ShopBot PRS: Assembly Manual

These assembly instructions apply to both PRSalpha and PRSstandard models of ShopBot CNC's. Note that there are different sections for connecting each type of tool to the control box. Make sure that you are using the correct connection section for your 'alpha' or 'standard' PRS model.

The boxes are very heavy! Several components are heavy! Make sure you have help or proper handling equipment when moving or positioning boxes or parts.

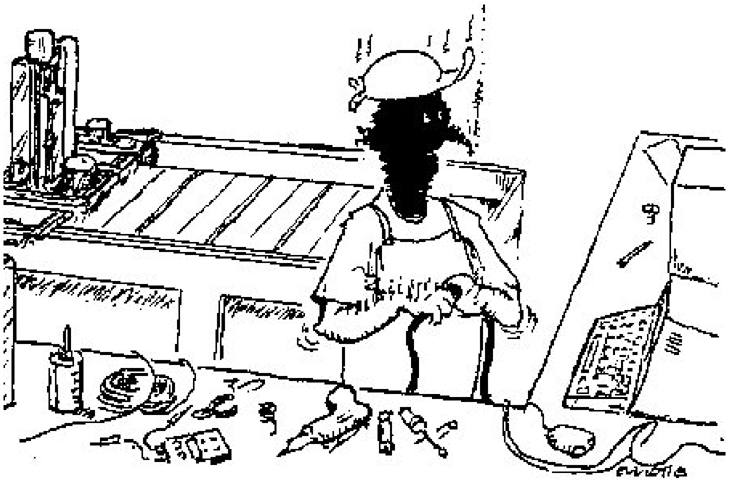
Contents

Table Surface Considerations

You will need to supply sheet material for the deck of your table. We recommend 3 sheets of material to give the table good rigidity. See discussion of the options at the end of the Table Assembly section. As a start you will need one layer of cabinet grade ¾" plywood for the bottom support layer – it will take several sheets to cover the work area if your tool is larger than 4x8.

if you are installing a vacuum hold-down system, you will need to decide on specific materials for your plenum and bleeder board.

Electrical Precautions

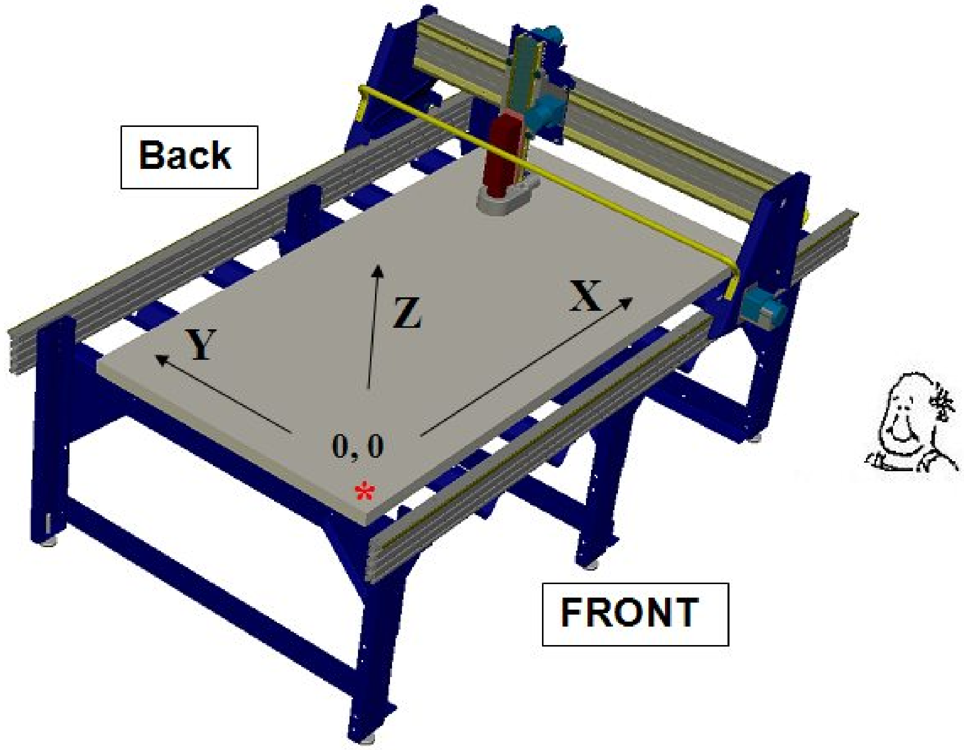


MOTOR CONNECTIONS - **DO NOT CONNECT OR DISCONECT ANY MOTOR WIRE CONECTORS WHILE YOUR CONTROL BOX IS TURNED ON !!** During the process of a 'hot' connect or disconnect there is a high load put on the motor driver circuitry which is very likely to damage the motor driver. A damaged driver means that motor does not run correctly. Also, do not unwrap the heat-shrink surround that keeps your motor cables connected to the motors. It is intended to help keep all connections permanently secure.

STATIC DISCHARGES – Electronic circuits are very sensitive to static and power surges, and your Control Box is no exception. Please have your electrician follow the wiring and grounding instructions in the wiring section to help prevent static from damaging components of your tool. In particular, avoid doing any vacuuming around your tool before you have grounded both the tool and your vacuum system. Large static build-ups can occur inside a vacuum collection system and discharge accidentally through the wiring of your ShopBot.

INDUCED CURRENTS - The stepper motors on your tool become significant little generators if they are manually turned. They can generate sizable voltages in your control box if you push the X or Y-axis of your tool around physically. Occasionally it may be necessary to move the tool by hand, but try to minimize such movement and when you must do it, make the move slowly. If you need to do a lot of manual movement, unplug the motors on the axis you are moving - having shut down the power first as noted above.

Overview of Your ShopBot PRS CNC Tool



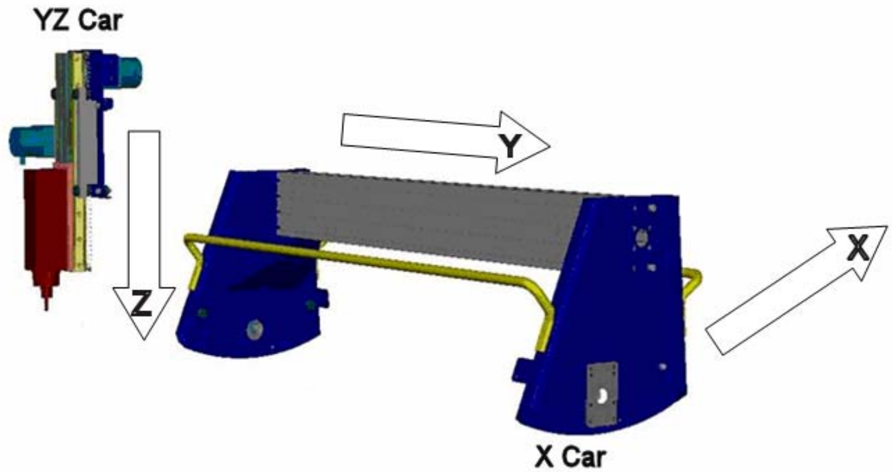
Note that the diagrams in this manual depict a generic ShopBot. Depending on the size and shape of your tool, the table layout may look a little different (fewer or more legs, different shape, etc.).

Before you unpack and start to assemble your ShopBot PRS tool, let's go over the some of the major components and get familiar with the terminology and directions we'll be using:

THE TABLE To get us located, refer to the orientation diagram above and imagine looking at the tool from the position of the little man in the drawing. From this position, we'll call the lower left hand corner of the work area the tool's 0,0 (or home) location. The X-axis is the long length of the table and values increase going to the right from where you are standing. The Y-axis is the narrow width of the table (or front to back from your position on the long side) and values increase as you move away towards the back. The Z-axis is the vertical movement or the plunging and withdrawal movement of your tool. Decreases in Z values are plunges down by your cutting tool. Increases are movements of the cutting tool up.

Still looking from the position of the little man, consider the furthest away X-axis track that the bearings ride on to be at the back of the tool, the track nearest the little man to be at the front, the left side the left, and so on. As you're positioning your tool in your shop, keep in mind that you will typically be loading sheet material from the left or right side so you should be sure to leave yourself some room to move around at one or both ends of the tool.

We'll use the words or 'car' to refer to the entire moving unit of a particular axis. The big gantry is thus the X Car, and the one that rides on it, the YZ Car.



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The electrical cabling will be arranged along the back of the tool, so this is the part of the tool that can be placed nearer a wall, obstruction, or where there will generally be less action. Note, however, that it is best if you are able to walk around and access your tool from all sides. The wiring for the Y and Z axes will be attached to a clear plastic Wire Guide. The Wire Guide arches out from the back right hand corner of the X-Car to the front right of the YZ-Car, as seen from the little man. Note that the X-Car mounts with the sloped side (front of car) to the left.

THE X-AXIS. The X-axis is the basis for your tool's right and left moves (as seen by you as the little man in the front of the diagram) -- it's the long axis on a standard ShopBot. Note that the distance between the tracks on the X-axis is wide. Because of this span, we power the X-Car movement with 2 motors, one on each side. The X-Car is driven by a rack and pinion power transmission system. The gear rack is mounted on the bottom of the long X rails and engaged by the pinion gear on the motor shaft.

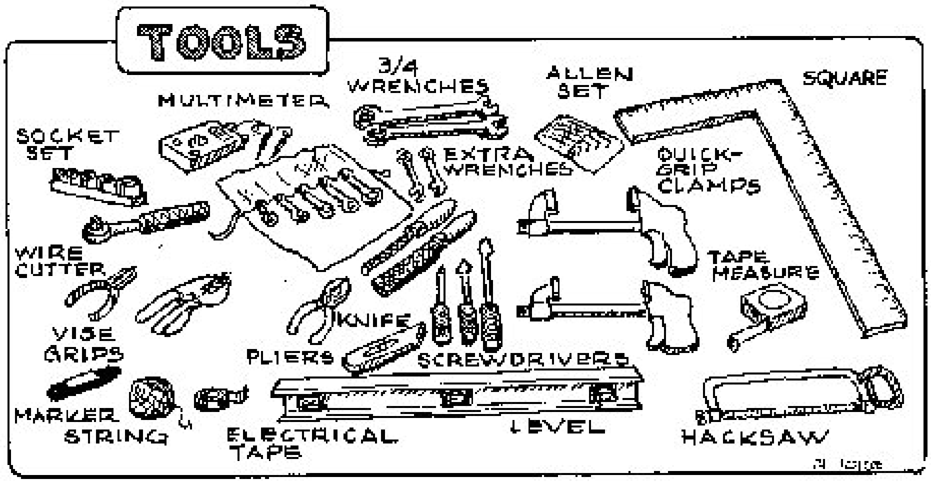
THE Y-AXIS. The Y-axis provides the front to back movement of your ShopBot (the short axis for a standard ShopBot). Note that the Y-axis rides on the X-axis. The gear rack for the Y axis is mounted in the face of the X-Car beam.

THE Z-AXIS. The Z-axis is vertical, rides the face of the YZ-Car, and moves the cutting tool up and down. The drive system for the Z-axis is also rack and pinion. The Z axis is spring-loaded to counterbalance the weight of your router or spindle.

THE ROLLING GEAR. Throughout your PRS ShopBot, precision motion bearings roll on hardened stainless steel rails to provide your tool with smooth travel.

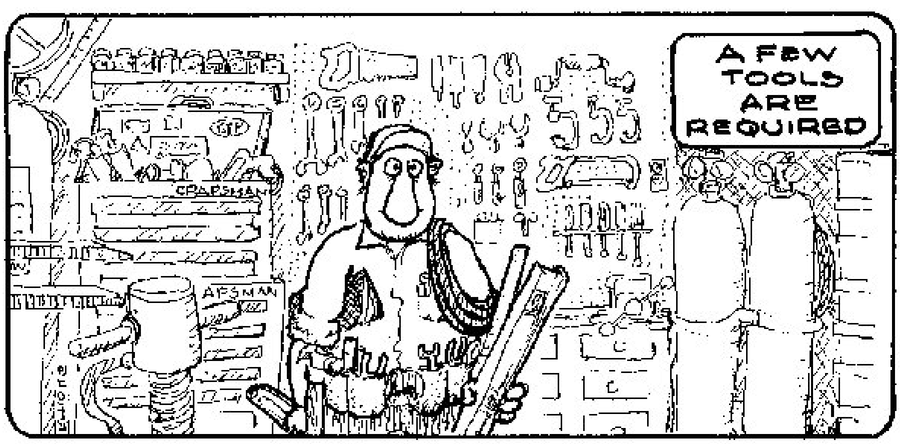
THE CONTROLS. Your ShopBot is moved and controlled by a personal computer (running Windows XP or Vista) that you provide. In the ShopBot Control software, signals are streamed from the PC's USB port through a USB cable to the ShopBot Control Box. The Control Box is placed near the tool and provides the driving power to the motors. The Control Box also receives incoming information from other devices such as your Z-Zero Plate and Proximity Switches.

Assembling Your ShopBot

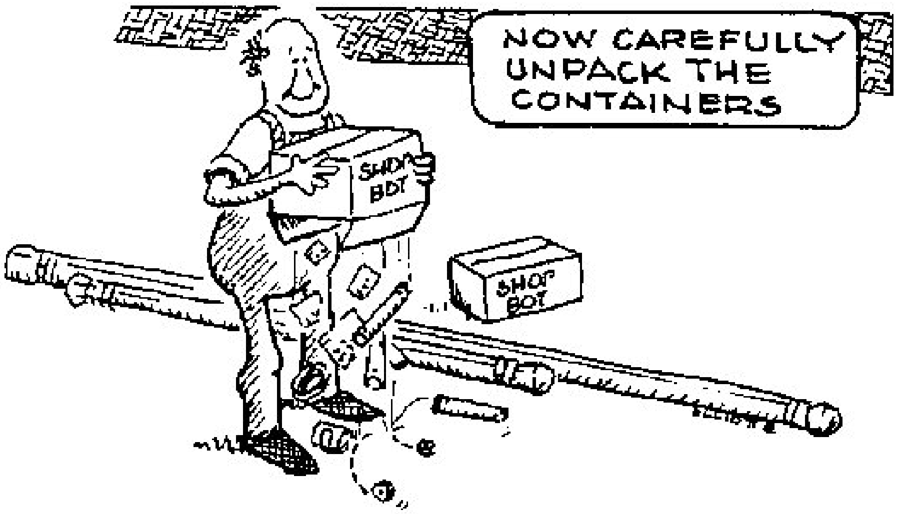


Tools You Will Need

- a wrench set with TWO wrenches of the following sizes 7/16", 1/2", 9/16", and 3/4"(the type with box end on one side and open end on the other works well).
- a socket wrench set with a 6" extension
- an Allen wrench set
- a drill for a couple of holes in the sheets of material you will use for your table surface (say 1/4" and 7/16")
- a good tape measure, a carpenter's square, and a level (a six foot one that you can use for a straight edge would be good)
- several Quick Clamps or large C-clamps to temporarily hold things and act as STOPS
- Misc: the odd screwdriver, adjustable wrench and pliers, utility knife, electrical tape (in a color that you can mark on) or masking tape, marking pen, your wits, etc.



Unpacking and Getting Your Work Area Organized:



You will receive a large shipping crate with the already-assembled X-Car and YZ-Car. One of the large cartons inside the crate holds the ShopBot Control Box. The motors and motor cables are packaged together. The long package with the rails and table sides will usually be strapped to the top of the shipping crate.

You can unpack the rails and cars so that you can identify them and have them ready. Be careful not to damage the gear rack on the bottom of the rails. Unpack and lay out the parts bags on your work surface.

Don't worry about the Control Box for the moment; you can set it aside until we're ready to connect your ShopBot.

We've pre-assembled most components of your tool to make things go a little more smoothly. In many places, bolts or hardware are loosely fit in place to show you their intended location; you may have to remove them to attach the part.

By way of giving you a little guidance: It takes one of us about 6 hours to assemble a ShopBot, so we think you should be able to put your ShopBot together over a pleasant weekend if you've already read through this Assembly Manual. Of course, the IRS thinks that preparing your 1040 should take 2 hours and 43 minutes, with a further 23 minutes for copying, assembling, and mailing the form!!

There are several stages in the assembly process where having a helper or two will be useful to you. In particular, you will want help unloading and unpacking, getting the table assembly started, and putting the X-Car on the rails.

Please remember that several of the components are very heavy!

Connection to Electrical Service

The Control Box for a PRS alpha tool needs to be connected to your electrical service by a licensed electrician. This connection can be made at any convenient time, before or after you complete assembly of the tool. The electrician does not need to be present when you plug the wiring from the tool into the Control Box. However, it may be best to wait until the tool is assembled and in its final position before having the electrical service hooked up. Waiting will allow you to make sure you have the Control Box positioned in the best location for your tool. The complete wiring diagrams for connecting the Control Box can be found inside the door of the Control Box and will be needed by the electrician to correctly wire the box into the electrical service.

If you have purchased a high frequency spindle and/or a vacuum blower, these will also need to be wired by a licensed electrician. The electrician will wire the spindle into the Control Box and connect the appropriate electrical service. The electrician will also wire your blower to the correct electrical service.

The Control Box for a PRSstandard tool plugs into a standard 110v/15A (or 220v international) circuit. However, if you have spindle or blower, you should have an electrician do the wiring for these accessories.

Overview of the Assembly Process

Assembling the Table.
This has the most parts, the most steps, and will probably take the most time. A helper is useful at the start, but not essential for this project. A couple of saw horses or other supports will help you out. See the section of MEASURED ASSEMBLY DRAWINGS for your specific size PRS (fixed table) for dimensions.

Installing the X-Rails and Gantry
Take your time to align the parts correctly. This is critical in terms of getting your tool running true. You will need help to lift and position the X Car on the rails.

Attaching the Motors

Mounting Your Router or Spindle
Your cutting tool needs to be attached to the front of the Z axis beam. A helper is useful, but not essential for this project.

Wheel Guards, Proximity Switches, Z-zero, and Echain
More to install, then tidy up all the wiring and make sure you are ready to roll.

Connecting Your Tool to the Control Box
Note there are different sections for the PRSstandard and the PRSalpha.

Off and Running…

Stopping the ShopBot
How to stop the ShopBot with the E-Stop, 3-Button Pendant, Remote Stop Switch and the “S” key.

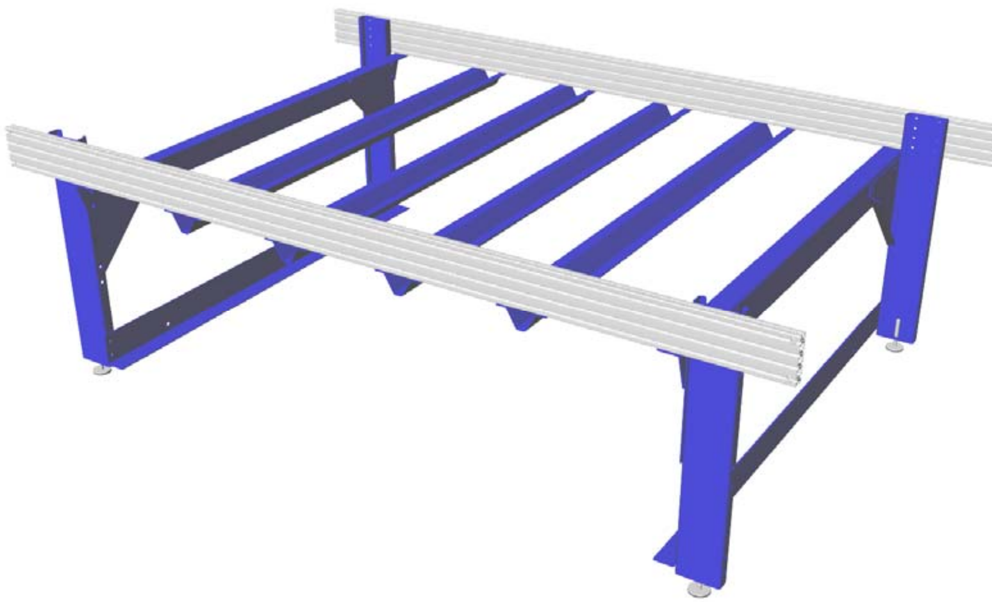
Taking a Test Drive
Ok, let’s go for a little spin, then we’ll review a couple of other things you will need to attend to before you get into production.

Surfacing the Table Deck–
Here’s a first CNC project: Surfacing your table.

Squaring and Adjusting the X-Car
You shouldn’t need to adjust, but you will want to read about setting your End Stops square.

Table Drawings with Measurements
Use the one for the size of the table you have.

Assembling the Table

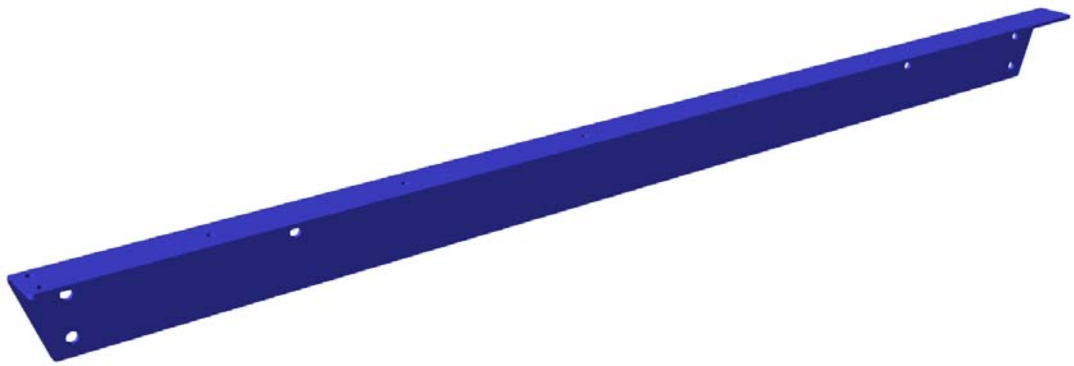


These are general assembly instructions for our steel and aluminum extrusion tables. For specific dimensions and part identification, refer to the included Measured Drawing (located at the back of this section) specific for the size ShopBot you are assembling. The Measured Drawing plans show the dimensions of the tools, the spacing of the cross supports, and the correct position for the table surface. NOTE that the number of legs on each side of the table differs according to the size ShopBot you are assembling.

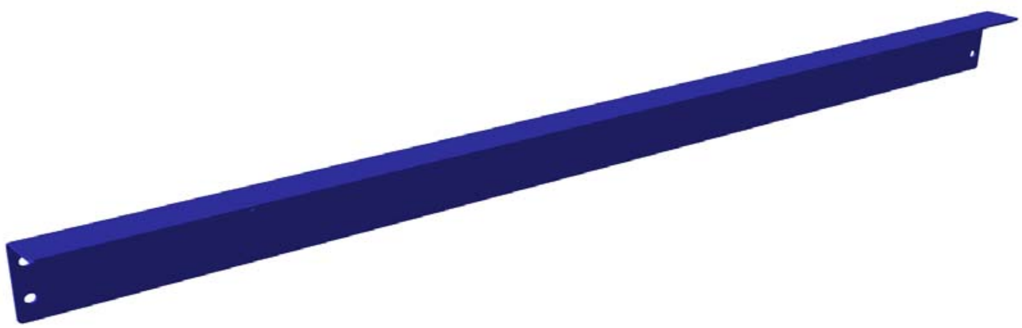
Take a look at Step 1.6 before you start. The goal of this assembly process is to have a square and correctly dimensioned table at the end point. In the final step you will be attending to getting the table square and the table sides exactly dimensioned for your tool.

Table Parts

Upper Support (note beveled ends in upper support)



Lower Support



Cross Support

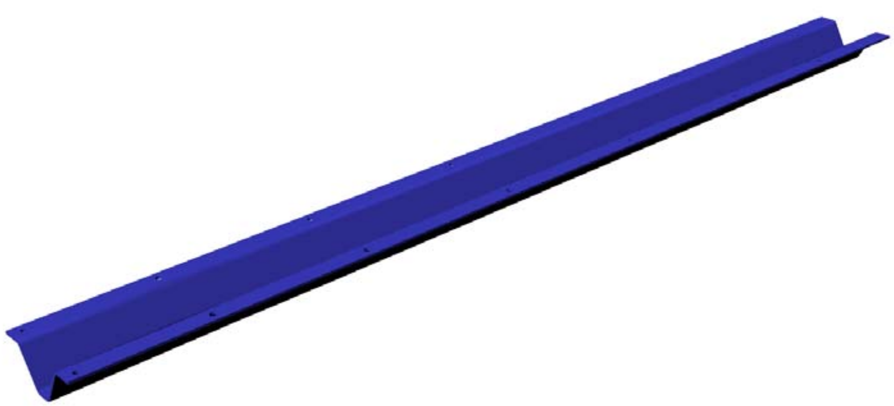
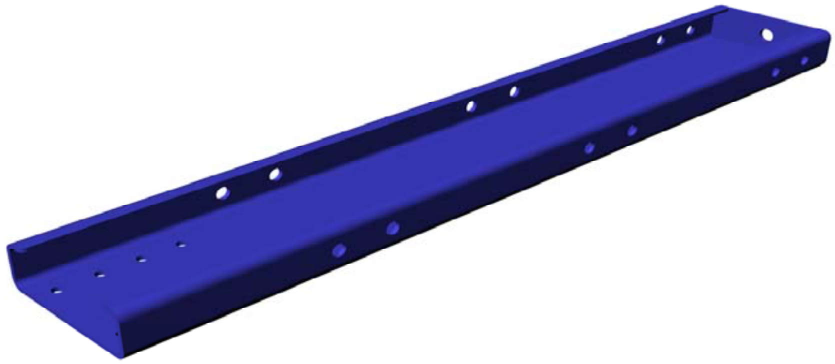
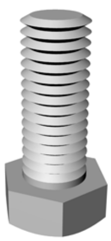
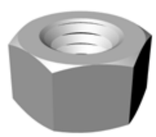
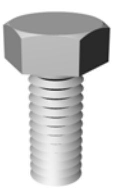
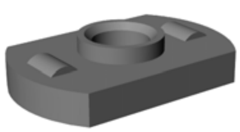


Table Gusset	**Table Leg**
	

1/2Bolt	**1/2Flat washer**	**1/2Hex nut**	**1/2Lock Washer**
			

5/16 Bolt	**5/16 Flat washer**	**Tee nut**	**Machine Glide**
		**(in several sizes)** 	**(w 5/8 nut and lockwasher)** 

Assembly Steps

Step1.1: Attach a Machine Glide to the Bottom of Each of the Table Legs

Screw a Machine Glide through the 5/8″ nut in the bottom of each Table Leg. Place a 5/8″ lock washer and hand tighten a 5/8″ hex nut on the Machine Glide. Do not tighten at this time (see Step 5). Repeat for all legs.

Bottom of Table Leg showing Machine Glide assembly

Step 1.2: Attach the Table Legs to the Table Sides

Place 5/16″ bolts, flat washers and T-nuts at the eight holes on each of the Table Legs.

Looking down on table leg

Attach the first leg to the inside of the Table Side by sliding the T-nuts into the side channels on the Table Side. Square the Table Leg to Table Side and tighten just enough to hold the pieces securely in place. Keep in mind that you will want to tighten all nuts securely at the end of the table assembly when you square the table. If you tighten all fasteners too much now, you won't be able to square the table later.

Temporarily attach the other Table Leg to the outside of the Table Side. This leg will be moved to the inside of the table in Step 1.4.

Repeat for the other Table Side. Use saw horses to temporarily support the side assemblies as you continue.

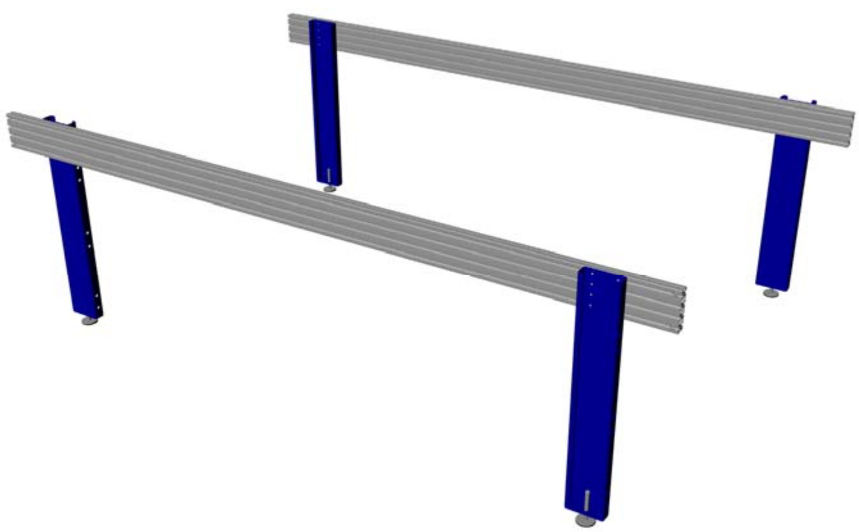
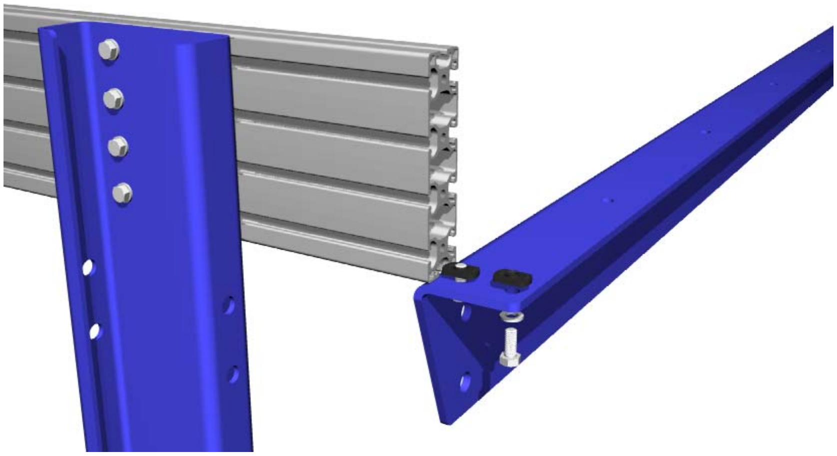


Table Sides with legs attached

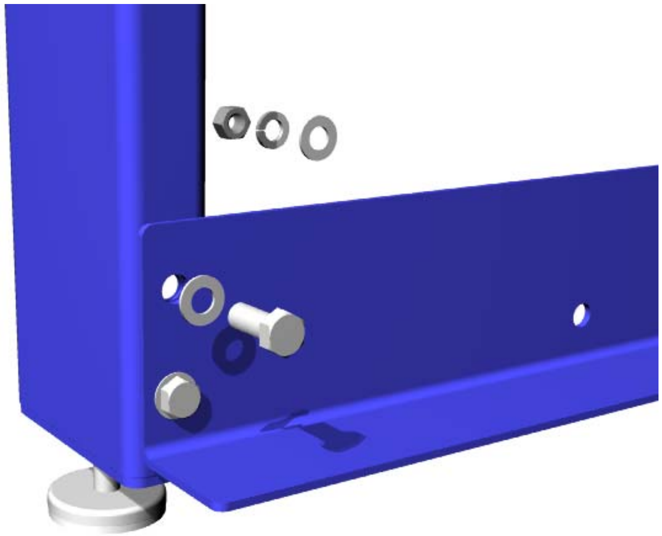
Step 1.3: Attach the First Upper Table Support

Attach the first Upper Table Support to the end of the table. Start it on from the side with the temporary outside leg. Slide the T-nuts for the Upper Table Support into the bottom channel of each Table Side on the far end. Then slide the Support all the way down and close to the Table Leg, leaving approximately 3/16" between the leg and the upper support for the Gussets.



Insert the Gussets between the Table Legs and the Upper Table Support and attach using ½" Hardware Assemblies.

Attach the Lower Table Support to the bottom holes in the Table Legs using ½" Hardware Assemblies.



Lower Table Support showing attachment to Table Leg.

