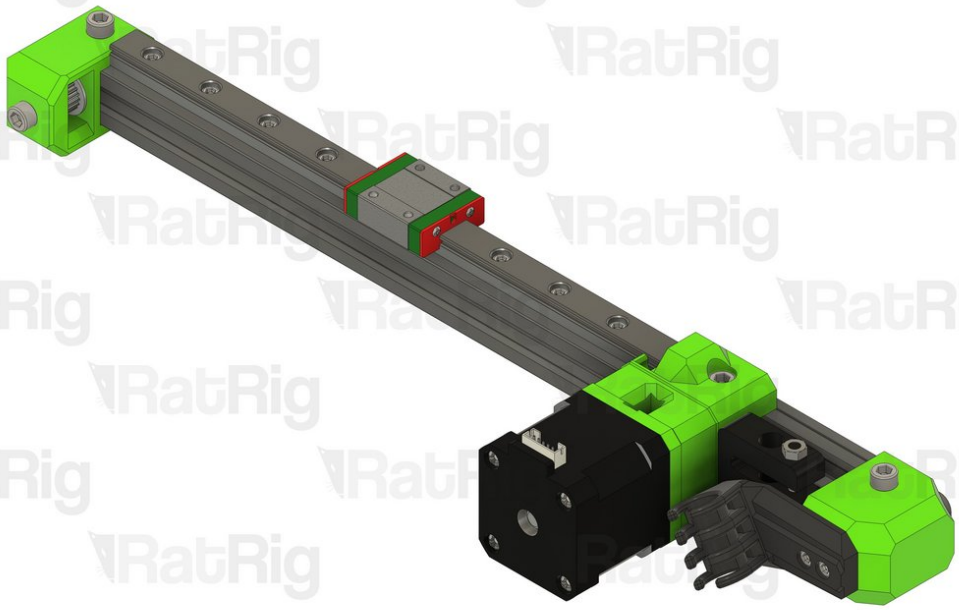
Rat Rig

05. X-Axis Assembly

Written By: Simon Davie



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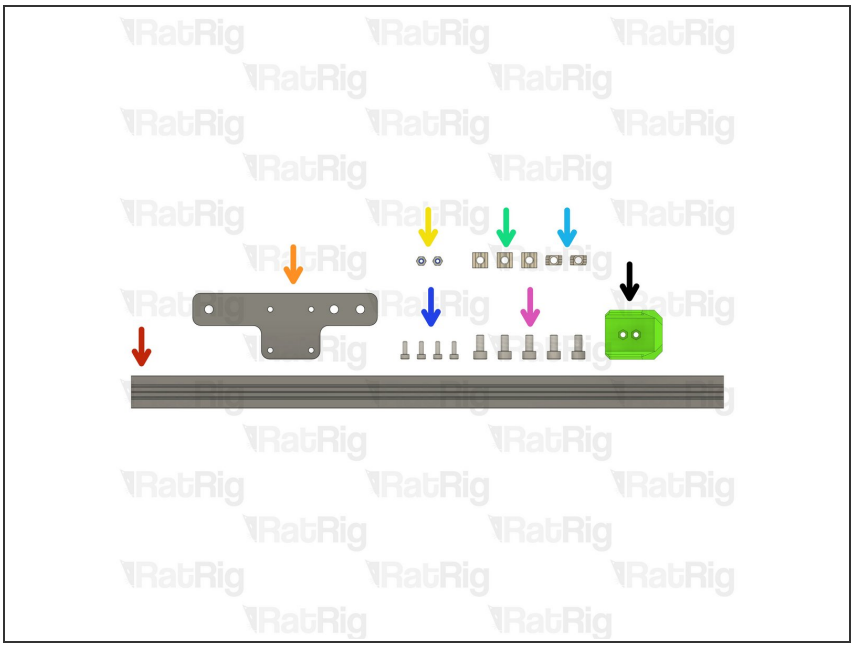
INTRODUCTION

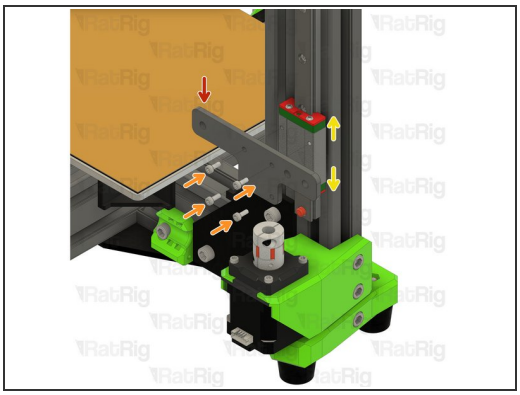
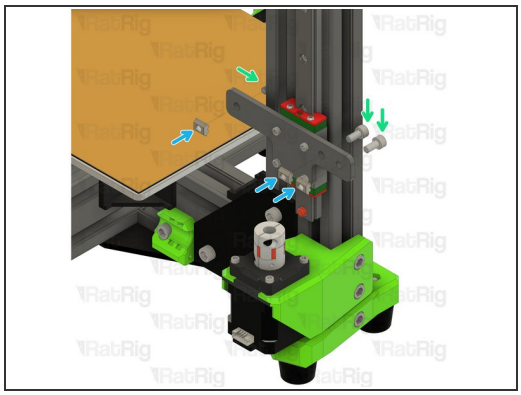
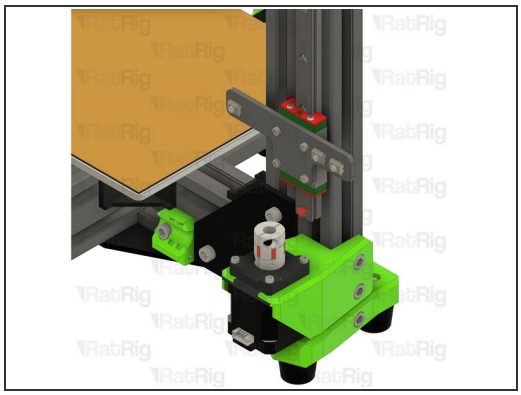
[video: https://youtu.be/uS03uHjnyrY]

Step 1 — Prepare the X-axis parts



- 1x 362mm 2020 Extrusion
- 1x V-Minion X-Plate
- 2x M3 Nylon Locking Hex Nut
- 3x 2020 Square T-Nut - M5
- 2x 2020 Drop-in T-Nut - M5
- 4x M3x8 Cap Head Screw
- 5x M5x10 Cap Head Screw
- x_gantry_end_cap printed part

Step 2 — Install the X-axis - Part 1

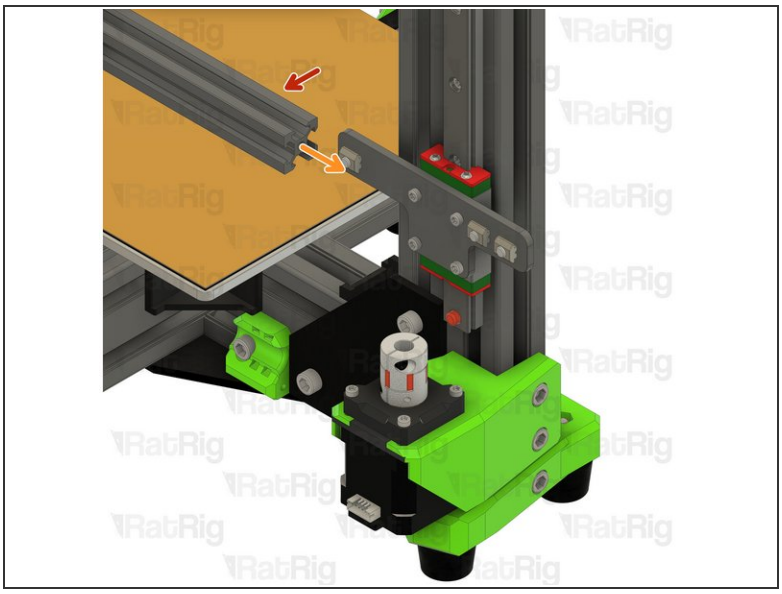




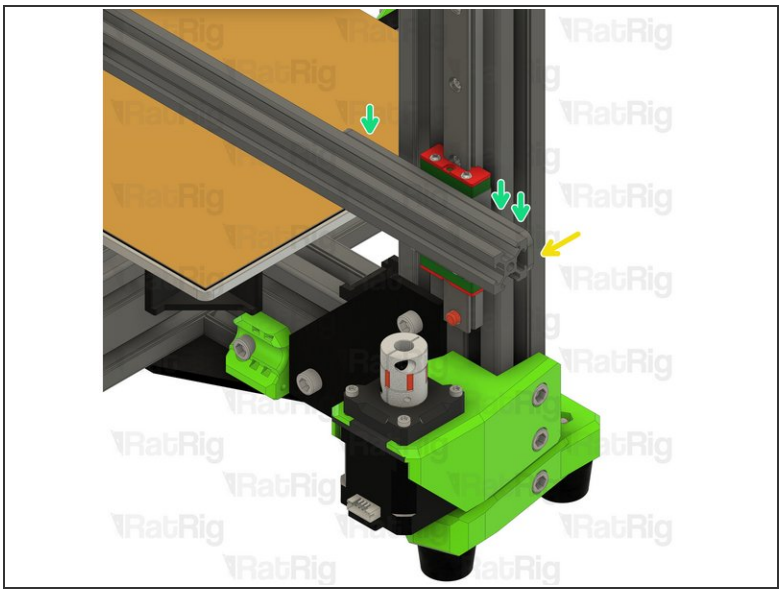
- V-Minion X-Plate
- M3x8 Cap Head Screw
- Slide the Z-axis up and down the rail to make sure it moves smoothly

