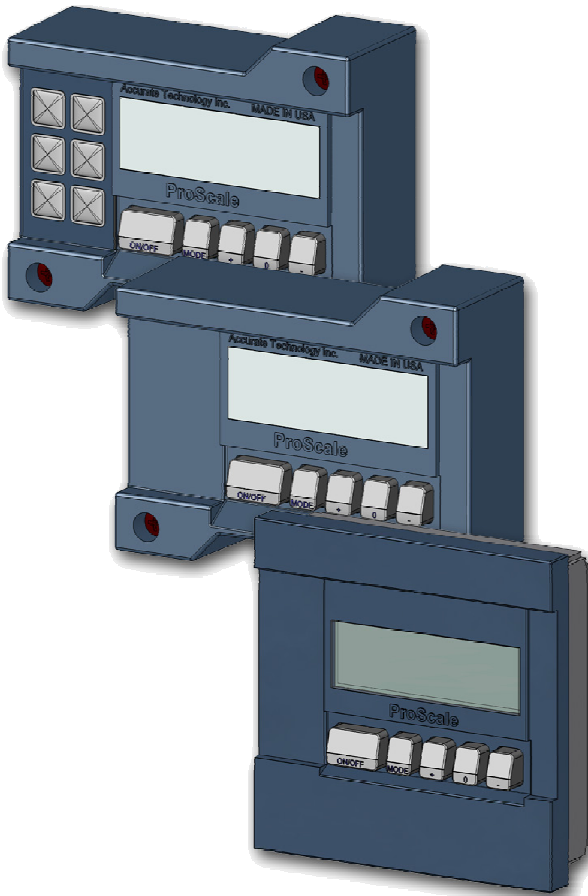# Accurate
TECHNOLOGY INC.
Linear Digital Measuring Systems

ProScale®
LCD Digital Readouts

Basic, General Purpose &
Panel Mounted LCD Digital Readouts

OPERATION

WARRANTY

Accurate Technology, Inc., warrants the ProScale® Digital Measuring 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).

Except as expressly provided in this warranty, Accurate Technology, Inc., does not make any warranties with respect to the product, either expressed or implied, including implied warranties of merchantability or fitness for a particular purpose, except as expressly provided in this agreement.

Accurate Technology, Inc., shall not be liable for any special, incidental, or consequential damages or for loss, damage or expense directly or indirectly arising from the customer's use of or inability to use the equipment either separately or in combination with other equipment, or for personal injury or loss or destruction of other property, or from any other cause.

To request repair work (either warranty qualified parts or not), contact Accurate Technology, Inc. directly by phone, fax, or e-mail. A Returned Merchandise Authorization (RMA) number is required before returning a product for repair.

Accurate Technology, Inc.
+1 828.654.7920   800.233.0580   828.654.8824 (F)
www.proscale.com   info@accurate-technology.com

<div>

SAFETY WARNING

Before installing this product on any machinery disconnect all power and follow the INSTALLATION manual supplied.

</div>

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FCC NOTICE

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the equipment and the receiver.

- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/television technician for help.

Operation with non-approved equipment is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.

SECTION 1   GENERAL INFORMATION

Introduction

ProScale® digital measuring systems are affordable precision electronic devices for making linear measurements with speed and accuracy. ProScale consists of a SCALE, an ENCODER (also called READHEAD) and a DIGITAL READOUT (DRO). ProScale Models 150 and 250 use Capacitive Absolute measuring technology, while the Model 180, 280, 380 & 580 systems use Inductive Incremental measuring technology.

ProScale is ideal for most measuring requirements up to 6m (20ft.) where high accuracy, better than 10 µm, (approximately .0005") is not needed, but affordable repeatability, (better than a tape measure), or accuracy to 50 µm (.002") is desired.
Because ProScale shows the exact measurement on its Digital Readout, it eliminates the guesswork involved in reading and interpreting tape measures, scales & pointers, or shaft encoders. It is compatible for any general purpose measurement application where data is collected (SPC, RS232, RS485 or wirelessly) and/or digital accuracy and repeatability is desired. It is also suitable for retrofitting, or as original equipment, on most types of machinery.

ProScale Model 150 & 250 General Purpose Measuring Systems and products based on Absolute measuring technology can be used with any of the several different Digital Readout models available.

ProScale Model 180, 280, 380 & 580 Systems and the products using Inductive technology may be used with a select group of Digital Readouts available from Accurate Technology.

This manual covers only Digital Readouts (DROs) with an LCD display and with operating firmware (FW) of 3.0 or greater.

About This Manual

This manual includes Operating and Programming information for:
ProScale Basic, General Purpose and Panel Mount LCD Digital Readouts with firmware 3.000 or higher.
(Firmware version is displayed on power-up, ie P3.000)

LCD BASIC Digital Readout
Part Number 700-1600-230

LCD General Purpose Digital Readout
Part Number 700-1600-235   (Battery Operation)
Part Number 700-1600-235G (24VDC Operation)
Part Number 700-1600-236* (with compensation)

LCD Panel Mount Digital Readout
Part Number 700-1600-435   (Battery Operation)
Part Number 700-1600-435G (24VDC Operation)
(Not compatible with older M100 & M200 Systems)

These Digital Readouts are compatible with ProScale Models 150, 250, 180, 280, 380 and 580 ProScale measurement systems as well as several other ProScale products using integrated measuring systems.

The BASIC and General Purpose Digital Readouts are also backward compatible with legacy ProScale Models 100 & 200 and other products using these models as the integrated measuring device.

* Supplied with Model 580, ProKit 580, ProPanel and ProTable products

This manual DOES NOT include installation information for any other ProScale product.

Digital Readout Specifications

Linear Measurements:

Display Ranges:	$\pm$ 999.999 in; $\pm$ 399 63/64 in
	$\pm$ 9999.99 mm; $\pm$ 999.999 cm
Resolution:*	.1inch .1mm .1cm or
	.01inch .01mm .01cm or
	.001inch .01mm .001cm or
	.0005inch .01mm .001cm
Repeatability:	.001in or .01mm or .001cm

Temperature Measurement:

Accuracy:	$\pm$ 1º C from 0 to 70º C, $\pm$ 2º C otherwise.
Resolution:	.1º C

Operating Power:

Basic:	2 AA Batteries
General Purpose:	2 AA Batteries or 9-24VDC
Panel Mount:	1 CR123 3V Lithium Battery or 24VDC

Operating Temperature: 32 to 120°F, 0 to 50°C

Output:

Basic:	None
General Purpose:	Mitutoyo Digimatic® SPC
Panel Mount:	Mitutoyo Digimatic® SPC

* Position data displayed on the LCD and sent to the SPC port is auto-ranging. This means that the defined resolution may be temporarily overridden by the system if the position to be displayed or sent exceeds the allowable maximum position for that resolution. In that case, the system will continue to reduce the resolution until either an allowable resolution is achieved or to 1 decimal place to the right of the decimal point. Maximum displayable values are:

Inch Resolution	Maximum Value (Inches)
4 decimal places	99.9999
3 decimal places	999.999
2 decimal places	9999.99
1 decimal place	99999.9

Millimeter Resolution	Maximum Value (mm)
2 decimal places	9999.99
1 decimal place	99999.9

Table 1.1   Maximum Resolution

Digital Readout Feature Matrix

This matrix is shown for comparison of features available among the several Digital Readouts available from Accurate Technology. Readouts and their features that are Grayed Out are not supported in this manual.

	Surface Mount		Compact	Panel Mounts		
	Basic	GP	LCD	LCD	LED	Dual
DRO Function:						
Battery Operation	●	●	●	●		
24VDC Operation		●		●	●	●
Programmable Datum	●	●	●	●		
Selectable Resolution	●	●	●	●	●	●
Selectable Units	●	●	●	●	●	●
Fractions	●	●	●	●		●
Auto on/off	●	●	●	●		
Offset Addition		●			●	
Upper/Lower Limit	●	●		●		●
Go/NoGo		●				
Monitor Position		●				●
Drift Alert		●			●	●
Backlight				●		●
Noise Suppression	●	●	●	●	●	
Linear Compensation	●	●		●		●
Non-Linear Compensation*		●				
Temperature Compensation*		●				
Sum/Difference						●
Statistics		●				
Use w/Model 150/250	●	●		●	●	●
Use w/Model 180/280/380/580	●	●	●	●		
Use w/ProRF Wireless SPC		●		●		●
Output Signal(s)	None	SPC	None	SPC	RS485	RS232 SPC

* Available ONLY on Part # 700-1600-236 supplied with select ProScale systems. These General Purpose DROs will indicate Firmware ending in "C". (Firmware version is displayed on power-up, ie P3. 000C).

