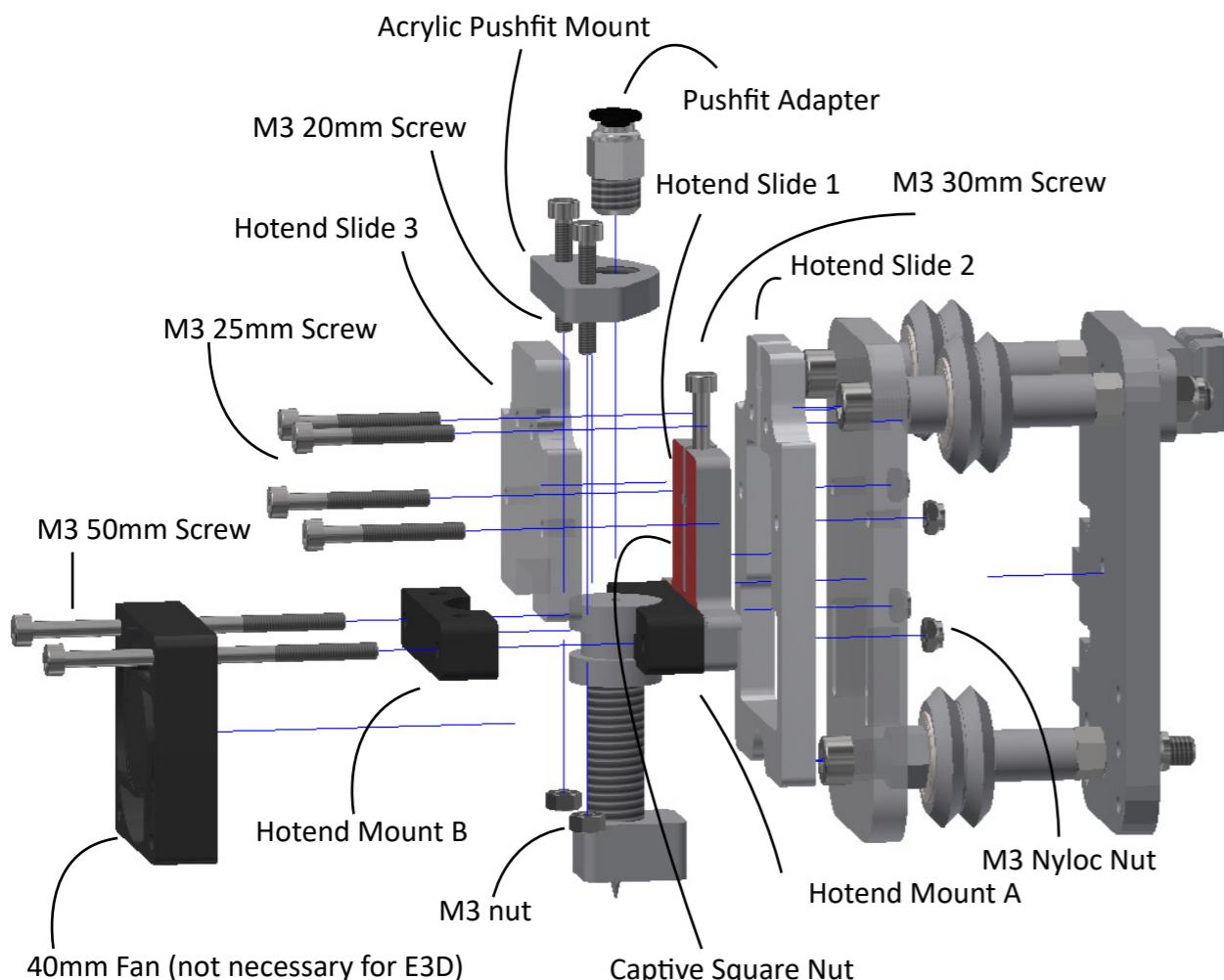


Hotend Carriage Assembly

ASSEMBLY NAME▶



Ensure a **square nut** is used as the captive nut in the Hotend Mount 1 (pictured in red) and that **both faces (front and back) of this part are well lubricated with Teflon Lube.**



PART / SUB ASSEMBLY NAME ▶

Hotend Carriage Assembly

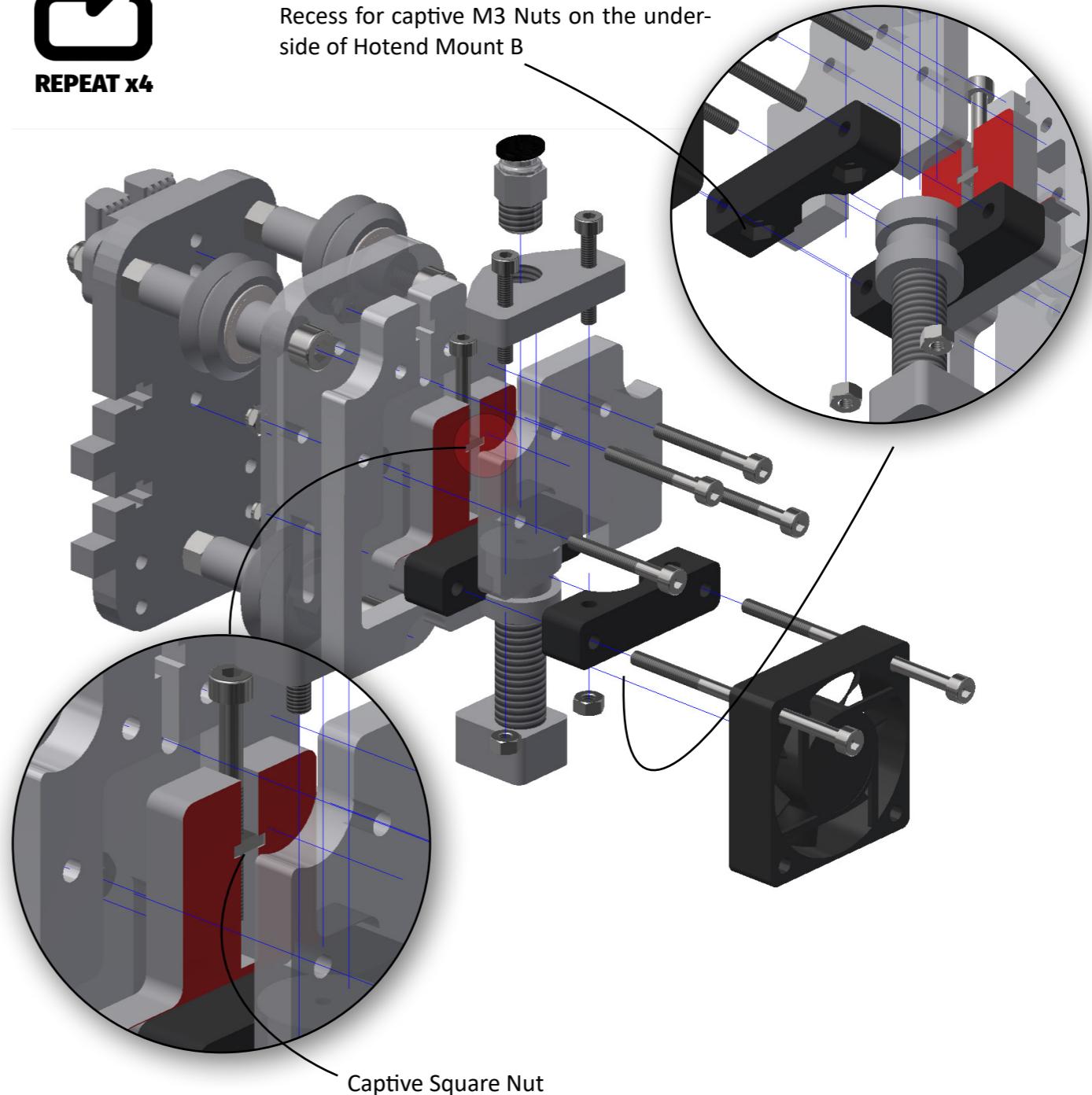


Hotend Carriage Assembly

ASSEMBLY NAME▶



Recess for captive M3 Nuts on the under-side of Hotend Mount B



PART / SUB ASSEMBLY NAME ▶

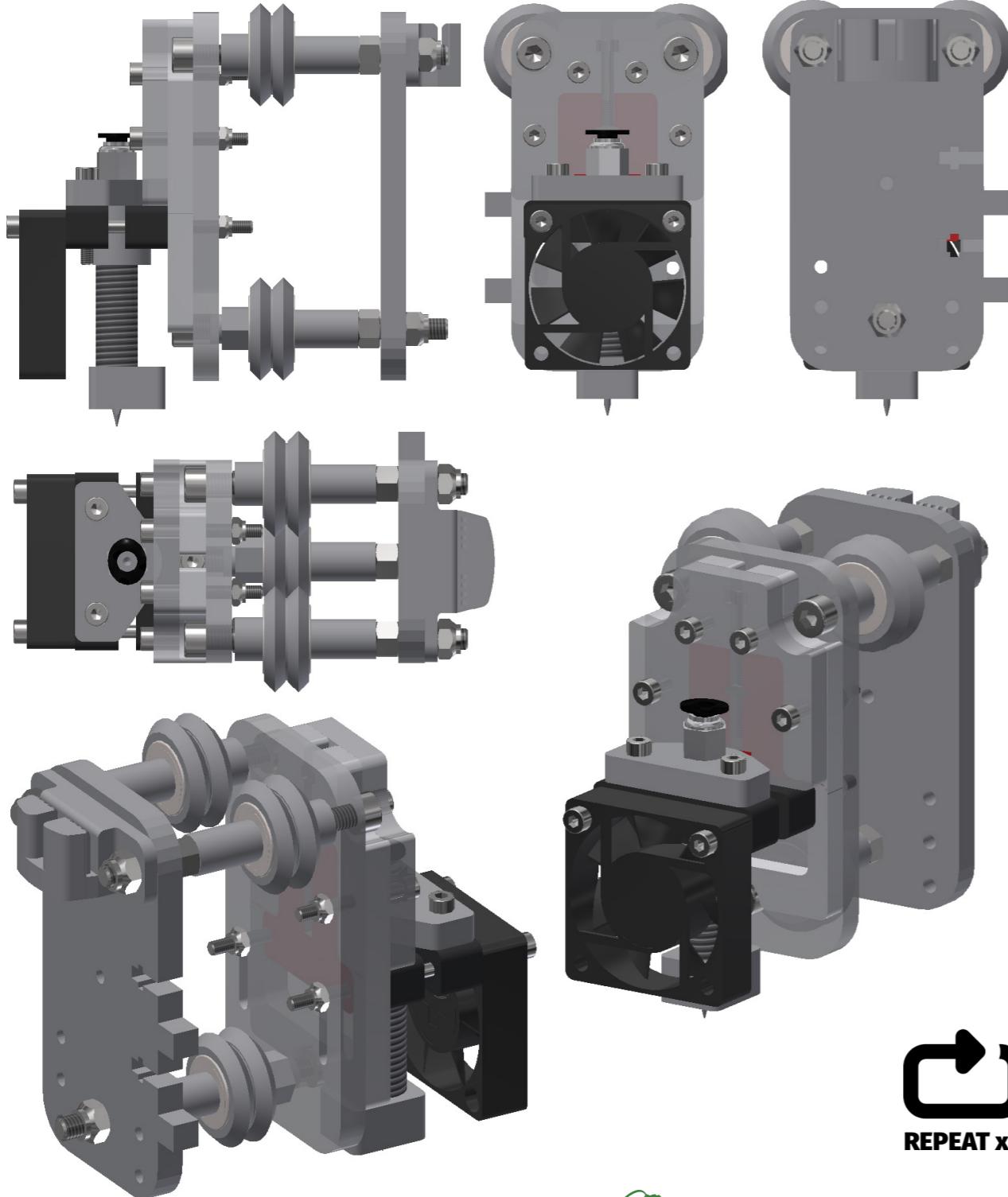
Hotend Carriage Assembly





Hotend Carriage Assembly

ASSEMBLY NAME ▶



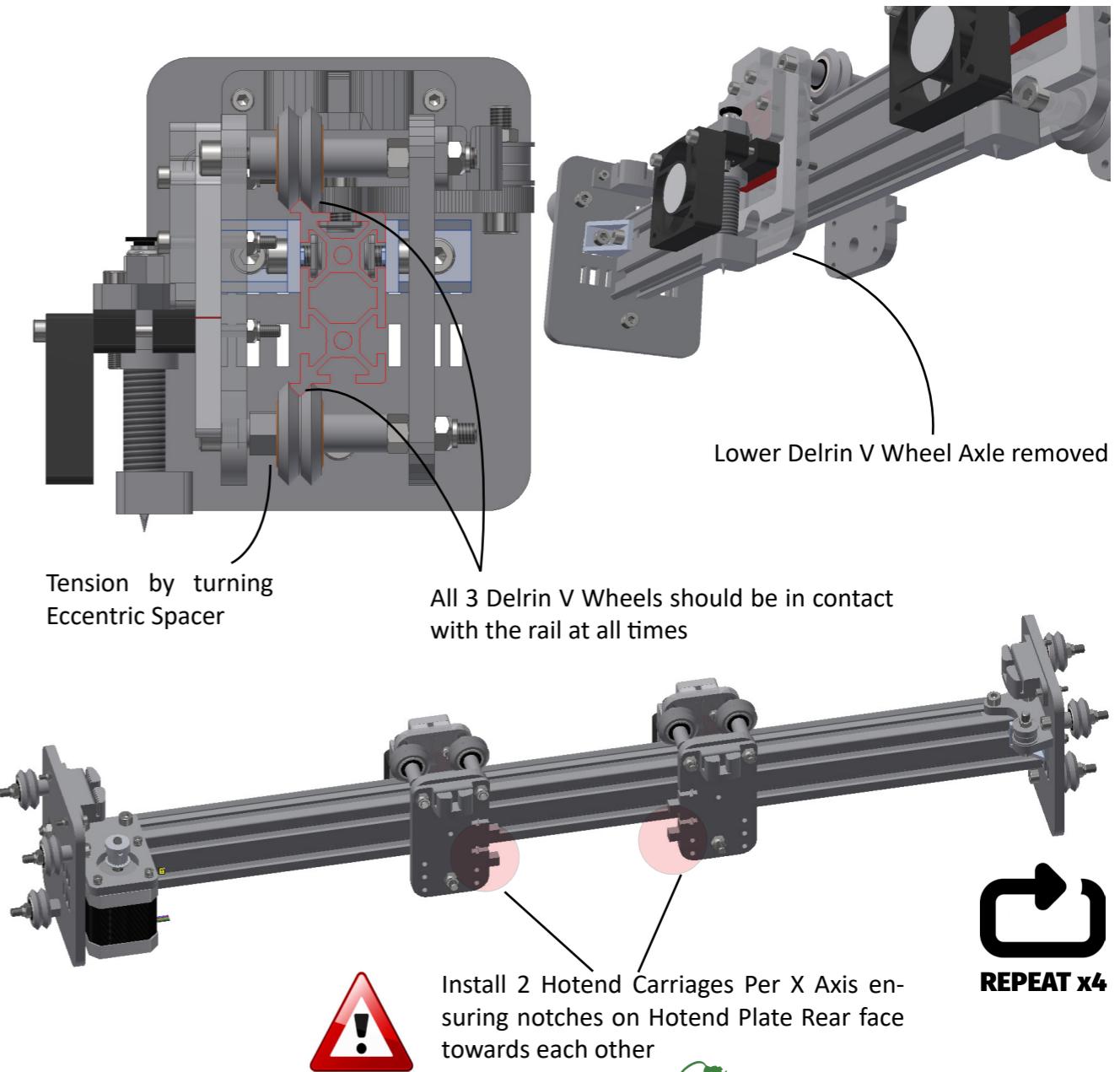
PART / SUB ASSEMBLY NAME ▼
Hotend Carriage Assembly



Fit Hotend Carriage to X Axis

ASSEMBLY NAME ▶

To fit each Hotend Carriage to the X Axis, Remove the lower Delrin V Wheel Axle assembly from the Hotend Carriage and drop onto rail as pictured. **Once in place, replace the Lower Delrin V-Wheel Axe** and **rotate the Eccentric spacer to tension**. The Hotend Carriage should be tight enough to move freely along the rail and should not deflect from the rail if the carriage is twisted.



