Shapeoko 4 XL

Table of Contents

Welcome and Congratulations

The Shapeoko 4 XL is a powerful CNC machine purpose-built for rigidity and accuracy. An upgraded controller, inductive homing switches, and a robust hybrid table system with multiple built-in workholding options will save you time and increase your productivity and workflow efficiency.

In this guide we will walk you step-by-step through the assembly of your Shapeoko 4 XL. Precision-machined parts, pre-assembled components, and self-contained packaging mean assembling your Shapeoko 4 XL is quick and easy. You'll be up and machining in no time.

Shapeoko 4 Assembly Overview Video

Watch the XXL Assembly video at youtu.be/wUxKKApCzfs. Assembly steps for the XXL and XL are nearly identical, with only minor differences in the size or quantity of some components and hardware.

Warranty

Visit carbide3d.com/policy/warranty for Shapoeko machine warranty details.

Power Tools

The use of power tools is not recommended for assembly. Use hand tools only.

Finger-Tight Only

Several steps rely on non-tightened fasteners. Do not tighten fasteners beyond finger-tight until instructed.

Directional References

In this guide, any reference to direction or placement, such as front, back, left, right, inside, and outside, are given from the perspective of one standing in front of and facing the machine.

Notes Used in This Guide

In this guide, we use three types of call-outs to highlight information: Warning, Note, Pro Tip, and Important.

Stepper Motors

Your Shapeoko 4 gantry is powered by NEMA 23 stepper motors. When the power is off, moving the motors by hand will cause them to generate electricity.

WARNING: When moving the gantry by hand, go slowly. The power generated by the stepper motors will feel like bumps. If the lights on the controller are lighting up, it's very important to slow down because you are pushing electricity back through the board. Too much back flow could damage the controller.

Firmware and Software

The Shapeoko 4 controller ships with GRBL 1.1 firmware, which must be used with Carbide Motion 5. This guide supersedes any information you may find regarding firmware/software on the Carbide 3D website.

This guide includes screenshots from Carbide Motion 5, build 542. Buttons and screens shown in the figures may change as new versions are released.

Glossary of Terms

See the Glossary of Terms at the end of this guide for common CNC terms and definitions.

Have Questions? Need Help?

We have a fully-staffed support team waiting to help if you run into any trouble while assembling your Shapeoko 4 XL. Just email us at support@carbide3d.com and we'll get back to you right away!

Important Safety Instructions

Shapeoko 4 is a machine tool and requires the same caution that should be exercised with any power tool.

Eye Protection

Always wear safety glasses or goggles which are suitably impact-resistant.

Hearing Protection

Always wear earplugs or ear muffs. For long jobs, it may be desirable to wear both. Hearing damage is cumulative and irreversible, so one should always err on the side of caution.

Respiratory Protection

Always wear a filter or respiratory mask suitable for the type of dust generated by the material being cut. If necessary, arrange for dust collection and proper ventilation.

Clothing, Hair, and Jewelry

Always ensure that clothing, hair, and jewelry cannot become caught in the machine. Always wear appropriate clothing; long-sleeved shirts, pants, and suitable footwear are recommended. When metal-working, gloves and an apron are also recommended.

Machine Safety

Never reach into the machine's working envelope while it is running. Always shut off and unplug the router to perform tool changes, adjustments, and maintenance. Never leave the machine running unattended. Always inform someone before operating the machine and check in with them after successfully completing work. Never allow children to use the Shapeoko 4 unsupervised.

Shut Off Machine When Not In Use

Always make sure to power down the Shapeoko 4 when you are finished using it.

Fire Prevention

Consider the possibility of a fire caused by friction from the router and take suitable fire prevention precautions (e.g. having a fire extinguisher handy and other suitable precautions).

Outlet Requirements

Plug the router into an outlet that has a dedicated on/off switch. Be sure this is accessible while the machine is running, in case you should need to shut off the Shapeoko 4 immediately.

End Mill Safety

Use care when handling end mills—both to avoid being cut and to avoid damaging them. Handling end mills with suitable gloves, or using a cloth to avoid contaminating them, is recommended. Inspect end mills carefully before each use, and ensure that they are securely held by the collet.

Debris Disposal

Recycle or safely dispose of milling debris and dust, keeping in mind flammability, (potential) spontaneous combustion, and chemical considerations. Even natural materials can have disposal implications. For example, walnut wood dust is allelopathic (it inhibits plant growth), an irritant to the skin and respiratory tract, and potentially poisonous to some animals. All of these possible disposal implications are in addition to the spontaneous combustion hazard posed by all types of sawdust.

Inventory

The packaging for your Shapeoko 4 XL was designed to facilitate easy assembly. Your Shapeoko 4 XL arrives in two shipping boxes: box 1 contains components you will need to complete steps 1–4, including your assembly tool kit[1], and box 2 contains components you will need for steps 5–9. The individual boxes in the shipping packages are self-contained steps, allowing you to focus on one step at a time. Early in the assembly you will be instructed to set a few components aside for later steps. Don't worry—each set-aside component is clearly labeled in the component table and at the point you will need to use it. It's best to resist the urge to open all of the boxes at once, unless directed to do so by the Carbide 3D support team.

PRO TIP: Your Shapeoko 4 XL kit has been carefully packaged by hand. If you find that you're missing hardware in any step, check the extra hardware bag included in Box 1. If you don't find the hardware you need in the extra hardware bag, or one of your components was damaged in shipping, contact us at support@carbide3d.com and we'll ship you a replacement ASAP.

Shipping Box 1 Contains
Step 1: Baseframe Box
Step 2: Y-Rails Box
Step 3: Gantry Box
Step 4: Endplates Box

Shipping Box 2 Contains
Step 5: X/Z Assembly Box
Step 6: Drag Chain Box
Step 7: Router Box
Step 8: Hybrid Table Box[2]
Step 9: Controller Box
Sweepy 65 V2.0 Box

1. A pair of flush-cut pliers or scissors and a tape measure may also be helpful during assembly.

2. The hybrid table box is not included if you selected "No Table" when ordering your Shapeoko 4.
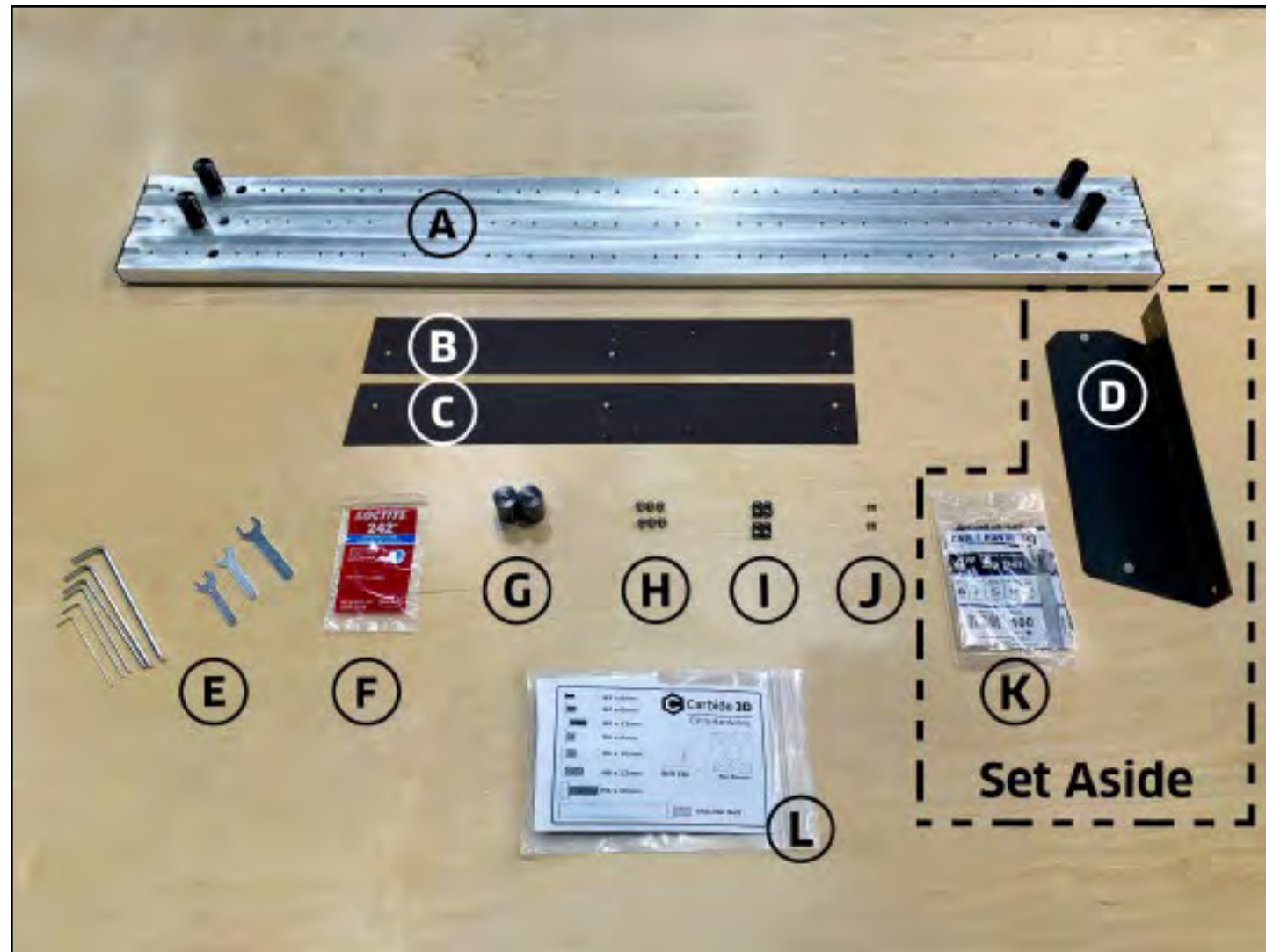
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1.1 Review Box 1 Components

Figure 1-1

Item	Description	Qty
A	Crossmember (2 with Pre-Installed Standoffs; 1 Without Standoffs)	3
B	Y-Axis LEFT Drag Chain Support Panel	1
C	Y-Axis RIGHT Drag Chain Support Panel	1
D	Controller Mount ****SET ASIDE FOR USE IN STEP 9****	1
E	Tool Kit: 1.5, 2, 2.5, 3, 4, 5mm Ball-Nose Hex Keys; 8, 10, 13mm Wrenches	1
F	Loctite 242 Medium-Strength Threadlocker (Non-Permanent)	1
G	Standoff	2
H	M6×6mm Button Head Cap Screw (+2 Extra)	6
I	Cable Tie Mount	4
J	M3×6mm Button Head Cap Screw	4
K	Pack of 100 Cable Ties ****SET ASIDE FOR USE IN STEP 9****	1
L	Extra Hardware Bag[3] (Items Not Individually Pictured)	1
(J)	M3×6mm Button Head Cap Screw	
(M)	M5×6mm Button Head Cap Screw	
(N)	M5×12mm Socket Head Cap Screw	
(H)	M6×6mm Button Head Cap Screw	
(O)	M6×10mm Flat Head Screw	
(P)	M6×12mm Button Head Cap Screw	
(Q)	M6×20mm Socket Head Cap Screw	
(R)	Shoulder Bolt	
(S)	15mm Universal Belt Clip	
(T)	Self-Adhesive Cable Tie Down	

3. The extra hardware bag includes a few of each listed item in case you find you are missing anything during assembly. The bag label shows a 1:1 illustration of each item for easy identification.

1.2 Position Crossmembers and Drag Chain Support Panels

1. Place a drop of Loctite on the threads of one standoff.
2. Locate the two threaded holes on each end of the crossmember without standoffs.
3. Screw the standoff into the inner-most of the two threaded holes.
4. Repeat steps 1–3 above to install the remaining standoff.
   a. Each crossmember will have 2 standoffs.
   b. Standoffs will all line up.

5. Check each standoff and make sure each is finger-tight.
6. Position the three crossmembers horizontally across your table. See *Fig. 1-2*.
   a. Standoffs up, about 10 inches apart.
7. Position the two support panels, face up, front to back, across the outside edges of the three crossmembers. See *Figs. 1-2* and *1-3*.
   a. Look for outline of nuts to identify back—they are pressed into back-side of panel.
   b. M3 integrated nuts to the outside.
   c. Two close-set M3 nuts toward the front.
   d. Three wide-set M3 nuts toward the back.

1.3 Assemble Baseframe

1. Use a 4mm hex key and six (6) M6×6mm BHCS to loosely attach the support panels to the crossmembers. See *Figs. 1-2* and *1-3*.
   a. Snug the screws, then back out ¼ turn.
   b. Don't worry about squaring the baseframe yet.

1.4 Install Cable Tie Mounts

1. Use a 2mm hex key and four (4) M3×6mm BHCS to secure two (2) cable tie mounts to each support panel. See *Fig. 1-3*.
   a. Secure mounts to the first and third of the three wide-set M3 integrated nuts at the back of the support panel.

Figure 1-2

Figure 1-3

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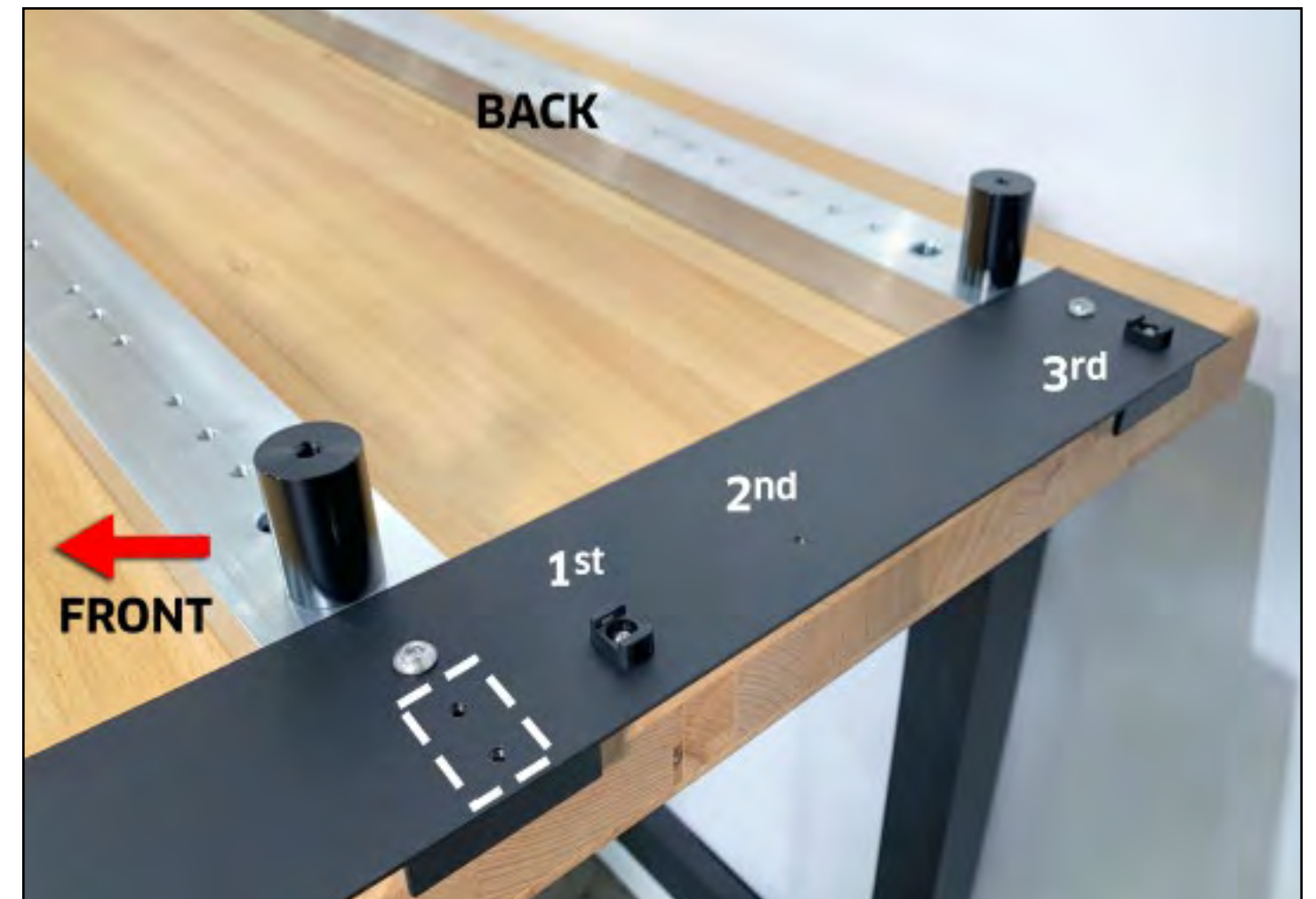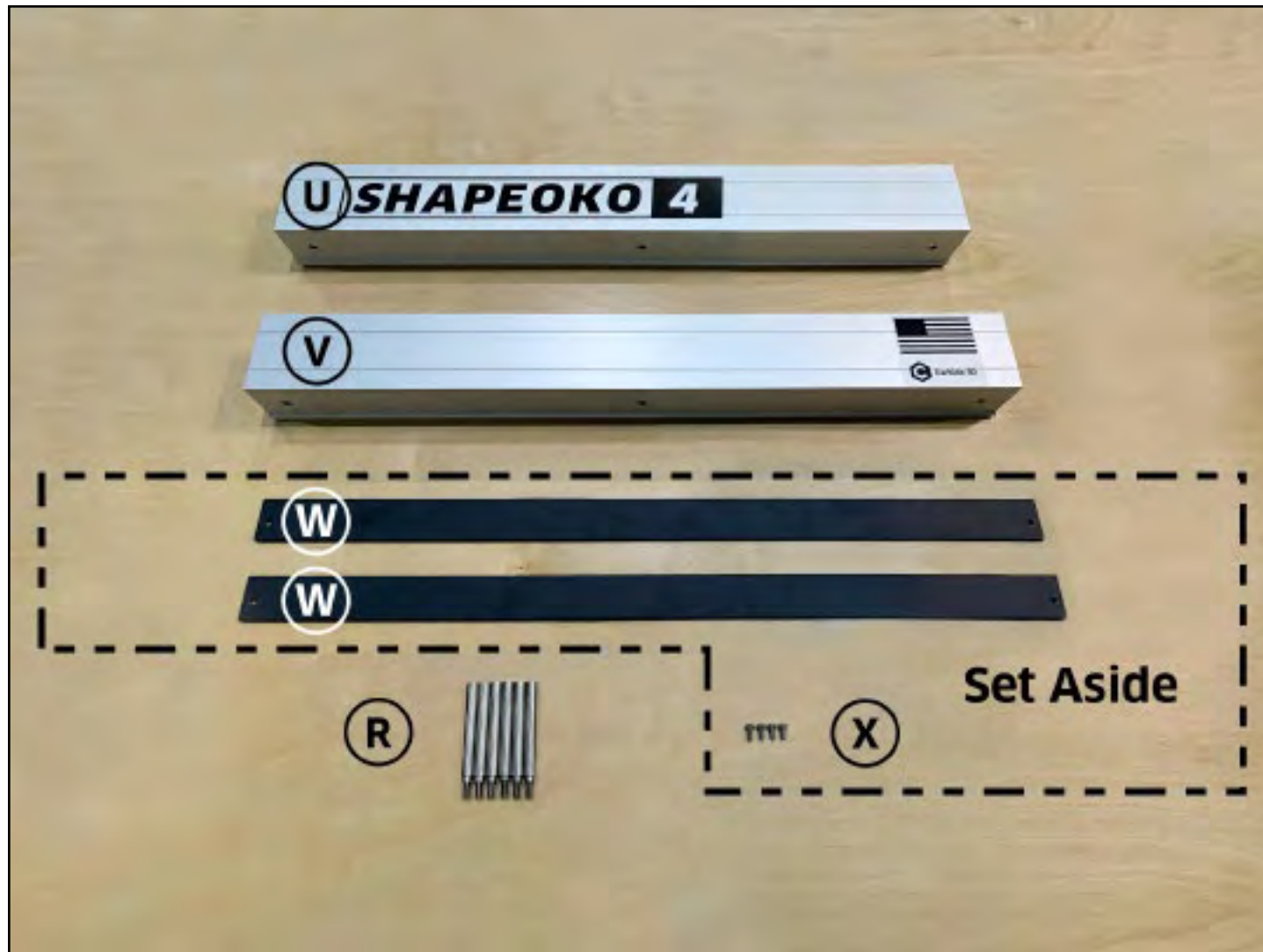
Figure 2-1

2.1 Review Box 2 Components

Item	Description	Qty
U	Y-Axis LEFT Extrusion Rail with Shapeoko 4 Decal (Y-Left Rail)	1
V	Y-Axis RIGHT Extrusion Rail with Carbide 3D Decal (Y-Right Rail)	1
R	M6×85mm Shoulder Bolt	6
W	Y-Axis Side Skirt **SET ASIDE FOR USE IN STEP 4**	2
X	M5×8mm Button Head Cap Screw **SET ASIDE FOR USE IN STEP 4**	4

2.2 Install Y-Left Rail

1. Position the Y-Left extrusion rail on the three standoffs on the left side of the baseframe. See **Fig. 2-2**.

   a. Shapeoko 4 decal to inside-front.

   b. V-rail to outside.

2. Use a 5mm hex key and three (3) M6×85mm shoulder bolts to loosely attach the Y-Left rail to the standoffs. See **Fig. 2-2**.

   a. Insert bolts in order: front, back, center.

   b. Ensure bolts fit snugly into the lower through-holes with the shoulder flush against the rail as shown in **Fig. 2-3**.

   c. Snug the bolts, then back out ¼ turn.

2.3 Install Y-Right Rail

1. Position the Y-Right extrusion rail on the three standoffs on the right side of the baseframe. See **Fig. 2-2**.

   a. Carbide 3D/flag decal to inside-front.

   b. V-rail to outside.

2. Use a 5mm hex key and three (3) M6×85mm shoulder bolts to loosely attach the Y-Right rail to the standoffs. See **Fig. 2-2**.

   a. Insert bolts in order: front, back, center.

   b. Ensure bolts fit snugly into the lower through-holes with the shoulder flush against the rail as shown in **Fig. 2-3**.
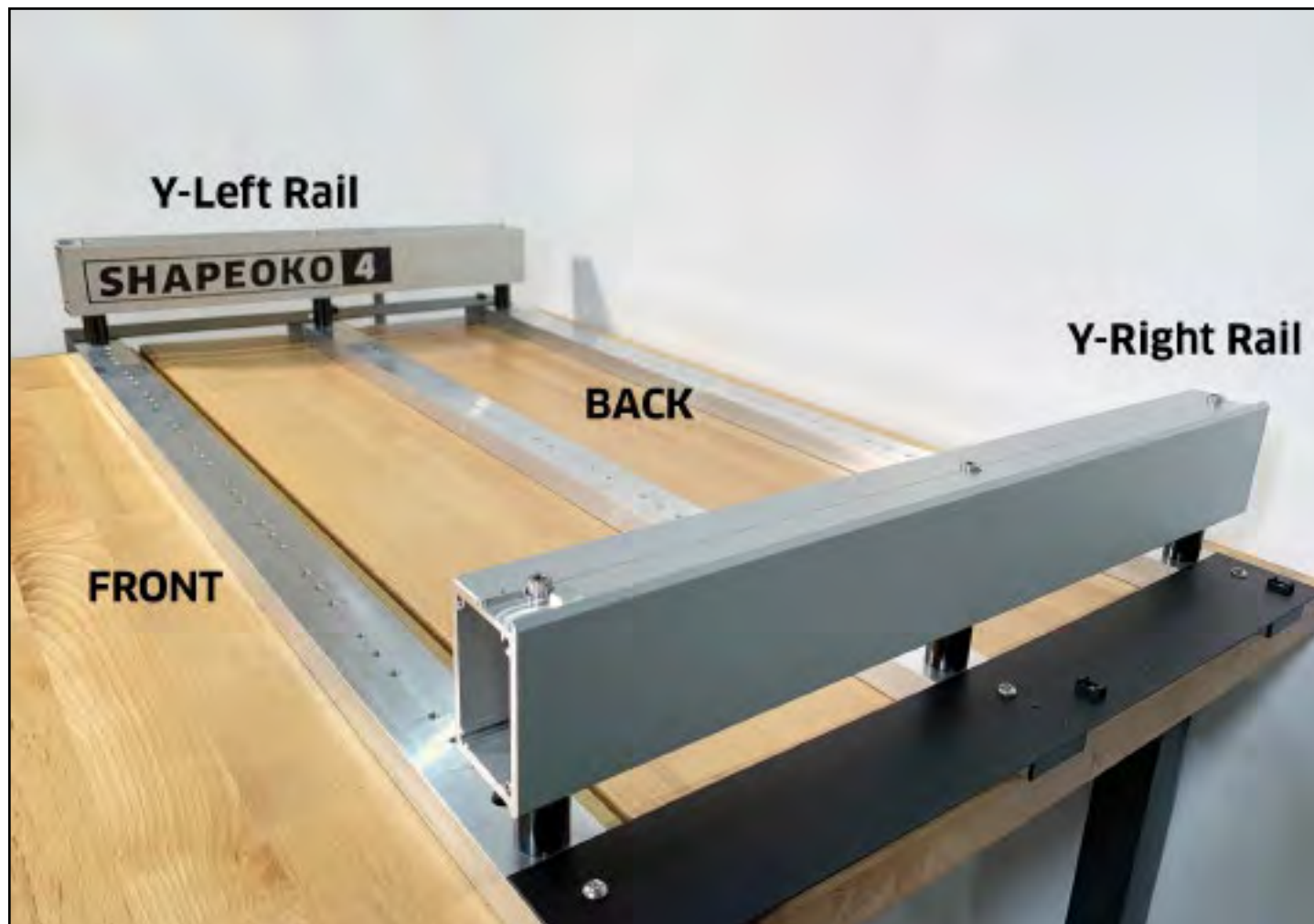
   c. Snug the bolts, then back out ¼ turn.

Figure 2-2

Figure 2-3

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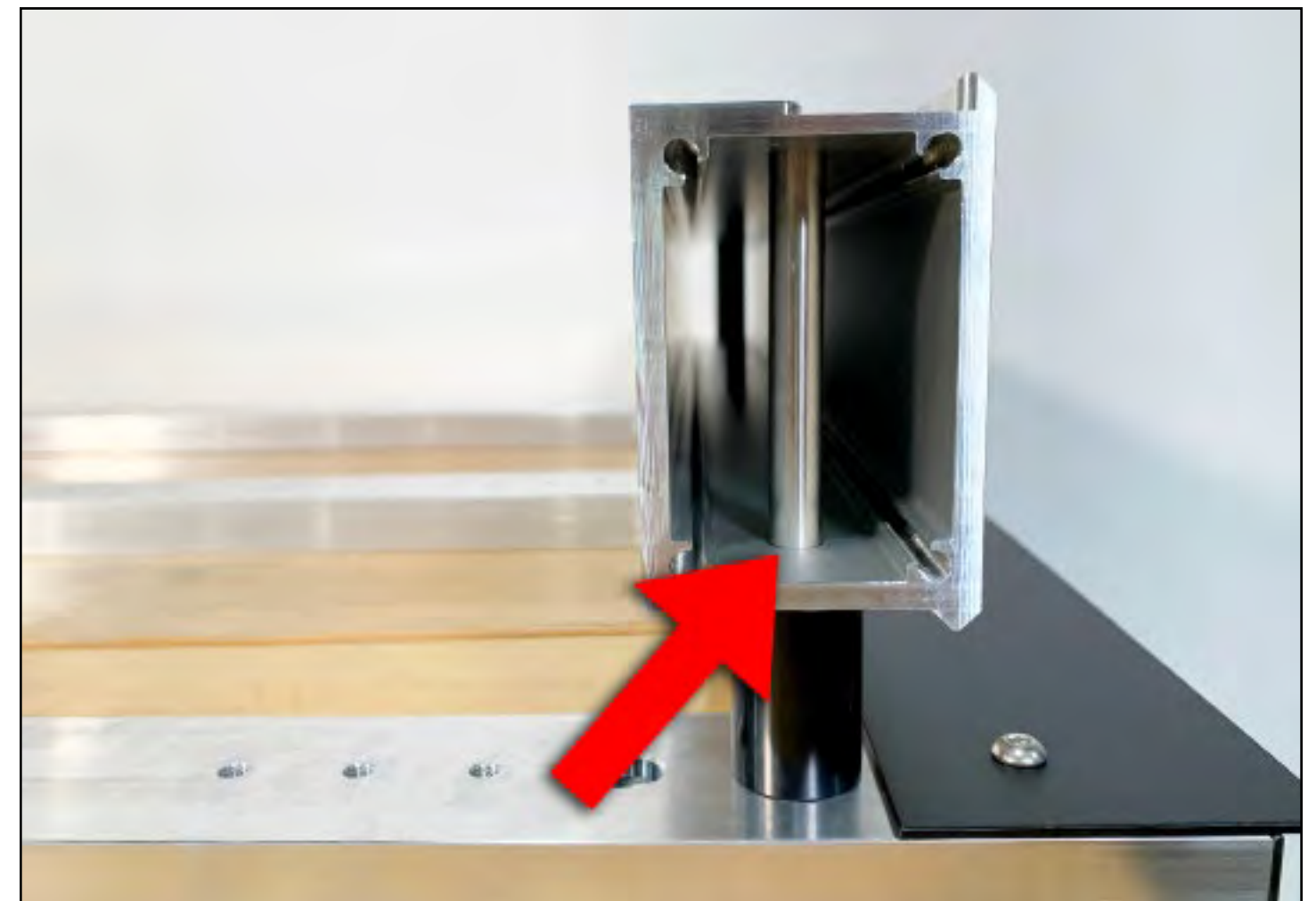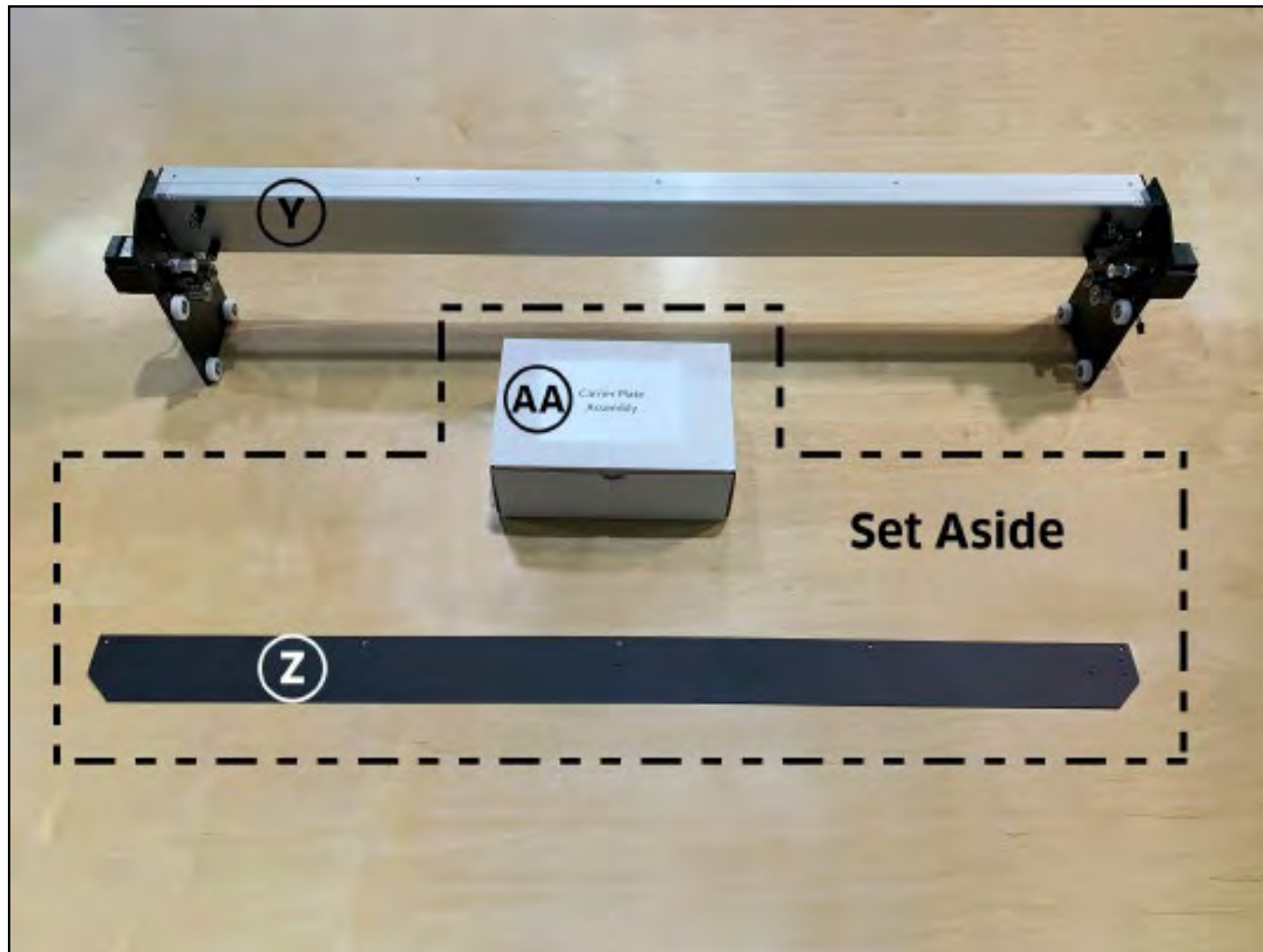
Figure 3-1

3.1 Review Box 3 Components

NOTE: Inspect the Y-Axis gantry plates at either end of the gantry for shipping damage.

