

**TQC ULTRASONIC THICKNESS GAUGE BASIC**

LD7015 Manual LD7016: page 6-13

MANUAL

**1 PRODUCT DESCRIPTION**

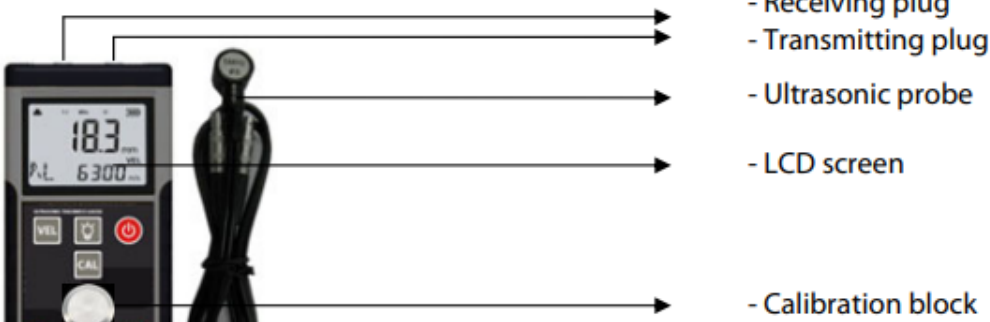
Ultrasonic thickness gauge specifically designed to measure the thickness of metallic and non-metallic materials e.g. aluminium, titanium, plastics, ceramics, glass and plastics. It can also be used to monitor all types of pipes and pressure vessels for loss of thickness due to corrosion or erosion. The gauge is easy to use and will give accurate readings to an accuracy of 1%. This unit is not suitable for cast iron due to its big crystalloid composition.



**1.1 Specifications**

Measuring method:	Ultrasonic pulse echo
Measuring frequency:	5MHz
Measuring range:	1.20 - 220 mm (steel); (deviation possible with use of other materials)
Measuring range (tubes):	20x3mm (steel)
Nauwkeurigheid:	+/- (1%H + 0.1) mm
Display:	LCD
Resolution:	0.1mm
Operation temperature:	0 °C ~ 40 °C
Batteries:	3x AAA alkaline batteries (total 5V)
Size:	70x135x38mm

**1.2 Details**



- ON/OFF key
- Calibration key
- Sound velocity select key
- Backlight activation key

- Battery indicator
- Coupling indicator
- m/s - Sound velocity unit
- mm - Thickness unit
- VEL - Sound velocity indicator
- Backlight indicator
- Material indicator



## 2 WHAT'S IN THE BOX?

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Ultrasonic thickness gauge basic  
Ultrasonic gel 60ml  
Transducer 10mm - 5.0MHz  
Calibration block

## 3 OPERATION INSTRUCTIONS

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- Operation area condition: This gauge can measure all samples which are equal to or bigger than the transducers surface area.
- Curved surface condition: When materials have a curved surfaces like a boiler wall or tubing, the curvature radius must be equal to or more than 10mm and the wall thickness must be equal to or more than 3mm.
- Roughness condition: This gauge is applicable for a wide range of materials. In most cases the supplied transducer makes very accurate readings. However if the roughness is too big due to rust etc. an error may occur. In this case please try to minimise the roughness or select the 2.5MHz transducer. If the transducer is worn-out, please contact your local distributor for a replacement transducer
- Working temperature condition: Material and sound velocity will change along with temperature. In normal measurement conditions environment temperature impact can be ignored. The transducer is made of propylene material. Considering the protection of the transducer and its precision we recommend a surface temperature of the work piece should not be over 60°C otherwise the transducer could be damaged.
- Operation temperature: 0 - 40°C
- Relative humidity: <90% RH
- Hardware / Work piece/ Material temperature: < 60°C
- Do not apply on vibrating or erosive material
- Avoid impact and moisture

## 4 PREPARATIONS

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### 1. Switching on the instrument

Connect the probe with the main unit, press ON/OFF to turn on the instrument. All display signs will light up for 0.5 sec on the LCD screen. Then it will show a value of 0.0mm and 5900 VEL and after that the last registered sound velocity with selected memory unit. The instrument is now ready for use.



