

# ENC 250™ MULTI-SECTION

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REFERENCE MANUAL

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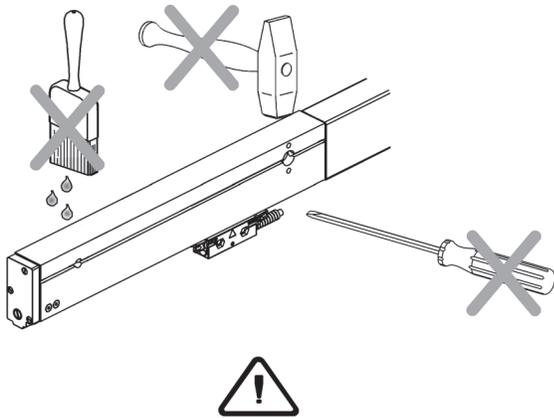
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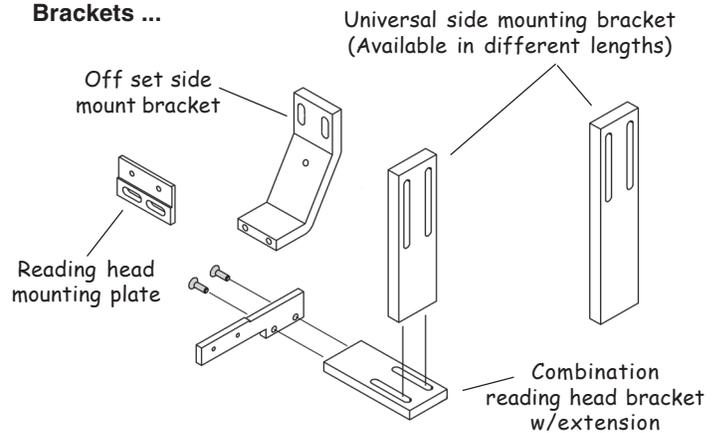
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**Brackets ...**



- Installation brackets are available.
- Your authorized distributor can assist you in selecting brackets for your installation.

**Introduction**

The ENC 250 linear encoder provides the accuracy and reliability of an Acu-Rite Companies Inc. measuring system with digital output. Features and options include:

- Resolution of [.0002in.] 5µm
- Accuracy grade of [.00018 in/ft] +/-15µm/M
- [2 ft.] .61m armor cable and extension cables up to a maximum of [75 ft.] 22.9m for a VRO; [35 ft.] 10.7m for a DRO
- Mounting hardware
- Brackets and accessories

Contact your Authorized Distributor for a complete list of other products and accessories.

For future ordering information or warranty service, record the linear encoder catalog number located on the scale assembly tag, and the serial number from the reading head tag.

	Catalog No.	Serial No.
Axis:	_____	_____
Tape tension value:	_____	
Date of purchase:	_____	
Distributor:	_____	
Address:	_____	
Telephone:	_____	

## Components

Each unit should consist of the following boxes:

Scale Section Boxes:

- Right End Section
- Left End Section
- Center Sections (One or more boxes depending on length)

Common Components Box:

- Scale Measuring Tape (Coiled On Spool)
- Lipseals (Coiled On Spool)
- Reading Head
- Mounting Hardware with RTV and Silicone Grease
- Reference Manual

\* NOTE: Both English and metric mounting hardware have been supplied. The mounting instructions reference to both. Tools required depend on the fasteners being used.

## Tools

You will need the following tools to complete the installation:

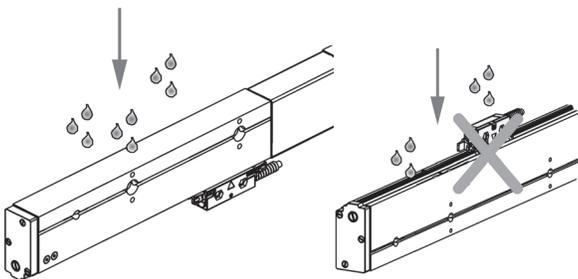
- 0.001" Dial Indicator with Magnetic Base
- English Hex Wrench Set
- Metric Hex Wrench Set
- Dial Calipers
- Feeler Gage
- Hand Drill
- Hand Tap
- Taps (English): 1/4-20 UNC & #8-32 UNC
- Taps (Metric): M6, M4
- Drills (English): #7 (.201"), #29 (.136"), N (.302")
- Drills (Metric): 5mm, 3.3mm, 7.7mm
- Reamer (English): .312"
- Reamer (Metric): 8mm
- Transfer Punch Set
- Hammer
- Center Punch
- Phillips Screw Driver
- Flat-tip Screw Driver
- Torque Wrench

## Mounting Preparation

Please follow these preparation guide lines.

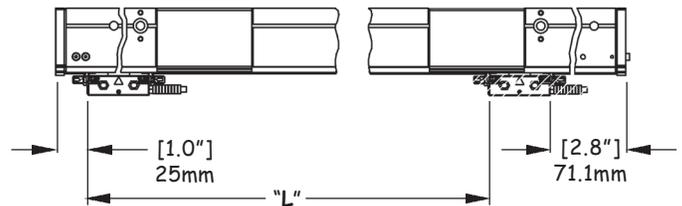
- Understand your mounting requirements.
- Mount with lip seals down and away from the work area.
- Brackets should be kept as short as possible and rigid.
- Surfaces must be in good condition, clean, and free of dirt. Remove paint from machined mounting surfaces.
- **Locate the machine's center of travel on the axis that the encoder will be mounted to. Move the axis to the center of travel prior to installing the encoder. Mark a reference line on the axis so that it can easily be returned to the center of travel.**

### Coolant spray ...



- Encoder lip seals to face away from coolant spray.

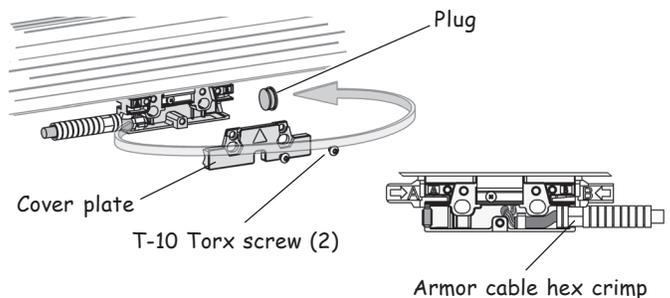
### Measuring length ...