  ⚠ If the carriage binds at all, slightly loosen the M3x8 screws and check again
- M5x10 Cap Head Screw
- 2020 Square T-Nut - M5

  ⓘ Loosely thread the 2020 square T-Nuts onto the M5x10 screws. Do not tighten them at this point

Step 3 — Install the X-axis - Part 2





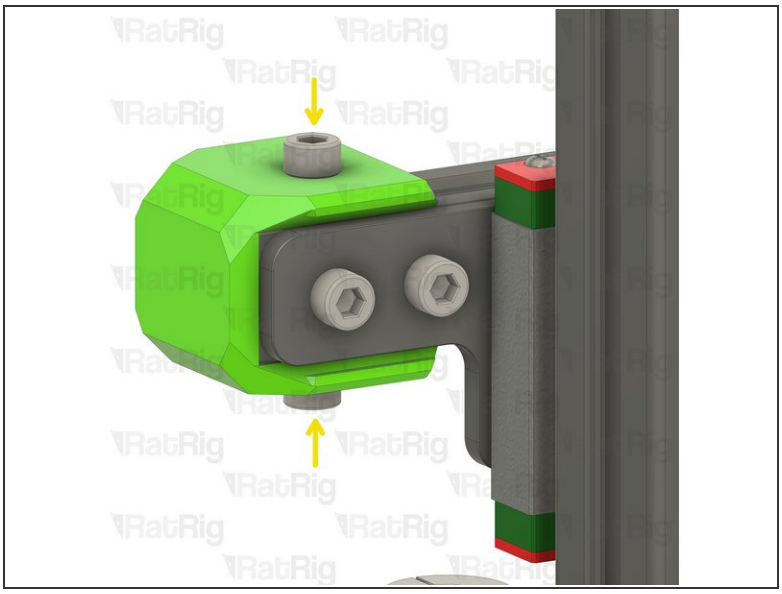
- 362mm 2020 Extrusion
- Slide the 2020 extrusion onto the 2020 square T-nuts as shown
- Make sure that the 2020 extrusion end is flush with the side of the V-Minion X-Plate
- Fasten the three M5x10 screws to secure the 2020 extrusion to the X-Plate

Step 4 — Assemble the X-axis end cap



- x_gantry_end_cap printed part
- M3 Nylon Locking Hex Nut
  - Insert the M3 nylon locking nuts into the printed part as shown
- M5x10 Cap Head Screw
- 2020 Drop-in T-Nut - M5
  - Loosely thread the 2020 T-Nuts onto the M5x10 screws. Do not tighten them at this point

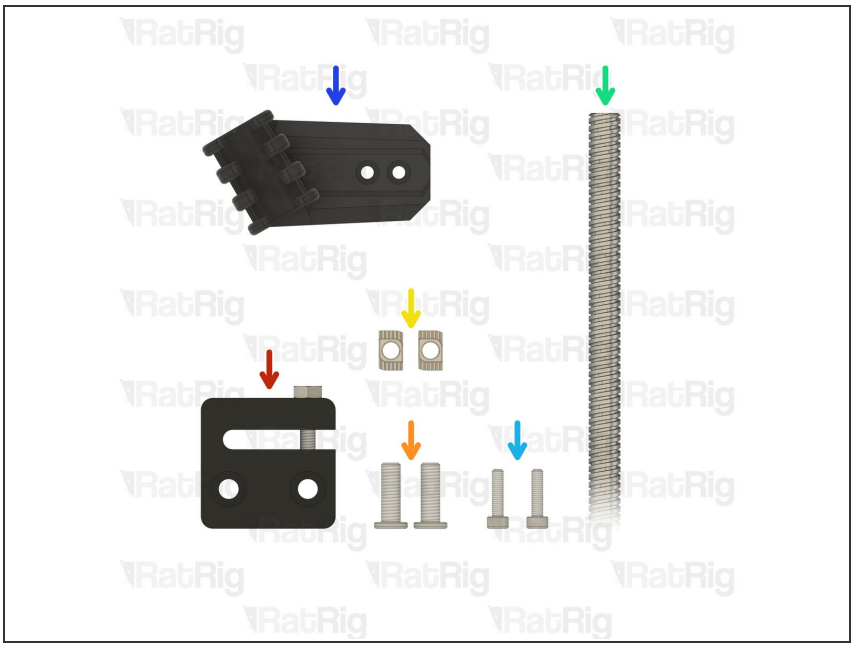
Step 5 — Install the X-axis end cap



- X-axis end cap assembly
- Slide the X-axis cap onto the end of the 2020 extrusion
- Fasten both M5x10 screws to secure the X-axis cap to the extrusion

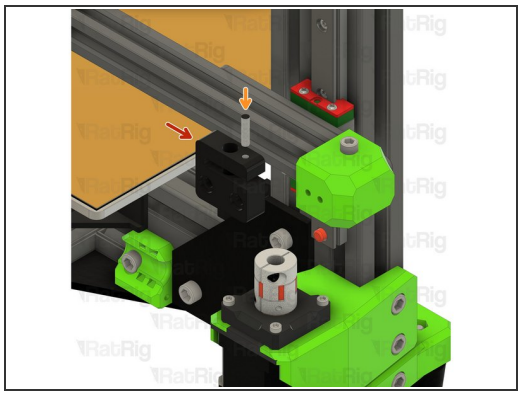
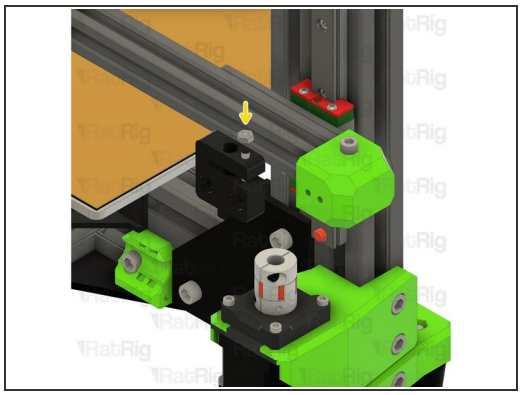
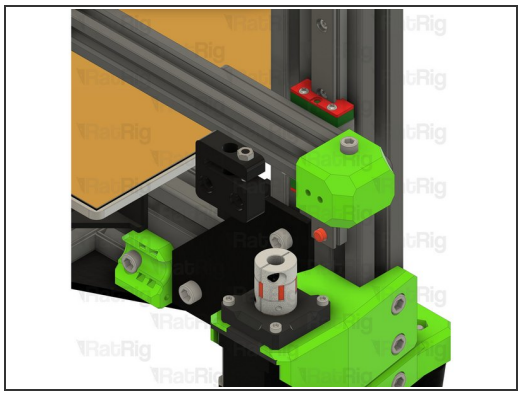
⚠ Take care not to over tighten the M5x10 screws as you can damage the printed part

Step 6 — Prepare the Z-axis leadscrew & cable management parts



- 1x Anti-Backlash Nut Block
- 2x M5x15 Low Profile Cap Head Screw
- 2x 2020 Drop-in T-Nut - M5
- 1x 250mm TR8*4 Leadscrew
- 2x M3x12 Cap Head Screw
- x_wire_holder printed part

Step 7 — Assemble the anti-backlash nut block

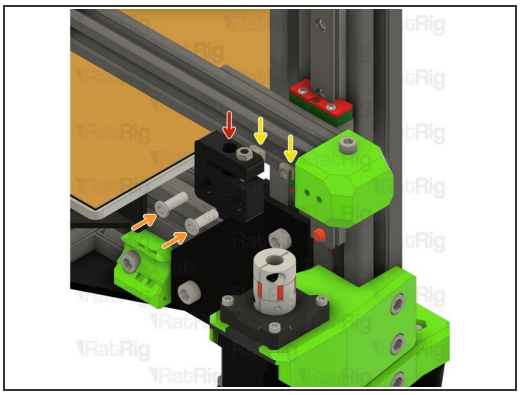
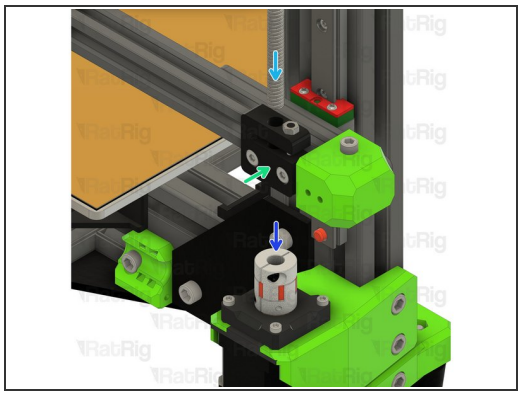
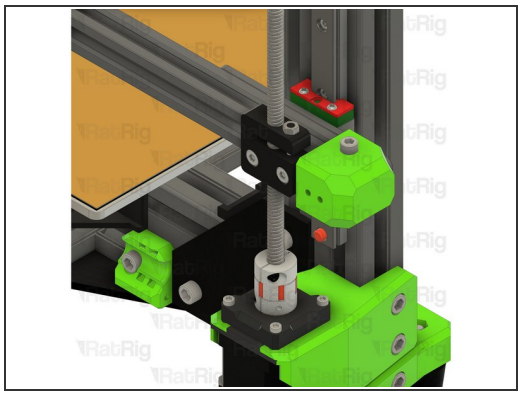
- Anti-Backlash Nut Block