PART / SUB ASSEMBLY NAME ▼
Fit Hotend Carriage to X Axis





The Beast

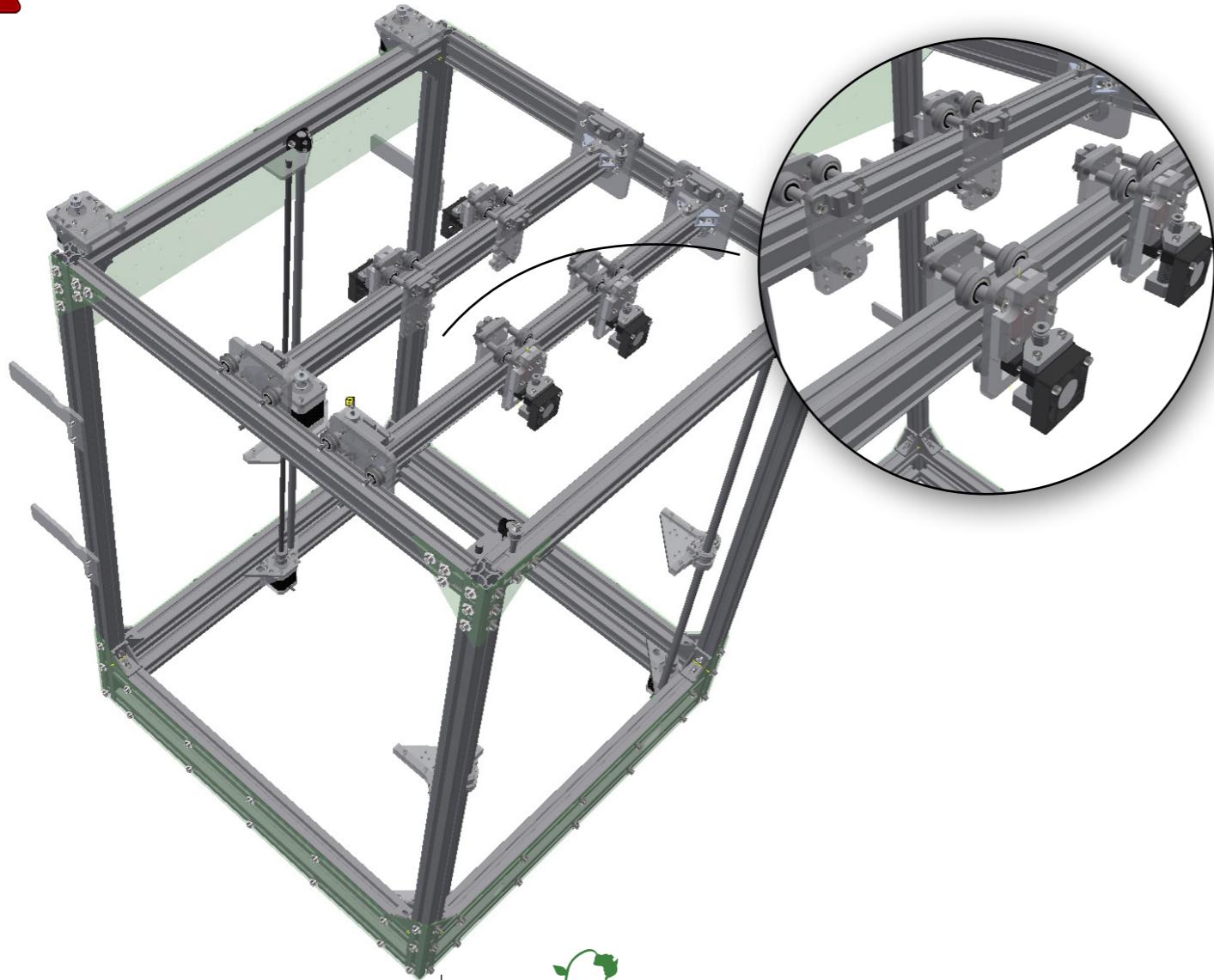
Fit X Axis to Printer Frame

ASSEMBLY NAME▶

To Fit each X Axis to the Printer frame, loosen the Nuts on the lower Delrin V Wheel Axle at each end. Once in place, re secure the V Wheel Axle and rotate the Eccentric spacer on each end to tension against rail. Again, X Axes assemblies should slide smoothly and wheels should not deflect from rail if the X Axis is twisted.



Both X Axes should be installed to the Hotends are on the outer side of each Axis. See picture below.



PART / SUB ASSEMBLY NAME ▾

Fit X Axes to Printer Frame



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x2
Hotend Carriage Brace



Fit Hotend Carriage Braces

ASSEMBLY NAME▶

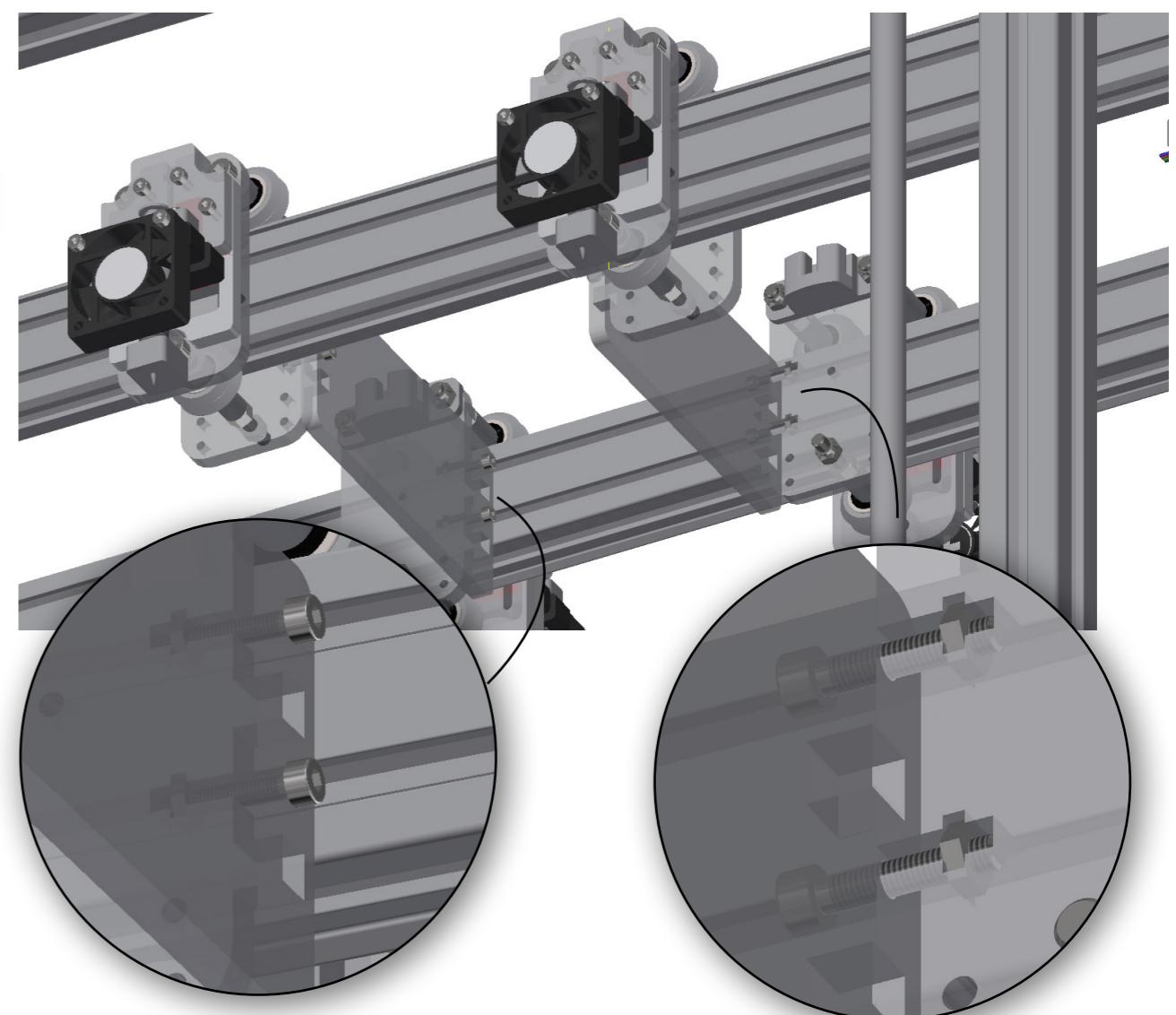


Parts Required (Per Assembly)

M3 16mm Screws
M3 Nuts

1x Hotend Carriage Brace

Attach a Hotend carriage brace between opposing Hotends on each X Axis as shown. Use M3 16mm Screws and Captive Nuts in the spaces provided to secure as shown.

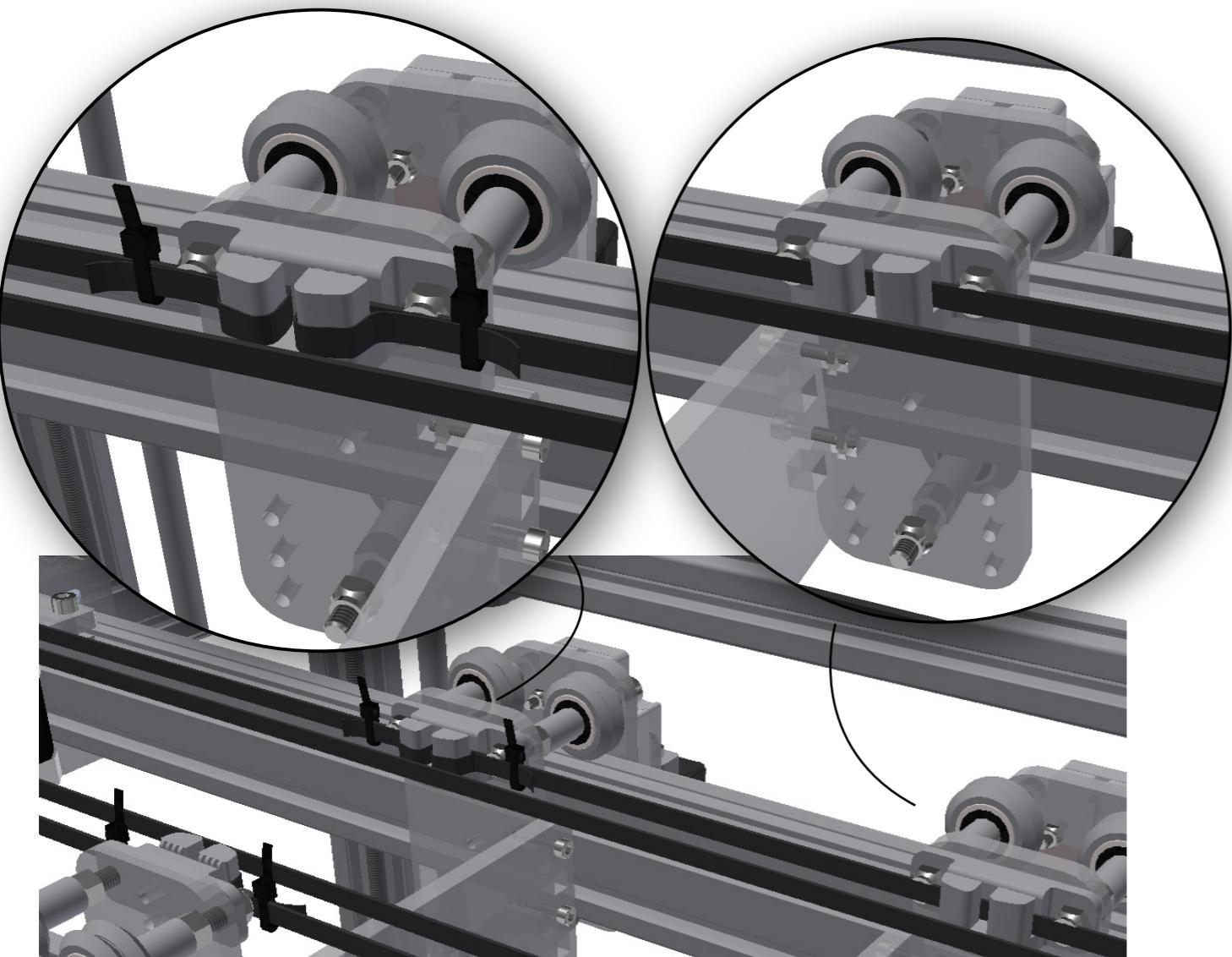




ASSEMBLY NAME ▾

Attach GT2 Belts

Attach the 2 Y GT2 Belts and the 2 X GT2 Belts in the positions as shown. Take note, the 2 longer belts are for the Y Axis Motors. The belts should pass through one of the Belt Clamps and wrap around the other, being fixed to itself with cables ties. The belt should be tight enough to deliver low bass sound when plucked.



