# Series *6000*

**Coating
Thickness
Gages**

*Built-In
Probe*
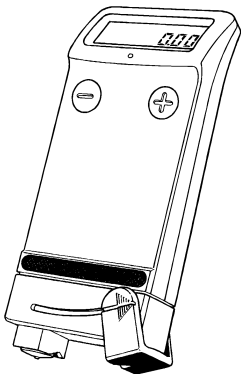
*Separate
Probe*
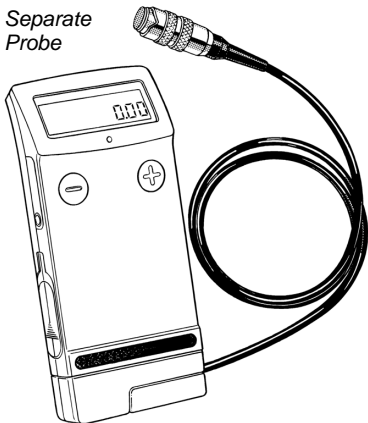
**DeFelsko**®
**Simple. Durable. Accurate.**

The *6000* hand-held, electronic Gage non-destructively measures the thickness of coatings on metals, quickly and accurately.

While all *6000* Gages look the same and behave in a similar fashion, each model has specific abilities or features as denoted by the model number (e.g. *6000 FNS3*). The model number is engraved on the back and the probe type is displayed when the Gage is turned on.

### Styles

***Built-In Probe*** gages have a permanent, built-in probe for easy, one-hand operation. These probes are not interchangeable.

***Separate Probe*** gages have the probe mounted at the end of a 4 ft. (1.2m) cable and have an "*S*" suffix in the model number. They allow greater accessibility onto small parts or into hard-to-reach areas. These completely interchangeable probes retain their own unique calibration information. On power-up the *6000* automatically determines what type of probe is attached, then performs an automatic self-check. It is important to pull only on the probe connector when changing probes. **Do not pull on the probe cable**.

### Probes

All **6000** probes fall into one of two categories:

**One-point Optimization** probes can be optimized using the **One-point Optimization** technique.

**Two-point Optimization** probes can be optimized using the **Two-point Optimization** technique.

### Principles of Operation

- **F** models use the *magnetic principle* to measure the thickness of non-magnetic coatings on ferrous metals.
- **N** models use the *eddy current principle* to measure the thickness of non-conductive coatings on non-ferrous metals.
- **FN** models combine the full abilities of *both* the *"F"* and *"N"* models.

### Models

- **1** = **BASIC** - mils/microns, **FLIP LCD**, average **ZERO** and **RESET** features.
- **2** = **STANDARD** - all **BASIC** features **plus** average, standard deviation, user adjustable **HiLo** limits, Max/Min thickness by group of measurements, HI **RES**, button **LOCK** and user-selectable power-down times.
- **3** = **MEMORY** - all **STANDARD** features **plus** storage & printer/computer downloading for 5000 measurements.

## Power-up / Power-down

The *6000* powers-up when any button is depressed and displays the last measurement. *Built-In* probe gages turn on automatically when the probe touches the surface.

To preserve battery life, the gage powers-down after 60 seconds of no activity.

There is no OFF button. However, to quickly power-down, press both buttons simultaneously and hold until gage displays "**OFF**".

All settings are retained during power-down including the last measurement. Always be sure the gage is powered down before changing the batteries.

## How To Take A Measurement

1. On *Built-In* probe models, slide the probe cover open FULLY. It acts as a second "foot" to steady the Gage.

2. Turn gage on with any button. *Built-In* probe models turn on automatically when the probe is placed on a surface.

3. Place the probe FLAT on the surface to be measured and HOLD STEADY. When a valid measurement is calculated, the Gage BEEPS, BLINKS twice and displays the measurement.

4. Lift probe AT LEAST 2 INCHES (50 mm) from the surface between measurements - OR - leave probe in the same location for continuous measurements about every 5 seconds.

5. When finished, slide the Built-In probe cover FULLY shut to prevent Gage from accidentally turning on and draining the battery. Keep Separate probes away from metal so they can power down automatically.

## Golden Rule

Measure your *uncoated* part first!

This quick *zero-check* determines if any adjustment is needed for your particular substrate. *Zeroing* compensates for deviations in shape, diameter, composition, roughness, etc.

## Menu Operation

Gage functions are *menu controlled*, by two menus, the *Main Menu* (see p.6) and the *Config Menu* (see p.7). The *Main Menu* is used to turn the features and special functions of the gage on or off. The *Config Menu* is used to change basic gage configuration settings, such as the displayed language, power-down interval, and displayed resolution.

