ShopBot®

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Assembly Guide

For PRSalpha and PRSstandard Tools

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General Safety and Precautions

This safety summary contains general safety warnings that should be understood during operation of this machine. Failure to observe these precautions could result in injury.

Learn and understand safe use of the machine. Do not allow untrained individuals to operate the machine without supervision. Be aware of the location of the Emergency Stop switches at all times.

Eye and ear protection MUST be worn by the machine operator as well as any bystanders or observers. Flying sawdust, material chips, and other debris can cause serious eye injury.

Wear closed-toe shoes at all times.

Make sure that your material is properly secured before cutting, and be aware of any small parts that may come loose after being cut. If a small part catches the edge of a spinning bit, it can be thrown forcefully in any direction, causing injury or damage.

Never place your hands on the rails of the ShopBot. Be aware that the machine may move unexpectedly in any direction, which can cause serious injury if your hands are in the path of movement.

Never wear gloves while operating the machine. As with any power tool, a glove can get caught in moving or spinning parts and pull your hand into the machinery.

Never leave a machine running and unattended. Understand that a spinning tool generates friction and heat, creating a risk of fire. This risk is minimized by using correct chip load, using sharp bits, and by always double-checking your files before cutting. Be prepared to pause or stop the cut if something seems incorrect or unsafe.

Keep a working fire extinguisher within reach of the machine, for the reasons listed above.

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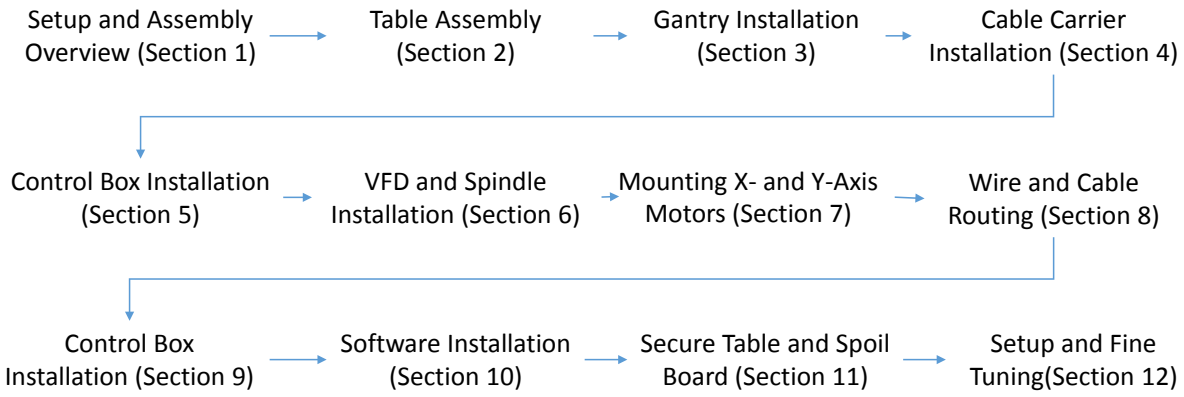
PRS Tool Assembly Process Flow



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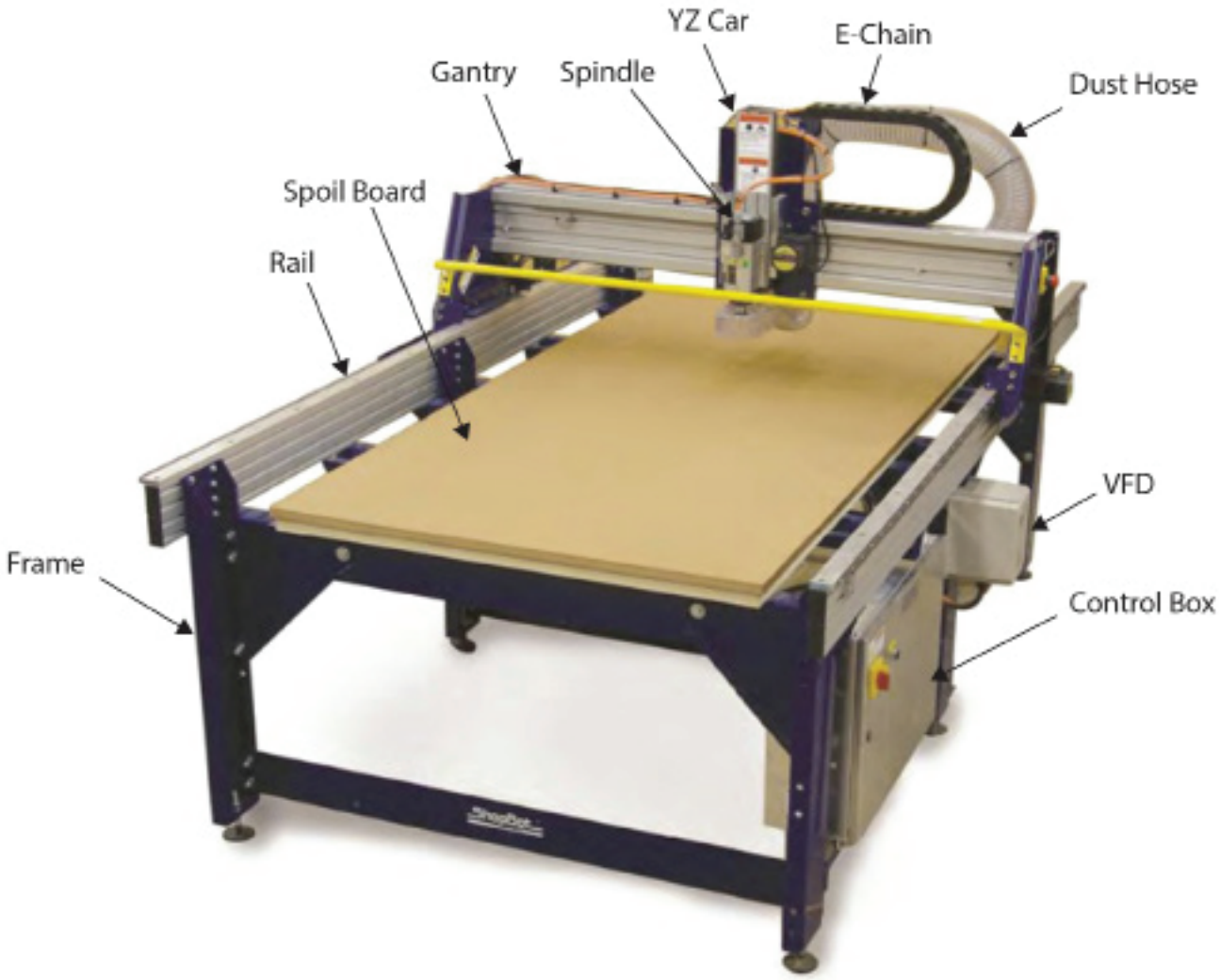
Main Parts of PRSalpha



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Section 1. Setup and Assembly Overview

Electrical Precautions

WARNING: RISK OF ELECTRIC SHOCK

The control box needs to be connected to electrical service by a licensed electrician who has experience with industrial equipment. Personal injury or damage to the machine may occur if an unlicensed individual performs this job.

Schedule the services of a licensed electrician to complete the ShopBot setup. Connecting power to the control box can be done before or after assembly of the machine, but it is easiest to wait until the tool is set up in its final position. If machine includes a high frequency spindle and/or a vacuum blower, these will also need to be connected by an electrician. Wiring diagrams and specifications are located inside the door of the control box.

Other Electrical precautions:

Motor connections: DO NOT connect or disconnect motor cables while power to the control box is on. This can damage or destroy the motors or drivers.

Induced currents: AVOID moving any axis by hand when the control box is powered off. If you must push/pull an axis by hand, do so very slowly. Spinning the motors can generate an electric charge and damage the drivers or other electronic components.

Static Discharges: Follow all wiring and grounding instructions - electronic circuits are very sensitive to static and power surges. Avoid doing any vacuuming around your machine before it is properly grounded, as vacuums can generate a large amount of static electricity that can damage the control box.

Safety

Use caution when lifting boxes and assembled components out of the crate. Having an assistant will make things much easier – particularly when unpacking the crate and lifting the gantry onto the table rails. Do not attempt to lift the gantry without assistance.

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Unpacking the Crate

The ShopBot components arrive in two packages: a large wooden crate and a long box. The crate and box leave ShopBot banded together. Contact the shipping company if a piece is missing, or if they do not arrive together.

The components are packaged to avoid shifting during shipping. Use a large screwdriver to pry off the clips on top on the crate, and a Phillips head screwdriver to uncrate the components. It will require two people to lift out some of the heavier pieces.

Take a few moments to read through the assembly directions, and sort the components by their function to help organize the assembly process. Sort hardware by size to reduce the amount of time searching for the correct bolts, nuts and washers for a given stage of the assembly.

Many components of the machine come pre-assembled to reduce the number of assembly steps. In many places, bolts or hardware may be loosely fit in place to show their intended location. Remove this hardware prior to fitting the applicable component into place.

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Terms to Know

This is only a quick overview to get started. For each assembly section, there will be a visual guide with all parts and hardware clearly labeled.

Major Components:

The base of the machine is referred to as the **table frame**.

The two long aluminum extrusions on each side are called **table sides**. Atop the sides are the **rails**, which create the path of travel for the X-axis.

The table sides and rails are included in the long cardboard package secured to the top of the crate.

The assembly that rides along the table sides is called the **gantry**.

The gantry consists of an extruded aluminum beam, which has been fitted with V rails (for wheel bearings) and gear rack. This forms the path of travel for the Y-axis.

The blue plates on either side of the gantry are referred to as **end plates**.

The **YZ car** moves across the gantry, and controls the height of the **cutter head** (either a router or high-speed spindle, depending on the tool).

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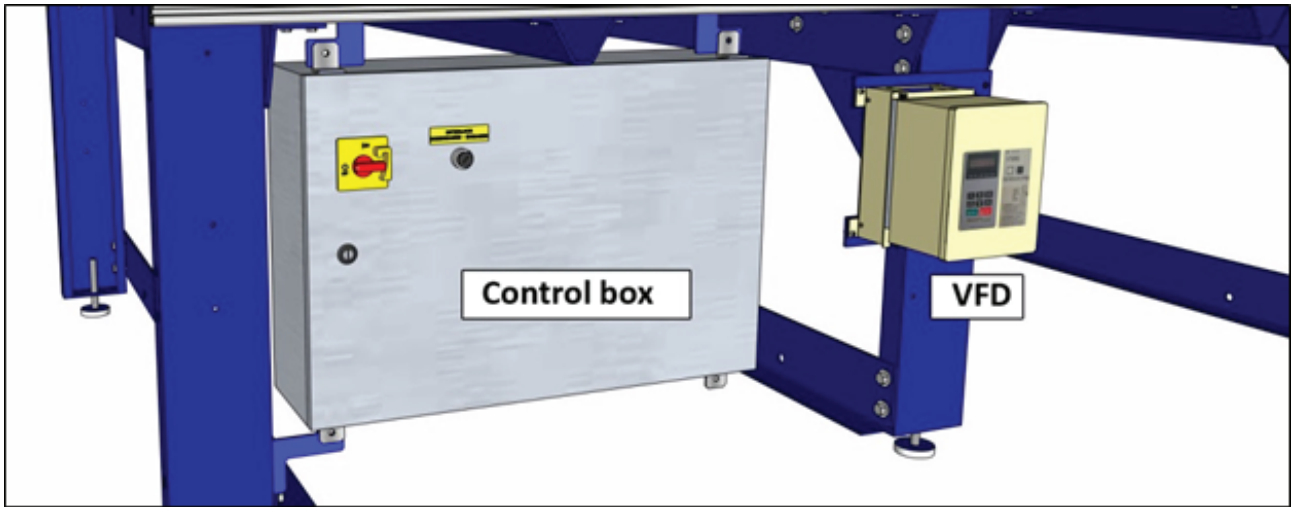
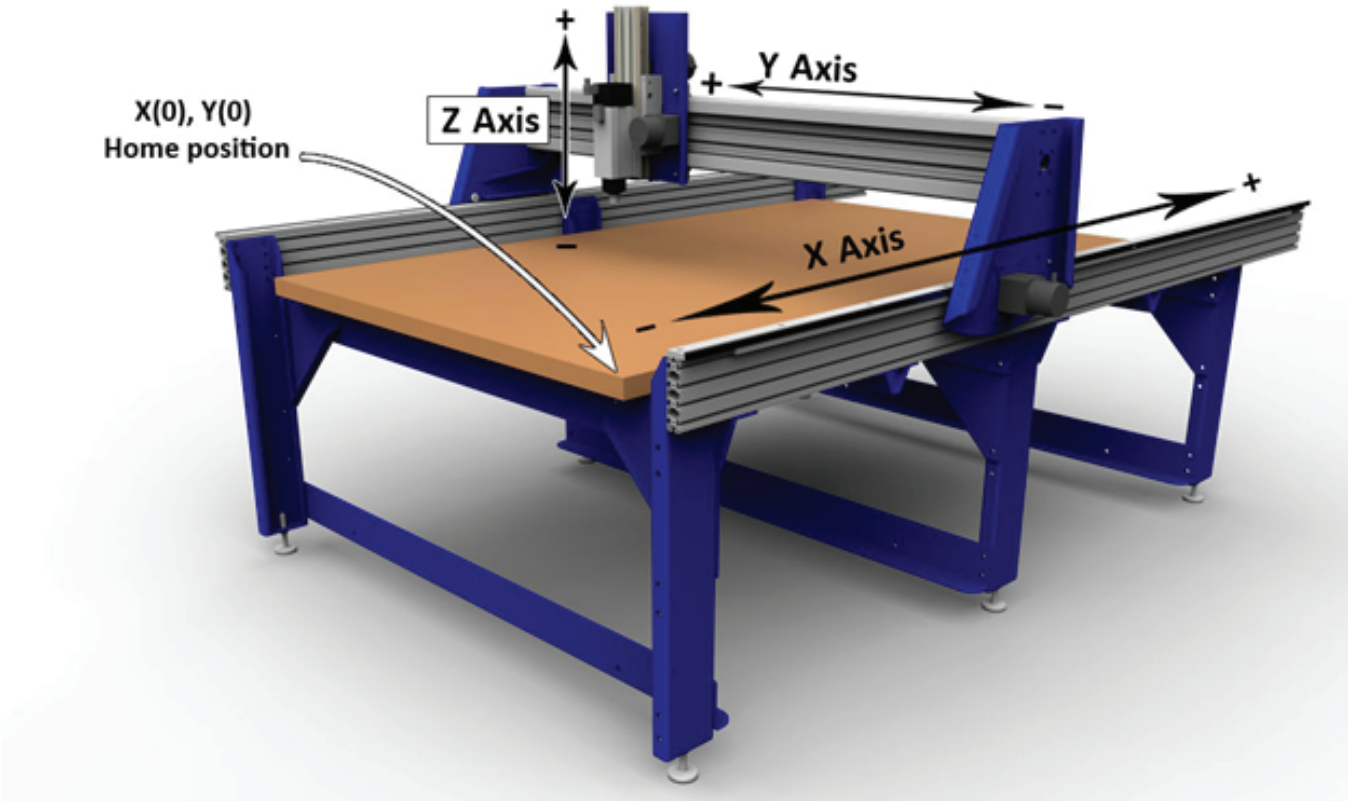


The **control box** is the “brain” of the machine and contains a control board, motor drivers, and other electronic components that allow the tool to move with precision, accuracy, and power. It connects to the PC through a single USB cable.

The **variable frequency device (VFD)** is used on machines that contain a spindle only (not a router). It controls speed and power for the spindle. The control box provides the VFD with on/off signals, but speed is controlled through an RPM controller unit, which connects to the PC through a separate USB cable.



In most cases, the **X-, Y-, and Z-axes** will be referred to in respect to the machine. Another frequently-used term is the **XY home position**, as indicated here.

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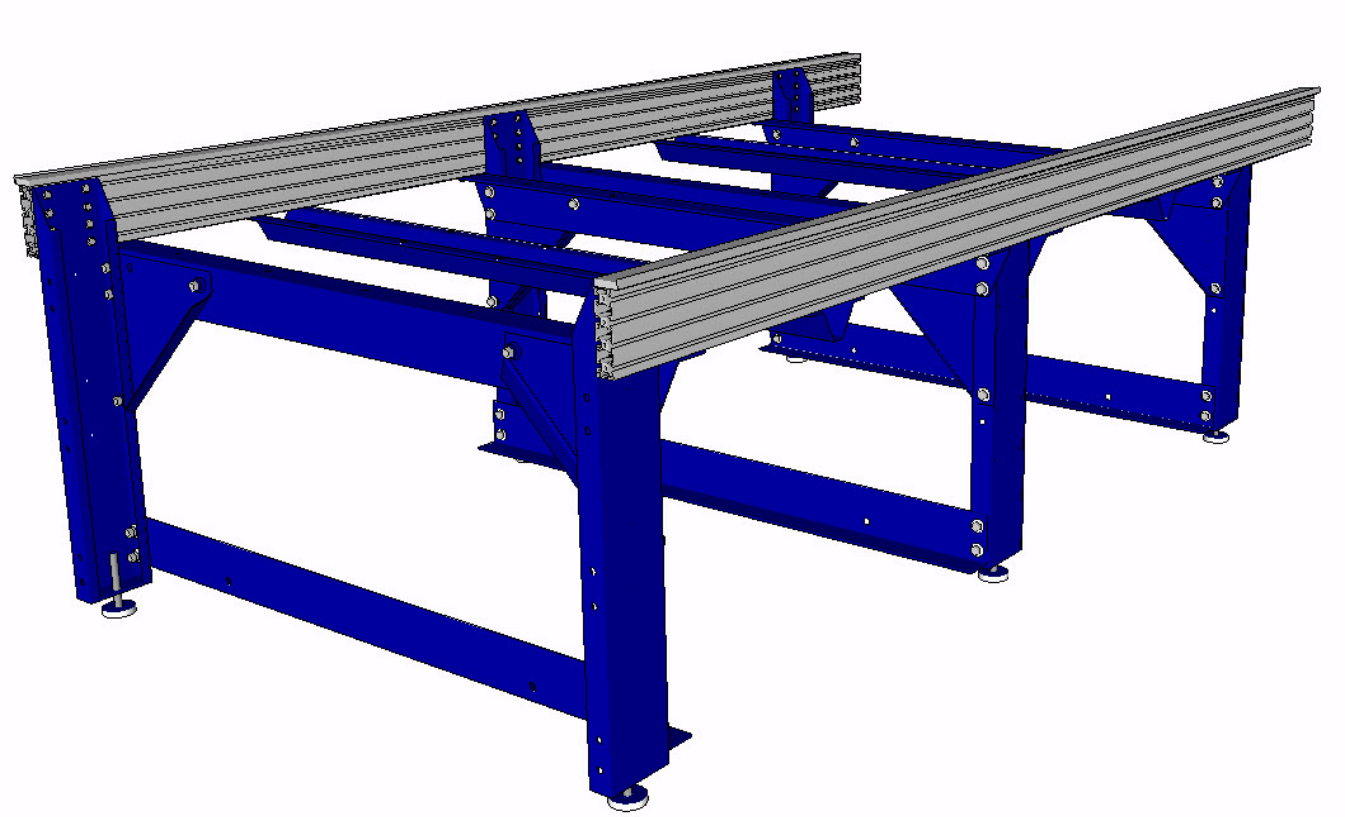
Section 2. Table Assembly



Introduction

The ShopBot table provides a firm foundation for all other components. This section contains instructions to assemble, square, and level the table.

The diagrams in this manual depict a 96” x 48” table, the most common ShopBot table size. The table layout may look a little different (fewer or more legs, tool changer bar, etc.) depending on the size, shape, and accessories, but the same basic steps will be followed. The table drawings provided will detail the specific measurements.

Note: It is critical to follow the table drawing carefully to ensure correct assembly of the table and accessories.

The table leveling and squaring steps should be completed with the table is in its final location. Moving the table after these steps may alter the level and square.

Note: This section shows a conventional table with a 6” Z-axis. Tables configured for 12” and 24” axes have extra table side extrusions and table legs with added mounting holes.

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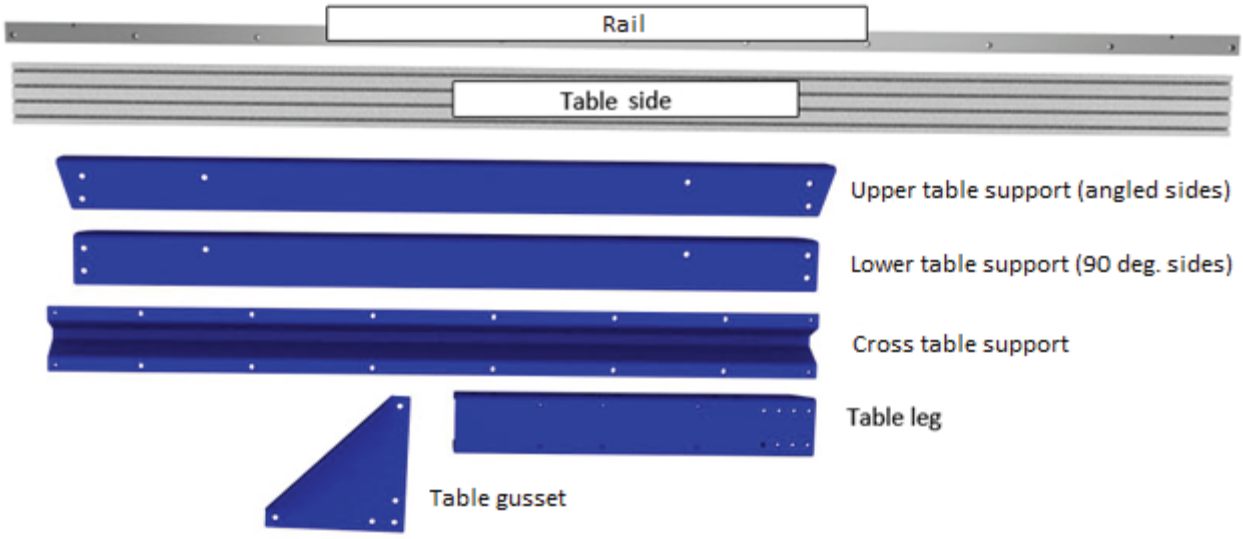
Hardware

Part Name	Quantity	ShopBot P/N	Notes
Table side	2	000925	
Rail	2	001872	
Lower table support	3	000921	Different for other lengths
Table gusset	6	000770	Different for other lengths
Upper table support	4	000915	Different for other lengths
Table leg	6	000919	Different for other lengths
Table cross support 48E	2	000926	Different for other lengths



Except for the table levelers, all of this hardware is included in the small box marked “table hardware”:

Part Name	Quantity	ShopBot P/N	Notes
1/2-13x1 1/2 Hex bolt	Varies	001956	Used for components to leg
1/2" Lock washer	Varies	000588	Used for components to leg
1/2" Flat washer	Varies	000029	Used for components to leg
1/2-13 Hex nut	Varies	000440	Used for components to leg
5/16-18x3/4 Hex bolt	Varies	000529	Used for cross supports, leg
5/16” Schnorr washer	Varies	004487	Used for cross supports, leg
5/16” Flat washer	Varies	000848	Cross supports, leg, control box
5/16-18 T-nut	Varies	002498	Used for control box
5/16-18x3/4 Button head cap screw	Varies	002033	Used for control box
5/16-18x3/8 T-nut	Varies	001569	Used for cross supports, leg

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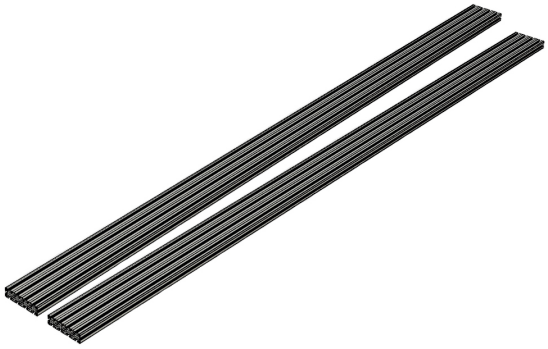
Part Name	Quantity	ShopBot P/N	Notes
5/8-11 Hex nut	Varies	000160	1 per table leg
Table leveller w/Nut	Varies	002926/000862	1 per table leg
3/8-16x1 1/2 Carriage bolt	Varies	000953	Used to secure base board
3/8” Lock washer	Varies	000092	Used to secure base board
3/8” Flat washer	Varies	000444	Used to secure base board
3/8-16 Hex nut	Varies	000452	Used to secure base board

* Specific quantities can be found on the packing list enclosed with the hardware.

Marking the rails



Remove table sides from packaging and lay them on the floor side by side. Locate where the Home Position (X =0) will be.

Locate the machine specific table drawing at the back of this assembly manual. This drawing provides dimensions for the placement of the table legs and cross supports in relation to the end of the side rails.

Note for international customers: The location of the table legs and cross supports along the X-rails can be adjusted slightly to reflect metric units.

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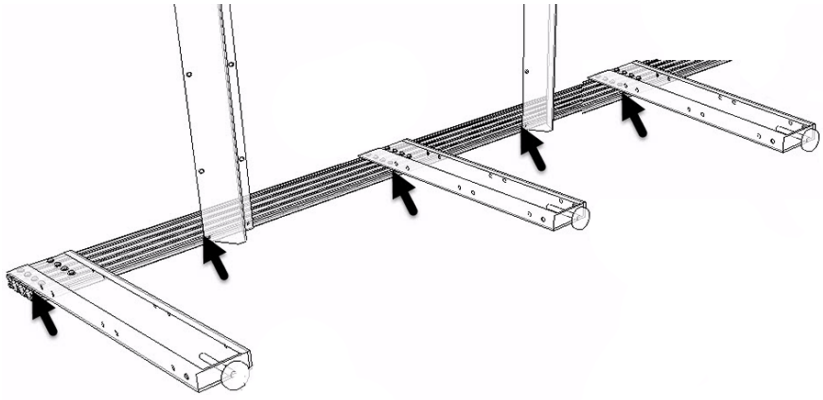

Measuring from the X=0 location, use a permanent marker to mark the inside of the rails where each table leg and cross support will attach to allow for easy orientation.

Note: This image indicates the rail marking locations for a 96” long tool. The marks will differ for other table configurations.

Move rails into approximate location, orientation, and space that the tool will occupy.

Mount Table Levelers to Legs

Screw a leg leveler into the bottom of each table leg, to its approximate half-way point. Thread a 5/8” hex nut onto the leg leveler. Leave this nut loose until the table is leveled.

Thread the middle leg levelers all the way up to ensure that the feet do not interfere during the leveling procedure.

Install Table Legs

Insert eight T-nuts per table leg into the T-slots in the pattern shown. The T-nuts slide in with the rough side down. Note the line marked for alignment. Do not forget to insert the T-nuts for the middle legs in the T-slots prior to assembling the end legs.

