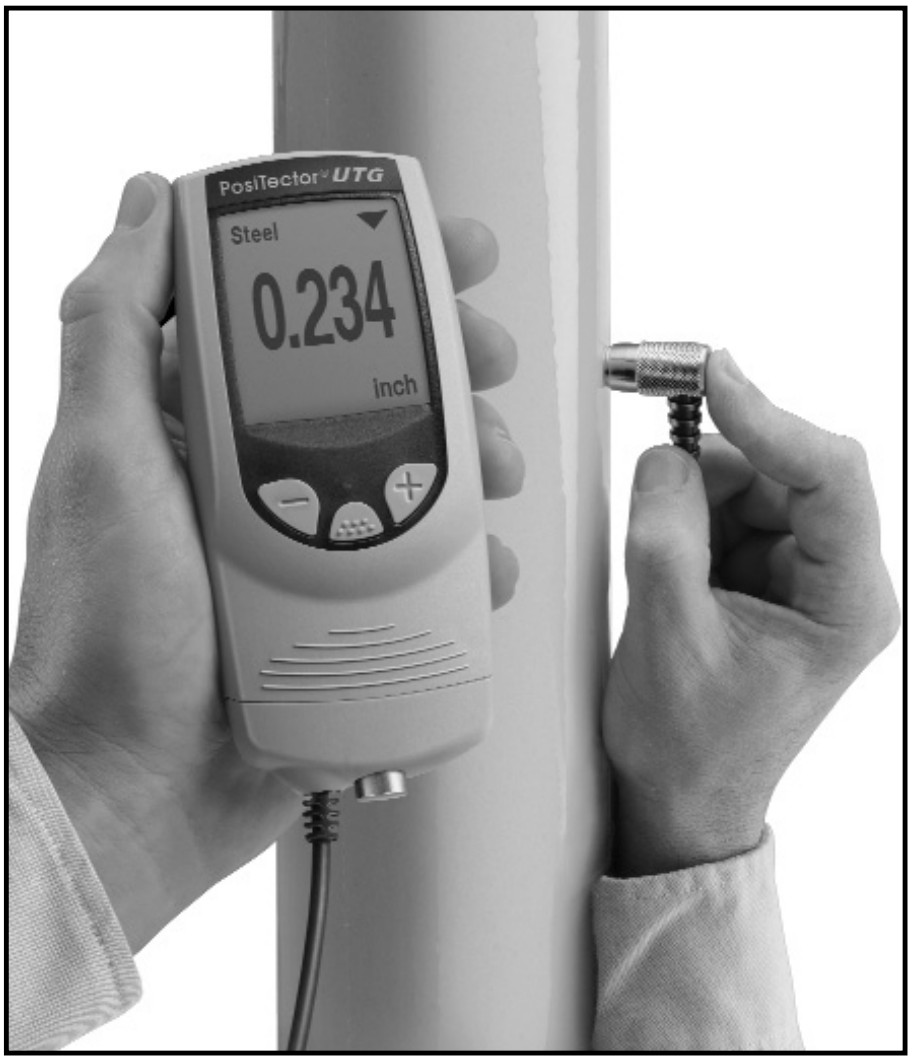
PosiTector UTG

Ultrasonic Thickness Gage

INSTRUCTION MANUAL v. **2.2**
for **UTG ME** models



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Simple. Durable. Accurate.

Introduction

The ***PosiTector UTG ME*** 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. The default and most common setting for the **PosiTector *UTG*** is multiple-echo (ME) mode. In **ME** mode the Gage measures the metal thickness of a painted structure, disregarding the paint thickness. The user can switch the gage to single-echo mode by selecting **SE Mode** from the Gage menu (see pg.15).

The probe (a single element contact transducer) transmits an ultrasonic pulse into the material to be measured. This pulse travels through the material towards the other side. When it encounters an interface such as air (back wall) or another material, the pulse is echoed back to the probe. The time required for the pulse to propogate through the material is measured by the Gage, represented as $\mathbf{t_1}$ and $\mathbf{t_2}$ below.