Digital Readout Replacement Chart

Digital Readout Type	Old Number	Replacement
General Purpose	700-1600-225	700-1600-235
General Purpose	700-1600-200	700-1600-235
General Purpose	700-1600-001	700-1600-235
General Purpose Basic	700-1600-220	700-1600-230
Basic	701-1495-001	700-1600-230
Standard	701-1500-00x	700-1600-235
SPC	701-1505-00x	700-1600-235
Programmable	701-1115-00x	700-1600-235
Panel Mount, Battery	700-1600-450	700-1600-435
Panel Mount, Battery	700-1600-405	700-1600-435
Panel Mount, 24VDC	700-1600-305	700-1600-435
Panel Mount, Battery	700-1600-400	700-1600-435
Panel Mount, Battery	701-1570-001	700-1600-435
Panel Mount, 24VDC	701-1560-001	700-1600-435
Panel Mount, Battery	701-1525-00x	700-1600-435
Panel Mount, 24VDC	701-1550-00x	700-1600-435
Incremental Model 100/200	701-2000-025	700-1600-230
Incremental Model 100/200	701-2000-002	700-1600-230
Incremental Model 100/200	701-1495-002	700-1600-230

('x' denotes any number from 1-4.)

For the latest information about available Digital Readouts for ProScale Measuring Systems please visit:
http://www.proscale.com/Digital Readouts/Digital Readouts.htm

Mounting the Digital Readout

General Purpose & Basic DRO

The SURFACE MOUNT Digital Readout may be mounted:
- Using Velcro or Double sided tape
- Drilling out the 3 holes from the inside of the case
- Using any of the six holes on the back of the case which may tapped for M2 or 4-40 screws.

Panel Mount DRO

A cutout should be made in the panel at least 90mm x 90mm (3.6 x 3.6 inches), but no larger than 93mm x 93mm (3.7 x 3.7 inches).
The cases of the Digital Readout are designed to "sandwich" panel thicknesses between 3mm (0.125") and 20mm (0.750") between the front and rear Digital Readout cover.

NOTE: If Panel is thinner than 3mm (0.125 in), shorter screws must be used for the Digital Readout casing or damage to the front cover of the Digital Readout will occur.

24VDC Operation

The General Purpose and the Panel Mounted LCD Digital Readouts will operate on batteries or 24VDC. The General Purpose Readout uses a multi-purpose plug-in connector for power as well as input and output signals. The Panel Mount Readout uses screw terminals for these connections. (Connections can be configured as outputs or inputs, but not both at the same time).   **See Section 3***: Circuit Board Jumpers*

General Purpose DRO
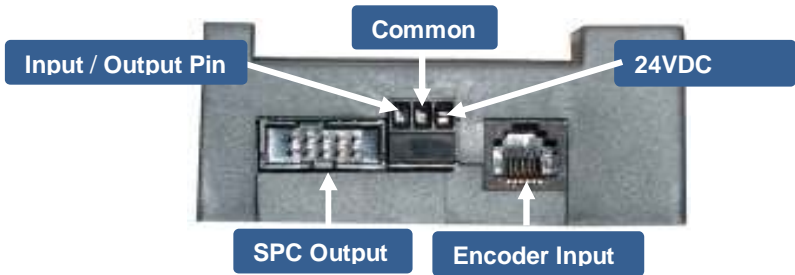
Panel Mount DRO
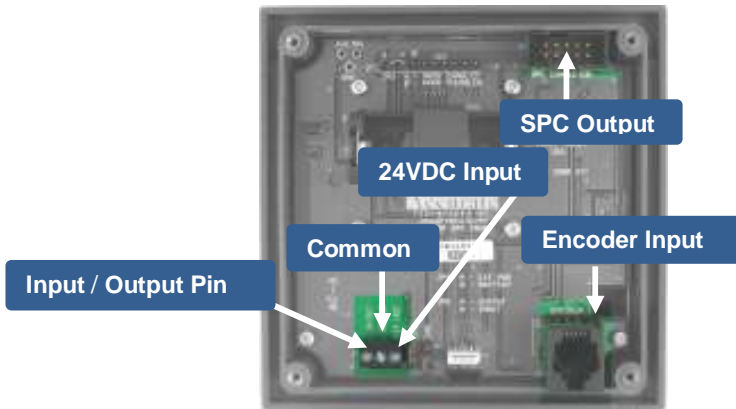
Notes:
When powering Readouts with 24VDC the Scale and the Readout's ground must be connected to each other, or connected to each other via a machine's metal frame. A proper connection will eliminate ground loops that may cause unstable readings on the Readout. **In 24VDC systems, proper ground connections will be improved by using only Readouts, Scales, & Encoders whose part #'s end in 'G'.**
24VDC Digital Readouts are designed to run on DC voltage ONLY.
DO NOT ATTEMPT TO OPERATE THESE READOUTS with AC VOLTAGE!

The LCD
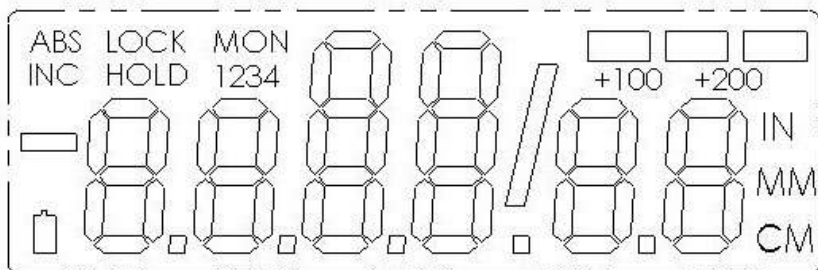
The above figure illustrates all the segments available on the LCD

Pressing and holding the ON/OFF and UNITS key for 10 seconds with power OFF will perform a full segment LCD test, display the current firmware version, AND RESET ALL PROGRAMMING PARAMETERS TO FACTORY DEFAULT VALUES.

NOTE: The DRO may also be defaulted to original factory settings by removing the battery and then pressing and holding the **UNITS** key while re-inserting battery. *****

* Internal jumper JP3 must be set to the *Program Enable* position to allow the DRO to be reset to factory defaults as described above.

Fundamental Operation

The following operations & functions apply to the Basic, General Purpose and Panel mount LCD Digital Readouts.

KEY TIMING

The keys pictured below have multiple functions. Timing (how long a key is depressed) is important. This manual uses the term "*momentarily*" to describe a key *press and release* of less than .8 seconds. Whereas *"press and hold"* is used to describe a key *press and release* of 1 second or longer.
See Table Below:

	Momentarily	**Press & Hold**
How long a key is pressed?	Less than .8 seconds	More than 1 second
When is key function executed?	On key release	While holding

A function is executed on the "key release" for momentary key presses.
A function is executed after the allotted time has elapsed for "press & hold" operations. **See Table Below:**

	Momentarily Press	**Press & Hold**
UNITS	Cycles measurement units: inches, fractions, mm	No effect
(in programming mode)	Increments program parameter list	Displays Pr #
Plus (+)	increments displayed value	increments faster
(in programming mode)	increments parameter value	increments faster
Datum	forces reading to programmed datum value	After 6 seconds: battery voltage After 9 seconds: Temperature
(in programming mode)	forces parameter to factory default	no effect
Minus (-)	decrements displayed value	decrements faster
(in programming mode)	decrements parameter value	decrements faster

Key Functions for standard operation
ON/OFF KEY

Momentarily press

Momentarily press the **ON/OFF** key to turn DRO off then momentarily press it again to turn it back on. The Firmware version is displayed for two seconds at power-on.

UNITS KEY

Momentarily press

Momentarily depressing the **UNITS** key will display measurement/position information in inches, fractions or millimeters (or centimeters). With each key press, the DRO will cycle through decimal inches, fractions (16ths, 32nds, 64ths) and millimeters (or centimeters). To limit the modes that may be displayed by depressing the **UNITS** key *See Programming Parameter (Pr11).*

When the DRO is in 1/16 or 1/32 inch fraction mode, a series of "bars" in the upper right corner of the LCD, each representing 1/64th of an inch, may appear. (ie. When in 1/16 inch mode and three bars are showing, the measurement displayed is rounded *down* to the closest 1/16 inch and each illuminated bar indicates an additional 1/64 of an inch of additional measurement.) For better resolution, switch to 1/32 or 1/64 mode. For the best resolution switch to a decimal mode.

When the measurement is greater than 99 63/64 inches, a **+100** and/or **+200** will illuminate in the upper right portion of the display to indicate this amount must be added to the displayed reading. ie: If the measurement is 154 5/8 inches, 54 5/8 and **+100** will be illuminated on the display. If the measurement is -307 23/64 inches, - 7 23/64, **+100** <u>and</u> **+200** will be illuminated on the display.

