ANILAM

RBM-T Linear Encoder Installation Manual and Owner's Guide

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This warranty applies to all products when used in a normal industrial environment. Any unauthorized tampering, misuse or neglect will make this warranty null and void.

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Contents

Introduction

The RBM-T is the latest design of linear encoders offered by Anilam. RBM-T linear encoders have absolute reference marks. To take advantage of the absolute reference marks a compatible Anilam DRO or CNC must be used and properly set up. A product that does not support absolute reference marks will interpret the absolute reference marks as reference marks every 0.5in (12.70mm). The RBM-T linear encoders are shipped pre-assembled and come with a mounting kit suitable for most installations.

This document outlines standard RBM-T encoder installation procedures for knee mills, lathes, and EDM machines. It contains specifications, maintenance information, and a troubleshooting guide for encoder owners.

For additional information, please contact your local authorized ANILAM distributor, or call us directly:

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Encoder Specifications

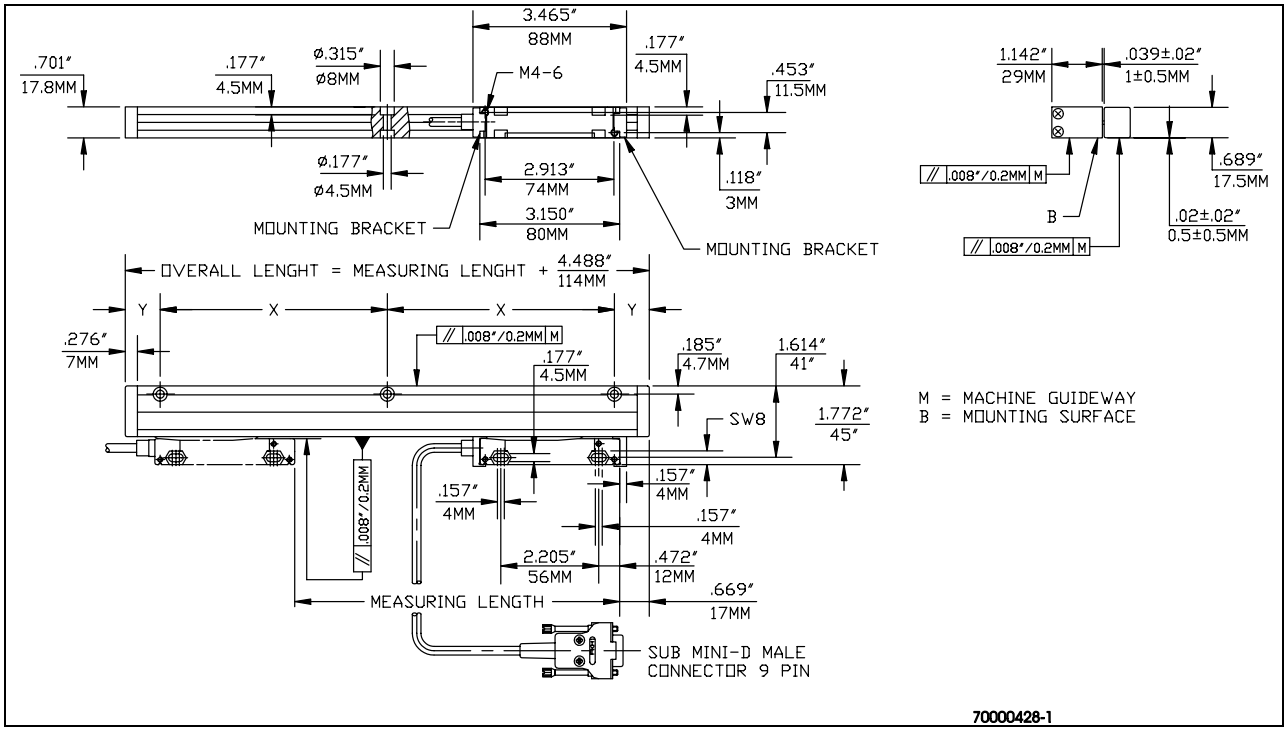

Figure 1, RBM-T Encoder Mounting Dimensions

Table 1, Encoder Lengths

Measuring Length	X	Y	Overall Length
50	1x100	32	164
100	1X150	32	214
150	1x200	32	264
200	1x200	57	314
250	1x300	32	364
300	1x300	57	414
350	1x300	82	464
400	1x300	107	514
450	1x300	132	564
500	2x287.5	19.5	614
600	2x300	57	714
675	2x300	94.5	789
750	2x300	132	864
825	3x300	19.5	939
900	3x300	57	1014
1050	3x300	132	1164
1200	4x300	57	1314

Table 2, RBM-T Encoder Operating Specifications

Weight	<1,060 g (<37.312 oz)	Operating Temp	0°C to 50°C
Grating Pitch	0.10 mm (.004 in.)	Storage Temp	-20°C to +70°C
Resolution	0.005 mm / 0.001 mm (.0002 in./ .00004 in.)	Operating Humidity	5% to 95%RH.
Accuracy	± .005 mm/m or ±.001 mm/m (.00006 in./ft or .000012 in./ft)	Storage Humidity	5% to 95% RH
Repeatability	1.4 μm	Required Move Force	<3 N max.
Slew Rate	0.5 m/s (.02 in./s)	Coefficient of Linear Expansion	10 μm/°/m
Acceleration	5g shock, 14g @ 10 ms	CE Mark	Yes
Feed Power	5V ± 5%, 120 mA max.	Reference Marks	Absolute reference marks or standard marks approximately every 12.70 mm (0.5 in.)
Cable Length	3 m (9.840 ft) std, Max cable extension: 20 m (65.60 ft).	Light Source	Siemens LED OP 264

Table 3, ANILAM Encoder Part Number Listing

1 Micron Encoders	**ANILAM Part Number**
≅2 in./50 mm	20701002
≅4 in./100 mm	20701004
≅6 in./150 mm	20701006
≅8 in./200 mm	20701008
≅10 in./250 mm	20701010
≅12 in./300 mm	20701012

5 Micron Encoders	**ANILAM Part Number**
≅2 in./50 mm	20705002
≅4 in./100 mm	20705004
≅6 in./150 mm	20705006
≅8 in./200 mm	20705008
≅10 in./250 mm	20705010
≅12 in./300 mm	20705012

Tools & Equipment Required

- Indicator, 0.0005 in. resolution, with magnetic base
- Spirit (bubble) level
- Hex keys (Allen wrenches), metric sizes
- Hex keys (Allen wrenches), English sizes
- Drill, 3/8 in. chuck
- Taps, sized as follows: #8-32, #10-32, 1/4-20
- Drill bits, sized as follows: #29, #21, #7, and ¼".
- Tap handle
- Transfer punches, complete set
- Ball peen hammer
- Center punch
- Safety glasses
- Combination square, 12"
- Torque wrench (set to 24 in-lbs.)