ⓘ The following parts are provided with the anti-backlash nut

- M4 Grub Screw
- M4 Nut

- Install the M4 grub screw into the anti-backlash nut block as shown. Stop turning the grub screw when it touches the bottom part of the nut block
- Secure the grub screw by installing the M4 nut as shown

Step 8 — Install the Z-axis leadscrew

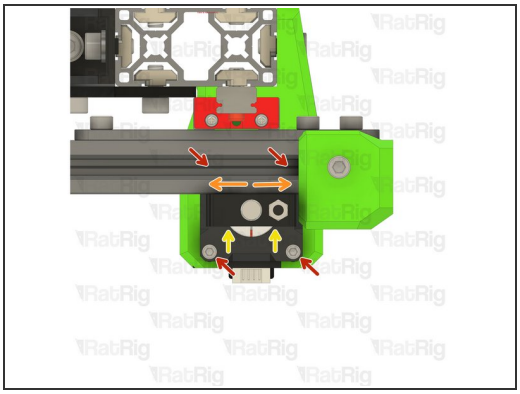




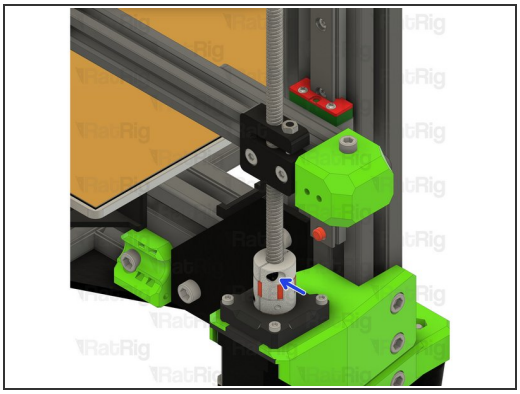
- Anti-Backlash Nut Block
- M5x15 Low Profile Cap Head Screw
- 2020 Drop-in T-Nut - M5

  ⓘ Loosely thread the 2020 T-Nuts onto the M5x15 screws. Do not tighten them at this point
- Fit the anti-backlash nut block to the 2020 extrusion, but do not tighten the M5x15 screws fully
- Thread the leadscrew through the anti-backlash nut block...
- ...and into the Z-axis spider coupler

⚠ Do not fasten the M5x15 screws, or the M3 screw on the spider coupler yet. We will do so after aligning everything in the next step

Step 9 — Align the Z-axis leadscrew





- Begin by loosening the four M3x18 screws on the Z-axis stepper motor

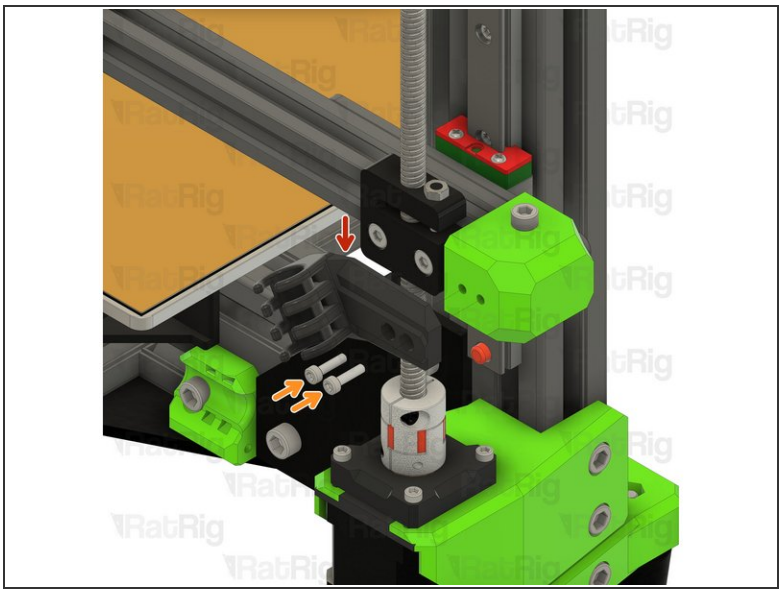
To align the leadscrew, look at the V-Minion from above, as pictured:

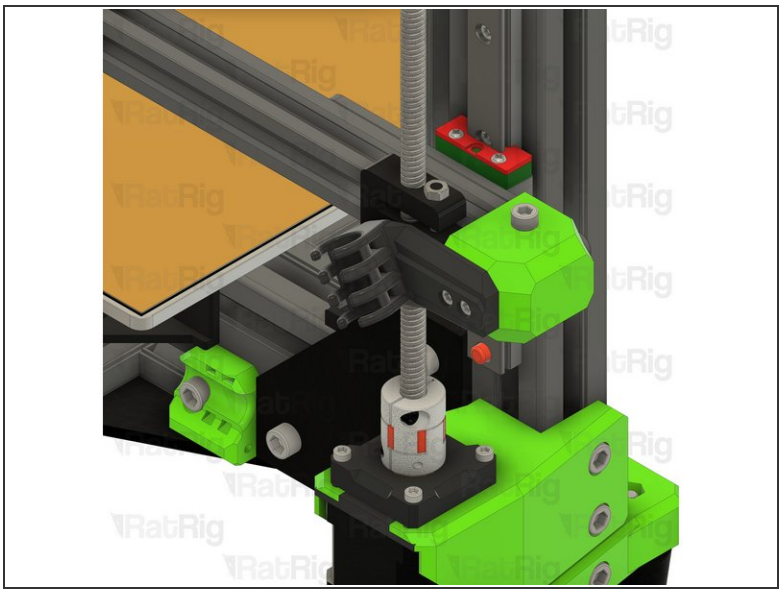
- Adjust the position of the anti-backlash nut left or right until the leadscrew is in-line with the Z-axis stepper motor
- Secure the two M5x15 screws when this is achieved
- Adjust the position of the Z-axis motor forwards and backwards until the leadscrew is parallel with the frame
- Secure the four M3x18 screws when this is achieved

Take care not to over tighten the M3x18 screws as you can damage the printed parts

- Fasten the M3 screw on the spider coupler to secure the leadscrew

Step 10 — Install the X-axis wire holder



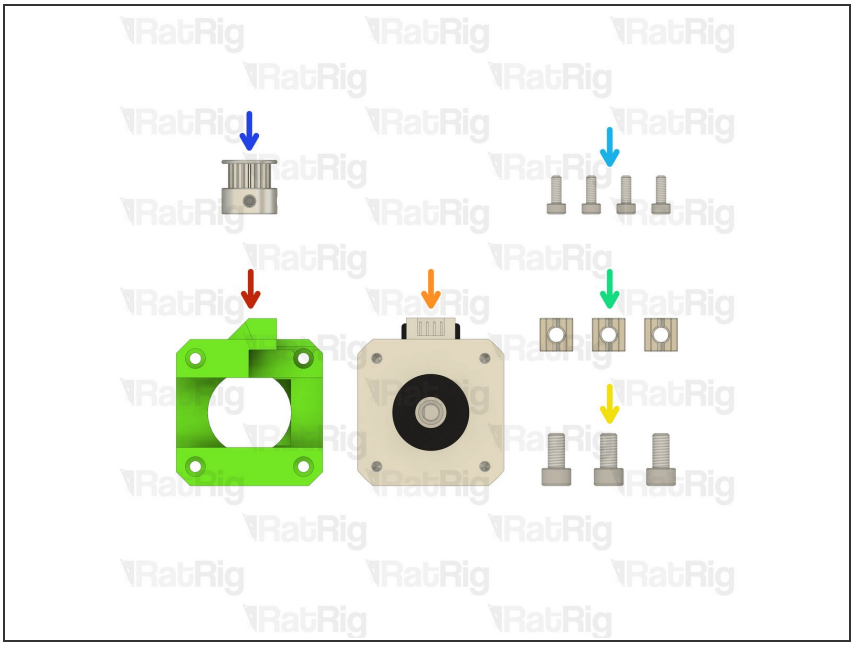


- x_wire_holder printed part
- M3x12 Cap Head Screw

Fasten the x_wire_holder to the X-axis using the M3x12 screws

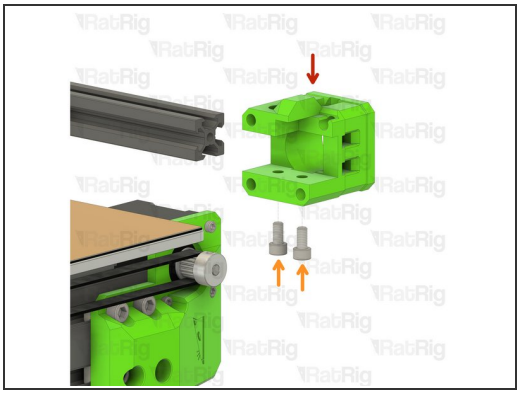
Take care not to over tighten the M3x12 screws as you can damage the printed parts