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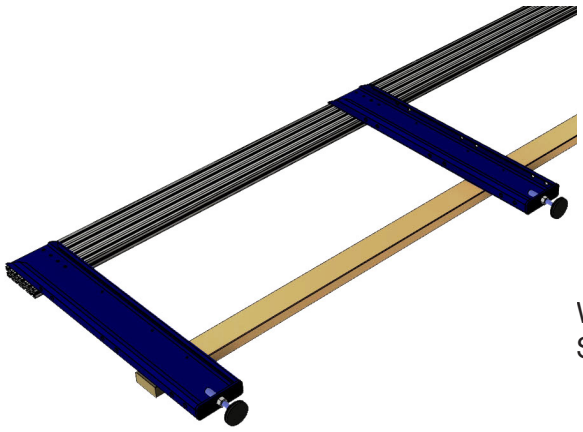
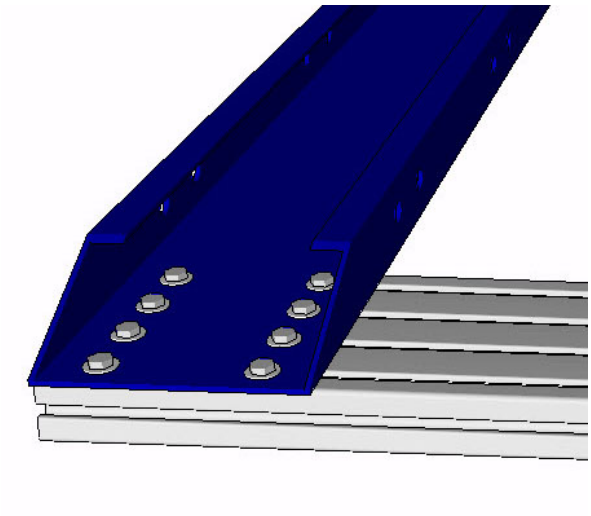
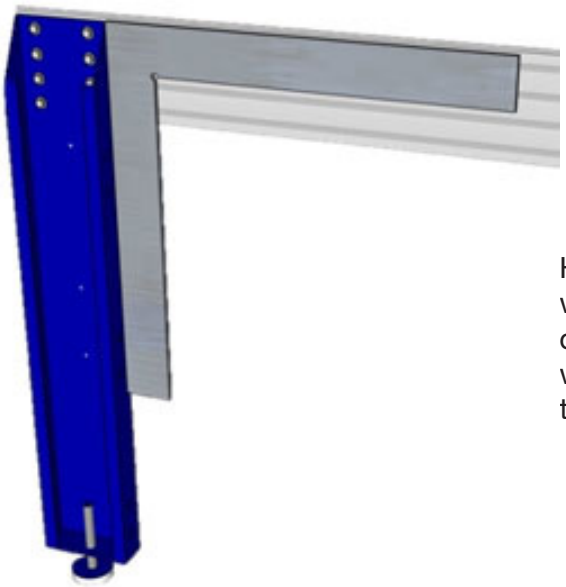


When the T-nuts are in place, position the table legs. Support the legs so they stay flush during installation.



Secure the legs with 5/16” hex bolts, Schnorr washers, and flat washers.

Note: The Schnorr washers are to be located with curve towards the bolt head. They can make threading the bolts into the T-nuts difficult. If necessary, use a zip tie or other shim behind the T-nut to force it closer to the surface of the slot so it is easier to catch the threads with the bolt assembly.



Hold a framing square against the leg and the table side while bolts are tightened to ensure leg is installed at a 90 degree angle. **Hand-tighten** the **top and bottom bolts** when the leg is square. Do not tighten other bolts at this time.

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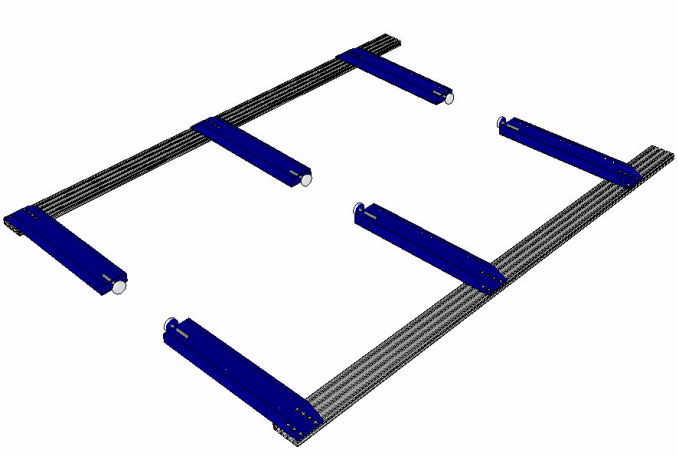


Install and square the remainder of the legs, working from one side of the rail to the other.

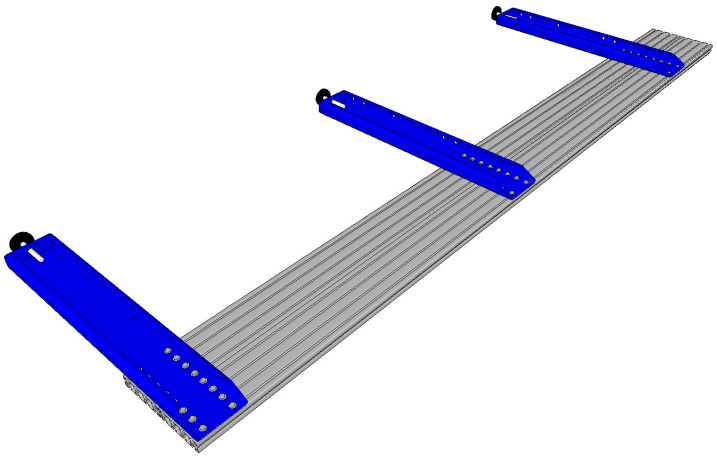
Table Sides for 12” and 24” Z-Axis Configurations

Tables configured for 12” and 24” axes have extra table side extrusions and table legs with added mounting holes.

Assembly of these table configurations is identical with the exception of these unique parts and extra mounting hardware.

The table supports and gussets will go under the bottom table side extrusion, and the rails will mount to the top extrusion.

To turn the spindle off, click the output 1 switch again or close the keypad window.



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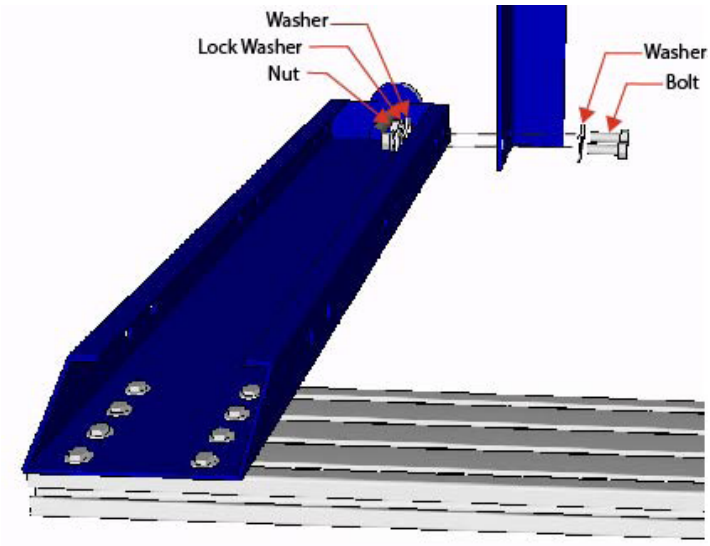
Stabilize with Lower Table Supports



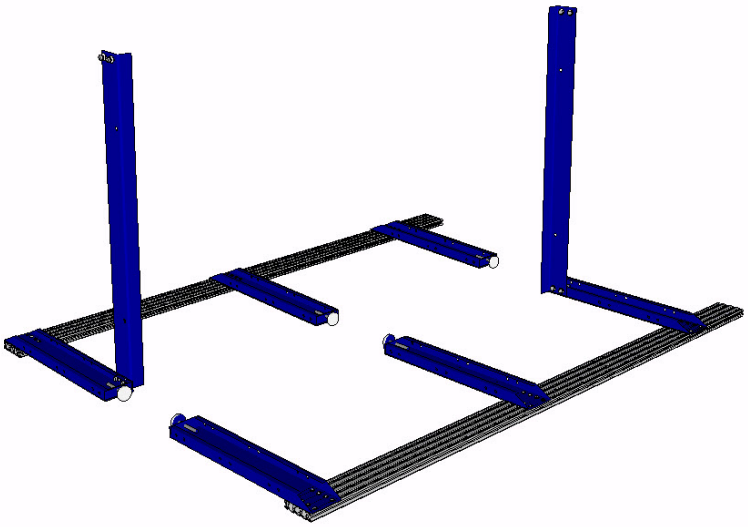
Use the 1/2” hardware (bolt and flat washer on one side—flat washer, lock washer, and nut on the back side) to secure the lower support to the first exterior table leg with the L shape facing the interior of the machine.

Tighten bolts until they don’t move easily.

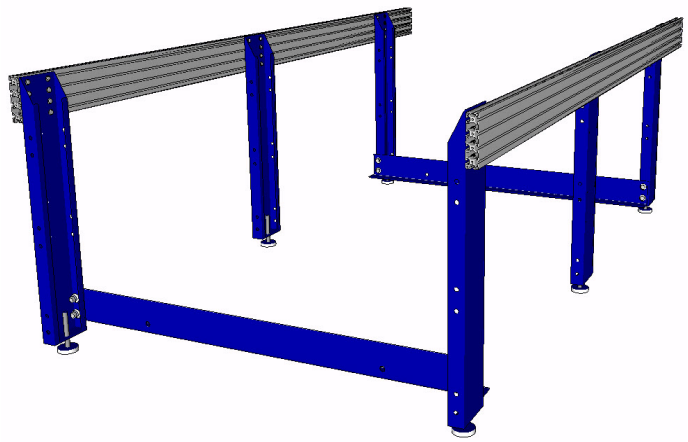
Repeat process on the opposite exterior table leg on the other rail. The lower table supports will act as a “kickstand” and hold the table sides up for assembly.

Raise each table side. If performing the assembly alone, use safety straps to secure the sides in place to prevent injury or damage to the frame.

Note: If the rubber foot of a leveler pops off while lifting the sides in place, simply place the rubber foot under the ball of the hardware and press down on the table side to reseat it.



Connect Side Assemblies



Attach lower table supports to opposite table sides.

If working alone, keep safety strap attached until the frame is self-supporting to prevent injury or damage to tool.

Note: Do not install upper bolt on lower front right side - this is where the control box will be attached.

Square sides with the lower supports and snug the bolts enough to preload the lock washers.

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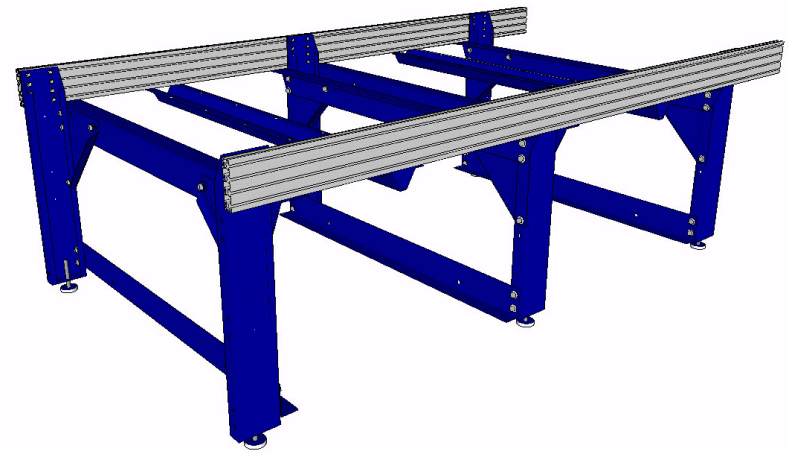
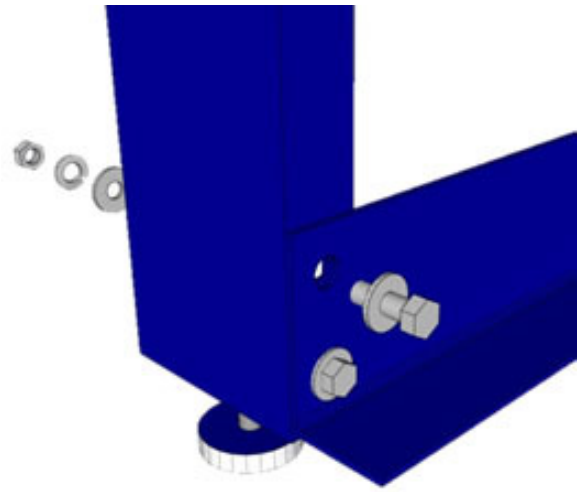
Install Middle Lower Cross Support

Install the middle lower cross support. The horizontal flange should point to the flush end of the side rails (on left in this picture).





Use the same order of 1/2” hardware (hex bolt and flat washer on one side—flat washer, lock washer, and hex nut on the back side) to secure the lower support to the middle set of table legs.

Snug the bolts enough to preload the lock washers.

If the middle table levelers touch the floor, raise them until they no longer make contact.

Insert T-Nuts in Bottom Slot

The table and cross supports are fastened to the side rail using threaded T-nuts. Insert T-nuts so the solid face is to the outside (face down) of the slot and move them to their approximate locations before mounting any components.

Note: Failure to perform this step will require disassembly to fix.

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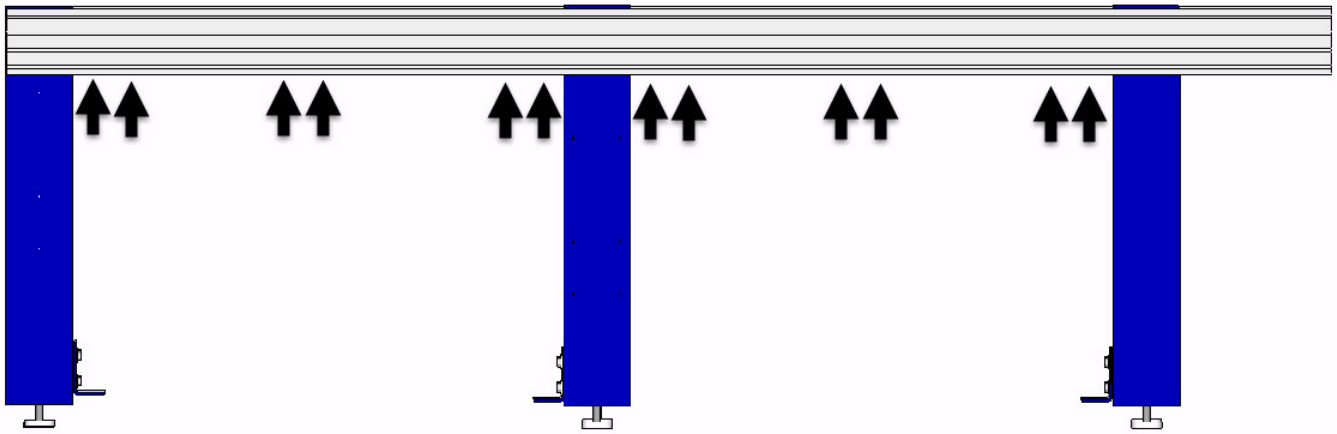
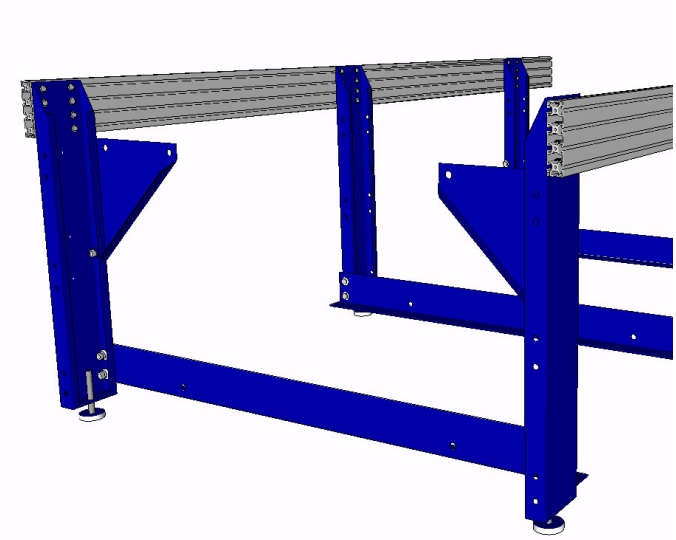
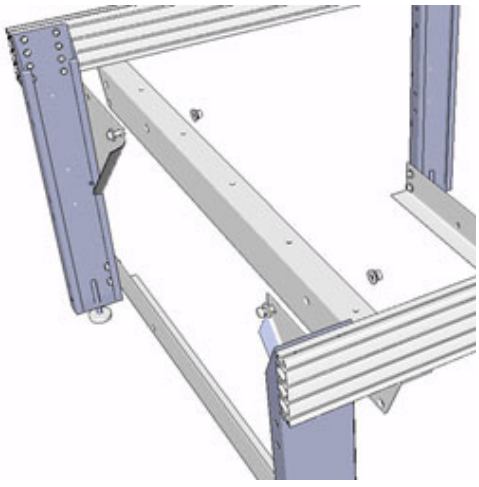


Note: This image shows the approximate T-nut locations for the upper table supports and cross supports for the PRSalpha 96-48 table set up. A table configuration with more table legs or cross supports will require additional T-nuts as indicated on table drawing. Two are needed for every component.

Mount Table Supports and Gussets to Table Legs



Orient the gusset as in the illustration (the flange faces the table leg). Use the same 1/2" hardware (hex bolt and flat washer on one side—flat washer, lock washer, and hex nut on the back side) to secure the **bottom** corner of each gusset. When a gusset is properly oriented, the gusset flange will rest against the table leg, holding it in position. Tighten bottom bolt, but not the top one.



If performing this step without assistance, mount the middle two bolt locations of the table support to the gusset to hold the table support in place while the remaining hardware is installed.

Note: The front table support is the one with the ShopBot decal.

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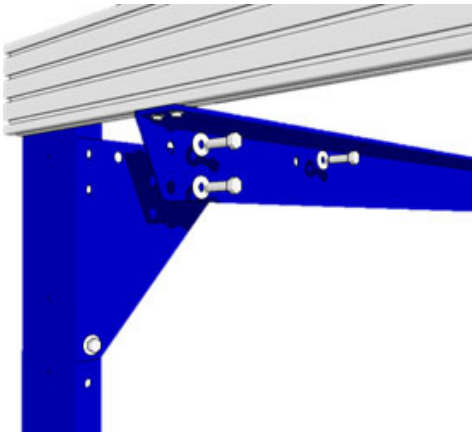
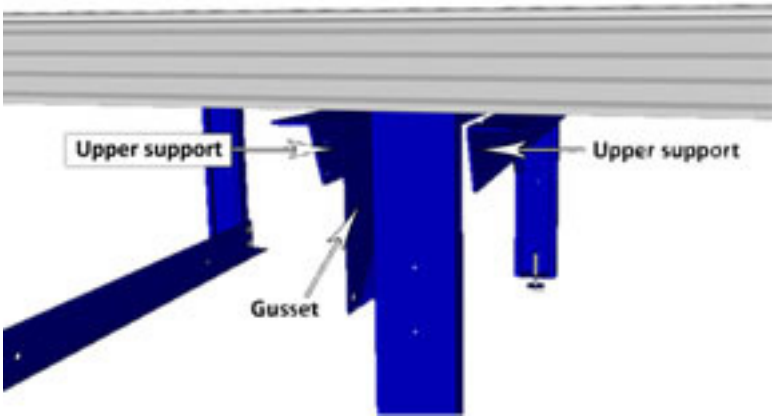


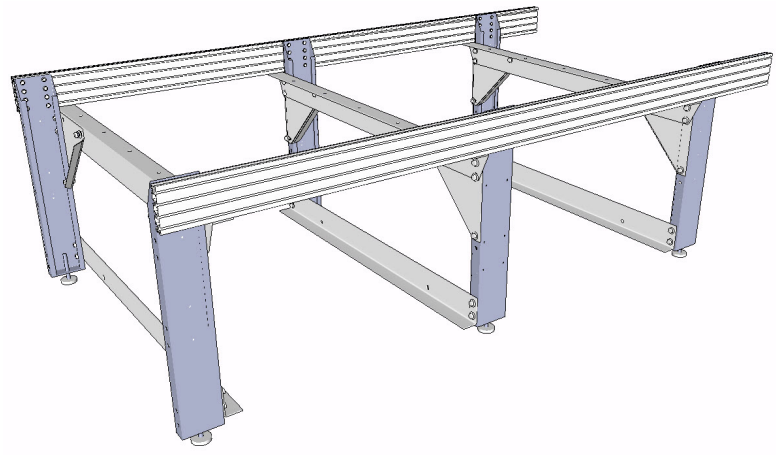
Install the 1/2” inch hardware into each side of the table support and gusset.

Do not snug bolts at this time.

Note: The middle legs will have an upper table support on both sides of the leg. Only one side uses gussets.

The second middle table support is installed facing the opposite direction as the first one. The middle leg will be “sandwiched” between two upper supports. If working alone, use clamps or a sling to hold the table support in place until the appropriate hardware is attached.





Install the remaining gussets and table supports using 1/2” hardware (hex bolt, lock washer, flat washer on one side… flat washer and hex nut on other side).

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Mount Table Supports and Cross Supports to Rails

Use a zip tie to move the T-nuts (positioned earlier) so the threads are in line with the mounting holes.

Attach the table support to the rail using two 5/16" hex bolts, and flat washers on each side of the upper supports.

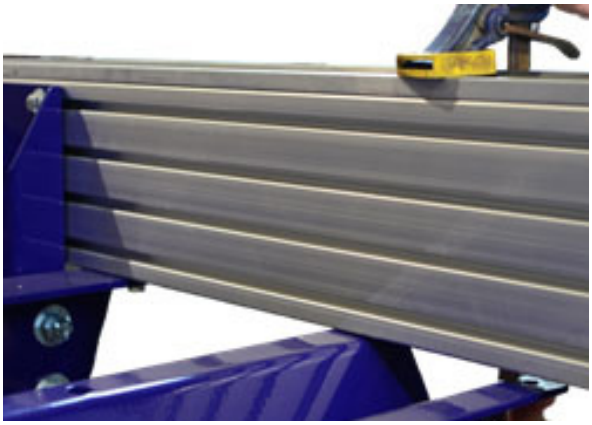
NOTE: Do not use lock washers with the table support assembly.

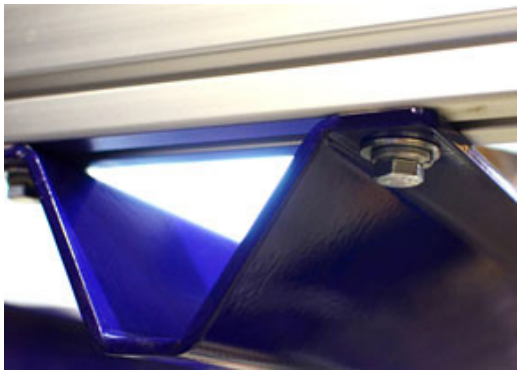
Do not fully tighten the table supports yet.

Install Cross Supports

Use an assistant or sling(s) to hold the cross supports in place for installation.

Line up T-nuts that were installed earlier with the mounting holes using a zip tie.





Attach each end of the cross support with 5/16" Hex bolt, lock washer, and flat washer into the T-nuts.

Line up the leading edge of each cross support with mark and snug the bolts enough to compress the lock washers.

Do not fully tighten the cross supports.

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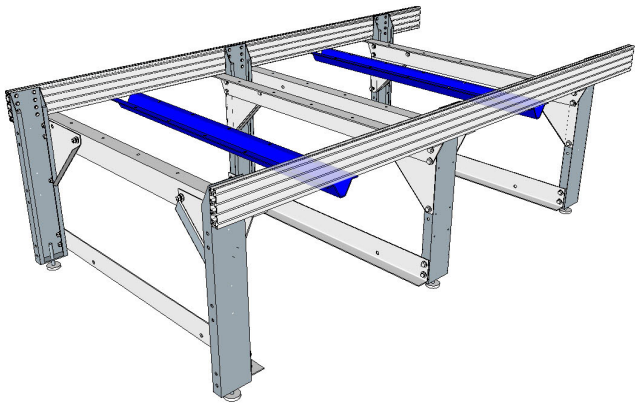
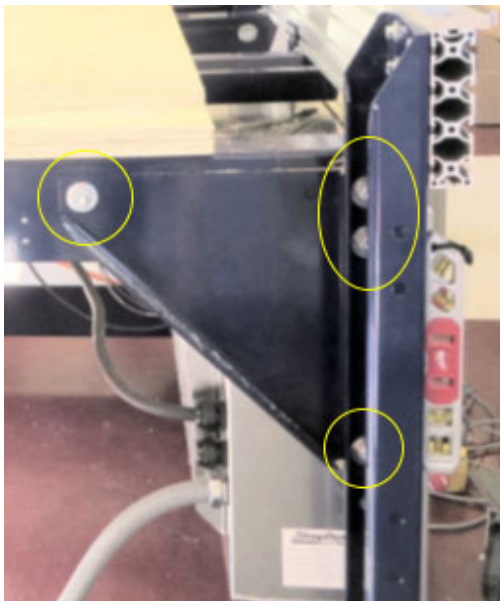


Ensure that there are no leftover cross-supports or gussets. It is typical to have at least one extra of table hardware, so don't be too concerned with extra nuts and bolts.

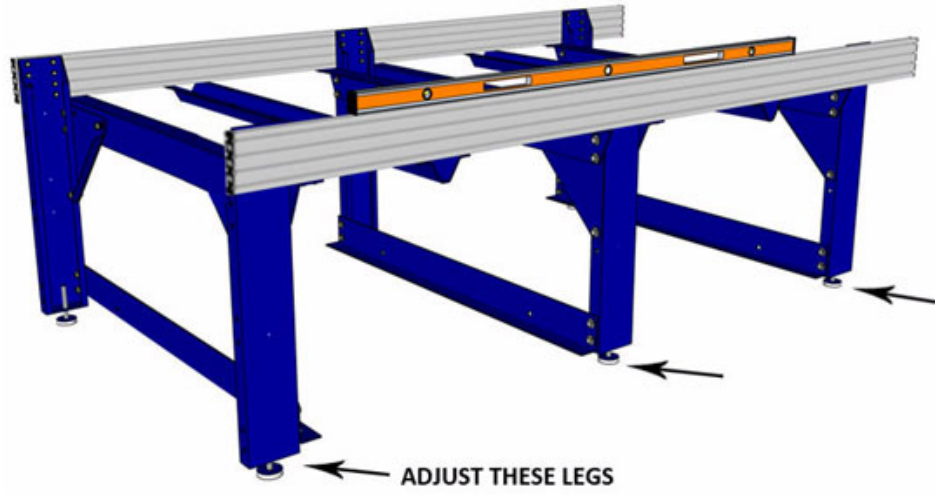


Level and Square the Table

It is very important that the table is level and square. Make sure that the table is located in the position where it will be used. Moving the table can alter the level and square due to variances in floor height and moving forces.

Note: When referring to the front side of the table, it is assumed that this will be closest to the 0, 0 point as indicated on your table drawing.

Starting with the front side of the table, place a level on the outside of each leg to ensure that it is perpendicular to the floor. Pull the table into square side to side, and tighten the hardware on the gussets and table supports to hold the table square.



Level the Front Table Side

Set a level on the front table side and adjust the leg levelers until this table side is level. Do the main adjustments with the end legs, as the middle leg is primarily for support. **Do not** lower the middle leg levelers until the gantry is installed, the table is level and square.

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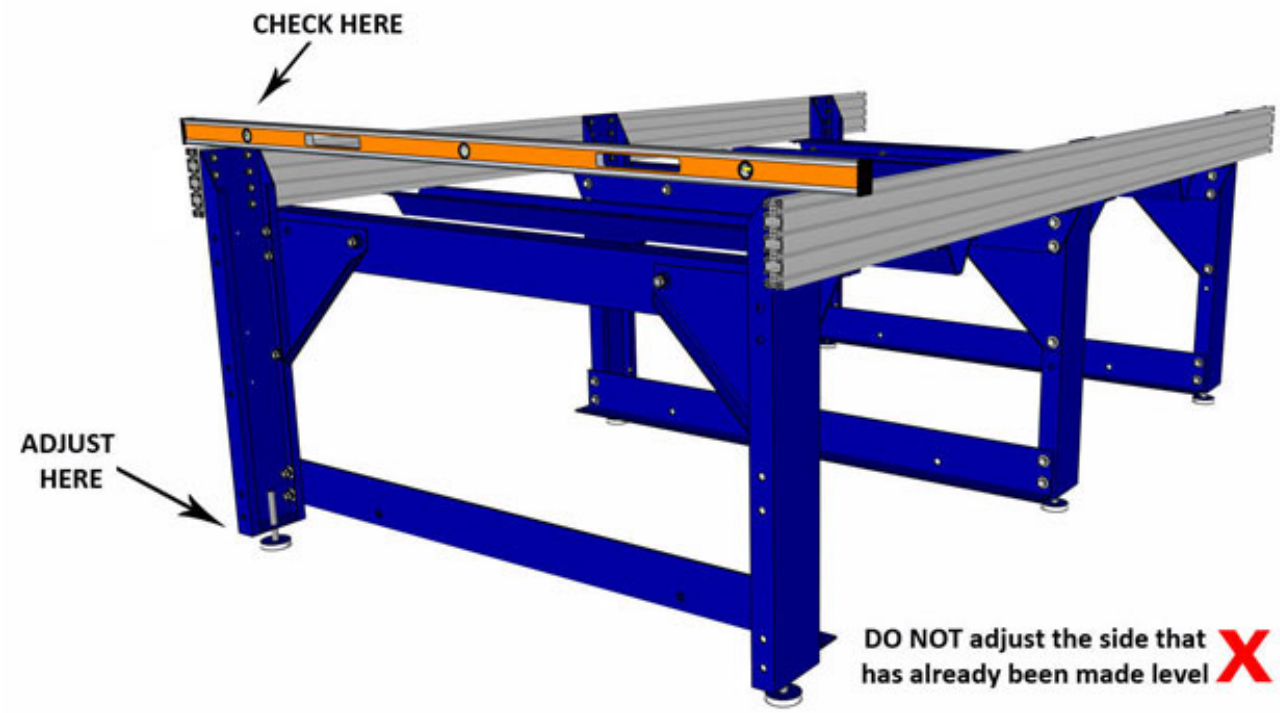
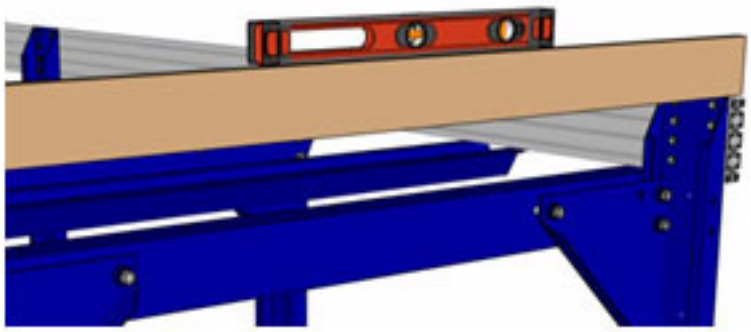
Level the Rear Table Side

Level the rear table side by checking it against the front. Place the level to span the two table sides at one end, and adjust the leveling feet on the back table side. Once this is level, move down to the next set of legs.



