Shapeoko PRO

Carbide **3D**

Table of Contents

Welcome and Congratulations

Stronger. Faster. Beefier. The Shapeoko Pro XL is an incredibly powerful CNC machine purpose-built for rigidity and accuracy. An upgraded controller, integrated tool-offset probe, inductive homing switches, and 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 Pro XL. Precision-machined parts, pre-assembled components, and self-contained packaging mean assembling your Shapeoko Pro XL is quick and easy. You'll be up and machining in no time.

Shapeoko Pro XL Assembly Video
Watch the Shapeoko Pro XL Assembly Overview video at: youtu.be/krwt3C9aSTY.

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 to do so.

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. This is true, even when the figure is shown from the rear of the machine.

Notes Used in This Guide
In this guide, you will find information that we've called out for you to pay particular attention to. We use three types of call-outs: Warnings, Notes, and Pro Tips.

Stepper Motors
The Shapeoko Pro XL 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
The Shapeoko Pro XL 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 and software on the Carbide 3D website.

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 Pro XL. Just send us an email at support@carbide3d.com and we'll get back to you right away!

Important Safety Instructions

The Shapeoko Pro 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 Pro unsupervised.

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 Pro 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 Pro XL was carefully designed to facilitate the easiest assembly possible. Your Shapeoko Pro XL arrives in two shipping boxes: box 1 contains everything you will need to complete steps 1–4, including your assembly tool kit*, and box 2 contains everything 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. Therefore, it's best to resist the urge to open all of the boxes at once.

Figure I-1

Shipping Box 1 Contains

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

Figure I-2

Shipping Box 2 Contains

| Step 5: X/Z Assembly Box |
| Step 6: Drag Chain Box |
| Step 7: Router Box |
| Step 8: Hybrid Table Box |
| Step 9: Controller Box |
| Sweepy 65 V2.0 Box |

PRO TIP: Your Shapeoko Pro XL kit has been carefully packaged by hand. If you find that something is missing or damaged, contact us at support@carbide3d.com and we'll ship it to you ASAP.

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

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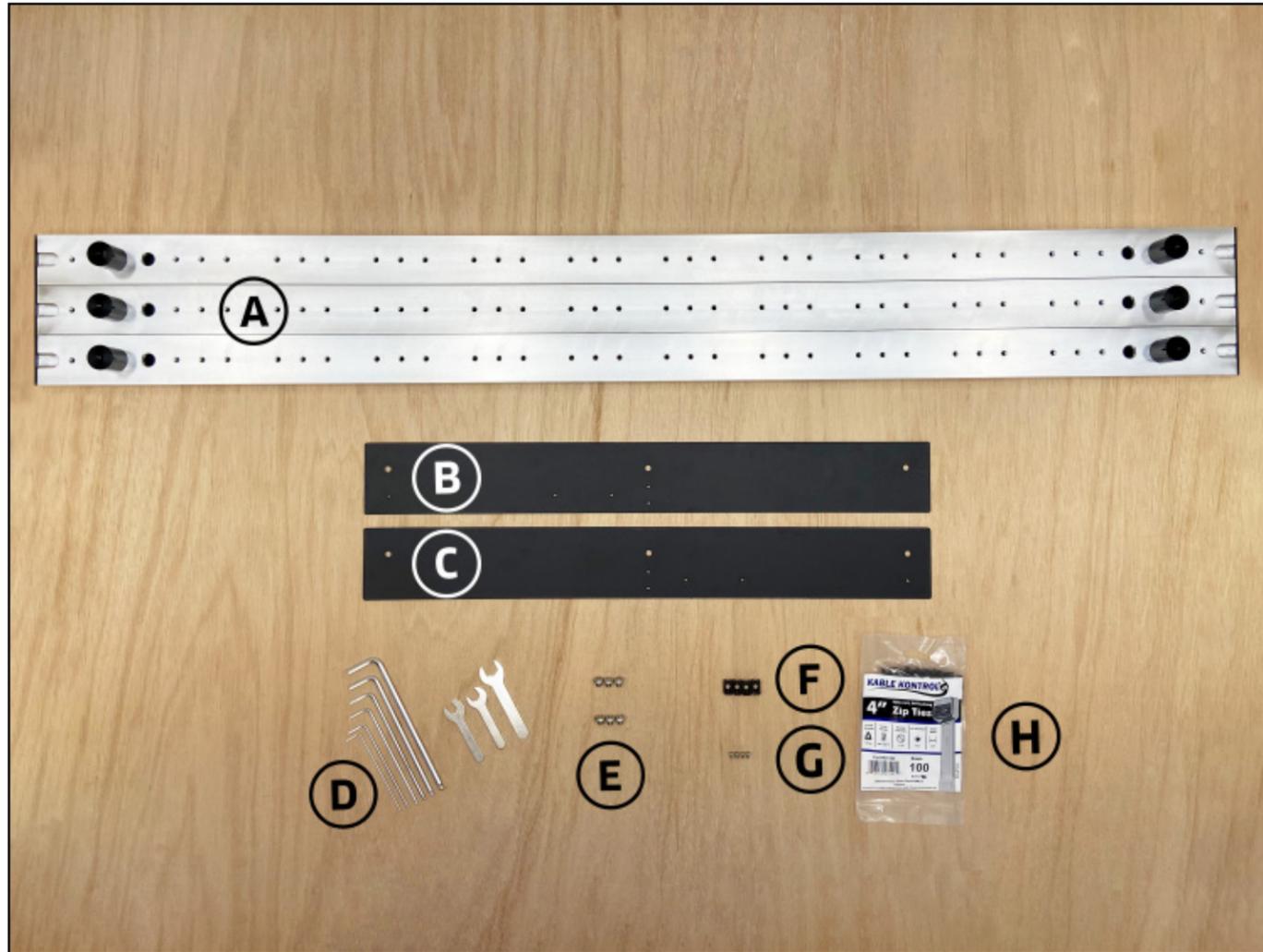
Figure 1-1

Box Components

Step 1 – Baseframe box contents; **see *Fig. 1-1*.**

Item	Description	Qty
A	Crossmember (with Pre-Installed Standoffs)	3
B	Y-Axis LEFT Drag Chain Support Panel	1
C	Y-Axis RIGHT Drag Chain Support Panel	1
D	Tool Kit: 1.5, 2, 2.5, 3, 4, 5mm Ball-Nose Hex Keys; 8, 10, 13mm Wrenches	1
E	M6×6mm Button Head Cap Screw	6
F	Cable Tie Mounts	4
G	M3×6mm Button Head Cap Screw	4
H	Pack of 100 Cable Ties	1

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1.1   Position Crossmembers and Drag Chain Support Panels

1. Position the three (3) crossmembers horizontally across your table. **See *Fig. 1-2***.

    a. Standoffs up, about 10 inches apart.

2. Check each standoff and make sure each is finger-tight.

3. Position the two (2) support panels, front to back, across the outside edges of the three crossmembers. **See *Figs. 1-2* and *1-3***.

    a. M3 threaded holes to the outside.

    b. Two close-set M3 holes toward the front.
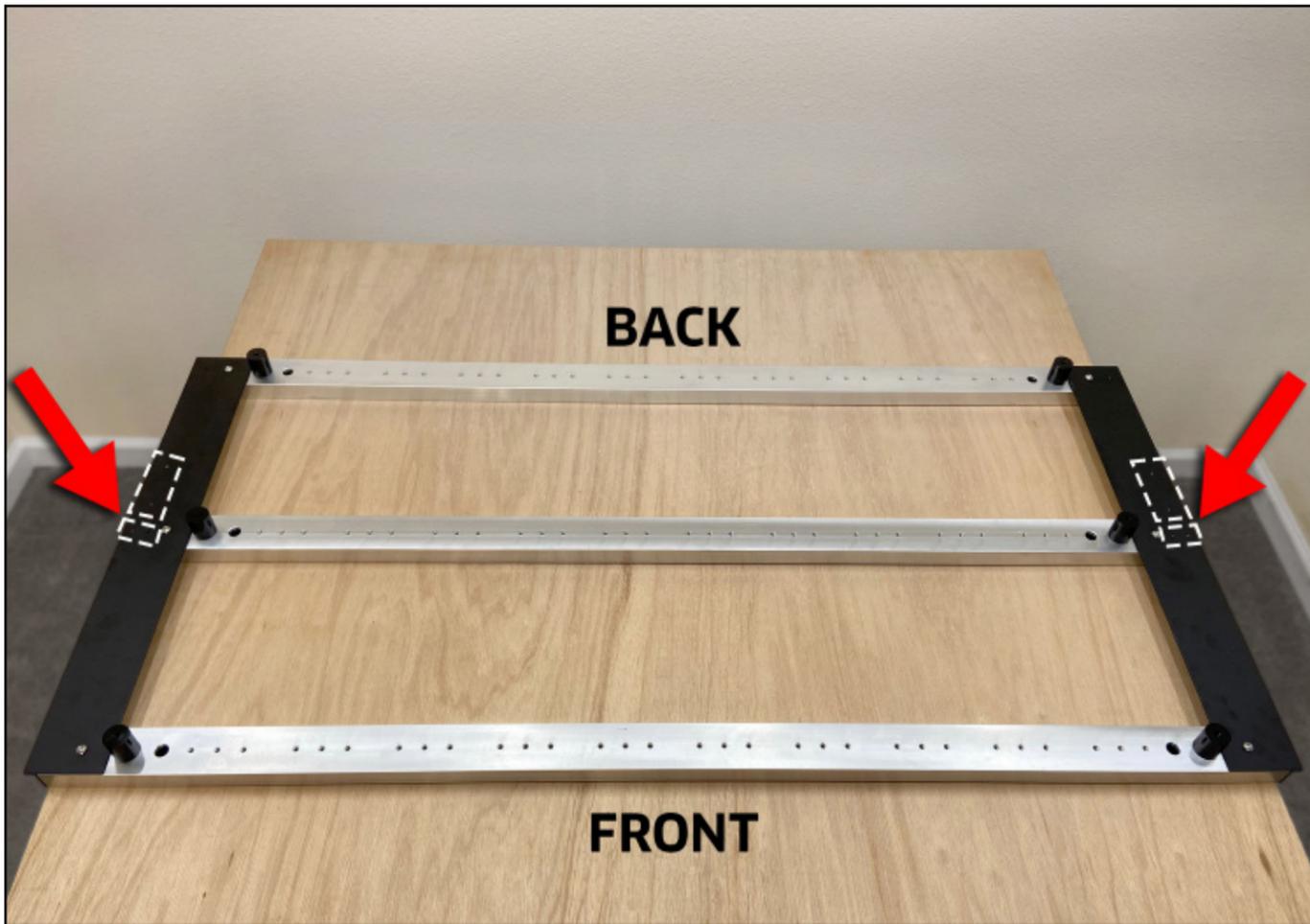
    c. Two wide-set M3 holes toward the back.

1.2   Assemble the 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.

1.3   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 wide-set M3 holes toward the back.

NOTE: Set aside the pack of zip ties for cable cleanup later.

Figure 1-2

Figure 1-3

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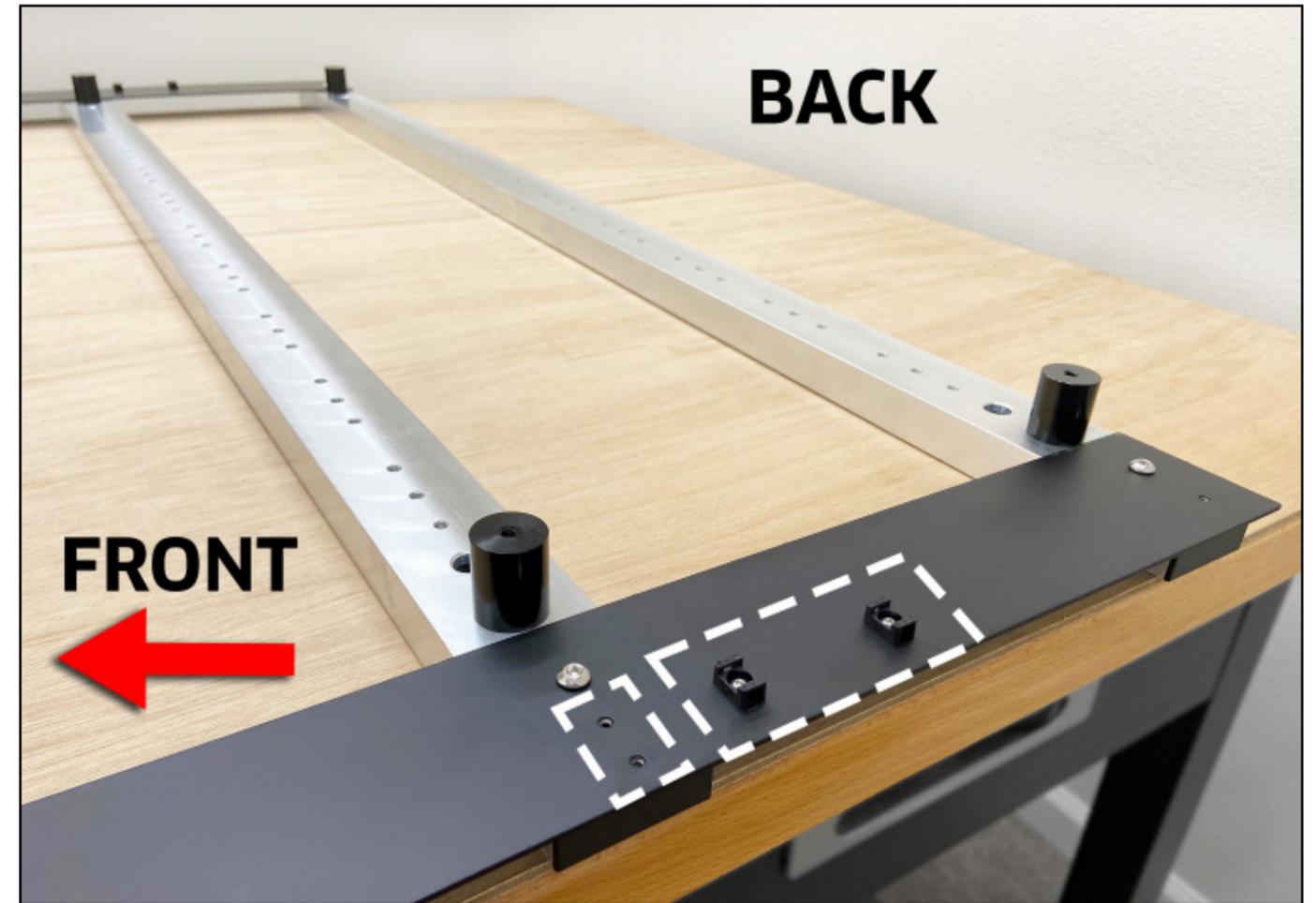
Figure 2-1

Box Components

Step 2 – Y-Rails box contents; **see *Fig. 2-1*.**

Item	Description	Qty
I	Y-Axis LEFT Extrusion Rail (Y-Left Rail)	1
J	Y-Axis RIGHT Extrusion Rail with Pre-Installed Wiring (Y-Right Rail)	1
K	M6×85mm Shoulder Bolts	6

2.1 Install the 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 Pro decal to inside-front.

   b. Linear rail and carrier plate to outside.

   NOTE: Don't remove the SHCS shipping screws keeping the carrier plates from moving just yet.

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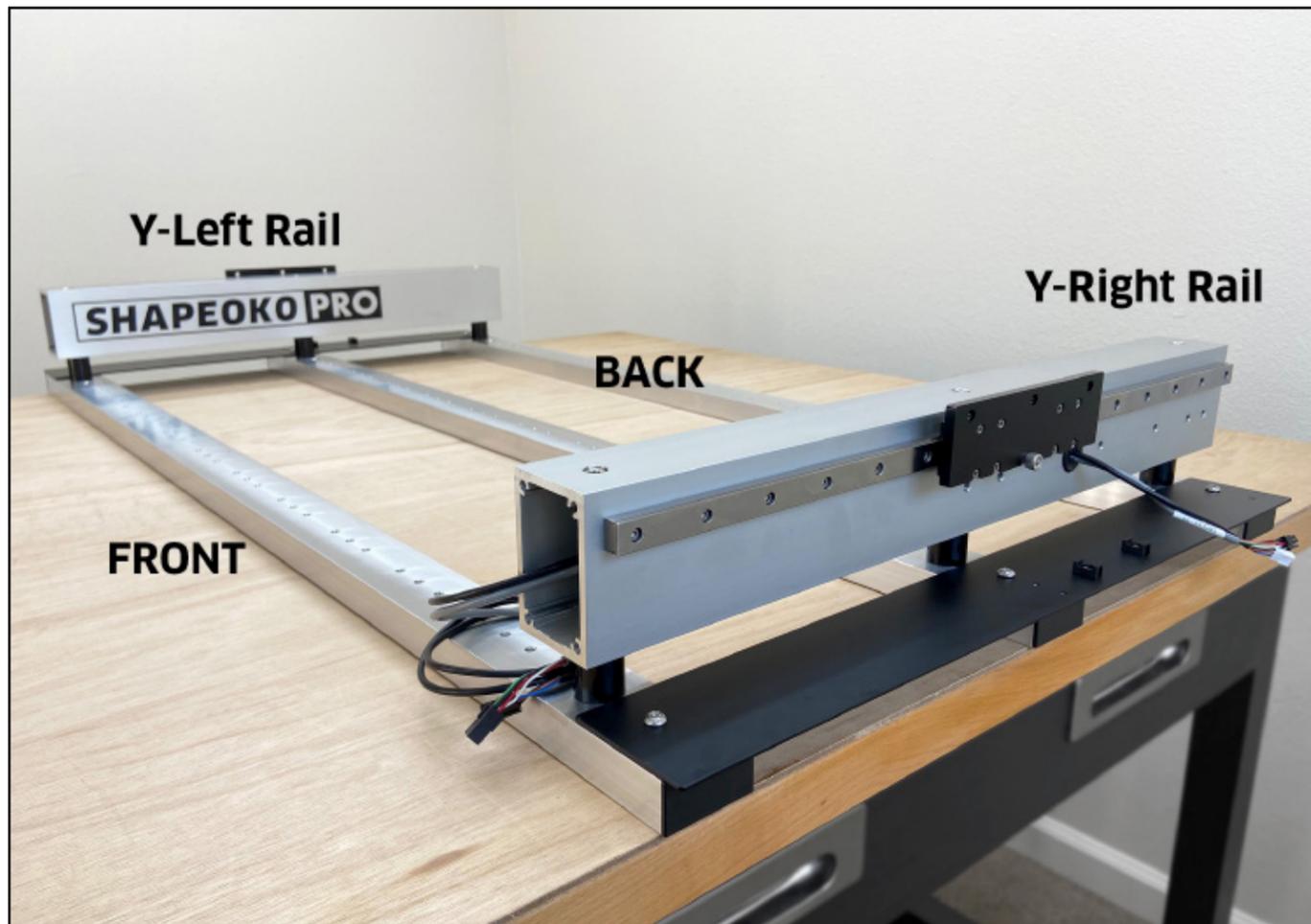
   c. Snug the bolts, then back out ¼ turn.

2.2 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. Linear rail and carrier plate to outside.

2. Pull the ends of the two cables out of the front of the rail.

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

   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***.

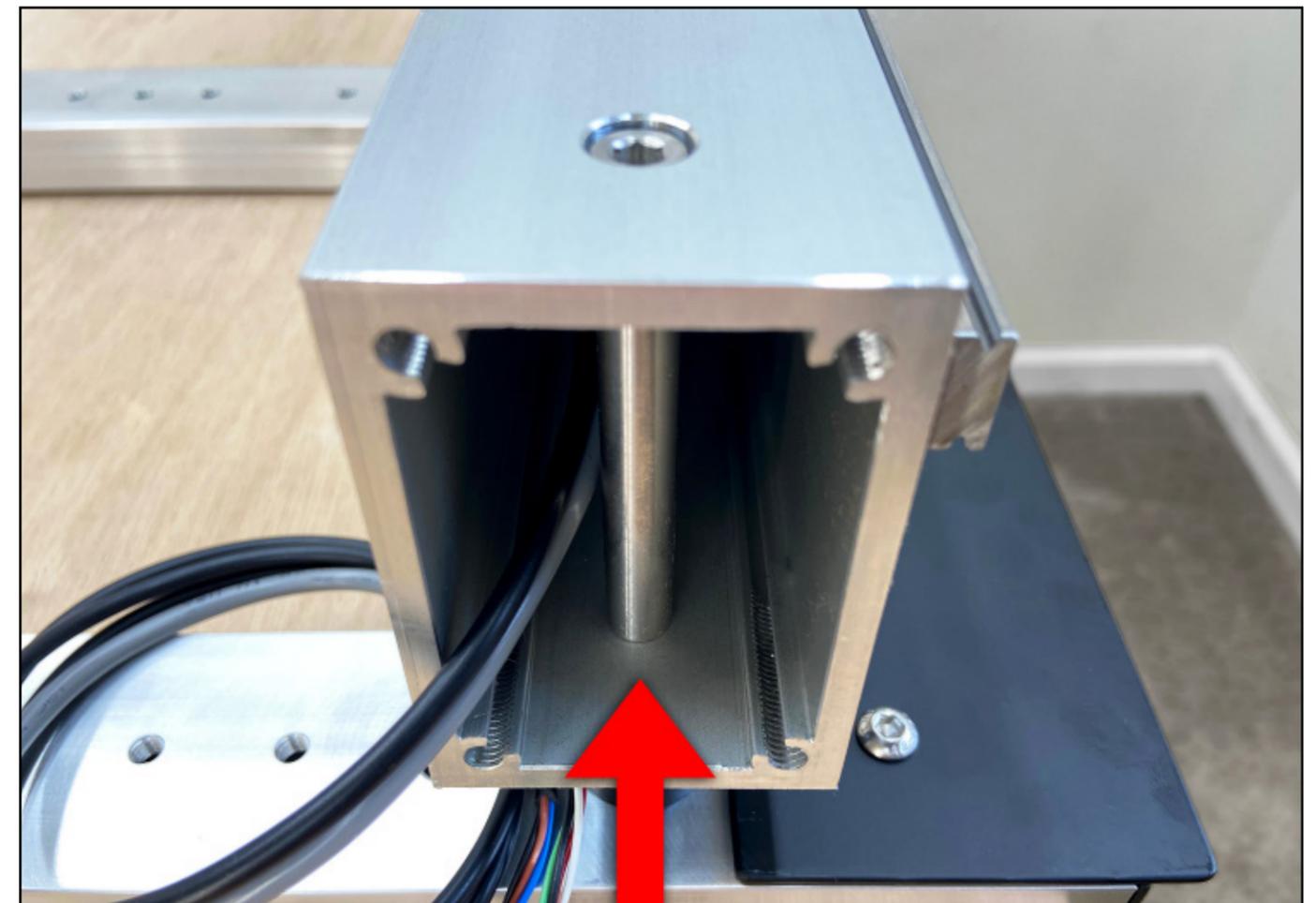   c. Snug the bolts, then back out ¼ turn.

