

Sherline/MASSO CNC Controller Initial Start Instructions

Clockwise, from upper right

1. Controller box
2. 4-axis CNC driver box*
3. Wifi antenna
4. Parallel cable
5. Limit switch main cable bundle
6. USB 4 GB flash drive
7. Limit switches (with pigtail and connector)
8. Speed control cable
9. P/N 68047 Plastic plug for speed control housing
10. Tach/spindle control cable bundle
11. Optical encoder
12. Tach gap setter and cover
13. Tach spindle pulley RPM sticker
14. Tach bracket and headstock spacer (standard or 3C)
15. Ball screw mill headstock cable support (zip ties for leadscrew mills)

* **NOTE:** P/N 8780 includes the driver box. P/N 8781 does not include the driver box.

CAUTION—Protect your motors, cables, and driver board!

- **Never connect or disconnect the optical encoder grounding cable or the stepper motor cables with the Controller/Drive box power on.**
- **Do not unplug stepper motors using the rectangular white plug that goes into the motor. Disconnect only at the cable plug.**
- **Do not pull on cable wires to disconnect plug—*grip at connector.***
- **Turn handwheels slowly (1 rev/sec) with driver power OFF when manually positioning. For longer travels use Jog Mode.**

Assembling Your System

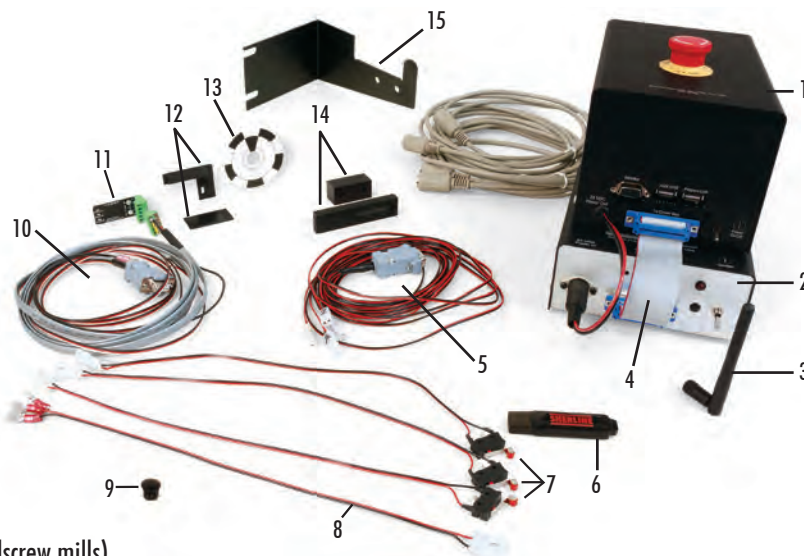
Mill or Lathe: Unpack and assemble your machine according to the instructions included in the *Sherline Assembly and Instruction Guide* packed with the your new machine.

Unpack the P/N 8760 driver box and the P/N 8781 Sherline/MASSO controller box.

Set the driver box on your table first, then set the controller box on top of the driver box.



FIGURE 1—Back view of the controller box and the driver box



WHAT'S INCLUDED
Shown here is what comes with the Sherline/MASSO Controller for our mill package. A lathe package will be similar except that it will have two limit switches instead of three, and different mounting hardware.

CUSTOMER FEEDBACK REQUEST

After you have read all the instructions and watched all the how-to videos, please feel free to send us any feedback so we can improve our MASSO controller documentation. Email marketing@sherline.com with your suggestions.



FIGURE 2—Front view of the controller box and the driver box.

Connect the white X, Y, and Z stepper motor cables leading from the back of the driver box to each of the stepper motor connectors. The axis that the cables will control are laser engraved on the driver box (see Figure 3). A fourth cable is unused unless you have purchased an optional CNC rotary table, which can be connected here as a 4th (A) axis.



FIGURE 3—Each axis is laser engraved above the cable ports. Plug in the limit switch connector, the encoder/spindle connector, and the 24VDC power supply cable into the backside of the controller box.



FIGURE 4—Encoder/Spindle drive cable P/N 87820



FIGURE 5—Limit Switch Cable P/N 87825



FIGURE 6—Backside of control box.

The controller and the drive box only need one power supply. When you look at the front of the controller box you will see the 24VDC power out connector. Plug it into the power in connector on the drive box.



FIGURE 7—Power connector cable plugged into the driver box. Now take the parallel port cable P/N 87605 and plug the female end into the driver box.



FIGURE 8— Female end of the parallel cable.

Now plug the male end of the parallel cable into the controller box.



FIGURE 9—Male end of the parallel cable.

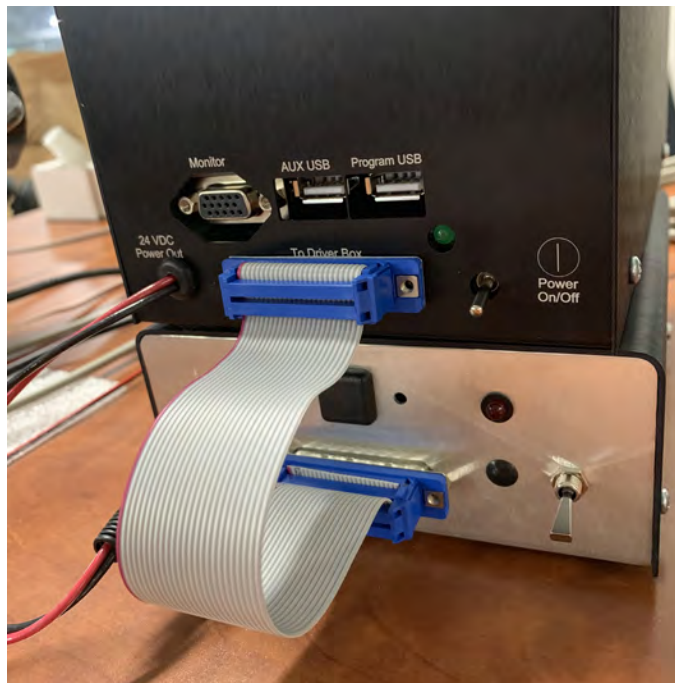


FIGURE 10—The parallel cable shown plugged into both the driver box and the controller box.

Plug your monitor cable into the monitor port (see Figure 11). The monitor port is set up for a VGA connector. If you have an HDMI connection on your monitor, you will need to buy a VGA-to-HDMI converter* (see Figure 12 for an example). You can pick these up on eBay, Amazon, or at your local electronics supplier, and most are inexpensive.

***NOTE:** Make sure you purchase a VGA-to-HDMI converter. There are many HDMI-to-VGA connectors out there and they will not display the VGA video output signal to your HDMI monitor.



FIGURE 11—Monitor connection. The VGA connector is plugged into the monitor port on the controller box.



FIGURE 12—Shows an example of a VGA-to-HDMI converter. Please note that some VGA-to-HDMI converters require a USB powered connection.

Now plug your USB dongle for your wireless mouse and keyboard into the AUX USB connection*. You cannot use a multi-port USB hub connector in either of the USB ports to operate your old, USB-wired mouse and keyboard. The software is designed to take single-source information only from each of the USB ports. A multi-port connector will not work. You must use a wireless USB dongle for your peripherals.

***NOTE:** We do not supply the wireless mouse, keyboard, or dongle. There is only one USB port for your mouse and keyboard. Make sure you buy a wireless mouse and keyboard set.



FIGURE 13—Left: close-up of the USB dongle; Right: the dongle plugged into the AUX USB port.

Now plug in your flash drive with your machine settings, tool settings, and programs into the Program USB connection.

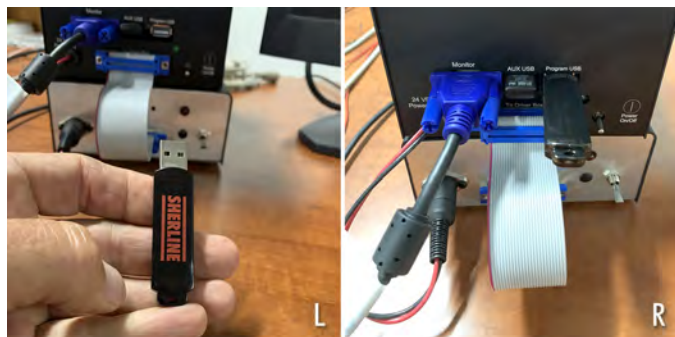


FIGURE 14—Left: close-up of the Sherline 4 GB USB flash drive; Right: the flash drive plugged into the Program USB port.

Connecting the Cables to Your Machine

Now that all of your cables are hooked up to the control and driver boxes, it's time to connect them to your machine.

NOTE: Make sure that all power is off on the controller and drive box before proceeding.

First we will install the headstock cable support P/N 87840. This cable support is easy to install. It has two slots that go onto the two 10-32 screws that hold the motor mount to the headstock.

NOTE: This bracket is not included for “leadscrew machines” (only ball screw machines). See instructions for leadscrew machines at the end of this document.



FIGURE 15—P/N 87840 mill headstock cable support. Loosen these two 10-32 screws about three turns.



FIGURE 16—The red arrows indicate the screw locations.

This should give you a large enough gap between the motor bracket and the headstock for the cable support to fit in easily.

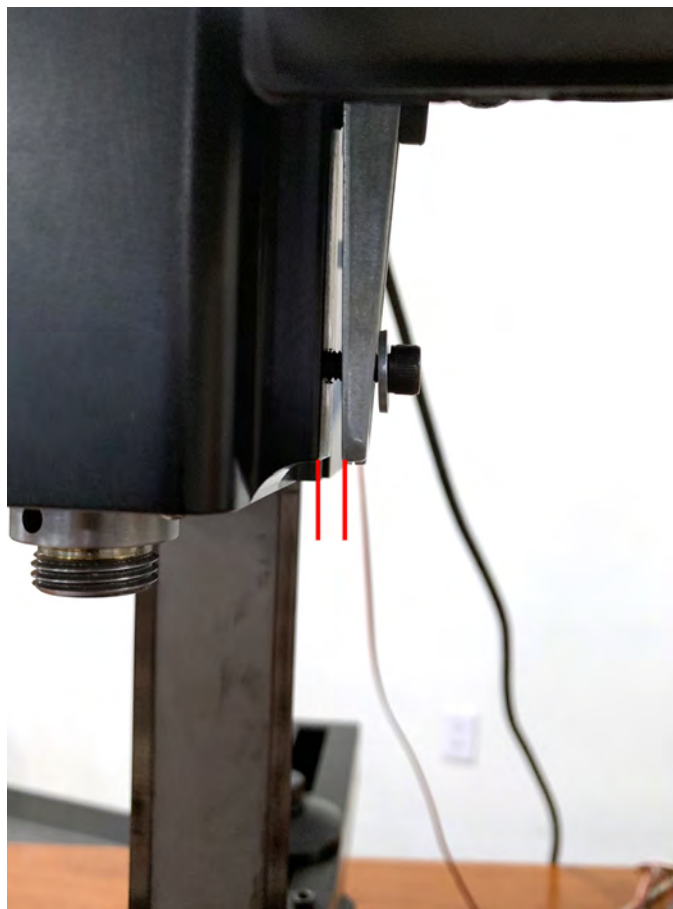


FIGURE 17—The photo above shows the gap between the headstock and the mounting bracket.

Now position the cable support so the slotted side can be positioned onto the 10-32 screws between the motor mount and the headstock.

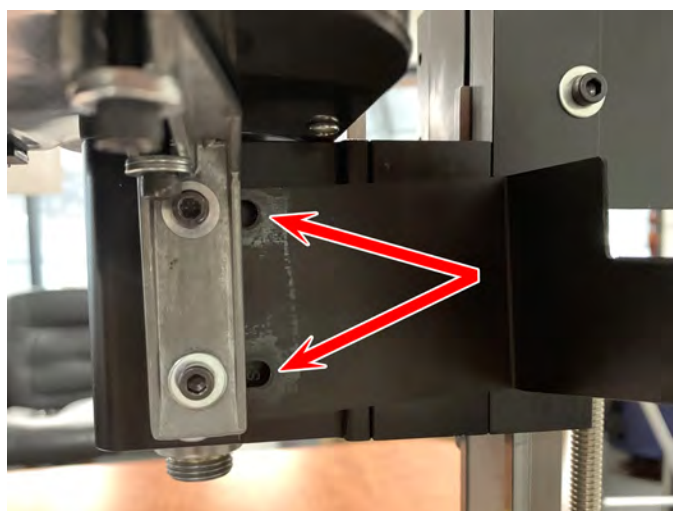


FIGURE 18—The red arrows show how the slots on the cable support align to the 10-32 screws on the headstock mounting bracket.

