DRO 200G™

REFERENCE MANUAL

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Readout Parameter Access Code

An access code must be entered before machine-related parameters can be set or changed. This prevents inadvertent adjustments to the setup parameters.

IMPORTANT
The access code is 8891

Refer to the <u>Setup</u> section. Begin by pressing the [SETUP] key. When "SETUP" is displayed, press the [8], [8], [9], [1], and [ENTER] keys. The readout is now ready for machine parameter setting operations.

IMPORTANT
Supervisors may wish to remove this page from the Reference manual after initially setting up the readout system. Retain in a safe place for future use.

Warranty

ACU-RITE Products and accessories are warranted against defects in material and workmanship for a period of three years from the date of purchase. ACU-RITE will, at its option and expense, repair or replace any part of the ACU-RITE product that fails to meet this warranty. This warranty covers both materials and factory labor. In addition, authorized ACU-RITE service representatives will provide service labor (field service) for a period of one year at no charge. Notice of the claimed defect must be received by ACU-RITE within the warranty period.

This warranty applies only to products and accessories installed and operated in accordance with this reference manual. ACU-RITE shall have no obligation, with respect to any defect or other condition caused in whole or part by the customer's incorrect use, improper maintenance, modification of the equipment, or by the repair or maintenance of the product by any person except those deemed qualified by ACU-RITE.

Responsibility for loss of operation or diminished performance due to conditions beyond ACU-RITE's control cannot be accepted by ACU-RITE.

The foregoing warranty obligations are in lieu of all expressed or implied warranties. ACU-RITE INCORPORATED shall not be liable under any circumstances for consequential damages.

30 Day Red Carpet Warranty

All ACU-RITE products are covered by a 30-day Red Carpet Warranty. If in the first 30 days this product fails for any reason, repack it in the original packing materials and contact your Authorized ACU-RITE Distributor for return procedures.

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⚠

This symbol alerts you to the fact that important information concerning the installation and operation of this readout has been included in this manual.

Keep these instructions in a secure place for future reference.

Introduction

ACU-RITE's DRO 200 readout series provides application-specific features required for you to obtain the most productivity from your manual machine tools.

The DRO 200G is designed specifically for grinding and general applications. Special features include presetting, radius/diameter conversion, and Position-Trac.

A Tour of the Readout

Front and Back Views

Indicators
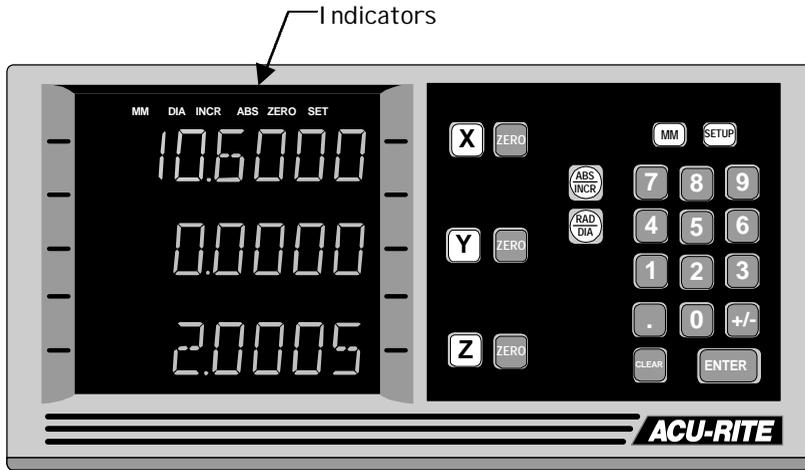
Electrical & fuse rating information

Electronic edge finder input
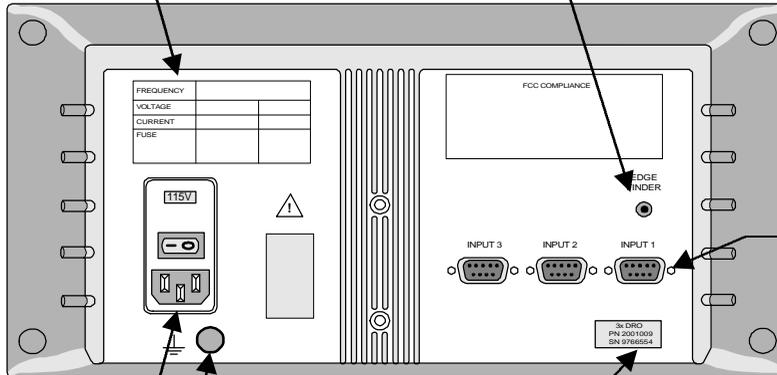
Encoder inputs

