Accurate
TECHNOLOGY INC.
Linear Digital Measuring Systems

ProTable

User Manual for:

ProTable Measuring System

LCD Display Firmware V2.1x and Higher

This manual is for ProTable:

ProTable Serial Number:

_____

Display Serial Number:

_____

ReadHead Serial Number:

_____

Scale Serial Number:

_____

Factory Scaling Factor:

__._____

DO NOT CHANGE THIS SCALING FACTOR; DOING SO MAY VOID YOUR CALIBRATION. If your display is ever replaced or reset to factory defaults, reprogram the scaling factor (shown above) to ensure optimal accuracy.

See Section 4: DISPLAY OPERATION, PROGRAMMING, PARAMETER PR7, PG. 15

WARRANTY

Accurate Technology, Inc., warrants the ProTable Measuring System 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.

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:

- Reorient or relocate the receiving antenna.
- 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.

Table of Contents

SECTION 1 GENERAL INFORMATION

Introduction

ProTable™ is a complete single or multi-axis, contact or non-contact, linear digital measuring system. It is ideal for a Quality Control or Quality Assurance applications.

ProTable comes in two standard configurations (free-standing or benchtop) and two standard sizes (50 inches or 96 inches), but is often built to customer specifications to meet the requirements of a particular application or measuring system.

The heart of the ProTable system is an Accurate Technology ProScale™ linear measuring system. ProScale is ideal for most measuring requirements up to 20ft. where high accuracy is not needed, but affordable *repeatability*, (better than a tape measure), is desired. Because ProScale shows the exact measurement on its display, it eliminates the guesswork involved in reading and interpreting tape measures. ProScale is a solid-state electronic device so there's very little to wear out. The readhead and scale are designed to withstand shop dirt, dust, and other airborne contaminants, and the display is sealed with a protective cover. With normal care, ProTable will last for years.

All ProTable systems consist of specially manufactured SCALEs, READHEADs, and DISPLAYs. The SCALE is a series of conductive patterns bonded to an aluminum extrusion. The READHEAD, or encoder, transmits signals to the display. This position data is translated by the DISPLAY, where it is displayed in millimeters, centimeters, or inches, and can be sent to an external data acquisition device.

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 installation, operation and maintenance information for all ProTable Measuring Systems manufactured after March 2005 using Digital Displays with firmware version 2.1x or greater.

ProTable Specifications

Measuring Range:	Up to 231 inches, depending on model.
Accuracy:	± .010in Maximum error @ 72°F
Resolution:	Reduced: .1mm/.01cm/.01in; Normal: .01mm/.001cm/.001in; Increased: .01mm/.001cm/.0004in
Repeatability:	.01mm or .001cm or .001in
Display Range:	± 9999.99 mm; ± 999.999 cm; ± 999.999 in; ± 399 63/64 in
Operating Temp:	55 to 85°F
Temp Coefficient:	13ppm / °F
Power:	Two AA Alkaline Batteries (custom units may use 24VDC)
Battery Life:	8-12 months With RF Display: 4-6 months depending on use
System Warranty:	One year from date of purchase.
Output Format:	Mitutoyo SPC
Readhead:	*High Speed* with six-conductor cable terminated by RJ12 modular connector.
Max. Slew Rate:	24 inches/sec.
Scale:	Selected for ProTable use
US Patents:	4420754, 4879508, 4878013, 4959615

All ProScale products are MADE IN USA

SECTION 2 INSTALLATION

ProTable is easy to use. By following these instructions, reliable, error-free operation can be expected, with only an occasional need for adjustments or realignment of the jaws.

Assembly

A CD-ROM has been included with a video of the assembly process for ProTable. Please use this video along with the steps below to assemble your ProTable.

1. **Free-standing models:** Mount the legs to the bottom of the main table using the included fasteners.
2. **Free-standing models:** 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. **Free-standing models:** Attach the shelf between the legs using the included fasteners.
4. The moving jaw has been adjusted at the factory prior to testing and shipping for Squareness and parallelism. If the jaw assembly arrived with any "looseness" in its movement along the linear shafts, it may require adjustment. See **Maintenance**, page 11, for details. **If any changes are made to the jaws, be sure to re-zero the system by closing the jaws together, and pressing the 0 key on the display.**
5. ProTable comes standard with a customizable digital display. Programming and operation details for the display can be found in Section 4: *Display Operation*.

Operation

If your ProTable was ordered with any accessory products, refer to the individual manuals for these products or check the included CD-ROM for information.

To measure a part:

1. Slide the moving 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.
4. Press the HOLD key to freeze the displayed reading. Press the SEND key to transmit the reading to the SPC output (and/or the RF output, if equipped).

To measure parts relative to a reference (standard):

1. Slide the moving assembly to the right until the reference part 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 part length is displayed. Press the ABS/INC key to switch to relative measurement mode.
5. Measure a production part using the same method as in steps 1 to 3. The difference in length between the reference and the production parts is shown on the display. 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.

