



HDZ 4.0

ASSEMBLY GUIDE

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Introduction

We're here to help! If you encounter any issues during assembly, please contact us at: support@carbide3d.com.

The HDZ kit includes everything you need to upgrade your existing X/Z-carriage to the HDZ, or heavy-duty X/Z. The HDZ kit also includes new inductive proximity switches to replace the original homing switches on the belted-X/Z machines.

How to Use this Assembly Guide

For simplicity, we've split up this assembly guide to individually address the two existing machine versions:

- For Belted-X/Z to HDZ Assembly Guide, please go to page 5.
- For Z-Plus to HDZ Assembly Guide please go to page 39.

Special Instructions and Call-Outs

There are minor differences in the installation procedures between Shapeoko 3, XL, and XXL models AND between Shapeoko models shipped pre-Dec 2019 and post-Dec 2019. We've added special notes to guide you whenever these differences require alternate instructions:

SPECIAL INSTRUCTIONS: These call-outs will draw your attention to special instructions for different models.

Throughout the guide you will also find information that we've called out for you to pay particular attention to. We use two additional types of call-outs, WARNINGS and NOTES:

WARNING: This is a warning—please pay close attention.

NOTE: This is a note—information that points out critical steps or information for future reference.

Directional References

In this guide, any reference or instructions with regard to direction or placement, such as: Front, Back, Left, Right, etc. are given from the perspective of one standing in front of and facing the machine. This is true, even when a photo is taken from the rear of the machine.

Also, we use the term "Y1" in place of "Y-Axis Left" and "Y2" in place of "Y-Axis Right" to help avoid directional confusion.

IMPORTANT Software Information

You must run Carbide Motion 4.17 or later with the HDZ. Download it from: carbide3d.com/carbidemotion/download/

WARNING: After installing the HDZ, you must update your GRBL settings. **DO NOT HOME UNTIL YOUR SETTINGS HAVE BEEN UPDATED!**

Belted-X/Z to HDZ Assembly Guide

Prior to Assembly & Installation

Disable the BitSetter

Machines With BitSetter: Please complete the following steps before moving on to “Gather the Required Tools” section below.

Before beginning the HDZ upgrade:

1. Connect your machine to Carbide Motion.
 - a. Plug in your USB cable.
 - b. Open Carbide Motion.
 - c. Turn on your Shapeoko.
 - d. Click the **Connect to Cutter button**.
2. Click **Settings** in the top menu bar.
3. If you have the BitSetter checkbox checked, go ahead and uncheck it.

You will need to re-calibrate the BitSetter after successful homing with your new HDZ. See pages 59-61 for instructions.

Gather the Required Tools

A basic mechanical know-how and an understanding of how the Shapeoko is assembled is required. Installation will take approximately 2 hours.

Required tools:

- Metric hex keys: 1.5mm – 5mm
- Wrenches: 8mm and 10mm
- 2 flat head screw drivers for prying
- Flush cut pliers
- Needle nose pliers
- Permanent marker
- Masking tape

Inventory

Belted-X/Z to HDZ Kit Contents

The HDZ kit comes with the components listed in the tables on the following pages and shown in *Fig. 1 and Fig. 2*.

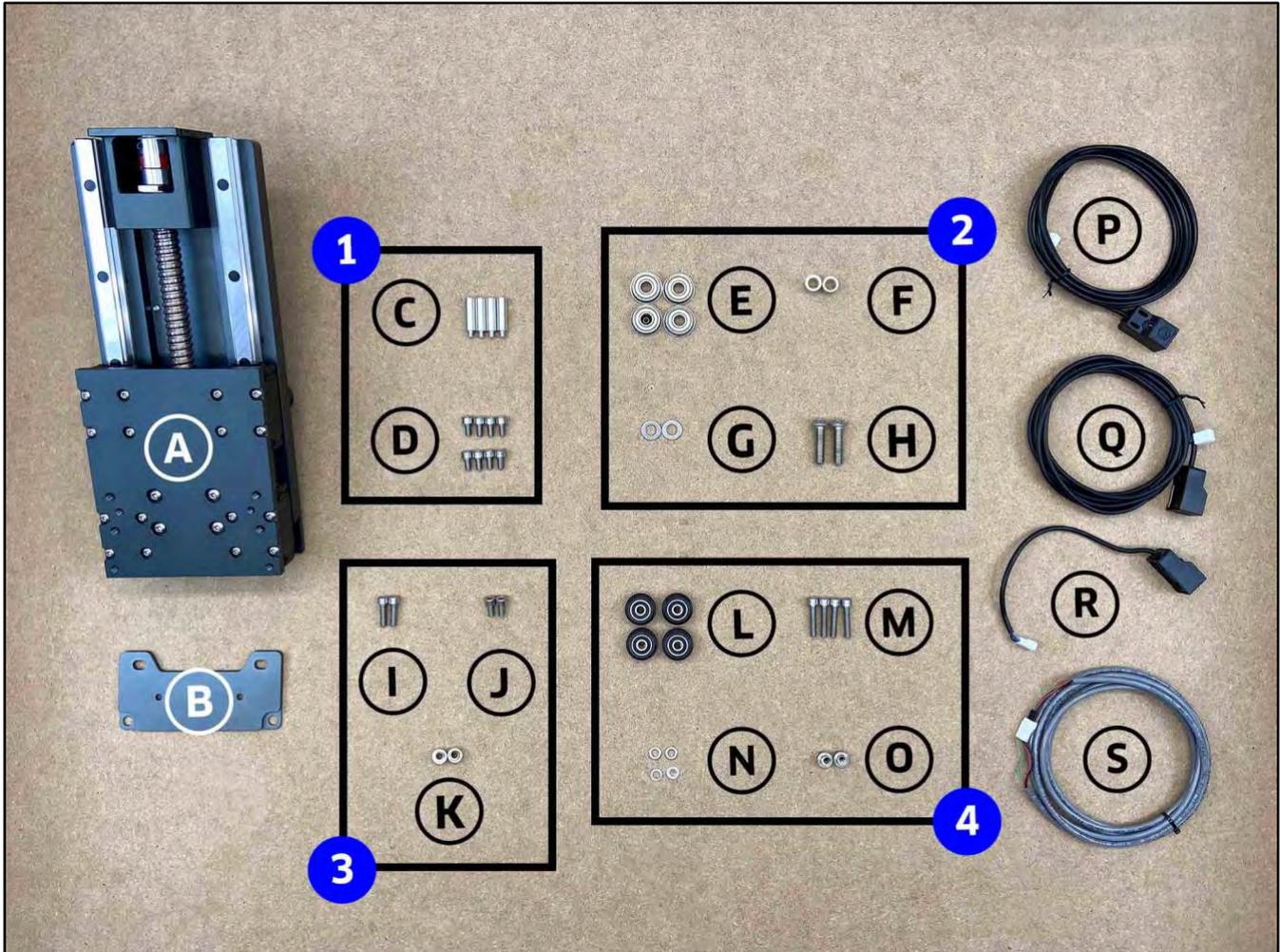


Figure 1

HDZ Box

The HDZ box components are listed in the tables below and shown in *Fig. 1*.

Item	Description	Qty
A	HDZ (Heavy-Duty Z/X Carriage)	1
B	EZ-Tram Plate	1

HDZ Kit Components and Hardware Bag

Item	Description	Qty
Motor Mount Baggie (1)		
C	M5 × 25mm X-Motor Standoff	4
D	M5 × 10mm Socket Head Cap Screw	8
X-Motor Idler Baggie (2)		
E	M8 Guide Bearing	4
F	M8 Spacer	2
G	M8 Washer	2
H	M8 × 30mm Button Head Cap Screw	2
EZ-Tram Plate Hardware Baggie (3)		
I	M5 × 18mm Socket Head Cap Screw	2
J	M5 × 10mm Socket Head Cap Screw	2
K	HD Eccentric Spacer (Non-Threaded)	2
V-Wheel Baggie (4)		
L	Replacement V-Wheel	4
M	M5 × 25mm Socket Head Cap Screw	4
N	M5 Washer (Shim)	4
O	HD Eccentric Nut (Threaded)	2

Belted-X/Z Proximity Switch Kit Box

Proximity Switch Baggie

The proximity switch baggie components are listed in the table below and shown in *Fig. 1*.

Item	Description	Qty
P	X-Axis Proximity Switch (2675mm for XXL, 2350mm for XL, and 712mm for Shapeoko 3)	1
Q	Y-Axis Proximity Switch (2540mm for XXL, 2220mm for XL, and 610mm for Shapeoko 3)	1
R	Z-Axis Proximity Switch (200mm for XXL, XL, and Shapeoko 3)	1
S	Z-Axis Proximity Switch Extension Cable (2438mm for XXL, 2235mm for XL, none Shapeoko 3)	1



Figure 2

Proximity Switch Kit Baggie

The proximity switch kit baggie components are listed in the table below and shown in *Fig. 2*.

Item	Description	Qty
X-Axis Proximity Switch Mount Baggie		
T	X-Axis Proximity Switch Mount	1
U	M5 × 25mm Socket Head Cap Screw	2
V	M3 × 18mm Socket Head Cap Screw	2
Y-Axis Proximity Switch Mount Baggie		
W	Y-Axis Proximity Switch Mount	1
X	M5 × 35mm Socket Head Cap Screw	2
Y	M3 × 18mm Socket Head Cap Screw	2
Z-Axis Proximity Switch Mount Baggie		
Z	Z-Axis Proximity Switch Mount	1
AA	M4 × 6mm Button Head Cap Screw	1
BB	M3 × 18mm Socket Head Cap Screw	2
CC	PCB Riser Board	1
X-Axis Drag Chain Bracket Baggie		
DD	X-Axis Drag Chain Head Bracket	1
EE	Drag Chain Middle Bracket [Used with Post-Dec 2019 Extrusion Rails Only]	2
FF	Drag Chain Tail Bracket [Used with Post-Dec 2019 Extrusion Rails Only]	1
GG	M5 × 8mm Socket Head Cap Screw	2
HH	M4 × 6mm Socket Head Cap Screw [Used with Post-Dec 2019 Extrusion Rails Only]	6
II	M3 × 6mm Flat Head Cap Screw [Used with Post-Dec 2019 Extrusion Rails Only]	3
Y-Axis Drag Chain Bracket Baggie		
JJ	Y-Axis Drag Chain Head Bracket	1
KK	Drag Chain Middle Support Bracket [Used with Post-Dec 2019 Extrusion Rails Only]	1
LL	Drag Chain Tail Support Bracket [Used with Post-Dec 2019 Extrusion Rails Only]	1
MM	M5 Nut	2
NN	M5 × 16mm Socket Head Cap Screw	2
OO	M4 × 6mm Socket Head Cap Screw [Used with Post-Dec 2019 Extrusion Rails Only]	4
PP	M3 × 6mm Flat Head Cap Screw [Used with Post-Dec 2019 Extrusion Rails Only]	3
Drag Chain Support Plate Baggie [Used with Pre-Dec 2019 Extrusion Rails Only]		
QQ	Drag Chain Middle Support Plate	2
RR	Drag Chain Tail Support Plate	2
SS	M3 × 6mm Flat Head Cap Screw	2
TT	Alcohol Wipes	2
Cable Tie Cleanup Baggie		
UU	Cable Tie Mount	5
VV	M4 × 6mm Button Head Cap Screw	5
WW	Cable Ties (Pack of 100)	1

Shapeoko Carryover Components

The HDZ utilizes several parts from the existing Shapeoko setup. All components and hardware to be carried over are listed in the table below and shown in **Fig. 3**.

Throughout this guide, carryover parts will be called out by the words: **CARRY OVER**.

NOTE: Please use the replacement screws provided in the HDZ Kit.

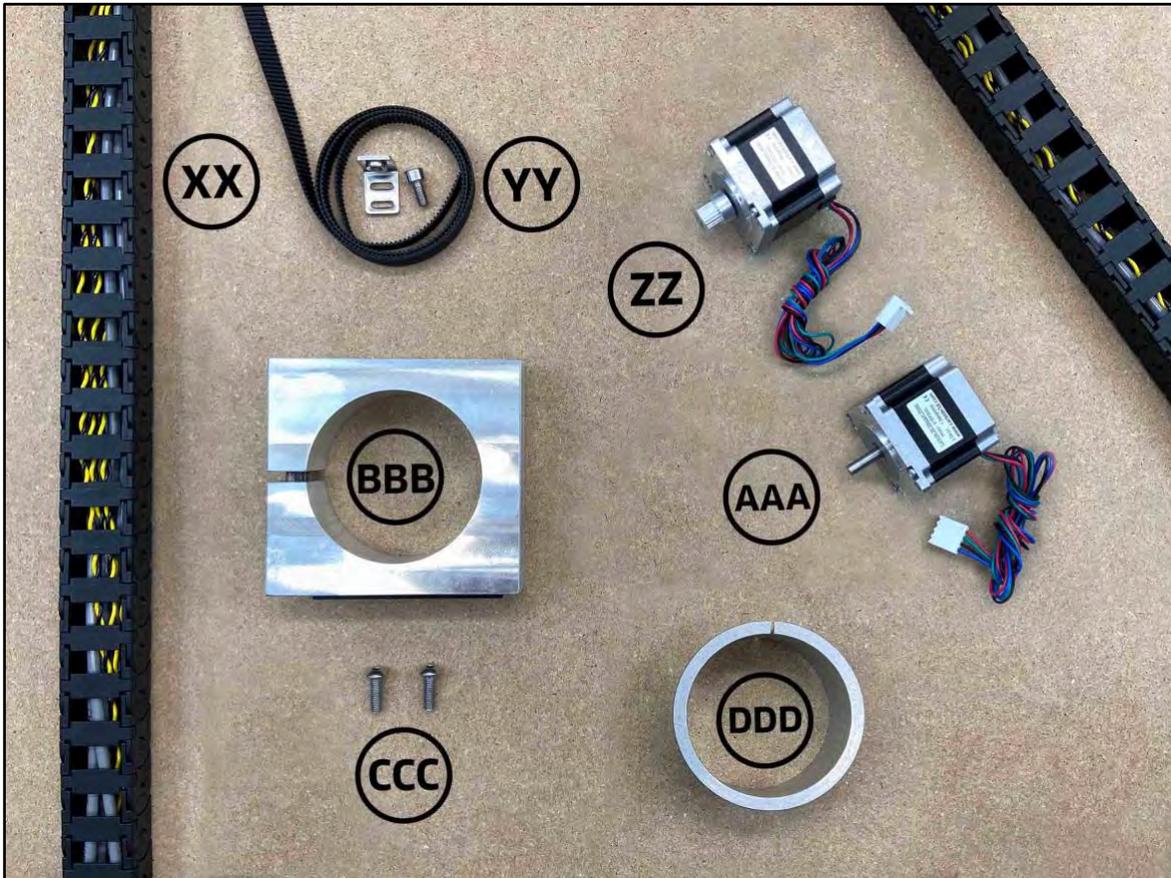


Figure 3

Item	Description	Qty
XX	Drag Chain	1
YY	X-Rail Belt and Hardware: Belt Clip (1) and M5 × 10mm Socket Head Cap Screw (1)	3
ZZ	X-Motor	1
AAA	Z-Motor	1
BBB	Spindle/Router Mount	1
CCC	M5 × 16mm Button Head Cap Screw	2
DDD	Router Mount Adapter Ring (Optional)	1

Disassemble the Existing X/Z-Carriage

NOTE: As you complete the disassembly process, you may find it helpful to keep each carryover component and its associated hardware together and away from the new HDZ parts to avoid any mix ups.

Disconnect Cables and the X-Axis Belt

1. Turn off your machine, unplug it, and disconnect the USB and power cables.
2. Clip all cable ties.
3. Unplug the router/spindle and remove it from the spindle mount.
 - a. Use a 4mm hex key to loosen the two (2) M5×55mm SHCS on the front of the mount.
4. Free the Y2-end of the X-Axis belt from the Y2-carriage. (No need to remove the Y1-end).
 - a. Use a 4mm hex key to remove the M5×10mm SHCS securing the belt clip.
 - b. Remove the clip from the end of the belt and pull the belt free from the X-motor pulley and idlers.
 - c. **CARRY OVER** the **belt**, **belt clip**, and **M5×10mm SHCS**.
5. Label all motor lead cables AND their gray extension cables.
 - a. Use a permanent marker or piece of tape to label all the white male/female connectors of the X-, Y1-, Y2-, and Z-stepper motor lead cables AND the gray X-, Y1-, Y2-, and Z-stepper motor extension cables.
6. Disconnect all cables.
 - a. Remove the Carbide Motion board enclosure cover.
 - b. Disconnect the X-, Y1-, Y2-, and Z-motor leads from their extension cables AND disconnect all extension cables and homing switches from the Carbide Motion board.

