

## Assembly Instructions for Seig X2 and X2D Benchtop Mini Mill



Congratulations! You have purchased the best cnc conversion kit for the Seig Model X2 and X2D benchtop mini mill on the market. This kit is a true bolt-on conversion kit that requires no drilling or tapping of any holes to install the kit. However, due to casting irregularities from the manufacturer, some modifications to the castings may be required.

The kit includes:

(3) 16mm ball screw and ball nut assemblies

(3) NEMA 23 stepper motor mounts

All necessary mounting hardware

All new thrust bearings assemblies

All new shaft connectors to connect the ball screw to your stepper motor

This kit has been developed over the past three years with ease of installation, functionality and dependability giving your Seig X2 or X2D benchtop mini mill full three axis capabilities. In addition, it can support the addition of a fourth axis if you desire. (Software used by customer must have fourth axis capabilities)

For this installation you will need the following:

Metric hex key set

SAE hex key set

Phillips screwdriver

Flat screwdriver

Small adjustable wrench

Deadblow or rubber hammer

Lithium grease (any grease will do but lithium is recommended)

An electric drill

To prepare the machine, if new, please remove all the rust prohibitive applied by the factory. If used, please remove all shavings and dirt from the machine

A large work table for disassembling the machine

Clean shop rags

Grease gun

A can of WD 40 or some other lubricant

Several containers to put the disassembled part in order

Good lighting

Some music

The kit will arrive assembled. All thrust bearings will be adjusted. Note: thrust bearings are designed to eliminate or reduce axial slack. They are not intended to be over tightened. They are pre-set in assembly.

The stepper motor can be mounted on either end. As delivered, it is set up to be on the left side of the table (looking at the machine). If you decide to move the stepper motor to the right side, you will have to reverse the direction of the ball nut. You must be very careful when removing the ball nut from the ball screw using the cardboard tube supplied. You will have to unscrew the nut from the ball screw onto the cardboard tube to assure that you do not let any of the .125" diameter ball bearing from the nut. Please watch the following video if you decide to move the motor to the other side of the table.

<https://www.youtube.com/watch?v=5IN-bS3OQXY>

At final assembly, apply a generous coat of lithium based grease on the entire length of each ball screw and the thrust bearings.

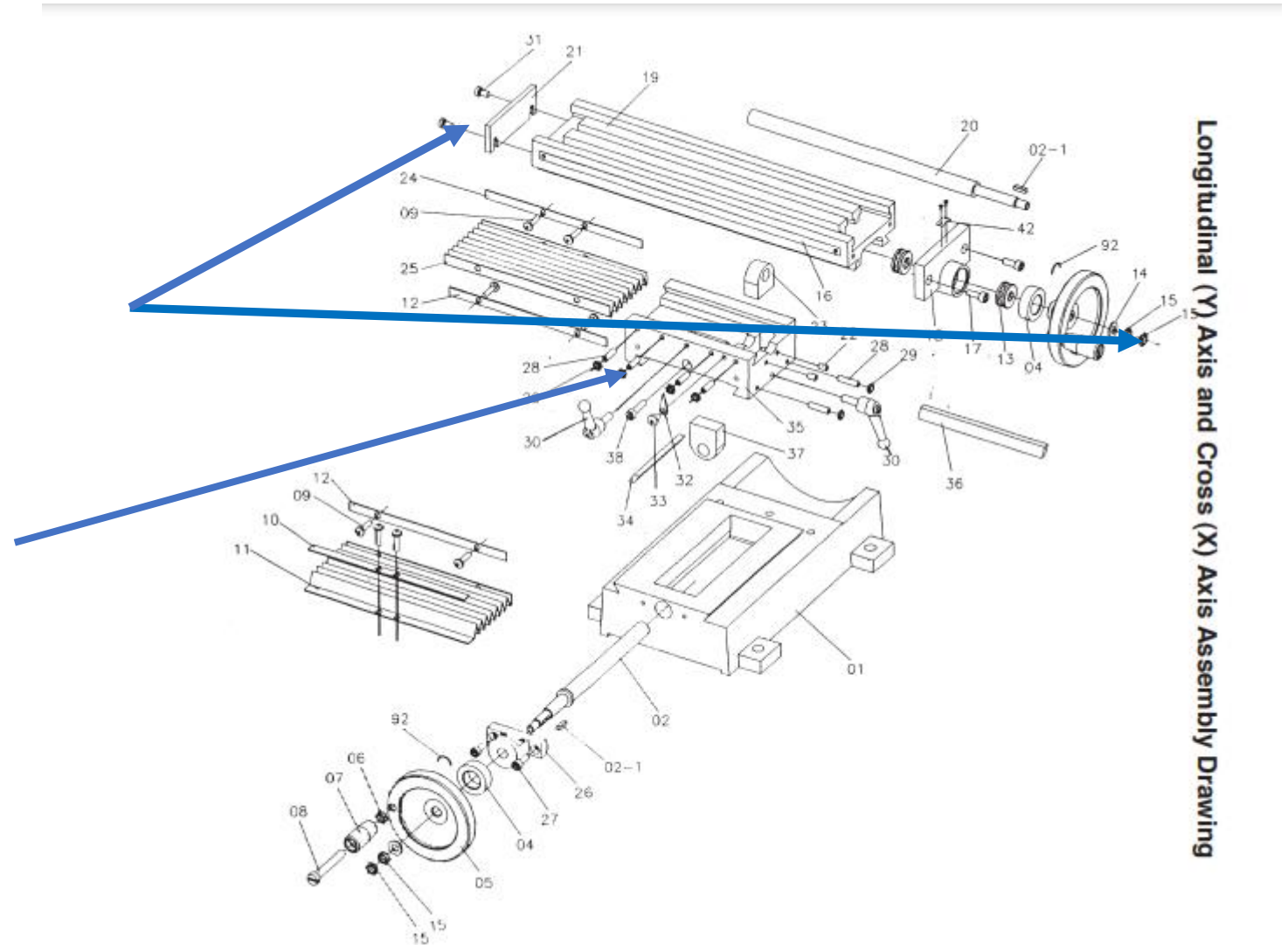
If your machine has a lift assist device for the head, it must be removed. (directions to remove lift assist in the following slides.

Let's start by removing the table. First, remove the screw or nut holding the crank handle from the lead screw.

Then remove the two bolts that hold the right side table endplate from the table, then the two bolts that hold the left side table endplate from the table

Now loosen the jam nuts that hold the gib in place. Once these are loosed, use an Allen wrench to back out the gib adjustment screws.

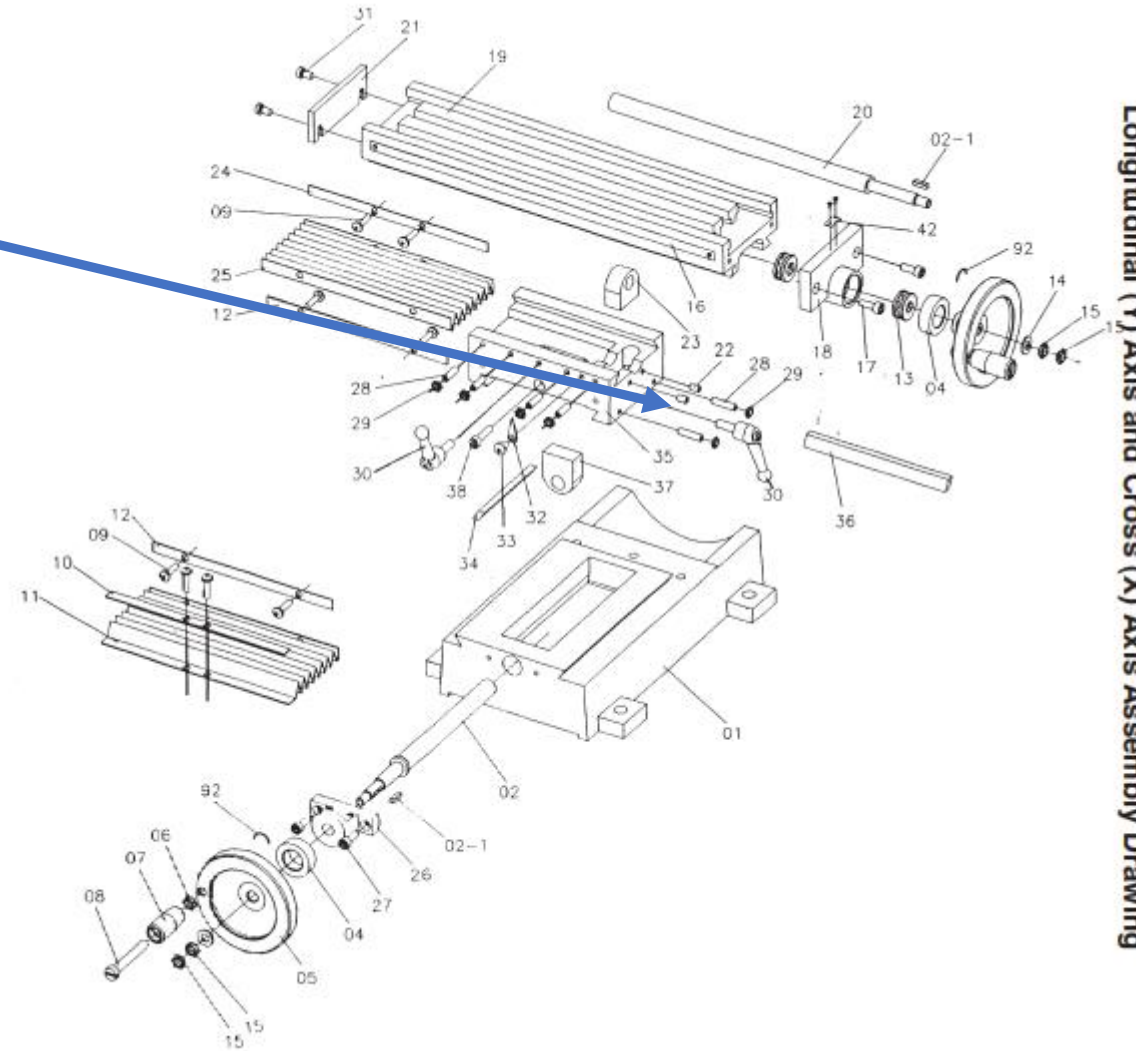
The table is now loose and can be slid to either side. Be careful, the table is pretty heavy and when it clears the base it will become completely in your hands. Be sure to take the gib and mark it as X axis and set it somewhere for re-assembly.



