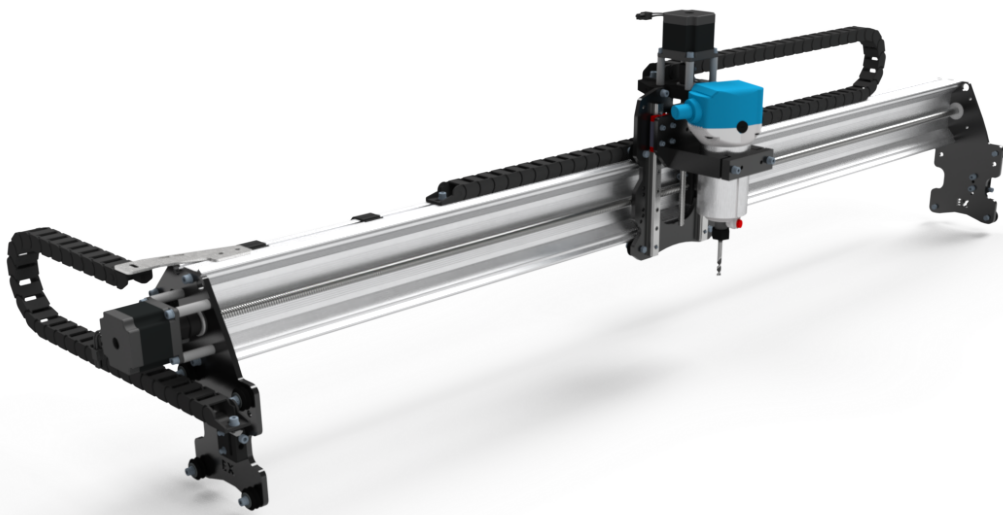


LongMill MK1 48" Extension Kit



 **LONGMILL**

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Congratulations on getting your LongMill MK1 48" extension kit! In just a few steps, you'll soon have a much larger CNC with 50%+ more cutting area than before, as well as the ability to pass full width 4' sheets of material through.

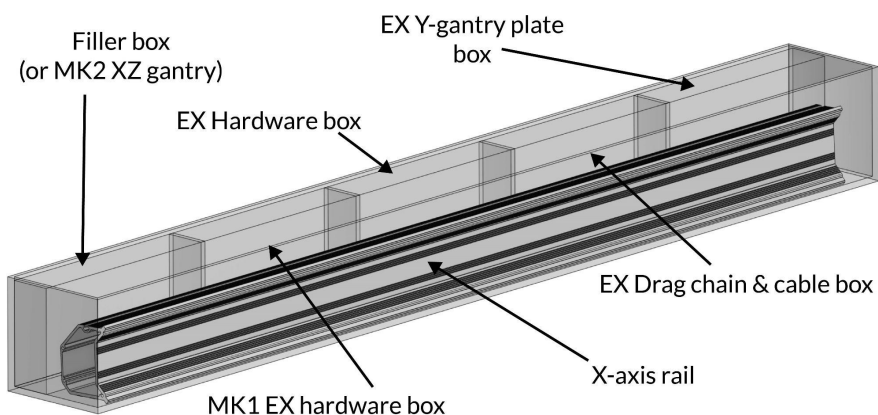
Please read this whole section before continuing on with assembly. It will provide you with the startup information and context needed to have a smooth and successful assembly.



This symbol indicates that alternative steps are needed if assembling the MK2 XZ Gantry upgrade along with this extension kit.

Unpacking

Inside the extension kit, you'll find the X-axis rail and leadscrew packaged with 5 boxes.



The 'EX Hardware box' contains core components for assembling the extension kit, the "MK1 EX Hardware box" contains additional parts specific to extending the longmill MK1, the "EX Drag chain & cable box" contains a longer 1400mm drag chain and cables, the EX Y-gantry plates box contains the two EX Y-gantry plates.



If you've opted for the 'MK2 XZ Gantry' upgrade for your extension kit, you'll receive a pre-assembled MK2 XZ gantry instead of a 5th empty filler box.



Tools you'll need

You'll need these tools on hand for assembly. Most people will have these in their shop:

- Metric Allen keys (we provide)
- Metric wrenches, metric socket set, or adjustable wrenches.
- A small flat head screwdriver

We don't recommend you use an impact driver for assembly except when mounting the machine because you won't save much time and some assemblies are prone to damage if they're overtightened

Missing/broken parts?

Don't sweat it - your extension kit has spares and redundancy included. If a part is lost or isn't going together how you expect, no worries; just check through the bags and you'll likely find what you need to continue assembly. Expect a pile of bolts left over at the end and feel free to set these aside for future machine maintenance.

We supply extra parts so that:

- If a part doesn't work properly the extra one can be used instead
- If you lose something (especially small things) you don't have to search the floor
- We reduce the chance of packing too few on our end

If a part is missing completely, check that you're looking for the right thing and ensure you look through all the packaging you received with your LongMill. Some parts and add-ons such as the t-tracks ship in a separate package if they can't fit into one box..

If a part arrives broken and doesn't have a spare, warranty covers replacement parts and we'll even be happy to help you out if you break it yourself. Just shoot us a message here (<https://sienci.com/contact-us/>) and see if there are any other areas of assembly you can continue with in the meantime. We'll get back to you as soon as we can.

Assembly tips

1. Take breaks when needed

The assembly process can take a few to several hours. Pace yourself and enjoy the process - after all, you are learning CNC as a hobby!

2. Read the instructions

Many issues during assembly can be solved by re-examining the instructions. Check that you didn't skip a page and that you completed the previous step correctly. Some steps are hard to explain and some parts have names that are hard to remember so looking at the pictures more closely can also help you to better understand what needs to be done. Reading is encouraged if you'd like more detail on where to locate the part, what function it serves on the machine, and other elaborative information.

Our assembly videos can't be updated as often as the online or PDF instructions so if packaging or parts change the written manual will always be able to clarify these changes.

3. Remember the language

This manual contains some technical language as well as a distinct visual language. Keeping these in mind will make the assembly easier for you to understand and ensure that less mistakes happen.

Section title pages: show the part of the machine you'll be working on next

Straight arrows: are in blue and show how you will need to bring parts together

Rotation arrows: come as either blue or red, blue indicating a loose placement of the part and red indicating a firm tightening required to fasten the part into place

Caution triangles: marks something that requires attention

Large green circles: provide a secondary view of the current step for added clarity

X, Y, and Z: during assembly if you see these capitalized letters used it's because we refer to some parts by the axis they belong to. For reference, if you're looking at the Longmill from the front the X-axis is when the machine moves left/right, the Y-axis is towards/away from you, and the Z-axis is moving up/down from the tabletop

4. Set aside a clean space for disassembled parts

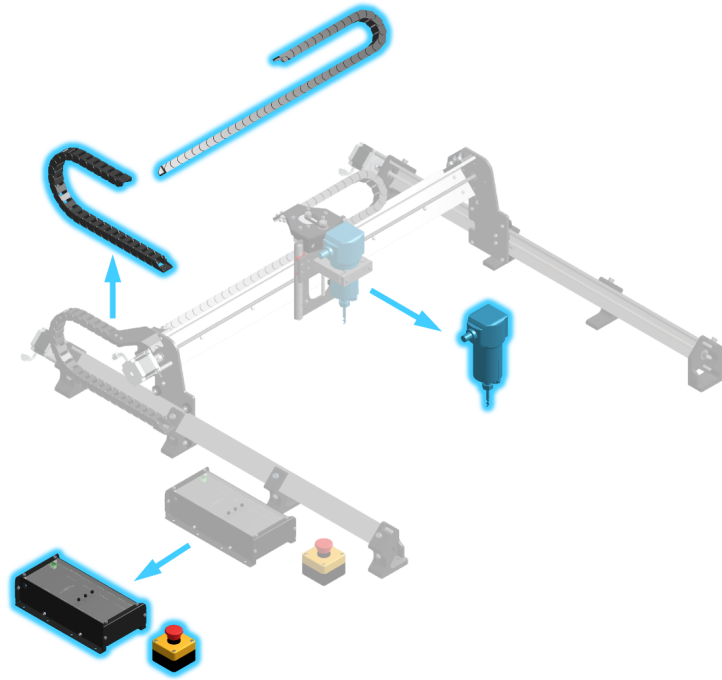
Since installing this extension kit will require the removal of some parts, as well as the reusing of some, make sure you can set these parts aside without losing any or mixing anything up. Pay special attention to not lose any small parts such as washers, screws, and nuts.

This manual will specify which parts will and will not be reused for final assembly of the 30x48" machine.

5. Connect with the community

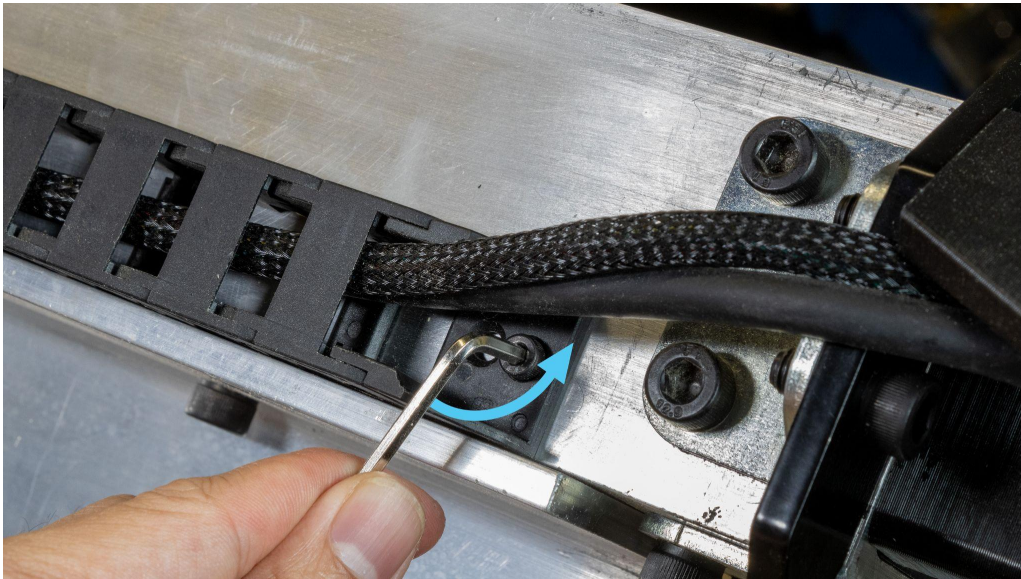
If you are looking to get quick advice or to share your excitement about the LongMill, post in our [forum](#) or [Facebook group](#)! We have a large and friendly group of CNC enthusiasts who enjoy engaging in conversations and sharing their CNC experiences.

Drag chain and wiring disassembly



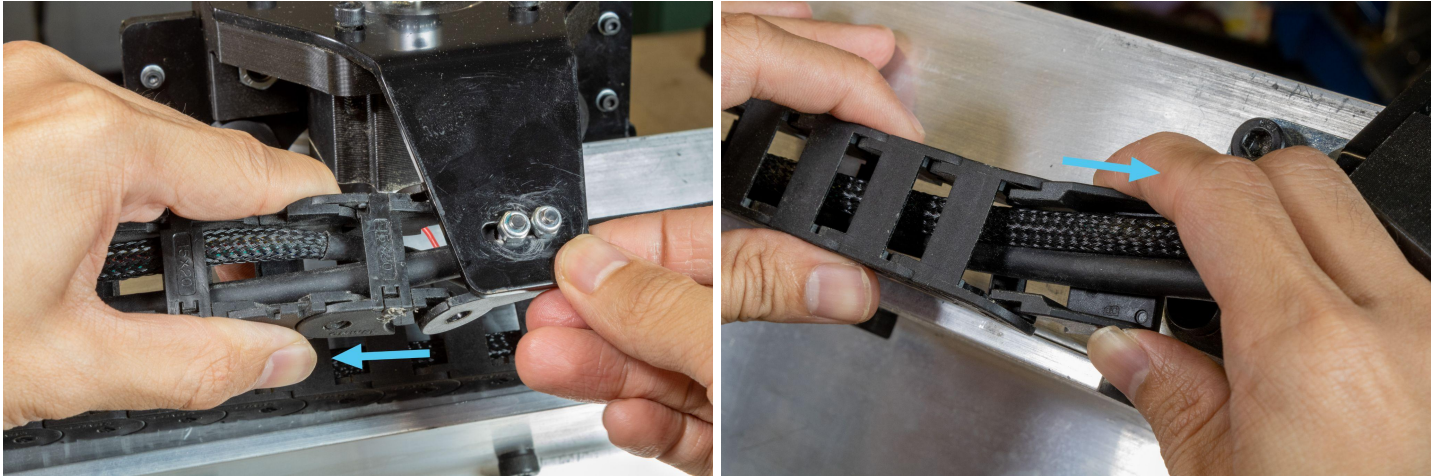
Disassembling the drag chain

Start by removing the M4-12mm bolt securing the X-axis drag chain to the X-rail as shown.



Next, detach the end link on both ends of the X-axis drag chain.

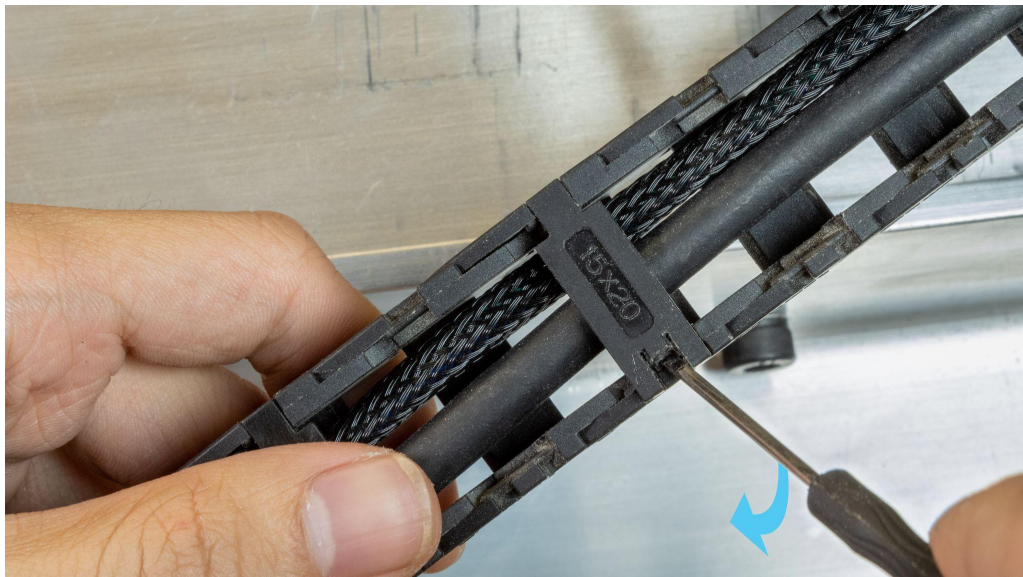
Note: A small screwdriver may be helpful in removing drag chain end links - be careful not to over-bend the links however.



Detach the end link on both ends of the Y-axis drag chain as well.

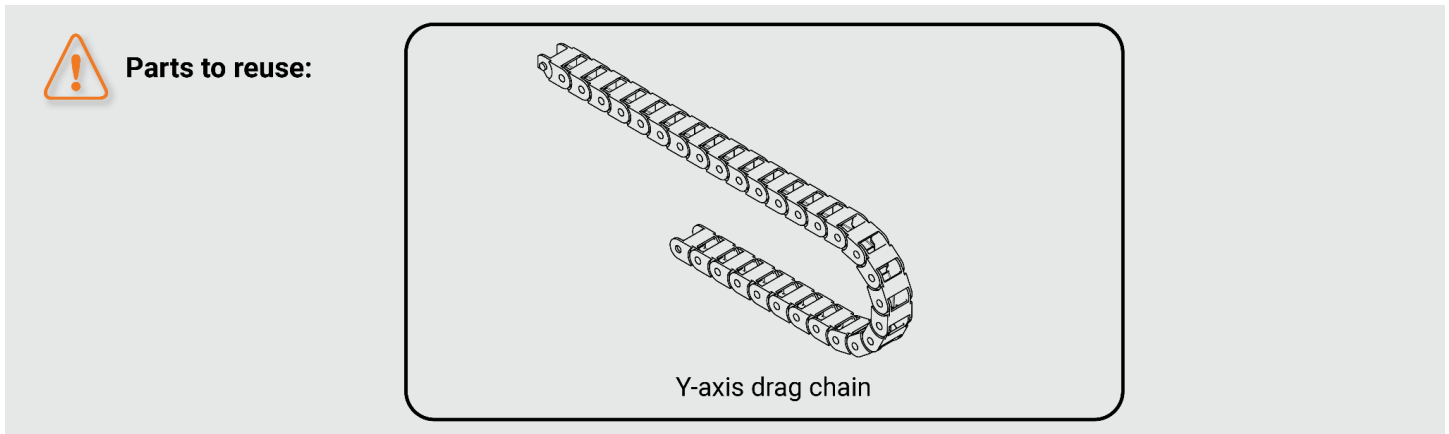


With the end links detached, unclip any of the clips securing the wires for both drag chains.



You should set aside the body of the shorter Y-axis drag chain as it will be reused later. There is no need to remove the remaining end links from the machine at this time.

Note: Throughout disassembly you will be asked to set parts aside for reuse, the exact parts you need to put away will be highlighted by a diagram like the one shown here.

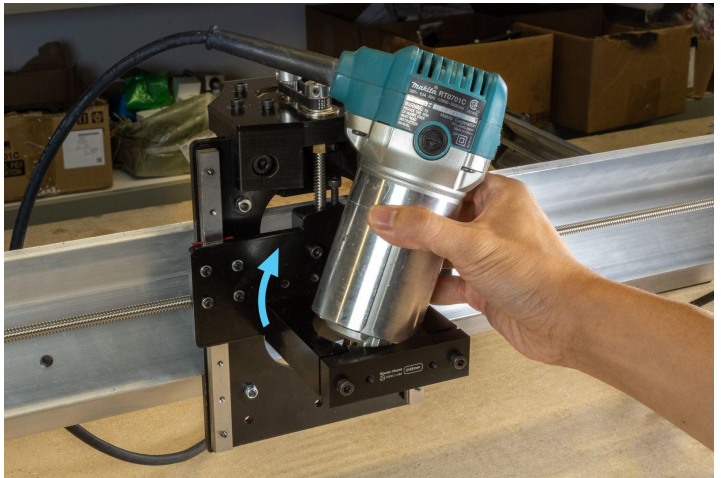
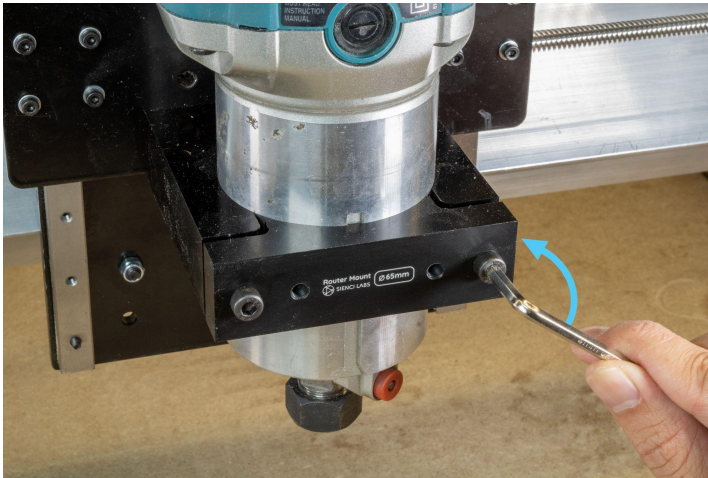


Disconnecting wires

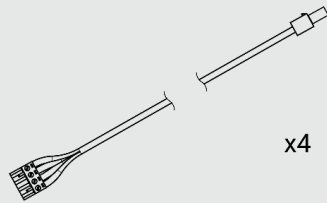
Disconnect the motor cables going to the X, Y and Z-axis motors. Disconnect and remove any other add-ons such as limit switches or laser if installed. Disconnect any of these cables from your control box as well.



Remove the router from the router mount by loosening the two M5-25mm bolts at the front of the router mount. Slide the router body out and remove any zip ties holding the router power cord if applicable. Set the router aside for re-installation later on.

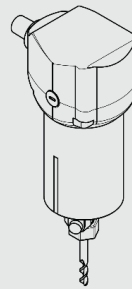


Parts to reuse:



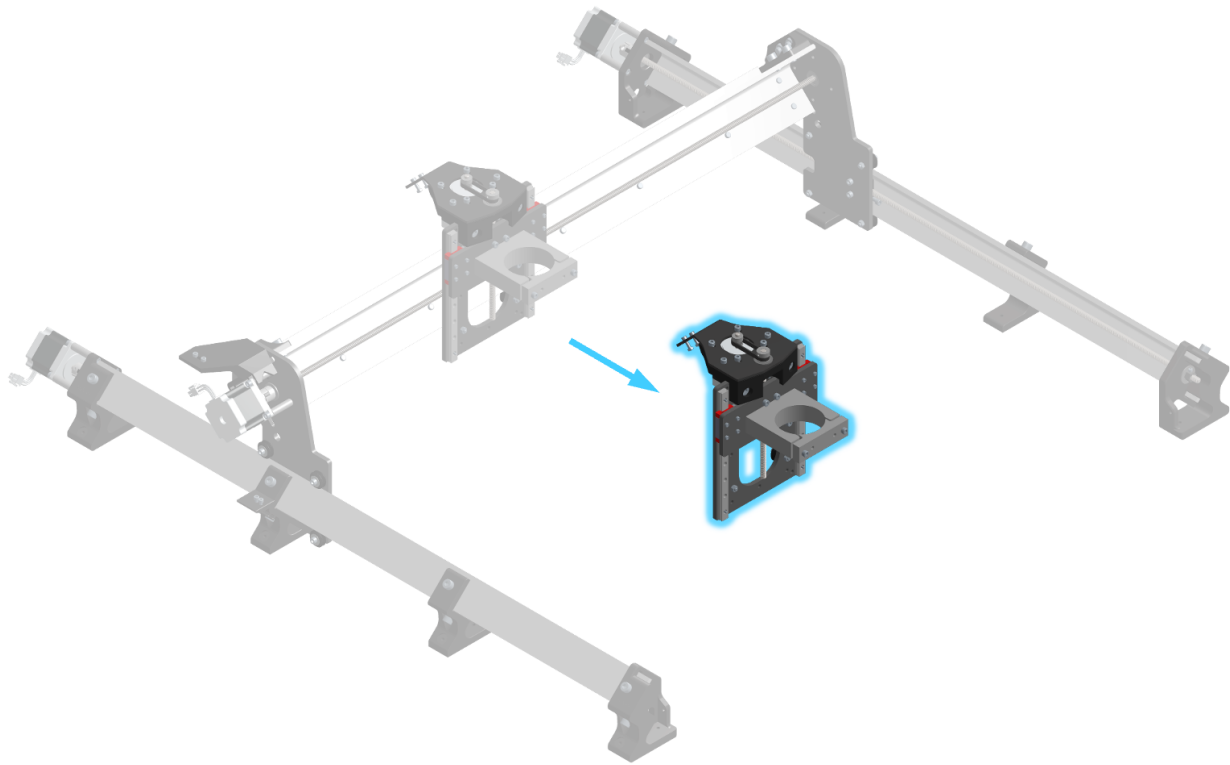
x4

Motor Cable



Router

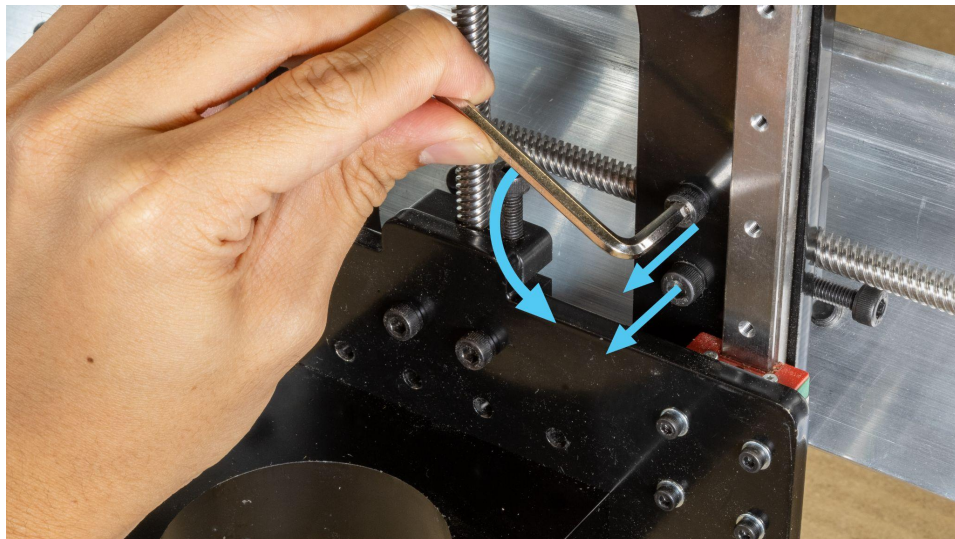
XZ gantry disassembly



Detaching the XZ Gantry

In this section, we'll remove the XZ gantry from the X-axis rail.

Start by removing the two M5-25mm bolts securing the Delrin nut to the XZ gantry as shown. You may have to manually lower the Z-axis gantry if the two bolts are hidden from view.



Next, place one of the smaller boxes found inside your kit (with its contents removed) under the XZ gantry to prevent it from dropping onto the wasteboard once it is disconnected.



Undo the two M5-25mm bolts securing the **top V-wheels** to the XZ gantry. The gantry will be unsupported once the bolts are removed, so make sure you hold on to the gantry as you loosen the second bolt.



At this point, you should have the XZ gantry removed from the X-axis rail.

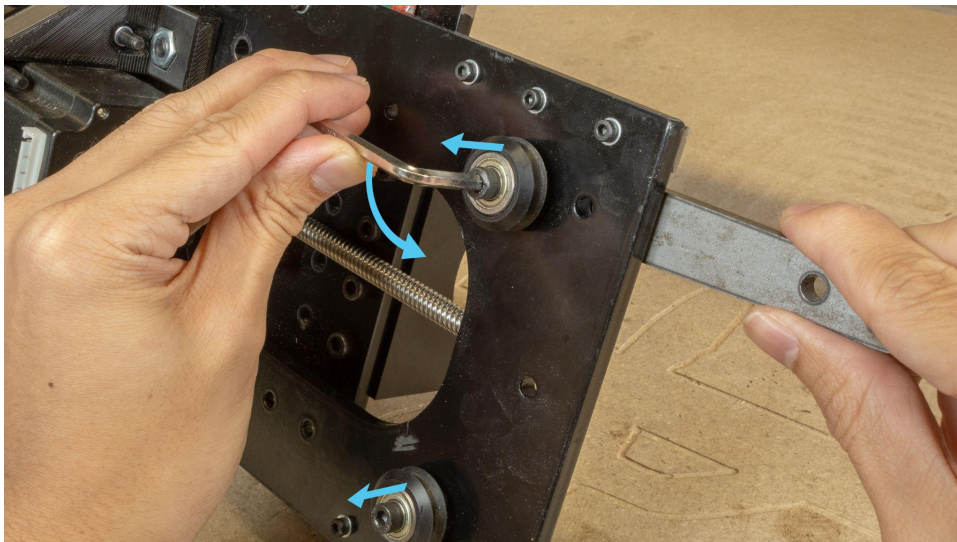


Preparing the XZ Gantry for reuse

MK2 XZ

The next few steps will not apply to you if you have purchased the MK2 XZ upgrade and you can skip to the next subsection titled [MK2 XZ - Reusing the router mount](#).