WARNING: Do NOT disconnect motor connectors by pulling on the wires or by prying at the latch. Use pliers to gently grip the base of each white connector and pull apart.

Remove the Homing Switches, Drag Chain, and Belted-X/Z

1. Remove the Z-Axis homing switch plate from the front of the X/Z-carriage. See **Fig. 4**.
 - a. Use a 3mm hex key to remove the four (4) M5×10mm BHCS securing the plate. (No need to separate any of the switches from their mounting plates.)
2. Remove the X-Axis homing switch plate from the rear of the X/Z-carriage.
 - a. Use a 4mm hex key to remove the two (2) M5×35mm SHCS and two (2) 1-inch spacers.
3. Remove the Y-Axis homing switch plate from the outside of the Y2-carriage.
 - a. Use a 4mm hex key to remove the two (2) M5×35mm SHCS and two (2) 1-inch spacers.

Shapeoko 3 Machines: Skip 4-7 and move ahead to 8 on the next page.

4. Disconnect the X-Axis drag chain from the X-Axis head bracket on the rear of the X/Z-carriage. See **Fig. 5**.
 - a. Use a 2mm hex key and needle nose pliers to remove the two (2) M3×6mm FHS and two (2) M3 nylon lock nuts securing the drag chain to the head bracket.
5. Disconnect the Y-Axis drag chain from the Y-Axis head bracket on the outside of the Y1-carriage.
 - a. Use a 2mm hex key and needle nose pliers to remove the two (2) M3×6mm FHS and two (2) M3 nylon lock nuts securing the drag chain to the bracket.
6. Remove the drag chain from the rails and lay it on the baseframe as shown in **Fig. 6**.
 - a. Pry the tail ends of the drag chain from the VHB tape securing them to the rails.
 - b. Remove the VHB tape from the rails.
 - c. **CARRY OVER** the drag chain.

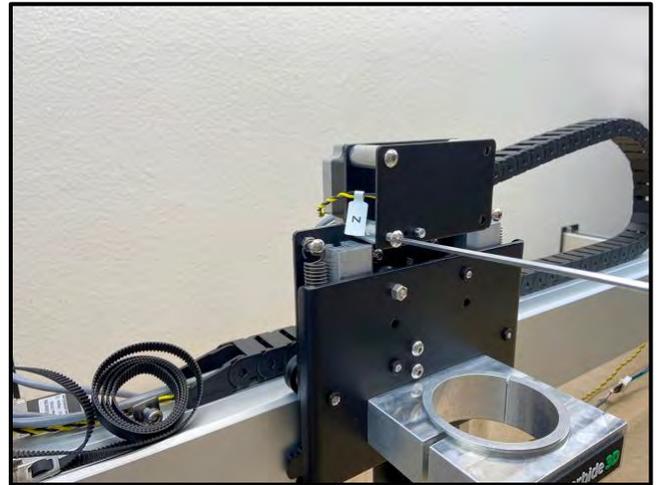


Figure 4

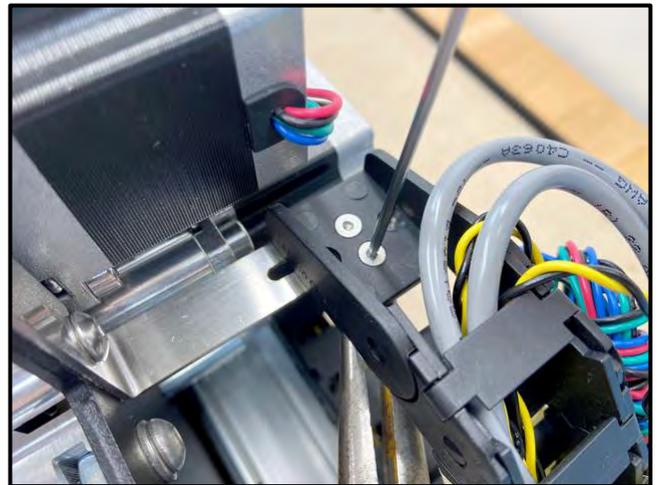


Figure 5

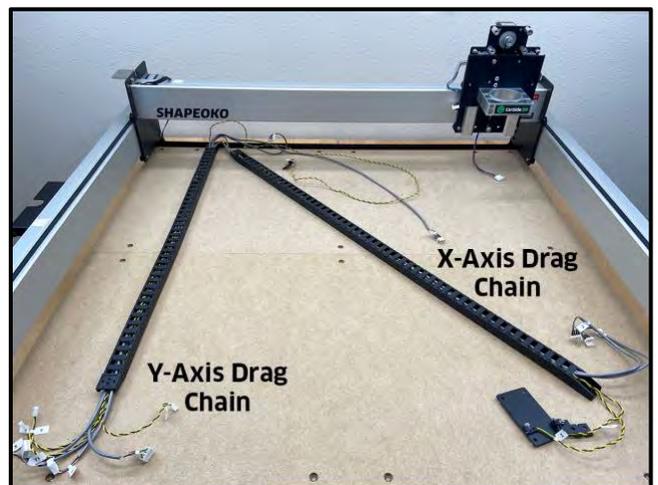


Figure 6

7. Remove the Y-Axis drag chain head bracket from the outside of the Y1-carriage.
 - a. Use an 8mm wrench and a 4mm hex key to remove the two (2) M5 nuts AND the two (2) M5×16mm SHCS.
8. Remove the lower two V-wheels from the X/Z-carriage.
 - a. Hold the eccentric nuts steady with an 8mm wrench and use a 3mm hex key to remove the V-wheels.
9. Lift the X/Z-carriage away from the X-rail and lay it on the baseframe.

Disassemble the X/Z-Carriage

1. Separate the Z-carriage from the X-carriage. See *Fig. 7*.
 - a. Remove the springs from both sides of the X/Z-carriage.
 - b. Loosen the tensioning screw at the bottom of the X-carriage plate.
 - i. Use a 3mm hex key to loosen the tensioning screw.
 - c. Loosen the idler assembly at the bottom of the X-carriage and free the belt.
 - i. Use a 4mm hex key and a 10mm wrench to loosen the nut holding the idler in place.
 - ii. Free the belt from the idler and the Z-motor pulley.
 - d. Slide the smaller Z-carriage down and away from the larger X-carriage.

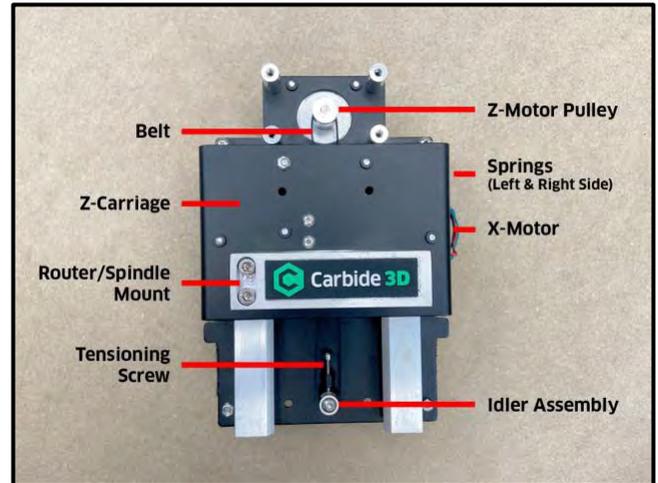


Figure 7

2. Remove the router/spindle mount from the Z-carriage plate.
 - a. Use a 3mm hex key to remove the two (2) M5×16mm BHCS securing the mount.
 - b. **CARRY OVER** the **router/spindle mount** and **M5×16mm BHCS**.
3. Remove the X-motor (lower motor) from the back of the X-carriage plate.
 - a. Use a 4mm hex key to remove the four (4) M5×10mm SHCS securing the motor.
 - b. **CARRY OVER** the **X-motor**.

4. Remove the Z-motor (upper motor) from the back of the X-carriage plate.
 - a. Use a 4mm hex key to remove the four (4) M5×10mm SHCS securing the motor.

WARNING: Do not mix up the X- and Z-motors. The orientation of the X motor's drive pulley on the drive shaft is very important for the HDZ assembly. See *Fig. 8*.

5. Remove the drive pulley from the Z-motor drive shaft.
 - a. Use a 1.5mm hex key to loosen the two (2) set screws on the drive pulley.
 - b. Use even pressure to pry off the drive pulley with a couple of screwdrivers, needle nose pliers, or both. **DO NOT BEND THE DRIVE SHAFT.** See *Fig. 9*.
 - c. **CARRY OVER** the Z-motor.

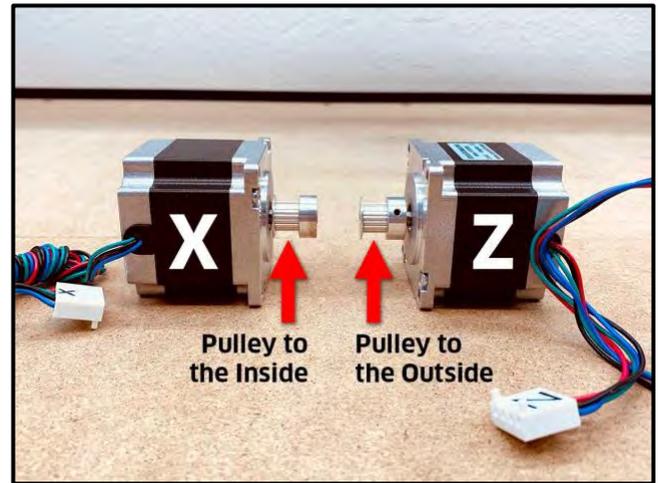


Figure 8

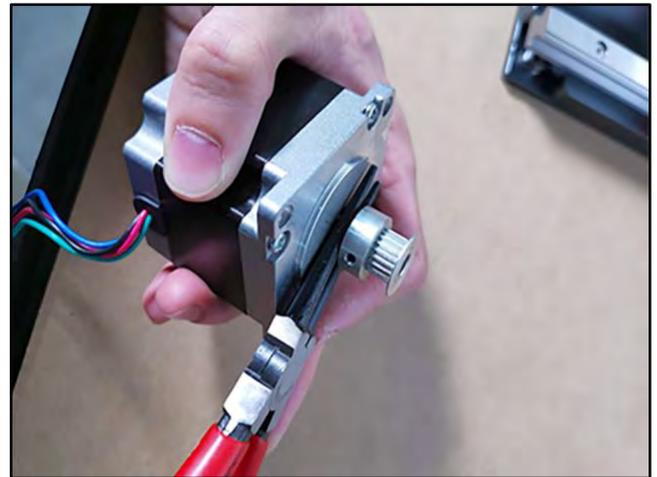


Figure 9

Assemble the HDZ

NOTE: The application of a blue (i.e. light/medium grade) thread locker is at your discretion. We suggest adding it post-assembly if any screws happen to work their way loose during use.

Get Familiar with the HDZ

1. Take a minute to familiarize yourself with the front and back of the HDZ. See *Fig. 10*.

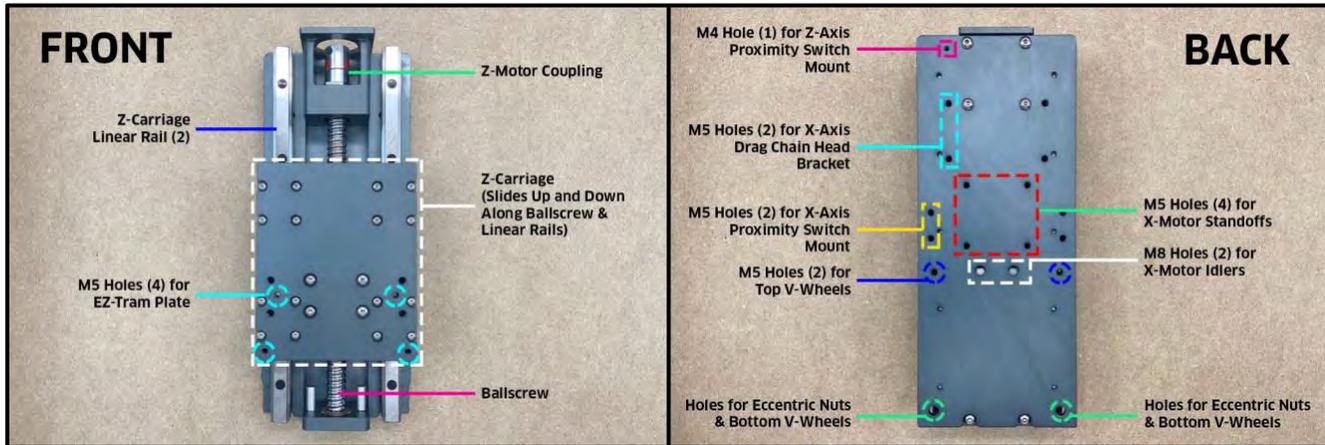


Figure 10

Install the Idlers, X-Motor Standoffs, and X-Axis Proximity Switch Mount

Located in HDZ Kit:

Item	Description	Qty
E	M8 Guide Bearing	4
F	M8 Spacer	2
G	M8 Washer	2
H	M8 × 30mm Button Head Cap Screw	2
C	X-Motor Standoff	4
T	X-Axis Proximity Switch Mount	1
U	M5 × 25mm Socket Head Cap Screw	2

1. Assemble the two X-motor idlers in this order:

- M8×30mm BHCS
- M8 washer
- M8 guide bearing, flange **TOWARD** BHCS head
- M8 guide bearing, flange **AWAY FROM** BHCS head
- M8 spacer

2. Install idlers onto the back of the HDZ. See **Fig. 11**.

- Use a 5mm hex key to secure the idlers to the two M8 screw holes in the center of the plate.

2. Hand-screw the standoffs to the back of the HDZ.

See **Fig. 11**.

- Do NOT use tools or overtighten the standoffs.
- Screw the standoffs into the four evenly-spaced M5 screw holes at center of the plate just above the idlers.

3. Install the X-Axis proximity switch mount to the back of the HDZ. See **Fig. 11**.

- Align the mount with the two M5 screw holes on the Y2-side of the X-motor standoffs.
- The two M3 PEM nuts face out (away from X-motor standoffs).
- Use a 4mm hex key and two (2) M5×25mm SHCS to secure.
- Before fully tightening the screws, slide the mount toward the X-motor standoffs as far as it will go.



Figure 11

Install the X-Axis Drag Chain Head Bracket, Z-Axis Proximity Switch Mount, and V-Wheels

HDZ Kit:

Item	Description	Qty
DD	X-Axis Drag Chain Head Bracket	1
GG	M5 × 8mm Socket Head Cap Screw	2
Z	Z-Axis Proximity Switch Mount	1
AA	M4 × 6mm Button Head Cap Screw	1
L	V-Wheel	2
M	M5 × 25mm Socket Head Cap Screw	2
N	M5 Washer (Shim)	2

1. Install the X-Axis drag chain head bracket to the back of the HDZ. See **Fig. 12**.
 - a. Align the bracket with the two vertical M5 screw holes above and to the Y2-side of the X-motor standoffs.
 - b. Use a 3mm hex key and two (2) M5×10mm SHCS to secure.
2. Install the Z-Axis proximity switch mount to the back of the HDZ. See **Fig. 12**.
 - a. Align the mount with the M4 screw hole at the top of the HDZ.
 - b. Use a 2.5mm hex key and one (1) M4×6mm BHCS to secure the mount at the top of the HDZ.
3. Assemble the top two V-wheels in this order:
 - a. M5×25mm SHCS
 - b. V-wheel
 - c. M5 washer (shim)
4. Install the top two V-wheels on the back of HDZ, in line with the idlers. See **Fig. 12**.
 - a. Use a 4mm hex key to secure the V-wheels to the M5 screw holes to the outside of the idlers.
 - b. Check wheel spin. If shims are properly placed between wheels and carriage plate, the wheels will spin with little to no resistance.



Figure 12

Install the Z-Motor

HDZ Kit + Carryover Components:

Item	Description	Qty
D	M5 × 10mm Socket Head Cap Screw	4
AAA	Z-Motor [CARRYOVER]	1

1. Install the Z-motor at the top of the HDZ. See *Fig. 13* and *Fig. 14*.
 - a. Insert the Z-motor drive shaft into the motor coupling at the top of the HDZ.
 - b. Position the motor with the lead cable toward the back of the HDZ.
 - c. Use a 4mm hex key and four M5×10mm SHCS to secure the motor.
 - d. Use a 2.5mm hex key to tighten the set screw at the top of the motor coupling.

NOTE: Ensure both set screws on the coupling are tight. Failure to do so will lead to slippage. Using a small amount of blue thread lock on the motor shaft and ball screw shaft is acceptable.

