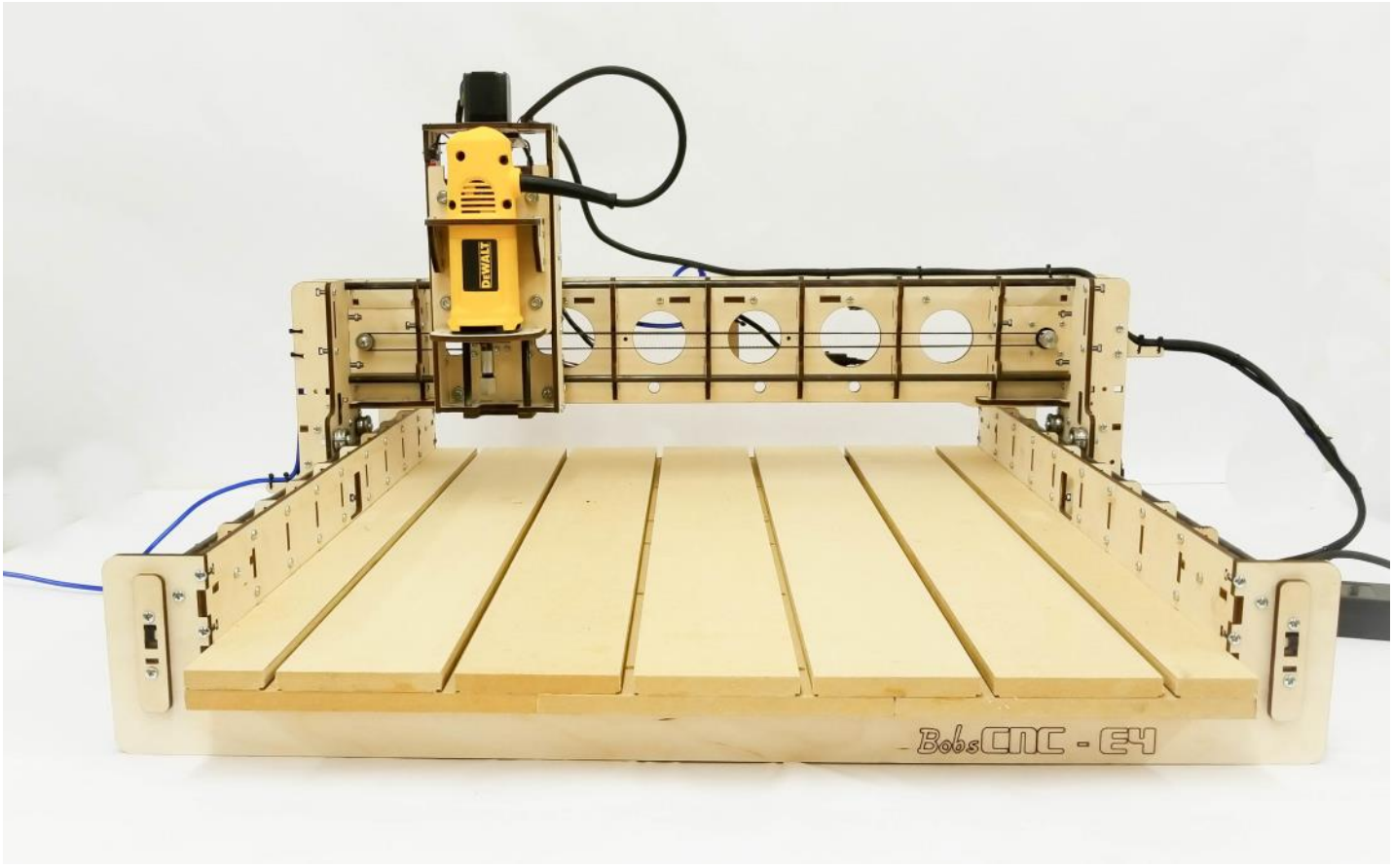
BobsCNC E4

Simple Cost Effective Designs



Assembly Manual

Version 1.11

Table of Contents

Specifications

The E4 CNC Router has the following features:

- Rigid laser cut frame.
- Fully supported rail system with SG20U bearings.
- GT2 belt drive on X and Y axis.
- 5/16-18 coupler nut on the Z axis.
- Home switches on all axes.
- MDF T-Slot Spoilboard with T-Nut inserts.

The assembled footprint:

Length:	30" (630 mm)
Width:	37.2" (945 mm)
Height:	18.9" (480 mm)

Assembled Weight:

32 lbs.

Cutting Area:

X:	24" (610 mm)
Y:	24" (610 mm)
Z:	3.3" (85 mm)

The complete E4 parts list can be found in the appendix.

Safety First

Safety is *your* responsibility. Use the proper protective equipment and "safety sense" when building and operating your CNC Router.

Routers have a high voltage power supply and use bits that spin at 30,000 rpm with cutting edges that are hazardous. The operator must understand these hazards and is responsible to take appropriate safety precautions before operating the Router.

Please review the entire assembly instructions before starting to build the E4 CNC Router.

E4 Shop Safety Precautions & Warnings

Safety First

Read and follow all operating and safety instructions in the Assembly Instruction Manual before operating machine.

- **Use only extension cords rated for 20 amps plugged into a dedicated outlet.**
- **Inspect the machine for maintenance issues: loose fasteners, damaged power cords, dull bits, etc.**
- **Do not operate machine with dull or damaged router bits.**
- **Always unplug machine after each use and when cleaning the router or changing router bits.**
- **Remove rings, bracelets, watches, necklaces before using machine.**
- **Wear tight fitting clothing and/or roll up long sleeves to prevent snagging.**
- **Use appropriate personal protective equipment (PPE) when operating machine including safety glasses and hearing protection.**
- **Keep hands, hair and clothing away from the moving parts of the machine.**
- **Do not operate the machine when under the influence of alcohol or drugs.**
- **Make certain workpiece is clamped securely in place before starting machine.**
- **Never leave the machine running unattended.**
- **Children must be supervised by adults when operating machine.**
- **Do not operate the machine in the presence of flammable materials.**
- **Keep floors clean, dry, and free of debris to eliminate slip and/or trip hazards.**
- **Have a suitably rated fire extinguisher on hand when machine is in operation.**

Getting Started

Required Tools

To assemble the kit you will need the following:

- Two ½" end wrenches to tighten Z Bearing nuts.
- A pair of long nose pliers to hold the nuts.
- Diagonal Cutters or sharp knife to trim nylon ties.
- Calipers or measuring tape to measure part placement.
- Small standard screwdriver to connect electronics.
- Small Phillips screwdriver to mount home switches and stepper motors.
- Medium Phillips screwdriver to build the main components.
- Sand paper to remove laser marks on the faces.
- Torx Driver or flat blade screwdriver for DeWalt disassembly.
- LOCTITE® 243 thread lock (fingernail polish can be used as a substitute).
- Wood Glue (e.g. Titebond®) for Spoilboard Assembly

To operate the E4 CNC Router you will need:

7/16" & 5/8" wrench to change router bits.

Computer with control software for GRBL.

Material for Project.

1/8" or 1/4" Router bits.

Dry lubrication (e.g., Teflon®).

Tools you may need for the electronic setup include:

Multimeter to correctly connect the power supply and stepper motors. A multimeter is a good tool to have for general electronic trouble shooting.

- We recommend using a large flat, clean working surface for assembling your E4.
- All screws (unless noted) should be installed snug, then rotated one 1 to 2-1/2 turns.
- Light sanding of the wood surfaces will clean up the marks made by the laser.
- Painting or applying stain with a clear coat will give added protection to the wood components.
- During assembly try placing 1 inch strips of blue painters tape behind the T-Slots to hold the nuts in place during assembly.

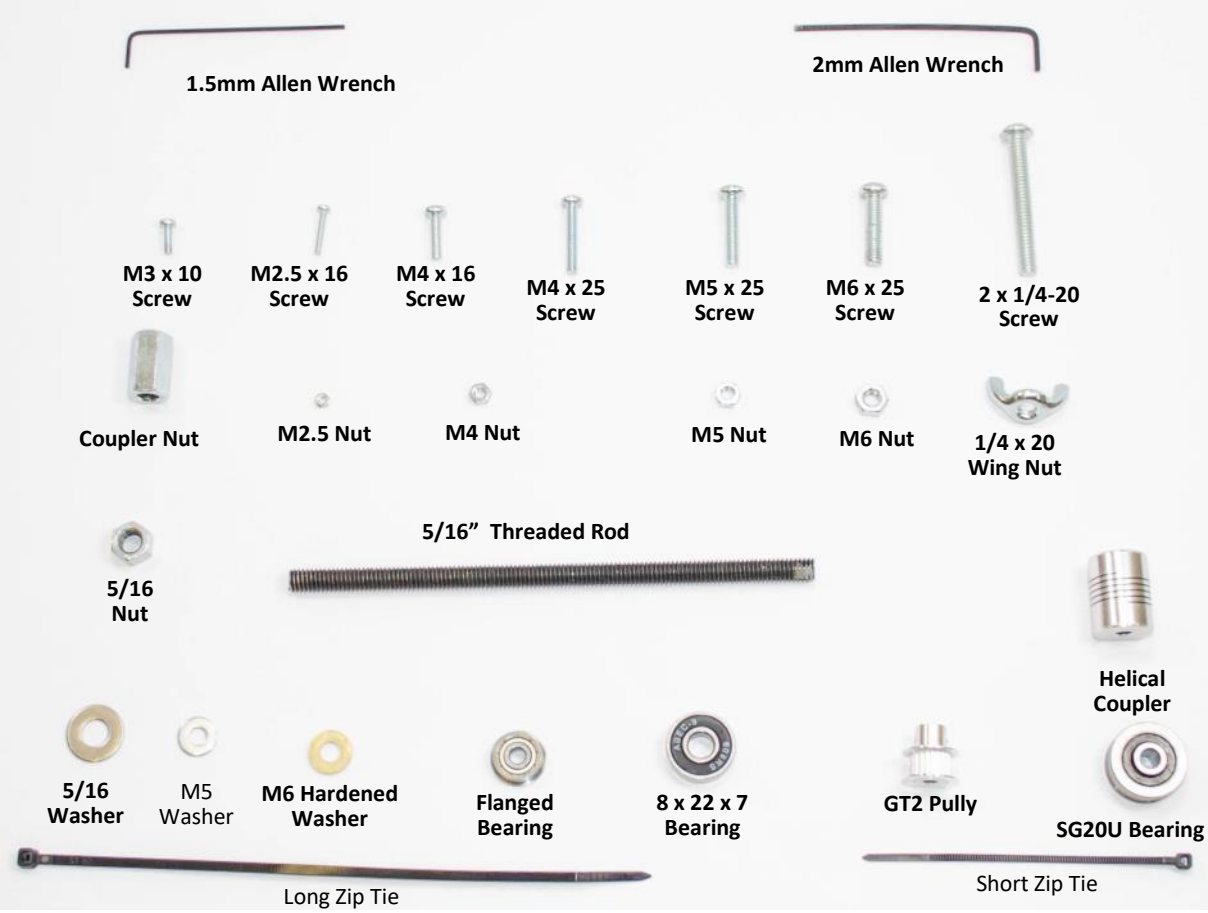
***For More Information: Click on the Links**

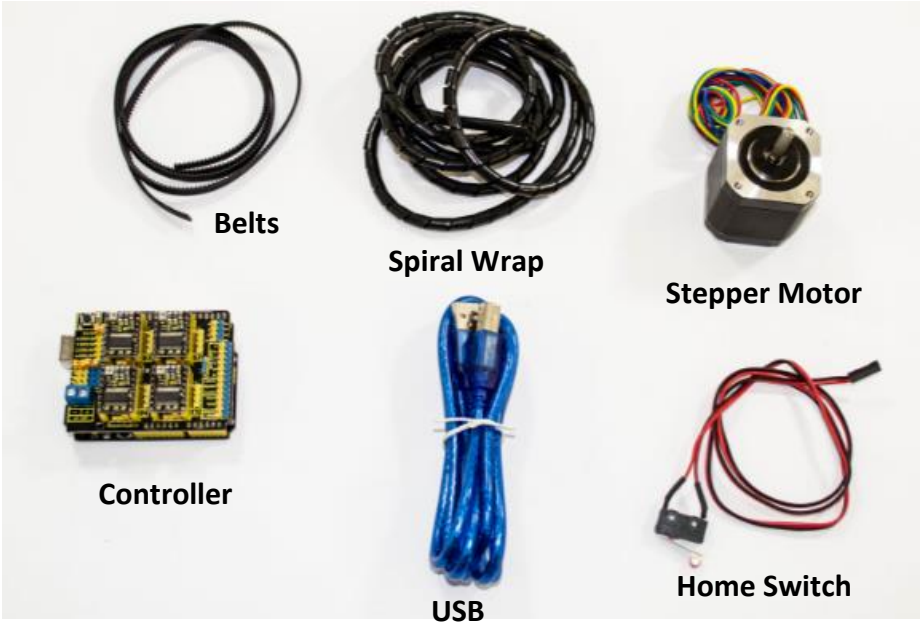
Quick Start and Troubleshooting guides are available to help you get up and running. Please check BobsCNC.com for the latest version.

CAUTION

Caution: This kit includes small parts that are a choking hazard for small children. Prior and during assembly, keep all parts out of the reach of small children.

E4 Parts Identification



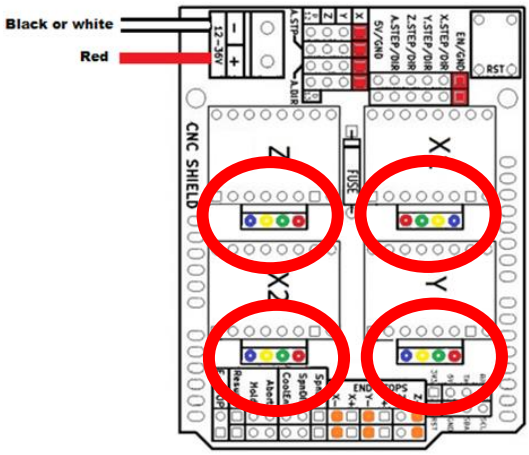


IMPORTANT NOTICE: The colored wires used to connect the Stepper Motor to the Controller will vary depending on the manufacturer. Please verify which type of motor you have received and follow the correct wiring diagram. Make certain the color of wire is attached to its corresponding connection as illustrated.

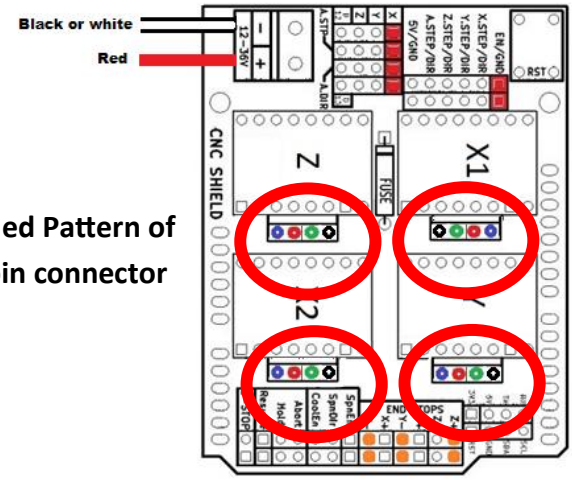
Type 1. See page 82 for wiring instructions.

Note Color Coded Pattern of the stepper 4 pin connector

Blue
Yellow
Green
Red



Type 2. See page 83 for wiring instructions.



The Type 2 Stepper motor ships with a separate wiring harness which must be connected to the motor. See below.

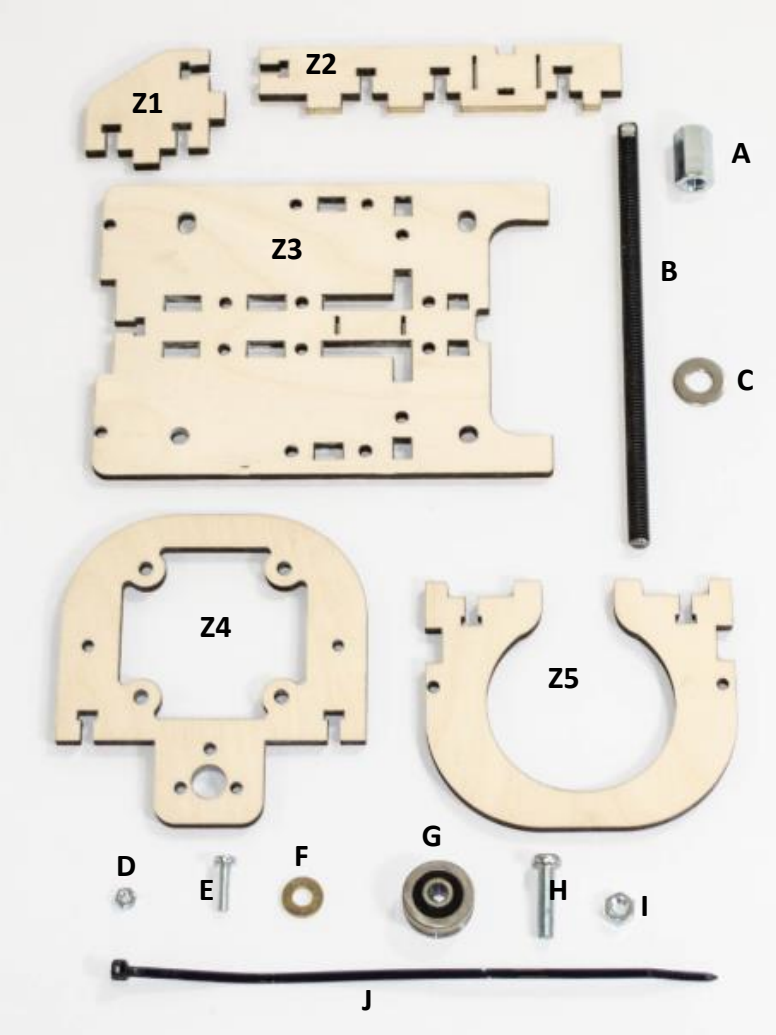
Note Color Coded Pattern of the stepper 4 pin connector

Black
Red
Green
Blue

Z Spindle Mount Assembly Instructions

Z Spindle Mount Wood Components

Part #	Qty	Component
Z1	2	Frame Mount Support
Z2	2	Z Frame Support
Z3	1	Z Frame
Z4	1	Z Spindle Bottom Mount
Z5	1	Z Spindle Top Mount



Z Spindle Mount Hardware

Part #	Qty	Hardware Description
A	1	Coupler Nut
B	1	Threaded Rod
C	2	5/16” Washers
D	19	M4 Nut
E	19	M4 x 16 Screws
F	8	M6 Hardened Washers
G	4	SG20U Bearings
H	4	M6 x 25mm Screws
I	4	M6 Nuts
J	1	Large Zip Tie
K	1	DeWalt 660 Rotary Tool

Step 1

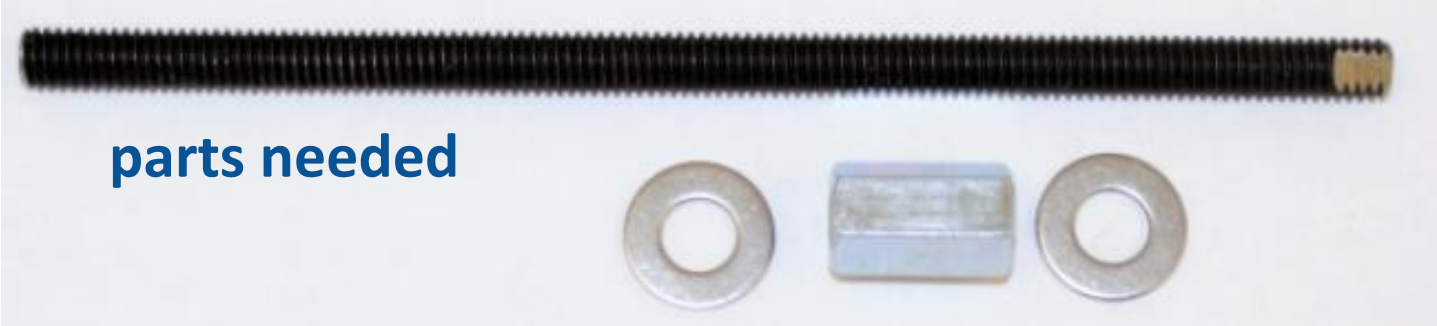
Apply dry lube (e.g. Teflon®) to the threads of the Threaded Rod.

IDEA

APPLY DRY LUBE TO THE THREADED ROD ONCE A MONTH . DRY LUBE IS A GOOD LUBRICANT FOR THE DUSTY ENVIRONMENT CREATED WHEN OPERATING YOUR E4 CNC.

Step 2

Thread the Coupler Nut on the Threaded Rod in the order as shown below: Steel Washer > Coupler Nut > Steel Washer (see photo below).

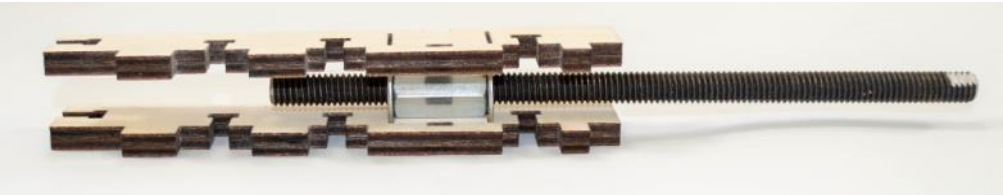


Step 3

Insert the washer and nut assembly in the Z Frame Support Slots.

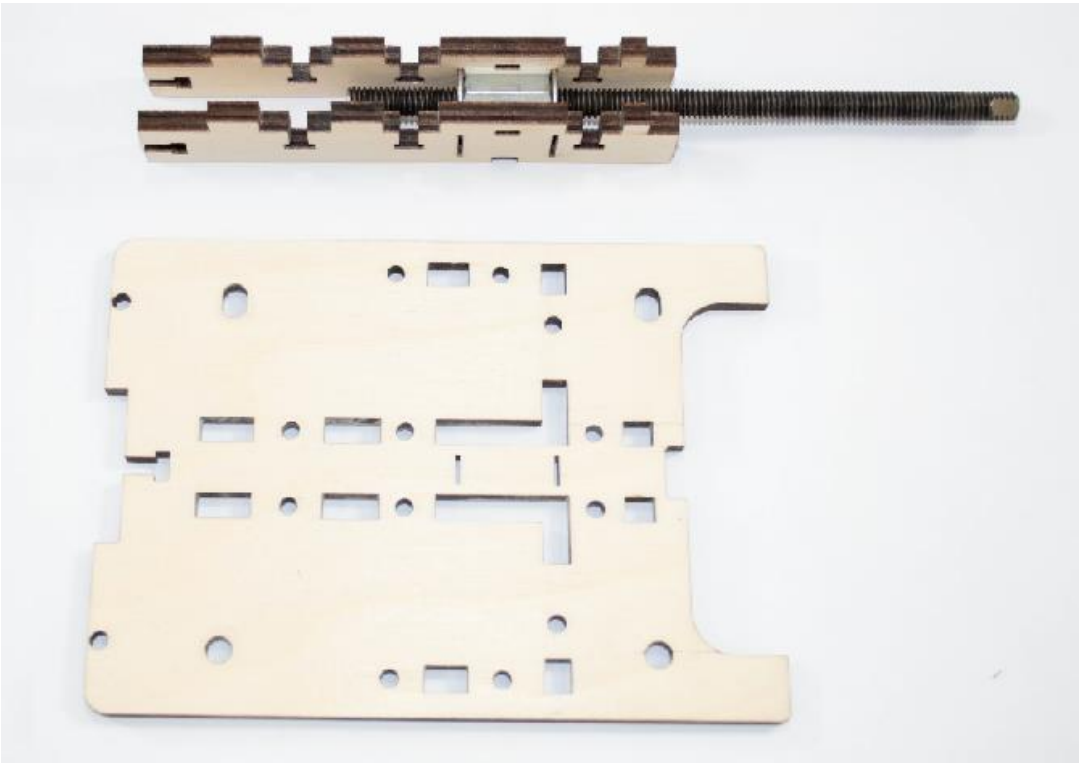
Step 4

Position second Z Frame Support on top of the washer and nut assembly.

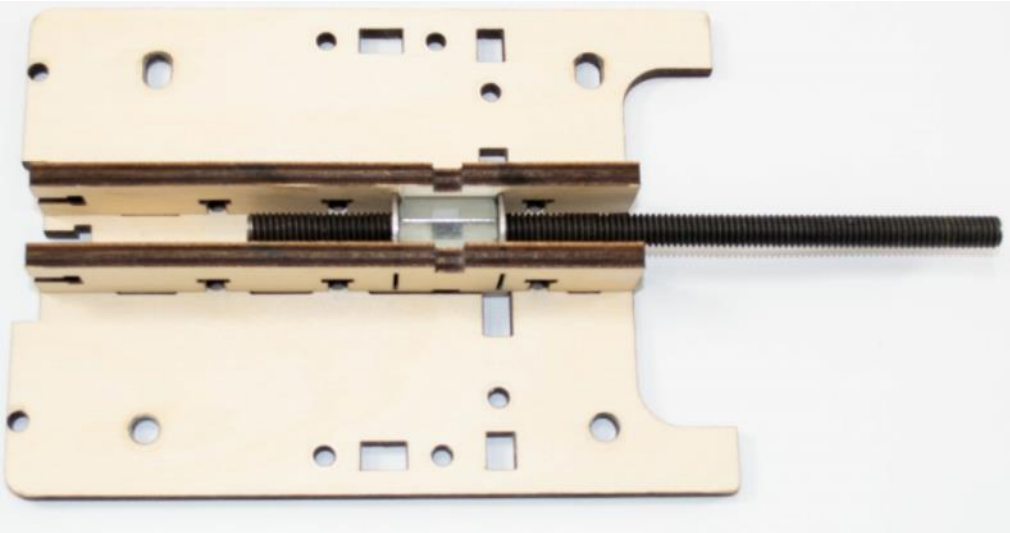


Step 5

Set tabs of Z Frame Supports in the corresponding Z Frame slots.



(The assembly should look like this).

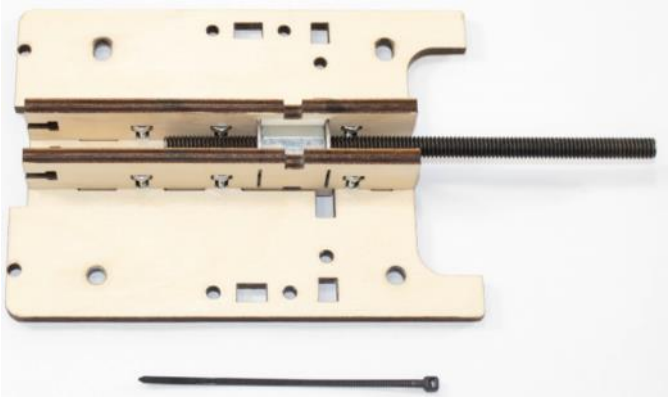


Step 6

Secure Assembly components with six M4 x 16 Screws and Nuts.

Apply LOCTITE® to all screws.

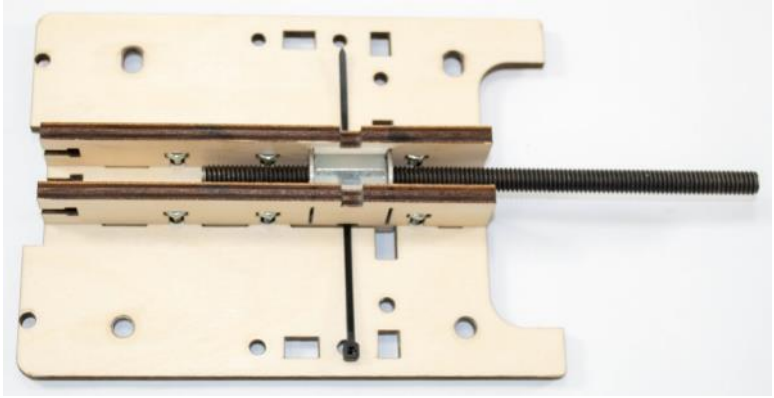
All screws (unless noted) should be installed snug, then rotated 1 to 2-1/2 turns.

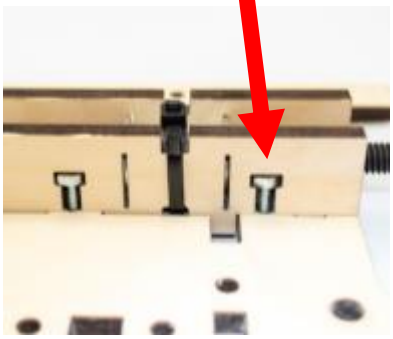


Position the nut in "T" of the T-Slot before inserting screws and tightening.

Step 7

Thread Large Zip Tie beneath Z Supports and coupler as shown and tighten securely.

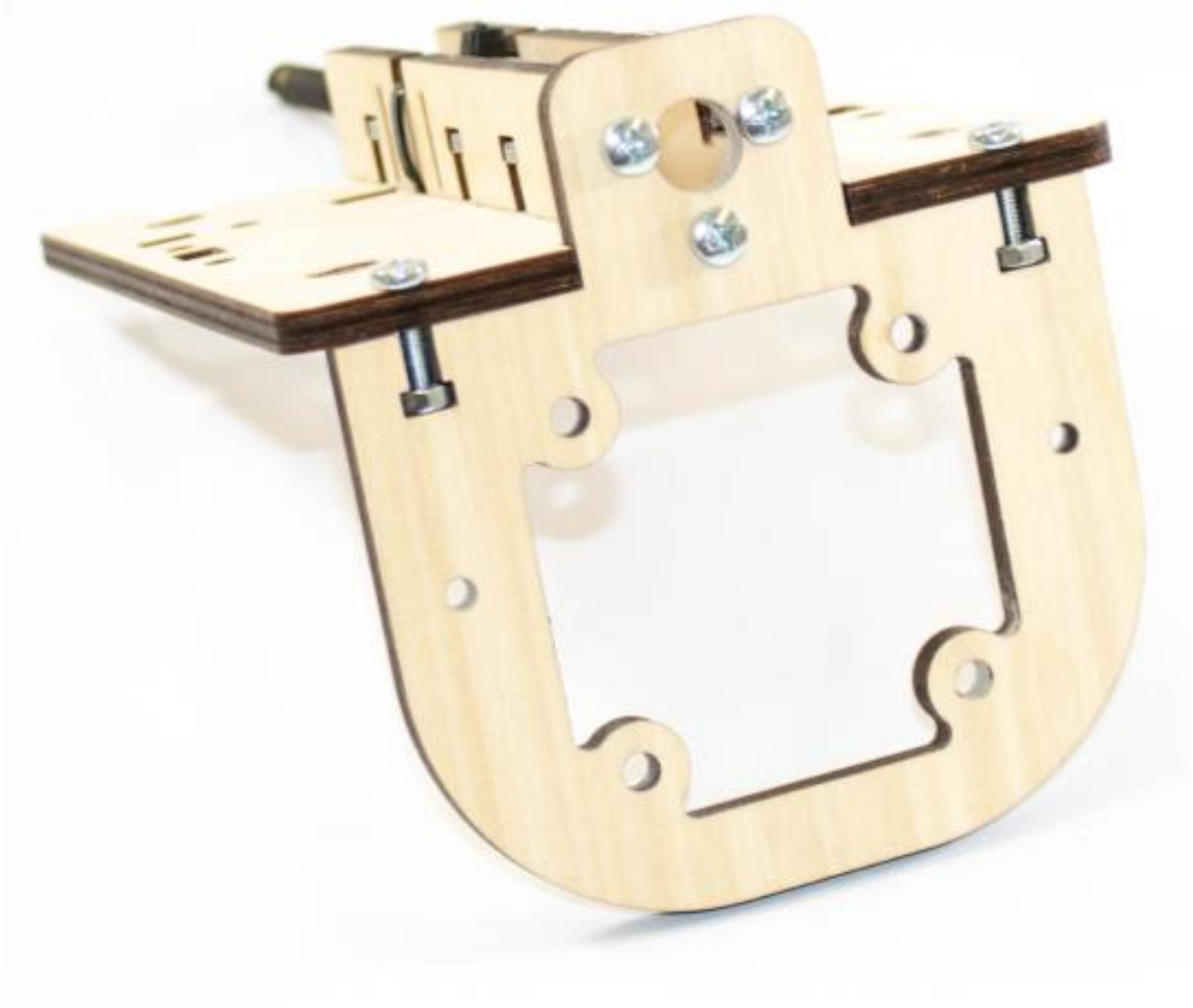




The 5/16 Threaded Rod should be centered through both washers, turn freely through the Coupler Nut and not rub on the washers.

Step 8

Place the Z Spindle Bottom Mount into the Z Frame and secure with five M4 x 16 Screws and Nuts as shown below.



Step 9

Preparing the DeWalt 660 Rotary Tool for Mounting (see next page for step by step instructions).




















Step by Step Instruction for preparing the DeWalt 660

A. Remove guide base assembly.

B. Remove the Collet Nut.

1. Press and hold down the Spindle Lock.
2. Use wrench to loosen Collet nut.
3. Remove Collet nut (do not discard the collet or the collet nut).

C. Remove the Spindle Cover

1. Using a Torx Driver (or flat blade screwdriver) remove the four DeWalt attachment screws. (DO NOT DISCARD).
2. Gently wiggle and slowly lift the shroud, *be careful not to remove spindle shaft*.
3. Remove Shroud exposing Spindle shaft .

Don't allow the black mount and spindle shaft to slip out of the yellow housing. If this happens you will need to remove the top cover and remove the motor brushes. Then you can reinsert the spindle shaft and re-install the brushes. Please see our Troubleshooting Guide for instructions on how to correctly remove and replace brushes.

Do not attempt to insert the motor shaft back into the housing without first removing the motor brushes. This will damage the DeWalt brush mount and void the warranty on your DeWalt 660 Rotary Tool .

Step 10

Place Z Spindle Top Mount over the DeWalt and slide into position.

The top mount must be compressed into the correct position so that the slots on the frame are aligned with the top mount tabs. Note the position of the cord stress relief (to the left) The DeWalt name plate will be facing up. The ID surface of the top mount may need to be sanded so that it can be squeezed into position.

Step 11

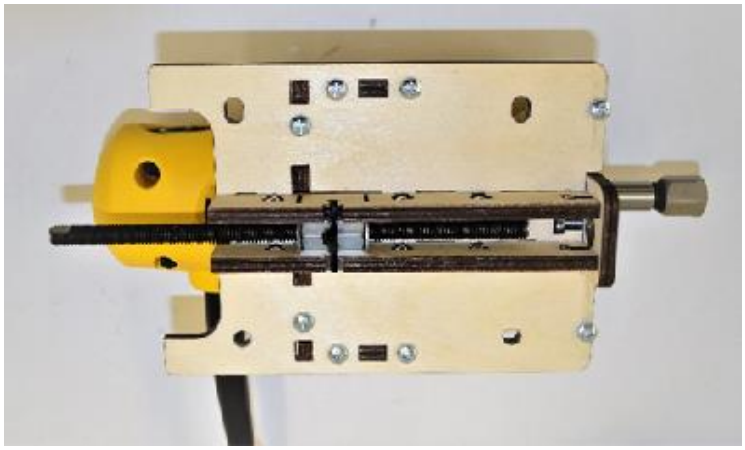
Using a Torx Driver (or flat head screwdriver), reinsert the four original DeWalt screws through the mount into the DeWalt as shown below:

Step 12

Place the Frame Mount Supports into the Z Frame and secure each with three M4 x 16 screws and nuts (see below):

Step 13

Secure the Z Spindle Top Mount with two M4 x 16 screws and nuts as shown.



Step 14

Install two SG20U Bearings with the M6 x 25 screws, M6 washers and M6 nuts in the round holes. The bearing hubs must face the wood as illustrated below. The screws should be installed snug, then rotated two to four turns.

Apply LOCTITE® to all screws.

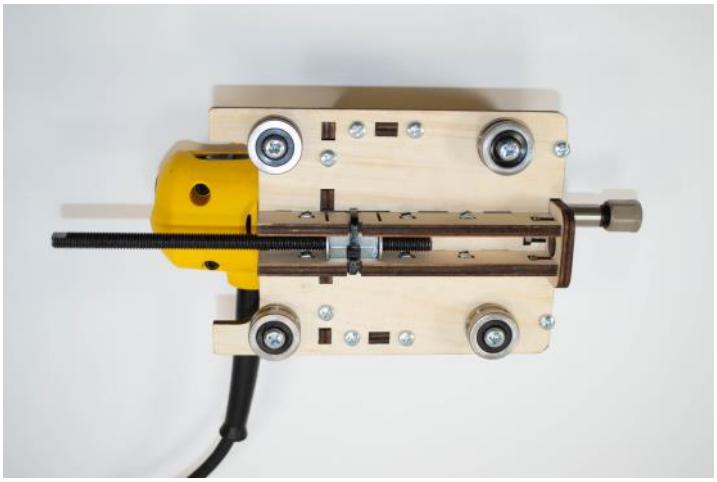
Make sure the hub of the bearing faces the wood. IMPORTANT: the screw must be oriented so that the nut is visible when looking at the front of the carriage (see photo below).

