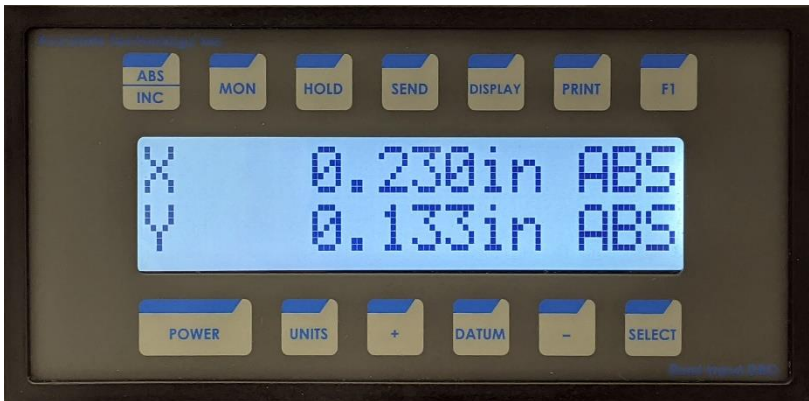


# Accurate

TECHNOLOGY INC.

*Linear Digital Measuring Systems*

## Dual Input Readout



**Installation & Operation**

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## WARRANTY

Accurate Technology, Inc. warrants the ProScale Systems against defective parts and workmanship for 1 year commencing from the date of original purchase. Upon notification of a defect, Accurate Technology, Inc., shall have the option to repair or replace any defective part. Such services shall be the customer's sole and exclusive remedy. Expenses incidental to repair, maintenance, or replacement under warranty, including those for labor and material, shall be borne by Accurate Technology, Inc. (Including freight or transportation charges during the first 30 days).

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### **SAFETY WARNING**

**Before installing this Readout on any machinery:  
Turn off the machine and disconnect the power.**

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## Introduction

This manual includes information for ProScale [Dual Input Readout](#) (DRO) with operating firmware (F/W) of 1.xxx or higher.

This manual DOES NOT include installation information for any other ProScale Readout, or for installation of any ProScale system.

Please refer to the appropriate [Installation manual](#) supplied with your system.

## Readout Specifications

<b>Inputs:</b>	2 ProScale Absolute or Incremental Encoders
<b>Display Range:</b>	$\pm 394.000$ in or $\pm 9999.99$ mm or $\pm 999.999$ cm or $\pm 99$ 63/64 in
<b>Resolution:</b>	.001in .01mm .001cm 1/64 r
<b>Repeatability:</b>	.001in or .01mm or .001cm
<b>Operating Power:</b>	12-24VDC @ 125mA
<b>Operating Temperature:</b>	32 to 120°F, 0 to 50°C
<b>Output:</b>	<a href="#">Digimatic® SPC</a> (2) RS232

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## About the Dual Input Readout

The Accurate Technology Dual Input Digital Readout (DRO) provides the user with the capability of interfacing two [ProScale™](#) linear encoders with one digital readout unit.

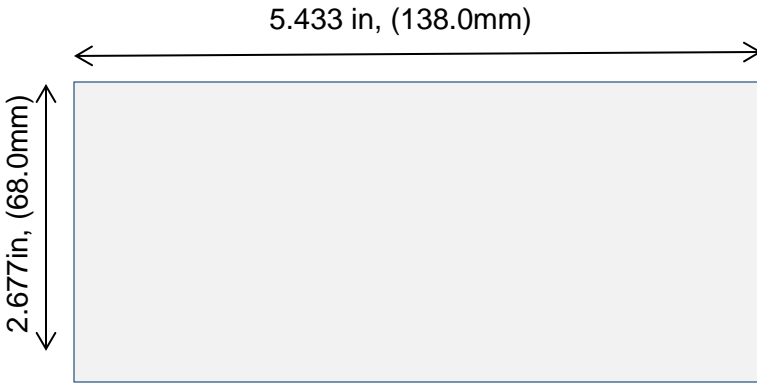
In addition, the Dual Input Readout provides the following features and flexibility.

- Display axis positions in X, Y, X & Y and a programmable Math function.
- Programmable math functions including sum of axes, difference of axes and arc tangent (angular measurement using X and Y).
- Absolute and incremental measurement capabilities.
- Serial printer interface function.
- Arc measurement functions including center of radius, length of arc and radius length measurement.
- Two programmable optically isolated inputs that can be configured for keypad emulation operations.
- Two programmable relay outputs that can be activated by axis position drift or exceeding axis limits.
- Computer interface capabilities via an RS-232 serial port.
- SPC output capability via Mitutoyo Digimatic™ interface.
- Fully programmable operation using plain English prompting.
- Measurements can be displayed in decimal inches, millimeters, centimeters or fractional inches in either 16<sup>th</sup>, 32<sup>nd</sup> or 64<sup>th</sup> modes.
- Either or both axes may be monitored for drift utilizing a user programmable tolerance.
- 12 to 24 volt DC operation. 24 VDC @ 125 mA current consumption.
- Flush panel mounting.
- Alpha-numeric dot matrix LCD.

## Mounting the Readout

The Dual Input Readout is a panel mount readout that requires a cut out opening in a panel or housing for installation.