To access the *Main Menu*, <u>turn the gage on</u> and press ⊖ ⊕ simultaneously to display the first menu choice.

To access the *Config Menu*, allow the gage to power-down. <u>While the gage is off</u>, press ⊖ ⊕ simultaneously and hold for 3 seconds to display the first menu choice.
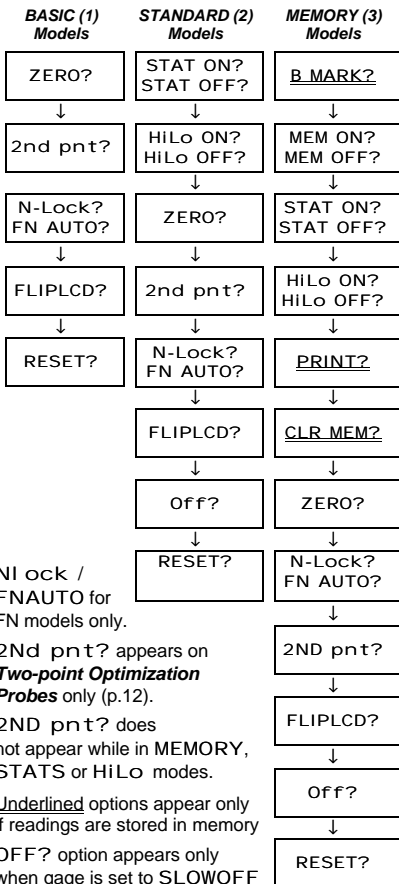
In both menus,

- To answer "YES" press ⊕ and the current choice will be selected.
- To answer "NO" press ⊖ and the next option will be displayed.

After the last *Main Menu* option, the Gage re-displays the last measurement. After the last *Config Menu* option the gage powers down.

### *Main Menu*

This menu can be accessed when the gage is turned ON by simultaneously pushing ⊖ ⊕.

| *BASIC (1)* *Models* | *STANDARD (2)* *Models* | *MEMORY (3)* *Models* |
|---|---|---|
| **ZERO?** | **STAT ON?** **STAT OFF?** | **B MARK?** |
| ↓ | ↓ | ↓ |
| **2nd pnt?** | **HiLo ON?** **HiLo OFF?** | **MEM ON?** **MEM OFF?** |
| ↓ | ↓ | ↓ |
| **N-Lock?** **FN AUTO?** | **ZERO?** | **STAT ON?** **STAT OFF?** |
| ↓ | ↓ | ↓ |
| **FLIPLCD?** | **2nd pnt?** | **HiLo ON?** **HiLo OFF?** |
| ↓ | ↓ | ↓ |
| **RESET?** | **N-Lock?** **FN AUTO?** | **PRINT?** |
| | ↓ | ↓ |
| | **FLIPLCD?** | **CLR MEM?** |
| | ↓ | ↓ |
| | **Off?** | **ZERO?** |
| | ↓ | ↓ |
| | **RESET?** | **N-Lock?** **FN AUTO?** |
| | | ↓ |
| | | **2ND pnt?** |
| | | ↓ |
| | | **FLIPLCD?** |
| | | ↓ |
| | | **Off?** |
| | | ↓ |
| | | **RESET?** |

**Nl ock** / **FNAUTO** for FN models only.

**2Nd pnt?** appears on *Two-point Optimization Probes* only (p.12).
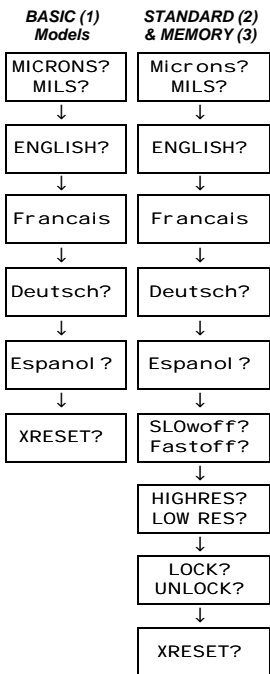
**2ND pnt?** does not appear while in **MEMORY**, **STATS** or **HiLo** modes.