PLUS (**+**) & MINUS (**−**) KEYS

Momentarily or Press & Hold
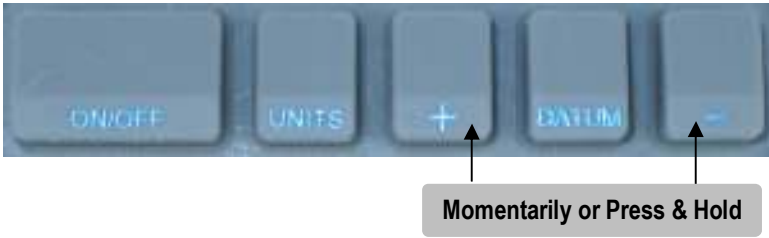
Momentarily depressing the **+** or **−** key increments or decrements the current displayed value by one unit of measurement.

Pressing and holding the **+** or **−** key will cause the displayed value to change continuously. Continue pressing the key to cause the amount of change to speed up. This allows for quick adjustments over a large range of values. These keys may be locked out to prevent accidental offset entries.
See LOCK FUNCTION *and Programming Parameter (Pr3).*

DATUM KEY

Momentarily press   **Press & Hold**

The DATUM key is used to change the currently displayed value.
Momentarily pressing the DATUM key forces the display to a user programmed value. This can be zero or any other displayable value.
See Programming Parameter (Pr1).
The DATUM key can be locked out to prevent accidental entries.
See LOCK FUNCTION *and Programming Parameter (Pr3).*

Press and hold the DATUM key for 6 seconds to display the battery voltage.

Press and hold the DATUM key for 9 seconds to display the temperature.
The temperature is displayed in the format "xx.x F" or "xx.x C" where xx.x is the temperature and the units are in degrees Fahrenheit or degrees Celsius based on the current measuring units setting (Inch or Metric). The temperature readout will continue to be displayed until the datum key is released.
Temperature is sampled on startup and every 10 minutes thereafter.

Basic Functions

MEASUREMENT READING DIRECTION

Once the system has been put into operation, if the direction of readings, (positive or negative values) is opposite the desired direction, the DRO programming may be changed to correct the direction.
See Programming Parameter (Pr2).

KEY LOCK

The Digital Readout provides a function that can be used to "lock-out" the position offset adjustment keys (**+, DATUM, −**) to prevent accidental changes of the current displayed value. To activate the Lock function, press and hold the **ON/OFF** key and then momentarily press the **UNITS** key. The word L0CK will be displayed in the upper left corner of the LCD. When the L0CK symbol is displayed, the **+, DATUM** and **−** keys become inactive.

To de-activate the Lock function, press and hold the **ON/OFF** key and then momentarily press the **UNITS** key.

The Lock function can also be enabled through programming. This allows a more permanent Lock function since programming can be disabled with a hardware jumper inside the DRO. *See Programming Parameter (Pr3)*

DISPLAY RESOLUTION

Four display resolutions are available with all the LCD DRO's.

.1in	.1mm	.1cm	or
.01in	.01mm	.01cm	or
.001in	.01mm	.001cm	or
.0005in	.01mm	.001cm	

To change to another display resolution *See Programming Parameter (Pr4)*

NOTE: Data displayed on the LCD and sent to the SPC port is auto-ranging. This means that the selected resolution may be temporarily overridden by the DRO if the position to be displayed exceeds the maximum displayable position for the selected resolution. The DRO will continue to reduce the resolution until either an allowable resolution is achieved or to 1 decimal place to the right of the decimal point. Allowable ranges are:

Inch Resolution	Maximum Value (Inches)
4 decimal places	99.9999
3 decimal places	999.999
2 decimal places	9999.99
1 decimal place	99999.9

Millimeter Resolution	Maximum Value (mm)
2 decimal places	9999.99
1 decimal place	99999.9

DISPLAYED MEASUREMENT UNITS

The measurement units displayed on the Readout when the **UNITS** key is depressed is user configurable. The table below provides a matrix for selecting which units will be displayed (based on the value entered in programming parameter *Pr11*).

See Programming Parameter (Pr11).

Programming Parameter Pr 11 Value	Measurement Units Displayed
0	All inch units, metric in millimeters
1	Millimeters only
2	Decimal inches and millimeters
3	Decimal inches and centimeters
4	All inch units, metric in centimeters
5	Centimeters only
6	Decimal inches only

AUTO ON/OFF

In order to prolong battery life, the Digital Readout has a built-in function that will turn off the LCD after a period of no encoder movement or key activity. This function does NOT turn off power to the encoder so the system will not lose its position. Auto shutoff is programmable from 0 (always on), to 240 minutes before going into sleep mode. Press the **ON/OFF** key or move the scale to wake up the DRO. Any key press or encoder motion while the DRO is not in sleep mode will restart the auto shutoff timer.

The default time period before the LCD turns off is 15 minutes. This time period may be changed, or completely disabled through programming.

See Programming Parameter (Pr12).

LINEAR SCALING

All LCD Digital Readouts have the ability to "scale" the actual measurement. This function is useful when the actual measurement must be multiplied or divided before being displayed. Care should be taken when using this function since invoking it will cause the unit to display a reading different than the actual measured value.

This function has a range of: 0.0001 to 99.9999 allowing the actual measured value to be multiplied or divided in very small or very large increments.

See Programming Parameter (Pr13).

SEGMENT OFFSET ADJUSTMENT

This function applies to <u>ProScale Model 150 & Model 250</u> systems and all other ProScale products employing Absolute measurement technology that measure <u>more than 17 inches (430mm)</u>.

If the scale on your product looks like this:
It uses Absolute measuring technology

For Scales that are longer than 17 inches (430mm), multiple Scale pattern segments are installed end-to-end on the aluminum extrusion. This provides a quasi-absolute measurement capability in which the Encoder can calculate its position on any individual segment but cannot determine which particular segment it is on. To solve this problem, the Digital Readout tracks which segment the Encoder is on by detecting the transition between one segment and adjacent segments. In certain situations, the crossing from one segment to another may not be detected. This may occur if the Encoder is disconnected from the Digital Readout and then moved along the Scale to another segment. It may also occur if the Encoder is moved too quickly between segments. If the segment tracking count is incorrect because of one of the above situations, the user can re-adjust the Readout to correct the error. This adjustment is referred to as the SEGMENT OFFSET ADJUSTMENT. To add one segment value (430.08mm) to the displayed value, press and hold the **UNITS** key and then momentarily press the **+** key. The displayed position will increase by 430.08mm (16.933 inches). To subtract one segment, 430.08mm, from the displayed value, press and hold the **UNITS** key and then momentarily press the **-** key. This function is operative only when Pr14 is set to 1.
See Programming Parameter (Pr14).

UPPER/LOWER LIMITS

The Digital Readout can display either **LL** for Lower Limit or **UL** for Upper Limit if a pre-programmed upper or lower reading is exceeded. Upper and Lower Limits are set with *Programming Parameters Pr28 and Pr29* but are only active if *Pr27* is set to 1. The LCD display toggles for 2 seconds between current position and **LL** if the Lower Limit is exceeded, or **UL** if the Upper Limit is exceeded. This continues as long as either limit is exceeded.
See Programming Parameters (Pr27, 28, 29).

In addition, the programmable output can be configured to activate on General Purpose Digital Readouts when either the Upper or Lower limit is exceeded.
See PROGRAMMABLE OUTPUT OPERATION.

Advanced Functions

The following additional functions & operations are available on General Purpose Digital Readouts
See PROGRAMMING PARAMETER (Pr23).

ABSOLUTE VS INCREMENTAL MEASUREMENTS.

The Digital Readout has two measurement "indexes". One is referred to as **ABS** and the other is **INC**. The ABS measurement setting is designed to allow the user to set an "absolute" zero point on the Digital Readout referenced from a fixed or known position. The INC measurement setting is designed to take relative or "incremental" distance measurements from one arbitrary point to another. The settings operate independently allowing separate position offsets to be programmed for ABS and INC. The Absolute position of the measuring system is not lost when using the Incremental (INC) settings and will be recalled and displayed when the Readout is returned to Absolute (ABS) mode. **The terms "*Absolute*" and "*Incremental*" are used here to describe a measurement function or technique and should not be confused with the terms Absolute and Incremental when used in reference to the type of "Measuring Technology" employed by different ProScale products.**

ABS

The Digital Readout automatically enters ABS (Absolute) mode when power is first applied. This is indicated by the ABS symbol in the upper left corner of the LCD. While in the ABS mode, all position measurements are related to the current system reference point. To enter the INC (Incremental) mode, press & hold the **ABS/INC** key for 1.2 seconds.