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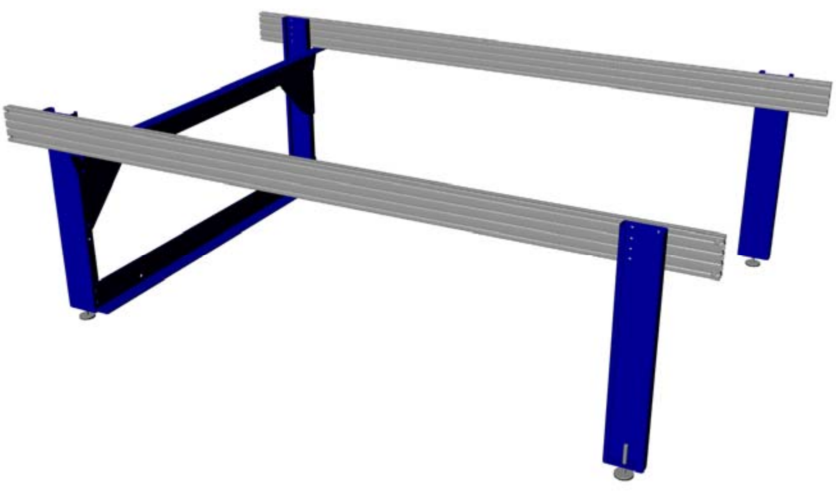
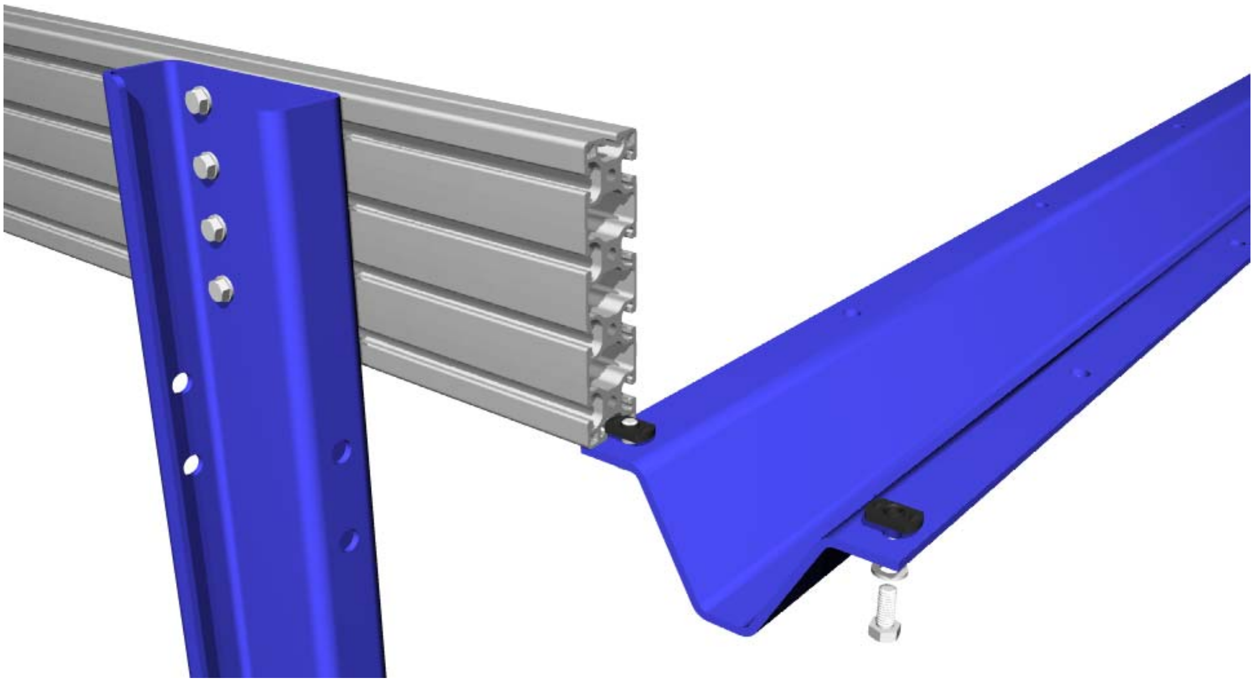
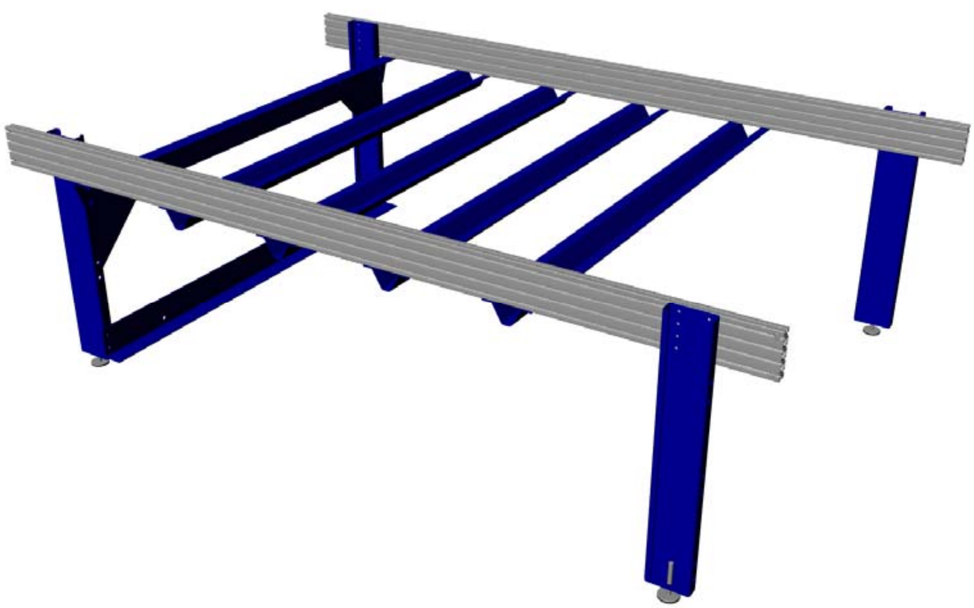
Your table should now look like this:



Step 1.4: Slide the Cross Supports into Position

Attach two 5/16" Hardware Assemblies to each end of the Cross Supports. Then slide the T-nuts into the bottom channels of the Table Sides and slide the Cross Supports into position. Refer to the Measured Drawing for your table size for proper spacing of the Cross Supports.

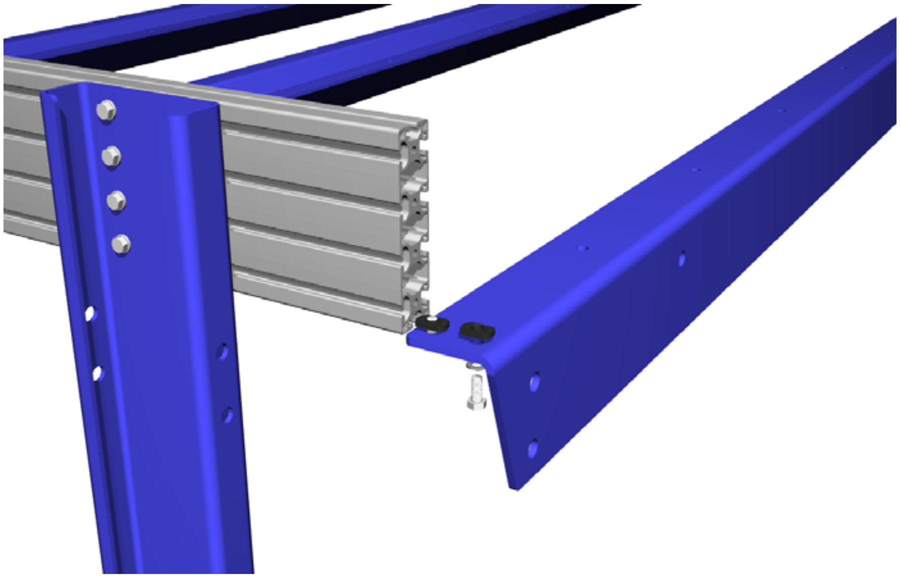




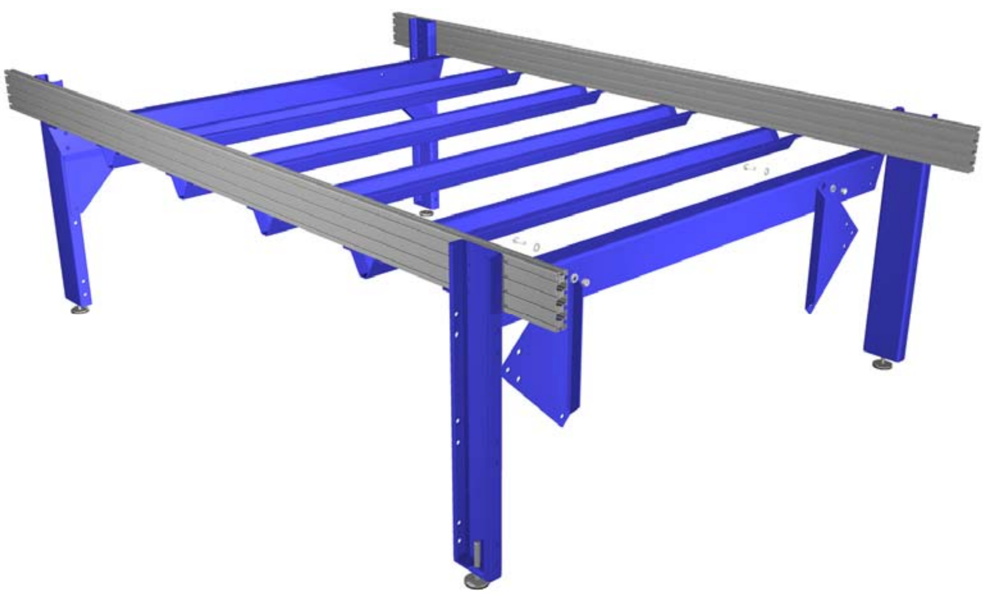
Cross Supports in position

Step 1.5: Working on the other End of the Table where the Legs are still temporarily attached to the Outside of the Table Sides

Install 5/16" Hardware Assemblies on the Upper Table Support and slide it into position. Notice that the lead edge of the support inserts first, this time

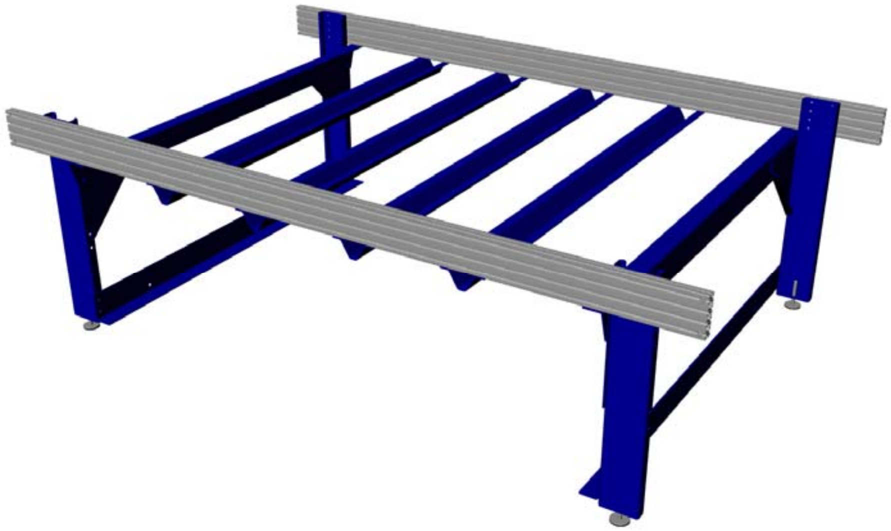


Attach the Gussets on this end to the Upper Table Support . Use ½" Hardware Assemblies. Your table should look like this.



Move these Table Legs to the inside.

Attach the Lower Table Supports to the bottom holes in the Table Legs using ½" Hardware Assemblies. Attach remaining bolts on gussets.
Your table should now look like this:



Step 1.6 Square and Level Table

Set the table where it will be used. Plan to spend a little time getting it square and adjusted to the exact correct width measurement. [SEE DRAWING & TABLE BELOW]

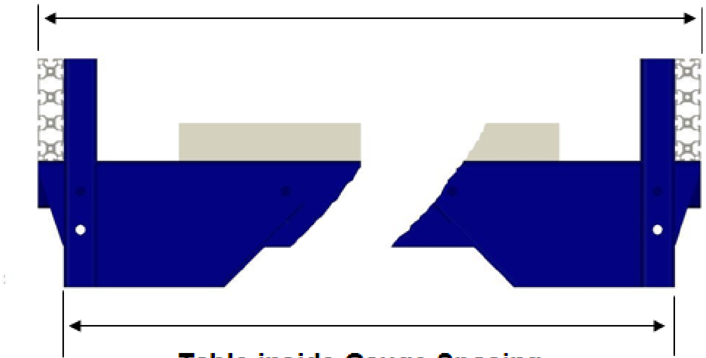
Set the legs perpendicular to the Table Sides with a square and tighten.

Level the tops of the Table Sides across and diagonally using the Machine Glides. Then tighten the 5/8" nuts on the Machine Glides.

Measure the table across both diagonals. If the measurements are not the same, the table is not square. You will need to shorten the longer diagonal by one-half the difference of the two diagonal measurements. With a mallet or hammer & protective block of wood, gently tap the end of the table side at one end of the longer diagonal to shorten as needed. Adjust the table until the measurements across the diagonals match.

Then, work to adjust the distance between the rails to the exact spacing indicated in the table below. It can be helpful to cut a measurement gauge from a 2x4 to use to set the distance between the table sides. Make sure the gauge distance is right and giving you the correct outside to outside measurements.

Tighten all hardware once the table is measured and square. Check the diagonals and the distances frequently as you move around the table tightening the bolts.



	==========	WORK AREA WIDTH	==========
DIMENSION	48″ (121.92cm)	60″ (12.40cm)	72″ (182.88cm)
Outside to Outside of Table Sides	64.5″ (163.83cm)	76.5″(194.31cm)	88.5″(234.79cm)
Gauge between Rail Spacing	61.5″(156.21cm)	73.5″(186.69cm)	85.5″(217.17cm)

Table Surface (probably attach later?)

The deck surface of your table is created from several sheets of plywood or MDF. It makes logical sense to consider how you will install the deck at this time, but most customers find it more convenient to wait to do the final attachment of the table surface until after the tool is fully assembled. At the moment, you'll probably want to just lay a sheet or two of plywood onto the cross supports to use as a work area. But we'll explain the table surface now.

Suggested Materials

For your Table Surface or Deck we recommend 3 layers of material to provide good rigidity.

- **Support Board (bottom layer)**
  ¾″ Shop grade or cabinet grade plywood or better (birch, maple, poplar…hardwoods)
- **Plenum Board or 2nd Layer if not installing a Vacuum System**
  ¾″Medium Density Fiberboard (MDF) or
  ¾″ High Density Polyethylene (HDPE) or
  Another sheet of ¾″ plywood if not installing vacuum
- **Spoil Board**
  ½″ LDF or
  5/8″ MDF surfaced on both sides to a thickness of 3/8″ or
  ½″-¾″ MDF if not installing vacuum

Attaching the Table Surface

Refer to the Measured Table Drawing for your tool for positioning information for the table surface. The drawings also show how to position multiple sheets if your table is larger than 4x8. You will center the support board(s) in the X direction. There should be about 1.5″ of material past the end support at each end. In the Y direction if your material exactly matches the tool's work area, center the support board(s) in the Y direction between the front and back table sides. For example, for a 4x8 tool, a 4x8 sheet should be exactly centered. If your sheet material is oversize, then for all tool sizes locate the front side of the sheet 6.75" in from the front side of the tool.

Clamp the sheet(s) in position, then attach through the holes in the cross supports with the 3/8" by 1.5" carriage bolts that are included in your parts. Use, every-other diagonal hole in an alternating pattern in the Center Cross supports; every hole in the end supports.

From under the table, at each hole in the Upper End Cross Supports and alternating holes in the center Cross Supports, drill a ⅜" hole through the Support Board

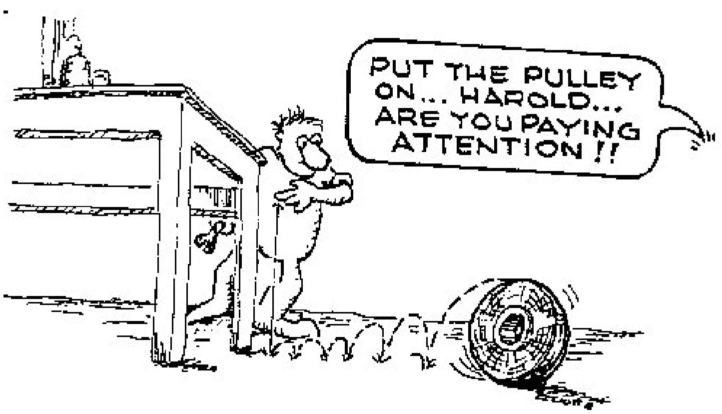
Countersink the holes on the top of the Support Board with a spade bit.

Insert the ⅜" x 1½" carriage bolts down through the Support Board, Upper End Cross Supports or center Cross Support and attach with flat washers, lock washers and nuts.

If you are putting a vacuum hold-down system on your ShopBot. Please see the documentation for the vacuum hold-down system for more information on installing your plenum and bleeder board.

If you are not installing vacuum. Then attach a second layer to the support layer board using countersunk drywall or plastic screws. When your tool is operational, you will be able to surface this layer, and then attach a final sacrificial or working layer to your table.

The choice of actual material and methods for attaching your table depends on the nature of work you will be doing, the kind of hold-down system that you use, and the experiences that you gain with various materials. Your table surface is likely to evolve over time.



Installing the Gantry

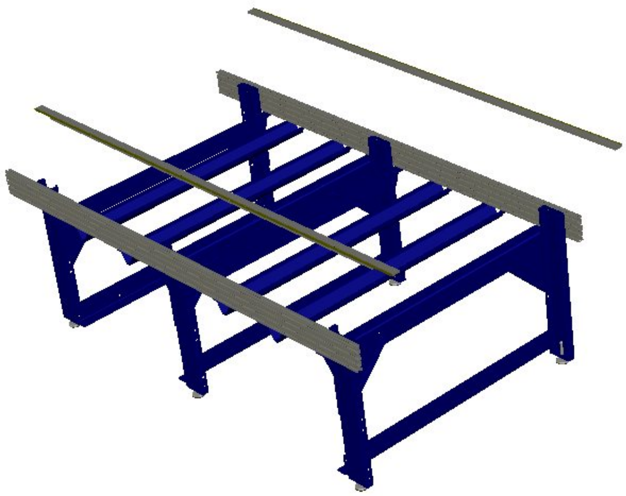
Installing the X-Rails and Getting One Rail Straight

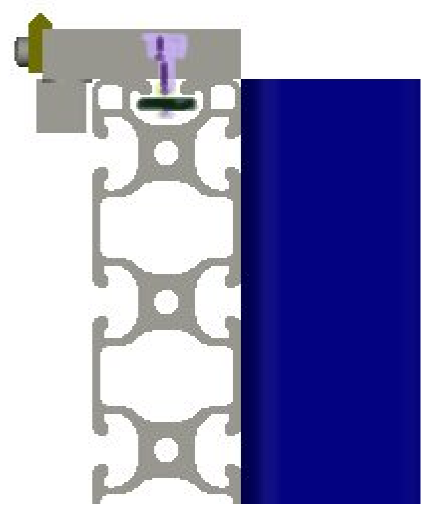
Slide the X-Rails onto the Table

- Mount the X-rails with 5/16 bolts and T-nuts. Slide these nuts into the top track of the table sides as you did with the table legs and cross supports.

- After you get both rails in position, hand-tighten the bolts.

- **BE CAREFUL SLIDING THE RAILS ONTO THE TRACK. IT IS VERY EASY TO PINCH YOUR FINGERS WHEN INSERTING THE NUTS INTO THE TRACKS AS YOU SLIDE THE RAIL ON.**





Set the Front Side X-Rail and Check for Straightness

- With bolts "finger tight," move along the X-Rail on the front side of your tool, aligning the aluminum bar on the inside exactly flush with the inside of the table side.

- Then start at one end further tightening the bolts.

- As you continue to lock the front X-Rail in position, slide your 6ft level or straight edge along the outside edge of the rail to check for straightness. Nudge the aluminum bar slightly if it needs adjustment.

- When you've got the front side rail in position and straight, fully tighten all the bolts on the front side rail.

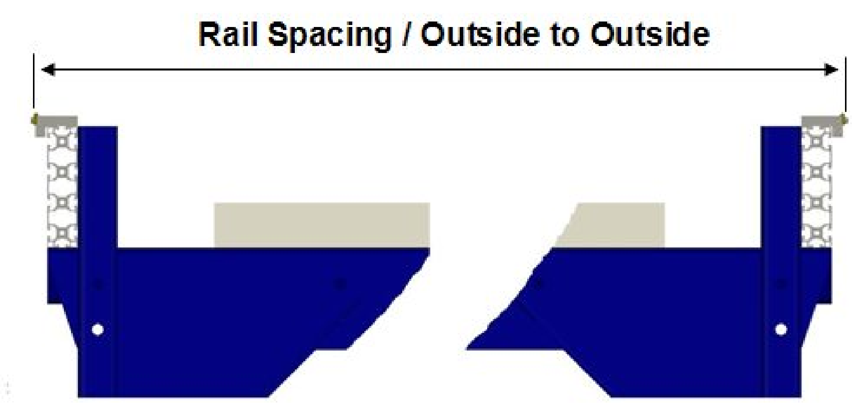
Adjust the Position of the Rear X-Rail

You'll use a tape measure to set the initial position of the rear X-Rail. Always make these kinds of important measurements from the 1" mark on the tape. Do not trust the accuracy of the clip at the end of the tape.

- Consult the chart below for the exact distance, outside edge to outside edge, for the rails.

- Use the tape to check the distance at each of the bolts, and adjust where necessary. Try to get within 1/32in of the distance. Note that the edge portion of the rails is ¼" wide, so there will be a 1/16" mark that should fall on the exact centerline of the 'V' of the rail.

- Tighten these bolts on the rear rail down just a bit. But note that you are probably going to need to adjust the rear rail again slightly, after putting the X-Car in place.

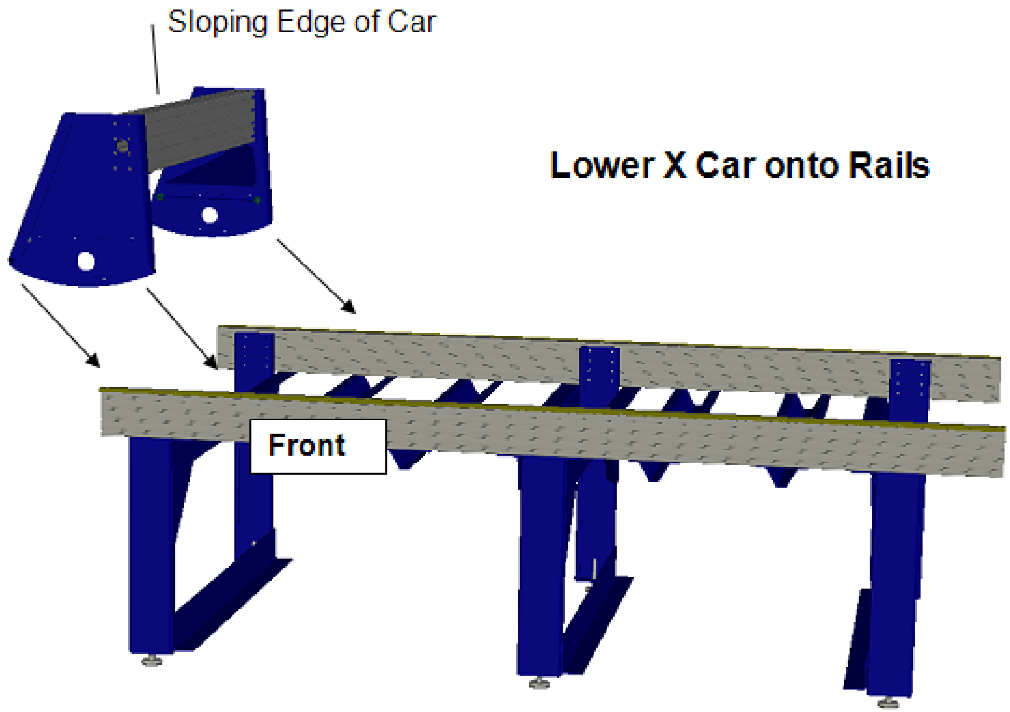


	==========	WORK AREA WIDTH	==========
DIMENSION	48" (121.92cm)	60" (12.40cm)	72" (182.88cm)
Outside to Outside of Rail	65.812"(167.16cm)	77.812"(197.64cm)	89.812"(228.12cm)
Outside to Outside of Table	64.5" (163.83cm)	76.5"(194.31cm)	88.5"(234.79cm)

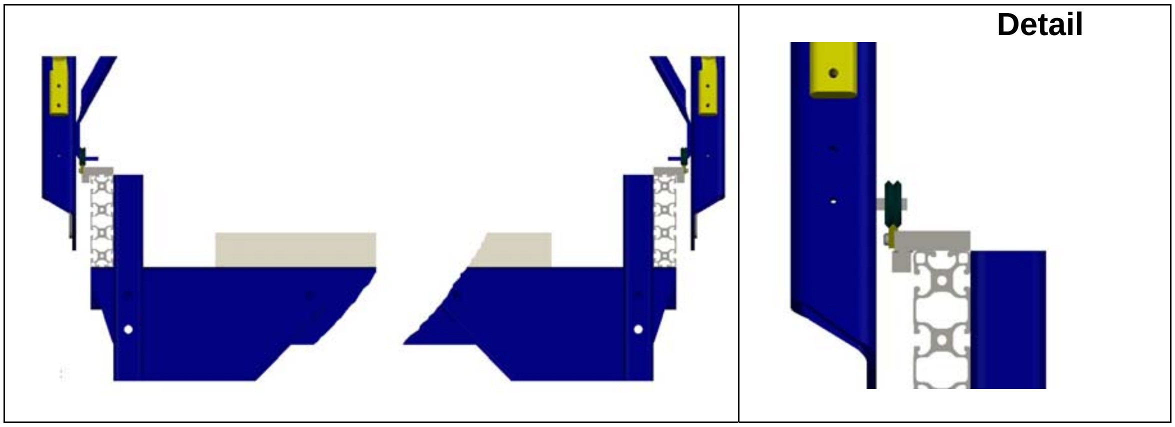
Putting the X-Car on the Rails and Using it to Align the Rear X-Rail

Lower the X-Car onto the X-Rails

The X-Car is fully assembled and ready to be placed on the rails. This is a 2-4 person operation as the car is HEAVY! Note that the car goes on the rails so that the sloping edge of the X-Car faces towards the left when you are at the front of the tool.



- As you put the car in position, seat the wheel bearings on the front side X-Rail and then place the rear bearings over the rear X-Rail. You may find it easier to lay the Car over on its back first, with the beam across the rails and engaging only the bearings on the back of the X-Car. Then, when you are ready, you can stand it up and engage the wheel bearings on the Car's front end. You may need to loosen the rear X-Rail at this point and adjust it slightly so that the bearings come into exact alignment.



- Put a C-Clamp across the rails at each end of the table to create a temporary end stop to prevent the X-Car from rolling off the table while you are carrying out the next tasks!

Use the X-Car as a Guide to Align the Rear X-Rail

Note that the weight and rigidity of the cars, their wide wheel base, and the self-centering nature of the V-groove wheels will take care of slight errors in the rails, but you want to get the rails as well aligned as you can.

- Roll the car down to the middle bolt of the X-Rail so that you start the process from the center of the table and work out to the ends.

- Clamp the side of the X-Car on the straightened, front rail so that the wheel bearings are centered and locked onto the rails.

- Move back to the rear rails. Loosen up all the bolts a tad. Then make whatever adjustment is needed to get the rails perfectly under the rear bearings.

- Work on this progressively over the rear rails, moving out from the center. There should be enough adjustment in the rail to allow you to get the rear rail perfectly aligned over its full length.

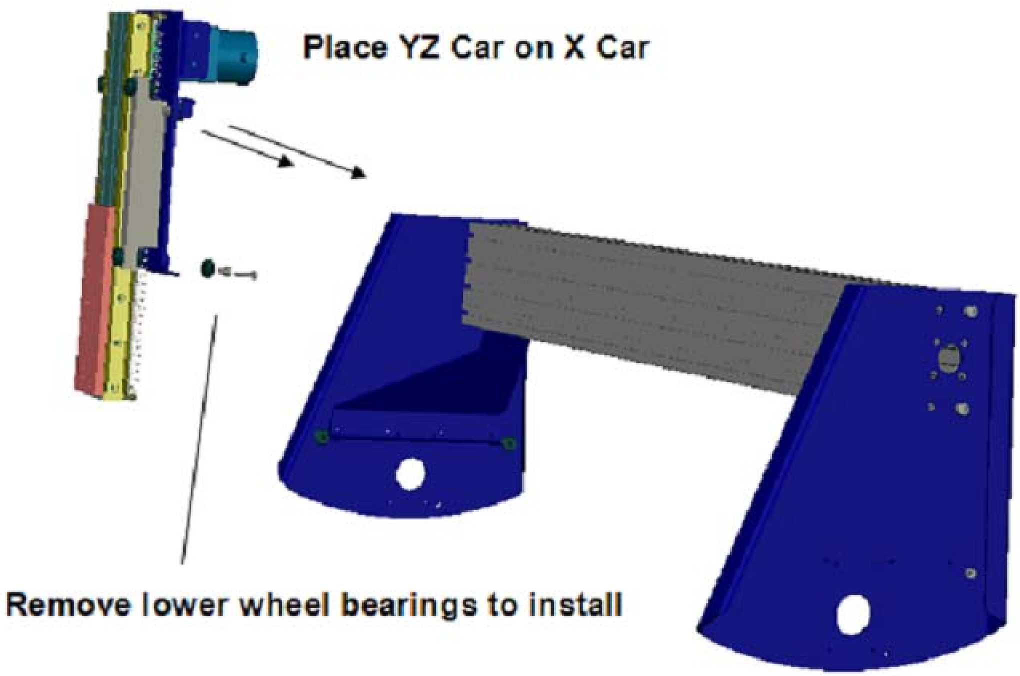
This is the hardest step, so take a deep breath and congratulate yourself when you've gotten it accomplished!!!

Mounting the YZ-Car and adjusting its lower wheel bearings

Place YZ-Car on the X-Car

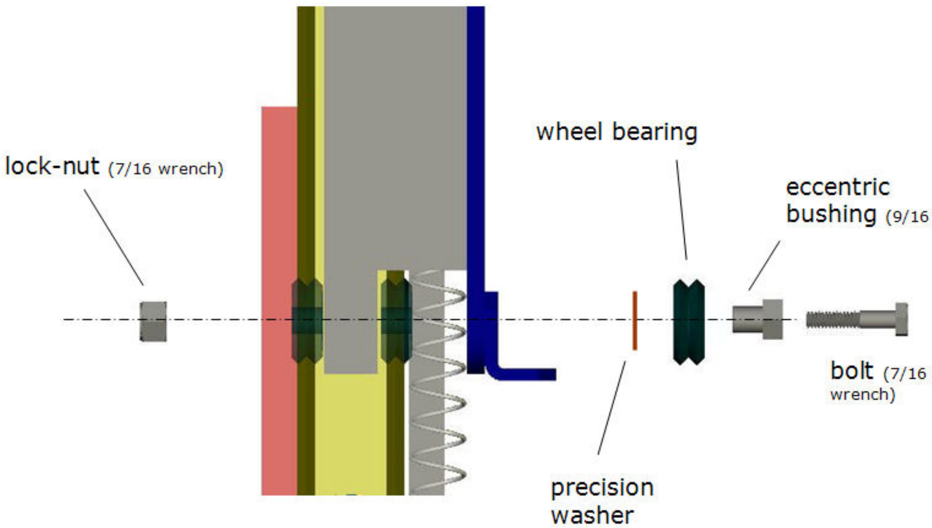
The YZ-Car is a single piece that is ready to be placed onto the rails that cross the face of the X-Car beam.

- Roll the X-Car up to the far left side of the table and clamp it in place to make the installation easy.
- Remove the lower wheel bearings before setting the YZ-Car in place. Notice that these bearings are on an eccentric (adjustable) bushing and that there is a small, precision washer behind the bearing and bushing. This washer is critically important.
- After you have removed the lower bearings, lower the YZ-Car down onto the rail, seating the upper bearing wheels on the upper Y-Rail. The car will sit in place on these top bearings.



Attach the Lower Wheel Bearings on the YZ-Car

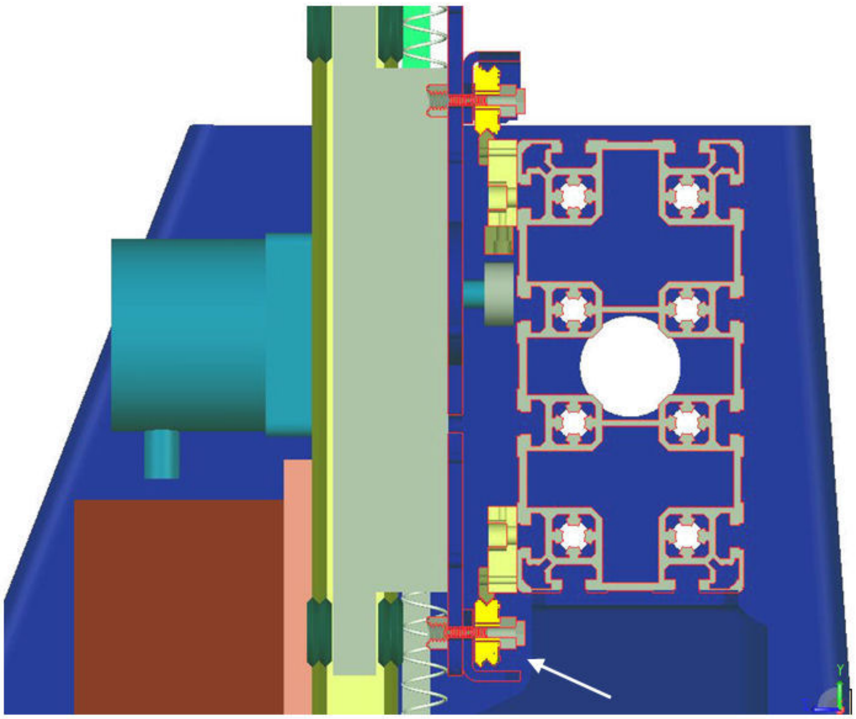
With the YZ-Car in position riding on its upper wheel bearings, you can install the lower bearings. Study the diagram below because the parts in this assembly need to be installed exactly as indicated. Note that the assembly incorporates an eccentric bushing (having an off-center hole), which will be used for the final adjustment of the bearing. This bushing has a small precision washer behind it. This washer is critical for the alignment of the car and for the normal operation of the bearing. (We've put extras in the "Extra" bag, just in case you might drop one.)



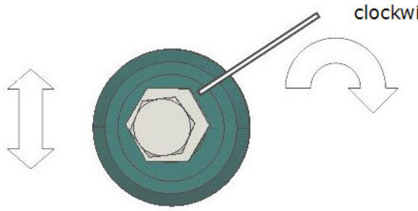
- Insert the bushing into the wheel bearing, then insert the bolt so it protrudes just far enough through the bushing to hold of the precision washer.
- *The trick to the whole operation* is to slide the wheel in from the side of the car, after you have placed the 'V' of the wheel over the track. When you get the wheel directly behind the hole in the car, push the bolt through.
- After pushing the bolt into place, put the washer on, and start the lock-nut. Leave the assembly loose while you install the wheel bearing on the other side.
- When both wheels are in place, make sure that both are fully seated on the rail.
- Find the black mark on the edge of the eccentric bushing indicating the narrowest spot. Put this side closest to the rail. Then, tighten down the ¼" bolt with 7/16" wrenches.

Adjust the Lower Wheel Bearings on the YZ-Car

Cross section through X Car showing YZ Wheel Bearings



Adjust Lower Bearing



The lower bearing is adjusted tight by rotating the eccentric bushing. It has an off-center hole so that rotating the bushing moves the wheel into and out of contact with the rail. The adjustment is done most easily with a 9/16" socket on a wrench with a 6" extension.

- Rotate the bushing in a clockwise direction in small increments until it fully engages the rail. Push the YZ-Car back and forth from the front to make sure the wheel is tightly engaged and there is no wiggle, but do not over-tighten.
- Check your adjustment over the entire rail. You should not be able to stop the wheel from turning with finger pressure. It can be tight enough to produce a slight amount of resistance to rolling.