Power switch and voltage selector

Ground wire connection

Model number and Serial number

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Keypad

Selects absolute or
incremental display

Selects radius or
diameter display

English / metric
conversion

System setup
parameters

Enter all numeric values
with these

Begin a preset

Zero an axis display

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Displays

At the top of the display window is a row of indicators. These tell you the current state of the readout.

```
   MM   DIA  INCR  ABS  ZERO  SET
        10.6000
         0.0000
         2.0005
```
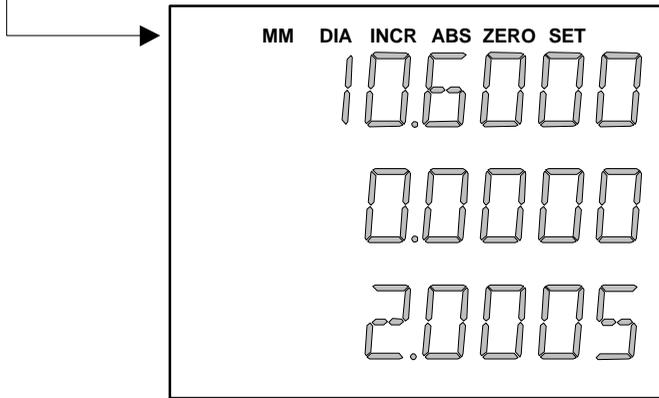
ZERO

Appears when setting an absolute zero.

SET

Lets you know when you are setting a preset or an absolute zero.

DIA

Tells you when an axis is displaying diameter.

MM

Appears when you're positioning in metric, dark when you're positioning in inches.

INCR ABS

These tell you if the position display is incremental or absolute. They also refer to the type of preset.

In addition to the lighted indicators along the top of the display, the top axis display will scroll longer messages that will help you step through some of the procedures.

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Power-On Position Recovery

Position-Trac

Certain ACU-RITE encoders, such as the ENC 150, contain closely-spaced reference marks that enable the display to show the correct position after a power interruption. The readout will indicate when power has been lost, and will prompt you to move each axis until a reference mark is located. By traversing the reference marks once in each axis, you will re-establish the display position relative to the last known zero. The most you will ever have to move an axis is about one inch. You must move in a positive count direction. A flashing decimal point will indicate that the last position has not been recalled.

If you use an encoder without Position-Trac, the procedure for recovering your position is slightly different. Reference marks on these encoders are about 8" apart. You must find a convenient reference mark and then use the same mark every time.

   1.   Move near the desired reference mark.

   2.   Press and hold the (ABS/INCR) key until the decimal point starts to flash.

   3.   Move slowly past the reference mark until the readout recalls its position. You must move in a positive direction.

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Readout Operations

Clear Key

Use the $\boxed{\text{CLEAR}}$ key to erase digits that you entered by mistake, or to take you back if you've pressed a wrong function key.

Absolute and Incremental Displays

Absolute Display

Shows the distance from your current position to *absolute zero.*
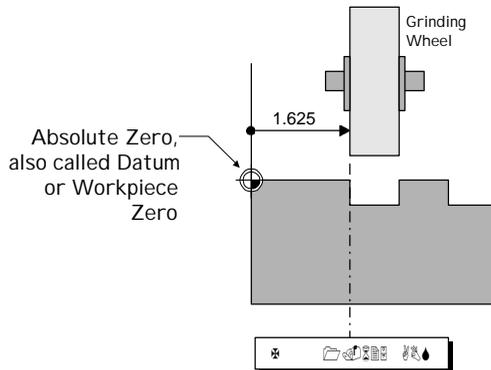
Incremental Display

Shows the distance from your current position to *incremental zero.* An incremental zero is set when you preset a dimension, or when you zero the incremental display.

