



PCE-2000N Hardness Tester User Manual

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PCE-2000N Hardness Tester



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.
- 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.
- The hardness tester cannot be used for testing tungsten steel or harder materials as this can damage the impact body.
- Never press the trigger button when the impact body is not placed on the sample as otherwise the support ring can come loose easily.
- 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.

Safety symbols

Safety-related instructions the non-observance of which can cause damage to the device or personal injury carry a safety symbol.

Symbol	Designation / description
	General warning sign Non-observance can cause damage to the device and injuries to the user.
	Warning: hand injuries Non-observance can cause hand injuries.

Specifications

Technical specifications

Specification	Description
Measurement range	170 ... 960 HLD
Included impact device (Optional impact devices)	D (DC, D+15, C, G, DL)
Cable length of impact device	1.5 m
Accuracy	±0.5 % (@ 800 HLD)
Repeatability	0.8 % (@ 800 HLD)
Hardness scales	HL (Härte: Leeb) H (Härte: Vickers) HB (Härte: Brinell) HRC (Härte: Rockwell C) HS (Härte: Shore) HRB (Härte: Rockwell B) HRA (Härte: Rockwell A)
Materials	(Cast) steel Alloyed steel Stainless steel Grey cast iron Nodular cast iron Cast aluminium Copper-zinc (brass) Copper-aluminium (bronze) Copper Forged steel
Display resolution	128 x 64 pixel OLED display
Memory	Capacity for 600 average values in 6 files
Data output	USB pen drive
Batteries	3 x AAA batteries
Power Off	After 12 minutes of inactivity, device makes a sound and powers off automatically
Operating time	More than 50 hours
Operating conditions	Temperature: 10 ... 50 °C Air humidity: 20 ... 90 % RH
Dimensions	160 x 80 x 40 mm
Weight	Meter with batteries: 300 g Impact device: 75 g

Delivery contents

- 1 x hardness tester PCE-2000N
- 1 x hardness test block
- 1 x impact device Typ D
- 1 x carrying case
- 1 x cleaning brush
- 1 x user manual
- 3 x AAA 1.5 V battery
- 2 x support ring
- 1 x 2 GB USB pen drive
- 1 x factory calibration certificate

Optional accessories

Impact device	Item no.	Picture
D	PCE-2000N Probe D	
DC	PCE-2000N Probe DC	
C	PCE-2000N Probe C	
D+15	PCE-2000N Probe D+15	
E	PCE-2000N Probe E	
G	PCE-2000N Probe G	

Item no.	Picture	Description
CAL-PCE-2000N		ISO calibration
Z10-15		Adaptor cylindrical concave, radius: 10 ... 15 mm
Z25-50		Adaptor cylindrical concave, radius: 25 ... 50 mm
HK11-13		Adaptor spherical convex, radius: 11 ... 13 mm
HK12.5-17		Adaptor spherical convex, radius: 12.5... 17 mm
HK16.5-30		Adaptor spherical convex, radius: 16.5... 30 mm
HZ11-13		Adaptor cylindrical convex, radius: 11 ... 13
HZ12.5-17		Adaptor cylindrical convex, radius: 12.5...17 mm
HZ16.5-30		Adaptor cylindrical convex, radius: 16.5...30 mm