Attaching the Motors

Put the Pinion Gears on the Motors

Locate the X and Y motors. These motors will already be fitted to a blue mounting bracket and have a long cable attached. Also find the bag with your pinion gears.

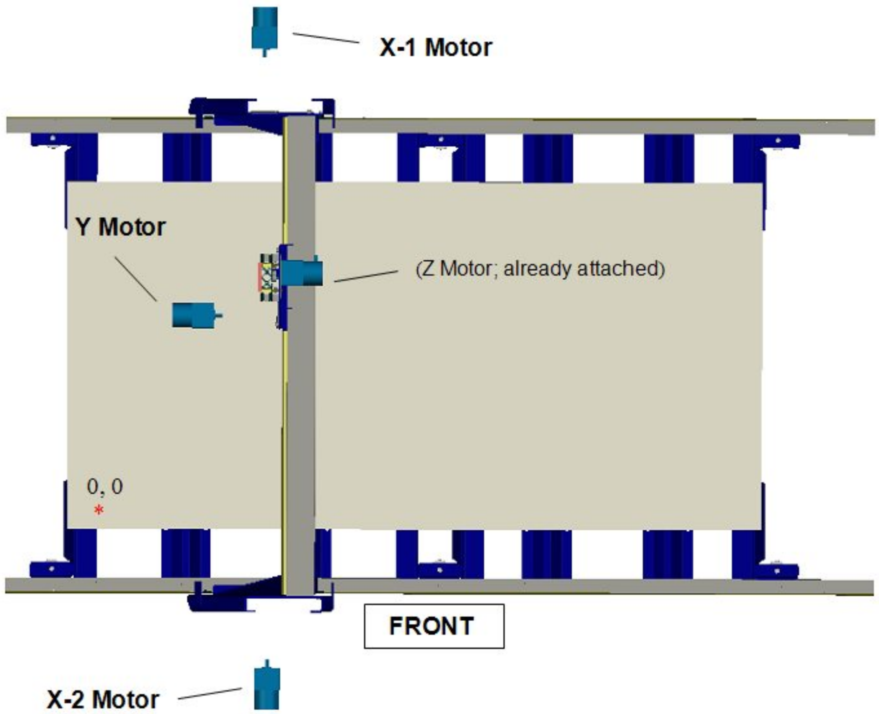
- Fit a pinion gear on each of the motors and set the end of the gear flush with the motor shaft. Don't tighten the set screw yet; we'll test fit the motors on the tool first.

- Note that the motor cables are *color-coded to indicate the axis of the motor.*
  RED is X axis (there is an X-1 and an X-2 motor).
  BLUE is the Y axis.
  WHITE is the Z axis.
  YELLOW is an accessory axis.

DO NOT REMOVE THE HEAT SHRINK THAT ENCASES THE CONNECTION BETWEEN THE MOTOR AND CABLES. IT IS THERE TO INSURE SOLID CONNECTIONS IN ALL CONDITIONS.

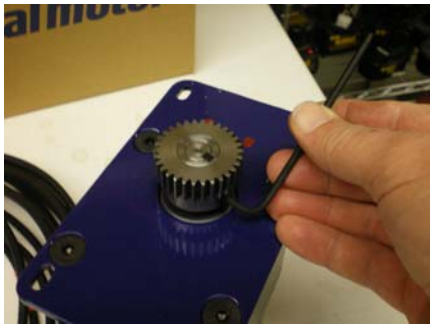
Mount the Motors

Since the motor cables (of correct lengths and motor direction orientation) have already been attached to the motors, it is important that the motors and brackets be mounted *in the correct location.* The mounting hardware for each motor (4 bolts) is already fitted to the tool in the locations where the motors will be mounted.

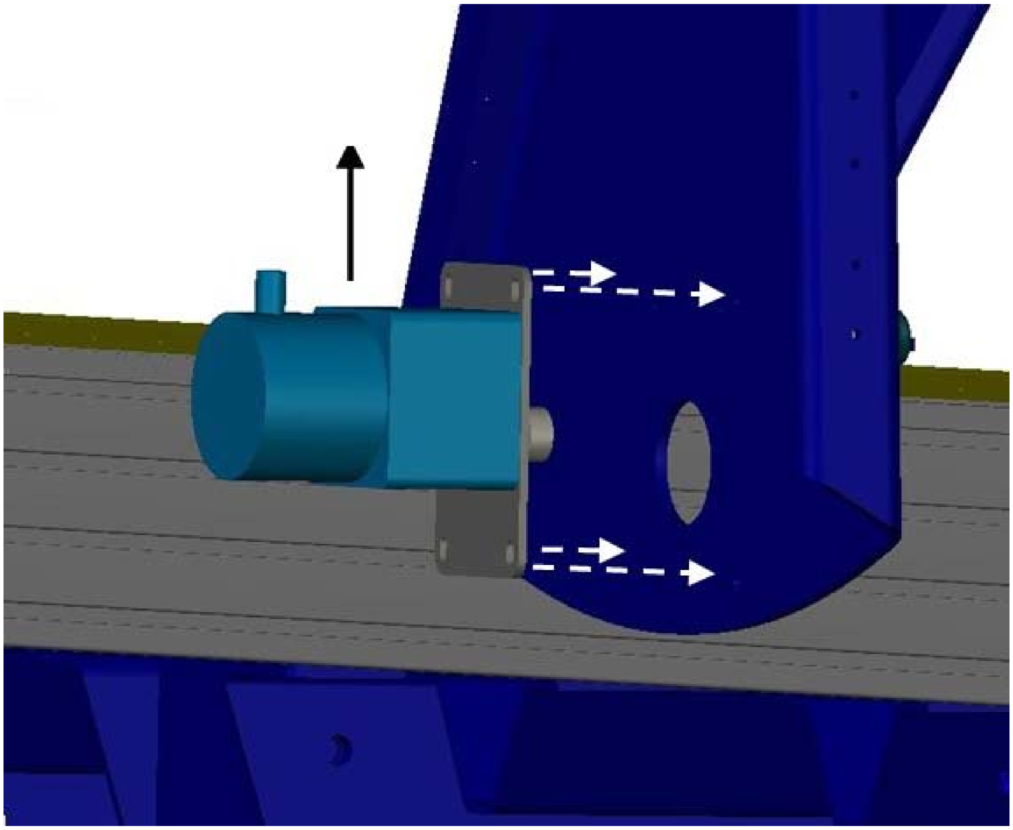


- Make sure that you've got the right motor for the right location, then attach the motor with two bolts and check to make sure the pinion is aligned on the shaft with the rack.

- After checking the pinion alignment, remove the motor. Adjust the pinion location on the motor shaft if necessary. Then tighten the two set screws. **These set screws have an embedded locking compound. Make sure you get them seated tightly at this point.**



- With the pinion now fully tightened, mount the motor with all 4 bolts. Note that the brackets are slotted. Slide the motor up so that the pinion is tightly engaged into the rack.

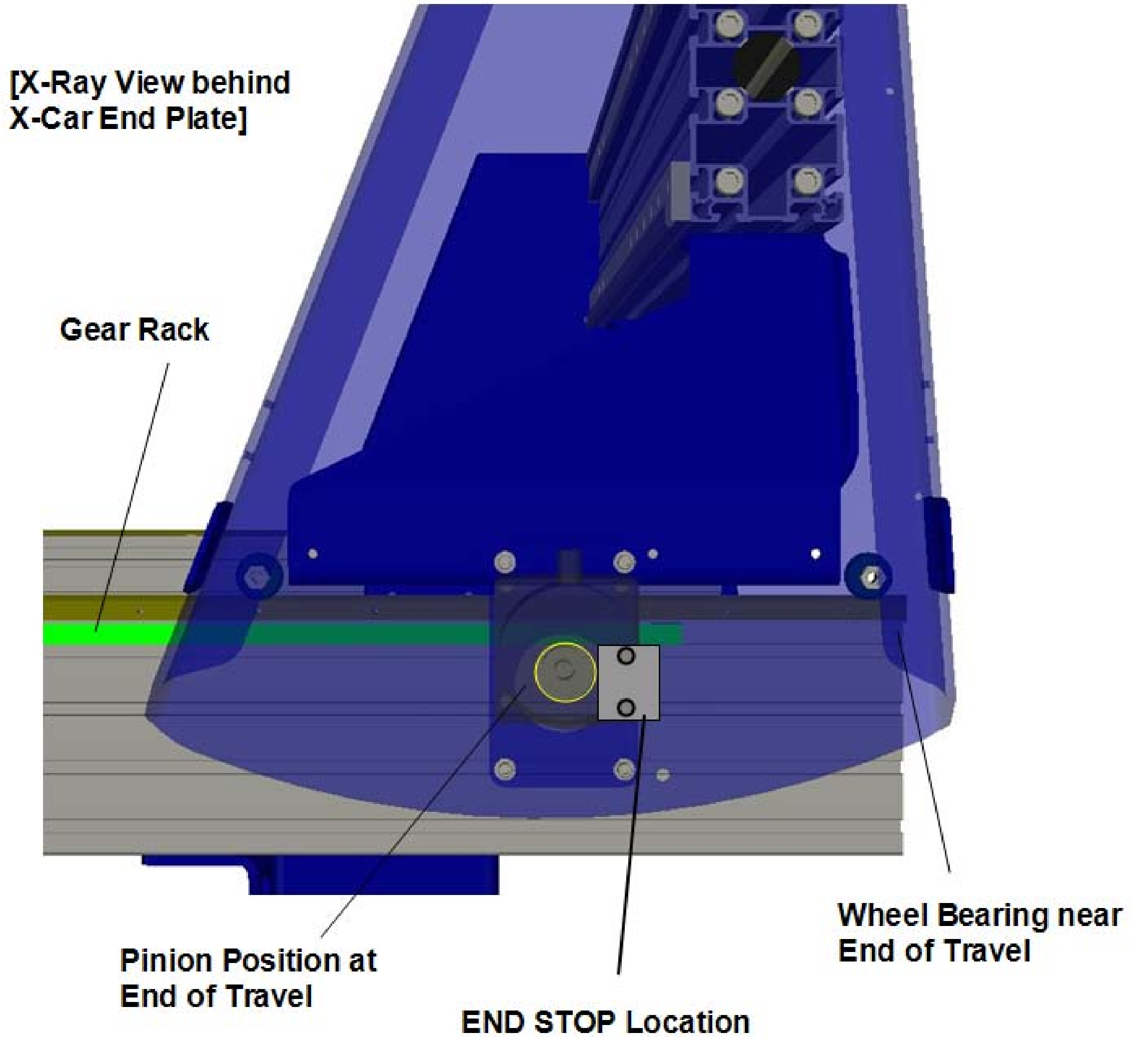


We recommend applying grease to the rack and pinions. A good quality bearing, lithium, or Teflon grease will work well. The grease will keep the rack motion smooth and reduce gear wear. (Surprisingly little debris actually collects in the grease.) Apply it by squeezing a little into the rack every few inches. Moving the tool around will spread the grease and you can wipe off any excess. It's OK to push the cars around, but **do not plug them in** to the Control Box yet.

Set the Mechanical End Stops for the X Axis

The Mechanical End Stops are aluminum blocks that limit the movement of the car on the axis by stopping the pinion motion for the X-axis (The Y stops are already positioned). The blocks are locked into the slotted track just under the gear rack by two set screws. You will position one the end of each rail. So you will put 4 on the X-Rails - one on each end of each rail.

- Take a moment to be sure that both X- and Y- Cars are moving up and down the rails smoothly. The motors will create some resistance, but the motion should be smooth and even with all wheel bearings riding on the rails and pinions fully engaged.
- Lay out the 4 mechanical stops, one at each end of the rack on the X-Rails. Check to make sure that the stops slide firmly into place over the ½” rack.
- Use the ⅛” Allen wrench, supplied with the pinion gear pack, to tighten on the blocks.
- Carefully roll the X-Car to one end of the X-Rails, watching the inside of the X-Rail. Roll the car until the wheels are resting within ¼” of the end of the X-rails. Put a clamp on the rail to hold the car in place at that position.



- Slide the Mechanical Stops into the track and up against the pinion on each rail. Then push the car back.
- Tighten the stops in position.
- Move the X-Car to the other end of the table and set the other stops.
- When you later fine tune the square of your tool, you may do a final adjustment of the position of the X-Car end stops. See section on Squaring.

Run the X-2 Motor Cable through the Aluminum Beam

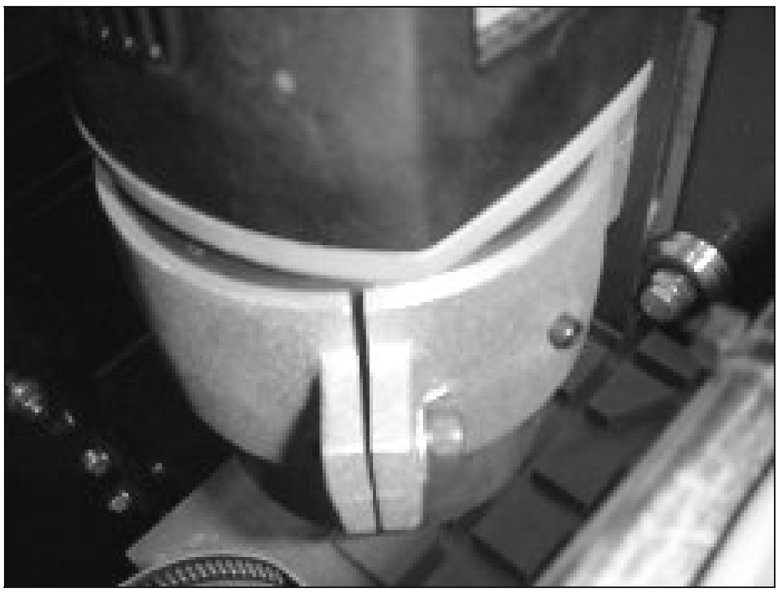
The X-2 cable from the motor on the front side of your ShopBot runs through the X-Car aluminum beam to the back side of your ShopBot before going to the Control Box.

- Run it through now by starting the connector through and then feeding the rest of the cable.

Mounting the Router or Spindle

Since the power requirements are different for a Porter Cable router than for a Spindle, we install different components in the Control Box depending on which cutter you specified at the time you placed your order. They are not interchangeable. Before retro-fitting your tool from a router to a spindle or vice-versa, please call ShopBot to discuss the changes you will need to make to reconfigure your tool.

If You Have a Porter Cable Router

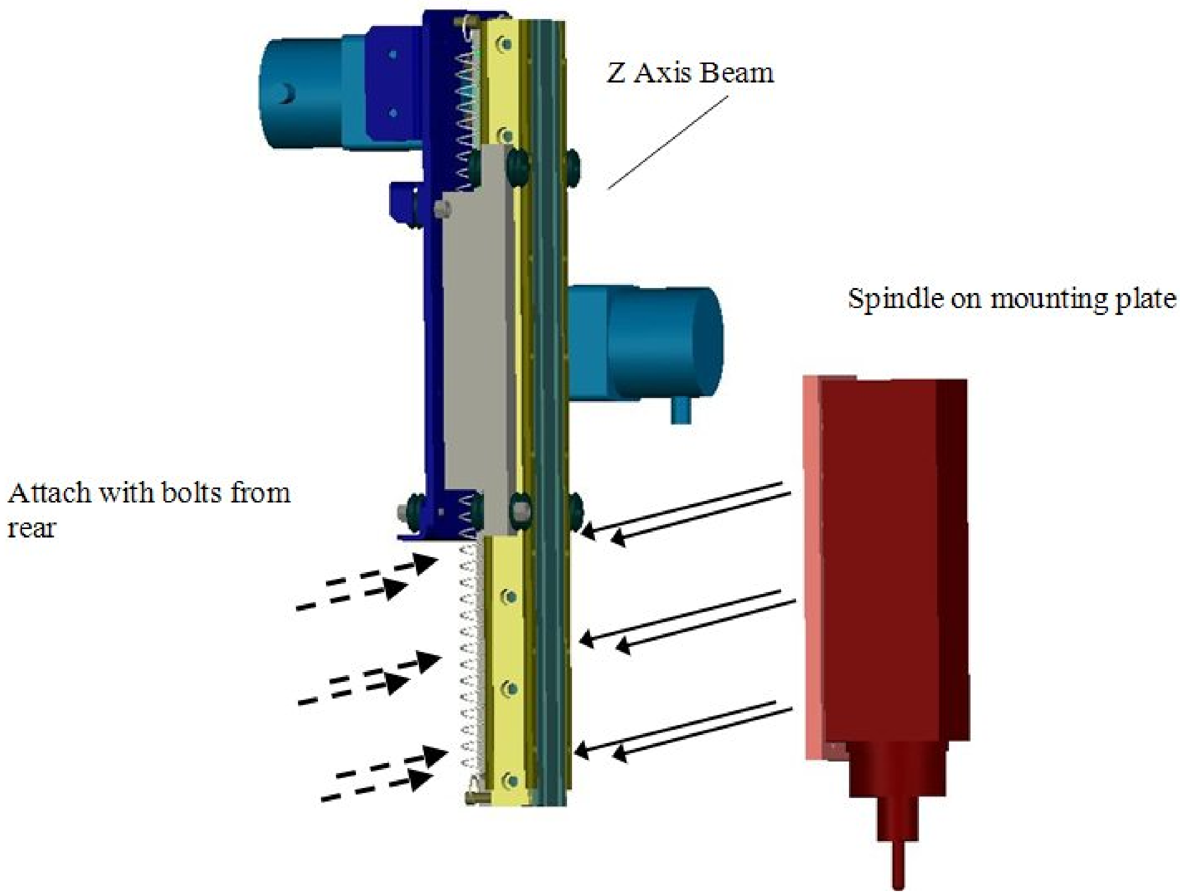


The Porter Cable fits into the aluminum sleeve that is already attached to the Z-axis.

- Remove the plastic insert from the router mount.
- Slide the router barrel into the plastic insert and then into the aluminum sleeve. Note that there is a hole in the plastic insert for so that the grounding screw can be tightened into electrical contact with the router shell. Line this up when you are inserting the router into the mounting sleeve.
- Tighten the router into the bracket with an Allen wrench. Then tighten the grounding screw "hand-tight".

If You Have a High Frequency Spindle:

The spindle will come fitted with a custom aluminum backing plate. This plate attaches to the pre-drilled holes at the bottom of the Z axis using 6, 5/16" socket-head bolts. These bolts pass through the beam and into the plate. As they are tightened, they will seat at the bottom of the groove in the slot..



- Pull the Z axis beam down to expose the back of the 6 bolt holes. Clamp it in position so it does not pull back up while you are working on it. Hold the spindle to the beam and start the 6 bolts into the plate. Note that these bolts have no washers.

- Pull the plate up evenly by tightening all the bolts gradually. Then do a final tightening of all the bolts.

- To mount the spindle, move the gantry up to the far end of the table. Pull the Z axis beam down to expose the back of the 6 bolt holes. Clamp it in position so it does not pull back up while you are working on it. Hold the spindle to the beam and start the 6 bolts into the plate. Note that these bolts have no washers.

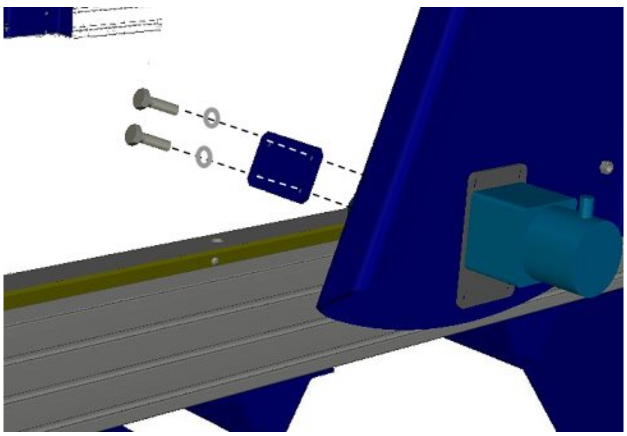
After Mounting the Router/Spindle

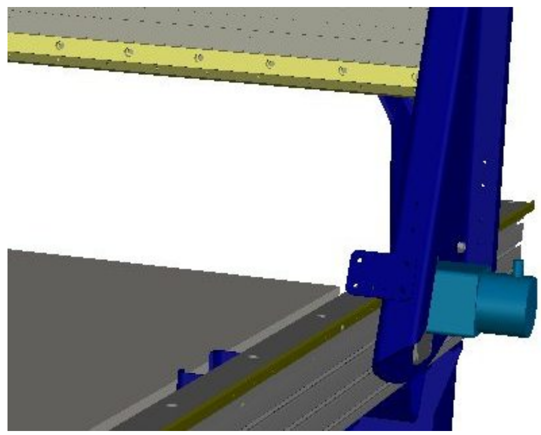
Now you will run the wire for motors and accessories and do a little tidying up, then you'll be ready to plug in your tool, test it out, and put it to use. We will use a lot of wire-ties in this step, so in addition to your other tools, get the wire-tie bag handy and a set of nippers to trim them with. If you have never done it before, note that if you need to cover a long distance with ties, you can piggy-back 2 or 3 of them together to create a larger loop.

Wheel Guards

The guard plates are universal and come in a package of 7; others will be used below. You'll find all the hardware in a packet

Put all 4 of the Wheel Guard plates on now. Mount a Wheel Guard on the leading and trailing edges of each X-Car End Plate outside each of the 4 Wheel Bearings. Attach to the End Plates using two, ¼" socket-head bolts and lock washers.





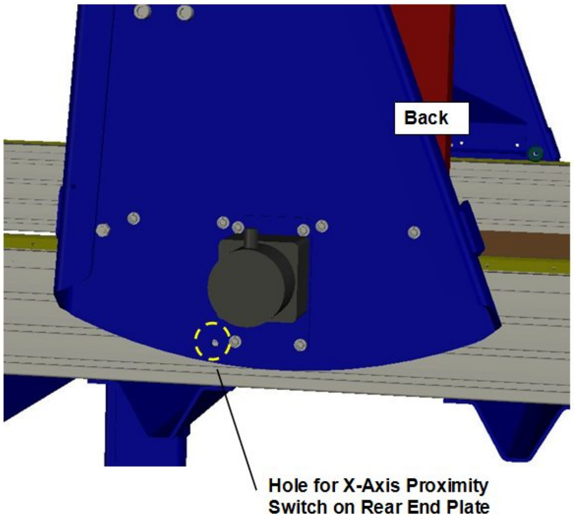
Proximity Switches

You'll find the Proximity/Limit Switches, targets and mounting hardware bagged together. These switches are used to set the zero location for the X- and Y-axes, and also serve to signal the end of the axis to the tool and limit its motion. They switches look like a piece of threaded rod with a wire exiting from one side. Mount these sensors on the YZ-Car and on the back of the X-Car.

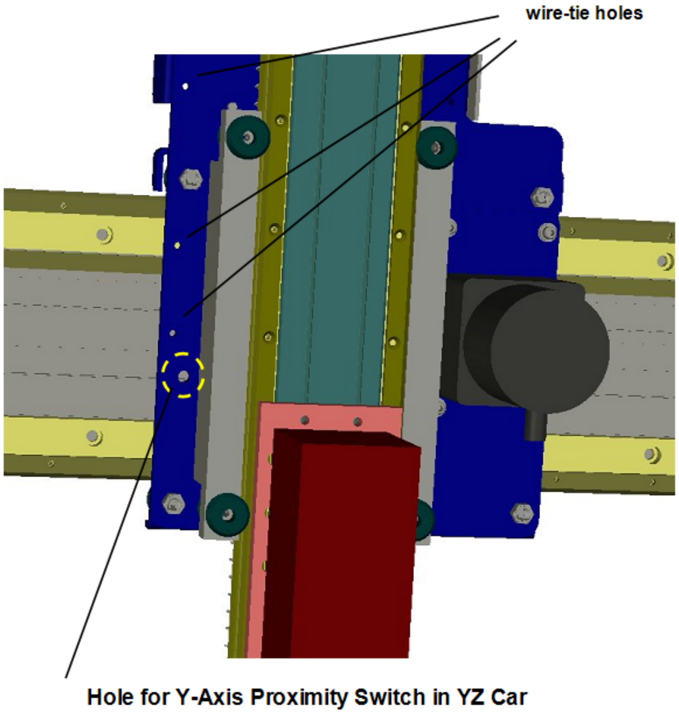
Install the Proximity Switches

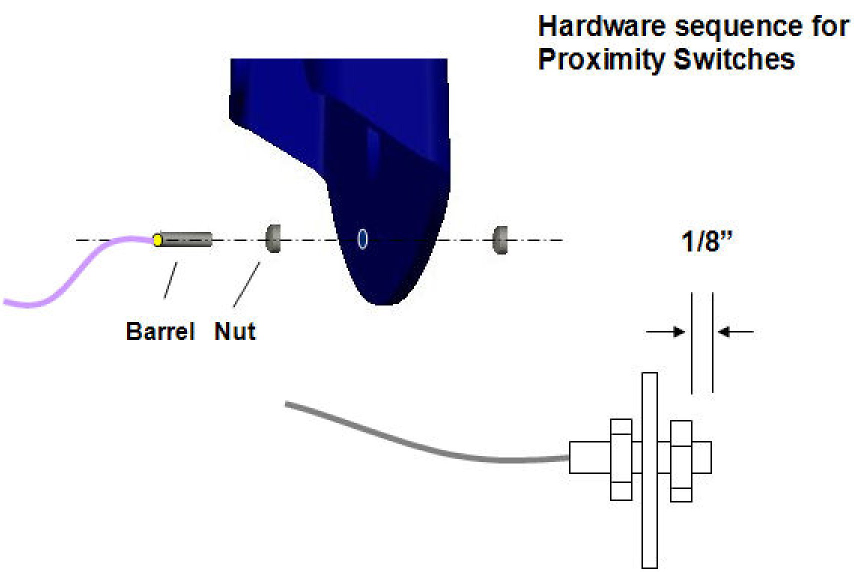
- Attach the switches as indicated, with a nut holding them on each side of the plate. The switches should protrude about 1/8" from the inside of the car.

- Mount one Proximity Switch (for the X-axis) through a hole in the bottom of the rear End Plate on the X Car.



- Mount the second Proximity Switch (for the Y Axis) through a hole on the left side of the YZ-Car.





Y-axis Targets

Look at the front side of the Y-Axis Beam on the X Car. You will see t two bolt heads sticking up in the grooves between the two rails. These are the targets for the proximity switches (the switches work by electrical induction).

- Push the Proximity Switch over these targets and check the spacing. You want about a 2mm gap (.08") between the target and the Proximity Switch. After you get your tool connected, you can check and adjust these targets.

X-Axis Targets.

In your hardware pack, you will find hardware for 2 additional targets. After you get the tool running, you will set these at the appropriate location and set the switch to the height to just clear the target. See Test Spin???

Z-Zero Plate Holster

The Z-Zero plate is a narrow stick of aluminum that is used to set the zero position of the Z-axis of your tool. This can be set to the height of the material you are working with or to your table surface and is typically done. after you have changed cutters or materials. You'll find it with its cable in a bag in your shipping crate.

Mount the Z-Zero Plate Holster anywhere that is convenient for you, either on or off the tool. Here we'll describe how to 'holster' it on the tool, near where you will need it. The holster is made of two pieces of aluminum channel that capture the Z-Zero Plate from the side. We find the best location in our use to be in the middle of the Z axis beam if you are using a router, or on the side of the spindle if using a spindle.

You can go ahead and install the holster brackets now so that you can run the wire along with other cabling, or you can wait until you've used the tool for a while to decide if you want the Z-Zero plate on the tool, or at your work station.

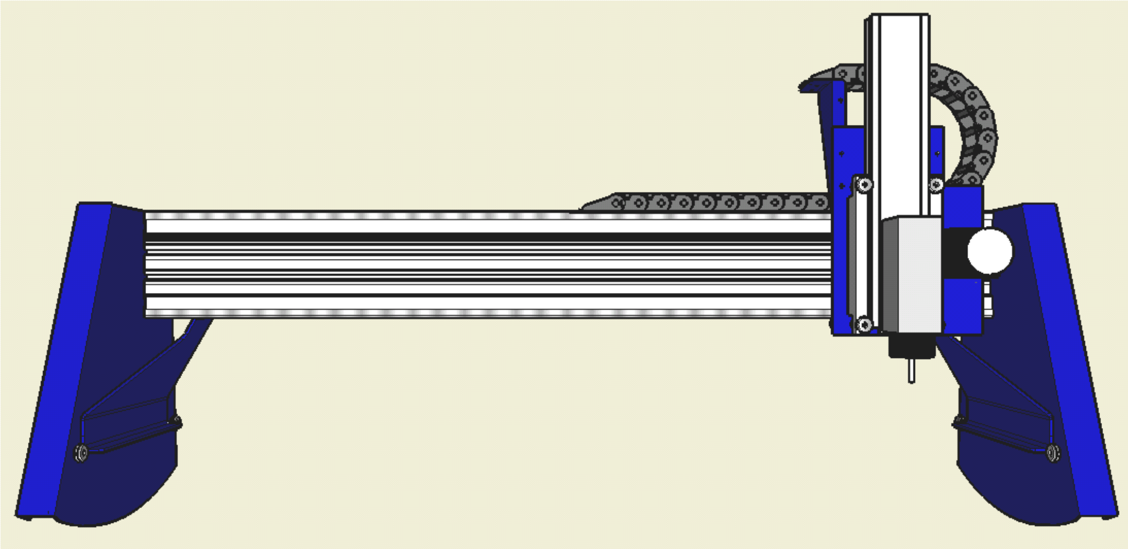
The channel pieces have adhesive on the back that is used to mount them. Mount them so they will just capture the plate as it slides in and jam tight at the bend at the top. The adhesive also electrically isolates the plate when not in use.

Note that the cabling for the Z-Zero plate also has a connector that can be used to connect the optional digitizing probe.

Holster positioned for Router

Holster positioned on Spindle

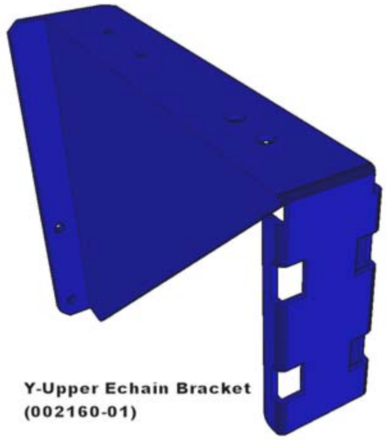
PRS Y-axis EChain Installation



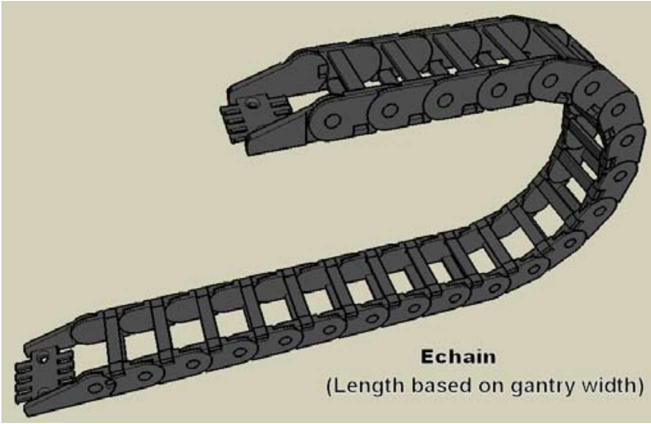
This document shows how to install the Energy chain (Echain) on the Y-axis on ShopBot PRS and PRS BT models. Note that the dust collection hose from the ShopBot Dust Skirt must be routed **overhead** when an Echain is installed; the Y-upper Echain bracket has a fixed attachment point for the dust collection hose.

The Y-axis Echain Components

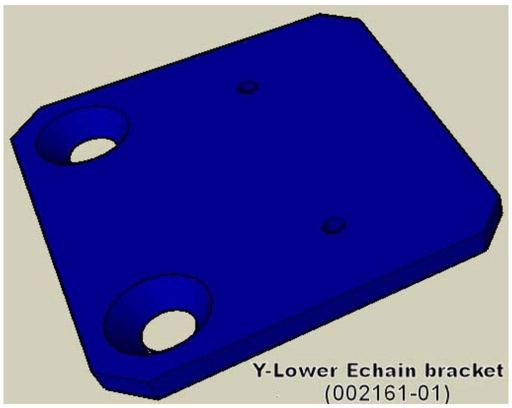
The Y-axis Echain has three main components and a few specialized pieces of hardware.



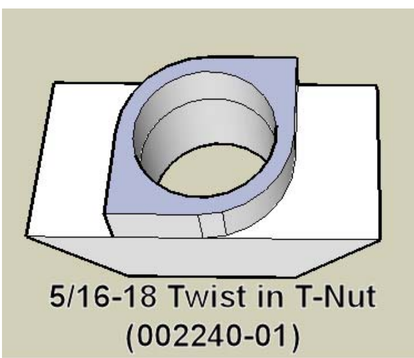
The Y-upper Echain bracket (002160-01) mounts to the back of the YZ-car and carries the Echain. Hose clamps in the slots of the tab support the dust hose. This bracket is mounted on either the left (PRS) or the right (PRS BT) of the YZ-car if you are looking at the spindle head on.



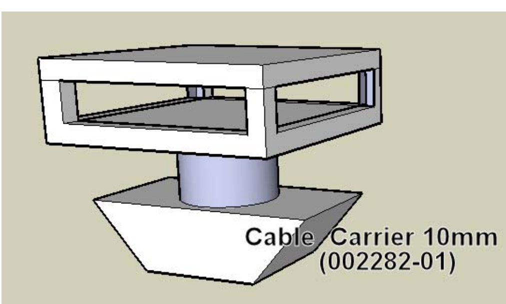
The Echain comes in the length to match the width of the Y-axis of the ShopBot ordered. These Echains are center mounted so the Echain itself will not physically extend from the end plate to the Y-upper Echain bracket.



The Y-lower Echain bracket (002161-01) mounts to the top of the Y-beam extrusion and holds the Echain at a fixed location near the center of the gantry. Location of this bracket differs on various width ShopBots. A chart is included later in the instructions..



One of the specialized pieces of mounting hardware is the 5/16-18 Twist in T-Nut (002240-01). Two of these are used to mount the Y-lower Echain bracket to the Y-beam extrusion. They slide into the slot of the extrusion and turn 90° when tightened.

