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 installation related (machine) setup parameters.

IMPORTANT
The access code is 8891

Refer to the Setup 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.

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.

ACU-RITE®

TABLE OF CONTENTS

DRO 200E

⚠

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.

ACU-RITE®

Introduction

ACU-RITE readouts provide application-specific features allowing you to obtain the most productivity from your manual machine tools. This readout is designed specifically for EDM applications. Specific features include a special EDM display, retract relays, and dwell capabilities.

A Tour of the Readout

Front and Back Views

Axis keys

Zero keys

Indicators

EDM function keys
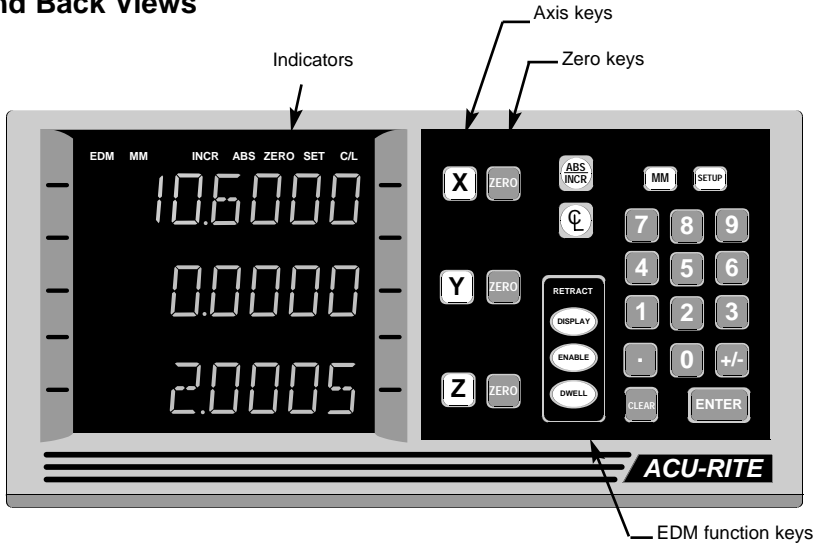
Electrical & fuse rating information

Input for electronic edge finder or spark detector

Scale inputs

Power switch & voltage selector

Ground wire connection

Output relay connector

Model number and Serial number
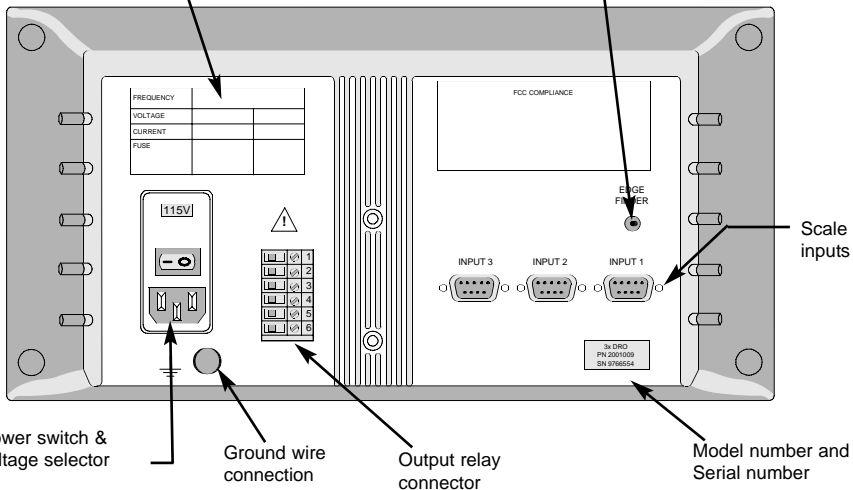
Keypad

Selects absolute or incremental display

English /metric conversion

System setup para-meters

Used to locate centerlines

Enter all numeric values with these
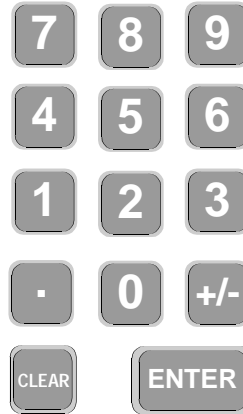
Use to begin a preset

Use Clear key to erase digits that you entered by mistake, and to take you back to a previous para-meter.

RETRACT

DISPLAY

ENABLE

DWELL

Switches display between DRO and EDM views. Program retract and dwell functions.

Displays

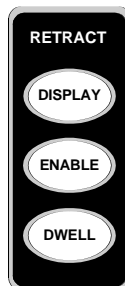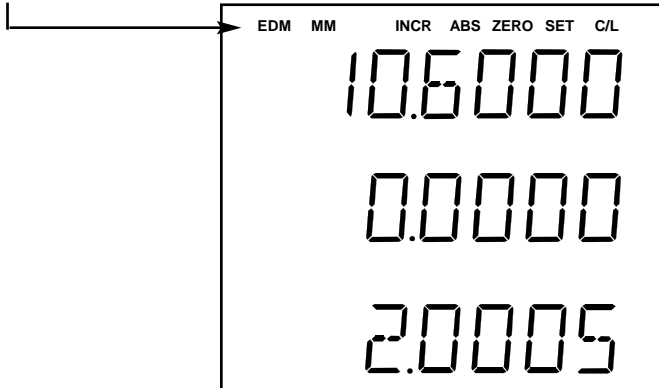At the top of the display window is a row of indicators. These tell you the current state of the readout.

ZERO

Appears when setting an absolute zero.

SET

Appears when you are setting a preset or an absolute zero.

C/L

Tells you when the centerline function is active.

EDM

Appears when EDM view is displaying cut depth information.

MM

Appears when the display is in metric, dark when the display is in inches.

INCR   ABS

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

In addition to the lighted indicators along the top of the display, the top axis display will scroll longer messages to assist you with some of the procedures.

In this manual, the text representing key presses, indicators and display text are shown in their own individual font styles so they are more easily distinguished from each other and the rest of the manual text.

Key Presses: ENTER Y SETUP

INDICATORS

"DISPLAY TEXT"

ACU-RITE®

Power-On Position Recovery

Position-Trac™

Current ACU-RITE precision glass scales, including the ENC 150, contain distance-encrypted reference marks allowing you to quickly recall absolute zero (datum) after a power interruption. When power is restored, the readout will scroll a message indicating power has been lost, and will prompt you to move each axis until a reference mark is located. After this message, a flashing decimal point will indicate that absolute zero has not been recalled for each axis. To recall zero, move each axis in a positive count direction. By traversing approximately 2 inches on each axis, you will re-establish and display current position relative to your last set zero.

If you use a scale without Position-Trac™ distance-encrypted reference marks, the procedure for recovering your position is slightly different. You must find a specific reference mark and then use the same mark when recalling zero. To setup your display for non-Position-Trac™ scales, refer to page 21, "Machine Related Parameters".

To recall Zero using non-Position-Trac™ scales:

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 the positive count direction.

