PosiTector Ultrasonic Thickness Gage

INSTRUCTION MANUAL ver. **1.1**

DeFelsko®

Simple. Durable. Accurate.

CONTENTS

Introduction

The ***PosiTector UTG*** is a hand-held Ultrasonic Thickness Gage that uses the non-destructive ultrasonic pulse-echo principle to measure the wall thickness of a wide variety of materials. It is ideal for quality control and for measuring the effects of corrosion or erosion on tanks, pipes or any structure where access is limited to one side.

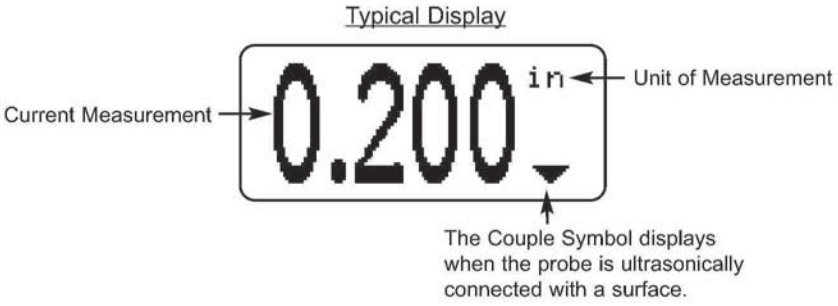
The probe (transducer) transmits an ultrasonic pulse into the part. This pulse travels through the material to the other side. When it encounters an interface such as air or another material, the pulse is reflected back to the probe.

To determine thickness, the Gage measures the time needed for the pulse to make this round trip and divides it by two. The result is multiplied by the velocity of sound for that material.

The velocity of sound is expressed in inches per microsecond or meters per second. It is different for all materials. For example, sound travels through steel faster (~0.233 in/µs) than it travels through plastic (~0.086 in/µs).

Operation Overview

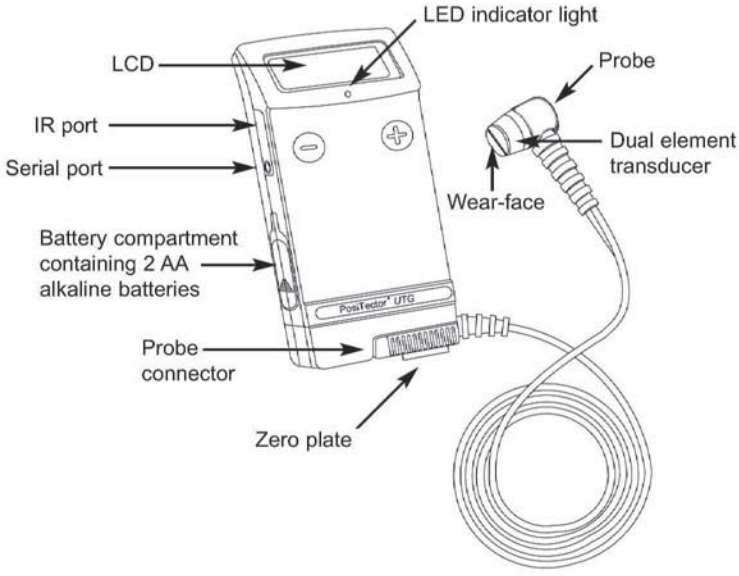
1. Turn the Gage **ON** (see Power-Up below)
2. **ZERO** the probe (see pg. 5)
3. Select the correct velocity of sound (see pg. 8)
4. Measure the part (see pg. 4)



Power-up / Power-down

The ***PosiTector UTG*** powers-up when ⊖ or ⊕ is pressed and displays zero. To preserve battery life, the Gage powers-down after 60 seconds of no activity. Alternatively, hold both buttons down for at least 5 seconds. All settings are retained during power-down.

Gage Features



How to Measure

1. Couplant must be applied to the surface to be tested when measuring to eliminate air gaps between the wear-face and the surface. A single drop of couplant is sufficient when taking a spot measurement; a line of couplant is necessary when dragging the probe during SCAN mode (see pg. 11).

