

# MICRO-LINE™

*For Milling Applications*

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## REFERENCE MANUAL



# **ACU-RITE®**

*Readout Systems  
Precision Glass Scales*

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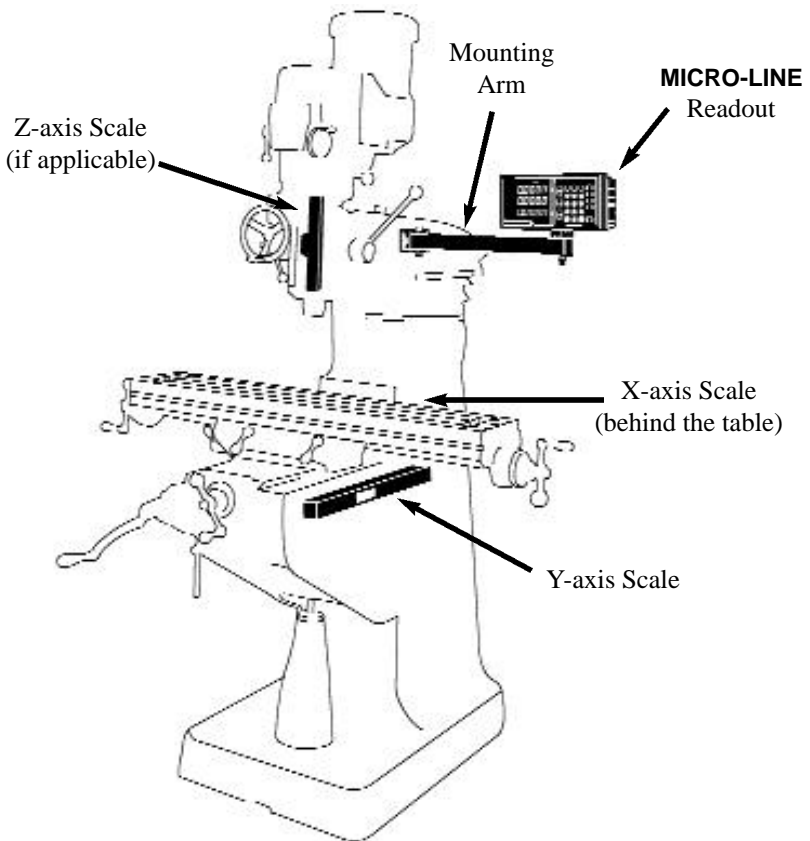
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## Overview

This manual will guide you through the installation, setup, and operation of the **MICRO-LINE** system. Use it to get your system up and running “out of the box” and as a quick reference guide for your day-to-day operations.

Install the scales first, according to the instructions included in this manual. After the scales are in place, install the readout and then finish setting up the system.

Here’s how a typical machine will look after the installation is complete:



# GENERAL

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## Preparation

### Packing List

Verify that you have received all of the components for your system:

- Readout instructions
- Installation instructions
- Mounting arm
- **MICRO-LINE** scale(s)
  - Cable mounting hardware
  - Scale mounting hardware
- Warranty card

If a component is missing, contact your **MICRO-LINE** distributor immediately for replacement.

### Warranty Records

Complete the warranty card included with your **MICRO-LINE** system. The readout's catalog and serial numbers are on the back of the display; the scale's catalog number is on the scale assembly label; and the serial number is on the scale case.

Copy the information here for your own records and mail the warranty card as soon as possible.

Distributor:	_____	
Address:	_____	
Telephone:	_____	
	Catalog No.	Serial No.
Readout	_____	_____
Axis #1:	_____	_____
Axis #2:	_____	_____
Axis #3:	_____	_____
Date of Purchase:	_____	

## **Installing the Scales**

Install the scales according to installation instructions found in this manual. These general installation instructions are found on page 40. Please read the instructions completely before beginning. If specific bracket kit instructions are included, they supersede instructions contained within this manual.

## **Installing the Readout**

Follow the readout installation instructions that are included with your mounting arm bracket kit. The electrical specifications for the readout are listed on pg. 33.

After the installation is complete, proceed to “Power Up.”

## Power Up

Press the switch on the back of the readout to power up the system. A series of tests will check that the display, keypad, and memory are all working properly.

If a problem is detected, an error code will appear on the screen. (Error messages and solutions are listed on pgs. 31 - 32.) It is important to note that the **E1 message** will appear every time you power up your system and does not indicate a problem. It merely indicates that the system had lost power. To acknowledge the message, press the **CLEAR** key and proceed to the DRO mode.

Note: If the E1 message appears at any other time during normal operation, refer to pg. 31 for possible problems and solutions.

## Display Saver

When the system is not used for more than 90 minutes, a decimal point will “scroll” across the X-axis display, indicating that the display saver has been activated. The display saver, like a screen saver on a computer monitor, will help prolong the life of your readout.

If the display saver has been activated, press any key on the readout or move the table to return to the normal DRO view.

## Parameter Setup

There are four parameters that you can define on your system:

- Display resolution (diS)
- Linear error compensation (LEC)
- Scale resolutions (rES)
- Scale count directions (Ct dir)

Establish each setting the first time you power up the system. You can change the parameters later by returning to Setup and then using the **ENTER** key to scroll to the appropriate category.

Anytime you change the linear error compensation, or count direction for an axis, the absolute and incremental displays for that axis will be reset to 0. If you change these settings, you will need to re-establish the datum point.

For international units using 5 $\mu$ m (0.0002") scales with reference marks, you will need to recall Datum. Refer to pg. 38 for instructions.

When in the Setup mode, use the **CLEAR** key when you want to back-space, restore the previous value or access the previous parameter.



# SETUP

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## Display Resolution

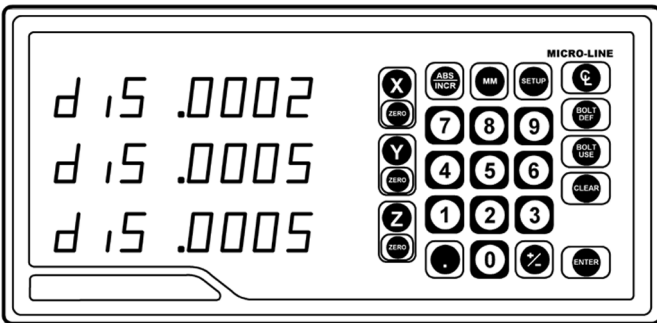
The display resolution determines how detailed each scale's position will be displayed on the readout. Use the setting that best suits each job.

To change the display resolution:

- Press the **SETUP** key. (“diS” will show on the display.)
- Press the **X**, **Y**, or **Z** key for the display you want to change.

For 10 $\mu$ m scales, the display resolution will toggle between 0.01 mm (0.0005”) and 0.02 mm (0.001”). For 5 $\mu$ m scales, it will toggle between 0.005 mm (0.0002”) and 0.01 mm (0.0005”).