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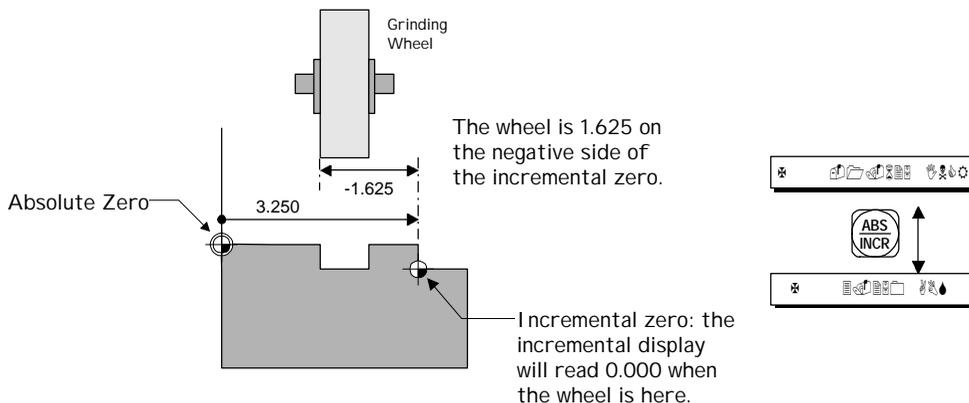
Automatic Display Switching

Sometimes the readout will switch from one display to another automatically. When you enter a preset, for example, the display switches to the incremental display so you can move to zero. Whenever the readout does an automatic display switch, INCR will appear briefly in the display.

Radius/Diameter Display

Pressing the ⟨RAD/DIA⟩ key lets you view the part dimension either as a radius or as a diameter.

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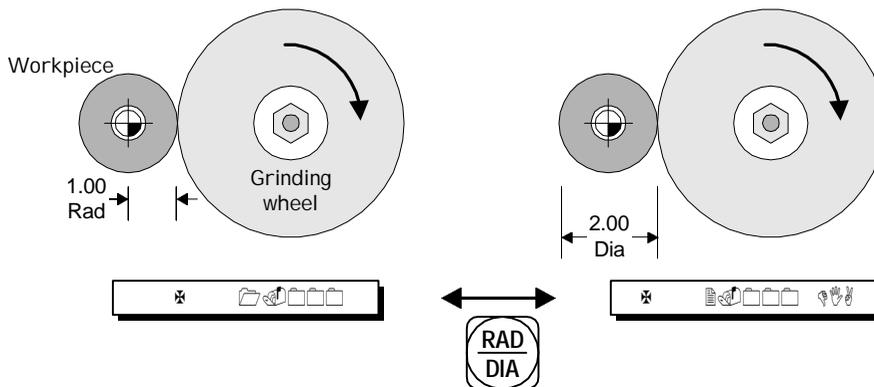
Zeroing the Displays

Absolute Zero

On many prints, dimensions are
measured from one or two
surfaces of the part. By setting the
readout's absolute display to zero at a well-
chosen surface, you can enter the part's
dimensions directly from the print, using
absolute presets.
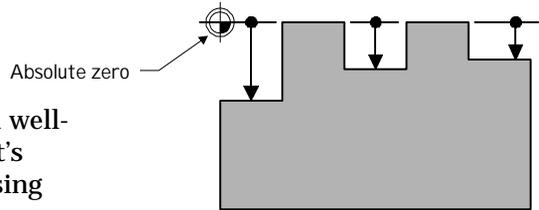
Absolute zero

Setting Absolute Zero at the Current Position

1. Move to desired location.
2. Make sure that the absolute position is displayed.   [ABS/INCR]   ABS

3. Zero the display.   [ZERO] [ENTER]   Shortcut   [ZERO] [ZERO]

Setting Absolute Zero

1. Touch the tool to the edge of the workpiece.
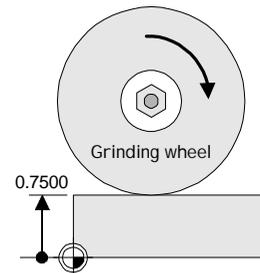
Grinding wheel

0.7500

2. Make sure that the absolute position is displayed.   [ABS/INCR]   ABS

3. Press the [ZERO] key for the appropriate axis.   [ZERO]   ABS ZERO SET

4. Enter the position of the tool.   [0] [.] [7] [5] [ENTER]

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Setting Absolute Zero Using an Electronic Edge Finder

1. Install the electronic edge finder and connect it to the readout.

2. Make sure that the absolute position is displayed. (ABS/INCR)   ABS

3. Press the ⌈ZERO⌋ key for the appropriate axis.   ZERO   ABS ZERO SET

4. Move slowly until the electronic edge
    finder touches the edge of the workpiece.
    The absolute position display will
    automatically be set to zero at the center
    of the edge finder.