Underlined options appear only if readings are stored in memory

**OFF?** option appears only when gage is set to **SLOWOFF** mode (see Config Menu).

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### *Config Menu*

This menu can be accessed when the gage is turned OFF by simultaneously pushing ⊖ ⊕ and holding for 3 seconds.

| *BASIC (1) Models* | *STANDARD (2) & MEMORY (3)* |
|---|---|
| MICRONS? MILS? | Microns? MILS? |
| ↓ | ↓ |
| ENGLISH? | ENGLISH? |
| ↓ | ↓ |
| Francais | Francais |
| ↓ | ↓ |
| Deutsch? | Deutsch? |
| ↓ | ↓ |
| Espanol ? | Espanol ? |
| ↓ | ↓ |
| XRESET? | SLOwoff? Fastoff? |
| | ↓ |
| | HIGHRES? LOW RES? |
| | ↓ |
| | LOCK? UNLOCK? |
| | ↓ |
| | XRESET? |

## Calibration and Optimization

Calibrate ➡ Optimize ➡ Measure

The 6000 is factory aligned and performs an automatic self-check each time it takes a measurement. For many applications no adjustment is necessary - just ZERO on the uncoated substrate, then measure.

However, gage readings can be influenced by changes in substrate shape, diameter, composition, surface roughness or by measuring in a different location on the part.

The 6000 can be *Calibrated* to verify that it is operating correctly and measuring accurately. The *6000* can also be *Optimized* for use on your specific application.

*Calibration* is the act of measuring known *Calibration Standards*, and verifying that the results are within the tolerance of the Gage.

*Optimization* is the act of changing the Gage's thickness reading to match that of a known sample in order to improve the effectiveness of the Gage on a specific surface or in a specific portion of its measurement range.

The need to *Calibrate* or *Optimize* depends upon a number of factors including the level of accuracy required and the need to satisfy ISO or other in-house quality control requirements.

## How to Calibrate

Make several measurements on each of three to five traceable *Calibration Standards* (see below).

If all of the readings on each standard is within the tolerance of the Gage, the Gage is operating properly and the calibration is complete.

If the readings are not within tolerance, first verify that your standards are good, then repeat the measurements. If the measurements are still out of tolerance, you may wish to try a second set of standards. If after this step the Gage is still reading out of tolerance, the Gage should be returned for service. *There are no user alignments possible.*

(*Written Calibration Procedures are available from DeFelsko at no charge, and are included on the PosiSoft CD with every Memory model*).

### Calibration Standards:

To calibrate the *6000* you must have a set of *Thickness Calibration Standards* with 3 to 5 values that cover the full range of the probe being used. These standards must have been measured to an accuracy that is four or more times better than the accuracy of the Gage at the thickness being measured.

*Example:* If the gage has an accuracy of ±2 microns at the thickness being measured, then the standards have to have been verified to an accuracy of better than or equal to ±0.5 micron.

(*Traceable Calibration Standards are available for each 6000 model. Contact your dealer for details*).

## Calibration Interval

User specific intervals should be established based upon frequency of use, handling practices and measuring environment.

## Effects of Temperature

If measurements will be made in extreme hot or cold temperatures, measure your *Calibration Standards* in the working environment. The **6000** should then be optimized in that same environment.

### How to Optimize

*One-* or *Two-point Optimization* should be performed if readings are not falling within the expected range of thickness for the application being measured.

## One-point Optimization

### *Simple Zero Adjustment*

*(F, FS, FRS, N, NS, NRS, FN, FNS, FNRS, SPFS and NAS probes only)*

Measure your uncoated part. If the Gage does not read "**O**" within the tolerance of the probe being used, lift the probe from the surface and adjust the display down ⊖ or up ⊕ until the display reads "**O**". Measure and adjust until the average of a series of readings on the uncoated surface is "**O**" (within tolerance).

### *Average Zero Adjustment*

*(Main Menu)*

On rough or curved surfaces the **Simple Zero Adjustment** method must be repeated several times to get a good "**O**". A preferred method is to take several readings on the uncoated part and average the result.

1. Select the **ZERO?** menu option.

2. Press ⊕ to select the number of readings to be used to obtain an average; typically 3 to 9 readings. The greater the variation between readings, the more readings should be taken to obtain an average. The display will show the number of readings remaining; i.e. **ZERO 4X?**

3. Repeatedly measure the uncoated part in the same area. The Gage will display a "**WAIT**" message for 2 seconds between readings to allow the user to correctly position the probe on the surface. After the last measurement the Gage will calculate and display "**O**" as indicated by a "triple BEEP". This "**O**" represents the average of all the **ZERO** readings taken.

 **NOTE:** "*FN*" models retain separate "*F*" and "*N*" zero settings. Adjustments are made to the currently displayed substrate only.

### *Adjustment To A Known Thickness*

*(F, FS, FRS, N, NS, NRS, FN, FNS, FNRS, SPFS and NAS probes only)*

It is sometimes desirable to adjust the gage to a known thickness rather than adjusting it to zero.

