Ultrasonic Thickness Gauge and Meter | D1140772 • D1141137

User Manual
Deelat’s Ultrasonic Thickness Gauge is a handheld measurement device that measures the thickness of most common industrial materials. In order to measure the thickness, it uses a microprocessor to emit a sound pulse and measure the amount of time it takes for the pulse to return a probe to the device.

It is commonly used in operations where the thickness of a container or pipe might decrease due to usage with certain media or when under pressure. The thickness must then be measured to ensure safety of operation.

It is also used in manufacturing processes where these containers or pipes are being built to ensure the correct thickness has been achieved.

### 1.1. Scope of application

Deelat’s Ultrasonic Thickness Gauges are suitable for measuring materials that conduct ultrasonic waves such as metal, plastic, ceramic, glass and also as long as the measured part is presented in two parallel surfaces to measure the thickness.

These devices (D1140772 and D1141137) are not suitable for measuring the thickness of cast iron.

### 1.2. Package Contents

1.2.1 > Standard packing:

1 x Ultrasonic Thickness Gauge (Device)
1 x Transducer (10mm 5MHz)
Coupling Agent: 1 Pc (50ml)
4mm Calibration Piece
Ultrasonic Thickness Gauge and Meter | D1140772 • D1141137

1.2.2 > Parts description:

- Receiving Socket
- Transmitting Socket
- LCD Screen
- Casing
- Keypad
- Transducer
- Calibration Piece
- Battery compartment (rear case)

1.2.3 > LCD diagram

- Low battery indicator
- Coupling indicator m/s
- Sound velocity unit
- Thickness unit
- Sound velocity indicator
- Thickness indicator
- Store / recall indicator
- Stored unit indicator
- Calibration indicator

1.3. Specification

- Display: 4-digital LCD display
- Minimum display unit: 0.1 mm
- Working frequency: 5MHz
- Measuring Range: 1.2 – 220.0mm (steel)
- Minimum limit for tube measuring: Ø20*3mm (steel) Accuracy: +/- (1%H+0.1)mm H denotes the measured thickness.
- Sound velocity range: 1000 to 9999 m/s Measuring sound velocity with a given thickness: measuring range:1000 to 9999 m/s.
  - When the given thickness is over 20mm, the accuracy is +/-1%; when the given thickness is less than 20mm, the accuracy is +/-5%.
- Operation temperature: 0°C to 40°C
- Power supply: 3*1.5V AAA alkaline batteries
- Operation current: Normal operation current ≤50mA
  - With Backlight turned on, the current is ≤120mA
  - Stand-by current: ≤20μA
- Size: 72*146*29mm
- Weight: 202g
1.4. Features

- Auto calibration to ensure accuracy
- Auto linear compensation: Deelat’s advanced software program enhances the precision by correcting the non-linear accuracy of the transducer.
- Use ▼ and ▲ keys to make quick adjustments to the sound velocity/thickness. They are also used for quick recall of recent stored data (measurements)
- Coupling status indication: Watch for the coupling icon to confirm if the coupling has been successful.
- 10 thickness measurement storage and recall functions are available, so that you can take multiple readings when measuring multiple items.
- Sound velocity measurement: With a given thickness by a sample hardware to measure the sound velocity, which avoid the further conversion or consultation of the table.
- 12 different sound velocity settings allowing for measurement of different materials.
- Low battery indicator
- Auto power off mode: This will save you battery life.
- Deelat’s Ultrasonic Thickness Gauge has stored memory that retains all recent settings even when the unit is powered off.

2. Conditions for Proper Operation

2.1. Conditions for curved surfaces

When the material that you are measuring has a curved surface like piping, the curvature radius must be more than or equal to 10 mm, and the wall thickness must be more than or equal to 3 mm. This requirement is most applicable to steel, as the data generated for other materials will not be exact.

2.2. Texture Condition:

This gauge can have varying results based on the texture of the material being measured. For example, if you are measuring pipe that contains rust or other non-smooth surfaces it can affect the measurement reading. You can minimize errors by using a 2.5MHz transducer.

2.3. Working Temperature Condition:

Material thickness readings and sound velocity readings can/will change when there are changes in temperature.

The transducer is made of propylene, in order to avoid damage to the transducer and maintain the precision of the readings we recommend that the surface temperature of the material being measured should not exceed 60°C otherwise you may incur damage to the transducer.