    > You don't have to worry about
    > overtraveling because the edge
    > finder probe shaft is flexible. The
    > readout will zero on contact.
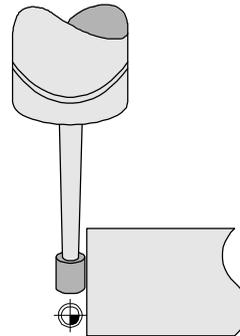
Incremental Zero

From the incremental display, press the ⌈ZERO⌋ key. This sets the display to zero at
the current tool position.

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Presetting

When you preset a dimension, the readout places an incremental zero at the location you specify. Then, the display automatically switches to incremental display so that you can move to zero.

Begin a preset by pressing an axis key (X for example). The information of the previous preset will appear. The display will show you if the preset is absolute or incremental. Use the $\begin{smallmatrix} ABS \\ INCR \end{smallmatrix}$ key to change it if needed.

Grinding
Wheel

The wheel is at 0.000 ABS.

Absolute Zero

3.250
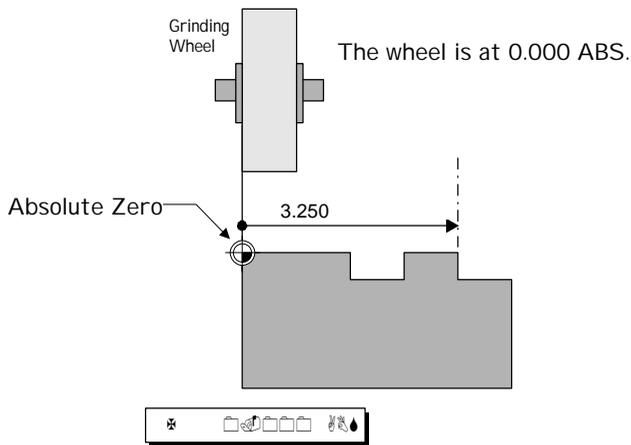
Preset the absolute location of the edge.

X   **3**   **.**   **2**   **5**   **0**   **ENTER**

Now the wheel is 3.250 on the negative side of the edge.

-3.250

$\begin{smallmatrix} ABS \\ INCR \end{smallmatrix}$

Incremental zero: the incremental display will read 0.000 when the wheel is here.

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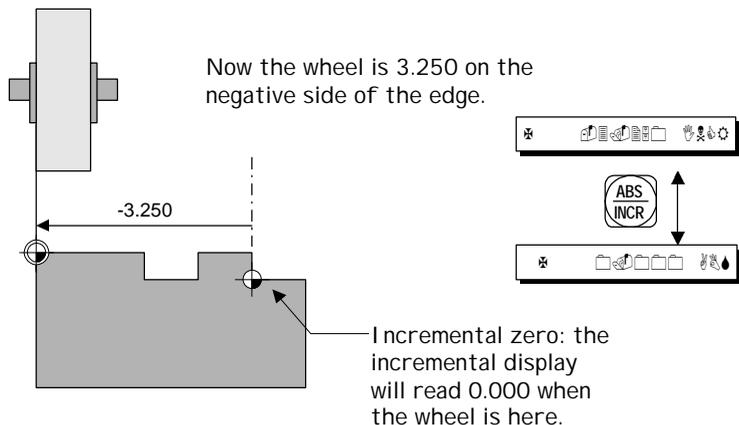
Absolute and Incremental Presets

To maintain the best tolerance and to minimize the chance for errors, use

- **absolute presets for absolute dimensions**

- **incremental presets for incremental dimensions.**

When you enter an absolute preset, it **does not matter** where the tool position is. The DRO 200G calculates the desired location automatically.
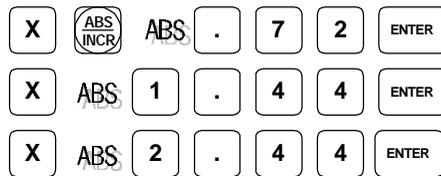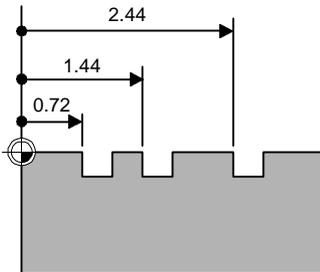
When you enter an incremental preset, the tool **must** be positioned at the location you are dimensioning from.