Measure the object. If the expected reading (within tolerance) is not obtained, lift the probe from the surface and adjust the display down ⊖ or up ⊕ to the expected thickness.

## Two-point Optimization

*(FT, FTS, NT, NTS, FNT, FNTS, FHS, NHS and Microprobes only)*

This method requires taking a reading on both the uncoated object (**ZERO**) <u>and</u> on a known thickness (**2ND PNT**). This second point should be near the top end of your application thickness to be measured.

1. *"***ZERO?***"* the Gage as described in "***Average Zero Adjustment***" (p.10).

2. Select the **2ND PNT?** *(Main Menu)* option.

3. Press ⊕ to set the number of readings used to obtain an average, typically 3 to 9. The greater the variation between readings, the more readings should be taken to obtain an average. The display will show the number of readings remaining to be taken; i.e. "**2NDPNT4X**"

4. Repeatedly measure the known thickness (coated part, a plastic shim or a Coating Thickness Standard) until the display shows **2PT=***value*. The Gage will display "**WAIT**" for 2 seconds between readings to allow the user to correctly position the probe on the surface.

5. Lift the probe from the surface and adjust the displayed reading down ⊖ or up ⊕ to the known thickness value. Press ⊖ ⊕ simultaneously to accept this value.

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## Inch/Metric Conversion

*(Config Menu)*

Selecting the **MILS?** or **MICRONS?** Config Menu option converts the display and all stored readings from inch to metric or vice versa.

## RESET Feature

It may be desirable to return the *6000* to a "known" state when settings have been changed purposely or inadvertently, if the gage behaves in an unfamiliar or unexpected manner, or if an object of known thickness is not available to adjust gage readings.

There are two types, **RESET** and **XRESET**.

**NOTE:** Keep the probe away from metal during **RESET** or **XRESET**.

### RESET

*(Main Menu)*

Selecting **RESET** returns the gage to a basic condition without erasing any readings stored in gage memory. The following changes are made to the gage after selecting **RESET**:

- all MODES are turned off (*memory, statistics, HiLo*).
- a zero reading and a $\sqrt[n]{\phantom{0}}$ symbol appear on the display. The $\sqrt[n]{\phantom{0}}$ symbol disappears if the Gage is zeroed or optimized.

**RESET** is handy when:

- you wish to return the gage to a basic condition, but you do not wish to lose stored readings and Config Menu settings

## XRESET

Selecting **XRESET** returns the gage to an out-of-the-box condition by performing a RESET <u>and</u> restoring factory settings. The **XRESET** function makes all of the same changes as **RESET**, and also make the following changes:

- all readings in memory are <u>erased</u>.
- measuring units, power down, button lock and resolution settings are restored.

**XRESET** is handy when:

- attempting to correct unexpected gage behavior
- you are uncertain what previous adjustments have been made and wish to return the Gage to a known condition.

### FN Combination Probes

**FN** probes combine the capabilities of both "*F*" and "*N*" probes.

The probe first attempts a measurement using the *magnetic principle*. If the coating is non-magnetic, within the probe's thickness range and the substrate is ferrous, a reading is displayed with the letter *"F"*.

If no valid reading is obtained with the *magnetic principle* the probe automatically attempts a measurement using the *eddy current principle*. If the coating is non-conductive, within the probe's thickness range and the substrate is a non-ferrous metal, a reading is displayed with the letter *"N"*.

If a reading is still not obtained, dashes ( -- -- -- -- -- ) appear on the display.

## Non-Ferrous Lock (N LOCK?)

*(Main Menu)*
*(FN Probes only)*

Select the *N LOCK?* menu option (non-ferrous lock) when operating regularly on non-ferrous substrates. This disables the automatic substrate determination ability and forces the probe to only use the *eddy current principle* when measuring, regardless of the substrate. This shortens measurement time and extends battery life.

- **TIP**: **N LOCK** is also useful in instances such as measuring paint on galvanized (zinc coated) steel. In *AUTO*matic (normal) mode the probe measures both the paint and zinc over the steel using the magnetic principle. **N LOCK** makes the Gage measure the paint over the zinc only.

- **TIP**: Select **N LOCK** to measure over slightly magnetic substrates; i.e. clear-coat on gold over nickel-plated brass. Although the probe's magnet is used for the *magnetic principle*, it is also used in **N LOCK** to magnetically saturate a slightly magnetic substrate and allow the *eddy current principle* to operate unhindered.

**WARNING:** With **N LOCK** engaged it is possible to obtain a reading when measuring non-conductive coatings on steel. However, eddy current is not the preferred measuring principle on steel.