SECTION 3 CALIBRATION/MAINTENANCE

Calibration

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 display is sometimes used to correct for linear errors.

DO NOT CHANGE THIS SCALING FACTOR; DOING SO MAY VOID YOUR CALIBRATION. If your display is ever replaced or reset to factory defaults, reprogram the factory scaling factor (shown on the front cover) to ensure optimal accuracy.

Section 4: DISPLAY OPERATION, PROGRAMMING PARAMETER PR7

NOTE: When any mechanical devices are built on, or attached to, a measuring device; the accuracy of the "total system" will not be equal to the accuracy of the measurement device due to mechanical inaccuracies, and/or physical measurement errors (Section 5: ABBE ERROR). ProTable measurement systems have been designed to minimize these 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 different operators) can contribute to measurement errors. A Gage R & R study should be considered if numerous operators will be using the ProTable.

Maintenance

A regular schedule for cleaning and adjustment is highly recommended.

Free-Standing Units: All legs, feet, and shelf fasteners should be checked regularly for tightness. Tighten as needed.

Table surface, Jaw Faces, Scale, and Display: 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.

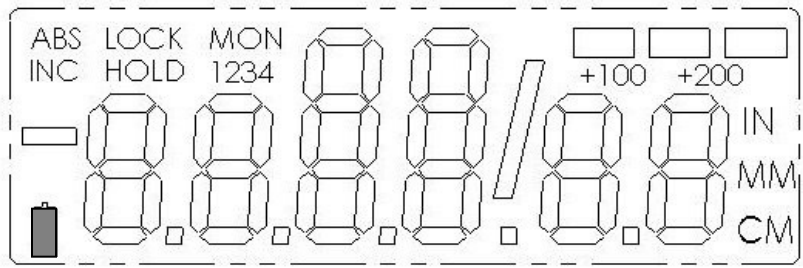
Bearing Rails: The bearing rails should be kept as clean as possible at all times, as any contaminants could cause an Abbé error. There are four pads that clean the bearing rails as the sliding assembly is moved. These pads should be saturated with light machine oil as needed to ensure long life. Replacement pads are available from Accurate Technology (P/N: 100-3308-001).

Moving Jaw/Bearing Adjustment: ProTable's moving head has roller bearings which help it to slide easily along the table. Of these bearings, the two in the front are eccentric and can be used to adjust the front-to-back parallelism of the moving jaw.
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.

Changing the Batteries

A low battery indicator will appear in the lower left corner of the LCD Display when new batteries are needed.



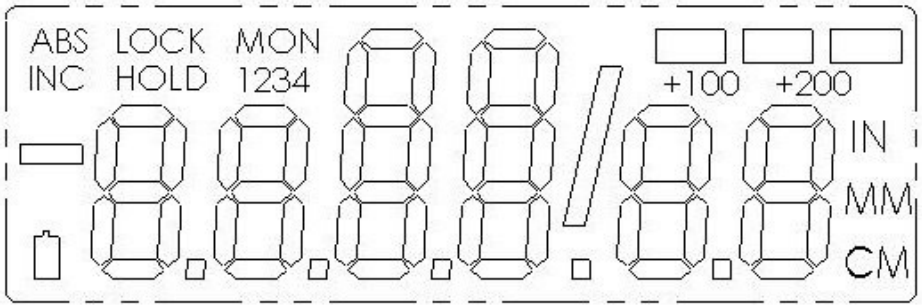
Remove the screws in the upper right and lower left corners. Pull the cover off. Remove the old batteries. Reinstall 2 new AA Alkaline batteries, noting the proper orientation. Replace the cover and tighten the screws.

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 CASES ARE SCREWED TOGETHER.

SECTION 4 DISPLAY OPERATION

This section covers the programming and operation of ProTable Displays with Firmware V2.1x and higher. If your Display Firmware is prior to 2.1x, or your Display is different than the unit described here, you must use the appropriate user manual for that Display.
(F/W version is displayed on power-up or when **ON/OFF** key is pressed.)

The LCD



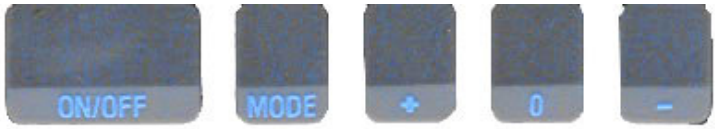
The above figure illustrates all the segments available on the Display.

Pressing and holding the ON/OFF and MODE key for 10 seconds *with power off* will perform a full segment LCD test AND set all programming parameters to factory defaults.

Programming

Several functions of the Display are user programmable. The following describes what features are available and how to change the system's factory defaults to customize the Display for your application.

The keys pictured have multiple functions. Timing, or how long a key is depressed, and the combination of the keys pressed is important. **This manual uses the term "*momentarily*" to describe a key press of typically less than 1 second. Whereas *"press and hold*" is used to imply a key press of typically longer than 1.5 seconds.**
As an example: When using a computer keyboard to type a capital letter you "*press and hold*" the SHIFT key and "*momentarily"* depress the appropriate LETTER key.
The "*function*" associated with key(s) pressed is executed on the key *RELEASE*, not the key *DEPRESS*. This is important since some keys execute different functions based on how long they are depressed.



