Accurate
TECHNOLOGY INC.
Linear Digital Measuring Systems

ProTable™

Operation Manual
For ProTable
Serial Number _____

System Serial Numbers

ProTable: _____

Readout: _____

Encoder: _____

Scale: _____

Factory Scaling Factor: _____

DO NOT CHANGE the Scaling Factor setting. DOING SO WILL VOID YOUR CALIBRATION. If the Readout is reset or replaced, reprogram it with the Scaling Factor shown above.
See Section 4: PROGRAMMING, PR 13

Additional settings for ProTable Systems ordered with Enhanced Accuracy option.

Pr 39 – Non-Linear Compensation Enable set to: ____

Pr 40 – Non-Linear Compensation Interval set to: ____

Pr 41 – Temperature Compensation Enable set to: ____

Pr 44 – Temperature Comp. Coefficient set to: ____

If your ProTable is equipped with Enhanced Accuracy, and the Readout, Scale or Encoder is replaced, it will require re-calibration and the settings above will need to be programmed in the replacement DRO and the system will require non-linear compensation and re-calibration.

See Section 4: PROGRAMMING, PR39 & PR40

WARRANTY

Accurate Technology, Inc. warrants the ProScale 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

Please register your system at:
www.proscale.com/registration.htm

TABLE OF CONTENTS

Introduction

ProTable™ is a family of single and multi-axis, contact and non-contact, dimensional measuring systems. They are ideal for Quality Control or Quality Assurance applications in both controlled and non-environmentally controlled areas of manufacturing.

ProTable comes in two configurations: free-standing (with optional legs) or as a benchtop system (standard).
Several standard measurement ranges are available up to 228in. (5.8m).

ProTable is often built to meet customer specifications or requirements for a particular application or measuring environment. Custom lengths, measuring jaws and other distinct features are also available through on-line collaboration with our CAD department. See ProTable Designs for examples of some of the various designs we have produced..

ProTable is available with several options and accessories. Please refer to Section 6: **OPTIONS/ACCESSORIES**, or visit www.proscale.com.
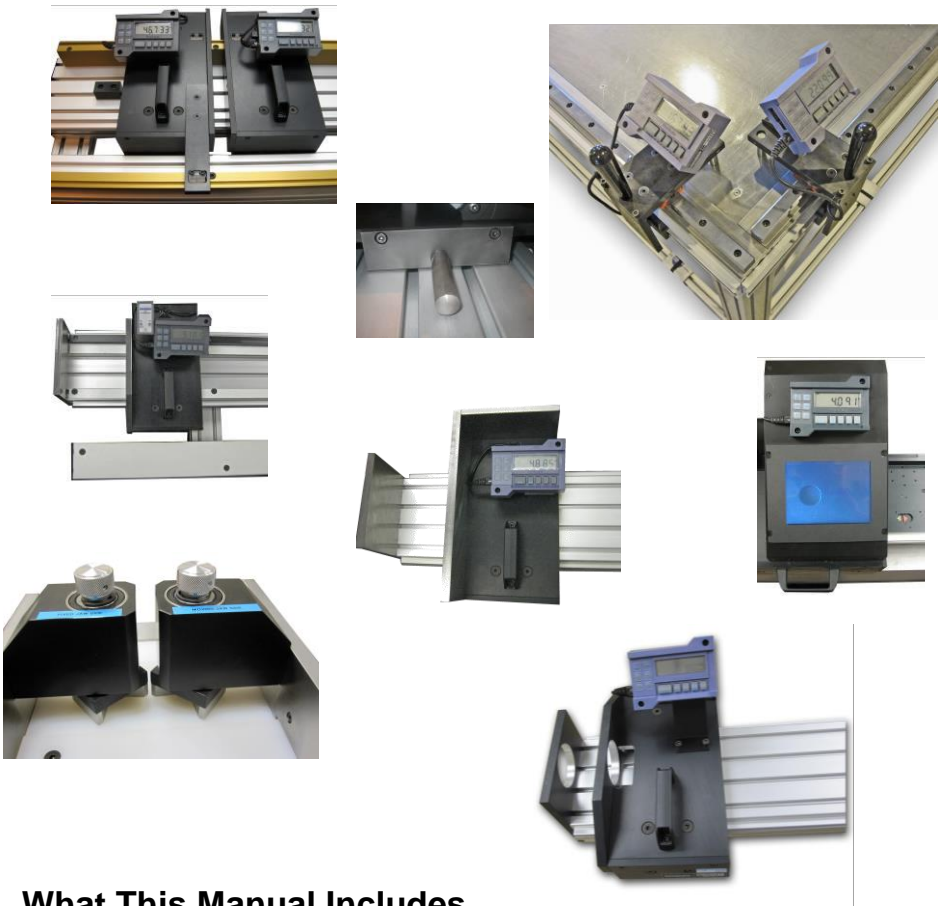
What This Manual Includes

This manual includes set-up and operation information for all ProTable Measuring Systems with Readout firmware version 3.1 or higher. (The Firmware version is displayed on Readout power-up, i.e. P3.100)

ProTable Specifications

Measuring Range:
ProTable-4   Up to 50 inches, 1.2M
ProTable-6   Up to 72 inches, 1.8M
ProTable-8   Up to 96 inches, 2.8M
ProTable-10   Up to 120 inches, 3.0M
ProTable-12   Up to 144 inches, 3.6M
ProTable-16   Up to 192 inches, 4.8M
ProTable-20   Up to 228 inches, 5.8M

Accuracy:

Standard Model $\pm$ .010inches, .25mm   over entire range
Enhanced Accuracy (opt) $\pm$ .003inches, .08mm   over entire range

Resolution: .1inch   .1mm   .1cm   or
                            .01inch   .01mm .01cm   or
                            .001inch .01mm .001cm   or
                            .0005inch .01mm .001cm

Repeatability: .01mm or .001cm or .001in

Readout Range: $\pm$ 999.999 in; $\pm$ 399 63/64 in
                            $\pm$ 9999.99 mm; $\pm$ 999.999 cm

Operating Temp: 55 to 85°F

Temp Coefficient: 13ppm / °F

Power: One CR123 Lithium Battery
                            (custom units may use 24VDC)

Battery Life: 8-12 months

System Warranty: One year from date of purchase.

SPC Output Format: Mitutoyo Digimatic® SPC

Encoder: Custom *High Speed* with six-conductor molded
                            cable terminated by RJ12 modular connector.

Max. Slew Rate: **16** inches/sec.

All ProTables are manufactured in the USA

Assembly

The moving jaw has been adjusted for squareness and parallelism and sealed at the factory prior to shipping. If the jaw assembly arrived with any looseness in its movement along the linear shafts, it may require adjustment. **Notify Accurate Technology before any adjustments are attempted.** See **Maintenance**, page 15, for details.

Free-standing models:
1. Mount the legs to the bottom of the main table using the included fasteners.
2. Attach the feet to the legs using the included fasteners. (If equipped with casters, attach them using the supplied M8 bolts and T-nuts, 2 per caster).
3. Attach the shelf between the legs using the included fasteners.