Select the **FN AUTO?** menu option to return the probe to its auto selecting capability.

## Slow-off / Fast-off

*(Config Menu)*
*Standard (2) and Memory (3) models only*

When **SLOWOFF?** is selected the gage powers-down after approximately 30 minutes of no activity, or when **OFF?** is selected from the *Main Menu* (see p.6).

When **FASTOFF?** is selected the gage powers-down after approximately 60 seconds of no activity. This is the default factory setting.

## Hi-Resolution Mode

*(Config Menu)*
*Standard (2) and Memory (3) models only*

When **HIGHRES?** is selected, the displayed gage resolution becomes as follows:

| Resolution | Range |
|---|---|
| 0.01 mil | 0.00 – 99.00 mils |
| 0.1 mil | 100.0 – 999.9 mils |
| 0.1 μm | 0.0 – 999.9 μm |
| 0.01 mm | 1.00 – 99.99 mm |

When **LOW RES?** is selected, **HI-RESOLUTION** Mode is deactivated and the gage resolution is returned to the default factory setting.

**NOTE:** Gage accuracy is not affected by the HI-RESOLUTION Mode.

## Lock Mode

*(Config Menu) - One-point Optimization Probes only*
*Standard (2) and Memory (3) models only*

The **LOCK?** Menu option locks the ⊖ ⊕ buttons. This prevents accidental adjustments to readings when you have set the gage up for a specific application.

Select **UNLOCK?** to unlock the buttons. This is the default factory setting.

## Flip LCD

The **FLIPLCD?** menu option causes the display to read upside down. On **Separate Probe Gages** this feature allows the Gage to be laid on a worktable with the LCD conveniently pointed toward the operator, thus freeing the operator's hands to hold the probe and part to be measured. On **Built-In Probe Gages** this feature is useful when the Gage is used upside down to measure on a ceiling.

## Statistics Mode

When **STAT ON?** is selected, a $\overline{x}$ symbol and a counter (**N O**) appear on the display. As each measurement is taken, the reading is displayed *and* the counter is increased. An incorrect reading can be removed by pressing $\ominus$ before another reading is taken. After a desired number of readings, lift the probe from the surface and press $\oplus$ to display statistics.

example:

|  | mils | microns |
|---|---|---|
| average: | x = 1.8 | x = 46 |
| standard deviation: | $\sigma$ = 0.5 | $\sigma$ = 13 |
| number of readings: | n = 3 | n = 3 |
| maximum thickness: | MAX 1.9 | MAX 48 |
| minimum thickness: | MIN 1.7 | MIN 43 |

These statistics are automatically displayed one-after-the-other with a one second pause between each. Speed up the cycle by pressing $\oplus$**.** The auto-cycle continues until:

- the Gage powers-down.

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- another reading is taken, in which case the sequence starts over.

- the ⊖ button is pressed, in which case the last reading is displayed.

**HILO** Mode must be off to activate **STATISTICS** Mode. Adjustments cannot be made to readings while in **STATISTICS** Mode. To turn **STATISTICS** Mode off, select **STATOFF?**

## HiLo Mode

*(Main Menu)*
*Standard (2) and Memory (3) models only*

When **HiLo ON?** is selected, the current **Lo** setting is displayed. Adjust down ⊖ or up ⊕. Alternatively, measure a coating with a thickness close to the required value and make final adjustments with the ⊖ ⊕ buttons. Press ⊖ ⊕ simultaneously to accept this value.

The last **Hi** setting is now displayed. Follow the same procedure to adjust the **Hi** setting. The $\underline{\overline{\text{II}}}$ symbol will indicate **HiLo** Mode is now ON.

Measurements will now be compared to your defined limits. The Gage BEEPS TWICE (normal) if results are within those limits and ONCE if outside. The single BEEP is a LOW tone with a ↘ if it is below the *Lo* limit, and a HIGH tone with a ↗ if it is above the **Hi** limit.

**NOTE:** The LED will only BLINK if readings are within limits.

**STATISTICS** Mode must be off. Calibration adjustments cannot be made while in **HILO** MODE. To turn **HILO** MODE off select "**HiLoOFF?**".

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*(Main Menu)*
*Memory (3) models only*

When **MEM ON?** is selected the 📼 symbol and a counter (**O**) appear. 5000 readings in up to 100 batches (groups) can be recorded.

In MEMORY MODE readings are simultaneously displayed and stored. The current BATCH number (**B1**) is displayed. Remove the last reading from memory by pressing ⊖. <u>Erase ALL stored readings</u> by selecting "**CLR MEM?**". Calibration adjustments cannot be made while in **MEMORY** Mode. To turn **MEMORY** Mode off select "**MEM OFF?**".