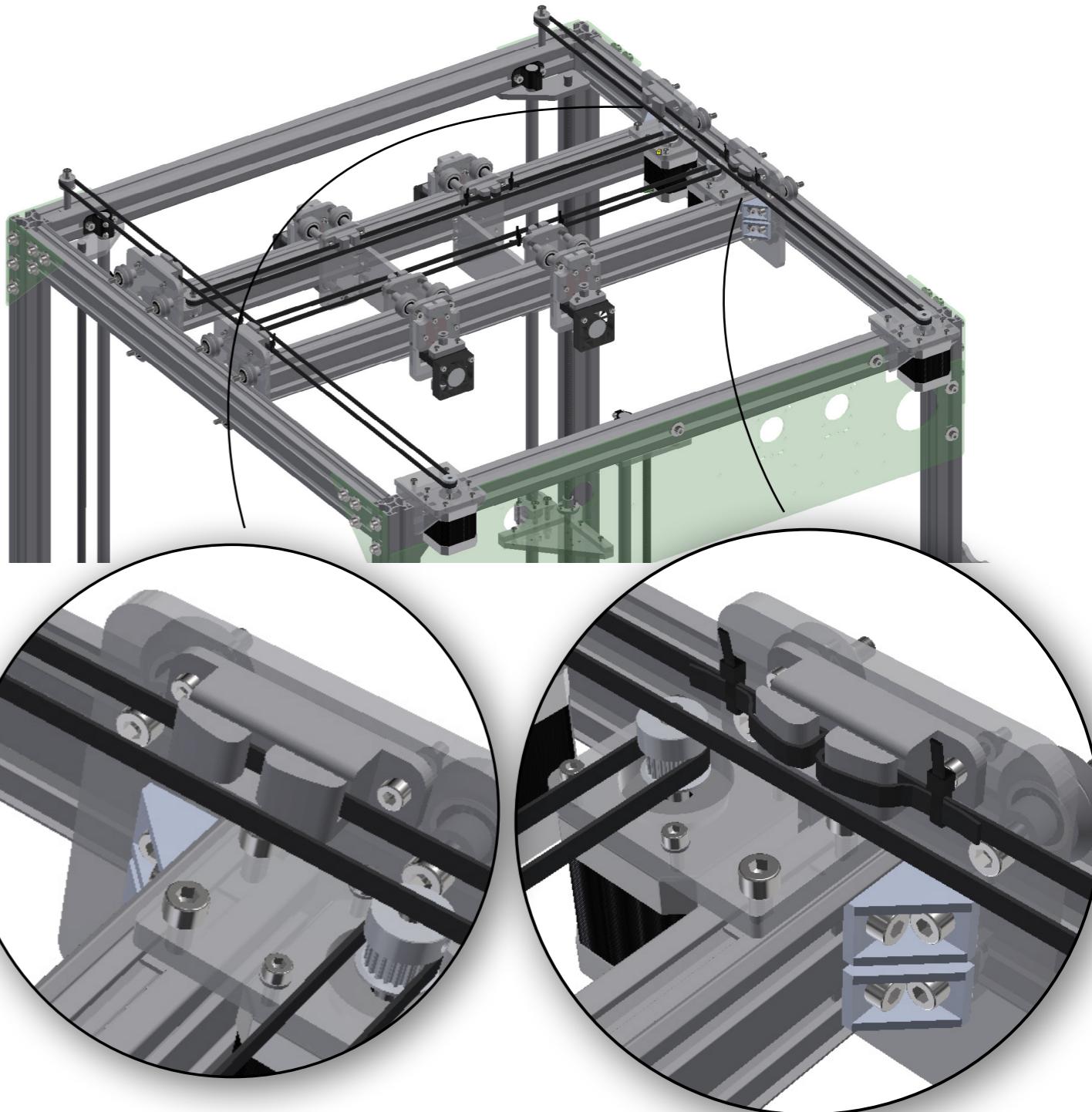
PART / SUB ASSEMBLY NAME ▾

Attach GT2 Belts

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ASSEMBLY NAME ▾

Attach GT2 Belts



PART / SUB ASSEMBLY NAME ▾

Attach GT2 Belts

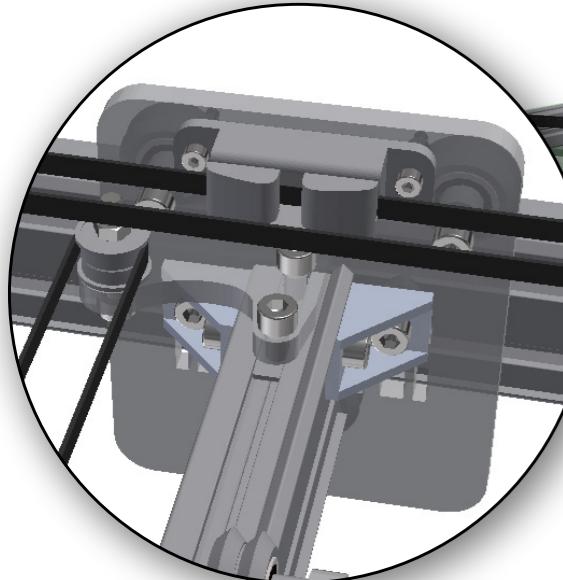
**cultivate3d**



ASSEMBLY NAME▶

Separation of X Axes

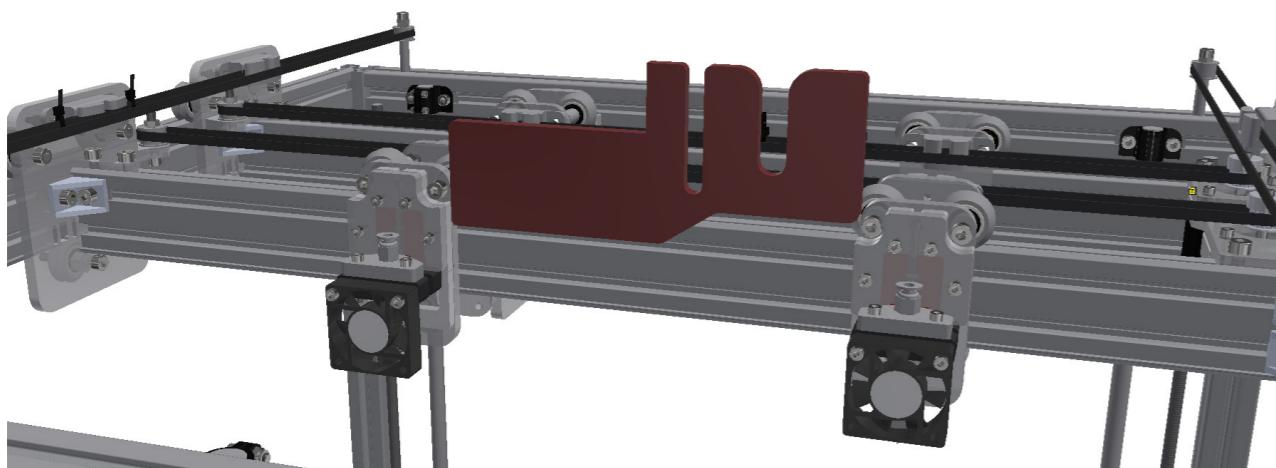
Use the Handy Dandy Tool as pictured to set the separation of the X Axes. When in place, slide the GT2 belt into the free Y Belt clamp as shown. Repeat for the other side.



ASSEMBLY NAME▶

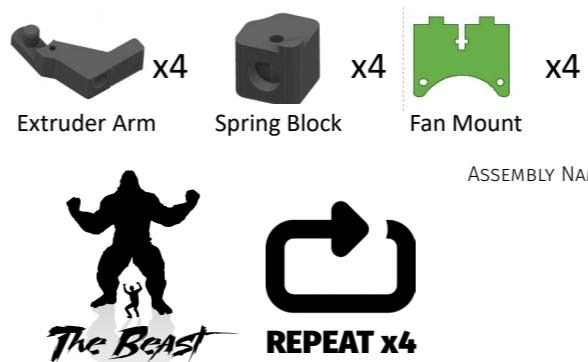
Separation of Hotend Carriages

Use the Handy Dandy Tool as pictured to set the separation of the Hotend Carriages as shown. When in place, slide the GT2 belt into the free X belt clamp as done previously. Repeat for the other X Axis.



PART / SUB ASSEMBLY NAME ▾

Separation of X Axes

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ASSEMBLY NAME▶

Extruder Assembly

Parts Required (per assembly)

M3 8mm Screws

M3 16mm Screws

M3 20mm Screws

M3 Nuts

1 x Nema 17 Motors

1 x Extruder Arms

1 x Spring Blocks

1 x Acrylic Fan Mounts

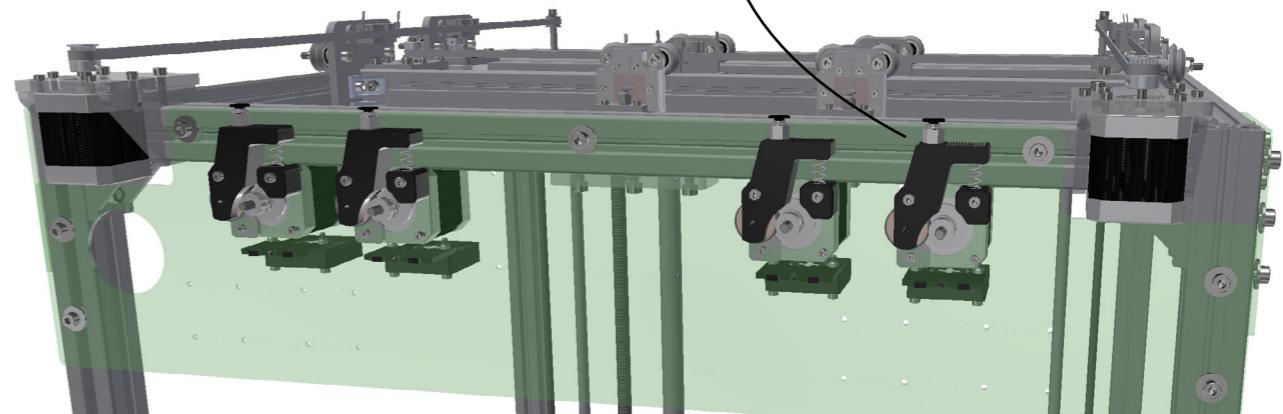
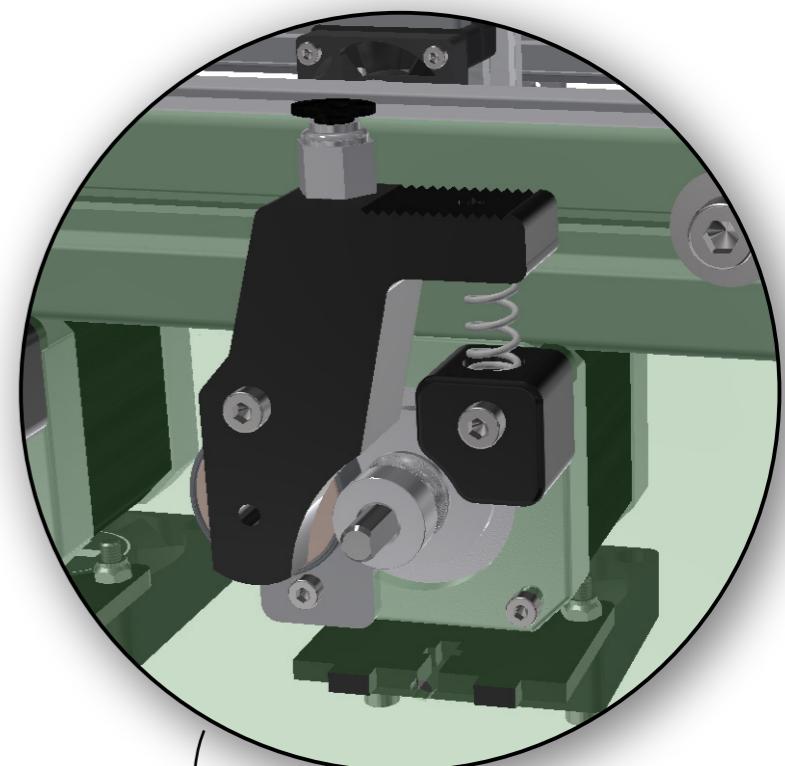
1 x Hobbed Gear

1 x 40mm Fans

1 x Springs

1 x Pushfit Adapter

1 x 608ZZ Bearings



PART / SUB ASSEMBLY NAME ▾

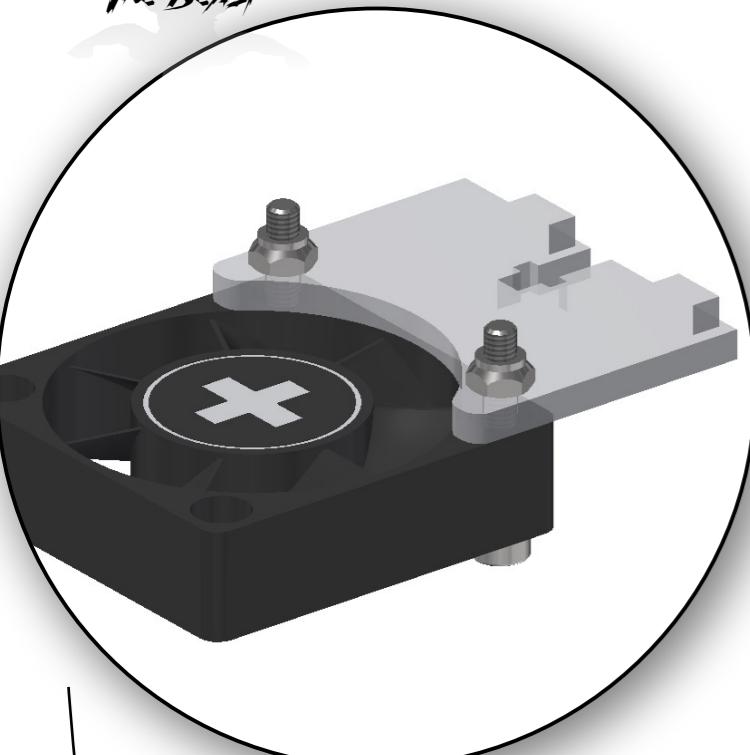
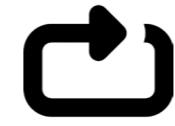
Extruder Assembly

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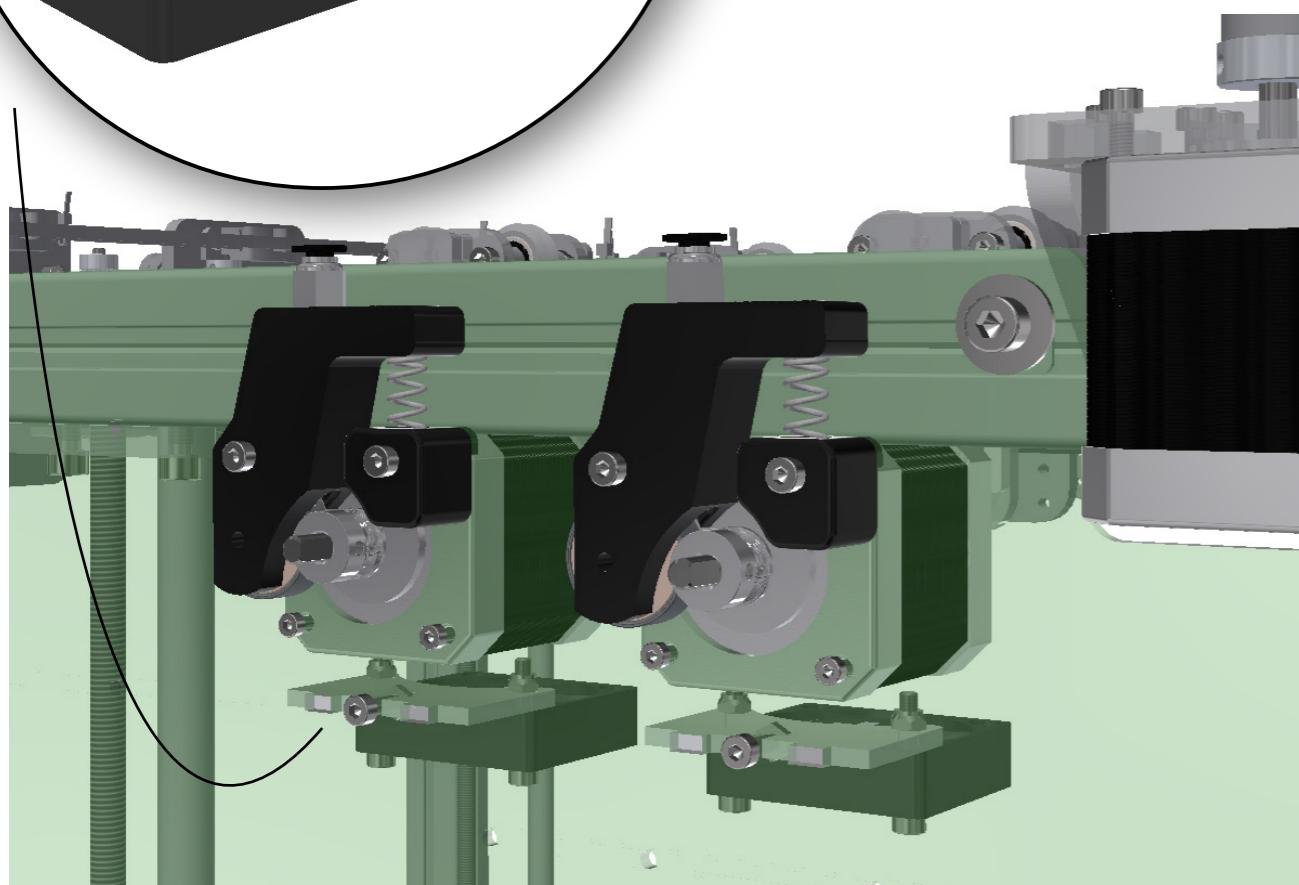


ASSEMBLY NAME ▾

Extruder Assembly



Attach a 40mm fan to the Fan Mount with 2 x M3 x 16mm screws and nuts. Then attach this assembly to the inside of the extruder panel using an M3 x 12mm screw and a captive nut in the Fan Mount.



PART / SUB ASSEMBLY NAME ▾
Extruder Assembly

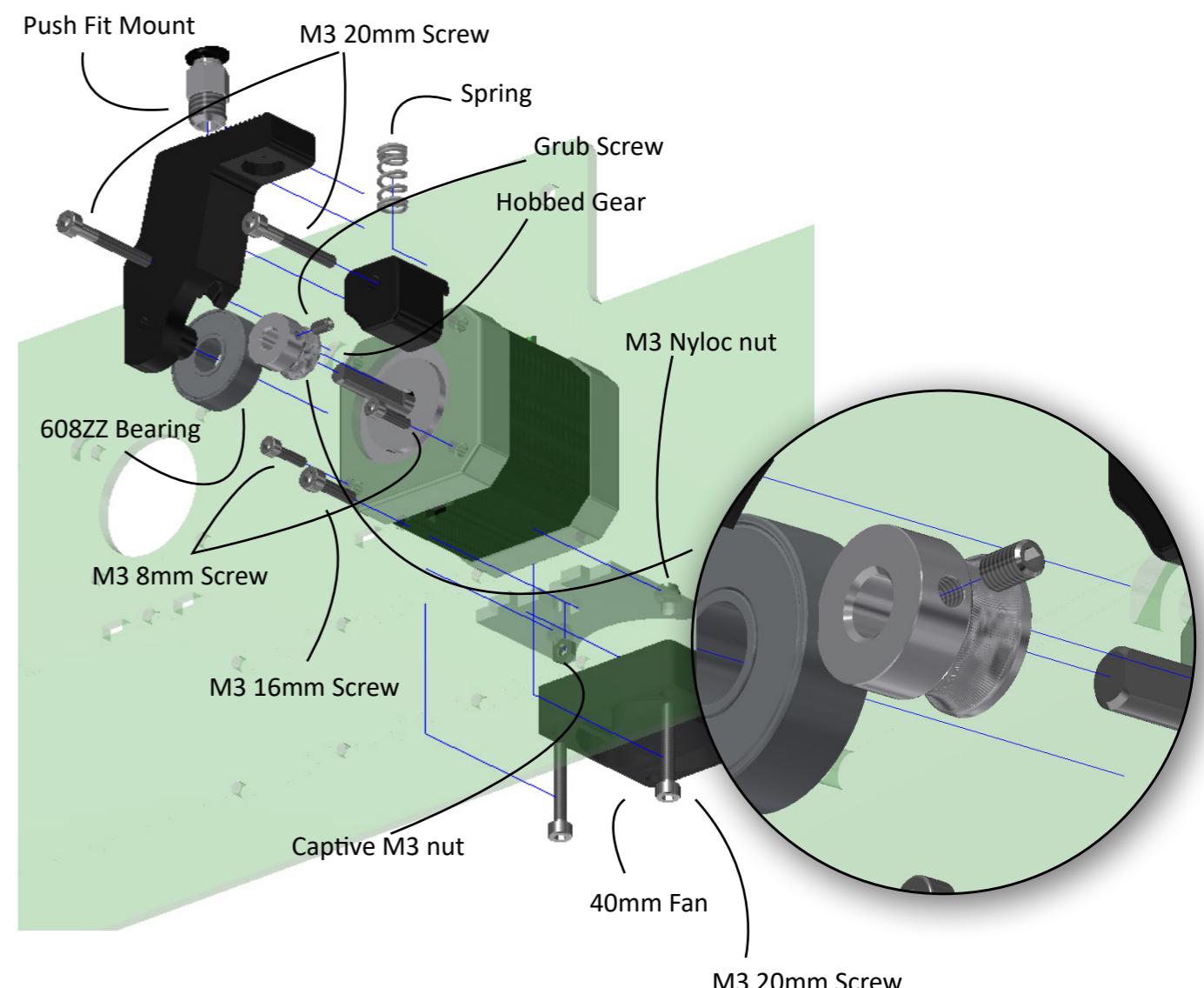


ASSEMBLY NAME ▾

Extruder Assembly



Assemble the 4 extruder assemblies as shown below. Ensure the Extruder arms shaft faces inwards to trap the bearing against the extruder mount plate. Make sure you tighten the grub screw against the flat of the motor shaft.