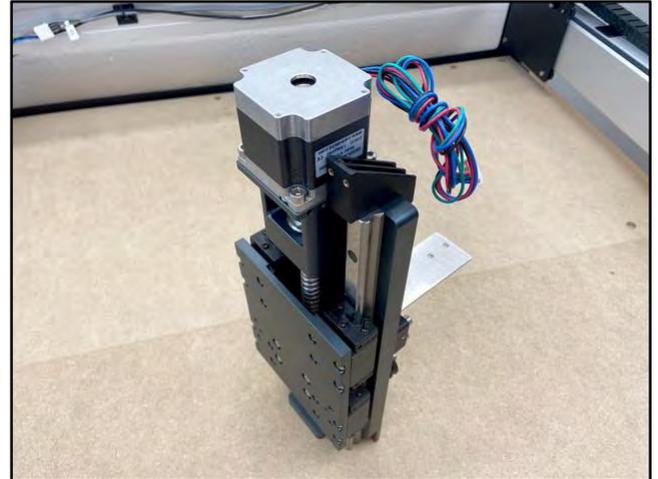


Figure 13

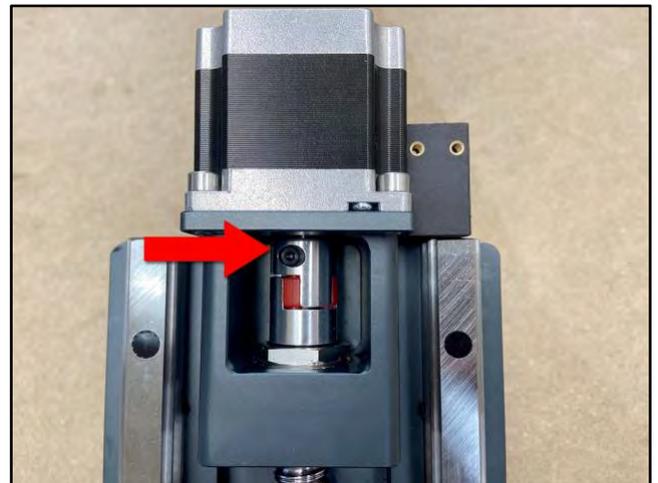


Figure 14

Install the Router/Spindle Mount and EZ-Tram

HDZ Kit + Carryover Components:

Item	Description	Qty
B	EZ-Tram Plate	1
I	M5 × 18mm Socket Head Cap Screw	2
J	M5 × 10mm Socket Head Cap Screw	2
K	HD Eccentric Spacer (Non-Threaded)	2
BBB	Router/Spindle Mount [CARRYOVER]	1
CCC	M5 × 16mm Button Head Cap Screw [CARRYOVER]	2

1. Attach the EZ-Tram plate to the router/spindle mount. See **Fig. 11**.
 - a. Align the front of the plate with the M5 screw holes on the back of mount.
 - b. Ensure the plate's recessed holes face out and the oval through-holes are on top.
 - c. Use a 3mm hex key and the two (2) M5×16mm BHCS to secure.
2. Assemble eccentric spacers in this order:
 - a. M5×18mm SHCS
 - b. HD eccentric spacer (nut side **TOWARD** screw head).



Figure 11

NOTE: Be careful not to confuse the eccentric spacers and eccentric nuts. Eccentric spacers are non-threaded.

3. Loosely attach the EZ-Tram to the front of the HDZ. See **Fig. 12**.
 - a. Align the EZ-Tram with corresponding M5 screw holes on the front of the HDZ.
 - b. Insert M5×18mm SHCS and spacers into the through-holes at the top of the EZ-Tram.
 - c. Finger-tighten the SHSC and position the eccentric spacers with the dimple facing up.
 - d. Insert the two (2) M5×10mm SHCS into the EZ-Tram's bottom through-holes and finger-tighten.

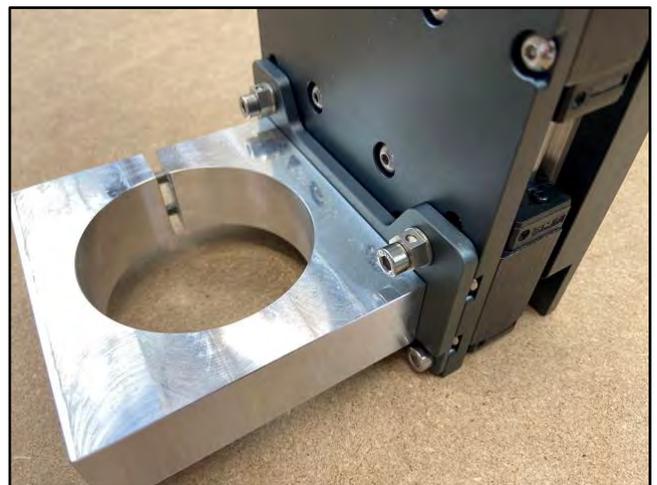


Figure 12

NOTE: See Trimming Instructions at the end of this guide for information on how to tram the HDZ.

Install the Drag Chain Support System

Shapeoko 3 Machines: Skip ahead to the “Install the HDZ” section on page 26.

Install the Y-Axis Head Bracket

HDZ Kit:

Item	Description	Qty
JJ	Y-Axis Drag Chain Head Bracket	1
MM	M5 Nut	2
NN	M5 × 16mm Socket Head Cap Screws	2

1. Install the Y-Axis drag chain head bracket to the outside of the Y1-carriage. See **Fig. 17**.
 - a. Use a 4mm hex key and two (2) M5×16mm SHCS to replace the Y1-motor’s top two screws
 - b. Place the head bracket, flange down, onto the protruding screws.
 - c. Use an 8mm wrench and two (2) M5 nuts to secure the bracket to the screws.

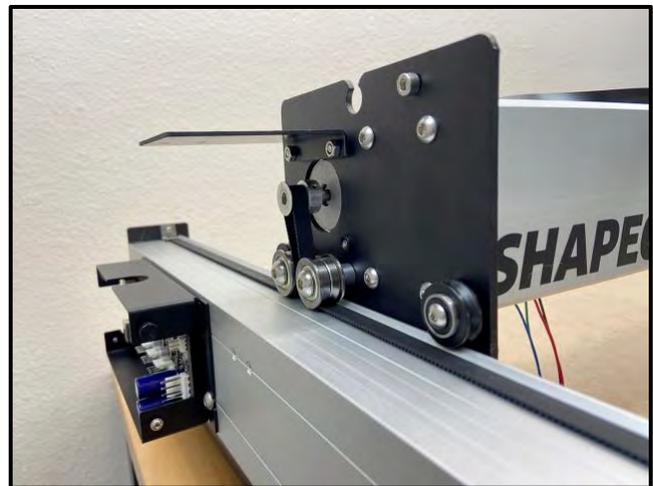


Figure 17

Identify Your Extrusion Rail Version

1. Examine your X- and Y1-Rails. You will have either:
 - Pre-Dec 2019 extrusion rails. See **Fig. 18**.
 - **X-Rail:** No screw holes.
 - **Y1-Rail:** Two M5 threaded screw holes in the center.

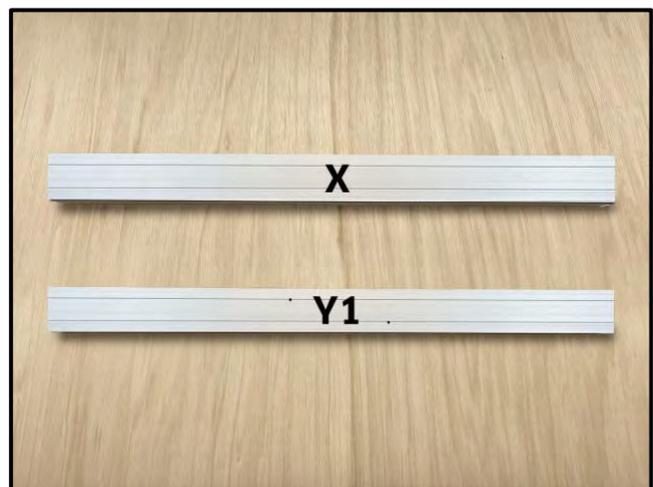


Figure 18

Pre-Dec 2019 Rails: Your setup may look slightly different than the setup pictured in this document.

- Post-Dec 2019 extrusion rails. See **Fig. 19**.
 - **X-Rail:** Sixteen M4 threaded screw holes.
 - **Y1-Rail:** Two M5 threaded screw holes on the left-side of the rail and four M4 threaded screw holes along the top of the rail.



Figure 19

Install Drag Chain Supports

Pre-Dec 2019 Rails: You will need to install the four (4) included drag chain support PLATES. Complete the instructions in “Install the Drag Chain Support Plates” below.

Post-Dec 2019 Rails: You will need to install the five (5) included drag chain support BRACKETS. Skip ahead to “Install the Drag Chain Support Brackets” on page 23.

Install the Drag Chain Support Plates [Pre-Dec 2019 Rails ONLY]

HDZ Kit:

Item	Description	Qty
QQ	Drag Chain Middle Support Plate	2
RR	Drag Chain Tail Support Plate	2
TT	Alcohol Wipe	2

Drag chain support plates install onto the top of the rail with the long edge perpendicular to the rail. Each support plate has a piece of double-sided VHB tape pre-applied to one half of the plate. The short edge of the plate, with a piece of pre-applied VHB tape, lines up with the rail’s centerline, allowing the plate to overhang the back side of the rail by 1”. The PEM nuts in the drag chain tail support plates overhang the rail.

1. Attach one (1) middle support plate and one (1) tail support plate onto the X-rail. See **Fig. 20** (image from rear).
 - a. Measure and mark 5" and 19 ½" from the Y1-carriage.
 - b. Clean the rail, on the far side (Y2-side) of each mark, with an alcohol wipe.
 - c. Stick the middle support plate (no PEM nut) to the top of the rail, to the far side of the 19 ½" mark.
 - d. Stick the tail support plate (with PEM nut) to far side of the 5" mark. Orient the plate with the PEM nut overhanging and toward the Y1-side of the rail.
 - e. Press each plate firmly to the rail for 30 seconds.

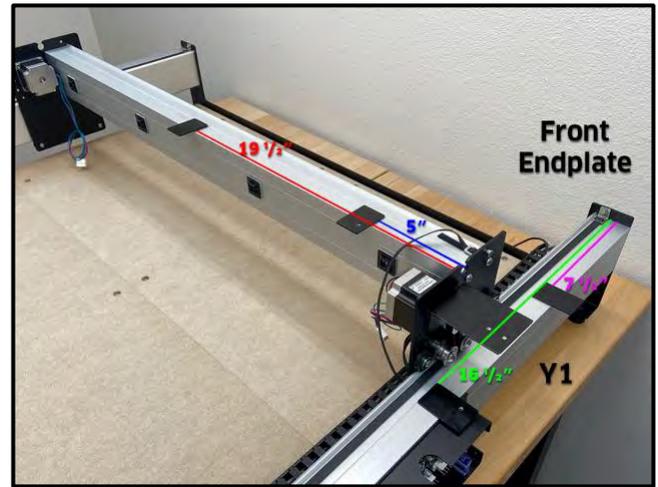


Figure 20

2. Attach one (1) middle support plate and one (1) tail support plate onto the Y1-rail. See **Fig. 20**.
 - a. Measure and mark 7 ½" and 16 ½" from the front endplate.
 - b. Clean the rail, on the far side (rear-endplate-side) of each mark, with an alcohol wipe.
 - c. Stick the middle support plate (no PEM nut) to the top of the rail, to the far side of the 7 ½" mark.
 - d. Stick the tail support plate (with PEM nut) to the far side of the 16 ½" mark. Orient the plate with the PEM nut overhanging and toward the front endplate.
 - e. Press each plate firmly to the rail for 30 seconds.

Install the Drag Chain Support Brackets [Post-Dec 2019 Rails ONLY]

HDZ Kit:

Item	Description	Qty
X-Axis Drag Chain Supports		
EE	Drag Chain Middle Support Bracket	2
FF	Drag Chain Tail Support Bracket	1
HH	M4 × 6mm Socket Head Cap Screw	6
Y-Axis Drag Chain Supports		
KK	Drag Chain Middle Support Bracket	1
LL	Drag Chain Tail Support Bracket	1
OO	M4 × 6mm Socket Head Cap Screw	4

Drag chain support brackets install flange down to the horizontal sets of M4 screw holes on the extrusion rails. The top of the bracket sits flush with the top of the rail.

1. Install two (2) middle support brackets (no PEM nut) and one (1) tail bracket (with PEM nut) to the back side of the X-rail. See **Fig. 21** (image from rear).
 - a. Install the tail bracket to the set of M4 holes closest to the Y1-carriage.
 - b. Use a 3mm hex key and two (2) M4×6mm SCHS to secure each bracket.
2. Install one (1) middle support bracket (no PEM nut) and one (1) tail bracket (with PEM nut) to the outside of the Y1-rail. See **Fig. 21** (image from rear).
 - a. Install the tail bracket to the set of M4 holes closest to the Carbide Motion board enclosure.
 - b. Use a 3mm hex key and two (2) M4×6mm SCHS to secure each bracket.

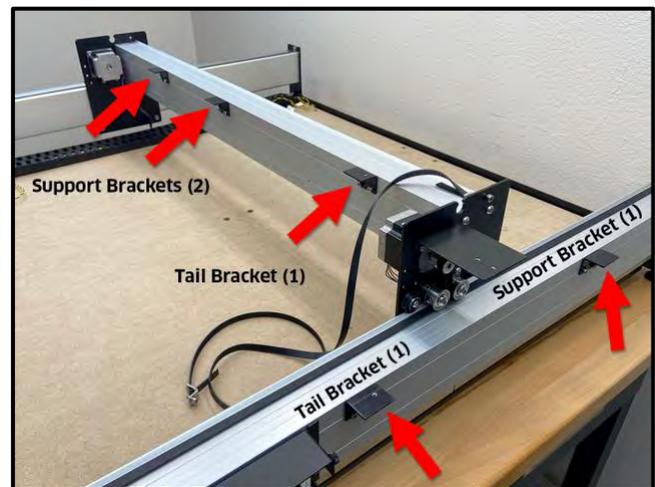


Figure 21

Insert the Proximity Switch Cables into Drag Chain

Install the Proximity Switch Cables

HDZ Kit:

Item	Description	Qty
P	X-Axis Proximity Switch Cable (2675mm XXL and 2350mm XL)	1
Q	Y-Axis Proximity Switch Cable (2540mm XXL and 2200mm XL)	1
S	Z-Axis Proximity Switch Extension Cable (2438mm XXL, 2235mm XL)	1

1. Open up the drag chain and remove the black and yellow homing switch cables. See *Fig. 22* and *Fig. 23*.

- a. Position the drag chain on the baseframe as shown in *Fig. 23*, with the chain's clip-on panels facing up. (Only one side of the chain will open; be sure this side is facing up.)
- b. Use a hex key or screw driver as a lever to pry open one side of each drag chain link. Start from the rear of the machine and work your way forward as shown in *Fig. 22*.
- c. Remove the three black and yellow X-, Y-, and Z-Axis homing switch cables.

2. Label the proximity switches AND gray 3-pin extension cable.

- a. Identify the X- and Y-Axis proximity switches by comparing the length printed on the switch body with the table above.
- b. Use a permanent marker or piece of tape to label the white female connectors of X- and Y-Axis proximity switch cables AND the gray Z-Axis proximity switch extension cable.

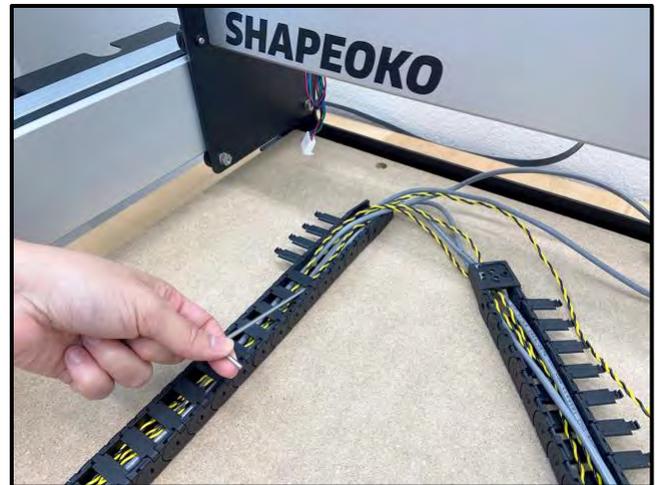


Figure 22

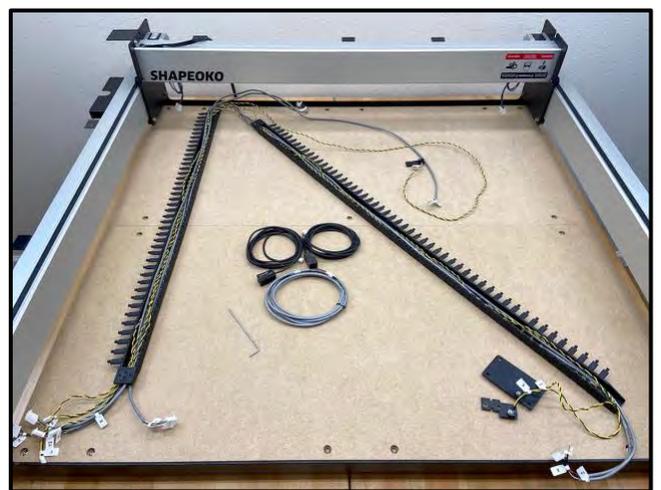


Figure 23

3. Insert the proximity switches and extension cable into the drag chain. See *Fig. 24*.

NOTE: Position the female end of the gray Z-Axis proximity extension cable at the tail of Y-Axis drag chain.