2. Place the probe flat on the surface. Use moderate pressure to press against the top of the probe with the thumb or index finger. When the probe senses echoed ultrasound, a coupled symbol ▼ will appear on the display and thickness values will be displayed. While the probe is coupled, the ***PosiTector UTG*** will perform 6 readings per second, updating the display each time.

3. When the probe is removed from the surface, the last measurement will remain on the display.

NOTE: The wear-face of the probe (transducer) consists of two semicircles. One semicircle transmits ultrasonic sound into the material being measured while the other receives the echo. When measuring thin materials, the ***PosiTector UTG's*** automatic V-path correction uses proprietary algorithms to insure accurate measurements.

Occasionally, excess couplant will remain on the probe when the probe is lifted from the surface. This may cause the ***PosiTector UTG*** to display a final measurement value different from those observed when the probe was on the surface. Discard this value and repeat the measurement.

Surface Conditions

Ultrasonic measurements are affected by the condition, roughness and contour of the surface to be tested.

To optimize measurement results, the surface should first be cleaned of any foreign debris including rust and scale. Dependent on the amount of contamination, abrasion with a wire brush or grinding tool may be necessary.

Measurement results may vary on coarse surfaces. Where possible, it is recommended to seat the transducer on a smooth flat surface that is parallel to the opposite side of the material.

On rough surfaces, the use of a generous amount of couplant minimizes the surface effects and serves to protect wear of the transducer, particularly when dragging the probe across a surface.

Zero Menu Option

The ***PosiTector UTG*** probe can be "zeroed" to compensate for temperature and wear. During zeroing, it does not matter what the current velocity setting is.

1. Make sure the ***PosiTector UTG*** is on.
2. Apply a single drop of couplant onto the zero plate located on the underside of the ***PosiTector UTG***.
3. Select the ZERO menu option. The LCD will display the image shown in *Figure A*.
4. Press the probe against the zero plate as shown in *Figure B*.
5. When the ***PosiTector UTG*** beeps and the image shown in *Figure C* appears, remove the probe from the zero plate. The ***PosiTector UTG*** will display 0.00.

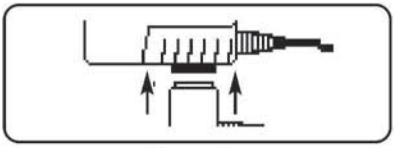


Figure A

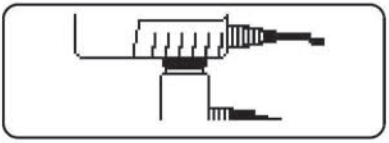


Figure B

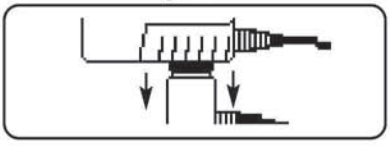
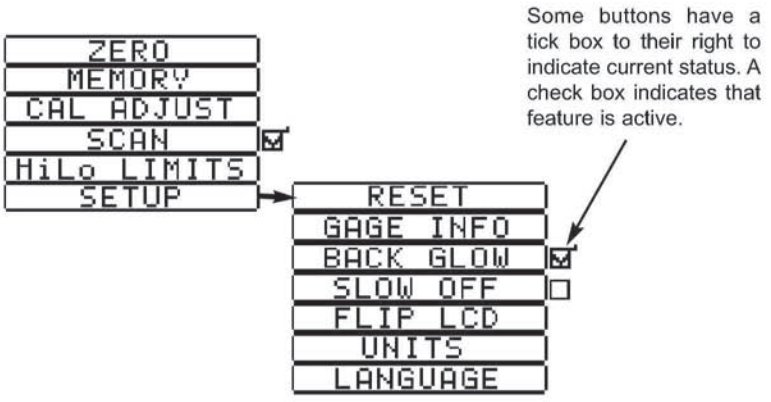


Figure C

Menu Operation

Gage functions are menu controlled. To access the Menu, turn the Gage on and press the ⊕ button.