Hub

Step 15

Insert and move the two remaining SG20U Bearings in the elongated holes (photo below right) inward and snug the nuts then rotate 1/4 turn. The nuts will be tightened later when installed on the Y Carriage.

Completed Spindle Mount Assembly (back view):

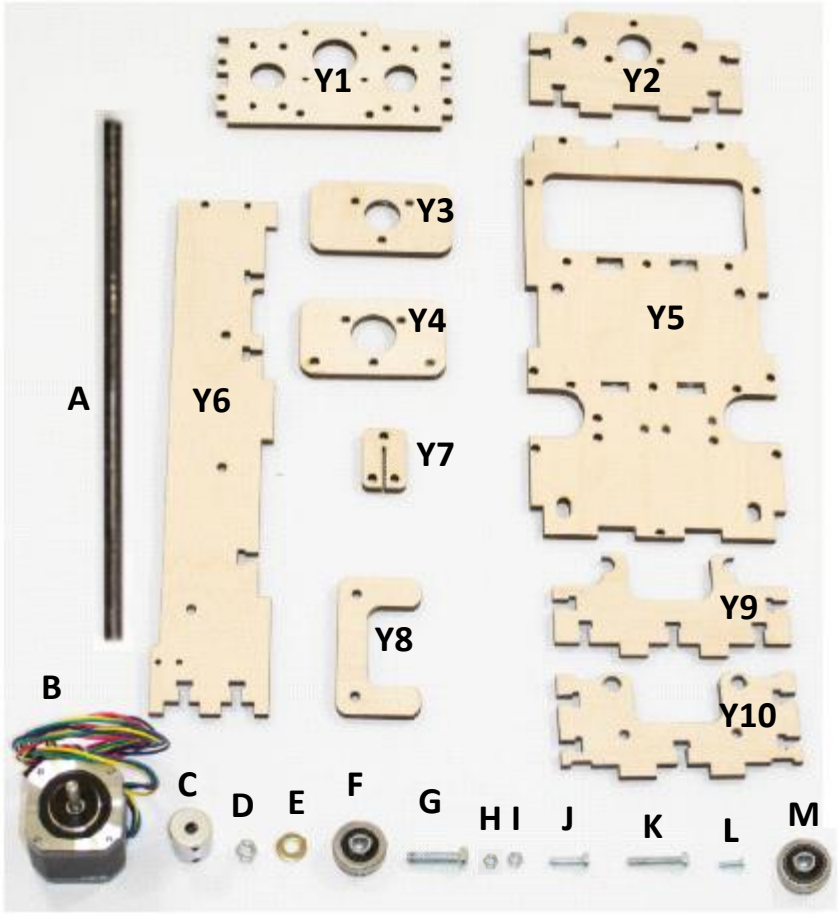


Completed Spindle Mount Assembly (front view):

Y Carriage Mount Assembly Instructions

Y Carriage Wood Components

Part #	Qty	Component
Y1	1	Z Stepper Motor Mount
Y2	1	Bearing Bottom Plate
Y3	1	Bearing Top Plate
Y4	1	Bearing Middle Plate
Y5	1	Y Carriage Frame
Y6	2	Y Carriage Side Support
Y7	2	Belt Retainers
Y8	1	Z Rail Stop
Y9	2	Z Rail Supports
Y10	1	Y Carriage Bottom Support



Part #	Qty	Hardware Description
A	2	Z Rails
B	1	Stepper Motor
C	1	Helical Coupler
D	2	5/16” Nuts
E	8	M6 Hardened Washers
F	4	SG20U Bearings
G	4	M6 x 25 Screws
H	4	M6 Nuts
I	40	M4 Nuts
J	37	M4 x 16 Screws
K	3	M4 x 25 Screws
L	4	M3 x 10 Screws
M	1	8 x 22 x 7 Bearing

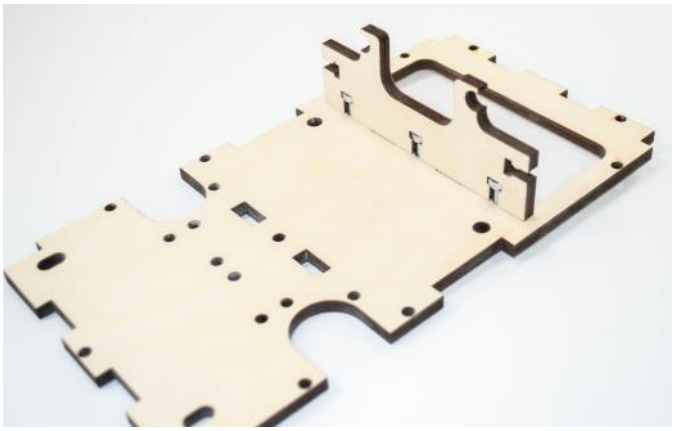
Try placing 1” strips of blue painters tape behind the T-Slots to help hold the nuts in place.

All screws (unless noted) should be installed snug, then rotated 1-1/2 to 2 turns.

Apply LOCTITE® to all screws.

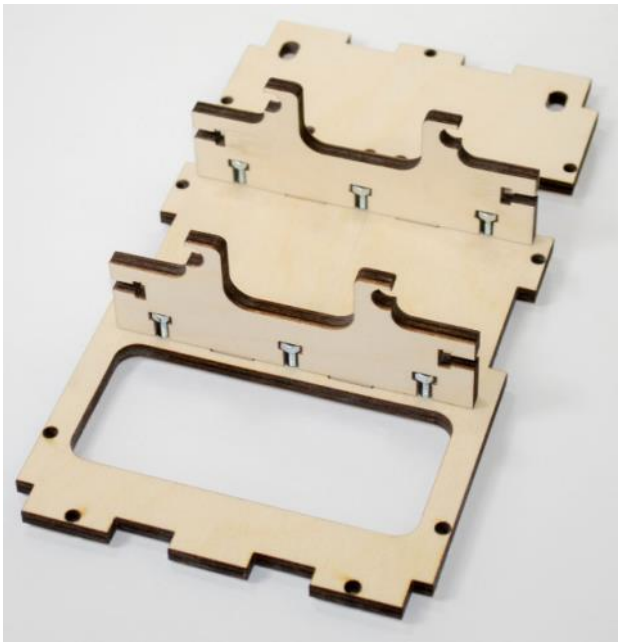
Step 1

Place Z Rail Support into the Y Carriage Frame and secure with three M4 x 16 Screws and Nuts (see below):

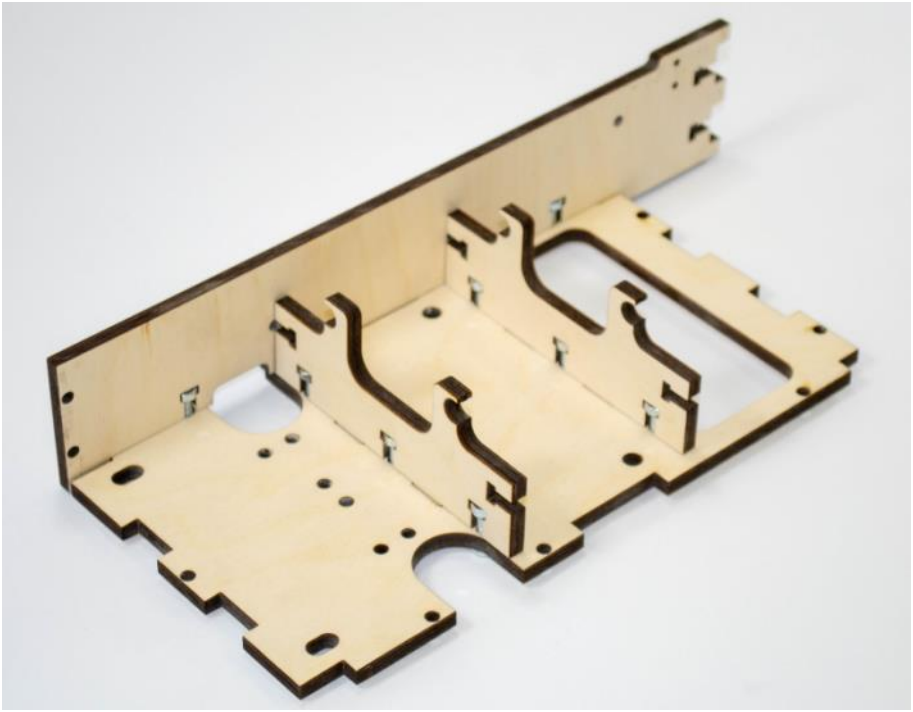


Step 2

Place second Z Rail Support into the Y Carriage Frame and secure with three M4 x 16 Screws and Nuts (see below):



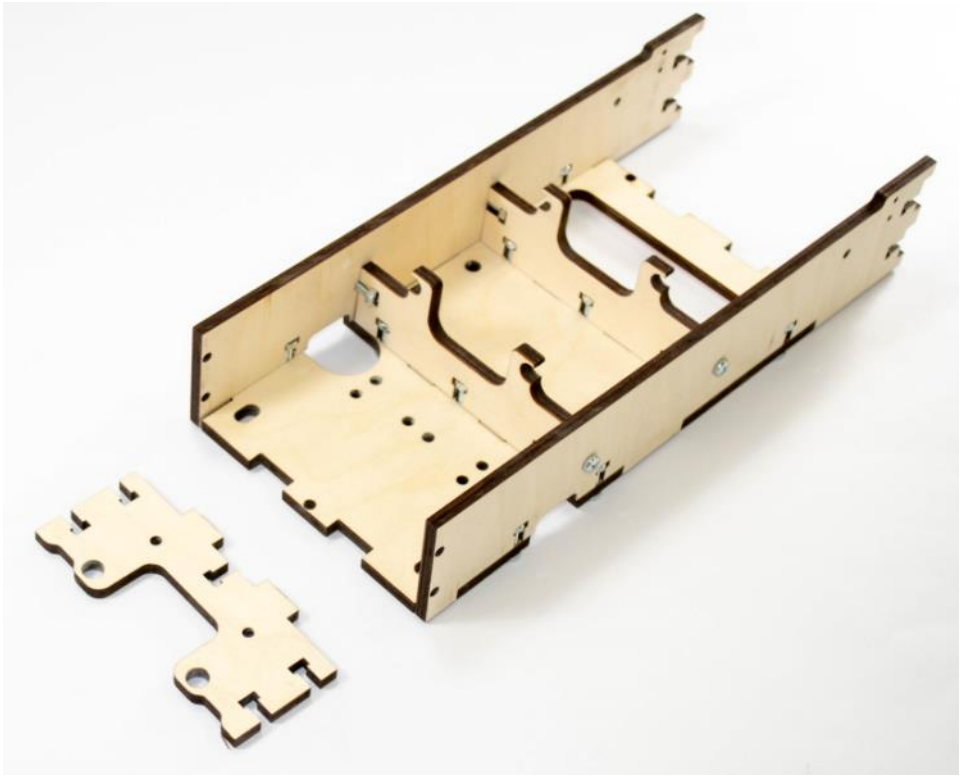
Step 3 Attach Y Carriage Side Support and secure with five M4 x 16 Screws and Nuts.

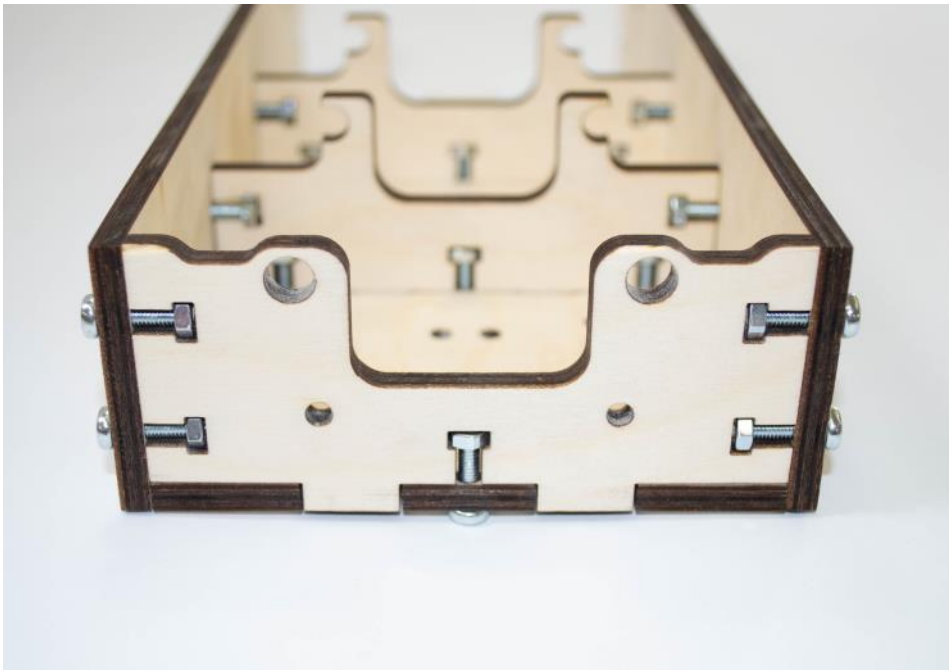


Step 4 Attach second Y Carriage Side Support and secure with five M4 x 16 Screws and Nuts.

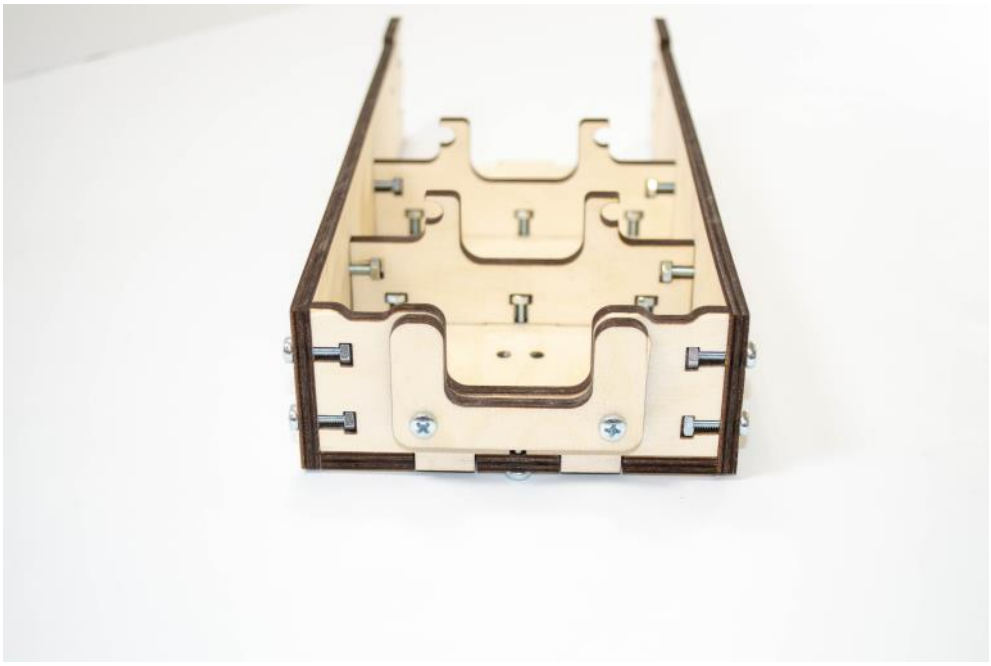
Step 5

Attach Y Carriage Bottom Support and secure with five M4 x 16 Screws and Nuts.





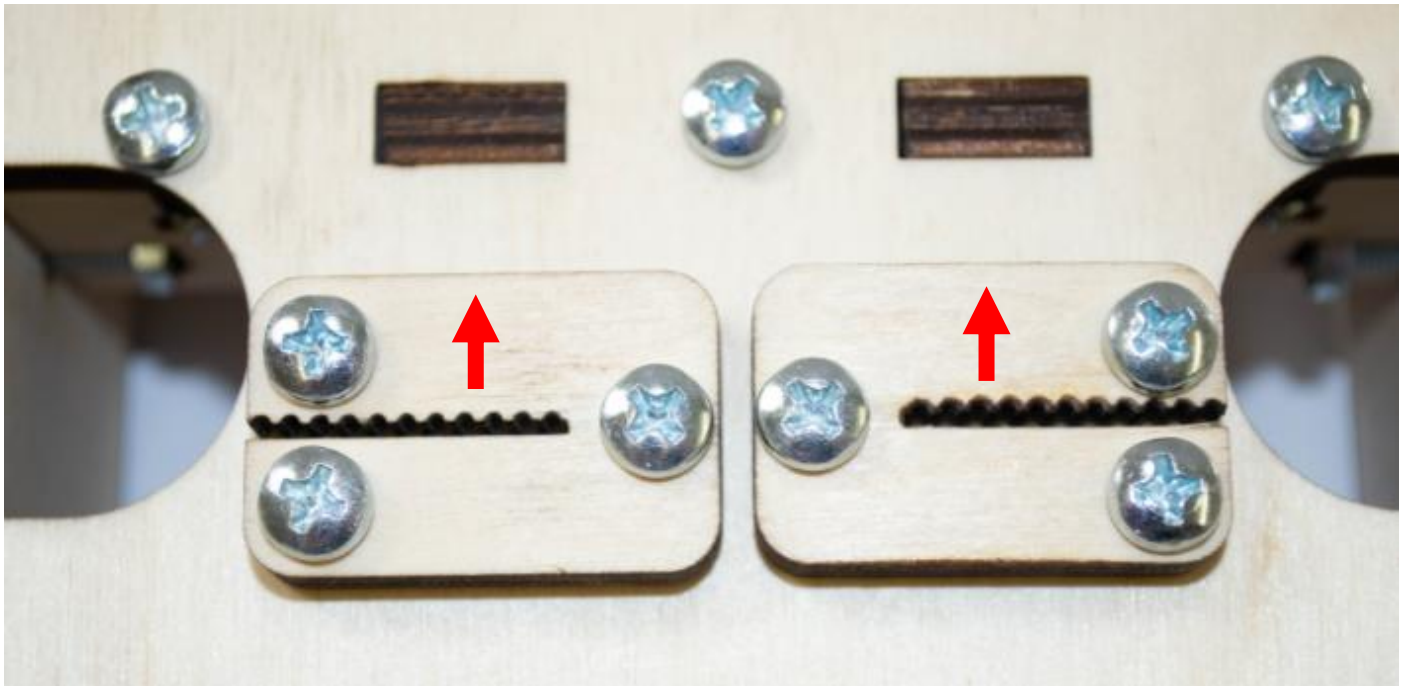
Step 6 Attach Z Rail Stop and secure with two M4 x 16 Screws and Nuts.



Step 7

Attach both Belt Retainers and secure with six M4 x 16 Screws and Nuts.

Be sure the tooth profile is on the top, smooth profile on the bottom (see photo below).



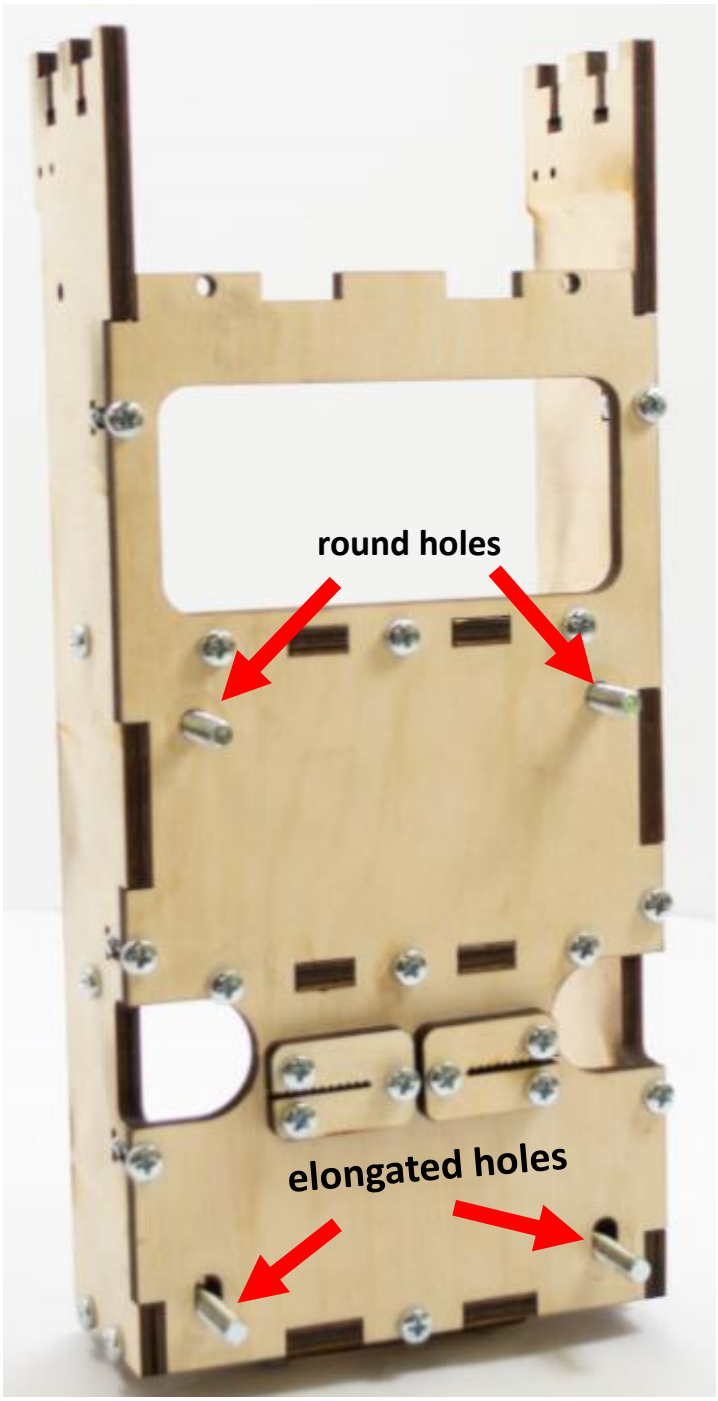
Step 8

Install four SG20U Bearings with the M6 x 25 Screws, 6 mm washers, and M6 Nuts .

Make sure the hub of the bearing faces the wood. IMPORTANT: the screw must be oriented so that the nut is visible when looking at the back of the carriage (see photo below).

Y Carriage Bolt sequence: Screw head / Hardened Washer / Plywood / Hardened Washer / Bearing / Nut

Notice that there are two round and two elongated holes in the Y Carriage Frame (left photo):



Insert screw through the hardened washer then through the plywood hole. Next, put second washer on the screw, then the bearing with the hub against the washer. Last, thread the nut on the screw and snug, then rotate two to four turns.

The finished installation of the bearings should look like this:

The Bearings in the round holes (on top) must be tight.

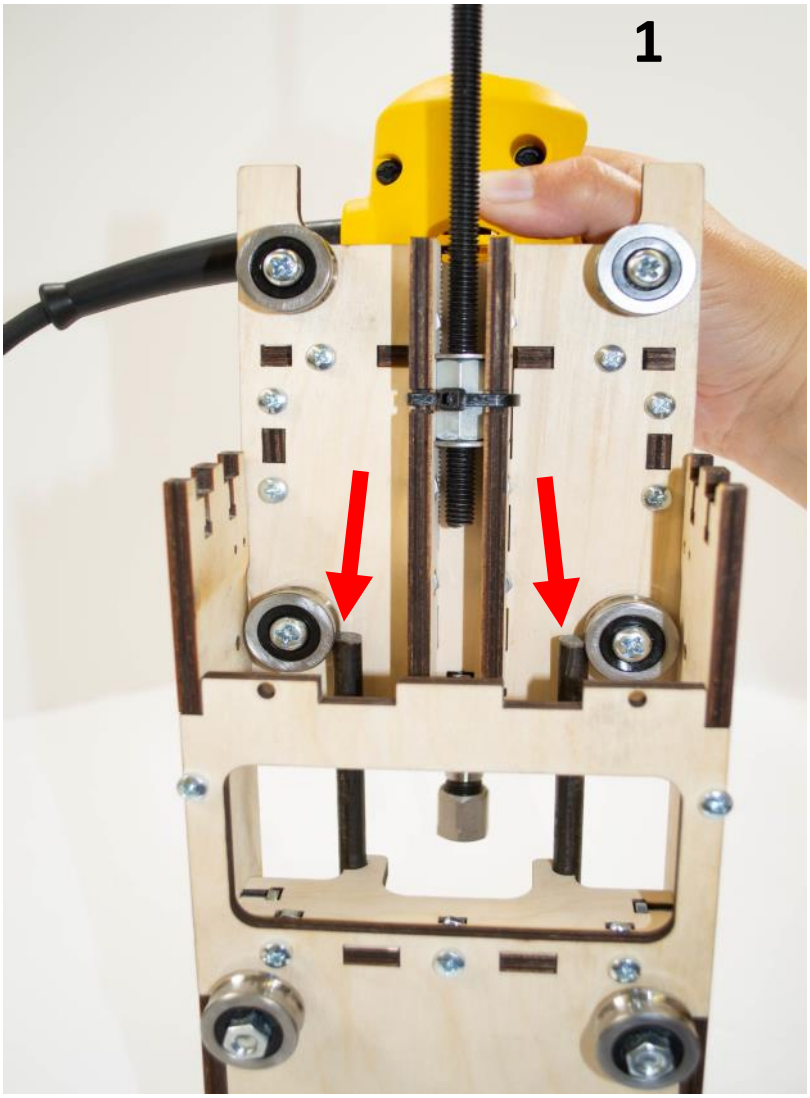
Bearings in the elongated holes should be snug and then rotated 1/4 turn.

Step 9

Gently insert the two Z Rails through the Z Rail Supports and into holes in the Y Carriage Bottom Support. Rotate the rails and thread them through the Z Rail supports. Do not “snap” the rods into the Rail Support.

Step 10

Attach Z Drive to Y Carriage. Gently slide Z Assembly Bearings over the Z Rails.

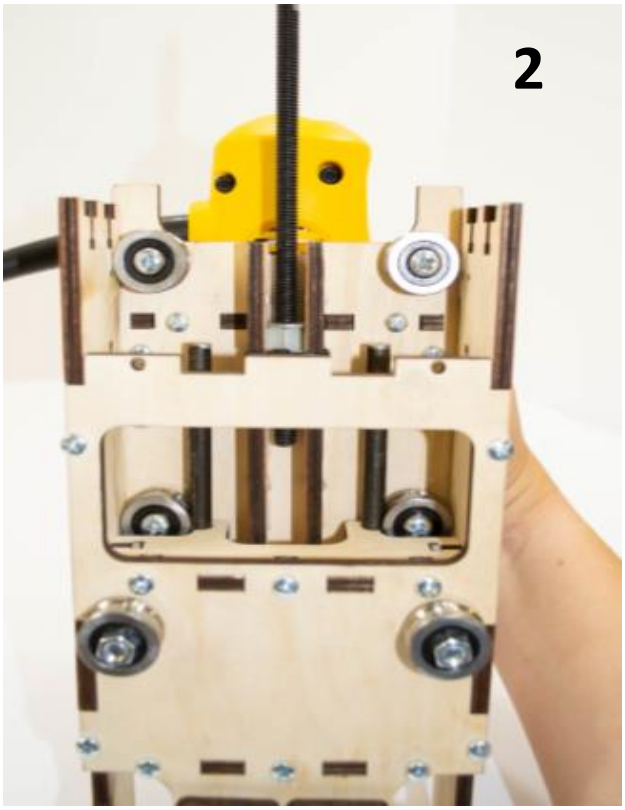


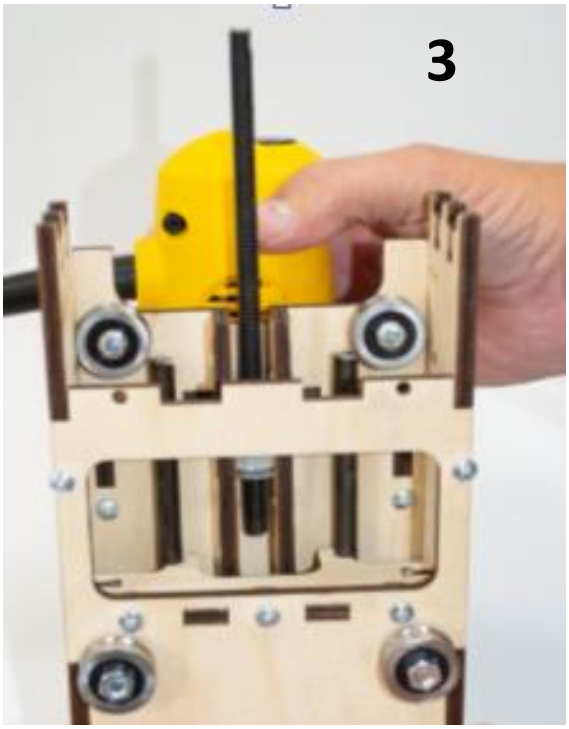
Do not force.

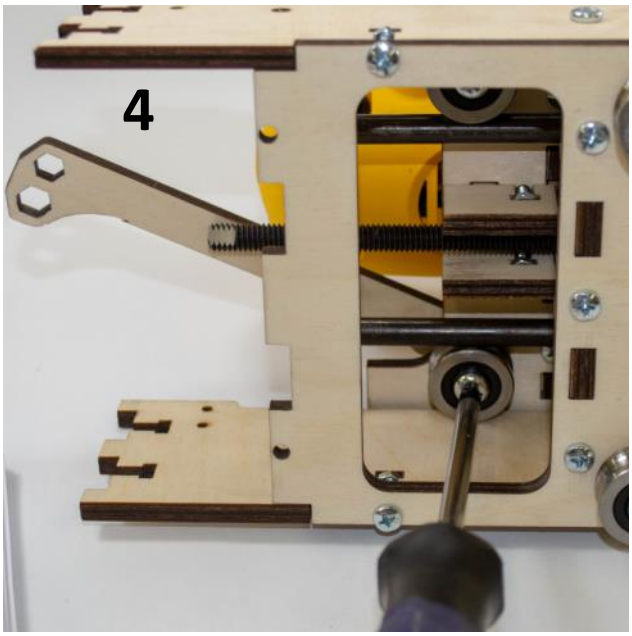
Please see the highlighted text below.

The SG20U Bearings should roll firmly. There should be a small amount of preload. If the Z Assembly doesn't gently of slide onto the rails or if the assembly sets loosely on the rails:

- **Remove the Z-Assembly from the rails.**
- **Loosen the 2 nuts on the slotted bearing holes and slide the bearings inward.**
- **Snug the bearing nuts. They will need to be able to move outward when installing the Z-assembly**
- **Repeat Step 10**



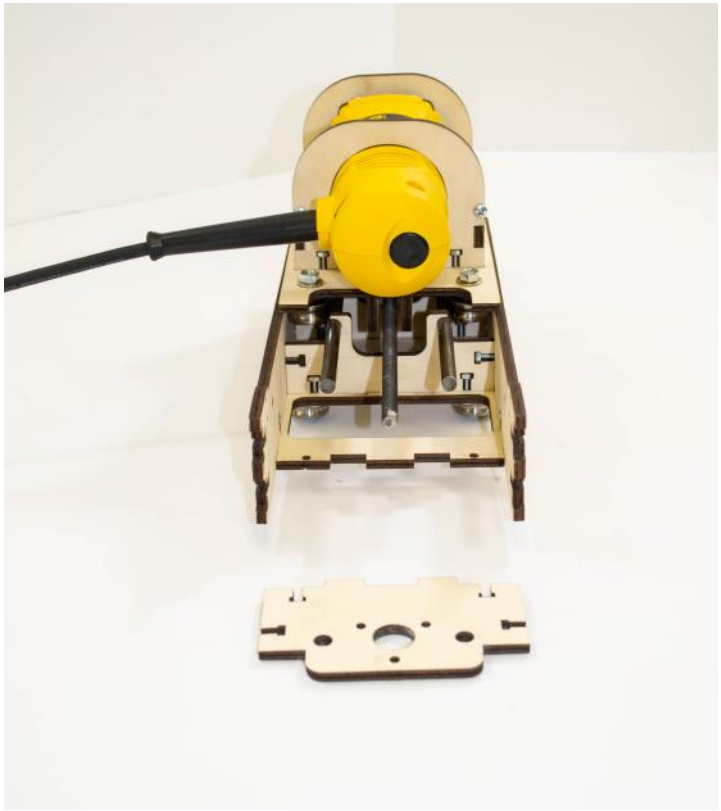




Tighten the M6 nuts as shown in picture 4.

Step 11

Slide Bearing Bottom Plate over the Threaded Rod, setting tabs in slots.



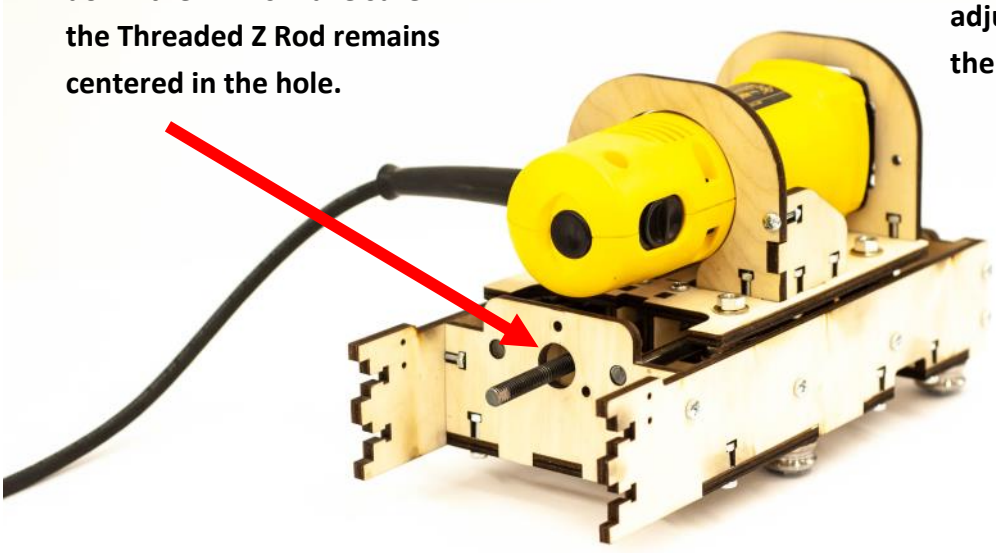
Step 12

Attach the Bearing Bottom Plate and secure with four M4 x 16 Screws and Nuts.

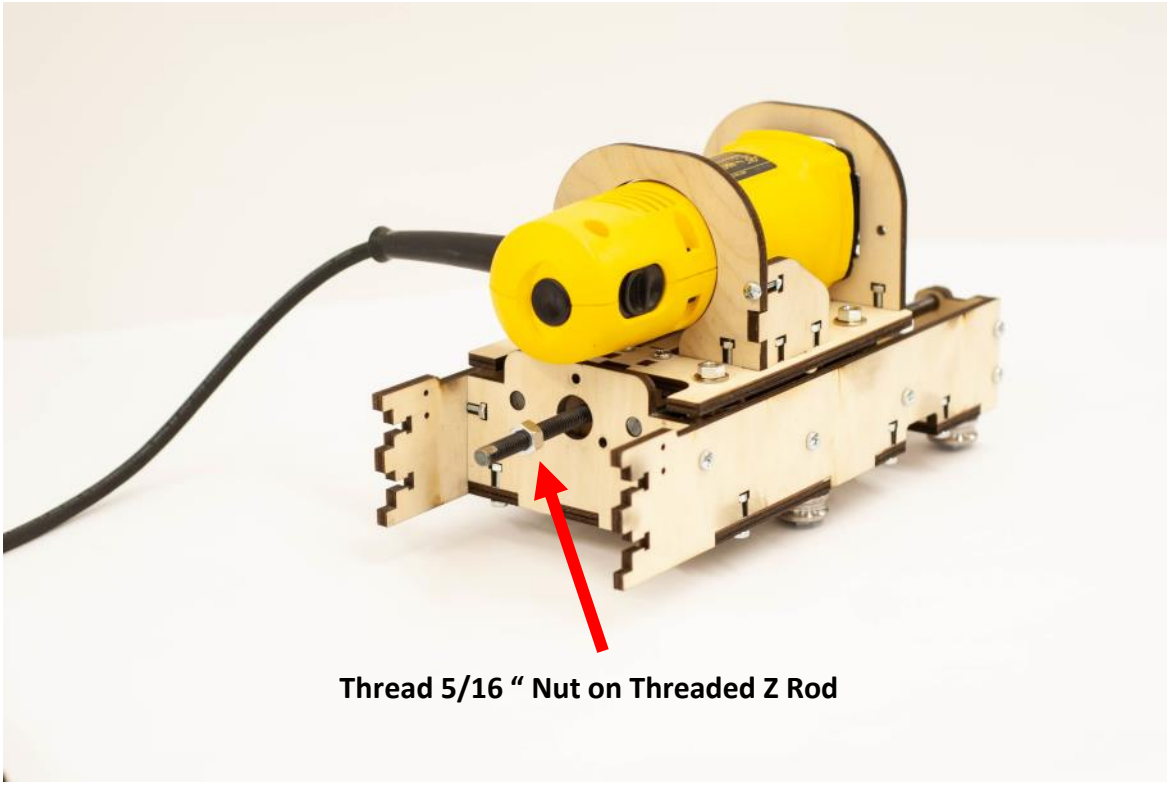
Step 13 Checking Z Thread Rod Alignment

As the Router travels up and down the Z Axis make sure the Threaded Z Rod remains centered in the hole.