Machine Conventions

For the purposes of this manual, all of the examples are based on the following conventions.

As you face the machine:

- The tool moving right is X-axis positive

- The tool moving away from you is Y-axis positive

- The tool moving up is Z-axis positive
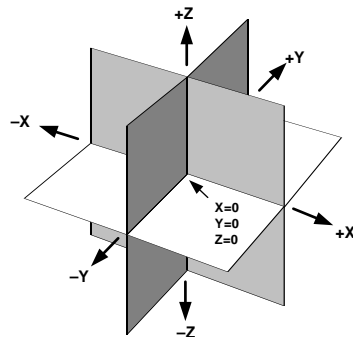
Readout Operations

DRO View

This section describes the readout's functions when it is in the DRO view. This includes a description of absolute and incremental displays, the various methods of setting absolute zero (datum) and presetting absolute and incremental distances.
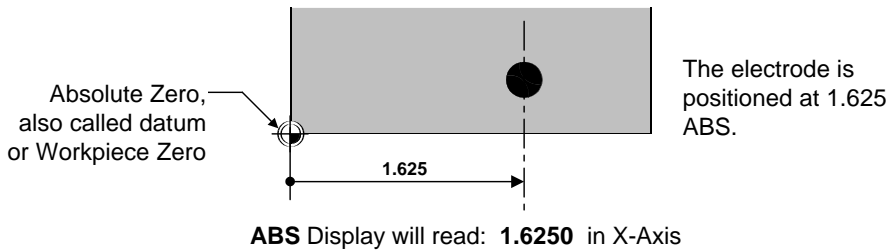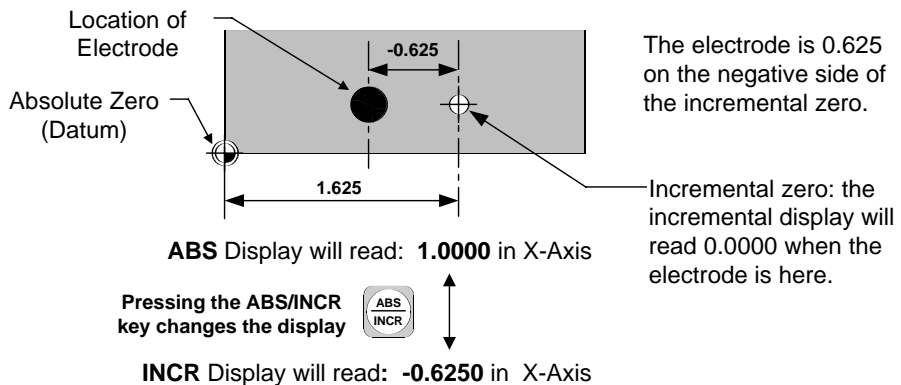
Absolute Display

Shows the distance from your current position to *absolute zero (datum)*.

Absolute Zero, also called datum or Workpiece Zero

1.625

The electrode is positioned at 1.625 ABS.

ABS Display will read: **1.6250** in X-Axis

Incremental Display

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

Location of Electrode

Absolute Zero (Datum)

-0.625

1.625

The electrode is 0.625 on the negative side of the incremental zero.

Incremental zero: the incremental display will read 0.0000 when the electrode is here.

ABS Display will read: **1.0000** in X-Axis

Pressing the ABS/INCR key changes the display

ABS INCR

**INCR** Display will read**: -0.6250** in X-Axis

Automatic Display Switching

Sometimes the readout will switch from absolute to incremental automatically. For example, when you enter a preset the readout 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 X-axis display.

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Zeroing the Displays

Absolute Zero (Datum)

On many prints, dimensions are measured from a datum. By setting the readout's absolute display to zero at a well-chosen edge, you can position the ram based on dimensions directly from the print.

1.25

Absolute Zero (Datum)

0.72

1.44

2.44
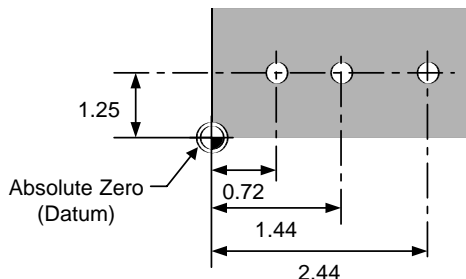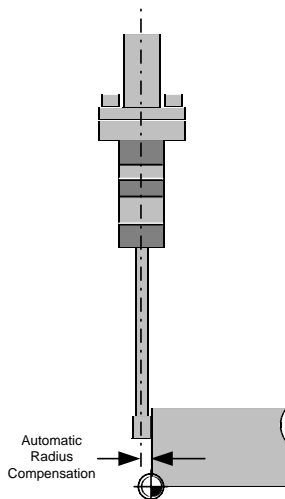
Setting Absolute Zero (Datum) at the Current Position

1. Move to desired location.

2. Make sure that the absolute indicator (**ABS**) is lit. Press the (ABS/INCR) key if it is not.

3. Press the |zero| key next to the desired axis twice.

Setting Absolute Zero (Datum) Using an Electronic Edge Finder

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

2. Make sure that the absolute indicator (**ABS**) is lit. Press the (ABS/INCR) key if it is not.

3. Press the |zero| key for the appropriate axis once. The readout will display the following; "_ _ _ _ _ _ _ 0".

4. Move slowly until the edge finder touches the edge of the workpiece. The absolute position display will automatically be set to zero at the edge of the workpiece. Refer to setup to automatically compensate for the edge finder's tip diameter.

    Note: You don't have to worry about overtraveling. The readout will zero on contact.

    Note: If you are using an electronic edge finder with your readout, a metallic surface must be present in order for the edgefinder to work properly.

Automatic Radius Compensation

Setting Absolute Zero (Datum) with a Tool

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

2. Make sure that the absolute indicator (**ABS**) is lit. Press the (ABS/INCR) key if it is not.

3. Press the [ZERO] key for the appropriate axis.
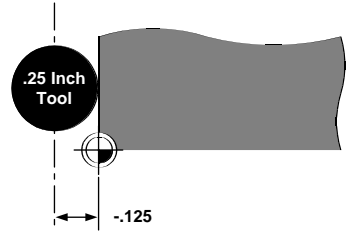
    The readout will display these indicators: **ABS ZERO SET**

4. Enter the position of the tool center and press [ENTER].

Setting Absolute Zero (Datum) Using Center Line

You can set absolute zero (datum) at the center of your workpiece or in the center of a hole. To set absolute zero using centerline:

1. Verify the readout is in **ABS** mode. The **ABS** indicator will be displayed. If not press the (ABS/INCR) key to select the absolute mode.

2. Press the [ZERO] key for the appropriate axis.

3. Press the (¢) key. A message will ask you to "ENTER FIRST EDGE". Move to the first edge.

    Note: The closer you are to the center of the feature the more accurate your centerline calculation will be.