Now push the cable support into place. Once the cable support is in place, tighten the two 10-32 screws in order to clamp the cable support between the motor mount and the headstock.

At this point just tighten the top screw all the way, and leave the bottom screw alone. We will be attaching the grounding cable from the encoder cable to the bottom screw.



FIGURE 19

Below is a picture of the end of the encoder cable with the black grounding cable.



FIGURE 20—The black grounding cable is above the encoder cable.

Place the encoder cable on top of the column saddle assembly with the grounding cable hanging inside of the cable support (see Figure 21).



FIGURE 21—Notice that the grounding cable is inside the support toward the front of the machine.

⚠ CAUTION

Any time that you connect or disconnect the grounding cable, all power to the machine and the Controller/Drive boxes must be off.

Failure to do so may result in a ground fault that will severely damage the Optical Encoder.

Now push the spade connector on the end of the grounding cable onto the 10-32 screw and between the washer and the motor bracket.



FIGURE 22—Make sure the spade connector is located behind the washer. The inset photos shows an alternate location for the grounding wire on the opposite side of the headstock.

Make sure that the spade connector is straight up and down so it sits in the middle of the motor bracket. Also be sure that the washer is not clamping on the insulation of the spade connector, but directly on the metal area of the connector. Then tighten the bottom 10-32 screw (see Figure 23).



FIGURE 23—The orientation of the grounding wire is straight up and down.

Now that the grounding cable is mounted, we can power up the controller. You will need access to the Setup page on the controller in order to adjust your limit switches.

Flip the power toggle switch on the controller up, and you should see the green power light come on.



FIGURE 24—The white arrow shows the on/off controller switch.

Now flip the power toggle switch on the driver box up, and you should see the red power light come on.



FIGURE 25—The black arrow shows the on/off driver box switch.

When your monitor comes on, you will see the control page below. The yellow Home icon will be flashing. The red E-Stop icon will be flashing, and the password box will be on.



FIGURE 26—The white arrows point to the “HOME,” and “E-STOP,” buttons.

First turn the E-stop button clockwise on the top of the controller box to deactivate it. If you didn't use the E-Stop button to turn the machine off when you last used it, you will need to push the button down to activate it first, and then turn it to deactivate it.



FIGURE 27—Note the clockwise direction of the arrows on the red button.

When you deactivate the E-Stop button, the red flashing E-Stop icon will stop blinking.

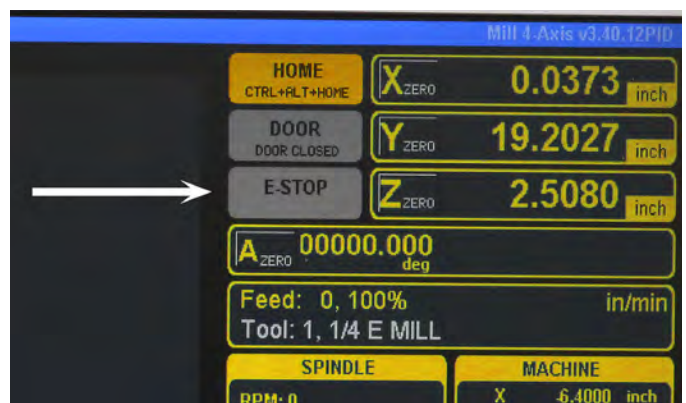


FIGURE 28—The E-stop button stops flashing red.

Now enter the password [SP] into the password box. The [SP] must be ALL CAPS.



FIGURE 29

At this point you would normally home out your machine. Instead of homing the machine, we are going to go to the Setup page so you can see the input signals from your encoder and your limit switches.

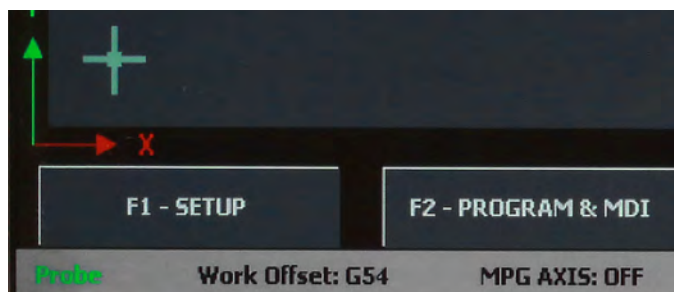


FIGURE 30—At the bottom left-hand corner, you will see the “F1 Setup,” button. Click on it and the setup page will come up.

Mounting Instructions for the Encoder

Tach Decal for the Optical Encoder

First, remove any dirt, oil, or grease from the mounting surface of the pulley. You can use rubbing alcohol on a clean cloth or paper towel.

Then, place the Tach/Encoder sticker on the headstock pulley.



FIGURE 31—Clean the spindle pulley surface before placing the tach/encoder decal.



FIGURE 32—Tach/Encoder sticker P/N 68060.

The center hole on the sticker is made to fit our standard headstock pulley. If you are placing the sticker on one of our 3C headstocks, you will need to cut out the center on the line shown below.

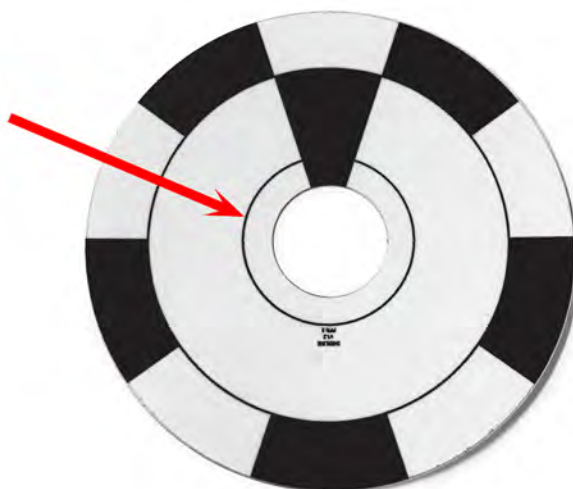


FIGURE 33—The red arrow indicates the 3C spindle diameter.

Peel off the paper backing on the sticker. Then align the sticker on the end of the spindle and lower it down onto the pulley. If you bow the sticker slightly so the center is lower than the outer edge, you can use the spindle to locate the sticker. Then lower it down until the center makes contact with the pulley area near the spindle. The location doesn't need to be perfect and you should be able to get it close enough by centering it around the spindle. Once the center has made contact with the pulley, check your centering before there is too much surface contact and make minor adjustments. Now lower the rest of the sticker onto the pulley. The outer edge should be centered with the outer edge of the pulley as well. Now press down on the sticker with your fingers at the center and then rub from the inside outward to remove any bubbles or imperfections. The sticker has to be flat or it will interfere with the encoder readings.

Optical Encoder

Next, we will mount, adjust, and connect the optical encoder to the headstock.

We are mounting this encoder on one of our standard

headstocks. The parts and the procedures are the same for our 3C headstock with the exception of the encoder spacer block. For the standard headstock we use spacer P/N 87816 and mounting screws P/N 40720 (10-32 x 1-1/2" SHCS). For the 3C headstock we use spacer P/N 87817 and mounting screws P/N 40340 (10-32 x 1" SHCS).

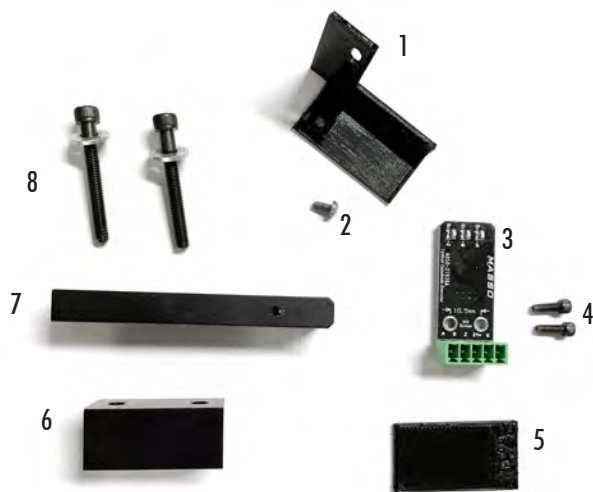


FIGURE 34—Encoder parts, clockwise from top right:
 (1) P/N 87812 optical encoder cover
 (2) P/N 87811 5-40 x 3/8" Phillips, button-head machine screw
 (3) P/N 87810 optical encoder
 (4) P/N 40530 5-40 X 3/8" SHC Screws (2 ea.)
 (5) P/N 87813 .129 optical encoder gauge
 (6) P/N 87816 optical encoder spacer for standard headstock*
 P/N 87817 optical encoder spacer for 3C headstock**
 (7) P/N 87814 optical encoder bracket
 (8) P/N 40720* 10-32 x 1-1/2" SHC Screws and P/N 40660 #10 washers (2 ea.) for standard headstock spacer
 P/N 40340** 10-32 x 1" SHC Screws and P/N 40660 #10 washers (2 ea.) for 3C headstock spacer

Optical encoder mount, spacer, and mounting screw assembly (see Figure 35).

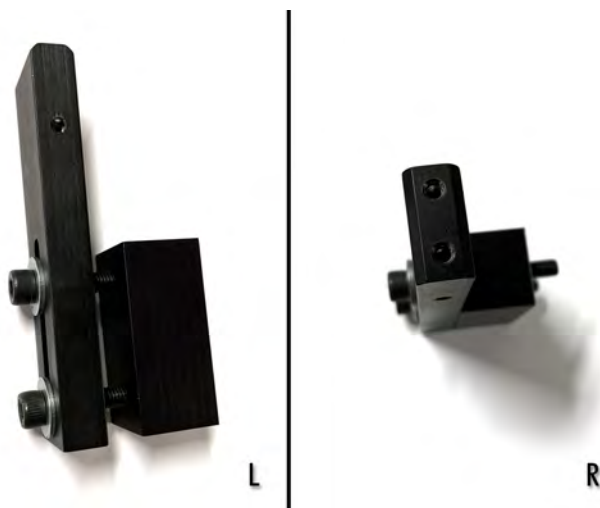


FIGURE 35—Left: side view; Right: end view.

Mounting the Optical Encoder

⚠ CAUTION

The power switch on the speed control must be in the off position when the spindle is not in use.

Notice the tapered sides of the mounting bracket and the two lines on the mating surface of the encoder. Any contact with the encoder must be between the two white lines (see Figure 36).

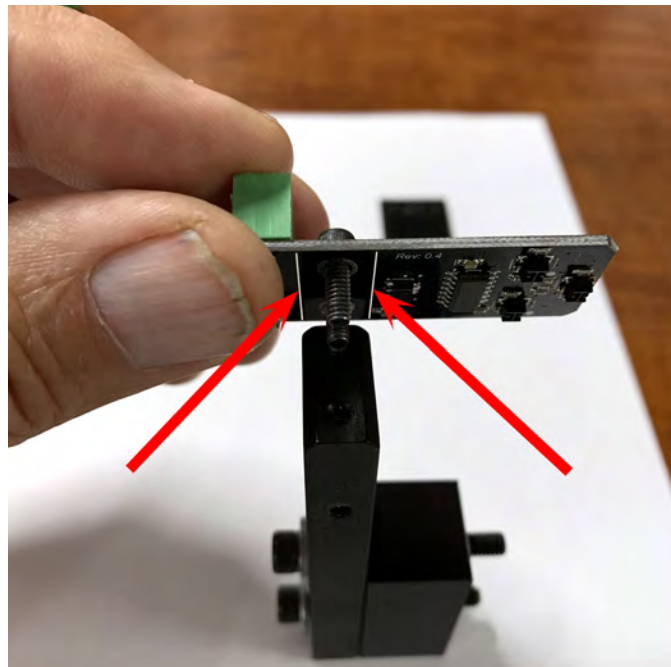


FIGURE 36—The arrows point to the two white lines on the encoder surface.