NOTE: To change the timing of this key to a *momentary press* to enter INC mode, *See Programming Parameter (Pr22).*

INC

While in the INC (Incremental mode), the INC symbol is shown in the upper left corner of the LCD. When the INC mode is initially entered, the displayed position will change to reflect a new reference point at the current position of the Encoder. This is typically a position of zero (**0**) but may be changed by using the **+** or **−** Key to enter an offset. Moving the Encoder in either direction will display the distance moved from the initial Incremental starting point (plus any offset). To complete another incremental measurement from the new position, momentarily press the **ABS/INC** key. The Digital Readout will again change to 0.00 (or the previously programmed offset). To return to the ABS mode, press and hold the **ABS/INC** key for 3 seconds.

SEND

The Digital Readout has an output port that can be used to send measurement information to a compatible SPC device such as a data acquisition unit or wireless transmitter (See Section 6: *Accessories*). After connecting the SPC device to the 10 pin connector on the Digital Readout, the user may initiate the data transmission by momentarily pressing the **SEND** key. This instructs the SPC device to acquire the data from the Digital Readout. Pressing the **SEND** key will cause **Snd** to display on the LCD for 1 second to show activation of the send function (even if no SPC device is attached to the Digital Readout).

All inch modes are transmitted as decimal inches. All metric modes are transmitted as millimeters. The SPC position data transmitted is typically the displayed position on the LCD with the exception of when Special Function Mode is set to Measurement Accumulation or Statistics modes (See *Special Functions*). In those modes, the displayed (calculated) values are sent, NOT the current encoder position.

The data format and connector style of the DRO SPC output is Mitutoyo Digimatic®. This is an industry standard that can be interfaced with most available SPC products including multiplexers & RS232 converters (See Section 6: *Accessories*). If no SPC device is attached to the Digital Readout, the SEND key has no other function.

OFFSET ADDITION

Offset addition allows values to be pre-programmed that are then added to the measurement and the sum is displayed on the LCD. This function allows the user to quickly switch from one reference point to another.

The General Purpose DRO can support up to 4 user definable offsets that can be added to the current ABS position. *PROGRAMMING PARAMETER PR30* enables or disables this function. For example: If *PR30* = 2, only offset 1 and 2 are available for use. *PARAMETERS PR31* through *PR 34* are the individual offset adders respectively.

When enabled, the operator scrolls through the active offsets by pressing the **F1** key. The numbers **1, 2, 3, 4** will be displayed in the upper left corner of the LCD with each press of **F1**. When no numbers are displayed, no offset addition is active.

When the number **1** is displayed in the upper left corner, Offset Addition Preset 1 (*PR31*) has been applied to the measurement and the result is now displayed on the LCD.

When the number **2** is displayed in the upper left corner, Offset Addition Preset 2 (*PR32*) has been applied to the measurement and the result is now displayed on the LCD.

When the number Ɛ is displayed in the upper left corner, Offset Addition Preset 3 (*PR33*) has been applied to the measurement and the result is now displayed on the LCD.

When the number ч is displayed in the upper left corner, Offset Addition Preset 4 (*PR34*) has been applied to the measurement and the result is now displayed on the LCD.

PROGRAMMABLE OUTPUT OPERATION
The multi-purpose connector on the General Purpose Readout provides a power input connection and, a keyboard input or solid-state output (.1A / 30 VDC) connection. The input and output functions are mutually exclusive and cannot be used at the same time.

The output signal can be configured to activate on the following conditions:
- Special Function 1: Monitor drift condition
- Special Function 2: Go/NoGo function
- Upper/Lower LIMIT error

The LCD will flash when any of the conditions above are encountered, but the output signal only changes state once and then toggles back when an in-tolerance condition is restored. The output can be configured for normally open (N/O, not conducting to ground) or normally closed (N/C, conducting to ground), see **PROGRAMMABLE OUTPUT POLARITY.**
See PROGRAMMING PARAMETER (Pr38) & Circuit Board Jumper JP5

Caution: The output remains active during Programming. If parameters relating to the output are changed during Programming the output signal could become active! When the Monitor mode is active AND the programmable output is enabled, the hardware output will not become active until the error condition has lasted at least 2 consecutive seconds.

PROGRAMMABLE OUTPUT POLARITY
The polarity of the programmable output signal when not activated is user defined. The output is a transistor that conducts to Negative. The factory default is *normally open* (NO).
See PROGRAMMING PARAMETER (Pr37).

Common

Input / Output Pin

24VDC Input
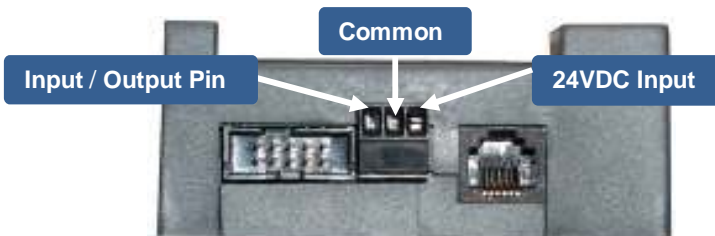
EXTERNAL KEYPAD INPUT

The multi-purpose connector on the General Purpose (GP) DRO and the circuit board connections on the Panel Mount and GP DROs can be configured as inputs providing the ability to simulate any front panel key press with an external switch. There are three solder pads on the DRO circuit boards, labeled **IN1, IN2** and **GND** (see below) that are used for key inputs. Any of the DRO's front panel keys may be mapped to respond to an external input. See *PROGRAMMING PARAMETERS Pr35 & Pr36* along with the associated Key Function Mapping Table. The inputs must be from a normally open "dry" (**no voltage applied**) switch, connected between ground (**GND** or common) and **IN1** and/or **IN2**. The switch input operates exactly the same as the mapped key providing both momentary and "press and hold" functionality.

JUMPER JP5 on the DRO circuit board is set to allow the input/output terminal on the GP 24 VDC power connector to be reconfigured as a direct connection to **IN1**. (This allows for easy external interfacing without modifying the DRO enclosure or soldering on the circuit board). Panel Mount DRO connections are limited to the circuit board solder pads.

Pr35 maps a key to **IN1**. *Pr36* maps a key to **IN2**.

CAUTION:. DO NOT APPLY VOLTAGE TO THESE INPUTS. These inputs should only be switched to circuit negative.

Input Circuit Board Solder Pads

Jumper JP5
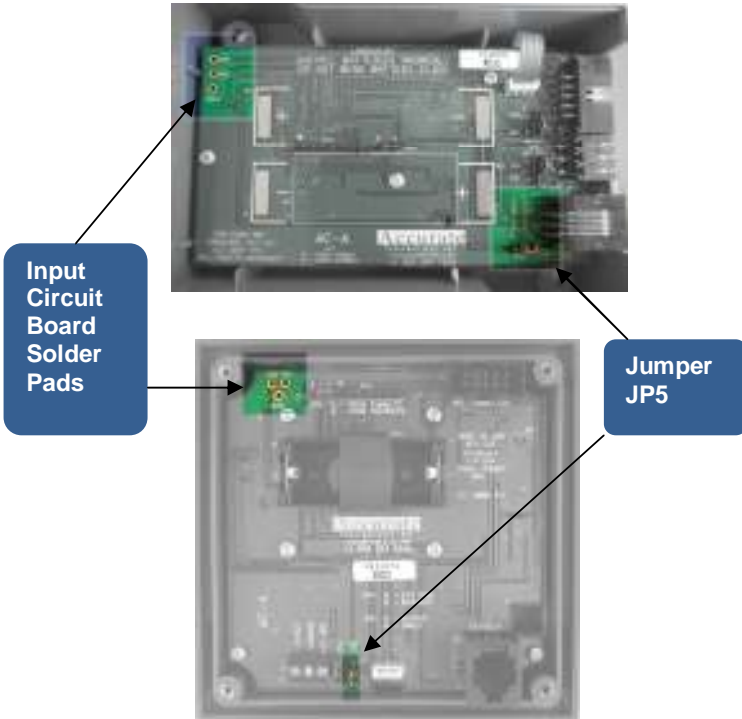
SPECIAL FUNCTIONS
See PROGRAMMING PARAMETERS (Pr24, 25, 26)

Special Function Mode allows the DRO to perform special tasks or custom programming. These tasks interact with the **F** keys to perform functions related to a specific task or programming operation.
Note: The operations configurable via the Special Function Mode are mutually exclusive of each other. The table below provides a summary of the included standard operations and each feature is further defined below.