4. Press the [ENTER] key.

5. A message will ask you to "ENTER SECOND EDGE". Move to the second edge.
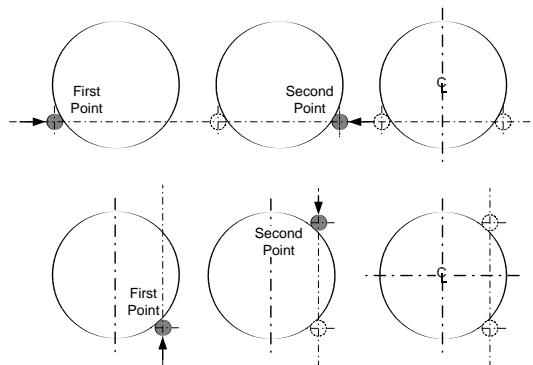
6. Press [ENTER] key.

    Absolute zero (datum) is now set at the center between the two points. The display will change showing you the distance to center line on that axis.

Repeat this procedure to set absolute zero center line in the other axis.

Absolute zero is now set in the center on both X and Y-axes.

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Incremental Zero

From the incremental display (**INCR**), press the [zero] key next to the appropriate axis. This sets the display to zero at the current tool position.

Presetting

Absolute

The absolute preset is based on datum. When an absolute preset is entered, the readout calculates the incremental distance to the preset position. In the example below, the current position is 1.0000" and the desired position is 1.5000" as measured from datum. The key press sequence is [X], (ABS/INCR) (**ABS** indicator is lit), [1], [·], [5], and [ENTER]. The readout will automatically shift to incremental display mode and show the distance remaining to the preset position.

[X] [ABS/INCR] **ABS** [1] [·] [5] [ENTER]   An absolute (ABS) preset is based on Absolute Zero (Datum).

INCR Display will read: **-0.5000** in X-Axis

◄————1.50————► ◄—— **Absolute Preset**
◄——1.00——►

Current Position

Absolute Zero (Datum)

◄————1.50————► ◄—— **Incrementel Preset**

[X] [ABS/INCR] **INCR** [1] [·] [5] [ENTER]   An incrementel (INCR) preset is based on current position.

INCR Display will read: **-1.5000** in X-Axis
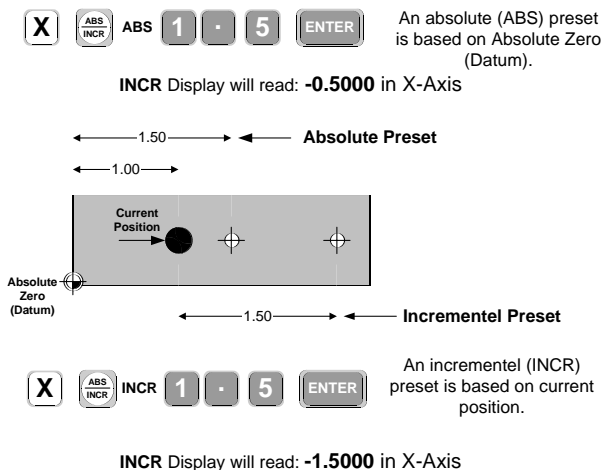
Incremental

The incremental preset is based on current position. When an incremental preset is entered, the readout displays the length of preset value. In the above example, the current position is 1.0000" and the desired position is 1.5000" from current position. The key press sequence is [X], (ABS/INCR) (**INCR** indicator is lit), [1], [·], [5], [ENTER]. The readout will automatically shift to incremental mode and show the distance to move.

Absolute and Incremental Presets

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

- absolute presets for absolute dimensions.

- incremental presets for incremental dimensions.

The following examples, shows how to make the identical part using absolute presetting or incremental presetting.

Absolute Example:

1. Verify the readout is in **ABS** mode. If not press (ABS/INCR).

2. Press, in order, ☒ key, then type in ⬚·, ☐7, ☐2, then ⟨ENTER⟩.

3. Repeat for dimensions 1.44 and 2.44.

Note: When you enter an absolute preset, it does not matter where the tool position is. This system calculates the desired location from absolute zero (datum).
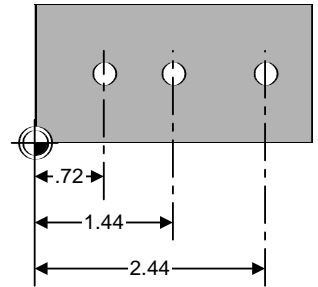
Incremental Example:

1. Verify the readout is in **ABS** mode. If not press (ABS/INCR).

2. Enter the key sequence:

   ☒, ⬚·, ☐7, ☐2, ⟨ENTER⟩.

3. Display will automatically shift to incremental. Move the X-axis until "0.0000" is displayed.

4. Enter the key sequence:

   ☒, (ABS/INCR), to select incremental (**INCR**)

   ⬚·, ☐7, ☐2, ⟨ENTER⟩.

5. Move the X-axis until "0.0000" is displayed.

6. Repeat steps 4 & 5 for incremental dimension 1.00.
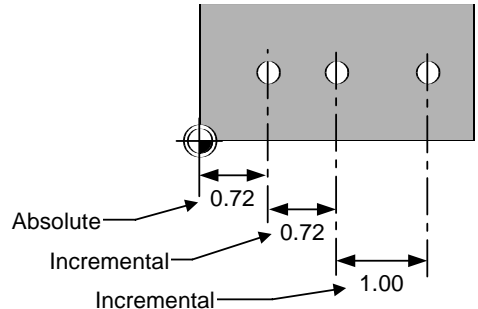
Note: When you enter an incremental preset, the tool must be positioned at the location you are dimensioning from.

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Center-line Presets

You can set a preset at the center of
a workpiece, or in the center of a hole.

To preset incremental zero on a center-
line:

1. Press the axis key you wish to find
    center with.

2. Press the centerline Ⓒ key. The
    SET C/L indicator will be lit.

3. A message will ask you to "ENTER
    FIRST EDGE".

4. Move to first edge and press the ENTER key.

5. A message will ask you to "ENTER SECOND EDGE." Move to the second
    edge and press ENTER key.

6. The display will automatically change to show you the incremental distance
    to the center between the two entered points.

7. Repeat this procedure for each axis as needed.
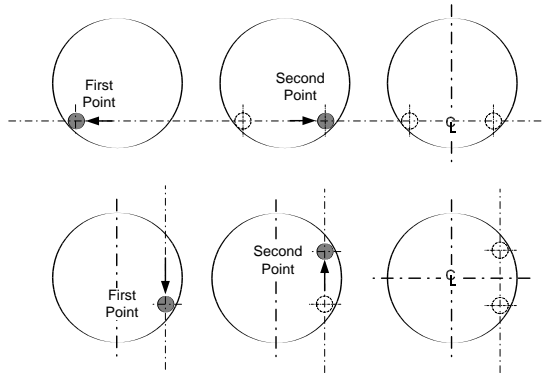
EDM View

This readout provides a very flexible dwell and retract capability which can be config-ured to a wide variety of EDM control schemes. Your particular EDM machine may not have the ability to use all of these features described in this section.