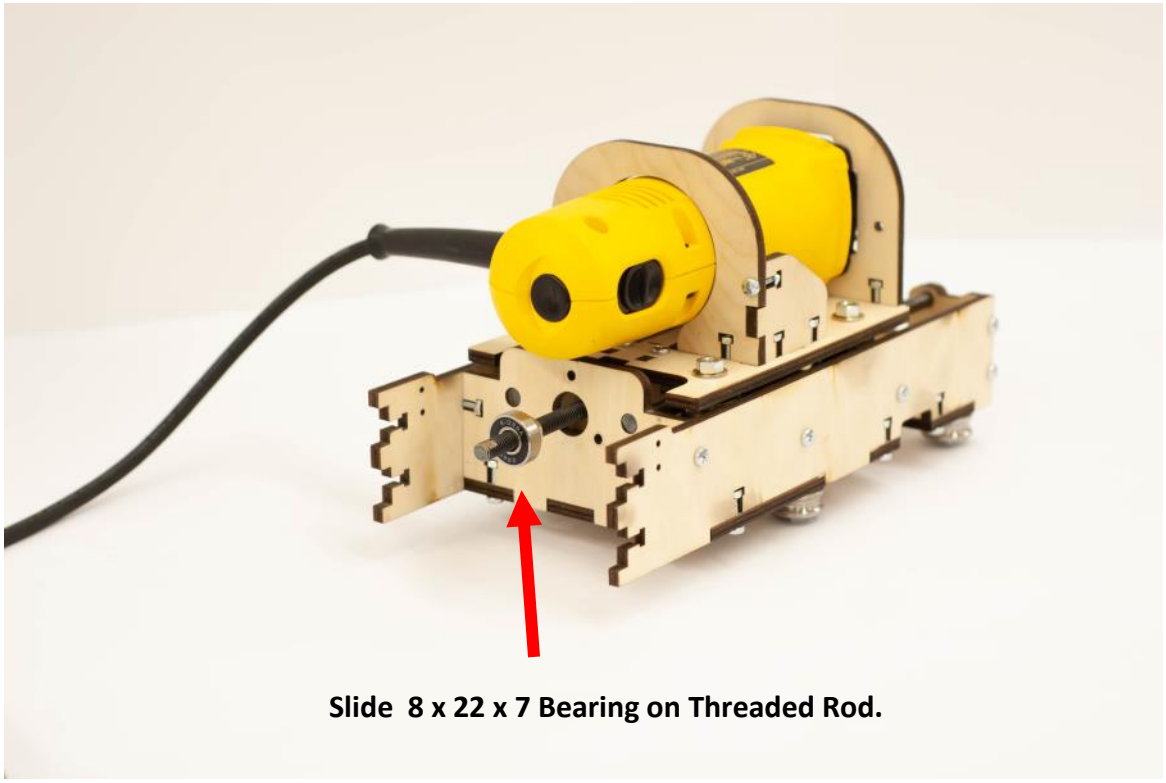
If necessary, adjust to center the rod.



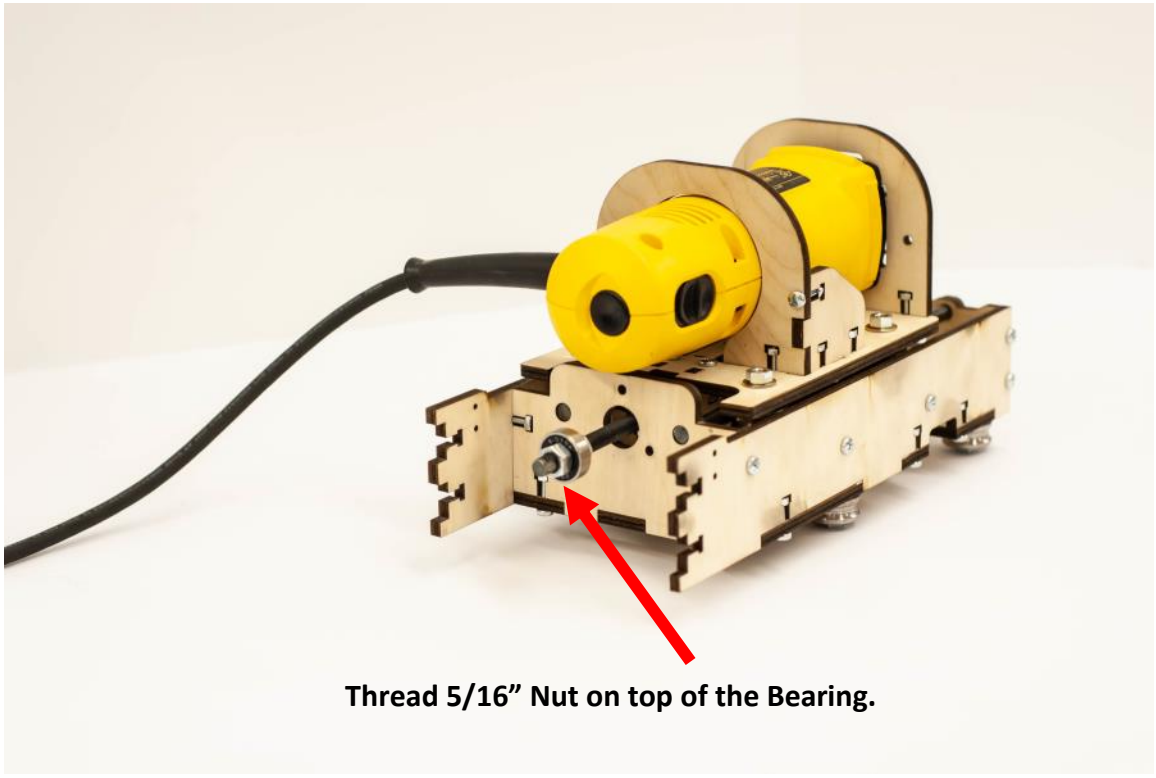
Step 14 Attach 5/16 Nuts and Bearing on Threaded Z Rod



Thread 5/16 " Nut on Threaded Z Rod

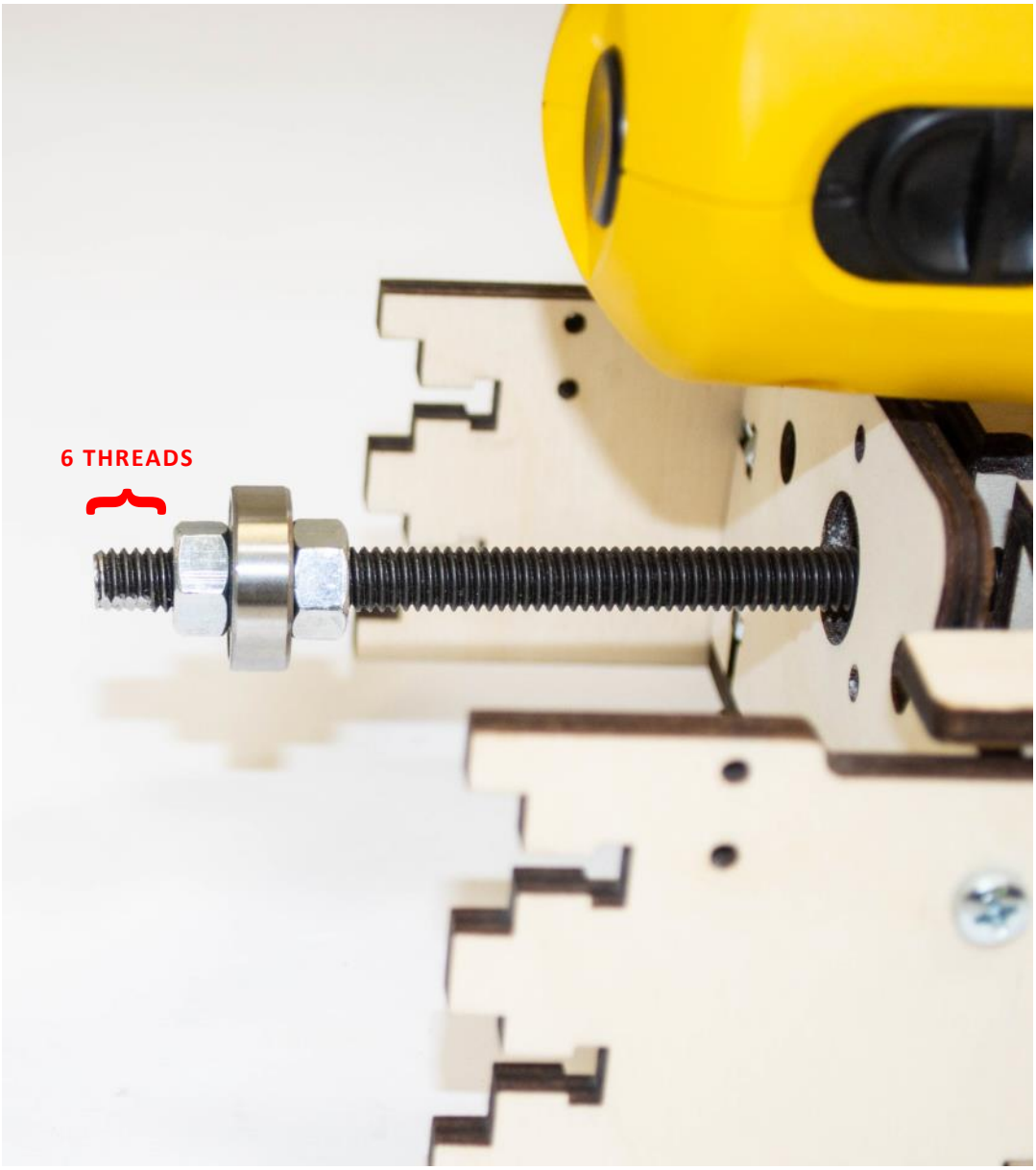


Slide 8 x 22 x 7 Bearing on Threaded Rod.



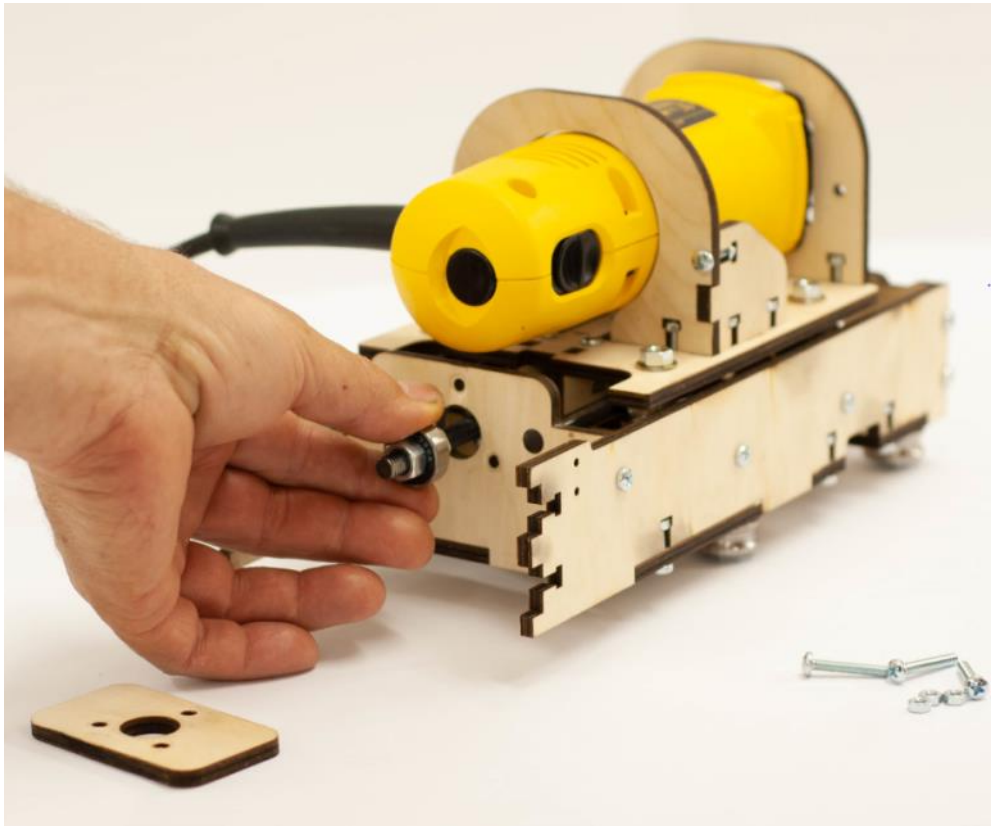
Thread 5/16” Nut on top of the Bearing.

The 5/16” Nut on top of the bearing should be turned approximately 6 threads down from end of the Z Rod. The nuts on top and below the bearing must be tightened against the bearing as firmly as possible while maintaining the six thread spacing from the end of the threaded rod.



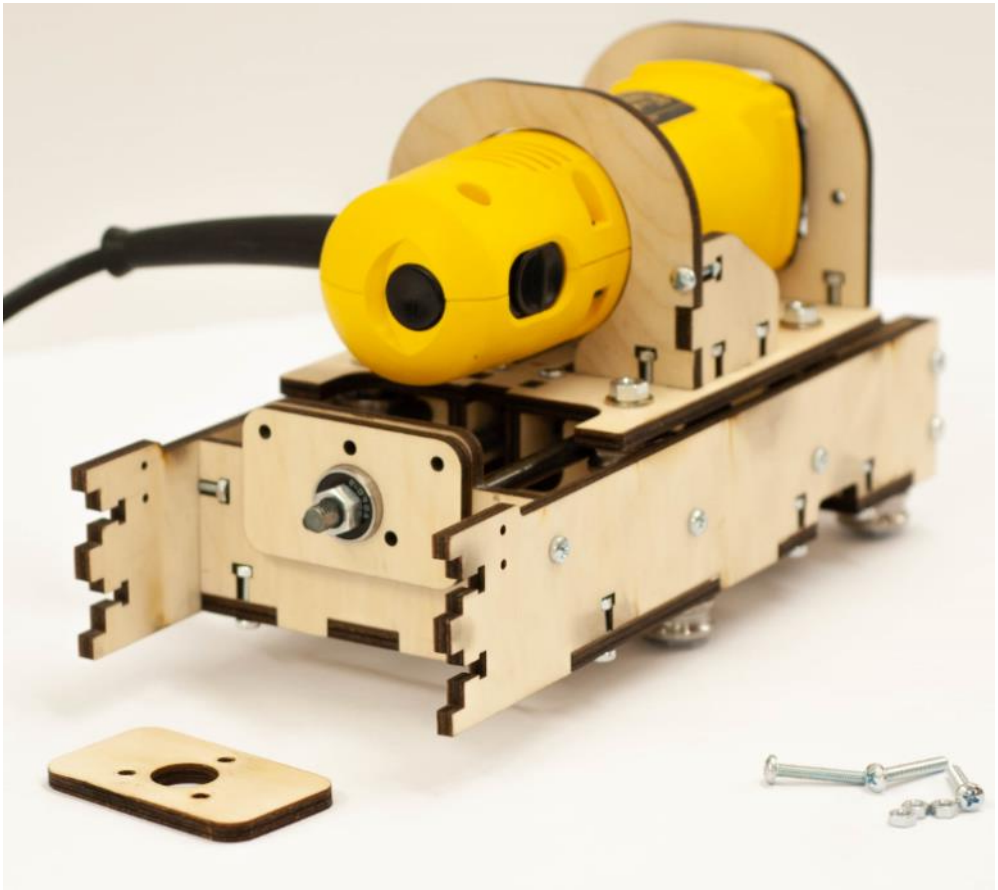
Step 15

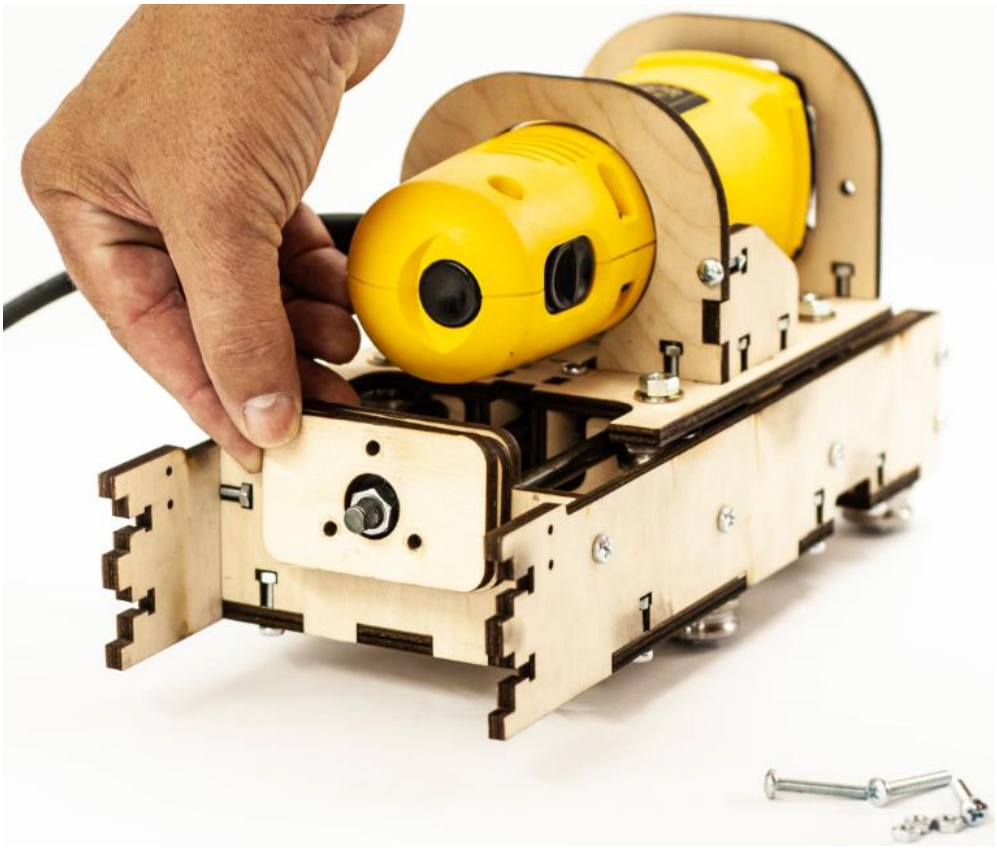
Secure Bearing with Bottom, Middle, and Top Bearing Plates.



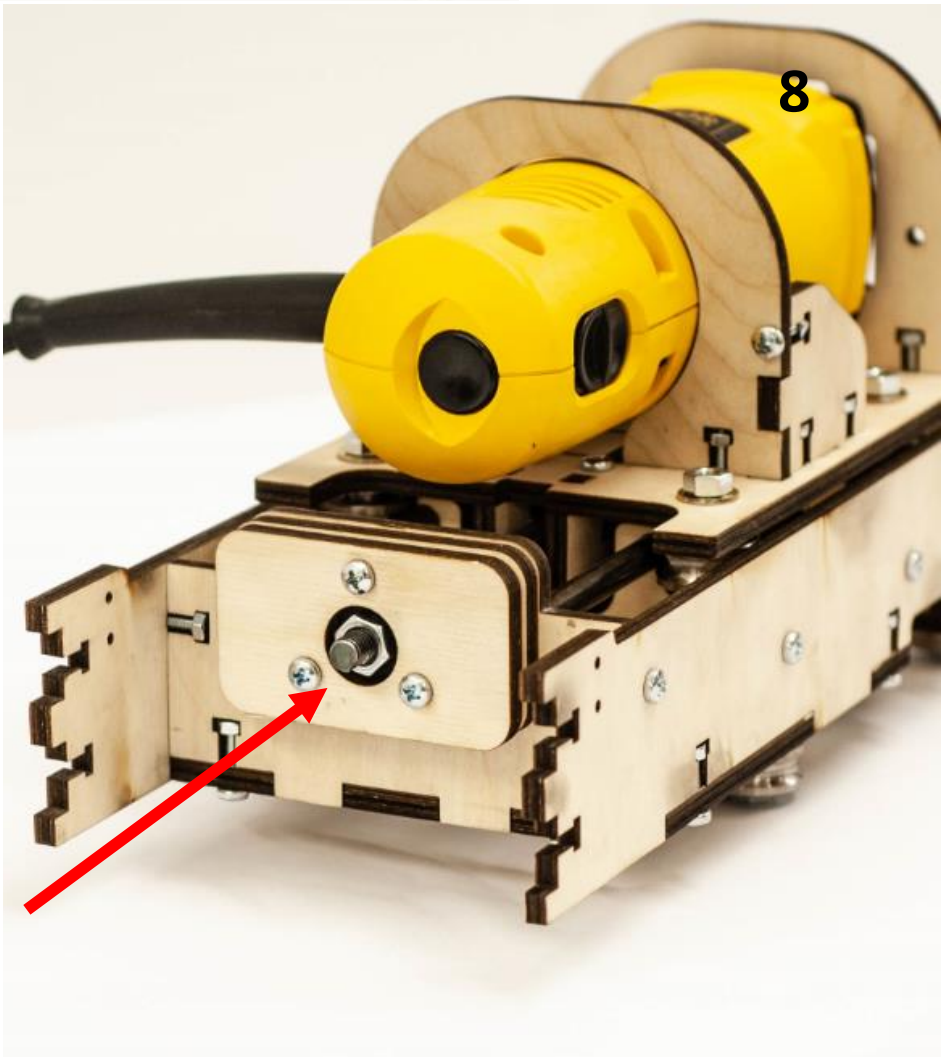
Slide Z Spindle Mount down rails until nut and bearing assembly rests on Bearing Bottom Mount.

Slide Middle Bearing Plate over the Threaded Rod and Bearing.





Slide Top Bearing Plate over the Threaded Rod and up against the top of the Bearing and secure with three M4 x 25 Screws and M4 Nuts.

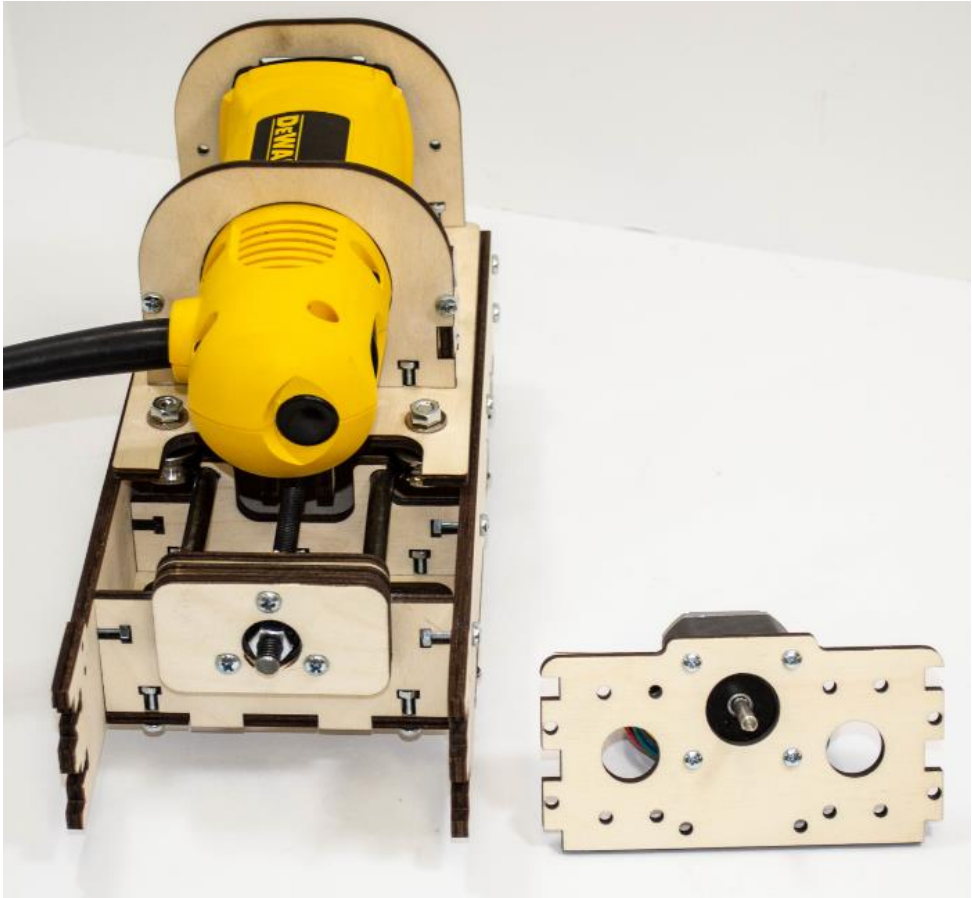


In order to properly retain the bearing securely, evenly tighten screws and nuts in a rotating pattern so that the plywood components are compressed uniformly and tightly together.

Step 16

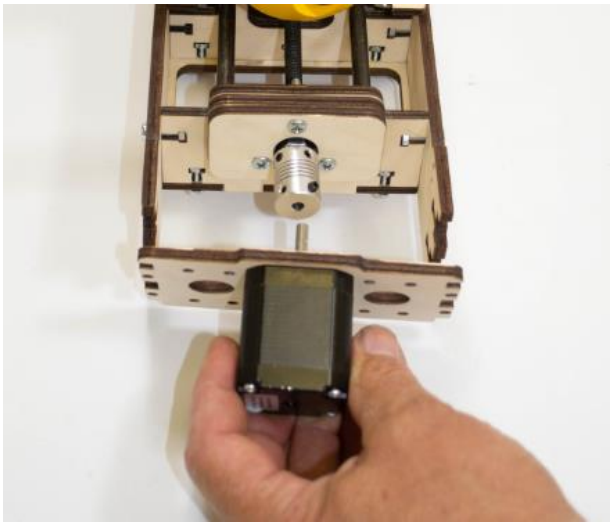
Attach Stepper Motor to the Stepper Motor Mount and secure with four M3 x 10 Screws.

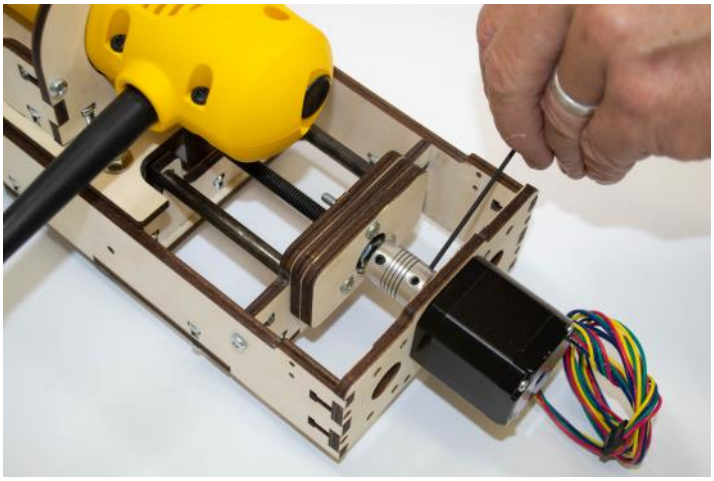
Apply LOCTITE® to all screws.



Step 17

Attach Helical Coupler to Stepper Motor shaft and Threaded Z Axis Rod



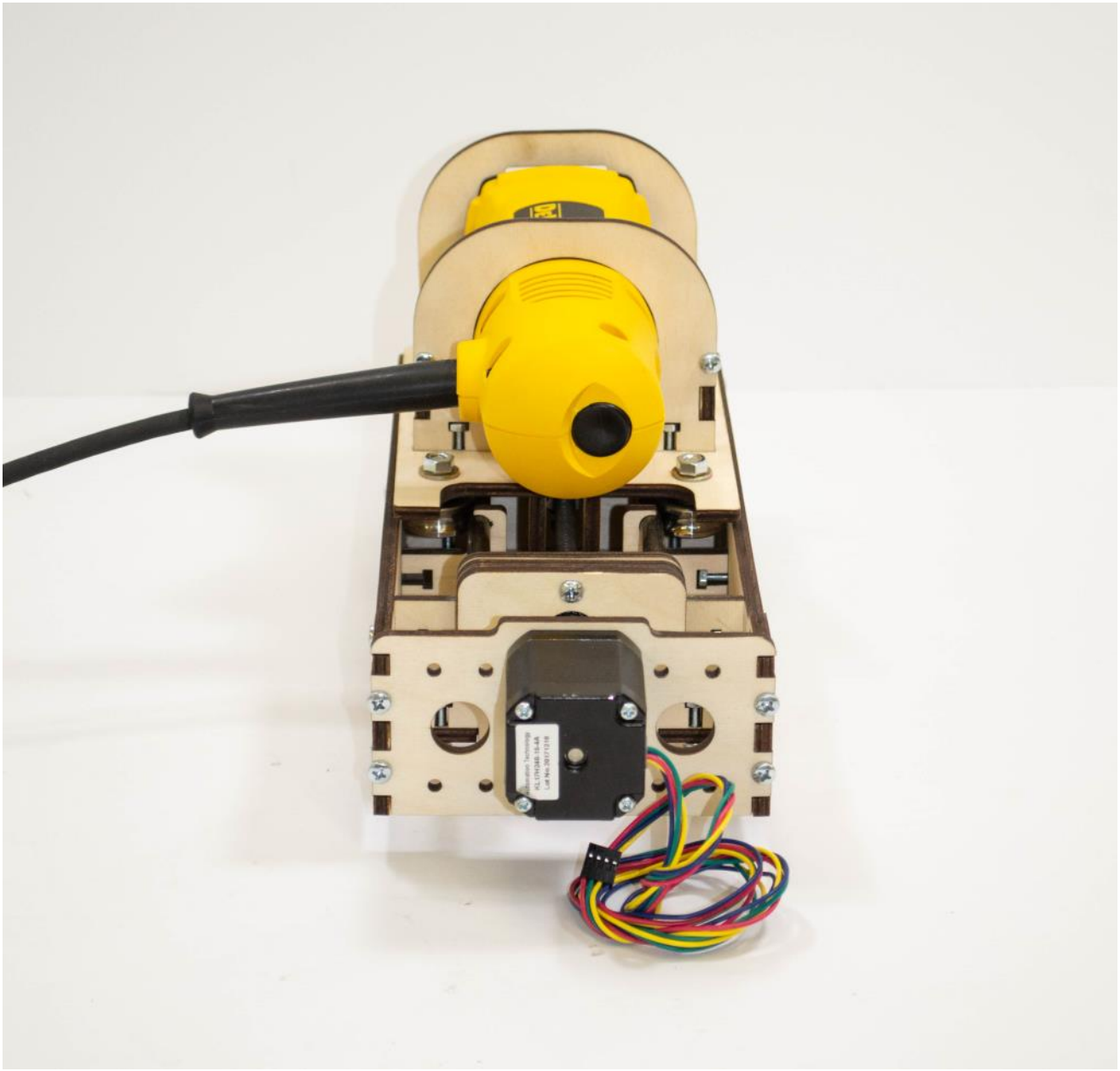


Align the milled flat spot on the end of the Threaded Z Rod so that the set screw will be tightened directly against the flat spot.

Tighten both set screws with a 2mm Allen Wrench.

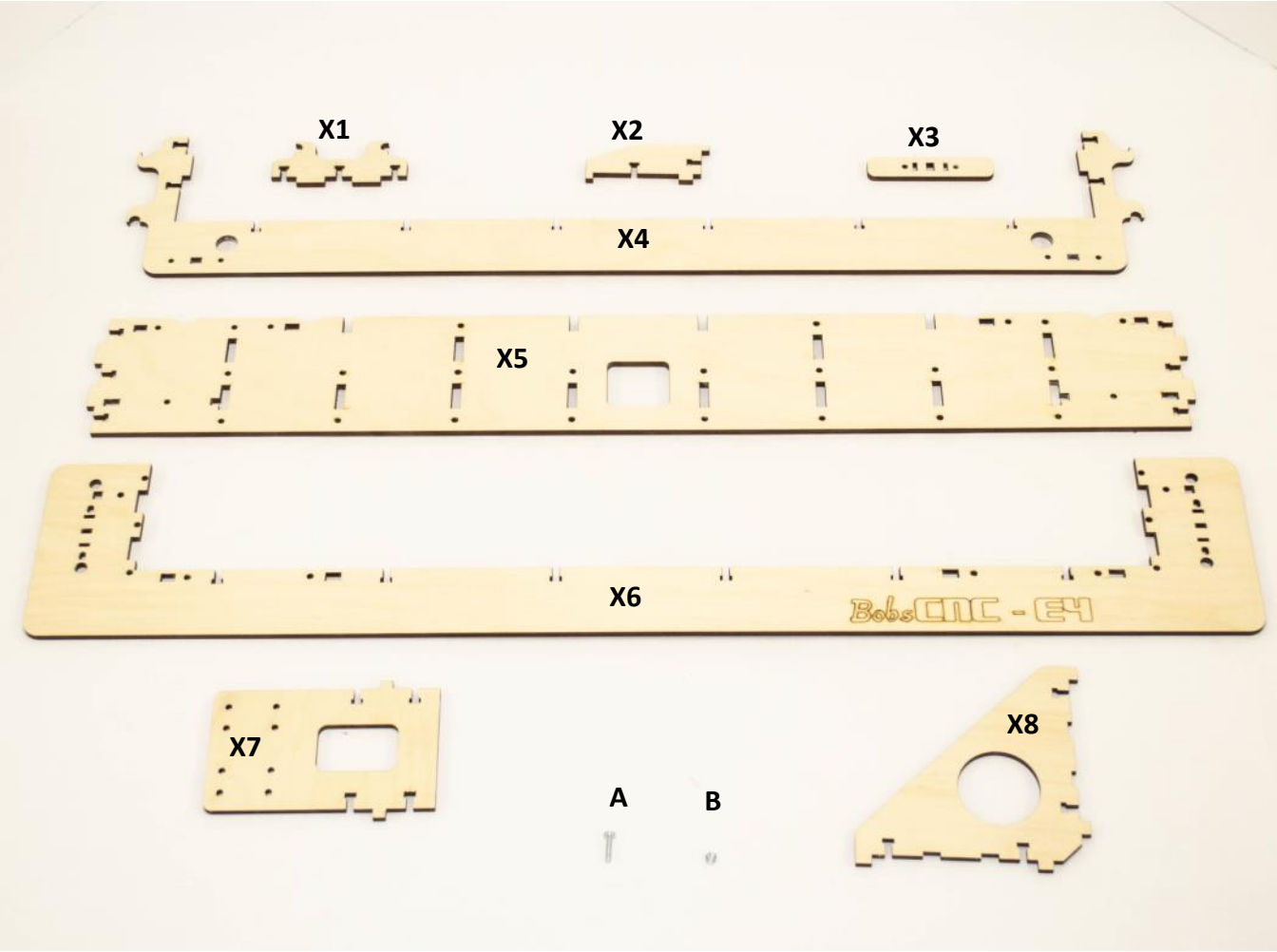
Set the Stepper Motor Mount in place. Align the flat spot on the motor shaft with the set screw of the Helical Coupler and tighten both set screws securely.

Secure Stepper Motor Mount with four M4 x 16 Screws and Nuts.



Frame Assembly Instructions

X Frame Assembly & Hardware



Part #	Qty	Component
X1	8	X Rail Support
X2	4	Frame Corner Braces
X3	4	X Rail Stops
X4	4	Frame Mid Supports
X5	2	Frame Side Supports
X6	2	Frame End Supports
X7	2	X Cable Mounts
X8	4	X Large Corner Supports

Part #	Qty	Hardware Description
A	92	M4 x 16 Screws
B	92	M4 Nuts

The four X3 pieces will not be used until the Gantry is installed on page 64.

Step 1

Place the four X Rail Supports onto the Frame Side Support and secure each with three M4 x 16 Screws and Nuts.