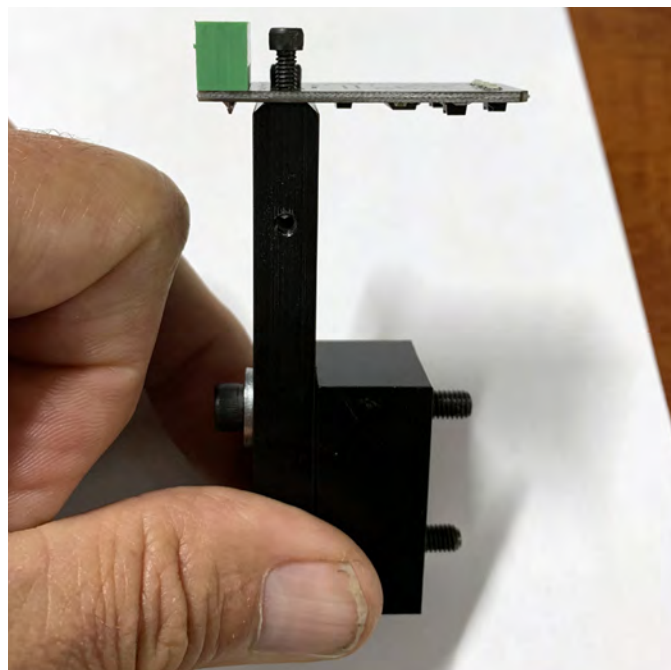


FIGURE 37—Full assembly side view: The screws are just in place for show. Nothing is tightened at this point.

You may need to drill and tap the 10-32 holes on your headstock to mount the optical encoder. If this is the case, please go to the page 21 of this document for the *Optical Encoder Mounting Template Instructions*.

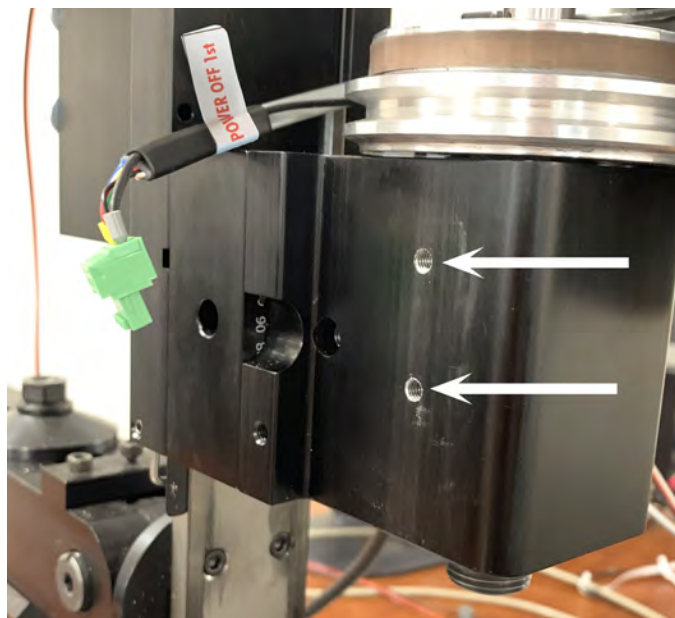


FIGURE 38—Mounting hole locations on the headstock. Use the template at the end of this document to drill and tap the mounting holes.

The encoder assembly is mounted to the headstock (see Figure 39), with the 10-32 screws just snug, so we can adjust the encoder bracket to get the encoder gap set (see Figure 40).

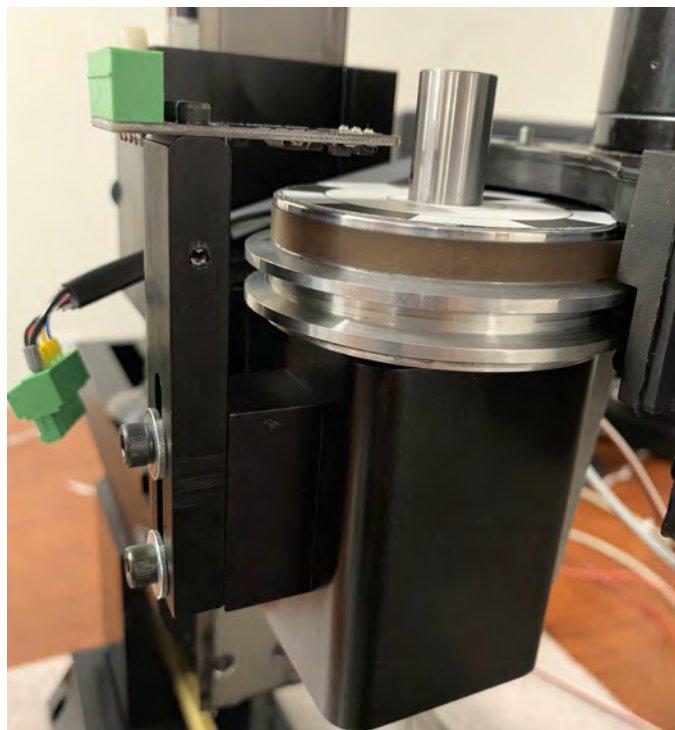


FIGURE 39

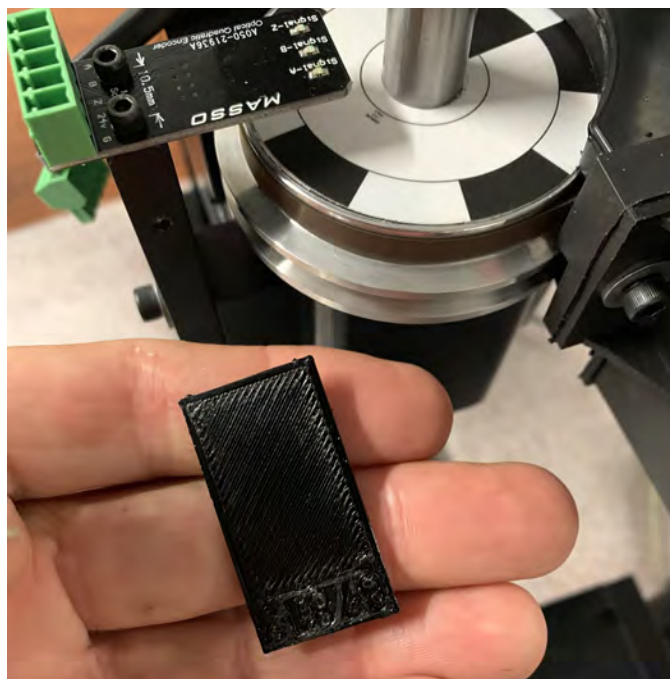


FIGURE 40—Encoder Gap Gauge P/N 87813.

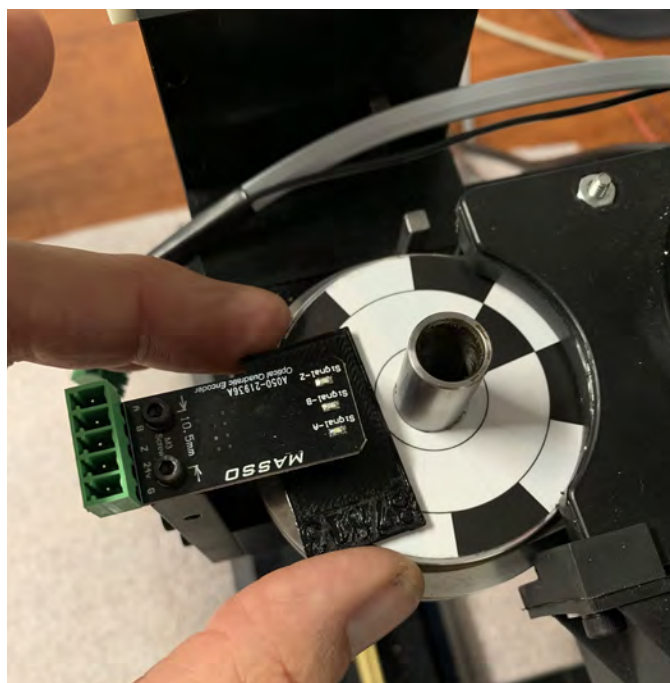


FIGURE 41—Gap gauge placement.

With the two 10-32 bracket mounting screws loose, lower the optical encoder down until it makes contact with the gap gauge. Make sure that the screws are loose enough so the optical encoder body is not flexing when you lower it into position.

Once the encoder is touching the gap gauge, put pressure on the top of it with your finger (see Figure 42).

While pressing on the encoder, tighten the two 10-32 bracket mounting screws.



FIGURE 42—With the gap gauge in place, apply pressure on top of the encoder.

There will generally be some space between the encoder and the gap gauge after you tighten the screws. This is fine. The gap gauge is set to the middle of the LED focal point length (.129" or 3.27 mm). Therefore, if the encoder is slightly higher or lower than the gap gauge, it will still be in tolerance.

Once the screws are tight, remove the gap gauge.

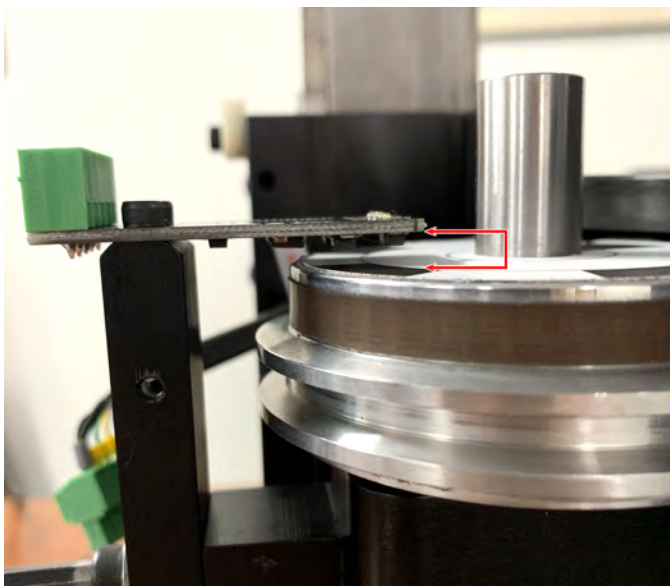


FIGURE 43—The red arrow shows the gap between the pulley and the LED sensors.

⚠ CAUTION

Do not connect or disconnect the optical encoder connector or the ground wire with the power on or you will do irreparable damage to the optical encoder!

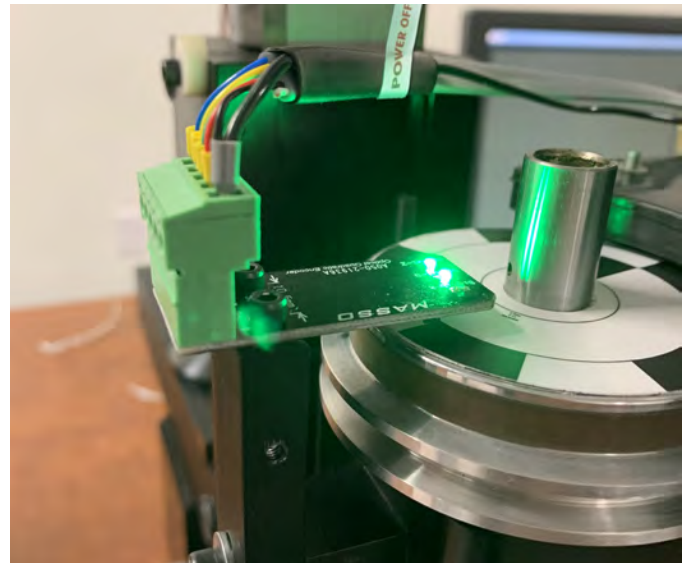


FIGURE 44—Shows the LED lights on the encoder with the power connection plugged in (Just for show). Remove the connection until the cover is in place.

Now we are going to mount the encoder cover.

First a special note: The primary reason for the cover is to help avoid any damage to the encoder and also to keep oil and machine debris off of it. The second reason (which we found out the hard way) is to avoid exterior LED light interference with the LEDs that are on the encoder. If your machine is in an area that has fluorescent lighting, then exterior light interference will not be a problem. However, if you are using LED lights around your machine, such as overhead energy saving LED lights. The exterior LED light will bounce off of the tach/encoder sticker and cause the encoder to receive bad light readings and send inaccurate signals to the controller. This will cause erratic RPM and cross threading on the lathe threading cycle.

