SUPERIOR

4-14 S2
Line Boring Machine
Operating Manual

CONFIDENTIALITY STATEMENT

DOCUMENT NUMBER SPR-MAN-4-14 S2

REV 01

SUPERIOR

One Company, *Superior* Results.

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ABOUT US

Superior Plant Rentals, LLC. (SPR) specializes in portable machining, bore welding, line isolation, and testing solutions, providing equipment and tools manufactured under the highest standards of quality control and engineering expertise along with 24/7 service and support. Designed with the operator in mind, our tools and equipment deliver dependable and precise performance, providing cost-effective solutions and reduced downtime, making them beneficial resources in the Oil and Gas, Mining, Heavy Construction, Shipbuilding, Aerospace, Defense, and Power Generation industries.

SPR manufactures, rents, and sells equipment and tools; we offer our own line of portable ID/OD flange facers, linear/gantry and rotary mills, end prep bevelers, isolation and test plugs, line boring, and bore welders, as well as custom-designed equipment and tools.

Our team includes machining, test and isolation, and engineering experts, all with a thorough working knowledge of applications to support you with our equipment on any job. We understand the urgency of your projects and are committed to delivering the highest quality equipment and tools to satisfy the requirements of your clients.

SPR delivers outstanding customer service, specialized training by seasoned professionals, and tools as tough as the jobs you need them to do.

YORK
PORTABLE MACHINE TOOLS

SUPERIOR
PLANT RENTALS

CLIFF'S BITS
PRECISION GRINDING & TOOLING

5M MANUFACTURING
HEAT EXCHANGER TOOLS & MACHINERY

WARNING:

SPR is committed to continued product improvement; therefore, the machine you received may be slightly different than the one described herein. This manual and the information provided is a basic guideline for our customers. SPR will do its best to ensure that the information and procedures contained in this manual are correct and up-to-date. Superior cannot guarantee that the information and procedures contained herein are correct for all applications or situations.

The contents of this manual are subject to change without notice. It is the obligation of the user to read all information in this manual, become familiar with the equipment to be used, and exercise the utmost care in equipment operation. **Do not make any modifications to this equipment. Any modifications will void all warranty claims, as well as increase the risk of injury or harm.** Do not operate this equipment if all parts are not functioning at 100% efficiency. Notify us immediately for any needed repairs.

Note: SPR will supply all repair and replacement parts necessary for maintenance and operation of this machine. For repair, service, or additional information, please locate repair and replacement part description/part numbers within the O&M manual in the exploded view section and contact us for ordering.

USA

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INTRODUCTION

This manual contains information necessary for the setup, operation, and maintenance, of your 4-14 S2 line boring machine. The manual must be read in its entirety to familiarize yourself with the 4-14 S2 before attempting to setup or operate the machine. Failure to do so may result in injury to the operator or damage to the 4-14 S2.

APPLICATIONS

The 4-14 S2 is the ideal choice for line boring repairs on earthmoving, forestry, industrial manufacturing, mining, and marine equipment. This portable, powerful machine interfaces with SPR York's bore welders so there is only one set up to do both. Many optional accessories are available allowing a wide range of line boring repairs.

RECEIVING YOUR 4-14 S2

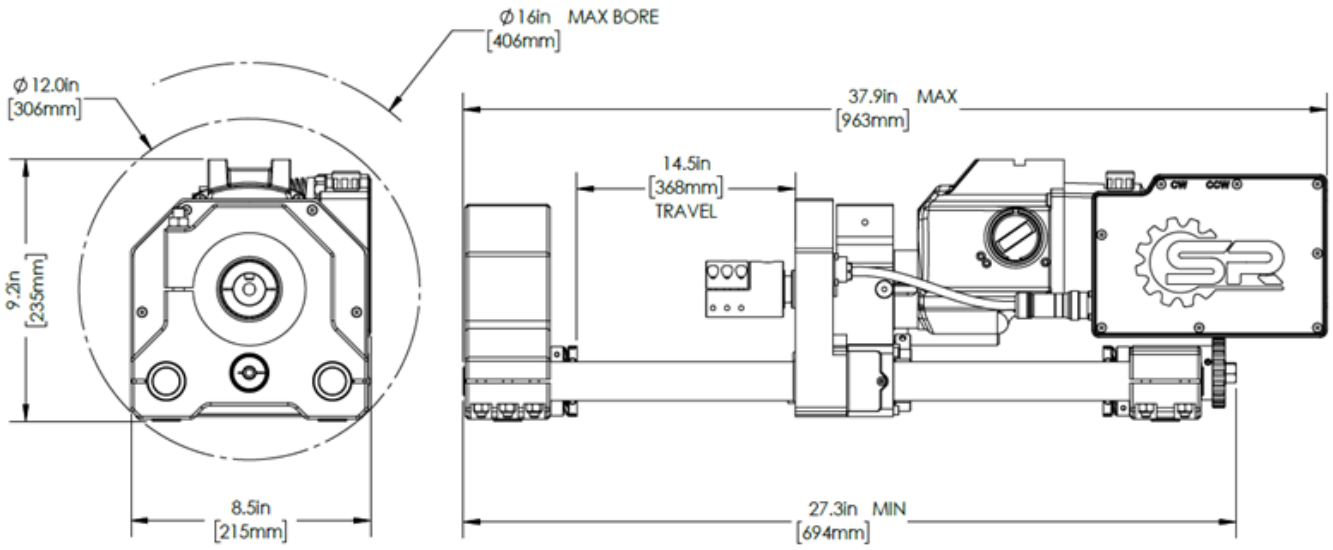
Inspect the machine for shipping damage. Verify that all the parts listed below, or on the Bill of Materials, are present. The 4-14 S2 kit is shipped in one crate. The boring bars are at the bottom under a false floor. If any parts are missing, or if you have questions regarding the 4-14 S2, please contact a SPR York Portable Machine Tools or Superior Plant Rentals location nearest you immediately.