The diagram below shows the recommended cut out opening to be used for proper installation.



The Readout requires at least 3.35 in (85mm) of depth for adequate installation clearance.

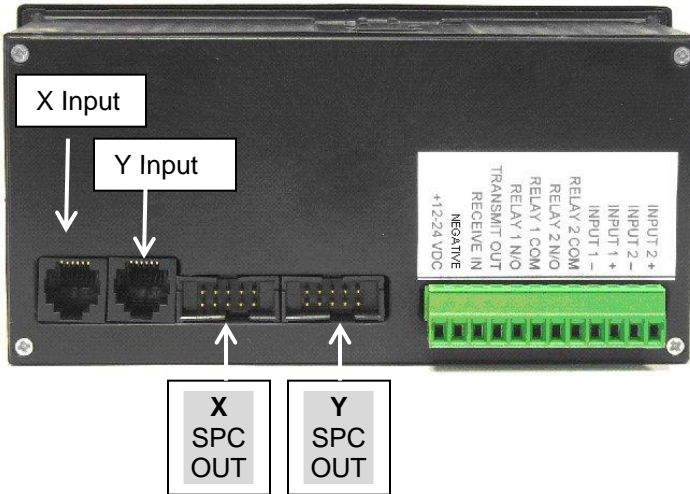
The readout uses two spring-type expansion clips that hold the housing in position after it has been inserted into the opening. The clips may be installed either on the sides of the housing or on the top and bottom of the housing depending on the application.

It is recommended that the panel thickness be at least 1.58mm (.0625in). Thinner panel material may provide insufficient support.



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## Connecting the Readout



### Connections:

Connect the power inputs at terminals 1 and 2 to a regulated and filtered DC power supply that can provide at least 150 milliamps of supply current. Terminal 1 is positive, terminal 2 is negative.

If the DRO is to be used with a computer, connect terminal 3, Receive Data In, to pin 3 of the 9-pin serial connector on the PC. Connect terminal 4, Transmit Data Out, to pin 2 of the 9-pin serial connector on the PC.

If the DRO is to be used with a printer, connect terminal 4, Transmit Data Out, to pin 3 on the 9-pin serial connector on the printer.

The DRO provides two relay contacts that can be used to activate on drift or limit conditions. If either or both relays are to be used, connect the relay outputs to the desired annunciator. Connect the relay contacts in series with load. The outputs can be configured for normally open or normally closed operation. The relays have a current capacity of 10 amps at 130 volts AC.

Two optically isolated inputs are available on the DRO for keyboard emulation and control. If either or both of these inputs are to be used, connect the inputs as follows:

1. Connect the negative input terminal to ground.
2. Connect the positive input terminal to one side of the switch or device.
3. Connect the other side of the switch or device to positive 24 volts.

---

The inputs are designed to operate from twelve to 24 volt DC. Input current is approximately 50 milliamps at 24 volts and 25 milliamps at twelve volts. Do not exceed 24 volt DC or apply AC voltage directly to these inputs as serious damage will occur.

The inputs can be configured for normally open or normally closed operation via programming.

The rear panel of the dual input readout includes an removeable terminal strip, two 10 pin connectors for SPC interfacing and two 6-pin modular jacks for connection of the ProScale encoders.

## **Terminal Strip**

**+24 volt DC input** - This is the primary power input to the readout unit. The voltage range is from 12 volts to 24 volts DC at approximately 125 milliamps.

**Negative** – This terminal provides electrical negative supply for the readout.

**Receive Data In** - This is the serial receive input to the DRO for use with a computer or printer interface.

**Transmit Data Out** - This is the serial transmit output from the DRO for use with a computer or printer interface.

**Relay 1 N/O** – This is the normally open output contact for relay 1. This output can be configured to activate on either a drift or limit condition depending on programming.

**Relay 1 Common** – This is the common contact for relay 1.

**Relay 2 N/O** – This is the normally open output contact for relay 2. This output can be configured to activate on either a drift or limit condition depending on programming.

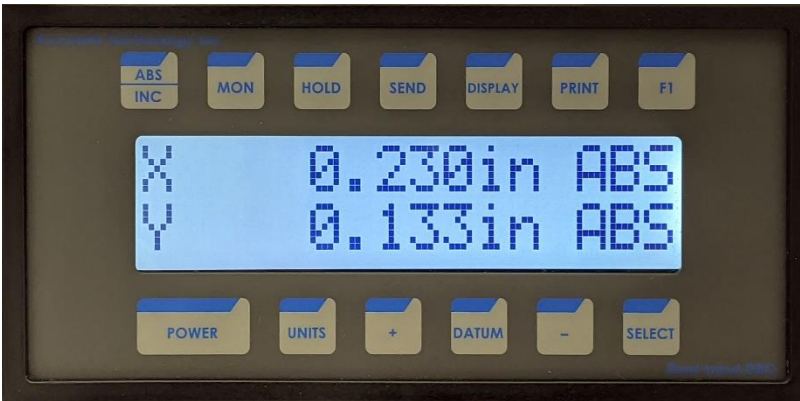
**Relay 2 Common** – This is the common contact for relay 2.

**Input 1 Negative** – This is the negative connection for input 1. This input can be configured to emulate a specific keyboard function depending on programming.