- a. Insert the X-Axis proximity switch cable and the gray Z-Axis proximity switch extension cable through both the Y-Axis and X-Axis portions of the drag chain.
 - b. Insert the Y-Axis proximity switch cable through the Y-Axis drag chain ONLY.
4. Close up the drag chain. Do not install onto the rails just yet.

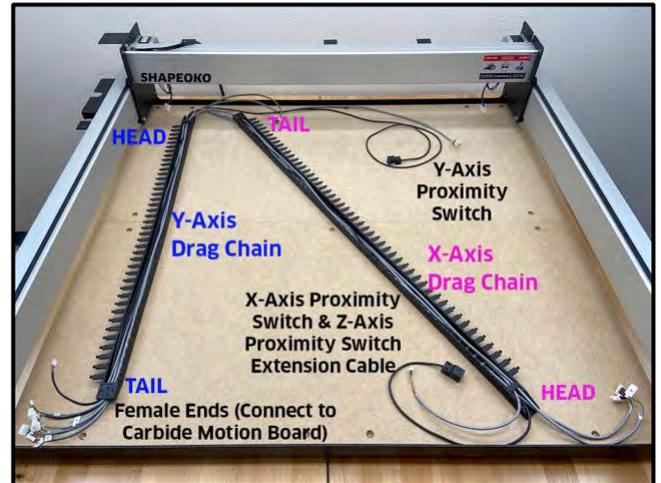


Figure 24

Install the HDZ

Insert the Eccentric Nuts

HDZ Kit:

Item	Description	Qty
O	HD Eccentric Nut (Threaded)	2

1. Insert the two HD eccentric nuts into the bottom of the HDZ. See *Fig. 25*.
 - a. Rotate the eccentric nuts into their fully-open position with the dimple facing up.



Figure 25

Install the HDZ onto the X-Rail

HDZ Kit:

Item	Description	Qty
L	V-Wheel	2
M	M5 × 25mm Socket Head Cap Screw	2
N	M5 Washer (Shim)	2

1. Assemble the bottom two V-wheels in this order:
 - a. M5×25mm SHCS
 - b. V-wheel
 - c. M5 washer (shim)
2. Lift the HDZ onto the X-rail, aligning the top V-wheels with the upper V-rail.
3. Install the bottom two V-wheels on the back of the HDZ. **Fig. 26** and **27**.
 - a. Be sure V-wheels are properly seated on lower V-rail.
 - b. Use a 10mm wrench to hold eccentric nuts in the fully open position (dimples up).
 - c. Use a 4mm hex key to secure both V-wheels to the HD eccentric nuts.
 - d. Check HDZ movement by rolling carriage back-and-forth along the X-rail.
4. Tension the HD eccentric nuts.
 - a. Rotate the eccentric nuts **CLOCKWISE** to tension. Reach under and spin the V-wheel with your finger. If it rotates freely, keep tightening until you feel some friction against the rail.

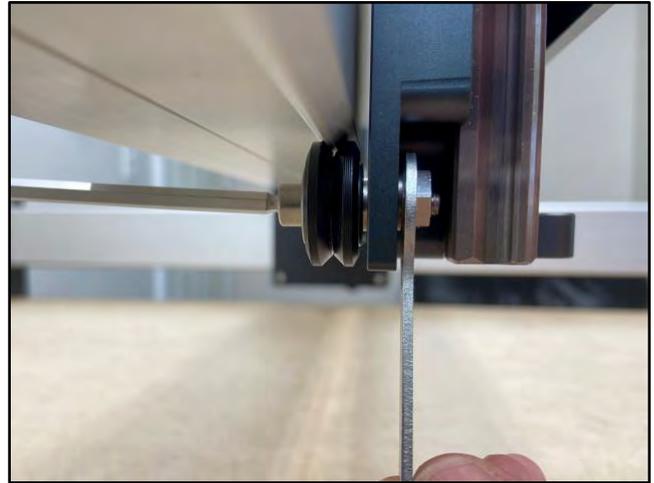


Figure 26

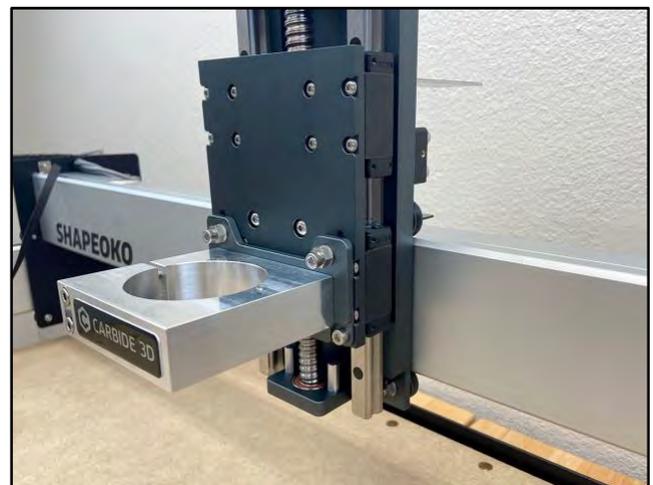


Figure 27

NOTE: If your V-wheels are not turning freely, check to make sure the shims are correctly positioned between the V-wheel and carriage plate.

Install the X-Motor

HDZ Kit + Carryover Components:

Item	Description	Qty
D	M5 × 10mm Socket Head Cap Screw	4
ZZ	X-Motor [CARRYOVER]	1

1. Thread the free end of the X-Axis belt under the idlers at the back of the HDZ.
2. Push a large loop of belt up between the idlers. See *Fig. 28*.
3. Attach the X-motor to the four standoffs on the back of the HDZ.
 - a. Position the motor lead cable to the Y1-side.
 - b. Use a 4mm hex key and four (4) M5×10mm SHCS to secure. See *Fig. 29*.
4. Pull the slack out of the belt.

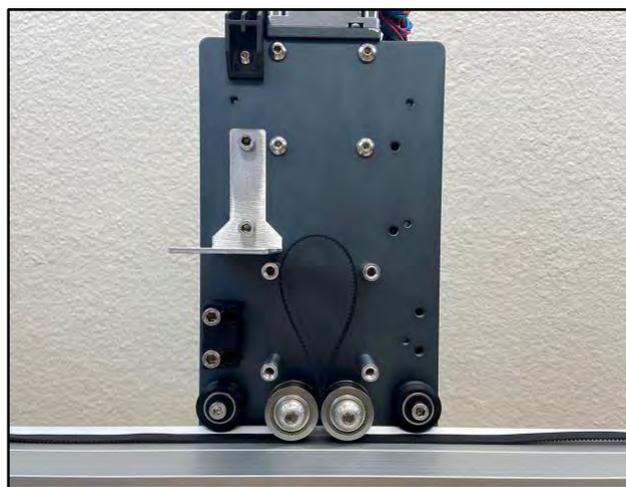


Figure 28

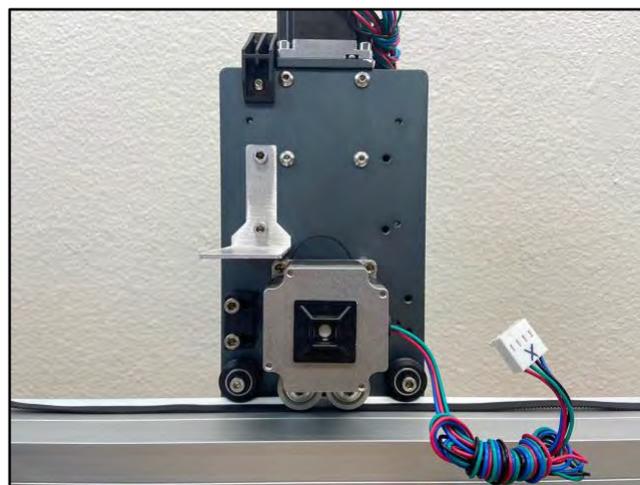


Figure 29

Install the X-Axis Belt

Carryover Components:

Item	Description	Qty
YY	X-Axis Belt & Hardware: Belt Clip (1), and M5 × 10mm Socket Head Cap Screw (1) [CARRYOVER]	3

1. Install and tension the X-Axis belt. See **Fig. 30**
 - a. Attach the belt clip to the free end of the belt.
 - b. Place the belt flat along the rail leaving a ¼-inch gap between the clip and carriage plate.
 - c. Use a 4mm hex key and the M5×10mm SHCS to secure.
 - d. Tighten until an audible tone can be heard when the belt is plucked.

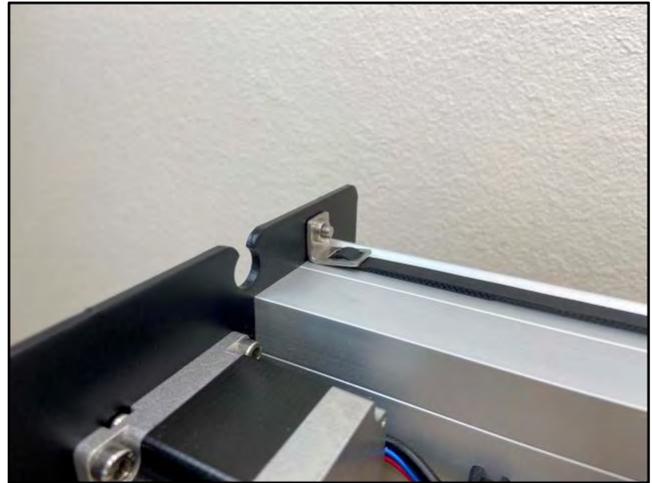


Figure 30

Install the Drag Chain

Shapeoko 3 Machines: Skip ahead to the “Install the Proximity Switches” section on page 32.

Install the Drag Chain to the X- and Y1-Rails

HDZ Kit:

Item	Description	Qty
II	M3 × 6mm Flat Head Screw	3
PP	M3 × 6mm Flat Head Screw	3

1. Move the X-rail to the back of the machine.
2. Lay the drag chain on the rails. See **Fig. 31**.
 - a. First, place the three cables not threaded through the X-Axis drag chain (the Y-Axis proximity switch cable and the Y1- and Y2-motor leads) over and behind the X-rail
 - b. Second, lift the drag chain and place it across the Y1- and X-rails.
 - c. Lay the drag chains so that the tail of the Y-Axis drag chain will curl under and the head of the X-Axis drag chain will curl up.



Figure 31

3. Secure the drag chain to the rails. See **Fig. 32**.
 - a. Secure the head of the Y-Axis drag chain to the head bracket on the outside of the Y1-carriage.
 - i. Use a 2mm hex key and two (2) M3×6mm FHS to secure.
 - b. Secure the tail of the Y-Axis drag chain to the tail bracket (or tail plate) next to the Carbide Motion Board enclosure.
 - i. Curl the tail of the drag chain under and toward the enclosure.
 - ii. Use a 2mm hex key and one (1) M3×6mm FHS to secure.

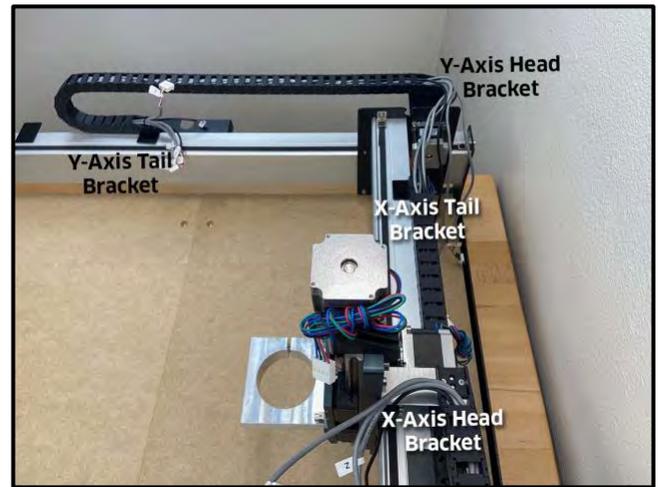


Figure 32

- i. Curl the tail of the drag chain under and toward the enclosure.
 - ii. Use a 2mm hex key and one (1) M3×6mm FHS to secure.
 - c. Secure the tail of the X-Axis drag chain to the tail bracket (or tail plate) near the Y1-motor.
 - i. Use a 2mm hex key and one (1) M3×6mm FHS to secure.
 - d. Secure the head of the X-Axis drag chain to the head bracket on the rear of the Z-Plus.
 - i. Curl the head of the drag chain up and toward the Z-Plus.
 - ii. Use a 2mm hex key and two (2) M3×6mm FHS to secure.

Install the Proximity Switches

Install the X- and Z-Axis Proximity Switch to the Mount

HDZ Kit:

Item	Description	Qty
P	X-Axis Proximity Switch (2675mm XXL, 2350mm XL, and 712mm Shapeoko 3)	1
V	M3 × 18mm Socket Head Cap Screw	2
R	Z-Axis Proximity Switch (200mm XXL and XL, 610mm for Shapeoko 3)	1
BB	M3 × 18mm Socket Head Cap Screw	2

1. Attach the X-Axis proximity switch to the X-Axis proximity switch mount installed on the rear of the HDZ. See **Fig. 33**.

- a. Locate the X-Axis proximity switch exiting the drag chain at the X-Axis head bracket.
- b. Position the proximity switch with the red LED facing the Y2-carriage and the target pointing down.
- c. Align the proximity switch's mounting slots with the two M3 holes on the face of the mount.
- d. Use a 2.5mm hex key and two (2) M3×18mm SHCS to secure the proximity switch.
- e. Before fully tightening the screws, slide the switch up as far as it will go.

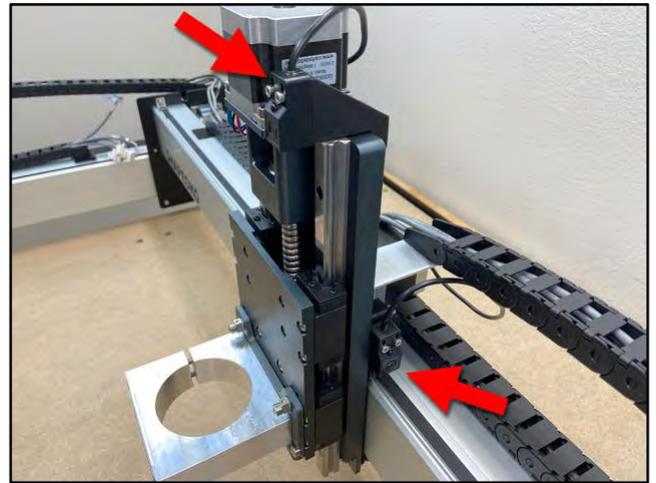


Figure 33

2. Attach the Z-Axis proximity switch to the Z-Axis switch mount installed at the top of the HDZ. See **Fig. 33**.
 - a. Position the Z-Axis proximity switch with the red LED facing the front and the target pointing down.
 - b. Align the proximity switch's mounting slots with the two M3 holes on the face of the mount.
 - c. Use a 2.5mm hex key and two (2) M3×18mm SHCS to secure the proximity switch.
 - d. Before fully tightening the screws, slide the switch up as far as it will go.

Shapeoko 3 Machines: Skip 3 and move ahead to the “Install the Y-Axis Proximity Switch” section on page 33.

3. Connect the Z-Axis proximity switch to the gray extension cable.
 - a. Locate the 2-pin gray Z-Axis proximity switch extension cable exiting the drag chain at X-Axis head bracket.
 - b. Connectors are polarized. Be sure to align them properly.