To enter PROGRAMMING MODE, *press and hold* the **MODE** key and then *momentarily* press the **0** (zero) key. The **MODE** key must be held for approximately 1 second before the depression of the **0** (zero) key.

Once you are in the Programming Mode, *momentarily* pressing the **MODE** key will advance through the Programming Parameter list.

To step backwards in the Programming Parameter list *press and hold* the **ON/OFF** key and *momentarily* press the **MODE** key.

Momentarily pressing the **+** (plus) key while displaying a Programming Parameter will increase the parameter setting.

Momentarily pressing the **-** (minus) key while displaying a Programming Parameter will decrease the parameter setting.

Momentarily pressing the **0** (zero) key while displaying a Programming Parameter will reset the parameter to its factory default setting.

CAUTION: The Limit Mode **(See Programming Parameters 14, 15, 16, 17)** functionality is still active even while the Display is in PROGRAMMING MODE. Changing LIMITS may result in the Limit/Monitor Signal hardware output becoming active immediately.

To exit PROGRAMMING MODE, *press and hold* the **MODE** key and then *momentarily* press the **0** (zero) key.
NOTE: The Display will automatically exit PROGRAMMING MODE after 60 seconds of no key activity.

Programming Parameters

Programming Parameters are listed below. Values in [ ] are the available range of values that can be programmed for that entry. Factory defaults are shown in **Red.**

Some Programming parameters, Offset Addition and Limit mode, indicate a **'factory default set in inches'**. The equivalent offset/limit value in mm or cm is applied if you switch the measurement MODE of the Display to mm or cm. (ie. If 5.00(in) is set, when the Display is switched to mm the programmed offset/limit is now 127mm.)

Pr0 – Reading Direction [**0**,1]

Change/Reverse the direction (+ vs -) of readings.

Pr1 – Enable/Disable Segment Offset [0, **1**]

0 = For Incremental Systems
1 = For All ProTable Systems

Pr2* – High Speed Readhead [**0**, 1]

0 = Normal Readhead
1 = For All ProTable Systems

Pr3 – Enable/Disable the +, - and ZERO keys [0,**1**]

0 = Disables operation of Zero, + and – keys (Forced Lock Mode).
1 = Enables operation of Zero, + and – keys.

Pr4 – Display Resolution [0, **1**, or 2]

Sets the displayed resolution. (No change in fractions mode.)

0 = Reduced resolution	Inch = xxx.xx	MM = xx.x
1 = Normal resolution	Inch = xxx.xxx	MM = xx.xx
2 = Increased resolution	Inch = xx.xxxx	(no change in mm)

(Automatic scaling will allow measurements of over 100 inches when using increased resolution. Measurements over 100 inches will automatically be reduced to 3 decimal places.)

Pr5 – Metric Display Units [**0**, 1]

Controls whether the measured value is displayed in millimeters or centimeters when metric mode is selected.
0 = millimeters
1 = centimeters

Pr6 – Disable Fractions/Inches [**0**, 1, 2]

0 = All measurement modes (mm or cm, inches and fractions).
1 = No Fractions; only decimal inches and metric units.
2 = Only Metric. No Imperial (inches or fractions) will be displayed.

Pr7* – Scaling Factor [.0001 .. 99.9999] **Default = 1.0000** (No Scaling.)

The multiplier applied to the measurement. Scaling factors less than 1.0000 will make the displayed measurement less that the actual measurement. Scaling factors greater than 1.0000 will make the displayed measurement greater than the actual measurement.

** These parameters should immediately be checked and changed as needed if the digital display is ever reset or replaced.*

Pr8 – Automatic Power Off [0 to 60] **Default = 15**

Sets the amount of time in 'minutes without activity' before the Display automatically turns off.
0 = Disables Automatic Power Off.
ReadHead motion or ON/OFF key will "wake-up" the Display and reset the timer.

Pr9 – Auxiliary Keys Enable/Disable [0..7]

0 = ABS/INC, MON and HOLD Disabled
1 = ABS/INC Key Enabled
2 = MON Key Enabled
4 = HOLD Key Enabled
7 = All Keys Enabled
To enable keys, add up combination of key values. A value of 2 enables only the MON key. A value of 7 enables all 3 keys.

Pr10 – Offset Addition Enable [**0**, 1]

0 = Offset Addition Disabled.
1 = Offset Addition Enabled.
SEE ALSO Pr11, Pr12, Pr13.