"L" = Measuring length + [2.0"] 50.8mm nominal over travel  
Travel is limited by stops at each end of scale

- Machine travel can not exceed the encoder measuring length.
- Either limit machine travel or obtain correct length scale.

### Changing cable exit direction ...



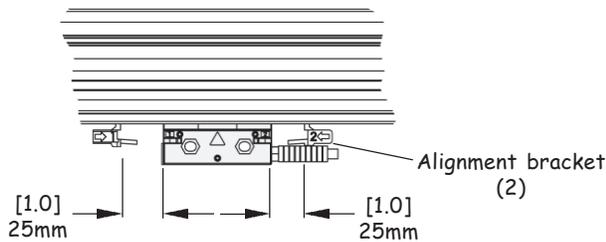
- Determine the cable exit direction before installing the reading head.
- To change the cable exit direction; remove the cover plate and rotate the cable 180°.

## Mounting Information

Use this information to plan your Linear Encoder installation.

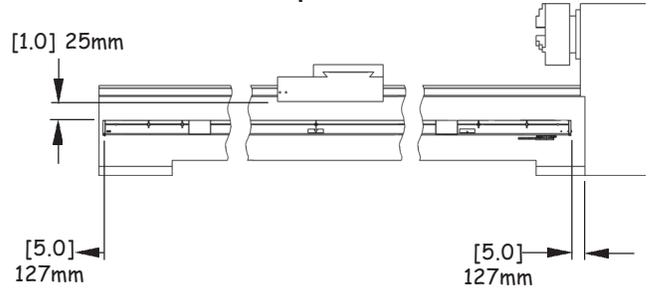
- Mount the linear encoders close to machine guide ways to ensure system accuracy.
- Space between reading head casting and mounting bracket or surface must not exceed [.188"] 4.7mm.

### Alignment bracket removal clearance



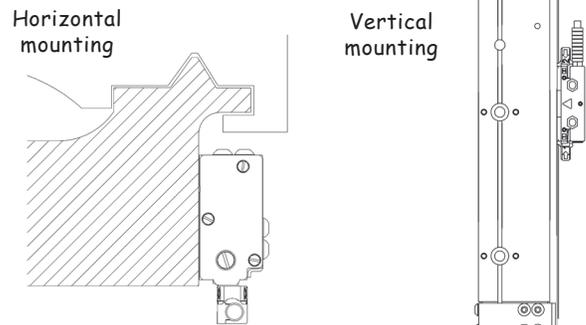
- Allow clearance for alignment bracket removal.
- **⚠ Alignment brackets must not be removed until instructed.**

### End of scale clearance requirements ...



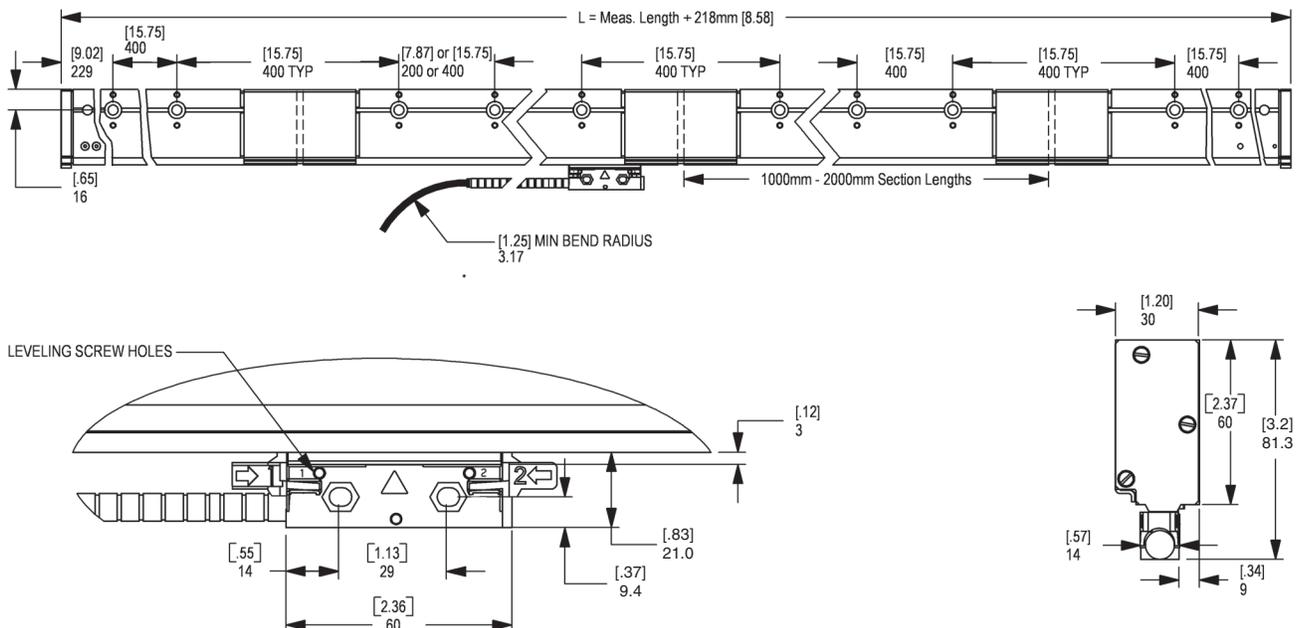
- Minimum clearance is required above the scale case top.
- A minimum clearance of [5.0] 127mm is required at each end of the scale case.

### Positioning ...



- Mount encoder in a horizontal or vertical position as shown.
- **Do not mount flat or inverted.**

## Encoder Dimensions



Mounting Requirements

A variety of mounting conditions can be accommodated.

