

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.

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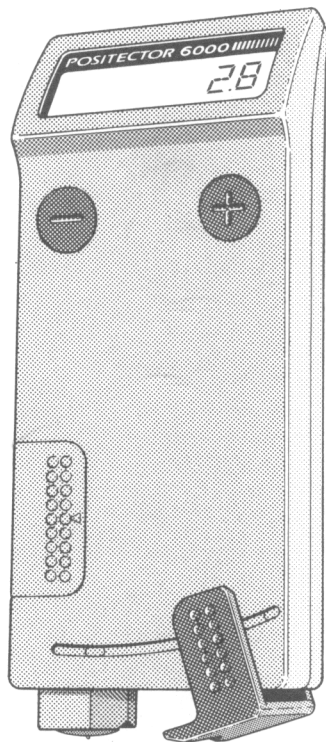
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6 0 0 0 Series

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Coating Thickness Gage



INSTRUCTIONS

6000 Series

COATING THICKNESS GAGE

- INSTRUCTIONS -

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

Each **6000** has a model number containing the letters **F**, **N** or **FN** (eg 6000 F3).

"F" models use the magnetic principle to measure the thickness of **NON-MAGNETIC** coatings (including paint, enamel, plastic, epoxy, plating, galvanizing, etc.) on **FERROUS METALS** such as steel and iron.

"N" models use the eddy current principle to measure the thickness of **NON-CONDUCTIVE** coatings (including paint, enamel, epoxy, plastic, anodizing, etc.) on **NON-FERROUS METALS** such as aluminum, copper, stainless steel, lead and graphite.

"FN" models combine the full abilities of both the **F** and **N** models.

CALIBRATION

The **6000** permanently stores N.I.S.T. (National Institute of Standards and Technology - formerly NBS) calibration data.

Calibration is instant and automatic. The Gage requires no further calibration. Just set to ZERO (0) on the uncoated substrate, then measure.

Verify calibration by measuring N.I.S.T. standards or by placing the enclosed precision plastic shim standards on your uncoated metal. Measurements should be within the combined tolerances of the standards and the Gage.

Measuring a plastic shim with a micrometer, paper thickness gage, **6000** or PosiTest® might not produce identical readings. This is due to the shape of the contact surfaces of the Gage and to its contact pressure.

HOW TO TAKE A MEASUREMENT

The **6000** is always ready to measure. It powers-up when the probe is depressed and powers-down after 30 seconds of no activity to preserve battery life. All settings are retained during power-down, including the last reading.

Slide the probe cover open FULLY. It acts as a second "foot" to steady the Gage when required.

Place the probe of the Gage FLAT on the surface to be measured. The Gage turns on and begins calculating a measurement immediately. Hold the Gage steady. When a valid coating thickness measurement is calculated, the Gage BEEPS twice and displays the measurement.

To take a second measurement, lift the Gage from the surface and repeat.

When finished measuring, slide the probe cover FULLY shut to prevent the Gage from accidentally turning on and draining the battery. The cover must be shut to fit properly into the leather pouch.

INCLUDED IN THE SHIPMENT

- **6000** Coating Thickness Gage
- Operating instruction booklet
- Precision plastic shim standards
- 9 volt alkaline battery
- Leather pouch

6000 MODELS

- F1/N1/FN1 - basic Gages
- F2/N2/FN2 - display averages, Standard Deviations, Hi/Lo limits
- F3/N3/FN3 - as above PLUS memory for SPC downloading to printer or computer
- F4 - measure thick coatings on steel up to 250mils/6mm
- N4 - measure thin coatings on aluminum such as anodizing and thin paint.

GOLDEN RULE

Before measuring, always check the Gage reads "0" on the uncoated substrate or reads a known thickness accurately, especially if the substrate changes in shape, diameter, composition, surface roughness or when measuring in a different location on the part. If necessary, make adjustments as described below.

ADJUSTMENT TO ZERO

Although the **6000** requires no adjustment for most applications, it is recommended that the operation of the Gage be tested on the particular substrate on which it is to be used. A quick check will determine if an adjustment is required. If so, it is easy to perform and verify.

If possible, measure the object before it is coated. Significant substrate variations can influence Gage readings.

If the Gage does not read zero (0) or close to zero, lift the Gage from the surface and adjust the display down \ominus or up \oplus by pressing the appropriate button until the display reads "0".