There is a scannable QR code on the machine, this will bring you to our website with the latest updated owner's manual and any other information regarding this machine.

SPECIFICATIONS CHART

4-14 S2 Electric Feed Carriage	
Cutting Tool Travel	14.5 in (368 mm)
Feed per Minute	0 – 6.5 inch per minute (165 mm per minute)
Feed per Rev	.1 – 20.5 thou per rev (.0025 mm - .521 mm per rev)
Rapid Traverse	8.3 inch per minute (211 mm per minute)
Weight	Machine 51 lbs (23 kg), Pendant 3lbs (1.3kg)
Electric Bar Drive - Eibenstock 4 Variable-Speed	
Bore Diameters	1.5 to 16 in (38.1 mm to 406.4 mm)
Power Options	110 V, 20 amps, 3 hp (2200 W)
Bar Drive Torque	114 ft-lbs torque (154.56 Nm)
4 Variable-Speed Reversible Bar Drive Motor Weight	26.5 lbs (12 kg)

DIMENSIONS



SAFETY PRECAUTIONS

Please follow this list of general safety guidelines when operating the 4-14 S2 Line Boring Machine. Safe machining practices should always be followed when operating SPR machines.

The customer shall ensure that only people thoroughly trained in safe work procedures operate this machine. Rotating machine parts can cause serious injuries, even death!

Before operating this machine, read the entire operating manual. Inspect machine, cord, and accessories for any damage. Wear safety glasses, ear plugs, and safety shoes while operating the 4-14 S2. Do not wear loose fitting clothing that could get wrapped up in the machine. For maximum protection, keep your equipment clean and in good condition. Follow company and OSHA safety rules when operating equipment. Always disconnect the power supply when inserting or adjusting the cutting tool or servicing the machine. Moving machine parts can seriously injure operators. Understand and read all instructions before operating this machine.

WARNING!
MOVING PARTS.
Keep hands, loose clothing, and hair away from rotating or moving parts. Disconnect the air supply from the machine and unplug all equipment prior to adjusting or servicing. If electric, remove power from the machine prior to adjusting or servicing.

WARNING!
ELECTRICAL SHOCK.
Possible shock if not handled properly.

WARNING!
EYE PROTECTION.
Eye protection must be worn while operating or working near powered equipment.

WARNING!
EAR PROTECTION.
Ear protection should be worn while operating or working near loud equipment.

The 4-14 S2 is equipped with emergency stops located on the motor E-box and the handheld control.

- Do not leave machine unattended while in operation.
- Beware of pinch points. Keep all body parts clear of the machine while it is running.
- Avoid leaving set screws (that are not being used) in the boring bar. They can vibrate loose and become seized in the bearings. This can cause damage to the bearings and feed system.
- Check the bars for any nicks or gouges. Minor nicks can be cleaned up using emery cloth. Do not use damaged bars.
- Wait until the bar has come to a complete stop before changing direction of the bar drive motor.

PRODUCT DESCRIPTION

INTRODUCTION

The 4-14 S2 is our most innovative line-boring system yet. We have taken all our experience from the 4-14 ET and made a machine that is lighter, more rigid, has a smaller footprint, and has more precise controls, as well as allowing automation of the cut.

WHATS NEW?

The machine's features include:

- 2.5x stiffer guide bars than the 4-14 ET for more rigidity and better quality cuts,
- 10lb lighter main assembly than the 4-14 ET,
- 50% more powerful motor than previous 4-14 models,
- A new electronic control box featuring:
  - Feed/Rev mode allowing the user to re-use cut parameters on different size bores,
  - Digital Roeadout (DRO) displays digital position, allowing user to monitor a bore depth,
  - Cycle Mode – automatically returns bar to start position after cutting, for adjusting tool depth,
  - Feeds and speeds are both adjustable and displayed on the pendant,
  - Magnet back for attaching to steel workpiece,
  - Bar Drive current level display shows user how far they can push the cut.
- Hi-current indication light on the motor,
- Positional end-stops with 60 thou of micro adjustment,
- New boring bar clamp interface compensates for up to 10 thou misalignment, thus reducing vibration,
- Spindle draw-bolt locks taper in place for back cutting,
- Durable foam encased roller-case for better protection and easy transport,
- Easy access e-boxes for field replaceable components,
- Load monitoring that shuts the system down if current is too high.

TOOLS

For normal operation this machine requires a 4 mm t-handle and 8 mm hex key, as well as a 17 mm ratchet wrench, all of which are included with the machine.

Warning: If you are using bars with inch-size insert holders, the setscrews require a 3/16” hex key. Do not use a 5 mm key for the motor clamp screws, as it will strip the fasteners.