**Input 1 Positive** – This is the positive connection for input 1.

**Input 2 Negative** – This is the negative connection for input 2. This input can be configured to emulate a specific keyboard function depending on programming.

**Input 2 Positive** – This is the positive connection for input 2.



## Keypad Description

The dual input DRO contains thirteen keys that are used to control the operations and performance of the readout unit. This subsection will describe the operation of each of the keys in detail.

### ABS/INC

This key is used to control the absolute or incremental measurement function of the display. By default, the display is in absolute mode. If the DRO is displaying a single axis, pressing the ABS key will place the display in incremental mode. Incremental mode is used to take repetitive measurements allowing each measurement to be zeroed independently. Each time the ABS key is momentarily pressed, the display will either zero or apply a programmed kerf to the current position. To return to the absolute measurement mode, press and hold the ABS key for approximately four seconds. Note: If the DRO is currently displaying both axes, then the **Select** key must be used to choose which axis is to be placed in incremental mode. See the description of the **Select** key for details.

### MON

This activates or deactivates the monitor function of the DRO. The monitor function is used to detect axis drift and provide a visual and optional relay output. To activate the monitor mode, momentarily depress the MON key. The LCD will periodically display the message "POSITION MONITOR ENABLED." If the displayed axis moves from its initial position by a programmed tolerance, the DRO will indicate that the axis has drifted and optionally activate one of the

---

relay outputs. To disable the monitor mode, momentarily press the MON key. The DRO will indicate that the monitor mode has been disabled.

## **Hold**

Use of this key allows the operator to temporarily freeze the displayed positions of the axes while the position of the encoders may change. When activated, the DRO will indicate the displayed axes to be in hold mode. This message will alternate with the position display of the axes when the hold mode was activated. Pressing the Hold key again will turn off to hold feature.

## **Send**

This key activates the respective SPC output port on the rear of the DRO based on the currently displayed axis. If the individual X or Y axes are being displayed, pressing the send key will activate the corresponding SPC output. If the DRO is displaying both X and Y axes, the operator can use the Select key to indicate which axis should be activated. If neither axis is selected, both X and Y SPC outputs will become active.

## **Display**

Each depression of this key will cycle the DRO through the available display modes. The displayed modes that are available depend on system programming. The modes are:

- X axis
- Y axis
- X and Y axes
- F axis (Math Function if enabled)
- Tool measurement (if enabled)
- Arc measurement (if enabled)

Pressing the Display key after the last mode will cause the DRO to return to displaying the X axis position.

## **Print**

If a user-provided printer is attached to the DRO, pressing the Print key will cause a print command to be sent to the printer. This will generate a label with the displayed axis position along with blank lines for additional information. The axis position that is printed on the label will depend on the current display setting of the DRO.

## **F1**

This key is for future use.

## **Power Key**

Depressing the Power key will cycle the LCD power on and off. When the unit is turned on, the DRO will momentarily display a title screen and a firmware

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revision number. Note: The Power key does not completely remove power from the DRO.

## **UNITS**

Use this key to control the type of measurement units to be displayed. The types of measurement units displayed are as follows:

- millimeters/centimeters
- decimal inches
- 1/16in. fractions
- 1/32in. fractions
- 1/64in. fractions

When the last units mode has been displayed, pressing the UNITS key again returns to millimeter mode. Note: The DRO may be programmed to show only metric mode or to disable fractional inch mode.

## **+**

This key is used for several purposes on the DRO. They are:

1. Increment position offset of a selected axis.
2. Increment the segment offset of a selected axis when used with the UNITS key.
3. Increment through a list of options in programming mode.

## **DATUM**

This key is used for several purposes on the DRO. They are:

1. Zero the position offset of the selected axis.
2. When used in conjunction with the UNITS key, enters and exits programming modes.

## **-**

This keys used for several purposes on the DRO. They are:

1. Decrement position offset of the selected axis.
2. Decrement the segment offset of a selected axis when used with the UNITS key.
3. Decrement through list of options in programming mode.

## **Select**

This key is used to either select an axis for position offset modification or to choose a sub-menu option when in programming mode.

---

## Measurement Operations

### Setting the DRO Position Offsets

This operation is used to calibrate the X, Y, or F position offsets.

1. Select the axis to be displayed by depressing the Display key.
2. Press the Select key to unlock the axis for offset adjustment. When an axis is unlocked, the axis label will flash.
3. Use the +, - and DATUM keys to change the offset of the axis.
4. When the axis offset has been changed, momentarily press the Select key to lock the axis. Note: Pressing the Display key will automatically lock the axis.
5. Repeat these steps for the remainder of the axes in the system.

### Setting the Units of Measure

Use the UNITS key to select the measurement units. The possible selections are:

- millimeters/centimeters
- decimal inches
- 1/16in. fractions
- 1/32in. fractions
- 1/64in. fractions

### Incremental Measurements

Incremental measurements allow repetitive measurements to be conducted relating a new zero point from the end of the last measurement. The original zero point or reference in absolute mode is unaffected.