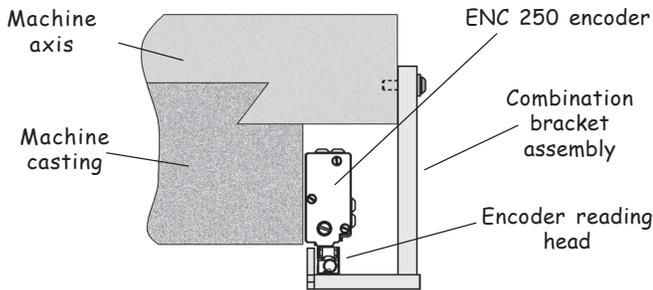
- The machine configuration determines the brackets required to install the encoder.
- Two typical mounting conditions are shown; reading head mounting plate, and a three piece combination assembly for mounting the reading head to the machine.
- The [8-32] 4mm SHCS for mounting the reading head is a standard low head style fastener, supplied with the mounting hardware.
- Tool requirements are listed on page 2.

- Due to the long length of the encoder sections, the installation illustrations have been modified.

In most cases, the sections have been shortened to accommodate the information that they are presenting.

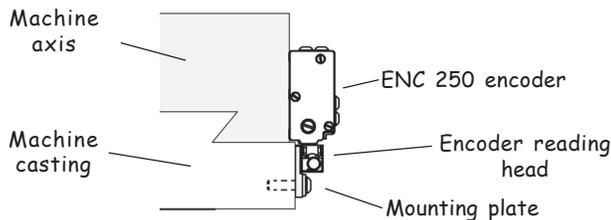
Please keep this in mind as the encoder is being installed.

Three piece combination bracket ...



- This combination typically applies to a lathe where the cross feed over hangs the bed mounting surface.
- A wide range of combination lengths are available.

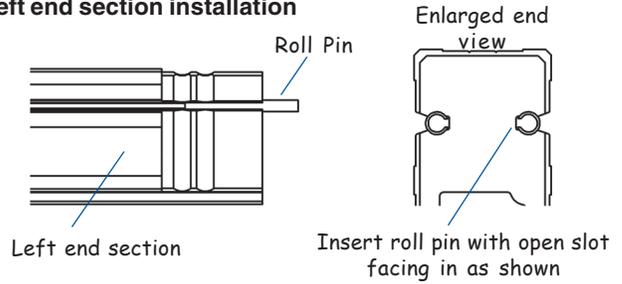
Reading head mounting plate ...



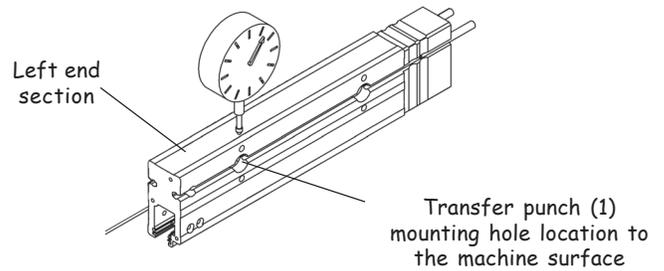
- The mounting plate typically applies to surfaces that are flush, or slightly offset.

Scale Case Installation Procedure

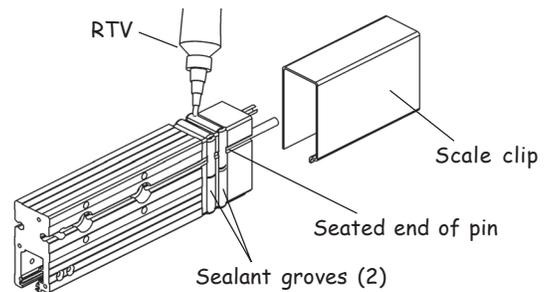
Left end section installation



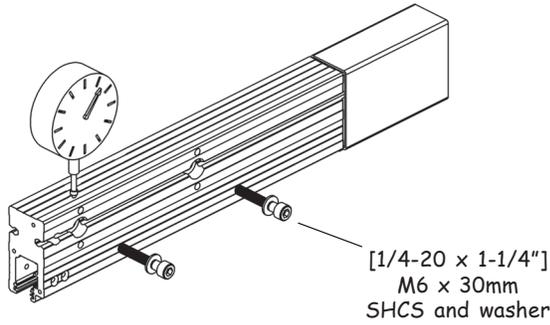
- Tap two roll pins into the extruded slots in the "left end section" as shown. Pins should protrude approximately [5/8"] 15.87mm.
- The seams on the roll pins face towards the inside of the scale case.
- Repeat this step for all middle scale sections, inserting the roll pins into the **right end** of each.



- Hold the left end section against the selected mounting surface and transfer punch one mounting hole.
- Remove section, drill and tap the location for a [1/4-20 x 1/2"] M6 x12mm deep minimum.
- Attach the section to the machine, and align the top surface to within [.012"] .3mm of the axis travel. Measuring directly over each mounting hole location.
- Transfer punch the second mounting hole. Remove the section; drill and tap second hole location for a [1/4-20 x 1/2"] M6 x12mm deep.

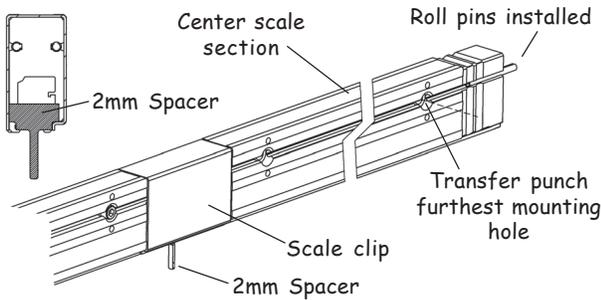


- Apply RTV Silicone Rubber to the two sealant grooves in the left end section. The sealant must be applied on all three sides of the case. Seal the seated ends of the spring pins. Keep the end and inside of the section free of sealant.
- Slide the scale clip over the end of the scale section to the stop machined in the scale case. There is sufficient spring in the clip to clamp it securely around the case.
- Clean off any excess RTV on the outside of the case.

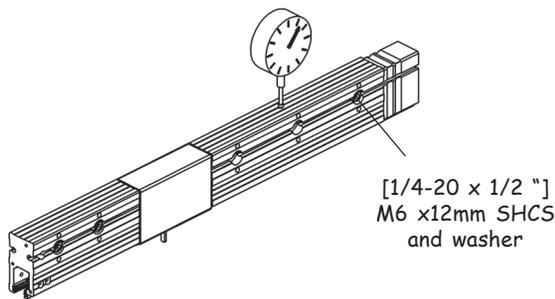


- Attach this section to the machine using two [1/4-20 x 1-1/4"] M6 x 30mm SHCS and washers provided in the hardware kit.
- Align the top of the section parallel to the axis travel to within [.012"] .3mm and secure the fasteners.