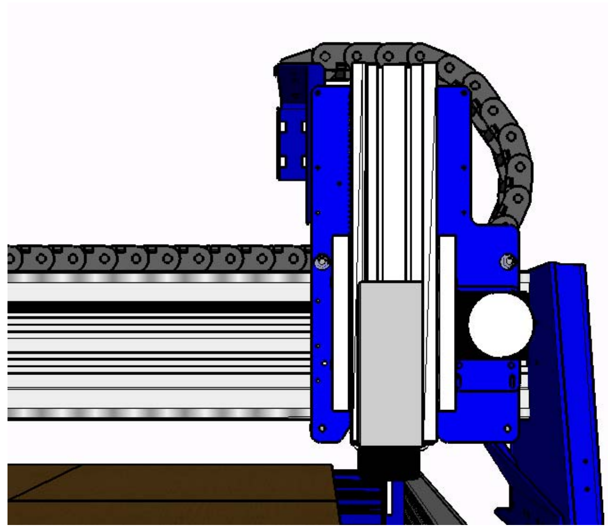


The last piece of specialized hardware is the cable carrier (002282-01). These slip inside the slot of the Y-beam extrusion and turn 90° to help with wire management for cables going through the Echain. Zip ties are used in combination with these to achieve this.

Other hardware used to mount these will be called out through out this document when needed.

Mounting the Y-axis Echain on the PRS

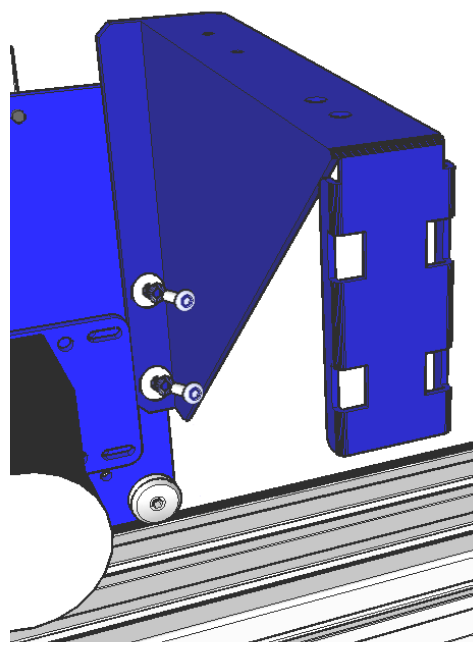
Remove any previously-installed wire guide and wire guide brackets from the gantry and YZ-car if necessary. When the YZ-car is viewed head on, the Y-upper Echain bracket will be located on the back left side of the YZ car and the Echain will loop to send the cables toward the back of the ShopBot.



Step 1: Installing the Y-upper Echain bracket.

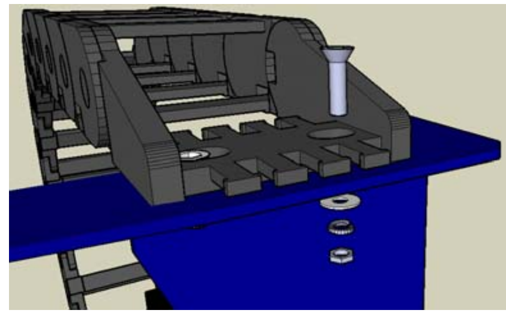
- (1) Y-upper Echain bracket (002160-01)
- (2) ¼-20 x 1/2 socket head screws
- (2) ¼" lock washers
- (2) ¼" flat washers

On the back left side edge of the YZ-car there are 2 ¼-20 holes. Align the holes in the longest tab of the Y-upper Echain bracket with the tapped holes of the YZ car. Using the ¼-20 screws, lock washers, and flat washers, secure the bracket tightly to the YZ car.



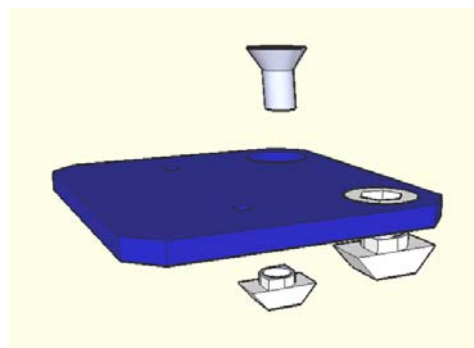
Step 2: Mounting the Echain to Y-upper bracket

- (1) Echain
- (2) 10-32 flat head screws
- (2) #10 flat washers
- (2) #10 lock washers
- (2) 10-32 hex nuts



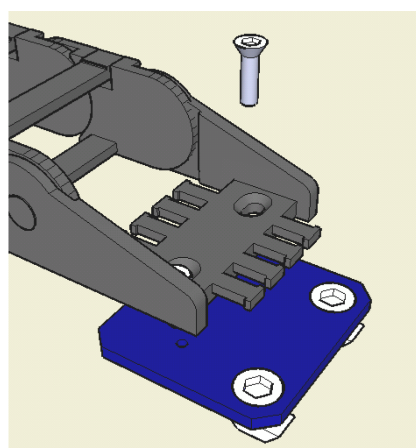
Position the Echain so that it loops towards the right when you are facing the front of the YZ car. Align the counter sunk holes in the Echain with the holes in the top tab of the Y-upper bracket. Use the screws, flat washers, lock washers, and hex nut to tighten the Echain to the Y-upper bracket.

Step 3: Mounting the Y-lower Echain bracket



- (1) Y-lower Echain bracket (002161-01)
- (2) 5/16-18 Twist in T-Nut (002240-01)
- (2) 5/16-18 x 5/8 flat head screws
- (2) 10-32 x ¾ flat head screws

Place the 5/16 flat head screws into the Y-lower Echain bracket. Start a few of the threads of the twist in T-nut onto the screws.

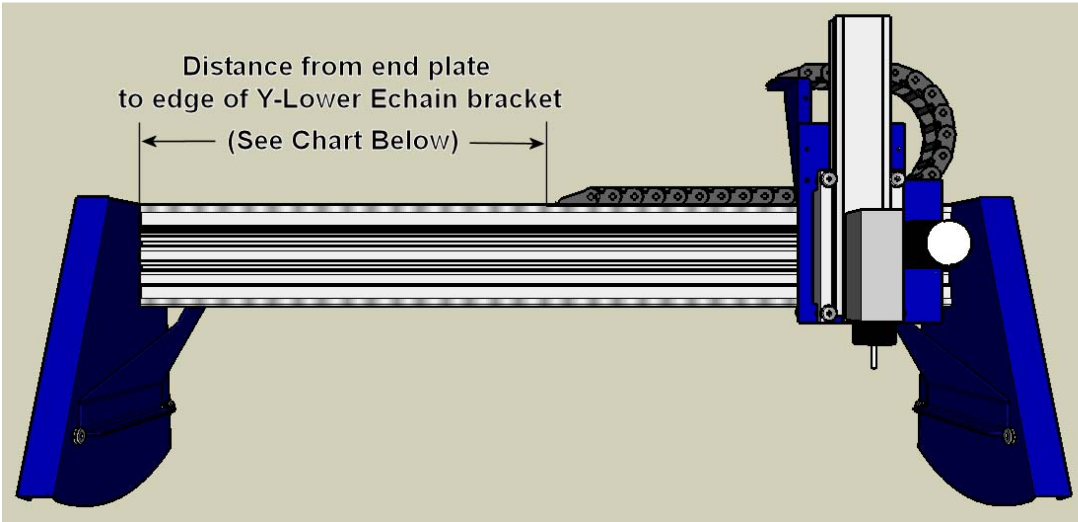


Align the counter sunk holes in the Echain with the holes in the top of the Y-lower bracket. Loosely start the 10-32 x ¾ screws into the Y-lower Echain bracket. Position the Y-lower bracket the correct distance from the back side end plate on the PRS ShopBot from the chart below.

Note: Distances are measured from the edge closest to the counter sunk holes of the Y-lower bracket to the inside edge of the back side end plate.

Tighten the 5/16-18 flat heads and Twist in T-nuts into the slots of the gantry extrusion and then tighten the 10-32 screws fully.

Chart showing distance from End Plate to edge of Y-Lower Bracket



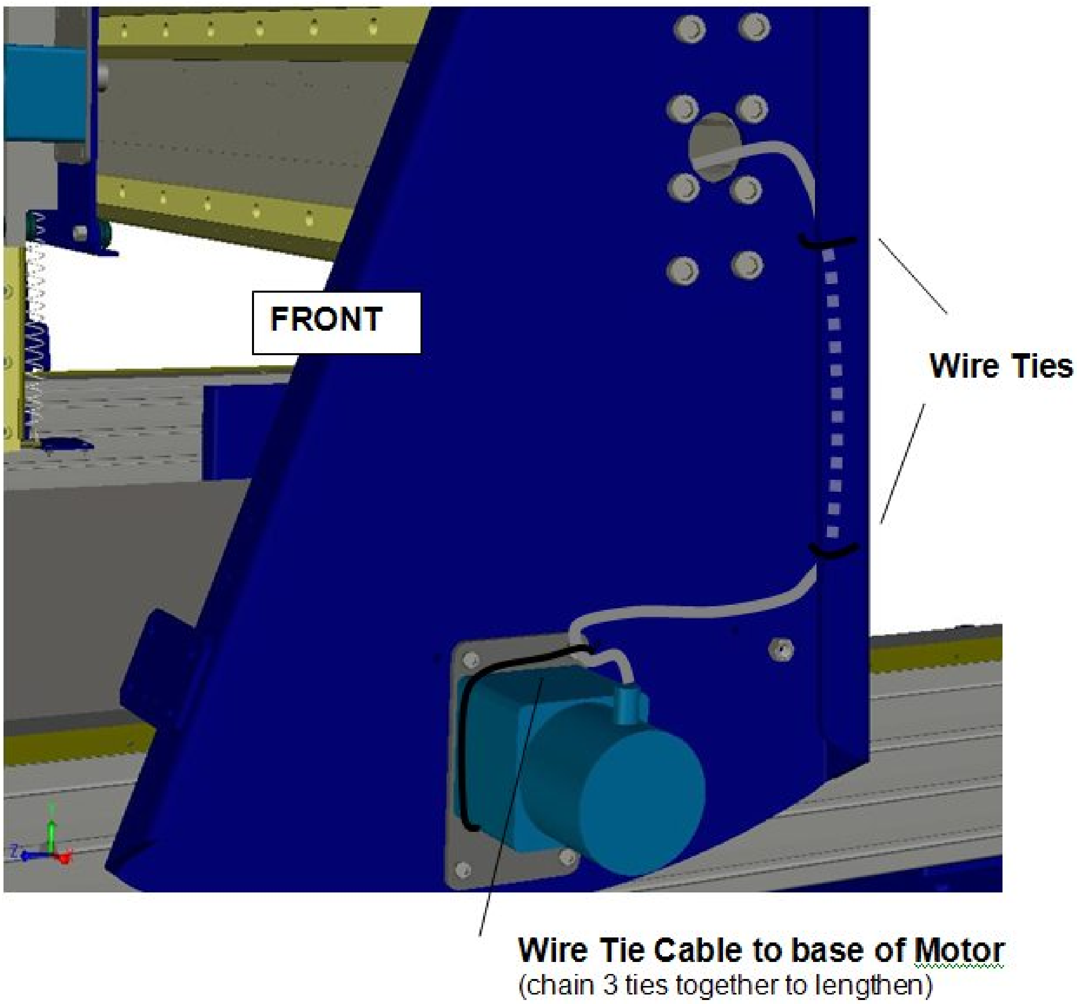
Cutting width in Y-axis (Beam length)	**Distance between end plate and Y-lower bracket**
32in (47.992in or 1219mm)	22.50in (572mm)
48in (66.338in or 1685mm)	31.50in (800mm)
60in (78.346in or 1990mm)	37.50in (953mm)
72in (90.354in or 2295mm)	43.50in (1105mm)
108in (126.456 or 3212mm)	61.50in (1562mm)

After the Echain is installed, move the Y-axis back and forth the full extent of travel. The Echain should at no time feel as though it is binding or under tension. If this appears to be the case, loosen the 5/16-18 flat heads and adjust the Y-lower bracket slightly.

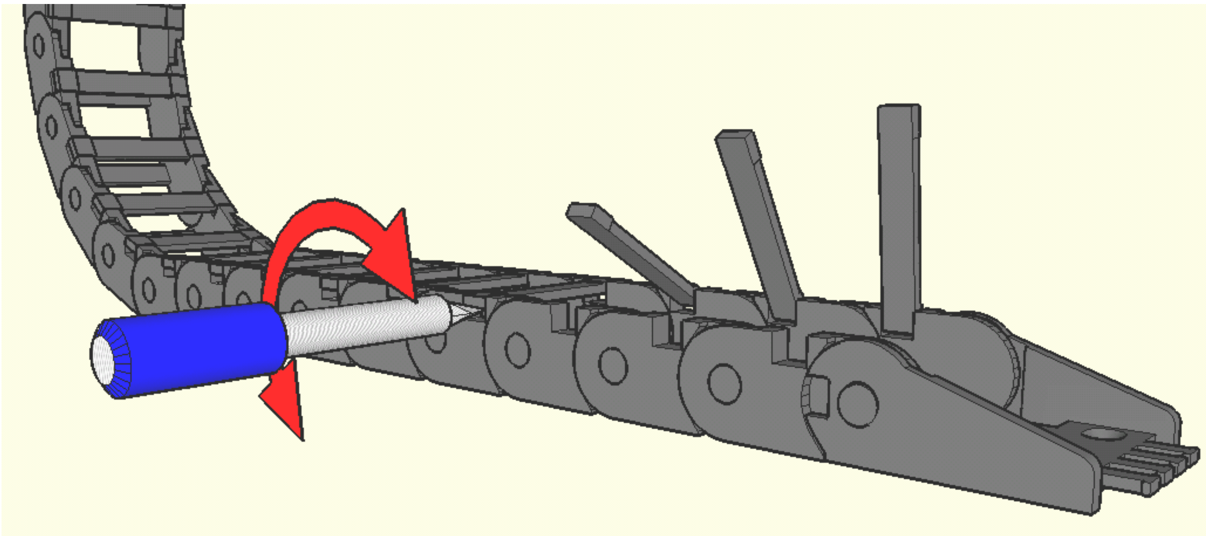
Secure cables and wiring

Use a chained wire tie (link 3 standard wire ties together) and secure the X-2 Motor Cable to the base of the X-2 Motor.

Run the cable to the back side of the front End Plate, and secure it with two wire ties behind the back lip of the plate.



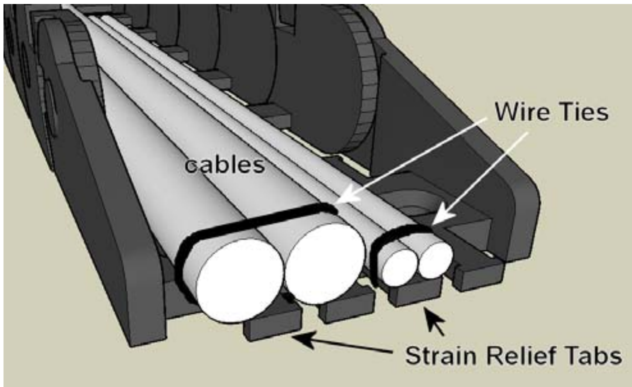
Opening the Echain



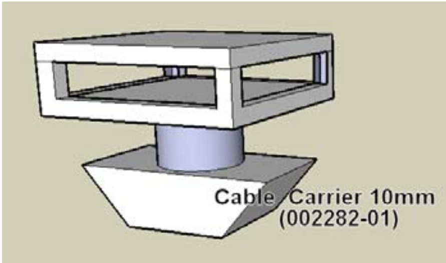
Move the YZ-car to the far end of the Y-axis so that the motor is not over the Echain. This keeps the motor from interfering with the hinged access bars. With a flat head screw driver, insert the tip into either side of the hinged access bar. Turn the screw driver approximately ¼ turn clockwise and then ¼ counterclockwise or until the sides of the access bars release. Open the access bars to run all wiring that is common to the YZ-car, spindles, or air drills.

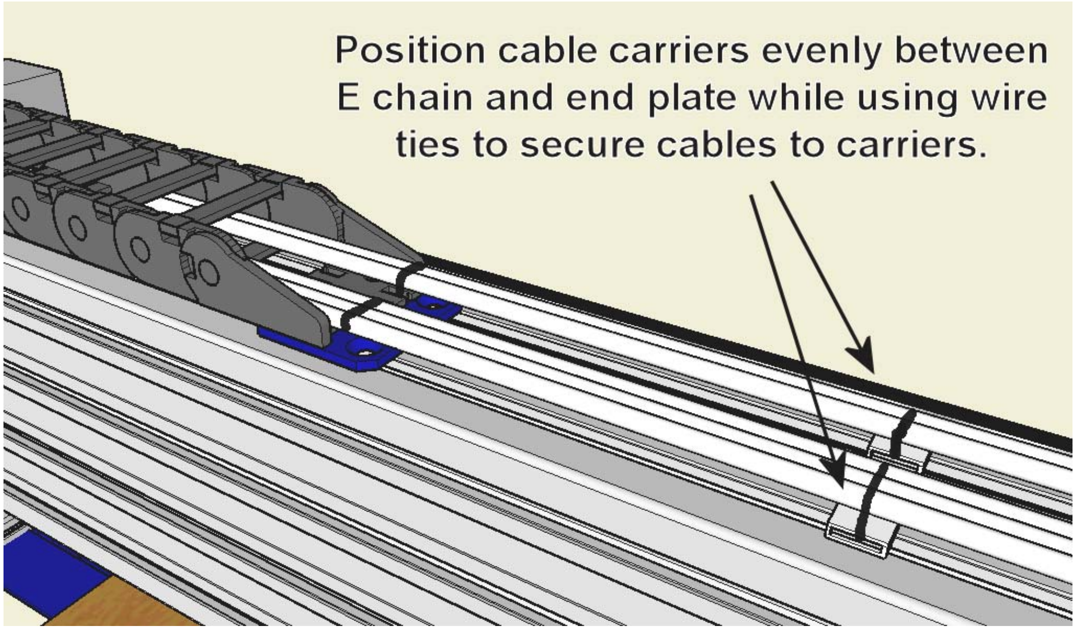
Caution: Do to the low clearance of the Z motor in relation to the Echain. DO NOT attempt to move the YZ-car while the hinged access bars are in the open position. Doing so will result in the snapping off of these access bars.

Use wire ties in addition with the strain relief tabs on the ends of the Echain to help with the strain relief of the cables. **DO NOT use wire ties inside the Echain. This could result in added strain on the cables.**

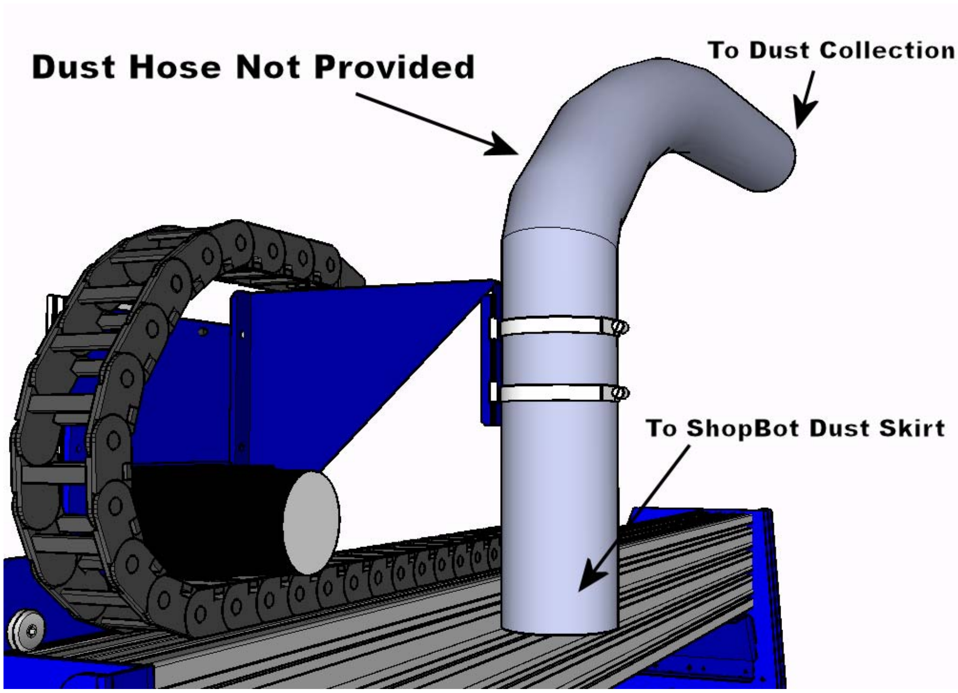


Place the cable carriers on the top side of the gantry extrusion. Evenly space these between the Y-lower bracket and the end plate inside the 2 slots in the extrusion. Place the lower end into the slot and turn 90° to lock the cable carrier in place. Use wire ties to secure cables along the length of the gantry and off the back of the machine.





Connecting Overhead Dust Collection



The Y-upper Echain bracket has a tab that comes with two hose clamps to hold a 4" overhead dust collection hose. Neither the hose nor the dust collection system is provided by ShopBot. Extend the length of the overhead dust hose to the ShopBot dust skirt and connect the dust skirt. For more information about the installation and use of the dust skirt, please see **Installing the PRS Dust Skirt** (SBG00326DustSkirtPRS). Make sure that there is enough hose to accommodate the lowest position of the Z axis, then secure the hose to the Y-upper Echain bracket with the provided hose clamps.

Run the YZ Wiring

You'll run the wiring from the YZ motors, router/spindle, proximity switch, and Z-Zero plate (if mounted) from the YZ Car, through the Echain. You will tie the router/spindle cable on the left side of center, and the motor and accessory wires to the right side of center. You want to keep the electrically-noisy router/spindle wires as separate as possible from the other wires.

As you are first laying the wires out, only tighten the wire ties in a loose loop. After you are sure everything is in the right place you can draw the ties tight and trim them. Later, you can also attach your dust collector hose.

- Now run the router/spindle wire directly from the router/spindle using a large loop and attaching it at the second wire-tie, The loop from the router/spindle should allow the router/spindle full motion without the wire being in danger of chaffing on the Z beam or YZ Car.

- Before running the motor wires, secure them first as they exit the motor, close to the base of the motor using a long wire-tie (3 linked together).

- Note that for the Proximity Switch, there are two holes for securing the wire up to the wire guide. Make sure this wire can't get under the wheel bearing.

Neaten up the Wiring at the Back Side of the X Car

Wire-tie the X-1 Motor Cable to the base of the motor with a lengthened wire tie.

Secure all the cables coming from the Echain (except the router/spindle cable), along with the X-1 Motor Cable, behind the rear lip of the Back End Plate using 2 wire ties.

Create a Cable Loop on the way to the Control Box

- From the point where the cables leave the back of the X Car, you can tie the motor and accessory cables into a single bundle with a wire every foot or so.

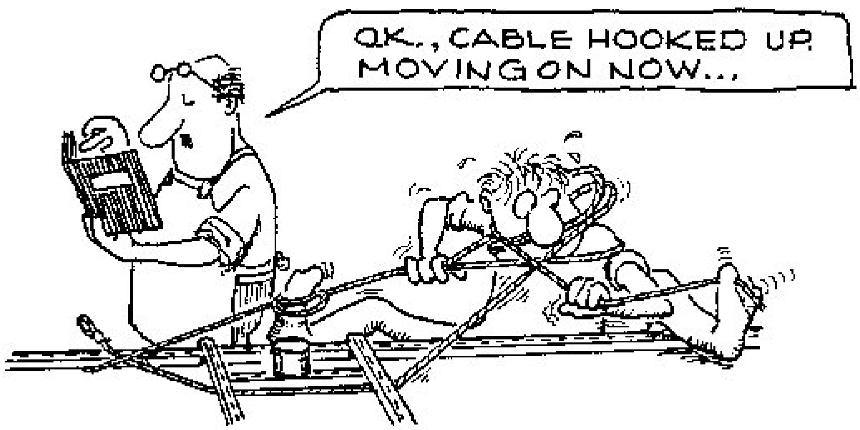
- But don't bundle the router/spindle cable with the other wiring. You will run the Router/Spindle cable over basically the same route as the Motor Cables. But avoid having it any closer or more parallel than necessary by letting it hang slightly differently, etc.

- Use the remaining 3 universal Bracket Plates to attach the wiring to the bottom of the table. Use 5/8" ¼" bolts and Tee-nuts in the bottom groove and then wire-tie through the holes in the plate below.

- Create a large loop in both the Motor Wire Bundle and the router/spindle cable as it exits the X gantry. This loop should be just long enough that the car is able to transit from one end to the other of the tool without straining the cable.

You've now completed assembly of your PRS CNC Tool and are ready to connect it to the Control Box and try it out. The instructions for hooking up to your Control Box are different for PRSalpha and PRSstandard tools. Make sure to use the correct section that describes the connection process for your specific tool.

Hooking Up to the Control Box



Do's and Don'ts

DO contract with a licensed electrician experienced with industrial equipment to wire the power to the PRSalpha control box, a spindle/VFD and for a displacement or regenerative vacuum blower system for hold-down. Documentation provided with spindles and blowers details their power requirements.

DON'T plug in or unplug motors or motor cables when the control box is on.

DON'T disconnect the motor, or the motor cable at the junction in the Control Box, without first turning off and unplugging the control box. The Control Box for your new ShopBot contains integrated circuit components for driving your stepper motors ('drivers' for short). These drivers are at the heart of the performance capabilities of your tool. Each one has sophisticated logic circuitry for micro-stepping as well as current handling paths that control and rapidly switch four output lines that each deliver up to 60 volts at 2 amps to the motors of your tool. Each chip programs the output to the coils of your stepper motors, regulates the actual currents that flow on a micro-second basis, and moves your stepper motors at up to several thousand steps per second. Despite their current handling capabilities, these chips can be vulnerable to the large voltage spike that occurs if the drive is disconnected under load.

DON'Tt push the tool manually with the motors plugged into the driver but powered off. The motors will send currents back into the drivers. Use the software keypad control of your ShopBot which gives you convenient, full-movement capability. If you need to move the tool manually for a set-up or maintenance task, shut down and unplug the control box, then disconnect the motors before pushing the carriages.

DO use instructions for either the PRSalpha or the PRSstandard – whichever one you have.

Hooking Up Your PRSalpha

Powering the PRSalpha Control Box

The power to the PRSalpha Control Box should be wired into a fused disconnect by a licensed electrician familiar with industrial equipment.

The Power Requirements for the PRSalpha Control Box and Router/Spindle vary according to your configuration. The table below outlines some of the power requirements for different configurations. A schematic for the power requirements for your specific configuration can be found in the door of the PRSalpha Control Box

Since the power requirements for a Porter Cable router and for a Spindle are different, we install different components in the PRSalpha Control Box depending on which you will be using. This is not user configurable. You specified which you would be using at the time you placed the order.

ShopBot Configuration PRSalpha: US Standard, 60Hz

PRSalpha Control Box and Porter Cable Router
220V single phase, 25A circuit. The 2 legs will be split into two 110 circuits inside the PRSalpha Control Box: one for the PRSalpha Control Box, and one for the router.

PRSalpha Control Box and Spindle (3 phase)
110V 25A circuit for the PRSalpha Control Box plus 230V 3-phase circuit for the spindle. Specifications for full-load current of the different models of spindle are provided with the spindle.

PRSalpha Control Box and Spindle (single phase)
110V 25A circuit for the PRSalpha Control Box plus 220V single phase circuit for the spindle. Specifications for full-load current of the different models of spindle are provided with the spindle.

PRSalpha Control Box and two Porter Cable routers
220V single phase, 30A circuit. The 2 legs will be split into two 110 circuits inside the PRSalpha Control Box: one for the PRSalpha Control Box, and one for the two routers.

PRSalpha Control Box and two Spindles
110V 25A circuit for the PRSalpha Control Box plus the appropriate 220V or 230V circuit for the spindles.

ShopBot Configuration PRSalpha: European Standard, 50Hz

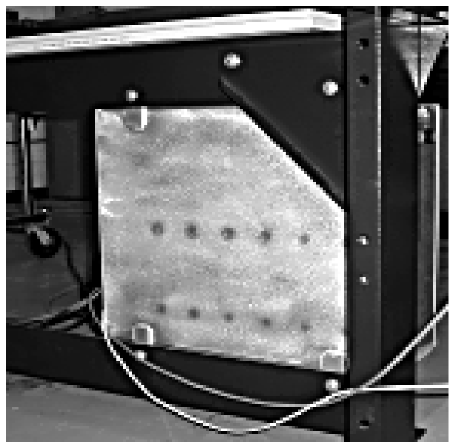
PRSalpha Control Box and 230V/50Hz Porter Cable Router (single speed)
230V single phase line with 15A circuit for the PRSalpha Control Box plus 15A/230V single phase line for the Porter Cable Router.

PRSalpha Control Box and Spindle (3-phase)
230 V single phase circuit (15A) for the PRSalpha Control Box plus 380V 3-phase circuit for the Spindle. Specifications for full-load current of the different models of spindle are provided with the spindle.

Mount the PRSalpha Control Box

Mount the PRSalpha Control Box in a location so that the operator can reach the front of the Box each time a file is run because it is necessary to hit the start button to engage the safety contactors.

There are flanges at the top and bottom of the PRSalpha Control Box for mounting it. One option is to attach it to your ShopBot near the Home position (Lower Left corner). Drill holes through the table cross supports and gussets to mount the PRSalpha Control Box to the Table. The PRSalpha Control Box can also be mounted on the wall near your tool as shown in the accompanying image. Your PRSalpha Control Box may look different depending on the model purchased.



If you mount the PRSalpha Control Box on the table and you also have a vacuum hold-down system, mount the shut-off valves for the vacuum system at the opposite end of the table. Locate the vacuum pump itself and any exhaust pipes away from the PRSalpha Control Box. Vacuum shutoff valves mounted at opposite end of table from PRSalpha Control Box

If you mount the PRSalpha Control Box to the wall, allow ***at least 1 1/2" of clearance*** between the back of the PRSalpha Control Box and the wall to allow heat to dissipate from the PRSalpha Control Box. Allow enough space above and below the box for air to circulate around the PRSalpha Control Box. ***The PRSalpha Control Box enclosure acts as a heat sink for the electronics.***

Explore the PRSalpha Control Box

After the electrician has hooked up your PRSalpha Control Box and router or spindle, it's time for you to get involved again. The electrician is not expected to know how to hook-up the tool itself to the PRSalpha Control Box. That process is covered in the following instructions.

Disconnect electrical power to the PRSalpha Control Box.

Open the side of the box with a screwdriver (quarter turn). Note that the door cannot be opened or closed unless the switch is turned off.

Refer to the labeled picture of the PRSalpha Control Box on the next page.

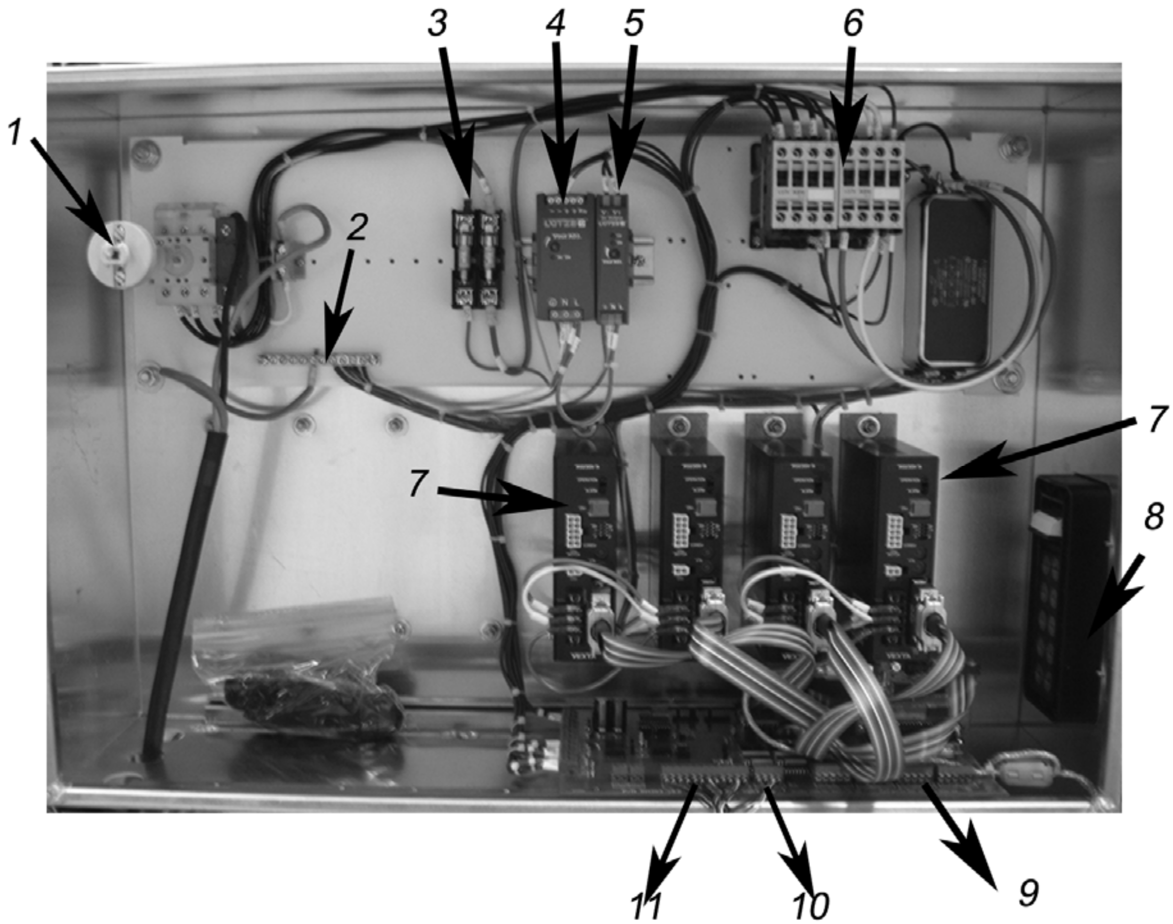
The Contactors, located at the top of PRSalpha Control Box, are the large relays that control power to the equipment. They are controlled by the e-Stop and by software. The size of the contactor may vary with the power requirements of the device it is powering. Additional contactors for additional devices (example, second router or spindle) are added to the left of the standard contactors.