Figure 2-2
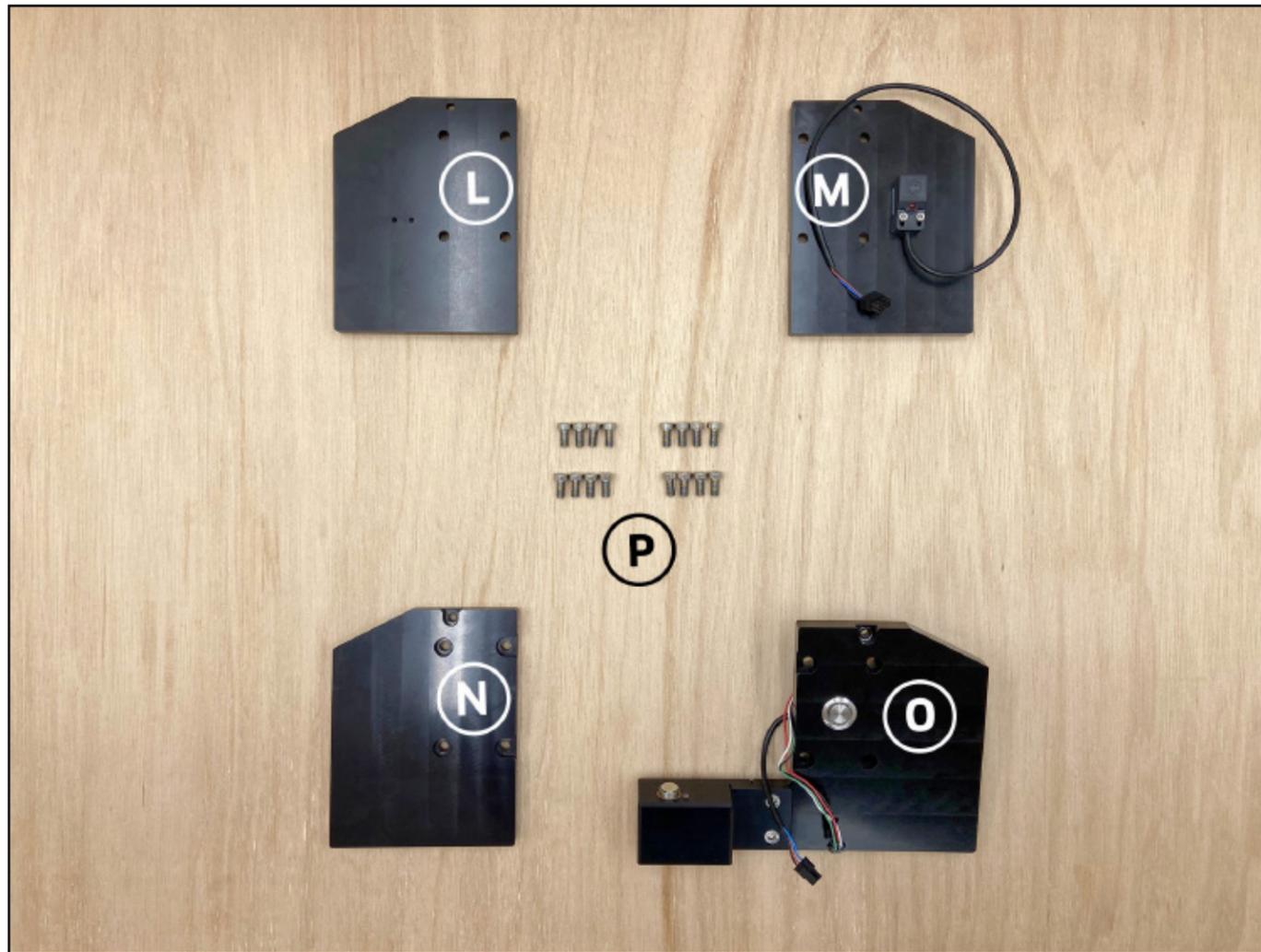
Figure 2-3

Figure 3-1

Box Components

Step 3 – Endplates box contents; **see *Fig. 3-1*.**

Item	Description	Qty
L	Back-Left Endplate	1
M	Back-Right Endplate	1
N	Front-Left Endplate	1
O	Front-Right Endplate (with Integrated Power Button and BitSetter)	1
P	M6×12mm Low-Profile Socket Head Cap Screw	16

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3.1　Install Front-Right Endplate

1. Position the front-right endplate near the front end of the Y-Right rail.

   a. Power button faces front.

   b. BitSetter extends to left.

2. Connect the 4-pin power and the 3-pin BitSetter leads to the corresponding extension cables exiting the front of the rail. See **Figs. 3-3** and **3-4**.

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

3. Tuck the connected cables into the rail cavity, so the endplate sits flush against the end of the rail.

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

NOTE: Be careful not to pinch the wires between the rail and endplate.

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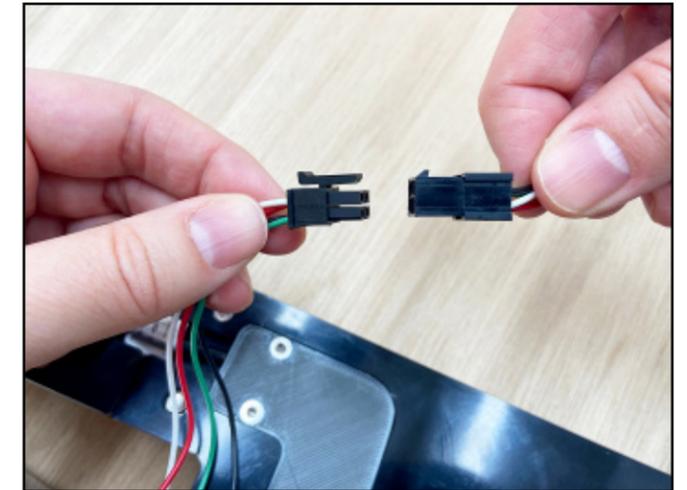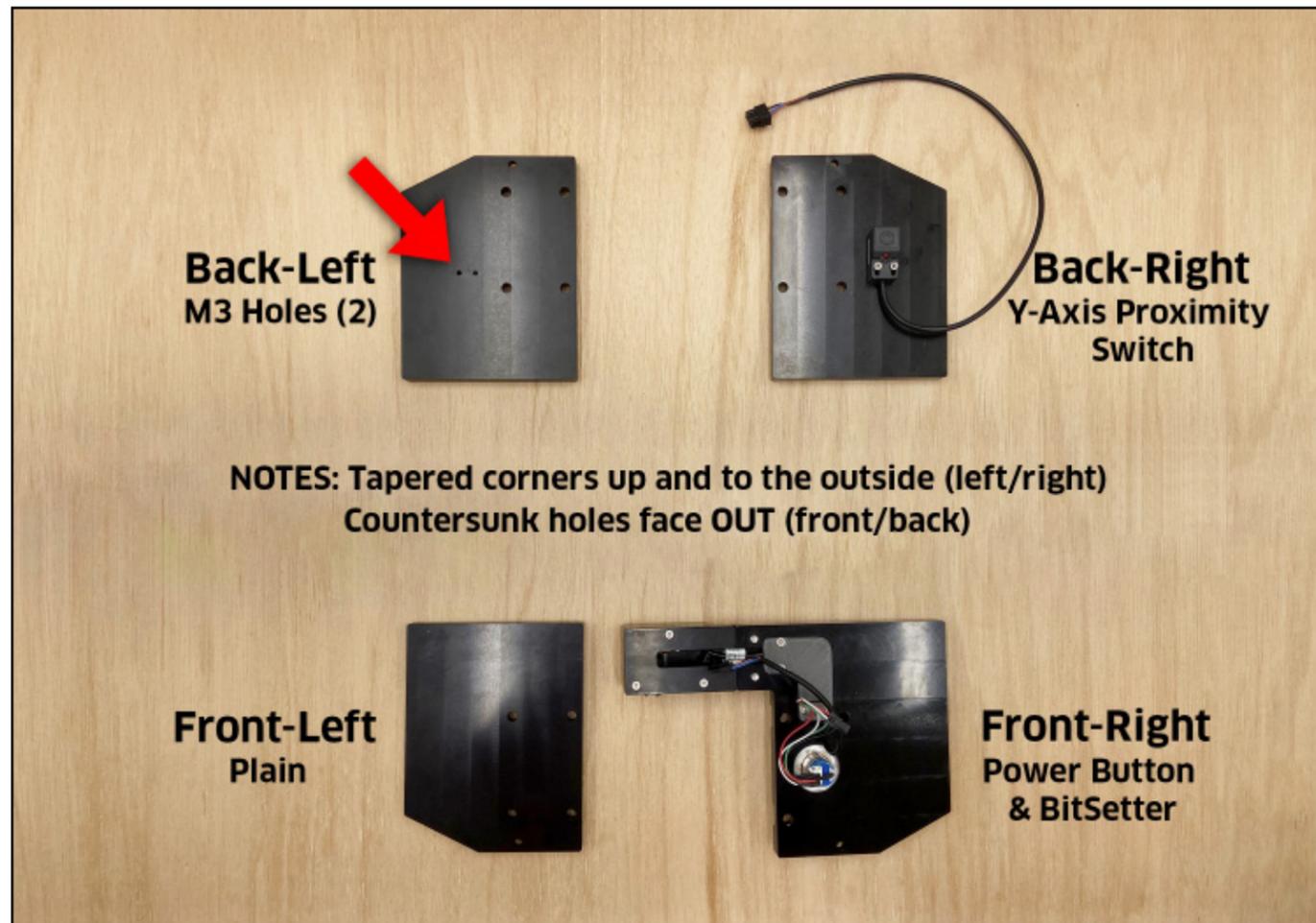

Figure 3-3
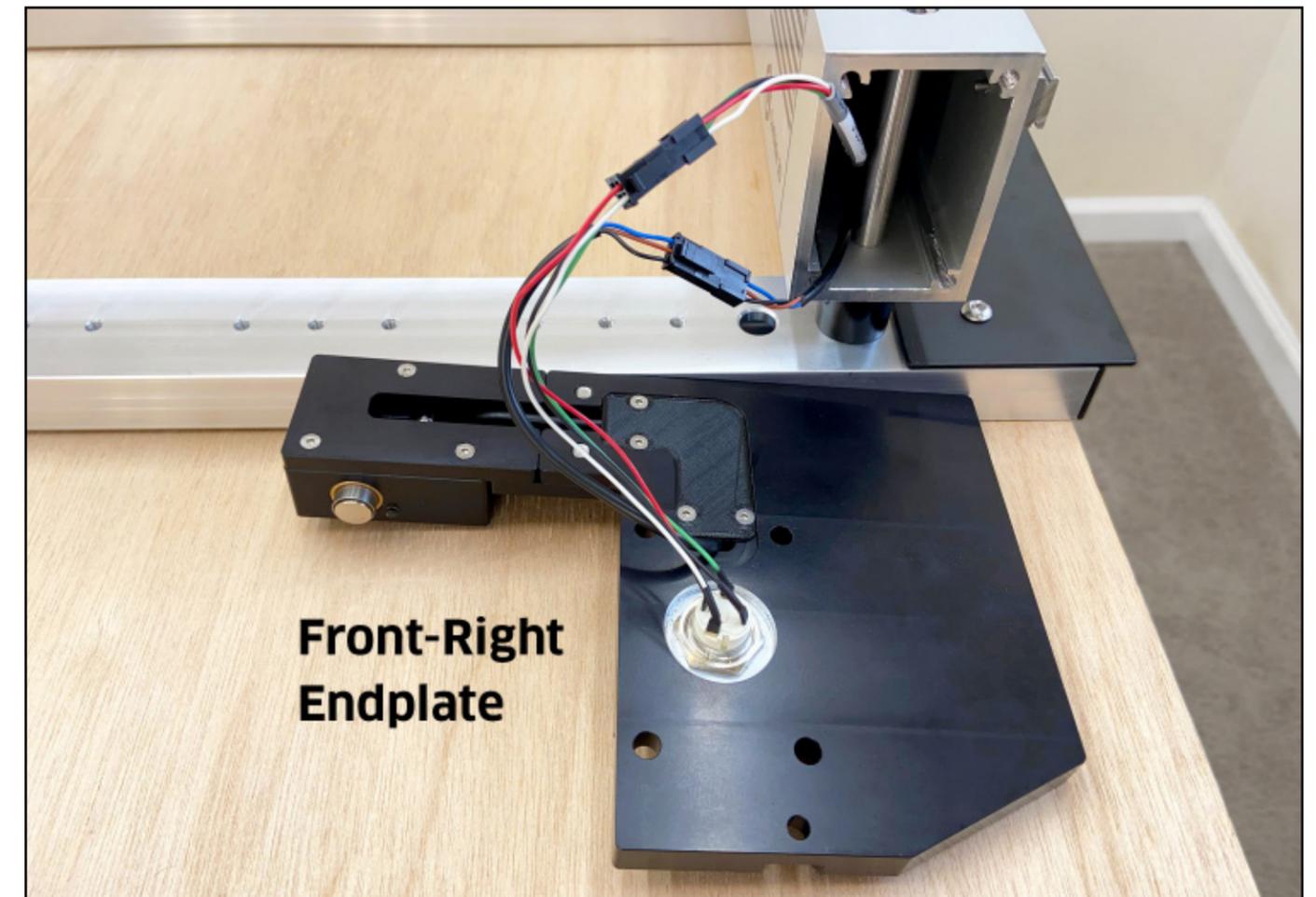

Figure 3-2

Figure 3-4

3.2　Install Back-Right Endplate

1. Position the back-right endplate at the back end of the Y-Right rail. **See *Fig. 3-5***.

   a. Proximity switch to outside/front.

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

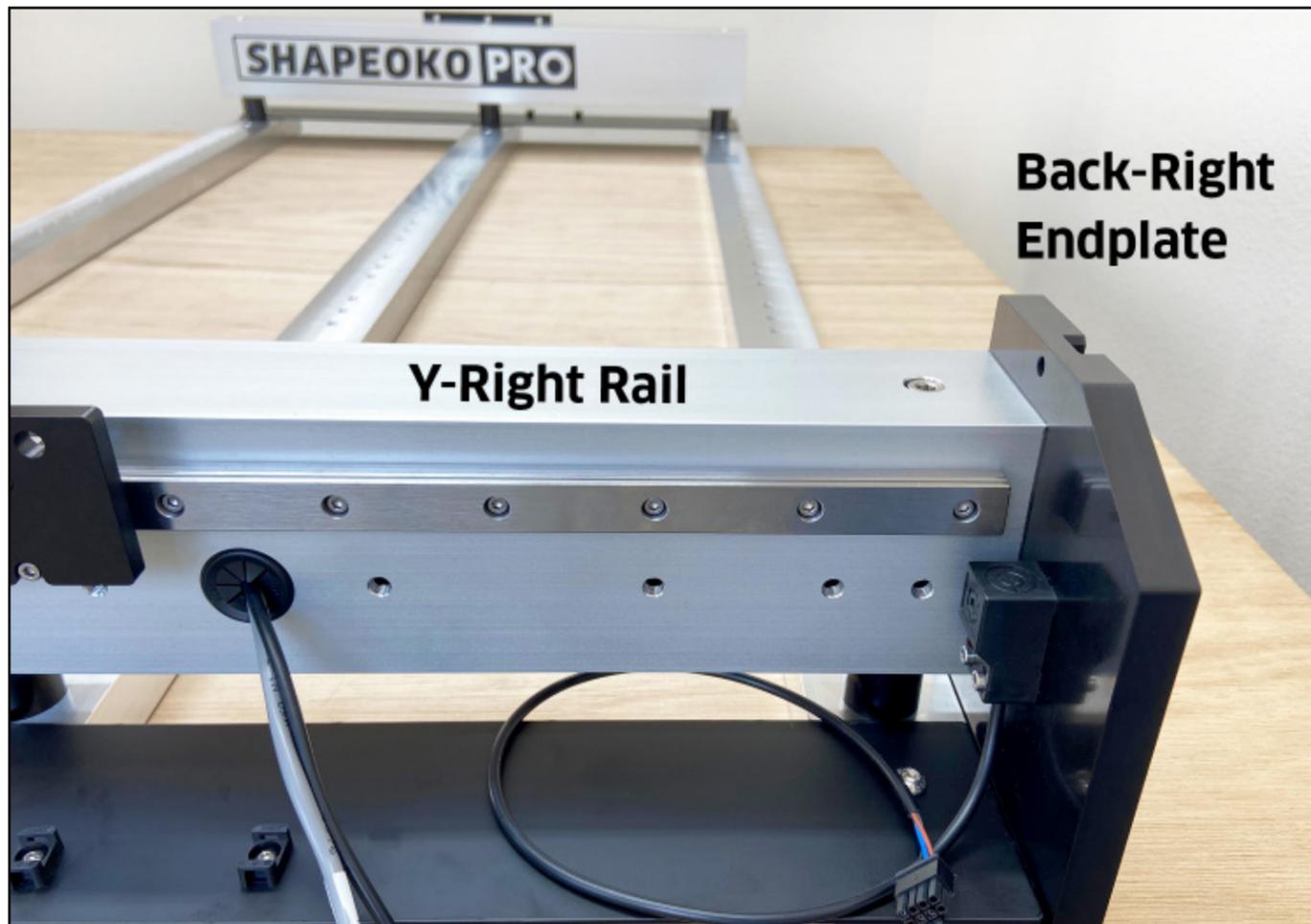## 3.3　Install Left Endplates

1. Position the two remaining endplates at either end of the Y-Left rail. **See *Fig. 3-6***.

   a. Countersunk holes to the outside; flat side flush against the rail ends.

   b. Tapered corners to the outside/top.

2. Use a 4mm hex key and four (4) M6×12mm low profile SHCS to secure each endplate to the rail. Fully tighten.
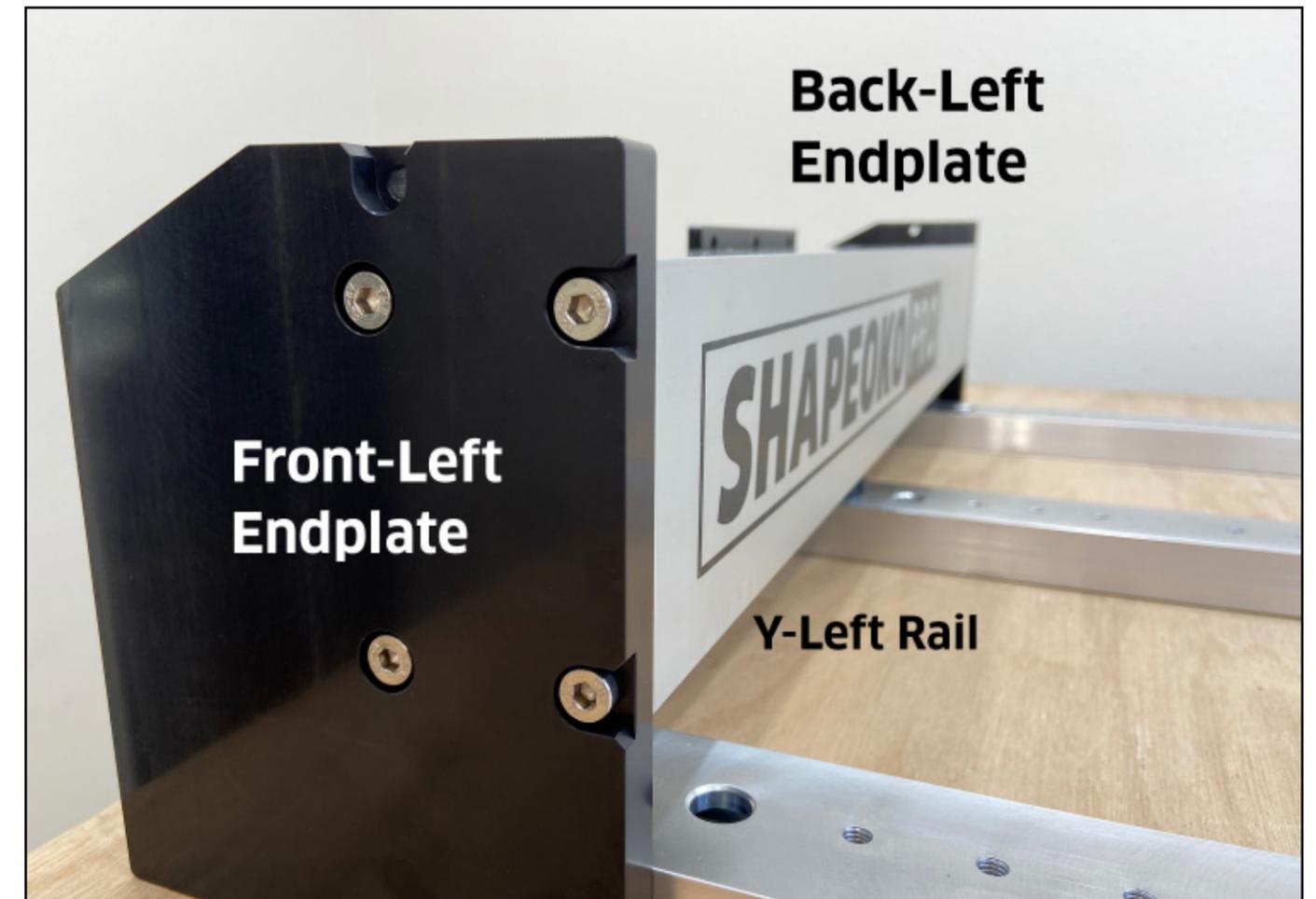
Figure 3-5

Figure 3-6

Figure 4-1

Box Components

Step 4 — Gantry box contents; **see** *Fig. 4-1*.