EDM Display

To help you monitor the progress of a cut, press the (DISPLAY) key. The **EDM** indicator will light up. All three displays show you something about the Z-axis.
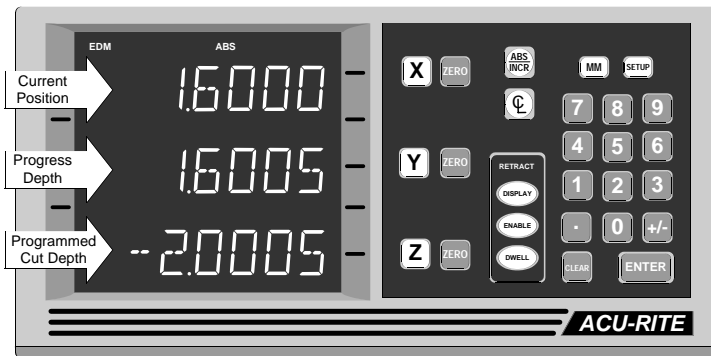
- The top display shows the current position of the electrode.

- The center display shows the progress depth.

- The bottom display shows the programmed cut depth.

Press (DISPLAY) key again to return to X-Y-Z display.

Presetting the Cut Depth

The cut depth is the point at which you want the cut to end. At this point, you can program the ram to dwell and or retract. You need to preset the cut depth when using the ram retract, dwell, sparkout and reverse fault features. The cut depth can be set prior to, or after, setting datum.

To preset the cut depth:

1. Press the (DISPLAY) key to switch to the **EDM** display.

2. Verify the readout is in **ABS** mode. If not press (ABS INCR).

3. Press the Z key.

4. Enter the desired cut depth and press (ENTER).

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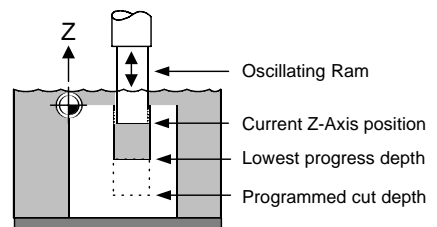
Setting Absolute Zero (Datum) at Current Position

1. In either DRO or EDM view, verify the readout is in **ABS** mode. If not press (ABS/INCR).

2. Position the ram to the point where 1st spark will occur.

3. Press the [ZERO] key next to the [Z] key twice.
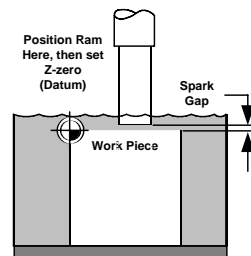
Setting Absolute Zero (Datum) Using a Preset

Presetting absolute zero (datum) allows the operator to establish absolute zero at a point other than the current position. To preset absolute zero:

1. Verify the readout is in **ABS** mode. If not press (ABS/INCR).

2. Position the ram to a known location.

3. Press the [ZERO] key next to the [Z] key once.

4. Enter the distance to the desired zero location.

Example:

The desired absolute zero (datum) is at the top of the work-piece. The electrode is known to be 2.5 inches long and is too fragile to be used to set zero.

1. Verify the readout is in **ABS** mode. If not press (ABS/INCR).

2. Position the electrode clamp at the top of the work-piece.

3. Press the [ZERO] key next to the [Z] key once. The display will show; " _ _ _ _ _ _ _ 0".

4. Press ± [2], [.], [5] and then the [ENTER] key. The display will show "-2.5000" in the Z-axis.

   With the electrode installed, the Z-axis absolute zero is now set at the top of the workpiece.

Preset at -2.5 inches
ABS Display shows
-2.5000 in Z-Axis

Electrode Clamp

Work Piece
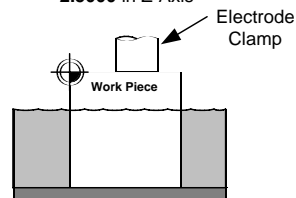
Without Electrode

ABS Display shows
0.0000 in Z-Axis

2.500 electrode length

Work Piece
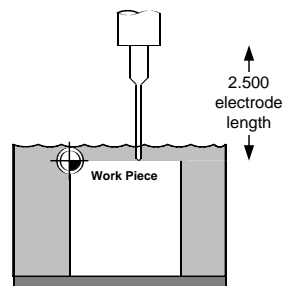
With Electrode

Zeroing the Z-axis Using the Spark Detector

If you set zero using the optional ACU-RITE spark detector, you can easily compensate for spark gap and electrode erosion from one cut to the next.

1. Preset the depth of the cut (explained on page 11).

2. Verify the readout is in **ABS** mode. If not press (ABS/INCR).

3. Press the [ZERO] key next to the [Z] key once.
   The Z-AXIS display will look like this;
   "_ _ _ _ _ _ _ 0".

4. Start the cut. When the first spark is detected,
   the readout sets the top of the workpiece to zero.

5. When the retract point is reached, any programmed dwell and/or retract will occur.
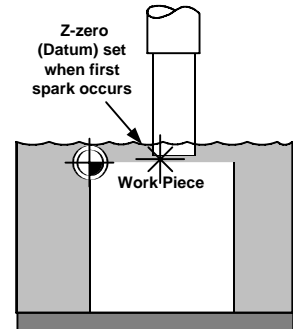
EDM Parameters

Pressing the (ENABLE) key allows the operator to access four EDM function parameters. When (ENABLE) is pressed, "EDM" is displayed along with a flashing dash. A flashing dash indicates that the key to the right of it has a function. Pressing the [X] key will advance you to the next parameter. Pressing the [Y] key will allow you to change the parameter setting. Pressing the [CLEAR] key will clear information entered or take you back to the normal display.

Enable

This parameter allows you to suspend all EDM functions. When "ON" the Dwell, Retract and Position Hold relays are active. When "OFF", all relays remain in their relaxed states. Turning off all functions allows you to setup a job without the concern of activating the retract or dwell functions accidentally. To indicate all functions are off, the entire Z-axis display will blink.

1. Press the (ENABLE) key.

2. Press the [Y] key to toggle between "ON" and "OFF".

3. Press the [X] key to continue to the next parameter or press the (ENABLE) key to return to EDM/DRO view.

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R DIST

R DIST, or Retract Distance, allows you to establish an incremental distance above the cut depth where the Retract relay will relax, stopping retraction movement.

When used, the Retract relay will activate when the cut depth is reached and after any dwell cycle has completed. Retract ends when the current Z position equals R-DIST or Z-TOP whichever occurs first.

To establish a retract distance:

1. Press the (ENABLE) key then the [X] key. The display will read "R DIST".

2. Press the [Y] key to toggle the R-DIST function "OFF" or to begin entering a distance.

3. Enter the retract distance. For example, type in [2],[.],[5] and press the [ENTER] key. Pressing [ENTER] saves the information entered and advances you to the next parameter.