PART / SUB ASSEMBLY NAME ▾
Extruder Assembly

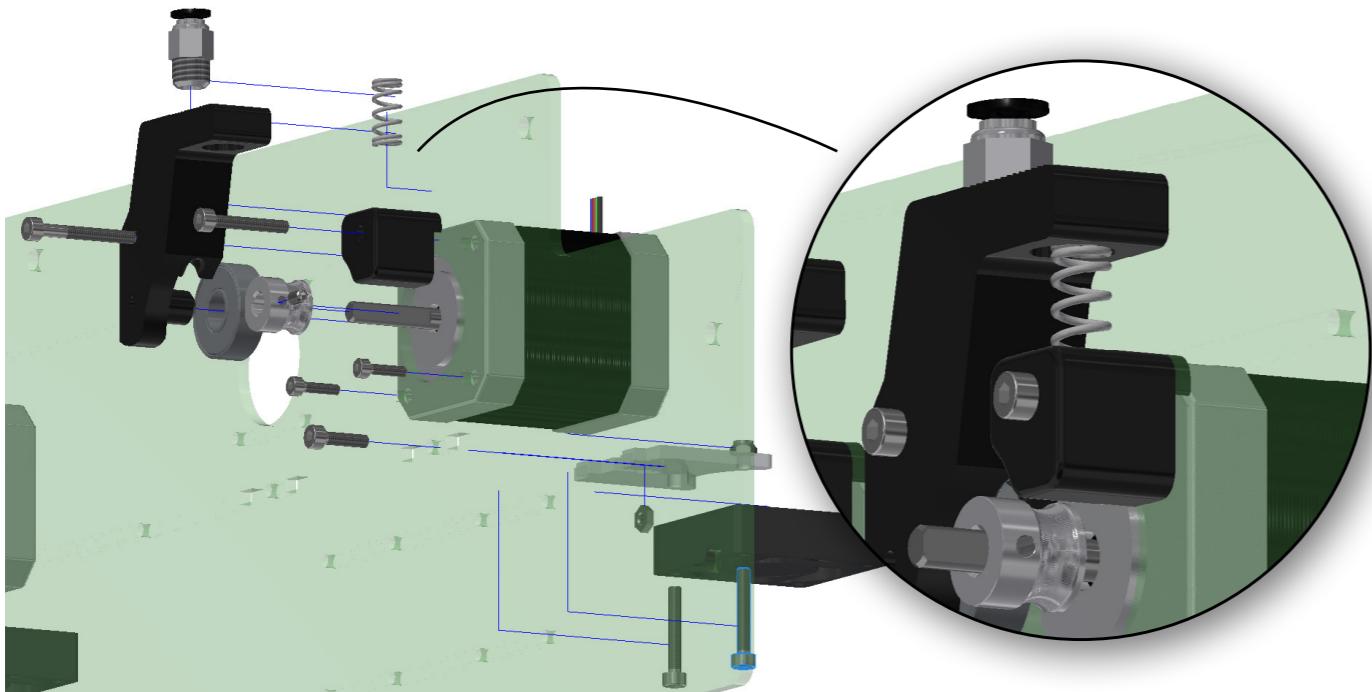




The Beast



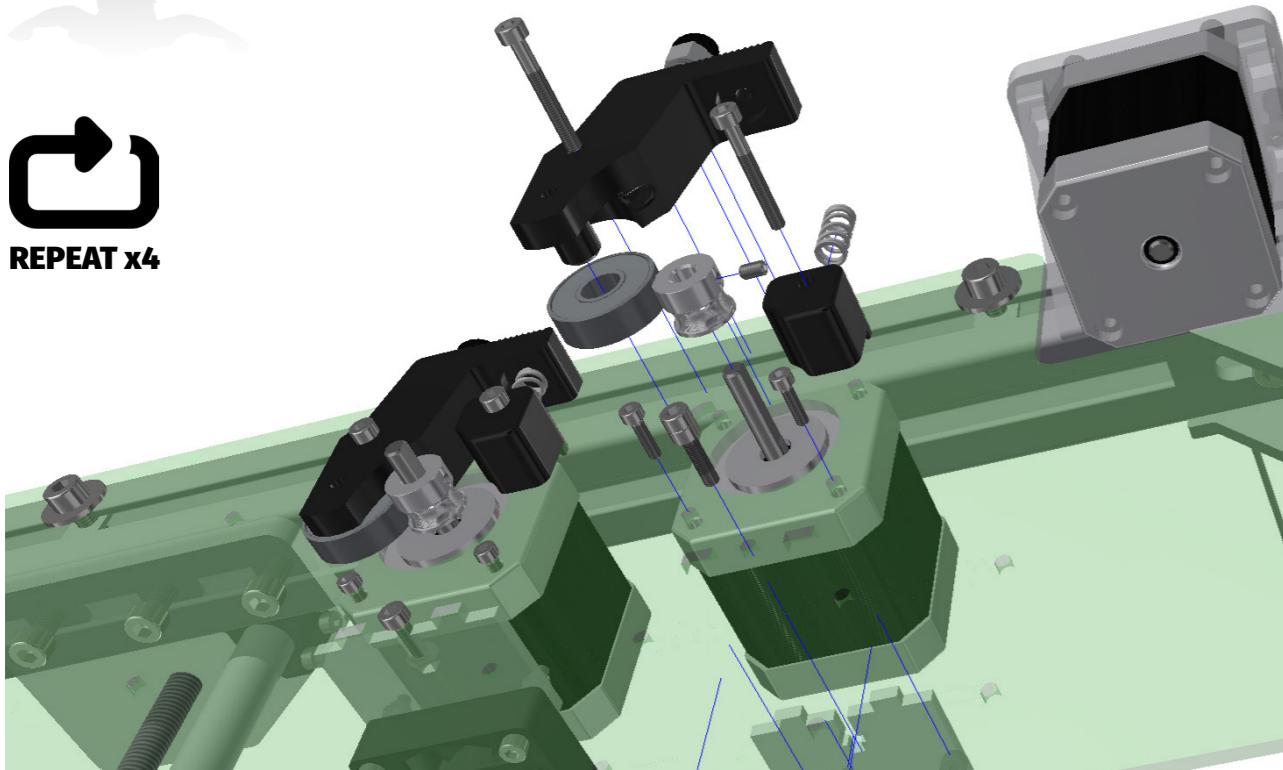
REPEAT x4



PART / SUB ASSEMBLY NAME ▾
Extruder Assembly

ASSEMBLY NAME ▾

Extruder Assembly



x1 x1 x1
X Endstop Holder Y Endstop Holder Z Endstop Holder



The Beast

Parts Required

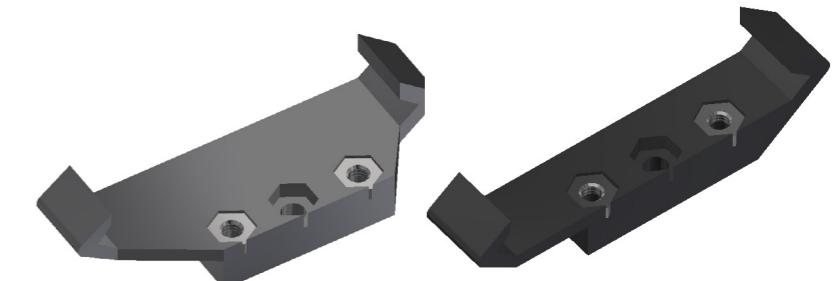
M3 10mm Screws
M3 16mm Screws
M3 25mm Screws
M3 Nuts

1x X Endstop Holder
1x Y Endstop holder
1x Z Endstop Holder
3x Standard Mechanical Endstop
1x X Endstop extension wire
1x Y Endstop Extension wire
1x Z Endstop extension wire.

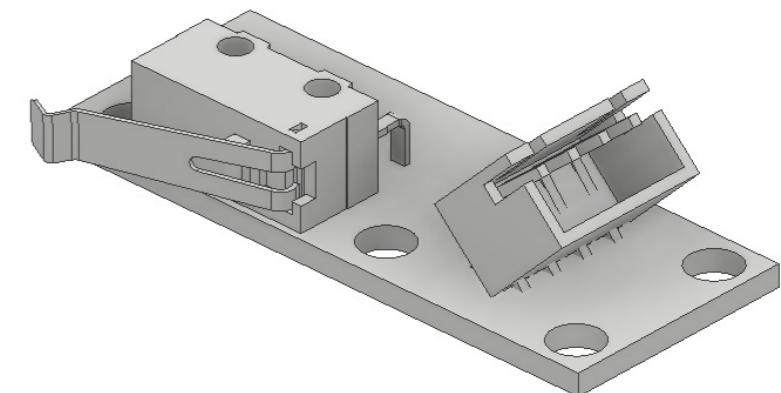
X , Y and Z Endstops

ASSEMBLY NAME ▾

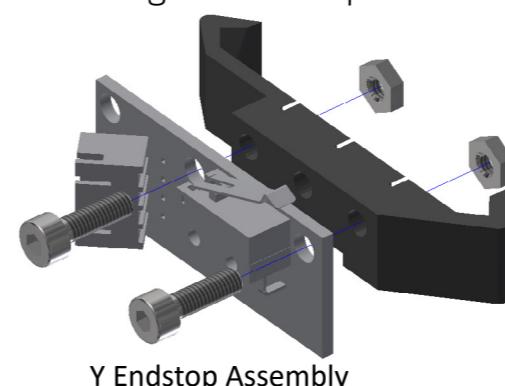
Insert 2x captive nuts into the X Endstop Holder and Y Endstop Holder as shown.



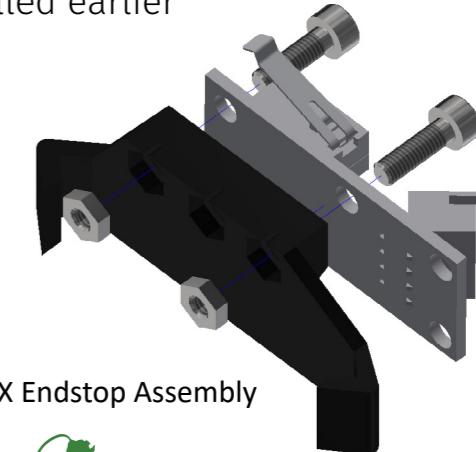
Gently bend up the connector for one Mechanical Endstop as shown below. This is to allow space for a screw to secure the Z Endstop to the



Assemble the X and Y Endstop assemblies as shown below with M3 10mm screws through to the captive M3 Nuts installed earlier



Y Endstop Assembly



X Endstop Assembly

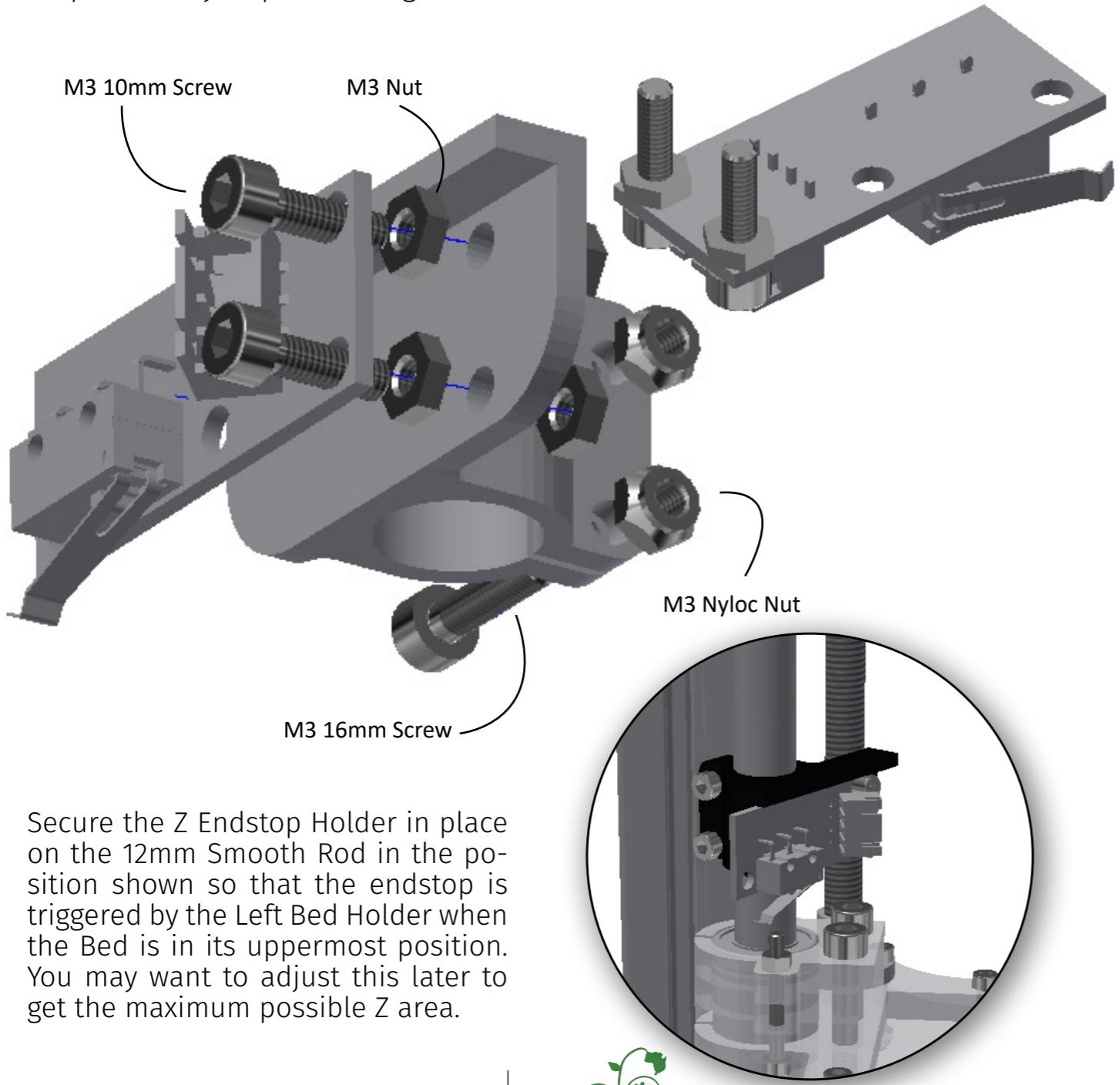




X , Y and Z Endstops

ASSEMBLY NAME▶

Insert 2x M3 10mm screws through the front of the remaining Endstop, followed by an M3 nut on each screw as pictured. Assemble the rest of the Z End Stop Assembly as per the diagram below.