Item	Description	Qty
Y	X-Axis Gantry Assembly (with Pre-Installed X-Axis Proximity Switch)	1
Z	X-Axis Drag Chain Support Panel ****SET ASIDE FOR USE IN STEP 5****	1
AA	Carrier Plate Assembly Box ****SET ASIDE FOR USE IN STEPS 4 AND 5****	1

3.2 Eccentric Nuts and V-wheels Explained

Eccentric nuts and V-wheels are used to adjust the gantry at the intersect between the carriage V-wheels and the V-rails. A loose connection here is referred to as slop. To eliminate slop, a very small amount of tension is added between the V-wheels and V-rail. Too much tension and the V-wheels will deform, causing bumpy and constrained motion. Not enough tension, and the carriage will wobble. When tension is just right, the carriages glide smoothly along the rails for the highest-quality cuts.

A dimple on one the side of the nut indicates the furthest point from center of the offset threads. When the dimple is facing UP, the distance between the top and bottom V-wheel is at its greatest and the V-wheels are OPEN. When the dimple is facing DOWN, they are CLOSED. *Figs. 3-2* and *3-3*.

When adding tension to a loose V-wheel, turn the eccentric nut CLOCKWISE. Turning counter-clockwise will loosen the bolted connection

between nut and V-wheel. If this happens, re-tighten with a 10mm wrench and a 3mm hex key.

Not much tension is needed for the carriages to be secure. The V-wheels should only be snug against the V-rail. Reach under and spin the V-wheel with your finger. If it rotates freely, turn the eccentric nut clockwise until you feel some friction against the rail and the carriage is free from slop. See *Figs. 3-2* and *3-3*.

3.3 Open V-wheels
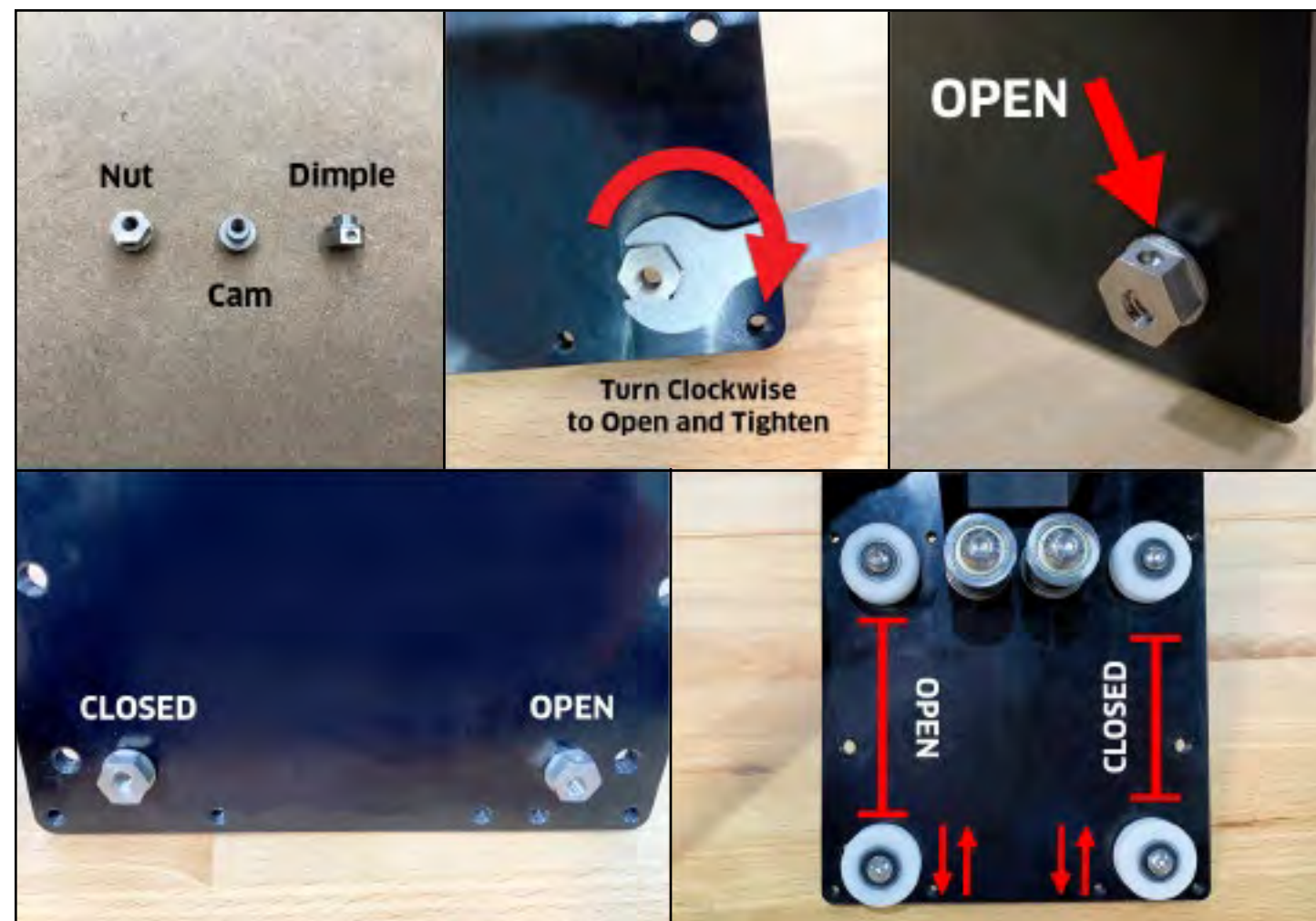
1. Use a 10mm wrench to fully open the X-Axis gantry's four (4) eccentric nuts.

   a. Turn CLOCKWISE until the dimple faces UP. See *Figs. 3-2* and *3-3*.

NOTE: You may need to use a 3mm hex key to loosen the V-Wheel screws to be able to turn the eccentric nuts.

NOTE: Feel free to use a 10mm combination wrench in lieu of the included wrench.

Figure 3-2

Figure 3-3

3.4 Install X-Axis Gantry

1. Position the X-Axis gantry in front of the baseframe.

   a. V-rail, Y-Axis proximity switch, and four standoffs to the FRONT.

   NOTE: You may need to have another person help you lift the gantry into position.

2. Pick the gantry up and rest the X-rail on its back across the Y-rails. See *Fig. 3-4*.

   a. Top of X-rail pointing to the back of the machine.

   b. Top-back V-wheels resting on the left and right V-rails.

   c. Bottom two V-wheels on each side overhanging the front of the left and right rails.

3. Rotate the top of the gantry up and back toward you 90°, so that the bottom V-wheels on each side align with the lower V-rails. See *Fig. 3-5*.

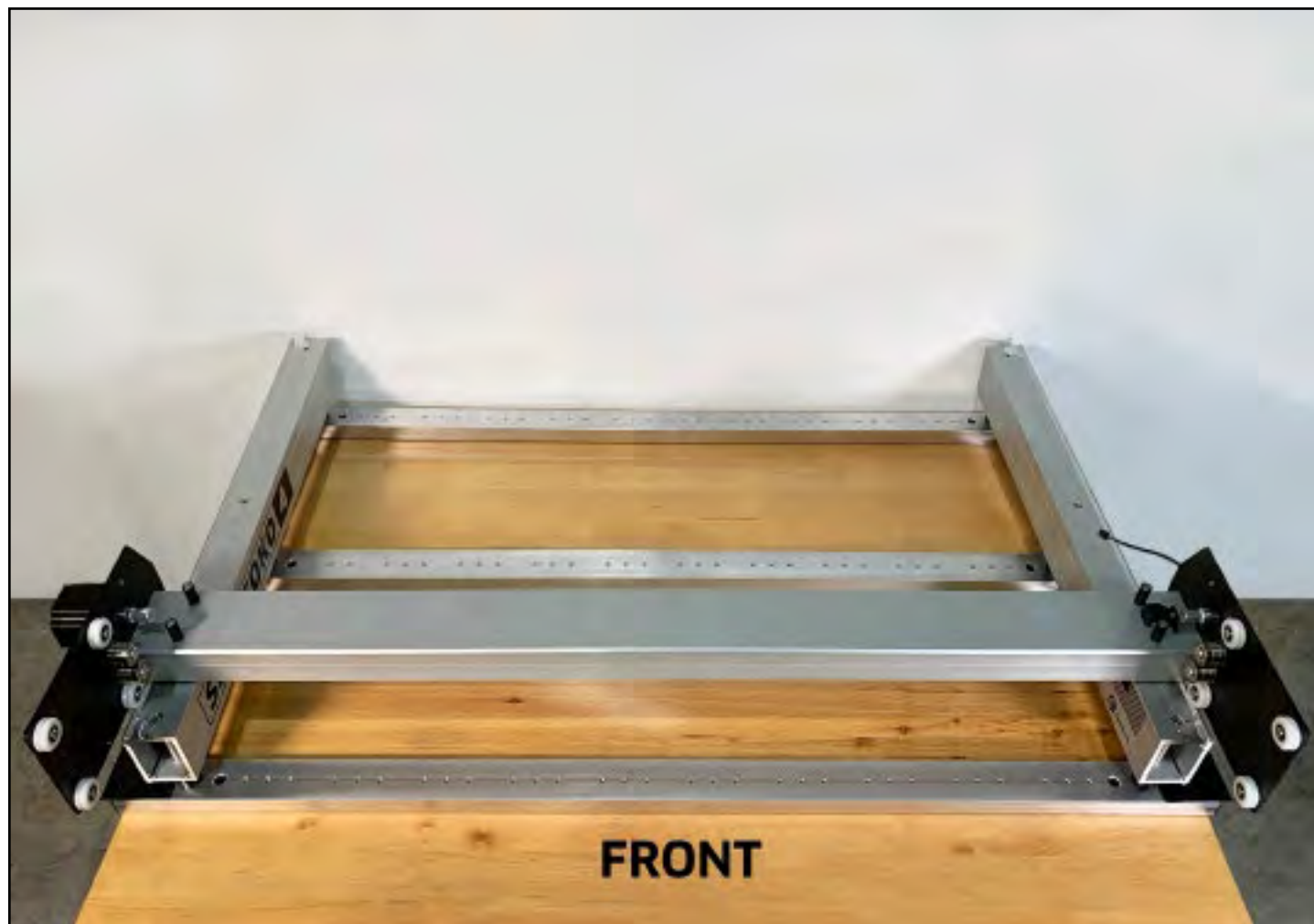4. Slide the gantry into place on the Y-Left and Y-Right rails. See *Fig. 3-6*.
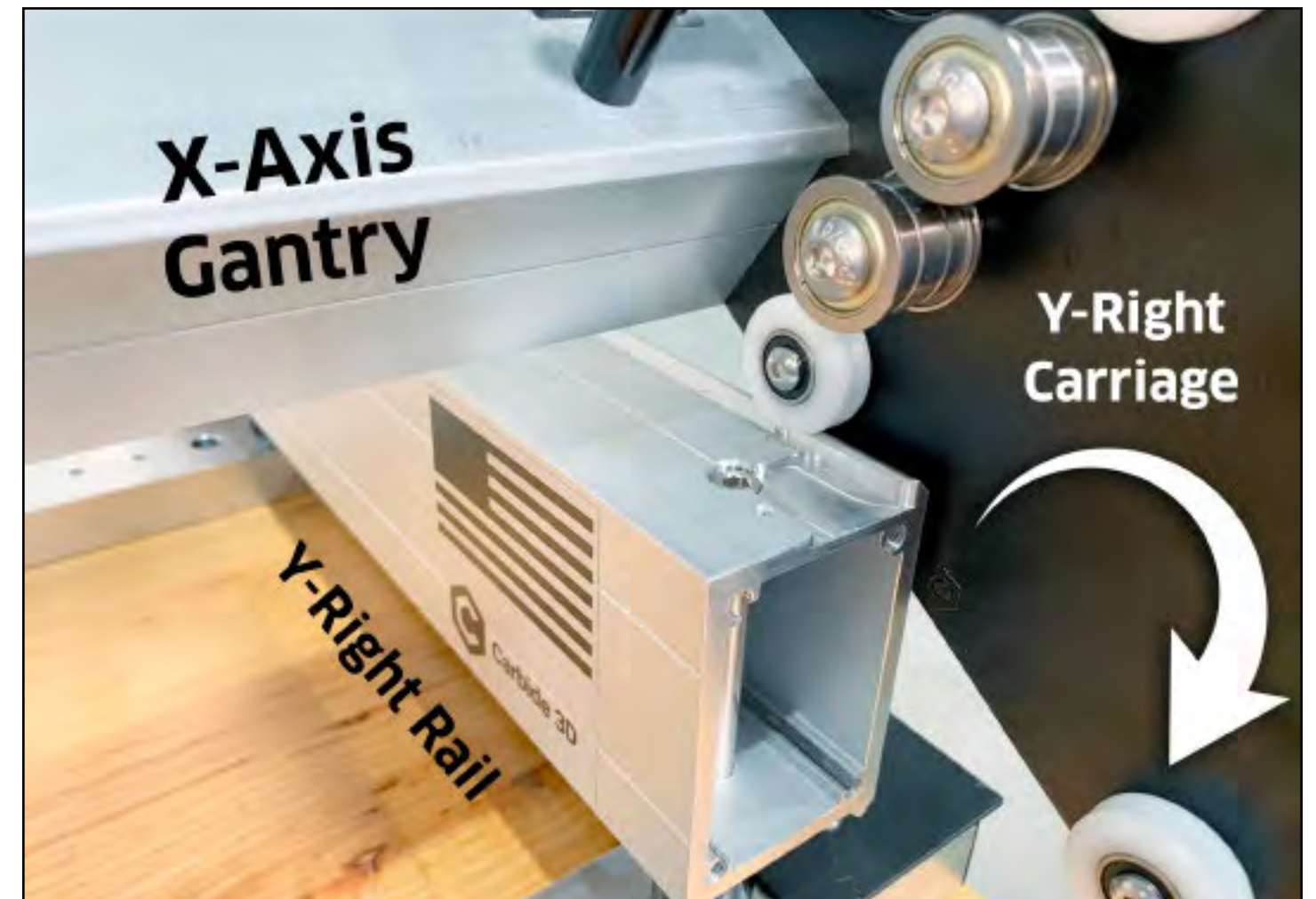

Figure 3-6

Figure 3-4

Figure 3-5
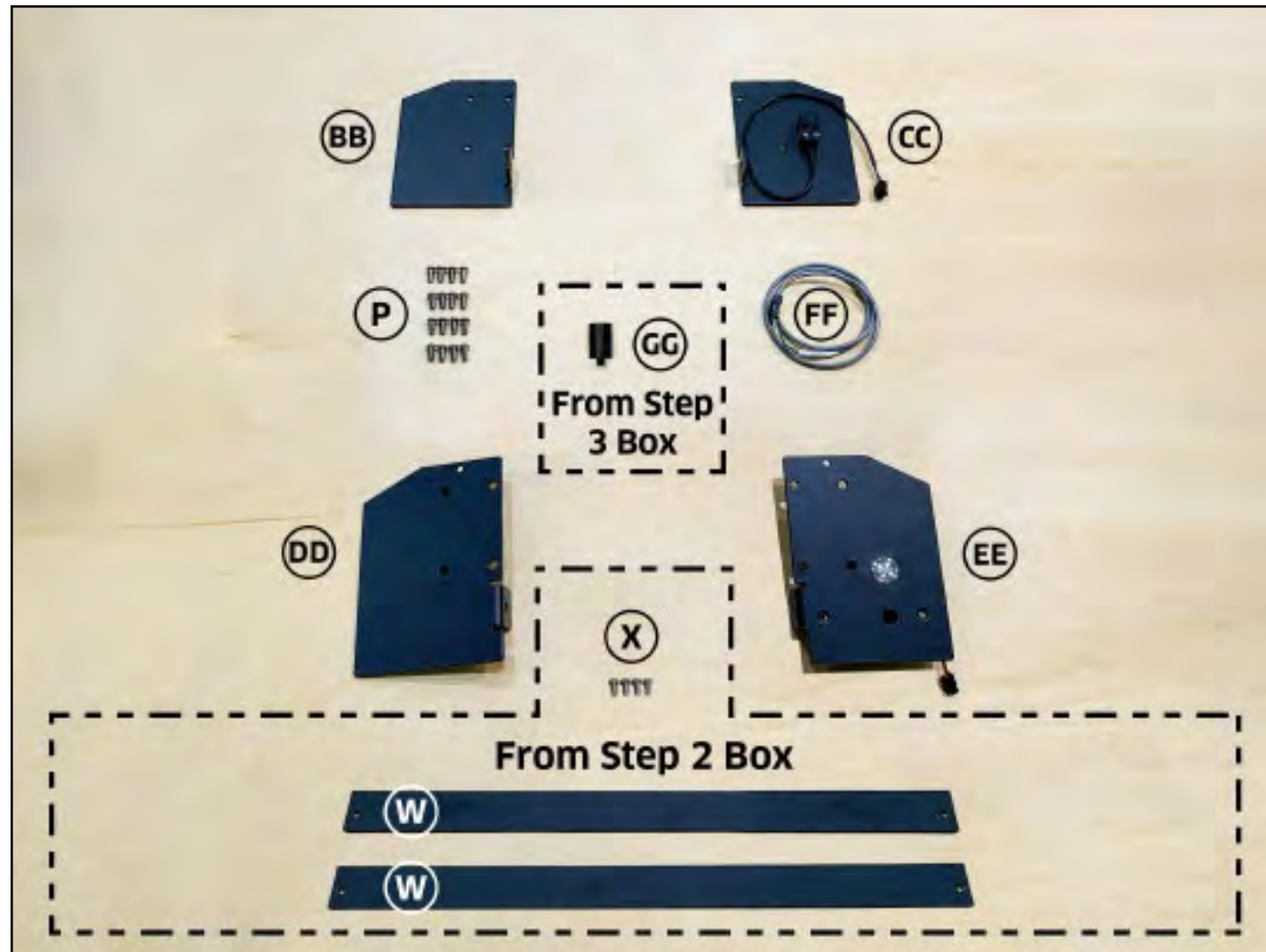
Figure 4-1

4.1 Review Box 4 Components

Item	Description	Qty
BB	Back-Left Endplate	1
CC	Back-Right Endplate (with Pre-Installed Y-Axis Proximity Switch)	1
DD	Front-Left Endplate	1
EE	Front-Right Endplate (with Integrated Power Button)	1
FF	4-Pin Male-to-Female Power Extension Cable	1
P	M6×12mm Button Head Cap Screw	16
W	Y-Axis Side Skirt **FROM STEP 2 BOX**	2
X	M5×8mm Button Head Cap Screw **FROM STEP 2 BOX**	4
GG	Y-Axis Limit Trigger[4] **FROM STEP 3 BOX**	1

4. The Y-Axis Limit Trigger is an M5 standoff located in the Carrier Plate Assembly Box. The trigger will be screwed into the M5 screw hole on the Y-Right gantry plate. When the trigger gets close to the face of the Y-Axis proximity switch, it triggers the switch, telling the gantry that it has reached the far end of travel.

4.2 Install Front-Right Endplate

1. Connect the 4-pin male-to-female power extension cable to 4-pin male connector exiting the back of the front-right endplate. See *Figs. 4-2* and *4-3*.

NOTE: Connectors are polarized and will only connect one way. Do not force a connection. See *Fig. 4-3*.

2. Align the front-right endplate with the four M6 screw holes in the front end of the Y-Right rail.

   a. Power button faces front.

   b. Curved flange on the lower part of the endplate goes to INSIDE.

   c. Tapered corner to the outside-top.

3. Use a 4mm hex key and four (4) M6×12mm BHCS to secure the endplate to the rail. Fully tighten.

NOTE: Be careful not to pinch the power wires between the endplate and the drag chain support panel or rail.

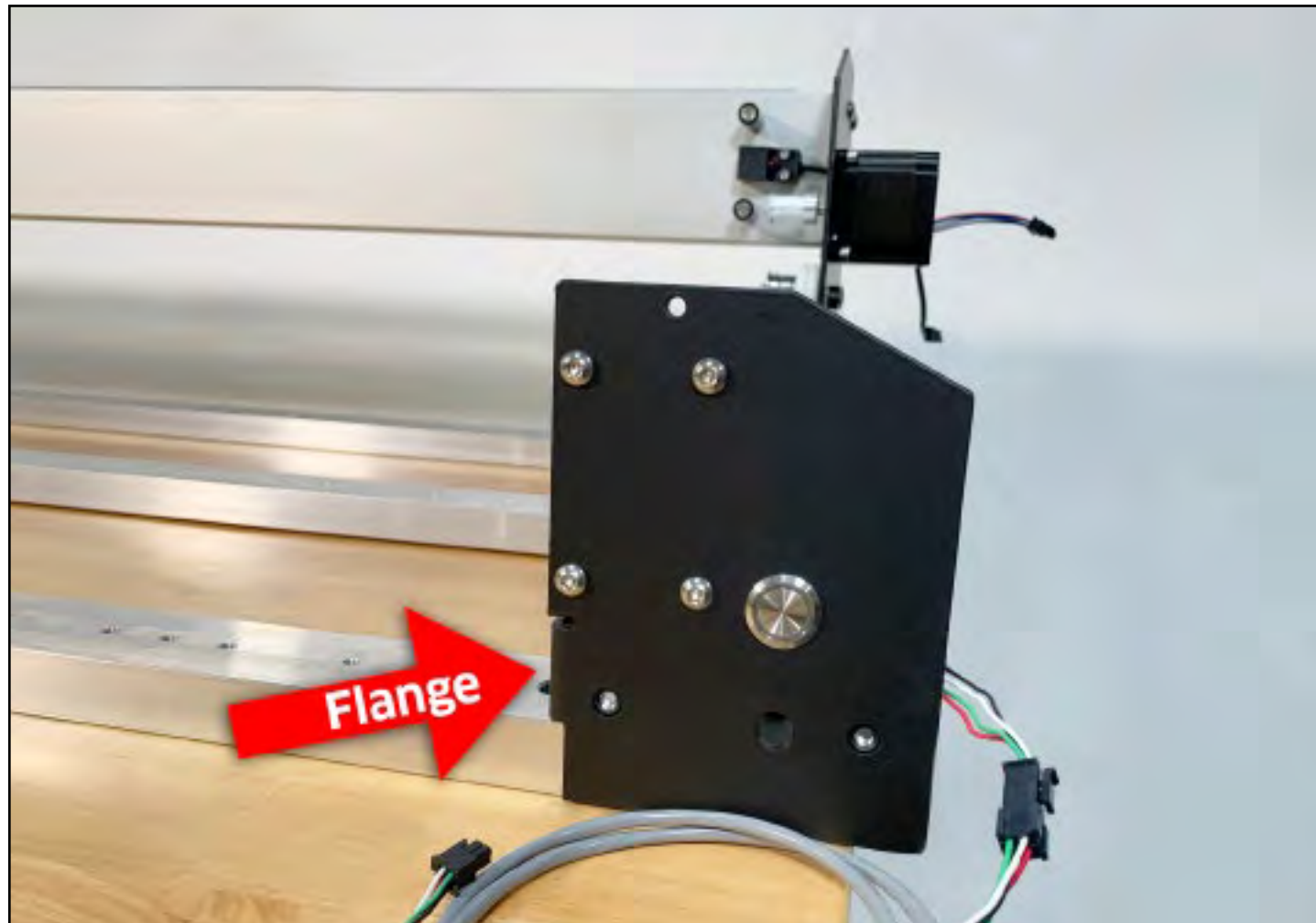**NOTE:** Be careful not to cross-thread the screws.

Figure 4-2
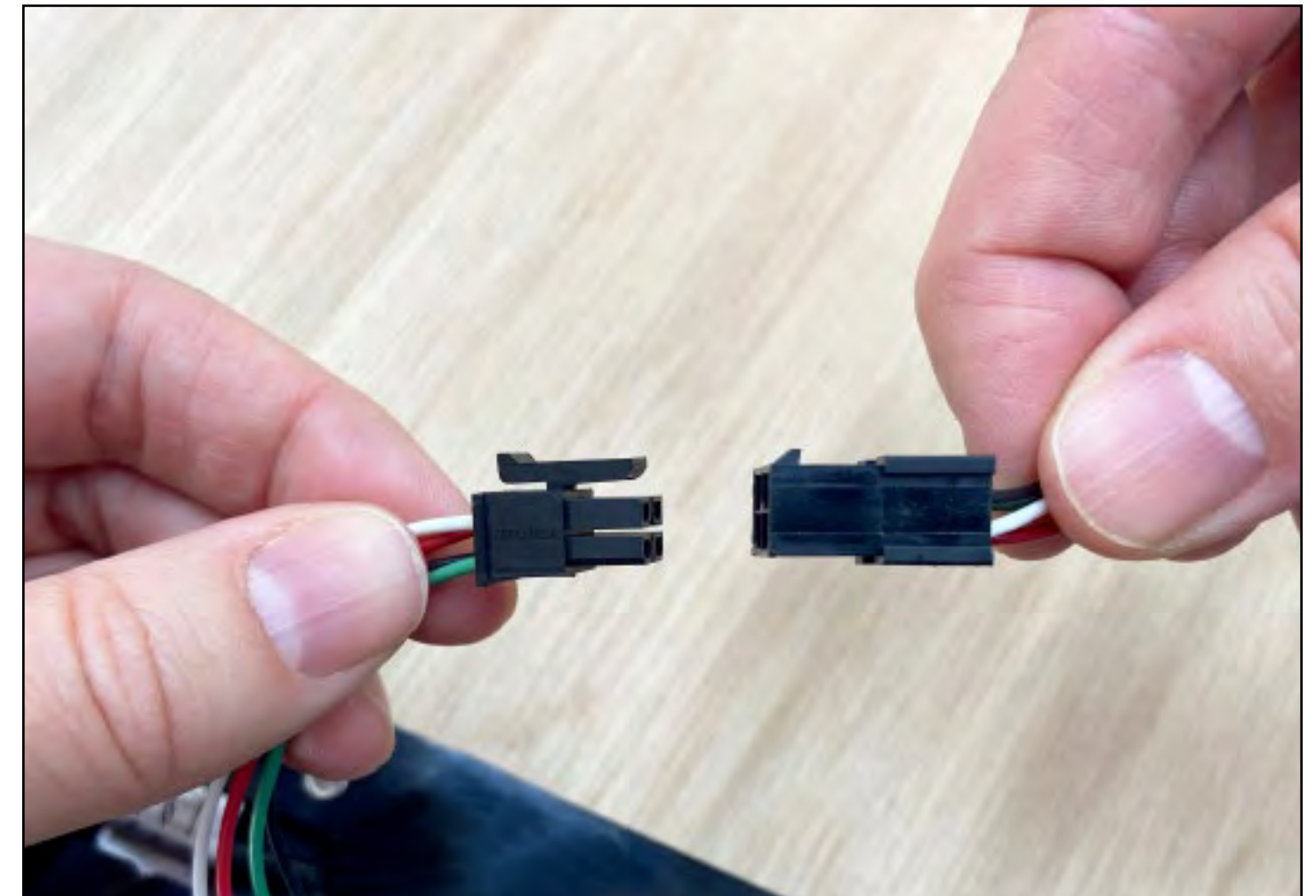
Figure 4-3

4.3 Install Back-Right Endplate

1. Position the back-right endplate at the back end of the Y-Right rail. See **Fig. 4-4**.

   a. Proximity switch to outside-front.

   b. Be careful not to pinch the Y-Axis proximity cable between the endplate and drag chain support panel or the end of the rail.

2. Use a 4mm hex key and four (4) M6×12mm BHCS to secure the endplate to the rail. Fully tighten.

4.4 Install Front-Left and Back-Left Endplates

1. Position the two remaining endplates at either end of the Y-Left rail. See **Fig. 4-5**.

   a. Curved flange on the lower part of the endplate goes to INSIDE.

   b. Tapered corners to the outside-top.

2. Use a 4mm hex key and four (4) M6×12mm BHCS to secure each endplate to the rail. Fully tighten.

Figure 4-4

Figure 4-5

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4.5 Install Y-Axis Limit Trigger and Square Machine
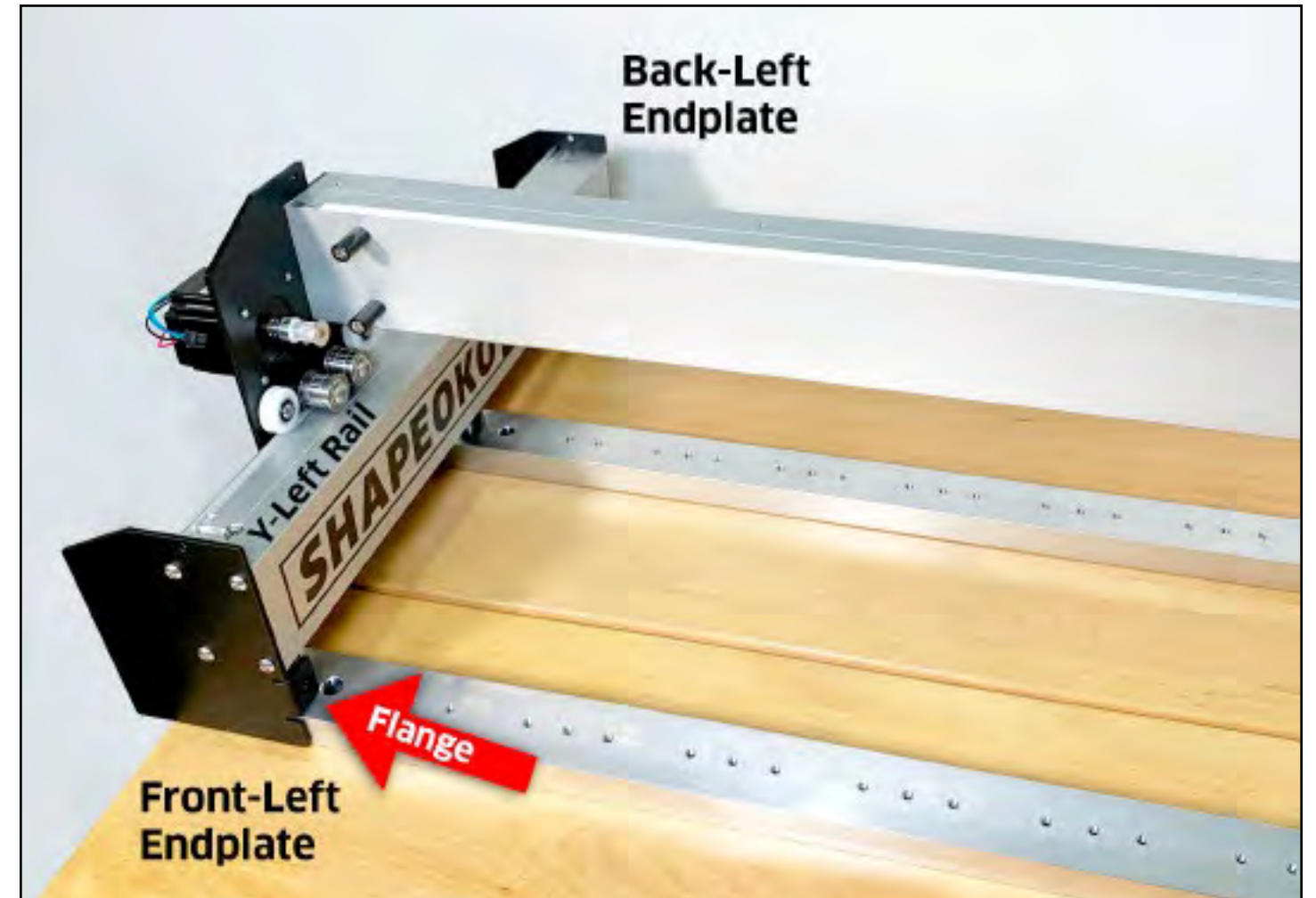
1. Locate the bag labeled "Y-Axis Limit Trigger" which (contains an M5 standoff) in the Carrier Plate Assembly Box from step 3.

   a. The M5 standoff serves as the "trigger" for the Y-Axis limit (the proximity switch).

2. Screw the M5 standoff into the M5 screw hole in the Y-Right gantry plate. See **Fig. 4-6**.

3. Slide the gantry as far forward as it will go.

4. Adjust the squareness of the baseframe until both ends of the gantry touch the front endplates. See **Fig. 4-6**.

5. Use a 5mm hex key and fully tighten the front-left and front-right shoulder bolts securing the Y-rails to the baseframe.

   a. Fully tighten the remaining shoulder bolts, moving front to back, sliding the gantry as you go, and alternating sides.