If the encoder is positioned correctly, you will see the signals coming into the setup page.

Click on the F1 Setup button on the lower left corner of the screen. If you double click on the password box and then click on the setup page, the password box will close.

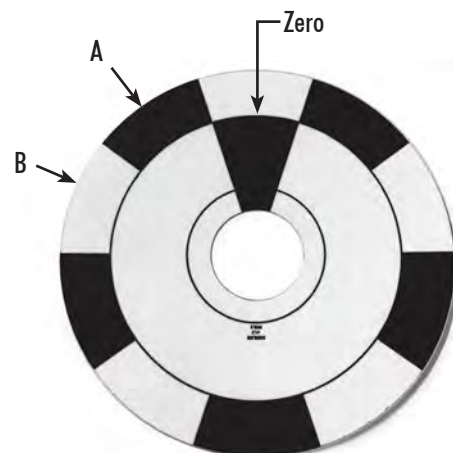


FIGURE 45—On the tach sticker, the black and white sections on the outer ring are for the A and B signals. The solitary black section in the center area is for the Index signal.

If you turn the spindle pulley by hand starting with the index point under the encoder, the signals will come into the setup page. See the signal sequence below.

INPUTS			
Inputs	Function	Invert	Status
EStop	EStop	No	High
Encoder	Signal - A	No	Low
Encoder	Signal - B	No	Low
Encoder	Index: 0, Pos: 5	Yes	Low
MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

FIGURE 46—Starting between the index point and position 1, the status for A, B, and Index will be Low.

INPUTS			
Inputs	Function	Invert	Status
EStop	EStop	No	High
Encoder	Signal - A	No	High
Encoder	Signal - B	No	Low
Encoder	Index: 1, Pos: 1	Yes	Low
MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

FIGURE 47—Turning the pulley slowly, Signal-A will turn to High.

INPUTS			
Inputs	Function	Invert	Status
EStop	EStop	No	High
Encoder	Signal - A	No	High
Encoder	Signal - B	No	High
Encoder	Index: 1, Pos: 1	Yes	Low
MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

FIGURE 48—Continue to turn and Signal-B will turn to High.

INPUTS			
Inputs	Function	Invert	Status
EStop	EStop	No	High
Encoder	Signal - A	No	Low
Encoder	Signal - B	No	High
Encoder	Index: 1, Pos: 1	Yes	Low
MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

FIGURE 49—Continue to turn and Signal-A will change to Low.

INPUTS			
Inputs	Function	Invert	Status
EStop	EStop	No	High
Encoder	Signal - A	No	Low
Encoder	Signal - B	No	Low
Encoder	Index: 1, Pos: 1	Yes	Low
MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

FIGURE 50—Then Signal-B will change to Low.
The inputs will follow this sequence from position 1 through position 4.

INPUTS			
Inputs	Function	Invert	Status
EStop	EStop	No	High
Encoder	Signal - A	No	High
Encoder	Signal - B	No	Low
Encoder	Index: 1, Pos: 5	Yes	High
MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

FIGURE 51—When you get to position 5 for the index point, first Signal-A will change to High, then Index Position 5 will change to High.

INPUTS			
Inputs	Function	Invert	Status
EStop	EStop	No	High
Encoder	Signal - A	No	High
Encoder	Signal - B	No	High
Encoder	Index: 1, Pos: 5	Yes	High
MPG	Dial Signal - A	No	Low
MPG	Dial Signal - B	No	Low

FIGURE 52—Then Signal-B will change to High so all three Inputs are showing High.

Then Signal-A will change to Low, Index Position 5 will change to Low and then position B will change to Low.

NOTE: If you are not getting these readings, try shading the encoder and the tach sticker with a piece of cardboard to eliminate any outside light source. Then turn the spindle again.

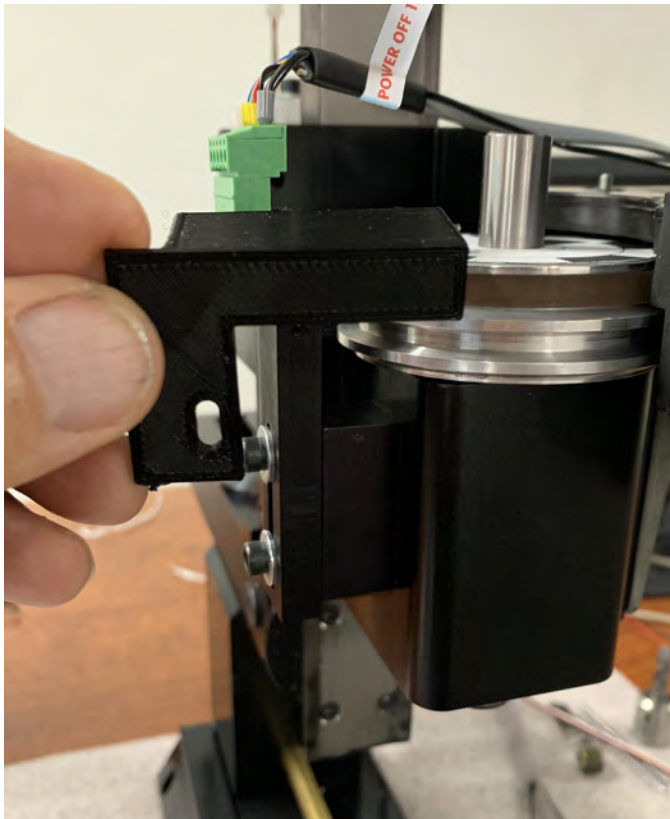


FIGURE 53—Placement of encoder cover P/N 87812.

There must be a gap between the front edge of the cover and the tach/encoder sticker so it doesn't rub on the sticker.

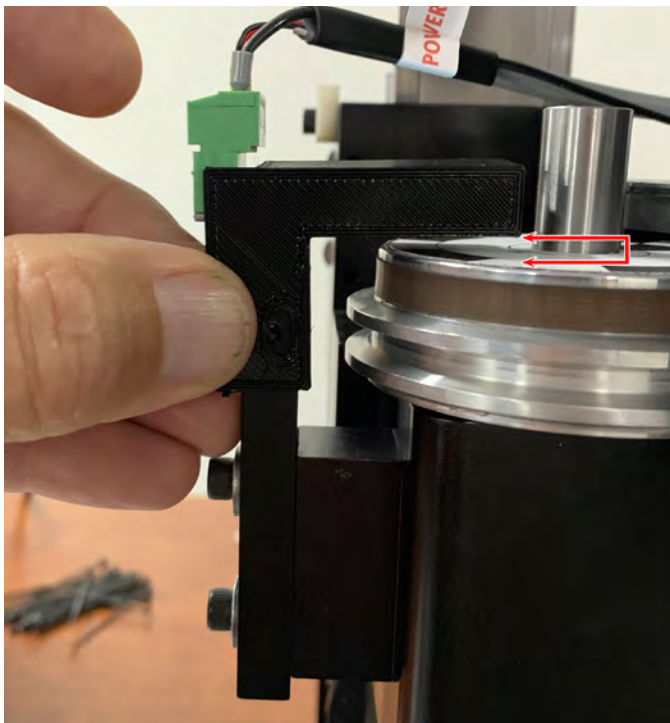


FIGURE 54—The red arrows indicate the gap between the encoder cover and the tach/encoder sticker.

NOTE: The gap is approximately .020"-.050" (.50 – 1.27mm).

Tighten the mounting screw snug. Then readjust the cover so there is still a gap between the cove and the pulley.

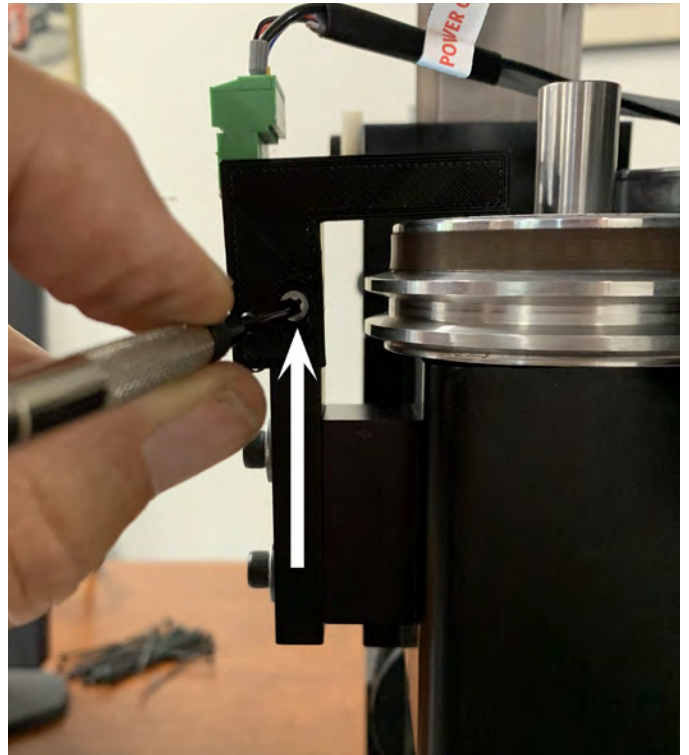


FIGURE 55—Encoder cover mounting screw P/N 87811 5-40 x 3/8" Phillips, button-head machine screw.

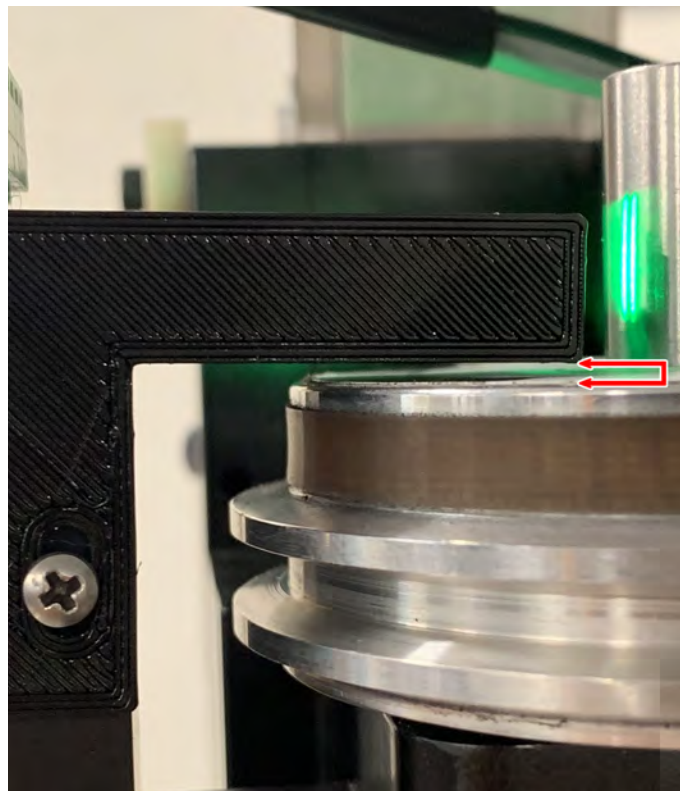


FIGURE 56—The red arrows show the gap after final adjustment.

Turn the Spindle on and Check the Readout

For customers who are doing a retrofit, see this video, Speed Control Retrofit for CNC Controller (<https://youtu.be/1zIAY6I4MBo>), for instructions on how to wire the speed control for the MASSO controller.

1. Flip the spindle control power switch to the ON position.



FIGURE 57—The white arrow indicates the direction of the “ON,” position.

2. Click on the “F2 Program & MDI,” button.

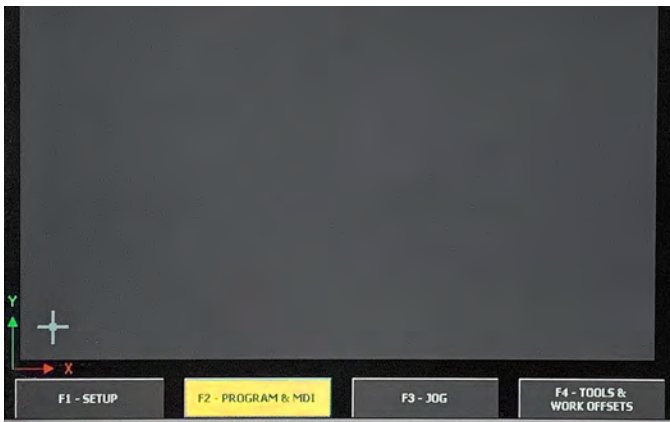


FIGURE 58—The F2 Program & MDI button should be highlighted yellow.