TIP: When checking a long span, a longer level will give a more accurate reading. If possible, use a level that spans the entire width of the table.

If this is not possible, place a shorter level on top of a straightedge. Whatever method used, make sure that the straightedge is actually straight with parallel sides.



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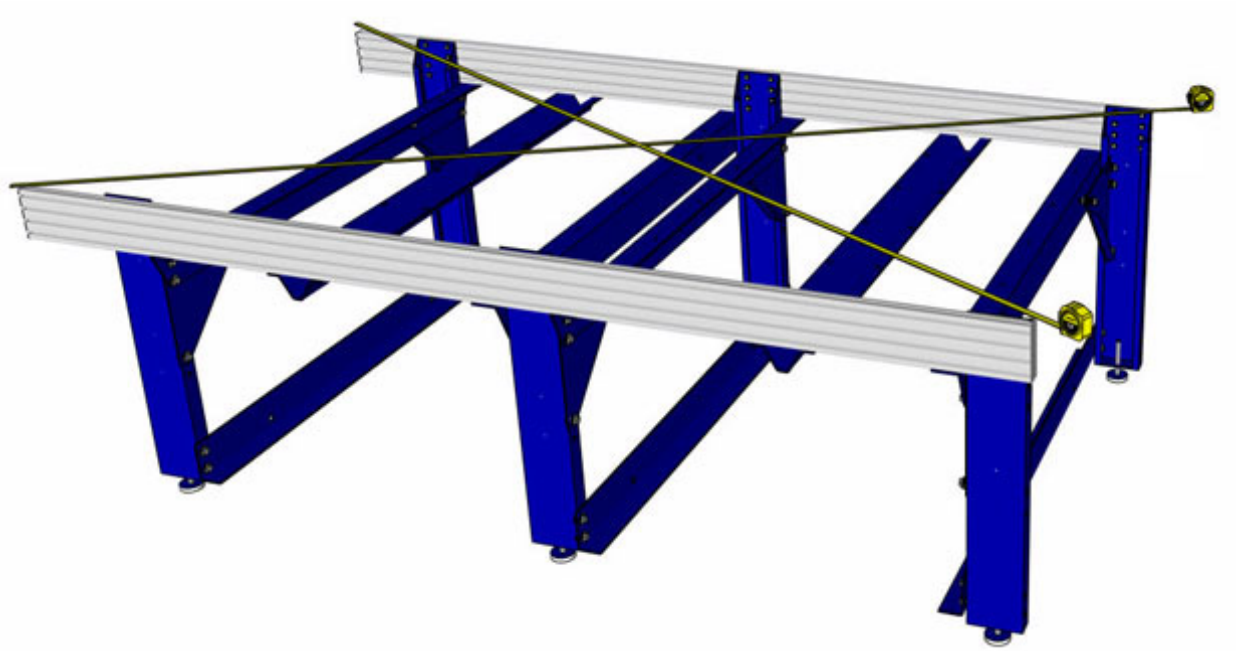
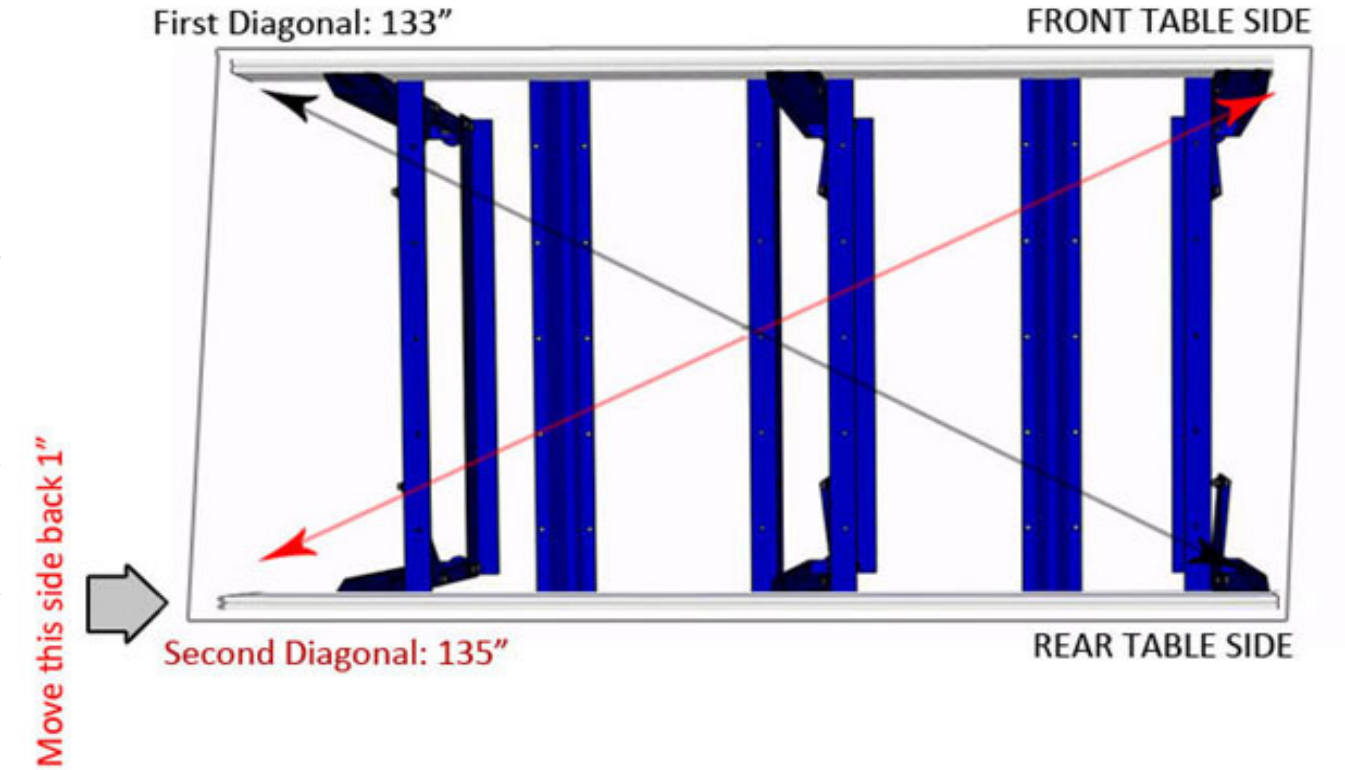
Square the Rear Table Side

Measure the table across both diagonals. The measurements should be the same to within 1/16”. If measurements are different, adjust the rear table side. Ensure the bolts holding the cross-supports onto the rear table side are loose enough to slide within the grooves.



This example is exaggerated to illustrate the correct method of squaring table:



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The rear table side should be moved half the difference between the two diagonal measurements. In this example, there is a 2” difference between the measurements, so the rear table side should be moved 1”. With one person holding the opposite diagonal in place, use a rubber mallet (or a hammer and protective block of wood) to carefully knock the table into square. Fully tighten the bolts once the diagonal measurements are verified. Ensure all table leg and table support bolts are tight.

Install Rails

Lay the rail on top of the side with the rack on the outside of the table side. Mark on the inside of the rail where the T-nuts go under each counter-bored hole in the top of the rail.

Set the rail aside, and slide the T-nuts into position, smooth side up.

Set the rail on top of the sides to make sure the T-nuts are visible under the counter-bored holes. Adjust as necessary.

Place one 5/16 x 3/4” button head screw into each counter-bored hole in the top of each rail.

Using a 5/16” allen wrench, loosely install the bolts into the T-nuts to prevent any rocking, while still allowing some side to side play.

Do not fully tighten the bolts on either rail.

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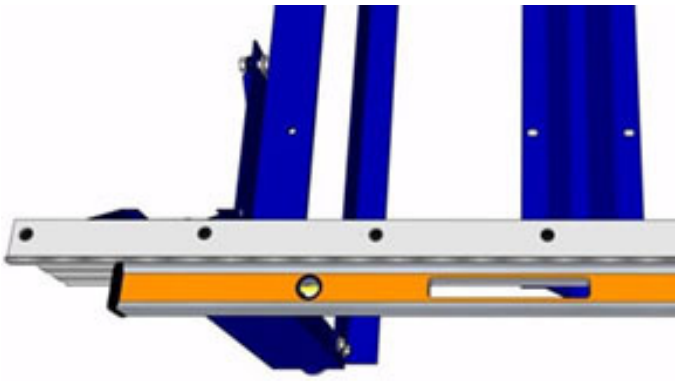
Adjust the Front Rails



Align the end of the rail with the end of the table side at the 0 position.

Start at one end of the table and tighten the bolts down the length of the rail. While performing this step, check each side of the rail with a level or straight edge to be sure that the rail is perfectly straight.

Do not tighten the second rail at this time.

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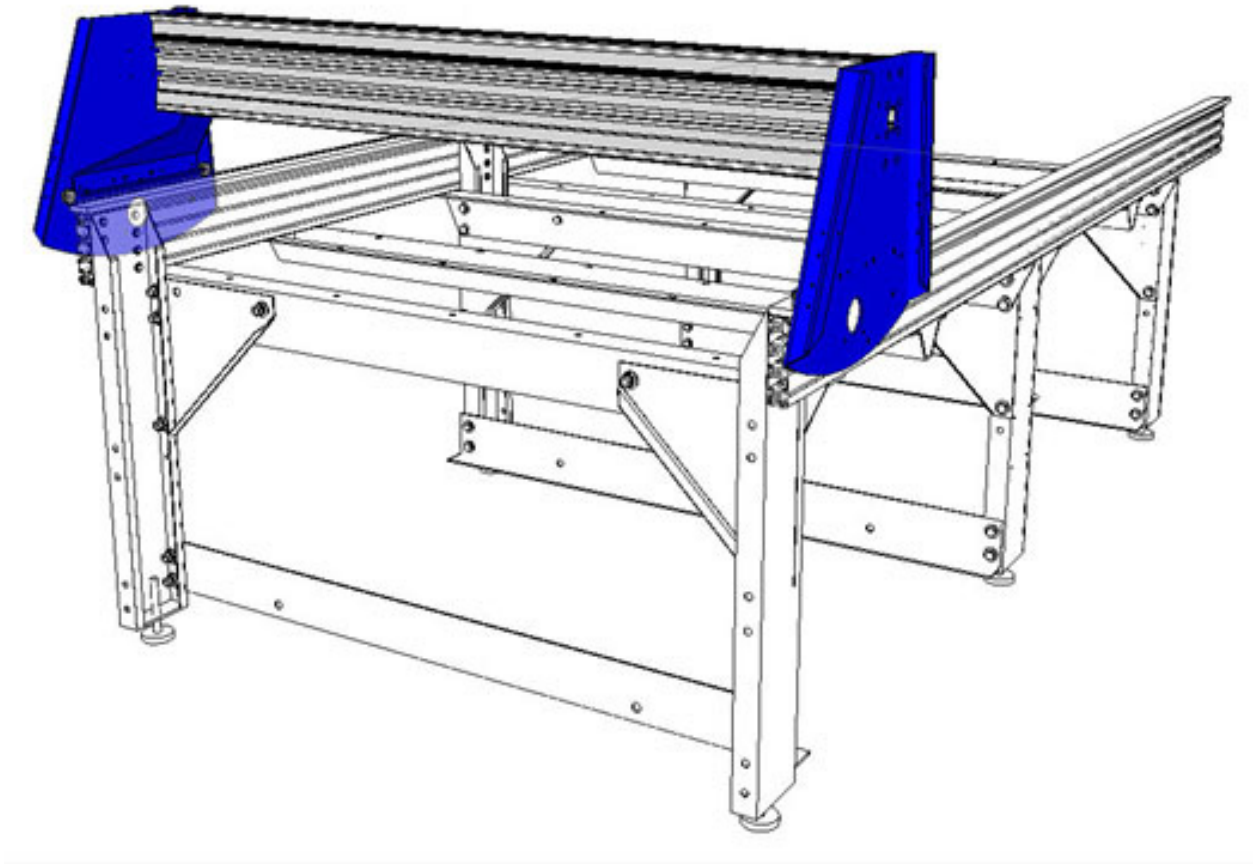
Section 3. Gantry Installation



Introduction

The gantry will come mostly assembled in the crate. Assistance will be required to safely lift the main assembly and place it on the table assembly.

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Hardware

Part Name	Quantity	ShopBot Part Number	Notes
Gantry			
32”	1	002733	
48”	1	002734	
60”	1	002735	
72”	1	002736	
108”	1	002737	
YZ Assembly			
8”	1	002742	
12”	1	003336	
18”	1	003520	
24”	1	003343	
Push bar mounting kit	1	003532	
1/4-20x5/8	8	002407	
1/4” lock washer	8	000031	
48” push bar kit	1	001996	
Push bar	2	001898	
1/4-20x5/8	8	002407	
1/4” lock washer	8	000031	
60” push bar kit	1	001997	
Push bar	2	001919	
1/4-20x5/8	8	002407	
1/4” lock washer	8	000031	
72” push bar kit	1	001998	
Push bar	2	001920	
1/4-20x5/8	8	002407	
1/4” lock washer	8	000031	
108” push bar kit	1		
Push bar	2	002012	
1/4-20x5/8	8	002407	
1/4” lock washer	8	000031	
Zip tie	A/R	003100	
Hard stops			
X mechanical stop	4	000660	
1/4-20x1/2 Hex Cap Screw	2	001006	
1/4-20x3/8 Socket Head Set Screw	8	001288	

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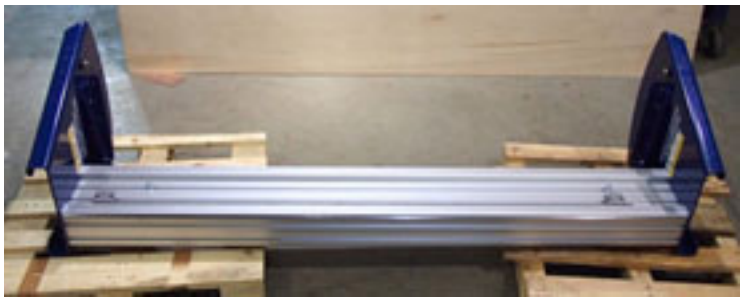
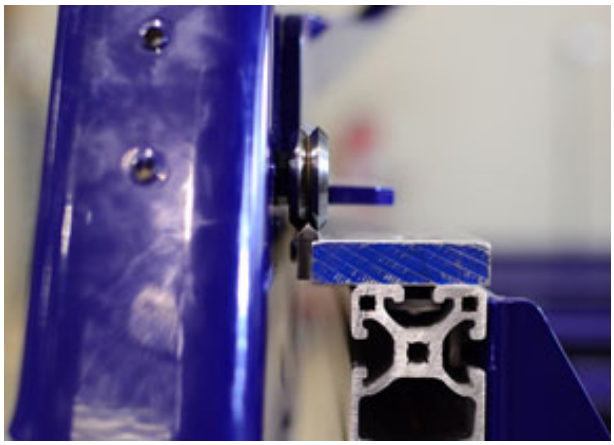
Install Gantry



Caution: The gantry is approximately 200 pounds and awkwardly weighted. Two people should be used to lift the gantry.

Note: Ensure front rails are already tightened.

With the help of another person, lift the gantry onto the rails.



The dual V wheels should ride on each rail as shown.

Adjust the Rails

Align the back rail by running the gantry up and down the length of the rail while watching from above to make sure rail is centered in the wheel. Starting at one end of the gantry, adjust, then tighten the rail as the gantry is slid down the length.

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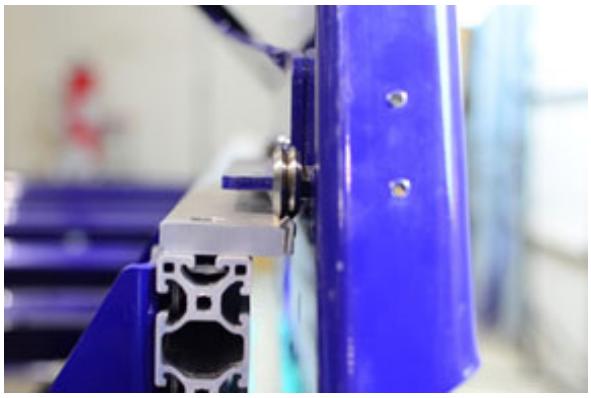
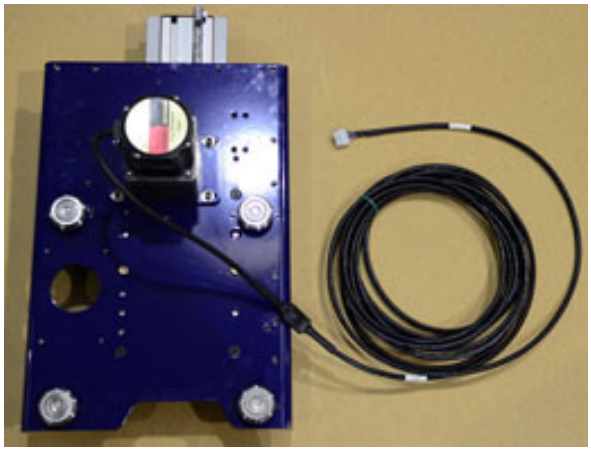
Fine Tune the Rail Level



Adjust middle leg feet until they are lightly touching the ground.

Adjust the feet or shim the leg if the gantry wheels are floating in relation to the rails. Continue adjusting until the gantry rides smoothly.

Tip: Place a sheet of plywood or other material over the cross supports at this time to serve as a temporary workbench.

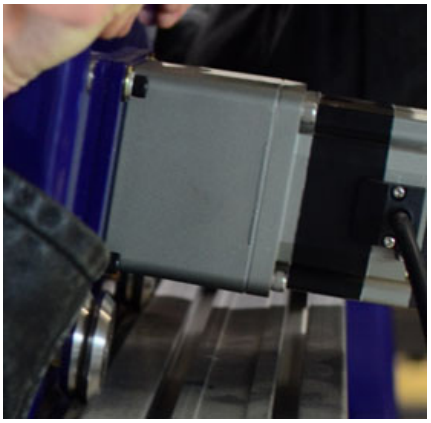


Install the YZ Car

The YZ car comes with the Z motor already mounted.

The two pairs of V wheels mount to the gantry rails.

The top two wheels (near the motor) are concentric and should remain snug.



Remove the lower wheels (marked with a paint dot) using the 5/8” wrench and the provided gantry wheel wrench.

Place the YZ car on the gantry. Ensure the wheels rest on the hardened rail on the front of the gantry.

Loosely snug the bottom wheels and nuts so the V groove captures the bottom rail.

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The bottom set of wheels are also eccentric and will change position as they are rotated. This allows the tension of the wheels against the rail to be adjusted.

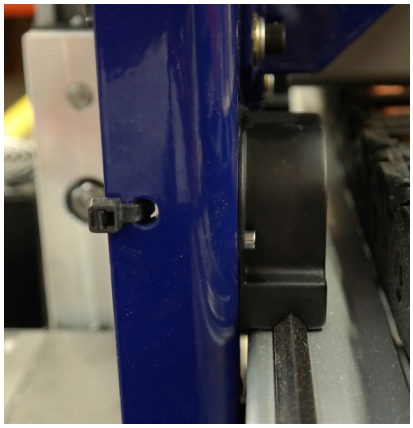
Use the gantry wheel wrench to rotate the wheel until it engages the rail. Hold the wrench in place while snugging the nut with an adjustable wrench.

Repeat for the other wheel.

Test and adjust wheel tension

Test each wheel by holding it firmly while moving the YZ car (be mindful not to pinch fingers). When it's possible to just stop the wheel, tighten the nut an additional 1/16th of a turn. Test again to ensure each wheel stays snug along the entire rail.

Note: Do not over tighten the wheels. This will stress the bearings, creating binding, and reducing component life.



Install wheel covers for YZ car and gantry.

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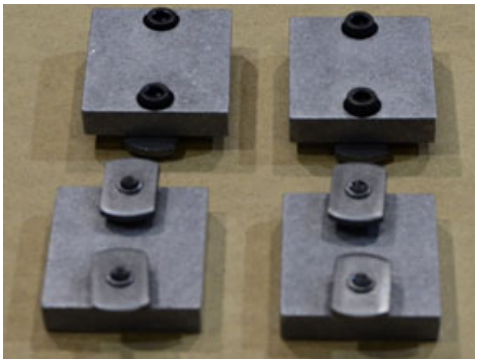
Mount the X-Axis Stop Blocks and Proximity Targets



Assemble X-axis mechanical stop blocks using the X-axis mechanical stop, 1/4-20x1/2 Hex Cap Screws, and 1/4-20x3/8 Socket Head Set Screws.

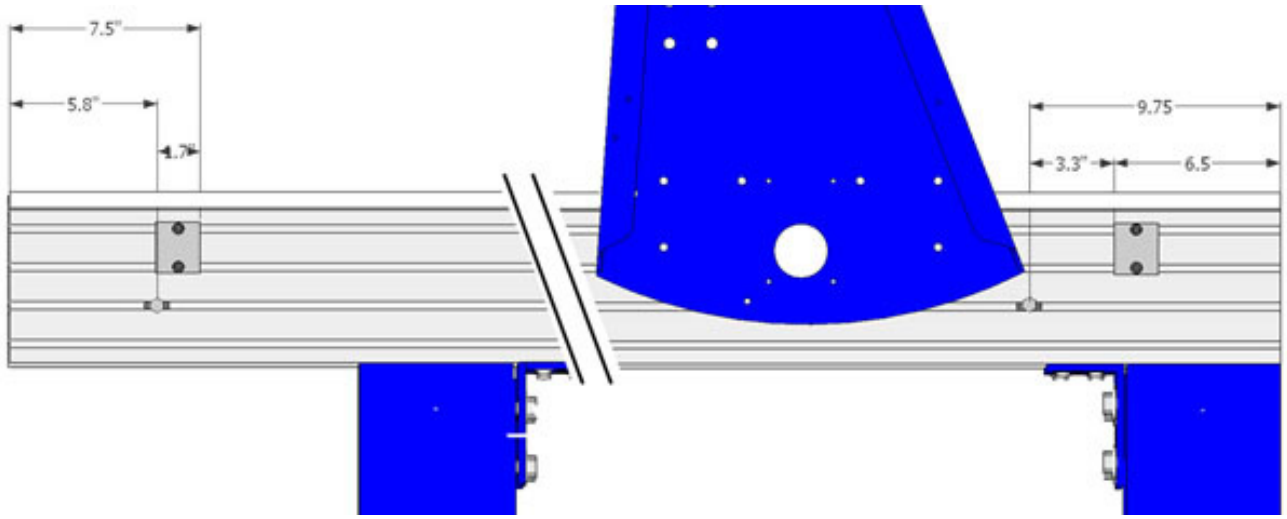
Assemble the X proximity switch targets with the 1/4-20x3/8 Socket Head Set Screw, T-nut, and 5/16-18x3/4 Hex Cap Screw.

Caution: The mechanical stop blocks will not stop the gantry from rolling off the end of the rails until the motors have been attached to the end plates. Use caution when rolling gantry near the end of the rails, or place a clamp at the end of the rails to prevent the gantry from rolling off the end of the tool.

The X-axis mechanical stop blocks prevent the gantry from leaving the rails. One goes at each end of both side plates. They must hit on both sides of the gantry at the same time. Orient the bolts vertically in the top two slots on the side rail. The stop block should just clear the geared track below the rails.

Leave stop blocks loosely attached, they will be adjusted and tightened in Section 10.

The X-axis proximity switch targets provide should be positioned so that the X proximity switch just clears the stop blocks by 1-2 mm (approximately 1/16”). They should be placed at each end of the back rail (opposite from the control box side). The targets will be centered under the proximity switch when the pinion is butted against the stop block.



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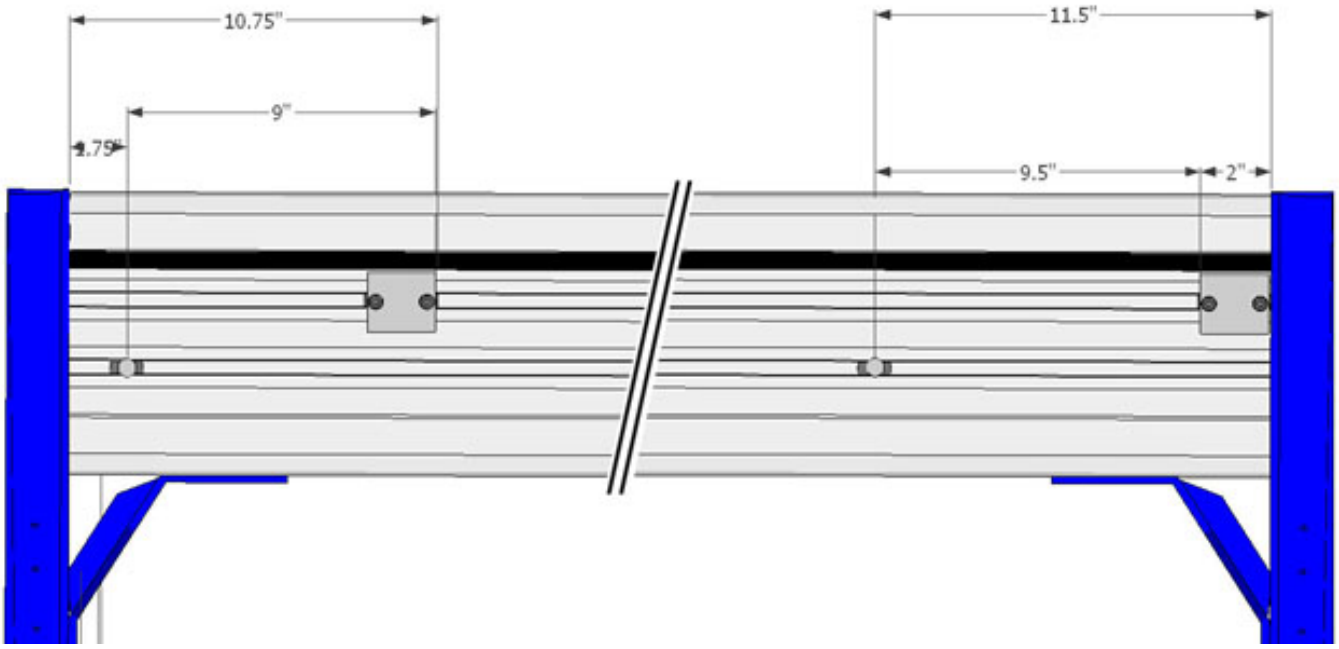
Adjust the Y-Axis Stop Blocks and Sensor Targets

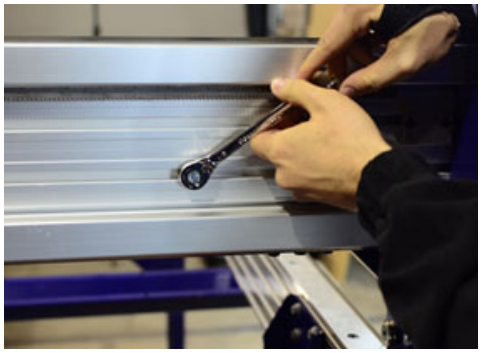


The Y-axis stop blocks and sensor targets are mounted at the factory, but may need to be adjusted.