If you are reusing the MK1 XZ gantry, you can continue disassembly by removing the **bottom V-wheels** from the XZ gantry using an M5 allen key and wrench.

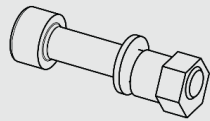


Collect all the fasteners obtained during V-wheel removal and place them in the reuse parts area. The V-wheels for the X-axis will be replaced later in the assembly so are no longer needed.

You should also partially reassemble the fasteners into sets so that they are not misplaced during the remainder of disassembly.

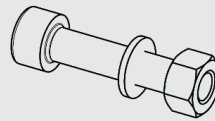


Parts to reuse:



x2

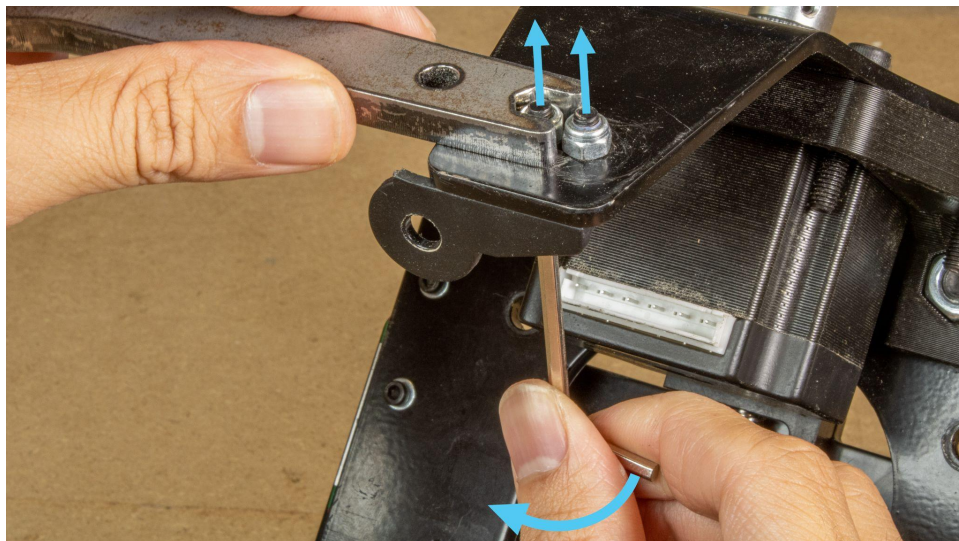
Eccentric Nut Sub-Assembly



x2

Nylock Nut Sub-Assembly

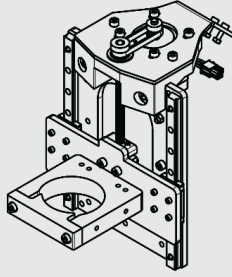
To complete XZ gantry disassembly, undo the two M4-12mm bolts at the top of the gantry and remove the drag chain end link.



The XZ gantry is now fully disassembled and you can transfer it to the reuse parts area for later use.



Parts to reuse:



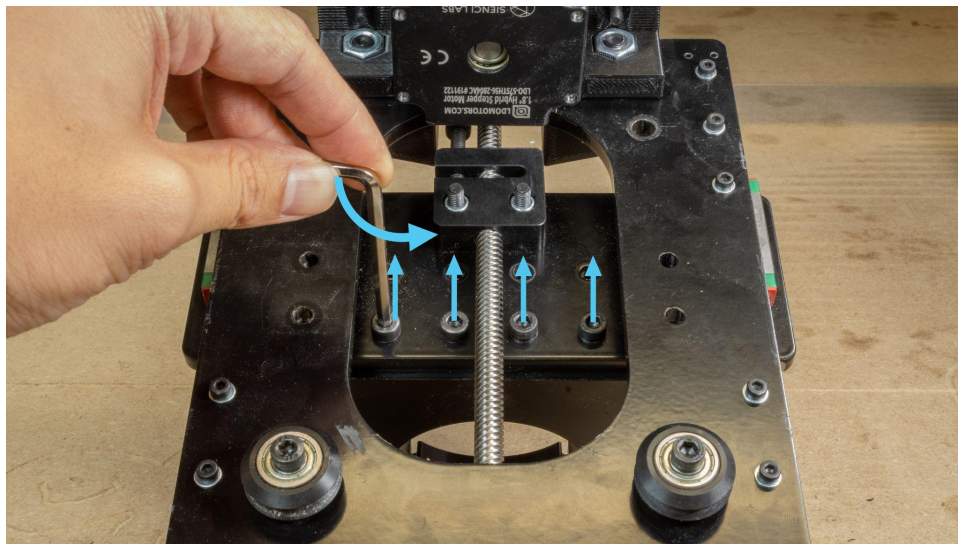
Partially disassembled XZ Gantry Assembly

MK2 XZ

MK2 XZ - Reusing the router mount

If you have ordered the gantry upgrade with the kit, the only part you'll need to reuse from the old gantry is the router mount.

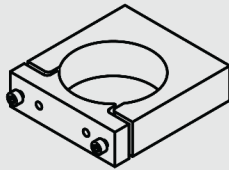
To remove this, flip the XZ gantry over so that the router mount is facing away from you. Turn the leadscrew clockwise by hand until the 4 bolts holding the router mount are easily accessible, then undo the four M5-25mm bolts to free the router mount.



You can now set the router mount and the four M5-25mm bolts aside in the reuse parts area for later. The old gantry and the V-wheel assemblies you took off earlier will no longer be needed from this point forward.



Parts to reuse:



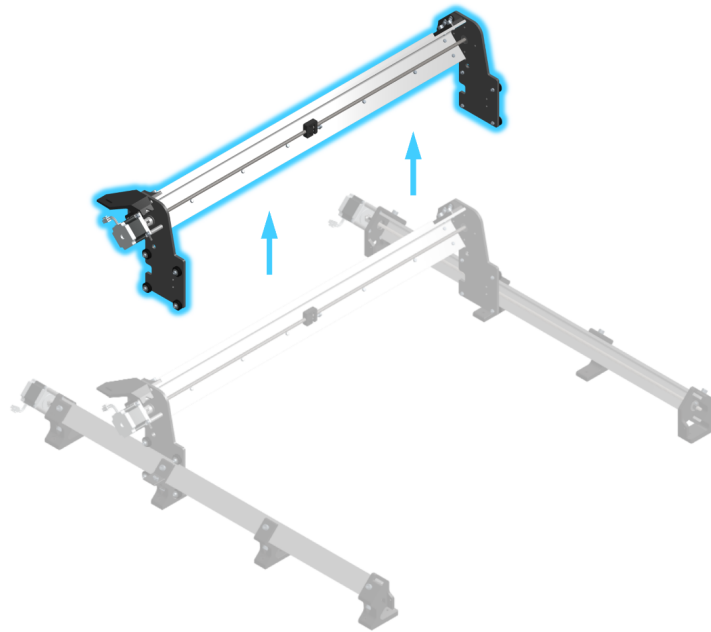
Router Mount



x4

M5-25mm Bolt

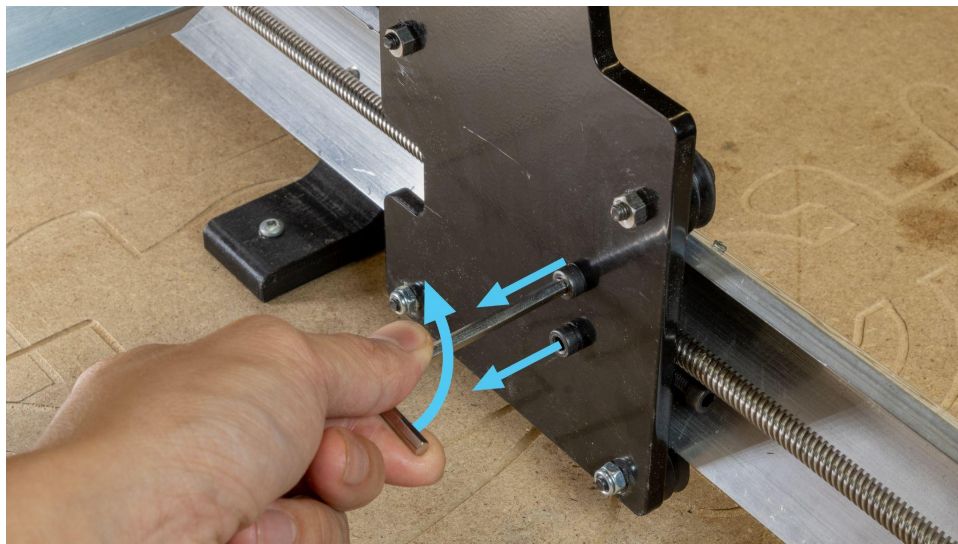
X axis disassembly



X-Axis assembly

Now that the XZ gantry is free from the X-axis rail, we can proceed to remove the X-axis assembly from the Y-axis rail in a similar fashion.

Start by removing the two M5-25mm bolts holding the Delrin nut to the Right Y-Axis Gantry plate, then repeat the same procedure for the Left Y-Axis Gantry plate.



You will need to reuse these four bolts during assembly so set them aside in the reuse parts area.



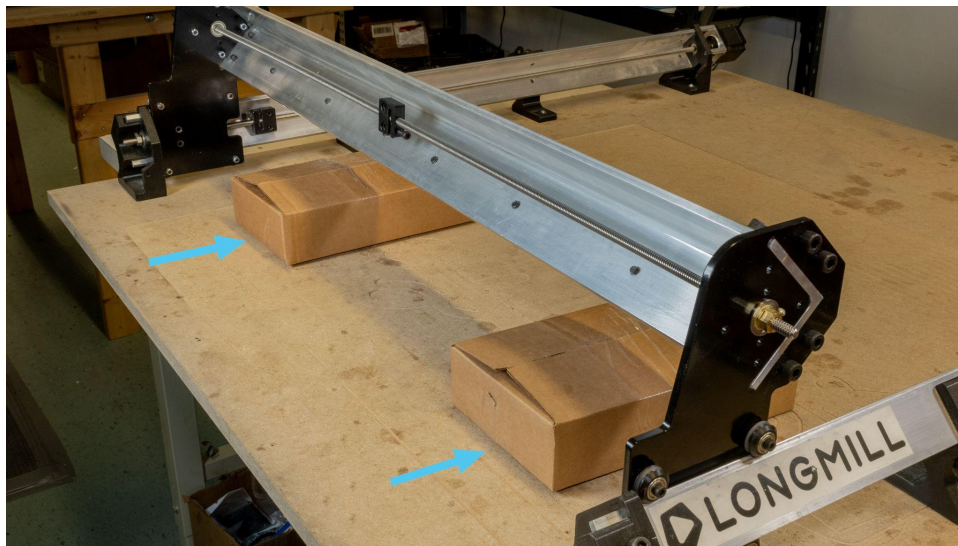
Parts to reuse:



x4

M5-25mm Bolt

The X-axis assembly is top heavy and will tip over backwards when it is detached from the Y-axis rails. As a precaution, you can place two of the smaller packaging boxes under the X-rail to prevent it from falling onto the wasteboard.

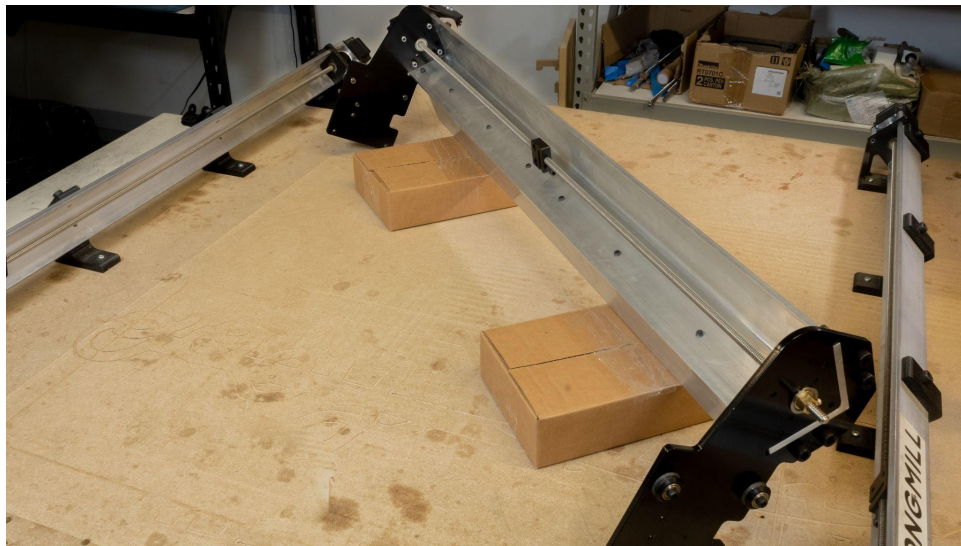


Once the boxes are in place, undo the two M5-25mm bolts holding the **bottom V-wheels** on each of the Y-Axis gantry plates. Try to support the X-axis so it does not tip over as you remove the last bolt.

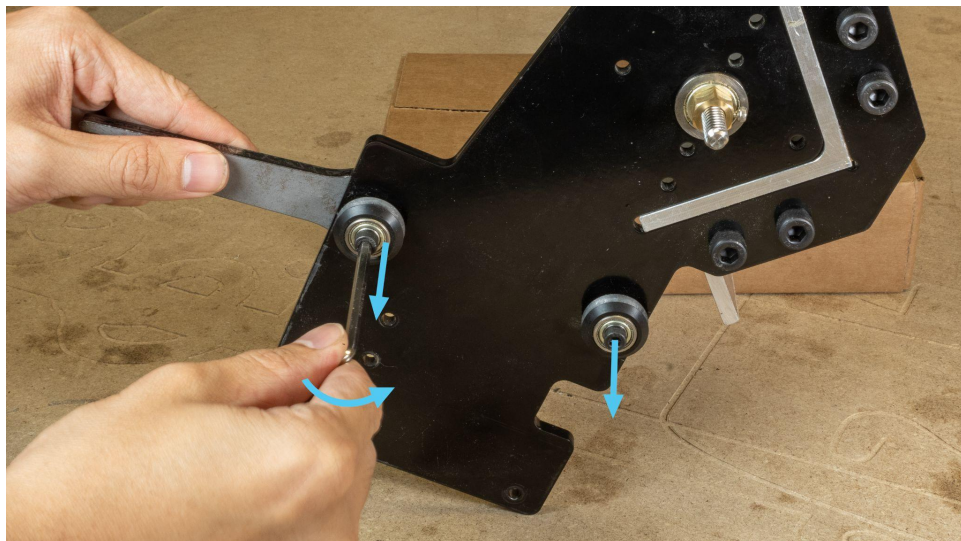




You can now lift the X-axis off the Y-axis rails and set it on the wasteboard.



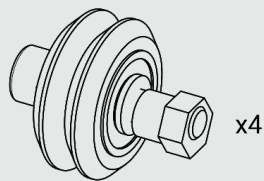
Lastly, remove the **top V-wheels** from both the left and right Y-gantry plates using an M5 allen key and wrench.



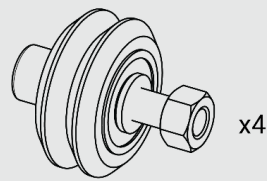
All 8 V-wheels from the Y-axis and their associated fasteners will be reused during reassembly so it is important that you transfer them to the reuse parts area before continuing. We again suggest that you partially reassemble the fasteners into sets so that they are not misplaced.



Parts to reuse:



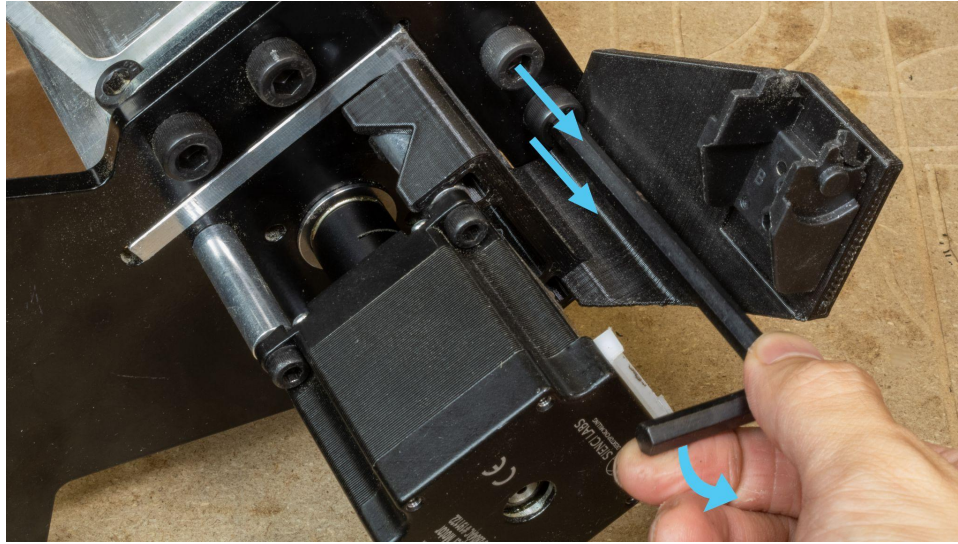
V-wheel Assembly w/
Eccentric Nut



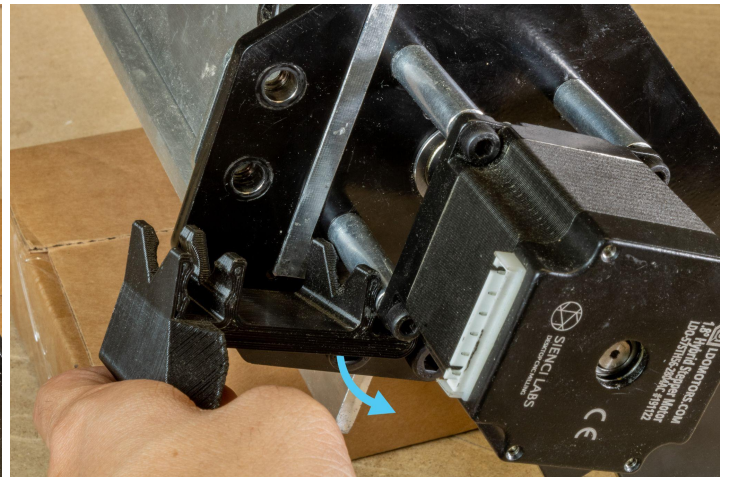
V-wheel Assembly w/ M5
Nylock Nut

Y-Axis drag chain holder

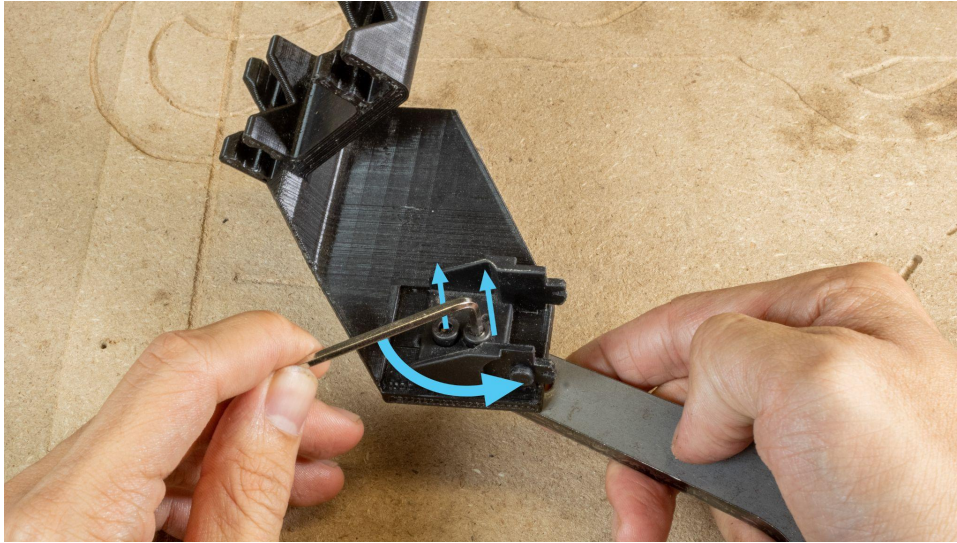
Remove the two M8-25mm bolts above of the X-Axis Stepper motor using an M8 (6mm) allen key. If your Longmill uses a steel Y-axis drag chain holder, the holder will become detached as you remove these two bolts.



If your Y-axis chain holder is 3D printed (as pictured), it will be clipped onto two of the X-axis motor standoffs. You can free the holder by grabbing onto the flange area and pulling loose the top clip, then wiggle the clip from side to side to free the bottom clip.



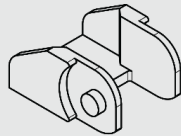
Remove the drag chain end link from the sheet metal / 3D Printed Y-axis drag chain holder using an M4 (3mm) allen key and wrench. The drag chain end link should be set in the reuse parts area.



Note: If you're not assembling the MK2 XZ gantry upgrade, we recommend that you hold onto the **M4-12mm bolts and nuts** removed during this step as well.



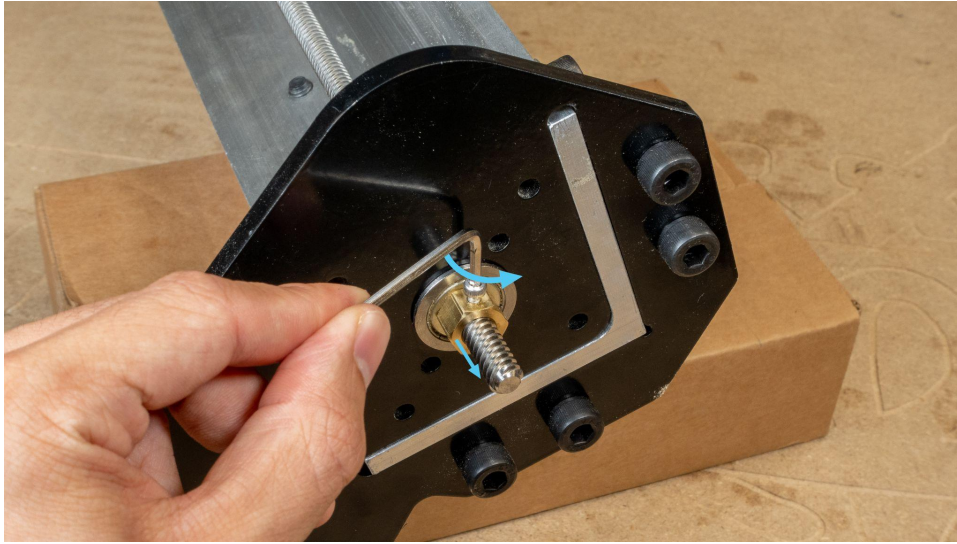
Parts to reuse:



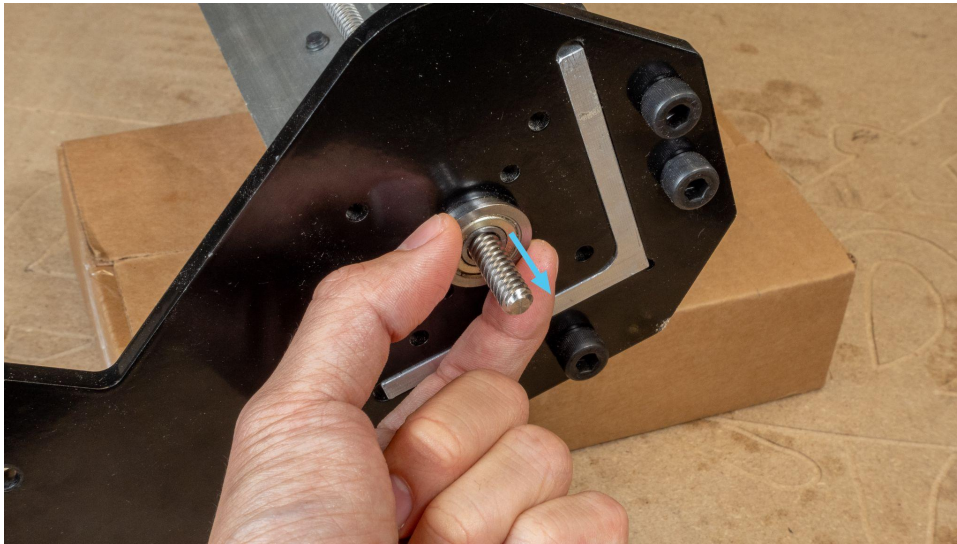
Y-axis Drag Chain End Link

X-Axis stepper motor

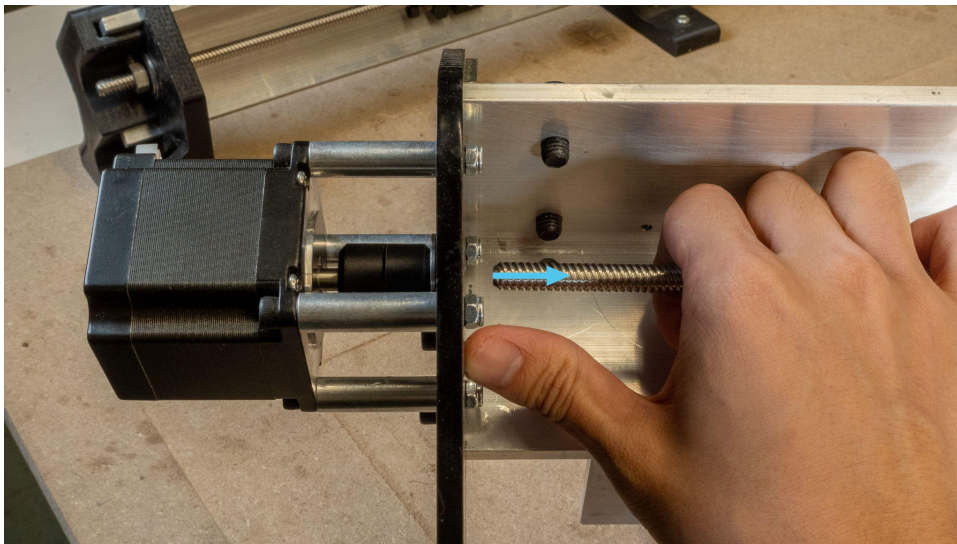
Loosen the set screw on the X-Axis ACME nut using an M3 (2.5mm) allen key and unthread the ACME nut from the lead screw.