OPTIONS

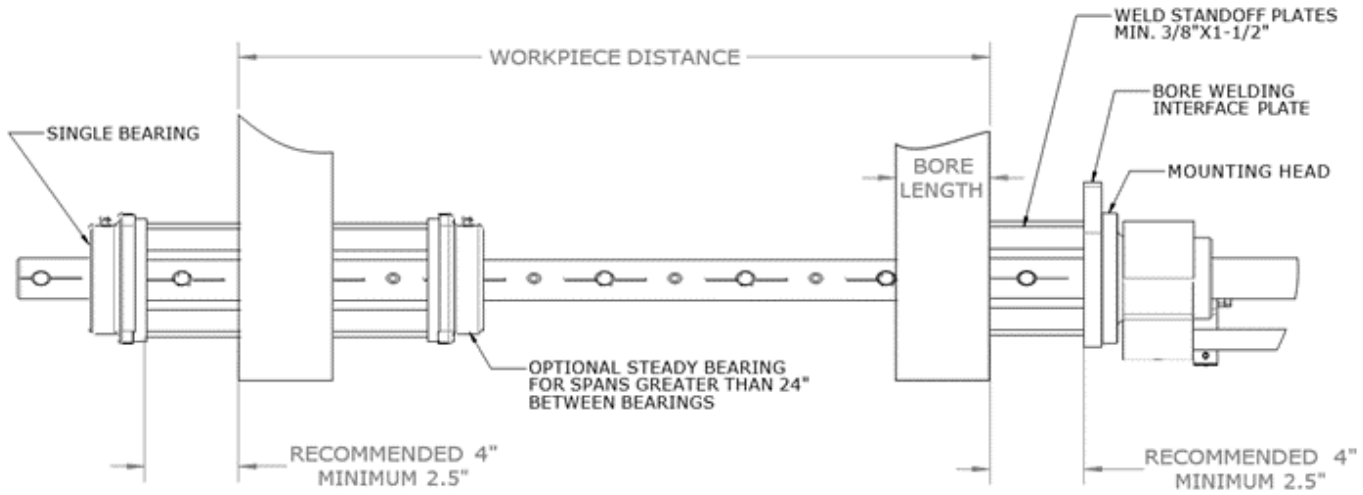
- 5 bar packages - 1 1/4”, 2”, polished or chrome; other sizes available
- Carbide inserts
- Thru Bar Measuring kits
- Facing tool
- Snap Ring Grooving tool
- Off-set bar drive

INITIAL SETUP

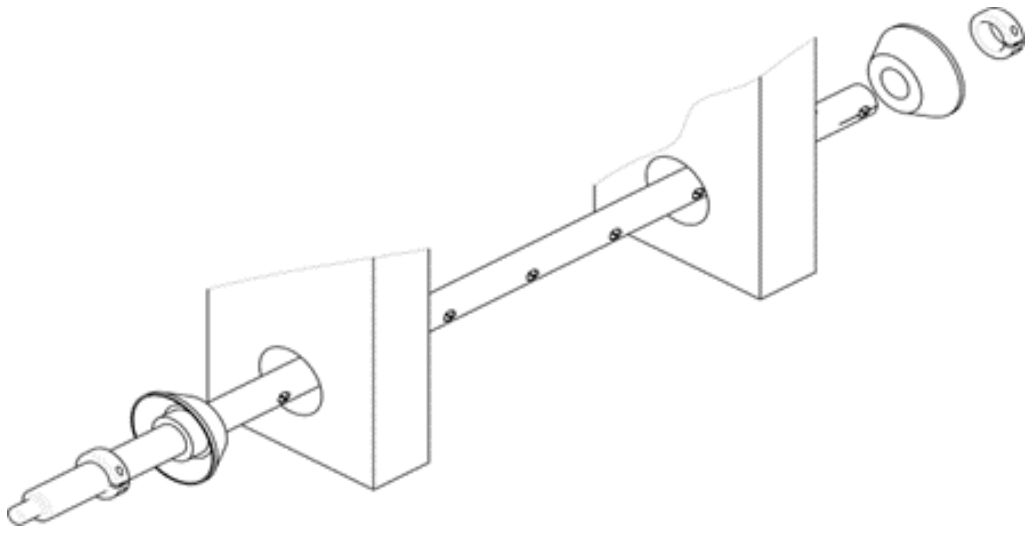
BAR SET-UP

Select the appropriate boring bar and insert it into the bore to be machined.