General Installation and Safety Information

Qualified personnel should only perform this installation. Read the entire procedure and become familiar with the parts before starting the installation.

Wear eye protection and follow standard shop safety practices while installing this equipment.

Encoders contain glass components that can break. Do not drop the encoder. Do not use a hammer on the encoder.

This document describes typical installations. Custom installations could require different arrangements of mounting brackets. The following guidelines apply to every installation:

- The reader head mounting bracket must maintain the alignment set by the plastic alignment brackets. This alignment must be preserved through out the machine's entire range of travel along the encoder.
- The runout along the top of the encoder must be parallel to the machine's movement along the axis (within 0.002") over the entire range of travel.
- The runout along the face of the encoder must be parallel to the machine's movement along the axis (within 0.005") over the entire range of travel.
- The encoder should be mounted so the reader head can never come in contact with the end caps.

Mounting brackets for large custom applications can be manufactured locally. When designing custom brackets, note that excessively long or weak brackets can cause the readout display to flutter from machine vibration.

Ensure that all mounting surfaces are solid.

When planning an installation, consider the routing of the cable. The cable should not be routed so it is in danger of being pinched or crushed by moving parts. Cables should not drape across any more open space than necessary.

The encoder can be installed with either side against the machine. Switching sides changes the direction that the cable feeds out of the reader head. Choose the side that permits the most convenient cable routing.

All holes should be drilled and tapped 90 degrees to the mounting surface.

RBM-T Linear Encoders are precision measuring instruments. Failure to mount the encoder properly can result in encoder damage or poor accuracy.

RBM-T Linear Encoders are optical devices. Dirt or debris blown past the lip seals into the encoder housing can affect the performance of the encoder. Install the encoder in a manner that minimizes the possibility of coolant and debris getting into the encoder body. In extreme environments consider fitting a splash shield to the encoder.

In all cases, the encoder should be installed with the lip seal and reader head down and away from a direct spray of coolant and chips.

Inventory the parts in each installation kit. Check that all of the required parts are included and not damaged.

Check the machine's travel along each axis and verify that encoder sizes are correct for the machine.

Encoders contain no internal alignment mechanism. When the plastic reader head alignment brackets are removed, the reader head is floating loose inside the encoder body. The only way to position the reader head for installation is by installing the plastic alignment brackets.

The goal of the reader head alignment procedure is to preserve the alignment set by the plastic alignment brackets when the reader head is mounted to the machine.

CAUTION: Do not use an encoder that is shorter than the machine's range of travel.

Knee Mill Installations

ANILAM kits provide all of the necessary parts and hardware for the standard knee mill installations described here.

Installing and Aligning Z Axis Encoder

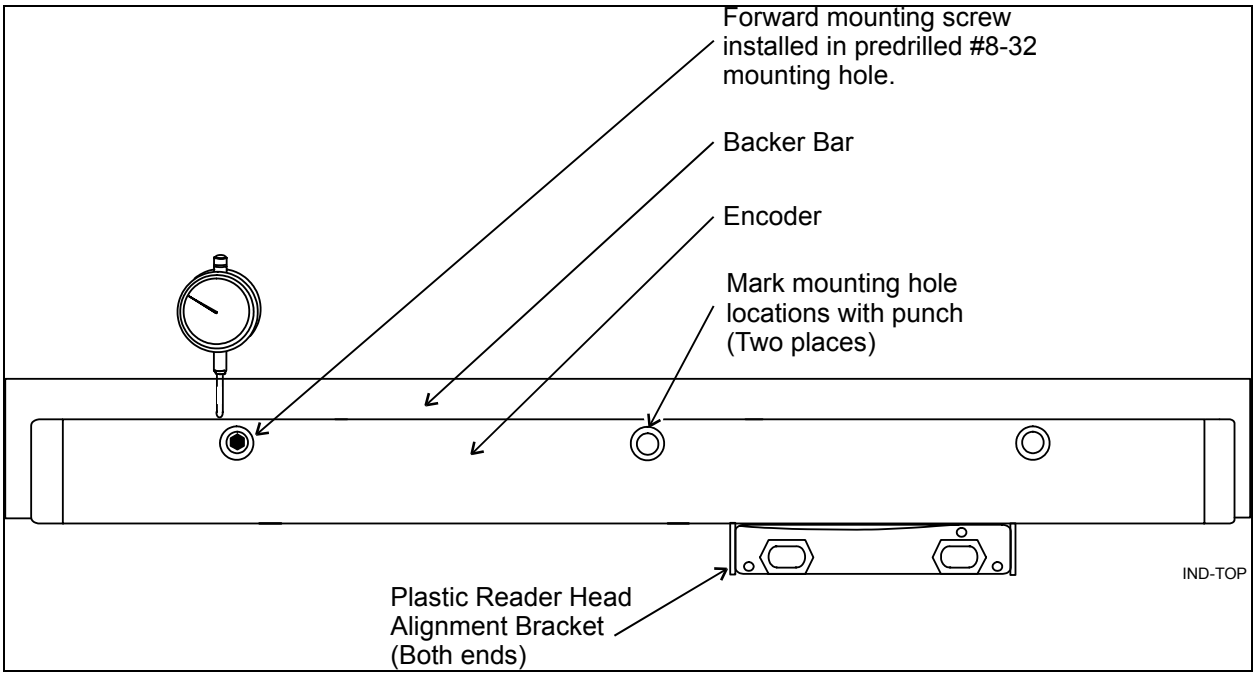

Figure 2, Aligning the Encoder

1. Before you install the encoder, remove both end caps and visually check the alignment of the reader head. Verify that the reader head is centered within the housing and is not twisted in any way. Do not reinstall the end caps at this time.
2. Break loose the two screws holding the reader head alignment bracket to the reader head. Retighten only enough to keep the brackets in place. Install the reader head alignment brackets to align the reader head. They will be removed at the end of the procedure.
3. Place the encoder against the backer bar and install the forward #8-32 mounting screw.