3. Click on the blank box to the right of “Spindle CW,.”

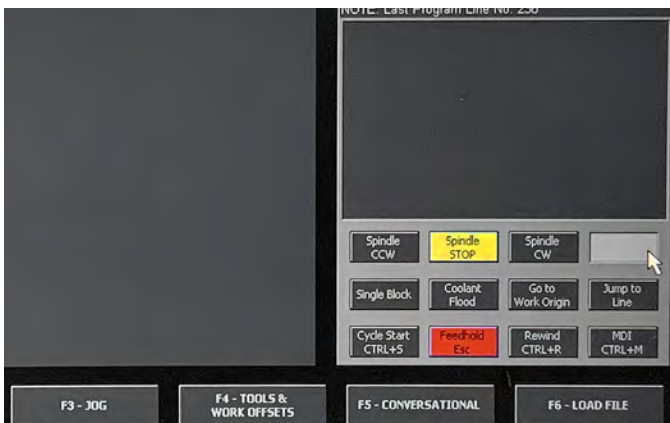


FIGURE 59— The cursor arrow is over the blank box.

4. Type in 1000. Then hit enter.
5. Now click on the “Spindle CW,” button and the spindle will turn on.



FIGURE 60—The cursor arrow is over the “Spindle CW,” button.

NOTE: Do not click on the “Spindle CCW,” button. Our motors do not turn CCW. If you click on the CCW button, the motor will hum and it may oscillate a bit, but it will not turn CCW or CW. Click on “Spindle STOP,” and then use “Spindle CW,” to start it.

6. The spindle RPM will fluctuate a bit at first, and then they will settle down and bounce between 995 and 1008 RPM. You can see the actual RPM on the control page.

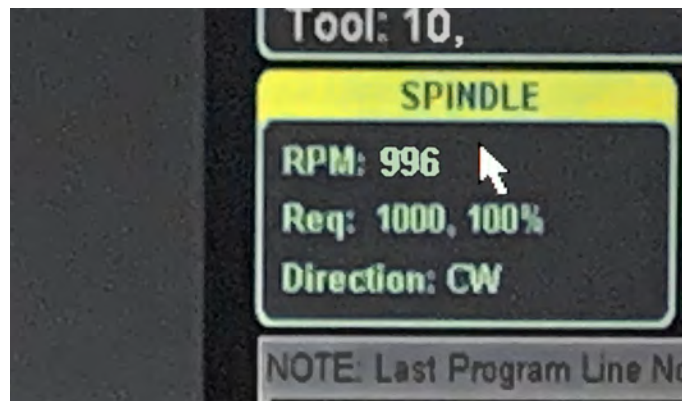


FIGURE 61

7. To turn off the spindle, click on the yellow “Spindle STOP,” button.



FIGURE 62

If your RPM are incorrect, or if they are fluctuating excessively, make sure that the encoder cover is on and positioned correctly. If the RPM are still off, reset your encoder gap.

Mounting and Adjusting the Limit Switches

Y-axis Limit Switch and Eccentric Trigger

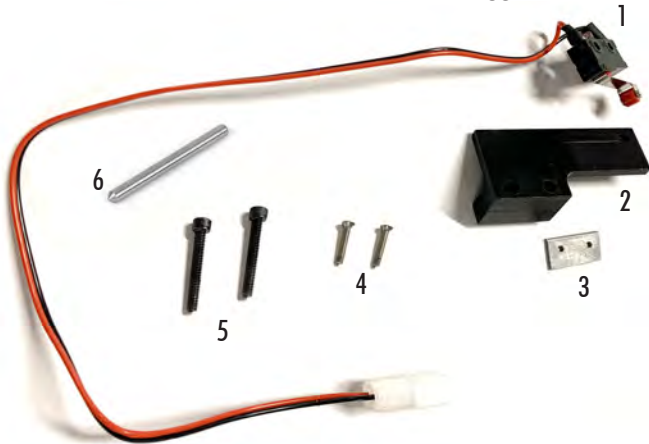


FIGURE 63—Y-axis limit switch parts, clockwise from top right:
 (1) P/N 68040 limit switch w/pigtail
 (2) P/N 68024 Y-axis limit switch mount
 (3) P/N 68046 Limit switch mounting tab
 (4) P/N 68049 #2 Phillips x 5/8" flat-head sheet metal screws (2 ea.)
 (5) P/N 67115 5-40 x 7/8" SHC screws (2 ea.)
 (6) P/N 87841: 1/8" x 1-1/2" steel transfer punch for mill Y-axis limit switch (Retro)
 (7) Zip ties

Figure 64 shows the limit switch positioning on the Y-axis mount: Limit switch P/N 68040, Mounting screws P/N 68048, and Y-axis mounting bracket P/N 68024.



FIGURE 64—The mounting screws are used to attach the limit switch to the Y-axis limit switch mount.

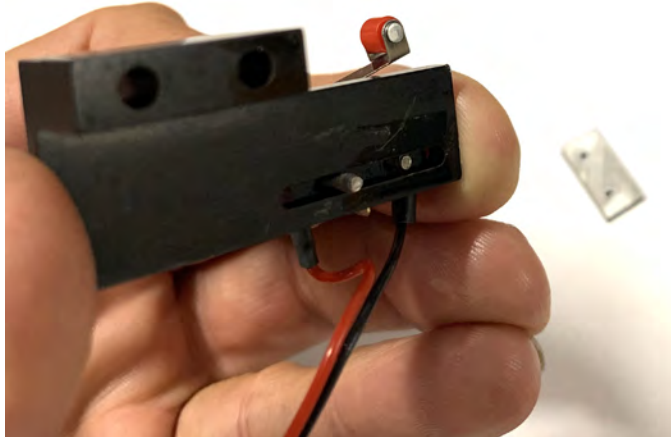


FIGURE 65—Backside view of the Y-axis limit switch assembly.



FIGURE 66—Y-axis limit switch assembly with the backing plate P/N 68046 attached.

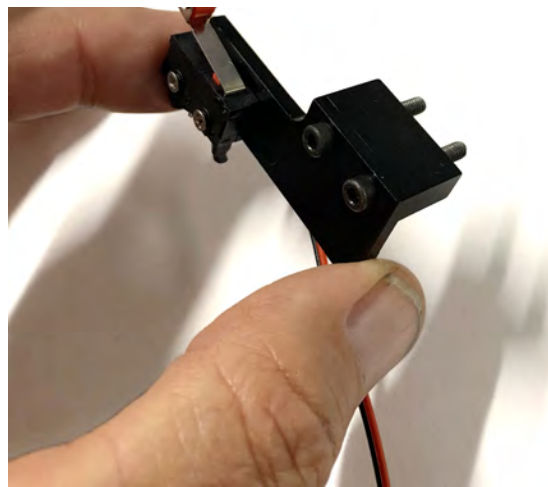


FIGURE 67—Front side view.



FIGURE 68—The red oval shows the mounting hole location for the Y-axis limit switch assembly.*

***NOTE:** If you are doing a retrofit, see the **Limit Switch Hole Templates** for the Y and Z-axes on page 21.

You can also watch our YouTube video, **Mill Base Limit Switch Retrofit**, for how to drill and tap these mounting holes. (<https://youtu.be/8-BOprooqIQ>)



FIGURE 69—The limit switch mounted the with wires going between the mounting bracket and the mill base.

The Eccentric Trigger Assembly and Mounting

Eccentric trigger parts.

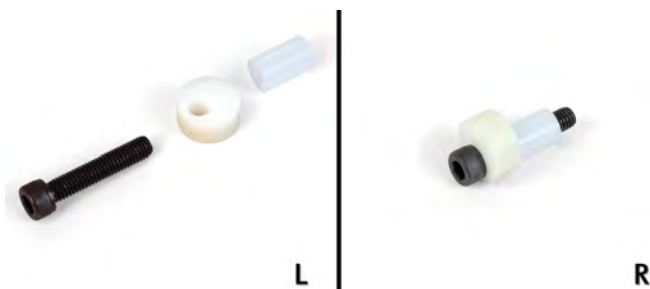


FIGURE 70—**Left:** 10-32x1" SHCS P/N 40340, eccentric trigger P/N 68039, and nylon spacer P/N 68044; **Right:** Assembly

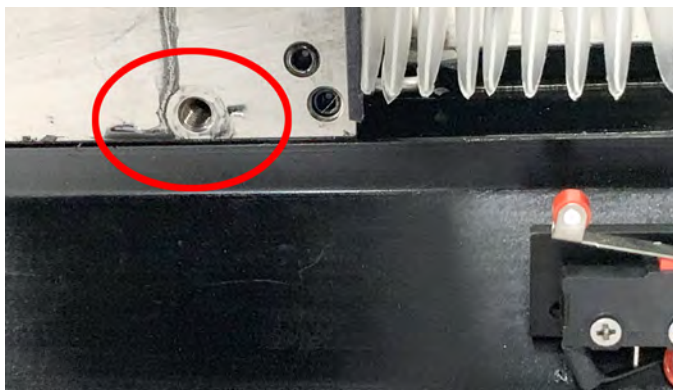


FIGURE 71a—The red oval shows the location of the eccentric trigger mounting hole on the ball screw saddle.

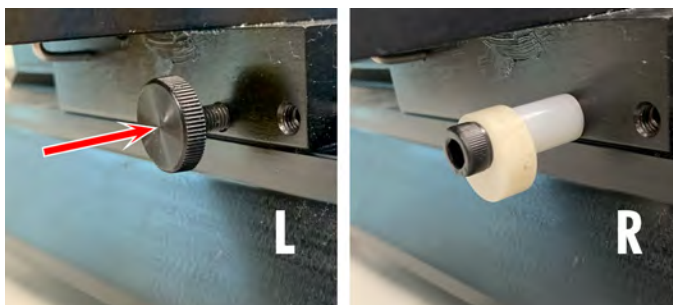


FIGURE 71b—**Left:** On a standard leadscrew machine, you will remove the Y-axis locking screw; **Right:** Then install the eccentric trigger where the Y-axis locking screw was.

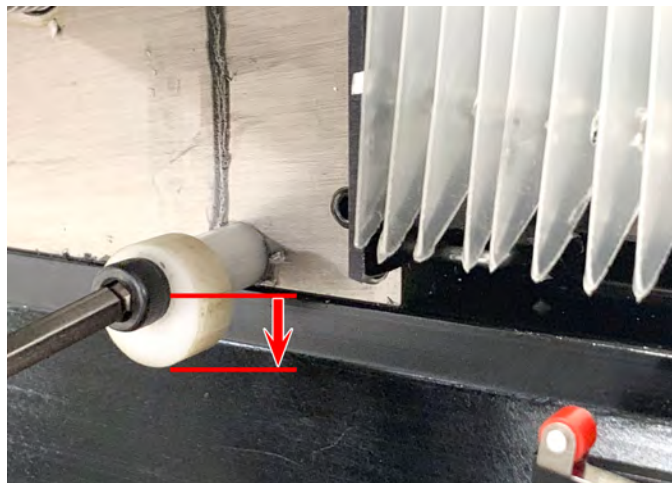


FIGURE 72—Mount the assembly with the wide side of the eccentric trigger facing down.

At this point the 10-32 screw on the eccentric trigger and the two screws that secure the limit switch are snug on the verge of being loose, so the trigger and the limit switch can be adjusted.

First turn the driver box power “Off,” and then disconnect the Y-axis stepper motor cable (**NOTE:** Never disconnect or connect the stepper motor cables with the power on).

Now by hand, move the Y-axis towards the stepper motor until the Y-axis accordion cover is almost fully closed (you want to leave some room for the inevitable chip build-up). You also need some extra room for the slight over-travel when the trigger sets the limit switch (about .100" or 2.54 mm).

Now open the F1 SETUP screen on the controller (push F1 or click on the F1 Setup button on the screen).



FIGURE 73—Setup screen with password box.

You don't need the password to see the input and output status of your limit switches and your encoder signal. If the password box is in the way, click on it a couple times and then click on the screen once and it will close.

Make sure that your limit switch connector is plugged into the control harness.