Adjust the stop blocks to the measurements shown using a 3/16” Allen wrench.

Adjust proximity switch targets using a 1/2” wrench. They should be the specified distance away from the stop blocks.

Note: Measurements are to the edge of the stop blocks and the center of the target bolts. Targets should be installed with the nuts and head aligned with one of their flat surfaces vertical for best performance.



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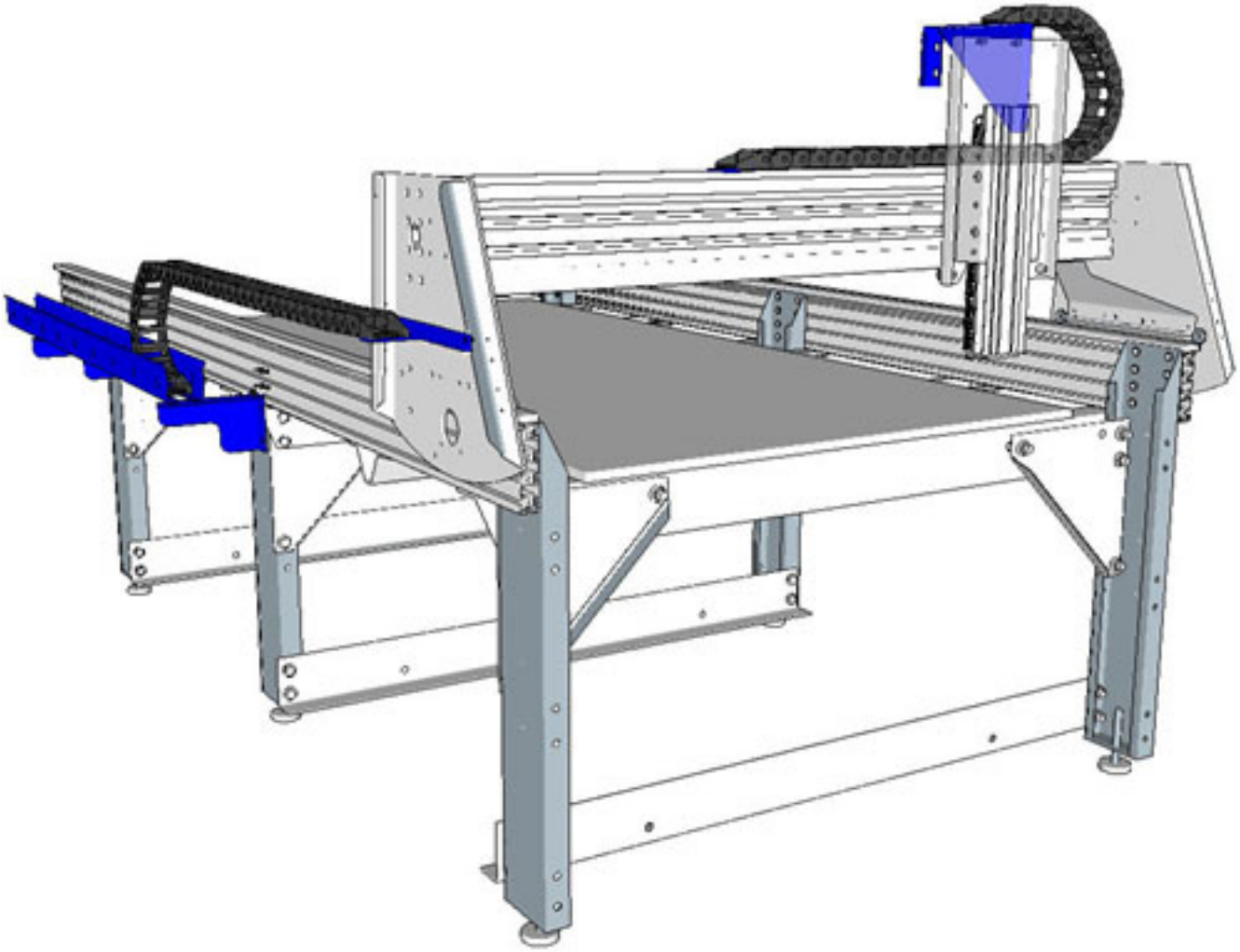
Section 4. Cable Carrier Installation

Introduction

Cable carriers are also called “e-chains”. These components are used to house and protect the power and communication cables during operation. As the machine moves, the carriers flex and support the cables to keep them organized and prevent tangling or damage. All tools feature a Y-axis cable carrier going from the top of the gantry to the YZ car. X-axis cable carriers are included with PRSalpha and PRSstandard machines 96” and above. 48” or 72” X-axis machines use the included “cable carrier kit” to keep the cables organized along the X-axis. Instructions for these should be included in the shipment. If not, they can be accessed under the “E-Chain” section at http://www.shopbottools.com/ShopBotDocs/accessories_upgrades.htm.

The cable carriers are sized to match the length of the ShopBot’s axes. They are center-mounted, meaning that they will be shorter than the actual length of the machine.



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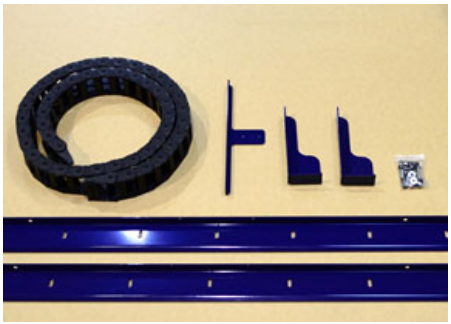
Hardware

Part Name	Quantity	ShopBot Part Number	Notes
Lower Y-chain bracket	1	002161-01	
5/16-18 Twist in T-nut	2	002240-01	
5/16-18 x 5/8 flat head screws	2	002279	
Upper Y-chain bracket	1	002160-01	
¼-20 x 1/2 socket head screws	2	001601	
¼" lock washers	2	000031	
¼" flat washers	2	000534	
10-32 x 3/4 flat head screws	4	002246	
#10 flat washers	4	000629	
#10 lock washers	2	000539	
10-32 hex nuts	2	002247	
E-chain trough bracket	1	002155	
5/16-18 x 3/4 Button head screws	2	002033	
5/16" Lock washer T-Nut	2		
T-Nut	2	000728	
64" E-chain trough or 74" E-chain trough	2	002158 002159	
1/4-20 x 3/4 Flat head screws	4	001600	
1/4" Lock washer	4	000031	
1/4" Flat washer	4	000030	
1/4" Nylock nut	4	000454	
Alternate parts:			
12" E-chain trough bracket	2	003293	
5/16-18 T-nuts		002498	
X upper E-chain bracket	1	002156	



Parts for X-Axis carrier 6" Z

Parts for X-Axis carrier 12" or 24" Z

Parts for Y-Axis carrier

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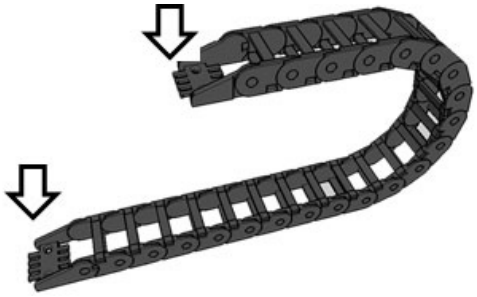
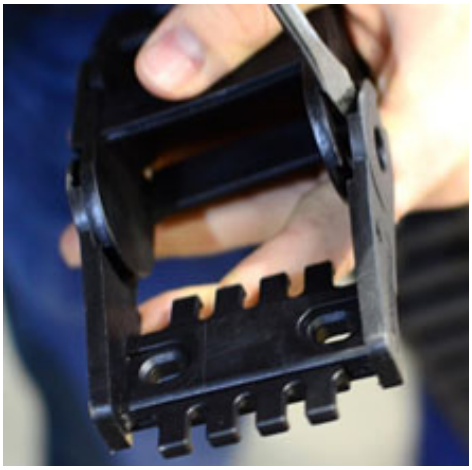
Prepare the Cable Carriers



Before installation, check each cable carrier by bending it into the installed position. Check end link orientation. Both end links should face down as shown.

Reversing the End Links

If the end links are not in the correct orientation, insert a screwdriver blade into the slot at the end of the link and twist until the flange pops off the side lugs.



Reverse the end link as needed. Push the end link until the flanges snap into the side lugs.

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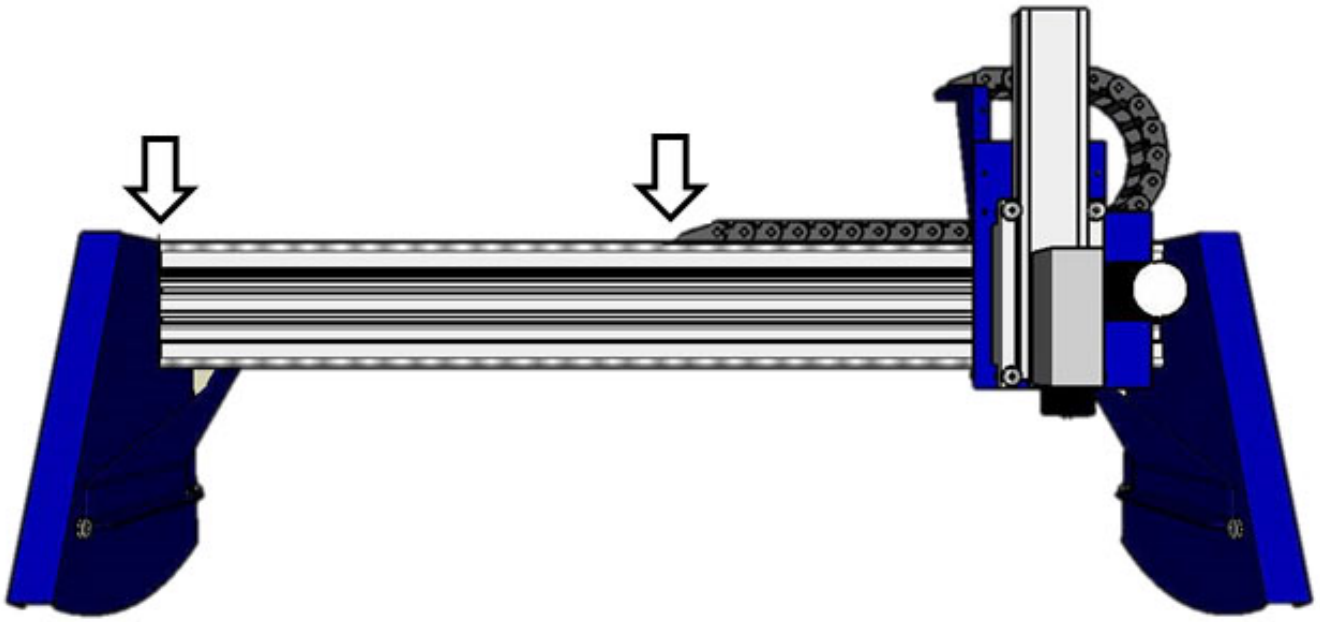
Y-Axis Cable Carrier

Mount the Lower Y Bracket

Note the orientation of the cable carrier on the Y-axis across the gantry. When facing the YZ car, the curve of the carrier sits on the right side of the gantry.

Install the lower Y-chain bracket and loosely secure with 3/16” flat head screws. Start a few of the threads of the twist in T-nut onto the screws.

Use the chart below to position the lower bracket and then tighten the 3/16” flathead screws.



Y-axis cutting length (Beam length)	Distance between end plate and Y lower bracket
32 in (47.992 in or 1219 mm)	22.50 in (572 mm)
48 in (66.338 in or 1685 mm)	31.50 in (800 mm)
60 in (78.346 in or 1990 mm)	37.50 in (953 mm)
72 in (90.354 in or 2295 mm)	43.50 in (1105 mm)
108 in (126.456 in or 3212 mm)	61.50 in (1562 mm)

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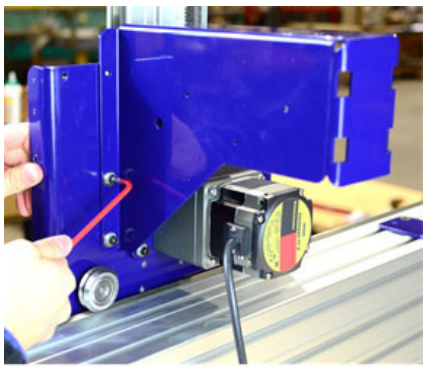
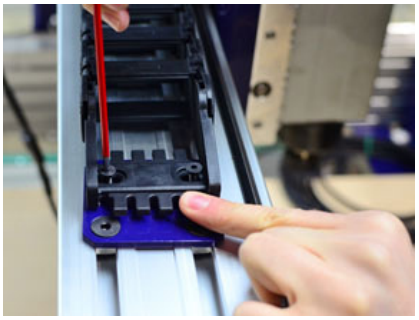


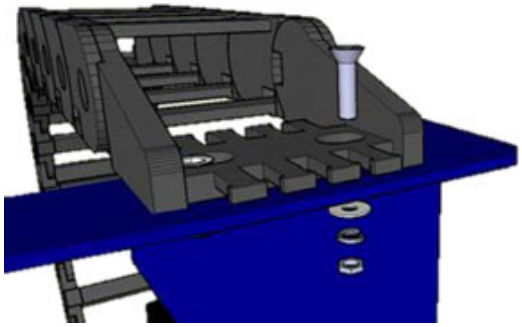
Install Upper Y-Chain Bracket

On the back left side edge of the YZ car there are two ¼-20 holes. Note the location of the bracket in relation to the Z motor on the YZ car. Align holes in the longest tab of the upper Y-chain bracket with the tapped holes of the YZ car. Use the ¼-20 screws, lock washers, and flat washers to tighten the bracket securely to the YZ car.



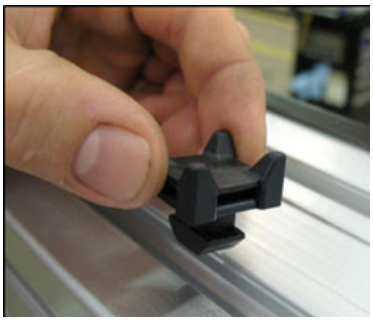
Mount Cable Carrier to Lower Y Bracket

Align the counter sunk holes in the cable carrier with the holes in the top of the lower Y bracket. Loosely start the 10-32 x ¾ screws into the lower Y chain bracket.

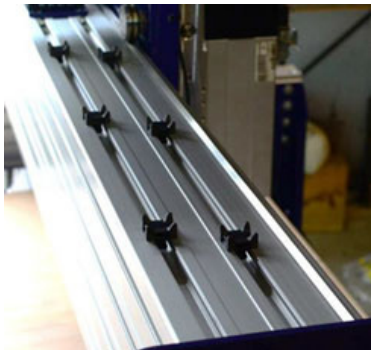


Mount Cable Carrier to Upper Y Bracket

Align the counter sunk holes in the cable carrier with the holes in the top tab of the upper Y bracket. Use screws, flat washers, lock washers, and hex nuts to secure the end link to the Y upper bracket.



Install cable tie brackets. These will be used to secure cables along the top of the gantry after they have been routed. Drop T-section into gantry slot at desired position. Twist T-section 90 degrees to lock in place.



Position cable tie brackets evenly between cable carriers and end plate.

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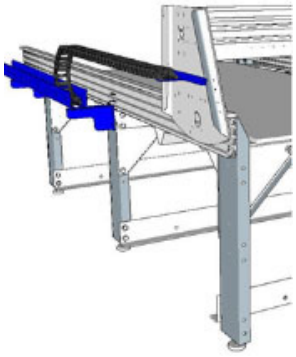
X-Axis Cable Carrier



X-axis cable carriers are included with PRSalpha and PRSstandard tools with table sides 96” and up. Table configurations with 48” and 60” are not shipped with X-axis cable carrier kits.

The first steps are to assemble the trough for the cable carrier to ride in, and to attach the support to the end plate of the gantry.

Attach one end of the cable carrier to the trough at the midpoint of the table, and the other end attached to the support on the gantry.

Diagrams of where to place the brackets for the troughs for different sized tools are found at the end of this section.

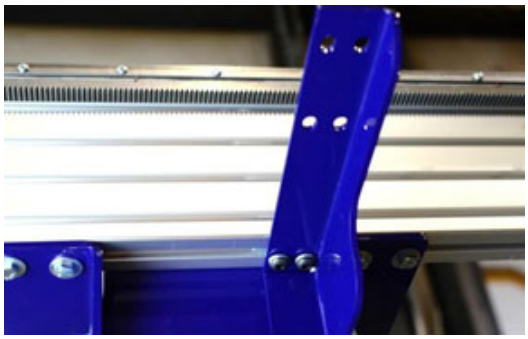
Install Trough Brackets for ShopBots with 6” Z’s

Depending on the length of the machine, the number of trough brackets needed can vary from 2-4. The hardware called for here will reflect the mounting of a single trough bracket for a tool with a 6” Z.

Note: Tools configured for 12” and 24” Z’s have dual side plates and require different mounting brackets.

Place ball and spring pivot inserts into slot on bottom of the rail in in line with the middle table leg.

Inserts will need to be positioned so the holes are turned toward each other to match the hole spacing of the trough bracket.



Loosely install the cable carrier trough bracket with button head screws, lock washers, and washers.

Mount additional trough brackets as needed. Most often, the middle leg and the back leg (farthest from the 0, 0 home position) are used. See diagrams at the end of the document for common configurations of the brackets and trough.

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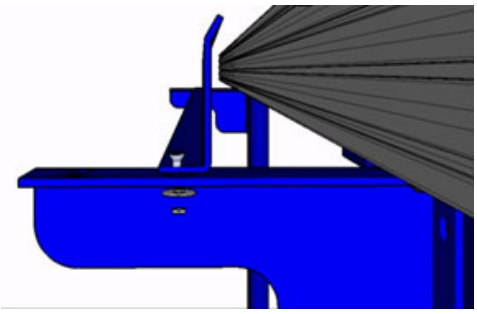
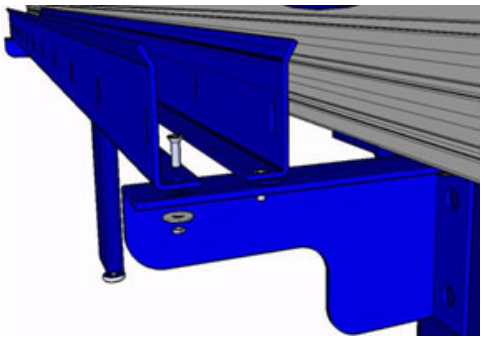
Install the X-Axis Trough: 6” Z-Axis

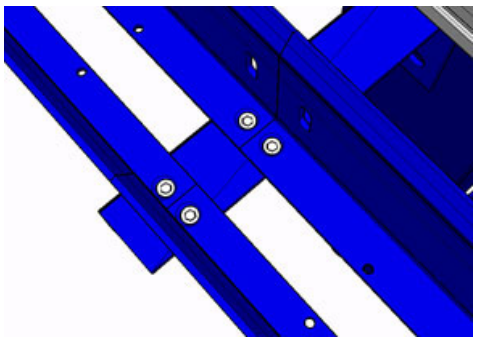


Position the first cable carrier trough so the holes closest to the edges are over the inside holes in the trough brackets.

Fasten the trough to the bracket using 1/4” flat head screws, flat washers, and nylock nuts. Leave these loose until range of motion is checked.



Repeat installation of the other trough piece, using the outer holes on the bracket.



For models that need extended lengths of trough (longer than 96” in the X), use the second set of holes in the cable carrier bracket to butt the trough sets together.

Machines with 12” and 24” Z-Axis

Machines with two side rails require alternate mounting brackets for the X-axis trough brackets. The brackets are attached to the outside of the lower frame rail with T-nuts.

Slide a 5/16-18 T-nut into each of the top three grooves on the lower table side extrusion, with the flanged face of the nuts facing towards the inside of the table. Loosely thread a 5/16-18 x 3/4 Button Head Screw and 5/16 Lock Washer through the trough bracket into each T-nut, as shown below.

Repeat this step with the remaining bracket(s) (extended tables may have 3-4 brackets). Keep the mounting hardware loose so the brackets can slide along the table side in order to be moved into the proper position.

Attach the trough to the brackets in the same manner as for the tools with the 6” Z.

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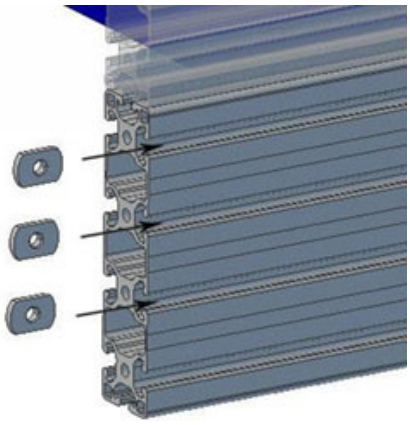
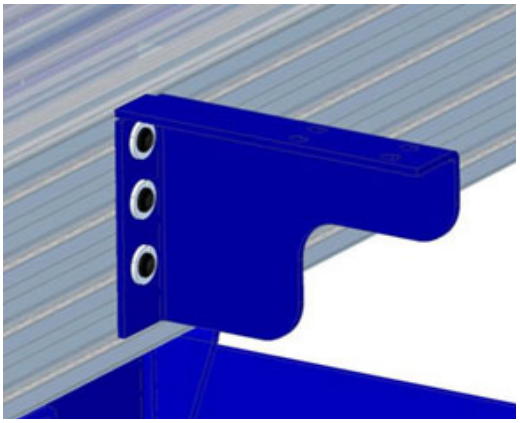
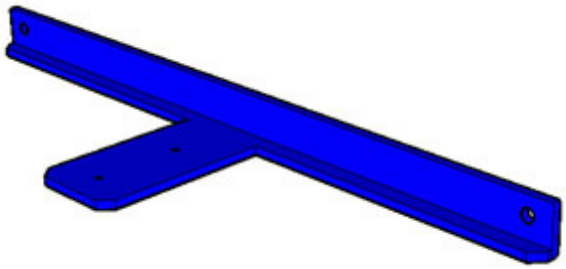




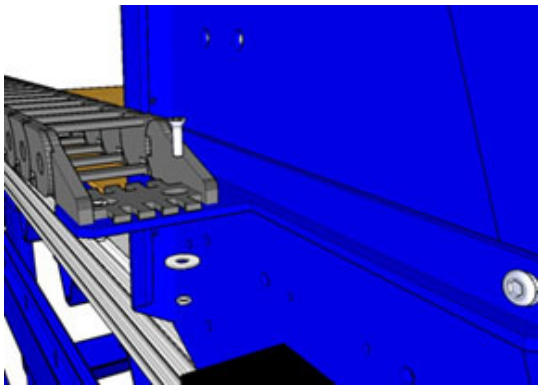
Install the Upper X Cable Carrier Bracket



This bracket mounts to the outer side of the gantry end plate and serves as an attachment point for one end of the carrier.

Mount the X upper cable carrier bracket to the 1/4- 20 holes located in the side of the endplate. Use the button head screw and lock washer to secure the X upper cable carrier bracket to the endplate.

Cable Carrier to Upper X Bracket



Attach one end of the cable carrier to the tab that extends from the X upper cable carrier bracket. Use flat head 10-32 screws, flat washer, lock washer and nut.

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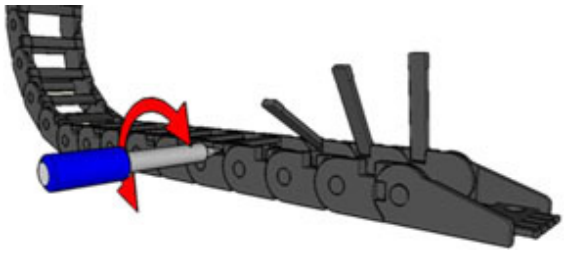
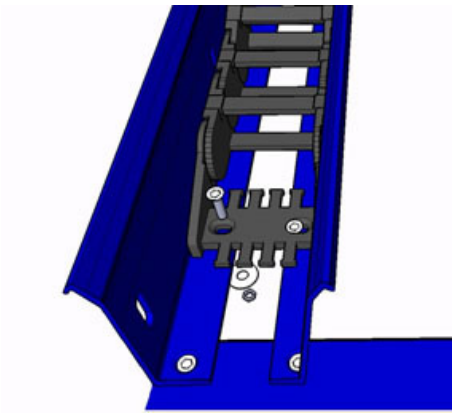
Cable Carrier to Lower X Bracket



Open the first five access gates by inserting the tip of a flathead screwdriver into either side of the hinged access gate. Turn the screw driver approximately 1/4 turn in each direction until the side of the access gate releases.

Attach that end of the cable carrier to the holes located 3 1/2” (64mm) from the end of the trough and closest to the middle of the machine.

Use flat head 10-32 screws, flat washer, lock washer and nuts to attach the lower portion of the cable carrier to the trough.



Test Cable Carrier Mobility on Both Axes

Place the open access gates close to their clasps to keep them from snagging and breaking off while testing the carrier mobility. Move the X-axis back and forth the full extent of travel. The cable carrier should not feel as though it is binding or under tension. If need be, adjust the trough brackets slightly along the table side (X-axis.) Finishing by tightening the 5/16 button head screws holding the brackets to the table. The lower end plate on the Y-axis can also be adjusted slightly if the Y-axis binds.