6. Slide the gantry as far back as it will go. Both ends of the gantry should touch the rear endplates.

7. Use a 4mm hex key to fully tighten the eight (8) M6×6mm BHCS securing the left and right drag chain support panels to the baseframe.
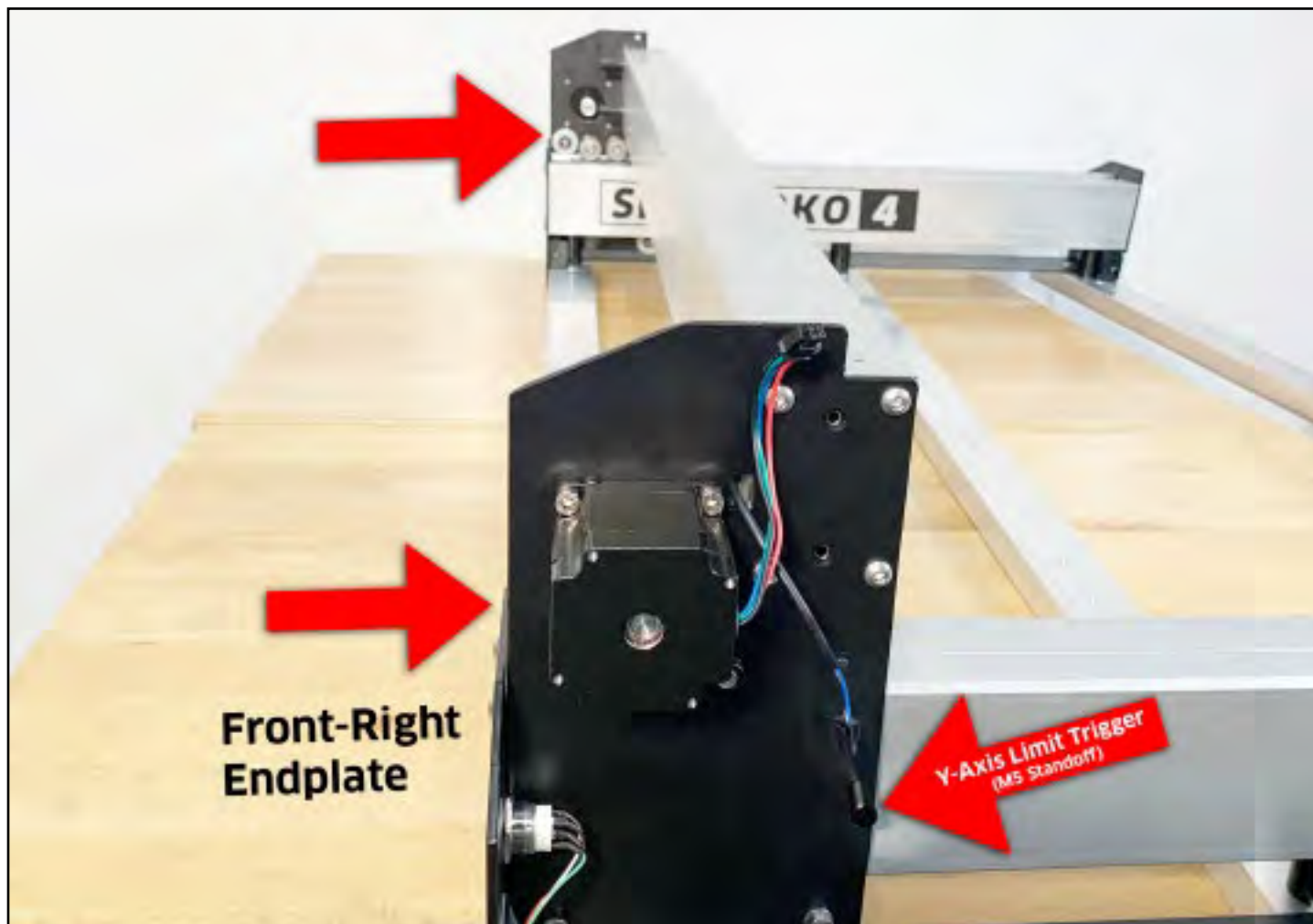

Figure 4-6

4.6 Install Side Skirts

1. Locate the two identical side skirts and M5×8mm BHCS set aside from the step 2 box.

2. Position one side skirt along the bottom-inside edge of the Y-Right rail. See **Fig. 4-7**.

   a. Through-hole to the bottom.

   b. Align with the screw holes in the flanges on the front and back endplates.

3. Use a 3mm hex key and two (2) M5×8mm BHCS to secure the skirt to the endplate flanges. Fully tighten.

4. Position the second skirt along the bottom-inside edge of the Y-Left rail.

   a. Through-hole to the bottom.

   b. Align with the screw holes in the flanges on the front and back endplates.

5. Use a 3mm hex key and two (2) M5×8mm BHCS to secure the skirt to the endplate flanges. Fully tighten.
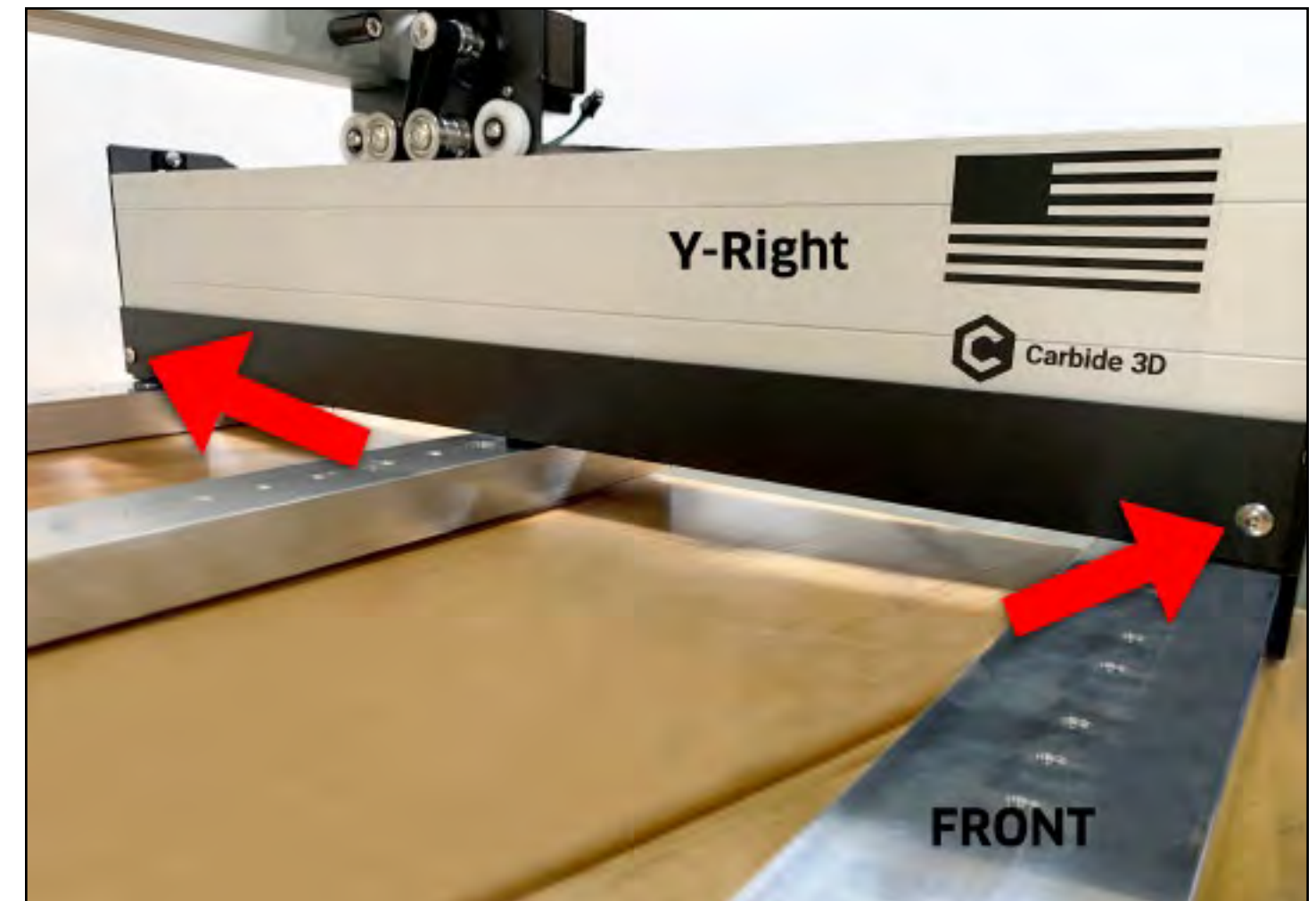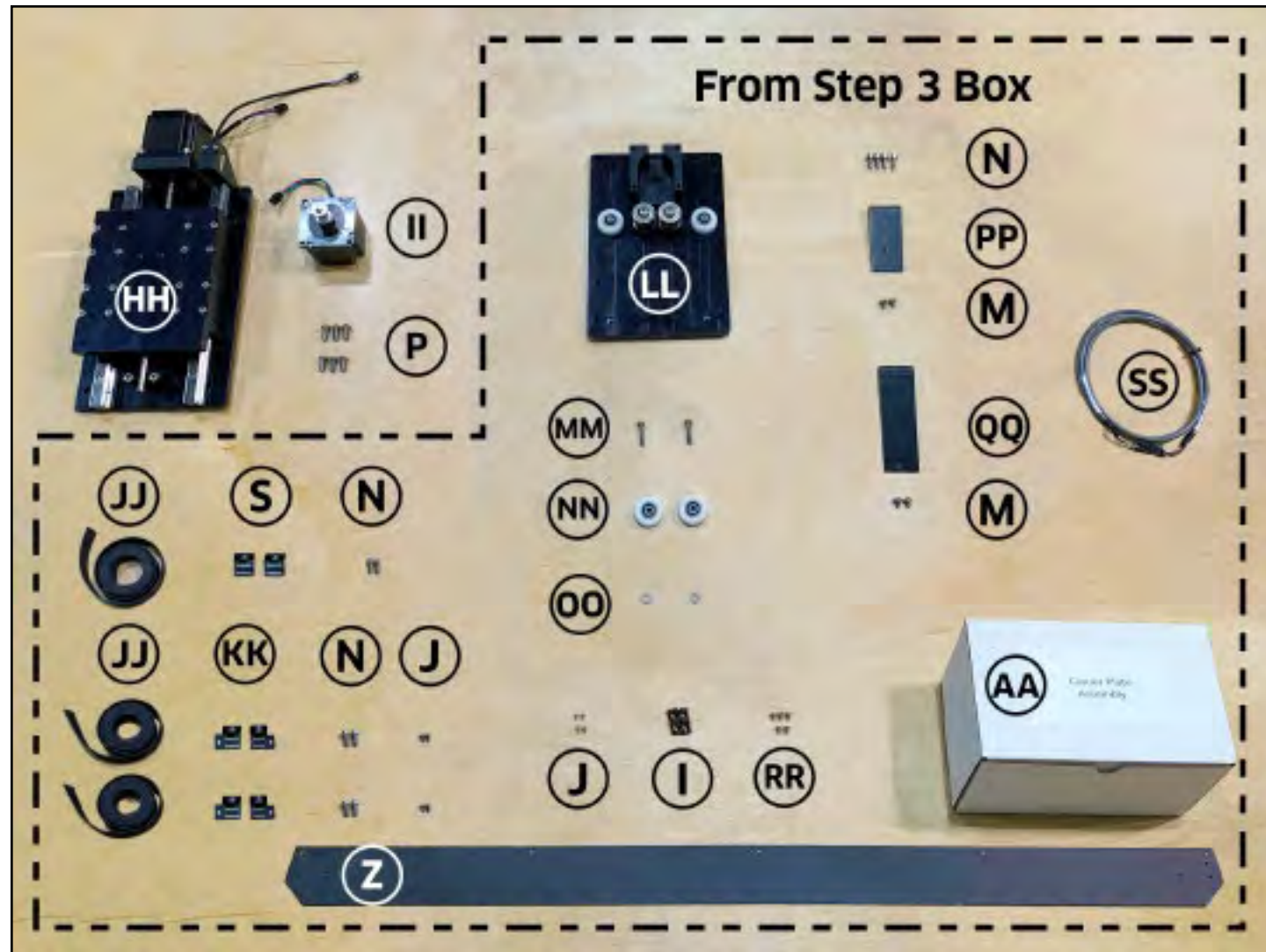

Figure 4-7

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Figure 5-1

5.1 Review Box 5 Components

Item	Description	Qty
HH	X/Z Assembly	1
II	Nema 23 Stepper Motor	1
P	M6×12mm Button Head Cap Screw	6
Z	X-Axis Drag Chain Support Panel **FROM STEP 3 BOX**	1
AA	**Carrier Plate Assembly Box** **FROM STEP 3 BOX**	1
	X-Axis Belt Kit	1
(JJ)	15mm GT2 1400mm Belt	1
(S)	15mm Universal Belt Clip	2
(N)	M5×12mm Socket Head Cap Screw	2
	Y-Axis Belt Kit	2
(JJ)	15mm GT2 1400mm Belt	2
(KK)	15mm Belt Clip Pair (Front and Back)	2
(N)	M5×12mm Socket Head Cap Screw	4
(J)	M3×6mm Button Head Cap Screw	2
(LL)	X/Z Carrier Plate	1
(MM)	M5×22mm Button Head Cap Screw	2
(NN)	V-wheel	2
(OO)	M5 Shim	2
(N)	M5×12mm Socket Head Cap Screw	4
(PP)	Data Drag Chain Head Bracket	1
(M)	M5×6mm Button Head Cap Screw	2
(QQ)	Router Drag Chain Head Bracket	1
(M)	M5×6mm Button Head Cap Screw	2
(J)	M3×6mm Button Head Cap Screw (+1 Extra)	3
(I)	Cable Tie Mount (+1 Extra)	3
(RR)	M4×6mm Button Head Cap Screw	5
(SS)	4-Pin Male-to-Female Y-Left Stepper Motor Extension Cable	1

5.2 Open Eccentric Nuts

1. Locate the carrier plate assembly box and the X-Axis drag chain support panel set aside from the step 3 box.

2. Lay the X/Z carrier plate on the work surface with the eccentrics face up and to the bottom.

3. Use a 10mm wrench to open the eccentrics. See *Fig. 5-2*.

   a. Dimple faces UP.

   b. Refer back to 3.2 Eccentric Nuts and V-wheels Explained, if necessary.

5.3 Pre-Assemble V-Wheels

1. Pre-assemble the bottom two V-wheels for the X/Z carrier plate, in order (See *Fig. 5-3*):

   a. M5×22mm BHCS

   b. V-wheel

   c. M5 shim (washer)

NOTE: Be sure the shim goes between the V-wheel and the X/Z carrier plate.

5.4 Install X/Z Carrier Plate

1. Place the X/Z carrier plate onto the gantry, aligning the two pre-installed V-wheels on the top with the upper V-rail.

2. Use a 3mm hex key to install the bottom two V-wheels on the back of the carrier plate. See *Fig. 5-3*.

   a. Be sure the V-wheels are properly seated on the lower V-rail.

   b. Use a 10mm wrench to hold eccentric nuts in the fully open position (dimples up).

   c. Use a 3mm hex key to tighten the BHCS to secure the V-wheels to the eccentric nuts.

3. Check the carrier plate movement by rolling it back and forth along the X-Axis gantry.

4. Use a 10mm wrench to tension the eccentric nuts.

   a. Rotate the eccentric nuts CLOCKWISE to tension. Adjust a little at a time. Not much tension is needed.

   b. Reach under and spin the V-wheel with your finger. If it rotates freely, keep tightening until you feel some friction against the rail.
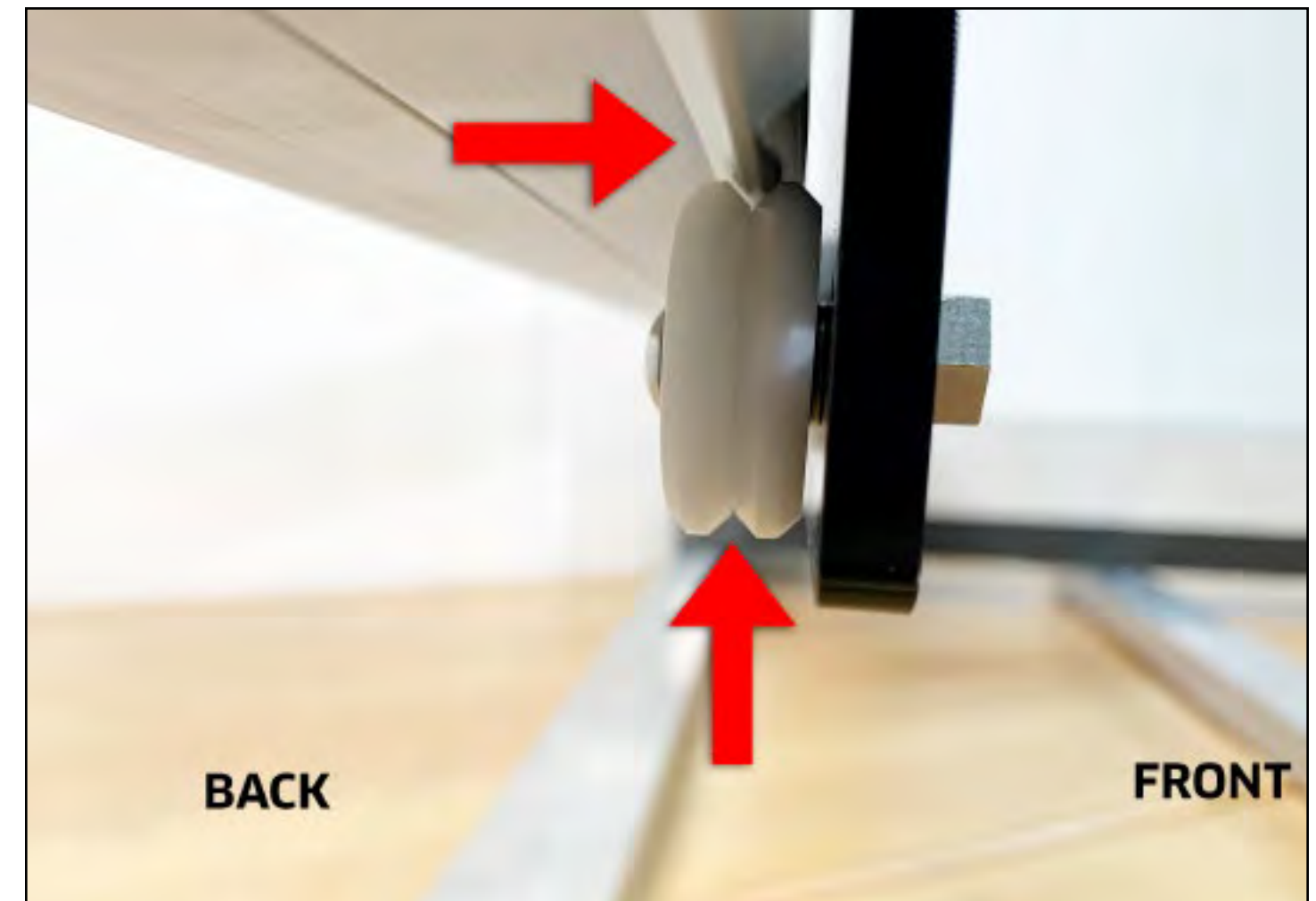

Figure 5-2

Figure 5-3

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5.5 Attach Belt Clip to Belt

See *Fig. 5-4*.

1. Thread about 2 inches of belt through the outer slot of the clip, with teeth facing toward the integrated nut.

2. Loop the belt down through the inner slot and pull the belt tight against the clip.

3. Bring the two sections of belt together. Interlock the teeth and extend the belt away from the integrated nut.

5.6 Install X-Motor and Belt

1. Locate the X-Axis belt kit.

    a. Contains two identical universal belt clips.

2. Thread one end of the belt through a belt clip. (Refer back to 5.5 Attach Belt Clip to Belt, if necessary.)

3. Use a 4mm hex key and one (1) M5×12mm SHCS to secure the belt clip to the top of the Y-Left gantry plate. See *Fig. 5-5*.

a. Slotted end of the clip against the rail.

b. Ensure belt teeth interlock where they meet at the clip.

c. Ensure teeth face down as the belt extends along the X-rail.

d. Insert SHCS through the outside of the gantry plate.

e. Fully tighten.
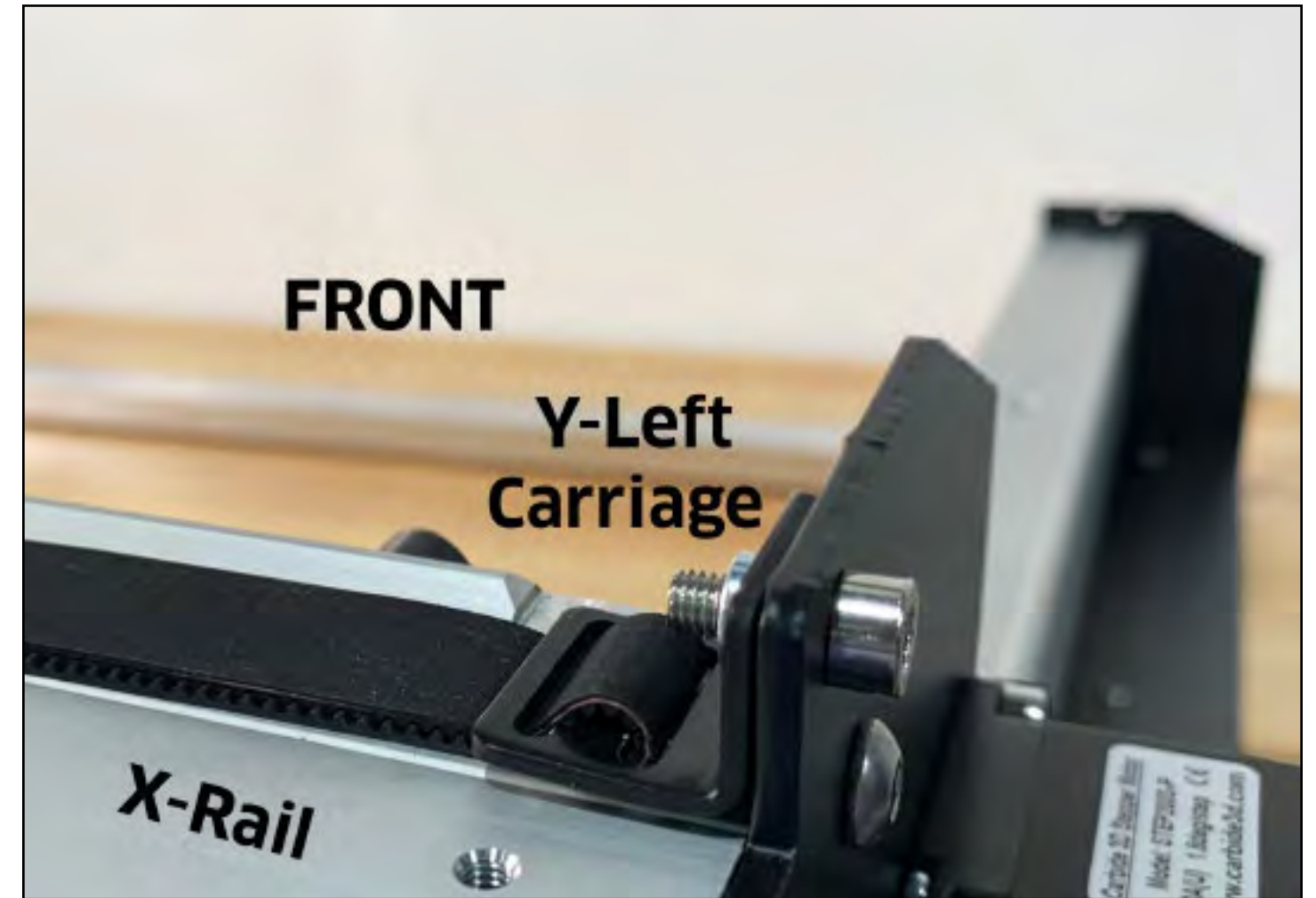

Figure 5-4

Figure 5-5

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4. Thread the belt, teeth down, under the two idlers on the back of the X/Z carrier plate.

5. Use a small hex key to pull a large loop of belt up between the two idlers and into the X-motor housing. See **Fig. 5-6**.

6. Position the X-motor over the threaded screw holes on the motor housing. See **Fig. 5-7**.

   a. Motor pulley faces into motor housing and under the belt loop.

   b. Motor lead cables extend up.
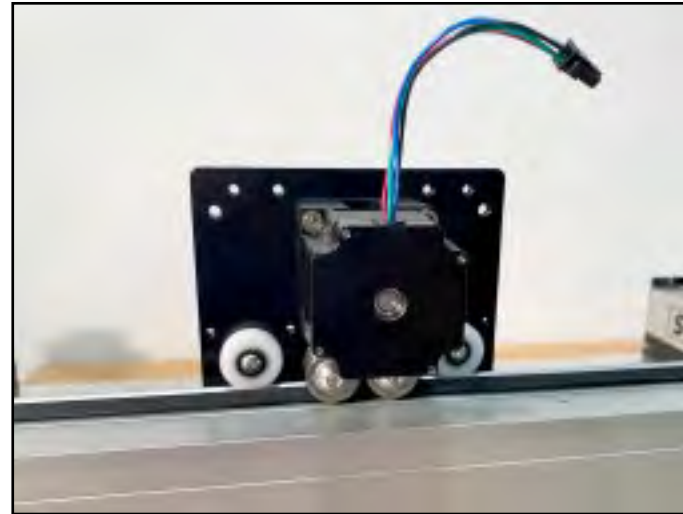

Figure 5-7

7. Use a 4mm hex key and four (4) M5×12mm SHCS to secure the X-motor to the motor housing. Fully tighten. See **Fig. 5-7**.

8. Pull the slack out of the belt.

   a. Look through the slot in the top of the X-motor housing to make sure the belt stays properly on the motor pulley.

9. Thread the second belt clip onto the free end of the belt. (Refer back to 5.5 Attach Belt Clip to Belt, if necessary.)

10. Hold the clip flat against the end of the X-rail.

11. Adjust the length of the belt so that there is a 2–3mm gap between the clip and the Y-Right gantry plate. See **Fig. 5-8**.

12. Use a 4mm hex key and one (1) M5×12mm SHCS to secure the clip.

   a. Maintain downward pressure on the clip.

   b. Fully tighten the screw.

   c. The belt should snap back against the rail when gently lifted.

NOTE: Do not overstretch the belt. Stretching more than 3mm could damage the belt or motor.
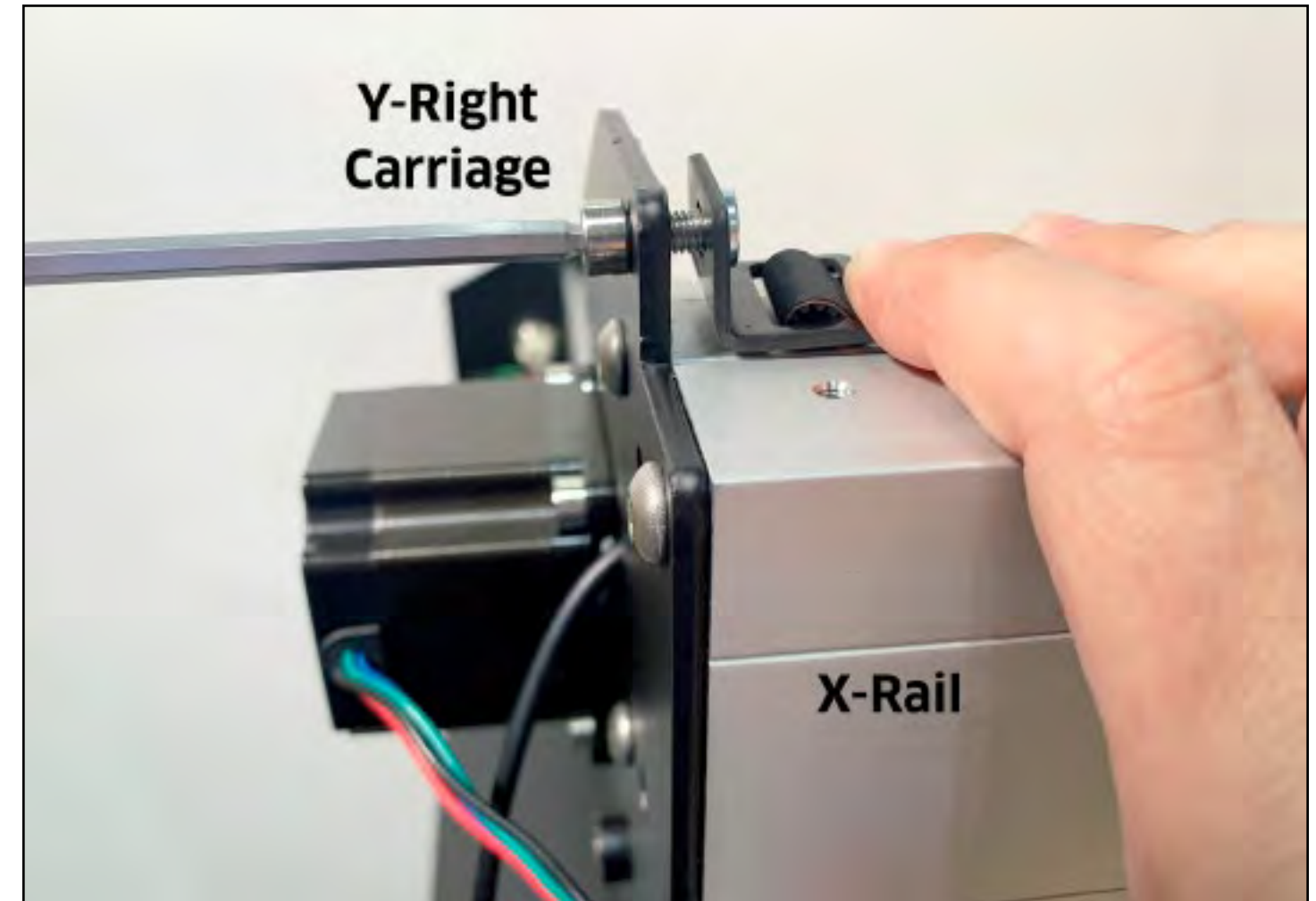

Figure 5-6

Figure 5-8

5.7 Install Data Drag Chain Head Bracket

1. Position the (shorter) data drag chain head bracket on the BACK of the X/Z carrier plate **(**See **Fig. 5-9)**:

   a. Align to the two (2) M5 holes in the upper-right corner (from the rear).

   b. Flange down.

2. Use a 3mm hex key and two (2) M5×6mm BHCS to secure the bracket to the X/Z assembly. Fully tighten.
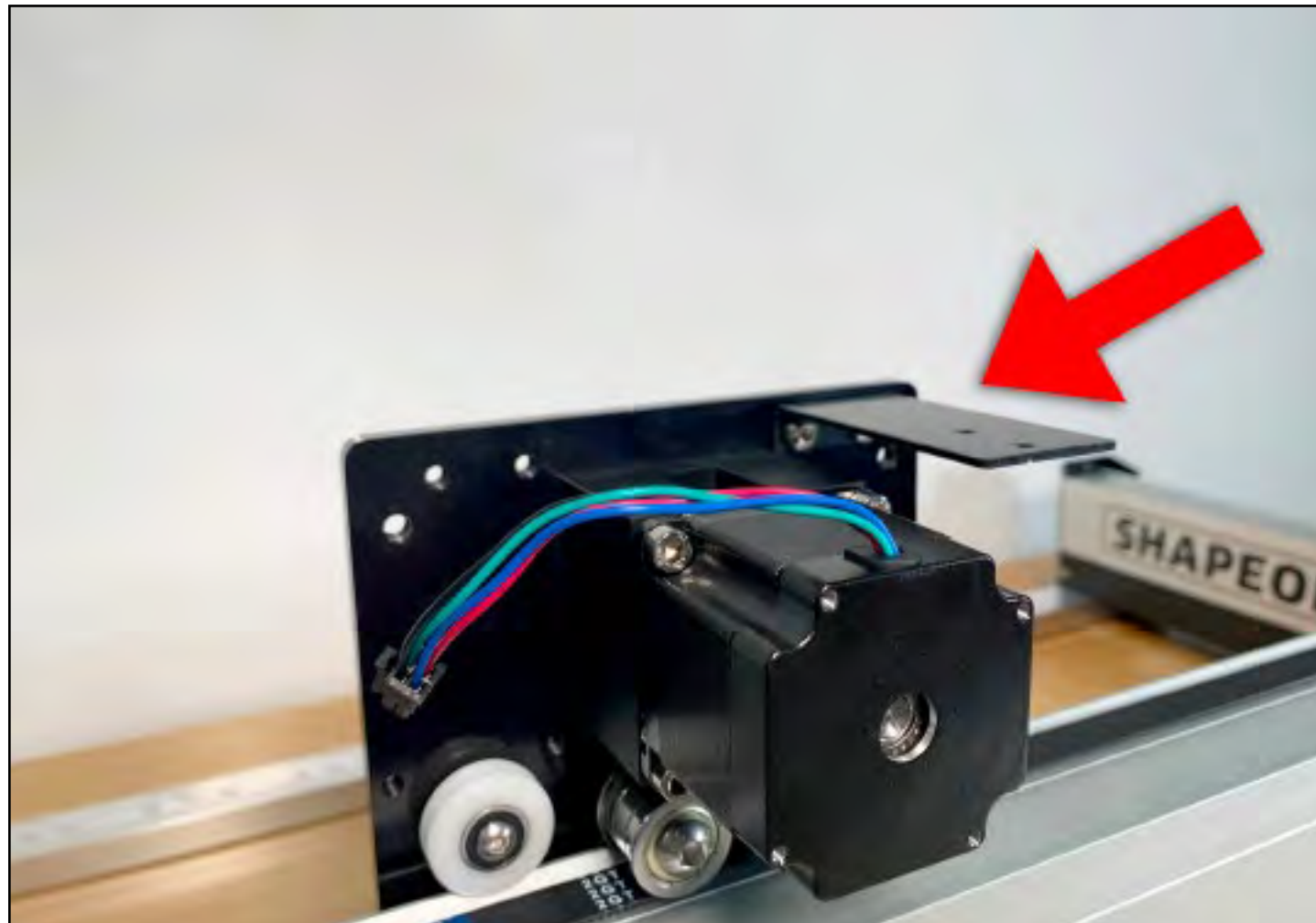

Figure 5-9

5.8 Install Router Drag Chain Head Bracket

1. Position the (longer) router drag chain head bracket on the BACK of the X/Z assembly **(**See **Fig. 5-10)**:

   a. Align to the two (2) M5 holes in the upper-left corner (from the rear).

   b. Flange down.