Programming Parameter Pr24 Value	Function
0	No Special Functions. No F key Operation
1	F3 = MON F4 = HOLD F2 = SPC delete
2	Go/No Go gauge operation
3	Measurement Accumulation
4	Statistics Mode

Note that when *PROGRAMMING PARAMETER Pr24* is set to 0, the **F2** to **F4** keys are disabled and have no function. (**F1**, used only for Offset Addition, is controlled by *Pr30*).

SPECIAL FUNCTION 1: MONITOR, HOLD, DELETE
PROGRAMMING PARAMETER Pr24 set to 1

Monitor Mode: F3

The Digital Readout has the ability to monitor a measurement position to detect position drift or measurement variance. To activate the Monitor Mode, position the Encoder to the desired location and momentarily press the **F3** key. The **MON** symbol will illuminate on the LCD to indicate that the Monitor mode is active.
If the Encoder moves outside the programmed tolerance *(PR26)* the LCD reading flashes, indicating a drift condition. When the Encoder is moved back within the programmed tolerance, the displayed reading will stop flashing.
To exit the monitor mode, momentarily press the **F3** key. The **MON** symbol will turn off and the currently displayed position will stop flashing.

Monitor mode can only be activated while in the ABS measuring mode. If the **ABS/INC** key is depressed while monitoring, or the normal operational mode is left, (programming mode, sending a data transmission), the DRO will automatically exit Monitor mode.

When the monitor mode is enabled AND the programmable output is configured for drift monitoring, the hardware output will not become active until the encoder has remained out of position for at least 2 consecutive seconds.

Hold: F4

The Digital Readout provides a feature that allows the displayed position to be "frozen" in time while the Encoder is moved from its current position. This allows measurements to be captured on the Digital Readout and held for later viewing regardless of the current Encoder position. To activate the Hold Mode, momentarily press the **F4** key. **HOLD** will be displayed in the upper left corner of the LCD. The currently displayed position and selected key presses will be frozen at this point. To release the HOLD feature, momentarily press the **F4** key again, or cycle power.

NOTES: If power is cycled when Hold Mode is active, any key (such as UNITS, DATUM, + or –) that was depressed while in Hold Mode will be executed when power is restored.
Leaving the normal measurement mode, (enter programming mode, send data transmission, or using the Go/No Go editor) causes the DRO to automatically exit Hold mode.

Delete: F2

Momentarily pressing **F2** sends a special "*delete*" signal to the SPC data port. When a ProRF Transmitter is attached to the port, a "*delete*" message will be sent to the ProRF Receiver. This "*delete*" message removes the last measurement from the cut list when connected to a TigerStop® controller.

SPECIAL FUNCTION 2: GO/NOGO
PROGRAMMING PARAMETER Pr24 set to 2

In certain applications (particularly with a ProTable or ProPanel) it may be desirable to program upper and lower measurement tolerances to gauge parts. If the measurement falls within the programmed tolerance, a "Go" condition occurs. If the measurement is not within the upper or lower tolerance, a "No Go" condition occurs.

The General Purpose DRO can store up to 16 individual measurement indexes (*SET BY PR25*), each with its own upper and lower tolerance. Each measurement index is identified with a number from 1 to 16.
A Go/No Go Editor is used to enter the individual upper and lower tolerances for each measurement index.

To enter the Go/No Go Editor press F3.
This will select one of the 16 measurement indexes to be programmed. Each press of **F3** will display **Go X** where **x** is a number from 1 to 16 representing the particular index to be edited. After the last number is reached (determined by the setting of Pr25), pressing the **F3** key again will display **Go oFF** indicating that the Go/No Go function is turned off. (The **F4** key works similarly but decrements through the list).
Once a measurement index is selected the LCD will alternate between the current Encoder position and **Go** or **no Go** depending on the current position and programmed tolerances for that index.

Next, press and hold the UNITS key and momentarily press the F4 key.
The LCD will display **GoX U** for 1 second where **X** is the measurement index and **U** indicates the *upper tolerance* is to be programmed. The LCD will then display the current programmed upper limit.
Use the **+** and **–** keys to set a new upper limit.

Next, momentarily press F3.
The LCD will display **GoX L** for 1 second where **X** is the measurement index and **L** indicates the *lower tolerance* is to be programmed. The LCD will then display the current programmed lower limit.
Use the **+** and **–** keys to set a new lower limit.

Next, exit the Go/No Go Editor by momentarily pressing F3.

Operation of Go No/Go Special Function

To increment through the list of measurement indexes press **F3**
To decrement through the list of measurement indexes press **F4**

To display which measurement index is currently active press and hold **F3** or **F4** for 3 seconds. The LCD will display **Go X** where **X** is the measurement index currently active.

SPECIAL FUNCTION 3: ACCUMULATOR
PROGRAMMING PARAMETER Pr24 set to 3

The Measurement Accumulator Special Function allows multiple measurements to be made and a summation of the measurements displayed on the Digital Readout.

To begin accumulation measurements do the following:

1. Press the **F4** key to view any previous accumulator total value.
    The LCD will display **Accu** for 1 second followed by the total accumulated measurements. The display format for the accumulated total is controlled by both the currently selected units mode (**UNITS** key) and the Special Functions Option, *PR 25*.

    a. If *PR 25* is set to 0, and the Digital Readout is in one of the inch modes, (decimal or fractions), the accumulated total is displayed in Decimal Inches.
    b. If *PR 25* is set to 0, and the Digital Readout is in metric mode, (mm or cm), the accumulated total is displayed in mm.
    c. If *PR 25* is set any non-zero value, and the Digital Readout is in one of the inch modes, (decimal or fractions), the accumulated total is displayed as feet and inches. (fff ii) where f=feet and i = inches
    d. If *PR 25* is set any non-zero value, and the Digital Readout is in metric mode, (mm or cm), the accumulated total is displayed as meters and millimeters. (MM mmm) where M=meters and m=millimeters.

2. Press the **F3** key to clear the accumulator.
    The LCD will display **CLr** for 1 second. The DRO will return to the normal measuring mode.

3. Start accumulating measurements.
    To add a measurement to the accumulator, make a measurement and then press the **F3** key. The LCD momentarily displays **Add** to indicate that the measurement has been added to the accumulated total. Additional measurements can then be taken and added to the total using the same procedure.

4. View Accumulated Total.
   To view the accumulated total, press the **F4** key.
   The following options are now available:

   a. Press **F3** to clear the total and return to the measuring mode.
   b. Press **F4** (DOES NOT clear the accumulation total) to return to the measuring mode.
   c. Press **SEND** to transmit the accumulated total to the SPC port.

NOTE: Measurement Accumulation mode maintains a running summation of the measurements taken. Individual measurements in the summation series cannot be edited or deleted. If an error is made and an incorrect measurement is taken, the entire summation must be cleared and completed again. No rounding of inches or millimeters occurs when configured for feet/inches or meters/millimeters.

SPECIAL FUNCTION 4: STATISTICS
PROGRAMMING PARAMETER Pr24 set to 4

The General Purpose Digital Readout can perform some basic statistical analysis without the use of SPC data collection on a PC or other device. The DRO's Statistics mode can provide the following functionality:
1. Measurement Count.
2. Minimum Measurement.
3. Maximum Measurement.
4. Average Measurement in two modes:
    a. Standard average (Measurement Sum ÷ Count)
    b. Trimmed average ((Measurement Sum - Max - Min) ÷ (Count - 2))

To begin the Statistics mode, complete the following:

1. Clear the statistics variables by pressing the **F4** key.
If the variables are already clear, the LCD will display `CLr`.
If there is a previous sample in memory, the LCD will display `Cn` representing the measurement count for 1 second followed by a non-zero number.
Press the **F3** key to clear the statistics variables. The LCD will display `CLr` for 1 second and then return to normal measurement mode

2. Take a measurement sample and press the **F3** key. The LCD displays `Add` momentarily to indicate that the measurement has been accumulated. At this time the measurement is also compared to the current Min and Max values to determine if it is less than the current Minimum or greater than the current Maximum. Continue to take additional measurements and press the **F3** key after each measurement.

3. When you are ready to review the statistical data, momentarily press the **F4** key. The LCD will display `Cn` for 1 second followed by a non-zero number. This number represents the measurement **Count**.
Press the **F4** key again and the LCD will display `Lo` for 1 second followed by the **Minimum Measurement** value.
Then:
a. Press the **F3** key to clear statistics variables and exit.
b. Press the **F4** key to continue <u>without</u> clearing the statistics variables.
c. Press the **SEND** key to transmit the Minimum Measurement to the
   SPC port.

Press the **F4** key again and the LCD will display `Hi` for 1 second followed by the **Maximum Measurement** value.
Then:
a. Press the **F3** key to clear statistics variables and exit.
b. Press the **F4** key to continue <u>without</u> clearing the statistics variables.

c. Press the **SEND** key to transmit the Maximum Measurement to the SPC port.