Secure the Z Endstop Holder in place on the 12mm Smooth Rod in the position shown so that the endstop is triggered by the Left Bed Holder when the Bed is in its uppermost position. You may want to adjust this later to get the maximum possible Z area.

PART / SUB ASSEMBLY NAME ▶

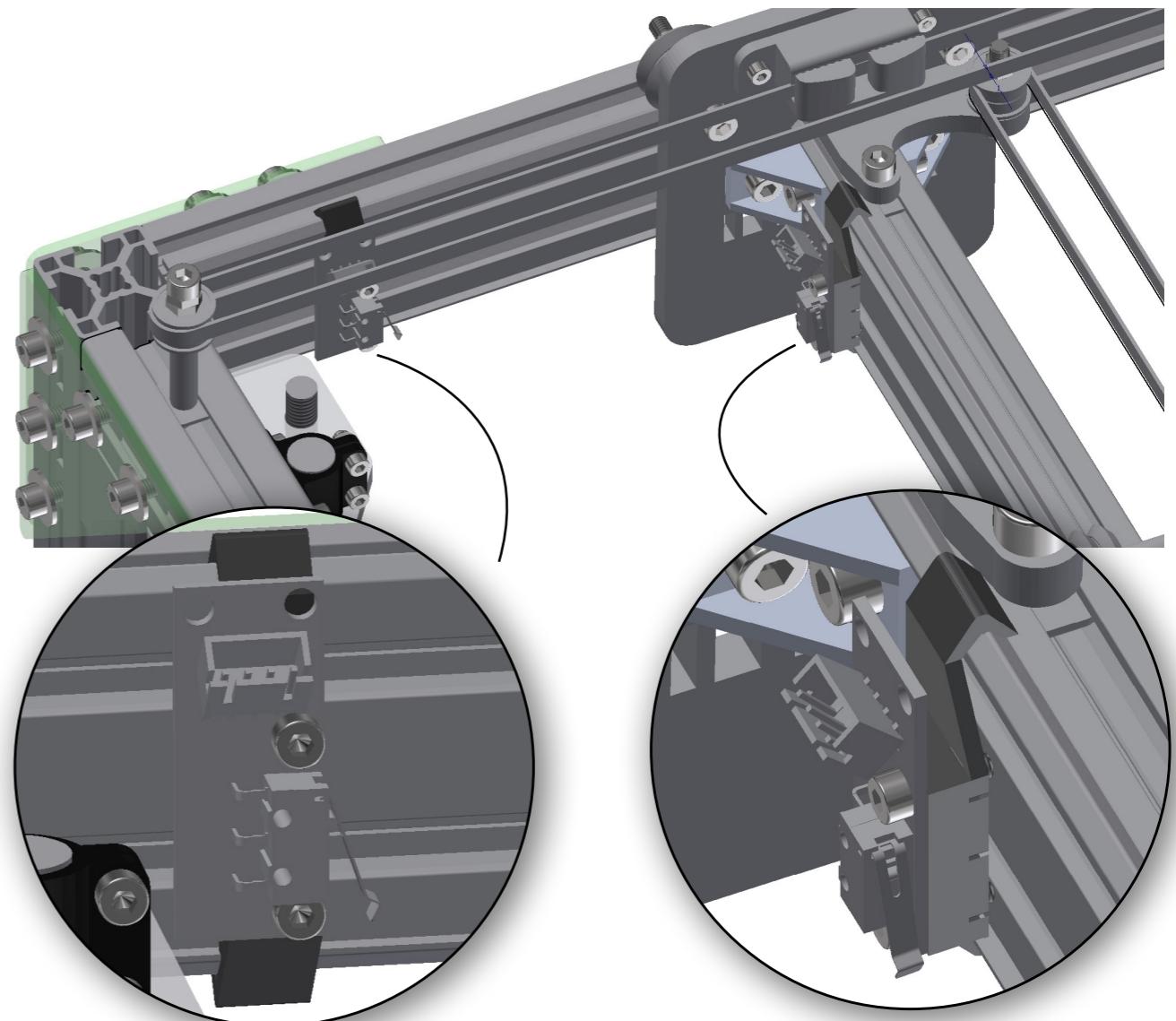
X Y and Z Endstops



X , Y and Z Endstops

ASSEMBLY NAME▶

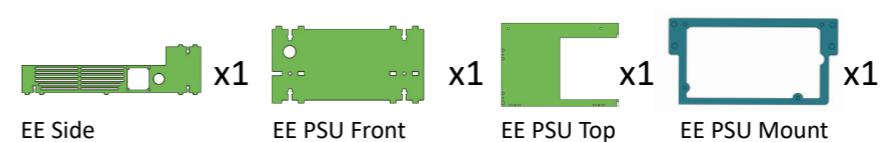
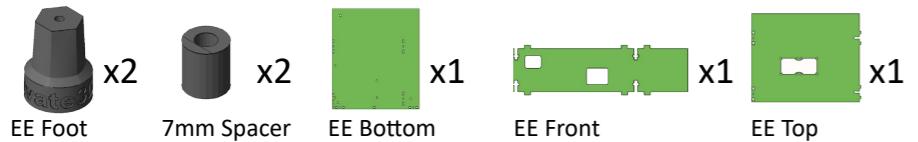
Clip both the X and Y Endstops into position on the X and Y extrusions as shown.



PART / SUB ASSEMBLY NAME ▶

X Y and Z Endstops





Electronics Enclosure

ASSEMBLY NAME▶

Parts Required

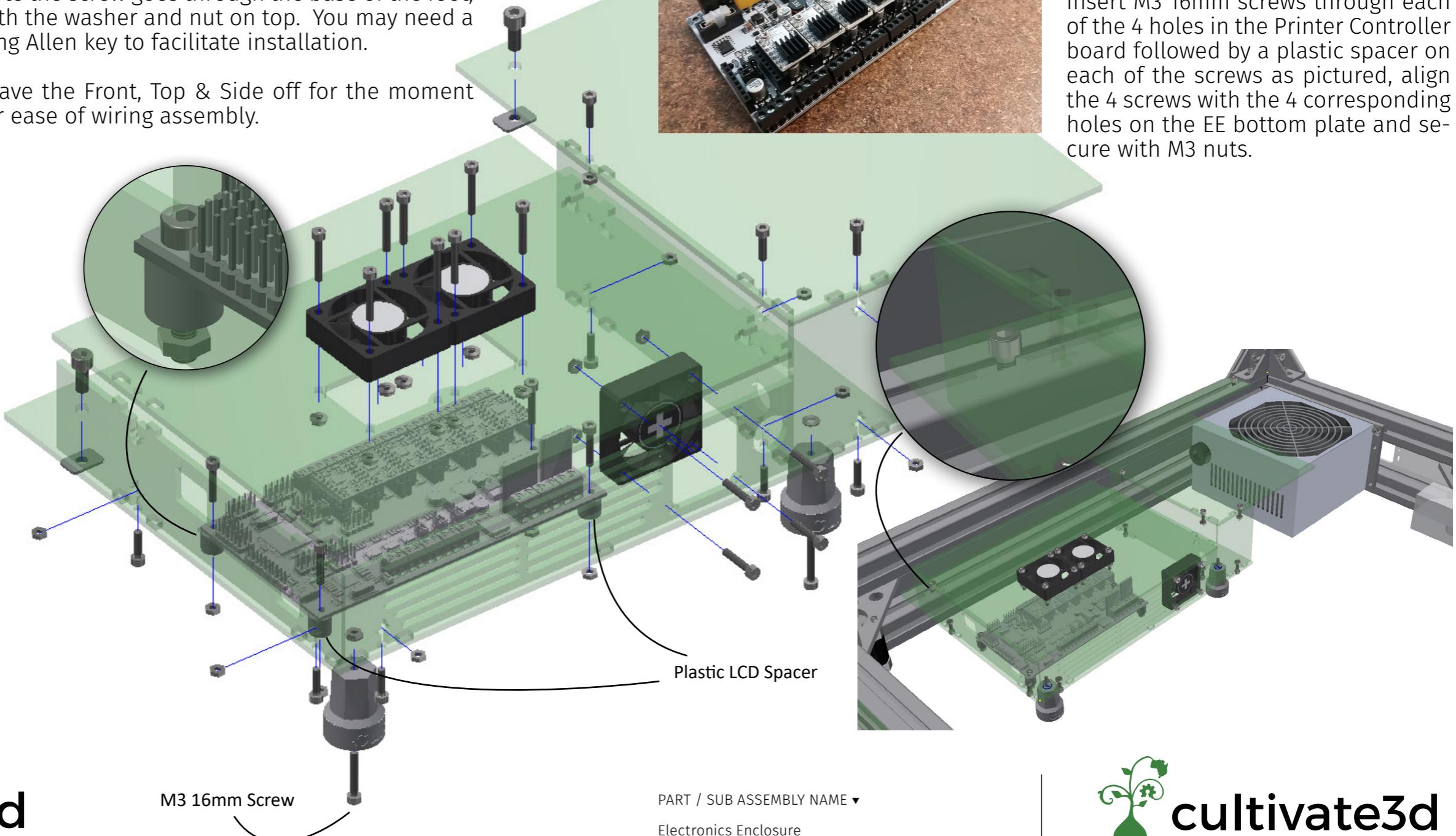
M3 12mm Screws
M3 16mm screws
M3 Washers
M3 Nuts (Captive insert)
M5 10mm Screw
M5 T-Slot Nut

2x EE Foot
4x 7mm Spacers
1x EE Bottom
1x EE Front
1x EE Top
1x EE Side
1x EE PSU Front
1x EE PSU Top
1x EE PSU Mount
1x PSU
1x Emergency Stop Button
1x 900mm Red Wire
1x 900mm Black Wire
2x Terminal Blocks
3x 40mm Fans
Motor Extension Wires
Extruder Fan Extension Wires

Assemble the EE Bottom, EE Rear and PSU top plates by inserting captive nuts into the captive nut spaces and securing with M3 12mm screws. Attach the EE Feet to the EE Bottom using 2x M3 16mm screws / washer / nut. Refer to picture below.

Note the screw goes through the base of the foot, with the washer and nut on top. You may need a long Allen key to facilitate installation.

Leave the Front, Top & Side off for the moment for ease of wiring assembly.



PART / SUB ASSEMBLY NAME ▶
Electronics Enclosure



Attach Heat-sinks to each printer driver on the Printer control board using double sided tape (supplied with board). Ensure the Heatsinks do not come into contact with any of the soldered components.

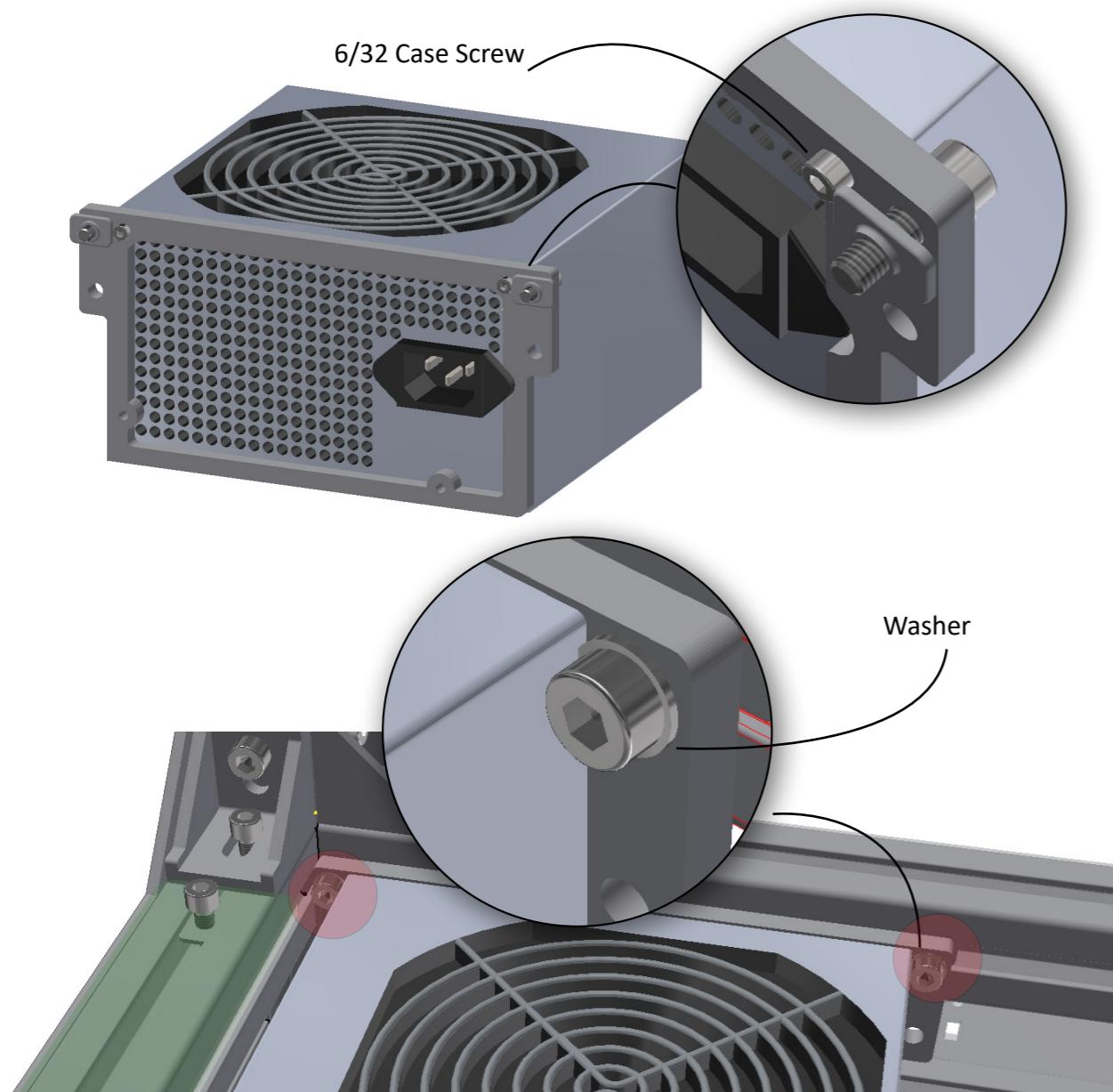
Insert M3 16mm screws through each of the 4 holes in the Printer Controller board followed by a plastic spacer on each of the screws as pictured, align the 4 screws with the 4 corresponding holes on the EE bottom plate and secure with M3 nuts.



Electronics Enclosure

ASSEMBLY NAME►

Secure the PSU to the PSU Mount with 2x 6/32 Case screws and flush to the lower rear, left hand corner of the printer as shown with 2x M5 16mm screws with **washer** and T-Slot Nuts.