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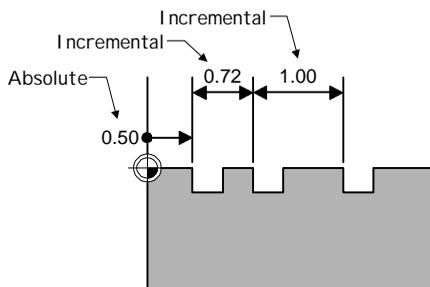
Near Zero Warning

When you are moving to zero, the readout can "warn" you when you are getting close. This allows you to machine faster and avoid overshooting your desired location.

You can set the near zero range in Setup.

Near zero range: digit left of
decimal point flashes to warn you.

Grinding wheel

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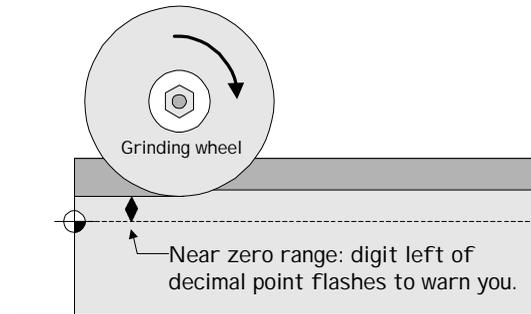
Setup

The ⒮ᴇᴛᵁᴾ key lets you change the system parameters. Some of these parameters are job related, meaning that they may change from job to job. Others are machine related and should be set as part of the installation. The machine-related parameters can be accessed by pressing:

SETUP ⬜ Access Code ⬜ ENTER

Use the X key to move from one parameter to the next. After the last parameter, the X key ends the setup process and saves any changes. Use the CLEAR key to move back to a previous parameter.

Some parameters have choices. Use the Y key to cycle through the available choices.

Pressing the ⒮ᴇᴛᵁᴾ key will terminate the setup process and save the changes.

Machine-Related Setup Parameters

Count Direction

This determines which way is positive. Move each axis in the positive count direction. The display will show a 1 or a 2 depending on count direction. You can change the count direction by pressing the Y key.

Encoder Resolution

Move each encoder until the readout senses and displays the resolution. You won't have to move more than two inches. For encoders without Position-Trac, you need to enter the scale resolution. You can press the Y key to select from common choices, or you can use the keypad to enter the resolution directly.

Job Setup Parameters

Display Resolution

The display resolution will be the same as the encoder resolution. If the job tolerance is coarser than the encoder resolution (±0.005 for example), you can adjust the display resolution so you won't be tempted to waste time by machining to a finer resolution. Use the $\boxed{Y}$ key to cycle through all the possible choices. The choices available depend upon the resolution of the encoders.

Scale Factor

You can define a scale factor for each axis. The typical scale factor is 1.000, which means that the displayed dimensions are the actual part dimensions. A scale factor less than 1 causes the part to be smaller than the print dimensions; a scale factor greater than 1 causes the part to be larger.

For a scale factor that allows for 3% material shrinkage, use this formula:

$$ScaleFactor = \frac{1}{1 - .03} = \frac{1}{.97} = 1.0309$$

Enter the factor by pressing $\boxed{1}$ $\boxed{.}$ $\boxed{0}$ $\boxed{3}$ $\boxed{0}$ $\boxed{9}$ $\boxed{\text{ENTER}}$

Additionally, a scale factor of −1.00 will produce a mirror image of the part. You can both mirror *and* scale a part.
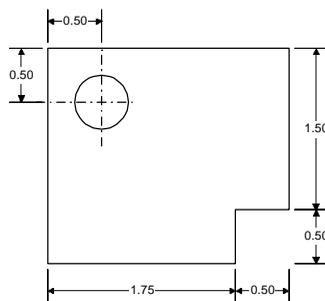
Print
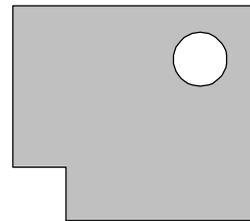
Resulting part with
X scale factor = -1
Y scale factor = +1

Near Zero Warning

Each axis has its own near zero range. You can activate or deactivate the near zero warning feature by pressing the $\boxed{Y}$ key. When the warning is activated, you can enter the range. Refer to page 11.