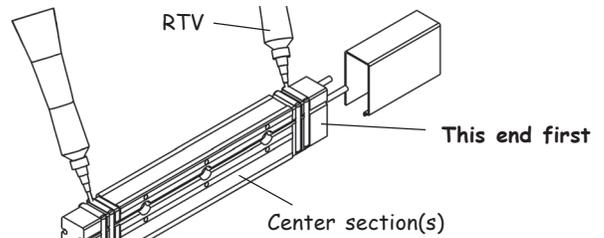
**Center section installation**



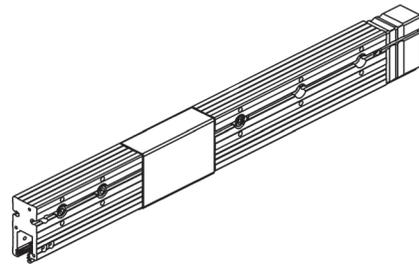
- Center sections can be mounted in random order.
- Place the 2mm spacer provided in the hardware kit into the scale clip as shown.
- With the roll pins already installed, insert the left end of the center section into the scale clip and butt it to the mounted end section. Tap the end of the center section with a soft hammer to seat it against the 2mm spacer.
- Align the top of the section parallel to the axis travel to within [.012"] .3mm. Transfer punch the furthest right end mounting hole to the mounting surface.
- Remove the center section, drill and tap the location for an [1/4-20 x 1/2 "] M6 x12mm deep.



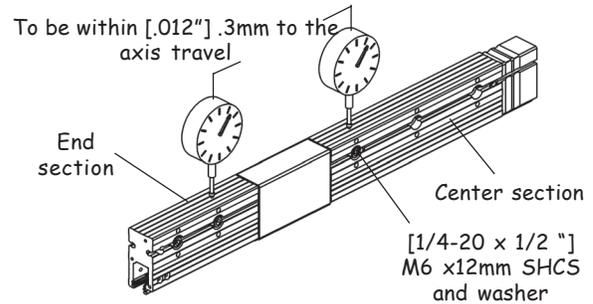
- Re-insert the center section back into the scale clip as done previously, seating it against the 2mm spacer.
- Attach the right end to the machine but do not tighten.
- Transfer punch remaining mounting holes by aligning the top surface to within [.012"] .3mm to the axis travel over each mounting hole. Remove the center section, drill and tap the locations for an [1/4-20 x 1/2 "] M6 x12mm deep.



- Apply RTV to the two sealant grooves in the **right end** on all three sides as done previously. Seal the seated ends of the spring pins, keeping the end and inside of the section free of sealant.
- Slide the scale clip over the end of the scale section up to the stop in the scale case.
- Clean off any excess RTV on the outside of the case.
- Now apply RTV Silicone Rubber to the sealant grooves in the left end keeping the end and inside of the section free of sealant.



- Reinsert the center section back into the scale clip as done previously, seating it against the 2mm spacer.
- Attach the right end to the machine but do not tighten. Clean off any excessive RTV sealant.

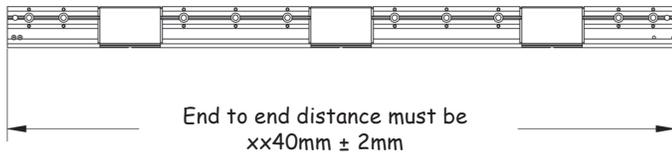


- Align the top surface to within [.012"] .3mm to the axis travel measuring over each mounting hole. Secure the scale case in place maintaining the alignment.
- Turn the handle of the 2mm spacer forward and remove it through the bottom of the scale clip.

**Remaining section(s) installation**

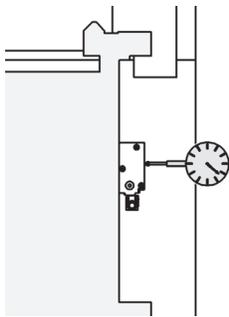
- Mount any remaining center sections and the right end section to the machine repeating this procedure. Use the 2mm spacer each time to set the required gap between each section. Complete the next step prior to drilling and tapping the right end mounting holes.

## ENC 250™ MULTI-SECTION



- Check for proper spacing between sections. Using a tape measure, record the over all length of the mounted scale sections (no end caps). Convert the length to millimeters by multiplying by 25.4. If the sections are mounted correctly, the last two digits of your measurement should be very close to 40 mm; (e.g. 6640 mm, 8040 mm, 10840 mm etc.). If this distance is off by more than two millimeters from nominal (e.g. 6637 mm, 6643 mm) shift the location of the right end section to bring it within the nominal distance.

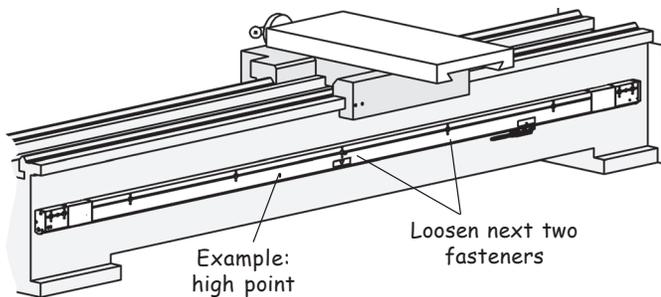
### Scale face alignment



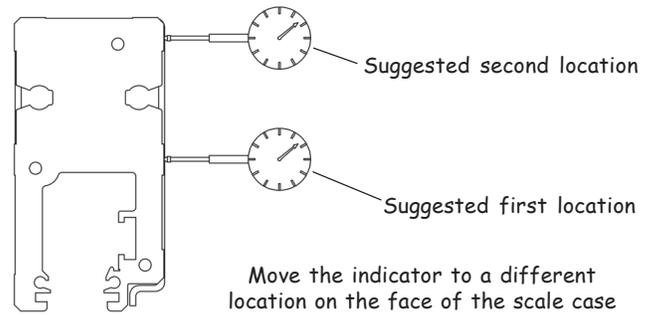
Run an indicator along the front face to locate the high point.