Start screen

### 2. Material selection

To select a material please press the VEL button several times to your needed material sign appears as per below schedule:

Code	Material	Sound Velocity (VEL)
FS	Iron/Steel	5900
AL	Aluminium	6320
CP	Copper	4700
bR	Brass	4430
Zn	Zinc	4170
TIN	Tin	3320
Pb	Lead (Pb)	2400
GL	Glass / Stainless Steel	5800
PVC	Polyvinylchloride	2390
PMM	Acrylic	2730

### 3. Calibration

If necessary this step should be repeated; Press the “ZERO” key for 2 seconds, after a short time “CAL” will appear on the display, this indicates the unit is in calibration mode. Put a small amount of coupling gel on the sample block and then place the probe on the sample block. When the display shows 4.0mm the calibration is completed. After calibration the sound velocity will remain the same as previous selected. A calibration should be made the every time the probe or batteries are replaced. This is very important to make sure measurements will be accurate.




Calibration status

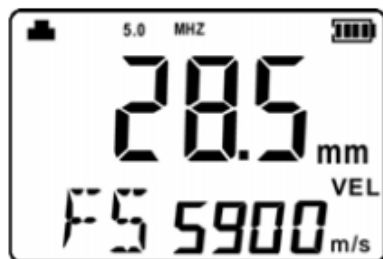


Calibration accomplished

## 5 PERFORM A MEASUREMENT

### 5.1 Thickness measurement

Put some coupling gel on the material surface, press the ultrasonic probe on the material surface to measure. Please make sure there is good coupling, which will be indicated with this symbol  appearing on the display. If this symbol does not appear or flashes it means there is not a good coupling. The reading on the display is the measured value. After removing the probe, the reading will be held.




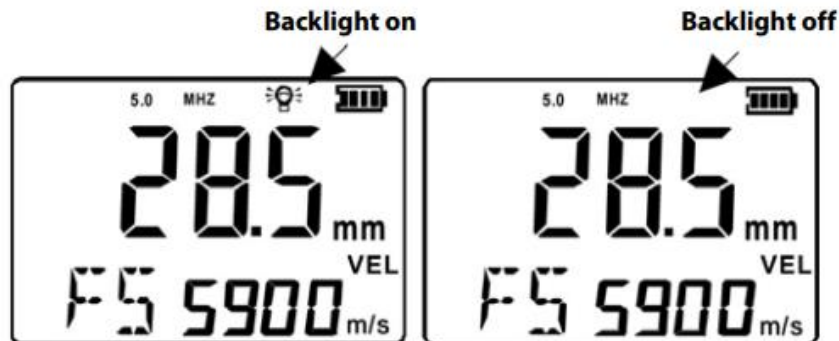
Correct coupling



Measurement completed

### 5.2 LCD backlight

By pressing this button  you will activate the LCD backlight. With each operation the light will switch on for about 7 seconds. When switching off the gauge the light will also automatically switch off.



### 5.3 Automatic power shut down

If the instrument is not operated for over 2 minutes it will automatically switch off.

## 6 CALIBRATIONS


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We recommend annual calibration. For calibration, send the instrument, together with a RMA form\* to TQC, Molenbaan 19, 2908 LL Capelle aan den IJssel, NL.

\*You can download the RMA form here: <http://www.tqc.eu/en/service/repairs-calibrations/>

## 6 REPLACING BATTERIES

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When the icon  flashes, please replace the batteries before taking any new measurements. Turn the instrument off by pressing the ON/OFF button. Open the battery lid and replace them with 3 pcs of AAA alkaline batteries.

## 7 MAINTENANCE

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- Though robust in design, this instrument is precision-machined. Never drop it or knock it over
- Always clean the instrument after use.
- Clean the instrument using a soft dry cloth. Never clean the instrument by any mechanical means such as a wire brush or abrasive paper. This may cause, just like the use of aggressive cleaning agents, permanent damage.
- Do not use compressed air to clean the instrument.
- Always keep the instrument in its case when not in use.
- We recommend annual calibration

## 8 DISCLAIMER

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The right of technical modifications is reserved.



The information given in this manual is not intended to be exhaustive and any person using the product for any purpose other than that specifically recommended in this manual without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at his own risk. Whilst we endeavour to ensure that all advice we give about the product (whether in this manual or otherwise) is correct we have no control over either the quality or condition of the product or the many factors affecting the use and application of the product. Therefore, unless we specifically agree in writing to do so, we do not accept any liability whatsoever or howsoever arising for the performance of the product or for any loss or damage (other than death or personal injury resulting from our negligence) arising out of the use of the product. The information contained in this manual is liable to modification from time to time in the light of experience and our policy of continuous product development.