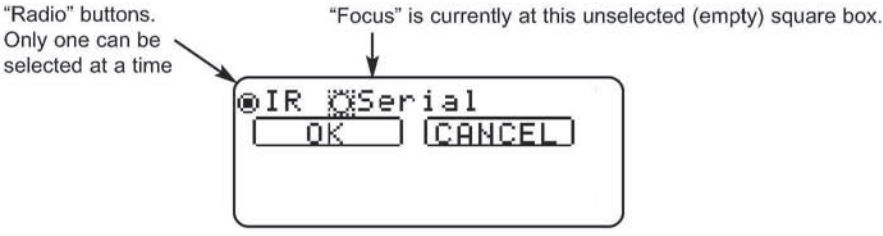
To navigate, press ⊖ for **NEXT**, ⊕ for **SELECT**. Press both at any time to exit any menu.

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 by being surrounded by dots. The ⊕ button acts on the element in focus.

Example



Calibration, Verification and Adjustment

Three steps ensure best accuracy...

1. **Calibration** (typically done by the manufacturer or a certified lab)
2. **Verification of Accuracy** (as done by the user)
3. **Adjustment** (entering the correct sound velocity for the material to be measured)

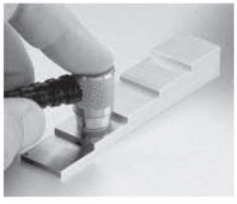
Calibration

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 UTG*** is shipped with a Certificate of Calibration showing traceability to a national standard. For organizations with re-certification requirements, the ***PosiTector UTG*** may be returned at regular intervals for calibration. The recommended re-certification interval is one year from receipt of the instrument. The interval should be adjusted according to experience, individual usage, and the work environment.

Written Calibration Procedures are available from DeFelsko Corporation at no charge.

Verification



Gage accuracy can and should be verified using known reference standards of the material to be tested.

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. Calibration step blocks are also available for this purpose.

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 wear-face. 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.

The ***PosiTector UTG*** is factory calibrated. But in order for it to take accurate thickness measurements of a particular material it must be set to the correct sound velocity for that material. Be aware that material composition (and thus its sound velocity) can vary from stated tables and even between lots from a manufacturer. Adjustment to a sample of known thickness of the material to be measured ensures that the Gage is adjusted as close as possible to the sound velocity of that specific material. Samples should be flat, smooth and as thick as the maximum expected thickness of the piece to be tested.

The ***PosiTector UTG*** allows four simple adjustment choices:

All four methods are based on the simple premise of adjusting the sound velocity.

The first three adjustment methods make 1-point calibration adjustments to optimize the linearity of the Gage over small ranges. The fourth method makes a 2-point calibration adjustment to allow for greater accuracy over a large range.

The most common method of adjustment is to measure a sample of known 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 part to be measured.

1. Apply a drop of couplant onto the reference standard.

2. Measure the reference standard.
3. Lift the probe. Select the **CAL ADJUST➔ THICKNESS** menu option.
4. Adjust the display down ⊖ or up ⊕ to the reference standard thickness.
5. Press ⊖⊕ simultaneously to store the adjustment and exit.

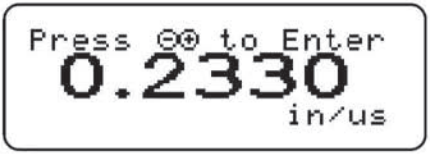
MATERIAL

If a known thickness of the material is not available, but the material is known, this quick adjustment allows the user to load one of several preprogrammed material velocities.

1. Select the **CAL ADJUST➔ MATERIAL** menu option.
2. Adjust the display down ⊖ to the desired material.
3. Press ⊕ to store the adjustment and exit.

VELOCITY

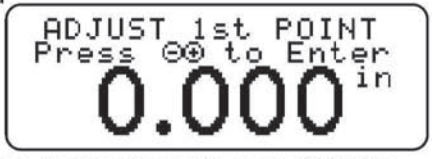
If the sound velocity for the test material is known, the Gage can be adjusted to that specific sound velocity by performing the following steps.



1. Select the **CAL ADJUST➔ VELOCITY** menu option.
2. Adjust the display down ⊖ or up ⊕ to the desired velocity. Holding the ⊖ or ⊕ buttons increases the rate of change.
3. When the expected velocity is reached, press ⊖⊕ simultaneously to store the adjustment and exit.