Item	Description	Qty
Q	X-Axis Gantry Assembly (with Pre-Installed Wiring)	1
R	X-Axis Drag Chain Support Panel	1
S	M6×12mm Button Head Cap Screw	6
T	15mm 2GT Belt 1400mm	2
U	M5×12mm Socket Head Cap Screw	4
V	15mm Belt Clip	4
W	M4×8mm Flat Head Screw	5

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4.1   Install X-Axis Gantry

1. Position the X-Axis gantry across the center of the baseframe, resting it on the Y-Left and Y-Right carrier plates/bearing blocks. **See Figs. 4-2 and 4-4**.

   a. Gantry linear rails and carrier plate to front.

   b. Left and right gantry endplates rest on top of the bearing blocks to the inside of the Y-Axis carrier plates.

NOTE: Tolerances are tight. Be sure the gantry is centered. If necessary, tilt the still loose Y-rails outward to fit the gantry between the plates.

2. Align the holes in the two Y-Axis carrier plates with the left and right gantry endplates.

3. Use a 4mm hex key and six (6) M6×12mm BHCS to loosely attach the gantry to the carrier plates. **See Fig. 4-4**.

   a. Snug the screws, then back out ¼ turn.

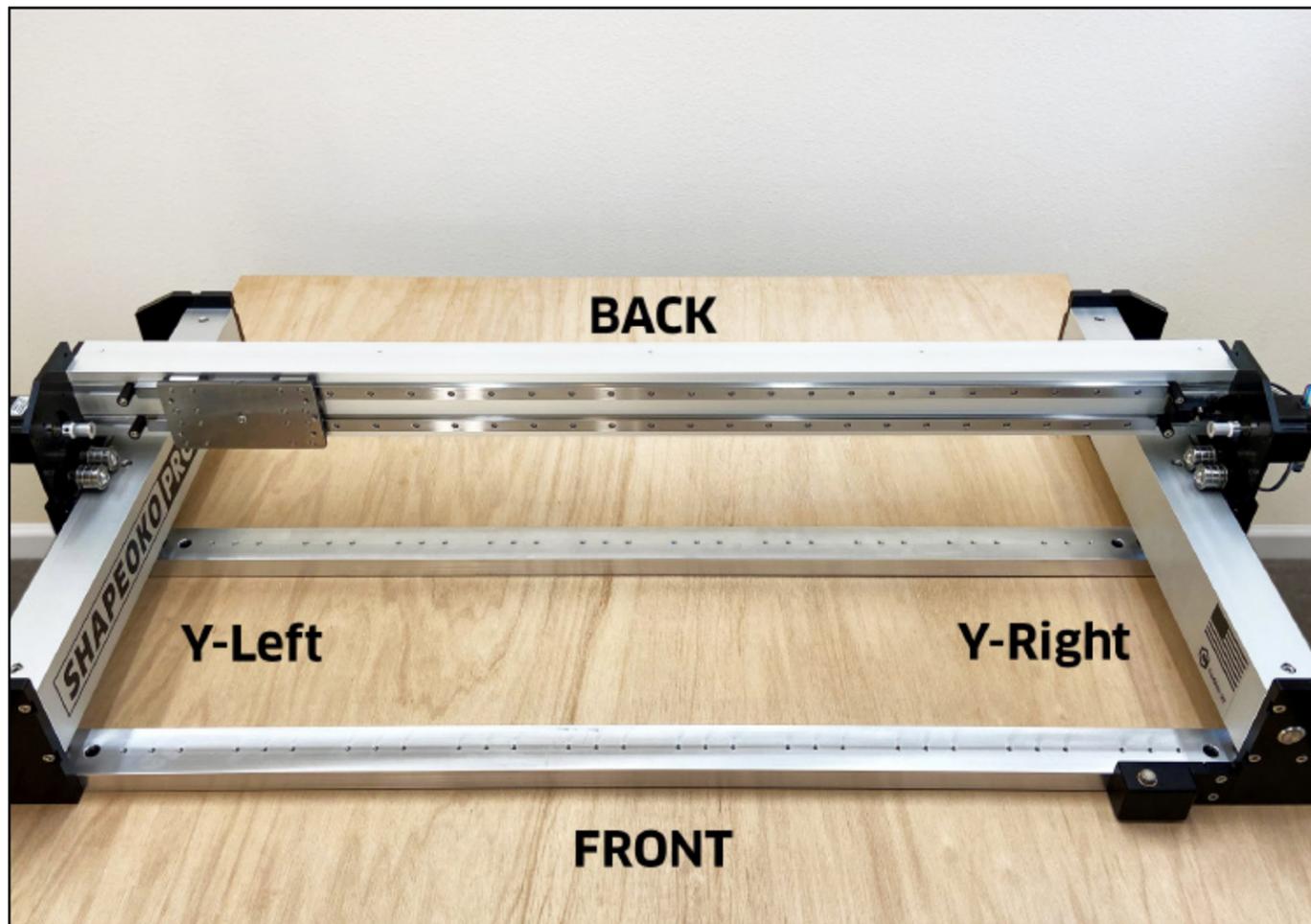## 4.2   Install X-Axis Drag Chain Support Panel

1. Position the support panel across the top-back of the gantry. **See Fig. 4-3**.

   a. Countersunk holes up.

   b. Tapered corners to back.

   c. Two threaded M3 holes to left.

2. Use a 2.5mm hex key and five (5) M4×8mm FHS to secure the panel to the gantry.
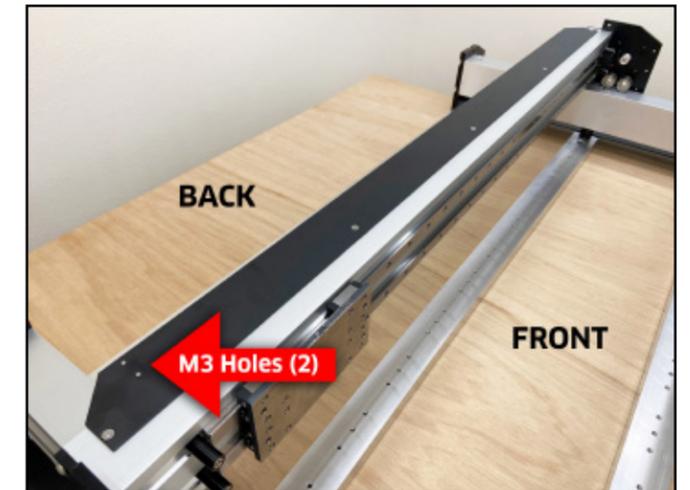
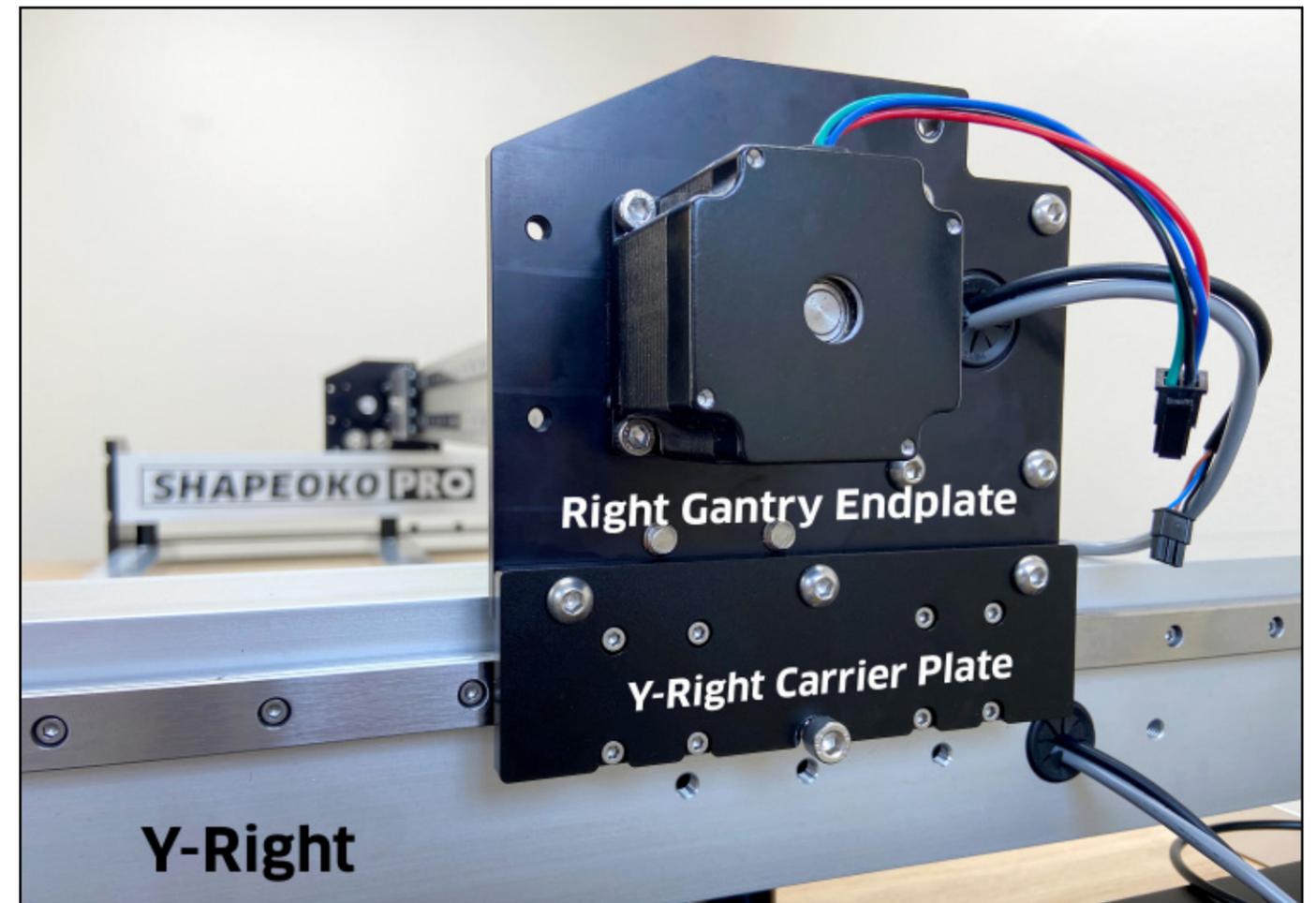   a. Start all screws before fully tightening.

Figure 4-3

Figure 4-2

Figure 4-4

4.3   Attach Belt Clip to Belt

See *Fig. 4-5*.

1. Thread about 5 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.

4.4   Install Y-Axis Belts

1. Use a 4mm hex key and one (1) M5×12mm SHCS to secure the clip to the back-left endplate. See *Fig. 4-7*.

   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 rail.

   d. Fully tighten.

2. Thread the belt, teeth down, under the two idlers onto the left gantry endplate.

3. Use a small hex key to pull a loop of belt up between the two idlers. See *Fig. 4-6*.
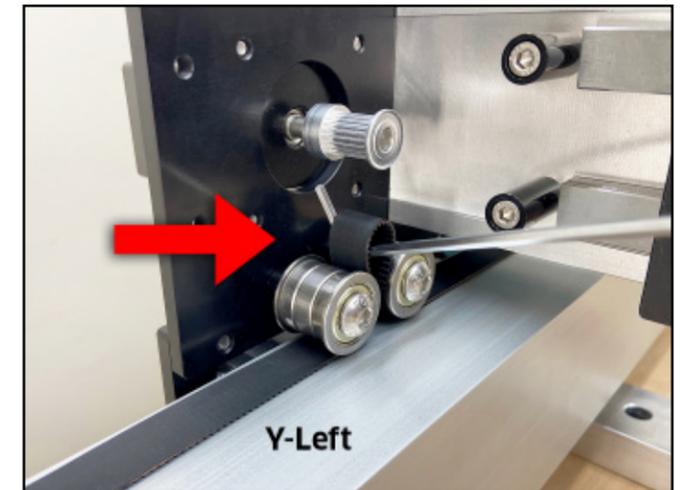
4. Place the loop over the stepper motor pulley.

Figure 4-6

Figure 4-5

Figure 4-7

5. Thread a second belt clip onto the free end of the belt.

6. Firmly hold the clip flat against the rail.

7. Adjust the length of the belt so that there is a 2–3mm gap between the clip and the front-left endplate. See *Fig. 4-8*.

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

   a. Maintain downward pressure on the clip.

   b. Fully tighten the screw until the belt snaps back against the rail when gently lifted.

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

9. Repeat Steps 4.3 and 4.4 to install the second belt to the Y-Right rail.

4.5 Square the Machine

1. Use a 5mm hex key to remove the M6×35mm SHCS shipping screws from both Y-Axis carrier plates, allowing the gantry to slide freely front and back.

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

3. Adjust the squareness of the baseframe until both ends of the gantry touch the front endplates. See *Fig. 4-9*.

4. 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.

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

6. Use a 4mm hex key to fully tighten the six (6) M6×12mm BHCS securing the gantry to the left and right Y-Axis carrier plates.

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 4-8

Figure 4-9

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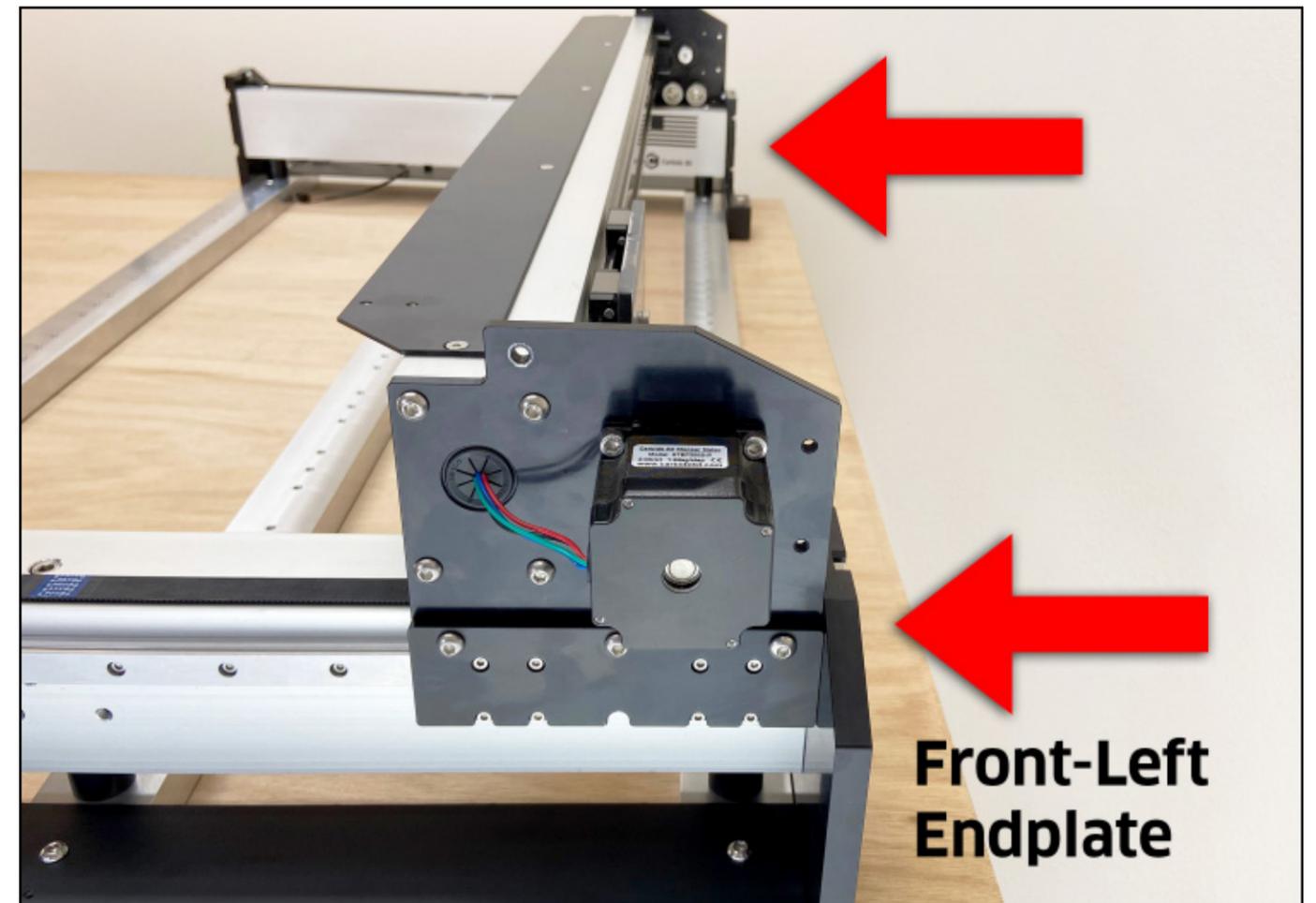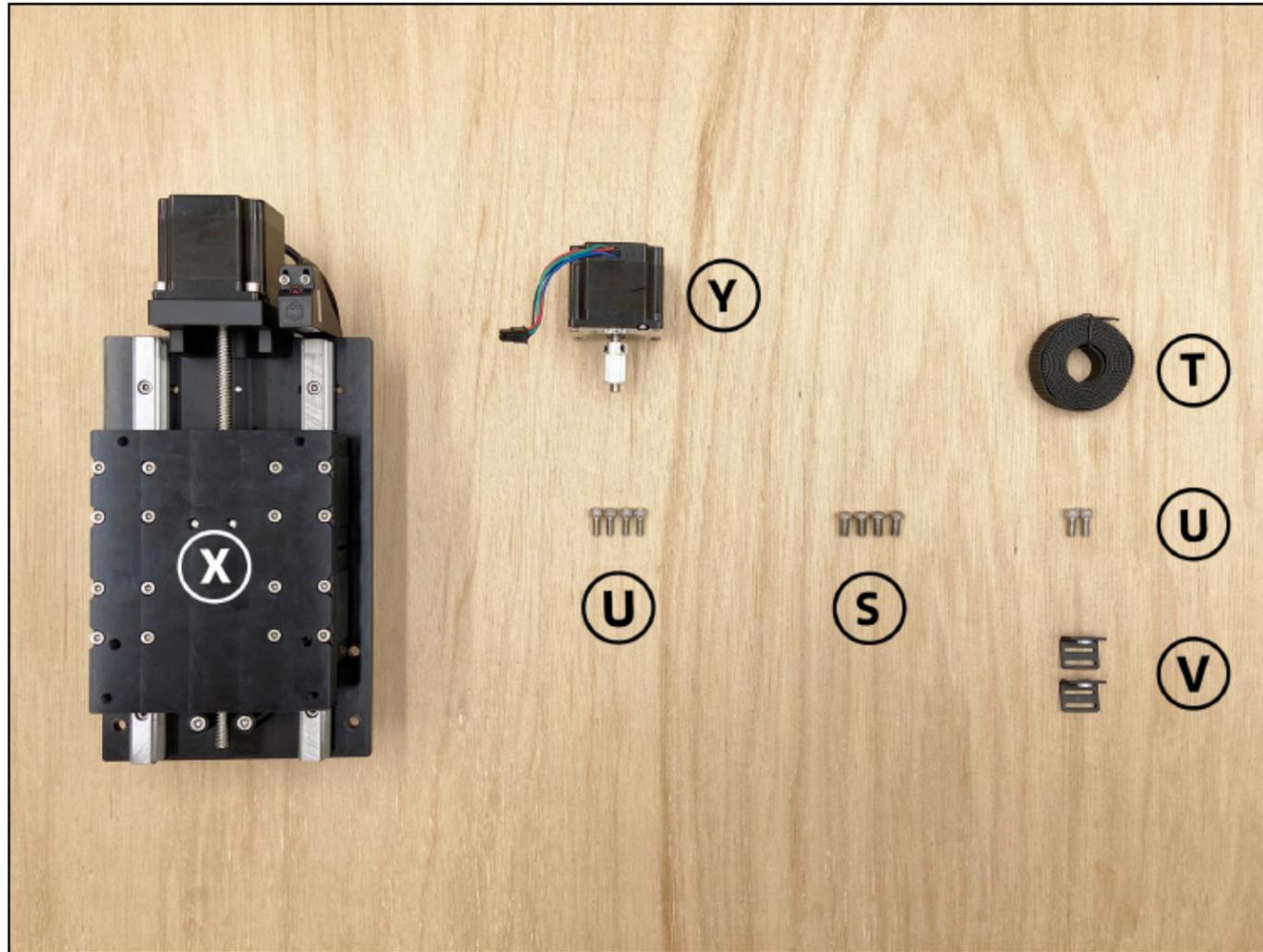
Figure 5-1

Box Components

Step 5 – X/Z Assembly box contents; **see *Fig. 5-1***.

Item	Description	Qty
X	X/Z Assembly	1
Y	Nema 23 Stepper Motor	1
U	M5×12mm Socket Head Cap Screw	4
S	M6×12mm Button Head Cap Screw	4
T	15mm 2GT Belt 1400mm	1
U	M5×12mm Socket Head Cap Screw	2
V	15mm Belt Clip	2

5.1   Install X/Z Assembly

1. Use a 4mm hex key to remove the M5×25mm SHCS shipping screw from the front of the X-Axis carrier plate, allowing it to slide freely left and right.

2. Position the X/Z assembly over the front of the X-Axis carrier plate. **See *Fig. 5-2*.**

   a. Z-Axis plate facing front.

   b. Z-Axis stepper motor on top.