Longitudinal (Y) Axis and Cross (X) Axis Assembly Drawing

Now, remove the two bolts that hold the lead screw nut in the Y axis cross slide. Be sure and mark these two bolts as you will need them later for re-assembly.

You should be able to lift the lead screw and nut up from the base. Set it to the side, it is no longer needed for this machine.



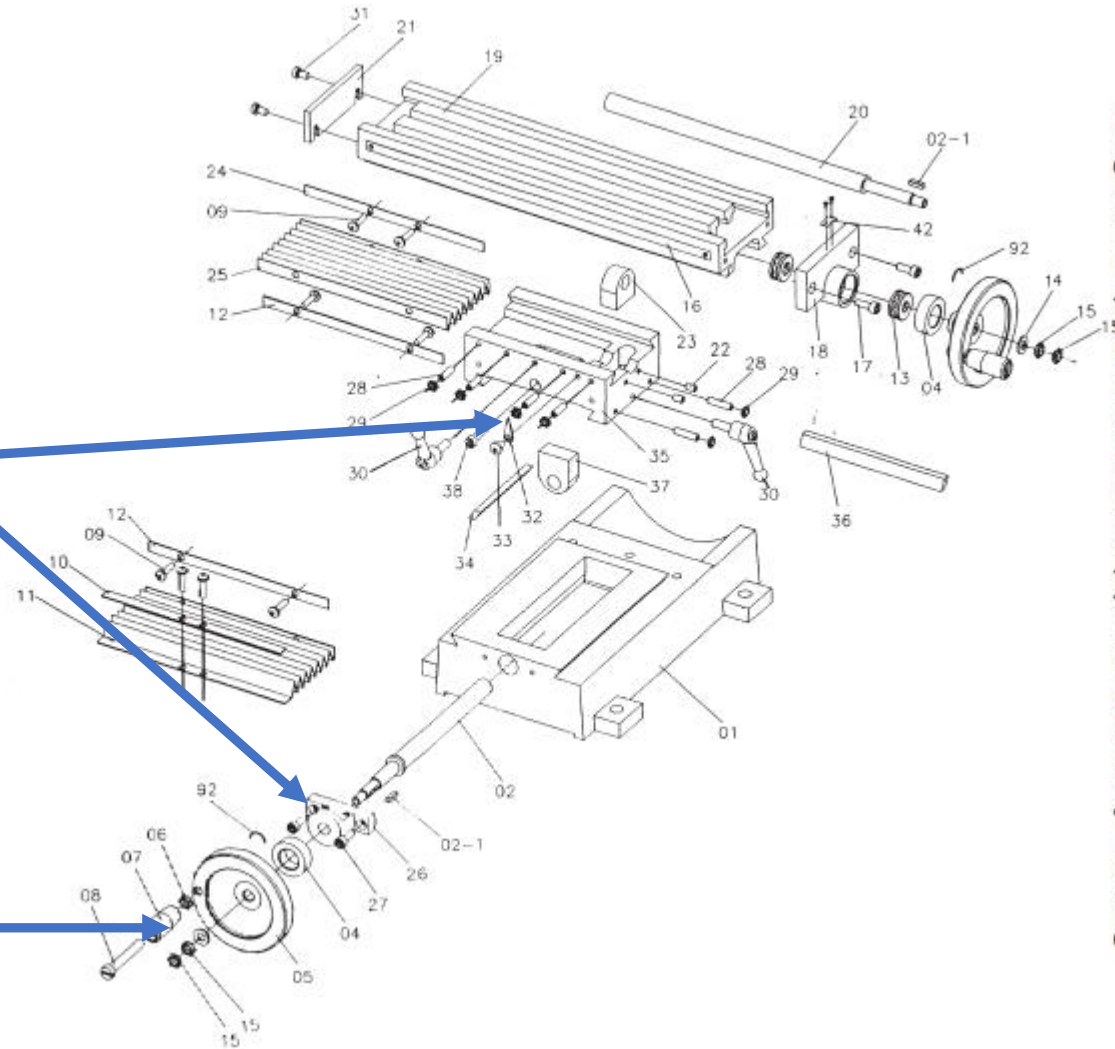
Longitudinal (Y) Axis and Cross (X) Axis Assembly Drawing

It's now time to remove the Y axis cross slide. Remove the screw or nut from the cranking handle.

Then remove the two bolts that hold the bearing housing from the front of the base

Then remove the bolt that holds the Y axis lead screw nut from the cross slide casting.

You should now be able to unscrew the lead screw from the machine and remove the lead screw nut from the base. The lead screw and nut are no longer needed.

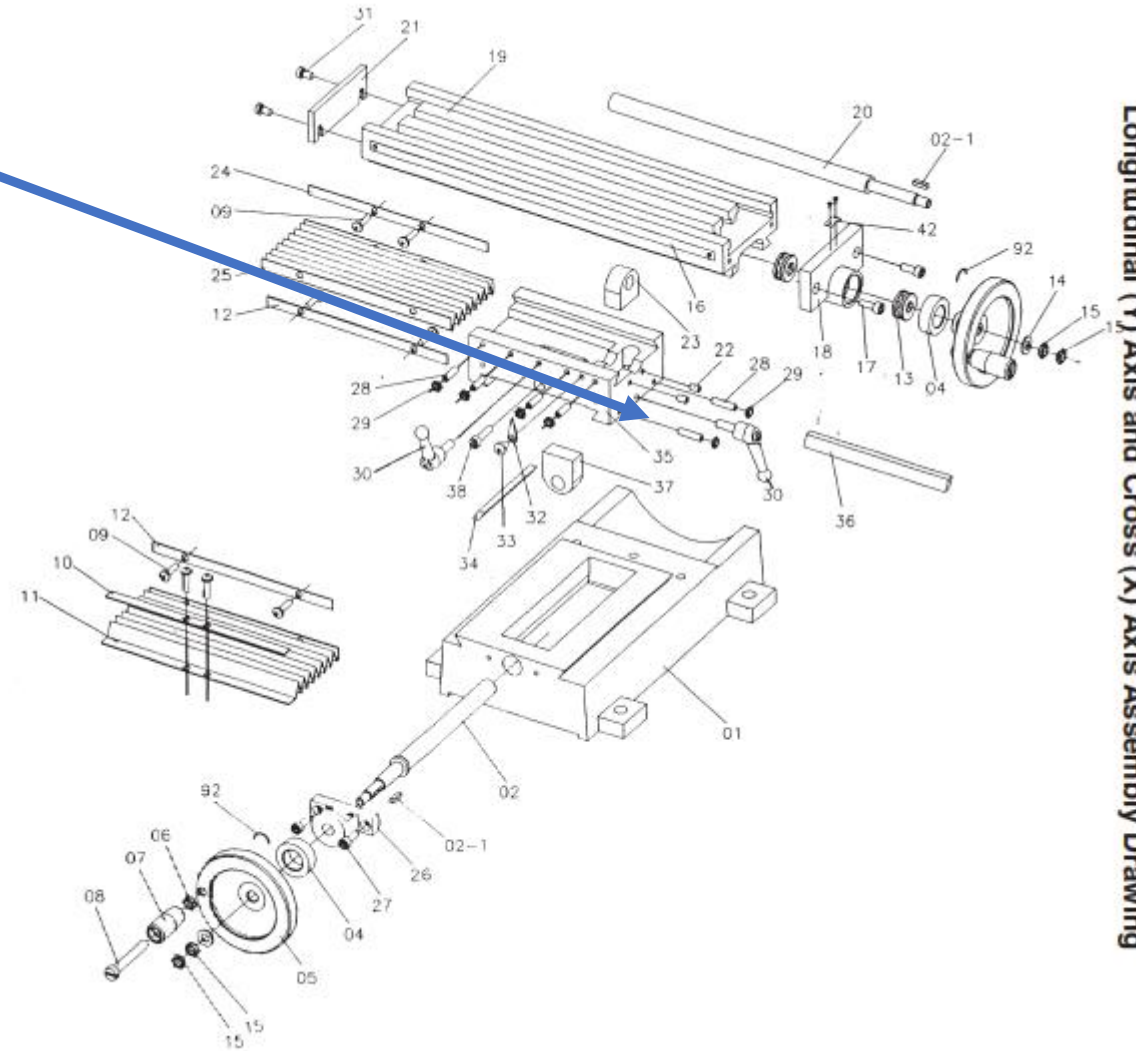


Longitudinal (Y) Axis and Cross (X) Axis Assembly Drawing

Let's remove the cross slide base casting from the machine base. Loosen the jam nuts from the gib adjustment screws and back out the gib adjustment screws as before. They are located on the right side of the Y axis cross slide casting.