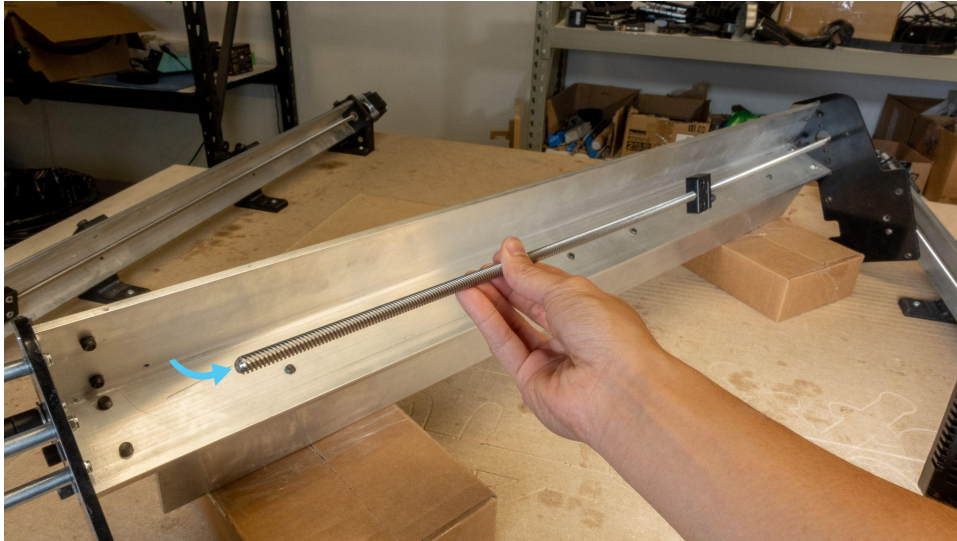
Remove the flange bearing under the ACME nut by sliding it off of the lead screw.



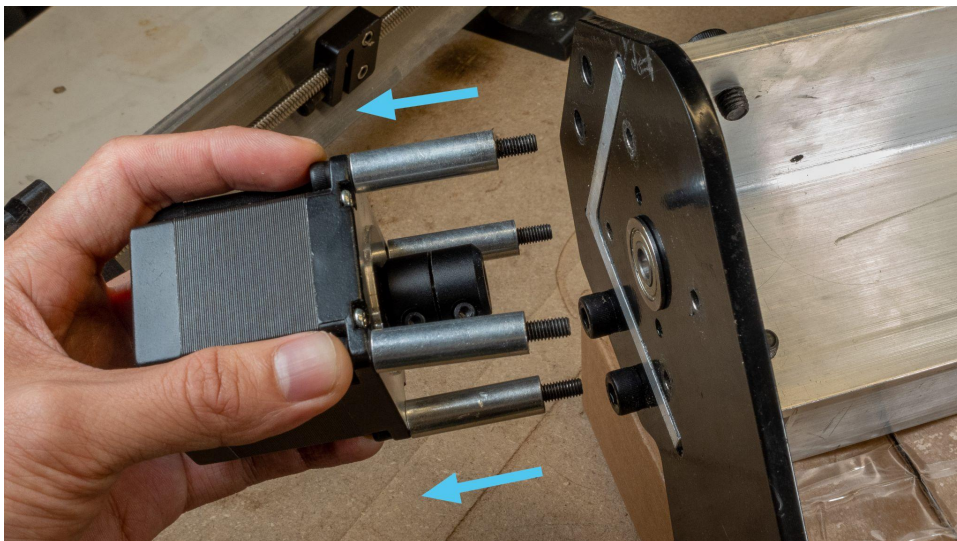
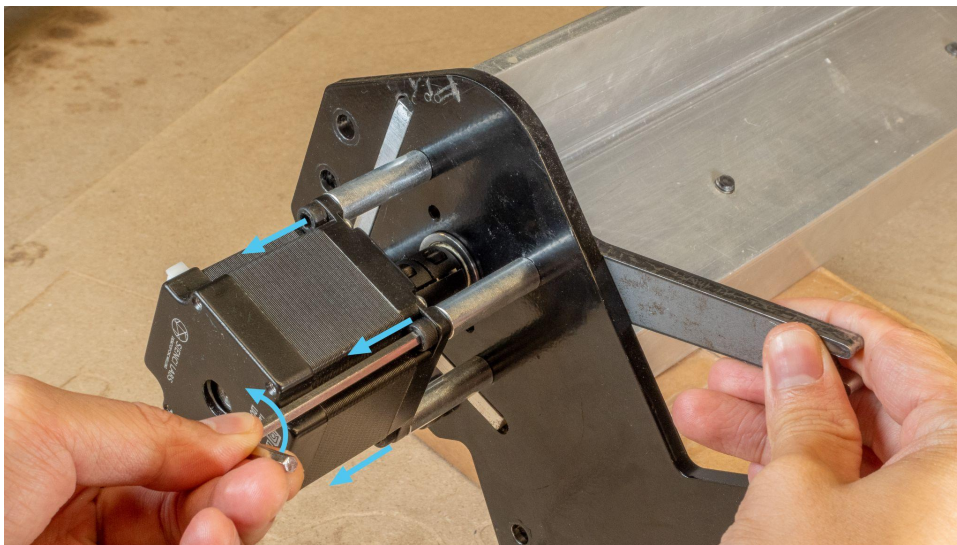
Next, loosen both set screws on the X-axis motor coupler, then slide the lead screw out of the left flange bearing.



You can now lift the lead screw up on the left side and pull it out of the assembly.



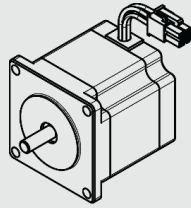
Undo the four M5-50mm bolts holding the motor to the left Y-axis gantry plate and remove the motor from the X-axis assembly. These bolts will not be reused and can be discarded.



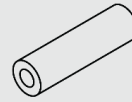
Remove the X-axis motor and aluminum spacers to the reuse parts area. You can then put away the X-axis assembly as it will not be reused.



Parts to reuse:



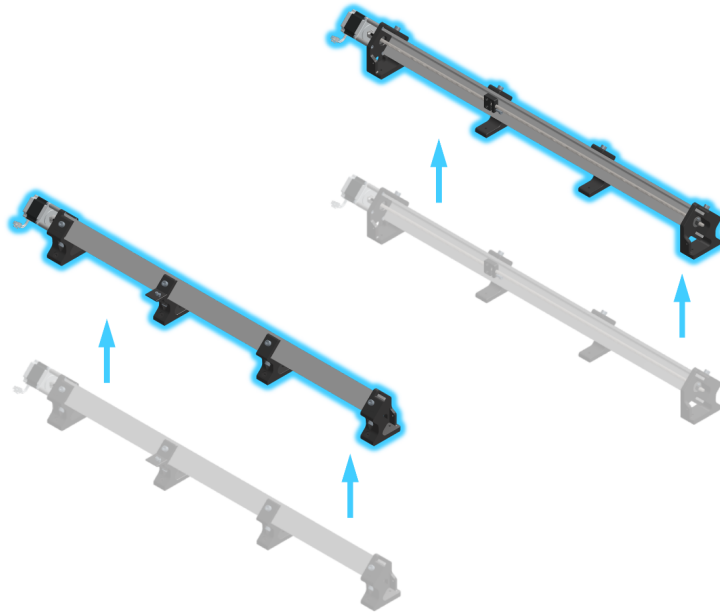
Nema 23 Motor



x4

35mm Aluminum Spacer

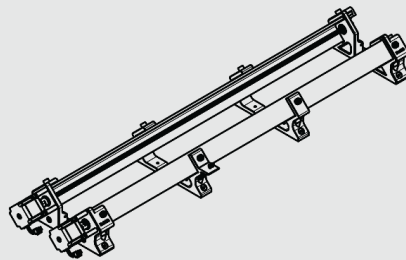
Y axis disassembly



Undo all sixteen wood screws securing the Y-axis assembly to the wasteboard and move both Y-axis rails to the reuse area.



Parts to reuse:



Left & Right Y-axis Assemblies

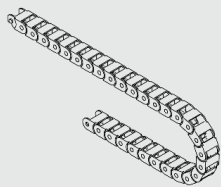
Intermission

You have finished taking apart the machine and it's all assembly from now on!

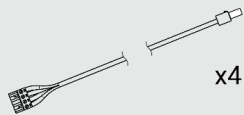
Before we do that however, please check your reuse parts area against the parts list below. If anything is missing, you can refer back to the step where they are removed to double check. Make sure any small assemblies have their washers installed.



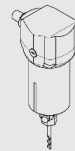
Parts to reuse:



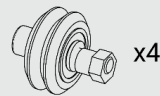
Y-axis Drag Chain



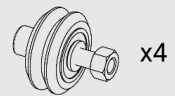
Motor Cable



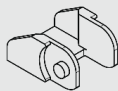
Router



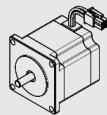
V-wheel Assembly w/
Eccentric Nut



V-wheel Assembly w/
Nylock Nut



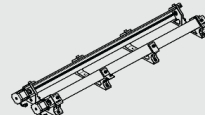
Y-axis Drag Chain
End Link



Nema 23 Motor



35mm Aluminum
Spacer

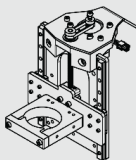


Left & Right Y-axis
Assemblies

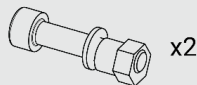


M5-25mm Bolt

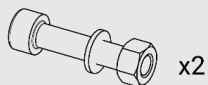
If reusing **MK1** XZ Gantry



Partially Disassembled
XZ Gantry

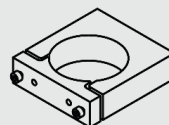


Eccentric Nut
Sub-Assembly

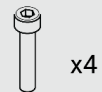


Nylock Nut
Sub-Assembly

If using new **MK2** XZ Gantry



Router Mount



M5-25mm Bolt

Modifying the XZ gantry

MK2 XZ

This section does not apply to you if you have purchased the MK2 XZ upgrade and you can skip to the next major section titled [MK2 XZ - XZ Gantry Assembly](#).

With disassembly out of the way, let's continue on to the overall assembly. First you'll want to lay out all the parts from the MK1 EX hardware box in front of you, as almost everything you need to adapt the MK1 XZ-gantry will be from this box unless otherwise specified.

Replacement v-wheels

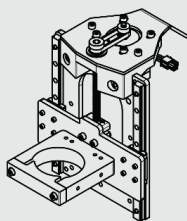
Parts Needed:



x4

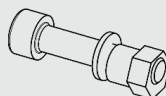
V-wheel

Reused From Disassembly



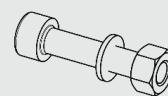
x1

Partially Disassembled
XZ Gantry



x2

Eccentric Nut
Sub-Assembly



x2

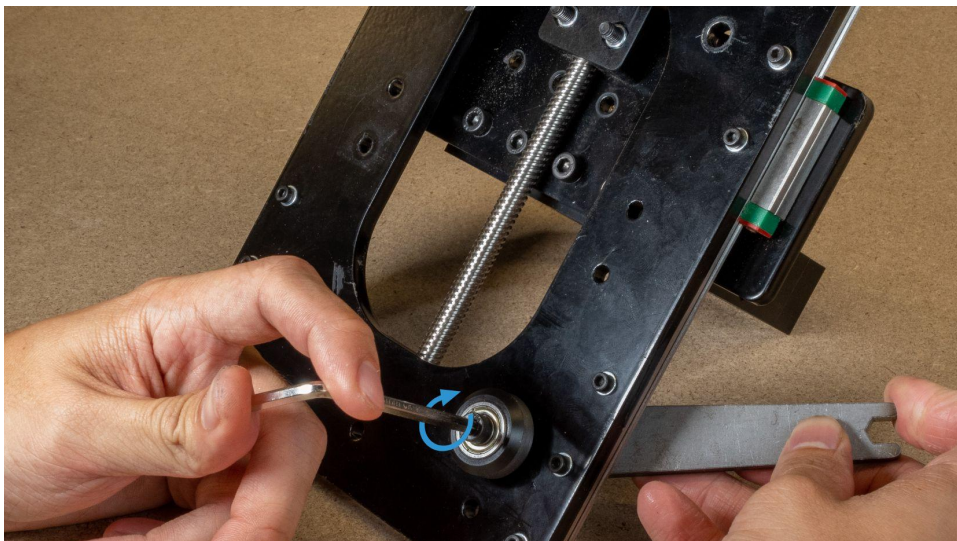
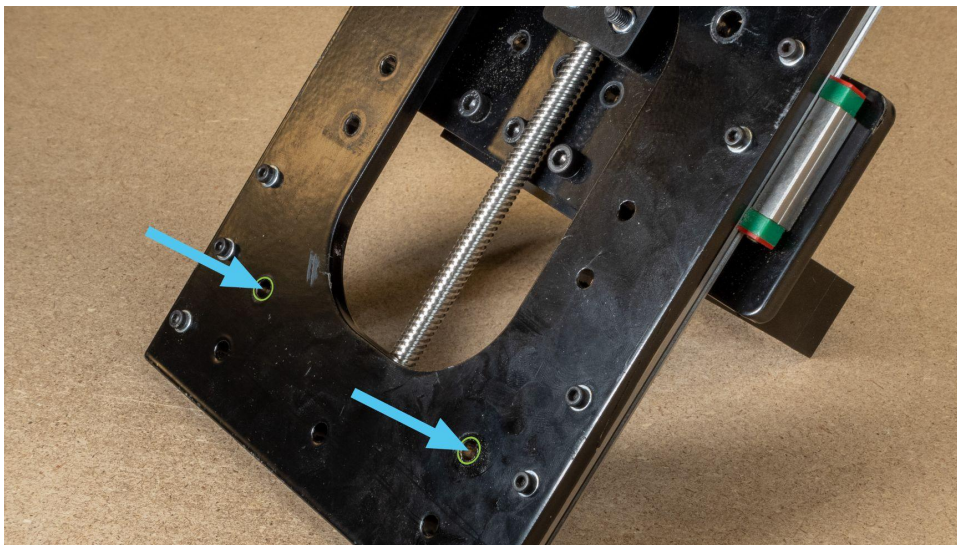
Nylock Nut
Sub-Assembly

Grab the MK1 XZ gantry that you have put away earlier and the four sets of fasteners used in securing the old V-wheels. You'll also want to grab four new V-wheels from the parts you dumped out of the MK1 EX hardware box.

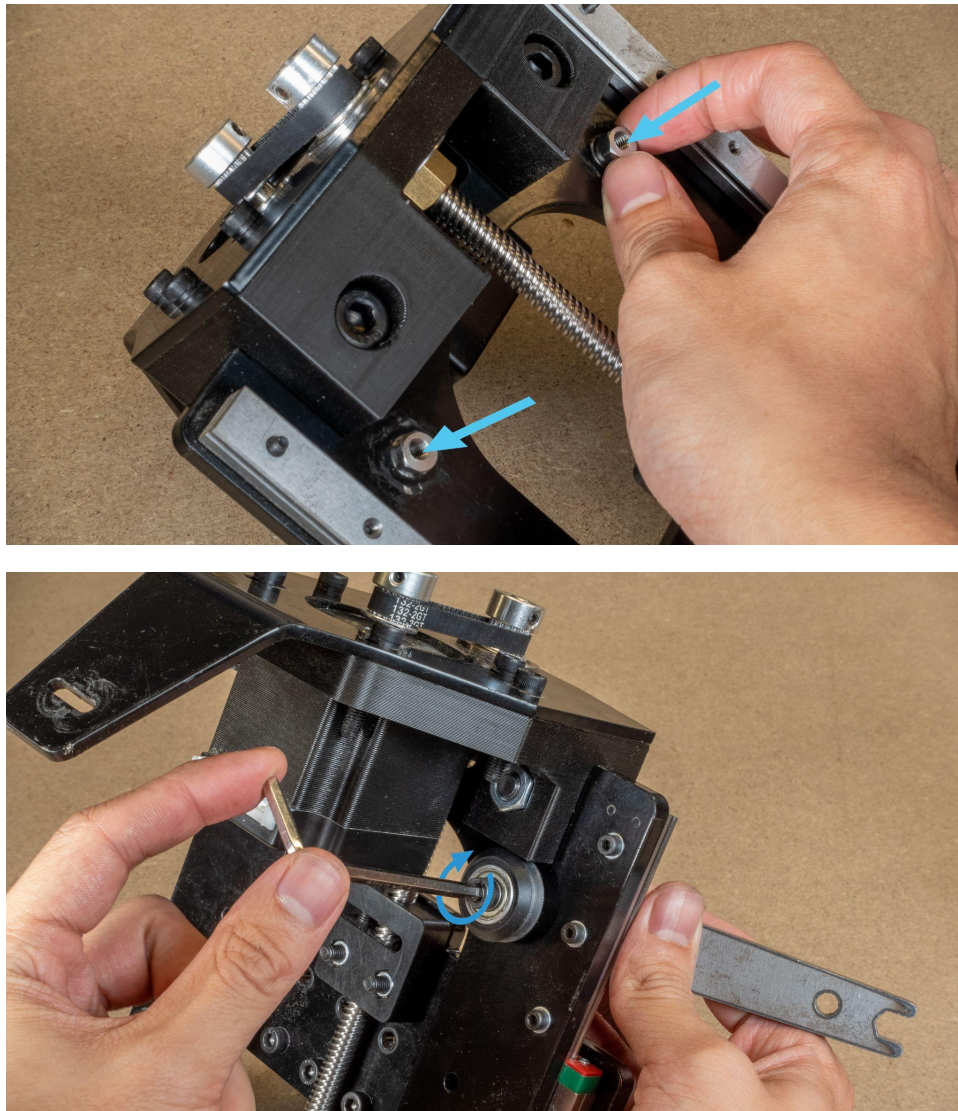
Disassemble each of the eccentric nut / nylock nut sub-assemblies and insert a new v-wheel alongside a washer onto each bolt.



Secure two of the four v-wheel assemblies onto the XZ-gantry with nylock nuts as shown.

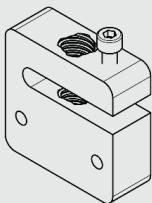


Install the two remaining v-wheel assemblies at the top of the gantry – except this time, use two eccentric nuts. When placing the eccentric nuts inside the gantry holes, ensure the inner holes of the nuts are oriented towards the top so that the V-wheels will be at their most ‘loose’ position.

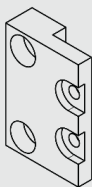


New anti-backlash nuts

Parts Needed:



EX Delrin Anti-Backlash
Block



MK1 Delrin Nut Adapter



M5-25mm SEMS Bolt

x4



x4

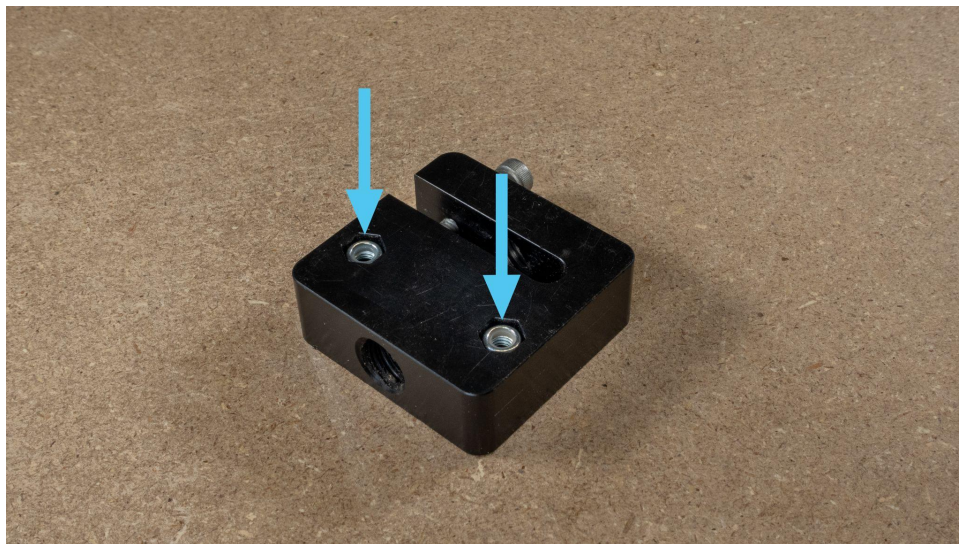
M5-Nylock Nut

You'll want to take out the **EX Hardware Box** and grab the "EX Delrin anti-backlash block" from the box. This is the only part we will need to get from this box for the time being so you can put the box away once you've found the anti-backlash block.

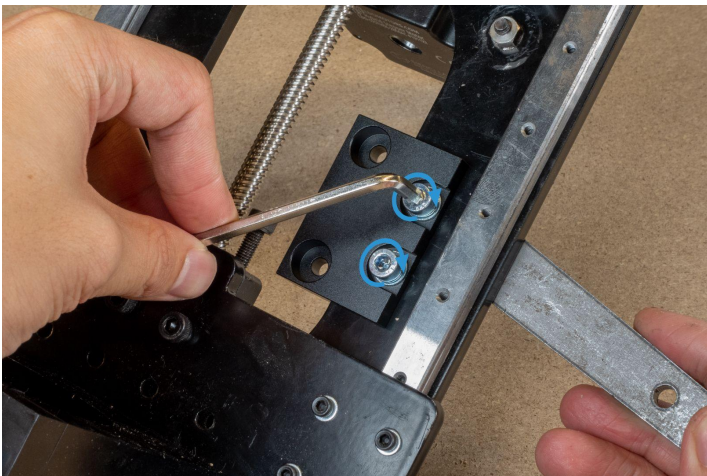
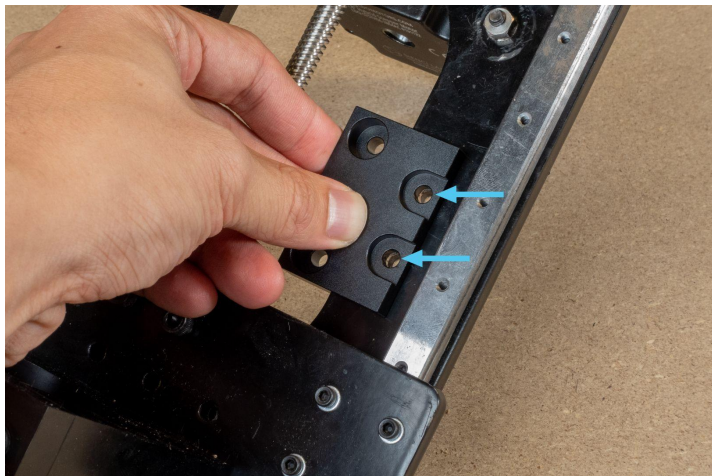


Returning to the pile of parts from the **MK1 EX hardware box**, grab two M5-nylock nuts and press them into the hexagonal cutouts in the plastic block. You can then set aside the partially assembled anti-backlash nut.

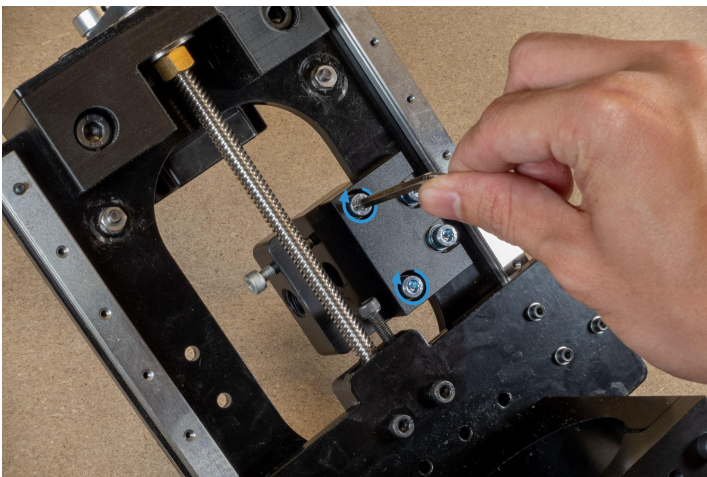
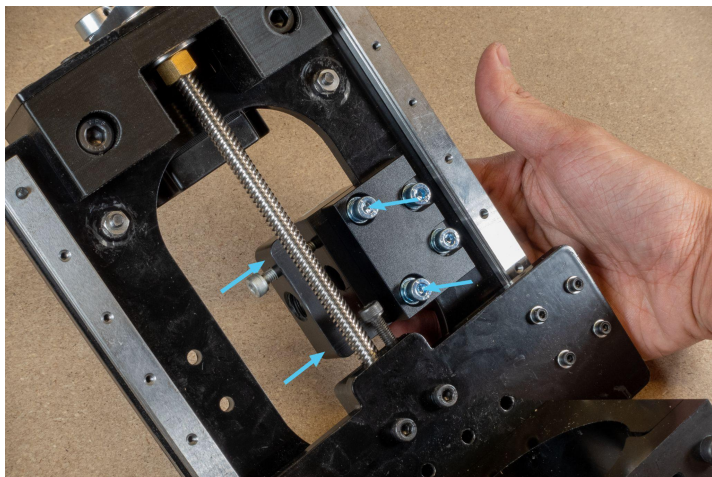
Note: The M5 nuts and bolts used in this step may be packaged together with the "MK1 Delrin nut adapter"



Next, grab the “MK1 Delrin nut adapter” and secure it onto the XZ gantry we have taken off earlier using two M5-25mm bolts and two M5-Nylock nuts as shown.



Lastly, loosely secure the Delrin anti-backlash nut we have assembled earlier to the Delrin nut adapter using the two remaining M5-25mm bolts. Do not over tighten these bolts as this will prevent the Delrin nut from self-aligning to the lead screw once installed.



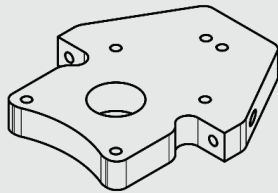
The XZ-Gantry is now ready to be reinstalled on the new X-axis rail. For now however, you can put the assembly away until it is called for in the next section.

Note: This section only applies if you have purchased the MK2 XZ Gantry upgrade. You can directly proceed to the section titled [Y-axis assembly](#) if you are reusing the MK1 XZ gantry.

Z-axis motor mount

With the disassembly out of the way, let's continue on to the overall XZ-axis assembly. First you will want to lay out all the parts from the **MK1 EX (+XZ) Hardware Box** in front of you, as almost everything you need to assemble the new XZ-gantry will be from this box unless otherwise specified.

Parts Needed:



Z-axis Motor Mount



608ZZ Flange Bearing

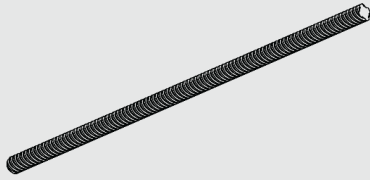
Grab the Z-axis motor mount and two flange bearings from the pile of parts.

Press the bearings into both sides of the bore on the Z-axis motor mount. You should be able to assemble these easily with your thumbs.