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

5.2   Install X-Motor and Belt

1. Attach one end of the belt to one end of the X-Axis gantry, threading about 3 inches of belt through the belt clip. (Refer back to Steps 4.3 and 4.4.) **See *Fig. 5-4*.**

2. Thread the belt, teeth down under the two idlers on the back of the X/Z assembly.

3. Use a small hex key to pull a large loop of belt up between the two idlers and into the motor housing. **See *Fig. 5-4*.**

4. Position the X-motor over the threaded screw holes on the motor housing. **See *Fig. 5-3*.**

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

   b. Motor lead cables extend up.

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

6. Pull the slack out of the belt and secure the free end to the other end of the X-Axis gantry. (Refer back to Steps 4.3 and 4.4.)
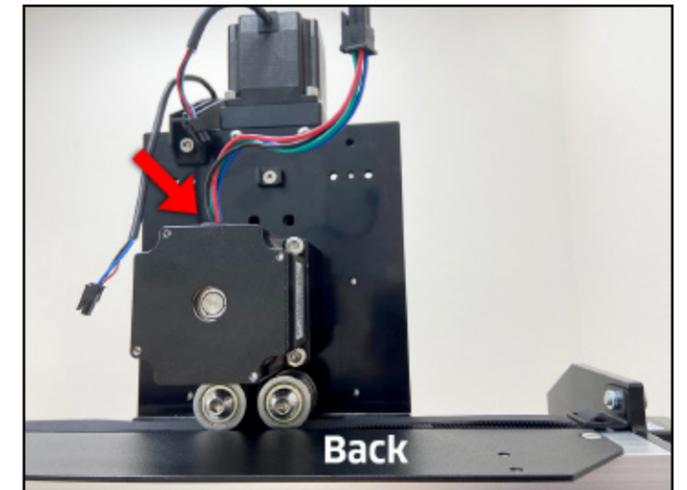

Figure 5-3

Figure 5-2

Figure 5-4

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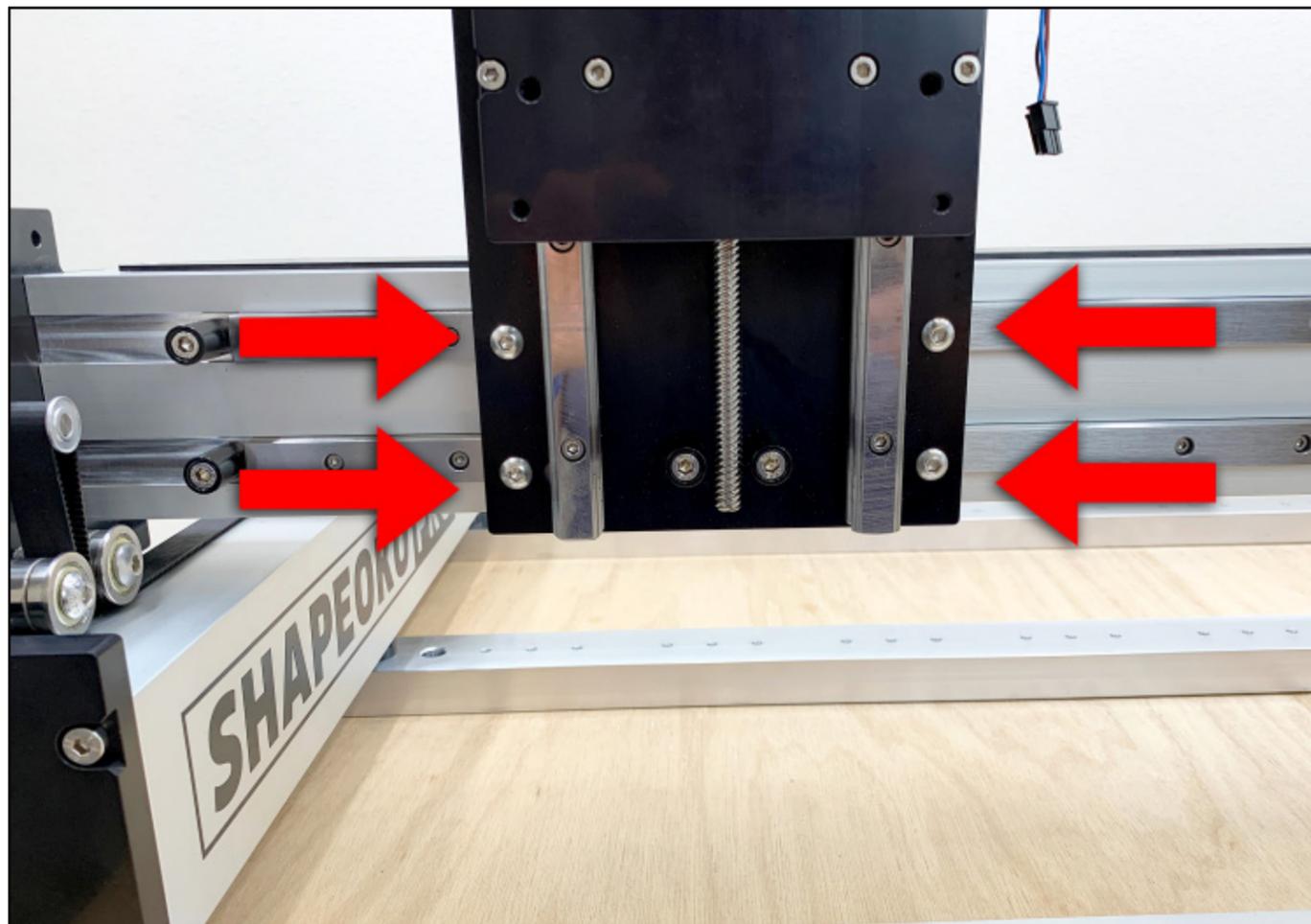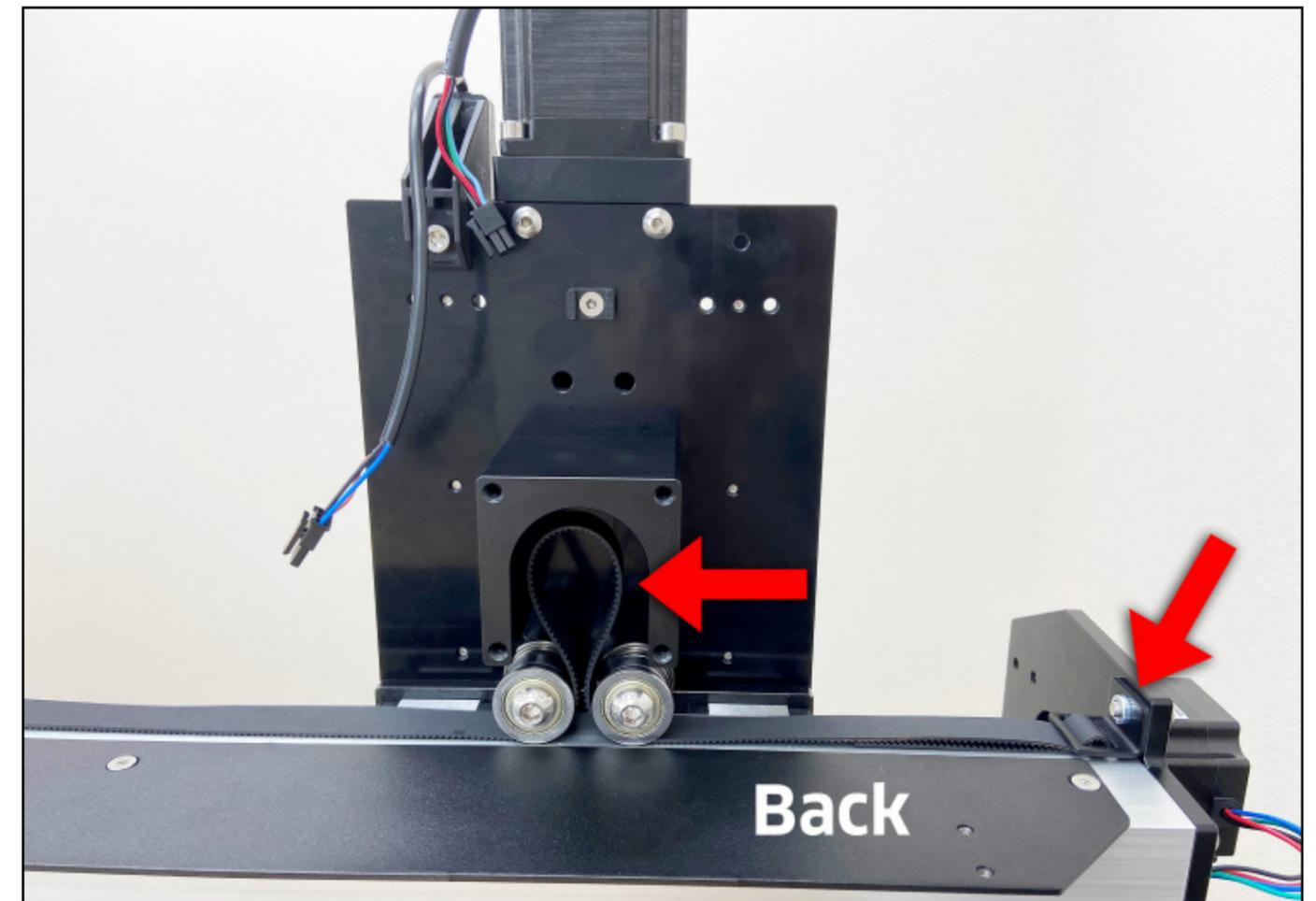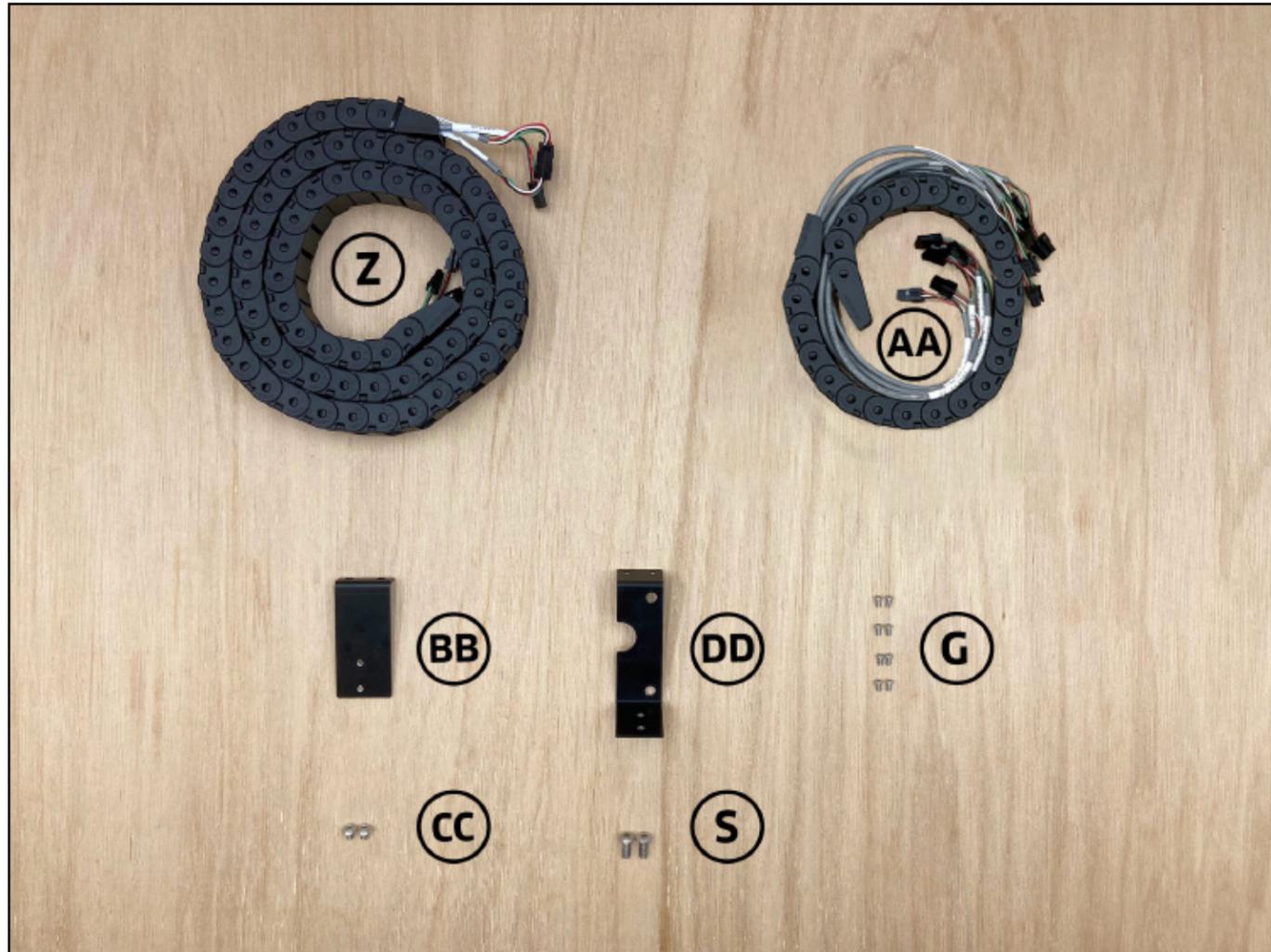
Figure 6-1

Box Components

Step 6 – Drag Chain box contents; see *Fig. 6-1*.

Item	Description	Qty
Z	X-Axis Data Drag Chain: 4-pin male-to-female extension (2), 3-pin male-to-female extension (1)	1
AA	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
BB	Drag Chain Head Bracket	1
CC	M5×6mm Button Head Cap Screw	2
DD	X/Y Right Transition Bracket	1
S	M6×12mm Button Head Cap Screw (Extra)	2
G	M3×6mm Button Head Cap Screw	8

6.1   Install Head Bracket

1. Position the drag chain head bracket on the back of X/Z assembly **(see *Fig. 6-2)*:**

    a. Upper-left corner (upper-right corner when viewed from back).

    b. Flange down, threaded holes to back.

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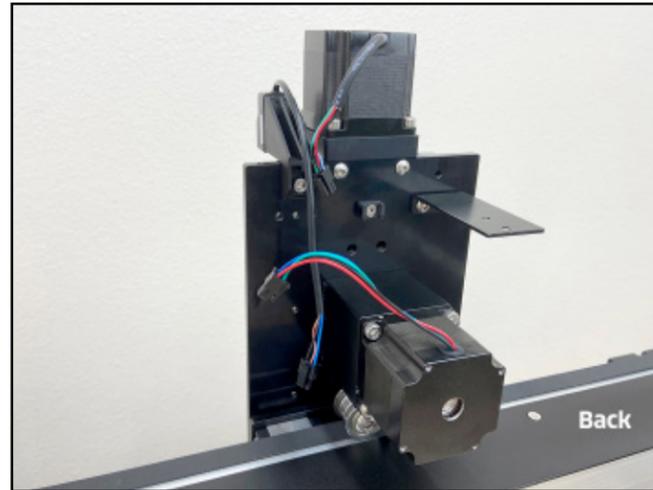
Figure 6-2

6.2   Install X-Axis Drag Chain

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

    a. Head of the chain to the left; the tail to the right, ending at the right gantry endplate.

    b. Head has all female connectors.

    c. Head curls up and attaches to the head bracket.

2. Use a 2mm hex key and two (2) M3×6mm BHCS to secure the drag chain to the head bracket. Fully tighten. **See *Fig. 6-3*.**

6.3   Attach Transition Bracket

1. Position the Z-shaped 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. Longer arm of the bracket attaches to the flat side of the head of the drag chain.

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

Figure 6-3

Figure 6-4

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

1. Use a 4mm hex key to remove the back two (2) M6×12mm BHCS from the right gantry endplate.

2. Position the bracket and Y-Axis drag chain combo alongside the Y-Right rail. **See *Fig. 6-5***.

   a. Align the bracket with the two M6 screw holes.

   b. Short arm of the bracket rests on top of the gantry.

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

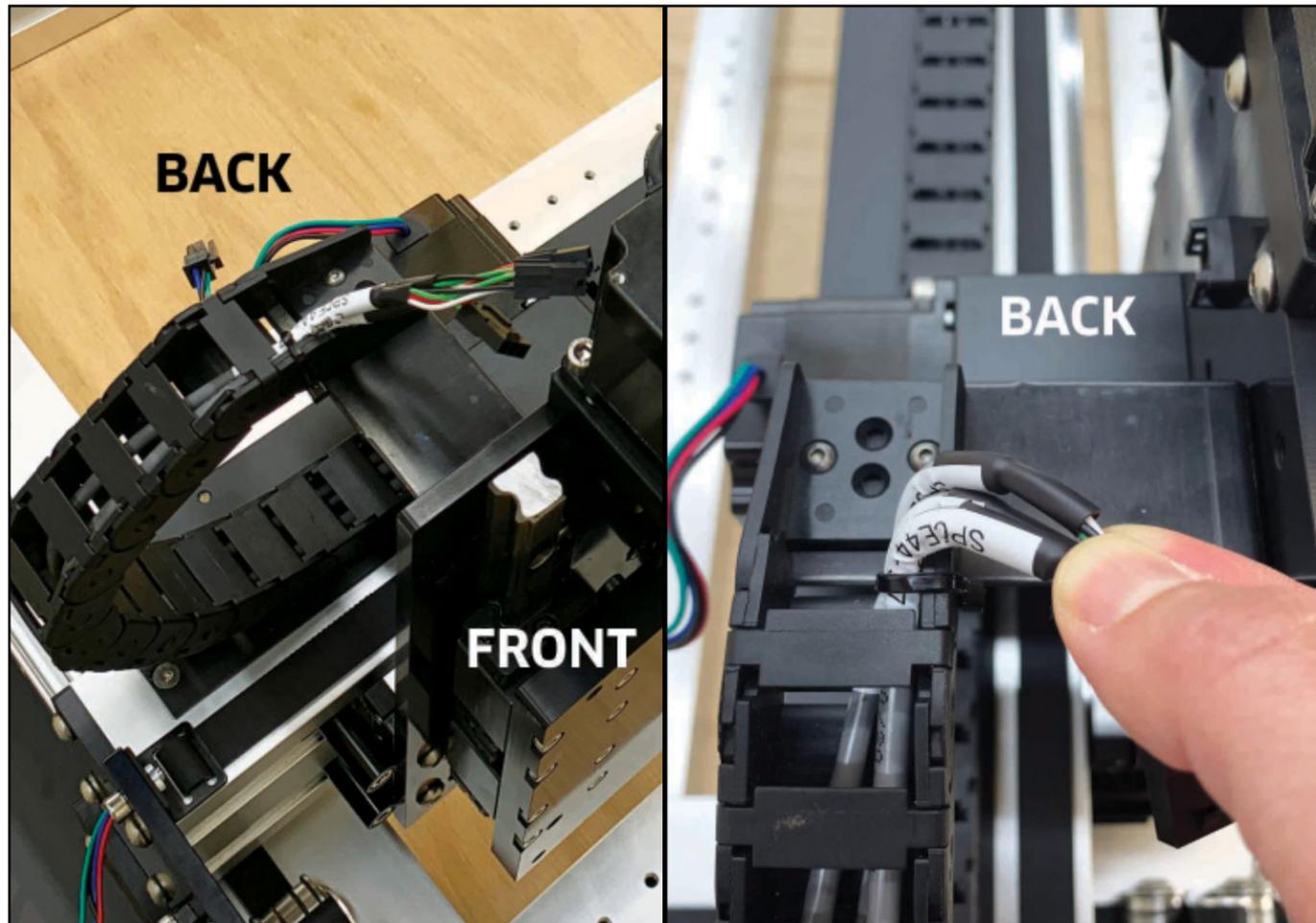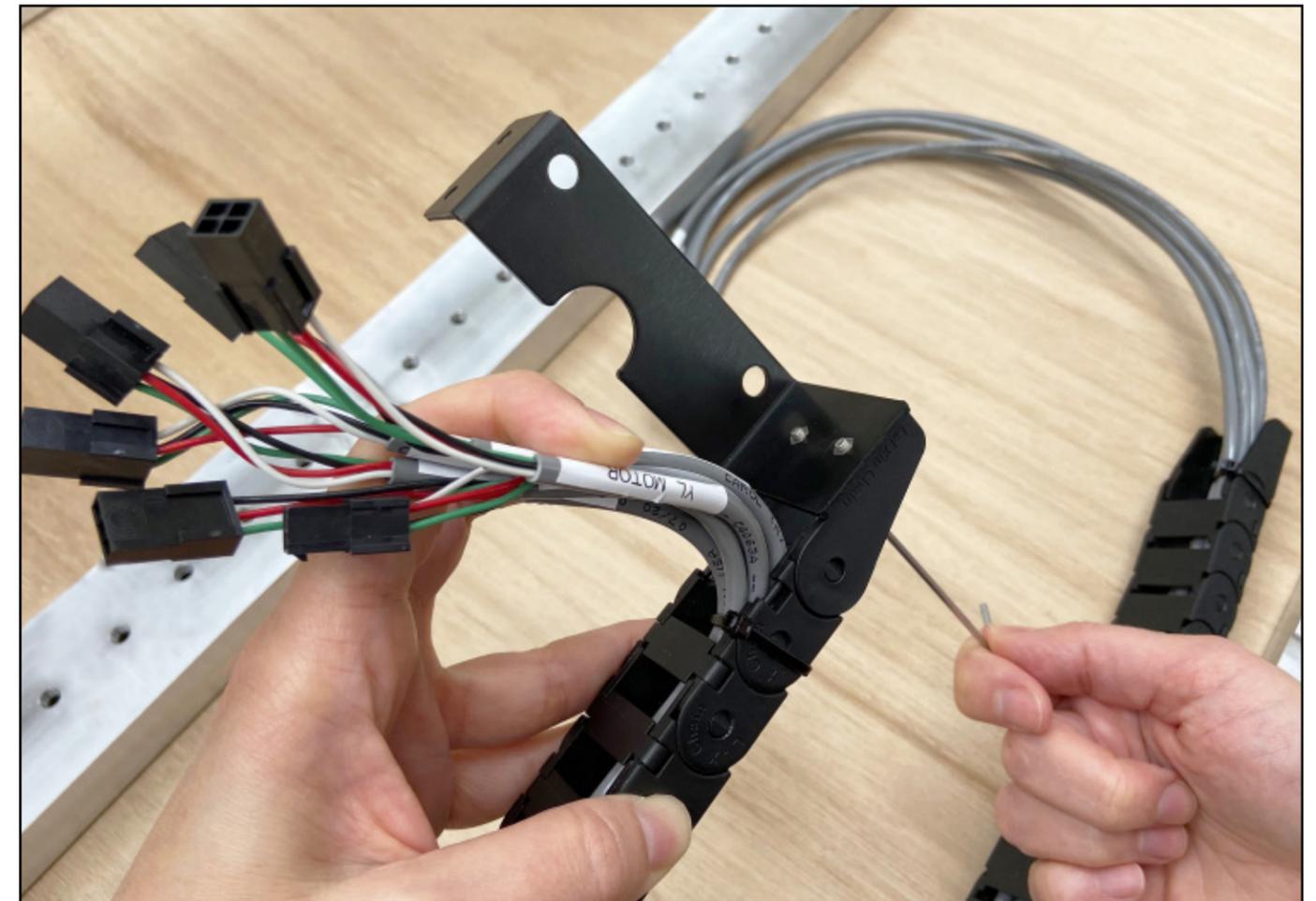3. Use a 4mm hex key and two (2) M6×12mm BHCS to secure the bracket to the gantry. Fully tighten.
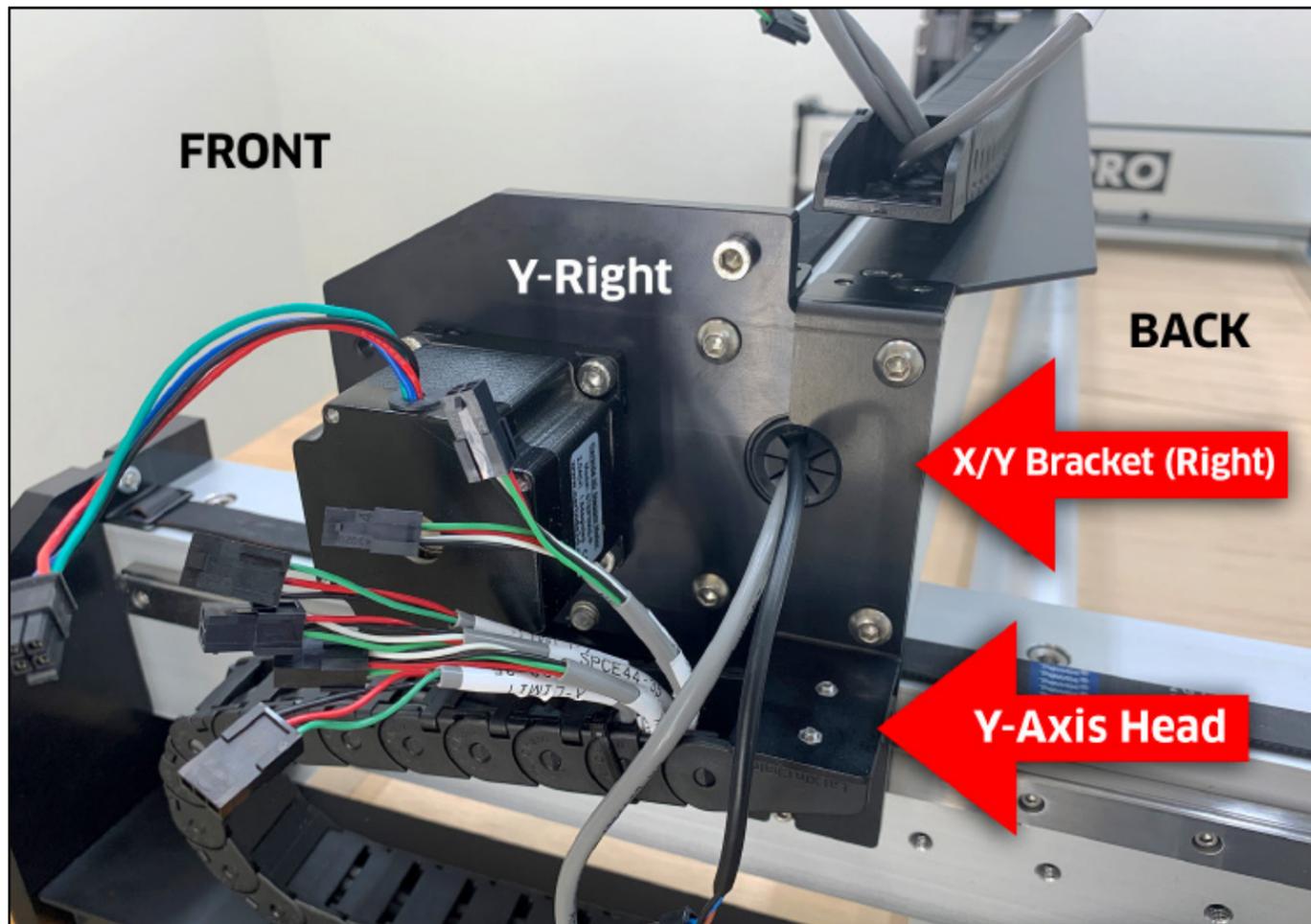
6.5   Secure Tails of the X- and Y-Axis Drag Chains