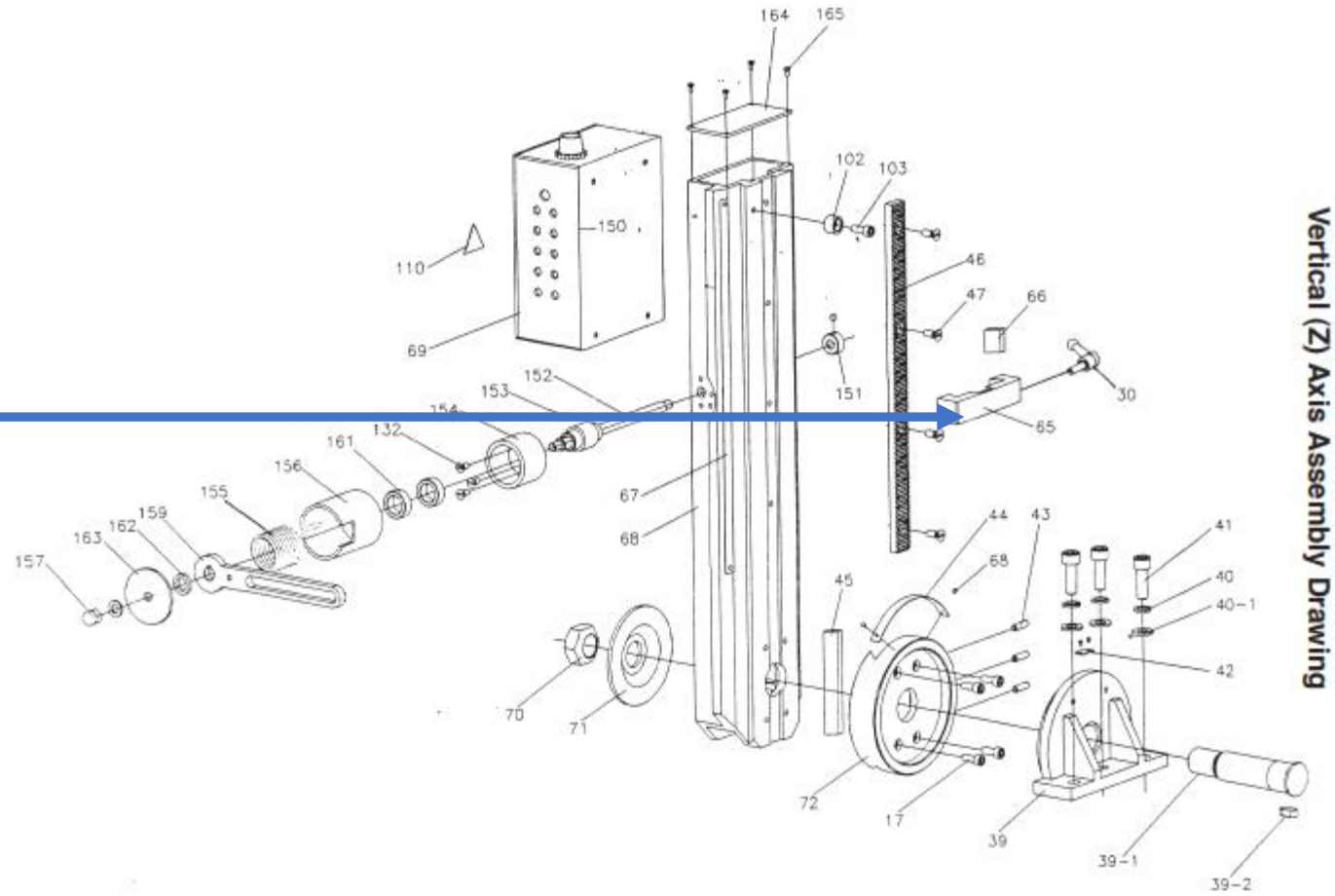
You should now be able to slide the Y axis cross slide casting from the base by sliding it forward. Set it the side for reassembly.

Be sure and mark the gib as Y axis.





Now let's remove the Z axis rack gear. For this you will need some assistance, or a way to stabilize the headstock, possible some wooden blocks or some small machinist jacks. You will be moving the head up and down using the handles on the right side of the head. However, when you remove the rack gear, the head is free to fall down and must be secured in place. The machine comes with a headstock clamp, but be extra careful if you decide to use this instead of another method such as the wooden blocks or jacks.



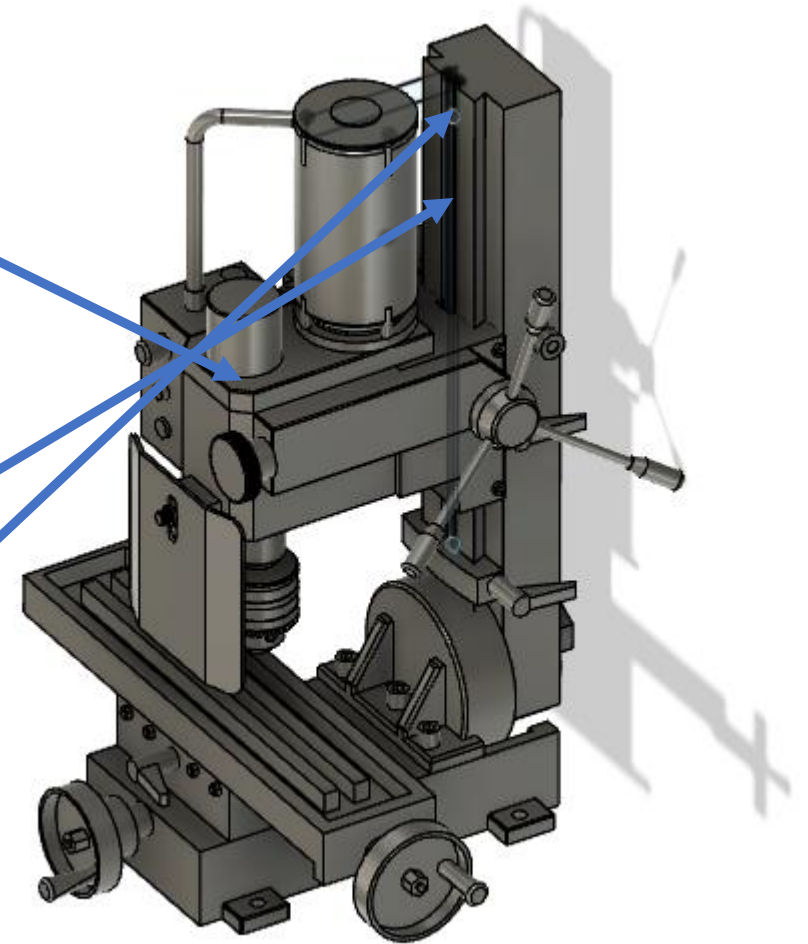
Vertical (Z) Axis Assembly Drawing

To remove the rack gear, you will first need to remove the spindle motor and mount from the headstock, There are 4 bolts that you will need to remove that are located on the top of the motor mounting plate.

Gently, and carefully, raise the spindle motor and mount from the head. Be extra careful not to drop it or you may pull the wires from the electronics box or the motor itself. You will need something to set the motor on while you remove the rack. This is an extremely important step!!!!

Start with the head in the lowered position exposing two of the screws that hold the rack in place

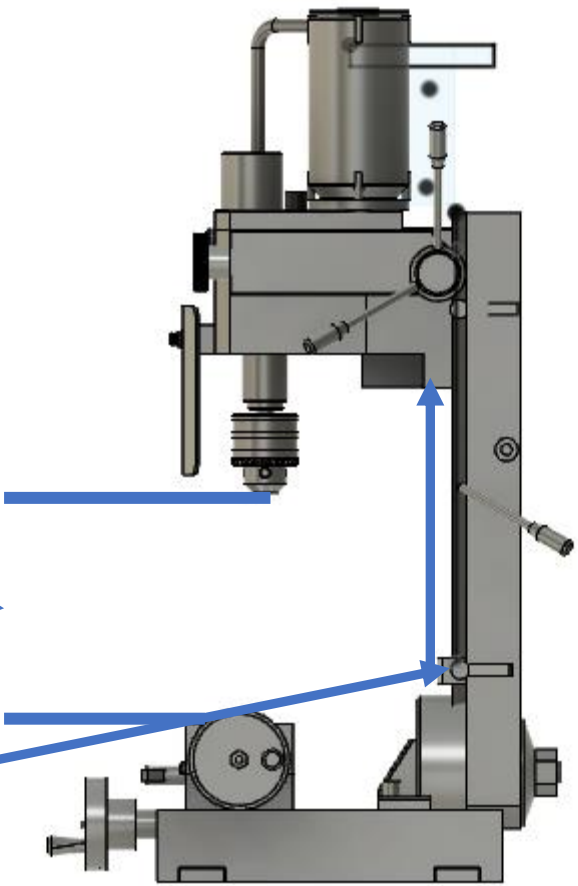
Finally, there is a headstock stop that must be removed as well.



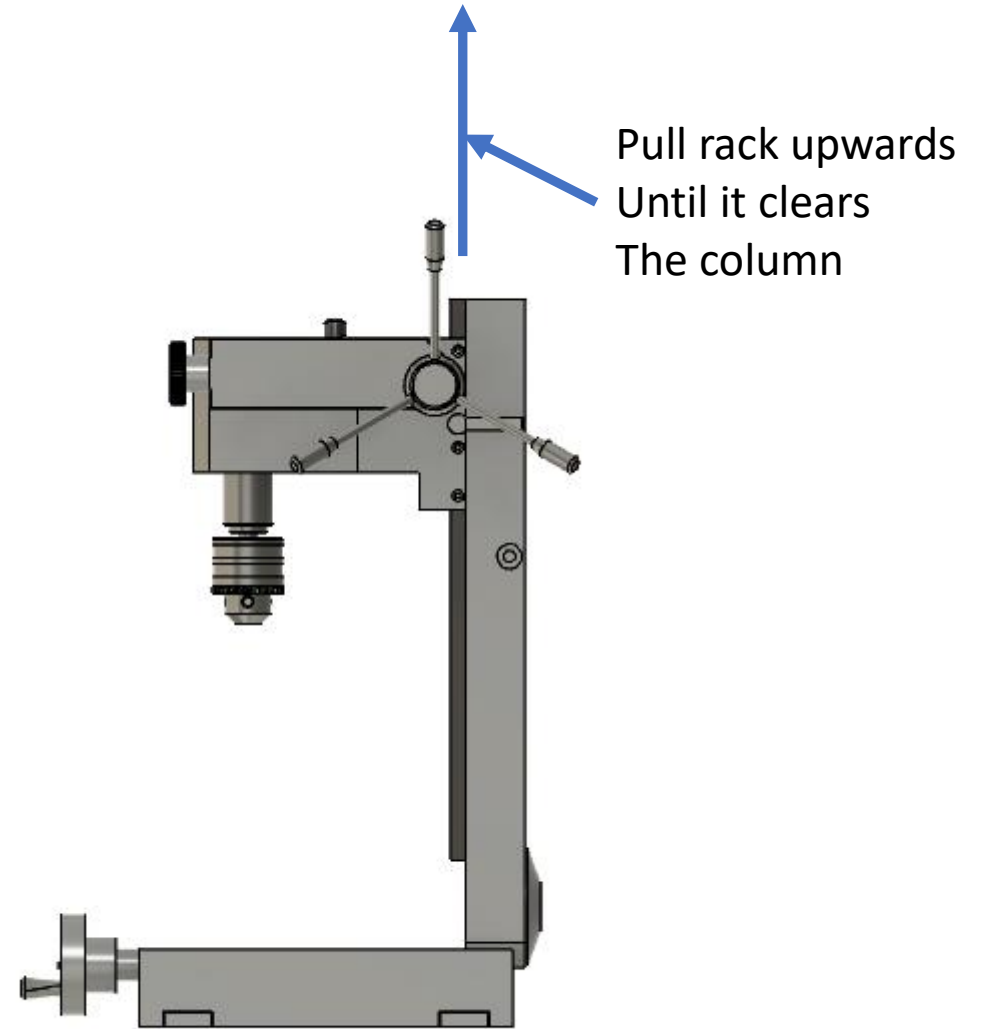
Now, raise the head to expose the remaining screws on the rack. This is where you will need to secure the head in place. The next step will remove the ability to raise or lower the head using the Z axis cranking levers.

