

Manual

Material Ultrasonic Tester PCE-TG1XX



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1 Introduction

Thank you for purchasing a PCE-TG1XX from PCE Instruments.

This instrument is very easy to use and can measure the material thickness of metals, glass and homogeneous plastics within seconds. For accurate measurement of wall thicknesses, the device uses ultrasonic technology. Different materials need different ultrasonic velocities. The PCE-TG1XX has been adjusted for five different sound velocities and for various materials at the factory. The sound velocity is freely adjustable and can thus be adapted to different materials. The ultrasonic probe is equipped with a measuring head which is fitted into a black spring washer. The round sections allow measurement on even, uneven or round material surfaces. For determining the material thickness in narrow sections, you can unscrew the adaptor head for a short period of time, so that only the sensor head itself is applied (diameter = 10 mm). The device is calibrated when supplied to you.

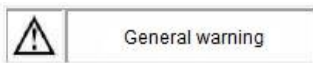
Delivery content:

- 1 x material thickness gauge
- 1 x test head with 1 m cable
- 2 x batteries
- 1 x coupling gel
- 1 x carrying strap
- 1 x carrying case
- 1 x instruction manual



2 Safety notes

2.1 Warning symbols



2.2 Safety precautions

Please read this manual carefully and completely before you use the device for the first time. The device may only be used by qualified personnel and repaired by PCE Instruments personnel. There is no warranty of damage or injuries caused by non-observance of the manual.

- The device may only be used as outlined in this manual. If used in any other way, this may cause dangerous situations.
- Do not expose this meter to extreme temperatures, direct sunlight, extreme air humidity or moisture.
- Never use this appliance with wet hands. The device may only be used if the operating conditions (temperature, relative humidity, etc.) are within the ranges stated in the specifications. The limit values for the measuring variables stated in the specifications must under no circumstances be exceeded.
- The meter must not be used within explosive atmospheres.
- Check the device before each use by measuring a known factor.
- The case should only be opened by qualified personnel of PCE Instruments.
- The instrument should never be placed with the user interface facing an object (e.g. keyboard side on a table).
- You must not make any technical changes to the device.
- Before each use, please check the case for damage. If there is visible damage, the meter must not be used.
- The device may only be used with PCE accessories or equivalent.
- The appliance should only be cleaned with a damp cloth / use only pH-neutral cleaner, no abrasives or solvents.

This manual is published by PCE Instruments without any guarantee.

We expressly point to our general guarantee terms which can be found in our general terms of business.

If you have any questions please contact PCE Instruments.

3 Specifications

Measurement range TG 100 TG 110 TG 120	0.8 ... 225 mm 2.5 mm ... 200 mm 1 ... 30 mm
Possible materials	ferrous and non-ferrous materials, steel, plastic, glass, gold and other homogeneous materials (without air pockets)
Frequency	standard 5 MHz
Resolution	0.1 mm
Accuracy	±0.1 mm
Calibration	3.0 steel calibration block integrated
Range sound velocity	500 ... 9999 m/s (freely adjustable, depending on the material to be tested)
Resolution sound velocity	1 m/s
Display	4-digit LCD
Surface temperature for probe TG 100 TG 110 TG 120	-10 ... +50 °C -10 ... +400 °C -10 ... +50 °C
Shape of measuring head	straight
Battery level indication	insufficient voltage is indicated
Power supply	2 x 1.5 V AA batteries
Battery life	250 h
Automatic Power Off	after approx. 3 minutes of inactivity
Operating conditions	0 ... 40 °C, 20 ... 90 % RH
Dimensions	127 x 67 x 30 mm (H x W x D)
Weight	approx. 240 g (incl. batteries)

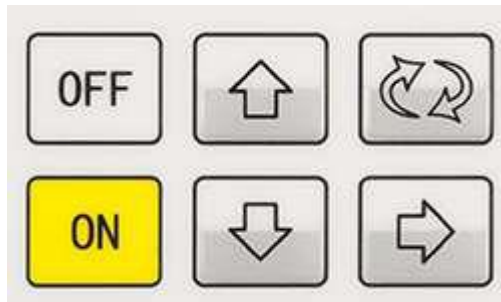
4 System description

4.1 Device



- 1 Probe head
- 2 Probe connections
- 3 Display
- 4 Keypad
- 5 Calibration block

