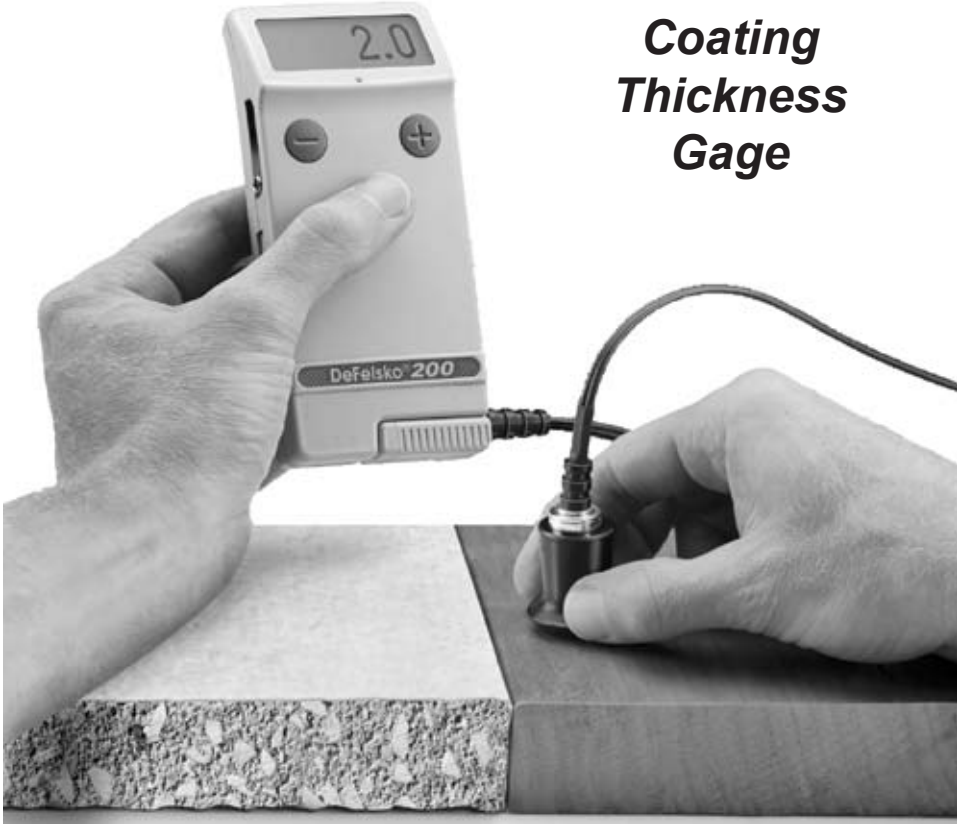
PosiTector 200

INSTRUCTION MANUAL ver. **1.2**

Ultrasonic Coating Thickness Gage



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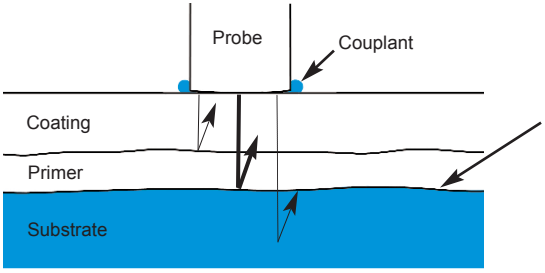
Introduction

The ***PosiTector 200*** is a hand-held Coating Thickness Gage that uses a non-destructive ultrasonic principle to measure coating thickness on a wide variety of substrates.

The ***PosiTector 200*** probe emits a high frequency sound pulse that travels into the coating via a coupling gel and reflects from ANY surface that is different in density. Coating thickness readings are obtained by measuring the time taken for the ultrasonic signal to propagate from the probe to the coating/substrate interface and back. The travel time is divided by two and multiplied by the velocity of sound in the coating to obtain the thickness of the coating.

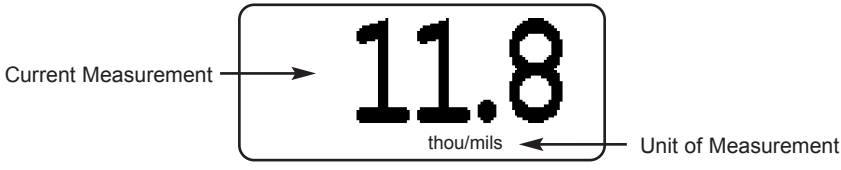


The ***PosiTector 200*** interprets the largest “echo” within the Gates as the coating/substrate echo.