Wooden blocks or jacks between the spindle and the table,

Or, raise the provided clamp to the bottom of the head and tighten securely.



With the headstock securely clamped in place, the remaining screws removed from the rack gear, rotate the head raising/lowering levers to raise the rack gear from the top of the column and remove it. It is no longer needed.



Exploded view of the headstock

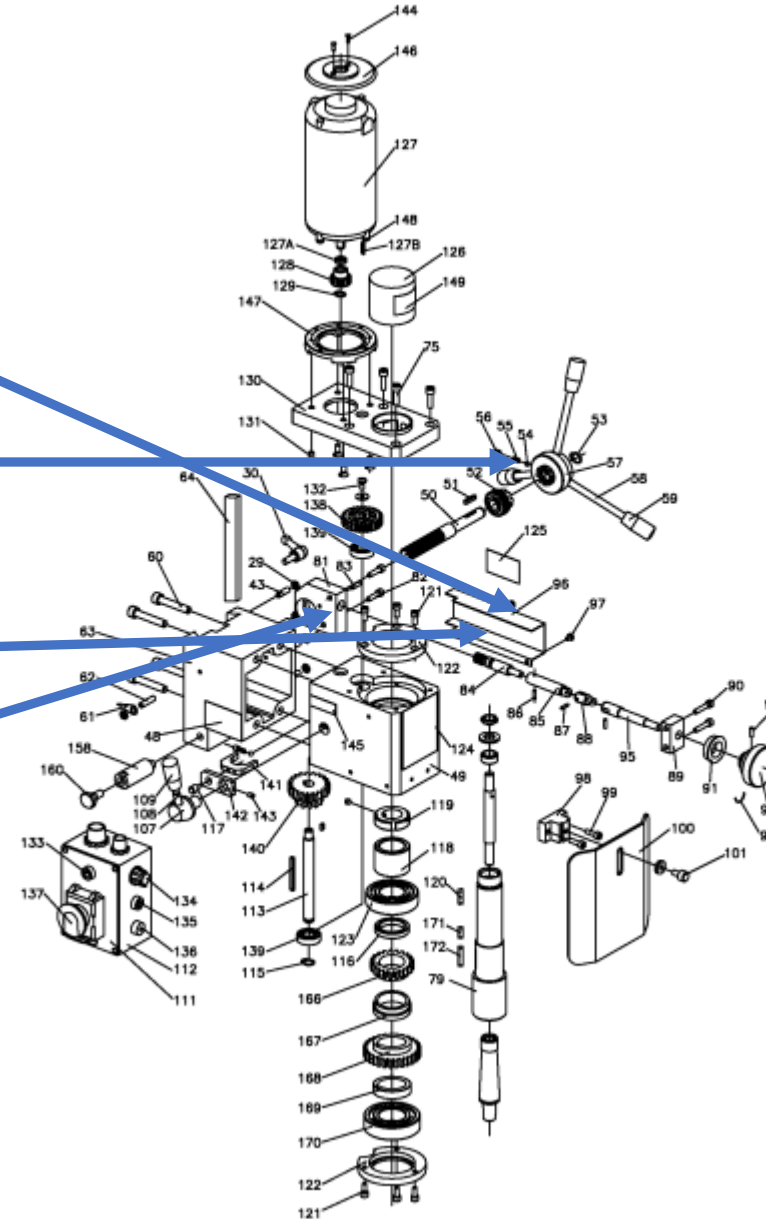
You will be removing the small Phillips screws

Remove the set screw that holds the crank levers in place and pull it off, it is no longer needed

Then remove the thin metal cover

Then remove the housing that holds the pinion gear, remove the pinion

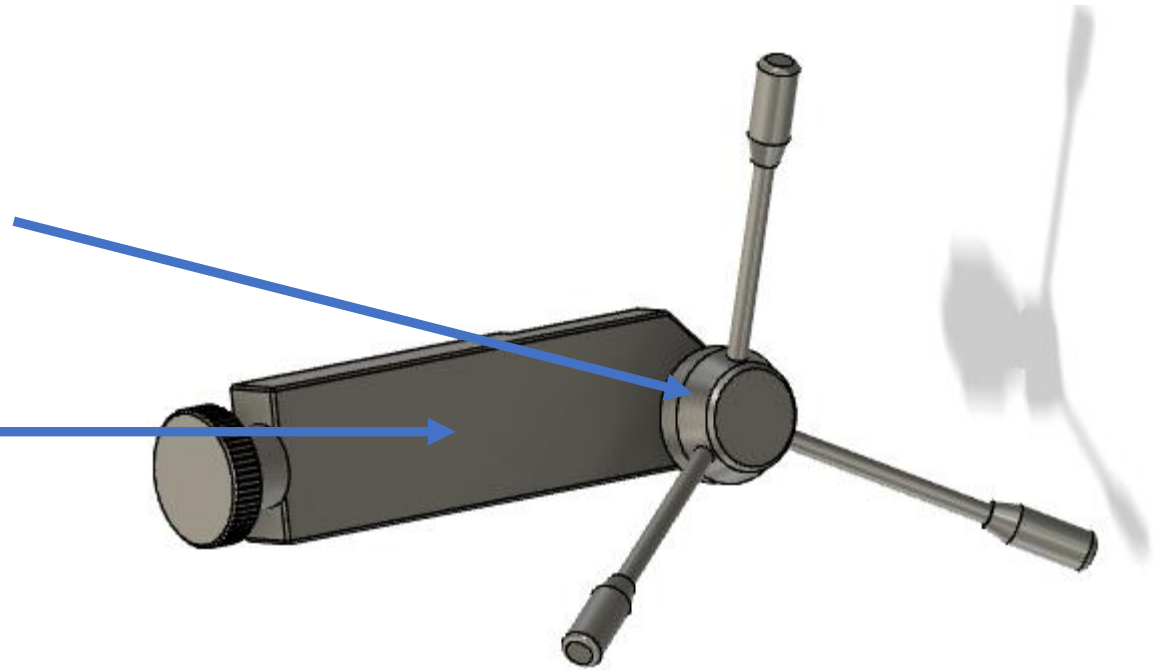
Refer to drawing on next slide



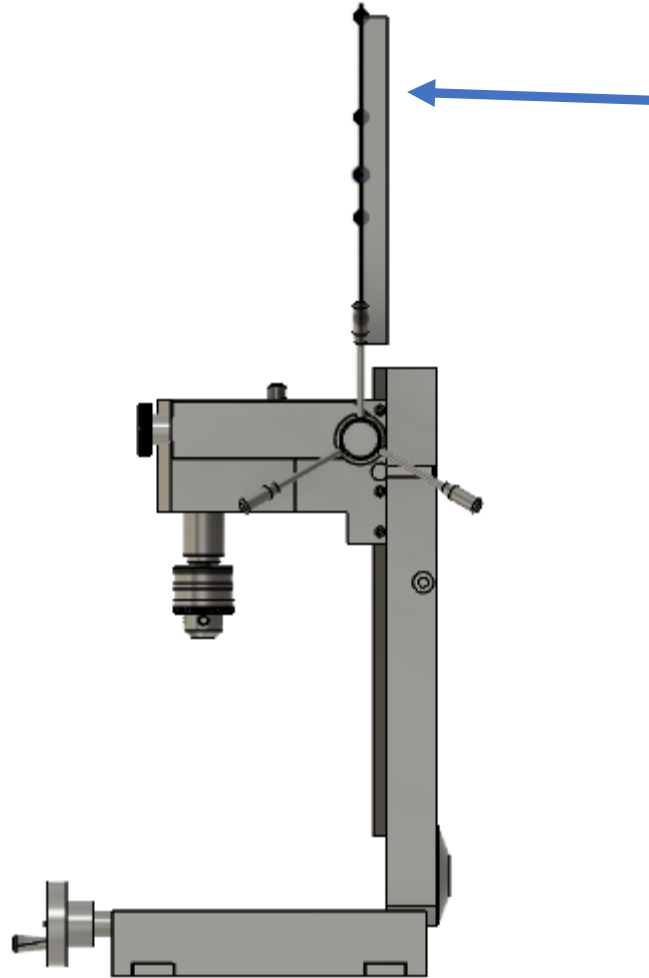
You will now remove the Z axis head raising/lowering assembly. Note: ***once removed, you may no longer raise or lower the head with the cranking levers.***

Start by removing the set screw that locks the handle assembly to the pinion gear that goes through the head. Set it to the side, it is no longer needed.

Next, remove the small Phillips head screws that hold this cover in place.



Align the holes in the clamp bar and use the screws provided, attach it to the column by putting the screws into the holes on the column that the rack gear was attached to. There are 4  $\frac{3}{4}$ " long stainless 10-24 cap screws installed into the bar when shipped. Tighten securely but do not over-tighten.



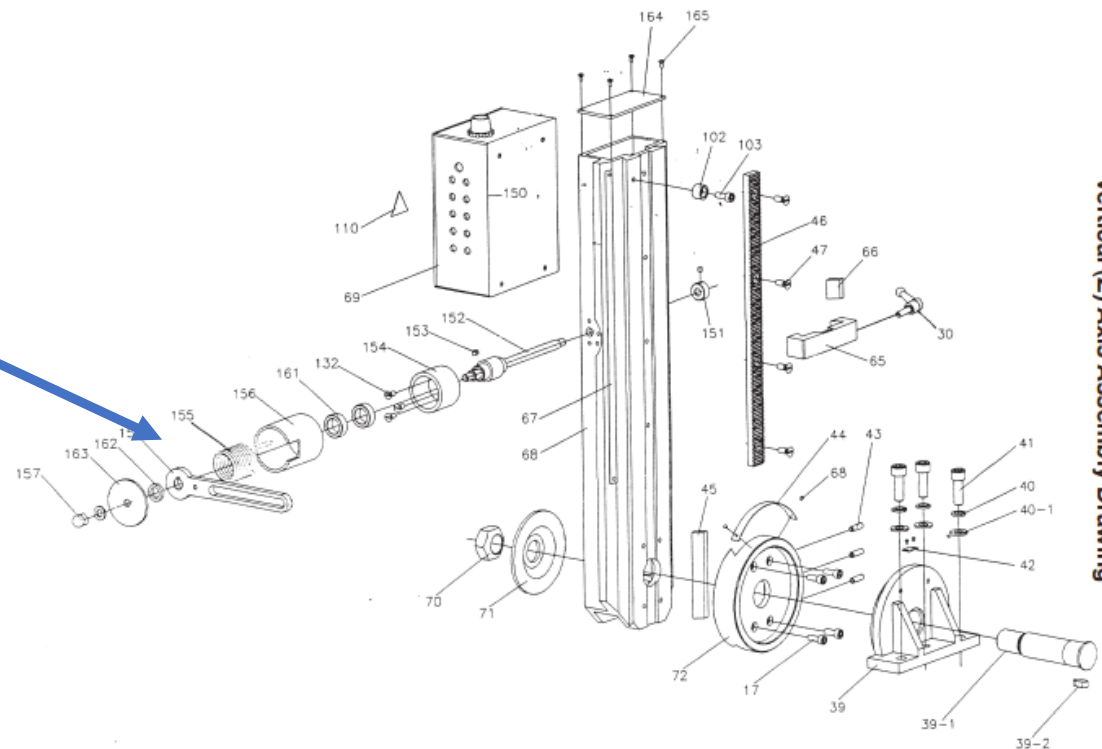
Clamp bar....slide it *inside* the column. Note, there is a 3/8-16 tapped hole in top of this bar. It must go up! This bolt is also useful to hold the bar while attaching the screws that connect it to the column.