4.2 Keys



- ON: switch on device
- OFF: switch off device
- Arrow keys up / down / right: select decimal place and set sound velocity
- Shift key: switch between normal measurement mode, calibration mode and sound velocity selection

4.3 LC display



THK (thickness): material thickness measurement

VEL (velocity): sound velocity adjustment in m/s

CAL: calibration

5 Instructions

5.1 Calibration

Press the shift key several times until CAL 0.0 is indicated in the LCD. Apply some coupling gel to the round steel block and press the test head firmly against the steel block (3 mm thick). The device is calibrated when 3.0 mm is displayed. The device will then automatically switch to thickness measuring mode (THK). If you would like to replace the battery or connect another test head, please repeat the calibration.



5.2 How to set the sound velocity

Press the shift key several times until VEL appears in the display along with the set sound velocity (e. g. 900 m/s). The first digit will flash, which means that it is ready for adjustment. You can increase or decrease the value by pressing the arrow keys (up or down). You can select the next decimal place by means of the arrow key to the right. You can find the sound velocity values in the chart in chapter 5.5. After entering the desired sound velocity, press the shift key again. A number like 024.0 mm will appear in the display, whereas the first digit will flash. Press the shift key again. The device is now set and will switch to normal measuring mode (THK) again.



5.3 Measurement

If the device has been adjusted for a certain material and a test head, it is very easy to use it for the same application again at any time as all settings remain saved in the device.

1. Switch on the device.
2. Put the test head with little coupling gel on the sample to be measured.
3. The device will display the wall thickness.

You only need very little coupling gel. Depending on the application, you only need to apply coupling gel once for several measurements. You can use any liquids or pastes that do not affect the test head and the object to be measured, such as, for example, water, silicone, machine oil or greases.

5.4 Special probes

Sensor / material	Measurement range	Surface temperature	Frequency	Min. contact	Shape
PCE-TG-ST Standard test head for PCE-TG 100, for measurements of steel, non-ferrous materials, aluminium alloys, ceramics, glass	0.8 ... 225 mm	-10 ... +50 °C	5 MHz	10 mm	straight
PCE-TG-THE High-temperature test head for measurements of steel, non-ferrous metals, aluminium, ceramics, glass, standard test head for PCE-TG 110	2.5 ... 200 mm	-10 ... +400 °C	5 MHz	12 mm	straight
PCE-TG-MT for all materials, for measurements at small edges and thin tubes, standard test head for PCE-TG 120	1 ... 30 mm	0 ... +50 °C	5 MHz	7 mm	rectangular
PCE-TG-HD cast iron test head for measuring materials with high strong damping such as, e. g. cast iron	3 ... 225 mm	-10 ... +50 °C	2.5 MHz	12 mm	rectangular

5.5 Sound velocities for different materials

The following chart lists the sound velocities of some materials. They are to be seen as a reference. The actual sound velocities of these materials can deviate due to material composition, porosity and temperature. Therefore, it is necessary to determine the exact sound velocity by testing a piece of the material in question by means of the meter.

Material	m/s
Aluminium (rolled)	6420
Beryllium	1289
Brass (70 Cu, 30 Zn)	4700
Copper (rolled)	5010
Duraluminium	6320
Iron	5960
Lead (rolled)	1960
Magnesium (drawn)	5770
Molybdenum	6250
Monel	5350
Nickel	6040
Steel (normal)	6100
Steel (slightly alloyed)	5734
Stainless steel	5790
Titanium	5990
Tungsten (drawn)	5410
Uranium	3370
Zinc (rolled)	4210
Zinc (sprayed)	4460
Aluminium	1019
Quartz glass	5968
Pyrex glass	5640
Perspex	2735
Nylon	2620
Polyethylene	1950
Polystyrene	2350
Silicone rubber	0948
Water	1490

6 Further information

6.1 Measurements with contacting test heads

For most materials, the contacting method is the most suitable way to transfer the ultrasound from the test head to the sample. Contacting test heads should be used whenever the requirements of the thickness measurement allow this method of measurement. This method can generally be used when the lowest thickness is at least 0.8 mm for plastics or approx. 1.0 mm for steel. Samples with a temperature above +50 °C require special test heads.

