



# Adding DRO Handwheels to Stepper Motors

## Introduction

To install CNC stepper motor mounts on a Sherline machine, you must remove the handwheels. Sherline's digital readout system measures handwheel rotation and translates it electronically into table movement rather than measuring table movement directly; therefore removing the special DRO handwheels eliminates the DRO function. Some CNC users prefer to have a DRO reading the leadscrew movement to crosscheck the CNC input to ensure that the axis has actually moved the amount of the stepper motor input. Another use of the DRO on a CNC machine is that it gives the operator the ability to switch between CNC and Manual machining. The DRO will give them a position readout when the CNC position screen is off." Though not part of the original design consideration for the DRO handwheels, there is a way they can be mounted to the back of a stepper motor so that they can be used in this application.

**NOTE:** If using the DRO on a CNC machine, the axis cannot be moved faster than 15 in/min (381mm/min). The DRO was designed for manual use and it will not give a correct position readout at faster feed rates.

## Parts Required

P/N 81300 is the DRO thrust collar that both centers the leadscrew and has a groove around its outer edge that locates the two halves of the encoder housing (see Figure 1). These thrust collars can be ordered as replacement parts. You will need one for each stepper motor to which you wish to attach a DRO handwheel/encoder unit.

## Installation of the Thrust

Spread a thin layer of grease on the rear shaft of the stepper motor near the housing to keep any excess glue from sticking to the shaft. Make sure the back of the stepper motor housing around the shaft is flat and clean. Wipe the housing with rubbing alcohol to remove any excess grease or oil. Mix a small amount of 5-minute epoxy and spread it on the back of one of the thrust collars. (**NOTE:** the back side is the side closest to the groove in the outer periphery.) Keep glue away from the center hole. Slide the thrust down the rear motor shaft and press it against the back of the stepper motor housing, making sure it seats squarely and that the shaft can turn freely. Repeat this for each stepper motor that will have a DRO handwheel mounted to it. Let the glue harden for several hours or overnight for maximum strength.

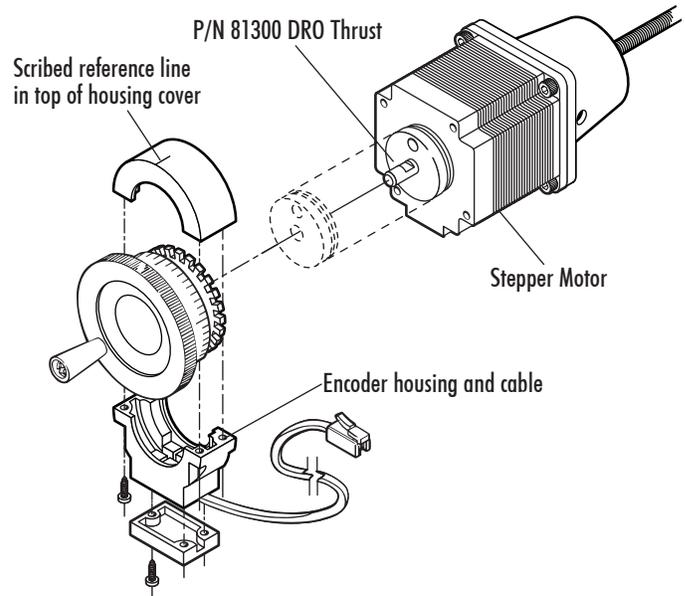
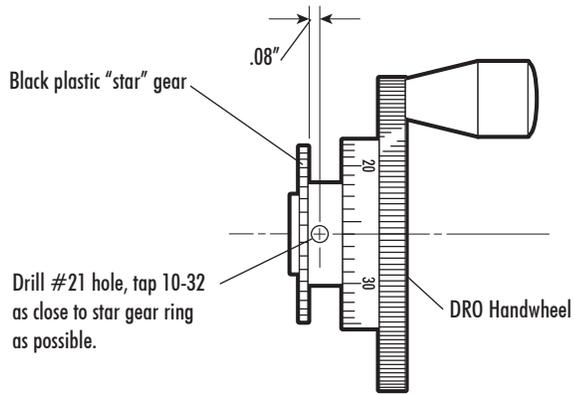


FIGURE 1—Grooved thrust collar from the DRO is shown glued to the back of the stepper motor. Note position of groove closest to stepper motor.