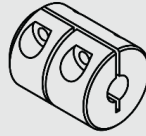


Z-axis mount sub-assembly

Parts Needed:



200mm Lead Screw



6.35mm to 8mm Coupler

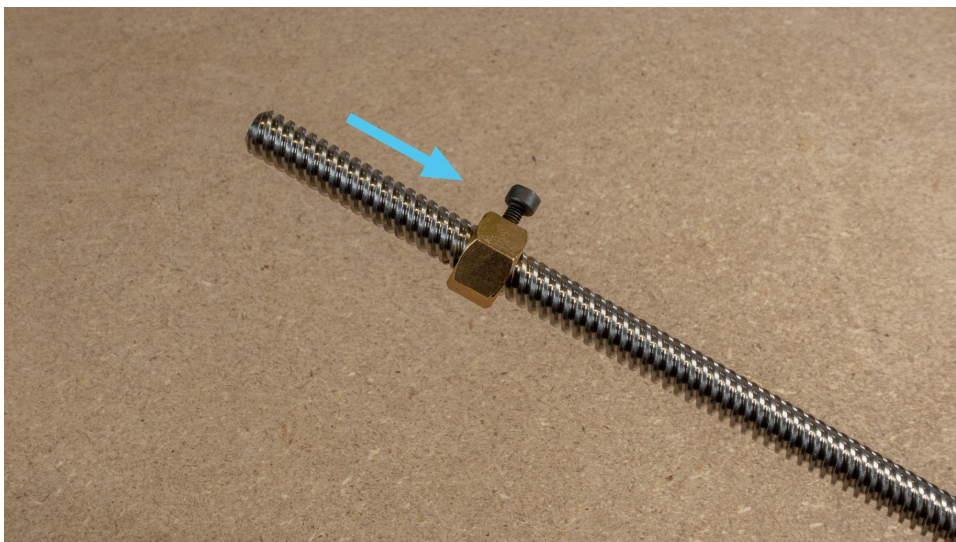


Locking ACME Nut w/
Set Screw

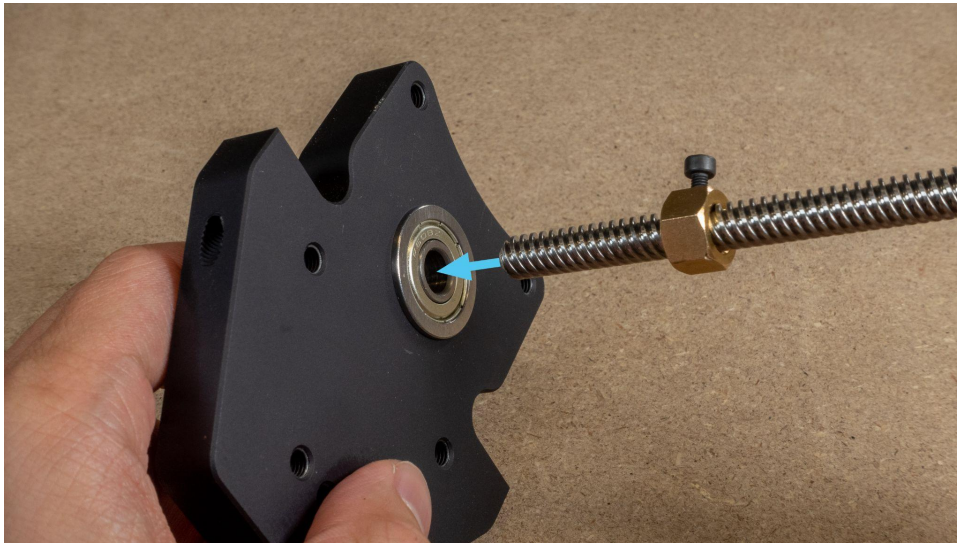
Next, find the brass ACME nut and the small set screw it is packaged with. Loosely thread this set screw into the ACME nut by about 2 turns.



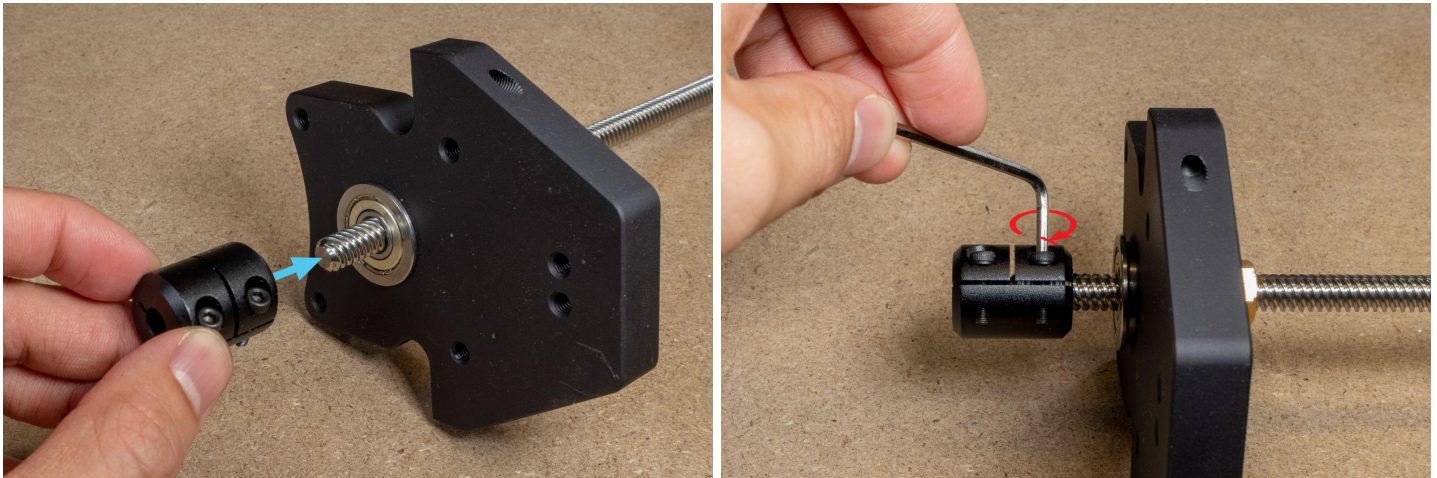
Locate the 200mm lead screw in the pile of parts and thread the ACME nut we just assembled a few inches onto the lead screw.



Next, slide the short end of the lead screw through the bearings on the Z-axis motor mount.



Grab the coupler and identify the end with the larger hole – this will be the side that fits onto the lead screw. Push the coupler onto the leadscrew until it bottoms out, then tighten the ‘lead screw side’ set screw using an M3 Allen key.

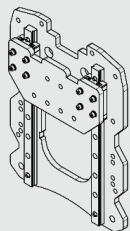


Now rotate the coupler and ACME nut in opposite directions so that they come together to clamp onto the two bearings. Once in this position, tighten the set screw on the locking ACME nut. If assembled properly, this should now feel like a solid, single piece where the lead screw should only be allowed to rotate, and not slide in-and-out. Set this assembly aside for now.



XZ-axis gantry sub-assembly

Parts Needed:



MK2 XZ Gantry



x4

V-wheel



x4

M5-25mm Bolt



x2

Eccentric Nut



x2

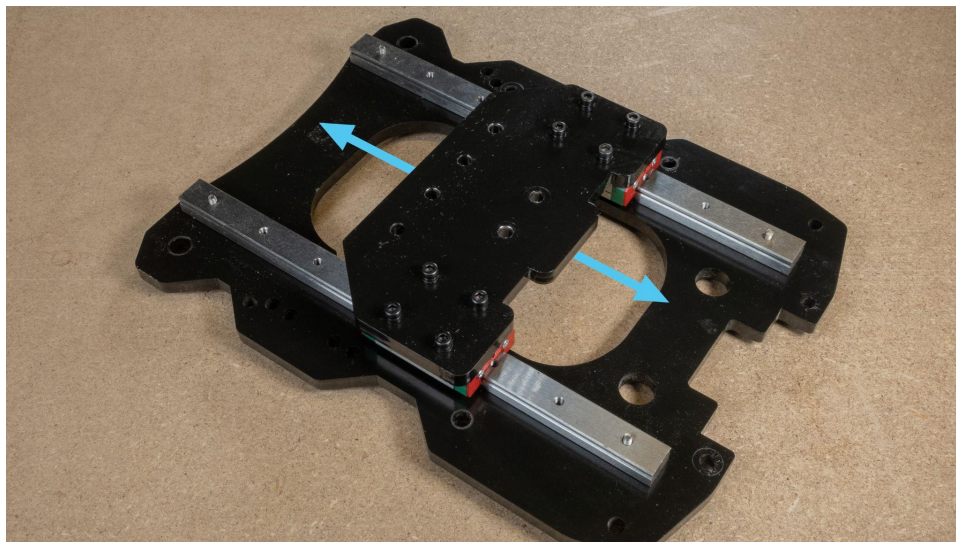
M5-Nylock Nut



x4

M5 Washer

You should now find the XZ-gantry assembly, it is cardboard wrapped and rests next to the x-axis rail in the original packaging. Once you unwrap it, check the movement of the Z-gantry by moving it up and down with your hand. The motion should be smooth, and there should not be any binding.



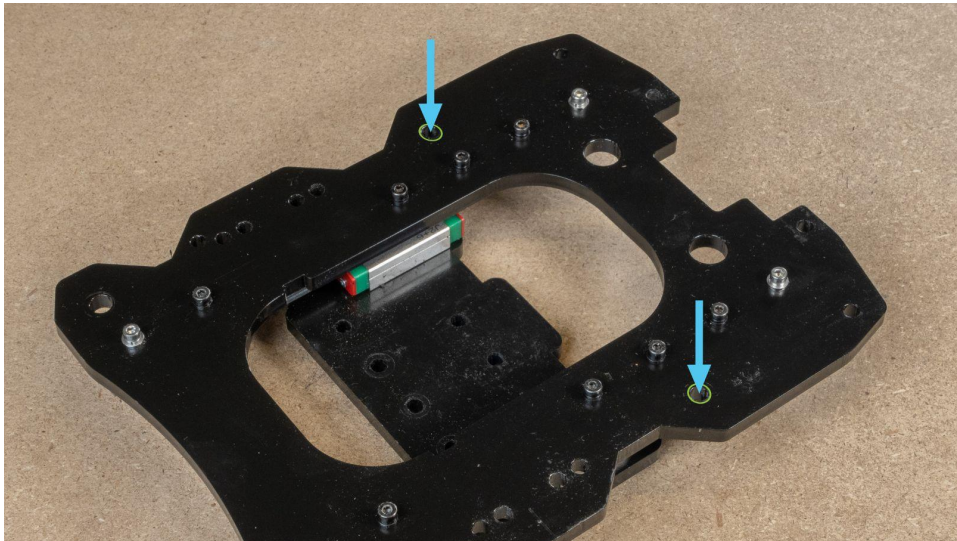
Next, grab the 'M5 washers', 'M5-25mm bolts' and the 'Delrin V-wheels' from the pile of parts. If the v-wheels have an off-centered ring in the middle (pictured), use the small Allen key to move the ring back to the center.



Insert a bolt into each of the four v-wheels along with a washer on the other end.



Install two of the v-wheel assemblies onto the XZ-gantry assembly with two M5-nylock nuts as shown.

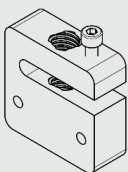


Install two v-wheel assemblies at the bottom edge of the gantry – except this time, use two eccentric nuts. When placing the eccentric nuts inside the gantry holes, ensure the inner holes of the nuts are oriented towards the bottom edge of the gantry so that the V-wheels are at their 'loose' position.

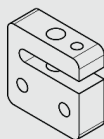


Attaching anti-backlash nuts

Parts Needed:



EX Delrin Anti-Backlash
Block



Derlin Anti-Backlash
Block



x4

M5-25mm Bolt



M5-16mm Bolt



x4

M5-Nylock Nut

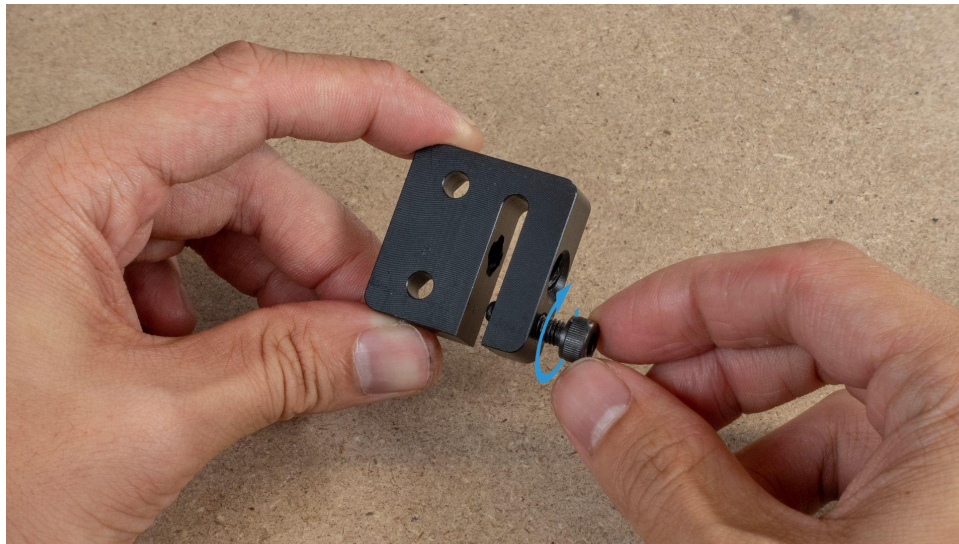
You'll want to take out the **EX Hardware Box** and grab the "EX Delrin anti-backlash block". This is the only part you'll need to get from this box for the time being so you can put the box away once you've found this EX Delrin anti-backlash block.



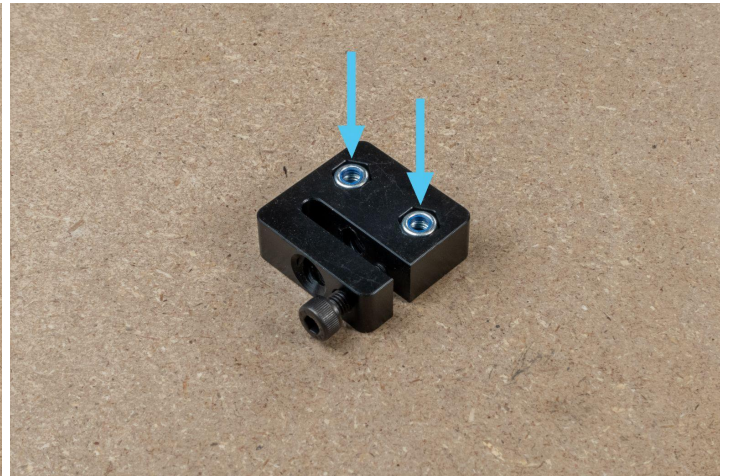
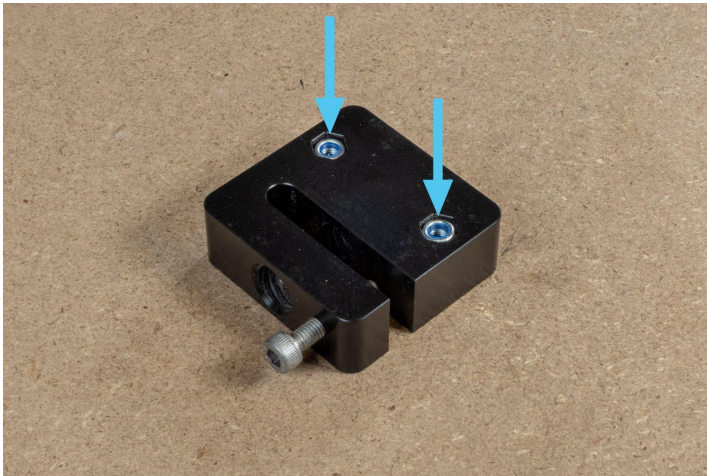
Next, return to the parts from the **MK1 EX + XZ Hardware Box** and grab the smaller "Delrin anti-backlash block", this block does not have the "EX" prefix and is considerably smaller in size.



Unlike the larger delrin block, the tensioning bolt may not come attached to the smaller delrin block. If that is the case, you will have to lightly thread the M5-16mm bolt onto the block as shown. Make sure not to tighten the bolt so it is in tension - leave this loose as this will be tensioned later on.



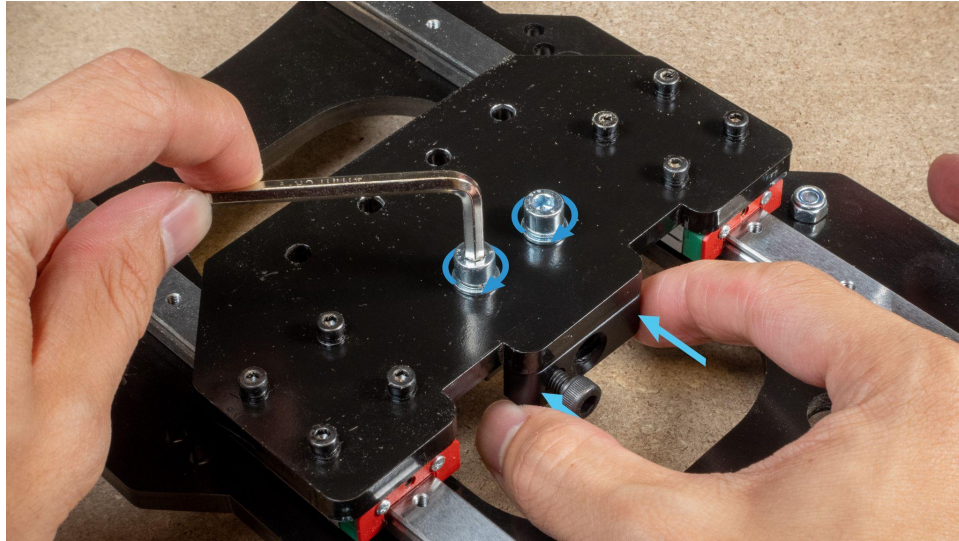
Now grab two M5-nylock nuts and press them into the hexagonal cutouts in one of the anti-backlash blocks, then repeat the same for the other block.



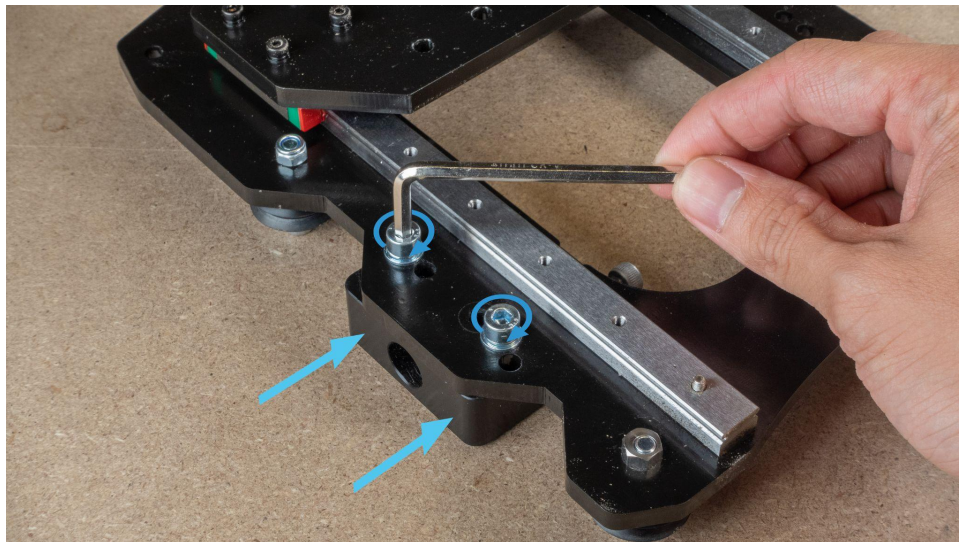
Although entirely optional, we recommend that you cover the nylock nuts with some tape to prevent them from falling out later in the assembly. If the nylock nuts fit tight within the cutouts, this is not necessary.



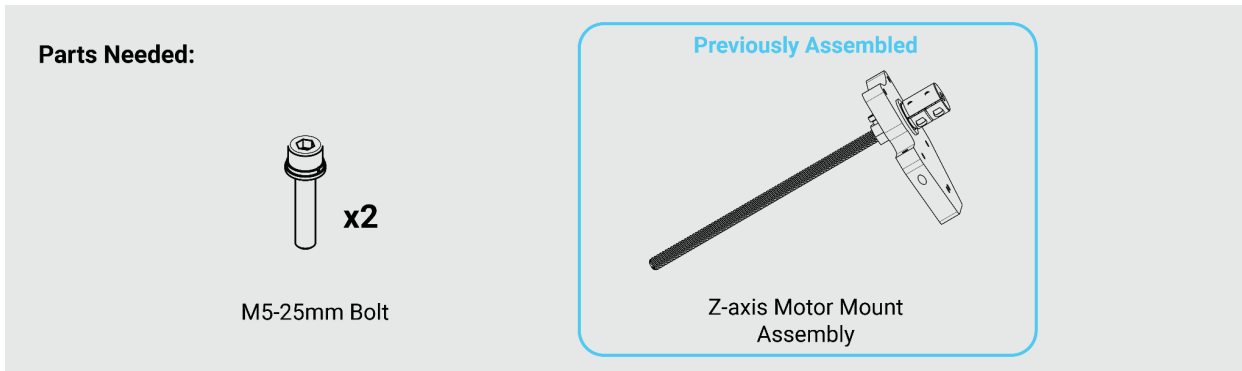
Using two M5-25mm bolts, loosely attach the **smaller Delrin anti-backlash block** to the back of the sliding Z-gantry. Make sure to use the two holes near the notch on the gantry and pay attention to the orientation of the tensioning screw.



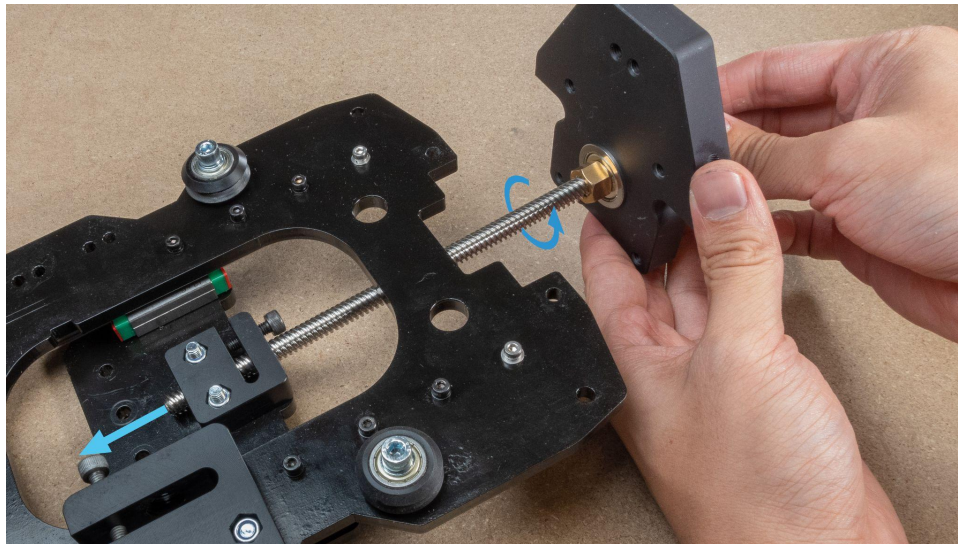
Using another two M5-25mm bolts, loosely attach the **larger Delrin anti-backlash nut** to the back of the X-gantry, again paying extra attention to the orientation of the tensioning screw which faces inwards.



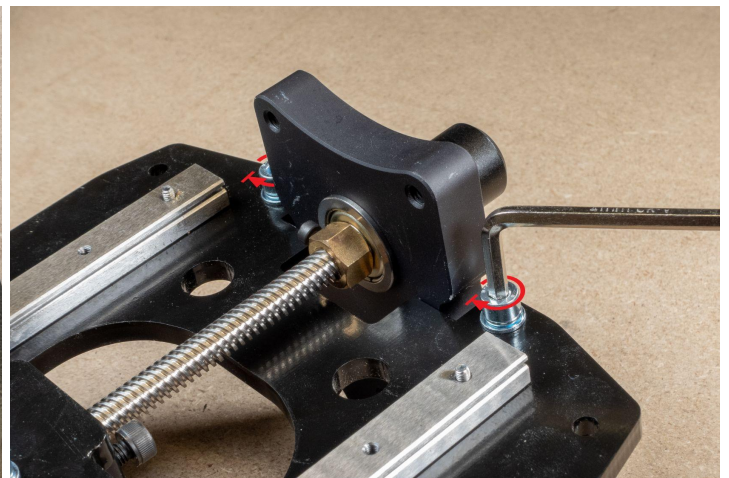
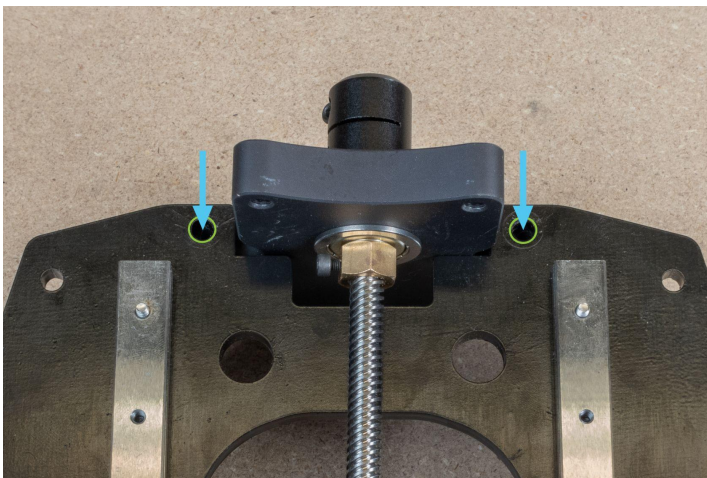
Connecting the sub-assemblies



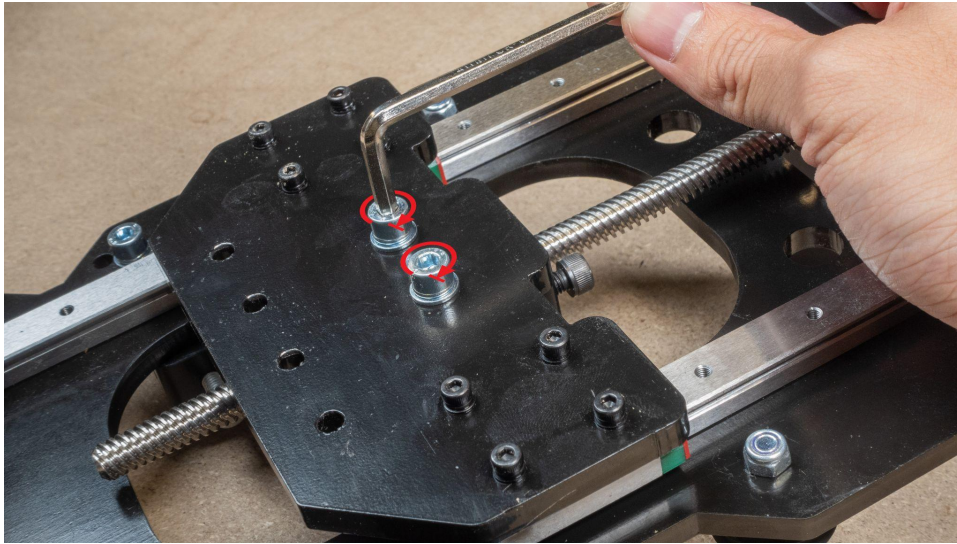
Slide the Z-axis motor mount onto the XZ-gantry assembly, checking that the orientation is correct (pictured). Thread the lead screw into the Z-gantry anti-backlash block between the two steel plates.



Fasten two M5-25mm bolts on both sides of the Z-axis motor mount to secure the two assemblies together.

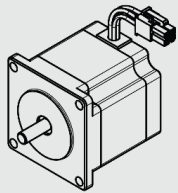


With everything secured together, you can finish tightening the two bolts holding the Z anti-backlash nut. Alternate making a couple turns onto one bolt and then the other until they're both tightened down. If you twist hard onto just one bolt while the other one is loose it can twist the anti-backlash nut and misalign it to the lead screw.