Apply LOCTITE® to all screws.

Step 2

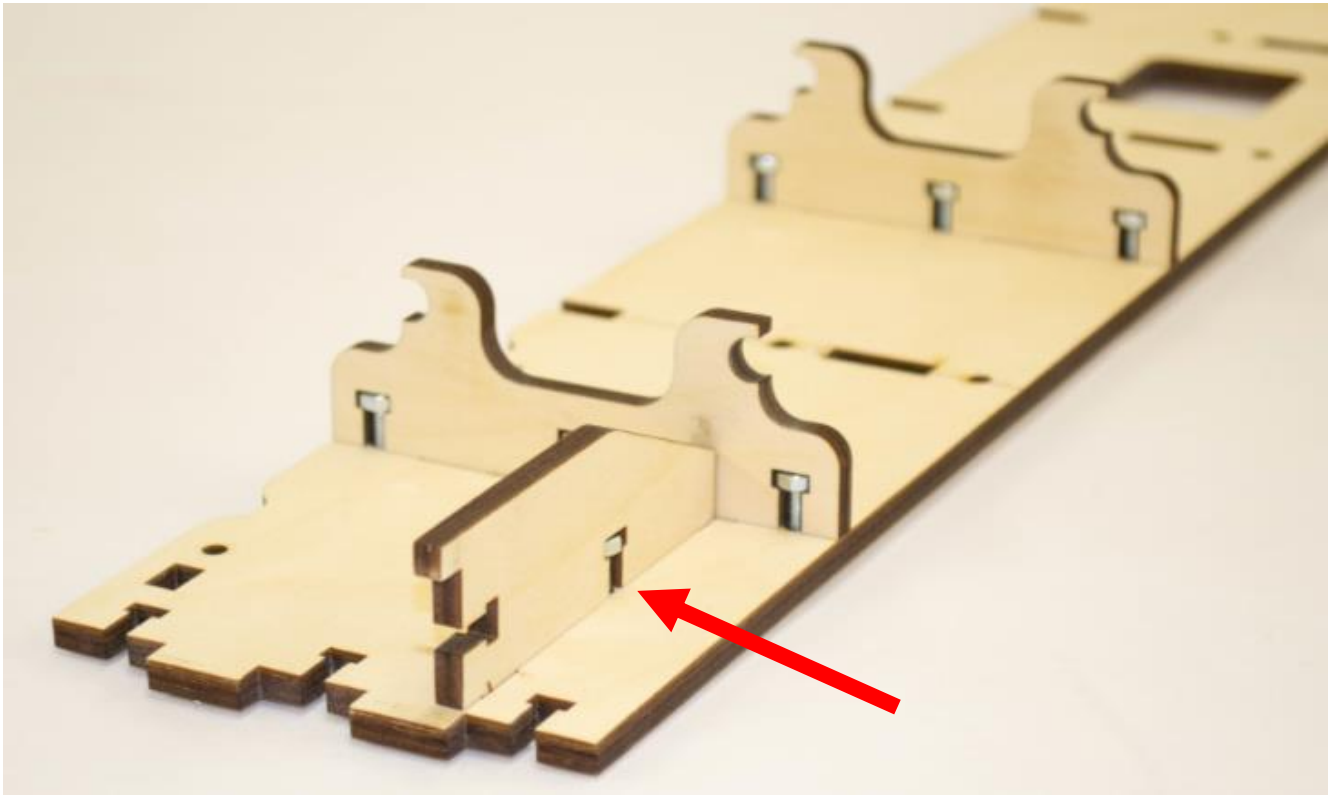
Repeat procedure with the remaining four X Rail Supports and second Frame Side Support and secure each with three M4 x 16 Screws and Nuts.

The assembled frames will mirror each other.

(See picture below:)

Step 3

Place the four Frame Corner Brace tabs into the corresponding slots as shown and secure each with one M4 X 16 Screw and Nut.

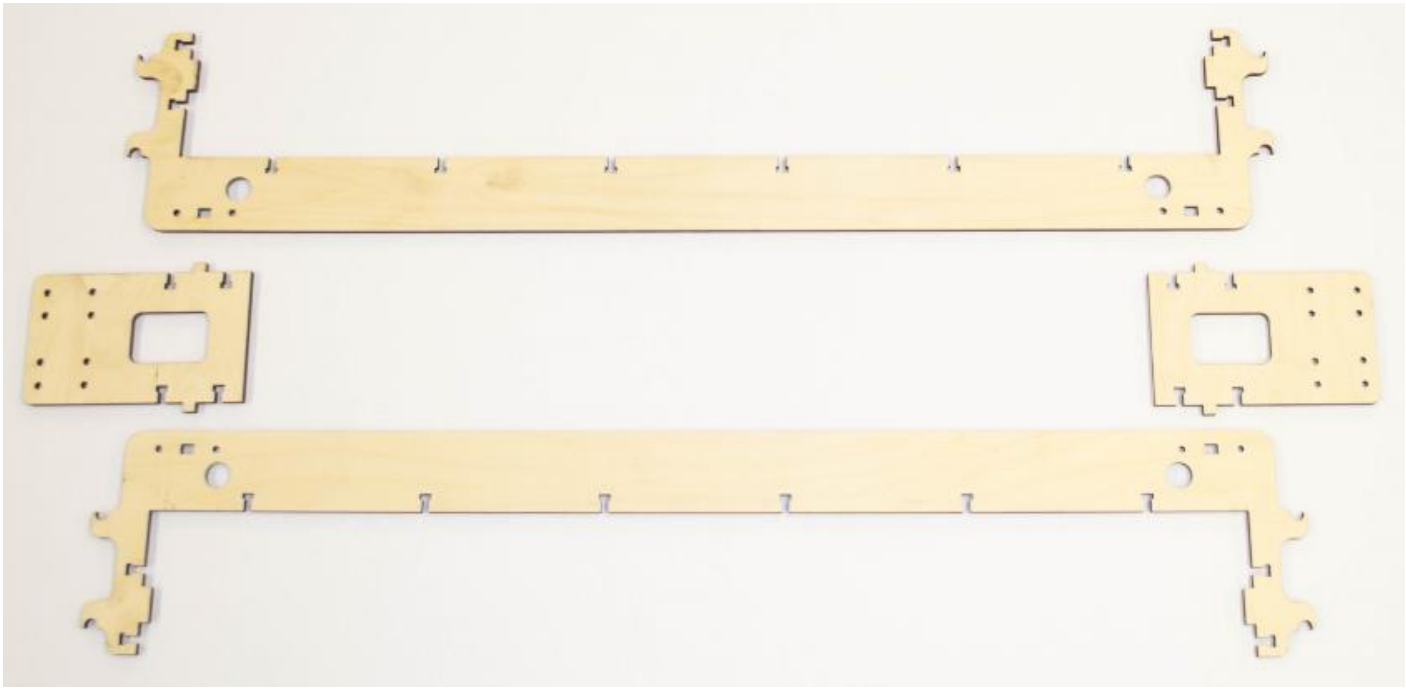


Step 4

Attach four X Large Corner Supports. Secure each with 2 M4 x 16 Screws and Nuts.

Step 5

Attach both X Cable Mounts to the Frame Mid Supports. Secure each with 4 M4 x 16 Screws and Nuts.



Step 6

Attach X Rail Support Assembly to the completed X Cable Mounts. Secure each with four M4 x 16 Screws and Nuts.

Step 7

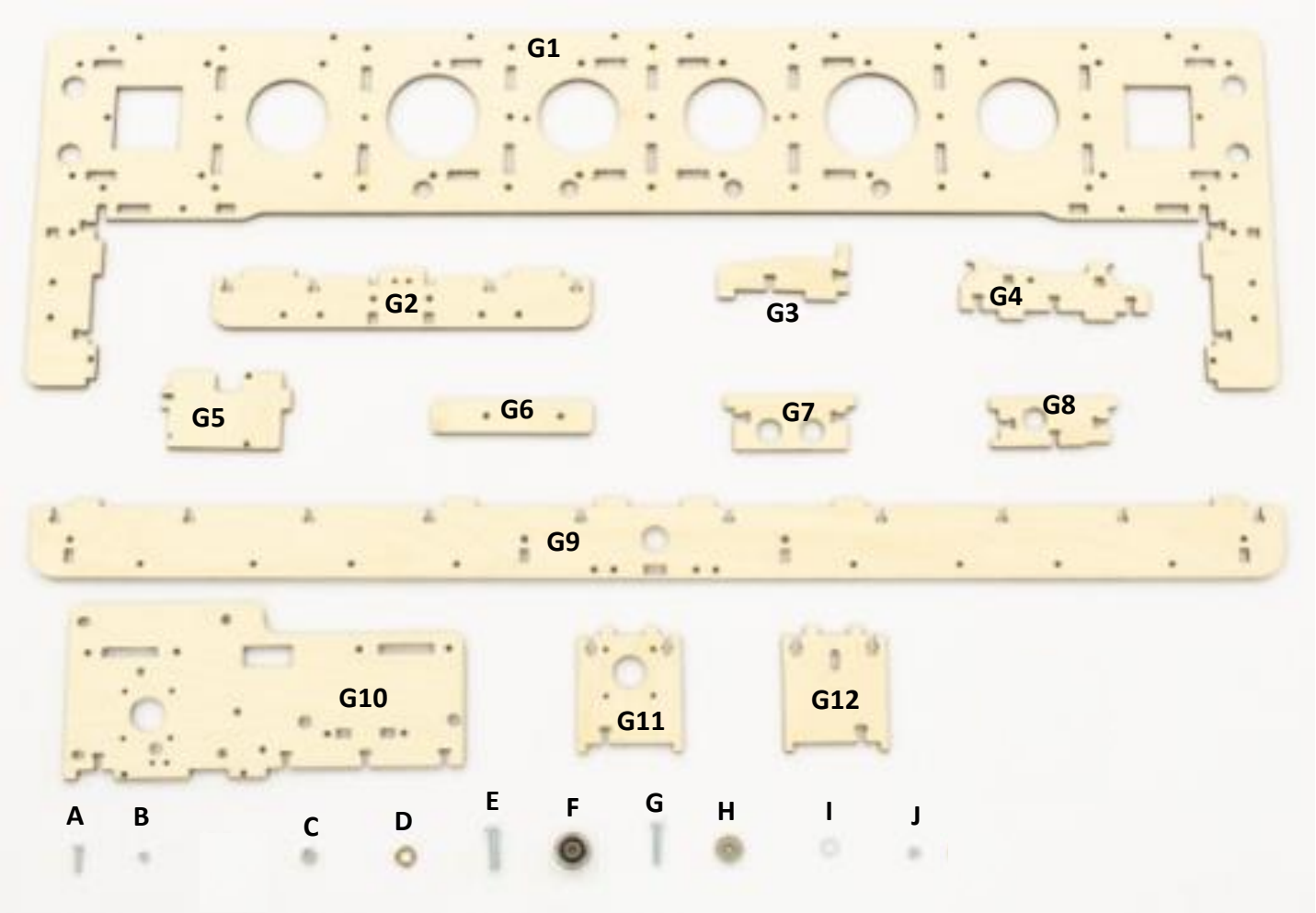
Attach the two remaining Mid Frame Supports to the X Rail Support Assembly. Secure each with four M4 x 16 Screws and Nuts.

Step 8

Attach both Frame End Supports and secure each side with twelve M4 x 16 Screws and Nuts.

Gantry Assembly Instructions

Gantry Wood Components & Hardware



Part #	Qty	Description
G1	1	Gantry Frame
G2	2	Gantry Side Supports
G3	2	Gantry Corner Braces
G4	7	Y Rail Supports
G5	1	Controller Mount
G6	2	Y Rail Stops
G7	4	Gantry Back Braces
G8	2	Gantry Side Braces
G9	2	Gantry Back Supports
G10	2	Gantry Side Frames
G11	1	Y Stepper Motor Mount
G12	1	Y Belt Idler Mount

Part #	Qty	Description
A	82	M4 x 16 Screws
B	82	M4 Nuts
C	8	M6 Nuts
D	16	M6 Hardened Washers
E	8	M6 x 25 Screws
F	8	SG20U Bearings
H	3	M5 x 25 Screws
H	6	F625 Idler Bearings
I	6	M5 Washers
J	6	M5 Nuts

The two G6 pieces will not be used until the Y Carriage is installed on the Gantry on page 70.

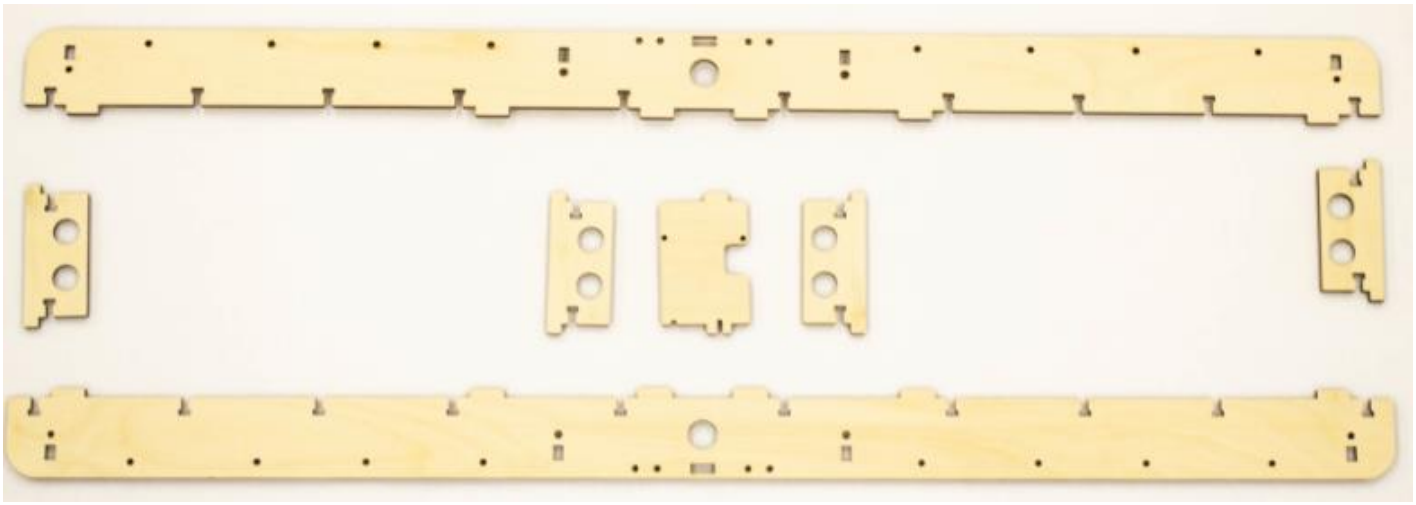
In order to properly complete the next step all five parts must be assembled before attempting to secure them with M4 x 16 screws and nuts.

Apply LOCTITE® to all screws.

Step 1

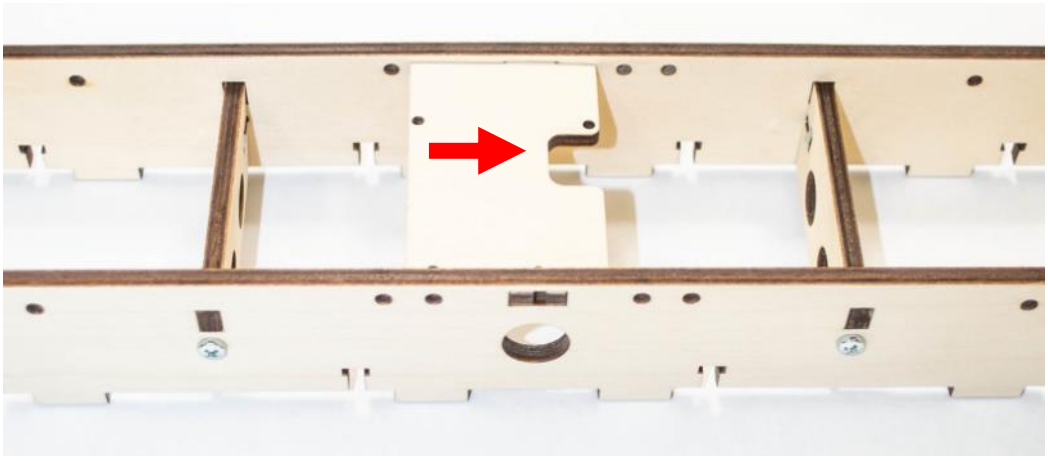
Position the Controller Mount, the four Gantry Back Braces and the two Gantry Back Supports and secure with eight M4 x 16 Screws and Nuts.

1.1



1.2

IMPORTANT! Note the orientation of the Controller Mount below:

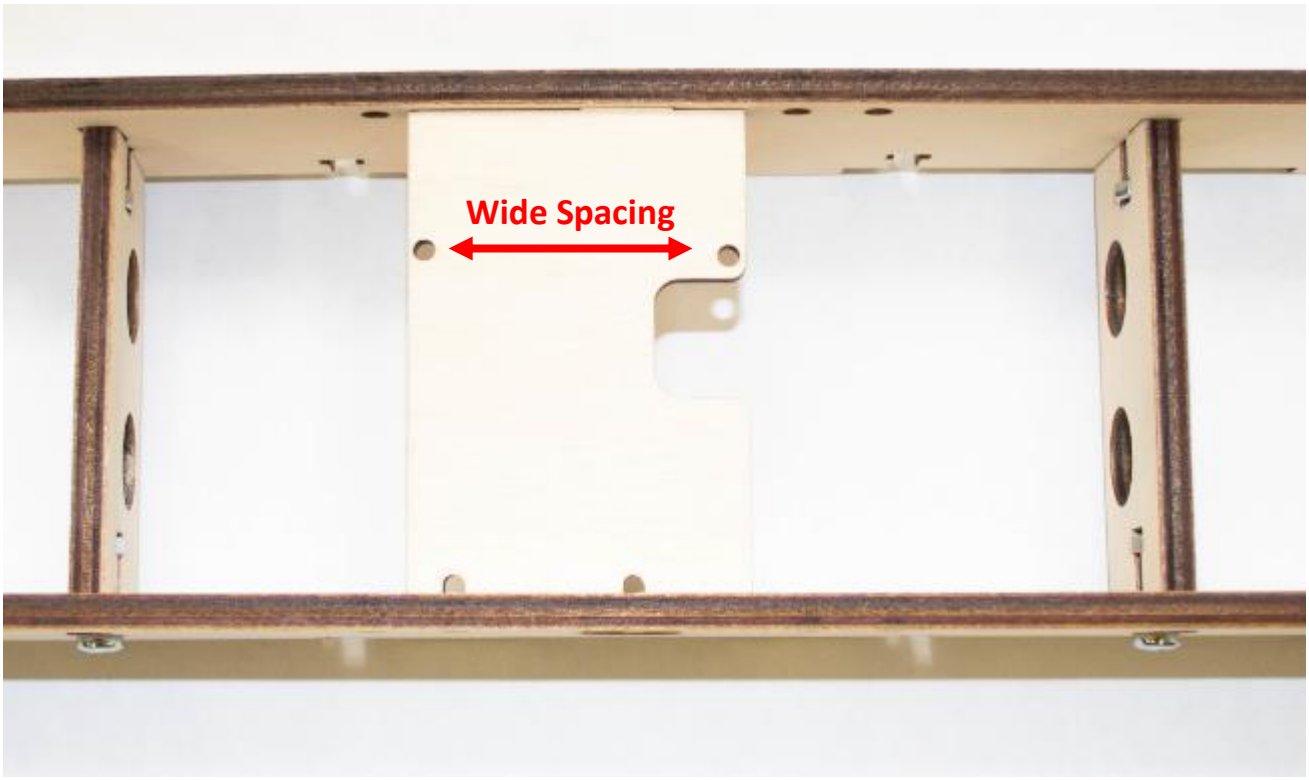


1.3

1.4

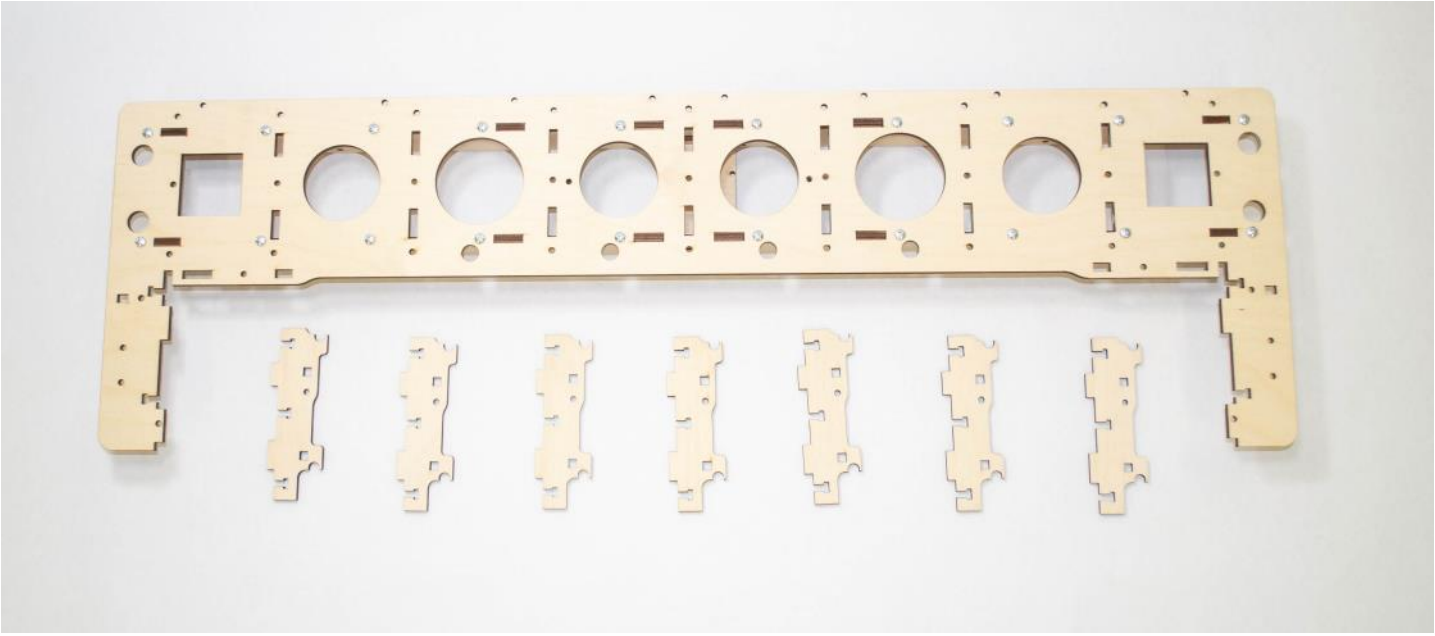
Using slots and tabs, set the controller mount assembly on the Gantry Frame and secure with 20 M4 x 16 Screws and Nuts.

IMPORTANT **Note the orientation of the Controller Mount below. Note that the hole in the Gantry Frame is accessible because of the cutout in the Controller Mount. Wide spacing for screw holes should be positioned on top.**



Step 2

Flip the gantry frame assembly over and insert the seven Y Rail Supports to the gantry assembly and secure each with three M4 x 16 Screws and Nuts.



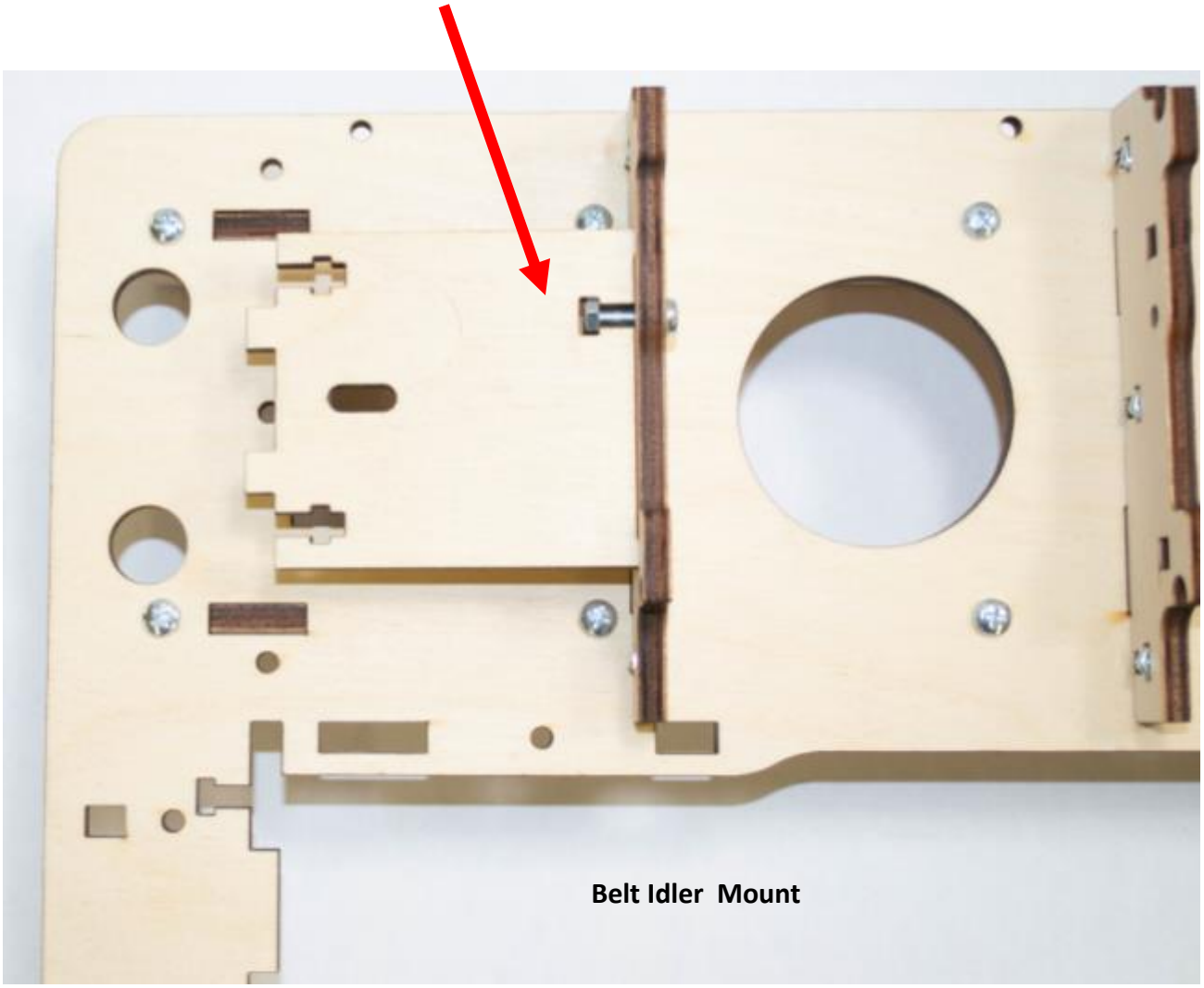
Step 3.

Attach Y Stepper Motor Mount and secure with one M4 x 16 Screw and Nut.

Stepper Motor Mount

Step 4

Attach Belt Idler Mount and secure with one M4 x 16 Screw and Nut.



Belt Idler Mount

Step 5

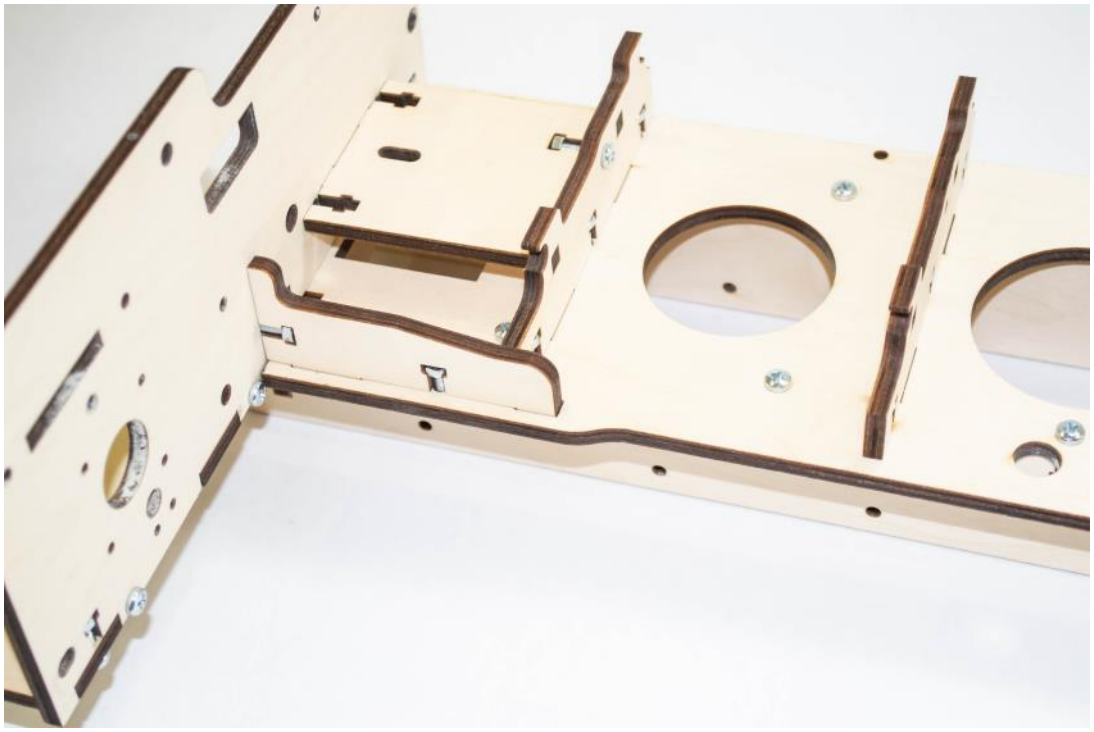
Attach both Gantry Side Frames and secure each with six M4 x 16 Screws and Nuts.

Do not install the two fasteners that connect the Gantry Side Frame to the Y Stepper Motor Mount or the Y Belt Idler Mount at this time. Two M4 x 25 Screws with Nuts will be inserted in each piece in a later step:

Step 6

Attach both Gantry Corner Braces and secure each with two M4 x 16 Screws and Nuts.

Left Side

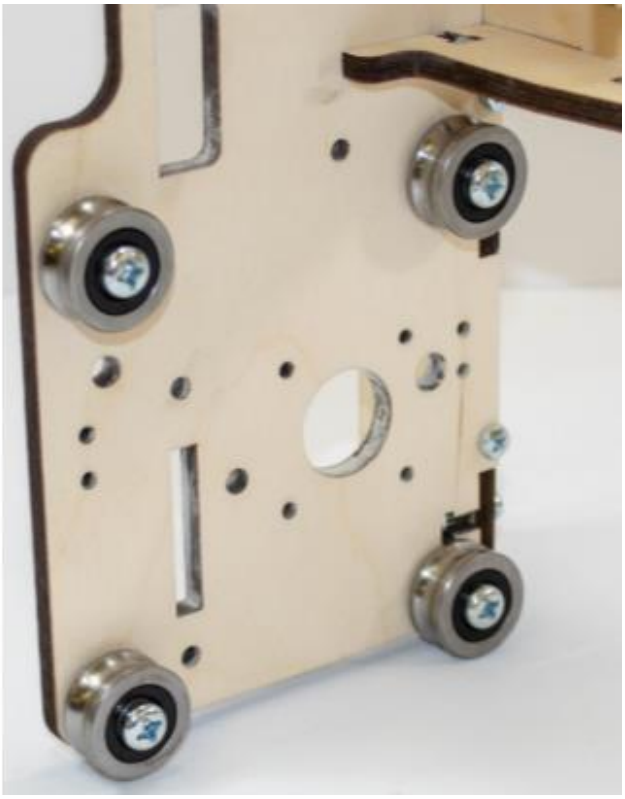


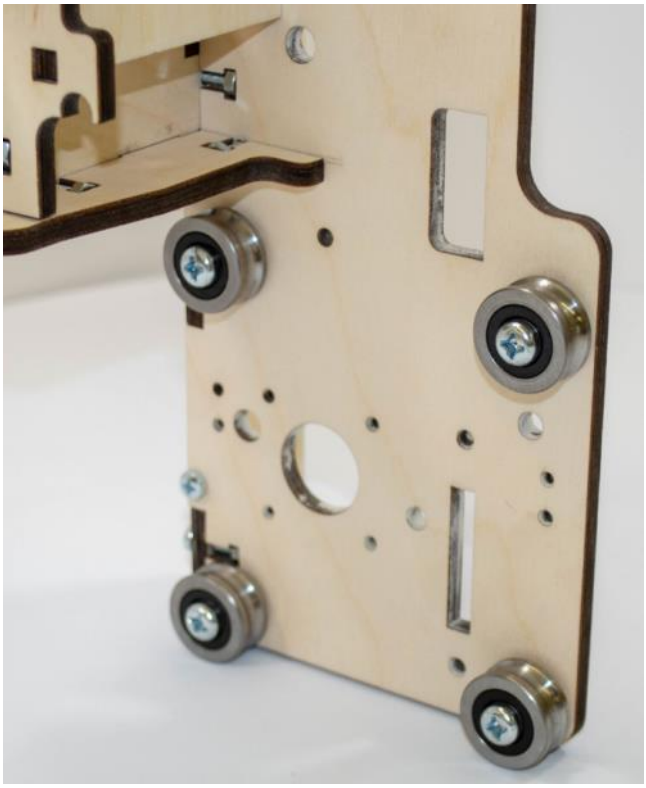
Right Side

Step 7

Install four SG20U bearings on the inside of both Gantry Sides Frames. Snug the bearings in the round holes then rotate 2 to 4 turns.

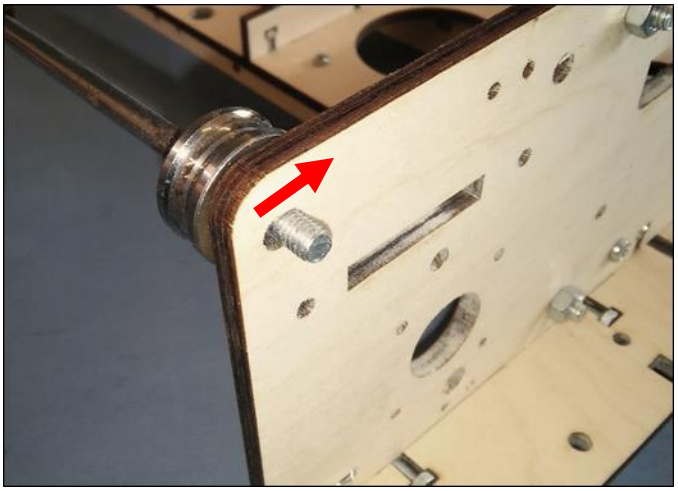
Gantry Bearing sequence: Screw head / SG20U Bearing (hub inboard)/ Hardened Washer/Plywood / Hardened Washer /Nut





Step 8

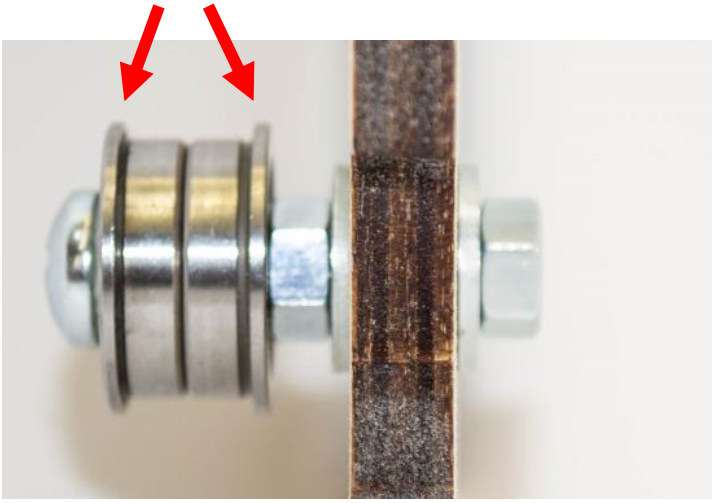
Move the four SG20U Bearings in the elongated holes upward and snug the nuts and rotate 1/4 turn. These will be tightened when installed on the Main Frame.