In single-echo mode ↘↗ (see Figure 1) the Gage determines thickness by measuring $\mathbf{t_1}$ (uncoated) or $\mathbf{t_2}$ (coated), dividing it by two and then multiplying by the velocity of sound for that material (steel).

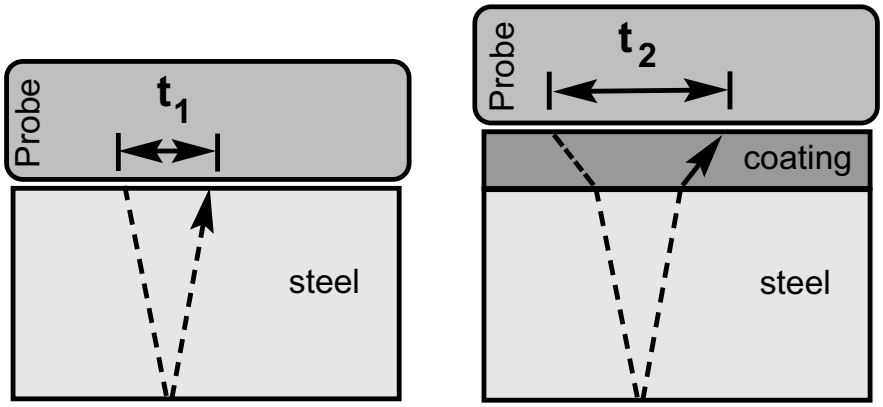


Figure 1 $\mathbf{t_2 > t_1}$

For uncoated materials $\mathbf{t_1}$ relates directly to material thickness. When a material is coated the propagation time is increased and is shown above as $\mathbf{t_2}$.

Coatings such as paint have a slower velocity of

sound than that of metal. Thus the single-echo technique will produce a thickness result greater than the actual combined coating+metal thickness.

In multiple-echo mode ↘↗↘ the Gage determines thickness by measuring the time between at least three consecutive back wall echoes.