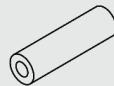


Installing the motor

Parts Needed:

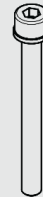


Nema 23 Motor



x4

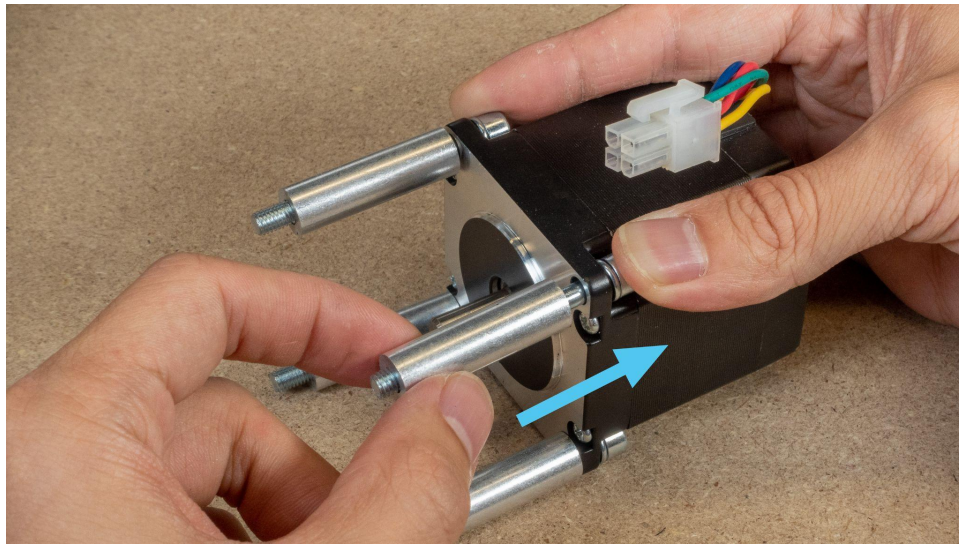
35mm Aluminum Spacer



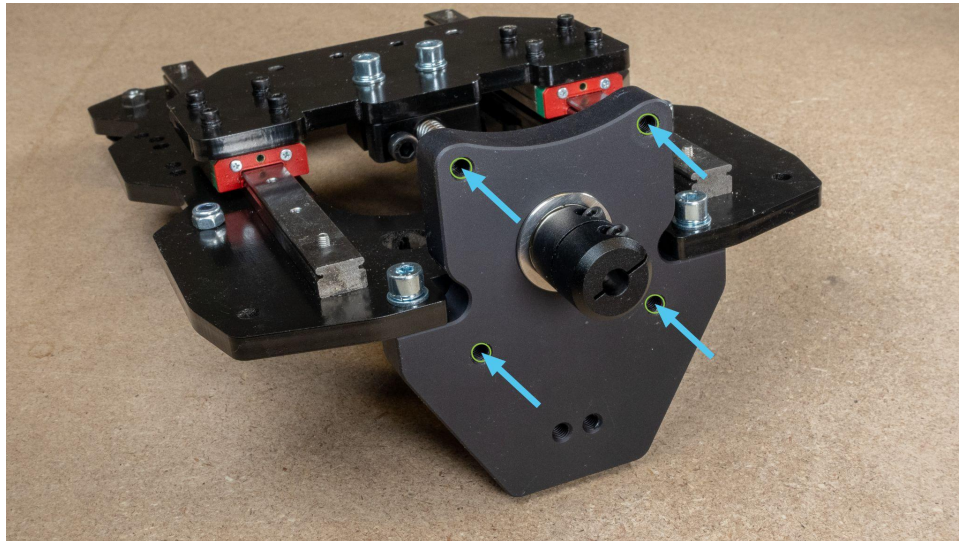
x4

M5-50mm Bolt

Grab the NEMA 23 motor from the parts pile of the MK1 +XZ hardware box and insert four M5-50mm bolts into the four holes on the motor along with an aluminum spacer.



Bring the motor assembly to the Z-axis motor mount making sure the motor wire faces backwards. Slide the motor shaft into the coupler, then tighten the four M5-50mm bolts into the motor mount.



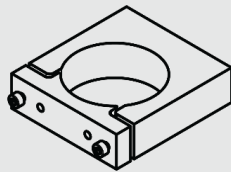
At the coupler, tighten the set screw at the motor side and ensure the lead screw can spin without excessive force.



Re-attaching the router mount

Parts Needed:

Reused From Disassembly



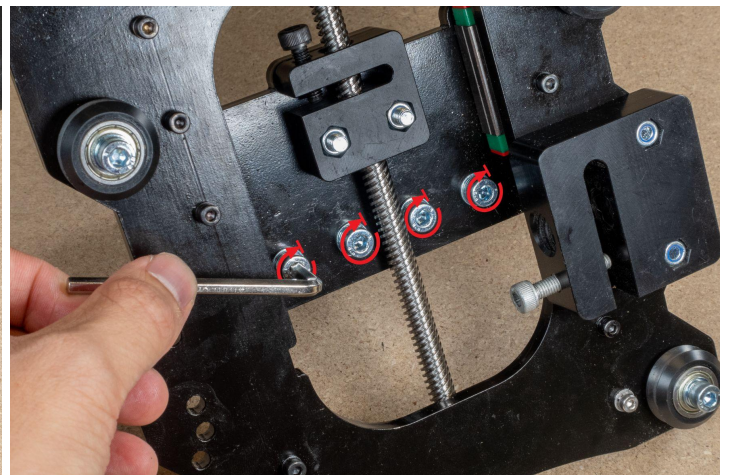
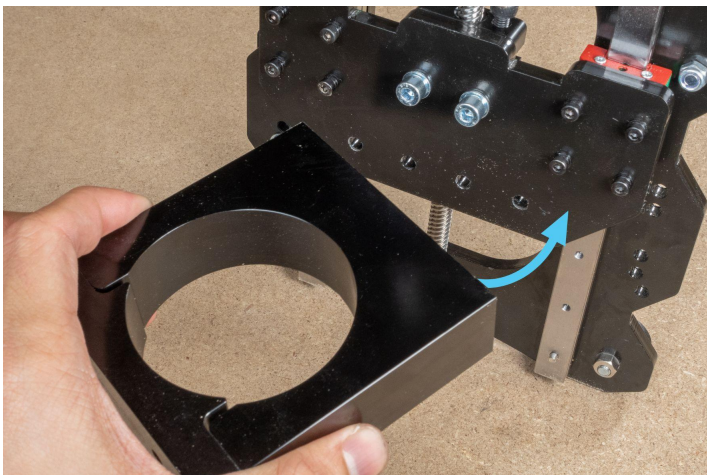
Router Mount



x4

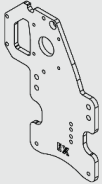
35mm Aluminum Spacer

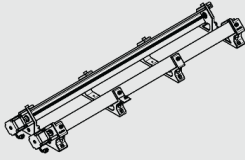
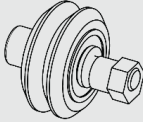
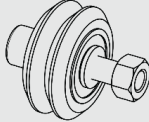
To wrap up the XZ Gantry, grab the router mount you have disassembled earlier and secure it to the XZ-gantry assembly with four M5-25mm bolts. Ensure the bottom of the router mount is flush with the bottom of the Z-gantry.



Y-axis assembly

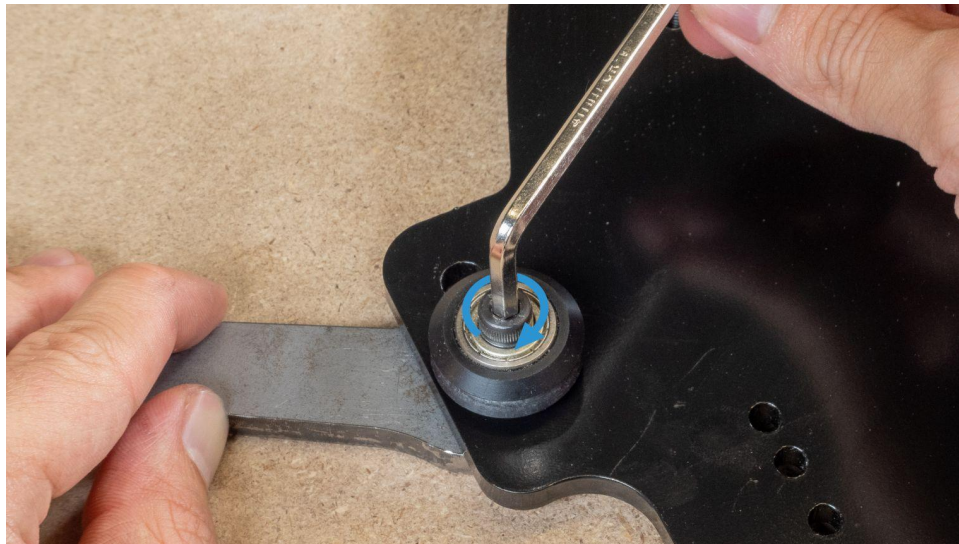
Y-axis gantry

Parts Needed:
**x2**
EX Y-gantry Plate

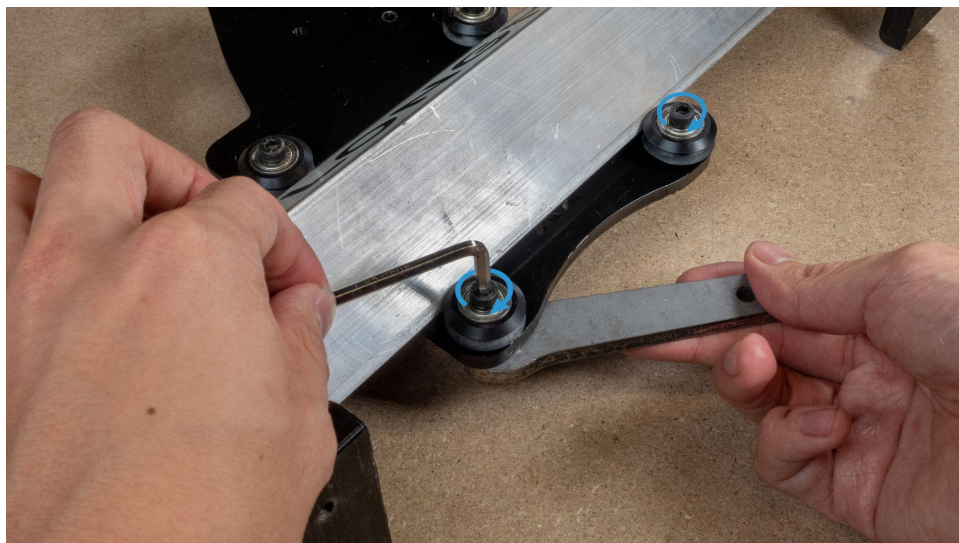
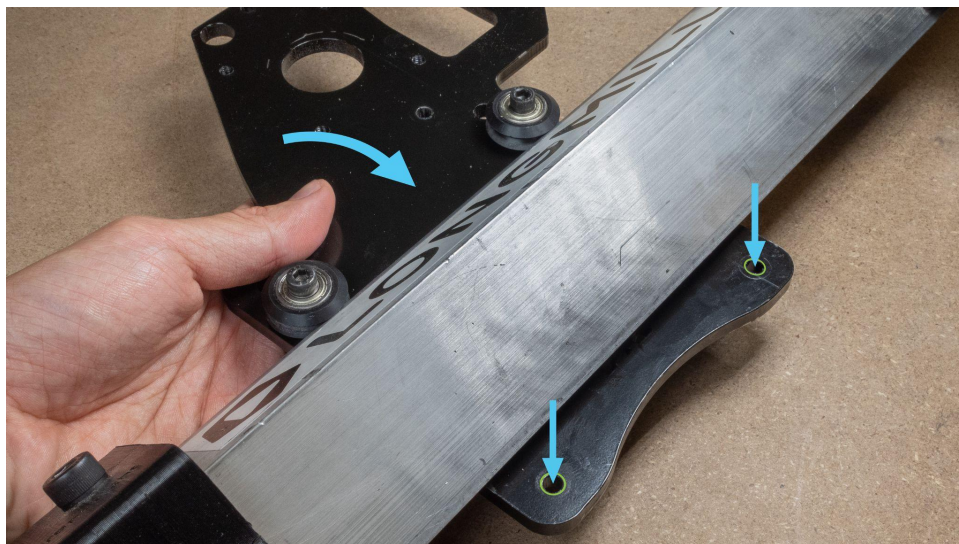
Reused From Disassembly
**Left & Right Y-axis Assemblies**
**x2**
V-wheel Assembly w/
Eccentric Nut
**x2**
V-wheel Assembly w/
M5-Nylock Nut

Grab one of the new Y-gantry plates included in the extension kit marked 'EX', begin installing the V-wheels into the second row of holes in the Y-gantry plate. Make sure the eccentric nuts are rotated so that the V-wheels are in their highest 'open' position to make assembly easier.





Rest the Y-gantry plate onto the right Y-axis rail and install the lower V-wheels into the Y-gantry plate to secure the Y-gantry plate on the rail. Check to make sure the gantries roll/slide easily along the rail.



Mirror the steps above to install the Y-gantry plate onto the left Y-axis rail.

Secure the delrin nuts

Parts Needed:

Reused From Disassembly

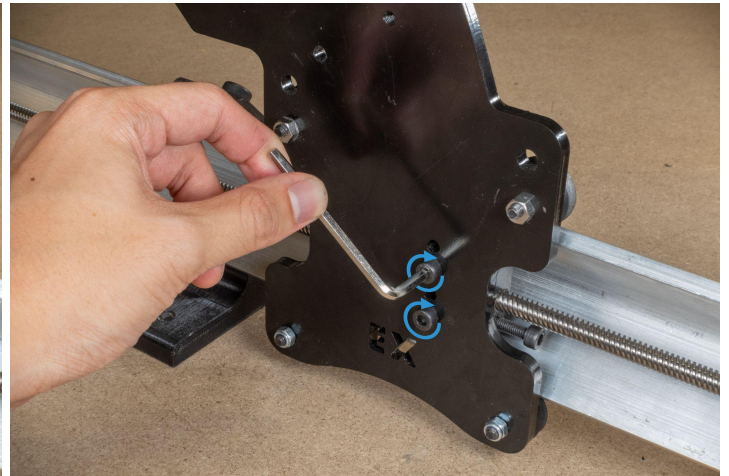
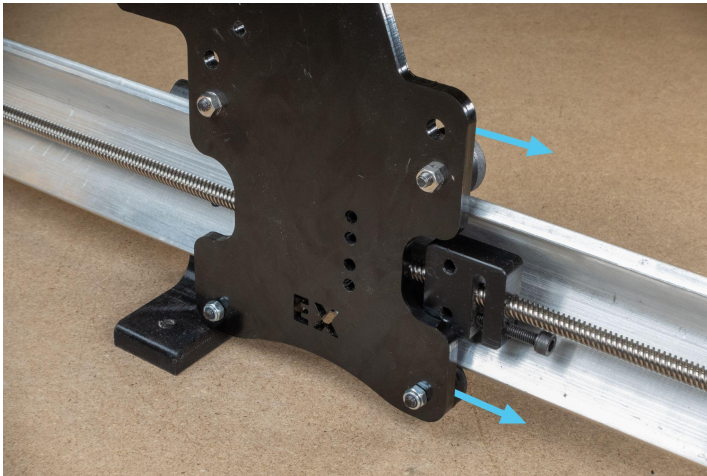


x4

M5-25mm Bolt

Slide the Y-gantries to line up the holes in the plate with the Y-axis delrin nuts. You'll want to use the second and fourth holes from the top.

Fasten the Y-gantry to the delrin nut by using the two M5-25mm bolts removed during disassembly. Only tighten these bolts until snug.

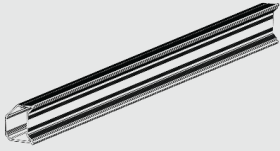


Mirror the steps above to secure the delrin nut on the left y-axis rail

X-axis assembly

X-axis rail

Parts Needed:



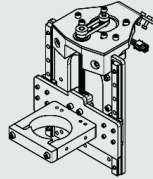
X-axis Rail



x8

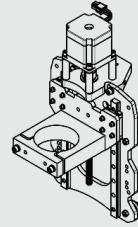
M5-25mm Bolt

If reusing **MK1** XZ Gantry



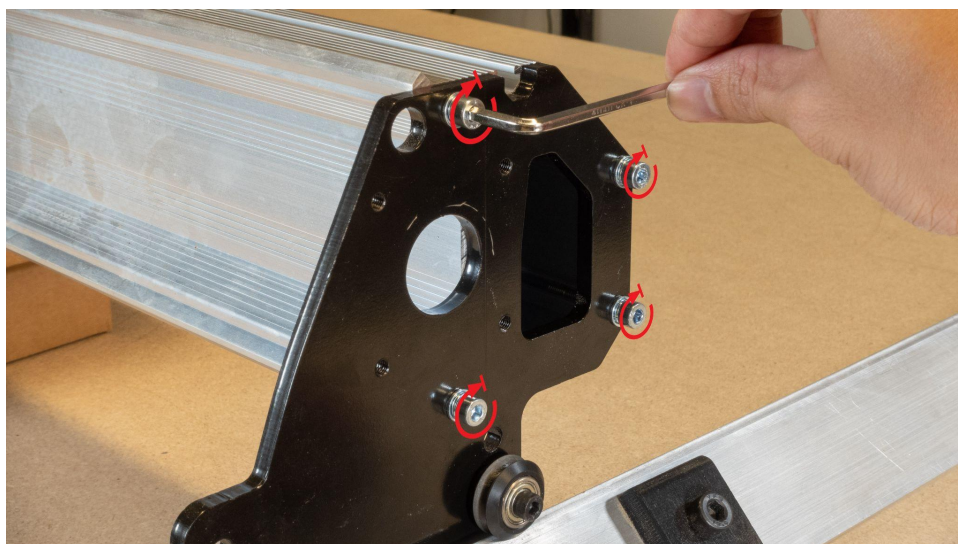
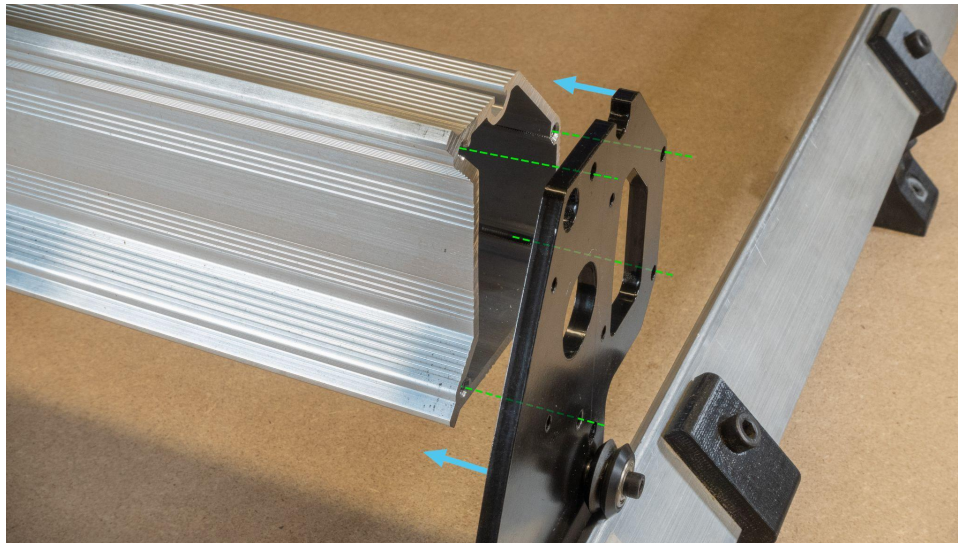
MK1 XZ Gantry Assembly

If using **MK2** XZ Gantry



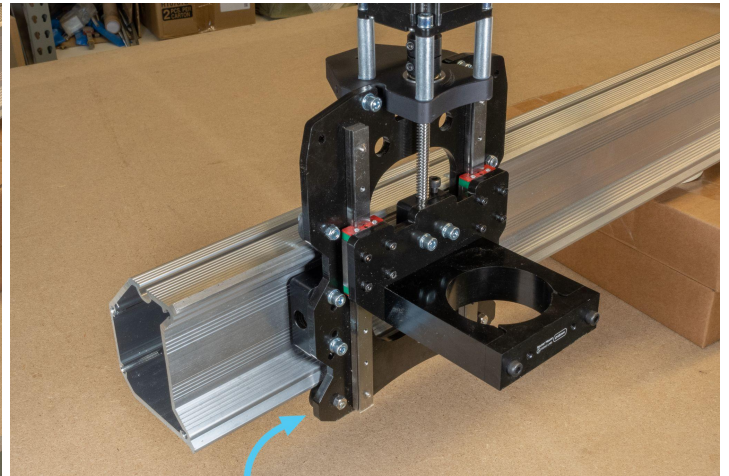
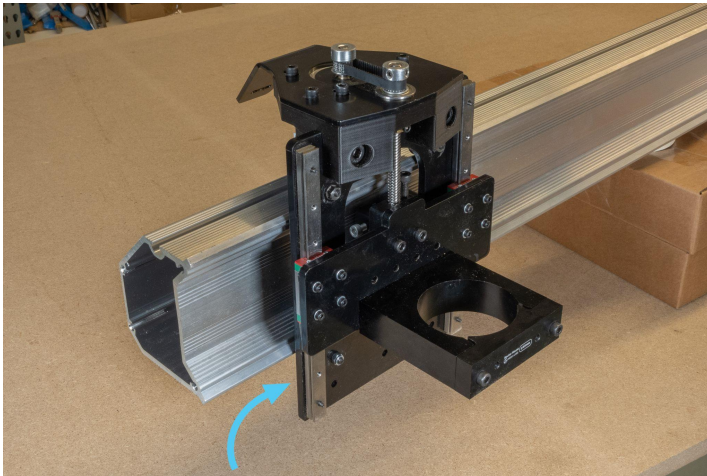
MK2 XZ Gantry Assembly

Lift the right side of the X-axis rail up to meet the matching holes on the right Y-axis gantry plate and bolt these together using four M5-25mm bolts. Optionally, you can place the X-axis rail on top of some packaging boxes so you do not have to lift the rail while installing the bolts.

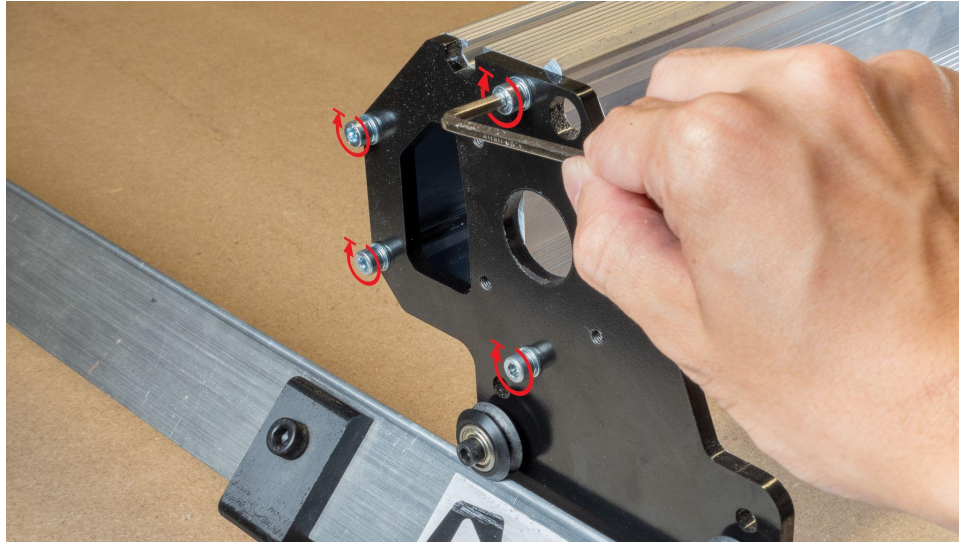




Pick the XZ-gantry that you will use in the assembled machine and slide it onto the X-axis rail. The v-wheels should sit on the pointed edges on each side of the X-axis rail.



To complete the assembly, lift the left side of the X-axis rail up to meet the left Y-gantry assembly and secure them together using the four remaining M5-25mm bolts.



X-axis motor

Parts Needed:



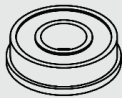
x4

M5-50mm Bolt

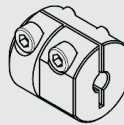


x4

Nylon Washer

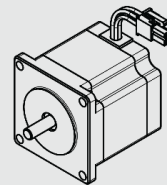


EX Flange Bearing

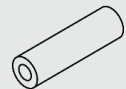


EX Coupler

Reused From Disassembly



Nema 23 Motor



x4

35mm Aluminum
Spacer

Slide the flange bearing into the left Y-axis gantry.



Take the motor coupler and sleeve it onto the motor shaft, you do not need to tighten the bolts on the coupler at this point.



Insert four M5-50mm bolts into the four holes on the motor, alongside an aluminum spacer and a nylon washer.

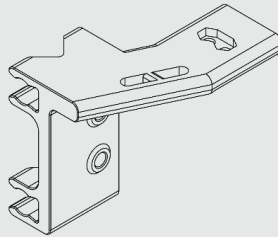


Line the motor assembly up with the corresponding holes in the left Y-axis gantry plate and fasten the four bolts. You should orient the motor so that the connector is facing the back of the machine.



Y-axis drag chain mount

Parts Needed:



MK1 Drag Chain Mount

Grab the Y-axis drag chain mount and clip it onto two of the 35 mm aluminum spaces on the side of the motor connector. You may find it easier to secure the clips one at a time.

