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Instruction manual mobile Leeb hardness tester

SAUTER HMM

Version 2.0
04/2020
GB



PROFESSIONAL MEASURING

HMM-BA-e-2020



SAUTER HMM

V. 2.0 04/2020

Instruction manual mobile Leeb hardness tester

Thank you for purchasing the mobile digital Leeb impact hardness tester from SAUTER. We hope that you will be very satisfied with the high quality of this device and its extensive functionality. For any questions, wishes and suggestions we are at your disposal.

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1 Before commissioning

Before putting the device into operation, check the delivery for any transport damage to the packaging, the plastic case and the device itself. Should this be the case, SAUTER must be contacted immediately.

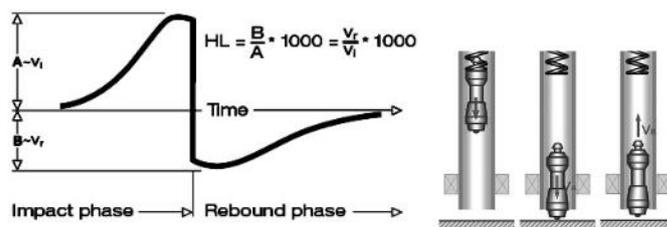
2 Introduction

2.1 Measuring principle

The HMM hardness tester is physically a rather simple dynamic hardness tester: A rebound sensor with a hard metal tip is driven against the surface of the test object with spring force. The surface can be damaged if the rebound body hits the surface, which is ultimately due to a loss of kinetic energy.

This energy loss is calculated from the speed measurements when the rebound sensor is at a certain distance from the surface for the rebound and trigger phases of the test. The fixed magnet in the rebound body generates an induced voltage in the simple wire coil of the rebound body.

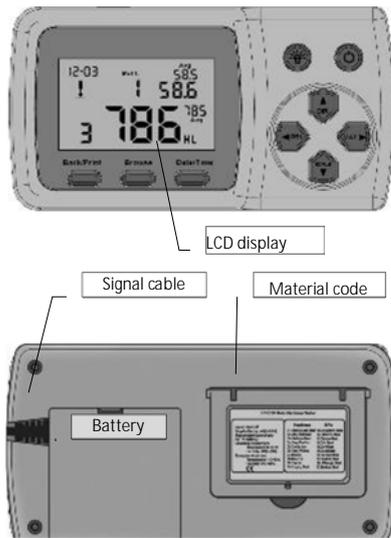
The voltage of the signal is proportional to the speed of the rebound sensor. The signal processing by the electronics ensures that the hardness value can be read on the display and stored.



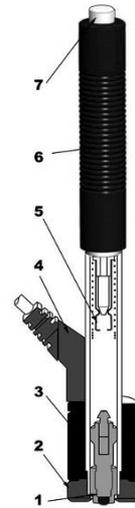
2.2 Structure

Display

Rebound sensor type D



1. rebound body
2. stabilising ring
3. bobbin
4. cable
5. pawl clamping device
6. charging tube
7. release button



2.3 Keys

Key for backlit display: This key is used to switch the backlighting of the display on or off.

On/off button: The button is pressed and held down for a short time to switch the unit on or off.

The "Back/Print" button:
 ① Press this key in the measuring mode to delete the measured data. If the mini-printer is connected to the instrument at the same time, these data will be printed before.
 ② In another mode, press the "Back/Print" key to complete the setup and save the preset parameters, then return to the measuring mode.

The "Browse" button: Press this button to view the stored used data.

The "Data/Time" key: This key is used to set the time and calendar.

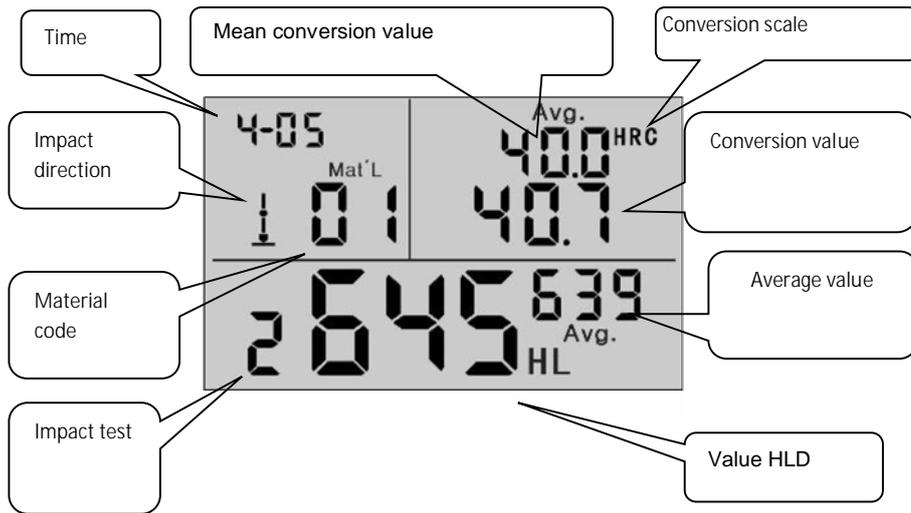
The key is pressed and held to cancel the current data in the measuring mode or in the browse mode.