2 Pt ADJUST

A 2-Point adjustment allows for greater accuracy while simultaneously adjusting probe zero. Select two reference standards as close as possible in composition to the intended application. For best results, the thickness of the thicker reference standard should be equal to, or slightly greater than the thickest part to be measured. The thickness of the thinner reference standard should be as close as possible to the lower end of the expected measurement range.



1. Select the **CAL ADJUST➔ 2 Pt ADJUST** menu option.
2. Measure the thinner reference sample.
3. Lift the probe from the sample and adjust the display down ⊖ or up ⊕ to the expected thickness.
4. When the expected thickness is reached, press ⊖⊕ simultaneously.
5. Measure the thicker reference sample.
6. Lift the probe from the reference sample and adjust the display down ⊖ or up ⊕ to the expected thickness.
7. Press ⊖⊕ simultaneously to store the adjustment and exit.

Storing Readings into Memory

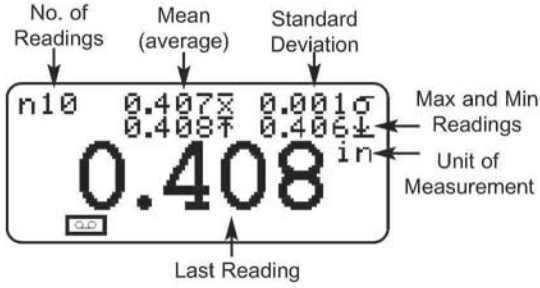
MEMORY

The ***PosiTector UTG*** can record up to 250 readings for on-screen viewing, for printing to the optional IR printer, for printing to a serial printer, or for downloading to a personal computer using the optional ***PosiSoft*** software.

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

ON

Begins recording. The icon appears and basic statistics are displayed. Reading is stored when probe is lifted from the surface. Remove the last reading by pressing ⊖. Use **GAGE INFO** to determine memory usage. (see pg. 13)



OFF

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

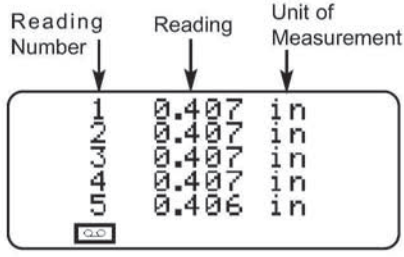
CLEAR

Removes all readings from memory.

VIEW

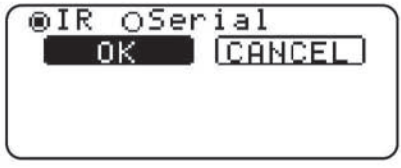
Lists all stored readings on the LCD. It begins by showing the last 4 measurement values. Scroll using the ⊖ or ⊕ buttons. Additional measurements can be taken while in this view screen.

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 ⊖ ⊕ 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. 14).
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} 0.15 IN{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 bit, 115200 baud, no handshaking

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

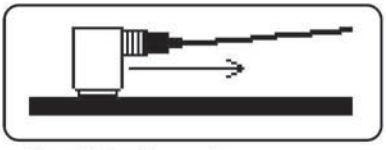
Pinout	Description
2	TXD Transmit data (from Instrument)
3	RXD Receive data (from PC / Printer)
5	GROUND

Scan Mode

Normally, the ***PosiTector UTG*** takes a single spot measurement at a rate of 6 readings per second while in contact with a surface. When the probe is lifted, the last reading will remain on the display.

It is sometimes necessary to examine a larger region to locate the thinnest point.

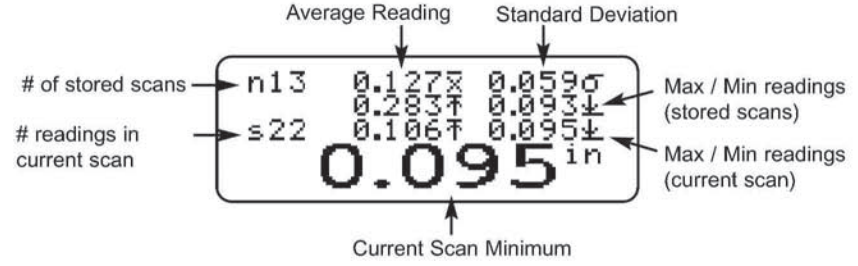
When **SCAN** is selected, the ***PosiTector UTG*** will measure at a rate of 20 readings per second and display min/max values.