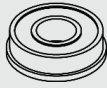


Lead screw

Parts Needed:



EX Lead Screw



EX Flange Bearing



EX ACME Locking
Hex Nut

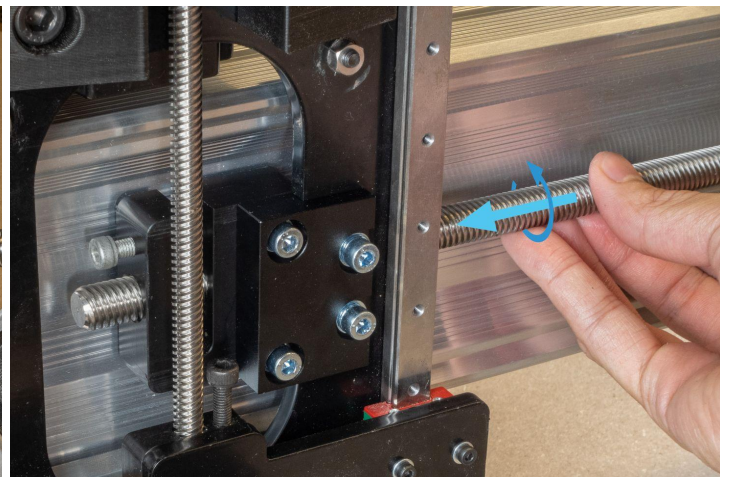
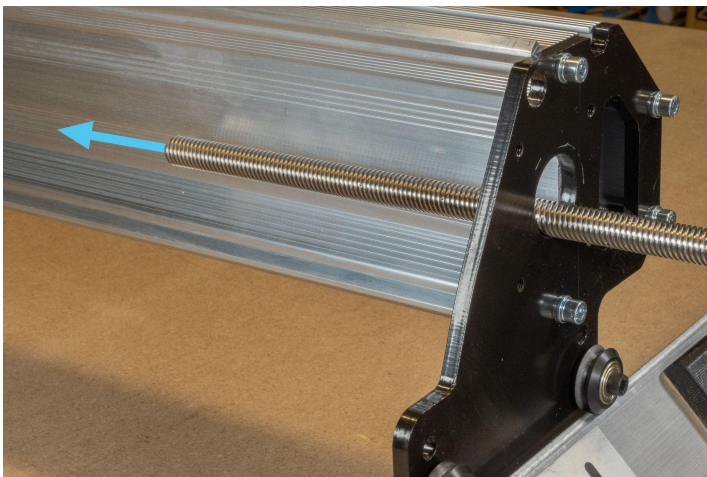


M5-16mm Bolt

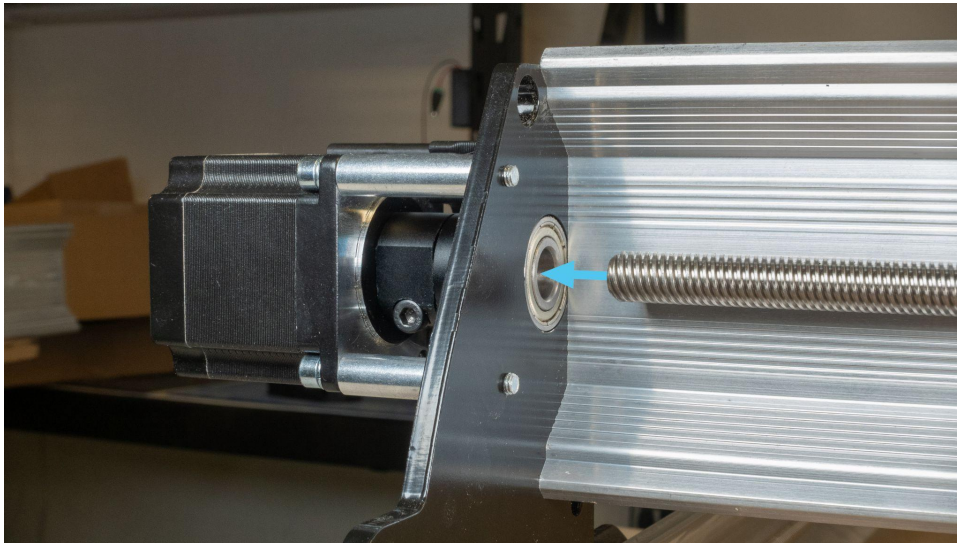
Lightly thread the M5-16mm bolt onto the side of the EX ACME locking nut. We will tighten this screw later.



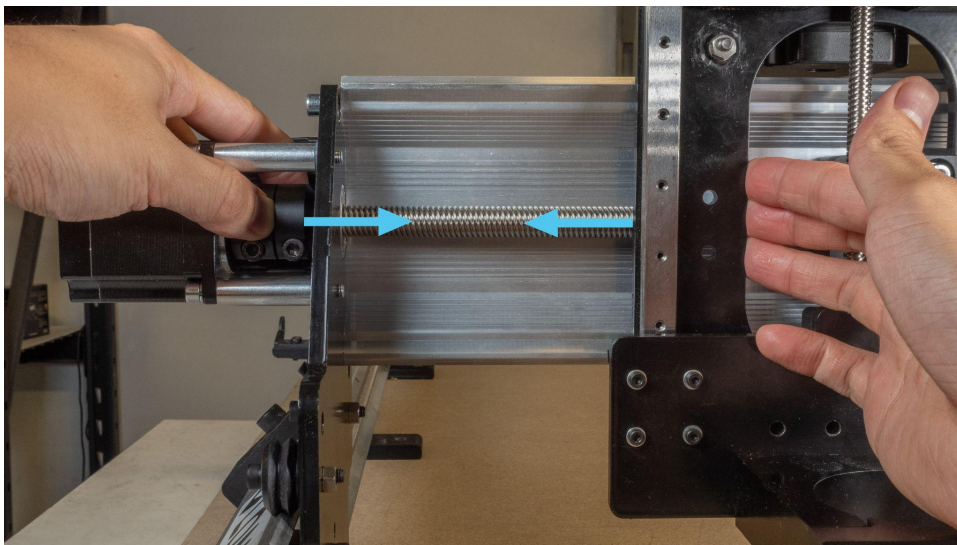
Pass the EX lead screw through the opening in the right Y-axis gantry plate and thread it through the anti-backlash block behind the XZ gantry.



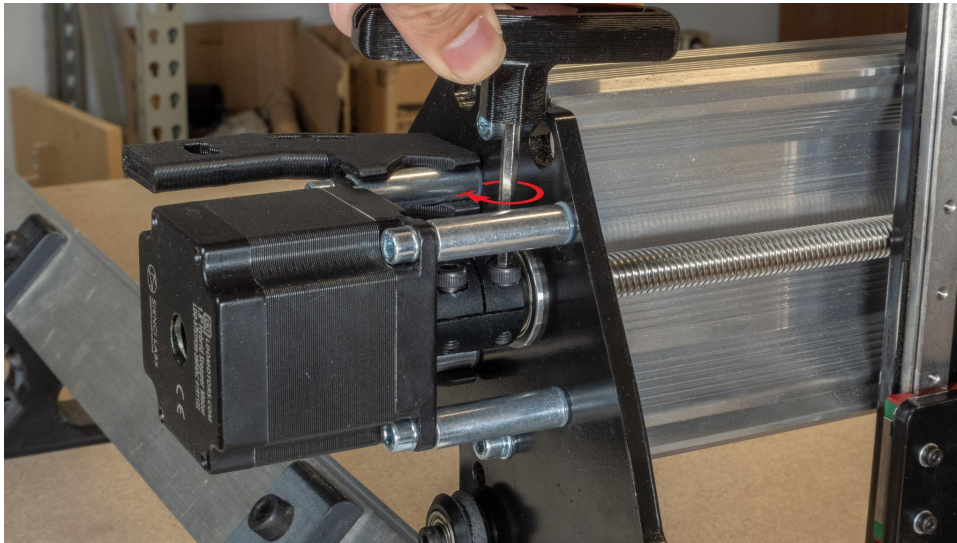
Pass the leadscrew through the left flange bearing and into the motor coupler.



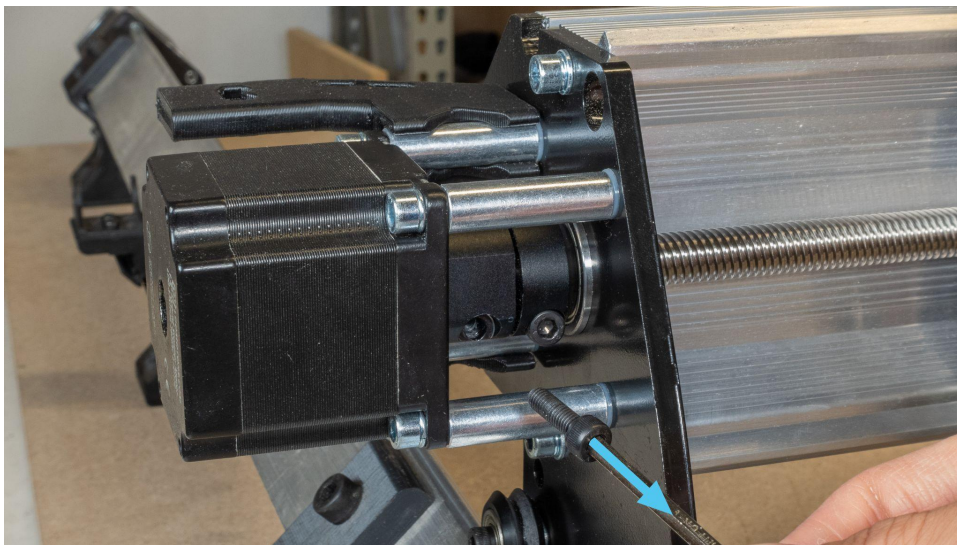
Push the coupler towards the right, and the X-gantry towards the left to ensure the lead screw is seated properly inside the coupler.



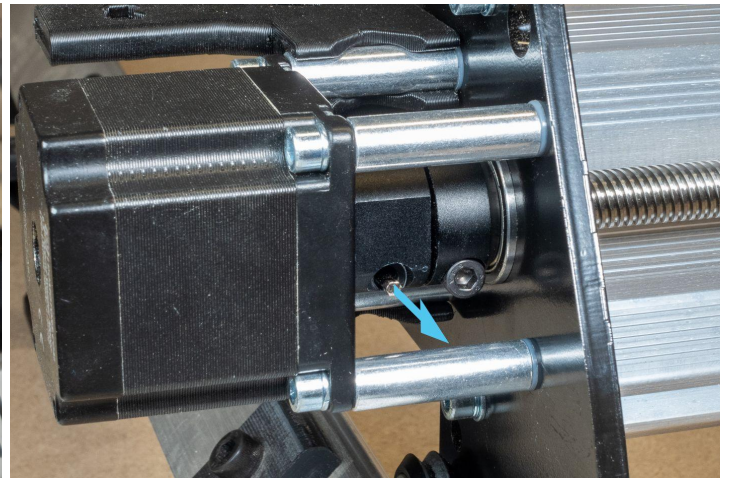
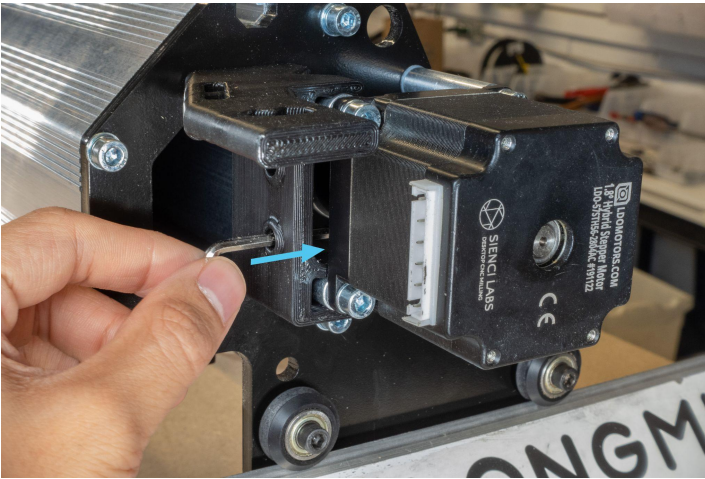
Tighten the motor coupler onto the leadscrew. This screw must be very tight.



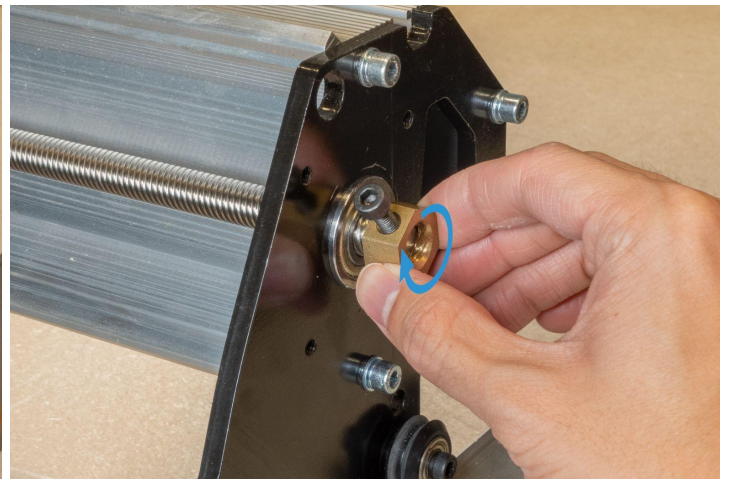
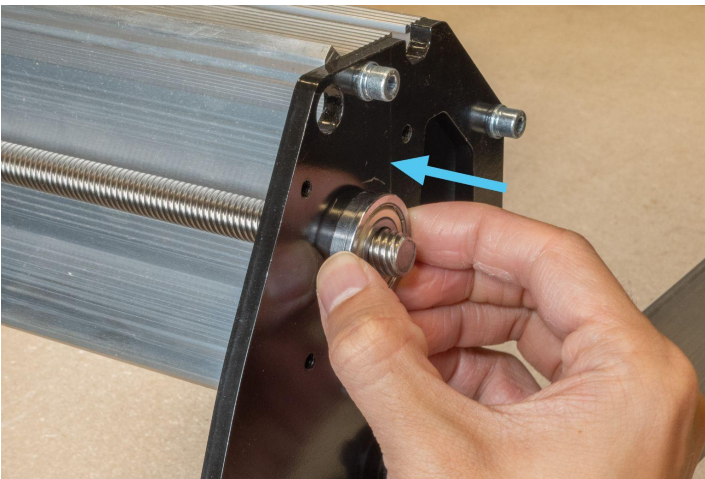
Remove the screw from the other end of the coupler, then turn the lead screw so that the screw hole on the coupler lines up with one of the holes in the 3D printed Y-axis drag chain holder.



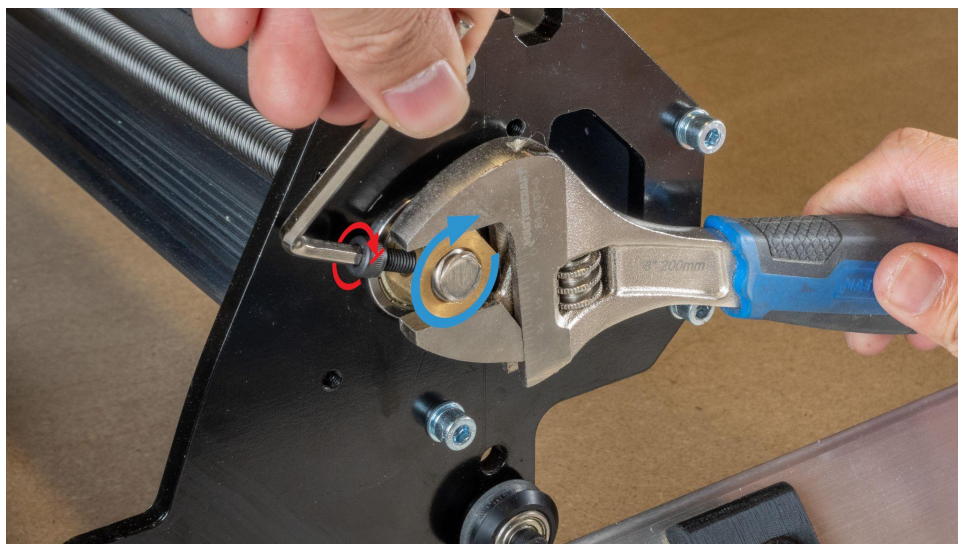
Insert a small screwdriver, allen key or bolt through one of the holes in the drag chain holder and into the motor coupler. This will prevent the lead screw from rotating and allow for easier installation of the ACME locking hex nut on the opposite side.



At the opposite side of the lead screw on the right Y-gantry plate, slide a flange bearing over the lead screw and into the Y-gantry plate, then begin threading on the brass ACME locking nut.



Tighten this ACME nut only until the lead screw no longer has any side-to-side play. Then tighten the M5 locking bolt to lock the ACME nut in place



Turn the lead screw by hand afterwards to make sure it spins freely. If you feel any significant resistance, loosen the brass ACME locking hex nut slightly.

Remove any screwdrivers, allen keys, or bolts from the coupler on the opposite side to allow the coupler and lead screw to freely rotate. Then reinstall the M5-16mm bolt into the motor side of the coupler and tighten this using the allen key handle - this should be tightened very tight.



Drag chain and wiring installation

MK2 XZ

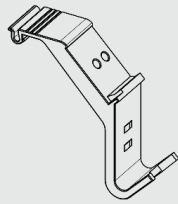
This section does not apply to you if you have purchased the MK2 XZ upgrade and you can skip to the section titled [MK2 XZ - Drag chain and wiring installation](#).

X Axis drag chain mounts

Parts Needed:



1400mm Drag Chain



x2

MK1 Cable Hanger



x4

M4-12mm Bolt



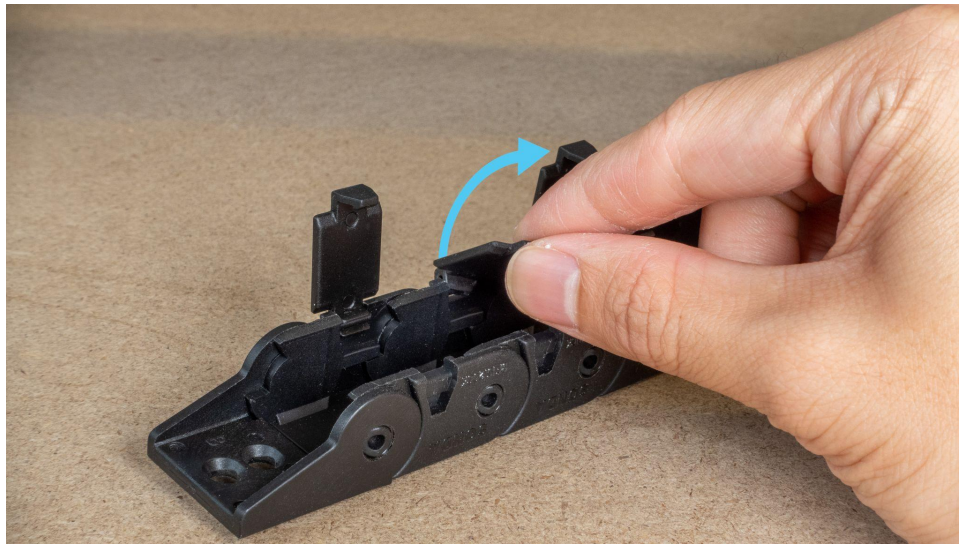
x4

M5-16mm Bolt

Unclip all the drag chain clips using a flat head screwdriver or anything else sharp like a wood screw.



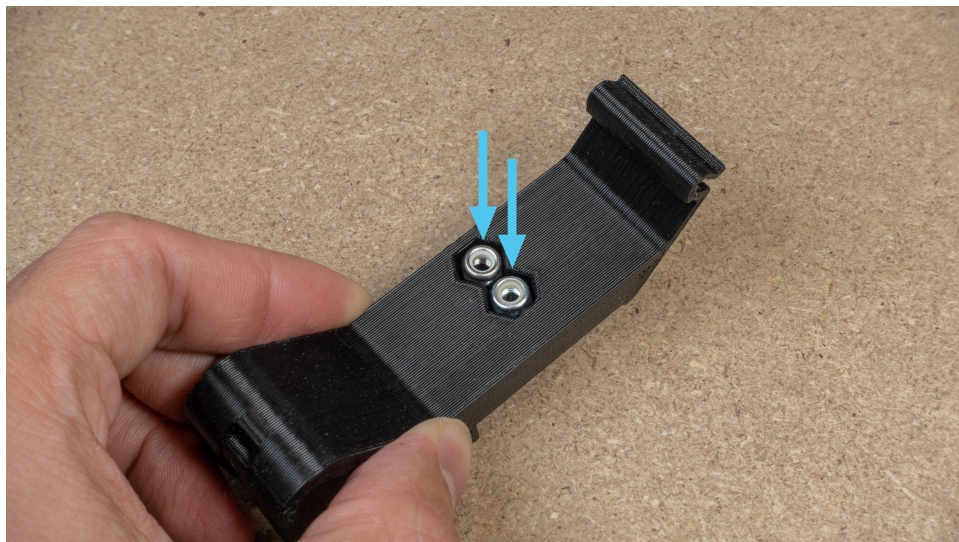
We recommend permanently removing every other clip if you plan on adding more wiring in the future



Remove the end links from the drag chain.



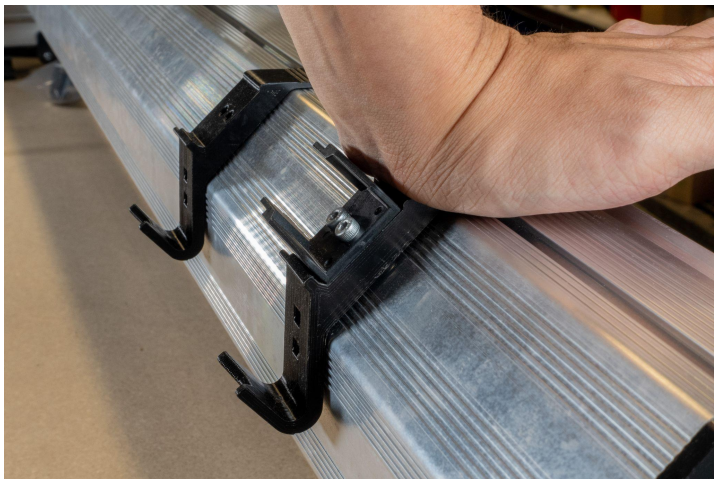
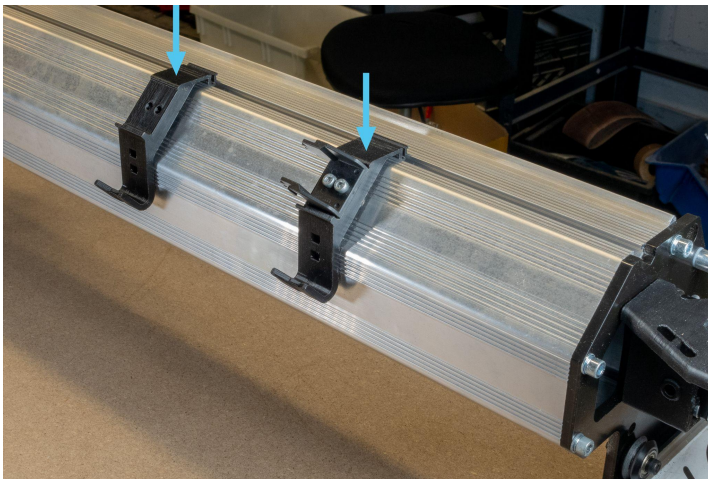
Grab one of the two 3D printed cable hangers and place two nylock nuts into the nut traps located at the back. The cable hangers are named such because they will also be used to organize excess wires at a later step.



Secure the pin type end-link to this cable hanger using two M4-12mm bolts as shown.



Position the cable hanger with end-link about 6" away from the left edge of the X-rail, and the second cable hanger about 6" away from the first. You can then clip both hangers in place by applying downward pressure using your palm.

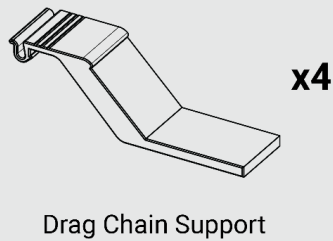


Lastly, secure the hole type end-link to the flange of the XZ gantry using two M4-12mm bolts and nylock nuts.

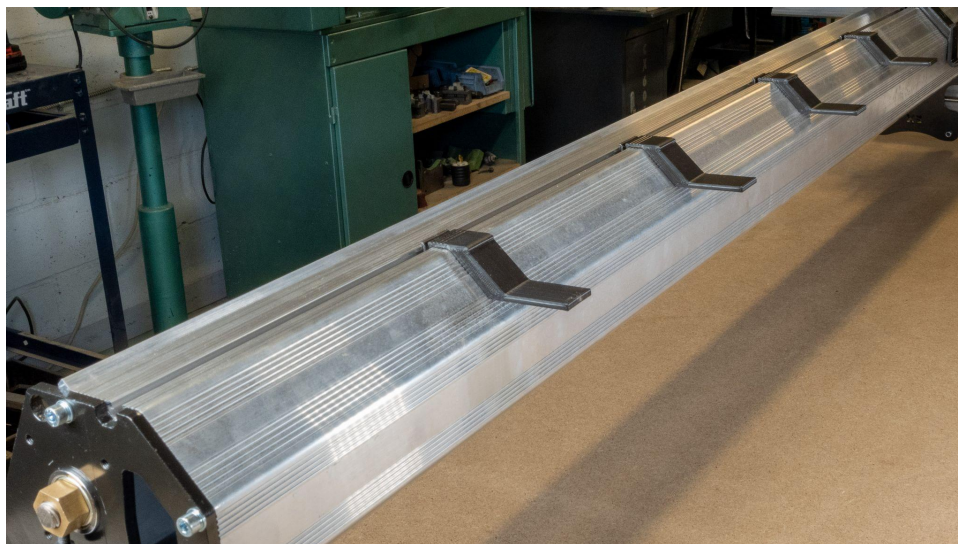


X Axis drag chain support

Parts Needed:



Space the 4 drag chain support clips approximately 10" apart from one another towards the right of the X-rail and snap them in place. These clips will prevent the longer 1400mm drag chain from dropping when installed.



Y Axis drag chain mount

Note: If you are running out of M4-12mm bolts and nuts from the extension kit, you can substitute these fasteners using ones taken off the Y-axis drag chain end link during disassembly.

Parts Needed:



x2

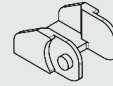
M4-12mm Bolt



x2

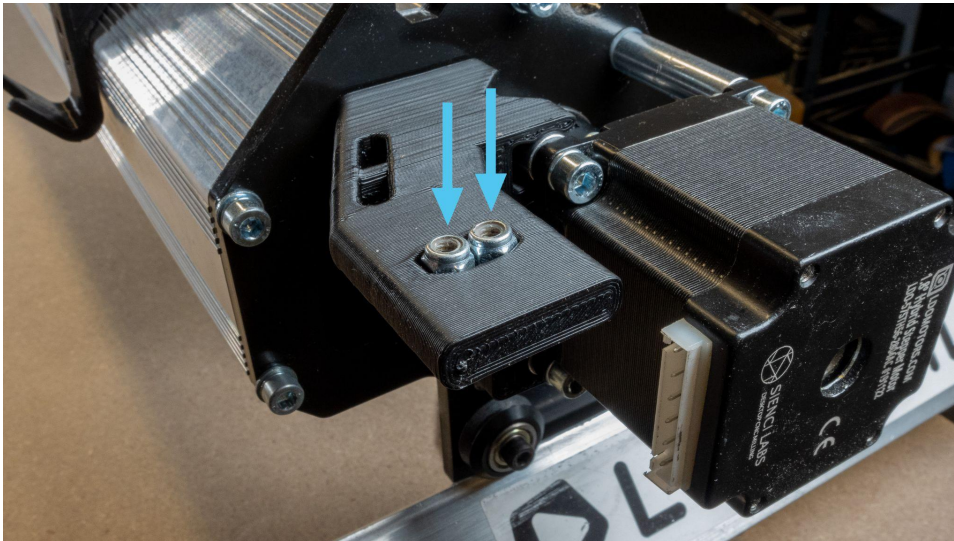
M4-Nylock Nut

Reused From Disassembly

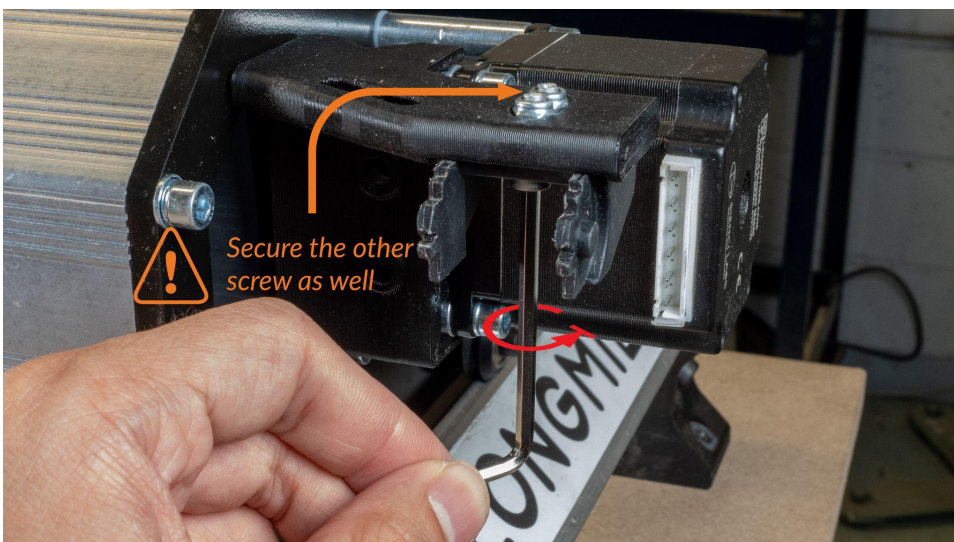


Y-axis Drag Chain End Link

Insert the two nylock nuts into the corresponding nut traps in the 3D printed drag chain mount.