1. Position the tail of the X-Axis drag chain over the two M3 screw holes at the top of the X/Y transition bracket. **See *Fig. 6-6***.

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

3. Position the tail of the Y-Axis drag chain over the two M3 screw holes on the Y-Right drag chain support panel. **See *Fig. 6-6***.

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

Figure 6-5

Figure 6-6

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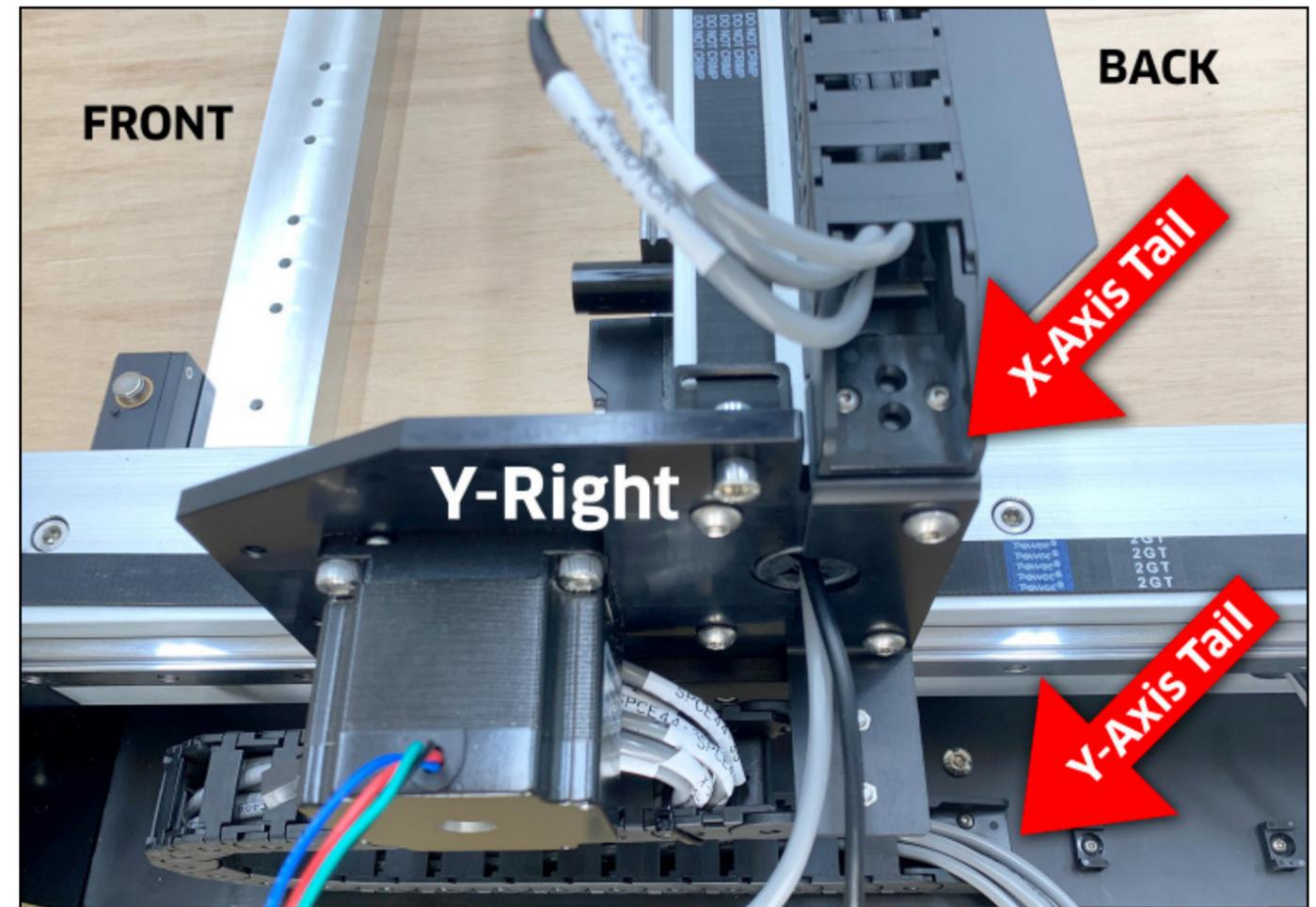
Figure 7-1

Box Components

Step 7 – Router box contents; **see** *Fig. 7-1*.

Item	Description	Qty
EE	Empty X-Axis Drag Chain	1
FF	Empty Y-Axis Drag Chain	1
GG	Router Drag Chain Head Bracket	1
CC	M5×6mm Button Head Cap Screw	2
HH	X/Y Left Transition Bracket	1
S	M6×12mm Button Head Cap Screw (Extra)	2
G	M3×6mm Button Head Cap Screw	8
II	Self-Adhesive Cable Tie Mount	1
JJ	65mm Router Mount	1
KK	M6×40mm Socket Head Cap Screw	2
LL	M5×40mm Socket Head Cap Screw	2
MM	M6×25mm Socket Head Cap Screw	2
NN	M6×10mm Grub Screw	1

Optional Shapeoko Pro CNC Router:

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

7.1   Install Router Mount

1. Position the router mount over the screw holes at the bottom of the Z-carriage. **See Fig. 7-2**.

    a.   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 of the mount. Fully tighten.

7.2   Install Router

1. Insert the router as far as it will go into the mount, with the power cable extending 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. 7-3**.

    a.   Insert the grub screw into the center threaded hole on the front-right of the 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. 7-4**.

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

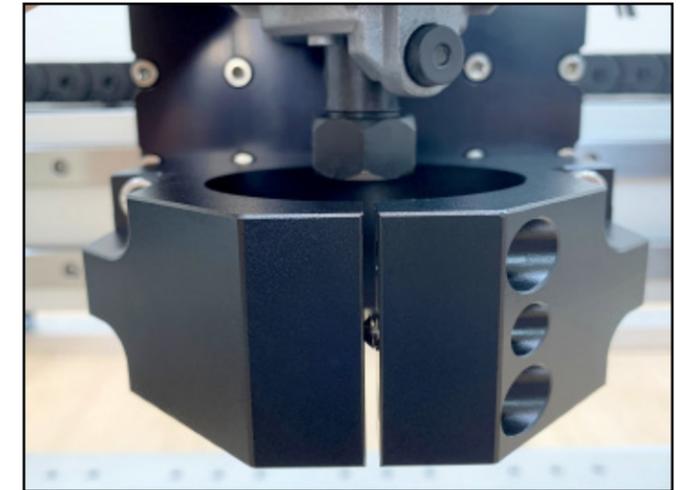   b.   Alternate tightening each screw until the router is secure.
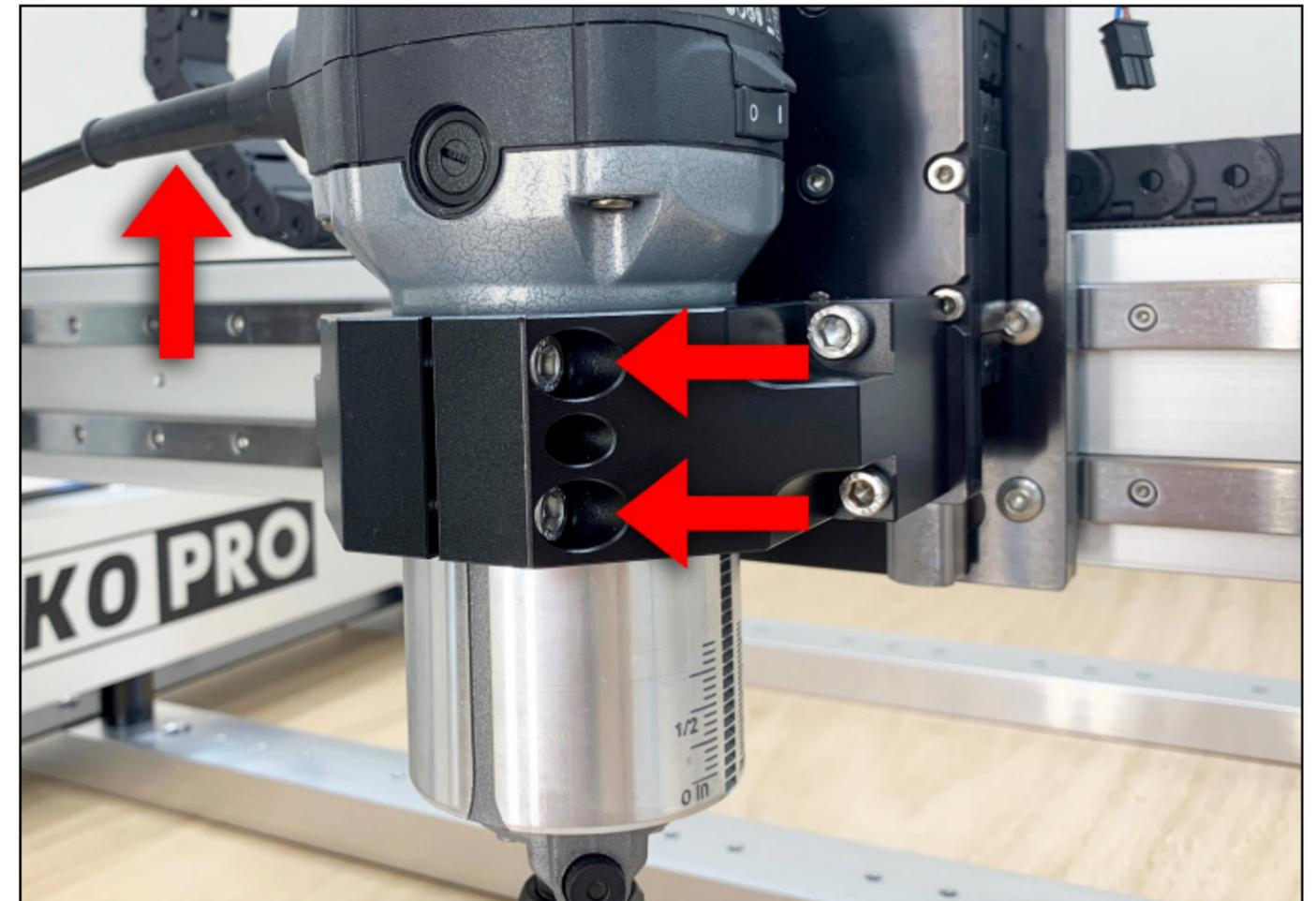

Figure 7-3

Figure 7-2

Figure 7-4

7.3 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
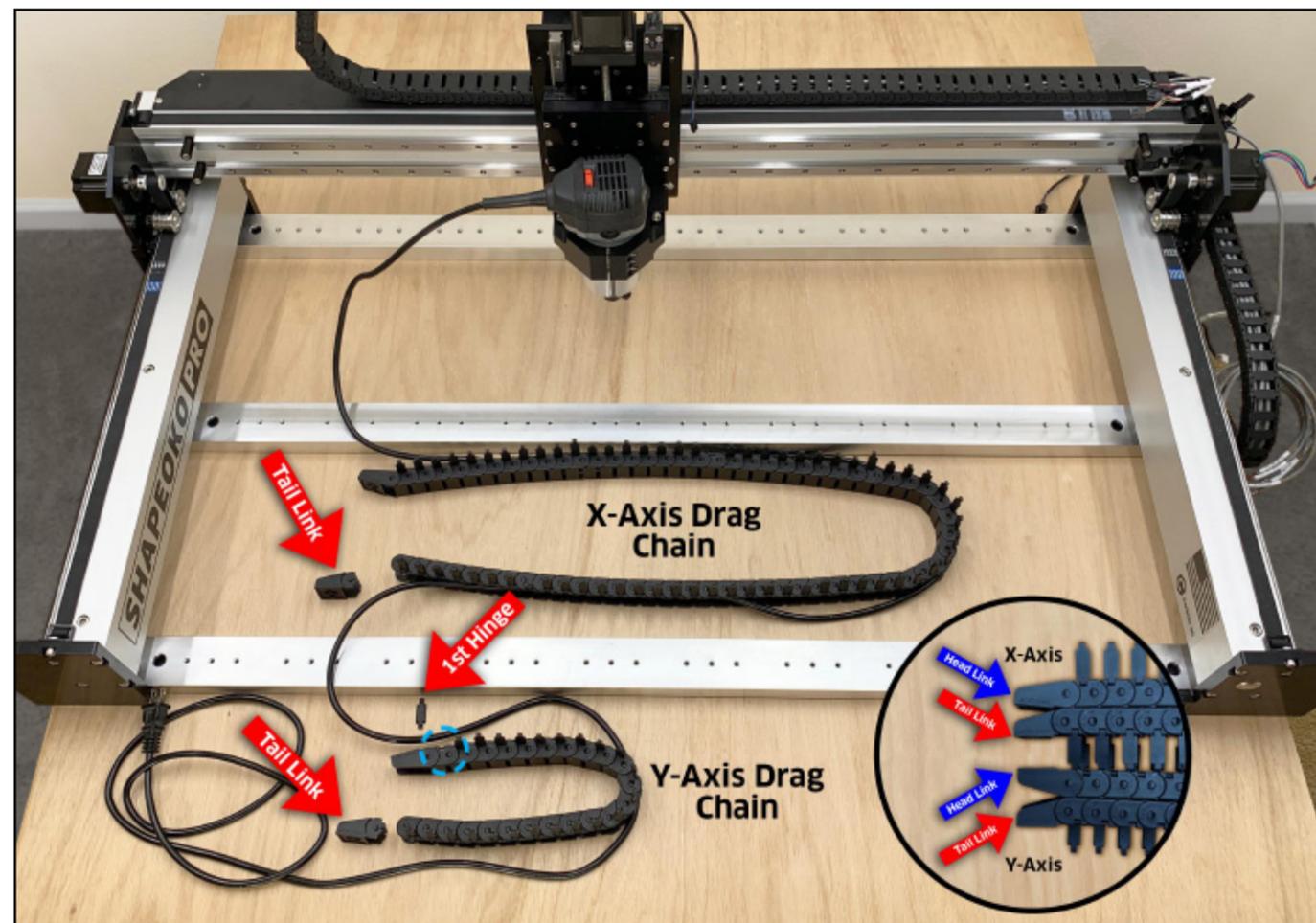
3. Lay out the shorter Y-Axis drag chain as shown in *Figs. 7-6* and *7-6 inset*.

    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.

7.4 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.

Figure 7-6

Figure 7-7

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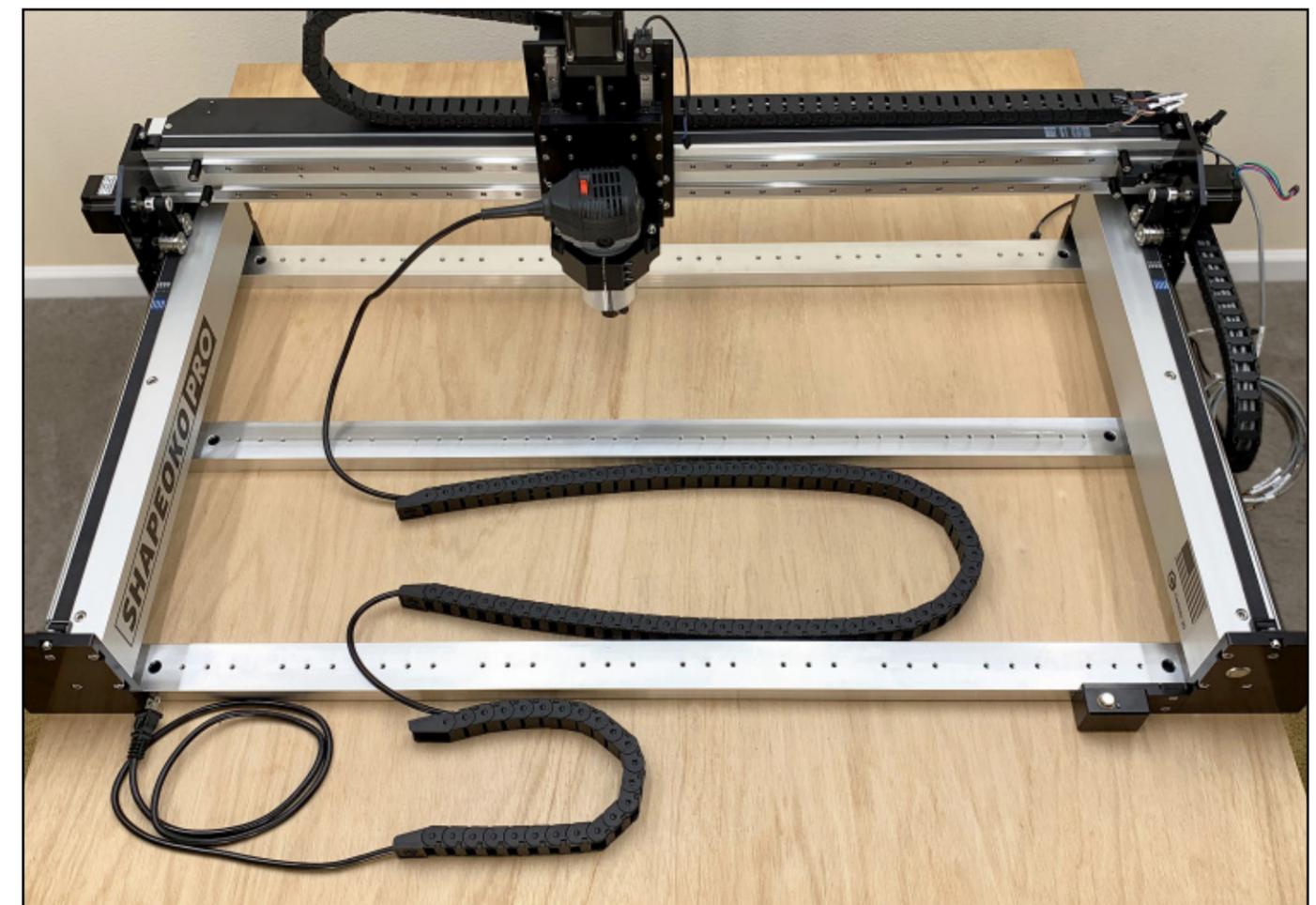
7.5   Install Head Bracket

1. Position the router drag chain head bracket on the back of X/Z assembly (see *Fig. 7-8)*:

    a. Upper-right corner (upper-left corner when viewed from back).

    b. Flange down, threaded holes to back.