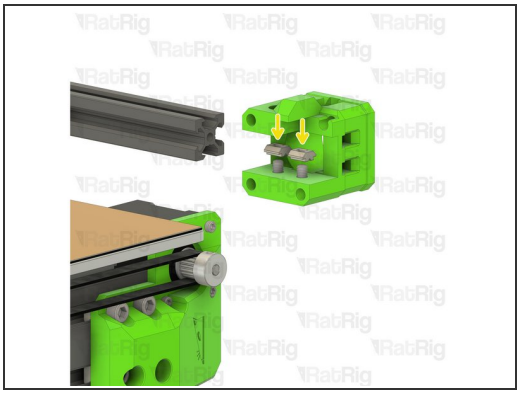
Step 11 — Prepare the X-axis motor parts

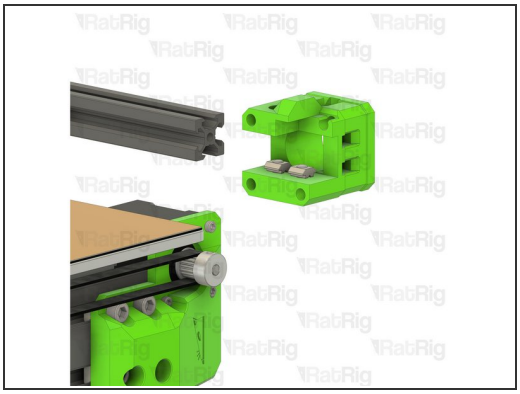


- x_motor_cage printed part
- 1x 40mm NEMA17 Stepper Motor
- 3x M5x10 Cap Head Screw
- 3x 2020 Square T-Nut - M5
- 4x M3x8 Cap Head Screw
- 1x 20 Tooth 2GT Timing Pulley for 6mm Belt

Step 12 — Assemble the X-axis motor - Part 1



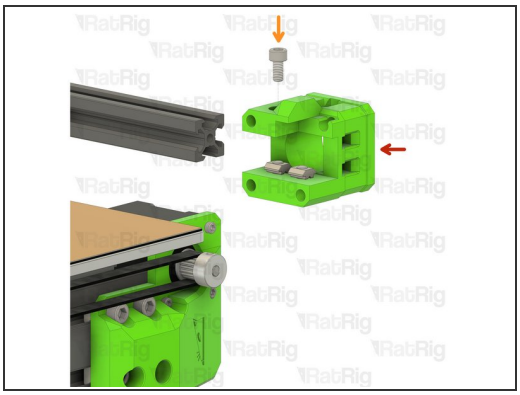
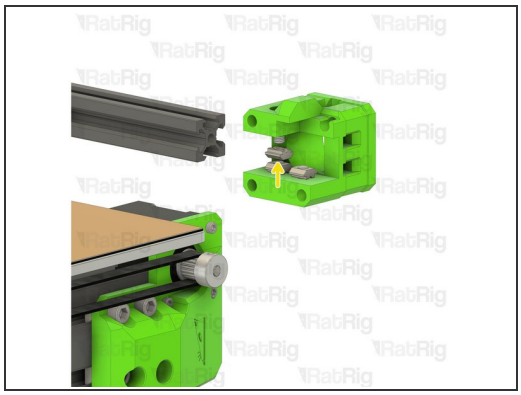
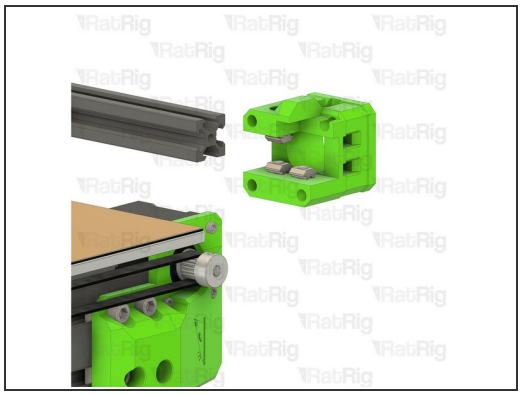




- x_motor_cage printed part
- M5x10 Cap Head Screw
- 2020 Square T-Nut - M5

ⓘ Loosely thread the 2020 T-Nuts onto the M5x10 screws. Do not tighten them at this point

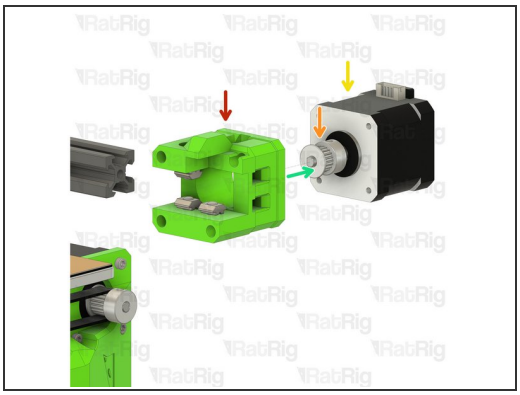
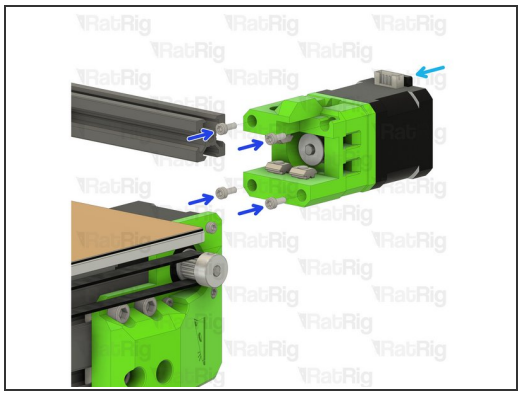
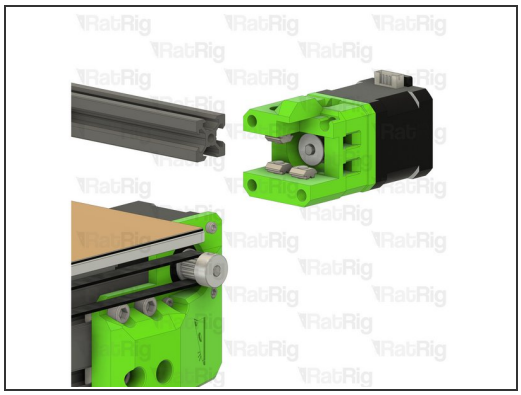
Step 13 — Assemble the X-axis motor - Part 2

- x_motor_cage printed part
- M5x10 Cap Head Screw
- 2020 Square T-Nut - M5

ⓘ Loosely thread the 2020 T-Nut onto the M5x10 screw. Do not tighten it at this point