SCALE
 ① This button is required to activate the scale for conversion to other hardness values.
 ② In the "Data/Time" mode, press the button to reduce the digit that is lit up by one numerical value at a time.
 ③ In the "Browse" mode, press this button to display the next data, measurement or browse mode.

DIS
 ① Press this button to set the orientation of the rebound sensor.
 ② In the "Data/Time" mode, press the button to increase the digit that is lit up by one numerical value at a time.
 ③ In Browse mode, press this button to display the previous data.

MAT
 ① Press this button to select the material to be examined.
 ② In "Data/Time" mode and in calibration mode, this key is used to select the next binary character to be changed.

2.4 Display overview



2.5 Technical data

HL Display Indication: 0~999HLD

accuracy: ± 6 HL (at 800HLD)

Resolution: 1 (HL, HV, HB, HSD, MPa); 0.1(HRC, HRB)

Rebound power: 11Nmm

Mass of the impactor: 5.5g

Diameter of the test tip: 3mm; Material: tungsten carbide; Hardness of the Test tip: ≥ 1600 HV

Power source: 3 x1.5V AAA

operating temperature: 32 ~ 122°F, 5% ~ 95% relative humidity;

Storage temperature: 14 ~ 144°F, 5% ~ 95% relative humidity

Dimensions: 150mm x 80mm x 24mm (display)

Rebound length: 147mm (Type D)

Weight: approx. 200 g (display); rebound sensor 75g (type D)

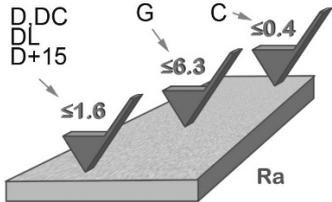
Compliance with the following standards: ASTM A956 & DIN50156

3 Test preparation

- Preparing the device
- Inserting the batteries
- Connect rebound sensor
- Switch on the device
- Check measuring accuracy: Insert sample test block to check the sensor for correct functioning

3.1 Preparation of the test object

Unsuitable material samples can cause measuring errors. Therefore, test preparation and execution should be carried out according to the sample properties. The preparation of the test object and its surface should meet these basic requirements:



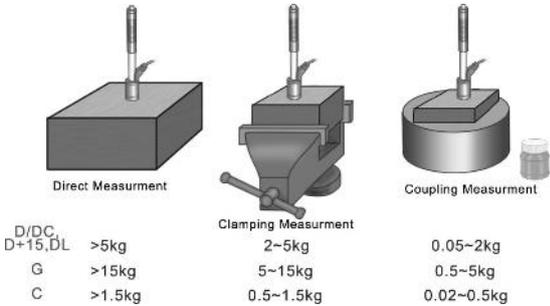
During the surface preparation of the test object, its surface should not be exposed to thermal cooling or heating.

The test surface should be flat and have a metallic gloss. There must be no oxide layers or other contamination.

Roughness of the test surface

The sample should have sufficient mass and stiffness. If not, the impact may cause a displacement or movement, which may lead to a significant measurement error.

As a general rule, if the weight of the sample is 5 kg or more, testing can be performed directly.

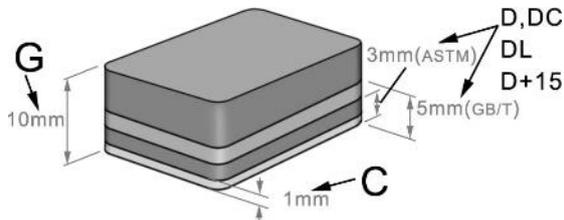


3.2 Sample thickness

The thickness of the sample as well as the thickness of the homogeneous layer (or the hardening layer of the surface) should have a sufficient material thickness.

If the sample surface is not flat, the radius of the test area should not exceed 30 mm (50 mm for type G). If it is not specified, an appropriate support ring should be used.

The sample should have no magnetic properties.