Install the Y-Axis Proximity Switch

HDZ Kit:

Item	Description	Qty
Q	Y-Axis Proximity Switch (2540mm XXL, 2200mm XL, 610mm Shapeoko 3)	1
W	Y-Axis Proximity Switch Mount	1
X	M5 × 35mm Socket Head Cap Screw	2
Y	M3 × 18mm Socket Head Cap Screw	2

1. Install the Y-Axis proximity switch mount to the outside of the Y2-carriage. See **Fig. 34**.
 - a. Use a 4mm hex key and two (2) M5×35mm SHCS to secure the mount to the outside of the Y2-carriage.
2. Attach Y-Axis proximity switch to the mount. See **Fig. 34**.
 - a. Locate the Y-Axis proximity switch exiting the drag chain at the Y1-Axis head bracket.
 - b. Position the proximity switch with the red LED facing out and the target pointing to the rear.
 - c. Align the switch's two mounting slots with the two M3 PEM nuts on the mount.
 - d. Use a 2.5mm hex key and two (2) M3×18mm SHCS to secure.
 - e. Before fully tightening the screws, slide the switch as far to the FRONT as it will go.

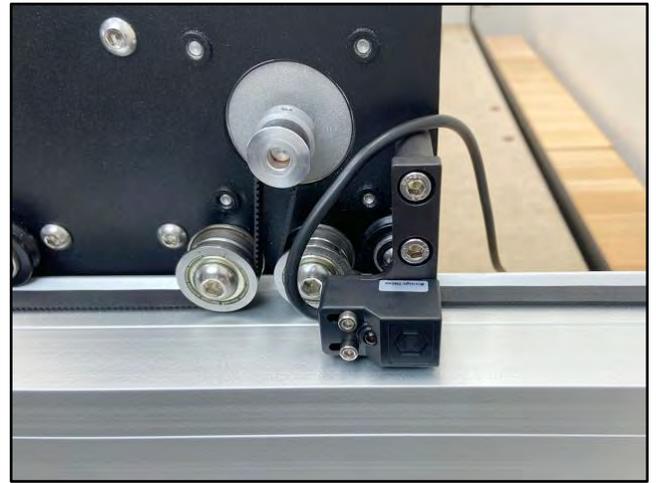


Figure 34

Connect the Wiring

Connect the Extension Cables

Shapeoko 3 Machines: Skip ahead to the “Connect Cables to the Carbide Motion Board” section below.

1. Connect the X- and Z-motor lead cables to their labeled extension cables at the rear of the HDZ.
 - a. Both the X- and Z-motor extensions exit the head of the X-Axis drag chain behind the HDZ.
 - b. Connectors are polarized. Be sure to align them properly.
2. Connect the Y1- and Y2- motor lead cables to their extension cables.
 - a. Both the Y1- and Y2-motor extensions exit the head of the Y-Axis drag chain at the Y1-carriage.
 - b. The Y2-motor lead cable stretches across the machine, behind the X-rail.
 - c. Connectors are polarized. Be sure to align them properly.

Connect Cables to the Carbide Motion Board

HDZ Kit:

Item	Description	Qty
CC	PCB Riser Board	1

Shapeoko XXL and XL Instructions

1. Plug the PCB riser board into the Carbide Motion board. See **Fig. 35**.
 - a. Plug the PCB riser board into the 2x8 open bank of pins in the top-right of the Carbide Motion board.
2. Plug the proximity switch cables and stepper motor extension cables into the Carbide Motion board. See **Fig. 35**.
 - a. Plug each of the 3-pin proximity switch cables, X, Y, and Z, into the PCB riser board, as labeled.
 - b. Plug each of the 4-pin motor extension cables Z, Y1, Y2, X, into the connectors across the bottom of the Carbide Motion board, as labeled.
 - c. Connectors are polarized. Be sure to align them properly.

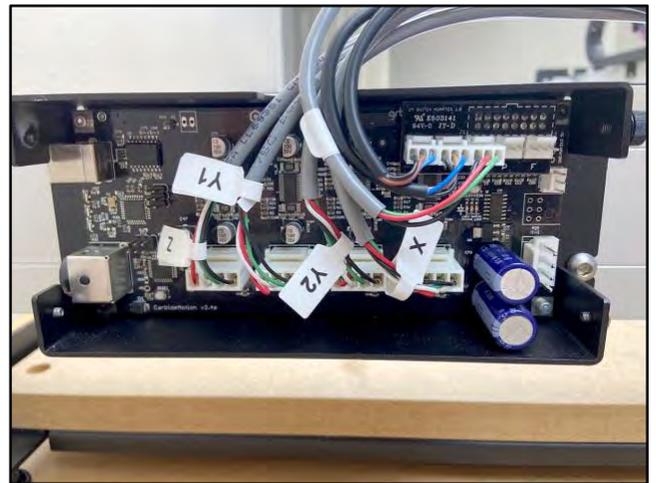


Figure 35

Shapeoko 3 Instructions

Shapeoko 3 Machines: Your Carbide Motion board should be installed upside down as shown in *Fig. 36*.

1. Plug the PCB riser board into the Carbide Motion board. See *Fig. 36*.
 - a. Plug the PCB riser board into the 2x8 open bank of pins in the bottom-left of the Carbide Motion board.
2. Plug the proximity switch cables and stepper motor extension cables into the Carbide Motion board. See *Fig. 36*.
 - a. Plug each of the proximity switch cables, Z, Y, and X, into the PCB riser board, as labeled.
 - b. Plug in the stepper motor extension cables X, Y2, Y1, Z, into the connectors across the top of the Carbide Motion board, as labeled.
 - c. Connectors are polarized. Be sure to align them properly.



Figure 36

Cleanup the Cables

Secure Cables at Y1-Carriage and Z-Plus

Shapeoko 3 Machines: Skip ahead to the “Secure Cables Along the X-Rail” section on page 37.

HDZ Kit:

Item	Description	Qty
WW	Cable Ties	Several

1. Secure the cables crossing the Y1-carriage plate. See *Fig. 37*.
 - a. Tuck all seven cables, one at a time, into the cutout at the top of the Y1-carriage plate.
 - b. Use two (2) cable ties, one on each side of the cutout, to secure the cables in place.
2. Secure the cables at the rear of the HDZ. See *Fig. 38*.
 - a. Bundle the X- and Z-cables at the rear of the HDZ.
 - b. Use a couple cable ties to secure the cables.

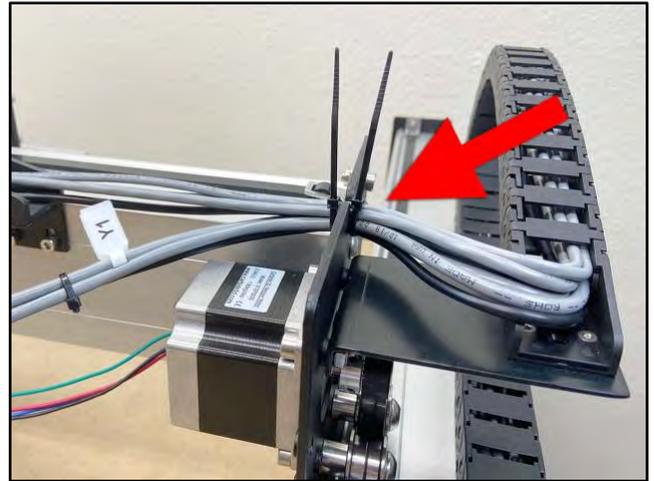


Figure 37

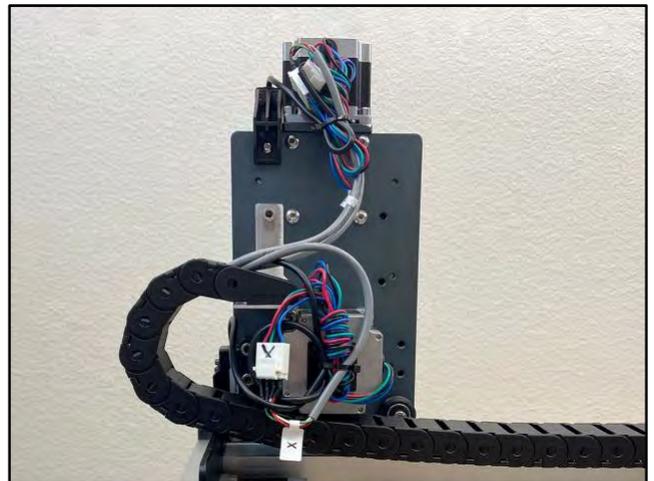


Figure 38

Secure Cables Along the X-Rail

Pre-Dec 2019 Rails (see page 20-21): Clean up cables at the rear of the X-rail using the self adhesive cable tie mounts already attached to your X-rail. Complete the instructions in “Cable Cleanup — Pre-Dec 2019 Rails ONLY” below.

Post-Dec 2019 rails (see pages 20-21): Clean up cables at the rear of the X-rail using the five (5) cable tie mounts included with the HDZ kit. Skip ahead to “Cable Cleanup — Post-Dec 2019 Rails ONLY” below.

Cable Cleanup — Pre-Dec 2019 Rails ONLY

HDZ Kit:

Item	Description	Qty
WW	Cable Ties	Several

1. Tidy up the cables along the rear of the X-rail. See *Fig. 39*.

- a. Secure the loose cables to the four self-adhesive cable tie mounts already attached to the back of the X-rail.

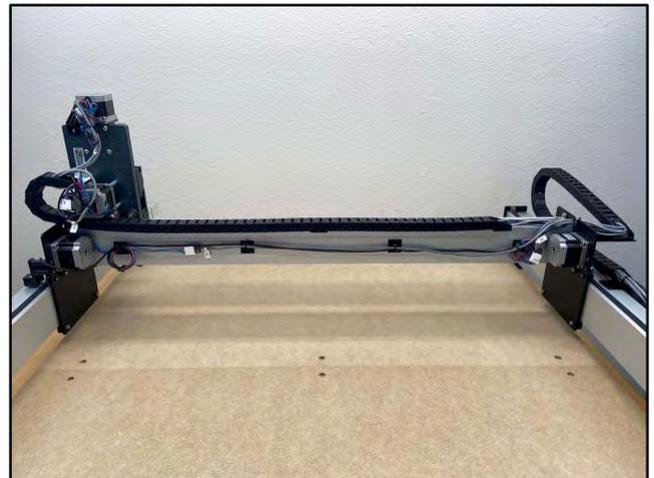


Figure 39

Pre-Dec 2019 Rails: The five (5) cable tie mounts and five (5) M4 × 6mm BHCS, are not needed for this rail setup.

Shapeoko 3 Machines: You will only use four (4) cable tie mounts and four (4) M4×6mm BHCS.

HDZ Kit:

Item	Description	Qty
UU	Cable Tie Mounts	5
VV	M4 × 6mm Button Head Cap Screw	5
WW	Cable Ties	Several

1. Install cable tie mounts to the back of the X-rail. See *Fig. 40*.
 - a. Remove the four self-adhesive cable tie mounts from the rear of the X-rail.
 - b. Cable tie mounts install vertically.
 - c. Install the five (5) mounts to the upper five M4 threaded screw holes along the middle of the rail.
 - d. Use a 3mm hex key and one (1) M4×6mm BHCS to secure each mount.
2. Tidy up the cables along the rear of the X-rail. See *Fig. 40*.
 - a. Secure loose cables to the cable tie mounts using cable ties.

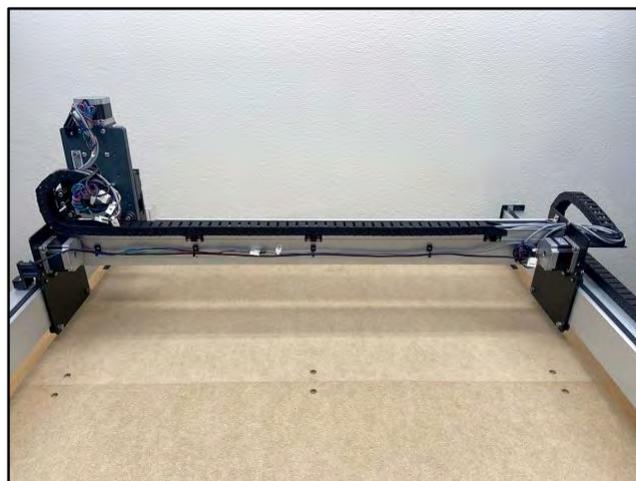


Figure 40

Z-Plus to HDZ Assembly Guide

Prior to Assembly & Installation

Disable the BitSetter

Machines With BitSetter: Please complete the following steps before moving on to “Gather the Required Tools” section below.

Before beginning the HDZ upgrade:

1. Connect your machine to Carbide Motion.
 - a. Plug in your USB cable.
 - b. Open Carbide Motion.
 - c. Turn on your Shapeoko.
 - d. Click the **Connect to Cutter button**.
2. Click **Settings** in the top menu bar.
3. If you have the BitSetter checkbox checked, go ahead and uncheck it.

You will need to re-calibrate the BitSetter after successful homing with your new HDZ. See pages 59-61 for instructions.

Gather the Required Tools

A basic mechanical know-how and an understanding of how the Shapeoko is assembled is required. Installation will take approximately 2 hours.

Required tools:

- Metric hex keys: 2mm – 5mm
- 10mm wrench
- Flush cut pliers
- Permanent marker
- Masking tape

Inventory

Z-Plus to HDZ Kit Contents

The HDZ kit comes with the components listed in the tables on the following pages and shown in *Fig. 1* and *Fig. 2*.

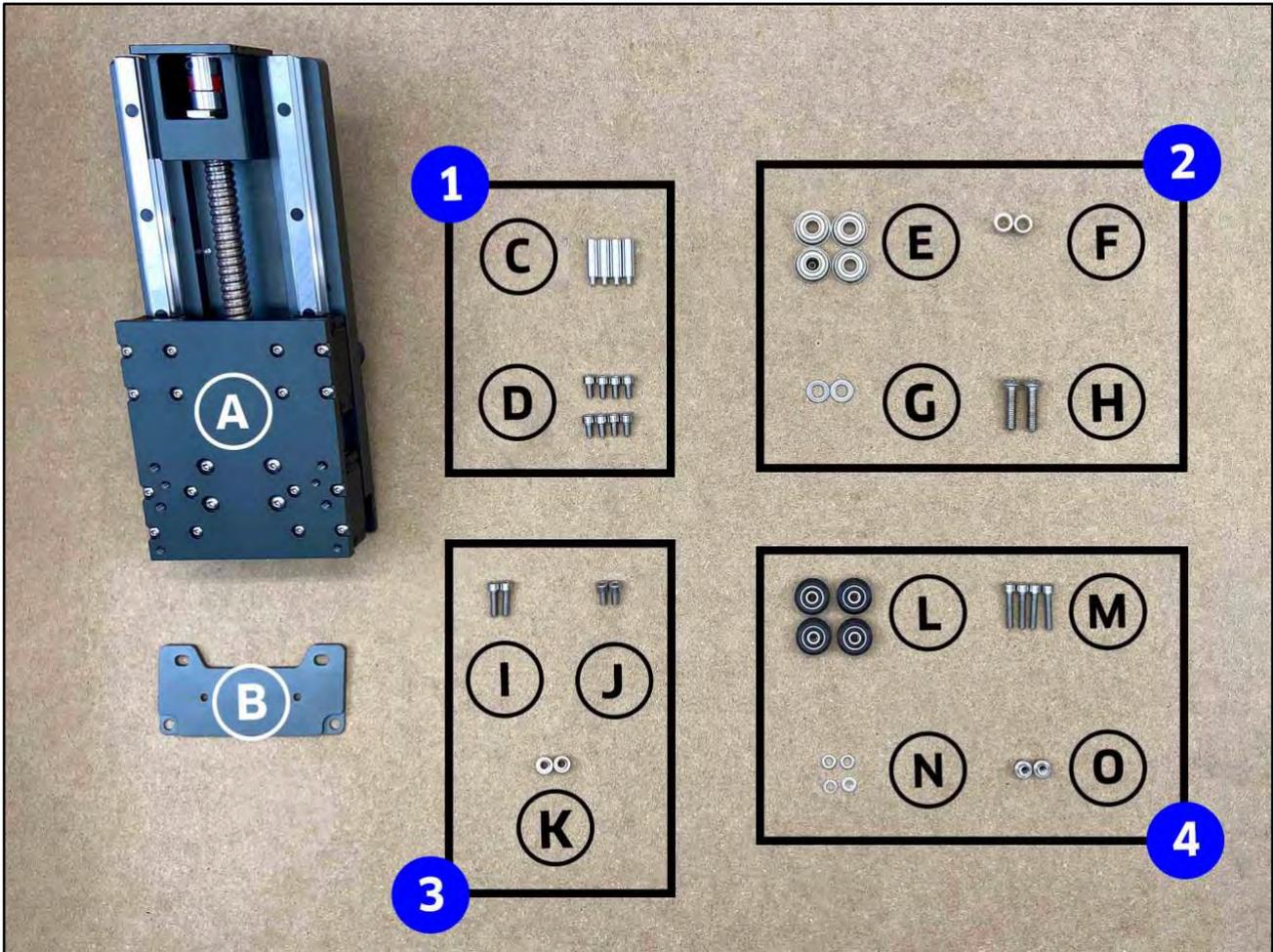


Figure 1

HDZ Box

The HDZ box components are listed in the tables below and shown in *Fig. 1*.