Step 14 — Assemble the X-axis motor - Part 3

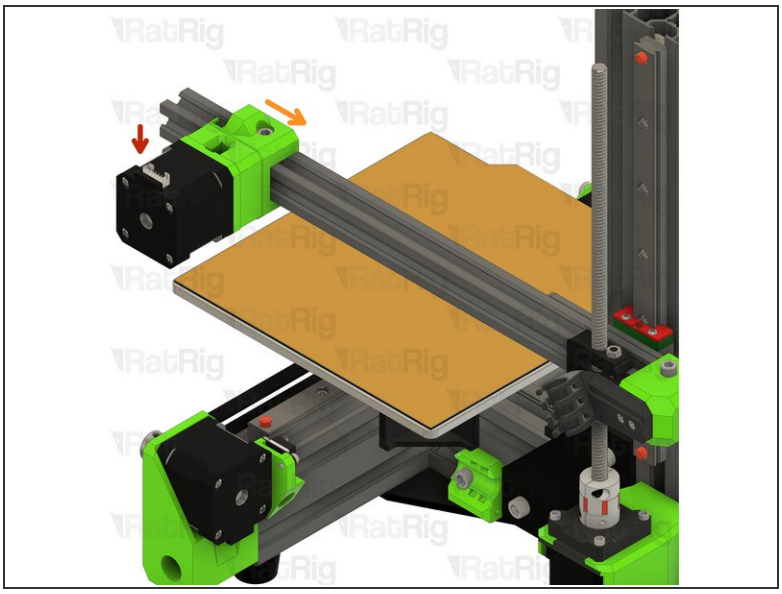




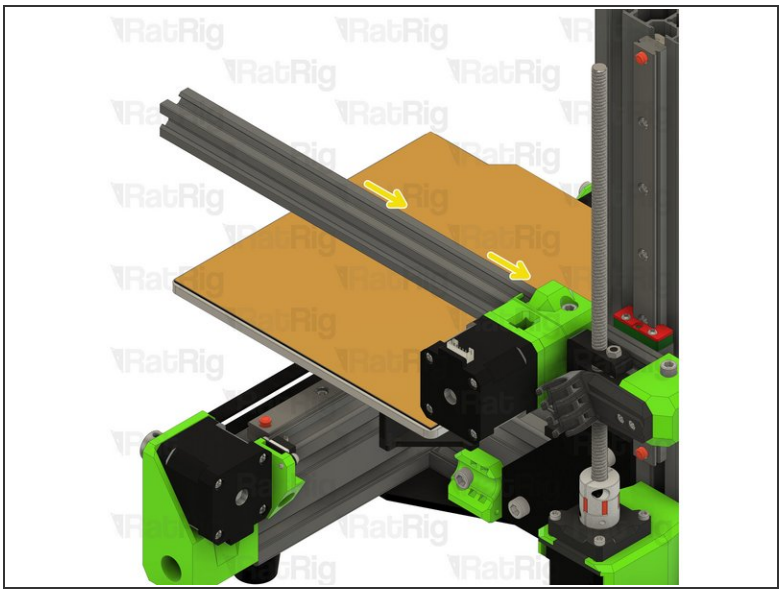
- Assembly from **Step 12**
- 20 Tooth 2GT Timing Pulley for 6mm Belt
- 40mm NEMA17 Stepper Motor
  - Position the timing pulley as shown. Do not fully tighten the grub screws yet as the alignment will need to be adjusted later
- Insert the stepper motor into the mount as shown
- M3x8 Cap Head Screw

ⓘ Fasten the stepper motor to the mount using the M3x8 screws

⚠ Take care not to over tighten the M3x8 screws as you can damage the printed parts

Step 15 — Install the X-axis motor

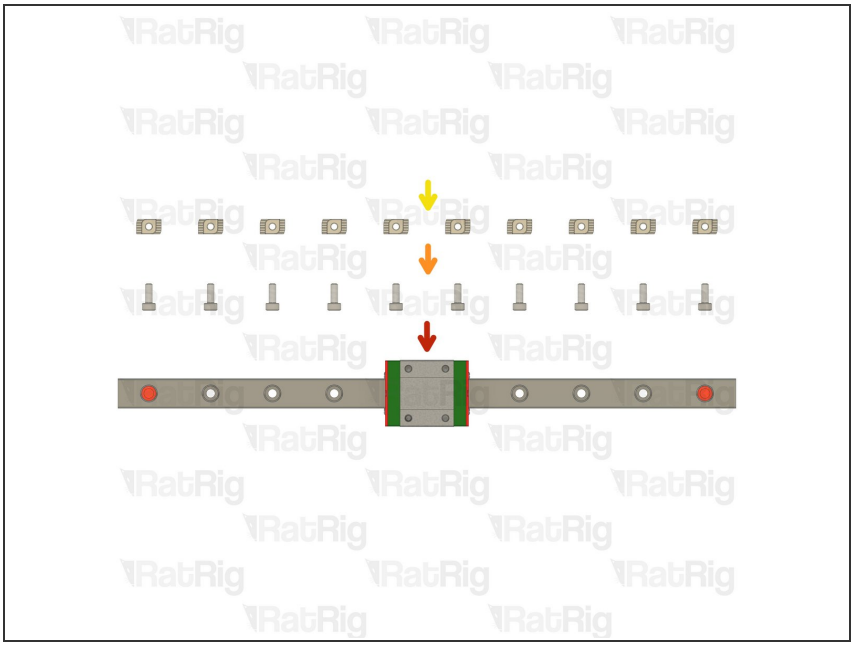




- X-axis motor assembly from **Step 13**
- Install the X-axis motor assembly onto the 2020 extrusion as shown
- Push the assembly all the way along the X-axis for the moment

⚠ Do not fasten the M5x10 screws yet, this will be done later

Step 16 — Prepare the X-axis linear rail parts

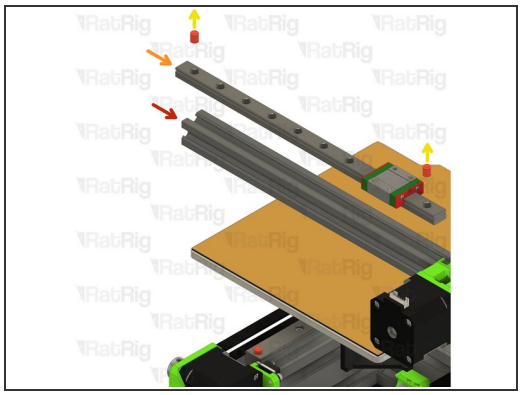
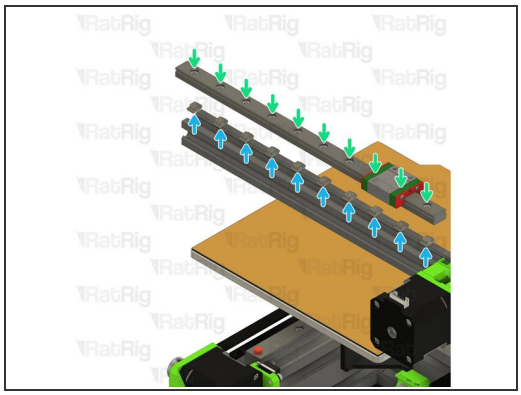
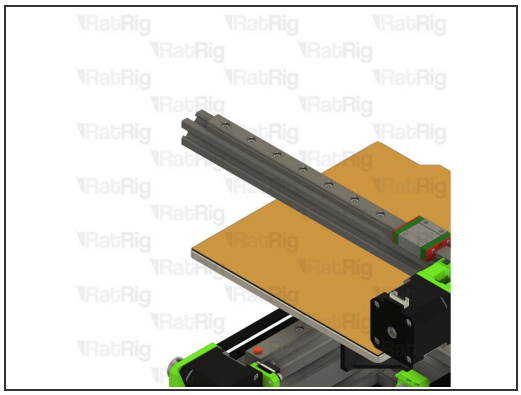


- 1x 250mm MGN12 Linear Rail
- 10x M3x8 Cap Head Screw
- 10x 2020 Drop-in T-Nut - M3

⚠ Please refer to the Rat Rig Linear Rail Guide (Steps 1 & 2) for full details on preparing the rails before installation.

⚠ The linear rail carriages are not interchangeable. Do not try to use a carriage on a different linear rail than the one it was supplied with.

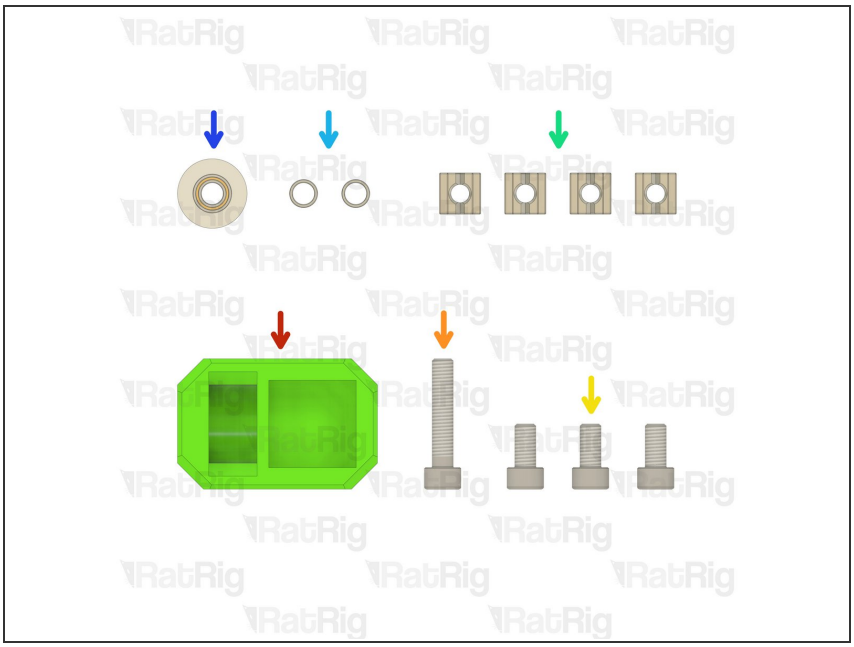
Step 17 — Assemble the X-axis linear rail

- Frame assembly from **Step 14**
- MGN12 Linear Rail
- Remove the plastic stops installed in the ends of the linear rail