The Fuses in the PRSalpha Control Box (US 60Hz power) are dependent upon the setup:
Porter Cable router (single): 1 30A fuse, 1 15A fuse
Porter Cable routers (two): 1 30A fuse, 2 15A fuses
Colombo Spindle: 1 30A fuse, no other fuses (Colombo protected by fused disconnect before the PRSalpha Control Box.)

Troubleshooting: Although the fused disconnect should protect the PRSalpha Control Box, if you lose power to everything in the PRSalpha Control Box, please check the fuses and replace if necessary.

Inside the PRSalpha Control Box

Your box may not be exactly the same as illustrated depending on the model.



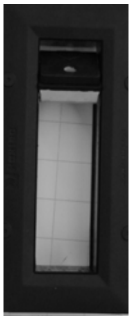
1. Disconnect switch
2. Grounding strip
3. Fuses
4. 24v Power Supply
5. 12v Power Supply
6. Contactors
7. Motor drivers – 4
8. Roxtec Fixture
9. Inputs/Outputs
10. to separate E-stop switch
11. to 3-Button Pendant

Open the Roxtec Fixture

You will be routing cables through the Roxtec Wire Management Fixture attached to the side of the PRSalpha Control Box. This device gives all wires a tight entry and will seal your PRSalpha Control Box against dust and debris.

Take a screw driver to lever open the pivot seal of the Roxtec fixture. There is no screw; just pry it open.

Remove all of the gaskets from the Roxtec fixture.



Once you have attached all of the cables inside the PRSalpha Control Box, you will run the cables through the gaskets and tighten the fixture to keep dust out of the PRSalpha Control Box. You may need to run more than one of the smaller cables in the same gasket.

Plug the Motor Cables into Drivers

Bring the motor cables through the Roxtec opening and plug them into to the drivers which are the black boxes arrayed horizontally in the PRSalpha Control Box (#7 in the open PRSalpha Control Box illustration shown earlier).

Plug each motor cable into its driver. The white plug fits the white receptacle on the driver in only one way. Make sure it is aligned correctly and fully seated.

From the entry point of the cables:

- X1 (one red tape) and X2 (two red tapes) go to the two drivers at the far right. As those two drivers are both on Channel 1 (they move simultaneously), an X motor cable can be plugged into either driver.
- The Y motor cable (blue tape) is plugged into Channel 2, the 3rd driver from the right.
- The Z motor cable is plugged into Channel 3, the 4th driver from the right.
- Additional motors (Accessory Z, etc.) would be plugged into the additional drivers to the left of the 4 standard drivers.

Connect the Emergency Stop Switch and the 3-Button Pendant

The 3-Button Pendant and the separate E-Stop are bundled together for shipping. Both must be attached in order for the E-Stop and the 3-Button Pendant to function. Order of attachment does not matter.

The ShopBot 3-Button Pendant allows you to place the reset, start and extra emergency stop buttons at a convenient location away from the PRSalpha Control Box. It has been prewired so that hooking it up to your PRSalpha Control Box entails plugging the terminal block from the pendant into the control board inside the PRSalpha Control Box. Your PRSalpha Control Box may differ slightly from pictures in the manual depending on which model you have. If you have a 3-Button Pendant, your PRSalpha Control Box will not have Start/Reset buttons.

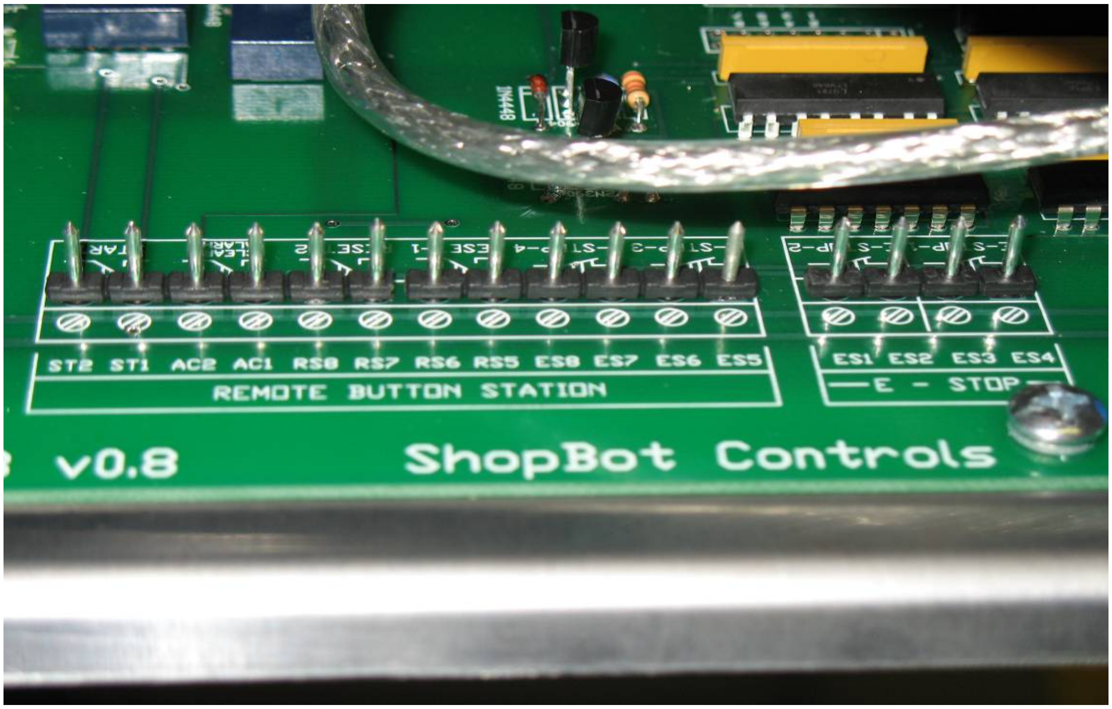
The separate E-Stop Switch also comes fitted with a terminal block that plugs into the Control Board. Power for the router or spindle is routed through the PRSalpha Control Box safety controls so that activating the E-stop by hitting the RED BUTTON will stop the movement of the carriages and power down the router or spindle. We suggest mounting this to the gantry on your machine in an easy-to-access location. See section on Mounting the E-Stop Switch.

Note: If you try to run the ShopBot without the E-Stop connected, Input #4 will flash red on the computer screen and the ShopBot Control Software will not allow the ShopBot to move.

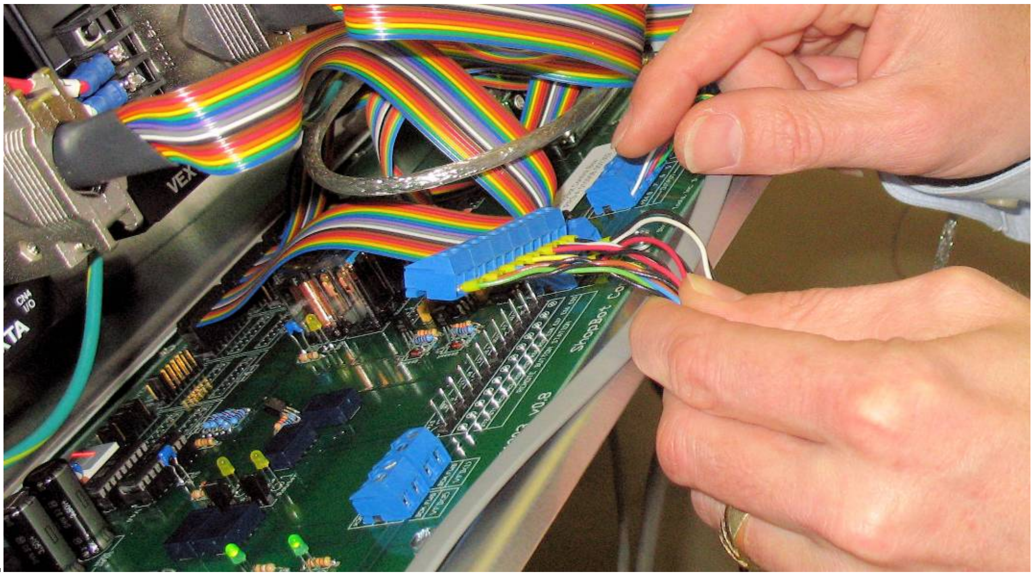
Installation

Run the cables from the 3-Button Pendant and the separate E-stop switch into the PRSalpha Control Box through the Roxtec opening and plug in the terminal blocks as shown below.

Below: The PRSalpha Control Box before the terminal block from the 3-Button Pendant is attached. Note that the terminal block for the separate E-Stop has not been attached yet.



Below: The terminal block from the separate E-Stop has been plugged in and the 3-Button Pendant block is being positioned.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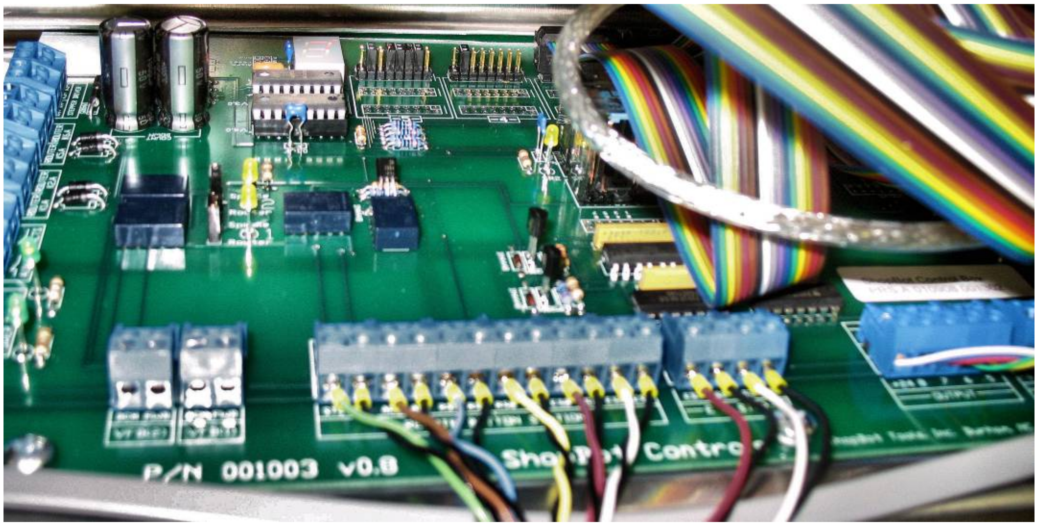
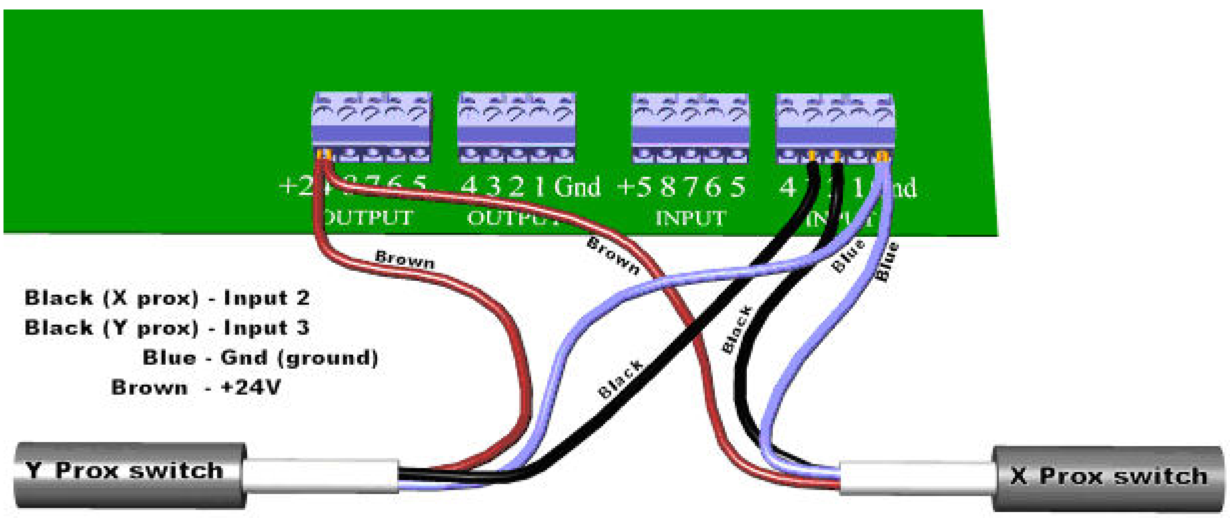
Below: Terminal blocks from the 3-Button Pendant and from the separate E-Stop in place.



Connect Cables from the Proximity Switch and Z-zero Plate

Run the cables from the proximity switches and the Z-zero plate through the Roxtec opening into the PRSalpha Control Box.

Inside the PRSalpha Control Box, take the Proximity Switch cable for the X-axis and place its black wire into Input 2 on the blue terminal block on the control board. Then take the Proximity Switch cable for the Y-axis and place its black wire into Input 3 on the same blue terminal block on the Control Board. The blue wires from both of the switches are placed in Gnd (ground). The brown wires from both of the switches will be placed in the +24V position on the blue output terminal block. Note that the terminal blocks can be removed to make wire insertion easier.



When the PRSalpha Control Box is powered up a red LED in the body of the proximity switch out on the tool will stay bright until it is triggered by coming near a target.

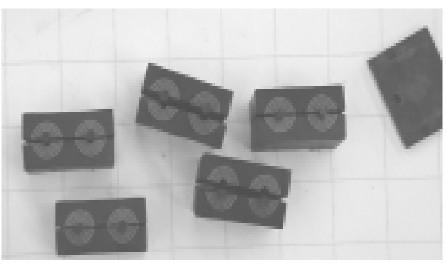
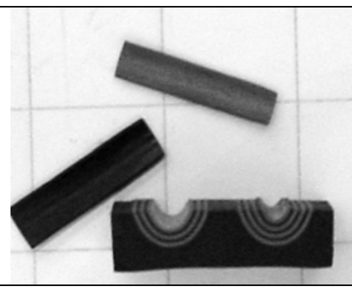
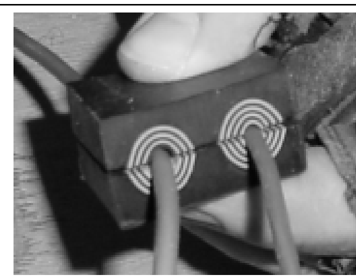
Now also plug in the Z-zero plate. The black wire goes in the Input#1 terminal and the white (or green) wire goes into a ground terminal (Gnd; you can use the one on the Input terminal block or the one on the Output block). The red wire goes to 5+ (it is only used by the Digitizing Probe).

There is USB cable connector for attaching the USB cable that will connect your PRSalpha Control Box to your computer. It is a short cable that exits on the right side of the Control Board. Plug the longer 10ft cable supplied with your ShopBot into this connector and run the longer cable out of the PRSalpha Control Box through the Roxtec fixture. Do not plug the USB cable into your computer at this point.

Seal the Cable Entry

When you have attached all the cables in the PRSalpha Control Box, it's time to put the gaskets around them and close up the Roxtec fixture.

The Roxtec system is designed to keep dust out of the PRSalpha Control Box. Take a moment to fit each of the cables into a gasket so that the cables fit snugly and the two halves of the gasket close well. It may be necessary to run two of the smaller cables through a single gasket. This also provides an element of strain relief if the cables are inadvertently pulled.

- The blue and black layers of the gaskets are layered like an onion. Take out the blue and black layers out one at a time (alternating sides) until cable fits snugly in the gasket.
- Position each gasket with cable into the fixture. Apply a small amount of the lubricant on the outside of each gasket so the parts are slightly sticky. When all the cables are placed, fill in with the rest of the empty gaskets.
- Fit the shim into the top of the 5 gaskets.
- Using a screwdriver, close the pivot to seal the Roxtec.

Ground the ShopBot PRSalpha

The Table of the ShopBot should be grounded to System Ground at the power box that supplies the PRSalpha Control Box. Attach the grounding wire (14-16 gauge) at a convenient bolt on the table, making sure to scratch off paint under the bolt.

Remember that your dust collection system should also be grounded to the System Ground. See alpha Dust Skirt Documentation for details on grounding the alpha Dust Skirt hoses to the Dust Collection device.

Connect the USB cable from PRSalpha Control Box to computer

If you have not installed the ShopBot Control Software on the computer, do it now. This will install the driver for the USB cable.

On many computers, there are multiple slots for the USB cable. Once you have decided on the one you are going to use, always plug the ShopBot USB cable into the same slot. Plug the USB cable into the USB port on your computer.

The USB cable provided is 10 feet long. If it is necessary to increase the length of the USB cable, use a USB 2.0 hub at the junction between the cable sections. Using a cable longer than 10 feet without a hub as a booster may result in loss of signal or increased electrical interference.

Hooking Up Your PRSstandard

Plug the Motor Cables into your PRS Standard Control Box

Remember the earlier warning…your PRS Standard Control Box should now be turned off and unplugged, correct?

Lay the PRS Standard Control Box down on its side (connectors down) and remove the two screws holding on the right side panel. Pull off the side so that you can work on the Control Board.
As you are plugging the motors wires into the PRS Standard Control Box, note that the connectors are keyed and will only fit one way. Make sure they are fully inserted and locked into position.

- The X1 (single red tape) motor cable goes into the connector at the top of the driver board visible at the back of the PRS Standard Control Box labeled X1.
- The X2 (double red tape) connects into the X2 connector, second from top.
- The Y (blue tape) cable goes into the Y connector, third from top.
- The Z (white tape) cable plugs into the Z connector, fourth from top.
- A second Z motor (yellow tape) plugs into the A driver connector, bottom.

Connect the Cable from the Remote-Stop Switch

The PRSstandard comes with a Remote Stop Switch (Stop). Hitting this 'Stop' button will immediately stop the motion of your PRSstandard tool and keep it stopped until the switch is unlocked. ***Power to the electrical cutter on your ShopBot is NOT turned off by this button.***

At the very back of the board, you will see 4 blue connectors with screw terminals. These blue connectors can be removed to install wires…just pull straight up on them. After you've made the connections, carefully place the wires back in the same position. Notice that the terminals are labeled on the circuit board underneath.

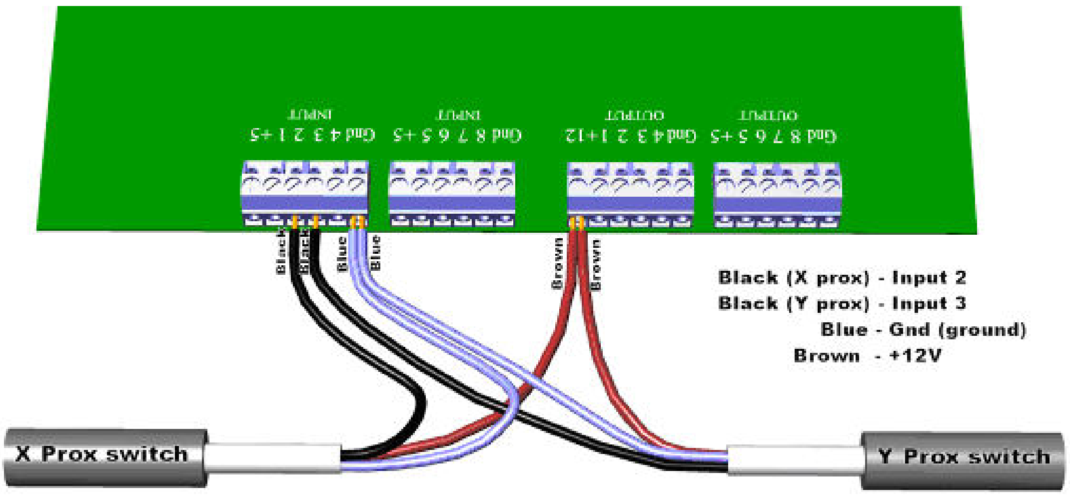
The 2 blocks towards the bottom of the box are the connectors for 'Inputs'. The 2 toward the top are for 'Outputs'. At this time, we will just be dealing primarily with the Input plugs.

The Stop button has two, normally closed switches (white/red; black/green). We will wire in only one switch using the black and white (was green in older models) wires.

The white wire from the Remote-Stop is connected to the Ground connection at the left side of the Input connector. The Black wire is connected to Input terminal #4, which corresponds to Input Switch #4 in your ShopBot Software. Using a tiny screw driver, snug up the wires into the correct location.

Connect the Cables from the Proximity Switch and Z-zero Plate

Inside the PRS Standard Control Box, take the Proximity Switch cable for the X-axis and place its black wire into Input 2 on the blue terminal block on the control board. Then take the Proximity Switch cable for the Y-axis and place its black wire into Input 3 on the same blue terminal block on the Control Board. The blue wires from both of the switches are placed in Gnd (ground). The brown wires from both of the switches will be placed in the +12V position on the blue Output terminal block. Remember that the terminal blocks can be removed to make wire insertion easier.



When the PRS Standard Control Box is powered up, a red LED in the body of the proximity switch out on the tool will stay bright until it is triggered by coming near a target.

Now also plug in the Z-zero plate. The black wire goes in the Input#1 terminal and the white (or green) wire goes into a ground terminal (Gnd; you can use the one on the Input terminal block or the one on the Output block). The red wire goes to 5+ (it is only used by the Digitizing Probe).

There is USB cable connector for attaching the USB cable that will connect your PRS Standard Control Box to your computer. It is a short cable that exits on the right side of the Control Board. Plug the longer 10ft cable supplied with your ShopBot into this connector. Do not plug the USB cable into your computer at this point.

Ground the ShopBot PRSstandard

The ShopBot Table should be grounded to System Ground at the power box that supplies the PRS Standard Control Box. Attach the grounding wire (14-16 gauge) at a convenient bolt on the table, making sure to scratch off paint under the bolt.

Remember that your dust collection system should also be grounded to the System Ground. See alpha Dust Skirt Documentation for details on grounding the alpha Dust Skirt hoses to the Dust Collection device.

Connect the USB cable from PRS Standard Control Box to the computer

If you have not installed the ShopBot Control Software on the computer, do it now. This will install the driver for the USB cable.

On many computers, there are multiple slots for the USB cable. Once you have decided on the one you are going to use, always plug the ShopBot USB cable into the same slot. Plug the USB cable into the USB port on your computer.

The USB cable provided is 10 feet long. If it is necessary to increase the length of the USB cable, use a USB 2.0 hub at the junction between the cable sections. Using a cable longer than 10 feet without a hub as a booster may result in loss of signal or increased electrical interference.

The Remote Stop Switch

The Remote Stop Switch comes with a long cable so that the switch can be mounted in a convenient location for your set up. Keep the remote stop switch away from devices that have their own power source, such as the spindle or router, or a vacuum system.

Some ShopBotters carry the Remote Stop Switch with them as they move about their tool. Others mount it on the tool.

Mounting the Switch

- Decide WHERE to mount the switch. One good spot for mounting is on the front side of the X-Car, with the cable run to the back of the tool through the center of the beam. Other possible locations are on the side of the table, at your computer station, or on the wall near the ShopBot.
- Decide HOW you want to attach it. You may use mounting tape, Velcro, or screws.

If you use screws to mount the Remote Stop Switch:

- Open the box by removing the 4 screws on the front cover and insert the mounting screws into the holes in the back of the box.

- Re-attach the cover and make sure that the screws are tightened all the way. If the cover isn't tightened completely, the switch may not work properly. The E-Stop switch itself is designed to fit together only in the correct manner. However, if you take it apart, make sure the screws are completely re-inserted and the top drawn tight on the seal.

- Note that when the lid is fitted back on the box, the switch plungers must slide inside the guide cylinder of the plunger mechanism.

Mission Accomplished!

You might have thought you'd never get here, but: "Mission Accomplished!"

Assembly Appendix

Stopping the ShopBot

Test Spin

Surfacing the Table

Squaring and Adjusting the X-Car

Table Drawings

Stopping the ShopBot

Using the PRSalpha E-STOP

You must be running ShopBot Control Software 3.5.x or higher for these instructions to apply. Go to www.shopbottools.com to download the latest control software.

Once it is properly attached, hitting the E-Stop Switch will instantly stop the movement of your X, Y and Z gantries. The power to the spindle/router, motors, and the rest of your tool will be cut off.

After you have activated the E-Stop Switch, to go back to work you will need to

- Release the red button on the E-Stop by rotating it
- Press the RESET button on the PRSalpha Control Box to send power to the spindle/router and motors on your tool.
- Clear the message box in the control software by pressing “Quit”.
- Re-zero the tool to make sure its location is correct because the motors were turned off

You can return to the location in the file you were cutting and continue from there by using the [FG] Command to start the file in the ‘G’oTo mode.

Use 3-Button Pendant

Place the 3-Button Pendant in a convenient spot for you to operate your machine. Both the **Reset** button and the **Start** button for your Spindle/router are now located on the **3-Button Pendant**, not on the PRSalpha Control Box. The **E-Stop** button on your **3-Button Pendant** and the separate E-Stop Switch function alike

Using the PRSstandard Remote Stop Switch

You must be running ShopBot Control Software 3.5.x or higher for these instructions to apply. Go to www.shopbottools.com to download the latest control software.

Once it is properly attached, hitting the Remote-Stop Switch will instantly stop the movement of your X, Y and Z gantries. Because the spindle/router is connected independently to power, the Remote Stop Switch will ***not*** turn off the spindle/router.

After you have activated the Remote Stop Switch, to go back to work you will need to

- Release the red button on the E-Stop by rotating it
- Clear the message box in the control software by pressing “Quit”.
- Re-zero the tool to make sure its location is correct because the motors were turned off

You can return to the location in the file you were cutting and continue from there by using the [FG] Command to start the file in the ‘G’oTo mode.

Stopping with the Space-Bar or "S" key

In a non-emergency situation, you might want to stop the movement of the carriages without cutting power to the motors. This can be done by hitting the SPACE BAR or the "S"top key. This will stop the movement of all three axes. If the tool is moving slower than 3"/sec, the router bit will stay in its current position. If the tool is going faster than 3"/sec, the movement speed of the X and Y axes will be ramped down, and the cutter will be pulled up and out of the material. The spindle/router will be not shut down.

In both cases, the computer will display a message screen to prompt you for what to do next.

The presence of a Remote Stop Switch does not alter the need to good safety procedures for operating your ShopBot. You should always stand clear of the tool when it is in movement, preferably positioning yourself near the computer controlling the operation. A Personal Robotic Tool can be a very safe power tool as long as all safety procedures are followed.

Take a Test Spin

Next we'll go for a quick trial spin with your tool and do a few tests to make sure things are working as they should be. Then you'll be ready to start putting your ShopBot to work for you!

Run Your ShopBot Now and Check out Some of its Basic Functions.

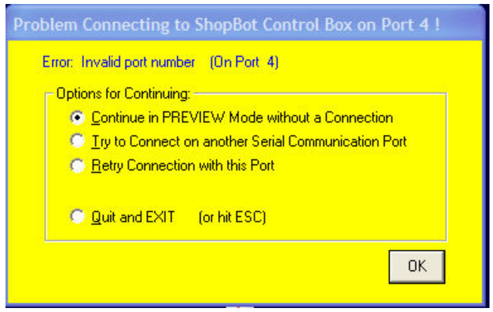
Start the Control Box. If your tool is a PRSalpha, also hit the blue "Reset" button on the box (this activates the relay systems). Your first moves will just be 'air' cuts, so you do not need to have a bit.

Start the ShopBot Control Software. The icon to start the Control Software is labeled "ShopBot 3" and should show up on your Windows Desktop. Double click it to start the software.

If this is the first time you have run the software, you will be prompted to select your tool type from a list. (If you get it wrong, you can correct later with Utilities > Reset.)

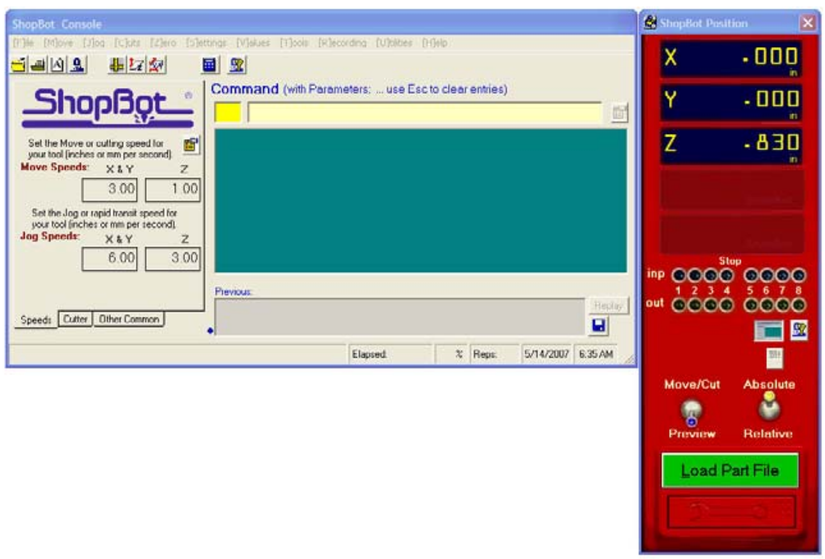
As the ShopBot Control Software begins to start, it should indicate that it is "trying to connect" to your ShopBot If you have run the software in Preview Mode previously, just click the 'Move' Switch on the Red Panel to switch out of the Preview Mode and into Move/Cut Mode. The connection process will start.

If a connection to a ShopBot Tool cannot be established, a yellow screen will come up with suggestions for you to try.



The software tries to establish a connection to your ShopBot on a default communications port number (usually COM4). If the yellow screen appears, choose "Try to Connect on Another Port" and hit OK. Then click the button to 'Automatically Find' your ShopBot. When the correct port is located, click OK. The connection will be established and the port will be remembered for future starts.

There is information in the README file on establishing connections is you have a problem, and also in the Troubleshooting section under Help in the Software.



Once you are connected, the ShopBot Control Software will bring up two Windows. The red one is the Locations Display for your tool. The second screen is the Control Console which is the place you to enter Commands to tell your ShopBot what you would like it to do.
You can use the keyboard or mouse to select commands from the Main Menu bar, or you can enter two letter ShopBot Commands right into the Command Box on the Console.

- Before starting, let's just check a few settings. First, make sure that the Distance Switch on the red panel is set to 'Absolute' (Up). And, then let's set the current location to zero by typing 'Z3' at the keyboard (the Location Display should now show 0 in all axes).

- 'Z3' is an example of a ShopBot 'Command' instruction. From here on, and in the manual Commands will be indicated with brackets, for example [Z3]. With ShopBot Commands you only need to type the two letters in the appropriate space. There are drop-down menus that remind you of the meaning of these Commands letters. This is fun, so relax and enjoy.

- Now we'll try a few moves. Before carrying out any of these instructions, make sure that the area is clear for the power stick to move. And remember, YOU CAN STOP ANY MOVE BY HITTING THE SPACE BAR!

- Try a 1" Z plunge.
    - Use: [MZ] ... first type 'MZ' as the Command, then put '-1' in for the parameter. Remember, negative numbers plunge for the Z axis. Then hit ENTER.
    - You should hear a few seconds of warning beeps, then the Z-axis should start plunging down. It should stop after moving 1" down. You should see the move on the tool, and the new location should show on the display.
    - Now, go another inch down ... you need to use an [MZ] -2 because you'll be moving 1" further down to the location -2.00. OK...? ... Then, return to your starting point at a faster (jog) speed with: [JZ] 0. This should give you a feel for how the Z-axis works.

- Now check out the Y axis in a similar fashion.
    - Let's go 3" in the positive direction on the Y-axis.
    - Use: [MY] 3. Your tool should have gone exactly 3" back (away from you on the Y-axis as you are facing the tool from the front) and the computer display should indicate a Y location of 3.00.
    - Then use [JY] to bring it back

- And give the X axis a try using [MX]. The table/power stick should move.

The 'KeyPad' Control

If all has gone well, it's time to try the KeyPad Control which is a more convenient way to move your tool from the Control Console when it is not running a file.

- Hit 'K' which the shortcut to KeyPad Control (full command = [SK]). You should see a new screen displaying a number of arrow key buttons. You can move your mouse over any of the items on the KeyPad to get an explanation of what they do. But basically, you can click on keys to move your tool, or you can use the equivalent arrow key on you computer keyboard.

- Try driving your tool around with the arrow keys. Use the ESC key when you are ready to close the KeyPad.

- If you want to Zero the X and Y axes in another location, use the KeyPad control to move the tool to that location, escape from the KeyPad control, and use the Z2 command to re-zero.

- If all has worked well so far, jog back to the starting point using both axes. Use: [J2] 0, 0. Your tool should move rapidly back to where you last zeroed it.

Try a Circle

- Do a 6" circle using the built-in circle command: [CC] 6 (The 6 is the only parameter you will need to provide on the 'Fill-In Sheet' that comes up). Your ShopBot should execute a smooth 6" circle.

- Note that the speeds of the motors change as the tool moves through the circle. The motor speed changes in order to maintain a constant vectored speed at the cutter.

Do an 'Air Cut' of a ShopBot Part File

Now let's try running a Part File (a file containing cutting instructions or 'tool paths'). We will do an 'air cut', which means to run it in the air above the cutting bed without the router or spindle running.

- Use: [FP; 'F'ile 'P'art], then use the arrow keys to scroll to the file called "S_SBLOGO.SBP" and hit ENTER (If you aren't in the c:\SbParts folder, you will need to browse to it). All the files which start 'S_' are sample files of one sort or another … you will probably find them interesting and helpful. Use the ['F'ile 'E'dit] Command to check out what's in them.

- We'll ignore the parameter settings on the fill-in sheet for the moment ... just hit ENTER twice again to start air-cutting the file.

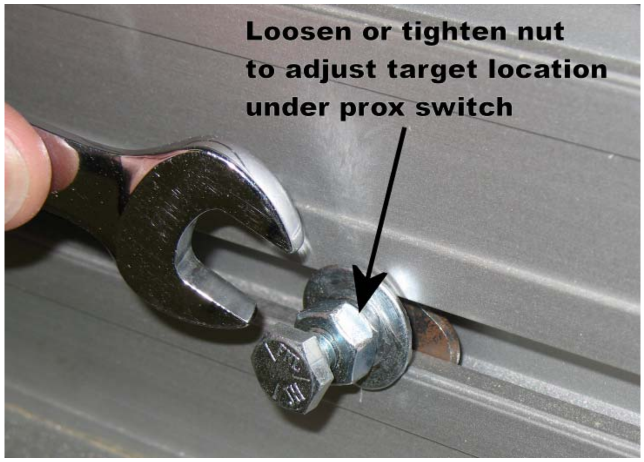
- This file cuts the ShopBot logo (normally you would use a 'V' bit), and you can cut it in all different sizes using the proportion feature in the [FP] Command. Note that the underline portion of the logo cuts first, followed by the letters. The file ends with a couple of 3D moves to carve the shape of the flying wood chips in our logo.