Z TOP is an absolute distance from Datum

R DIST is incremental from your programmed cut depth

4. Press the [X] key to continue to the next parameter or press the (ENABLE) key to return to the EDM/DRO display.

Z TOP

Similar to R DIST, Z TOP allows the operator to establish a distance above absolute zero (datum) where the Retract relay will relax, stopping retraction movement.

To establish a Z TOP position:

1. Press the (ENABLE) key then the [X] key twice. The display will read "Z TOP".

2. Press the [Y] key to toggle the Z TOP function "OFF" or to begin entering the Z TOP parameter.

3. Enter the Z TOP distance. For example, type in [2],[.],[5] and press the [ENTER] key. Pressing [ENTER] saves the information entered and advances you to the next parameter.

4. Press the [X] key to continue to the next parameter or press the (ENABLE) key to return to the EDM/DRO view.

R FAULT

R FAULT, or Retract Fault, stops a cut in the event that the ram drifts above a pre-set range from the lowest progress depth. When the R FAULT distance is reached the retract relay is actuated for 1/10th of a second to halt the cutting cycle.

R FAULT DISTANCE

If the electrode moves above this plane, the retract relay will trigger halting the cut cycle.

Oscillating Ram

Current Z-Axis position

Lowest progress depth

Programmed cut depth

The R FAULT value will follow the lowest progress depth during the cut cycle.
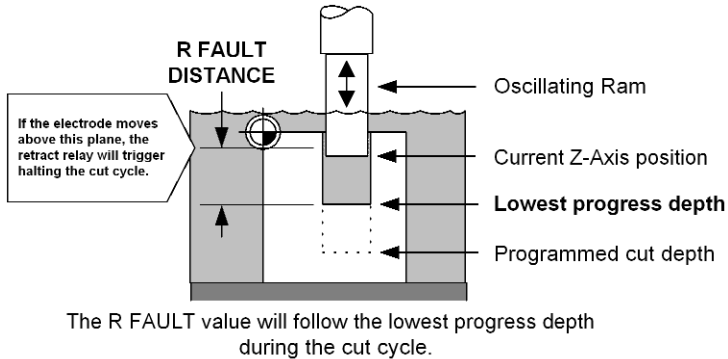
To establish an R FAULT point:

1. Press the (ENABLE) key then the [X] key three times. The display will read "R FAULT".

2. Press the [Y] key to toggle between the R FAULT function "OFF" or to begin entering a distance.

3. Enter the retract fault distance as a real number (positive value). For example, type in [2], [.], [5] then press the [ENTER] key.

4. Pressing [ENTER] key will save the information entered and return to the EDM/DRO view.

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README

Dwell

The two DWELL parameters tell the EDM control to hold at the cut depth to obtain a better finish or to allow an orbiter to operate. Press the (DWELL) key to view or change the parameters.

Timed Dwell

The D-TIME, or Dwell Time parameter causes the ram to hold a cut depth for the number of minutes that you enter.

To enter or change the dwell time use the keypad to enter the minutes you would like the EDM to dwell. The time is displayed in minutes and fractions of minutes (i. e. 1.0167 = 1 minute, 1 second, or 1.5 = 1 minute 30 seconds).

To set a Dwell time:

1. Press the (DWELL) key. The display will read "DWELL TIME MINUTES" and then "D TIME".

2. Press the **Y** key to toggle the D-TIME function "ON" or "OFF", and use the key pad to enter or change the Dwell time, then press ENTER. (Pressing ENTER saves the information and advances you to the next parameter.)

3. Set Sparkout condition, as shown below, or press the (DWELL) key to return to the EDM/DRO display.

Dwell Until Sparkout

With the optional ACU-RITE spark detector connected to the readout, you can set the dwell to last until sparkout is detected. The sparkout condition is determined by measuring the time between sparks. When this time becomes long enough (greater than the **S-TIME** parameter), the dwell cycle ends and the ram retracts. Use the **Y** key to turn the **S-TIME** parameter on or off. When it's on, the number of minutes can be entered that defines sparkout

1. Press the (DWELL) key then the **X** key the display will read "Sparkout time minutes" and then "S-TIME".

2. Press the **Y** key to toggle this parameter "ON" or"OFF", and use the keypad to enter the time between sparks you wish to monitor. For example: .0167 = 1 second, .5 = 30 seconds, then press ENTER. (Pressing ENTER saves the information and advances you to the next parameter.)

Both timed dwell and sparkout can be enabled at the same time. Whichever occurs first will terminate the dwell cycle.

Setup

The `SETUP` key lets you access the many readout configuration parameters. Some of these parameters are "job related", meaning that they may change from job to job. Others are "machine related" and are only set when the readout is installed or maintained.

Press the `SETUP` key to access these parameters. 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 return to a previous parameter. Some parameters have several possible selections. A flashing dash by the `Y` key indicates that the `Y` key can be used to cycle through the available choices. At any time during setup, pressing the `SETUP` key will end the setup process, and save changes.

"Job Related" Setup Parameters

These parameters are used to adjust the readout display to suit specific job requirements. You can access the job parameters by pressing the `SETUP` key. Then press the `X` or `ENTER` key. Use the `X` key to advance to the next parameter. Use the `CLEAR` key to return to a previous parameter. A flashing dash next to an axis key indicates that the key has a function.

Display Resolution

The display resolution parameter allows you to adjust the increment by which the display counts for each axis. Press the `X` key to advance to the next parameter. Press the `Y` key to change the numeric value of the parameter:

> "X DISP" indicates the display resolution for the X-axis.
> "Y DISP" indicates the display resolution for the Y-axis.
> "Z DISP" indicates the display resolution for the Z-axis.

Press the `X` key to continue with Setup or the `SETUP` key to save changes and exit Setup.

Scale Factor

This function allows the operator to adjust the display to automatically compensate for material shrinkage or expansion so you can quickly and easily finish a job with out the need to calculate each dimension. If the print has a shrinkage/expansion factor you can enter this value here and proceed to machine to nominal dimensions. Press the `X` key to advance to the next parameter. Use the keypad to change the display value.

> "X FACTOR" indicates the scale factor for the X-axis.
> "Y FACTOR" indicates the scale factor for the Y-axis.
> "Z FACTOR" indicates the scale factor for the Z-axis.

When power is turned off or power is interrupted scale factors will return to 1.000. Press the `X` key to continue with Setup or the `SETUP` key to save changes and exit Setup.

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Near Zero Warning

When used with presets, Near Zero Warning allows you to establish a distance from zero where the display will indicate you are nearing the end of your cut (zero).

When the established point is reached while approaching zero, the digit(s) to the left of the decimal will flash. The range is, in effect, on both the positive and negative side of zero. When zero is reached the flashing digits stop. Near Zero Warning will not reset until you preset or move a distance greater than the established range.