In the middle of the setup screen towards the bottom, you will see the "X, Y, Z, and A-Home Sensor Input,." When the limit switch is plugged in, and in the open position, the Status column will be "green – Low," (see picture).

MPG	Resolution 3	No	Low
Analog	Input 1		0.01v
Analog	Input 2		0.00v
Analog	Input 3		0.01v
Analog	Input 4		0.00v
Input 1	X - Home Sensor Input	Yes	Low
Input 2	Y - Home Sensor Input	Yes	Low
Input 3	Z - Home Sensor Input	Yes	Low
Input 4	A - Home Sensor Input	No	Low
Input 5		No	Low
Input 6		No	High
Input 7		No	High
F3 - JOG F4 - TOOLS & WORK OFFSETS			
Optional Stop: Off Job Counter: 2			

FIGURE 74—Home sensor screen for limit switches.

With your Y-axis in the home position, adjust the limit switch and the eccentric trigger so the limit switch closes at that point. You can hear the limit switch click when it closes.



FIGURE 75—Home position for the Y-axis.

When you believe that your limit switch is set correctly, manually move the Y-axis off of the limit switch. Then look at the setup page. Now move the Y-axis back slowly and when the limit switch closes, the "green – low," on the status will change to "red – High,,"

MPG	Resolution 3	No	Low
Analog	Input 1		0.01v
Analog	Input 2		0.01v
Analog	Input 3		0.01v
Analog	Input 4		0.00v
Input 1	X - Home Sensor Input	Yes	Low
Input 2	Y - Home Sensor Input	Yes	High
Input 3	Z - Home Sensor Input	Yes	Low
Input 4	A - Home Sensor Input	No	Low
Input 5		No	Low
Input 6		No	High
Input 7		No	High
F3 - JOG F4 - TOOLS & WORK OFFSETS			
Optional Stop: Off Job Counter: 2			

FIGURE 76—Red=High status.

By looking at the status on the setup screen and moving the Y-axis back and forth, you can adjust the limit switch and the eccentric so the limit switch closes at the desired position. Once the position is set, tighten the two limit switch screws and the 10-32 eccentric trigger screw.

Z-axis Limit Switch and Eccentric Trigger

The Z-axis and the X-axis are easier to mount and adjust. For these instructions we are mounting these limit switches on a ball screw machine. The mounting brackets will be different on a leadscrew machine.

Z-axis switch, mount, and screws.

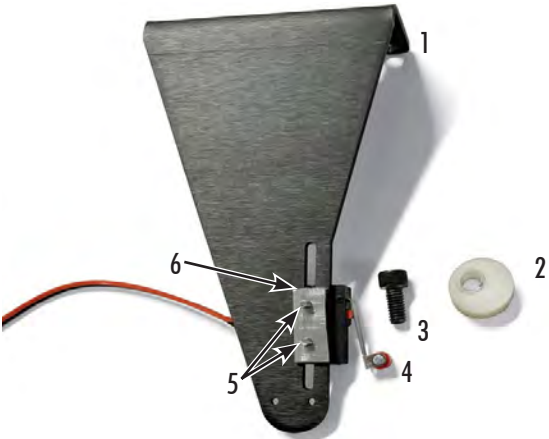


FIGURE 77—Z-axis limit switch parts, clockwise from top:

- (1) P/N 68020 Z-axis limit switch mount
- (2) P/N 68042 Eccentric trigger
- (3) P/N 12050 8-32 x 3/8" SHCS
- (4) P/N 68040 Limit switch
- (5) P/N 68048 #2 Phillips x 1/2" flat-head sheet metal screws (2 ea.)
- (6) P/N 68046 Limit switch mounting tab
- (7) Zip ties



FIGURE 78—Limit switch mounted to the Z-axis limit switch mount.

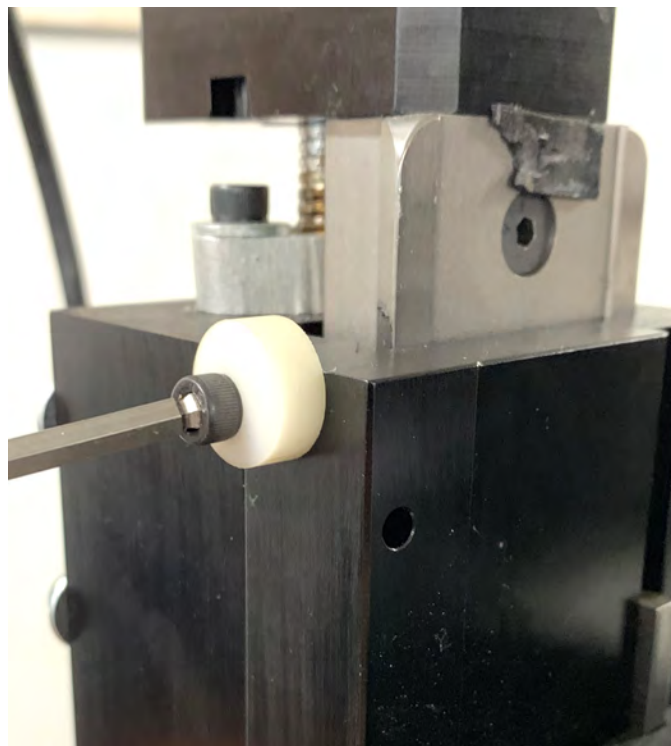


FIGURE 80—Mount the eccentric trigger on the column saddle and leave it loose.

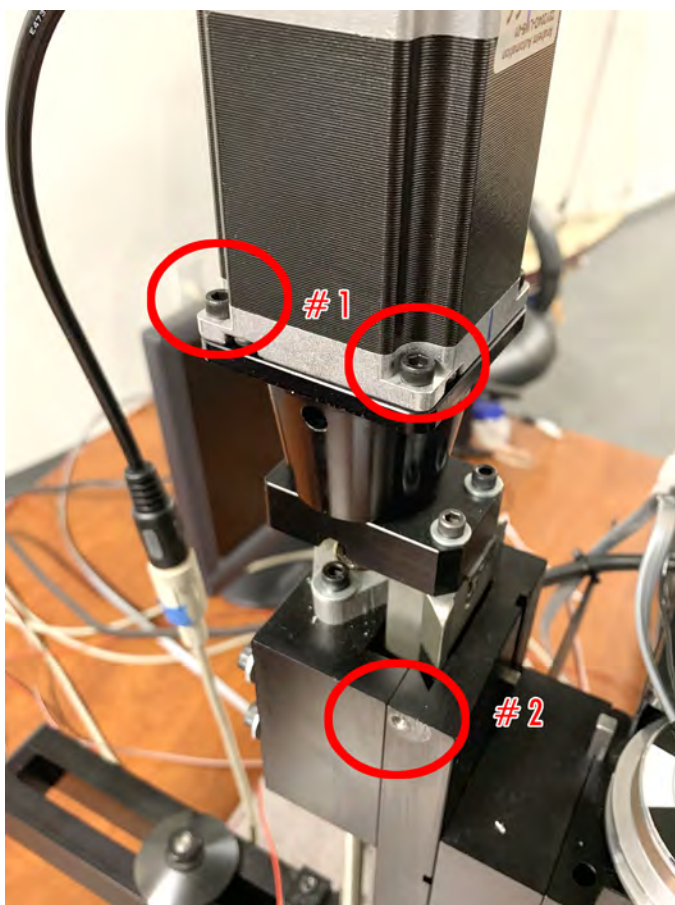


FIGURE 79—#1: The red ovals indicate the mounting screws from the stepper motors for the limit switch mounting bracket. #2: This red oval shows the location of the screw hole on the mill column saddle for the eccentric trigger.*

* **NOTE:** You may need to drill and tap the 8-32 hole on your column saddle to mount the Z-axis eccentric trigger. If this is the case, please go to page 21 of this document for the **Limit Switch Hole Templates** for the Y and Z-axes.

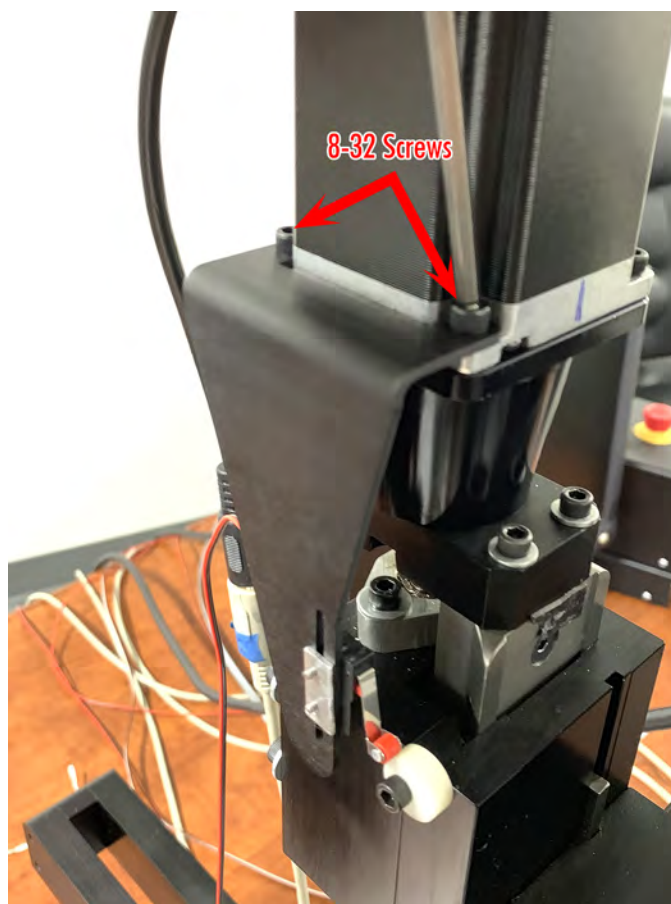


FIGURE 81—Install the Z-axis limit switch mounting bracket using the two 8-32 screws from the stepper motor.

Once the limit switch is mounted, turn off the driver box and then disconnect the power cord to the stepper motor.

Now raise the column saddle all the way to the top of travel. Then lower the column saddle one full revolution of the handwheel. This is where you want to set your limit switch "closed position." Adjust the eccentric and the limit switch for the Z-axis the same way that you did for the Y-axis. Once the position is set, tighten all of your screws.



FIGURE 82—Final Z-axis limit switch position.

X-axis Limit Switch Setting and Eccentric Trigger

X-axis limit switch parts.

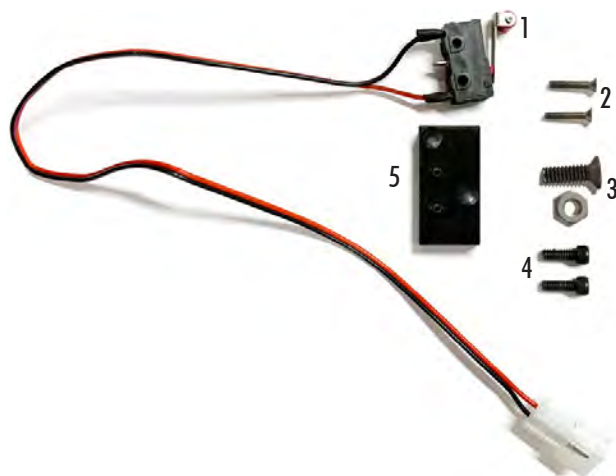


FIGURE 83—X-axis limit switch parts, clockwise from top right:
 (1) P/N 68040 limit switch w/pigtail
 (2) P/N 81270 2-56 x 3/8" Phillips head machine screws (2 ea.)
 (3) P/N 68035: 10-32 x 7/16" Phillips flat-head screw
 P/N 32100: 10-32 Hex nut (These are for the limit switch stop)
 (4) P/N 40530: 5-40 x 3/8" SHC screws (2 ea.)
 (5) P/N 68026 X-axis limit switch mount
 (6) P/N 67124: Zip ties (2 ea.)