Mount the X-Axis Proximity Switch Targets and Check The Y-Axis Proximity Switch

With your tool powered up and moving, we can finish up getting the Proximity Switches set up.

- Now (assuming you have the End Stops in position to keep the car from coming off the rails) move the car to about 2" from the end of the X track (you'll do both ends, so start at either). This is about where we want the limit switches to trigger.

- In the prox switch kit there are (2) 1/4"-20 bolts, (2) ¼" flat washers, (2) ¼" nuts, and (2) 1/4" T nuts. Place the nut on the bolt, the flat washer, followed by the T nut. Remove the black end caps from the table side and slide the target into the second slot from the bottom, of the table side extrusion. The target should capture the table side between the T nut and flat washer. Tighten the bolt until it begins to tighten into the slot, back off slightly to allow movement side to side.



- Slide the target along the slot until it is just under the Proximity Switch on the X car. Lock the position of the target by tightening down on the top nut and washer.

- Then set the distance between the Proximity Switch and the target to about 2mm by adjusting the Proximity Switch position using the two nuts. In this position, the Proximity LED should be off.

- Use the KeyPad to back off the Proximity Switch. The LED should come back on. You can test the “Limit” Function of the Proximity Switches with the KeyPad. First use the [VN] Command to turn the Limit Switch functionality on. Now use the KeyPad to drive into the switch. Your tool should stop. After hitting a switch, the KeyPad then overrides switches if you use it again, so you can drive off the switch. After you have driven off and released the arrow key. The switches will again function as limits.

- Set the Proximity Switch at the other end of the Table.

- Finally, check the Y-Axis Proximity Switches to make sure it is adjusted correctly and functional.

PartWorks and PartWorks 3D

This can be installed on a separate design computer if you wish. Tutorials will be copied to your computer as part of the installation process. Go to Start > All Programs > ShopBot > Tutorials to open them. The accompanying videos are available for download at www.shopbottools.com > support > documentation

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Surfacing Your Table

One of the first things you'll want to do after getting your ShopBot together and running is to smooth your work surface. Here are a set of general procedures for surfacing your table. There are several ShopBot Commands you will learn about in the process ...

You will want to make sure that you followed the instructions to square up your Z-axis before you start. The smoothness of the surfacing you do will depend on the Z-axis being perpendicular to the table. However, don’t be too disappointed if your surface has distinct tooling marks. After you've finished this surfacing, you will actually be able to adjust the Z-axis with even more precision because you will have a tool-defined, flat plane to measure against. The larger diameter the cutter that you use for surfacing, the less time it will take. But a wider cutter makes it more likely that you will have tooling ridges from the process and increases the load on your router. A .75”- 1.25” diameter bit will probably work well.

This little project is going to generate **a lot of sawdust**. We’d recommend you get your dust collector hooked up and running before starting the actual cutting.
The instructions use values appropriate for a table that is exactly 96” X 48”. If your ShopBot is a different size, the table surface slightly larger or smaller, or you are working in mm, just replace the ‘96’ and ‘48’ with appropriate dimensions for your table (for example ‘32’ and ‘24’ for a BT). *NOTE: If you are using a router bit that does not have a blade for plunging, you need to plunge to the cutting depth outside of the material, and move into the material. The instructions will give you suggestions on how to do this*.

By this point you should have the table surface material mounted on your ShopBot. You should have attached the support board to the table with the carriage bolts (recessed) included in the table hardware. Now, attach a sacrificial board to the underlying support board by countersinking drywall screws. If you can find them, plastic screws countersunk are a good option. If there are warps in the sacrificial board, check to be sure that all the screws are tight.

The table surfacing routine will use the Cut Rectangle **[CR]** Command (with pocketing) in the ShopBot Software to run a surfacing bit over the entire surface of the sacrificial board.

Remember: The **[Esc]** key will back you out of a command that you don’t want. Hitting the **Spacebar or the "S"** key (and Remote Stop on a PRSstandard) will stop the movement of the carriages without shutting down power to the router or spindle. The E-Stop on a PRSalpha will stop movement of the carriages AND shut down power to the spindle/router.

Steps for surfacing your table …

What	**How**
Set the diameter for the bit you are using	**[VC]** (Value Cutter)
Move the router bit to the starting point for the X and Y axes at the **lower left corner** of the table.	Call up the keyboard control **[SK]** (Set Keyboard or just **K**). Use your keyboard arrow keys to move the router into the lower left hand corner of the table (think of the little man). Carefully line up the center of the bit with the corner of the table. *Note: if you are using a bit with no plunge capabilities, move the bit to slightly beyond the material so that the bit plunges outside the material, and moves into the material to cut.*
Make that point 0,0 for the X and Y axes	**[Z2]** (Zero 2D)
Lower the router bit onto the surface of the board	Call up the keyboard control **[SK]** or **[K].** Use the PageUp and PageDown keys to raise and lower the Z-axis/router … move the bit down until it would just touch the table. **Esc**ape out of Keyboard Control
Set the surface as 0 for the Z-axis	**[ZZ]** (Zero the Z)
Raise the bit so that it is about ¼" off the surface of the table	Call up the keyboard control **[SK]** or **[K].** Use the PageUp and PageDown keys to raise and lower the Z-axis/router. [**Esc**ape]
Send the router across the table diagonally. Watch carefully for the low point on the surface of the board.	**[M2] 96, 48** to Move in 2 Dimensions (the X & Y) to the point that is 96" along the X axis and 48" along the Y axis. If your tool is not a 96x48, use the correct dimensions. Hit Enter to initiate the move. The router should glide along a diagonal line and end up at the upper right corner of the table board. **NOTE: the space after the M2 and the COMMA are very important.**
Send the router to the lower right corner	**[M2] 96, 0** to Move 2 Dimensions (the

of the table.	X & Y) to the point that is 96” along the X axis and 0” along the Y axis [hit Enter to move]
Send the router across the other diagonal. Watch carefully for the low point on the surface of the board.	**[M2] 0, 48** to Move 2 Dimensions (the X & Y) to the point that is 0” along the X axis and 48” along the Y axis **[Enter].** The router should glide along a diagonal line and end up at the upper left corner of the table board.
Move the router to what looks like the lowest area of the table surface.	Again call up the keyboard arrow key controls **[SK]** or **[K]** to move to the lowest point.
Lower the Z to that point.	**[K]** and PageDown. **Read the Z location on the screen** on the ShopBot Position screen (red)… it should be a negative number if this point is lower than your original start point.
Zero the Z-axis to reflect this new lowest point	**[ZZ]**
Raise the Z and Jog Home to 0,0	**[JH]** This command automatically pulls the Z up and moves you at jog speed back to the home location in X and Y.
Now you are ready to try the diagonals with the router on to see if the cutting head is at the right height to remove a small bit of material from the entire surface	TURN ON THE ROUTER/SPINDLE For PSRalpah Ctrl-1 to Activate; then hit Start Button.
[MZ] 0 to Move the Z to 0.	
[M2] 96,48 [Enter] will Send router across diagonal to the point 96, 48 (You may have to add an inch to the length or width if you plunge outside the material.)	
If the cutter removes a bit of material from all across the diagonal, you are at the right Z height. If not, lower the Z	

slightly and return to 0,0 **[M2 0,0]** You should confirm your final height by cutting the other diagonal … you've done this before, right ?	
Go back to home after getting the depth set with diagonal passes	**[JH]**

Now, you are ready to surface the table.

NOTE: You may want to try this up in the air first before you really cut the surface, (you can do a few passes to make sure all is going right, then stop the action with the space bar, jog home **[JH],** and start over … you can also try this in Preview Mode first)	**[CR]** for Cut Rectangle.
Fill in the blanks on the parameter sheet:	
Length x **96**, length y **48**, **T** (for True),	Use dimensions for your tool if not a 96x48.
1 (direction of cut=clockwise), Start*** 4,**	***set to 4 to start in bottom left**
Plunge per pass (set depth slightly below predetermined lowest point on table to be surfaced, say **-.025**), Reps **1,**	
Use the tab keys to move between rows of options, set Pocket function by marking box [X] with the spacebar. Set "Z Plunge Offset 0" by checking box with spacebar. Accept [**Enter**] then [**Enter**] again to run it.	YOU'RE OFF AND RUNNING ….

Tools > TS

There is also a Table Surfacing Tool in the ShopBot Software under Tools. This is a simplified version of what you've just done and will be useful for routine re-surfacings.

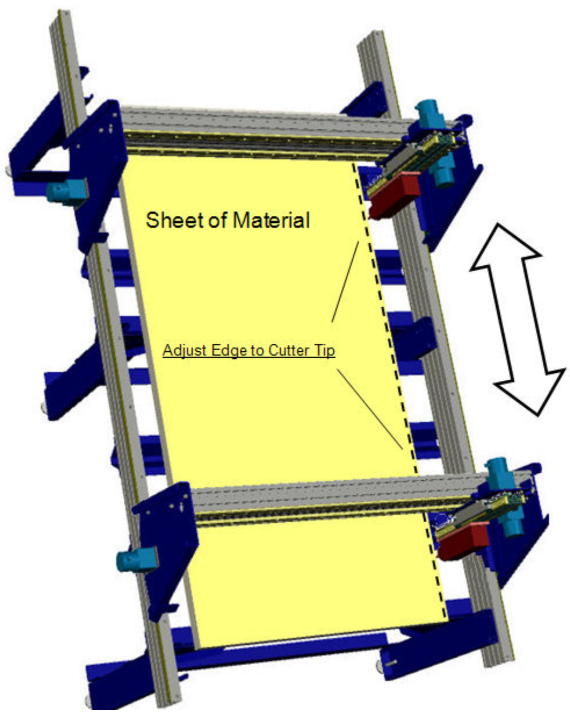
Squaring and Adjusting the X-Car

There are a number of good ways to evaluate whether your tool is "square". The first is just to cut a large rectangle, the bigger the better, and measure the diagonals. They should be equal. Short of cutting something out, you can inscribe a shallow, large square or rectangle (e.g. 30x50) on your table surface (or chuck up a pencil and draw one) and measure the diagonals. Alternatively drill 4 holes at the corners of a square and measure the diagonals. In all cases, **if the diagonals are equal** your tool is cutting square.

The technique decribed below provides a straightforward method to help you initially square your tool. Use it to get started. However, the "proof is always in the pudding." Use the approach above when you are ready to fully 'evaluate' square.

Use a Square Sheet

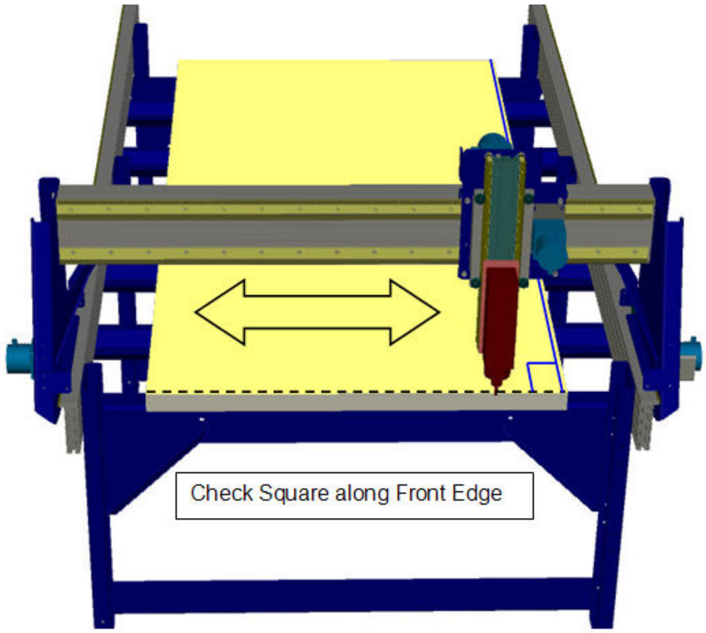
This initial squaring technique can be used either with or without the motors engaged. If you have had difficulty getting the wheels exactly aligned in the previous steps, then you may want to lower and disengage the motors from the rack to make a first pass at adjusting the alignment. You basically want to make sure the X-Car in its relaxed or natural position is pretty square. If things already look about right, then leave the motors engaged.



You will need to have mounted your router or spindle to use this squaring technique. Put a cutter with a v-tip or point in the collet. The only other thing you will need is a large square sheet of material. It should be a sheet that you are confident is square because you have measured the diagonals, say a 4x4 or 4x8 piece of plywood. [NOTE: Sheets from the factory are not necessarily square. Measure each edge to make sure they are equal, THEN compare the diagonals. The bigger the size the better, so a large <u>square</u> sheet works better than a carpenters square. In fact, the average carpenters square is not very square. Check it well if you are using one.]

Move the YZ Car to one end of the Y axis, bring the tip of the cutter down to the edge of the material, and align the sheet up and down the X axis by moving The X-Car up and down the rails, checking the position of the sheet at the tip of the cutter.

Now, because you've gotten the board parallel to the X axis, the short (Y) edge is square to the X. You can move the carriage down to one end of the sheet and move the tip of the cutter along the short edge, moving the YZ Car. By observing the tip of the cutter as it moves along the short edge, you will be able to evaluate the square of the two axes on the tool.



Relaxed Alignment vs Powered Alignment

Square is maintained on your tool by the 2, X-axis motors. The motors always move absolutely identically and they keep the X-Car perfectly square when they are powered. The X-Car itself, when not locked into position by the motors, is not designed to be capable of maintaining the alignment on its own. In the ideal world, the X axis will always 'relax' into a square position when powered off. But in practice, because the motors and gearboxes have a lot of friction, there may not be an exact, relaxed alignment position of the carriage and it will be possible to push one or the other end out of alignment.

To get the tool square with the motors installed and engaged, start powered off, push the carriage back and forth a few times from the center and let it take as natural an alignment position as possible. Do this over the edge of your sheet so you can check square. Your relaxed alignment should be within about 1/8" of square across the table, as indicated by your cutter tip moving up and down the Y edge of the sheet. If you are further out of alignment than this, visit the "Making Adjustment" section below.

Once the alignment is close and continuing with the motors powered off, push the one end of the car slightly to bring the whole gantry into perfect square with the board. You may need to lock one or both ends with clamps to manage this. Then, when you've got it square, turn the power to on to the Control Box, and if a PRSalpha, hit the Reset Button. The motors will power on and lock into position. Your tool is now square in X and Y, and it will remain square whenever it moves until the power is removed.

Setting the End Stops So Your Tool Will Always be Square

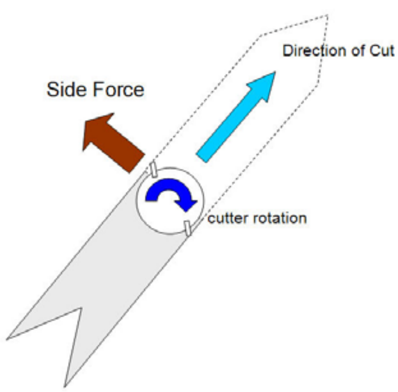
Because the X-Car is not intended to be able to physically maintain alignment when the power is off, after a period of being powered down you cannot be certain that in a busy shop the carriage has not been bumped a little out of square. So, you need a system for guaranteeing square each time you restart the tool. The mechanical End Stops do this for you.

First let's get the End Stops installed perfectly square at the bottom end of your tool. Do this by driving the X Car, using the KeyPad mode in the software, down to the bottom (X = 0) end of the tool. Slow down when you get close, and move the car to the point that each wheel bearing is about ¼" from the end of the rail.

Slide the End Stop on Each side into the Table Side and up against the motor pinion. Then back the X-Car off and tighten the End Stops securely into place. You now have End Stops that you can use to square the car.

When you turn the tool off, park the X-Car near the bottom end of the tool. Whenever you are ready to power up again, first gently/slowly pull the X-Car into the stops to square it, and then turn the power on. The car is square and will stay square for the duration of your work session.

Cutting Forces



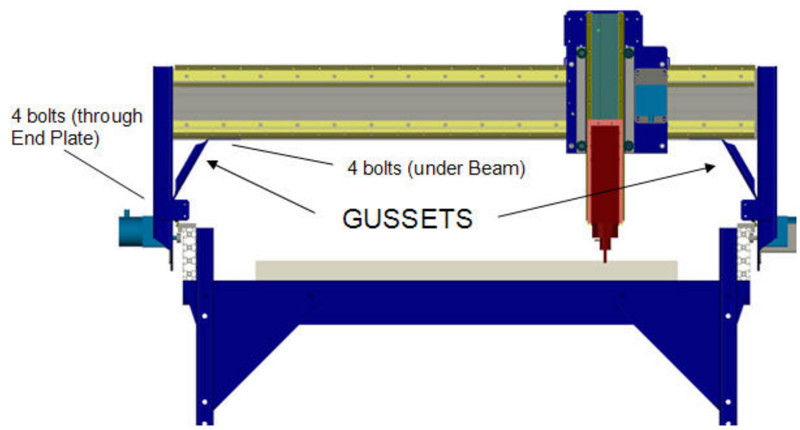
When the router bit is cutting through material, it is kicking 90 degrees to the left of the tool path. The more aggressive the cutting, the more force perpendicular to the cut. Because of the force, the router bit can bend slightly, the spindle/router may exhibit some run-out, and the tool can flex a little. For this reason, cutting forces can slightly alter the path of the tool. Such effects will alter the overall size of the shape that you are cutting by a small amount, though not the shape itself, or its squareness. For example, cutting a square in a clockwise direction forces the cutter to pull to the outside during cutting, and this can make the square slightly larger in overall size than specified. Similarly, cutting counter clockwise around an object can cause it to be slightly smaller. This is a feature of all machining. In either direction, the square should be square and as long as you are cutting at the same speed, cuts should be highly repeatable. If you are having problems with too much size variation from the intended size, try slowing the feed-rate or increasing the spindle RPMs. These changes will reduce the side force of cutting. Using a cutter that generates less cutting force because of its geometry will also reduce this type of error. Note that as a cutter becomes dull, it will require more force to push through the material and thus will also generate more side force.

Making an Adjustment for Wheel Bearing Alignment or Square

The X-Car of your PRS ShopBot is the primary structural component of the tool. We build the X-Car in a precision fixture that exactly spaces the wheel bearings and that assures a perfectly square and true gantry. After assembly, we handle and pack the gantry in a way that is intended to assure it stays square. However, we recognize that in the process of trucking the tool to your location, considerable stresses can be put on it and that a small amount of on-site adjustment could be necessary. The following is a general procedure for dealing with a wheel bearing that rides high or to one side, or with finding that in its relaxed condition the X-Car is more than the 1/8” out of square (see above for discussion of relaxed vs powered alignment).

First, make sure that if you are experiencing a problem with the ‘ride’ of one of the wheel bearings or with square, you have ruled out problems with the rails not being parallel. Make sure the rails are level. Then test the ride of the wheel bearings up and down the rails and re-measure the spacing of the rails. If the rail spacing is right, and you have the same ‘ride’ problem up and down the axis, then proceed to make the following adjustment.

Use clamps to lock the X-Car in position. This will take 4 clamps, one at the front and back of each End Plate of the car. If the car is square, the clamps will keep it locked square.



The Gussets under the beam are designed to define the orientation and position of the end plates. You’ll loosen them to correct the orientation. There are 4 bolts on the Gusset at the End Plate and 6 bolts on under the beam. Make sure all bolts are loose. The ones under the beam sometimes bind after you loosen one of the others, so keep going around and make sure all are free, but try not to let them come out of the t-nuts in the beam.

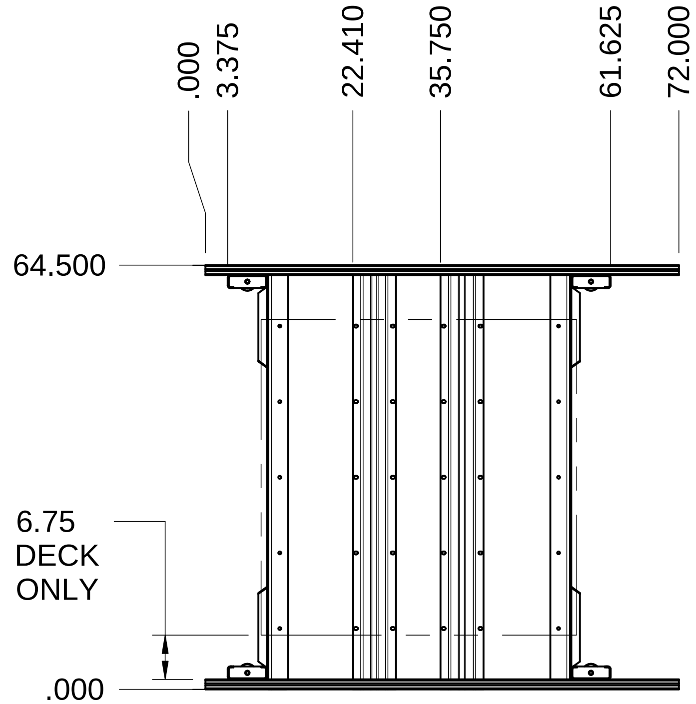
For the situation where you are adjusting a wheel: with Gussets loose, if the wheel bearing has not dropped onto the rail, give the End Plate a downward tap with a rubber mallet to get the wheel bearing into position.

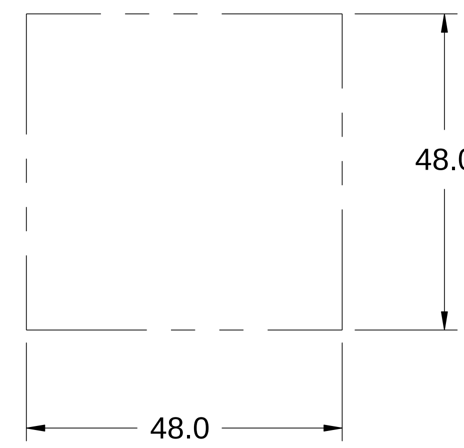
For the situation where you are adjusting square: with Gussets loose, use the clamps to move one side of the car the distance required to make it square, and check to see that all the wheels are correctly re-seat themselves, a tap with a rubber mallet may be necessary.

Now you are ready to re-tighten the Gussets. First, tighten the lower 4 bolts on each Gusset, then draw up the 6 top bolts tightening each a little at a time.

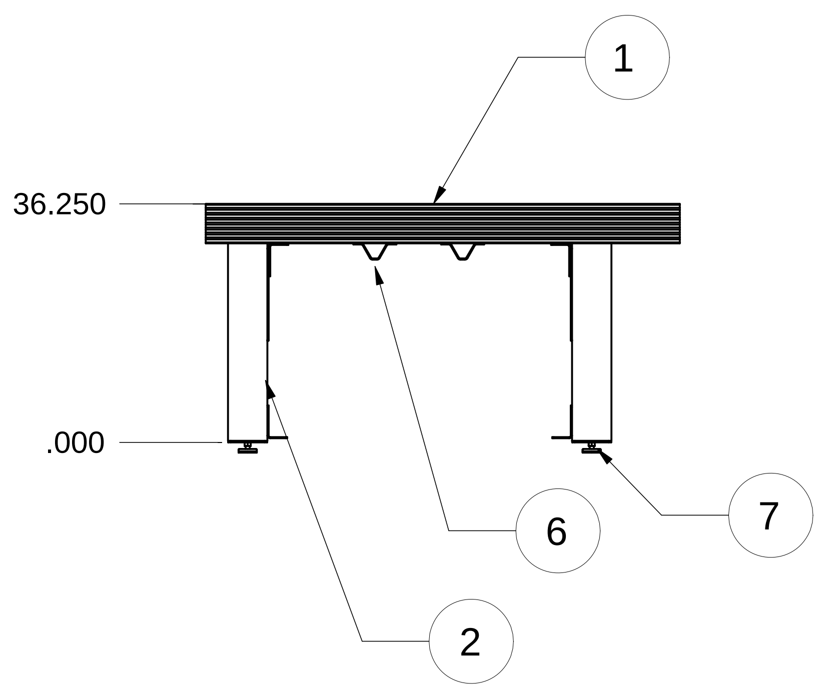
PRS Table Drawings

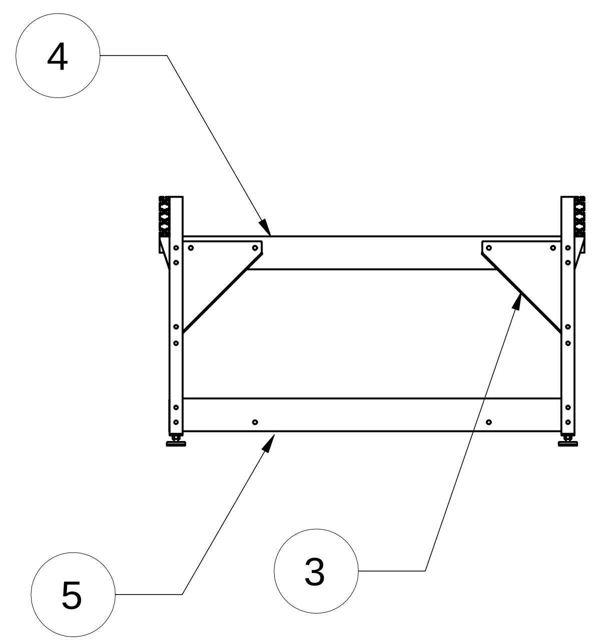
ShopBot Tools, Inc
3333B Industrial Dr
Durham, NC 27704
919-680-4800 or 888-680-4466
www.shopbottools.com





VIEW A
SEE NOTE 2





Item No.	Qty	Part Number	Description
1	2	000923-01	TABLE SIDE 48E
2	4	000919-01	TABLE LEG 6E
3	4	000770-01	TABLE GUSSET
4	2	000915-01	TABLE SUPPORT UPPER 48E
5	2	000921-01	TABLE SUPPORT LOWER 48E
6	2	000926-01	TABLE SUPPORT CROSS 48E
7	4	000661-01	MACHINE GLIDE
8	4	000160-01	NUT HEX 5/8-11 Z5
9	4	000845-01	WASHER LOCK 5/8 Z
10	48	000727-01	NUT T HEAVY DUTY 5/16-18
11	48	000529-01	HCS 5/16-18 X 3/4 Z5
12	48	000848-01	WASHER FLAT 5/16 Z USS
13	24	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	24	000440-01	NUT HEX 1/2-13 Z
15	48	000029-01	WASHER FLAT 1/2 USS Z
16	24	000588-01	WASHER LOCK 1/2 Z
17	24	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	24	000452-01	NUT HEX 3/8 Z
19	24	000444-01	WASHER FLAT 3/8 USS Z
20	24	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		06/20/07	DGC	INITIAL PRODUCTION RELEASE	

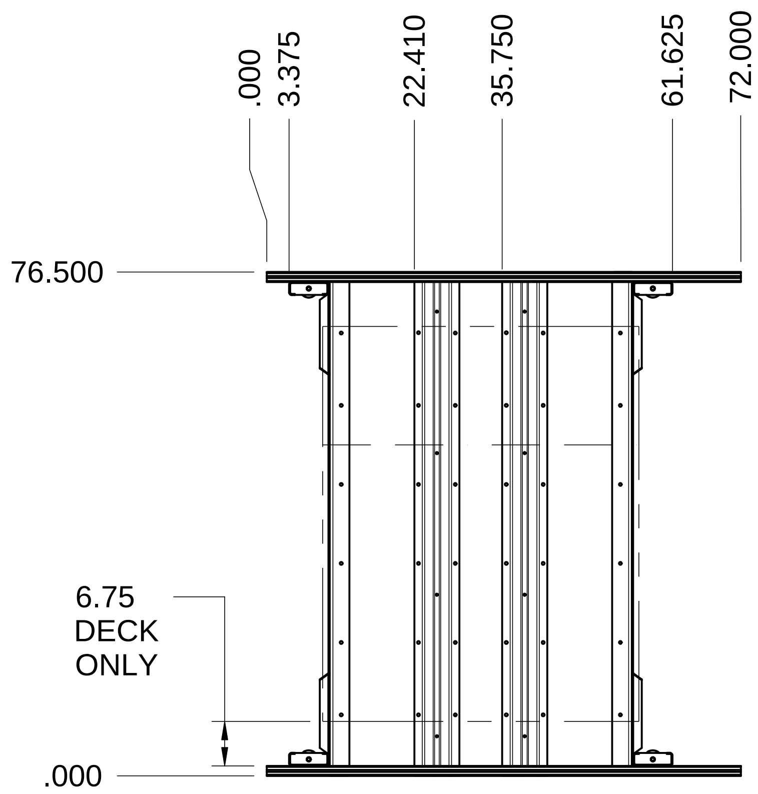
ShopBot
Durham, North Carolina

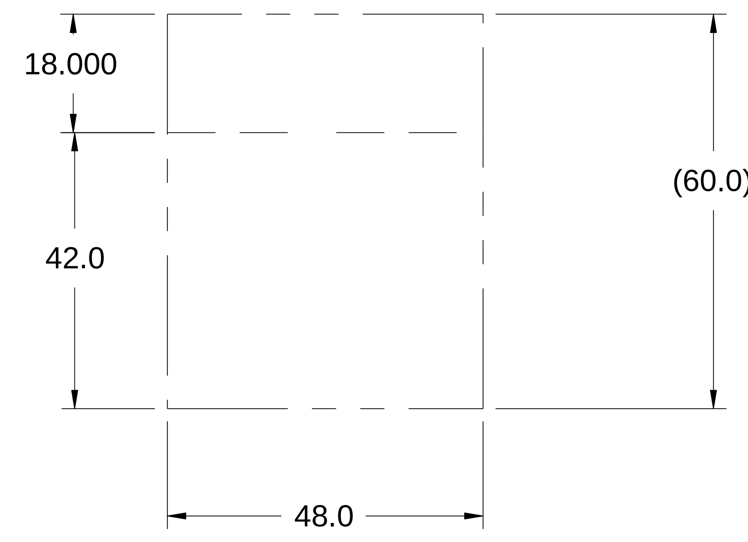
TITLE
TABLE 48-48-8S

DRAWN	DATE	CHECKED	APPROVED
DGC	06/20/07		

SIZE	DRAWING NUMBER	REV
B	10630-00	0

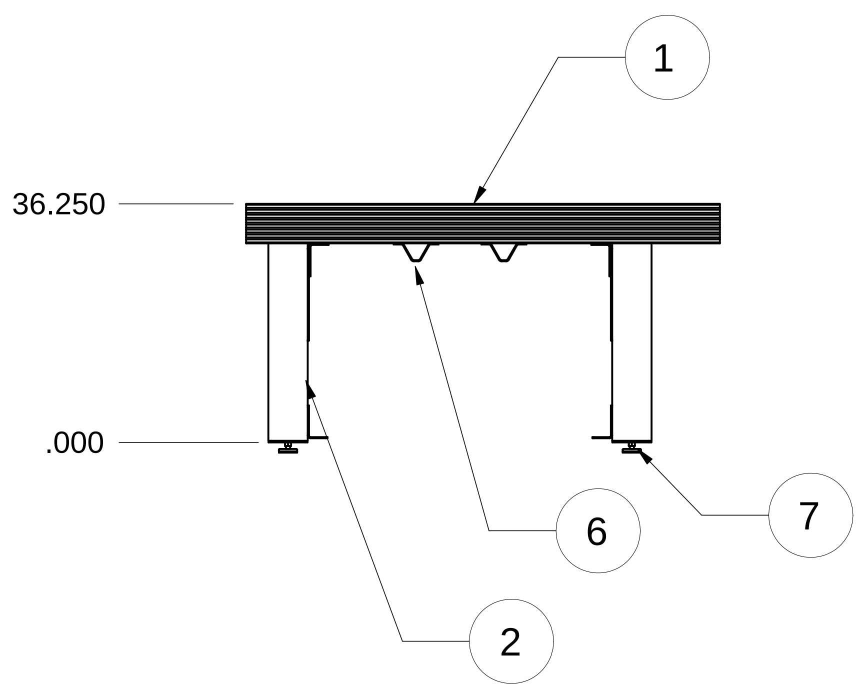
SCALE NONE — PART NUMBER 10630-01

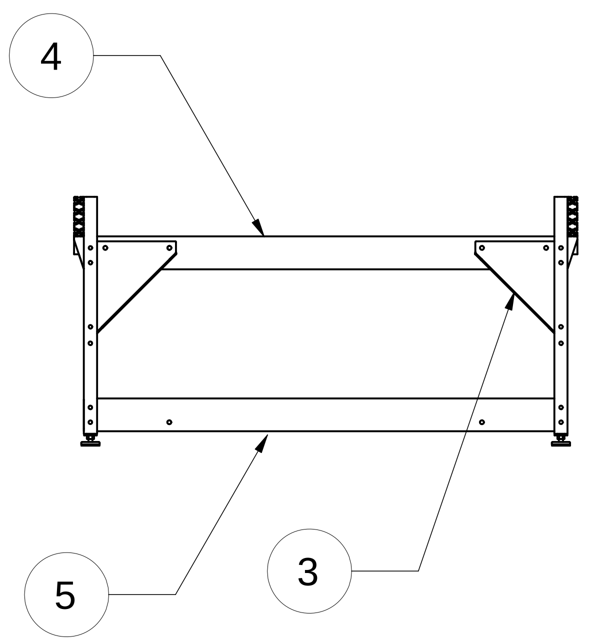




VIEW A
SEE NOTE 2

Item No.	Qty	Part Number	Description
1	2	000923-01	TABLE SIDE 48E
2	4	000919-01	TABLE LEG 6E
3	4	000770-01	TABLE GUSSET
4	2	001486-01	TABLE SUPPORT UPPER 60E
5	2	001487-01	TABLE SUPPORT LOWER 60E
6	2	001485-01	TABLE SUPPORT CROSS 60E
7	4	000661-01	MACHINE GLIDE
8	4	000160-01	NUT HEX 5/8-11 Z5
9	4	000845-01	WASHER LOCK 5/8 Z
10	48	000727-01	NUT T HEAVY DUTY 5/16-18
11	48	000529-01	HCS 5/16-18 X 3/4 Z5
12	48	000848-01	WASHER FLAT 5/16 Z USS
13	24	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	24	000440-01	NUT HEX 1/2-13 Z
15	48	000029-01	WASHER FLAT 1/2 USS Z
16	24	000588-01	WASHER LOCK 1/2 Z
17	28	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	28	000452-01	NUT HEX 3/8 Z
19	28	000444-01	WASHER FLAT 3/8 USS Z
20	28	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP