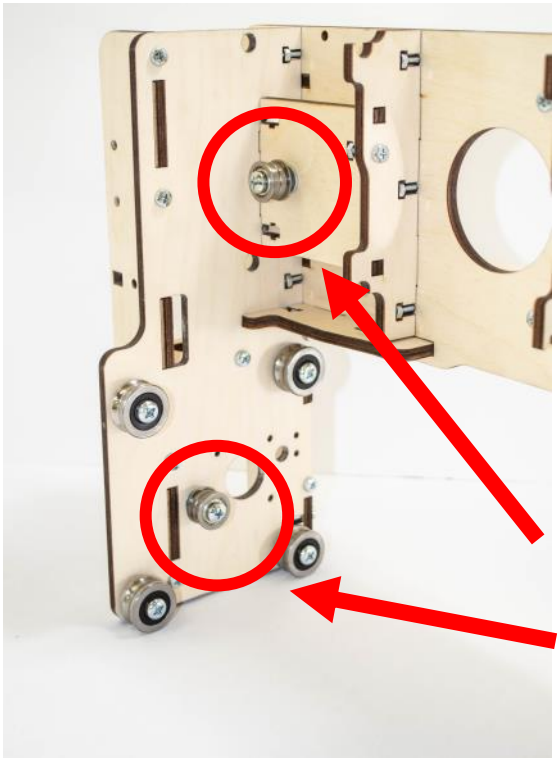
Step 9

Install three sets of Idler Bearings by inserting a M5 x 25 Screw into the Flanged Bearings (keeping the flanges outboard). Thread a nut on the M5 Screw and tighten (see bolt pattern below):

Flanges must be positioned toward the outside (outboard).



Left Side



Location of Idler Bearings

Right Side

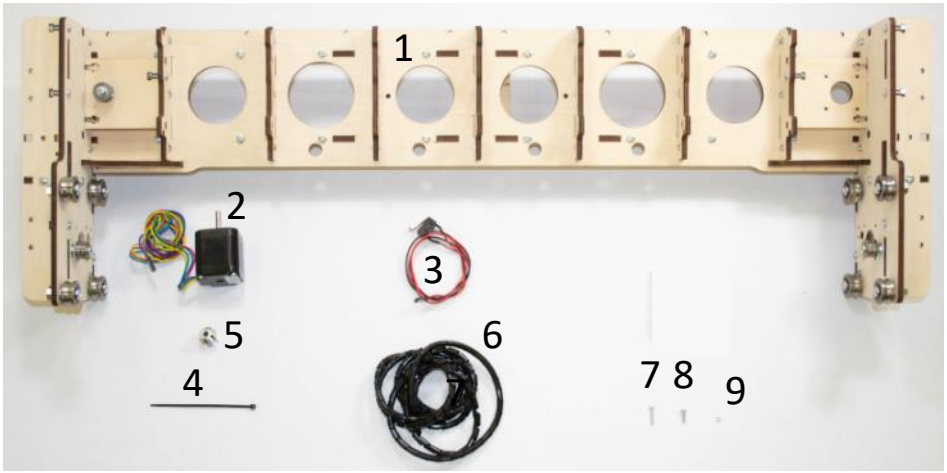
Step 10

Add Gantry Side Brace and Side Support and secure with seven M4 x 16 Screws and Nuts. Repeat for other side.

Gantry Assembly and GT2 Pulley Instructions

Parts Required

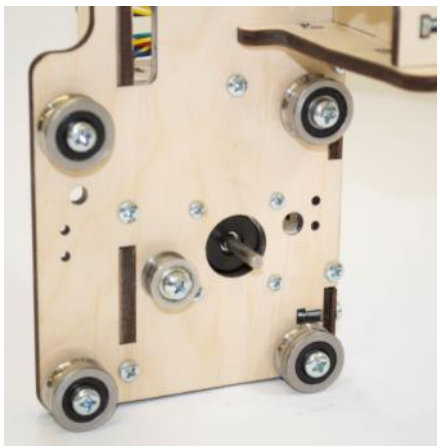
Part #	Qty	Description
1	1	Assembled Gantry
2	3	Stepper Motors
3	2	Switches
4	2	10 Small Zip Ties
5	3	GT2 Pulleys
6	1	Spiral Wrap
7	4	M2.5 x 16
8	12	M3 x 10 Screws
9	4	M2.5 Nuts



Step 1

Install each of the three Stepper Motors and secure each with four M3 x 10 Screws.

X1-Motor

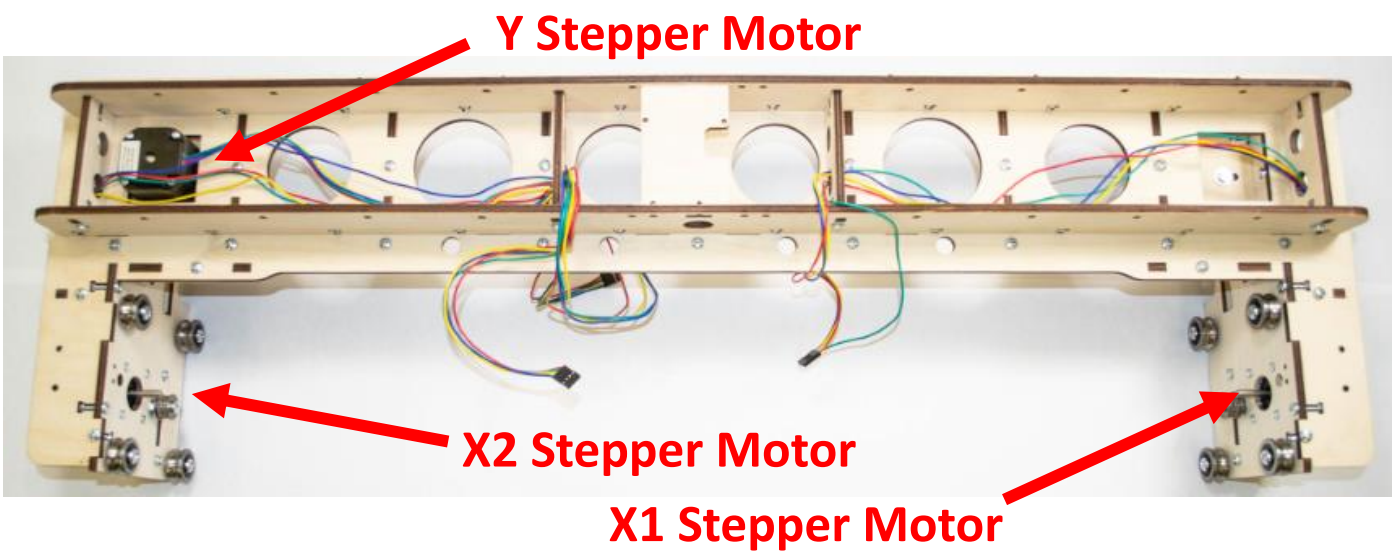


Y Motor

X2-Motor

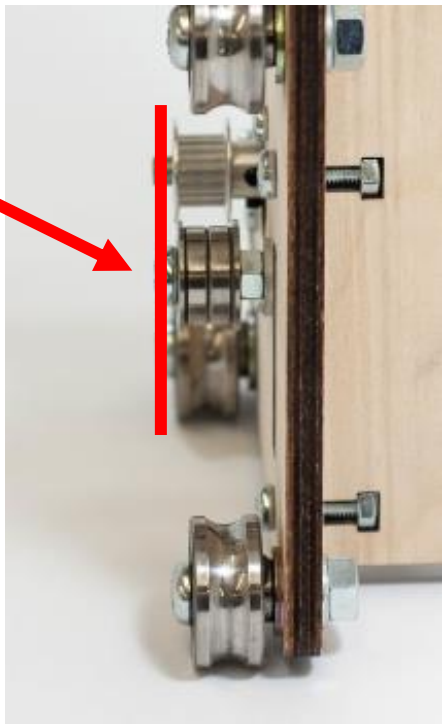
Carefully label each Stepper Motor connector so that the correct electrical connections will be made to the controller (see below):

Stepper Motor mounting viewed from the back side:



Step 2

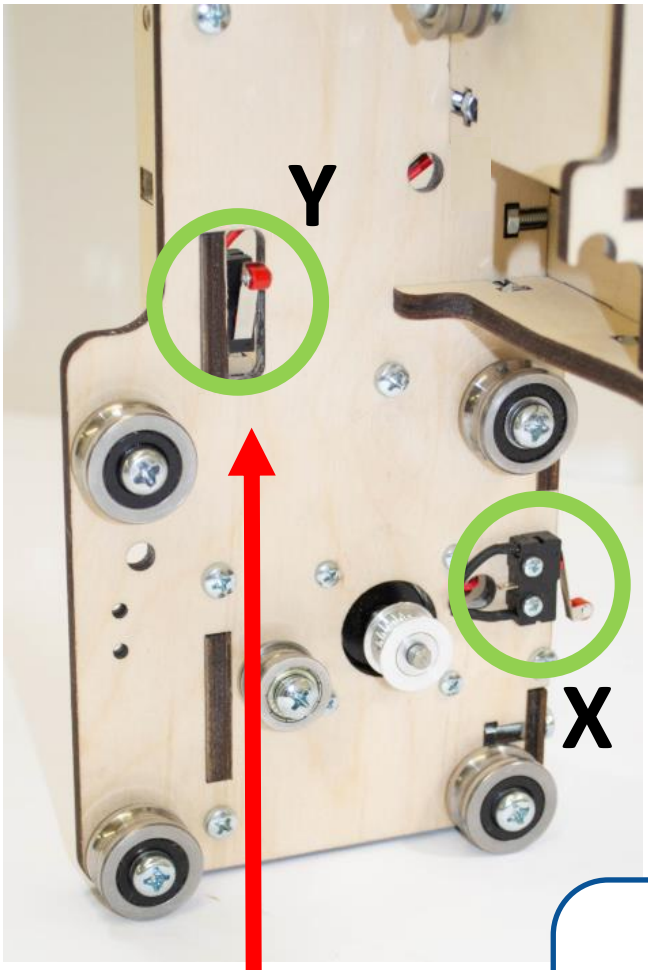
Insert each of the three GT2 Pulleys into position and tighten the set screws.

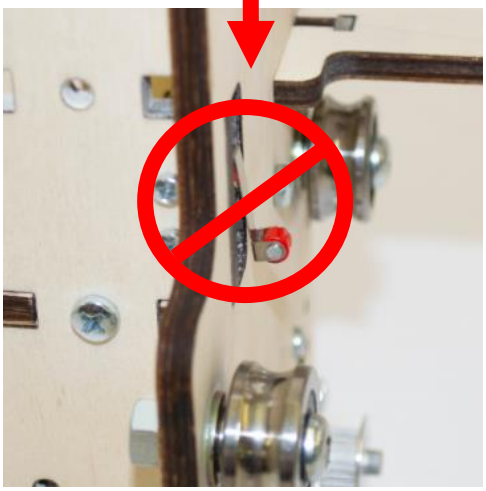


Step 3

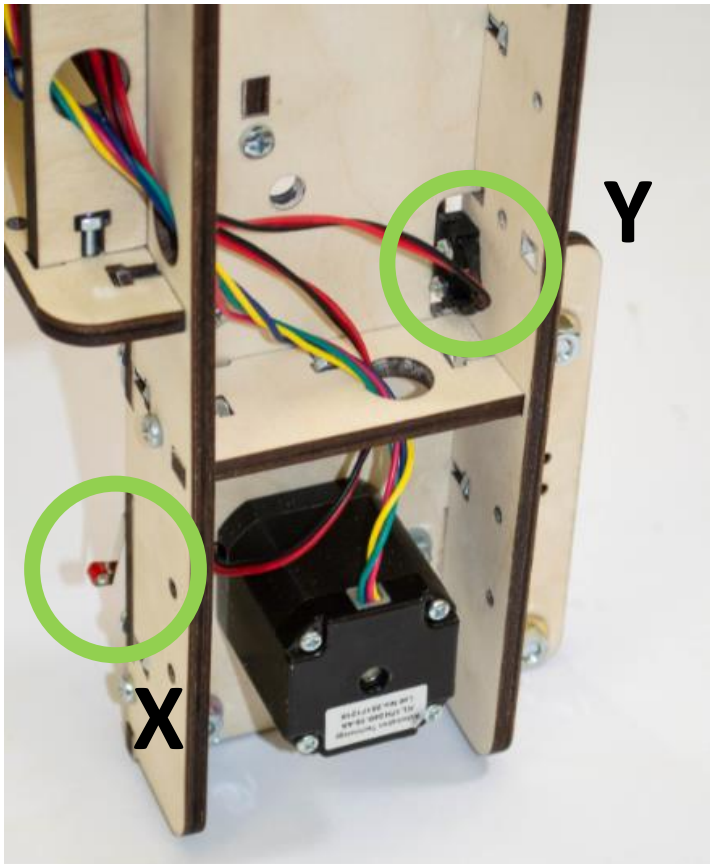
Install the X and Y Stepper Motor Home Switches on the same side of the Gantry, secure each with two M2.5 x 16 Screws and Nuts in the orientation as shown below . Mark each Home Switch connector so that you will be able to make the proper connection to the controller.

Left Inside View





Left Outside View



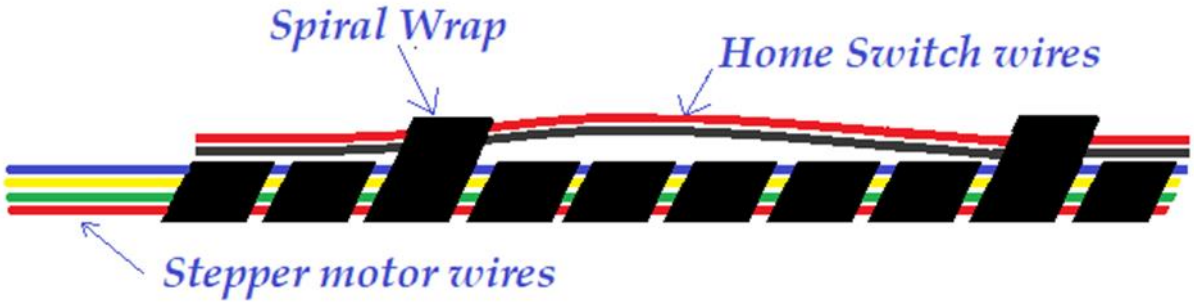
Do not overtighten the M2.5 x 16 Screws and Nuts when attaching a switch. Overtightening can cause the switch to fail.

Be sure the home switches are installed as shown. GREEN is correct RED is incorrect. The red roller is facing upward.

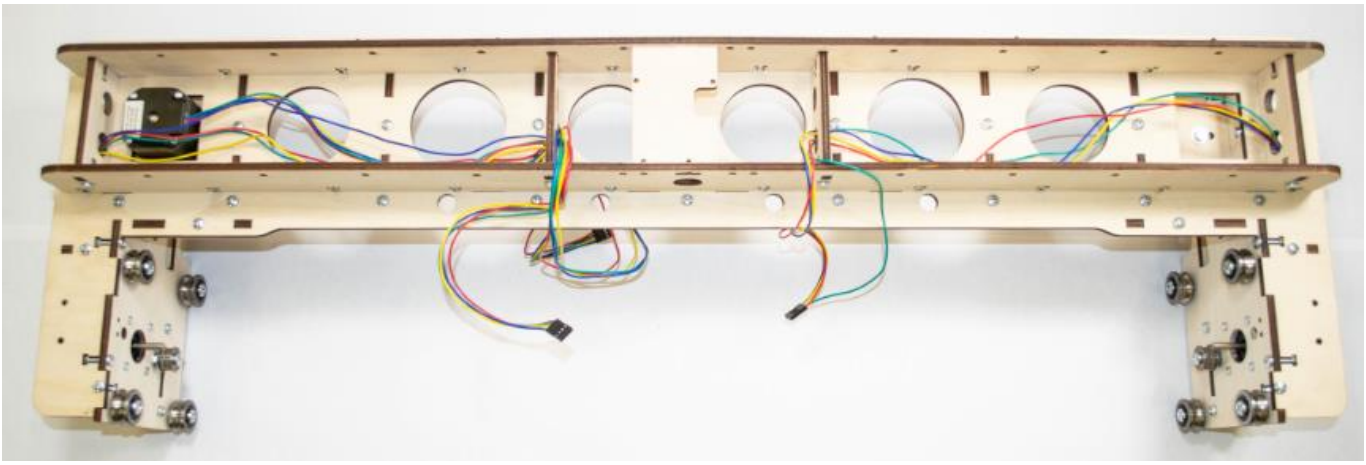
Step 4

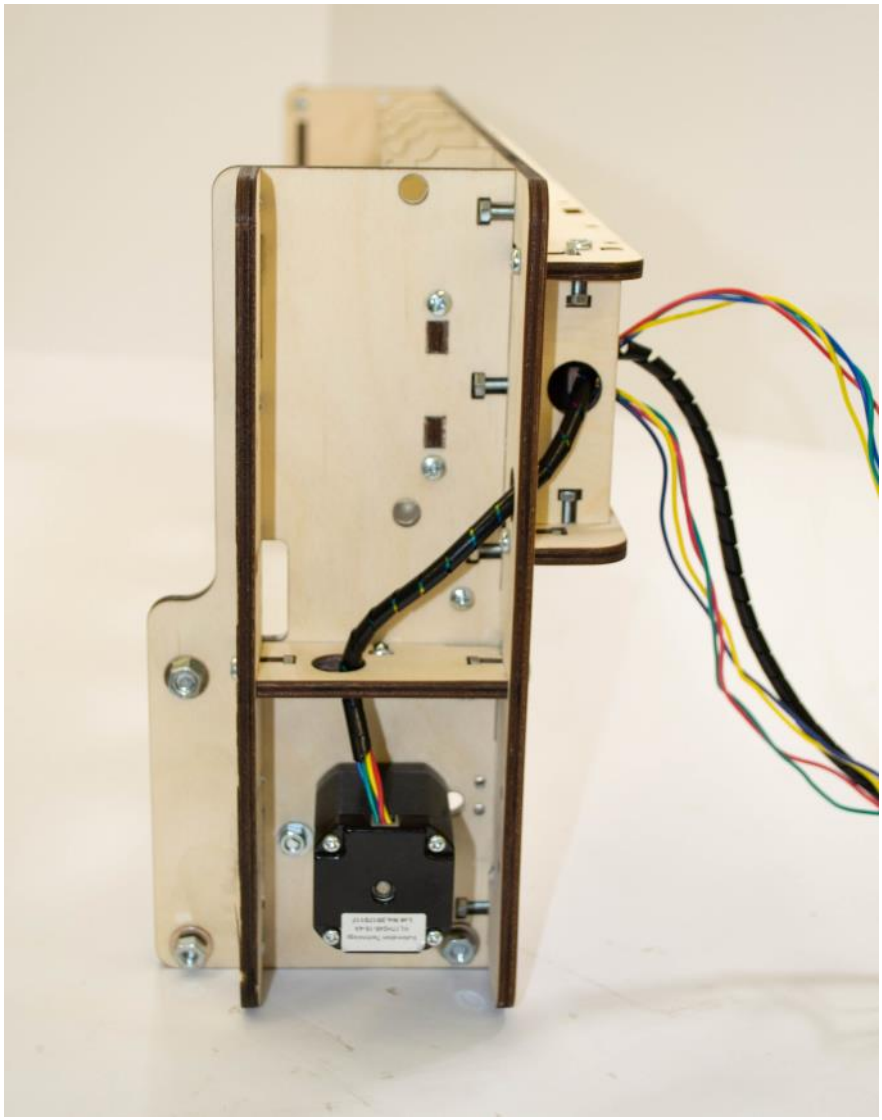
Carefully wrap the wires with Spiral Wrap then gently route them. There are different ways to route the wires, it is important that the wires are properly wrapped and Secured.

To avoid false triggering the X, Y and Z Home Switches caused by the electrical noise of the Stepper Motor wires, it is a best practice to secure the Home Switch wires with Spiral Wrap every 5 or 6 turns as shown below:



Excess wire can be bundled, then wrapped to control the length of the finished wrapped wire.

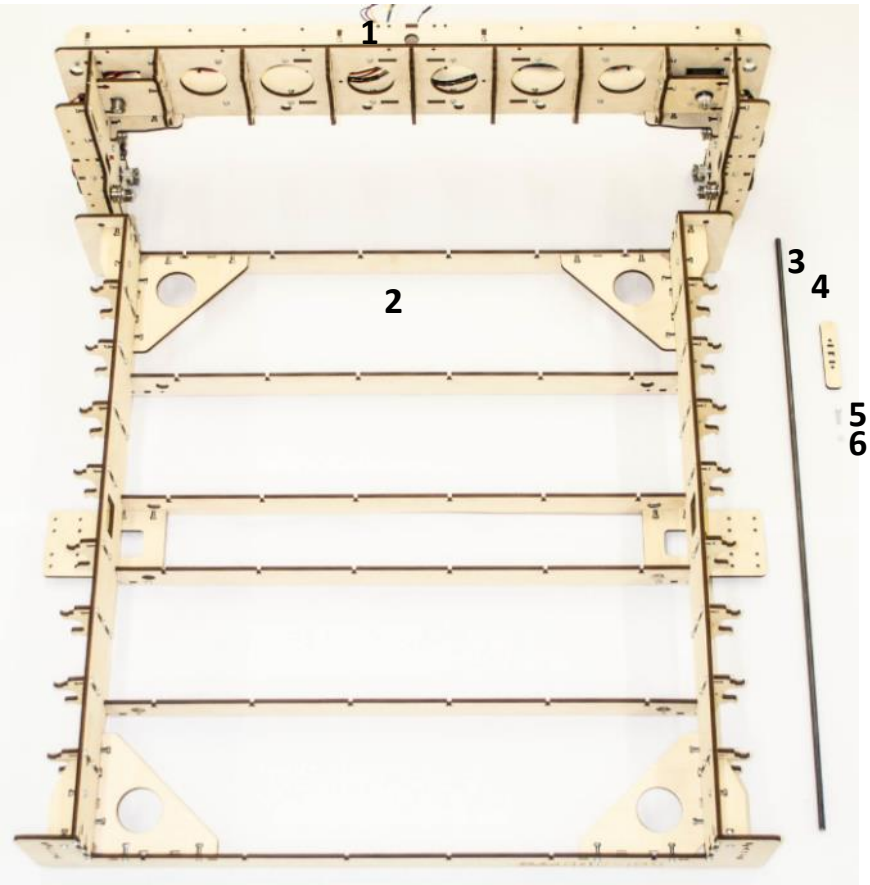




Gantry Installation Instructions

Gantry Wood Components & Hardware

1. Gantry Assembly
2. Frame Assembly
3. 4-Long Rails
4. 4-X Rail Stops
5. 8-M4 x 16 Screws
6. 8-M4 Nuts



Step 1

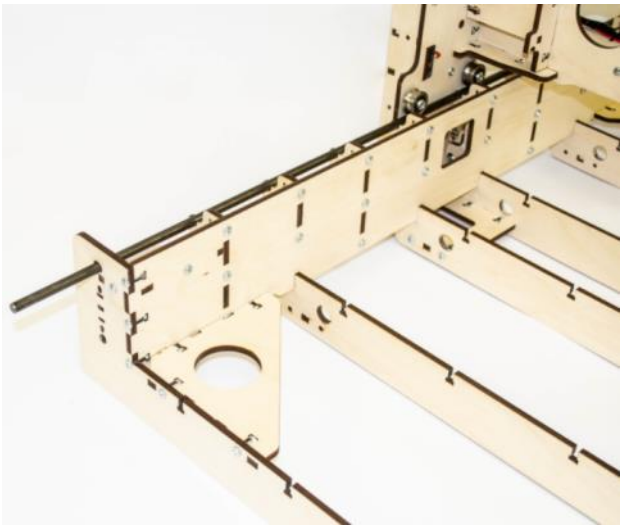
Place two of the X Rail Stops and secure each with two M4 x 16 Screws and Nuts (these will be thoroughly tightened after the GT2 Belts are installed, see below).

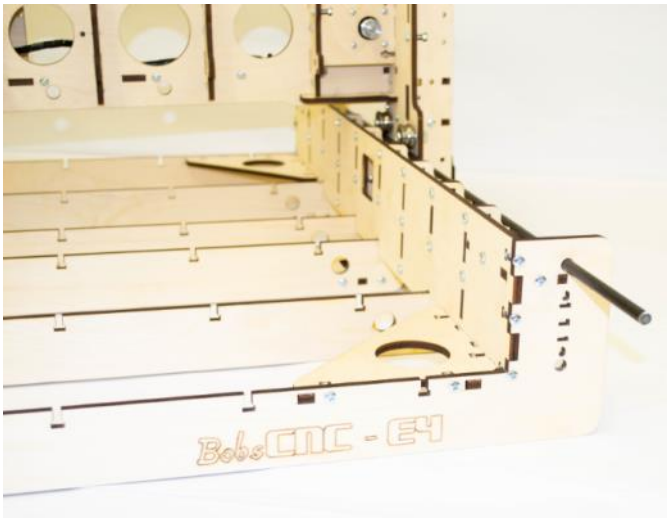
Step 2

Position gantry gently over the main frame.

Step 3

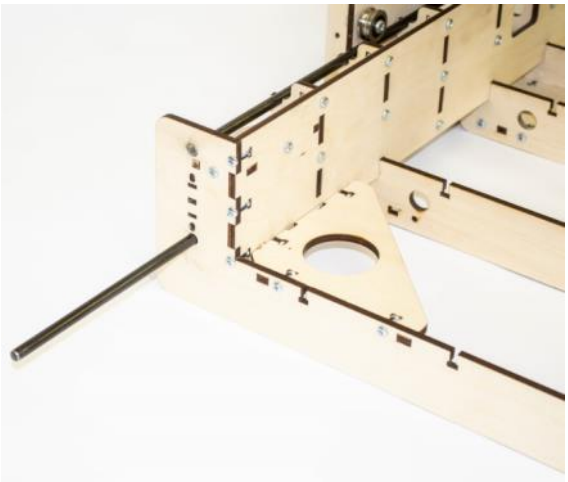
Carefully insert the upper rails through the main frame and *under the* upper pair of SG20U Bearings, through each of the X Rail Supports until the end of the rail is seated in the Frame End Supports .

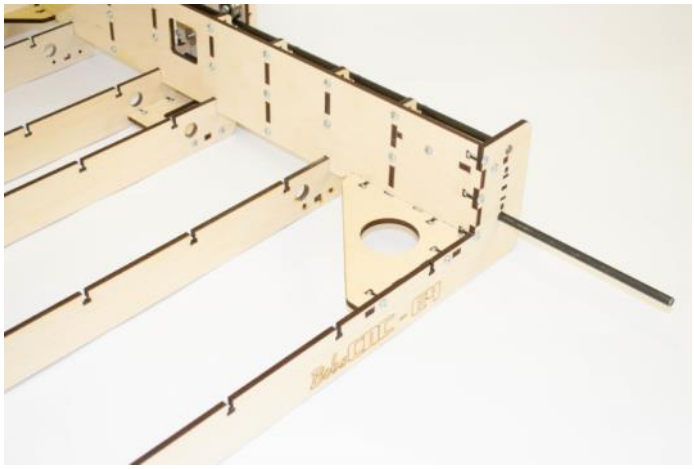




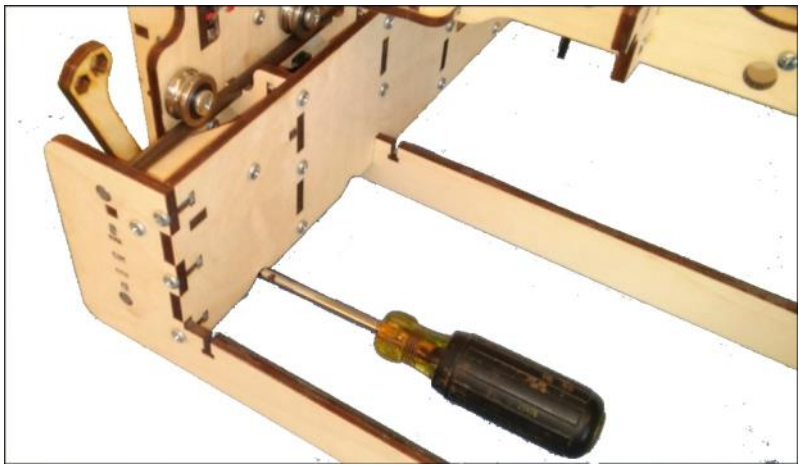
Step 4

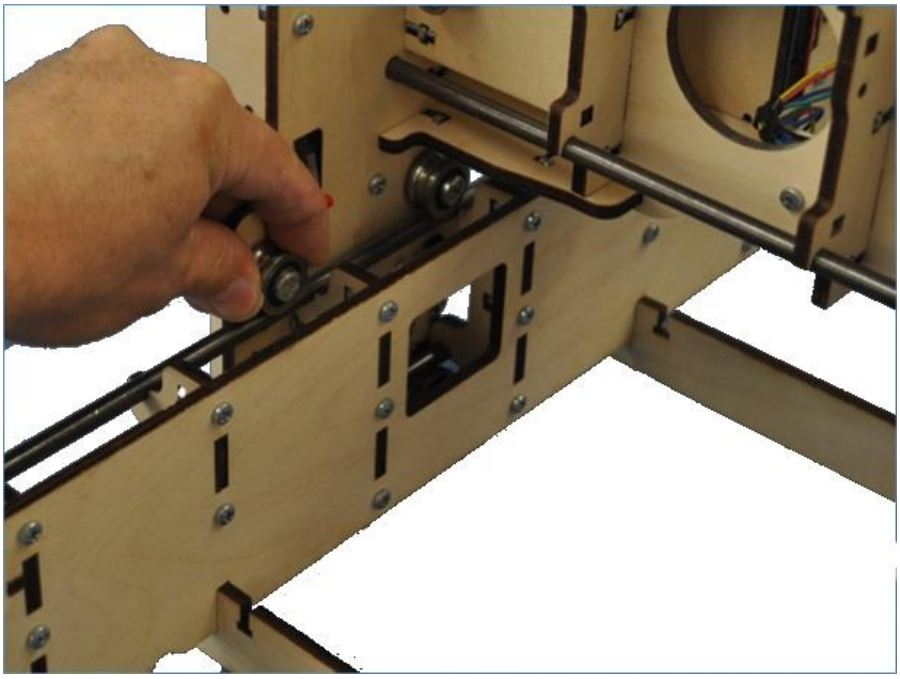
Carefully insert the lower rails through the main frame and *over* the bottom pair of SG20U Bearings, through each of the X Rail Supports until the end of the rail is seated in the Frame End Supports.





The SG20U Bearings should roll across the rod with a small amount of *preload* (i.e., they should securely engage the rail and roll firmly). Check the bearings to ensure that they are snug up against the rail. The bearing should move along the rail when rotated by hand.





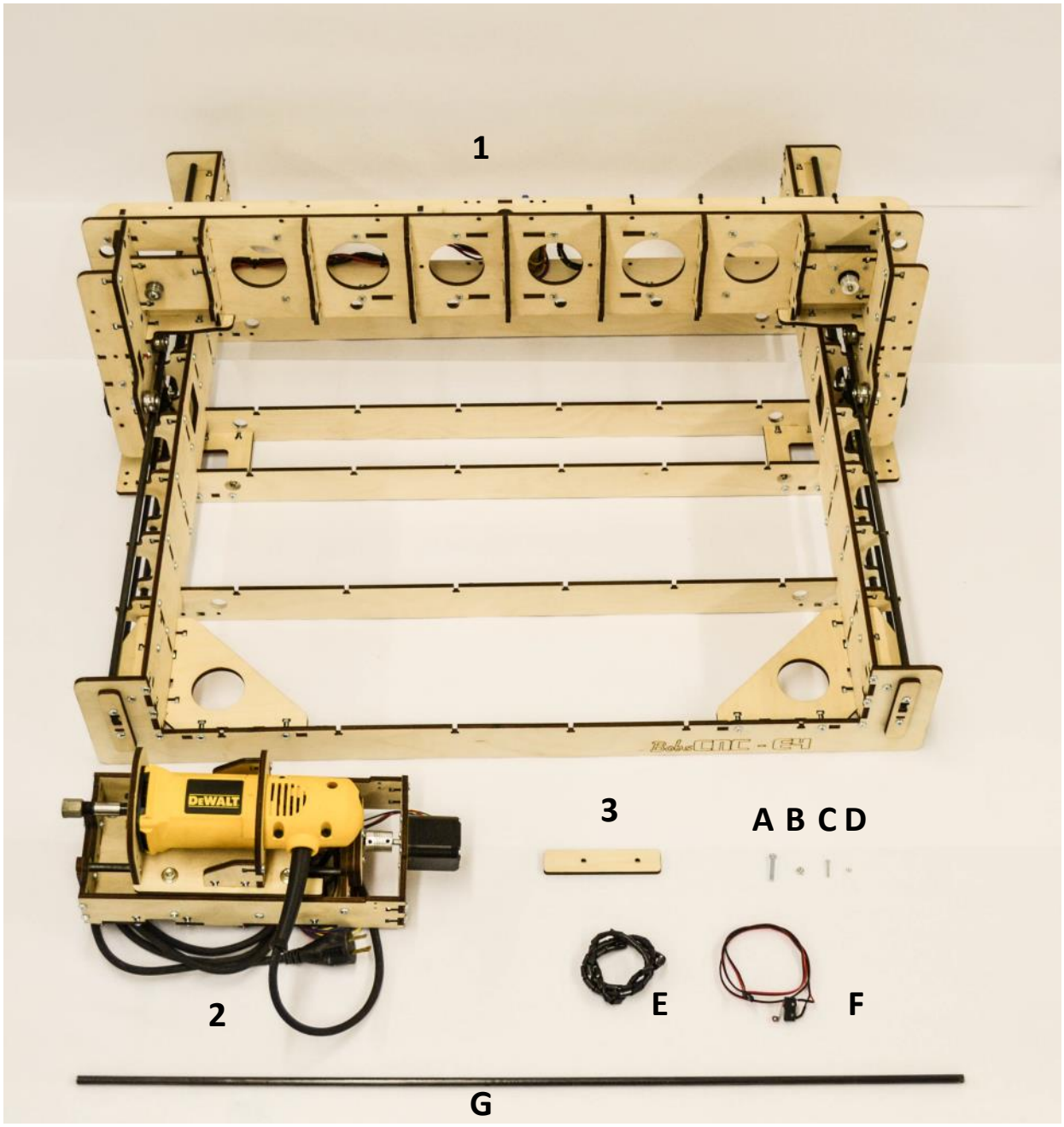
If any of the bearings rotate without engaging the rail:

- **Remove both of the X rods**
- **Loosen the 2 nuts on the slotted holes on each side & slide the SG20U bearings upward**
- **Snug the SG20U bearing nuts**
- **Repeat steps 1 thru 5.**

Step 5

Place the remaining X Rail Stops to the Frame End Supports and secure each with two M4 x 16 Screws and Nuts (these will be tightened after the GT2 Belts are installed).

Y Carriage Installation Instructions



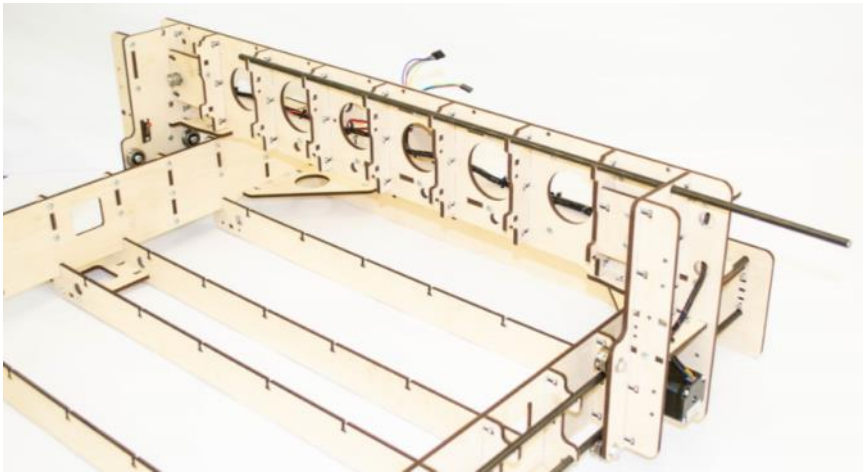
Parts Required:

Part #	Qty	Description
1	1	Gantry & Frame Assembly
2	1	YZ Carriage Assembly
3	2	Y Rail Stops

Part #	Qty	Description
A	4	M4 x 25 Screws
B	4	M4 x Nuts
C	2	M2.5 x 16 Screws
D	2	M2.5 Nuts
E	1	Spiral Wrap
F	1	Switch
G	2	Y Rails

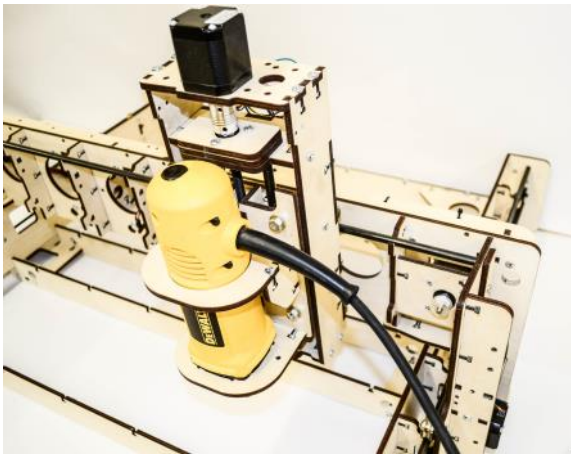
Step 1

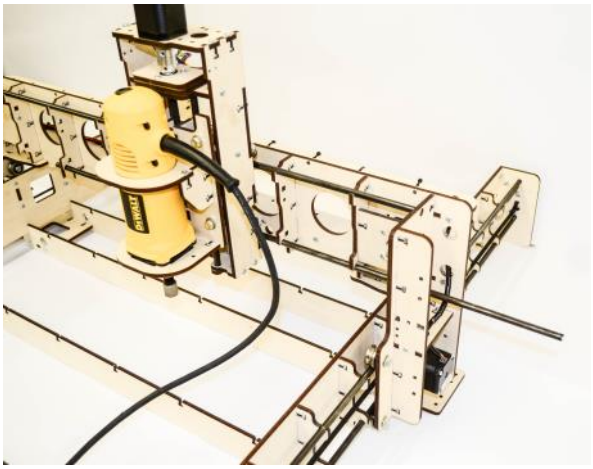
Insert the top rail through the hole in the Gantry Side Frame and carefully through the Y Rail Supports into the hole of the opposite Gantry Side Frame.