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Linear Error Compensation

The DRO 200G includes a linear error compensation feature that enables you to compensate for machine tool inaccuracies. You can have up to three different compensation segments per axis.

Segment 1	Segment 2	Segment 3

Machine table front view
(slightly exaggerated)
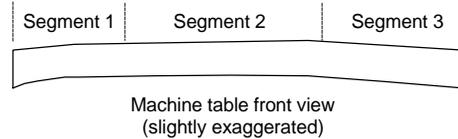
You will need a dial indicator and a measurement standard.

1. Enter the number of segments you will use. If you do not want to use any error correction, enter 0. Press $\boxed{X}$ to start the first interval.

2. Position the standard in the center of the first segment.

3. Press $\boxed{Y}$

4. Enter one edge of the standard.
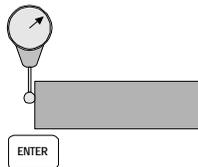
ENTER

5. Enter the other edge of the standard.
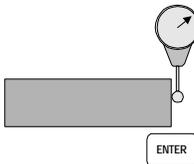
ENTER

6. Enter the actual size of the standard, including the probe diameter if necessary.

8.1250
Opposite sides
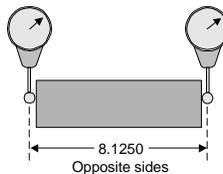
If the display shows all dashes, refer to "Display Overflow Errors" on page 23.

7. Press $\boxed{X}$ for the next segment or, if all segments are done, the next axis.

Installation

IMPORTANT

Before installing the DRO 200G readout, record the serial number on the warranty card and return it to ACU-RITE INCORPORATED. <u>The serial number label is located on the back of the readout</u>.

Selecting a Location

Selecting a location for the readout is an important consideration for proper installation. Keep the following points in mind when selecting a safe and convenient location:

- The readout should be within reach of the operator for easy access to the keypad.

- The readout should be approximately at eye level.

- Avoid moving components or tools and minimize coolant splash or spray.

- The operating environment must be within the temperature range of 0° to 40° C (32° to 104°F) with a non-condensing relative humidity of 25% to 85%.

Proper Mounting

ACU-RITE has developed special mounting kits for the readout which address the most common mounting requirements. Mounting kits include:

- Column and base machine mountings

- Hardware and mounting instructions

These kits are available from your factory authorized ACU-RITE Distributor or OEM/OEI.

If you fabricate a support device for the readout, it should be large enough and strong enough to accommodate the readout. It must also be stiff enough to minimize any vibration induced by machinery on the shop floor.

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Connecting the Encoders

Insert the connector from each encoder into the mating connector on the back of the readout. Fasten it with a small screwdriver.

Encoder input 1 will be displayed in the readout's top display, input 2 in the next display, and input 3, if any, in the bottom display.

Provide enough slack in the encoder cables to allow for full travel of all machine axes. Check that machine movements will not pinch the cables. Use the cable tie-down hardware kits supplied with the encoders to fasten the cables neatly to the machine.

Connecting a Ground Wire

Connect a ground wire from the terminal on the back of the readout to the machine. The machine should also be connected to a solid earth ground. If not, be sure that the readout is.

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Checking Voltage and Connecting Power

> ⚠️ **CAUTION**
>
> Connecting the readout to a power source outside of the acceptable range, or making an inappropriate setting with the voltage selector, may damage the readout, the encoders, or both.

Check that the voltage available at the power source is within specification before connecting it to the readout. If required, set the voltage selector to match the line voltage.

1. Remove the caution label from the input module, and use a thin-blade screwdriver in the slot at the top of the power input module to open the module cover.