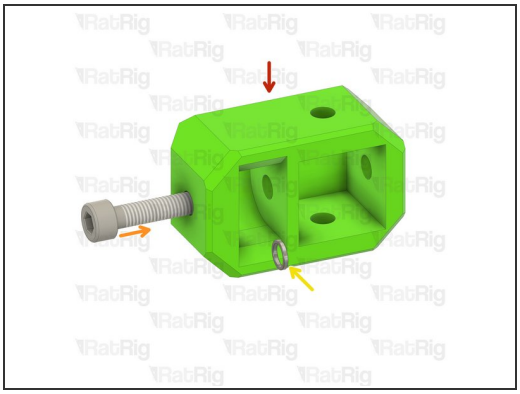
  ⚠ Do not allow the linear rail carriage to leave the end of the rail.
- Insert an M3x8 screw in each of the holes on the linear rail
- Loosely thread a 2020 T-Nut onto each of the M3x8 screws
- Slot the assembled linear rail into the X-axis 2020 extrusion, do not fasten any of the M3x8 screws yet

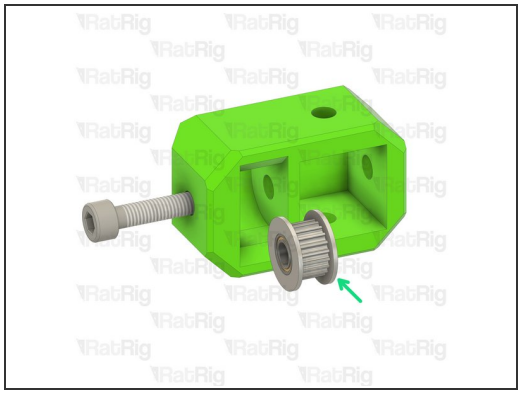
Step 18 — Prepare the X-axis idler parts

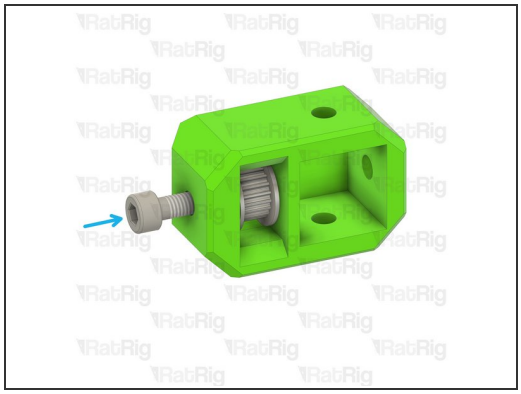


- x_idler printed part
- 1x M5x25 Cap Head Screw
- 3x M5x10 Cap Head Screw
- 4x 2020 Square T-Nut - M5
- 2x Micro Precision Shim
- 1x 20 Tooth 2GT Idler Pulley for 6mm Belt

Step 19 — Assemble the X-axis idler - Part 1

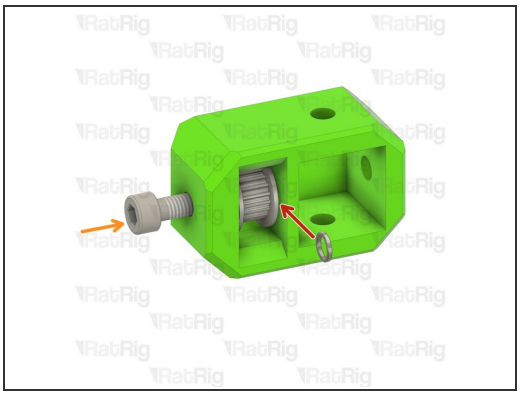
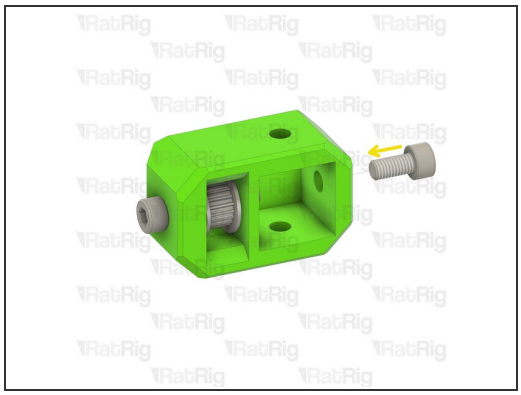
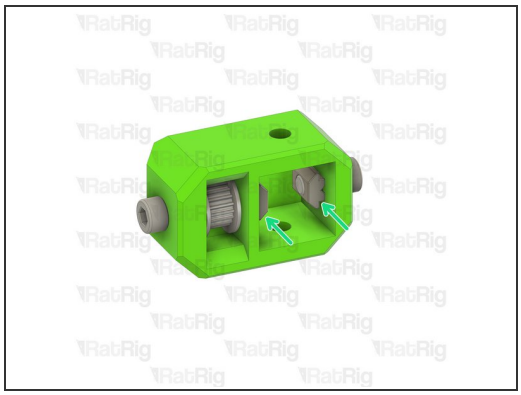






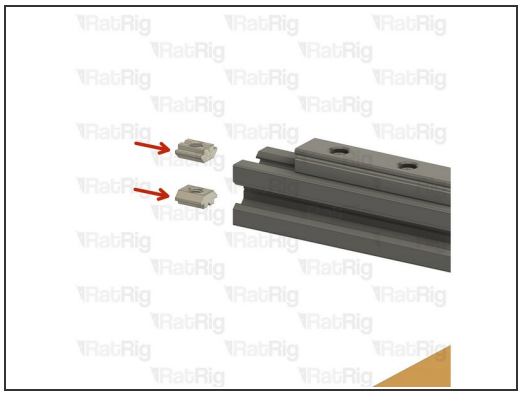
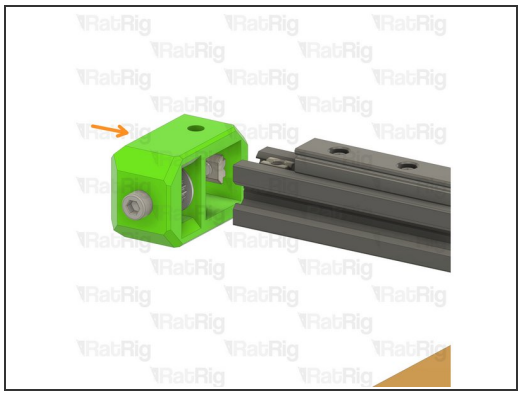
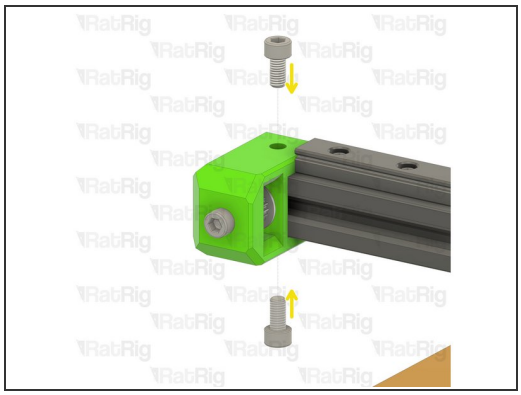
- x_idler printed part
- M5x25 Cap Head Screw
- Install one precision micro shim onto the M5x25 screw
- Install the toothed 2GT idler onto the M5x25 screw
- Insert the M5x25 cap head screw further in preparation for the next step

Step 20 — Assemble the X-axis idler - Part 2

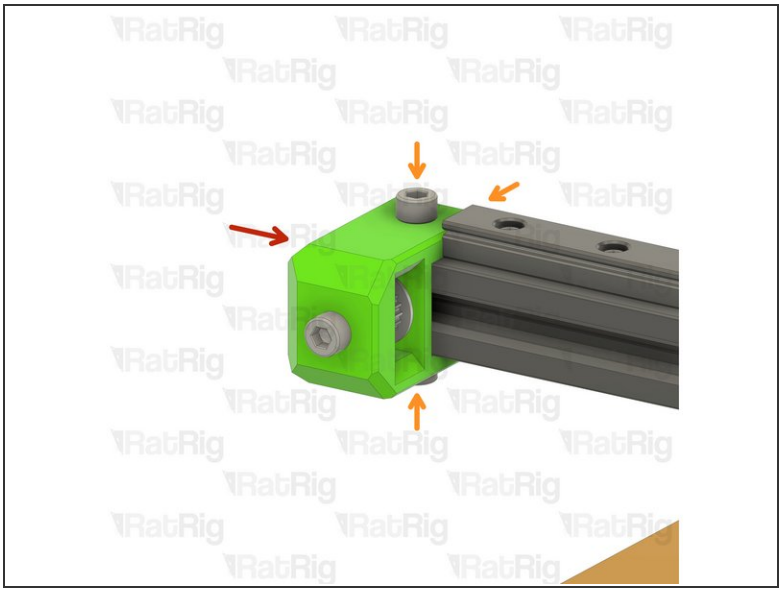
- Similar to the Y-axis idler assembly, install the second precision micro shim onto the M5x25 screw
  - ⓘ The assembly should have a micro precision shim on either side of the toothed idler
- Fully insert the M5x25 as shown
- M5x10 Cap Head Screw
- 2020 Square T-Nut - M5
  - ⓘ Loosely thread the 2020 T-Nuts onto the M5 screws. Do not tighten them at this point

