



User Manual

PCE-2500N/PCE-2600N Material Tester



User manuals in various languages (français, italiano, español, português, nederlands, türk, polski, русский , 中文) can be found by using our product search on: www.pce-instruments.com

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1 Safety notes

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. Damage or injuries caused by non-observance of the manual are excluded from our liability and not covered by our warranty.

- The device must only be used as described in this instruction manual. If used otherwise, this can cause dangerous situations for the user and damage to the meter.
- The instrument may only be used if the environmental conditions (temperature, relative humidity, ...) are within the ranges stated in the technical specifications. Do not expose the device to extreme temperatures, direct sunlight, extreme humidity or moisture.
- Do not expose the device to shocks or strong vibrations.
- Avoid dust, strong magnetic fields, oil, etc.
- The case should only be opened by qualified PCE Instruments personnel.
- Never use the instrument when your hands are wet.
- You must not make any technical changes to the device.
- The appliance should only be cleaned with a damp cloth. Use only pH-neutral cleaner, no abrasives or solvents.
- The device must only be used with accessories from PCE Instruments or equivalent.
- Before each use, inspect the case for visible damage. If any damage is visible, do not use the device.
- Do not use the instrument in explosive atmospheres.
- The measurement range as stated in the specifications must not be exceeded under any circumstances.
- Non-observance of the safety notes can cause damage to the device and injuries to the user.

We do not assume liability for printing errors or any other mistakes in this manual.

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. The contact details can be found at the end of this manual.

2 Features

- 128*64 OLED display;
- Micro USB storage device can be connected directly;
- Memory for 600 average values and 6 files;
- Limit alarm;
- Auto Power Off when battery is low;
- Easy-to-read display, clear digits
- Rechargeable Li-Ion battery
- Applications: ball bearings and other parts, fault analysis of pressure vessels, steam turbine generators and plants, heavy workpieces, mechanical and permanently installed parts, limited space

3 Delivery contents

- 1 x hardness tester PCE-2500N or PCE-2600N
- 1 x charging cable
- 1 x test block
- 1 x cleaning brush
- 1 x user manual
- 1 x carrying case

4 Measuring principle

The LEEB method of measurement was first used in 1978. It is defined as the quotient of the rebound velocity of an impact body over its impact velocity, multiplied by 1000. The harder a material surface, the higher the rebound velocity will be. The Leeb hardness value represents the direct relation of a group of materials (e. g. steel, aluminium) to its hardness properties.

For the most common metals, conversion charts are available. These enable the user to convert HL hardness values into other standard hardness units (HB, HV, HRC, etc.).

An impact body with a spherical measuring tip made of tungsten carbide is accelerated towards the test surface and then rebounds. The impact and rebound velocities are measured at a distance of 1 mm from the test surface, using the following method: a permanent magnet in the impact body induces an electrical current into the coil when passing through the coil in the coil holder. This electrical current is proportional to the velocities of the magnet. Leeb hardness values can be calculated by using the following formula:

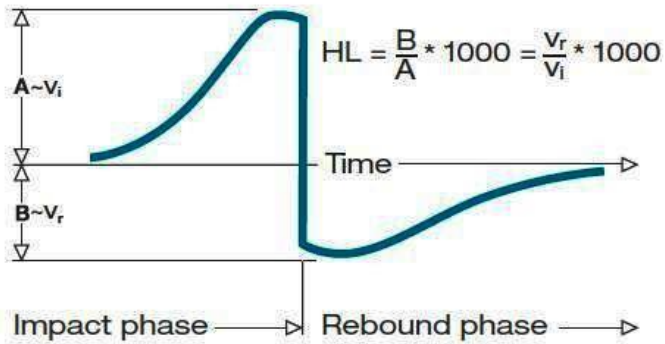
$$HL = 1000 \times (VB / VA)$$

HL : Hardness according to Leeb

VB : Rebound velocity

VA : Impact velocity

The voltage curve of the output signal when the impact body passes through the induction coil is shown in the following figure:



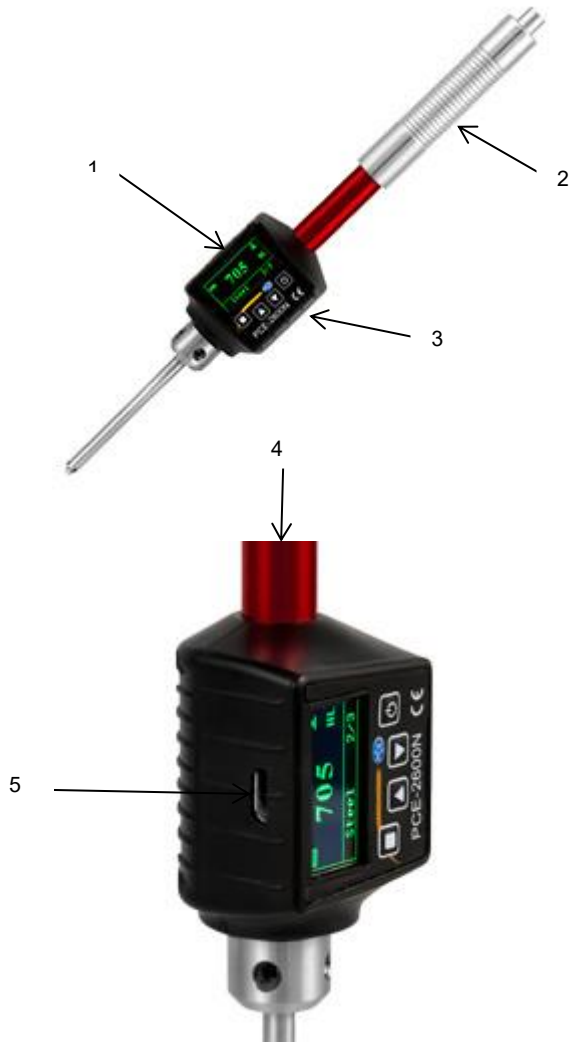
If you measure the hardness of a material with the conventional static test method, the pressure you apply will affect the reading, e. g. 720 HLD \neq 720 HLC. Since different impact devices correlate with different conversion charts when converting Leeb hardness values into other hardness units, the impact device used should be indicated in addition to the converted value.

5 Device description

PCE-2500N



1. Display
2. Keypad
3. Loading tube
4. D-type impact body (within guide tube)
5. Micro USB charging socket
6. Support ring



1. Display
2. Loading tube
3. Keypad
4. DL-type impact body (within guide tube)
5. Micro USB charging socket



Display

After switching on the device, it will show the main screen:



HL: Hardness scale

AVE: Average value



: Impact direction

Difference between PCE-2500N and PCE-2600N

- PCE-2500N has a D probe for even surfaces
- PCE-2600N has a DL probe for uneven, small surfaces



Keys


-On/Off

-Menu/Confirm



-Up

-Down

6 Technical specifications

Hardness scales	HL, HV, HRA, HRC, HRB, HB, HV, HS
Measurement ranges	170 ... 960 HLD 17.9 ... 69.5 HRC 19 ... 683 HB 80 ... 1042 HV 30.6 ... 102.6 HS 59.1 ... 88 HRA 13.5 ... 101.7 HRB
Testable materials	Steel and cast steel, alloyed tool steel, stainless steel, grey cast iron, spheroidal graphite iron, cast aluminium, copper-zinc alloy (brass), copper-tin alloy, copper (bronze)
Accuracy	HLD: $\pm 0.5\%$ (800 HLD)
Repeatability	HLD: 0.8% (800 HLD)
Resolution	128 x 64 OLED display
Operating time	Approx. 10 h
Operating conditions	Temperature: 10 ~ 50 °C Humidity max. 90 °C
Storage conditions	Temperature: -30 ~ 60 °C Humidity max. 90 °C
Power supply	Rechargeable lithium battery
Dimensions	PCE-2500N: 148 x 32 x 25 mm PCE-2600N: 205 x 32 x 25 mm
Weight	PCE-2500N: 64 g PCE-2600N: 80 g

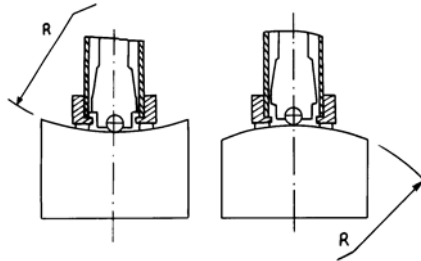
7 Operation

Before using the device, read the information on calibration and about the factors that have an effect on the measuring accuracy.

7.1 Preparation of sample surface

When preparing the sample, it is essential to observe the information given in the charts at the end of this manual.

- When preparing the sample surface, bear in mind that heat, cold, etc. affect the hardness of the surface to be tested.
- An excessively rough test surface can cause measurement errors. Therefore, the test surface should have a metallic gloss and be even and free from grease.
- Surface: The test surface should be as smooth as possible. When the radius of curvature R of the surface is smaller than 20 mm, a small support ring or another ring-shaped fixing aid should be used.