**NOTE:** Press ⊕ at any time for a summary view of the average, standard deviation, number of readings, minimum thickness reading and maximum thickness reading in the current batch. Then press ⊖ or take a reading to exit the summary view.

### Batch Markers

Readings taken for different jobs or parts can be grouped together or "separated" by placing Batch Markers between sets of measurements. Select **B MARK?** from the *Main Menu* after a series of readings. A Batch Marker is set automatically if you turn **HiLo** or **STATISTICS** Modes on or off. Statistical summaries are calculated for each batch during downloading.

### Memory AND Statistics Modes Together

When both these MODES are ON, individual measurements ARE NOT STORED. Instead, when ⊕ is pressed, the

average, standard deviation, number of readings, minimum thickness reading and maximum thickness reading are simultaneously <u>displayed and stored</u> in memory. Again, statistical summaries are calculated for each batch during printing. This delivers the average of a set of average readings as required by SSPC PA-2 guidelines.

**NOTE:** SSPC is a U.S.-based Society for Protective Coatings. PA-2 is a Paint Application specification.

## Printing

*Memory(3) models only*

Data can be sent from the *6000* to a serial printer, data collector or computer using the supplied RS232 serial cable -- or directly to the optional wireless *HP IR* printer using the Gage's built-in IR port.

### Printer Output

Select **PRINT?**

Choose an output option:
**ALL**: individual readings + Statistical Summary
**HISTO**: Statistical Summary + Histogram

Select **IR PRT** for the *HP IR* Printer -- or –
Select a **TYPE** as below if printing to a serial printer or computer. If uncertain which **TYPE** to use, try each one, one at a time.

| TYPE | BAUD | Handshake |
|--------|------|-----------|
| TYPE 1 | 9600 | Xon/Xoff |
| TYPE 2 | 9600 | DTR |
| TYPE 3 | 1200 | Xon/Xoff |
| TYPE 4 | 1200 | DTR |

Each batch (group of measurements) is printed separately. The mean, max/min

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measurement, standard deviation and number of readings is printed for each. Depending upon what MODE was active when the measurements were taken, three output types are possible:

**REGULAR** Mode - all readings are output

**STATISTICS** Modes - only averages and standard deviations are output

**HILO** Mode - all readings are output, each followed by an indication of which limit they exceeded.

**NOTE:** The portable, battery operated, wireless *HP IR* printer is available from your dealer. It provides quick, convenient, low-cost output in the field, on the shop floor, or in the lab.



**NOTE:** The *histogram* shows a visual interpretation of the distribution of readings. The total spread of thickness is divided into a number of equal bands. The printout consists of a bar chart, the length of each bar corresponding to the number of readings in that band.

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# Sample Printer Output (ALL)

6000 FNS3

S/N 123456

15 Readings                          ← Summary

 2 Batches

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STATISTICS BATCH # 1 FE        ← STATISTICS
PROBE MODEL FNS                   and
                                  MEMORY
                                  MODES on

| # | AVG | STDDEV | n |
|---|-----|--------|---|
| 1 | 15.20 mil | 0.05 | 5 |
| 2 | 15.20 mil | 0.05 | 3 | ← Only average |
| 3 | 15.10 mil | 0.00 | 3 | readings were stored |

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MAX        15.20 mil
MIN        15.10 mil
N          3
MEAN       15.17 mil        ← The Average
STD DEV    0.06 mil            of averages!

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HI/LO BATCH # 2 FE             ← HiLo and
PROBE MODEL FS                    MEMORY

                                  MODES on

| # | READING | |
|---|---------|---|
| 1 | 1.85 mil | OK |
| 2 | 0.00 mil | LO | ← 2 readings are |
| 3 | 5.30 mil | HI | ← outside limits |
| 4 | 1.85 mil | OK | |

------------------------------

MAX        5.30 mil
MIN        0.00 mil
N          4
MEAN       2.25 mil
STD DEV    2.21 mil

 1 READINGS BELOW   1.75 mil
 1 READINGS ABOVE   2.10 mil
 2 READINGS WITHIN HIGH/LOW

## Downloading Measurements As They Are Taken

If a serial printer, data collector or computer is connected to the Gage using the supplied RS232 serial cable, readings are immediately sent to the device as they are taken. Output is in the following form (example):

{STX} 15.0mil NONFE{CR}{LF}

*where*:

STX = ASCII code 02 = ^B
CR = ASCII code 13 = ^M
LF = ASCII code 10 = ^J

## Downloading Measurements Stored In Memory

Measurements stored in the Gage's memory can be downloaded to a computer using an RS232 serial communication cable and either the *PosiSoft* software included with all Memory(3) gages, or other types of communications software (see below). Measurements are not erased from memory after downloading.