1. Select the axis to be displayed by depressing the Display key.
2. If only one axis is being displayed, momentarily pressing the ABS/INC key will change the DRO to incremental mode. If the DRO is currently in the X and Y display mode, the desired axis must first be chosen using the Select key. When the desired axis is selected, the axis label (X, Y or F) will flash. Depress the ABS/INC key. The DRO will now be in incremental mode.
3. Initially, no kerf is programmed into the system and the current position will be at zero. If desired, a kerf offset can be entered into the display using the + or - keys.

- 
4. Move the axis to the desired distance from zero or the initial kerf value.
  5. To reinitialize the zero or initial kerf value, press the DATUM key. The display will change to either zero or the initially programmed kerf value.
  6. To return to the ABS mode, press and hold the ABS/INC key for approximately 4 seconds.

## Using the Monitor Mode

The DRO has the capability of monitoring the currently displayed axis position for drift due to vibration or inadvertent movement. When the DRO detects drift, the system will alert the user that a drift condition has been detected and optionally activate one of the relay outputs.

To activate the drift monitor mode:

1. Select the axis to be displayed by depressing the Display key.
2. Momentarily press the MON key. The DRO will periodically display a message indicating that the position monitor is enabled. This will alternate with the display of the current position of the axis.
3. If the axis drifts outside the preprogrammed tolerance, the DRO will indicate that the axis has drifted. If one of the relay outputs has been programmed for drift annunciation mode, the relay will become active after the axis has been out of position for three seconds.
4. Moving the axis back to within the program tolerance will clear the axis drifted message and reset the relay output if programmed.
5. To exit the monitor mode, momentarily press the MON key. The DRO will momentarily display a message indicating that the monitor mode is disabled. Note: Pressing the Display key will also disable the monitor mode.

## Using the Axis Limits

The DRO has the capability of monitoring the upper and lower limits of each axis to detect if the axis has exceeded its position boundary. To enable this function, see programming section 7 under axis parameters.

If axis limit monitoring is enabled and an axis is moved out of bounds, the DRO will generate an out of bounds message. To momentarily clear this message, press the Select key. The DRO will return to the normal position display. If a relay output is assigned to the limits bound function, its output will remain active until the axis is placed back within the acceptable bounds.

---

## Using the Math Function (If Enabled)

The math function, axis F, can be used to perform a mathematical function between axes X and Y. The available functions that can be programmed are:

1. Addition – Adds the position of axes X and Y.
2. Subtraction – Subtracts position of axis Y from axis X.
3. Arc Tangent – Generates an angular position readout using the Arctangent function.

By default, axis F is disabled. Use the basic parameters sub-menu in the programming mode to choose the desired math function. See section 7 for details on programming the math function.

If the math function is enabled, a separate position offset can be programmed similar to that for axes X and Y.

To display axis F position, press the Display key until axis F is shown.

## Using the Tool Measurement Mode (If Enabled)

The tool measurement mode is primarily used with the ProStand™ tool measurement system. The principal concept behind the measurement operation is to measure the radial and axial dimensions of a rotary cutting tool. This capability requires the use of both X and Y axes.

1. When this option has been enabled in programming mode, a new menu is provided after the standard axis positioning screens. The LCD will display: TOOL MEASUREMENT SELECT TO BEGIN. To begin tool measurement, press the Select key.
2. The DRO will provide a momentary message that instructs the user to locate the axial point on the tool. The DRO will then show the current X and Y positions. Move the crosshairs of the ProStand camera to a point that represents the axial reference point of the tool. Press the Select key when complete.
3. The DRO will provide a momentary message that instructs the user to locate the radial point on the tool. The DRO will then show the current X and Y positions. Move the crosshairs of the ProStand camera to a point that represents the radial reference point of the tool. Press the Select key when complete.
4. The DRO will then show a momentary message that instructs the user that the following positional information is the radial and axial positions that were digitized. The display will then show the radial and axial positions. Note that these positions are the latched positions that were digitized, not the current position of X and Y. Press the Select key to complete the sequence.



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## Using the Arc Measurement Mode (If Enabled)

The arc measurement mode is used for measurement and verification of arcs or circles under test. This is typically used with either the ProStand™ tool measurement system or a user-provided two dimensional measurement table. This measurement capability utilizes the digitization of three points along the arc and yields the arc radius, the arc center point and the length of the arc. This capability requires the use of both X and Y axes.

The steps for arc measurement using this functionality are outlined as follows:

1. When this option has been enabled in programming mode a new menu is provided as the last positioning screen. The LCD will display: ARC MEASUREMENT SELECT TO BEGIN. To begin arc measurement, press the Select key.
2. The DRO will momentarily provide a message instructing the user to digitize the first point. The DRO will then show the real time positions of the X and Y axes. Move the camera crosshairs on the ProStand or digitizer to the first point on the arc. The press the Select key when complete.
3. The DRO will momentarily provide a message indicating to digitize the second point along the arc. Complete this operation and press the Select key.
4. The DRO will prompt for the third point to be digitized. Complete this operation and press the Select key.
5. The system will then provide the arc radius in the current measurement units (decimal only). Press the Select key to continue.
6. The center point of the arc is then displayed. Note that the operating mode shows CTR indicating the center point. Press the Select key to continue.
7. The arc length is then provided. Press the Select key to complete the sequence.