**TQC ULTRASONIC THICKNESS GAUGE PRO**  
LD7016

MANUAL

**1 PRODUCT DESCRIPTION**



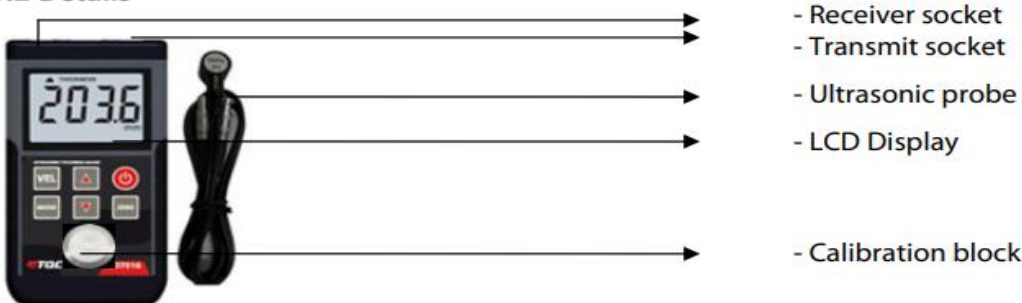
Ultrasonic thickness gauge specifically designed to measure the thickness of metallic and non-metallic materials e.g. aluminium, titanium, plastics, ceramics, glass and plastics. It can also be used to monitor all types of pipes and pressure vessels for loss of thickness due to corrosion or erosion. The gauge is easy to use and, after a simple calibration to a known thickness or sound velocity, the gauge will give accurate readings to an accuracy of 1%. This unit is not suitable for cast iron due to its big crystalloid composition.

**1.1 Specifications**

Measuring method:	Ultrasonic pulse echo
Measuring frequency:	5MHz / 2.5MHz
Measuring range:	1.20 - 220 mm (steel); Actual range varies with the type of material
Accuracy:	measured +/- (1%H + 0.1) mm, H denotes the measured thickness
Sound velocity:	1000 - 9999 m/s.
Display:	LCD
Resolution:	0.1mm
Working temperature	0 °C ~ 40 °C
Power Supply:	3x AAA alkaline batteries (total 5V)
Size:	70x135x38mm

Measuring sound velocity with a given thickness: Measuring range: 1000 to 9999 m/s. When the given thickness is over 20mm, the accuracy is +/-5%; when the given thickness is less than 20mm, the accuracy is +/- 1 mm/H\*100%

**1.2 Details**



- |                                 |                                      |
|---------------------------------|--------------------------------------|
| - Battery indicator             | - ON/OFF button                      |
| - Coupling indicator            | - Calibration button                 |
| m/s - Sound velocity unit       | - Sound velocity button              |
| mm - Thickness unit             | - Measurement function select button |
| VEL - Sound velocity indicator  | - Sound velocity adjust              |
| THICKNESS - Thickness indicator | - Backlight                          |
| M - Store/recall data           |                                      |
| 1 10 - Stored unit indicator    |                                      |
| - Calibration indicator         |                                      |



## 2 WHAT'S IN THE BOX?

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Ultrasonic wall thickness gauge  
Coupling gel 60ml  
Probe 10mm - 2.5MHz  
Probe 10mm - 5.0MHz  
Calibration plate

## 3 OPERATION INSTRUCTIONS

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- Operation area condition: This gauge can measure all samples which are equal to or bigger than the probes surface area.
- Curved surface condition: When materials have a curved surfaces like a boiler wall or tubing, the curvature radius must be equal to or more than 10mm and the wall thickness must be equal to or more than 3mm.
- Roughness condition: This gauge is applicable for a wide range of materials. In most cases the supplied probe makes very accurate readings. However if the roughness is too big due to rust etc. an error may occur. In this case please try to minimise the roughness or select the 2.5MHz probe. If the probe is worn-out, please contact your local distributor for a replacement probe.
- Working temperature condition: Material and sound velocity will change along with temperature. In normal measurement conditions environment temperature impact can be ignored. The probe is made of

propylene material. Considering the protection of the probe and its precision we recommend a surface temperature of the work piece should not be over 60°C otherwise the probe could be damaged.