System description

Device



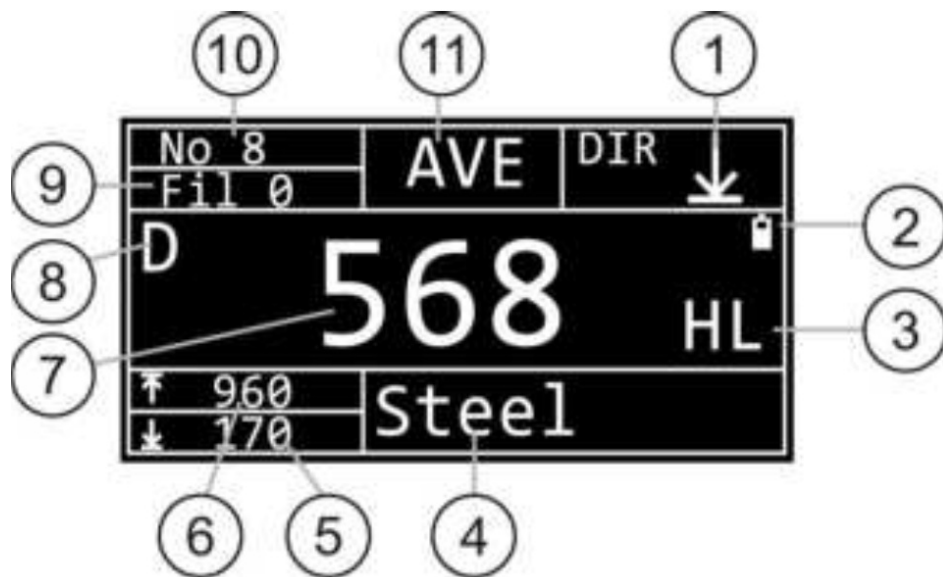
1. Connections
2. LED display
3. Keypad

Interfaces



1. Sensor connection
2. USB port

Display



1. Measuring direction (DIR)
2. Battery level indicator
3. Hardness scale, e. g. HL
4. Type of material, e. g. steel
5. Lower limit
6. Upper limit
7. Current measurement value or average value
8. Impact body, e. g. D
9. File no.
10. No. of measurements
11. Average value (AVE)*

- During the measurement, this area will show the number of measurements made as well as the number of measurements planned, e. g. 2/3.






Impact device



1. Trigger button
2. Cable

3. Plug
4. Support ring
5. Spherical probe tip
6. Sensor head
7. Loading tube
8. Handle

Function keys

Key	Designation	Function
	On-/Off key	Switch on/off
	Back key	Leave menu item or mode
	Delete key	Delete last measurement
	Arrow key „up“	Up
	Arrow key „right“	Right
	Arrow key „down“	Down
	Arrow key „left“	Left
	Menu key	<ul style="list-style-type: none"> • Open menu • Confirm selection within settings
	Direction key	Select measuring direction
	Hardness scale key	Select hardness scale
	Material key	Select material

Getting started

Power supply

The hardness tester is powered by three AAA batteries. By loosening the two screws at the rear side of the meter and taking off the battery compartment cover, you can change the batteries.

Note:

Ensure correct polarity as indicated in the battery compartment when inserting the batteries. Make sure to screw the battery compartment cover back on before turning on the device.

Tested material

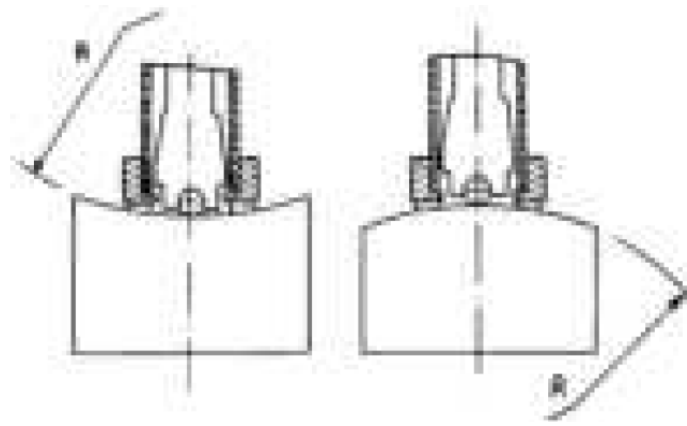
- The material that will be struck by the impact body must be placed evenly on a shock-free substrate.
- Interfering influences such as fluctuations in temperature must be avoided as these can falsify the measurement result.
- The sample must not be magnetic.
- The surface to be measured must not be too uneven or overly rough. This can cause errors.
- The sample must have a metallic lustre and be smooth, polished and free from grease.
- The surface temperature must be below 120 °C.