Pr11 – Offset Addition 2

[-999.999 to 999.999in] or [-9999.99 to 9999.99mm]
Default = 1.000 in. (25.40mm)

When offset 2 is selected (see Section 4: OFFSET ADDITION), this value is added to the current ABS position.
Only active if Pr10 is set to 1. ***Default is set in Inches.***

Pr12 – Offset Addition 3

[-999.999 to 999.999in] or [-9999.99 to 9999.99mm]
Default= 1.500 in. (38.10mm)

When offset 3 is selected (see Section 4: OFFSET ADDITION), this value is added to the current ABS position and displayed.
Only active if Pr10 is set to 1. ***Default is set in Inches.***

Pr13 – Offset Addition 4

[-999.999 to 999.999in] or [-9999.99 to 9999.99mm]
Default= 2.000 in. (50.80mm)

When offset 4 is selected (see Section 4: OFFSET ADDITION), this value is added to the current ABS position and displayed.
Only active if Pr10 is set to 1. ***Default is set in Inches.***

Pr14 – Output Signal Mode [**0**, 1]

Configures the hardware output signal for activation on MONitor drift conditions or Upper/Lower limit alarm conditions.

(ONLY applies to 24VDC Displays)

0 = Monitor drift

1 = Limit Alarm

SEE ALSO Pr15, Pr16, Pr17

Pr15 – Output Polarity [**0,** 1]

Used to configure the signal output.

(ONLY applies to 24VDC Displays)

0 = N/O, the output is Normally Open (not conducting to ground).

1 = N/C, the output is Normally Closed (conducting to ground).

Pr16 – Lower Limit [-999.999 to 999.999in] or [-9999.99 to 9999.99mm]

Sets the lower limit value. **Default = 0.000 in. (0.00mm)**

Pr17 – Upper Limit [-999.999 to 999.999in] or [-9999.99 to 9999.99mm]

Sets the upper limit value. **Default = 5.000 in. (127.00mm)**

Pr18 – Drift Tolerance [.001 to 999.999in] or [.01 to 9999.99mm]

Range of motion allowed (+ or -) while in MONitor mode.

Default is set in Inches. **Default =. 010 in. (.254mm)**

Pr19 – Automatic Monitor ON Time [**0**, 1 or 2]

Configures Display to automatically activate MONitor mode after 30 or 60 seconds of ReadHead inactivity.

0 = disabled

1 = 30 seconds

2 = 60 seconds

Pr20 – Automatic Monitor OFF Enable [**0**, 1]

Configures Display to automatically exit MONitor mode after a programmed distance **(Pr21)** has been exceeded from the drift tolerance position **(Pr18).**

0 = disabled

1 = enabled

Pr21 – Automatic Monitor OFF Distance

[0.001 to 999.999in] or [0.01 to 9999.99mm].

The distance that must be exceeded from the drift tolerance position **(Pr18)** to deactivate monitor mode**.**

Default set in Inches. **Default = 0.500 in.** ***(12.70mm)***

Active only when **Pr20=1**.

Pr22 – Backlight ON time [0, **1**, 2, 3 or 4]

The ON time of the LCD backlighting (***24VDC Displays only***).
0 = always off.
1 = 3 seconds.
2 = 7 seconds.
3 = 15 seconds.
4 = always on.

Pr 23 Future Use [**1**]

DO NOT CHANGE

Pr 24 Display RF Address [**0** to 63]

This parameter is used to set the address of the Display.
0= (RF off)

Pr 25 RF System ID [**0** to 31]

This parameter is used to set the ID of the Display system (or family).

Pr 26 Noise Suppression [**0**..7]

This setting helps filter error causing interference caused by stray electrical noise when the Display is mounted on or around a machine.
0 = Minimum filtering
7 = Maximum filtering

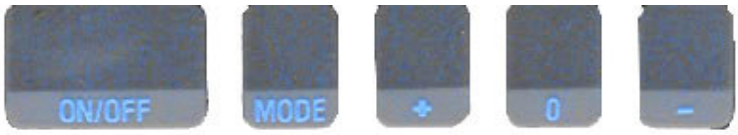
Pr 27 Non-Linear Compensation [**0**,1]

This parameter is used to enable the non-linear error compensation table. (Non-linear error compensation is only functional on digital readouts with firmware ending with a C.)
0 = Off
1 = On

Pr 28 Non-Linear Compensation Multiple

This parameter is used to configure the distance (multiple) between non-linear compensation points. Error correction occurs at each compensation point, and linear interpolation is applied between points. (Non-linear error compensation is only functional on digital readouts with firmware ending with a C.)
Default is 5.000 inches.
Active only when **Pr27=1**

Primary Key Functions



ON/OFF

Momentarily pressing the **ON/OFF** key will cause the Display to turn on or off. The Firmware Version is momentarily displayed on power-up. While on, if no key presses or positional changes occur within 15 minutes*, the Display will automatically turn itself off to conserve battery life. While off, if a position change is detected (larger than .05mm or .002in), the Display will automatically turn itself on with no loss of measurement information.
***(This timer can be changed using Programming Parameter Pr8.)**

Pressing and holding the **ON/OFF** key for 5 seconds while the Display is turned on will display internal battery voltage.

Pressing and holding the ON/OFF key and MODE key for 10 seconds *with power off* will perform a full segment LCD test AND set all Programming Parameters to factory defaults. Be sure to reprogram any custom settings – especially scaling factors – after resetting or replacing the display.