NOTE: On 12-in. installations, the forward mounting screw can usually support the encoders long enough to locate the undrilled mounting holes. When installing a long encoder, mark and drill the first mounting hole near the center of the encoder. This will help balance the weight of the encoder while you locate the holes.

4. Mount a magnetic indicator on the saddle so that the indicator probe measures the position of the top of the encoder.
5. Move the saddle through its full range of travel and observe the indicator. The top of the encoder should be parallel to the Y axis movement of the saddle (within 0.002 in.) along its entire length. Use a transfer punch to mark the remaining holes.
6. Drill and tap the remaining #8-32 mounting holes.
7. Install the encoder using the #8-32 screws provided. Tighten the screws just enough to hold the encoder in place.
8. Re-align the encoder. Using a torque wrench, tighten the screws to 24 in-lbs. Do not over-tighten the screws.

NOTE: If the encoder is improperly aligned, the reader head will not read correctly.

9. Recheck the alignment.

Lathe Installations

The following kits are required to perform lathe installations:

- Universal Reader Head Mounting Kit (P/N 32500030)
- Use ANILAM RBS cross slide mounting kit, P/N 32500174, for encoders with a travel of 12 in. or higher.
- Use ANILAM cross slide mounting kit, P/N 32500208, for encoders with a travel of 12 in. or less.

Cross Slide (X Axis) Installation

Installation on any specific machine may require custom brackets and some deviation from the steps outlined here.

Regardless of the machine, the encoder must be mounted so the total runout along the face of the encoder never exceeds 0.005”. The total runout along the top of the encoder should never exceed 0.002”. The encoder should also be mounted so motion within the full range of travel never brings the reader head in contact with the end caps.

All custom brackets should be designed so as not to interfere with any machine accessory that may not be in place at the time of installation.

If possible, the encoder should be mounted away from the head stock.

In a cross slide installation, the backer bar (and encoder) moves with the cross slide and the reader head is mounted to a bracket on the carriage.

It is acceptable to cut the backer bar down to fit a specific installation.

Mounting the Backer Bar

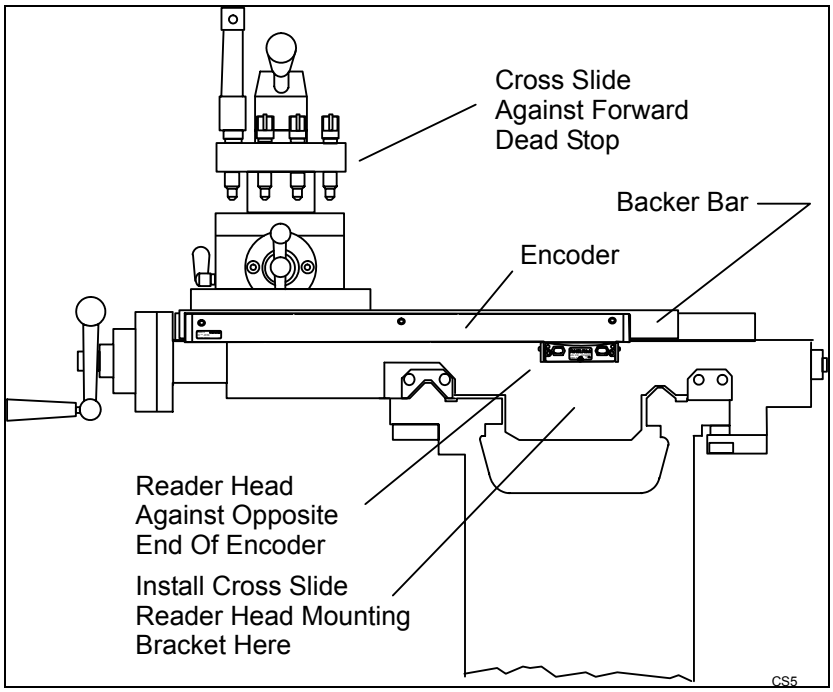

Figure 3, Locating Backer Bar Position

1. Refer to **Figure 3, Locating Backer Bar Position**. Move the cross slide to the dead stop position at the front of the machine.
2. Slide the reader head as far as possible to the opposite end of the encoder.
3. Line the forward mounting hole on the encoder with the predrilled #8-32 hole on the backer bar. Hold the backer bar and encoder against the cross slide and determine the best mounting position for the backer bar. Use a punch to mark the location of the backer bar mounting screws.
4. Drill and tap the mounting holes for the #10-32 cap screws.
5. Mount the backer bar using the #10-32 cap screws provided.
6. Mount an indicator so the probe runs along the face of the backer bar.
7. Check that the face of the backer bar is parallel to the cross slide's motion (within 0.005") over its full range of travel. Add shims to the backer bar if required.
8. Tighten the backer bar mounting screws.
9. Perform a final check of the backer bar's alignment.