- Operation temperature: 0 - 40°C
- Relative humidity: <90% RH
- Hardware / Work piece/ Material temperature: < 60°C
- Do not apply on heavily vibrating / erosive material
- Avoid impact and moisture

## 4 PREPARATIONS

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### 1. Turning on your instrument

Connect the probe with the main unit, press ON/OFF to turn on the instrument. The display shows a full screen for 0.5 sec with backlight, then a vertical bar is displayed twice circularly, meanwhile the main display area shows 0000 to 9999 progressively. After that the LCD displays the last applied sound velocity with registered memory.



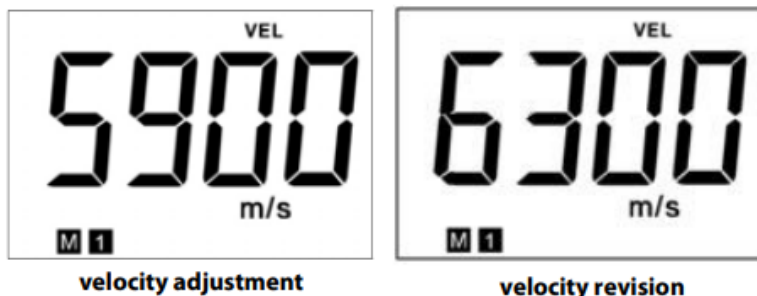
Full screen



Last applied sound velocity & unit no.

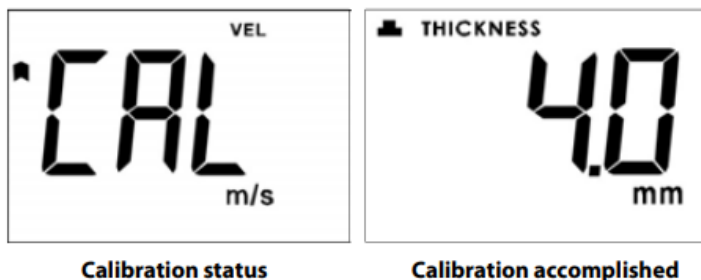
## 2. Sound velocity selection and adjustment.

Press "VEL" key to enter the sound velocity interface, press again, you can now select the velocity data by pressing ▲ or ▼ the word "VEL" will be blinking on the display. If you need to adjust the sound velocity, press the "VEL" key once more, the "VEL" and "m/s" will keep blinking. Then increase or decrease the sound velocity to the number you want by pressing ▲ or ▼ again. The data will be automatically stored into the current sound velocity memory unit. After this, press to confirm new sound velocity and the icons will stop blinking.




## 3. Calibration.

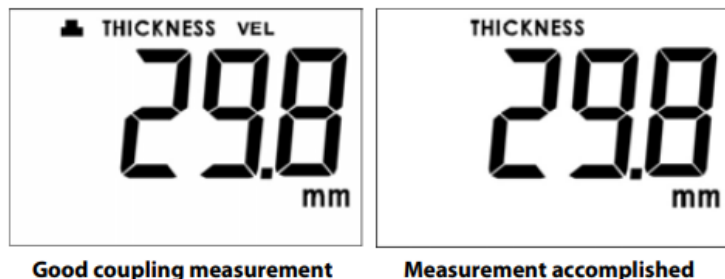
If necessary this step should be repeated; Press the "ZERO" key for 2 seconds, after a short time "CAL" will appear on the display, this indicates the unit is in calibration mode. Put a small amount of coupling gel on the sample block and then place the probe on the sample block. When the display shows 4.0mm the calibration is completed. After calibration the sound velocity will remain the same as previous selected. A calibration should be made the each time the probe or batteries are replaced. This is very important to make sure measurements will be accurate.



## 5 PERFORM A MEASUREMENT

### 5.1 Thickness measurement

Put some coupling gel on the material surface, press the ultrasonic probe on the material surface to measure. Please make sure there is good coupling, which will be indicated with this symbol  appearing on the display. If this symbol does not appear or flashes it means there is not a good coupling. The reading on the display is the measured value. After removing the probe, the reading will be held.