MODE

The ProScale can display measurement information in Inches or Metric. To change the display mode, momentarily press the **MODE** key. With each key press, the Display will cycle through decimal inches, fractional inches** (1/16), (1/32), (1/64) and metric***.
Fractional inches can be disabled using **Parameter Pr6.
***Metric units are defined using **Programming Parameter Pr5**).

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

When the measurement is greater than ± 99 63/64 inches, a +100 will show in the upper right portion of the LCD to indicate this amount must be added to the displayed reading.
ie: If the measurement is 114 5/8 inches, 14 5/8 and +100 will be displayed on the LCD.

+, 0, and – Keys

The **+** (plus), **0** (zero) and **–** (minus) keys are used to change the currently displayed position to a different value. The **0** key forces the unit to display 0. Momentarily depressing the **+** key increments the current position by one unit of measurement. Momentarily depressing the **–** key decrements the current position by one unit. Pressing and holding the **+** or **–** keys will cause the displayed position to change continuously. Holding down the key will cause the amount of change to speed up. This allows for quick adjustments over a range of large values. These keys can be "locked out" to prevent accidental offset or zero entries.

(Programming Parameter Pr3 can be used to lock out these keys.)

Auxiliary Keypad Functions

The Auxiliary Keypad is found on all ProTable Displays.

(Programming Parameter Pr9 can be used to enable or disable the auxiliary keys.)

ABS - INC

The Display 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 Display 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 **ABS** position of the measuring system is not lost when using the **INC** settings.

ABS Mode – The Display automatically enters ABS mode when power is first applied. This is indicated by the ABS symbol in the upper left corner of the Display. While in the ABS mode, all position measurements are related to the current system reference point. To enter the INC mode, momentarily press the **ABS/INC** button.

INC Mode – While in the INC mode, the INC symbol is shown in the upper left corner of the Display. When the INC mode is initially entered, the displayed position will change to reflect a new reference point at the current position of the gantry. This is typically a position of zero (0) but may be changed by using the + or - keys to provide an offset. Moving the gantry 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 Display will again change

to 0 (or the previously programmed offset). To return to the ABS mode, press and hold the **ABS/INC** key for approximately 3-4 seconds.

MONitor

The Display has the ability to monitor a measurement position to detect position drift or measurement variance. To activate the monitoring mode, position the gantry to the desired location and momentarily press the **MON** key. The MON symbol will flash on the display to indicate that the position monitor mode is active.

If the gantry moves outside the programmed tolerance (which can be adjusted using Parameter18), the reading flashes, indicating a drift condition. When the gantry is moved back within the programmed tolerance, the displayed reading will stop flashing.

To exit the monitor mode, momentarily press the **MON** key. The MON symbol and the currently displayed position will stop flashing.

NOTE: Monitor mode can only be activated while in the ABS measuring mode. If the ABS/INC key is depressed while monitoring, the position-monitoring mode is automatically exited.

The Display can be programmed to automatically enter or exit the MONitor mode based on elapsed time or movement of the gantry.

If the programmable auto monitor is enabled (Programming Parameter Pr19 is set to 1), the Display will automatically enter monitor mode after either 30 or 60 seconds without gantry movement. If the programmable auto monitor is disabled, the ProScale will automatically exit monitor mode if the gantry is moved beyond a programmable distance from the monitored position. This option, in conjunction with auto monitor activation, allows the ProScale to be kept in monitor mode without manually pressing the monitor key.

(For configuration, use Programming Parameters 18, 19 ,20 , and 21.)

HOLD

The Display provides a feature that allows the displayed position to be “frozen” in time while the gantry is moved from its measuring position. This allows measurements to be captured on the Display and held for later viewing regardless of the current gantry position. To activate the HOLD mode, momentarily press the **HOLD** key. The HOLD symbol will be shown in the upper left corner of the Display. The currently displayed position and selected key presses will be frozen at this point. To release the HOLD feature, momentarily press the **HOLD** key again, or cycle power.

SEND

The Display provides an output port that can be used to send measurement information to a compatible SPC device such as a printer or data acquisition unit. After connecting the SPC device to the 10 pin connector on the Display, the user may initiate the data transmission by momentarily pressing the SEND key. This signals the SPC device to acquire the data from the Display. Pressing the SEND key displays "**Snd**" on the Display for 1 second to show activation of the send function (even if no SPC device is attached to the Display).

The data format and connector style of the Display SPC output is the same as Mitutoyo (Digimatic®) SPC. This is an industry standard that can be interfaced with most available SPC products including multiplexers, RS232 converters and PC plug-in boards. Data from the Display is sent to the SPC connector in either millimeters or decimal inches, whichever is currently displayed on the LCD.

See www.proscale.com for interface and data acquisition product descriptions.

If your ProTable has been upgraded to use a *Wireless Display*, the SEND key activates the data transmitter and will send measurement information to the *RF Wireless Receiver*. The receiver decodes this information and makes it available at its RS232 connection in one of six output modes.