At this point, you are ready to start re-assembling the machine with the conversion kit. There is no definite way to re-assemble so you can start where ever you choose. But for the instructions, we will do the Y axis cross slide to the base first.

**Note: *If your machine has a lifting device mounted to the left side of the headstock, it must be removed. There is no instruction for this as there are only two screws/nuts that must be removed. However, be aware that this is spring loaded and may uncoil when removing. Please use caution!!***

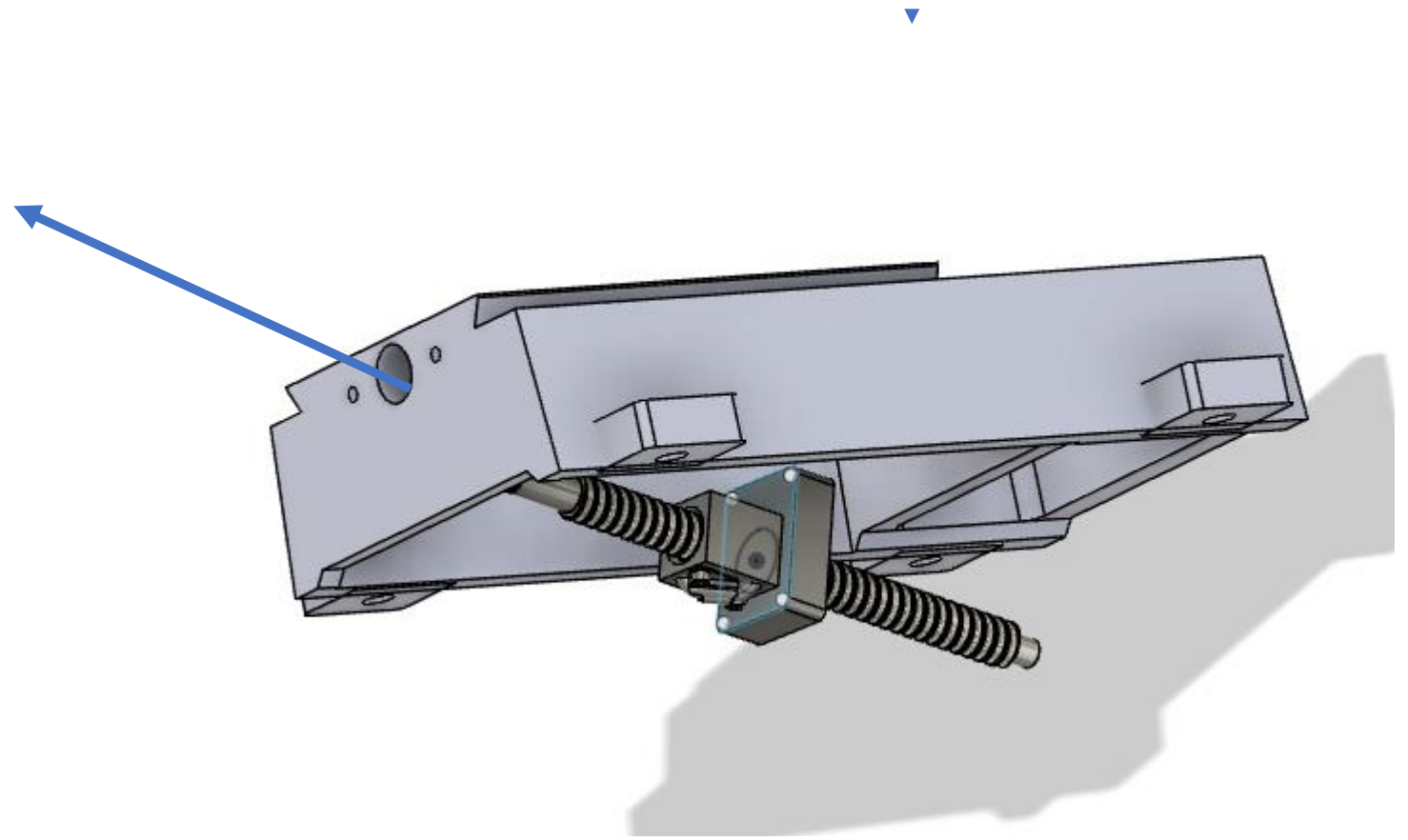
This is the lifting device that may or may not be  
On your machine.

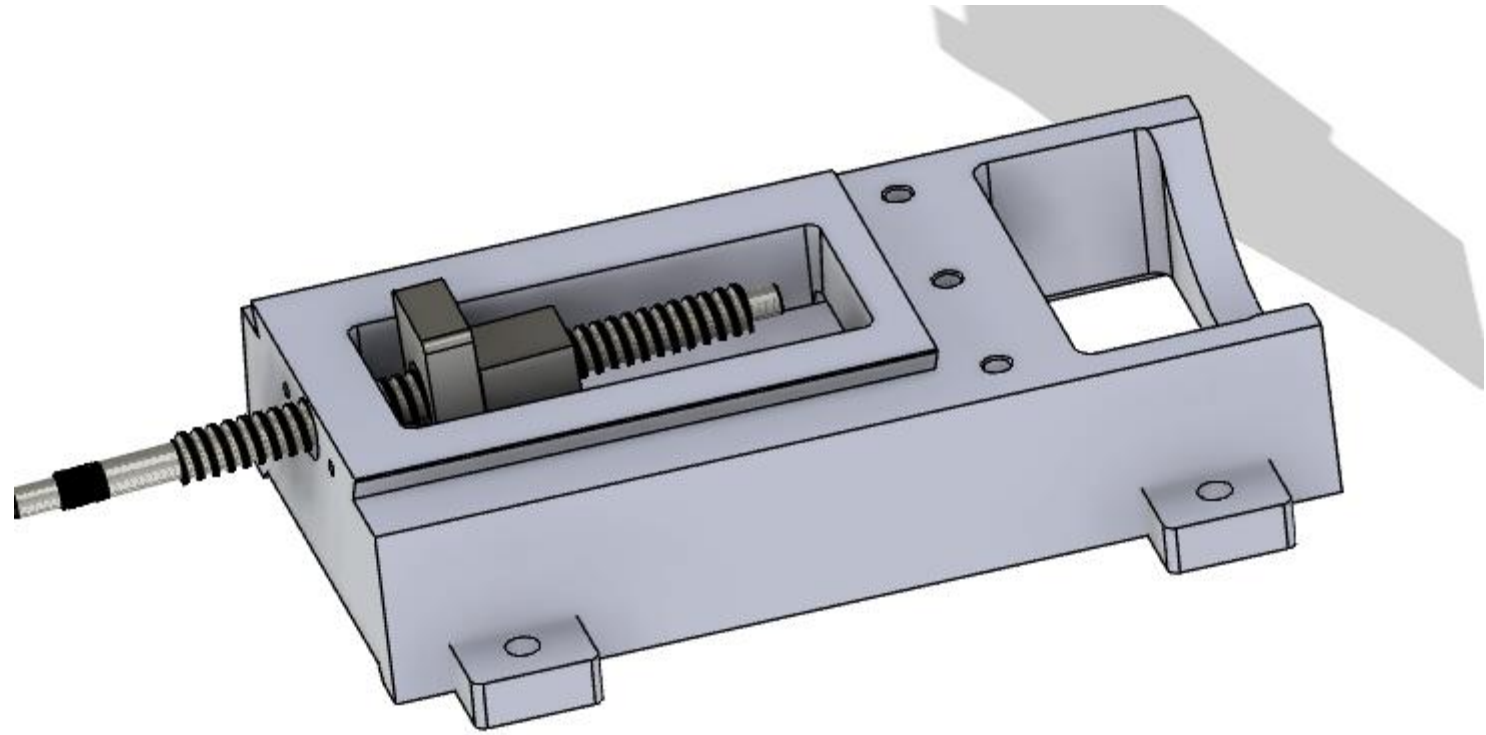
It is no longer needed and





This example shows the machine base only. Your column should be attached. You will need access to the bottom of the base and raised so that you can insert the Y axis ball screw assembly through the hole at the front of the casting. You will then need to set the base back to a flat position making sure that it is not setting on the ball screw assembly.