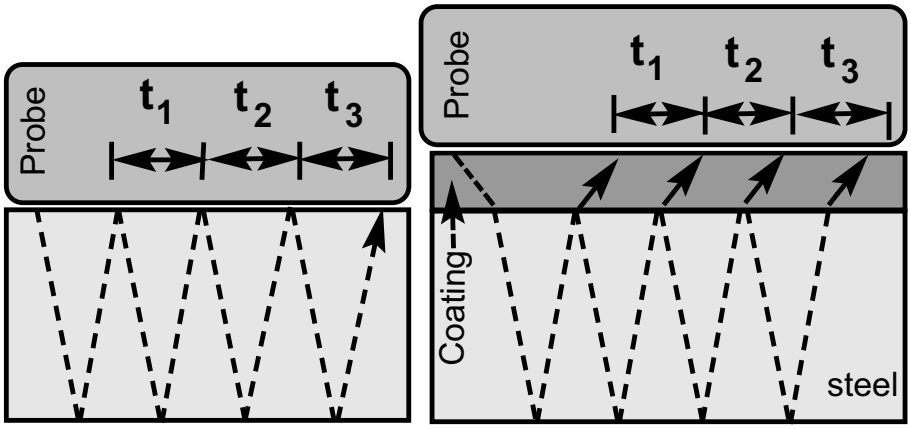


Figure 2

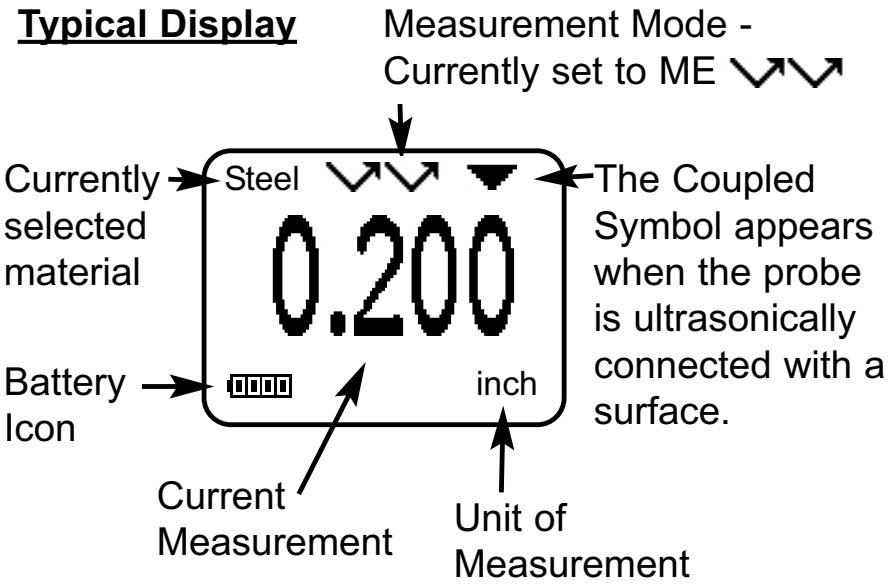
In the figure above, multiple-echo mode measures only the time between echoes. Regardless of whether the steel is coated or not, all times between echoes are the same. In multiple-echo mode the Gage determines thickness by measuring $\mathbf{t_1+t_2+t_3}$, dividing it by six and then multiplying by the velocity of sound for that material. The resultant thickness calculation made by the instrument is therefore an accurate measurement of the steel thickness only, disregarding the coating thickness.

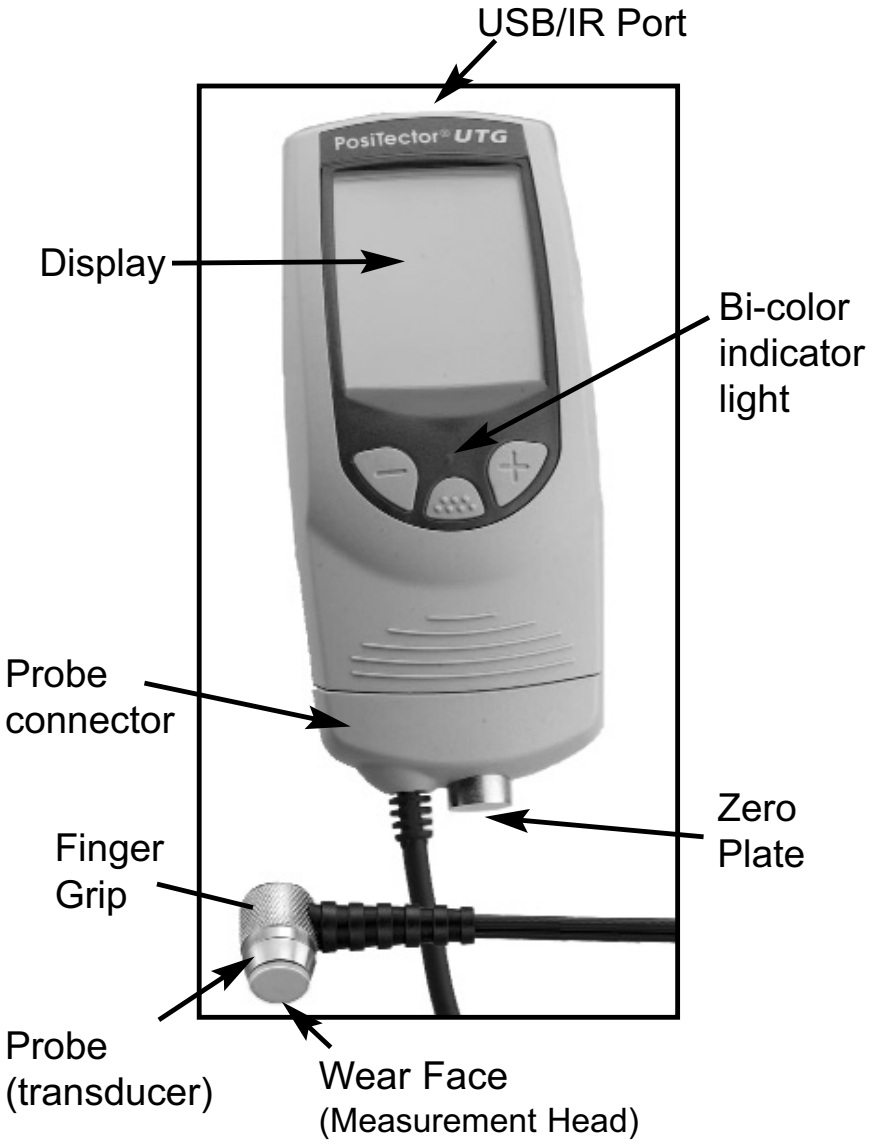
The velocity of sound is expressed in inches per microsecond or meters per second. It is different for all materials. For example, sound travels through steel faster (~0.233 in/µs) than it travels through plastic (~0.086 in/µs).