7.2 Stabilisation of the sample

- Heavy samples do not have to be stabilised;
- Medium-sized samples have to be placed on an even and hard surface. Make sure that the sample rests on the surface evenly and does not move.
- Make sure that the sample is thick enough. For minimum thicknesses of a sample, please refer to the charts at the end of this user manual.
- For samples with a hardened surface, find the minimum depths of the hardened layer in the chart at the end of this manual.
- Coupling
 - Lightweight samples must be closely coupled to a solid support. The two coupling surfaces must be even and you must make sure not to use too much coupling gel. The test direction should be vertical to the coupled surface.
 - When the sample is a large plate, bar or bent part, it can deform considerably and become unstable, even if the weight and thickness are as required. This causes incorrect readings. In this case, the test surface of the sample should be reinforced or supported.
- The magnetic field of the sample should not exceed 30 Gauss.

7.3 Prior to first measurement

Before making your first measurement, you should carry out a test measurement, using the test block which is included in the delivery. Make 5 measurements and calculate the average. If the values from the charts at the end of this manual are exceeded, the internal calibration function can be used.

7.4 Power on

Press the On / Off key. The hardness tester will switch on and automatically enter measurement mode.

7.5 Charging

- To lock the impact body, push down the loading tube completely. Do not release the loading tube before you have reached the bottom. Then slowly bring it back to its original position.
- Hold the device between your thumb and index finger and place it onto the sample. While doing so, make sure that the support ring lies firmly on the surface and that the impact direction is vertical to the test surface.

7.6 Measurement

- Before applying the trigger, make sure that the sample stands firmly. Also ensure that the direction of the starting force is in line with the axis of the impact device.
- Make a measurement by slightly pressing the trigger at the top of the device. The reading will be shown in the display.
- Each portion of the sample must be measured 5 times. The results should not be below or above the average value of ± 15 HL.
- The distance between any two points of impact or between the middle of a point of impact and the edge of a sample should fulfil the requirements in the following chart.

Centre to centre distance of the two points of impact	Distance from centre of point of impact to edge of sample
\geq	\geq
3 mm	5 mm

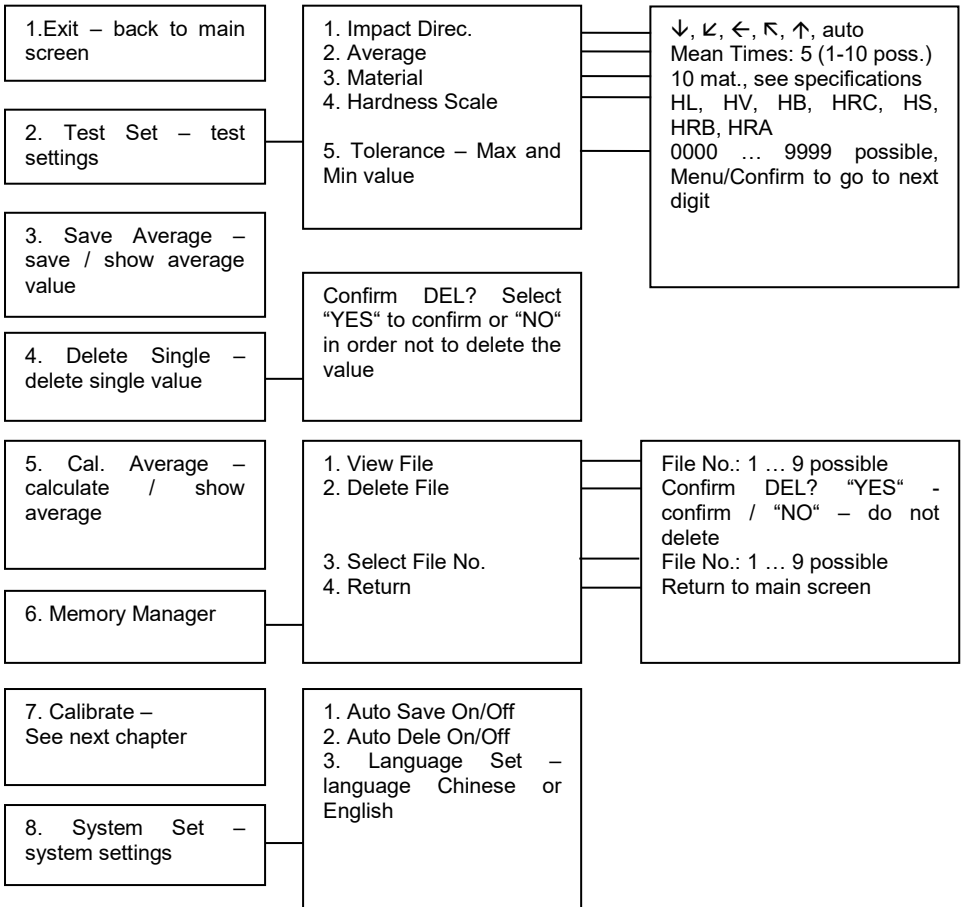
- At the end of the measurement, the results can be seen on the display. The hardness value is the average value of 5 measurements at different measuring points.
- To switch off the device, press the On/Off key.