Operation Overview

1. Turn the Gage **ON** (see Power-Up below)
2. **ZERO** the probe (see pg.6)
3. **ADJUST** to a known thickness, if necessary (see pg.7)
4. **MEASURE** the part (see pg.4)

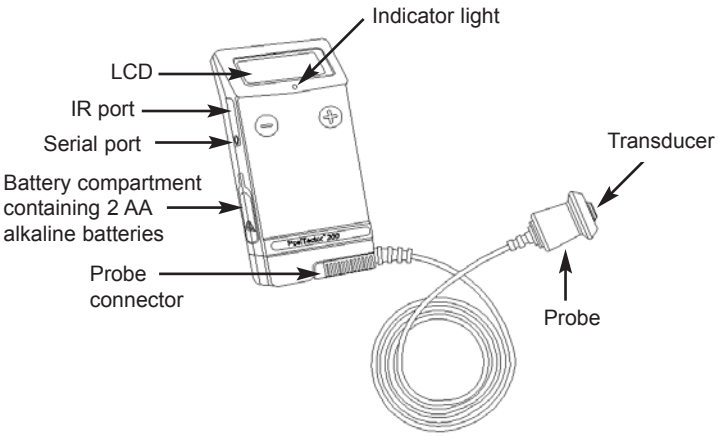
Typical Display



Power-up / Power-down

The ***PosiTector 200*** powers-up when ⊖ or ⊕ is pressed. On power-up dashes are displayed. To preserve battery life, the Gage powers-down after a period of no activity. To power-down manually, hold both buttons down for at least 5 seconds. All settings are retained during power-down.

Gage Features



Couplant

Couplant is required to propagate ultrasound into the coating. Water is a good couplant for smooth coatings. Use the supplied glycol gel for rougher coatings. While it is unlikely that the couplant will damage the finish or leave a stain on the surface, we suggest testing the surface by using the couplant on a sample. If testing indicates that staining has occurred, a small amount of water can be used instead of couplant. Consult the Material Safety Data Sheet available on our website and your coating supplier if you suspect the couplant may damage the coating. Other liquids such as liquid soap may also be used.

How to Measure

1. Apply couplant to the surface of your part.

2. After power-up, place the probe FLAT on the surface and press down.

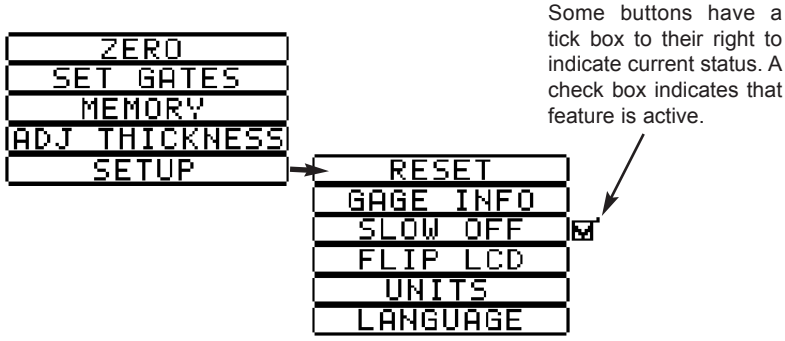
3. Lift the probe when you hear a double BEEP or see the green indicator light blink. Measurement result is displayed on the LCD.

A second reading may be taken at the same spot by simply holding the probe down on the surface.

4. When completely finished, wipe the probe clean of couplant then return both Gage and probe to the protective case. There is no need to disconnect the probe from the Gage during storage.

Menu Operation

Gage functions are menu controlled. To access the Menu, while the Gage is on press the ⊕ button.



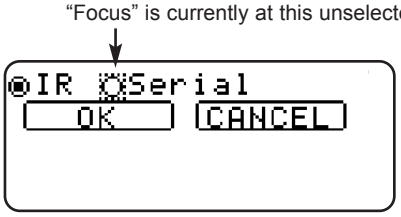
To navigate, press ⊖ for **NEXT**, ⊕ for **SELECT**. Press both at any time to exit any menu.