TO DETERMINE RECOMMENDED BAR LENGTH
FORMULA: 18” + WORKPIECE + ONE BORE LENGTH = RECOMMENDED BAR LENGTH

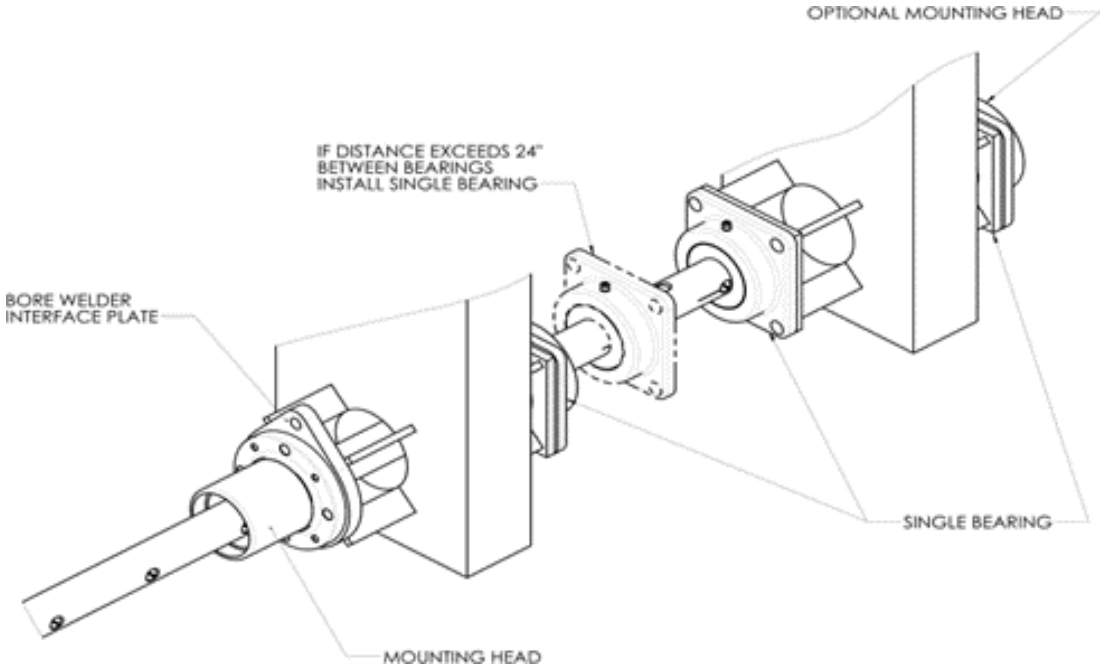


- Slide line-up cones onto the ends of the bar with the cones facing into the bores that are to be machined.
- Slide a locking collar up to each line-up cone. Tighten the first locking collar onto the bar so that there is approximately 3/16” between a tool hole on the bar and the locking collar.
- Slide the second locking collar along the bar until the bar is centered in the bore. Both line-up cones should be pulled tight into the bores.



The final tightening is as follows:

- Insert a tool bit or piece of square stock into the hole next to the clamping collar.
- Place a small pry-bar between the tool bit and the locking collar.
- Loosen the locking collar clamp screw.
- Pry the cones and the collar as tightly as possible. If this procedure is done correctly, you should not be able to move the bar in either direction.
- Check that the boring bar is in the correct position on the machine that you are boring. Is the bar parallel to any other bores on the machine? Is the bar square to the machine? Depending on the condition of the worn bores, the line-up cones may need to be shimmed to permit the bar to be in the correct plane for boring. Repeat the clamping procedure using shims if required.
- Slide the assembled double bearing-mounting head and bore welder interface plate onto the bar end. On the other end of the bar, slide on a single bearing. Weld the bearings into position using four small pieces of flat bar. Be sure to leave enough room to remove the line-up cones. Care should be taken to avoid pulling the bearings out of alignment. Too much welding causes binding from excessive heat. We recommend small tack welds. Tack all four pieces (with as small a weld as possible) to the bore welder interface plate and the work piece. Only then can the welds be increased from ¼" to ½ " long. By welding the flat bar on one edge, their removal after the job is made easier. The welds can be broken off after the job by hitting them with a small hammer. The distance between the two bearings should not exceed 2 inches apart. A third bearing may need to be installed to control vibration and tool chatter while machining.



On jobs where a third bearing is not possible, use a double bearing on each end of the bar. With a double bearing on each end, the line boring machine can be placed on either side of the job for maximum visibility.

- Loosen the locking collar clamps and slide the bar out of the bearings, allowing the line-up cones to be removed. If the bar slides through the bearings, you may proceed to the next step. If the bar binds, you will need to repeat the previous steps. In some cases, you can loosen the double bearing mounting head bolts on the welding plate and reposition the bearings using the set screws built into the mounting head. This may help to remove the bind.

- With the bar in position, slide the boring machine onto the double bearing mounting-head and tighten the nuts. DO NOT OVER TIGHTEN.

- Mount the bar drive motor onto the boring machine. Tighten the nuts to clamp the bar drive motor into place. DO NOT OVER TIGHTEN.

Be sure that extension cords match the power requirements of the machine. Do not operate in wet or explosive conditions.

- Connect the boring bar to the bar drive motor by aligning the clamp on the end of the bar drive motor and tighten the clamp screws.

- Ensure the drive pin is secured.

- Select a tool port in the boring bar you wish to use. Install an adjusting screw in the tool porthole. Insert the tool bit until it is tight against the adjusting screw. Clamp the tool bit in place using a flat point set screw.

MACHINE OPERATION

Extreme caution should be used operating this machine. Misuse can cause serious injuries, even death.