Mounting the Encoder

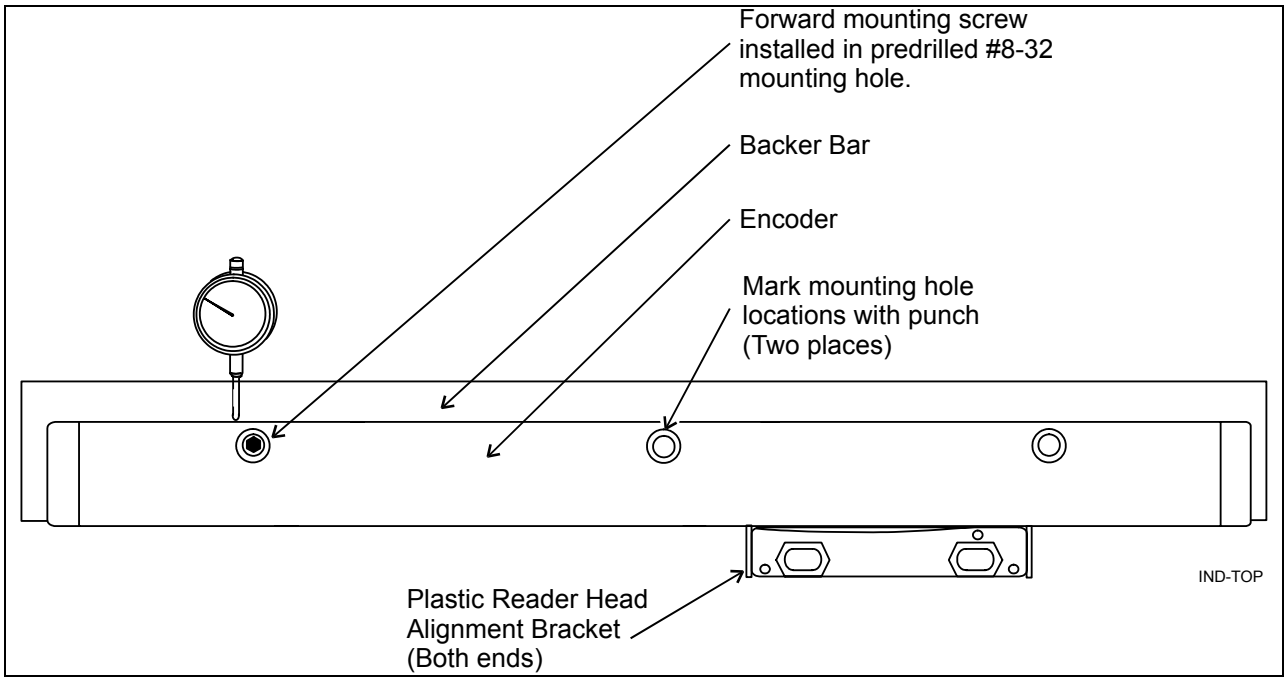

Figure 4, Aligning the Encoder to the Top of the Backer Bar.

1. Refer to **Figure 4, Aligning the Encoder to the Top of the Backer Bar**. Before installing the encoder, remove both end caps and visually check the alignment of the reader head. Verify that the reader head is centered within the housing and is not twisted in any way. Do not reinstall the end caps at this time.
2. Break loose the two screws holding the reader head alignment bracket to the reader head. Re-tighten only enough to keep the brackets in place. They will be removed at the end of the procedure.
3. Place the encoder against the backer bar and install the forward #8-32 mounting screw.
4. Mount a magnetic indicator on the carriage so the indicator probe measures the position of the top of the encoder.
5. Move the cross slide through its full range of travel and observe the indicator. The top of the encoder should be parallel to the movement of the cross slide saddle (within 0.002") along its entire length. Use a transfer punch to mark the remaining holes.
6. Drill and tap the remaining #8-32 mounting holes.
7. Install the encoder using the #8-32 screws provided. Tighten the screws just enough to hold the encoder in place.
8. Re-align the encoder. Using a torque wrench, tighten the screws to 24 in-lbs. Do not overtighten the screws.

NOTE: If the encoder is not properly aligned the reader head will not read correctly.

9. Recheck the alignment.

Mounting the Reader Head

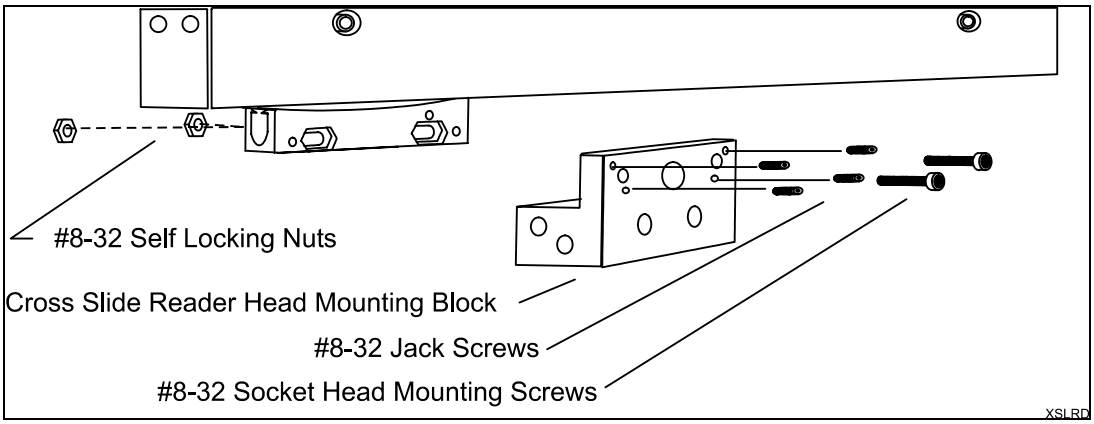

Figure 5, Cross Slide Reader Head Mounting Bracket

The cross slide reader head mounting block can be mounted directly on the carriage or to a spacer block that is mounted to the carriage. The reader head mounting block is drilled to provide two sets of mounting holes. Use the mounting holes best suited for the installation at hand.

The reader head bracket should be at least roughly parallel to cross slide movement along the top and front face. The reader head bracket should be mounted to within 1/4" of the reader head.

CAUTION: Ensure that the reader head mounting bracket and any additional mounting blocks are in proper alignment with the reader head. The reader head mounting brackets must not impose any twisting or pulling load on the reader head.

1. Refer to **Figure 5, Cross Slide Reader Head Mounting Bracket**. Mount the reader head bracket to the carriage (or a spacer block) using the 1/4 in. cap screws provided.
2. Start the #8-32 reader head mounting screws, but do not tighten. Start the four jack screws.

CAUTION: Do not use the reader head mounting screws to pull the reader head flush against the reader head mounting bracket. The reader head must stay aligned with the encoder body. The jack screws hold the reader head away from the reader head mounting bracket when the mounting screws are tightened.