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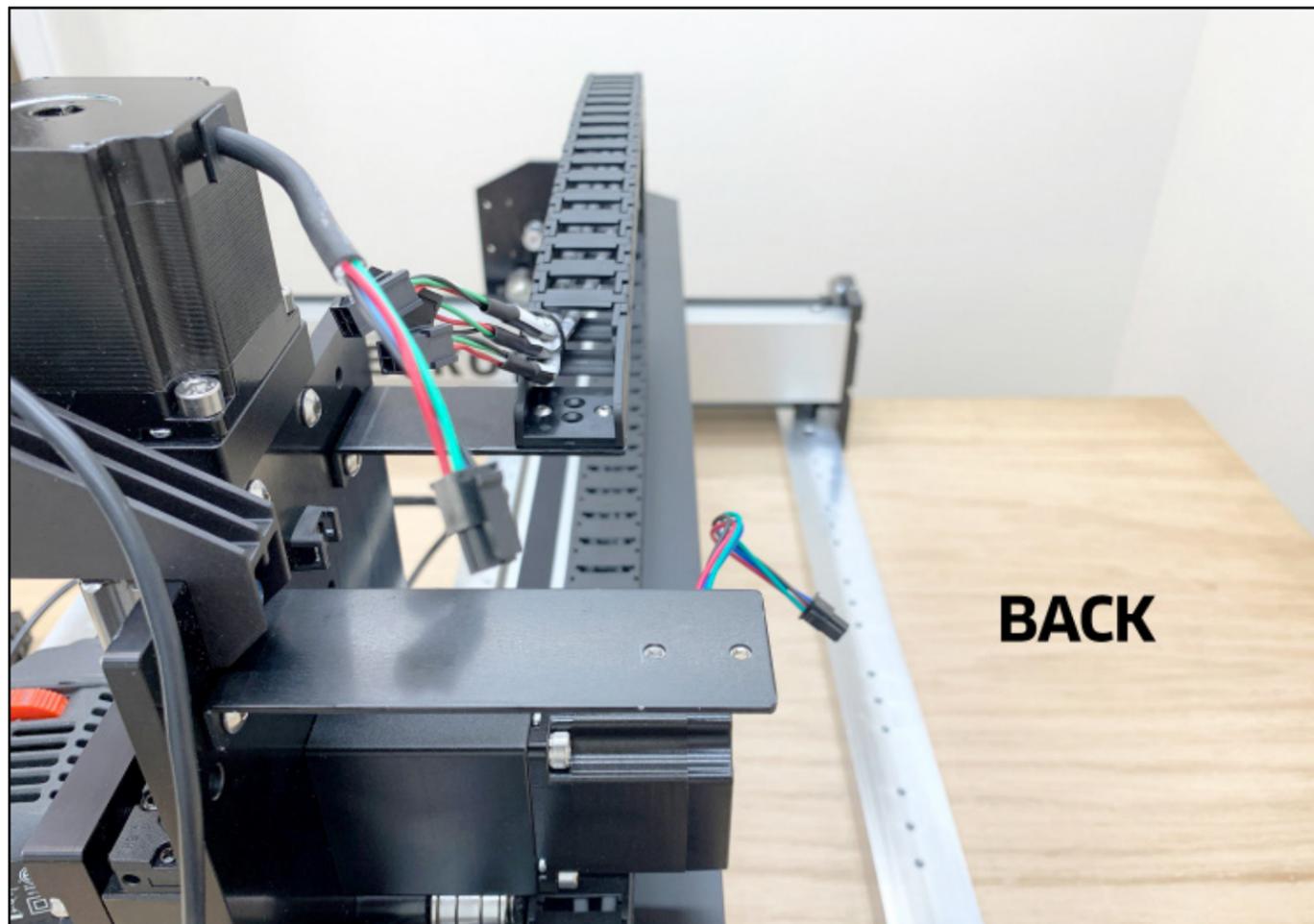
7.6   Attach Transition Bracket

1. Position the Z-shaped X/Y transition bracket on the head of the Y-Axis drag chain. **See Fig. 7-9**.

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

    b. Longer arm of the bracket attaches to the head of the drag chain.

    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.

Figure 7-8

Figure 7-9

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 head bracket. **See *Fig. 7-10*.**
   b. Body of the chain extends right from the head bracket before curling down and left, ending at the left gantry endplate.
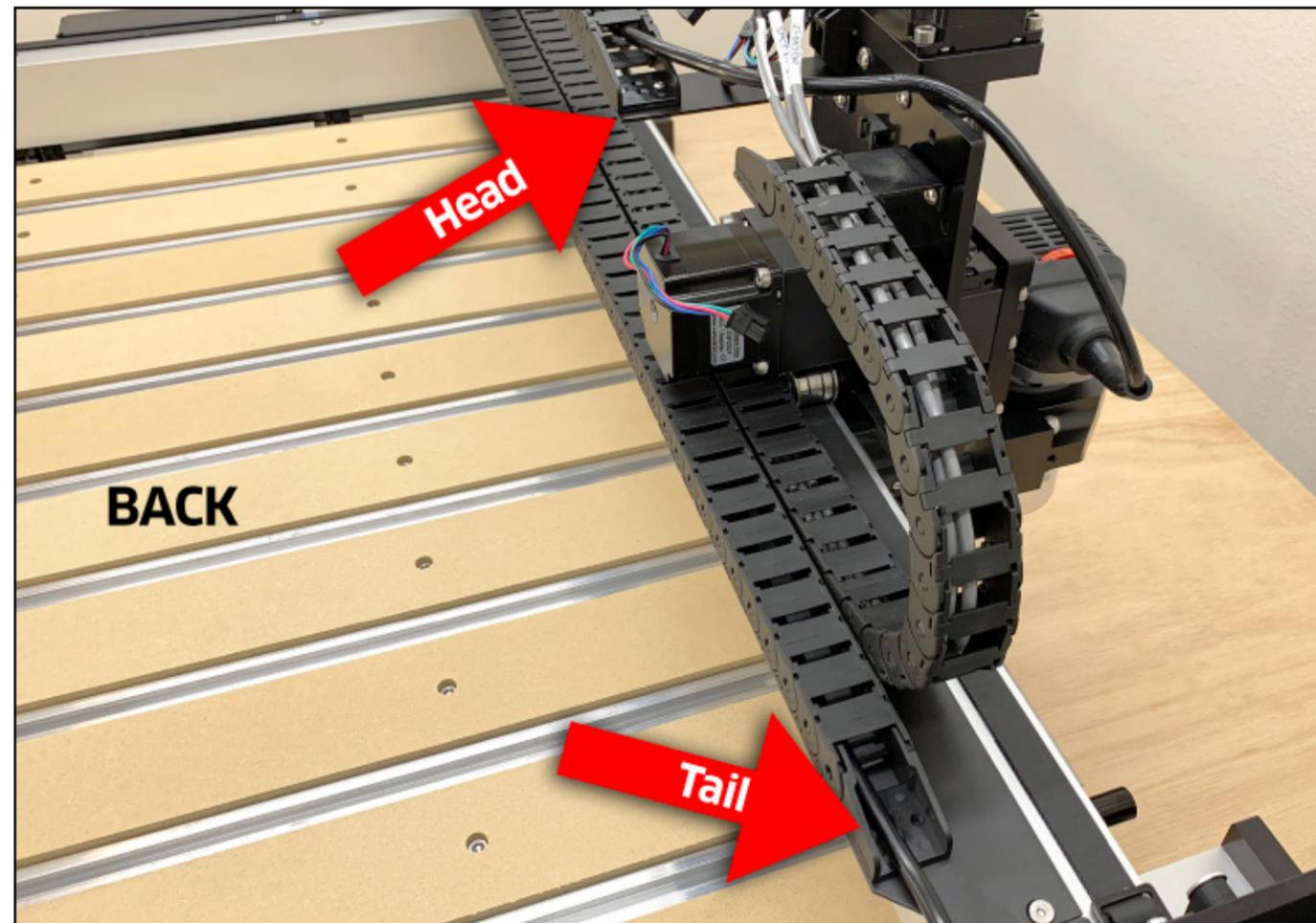2. Use a 2mm hex key and two (2) M3×6mm BHCS to secure the drag chain. Fully tighten.

7.8   Install Y-Axis Drag Chain

1. Use a 4mm hex key to remove the back two (2) M6×12mm BHCS from the left gantry endplate.
2. Position the transition bracket and Y-Axis drag chain combo alongside the Y-Left rail. **See *Fig. 7-11*.**
   a. Align the bracket with the two M6 screw holes.
   b. Short arm of the bracket rests on top of the gantry.
3. Use a 4mm hex key and the two (2) M6×12mm BHCS to secure the bracket. Fully tighten.

7.9   Secure Tails of the X- and Y-Axis Drag Chains

1. Position the tail of the X-Axis drag chain over the two M3 screw holes at the left end of the X-Axis drag chain support panel. **See *Fig. 7-11*.**
2. Use a 2mm hex key and the two (2) M3×6mm BHCS to secure the tail to the support panel.
3. Position the tail of the Y-Axis drag chain over the two M3 screw holes on the Y-Left drag chain support panel. **See *Fig. 7-11*.**
4. Use a 2mm hex key and the two (2) remaining M3×6mm BHCS to secure the tail to the support panel.
5. Remove the slack from the router power cable.

NOTE: A self-adhesive cable tie mount is included in the kit in case you need it to secure the router power cable or for other cable cleanup.

Figure 7-10

Figure 7-11

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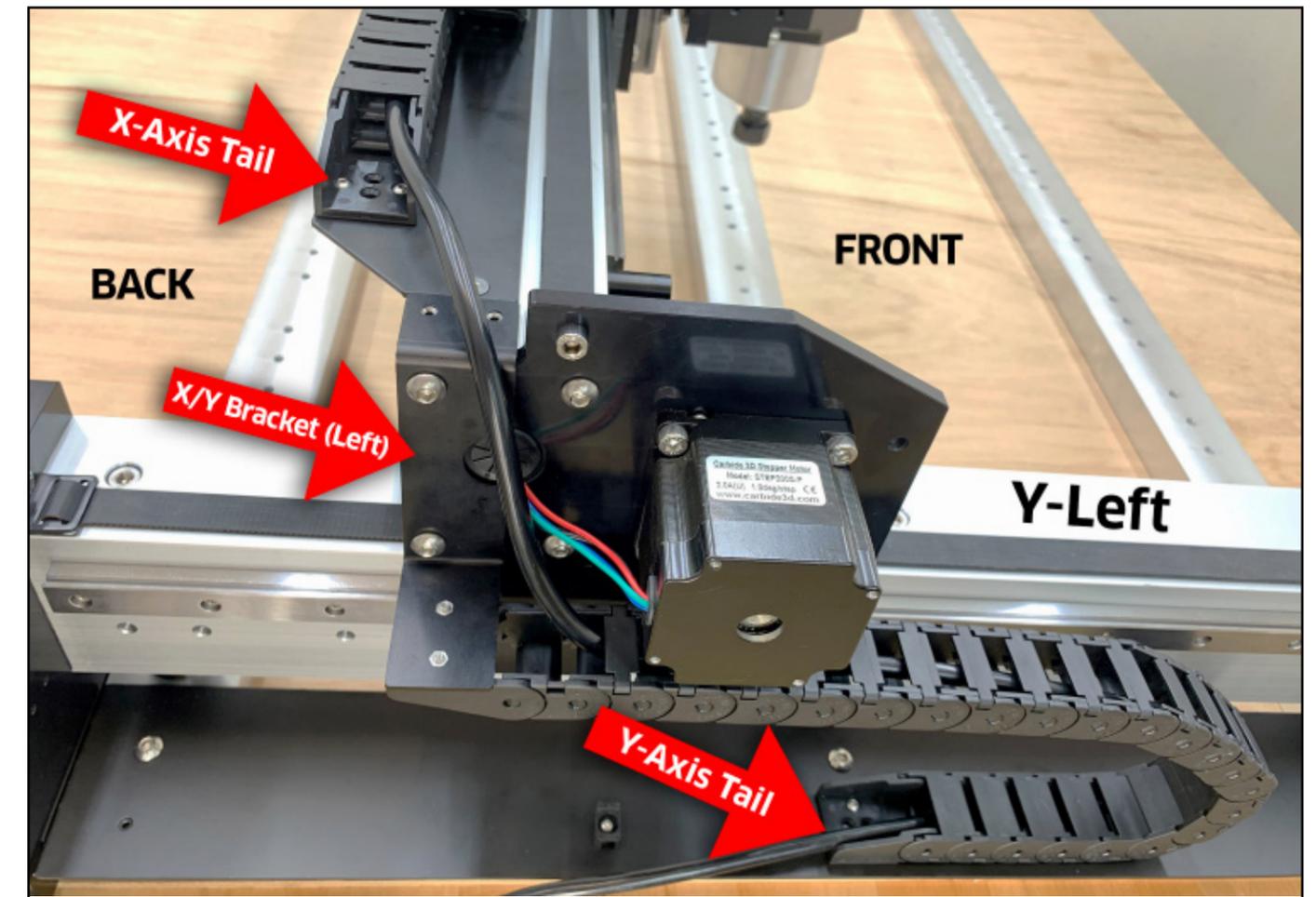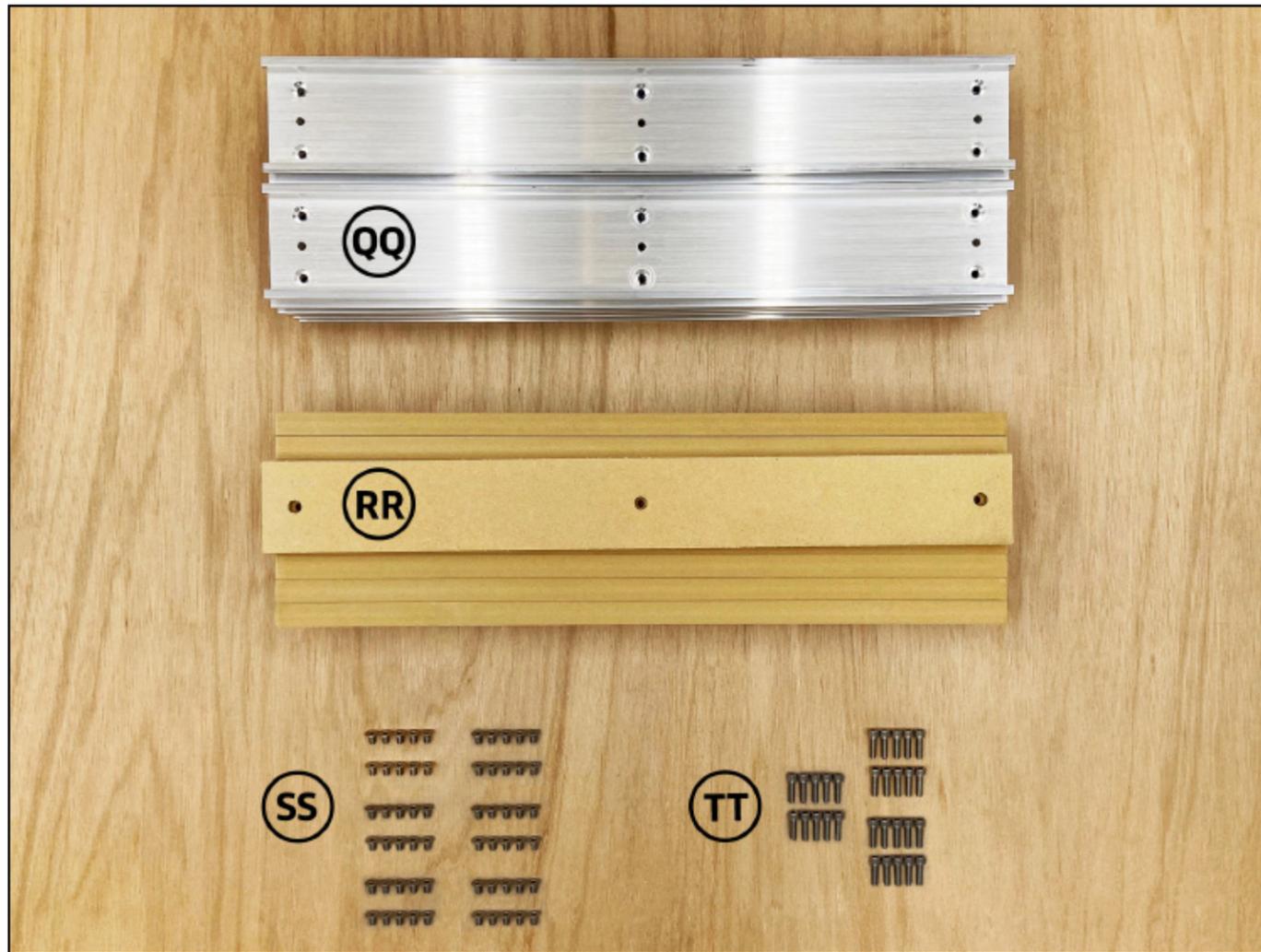
Figure 8-1

Box Components

Step 8 – Hybrid Table box contents; see *Fig. 8-1*.

Item	Description	Qty
QQ	Hybrid Extrusion	10
RR	MDF Strip	10
SS	M6×10mm Flat Head Screw	60
TT	M6×20mm Socket Head Cap Screw	30

8.1   Install Hybrid Extrusions

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

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

   a. Loosely insert all screws in an extrusion before fully tightening.

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

8.2   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 secure each MDF strip. Fully tighten.