## Re-drilling the Handwheel Set Screw Hole if Needed

Put the handwheel onto the motor shaft and see where the set screw hits the shaft. The additional thickness of the thrust collar means that the handwheel set screw may tighten too close to the end of the motor shaft. It might be necessary to drill and tap a new 10-32 hole in the handwheel as close to the plastic encoder gear as possible so that the set screw will fully engage the shaft. If the set screw does tighten on the shaft, this step will not be necessary. If a new hole is needed, the handwheel can be slipped over a 1/4" diameter wooden dowel or other 1/4" rod which is held in the grooved jaw of the mill vise. Secure the handwheel to the shaft with the existing set screw. Drill the new #21 (0.1590") hole. Remove the handwheel from the shaft and tap the hole 10-32. Reuse the existing set screw in the new hole.

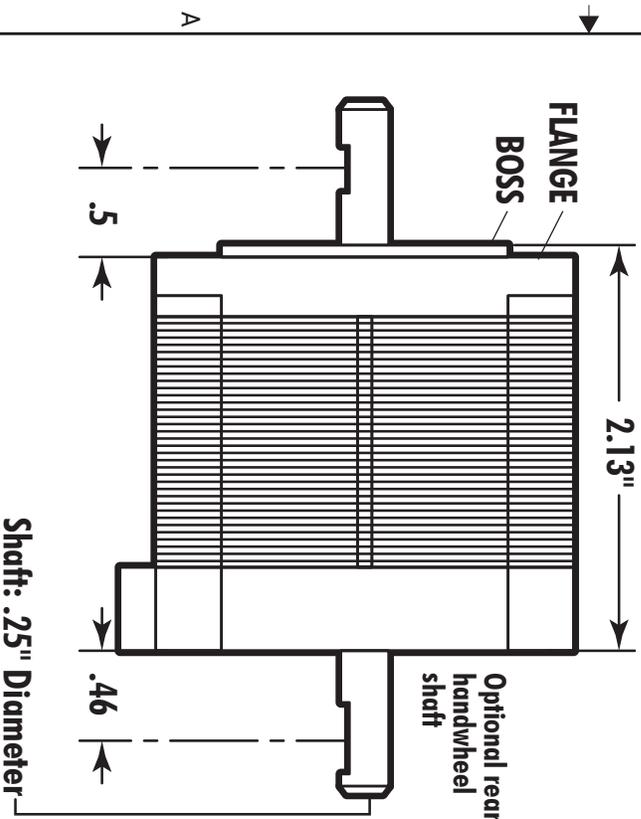
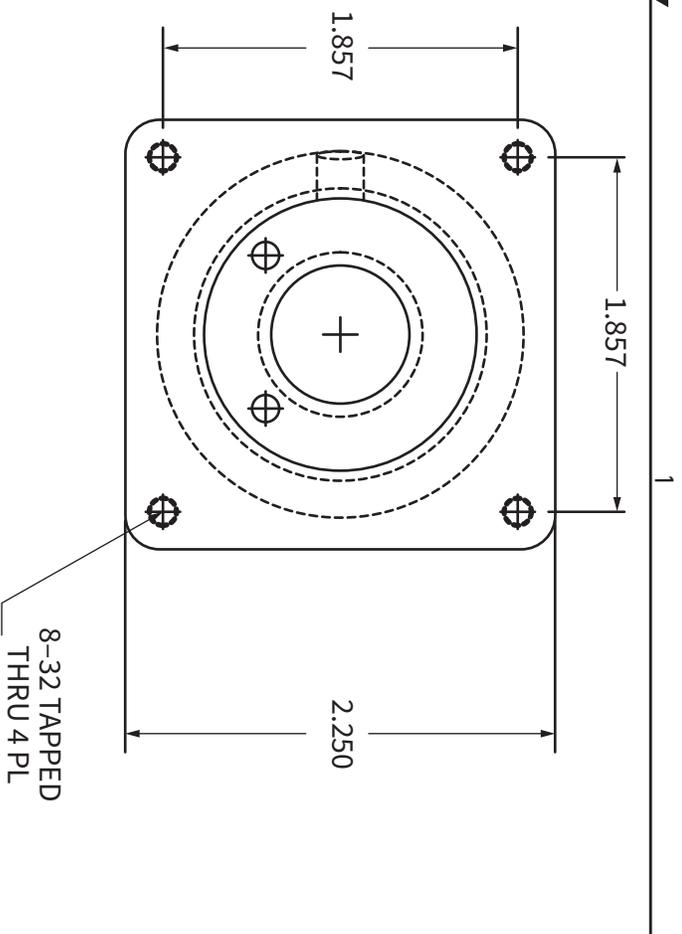
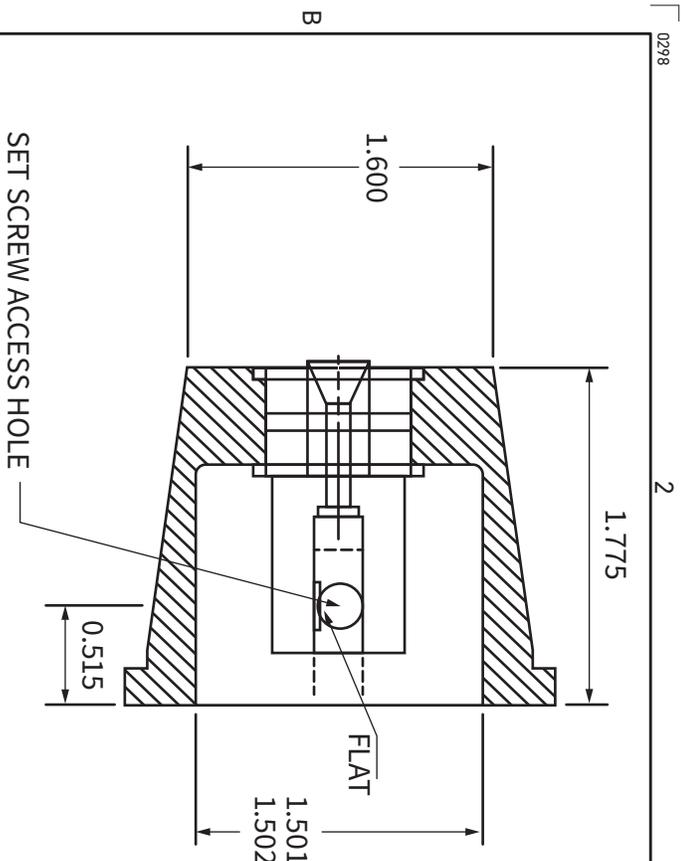
When installing the handwheel, align the set screw with the flat on the stepper motor shaft. Because of how close the set screw will be to the end of the shaft, it may be necessary to file or grind off the lip at the end of the flat so that the flat extends all the way to the end of the shaft.