Press the **F4** key again and the LCD will display either **AG** or **AAG** depending on the setting of the Special Function Option parameter*, PR 25*.
If *PR 25* is set to 0, the Standard Averaging method is used and the LCD displays **AG** for 1 second followed by the **Standard Average**: (Measurement Sum ÷ Count)
If *PR 25* is NOT set to 0, the LCD displays **AAG** for 1 second followed by **Trimmed Average** ((Measurement Sum - Max - Min) ÷ (Count - 2))

  a. Press the **F3** key to clear statistics variables and return to measurement mode.
  b. Press the **F4** key to return to measurement mode without clearing the statistics variables.
  c. Press the **SEND** key to transmit the Average Measurement to the SPC port.

4. Press the **F3** key to clear statistics variables and return to a NEW measurement sequence.
    Press the **F4** key to return to measurement mode without clearing the statistics variables and continue.

Notes on the Statistics function:
Standard averaging will be influenced by the Min and Max measurement values. If these values vary greatly from the measurement population, the average will not reflect a "centered" representation of the measurement population.

Trimmed averaging, in this implementation, subtracts the Min and Max values prior to the averaging calculation. This yields a more "centered" representation of the measurement population that will be closer to the median value of the measurement population.

Lack of memory resources has limited this implementation to averaging. Only a running summation is kept in memory, not the value of each measurement sample. Because of this, we cannot calculate statistical values such as median or standard deviation. On the other hand, this implementation allows for a large number of measurement samples to be accumulated. Measurement count can be up to 65,536 samples. Measurement summation can be 9.223×10^{14} mm.

Compensation Functions

NOTE: The following features are available ONLY on General Purpose Digital Readouts with firmware ending in 'C', (Part # 700-1600-236) supplied on ProScale Model 580 and ProTable systems.
(The firmware version is displayed on power-up, ie P3. OOOC).

TEMPERATURE COMPENSATION
This feature provides automatic compensation of measurement variations caused by changes in the ambient temperature where the measurement system is being used.
Additionally, coefficients of expansion other than aluminum may be programmed into the DRO and the resulting measurement compensated for the different expansion rates based on a temperature sensor inside the DRO.
Use this feature to maintain the highest measurement accuracy possible when using the system under wide temperature variations or when mounting the ProScale aluminum scale extrusion to steel or other surfaces having a different temperature expansion rate than aluminum.
*See PROGRAMMING PARAMETERS (**Pr41 through Pr44**)/*

To turn on Temperature Compensation:

1. Set *Pr41* to 1.

2. Next, set the compensated Low and High positions using *Pr42* & *Pr43*. This step sets the lowest and highest ABS measurement value that will be temperature compensated. Most often this will be at 0.000 and the maximum measuring range of the system. It is possible however, if the system has been placed at a non-zero starting point that the 'lowest' reading could be a value other than 0.000.

3. If necessary, enter the expansion coefficient for the material the ProScale aluminum Scale is affixed to in *Pr44*.
    *See **Pr44** for details relating to the expansion coefficient setting.*

    Use care if changing this setting. It will affect system accuracy!

Note: Parameters *Pr41*, *42* & *43* have been preset at the factory for ProTables ordered with the "Enhanced Accuracy" option.

NON-LINEAR COMPENSATION

This function is used to enhance the basic accuracy of the ProScale system by creating a table of correction values in the DRO based on known measurement points along the length of the measurement system.

The compensation table consists of 126 elements. This should provide adequate compensation for any length measurement system currently manufactured by Accurate Technology.

For ProTable products purchased with the "Enhanced Accuracy" option, this feature has already been enabled and set-up at the factory and it is not necessary to repeat the initial error compensation procedure unless a measuring system component of the ProTable has been replaced.

For ProScale Model 580 users, the initial error compensation procedure must be performed by the end user on the 'total measuring environment' in order for this function to be meaningful.

Before beginning an error compensation calibration, you will need to determine how many points and the interval to calibrate. The DRO has a maximum number of 126 correction points. The smaller the compensation interval (more points) the smoother the calibration curve will be. Measurement standards such as Gage Blocks in lengths from .50 inch to 10.0 inches should be used. Keep in mind however, that you will need a sufficient number and selection of standards to create the number of points you decide to correct.

As an example: For a measuring system 100 inches long the smallest interval that can be corrected is .8 inches, (100 ÷ 126). This also means you will need sufficient standards to create a known measurement point EVERY .8 inches. A more realistic approach would be to use an interval of two or more inches and calibrate fewer points. Keep in mind whatever interval you choose, you will need a sufficient quantity of standards to replicate every point along the measuring length.

It is IMPORTANT that the placement of the measurement standard(s) during calibration be repeatable and that it be a useable point to make measurements from during normal operation. This becomes even more critical as the surface area used for normal measurements increases beyond the size (point) at which the correction is made.

The following example uses 5 inch (interval) measurement standards and an Accurate Technology ProTable as the measuring system under calibration. Other applications would use a similar procedure.

1. Set *Pr39* (Compensation Enable) to 1

2. Set *Pr40* (Compensation Interval) to the length of the measurement standards multiple that will be used during the calibration, i.e. 5.00"

3. Turn the Digital Readout off. Press and hold down the **DATUM** key and the **ON/OFF** key for approximately 10 seconds. After that time, the LCD will turn on and complete a segment test. You can release the **ON/OFF** and **DATUM** keys at this time.

4. After the LCD test is complete, the Readout will show the firmware version for about 1 second. This will be followed by the LCD showing the current position alternating with `cal` . This indicates the Digital Readout is in the correction table calibration mode. This alternating display will continue throughout the calibration process.

5. Place the moving jaw of the ProTable against the fixed jaw. Press **DATUM** to zero the Readout.

6. Press the **F1** key. This enters the first correction point into the table. The LCD will momentarily show `Co 0` indicating that the entry was accepted.

7. Open the jaw and place the first measurement standard (5") against the back-fence, if installed. Close the moving jaw until the face of the jaw gently touches the measurement standard. Press the **F1** key. The LCD will show `Co 1` indicating the first measurement standard has been digitized.

8. Open the jaws and insert another measurement standard (5"). Close the moving jaw until the face of the jaw gently touches the measurement standard. Press **F1**. The LCD will show `Co 2` briefly. Continue this step with additional standards placed end to end every 5" until the maximum measuring range has been achieved.

9. After the last standard distance has been digitized, press the **F2** key. The LCD will momentarily show `CoE` indicating that the calibration process has ended.

During the calibration process outlined in step 6, the user may wish to verify the correction point that is to be programmed next. i.e. the next `Co X`. This can be accomplished by momentarily pressing the **F3** key. The LCD will display `CP X`, where **X** is the **next** correction point number that will be programmed.   This feature is helpful after programming many correction points since it can be easy to loose track of the number of standards programmed.

If an error is made during the calibration process where an incorrect table entry is recorded, the entire process must be repeated starting at step 3 above.

Operating the system in compensated mode.

After a successful correction table has been programmed, the DRO will operate normally and the measuring system will have a higher level of accuracy. If the encoder is positioned outside the calibrated range of operation, the LCD will display **No Co** alternately with the current position. This indicates that the system is operating outside the calibrated measuring range and has a reduced measuring accuracy.

If you choose to turn off Non-Linear Compensation (*Pr39=0,*) the compensation table will be saved in memory. Changing *Pr39* to 1 will re-enable the previously stored compensation table.

Note: Re-setting the Digital Readout to factory settings does not erase the compensation table.

Changing the Battery

A low battery indicator will appear in the lower left corner of the LCD.
Press and hold **DATUM** key for 6 seconds to display the Battery Voltage.
When battery voltage drops below approximately 2.6V the DRO will turn itself off until the batteries are replaced.

To replace the battery:

General Purpose & Basic Digital Readouts:

Remove the screws in the upper right and lower left corners. Pull the cover off.
Remove the old batteries. Reinstall 2 new AA Alkaline batteries, noting the proper orientation. Replace the cover and tighten the screws.

CAUTION: DO NOT BEND BATTERY CLIPS!
THESE CLIPS ARE DESIGNED TO BE LOOSE WHEN THE CASE IS OPEN AND WILL COMPRESS AND SECURE THE BATTERIES IN PLACE WHEN THE CASE HALVES ARE SCREWED TOGETHER.

Panel Mount Digital Readout

Remove the screws holding the back cover in place. Pull the cover off.
Remove the old battery. Reinstall a new CR123 or EL123 3V Lithium battery, noting the proper orientation. Replace the cover and tighten the screws.