PART / SUB ASSEMBLY NAME ▾
Electronics Enclosure



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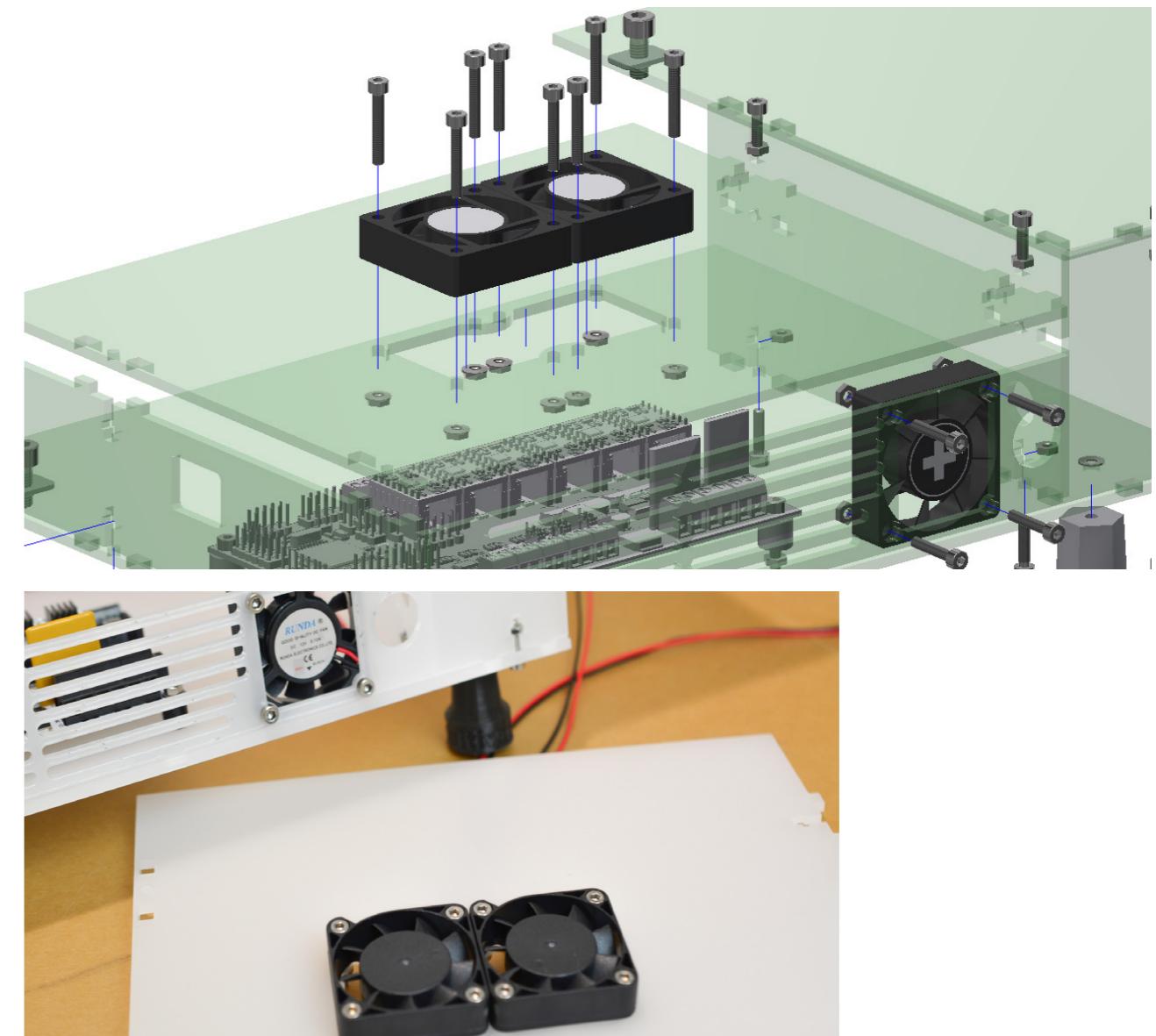
Electronics Enclosure

ASSEMBLY NAME►

Attach the 2 electronic enclosure fans to the EE top plate with 4x M3 12mm screws and Nuts as pictured – ensure the fans are installed sticker side down

Ensure all screws are firmly tightened to prevent them from working loose and landing on the printer control board.

Attach the exhaust fan to the EE side with 4x M3 16mm screws and nuts, ensuring the air flow (sticker side) is facing outward.



PART / SUB ASSEMBLY NAME ▾
Electronics Enclosure



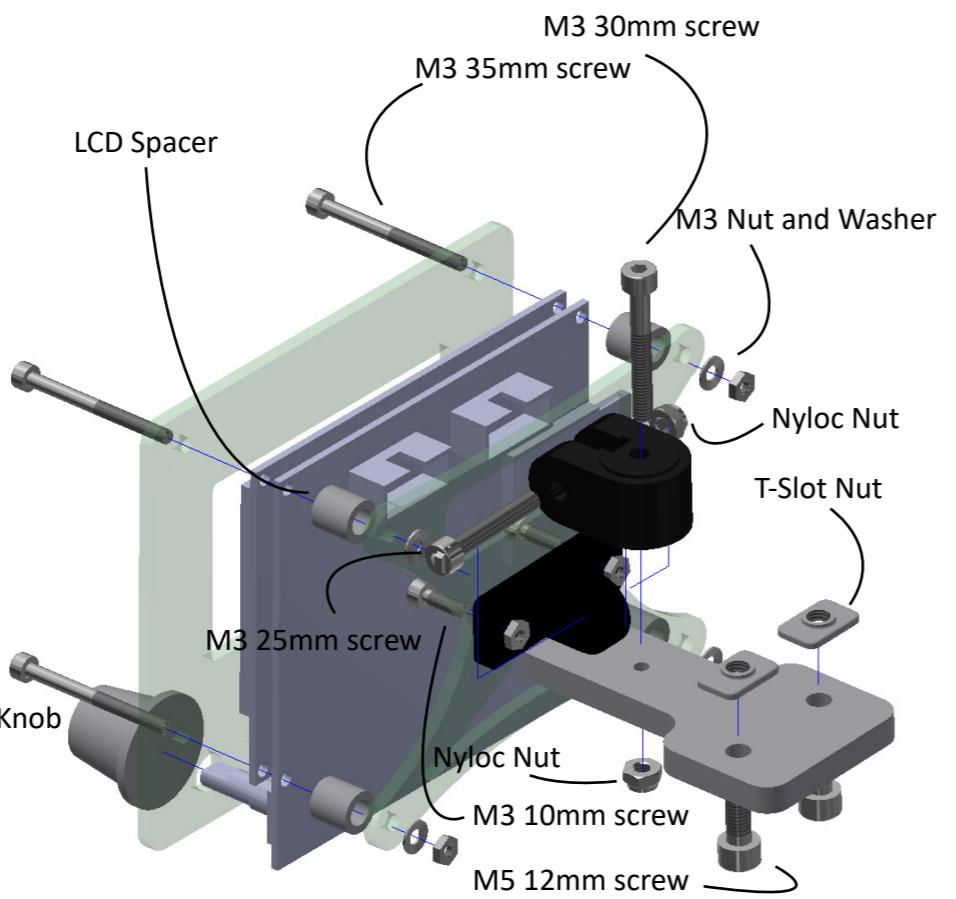
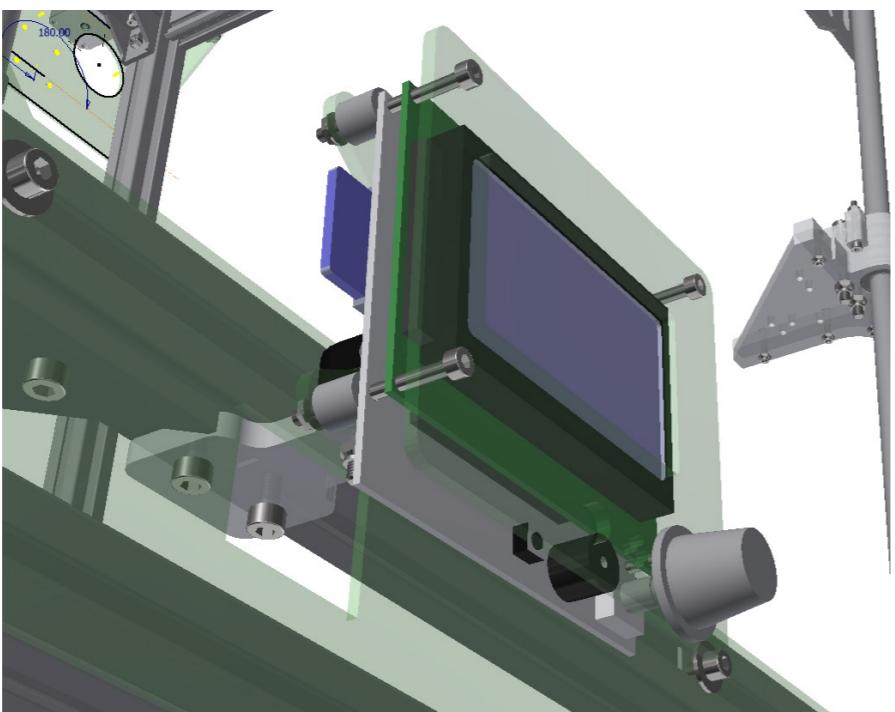
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Parts Required

M3 x 35mm Screws
M3 x 30mm Screws
M3 x 25mm Screws
M3 10mm Screws
M3 Washers
M3 Nuts
M3 Nylon Lock Nuts
M5 x 12mm Screws

1x LCD Mount Part 1
1x LCD Mount Part 2
1x LCD Mount Part 3
4x 9mm Spacers
1x LCD Mount Plate
1x LCD Face Plate
1x LCD Controller
1x LCD Encoder Knob



ASSEMBLY NAME ▶

LCD Display

Assemble the LCD as per the diagram below and fix to 3030 extrusion on the front of the printer as pictured.



The Beast

ASSEMBLY NAME ▶

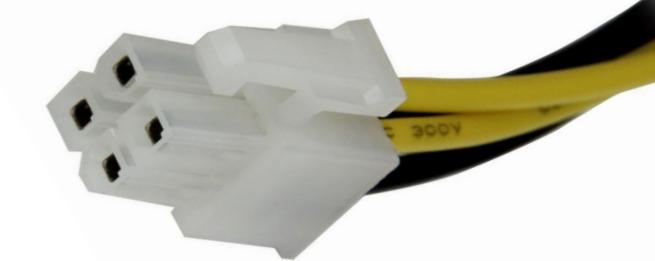
Wiring

Note, the following steps require electrical common sense. Do not connect any component to any form of electrical supply while performing the following steps.

For more information on wiring, please refer to the complete **wiring diagram/map** on the last page of this manual.

Parts Required

1x Emergency Stop Button
1x 900mm Red Wire
1x 900mm Black Wire



1x Motor Extension Wires
1x Extruder Fan Extension Wires
1x Terminal Blocks
1x 600mm Trunking
1x 500mm Trunking
1x Double Sided Foam Tape



Cut and strip 1cm off all 4 wires (2 yellow and 2 black) close to the connector as shown.

Separate both pairs of black and yellow cables (on some PSU's the colour may be brown and yellow) and twist the exposed wires from each pair together forming 1 yellow twisted pair and 1 black twisted pair. This is done to double the amperage available to the printer control board. Each yellow wire carries 12v+ and each Black wire is connected to common earth. The wires will be used to provide power to the printer control board. Do not connect them to the control board yet.

PART / SUB ASSEMBLY NAME ▶

X Y and Z Endstops / Wiring



The Beast



Identify the (loose - not labeled) red and black 900mm wires and strip one end of each. Loosen the screw terminals on the emergency stop button and secure the stripped end of the black wire to one side and the red to the other. It does not matter which side of the Emergency stop button the red and black wires are connected, but ensure both black and Red are connected to the orange terminals.

Ensure there is no exposed (stripped) wire protruding from the terminals of the Emergency Stop Button. See picture.

Unscrew the red twist end (red cap) and chrome collar from the Emergency stop button as pictured.

Position the body of the emergency stop button in place as shown. Secure the Emergency stop button body to the printer with the chrome collar as shown. Complete the assembly by screwing the red twist end onto the Emergency Stop Button body.

Identify the green wire leading from the ATX PSU and cut and strip the wire as close to the connector as possible as shown. This wire will be used as a trigger to power on / off the printer. Trim a 20mm length of shrink wrap and feed this over the green wire you have just stripped.

ASSEMBLY NAME▶

Wiring



The Beast

ASSEMBLY NAME▶

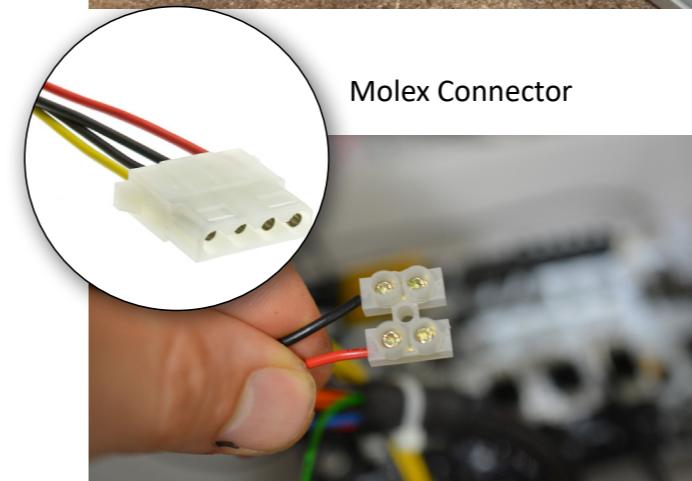
Wiring

Connect the green wire to the red wire leading from the Emergency Stop Button by twisting the exposed wire ends together and soldering the connection. If you do not have a soldering iron, simply twisting these wires and covering in heat shrink will suffice.

Identify the black wire that is next to the green wire you have just cut, and cut and strip this black wire. Connect this black wire to the black wire leading from the emergency stop button the same as you did the green to red.



The previous 2 connections carry very low amperage. Soldering both connections is optional - insulating them is not.



PART / SUB ASSEMBLY NAME ▶

Wiring



Gather the cables for the front right Z motor and emergency stop button and wrap with plastic spiral wrap. Once wrapped, cables should fit neatly inside the top slot of the lower 3030 extrusion, running back towards the left front of the printer across the outside of the motor, and down the left side of the printer where the electronics enclosure will be installed. Refer to fig.

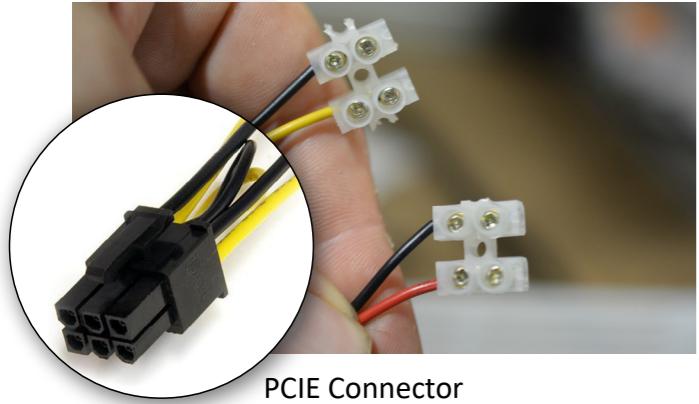
Identify a 2x2 Terminal block. Trim and strip 1cm from 1 Black and 1 Red wire behind a 4 pin Molex connector (See Fig.....) (close to the connector) coming from the PSU and screw into each side of a Terminal Block as shown. This will be used as a connection point for the hotend / extruder fan wires later. Ensure no wire is exposed.



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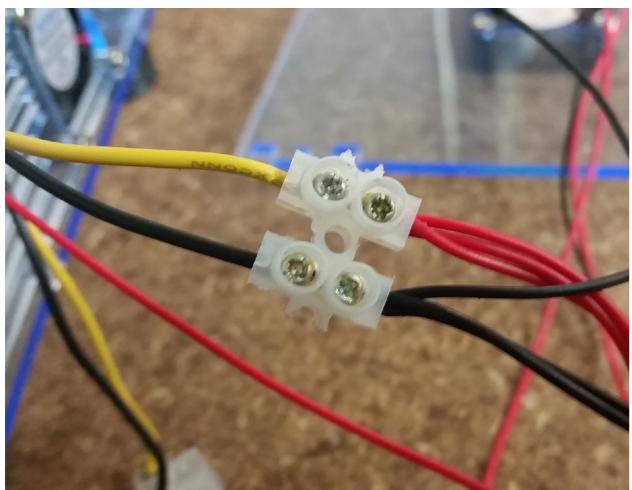
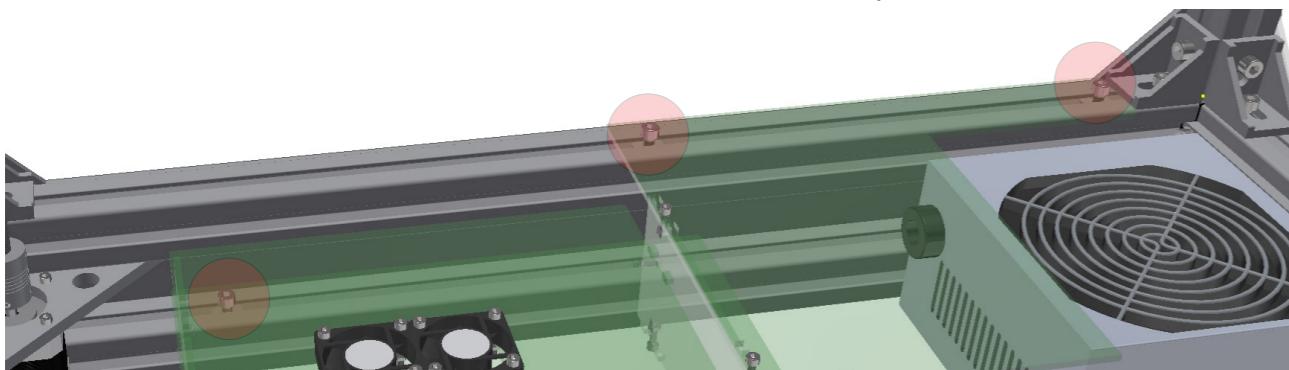
The Beast



PCIE Connector

You should now have 2 terminal blocks. One wired with yellow/black cables and one wired with Red/Black cables.