The batteries in the ProScale *WIRELESS* Display can provide approximately 50,000 data transmissions before needing replacement.

F1 / F2

F1 is used for OFFSET ADDITION (See Parameters 10-13).

F2 is used on **Wireless Displays** to send "DEL" indicating the last measurement sent should be ignored/deleted.

Display Functions

Lock Mode

The user can "lock-out" the position offset adjustment functions (**+, 0, -** keys) to prevent accidental changes of the current displayed position. To activate the lock mode, press and hold the **ON/OFF** key and then momentarily press the **MODE** key. The word LOCK on the LCD Display will turn on or off with each lock/unlock operation. When the LOCK symbol is displayed, the **+, 0,** and **-** keys will not change the displayed position. On Displays with an auxiliary keypad: ABS and INC modes have independent lock operations. **(Programming Parameter Pr3 can also be used to lock the display.)**

Segment Offset Adjustment

For Scales that are longer than 430mm (17 inches), multiple Scale pattern segments are installed end-to-end on the aluminum extrusion. This provides a quasi-absolute measurement capability in which the Readhead can calculate its position on any individual Scale segment but cannot determine which particular segment it is on. To solve this problem, the Display tracks which Scale segment the Readhead is on by detecting the "joint" between one segment and adjacent segments.

In certain situations, the crossing from one segment to another may not be detected by the Display. This may occur if the Readhead is disconnected from the Display (power source) and then moved along the Scale to another segment. It may also occur if the Readhead is moved too quickly between two segments. If the segment tracking count is incorrect because of one of the above situations, the user can re-adjust the Display 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 **MODE** key and then momentarily press the **+** key. The displayed position will increase by 430.08mm (16.933 inches). To subtract one segment from the displayed value, press and hold the **MODE** key and then momentarily press the **-** key. The displayed position will decrease by 430.08mm.

(Programming Parameter Pr1 must be set to 1 for Scales longer than 430mm.)

Offset Addition

Offset addition allows the user to preset up to 3 different values that are added to the Display reading when selected. This function allows the user to quickly switch from one reference point to another.

To utilize the offset addition feature, programming parameter Pr10 must be set to 1. The Display will then flash one of "offset" numerals 1, 2, 3 or 4 located in the upper left corner of the LCD. Offset 1 is the ABS position with no offset value added. Offset 2 is the ABS position with parameter Pr11

(Offset Addition 2) added to it. Offsets 3 and 4 have similar functions with parameters Pr12 and Pr13 added to the ABS position respectively.
To move from Offset 1 to 2, momentarily press the F1 key. Each depression of the F1 key will advance to the next offset. After offset 4, the Display will move back to offset 1.
(Change Offset Addition values using Programming Parameters 10, 11, 12 and 13.)

Limit Mode

The Display will show either “LL” for Lower Limit or ”UL” for Upper Limit if a pre-programmed upper or lower reading is encountered. Upper and Lower Limits are set with Programming Parameters Pr16 and Pr17 but are only active if Pr14 is set to 1. The readout toggles for 2 seconds between current position display and "LL" or "UL". This continues as long as limit is exceeded.
(The Limit Mode can be controlled with Programming Parameters 14, 16 and 17.)

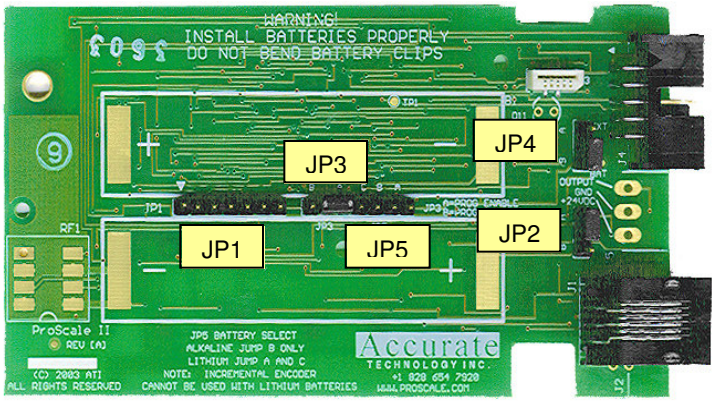
Scaling

All General Purpose Displays 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 system to display a reading different than the actual measured value.

Your ProTable comes from the factory with this function pre-programmed. See inside front cover for the factory’s recommended scaling factor. Be sure to verify the scaling factor for each ProTable unit using the serial number.
(Scaling factors are set using Programming Parameter Pr7.)

Jumpers

Although the ProScale Display uses a keyboard-programming method to enable and configure features in the unit, several selection jumpers are located on the circuit board for additional system configuration.
User configurable jumpers consist of three pins and a 'shorting block'.
The center of these pins is 'Common'. One end pin is labeled 'A' and the other end pin is labeled 'B'.



JP1 **FOR FACTORY USE ONLY**

JP2 **Technology Selection**
The Digital Display supplied on your ProTable supports two different technology measuring systems. It has been configured with the proper settings at the factory. For all ProTable measuring systems this jumper should be installed in position **A**.