When there are more menu buttons than can fit onto one screen, a scroll bar will appear. The dark area indicates what portion of the total menu you are currently viewing.

Some buttons have an adjacent tick box to indicate current status. ☑

As you navigate using the ⊖ button, each element on the display will receive "focus" as indicated by the item reversing color to black, or being surrounded by dots. The ⊕ button acts on the element in focus.

Example



Press ⊕ to select Serial, then press ⊖ to move to OK.

Zero Menu Option

ZERO

The probe must be periodically zeroed using the ZERO menu option to compensate for both extreme temperature and probe wear effects. Before using, allow the probe to reach ambient temperature. Wipe the probe clean of couplant.

If measurements will be made in extreme hot or cold temperatures, it is recommended to ZERO the probe in the working environment.

If measurements will be made on rough substrates, it is recommended to periodically ZERO the probe to compensate for wear.

Set Gates Option

SET GATES

Although the ***PosiTector 200*** is designed to measure the thickness of polymer coatings in the thickness range of 25 to 1000 microns (1 to 40 mils) circumstances may require the user to restrict this measuring range using Gates.

Gate **A** sets the minimum thickness limit and Gate **B** the maximum limit. The default Gate **A** setting is 25 microns (1 mil). The default Gate **B** setting is 1000 microns (40 mils). These defaults can be restored at any time by performing a gage RESET (pg.10).

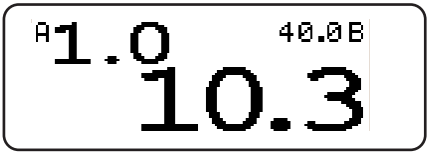
For most applications these Gate values do not have to be adjusted. But some conditions may exist in the user's application that cause the Gage to display very low or non-repeatable readings. These conditions include…

- ·rough or textured coatings
- ·hard (dense) coatings
- ·coatings applied in multiple layers
- ·coatings applied on a very thin, hard substrate

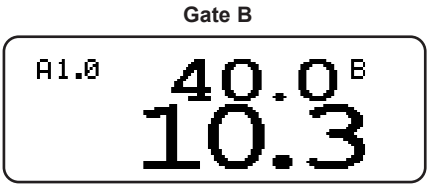
Important: When measuring, the Gage finds the most distinct interface within the two Gate settings. If the coating thickness is outside this range, incorrect or dashed readings may occur. The ***PosiTector 200*** interprets the largest “echo” within the gates as the coating/substrate echo.

Gate A

Gate **A** should be high enough to prevent the Gage from reading surface roughness. Unusually low readings indicate that Gate **A** may be set too low.



Gate **B** should be low enough to prevent total thickness measurements of the coating plus substrate. If results are much greater than the expected thickness, lower the value of Gate **B**.



To make adjustments:

1. Measure the coated part.
2. Select the **Set Gates** menu option.
3. Gate **A** can be changed first. Adjust the value down ⊖ or up ⊕. Press ⊖⊕ simultaneously to accept the value and to move to Gate **B**.
4. Gate **B** can now be changed. Adjust the value down ⊖ or up ⊕.
5. Press ⊖⊕ simultaneously to accept the value and exit.

Here are some typical Gate settings...

Expected paint thickness	**Gate A**	**Gate B**
20 mils (500µm) on concrete	5 mils (127µm)	40 mils (1000µm)
2 mils (50µm) on wood	1 mil (25µm)	10 mils (250µm)

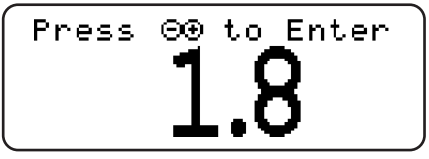
NOTE: The displayed thickness reading may change when Gate values are adjusted. The new thickness value represents the distance to the "loudest" interface within the new A/B Gate values (see pg.3). This handy feature makes it easy to ignore other measurements such as surface roughness.

For additional help with Gates see Application Notes (pg.15)

Adjust Thickness Option

ADJ THICKNESS

Select a reference standard of material as close as possible in composition to the intended application. For best results, the thickness of the reference standard should be equal to or slightly greater than the thickness of the coating to be measured.



1. Apply a drop of couplant onto the reference standard.
2. Measure the reference standard.
3. Lift the probe. Select the **ADJ. THICKNESS** menu option.
4. Adjust the display down ⊖ or up ⊕ to the reference standard thickness.
5. Press ⊖⊕ simultaneously to store the adjustment and exit.