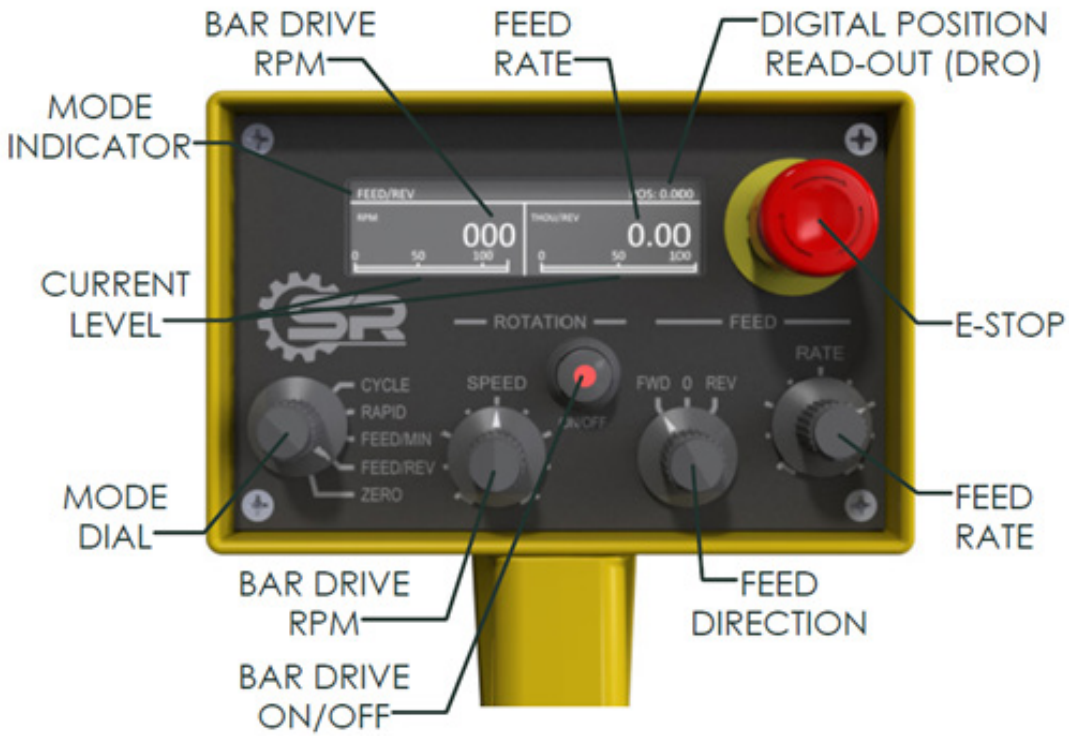
USER INTERFACE

The 4-14 S2 has controls on the motor, on the motor e-box and on the pendant.

Motor Controls
The bar drive motor has four variable speeds. To set these speeds turn the silver knobs on either side of the motor to the position indicated with one or two dots. The motor spindle may need to be twisted back and forth a little to engage the gears correctly as you are switching. There is a sticker on the top of the motor showing which positions provide the different speeds.

Motor E-box Control
The motor e-box has both the machine on/off switch as well as the bar drive direction switch.

Handheld Control Box
The control box is where you set the functions for running the machine, as shown in the picture below.



MODES

The mode dial has five positions, which includes four modes, and a zeroing position for the DRO.

Zero
Turning the dial to the zero position sets the DRO to zero on the top right of the display.

Feed/Rev
Feed per Rev controls how much the machine advances in thousands of an inch per revolution of the motor. The advantage of this mode over Feed/Min is the same feed per rev can be used for any bore size to achieve the same surface finish. For example, to achieve a Ra 63 µin (1.6 µm) finish with a .031" (.8 mm) corner radius, set the Feed/min at 1.3 thou per rev.

 **Feed/Rev cannot be used for positioning the carriage when the bar drive motor is turned off.**

Feed/Min
Feed per minute is an alternate way to control the feed rate and requires an additional calculation of the rpm of the motor to achieve a certain surface finish.

 **Feed/Min can be used to position the carriage, but its max speed is lower than the rapid mode.**

Rapid
Rapid is the mode used to position the carriage when not taking a cut.

 **The bar drive motor cannot be turned on in this mode.**

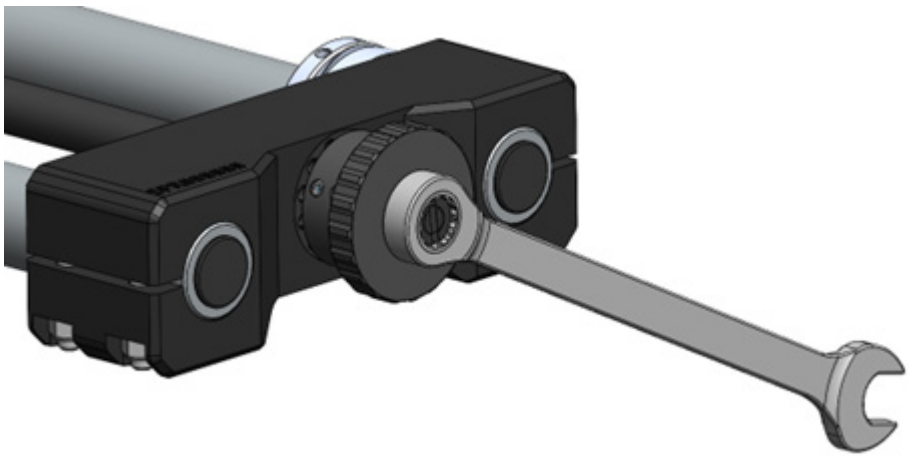
Cycle Mode
Cycle Mode is used to create a simple automation of a line-boring process, by cutting the bore and then automatically retracting the cutter back to a pre-defined position where the tool can be adjusted, thus allowing the operator to multi-task. See the Cycle Mode section on page 13 for instructions on using this mode.

POSITIONING THE CARRIAGE

The carriage can be positioned both manually and with power using the control box.

Manual feed

- To manually feed the carriage position, first pull out the handwheel.
- Turn the handwheel either by hand or with the provided 17mm wrench.



The DRO does not change with manual feed, only power feed.

Power feed

- To power feed the carriage switch to Rapid mode.
- Rapid Mode allows a complete range of feed speeds up to 8.3 in/min and does not allow the bar-drive to be turned on in this position.

Precise Positioning with DRO (Powered only)

- In the upper right-hand corner of the pendant display is a DRO which reads out the position of the machine. This can be set to zero by switching the mode dial to zero and then switching back Rapid.
- The DRO can be used for precise feeding of the system by monitoring its position.

Manually positioning with the hand wheel does not increment the DRO.

MACHINE OPERATION

General Line Boring
To run this machine, follow the steps outlined below.

1. Set up your bar and cutting tools with the machine powered off.

2. Power the machine on, using the power button on the motor E-Box.

3. Position the initial tool position using Rapid mode.

4. Set the mode dial to 0 to zero the DRO, which can be read in the top right of the pendant LCD.

5. Choose a bar-drive rotation direction using the switch on the motor E-box.

6. Choose a bar-drive motor gear based on the label on the motor.

7. Turn on the bar-drive motor and select the RPM with the dial. It initially shows a percentage and then calculates the speed.