Short cut: Scan mode can be enabled by pressing the ⊖ button when memory mode is turned off. Pressing ⊖ again will disable Scan Mode.

To measure, apply an adequate path of couplant over the surface to be measured. Place the probe on this surface and drag the probe over the determined measurement area. Lift the probe from the surface, the Gage will beep and the LCD will display a scan summary as shown below.

Memory Mode may be enabled while in Scan Mode for storage of up to 250 thickness values. When memory is enabled, the minimum thickness measurement is stored each time the probe is lifted or uncoupled from the surface.



The ⊖ button may be used to delete the last scan from memory.

Hi Lo Limits (Alarm)

HiLo LIMITS

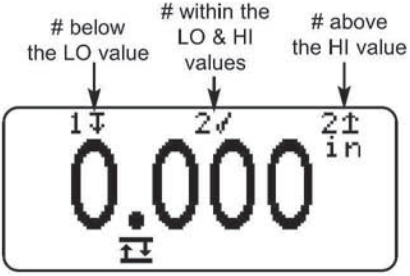
When **Hi Lo Limits** is selected the following options are presented:

CLEAR

Zeros all on-screen tabulations.

ON

Displays the current **LO** setting. Adjust down ⊖ or up ⊕. Alternatively, measure a material with a thickness close to the required value and make final adjustments with the buttons. Press ⊖ ⊕ simultaneously to accept this value. The current **HI** setting is now displayed. Follow the same procedure to adjust this setting. The ↕ icon will light.



Measurements will now be compared to your defined limits. The Gage emits a LOW tone if below the **LO** limit, and a HIGH tone if above the **HI** limit. The Gage remains silent when measurements are within defined limits.

OFF

Turns this mode off. Existing tabulations are maintained in memory, but not displayed.

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 steel.
- menu settings are changed to the following:

MEMORY = OFF	**HILO LIMITS** mode = OFF
SLOW OFF = OFF	**BACKGLOW** = ON
FLIP LCD = Normal	**SCAN** = OFF

A "hard" **RESET** can be performed when the Gage is powered down. It is handy when 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.

GAGE INFO

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

BACK GLOW ☑

The ***PosiTector UTG*** has a unique glow screen that evenly lights the LCD to provide visibility and contrast. In most lighting conditions this is not necessary, so the glow can be switched off for slightly longer battery life.

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 inch to mm or vice versa.

LANGUAGE

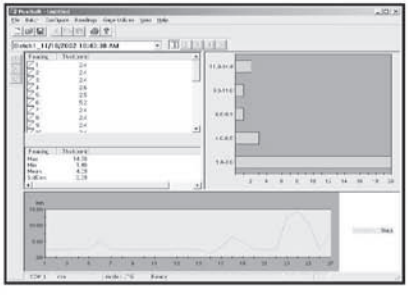
Displays a list of supported languages including English, French, German, Spanish and Japanese.

Optional Accessories

The ***PosiTector UTG*** 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. 2.8.5 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

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

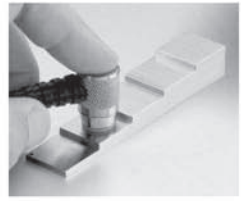
Print Sample:

```
UTG                                  <- Gage info
S/N 1234
-----------------------

#    Reading
1    14.80  mm
2    38.57  mm
3    14.99  mm
4    15.37  mm                      <- Measurements
5    14.36  mm
6    14.57  mm
7    38.53  mm
8    14.99  mm
9    21.92  mm
10   15.21  mm

#      10
Min          14.36  mm
Max          38.57  mm              <- Statistics
Mean         20.33  mm
Std Dev       9.85  mm
```