Mark the location, and set the indicator to 0.000" [0.0mm]

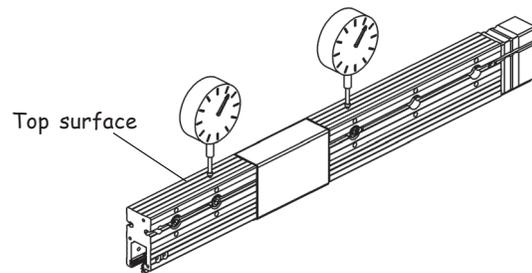
- To align the front face of the scale case to the axis travel, first locate the high point. This is the TIR point furthest away from the mounting surface along the axis travel.



- Loosen the next two fasteners to the right of the high point.
- Move indicator to the first hole location, insert two M3 x 25mm SHSS (leveling set screws).
- Use the leveling screws to align the face to within [.012"] .3mm to the high point along the axis travel and secure the fastener.
- Move indicator to the next hole location, then loosen the next fastener to the right. Align this location to within [.012"] .3mm. Continue alignment with the remaining fasteners.
- Return to the high point, and use the same procedure working out to the left end.

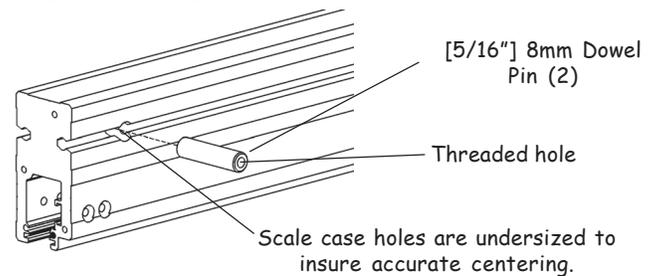


- Recheck the scale face alignment at a second location to insure the encoder is parallel. Use the leveling screws for further alignment if necessary.



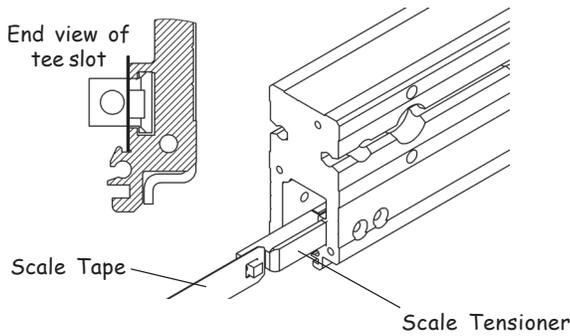
- Following the face alignment procedure, the top alignment must be rechecked. Follow the previous steps placing the indicator over each mounting hole.

### Dowel pin anchoring ...

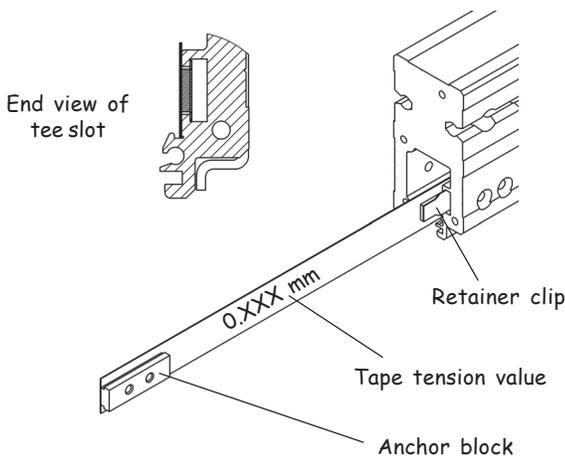


- Drill a [.302"] 7.7mm diameter hole through the dowel pin hole locations at each end of the scale case [3/8"] 9.5mm deep.
- Use a [.312] 8mm reamer to provide a press fit.
- Insert the dowel pins at each end, with the threaded hole facing outward.

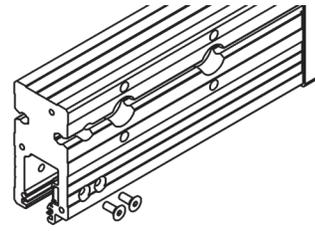
Scale Tape Installation



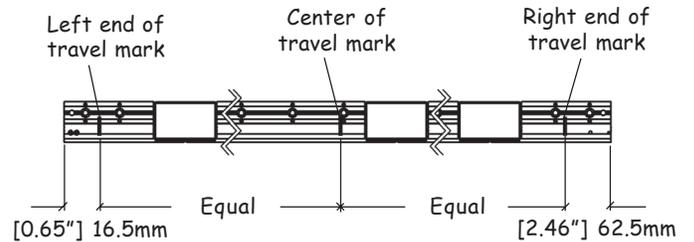
- Place the Scale Tensioner into the tee slot on the left end of the scale case.
- Retrieve the scale tape from the carton. The scale tape is shipped in a protective plastic coil. Do not uncoil the tape. It should be uncoiled as it is inserted into the case. The tape must be kept free of fingerprints and contaminants. It is best to wear clean cotton gloves when handling it. If necessary, the scale tape may be cleaned with cotton cloth soaked in alcohol or acetone.
- Hook the boss on the scale tensioner through the square hole in the scale tape to capture the tape and slide the scale tensioner into the scale case. **Note – the gold rulings on the scale tape must face into the scale cavity.**



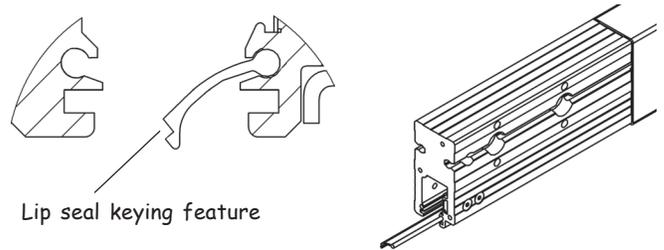
- Before inserting the tape completely into the case, check the tension value on the backside of the scale tape at the anchor end. Check the value on the label attached to the right end section, and verify that it is correct.
- The two M3 x 8mm Flat Head Socket Screws must be removed from the scale anchor block. Continue pushing the scale tape into the case until the anchor end is flush with the left side of the case. **Make sure that all the scale tape retainer clips go into the T-slot.** If the scale tape can not be inserted completely by pushing at one end, the scale tensioner may be pulled along the case with a small steel ruler from the bottom of the scale case.