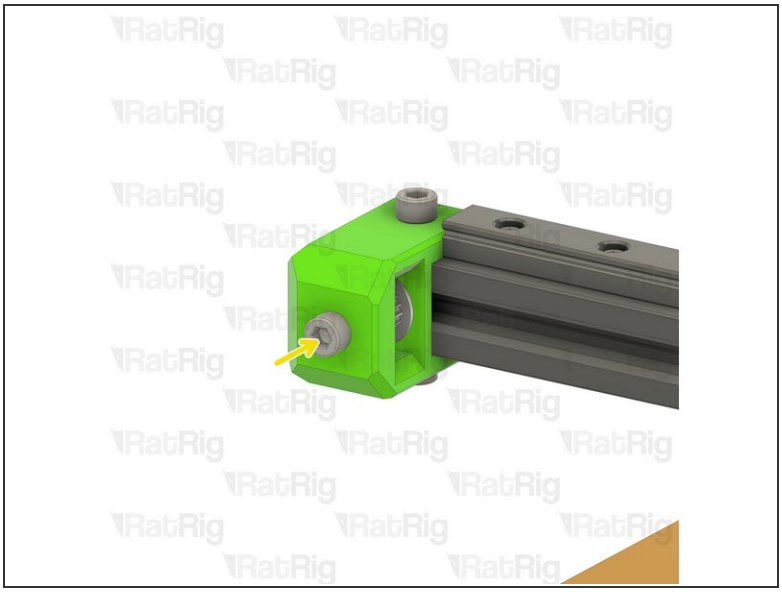
Step 21 — Install the X-axis idler - Part 1

- 2020 Square T-Nut - M5
  - Insert one 2020 T-nut into the top of the 2020 X-axis extrusion as shown...
  - ... and one into the underside of the extrusion
- Install the X-axis idler onto the end of the 2020 X-axis extrusion
- M5x10 Cap Head Screw
  - Insert one M5x10 screw in both the top and bottom of the X-axis idler, loosely fastening them into the 2020 T-nuts in the extrusion

Step 22 — Install the X-axis idler - Part 2





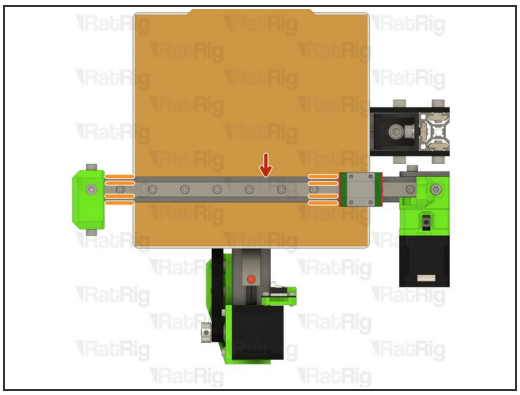
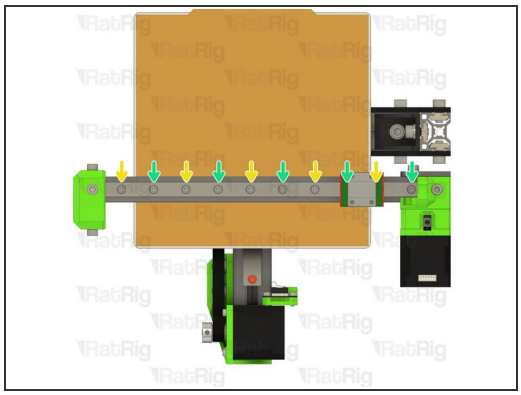
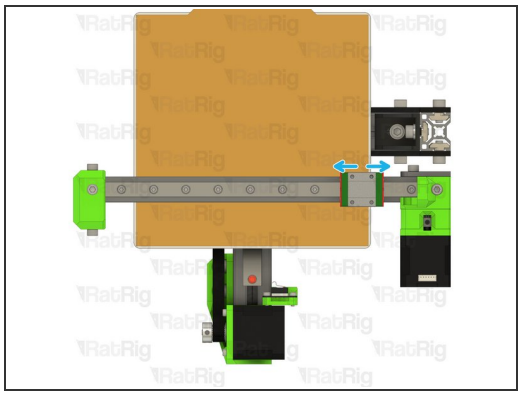
- Make sure the 2020 extrusion is fully inserted into the X-axis idler
- Fasten all three M5x10 screws

  ⚠ Take care not to over tighten the M5x10 screws as you can damage the printed part
- Fasten the M5x25 screw

  ⚠ Check that the toothed idler rotates without binding. If the idler is difficult to rotate, loosen the M5x25 screw until the idler rotates smoothly

  ⚠ Take care not to over tighten the M5x25 screw as you can damage the printed part

Step 23 — Align and secure the X-axis linear rail

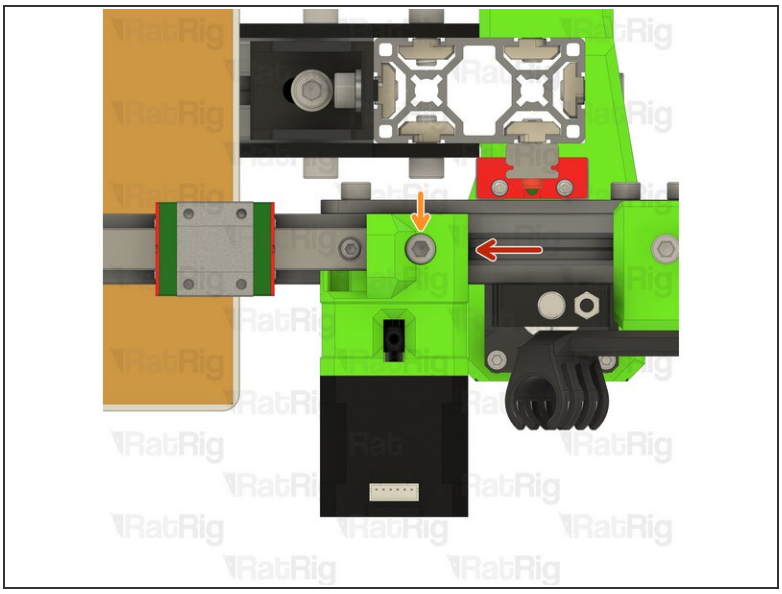




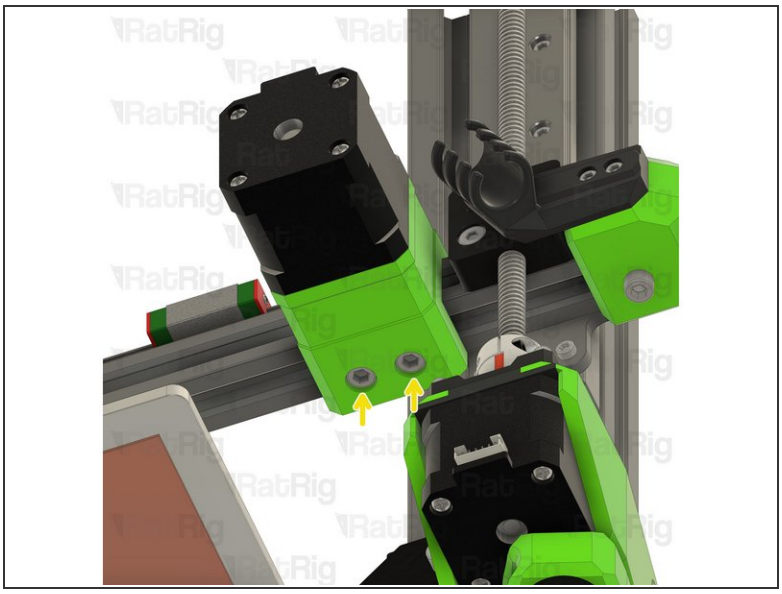
- MGN12 Linear Rail
- Make sure the linear rail is centred on the 2020 extrusion
  - ⓘ The measurement between the linear rail and the side of the 2020 extrusion should be 4mm at all points
- Fasten the M3x8 screws, starting from the left side

ⓘ Double check the position of the linear rail

- Fasten the remaining M3x8 screws, starting from the left side
- Check that the carriage runs smoothly along the length of the rail