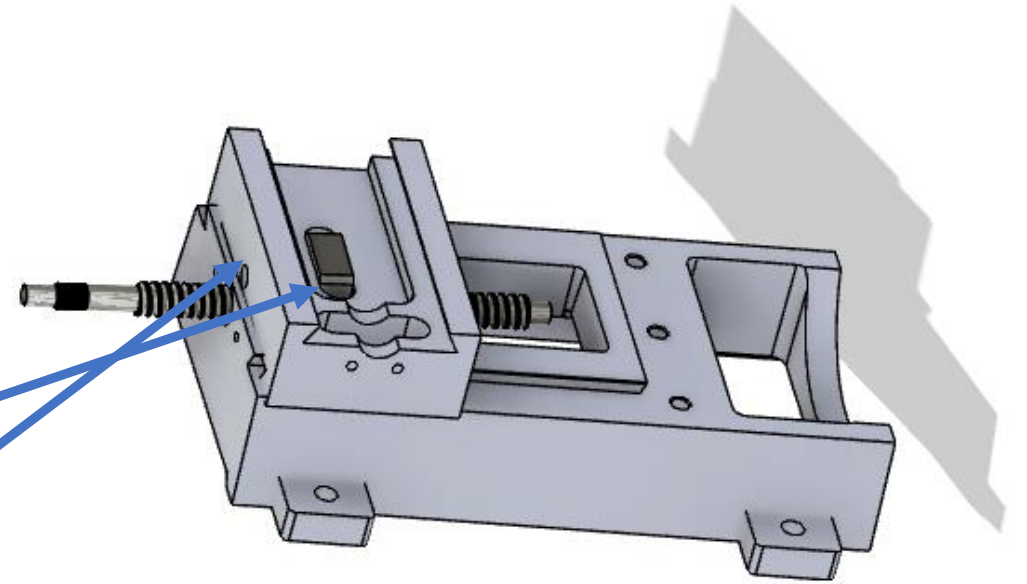


Slide the Y axis cross slide casting onto the machine base. Insert the gib that you previously marked Y axis, then, if you removed the gib adjustment screws, re-insert them into the right side of the Y axis cross-slide casting (not shown) but the are located here

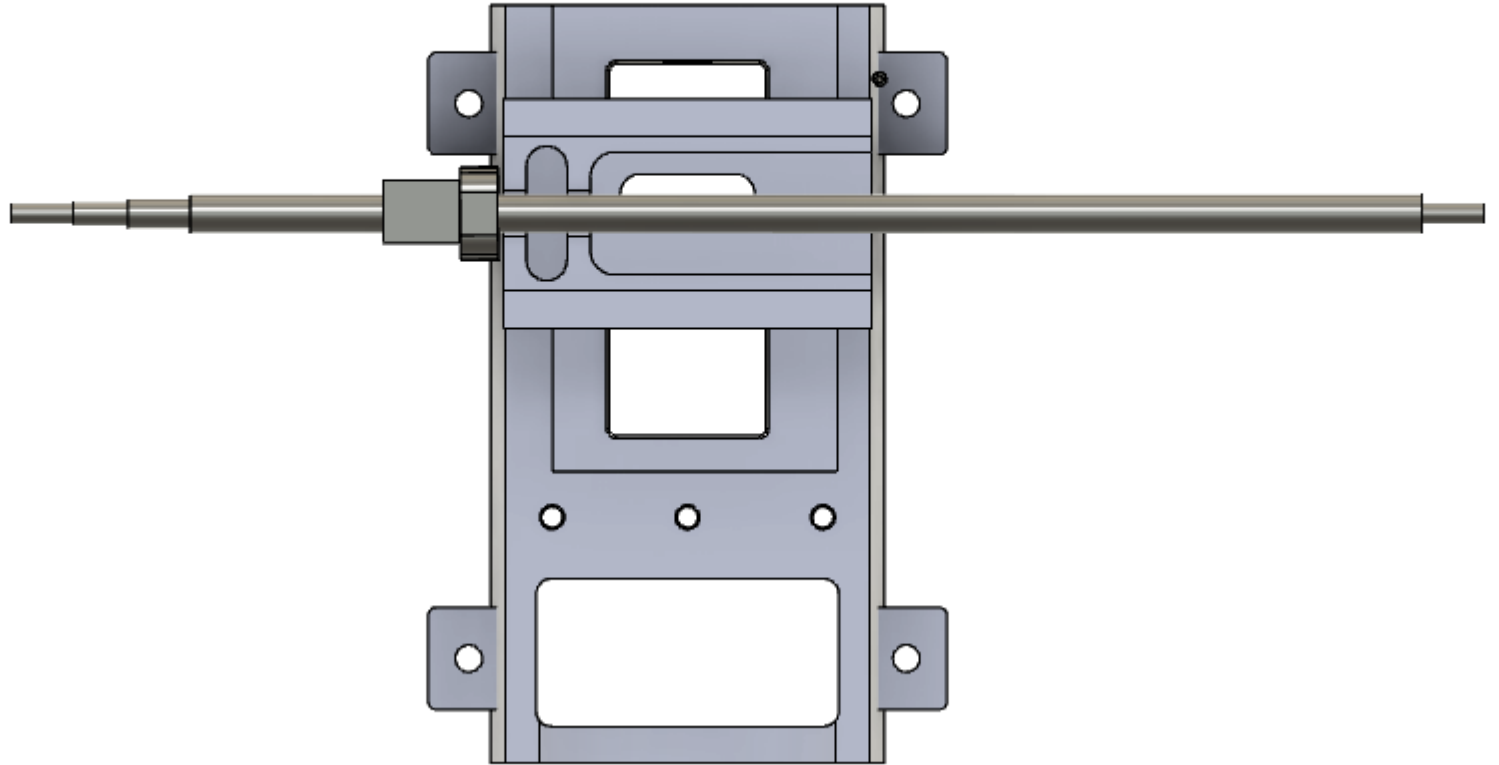
Do not tighten at this point, screw in just enough to engage the gib. Note: the gib has indentions that the end of these screws go into. Make sure they are just inside the indentions so that when you slide the casting the gib moves with it.

Move the ball screw assembly so that the ball nut mount fits into the slot on the cross slide casting as shown.

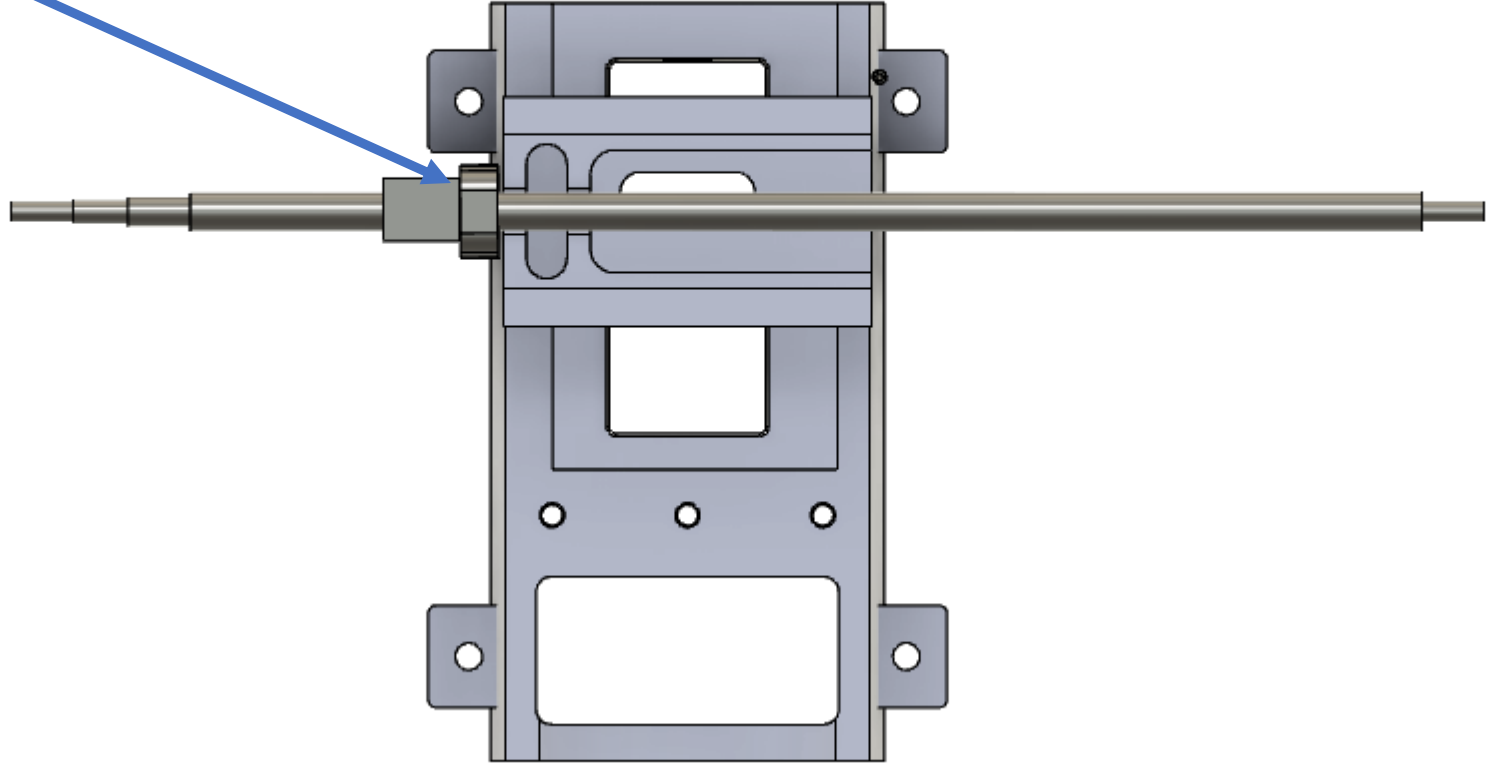
Insert the screw into the casting and tighten it just enough to hole it in place. You will adjust later.

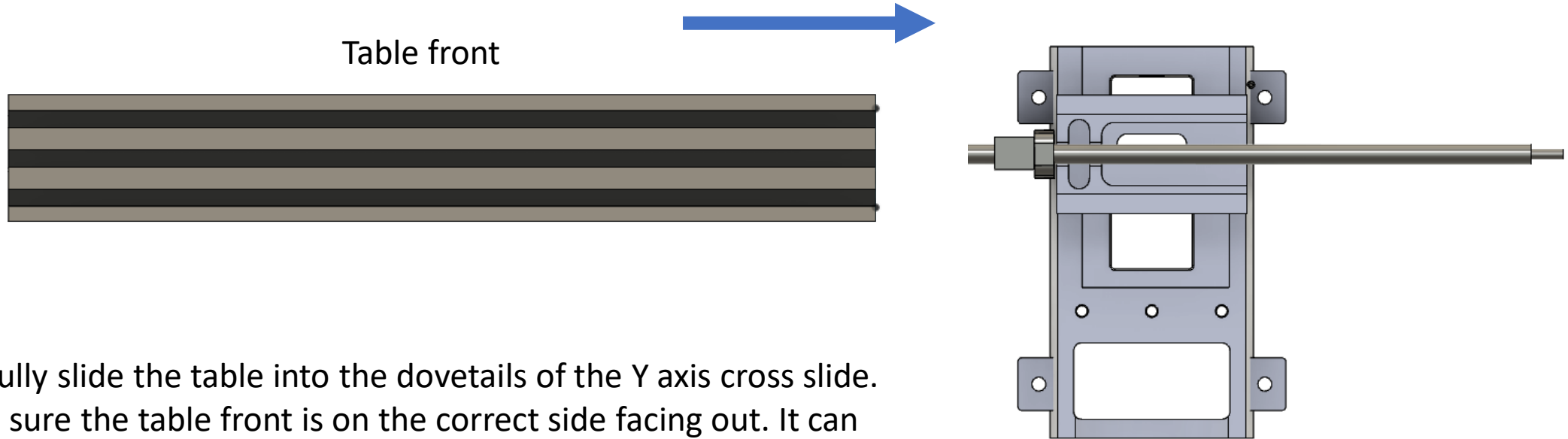


Now, install the X axis ball screw and nut. This is the point where you need to decide which side of the table that you want to mount the stepper motor. This is shown with a left sided mount. If you decide to mount it on the right side, you will need to remove the ball nut from the screw and reverse. To do so you must be very careful when removing the nut so the balls inside do not fall out or become trapped in one of the recirculation paths. Please refer to this video on removing and reinstalling the nut.