---

## Adjusting the Pattern Offset

As outlined in Section 1, ABS style scales are fabricated using multiple 430mm scale patterns. For several reasons described in that section, there may be a possibility for the system to become uncalibrated by a multiple of 430mm.

To remedy this situation without recalibration, execute the following operation:

- Use the Display key to select the desired axis to modify.
- Unlock the axis using the Select key. The axis label will begin to flash.
- If the displayed reading is above the known position by a multiple of 430mm, press and hold the UNITS key and momentarily press the – key. For each depression of the – key, the displayed position will be decreased by approximately 430mm.
- If the displayed reading is below the known position by a multiple of 430mm, press and hold the UNITS key and momentarily press the + key. For each depression of the + key, the displayed position will be increased by approximately 430mm.

Note: This operation will only be enabled if the axis is programmed for long scales.

## Operational Notes

- Changing the display mode by depressing the Display key will:
  - Automatically lock any axis that has been unlocked for offset modification.
  - Remove the DRO from monitor mode if it is activated.
  - Reset the DRO to ABS mode.
- Monitor mode can only be used when the DRO is then ABS mode. Pressing the MON key while in incremental mode will automatically return the unit to ABS operation and activate the monitor function.
- An axis must be unlocked using the Select key to have the position offset modified.
- Tool measurement and arc measurement functions only provide measurement units in decimal mode, no fractional inch display.
- To abort the tool measurement or arc measurement functions, press the Display key to advance to the next display mode.

User programming allows the DRO to be customized for a specific type of application and/or use. Programming on the dual input DRO is divided into three separate sections.

## Axis Parameters

These features are specifically related to the individual axes on the DRO. They include encoded direction, scaling factor and related options.

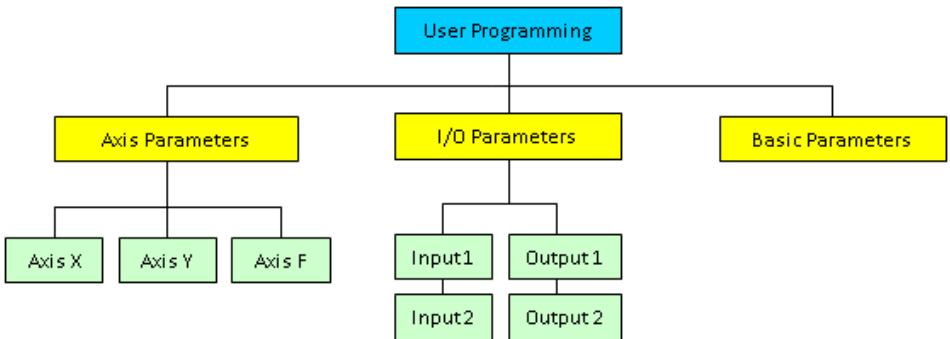
## I/O Parameters

These are related to the optically isolated inputs and relay outputs of the DRO. They include function assignments and normalized states.

## Basic Parameters

These relate to the global functionality of the system. They include features such as printer/ computer configuration, system resolution and relation options.

The diagram below illustrates the structure of the User Programming mode.



## Entering User Programming Mode

To access the user programming mode, press and hold the UNITS key while momentarily pressing the DATUM key. Note: Jumper JP5 inside the DRO must be installed on pins 1 and 2 for access to the user programming mode.

After entering programming mode, the system will momentarily display an instructional message for navigation through the programming menu system:

- 
1. UNITS = CHANGE MENU – Use the UNITS key to traverse to different sub-menus within the programming system.
  2. SELECT = SUB MENU – When a desired sub-menu is displayed on the LCD, press the Select key to choose that sub-menu.
  3. +/- CHANGE VALUE – To change the value of the displayed menu item, use the + and - keys to move up and down the list of selections.

The first sub-menu displayed is Axis Parameters. Use the UNITS key to move to the next sub-menu or press the Select key to choose this sub-menu.

Note: The DRO will automatically exit from the programming mode if no pushbutton activity occurs for 60 seconds.

## Axis Parameters

Upon entering the sub-menu, select which axis to modify. Use the + and - keys to cycle through a list of axis choices, typically, X, Y and F. When the axis name has been chosen, press the Select key to continue.

- Use the UNITS key to move through the list of parameters.
- Press and hold the UNITS key and momentarily press the DATUM key to exit from the sub-menu and return to the list of sub-menus.

The following is a list of parameters that may be modified for each axis.

## Axis Direction

This parameter controls the direction in which the display increases in position. The choices are either positive or negative. If the positional information is changing in magnitude in the wrong direction for the application, change this parameter to its opposite value. Use the + and - keys to change the value.

## Scale factor

This function is used to perform a scaling operation on the axis. By default, the scale factor is 1.00 which yields 1:1 positional information. To multiply the distance measured by two, change the scale factor to 2.0. To produce a measurement reading that is half the actual distance, change the scale factor to 0.5. Use the + and - keys to change the value.

---

## **Drift Tolerance**

This value controls the amount of axis drift that must occur while in the monitor mode before the error is reported. By default this value is 0.010in. Note: this value is a tolerance and thus represents a plus and minus distance from the monitored position. Use the + and - keys to change the value.