Operation Overview

1. Turn the Gage ON (see *Power-Up* - pg. 5)
2. Verify accuracy (see *Verification* - pg. 9)
3. Select the correct velocity of sound (see pg. 10)
4. Measure the part (see *How to Measure* - pg. 5)

Typical Display





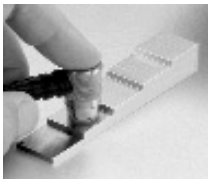
NOTE: Throughout this manual, the Ⓦ symbol indicates more information about the particular topic or feature is available on our website.

Go to: www.defelsko.com/manuals

Power-up / Power-down

The ***PosiTector UTG*** powers-up when any button is pressed. To preserve battery life, the Gage powers-down after approximately 3 minutes of no activity. All settings are retained.

How to Measure



1. Remove black rubber cap from probe if supplied. Couplant (glycol gel - included) must be applied to the surface to be tested to eliminate air gaps between the wear face and the surface. A single drop of couplant is sufficient when taking a spot measurement.

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 3 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.

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.

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 the transducer from wear, particularly when dragging the probe across a surface.

ME Mode Note: On smooth, uncoated metal surfaces the Gage (in ME mode) may occasionally be unable to give a measurement result even when the "coupled" symbol appears. Use additional couplant and lighter pressure on the probe when measuring. Alternatively, laying a plastic shim on the surface with couplant applied to both sides to simulate a painted surface will help produce a steel-only thickness measurement (multiple-echo mode). Switching the Gage to **SE mode** (see pg.15) will also help produce a steel-only thickness measurement.

Zero Menu Option

Zero

The **PosiTector *UTG*** probe can be "zeroed" to compensate for temperature and wear. This action is not required when operating in ME (multiple-echo) mode except when the Gage is new and after a **Reset** (pg. 16). However it ensures best accuracy when operating in SE (single-echo) mode. Therefore it is a good idea to "zero" the probe before each work shift and when the temperature of the part changes. During zeroing, it does not matter what the current velocity setting is.

Important: ***DO NOT*** place probe on the Zero plate until Step 4.

1. Make sure the Gage is on and the probe is wiped clean.
2. Apply a single drop of couplant ***onto the zero plate*** located on the underside of the Gage. ***DO NOT*** apply couplant directly onto the probe face.
3. Select the **Zero** menu option (LCD will display image shown in *Figure A). **Hold the probe in the air*** and press the button to select **OK** to continue.
4. When the image shown in *Figure B* is displayed, press and hold the probe against the zero plate.
5. When the Gage beeps and the image shown in *Figure C* appears, remove the probe from the zero plate.

   The Gage will display 0.00.