Typically, with carbide inserts on mild steel, users cut at 200-300 Surface Feed per minute. RPM = 4 x SFM/Bore Ø (inches)

8. Choose Feed/Rev (or Feed/Min) mode and adjust the feed speed.

In Feed/Rev and using a .032in radius cutter, setting the Feed/Rev at 1.3 thou/rev will produce a surface finish of ~RA 63 µin

9. Set the Feed Direction knob to the direction you wish to advance. When the feed rate is set low, it can be difficult to see if you are feeding. Check the DRO in the top right of the LCD display to see if the position value is changing.

Counter-Boring to Precise Depth
To counter-bore to a specific depth:

1. Always set the zero position on the face of the bore using powered positioning. Manually setting the zero point will result in a position error because manual positioning is not picked up by the DRO.

2. In feed/minute mode, position the cutter close to the surface without touching.

3. Using a piece of standard paper between the face of the bore and the cutter, feed in at the lowest feed setting (.03 in/min) and note the point where the paper no longer slides between the bore face and stops the feed. The cutter will be less than .004” from the bore face if this is done correctly.

4. Set the mode dial to Zero.

5. Feed the tool back off the face and turn on the bar-drive motor.

6. Feed into the bore watching the DRO position in the top right corner of the LCD Display.

7. Stop when desired depth is reached.

Cycle Mode
To run Cycle Mode:

1. Position the front end stop on the guide-bar using a 4 mm hex key. This end-stop should be set at, or after the end-of-cut position, which for most jobs will be triggered after the cutter completes the bore.

2. Position the rear end-stop on the guide-bar using a 4 mm hex key, such that the insert holder is in a position convenient for being adjusted.

3. Switch to Cycle Mode on the pendant and set the Feed/Rev feed rate.

4. Turn on the bar-drive.

5. Turn the feed direction dial to advance the tool into the bore.

6. The tool will cut at the predefined speed and then retract through the bore quickly with the bar-drive motor on and retract to the rear limit where it will shut itself off.

7. To run the mode again, simply turn the Feed Direction knob to neutral and back to feed.

8. Cycle mode can be run in either direction.

OVERLOAD DETECTION

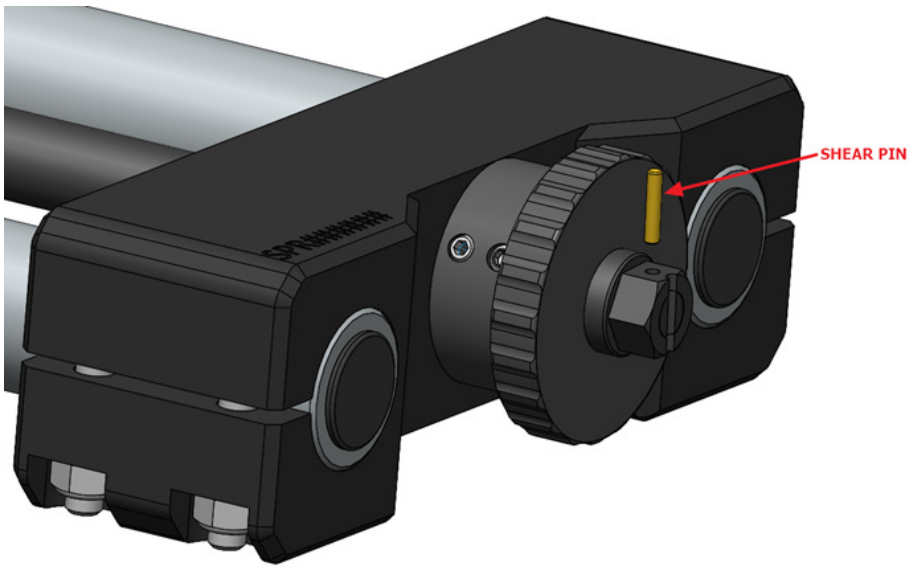
This machine has overload protection which causes it to shut down if the Bar Drive or Feed motor current gets too high. Damage to the cutter and workpiece may occur prior to shutting itself off.

One can monitor the current of the bar drive and feed on the bottom of the pendant screen. See picture of pendant in User Interface section. There is also a light on the back of the motor to indicate the bar-drive is nearing max current.

SHEAR PIN REPLACEMENT

There is a shear pin in the hand wheel to prevent putting too much torque into the feed screw during manual operation. In the unlikely case where this shear pin breaks, there are four extras in the tool kit that ship with the machine. Disassemble the hand wheel as shown to replace this shear pin.

- Push handwheel in so that pins are engaged.
- Knock remaining shear pin out with a 1/8” [3 mm] or smaller punch.
- Use the line-up feature on end of shaft to align holes.
- Tap in new shear pin.