12-24VDC Operation

The standard Digital Readout will operate on one CR123 lithium battery or 12-24VDC. The readout uses a multi-purpose plug-in connector for power as well as input and output signals.
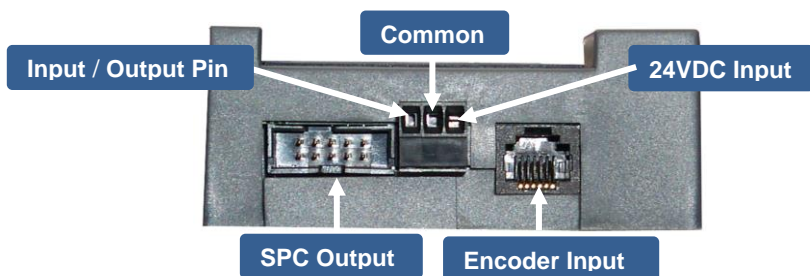
Initial Set-up

In most instances the initial parameters such as a reference point, measurement units and resolution will be factory set for your ProTable System.

Measurement Units: The measurement units that are displayed (inch, mm, cm) are selected with the UNITS Key.

Current Position: The Readout allows the current position to be easily configured, using the +, - & (optionally) DATUM Key.

Reference Point: The Readout allows a reference point (zero or other value) to be easily recalled using the DATUM Key. The value of this reference point is programmed at Programming Parameter Pr1..

Reading Direction: The direction, of the reading as the measurement system is moved is programmed using Programming Parameter Pr2.

Resolution: The resolution of the displayed units is programmed using Programming Parameter Pr4.

Calibration

Your ProTable has been calibrated at the factory using NIST traceable gage bars. However, since ProTable is made from aluminum which has a temperature coefficient of 13ppm/°F, changes in temperature can cause differences in a given measurement. It is therefore recommended you use ProTable in a temperature stable environment.

ProTable is based on the ProScale measurement system, which is a passive device in terms of its accuracy. As such, except for temperature changes, it will not "lose" its original accuracy. When ProTable is calibrated at the factory, a scaling factor in the digital readout is sometimes used to correct for linear errors.
DO NOT CHANGE THIS SCALING FACTOR; DOING SO MAY VOID YOUR CALIBRATION. If your readout is replaced or reset to factory defaults, reprogram the factory scaling factor (shown on page 2) to ensure optimal accuracy.

For ProTable systems ordered with the Enhanced Accuracy option:
See **COMPENSATION FUNCTIONS** on page 35 for additional information.

ProTable measurement systems have been designed to minimize mechanical measurement errors*. However, changes in mechanical soundness (such as loose bearings), table deflection (due to a non-level surface, or large loads), or severe temperature changes can affect the accuracy and repeatability of the entire system. In addition, inconsistent measuring techniques (such as multiple operators) can contribute to measurement errors. A Gage R & R study should be considered if numerous operators will be using the ProTable.
* See: **ABBE ERROR.**

Readout

Most ProTable Systems (Standard Models and some Custom Designs) use a ProScale General Purpose Digital Readout with built-in Temperature and Non-Linear Compensation functions.

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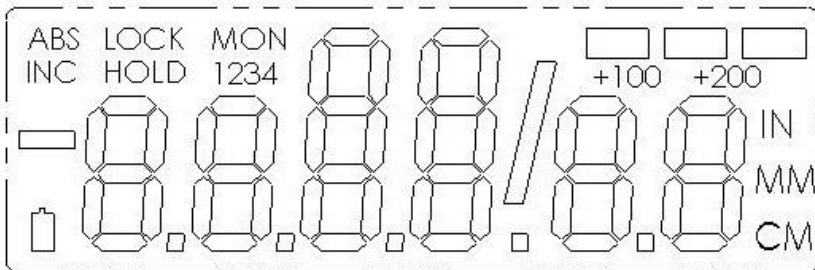
The figure above illustrates all the segments available on the DRO LCD

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

* Internal jumper JP3 must be set to the Program Enable position to allow the DRO to be reset to factory defaults as described above.
See Section 2: **CIRCUIT BOARD JUMPERS**

Circuit Board Jumpers
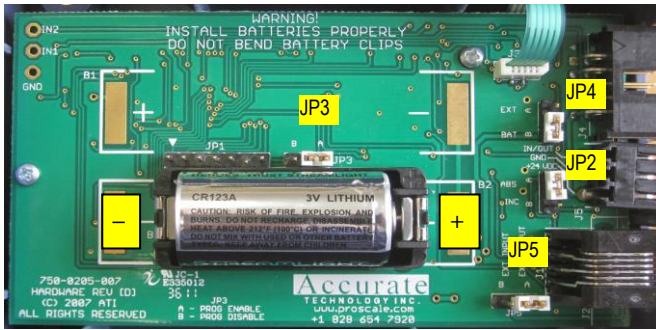
JP1   **FACTORY USE ONLY**

JP2   **FACTORY USE ONLY**   **Position A ONLY**

JP3   **Programming Lock-out**   **Default = Position A**

Front panel programming of the Readout can be enabled or disabled though the use of this jumper.   ***Factory set for ProTable Systems to B position.***

Position **A:** Front panel Programming is *enabled*
Position B: Front panel Programming is *disabled*
When programming is disabled, the user cannot access the programming functions via the front panel as described in the <u>Section 4: PROGRAMMING</u>. This provides a method of configuring the Readout with specific parameters for ProTable operation and preventing unauthorized or accidental configuration changes from the front panel.

JP4   **Readout Power**   **Default = Position B**

The Readout will operate on an internal CR123 lithium battery or a supplied 12-24VDC. When this jumper is installed in position A the Readout is powered by an external DC power source via the power connector. When this jumper is installed in position B the Readout is powered from the internal battery.

JP5   **Input/Output Selection**   **Default = Position A**

The Readout has connections used for External Power or an Input/Output connection. This jumper is used to configure the connections as Inputs or Outputs.
In position **A**, the connections are configured for OUTPUT.
In position **B**, the connections are configured as INPUTS

Replacing the Battery

When the Readout battery needs to be replaced, a low battery indicator will appear in the lower left corner of the LCD. Press and hold the **DATUM** key for 6 seconds to display the Battery Voltage.

When battery voltage drops below 2.6v, the Readout will turn itself off until the battery is replaced.
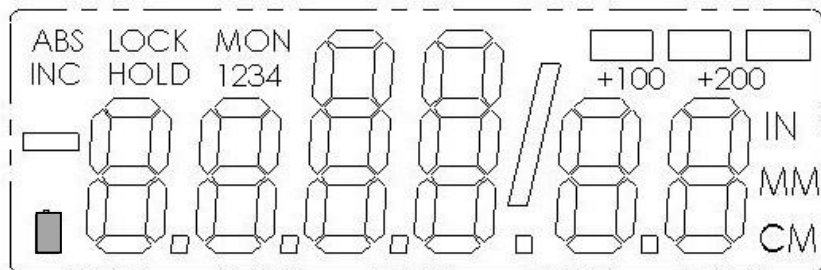
To replace the battery:
Remove the screws in the upper right and lower left corners. Pull the cover off. Remove the old batteries. Install a new CR123 battery noting the proper orientation. Replace the cover and screws.

Maintenance

A regular schedule for cleaning is recommended.