Figure A

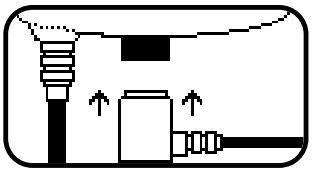


Figure B

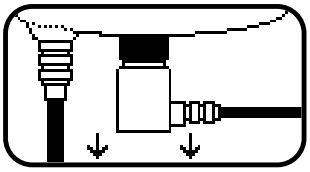
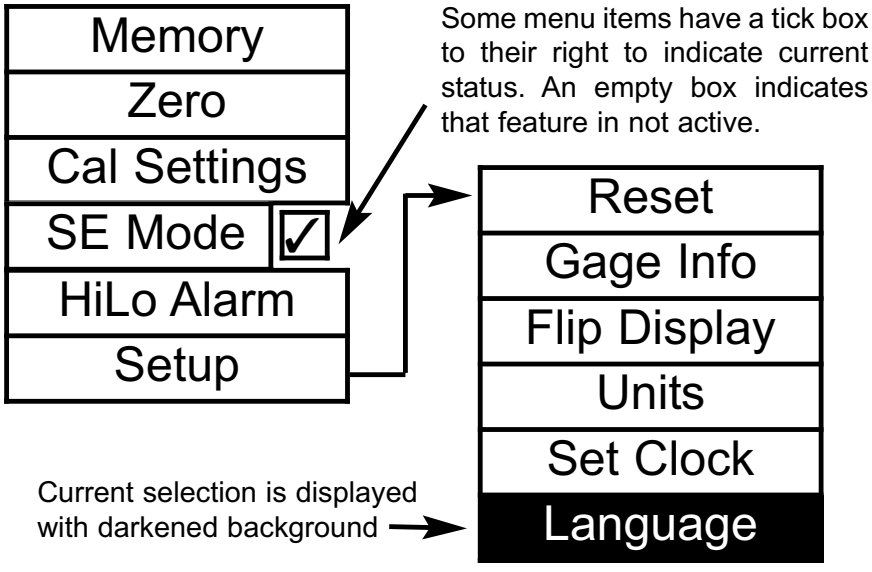


Figure C

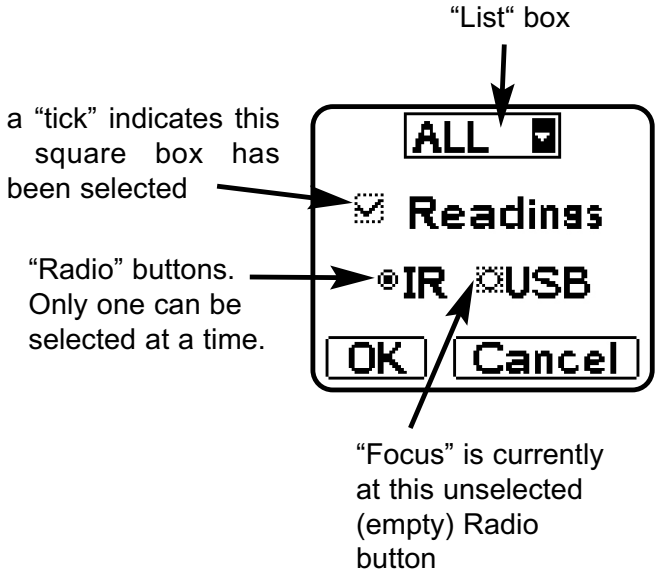
Menu Operation

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



To navigate, press **(-)** to scroll **DOWN**, **(+)** to scroll **UP** and to **SELECT**. Press both **(-)(+)** buttons at any time to exit any menu or select **Exit** from the Menu.

List boxes have a down arrow on the right-hand side. Use the **(-)** and **(+)** buttons until your desired choice appears, then press to select this choice and move focus onto the next item.



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 or 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. Ⓦ

Certification: All ***PosiTector UTG*** instruments ship with a Certificate of Calibration. For organizations with re-certification requirements, gages may be returned at regular intervals for calibration. DeFelsko recommends that customers establish 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

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 available for this purpose. But while they are valuable for verifying gage accuracy to tight, traceable tolerances, they may not represent the actual material to be measured.

Therefore a reference standard can also be a small piece of the material to be measured. If the actual material is not available, material of the same composition (sound velocity) can be used. Thickness can be determined with alternate means such as a

micrometer. If the Gage does not measure the sample within the combined tolerances of the Gage and the micrometer, the Gage can be adjusted (see below). For best accuracy this process should be repeated if the temperature of the part changes substantially.

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.

Adjustment

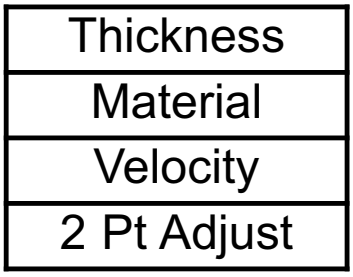
Adjustment, or *Calibration Adjustment* is the act of aligning the Gage's thickness readings to match that of a known reference sample.

Cal Settings

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.