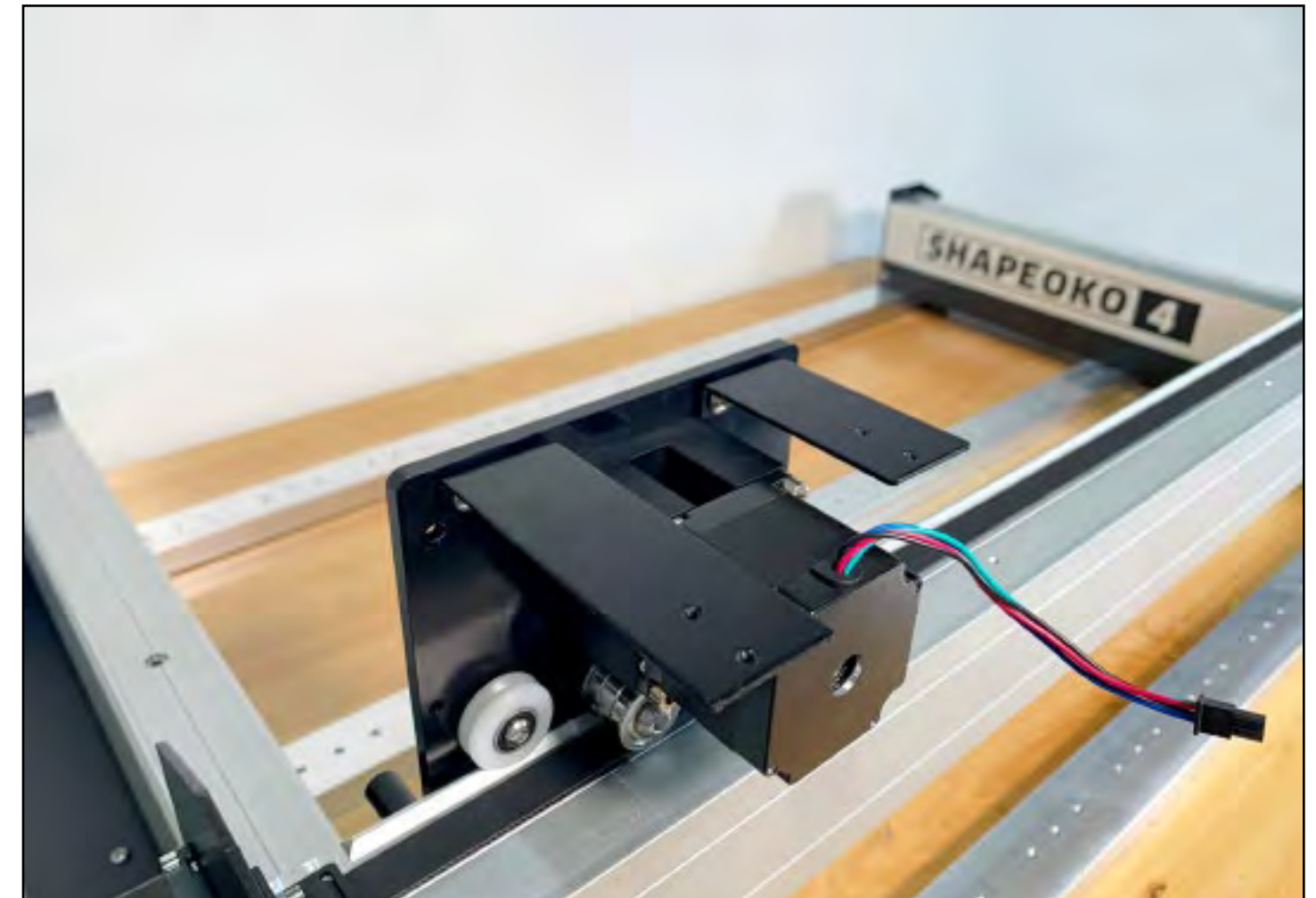2. Use a 3mm hex key and two (2) M5×6mm BHCS to secure the bracket to the X/Z assembly. Fully tighten.

Figure 5-10

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5.9 Install X/Z Assembly

1. Slide the Z-Axis plate on the front of the X/Z assembly until it is centered on the linear rails and all six M6 holes on the front of the assembly are accessible. See **Fig. 5-11**.

2. Position the X/Z assembly over the FRONT of the X/Z carrier plate. See **Fig. 5-11**.
   a. Z-Axis plate facing front.
   b. Z-Axis stepper motor on top.
   c. Align M6 holes in the two components.

3. Use a 4mm hex key and six (6) M6×12mm BHCS to secure the X/Z assembly to the carrier plate. Fully tighten.

5.10 Install X-Axis Drag Chain Support Panel

1. Identify the back-side of the X-Axis drag chain support panel. See **Fig. 5-13**.
   a. The set of two M3 integrated nuts, spaced about 1″ apart and located at each end of the panel, are pressed into the BACK-SIDE of the panel. Look for the outline of these four nuts on the back-side.

IMPORTANT: Be sure to correctly identify the back-side of the support panel. The panel will only work properly one way.

2. Use a 2mm hex key and three (3) M3×6mm BHCS to secure three cable tie mounts to three right-side up nuts along the center of the BACK-SIDE of the support panel.

3. Position the support panel RIGHT-SIDE UP across the top-back of the gantry.
   a. Tapered corners to the back.
   b. Five M4 holes along the front edge.
   c. Two integrated M3 nuts at each end.

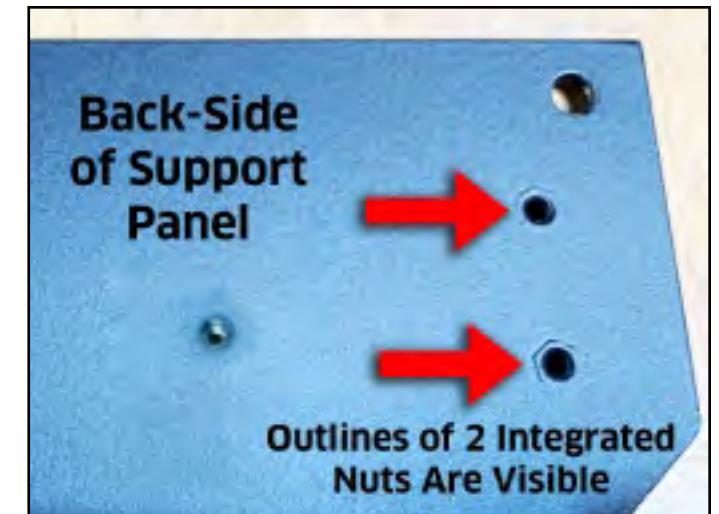4. Use a 2.5mm hex key and five (5) M4×6mm BHCS to secure the support panel to the gantry. See **Fig. 5-12**.
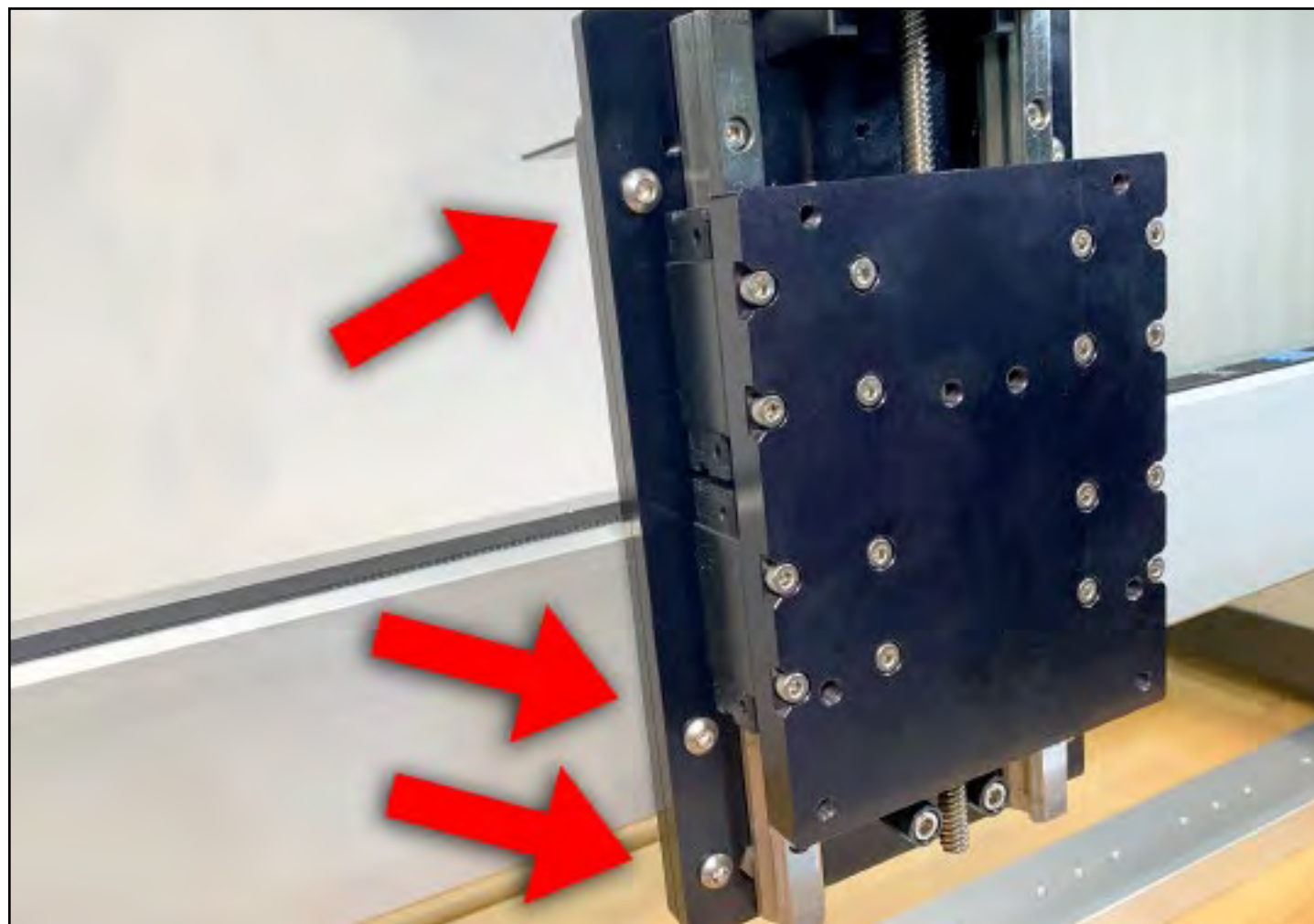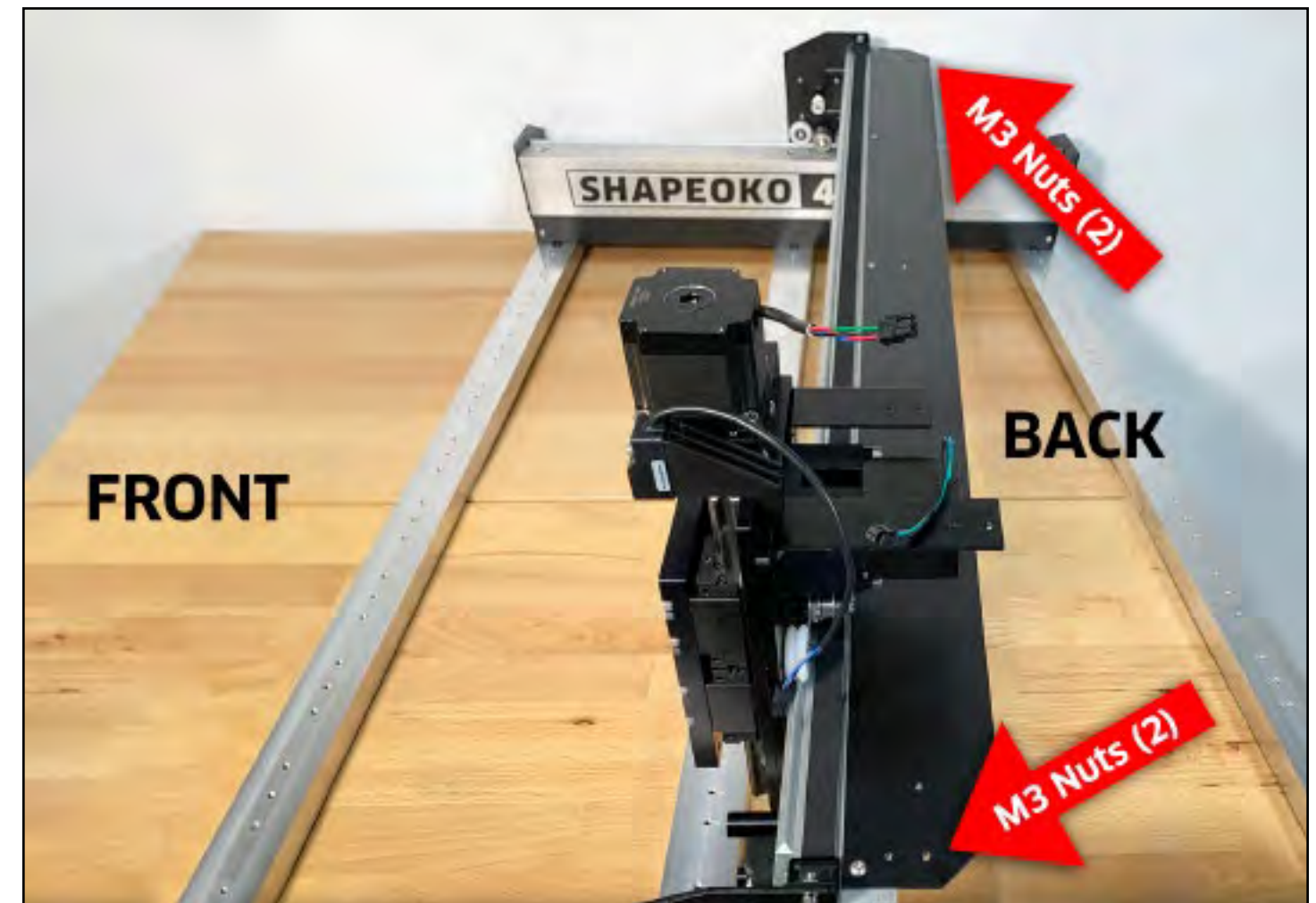

Figure 5-13

Figure 5-11

Figure 5-12

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5.11   Install Y-Axis Belts

Each Y-Axis belt kit includes a pair of belt clips: one which will sit at the front endplate and one which will sit at the back endplate. See *Fig. 5-14*. Each belt clip has a small slotted tab on one side. When positioned correctly, the slotted tab will face to the INSIDE of the machine. The M3 screw in the belt kit screws through the small slotted tab and into the top of the rail, preventing the belt clip from twisting when the M5 screw, which secures the belt clip to the endplate, is fully tightened.

Refer back to 5.5 Attach Belt Clip to Belt, if necessary.

5.12   Install Y-Left Belt

1. Insert one end of a belt into the front-left belt clip (the slotted tab will face to the INSIDE of the machine). See *Fig. 5-14*.

2. Place the belt clip on the Y-Left rail at the front-left endplate. See *Fig. 5-15*.

   a. Small slotted tab sits over the M3 screw hole in the top of the rail.

   b. Ensure belt teeth interlock where they meet at the clip.

   c. Ensure teeth face down as the belt extends along the rail.

3. Use a 2.5mm hex key and one (1) M3×6mm BHCS to LOOSELY secure the belt clip to the threaded M3 hole in the top of the rail. See *Fig. 5-15*.

4. Use a 4mm hex key and one (1) M5×12mm SHCS to secure the clip to the front-left endplate. Fully tighten.

   a. Insert the SHCS from the front side of the endplate.

5. Use a 2.5mm hex key to fully tighten the M3 BHCS on the top of the rail.

6. Thread the belt, teeth down, under the two idlers on the Y-Left gantry plate.

7. Push a loop of belt up between the two idlers. Use a small hex key to pull the loop up between the idlers, if necessary.
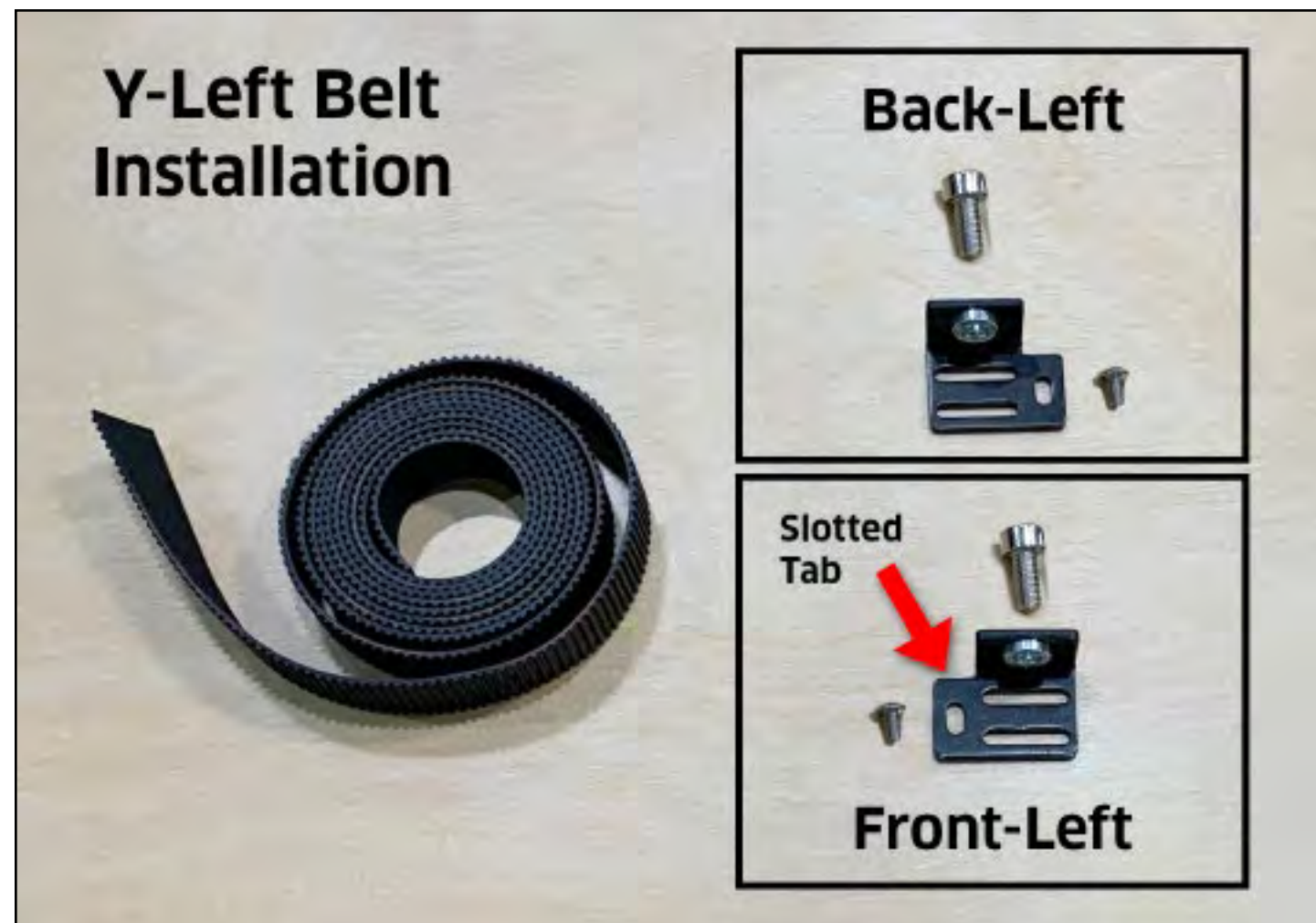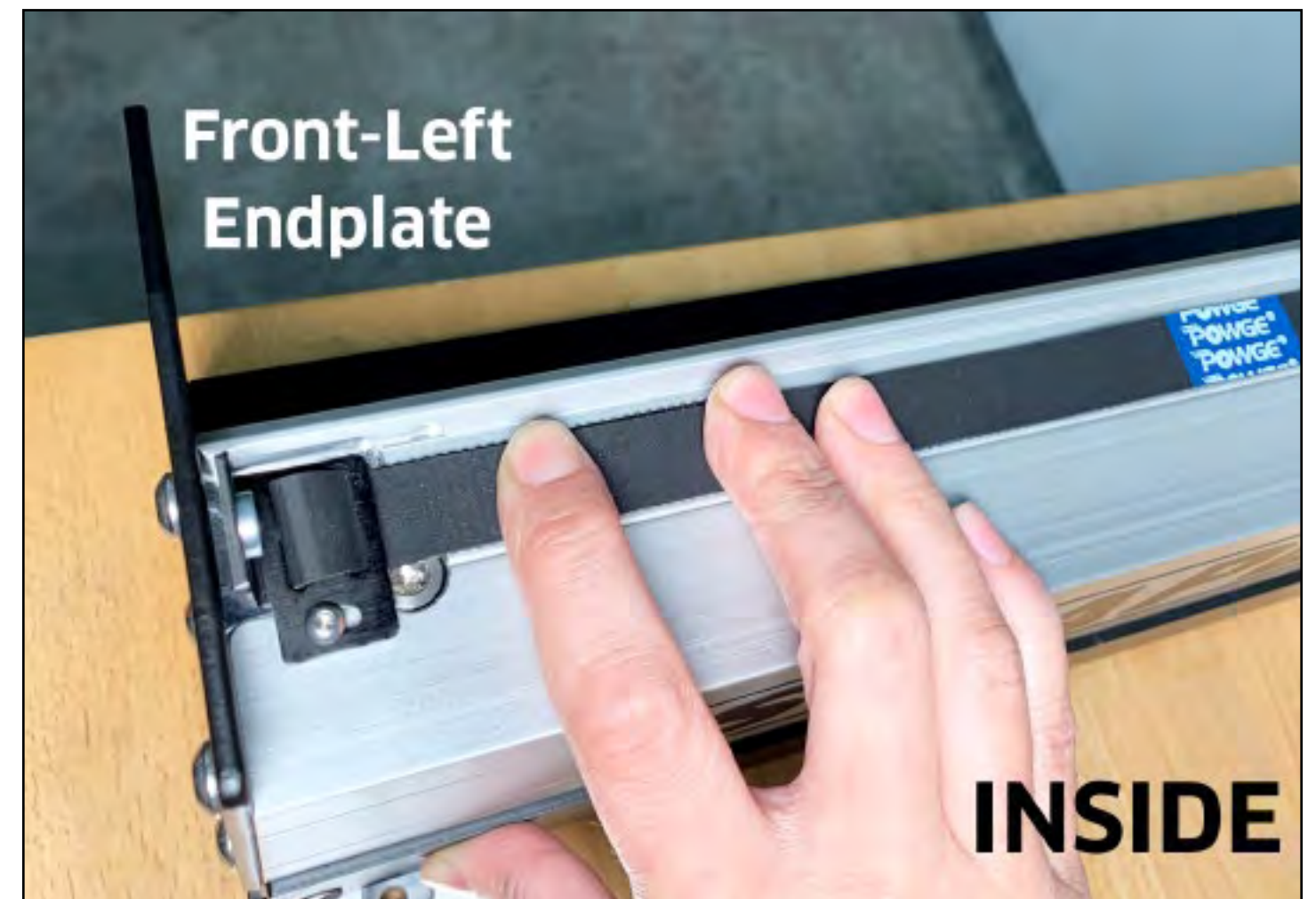

Figure 5-14

Figure 5-15

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8. Place the loop over the stepper motor pulley. See **Fig. 5-16**.

9. Thread the second belt clip onto the free end of the belt.

10. Place the belt clip on the Y-Left rail at the back-left endplate and hold it flat to the rail.

    a.   The small slotted tab faces to the INSIDE.

11. Adjust the length of the belt so that the small slotted tab sits over the M3 screw hole in the rail **and** the M3 screw hole is at the back-most edge of the slot.

12. Trim off the excess belt, leaving about 2 inches of length from the end of the belt clip.

13. Use a 2.5mm hex key and one (1) M3×6mm BHCS to LOOSELY secure the belt clip to the M3 hole in the top of the rail.

14. Use a 4mm hex key and one (1) M5×12mm SHCS to secure the clip to the back-left endplate. Fully tighten. See **Fig. 5-17**.

15. Use a 2.5mm hex key to fully tighten the M3 BHCS on the top of the rail.

    a.   The M3 screw head should now be in the middle of the slotted tab.

NOTE: The belt will snap back against the rail when gently lifted. Do not overstretch the belt as this could damage the belt or motor.

5.13   Install Y-Right Belt

1. Repeat all steps in 5.12 to install the second Y-Axis belt to the Y-Right rail.

NOTE: The Y-Right belt clips will be opposite those on the Y-Left rail. The small slotted tabs will always face to the INSIDE of the machine.

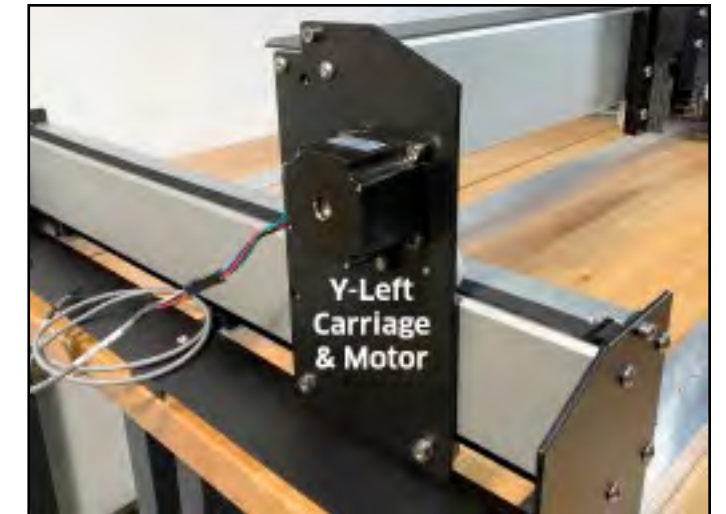2. Plug the Y-Left stepper motor extension cable into the Y-Left motor cable. See **Fig. 5-18**.
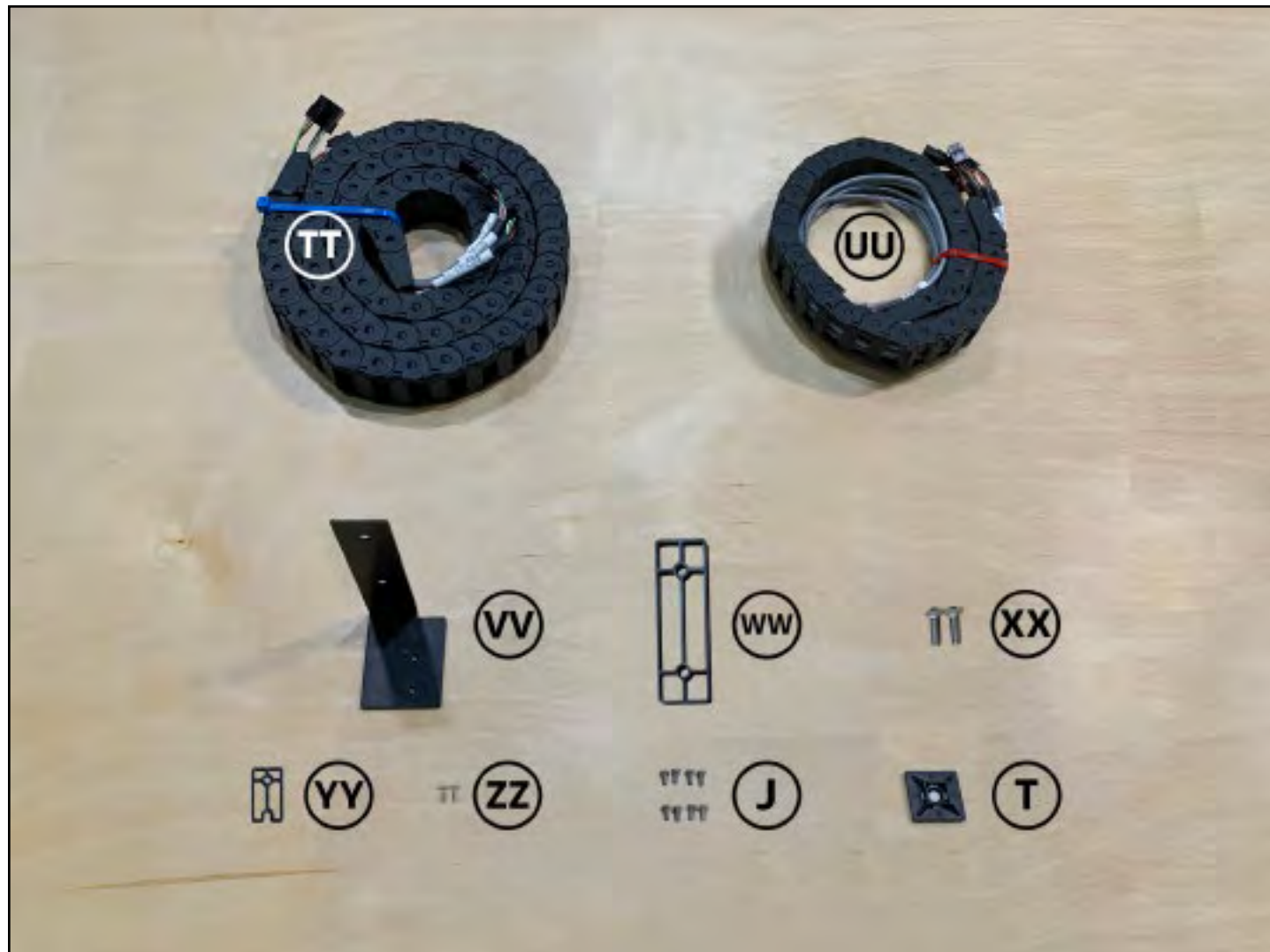

Figure 5-18

Figure 5-16

Figure 5-17

Figure 6-1

6.1 Review Box 6 Components

Item	Description	Qty
TT	X-Axis Data Drag Chain: 4-pin male-to-female extension (2), 3-pin male-to-female extension (1)	1
UU	Y-Axis Data Drag Chain: 4-pin male-to-female extension (4), 3-pin female to 8-pin male proximity switch extension (X and Z) (2)	1
VV	X/Y-Right Transition Bracket	1
WW	6mm Spacer[5]	1
XX	M5×16mm Button Head Cap Screw	2
YY	2mm Spacer[5]	1
ZZ	M3×8mm Flat Head Screw	2
J	M3×6mm Button Head Cap Screw (+2 Extra)	8
T	Self-Adhesive Cable Tie Down	1

5. The two spacers allow the drag chain to move freely during travel. The 6mm standoff will be placed between the X/Y transition bracket and the Y-Right gantry plate. The 2mm spacer will be placed between the tail of the Y-Axis drag chain and the Y-Right drag chain support panel.

6.2 Install X-Axis Drag Chain

1. Position the X-Axis drag chain along the top of the X-Axis gantry. See *Fig. 6-2*.

    a. Head of the chain to the left; the tail to the right, ending at the Y-Right gantry plate.

    b. Head has all female connectors.

    c. Head curls up and attaches to the shorter data head bracket.
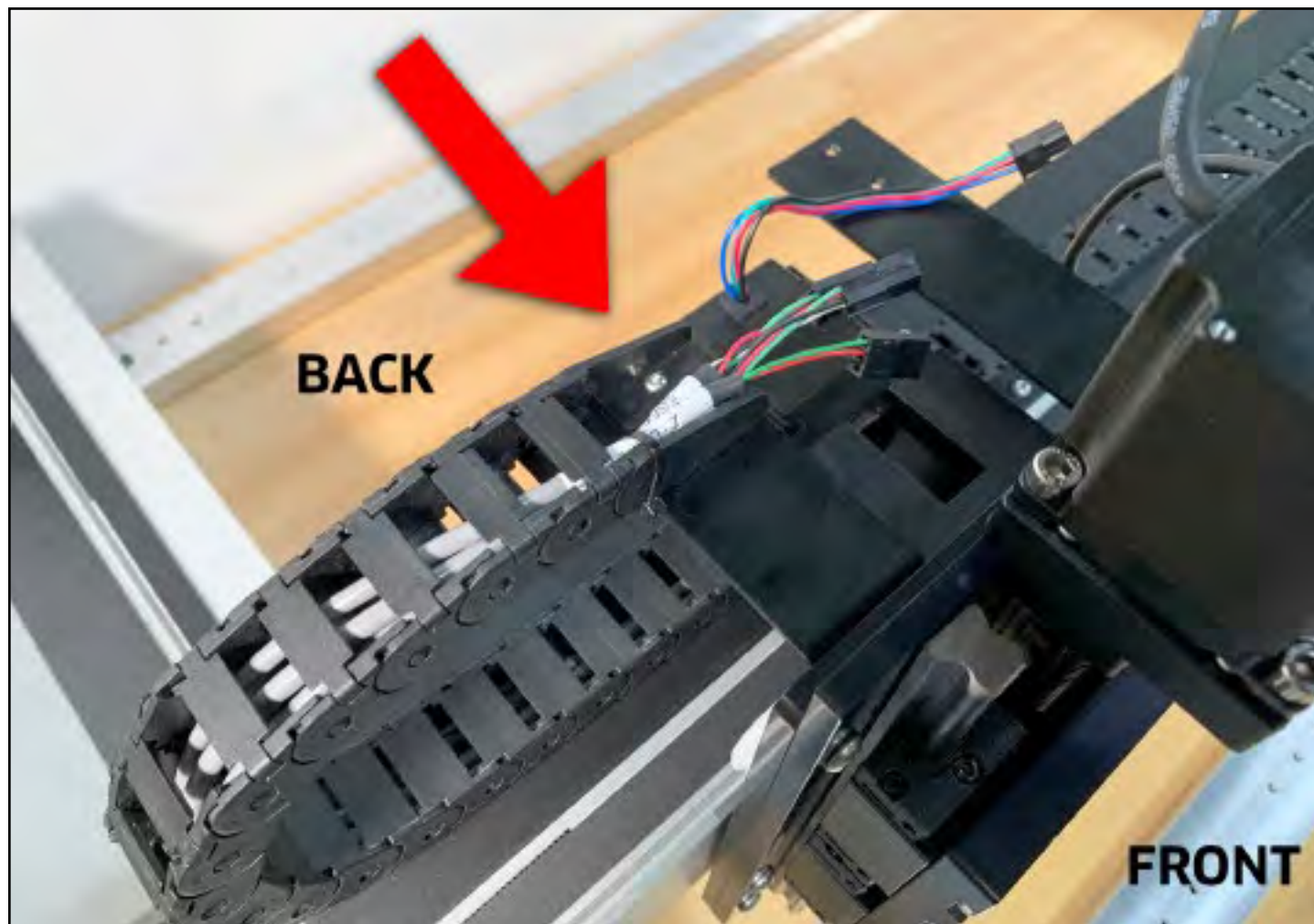
6.3 Secure X-Axis Drag Chain Head and Tail

1. Use a 2mm hex key and two (2) M3×6mm BHCS to secure the X-Axis drag chain to the data drag chain head bracket. Fully tighten. See *Fig. 6-2*.

    a. Data drag chain head bracket is the shorter bracket.