Weight of the sample

- In order to ensure correct measurement results, the sample must be as thick, heavy and solid as possible.
- A solid sample that is heavier than 5 kg can be tested without any further preparation and without any certain base.
- A sample between 3 and 5 kg should be attached to a support or bracket that has a weight of more than 5 kg in order to avoid bending, deformation or moving of the sample during the hardness measurement.
- If the sample's weight is below 2 kg, it should be attached to a workbench or a stable support. The area between the sample and the support must be hard, clean and smooth. In order to couple the sample, apply some petroleum jelly or old cooking fat to the overlapping surfaces of the sample and of the support. We recommend you to use the ultrasonic contact gel called TT-GEL, available at PCE Instruments. Then firmly press the sample onto the support and move it around a little bit to avoid bubbles between the sample and the support.
- Samples with a very low weight must be solidly and evenly coupled to the base they are placed on.
- The rebound will be vertical to the coupled surface.
- Even large panels, bars and curved parts can deform or break, even when their weight and thickness comply with the requirements. This results in inaccurate measurement values or failure to get any measurement values. Therefore, the rear side of the sample should be reinforced or supported.

Surface curvature and selecting the right support ring

When the radius of the surface curvature is ≤ 30 mm, we recommend you to use the smaller support ring with an outer diameter of approx. 14 mm. If the radius of the surface curvature is > 30 mm, the larger support ring with an outer diameter of approx. 20 mm should be used.



Background information

Measuring principle

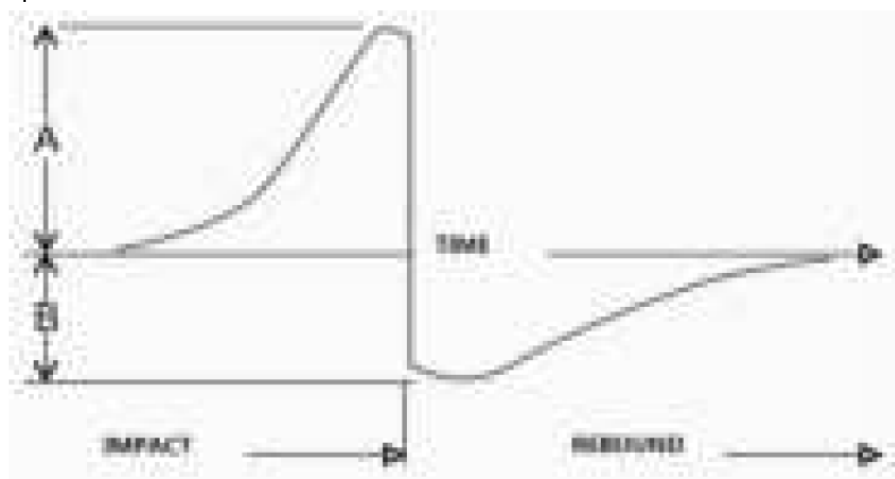
Measurements are made in line with the Leeb principle, i. e. an impact body that has a certain weight hits the surface of the material to be tested at a given speed. The speed of the impact and of the rebound of the impact body will then be measured 1 mm above the point of impact.

Formula: $HL = 1000 \cdot B / A$

HL = Leeb hardness

B = Rebound speed

A = Impact speed



Measurement ranges according to material

Material	HRA	HRC	HRB	HB	HSD	HV
(Cast) steel	59.1...85.8	20...68.5	38.4...99.6	127...651	32...99.5	83...976
CWT steel	–	20.4...67.1	–	–	–	80...898
Stainless steel	–	–	46.5...101	85...655	–	85...802
Grey cast iron	–	–	–	93...334	–	–
Nodular cast iron	–	–	–	131...387	–	–
Cast aluminium	–	–	23.8...84	19...164	–	–
Brass (copper- zinc)	–	–	13.5...95	40...173	–	–
Bronze (copper-aluminium)	–	–	–	60...290	–	–
Copper	–	–	–	45...315	–	–

Technical data of optional impact devices

Impact device	D / DC	D+15	C	G	DL
Impact energy [mJ]	11	11	3	90	11
Mass of impact body [g]	5.5	7.3	3.0	20	7.3
Max. sample hardness [HV]	940	980	1000	650	940
Penetration depth					
At 300 HV [µm] Ø [mm]	24 0.54	24 0.54	12 0.38	53 1.03	24 0.54
At 600 HV [µm] Ø [mm]	17 0.45	17 0.45	8 0.32	41 0.90	17 0.45
At 800 HV [µm] Ø [mm]	10 0.35	10 0.35	7 0.30		10 0.35

Operation

Measuring tips and start-up

CAUTION:

Non-observance of safety notes and of the following information can cause injuries.