Opening slot
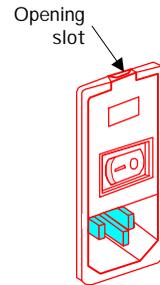
2. Pull the selection block out.
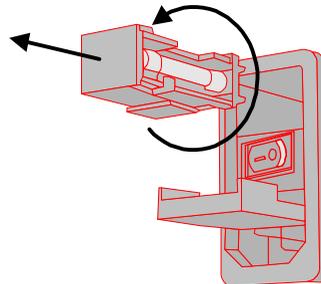
3. Remove the fuse, move the shorting bar to the other side, install the proper fuse, and push the block back into place.
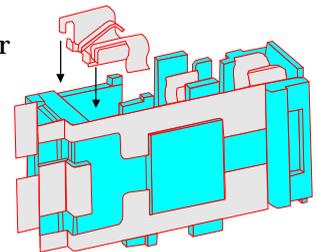
4. Close and snap the cover shut.

The voltage setting will show through the window in the voltage selection cover. Connect the readout to the power source using the power cord supplied.

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Readout Specifications

Characteristic	Specification
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 95% relative humidity (non-condensing)

Input requirements
 	
  Voltage:
 	
  Frequency:
 	
  Current:
	
	115VAC or 230VAC (+/-20%), single phase
	
	47-63 Hz
	
	300ma @115V, 150ma @230V

Fuse	115V operation: ½ A, 250V, 3AG, Slo-blo 230V operation: ¼ A, 250V, 3AG, Slo-blo

Encoder input	Position signals: channels A & B
	     TTL square wave signal in quadrature
	     (90° nominal phase relationship)
	     Maximum input rate: 50 KHz
	
	Reference signal: TTL square wave

Edge finder input	Compatible with ACU-RITE electronic edge finder
Size	12.5"W x 5.125"D x 6.5H"
Weight	7.5 lbs.
Mounting	Bottom: two ¼ -20 threaded inserts
FCC compliance	Class A

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Troubleshooting

This section is intended to provide you with some basic troubleshooting assistance with your readout system. If you cannot correct the problem after following these instructions, contact your authorized ACU-RITE distributor or OEM/OEI for repair or replacement procedures.

No Operation

> **NOTICE**
>
> If you turn power off, you must wait at least 5 seconds before turning it back on, or the readout may not power up. This is because the power supply, in order to withstand brief power outages and brownouts, requires several seconds to reset itself.

If the readout display will not operate, check the following conditions:

- **Check AC power source.** If the readout cannot be powered up, confirm that line voltage is present at the source and that the line voltage meets the required specifications.

- **Check power cord.** Remove the power cord at the electrical input module on the back of the readout. Determine if line voltage is present at this end of the cord.

- **Check fuse.** With the power cord removed, use a thin straight-blade screwdriver to remove the cover of the electrical input module. Refer to page 17. Slide out the fuse holder and check the fuse. If necessary, replace it. Replace the input module cover by snapping it back into place, and reconnect the power cord.

> ⚠ **CAUTION**
>
> Replace fuses only with the specified type. Using incorrect fuses can present a safety hazard. The readout may also be permanently damaged. Refer to the Readout Specification chart on page 18 for the correct fuse.

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Incorrect Operation

If system positioning does not seem to be repeatable, the problem could be with the machine tool or with the readout system.

- ***Check the machine tool.*** Check that the table is not locked. Ensure that the knee, ram, head bolts, turret-to-column bolts, and head-to-knuckle bolts are properly secured. Check the gib adjustments. Tram the heads. Check spindle run-out.

- ***Check linear encoders.*** Check each encoder and reading head for proper installation. Ensure that the mounting brackets are secure.

If the system seems to be displaying incorrect postions, check the following items.

- ***Verify presets.*** Make sure the numbers you enter are correct.

- ***Verify tool.*** Check that the correct tool or grinding wheel is being used. Check the tool or grinding wheel for wear.

- ***Verify the scale factor.*** Ensure that the correct scale factor is being used.

- ***Verify linear error compensation.*** Make sure that the factors used for linear error compensation are correct.

Power-On Self Test

There are four tests performed when power is applied to the readout. You will not notice these tests unless a problem is found, in which case a message will scroll across the display.

Keypad—a key was detected stuck down. The message will display what *row* (x) and *column* (y) the stuck key is in:

<div align="center">

KEY STUCK – RxCy – PRESS CLEAR

</div>

Parameter memory—some of the system setup parameters are not valid. You may be able to check and reset these settings, but it's possible they will be lost again. The readout should be serviced as soon as possible.