- Apply a small amount of silicone grease – as a sealant - to the two M3 x 8mm FHSS.
- Insert the screws through the scale case and thread into the anchor block. Tighten fasteners completely.



- Draw a line onto the front of the scale case at a distance of [0.65"] 16.5mm from the left end. Similarly draw a line onto the front of the scale case at a distance of [2.46"] 62.5mm from the right end. These are the end-of-travel marks. The ends of the reading head must not travel beyond those lines.
- Find the center distance between the two lines and draw another line onto the front of the scale case. This line represents the center of travel. The reading head must be mounted so that it is centered under this line when the machine carriage is located at the center of its axis travel.

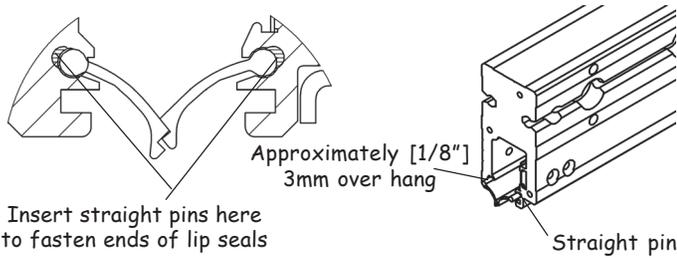


- Insert a lip seal into the front keyhole slot (the one closest to the scale tape) until it protrudes at least 1/2" [12mm] from the far side. Lip seals must be installed with the keying features opposing each other.



- Similarly, insert the rear lip seal. Make sure that the lip seals are not under excessive tension in the case. Normally, the lip seal can be pulled through completely with a pair of needle-nose pliers.

# ENC 250™ MULTI-SECTION

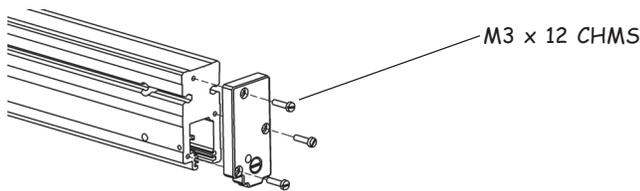


Insert straight pins here to fasten ends of lip seals

Approximately [1/8"]  
3mm over hang

Straight pin

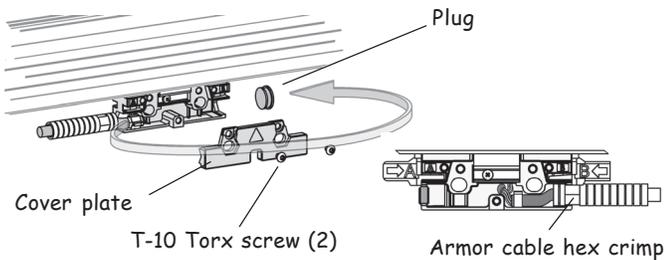
If necessary pull the lip seal along at different points along the inserted length. Insert the 4 straight pins from the hardware kit into the ends of the lip seal grooves to keep the lip seals from pulling away from the ends of the scale case. Trim the lip seals ends with a pair of scissors so that there is an overhang of approximately [1/8"] 3mm at each end.



M3 x 12 CHMS

- Attach the right end cap with M3 x 12 CHM screws provided in the hardware kit. Tighten these screws securely to compress the end cap gasket.

## Changing cable exit direction ...



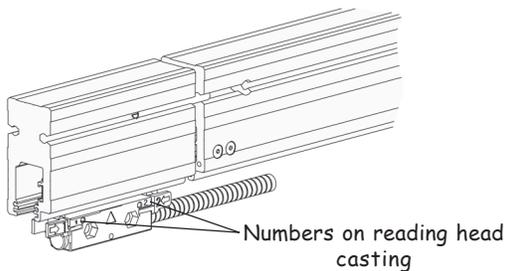
Plug

Cover plate

T-10 Torx screw (2)

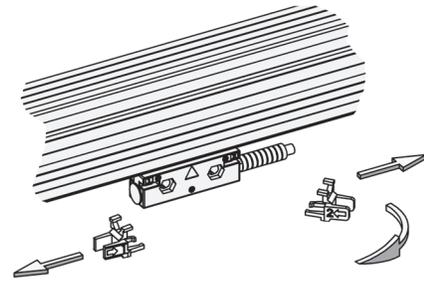
Armor cable hex crimp

- Determine the cable exit direction before installing the reading head.
- To change the cable exit direction; remove the cover plate and rotate the cable 180°.

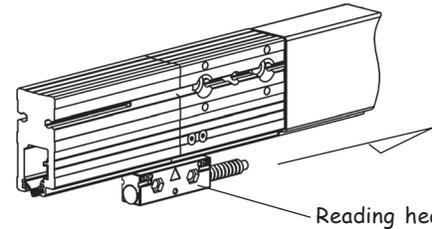


Numbers on reading head casting

- The reading head is shipped attached to the installation tool. Push the protruding roll pins of the reading head installation tool assembly into the left end of the scale case. Push on securely to close the gap between the scale sections. **The number indicators of the reading head are always facing out.**

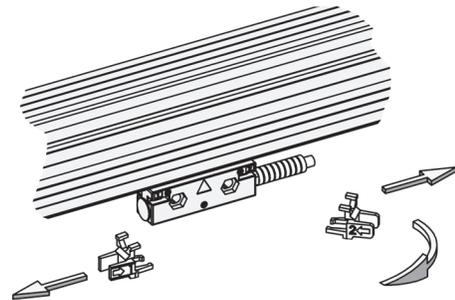


- Support the reading head by hand, and remove the alignment brackets by sliding them away from the reading head and twisting them 45° to remove them from the scale case. Gently pry them away from the reading head with a small screw driver if needed.