◄.2500 Near Zero Warning Range►

Display Begins Flashing	Display Stops Flashing	Display Stops Flashing	Display Begins Flashing

Near Zero Resets	Near Zero Resets

-1/2	0	1/2

Digits Left of the decimal flash when you are within the Near Zero range. ➔ **.2500**
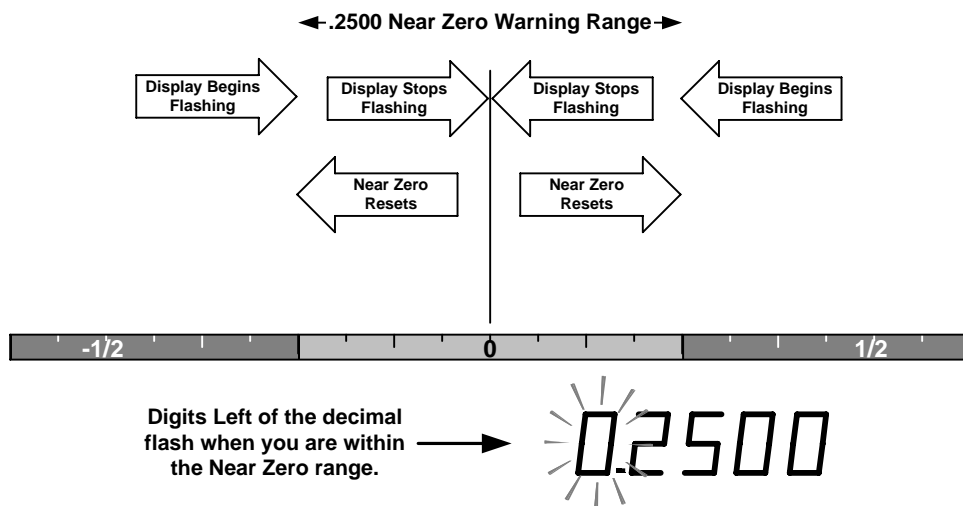
When you are in the Near Zero parameter for the X-axis "X NEAR 0" will be displayed. "OFF" will be displayed if the parameter is currently off. A numeric value will be displayed if the parameter is already on. Press the **Y** key to turn the Near Zero parameter on or off. Use the keypad to change the value displayed.

Press the **X** key to cycle through the remaining axis factors:

> "X NEAR 0" indicates the near zero setting for the X-axis.
> "Y NEAR 0" indicates the near zero setting for the Y-axis.
> "Z NEAR 0" indicates the near zero setting for the Z-axis.

Press the **X** key to continue with Setup or the **setup** key to save changes and exit Setup.

Linear Error Compensation

This readout includes a linear error compensation (LEC) feature that enables you to compensate for machine tool inaccuracies by using a simple measuring standard. You can have up to three different compensation segments per axis. For linear error compensation to be effective, the error must repeat. If the error is different each time it is measured, check and adjust the machine ways and lead screws. Also check scale mounting bracketry.

If only one segment per axis is being used, the correction factor will be applied along the entire length of the scale.

To use two or three segments you must first find home using the Power On Position Recovery (page 4). The segments must be sequenced in order from negative to positive without overlapping. Segment centers will be located midway between the two ends of the standard. Segment boundaries will be located midway between the segment centers.

The standard must be parallel with the axis of travel. Use an indicator to insure this. If you approach the ends of the standard from opposite sides, you must add the indicator tip diameter to the length of the standard.
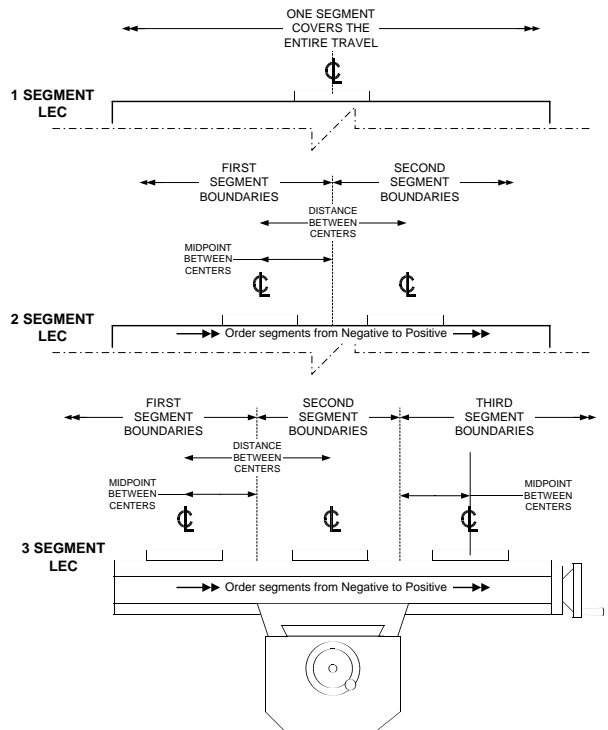
When the LEC parameter is reached a message will prompt you to "ENTER NUMBER OF ERROR COMPENSATION INTERVALS (0-3)", then "X-INT" and the number of intervals previ-ously selected will be displayed.

*   Using the keypad, press $\boxed{1}$, $\boxed{2}$, or $\boxed{3}$ to select the number of LEC segments. Press $\boxed{0}$ if no LEC is indicated for this axis.

*   Press $\boxed{X}$ to begin the first interval.

To automatically calculate the LEC, press the $\boxed{Y}$ key.

A message will prompt you to "MOVE TO FIRST SIDE OF GAUGE – PRESS ENTER".

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1. Move to the first side of the standard and press [ENTER].
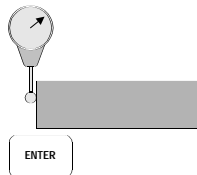
    [ENTER]

2. When prompted, move to the second side of the standard and press [ENTER].
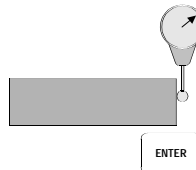
    [ENTER]

3. When prompted, use the keypad to enter the actual length of the standard and press [ENTER]. "X LEC 1" and the "LEC" value are displayed.

    8.1250
    Opposite sides

    8.0000
    Same side
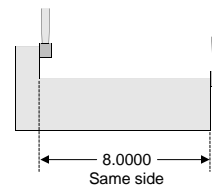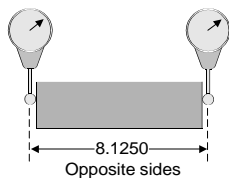
    You can press the [Y] key to repeat this process for the same segment to verify if the error is repeatable.

4. Press the [X] key to begin the next segment or, if all segments are complete, to advance to the next axis.

    Repeat this procedure for each segment of each axis.

To calculate linear error compensation use this formula:

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).

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

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

"Machine Related" Setup Parameters

Machine related setup parameters are generally set during installation or when maintenance is performed. These parameters affect the readout performance in dramatic ways and are protected by an access code to prevent accidental modifications. The machine related parameters can be accessed by pressing [setup], entering the 4-digit access code and then pressing [enter].

The access code number is given on a tear-out sheet on the first page of this manual.

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 return to a previous parameter. A flashing dash by the [**Y**] key indicates that the [**Y**] key can be used to select an optional setting and to cycle through the available choices. At any time during setup, pressing the [setup] key will end the setup process and save your changes.