2. Position the tail of the X-Axis drag chain over the two M3 integrated nuts on the right side of the X-Axis drag chain support panel. See *Fig. 6-3*.

3. Use a 2mm hex key and two (2) M3×6mm BHCS to secure the tail of the X-Axis drag chain to the support panel. Fully tighten.
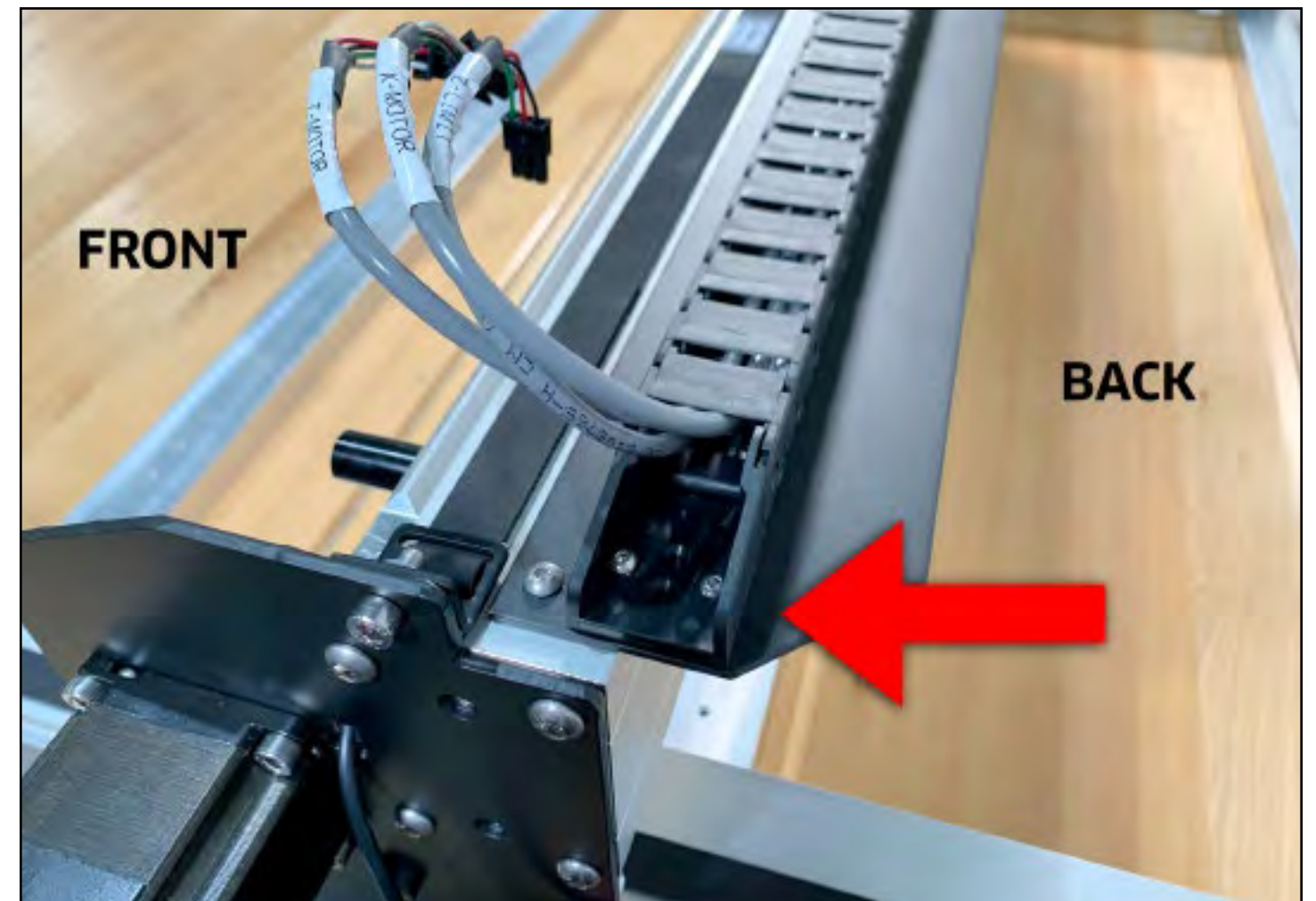

Figure 6-2

Figure 6-3

6.4 Attach Transition Bracket to Y-Axis Drag Chain Head

1. Position the X/Y transition bracket on the head of the Y-Axis drag chain. See **Fig. 6-4**.

   a. Head of chain has all female connectors.

   b. The flat side of the drag chain head attaches to the two integrated nuts in the bracket.

2. Use a 2mm hex key and two (2) M3×6mm BHCS to secure the bracket. Fully tighten.
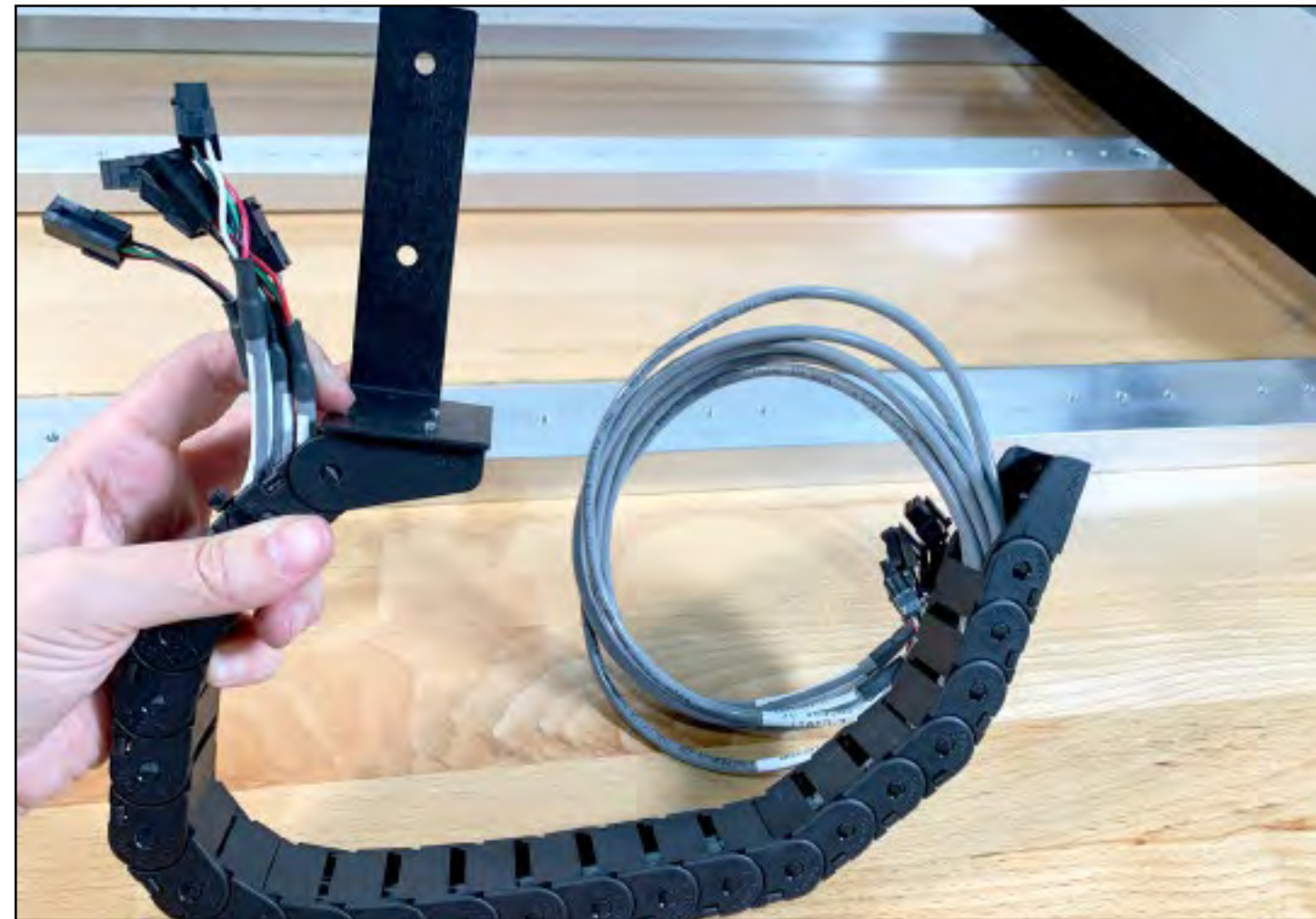
6.5 Install Y-Axis Drag Chain

1. Position the X/Y transition bracket, 6mm spacer, and Y-Axis drag chain combo alongside the Y-Right rail. See **Fig. 6-5**.

   a. Place the 6mm spacer between the bracket and the Y-Right gantry plate.

   b. Align the bracket and spacer with the two M5 screw holes in the gantry plate.

   c. Body of the drag chain extends forward from the bracket, then curls down and back.

2. Use a 3mm hex key and two (2) M5×16mm BHCS to secure the bracket and spacer to the gantry plate. Fully tighten. See **Fig. 6-5**.

6.6 Secure Y-Axis Drag Chain Tail

1. Position the tail of the Y-Axis drag chain and the 2mm spacer over the two M3 integrated nuts on the Y-Right drag chain support panel. See **Fig. 6-5**.

   a. Place the 2mm spacer between the drag chain tail and the support panel.

2. Use a 2mm hex key and two (2) M3×8mm FHS to secure the tail of the Y-Axis drag chain and the 2mm spacer to the support panel. Fully tighten.

6.7 Attach Cable Tie Down

1. Stick the self-adhesive cable tie down to the Y-Right drag chain support panel near the front-right endplate.

   a. The tie down will be used to help tidy power button wiring in step 9.

NOTE: Additional tie downs are included in the Extra Hardware Bag in box 1, in case you need them.
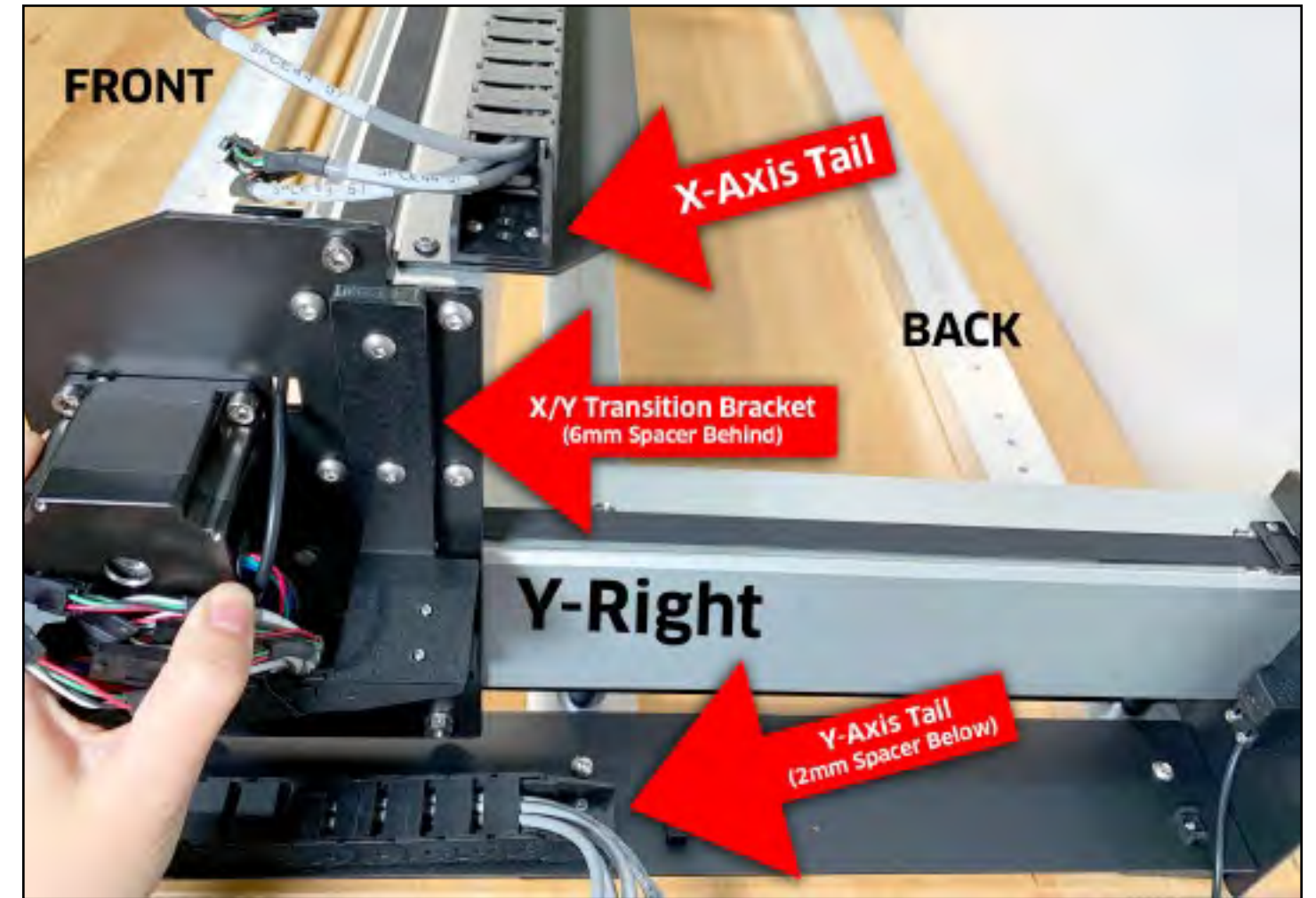

Figure 6-4

Figure 6-5

Figure 7-1

7.1 Review Box 7 Components

Item	Description	Qty
AAA	Empty X-Axis Drag Chain	1
BBB	Empty Y-Axis Drag Chain	1
CCC	X/Y-Left Transition Bracket	1
DDD	M5×10mm Button Head Cap Screw	2
J	M3×6mm Button Head Cap Screw	8
T	Self-Adhesive Cable Tie Down	1
EEE	65mm Router Mount	1
FFF	M6×40mm Socket Head Cap Screw	2
GGG	M5×40mm Socket Head Cap Screw	2
HHH	M6×25mm Socket Head Cap Screw	2
III	M6×10mm Grub Screw	1

Optional Shapeoko 4 CNC Router:

Item	Description	Qty
JJJ	Shapeoko 4 CNC Router Box: Includes Shapeoko 4 CNC Router with Collet and Collet Nut Installed, 13mm and 22mm Wrenches, Carbon Brushes (4), User Manual	1
KKK	0.25″ and 0.125″ Precision Collets	2

7.2 Install Router Mount

1. Position the router mount over the four screws holes at the bottom of the Z-Axis. See **Fig. 7-2**.

   a. Two larger M6 mounting holes on top.

2. Use a 5mm hex key and two (2) M6×40mm SHCS to secure the top of the mount. Fully tighten.

3. Use a 4mm hex key and two (2) M5×40mm SHCS to secure the bottom. Fully tighten.
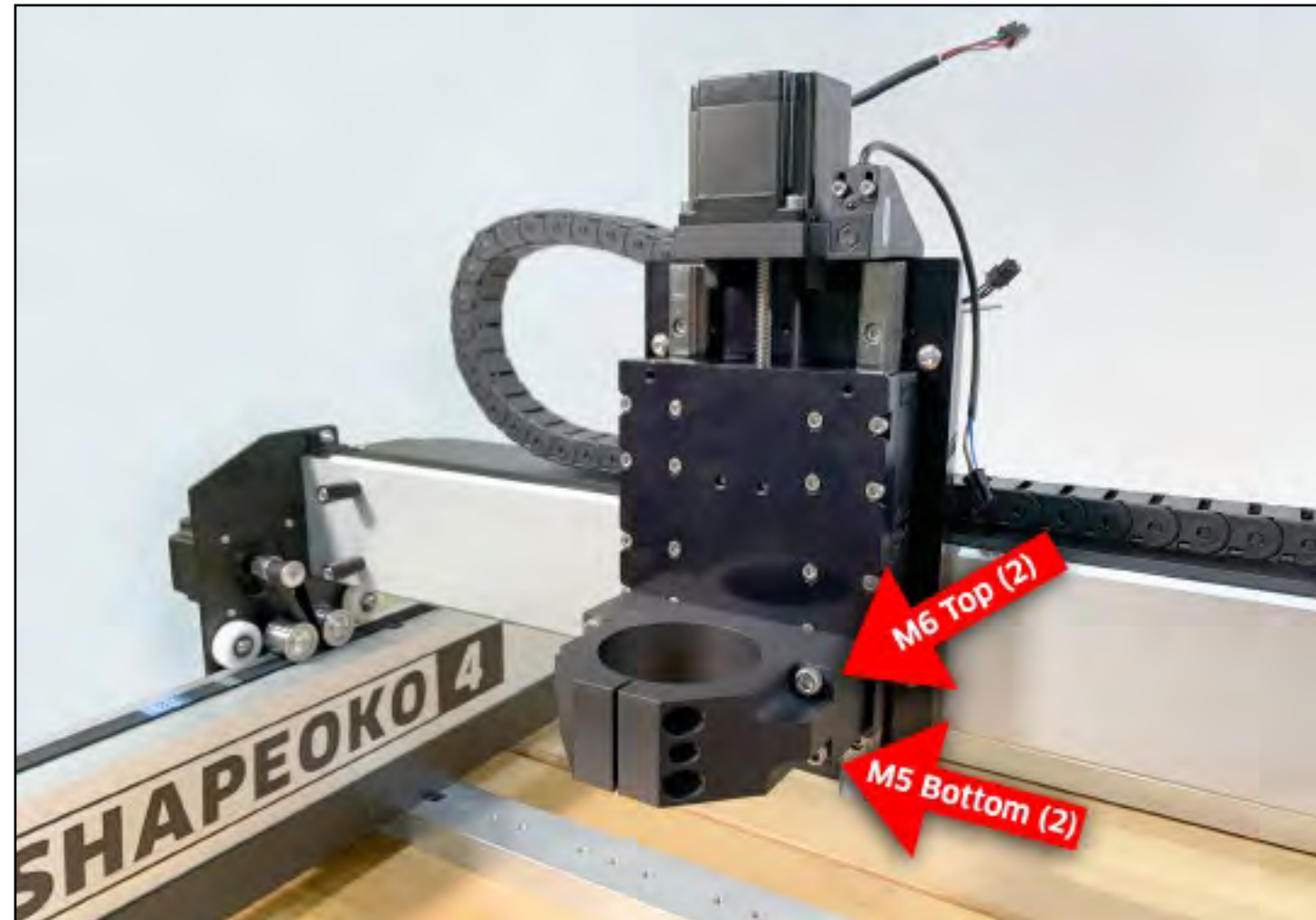
7.3 Install Router

1. Insert the router as far as it will go into the mount. See **Fig. 7-3**.

   a. Power cable extends to the left.

2. If the router doesn't quite fit, use a 3mm hex key and the M6 grub screw to gently pry open the mount (See **Fig. 7-4**):

   a. Insert the grub screw into the center threaded hole on the right side of mount.

   b. Tighten until the opening is just wide enough to insert the router.

   c. Remove the grub screw.

3. Use a 5mm hex key and two (2) M6×25mm SHCS to secure the router in the mount. Fully tighten. See **Fig. 7-3**.

   a. Insert screws into the top and bottom through-holes on the front-right of mount.

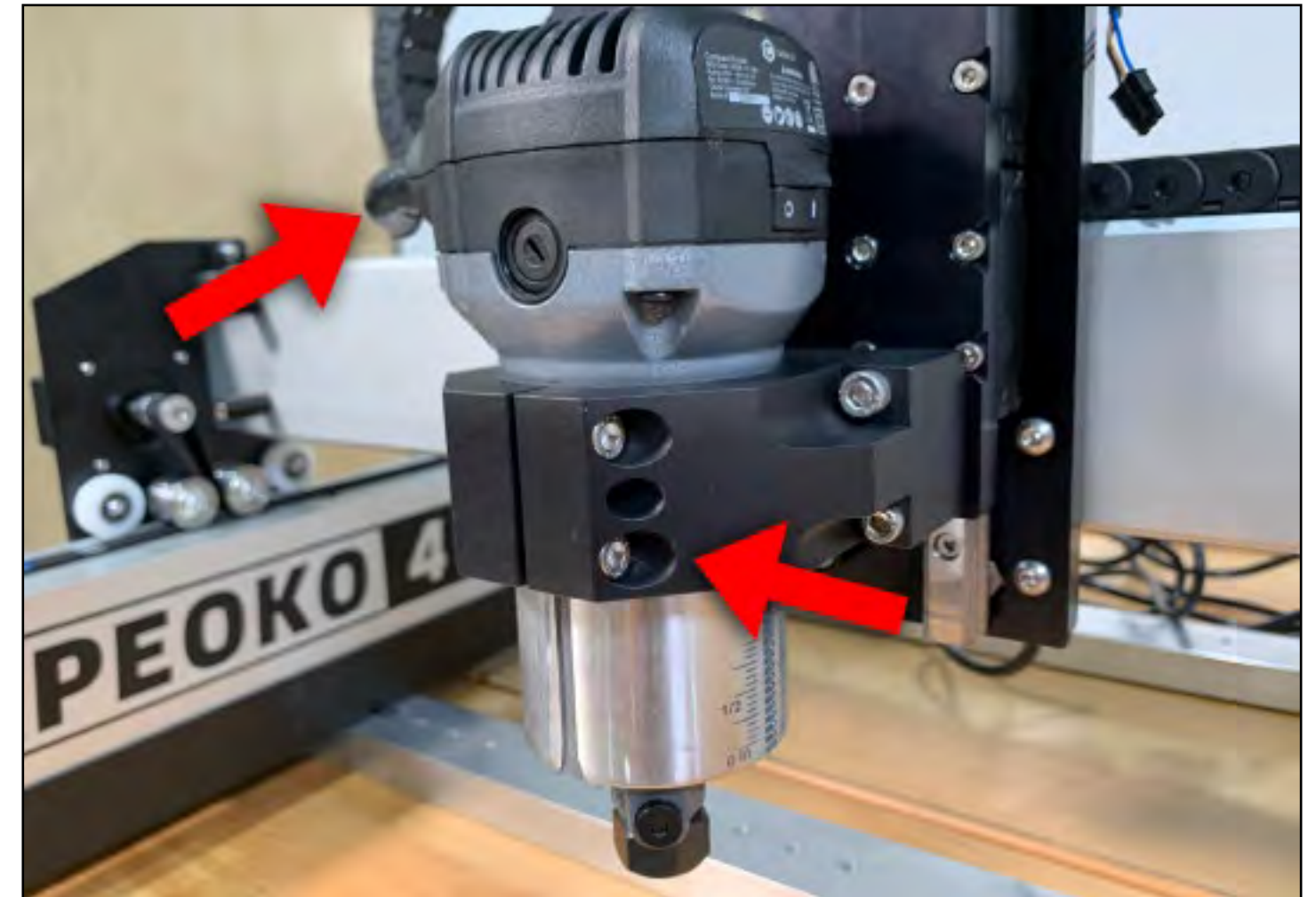   b. Alternate tightening each screw until the router is secure.

Figure 7-4

Figure 7-2

Figure 7-3

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7.4 Prepare Drag Chains

1. Open both drag chains.

   a. Lay chains flat, hinged-side up, and use a hex key to pry open the links from one side. See **Fig. 7-5**.

2. Lay out the longer X-Axis drag chain as shown in **Figs. 7-6** and **7-6 inset**.

   a. Bottom (flat side) of both the head and tail links face the front of the machine.
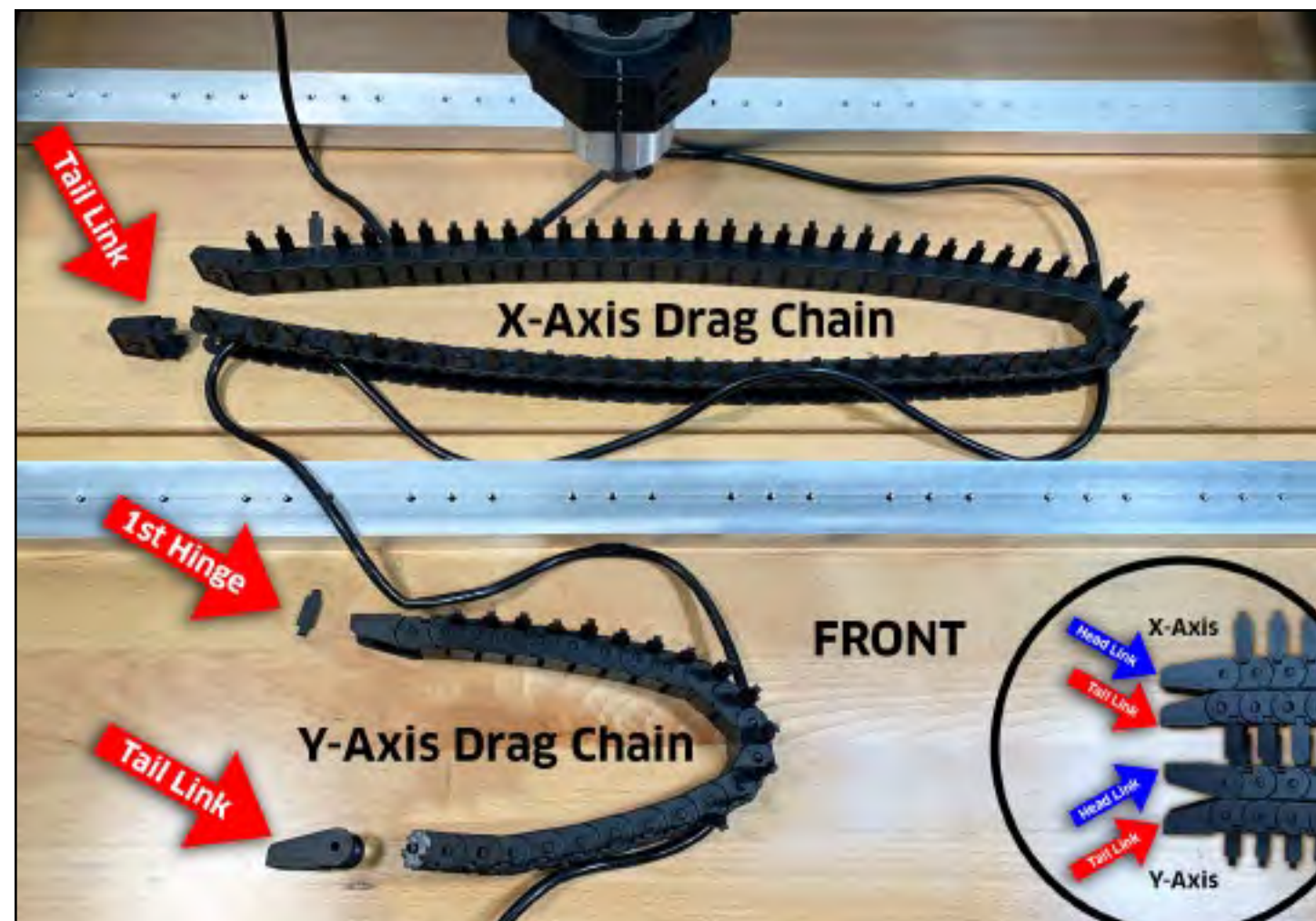

Figure 7-5

3. Lay out the shorter Y-Axis drag chain as shown in **Figs. 7-6** and **7-6 inset**.

   a. Head and tail links are interchangeable.

4. Use a small screwdriver to pry the tail links off both drag chains.

5. Remove the first link hinge at the head of the Y-Axis drag chain.

7.5 Insert Power Cable

1. Insert the router power cable through both drag chains and close up the links. See **Fig. 7-7**.

2. Snap the tail links back onto both drag chains. See **Fig. 7-7**.

NOTE: The power cable enters the head of the Y-Axis drag chain BEHIND the head link, in the space created by removing the first link hinge.

Figure 7-6

Figure 7-7

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7.6 Attach Transition Bracket to Y-Axis Drag Chain Head

1. Position the X/Y transition bracket on the head of the Y-Axis drag chain. See *Fig. 7-8*.

   a. Head of the chain is closest to the router.

   b. Flat side of the drag chain head attaches to the two integrated nuts in the bracket.

   c. Router cable must enter the chain OVER the bracket arm and through the opening where the first link hinge was removed.

2. Use a 2mm hex key and two (2) M3×6mm BHCS to secure the bracket to the drag chain head. Fully tighten.

7.7 Install X-Axis Drag Chain

1. Position the X-Axis drag chain along the top of the X-Axis gantry.

   a. Head of the drag chain attaches to the router head bracket. See *Fig. 7-9*.

   b. Body of the chain extends right from the head bracket before curling down and left, ending just before the Y-Left gantry plate.

7.8 Secure X-Axis Drag Chain Head and Tail

1. Use a 2mm hex key and two (2) M3×6mm BHCS to secure the drag chain head to the router head bracket. Fully tighten.

2. Position the tail of the X-Axis drag chain over the two M3 integrated nuts at the Y-Left end of the X-Axis drag chain support panel. See *Fig. 7-9*.

3. Use a 2mm hex key and the two (2) M3×6mm BHCS to secure the tail to the support panel.
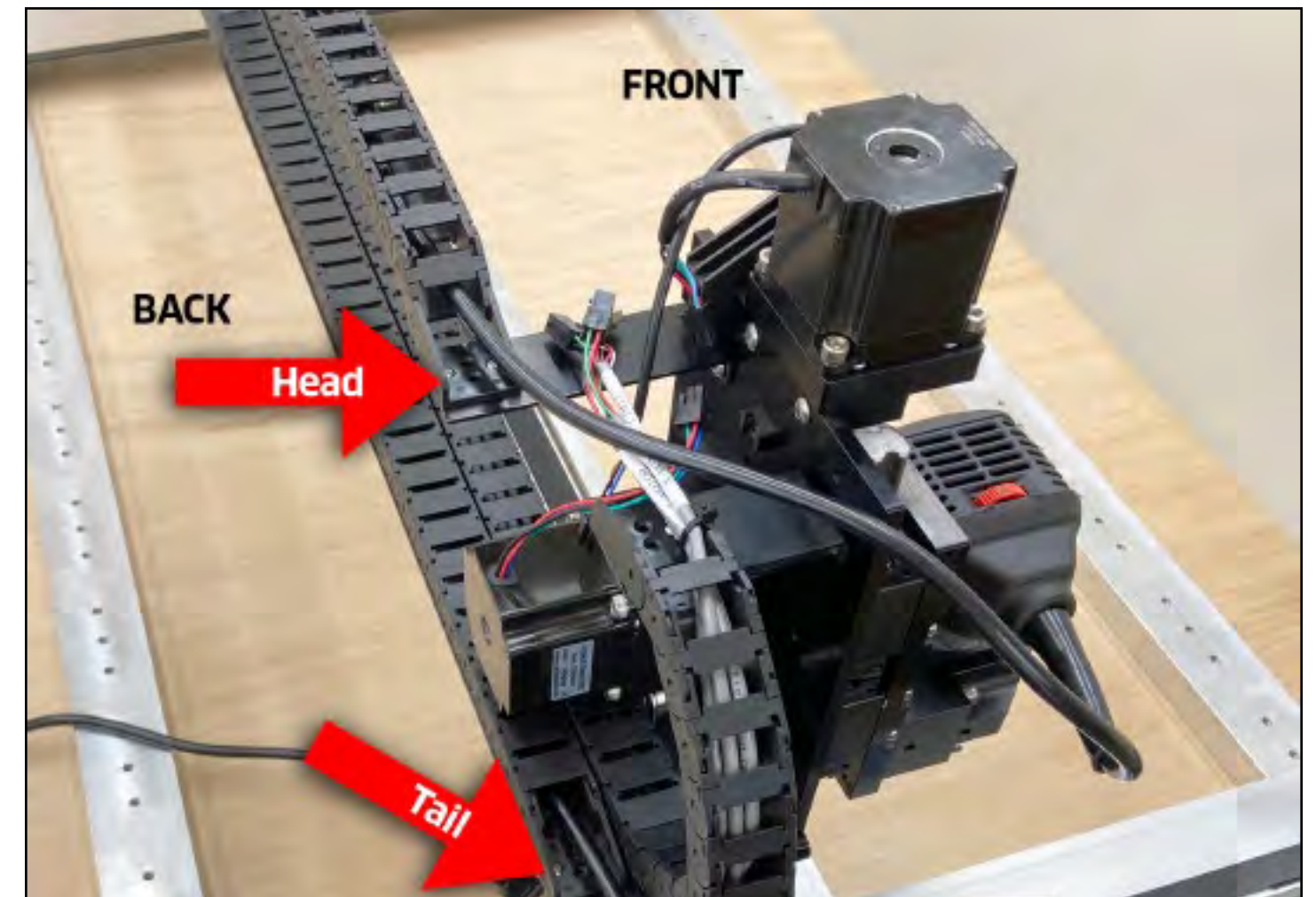

Figure 7-8

Figure 7-9

7.9 Install X/Y Transition Bracket and Y-Axis Drag Chain

1. Position the transition bracket and Y-Axis drag chain combo alongside the Y-Left rail. See *Fig. 7-10*.

   a. Align the bracket with the two M5 screw holes in the Y-Left gantry plate.

   b. Body of the drag chain extends forward from the bracket, then curls down and back.