Table Surface, Jaw Faces, Scale, and Readout: These components should be kept free of dust, dirt, and other residue as much as possible. These parts can be cleaned using compressed air (up to 80psi), or by wiping with a nonabrasive cleaner. DO NOT use solvent based cleaners to clean the measurement scale.

Bearing Rails: The steel bearing rails should be kept as clean as possible. There are four pads that clean the bearing rails as the sliding jaw assembly is moved. These pads should be saturated with light machine oil as needed to ensure long life. Replacement pads are available from Accurate Technology (P/N: 100-3308-001).

Moving Jaw Bearing Adjustment: The moving jaw assembly uses roller bearings which ride on the steel rails along the sides of the table. The two bearings in the front are eccentric and are used to adjust the front-to-back parallelism of the moving jaw.
Contact Accurate Technology before any adjustments are attempted.

To adjust the bearings:
1. Loosen the spanner nuts using the supplied spanner wrench. This is done by turning the spanner nuts counter-clockwise **as viewed from the bottom of the ProTable.**
2. Adjust each of the eccentric bearings until they contact the linear shaft on the front side of the ProTable.
3. Close the sliding assembly until the fixed and moving jaws make contact with each other.
4. Using very small adjustments rotate each of the eccentric bearings until the jaw faces are parallel. (The parallelism of the jaws can be checked by measuring a feeler gage at the front and rear of the jaws and comparing the readings.)
5. After the moving jaw is adjusted to parallel, lock the spanner nuts. When tightening the spanner nuts, be sure to keep the M6 hex wrench stationary. The spanner nuts should be rotated clockwise **as viewed from the bottom of the ProTable** until tight. Medium strength thread-locker may be used on the threads of the spanner nut if desired.
6. If excess adjustments are made, ProTable may need to be re-calibrated by a factory-authorized technician.

Free-Standing Systems: Tighten all leg, feet, caster and shelf fasteners as needed.

Measure a Part

1. Slide the moving Jaw assembly to the right until the part to be measured will fit between the jaws.

2. Place the part to be measured against the fixed jaw. If the backfence option was ordered, be sure the part is also placed against the backfence. If a V-block option was ordered, be sure the part is placed into the cradle of each V-block.

3. Slide the moving assembly up against the part to be measured. The part length is displayed on the Readout.

4. Press the SEND key to send the measurement data to the SPC output (and the RF transmitter, if equipped).

Measure Parts Relative to a Reference

1. Slide the moving Jaw assembly to the right until the reference part (ie a gage bar) to be measured will fit between the jaws.

2. Place the reference part to be measured against the fixed jaw. If the backfence option was ordered, be sure the reference part is also placed against the backfence. If a V-block option was ordered, be sure the reference part is placed into the cradle of each V-block.

3. Slide the moving assembly up against the reference part.

4. The reference length is displayed on the Readout. Press the ABS/INC button to switch to relative (INC) measurement mode.

5. Measure the production part using the same method as in steps 1 - 3. The difference in length between the reference and the production parts is shown on the Readout. A negative number indicates the production part is shorter than the reference part.

6. If desired, the difference can be transmitted by pressing the SEND key.

Readout Operation and Programming

Key Timing

Several keys on the Readout have multiple functions. The function executed when the key is depressed is dependent on <u>how long the key is depressed</u>. Therefore, how long the key is depressed is important.

This manual uses the term "*Momentarily*" to describe a key depression of less than .8 seconds, and *"Press and Hold*" to describe a key depression of longer than 1 second.

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

For *Momentary* operations, Functions are executed when key is <u>released</u>.

For *Press & Hold* operations, Functions are executed after key has been <u>depressed for the prescribed amount of time</u>.

See the chart below for a summary of the functions performed by these keys:

	Momentarily	*Press & Hold*
On/Off Key	Turns Readout power On or Off	No effect
Units Key	Cycles through measurement units: inches, fractions, mm	No effect
Plus (+) Key	Increments displayed value	Increments faster
Datum Key	Forces displayed reading to programmed Datum value	After 6 seconds displays battery voltage After 9 seconds displays Temperature
Minus (-) Key	Decrements displayed value	Decrements faster

For a video demonstration of KEY TIMING click HERE.

Key Functions

On/Off Key

Momentarily Depress

Momentarily depress the **ON/OFF** key to turn the Readout on or off.
(The Readout Firmware version displays for two seconds at power-on.)

Units Key

Momentarily Depress
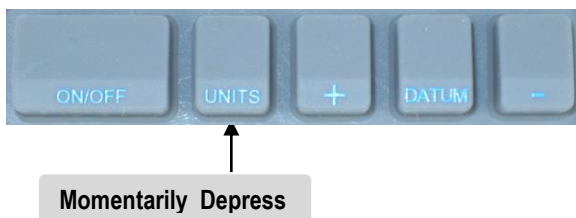
Momentarily depressing the **UNITS** key will display measurement/position information in inches, fractions or millimeters (or centimeters). With each key press, the readout will cycle through decimal inches, fractions (16ths, 32nds, 64ths) and millimeters (or centimeters). To set the measurement modes that are displayed when pressing the **UNITS** key use *__Programming Parameter (Pr11).__*

When the Readout is in 1/16 or 1/32 inch fraction mode, a series of "bars" in the upper right corner of the LCD may appear each representing 1/64th of an inch. (ie. When in 1/16 inch mode and three bars appear, 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.

In Fractions mode, when the measurement is greater than 99 63/64 inches, +100 and/or +200 will illuminate in the upper right portion of the LCD 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 appear on the LCD, If the measurement is -307 23/64 inches, - 7 23/64, +100 and +200 will appear on the LCD.

Plus (+) & Minus (−) Keys

Momentarily Press, or Press & Hold

Momentarily depressing the **+** or **−** key will increment or decrement the current displayed value by one unit of measurement. (in, mm, cm or 1/64)
Press & Hold the **+** or **−** key to continue to increment or decrement the displayed value. The longer the key is depressed, the faster changes occur.

The **+** & **−** keys may be locked out to prevent accidental entries by using *key lock* and/or *Programming Parameter (Pr3).*

Datum Key

Momentarily Press, or Press & Hold

Momentarily depressing the **DATUM** key forces the Readout to a user programmed value. This can be zero or any other displayable value.
Set the **DATUM** key value by programming *Parameter (Pr1).*

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 "F" or "C" based on the current units setting (Inch or Metric).

The **DATUM** key may be locked out to prevent accidental entries by using *key lock* and/or *Programming Parameter (Pr3).*

Basic Readout Functions

Auto on/off
To prolong battery life, the Readout has a built-in function that turns off the Readout after a period of no movement or key activity. The Auto On/Off function is programmable from 0 (always on), to 240 (minutes) before entering sleep mode.
Press the **ON/OFF** key or move the measurement system to wake up the Readout. Any key press or system motion while the Readout is awake restarts the Auto On/Off timer. Use *Programming Parameter (Pr12)* to set this interval.

Reading Direction
If the direction of readings, (increasing vs. decreasing) is opposite the desired direction, use *Programming Parameter (Pr2)* to reverse the Reading Direction.

Resolution
Four selectable display resolutions are available.
Fractional inches display mode is not affected by resolution changes.