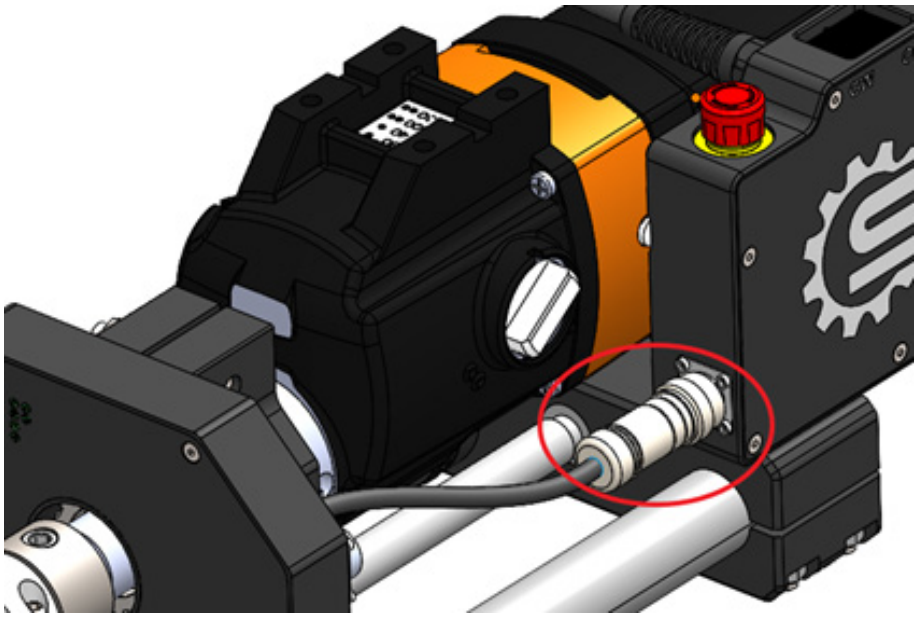


ELECTRONIC CONTROL OVERRIDE

This machine comes with an Electronic Override Connector, that can be used to by-pass the electronic control of the Bar Drive Motor in the case that electronics or pendant become damaged. This is intended only to complete a job prior to repairing the machine.

To use this Override:

- Make sure the E-box power switch is set to the Off position.
- Remove the connector on the E-box that goes to the carriage.



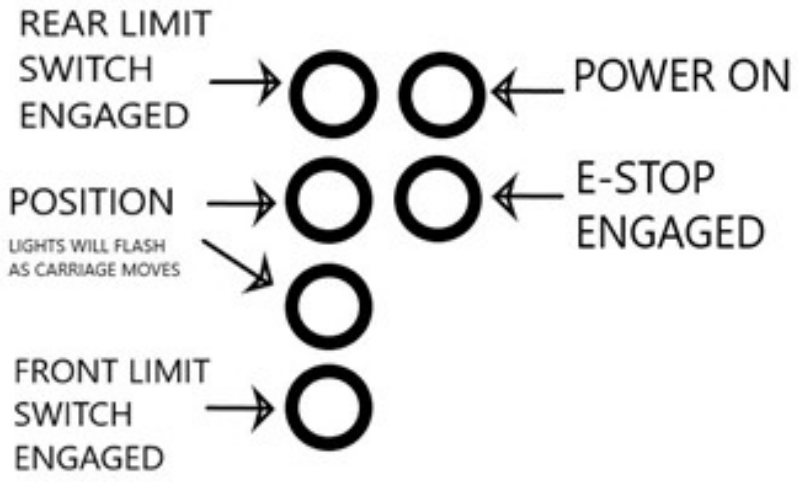
- Insert the Electronic Control Override into this position.
- Turning on power will now power up the bar drive at full speed.
- Manually feed the machine with the provided ¼" ratchet inserted onto the hex on the handwheel.

Warning: Make sure the machine is powered off when plugging in Control Override.

Warning: Turning on the machine will power up the bar-drive motor at full speed.

INDICATION LIGHTS

There are green LED lights on the front face of the carriage that indicate certain conditions and positions.



ADJUSTABLE LIMIT STOPS

Adjustable Limit Stops are located on the guide bars and can be used for defining the limits of motion of the carriage. Position the Stops close to the desired limit and tighten the screw to secure the location. Turn the Micro Adjusting Nut for precise positioning. It has 10 ridges around its perimeter, each representing .005” travel. The top left or bottom left light on the carriage will turn green when the limit stop is trigger.

TROUBLESHOOTING

Excess Vibration

- Make sure headstock clamp nuts are tightened.
- Make sure motor clamp nuts are tightened.
- Check insert is not chipped or dull. Try a new insert edge.
- Move carriage into the closest possible position to the headstock.
- Turn machine so guide bars are aligned vertically, rather than horizontally.
- Check drive pin in bar adaptor is tight.
- Check set screw to push apart the carriage clamp for motor removal is not engaged

DRO Not Changing While Manual Feeding

- The DRO is only changed when power feeding and cannot be used for manual feeding.

Machine Power Up then Turns Off

- Make sure the power switch clicks into its on position.

Machine Does Not Power Up

- Check the cable between the carriage and motor is plugged in.

Machine Acting Eratically

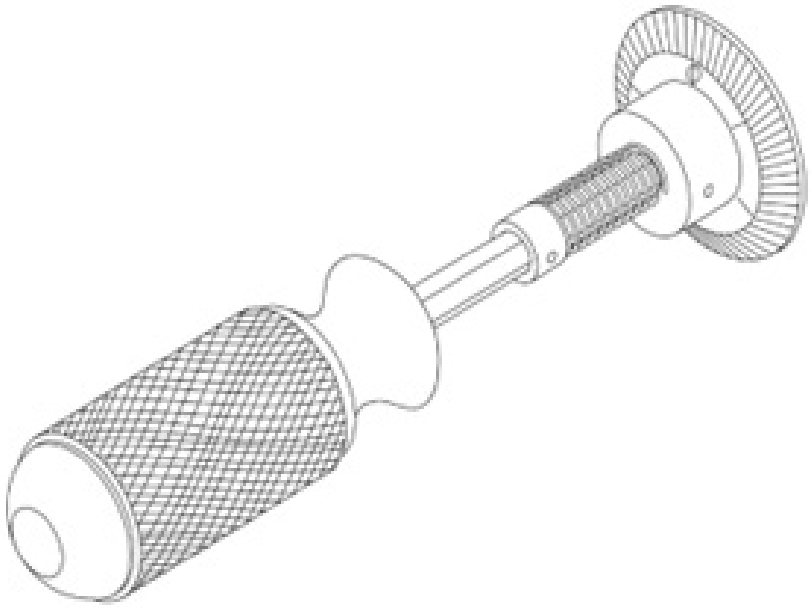
- Powering the machine directly from some welders can cause problems due to inconsistent power.