Thickness

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 Settings** ➔ **Thickness** menu option.
4. Adjust the display down **(-)** or up **(+)** to the reference standard thickness.
5. Press ⏠ 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 Settings** ➔ **Material** menu option.
2. Scroll 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 desired velocity is reached, press  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 
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  to store the adjustment and exit.

Memory Management

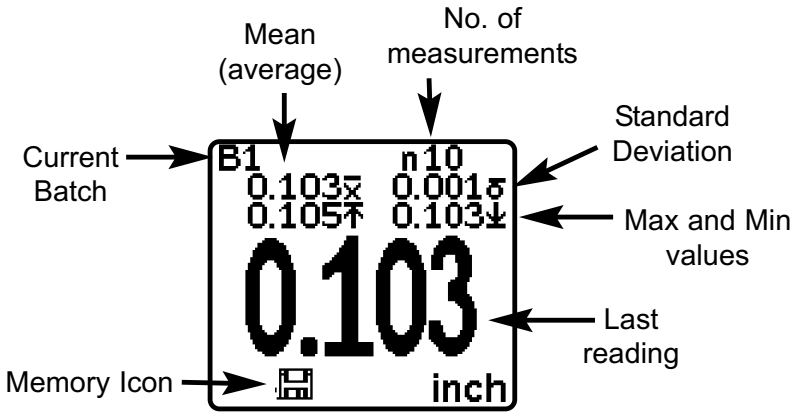
Memory

The ***PosiTector UTG*** can record 10,000 measurements in up to 1000 groups (batches) for on-screen statistical purposes, printing to an optional IR printer, or for downloading to a personal computer (optional ***PosiSoft*** software and USB cable required).

New Batch

Closes current batch and creates a new batch name using the next higher number. For example, if only **Batch 1** and **Batch 3** exist, then **Batch 4** would be created and made the current batch. The icon appears and statistics are displayed and each measurement will now be simultaneously shown on the display and stored into this new batch. On screen statistics are immediately updated with each measurement. New batch names are date stamped at the time they are created.

Shortcut: When a batch is open, create a new batch by pressing **(+)**



Open

Selects a previously created batch name to open and make current. If it contains measurements, on-screen statistics will immediately reflect values calculated from this batch.

Close

Stops the recording process, closes the current batch, and removes the statistics from the display.

Delete

Removes a batch completely from memory. The name is deleted and all measurements are erased.

View

Lists all readings on the display from the current or most recently used batch. It begins by showing the last 10 measurement values. Scroll using the **(-)** or **(+)** buttons. Hold for 1 second to scroll a page at a time.

To delete a value, scroll to that value (align the "+" symbol beside it) then either take another measurement to change it, or press  to delete it or exit. Statistics are updated.

Print

Prints all stored measurements to the optional IR printer or to a PC's default Windows printer via the optional USB cable and PosiSoft software. Press **(-)(+)** simultaneously to cancel printing.

NOTE: Remove the last reading from the current open batch by pressing **(-)**.

Downloading Measurements Stored in Memory

Measurements stored in the Gage's memory (in batches) can be downloaded to a computer using optional PosiSoft software and USB cable. Measurements are not erased from memory after downloading.

PosiSoft® allows entry of notes and annotations, prints histograms and basic charts, manages data, and readings can be exported to a document or spreadsheet. 

Single Echo Mode

SE Mode ☑

The default and most common setting for the **PosiTector *UTG*** is multiple-echo mode ↘↗↘↗

The user can switch the gage to single-echo ↘↗ mode by selecting **SE Mode** from the Gage menu

- To detect pits and flaws
- To increase the measurement range
- To obtain thickness measurements in circumstances where multiple-echo can not

Shortcut: Press **(-)** to quickly toggle between ME and SE measurement modes.

Hi Lo Limits (Alarm)

HiLo Alarm

This mode allows the Gage to visibly and audibly alert the user when measurements exceed user-specified limits.

When **HiLo Alarm** is first selected, the current Lo setting is displayed. Adjust down **(-)** or up **(+)**. Alternatively, measure a material with a thickness close to the required value and make final adjustments with the buttons. Select  to accept this value. The current **Hi** setting is now displayed.

Follow the same procedure to adjust this setting. The  icon will appear on the display.