Position the Electronic Enclosure (EE) in the back left corner of the printer and secure with M5 10mm Screws and T-Slot Nuts in the positions shown.



Trim and Strip 1cm from the ends of all 3 40mm fans attached to the EE Enclosure. Twist together the 3 red wires of each fan and the 3 black wires of each fan. Connect to the terminal block with the Yellow & Black wires that you prepared earlier. Connect the group of red wires in-line with the yellow wires and the group of black to black. Refer to fig. Ensure there is no bare wire protruding from either side of the terminal block.

PART / SUB ASSEMBLY NAME ▾

Wiring

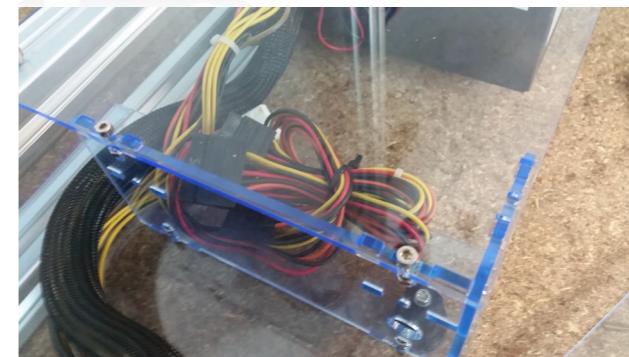


ASSEMBLY NAME ▾

Wiring



The Beast



Separate the Printer control board power cables and the green & black emergency stop button cables from the excess cables of the ATX Power supply. Gather the excess cables, tidy them up using cable ties and seat the group of excess cables in behind the EE Rear plate.

Unwrap each of the printer motor wires and label each set of wires as follows:

X Motor A (Make this the X Motor closest to the FRONT LEFT of the machine)

X Motor B

Y Motor A (Make this the Y Motor on the RIGHT hand side of the printer)

Y Motor B

Z Motor A (It does not matter which Z Motor is labeled A/B/C)

Z Motor B (It does not matter which Z Motor is labeled A/B/C)

Z Motor C (It does not matter which Z Motor is labeled A/B/C)

Extruder 1 (Label these from left to right if looking from the front)

Extruder 2

Extruder 3

Extruder 4

Use the corresponding extension wires to extend each of the motor wires you labeled in the previous step. The Z Motors do not need to be extended. Make sure the colour of the cables are matched. ie. don't plug them in backwards **with the following exceptions.**



Connect the front X Motor BACKWARDS and the Left Y Motor Backwards. This is to ensure all motors pull their Axis in the correct direction.

As you extend the cables, move the labels to the end of the extensions. This is extremely important as it becomes very difficult to identify which cables run to which motors and you run the cables to the control board

PART / SUB ASSEMBLY NAME ▾

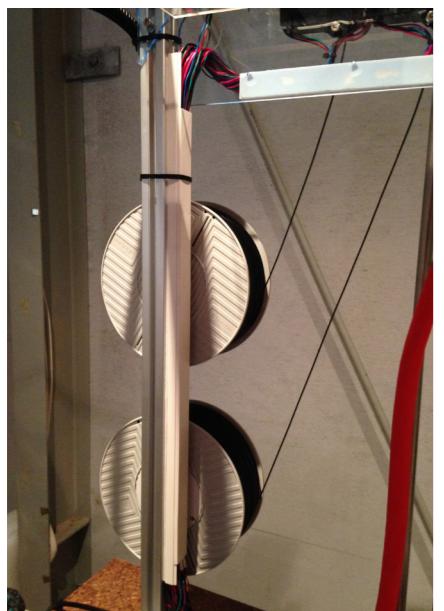
Wiring





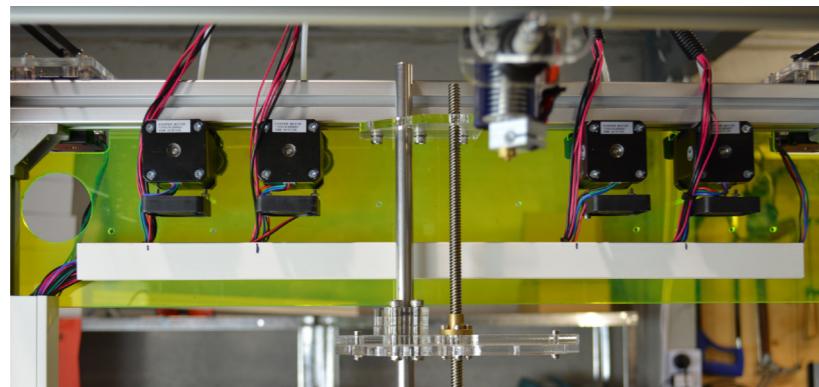
ASSEMBLY NAME ► **Wiring**

Connect the Extruder Fan extension wires to each of the extruder fans, again making sure the cables are not plugged in backwards. Once all the fan wires are extended, gather them all together and label them (towards the end of the extended wires) "Extruder fans".



Attach double sided foam tape to the rear side of the 600mm Trunking and adhere to the rear left vertical 3030 extrusion as shown.

Attach double sided foam tape to the rear side of the 500mm Trunking and adhere to the inner side of the Extruder Panel, approximately 30mm below the extruder motors.



Wrap the X Endstop and X Motor A and B wires in Split Tube wrap, leaving enough slack to facilitate a full range of movement of the X and Y Axis. Wrap these wires together in towards the back of the printer. Cables should run around the outside of the rear 3030 extrusion and back into the hole at the rear of the extruder plate, then down into the conduit installed in the previous step. See picture (right).

PART / SUB ASSEMBLY NAME ▾
Wiring

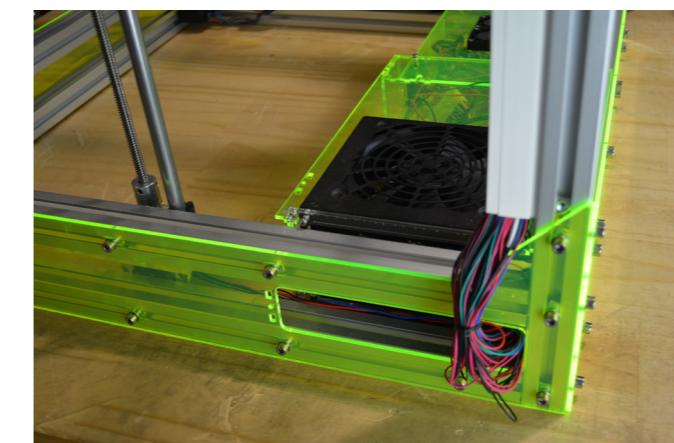
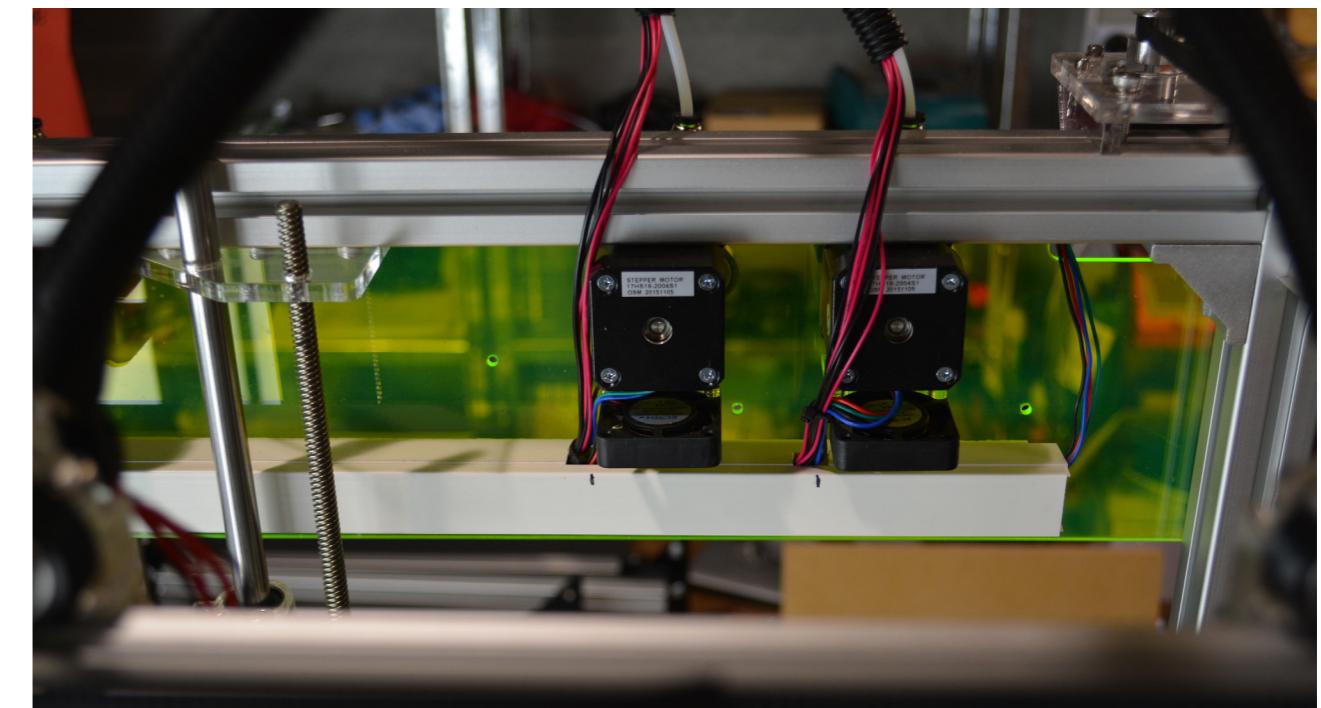


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ASSEMBLY NAME ► **Wiring**

Measure and cut notches in the trunking with side cutters to facilitate the entry of Extruder & Hotend wires in the 500mm length of channel conduit and neatly run cables down into these notches then right (if looking from the back) towards the vertical conduit. See pictures.



All wires when exiting the horizontal length of trunking should then run through the large hole in the extruder panel and down into the vertical conduit, where they exit and run back in towards the electronics enclosure via the hole to the right of the PSU, in the corner of the printer.

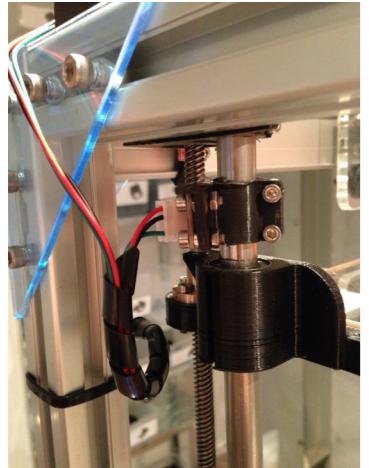
PART / SUB ASSEMBLY NAME ▾
Wiring



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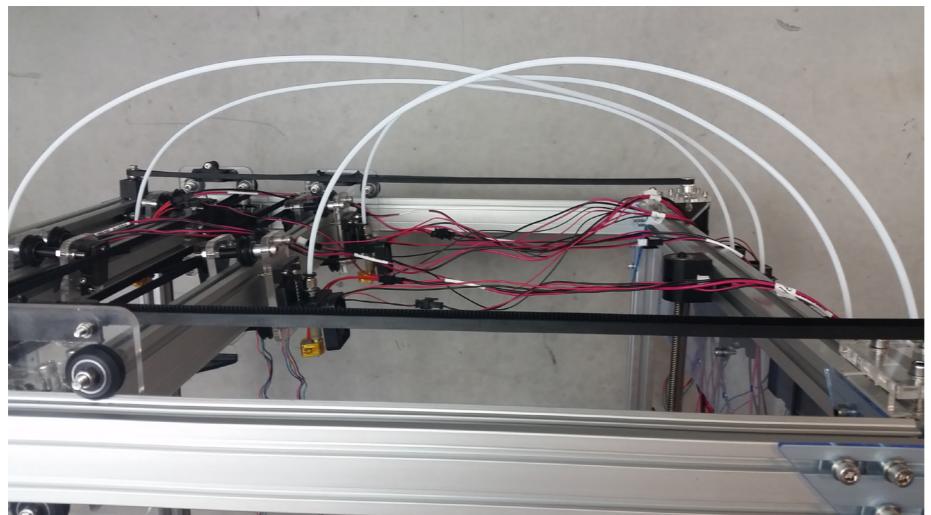


The Beast



Wrap in Spiral wrap and run the Z Endstop and Y Endstop wires together down the front left vertical 3030 extrusion, then back towards the electronics enclosure.

Use extension cables to extend the cable length of the Hotend Fans, Thermistors and Heater Cartridges (Group each set for each hotend and label the group hotend 1, 2, 3 & 4). Hotend 1 should be front left, 2 the front right, 3 the rear left & 4 the rear right).



Cut 4 approximately 1000mm length of PTFE Tube for each hotend and connect to the corresponding extruder by pushing each end into the appropriate push fit adapter. Connect Hotend 1 to Extruder 1, Hotend 2 to Extruder two and so on. When connecting, trim each PTFE length only long enough so that there is enough slack for the **all print-heads to move in a full range of motion** while maintaining **a smooth arc**. This basically means each PTFE tube will be a slightly different length. See pictures.

PART / SUB ASSEMBLY NAME ▾

Wiring



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ASSEMBLY NAME ▾

Wiring

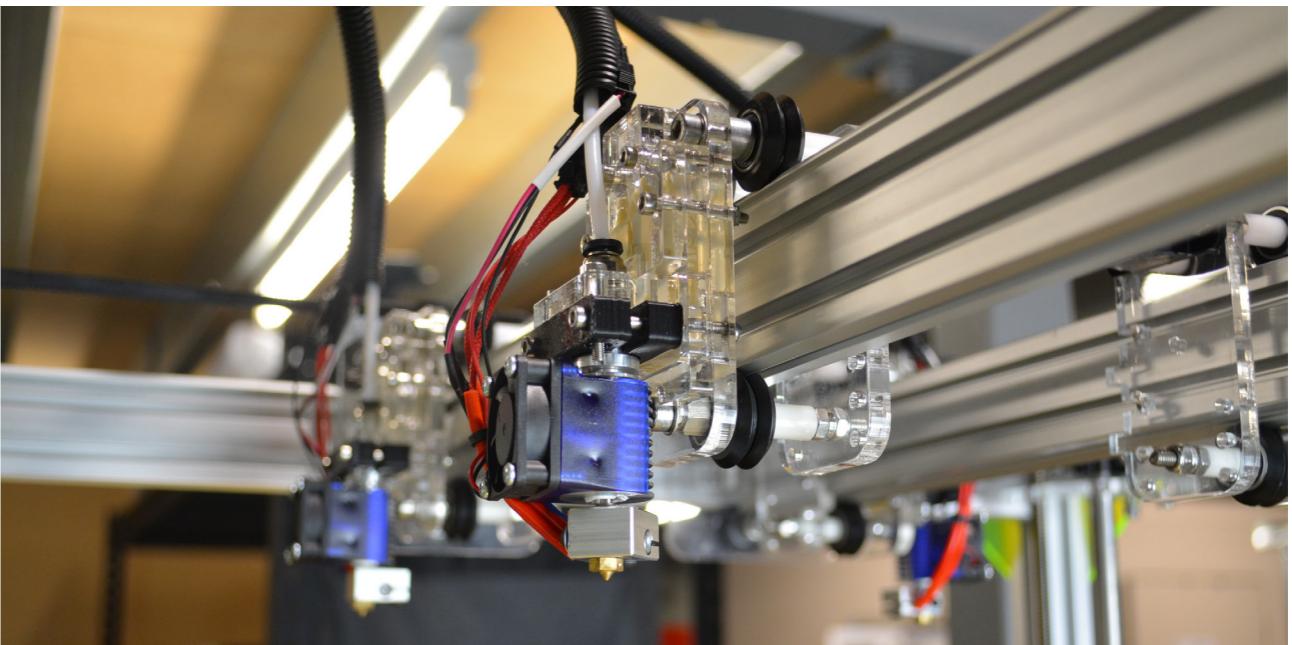
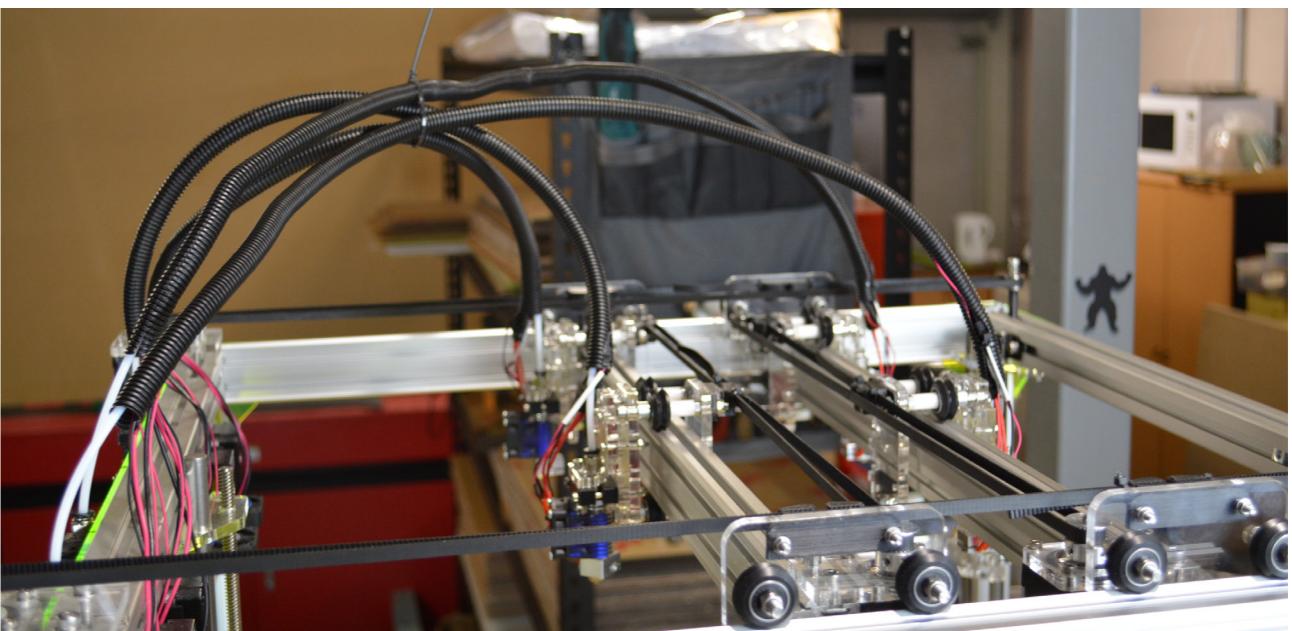


The Beast

ASSEMBLY NAME ▾

Wiring

For each Hotend, group the Heater Cartridge, Thermistor and Fan wires with each PTFE tube and wrap in Split Tube which has been cut to length. See pictures. Once complete you should have 4 groups of wires/tubes for 4 extruder groups.