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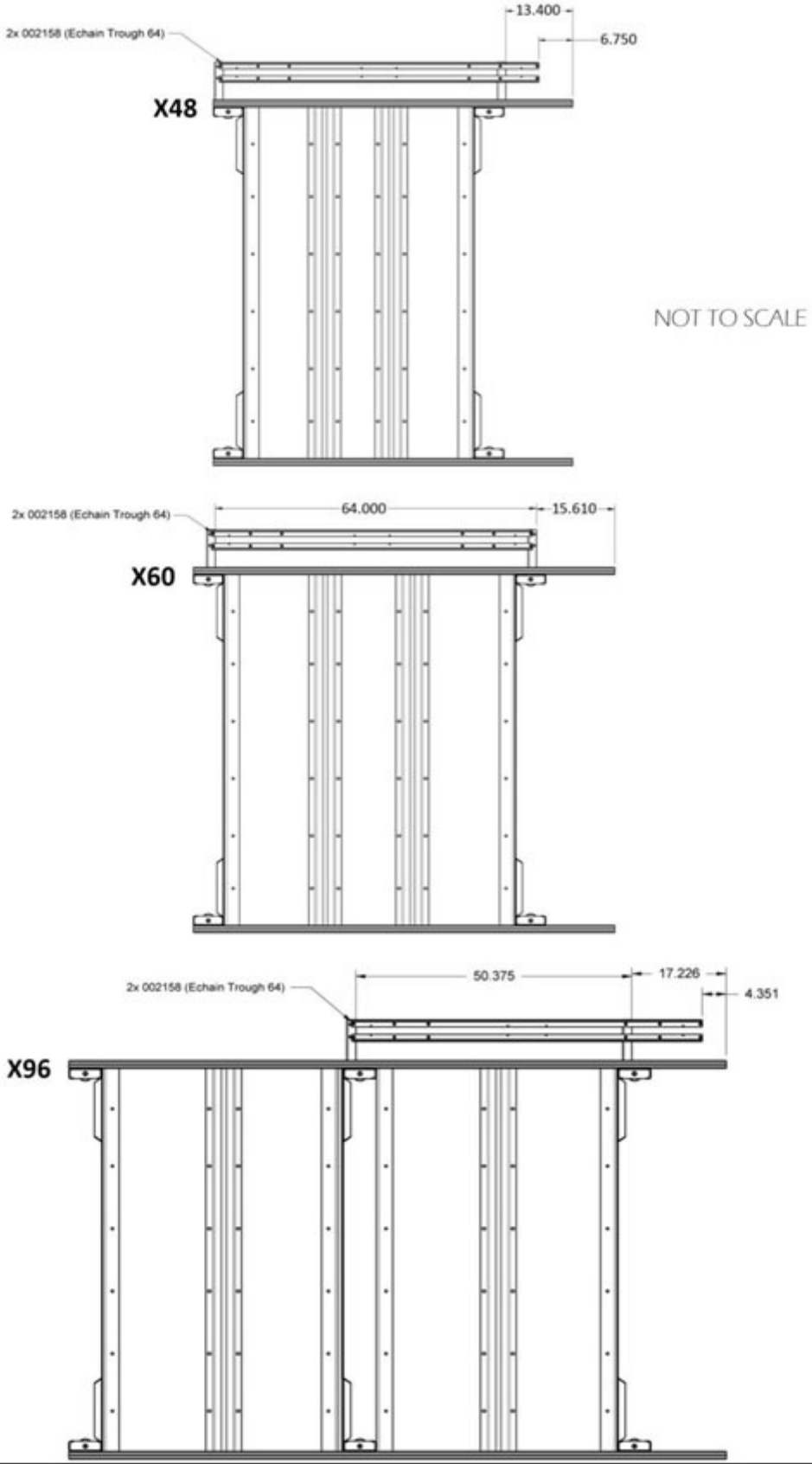
X-Axis Cable Carrier Configurations



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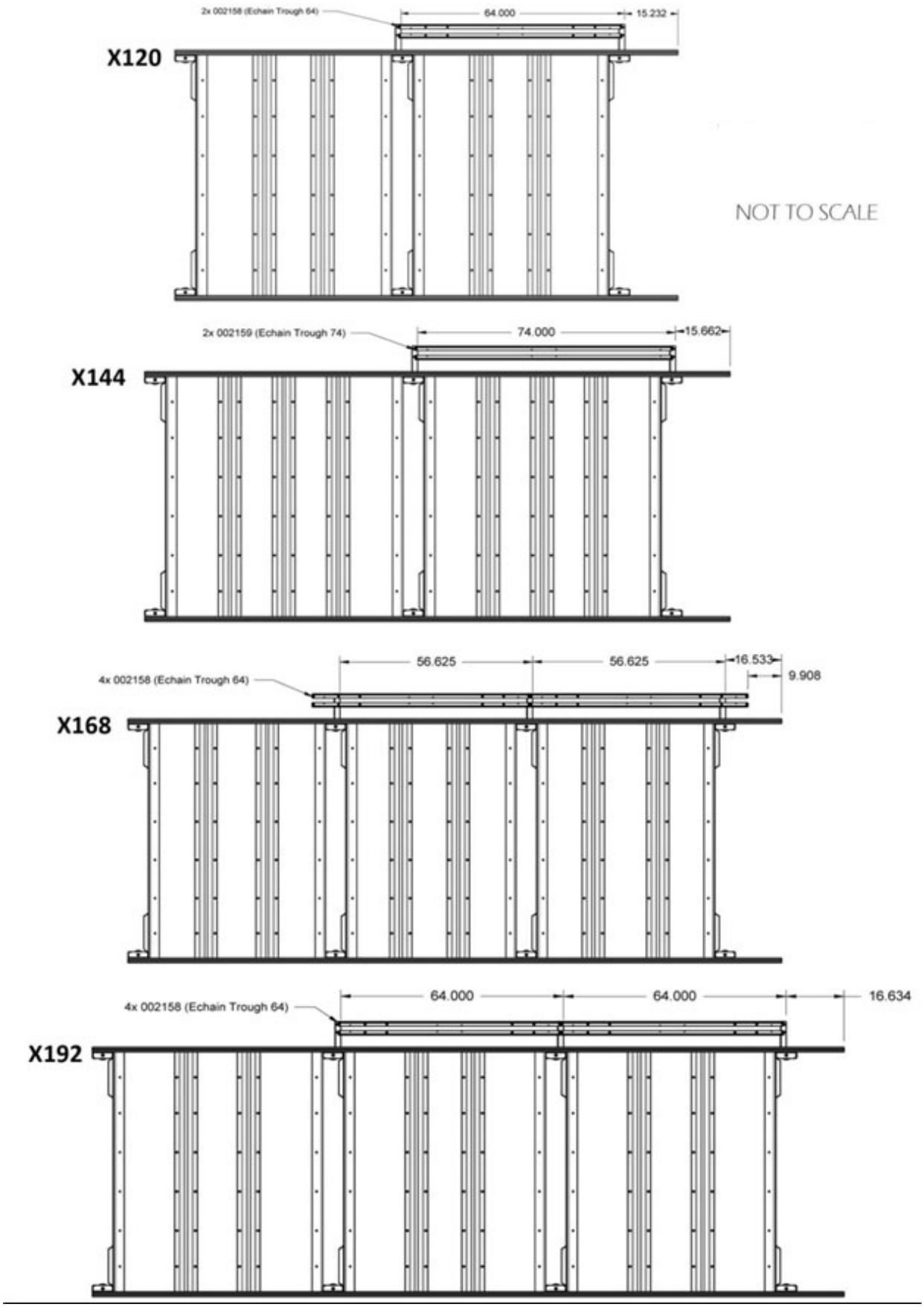

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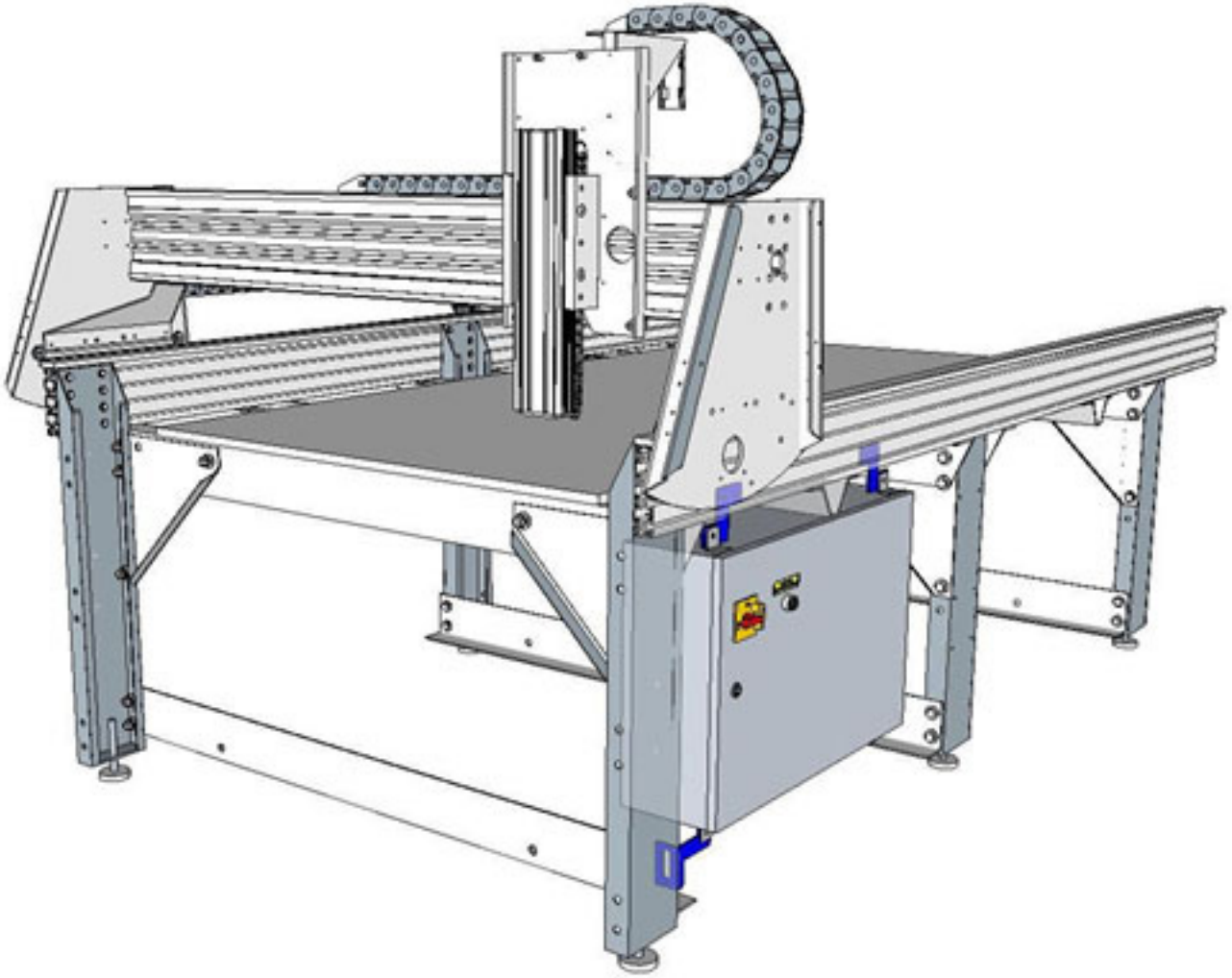
Section 5. Control Box Installation

Introduction

All power, inputs, and outputs are routed through the control box. In this section, the control box will be mounted to the table.

Note: This section shows a conventional table with a 6” Z-axis. Tables configured for 12” and 24” axes have an extra side rail on each side and require an alternate mounting bracket. Refer to the last page of this manual for the alternate orientation. Control box mounting for 18” Z-axis tables is identical to the 6” table.



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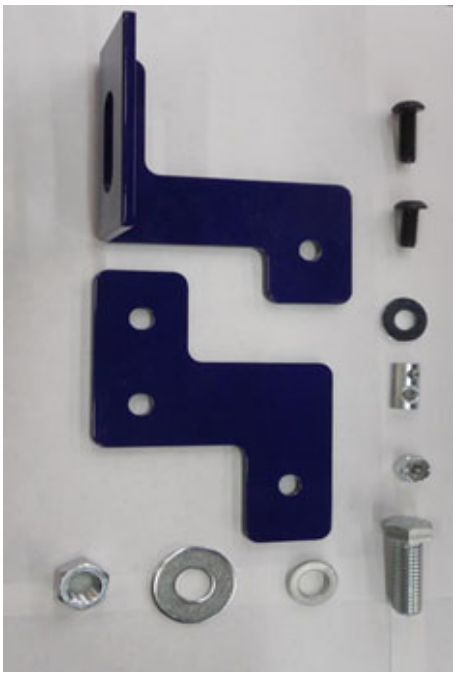
Hardware

Part Name	Quantity	ShopBot Part Number	Notes
Lower control box bracket	1	002580	for tools with 6” and 18” Z-axis
Lower control box bracket	1	003137	for tools with 12” and 24” Z-axis
Upper control box bracket	2	002579	
HSCS 5/16-18x1”	3	002415	
BHSCS 5/16-18x3/4”	4	002033	
Washer flat 5/16” Z USS	10	000848	
T-nut standard 5/16-18 ball and spring pivot insert	4	000728	
Nylock Hex Nut 5/16-18	3	002264	
Nut 1/2-13 Z	1	000440	
Flat Washer 1/2" SAE Z	2	000442	
Lock Washer 1/2" Z	1	000588	
Hex Cap Screw 1/2-13x1 1/2" Z5	1	000589	



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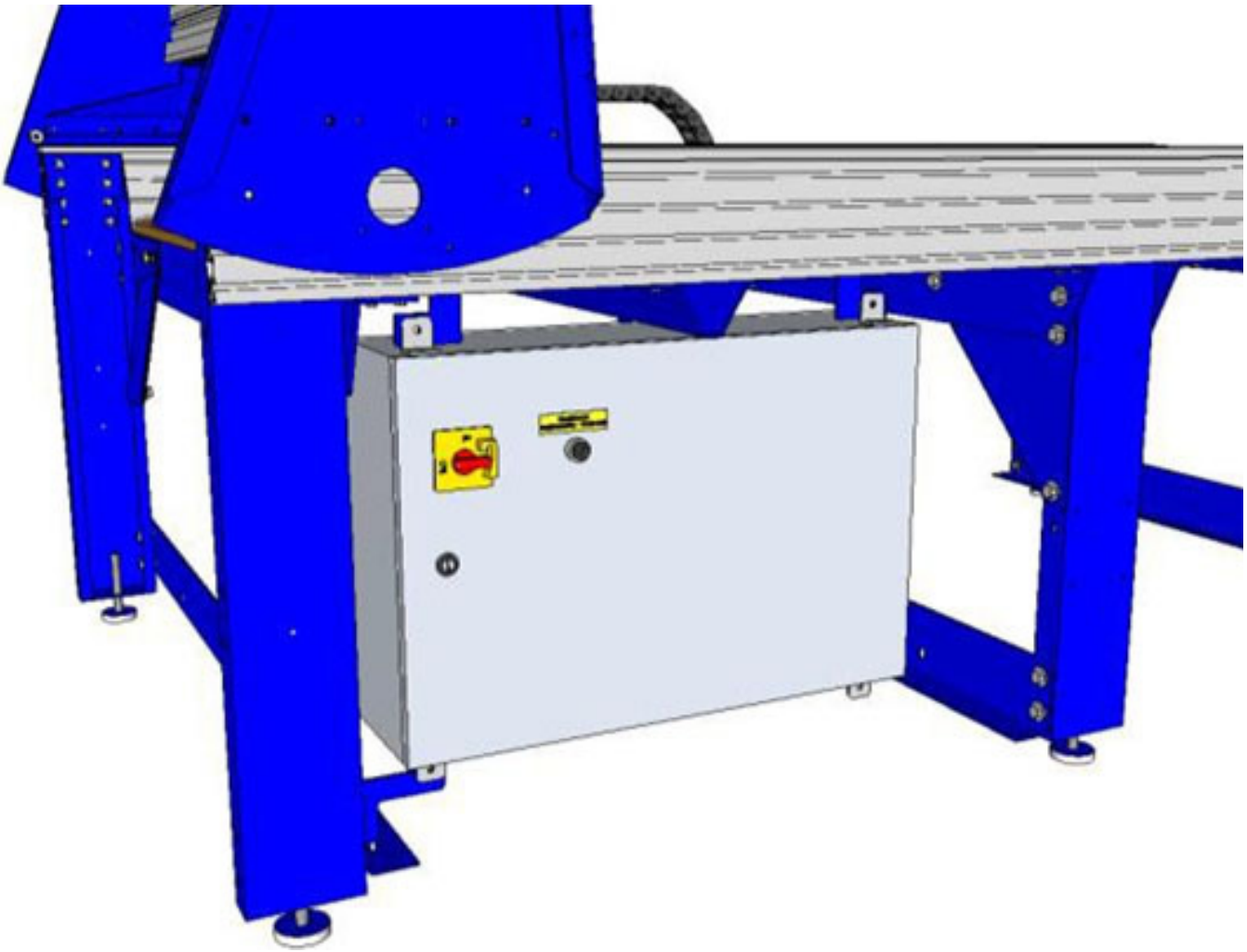

Note: The brackets for the control box are attached to the INSIDE of the table.

Notice that the control box flanges are in front of brackets at both the top and bottom. If the placement of the flanges against the brackets is not consistent, the control box will sit at an angle, and not open or close easily.

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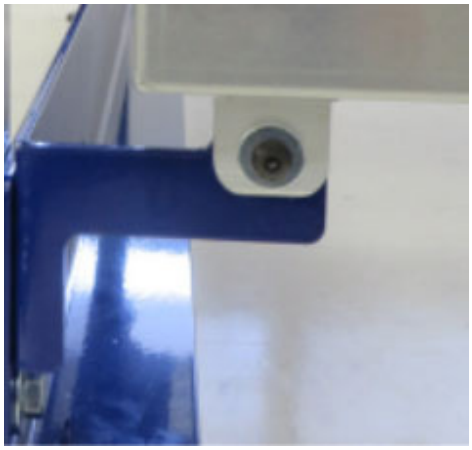
Installation

Snap in T-nut ball and spring pivot inserts on the inside face of the tableside in lowest slot.

Loosely attach the two upper control box brackets to the T-nuts inside the table side slot with 3/4” button head screws and flat washers.

Be aware that their orientation may need to be flipped to keep from interfering with the existing cross supports.



Mount the lower control box bracket to the lower left tab of the control box using flat a 1” button head screw , flat washer, control box tab, through the bracket, washer, and a nylock nut.

Note: it is important that the control box tabs sit on the same side of the blue brackets at both the top and the bottom of the control box.

Space the upper control box brackets to the approximate distance of the tabs on the control box. Lift the control box into place and mount with a button head screw, flat washer, control box flange, through the bracket, flat washer, and a nylock nut for each bracket.

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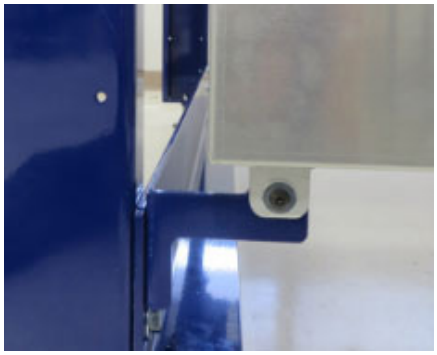
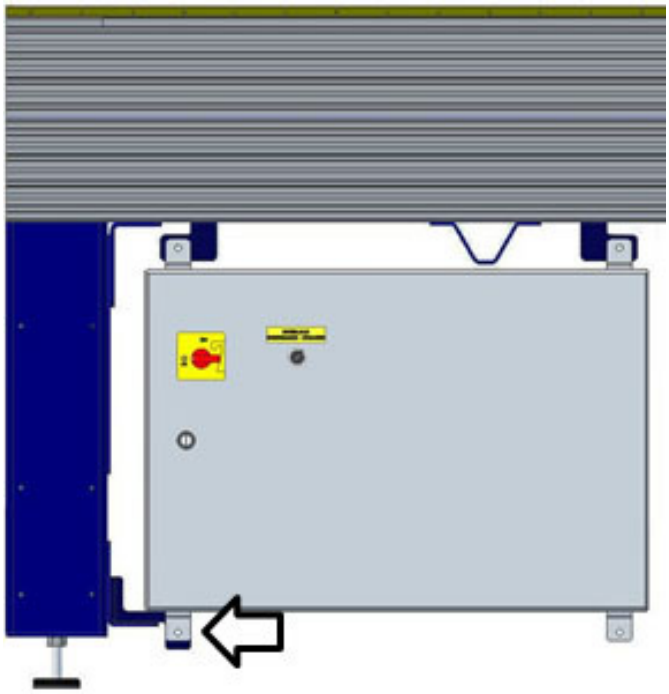
If installed, remove the hardware from the top hole where the lower cross support is attached to the leg.

Slide the top brackets holding the control box toward the left until the lower bracket touches the table leg.



Securely mount the lower control box bracket to the side of the leg with bolt, flat washers, lock washer, and nut.

Once the lower bracket is firmly in place, tighten the button head screws holding the upper brackets to the table sides.



Alternate Mounting for 12” and 24” Z-Axis Models

12” and 24” Z-axis tools are configured with two side plates on each side. The second side rail requires a different lower mounting bracket. This bracket will be installed over the lower cross support with the control box mounting tab pointing down.

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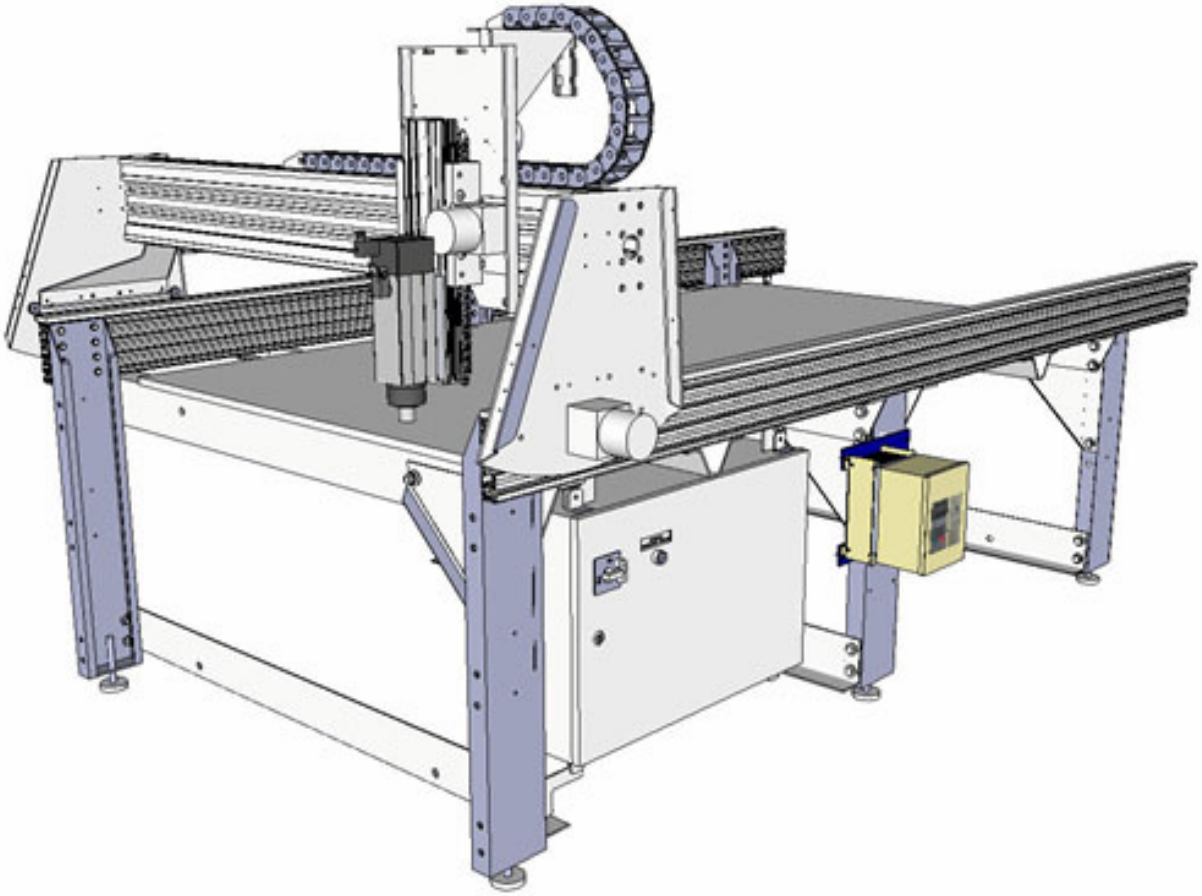
Section 6. VFD and Spindle Installation

Introduction

This section covers mounting the variable frequency display (VFD) and spindle.

If attaching a router instead of a spindle, refer to Installing and Removing Router document. This document was provided with the tool, and can also be accessed at http://www.shopbottools.com/ShopBotDocs/files/RouterRemovalInstall.pdf.

If attaching Automatic Tool Changer (ATC), refer to ATC Installation Manual. This document was provided with the tool, and can also be accessed at http://www.shopbottools.com/ShopBotDocs/files/ATCCombinedManual.pdf



VFD Installation

ShopBot Tools with spindles use a VFD to regulate input power and control rotation speed. There are two major body sizes, 10” and 16”, which are used depending on specific voltage and phases requirements. The supplied bracket will work for each size.

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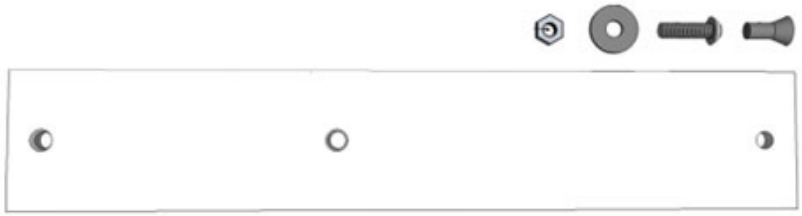
Hardware

Part Name	Quantity	ShopBot Part Number	Notes
Yaskawa V1000 VFD	1		Part numbers vary based on the options available. Refer to paper work to determine model.
VFD Mounting Kit V1000	1	003065	
FHSCS 1/4-20x5/8	2	003064	
BHSCS 1/4-20x3/4	4	002135	
flat washer 1/4 USS Z G5	6	000534	
Nylock hex nut 1/4-20 Z	6	000454	
VFD mounting strap	2	003036	



Determining the VFD Model

There are two main types of VFDs, a 10” model and a 16” model. These can be easily differentiated by their size and model numbers. Model numbers are found on the front of the VFD underneath the “RUN” and “STOP” buttons as shown on left.

There are five different amperage configurations. These will not impact installation, but it may be beneficial information for tech support.

Voltage Amperage (Determines Size)

An example model number is shown below.

The model number is CIMR–VU2A0040GAA.

The first bold and underlined number in the written example is the voltage.

2 = 200-240 Vac, 3-phase

4 = 380-480 Vac, 3-phase

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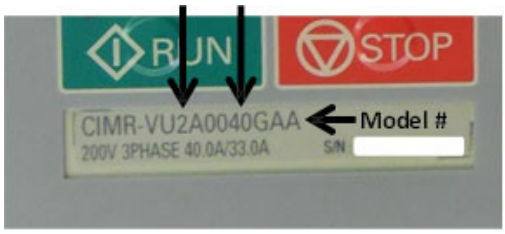
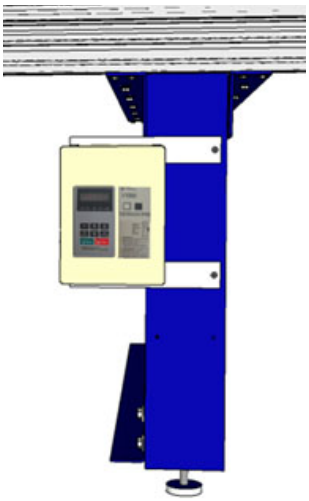
Mounting the 10” VFD

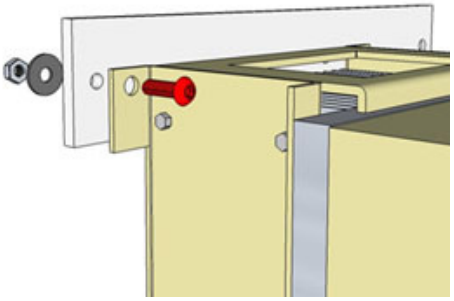
The 10” VFD mounts to the top and middle set of holes in the middle leg of the ShopBot gantry tools with the VFD 1000 mounting kit.



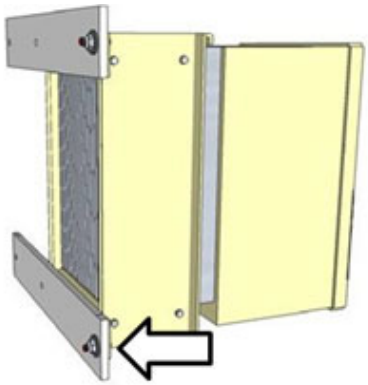


Mount VFD straps.

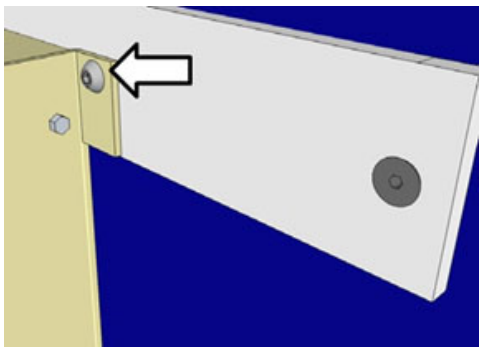
Use a 1/4-20x3/4” button head screw to attach the upper hole of the VFD to the left hole in the strap. Using the 1/4” flat washer and 1/4” nylock nut, securely fasten the VFD to the strap.



Repeat the above step for the other strap on the bottom of the VFD.



Use a 1/4-20x3/4” button head screw to attach the right upper hole of the VFD to the middle hole in the strap and upper left hole of the leg. Securely fasten the VFD and strap to the leg with 1/4” flat washer and 1/4” nylock nut. Repeat for the lower strap.



Leave VFD cables neatly in place until routing and wiring in Section 8.

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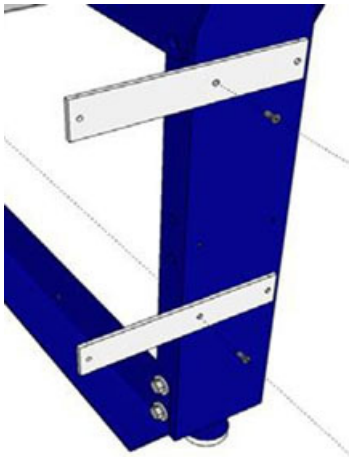
Mounting the 16” VFD

The 16” VFD mounts to the top and bottom set of holes in the middle leg of the ShopBot gantry tools with the VFD 1000 mounting kit.