## PosiSoft® Coating Thickness Software for Windows®

**POSISOFT**® is supplied with all *6000* Memory(3) gages for downloading readings to a computer. It runs on Windows-based PC computers using Microsoft Windows® 95 or higher version and having a COM port. It allows entry of notes and annotations, prints histograms and basic charts and is ideal for monitoring coating thickness applications. Complete operating instructions can be accessed by first installing the software, starting the program, then selecting the *Help → PosiSoft Help* menu option.

### Other Communications Software

Existing communication software can be used, providing it can capture data from a COM port. Select *"PRINT?"* and a download *"TYPE?"*

### Serial Communications Configuration

Type 1
8 bit words, no parity, 1 stop bit
9600 baud
XON-XOFF handshaking

The supplied serial cable is a 3.5 mm STEREO PLUG to a DB9 F.

| Pinout | Description |
|--------|-------------|
| 2 | TXD Transmit data (from Gage) |
| 3 | RXD Receive data (from PC / Printer) |
| 5 | GROUND |

### HP IR Printer

A convenient, portable printer is available for use with *Memory* models. The Gage transmits data to this battery-operated printer through the infrared port without connectors or cables.

### Traceable Standards

Calibration standards are available for each particular probe. They are ideal for ISO 9000 compliance and for verifying the operation of your Gage.

### Plastic Shims

A set of five *Plastic Shims* is included. They provide a quick operational check and to help insure proper use of the Gage by performing practice measurements. In addition, they can be used to protect the probe when measuring on tacky, rough or hot surfaces. See your dealer to order more *Plastic Shims.*

### User Mode

The *User Mode* enables a user to load customizable and pre-configured calibration data into the Gage for measuring specialty coatings such as ferrous-loaded paints.

This mode is not found on *6000* Gages unless it is specifically requested at the time the Gage is ordered.

Please contact your dealer for more information on this option if your application requires such capability.

## Temperature

Operating range: +32° to +120°F
(0 to +50°C).

The *6000* compensates automatically for temperature. Allow a few minutes for the Gage to reach ambient temperature before measuring.

Discard the first measurement taken in a notably different temperature condition. When measuring surfaces much hotter or colder than ambient, allow 1 second off the surface between measurements.

**TIP**: Ferrous substrates with extreme temperatures between -150°F and +450°F (-100°C and +230°C) can be measured with the **PosiPen®**. It is ideally suited for measuring on small, hot or hard-to-reach surfaces. Contact your dealer.

**NOTE:** The gage will not perform temperature compensation unless the probe is lifted from the surface by at least 6 inches for at least 10 seconds after a reading.

**NOTE:** If readings on thick coatings appear to be inconsistent, remove the gage from the surface by at least 6 inches for at least 10 seconds to allow the gage to periodically compensate its calibration.

## Instability Indication

A high, fast, beeping sound emitted during measuring indicates the Gage requires more time than usual to determine a coating thickness measurement.

This occurs if the probe is touching a very hot or cold surface, or if the probe is not being held steady.

When temperature compensation has been made or the probe has stabilized, the beeping will stop and a measurement will be displayed.

## Quick Release Adapter

The *F0S* and *N0S Microprobes* are supplied with a quick release adapter to convert them to constant pressure probes for alignment on small, flat or curved parts.

The adapter is held in place by a spring located on the microprobe cable. If the sleeve is not required, simply pull it off the probe. To re-attach it, slide it over the microprobe and screw it into the spring.

**NOTE:** Due to their exceptional measuring sensitivity, it is necessary to fixture the *N0S*, *N45S* or *N90S* probes when measuring.

## Maintenance

The *6000* requires no regular maintenance other than battery replacement. Paint, dirt and other marks on the gage housing may be removed with a solvent such as acetone.

### Certification

All Gages are shipped with a *Certificate of Calibration*. Some organizations have a compliance requirement to re-certify Gages periodically. This can be done by measuring traceable Standards (*available from your dealer*) or by returning the Gage to an authorized dealer to be re-certified.

## Changing The Battery

As the batteries become weak the ▣ symbol will appear during measuring. The Gage can still be used in this condition but the batteries should be changed at the earliest opportunity.