Count Direction

After entering the access code, the operator will be prompted to "MOVE EACH SCALE IN A POSITIVE COUNT DIRECTION". Then the display will read "X DIRECT" and a number will show in the Y-axis. This is the X-axis count direction and is used to determine which direction is positive.

*   Move the X-axis in the direction you would like to be positive. The display will show a 1 or a 2 depending on the direction you move. The operator can also change the count direction by pressing the [**Y**] key. Count direction settings for each additional axis will follow and are set in the same manner. Press the [**X**] key to access each additional axis. Refer to page 4 to review "Machine Conventions" assumed in this manual.

*   Press the [**X**] key to continue with setup, or press the [setup] key to save changes and exit setup.

Scale Resolution

In order for the readout to count correctly each scale resolution must be entered. Factory default settings are 10μm (0.01mm).

Automatic Resolution Detection

Scales with Position-Trac™, a distance encrypted reference system, allow the readout to automatically detect and record the scale's resolution. You will be prompted to "MOVE EACH SCALE UNTIL RESOLUTION DECTECTED", then "X SCALE" will be displayed.

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To automatically detect the scale resolution:

• Move the X-axis scale in a positive direction until the displayed resolution blanks continue moving axis until a resolution value appears in the Y-axis display field. Scale Resolution settings for each additional axis will follow and are set in the same manner.

• Press the $\boxed{\textbf{X}}$ key to continue or, press the $\boxed{\text{SETUP}}$ key to save changes and exit setup.

Entering A Scale Resolution Manually

To establish the resolution for scales without Position-Trac™, or to disable the Position-Trac™ Power-on Position Recovery routine described on page 4, you need to enter the scale resolution manually.

When you first enter this parameter, you will be prompted to "MOVE EACH SCALE UNTIL RESOLUTION DETECTED", then "X SCALE" will be displayed. This is the X-axis scale resolution parameter.

To establish the scale resolution for non-Position-Trac™ scales:

• Press the $\boxed{\textbf{Y}}$ key to cancel the automatic resolution detection routine. "Scale does not have Position-Trac Feature" will scroll across the X-axis display.

• Continue to press the $\boxed{\textbf{Y}}$ key to select from common resolution choices, **OR** use the keypad, to enter the resolution in millimeters (Enter inches for English resolution scales. Press the $\boxed{\text{MM}}$ key to toggle to English, then press $\boxed{\text{ENTER}}$ when entering these values.)

• Press the $\boxed{\textbf{X}}$ key to continue or, press the $\boxed{\text{SETUP}}$ key to save changes and exit setup.

The chart below will help to determine the resolution value to enter.

Resolution on Scale Label	Resolution value to enter
Metric Resolutions	MM indicator will be lit
10µm (.0005")	.01mm
5µm (.0002")	.005mm
2µm (.0001")	.002mm
1µm (.00005")	.001mm
.5µm (.00002")	.0005mm
English Resolutions	Press the MM key to toggle to English MM indicator will "not" be lit.
.0005" (10µm)	.0005"
.00025" (5µm)	.00025"
.0001" (2µm)	.0001"

Sleep

In order to prolong the life of the vacuum fluorescent display the readout will go to "sleep" after being idle for approximately 30 minutes. When the display is sleeping, a dot will scroll along the X-axis indicating that the readout is still active. To wake the readout, either press any key, or move any axis. The display will instantly return to normal. If you wish to prevent your display from going to sleep, press the $\boxed{Y}$ key until "0" is displayed. To reactivate sleep, press the $\boxed{Y}$ key until a "1" is displayed.

To change the SLEEP parameter:

- Press the $\boxed{Y}$ key to select your option.

    0 = OFF
    1 = ON

- Press the $\boxed{X}$ key to continue or, press the $\boxed{\text{setup}}$ key to save changes and exit setup.

Language

The readout is capable of displaying several languages.

To change the language displayed:

- Press the $\boxed{Y}$ key to scroll through the options.

DISPLAY	LANGUAGE
ENGLISH	English
F	French
S	Spanish
D	German
IT	Italian
DK	Danish
PL	Polish
CZ	Czechoslovakian
TK	Turkish
NL	Dutch

- Press the $\boxed{X}$ key to continue or, the $\boxed{\text{setup}}$ key to save changes and exit setup.

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Installation

```
                        IMPORTANT
    Before installing the readout, record the serial number
         on the warranty card and return it to ACU-RITE
    INCORPORATED. The serial number label is located
                  on the back of the readout.
```

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 and tools.
- Minimize coolant splash or spray.
- The operating environment must be within the temperature range of 0°C to 40°C (32°F 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 the machinery.

Connecting the Scales

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

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

Provide enough slack in the scale cables to allow for full travel of all machine axes. Check that machine movements will not pinch the cables. Use the cable tiedown hardware kits supplied with the scales 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 grounded.

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 scales, 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
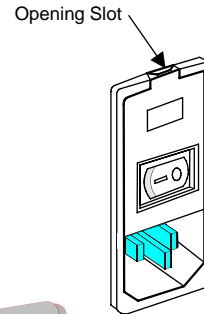
2. Pull the selection block out. Rotate the block 180° so the proper voltage setting will be seen through the window of the cover.
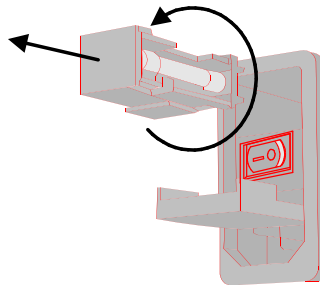
3. Remove the fuse, move the shorting bar to the other side, install the proper fuse, and push the block back into place.
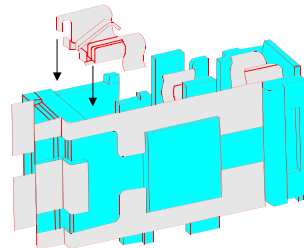
4. Close and snap the cover shut.

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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Connecting the Output Relays

The readout has three output relays:

- The Retract relay indicates to the control that the ram has reached the target depth. The operator can define how far the ram will retract from the target depth. The ram can be raised to a pre-determined position or a preset distance from the target depth. The characteristics of your particular control and work piece setup will determine how the operator should set the Retract relay.

- The Dwell relay tells the control to hold at the target depth (the bottom or top of the burn) in order to obtain a better finish or to allow an orbiter to operate. The operator can set this dwell to a specified time period, or with the optional Spark Detector, it can be set for a sparkout condition.

- The Position Hold relay is active only while the Dwell relay is de-energized. It maintains the relative position of the ram with respect to the target depth. If the ram position is above the target depth, the relay is de-energized (contacts open). If the ram position moves below target depth, the relay is energized (contacts closed). Refer to the Relay Timing Diagrams on pgs. 27-29.

The optional Spark Detector can be connected so that the readout can determine the sparkout condition. Sparkout occurs when no spark is detected for a predetermined period of time. The Spark Detector connects to the Electronic Edge Finder input on the back of the readout.