- After you complete setting your display resolution, press **ENTER** to continue with setup or press **ENTER** then **SETUP** to return to the normal DRO display.



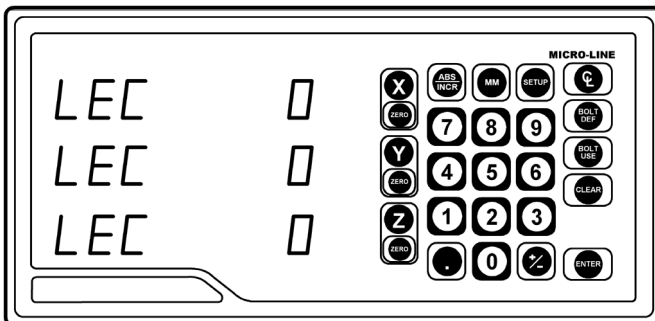
## Linear Error Compensation

With **MICRO-LINE**, you can compensate for machine tool wear. If you know the linear error compensation (LEC) value in parts per million (PPM), you can enter it directly.

If you don't know the LEC, use the formula on the next page to determine the value for each axis.

To change the linear error compensation:

- Move to the “Linear Error Compensation” display in the Setup mode. (Press **SETUP** and then the **ENTER** key until the display appears).
- Press the **X**, **Y**, or **Z** key for the axis you want to change. **MICRO-LINE** will display the current LEC value for that axis.
- Using the keypad, enter the linear error compensation factor (in PPM), followed by a **+** or **-** sign. The number must be within -9999 and 9999 (use whole numbers). The formula for calculating the value is on the next page.
- After you complete setting your LEC, press **ENTER** to continue with setup or press **ENTER** then **SETUP** to return to the normal DRO display.



# SETUP

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## How to Determine the Linear Error Compensation

Follow this procedure for each axis:

- In the DRO mode.
- Place a standard of known length on the table. Make sure it's parallel with the table's travel.
- Put the readout in the absolute display mode (**ABS/INCR** key).
- Using an edge finder or dial indicator, locate one end of the standard.
- Press the **ZERO** key twice for the axis you are measuring. "0" should appear on the display.
- Move the table along the axis until the edge finder or dial indicator reaches the opposite end of the standard.
- Write down the length that is shown on the readout display for that axis.
- Use the formula below to calculate the LEC for the axis you just measured. Enter the result in the LEC screen (previous page).

Note: If the measured length is greater than the standard length the LEC value will be negative.

### Formula

S = Standard length  
M = Measured length

$$LEC = \left( \frac{S - M}{M} \right) \times 1,000,000$$

### Example

If the length of the standard you used is 10" and the measured length along the X-axis is 9.995", then the LEC for the X-axis is 500 parts per million (PPM).

$$LEC = \left( \frac{10 - 9.995}{9.995} \right) \times 1,000,000$$

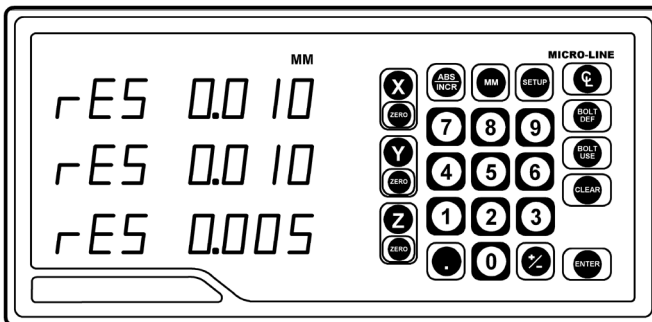
$$LEC = \begin{array}{l} 500 \text{ PPM} \\ \text{(rounded to the nearest} \\ \text{whole number)} \end{array}$$

## Scale Resolution

To ensure accurate readings, the scale resolution shown for each axis must correspond with the resolution of the scales on your machine.

### To change the scale resolution:

- If necessary, choose “Scale Resolution” from the Setup menu. (Press **SETUP** and then the **ENTER** key until the screen appears).
- Press the X-axis key until the appropriate resolution appears. Choose 0.01 mm for 10 $\mu$ m (0.0005”) scales and 0.005 mm for 5 $\mu$ m (0.0002”) scales (international units only).
- Repeat the procedure for each axis.
- Press **ENTER** to continue with Setup.



# SETUP

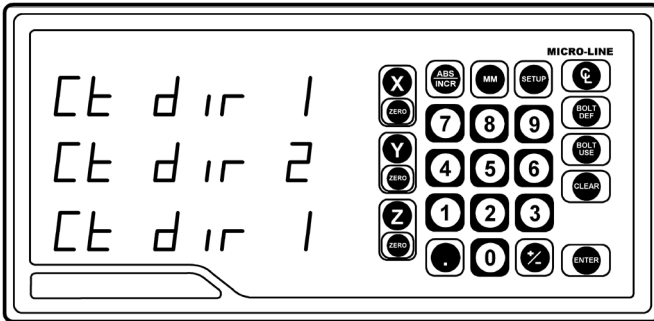
## Count Direction

Use the count direction setting to define the positive counting direction for each scale. The direction will be displayed as a “1” or a “2” (the numbers are not assigned to a particular direction). You only need to change the count direction if the scale is counting in the negative direction during a positive table move, or vice versa.

Refer to Conventions on pg. 37 for more guidelines.

### To change the count direction:

- Move to the “Count Direction” display in the Setup mode. (Press **SETUP** and then the **ENTER** key until “Ct dir” appears).
- Press the appropriate axis key (**X**, **Y** or **Z**). The current count direction (1 or 2) will appear.
- After you complete setting your count direction, press **ENTER** to continue with setup or press **ENTER** then **SETUP** to return to the normal DRO display.



## Testing the Scales

Follow these steps to confirm that the scale has been installed properly. The Counting Test will confirm the scale's electrical operation, and the Repeatability Test will check the installation integrity.

### Counting Test

- Move the table along each axis, one at a time. Check that the readout correctly displays the table's movement. If it doesn't, then the scale resolution you selected may not be accurate. Refer to Scale Resolution on pg. 9 for instructions.

### Repeatability Test

- Locate a magnetic base and dial indicator on the end of the scale. Zero the readout and the indicator.
- Move the axis through the full travel and return the dial to "0." The readout should also read 0 ( $\pm 0.0005$ " for 10 $\mu$ m scales;  $\pm 0.0002$ " for 5 $\mu$ m scales). If it doesn't, then the scale cable may be loose, or the scale, mounting bracket, or reading head may need to be tightened or realigned.
- Repeat these steps for each scale.