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

Use *Programming Parameter (Pr4)* to set the displayed resolution.

Data displayed (and sent to the SPC output) is auto-ranging. This means the selected resolution may be temporarily overridden if the measurement or position to be displayed exceeds the maximum displayable value for the programmed resolution. The Readout will continue to automatically reduce the resolution to 1 decimal place or until an allowable resolution is achieved. The available resolutions 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

Measurement Units

The measurement units displayed on the Readout are user configurable. The table below provides a matrix for selecting the measurement units that may be displayed when pressing the **UNITS** key.

Use *Programming Parameter (Pr11)* to set this value.

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

Key Lock

The Readout provides a function that can "lock-out" the position adjustment keys (**+, DATUM** & **–**) to prevent accidental changes of the displayed value.

To activate Key Lock: *Press and Hold* the **ON/OFF** key and, while pressing it, *Momentarily* depress the **UNITS** key, then release both keys. The word **LOCK** will be displayed in the upper left corner of the LCD.

When **LOCK** is displayed, the **+, DATUM** and **–** keys become inactive.

To de-activate the Key Lock: Press and Hold the **ON/OFF** key and, while pressing it, Momentarily depress the **UNITS** key, then release both keys.

Key Lock may also be enabled through Readout Programming. This method allows a more permanent Key Lock since programming can be disabled with a hardware jumper inside the Readout.

See Programming Parameter (Pr3) to enable this function.

Segment Offset Adjustment

This function applies to all ProScale products employing Absolute measurement technology that measure more than 17 inches (430mm).
The scale on your ProTable looks like this:

And it uses Absolute technology

To manufacture measuring scales longer than 17 inches, multiple scale 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 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 Readout and then moved along the Scale to another segment. It may also occur if the Moving Jaw (Encoder) is moved too quickly along the length of the table. 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.
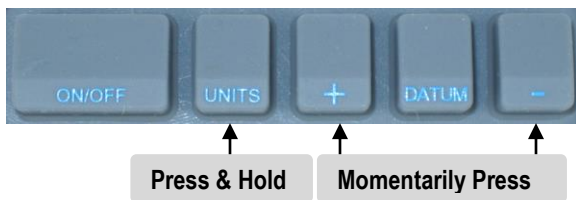
To add one segment value (430.08mm) to the displayed value, press and hold the **UNITS** key and then momentarily press the **+** key. The displayed position will increase by 430.08mm (16.933 inches). To subtract one segment, 430.08mm, from the displayed value, press and hold the **UNITS** key and then momentarily press the **-** key.
Alternatively, close the moving jaw and press the **DATUM** key to re-zero the ProTable.
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 the DRO when either the Upper or Lower limit is exceeded.
See **PROGRAMMABLE OUTPUT OPERATION.**

Linear Scaling

This function is useful when the actual measurement or position must be multiplied or divided before being displayed on the Readout.
This function has a range of 0.0001 to 9.9999 allowing the actual measured value to be multiplied or divided in very small or very large increments.
See ***Programming Parameter (Pr13****) f*or additional information.*

See page 2 of this manual for the Linear Scaling Factor applied to your ProTable system.

Advanced Readout Functions

The Readout has two measurement indexes. One is called ABS (absolute) and the other INC (incremental). The ABS measurement setting is designed to allow a user to set an origin point on the Readout referenced to a fixed or known position. The INC measurement setting is designed to take relative or incremental measurements from one point to another. The settings operate independently allowing separate position offsets to be programmed for ABS and INC. The origin, or known position of the measuring system is not lost when using the INC measurement mode and is recalled and displayed when the Readout is returned to ABS mode.

NOTE: The terms "*Absolute*" and "*Incremental*" are used here to describe a measurement function or technique and should not be confused with Absolute and Incremental when used in reference to the type of Measuring Technology employed by different ProScale products.

Absolute (ABS) Measurements

The Readout automatically enters ABS mode when power is first applied. This is indicated by **ABS** in the upper left corner of the LCD. While in ABS mode, all position measurements are related to the current system reference point.

To enter INC (Incremental) mode:

Press and Hold the **ABS/INC** key for 3 seconds.

NOTE: To change the timing of this key to *Momentarily*, see *Programming Parameter (Pr22).*

Incremental (INC) Measurements

While in the INC mode, **INC** is shown in the upper left corner of the LCD. When 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 (**0.00**) but may be changed by using the **+** or **−** Key to enter an offset. Moving the Jaw in either direction will display the distance moved from the initial INC starting point (plus any offset). To complete another incremental measurement from the new position, *Momentarily* press the **ABS/INC** key. The Readout will again change to zero (or the previously programmed offset). To return to the ABS mode, *Press and Hold* the **ABS/INC** key for 3 seconds.

Send

The Readout has an output port that may be used to send measurement or position information to another device (i.e. a PC) via a wireless transmitter.

See Section 6: *Accessories*

After connecting a transmitter or cable to the 10 pin output connector on the Readout, the user may initiate the data transmission by momentarily pressing the **SEND** key. This will cause Snd to display on the Readout for 1 second to show activation of the send function (even if no device is attached to the Readout).

All inch modes are transmitted as decimal inches. All metric modes are transmitted as millimeters. The 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 *Advanced Readout Functions*). In those modes, the displayed (or calculated) values are sent, NOT the current encoder position.

The data format and connector style of the output port is Mitutoyo Digimatic. This is an industry standard that can be interfaced with most products including multiplexers & RS232 converters (See Section 6: *Accessories*).

NOTE: If a Wired Data Converter is preferred, ProTable MUST BE ORDERED with Scales and Encoders having part numbers ending in 'G'.

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 switch from one reference point to another.

See PROGRAMMING PARAMETERS (Pr30, 31, 32, 33 & 34)

The General Purpose and 950 Series Readouts support up to 4 user definable offsets that may be added to the ABS position.

PROGRAMMING PARAMETER Pr30 enables or disables this function.

PROGRAMMING PARAMETERS Pr31, 32, 33 & 34 are used to configure this function.

When enabled, the user can scroll through the active offsets by pressing the **F1** key. The numbers $1, 2, 3$ or 4 will be displayed on the upper left part 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.

Similarly, when the number 2 is displayed in the upper left corner, Offset Addition Preset # 2 (*Pr32*) has applied to the measurement. When the number 3 is displayed, Offset Addition Preset 3 (*Pr33*) has been applied to the measurement, and when the number 4 is displayed, Offset Addition Preset 4 (*Pr34*) has been applied to the measurement and the result displayed.

Advanced Programming Functions

Advanced Programming Functions allow the Readout to perform special tasks or invoke custom programming. These tasks interact with the **F** keys to perform functions related to a specific task or programming operation.
Note: The Advanced Functions configurable via *Pr24* are mutually exclusive of each other. The table below provides a summary of the functions available.

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

Note: When *PROGRAMMING PARAMETER Pr24* is set to **0**, the **F2, F3 & F4** keys are disabled and have no function. However, the **F1** key, used only for Offset Addition, is independently controlled by Pr30.

Set Programming Parameter *Pr24* = **1** to enable this function.

Monitor

The Readout can monitor a position to detect drift or measurement variance. To activate the Monitor mode, position the Encoder (system) to the desired location and *Momentarily* press the **F3** key. The **MON** symbol will illuminate on the LCD to indicate Monitor mode is active.