<div align="center">

MEMORY FAILURE [1] – PRESS CLEAR

</div>

> ⚠️ **CAUTION**
>
> Some working settings are not valid. Proceed with caution.

Working memory—the memory used by the readout for calculations is faulty. While it may be possible to use the readout, it's position display and other information will not be reliable.

MEMORY FAILURE [2] – PRESS CLEAR

⚠️ **CAUTION**

The readout cannot be relied on for correct operation if any memory failure is indicated. The readout should be serviced immediately.

Program memory—the memory used to store the software is faulty. While it may be possible to operate the readout, some functions will not work properly and incorrect information may be displayed.

MEMORY FAILURE [3] – PRESS CLEAR

⚠️ **CAUTION**

The readout cannot be relied on for correct operation if any memory failure is indicated. The readout should be serviced immediately.

Internal Testing

Several internal tests may be performed to ensure that the readout is functioning properly. Tests are available for the internal memory, the keypad, and the display. In addition, the testing procedure reports the software version of the readout.

Begin the internal testing by holding down the [.] key for about 2 seconds. The software version will appear in the X-axis display

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Keypad test Begin by pressing the $\boxed{\text{X}}$ key, then press each key (except the $\boxed{\text{X}}$ key) in turn to verify that it is functioning properly. When a key is pressed, the X-axis activates a "plus sign" indicator and increments a count. When you release the key, the plus sign disappears.

Display test Begin by pressing the $\boxed{\text{X}}$ key. All indicators in all displays will light. Visually check each portion of each display to ensure that they are functioning properly.

Press $\boxed{\text{X}}$ again to test the display electronics. All decimal points on all displays will light momentarily, then each segment of all displays will light in turn. Press $\boxed{\text{X}}$ again, and each digit of all displays will light, one digit at a time, starting with the leftmost digit and moving to the right.

Exit the diagnostics by pressing the $\boxed{\text{X}}$ key.

Other Errors

The readout includes built-in test and error-checking circuitry. This circuitry identifies errors that occur, and reports the problem to the operator. Errors are reported by scrolling messages in the X-axis display.

Loss of power is indicated by the "Power was off" message. Loss of power means that power to the readout has been interrupted. Since power to the encoders has also been interrupted, positioning information may no longer be accurate. Press the $\boxed{\text{CLEAR}}$ key to clear the error message. All display measurements will be zeroed. Refer to page 4 for information about position recovery.

Counting errors are indicated by the "Scale miscount" message, telling you in which axis the miscount occurred. Counting errors result from distorted electrical signals from an encoder. These signals can be a result of an encoder malfunction, misalignment, mounting problems, or electrical interference. Press the $\boxed{\text{CLEAR}}$ key to clear the error message. The axis display (for both absolute and incremental measurements) will be zeroed. Follow these steps to determine if your difficulties are associated with the readout or with the encoder.

• Ensure that the linear encoder connectors are correctly seated.

• Swap linear encoder cables at the readout to see if the problem still appears in the same display.

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- If the problem remains in the same display, the readout is in error.

- If the problem follows the connection change, the linear encoder may be in error. Refer to the Checking the Linear Encoders section of your encoder reference manual.

Display overflow errors are indicated by dashes in all digits in an axis display. A numeric overflow occurs when the intended measurement is too large for the eight-digit display. Clear the error by returning the machine table into an area where measurements can again be displayed, selecting a lower display resolution, setting a new preset, or zeroing the display.

This error may also occur when using the automatic compensation routine while setting the LEC parameter. An error indicates that the calculated compensation factor was outside the acceptable range of -9999 to +9999, and usually is the result of incorrectly entering data. Clear the error and return to the beginning of the linear error compensation routine. Refer to page 14.

Data Logging

The readout collects information about itself while it is being used. This information is stored in memory for review at a later time.

Press and hold the ⎡ · ⎤ key until the software version is displayed. Then press the ⎡SETUP⎤ and ⎡MM⎤ keys simultaneously. Use the ⎡ X ⎤ key to cycle through the following information.

Power on time—displayed in decimal hours.

Scale travel distance—the travel distance for each axis is scrolled one after the other.

Last 3 errors—the most recent three errors are remembered and messages for the errors are scrolled one after the other.

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