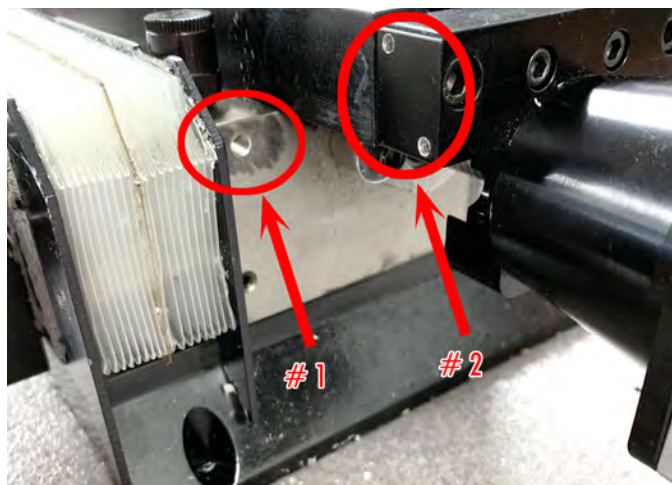


FIGURE 84—X-axis mounting holes:
 #1: 10-32 screw for the eccentric trigger.
 #2: 8-32 screws for the limit switch mounting bracket.



FIGURE 85—Thread the 10-32 x 7/16" Phillips flat-head screw* with the 10-32 hex nut into the side hole on the saddle. If there is a set screw in this hole, remove it first, then thread in the 10-32.

***NOTE:** We changed this 10-32 screw from a socket-head cap screw to a Phillips flat-head screw because the roller on the limit switch can sometimes go into the hex head indent and change the home position.



FIGURE 86—Attach the X-axis limit switch mounting bracket, P/N 68026, using the two 8-32 screws.

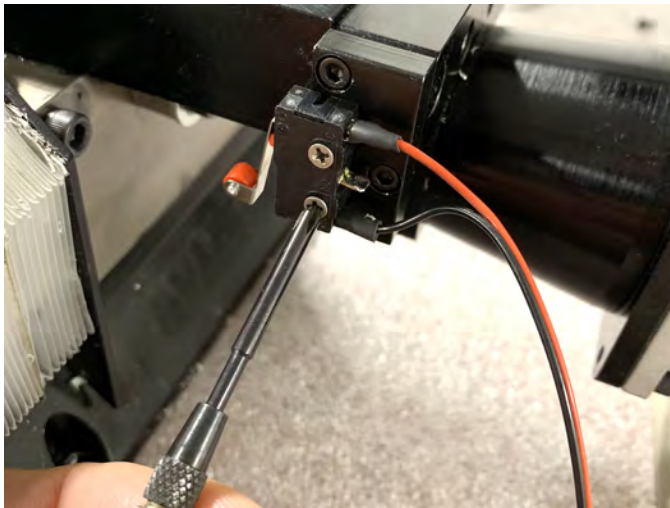


FIGURE 87—Mount the limit switch with the spring roller facing own using the two 2-56 screws P/N 81270.

The alignment of the limit switch and the 10-32 screw is fine just the way it is. No adjustments needed.

Plug in the limit switch to the main cable connector for the X-axis.

Go to the setup page.

Move the table by hand until the limit switch makes contact with the 10-32 screw. Slowly continue to move the table towards the saddle and look for the “Low Green,” status to turn to “High Red,” when the limit switch closes.

For each axis, use a small zip tie and secure the limit switch pigtail to the stepper motor cable (see pictures below).

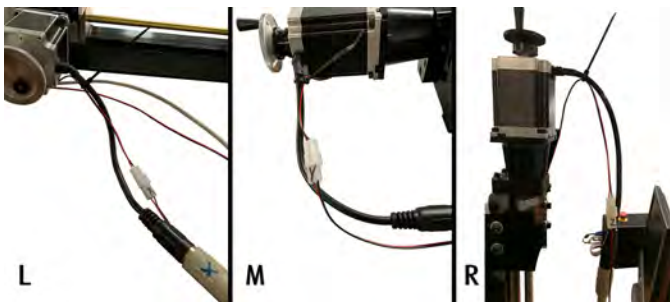


FIGURE 88—Limit switch axes connections. **Left:** X-axis; **Middle:** Y-axis; **Right:** Z-axis

Trim the Zip Ties.

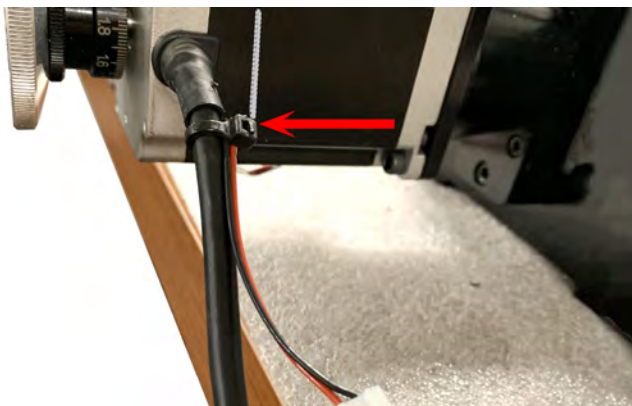


FIGURE 89—Use wire cutters to trim off the excess zip tie flush at the knuckle. Exposed zip tie ends will cut you, so trim them flush.

Now We Can Home out the Machine

With the control box and driver box both on, and the E-stop triggered, and the password (SP) entered, press the Ctrl, Alt, and Home buttons on your keyboard. All of your axes will now home out on their respective limit switches. Each axis will move until they make contact with their limit switch, then the axis will stop, then it will move away from the limit switch approximately one full revolution of the leadscrew and stop. The setup files are set to home out the Z-axis first, then the Y-axis, and then the X-axis.

If you have an axis that does not home out correctly, check to see if your limit switch connector is plugged in all the way. If you are still having problems, call us for assistance (760-727-5857).

Modifying the Mill Way Cover for Use with Limit Switches

If you are doing a limit switch retrofit to an existing machine, you will need to modify the mounting plates on your accordion way cover. Please see the instructions, *Way Cover Modification for Mills with Limit Switches* (https://www.sherline.com/wp-content/uploads/2019/08/way_cvr_mod_inst.pdf).

Optical Encoder and Speed Control Wires on Leadscrew Machines

For the leadscrew machine, we don’t supply a bracket for the encoder and speed control cables. We supply zip ties.

1. Push the encoder cable up so it creates a loop that goes above the end of the spindle pulley and allow enough room to use the draw bolt on the end of the spindle. Then zip tie the cable to the power cord that is coming out of the motor (see Figure 90).

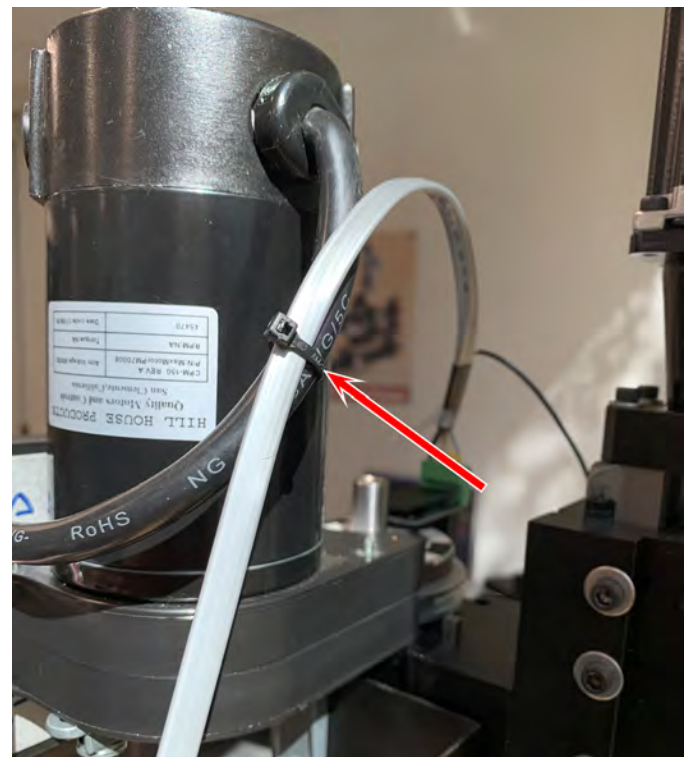


FIGURE 90

2. Now zip tie the speed control cable and the encoder cable to the power cord that is coming out of the speed control (see Figures 91 and 92).

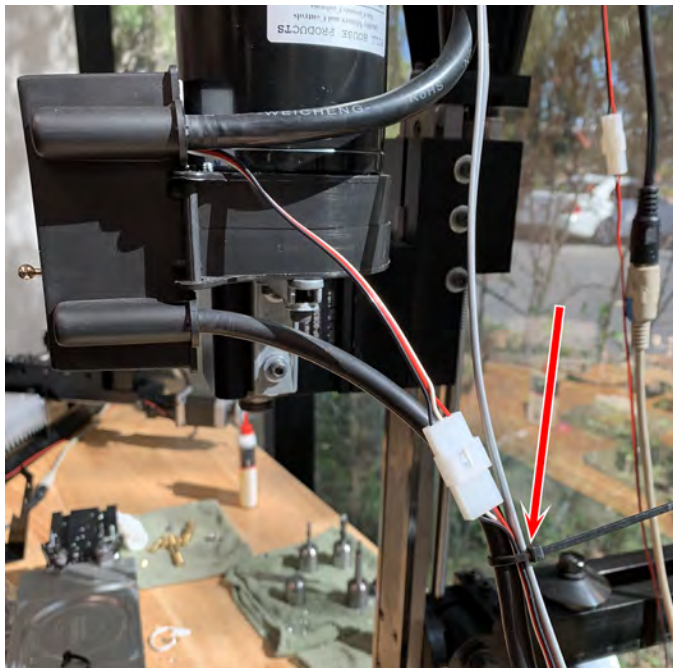


FIGURE 91—See the red arrow for the zip tie location.

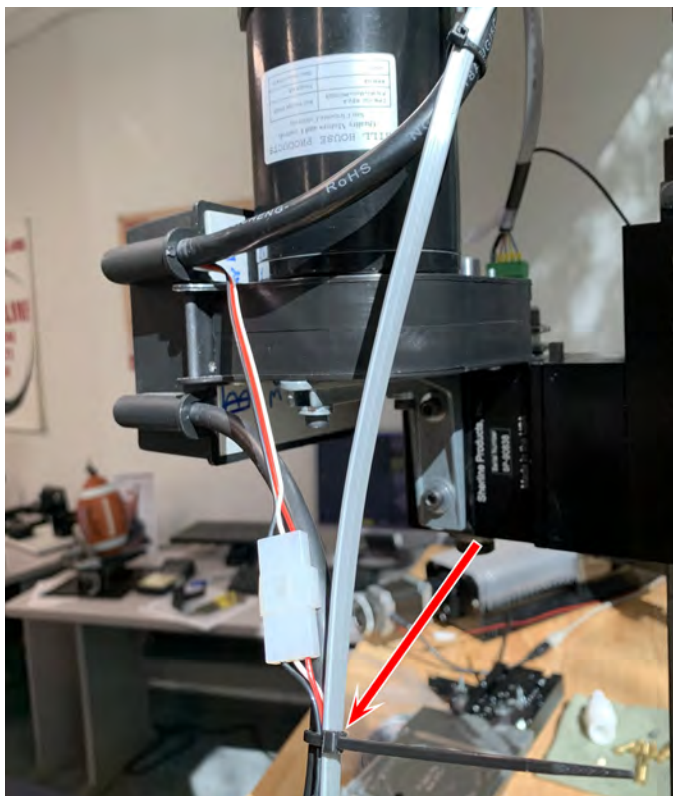


FIGURE 92

3. We highly recommend using the alternative ground wire mounting location, so there will be one less wire going over the spindle and pulley (see Figure 93).

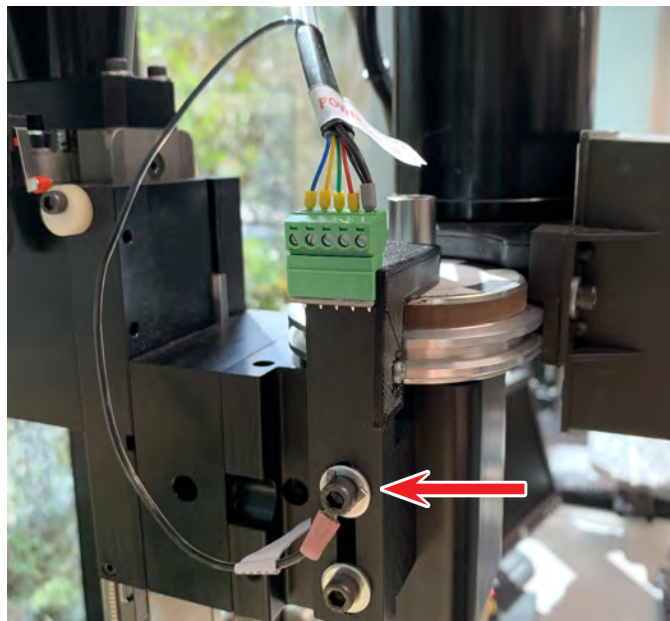


FIGURE 93— The photo shows an alternate location for the grounding wire on the opposite side of the headstock.