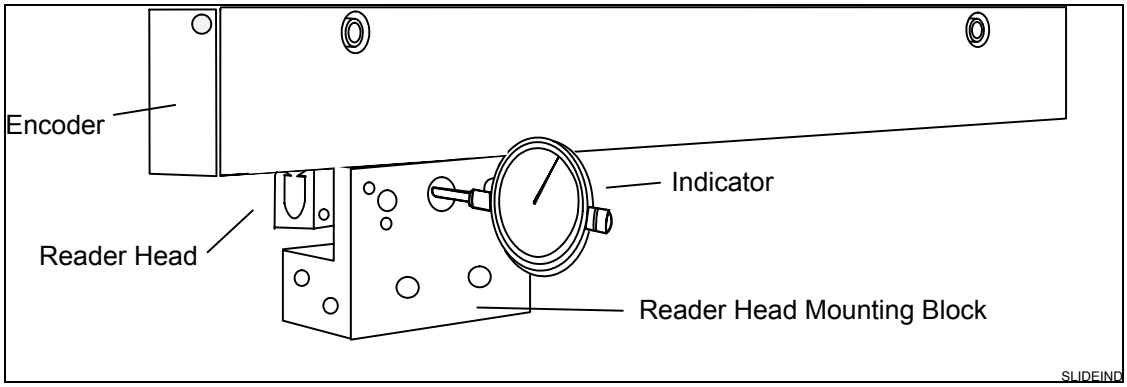

Figure 6, Indicator Setup for Cross Slide Reader Head Alignment

3. Refer to **Figure 6, Indicator Setup for Cross Slide Reader Head Alignment**. Set up an indicator so that the probe measures the position of the front of the reader head. A hole is drilled in the center of the bracket to provide access for the indicator probe.

   Zero the indicator. Screw in the first jack screw until it just contacts the reader head. Continue turning the jack screw until it pushes the reader head 0.001". Do this for each of the four jack screws. The reader head should be about 0.004" away from its original position.

4. Using a torque wrench, tighten the two mounting screws to 24 in-lbs. Tightening the reader head mounting screws should pull the reader head back against the jack screws taking out the 0.004" and restoring its original position.

   If the reader head does not return to within 0.001" of its original position, loosen the mounting screws and repeat the alignment procedure. When repeating the procedure, compensate the adjustments so that the reader head returns to its original position when the mounting screws are tightened.

5. Remove the plastic alignment brackets from the reader head.

   Note: Save the plastic alignment brackets. If the encoder is ever removed from the machine, it cannot be reinstalled without the reader head alignment brackets.

6. After the installation is complete, perform a second visual inspection of the reader head. Reinstall both end caps.

Installing and Aligning the Reader Head

Refer to **Figure 7, Universal Reader Head Mounting Bracket.** The universal reader head mounting bracket is packaged with a spacer block. Drill and bolt the spacer block to the saddle so that the reader head mounting bracket aligns within 1/4 in. of the reader head.

The bracket can be positioned in front or in back of the reader head. The bracket can also be positioned to the right or to the left of the spacer block.

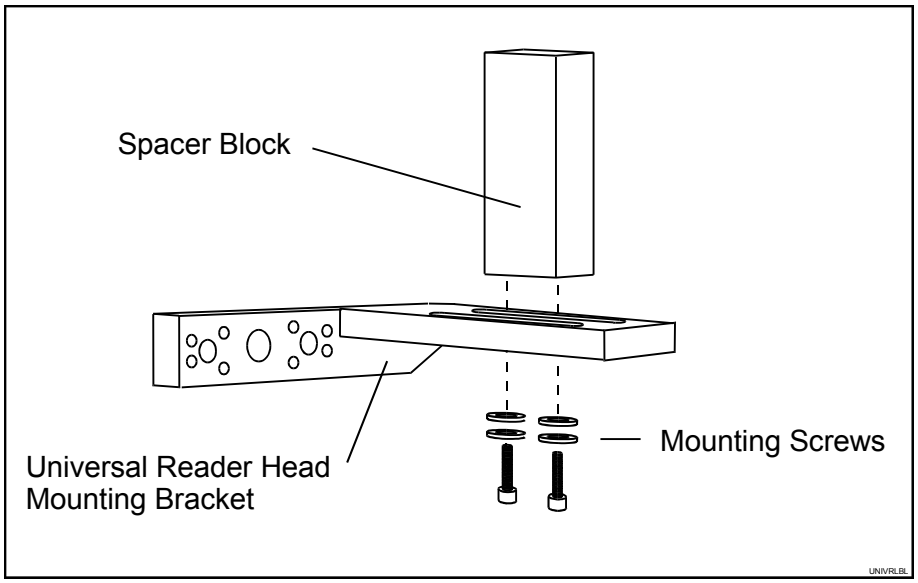

Figure 7, Universal Reader Head Mounting Bracket

When the reader mounting bracket is installed, the mounting screw holes should be aligned and within 1/4 in. of the front or back face of the reader head.

CAUTION: Ensure that the reader head mounting bracket and any additional mounting blocks are in proper alignment with the reader head. The reader head mounting brackets must not impose any twisting or pulling load of any kind on the reader head.

1. Mount the spacer block to the saddle.
2. Mount the reader head mounting bracket to the spacer block with the 1/4-in. cap screws provided.