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

Figure 8-2

Figure 8-3

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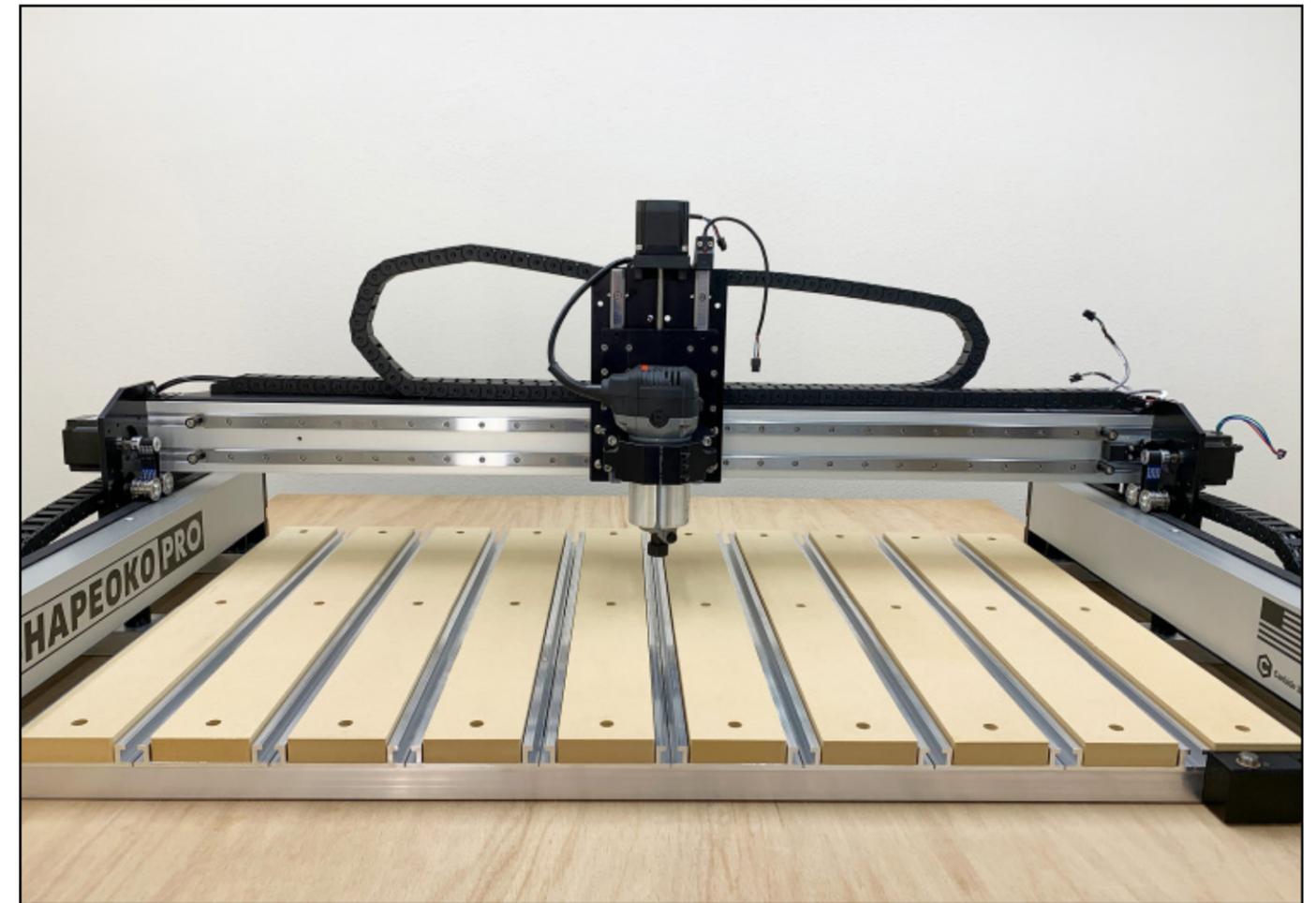
Figure 9-1

Box Components

Step 9 – Controller box contents; see *Fig. 9-1*.
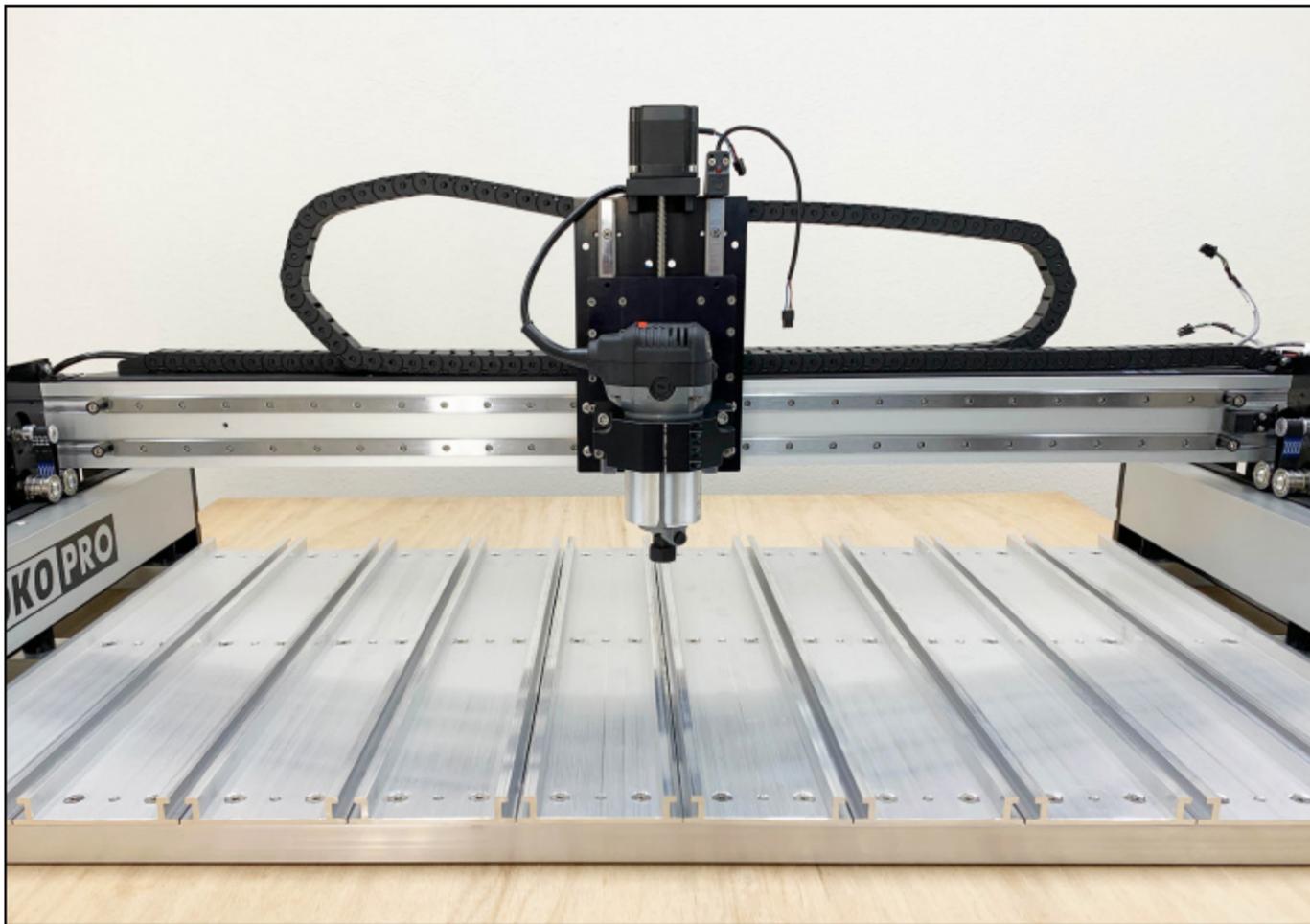
Item	Description	Qty
UU	Controller and Lid	1
VV	Thumbscrew (In a Baggie Inside Controller)	4
WW	Power Cord	1
XX	Power Supply	1
YY	USB Cable	1
ZZ	Controller Standoffs	2
S	M6×12mm Button Head Cap Screw	2
AAA	Permanent Marker	1
BBB	Loctite 242 Medium-Strength Threadlocker (Non-Permanent)	1
CCC	Shapeoko Pro Build Plate	1
DDD	#201 0.25" Square End Mill	1
EEE	Extra Hardware Bag	
	(SS) M6×10mm Flat Head Screw (Not Individually Pictured)	10
	(TT) M6×20mm Socket Head Cap Screw (Not Individually Pictured)	2
	(S) M6×12mm Button Head Cap Screw (Not Individually Pictured)	2
FFF	Hold-Down Clamps	6
GGG	M6 T-Nuts	12
MM	M6×25mm Socket Head Cap Screw	6

9.1   Install Controller

1. Screw the two (2) controller standoffs into the second and sixth threaded holes from the REAR of the Y-Right rail. Hand tighten.

2. Adjust the length of the two cables exiting the rail between the standoffs to about 8 inches.

3. Position the controller over the standoffs.

   a. Power and USB to the back. **See *Fig. 9-2***.

   b. PCB will be upside down.

4. Use a 4mm hex key and two (2) M6×12mm BHCS to secure the controller to the standoffs. Fully tighten.

9.2   Connect Controller Cables

1. Use a 4mm hex key and one (1) M6×10mm FHS (found in the Extra Hardware Bag) to secure the green grounding wire to the first threaded hole from the rear of the rail. **See *Fig. 9-2***.

2. Plug the 4-pin male power cable into the 4-pin female connector at the top-right of the controller labeled "Pwr_conn".

3. Plug the 3-pin female BitSetter cable into the 3-pin male connector at the bottom of the controller labeled "BitSetter".

4. 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. 9-3***.

5. 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. 9-3***.

   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.

6. Use the four (4) thumbscrews to attach the controller cover.

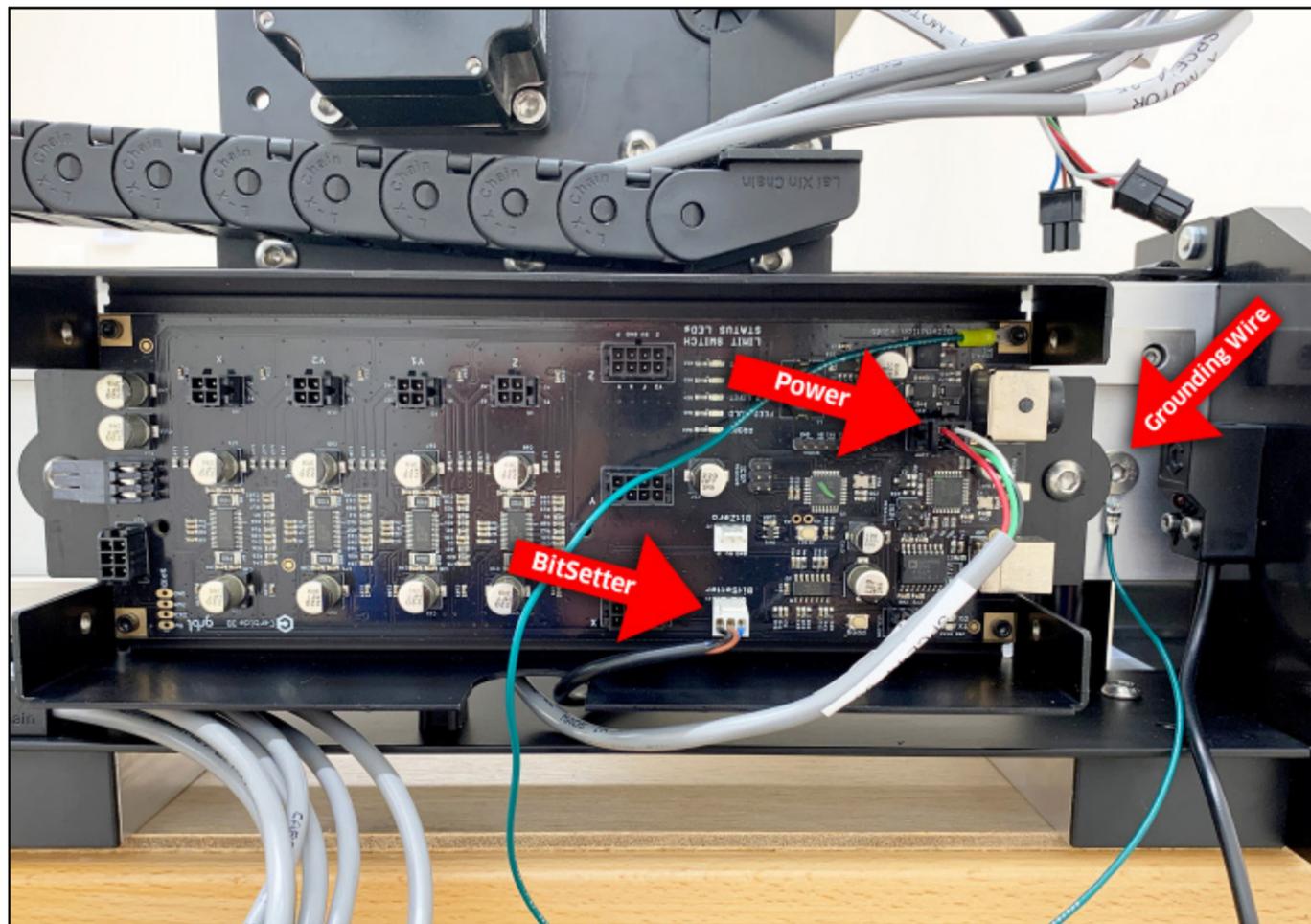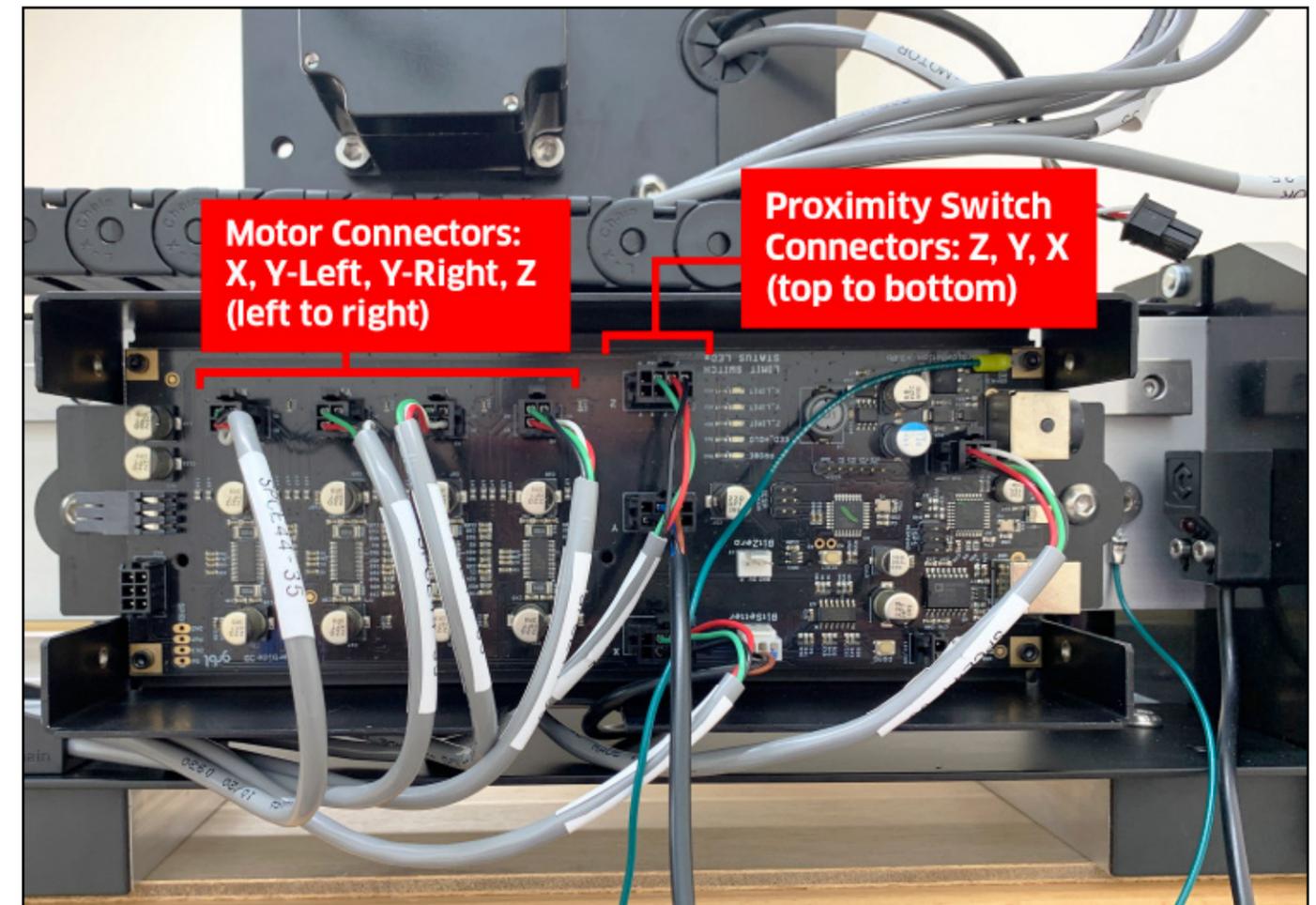   a. Direct all of the cables into the notch at the bottom.

Figure 9-2

Figure 9-3

9.3 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 *Figs. 9-4* and *9-6***.

   a. Z-motor is the top motor.

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

2. Connect the X-, Y-Left, Y-Right, and Z-motor extension cables, and the X- and Z-proximity switches at the right end of the gantry. **See *Fig. 9-4***.

3. Check the connection of the Y-Left motor at the left end of the gantry. Gently pull the cable connection out of the rail, if necessary.

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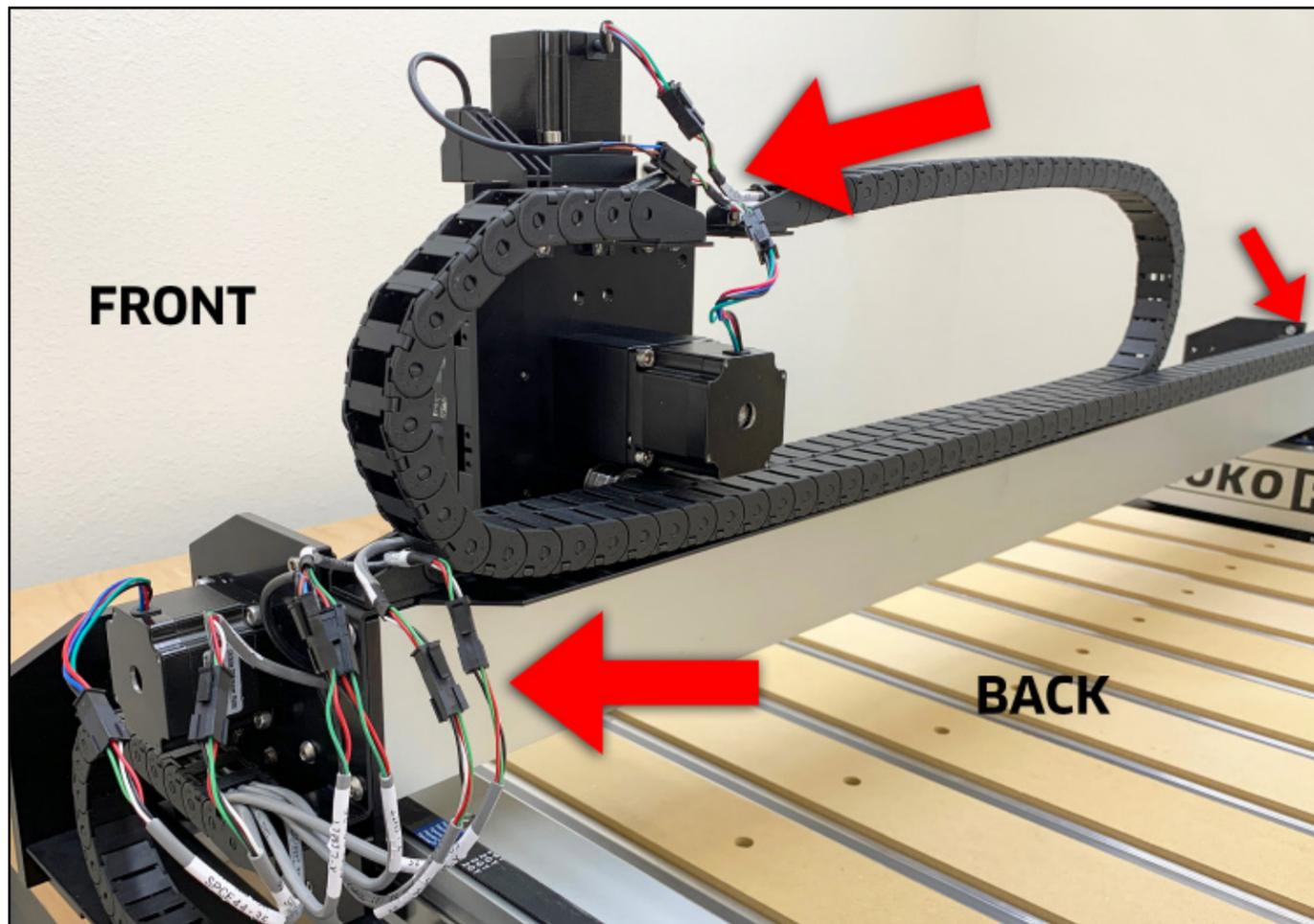
9.4 Tidy Cables

1. Use a few zip ties to secure loose cables **(see *Figs. 9-5* and *9-6)***:

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

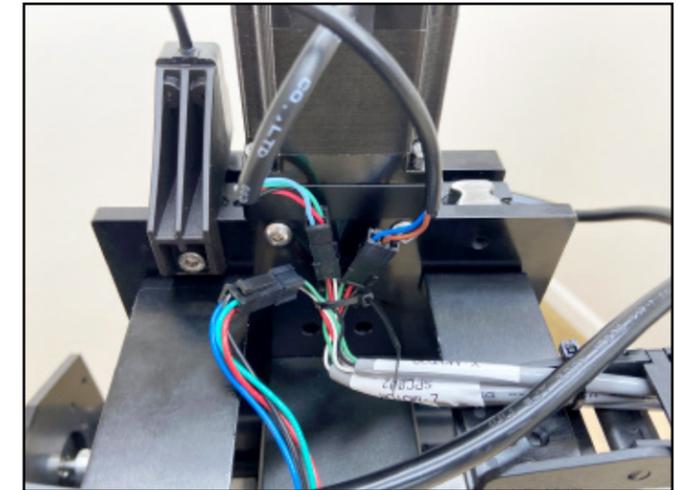   b. At Y-Left (router power cable).

Figure 9-5

Figure 9-4

Figure 9-6

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9.5   Connect Power and USB

1. Plug the power cable into the power port at the back of the controller. **See *Fig. 9-7***.

   a. Flat side of the connector faces out.

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

9.6   Install an End Mill

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

The Carbide Compact Router includes a 0.25″ collet and nut, 22mm collet nut wrench, and 13mm spindle wrench.

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

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

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

Congratulations, the assembly is complete!
All that's left to do is sign and proudly display your Shapeoko Pro build plate. **See *Fig. 9-8***.