## 5.2 Sound velocity measurement

To get a read out of sound velocity of the material with a known thickness: Obtain the thickness of the material by using a micrometer or calliper, then put the probe on the material until a value appears on the display. Remove the probe and press ▲ or ▼ to adjust the value to match the same thickness as measured with the micrometer/calliper. Then press VEL to display the sound velocity and save the current velocity in the memory unit.



Thickness measurement

Adjusting the thickness

Velocity read out

## 5.3 Data storage

Press "MODE" key to enter the data save mode. The display will show the "Thickness and mm" icons with the first memory unit (M 1) If the first memory unit wasn't registered, the display will show 0. 0.

Press ▲ or ▼ to select your desired memory unit(1-10) and press "MODE" again to store.

After selecting your memory unit you can start measuring again. While measuring, the memory unit will flash and the new measurement will delete the stored value. When your measurement is completed the last reading will be held again in the selected memory unit automatically. Afterwards the memory unit no. will stop blinking.


## 5.4 Review the saved data

Press "MODE", then memory unit no. and stored data will be displayed. You can review the saved data in unit 1-10 by pressing ▲ or ▼, they are read only. By pressing "MODE" again you will return to the measuring mode.



Review saved data

## 5.5 Low battery indication

When the following icon  flashes, please replace the batteries before taking any new measurements.

## 5.6 LCD backlight and automatic power shut-down

Hold the "ZERO" button pressed for a second and then also simultaneously press the ON/OFF button. This way

the backlight will be activated. Every operation the backlight will turn on for 7sec. until the gauge is switched off again. If the gauge is not operated for over 2 minutes, it will automatically switch off and the backlight function will be cancelled.

## 5.7 Measurement tips

### 1. Cleaning the surfaces

Before making a measurement please make sure dust, dirt rust and grease are removed from the surface.

### 2. Decreasing the surface roughness

Too rough surfaces may result in measuring faults or error readings. Please try to smooth the surface by milling, polishing, filling or a use a high viscosity coupling gel.

### 3. Rough machined surfaces

The regular tiny texture/slots resulting from rough machining processes may cause errors. Please follow the method as mentioned at paragraph 3 Operating Instructions "Roughness condition". Adjusting the angle between the crosstalk segregating board of the probe (a metal membrane crossing the detector bottom centre) and linear texture slots (parallel or vertical) may also get better results.

### 4. Measuring cylindrical surfaces

When measuring cylindrical surfaces like pipes, oil tubes etc. it is critical to select an angle between the crosstalk segregating board of the probe and axis of the material to be measured. In simple terms; couple the probe and material, keep the crosstalk segregating board of the probe right-angled to the axis of the pipe to be measured. For small pipes two measurements should be performed, one with the axis of the pipe perpendicular, the other one parallel. The smallest of the 2 values displayed, should then be taken as the thickness at that point.

### 5. Complex shaped materials

For complex shaped material measurements please check paragraph 4.7.3., the smallest of the two readings should in this case be used as the thickness.

### 6. Non-parallel surfaces

To get a satisfying ultrasonic response, the surface must have got one measuring side parallel to another side, otherwise the results will be faulty.

### 7. Material surface temperature influences

The size and sound velocity of material will change at different temperatures. When precision is critical please make 2 different measurements under the same temperature conditions to determine the correct thickness reading. When making steel measurements with high temperatures, this method may be used also to get a correct reading.

### 8. High acoustic reduction materials

For materials such as fiber, poriferous or big granular, acoustic dispersion will cause energy attenuation which may result in abnormal readings (the reading is less than the actual thickness) In this case, the material is not suitable for the gauge.

### 9. Reference sample block

Calibrating the gauge, a given thickness or sound velocity of the material is very important. Calibration needs at least one standard reference sample block. This gauge is provided with a 4.0mm sample block on the front of the casing. Please check the calibration procedure.

With different materials and situations, only one sample block may not be enough to get the most exact calibration. The more similar sample blocks, the more exact readings will be obtained. Ideally reference blocks are a group of different thicknesses of the same material. When calibration the gauge with different blocks, the variation of sound velocity will be minimised. To get a most exact measurement, a set of reference blocks is very important.

In most situations using only one reference block will result in a proper measurement. This reference block must be the same material and thickness as the parts to be tested. The thickness of the reference block should be read out in micrometers.