Note: A **RESET** (pg.10) will restore factory settings.

Storing Readings into Memory

MEMORY

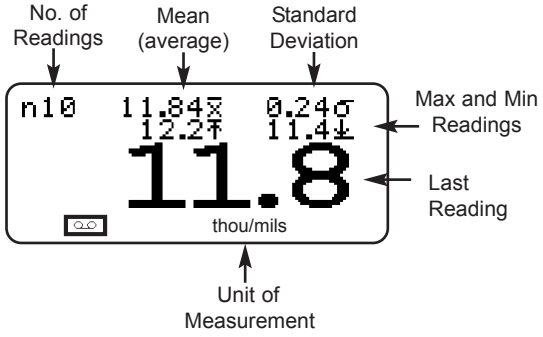
The ***PosiTector 200*** can record up to 1000 readings for on-screen viewing, for printing to the optional IR printer (pg.12), for printing to a serial printer, or for downloading to a personal computer using the optional ***PosiSoft*** software (pg.11) .

When **MEMORY** is selected, the following options are displayed:

ON
OFF
CLEAR
VIEW
PRINT

ON

Begins recording. The icon appears and basic statistics are displayed. Readings are stored when the probe is lifted from the surface. Remove the last reading by pressing ⊖ . Use **GAGE INFO** to determine memory usage. (see pg.10)



OFF

When selected, the disappears and recording stops. Stored readings remain in memory.

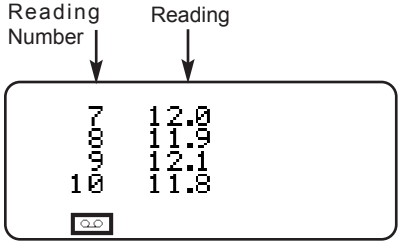
CLEAR

Removes all readings from memory.

VIEW

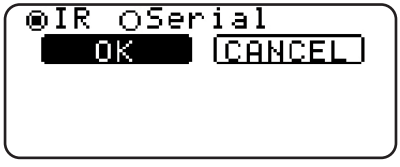
Lists all stored readings on the LCD. It begins by showing the last 4 readings. Scroll using the ⊖ or ⊕ buttons. Additional readings can be taken while in this view screen.

Exit by pressing ⊖ ⊕ simultaneously.



PRINT

Prints all stored readings to the optional IR printer or serial printer. (RS232 cable required for printing to a serial printer, not included) Press and hold ⊖ ⊕ to cancel printing.



Downloading Readings Stored in Memory

There are two ways to download readings stored in the Gage memory.

1. To a computer using the RS232 serial communication cable supplied with our optional ***PosiSoft*** software (see Options, pg.11).

2. Existing communication software providing it can capture data from a COM port. Select the **PRINT** menu option and the serial radio button. Readings are not erased from memory after downloading.

Downloading Readings 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} 7.2 mil{CR}{LF} where: STX = ASCII code 02 = ^B
CR = ASCII code 13 = ^M
LF = ASCII code 10 = ^J

Serial Communications Configuration:

8 bit words, no parity, 1 stop-it
115200 baud
No handshaking

The serial cable *(supplied with optional PosiSoft software)* is a 3.5 mm STEREO PLUG to a DB9 F.

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

USB to Serial Adapter

USB to Serial Adapter cables are available for PC's supporting only USB connections. This solution is easy to install and is compatible with Windows 98, ME, 2000 and XP.

Contact your dealer for additional information.

Setup Menu Option

SETUP

When **SETUP** is selected the following options are presented:

RESET

RESET restores factory settings and returns the Gage to a known, out-of-the-box condition. It is handy when you want to "start all over". When **RESET** is selected, the following screen appears:

The following changes are made to the Gage:
- all stored measurements are erased.
- the calibration adjustment is returned to the Gage's original factory setting for polymer.
- Gates are returned to Gate A=25um (1 mil) and Gate B=1000um (40 mil)
- menu settings are changed to the following:

MEMORY = OFF
SLOW OFF = OFF
FLIP LCD = Normal

A "hard" **RESET** can be performed when the Gage is powered down. In the unlikely event the Gage fails to power-up or operate properly, hold the ⊕ button until the **RESET** symbol appears.