Mount the VFD straps.

Use a 1/4-20x3/4 flat head screw in the middle hole of the VFD mounting strap and the upper left hole on the front middle leg of the ShopBot. Attach securely with 1/4” flat washer and 1/4” nylock nut. Repeat this step on the lowest set of holes on the leg with the second strap.

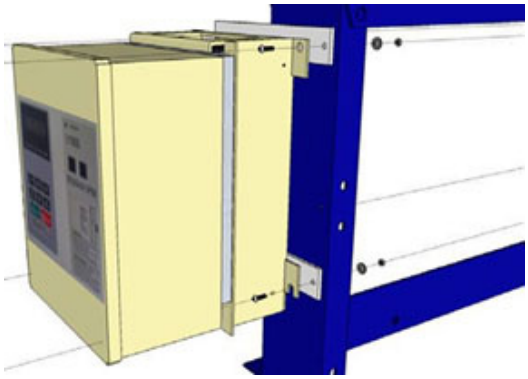
Install two 1/4-20x3/4” button head screws button head screws, 1/4” flat washers and 1/4” nylock nuts on the bottom bracket.



Install the VFD.

Slide the VFD onto the bottom bracket screws, and install two 1/4-20x3/4” button head screws through the upper holes of the VFD. Secure VFD with two 1/4” flat washers and 1/4” nylock nuts. Secure all nuts.

Leave VFD cables neatly in place until routing and wiring in Section 8.



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Spindle Installation

Hardware

Part Name	Quantity	ShopBot Part Number	Notes
Spindle mounting hardware kit	1		
Spindle (For Colombo spindles Some machines have two)			
Colombo 3HP 220/230V 1Ph		12513	
Colombo 3HP 230V 3Ph 15.5A		12581	PRS 24V onbrd spindle
Colombo 3HP 230V 1PH 22A		12580	PRS Alpha
Colombo 3HP 230V 3PH 15.5A		12582	PRS Standard
Colombo 3HP 230V 3PH 15.5A		12583	PRS Standard
Colombo 3HP 380/460V 3PH 5.9A		12584	PRS Alpha
Colombo 3HP 380/460V 3PH 5.9A		12585	PRS Standard
Colombo 5HP 220/230V 1PH 34A		12592	PRS Alpha
Colombo 5HP 220/230V 1PH 34A		12593	PRS Standard
Colombo 5HP 230V 3PH 20.6A		12511	PRS Alpha
Colombo 5HP 230V 3PH 20.6A		12594	PRS Alpha
Colombo 5HP 230V 1PH 20.6A		12595	PRS Standard
Colombo 5HP 380/460V 3PH 11.2A		12596	PRS Alpha
HSD 2.2HP 220V 1PH		12569	PRS Standard
HSD 2.2HP 220V 1PH		12573	Standard PO957
HSD 2.2HP 230V 3PH		12558	
HSD 2.2HP 230V 3PH		12577	Standard PR957
HSD 4HP 380/460V 3PH		12574	
HSD 4HP 380/460V 3PH		12575	Standard PO957
HSD 9HP 230V 3PH		12619	
HSD 9HP 380/460V 3PH		12621	
HSD 4HP 220V 1PH		12562	
5/16”-18 x 1-1/2” Socket Cap Screw	6	001326	

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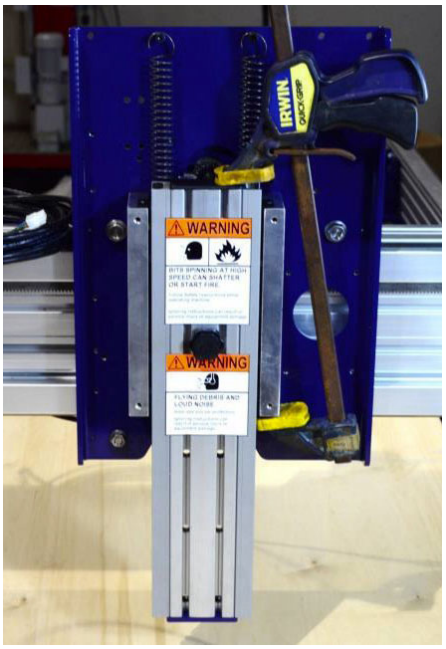
NOTE: Misalignment of the spindle can result in poor cut quality, inaccurate dimensions, and decreased bit life. Squaring the spindle will occur after spoil board installation.

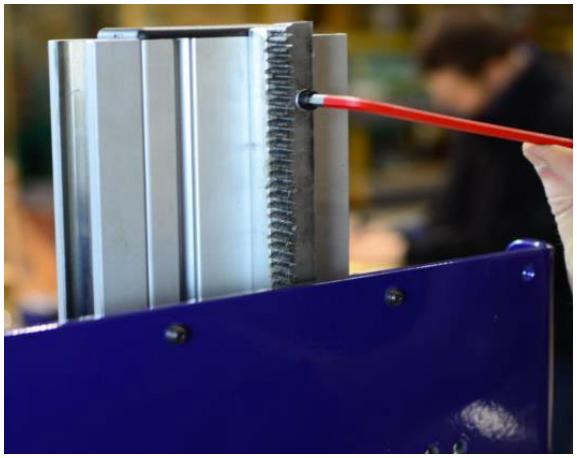


Lower the Z-Axis Extrusion

If it hasn't been done already, place a sheet of plywood on top of the table.

Clamp the Z-axis extrusion at its lowest point as shown at left.

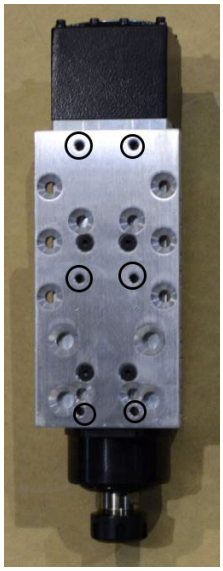
Note: An assistant can also hold the Z-axis during spindle installation.



If the Z-axis will not travel down far enough to access the top two holes from behind, the stop screw may be limiting movement. The screw can be temporarily removed to complete this step.

Raise the Z-axis above YZ car until a screw that is not recessed into the rack is visible on the backside as shown. Be careful to support the Z-axis and ensure it does not move down enough to disengage the rack from the pinion gear.

Note: Do not remove any low profile screws as they secure the rack and removal may cause misalignment.



Spindle Mounting Plate

The spindle will already have a mounting plate attached. The six tapped holes (circled in picture) correspond with the holes on the Z-axis extrusion.

Note: The spindle mounting plate has two mounting orientations on the spindle. Removing the four countersunk screws allows the plate to be rotated 180 degrees. Mounting plate in this orientation shifts the spindle up 1.5" (38mm) in relation to the Z-axis. This allows clearance of taller work stock at the expense of maximum cut depth.

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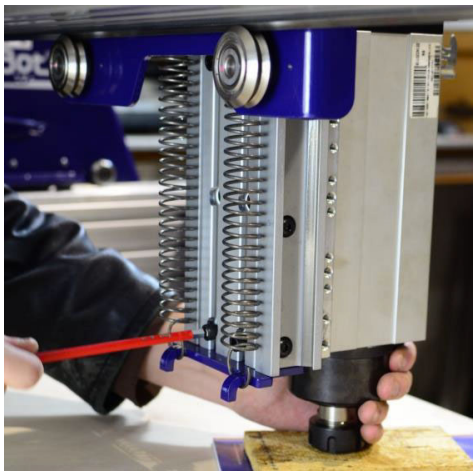
Attach Spindle

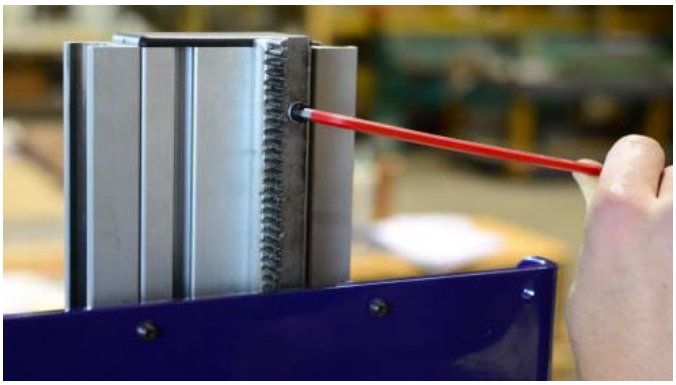


Hold the spindle up to the Z-axis extrusion and loosely attach the six 5/16”-18 x 1-1/2” bolts to hold the spindle in place.

Use shims or an assistant to hold the spindle plate threads level with the Z-axis through holes.

Replace Stop Screw

If the Z-axis stop screw was removed, reinstall it. Install it snug and test the Z travel to ensure the screw stops travel before the pinion leaves the rack.



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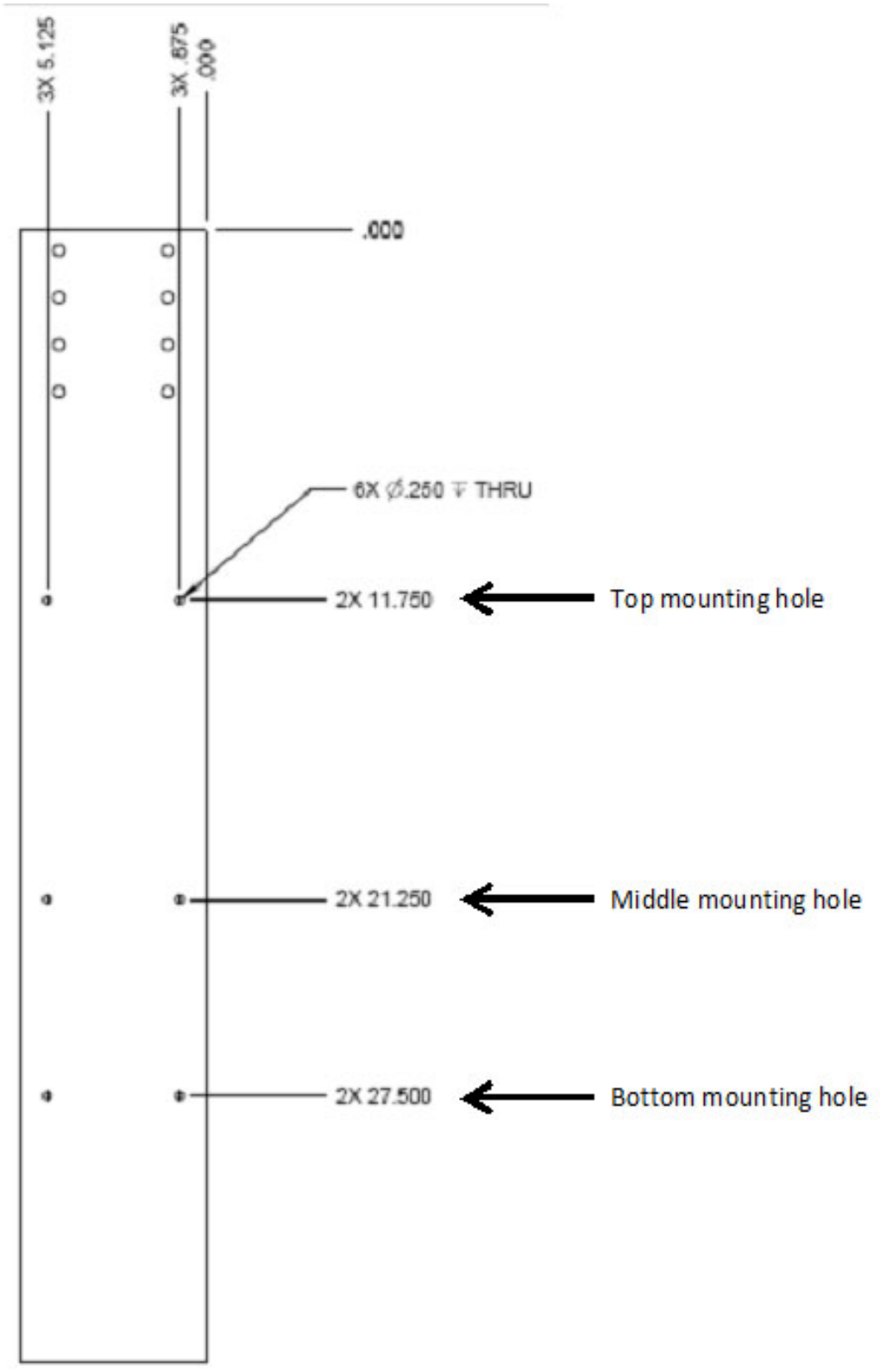
Section 6 Appendix: Table Leg Drawings

6” Table Leg



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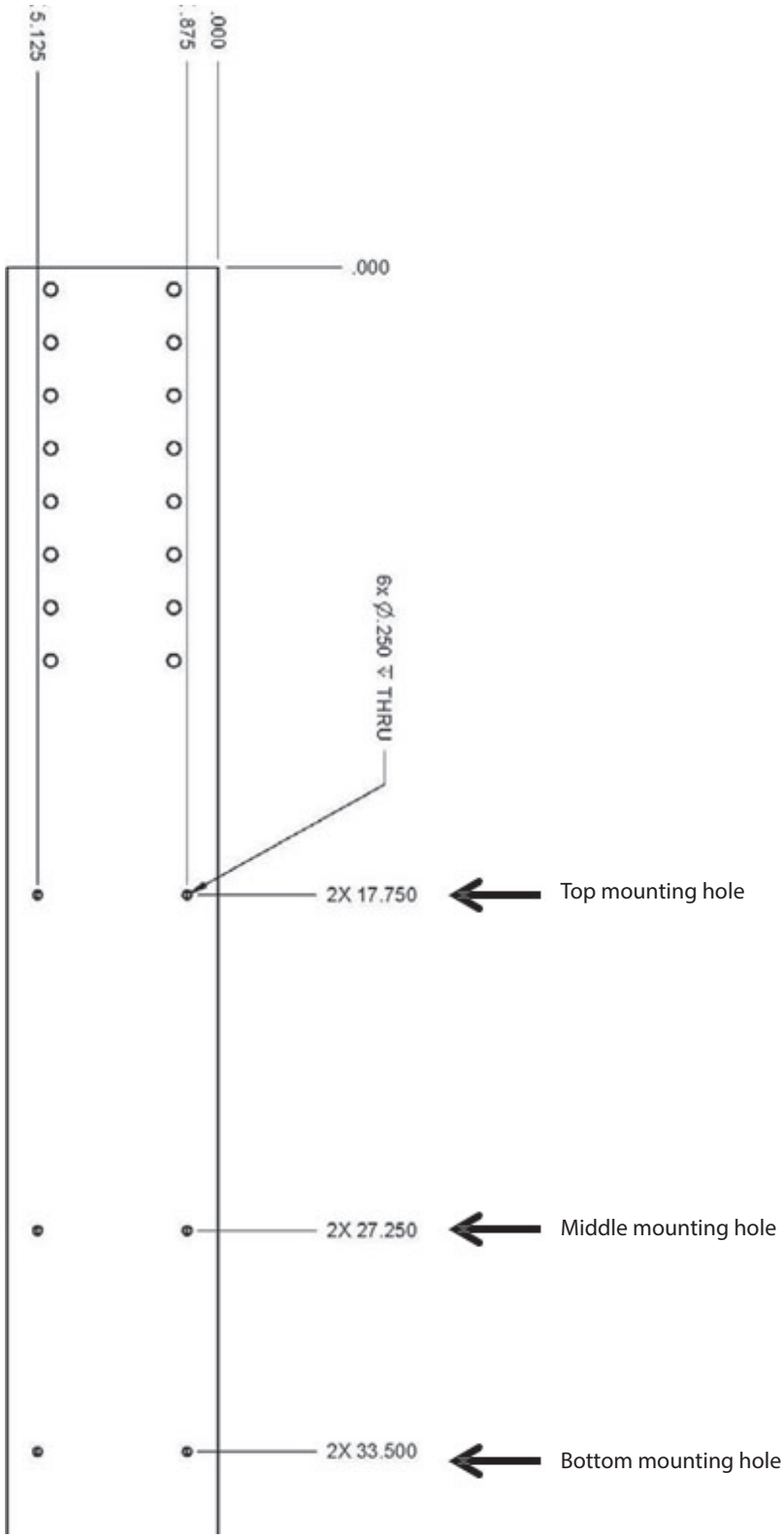
Section 6 Appendix: Table Leg Drawings (cont'd)

12" Table Leg



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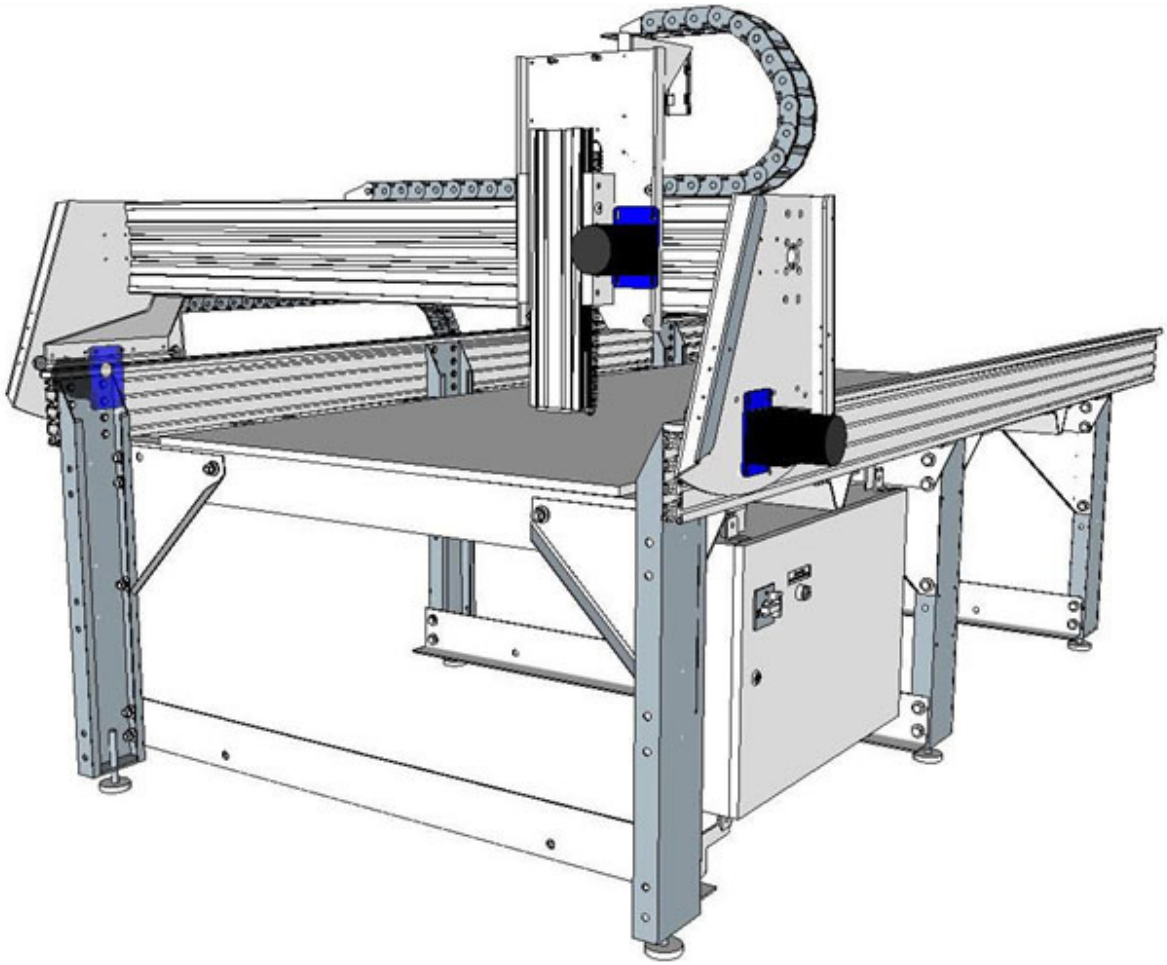
Section 7. Mounting X- and Y-Axis Motors

Introduction

The motors providing movement along the X-, Y-, and Z-axes use a geared pinion that engages a rack mounted to the side rails and gantry. In this section the motors to power the X- and Y-axes will be installed. The Z-axis motor comes preinstalled on the YZ car and will only need minor adjustment.



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Hardware

Part Name	Quantity	ShopBot Part Number	Notes
Pinion 30 tooth	3	000071	
Check if “standard “ pinion gears are same size			
X1 motor	1	See chart below	One red dot
X2 motor	1	See chart below	Two red dots
Y motor	1	See chart below	One blue dot
1/4 -20 x 5/8 socket head cap screw	12	001964	Preinstalled on tool
1/4” lock washer	12	000031	Preinstalled on tool
1/4” flat washer	12	000849	Preinstalled on tool

Motors

	Standard	AR	AS
Part Number (110v)	002259	003347	x
Part Number (220v)	x	x	001959
	Domestic	Domestic	International

Mount Pinions to Motors

Pinions can be found in a bag that includes hex keys, lithium grease, and the eccentric bearing wrench

Motors for PRS machines come with the cable attached. Inspect the motor and cable combination to make sure they are in good condition and free of cuts or kinks.

Remove the plastic sleeve from the motor shaft.

Mount pinion gears onto the motor shafts.

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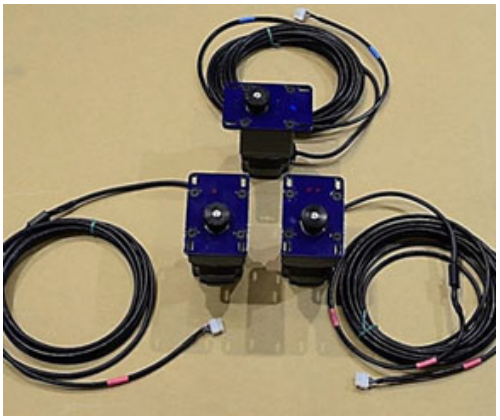
Identify Motors

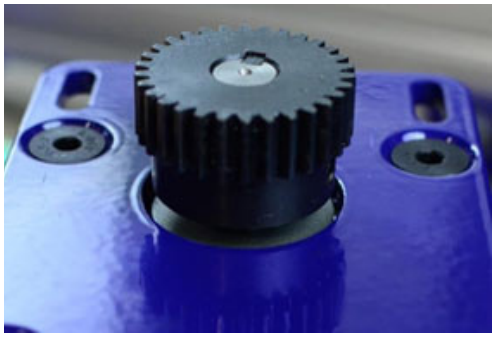


Identify each motor to determine the position it will mount on machine. Colored dots are located on each motor plate.

Blue dot indicates Y-axis motor.

Red dot indicates X-axis motors. one dot marks motor X1, and two dots identifies motor X2.

The end of the cables also have colored labels. Accessory item such as a rotary indexer, is marked yellow.

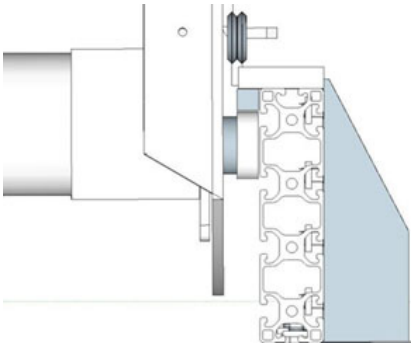


Slide pinion onto motor shaft while ensuring the key stays in place. If resistance is encountered, loosen set screws with 1/8” hex key.

Secure set screws with the 1/8” hex key.

Check Alignment of Pinions with Rack

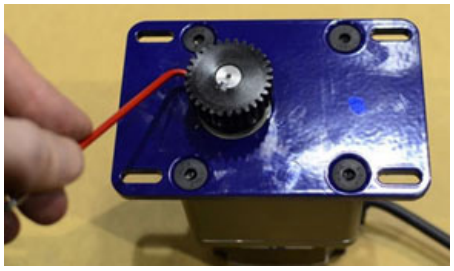
Check Pinion/Rack Alignment



To ensure full engagement and even wear, the outside edge of the rack should line up with the edge of the pinion. The pinion should never rub on the face of the aluminum side plate extrusion.

This image shows the pinion in correct alignment.

Adjust Pinions (If Required)



Remove any motors requiring pinion adjustment.

Loosen the pinion set screws using the 1/8” hex key. Adjust as needed and retighten the set screws.

Replace motors and confirm pinion/rack alignment.

Ensure that the pinion gear set screws are really tight against the shaft

Apply a small amount of Lithium grease to each pinion. This will ensure smooth movement and prevent corrosion.

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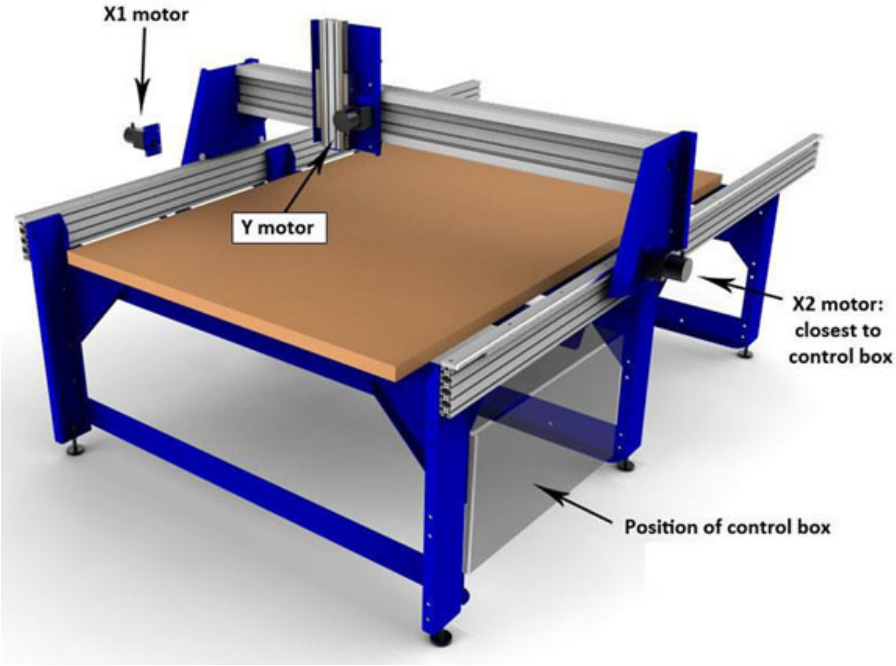
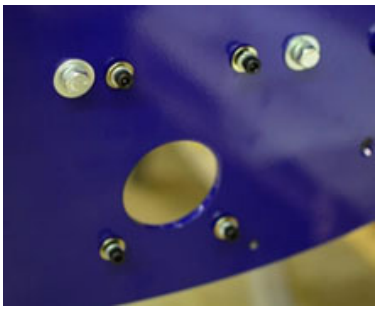
Mounting Locations

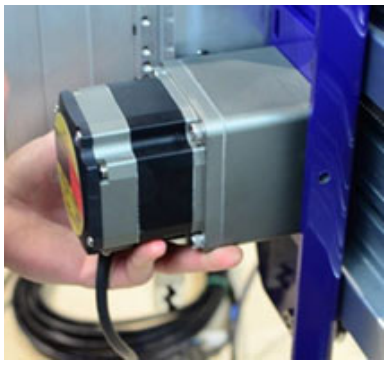


Position Motors on Tool

It is very important to mount each motor in its correct location. Verify the markings on the motor plates as they are mounted onto the tool.



Mounting hardware (1/4-20 x 3/4” button head screw, 1/4” lock washer, 1/4” flat washer) is already fitted to the gantry end plates and YZ car where the motors will be mounted.



Place each motor in proper location and loosely secure the motor with the mounting hardware and the 3/16” hex key. After all hardware is installed, snug all hardware.

Note: Do not engage the pinion teeth with the rack. This will be done in Section 11.