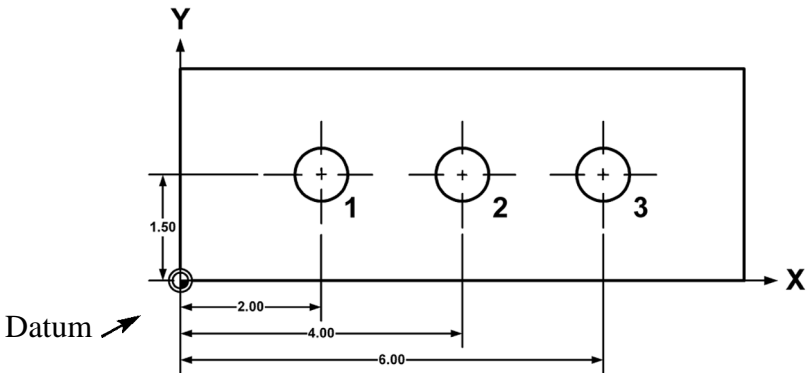
## Setting the Datum (Absolute Zero)

**MICRO-LINE** allows you to measure both absolute and incremental dimensions. A dimension measured from the point you define as the datum is an absolute dimension. A dimension measured from any other point on your print is an incremental dimension.

Datum, also known as absolute zero or workpiece zero, is the reference point from which **MICRO-LINE** will base all of your part's coordinates. When the readout is in the ABS mode, it is actually measuring the distance from the datum to the table's current position.

You will need to establish a datum for every job. Your datum may already be identified on your print; if it isn't, then establish a datum that allows you to enter most of your part's dimensions directly, with the least number of calculations.

All of the dimensions in the drawing below are based from the datum.



If you are using 5 $\mu$ m (0.0002") scales (international units only), **MICRO-LINE** can recall your last datum position each time you power up the system. Refer to pg. 38 for the proper procedure.

To set the datum at the tool's current position:

- Position the workpiece on the table. Move the table until the tool is centered on the edge of the workpiece at the location where you would like to establish the datum.
- Using the **ABS/INCR** key, select the absolute (ABS) mode.
- Press the X-axis **ZERO** key twice to establish the current X-axis position as the datum. Repeat for the Y- and Z-axes.

To set the datum using an offset:

- Using the **ABS/INCR** key, select the absolute (ABS) mode. Also check that the proper measurement (inch or mm) is selected.
- Move the tool to a known point, i.e. the outside diameter of the workpiece or the face of the workpiece.
- Press the **ZERO** key for the axis (X, Y or Z) you are entering a dimension for.
- Using the keypad, enter the distance from your tool's current location to the point you want to establish as the datum. Include a decimal point (.) and minus (-) sign when necessary.
- Press the **ZERO** key for another axis, or press **ENTER** to return to the DRO display.

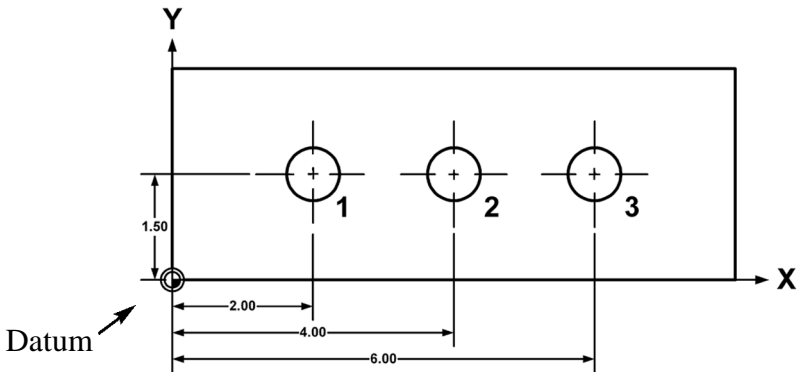


# OPERATION

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## Example: Absolute Dimensions

Let's say that your print looks like this:



Here is how you would drill the holes using absolute dimensions. Notice that all of the dimensions are measured from the point that was established as datum (0, 0, 0).

- Check that “ABS” is selected on the DRO display (press the **ABS/INCR** key, if necessary). By selecting ABS, you’re telling **MICRO-LINE** to measure the machine’s movement on the X-, Y-, and Z-axes from your datum (0, 0, 0).
- Press the **MM** key until “Inches” is selected (the MM display is not lit up).
- For Hole 1, move the table until X = 2.00” and Y = 1.50”. Drill Hole 1.
- Move the table until X = 4.00” and Y = 1.50”. Drill Hole 2.
- Move the table until X = 6.00” and Y = 1.50”. Drill Hole 3.

## Incremental Dimensions

As described earlier, incremental dimensions are measured from the current tool position to the next. If the tool is currently at 2" and you want to move an additional 3.125", you would select the incremental mode, zero out the axis, and move the table until the display reads 3.125.

An example of how to measure using incremental dimensions is shown on the next page.

### To use an incremental dimension:

- Move the table to the point where you want to measure an incremental distance from.
- Using the **ABS/INCR** key, select the incremental (INCR) mode on the readout. Also check that the proper measurement (inch or mm) is selected.
- Press the **ZERO** key below the axis(es) from which you are measuring.
- Move the table. **MICRO-LINE** will display the table's position in relation to the "0" point(s) for the axis(es) you chose.

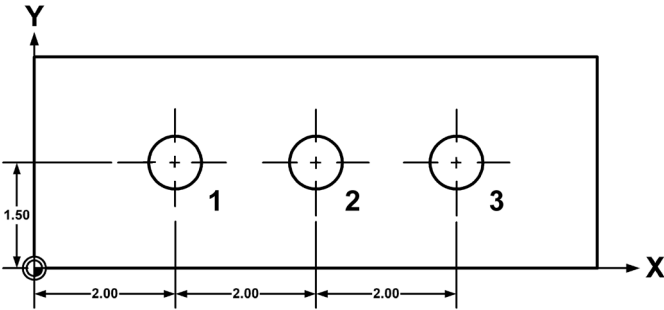
After you have reached the position you want and have milled the part, you can "zero" each axis again and then measure from that location to the next point on the workpiece or press **ABS/INCR** to return to the absolute mode.

# OPERATION

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## Example: Incremental Dimensions

Let's say that your print looks like this:



Hole 1 is an absolute dimension (measured from the datum), while Holes 2 and 3 are measured incrementally. By putting **MICRO-LINE** in the incremental mode for the last two holes, you can measure their distances just as the print specifies, without any calculations.

1. Press the **ABS/INCR** key until “ABS” is selected on the DRO display. Press the **MM** key until “Inches” is selected (the MM display is not lit up).
2. For Hole 1, move the table until  $X = 2.00''$  and  $Y = 1.5''$ . Drill Hole 1.
3. Now press the **ABS/INCR** key so that “INCR” is selected on the DRO display. This tells **MICRO-LINE** that you want to measure the distance from the current position to the next point.
4. Press the **ZERO** keys that are below the X- and Y-axes keys. This resets the X- and Y-axes displays at “0.”
5. Move the table until  $X = 2.00''$  and  $Y = 0.000''$ . Drill Hole 2.