This performs the same function as a menu **RESET** with the *addition* of **UNITS** = inch and **LANGUAGE** = English.

The probe must always be zeroed after a RESET using the ZERO menu option (pg.6).

GAGE INFO

This menu option displays the Gage model number, serial number, revision number and the amount of remaining memory for storage of readings.

SLOW OFF ☑

Normally the Gage powers-down after approximately 60 seconds of no activity. When **SLOW OFF** is selected the Gage powers-down after approximately 30 minutes of no activity. Additionally, an **OFF** button is placed in the menu. The Gage can always be powered-down at any time by holding both buttons for 5 seconds.

FLIP LCD

This option causes the display to read upside down. 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.

UNITS

Converts the display and all stored readings from thou/mils to microns or vice versa.

LANGUAGE

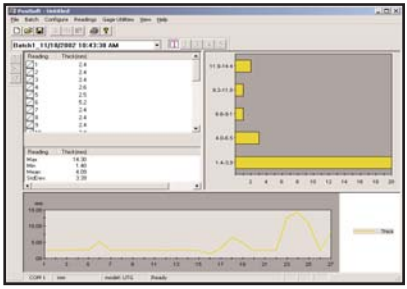
Displays a list of supported languages including English, Spanish, French, German, Portuguese, Chinese, Japanese, Dutch, Finish, Norwegian, Russian, Turkish, Czech and Italian.

Optional Accessories

The ***PosiTector 200*** has the following available accessories. Contact your dealer for assistance in determining which is best for your requirements.

PosiSoft® for Windows® analysis software

PosiSoft® ver. 2.10.0 or higher runs on Windows-based PC computers using Microsoft Windows® 95 or higher version and an available COM port.

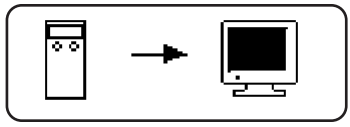


-Allows entry of notes and annotations.

-Prints and displays basic Charts and Histograms.

-Exports to a document or spreadsheet.

-Includes serial cable for printer or computer hook-up.



This connection graphic is displayed on the Gage's LCD when communicating with ***PosiSoft***. If it remains on the LCD for more than 5 minutes and ***PosiSoft*** is not connected to the Gage, the Gage can be turned off by opening the battery door.

Complete operating instructions can be accessed by first installing the software, starting the program, then selecting the **HELP - POSISOFT HELP - DOWN LOADING** menu option.

IR Printer

Battery operated infrared printer receives data from the Gage without connectors or cables. Great for use in the field or back at the office.

Print Sample:

```
MODEL 200
S/N 1234
------------------------

#    Reading
1    280  um
2    292  um
3    284  um
4    284  um
5    294  um

#      5
Min          280  um
Max          294  um
Mean         286.8  um
Std Dev        5.9  um
```

Gage info

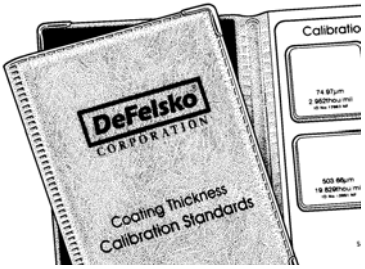
Reading #

Measurements

Statistics

Certified Thickness Standards

Certified Thickness Standards are available. They are ideal for verifying the operation of your Gage. All *Certified Thickness Standards* ship with a Certificate of Calibration.



Plastic Shims

A variety of non-certified colored plastic shims are included. They provide a quick operational check of the Gage. Place the shims on a hard, flat surface (i.e. glass) and apply water only to the top of a shim. Plastic shims are not always manufactured with the same material. Therefore it is not important that the Gage measure their exact thickness, rather readings should be close to the specified thickness and consistent.

Calibration, Verification and Adjustment

Three steps ensure best accuracy…

1. **Calibration** - typically done by the manufacturer or a qualified lab
2. **Verification** of Accuracy - as done by the user
3. **Adjustment** - to a known thickness

Calibration

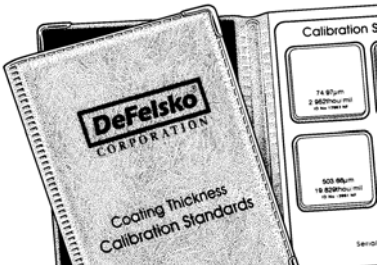
Calibration is the controlled and documented process of measuring traceable calibration standards and verifying that the results are within the stated accuracy of the Gage. Calibrations are typically performed by the Gage manufacturer or by a certified calibration laboratory in a controlled environment using a documented process. The standards used in the calibration are such that the combined uncertainties of the resultant measurement are less than the stated accuracy of the Gage. Typically a 4:1 ratio between the accuracy of the standard and the accuracy of the Gage is sufficient.