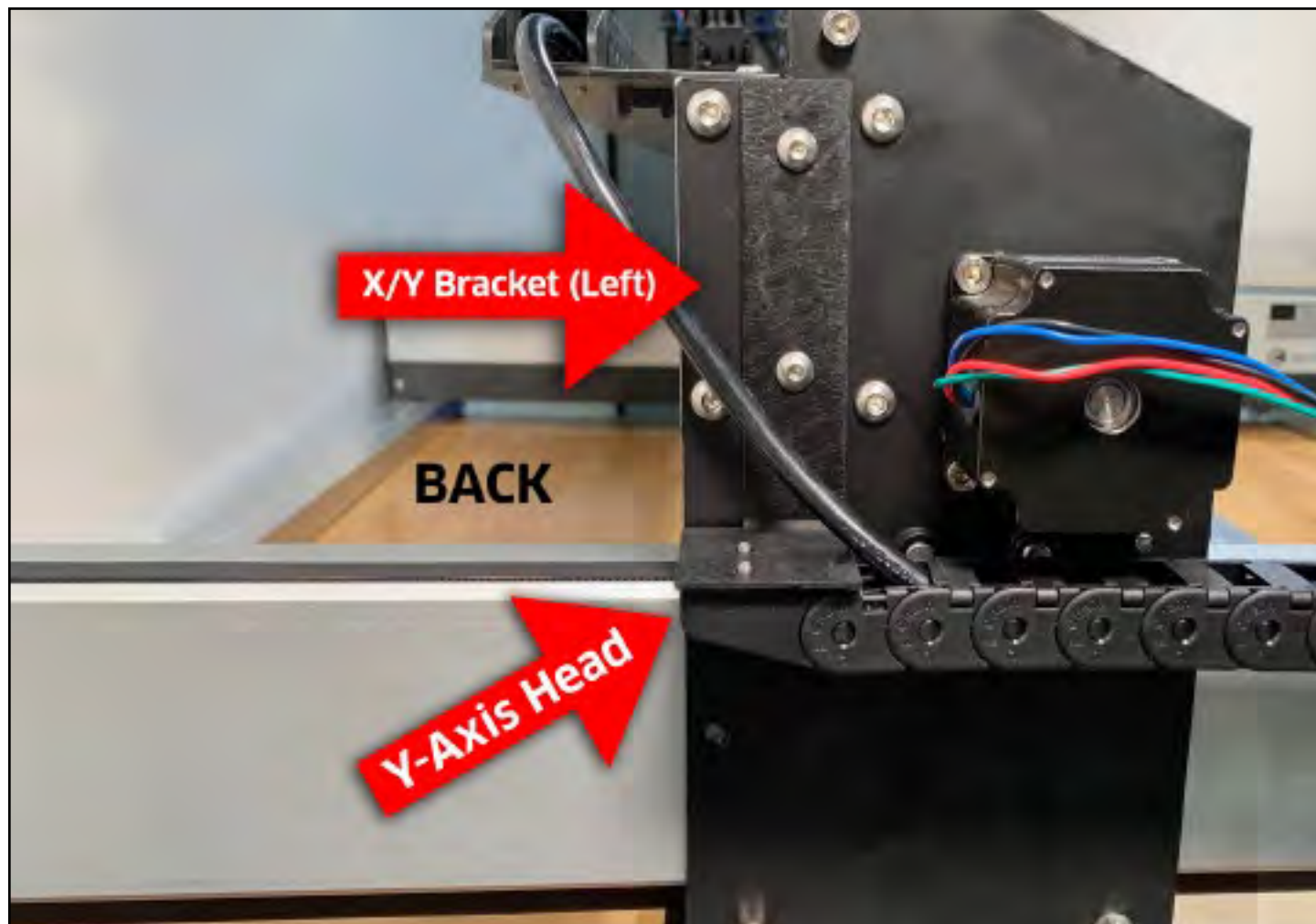2. Use a 3mm hex key and two (2) M5×10mm BHCS to secure the bracket. Fully tighten.

7.10 Secure Y-Axis Drag Chain Tail

1. Position the tail of the Y-Axis drag chain over the two M3 integrated nuts on the Y-Left drag chain support panel. See *Fig. 7-11*.

2. Use a 2mm hex key and the two (2) remaining M3×6mm BHCS to secure the tail to the support panel.

3. Remove any slack from the router power cable.

7.11 Attach Cable Tie Down to Drag Chain Support Panel

1. Stick a self-adhesive cable tie down to the Y-Left drag chain support panel near the back-left endplate.

   a. The tie down will be used to help secure the router power cable in step 9.

NOTE: Additional tie downs are included in the extra hardware bag in box 1, in case you need them.
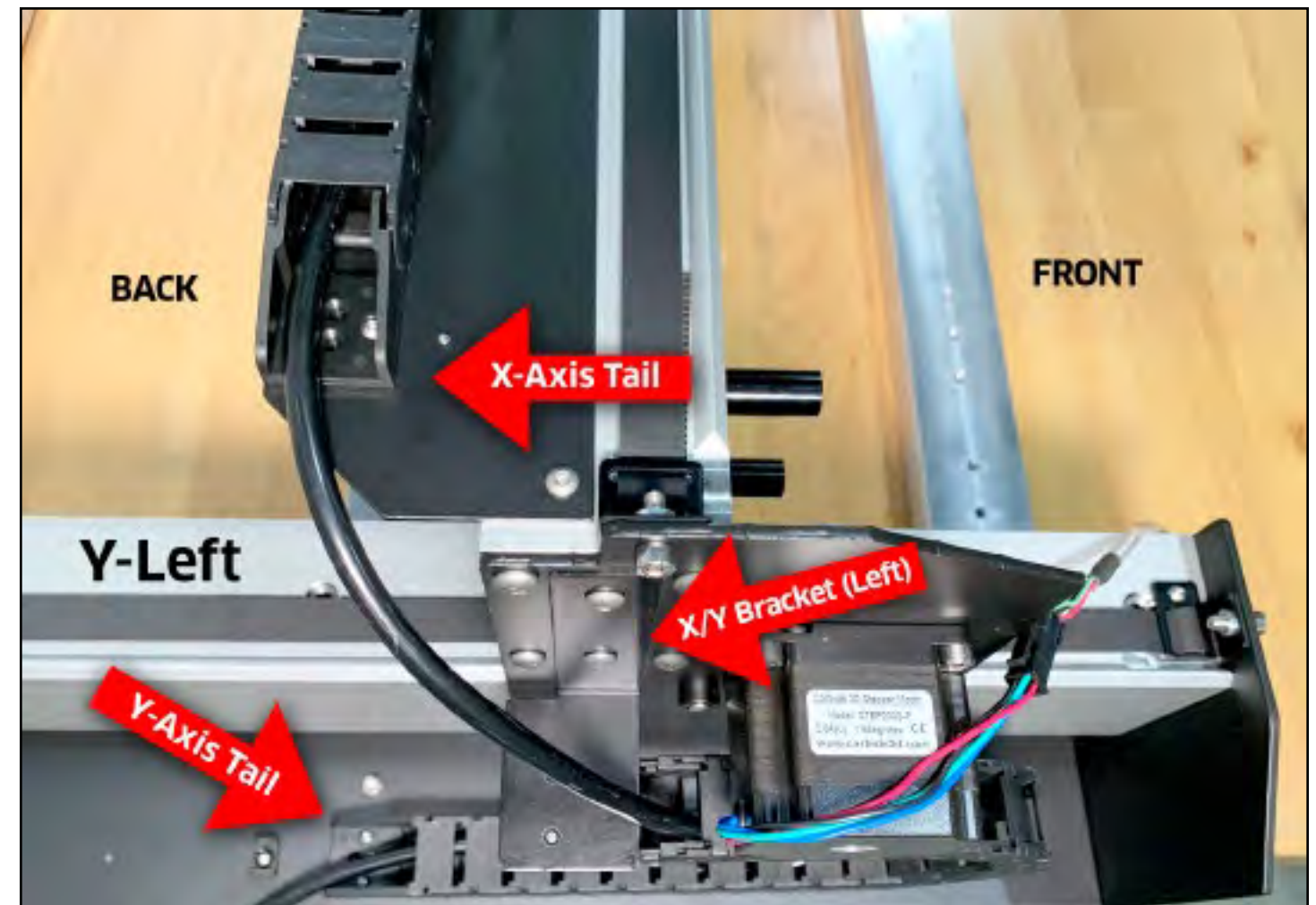

Figure 7-10

Figure 7-11

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Figure 8-1

8.1 Review Box 8 Components

NOTE: The step 8 hybrid table box is not included if you selected "No Table" when you ordered your Shapeoko 4. If you did not order a hybrid table, skip ahead to step 8.4 Install a Full MDF Sheet (Optional) on page 61.

Item	Description	Qty
LLL	Hybrid Extrusion	10
MMM	MDF Strip	10
O	M6×10mm Flat Head Screw	60
Q	M6×20mm Socket Head Cap Screw	30

8.2 Install Hybrid Extrusions

1. Position the ten (10) hybrid extrusions across the baseframe, from front to back. See *Fig. 8-2*.

2. Use a 4mm hex key and six (6) M6×10mm FHS to loosely attach each hybrid extrusion to the baseframe.

    a. Loosely insert screws in order: front, back, center.

3. Fully tighten all screws to secure the hybrid extrusions.

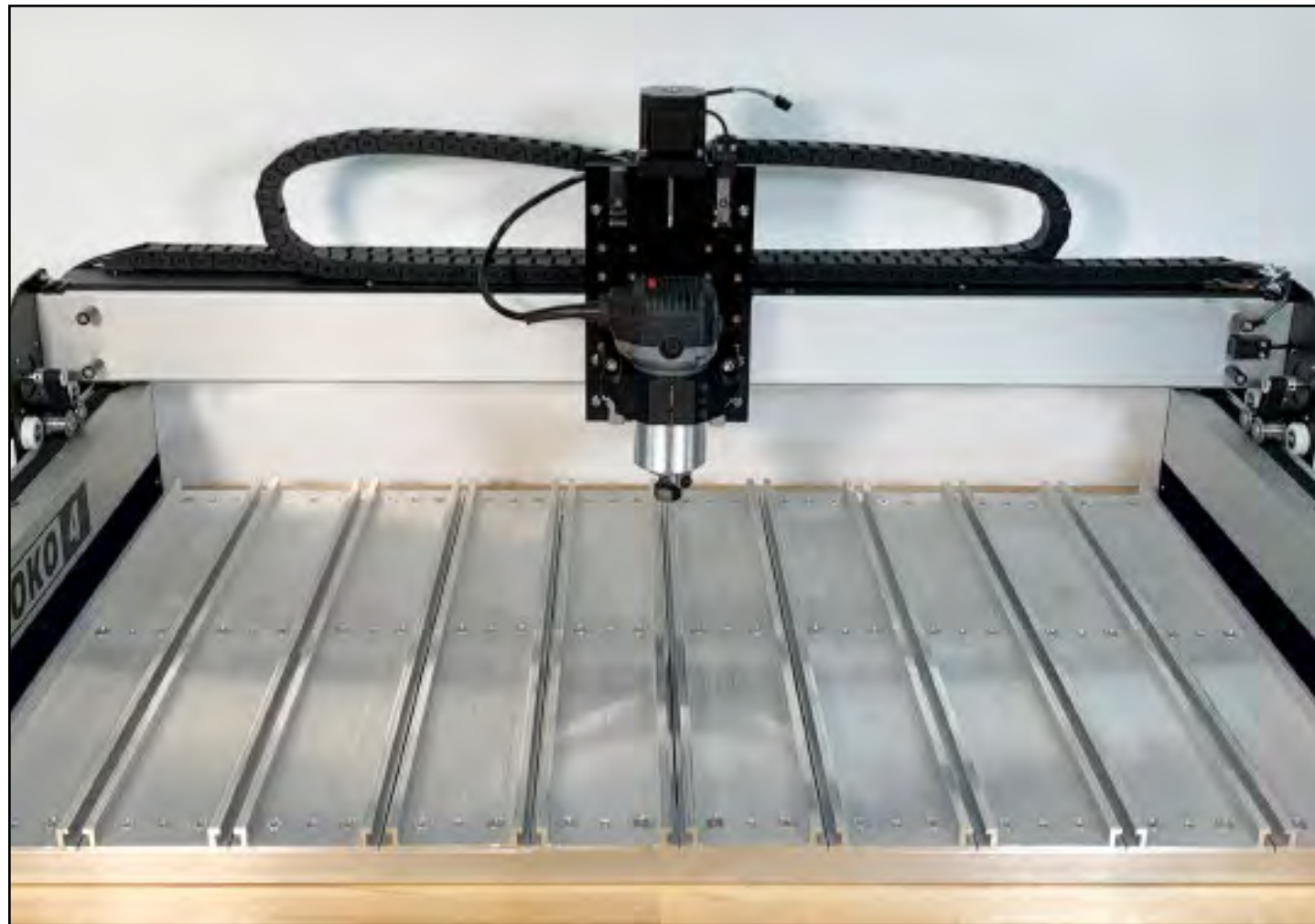**NOTE:** We do not recommend using power tools here; the risk of cross-threading is too high.

8.3 Install MDF Strips

1. Position the ten (10) MDF strips inside the hybrid extrusions. See *Fig. 8-3*.

2. Use a 5mm hex key and three (3) M6×20mm SHCS to loosely attach each MDF strip.

    a. Loosely insert screws in order: front, back, center.

3. Fully tighten all screws to secure the MDF strips.

NOTE: Installing the hybrid table brings the machine fully into square. No additional squaring steps are required.
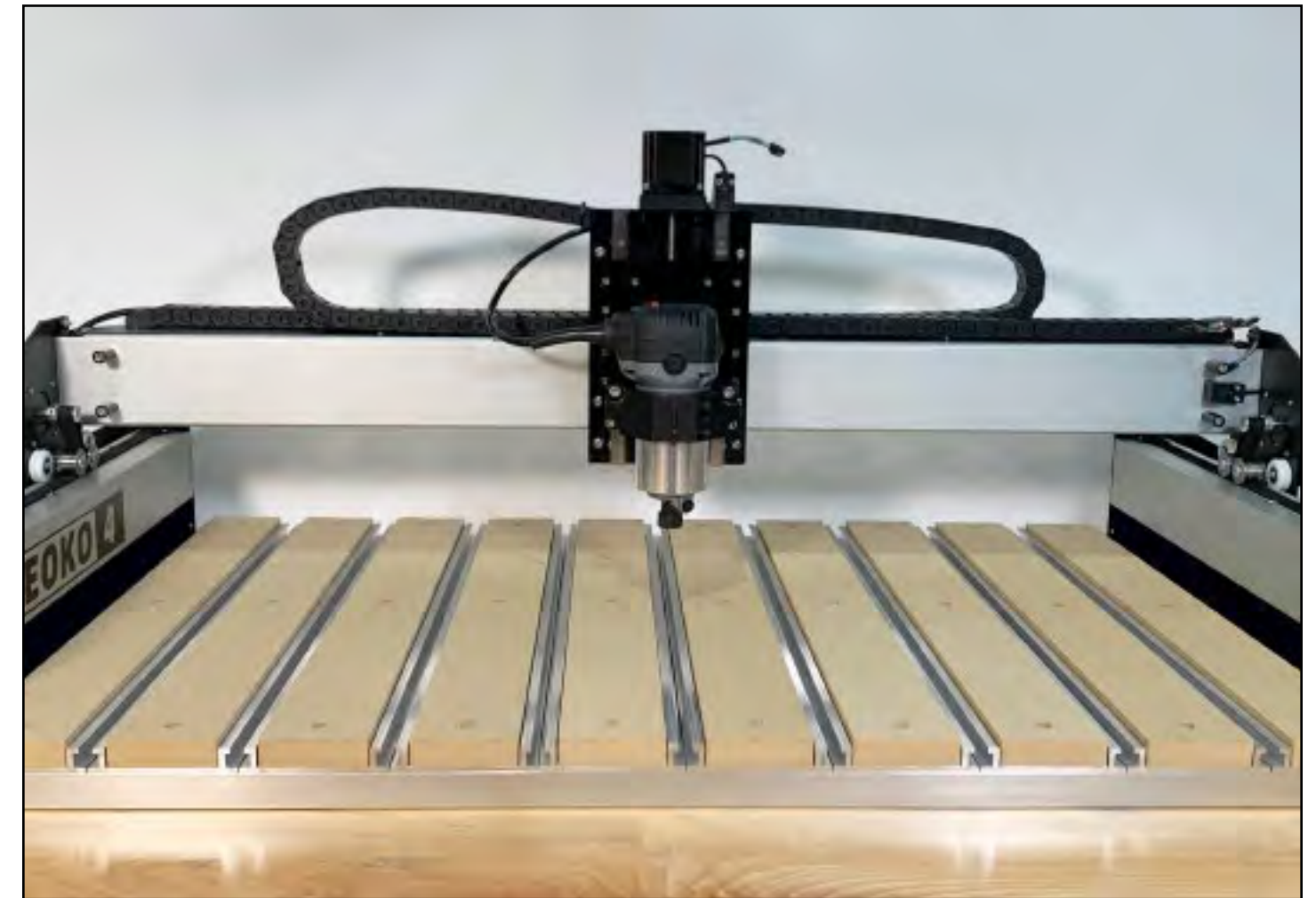
8.4 Install a Full MDF Sheet (Optional)

This step is only for users who did not order a hybrid table for their Shapeoko 4.

1. Download the S4 MDF Layout instruction PDF: docs.carbide3d.com/assembly/shapeoko-4/S4_MDF_LAYOUT_FULL_LINEUP.pdf.

2. Cut a piece of MDF to size per the Shapeoko 4 XL instructions in the PDF.

3. Use twelve (12) M6×16mm SHCS to install the MDF to the baseframe.

Figure 8-2

Figure 8-3

Figure 9-1

9.1 Review Box 9 Components

Item	Description	Qty
NNN	Controller and Lid	1
OOO	Thumbscrew (In Bag Inside Controller)	4
P	M6×12mm Button Head Cap Screw	2
M	M5×6mm Button Head Cap Screw	2
PPP	USB Cable	1
QQQ	Shapeoko 4 Build Plate	1
RRR	#201 0.25" Square End Mill	1
SSS	Permanent Marker	1
TTT	Power Supply	1
UUU	Power Cord	1
VVV	Hold-Down Clamps	6
WWW	M6 T-Nuts	12
HHH	M6×25mm Socket Head Cap Screw	6
D	Controller Mount **FROM STEP 1 BOX**	1
K	Pack of 100 Cable Ties **FROM STEP 1 BOX**	1

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9.2 Install Controller Mount

1. Remove the two rear M6×6mm BHCS from the Y-Right drag chain support panel.

2. Locate the controller mount set aside from the step 1 box.

3. Position the controller mount so the M6 through-holes in the base of the mount are aligned with the two rear through-holes in the support panel. See *Fig. 9-2*.

   a. Flange faces to the INSIDE of the machine.

4. Use 4mm hex key to insert one (1) M6×12mm BHCS to secure the front end of the base of the mount to the support panel.

   a. Set aside the second M6×12mm BHCS; it is needed in step 9.4.
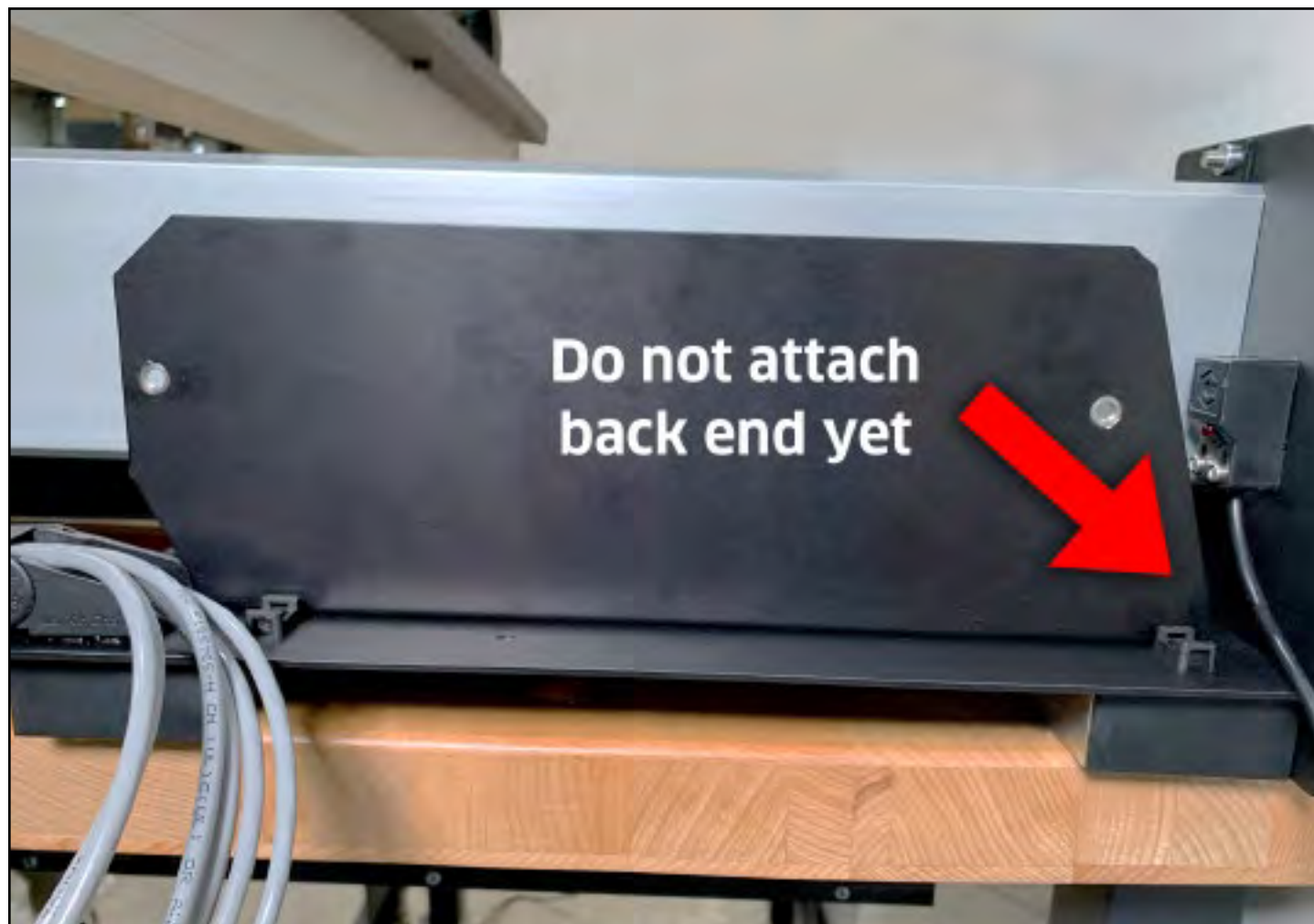
9.3 Install Controller

1. Position the controller over the two M6 integrated nuts on the face of the controller mount.

   a. Power and USB to the back. See *Fig. 9-3*.

   b. PCB will be upside down.

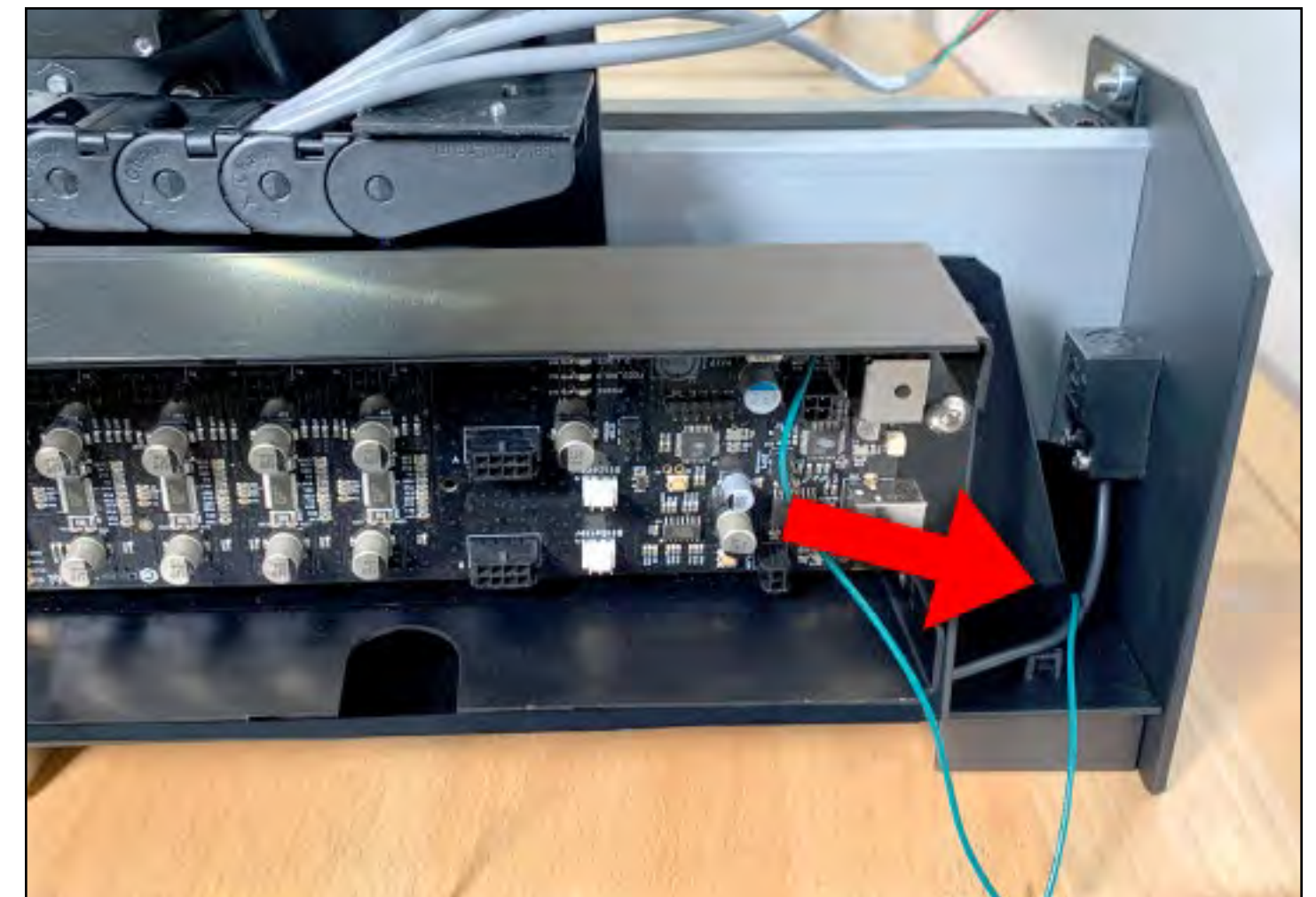2. Use a 4mm hex key and two (2) M5×6mm BHCS to secure the controller to the mount. Fully tighten.

9.4 Attach Grounding Wire

1. Place the green grounding wire loop on the end of the M6×12mm BHCS set aside in step 9.2.

2. Use a 4mm hex key and the M6×12mm BHCS to secure the back end of the controller mount and the grounding wire to the support panel. Fully tighten. See *Fig. 9-3*.

Figure 9-2

Figure 9-3

9.5 Connect Controller Cables

1. Plug the gray 4-pin male power extension cable into the 4-pin female connector at the top-right of the controller labeled "Pwr_conn". See *Fig. 9-4*.

2. If you have purchased the optional BitSetter accessory, plug the 3-pin female BitSetter cable into the 3-pin male connector at the bottom of the controller labeled "BitSetter". See *Fig. 9-4*.

3. Plug the three 8-pin male proximity switch cables into the 8-pin female connectors down the center of the controller labeled "Z", "Y", "X". See *Fig. 9-4*.

4. Plug the four 4-pin male stepper motor cables into the 4-pin female connectors at the top-left labeled "X", "Y2", "Y1", "Z". See *Fig. 9-4*.

   a. Y-RIGHT motor cable into "Y1" connector.

   b. Y-LEFT motor cable into "Y2" connector.

PRO TIP: Keep an eye on the gantry when you home the machine for the first time. The gantry should home to the back-right corner. If your gantry moves forward during homing, you may need to swap the Y-Left and Y-Right motor cables at the controller.

5. Use the four (4) thumbscrews to attach the controller cover. See *Fig. 9-5*.

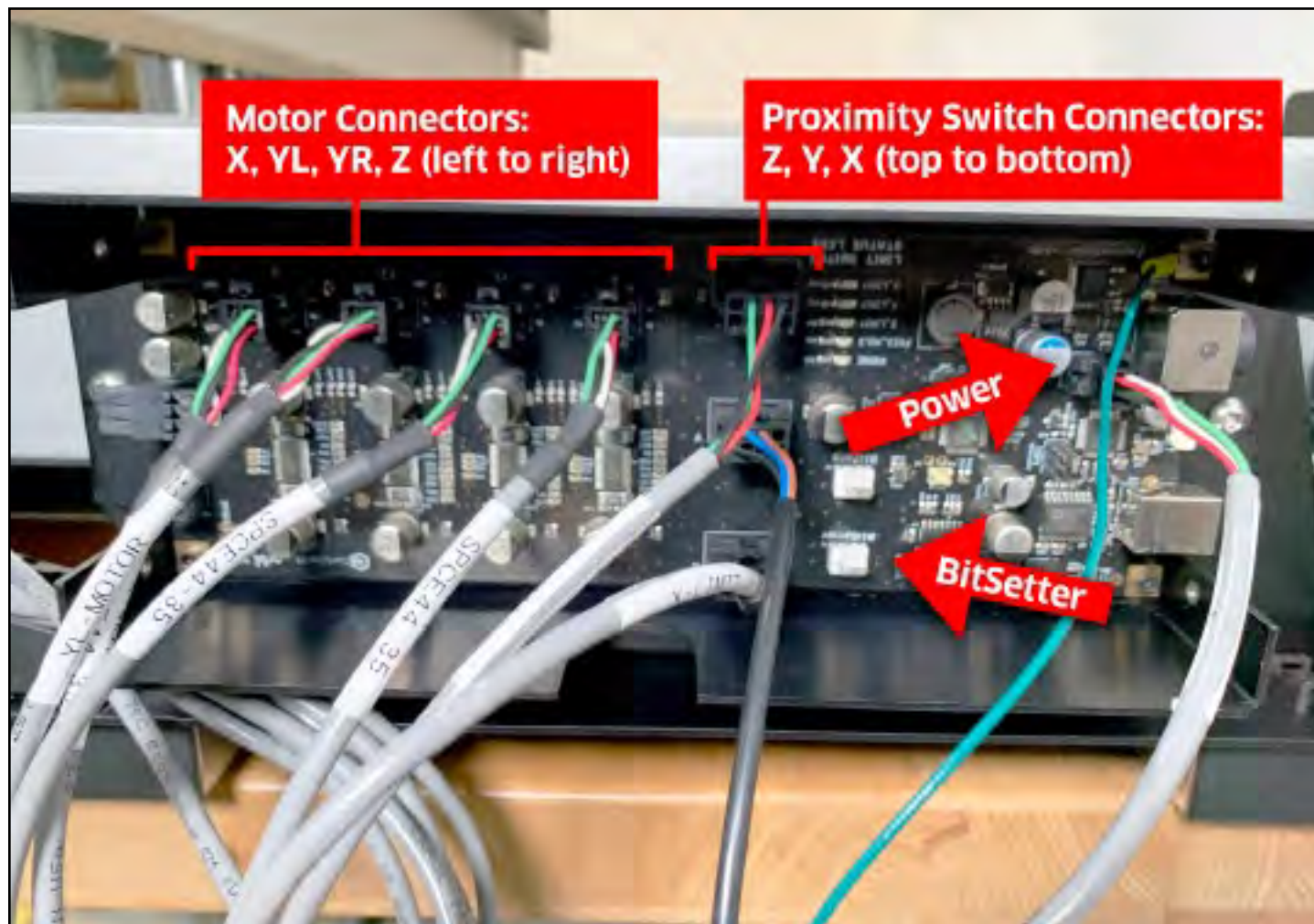   a. Direct all of the cables into the notch at the bottom of the controller.
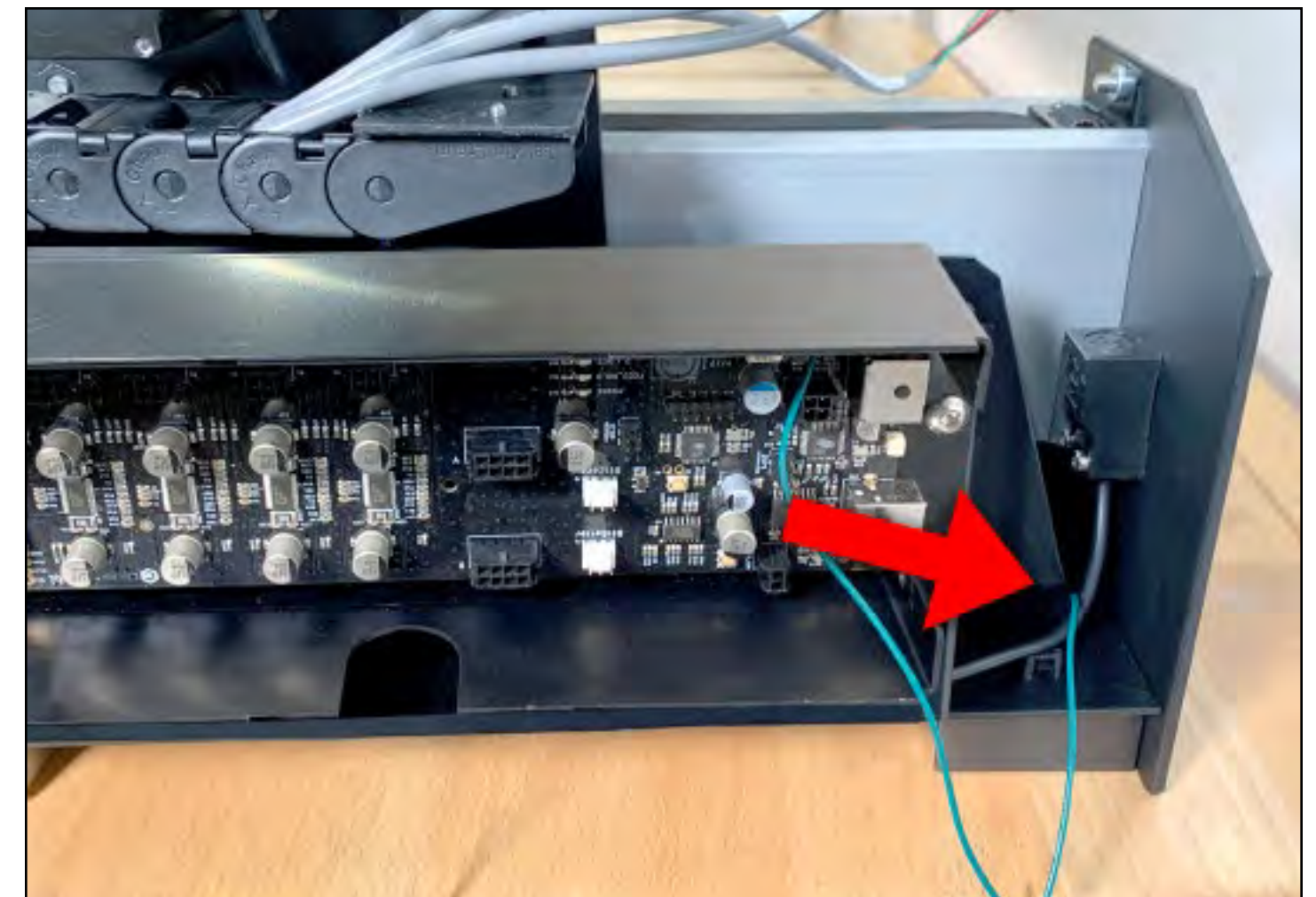

Figure 9-4

Figure 9-5

9.6 Connect Cables

1. Connect the X- and Z-motor cables and the Z-proximity switch connectors at the back of the X/Z assembly. See **Fig. 9-6**.

    a. Z-motor is the top motor.

    b. Z-proximity switch has a 3-pin connector.