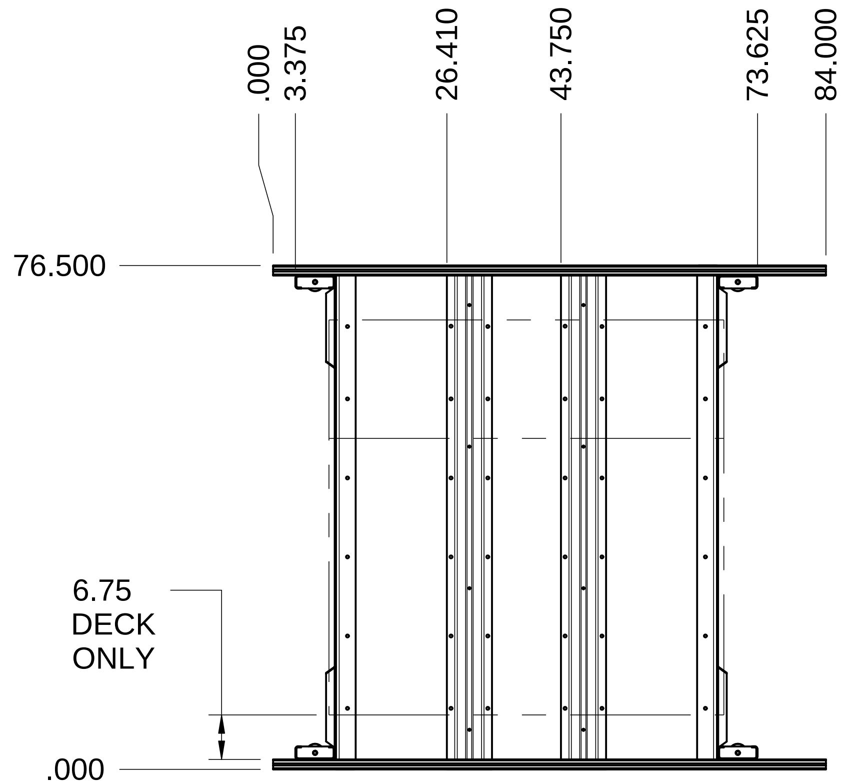
NOTES:

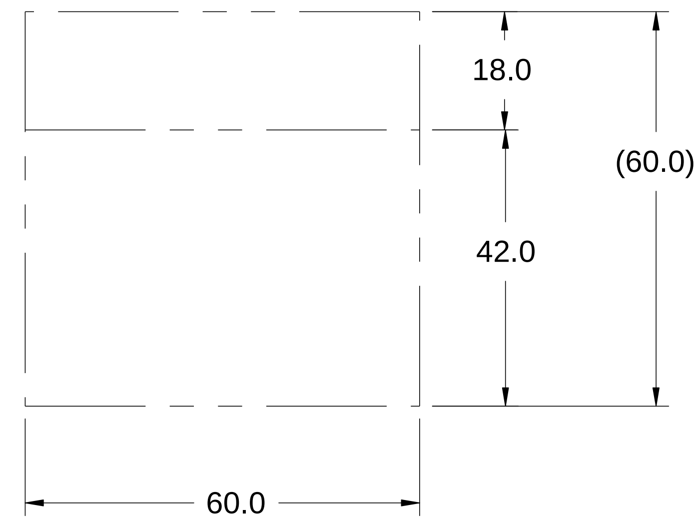
1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

ShopBot
Durham, North Carolina

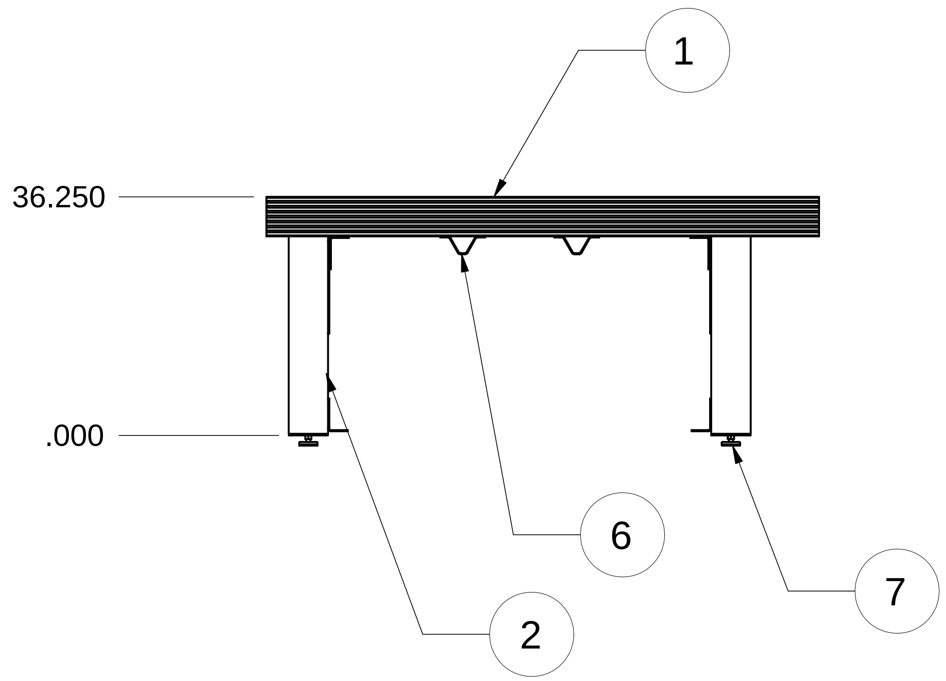
TITLE	TABLE 48-60-8S		
DRAWN DGC	DATE 06/20/07	CHECKED	APPROVED
SIZE B	DRAWING NUMBER 10631-00		REV 0
SCALE NONE	PART NUMBER 10631-01		

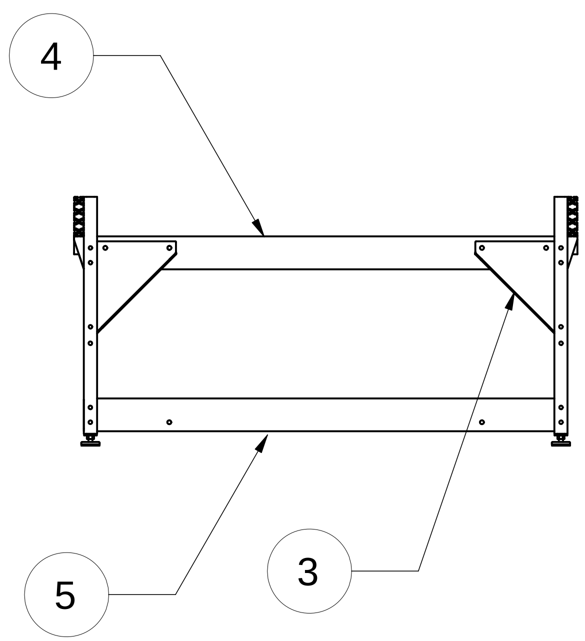
REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		06/20/07	DGC	INITIAL PRODUCTION RELEASE	





VIEW A
SEE NOTE 2





Item No.	Qty	Part Number	Description
1	2	000924-01	TABLE SIDE 60E
2	4	000919-01	TABLE LEG 6E
3	4	000770-01	TABLE GUSSET
4	2	001486-01	TABLE SUPPORT UPPER 60E
5	2	001487-01	TABLE SUPPORT LOWER 60E
6	2	001485-01	TABLE SUPPORT CROSS 60E
7	4	000661-01	MACHINE GLIDE
8	4	000160-01	NUT HEX 5/8-11 Z5
9	4	000845-01	WASHER LOCK 5/8 Z
10	48	000727-01	NUT T HEAVY DUTY 5/16-18
11	48	000529-01	HCS 5/16-18 X 3/4 Z5
12	48	000848-01	WASHER FLAT 5/16 Z USS
13	24	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	24	000440-01	NUT HEX 1/2-13 Z
15	48	000029-01	WASHER FLAT 1/2 USS Z
16	24	000588-01	WASHER LOCK 1/2 Z
17	28	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	28	000452-01	NUT HEX 3/8 Z
19	28	000444-01	WASHER FLAT 3/8 USS Z
20	28	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		06/20/07	DGC	INITIAL PRODUCTION RELEASE	

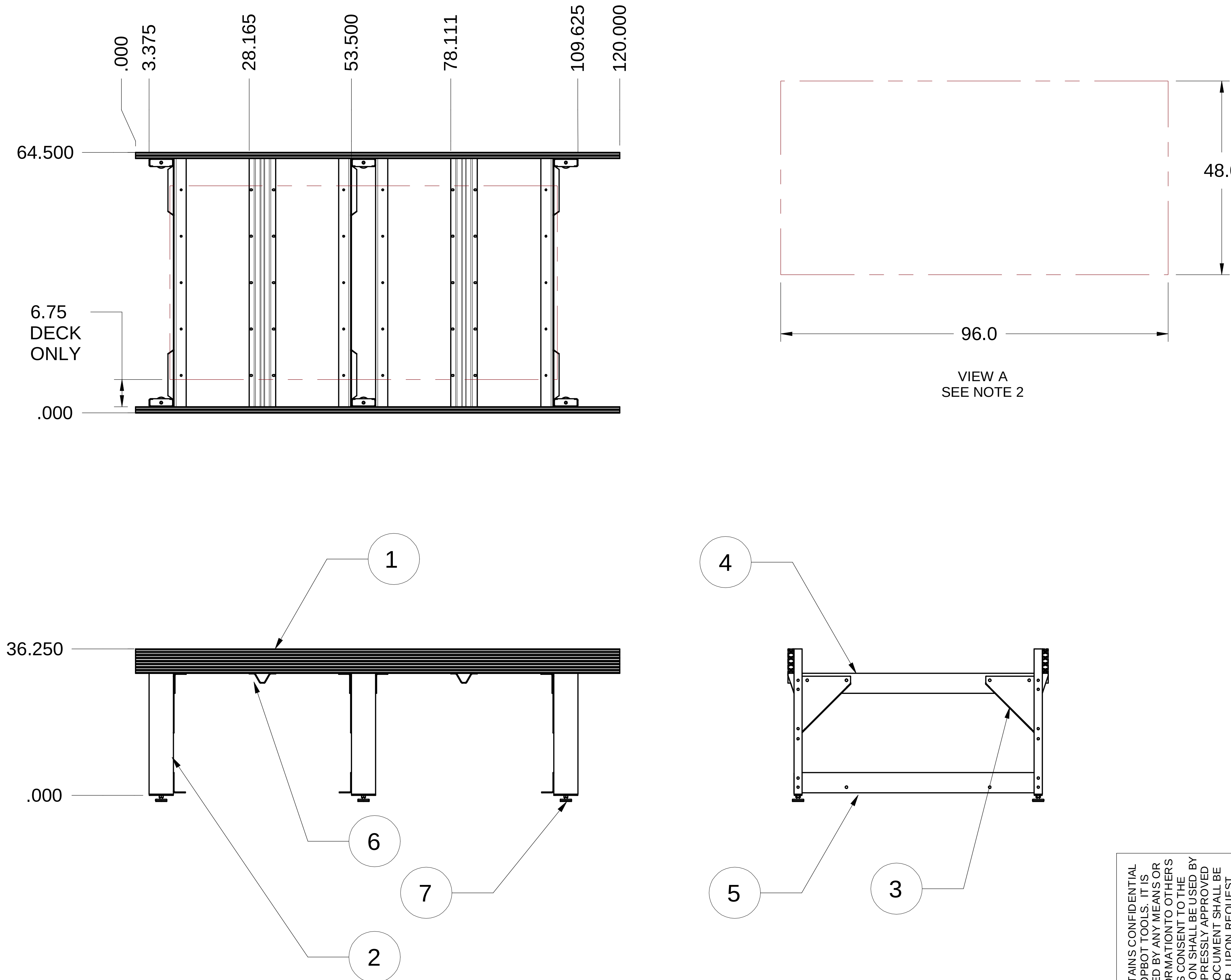
ShopBot
Durham, North Carolina

TITLE: **TABLE 60-60-8S**

DRAWN: DGC | DATE: 06/20/07 | CHECKED: | APPROVED:

SIZE: B | DRAWING NUMBER: **10634-00** | REV: 0

SCALE: NONE | PART NUMBER: 10634-01



Item No.	Qty	Part Number	Description
1	2	000925-01	TABLE SIDE 96E
2	6	000919-01	TABLE LEG 6E
3	6	000770-01	TABLE GUSSET
4	4	000915-01	TABLE SUPPORT UPPER 48E
5	3	000921-01	TABLE SUPPORT LOWER 48E
6	2	000926-01	TABLE SUPPORT CROSS 48E
7	6	000661-01	MACHINE GLIDE
8	6	000160-01	NUT HEX 5/8-11 Z5
10	72	000727-01	NUT T HEAVY DUTY 5/16-18
11	72	000529-01	HCS 5/16-18 X 3/4 Z5
12	72	000848-01	WASHER FLAT 5/16 Z USS
13	40	000589-01	HCS 1/2-13 X 1 1/2 Z5
14	40	000440-01	NUT HEX 1/2-13 Z
15	80	000029-01	WASHER FLAT 1/2 USS Z
16	40	000588-01	WASHER LOCK 1/2 Z
17	40	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	40	000452-01	NUT HEX 3/8 Z
19	40	000444-01	WASHER FLAT 3/8 USS Z
20	40	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
1	ECO #198	5/12/09	JLK	ADDED CENTER LEG	

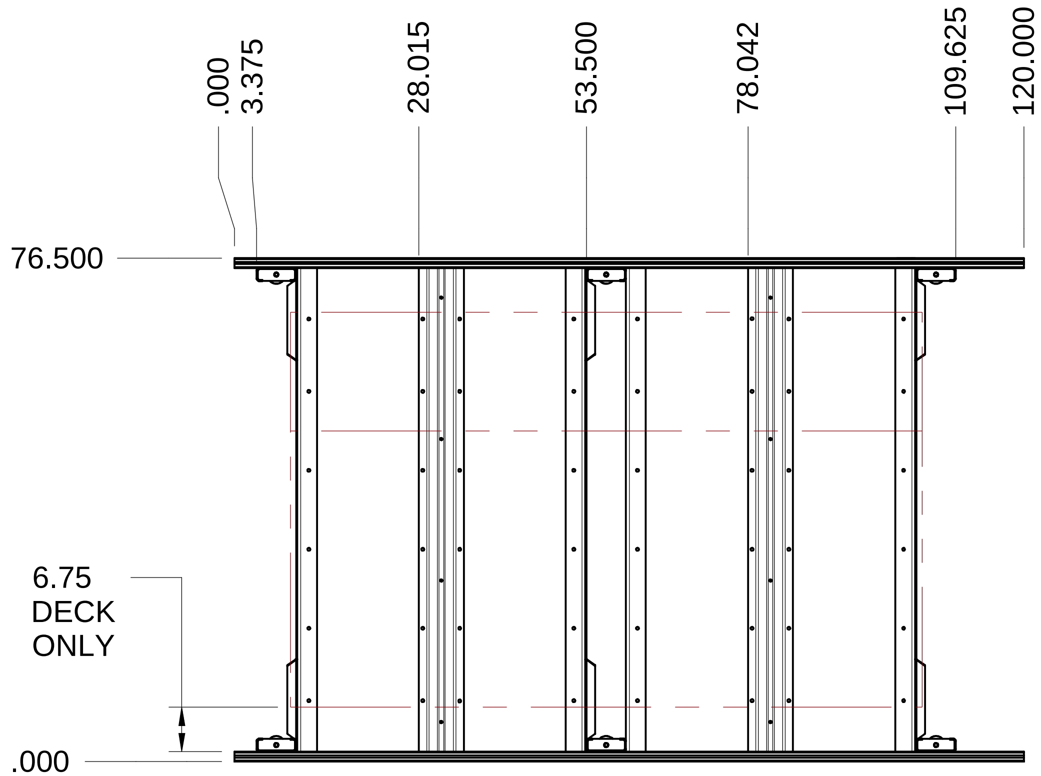
ShopBot
Durham, North Carolina

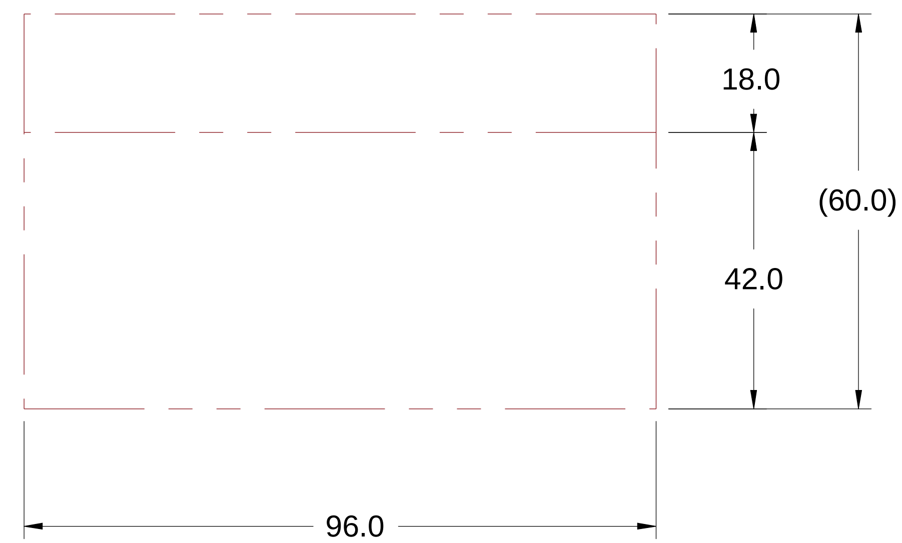
TITLE: **TABLE 96-48-8S**

DRAWN: DGC — DATE: 06/20/07 — CHECKED: — APPROVED:

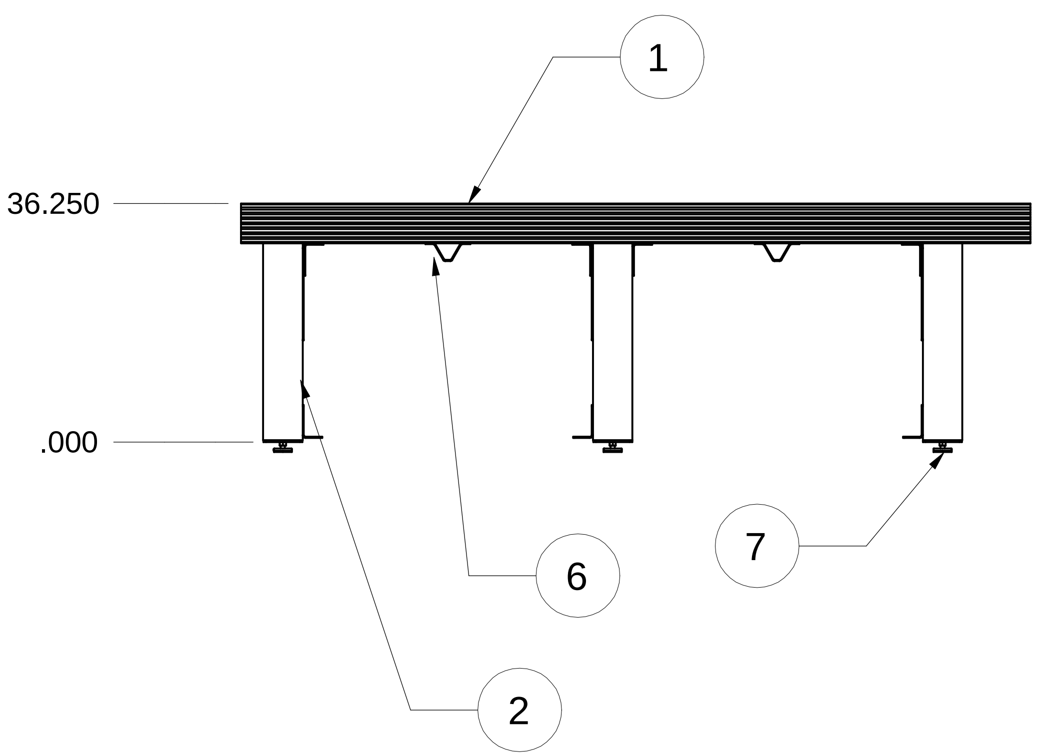
SIZE: B — DRAWING NUMBER: **10632-00** — REV: 1

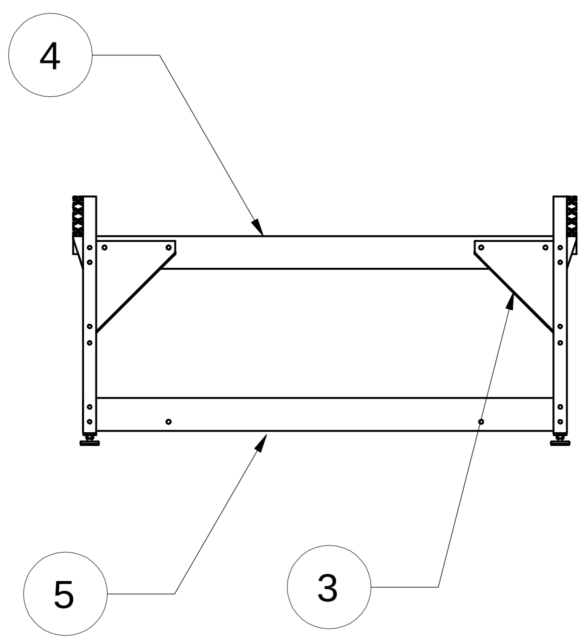
SCALE: NONE — PART NUMBER: 10632-01





VIEW A
SEE NOTE 2





Item No.	Qty	Part Number	Description
1	2	000925-01	TABLE SIDE 96E
2	6	000919-01	TABLE LEG 6E
3	6	000770-01	TABLE GUSSET
4	4	001486-01	TABLE SUPPORT UPPER 60E
5	3	001487-01	TABLE SUPPORT LOWER 60E
6	2	001485-01	TABLE SUPPORT CROSS 60E
7	6	000661-01	MACHINE GLIDE
8	6	000160-01	NUT HEX 5/8-11 Z5
10	72	000727-01	NUT T HEAVY DUTY 5/16-18
11	72	000529-01	HCS 5/16-18 X 3/4 Z5
12	72	000848-01	WASHER FLAT 5/16 Z USS
13	40	000589-01	HCS 1/2-13 X 1 1/2 Z5
14	40	000440-01	NUT HEX 1/2-13 Z
15	80	000029-01	WASHER FLAT 1/2 USS Z
16	40	000588-01	WASHER LOCK 1/2 Z
17	48	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	48	000452-01	NUT HEX 3/8 Z
19	48	000444-01	WASHER FLAT 3/8 USS Z
20	48	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

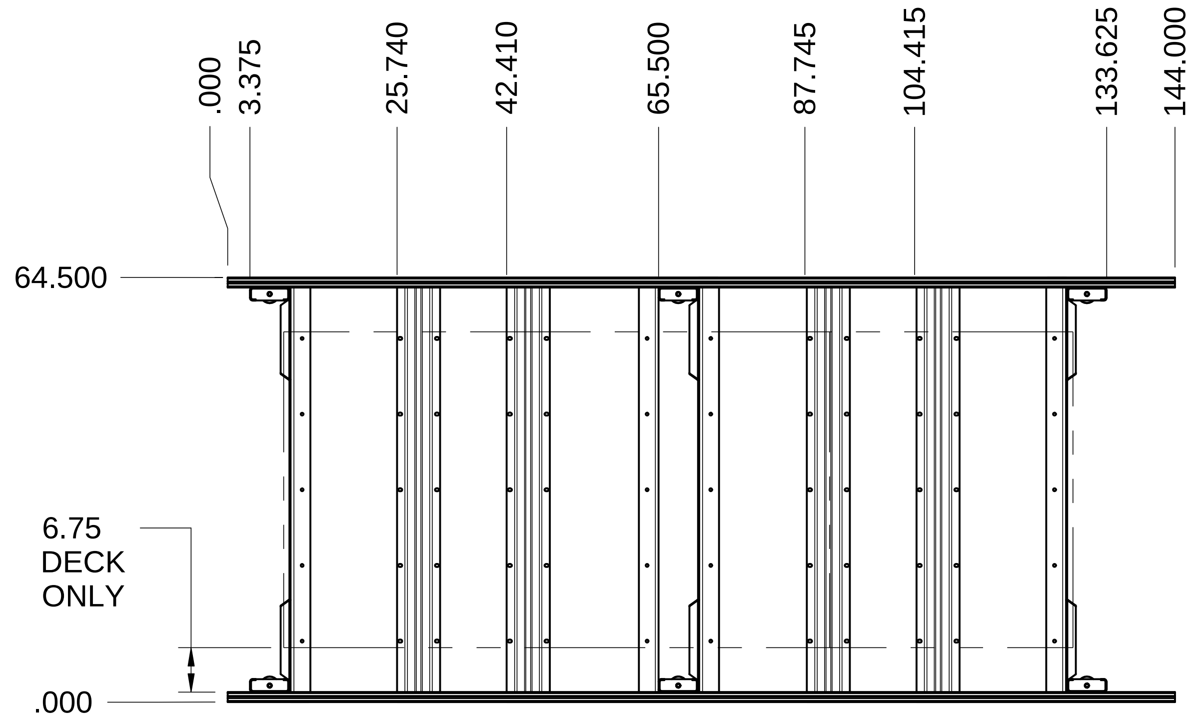
NOTES:

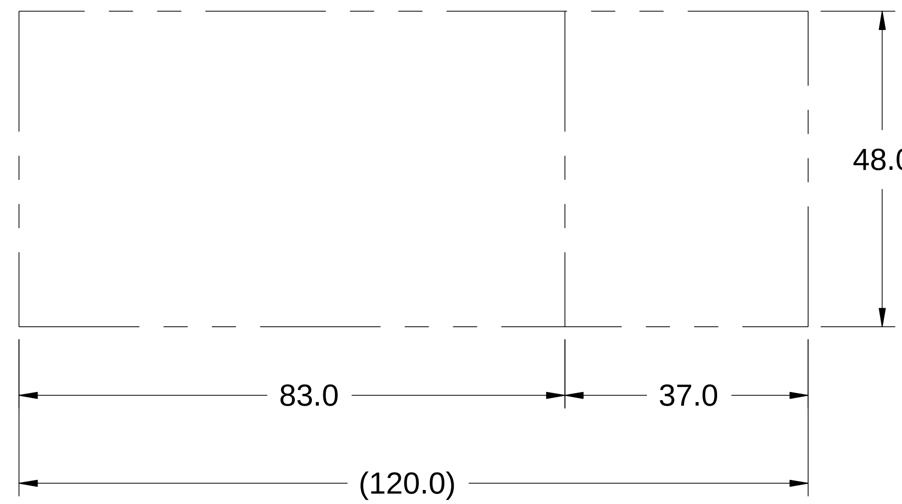
1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

ShopBot
Durham, North Carolina

TITLE	TABLE 96-60-8S		
DRAWN DGC	DATE 06/20/07	CHECKED	APPROVED
SIZE B	DRAWING NUMBER 10633-00		REV 1
SCALE NONE	PART NUMBER 10633-01		

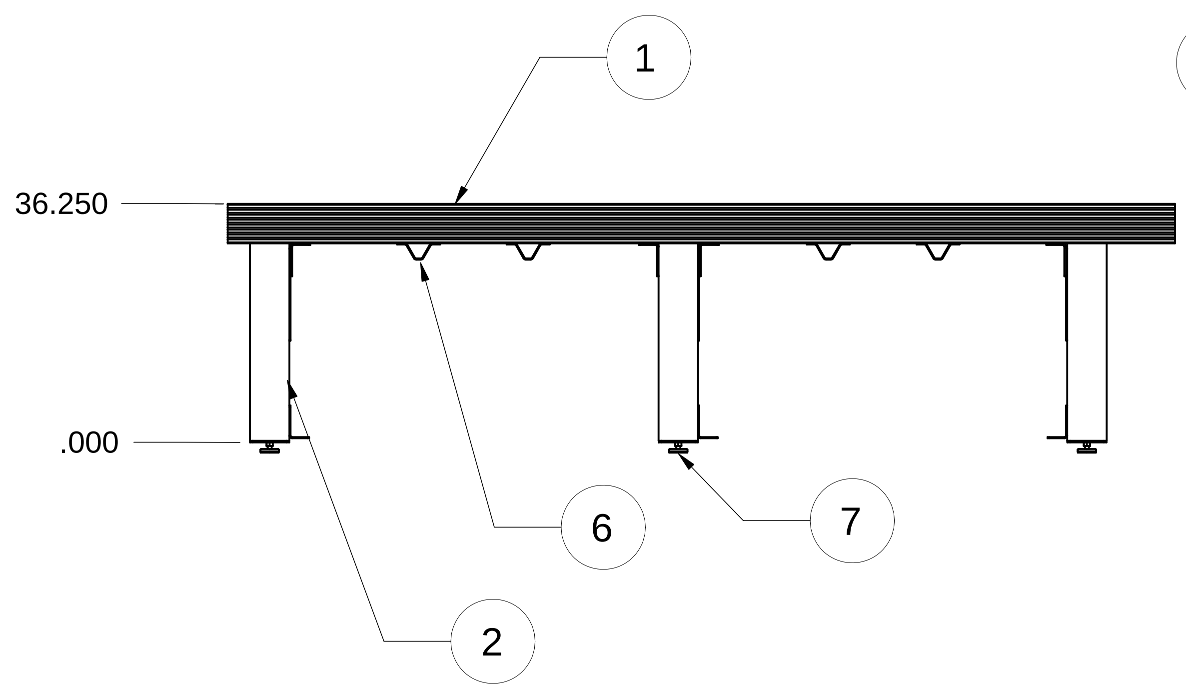
REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
1	ECO #198	5/12/09	JLK	ADDED CENTER LEG	

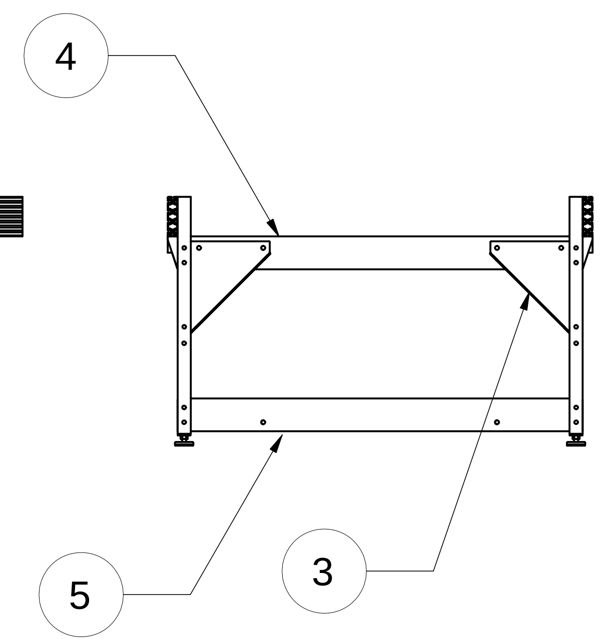




VIEW A
SEE NOTE 2

Item No.	Qty	Part Number	Description
1	2	001550-01	TABLE SIDE 120E
2	6	000919-01	TABLE LEG 6E
3	6	000770-01	TABLE GUSSET
4	4	000915-01	TABLE SUPPORT UPPER 48E
5	3	000921-01	TABLE SUPPORT LOWER 48E
6	4	000926-01	TABLE SUPPORT CROSS 48E
7	6	000661-01	MACHINE GLIDE
8	6	000160-01	NUT HEX 5/8-11 Z5
9	6	000845-01	WASHER LOCK 5/8 Z
10	80	000727-01	NUT T HEAVY DUTY 5/16-18
11	80	000529-01	HCS 5/16-18 X 3/4 Z5
12	80	000848-01	WASHER FLAT 5/16 Z USS
13	40	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	40	000440-01	NUT HEX 1/2-13 Z
15	80	000029-01	WASHER FLAT 1/2 USS Z
16	40	000588-01	WASHER LOCK 1/2 Z
17	52	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	52	000452-01	NUT HEX 3/8 Z
19	52	000444-01	WASHER FLAT 3/8 USS Z
20	52	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP





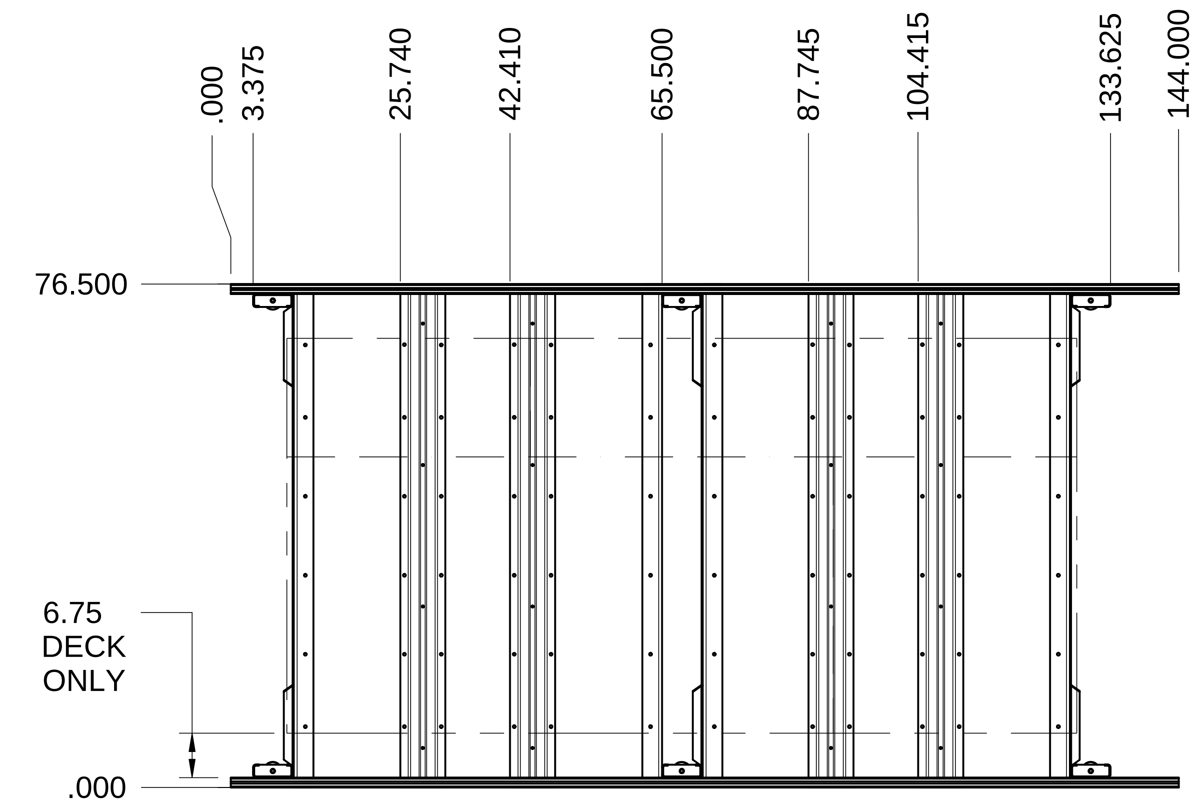
NOTES:

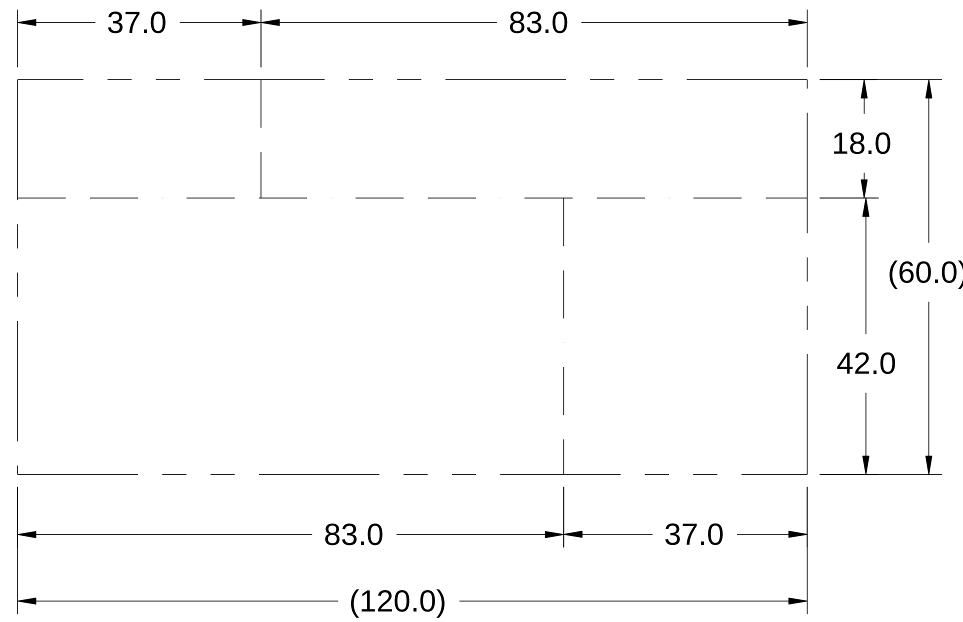
1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

Durham, North Carolina

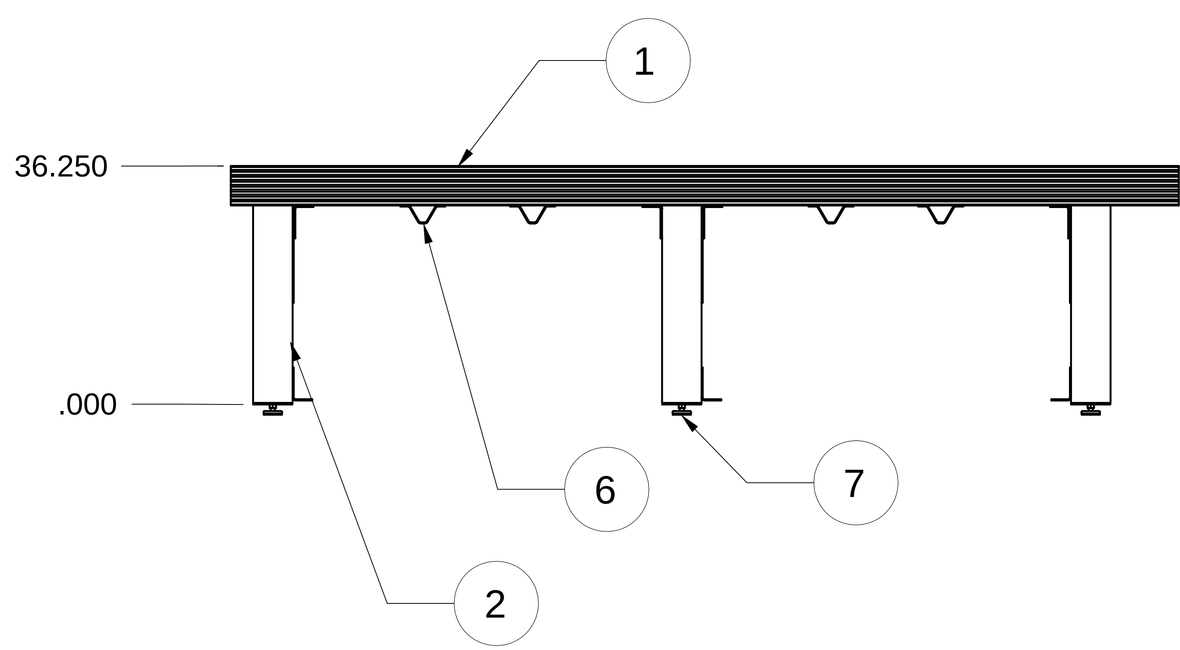
TITLE	TABLE 120-48-8S		
DRAWN DGC	DATE 06/20/07	CHECKED	APPROVED
SIZE B	DRAWING NUMBER 10635-00		REV 0
SCALE NONE	PART NUMBER 10635-01		

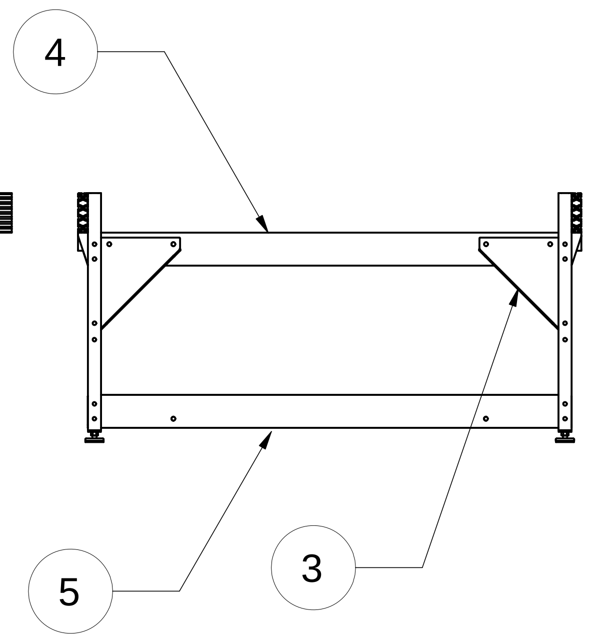
REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		06/20/07	DGC	INITIAL PRODUCTION RELEASE	





VIEW A
SEE NOTE 2





Item No.	Qty	Part Number	Description
1	2	001550-01	TABLE SIDE 120E
2	6	000919-01	TABLE LEG 6E
3	6	000770-01	TABLE GUSSET
4	4	001486-01	TABLE SUPPORT UPPER 60E
5	3	001487-01	TABLE SUPPORT LOWER 60E
6	4	001485-01	TABLE SUPPORT CROSS 60E
7	6	000661-01	MACHINE GLIDE
8	6	000160-01	NUT HEX 5/8-11 Z5
9	6	000845-01	WASHER LOCK 5/8 Z
10	80	000727-01	NUT T HEAVY DUTY 5/16-18
11	80	000529-01	HCS 5/16-18 X 3/4 Z5
12	80	000848-01	WASHER FLAT 5/16 Z USS
13	40	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	40	000440-01	NUT HEX 1/2-13 Z
15	80	000029-01	WASHER FLAT 1/2 USS Z
16	40	000588-01	WASHER LOCK 1/2 Z
17	56	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	56	000452-01	NUT HEX 3/8 Z
19	56	000444-01	WASHER FLAT 3/8 USS Z
20	56	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

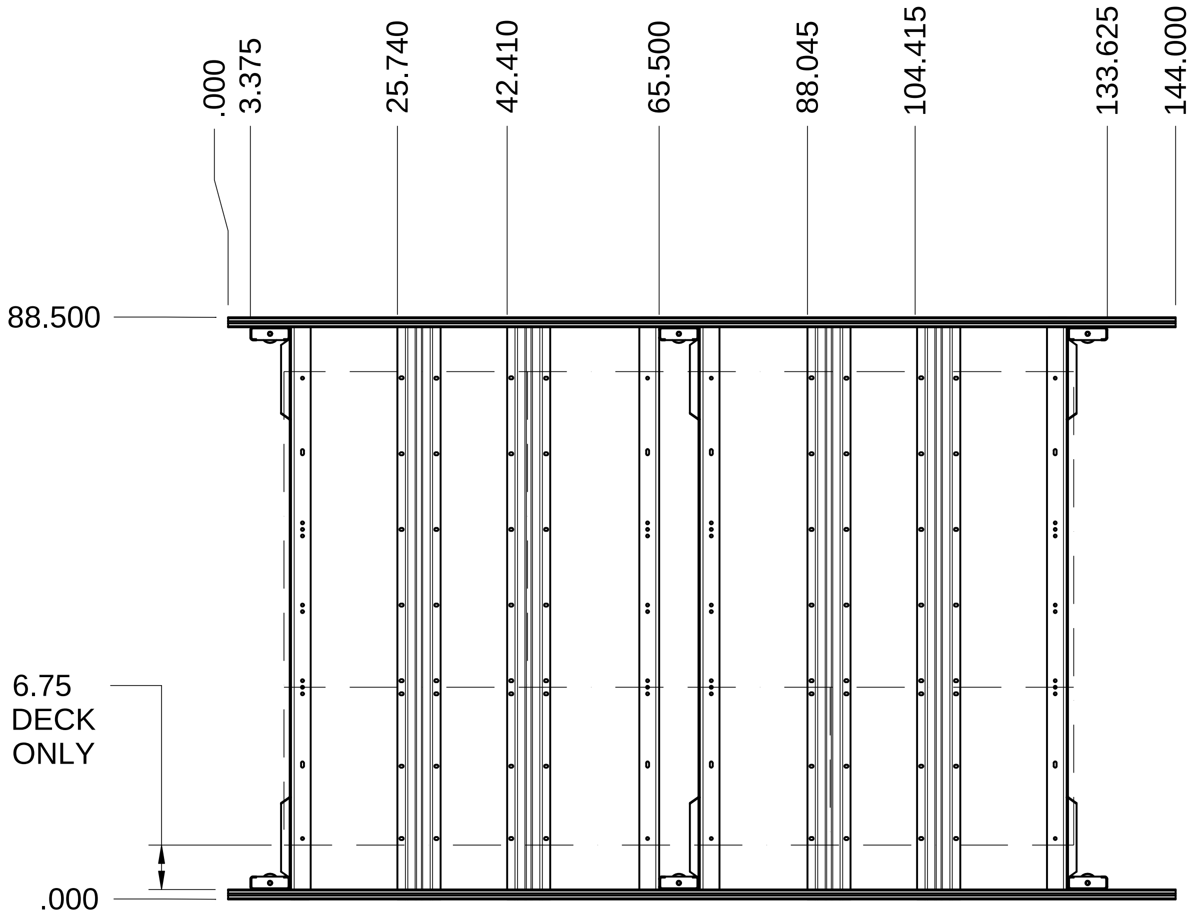
NOTES:

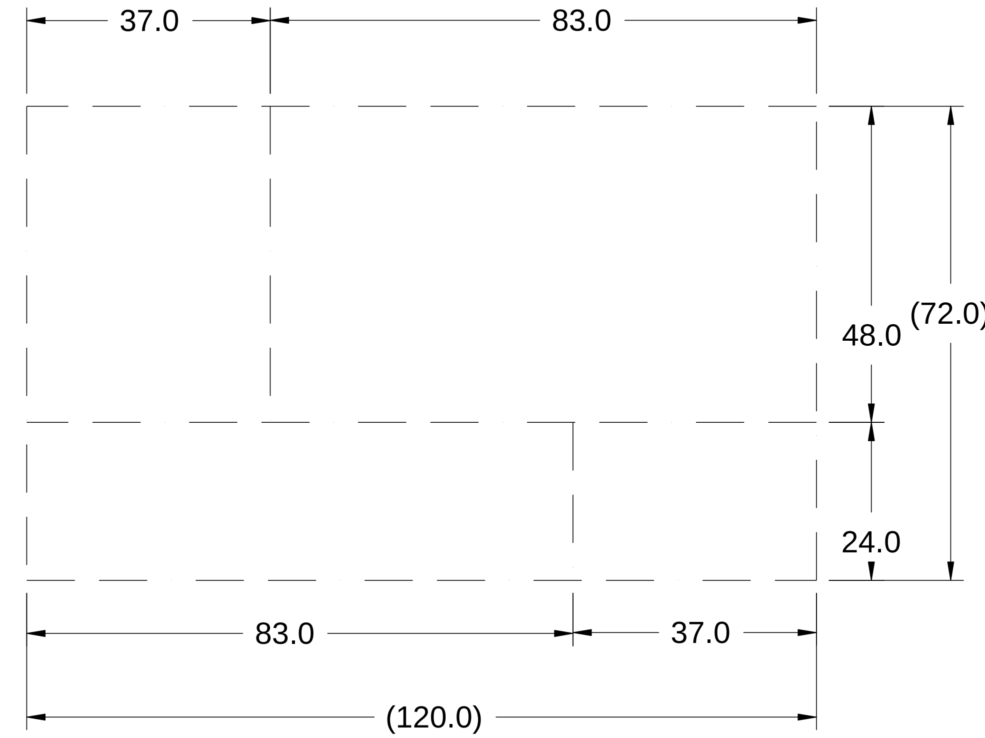
1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

ShopBot
Durham, North Carolina

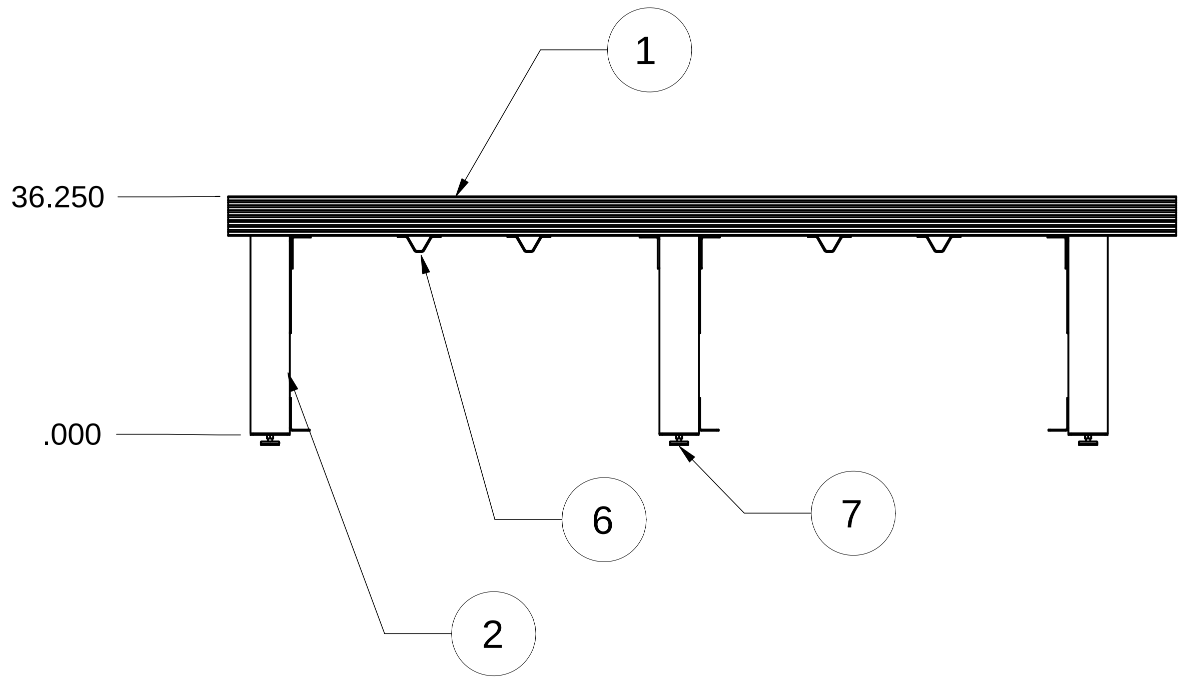
TITLE	TABLE 120-60-8S		
DRAWN DGC	DATE 06/20/07	CHECKED	APPROVED
SIZE B	DRAWING NUMBER 10636-00		REV 0
SCALE NONE	PART NUMBER 10636-01		

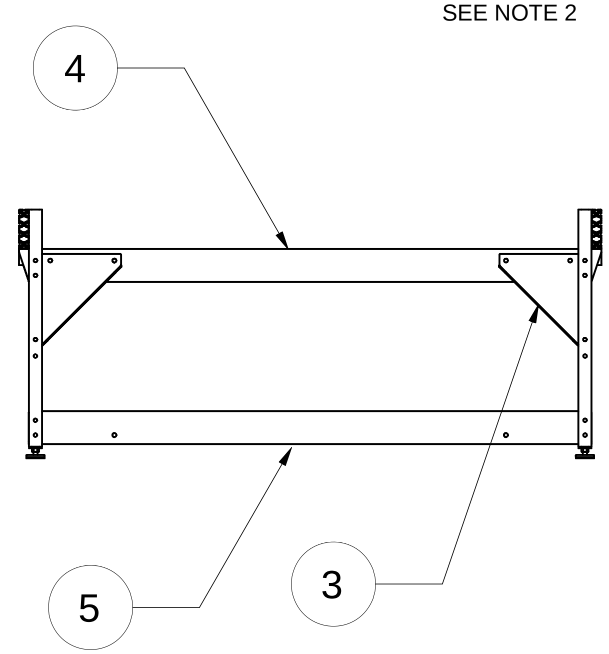
REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		06/20/07	DGC	INITIAL PRODUCTION RELEASE	





VIEW A
SEE NOTE 2





Item No.	Qty	Part Number	Description
1	2	001550-01	TABLE SIDE 120E
2	6	000919-01	TABLE LEG 6E
3	6	000770-01	TABLE GUSSET
4	4	001881-01	TABLE SUPPORT UPPER 72E
5	3	001882-01	TABLE SUPPORT LOWER 72E
6	4	001880-01	TABLE SUPPORT CROSS 72E
7	6	000661-01	MACHINE GLIDE
8	6	000160-01	NUT HEX 5/8-11 Z5
9	6	000845-01	WASHER LOCK 5/8 Z
10	80	000727-01	NUT T HEAVY DUTY 5/16-18
11	80	000529-01	HCS 5/16-18 X 3/4 Z5
12	80	000848-01	WASHER FLAT 5/16 Z USS
13	40	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	40	000440-01	NUT HEX 1/2-13 Z
15	80	000029-01	WASHER FLAT 1/2 USS Z
16	40	000588-01	WASHER LOCK 1/2 Z
17	56	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	56	000452-01	NUT HEX 3/8 Z
19	56	000444-01	WASHER FLAT 3/8 USS Z
20	56	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

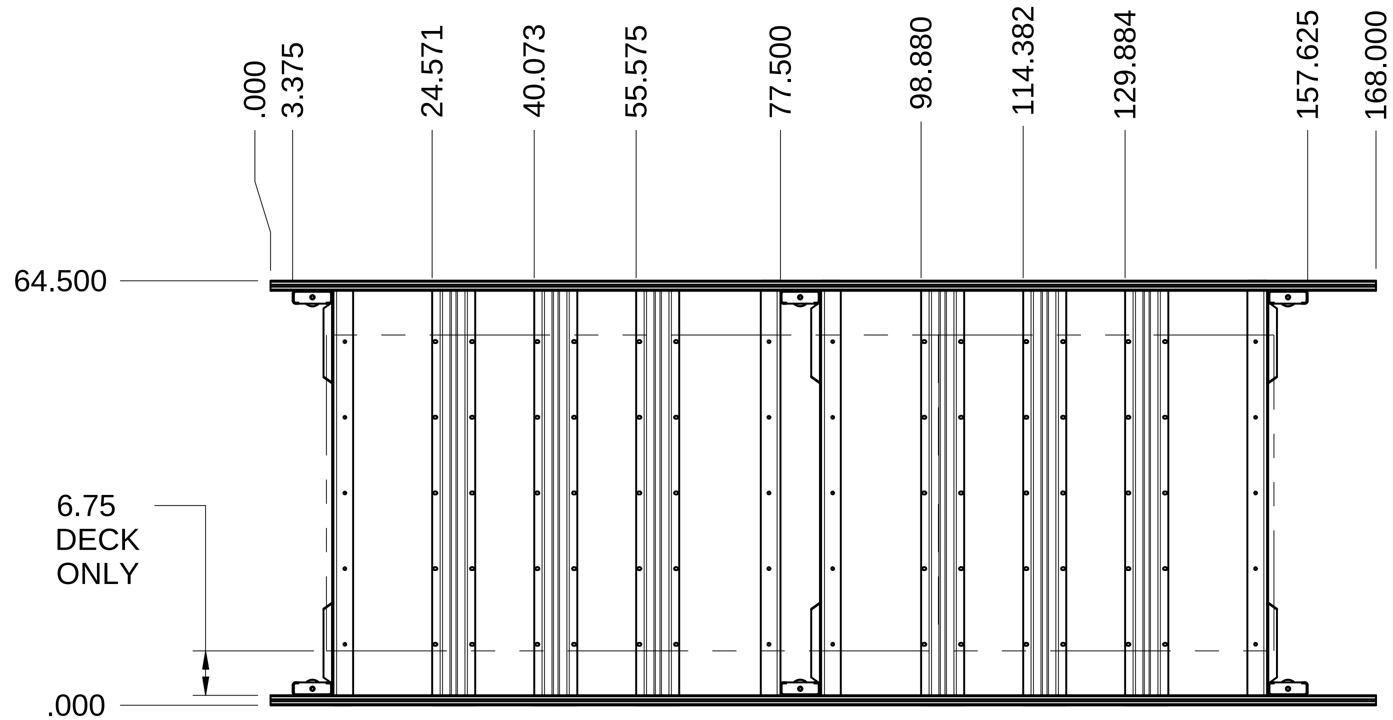
NOTES:

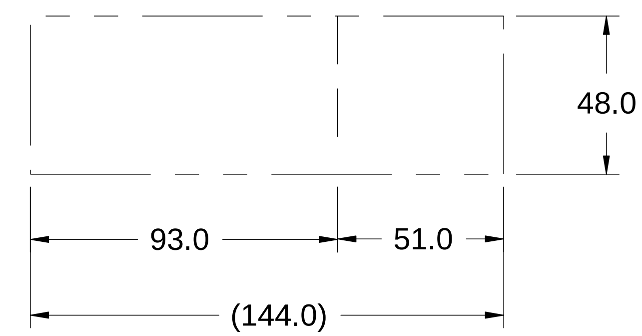
1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

ShopBot
Durham, North Carolina

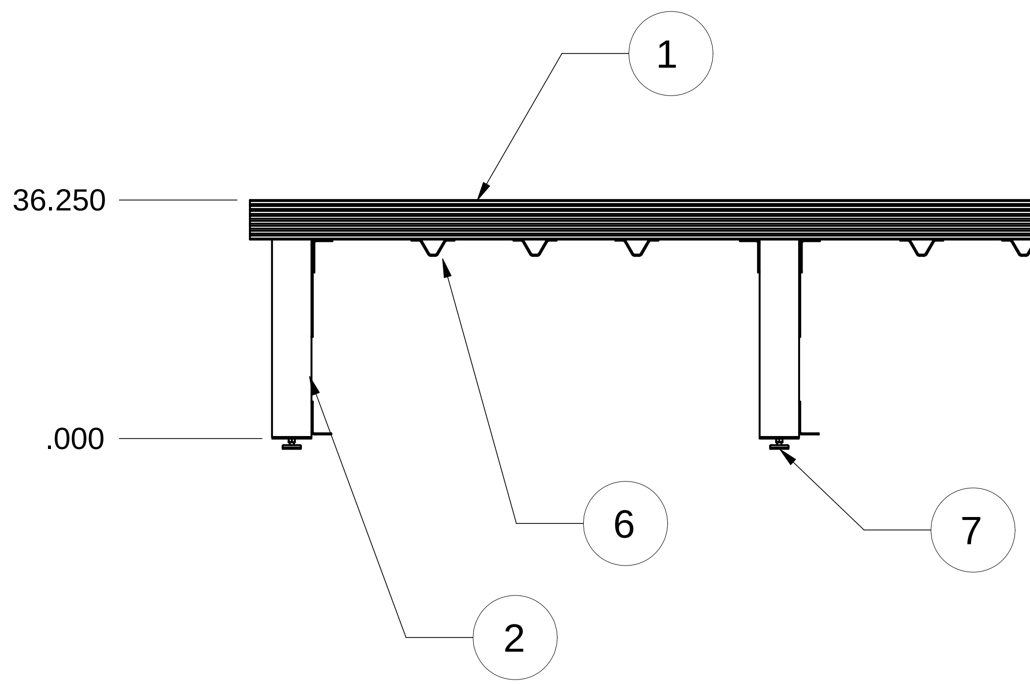
TITLE	TABLE 120-72-8S				
DRAWN DGC	DATE 03/02/07	CHECKED	APPROVED		
SIZE B	DRAWING NUMBER 10625-00			REV 0	
SCALE NONE	PART NUMBER 10625-01				

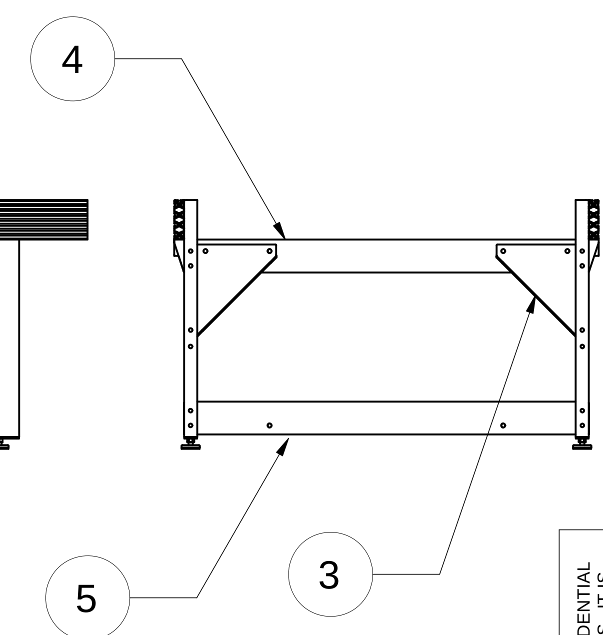
REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		05/08/07	DGC	INITIAL PRODUCTION RELEASE	





VIEW A
SEE NOTE 2





Item No.	Qty	Part Number	Description
1	2	001581-01	TABLE SIDE 144E
2	6	000919-01	TABLE LEG 6E
3	6	000770-01	TABLE GUSSET
4	4	000915-01	TABLE SUPPORT UPPER 48E
5	3	000921-01	TABLE SUPPORT LOWER 48E
6	6	000926-01	TABLE SUPPORT CROSS 48E
7	6	000661-01	MACHINE GLIDE
8	6	000160-01	NUT HEX 5/8-11 Z5
9	6	000845-01	WASHER LOCK 5/8 Z
10	88	000727-01	NUT T HEAVY DUTY 5/16-18
11	88	000529-01	HCS 5/16-18 X 3/4 Z5
12	88	000848-01	WASHER FLAT 5/16 Z USS
13	40	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	40	000440-01	NUT HEX 1/2-13 Z
15	80	000029-01	WASHER FLAT 1/2 USS Z
16	40	000588-01	WASHER LOCK 1/2 Z
17	62	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	62	000452-01	NUT HEX 3/8 Z
19	62	000444-01	WASHER FLAT 3/8 USS Z
20	62	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

ShopBot
Durham, North Carolina

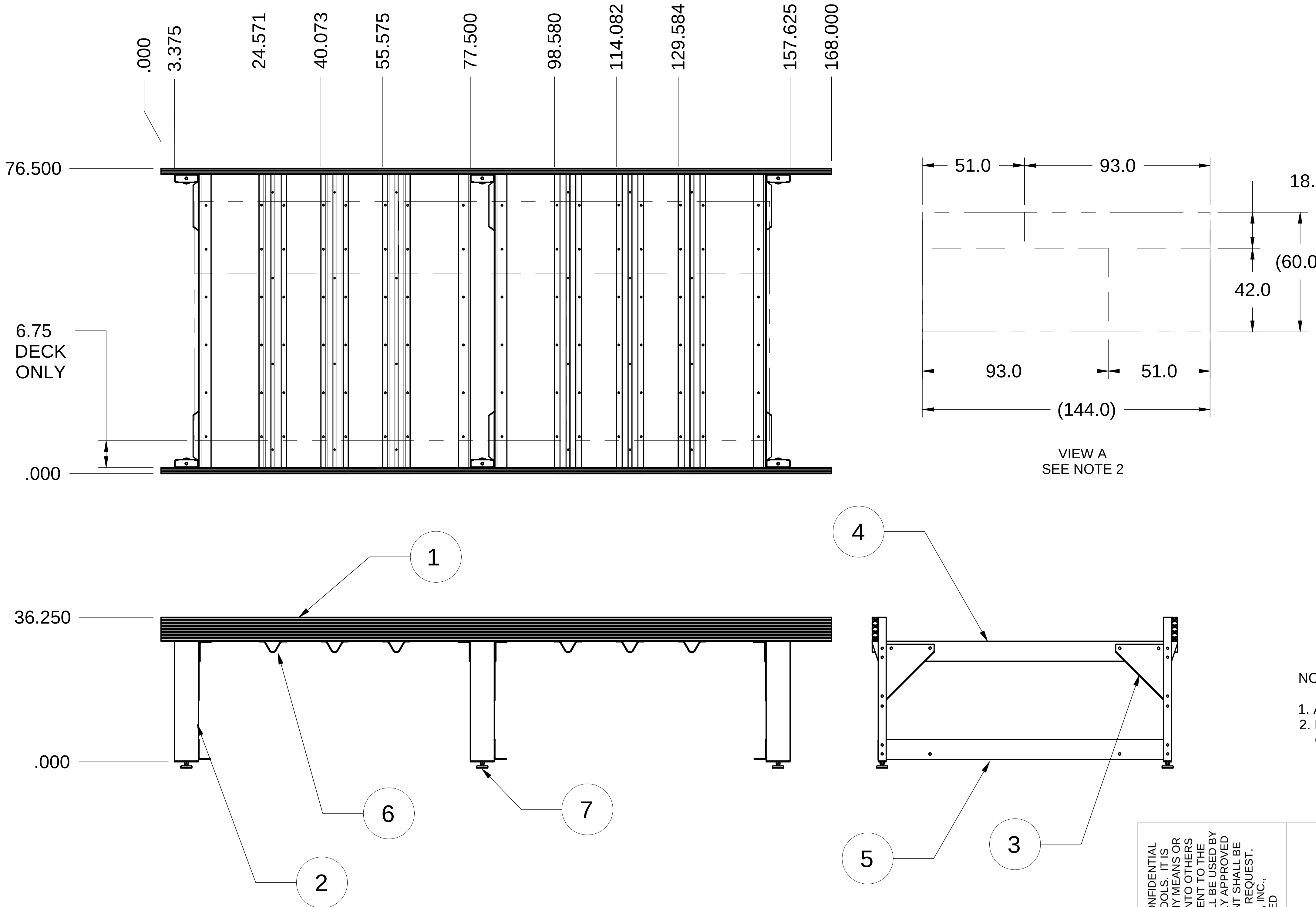
TITLE: **TABLE 144-48-8S**

DRAWN	DATE	CHECKED	APPROVED
DGC	06/20/07		

SIZE	DRAWING NUMBER	REV
B	10637-00	0

SCALE	PART NUMBER
NONE	10637-01

REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		06/20/07	DGC	INITIAL PRODUCTION RELEASE	



Item No.	Qty	Part Number	Description
1	2	001581-01	TABLE SIDE 144E
2	6	000919-01	TABLE LEG 6E
3	6	000770-01	TABLE GUSSET
4	4	001486-01	TABLE SUPPORT UPPER 60E
5	3	001487-01	TABLE SUPPORT LOWER 60E
6	6	001485-01	TABLE SUPPORT CROSS 60E
7	6	000661-01	MACHINE GLIDE
8	6	000160-01	NUT HEX 5/8-11 Z5
9	6	000845-01	WASHER LOCK 5/8 Z
10	88	000727-01	NUT T HEAVY DUTY 5/16-18
11	88	000529-01	HCS 5/16-18 X 3/4 Z5
12	88	000848-01	WASHER FLAT 5/16 Z USS
13	40	001956-01	HCS 1/2-13 X 1 1/2 Z5
14	40	000440-01	NUT HEX 1/2-13 Z
15	80	000029-01	WASHER FLAT 1/2 USS Z
16	40	000588-01	WASHER LOCK 1/2 Z
17	72	000953-01	BOLT CARRIAGE 3/8-16 X 1 1/2
18	72	000452-01	NUT HEX 3/8 Z
19	72	000444-01	WASHER FLAT 3/8 USS Z
20	72	000092-01	WASHER LOCK 3/8 Z
21	8	001539-01	TABLE SIDE END CAP

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. RECOMMENDED SIZE AND ORIENTATION OF DECK MATERIAL.

REV	CHG NOTICE	DATE	BY	REVISION DESCRIPTION	APVD
0		06/20/07	DGC	**INITIAL PRODUCTION RELEASE**	

ShopBot
Durham, North Carolina

TITLE **TABLE 144-60-8S**

DRAWN **DGC** DATE **06/20/07** CHECKED APPROVED

SIZE B DRAWING NUMBER **10638-00** REV **0**

SCALE **NONE** PART NUMBER **10638-01**