## **Use Soft Limits**

Controls whether the axis is to observe an upper and lower soft limit range. The options are: limits enabled or limits disabled. The default values is limits disabled. Use the + and - keys to change the value. Note: If limits are enabled and the current position of the encoder is outside of the allowable limits, the system will indicate that the axis is out of bounds. Press the Select key to temporarily clear this error message.

## **Lower Soft Limit**

Sets the lower soft limit to be observed by the system when soft limits are enabled. The default value is 0 inches. Use the + and - keys to change the lower limit value.

## **Upper soft limit**

Sets the upper soft limit to be observed by the system when soft limits are enabled. The default value his 3.000 inches. Use the + and - keys to change the upper limit value.

## **Axis Operational**

Enables or disables the axis during measurement operations. Disable the axis if it is not to be used in the system. The options are axis enabled or axis disabled. The default value is axis enabled. Use the + and - keys to change the value.

## **Axis Scale Type**

Selects whether the attached encoder is a long scale type or short type scale. Short scales are defined as being less than 17 inches in length. The options are long scales and short scales. Choose the appropriate setting for proper system operation. Use the + and - keys to change the value.

## **Axis Parameter Notes**

Axis F is a virtual axis composed of a math function of X and Y. Because of this, it does not have Axis Operational and Axis Scale Type parameters.

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## I/O Parameters

This sub-menu is used for programming the DRO's hardware inputs and outputs.

- Use the UNITS key to move through the list of parameters.
- Press and hold the UNITS key and momentarily press the DATUM key to exit from the sub-menu and return to the list of sub-menus.

### Input Port 1 Mode

This parameter is used to choose the operation that is executed when input 1 is activated. By default, the input is disabled. The following is a list of choices that can be selected for the input mode. Each of these operations emulates depressing of the associated key on the keypad.

- Activate hold key
- Activate send key
- Activate monitor key
- Activate printer key
- Activate select key

Use the + and - keys to move up and down the list of choices.

### Input Port 1 State

Use this setting to control the input state for activation. By default, the input is activated on "closure" or application of voltage to the optically isolated input. The alternative option is for activation on "open" or removal of voltage from the isolated input. Use the + and - keys to toggle between the list of choices.

### Input Port 2 Mode

This parameter is used to choose the operation that is executed when input 2 is activated. By default, the input is disabled. The following is a list of choices that can be selected for the input mode. Each of these operations emulates depressing of the associated key on the keypad.

- Activate hold key
- Activate send key
- Activate monitor key
- Activate printer key
- Activate select key

Use the + and - keys to move up and down the list of choices.

---

## Input Port 2 State

Use this setting to control the input state for activation. By default, the input is activated on “closure” or application of voltage to the optically isolated input. The alternative option is for activation on “open” or removal of voltage from the isolated input. Use the + and - keys to toggle between the list of choices.

## Output Port 1 Assignment

This option is used to assign a relay output to a specific axis. By default, the output is not assigned to an axis. A list of selectable options for this parameter is as follows:

- Disabled
- Use with axis X
- Use with axis Y
- Use with axis F

Use the + and - keys to move up and down the list of choices.

## Output Port 1 Mode

Use this parameter to assign the functionality of the relay output. The possible functions are:

- Active on limits
- Active on drift

Use the + and - keys to toggle between the list of choices.

## Output Port 1 State

This parameter is used to determine the normal state of the output relay. By default, the relay is normally open. Use the + and - keys to toggle between the list of choices.

## Output Port 2 Assignment

This option is used to assign a relay output to a specific axis. By default, the output is not assigned to an axis. A list of selectable options for this parameter is as follows:

- Disabled
- Use with axis X
- Use with axis Y
- Use with axis F

Use the + and - keys to move up and down the list of choices.

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## Output Port 2 Mode

Use this parameter to assign the functionality of the relay output. The possible functions are:

- Active on limits
- Active on drift

Use the + and - keys to toggle between the list of choices.

## Output Port 2 State

This parameter is used to determine the normal state of the output relay. By default, the relay is normally open. Use the + and - keys to toggle between the list of choices.

Pressing the UNITS key after this parameter will return to the start of the sub-menu system.

## I/O Notes

The relay outputs are mechanically normally open. If an output is configured for normally closed, the relay coil is normally held active providing closure. When power is removed from the system, the relay contact will open.

Configuring an axis for limits detection (see Axis Parameters) does not require a relay output to be configured for limits operation. If a relay output is configured for limits operation, it is necessary for the limits detection option to be enabled in the Axis Parameters.



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## Basic Parameters

This sub-menu is used to program the DRO's basic (global) parameters.

- Use the UNITS key to move through the list of parameters.
- Press and hold the UNITS key and momentarily press the DATUM key to exit from the sub-menu and return to the list of sub-menus.

## Offset Change

This parameter controls whether the user can modify an axis position offset. If this value is set to disabled, the axis cannot be selected for offset modification. The default value is enabled.

## Units Resolution

Use this parameter to determine the amount of position resolution that is to be displayed. The table below shows the options and their precision:

- Standard - 3 places in inch mode, 2 places in millimeters.
- High – 4 places in inch mode, 2 places in millimeters.
- Low – 2 places in inch mode, 1 place in millimeters.