2. Connect the X-, Y-Right, and Z-motor extension cables, and the X- and Z-proximity switches at the Y-Right gantry plate. See **Fig. 9-6**.

3. Connect of the Y-Left motor extension cable to the Y-Right motor cable.

    a. Extend the long Y-Left motor extension cable across the back of the gantry.

PRO TIP: After connecting all labeled cables, any unlabeled cables can be matched according to connector type.
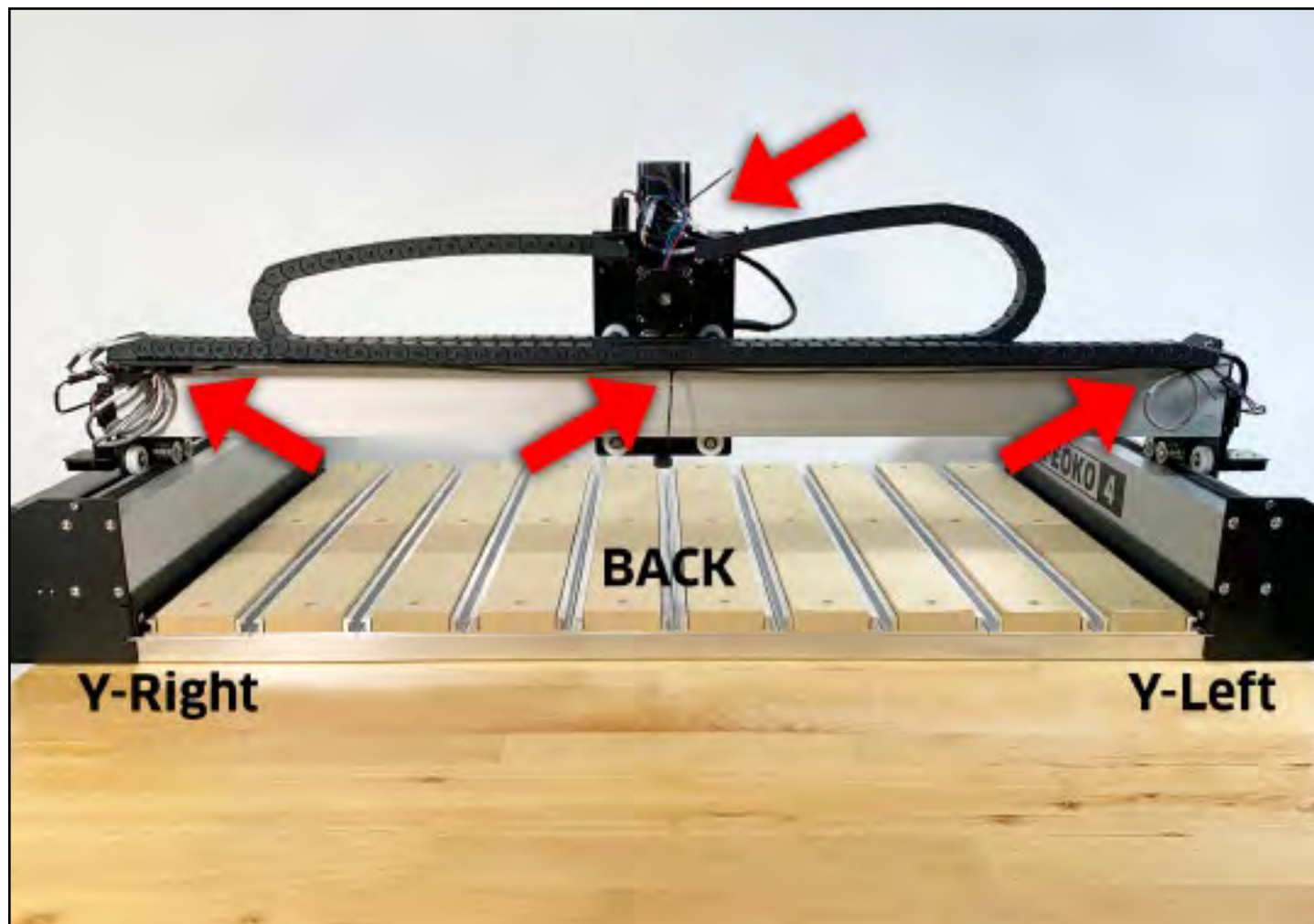
9.7 Tidy Cables

1. Use a few zip ties to secure loose cables (See **Figs. 9-6**, **9-7**, and **9-8**):

    a. At the back of the X/Z assembly.

    b. Extending along the back of the X-Axis gantry to the underside of the X-Axis drag chain support panel.

    c. Entering the controller.

    d. Power button wiring along Y-Right.

    e. Router power cable along Y-Left.

Figure 9-8

Figure 9-6

Figure 9-7

9.8 Connect Power and USB

1. Plug the power cable into the power port at the back of the controller. See *Fig. 9-9*.

    a. Flat side of the connector faces out.

2. Plug the USB cable into the USB port below the power port.

9.9 Install an End Mill

These instructions are specific to the Carbide Compact Router. For all other routers, refer to the router manual for end mill installation instructions.

1. Replace the stock collet with the included 0.25" precision collet.

2. Insert the end mill shank into the loosened collet a minimum of 0.75" (20mm), the entire length of the collet and nut.

3. Use the 22mm and 13mm wrenches to tighten the collet nut securely. See *Fig. 9-10*.

WARNING: Never tighten the collet nut without an end mill inserted in the collet.

4. Install the Sweepy 2.0 Dust Boot. See video for instructions youtu.be/nCkgoh09eiM.

5. Sign and display your Shapeoko 4 build plate. See *Fig. 9-11*.

Congratulations, the Shapeoko 4 XL assembly is complete!

IMPORTANT: Before homing your machine, you MUST update your machine configuration settings. Go to the next page for detailed instructions.

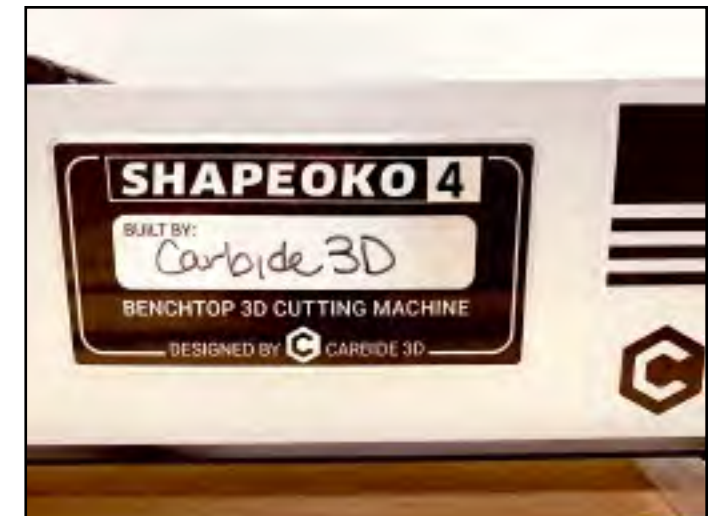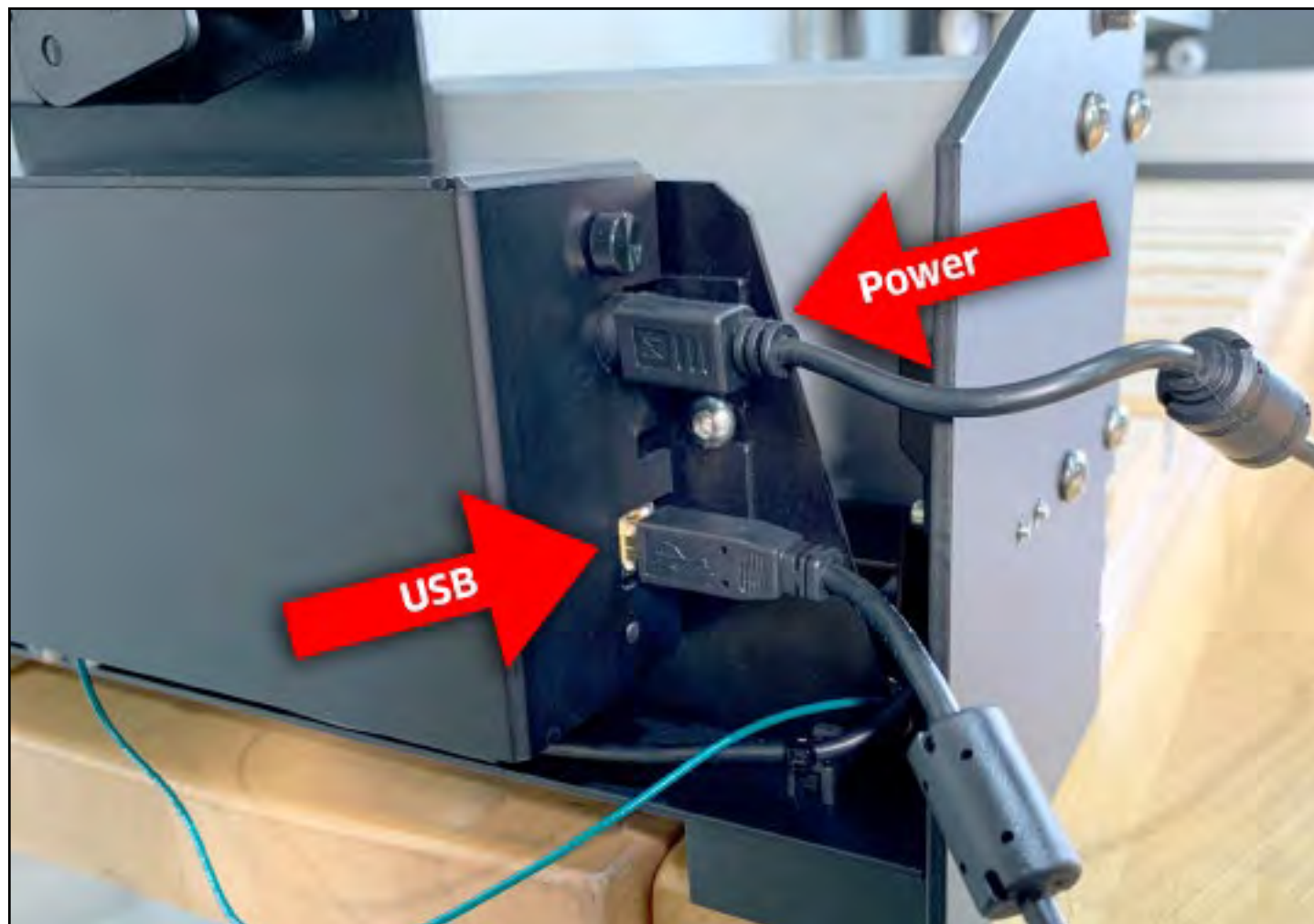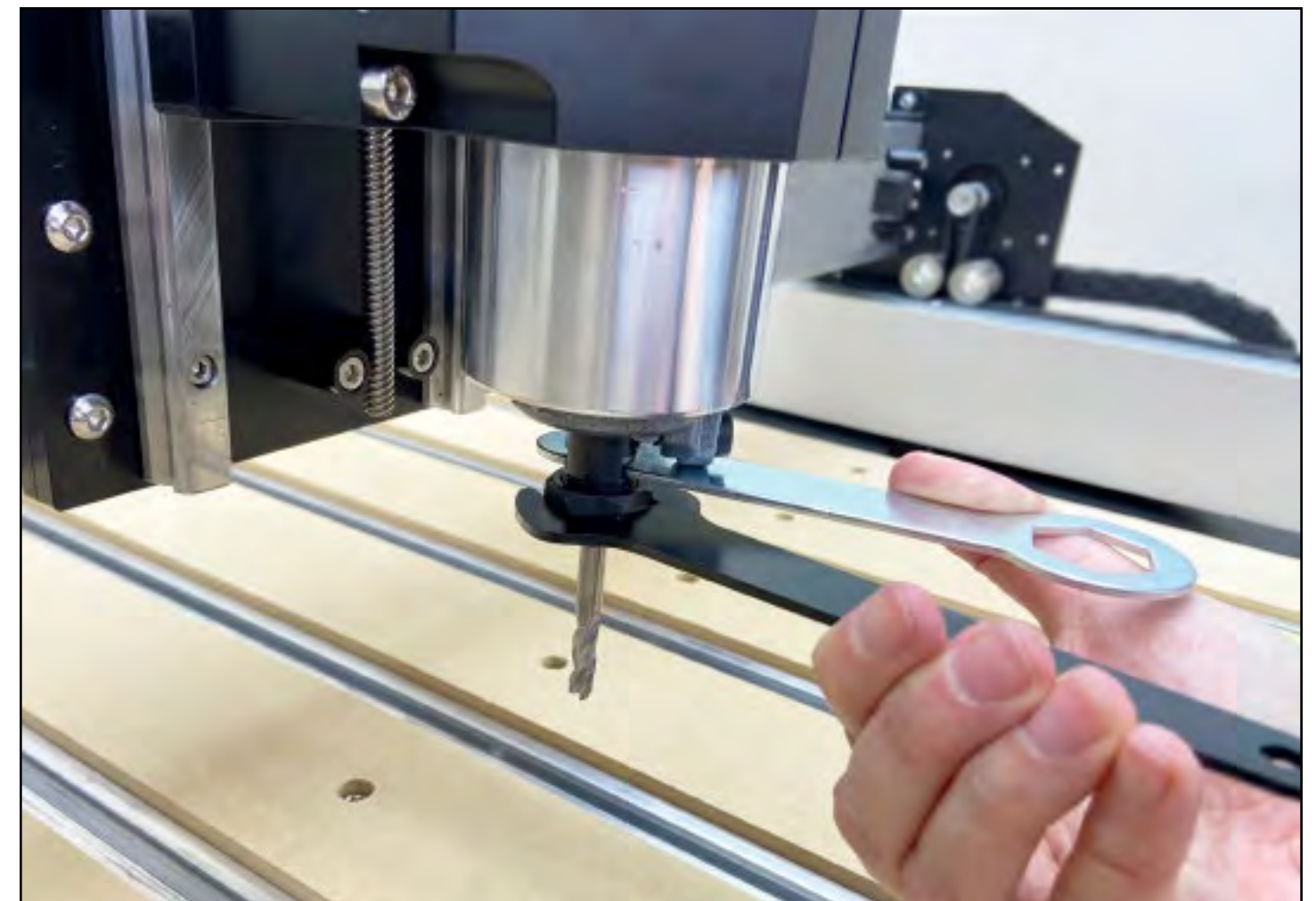*Figure 9-11*

Figure 9-9

Figure 9-10

docs.carbide3d.com

support@carbide3d.com

10.1   Install Software

1. Download and install Carbide Motion from: carbide3d.com/carbidemotion/download.

2. Download and install Carbide Create: carbide3d.com/carbidecreate/download.

Carbide Motion lets you control your machine by jogging, setting zeros, and loading and running G-code. Carbide Create, our cross-platform CAD/CAM program, lets you create 2D sketches, generate toolpaths, and export G-code to execute your design.

NOTE: The post processor in Carbide Create must be set to **Carbide 3D Shapeoko** for the optional BitSetter accessory to work. See step 10.8 on page 80.

10.2   Connect to Machine

1. Turn your computer on.

2. Connect the USB cable to your computer.

3. Start Carbide Motion on your computer.

4. Flip the in-line rocker switch on the power supply to the ON position.

5. Press the power button on the front-right endplate.

6. In Carbide Motion, click the **Connect to Cutter button**. See *Fig. 10-1*.

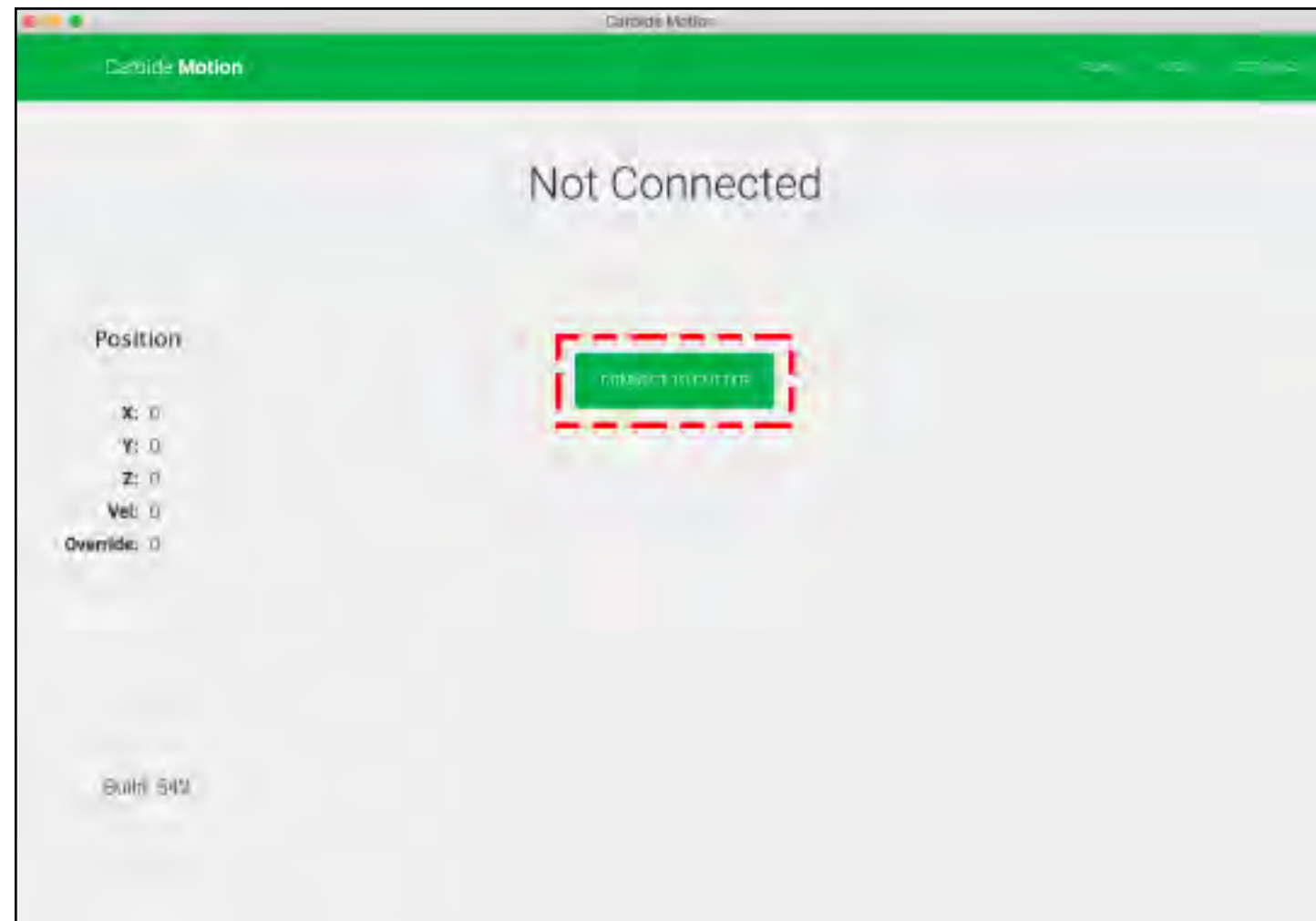7. **DON'T HOME YOUR MACHINE YET.** We need to update the configuration settings first.

10.3   Update Machine Configuration Settings

1. In Carbide Motion, click **Settings** in the menu bar at the top of the screen.

2. Click the **Machine tab** at the top of the window if it does not open by default.

3. Click the **Send Configuration Data button**. See *Fig. 10-2*.

4. In the *Send Configuration popup* choose your Machine Type from the dropdown list (see *Fig. 10-2)* :

- Choose **"Shapeoko 4"** if you purchased a Shapeoko 4 with the standard Z-Axis (Z-Plus).
- Choose **"Shapeoko 4 - HDZ"** if you purchased the Heavy Duty Z-Axis (HDZ) as a separate accessory.

NOTE: The "Belt Drive Z" option is for Shapeoko 3 machines only.
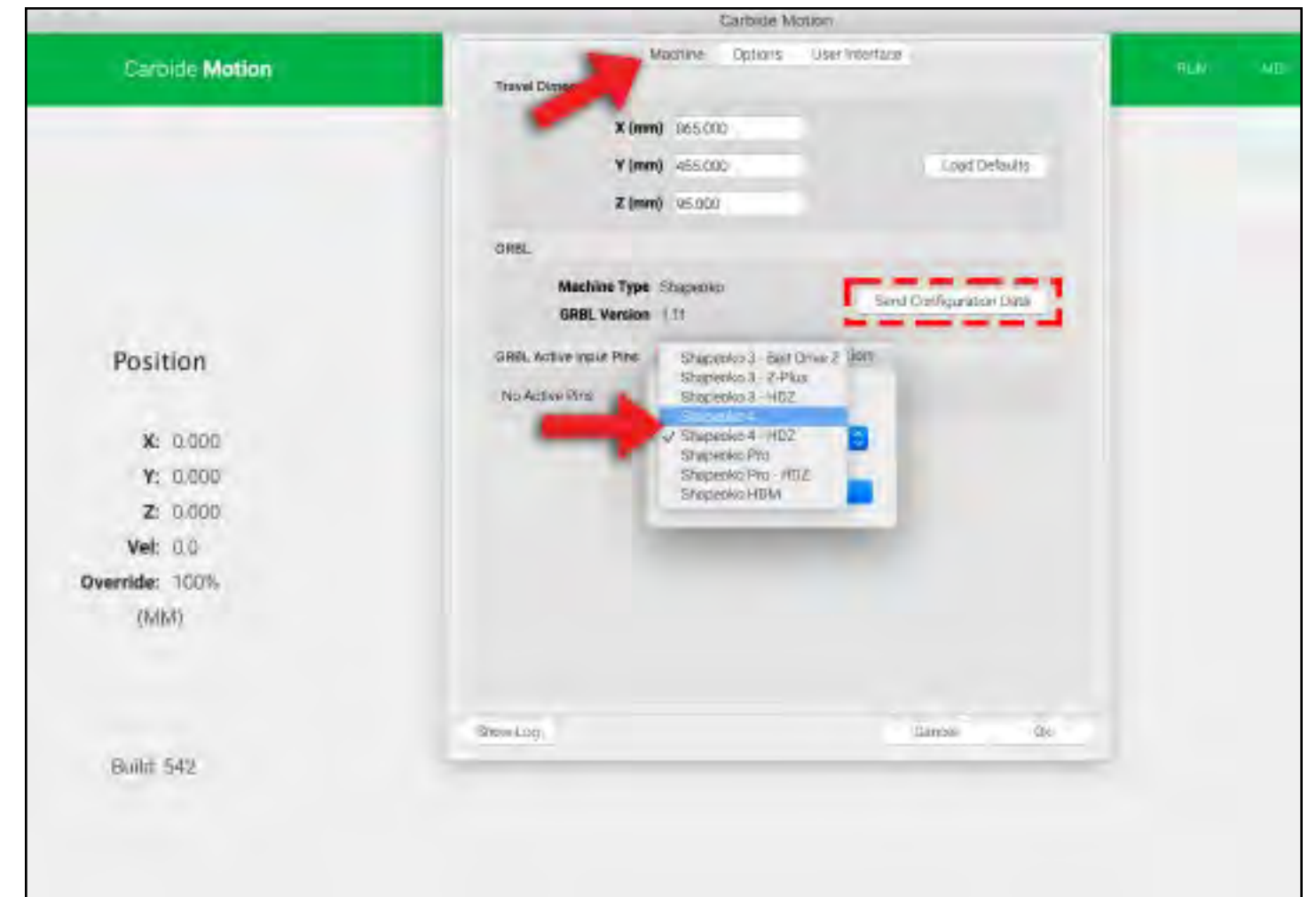
5. Click **OK** to close the popup.

Figure 10-1

Figure 10-2

6. Once the configuration settings finish sending, click the **Load Defaults button** at the top of the *Settings window*. See ***Fig. 10-4***.

7. In the *Set X/Y Travel popup*, select **"Shapeoko 4 XL"** from the dropdown list, and click **OK**. See ***Fig. 10-4***.

8. In the *Set Z-Travel popup*, select your **Z-Axis Type** from the dropdown list (see ***Fig. 10-3***):

   • Choose **"Z-Plus (Leadscrew)"** if you have a standard Shapeoko 4 with a Z-Plus.

   • Choose **"HDZ (Ballscrew)"** if you purchased a separate HDZ accessory.

9. Click **OK** to close the popup.

Figure 10-3

10.4   Disable BitSetter Accessory (Optional)

If you purchased an optional BitSetter accessory, you will need to disable it in the *Settings window* before moving on to step 10.5 on the next page.

1. In Carbide Motion, click **Settings** in the menu bar.

2. Click the **Options tab** at the top of the window.

3. In the *BitSetter section*, make sure the **Enabled check box** is NOT checked. See ***Fig. 10-5***.

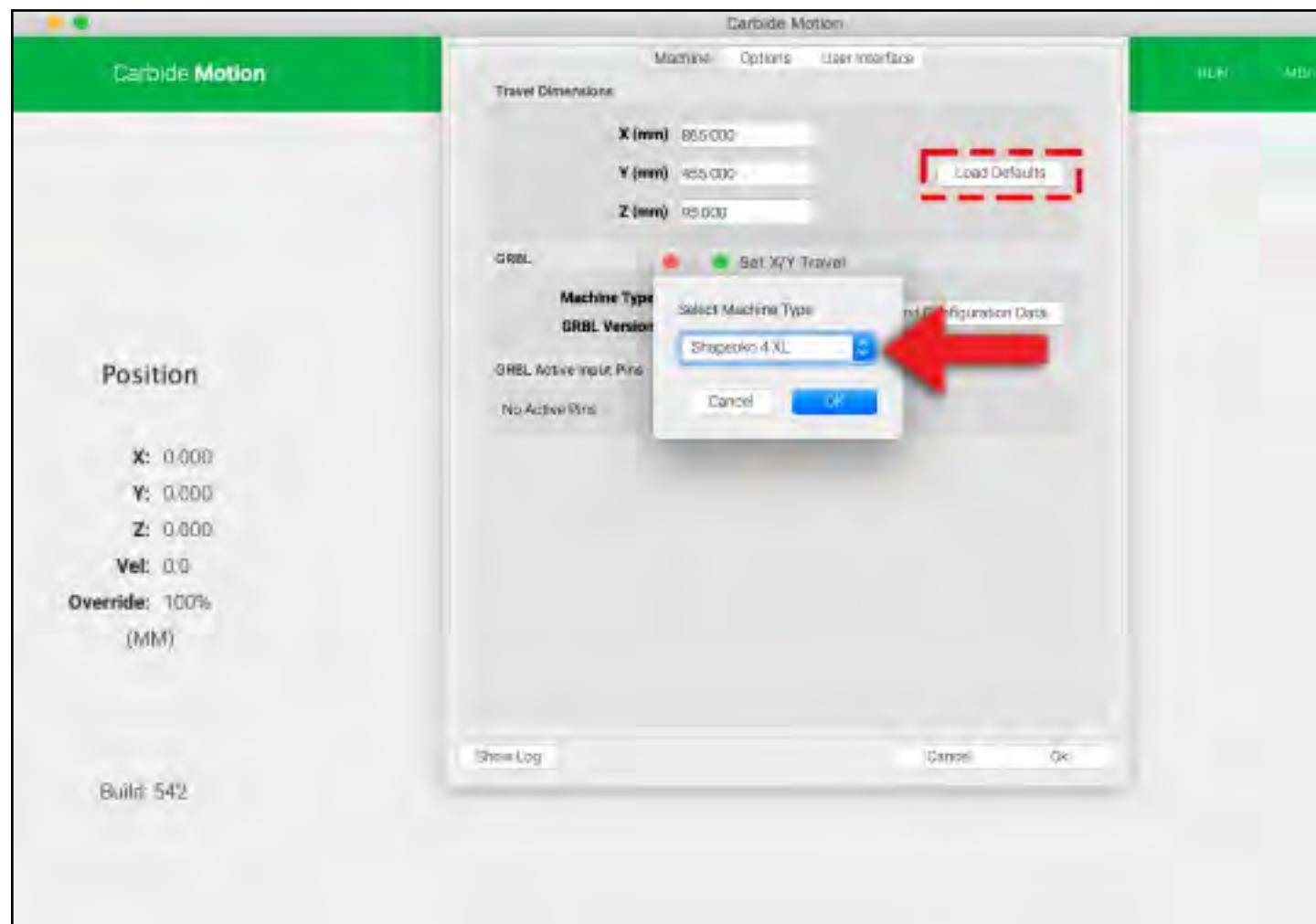4. Click **OK** at the bottom of the *Settings window* to close it.
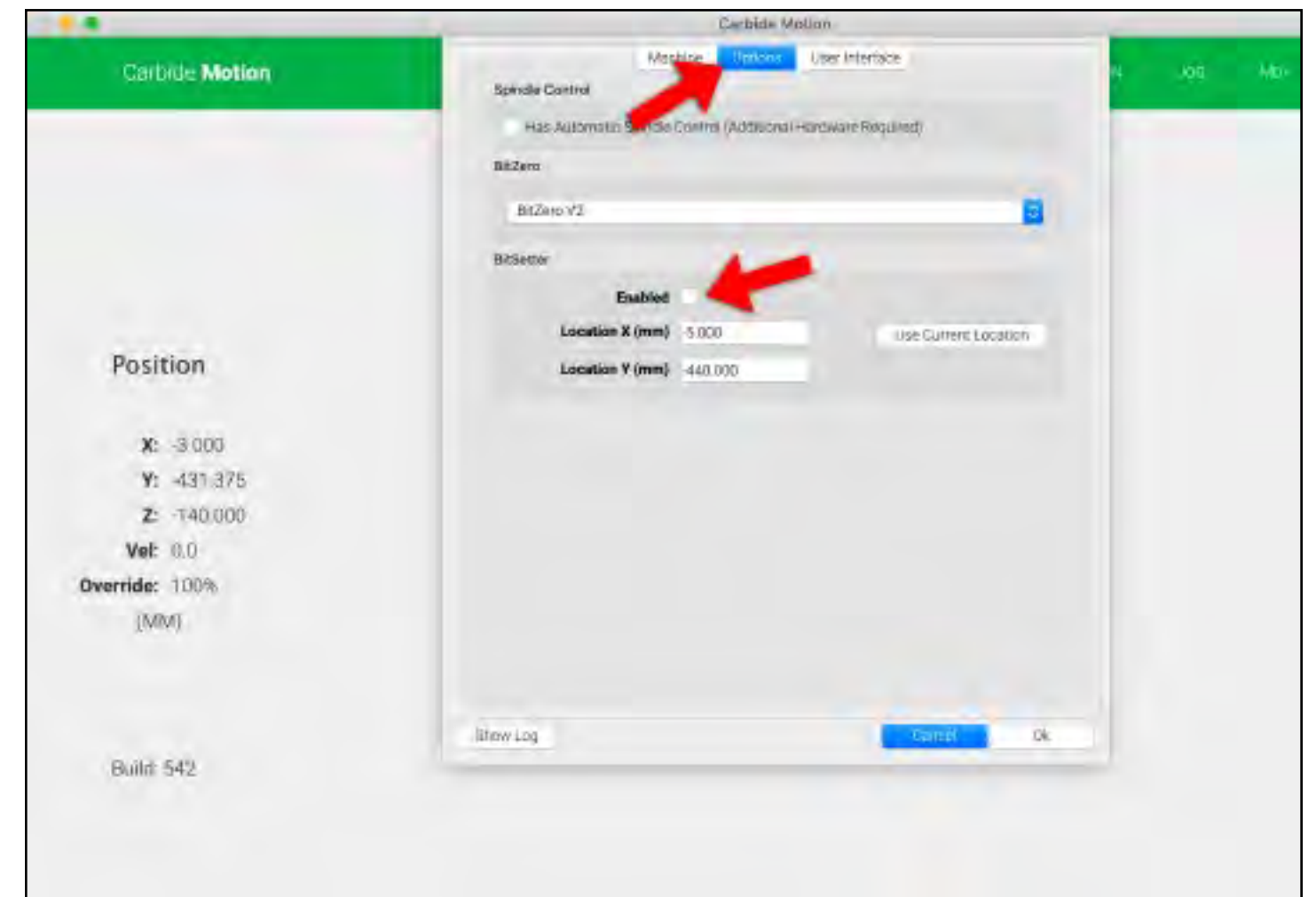

Figure 10-4

Figure 10-5

10.5   Test Proximity Switches

Double check that each of the proximity switches are connected and functioning properly:

1. Place a metal object, such as a wrench, in front of each proximity switch target in turn.

2. Check to see if the red LED on the proximity switch lights up. You can also check to see that a blue LED lights up on the controller board.