7.7 Readings displayed

- The hardness value is displayed in a certain hardness unit. If, for instance, a value of 700 is measured with a Leeb impact device and a D-type impact body, the hardness value will be displayed as 700 HLD, HL standing for hardness according to Leeb and D for the D-type impact body.
- When converting the HLD value into a different hardness unit, the test method should be written as part of the unit. 400HV/HLD, for example, stands for a hardness value of 400 HV (hardness according to Vickers), tested by the HLD method (Leeb hardness with D-type impact device).

7.8 Menu structure

Settings and additional functions can be found in the parameter menu. In the main screen, press the Menu key to enter the main menu.



Select the corresponding options to set the parameters. You can make a selection using the arrow keys. Confirm your selection with the Menu/Confirm key.



8 Calibration

Before first use and after not using the hardness tester for a period of time, it must be calibrated by means of the Leeb test block.

Go to calibration mode via menu item 7.

x/5
000
Calibration

Measure 5 measuring points of the Leeb hardness block. The impact direction must be vertically down.

1/5
772 HL
Calibration

After the measurement, the hardness tester will show the average value.

Press the arrow keys to set the average value to the standard value of the test block. (You can set the value up to 15 HL higher or lower). Confirm with the Menu/Confirm key. "Calibration complete" will be displayed.

9 Battery replacement

- Unscrew the cover on the back side of the display unit.
- Remove the battery.
- Insert the new battery. Observe correct polarity.
- Screw the cover back on.
- Switch on the device to find out if it works properly.

10 Additional information

10.1 Specifications of impact device

Type of impact device	D (PCE-2500N), DL (PCE-2600N)
Impact energy	11 mJ
Impact weight	5,5 g
Ball hardness	1600 HV
Ball diameter	3 mm
Ball material	Tungsten carbide
Diameter of impact device	20 mm
Length of impact device	147 mm
Weight of impact device	50 g

10.2 Sample requirements

Max. sample hardness	940 HV
Max. sample roughness Ra	1.6 µm
Min. sample weight	
Measurement without stabilisation	>5 kg
Stabilisation	2 ~ 5 kg
Coupling necessary	0.05 ~ 2 kg
Max. sample thickness	
Measurement without coupling	>5 mm
Coupling necessary	≤5 mm
Min. depth of hardened layer	0.8 mm

10.3 Ball indentation

Hardness 300 HV	Indentation diameter Penetration depth	0.54 mm 24 μ m
Hardness 600 HV	Indentation diameter Penetration depth	0.54 mm 17 μ m
Hardness 800 HV	Indentation diameter Penetration depth	0.35 mm 10 μ m

10.4 Conversion chart

Material	Hardness scale	Value
Steel and cast steel	HRC	17.9~68.5
	HRB	59.6~99.6
	HRA	59.1~85.8
	HB	127~651
	HV	83~976
	HS	32.2~99.5
Steel	HB	143~650
Alloyed tool steel	HRC	20.4~67.1
	HV	80~898
Stainless steel	HRB	46.5~101.7
	HB	85~65 5
	HV	85~802
Grey cast iron	HRC	
	HB	93~334
	HV	
Spheroidal graphite iron	HRC	
	HB	131~387
	HV	
Cast aluminium	HB	19~164
	HRB	23.8~84.6
Brass	HB	40~173
	HRB	13.5~95.3
Bronze	HB	60~290
Copper	HB	45~315



11 Warranty

You can read our warranty terms in our General Business Terms which you can find here: <https://www.pce-instruments.com/english/terms>.

12 Disposal

For the disposal of batteries in the EU, 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.

For countries outside the EU, batteries and devices should be disposed of in accordance with your local waste regulations.

If you have any questions, please contact PCE Instruments.



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