6.2 Adjustment / ISO calibration

The accuracy of the measurement is as high as the accuracy with which the device has been adjusted. The devices are adjusted thoroughly before leaving the factory and must rarely be recalibrated. For your own control, we recommend you to check for correct indication by means of a sample with a known thickness on a regular basis. You can also send the meter to PCE Instruments for ISO laboratory calibration.

6.3 Surface accuracy

The highest accuracy is achieved when the surface to be tested as well as the counterface (back wall) are even. When the surface to be tested is coarse, the lowest thickness that can be measured increases because the sound running time rises with the increasing thickness of the coupling layer. On the other hand, the roughness of the counterface causes strong dispersions of the reflected echo and thus an inaccurate indication of the thickness measurement. Therefore, it is important that the reflection side (back side) of the material to be tested is free from coupling agents, grease, paint or other impurities to ensure maximum accuracy.

6.4 Coupling technique

For contacting measurements, the thickness of the coupling agent layer plays an important part in the measurement. In order to achieve maximum accuracy, you must apply a reproducible coupling technique. This is ensured when a suitable coupling agent with low viscosity is used. Use only little coupling agent, so that a reliable readout is ensured. Press the test head against the sample with medium pressure. Several tries with slight to firm pressure will be necessary to achieve reproducible measurements. Generally, test heads with a smaller diameter need less coupling pressure than test heads with larger diameters.

6.5 Tapering and eccentric surfaces

When the contact surface runs tapering or eccentric to the surface of the back wall, the back wall echo is not reflected precisely as phase rotations occur which affect the accuracy of the measurement. A constant non-parallelism further reduces the measuring accuracy.

6.6 Sound scattering

In some materials, particularly in stainless steel castings, cast iron and other alloys, the sound energy is scattered by the crystalline structure in the cast or by the different material portions in the alloy. This reduces the ability of the device to recognise an evaluable echo coming from the back side of the material and thus limits measurements of these materials by means of ultrasonic technology.

6.7 Sound velocity change

Some types of materials show clear changes in the sound velocity throughout the material. Stainless steel and brass castings show this effect particularly as they have a relatively large grain size and varying grain orientation and because the sound velocity varies with the position of the crystals. Other materials show high fluctuations in the sound velocity with the temperature. This often applies to plastic materials. If you wish to measure these materials, you must consider the temperature to ensure high measuring accuracy.

6.8 Sound attenuation or absorption

In many organic materials such as plastics or rubber, the sound is easily weakened. Therefore, the maximum thickness which can be measured in this material is often limited due to sound attenuation. The attenuation is higher if the frequency is higher and it is lower if the frequency is lower.

7 Maintenance and cleaning

7.1 Maintenance



Warning: To prevent measuring errors and resulting injuries, please replace the batteries as soon as the battery symbol appears.

If the battery voltage is insufficient, a battery symbol is indicated in the display. In this case, replace the two AA batteries immediately to avoid measuring errors and resulting hazards. To replace the batteries, remove the battery compartment cover, remove the used batteries and replace them by two new batteries of the same type. Put the battery compartment cover back on.

7.2 Cleaning

Clean the device with a damp, lint-free cotton cloth and, if necessary, a mild cleaning agent. Do not use any abrasives or solvents.

8 Disposal

For the disposal of batteries, the 2006/66/EC directive of the European Parliament applies. Due to the contained pollutants, batteries must not be disposed of as household waste. They must be given to collection points designed for that purpose.

In order to comply with the EU directive 2012/19/EU we take our devices back. We either re-use them or give them to a recycling company which disposes of the devices in line with law.

If you have any questions, please contact PCE Instruments.

9 Contact

If you have any questions about our range of products or measuring instruments please contact PCE Instruments.

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