Step 24 — Align and secure the X-axis motor

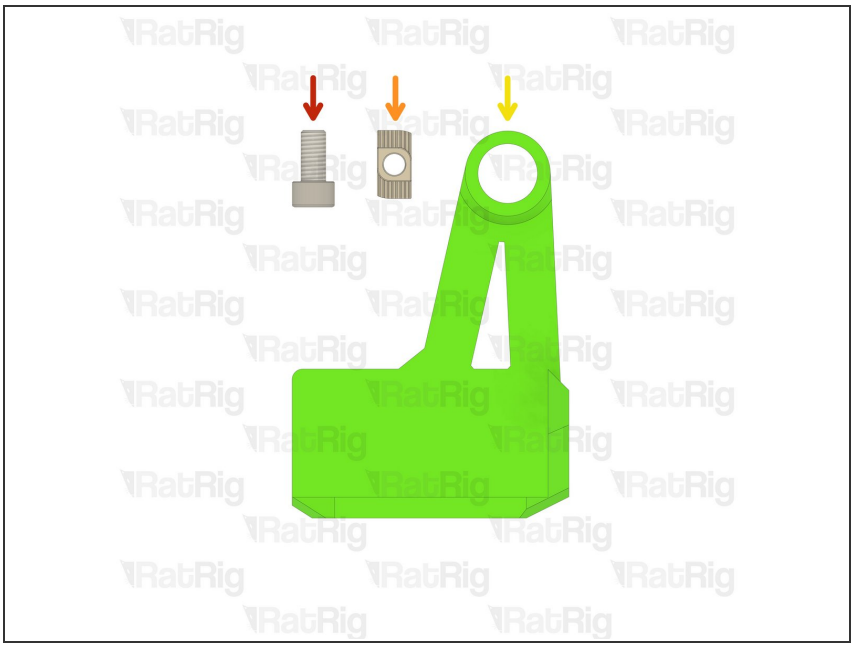




- Push the X-axis motor as shown, it should be flush with the end of the linear rail
- Fasten the marked M5x10 screw
- Fasten the two marked M5x10 screws to fully secure the X-axis motor into place

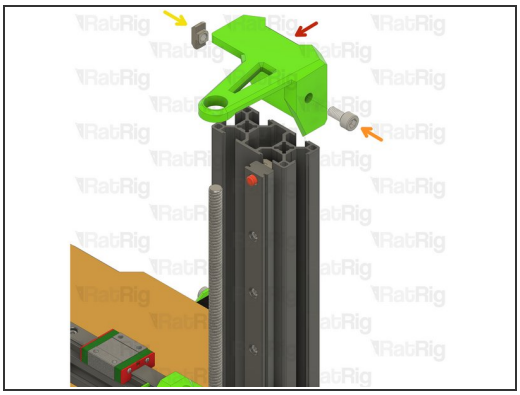
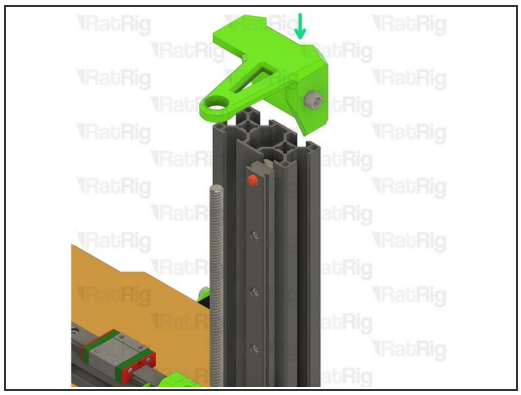
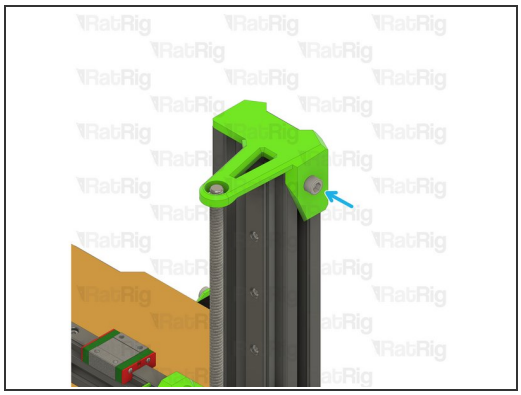
⚠ Take care not to over tighten the M5x10 screws as you can damage the printed part

Step 25 — Prepare the Z-axis cap parts



- 1x M6x12 Cap Head Screw
- 1x 3030 Drop-in T-Nut - M6
- z_cap printed part

Step 26 — Install the Z-axis cap

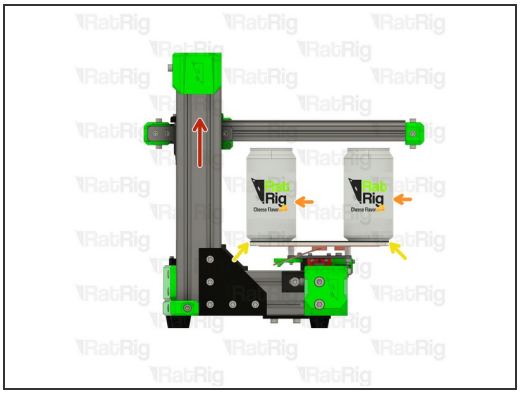
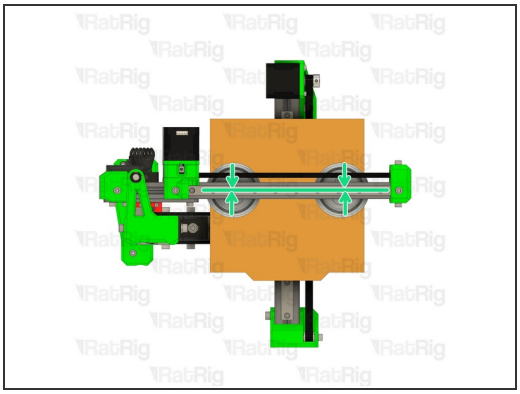
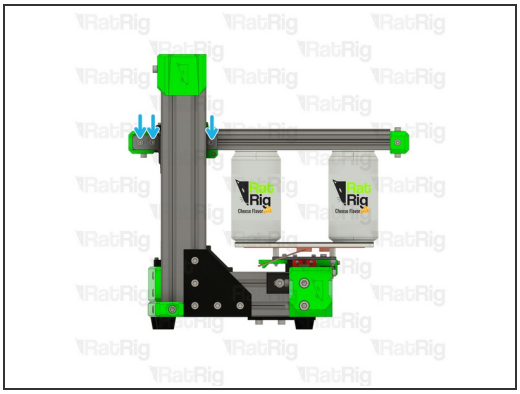




- z_cap printed part
- M6x12 Cap Head Screw
- 3030 Drop-in T-Nut - M6

  ⓘ Loosely thread the 3030 T-Nut onto the M6x12 screw. Do not tighten it at this point
- Install the z_cap as shown
- Fasten the M6x12 screw to secure the cap to the V-Minion frame

  ⚠ Take care not to over tighten the M6x12 screw as you can damage the printed part

Step 27 — Square the X-axis - Part 1

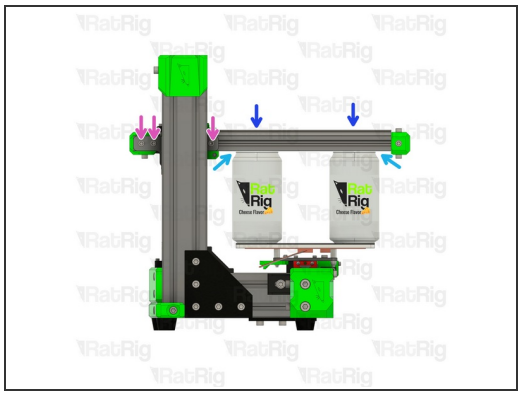
- Rotate the lead screw to lift the X-axis
- Place two soda cans on top of the bed

  ⓘ Use two soda cans of the same brand if possible. Soda cans have very good dimension tolerances due to shipping and brand refill, this makes them a easy to source precise tool.
- Make sure the Cans are fully seated on the bed
- Place the Cans on the middle of the X-axis
- Lossen the screws on the X-gantry plate

⚠ Cans are not included in the Rat Rig Kit!

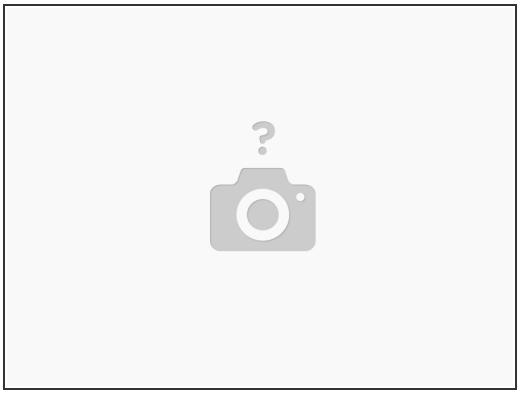
Step 28 — Square the X-axis - Part 2





- Rotate the lead screw to lower the X-axis
  - If the X-axis is lowered too far, the gap on the right soda can will increase
- Rotate the lead screw to lift the X-axis
  - If the X-axis is lifted too much, the gap on the left soda can will increase
- Adjust the height of the X-axis until the gap on both soda cans is the same
- Push the X-axis down with 2 fingers to really make sure the extrusion sits flush with the cans.
- Re-tighten the screws on the X-gantry plate, making sure the gap on both soda cans remains the same

Step 29 — Next guide



Continue with the next guide: [06. Spool Holder Assembly]