Measure and adjust until you are satisfied that the average of a series of readings on the uncoated surface is "0".

If it is not possible to measure the uncoated object, measure an uncoated object that is as close as possible in shape, composition and surface roughness as the object to be measured.

"FN" models retain separate zero settings for both "F" and "N" materials. A zero adjustment on one material does not affect the zero setting of the other.

Adjustments using the \ominus \oplus keys are made to the substrate type currently displayed, ie "F" or "N".

ADJUSTMENT TO A KNOWN THICKNESS

Sometimes it is necessary to adjust the Gage to read a known thickness such as another coated object, standards or the enclosed precision plastic shims.

Measure the object. If the expected reading is not obtained, lift the Gage from the surface and adjust the display down \ominus or up \oplus by pressing the appropriate button.

RESET FEATURE


The **6000** comes with a unique **RESET** feature which restores factory calibration settings instantly and returns the Gage to an "out-of-the-box" condition.



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 behaviour. A **RESET** will enable the Gage to recover from many of these disturbances without the necessity of returning the Gage for service.

RESET is also handy when:




- an uncoated object is not available to zero the Gage on.
- an object of known thickness is not available to adjust Gage readings to.
- you are uncertain what previous adjustments have been made and wish to return the Gage to a known condition.

What happens when the Gage is **RESET**?

- all other **MODES** are turned off
- all readings in memory are erased
- the Gage is adjusted to factory settings
- the  symbol appears on the display

To **RESET** the Gage, allow the Gage to power-down. Hold the  key down. Depress and release the probe with your finger. The word "**RESET**" will appear on the display. Release the  key.

When factory calibration settings are in place, a reset symbol  appears on the display.

If the Gage is adjusted from this setting using the  or  keys, the  symbol will turn off.

"FN" COMBINATION MODELS

The **6000 FN** combines the capabilities of both "F" and "N" models.

When the probe of the Gage is placed onto a surface, the magnetic principle is first used to attempt a measurement. If the coating is non-magnetic under 60 mils/1500 μ m and the substrate is ferrous, a reading will be displayed with the letter "F".

If no valid reading is obtained, the Gage then automatically uses the eddy current principle to attempt a measurement. If the coating is non-conductive under 60 mils/1500 μ m and the substrate is non-ferrous, a reading will be displayed with the letter "N".

If a reading is still not obtained, dashes will appear on the display.

N LOCK

The automatic substrate determination ability can be disabled. "N LOCK" forces the Gage to only use the eddy current principle when measuring.

This is useful when operating regularly on non-ferrous substrates. By preventing the Gage from attempting a magnetic reading every time, N LOCK decreases measurement time and extends battery life.

N LOCK is also very useful in instances such as measuring coating thickness on galvanized (zinc coated) steel. Normally the Gage would measure the thickness of both the paint and zinc over steel using the magnetic principle. "N LOCK" makes the Gage measure the thickness of the paint over the zinc only.

To enable or disable "N LOCK" press and release both \ominus and \oplus buttons simultaneously when the Gage is powered up. This brings up a menu. Press \ominus until the words "NLOCK?" or "FNAUTO?" appear. Press \oplus to activate.


WARNING. With "N LOCK" engaged it is possible to obtain a reading when measuring a non-conductive coating on steel. Eddy current is not the preferred measuring principle on steel and care should be taken when interpreting results.


METRIC AND INCH DISPLAY

On basic models, to convert the display from inch to metric or vice versa, press and release both \ominus and \oplus buttons simultaneously when the Gage is powered-up. The displayed measurement is converted.

On the advanced models, pressing both \ominus and \oplus buttons simultaneously brings up a menu. Press \ominus until the "MICRONS?" or "MILS?" option appears. Select the option by pressing \oplus .

CHANGING THE BATTERY

As the battery becomes low, the  symbol will appear during measuring. The Gage can still be used in this condition.

When the  symbol stays on, the battery should be changed at the earliest opportunity. The Gage will continue to operate properly until complete battery failure.

USE ONLY ALKALINE BATTERIES.

To retain all settings and readings, disconnect the battery only after the Gage has automatically powered-down.

Make sure the probe cover is FULLY shut when the Gage is not in use to prevent the Gage from accidentally turning on and draining the battery.