Circuit Board Jumpers

JP1   **FACTORY USE ONLY**

JP2   **Encoder Technology Voltage**   **Default = Position A**
When this jumper is in the position A, the DRO is compatible with all current ProScale 150, 250, 180, 280, 380 and 580 systems. In order to use this digital readout with older ProScale Model 100 & 200 systems and other more recent products based on Capacitive Incremental Technology, (see picture below) this jumper must be set to the position B.

If your Scale looks like this: *set JP2=B*

There is NO JP2 Circuit Board Jumper on the Panel Mount DRO.
This readout does not support legacy Model 100 & 200 ProScale systems.

JP3   **Programming Lock-out**   **Default = Position A**
Front panel programming of the Digital Readout can be enabled or disabled though the use of this circuit board jumper.
Front panel Programming is enabled when the shorting jumper is installed in position **A**. To disable Front panel Programming, install jumper on position B. When programming is disabled, the user cannot access the programming functions via the front panel as described in the Section 4: PROGRAMMING PARAMETERS. This provides a method of configuring the Digital Readout with specific parameters then preventing unauthorized or accidental configuration changes.

JP4   **DRO Power Selection**   **Default = Position B**
The General Purpose and Panel Mount DRO will operate on either on internal battery power or external 24VDC. When this jumper is installed in position A, the DRO is powered by an external DC power source via the power connector When this jumper is installed in the **B** position, the DRO is powered from the internal battery(ies).

JP5   **Input/Output Selection**   **Default = Position A**
The General Purpose and the Panel Mount DRO have multipurpose connectors used for External Power and, either an Input or Output connection. The Input & Output functions are mutually exclusive. This jumper is used to configure the connector to be used as an Input or an Output. In position **A**, the connector is configured for OUTPUT. In the B position, the connecter is configured for INPUT and is connected directly to the IN1 solder pad on the circuit board. See: EXTERNAL KEYPAD INPUT & PROGRAMMABLE OUTPUT OPERATION **UNDER ADVANCED PROGRAMMING.**

General Purpose & Basic DRO Circuit Board

Panel Mount DRO Circuit Board

Several functions of the Digital Readouts are user programmable. The following describes what features and functions are available and how to change the factory defaults to customize your Digital Readout.

To enter Programming Mode:

1. Press and hold the **UNITS** key then momentarily press the **DATUM** key.
2. The LCD will briefly display: **PG on** (Programming On), then **Pr 1**, (indicating Programming Parameter #1)
3. Release the **UNITS** key
4. The value stored for *Pr1* is displayed.

| Press & Hold | Momentarily press |
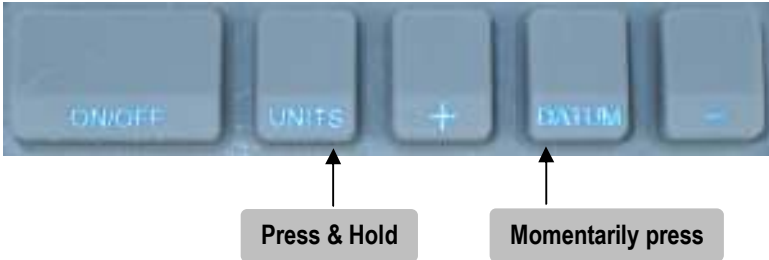
Once in the Programming Mode:

Moving up parameter list - Momentarily press the **UNITS** key to advance through the Programming Parameter list, first displaying the Programming Parameter number then the currently programmed value.

Moving down parameter list - Press and hold the **ON/OFF** key and momentarily press the **UNITS** key to move backward through the Programming Parameter list.

Increase parameter value - Momentarily press the **PLUS (+)** key while displaying a Programming Parameter Value to increase the parameter setting.

Decrease parameter value - Momentarily press the **MINUS (-)** key while displaying a Programming Parameter Value to decrease the parameter setting.

Reset parameter value to default setting - Momentarily press the **DATUM** key while displaying a Programming Parameter Value to reset the parameter to the factory default value.

Exit programming mode - Press and hold the **UNITS** key. Momentarily depress the **DATUM** key. The LCD will briefly display: **PG oFF** (Programming Off), then return to normal operation. NOTE: The system will automatically exit programming mode after 60 seconds of no key activity.

The Digital Readout Programming Parameters are listed below.
Values in **[ ]** are the range of values available for that Parameter.
Factory defaults values are shown in **Bold Red.**

NOTE: Programming parameters are not sequentially numbered due to firmware differences between systems and provision for future enhancements / features.

Pr 1 – Datum Key   **[0** to ± 999.999in**]**   or   **[0** to ±9999.99mm**]**
The programmed value that will be recalled whenever the Datum key is pressed during normal operation.
Default = 0.00

Pr 2 – Direction of Travel   **[0** or 1**]**
This parameter controls the sign of travel (positive vs. negative) when the measuring system is moved.
Default = 0

Pr 3 – Key Lockout   **[0** or 1**]**
This parameter controls the operation of the **+**, **-** and **DATUM** keys. If enabled, (set to 1), these keys will not function and the **LOCK** symbol will appear on the display. This prevents accidental changes when depressing these keys during normal operation.
Default = 0

Pr 4 – Display Resolution   **[**1, 2, **3** or 4**]**
This parameter sets the number of places to the right of the decimal point on the display. When the DRO is in a decimal mode (in, mm or cm), it will auto-range to the next resolution if the value is too large to be displayed in the current resolution but is displayable in an alternate resolution.
A value of **1** will display x.x.
A value of **2** will display x.xx
A value of **3** will display x.xxx
A value of **4** will display x.xxxx
Default = 3
NOTES:
- Decimal inches have a maximum of 3 decimal places (4 places ± .0005).
- Millimeters have a maximum of 2 decimal places (even if the programming parameter is set to 3 or 4).
- This programming option has no effect when displaying fractions.

Pr 5 – Movement Required for DRO Auto-On function   **[**0.3 to 10mm**]**
This parameter sets the amount of encoder, or system, movement required to automatically wake up the digital readout when it is turned off.
Default = 0.1mm

Pr 11 – Displayed Measurement Units   [0 to 6, **0**]
This parameter controls the type of measuring units that will be displayed on the DRO.
The table below illustrates the possible combinations of measuring units that can be configured by changing the value of this programming parameter.
Default = 0

Pr 11 Parameter Setting	Displayable Units
0	All inch units, metric in millimeters
1	Millimeters only
2	Decimal inches and millimeters
3	Decimal inches and centimeters
4	All inch units, metric in centimeters
5	Centimeters only
6	Decimal inches only

Pr 12 – Auto-Off Time   [0 to 240, **15**]
This parameter allows changing of the amount of time before the display turns off to conserve battery power. The value of this parameter represents the number of minutes of idle operation (no movement or key presses) before the display turns off.
When Auto off is enabled, pressing the **ON/OFF** key or movement of the encoder will wake up the DRO.
A value of '**0**' disables the auto off feature (DRO is always ON).
Default= 15

Pr 13 – Linear Compensation   [0.00001 to 9.99999, **1.00000**]
This parameter sets a linear multiplier correction factor in the DRO that is applied to the actual measurement prior to any offsets and then the adjusted measurement is displayed on the LCD. This is useful, for instance, if you would like to display half, double, or any other value that can be achieved by multiplying the amount of actual movement by the value of the parameter setting.
Default = 1.00000

Pr 14 – ProScale Compatibility   [0 or **1**]
This enables or disables compatibility with long ProScale ABS systems.
Disable [set to **0**] for all ProScale 150-10, 180, 280, 380 and 580 systems.
Enabled [set to **1**] for ProScale Model ABS systems longer than 16 inches (Model 150-18 and all Model 250 systems).
Default = 1

Pr 21 – Backlight Control   [0 to 10]
(Panel Mount DROs only.)
If the Backlight Option is ordered, this parameter controls the amount of time, in seconds the backlight is on when either a key press or motion is detected.
0 = Always Off, 10 = Always On, 1 – 9 is in seconds of ON time.
Default = 10 (Always On)

Pr 22 – ABS/INC Key Operation   [0 or 1]
(General Purpose DROs only.)
This controls the amount of time the **ABS/INC** key needs to be pressed to enter the INCremental measuring mode.
0 = Hold **ABS/INC** key for 1.2 seconds to enter INC mode.
1 = Momentary (less than 1 sec) press **ABS/INC** key to enter INC mode.
Default = 0 (1.2 seconds)

Pr 23 – Auxiliary Keypad Enable   [0 to 3, 3]
(General Purpose DROs only.)
Enables or disables the operation of the **ABS/INC** and **SEND** keys on the auxiliary keypad. See a list of values below for key mapping.
0 = Disable Both Keys
1 = Enable **ABS/INC** Key only
2 = Enable **SEND** Key only
3 = Enable Both Keys
Default = 3 (Enable both keys)