3. In Carbide Motion, click **Settings** in the menu bar.

4. In the *Machine tab*, check to see that the correct proximity switch appears in the *GRBL Active Input Pins section*. See *Fig. 10-6*.

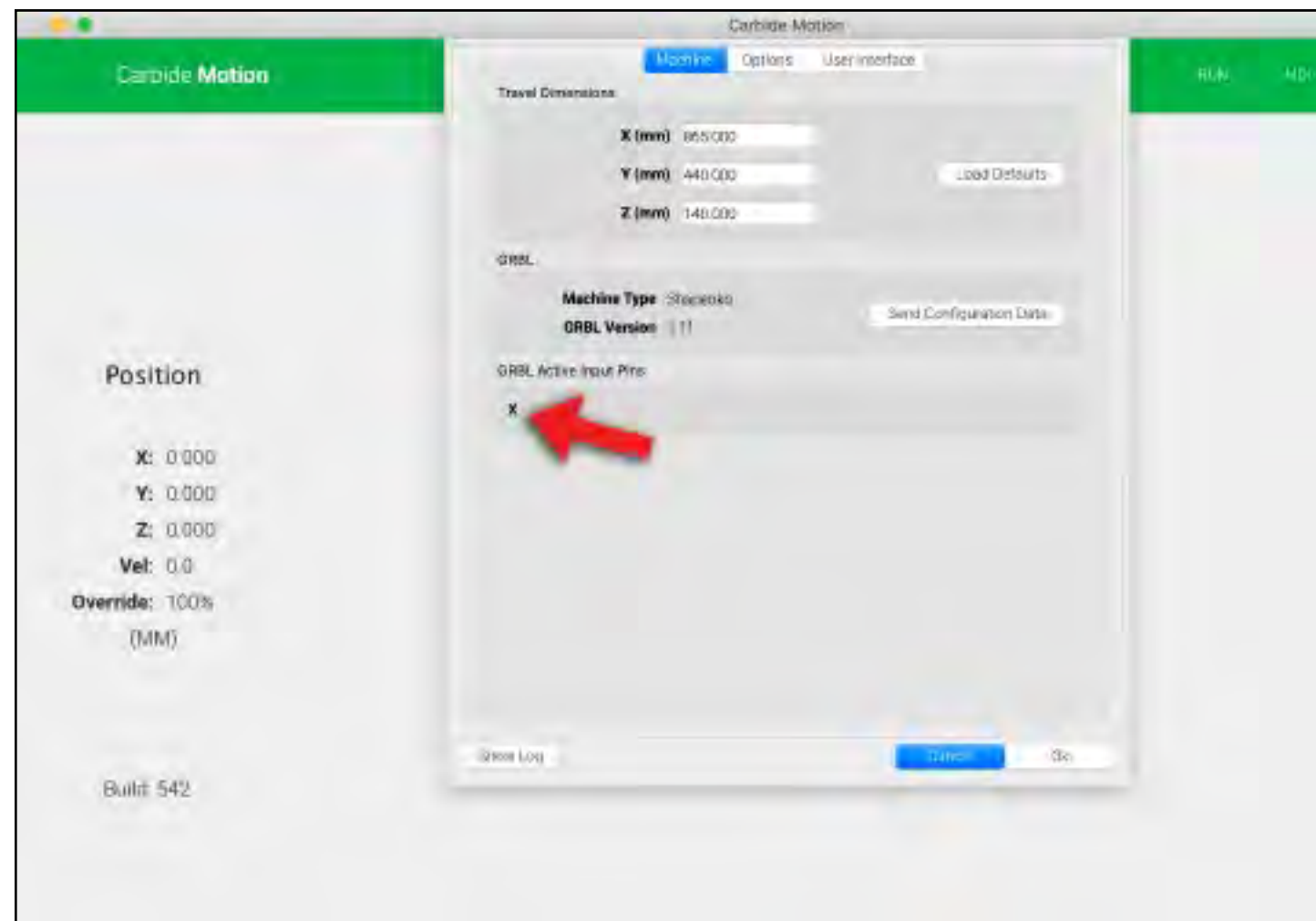**NOTE:** Watch our Proximity Switch Troubleshooting video for additional information at youtu.be/Zf8NPmxrEDs.

10.6   Home Machine

Now, it's time to home the Shapeoko 4:

1. Click the yellow **Initialize Machine button** to home your Shapeoko 4. See *Fig. 10-7*.

2. The Z-Axis will move up, then the gantry will move to the back and the X/Z assembly will move to the right.

NOTE: If your gantry moves forward during homing, you may need to swap the Y-Left and Y-Right motor cables at the controller. See *Fig. 10-8*.
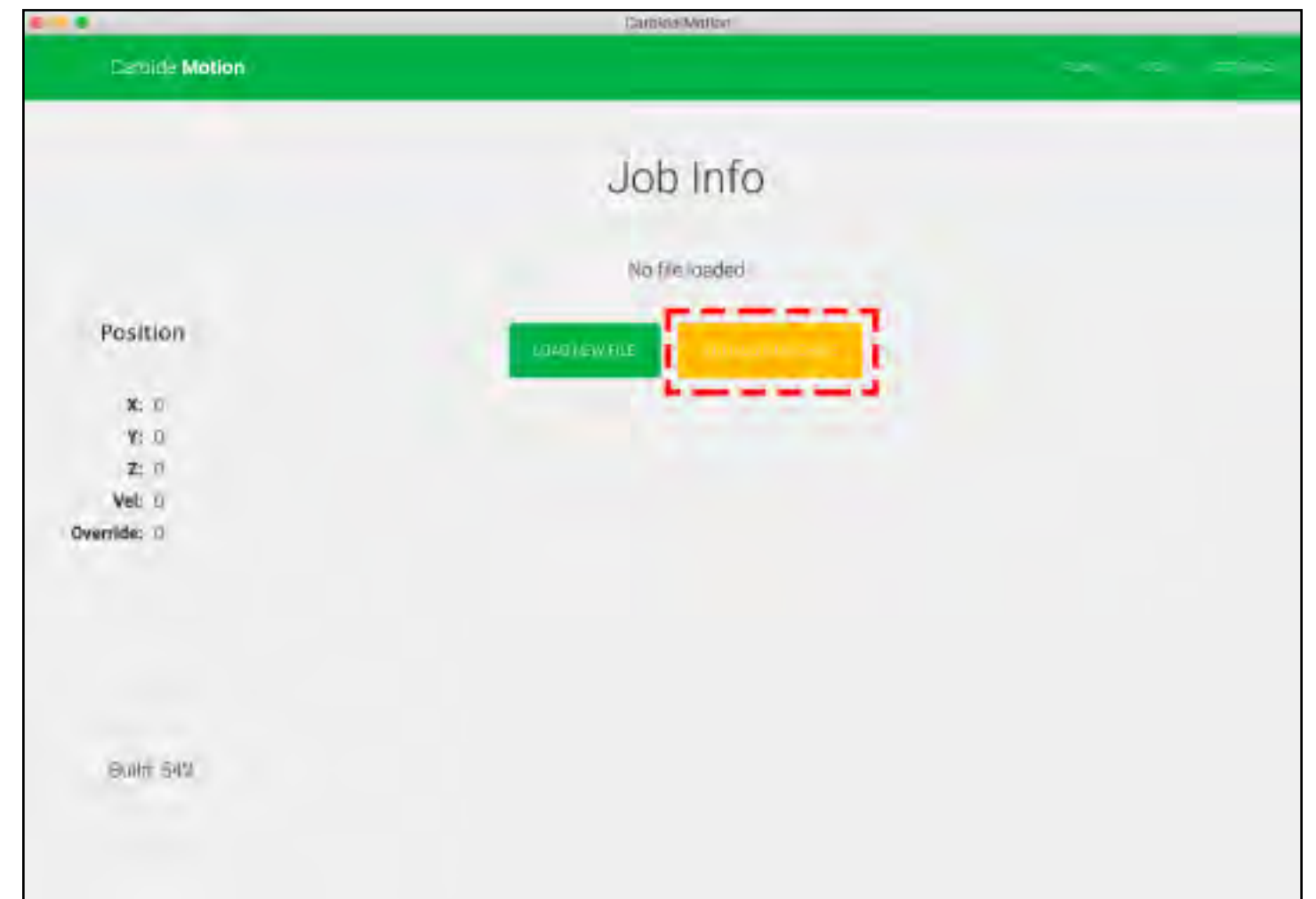

Figure 10-8

Figure 10-6

Figure 10-7

10.7   Set Up BitSetter Accessory (Optional)

If you purchased the optional BitSetter accessory, you're ready to set it up. BitSetter is an automatic tool offset probe which measures the length of each tool. BitSetter makes it easy to run jobs using multiple tools without the need to stop and re-zero your Z-Axis manually.

Position Router Above BitSetter

1. In Carbide Motion, click **Jog** in the menu bar.
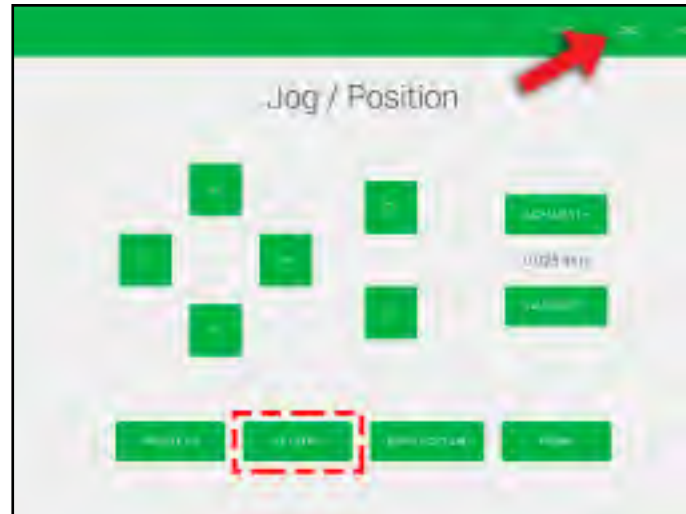2. On the *Jog screen*, click the **Set Zero button**. See **Fig. 10-9**.
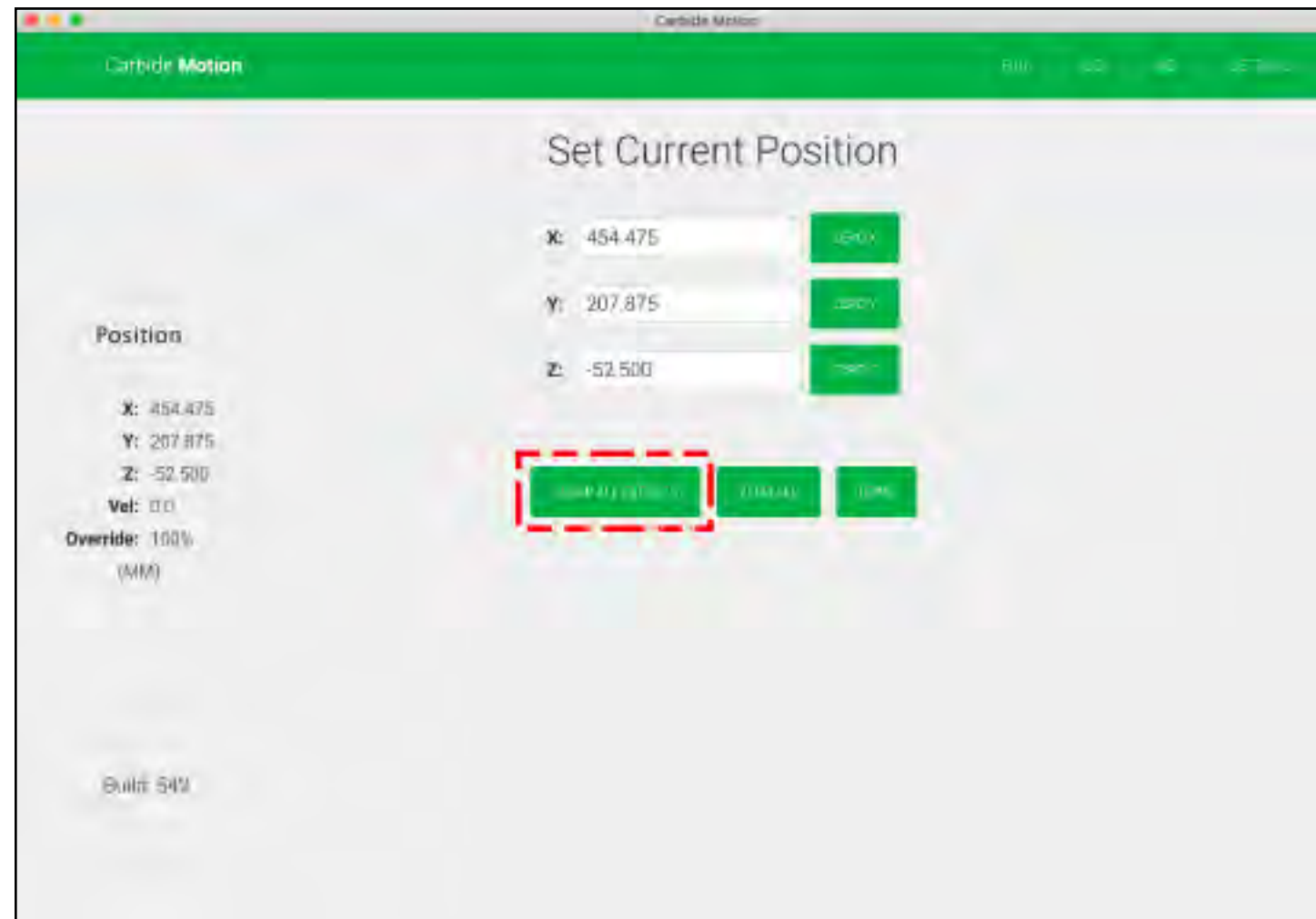

Figure 10-9

3. Click the **Clear All Offsets button** and then click **Done**. See **Fig. 10-10**.
4. On the *Jog screen*, click the **Rapid Position button**. See **Fig. 10-11**.
5. Click the **SE button** to move the router to the front-right corner of the machine. See **Fig. 10-12**.
6. Once the machine is in position, click **Done**.
7. On the *Jog screen*, use the **Y+** / **Y-** and **X+** / **X-** buttons (or the arrows on your keyboard) to jog the gantry so the router is directly above the BitSetter trigger button. See **Fig. 10-11**.
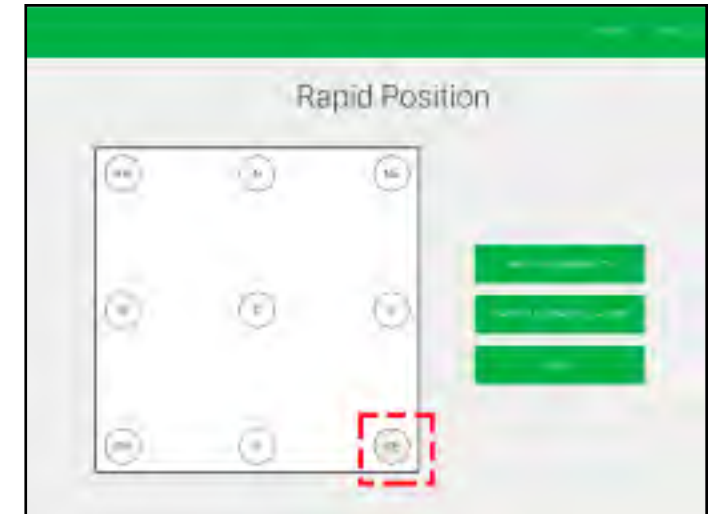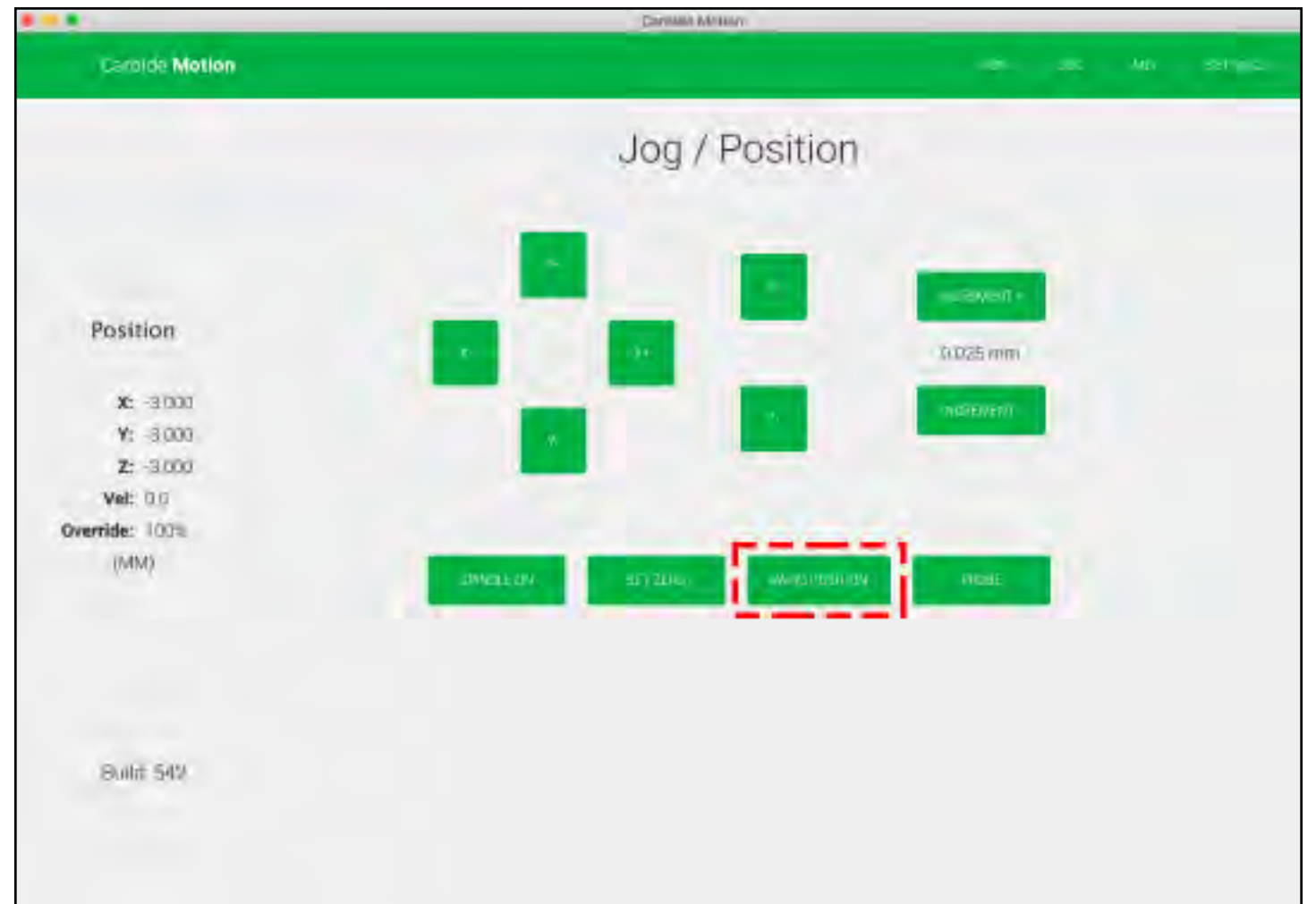

Figure 10-12

Figure 10-10

Figure 10-11

Configure BitSetter Position in Carbide Motion

1. Click **Settings** in the menu bar.
2. Click the **Options tab** at the top of the window.
3. In the *BitSetter section*, select the **Enabled check box**. See *Fig. 10-13*.
4. Click the **Use Current Location button** to save the X/Y location of your router. See *Fig. 10-13*.
5. Click **OK** to save and close the window.

Figure 10-13

10.8   Set Post Processor in Carbide Create (Optional)

The post processor must be set up in Carbide Create for the optional BitSetter accessory to work:

1. Open Carbide Create.
2. Go to **Edit** in the menu bar at the top of the screen.
3. Choose **Select Post Processor**, then choose **Carbide 3D Shapeoko**.
4. In the *Output Units dropdown list*, select **Inch** or **Metric**.
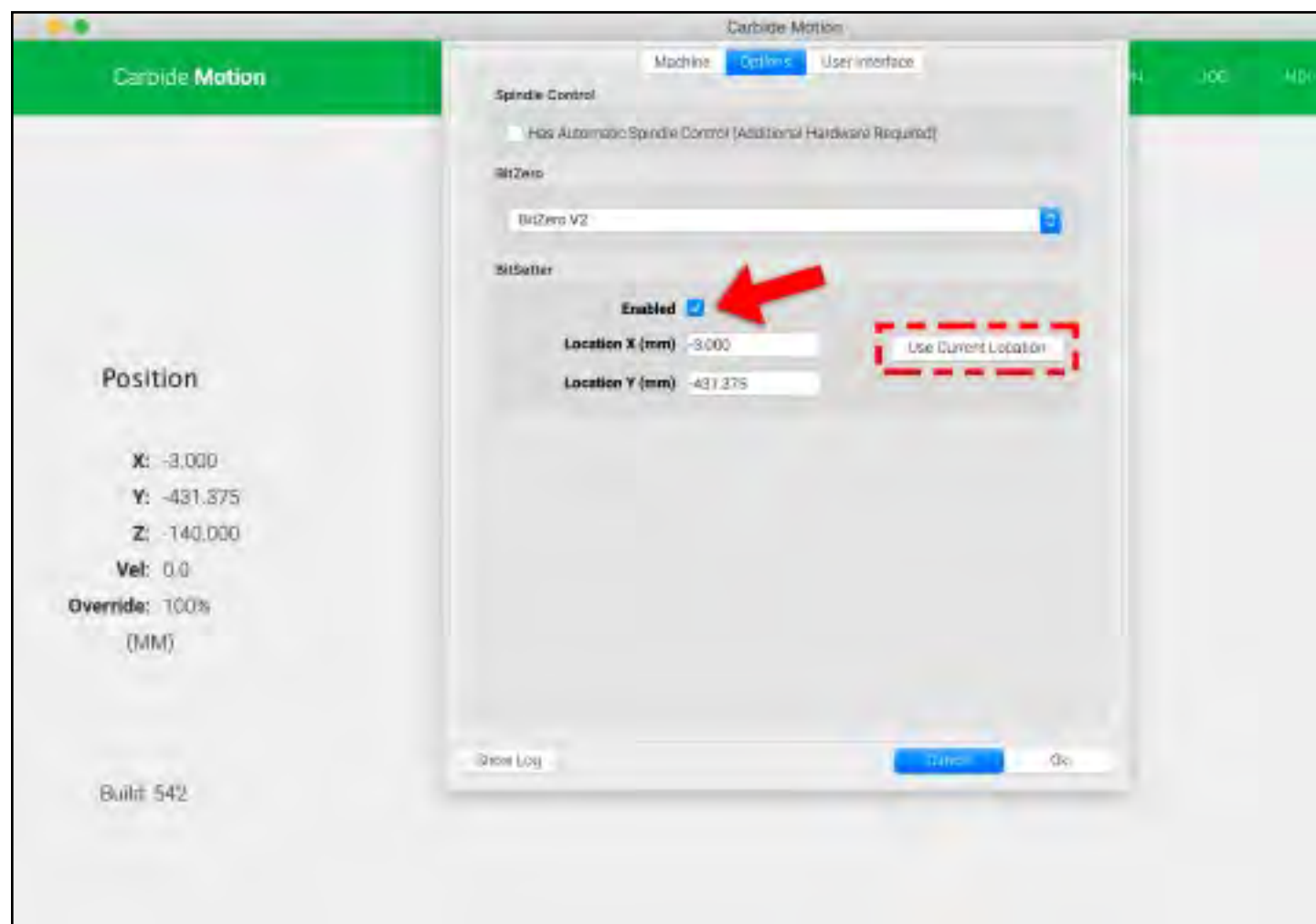5. Click **OK** to save and close.

Beginner Tutorials

If you're just getting started with CNC, the Star Wars Coaster Project is a great crash course on how to use your Shapeoko 4.

Follow the Star Wars Coaster Project tutorial at docs.carbide3d.com/tutorials/project-coaster.

Find more beginner cutting tutorials, visit the Carbide 3D docs site at docs.carbide3d.com/tutorials.

Projects and Inspiration on YouTube and CutRocket

Visit the Carbide 3D YouTube channel, youtube.com/carbide3d, for projects and inspiration. Projects include:

- Carbide Cruiser Aluminum Longboard Tutorial Series: youtu.be/alx1DKskyrQ
- Milling Expanded PVC: youtu.be/hbbV0K37UVQ
- Easy Engraved Wooden Sign: youtu.be/8CGzpQ79ySM
- Carbide Cannon CNC-Machined Foam Dart Blaster: youtu.be/VZjF25_WWi0
- Machining a Brass Branding Iron: youtu.be/8FA12Q0DMv8

Visit the Carbide 3D project site, cutrocket.com, to share project files. Projects include:

- French Cleat System: cutrocket.com/p/5fc46108153ea
- Thien-Type Dust Collector: cutrocket.com/p/5fc4036585191
- E-Stop / Pause Box: cutrocket.com/p/5fc2ba2ae12e5
- Bartop Arcade: cutrocket.com/p/5ad97a963f215
- Wooden Clock: cutrocket.com/p/5fa82afaa568a
- MDF Tripod Dolly: cutrocket.com/p/5d242643b604f
- Woodworking Bevel Gauge: cutrocket.com/p/5c199e292863a
- Laptop Articulating Arm: cutrocket.com/p/5ccc4c05450b8
- CNC Tool Organizer: cutrocket.com/p/5e5005c0ba548

Join Our Community

Join the Carbide 3D Community at community.carbide3d.com. Find discussions on software issues (Carbide Create, Carbide Motion, MeshCAM, Carbide Copper, Fusion 360), tutorial troubleshooting, general machining questions, product announcements, community contests, project galleries, and more.

Software User Guides and Tutorials

Carbide Create Video Tutorials: docs.carbide3d.com/assembly/carbidecreate/video-tutorials

Carbide Motion User Guide: docs.carbide3d.com/assembly/carbidemotion/userguide

Machining Guides

- Machine Operating Checklist: docs.carbide3d.com/general-faq/machine-operating-checklist
- Carbide 3D Tooling Guide: docs.carbide3d.com/tutorials/tutorial-tooling
- Tool Change Tutorial: docs.carbide3d.com/tutorials/tool-change
- How to Choose an End Mill for your Project: youtu.be/nxcnh7ZaI6g
- Shapeoko Feeds and Speeds Chart: docs.carbide3d.com/support/supportfiles/S3_feeds_250.pdf
  This is a great starting point for the Shapeoko 4.

Material Guide Videos

- Wood: youtu.be/cjoNGACBkks
- MDF: youtu.be/Hq8Imk4Zrgk
- Aluminum: youtu.be/RH4AXz_rtPo
- Stainless Steel: youtu.be/QYkDKkfUuFs
- Cast Acrylic: youtu.be/a9qi6Z-CEP8
- Expanded PVC: youtu.be/hbbV0K37UVQ
- Testing High-Efficiency Milling Techniques: youtu.be/wnv6Z72QI24
- Machining Aluminum with a Single-Flute Cutter (278-Z): youtu.be/0Odwye0-tYE
- What Happens If You Machine the Wrong Metal Alloy or Temper: youtu.be/rm-qSytjFnI
- Making Sense of Speeds and Feeds: youtu.be/devnew_Zy_E

Workholding and Dust Collection Videos

- Workholding 101: youtu.be/uzLHSKNOFF4
- SuperHold Kit: youtu.be/wern6Cj8sgI
- Lock Stops: youtu.be/dTltgmZIOxc
- Tiger Claw Clamps: youtu.be/W1eMo6-1Cwg
- Gator Tooth Clamps: youtu.be/4QjYt_R-bjE
- Sweepy 2.0 – New and Improved Dust Boot: youtu.be/HbeZPAC18uE

Glossary of Terms

Collet: Cone-shaped sleeve that holds an end mill in place in the router or spindle.

Eccentric Nuts / Eccentrics: Eccentric nuts are used to adjust the gantry at the intersect between the carriage V-wheels and the V-rails. These nuts have an attached spacer which serves as an axle, and off-center threads, which create a cam. Eccentrics are used in conjunction with V-wheels to apply tension at the V-rail and eliminate carriage slop.

End Mill / Cutter: Cutting tools used by a CNC machine. End mills are similar to drill bits, though, typically they can cut in all directions. End mills come in several varieties, including square, ball nose, and V-bit, and many sizes.

G-code: General, or geometric, code, is a CNC programming language that controls when, where, and how the machine tools move across the workpiece. For example, when to turn on or off, how fast to travel to a particular location, what paths to take.

Gantry: A multi-axis motion system of rails and carriages supported on the sides by, and spanning over, the baseframe, giving the router overhead access to a workpiece.

Homing: The process of sending the machine to a known, fixed, repeatable location. This means that every time you home, the machine will move to exactly the same position allowing you to move your machine to positions relative to the home position, with great precision. The home position for the Shapeoko 4 is in the back-right corner.

Integrated Nuts / PEM Nuts: Fastener providing self-clinching, permanent threads and mounting points in thin sheet metal.

Job Zero / Job Origin / Toolpath Zero / Program Zero: It may have many names, but job zero basically tells the machine where to begin running the job. Job zero is a point in your design where all of the toolpaths will be based from (the X, Y, and Z coordinates). Job zero is commonly set in the lower-left corner of your stock.

Jog: Move the router to a specific position (a set of X, Y, Z coordinates) in the work area.

Slop: Unwanted movement in the gantry at the carriages due to under-tensioned V-wheels.

Stock / Workpiece / Material: The sheet of material (wood, composite/synthetic, metal) being machined.

Tool Change: When running a job that require multiple tools, Carbide Motion will prompt you each time you need to change tools. If you purchased the optional BitSetter accessory, the Shapeoko 4 will use the BitSetter to measure the length of the new tool after each tool change. If you do not have a BitSetter, you will need to download a separate G-Code file for each tool used. For instructions for performing tool changes without a BitSetter, refer to docs.carbide3d.com/tutorials/tool-change.

Toolpath: A toolpath is the route the cutting tool will follow as it shapes the workpiece. We use Carbide Create, Carbide 3D's cross-platform CAD/CAM program, to define the toolpaths for a project.

V-wheels: V-wheels allow the gantry and carriages to slide along the rails.

Working Envelope: A working envelope is the CNC machine's range of movement across each of its three axes, X, Y, and Z.

Workholding: These are the options for securing your stock material to the machine table.

Machine-Use Log

It is good practice to keep a log of machine use so you can track when adjustments are made, fasteners are tightened, and parts are lubricated. Using your log to track use-time for specific end mills helps determine when end mills should be relegated to rough work, resharpened, or recycled and replaced. A log is a good place to keep a checklist of items that need to be inspected or verified before machining. Finally, you can record all of your project settings and the specifics of each tool chain in your log. You can use the sample machine-use log on the next pages or make one that fits your specific workflow and needs.

Date _____

Project Name _____

Material 1 _____

Dimensions _____

Material 2 _____
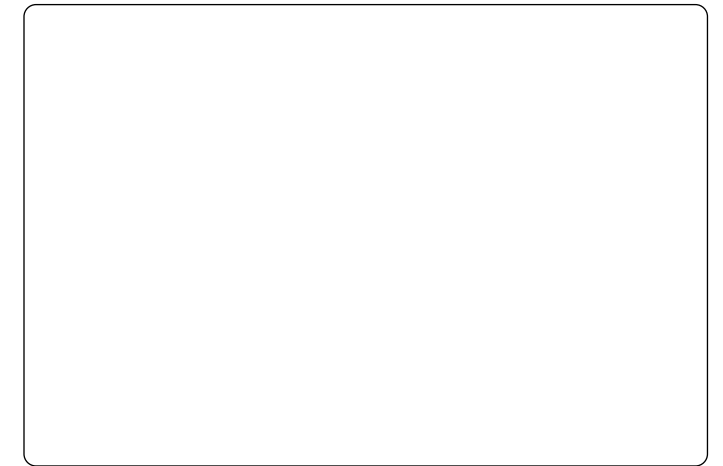
Dimensions _____

Fixture(s) _____

Origin(s) _____

Setup Notes _____

Image

Shapeoko 4 XL Operation and Maintenance Checklist

BEFORE EACH USE

☐ Workpiece Secure	**SAFETY**	
☐ Work Area Clear	☐ PPE	☐ Collet & Cutter
☐ End Mill Secure	☐ Dust Extraction	☐ Rails & Belts
☐ BitZero V2 Removed	☐ Emergency Stop	☐ Bolts/Screws

CHECK CONDITION

☐ V-wheels & Eccentrics   ☐ Router/Spindle
☐ Wiring & Switches
☐ Stepper Motors

MAINTENANCE
☐ Lubrication

Tool Chain

	End Mill	RPM	Feed Rate	Time (hr/min)
1.	_____	_____	_____	_____ / _____
2.	_____	_____	_____	_____ / _____
3.	_____	_____	_____	_____ / _____
4.	_____	_____	_____	_____ / _____
5.	_____	_____	_____	_____ / _____
6.	_____	_____	_____	_____ / _____
			Total Cutter Time	_____ / _____

Total Project Time

Estimated (hr/min) _____ / _____   Start Time _____

Actual (hr/min) _____ / _____   End Time _____

Total Machine Hours

_____

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Carbide 3D

3630 Skypark Drive
Torrance, CA 90505

310-504-3637

support@carbide3d.com

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