- If the loading tube is returned to its original position too quickly, parts of the meter can be damaged.
- First check the hardness tester by means of the standard test block.
- Insert the plug of the sensor cable into the connection on the upper side of the meter, while turning it slightly.
- Turn on the meter by pressing the On/Off key . You are now in measurement mode.
- To start up the meter, make sure that the power supply is sufficient. The battery icon in the display shows the current battery level.

Measurement

- Hold the impact device between your thumb and your index finger and place it on the sample. Make sure that it is placed firmly on the surface and that the impact direction is vertical to the test surface. Otherwise, incorrect measurement values can occur.
- Use one hand to press the support ring of the impact device onto the sample. Make sure that the support ring lies firmly on the surface and that the impact direction is vertical to the test surface. Use your other hand to hold the handle of the impact device between your thumb and index finger. Push the handle towards the support ring up to the stop. Then return the handle to its original position but do not stop holding it while doing this.
- During this movement, the impact body in the tube of the sensor will be placed in its original position.
- By pressing the trigger button on top of the moveable handle, the measurement is started. The impact body in the sensor tube strikes the test surface.
- The reading is displayed on the LC display.
- The distance between any two impact points or between the centre of any impact point and the edge of a sample must comply with the requirements in the following chart:

Impact device	Centre-to-centre distance of two impact points	Distance from centre of impact point to edge of sample
D	≥3 mm	≥5 mm

- On any surface to be measured, you should test at least five different measuring points to calculate the average.

Evaluation of the measurements

After each measurement, the measured value will be indicated in the display. The PCE-2000N calculates and saves an average value. Therefore, various measuring positions should be tested. As soon as the pre-set number of measurements is reached, the tester will make a sound and the display will show the average value.

Menu overview

1. Measure Config	2. Gauge Config	3. Data
1.1 Memory Location	2.1 Buzzer	3.1 USB
1.2 Strike Direction	2.2 Backlight	3.2 File No.
1.3 Threshold Values	2.3 Language Set	3.3 File List
1.4 Average Time	2.4 Software Ver	3.4 Delete Data
1.5 Material Type		
1.6 Hardness Scale		
1.7 Probe Option		

Settings

Switch on the device by pressing the On/Off key. You are now in measurement mode. In order to enter the menu, press the Menu key. In the menu, you will see the icons of the three menu items.

You can select one of the three menu items by using the arrow keys and Confirm your selection by pressing the Menu key again.

In order to return to measurement mode, press the Back key. This key is also used to and confirm any changes made.

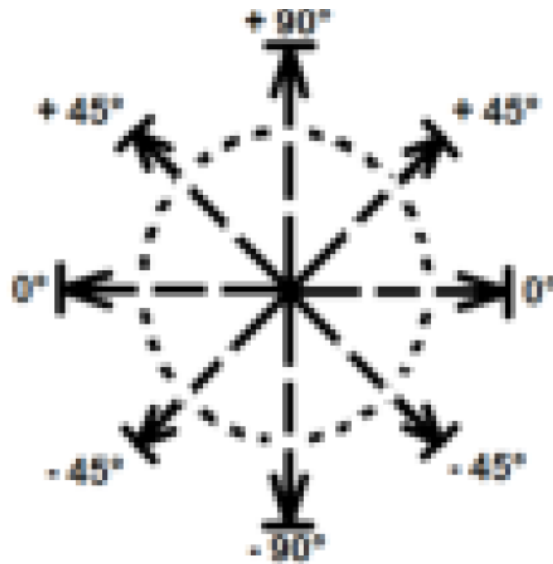
Measuring configuration

Memory Location

Here you can determine what file no. the measured values will be saved under. 5 memory locations are available. Use the arrow keys and to select a number between 0 and 5.

To return, press the Back key. This key is also used to and confirm any changes made.

Strike Direction



The arrows in the display show the impact direction of the impact body. (DIR)

Possible measuring directions:

- down (-90°)
- down left or down right (-45°)
- left or right (0°)
- up left or up right (45°)
- up (90°)
- automatic (Indication: DIRC auto)

Note:

You can also select the measuring direction directly via the Direction key when switching on the device.