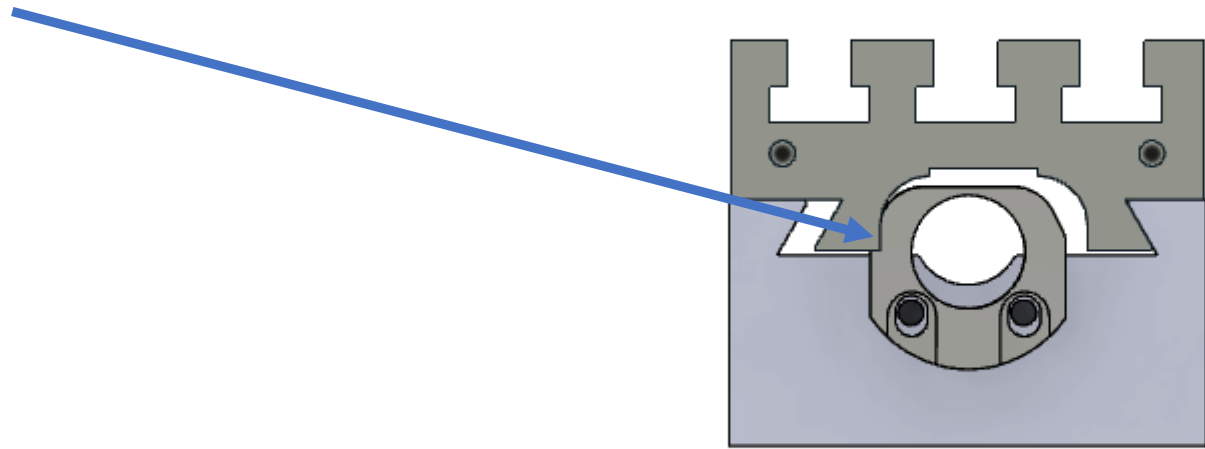
Using the two screws that you removed to free the X axis lead screw nut from the Y axis cross slide base, re-insert them through the ball nut mount and into the Y axis cross slide base. Note the orientation of the nut...the recirculation tubes are on the bottom side of the nut. This must be oriented this way to allow clearance through the table. Do not tighten completely, only snug. They will be tightened later.





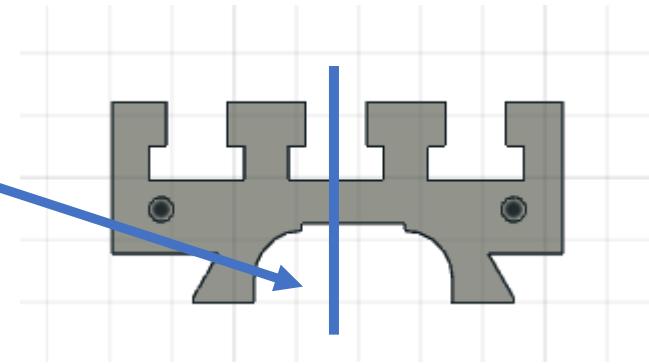
Carefully slide the table into the dovetails of the Y axis cross slide. Make sure the table front is on the correct side facing out. It can be identified by have a measuring scale on it!! Note: it can be installed from either side. Go slowly as the ball nut mount and table bottom are very close. In fact, on some tables, the castings are slightly off and some grinding my be required!!!!

Some grinding may be required!!!!

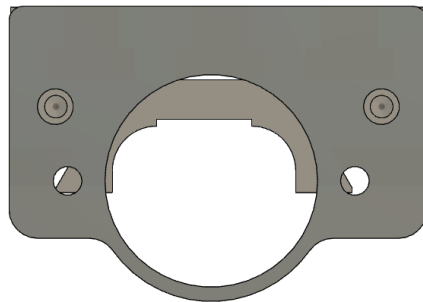


Note: VERY IMPORTANT!!!! The dovetails on the table are offset from the center of the table top as shown here.

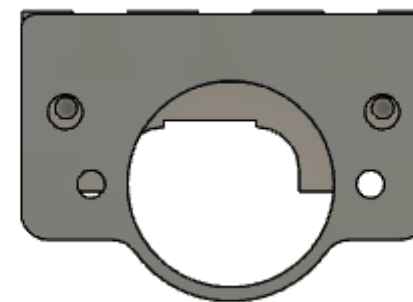
The table end plates can be installed either way, and, differently at each end of the table. The large hole in the table end plate is offset to match the dovetails but the holes that mount it to the table are in the center of the table. Therefore, the end plates can be installed incorrectly. Please make sure that they are aligned correctly on BOTH ENDS or the ball screw will be out of alignment and binding and interference will occur!!!!



Correct



Incorrect

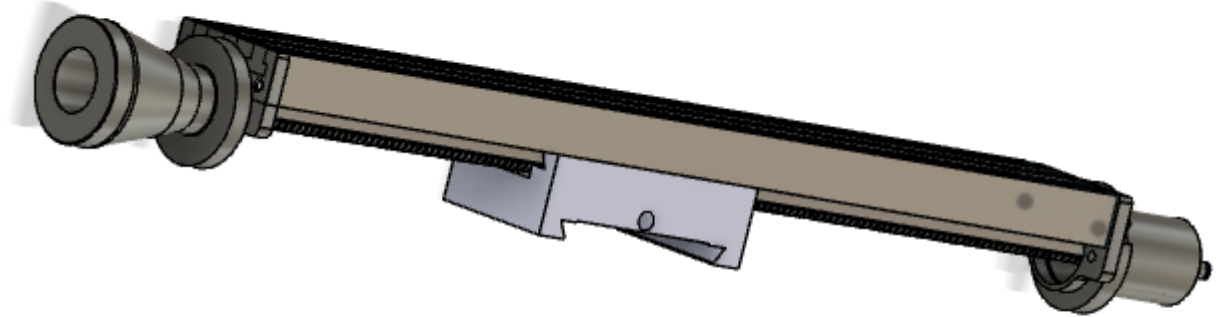


NOTE: TABLE FRONT IS IDENTIFIED BY HAVING A MEASUREING SCALE ON IT!!!!



Re-install the thrust bearings, nylok nut and stepper motor mount on the threaded end of the ball screw. Do not tighten the bolts at this point.

Install the ball nut receiver making sure the roller support bearing is in the receiver. Do not tighten the bolts at this point.



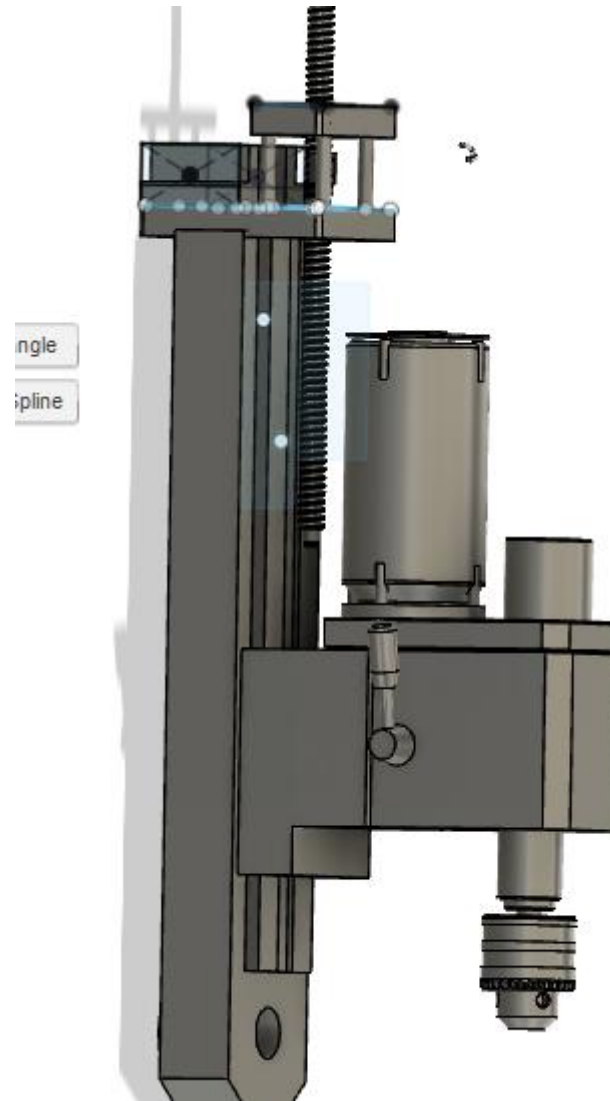
It's not time to install the Z axis assembly. This will be much easier since it is shipped assembled and, all you have to do is remove the lift rod and slip the assembly down on to the top of the column. You may have to rotate the ball nut to raise or lower the head lift assembly to fit over the sides of the head.