6. Now repeat the process for the third hole. Press the **ZERO** key for the X-axis to measure from your tool's current position.
7. Move the table until  $X = 2.00''$  and  $Y = 0.000''$ . Drill Hole 3.

### Using Incremental Presets

In the standard incremental mode, you would reset the display at "0" and move the table until the scale counts up to the point you want to reach. With the *preset* feature, you enter the distance you want to move first, and then count down to 0. For instance, if you enter 3.125" as the preset distance, **MICRO-LINE** will show -3.125 on the display. As you move the table in the positive count direction, the system will start counting. When the axis display reads "0," your tool is in the correct position.

#### To preset an incremental position:

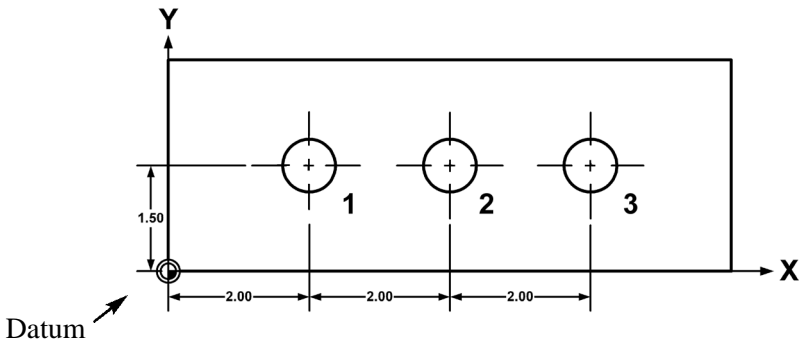
1. Press the key (**X**, **Y**, or **Z**) for the axis you want to preset. **MICRO-LINE** will automatically switch to the incremental mode.
2. Enter the distance from your tool's current position to the final location. Include a decimal point and minus (-) sign when necessary.
3. Repeat the step above for another axis or press **ENTER** to return to the DRO display.

To reach the preset position, move the table until the display for each preset axis reads "0."

# OPERATION

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## Example: Incremental Presets



Hole 1 is an absolute dimension because it's measured from datum. Holes 2 and 3 are incremental dimensions (measured from one hole to the next) that you can preset.

1. Press the **ABS/INCR** key until "ABS" is selected on the DRO display. Also check that the system is in the "inches" mode (the MM key should not be lit up).
2. For Hole 1, move the table until X = 2.00" and Y = 1.50". Drill Hole 1.
3. Now press the **ABS/INCR** key so that "INCR" is selected on the DRO display. This tells **MICRO-LINE** that you want to measure the distance from your current position to the next point.
4. Press the **X** key, enter **2** as the distance from Hole 1, and then press **ENTER**. Two inches is the incremental preset distance.
5. Move the table until X = 0.000" and Y = 0.000". Drill Hole 2.
6. Press the **X** key (2.00 should already appear as the distance), and then press **ENTER**. Two inches is the incremental preset distance.
7. Move the table until X = 0.000" and Y = 0.000". Drill Hole 3.

## Centerline

With **MICRO-LINE**, you can find the centerline (midpoint) between any two positions on your part. You can establish centerline as your datum by using absolute dimensions or you can create a centerline using incremental measurements without affecting your current datum.

Refer to “Setting the Datum (Absolute Zero)” on pg. 12.

### Setting the Datum on a Centerline

1. Press the **ABS/INCR** key until ABS is selected.
2. Move the table to the first location.
3. Press the **ZERO** key twice for the axis (X, Y, or Z) you want to find the centerline for.
4. Move the table to the second location along the same axis.
5. Press the **C/L** (centerline) key. Dashes will flash on the screen.
6. Press the appropriate key (**X**, **Y**, or **Z**) for the axis you’re measuring.
7. **MICRO-LINE** will measure the distance between the two points, then divide the sum in half. You can locate the centerline by moving the table until the position for the axis you measured reads “0.”

Repeat the procedure to locate the midpoint for multiple axes. An example appears on the next page.

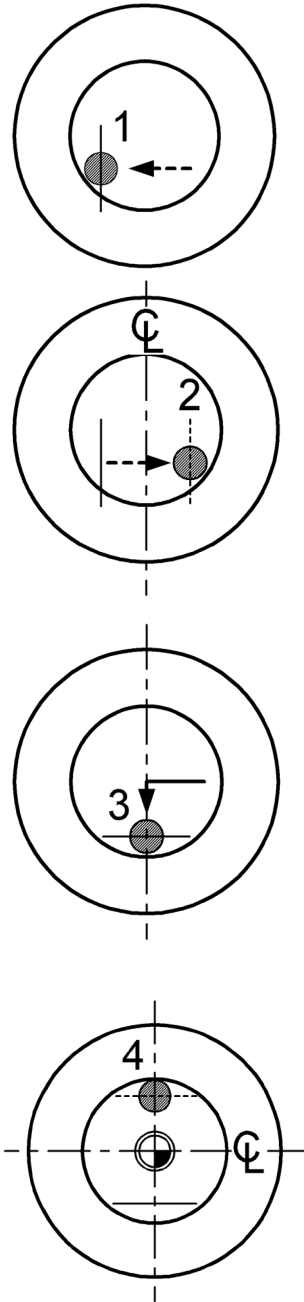
## OPERATION

### Example: Setting the Datum on a Centerline

Here's how you would establish the datum on the centerline of the part shown:

1. Using the **ABS/INCR** key, select the absolute (ABS) mode. Check that the proper measurement (inch or mm) is selected.
2. Rest the indicator against any point on the left or right side of the circle. (In graphic 1 above, we started on the left side.) Press the **ZERO** key for the X-axis twice.
3. Move the table until the indicator rests against the other side of the circle. Press the **C/L** (centerline) key. Press the **X** key, and **MICRO-LINE** will calculate the centerline between the two points. The display will show the distance from the current position to the centerline.
4. Now follow the same procedure for the Y-axis. Only this time rest the indicator against any point on the top or bottom half of the circle. Press the **ZERO** key twice for the Y-axis.
5. Move the table until the indicator rests against the other side of the circle. Press the **C/L** (centerline) key. Press the **Y** key, and **MICRO-LINE** will calculate the centerline and display the distance from the current position to the centerline.

Your datum is now located at the center of the circle.



### Locating Centerline Using Incremental Dimensions

1. Press the **ABS/INCR** key to select the incremental display mode.
2. Move the table to the first location.
3. Press the **ZERO** key for the appropriate axis. Doing so will zero the current position.
4. Move the table to the second location along the same axis.
5. Press the **C/L** (centerline) key. Dashes will flash on the screen.
6. Press the appropriate key (**X**, **Y**, or **Z**) for the axis you're measuring.
7. **MICRO-LINE** will measure the distance between the two points, then divide the sum in half. You can locate the centerline by moving the table until the position for the axis you measured reads "0."
8. Repeat the procedure for each axis.