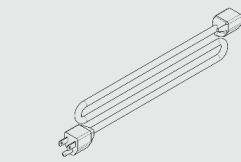


Secure the pin type end-link to the drag chain mount using the two M4-12mm bolts.

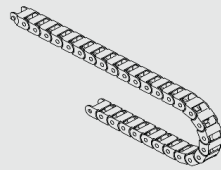


Wiring

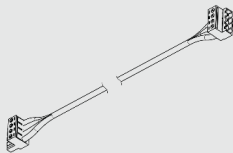
Parts Needed:



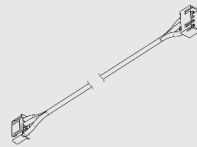
Router Power Cable Extension



1400mm Drag Chain

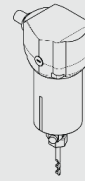


Motor Cable Extension

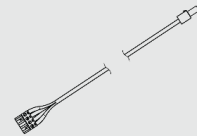


Limit Switch Cable Extension (If Applicable)

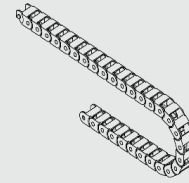
Reused From Disassembly



Router



Motor Cable

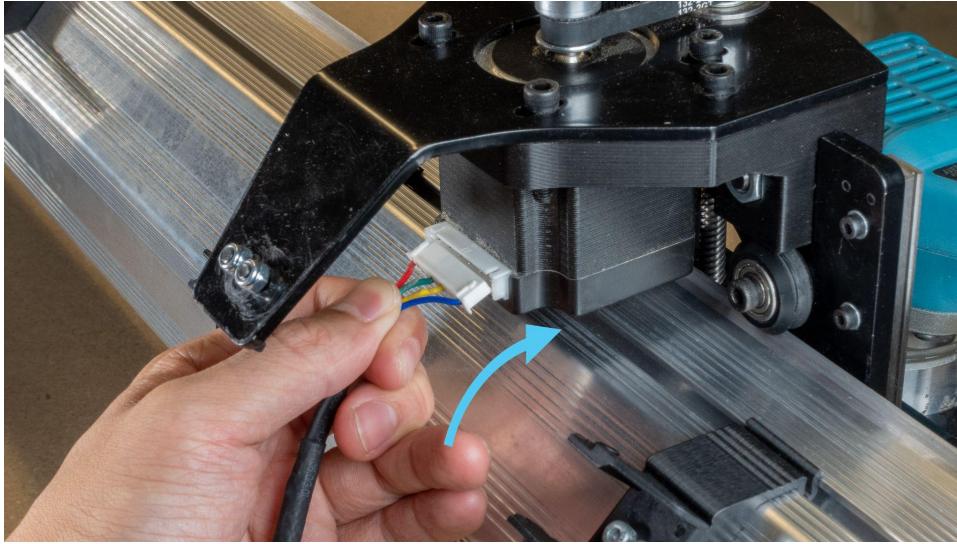


Y-axis Drag Chain

Reinstall your router into the router mount and optionally use the top left hole on the X-gantry as a zip tie point to keep your router wire out of the way during operation. If using a zip tie, ensure the cord has some extra slack to allow the router to travel all the way down during use



Grab one of the motor cables which were previously disconnected and connect it to the plug on the Z-axis NEMA 23 motor.

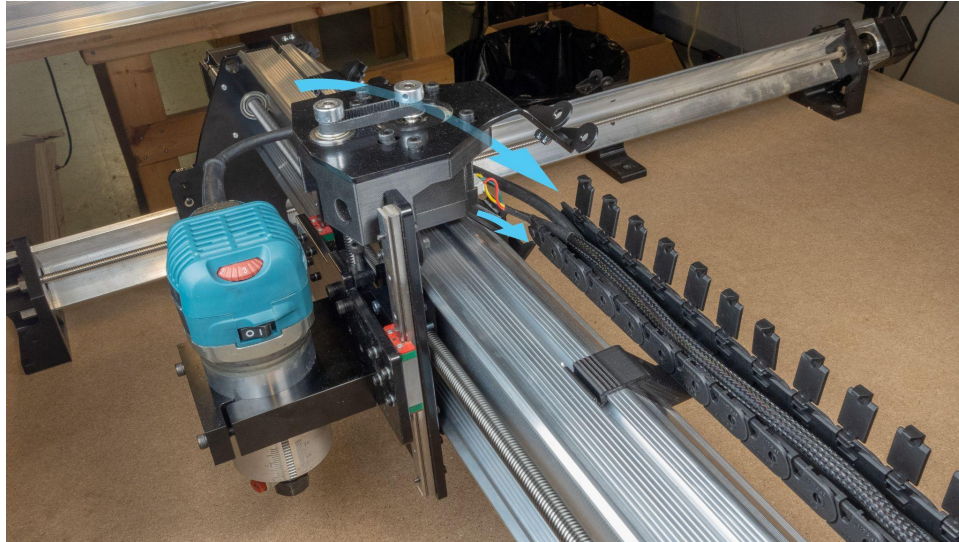


Connect the remaining motor cable to the plug on the X-axis NEMA 23 motor.



Grab the EX drag chain and position this running along the X-axis with the correct end of the drag chain oriented to clip on to the start and end links along the X-axis. Seat the Z-axis motor cable and router power cord into this drag chain.

Note: if you purchased the limit switch add-on kit, you'll want to install the Z-axis limit switch following the steps shown [here](#), and route this cable inside this drag chain as well.



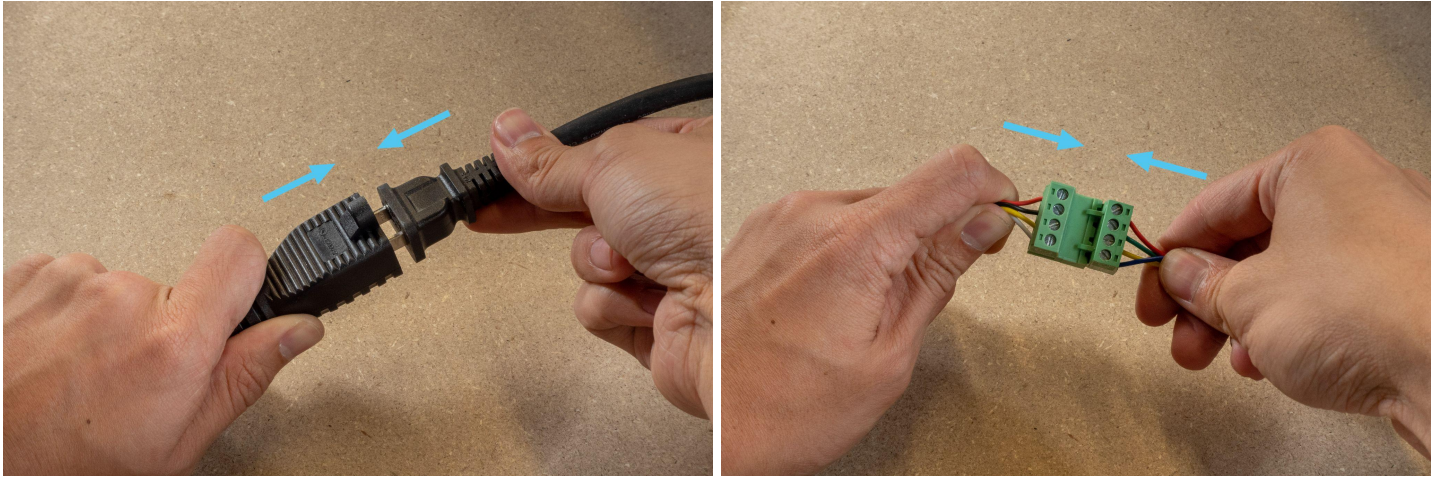
Secure the cables inside the drag chain by re-clipping each clip, then Attach the X-axis drag chain onto the start and end links mounted on the machine.



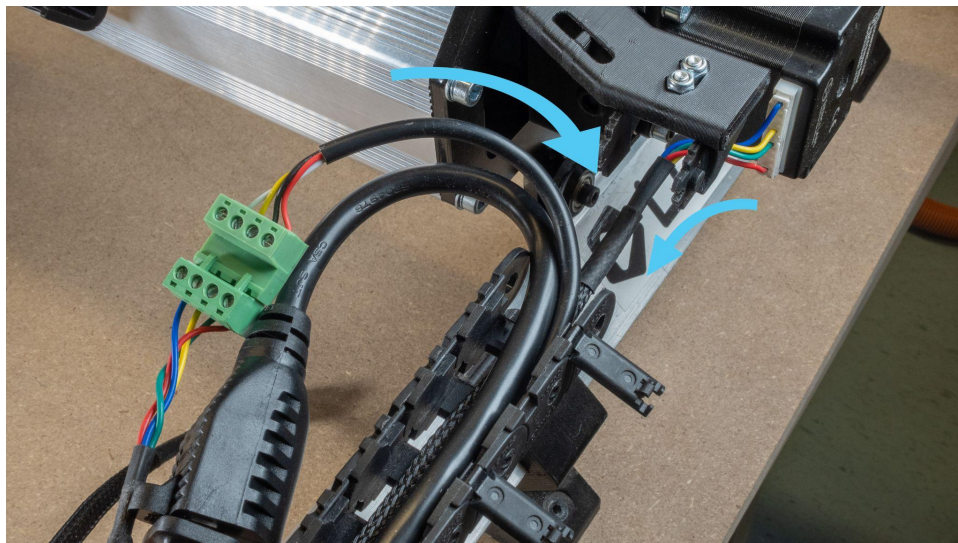
Grab the router power extension cable and motor extension cable from the drag chain box.

Note: If you purchased the limit switch add-on kit, grab the limit switch extension cable from here as well.

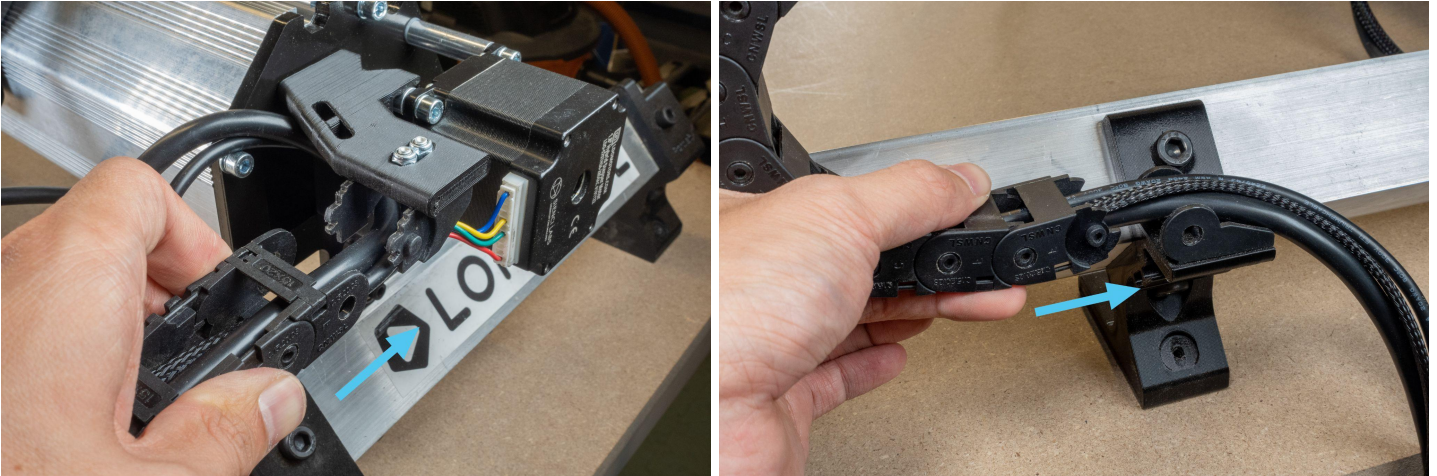
Connect the power extension and motor extension cables to the router power cord and Z-axis motor cable coming out from the X-axis drag chain. Connect the limit switch extension cable as well if applicable.



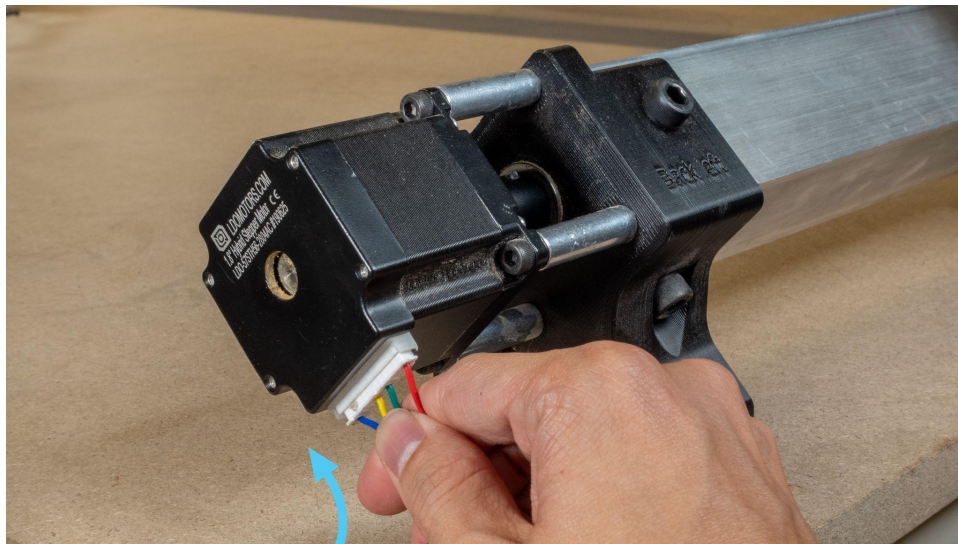
Begin routing these cables into the Y-axis drag chain, fitting these cables underneath the drag chain mount. Allow the connectors to sit outside of the Y-axis drag chain as shown. This excess bundling of cable will be organized neatly in the next step.



Secure the cables inside the Y-axis drag chain by re-clipping each clip, then attach the drag chain onto the start and end links mounted on the machine.

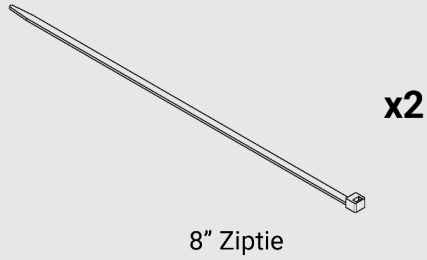


Lastly, plug the remaining motor cables into the 2 Y-axis NEMA 23 motors.

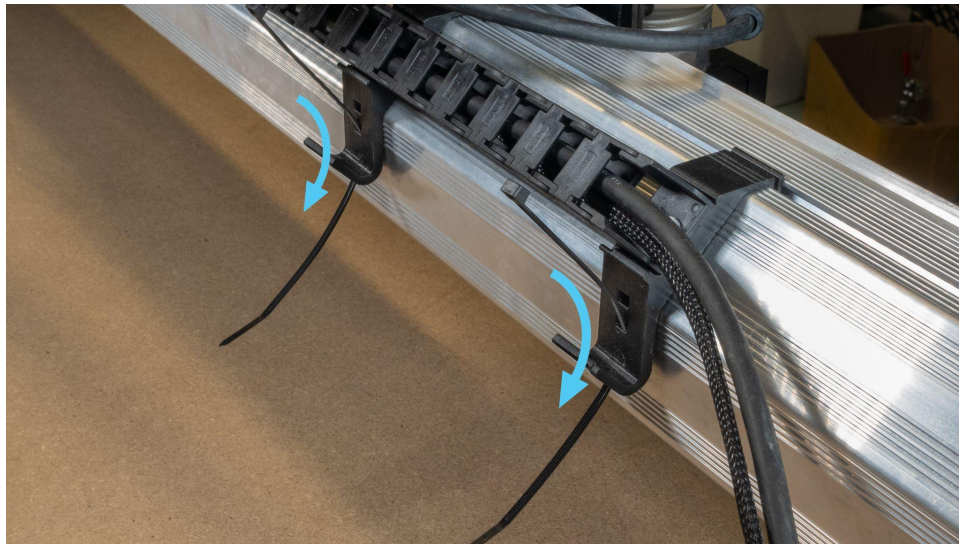


Organizing excess cable lengths

Parts Needed:

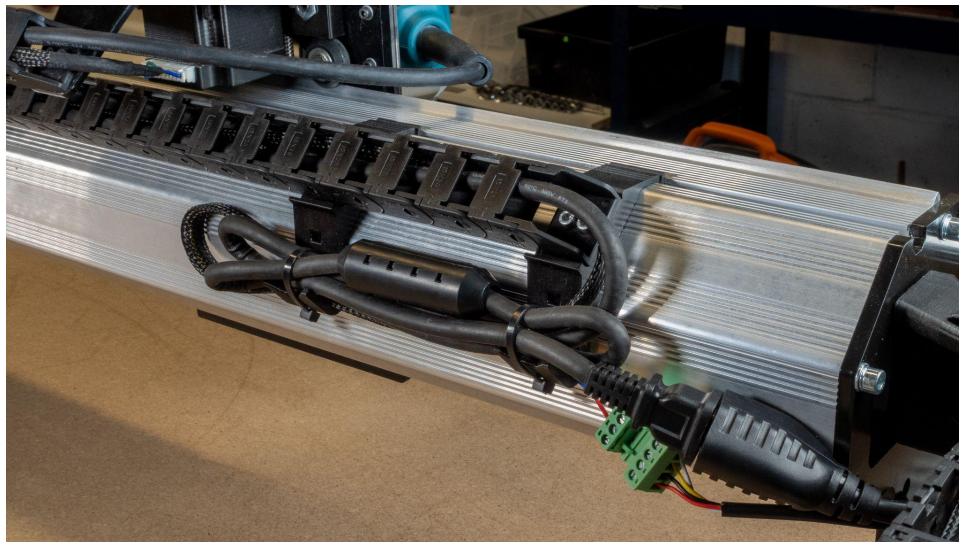


Get two zip ties from the kit and insert these into the lower hole in the cable hangers. Grab the end which will come out the hanger from below and engage the zip tie but leave this loose.

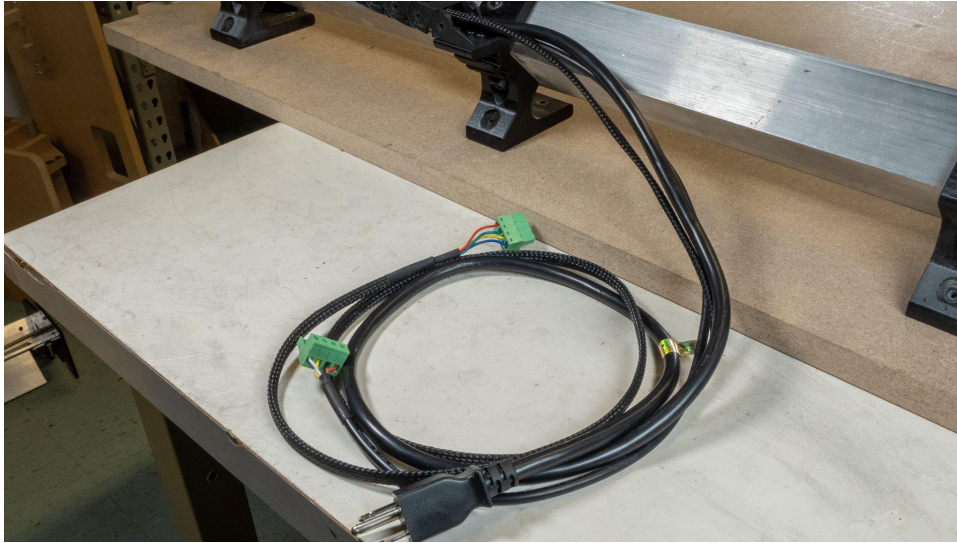


Straighten out the excess cabling into one bunch, then fold this in half.

The folded bunch of excess cables can then be secured into both cable hangers. Tighten the two zip ties at each hanger. Trim the excess length from the zip ties once finished.



Bring the cables around to the left of the machine so they're now all bundled together (pictured). You'll be plugging the motors cables into the control box shortly but otherwise the machine wiring is now complete!
Picture showing all the wires grouped together in front of the machine



Note: This section only applies if you have purchased the MK2 XZ Gantry upgrade. You can directly proceed to the section titled [Tuning Movement and Table Mounting](#) if you are reusing the MK1 XZ gantry.

X Axis drag chain mounts

Parts Needed:



1400mm Drag Chain



x2

M5-10mm Bolt



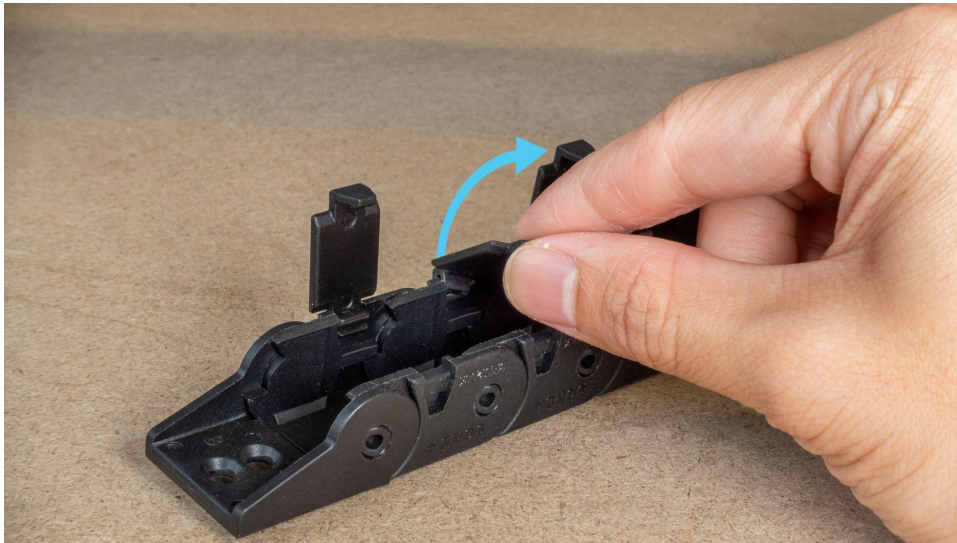
x1

T-Nut

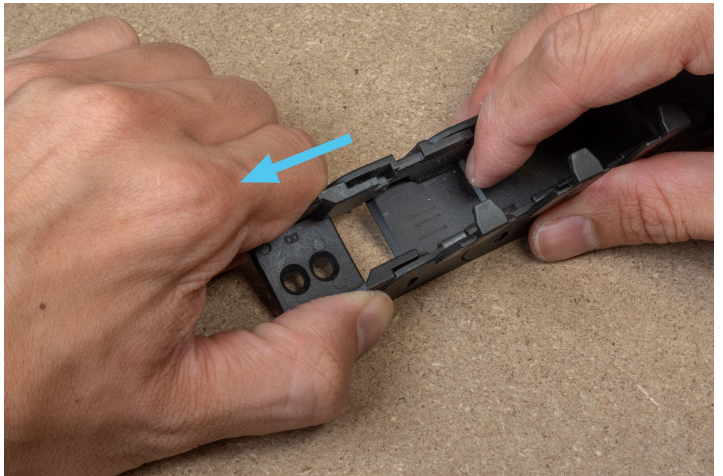
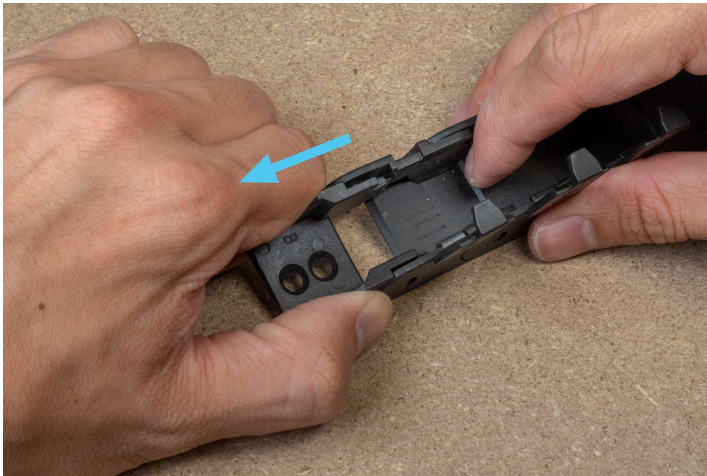
Unclip all the drag chain clips using a flat head screwdriver or anything else sharp like a wood screw.



We recommend permanently removing every other clip if you plan on adding more wiring in the future



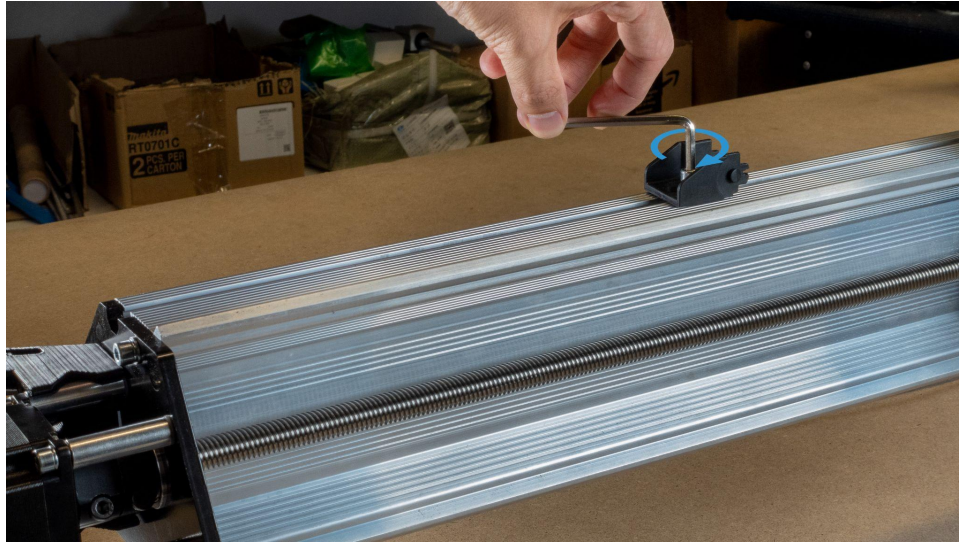
Remove the end links from the drag chain.