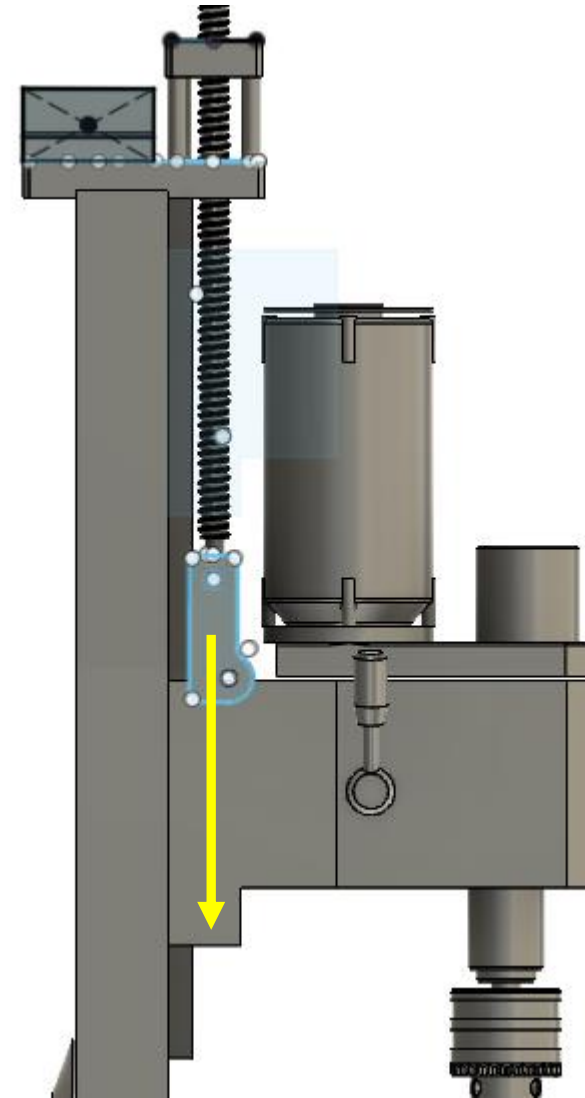
The column clamp bar is already inside the column



Slide the Z axis assembly down on top of the column. With the column top plate setting on the top of the column, move it around until the 3/8-16 threaded hold is in the slot on the top of the column top plate. Thread the 3/8-16 bolt that is provided into the column clamp bar with the washer provide. Screw the bolt in until it is loosely on top of the column top plate. Do not tighten at this point.

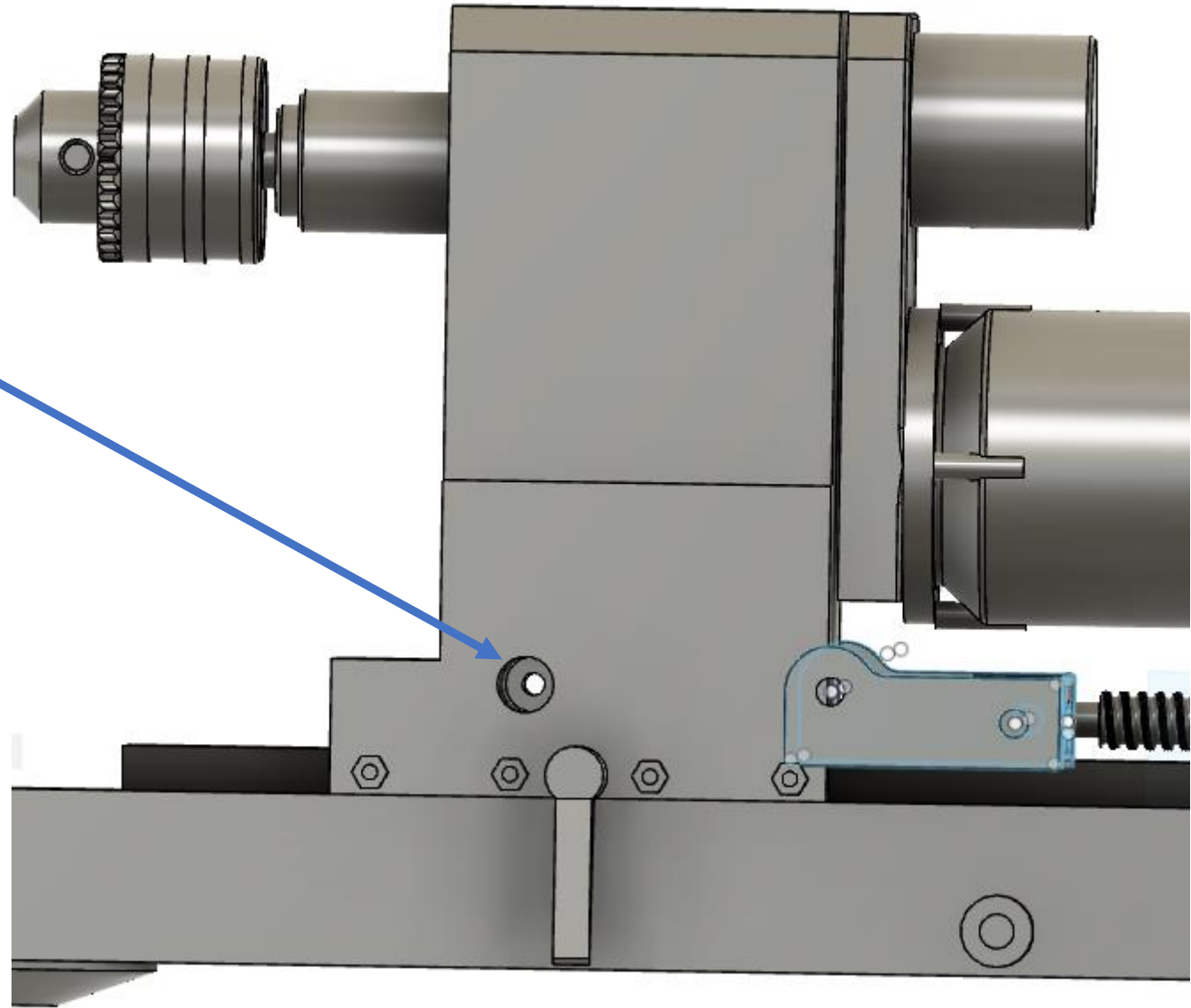


Rotate the ball nut and lower the ball screw down until the holes in the end of the side plates align with the holes in the side of the head that were left when you removed the rack and pinion from the headstock

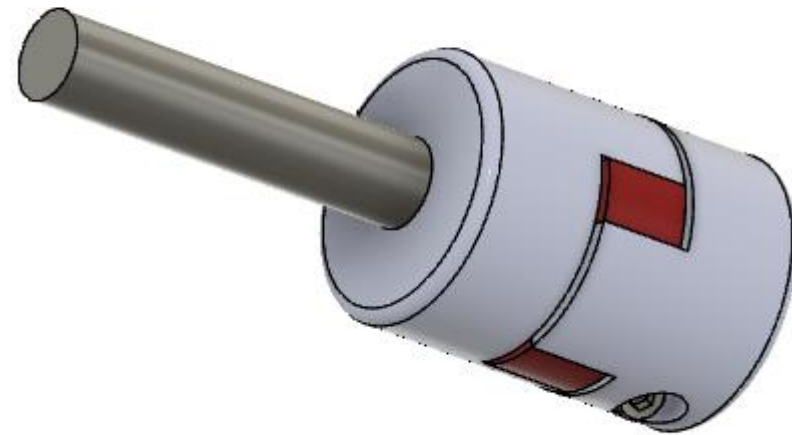


Insert the Z axis head lift pin into the 5/8" hole in the headstock. This is the hole that the pinion gear shaft fit into at dis-assembly.

Now, move the side plates  
Down until the holes align, insert the shoulder bolt provided through the side plate and into the lift pin. You can now move to the other side and insert the 1/4"-20 cap screw into the other side of the lift pin and secure the lift pin, side plates to the headstock.



At this point, the machine is assembled and is ready to make final adjustments. If you desire, you can install your steppers and controls. However, it may be a good idea to install the shaft couplings on the end of the X and Y ball screw shafts. Put a  $\frac{1}{4}$ " shaft into the other end of the coupling and use a drill to move the X and Y axis. Select an axis to adjust and place the end of the coupling on that axis ball screw shaft. Use a drill to slowly move the axis back and forth. This may take a few minutes to do, but it is extremely important.



## Axis Adjustment Procedure for X and Y

At this point, the machine is roughly assembled needing final adjustments.

1. X axis – move the axis with the drill and let it self align. It may stick at first but it will improve with each movement. Put a light film of lithium based grease on the dovetails (both sides) and spread some on the ball screw just on each side of the ball nut. Be generous with the grease.
2. Now move the axis all the way to one end and just snug the bolts on the table end plate. Then move it in the other direction until it is at the other end of the table. Snug the bolts on that table end plate.
3. Repeat the process several times before making the final tightening of the bolts.
4. It is now time to tighten the bolts that are holding the X axis ball nut mount. These are locate under the table to the right of the Y axis cross-slide. You will need a long hex key wrench and a pair of pliers or a small adjustable wrench (Crescent Wrench) to tighten.
5. Your axis should now be ready to mount the stepper.



The following slides are instructions for fine tuning the machine axis for movement. Before you start, you will need:

An electric drill

Some grease – lithium is best but really, any grease will do.

Your hex key wrenche

A small adjustable wrench (Crescent)

Some good music

And a lot of patience

Also, please refer to your machines operators manual for adjustment of the gibs. This is extremely important!!!! If the gibs are too tight, the machine will not move properly. And, if the stepper motors are installed at this point, they may bind and stall.

On the X and Y ball nut mounts there is a locking set screw that sets the ball nut in place. These must be tightened before starting the final adjustments.

The Z axis assembly comes pre-set, but make sure that the locking set screws are tightened securely in case they were missed at assembly

Place a nice coat of grease on all dovetails, all ball screws and thrust bearings during assembly

## Axis Adjustment Procedure for X and Y

### Y axis adjustment

1. Using the drill and coupling again, slowly move the Y axis back and forth. Apply grease as before.
2. Move the table all the way to the front of the machine. Tighten the stepper mount.
3. Now move the Y axis away from the operator and towards the column. Tighten the Y axis ball nut mount bolt located at the front of the Y axis cross slide casting in the center near the bottom.
4. Again, move the axis forward and backwards several times tightening the bolts a little more each time.
5. The Y axis should not be ready to install your stepper motor.

## Axis Adjustment Procedure for X and Y

### Z axis adjustment

1. Unfortunately, you will not be able to use a drill for this one. It is recommended that you wait until the Z axis stepper motor is installed and capable of being moved by the controls that you have installed.
2. The steps are the same...move the axis to the top of the column and snug the 3/8-26 bolt that is holding the column top plate to the column. Before tightening. Align the column top plate to the column as closely as you can by the eye. Then snug the bolt
3. Move the axis down and repeat the process several times until it moves freely. Again, apply a generous coat of grease the dovetails and ball screw.
4. Repeat the process.

Your machine should now be ready!!!!