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Section 8. Wire and Cable Routing

Hardware

Part	Quantity	ShopBot part number	Notes
Cable tie brackets	6	003062	
Proximity switch	2	002740	
Proximity switch cable	2	002739	
Z zero plate and wire kit	1	14524	
Emergency stop button	1	002723	PRS Standard
E-stop	1	000777	PRS Alpha

Cable Routing Strategy

Cable and wire routing will generally follow these steps. Greater detail is provided after this overview:

Spindle Power Cable

- Uncoil spindle power cable.
- Run cable from VFD under table to X cable carrier.
- Secure to one side of carrier so motor and signal cables can be run on other side of carrier.
- Run cable to Y cable carrier.
- Remain on opposite side of signal and motor wires.
- Arch cable over top of YZ car and install on spindle.
- Take up slack in cable moving from Y to X cable carriers and secure cable with zip ties.

Motors and Signal Cables

- Install the source if it is not already installed.
- Unroll cable to ensure even feeding and minimize coiling.
- Secure cable with zip ties along the route to the proper location.
- Route to first cable carrier (usually Y) and secure in place with two closed gates.
- Route all applicable cables through Y cable carrier.
- Relieve tension on Y cable carrier and secure wires at either end with zip ties.
- Route bundle from Y cable carrier to X cable carrier.
- Route other cables into X cable carrier (X motor cables, X prox switch, and emergency stop).
- Secure cables between cable carriers with zip ties.
- Organize and relieve tension on cables in X cable carrier and secure with zip ties.
- Route cables under table.

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Finishing

- Close or partially close all cable carrier gates.
- Move tool along each axis looking for even movement and binding.
- If binding or height tensions occurs, relieve tension and re-secure cables as needed.
- Clip off all zip tie ends using wire snips.

Spindle Fan Cable Installation

Uncoil cable.

Connect plug and tighten screw, locking it into place.

Zip tie the cable to the spindle power cable up to the point where it would enter the Y carrier.

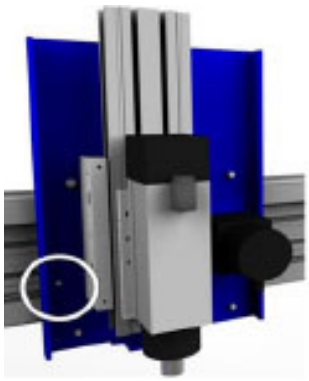
Proximity Switch Installation

Locate the proximity switches and the corresponding cables.

The cables are marked with colored tape at both ends for ease of identification.

Blue indicates Y-axis. Red indicates X-axis.

Note: The tape at the far end of the cable may be loose. If so, secure it with scotch tape or similar to prevent it from falling off during cable routing.



Y Proximity Switch

Locate 8mm threaded hole to the left of the spindle/router

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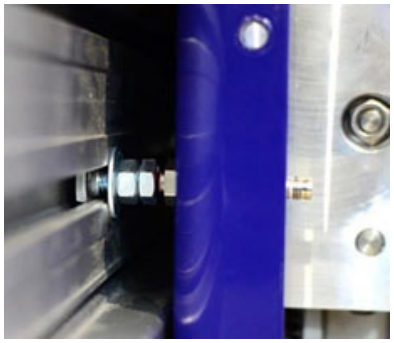
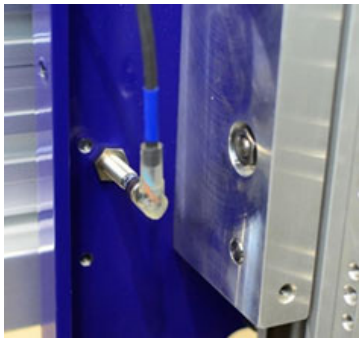
Thread proximity switch into hole until it rests on the target. Back it out 1 to 2 turns so there is a 1/32” – 1/16” (1-2mm) gap between them.



Tighten nuts and connect the Y-axis proximity switch cable (marked with blue tape).

For best cable routing, the orientation of the three pins in the switch should resemble an arrow pointing downward.



Screw Y cable carrier onto Y proximity switch.

Route cable up the left side of the YZ car and through the YZ plate.

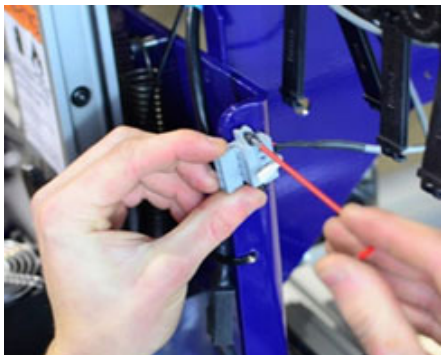
Secure cable to the YZ plate flange using zip ties in the pre-drilled holes.

Z Zero Plate Assembly

The Z zero plate assembly allows for accurately calibrating the height of the Z axis before cutting.

All of the Z zero plate components are packed in a plastic bag inside the box of accessories.

Locate 30’ gray cable and the two black 3mm screws in the Z zero assembly kit.



Attach the gray Wago connector to the upper right side of the YZ plate, as shown in this image.

Note: The white plastic hooked piece indicated by the arrow is known as a Wago tool. It’s used as a fulcrum to release wires from Wago connector terminals. Store it in a safe place.

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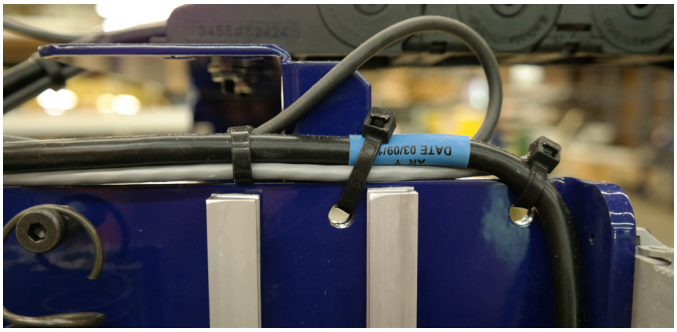
Route Wiring

Refer to Cable Checklist found on page 8-7.

Route Y motor cable along lip of YZ car.



Route cable from the Z Zero Wago connector, Y proximity switch, and fan spindle along with the Y motor cable across the top of the YZ car.

Route cables through Y-axis e-chain.

Ensure no zip ties are in the e-chain, as they will get hung up, and make sure cables are not too tight in the E-chain.

Zip tie cables to first and last e-chain links.

Zip tie cables to tie brackets (see picture on left).

Note: Spindle power cable is the orange cable in picture. This is not installed until p. 8-7.

Mount Auxiliary Emergency Stop Switch

There are pre-threaded holes available on both gantry endplates. The auxiliary emergency stop switch can be mounted on either location. The example shown will be mounted on the control box side gantry plate.

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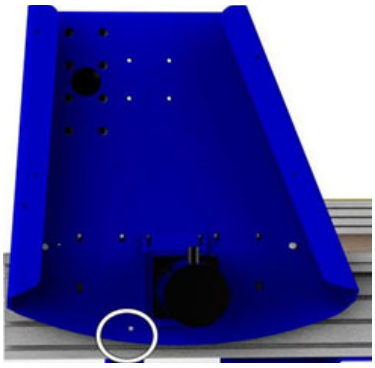
Secure the emergency stop switch using four self-tapping screws. The screws come through the back of the endplate.

Note: Pressing the emergency stop button will cause input #4 to flash red on the computer screen and the ShopBot control software will not allow the ShopBot to move.

Route Wiring (cont'd)

Run X2 motor cable along inside lip of gantry and secure with zip ties.

Slide X2 motor cable and e-stop wire through gantry to opposite side of machine.



X Proximity Switch

The X proximity switch is mounted in a threaded hole near the X1 motor on the gantry end plate.

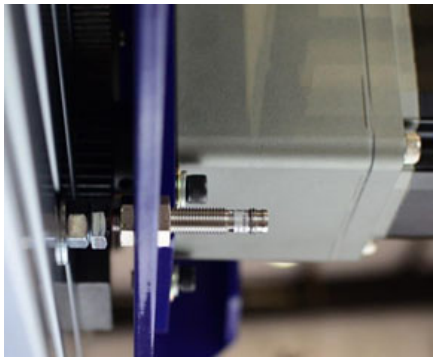
Roll the gantry until it is against the stop blocks. The proximity switch hole should be centered over the target bolt. Adjust the proximity target if needed.

Note: The powder coating process sometimes leaves residue on the threads of the end plate and YZ car. If installation of the threaded proximity switch is difficult, an M8 x 1 tap will clean the threads.

Thread the proximity switch into the hole until it rests on the target. Back it out 1 to 2 turns so there is a 1/32" – 1/16" (1-2mm) gap between them.

Loosely thread the 1/2" nuts onto the proximity switch so that the end plate is "sandwiched" between the two nuts.

This image shows the X proximity switch from slightly below. The X1 motor is in the background.



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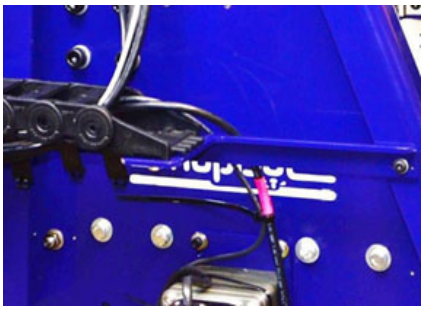
Rotate bolt so the three prongs are oriented as shown in the image at left. This ensures the cable will route cleanly.

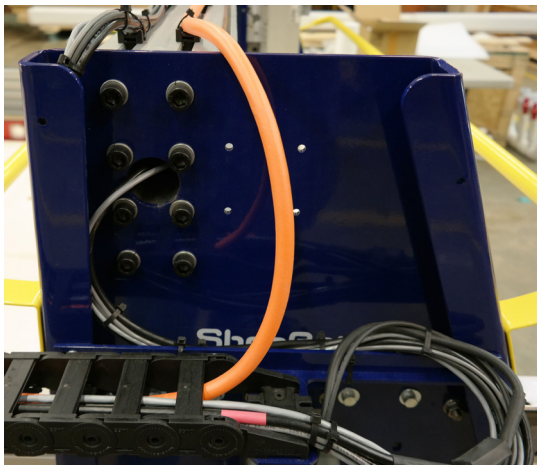
Make sure the switch to target clearance is still 1/32” – 1/16” (1-2mm), and snug both nuts with a 1/2” wrench.



Connect the X-axis proximity switch cable (marked with red tape) by threading the nut onto the connector on the back of the switch.

Uncoil the cable.

Route Wiring (cont’d)



Run cables inside lip of left hand gantry plate, and zip tie cables to e-chain bracket.

Snap open e-chain gates, and run cables through e-chain. Do not snap all e-chain gates shut.

Zip tie cables at both ends of e-chain.

Continue using zip ties along the rest of the cables, approximately 3-6” apart.

Note: Spindle power cable is the orange cable in picture. This is not installed until p. 8-7.

Pneumatic Air Hoses

Certain applications such as the automatic tool changer (ATC), pneumatic assist, and air drill have one or more air hoses that will route through the cable carrier.

To install an air drill, refer to PRS alpha Air Drill manual located at http://www.shopbottools.com/ShopBotDocs/files/PRSalphaAirDrillDV.pdf.

To install an ATC, refer to ATC Installation manual located at http://www.shopbottools.com/ShopBotDocs/files/ATCCombinedManual.pdf.

To install a pneumatic assist, refer to Installing a Z-axis pneumatic assist manual located at http://www.shopbottools.com/ShopBotDocs/files/PneumaticAssistInstall.pdf.

Route all air hoses before closing all gates.

Secure Y-axis cable gates.

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Route Spindle Cable

Route orange spindle cable from the VFD, under the table, through the X-axis e-chain, through the Y-axis e-chain, and into the spindle.

Keep spindle cable separate from the others, as it is capable of generating noise, which could affect the machine electronics.

Close all e-chain gates.

Route cables under table to control box. If installing (or planning to install) 10" table extension, ensure an extra 10" of slack is available in the cables.

Cable Checklist

Note: In both cable carriers, keep the spindle/router power cord separate from the other cables. This will prevent electrical interference that may cause connection problems during use.

All wires and cables from the gantry will be carried in the X and Y axis cable carriers. Use this checklist to inspect cables before closing the cable carrier.

Y Cable Carrier

_____ Spindle or router power cord

_____ Spindle fan cable (if applicable)

_____ Y motor cable

_____ Z motor cable

_____ Y-axis proximity switch

_____ Z-axis proximity switch (optional, stock for ATC tools only)

_____ Z zero plate and auxiliary function wire

Through Center of Gantry Beam

_____ X2 motor cable (route through the hole in the center of the gantry beam)

_____ Emergency stop switch (if mounted in predrilled location on end plate near X2 motor)

X Cable Carrier: All of the above, plus

_____ X1 motor cable (routed above the upper X cable carrier bracket)

_____ X-axis proximity switch

_____ Pneumatic air hoses (for ATC tools and optional air drills or pneumatic assists)

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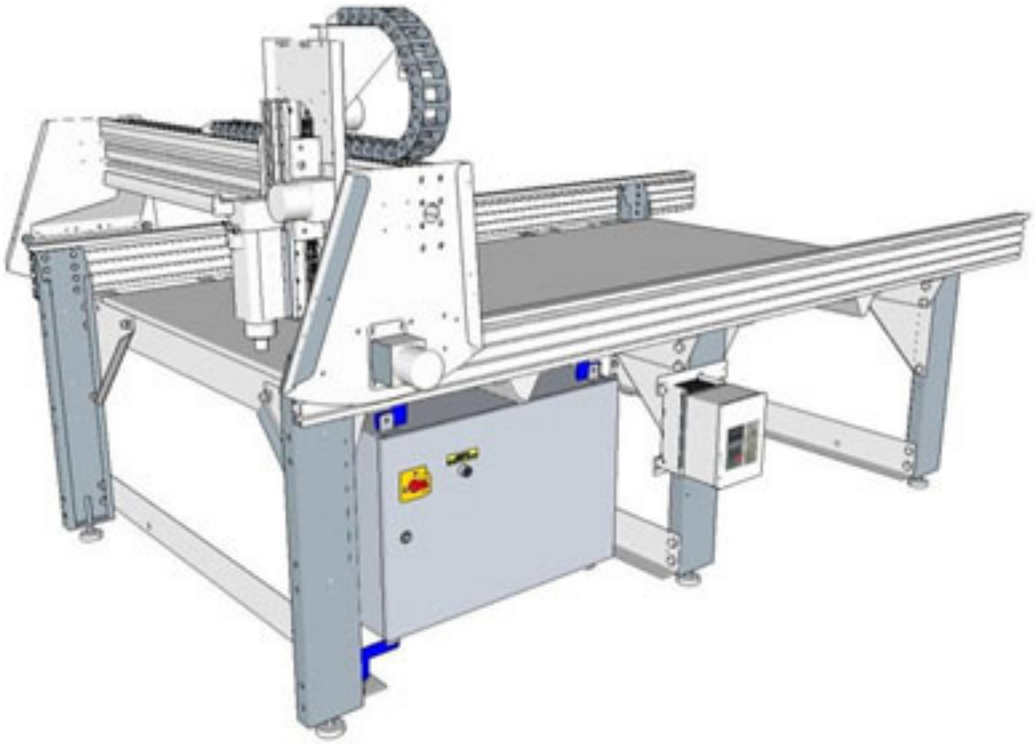
Section 9. Control Box Wiring

Introduction

ShopBot **highly recommends** that a licensed electrician hook up the source power according to local code and the wiring and power diagrams included with the tool.

The specific instruction for this section should follow this introduction. If the instruction is missing or otherwise not available, please see http://www.shopbottools.com/ShopBotDocs/gantry.htm, then “Control box mounting and wiring (standard models)” or “Control box mounting and wiring (alpha models)”, depending on the tool ordered.



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Section 10. Software Installation

Introduction

ShopBot tools are shipped with three software programs that can program, edit, and run part files. This section covers the installation of all software and provides a basic overview of the ShopBot control software. Additional information and training can be found in the control software “Help” menu as well as ShopBottools.com and Vectric.com.

The following software will be installed during this section:

ShopBot 3: Control software used to operate the ShopBot tool and run part files.

ShopBot Editor: Enhanced text editing software used to view and edit ShopBot part files.

VCarve Pro – ShopBot Edition: CAD/CAM software used to create and edit designs, and assign tool paths to create part files.

Hardware

Operating computer

ShopBot installation USB drive

ShopBot tool with wiring complete

USB communication cable

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Computer Recommendations

A PC running Windows XP/Vista/7/8 (Home Premium / Business, or higher) is required. The equivalent of a dual core or higher, Pentium processor, and a minimum of 4GB RAM (8GB preferred) is recommended.

A graphics display of 1024 x 768 will provide a good display, although a higher resolution may be preferable.

Computer Configuration

Important: Some programs and features will interrupt the proper installation of ShopBot 3 control software. To ensure trouble free installation and operation, ShopBot recommends performing the following actions before installation.

_____ Install program using administrative account.

_____ Set User Account Control (UAC, not applicable to Windows XP) to “Never Notify.”

_____ Disable network connection.

_____ Disable security and antivirus software.

_____ Make sure the USB cable from the ShopBot is not plugged in.

Install ShopBot 3 Control Software and VCarve Pro Software

Refer to “Installing ShopBot Applications” section in “Uninstalling and Reinstalling ShopBot and VCarve Software” document found at http://www.shopbottools.com/ShopBotDocs/files/SBG%2000441%20Uninstalling%20and%20Reinstalling%20ShopBot%20and%20VCarve%20Software.pdf.

Software Overview

All programs included with the ShopBot are now installed. The icons below represent how they will appear on the computer desktop.

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Engage Pinions with Rack

Loosen mounting bolts so motor plate can slide up and down.

Push motor up to engage pinion with the rack. It may be necessary to slightly jiggle the motor to ensure teeth interlock.

Maintain firm upward pressure (15-20 lbs) with one hand while tightening mounting bolts.

If necessary, a second person or quick clamp can hold the motor in position.

Connect ShopBot to Computer

USB Communication Cable

The USB cable is located in a packet inside the control box door.

Note: The black box pictured at left is a USB hub. It prevents older operating systems from spontaneously reducing the USB communication rate. Use only the ShopBot communication cord with this hub.

Locate the control box USB port. The control box ships with a sticker partially covering the port that reads; “Stop! Install Software First.” Remove this sticker only after installing the ShopBot control software.

Plug the cable into the control box and use a zip tie to secure the cable loop.

Load the Settings File

ShopBot control software is designed to work with all ShopBot models, each with different table dimensions, gear ratios, and other parameters. These settings are saved in an initiation (.INI extension) file that runs each time the software is started. The first time the software is connected to a tool, you’ll be prompted to set the default .INI settings file.

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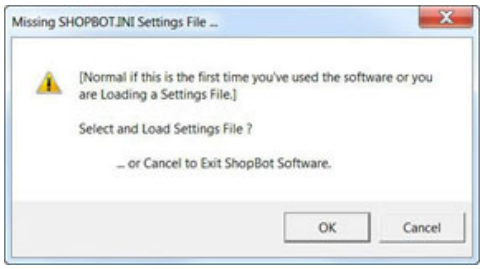
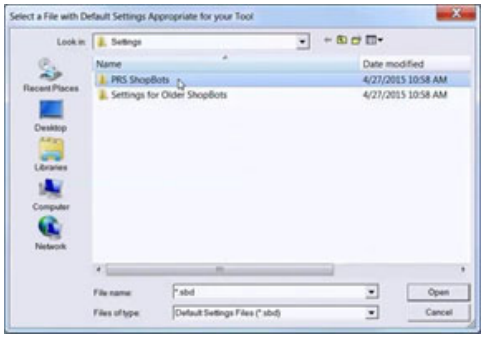
Locate the ShopBot 3 icon on the desktop or Windows Start menu. Double click on the icon to launch the control software.

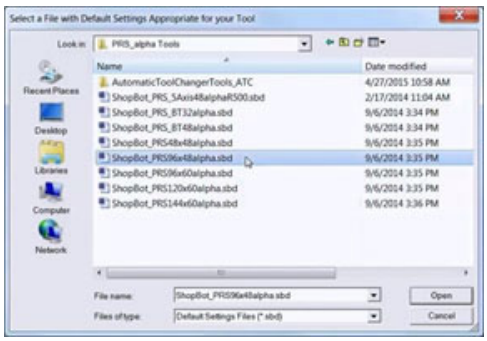


When the program is opened for the first time, a prompt will appear to load a settings file. Select “OK” to proceed.

Note: If this screen does not appear when the program is opened, or if you are unsure whether you loaded the correct file, it can be accessed again at any time by clicking on “Utilities,” and “Reset Default Settings.”



Double-click on “PRS ShopBots,” then select “PRS_alpha Tools.”



Select the proper file corresponding to the ShopBot tool size.

Default settings will load and the main ShopBot screen opens. Although it looks like no changes have been made, the correct settings have been loaded.

Install Control Box Firmware

The ShopBot control box is programmed with firmware needed to communicate with the ShopBot 3 control software. This is programmed at the factory for the software version shipped with the tool. If for some reason a different software version is loaded on the control computer, the firmware will need to be updated using this procedure.

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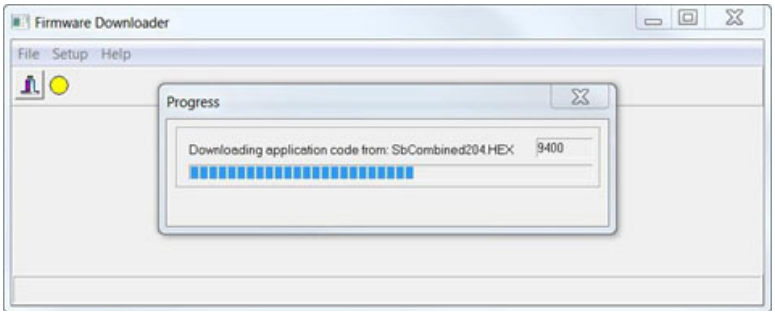
In ShopBot 3, select “Utilities,” then “Install Control Box Firmware.”

Follow the prompts in the window that appears, checking the box as each step is completed.

After the control box is turned on, the progress bar below should pop up. It will take about 10 seconds to complete.

Once this progress bar completes, the firmware has been loaded on the control box. If progress bar does not appear, conduct the firmware downloader operation again.



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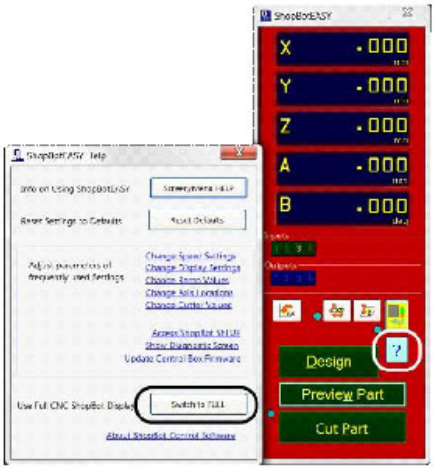
ShopBot Control Software Familiarization

Easy and Full Modes



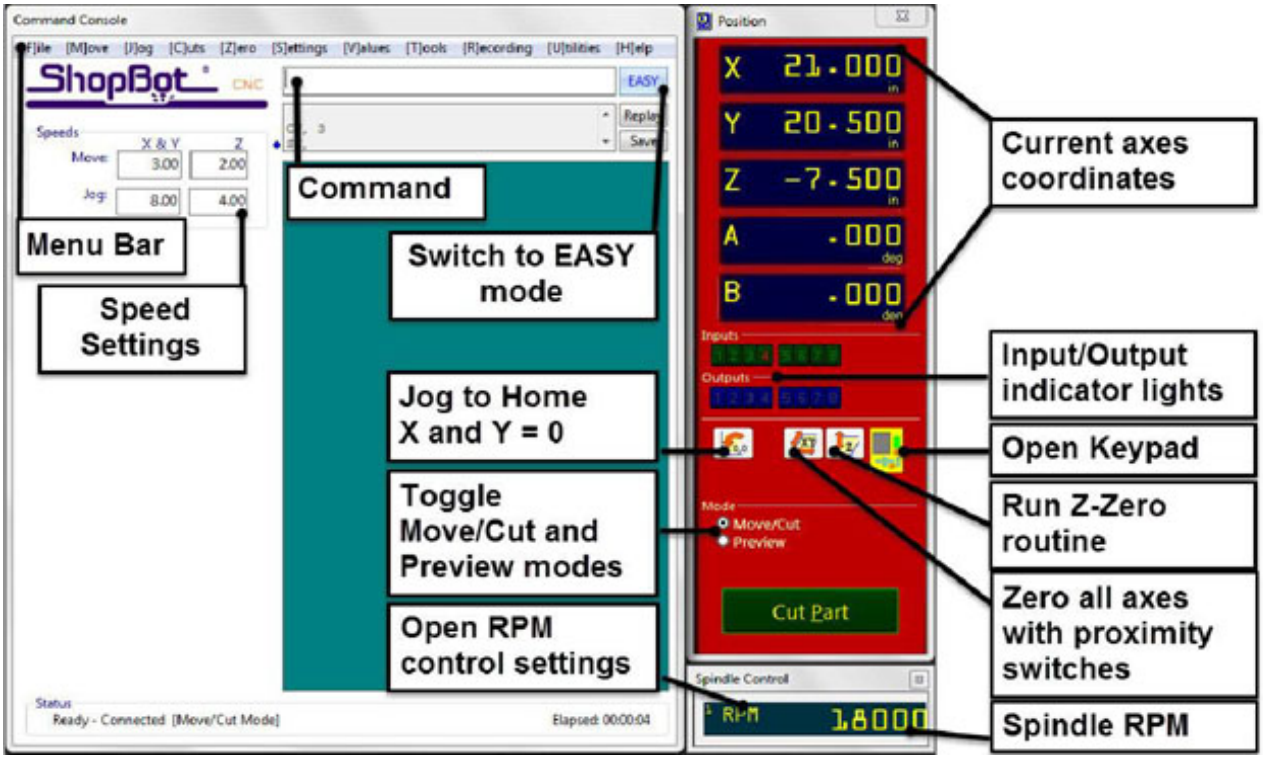
ShopBot 3 software has two user interface formats; “Easy” and “Full” modes. Easy mode is the default, and works well to run parts after all set up has taken place.

To access all features needed for setup, switch to the “Full” mode by pressing the blue question mark button. Select “Switch to FULL.”

Once setup is complete, return to the Easy display by pressing the “EASY” button at the top right of the command console window.

Full Display Overview

The Command Console window (left side) allows for adjusting settings, loading part files, and entering commands. The Position window (right side) is how the machine provides feedback in terms of its coordinates, switch positions, and alarms.



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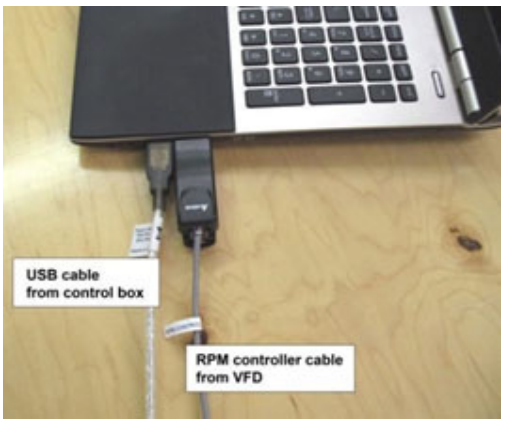
ShopBot Command Format

Note: This information is provided as a very brief overview to help keep up with the rest of the installation/setup instructions. Detailed information and a full list of available commands are available in the ShopBot User Guide.

In the ShopBot control software, commands are used to give specific directions to the machine. Any command that directs the machine to move must be followed by parameters. For example, an MX,20 command will “Move” the “X-axis” to an absolute position of 20.

Other commands are used as keyboard shortcuts to access items in the menu bar. These usually do not require parameters. FP is a useful command that is a shortcut for “File” and “Load Part File.” After entering this command, a window will appear prompting the selection of a part file.

To enter a command, click the command box in the main window and type the command followed by any parameters (if applicable).



Movement Testing

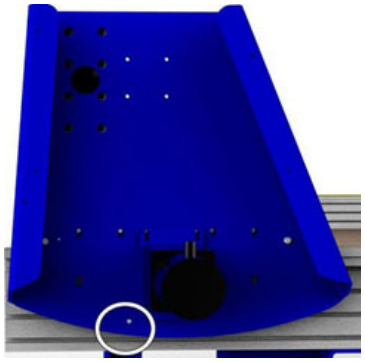
Connect the USB cable from the control box to the computer.

Note: Windows 7 computers can have both USB 2.0 and 3.0 ports. The control software works best if the control cable is plugged in to a USB 2.0 port. USB 3.0 ports can be unsatisfactory, and are identified by blue color coding and/or the initials SS. Reserve these ports for other uses.