Use the + and - keys to move up and down the list of choices.

## Metric Display

Parameter to control the type of metric display to be used. The DRO can be configured to display in millimeters or centimeters. The default value is millimeters. Use the + and - keys to toggle between the list of choices.

## Units Display

Used to limit the type of measurement units to display.

- Show all units.
- Show metric only.
- No fractions.

Use the + and - keys to move up and down the list of choices.

## Axis Labels

An option that is used to program the axis labels to be displayed in the measurement mode.

- Use Labels X and Y.
- Use Labels R and A.
- Use Labels A and B.

Use the + and - keys to move up and down the list of choices.

---

## **F Math Function**

This parameter is used to configure the type of math function to be associated with axis F. The default value is disabled.

- No Operation – Axis F is not used.
- Add – Adds the positional values of axes X and Y.
- Subtract – Subtracts the position of axis Y from axis X.
- Arc Tangent – Executes an arc tangent function to produce an angular measurement in degrees.

Use the + and - keys to move up and down the list of choices.

## **Arc Measurement Function**

This setting enables or disables the Arc Measurement operation. The default setting is disabled. Use the + and - keys to toggle between the list of choices.

## **Tool Measurement Function**

Used to enable or disable the Tool measurement operation. The default setting is disabled. Use the + and - keys to toggle between the list of choices.

## **Serial Baud Rate**

This parameter is used to configure the DRO's serial port to the desired baud rate. The options are 19,200 and 9600 baud. The default is 19,200 baud. Use the + and - keys to toggle between the list of choices. Note: If the printer support option is chosen (see next parameter), the baud rate is automatically set to 9,600.

## **UART Frequency Adjust**

This value is used to make minor adjustments in the UART clock to compensate for variations in the communications port of connected devices (i.e. Computer or printer). This value is preset at the factory but can be adjusted up or down if consistent serial communication does not exist. Contact Accurate Technology before making adjustments to this parameter.

## **Serial Port Mode**

Configures the DRO for either ProMUX 3 emulation or serial printer support. The default is printer support. Use the + and - keys to toggle between the list of choices.

## **Printer X offset**

Sets the amount of X offset used when printing labels on the serial printer. The value is in units of pixels. The default values 220. Use the + and - keys to increment or decrement the value.

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## **ABS Button**

Controls the operation of the ABS pushbutton on the keypad. Allows the key to be enabled or disabled. The default value is enabled. Use the + and - keys to toggle between the list of choices.

## **Hold Button**

Controls the operation of the Hold pushbutton on the keypad. Allows the key to be enabled or disabled. The default value is enabled. Use the + and - keys to toggle between the list of choices.

## **Send Button**

Controls the operation of the Send pushbutton on the keypad. Allows the key to be enabled or disabled. The default value is enabled. Use the + and - keys to toggle between the list of choices.

## **MON (Monitor) Button**

Controls the operation of the MON pushbutton on the keypad. Allows the key to be enabled or disabled. The default value is enabled. Use the + and - keys to toggle between the list of choices.

## **UNITS Button**

Controls the operation of the UNITS pushbutton on the keypad. Allows the key to be enabled or disabled. The default value is enabled. Use the + and - keys to toggle between the list of choices.

Pressing the UNITS key after this parameter will return to the start of the sub-menu system.

## **Basic Parameter Notes**

When the Units Resolution is set to High, the fourth decimal place (1/10,000 inch) will not increment or decrement by one. The resolution of the system is 10um or .000393 inches. The conversion of 10um resolution to decimal inches will generate a mathematical rounding of approximately .0003 to .0004 inches. Thus, the fourth digit will typically be added to or subtracted from by a value of either 3 or 4.

Disabling the UNITS key does not affect entering or exiting from programming mode.

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## Serial Port

The serial port on the DRO can be configured for two different operating modes.

1. Supports a serial printer for generating self adhesive labels. Currently, the principal printer(s) that are supported are produced by Zebra Technologies/Eltron International.
2. Emulates Accurate Technology's ProMUX multiplexer interface. The dual input DRO supports a subset of instructions typically used on the ProMUX.

## Printer Support

To support a zebra serial printer, the following connections are required:

1. Connect the DRO's serial transmit output to pin 3 of a DB 9 male connector. The DRO's receive input is left unconnected.
2. Connect the DRO's ground terminal to pin 5 of the DB 9 connector.
3. Connect the printer to the DRO via the nine pin connector.
4. Verify that the Serial Port Mode parameter is configured to printer support.
5. Pressing the Print key on the DRO should cause a labeled to be printed.
6. Use the Printer X Offset parameter (see Basic Parameters) to adjust the X offset of printing on the label if necessary.

## ProMUX Emulation

To configure the DRO for PC serial communications, the following connections are required:

1. Connect the DRO's serial transmit output to pin 2 on a DB 9 female connector.
2. Connect the DRO's serial receive input to pin 3 on the DB 9 connector.
3. Connect the DRO's ground terminal to pin 5 on the DB 9 connector.
4. Install the DB 9 connector to the serial port on the PC.

- 
5. Verify that the Serial Port Mode parameter is configured to ProMUX 3 support.
  6. Configure the Serial Baud Rate to either 19,200 or 9,600 baud.