USE ONLY <u>AA ALKALINE</u> BATTERIES

Nickel-cadmium and nickel-metal hydride rechargeable batteries will work but the low battery symbol may stay on.

To retain all user settings and stored memory readings, disconnect the battery <u>only</u> after the Gage has automatically powered-down.

Battery Life:     50 hours continuous or 36,000 readings

## Trouble Shooting

If "**SERVICE**" appears on the display, the Gage must be returned to the manufacturer or dealer for repair.

A "**PWR LOST**" condition may appear if the batteries are disconnected while the Gage is on. It may also indicate a low battery condition. Zero adjustments will have to be re-done and memory may be erased. If "**PWR LOST**" persists, change the batteries and perform an **XRESET**.

As with any electronic device, harsh temperature and electromagnetic environments or rough handling may alter the performance of some Gage components causing the Gage to exhibit unusual behavior. An **XRESET** will enable the Gage to recover from many of these disturbances without the necessity of returning the Gage for service.

## Returning the Gage for Service

Before returning the Gage for service…

1. Install new Alkaline batteries.

2. Examine the probe tip for dirt or damage. Constant-pressure probes should move up and down freely.

3. Perform a gage **XRESET**.

4. Place a plastic shim onto bare metal (steel or non-steel, depending upon whether you have an *"F"* or *"N"* probe) and attempt a measurement.

If you must return the Gage for service, describe the problem fully and include measurement results, if any. Be sure to also include the probe, your company name, company contact, telephone number and fax number.

## Technical Data

Conforms to the practices of: BS3900(C5), ISO 2178/2360/2808, ASTM B499/ D1186/D1400, SSPC-PA2

### Range:

| | |
|---|---|
| Microprobes, NAS | 0-25 mils & 0-625 microns |
| FT, FTS, NT, NTS, FNT, FNTS | 0-250 mils & 0-6 mm |
| FHS, NHS | 0-750 mils & 0-20 mm |
| All others | 0-60 mils & 0-1500 microns: |

### Default Resolution:

| | |
|---|---|
| Microprobes, NAS | 0.01 mil / 0.5 µm <br> 0.1 mil / 2 µm (> 4 mils / 100 µm) |
| FT, FTS, NT, NTS, FNT, FNTS | 0.5 mil / 0.01 mm |
| FHS, NHS | 1 mil / 0.02 mm |
| All others | 0.05 mil / 1 µm <br> 0.1 mil / 2 µm (> 2 mils / 50 µm) |

### Accuracy:

| | |
|---|---|
| Microprobes, NAS | $\pm$(0.01 mil + 1%)  0 - 4 mils <br> $\pm$(0.1 mil + 3%)  > 4 mils |
| | $\pm$(0.5 µm + 1%)  0 - 100 µm <br> $\pm$(2 µm + 3%)  > 100 µm |
| FT, FTS, NT, NTS, FNT, FNTS | $\pm$(0.5 mil + 1%)  0 - 100 mils <br> $\pm$(0.5 mil + 3%)  > 100 mils |
| | $\pm$(0.01 mm + 1%)  0 - 2.5 mm <br> $\pm$(0.01 mm + 3%)  > 2.5 mm |
| FHS, NHS | $\pm$(1 mil + 1%)  0 - 250 mils <br> $\pm$(1 mil + 5%)  > 250 mils |
| | $\pm$(0.02 mm + 1%)  0 - 6 mm <br> $\pm$(0.02 mm + 5%)  > 6 mm |
| All others | $\pm$(0.05 mil + 1%)  0 - 2 mils <br> $\pm$(0.1 mils + 1%)  > 2 mils |
| | $\pm$(1 µm + 1%)  0 - 50 µm <br> $\pm$(2 µm + 1%)  > 50 µm |

### **Physical Specifications:**

Gage dimensions:
5.8" x 2.4" x 1.0" (147 x 61 x 25 mm)

Gage Weight (without batteries):
6 ounces (170 grams)

Constant Pressure Probe Pressure:
3½ ounces (100 grams)

Maximum Pressure for Microprobes:
2 ounces (55 grams)

Operating Temperature:
+ 32° to + 120°F (0° to + 50°C)

Measuring Speed:
> 35 readings per minute (Built-In probe models only)

## Warranty

The manufacturer fully warrants its products against defects in workmanship or materials for a period of one year from date of purchase. In the event that a Gage is found to be defective, return the product with proof of purchase to your dealer, and the defective product will be repaired or replaced at the manufacturer's option.

No responsibility is assumed for incidental or consequential damages.

The warranty is voided if the Gage has been opened.

Data subject to change without notice.

**DeFelsko®**

*The Measure of Quality*

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