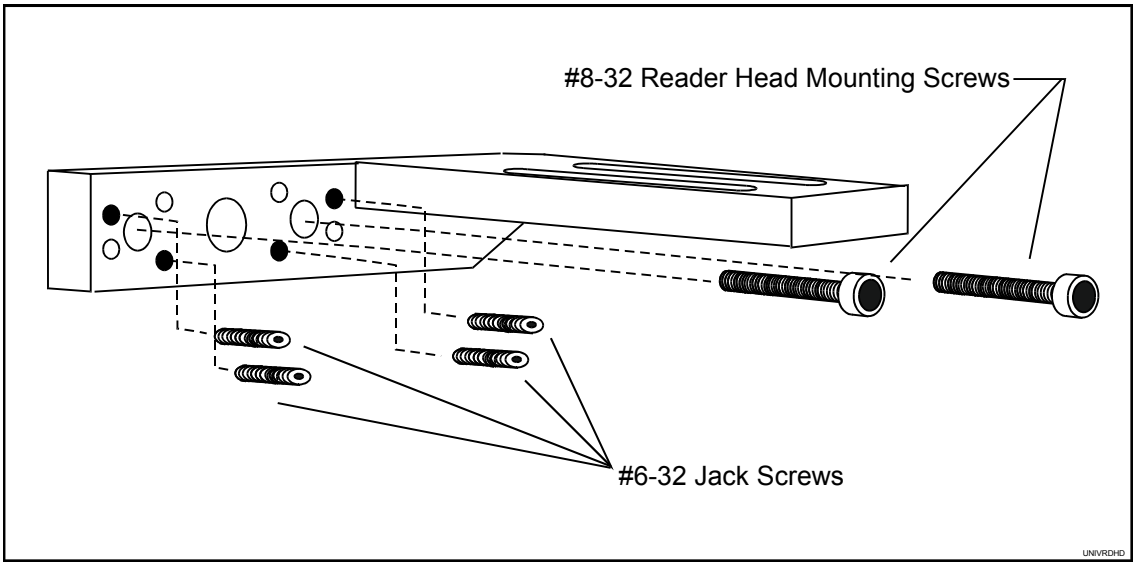

Figure 8, Reader Head Installation Hardware

3. Refer to **Figure 8, Reader Head Installation Hardware**. Start the #8-32 reader head mounting screws, but do not tighten.

   If the reader head mounting bracket is mounted in front of the reader head, start the four jack screws into the reader head mounting bracket.

   If the reader head mounting bracket is positioned behind the reader head, ensure that the jack screws in the reader head are installed so that the Allen sockets are accessible.

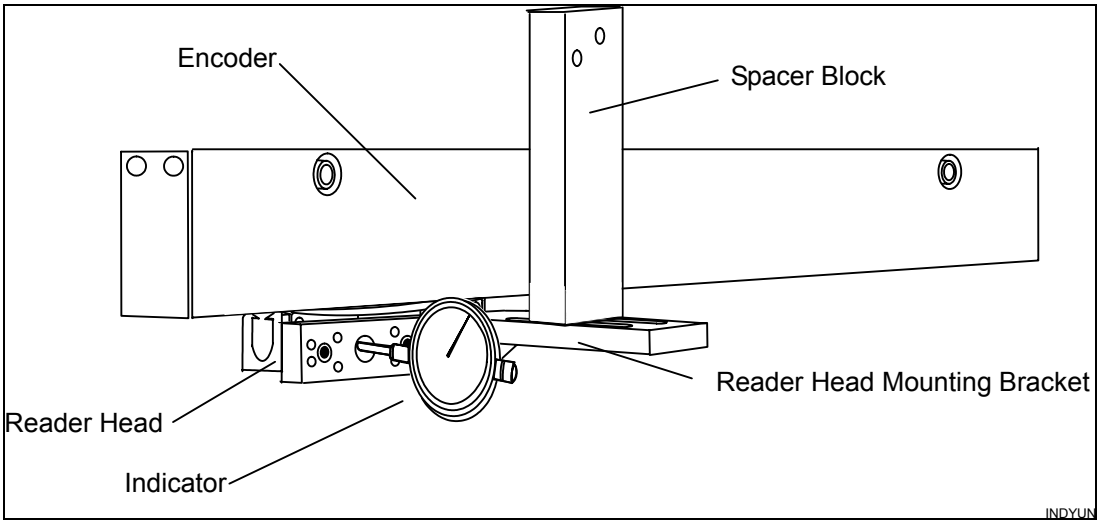

Figure 9, Universal Reader Head Indicator Setup

CAUTION: Do not use the reader head mounting screws to pull the reader head flush against the reader head mounting bracket. The reader head must stay aligned with the encoder body. The jack screws hold the reader head away from the reader head mounting bracket when the mounting screws are tightened.

4. Refer to **Figure 9, Universal Reader Head Indicator Setup**. Set up an indicator so that the probe measures the position of the front of the reader head. A hole drilled in the center of the bracket provides access for the indicator probe.

   Zero the indicator. Screw in the first jack screw until it contacts the reader head. Continue turning the jack screw until it pushes the reader head 0.001 in. Do this for each of the four jack screws. The reader head should be about 0.004 in. away from its original position.

5. Use a torque wrench to tighten the two mounting screws to 24 in.-lb. Tighten the reader head mounting screws to pull the reader head back against the jack screws, closing the 0.004" gap and restoring its original position.

   If the reader head does not return to within 0.001" of its original position, loosen the mounting screws and repeat the alignment procedure. When you repeat the procedure, compensate the adjustments so that the reader head returns to its original position when you tighten the mounting screws.

6. Remove the plastic alignment brackets from the reader head.

   NOTE: Save the plastic alignment brackets. If the encoder is ever removed from the machine, it cannot be reinstalled without the reader head alignment brackets.

7. After you complete the installation, perform a second visual inspection of the reader head. Reinstall both end caps.

EDM Installations

The XY axes of many EDM machines are similar to those of a knee mill. The same bracket kits designed for knee mills work well with an EDM.

Refer to the various knee mill installations described in this document and use the bracket kit and procedures that best suits the EDM installation. The alignment specifications of all RBM encoders and reader heads are the same, regardless of the type of equipment used on a particular installation.

Optical Comparator Installations

The XY axes of many optical comparators are similar to those of a knee mill. The same bracket kits designed for knee mills work well with an optical comparator.

Refer to the various knee mill installations described in this document and use the bracket kit and procedures and that best suits the comparator installation. The alignment specifications of all RBM encoders and reader heads are the same, regardless of the type of equipment on which it is installed.

Connecting the Encoder

Connect each cable to the appropriate connector on the back of the DRO. The connectors on the DRO are marked. Plug the connector into the port and tighten both the thumbscrews until secure. Perform this procedure when also connecting the Computer Numerical Control (CNC).