Item	Description	Qty
A	HDZ (Heavy-Duty Z/X Carriage)	1
B	EZ-Tram Plate	1

HDZ Kit Components and Hardware Bag

Item	Description	Qty
Motor Mount Baggie (1)		
C	M5 × 25mm X-Motor Standoff	4
D	M5 × 10mm Socket Head Cap Screw	8
X-Motor Idler Baggie (2)		
E	M8 Guide Bearing	4
F	M8 Spacer	2
G	M8 Washer	2
H	M8 × 30mm Button Head Cap Screw	2
EZ-Tram Plate Hardware Baggie (3)		
I	M5 × 18mm Socket Head Cap Screw	2
J	M5 × 10mm Socket Head Cap Screw	2
K	HD Eccentric Spacer (Non-Threaded)	2
V-Wheel Baggie (4)		
L	Replacement V-Wheel	4
M	M5 × 25mm Socket Head Cap Screw	4
N	M5 Washer (Shim)	4
O	HD Eccentric Nut (Threaded)	2

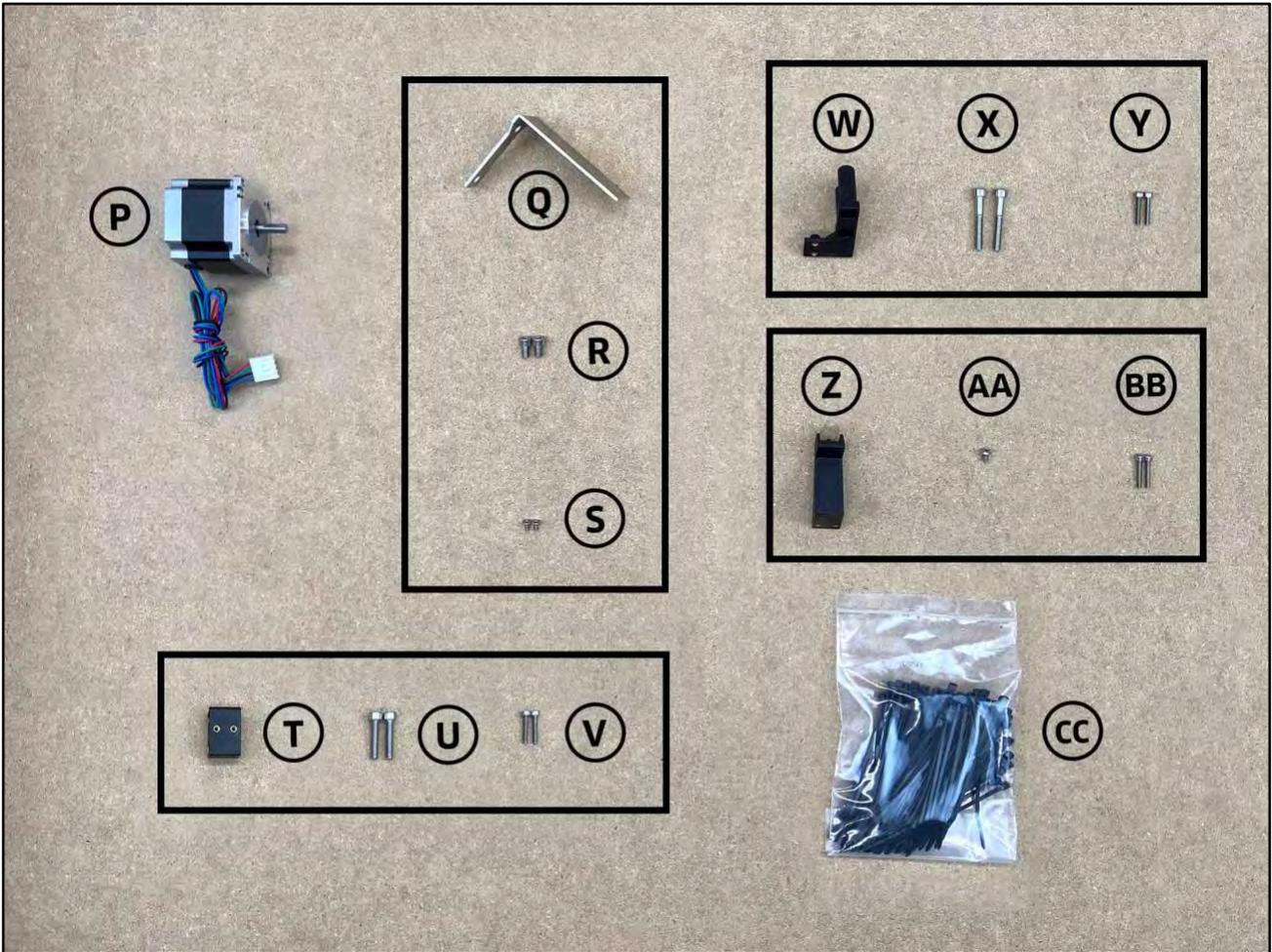


Figure 2

Proximity Switch Box

The proximity switch box components are listed in the table below and shown in *Fig. 2*.

Item	Description	Qty
P	Z-Motor	1
X-Axis Drag Chain Head Bracket Baggie		
Q	X-Axis Drag Chain Head Bracket	1
R	M5 × 8mm Socket Head Cap Screw	2
S	M3 × 6mm Flat Head	2
X-Axis Proximity Switch Mounting Baggie		
T	X-Axis Proximity Switch Mount	1
U	M5 × 25mm Socket Head Cap Screw	2
V	M3 × 18mm Socket Head Cap Screw	2
Y-Axis Proximity Switch Mounting Baggie		
W	Y-Axis Proximity Switch Mount	1
X	M5 × 35mm Socket Head Cap Screw	2
Y	M3 × 18mm Socket Head Cap Screw	2
Z-Axis Proximity Switch Mounting Baggie		
Z	Z-Axis Proximity Switch Mount	1
AA	M4 × 6mm Button Head Cap Screw	1
BB	M3 × 18mm Socket Head Cap Screw	2
CC	Cable Ties (Pack of 100)	1

Shapeoko Carryover Components

The HDZ utilizes several parts from the existing Shapeoko setup. All components and hardware to be carried over are listed in the table below and shown in **Fig. 3**.

Throughout this guide, carryover parts will be called out by the words: **CARRY OVER**.

NOTE: Please use the replacement screws provided in the HDZ Kit.

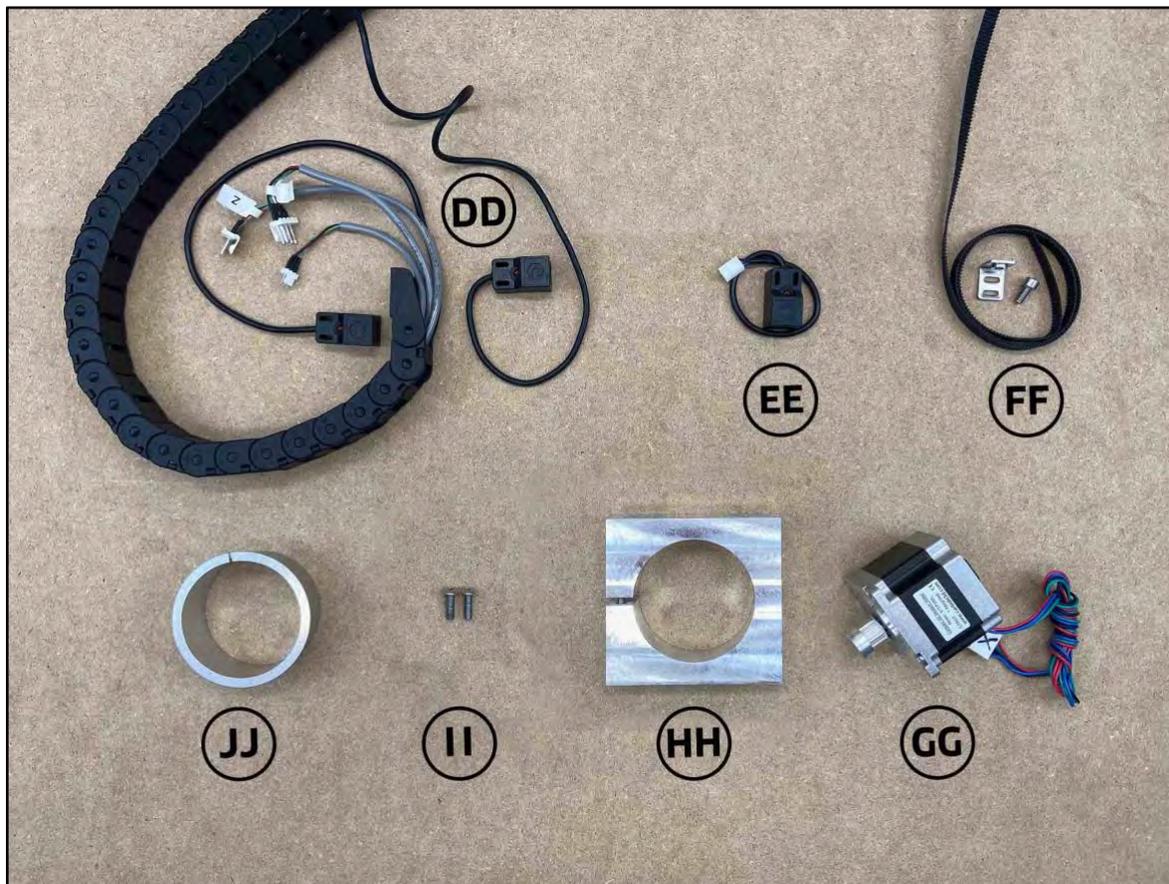


Figure 3

Item	Description	Qty
DD	Drag Chain (With X- and Y-Axis Proximity Switches Installed)	1
EE	Z-Axis Proximity Switch (Disconnected)	1
FF	X-Rail Belt and Hardware: Belt Clip (1) and M5 × 10mm Socket Head Cap Screw (1)	3
GG	X-Motor	1
HH	Spindle/Router Mount	1
II	M5 × 16mm Button Head Cap Screw	2
JJ	Router Mount Adapter Ring (Optional)	1

Disassemble the Existing Z-Plus Carriage

NOTE: As you complete the disassembly process, you may find it helpful to keep each carryover component and its associated hardware together and away from the new HDZ parts to avoid any mix ups.

Disconnect Cables and the X-Axis Belt

1. Turn off your machine, unplug it, and disconnect the USB and power cables.
2. Clip the cable ties at the back of the Z-Plus, those securing the X- and Y-Axis proximity switches to their mounting plates, and those securing the router cable.
3. Unplug the router/spindle and remove it from the spindle mount.
 - a. Use a 4mm hex key to loosen the two (2) M5×55mm SHCS on the front of the mount.
4. Free the Y2-end of the X-Axis belt from the Y2-carriage. (No need to remove the Y1-end).
 - a. Use a 4mm hex key to remove the M5×10mm SHCS securing the belt clip.
 - b. Remove the clip from the end of the belt and pull the belt free from the X-motor pulley and idlers.
 - c. **CARRY OVER** the **belt**, **belt clip**, and **M5×10mm SHCS**.
5. Label the X- and Z-motor lead cables AND their gray extension cables.
 - a. Use a permanent marker or piece of tape to label the white male/female connectors of the X- and Z-stepper motor lead cables AND the gray X- and Z-stepper motor extension cables.
6. Disconnect the X- and Z-motor cables at the back of the Z-Plus.

WARNING: Do NOT disconnect motor connectors by pulling on the wires or by prying at the latch. Use pliers to gently grip the base of each white connector and pull apart.

Shapeoko 3 Machines: Open the Carbide Motion board enclosure and disconnect the both the X- and Z-motor lead cables. Label the white female connector of the X-motor with a permanent marker or piece of tape.

Disconnect the Proximity Switches and X-Axis Drag Chain Head and Remove the Z-Plus

See **Fig. 4** (front) and **Fig. 5** (back).

1. Remove the Z-Axis proximity switch from the front of the Z-Plus.
 - a. Disconnect the Z-Axis proximity switch from the gray Z-Axis proximity switch extension cable.

Shapeoko 3 Machines: Disconnect the Z-Axis proximity switch from the Carbide Motion board.

- b. Use a 2.5mm hex key to remove the two (2) M3×18mm SHCS.
 - c. **CARRY OVER** the Z-Axis proximity switch.
2. Remove the X-Axis proximity switch from the switch plate on the rear of the Z-Plus.
 - a. Use a 2.5mm hex key to remove the two (2) M3×18mm SHCS securing the switch to the plate.
 - b. **CARRY OVER** the X-Axis proximity switch (installed in drag chain).

3. Remove the Y-Axis proximity switch from the switch plate on the outside of the Y2-carriage.
 - a. Use a 2.5mm hex key to remove the two (2) M3×18mm SHCS securing the switch to the plate.
 - b. **CARRY OVER** the Y-Axis proximity switch (installed in drag chain).

4. Remove the Y-Axis proximity switch plate and two (2) standoffs from the outside of the Y2-carriage.
 - a. Use a 4mm hex key to remove the two (2) M5×8mm SHCS securing the plate.
 - b. Remove the two (2) 30mm standoffs.

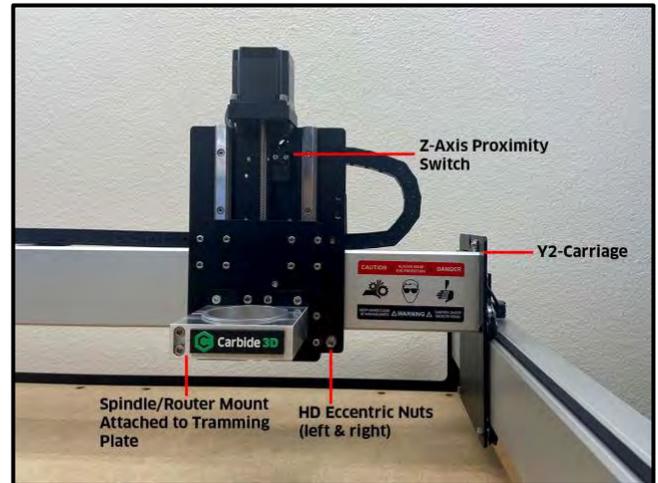


Figure 4

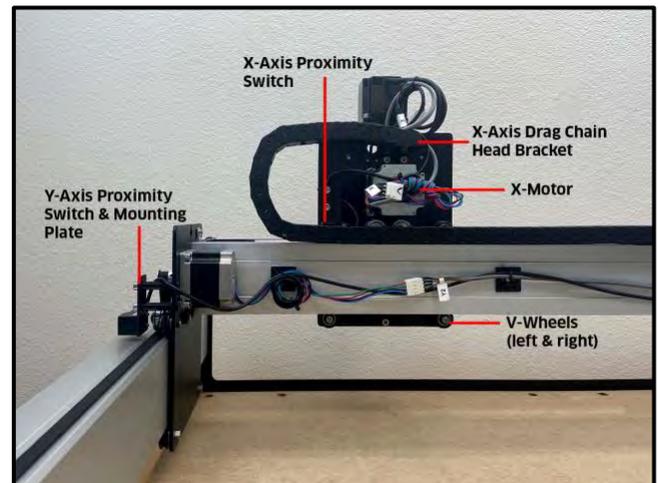


Figure 5

Shapeoko 3 Machines: Skip 5 and move ahead to 6 on the next page.

5. Disconnect the X-Axis drag chain from the X-Axis head bracket on the rear of the Z-Plus.
 - a. Use a 2mm hex key to remove the two (2) M3×6mm FHS securing the drag chain to the head bracket.
 - b. Drape the drag chain over the Y1-carriage to get it out of the way (no need to disconnect the tail end).
6. Remove the lower two (2) V-wheels from the Z-Plus.

- a. Hold the eccentric nuts steady with a 10mm wrench and use a 4mm hex key to remove the V-wheels.
7. Lift the Z-Plus away from the X-rail and lay it on the baseframe.

Disassemble the Z-Plus

1. Remove the tramming plate/spindle mount from the front of the Z-Plus.
 - a. Use a 4mm hex key to remove the four (4) M5x8mm SHCS securing the tramming plate.
2. Remove the router/spindle mount from the tramming plate.
 - a. Use a 3mm hex key to remove the two (2) M5x16mm BHCS securing the mount.
 - b. **CARRY OVER** the **router/spindle mount** and **M5x16mm BHCS**.
3. Remove the X-motor (lower motor) from the back of the Z-Plus.
 - a. Use a 4mm hex key to remove the four (4) M5x10mm SHCS securing the motor.
 - b. **CARRY OVER** the **X-motor**.