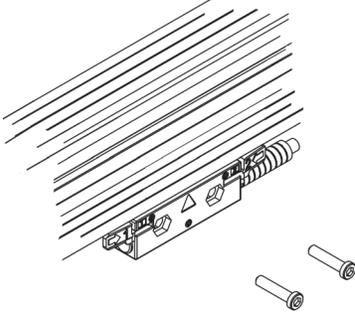
Reading head

- Slide the reading head onto the scale case to the center of travel mark on the case.



- Reinstall the alignment brackets by inserting each at 45° and twist to insert them into grooves on the bottom of scale case. Slide brackets against the reading head until they clip into place. Numbers and letters on reading head casting and alignment brackets must correspond.
- Align the triangle on the reading head with the center-of-travel mark previously placed on the scale.
- Return the axis back to its center of travel, and lock in place.

## Installing the reading head



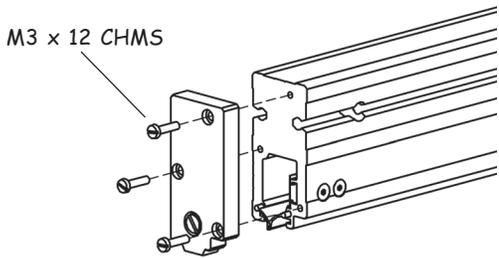
The reading head must be mounted in the same location as it is held by the alignment brackets. To attach the reading head to the mounting surface, follow these steps:

- Custom designed brackets by the installer should be solid, and rigidly assembled. Attach brackets to the machine with [1/4-20] M6 fasteners minimum. Allow clearance for removing alignment brackets once the reading head has been installed. Also, allow a small amount of clearance between the reading head and its mounting surface for setting the leveling screws. For custom brackets, transfer punch the two head mounting holes on the bracket and tap these holes for [8-32 x 1/2"] M4 x 12mm deep minimum.

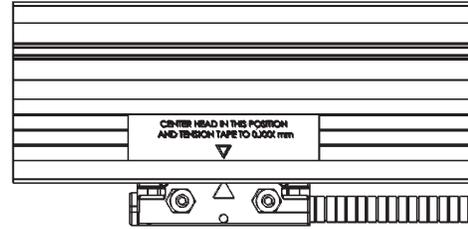
To mount the reading head proceed as follows:

- Insert, but do not tighten the [8-32] M4 reading head screws.
- Place a [.001 - .003"] .025 - .076mm shim between the leveling set screws and mounting bracket.
- Adjust each screw until a slight drag is felt on the shim.
- Evenly tighten the [8-32] M4 reading head mounting screws so that the head does not shift or twist. Remove the alignment brackets as done previously.
- Verify the reading head is able to move through the entire length of machine travel without interference.

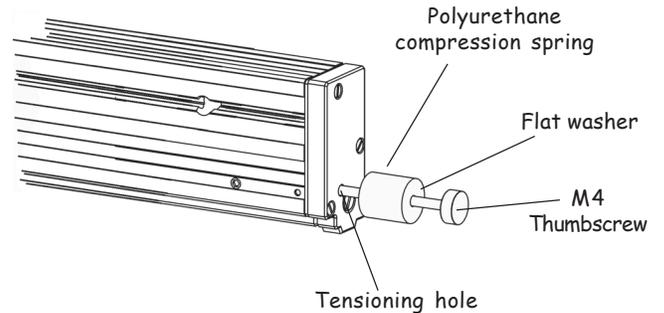
## Completing the installation



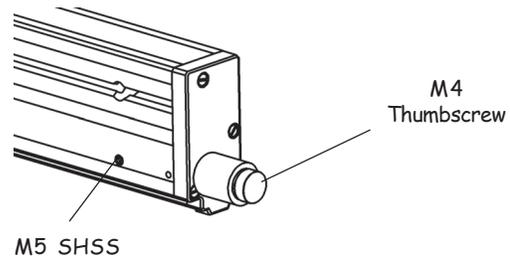
- Remove the Reading Head shipping tool from the end of the scale case. Attach the left end cap with M3 x 12 CHM screws provided in the hardware kit. Tighten these screws securely to compress the end cap gasket.



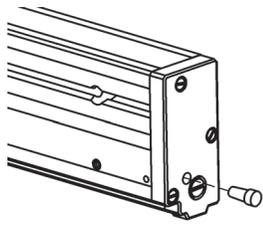
- Move the axis so that the reading head is at the tape tensioning position indicated by the tension label on the right side of the scale.
- Set the readout's display and encoder resolution to .005 mm. See readout reference manual for setting resolution.



- Remove tensioning hole plug from the right end cap.
- Insert the M4 thumbscrew from the hardware kit through the washer and polyurethane compression spring into the tensioning hole. Turn the thumbscrew until it engages the scale tensioner inside the scale case.

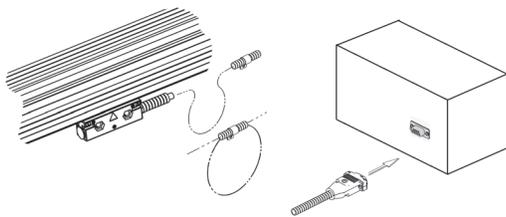


- Turn the thumbscrew clockwise to tension the tape until the display has changed approximately .050mm. Carefully back off the thumbscrew until the display stops changing. Reset the display to zero.
- Repeat this procedure two to three times to put the tape in a relaxed, slack-free position.
- Slowly tighten the thumbscrew until the display reaches the tensioning value shown on the scale label.
- Tighten the M5 SHSS on the right side of the case to 30 in-lb. [3.4Nm]
- **THE M5 SHSS MUST BE TIGHTENED SECURELY AFTER TENSIONING TO PREVENT TAPE SLIPPAGE.**
- Unscrew and remove the knurled tensioning screw assembly from the scale case.

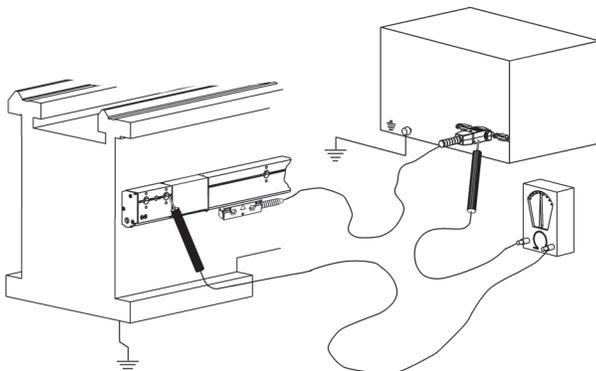


Apply silicone grease to plug and reinsert it

- Coat the plastic plug with silicone grease and install it into the tensioning hole.
- This completes the installation of the ENC 250.