When you route cables, position the machine so that the reader head is as far away from the DRO as possible. Tie-wrap each cable neatly. Ensure that enough slack remains to prevent tension anywhere along the cable. Arrange the cable so it cannot be pinched or crushed by any moving parts. Do not drape the cable across open spaces any more than is necessary. Avoid putting any sharp bends or kinks in the cable.

CAUTION: Be sure sufficient slack is left in the cables to permit the full range of up and down knee travel.

Testing the Encoders

1. Connect the encoder to an active DRO.
2. Move the table (or saddle) to the dead stop position closest to the machine column.
3. Set the indicator to measure the position of the rear face of the table (or saddle).
4. Set the DRO and the indicator to “0”.
5. Move the table (or saddle) through its full range of travel and back to the original position, as determined by the indicator.
6. Verify that the DRO and indicator both read “0” again.
7. Repeat this procedure for the other axis.

NOTE: This procedure can be applied to check encoder accuracy with many setup variations. When you check the encoders, always approach the “0” position from the same direction. This prevents reversal errors. Position errors are usually caused by encoder or head misalignment.

Maintenance and Cleaning

Encoders are precision optoelectronic devices. Clean them every six to nine months. A buildup of dirt and debris on the glass can cause the reader head to misread the markings. Clean the glass inside the encoder as follows:

CAUTION: Never insert any metal object into the encoder body. Never attempt to use an abrasive cleanser on the glass inside the encoder.

1. Remove the encoder end caps.
2. Slide the reader head away from the area to be cleaned.
3. With a soft swab soaked in isopropyl alcohol, gently wipe any dirt and debris from both sides of the glass.
4. Reinstall the encoder end caps.

Troubleshooting Guide

All encoders sold by ANILAM are laser-checked for accuracy and repeatability prior to shipment. If an encoder fails to operate properly, it could be for one of the following reasons:

Problem	Possible Cause	Corrective Action
1. Distance measured is not accurate, but DRO repeats to zero.	Excessive torque on mounting bolts. Excessive weight on table causing yaw or pitch. Using resolution 0.002 mm or less in uncontrolled temp environment. Ballscrew worn. Reader head alignment brackets are still installed.	Verify reader head brackets were removed. Verify encoder and reader head is secure; reinstall plastic alignment brackets and remount, if necessary.
2. DRO does not repeat to zero.	All causes listed in 1. – or – Machine gibs are loose. Reader head mounting bracket and/or reader head is loose. Faulty reader head.	Verify that encoder and reader head is secure. Reinstall plastic alignment brackets and remount, if necessary. Verify that machine gibs are adjusted properly. Swap cable connections at DRO to see if problem moves to other axis. Replace failed reader head.
3. DRO shows no movement in a specific area of the encoder.	All causes listed in 1. – or – Loose encoder mount. Glass inside encoder is dirty. Glass inside encoder scratched.	Verify encoder and reader head is secure. Reinstall plastic alignment brackets and remount, if necessary. Clean glass inside encoder; refer to the encoder “Maintenance and Cleaning” section.
4. DRO shows no movement. Display fluctuates between 0 and resolution setting.	Reader head over-torqued or improperly aligned. Reader head alignment brackets not removed. Cable damaged.	Verify that encoder and reader head is secure. Reinstall plastic alignment brackets and remount, if necessary. Swap cable connections at DRO to see if problem moves to other axis. Replace failed reader head.
5. DRO counts in one direction only.	Failed reader head.	Replace reader head.

Encoder Replacement Parts

Occasionally, a runaway machine overextends its range of travel. This in turn causes the reader head to break through the encoder end cap. If the glass inside the encoder is not broken, the encoder can be reused. Do not attempt to force a damaged reader head back on the glass after an accident. Doing so could break the glass. Usually, the reader head and encoder end cap must be replaced after this type of accident.

The encoder reader head (with cable attached) and the encoder end caps are available as replacement parts. Refer to **Table 4, Reader Head Replacements**.

NOTE: Consult an ANILAM service technician before you replace the reader head due to a suspected electrical fault.

Table 4, Reader Head Replacements

Replacement Reader Head & Cable Assembly	ANILAM Part Number
1 Micron Reader Head - 4 Meter Cable	P/N 19010139
1 Micron Reader Head - 6 Meter Cable	P/N 19010140
5 Micron Reader Head - 4 Meter Cable	P/N 19010141
5 Micron Reader Head - 6 Meter Cable	P/N 19010142

NOTE: Reader heads with custom cable lengths are available as special order items.

Replacing a Reader Head

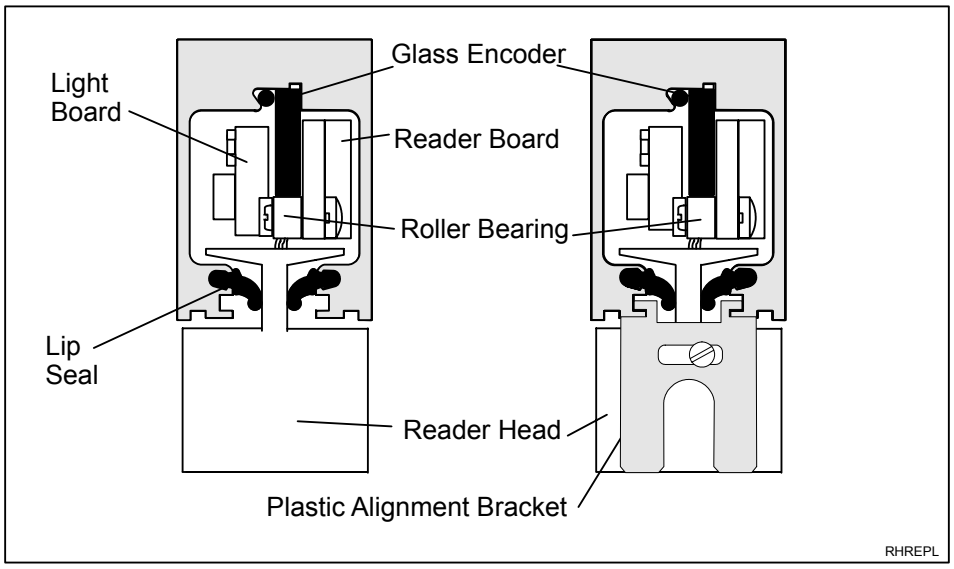

Figure 10, Reader Head and Encoder Cross Section View

When replacing a reader head, perform the following steps:

1. Turn off power.
2. Reinstall the two plastic reader head alignment brackets. Use the screws included with the encoder.
3. Remove the reader head mounting bolts. The head should slide freely along the encoder.
4. Remove one encoder end cap.
5. Slide reader head out with the alignment brackets attached.
6. Refer to **Figure 10, Reader Head and Encoder Cross Section View**. Carefully install the new reader head (with plastic alignment brackets attached) as shown. If the new reader head does not move smoothly on the way in, do not force it. Gently correct the alignment until the reader head glides into the encoder body.
7. Align the reader head as described in the appropriate installation procedure.
8. Remove and store reader head alignment brackets.
9. Replace the end cap.