*FIGURE 2—If the set screw won't tighten on the flat of the motor shaft, drill and tap a new hole as close to the star gear as possible.*

### **Installing the Handwheel and Encoder Housing**

See the instructions that came with your P/N 8100 or 8200 DRO. The handwheel, encoder housing, and sensor are now installed onto the thrust in the same manner as on a standard mill or lathe. See 8100inst.pdf ([https://www.sherline.com/wp-content/uploads/2015/11/8100inst\\_2021.pdf](https://www.sherline.com/wp-content/uploads/2015/11/8100inst_2021.pdf)) if you do not have instructions at hand. If a reference line was not previously scribed in the center of the top of the housing cover, it should be scribed before assembling the two halves of the housing.



If using a non-Sherline stepper motor, make sure to grind flats on the shafts as shown where the coupling and hand/wheel set screws contact the shaft.

**Mounting Instructions**

To mount the motor, start by turning the coupling set screw lines up with the access hole in the mount. Carefully insert the motor shaft into the coupling. With the flanges touching, rotate the stepper motor until the flat on the shaft is in alignment with the coupling set screw. Tighten the set screw. Rotate the motor to align with the motor with the 8-32 tapped holes. We usually attach the motor using three screws and use a zip tie in the fourth hole to secure the wire bundle.

If you decide to use Loc-tite® on the shaft set screw, a problem can occur if the motor has to be removed. What can happen is the shaft ends up glued to the coupling. If this occurs, loosen the preload nut until the motor and shaft can be backed out to expose the coupling so you can work on it. Be careful not to flex the coupling or it can break at the dampening slots.

DO NOT SCALE DRAWING !!!  
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES.