Step 2

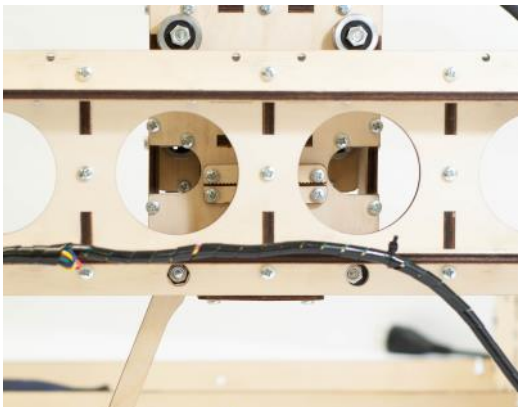
Carefully hang the upper bearings of the YZ carriage assembly onto the rail. Next, insert the bottom Y Rail through the hole in the Gantry Side Frame and over the lower set of bearings and through the Y Rail Supports into the hole of the opposite Gantry Side Frame.



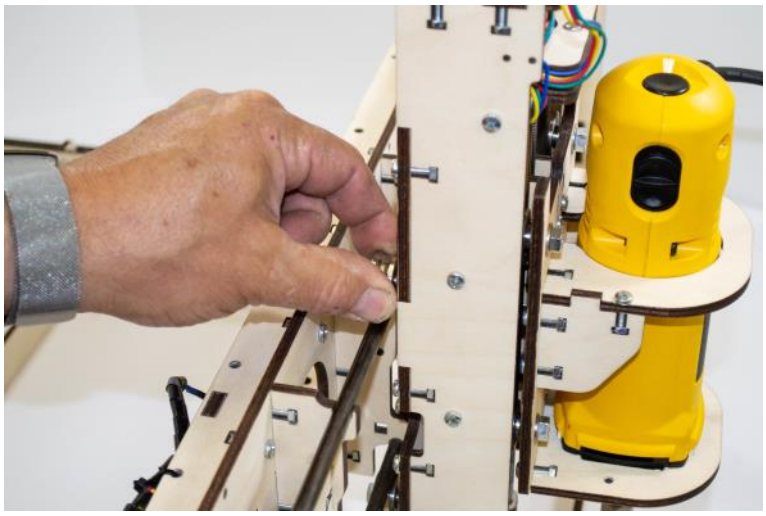


Step 3

Tighten both bottom SG20U Bearing Nuts on each side one full turn (see below:).



The SG20U Bearings should roll across the rail, there should be a small amount of *preload* (i.e., they should securely engage the rail and roll firmly). Check the bearings to ensure that they are snug up against the rail. The bearing should move along the rail when rotated by hand.



If any of the bearings rotate without engaging the rail:

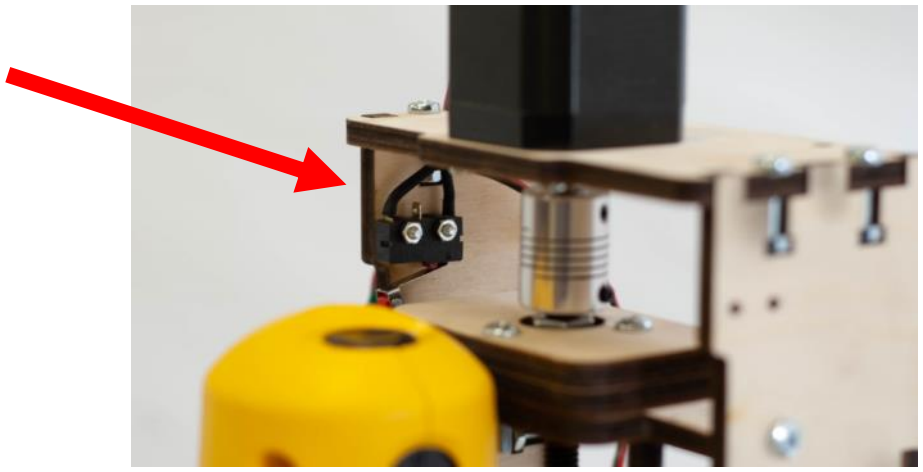
- **Remove both of the Y rods**
- **Loosen the 2 nuts on the slotted holes on each side and slide the SG20U bearings upward**
- **Snug the SG20U bearing nuts**
- **Repeat 1 thru 4.**

Step 4

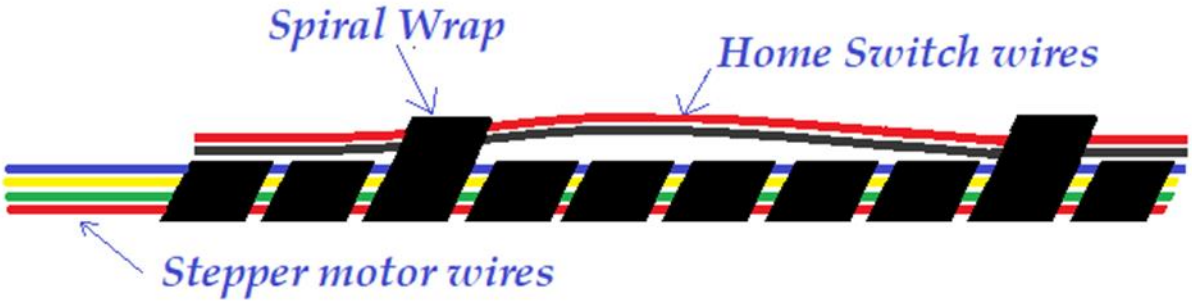
Place the Y Rail Stops one on each side of the gantry and secure each with 2 - M4 x 25 Screws and Nuts. Please note the orientation (the Rail Stop must cover the ends of the rails, keeping them in place).

Step 5 Attach the Z Home Switch to the inside of the Y Carriage Side Support and secure with two M2.5 x 16 Screws and Nuts.

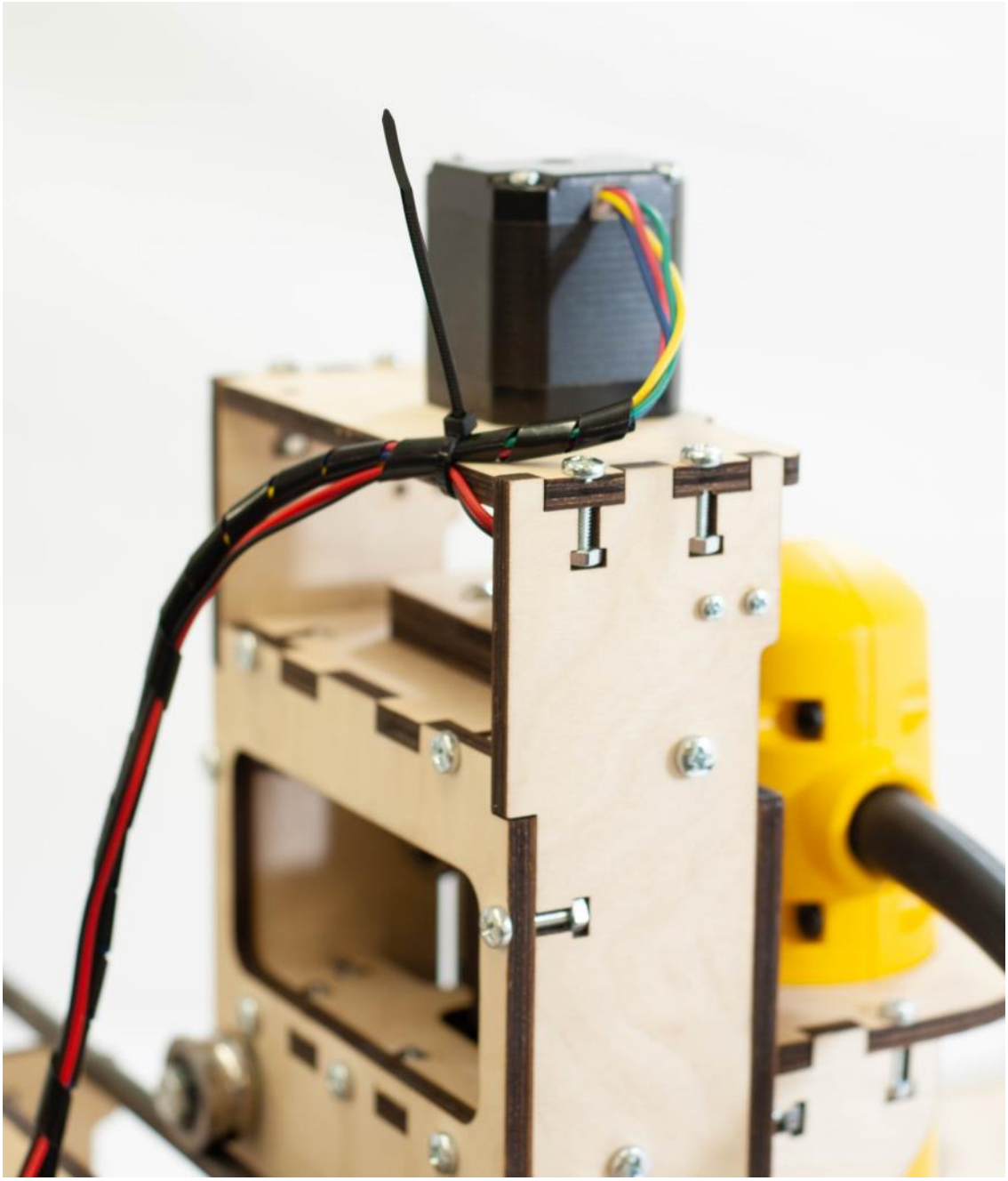
Do not overtighten the M2.5 x Screws and Nuts when attaching a switch. Overtightening can cause the switch to fail.



To avoid false triggering the X, Y and Z Home Switches caused by the electrical noise of the Stepper Motor wires, it is a best practice to secure the Home Switch wires with Spiral Wrap every 5 or 6 turns as shown below.



Step 6 Spiral wrap the Home Switch Wires and zip tie the wrapped wires as shown.



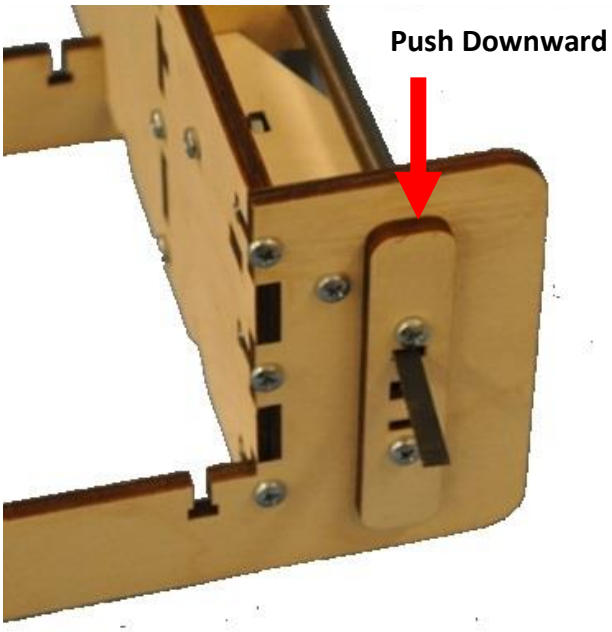
Installing the Belts

Parts for assembly include:

1. **1-E4 Assembly**
2. **2 -X Belts**
3. **1-Y Belt**
4. **4-Nylon ties**

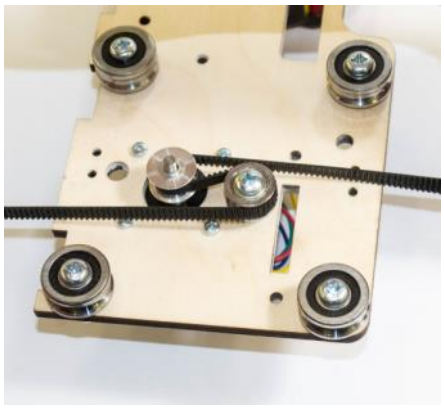
Step 1

Route the X Belt through the top of the Frame End Support and the top slot of the X Rail Stop as shown leaving approximately 2 inches. Push the X Rail Stop downward to trap a belt and tighten the two M4 x 16 Screws.

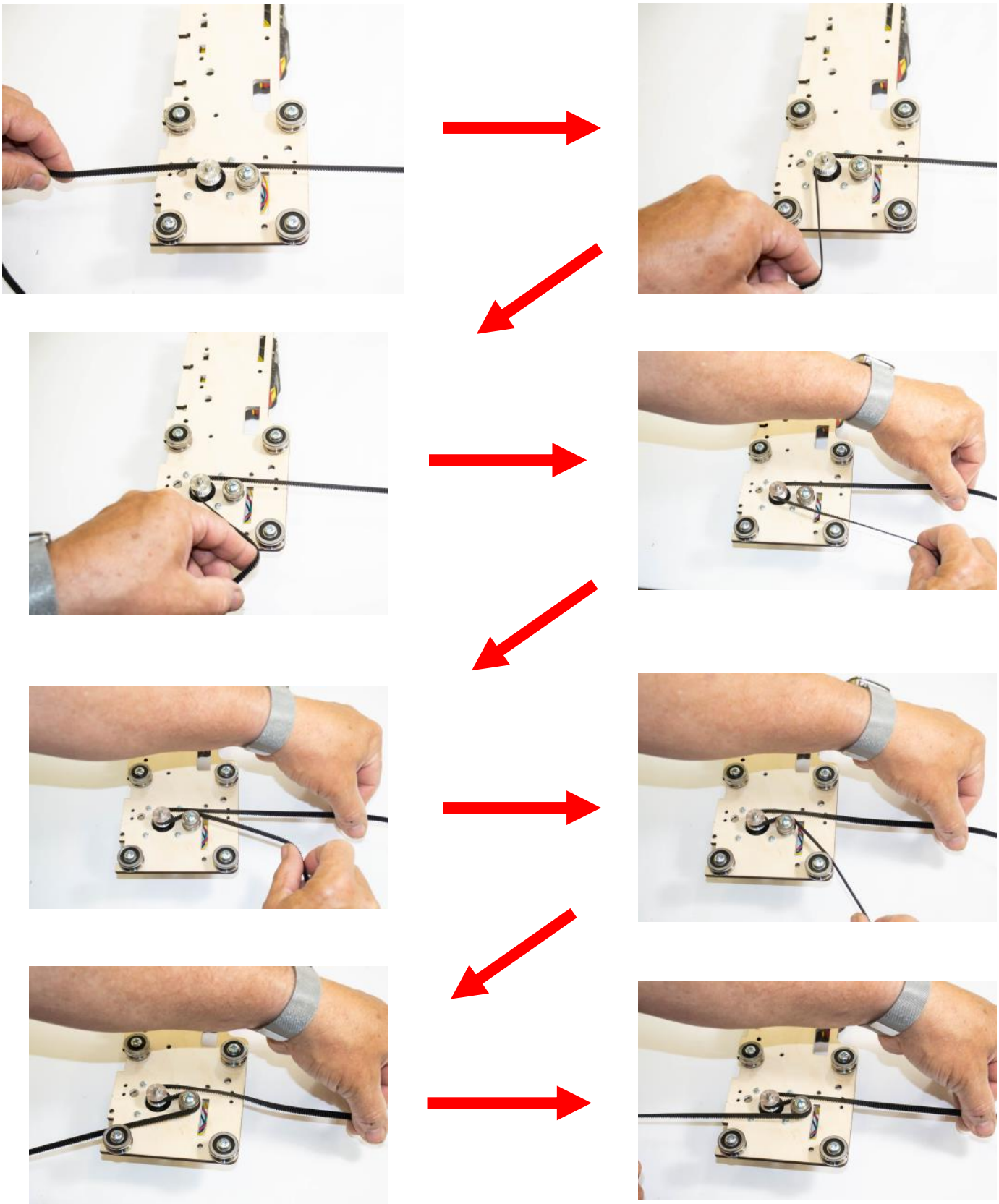


Step 2

Route the X Belt through and around the GT2 pulley & Idler as shown (note: teeth on belt are engaged in the GT2 Pulley).

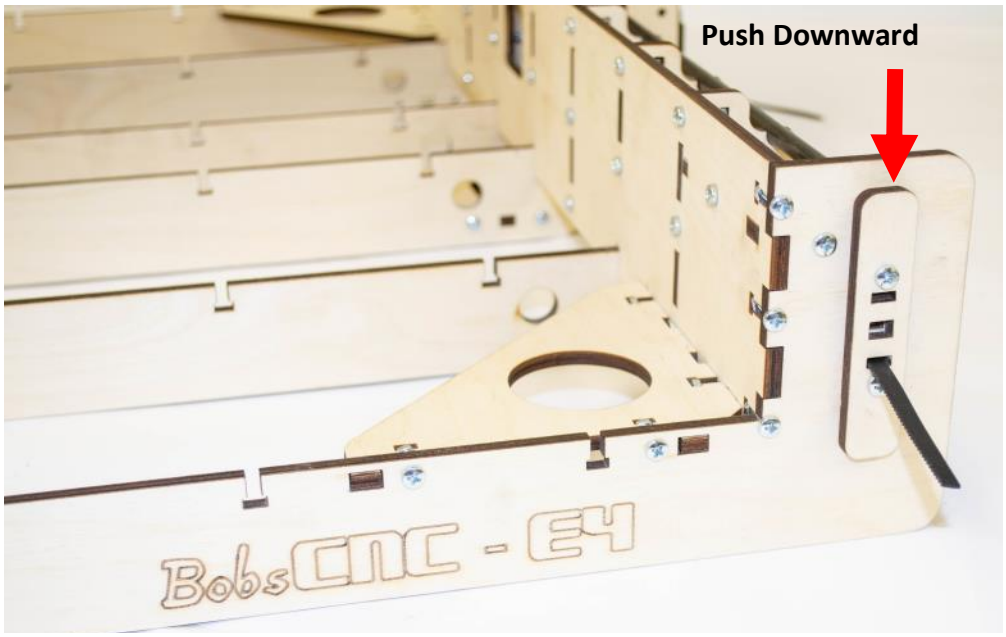


These photos illustrate how the belt wraps around the GT2 Pulley and Idler.



Step 3

Pull the belt through the lower slot on the X Rail Stop. Leave approximately 2-3 inches of the belt extending past the X Rail Stop. While keeping the belt taut, push the X Rail Stop downward to trap the belt. Tighten the two M4 x 16 Screws.



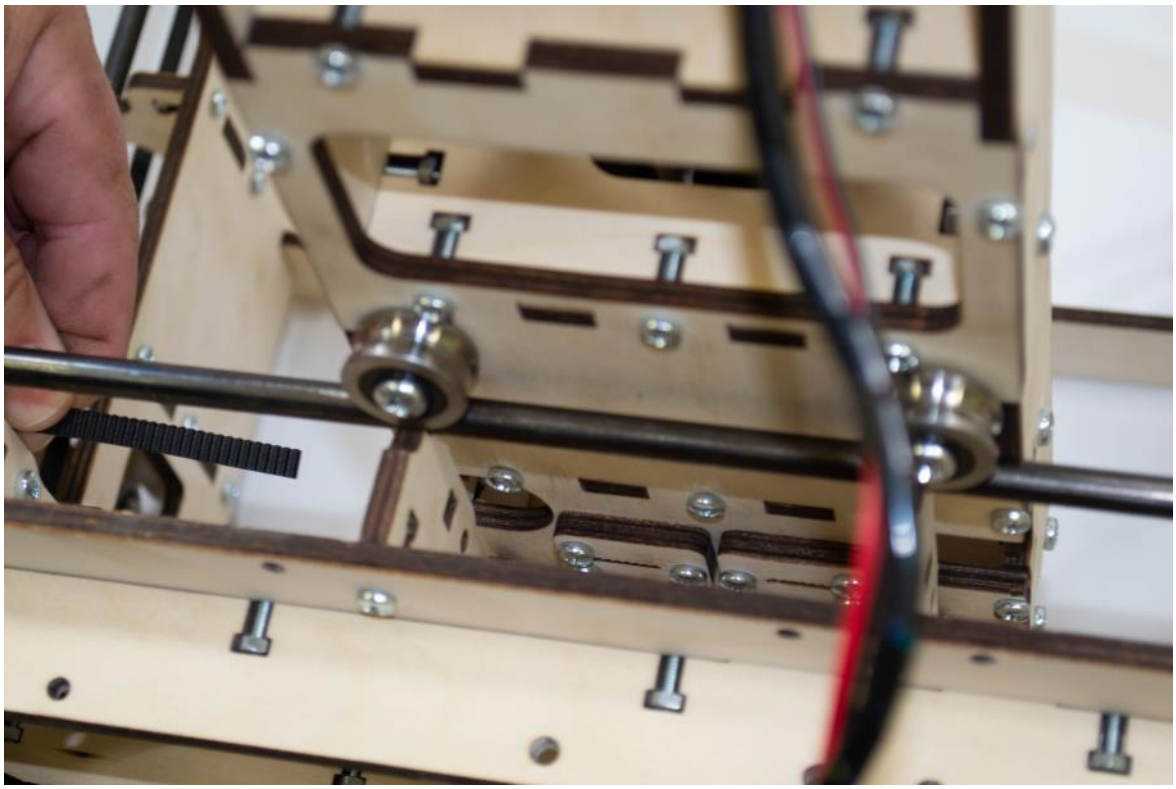
Step 4

Loop the belts through the X Rail Stops and Frame End Supports, through the large middle slot and secure the loose end to the belt with a small zip tie. Trim excess belt and zip tie as shown below. Repeat with belt on other side.

Left Side View

Right Side View

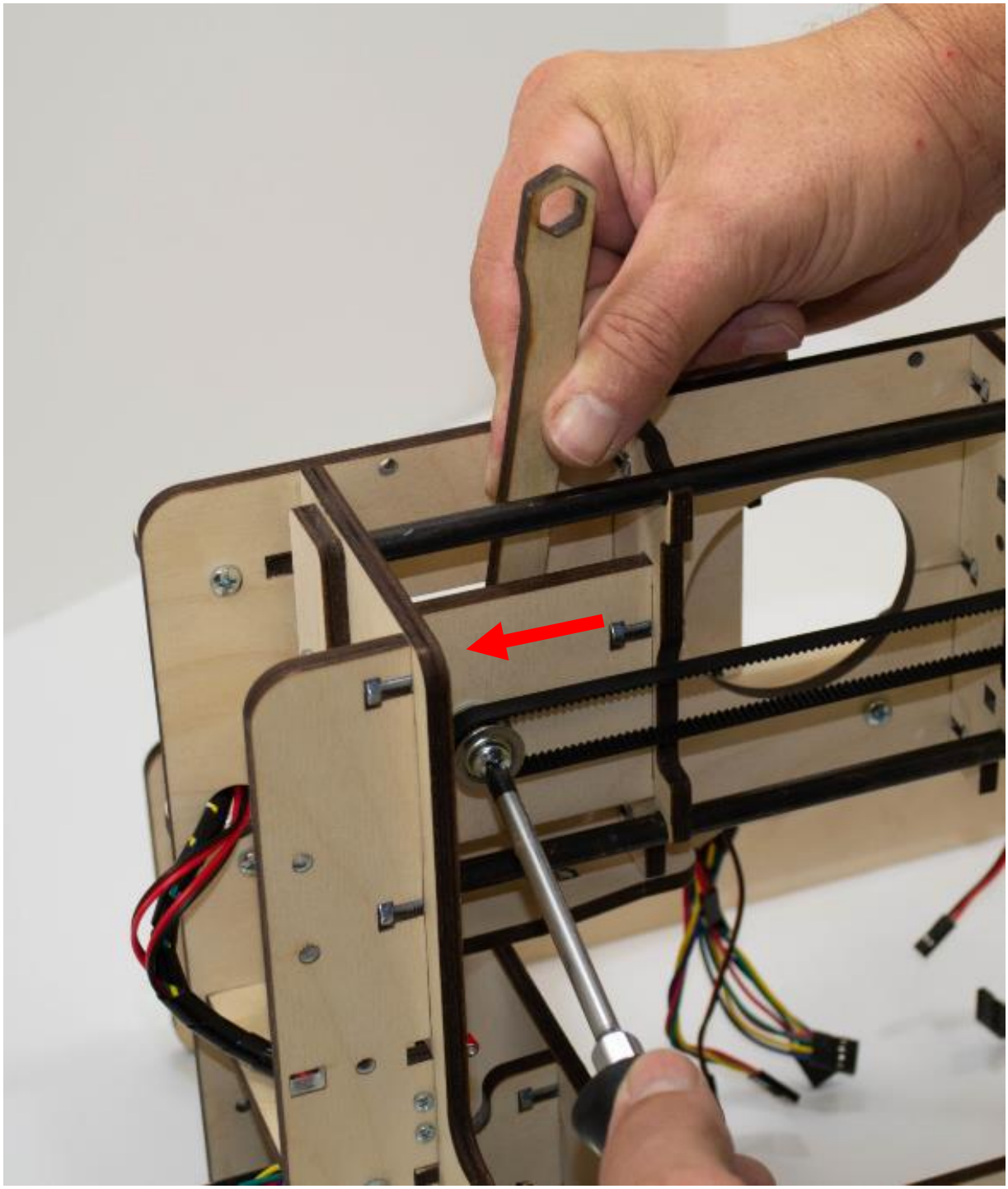
Step 5 Route the Y Belt into the Belt Retainer as shown.



Step 6 Route the loose end of the Y Belt around the GT2 Pulley and Idler and secure the loose end into the other Belt Retainer. (Be sure the teeth on the Belt engage the teeth on the GT2 Pulley.)

Step 7

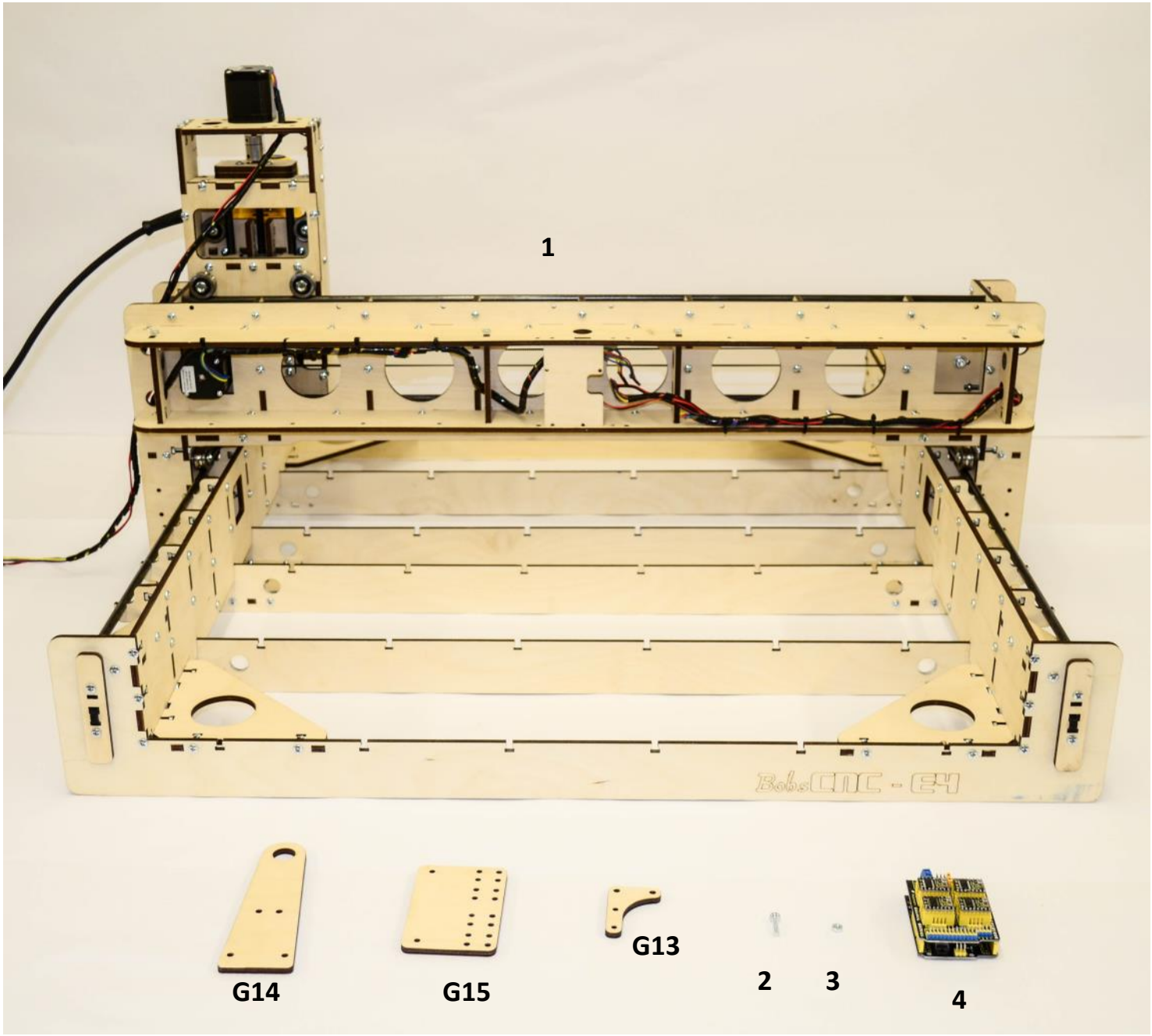
Tighten the belt by moving the Idler and tightening the Idler screw and nut (see below). Shorten belt if needed.



Electronics Installation Instructions

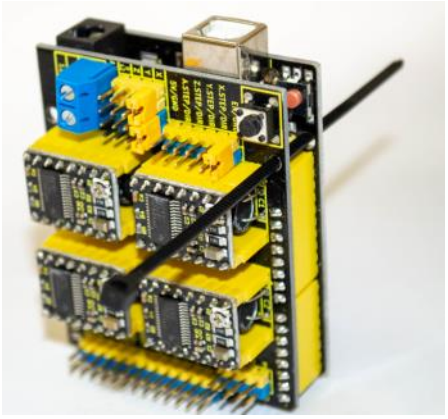
Parts for assembly include:

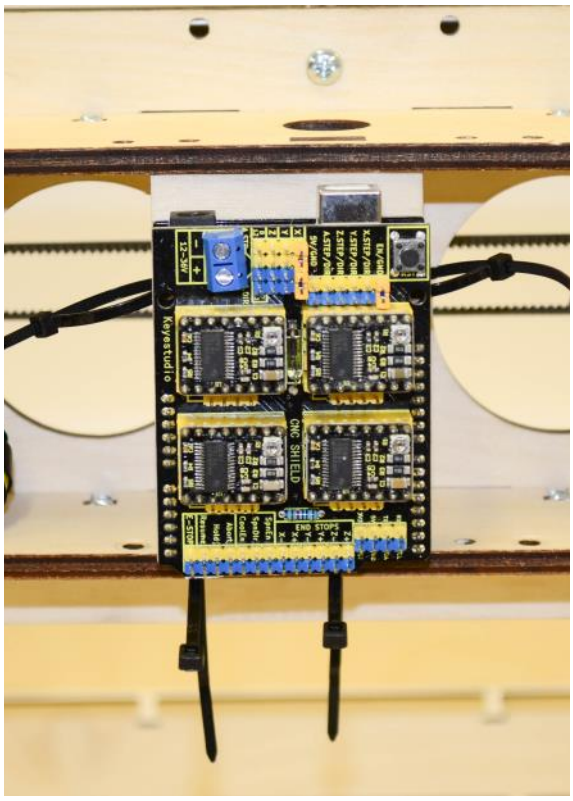
Part #	Qty	Description
1	1	E4 Assembly
2	8	M4 x 16 Screws
3	8	M4 Nuts
4	1	Controller
G13	1	Side Cable Mount
G14	1	Top Cable Mount
G15	1	Bottom Cable Mount

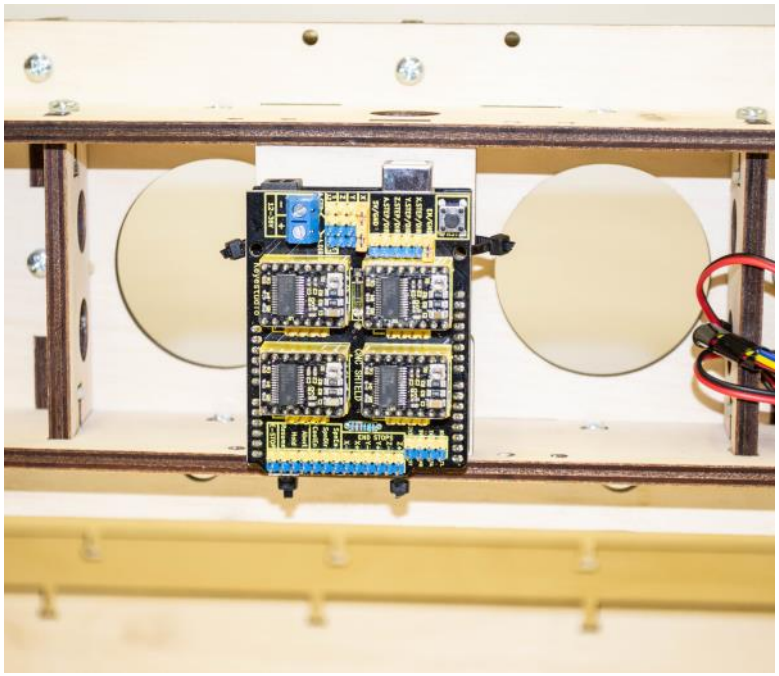


Step 1

Secure the Controller with 4 Small Zip Ties as shown. Be careful not to overtighten which can damage the Controller.

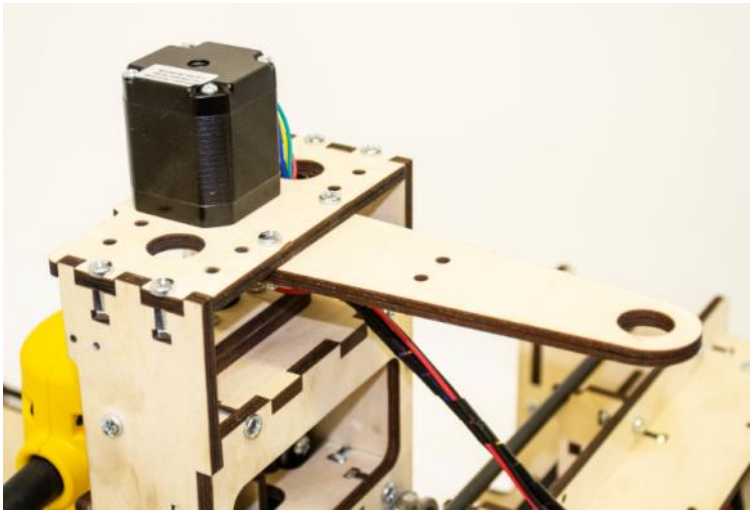






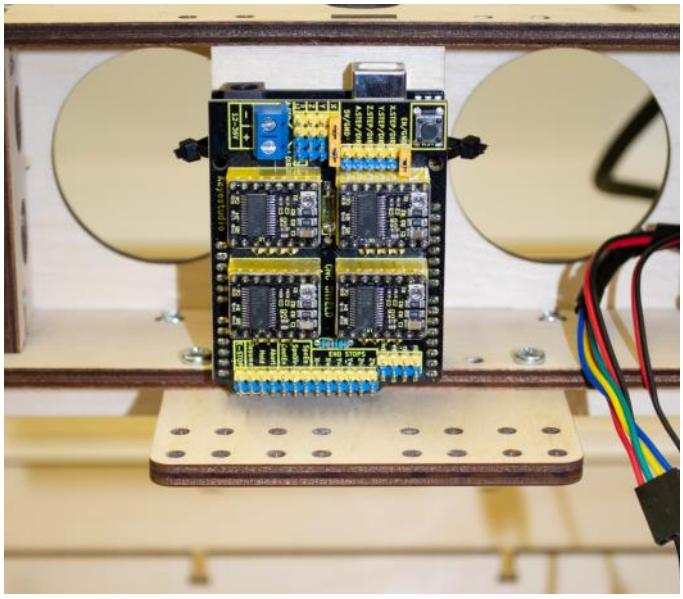
Step 2

Attach Top Cable Mount to top of Y carriage assembly using 2 M4 x 16 Screws and Nuts.