If the Encoder moves outside the programmed tolerance 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 can only be activated while in the ABS measuring mode. If the **ABS/INC** key is depressed, or the normal operational mode is changed (enter programming mode or sending a data transmission), the Readout will automatically exit Monitor mode.

NOTE: When the Monitor mode is enabled AND the programmable output is configured for drift monitoring, the output will not become active until the system has remained 'out of position' for at least 2 seconds.

Hold

The Readout provides a feature that allows the displayed measurement or position to be "held". This allows information to be captured on the Readout and held for later viewing regardless of the current Encoder position.

To activate the HOLD, *Momentarily* press the **F4** key. HOLD will be displayed in the upper left corner of the LCD. The currently displayed position <u>and selected key presses</u> will be held.

To release the HOLD feature, *Momentarily* press the **F4** key again, or cycle power.

NOTES:
- **If power is cycled when HOLD is active, any key (such as UNITS, DATUM, + or –) that is depressed while in HOLD will be executed when power is restored.**
- **Leaving the normal measurement mode, (i.e. enter programming mode, SEND, or using the Go/No Go editor) causes the Readout to automatically exit HOLD.**

Delete

Momentarily pressing **F2** sends a special "*delete*" signal to the output data port. When a ProRF Transmitter is attached to this port, a "*delete*" message will be sent to the ProRF Receiver. This "*delete*" message removes the last measurement from a cut list when connected to another device such as an automated stop or cutting system.

Go/NoGo

In certain applications, it may be desirable to program upper
and lower measurement tolerances to measure 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.

Set Programming Parameter *Pr24* = **2** to enable this function.
Programming Parameter *Pr25* is used to configure this function.
F3 & **F4** are used to edit the function parameters.

Programming the Go No/Go Function

The Readout can store up to 16 measurement points (set by *pr25*), each with
its own upper and lower tolerance. Each measurement index is identified with
a number from 1 to 16. The Go/NoGo Editor is used to enter individual upper
and lower tolerances for each measurement point as follows:

1. Press **F3** to enter the Editor.   The LCD will display **Go X** where x is a
    number from 1 to 16 representing the measurement point to be edited.
    (Pressing **F3** will increment through the list of points (Pr25), while
    pressing F4 will decrement through the list). When the point to be
    programmed is reached go to Step 2.
2. *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 point and
    U indicates the *upper tolerance* is to be programmed. Use the **+** and **−**
    keys to set an upper limit, go to Step 3
3. *Momentarily* press **F3**. The LCD will now display **GoX   L** for 1 second
    where **X** is the measurement index and **L** indicates the *lower tolerance* is
    to be programmed. Use the **+** and **−** keys to set a lower limit, go to Step 4.
4. After the last point is reached, (determined by Pr25), pressing **F3** again
    will display **Go oFF** indicating that the Editor is off.

Operation of Go No/Go Function

To increment through the list of measurement points press **F3.**
To decrement through the list of measurement points 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. Once a measurement point is selected, the LCD will
alternate between the current position and **Go** or **no Go** depending on the
current position and programmed tolerances for that measurement point.

Measurement Accumulator

This Function allows multiple measurements to be made, and the sum displayed on the Readout.

SET PROGRAMMING PARAMETER Pr24 = **3** to enable this function.
PROGRAMMING PARAMETER Pr25 is used to configure this function.
F3 & F4 are used to execute this function.

1. Press the **F4** key to view any previous accumulator 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 measurement mode (**UNITS** key) and the Programming Parameter *Pr25*.
   a. If *Pr25* is set to 0, and the Readout is in inch mode, (decimal or fractions), the accumulated total is displayed in Decimal Inches.
   b. If *Pr25* is set to 0, and the Readout is in metric mode, (mm or cm), the accumulated total is displayed in mm.
   c. If *Pr25* is set to any non-zero value, and the Readout is in inch modes, (decimal or fractions), the accumulated total is displayed as feet and inches. (fff ii) where f=feet and i = inches
   d. If *Pr25* is set to any non-zero value, and the 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. To add a measurement to the accumulator, make the measurement and then press the **F3** key. The LCD momentarily displays **Add** to indicate that the measurement has been added to the accumulated total. Continue to add measurements by pressing the F3 key as each measurement is made.

4. 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 total) to return to the measuring mode.
   c. Press **SEND** to transmit the accumulated total to the output port.

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

Statistics

This Function can perform some basic statistical analysis without the use of SPC data collection on a PC or other device. The Statistics Function can provide the following information:

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))

Set Programming Parameter *Pr24* = **4** to enable this function.
F3 & F4 are used to execute this function.

To begin the Statistics Function:

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

2. Take a measurement and press the **F3** key. The LCD displays A d d x momentarily to indicate that the measurement has been added and how many (x) have been accumulated so far. Continue to take additional measurements and press the **F3** key after each measurement.

3. Review the Data:
Press the **F4** key and the LCD will display C n 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 L o for 1 second followed by the **Minimum** Measured value.
    Then you may:
    a. Press **F3** to clear statistics variables and exit.
    b. Press **F4** to continue underline without underline clearing the variables.
    c. Press **SEND** to transmit the Minimum Measurement to the output port.

Press the **F4** key again and the LCD will display H I for 1 second followed by the **Maximum** Measured value.
    Then you may:
    a. Press **F3** to clear statistics variables and exit.
    b. Press **F4** to continue underline without underline clearing the variables.
    c. Press **SEND** to transmit the Minimum Measurement to the output port.

Press the **F4** key again and the LCD will display either **AG** or **AAG** depending on the setting of the ***PROGRAMMING PARAMETER PR25***.
Then you may:

    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 **SEND** key to transmit the Average Measurement to the output port.

If *Pr25* 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 *Pr25* is set to any **non-zero** value, the LCD displays **AAG** for 1 second followed by Trimmed Average ((Measurement Sum - Max - Min) ÷ (Count - 2))

Notes on the Statistics Function:
Standard averaging will be influenced by the Minimum and Maximum 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 limits this Function to Averaging. Only a running summation is kept in memory, not the value of each measurement sample. Because of this, we cannot calculate the statistical values of 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.

Advanced Hardware Features

Input/Output Connections

An external connector and internal circuit board pads on the General Purpose Readout, and the on-board connector and circuit board pads on the In-Panel Readout provide:

- External Power connection points
- A solid-state Output Signal connection (0.1A / 30 VDC).
- External Key Pad Input connections

This Function is configured using *PROGRAMMING PARAMETER (Pr38)* & *PROGRAMMING PARAMETERS Pr35 & Pr36* and *CIRCUIT BOARD JUMPER JP5*

These INPUT and OUTPUT functions are mutually exclusive and cannot be enabled concurrently.
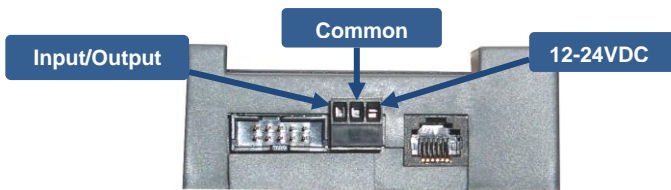
External Power

For 12-24VDC Power INPUT connections, see **12-24VDC Operation** earlier in this manual.
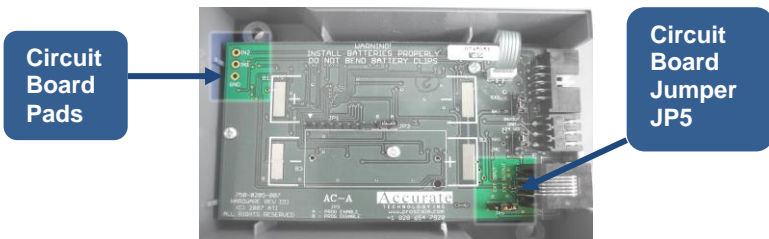
Output Signal Configuration

Set **JP5** on the readout circuit board to position **A.**
Set *PROGRAMMING PARAMETER (Pr38)* for the event that will trigger the output signal.