Installation Kit Parts

Lathe X Axis (Cross Slide) Kit

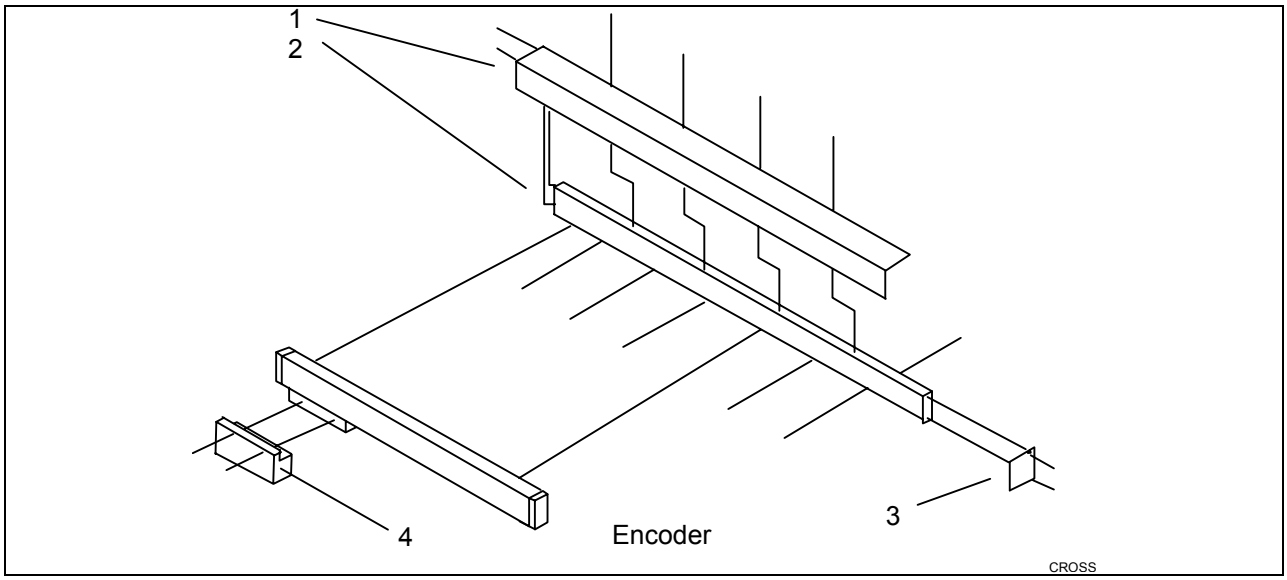

Figure 11, Lathe Cross Slide Mounting Kit

Table 5, Lathe Cross Slide Encoder Mounting Kit, P/N 32500174 (12 in. or over) or 32500208 (12 in. or under)

Item No.	Description	Kit Quantity
1	Cover	1
2	Bar, backer	1
3	Cap, end	1
4	Bracket, X axis reader head	
	* Hardware not listed.	

Universal Reader Head Mounting Kit

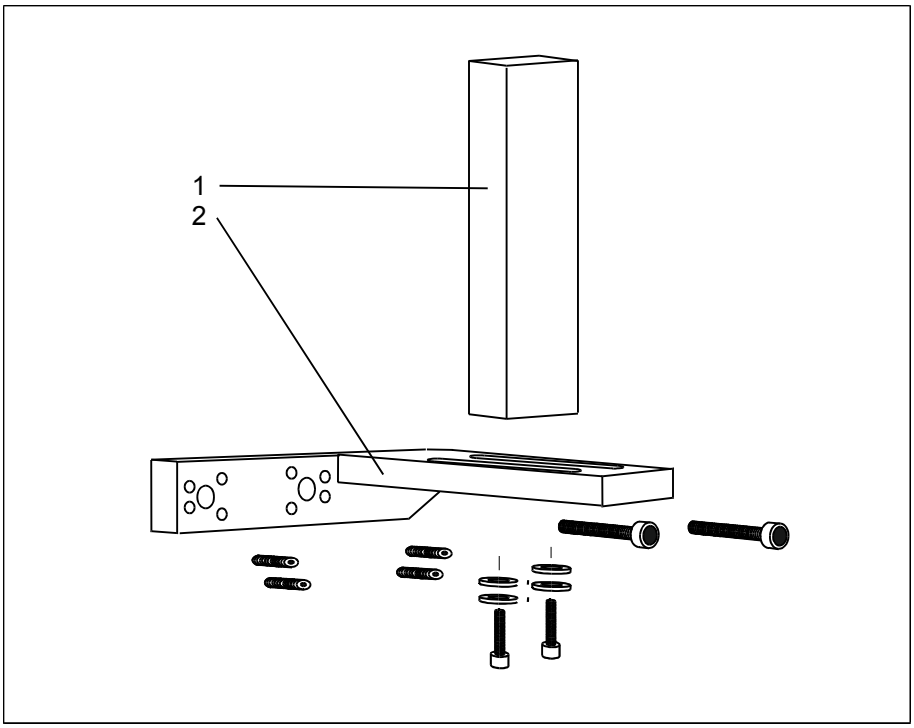

Figure 12, Universal Reader Head Mounting Kit

Table 6, Universal Reader Head Bracket Kit, P/N 32500030

Item No.	Description	Kit Quantity
1	Block, spacer	1
2	Bracket, universal, reader head	1
	* Hardware not listed.	

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