English

User Manual

PCE-2500N/PCE-2600N Durometer

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Last change: 16 May 2018
v1.0

Contents

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.

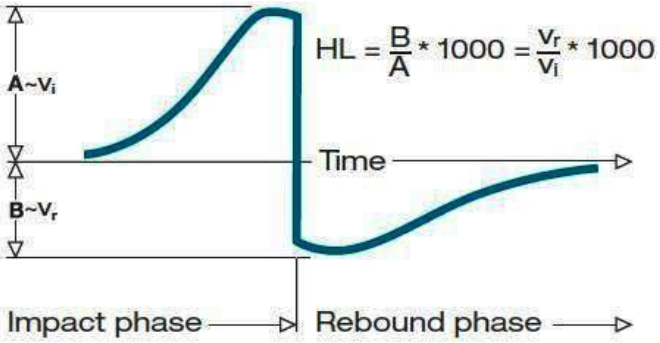
For the most common metals, conversion charts are available. These enable the user to convert HL hardness values into other standard hardness units (HB, HV, HRC, etc.).

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 x (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:



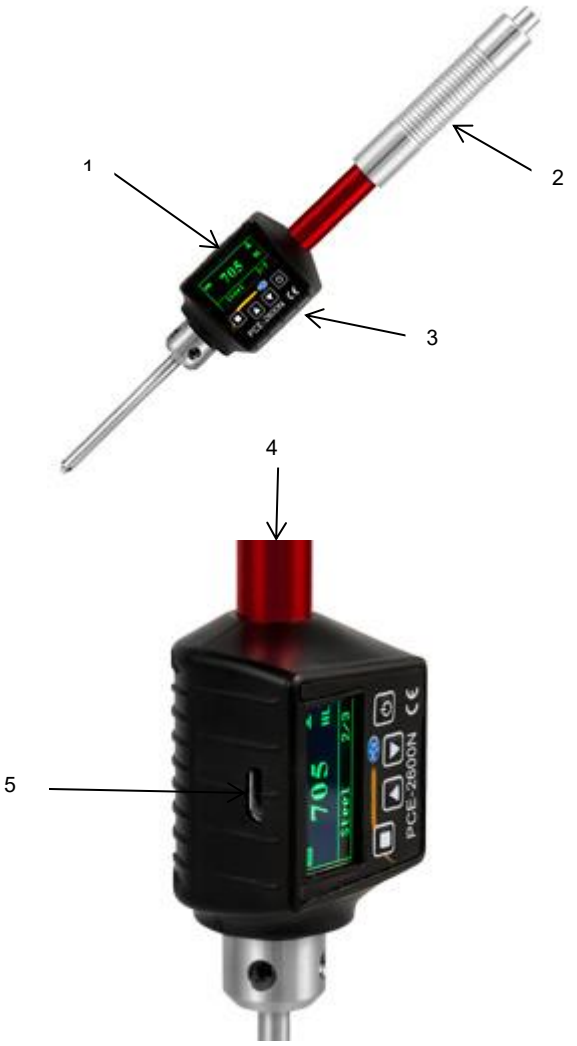
If you measure the hardness of a material with the conventional static test method, the pressure you apply will affect the reading, e. g. 720 HLD ≠ 720 HLC. Since different impact devices correlate with different conversion charts when converting Leeb hardness values into other hardness units, the impact 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

PCE-2600N



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

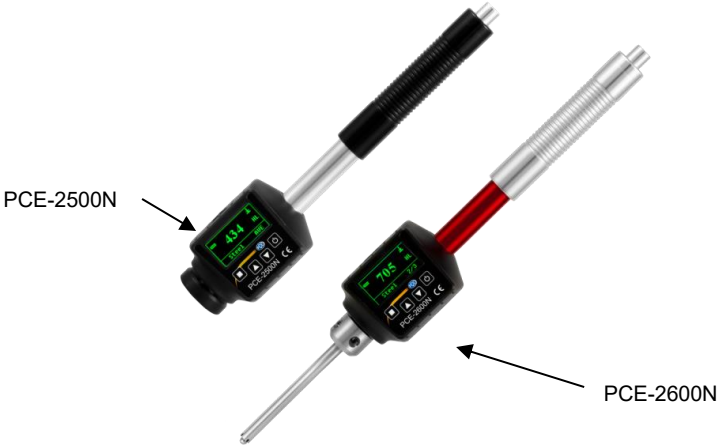
Display
After switching on the device, it will show the main screen:

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: ±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