Relay Connections

The Retract and Dwell relay contact are rated at 1 amp at 30 VDC, 0.5 amp at 125 VAC. The Position Hold relay contact rating is 0.10 amp at 30 VDC, 0.10 amp at 125 VAC.

Retract Relay — 1, 2, 3
Dwell Relay — 4, 5, 6
Position Hold Relay — 7, 8
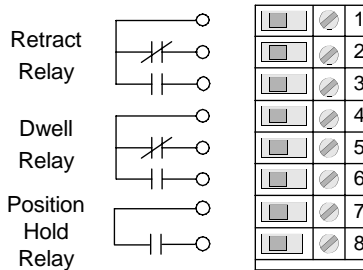
14 - 22 AWG wire, solid or stranded insulation rating: 600V/80 °C min.

.35"
9 mm
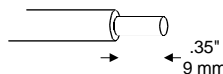
CAUTION

⚠ Connecting the relays improperly or exceeding the specified limits may result in damage to the readout system or to external equipment. Equipment connecting to the CFI relays is to have no live parts that are accessible.

Relay Timing Diagrams

The readout's (ENABLE) key lets the operator:

* turn all EDM functions "ON" and "OFF".

* change the distance (R-DIST) that the retract relay is de-energized, or

* enter a Z-Top position. When a Z-Top position has been entered, the Retract relay will energize at the preset retract depth, and will stay energized until the ram reaches the Z-Top position. The relay will relax if the RAM stops before the Z-Top position is reached.

There are three control function relay (CFI) outputs on the readout. When power is on the Retract and Dwell outputs are energized. The Position Hold relay energizes when ram is at or below programmed cut depth.

The Retract and Dwell relays can be wired normally open or normally closed. The Position Hold relay is always normally open.

In the event of a power failure to the readout all CFI outputs revert to a relaxed state.

The following figures show the state of each relay while under the given conditions; Retract Without Dwell, Retract After Dwell and Retract After Sparkout.

Retract Without Dwell

Spark
Spark ------
No Spark ------
Electrode is de-energized*

Retract Relay
Active ------
Relaxed ------
Retract begins when cut depth is reached.
Retract ends when Z = R-DIST or Z-TOP which ever occurs first.

Dwell Relay
Active ------
Relaxed ------
No dwell is programmed

Position Hold Relay
Active ------
Relaxed ------
Not Active

Fig. 1

 * The machine must be properly configured for the electrode to de-energize.

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Fig. 2

* The machine must be properly configured for the electrode to de-energize.

Retract After Sparkout

Spark

Spark -----
No Spark ------

The spark timer is reset with each spark.

Sparkout time expires

Electrode is de-energized*

Spark timer begins when cut depth is reached.

Retract Relay

Active ------
Relaxed ------

Retract begins when Spark out time expires plus a short delay of 100 ms.

Retract ends when Z = R-DIST or Z-TOP which ever occurs first.

Dwell Relay

Active ------
Relaxed ------

Dwell time begins when cut depth is reached.

Dwell Time

Dwell time is interrupted by sparkout condition.

Position Hold Relay

Active ------
Relaxed ------

Ram Position Monitoring Begins

Active when ram is at or below target depth.

Ram position is monitored until retract.

Fig. 3

* The machine must be properly configured for the electrode to de-energize.

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

Scale 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 and First Spark Detector
Size	12.5"W x 5.125"D x 6.5H"
Weight	7.5 lbs.
Mounting	Bottom: two ¼ -20 threaded inserts
Compliance	FCC Class A ETL CSA CE

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 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 open the cover of the electrical input module. Refer to page 25. Slide out the fuse holder and check the fuse. If necessary, replace it. Close the input module cover by snapping it back into place, and reconnect the power cord.

> **CAUTION**
> ⚠ Only replace fuses 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 30 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 linear scales.*** Check each scale and reading head for proper installation. Ensure that the mounting brackets are secure. Verify repeatability of the reading head.

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

- ***Verify presets.*** Make sure the numbers you enter are correct.
- ***Verify tool.*** Check that the correct electrode is being used. Check the electrode 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.

Diagnostics

Start Up Diagnostics

There are four diagnostic tests performed each time the readout is powered up. These tests run without indication unless a problem is detected. If a problem is detected, a message will be displayed at start up. The messages are as follows:

Test	Error Message
Key Pad Test	"KEY STUCK R(#) N(#) - PRESS CLEAR
EEPROM Test	MEMORY FAILURE [1] - PRESS CLEAR
RAM Test	MEMORY FAILURE [2] - PRESS CLEAR
ROM Test	MEMORY FAILURE [3] - PRESS CLEAR

If you experience any of these error messages please contact your ACU-RITE distributor for assistance.

> **CAUTION**
> If any memory failure is indicated the readout cannot be relied on for correct operation. The readout should be serviced immediately.

Operator-Performed Diagnostics

There are four operator-performed diagnostic tests to evaluate your readout. The tests can be operated by holding the decimal key for two seconds. When the software version is displayed, you are in the Diagnostics mode.

To run the diagnostics:

- Press and hold the [.] key until the software version is displayed (i.e. "V1.2.0").

- Press the [X] key to continue.

Key Pad Test

As a key is held a "+" is displayed on the left side of the X-axis. When the key is released the "+" will disappear. A count of the number of keys pressed will be displayed on the right side of the X-axis.

- Press any key, but [X] and observe the "+" to verify proper functioning.

- Press the [X] key to continue.

Display Test 1

All segments of the display are turned on. Carefully observe the display, checking for any missing segments.

- Press the [X] key to continue.

Display Test 2

All decimal points on all displays are lit momentarily, then all "a" segments, then all "b" segments. etc. This test allows you to look for segments that may have shorted to those not in the same location as all of the others.

- Press the [X] key to continue.

Display Test 3

All segments of all 3 displays are lit one digit at a time starting from left to right. This test allows you to look for digits that may have shorted together or for digits that are not in the same location as all of the others.

- Press the [X] key to exit diagnostics and return to normal DRO functions.

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Resetting Factory Defaults

In some cases, it may be advantageous to reset the readout factory default settings. Doing this will cause all parameters to revert to the state they were in when the readout left the factory. Once accomplished, it may be necessary to re-establish certain parameters as needed for proper EDM functions.

To reset factory default settings:

1. Turn power off to the readout, wait 5 seconds and turn power on.

2. While the power off message is being displayed, press and hold the ⬚MM⬚ key for two seconds.

3. Press the ⬚3⬚ key.

4. Turn power off to your readout, wait 5 seconds and turn power on again.

Factory default settings have now been reset.

Other Error Messages

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 ⬚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 a scale. These signals can be a result of an scale malfunction, mis-alignment, mounting problems, or electrical interference. Press the ⬚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 scale.

• Ensure that the linear scale connectors are correctly seated.

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

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

- If the problem follows the connection change, the linear scale may be in error. Refer to the Checking the Linear Scales section of your scale 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 19.

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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