OPTIONAL ACCESSORIES

CALIBRATION TOOL

The SPR York calibration tool allows accurate adjustment of the cutting tool in increments of .001”. The calibration tool inserts into an adjusting screw behind the tool bit. Across the center of each tool port is a scribed index line. As you turn the Calibration tool clockwise, you are advancing the tooling .001” for each graduation. (Note advancing the tool bit .001” will increase the bore diameter .002”).

Re-tighten the tool bit clamping set screw. It is important that only a flat point set screw be used. A regular cup point will tend to bite into the tool bit; this may move the tool bit away from the adjusting screw and cause an oversize hole to be bored.



MAINTENANCE

GENERAL MACHINE MAINTENANCE

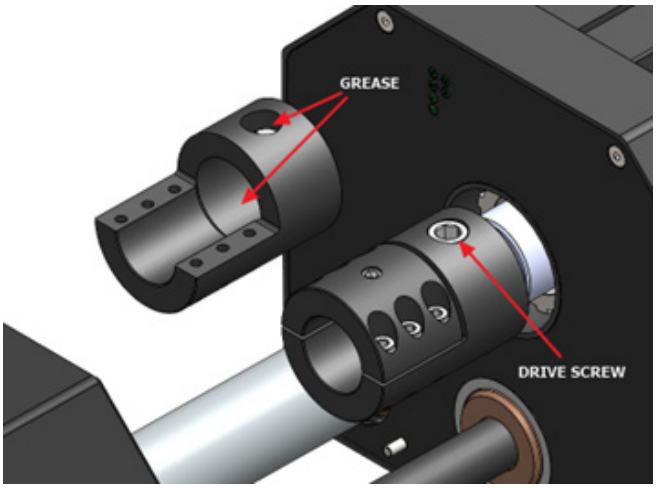
Do not lubricate the lead screw and guide bars. Oil or other lubricants will attract and hold dirt and grinding dust. Periodically clean the lead screw and the machine with compressed air. Wipe the guide bars and machine after each use; dirt and grit can severely shorten the life of the machine. Do not spray anything into the electric motor body.

BAR DRIVE

Monitor the temperature of the Eibenstock bar drive housing. Feel the back and sides of the motor. Air should be blowing out while running.

BAR DRIVE ADAPTER

A small amount of grease inside the bar adapter is required to keep the center lubricated. Remove the Drive Screw and slide off the Adaptor Coupling and grease the inside of this part as well as the hole the Drive Screw engages with.



PROPER HANDLING

Do not drop, hit, or otherwise abuse your line boring machine. This equipment is designed as a portable machining assembly, and as such, is not designed to withstand excessive abuse. Care for your equipment will increase your utilization, the life of the machine, and minimize your repair cost.

TOOL BITS

Remember that tool bits (cutting tools) in good condition perform better. Do not try to use dull tool bits or force the tool bits into the work piece. If The tool bits seem to be tearing rather than cutting replace your cutting tool bits right away. Also listen to how the cut sounds and whether there is chatter. This also could indicate a dull cutter. When possible, leave unused tool bits in their packages to prevent them from being damaged.

WARRANTY

Superior Plant Rentals, LLC (SPR) warrants that the equipment manufactured by it will: (i) conform to SPR's written specifications and descriptions, and (ii) be free from substantial defects in design, materials, and workmanship for a period of one year from date of shipment to the original buyer, or six months from date of placing in service by buyer, whichever date is earlier.

During this period, if any equipment is proved to SPR's satisfaction to be defective, SPR will, at our sole and absolute discretion, and as SPR's sole warranty liability and buyer's sole remedy, repair, replace, or credit buyer's account for any equipment that fails to conform to the warranties, provided that: (i) SPR is notified in writing within 10 days following discovery of such failure with a detailed explanation of any alleged deficiencies; (ii) SPR is given a reasonable opportunity to investigate all claims; and (iii) SPR's examination of such equipment confirms the alleged deficiencies and that the deficiencies were not caused by accident, misuse, neglect, improper use, unauthorized alteration, repair, or improper testing.

Shipping cost of the alleged defective equipment to SPR is to buyer's account. However, if SPR agrees that the equipment is defective, then pursuant to this warranty, SPR will reimburse buyer its shipping cost to return the equipment to SPR.

The warranty against defects does not apply to: (1) consumable components or ordinary wear items, and (2) use of the equipment with equipment, components, or parts not specified or supplied by SPR or contemplated under the equipment documentation.

The following actions will void the one-year warranty:

1. Repairs or attempted repairs have been made by persons other than SPR personnel, or authorized service repair personnel;

2. Repairs are required because of normal wear;

3. The tool has been abused or involved in an accident;

4. There is evidence of misuse such as overloading of the tool beyond its rated capacity, use after partial failure, or use with improper accessories.

5. Damage to the motor due to lack of oiler/mister while tool was in use (pending motor type).

NO OTHER WARRANTY IS VALID

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