IMPORTANT: Before homing the machine, go to page 58 to update your configuration settings.
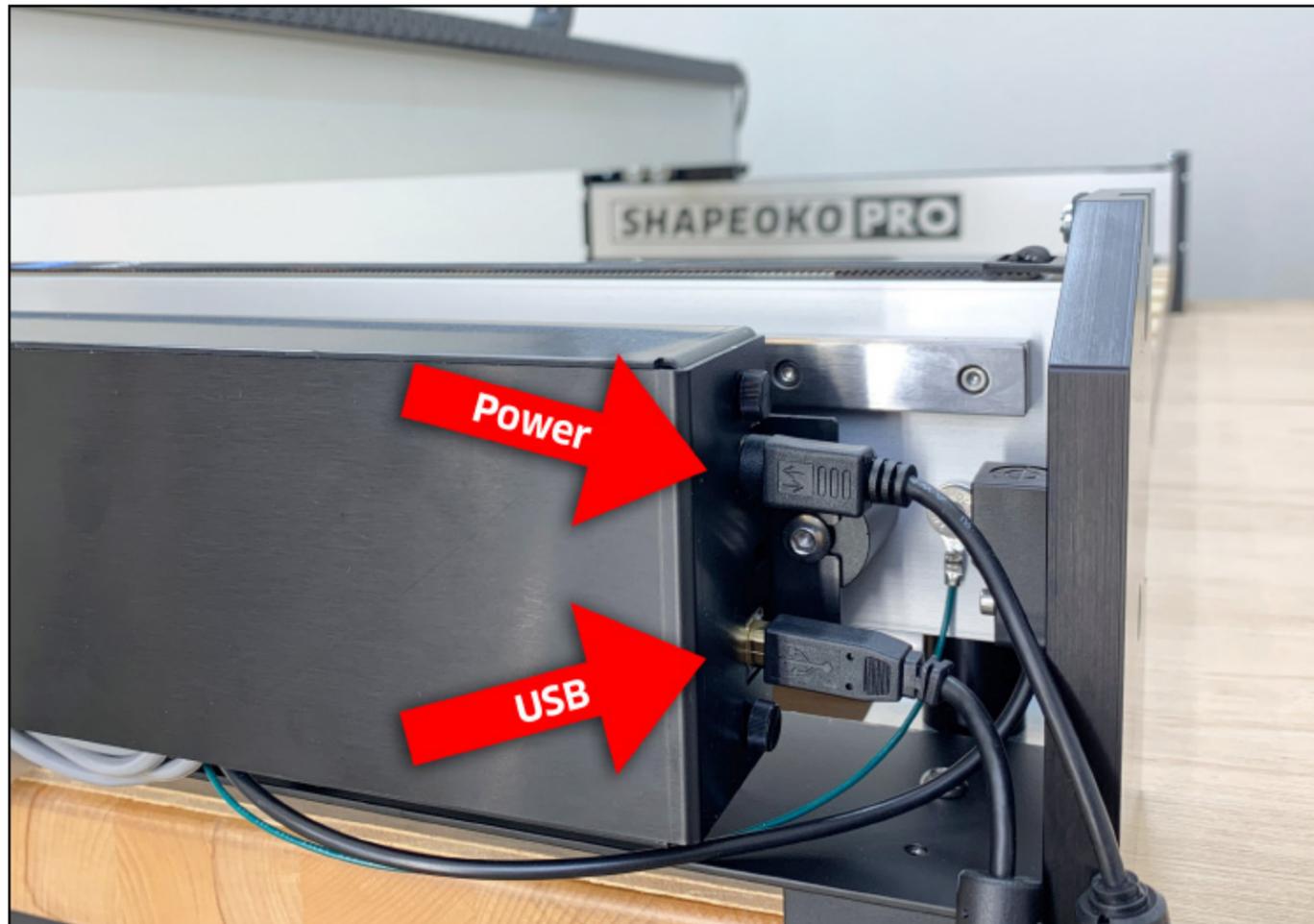

Figure 9-8
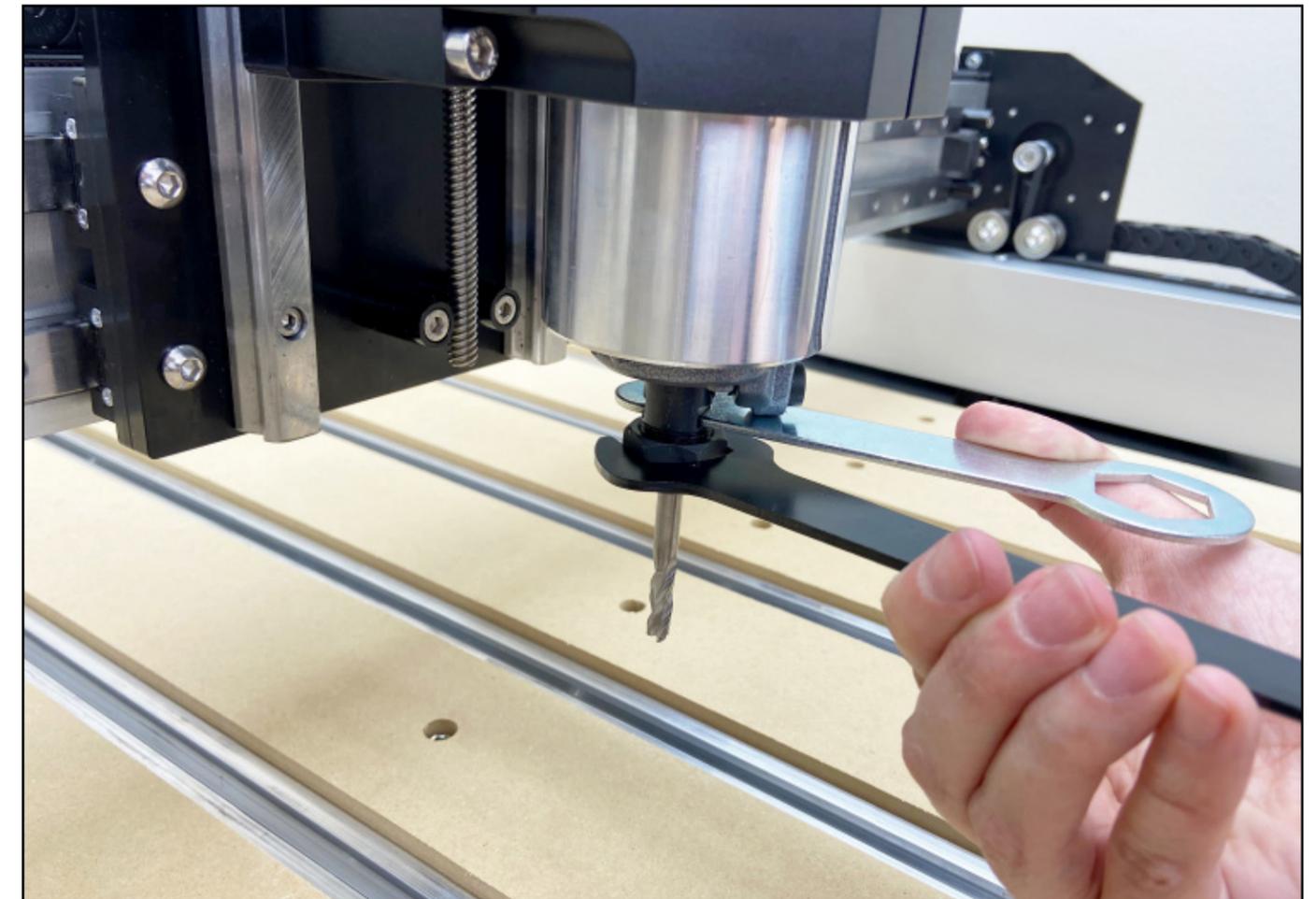

Figure 9-7

Figure 9-9

10.1   Download CAD/CAM and Machine-Control Software

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

2. Download Carbide Create from: carbide3d.com/carbidecreate/download.

3. Install both programs to your computer.

Carbide Motion lets you control your machine by jogging it around, setting zeros, and loading and running G-code. Carbide Create is a cross-platform CAD/CAM program used to design projects for the Shapeoko Pro. It allows you to create 2D sketches, generate toolpaths, and export G-code which you will run in Carbide Motion to implement your design.

NOTE: Carbide Create must have the post processor set to Carbide 3D Shapeoko for the BitSetter to work. See Step 10.7 Set the Post Processor in Carbide Create on page 61.

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*.

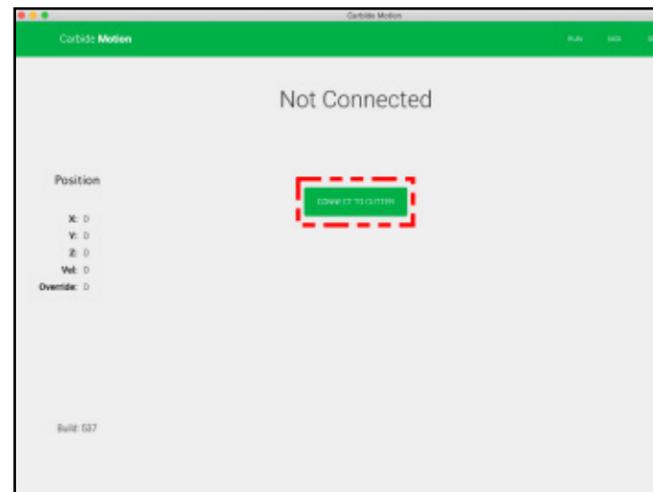7. **DON'T HOME YOUR MACHINE YET.** We need to update the configuration settings first.

Figure 10-1

10.3   Update Machine Settings

To update the machine's configuration settings (**see** *Fig. 10-2)*:

1. Click **Settings** in the top menu bar.

2. Click the **Load Defaults button** in the *Travel Dimensions section* at the top of the window. See *Fig. 10-2*.

3. In the *Set X/Y Travel popup window* that opens, select **Shapeoko Pro XL** from the dropdown list and click **OK**.
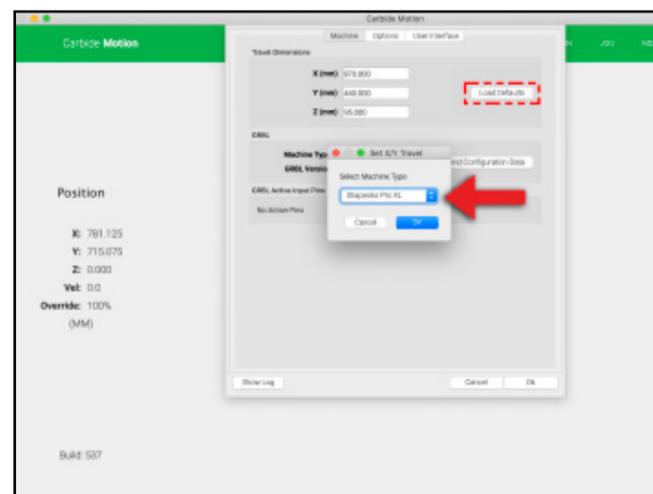

Figure 10-2

4. Click the **Send Configuration Button**. See *Fig. 10-3*.

5. In the *Send Configuration popup window* that opens, select **Shapeoko Pro** from the dropdown list and click **OK**.

6. Once the configuration settings finish sending, click **Ok** at the bottom of the *Settings window* to close it.

10.4   Check Proximity Switches

Double check that your proximity switches are connected and functioning correctly.

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 switch lights up. You can also check to see that a blue LED lights up on the controller board.

3. Watch the Proximity Switch Troubleshooting video for additional information at: youtu.be/Zf8NPmxrEDs.

10.5   Home the Machine

Once the machine settings have been sent and all of the proximity switches have been checked, the Shapeoko Pro XL is ready to home.

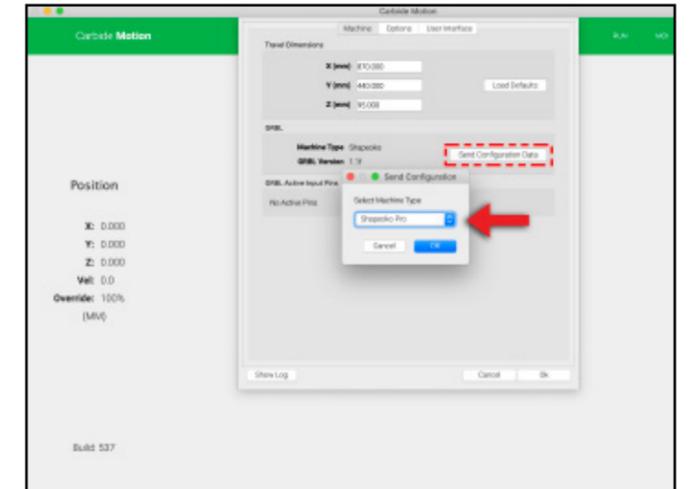1. Click the yellow **Initialize Machine button** to home your Shapeoko Pro XL. See *Fig. 10-4*.

Figure 10-3
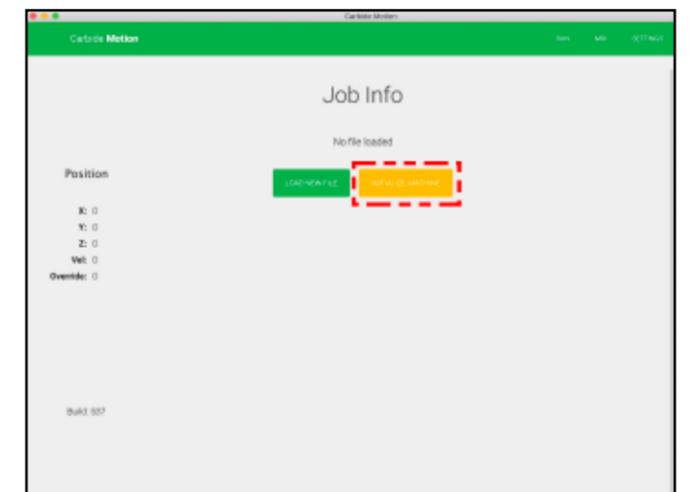

Figure 10-4

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10.6 Set Up the BitSetter

Now you're ready to set up the BitSetter. 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.

First, position the router above the BitSetter (**see Figs. 10-5 and 10-6)**:

1. Click **Jog** in the top menu bar.
2. On the *Jog screen*, click the **Set Zero button**.
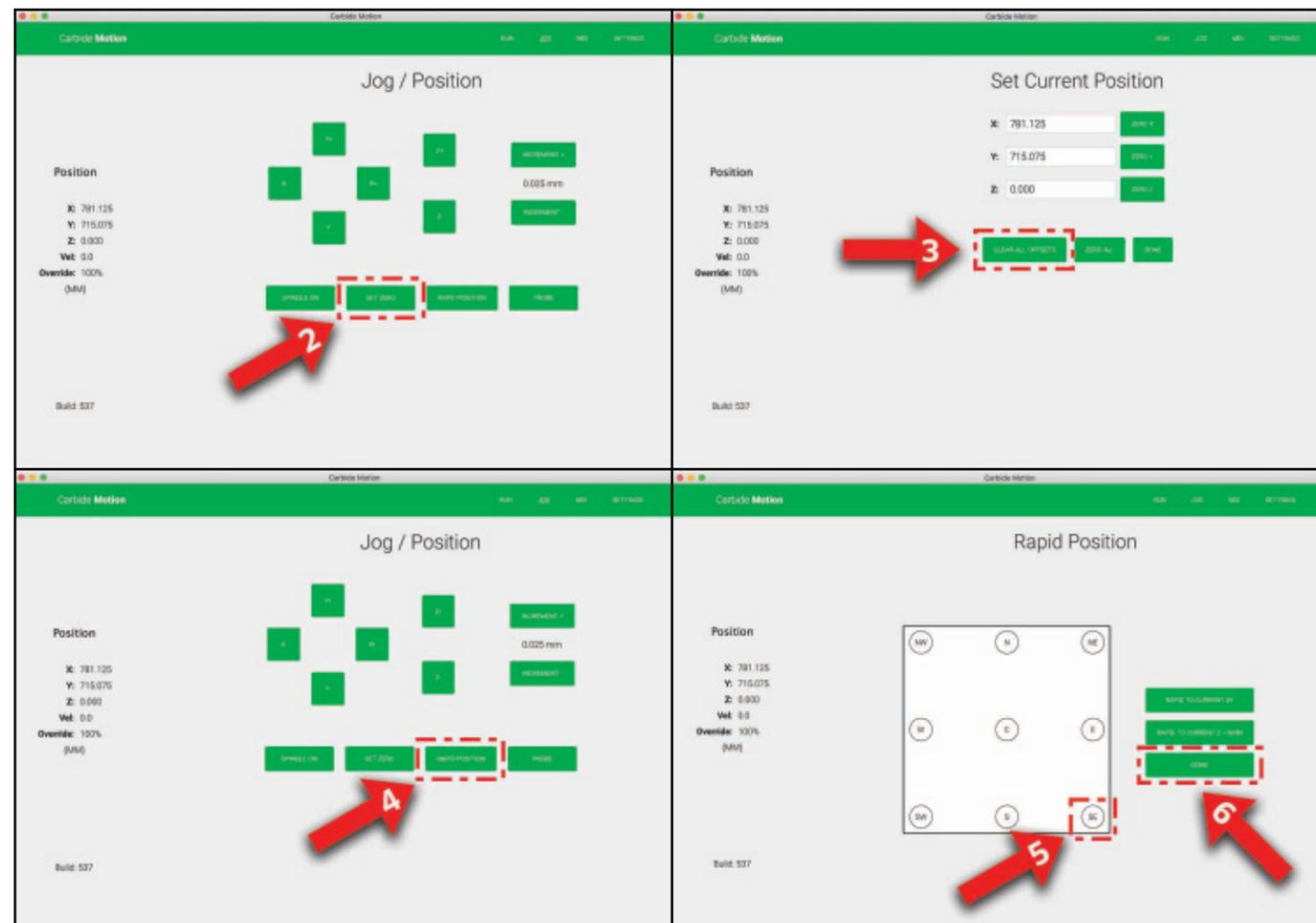3. Click the **Clear All Offsets button** and then click **Done**.

4. On the *Jog screen*, click the **Rapid Position button**.
5. Click the **SE button** to move the router to the front-right corner of the machine.
6. Once 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. 10-6**.

Next, configure the permanent position of the BitSetter in Carbide Motion (**see Fig. 10-6)**:

8. Click **Settings** in the top menu bar.
9. Click the **Options tab** in the Settings menu.
10. In the *BitSetter section*, select the **Enabled checkbox**.
11. Click the **Use Current Location button**. This will permanently save the X/Y location of your router.
12. Click **Ok** to save and close.

10.7 Set the Post Processor in Carbide Create

Carbide Create must have the post processor set to Carbide 3D Shapeoko for the BitSetter to work. To set the post processor:

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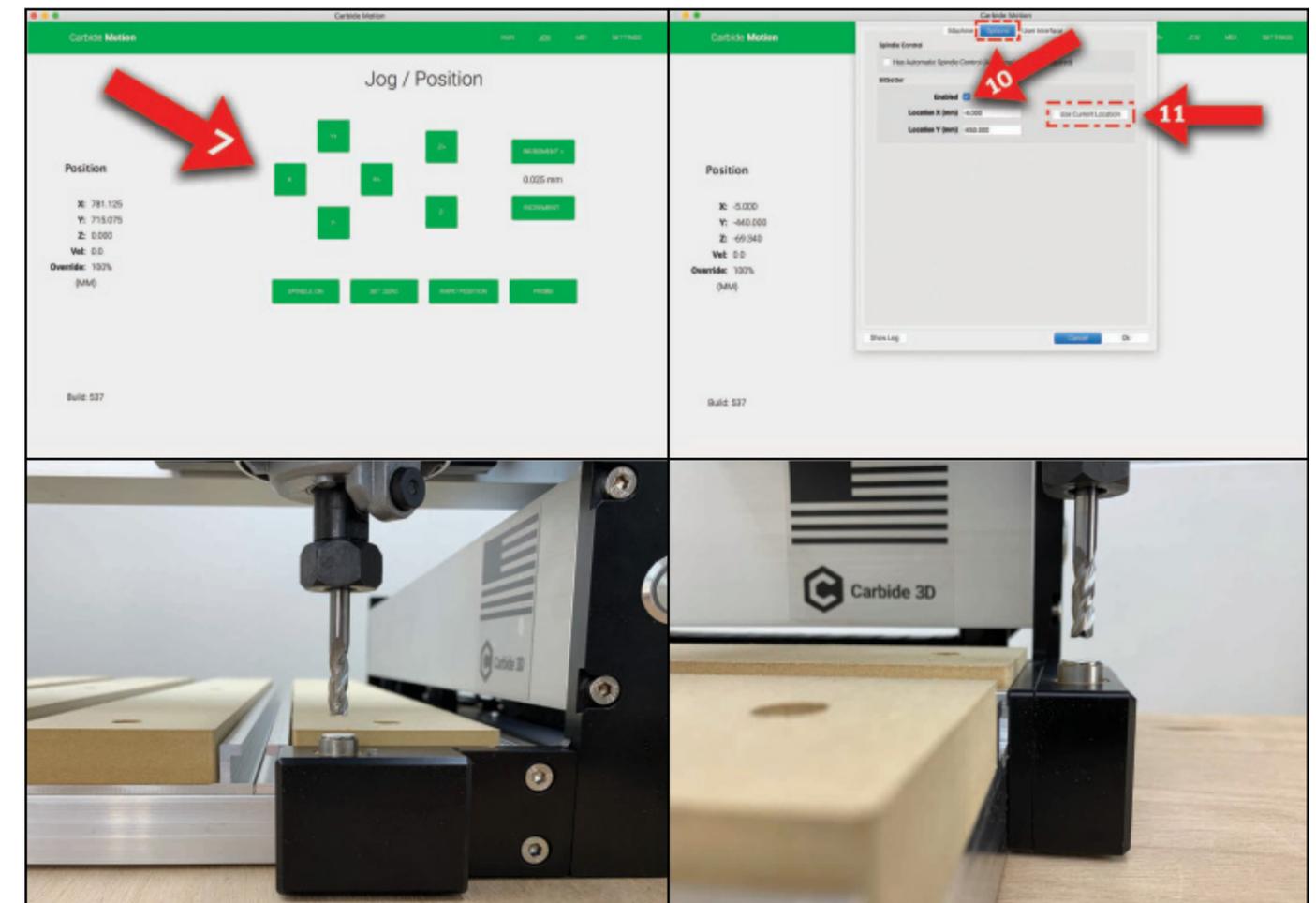6. Click **OK** to save and close.

Figure 10-5

Figure 10.6

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 Pro XL.

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: 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 Pro.

Material Guide Videos

- Wood: youtu.be/cjoNGACBkks
- MDF: youtu.be/Hq8lmk4Zrgk
- Aluminum: youtu.be/RH4AXz_rtPo
- Stainless Steel: youtu.be/QYkDKkfUuFs
- Cast Acrylic: youtu.be/a9qi6Z-CEP8
- Expanded PVC: youtu.be/hbbV0K37UVQ
- Shapeoko Pro Testing in Plywood: youtu.be/OSgGv8oORds
- 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

EXTRAS

Glossary of Terms

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

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 Pro XL is in the back-right corner.

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.

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. After each tool change, your Shapeoko Pro XL will use the BitSetter to measure the length of the new tool.

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.

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 page 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 Pro XL Operation and Maintenance Checklist

BEFORE EACH USE

☐ Workpiece Secure	**SAFETY**		**CHECK CONDITION**
☐ Work Area Clear	☐ PPE	☐ Collet & Cutter	☐ Router/Spindle	☐ Proximity Switches
☐ End Mill Secure	☐ Dust Extraction	☐ Rails & Belts	☐ Wiring & Switches	**MAINTENANCE**
☐ BitZero V2 Removed	☐ Emergency Stop	☐ Bolts/Screws	☐ Stepper Motors	☐ 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

_____

Carbide 3D
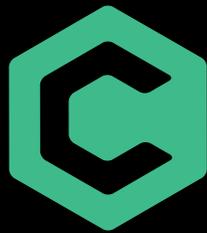
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