Connect the RPM controller from the VFD to a separate USB port on the computer.

Test machine movement using arrow keys.

X Proximity Switch



The X proximity switch is mounted in a threaded hole near the X1 motor on the gantry end plate.

Roll the gantry until it is against the stop blocks. The proximity switch hole should be centered over the target bolt. Adjust the proximity target with a 1/2” wrench if needed.

Note: The powder coating process sometimes leaves residue on the threads of the end plate and YZ car. If installation of the threaded proximity switch is difficult, an M8 x 1 tap will clean the threads.

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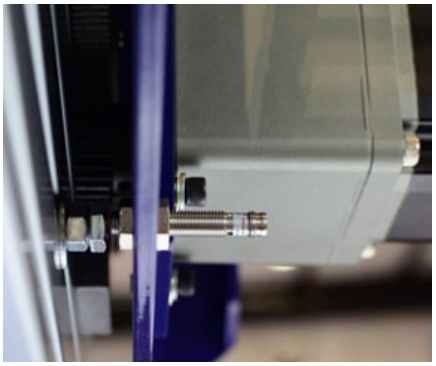
Thread the proximity switch into the hole until it rests on the target. Back it out 1 to 2 turns so there is a 1/32” – 1/16” (1-2mm) gap between them.

Loosely thread the 1/2” nuts onto the proximity switch so that the end plate is “sandwiched” between the two nuts.

This image shows the X proximity switch from slightly below. The X1 motor is in the background.



Rotate bolt so the three prongs are oriented as shown in the image at left. This ensures the cable will route cleanly.

Make sure the switch to target clearance is still 1/32” – 1/16” (1-2mm), and snug both nuts with a 1/2” wrench.

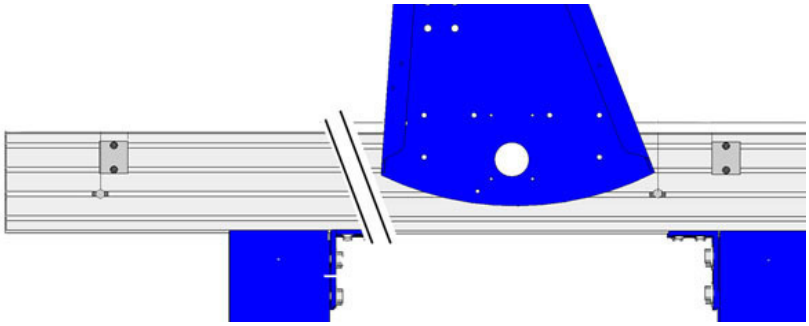
Set Stop Block Positions

Ensure stop blocks are loosened.

Move gantry to one end of rail, and back off gantry to access stop blocks.

Tighten stop block screws securely, ensuring stop blocks do not move during tightening.

Repeat process at other end of rail.



Check Y-Axis Proximity Switches

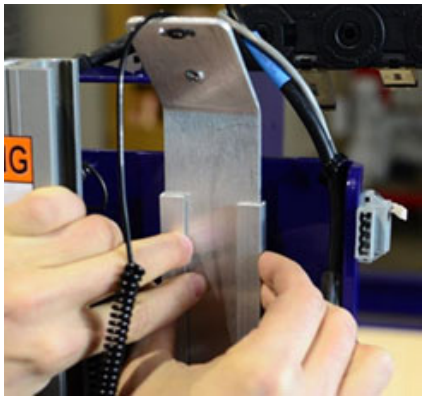
Run YZ car to the complete right and ensure proximity switch is triggered.

Repeat for left side.

Mount Z Zero Plate Assembly

Sandwich the Z plate between the two U channel brackets with the VHB tape facing opposite from the upturned Z plate flange.

Center Z plate between Z rail and the YZ plate flange. Position brackets 1” down from top of YZ plate. Remove backing tape from VHB tape and press the brackets onto the YZ plate.



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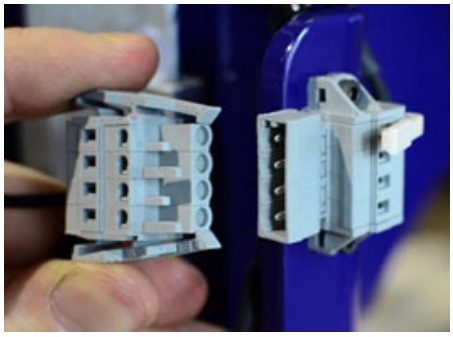
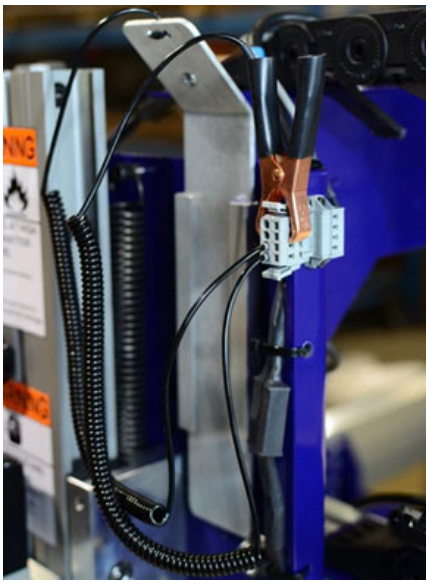


Insert the Z zero plate assembly Wago plug into the connector. Take care to align the plug correctly, and do not force installation.

Note: This connector is also used for optional accessories such as the 3D optical probe.



The Z zero plate kit includes two rubberized tabs which act as insulators. Place one or both on the V wheel bolt below the Z zero plate. This prevents erroneous signals to the control software.

The Z zero clip can be placed on the Wago connector or other convenient location until needed.

Secure Cables

Tie up cables underneath, along crossmember, with zip ties.

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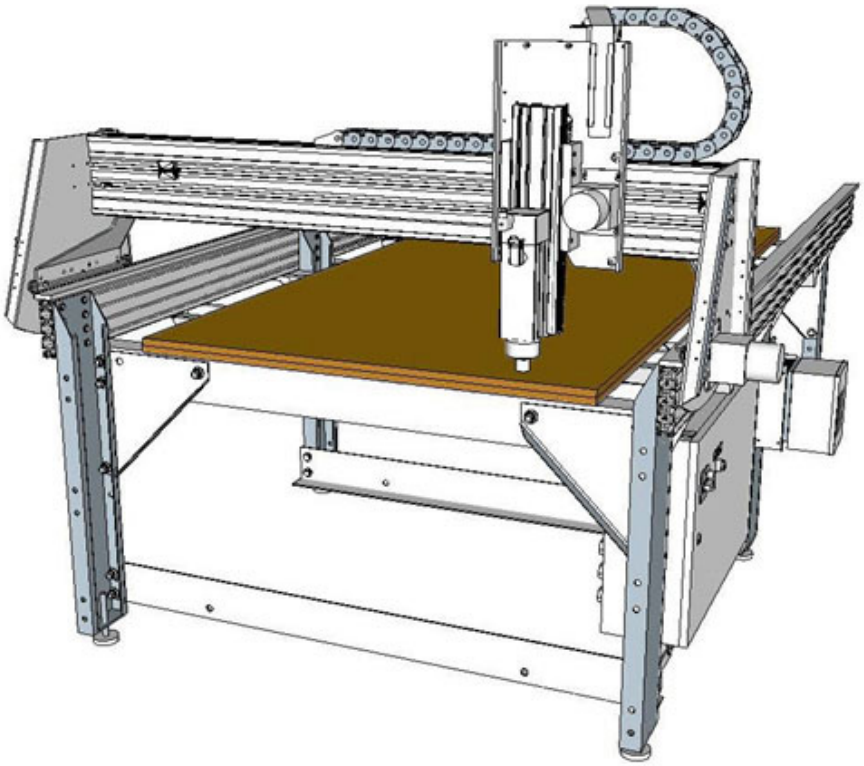
Section 11. Secure Table and Spoil Board

Introduction

These instructions are based on a ShopBot PRSalpha 96-48. Larger or smaller table sizes will require additional baseboards and/or cutting material to fit.



Hardware

Part Name	Quantity	ShopBot Part Number	Notes
3/8 x1 1/2” carriage bolts		000953	ShopBot supplied
3/8” Lock washer		000092	ShopBot supplied
3/8” Flat washer		000444	ShopBot supplied
3/8-16 Hex nut		000452	ShopBot supplied
3/4” cabinet grade plywood			
3/4” Medium-Density Fiberboard (MDF)			
Wood glue	1 Gallon		

NOTE: If table size is greater than 96x48”, it will be necessary to tile multiple sheets to cover the full working area.

Refer to the table drawing for specs and measurements specific to machine.

Base Layer

The base layer should be a sheet of 3/4” cabinet-grade plywood. This is the foundation of the work-bed, and will likely last the life of the tool. When choosing plywood, keep in mind that a higher number of plies typically creates a more stable board that is less likely to warp.

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The base layer is bolted directly to the table supports using 3/8 x1 1/2” carriage bolts (included in the hardware kit). Position plywood on table frame to locate mounting holes, according to the table drawing. It is imperative that the table drawing is followed on this step.

Clamp the sheet down to keep it from moving, then use an 1/8” drill bit to drill pilot holes through the cross-support holes up through the plywood. It is not necessary to drill out each hole. It is recommended to use every other one, creating a “checkerboard” pattern across the table.

Note: If installing a vacuum table, refer to vacuum table instructions.

Use a 1” Forstner or spade bit to drill a counter bore deep enough for the head of the carriage bolt to sit below the surface of the plywood.

Drill pilot holes with a 3/8” bit and press the carriage bolts into the clearance holes and through the cross-supports. Use a mallet to tap bolts through if necessary.

Measure the spacing and location of the sheet one last time to make sure that it is positioned according to the table drawing.

Use the included 3/8” flat washer and hex nuts to secure bolts to bed.

Spoilboard

The spoilboard is a sacrificial layer of 3/4” Medium-Density Fiberboard (MDF). As it gets damaged over time, it can be re-surfaced to a perfectly flat work surface until the entire board has been used up, and then simply replace it with a new sheet.

Spread a thin, even coat of glue across the entire surface of the base layer. A cheap paint roller works great.

Have someone help set the MDF sheet(s) onto the base. Place the spoil board on top of baseboard with 1/4” of overlap on all sides.

Place clamps and heavy objects onto spil board to help glue cure.

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Section 12. Setup and Fine Tuning

This section will setup and test all tool functions, secure the table, and set zeroing locations.

Check Inputs and Outputs

Input 1 – The Z zero plate and the fixed Z zero are connected on this input. When either of these plates are connected to a ground, the circuit is closed and input “1” on the ShopBot position screen will light up. The ShopBot ATC requires that the grounding clip be used during any zeroing of Z-axis.

Input 2 – The X-axis proximity switch is connected on this input. When working properly, the input “2” light will be off in the ShopBot position screen for normal operation. When the X-axis proximity switch passes the proximity targets the light will turn on. These will be used for homing the X and Y positions and for limiting the safe table cutting boundaries, among other things.

Input 3 – The Y-axis proximity switch is connected on this input. During normal operation the input “3” light will be off in the ShopBot position screen. If the Y-axis proximity switch passes the proximity targets the light will turn on. This feature will be used for homing the X and Y positions and for limiting the safe table cutting boundaries and other techniques that you may develop to help your productivity and accuracy.

Input 4 – This input is connected to the stop switch. When inactivated the switch allows for use of the tool and when depressed the connection is severed and the tool comes to a stop.

Input 5 – The Z-axis proximity switch is connected on this input. When working properly the input “5” light will be ON in the ShopBot position screen for normal operation. When the Z-axis proximity switch passes the proximity targets the light will be turned OFF. This switch will be used most often for a reference location in zeroing the bits in the tool rack and for limiting the safe Z cutting boundary.

Input 6 – NA

Input 7 – Drawbar closed.

Input 8 – Drawbar open (changing tools).

Output 1 – Switches on the spindle.

Output 2 – Secondary spindle

Output 3 – Toggles the ATC dust skirt gate open.

Output 4 – Turns on during machine operation (safety flashing screen). Required for spindle “on” signal.

Output 5 – Air drill (if applicable)

Output 6 – Air drill (if applicable)

Output 7 – Air drill (if applicable)

Output 8 - Toggles the spindle drawbar open /close (releases tool holders from spindle).

Caution: When the spindle is not spinning it is possible to drop the tools from the spindle if this output is triggered.

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Machine Orientation

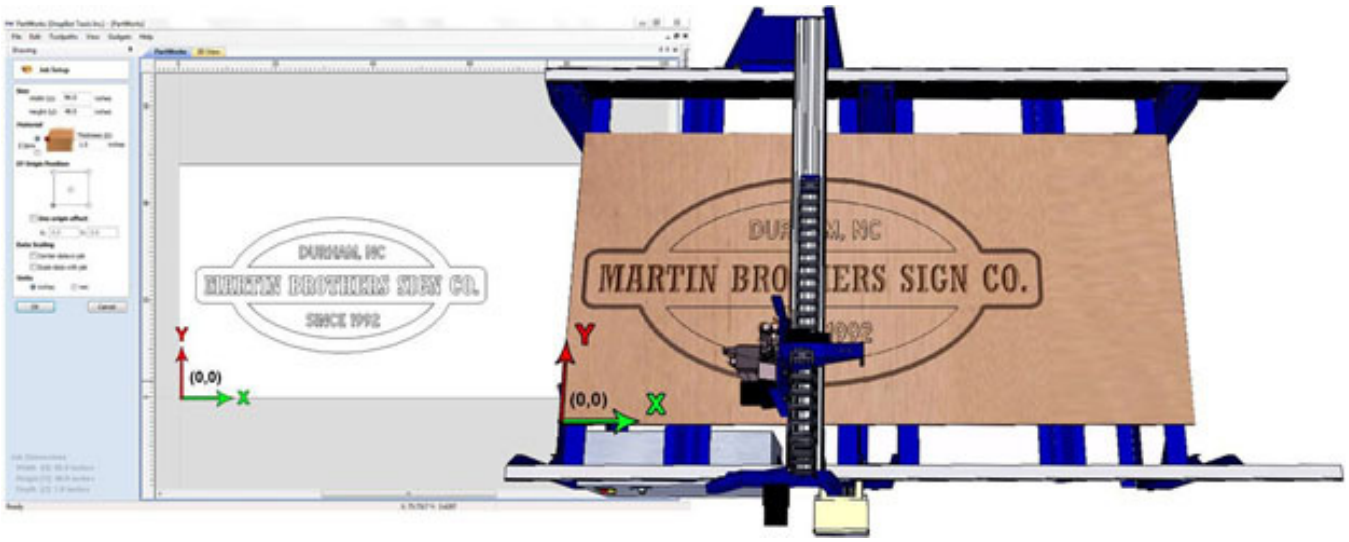
It's essential to understand how the X-, Y-, and Z-axes are oriented, and how this relates to job setup in the CAD/CAM software. The example below shows a design in VCarve Pro and its corresponding orientation on the tool.

The bottom left corner is referred to as the XY home location or "zero, zero." This is the registration point used to line up the software design with the physical material.

The X-axis is usually the longest axis of the tool. The model shown has a 96" X-axis. In the design software the X-axis goes from left to right on the screen.

The Y-axis moves across the gantry beam. The model shown has a 48" Y-axis. In the design software the Y-axis goes from bottom to top on the screen.

The Z-axis moves up and down over the table bed. The model shown has an 8" Z-axis. In the design software the Z-axis is represented by the depth of cut.



Optional Axes

Some models feature two cutting heads. This allows different types of bits to be used without spending time with tool changes. The A-axis is assigned to the second up and down axis (second Z).

Tools can also be equipped with a rotational indexer. This allows the tool to be used as a CNC lathe or perform machining operations on more than one side of a part. The B-axis is assigned to the rotational axis and is measured in degrees.

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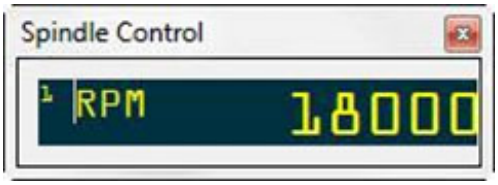
Setting Up RPM Control

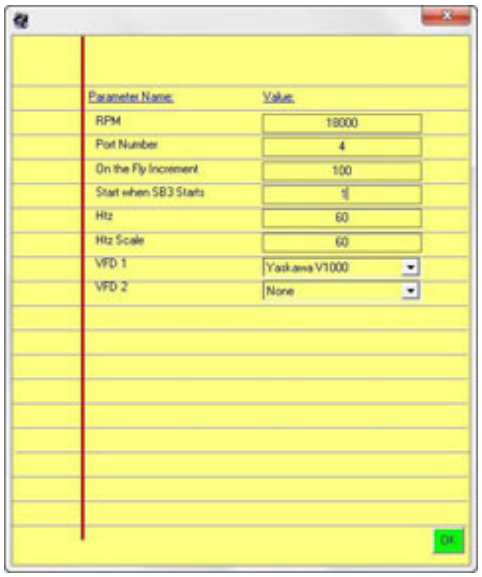
Tools equipped with a spindle must be configured to allow spindle RPM control. Without these steps, the tool will not change RPM when part files instruct it to.



In the main console window, click on “Tools” then “Spindle RPM control.” The Spindle Control window appears.

Important: The Spindle Control window must remain open during operation for the software to communicate with the VFD and change RPM.

Connect the RPM controller to the computer. Do not plug it into the hub alongside the main Shopbot USB; it should go straight into an empty port on your computer.



Click on **RPM** in the left corner of the “Spindle Control” window and a settings window appears. Change the following parameters:

Start when SB3 starts: 1 Opens the Spindle Control window every time ShopBot 3 starts.

Start when SB3 Starts: 1

Hertz: 60 (US, Canada, Mexico and Japan), or 50 (Europe, and most other regions).

Hertz Scale: Same as Hertz setting unless adjustment is required to match VFD and software RPM displays.

VFD 1: Yaskawa V1000

VFD 2: Leave blank unless tool is equipped with two spindles

To test the function of the RPM controller, turn on the spindle and then click on the listed RPM value in the spindle control window. Change this value and then press enter. The value on the VFD’s display should match what was just entered.

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System Check

Check Movement

Open the keypad control using the yellow keypad button on the red position window (or press the “K” key). Test for tool movement using the arrow keys to move X and Y. Move the Z-axis up and down using the Page Up and Page Down keys.

Check Stops and Targets

Check that the physical stops on the tool are tight and will not move when pinions hit them.

Make sure proximity target bolts are secure in the locations stated in earlier section. Check that the proximity sensors have 1-2 mm clearance over target bolts.

Note: If the stops and targets are not properly installed, a tool crash will occur in the next step.

Check Limit Switches

The proximity switches have red LED lights that are lit when the switch is not over a target. Look at each switch to identify this light. Place a small metal object such as a flat blade screwdriver near the end of the sensor. The LED light should turn off, and then turn back on when the object is pulled away.

Test the function of the limit switch and target setup. When set up properly, the sensors should “see” the targets and cause the tool to stop approximately 1/4” before the pinions hit the physical stop blocks.

Open the keypad and hold down the left arrow key to move the gantry in the negative X direction. The gantry should move down the rails until it encounters the limit switch target where the gantry should stop abruptly. Once the tool stops, release arrow key.

Note: Do not attempt to “sneak up” on the target by repeatedly pressing the arrow key. This can cause the tool to go past the target and not function properly. Always hold down the arrow button until the tool comes to a stop

Zero the X-axis: Click on the Zero Axis button on the keypad. Select the X checkbox and click the ZERO button. Notice that the X value changes to 0.000 in the position window.

Move the X-axis off the proximity target using the right arrow key.

Note: If the axis is not moved off the proximity target, the other proximity switches will be disabled and the next step will not perform properly.

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Test the Y-axis limit: Hold down the down arrow key to move the YZ car in the negative Y direction. The YZ car should move toward the gantry side plate until it encounters the limit switch target where it will stop abruptly. Once the YZ car stops, release the arrow key.

Click on the Zero Axis button on the keypad. Select the Y checkbox and click the ZERO button. Notice that the Y value changes to 0.000 in the position window.

Move the Y-axis off the proximity target using the up arrow key

Check Movement Distance

This step will help find the total available movement area on the X- and Y-axes. This information will make sure the target and physical stop locations are correct and help with table placement.

The tool should now be near the XY zero location. The X- and Y-axes should have been zeroed at the proximity target locations during the previous step.

Make sure that neither proximity switch is triggered as this will prevent proper function.

Test X-Axis Distance

Hold down the right arrow key to move gantry in the positive X direction. The gantry will move down the rails until it encounters the high X target. Release right arrow key when gantry stops.

Look at the red position window to check the X value. This is the total available X movement distance. This value should be at least 1” larger than the nominal X movement distance. Record this value.

The X-axis typically has extra movement available at this end for use with the Automatic Tool Changer option. For example a 96-48 table might have an X movement distance of 102.824”.

Move the X-axis off the proximity target using the left arrow key.

Test Y-Axis Distance

Hold down the up arrow key to move the YZ car in the positive Y direction. The YZ car will move across the gantry until it encounters the high Y target. Release the up arrow key after the YZ stops.

Check the Y value in the red position window. This is the total available Y movement distance. This value should be at least 1” larger than the nominal Y movement distance. For example, a 96-48 table might have a total Y movement of 49.427”.

Test Z Zero Function

Clip the Z zero alligator clip to the Z zero plate.

Check the software red positon window for Input 1 light.

Disconnect the alligator clip from the Z zero plate. The Input 1 light should go out.

Proximity Switch Targets

The proximity switch targets are metal bolts that the inductance based limit switches will sense. The limit switches should be set up to pass just over the target about 1/4” (5mm) before the movement axis reaches its hard stop. When the software receives this input it will stop the tool so that position is not lost.

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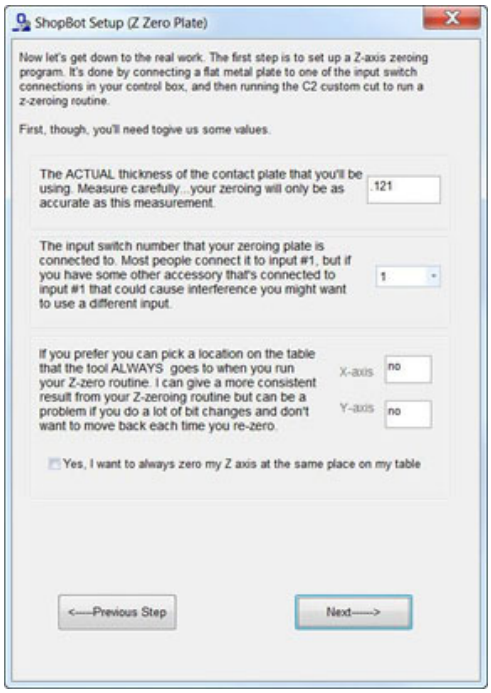
ShopBot Setup

Z Zero Plate



Zeroing the Z-axis is performed by placing the Z Zero plate on the zeroing surface under the bit and attaching the clip to the bit or collet. When the bit touches the plate a simple circuit is created, telling the tool to stop and record the location. This action is done using the Z zeroing program which can be run using the “Z” button in the red position window.

Z zeroing determines the zero position by adding the thickness of the zero plate to its position when the circuit is complete. By default this value is 0.121” (or 3.0734 mm). For critical applications, this value can be changed to exactly match the thickness of the plate supplied with the tool.

XY Zeroing Point

By default, the XY zeroing point will be the corner of the table nearest the control box. There is a program that will repeatedly and accurately find this point using the X and Y proximity switches. The XY zeroing program can be run by clicking on the “XY” button in the red position window. This is sometimes called a C3 routine, as entering C3 into the command line also runs this program.

Make sure the tool is clear and the Z-axis will not collide with any objects when moving toward the XY zero point. Click the “XY” button to run the XY zeroing routine. The machine will move along each axis until it stops at the proximity switch. It will then back off each a set distance to the XY zero location.

By default the offset from the proximity switches to the zero point is 1/2” (or 12.7 mm).

Move the corner of the plywood base board at this point and then square it with the table sides. This is the proper position for the spoil board and will allow maximum tool coverage.

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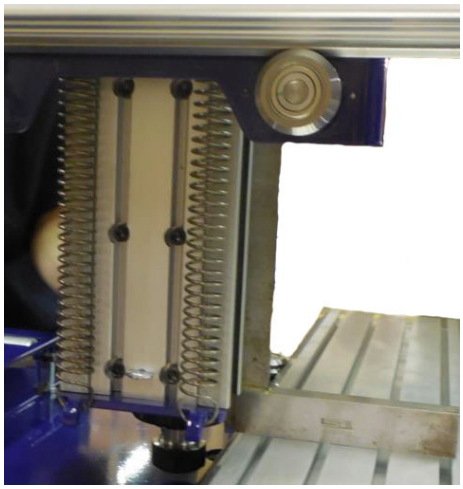
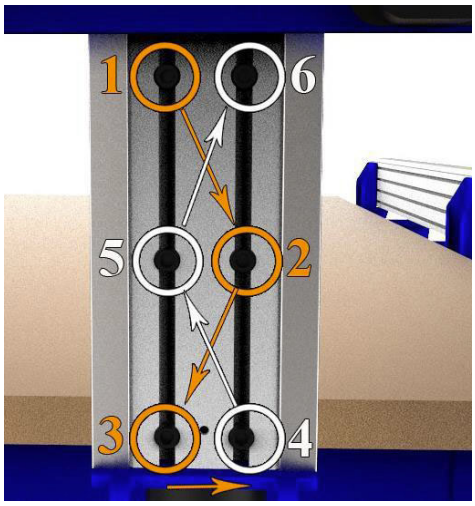
Fine Tune Setup

Square the Spindle



Move the spindle over the cutting surface. Use a square on the spindle side to adjust the spindle until it is perpendicular to the temporary work surface.

The spindle side is parallel with the spindle axis and is the most accurate measuring point for squaring with the tool deck.



Secure Mounting Screws

Tighten screws to hold spindle in proper alignment. Once the screws are snug, perform final tightening using sequence on left.

Check spindle square again after securing screws.

Test Movement Distance

Note: During this step, stay clear of the machine and be prepared to press the spacebar or emergency stop button if the machine travels further than expected.

Use the keypad controller to move the tool near the 0,0 location.

Mark the current position on the table with a pencil or pen.

Click on the zero axes button in the keypad control and check the boxes for the X- and Y-axes. The X and Y position values should change to 0.000 in the keypad and position windows.

Move the axis a set distance along the X-axis. In the keypad window click on the X value and change the value to 24 (1000 if in millimeters) then click the “Go to” button. The tool should move 24 inches (or 1000 mm) along the X-axis. If it doesn’t, go back to software setup and chose the correct default setting.

Move machine to 0,0 location. Verify jog by typing JX, 24 or JY, 24. Again, the tool should move 24 inches (or 1000 mm) along the particular axis. If it doesn’t, go back to software setup and chose the correct default setting.

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Install Push Bars

The Push Bar IInstallation document was provided with tool documentation, and can also be accessed through http://www.shopbottools.com/ShopBotDocs/files/PushBarInstallation.pdf

Install Dust Foot

The Dust Foot Installation document was provided with tool documentation, and can also be accessed through http://www.shopbottools.com/ShopBotDocs/files/SBG%2000326%20PRS%20Dust%20foot%20install%202014%2010%2029.pdf

Install End Caps

Pop end caps into place at ends of side rails.

The Gantry Tool Assembly is complete.

For usage information, see the ShopBot Quick Start Guide, which was provided with tool delivery, and can be found at www.shopbottools.com/ShopBotDocs/gantry ShopBot Quick Start Guide.

For maintenance and troubleshooting information, refer to http://www.shopbottools.com/ShopBotDocs/maintenance.htm.

Resources

To the best of our knowledge, these links are current. If you find that any of them are no longer working, please contact us so that we can update them accordingly.

Detailed chip load charts:
http://www.onsrud.com/plusdocs/Doc/index.html?model.code=FeedSpeeds

ShopBot user's forum:
http://www.talkShopBot.com/forum

Vectric training videos:
http://www.vectric.com/WebSite/Vectric/support/support_vcw_tutorials.htm

Additional Vectric support available within VCarve software: click on Help > Help Contents for an interactive PDF file.

100K Garages:
Post information, bid on projects, and connect with people who want to get things made!
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