Reading # <- 1 2 3 4 5 6 7 8 9 10

Certified Step Blocks

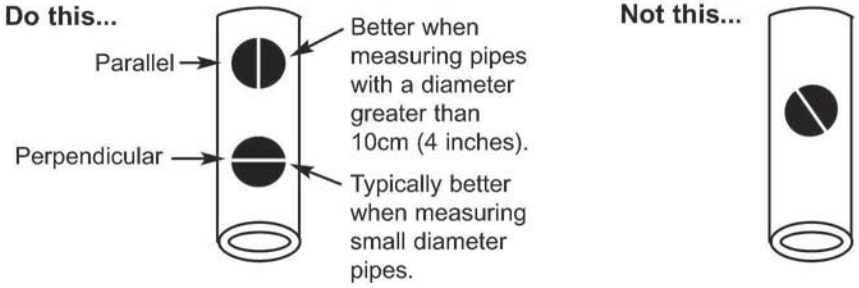
Certified Step Blocks are available. They are ideal for verifying the operation of your Gage. All Step Blocks ship with a Certificate of Calibration (see Calibration, pg. 7).



Application Notes

Measuring on pipes

When measuring the thickness of pipe walls, the proper placement of the transducer is important. On pipe diameters larger than 10cm (4 inches), it is recommended to place the probe parallel to the long axis of the pipe. For smaller diameter pipes, it is recommended that two measurements be taken, one with the probe perpendicular, and another with the probe parallel to the long axis of the pipe. The smaller of the two measurements should be recorded as the thickness for that area.



Measuring on rough surfaces

To optimize measurement results, the surface should first be cleaned of any foreign debris including rust and scale. Depending on the amount of contamination/ roughness, abrasion with a wire brush or grinding tool may be necessary.

On rough surfaces, the use of a generous amount of couplant minimizes the surface effects and serves to protect wear on the transducer, particularly when dragging across the surface is involved.

Measuring on hot surfaces

Measurements taken at higher temperatures (above 100° C / 212° F) require special consideration. Both material sound velocity and probe zero will change with temperature. For maximum accuracy at high temperatures, adjustment should be performed using a material of known thickness heated to the temperature where measurements are to be performed. The probe should remain on the surface only as long as it takes to get a measurement.

The surface temperature of the test piece should not exceed (150° C / 300° F)

Sound Velocity of Materials

For a list of the most common sound velocities, please visit our website.

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 fails to power down

Ensure the probe is clean and free of couplant. The Gage will not turn off if coupled symbol is displayed on LCD.

Probe continues to measure after lifted from surface

Excess couplant on probe tip. Wipe away any excess couplant.

Measurement jumps as probe is lifted from surface

Occasionally, excess couplant will remain on the probe when the probe is lifted from the surface. This may cause the ***PosiTector UTG*** to display a final measurement value different from those observed when the probe was on the surface. Discard this value and repeat the measurement.

Gage does not measure when placed on surface

Ensure adequate couplant is applied to the surface.

Gage displays erratic readings

Ensure probe is properly plugged in.

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. 13)

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 E797

Measurement Range:*	0.040 to 5.000 in.	1.00 to 125.00 mm
Resolution:	0.001 in.	0.01 mm
Accuracy:	± 0.001 in.	± 0.03 mm
Velocity Range:	0.0992 to 0.393 in/us	1250 to 10,000 m/s
Measurement Rate:		
Normal	6 readings / second	
Scan	20 readings / second	

Operating Range: Gage: 0 to 50° C (+32° to +120° F)
Probe: -20° to 55° C (-4° to +131° F) continuous
Material Surface Temp -40° to +150° C (-40° to +300° F)

*Measurement range is for carbon steel and depends upon surface condition, temperature and material.

Physical Specifications:

Body: 147 x 61 x 25mm (5.8" x 2.4" x 1")
Weight: 170g (6oz) without batteries
Battery Life: 80 hours continuous
>100 hours idle

Probe diameter: 12mm (0.5 in)
Probe height: 24mm (1 in)

Warranty

The manufacturer fully warrants its products against defects in workmanship or materials for a period of two years 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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