To verify data communication with the DRO, use HyperTerminal® or other terminal emulation program configured for 8 data bits, 1 stop bit and no parity. Handshaking should be set to none. Echo should be turned on to see the typed information.

To request the position information from the DRO, type P and the ENTER key from the PC:

P<ENTER> or p<ENTER> where <ENTER> is the return key.

The DRO will respond with the following string format:

Char 1 – \* Start of message indicator.

Char 2 – Encoder Status. 1 = encoder X ok, 2 = encoder Y ok, 3 = both encoders ok.

Chars 3 through 10 – ASCII position of encoder X.

Chars 11 through 18 – ASCII position of encoder Y.

Chars 19 through 26 – ASCII position of encoder F.

Char 27 Send Button Status – 1 = encoder X selected when send button pressed, 2 = encoder Y selected when send button pressed, 4 = encoder F selected when send button pressed.

Char 28 Carriage Return.

If an invalid command is sent to the DRO, the unit will return a question mark (\*?).

## Frequently Asked Questions

### What does no Enc mean?

If the Encoder is off the Scale, or the Encoder cable is unplugged from the Readout, **no Enc** will appear on the LCD. To clear:

1. Be sure the Encoder is on the Scale and properly oriented.
2. Unplug the Encoder from the Readout for one second and then reconnect the Encoder.
3. Connect the Encoder to the Readout.
- 4.

### The Readout numbers appear to be random. (Model 150, 250 & 950)

Be sure the Encoder is oriented correctly on the Scale. One end of the Scale is marked black; be sure that the arrow on the Encoder is pointed in this direction.

### The Readout does not change, or changes very little, as it moves.

1. The Readout is in the HOLD mode.
2. The Encoder is on the Scale backwards. (Model 150, 250 & 950)
3. The Scaling factor is set very low.

## Abbe Error

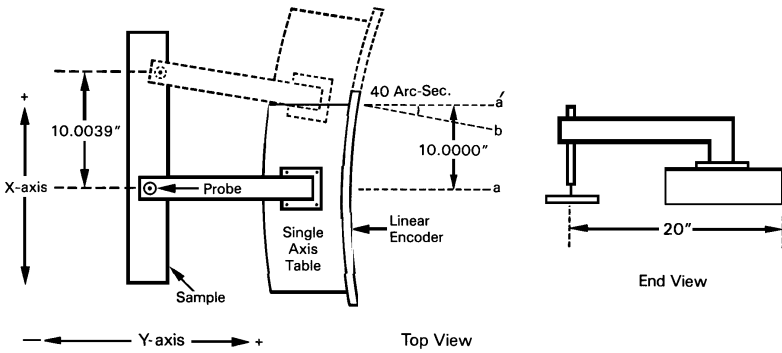
Abbe error is a condition that may not be visible to the human eye, but will affect linear measurements. Be sure to take precautions when installing ProScale in order to eliminate the possibility for Abbe error.

Abbe error refers to a linear error caused by the combination of an angular error and a dimensional offset between the sample and the measuring system. It is important to understand that the information the encoder is providing is only the position of the encoder on the scale. To illustrate this, see the figure, which shows a linear measuring device. (The apparent distortion in the measuring device is intentional - for this example - to show the measuring device with a curvature in its mounting.)

Suppose the curvature in the figure is sufficient to produce an angle of 40 arc-seconds. If the measuring device moves 10 inches, the probe will be found to have moved 10.0039 inches, resulting in an error of +0.0039 inches. Abbe error could be lessened by moving the measuring system closer to the sample. This effectively solves one half of the Abbe error problem (offset) and leaves only the angular mounting problem to be solved. Angular error can best be countered through proper design and placement of the linear scale. Sources of angular error include:

1. Mounting the linear scale to an imperfectly flat surface.

2. Mounting the linear scale to an imperfectly straight surface.
3. Curvature of ways (or linear bearings) used to measure the sample.
4. Contaminants between the probe and item being measured.
5. Friction in any part(s) of the measuring device.



### [ProRF SPC](#)

ProRF allows linear measurement or position data to be transmitted wirelessly to a PC (or other device with a USB or RS232 connection.) The system uses 802.15.4 radio modules to provide reliable two way communication. The transmitter plugs into the SPC data output connector on the General Purpose and 950 Series Readouts



### [ProRF Encoder](#)

Instead of a long cable between the Encoder and the Readout, a Transmitter at the Encoder sends data to a Receiver. The receiver can be connected to a Readout at a remote location or to a PC RS232 or USB port. (Not compatible with 950 Series systems)



### [ProMUX](#)

ProMUX-3 is an easy to use hardware interface that provides communication from Model 150 & 250 Encoders (or SPC equipped readouts) to a user's PC or PLC. ProMUX-3 supports three inputs, and one RS232 output. (Not compatible with 950 Series systems.)



### [Analog Interface Unit \(AIU\)](#)

The AIU is an interface designed to provide an analog signal output proportional to the displayed position of a ProScale measurement system. It connects to the SPC data output connector on the General Purpose and 950 Series Readouts.





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**Thank you for choosing a ProScale Product,**

**IT WAS PROUDLY MADE IN THE USA**



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828-654-7920

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