Operation temperature: 0~40°C
Relative humidity: <90%RH Hardware/workpiece/material temperature: <60°C
Avoid using on materials that have heavy vibration / corrosive material. Avoid impact and humidity.
3. Operating Instructions

3.1. Before Measuring

1> Connect the transducer with the Ultrasonic Thickness Gauge unit, and press \( \leftarrow \) to turn on the device. The LCD will display the full screen for 0.5 second with the back light present, followed by the \( \rightarrow \) icon which will continue scanning for 2 cycles. After completing the startup procedure, the LCD display will set up the last applied sound velocity setting, indicating the gauge is ready for use.

2> Press \( \text{VEL} \) to enter your sound velocity adjustment, and press \( \downarrow \) or \( \uparrow \) to select your desired velocity (There are 12 velocity settings stored in this unit). If you need to customize the sound velocity, during the adjustment press \( \text{VEL} \) again to enter velocity revision, while pressing \( \downarrow \) or \( \uparrow \) to revise the velocity. \( \text{VEL} \) and m/s icon will continue blinking until set. Press \( \text{VEL} \) to confirm to save the revised velocity, and the unit will go back to normal status (\( \text{VEL} \) and m/s icon will no longer blink).

3.2. Calibration

A calibration should be made whenever the batteries or transducer has been replaced. This calibration is important to ensuring precise measurement. If necessary, this step should completed when the accuracy of measurement is critical. Prior to calibration, apply coupling agent on the standard calibration piece supplied, and couple the transducer to the calibration piece. Press \( \text{CAL} \) to enter calibration mode and the vertical bar will keep scanning with \( \text{CAL VEL} \), m/s display, until the LCD display 4.0mm indicating the calibration is completed. After calibration, sound velocity will return to your selected value, and be ready to measure.

3.3. Measuring Thickness

Apply the coupling agent on the material to be measured to couple the transducer with the material and the LCD display will display the thickness reading.

Notes: \( \rightarrow \) icon on the screen indicates proper coupling. If the icon flashes or does not display you have not achieved proper coupling. After removing the transducer, the reading will be held and can be stored.

3.4. Sound Velocity Measurement

Get a measurement of sound velocity for a specific known thickness of the material you are measuring. Obtains the thickness of material by using a vernier caliper / micrometer. Then couple the transducer with that sample material until a reading displays on the LCD. Remove the transducer and press \( \downarrow \) or \( \uparrow \) to adjust the reading to match the thickness by caliper/micrometer, and then press \( \text{VEL} \) to display the sound velocity and save it in current sound velocity memory storage.

3.5. Data storage

1> Press and hold \( \text{STORE} \) for 2 second to enter the data store mode,. The LCD will display \( \text{THICKNESS} \) in mm and an \( M \) icon as the first memory unit. If the first memory unit is not being registered, the LCD will display 0.0.

2> Press \( \downarrow \) or \( \uparrow \) to select your desired memory unit (1-10).

3> After selecting the memory unit of choice, the new measurement will be replace the existing memory unit after you have taken your new measurement.
3.6. Review Saved Data
In normal status, press and hold STORE for 2 seconds. You will enter into review data mode. Now you can press ▼ or ▲ and it will display the saved data orderly. Press STORE to exit the review mode and back to normal status.

3.7. Low Battery Indication
When icon \(_{\text{□}}\) flashes, replace the batteries for in order to continue using the device.

3.8. LCD back light & Automatic power off
Before turning on the Ultrasonic Thickness Gauge, press and hold CAL, and press button to turn on the back-light mode., the back light will be activated for every operation and will turn on and remain on for 7 seconds. This unit will be turn off automatically in 2 minutes when not in use.

4. Measurement Tips

4.1. Clean the Surface
Prior to measuring, remove all the dust, dirt, rusting and grease if possible from the material that is to be measured.

4.2. Reduce uneven surfaces
Measuring uneven and irregular surfaces will result in errors. Try to smooth out the surface if possible by milling or polishing or using a coupling agent that has higher viscosity.

4.3. Rough surfaces resulting from Machining
Texture that is created during the machining process of a material can also cause reading errors. Adjust the angle of attack between the transducer and the uneven surface might provide more accurate readings. There is a metal center piece on the tip of the transducer. This tip can be angled so that the center metal line is crossing your uneven portion.

4.4. Measuring Pipe and Tubing
When measuring cylindrical parts to determine the thickness of the pipe wall, it will be important to maintain proper orientation of the transducer. If the diameter of the pipe is larger than approximately 4 inches, measurements should be made with the transducer oriented so that the center metal line on the tip is perpendicular (at right angle) to long axis of the pipe. For smaller pipe diameters, two measurements should be performed, one with the center metal line perpendicular, and another with the center line parallel to the long axis of the pipe.

The smaller of the two displayed values should then be taken as the thickness at that point.