Battery Life: 30 hours continuous
15,000 readings

TEMPERATURE

The operating range for the **6000** is $+32^{\circ}$ to $+120^{\circ}\text{F}$ (0 to $+50^{\circ}\text{C}$).

The Gage compensates automatically for temperature. However it is recommended the gage be allowed a few minutes 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.

If your application calls for measuring on ferrous substrates with extreme temperatures between -150°F and $+450^{\circ}\text{F}$ or -100°C and $+230^{\circ}\text{C}$ contact your dealer for information on our **PosiPen**[®]. It is ideally suited for measuring on small, hot or hard-to-reach surfaces.

TROUBLE SHOOTING

If "SERVICE" appears on the display the Gage must be returned to the manufacturer or an authorized representative for repair.

A "MEM LOST" condition may appear if the battery is disconnected during power-on. Simply depress the probe to continue. Substrate adjustments will have to be re-done.

If the gage experiences a shock (physical, temperature, etc.), it may be necessary to reset all its internal functions. To do this, refer to the section on the Reset Feature. (See Page 6)

INSTABILITY INDICATION

A high beeping sound may be emitted during measuring. This 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 very cold surface, or the Gage is not being held steady.

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

MEASURING ON ROUND STOCK

Use the "V" groove in the probe and probe cover to help align the gage onto your part. Be sure to first check the Gage reads "0" on the uncoated part and that the proper adjustments, if necessary, are made as described in the ADJUSTMENTS section. (See Page 4)

MAINTENANCE

The **6000** requires no regular maintenance besides battery replacement. Paint, dirt and other marks may be removed with a solvent.

ADVANCED FEATURES

The **6000** has several features and operating MODES. Most are activated from a MENU that appears on the display. The following table outlines features available on different models...





Feature	Models F2, N2, FN2, F4	Models F3, N3, FN3
Mils/microns switchability	■	■
RESET MODE	■	■
STATISTICS MODE	■	■
HiLo MODE	■	■
MEMORY MODE		■
Continuous download of readings as they are taken		■
SSPC PA-2 capability		■
SPC calculations by group		■
Software and cable included		■

The following section refers to the advanced features available on the F2, F3, F4, N2, N3, FN2 and FN3 models.

MODES OF OPERATION

The **6000** operates in various MODES as selected by the user:

MODE SYMBOL OPERATION

Regular	(none)	Normal measuring using operator adjustments.
Reset		Normal measuring with factory settings in place.
Statistics		Displays average/standard deviation calculations.
HiLo		Warns if measurements fall outside pre-set limits.
Memory		Stores readings internally for downloading later.

MENU OPERATION

Features and MODES are activated by selecting the appropriate choice from a displayed MENU. The Gage must be in a power-up condition and the probe must not be depressed.

Press $\ominus \oplus$ simultaneously to display the first MENU choice. Each choice is presented as a question (?).

To answer "NO", press \ominus .

To answer "YES", press \oplus .

Answering "NO" will display the next option. The choices are:

6000 Models

<u>F2.N2.FN2.F4</u>	<u>F3.N3.FN3</u>
STAT ON?	(B MARK ?)
HiLo ON?	MEM ON?
MICRONS?	STAT ON?
	HiLo ON?
	(PRINT ?)
	(CLR MEM?)
	MICRONS?

- NOTE i) options in brackets () are displayed only when there are readings in memory.
- ii) options may appear in a different order depending upon the current MODE.

If the last MENU option question is answered "NO" \ominus , the Gage will exit the MENU and re-display the last measurement. The \ominus key is temporarily disabled to prevent accidental calibration adjustments after menu exit.

STATISTICS MODE

When this MODE is selected from the MENU the $\bar{\chi}$ symbol will appear at the top of the display and a counter (n 0) will appear in the left portion of the display. (HiLo MODE must be off.)

As each measurement is taken, the reading is displayed and the counter is incremented.

To display the average of these readings lift the Gage from the surface and press \oplus . Three values will be alternately displayed:

$$\bar{\chi} = 1.8$$

$$\sigma = 0.5$$

$$n = 3$$

In this example, three (3) readings were taken before the \oplus key was pressed. The average of those readings was 1.8 mils (46 microns) and the standard deviation was 0.5.