JP3 **Programming Enable/Disable**
Front panel entry to the programming mode of the Display can be enabled or disabled. To enable programming (default), install the shorting jumper in position A. To disable programming, install in position B. When programming mode is disabled, the user cannot access the programming functions via the **Mode** + **0** keys as described in the SECTION 4: PROGRAMMING. This provides the user with a method of configuring the Display with specific parameters and prevents unauthorized configuration changes.

JP4 **Display Power**
This jumper configures the Display to operate on either Battery or 24VDC. This jumper will be set at the factory based on the type of Display you have ordered. **Standard Displays for ProTable are Battery Operated.**

JP5 **FOR FACTORY USE ONLY**

Jumpers and Key Press Summary

Printed Circuit Board Jumper Information:

JP1	Internal Use Only	DO NOT CHANGE
JP2	Position **A** for all ProTables	
JP3	Programming Enable/Disable	
JP4	Position **B** for all battery operated ProTables	
JP5	Internal Use Only	DO NOT CHANGE

Programming Summary

Parameter	Function	ProTable Setting
Pr0	Reading Direction	0
Pr1	Segment Offset	1 - On
Pr2	High Speed Readhead	1 - On
Pr3	Zero, Offset Entry	1 - Enable
Pr4	Display Resolution	1 - Normal
Pr5	mm or cm	0 - mm
Pr6	Fractions, mm, in	0 - all
Pr7	Scaling	See inside front cover.
Pr8	Auto off	15 - 15 min.
Pr9	Auxiliary Keypad	7 - all keys
Pr10	Offset Addition	0 - disabled
Pr11	Offset Addition 1	1.000 Inch
Pr12	Offset Addition 2	1.500 Inch
Pr13	Offset Addition 3	2.000 Inch
Pr14	Output Mode	0 - drift
Pr15	Output Polarity	0 – Normally Open
Pr16	Lower Limit	0.000
Pr17	Upper Limit	5.000 Inch
Pr18	Drift Tolerance	.010 Inch
Pr19	Auto Monitor ON	0 - disabled
Pr20	Auto Monitor OFF	0 - disabled
Pr21	Auto Monitor Distance	.500 Inch
Pr22	Backlight On	1 - Three seconds
Pr23	FUTURE FEATURE	1
Pr24	RF Display Address	0 - Off
Pr25	RF System ID	0
Pr26	Noise Suppression	0 - Minimum

Key Press Function Summary

How long a key is depressed, and the combination of the keys pressed is important. The term (*Momentarily)* describes a key press of typically less than 1 second. Whereas (*Press & Hold*) is used to imply a key press of typically longer than 1.5 seconds.
For example: When using a PC keyboard to type a CAPITAL letter you would "*press and hold*" the SHIFT key and "*momentarily"* depress the LETTER key. In addition, a key(s) "*function*" is executed on the key RELEASE, not the key DEPRESS of that key(s). This is important since some keys execute different functions based on how long they are depressed. These key operations, once tried, quickly become intuitive.

ON/OFF (*Momentarily)*
RESULT: Turn Display power on or off.

ON/OFF (*Press & Hold*) for 5 seconds
RESULT: Display Battery Voltage.

ON/OFF (*Press & Hold)* + MODE (*Momentarily)*
RESULT: Enable/Disable LOCK mode.

ON/OFF + MODE (*Press & Hold Both keys*) for 10 seconds (display off)
RESULT: LCD Segment Test & reset to factory defaults

MODE (*Press & Hold)* + '**+**' or '**-**' (*Momentarily)*
RESULT: Apply Segment Offset Adjustment.

MODE (*Press & Hold)* + '**0**'(*Momentarily)*
RESULT: Enter or Exit Programming Mode.

While in Programming mode:

MODE (*Momentarily)*
RESULT: Advances the Programming Parameter list.

ON/OFF (*Press & Hold)* + MODE (*Momentarily)*
RESULT: Steps Programming Parameter list backwards.

+ (*Momentarily)* while displaying a Programming Parameter
RESULT: Increases Programming Parameter setting.

- (*Momentarily)* while displaying a Programming Parameter
RESULT: Decreases Programming Parameter setting.

0 (*Momentarily)* while displaying a Programming Parameter
RESULT: Resets Programming Parameter to Default.

SECTION 5 MISCELLANEOUS

Frequently Asked Questions

What does "*no Enc*" mean?

If the Readhead is off the Scale, or the Readhead cable is unplugged from the Display, a "no Enc" will appear on the Display. To clear error:

1. Be sure the Readhead is on the Scale and properly oriented.
2. Unplug the connector from the Display for one second.
3. Reconnect the Readhead cable to the Display.

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

YES! **NEVER** attempt to 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 Display reads numbers but they seem to be random.

1. Be sure the Readhead is oriented correctly on the Scale. One end of the Scale is black; be sure that the arrow on the Readhead is pointed in this direction.
2. Be sure Programming Parameter Pr2 is set to 1.

The Display does not change, or changes very little, as the Scale or Readhead moves.