4.5. Odd shaped materials
For measuring materials that are odd shaped or complex shapes refer to point 4.4 above. (Take the smaller of the readings as this will be the most accurate reading.

4.6. Non Parallel Surfaces
To get the accurate results, the surface being measured must have the measuring side parallel to the opposite side. Meaning, if the opposite side is uneven it will be more likely to obtain an incorrect reading.
4.7. Influence of Temperature on the Material being Measured

The size & sound velocity of the material being measured will change as the temperature changes. When the accuracy of your measurement is critical, take 2 measurements from 2 different samples of the material under the same temperature to determine the most accurate reading. When taking measurement for steel parts in high temperature, this method may be adopted to obtain the correct reading.

4.8. Materials that induce acoustic absorption

Attempting to measure materials that are porous or made of fiber or granular in composition will cause acoustic dispersion making it difficult attain accurate readings and not suitable for use with this type of Ultrasonic Thickness gauge.

4.9. Reference Calibration Piece

To calibrate the device, a known thickness or sound velocity of the material is necessary. When calibrating you must use either the sample Calibration piece or a calibration piece of your own that has a known thickness and/or sound velocity. This Ultrasonic Thickness Gauge comes with a 4.0mm calibration piece attached to the front. It can be removed for use, and please refer to the calibration diagram on how to calibrate.

The supplied calibration piece may not be adequate when measuring different materials. The supplied calibration piece is great for measuring steel, however you will require additional calibration pieces that match your application to get the most accurate readings. After calibrating to the calibration piece, the effects of variation of sound velocity will be minimized. To achieve the best accuracy having a set of calibration pieces of varying weights is useful to keep handy depending on your application. However, generally, using one calibration piece will generate an accurate measurement.

The calibration piece should be made of the same material and ideally the same thickness as the parts to be tested. First take a reading of the thickness of the calibration piece using a micrometer. When measuring thin material that has a thickness that is close to the minimum limit range of this unit, please use a calibration piece to define the exact limit of the measured material (1.2mm for steel). Do not measure any material that has a thickness under the minimum limit.

When the material to be measured is a complex alloy in a large size use a calibration piece that has a similar thickness and similar material if possible.

Most metals have different molecular structures depending on the composition, therefore the sound velocity will be slightly different. To achieve an exact reading, the calibration piece should have a similar structure as the measured material if possible.

4.10. Selecting a transducer

You can check the most common sound velocity on the tables provided in this manual and use in the place of taking calibration for calibration piece. However, please note that this is simply a close guide, and occasionally the sound velocity will differ caused by different physical / chemical factors. The sound velocity of mild steel is adopted on the reference table.

This Ultrasonic Thickness Gauge has the function to measure the sound velocity, so the velocity can be obtained prior to measuring the thickness. Once Sound velocity has been measured, you can proceed with measuring the thickness.

4.11. Selecting a transducer

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Characteristic</th>
<th>Range</th>
<th>Operation temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>5MHz ø10mm</td>
<td>General-purpose</td>
<td>1.00mm to 300.0mm(steel)</td>
<td>-10 to 60°C</td>
</tr>
<tr>
<td>5MHz ø6mm</td>
<td>Thin workpiece</td>
<td>1.00mm to 50.0mm(steel)</td>
<td>-10 to 60°C</td>
</tr>
<tr>
<td>2.5MHz ø10mm</td>
<td>General-purpose</td>
<td>1.00mm to 300.0mm(steel)</td>
<td>-10 to 60°C</td>
</tr>
</tbody>
</table>

The transducer might become worn after heavy use and this will affect the measurements. When the following occur, please replace the transducer:
A. The reading remains the same when measuring varying thicknesses.
B. You achieve a reading without taking any measurements.
5. Precautions for Accuracy

5.1. Thin Materials
When using the ultrasonic thickness gauge, if the thickness of the material to be measured is less than the minimum limit your will receive a faulty reading.

Always use a sample testing piece to know the minimum limit of the material being measured.

When measuring thin materials that are beyond the minimal limit, an error might occur where the reading is double the actual thickness. To prevent this from happening ensure you know the minimum limit of the material being measured.

5.2. Rusty Surfaces
Measuring rusty surfaces can result in incorrect reading. The material you are measuring may also have rust on the inside of the pipe which can be hard to spot.

If you suspect that the material you are measuring has rust, make sure to make test measurement from different spots, and angles to ensure you are getting an accurate reading.

5.3. Re-calibrate when measuring different materials
A faulty reading will be obtained when measuring a new material if you have forgotten to re-calibrate the velocity of the new material. Always re-calibrate the velocity when you are measuring a new material.