The ***PosiTector 200*** is shipped with a Certificate of Calibration showing traceability to a national standard. For organizations with re-certification requirements, the ***PosiTector 200*** may be returned at regular intervals for calibration. DeFelsko recommends that our customers establish the gage calibration intervals based upon their own experience and work environment. Based on our product knowledge, data and customer feedback, a one year calibration interval from either the date of calibration, date of purchase, or date of receipt is a typical starting point.

Verification

Verification is an accuracy check performed by the user using known reference standards. A successful verification requires the Gage to read within the combined accuracy of the Gage and the reference standards.

A reference standard is a sample of a known thickness(es) against which a user may verify the accuracy of the gage. Reference standards may be coated thickness standards (pg.12), the included plastic shims (pg.12), or sample parts whose coating thickness has been determined using other means.



To guard against measuring with an improperly adjusted Gage, verify the Gage at the beginning and the end of each work shift.

During the work shift, if the Gage is dropped or suspected of giving erroneous readings, its accuracy should be re-verified.

In the event of physical damage, wear, high usage, or after an established calibration interval, the Gage should be returned to the manufacturer for repair or calibration.

Temperature variations change the sound velocity of materials and transducer delay tips. Thus verification of accuracy should be performed with the reference standard, materials to be tested, and the Gage at the same temperature.

Adjustment

Adjustment, or *Calibration Adjustment*, is the act of aligning the Gage's thickness readings to match that of a known reference sample in order to improve the accuracy of the gage on a specific coating. (pg.7)

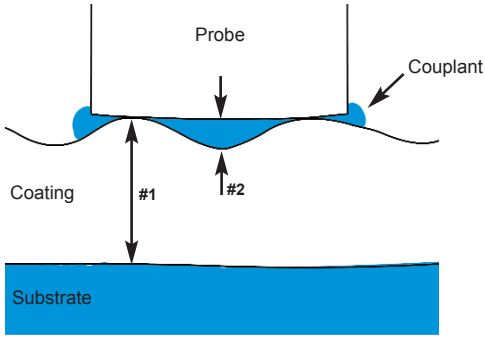
The ***PosiTector 200*** is factory calibrated. But in order for it to take accurate thickness measurements of a particular material it might be necessary to adjust the gage for that material. To determine if an adjustment is necessary for your application, measure a sample of known thickness of the coating material to be measured. If the average of a series of measurements is not close to the expected thickness, adjust to the expected thickness. Samples should be flat, smooth and as thick or thicker than the maximum expected thickness of the piece to be tested.

Application Notes

The ***PosiTector 200*** uses an ultrasonic principle to measure coating thickness of most coatings on most substrates. An ultrasonic signal is a very high frequency sound wave. Like the echoes you hear when you shout in a large hall or canyon the ***PosiTector 200*** listens for echoes from acoustic boundaries within your application.

The ***PosiTector 200*** probe emits a high frequency sound pulse that travels into the coating via a coupling gel and reflects from ANY surface that is different in density. Coating thickness readings are obtained by measuring the time taken for the ultrasonic signal to propagate from the probe to the coating/substrate interface and back. The travel time is divided by two and multiplied by the velocity of sound in the coating to obtain the thickness of the coating. The strength of the reflected signal from the coating/substrate interface determines the ability of the instrument to measure the thickness of the coating. Since most applications are not homogeneous the gage will "hear" many echoes when placed on a coating/substrate. The instrument "hears" ALL reflections within the measurement limits of the gage and assumes the largest “echo” is the coating/substrate echo. Adjustable measurement Gates have been provided for the user to force the instrument to ignore reflections from unwanted boundaries within the sample. Several examples below help to illustrate the use of Gates for specific applications.