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

Output Signal Polarity

The polarity of the output signal is set using *PROGRAMMING PARAMETER (Pr37).*
The output is a transistor that conducts to Negative. The factory default is *normally open* (NO).

NOTES: The LCD will flash when any of the programmed conditions above are encountered, but the output signal only changes state once and then toggles back when an in-tolerance condition is restored.

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.

CAUTION: **The output signal remains active during Programming.**
If parameters relating to the output are changed during Programming, the output signal could become active!

External Keypad Input

This Function allows external activation of two keys on the
Advanced Key Pad.
Pr35 maps a key to **IN1** (input 1) and *pr36* maps a key to
IN2 (input 2).

This function is configured using *PROGRAMMING PARAMETERS
PR35 & PR36* and *CIRCUIT BOARD JUMPER JP5*

JUMPER JP5 on the Readout circuit board must be set to
position **B** to enable external inputs.

The multi-purpose external connector on the General Purpose Readout
provides a direct connection to **IN1** (only). This allows for easy external
interfacing without modifying the case or soldering on the circuit board.
There are three solder pads on **both** Readout circuit boards, labeled **IN1, IN2**
and **GND** (the In-Panel readout connections are limited to circuit board solder
pads, no external connections.) Any two of the Auxiliary keys may be
mapped to respond to an external input by programming Pr35 and Pr36 using
the Key Function Mapping Table below.

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
Momentarily and *Press and Hold* functionality.

CAUTION:. DO NOT APPLY VOLTAGE TO THESE INPUTS.
These inputs should only be switched from OPEN to GROUND.

Value of Pr 35 & 36	Mapped to 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

Compensation Functions

Temperature Compensation

This Function provides automatic compensation of measurement variations caused by changes in the ambient temperature where the measurement system is used.
Additionally, coefficients of expansion other than aluminum may be programmed and the resulting measurement compensated for the different expansion rates based on a temperature sensor inside the Readout.
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.

This function is configured using *PROGRAMMING PARAMETERS (Pr41 through Pr44)*

To activate Temperature Compensation:

1. Set *Pr41* to **1**.

2. If necessary, enter the expansion coefficient for the material that the ProScale aluminum Scale is affixed to with *Pr44*.
   Use care if changing this setting. It will affect system accuracy!

Note: Parameters *Pr41* & *44* are preset at the factory for any products ordered with the "*Enhanced Accuracy*" option.

Non-Linear Compensation

This function is used to enhance the basic accuracy of the ProTable 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 ProTable 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.

Before beginning an error compensation calibration, you will need to determine how many points and at what interval to calibrate. Refer to the Correction Chart supplied with your ProTable. 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.

The following example uses 5 inch (interval) measurement standards for a ProTable 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 c a l . 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.

3. 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.

4. 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.

5. 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.

6. 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 Moving Jaw is positioned outside the calibrated range of operation, the LCD will display **NoCo** 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.

IMPORTANT NOTES about ENHANCED ACCURACY COMPENSATION

The placement of the measurement standard(s) during compensation must be repeatable. The placement of the measurement standards must also correlate to the point on the jaws where measurements are to be made during normal operation. For instance, if V-Blocks will be used, measurement standards should be placed at the vertex of the V-Blocks during the compensation procedure. If a backfence will be used instead, the measurement standards should be placed along its front edge.

It should also be noted the factory supplied Calibration Chart plots measurement points ***between*** the compensation points.   This method statistically provides that the worst case error will be charted.
For example: If the calibration interval, as described above, is 5 inches, the plotted points will include points at 2.5", 7.5", 12.5" …etc.

SECTION 4   READOUT PROGRAMMING

Many functions of these Digital Readouts are user programmable and may need to be configured for different applications.

Key Timing

Several keys on the Readouts have multiple functions. The function that is executed when a key is depressed is dependent on how long the key is depressed. Therefore, how long the key is depressed is important.
This manual uses the term "*Momentarily*" to describe a key depression of less than .8 seconds, and *"Press and Hold"* to describe a key depression of longer than 1 second.

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

For <u>Momentary</u> key operations, the Key Function is executed on <u>release.</u>
For <u>Press & Hold</u> operations, the Key Function is executed after the key has been <u>depressed for the prescribed amount of time</u>.

Resetting All Parameters

To reset all programming parameters to their Factory Default settings:
1.   Turn the Readout power off.
2.   *Press and Hold* the **ON/OFF** and **UNITS** keys for 10 seconds.

Press & Hold
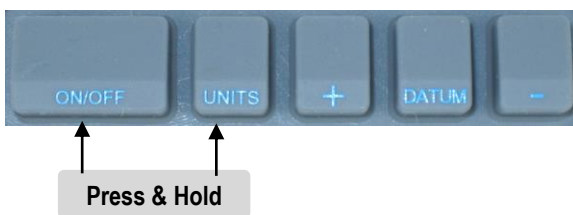
The Readout will:
1.   Perform a full segment LCD test
2.   Display the current firmware version
3.   **Reset all programming parameters to factory default values.**
       (not recommended unless instructed by factory technician)

Enter Programming Mode

Press and Hold the **UNITS** key while *Momentarily* pressing the **DATUM** key. The LCD will briefly display: PG on (Programming On). Release both keys. The LCD will then display Pr   1, (indicating Programming Parameter #1) for about 1 second, then display the value stored for *Pr1*.
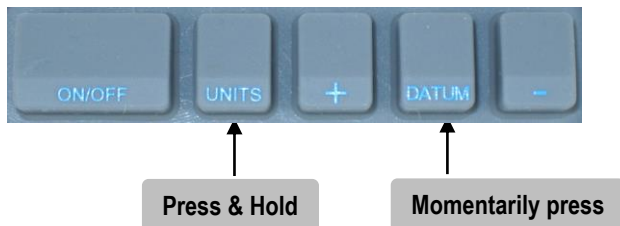
Press & Hold   **Momentarily press**

Navigating Programming Mode:

To move up Parameter list:
Momentarily press the **UNITS** key to advance up through the Programming Parameter list. The Readout will display the Parameter number, then the current programmed value.

To move down Parameter list:
Press and Hold the **ON/OFF** key and *Momentarily* press the **UNITS** key to move backward through the Parameter list.