These statistics will be displayed until:

- the Gage powers-down after 2 minutes of no further activity.
- another reading is taken, in which case the sequence starts over.
- any key is pressed.

Calibration adjustments using \ominus or \oplus can not be made while in STATISTICS MODE.

To turn STATISTICS MODE off, select the "STATOFF?" option from the MENU.

HiLo MODE


When HiLo MODE is selected from the MENU the current LO setting is displayed as follows: (STATISTICS MODE must be off.)

Lo = 2.0

The default setting is 2.0 mils (50 microns).

Adjust down or up using the \ominus or \oplus keys. Alternatively, measure a coating with a thickness close to the required value and make final adjustments with the \ominus \oplus keys.

Once set, "lock it in" by pressing \ominus \oplus simultaneously. The last HI setting will then be displayed. Adjust to your required value.

Again, "lock it in" by pressing \ominus \oplus simultaneously. HiLo MODE is now ON and the  symbol is displayed.

Future readings are now compared to your defined limits. If they are within those limits, the Gage BEEPS TWICE (as per normal).

If a reading is outside those limits, ONE BEEP is emitted: a LOW tone with a down arrow if it is below, and a HIGH tone with an up arrow if it is above.


Calibration adjustments using \ominus or \oplus can not be made while in HiLo MODE.

To turn HiLo MODE off, select the "HiLoOFF?" option from the MENU.

MEMORY MODE (F3, N3, FN3)

The **6000** has the ability to store 1500 readings in 100 batches (groups).

In MEMORY MODE, measurements (except invalid "- - -" results) are automatically stored for later downloading to a remote device.

When this MODE is selected from the MENU the  symbol appears at the top of the display and a counter (0) will appear in the left portion of the display.

Readings are simultaneously displayed and stored. The counter is incremented as each measurement is taken. While the probe is depressed, the current BATCH number is displayed in the left portion of the display (ie. B 1).

Delete the last reading from memory by pressing \ominus while in MEMORY MODE. All readings in the current batch can be deleted this way, one at a time.

The only way to erase ALL stored readings from memory is to select the "CLR MEM?" option from the MENU.

Calibration adjustments using \ominus or \oplus can not be made while in Memory MODE.

To turn MEMORY MODE off select the "MEM OFF?" option from the MENU.

BATCH MARKERS

Stored readings taken for different jobs or parts can be grouped together or "separated" by placing Batch Markers between sets of readings. Select the "B MARK ?" MENU option.

Batch Markers are set automatically if HiLo or STATISTICS MODES are turned on or off.

Statistical summaries are calculated for each batch during printer downloading.

STATISTICS and MEMORY MODES TOGETHER

When both these MODES are ON, measurements ARE NOT stored as they are displayed.

Instead, when ⊕ is pressed the average, standard deviation and number of readings are simultaneously displayed and stored in memory.

Again, statistical summaries are calculated for each batch during printer downloading. This delivers the average of a set of average readings as required when following SSPC PA-2 guidelines.

DOWNLOADING MEASUREMENTS AS THEY ARE TAKEN

When a device such as a serial printer or computer is connected to the **6000** (models F3, N3 and FN3) while measurements are taken, those readings will be immediately sent to the device one at a time.

Output is in the following form:

{line feed} 15.0mil{line feed}
or ^J 382um^J

DOWNLOADING MEASUREMENTS STORED IN MEMORY

Readings previously stored into memory can be sent (downloaded) to a data collection device such as a printer or computer if that device uses RS232 serial communication.

Readings are not erased when downloaded. You may continue to take readings or download additional copies.

SERIAL PRINTER

If the Gage has powered-down, depress the probe to turn it back on. Select the "PRINT ?" MENU option.

You will then be given a selection of output protocols such as "TYPE 1?". Details are as below:

	<u>BAUD</u>	<u>Handshake</u>
TYPE 1	9600	Xon/Xoff (PosiPrinter [®])
TYPE 2	9600	DTR
TYPE 3	1200	Xon/Xoff
TYPE 4	1200	DTR

If uncertain which TYPE pertains to your printer try each one, one at a time.

Each batch (group of readings) is printed separately. The mean, max and min thickness, standard deviation and the number of readings is printed for each batch.