Assemble the HDZ

NOTE: The application of a blue (i.e. light/medium grade) thread locker is at your discretion. We suggest adding it post-assembly if any screws happen to work their way loose during use.

Get Familiar with the HDZ

1. Take a minute to familiarize yourself with the front and back of the HDZ. See *Fig. 6*.

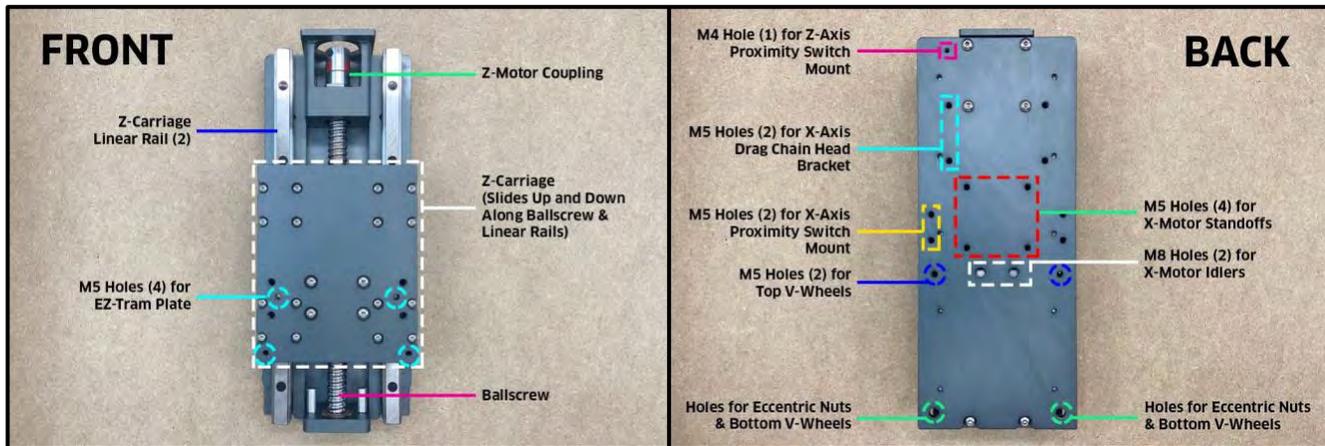


Figure 6

Install the X-Motor Idlers, X-Motor Standoffs, and X-Axis Proximity Switch Mount

Located in HDZ Kit:

Item	Description	Qty
E	M8 Guide Bearing	4
F	M8 Spacer	2
G	M8 Washer	2
H	M8 × 30mm Button Head Cap Screw	2
C	X-Motor Standoff	4
T	X-Axis Proximity Switch Mount	1
U	M5 × 25mm Socket Head Cap Screw	2

- Assemble the two X-motor idlers in this order:
 - M8×30mm BHCS
 - M8 washer
 - M8 guide bearing, flange **TOWARD** BHCS head
 - M8 guide bearing, flange **AWAY FROM** BHCS head
 - M8 spacer
- Install idlers onto the back of the HDZ. See *Fig. 7*.
 - Use a 5mm hex key to secure the idlers to the two M8 screw holes in the center of the plate.
- Hand-screw the standoffs to the back of the HDZ. See *Fig. 7*.
 - Do NOT use tools or overtighten the standoffs.
 - Screw the standoffs into the four evenly-spaced M5 screw holes at center of the plate just above the idlers.
- Install the X-Axis proximity switch mount to the back of the HDZ. See *Fig. 7*.
 - Align the mount with the two M5 screw holes on the Y2-side of the X-motor standoffs.
 - The two M3 PEM nuts face out (away from X-motor standoffs).
 - Use a 4mm hex key and two (2) M5×25mm SHCS to secure.
 - Before fully tightening the screws, slide the mount toward the X-motor standoffs as far as it will go.



Figure 7

Install the X-Axis Drag Chain Head Bracket, Z-Axis Proximity Switch Mount, and V-Wheels

HDZ Kit:

Item	Description	Qty
Q	X-Axis Drag Chain Head Bracket	1
R	M5 × 8mm Socket Head Cap Screw	2
Z	Z-Axis Proximity Switch Mount	1
AA	M4 × 6mm Button Head Cap Screw	1
L	V-Wheel	2
M	M5 × 25mm Socket Head Cap Screw	2
N	M5 Washer (Shim)	2

1. Install the X-Axis drag chain head bracket to the back of the HDZ. See **Fig. 8**.
 - a. Align the bracket with the two vertical M5 screw holes above and to the Y2-side of the X-motor standoffs.
 - b. Use a 3mm hex key and two (2) M5×10mm SHCS to secure.
2. Install the Z-Axis proximity switch mount to the back of the HDZ. See **Fig. 8**.
 - c. Align the mount with the M4 screw hole at the top of the HDZ.
 - d. Use a 2.5mm hex key and one (1) M4×6mm BHCS to secure the mount at the top of the HDZ.
3. Assemble the top two V-wheels in this order:
 - a. M5×25mm SHCS
 - b. V-wheel
 - c. M5 washer (shim)
4. Install the top two V-wheels on the back of HDZ, in line with the idlers. See **Fig. 8**.
 - a. Use a 4mm hex key to secure the V-wheels to the M5 screw holes to the outside of the idlers.
 - b. Check wheel spin. If shims are properly placed between wheels and carriage plate, the wheels will spin with little to no resistance.



Figure 8

Install the Z-Motor

HDZ Kit:

Item	Description	Qty
D	M5 × 10mm Socket Head Cap Screw	4
P	Z-Motor	1

1. Install the Z-motor at the top of the HDZ. See **Fig. 9** and **Fig. 10**.
 - a. Insert the Z-motor drive shaft into the motor coupling at the top of the HDZ.
 - b. Position the motor with the lead cable toward the back of the HDZ.
 - c. Use a 4mm hex key and four M5×10mm SHCS to secure the motor.
 - d. Use a 2.5mm hex key to tighten the set screw at the top of the motor coupling.

NOTE: Ensure both set screws on the coupling are tight. Failure to do so will lead to slippage. Using a small amount of blue thread lock on the motor shaft and ball screw shaft is acceptable.

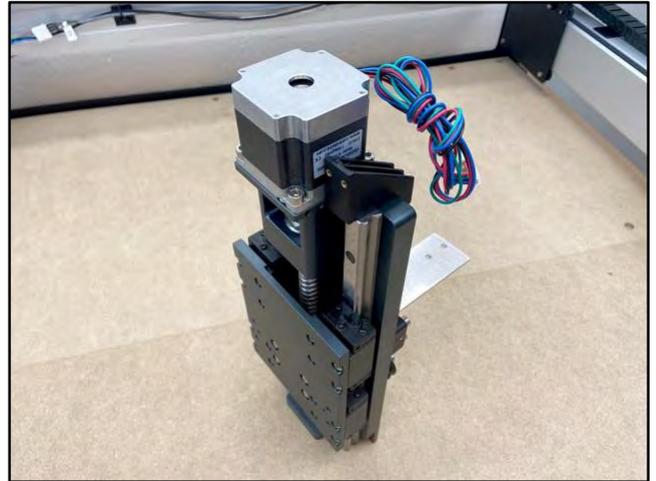


Figure 9

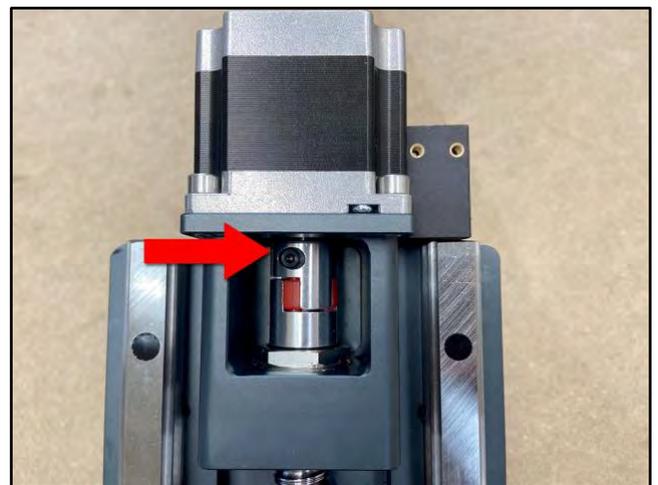


Figure 10

Install the Router/Spindle Mount and EZ-Tram

HDZ Kit + Carryover Components:

Item	Description	Qty
B	EZ-Tram Plate	1
I	M5 × 18mm Socket Head Cap Screw	2
J	M5 × 10mm Socket Head Cap Screw	2
K	HD Eccentric Spacer (Non-Threaded)	2
HH	Router/Spindle Mount [CARRYOVER]	1
II	M5 × 16mm Button Head Cap Screw [CARRYOVER]	2

1. Attach the EZ-Tram plate to the router/spindle mount. See **Fig. 11**.
 - a. Align the front of the plate with the M5 screw holes on the back of mount.
 - b. Ensure the plate's recessed holes face out and the oval through-holes are on top.
 - c. Use a 3mm hex key and the two (2) M5×16mm BHCS to secure.
2. Assemble eccentric spacers in this order:
 - a. M5×18mm SHCS
 - b. HD eccentric spacer (nut side **TOWARD** screw head).

NOTE: Be careful not to confuse the eccentric spacers and eccentric nuts. Eccentric spacers are non-threaded.

3. Loosely attach the EZ-Tram to the front of the HDZ. See **Fig. 12**.
 - a. Align the EZ-Tram with corresponding M5 screw holes on the front of the HDZ.
 - b. Insert M5×18mm SHCS and spacers into the through-holes at the top of the EZ-Tram.
 - c. Finger-tighten the SHSC and position the eccentric spacers with the dimple facing up.
 - d. Insert the two (2) M5×10mm SHCS into the EZ-Tram's bottom through-holes and finger-tighten.

NOTE: See Trimming Instructions at the end of this guide for information on how to tram the HDZ.



Figure 11

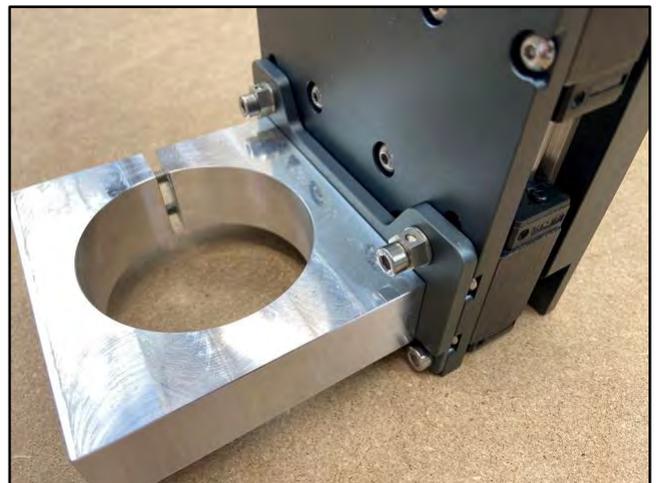


Figure 12

Install the HDZ

Insert the Eccentric Nuts

Located in HDZ Kit:

Item	Description	Qty
O	HD Eccentric Nut (Threaded)	2

1. Insert the two HD eccentric nuts into the bottom of the HDZ. See *Fig. 13*.
 - a. Rotate the eccentric nuts into their fully-open position with the dimple facing up.



Figure 13

Install the HDZ onto the X-Rail

HDZ Kit:

Item	Description	Qty
L	V-Wheel	2
M	M5 × 25mm Socket Head Cap Screw	2
N	M5 Washer (Shim)	2

1. Assemble the bottom two V-wheels in this order:
 - a. M5×25mm SHCS
 - b. V-wheel
 - c. M5 washer (shim)
2. Lift the HDZ onto the X-rail, aligning the top V-wheels with the upper V-rail.
3. Install the bottom two V-wheels on the back of the HDZ. **Fig. 14** and **15**.
 - a. Be sure V-wheels are properly seated on lower V-rail.
 - b. Use a 10mm wrench to hold eccentric nuts in the fully open position (dimples up).
 - c. Use a 4mm hex key to secure both V-wheels to the HD eccentric nuts.
 - d. Check HDZ movement by rolling carriage back-and-forth along the X-rail.
4. Tension the HD eccentric nuts.
 - a. Rotate the eccentric nuts **CLOCKWISE** to tension. Reach under and spin the V-wheel with your finger. If it rotates freely, keep tightening until you feel some friction against the rail.

NOTE: If your V-wheels are not turning freely, check to make sure the shims are correctly positioned between the V-wheel and carriage plate.

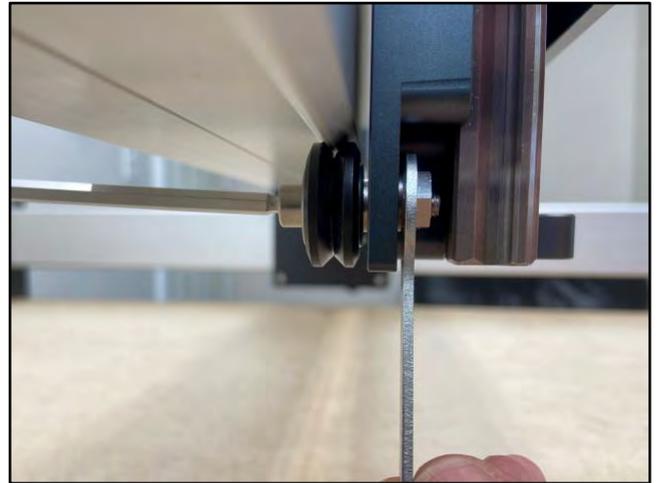


Figure 14

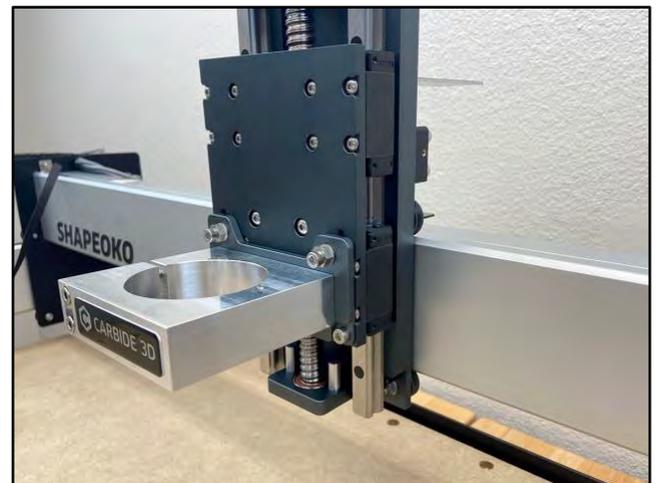


Figure 15

Install the X-Motor

HDZ Kit + Carryover Components:

Item	Description	Qty
D	M5 × 10mm Socket Head Cap Screw	4
GG	X-Motor [CARRYOVER]	1

1. Thread the free end of the X-Axis belt under the idlers at the back of the HDZ.
2. Push a large loop of belt up between the idlers. See *Fig. 16*.
3. Attach the X-motor to the four standoffs on the back of the HDZ.
 - a. Position the motor lead cable to the Y1-side.
 - b. Use a 4mm hex key and four (4) M5×10mm SHCS to secure. See *Fig. 17*.
4. Pull the slack out of the belt.

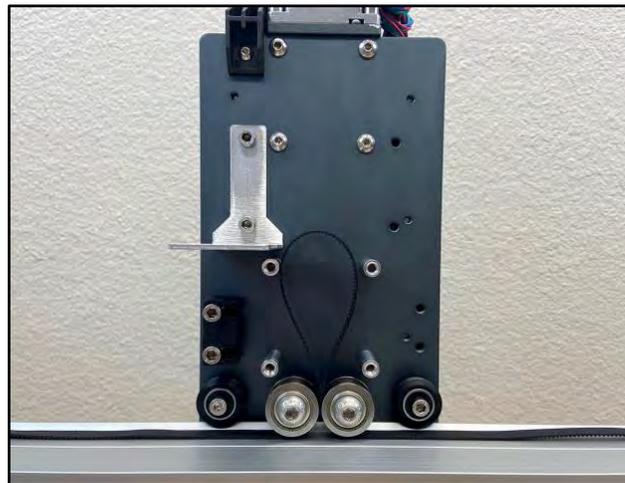


Figure 16

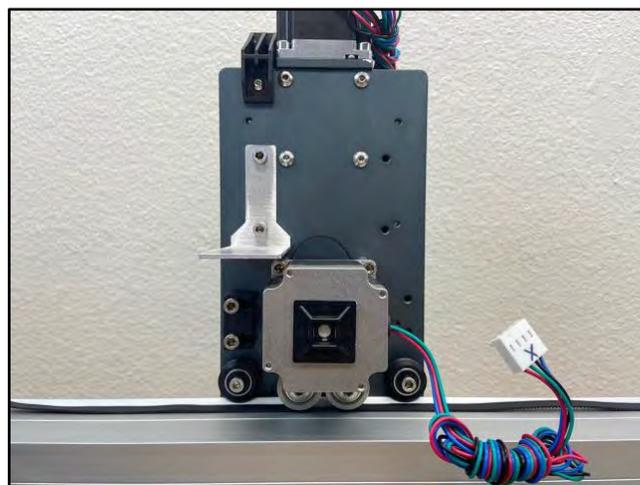


Figure 17

Install the X-Axis Belt

Carryover Components:

Item	Description	Qty
FF	X-Axis Belt & Hardware: Belt Clip (1), and M5 × 10mm Socket Head Cap Screw (1) [CARRYOVER]	3

1. Install and tension the X-Axis belt. See **Fig. 18** (image from back).
 - a. Attach the belt clip to the free end of the belt.
 - b. Place the belt flat along the rail leaving a ¼-inch gap between the clip and carriage plate.
 - c. Use a 4mm hex key and the M5×10mm SHCS to secure.
 - d. Tighten until an audible tone can be heard when the belt is plucked.