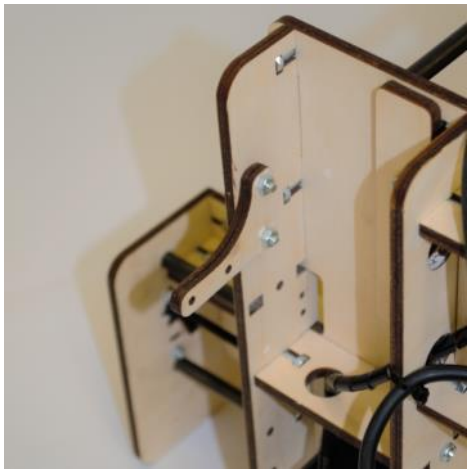
Step 3

Attach Bottom Cable Mount to the bottom of the gantry assembly beneath the controller using 2 M4 x 16 Screws and Nuts.



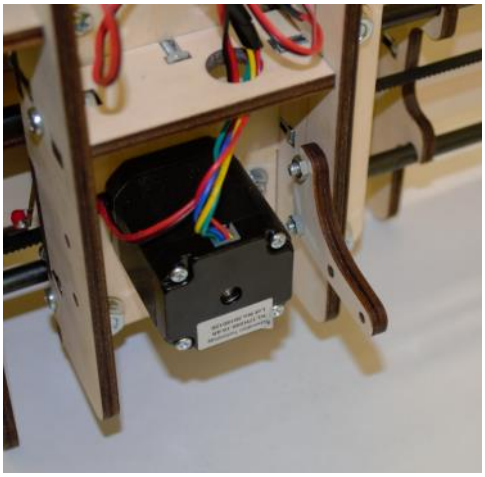
Step 4

Attach one Side Cable Mount to the each side of the gantry assembly using two M4 x 16 Screws and Nuts for each.

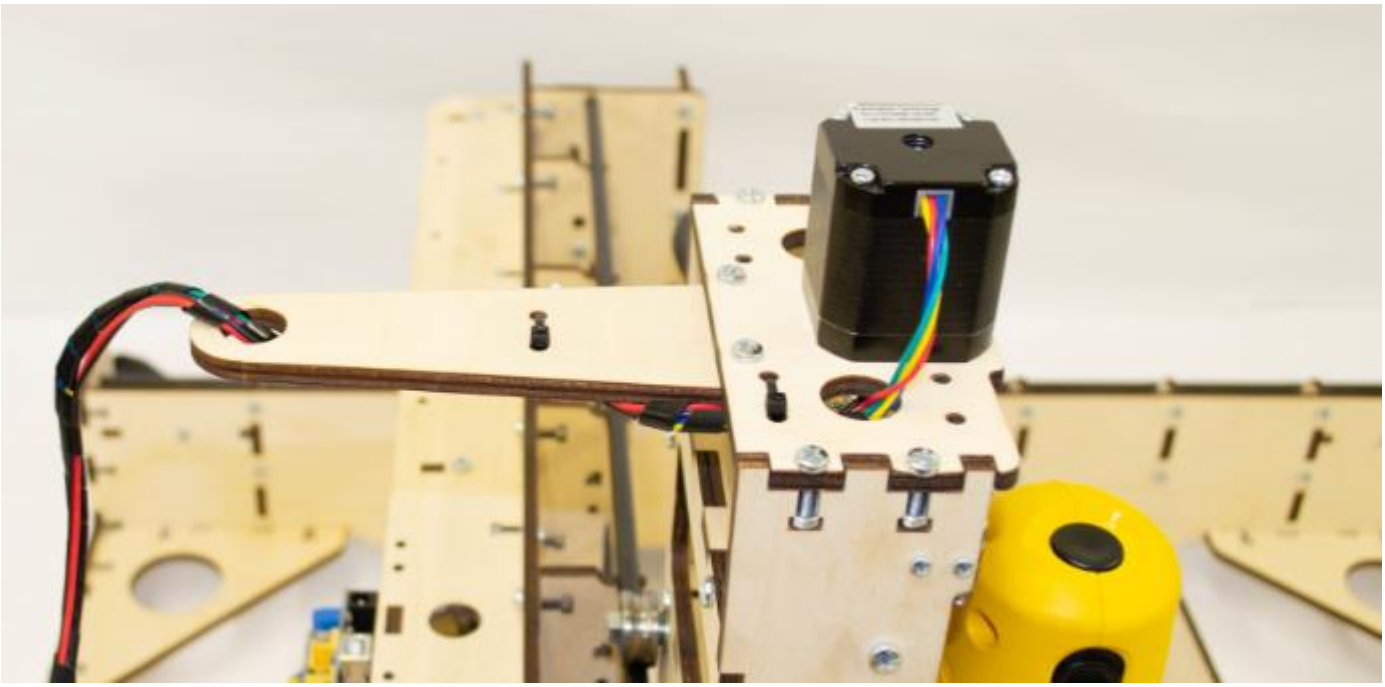


Use upper mount for power supply cords on the right side.

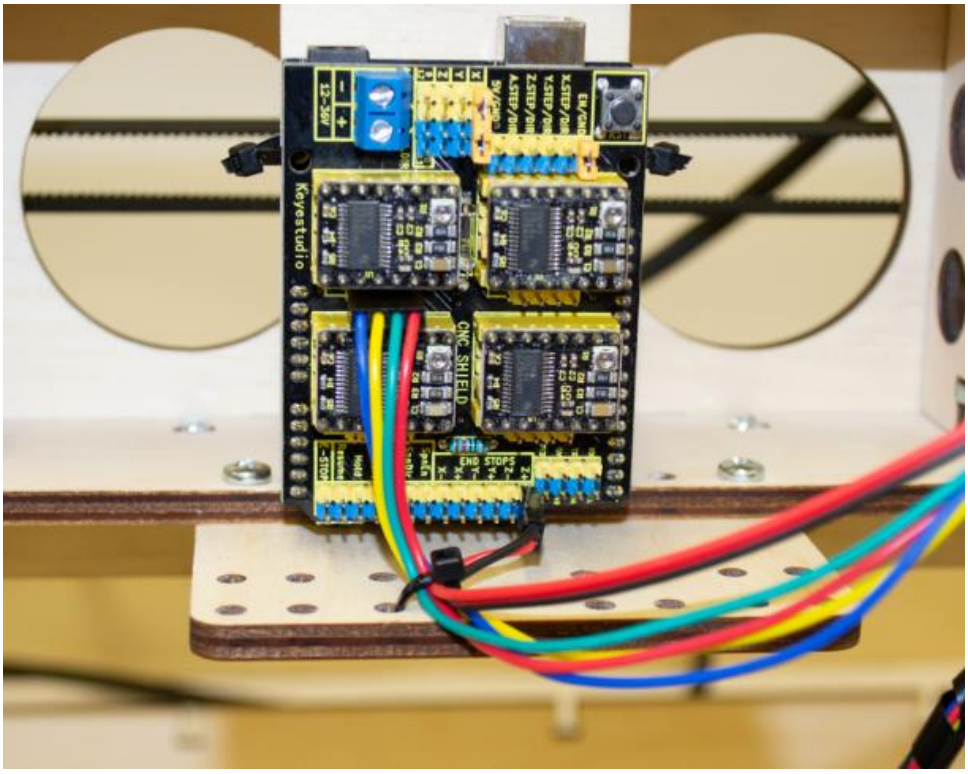
Use lower mount for USB cable on the left side.



Step 5 Thread spiral wrapped wiring though Top Cable Mount, secure with a Small Zip Tie.

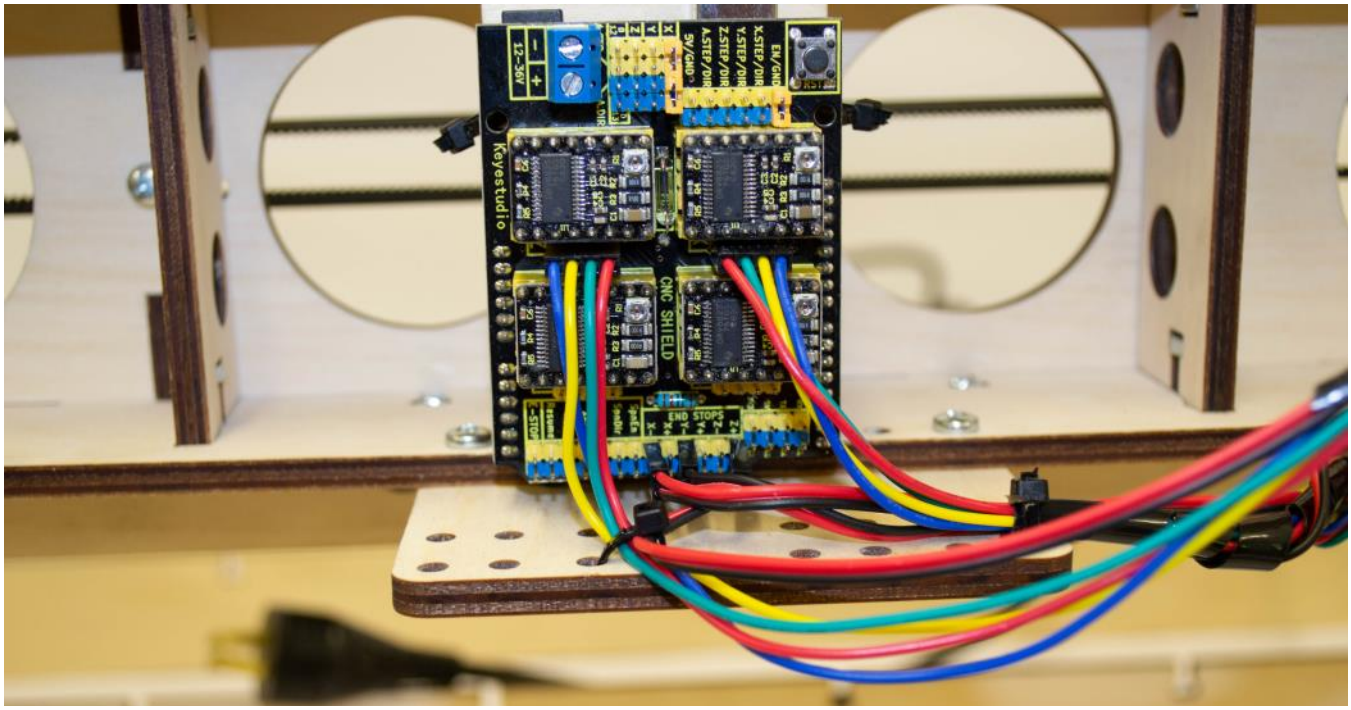


Step 6 Route Z Stepper and Z Home Switch wires and secure with small Zip Tie.



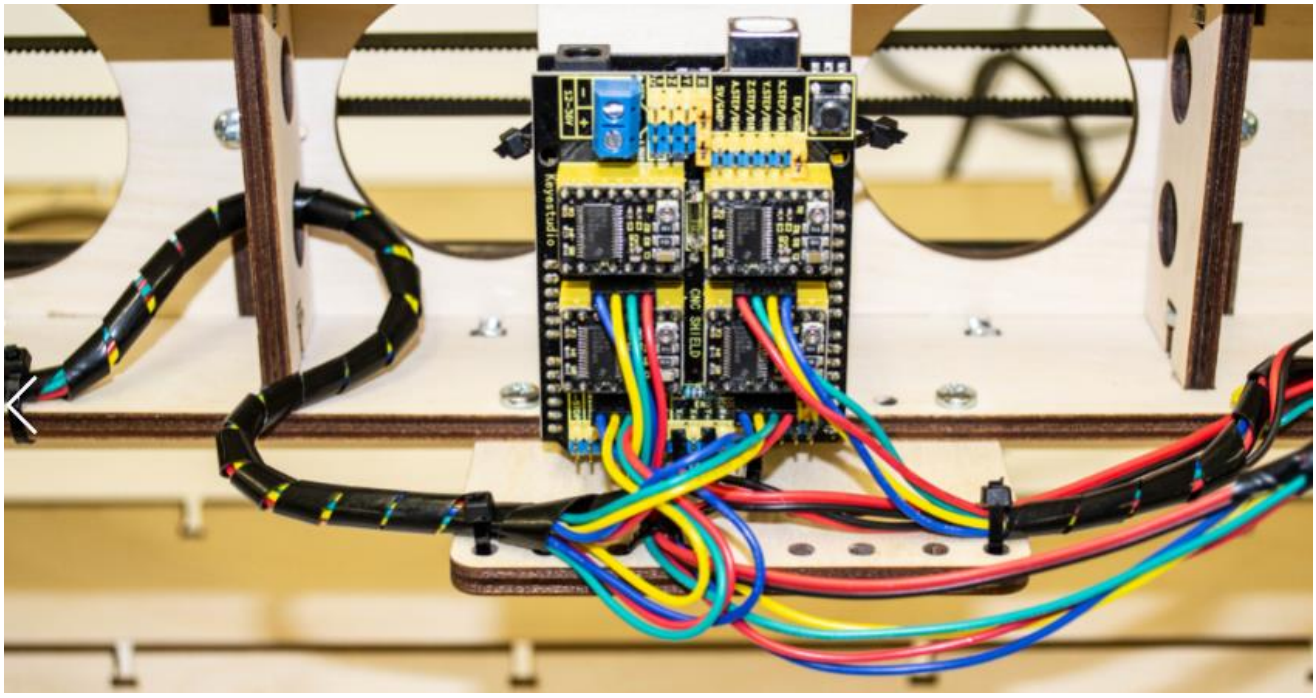
Step 7

Route X1 Stepper Motor and X and Y Home Switch Wires and secure with small Zip Tie.



Step 8

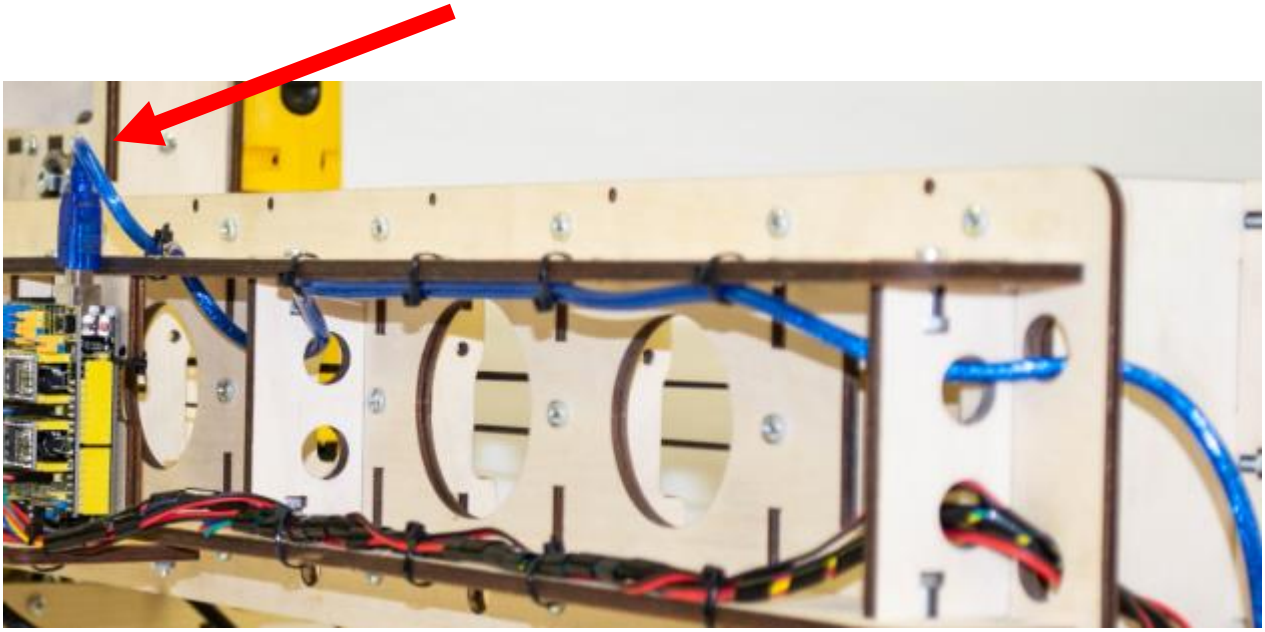
Route wires for X2 and Y Stepper Motors and secure with small Zip Tie .

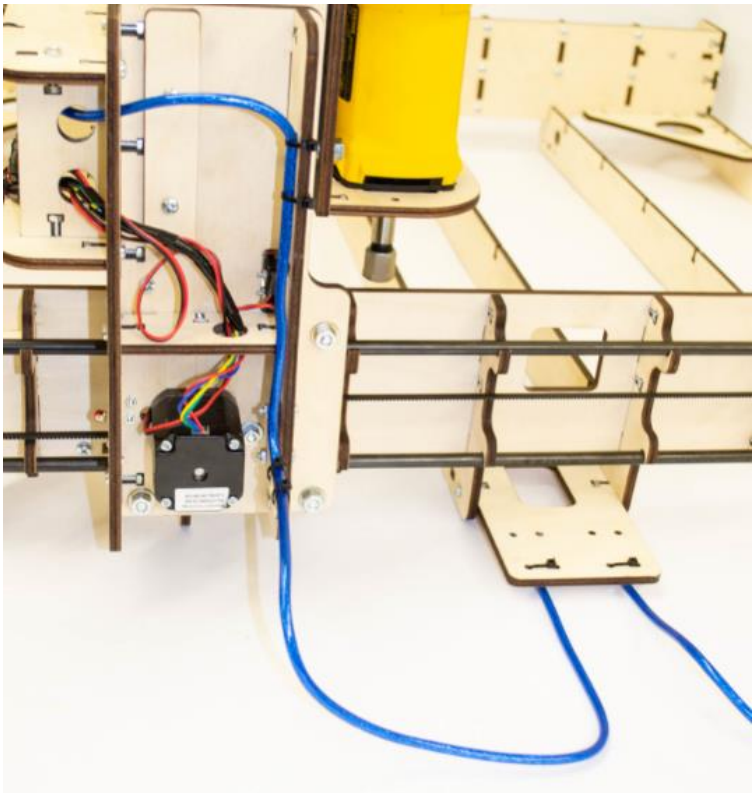


Please see page 86 for the connection diagram for details with connections of stepper motors and home switches.

Step 9 Route USB Cable across gantry assembly, down to the Side Cable Mount, then loop to the X Cable Mount and secure with small zip ties (see below).

Loop the USB cable as shown in order to avoid kinking the cable at the plug end. Give ample cable length between the Side and X Cable Mounts to ensure full gantry travel without binding.

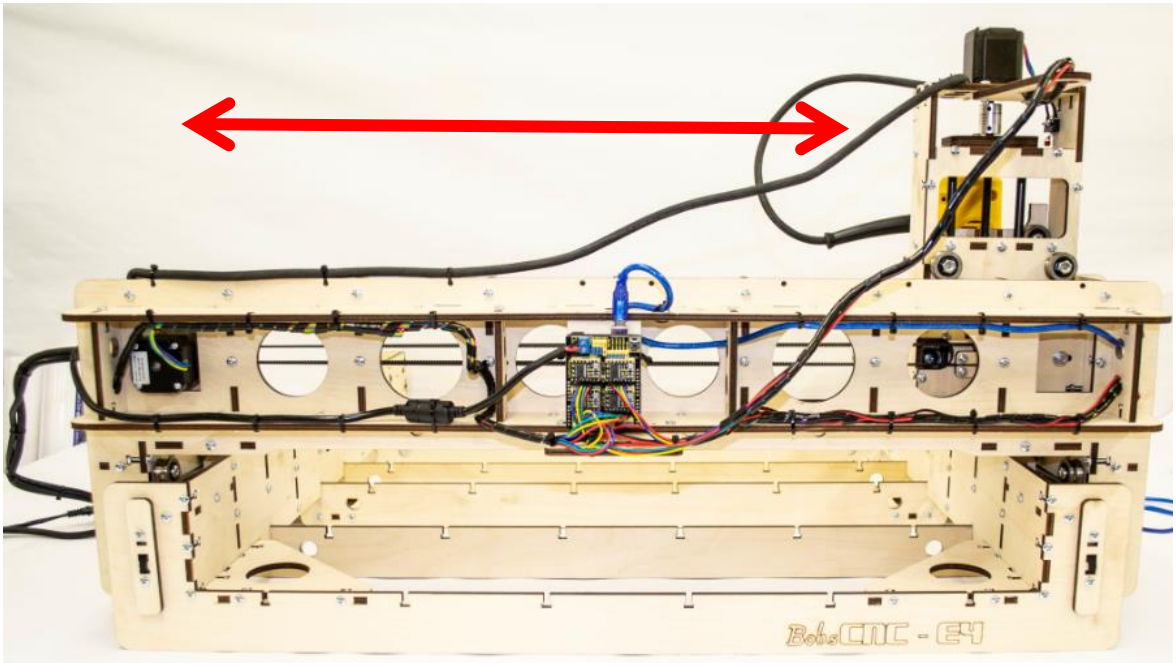


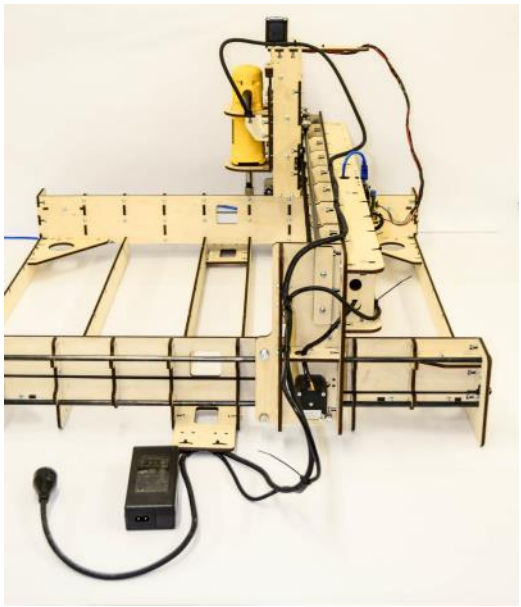


Step 10

Route the Power Supply and the DeWalt power cord as shown and secure in place with Small Zip Ties. Connect the red wire of the Power Supply to the positive(+) terminal on the Controller. Connect the remaining Power Supply wire to the negative (-)terminal on the Controller.

Give ample cable length between the Side and X Cable Mounts to ensure Make certain that the Y Carriage Assembly moves freely from one end to the other on the Rails without binding the wrapped/ bundled wiring. full gantry travel without binding.

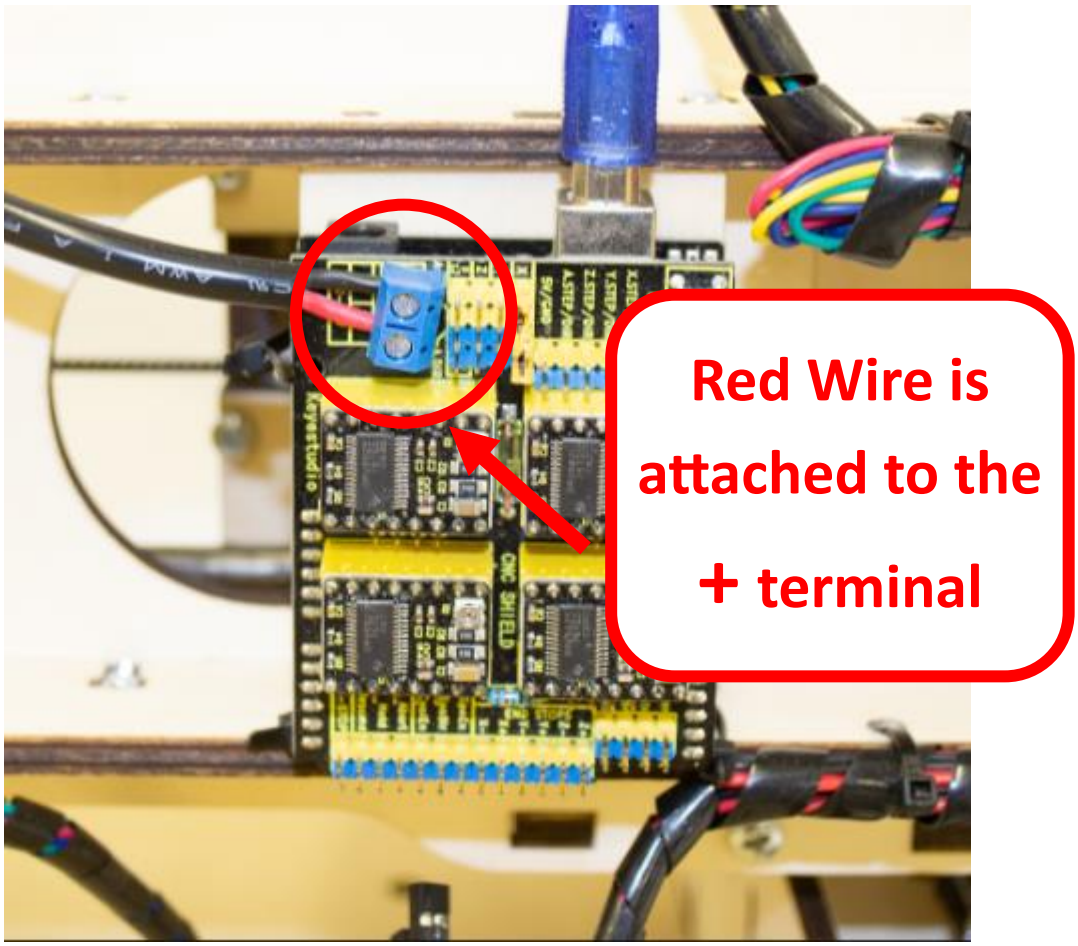




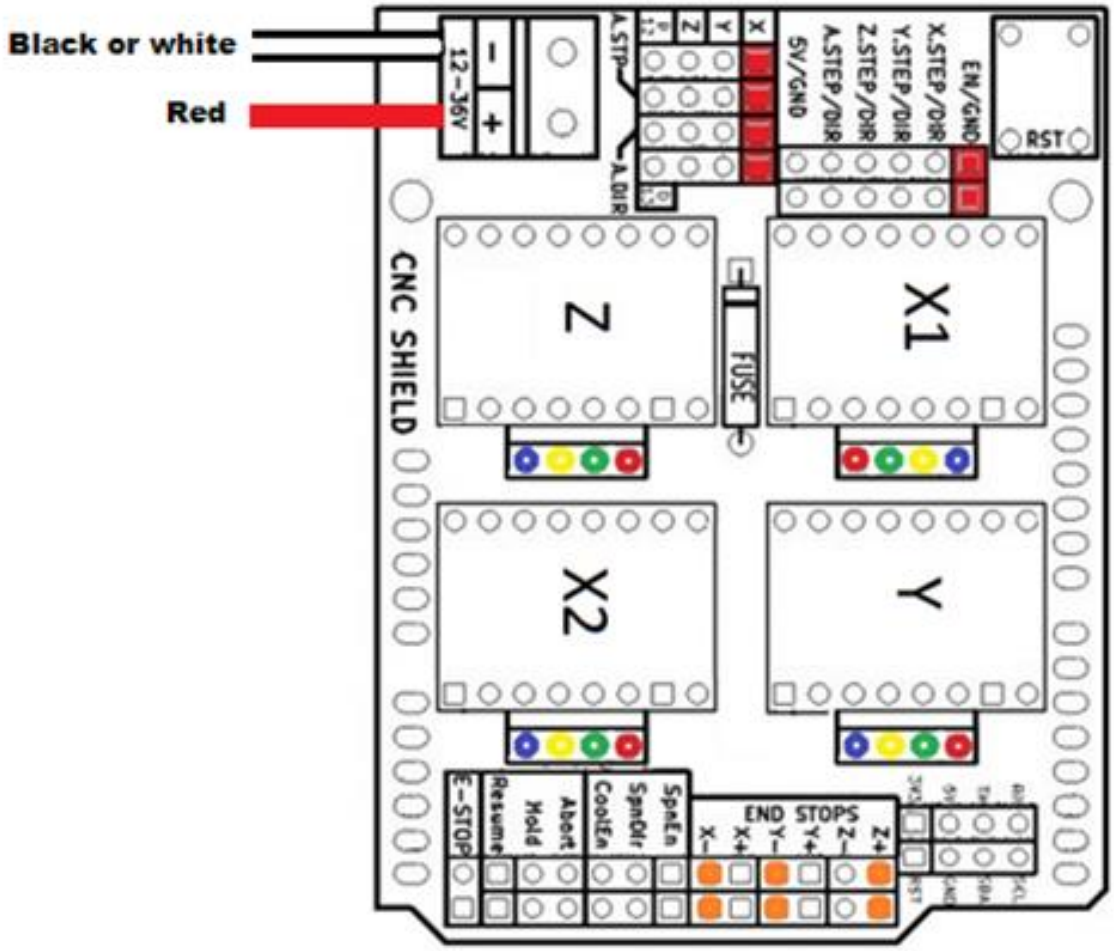
Connecting the controller

Tips to keep your controller from being damaged.

- **Always unplug the power supply when connecting or disconnecting the stepper motor connectors.**
- **Make sure all 4 pins are connected for each stepper motor connector. It is really easy to get the connector offset by one pin.**
- **Check and double check your connections before applying power to the board.**



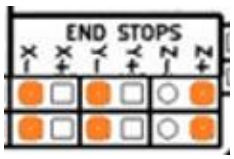
Make sure the Negative (-) is connected to the white or black wire and the Positive (+) is connected to the red or blue wire. Incorrect connections will damage the controller.



Note that the X1 Stepper orientation is opposite the others. (the red wire is on the left in the diagram and picture) 

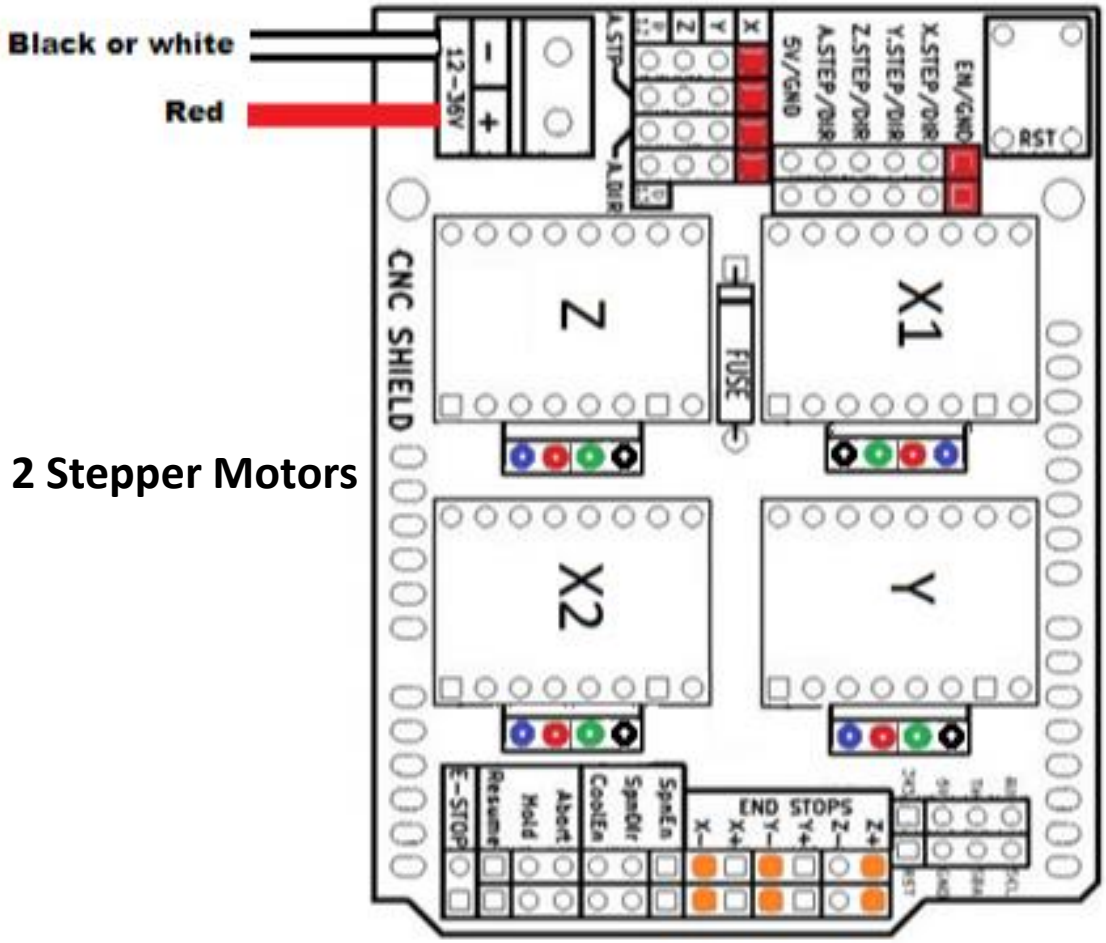
See page 60 for X1 and X2 motor location.

Home switch wires do not have polarity. The home switches are connected to the X , Y , and Z + as shown in orange in the diagram.

The red squares in the diagram are jumper connectors 

PLEASE—CAREFULLY FOLLOW THESE INSTRUCTIONS TO KEEP FROM DAMAGING THE CONTROLLER.

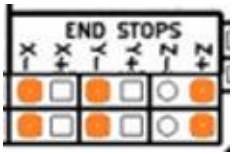
Make sure the Negative (-) is connected to the white or black wire and the Positive (+) is connected to the red or blue wire. Incorrect connections will damage the controller.



Type 2 Stepper Motors

Note that the X1 Stepper orientation is opposite the others. (the blue wire is on the left in the diagram and picture). 

See page 57 for X1 and X2 motor location.

Home switch wires do not have polarity. The home switches are connected to the X-, Y , and Z + as shown in orange in the diagram. The red squares in the diagram are jumper connectors 

PLEASE—CAREFULLY FOLLOW THESE INSTRUCTIONS TO KEEP FROM DAMAGING THE CONTROLLER.

Installing the Spoilboard

Parts for assembly include:

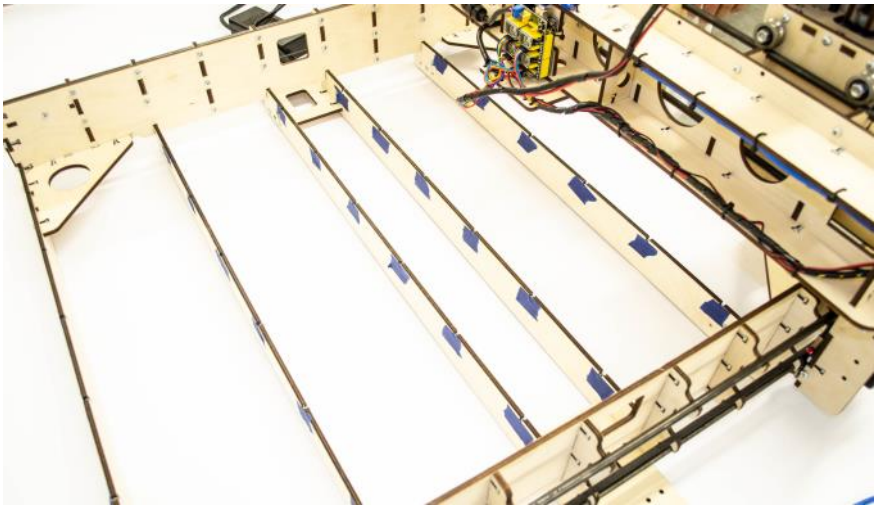
Part #	Qty	Description
1	1	E4 Assembly
2	3	Wide Base Boards
3	5	Wide Routed T-Slot Boards
4	2	Narrow Routed T-Slot Boards
5	36	M4 x 16 Screws
6	36	M4 Nuts
7	12	Steel Ball Bearings

The twelve steel ball bearings are used as temporary spacers to ensure the proper spacing for the Routed T-Slot Boards on the Spoilboard. Bearings should be removed after assembly.

Step 1 Place thirty six M4 nuts into the T-Slots on the Frame End and Frame Mid Supports.