- With the readout properly mounted, route the cable with sufficient slack loops for machine movement to the readout.
- Secure cables by fastening with clips or ties.
- Attach the encoder connectors to the readout.



### Electrical shielding ...

- Connect a ground wire from the terminal on the back of the readout to the machine or earth ground.
- Attach a ground wire from the machine to a solid earth ground.
- With the encoder attached to the cable connected to the readout, check shielding by measuring resistance between connector housing and scale unit.  
**Desired value: 1 ohm max.**

## Trouble Shooting

If you experience difficulties with your installation, do the following to determine the problem.

### Checking the Readout

Difficulties on more than one axis are usually associated with the readout. Follow these steps to determine if your difficulties are associated with the readout:

- Ensure that the linear encoder connectors are correctly seated.
- Swap linear encoder cables at the readout to see if the problem is still shown in the same display.
- If the problem remains in the same display, the readout may be in error. To determine if that is the problem, repeat above steps with both encoders, but with only one encoder connected at a time. This should allow you to determine if the problem is with the readout or the encoder.
- If the problem follows the connection change, the linear encoder may be in error.

If the Readout is at fault, refer to “**What to do**” to arrange for the parts necessary to repair your system. If a linear encoder appears to be at fault, proceed with “**Checking the Linear Encoders**”.

### Checking the Linear Encoders

Problems on a single axis are usually associated with the linear encoder or its installation. Difficulties can be caused by improper installation, loose or misaligned bracketry, or a damaged or inoperable encoder.

Follow these steps to determine the cause of your system difficulties:

- Confirm that your bracketry and installation does not interfere with other machine structures through the entire length of the linear encoder travel.
- Check for loose fasteners. If you find loose fasteners, first confirm that the linear encoder is installed to the tolerances specified and then retighten the fasteners as required.
- Confirm that the linear encoder is installed to the specified alignment tolerances. If the installation does not meet the tolerances, reinstall the encoder according to the “**Installation Procedure**”.
- Do not attempt to repair the reading head or scale assembly. The ENC 250 is field serviceable by assembly replacement only. Attempts to repair the encoder can permanently damage it and void the warranty.

### What to do

If an ACU-RITE linear encoder or readout is found to be at fault, please contact your Authorized Distributor for instructions prior to removing the encoders or readout.

# ENC 250™ MULTI-SECTION

## Mechanical Specifications

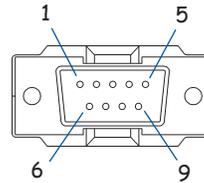
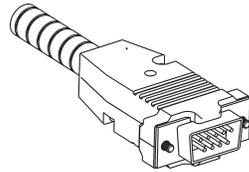
Mechanical Specifications	Digital
Resolution	5µm [0.0002 in.]
Grating pitch	100µm [0.00393 in]
Scale medium	Reflective Metal Tape
Accuracy @ 20° C	± 15µm/M [0.00018 in/ft]
Max. slew speed	1 M/sec [40 in/sec.]
Force required to move reading head	± 3.3 Newtons [0.75 lbs]
Operating Environment: Temperature Relative Humidity	0° to 40° C [32° to 104°F] 20% to 95% (non-condensing)
Storage Environment: Temperature Humidity	-40° to 60° C [-40° to 140°F] 20% to 95% (non-condensing)
Weight w/cable	1 kg + 3.2kg/m [2.2 lbs. + 0.18 lbs/in] of measuring length
Connecting cable: Armor	Length = .61m [2 ft] Connector: DE-9P
Max. cable length	22.9m [75 ft.] VRO / 10.7m [35 ft.] DRO
Measuring length	6240mm [246"] - 19,640mm [773"]
Reference Mark Interval	100mm [3.937"] Distance encrypted

## Electrical Specifications

Parameter	Digital
Output Signals	<p> <math>I_{OH}</math>=(High level output current) = 20mA  <math>V_{OH}</math>=(High level output voltage) &gt;2.5Vdc                 </p> <p> <math>I_{OL}</math>=(Low level output current) = -20mA  <math>V_{OL}</math>=(Low level output voltage) &lt; 0.5Vdc                 </p>
Incremental signals	Square-wave voltage signals. Channels A and B, in 90° quadrature relationship
Signal levels	Differential - TTL
Reference Mark signals	Square-wave pulse
Signal level	Differential - TTL
Power Supply	5.1 ± 0.1 VDC @ 140 mA max.

**Digital Differential**

Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
N/C	Green	Yellow	Blue	Red	White	Brown	Pink	Gray
N/C	Channel A+	Channel A-	Channel B+	Channel B-	Ground	Vcc, + 5.1 ± 0.1 VDC	Channel R+	Channel R-



**Hassle-Free Warranty**

Acu-Rite Companies Inc. readouts and precision scales are warranted to the end user against defects in material and workmanship and against any damage that occurs to the product within three (3) years from the original purchase date. Acu-Rite Companies Inc. will, at its discretion and expense, repair or replace the returned item or any of the item's component(s) as long as Acu-Rite Companies Inc. receives notice of the defect or damage within the three (3) year warranty period.

The foregoing warranty obligations are in lieu of all expressed and/or implied warranties of fitness or merchantability or otherwise, and state Acu-Rite Companies Inc.'s entire liability and the end user's exclusive remedy, under any circumstances, for any claim of damage.

In no event shall Acu-Rite Companies Inc. be liable for incidental or consequential damages nor shall Acu-Rite Companies Inc.'s liability for claims or damage arising out of or connected with this warranty or the manufacture, sale, delivery, or use of the products with which this warranty is concerned exceed the purchase price of said products.

**Acu-Rite Companies Inc.**  
**IS AN**  
**ISO 9001**  
**CERTIFIED**  
**MANUFACTURER**



One Precision Way • Jamestown, NY 14701

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104001-115 EDITION C 7/07