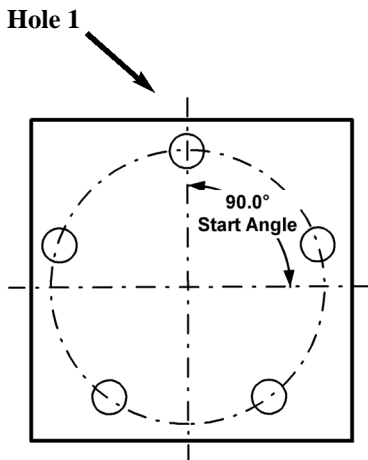
# OPERATION

## Bolthole Patterns

### Creating a Bolthole Pattern

A bolthole pattern is defined by its number of holes (up to 99), center point, radius, and start angle.

**MICRO-LINE** will automatically position "Hole 1" at the start angle and space the holes equally throughout the pattern.



To create a bolthole pattern:

1. Press the **BOLT DEF** key. "HOLES" will appear on the X-axis display.
2. Enter the number of holes (1-99) in the pattern. Press the **ENTER** key.
3. Press the **ENTER** key again. "Center" will appear, and then a flashing dash will appear on the X- and Y-axes.
4. Press the **X** key. Using the keypad, define the center point of the bolthole pattern on the X-axis. Use a decimal point and minus (-) sign when necessary.
5. Press **ENTER**.

HOLES  
5

Center  
Center

0.0000=  
0.0000=





Note: To select a different hole in the pattern, press the **BOLT USE** key and immediately press the number of the hole you want to mill. Press “2” on the keypad for Hole 2, “3” for Hole 3, etc. The holes are numbered counter-clockwise from the start angle.

You can also scroll through the series of holes by pressing the **BOLT USE** key repeatedly.

## **Troubleshooting Introduction**

Refer to this troubleshooting guide whenever you have questions or concerns about the operation of the **MICRO-LINE** system.

This guide is arranged in three columns entitled Symptom, Probable Cause and Recommended Corrective Action. The symptoms are listed in the order of the most common, easiest to check, and least expensive to correct.

First locate the symptom that best describes the problem you are trying to solve. Then identify the probable cause that most closely matches the problem and implement the recommended corrective action.

If a problem persists or cannot be resolved using this manual, contact your **MICRO-LINE** distributor for further assistance.

## TROUBLESHOOTING

Symptom	Probable Cause	Recommended Corrective Action
<b>Screen is blank</b>	<p>No power to the readout</p> <p>LED failure</p>	<p>Check that the power switch on the back of the console is "on."</p> <p>Check that the readout's power cord is properly connected to the power supply.</p> <p>Check the fuse. (Located above the power switch).</p> <p>Check that the power source meets the specifications required by your system (pg. 33).</p> <p>Contact your <b>MICRO-LINE</b> distributor for repair/ replacement procedures.</p>
<b>Decimal point scrolls across display</b>	<p>System has been idle for approximately 90 minutes and is in "display saver" mode</p>	<p>Press any key or move the table to return to the previous screen.</p>
<b>Dashes appear on screen</b>	<p>Display overflow</p>	<p>The value entered exceeds the display's 8-character capability. Enter a value with less than 8 characters.</p> <p><i>(cont'd next page)</i></p>

## TROUBLESHOOTING

Symptom	Probable Cause	Recommended Corrective Action
<b>Dashes appear on screen</b> <i>(cont'd)</i>	Display overflow	Move the table toward the "0" position. As the scale counts down, the display will show the correct position.
<b>Error message (E1) appears</b>	Power loss occurred	This is a normal message at power up. If the message appears at any other time during operation, a problem may have occurred. Refer to pg. 31 for details.
<b>Error messages (E2-E58) appear</b>	Causes vary	Turn the system "off" and then "on" again, using the switch on the back of the readout. If an error (besides E1) is still detected when the system is powered up, contact your <b>MICRO-LINE</b> distributor for repair/replacement procedures. Refer to pgs. 31 - 32 for a list of error messages.
<b>Keys not working properly</b>	Invalid keypress	Turn the system "off" and then "on" again, using the switch on the back of the readout. If an error (besides E1) is still detected when the system is powered up, contact your <b>MICRO-LINE</b> distributor for repair/replacement procedures. Refer to pg. 31-32 for a list of error messages.

## TROUBLESHOOTING

Symptom	Probable Cause	Recommended Corrective Action
<b>Scale won't count</b>	Loose cable	Check that the scale cable is securely connected to the readout.
	Wrong input	Check that the scale cable is connected to the correct input on the back of the readout. Refer to the readout installation instructions.
	Scale not installed properly	Check the scale and reading head for proper installation (refer to scale installation instructions).
	The scale's reading head is not working properly	Unplug the scale from the readout and plug it into an input for another axis. If the scale still does not count, the reading head may need to be replaced. If the scale counts on the other axis then the display may need to be replaced. See LED Failure.
<b>Scale counts, but not correctly</b>	Wrong scale resolution	Check that the correct scale resolution for the correct axis was selected (pg. 9).
	Wrong count direction	Change the count direction (pg. 10).
	Scale not installed properly	Check the scale and reading head for proper installation (refer to scale installation instructions included with your system). Clean the scale, if necessary.



# TROUBLESHOOTING

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Symptom	Probable Cause	Recommended Corrective Action
Setup does not save values	Improper procedure	Press the <b>ENTER</b> key after each value is entered into a Setup screen. If you press another key instead, the new value will not be saved. Refer to pgs. 5 - 10 for proper procedures.
Numbers don't appear/are faded on the display	LED failure	Turn the system "off" and then "on" again, using the switch on the back of the readout. If this does not correct the problem, contact your <b>MICRO-LINE</b> distributor for repair/replacement procedures.

## Error Messages (General)

When **MICRO-LINE** is powered up, it will run a series of tests to ensure that the software is working properly. If an error message appears, refer to the charts on this page and the next for a diagnosis and solution.

<b>E1</b>	A power loss has occurred. This message will appear every time you power up the system and can be cleared by pressing the <b>CLEAR</b> key. If the E1 message appears at any time other than at power up, a power interruption has occurred and your current table position may be lost. Re-establish the datum if necessary. If the problem persists, contact your distributor for repair/replacement procedures.
<b>E2</b>	An EEPROM memory error has occurred. Press the <b>CLEAR</b> key to acknowledge the error. The datum and setup information may be lost. These areas should be checked and reestablished upon power up. If the problem persists, contact your distributor for repair/replacement procedures.
<b>E3</b>	A ROM memory error has occurred. Press the <b>CLEAR</b> key to acknowledge the error. If the system does not operate properly, contact your <b>MICRO-LINE</b> distributor for repair/replacement procedures.
<b>E4</b>	A random access memory (RAM) error has occurred. Press the <b>CLEAR</b> key to acknowledge the error and continue with the next test. If the system does not operate properly, contact your <b>MICRO-LINE</b> distributor for repair/replacement procedures.
<b>E9</b>	A scale miscount error (invalid waveform) error has occurred. The E9 message will appear on the axis that has the error. Press <b>CLEAR</b> to reset the axis(es). Your current position may be lost. Re-establish the datum if necessary. If the system does not operate properly, contact your <b>MICRO-LINE</b> distributor for repair/replacement procedures.