When measuring thin materials of which the thickness is close to the minimum limit range of the gauge, please use a reference block to define the exact limit of the material (1.2mm for steel material) Do not measure material from which the thickness is under the minimum limit.

When material consist of a complex alloy in a large size, a block which has a similar material thickness, should be used for calibration.

Forged or casted hardware mostly have different inner structures which results in slightly different sound velocities. To reach the exact reading, the reference block most have a similar structure as the hardware. With common measurements you have to check the sound velocity table stated in this manual instead of calibrating the gauge with a reference block. However this table is just for reference, sometimes the sound velocity will be different caused by different physical/chemical factors. The sound velocity of mild steel is mentioned in the reference table.

## 5.8 Accuracy precautions

### 1. Thin material

When the thickness of the material is less than the minimum limit, any ultrasonic thickness gauge will give faulty measurements. Use the sample block comparing method to get a minimum limit of a material. When measuring thin material, an error may occur (the thickness reading is two times the actual thickness) To prevent wrong readings with thin material, double check the minimum limit of the material.

### 2. Stained/rusted material:

Stained or rusted surfaces on the contra side will result usually in wrong readings. Sometimes a small stained spot is hard to find. Be careful while measuring known rust spots/suspicious areas or use sound insulation board-celotex to locate the spots in different test angles.

### 3. How to determine velocity of various materials

A faulty reading will be obtained, when measuring the material with a velocity calibrated with a previous material. So a correct velocity should be obtained. The faulty reading may also result from the difference between the actual velocity of the calibrated value.

### 4. Wearing of the probe

Because the probe is made of propylene, long term use will cause the surface to roughen, this will result eventually in wrong readings. Please polish the surface with sand paper or whetstone to assure the smoothness. If the readings are still unsteady, the probe should be replaced by a new one.

#### 5. Multilayer-composite material

It is impossible to read out the thickness of uncoupled multilayer's as the ultrasonic wave cannot go through into the uncoupled space. Furthermore, the sonic wave cannot go through in to the composite material at an even speed. So ultrasonic reflect principles cannot be applied for measuring multilayer's and composite material.

#### 6. Influences from oxidized materials

For some metals such as aluminium, a layer of oxide can be generated on the surface. Although the oxidised layer combines with the substrate tightly, the sonic wave does need to travel through 2 different materials so it will lead to incorrect readings. With a thicker oxidised layer, more deviation will occur. Please calibrate the instrument with a reference block of the same material as the sample. Obtain the thickness of the sample block by using a micrometer/calliper.

#### 7. Any abnormal readings

An operator should be capable to distinguish any abnormal readings as a result of erosive, recess surface, incorrect calibration sample blocks or the inner flaw of materials.

#### 8. Coupling gel

Coupling gel causes the high frequency ultrasonic waves transmitting between the probe and material. Choosing incorrect coupling or wrong operation may cause errors or pour coupling which results in failure to measure. The coupling gel should be used in a proper way, normally, a small drop of gel is sufficient. It is important to use proper coupling gel, low viscosity gel (as supplied) is suitable for smooth surfaces. For rough, vertical, aluminium surfaces, high viscosity liquids like glycerine and lubrication grease is applicable. These kinds of agents are normally available in the local market but you can buy them also from a local distributor.

#### Sound Velocity table:

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

## 6 CALIBRATIONS

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We recommend annual calibration. For calibration, send the instrument, together with a RMA form\* to TQC, Molenbaan 19, 2908 LL Capelle aan den IJssel, NL.

\*You can download the RMA form here: <http://www.tqc.eu/en/service/repairs-calibrations/>

## 7 REPLACING BATTERIES

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When the batteries are low the battery icon will appear on the display. Turn the instrument of by pressing the ON/OFF button. Open the battery lid and replace them with 3 pcs of AAA alkaline batteries.

## 8 MAINTENANCE

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- Though robust in design, this instrument is precision-machined. Never drop it or knock it over
- Always clean the instrument after use.
- Clean the instrument using a soft dry cloth. Never clean the instrument by any mechanical means such as a wire brush or abrasive paper. This may cause, just like the use of aggressive cleaning agents, permanent damage.
- Do not use compressed air to clean the instrument.
- Always keep the instrument in its case when not in use.
- We recommend annual calibration

## 9 DISCLAIMER

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