TOLERANCES ARE:  
 DECIMALS .00 . . . . . ±0.006  
 DECIMALS .000 . . . . . ±0.003  
 ANGLES . . . . . 1°  
 DEBURR . . . . . HAND  
 HEAT TREAT . . . . . NONE

FINISH BLACK ANODIZE

**SHERLINE** SHERLINE PRODUCTS, INC.

TITLE STEPPER MOTOR MOUNT

DRAWN	JOE MARTIN	SCALE	1 = 1	SIZE	A	PART NUMBER	67102	REV.	1998-09
CHECKED	JOE MARTIN								
DESIGNER	JOE MARTIN	MATERIAL	3 5/16 ROUND 6061 T6	SHEET	1	OF	1		



# SHERLINE STEPPER MOTOR SPECIFICATIONS

Sherline P/N:	67127 (w/ DIN plug and flats on shaft) 67130 (no plug, flats on shaft)
Frame size:	NEMA #23
Step angle:	1.8°
Voltage:	3.2 V DC
Current:	2.0 A/Φ
Resistance:	1.6 Ω/Φ
Inductance:	3.6 mH/Φ
Holding torque:	.775 N.m (Newton meters) 7.9 kg-cm 109.71 oz/in (ounce inch) 6.856 in/lb (inch pound)
Rotor inertia:	250 g-cm <sup>2</sup>
Number of wire leads:	6 (See color code diagram FIG. 2)
Weight:	1.32 lb (0.6 Kg.)
Length:	2.13" (54 mm)
Shaft:	Double ended, 1/4" diameter

See figure 3 for the pin diagram and wire color layout of the stepper motor connector cables we supply with our stepper motors. Since there is no industry standard for wire colors in this field, if using a connector not supplied by Sherline each pin and color should be confirmed with a continuity tester before applying power.

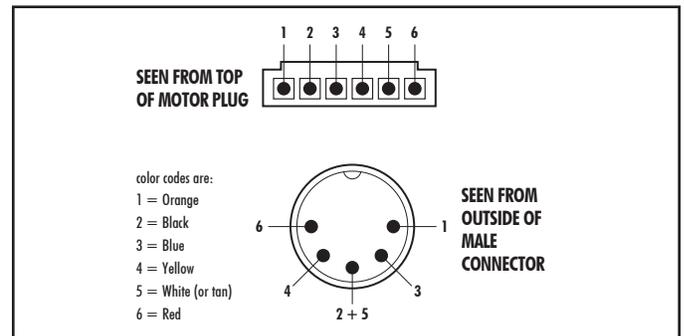


FIGURE 3: diagram shows which pin in the DIN connector is wired to which position in the motor connector.

NOTE: Motors can be wired in either unipolar or bipolar configuration depending on how the leads are connected. Sherline motors with plugs are wired for unipolar operation.

### PRECAUTIONS

- Make sure the ends of raw wires are not touching each other when turning the handwheel by hand to drive the stepper motor and leadscrew. It can cause the motor to feel rough and hard to turn.
- DC motors generate current when hand cranked that can damage the control unit. When positioning a stepper motor by hand using the handwheel, do not crank faster than about 1 rev/second. For long travels, use the jog mode of your CNC control software.
- Poor connections can cause arcing, which can burn out motors or control chips. Always make sure plugs and connections are fully engaged and making good contact.
- Always turn off driver box power before plugging in or unplugging a stepper motor.

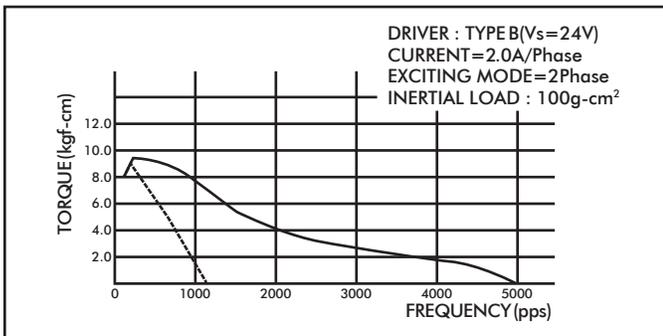


FIGURE 1—Motor torque curve

### Lead Wire Connection and Color Code

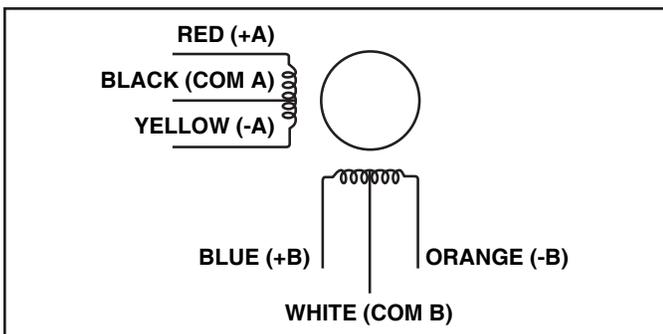


FIGURE 2— Color of internal wiring for NMB motors