## **TROUBLESHOOTING**

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### **Error Messages (Keypad Test)**

The messages below indicate that a problem was found during the keypad test at startup. If an error message appears, turn the system off, press the appropriate key to release it back into position, and then restart the system. (Or you can press the **CLEAR** key to clear the error message.) If the key does not work during normal operation, contact your distributor for repair/replacement procedures.

<b>E11</b>	<b>SETUP</b> key	<b>E35</b>	<b>5</b> key
<b>E12</b>	<b>C/L</b> key	<b>E36</b>	<b>4</b> key
<b>E15</b>	<b>MM</b> key	<b>E38</b>	<b>Y</b> key
<b>E16</b>	<b>ABS/INCR</b> key	<b>E41</b>	<b>3</b> key
<b>E18</b>	<b>X</b> key	<b>E45</b>	<b>2</b> key
<b>E21</b>	<b>9</b> key	<b>E46</b>	<b>1</b> key
<b>E22</b>	<b>BOLT DEF</b> key	<b>E48</b>	<b>ZERO</b> key for the Y-axis
<b>E25</b>	<b>8</b> key	<b>E51</b>	<b>±</b> key
<b>E26</b>	<b>7</b> key	<b>E54</b>	<b>ENTER</b> key
<b>E28</b>	<b>ZERO</b> key for the X-axis	<b>E55</b>	<b>0</b> key
<b>E31</b>	<b>6</b> key	<b>E56</b>	<b>Decimal point (.)</b> key
<b>E32</b>	<b>BOLT USE</b> key	<b>E57</b>	<b>ZERO</b> key for the Z-axis
<b>E33</b>	<b>CLEAR</b> key	<b>E58</b>	<b>Z</b> key

## Electrical Specifications

Follow these specifications when installing your **MICRO-LINE** system.

<b>Characteristic</b>	<b>Specification</b>
Operating conditions	0° to 40°C (32° to 104°F) 25% to 85% relative humidity (non-condensing)
Storage conditions	-40° to 60°C (-40° to 140°F) 25% to 85% relative humidity (non-condensing)
Input requirements: Voltage Frequency Current	115VAC or 230VAC, single phase 47 - 63Hz per channel 300mA @ 115V, 150mA @ 230V
Fuse	115V operation: 1/2A, 250V, 3AG, slo-blo 230V operation: 1/4A, 250V, 3AG, slo-blo
Encoder input	Position signals: channels A & B TTL square wave signal in quadrature (90° nominal phase relationship) Maximum input rate: 70 kHz
Size	9.875" x 4.679" x 4.75"
Weight	4 lbs., 2 oz.
Mounting	Bottom; two 1/4"-20 threaded inserts
FCC compliance	Part 15 of FCC rules for a class A computing device
CE compliance	For Europe
ETL compliance	For United States
ETLc compliance	For Canada

# REFERENCE

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## Factory Default Settings

<b>Display Resolution</b>	High (0.0005"/0.01 mm for 10µm scale)
<b>Linear Error Compensation</b>	0 parts per million
<b>Scale Resolution</b>	0.0005"/0.01 mm (10µm)
<b>Count Direction</b>	1
<b>Bolt Circle</b>	
<b>Number of Holes</b>	1
<b>Center</b>	(0, 0)
<b>Radius</b>	0
<b>Start Angle</b>	0 degrees
<b>Display Units</b>	Inches
<b>Display Mode</b>	ABS (absolute dimensions)



## REFERENCE

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<b>BOLT DEF</b>	Used to create a bolthole pattern.
<b>BOLT USE</b>	Used to run a bolthole pattern.
<b>CLEAR</b>	Acts as backspace key during numeric entry; otherwise, it clears or cancels the last operation.
<b>ENTER</b>	Completes numeric operations; selects next parameter in <b>SETUP</b> or <b>BOLT DEF</b> operations.
<b>±</b>	Changes the sign of the entered value from positive(+) to negative(-) or vice versa. Numbers are positive unless a (-) appears in front of them.
<b>.</b>	Decimal point can be used during numeric entry; also used to access the recall feature for systems with 5µm (0.0002") scales after power up.
<b>0-9</b>	Used to enter a distance, angle, or other number value.





### Recalling the Last Datum Setting For International Units

If you are using 5 $\mu$ m **MICRO-LINE** scales, **MICRO-LINE** can retrieve your last datum setting when you power up your system. This feature is especially useful when you have to shut down the system in the middle of a job, or if a power interruption occurs. When power is restored, **MICRO-LINE** will use Position-Trac™ technology to read the scales' reference marks and recall the datum within seconds.

The recall feature only works after you have completed the initial system setup and established a datum, so it won't be accessible the very first time you turn the readout on. After you have completed those operations, you can recall the datum for every power up thereafter.

#### To recall your last datum:

- Power up the system.
- Press the **CLEAR** key to clear the E1 message.
- Press the decimal point (.) on the readout's keypad. Move the table in the *positive* count direction along the X-axis. Keep moving it until the system recalls the datum and "found" flashes on the screen. The system will automatically reset the X-axis value to reflect the distance from the table's current position to the datum.

Repeat this step for the Y- and Z-axes, always moving the machine in the positive count direction.

After you have completed the recall procedure, you can move to the datum by positioning the table, saddle, and quill until the display reads "0" for each axis.