All measurements will now be compared to your defined limits. The Gage LED blinks green if results are within those limits or red if readings are outside set limits. A single low tone will display if it is below the **Lo** limit, and a HIGH tone if it is above the **Hi** limit.

Setup Menu

Setup

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”.

The following occurs:

- all batches are closed and stored measurements are erased.
- calibration adjustments are cleared and returned to the Gage’s factory calibration settings.
- menu setting are returned to the following:
  Memory = OFF **HiLo Alarm** = OFF **SE Mode** = OFF

A more thorough **Reset** can be performed by holding the **(+)** button when the Gage is powered down until the Reset symbol appears. It performs the same function as a menu Reset with addition of **Units** = inch, and **Language** = English.

NOTE: Date and Time are not affected by any **Reset**.

Units

This menu button converts the display and all stored readings from inch to mm or vice versa.

Set Clock

All batches are *date*-stamped when created, and all measurements are *time*-stamped (24 hour format) when stored into these batches. It is therefore important to keep both the date and time current using this menu button. Alternatively, the date and time can be automatically updated when the gage is connected to ***PosiSoft*** using the **Gage Utilities -> Set Clock** function in ***PosiSoft.***

Application Notes

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)

Troubleshooting

Some common reports received by our Service Department along with possible causes. Most conditions however can be cleared with a **Reset** (pg. 16).

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

Wipe away any excess couplant on probe tip.

Gage is coupled, but not measuring

See *Surface Conditions*, pg. 6.

Gage readings appear to be double the expected thickness

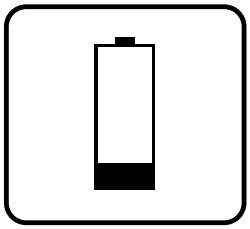
This sometimes occurs near the minimum measuring range of the instrument (0.100" or 2.5mm). The first return echo is unmeasurable, so the gage measures the second return echo. The resultant calculation is double the actual thickness.

Gage displays -.-- (dashed lines) when measuring on an smooth uncoated surface in ME mode
See *ME Mode* Note, pg. 6

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.

Changing The Batteries

The battery icon displays four bars with fresh alkaline batteries installed. As the batteries weaken, the number of bars will be reduced. When the batteries become very weak the Power Warning image will display and the Gage will automatically power-down. To maintain user settings and stored measurements, the batteries must be replaced. USE ONLY "AAA" ALKALINE BATTERIES


Power Warning

This image appears if the memory of the gage has become corrupt. This can occur in the event that the gage batteries were removed while the instrument was powered-on and the gage was not able to self power-down. If this message appears it will be followed by a full reset. All readings in memory will be erased and gage settings will be reset to "out-of-the-box" settings.

NOTES: To retain all user settings and stored memory readings, only replace the batteries after the Gage has automatically powered-down.

-Nickel-cadmium and nickel-metal hydride rechargeable batteries will work but the Gage may appear to have weak batteries.

Returning for Service

Before returning the Gage for service…

1. Install new Alkaline batteries in the proper alignment as shown within battery compartment.
2. Examine the probe tip for dirt or damage.
3. Perform a **Reset** (pg.16) and a **Zero** (pg.6)

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 or email address.

Website: www.defelsko.com/support

Technical Data

Conforms to: ASTM E797

Measurement Range* Single-Echo Multiple-Echo	 0.100" to 5.000" 0.100" to 2.500"	 2.50 to 125 mm 2.50 to 60 mm
Resolution	0.001 in.	0.01 mm
Accuracy	± 0.001 in.	± 0.03 mm
Velocity Range	0.0492 to 0.393 in/µs	1250 to 10,000 m/s
Measurement Rate	3 readings/second	

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

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)

Gage body dimensions:
146 x 64 x 31 mm (5.75" x 2.5" x 1.2")

Battery Life: 80 hours continuous (>100 hours idle)

Available Options

A variety of accessories are available to help you get the most from your **PosiTector UTG** ultrasonic thickness gage. (W)

Limited Warranty, Sole Remedy and Limited Liability

DeFelsko's sole warranty, remedy, and liability are the express limited warranty, remedy, and limited liability that are set forth on its website:

www.defelsko.com/terms

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