PART / SUB ASSEMBLY NAME ▾

Wiring



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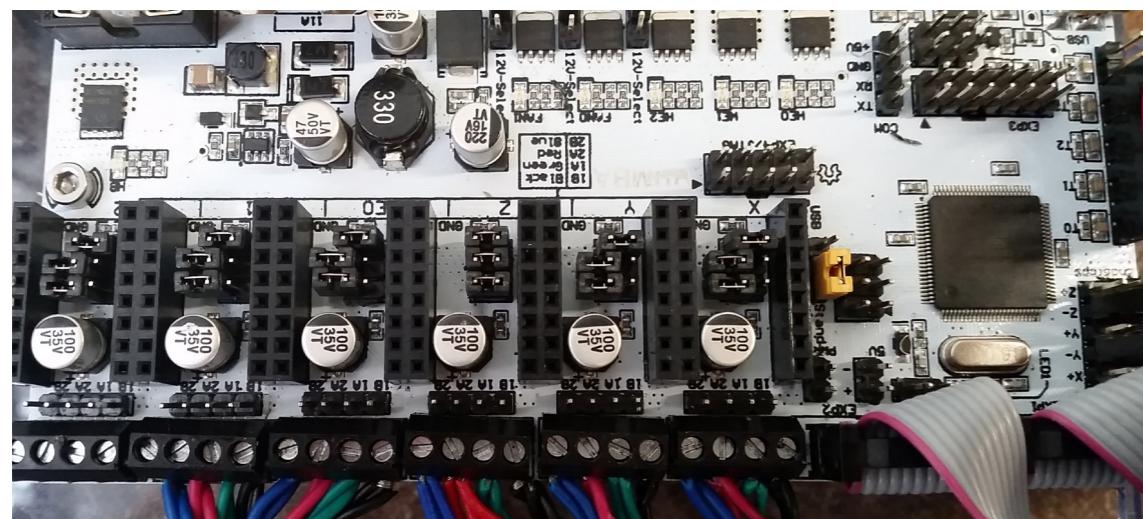
Final Connections to PCB

ASSEMBLY NAME ▾



It may be a good idea to read this entire section before starting. Given the complexity of documenting this subject, we feel it is easier to provide pictures rather than document this entire process with a few exceptions as follows :

Attach the LCD Cables to the LCD Controller with Red on right if looking from the front of the printer, running them through the hole into the electronics enclosure (EE Front). Connect EXP1 on the LCD to EXP1 on the PCB then EXP2 (LCD Panel) to EXP2 on the PCB. Red sides of the ribbon cables should be facing the motor connectors.



Remove the Z Motor Driver from the Printer Control Board and set the 3 jumpers so that all 3 are on (see glossary). (On means the jumper is connected between the 2 pins).

Remove the other Motor drivers and ensure only the top most jumper is set to on as pictured.

Trim the ends off all of the Z Motor wires, ensuring each wire is long enough to reach the "Z" screw in connector on the Printer Control Board (PCB). Strip and twist together the corresponding colours of each motor together as shown. Ensure if labels are trimmed off with the connector, that they are moved along the wires to ensure easy identification at a later stage.



When connecting to the PCB, ensure excess stripped (and twisted) wire is trimmed short enough so that no or very little wire is exposed outside of the connector to prevent short circuits. This applies to all wires which are screwed into the main board. Take note. PCBs damaged through short circuits will not be covered under warranty.



Final Connections to PCB

ASSEMBLY NAME ▾

It is a good idea to use cable ties to tidy the sets of cables as you go.

Trim, strip and twist both Y Motors together and connect to the Y Axis Screw terminals on the PCB in the same way as with the Z Motors.

Trim, strip and twist both X Motors together and connect to the X Axis Screw terminals on the PCB in the same way as with the Z Motors.

Trim, strip and twist Extruder 1 and Extruder 2 together and connect to the E0 Screw terminals on the PCB in the same way as with the Z Motors.

Trim, strip and twist Extruder 3 and Extruder 4 together and connect to the E1 Screw terminals on the PCB in the same way as with the Z Motors.

Tidy and wrap excess wire on the X Y and Z endstops and connect to the PCB taking note that the red wire goes at the end closest to the front of the printer. DO NOT CONNECT THIS BACKWARDS.

Gather all red and black Extruder & Hotend fan wires together (8 Fans = 16 Wires = 8 Black & 8 Red), strip approximately 2cm from the end of each and twist each set of 8 wires (red and black) together, making one set of red and one set of black as shown. Ensure you are not confusing the Red and Black fan wires with Heater Cartridge wires as Heater Cartridge wires are made of a heavier gauge.

Insert the **Red group of wires in line with the Red wire** on the Terminal block and the **Black Group in-line with the black wire** on the remaining terminal block as shown. Again ensure no exposed wire is outside of the terminal block by trimming appropriately to length. This is to prevent the chance of shorting your power supply. Once connected tidy this set of wires using cable ties and tuck back into the area at the rear of the PSU enclosure.

PART / SUB ASSEMBLY NAME ▾

Final Connections to Printer Control Board



Final Connections to PCB

ASSEMBLY NAME ▾

Wire the Hotend/Heater Cartridges to the PCB, connecting hotend 1 to HE0, Hotend 2 to HE1, Hotend 3 to HE2 and Hotend 4 to FAN 1 (Fan 1 has been remapped to be a hotend output).

Wire the Yellow and black set of 2 wires (main power wires you twisted together earlier) to the PCB as shown.

Install the finalised EE top to the top of the EE enclosure. Although spaces exist for permanent securing, It is not necessary to use screws to secure this in place as you may need to make adjustments during calibration and during general printer use.



Before powering on your printer, ensure no wire debris from trimming cables is present on the PCB. It may cause short circuits.



For post assembly, use and calibration instructions and downloads, please go to www.cultivate3d.com/the-beast-documentation

PART / SUB ASSEMBLY NAME ▾

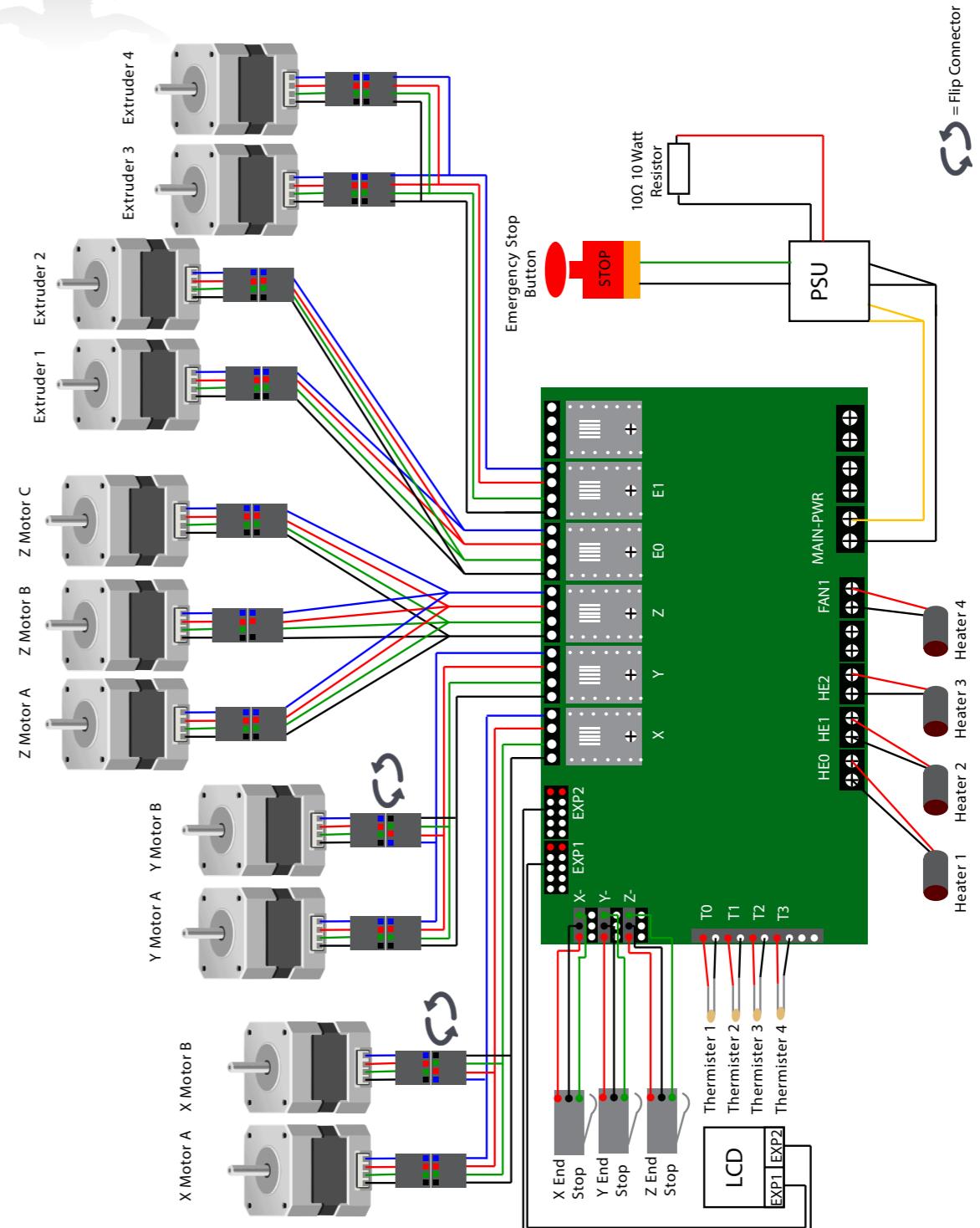
Final Connections to Printer Control Board



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Wiring Diagram



PART / SUB ASSEMBLY NAME ▾

Final Connections to Printer Control Board

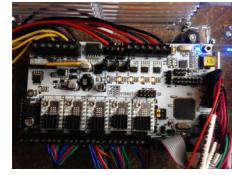


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Glossary



PSU / ATX Power Supply - A Generic Power Supply generally used to power personal computers



PCB / RUMBA Board - The Electronics that controls the printers movement and filament extrusion.



4 Pin Molex Connector - A Power connector leading from an ATX PSU which contains Ground, 12v and 5v wires.



6 Pin PCI Connector - A Power connector leading from an ATX PSU which contains 3x ground and 3x 12v wires



Extruder - The part of a 3D Printer which feeds filament to a hotend, in our case, via a bowden tube



Hotend - The part of a 3D Printer which melts the plastic to be laid down on a print bed



Bowden tube - A tube which facilitates the remote feeding of filament to a hotend from an extruder.



Trunking - Allows a quick, easy and neat way of hiding / tidying cables.



Spiral Wrap - A flexible cable tidy solution.



Split Tube - A cable tidy solution which is flexible but more rigid than spiral wrap.



Heat-Shrink Tube - A thermal sensitive tube in which cables are run. Heat is applied causing the tubing to shrink.



Push Fit Adapter - A device to allow the quick coupling and decoupling of tube, typically bowden (PTFE) Tube.



Teflon Tube / PTFE - Tube with a very low friction coefficient, mainly used as bowden tube.



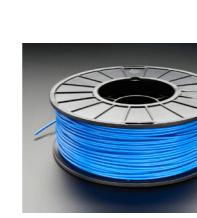
T-Slot Nut - A nut which locks into channels in T-Slot extrusions.



Extruded Rail - AKA Makerslide, an aluminum extruded rail system



3030 T-Slot - An Extruded Aluminum system with 4 channels to facilitate flexible attachment of other components



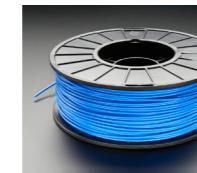
GT2 Pulley - A toothed pulley with a tooth pitch of 2mm



GT2 Belt - A toothed timing belt with a tooth pitch of 2mm



Linear Bearing (LM12UU) - A bearing which facilitates linear movement.



Filament - Plastic "wire" which is melted in a hotend to become a 3D Printed object.



Jumpers - A means of physically changing settings on a motherboard. A Jumper creates a short across 2 pins (on) or is placed across 1 pin to turn the feature off.

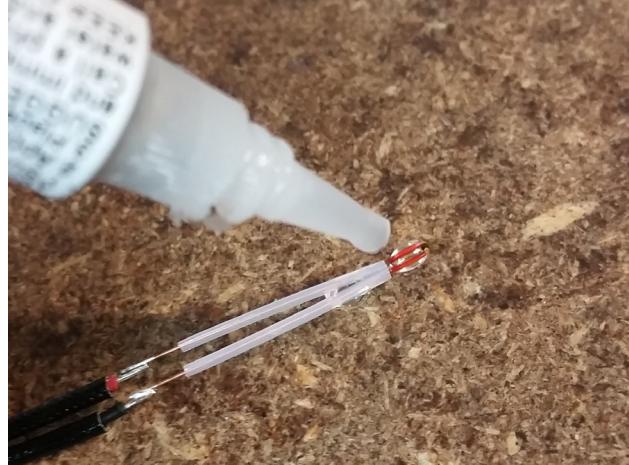




Merlin Hotend Assembly



For users who have purchased the "e3D Hotends", (optional extra) please refer to the following website for Hotend Build instructions.
http://wiki.e3d-online.com/wiki/E3D-v6_Assembly



Check the thermistor to ensure the PTFE tubes are pushed as far down towards the thermistor end as possible. The function of these tubes is to prevent the wires leading to the thermistor from making contact with each other and metal surfaces on the hot end itself. Once the PTFE Tubes are in place, use a drop of super glue to temporarily secure the PTFE tubes in place, so that they do not move during assembly of the hotend. Once glued, slide the black sleeving back over the PTFE tube as close to the thermistor tip as possible ensuring there is no exposed wire.



Insert the heater cartridge into the heater block as shown and secure with the grub screw.

Fill the remaining threaded hole with thermal paste and insert the thermistor as far into the hole as possible then secure both with Kapton tape as pictured.



It may be necessary to put another drop of super-glue on the kapton to prevent it from unraveling.

To each Hotend, screw a .5mm nozzle to start with. We do not recommend starting the calibration phase with smaller nozzles.



If using pliers to tighten nozzle in place, be very careful not to slip and squash the nozzle.

Tighten nozzle enough to squash the rubber grommet against the heater block. (Do not overtighten).