Measurement of coatings with rough surfaces.
When rough coatings are measured, the gage typically identifies the thickness from the top of the coating peaks down to the substrate (#1). Couplant fills the voids between the probe and the coating (#2) creating an additional interface. If echoes from the couplant/coating interface (#2) are stronger than the coating/substrate interface (#1), an adjustment (increase) of Gate **A** may be required for the gage to display the weaker (#1) echo.



Measurement of dense (hard) coatings.
A significant echo occurs at the probe/coating interface. The relative strength of this echo compared to the coating/substrate echo requires that Gate **A** be increased.

Measurement of total thickness in multi-layer coating applications.
The echoes from multiple coating/coating/substrate interfaces causes some confusion. The user may need to adjust Gates to ignore reflections from coating/coating interfaces

Measurement of a coating on a non-homogeneous substrate.
When a coating is applied to a non-homogeneous substrate multiple echoes from within the substrate can cause the gage to appear to read erratic. In most instances reducing Gate **B** will help. Example: Coatings over some types of fiberglass or composite.

Measurement of a coating on a rough or porous substrate.
The roughness of the substrate will scatter the echo from the coating/substrate interface. In some cases multiple closely spaced echoes will be overlapped causing the gage to appear to read erratic. In other cases the scattering from the substrate absorbs the echo and the gage will not be able to distinguish the coating/substrate echo. In the case of a porous substrate the coating might be absorbed into the substrate in an uneven fashion producing the same effect as a rough substrate. Examples: Coatings over very rough concrete; Coatings over very soft woods.

The above examples depict general factors that need to be considered when using ultrasound to measure coating thickness with the ***PosiTector 200***. These include the relative difference in density of the probe and the coating, the condition of the coating surface, the relative difference in density of the coating and substrate and the condition of the coating/substrate interface. There are situations where combinations of the above conditions result in very challenging measurement applications. Careful use of the Gate settings helps ensure successful measurement of the application.

Troubleshooting

Gage does not turn on

Make sure the + and - battery terminals are positioned properly and that fresh Alkaline batteries are being used.

Gage powers up but fails to stay on

Replace batteries with fresh Alkaline batteries. If problem persists return Gage for service.

Gage measurements are much lower than expected

Gage may be measuring surface roughness. Raise the value of Gate **A**. See pg.6

Gage measurements are much higher than expected

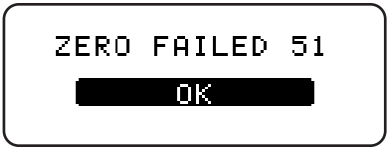
Gage may be measuring both the coating and substrate. Lower the value of Gate **B**. See pg.6

Gage does not yield accurate or consistent results

See the Set Gates (pg.6) and Adjustment (pg.7) sections to ensure the gage has been optimized for your application. Check the Gage on traceable standards.

Gage displays an error message while attempting probe ZERO

Make sure to hold the probe in the air and ensure the probe is free of couplant. If problem persists, note the error message and contact our technical support department.



Changing the Batteries

As the batteries become weak the - + symbol will appear and begin flashing during measuring. The batteries should be changed at the earliest opportunity. The symbol will remain on without flashing when the batteries are very weak.

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

NOTE: To retain all user settings and stored memory readings, open the battery door only after the Gage has automatically powered down.

Returning for Service

Before returning the Gage for service…

1. Install new Alkaline batteries in the proper alignment shown on the door.
2. Examine the probe tip for dirt or damage.
3. Perform a **RESET**. (pg.10) and a **ZERO** (pg.6)
4. Place a plastic shim onto a hard, flat surface (i.e. glass) and attempt a measurement. (see pg.12)

If you need to return the Gage for service, describe the problem fully and include reading results, if any. Be sure to also include the probe and contact information including your company name, company contact, telephone number and fax number or email address.

Technical Data

Conforms to: ASTM D 6132

Measurement Range:*	1 - 40 mils	25 - 1000 um
Resolution:	0.1 mils	2 um
Accuracy:	±(0.1 mils and 3% of reading)	±(2 um and 3% of reading)

Temperature Range: 0 to 40° C (+32° to +104° F)

*Range may change depending on surface roughness, temperature or coating properties.

Physical Specifications:

Body: 137 x 61 x 25mm (5.4” x 2.4” x 1”)
Weight: 170g (6oz) without batteries
Battery Life: 30 hours continuous

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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