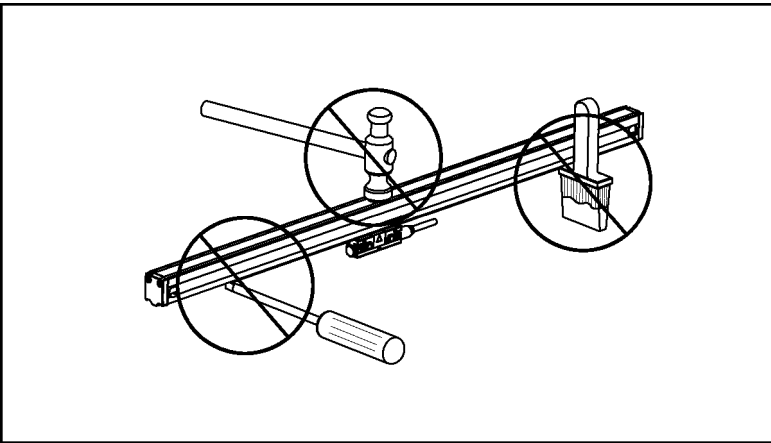
**Notes:**

# SCALE INSTALLATION

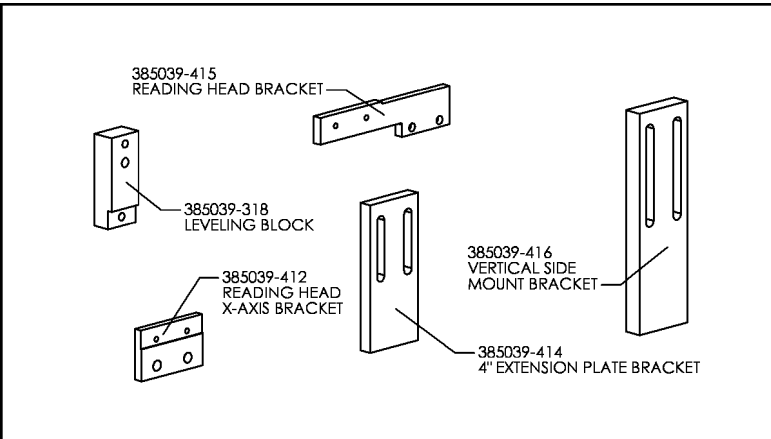
## General Installation Instructions for the Scale

Specific instructions may be included that will supersede this section.

Please do not expose the scale to the following:



## Installation Brackets



- Installation brackets and tools are already included with each system.
- Your Authorized ACU-RITE Distributor can assist you in selecting brackets and tools for your installation.

## Introduction

The **MICRO-LINE** precision glass scale provides the accuracy and reliability of an ACU-RITE measuring system. Features and options include:

- Digital resolutions of 5 or 10 $\mu$ m.
- Accuracy Grade of  $\pm 10\mu\text{m}/1000\text{mm}$ .
- Home reference signals on international units only.
- Braided cables in 10ft., 15ft., or 20ft. lengths.
- Two scale case forms:
  - Top mounting scale available 2 - 120" measuring length
  - End mounting scale available 2 - 22" measuring length
- Mounting Fasteners
- Installation Brackets

See Page 2 to fill out warranty record information.

Scale mounting hardware and cable mounting hardware are provided with each **MICRO-LINE** scale.

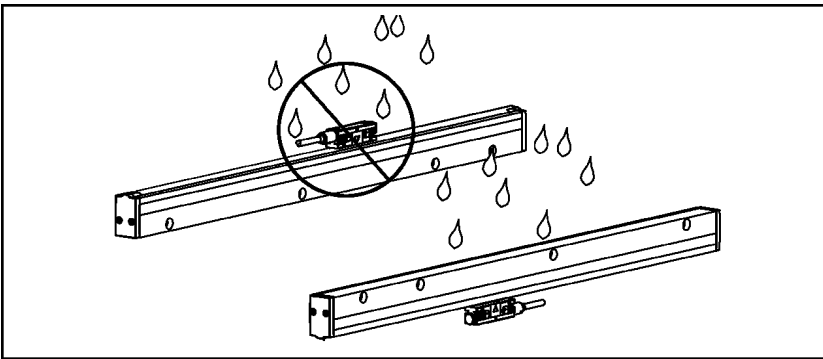
# SCALE INSTALLATION

## Mounting Preparation

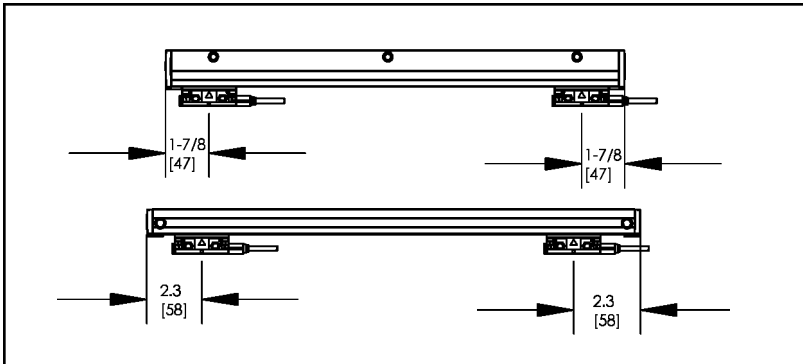
- Understand your mounting requirements.
- Mount with lipseals down and away from the work area.
- Brackets should be kept as short and rigid as possible.
- Clean all mounting surfaces.
- Ensure the correct length scale is being used for the total machine travel.



**Do not remove alignment brackets until instructed.**



Never mount with lipseals upward or toward work area.



Equipment travel **must not exceed** scale measuring length.

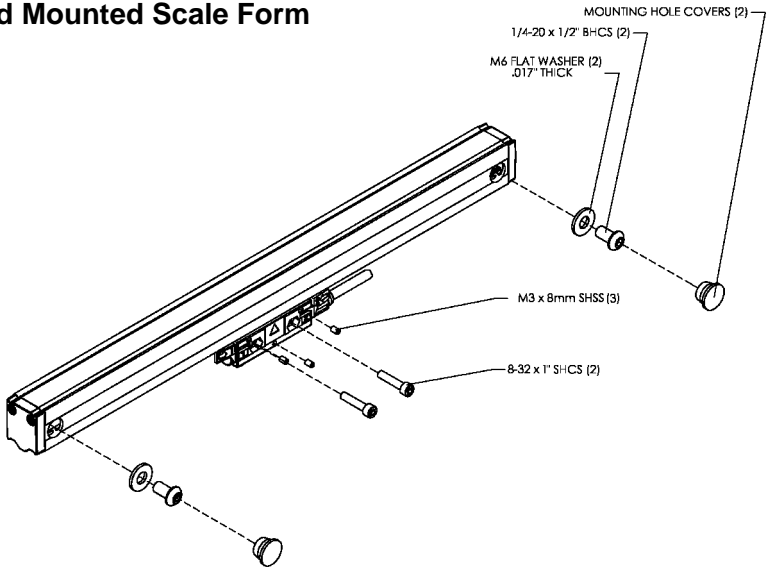




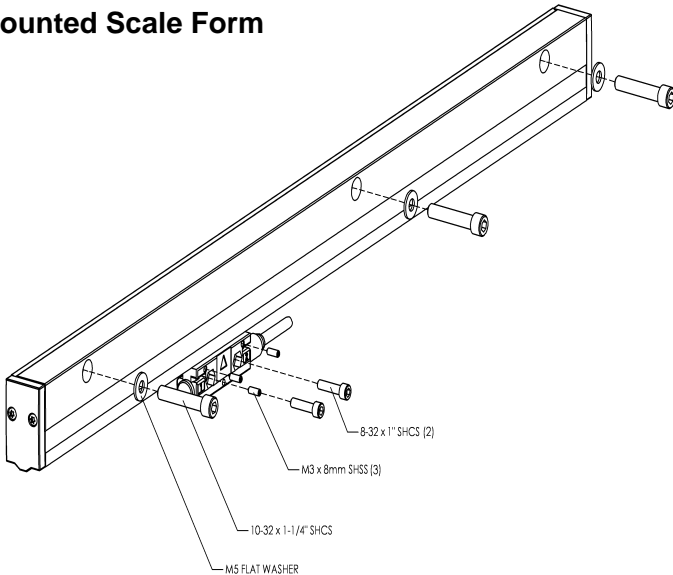
# SCALE INSTALLATION

## Mounting Illustrations

### End Mounted Scale Form



### Top Mounted Scale Form





# SCALE INSTALLATION

## Installation Procedure

These steps apply to typical mounting conditions. Although this may not pictorially represent your application, your installation procedure should follow these steps.