⚠ CAUTION

1. Always be sure to disconnect the power from the controller before connecting or disconnecting the ground wire or the optical encoder connection.

Failure to do so may result in a ground fault that will severely damage the Optical Encoder.

2. Make sure that the optical connector is plugged in correctly. The connector can only go in one way. HOWEVER, if you plug it in and only four of the five legs are plugged into the connector, the plug will still go all the way in. If all five legs of the plug are not in the connector, you will fry the optical encoder. Look at both sides of the plug and make sure they are flush with the connector (see Figure 94).

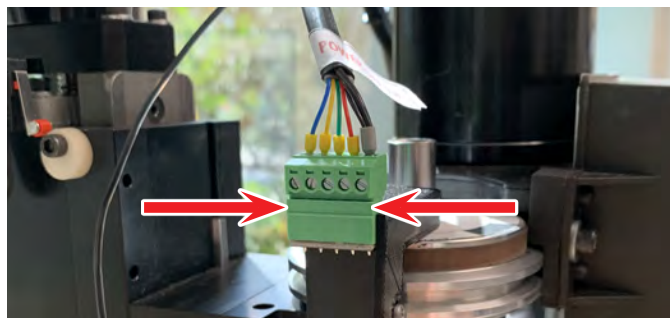


FIGURE 94

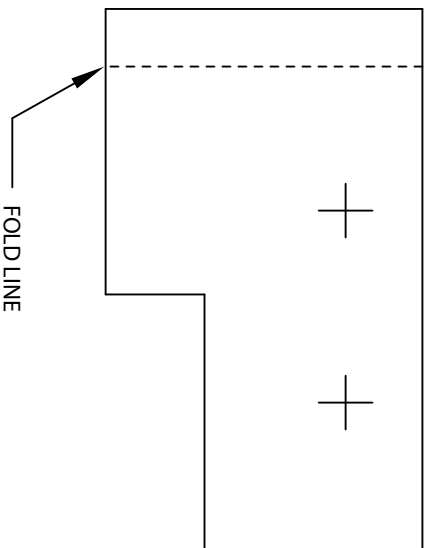
Related Sherline Video Links

Visit our YouTube channel, or by following the links below.

1. **Setting up Your New Sherline CNC Controller**
(How to connect your controller and use the controller.)
<https://youtu.be/obFdV17K9bw>
2. **Setting up the Optical Encoder**
(How to mount your encoder, set the gap, check the signals, and turn the spindle on for the final RPM check.)
<https://youtu.be/ynfJ38QLMoE>

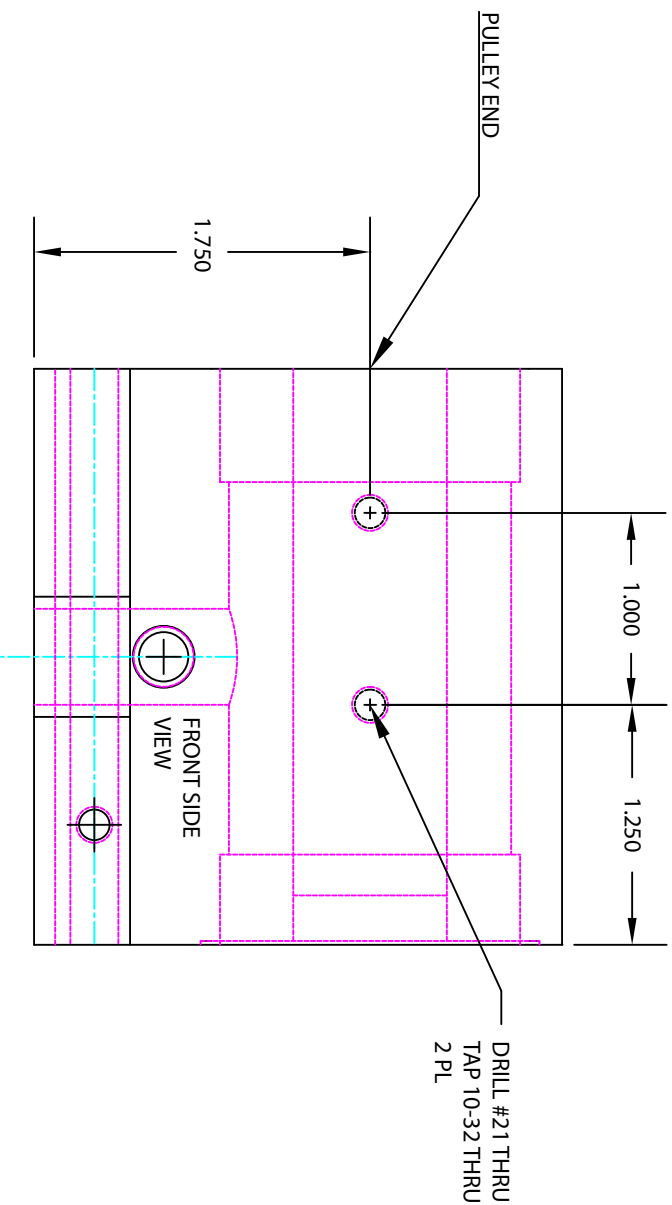
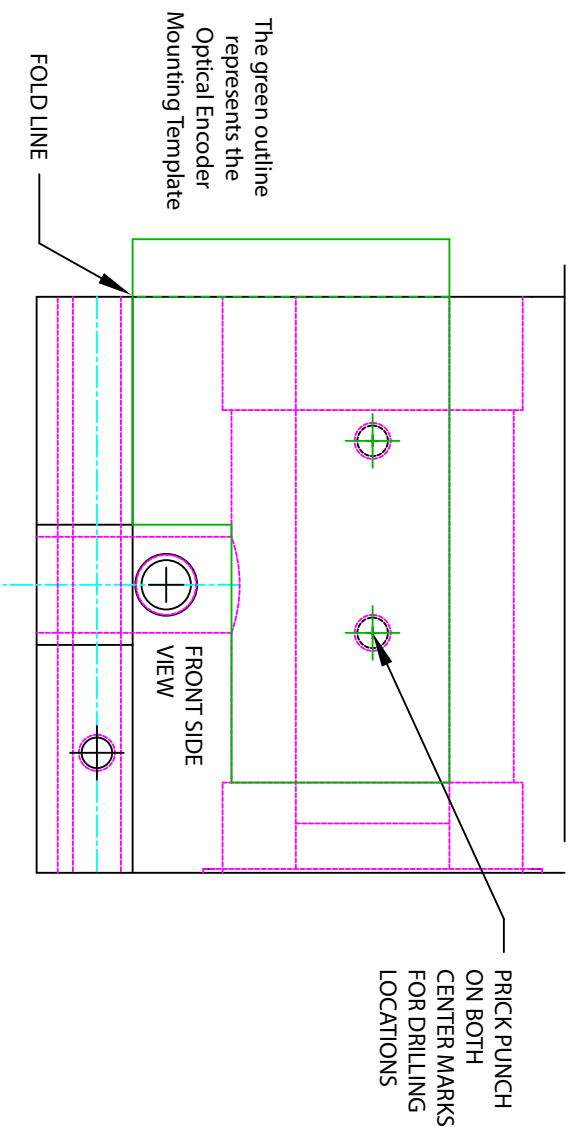
OPTICAL ENCODER HOLES FOR THE SHERLINE/MASSO CONTROLLER

Optical Encoder Mounting Template



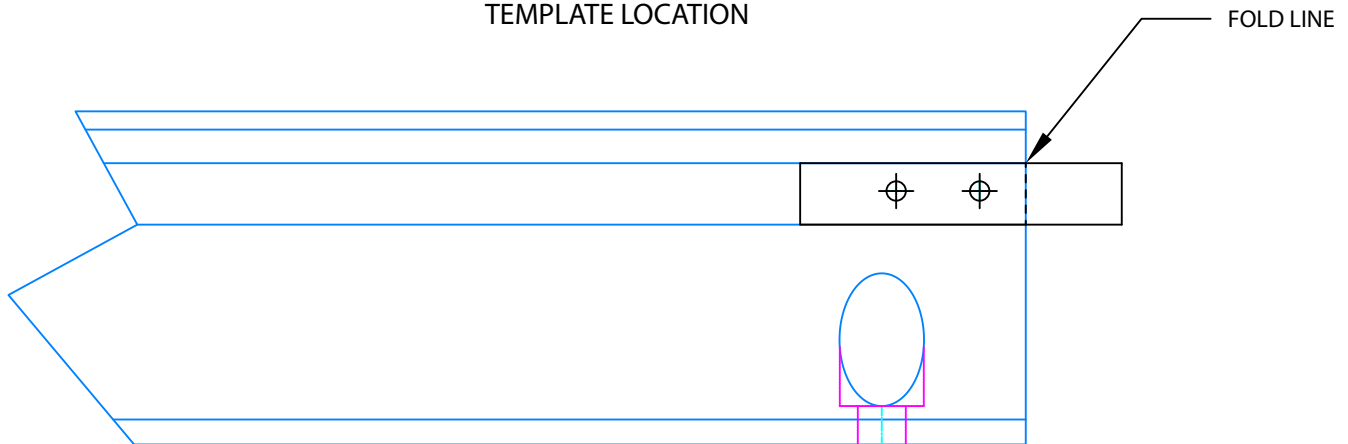
Optical Encoder Mounting Instructions

1. Cut out the template above.
2. Fold it on the dotted line.
3. Align the template with the folded edge on the "pulley" side of the headstock, and tape it in place as noted by the green outline in the example, (upper-right).
3. Prick punch on both of the center crosshairs to mark the drilling location.
5. Drill through with #21 bit in the example (bottom-right).
6. Tap a 10-32 thread.



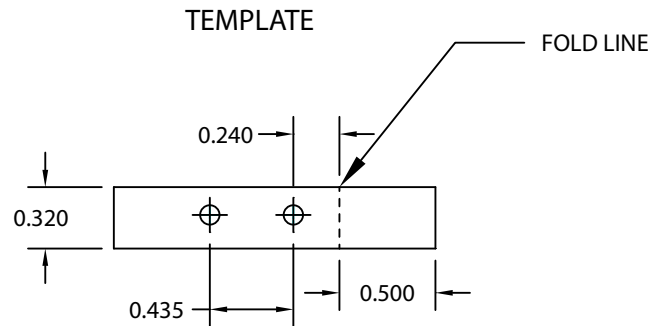
Limit Switch Mounting Templates

MILL BASE LIMIT SWITCH HOLES TEMPLATE LOCATION

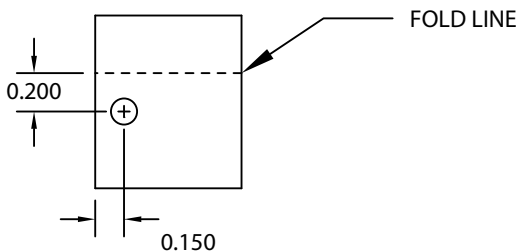


Mill Base Template Instructions

Cut the template out on the solid lines. Fold the template on the dashed line and tape it in place on your mill base. Position the targets on the side of the mill and the extra fold at the front of the base. The targets indicate the hole locations for the Y-axis limit switch mounting 5-40 screws. You will need to remove the accordion way cover plate before affixing the template if you have one mounted on your mill.



COLUMN SADDLE ECCENTRIC TRIGGER HOLE TEMPLATE LOCATION



TEMPLATE

Column Saddle Template Instructions

Cut the template out on the solid lines. Fold the template on the dashed line and tape it in place on the top of your column saddle as seen in the diagram to the right. Position the target on the side of the saddle and the extra fold on top of the saddle. The target indicates the hole location for the Z-axis eccentric trigger mounting 8-32 screws.