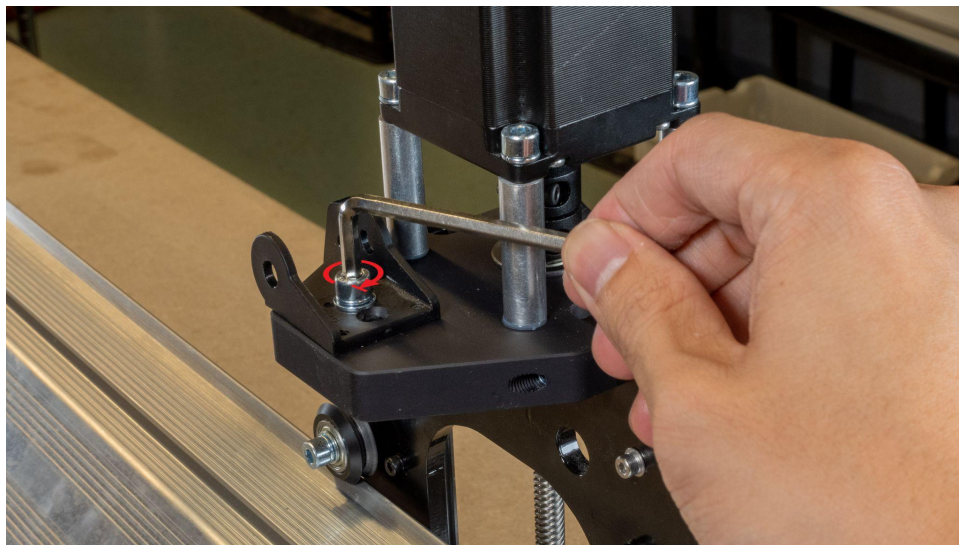
Loosely thread the M5-10mm bolt through the pin-type end link you have just taken off and into the t-nut as shown.



Insert the t-nut assembly into the X-axis rail from the left and slide it approximately 10" towards the middle and tighten the screw.



Lastly, secure the hole type end-link to the XZ gantry using the M5-10mm bolt.



Y Axis drag chain mount

Parts Needed:



x2

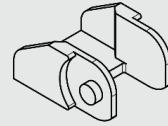
M4-12mm Bolt



x2

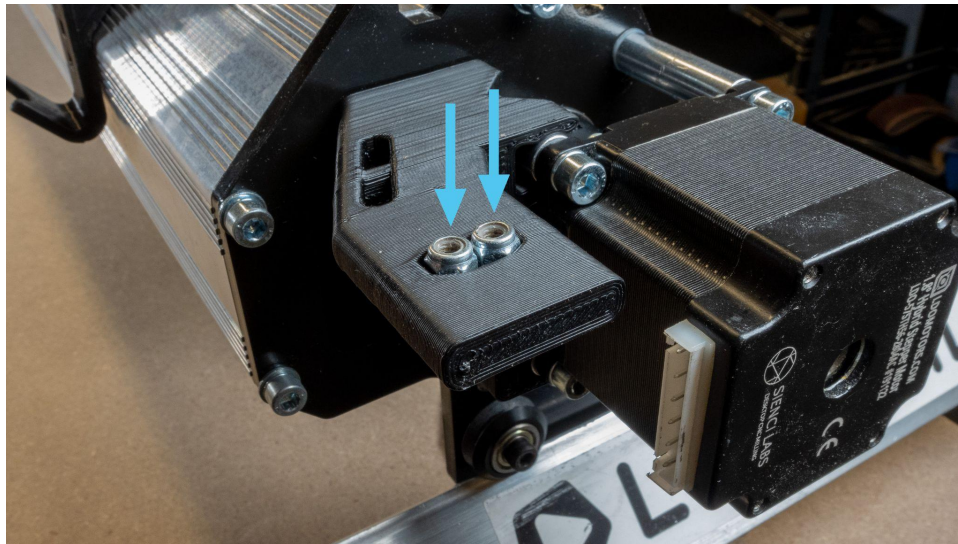
M4-Nylock Nut

Reused From Disassembly

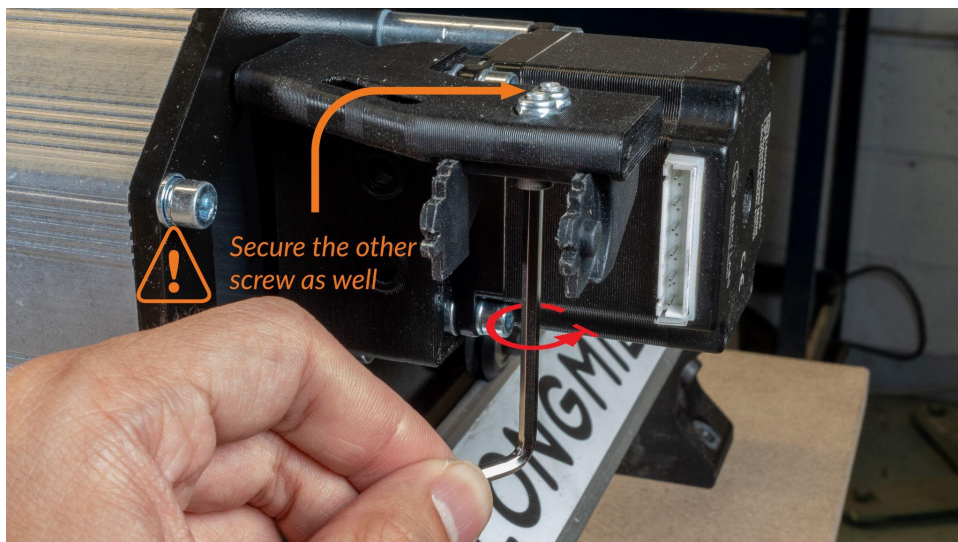


Y-axis Drag Chain End Link

Insert the two nylock nuts into the corresponding nut traps in the 3D printed drag chain mount.

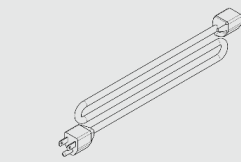


Secure the pin type end-link to the drag chain mount using the two M4-12mm bolts.

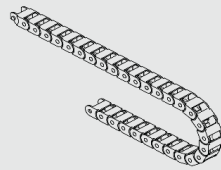


Wiring

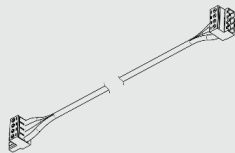
Parts Needed:



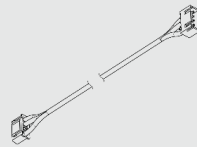
Router Power Cable Extension



1400mm Drag Chain



Motor Cable Extension

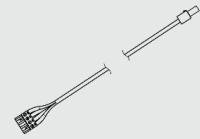


Limit Switch Cable Extension (If Applicable)

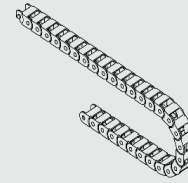
Reused From Disassembly



Router

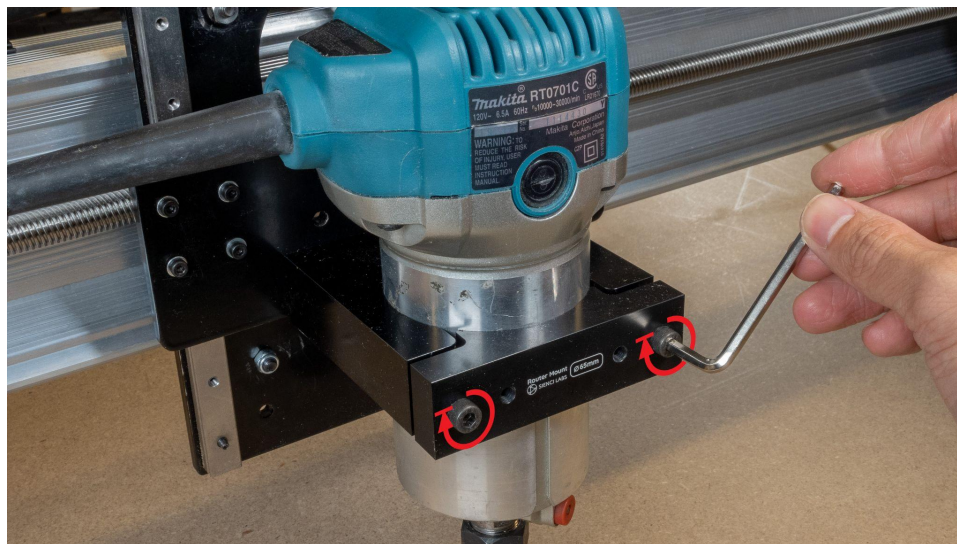


Motor Cable

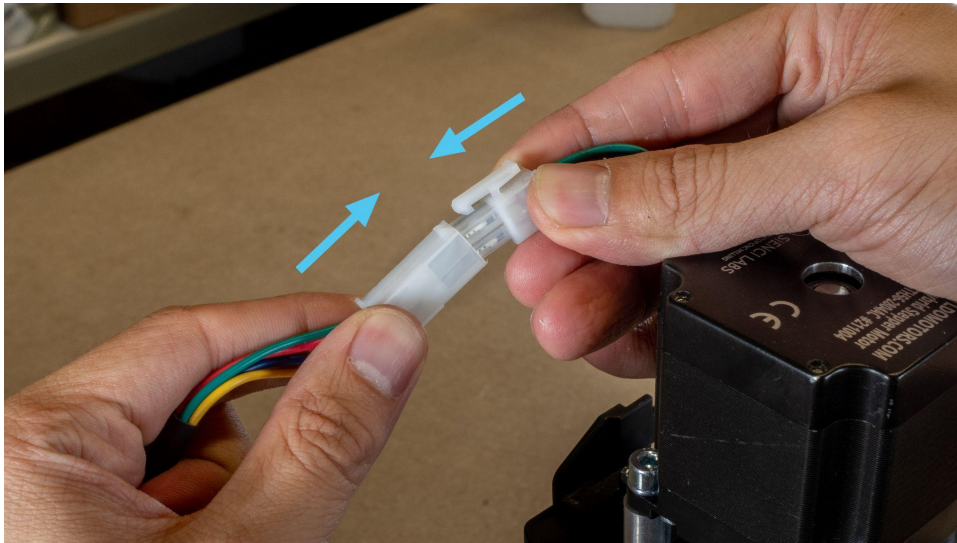


Y-axis Drag Chain

Reinstall your router into the router mount and optionally use the top left hole on the X-gantry as a zip tie point to keep your router wire out of the way during operation. If using a zip tie, ensure the cord has some extra slack to allow the router to travel all the way down during use



Grab the new motor cable from the kit and plug it into the Z-axis NEMA 23 motor.

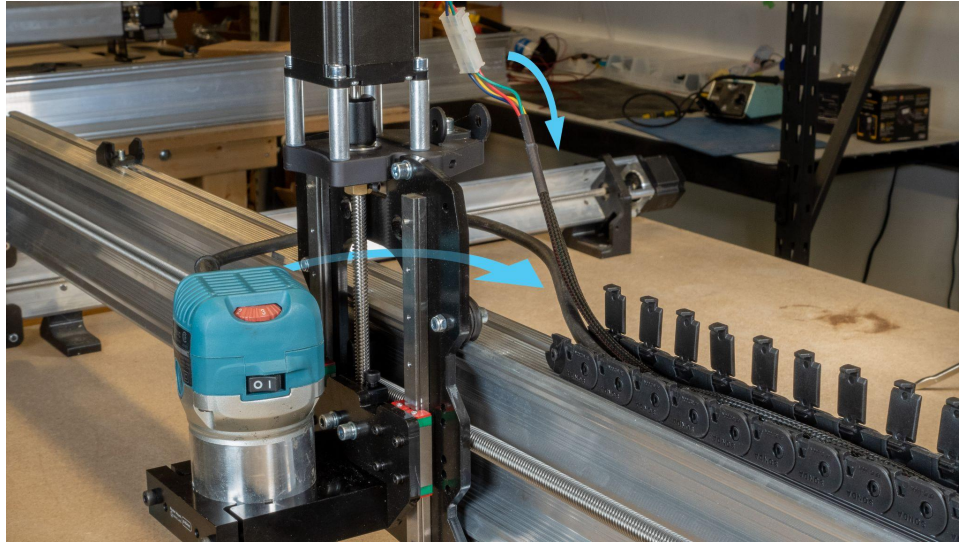


Next, take one of the motor cables disconnected earlier and plug it into the X-axis motor.

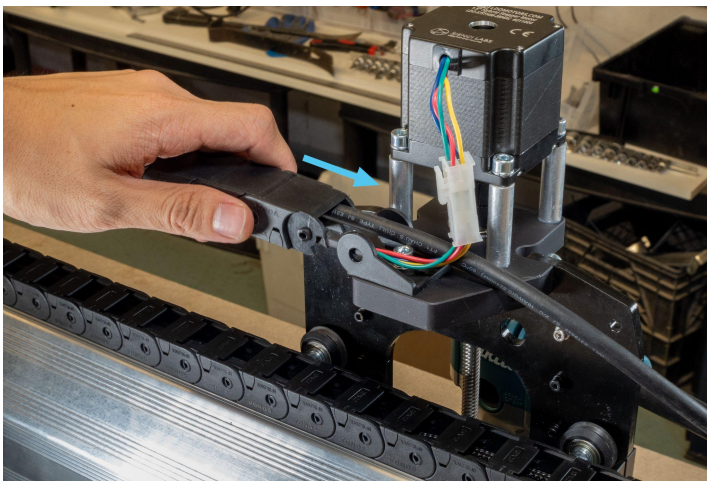


Grab the EX drag chain and position this running along the X-axis with the correct end of the drag chain oriented to clip on to the start and end links along the X-axis. Seat the Z-axis motor cable and router power cord into this drag chain.

Note: If you purchased the limit switch add-on kit, you'll want to install the Z-axis limit switch following the steps shown [here](#), and route this cable inside this drag chain as well.



Secure the cables inside the drag chain by re-clipping each clip, then Attach the X-axis drag chain onto the start and end links mounted on the machine.



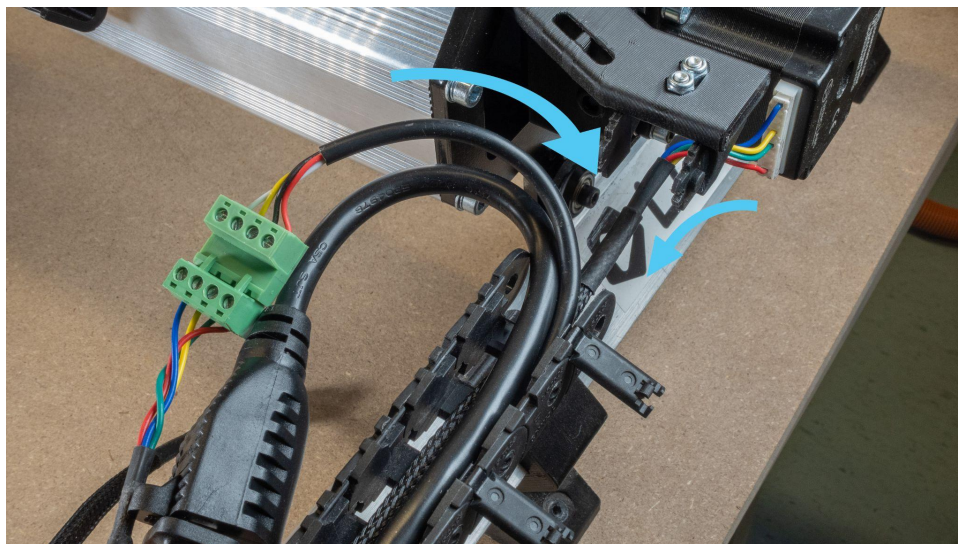
Grab the router power extension cable and motor extension cable from the hardware box in the X-axis rail box.

Note: if you purchased the limit switch add-on kit, grab the limit switch extension cable from here as well.

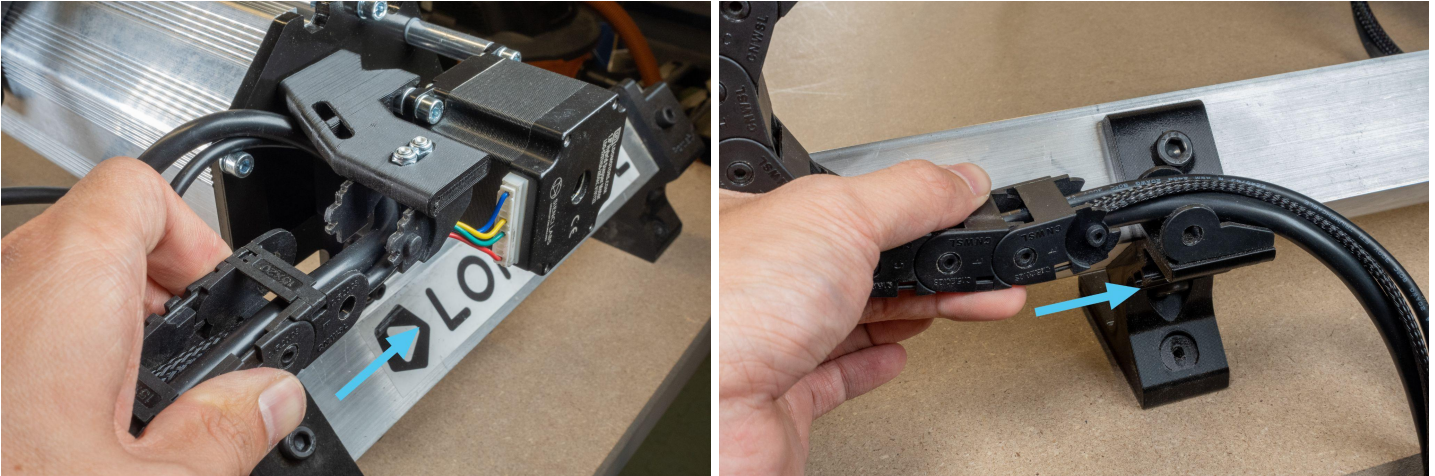
Connect the power extension and motor extension cables to the router power cord and Z-axis motor cable coming out from the X-axis drag chain. Connect the limit switch extension cable as well if applicable.



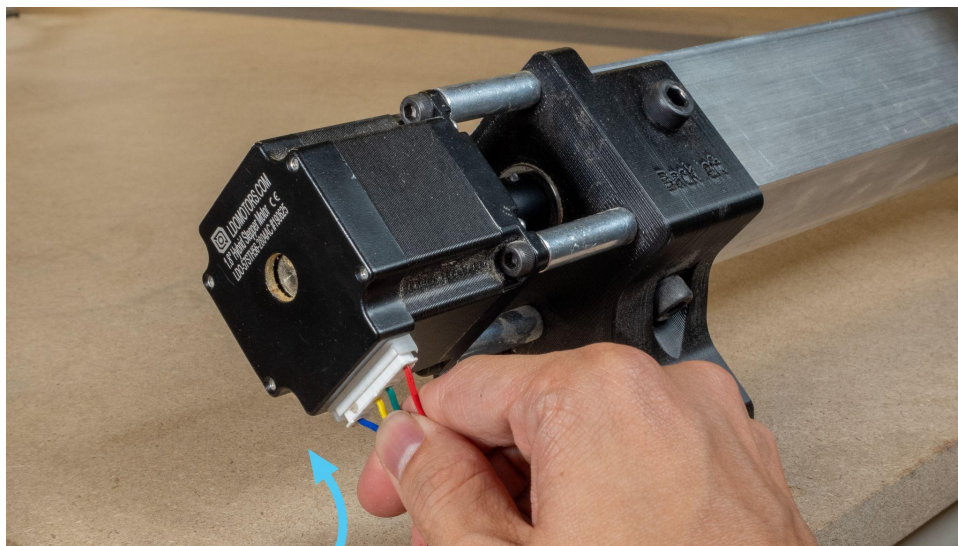
Begin routing these cables into the Y-axis drag chain, fitting these cables underneath the drag chain mount. Allow the connectors to sit outside of the Y-axis drag chain as shown. This excess bundling of cable will be organized neatly in the next step.



Secure the cables inside the drag chain by re-clipping each clip, then attach the Y-axis drag chain onto the start and end links mounted on the machine.

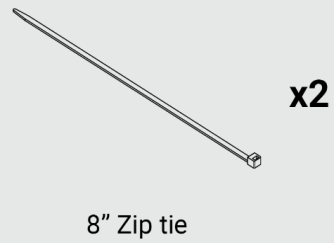
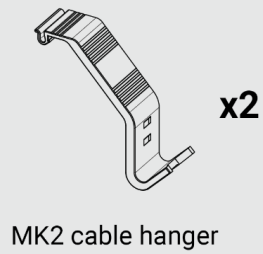


Lastly, plug the remaining motor cables into the two Y-axis NEMA 23 motors.



Organizing excess cable lengths

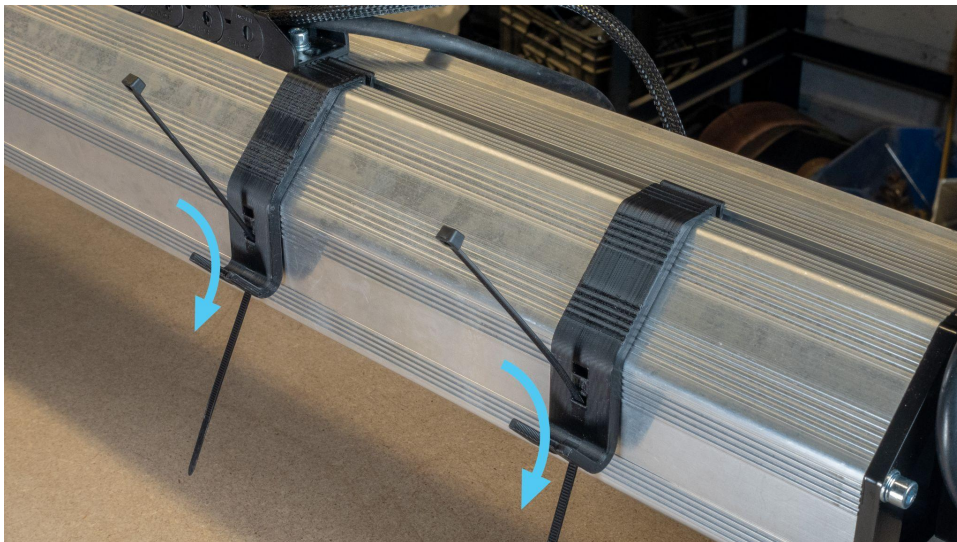
Parts Needed:



Grab both cable hangers and position it to the left of the drag chain end link as shown. You can clip them in place easily by applying downward pressure using your palm.



Get two zip ties from the kit and insert these into the lower hole in the drag chain mount. Grab the end which will come out the hanger from below and engage the zip tie but leave this loose.

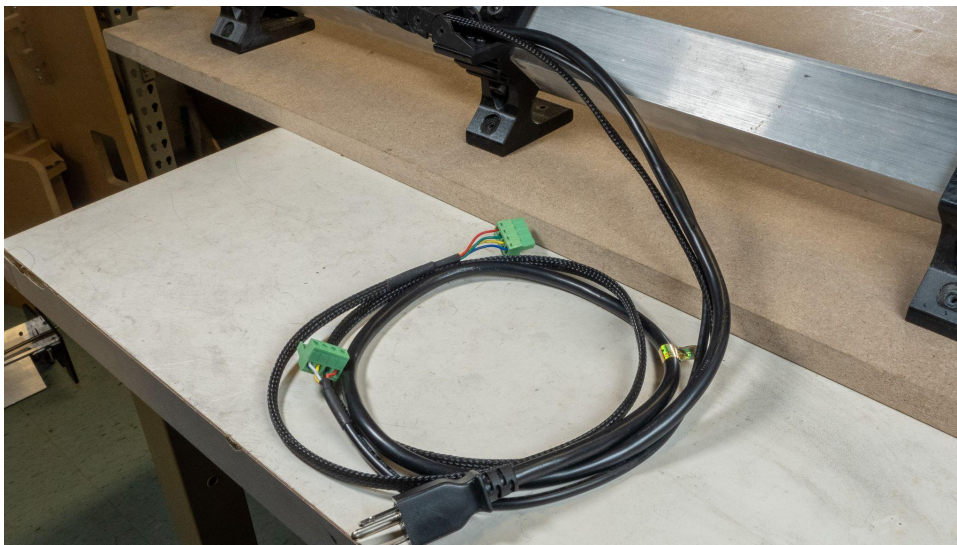


Straighten out the excess cabling into one bunch, then fold this in half.

The folded bunch of excess cables can then be secured into both cable hangers. Tighten the two zip ties at each hanger. Trim the excess length from the zip ties once finished.



Bring the cables around to the left of the machine so they're now all bundled together (pictured). You'll be plugging the motors cables into the control box shortly but otherwise the machine wiring is now complete!



Tuning Movement and table mounting

Tuning movement

Before the LongMill can be mounted onto the larger wasteboard, the V-wheels and Delrin nuts on the X and Y axes will need to be tuned to ensure the machine's axes will all self-align when moved.

Steps for tuning the tension on the V-wheels can be found [here](#).

Steps for tuning the anti-backlash Delrin nut tension can be found [here](#).



If you've installed the MK2 XZ gantry upgrade on your machine, you'll need to reverse the direction of your Z-axis within the firmware settings of your machine.

In gSender, open the 'Firmware' window, then toggle the Z-axis 'Step direction invert' setting to be set to 'off'. Click 'Apply new settings' to save this change. Alternatively, if using other machine control software such as UGS, enter '\$3=1' into the console and press 'Enter'.

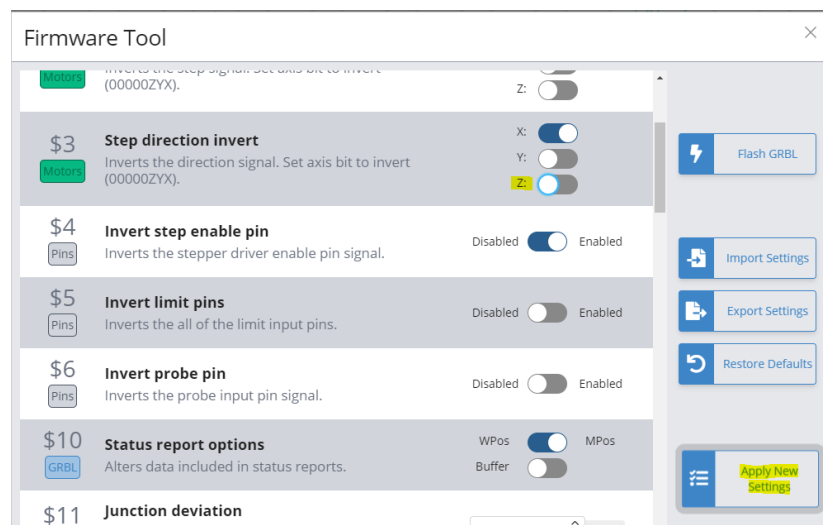


Table mounting

With the X-axis now being extended to 48" working capacity, your LongMill will of course need a much larger work surface now. The 48x30 LongMill MK2 will require a wasteboard that is 48"x70". The outer dimensions of the 48x30 LongMill MK2 are shown in the diagram below.