Figure 18

Secure the Drag Chain to the X-Axis Head Bracket

HDZ Kit:

Item	Description	Qty
S	M3 × 6mm Flat Head	2

1. Secure the X-Axis drag chain to the X-Axis head bracket on the back of the HDZ. See **Fig. 19**.
 - a. Use a 2mm hex key and two (2) M3×6mm FHS to secure.

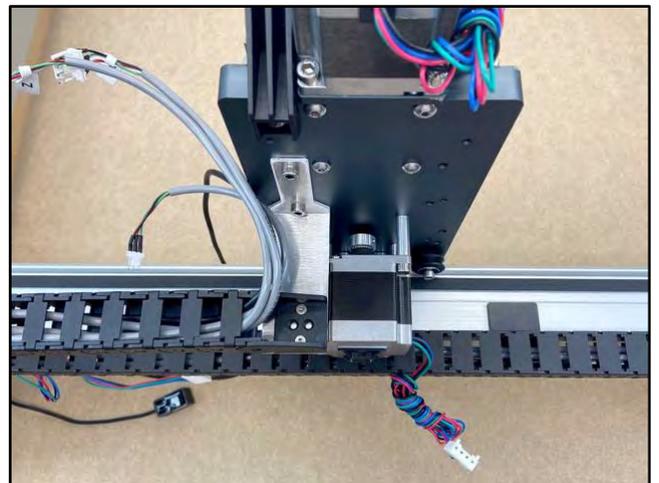


Figure 19

Install the Proximity Switches

Install the X- and Z-Axis Proximity Switches to the Mounts

HDZ Kit + Carryover Components:

Item	Description	Qty
DD	X-Axis Proximity Switch (Installed in the Drag Chain) [CARRYOVER]	1
V	M3 × 18mm Socket Head Cap Screw	2
EE	Z-Axis Proximity Switch [CARRYOVER]	1
BB	M3 × 18mm Socket Head Cap Screw	2

1. Attach the X-Axis proximity switch to the X-Axis proximity switch mount installed on the rear of the HDZ. See *Fig. 20*.

- a. Locate the X-Axis proximity switch exiting the drag chain at the X-Axis head bracket.
- b. Position the proximity switch with the red LED facing the Y2-carriage and the target pointing down.
- c. Align the proximity switch's mounting slots with the two M3 holes on the face of the mount.
- d. Use a 2.5mm hex key and two (2) M3×18mm SHCS to secure the proximity switch.

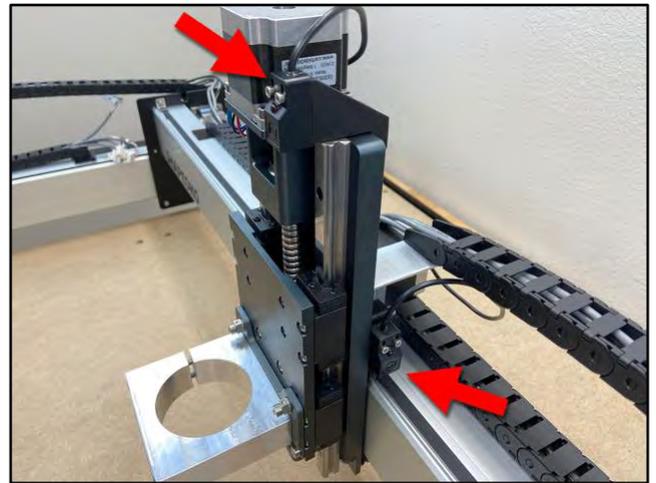


Figure 20

- e. Before fully tightening the screws, slide the switch up as far as it will go.
2. Attach the Z-Axis proximity switch to the Z-Axis proximity switch mount installed at the top of the HDZ. See *Fig. 20*.
 - a. Position the Z-Axis proximity switch with the red LED facing the front and the target pointing down.
 - b. Align the proximity switch's mounting slots with the two M3 holes on the face of the mount.
 - c. Use a 2.5mm hex key and two (2) M3×18mm SHCS to secure the proximity switch.
 - d. Before fully tightening the screws, slide the switch up as far as it will go.

Shapeoko 3 Machines: Skip #3 and move ahead to the “Install the Y-Axis Proximity Switch” section on page 58.

3. Connect the Z-Axis proximity switch to the gray extension cable.
 - a. Locate the gray Z-Axis proximity switch extension cable exiting the drag chain at X-Axis head bracket.
 - b. Connectors are polarized. Be sure to align them properly.

Install the Y-Axis Proximity Switch

HDZ Kit + Carryover Components:

Item	Description	Qty
DD	Y-Axis Proximity Switch (Installed in the Drag Chain) [CARRYOVER]	1
W	Y-Axis Proximity Switch Mount	1
X	M5 × 35mm Socket Head Cap Screw	2
Y	M3 × 18mm Socket Head Cap Screw	2

1. Install the Y-Axis proximity switch mount to the outside of the Y2-carriage. See **Fig. 21**.
 - a. Use a 4mm hex key and two (2) M5×35mm SHCS to secure the mount to the outside of the Y2-carriage.
2. Attach Y-Axis proximity switch to the mount. See **Fig. 21**.
 - a. Locate the Y-Axis proximity switch exiting the drag chain at the Y1-Axis head bracket.
 - b. Position the proximity switch with the red LED facing out and the target pointing to the rear.
 - c. Align the switch's two mounting slots with the two M3 PEM nuts on the mount.
 - d. Use a 2.5mm hex key and two (2) M3×18mm SHCS to secure.
 - e. Before fully tightening the screws, slide the switch as far to the FRONT as it will go.

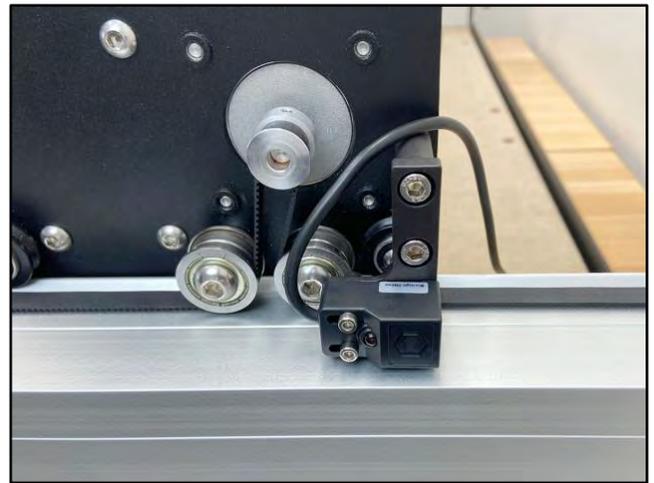


Figure 21

Connect and Cleanup Wiring

HDZ Kit:

Item	Description	Qty
CC	Cable Ties	Several

1. Connect the X- and Z-motor lead cables to their labeled extension cables at the rear of the HDZ.
 - a. Both the X- and Z-motor extensions exit the head of the X-Axis drag chain behind the HDZ.
 - b. Connectors are polarized. Be sure to align them properly.
2. Use a couple of cable ties to tidy up the X- and Z-motor cables at the rear of the HDZ.

Post Assembly

Update the Software Settings

WARNING: The HDZ is supported by Carbide Motion 4.17 onwards. Do NOT use an older version of Carbide Motion.

Update Software

1. Download and install Carbide Motion from: <https://carbide3d.com/carbidemotion/download/>.
2. Confirm all of the proximity switches and motors are connected correctly, then, ensure that there is nothing restricting the Shapeoko's movement.

Update Settings

WARNING: Do NOT try to home or jog the Shapeoko before applying the updated settings.

Machines With BitSetter: Do NOT enable or re-calibrate your BitSetter at this time. After updating your settings, checking your proximity switches, and homing, complete the "Re-Calibrate the BitSetter" steps on the next page.

Now, you're ready to turn the Shapeoko on and make the required software changes.

1. Connect your machine to Carbide Motion.
 - a. Plug in your USB cable.
 - b. Open Carbide Motion.
 - c. Turn your Shapeoko on.
 - d. Click the **Connect to Cutter** button.
2. Update your machine settings. See *Fig. 22*.
 - a. Click **Settings** in the top menu bar.
 - b. In the Settings window, choose your Shapeoko size from the **Size dropdown list**, then choose "HDZ, Full X Travel (Ballscrew)" from the **Z-Axis Type dropdown list**, and then choose "Inches" or "MM" from the **Units dropdown list**.
3. Click the **Send Configuration Data** button in the middle of the dialog window.
4. The configuration data will send. Wait until this has finished before moving on to test your proximity switches.

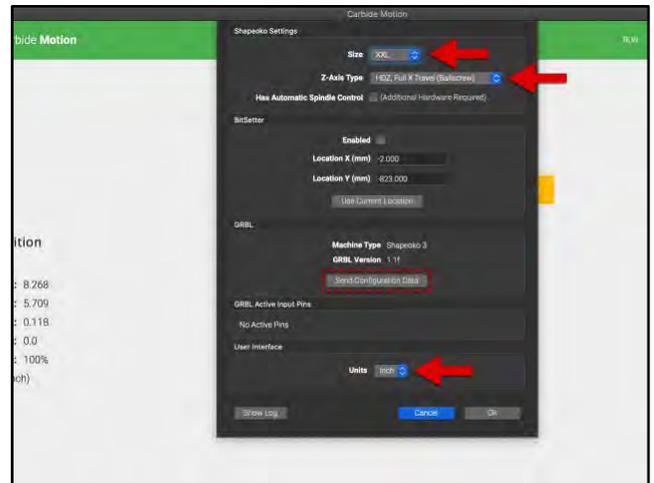


Figure 22

Check Proximity Switches

Double check that your proximity switches are installed 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 Carbide Motion board.

A detailed video on proximity switch testing is available here: <https://youtu.be/Zf8NPmxrEDs>.

Home Your Shapeoko

Once all proximity switches have been checked, you are ready to use your Shapeoko again!

1. Click the yellow **Initialize Machine** button to home your Shapeoko with the HDZ.

Re-Calibrate the BitSetter

Machines With BitSetter: Complete the steps below to re-calibrate your BitSetter.



Figure 23

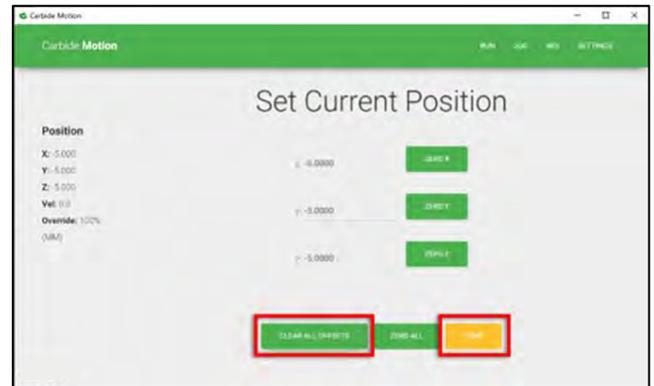


Figure 24

After updating your settings and homing your Shapeoko, you will need to clear offsets and change your machine coordinates:

1. Clear machine offsets.
 - a. Click **Jog** in the top menu bar.
 - b. Click the **Set Zero** button. See *Fig. 23*.
 - c. On the Set Current Position screen, click the **Clear All Offsets** button. Then, click **Done**. See *Fig. 24*.

2. Position your spindle directly above the BitSetter.
 - a. Click the **Position** label. This will toggle the view to the machine coordinates. See *Fig. 25*.
 - b. Click **Rapid Position**, then click the **SE** button to move the spindle to the front-right of the machine. Once in position, click **DONE**. See *Fig. 25*.
 - c. From the Jog screen, use the arrows on the screen (or the arrows on your keyboard) to jog the gantry so the spindle is directly above the BitSetter.

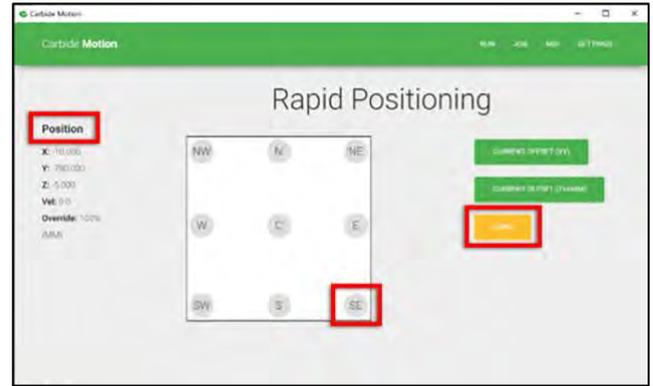


Figure 25

Once you have the spindle positioned directly above the BitSetter, we need to permanently save this location:

1. Click **Settings** in the top menu bar.
2. Recalibrate your BitSetter. See *Fig. 26*.
 - a. In the BitSetter box, select the **Enabled** checkbox.
 - b. With your spindle directly above the BitSetter, click the **Use Current Location** button to set the location. This will permanently save the X/Y location of your BitSetter.
3. Click **Ok** to save and close the window.

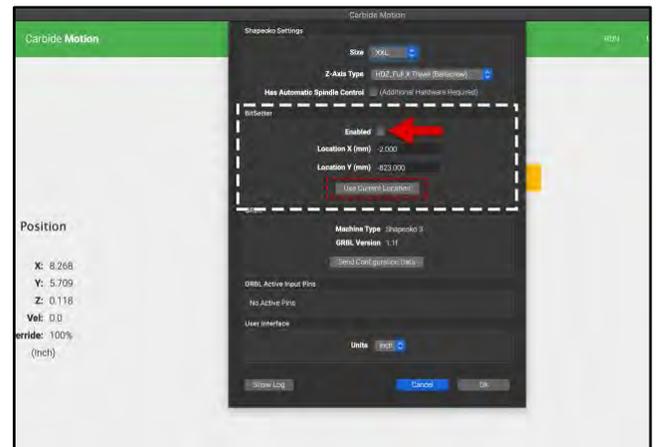


Figure 26

Maintenance

4. The HDZ is pretty much maintenance-free. We recommend keeping it as dust-free as possible. A quick coat of synthetic oil (such as Mobil Vactra No. 2 Oil) on the rails and ball screw every 6 months. All the parts are rubber-sealed. You can also inject oil by removing the central M4 screw from the end of a bearing block and injecting machine grease through a syringe.

Tramming Instructions

Once your spindle is re-installed you can tram it quickly and easily using the EZ-Tram plate.

1. Loosen the four (4) EZ-Tram screws so they are just finger tight. Rotate both eccentric spacers to their lowest points (dimple up).
2. Then level out your Z-Axis.
 - a. Rotate the eccentric spacers as needed to tram the spindle from front to back, using aluminum foil as a shim.
 - b. Once you're happy with the front-back, move on to left/right.
 - c. Use a 10mm wrench to rotate the upper eccentric nuts CLOCKWISE. This will lower or raise one side of the mount, adjust accordingly to tram your Z-Axis.
3. Once your Z-Axis is level, lock down the position of the eccentric nuts by tightening the M5×18mm SHCS.

You might need to repeat this process a few times doing a small surfacing cut in between each adjustment to analyze your level.

65mm or 80mm Spindle Mounts: There should be no need to tram the motor left/right, as it is precision milled. Fit the 65mm or 80mm mount directly to the holes on the front of the HDZ using the M6 bolts provided in the 65mm/80mm spindle mount kit.

A detailed video on tramming your Shapeoko can be found here: <https://www.youtube.com/watch?v=rGOGINurgIE>. For additional advice on tramming, check out the Carbide 3D community: community.carbide3d.com.

Happy milling!