To Increase a Parameter value:
Momentarily press the **plus (+)** key while the Parameter value is displayed.

To Decrease Parameter value:
Momentarily press the **minus (-)** key while the Parameter value is displayed.

To Reset a Parameter value to the Factory Default setting:
Momentarily press the **DATUM** key while the Parameter value is displayed.

Exit Programming Mode

1. *Press and Hold* the **UNITS** key until the Readout displays **P r   x**
2. *Momentarily* press the **DATUM** key. The LCD will display **P G   o f f**
3. Release <u>both</u> keys. The Readout will return to normal operation.
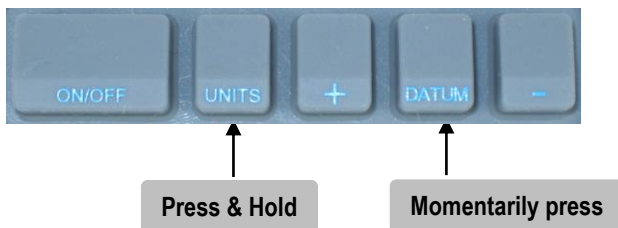
Video demonstration

NOTE: The Readout will automatically exit programming mode after 60 seconds of no key activity.

Programming Parameters

NOTE: Programming parameters are not sequentially numbered due to firmware differences between measurement systems and the provision for future enhancements, functions and custom features.

Programming Parameter Values in brackets **[ ]** represent the range of possible values available for that Parameter.
The Factory **Default Value** for each parameter is shown in **Bold Red.**

Pr1 – Datum Key ·················· **[0 to ± 999.999in]   or   [0 to ± 9999.99mm]**
The value that will be recalled (on the display) when the **DATUM** key is pressed during normal operation. This value would normally be set to 0.00, but may be set to any value the readout is capable of displaying.
Default Value= 0.00

Pr2 – Direction of Travel ·· **[0 or 1]**
This parameter controls the direction (positive vs. negative) displayed on the readout when the measuring system is moved.
Default Value = 0

Pr3 – Key Lockout ·· **[0 or 1]**
This parameter controls the operation of the **+**, **-** and **DATUM** keys.
Default Value = 0

Pr 3 Setting	Key Action
0	+, - and Datum keys respond normally
1	+, - and Datum keys are locked

Pr4 – Display Resolution ······································· **[1, 2, 3 or 4]**
This parameter sets the number of places to the right of the decimal point displayed on the Readout. When the Readout is in a decimal mode (in, mm or cm), it will auto-range to the next lower resolution if the value is too large to be displayed in the current setting but is displayable in a lower resolution.
Default Value = 3

Pr 4 Setting	Display Resolution
1	x.x
2	x.xx
3	x.xxx
4	x.xxxx

NOTES:
- Decimal inches have a maximum of 3 decimal places (4 places $\pm$ .0005).
- Millimeters have a maximum of 2 decimal places
- This option has no effect when displaying fractions.

Pr5 – Movement to Wake Readout ·························· **[0.3 to 10mm]**
This parameter sets the amount of encoder, (or system), movement required
to automatically wake up the Readout when it is turned off or in sleep mode.
Default Value = 0.1mm

Pr6-10 – NOT USED

Pr11 – Displayed Measurement Units ···························· **[0 to 6]**
This parameter controls the type of measuring units the Readout displays
when the **UNITS** key is pressed. The table below illustrates the possible
combinations of measuring units that will be displayed by changing this
parameter.
Default = 0, Factory pre-set to 2

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

Pr12 – Display Auto-Off Time ································· **[0 to 240]**
This parameter changes the amount of time before the display turns off to
conserve battery power. The value is the number of minutes of idle operation
(no movement or key presses) before the display turns off. When this
parameter is enabled ($\neq$ **0**), pressing the **ON/OFF** key or movement of the
encoder or system will wake up the Readout.
A value of '**0**' disables the Auto Off feature (the Readout is always on).
Default Value = 15 (minutes)

Pr13 – Linear Compensation ························· **[0.00001 to 9.99999]**
This parameter invokes a linear multiplier correction in the Readout that is
applied to the actual measurement prior to any offsets. This adjusted
measurement is then displayed on the Readout. This is useful, for instance, if
you would like to display half, double, or other values that can be achieved by
multiplying the actual measurement by the value of the parameter setting.
Default = 1.0000. See Front Inside cover, page 2, for THIS ProTable.

Pr 14 – ProScale Compatibility **[0 or 1]**
Preset at factory for compatibility with ProTable Measurement Systems.
ProTable = 0

Pr15-21 – NOT USED

Pr22 – ABS/INC Key Operation ·· **[0 or 1]**
This parameter controls the amount of time the **ABS/INC** key needs to be
pressed to enter the INCremental measuring mode.
Default Value = 0

Pr 22 Setting	Key press to enter INCremental mode
0	*Press and Hold* ABS/INC key (1.2 sec)
1	*Momentary* depress ABS/INC key (< 1 sec)

Pr23 – Auxiliary Keypad Enable ··· **[0 to 3]**
The parameter controls the operation of the **ABS/INC** and **SEND** keys.
Default Value = 3

Pr 23 Setting	ABS/INC and SEND keys
0	Disable Both Keys
1	Enable abs/inc Key only
2	Enable send Key only
3	Enable Both Keys

Pr24 – Special Functions ·· **[0 to 4]**
This parameter controls which Advanced Programming Function is active
Default Value = 0

Pr24 Setting	Advanced Readout Function
0	None
1	F3 = MON, F4 = HOLD, F2 = Delete
2	Go/NoGo
3	Measurement Accumulation
4	Statistics

Pr25 – Special Function Variable ······································ **[0 to 16]**
The parameter may be used by a special function to customize it's operation.
See Advanced Programming Function for instances when this parameter is
used.
Default Value = 0

Pr26 – Drift Monitor Tolerance [.01 mm to 3048 mm] or [.001 in to 120 in]
This parameter sets the amount of drift that must occur in MONitor mode to
trigger a drift indication.
Default Value = .01 in

Pr27 – Upper/Lower Limits ·· **[0 or 1]**
This parameter Enables/Disables the use of the Upper/Lower Limits Function.
(Set Pr 28 to the lower limit & Pr 29 to the upper limit).
 Default Value = 0

Pr 27 Setting	Upper/Lower Limits Function
0	Function DISABLED
1	Function ACTIVE

Pr28 – Lower Limit ·············· **[0 to ± 999.999in]   or   [0 to ± 9999.99mm]**
This value sets the lower limit of Upper/Lower Limits function when Pr27 = 1.
Default Value = 0.000

Pr29 – Upper Limit ·············· **[0 to ± 999.999in]   or   [0 to ± 9999.99mm]**
This value sets the upper limit of Upper/Lower Limits function when Pr27 = 1.
Default Value = 5.000 in. (127.00mm)

Pr30 – Offset Addition ··· **[0 to 4]**
This parameter Enables/Disables the use of the Offset Addition function.
Pr31, Pr32, Pr33, and Pr34 set the value of the offsets to be added.
Default Value = 0

Pr30 Setting	Offsets Enabled
0	None
1	Offset 1 Enabled
2	Offsets 1 & 2 Enabled
3	Offsets 1, 2 & 3 Enabled
4	Offsets 1, 2, 3 & 4 Enabled