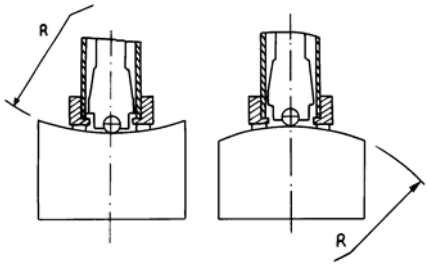
7 Operation

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
≥	≥
3 mm	5 mm

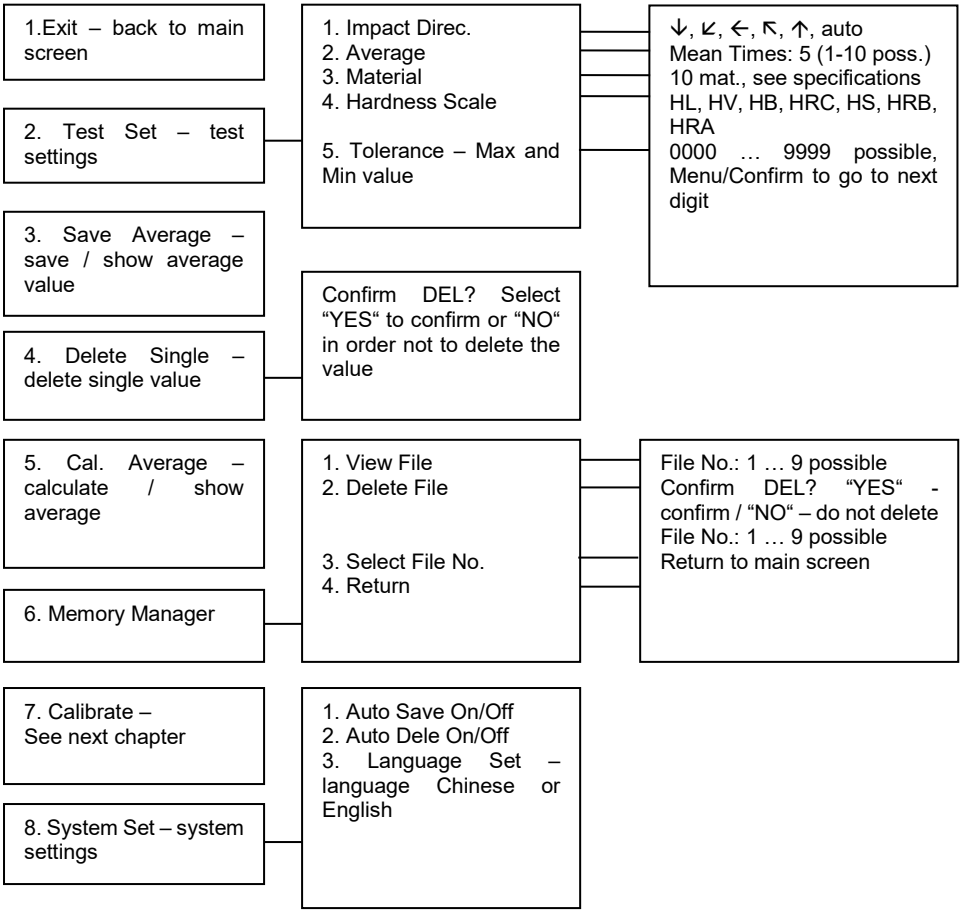
- At the end of the measurement, the results can be seen on the display. The hardness value is the average value of 5 measurements at different measuring points.
- To switch off the device, press the On/Off key.

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. 400HVHLD, 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.

The device shows values in HLDL. In order to calculate your HLD value, please refer to the conversion chart in 10.5.

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 Impact weight	11 mJ 5,5 g
Ball hardness Ball diameter Ball material	1600 HV 3 mm Tungsten carbide
Diameter of impact device Length of impact device Weight of impact device	20 mm 147 mm 50 g

10.2 Sample requirements

Max. sample hardness	940 HV
Max. sample roughness Ra	1.6 µm
Min. sample weight Measurement without stabilisation Stabilisation Coupling necessary	 >5 kg 2 ~ 5 kg 0.05 ~ 2 kg
Max. sample thickness Measurement without coupling Coupling necessary	 >5 mm ≤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 µm
Hardness 600 HV	Indentation diameter Penetration depth	0.54 mm 17 µm
Hardness 800 HV	Indentation diameter Penetration depth	0.35 mm 10 µm

10.4 Conversion chart materials

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

10.5 Conversion chart HLD/HLDL

HLD	300	304	306	308	310	314	316	318	322	324	328	330	334	336	338	340	344	346	348	352	354
HLDL	560	562	564	566	568	570	572	574	576	578	580	582	584	586	588	590	592	594	596	598	600
HLD	356	360	361	364	367	370	372	374	377	380	383	386	387	390	392	395	398	400	403	405	408
HLDL	602	604	606	608	610	612	614	616	618	620	622	624	626	628	630	632	634	636	638	640	642
HLD	410	413	415	418	420	423	425	429	431	433	436	438	440	444	446	448	451	453	456	458	461
HLDL	644	646	648	650	652	654	656	658	660	662	664	666	668	670	672	674	676	678	680	682	684
HLD	464	466	468	472	474	476	479	481	484	487	490	492	495	497	500	502	505	508	510	513	516
HLDL	686	688	690	692	694	696	698	700	702	704	706	708	710	712	714	716	718	720	722	724	726
HLD	518	521	524	527	530	532	534	537	540	544	546	548	551	554	557	560	563	566	569	572	574
HLDL	728	730	732	734	736	738	740	742	744	746	748	750	752	754	756	758	760	762	764	766	768
HLD	578	581	584	587	590	592	596	599	602	605	608	611	614	617	620	624	627	630	634	637	640
HLDL	770	772	774	776	778	780	782	784	786	788	790	792	794	796	798	800	802	804	806	808	810
HLD	644	647	650	654	657	660	664	667	670	674	678	681	684	688	691	695	698	702	706	709	712
HLDL	812	814	816	818	820	822	824	826	828	830	832	834	836	838	840	842	844	846	848	850	852
HLD	716	720	724	728	730	734	738	742	746	749	752	756	760	764	768	771	774	778	782	786	789
HLDL	854	856	858	860	862	864	866	868	870	872	874	876	878	880	882	884	886	888	890	892	894
HLD	793	797	800	804	808	812	815	819	823	826	830	834	837	841	845	849	852	856	860	864	867
HLDL	896	898	900	902	904	906	908	910	912	914	916	918	920	922	924	926	928	930	932	934	936
HLD	871	874	878	882	886	889	893	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HLDL	938	940	942	944	946	948	950	-	-	-	-	-	-	-	-	-	-	-	-	-	-

11 Contact

If you have any questions, suggestions or technical problems, please do not hesitate to contact us. You will find the relevant contact information at the end of this user manual.

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.

www.pce-instruments.com

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