Three types of output are possible. Readings taken while the Gage was in REGULAR MODE are output one at a time. Each reading taken while the Gage was in HiLo MODE are followed by an indication of which limit they exceeded. Finally, averages stored while the Gage was in STATISTICS MODE are output in a manner similar to that of REGULAR MODE. (See sample output).

The **PosiPrinter** is available from your dealer for printing. It is specifically designed for field and office use (AC/DC) with the **6000**.

SAMPLE PRINTER OUTPUT

15 Readings ← *Summary*
2 Batches

STATISTICS BATCH # 1 FE ← *STATISTICS and MEMORY MODES on*

#	AVG	STDDEV	n
1	15.20 mil	0.05	5
2	15.20 mil	0.05	3
3	15.10 mil	0.00	3

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

HI/LO BATCH # 2 FE ← *HiLo and MEMORY MODES on*

#	READING	
1	1.85 mil	OK
2	0.00 mil	LO ← <i>2 readings are outside limits</i>
3	5.30 mil	HI
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

COMPUTER

The **6000** sends stored readings in ASCII format to an IBM compatible personal computer (PC) for processing by the user. Use the supplied software package by putting the diskette into the PC and typing **P6000** at the DOS prompt. Follow the subsequent instructions. Additional information about this process is available in a READ.ME file located on the supplied diskette and can be accessed with the following DOS command:

TYPE A:README ; MORE

Alternatively, existing software can be used provided it can capture data from a COM port.

FEATURES OF THE P6000 SOFTWARE PROGRAM

The **P6000** program allows you to:

- download stored measurements from the Gage into the computer.
- display measurement results on the screen.
- store readings on the computer's disk in ASCII format or in other formats to allow direct loading by spreadsheet programs.
- view previously stored readings.
- display readings by batch graphically, either by Profile or Histogram.
- print readings on your computer's printer.

DOWNLOADING MEASUREMENTS

Existing communication software can be used providing it can capture data from a COM port. In this way, each reading can be captured by the computer as it is taken.

Alternatively, by selecting "PRINT ?" on the Gage MENU, your computer will accept the measurements in the printer format. These results can then be inserted into documentation or directed to your computer's printer.

COMPUTER SOFTWARE SWITCHES

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

CABLES

The supplied serial cable has a 3.5mm stereo jack (Gage connection) and a DB25M pin connector for the printer.

DB25M Pins:

- 2 RD (Receive DATA) from printer
- 3 TD (Transmitted DATA) to printer
- both at RS232 levels
- 7 SG (Signal Ground)

TECHNICAL DATA

Conforms to:

FERROUS: BS5411(11),
BS3900(C5),
SSPC-PA2, ISO 2178, ISO
2808, DIN 50981, ASTM B499

NON-FERROUS: BS5411(3),
BS3900(C5), ISO 2360,
ISO 2808, DIN 50984

Range:

F1, F2, F3, N1, N2, N3, FN1, FN2,
FN3:

0-60 mils and 0-1500 microns
(μm)

F4: 0-250 mils and 0-6 mm

N4: 0-4 mils and 0-100 microns (μm)

Increments:

F1, F2, F3:

0.1 mil (0.05 mil below 2 mils)
2 μm (1 μm below 50 μm)

N1, N2, N3:

0.1 mil or 2 μm

F4: 5 mil (2 mil below 150 mils)

0.1 mm (0.05 mm below 3.5
mm)

N4: 0.02 mil or 0.5 μm

Variable Tolerance:

$\pm 3\%$ of the reading

Fixed Tolerance:

F1, F2, F3:

± 0.1 mil (± 0.05 mil below 2 mils)

± 2 μm (± 1 μm below 50 μm)

N1, N2, N3:

± 0.1 mil or ± 2 μm

F4: ± 5 mil (± 2 mil below 150 mils)

± 0.1 mm (± 0.05 mm below 3.5
mm)

N4: ± 0.02 mil or ± 0.5 μm

Specifications for the "FN" Gages are the same as for the "F1" model when operating on ferrous substrates, and the "N1" model when operating on non-ferrous substrates.

Gage dimensions:

5.8" x 2.3" x 1.0"

147 x 58 x 25 mm

Probe Pressure:

3-1/2 ounces (100 grams)

Gage Weight:

6 ounces (170 grams)

Operating Temperature:

+32° to +120°F (0° to +50°C)

Measuring Speed:

> 35 readings per minute