5.4. Abrasions/Imperfections on the transducer
The transducer is made of propylene, and after long periods of use the surface will become rough, and decline in sensitivity, which can lead to inaccurate readings. Polish the transducer to and remove rough spots and this will allow for accurate readings. If you are still getting inaccurate readings the transducer should be replaced.

5.5. CAL (Calibration) Function
The CAL (calibration) button is used to calibrate the unit with the calibration piece on the panel. You can also use this key to calibrate other materials.

5.6. Multilayer and Composite Materials
Do not use this ultrasonic thickness gauge for measuring uncoupled multilayer objects as the wave will not pass through. It also cannot be used for composite material since the wave will not travel through the object at an even speed, the ultrasonic reflection principle will not be performed properly.

5.7. Oxidized Surfaces
Some metals such as aluminum will have an oxide layer, which will prevent the metal from oxidizing further. This can sometimes lead to an inaccurate reading. The more oxidized the layer, the reading will be more tolerant and produce a more accurate result. Please be aware of this when measuring and then

Make sure to calibrate using a calibration piece that is the same material as what you are trying to measure. You will also want to use a caliper/micrometer to obtain the actual thickness and input this as you calibrate.

5.8. Abnormal readings
If you use an ultrasonic thickness gauges regularly you should be able to distinguish an abnormal reading resulting from corrosion to the surface of objects or incorrect calibration. If you are new to using this device, you will need to review the procedures in this manual to fix/avoid abnormal readings.

5.9. Selecting a coupling agent
The coupling agent will transmit the ultrasonic wave between the transducer and the gauge. Selecting the wrong coupling agent for the job will lead to inaccurate readings. Typically a single drop of coupling agent will be sufficient.

It is important to use a low viscosity agent (this kit comes with low viscosity coupling agent) for smooth surfaces, while a high viscosity agent (such as Glycerin) should be used on rough/vertical/aluminum surfaces.
6. Maintenance

6.1. Replace the Battery
A. When you see the low battery icon appear, replace the batteries
   1. Turn off the gauge
   2. Open the access panel
   3. Replace the batteries
B. When the gauge is not being used for extended periods, remove the batteries.

6.2. Prevent scratches and wear on the transducer
Since the transducer is made of propylene, it can be scratched easily. Be gentle when using on rough surfaces and do not place it on materials that exceed 60°C, otherwise it may damage the transducer. Dust and oils that adhere to the transducer can cause a shorter life, so be sure to clean the lead after each use.

6.3. Cleaning the device
Do not use solvents or alcohol to clean the LCD screen or casing. Only use a moist cloth.

6.4. Cleaning the calibration piece
Clean after each use as coupling agents can cause rust and corrosion.

6.5. Avoid impact to the gauge. Keep it stored in the carry case when possible.

7. Table of sound velocity

<table>
<thead>
<tr>
<th>Material</th>
<th>Velocity (m/s)</th>
<th>Material</th>
<th>Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>6320</td>
<td>Acetate resin</td>
<td>2670</td>
</tr>
<tr>
<td>Zinc</td>
<td>4170</td>
<td>Phosphor bronze</td>
<td>3530</td>
</tr>
<tr>
<td>Silver</td>
<td>3600</td>
<td>Turpentine</td>
<td>4430</td>
</tr>
<tr>
<td>Gold</td>
<td>3240</td>
<td>Glass</td>
<td>5440</td>
</tr>
<tr>
<td>Tin</td>
<td>3230</td>
<td>Incoloy alloy</td>
<td>5720</td>
</tr>
<tr>
<td>Iron/Steel</td>
<td>5900</td>
<td>Magnesium</td>
<td>6310</td>
</tr>
<tr>
<td>Brass</td>
<td>4640</td>
<td>Monel alloy</td>
<td>6020</td>
</tr>
<tr>
<td>Copper</td>
<td>4700</td>
<td>Nickle</td>
<td>5630</td>
</tr>
<tr>
<td>SUS</td>
<td>5790</td>
<td>Steel 4330 mild</td>
<td>5850</td>
</tr>
<tr>
<td>Acrylic resin</td>
<td>2730</td>
<td>Steel 330</td>
<td>5660</td>
</tr>
<tr>
<td>Water 20°C</td>
<td>1480</td>
<td>Titanium</td>
<td>6070</td>
</tr>
<tr>
<td>Glycerin</td>
<td>1920</td>
<td>Zirconium</td>
<td>4650</td>
</tr>
<tr>
<td>Soluble glass</td>
<td>2350</td>
<td>Nylon</td>
<td>2620</td>
</tr>
</tbody>
</table>