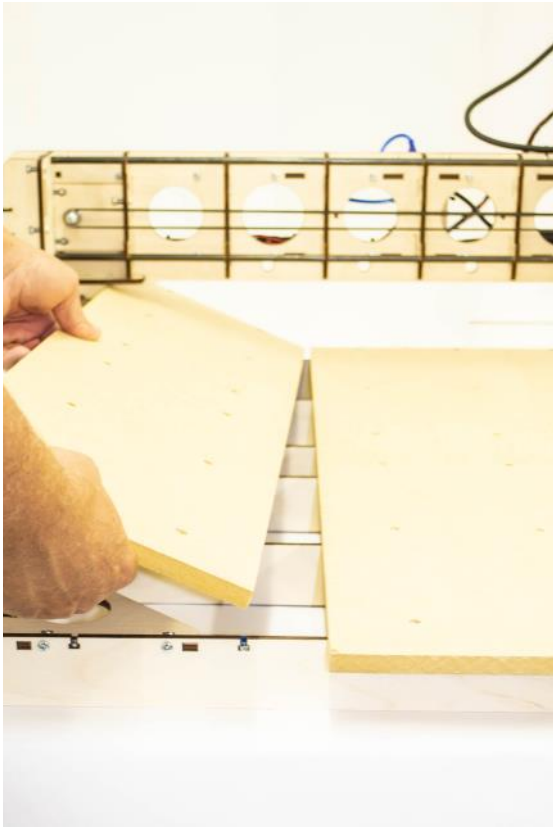
IDEA

- Place 1 inch strips of blue painters tape behind the T-Slots to hold the nuts in place.
- All screws (unless noted) should be installed snug, then rotated one 1 to 2-1/2 turns.



Step 2

Gently set first Base Board into position. Be sure the countersinks are facing up. Secure with twelve M4 X 16 Screws. Repeat with the remaining two Base Boards.



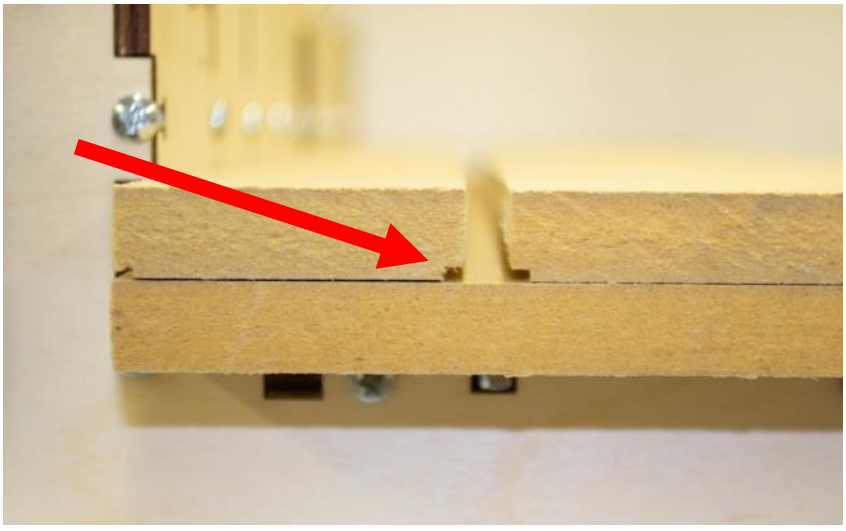
Step 2

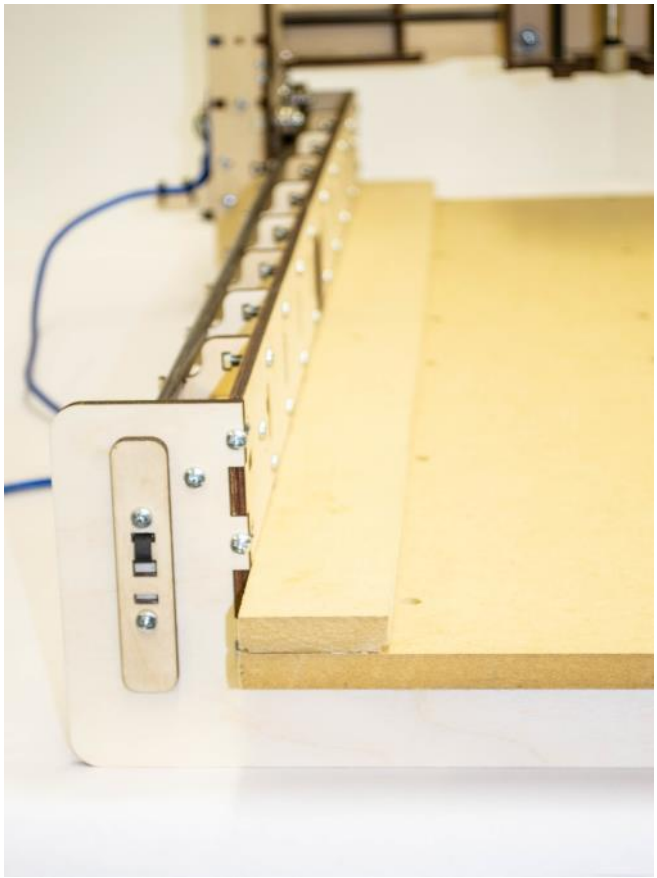
Tighten all screws and wipe off the surface of the Base Board Assembly to remove any dust or debris to prepare for gluing the T- slot boards.

Be sure to test fit the boards before securing with screws.

Step 3

When gluing and setting the T-Slot Boards in place make sure the routed slots are facing down





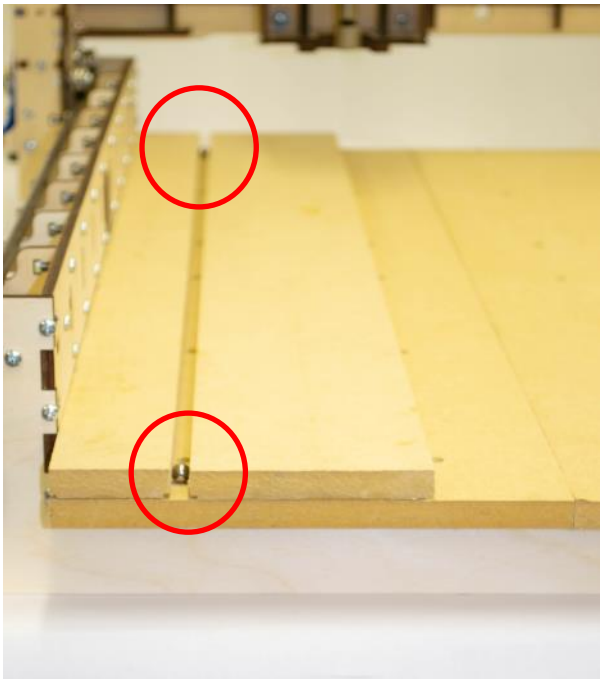
Do not use too much wood glue. Spread the glue evenly. Make certain routed slots are clean and glue free.

Begin by gluing a narrow T-Slot Board to the left side of the assembly.

Place one Steel Ball Bearing as a spacer at each end of the T-Slot channel.

Glue the five Wide T-Slot Boards Align ends with Base Board assembly using re-maining Ball Bearing to fill the spaces.

Finish by gluing the last narrow T-Slot Board in place.

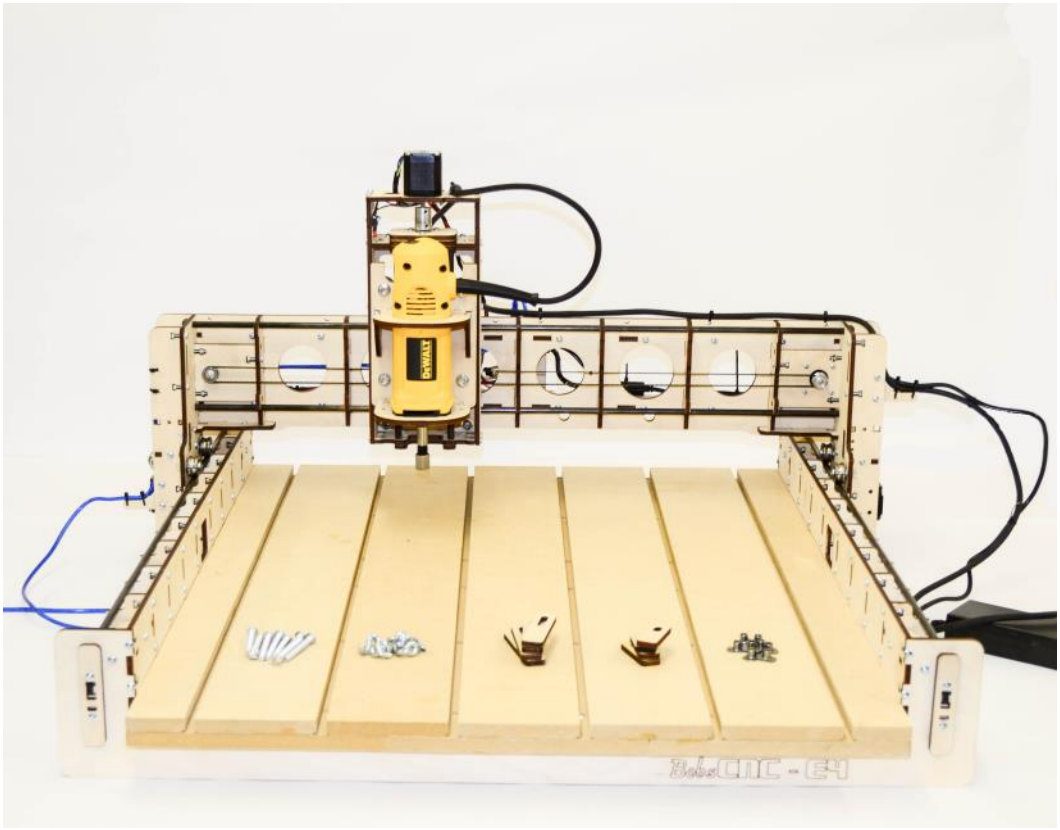


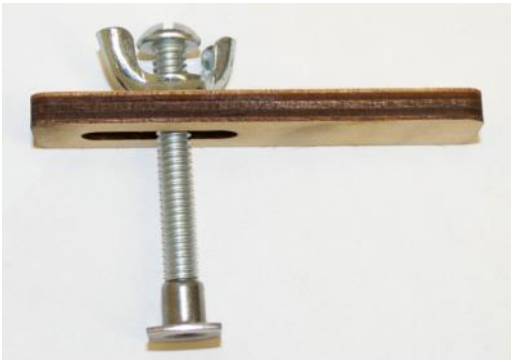
The Steel Ball Bearings must be used to create the proper spacing between the T-Slot member.

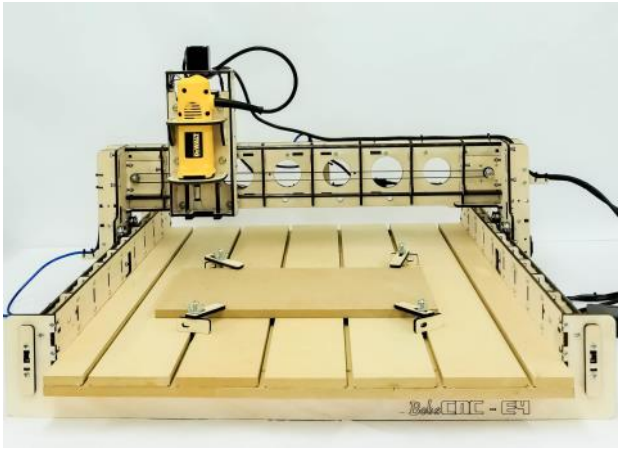
Notice the placement of one at each end.

Clamp the T-Slot Boards to the Base Boards by taping the ends as shown. We recommend that you place additional weight on the T-Slot Boards until the glue has dried. Make certain the routed slots are not filled with glue.

Clamping System







GRBL and Universal G-code Sender Software

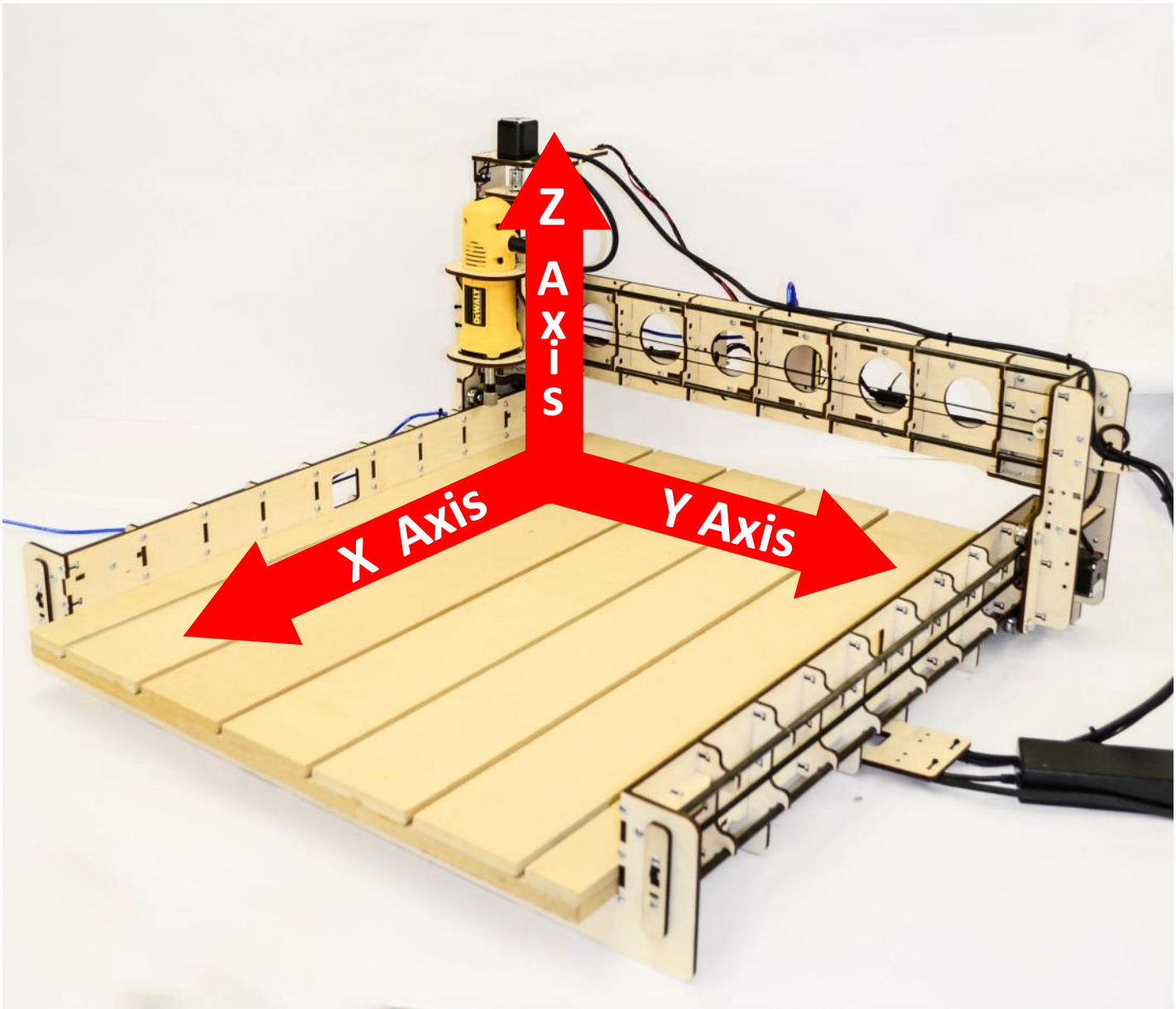
- **Version 1.1e of GRBL has been uploaded to the controller.**
- **There are several G-code senders for GRBL. I have had success with the Universal G-code Sender Platform Version**
- **Some of the firmware values can be changed from the G-code sender software. Below is a table for the default values uploaded into the firmware from GRBL 1.1e.**
- **Please see our support pages here: https://support.bobscnc.com/hc/en-us**

Key	Value	Description
$0	5	(Step pulse time, microseconds)
$1	25	(Step idle delay, milliseconds)
$2	0	(Step pulse invert, mask)
$3	0	(Step direction invert, mask)
$4	0	(Invert step enable pin, boolean)
$5	1	(Invert limit pins, boolean)
$6	0	(Invert probe pin, boolean)
$10	1	(Status report options, mask)
$11	0.01	(Junction deviation, millimeters)
$12	0.002	(Arc tolerance, millimeters)
$13	1	(Report in inches, boolean)
$20	1	(Soft limits enable, boolean)
$21	0	(Hard limits enable, boolean)
$22	1	(Homing cycle enable, boolean)
$23	3	(Homing direction invert, mask)
$24	500	(Homing locate feed rate, mm/min)
$25	8000	(Homing search seek rate, mm/min)
$26	250	(Homing switch debounce delay, milliseconds)
$27	5	(Homing switch pull-off distance, millimeters)
$30	1000	(Maximum spindle speed, RPM)
$31	0	(Minimum spindle speed, RPM)
$32	0	(Laser-mode enable, boolean)
$100	80	(X axis travel resolution, step/mm)
$101	80	(Y axis travel resolution, step/mm)
$102	2267.717	(Z axis travel resolution, step/mm)
$110	10000	(X axis maximum rate, mm/min)
$111	10000	(Y axis maximum rate, mm/min)
$112	500	(Z axis maximum rate, mm/min)
$120	800	(X axis acceleration, mm/sec^2)
$121	800	(Y axis acceleration, mm/sec^2)
$122	300	(Z axis acceleration, mm/sec^2)
$130	610	(X axis maximum travel, millimeters)
$131	610	(Y axis maximum travel, millimeters)
$132	85	(Z axis maximum travel, millimeters)

Defining the Axes

Axes Definition and Home Locations

The E4 CNC Router is set up using the right-hand coordinate system. The arrows in the diagram below display the positive direction for the X, Y, and Z axes. The positive Z axis is up. Once connected, the first operation should be to home the router. The home position will move the spindle to the X0 Y0 Z0 location. The Z will be the maximum distance away from the work.



Tips for Getting Started and Links to Help Files

The DeWalt should NEVER be plugged in when mounting a work piece or changing bits. Always unplug the power supply when removing or installing router bits. Failure to follow this simple procedure may result in serious personal injury.

Please see our getting started section here: https://support.bobscnc.com/hc/en-us/categories/360000808813-Getting-Started-

A good place to start is here: https://support.bobscnc.com/hc/en-us/articles/360012911133-Getting-Started-Start-Here- We have a step by step list that link to articles and videos that may help get you going.

Our troubleshooting section can be found here: https://support.bobscnc.com/hc/en-us/categories/360000809253-Troubleshooting

More Tips for cutting with the E4

- Use a scrap board underneath the work to keep from engraving into the spoil board.
- For work such as isolation routing for circuit boards, consider milling a scrap blank, then use double-sided tape to fasten the circuit board.

Appendix

Warranty and Return Policy

60 Day Warranty

BobsCNC guarantees all supplied parts for 60 days after the purchase date. If any parts are missing or defective, the buyer must contact BobsCNC during within the 60-day time frame using the Contact Us Form located at BobsCNC.com at: https://www.bobscnc.com/pages/contact-us).

After 60 days, no warranty is given nor will any refund be offered.

Refund Policy

The customer has thirty (30) days from receipt of the product to request a refund on a purchase. No refund will be offered on any purchase after thirty (30) days. To receive a refund, the customer must make their request using the *Contact Us Form* at BobsCNC.com.

The kit must be returned to BobsCNC in its original unassembled condition. Customers requesting a refund after assembling or partially assembling the kit must disassemble and repackage the kit to its original unassembled condition. Customers who return assembled or partially assembled kits that have not been disassembled will be charged a 15% restocking fee.

Refunds will only be processed after the kit has been received and inspected by BobsCNC. If any parts are missing or damaged the customer agrees to pay for all required replacement parts as listed in the E4 Replacement Part List. The cost of replacement parts will be deducted from the original purchase price. BobsCNC will provide documentation validating any necessary deductions from the original purchase price. Bobs CNC retains sole discretion to determine if a kit or any part of the kit is eligible for a refund.

Software

No warranty is given nor will any refund be offered for Vectric software. Please see the **"try before you buy"** on Vectric's webpage http://www.vectric.com/downloads/trial-software.html. If the BobsCNC kit is purchased with Vectric software, the refunded amount will reduced by the retail price of the Vectric software. Please contact Vectric for software transfer policies.

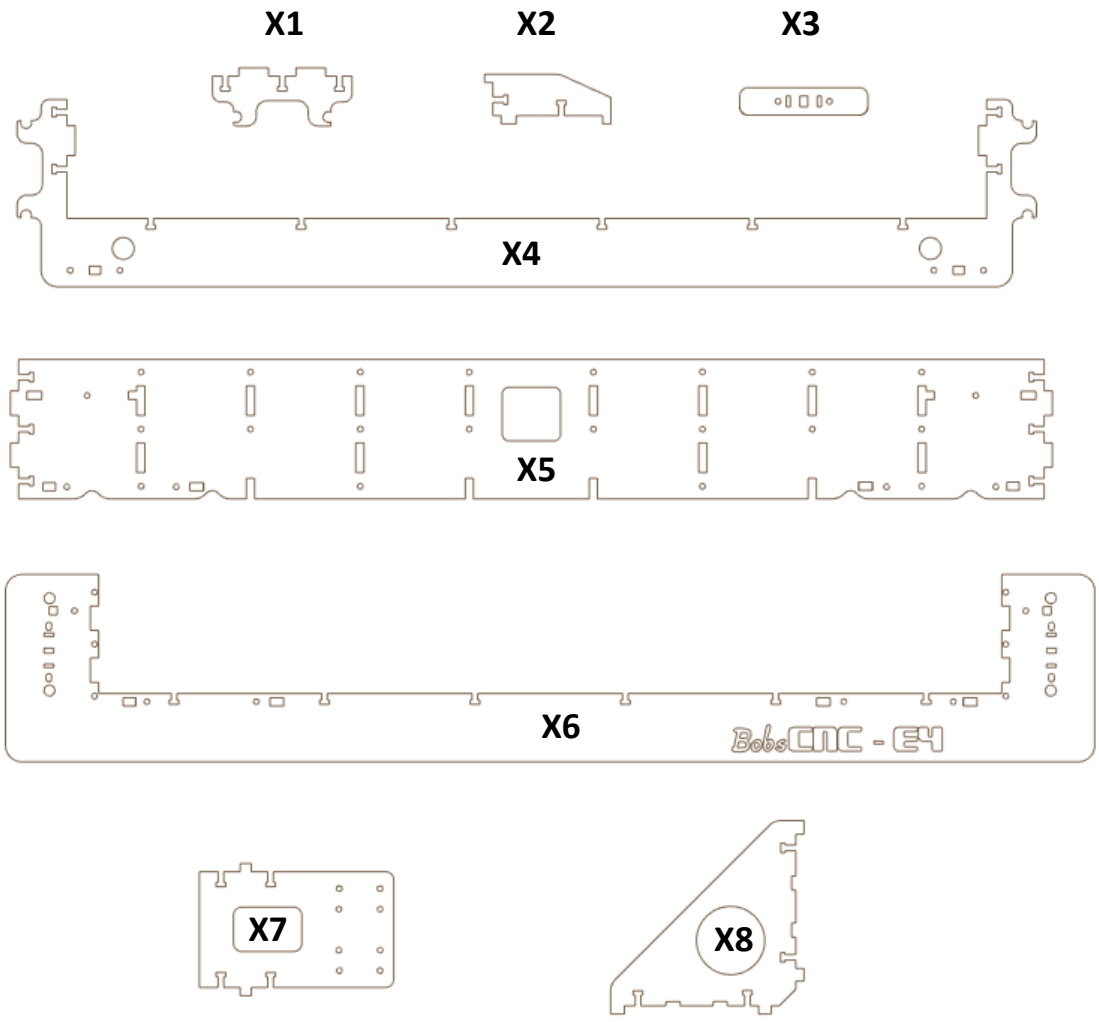
Technical Assembly

BobsCNC does not guarantee the buyer's ability to assemble, setup, or use our product(s). Since the quality of any project produced using the E4 is dependent upon its proper setup and the understanding of its operating parameters, BobsCNC does not guarantee the quality of the parts manufactured using the E4.

Miscellaneous Parts List	*Quantity*
M3x 10	16
M4x16	200
M4 Nuts	200
M4x25	7
M6x25	16
M6 Nuts	16
SG20 U Bearings	16
M6 Hardened Washers	32
M5X25	3
M5 nuts	6
M5 washer	6
Flanged bearings (F625Z)	6
M2.5 x 16 screws	6
M2.5 nuts	6
Wing nuts (1/4-20)	8
1/4-20 Screws 2"	8
GT2 Pulleys	3
GT2 belts	3
5/16-18 Threaded Rod	1
5/16 washer	2
5/16-18 Coupler Nut	1
5/16 nuts	2
Large Nylon Zip Tie	1
8x22x7 bearing	1
aluminum coupler 5 x 8	1
2 mm Allen Wrench	1
1.5 mm Allen Wrench	1
5/16" bearing steel rails (long)	6
5/16" bearing steel rails (short)	2
MDF Bed (17 x 24) with inserts	1
USB cable	1
Small nylon zip ties	30
Spiral wire wrap (6')	1
Home switches	3
DeWalt DW660 Spindle	1
Arduino Uno	1
Grbl shield	1
Stepper motors	4
Stepper motor drivers	4
Power supply with cord	1

Diagrams for Plywood Components

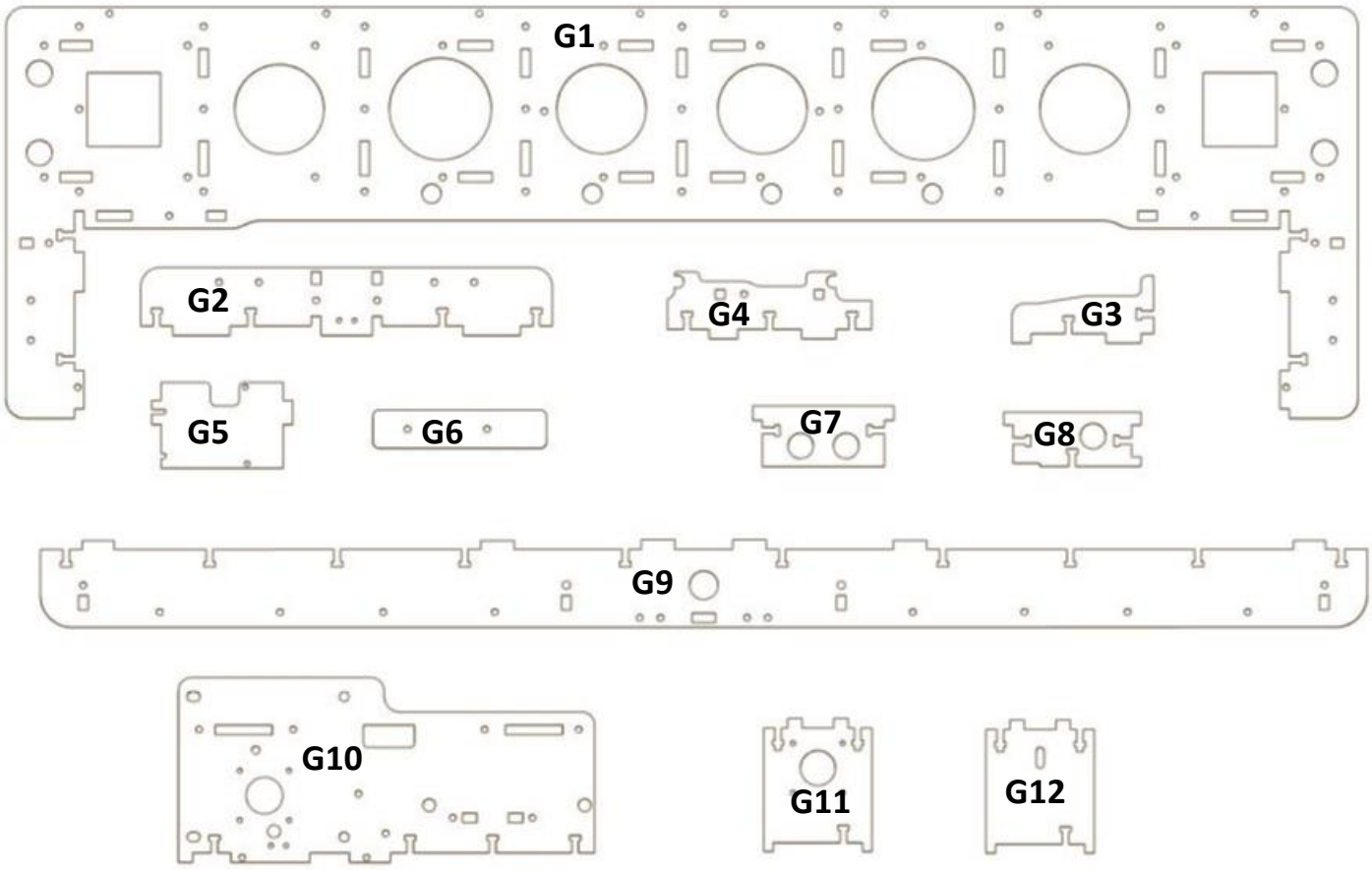
Frame Parts



Part #	Qty	Component
X1	8	X Rail Supports
X2	4	Frame Corner Braces
X3	4	X Rail Stops
X4	4	Frame Mid Supports
X5	2	Frame Side Support
X6	2	Frame End Supports
X7	2	X Cable Mounts
X8	4	Large Corner Braces

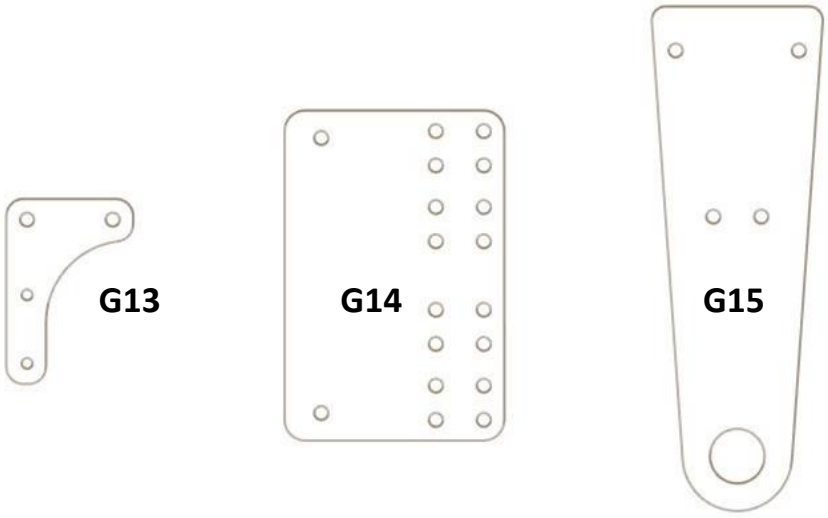
Diagrams for Plywood Components

Gantry Parts



Part #	Qty	Component
G1	1	Gantry Frame
G2	2	Gantry Side Supports
G3	2	Gantry Corner Braces
G4	7	Y Rail Supports
G5	1	Controller Mount
G6	2	Y Rail Stops
G7	4	Gantry Back Braces
G8	2	Gantry Side Braces
G9	2	Gantry Back Supports
G10	2	Gantry Side Frames

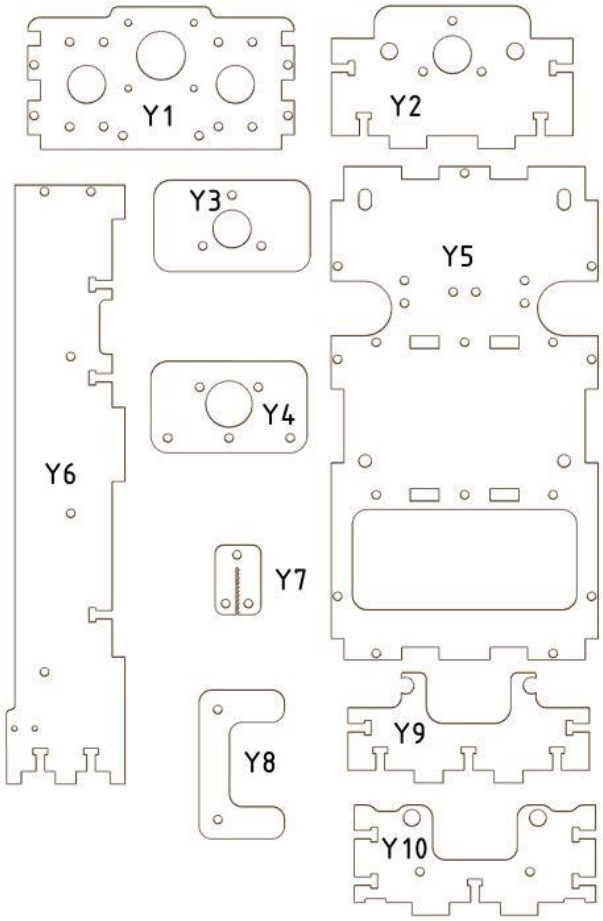
Part #	Qty	Component
G11	1	Y Stepper Motor Mount
G12	1	Y Belt Idler Mount



Part #	Qty	Component
G13	2	Side Cable Mount
G14	1	Bottom Cable Mount
G15	1	Top Cable Mount

Diagrams for Plywood Components

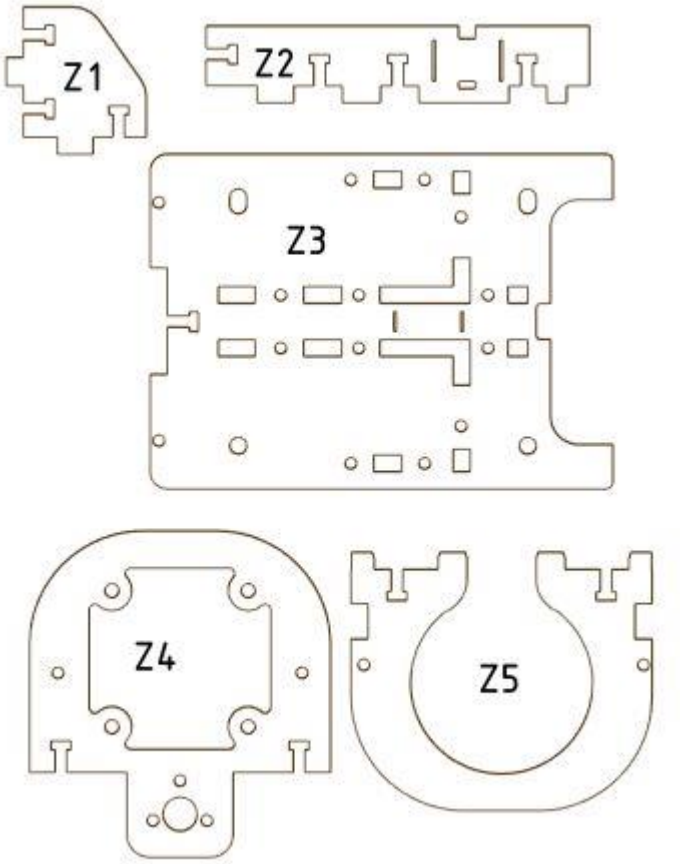
Y Carriage Parts



Part #	Qty	Component
Y1	1	Z Stepper Motor Mount
Y2	1	Bearing Bottom Plate
Y3	1	Bearing Top Plate
Y4	1	Bearing Middle Plate
Y5	1	Y Carriage Frame
Y6	2	Y Carriage Side Supports
Y7	2	Belt Retainers
Y8	1	Z Rail Stops
Y9	2	Z Rail Supports
Y10	1	Y Carriage Bottom Support

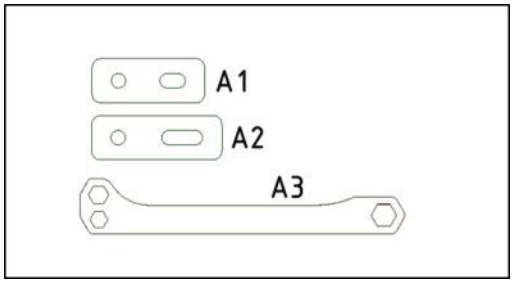
Diagrams for Plywood Components

Z Parts



Part #	Qty	Component
Z1	2	Frame Mount Support
Z2	2	Z Frame Support
Z3	1	Z Frame
Z4	1	Z Spindle Bottom Mount
Z5	1	Z Spindle Top Mount

Accessories



Part #	Qty	Component
A1	4	Short Clamp
A2	4	Long Clamp
A3	1	Wrench