Pr31 – Offset 1 ··················· **[0 to ± 999.999in]   or   [0 to ± 9999.99mm]**
This value is added to the current measurement (or position) when:
Pr 30 ≠ 0, and **1** is displayed in the upper left area of the LCD.
Default Value = .500 in. (12.7mm)

Pr32 – Offset 2 ··················· **[0 to ± 999.999in]   or   [0 to ± 9999.99mm]**
This value is added to the current measurement (or position) when:
Pr 30 ≠ 0, and **2** is displayed in the upper left area of the LCD.
Default Value = 2 in. (50.8mm)

Pr33 – Offset 3 ··················· **[0 to ± 999.999in]   or   [0 to ± 9999.99mm]**
This value is added to the current measurement (or position) when:
Pr 30 ≠ 0, and **3** is displayed in the upper left area of the LCD.
Default Value = 3 in.   (76.2mm)

Pr34 – Offset 4 ··················· **[0 to ± 999.999in]   or   [0 to ± 9999.99mm]**
This value is added to the current measurement (or position) when:
Pr 30 ≠ 0, and **4** is displayed in the upper left area of the LCD.
Default Value = 3 in.   (76.2mm)

Pr35 – External Key Input 1 ··· **[0 to 11]**
This parameter maps the Auxiliary Key to be activated externally.
Default Value = 0

Pr36 – External Key Input 2   **[0 to 11]**
This parameter maps the Auxiliary Key to be activated externally.
Default Value = 0

Value of Pr 35 & 36	Key
0	None
1	On/Off
2	Units
3	Plus
4	Datum
5	Minus
6	ABS/INC
7	Send
8	F1
9	F2
10	F3
11	F4

Pr37 – Programmable Output Polarity ································· **[0 or 1]**
This sets the normal state of the programmable output when **not** activated
and Circuit board jumper **JP5** is in position **A.**
Default Value = 0

Pr 37 Setting	Output Polarity
0	Normally Open (NO)
1	Normally Closed (NC)

Pr38 – Programmable Output Function ································· **[0 to 3]**
Selects the function that the programmable output activates on when Circuit
board jumper **JP5** is in position **A.**
Default Value = 0

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

The following Programming Parameters are available only for ProTables ordered with the Enhanced Accuracy option.

SEE PG 2 FOR SETTINGS APPLICABLE TO THIS PROTABLE SYSTEM.

Pr39 – Non-Linear Compensation ·· **[0 or 1]**
This parameter Enables/Disables the Non-Linear Compensation function.
Default = 0 (off), Factory set to 1 (on)

Pr 39 Setting	Non-Linear Compensation
0	Off
1	On

Pr40 – Non-Linear Compensation Interval ················· **[0.5 to 10.0 in.]**
This parameter sets the distance interval used while performing non-linear compensation calibration.
Default Value = 5.000 in.   (127mm)

Pr41 – Temperature Compensation ···································· **[0 or 1]**
This parameter enables (disables) the temperature compensation feature.
Default = 0 (off), Factory set to 1 (on)

Pr 41 Setting	Temperature Compensation
0	Off
1	On

Pr 42 & 43 – NOT USED

Pr44 – Temperature Compensation Coefficient ················· **[10 to 999]**
This parameter sets the temperature expansion coefficient used when temperature compensation Pr41 = 1.
Default Value = 150

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.

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 battery 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 battery to clear this message.

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.

The Readout alternately shows "no Co".
The readout has non-linear compensation enabled and either:
1. *The position of the encoder is outside the calibrated range*
   Move the encoder to a position within the calibrated range
2. The system datum has changed.
   Make sure the system datum is set properly.
3. The Readout is in INC mode.
   Return to ABS mode and check Datum.

Additional On-Line FAQs

Abbé Error

Abbé 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 and using your ProTable in order to eliminate the possibility for Abbé error.

Abbé 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 Readhead is providing is **only the position of the Readhead 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. Abbé error could be lessened by moving the measuring system closer to the sample. This effectively solves one half of the Abbé 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.
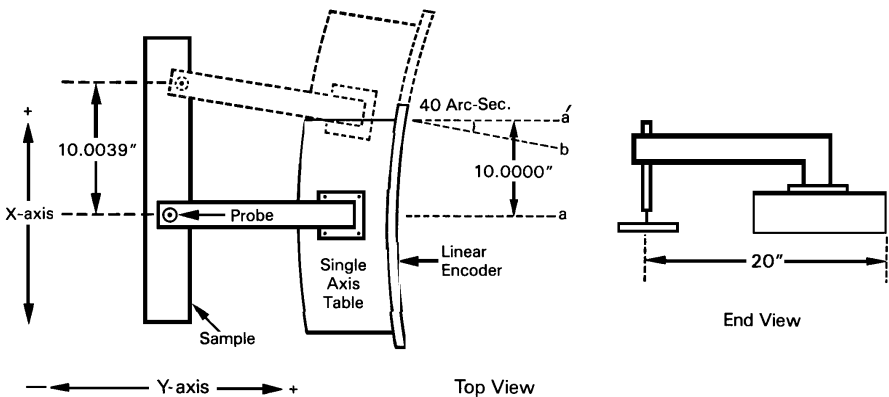
Sources of angular error include:
1. Mounting the linear Scale to an imperfectly flat surface.
2. Mounting the linear Scale to an imperfectly straight surface.
3. Curvature of ways (or linear bearings) used to measure the sample.
4. Contaminants between the probe and item being measured.
5. Friction in any part(s) of the measuring device.

ProTable Options

Custom Configurations

Custom designed ProTable systems are available to meet the unique requirements of your measuring application. Contact Accurate Technology for more details. See ProTable Designs for examples of some of the various designs we have produced..

Custom Jaws

- Hardened Steel
- Custom located holes

- Integrated V Blocks
- Standard or custom shapes and features

Back Fence

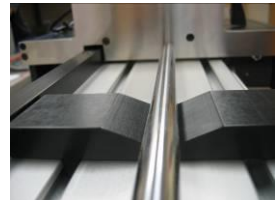- Full fixed back fence for part alignment

Wear Sheets

- Replaceable sheets for table surface protection

V Blocks

For facilitating measurement of round stock

- Integrated into Jaws or
- Movable along table length

Casters

- Heavy duty casters allow ProTable to be mobile

Corner-to-Corner fixture

- Attaches to the measuring jaws to facilitate corner-to-corner measurements.

Data Acquisition Accessories

ProRF SPC
ProRF allows linear measurement 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 ProTable Readout.

ProRF Encoder
This Transmitter can be located on the movable measuring jaw (instead of a readout) and transmit to a receiver that can be connected to a Readout at a remote location or to a PC RS232 or USB port.

ProMUX
ProMUX-3 is an easy to use hardware interface that provides communication from ProTables with multiple Encoders to a PC.
ProMUX-3 supports three inputs, and one RS232 output.

Thank you for choosing ProTable

IT WAS PROUDLY MADE IN THE USA

Accurate Technology, Inc.
270 Rutledge Rd. Unit E
Fletcher, NC 28732 USA
828-654-7920
www.proscale.com

Please [register](#) your ProTable product.