Pr 24 – Special Functions.   [0 to 4, 0]
This is used to control special functions that utilize the **F2**, **F3** & **F4** keys.
These functions are listed below.
Default = 0 (No Special Functions)

Programming Parameter Pr24 Value	Function
0	No Special Functions
1	F3 = MON F4 = HOLD F2 = SPC delete
2	Go/No Go gauge operation
3	Measurement Accumulation
4	Statistics Mode

Pr 25 – Special Functions Option.   [0 to 16, 0]
The parameter may be used when a special function has been selected to customize the operation of the special function. See the Special Functions section for details on this parameter's use.
Default = 0

Pr 26 – Position Monitor Drift Tolerance.   [.0004" to 120", **.01"]**
This parameter sets the amount of drift that must occur in MONitor mode to trigger a drift condition indication.
Default = .01"

Pr 27 – Use Soft Limits.   [0 or 1]
Enables or disables the use of soft limits. If enabled, a message on the LCD is displayed when the measuring system is operating outside the programmed (Pr 28 & Pr 29) position limits. 0 = off, 1 = on.
Default = 0 (off)

Pr 28 – Lower Soft Limit Position.   Range: Any displayable position.
Defines the position to be used as the lower limit if the **Use Soft Limits** parameter is enabled (Pr 27=1).
Default = 0.000

Pr 29 – Upper Soft Limit Position.   Range: Any displayable position
Defines the position to be used as the upper limit if the **Use Soft Limits** parameter is enabled (Pr 27=1).
Default = 5.000"

Pr 30 – Offset Addition Enable.   [0 to 4, **0]**
Enables or disables offset addition function. This feature allows the user to choose from up to 4 programmed values that can be added to the current position using the **F1** key.
1 = Offset 1 enabled   2 = Offsets 1 & 2 enabled
3 = Offsets 1, 2 & 3 enabled   4 = Offsets 1, 2, 3 & 4 enabled
Default = 0 (Disabled)

Pr 31 – Offset Addition Preset 1.   Range: Any displayable position
This value is added to the current ABS position when Offset Addition is enabled (Pr 30 not set to 0) and Offset Preset 1 is selected with the F1 key.
(1 segment displayed on LCD).
Default = .5" (12.7mm)

Pr 32 – Offset Addition Preset 2.   Range: Any displayable position
This value is added to the current ABS position when Offset Addition is enabled (Pr 30 not set to 0) and Offset Preset 2 is selected with the F1 key.
(2 segment displayed on LCD).
Default = 2" (50.8mm)

Pr 33 – Offset Addition Preset 3.   **Range: Any displayable position**
This value is added to the current ABS position when Offset Addition is enabled
(Pr 30 not set to 0) and Offset Preset 3 is selected with the F1 key.
(Ƹ segment displayed on LCD).
Default = 3" (76.2mm)

Pr 34 – Offset Addition Preset 4.   **Range: Any displayable position**
This value is added to the current ABS position when Offset Addition is enabled
(Pr 30 not set to 0) and Offset Preset 4 is selected with the F1 key.
(Ӌ segment displayed on LCD).
Default = 3" (76.2mm)

Pr 35 – External Keypad Input 1.   **[**0 to 11, **0]**
Allows an external normally open switch to be connected to the DRO and
emulate any key operation of the system. See: **CIRCUIT BOARD JUMPER JP5** also.
Default = 0 (no key map)

Pr 36 – External Keypad Input 2.   **[**0 to 11, **0]**
Allows an external normally open switch to be connected to the DRO and
emulate any key operation of the system.
Default = 0 (no key map)

Value of Pr 35 & 36	Key
1	On/Off
2	Units
3	Plus
4	Datum
5	Minus
6	ABS/INC
7	Send
8	F1
9	F2
10	F3
11	F4

Pr 37 – Programmable Output Polarity.   **[0** or 1**]**

Sets the normal state of the programmable output when **not** activated. The output is a transistor that conducts to negative.

0 = Normally open.
1 = Normally closed.
Default = 0 (NO)

Pr 38 – Programmable Output Operation.   **[**0, to 3, **0]**

Selects the function that the programmable output activates on.
See: **CIRCUIT BOARD JUMPER JP5** also.

0 – No Operation.
1 = Drift Monitor
2 = Soft Limits
3 = Go/No Go
Default = 0

Value of Pr 38	Function
0	No Operation
1	Drift (Monitor) Operation
2	Soft Limits
3	Go/No Go

The following Programming Parameters are available only on General Purpose DROs with firmware ending in "C" (part # 700-1600-236).

Pr 39 – Non-Linear Compensation Enable. **[0** or 1**]**
Enables or disables the Non-Linear Compensation feature of the DRO.
Default = 0 (off)

Pr 40 – Non-Linear Compensation Interval. **[**0.5 to 10.0, **5.0]**
Sets the distance interval used while performing non-linear compensation calibration.
Default = 5" (127mm)

Pr 41 – Temperature Compensation Enable. **[0** or 1**]**
Enables or disables the temperature compensation feature of the DRO.
Default = 0 (off)

Pr 42 – Temp. Comp. Low Position. Range: Any displayable position
This parameter indicates to the DRO the lowest (smallest) position of the encoder under normal operation based on the ABS position.
If a new datum is applied to the ABS position, this parameter must be updated for proper operation.
Default = 0.00

Pr 43 – Temp. Comp. High Position. Range: Any displayable position
This parameter indicates to the DRO the highest (largest) position of the encoder under normal operation based on the ABS position. If a new datum is applied to the ABS position, this parameter must be updated for proper operation.
Default = 0.00.

Pr 44 – Temperature Compensation Coefficient. **[**10 to 999, **222]**
This parameter allows the user to modify the temperature expansion coefficient value used when temperature compensation is enabled. The value displayed is internally multiplied by 10^{-7} to yield an expansion in meters/meter °K x 10^{-6}. For example, the thermal expansion coefficient for aluminum is 22.2 m/m °K x 10^{-6}. This would be entered into the display as 222.
Default = 222
Range: 10 to 999 will yield values from 1.0 m/m °K x 10^{-6} to 99.9 m/m °K x 10^{-6}.
Note: Coefficients MUST be in m/m °K, NOT in/in °F.

Frequently Asked Questions

What does `no Enc` mean?

If the Encoder is off the Scale, or the Encoder cable is unplugged from the Digital 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 Digital Readout for one second and then reconnect the Encoder.
3. Connect the Encoder to the Digital Readout.

What does `b FAIL` mean?

When the readout displays this message it means the battery voltage has dropped to a level where reliable operation is no longer possible. Install new batteries to clear this message.

What does `P FAIL` mean?

When the readout displays this message it means the battery voltage has dropped to a level where reliable programming is not possible. Install new batteries to clear this message.

The battery clips seem to be very loose. Is this normal?

YES! DO NOT bend these clips or wedge anything between them and the case. These clips are designed to expand when the two case halves are screwed together.

The Digital Readout numbers appear to be random. (Model 150 & 250 only)

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

The Digital Readout does not change, or changes very little, as the Scale or Encoder moves.
1. The Digital Readout is in the HOLD mode.
2. The Encoder is on the Scale backwards.
3. The Scaling factor is set very low.

The Digital Readout alternately shows "`no Co`".

The digital readout has non-linear accuracy compensation firmware and the position of the encoder is outside the programmed calibrated operating range **OR** the system datum has been changed. Move the encoder to a position within the calibrated range and make sure the system datum is set properly.

For additional information visit: http://www.proscale.com/support/faq.htm

ProRF SPC
ProRF allows linear measurement or position data to be transmitted wirelessly to a PC or other device having a USB or RS232 connection. The system uses 802.15.4 radio modules to provide reliable two way communication. The transmitter plugs into any Digital Readout with an SPC output.

ProRF Encoder
Instead of a long cable between the Encoder and the Readout, a Transmitter at the Encoder sends data to a Receiver connected to the Readout at a remote location, or to a PC Receiver with RS232 or USB output.

ProMUX
ProMUX-3 is an easy to use hardware interface that provides communication from M150 & 250 readheads (or SPC equipped readouts) to a user's PC or PLC. ProMUX-3 supports three inputs, and one RS232.

Analog Interface Unit
The AIU is an interface designed to provide an analog signal output proportional to the displayed position of a ProScale measurement system.

SPC Converter
GageWay SM ™ converts SPC output from many of our digital readouts to serial or USB data.

Thank you for choosing a ProScale Product,

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www.proscale.com/registration.htm