Threshold Values: MAX/MIN

This option allows you to set a measurement range. Values outside of this measurement range will not be accepted.

- The individual digits of the lower limit MIN or the upper limit MAX can be selected by means of the arrow keys and .
- The values can be set via the arrow keys and . When pressing these keys, you will hear a sound and the displayed value will increase or decrease by one unit.
- By pressing the Back key , you save the values and return to the previous window.

Average Time

Here you can determine how many measuring values will be used to calculate the average value. Up to 32 measurement values can be used.

Material Type

This function allows you to set the material to be tested. The possible materials are listed under 2.1 Technical specifications. Alternatively, you can press the Material key when you are in menu mode to enter the material selection window directly.

Hardness Scale: HB/HL

Via this function, you can set the hardness scale for your measurements. The possible hardness scales are also listed under 2.1 Technical specifications.

You can also select the hardness scale directly if you press the Hardness scale key

Probe Option

This setting allows you to select the impact device. A D-type impact device is included in the standard delivery. Optional impact devices of the types DC, D+15, C, G and DL are available at PCE Instruments.

Gauge configuration

Buzzer

Here you can turn the key tone on or off.

Backlight

This setting allows you to activate or deactivate the display backlight in line with the brightness in your environment and your individual requirements

Language

You can select either English or German as your menu language.

Software Ver

Here you can see the current software version. .

Data

USB

- Connect a data medium to the USB port of the meter.
- By using the arrow keys and you can select either “cur. file” or “all files”.
- When you press the Menu key a query (“Save?”) will appear.
- By pressing the Menu key again, you reply with “Yes“
- By pressing the Back key you reply with “No“

File No.

In this submenu, you can select the file in which you wish to save the measured values. To do so, use the arrow keys and to select a number from 0 to 5. The measurements that follow will be saved to the selected file.

File List

Here you can view all saved average values. With the arrow keys and , you can navigate through the readings within the file.

Delete Data

You can either delete the value last measured („Current Data“) or the whole file (“Cur Group”) or all files (“All Group”).

- You can select an option with the arrow keys and
- Confirm your selection by pressing the Menu key
- As the values will be deleted irrevocably, a further query will appear. (“Confirm?”)
- By pressing the Menu key again, you reply with “Yes“.
- The display will return to the previous menu (3.3 File list).
- By pressing the Back key , you answer “No“ and the deletion will be cancelled.
- The display will show the menu „3.4 Delete file“.

Calibration

If the device has not been used for a longer period of time, it must be calibrated carefully. A calibration is also necessary if the impact devices are changed frequently. Use the hardness test block to calibrate the meter.

- To enter calibration mode, switch on the instrument by pressing the On/Off key
Then press and hold the arrow key until the device indicates that it is in calibration mode.
- Measure five different points on the standard test block. You will see in the display how many measurements you have made. After the fifth measurement, the display will directly show the average value of the calibration.
- Compare the average value with the HLD value on the upper side of the standard test block.

- Use the arrow keys and to change the average value of the calibration.
The calibration range is $\pm 150\text{HL}$.
- Press the Menu key to confirm the calibration or the Back key to cancel the calibration.

Note:

Measuring parameters such as material, hardness scale and impact direction cannot be changed during the calibration.

Maintenance

Storage

Store the measuring instrument in its carrying case and make sure the environmental conditions are within normal ranges. Avoid magnetic fields, corrosion and shocks.

Removing the sensor cable from the meter

Hold the moveable connecting piece on the sensor cable which is inserted into the sensor connection and pull it away from the instrument.

Maintenance and care of the impact device

- After using the impact device approx. 1000 – 2000 times, the guide tube and the impact body should be cleaned by using the nylon brush that comes with the meter. To do so, unscrew the support ring, then take out the impact body, move the nylon brush through the guide tube counterclockwise, making helical movements until you reach the bottom. Repeat this procedure four times. Re-install the impact body and the support ring.
- Do not use any lubricants inside the impact device.
- Place the impact body back into the loading tube and screw the support ring back onto the end of the impact device.

Warranty

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

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.

Documents / Resources



PCE PCE-2000N Hardness Tester [pdf] User Manual
PCE-2000N Hardness Tester, PCE-2000N, Hardness Tester, PCE-2000N Tester

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