1. The Display is in the HOLD mode. Press & release the Hold button.
2. The Readhead is on the Scale backwards.
3. The Scaling factor is set very low.
4. Be sure Programming Parameter Pr2 is set to 1.

Product Communication

The ProScale display's electrical interface allows the Readhead position to be read directly or through the Display by a computer or other data acquisition device. Interface diagrams are available upon request.

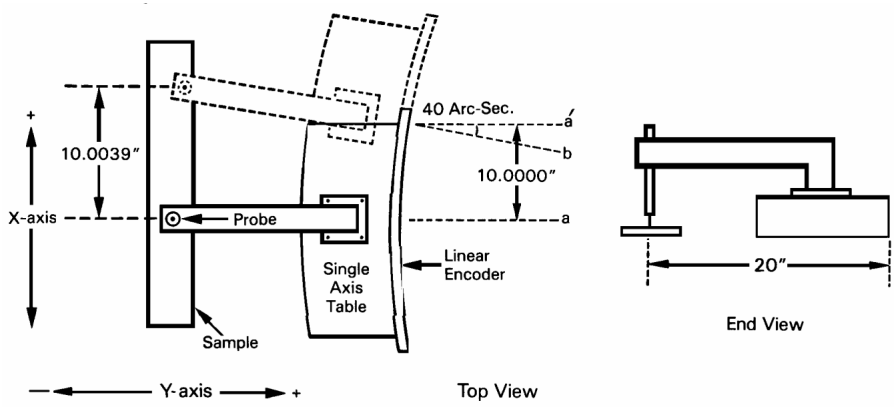
Output Format: Mitutoyo SPC

See Section 6 for Data Acquisition, Storage and Transmission choices.

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.

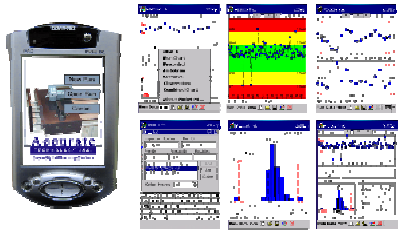


Sources of angular error include:
1. Mounting the linear Scale to an imperfectly flat surface.
2. Mounting the linear Scale to an imperfectly straight surface.
3. Curvature of ways (or linear bearings) used to measure the sample.
4. Contaminants between the probe and item being measured.
5. Friction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

SECTION 6 OPTIONS/ACCESSORIES

Pocket ML™

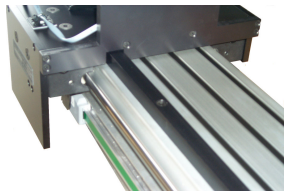
With Pocket ML and ProTable, a completely portable, battery operated, inspection station for measuring and data collection/wireless transmission is now possible.



iPAQ with Pocket charts

Custom Jaws

- Aluminum or Steel
- With no holes or with custom located holes
- Integrated V Blocks
- Standard or custom shapes and features



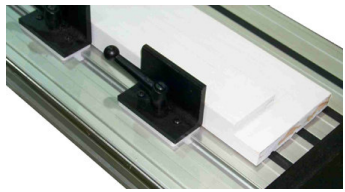
Fixed back fence shown

Wear Sheets

- Replaceable sheets for table surface protection

Back Fence

- Full fixed back fence
- Adjustable back fence



Adjustable back fence

Digital Calipers

- Mitutoyo Digimatic™ 6 or 12 inch.

V Blocks

For facilitating measurement of round stock

- Integrated into Jaws or
- Adjustable along table surface

Casters

Casters

- Heavy duty casters allow ProTable to be mobile

Canvas cover

- Custom made cover to protect ProTable

Data Acquisition Devices

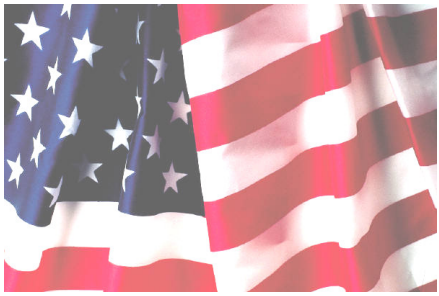
ProScale-RF Display
Battery operated one-way Wireless data transmission
Up to 10 ProTables equipped with Wireless Displays can be supported by one receiver.

Pro-RF™
A 2 way system consisting of a base module and a remote module that communicate over a bi-directional RF interface.
Up to 32 ProTables and/or other SPC devices can be supported by one receiver.

RS232 Adapter
This cable/adapter will convert the SPC output of the ProTable Display to an RS232 signal for input to a PC.
1 SPC INPUT; 1 RS232 OUTPUT

ProMUX 3
This adapter will convert the SPC output of the ProTable Display PLUS 2 other SPC devices to an RS232 signal for input to a PC or PLC.
1, 2 or 3 SPC INPUTS; 1 RS232 OUTPUT

Thank you for choosing a ProScale Product



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This manual is available at www.proscale.com

Please return your Product Registration Card or register your system at: www.proscale.com/registration.htm

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