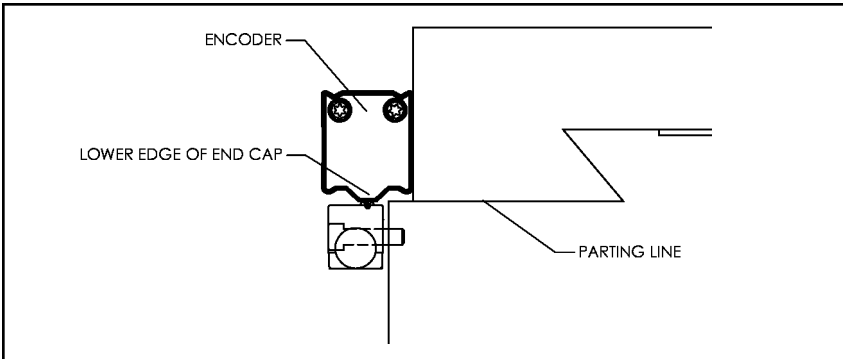


**ACU-RITE bracket kit instructions supersede this section.**

- Adjust drill depths and fastener lengths as required.
- Contact your Authorized ACU-RITE Distributor if assistance is required.

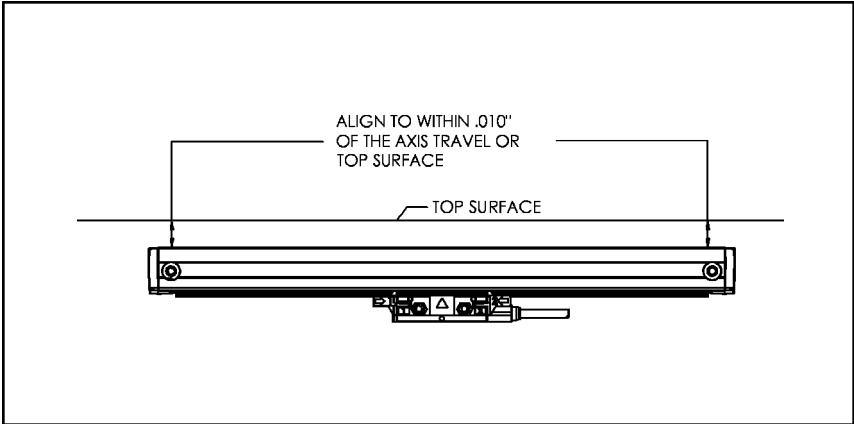
### First Steps:

1. Move the axis to its center of travel.
2. Mark the axis location so that it can be re-centered easily.
3. Slide the reading head with the alignment brackets attached, along the scale case to the center of the scale case.



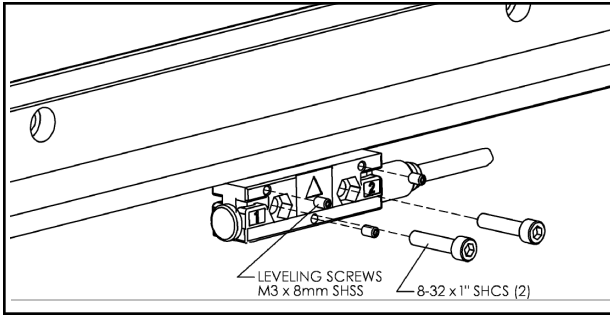
4. Locate the bottom of the end cap flush with the axis parting line.
5. Mark one end mounting hole.
6. Drill and tap the hole location 10-32 x 1/2" deep for the top mounting form and a 1/4-20 x 1/2" deep for the end mounting form. Attach the scale.

## SCALE INSTALLATION

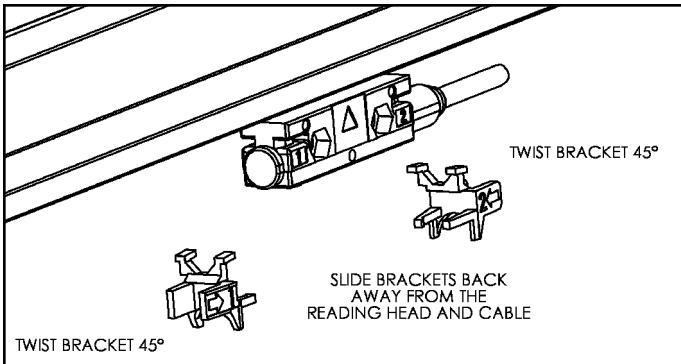


7. Align to within .010" TIR to axis of travel and mark the second end mounting hole. Remove scale, drill and tap correct hole size.
8. Attach the scale and align to within .010" TIR to axis of travel.
9. Top mounting requires the top surface to be indicated to within .010" TIR over each mounting hole. Mark remaining hole locations. Remove scale, drill and tap remaining holes. Attach the scale and align to within .010" TIR to axis of travel.
10. For end mounting form, after scale is attached and aligned, insert mounting hole covers.
11. Ensure the axis is still at its center of travel and the reading head is centered on the scale. Mark the reading head mounting holes.
12. Move the axis and drill and tap for 8-32 (M4).

# SCALE INSTALLATION



13. Move the axis to align reading head mounting holes.
14. A gap must exist between the reading head and the mounting surface.
15. Adjust the leveling screws, using a .001" -.003" feeler gage (or shim) between the leveling screw and the mounting surface. Adjust the leveling screw until a slight drag is felt on the feeler gage. Repeat this for each leveling screw, 3 total.
16. Evenly tighten the two 8-32 SHCS to secure the reading head.



17. Use the Allen wrench from the leveling screw adjustment to slide brackets away from the reading head.
18. Remove the alignment brackets and save with this Reference manual.
19. Route cable with slack loops allowing for axis motion.
20. Secure excess cable by fastening with clips and ties.
21. Move the axis through its full travel. Confirm that the assembly does not interfere with the machine movement.

## Hassle-Free Warranty

ACU-RITE readouts and precision glass 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 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 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's entire liability and the end user's exclusive remedy, under any circumstance, for any claim of damage.

In no event shall ACU-RITE be liable for incidental or consequential damages nor shall ACU-RITE's liability for any 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.



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ISO 9001  
CERTIFIED  
MANUFACTURER



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ACU-RITE INCORPORATED

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