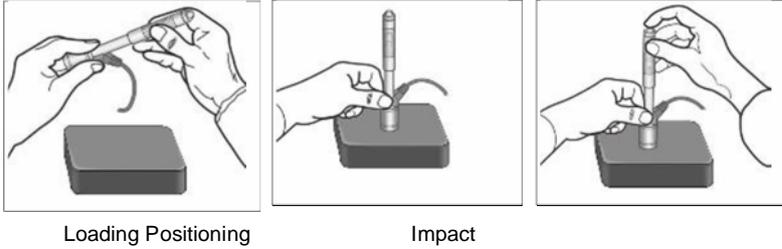


3.3 Test procedure

Unsuitable material samples can cause measuring errors. Therefore, test preparation and execution should be carried out according to the sample properties. The preparation of the sample and its surface should meet these basic requirements:

- During the surface preparation of the sample, its surface should not be exposed to thermal cooling or heating.
- The test surface should be flat and have a metallic gloss. There must be no oxide layers or other contamination.
- The roughness of the test surface shall be $R_a \leq 1,6$.
- The sample should have sufficient mass and stiffness to prevent displacement or movement on impact.
- As a general rule, if the weight of the sample is 5 kg or more, testing can be performed directly.
- If the weight is 2 to 5 kg, the sample should be clamped with suitable means so that it remains stationary. If the weight is 0.05 to 2 kg, the sample must be coupled with another object. If the weight is less than 0,05 kg, the sample is not suitable for testing with a Leeb hardness tester.
- The minimum thickness of the sample should be 5 mm, and the minimum thickness of the homogeneous layer (or the hardening layer of the surface) should be 0.8 mm.
- If the sample surface is not flat, the radius of the test area should not exceed 30 mm. It is also necessary to use an appropriate support ring.
- The sample should have no magnetic properties.

3.3 Test execution



3.3.1 Loading

Load the rebound sensor by pushing the loading tube forward.

3.3.2 Positioning

Then position the rebound sensor and hold it on the surface of the sample at the desired measuring point. The direction of impact should be vertical.

3.3.3 Impact (measurement)

Perform the measurement by pressing the release button. Measured hardness value is displayed immediately.

3.3.4 Reading test results

Read the measurement result of the test from the display.

Note:

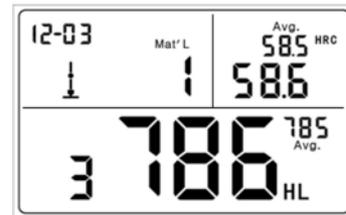
Normally, 5 individual measurements are made at each measuring point of the sample. The range of values (difference between the maximum and minimum values) should be less than 15 HLD. The distance between two measuring points should be $\geq 3\text{mm}$; the distance between the point of impact and the edge of the sample should be $\geq 3\text{mm}$.

3.4 Browse

The tester allows to store 9 hardness values which can be searched after the measurement is finished.

Press the "Browse" key to browse stored data and display the 1st record from the last 9th test records, including hardness value HLD, material, conversion values, impact direction, date and time, etc.

Press the "Up" or "Down" button to search a previous or subsequent record. To return to the measuring mode, press the "Browse" key again.



Hardness value: 786HLD;
 3rd measuring point;
 Mean value: 785HLD
 Conversion to HRC: 58.6HRC
 Average HRC: 58.5HRC

```

-----
Test Report
-----
Impact Unit Type: D
Material : Steel&Caststeel
1 808 HLD 61.2 HRC
Date: 06/07/31 Time: 18:21:27
2 808 HLD 61.2 HRC
Date: 06/07/31 Time: 18:21:27
3 805 HLD 60.8 HRC
Date: 06/07/31 Time: 18:21:27
4 808 HLD 61.2 HRC
Date: 06/07/31 Time: 18:21:27
5 805 HLD 60.8 HRC
Date: 06/07/31 Time: 18:21:27
-----
s = 3 HLD 60.4 HRC
x̄ = 806 HLD 61.0 HRC
Printed: 06/07/31 18:21:27
-----
    
```

3.5 Print test report

The tester can be connected to a wireless printer to print a test report.

Place the printer near the tester (at a distance of up to 2 m) and switch it on.

Press the "BackPrint" key and hold it for about 2s: the report is printed.

NOTE:

Original data is automatically deleted from the memory after printing is completed.

4 Settings

4.1 Material code

In measuring mode, press the "" button to select the code for the material to be tested. The material code is indicated on the label on the back of the housing (or see **Appendix A-3**).

NOTE:

It is necessary to carry out the material classification. If the material type is not known in advance, the material manual intended for this purpose must be consulted.

The standard default setting is 01 (steel and cast steel).

4.2 Impact direction

In the measuring mode, press the "" button to select the impact direction. The alignment sequence changes as follows:



The tester can automatically correct the direction of impact himself.

4.3 Scale

The tester can automatically convert HLD values into other hardness scales such as HRC → HRB → HB → HV → HSD or tensile strength (MPa) according to the corresponding material group (e.g. steel, aluminium).

For this purpose, the "" key is pressed in the measuring mode to perform a conversion to a known hardness scale or to tensile strength (MPa).

If this key is pressed continuously, the sequence of the scales changes in the following way:

HRC → HRB → HB → HV → HSD → MPa → HRC

NOTE:

If the symbol "----" appears on the display, the conversion is out of range.

If the measured value is converted from a hardness scale to tensile strength or vice versa, the material selection must be set again.

The conversion value merely provides a general reference value, which may result in a certain shift. An exact translation requires assigned comparison tests for this.

The standard setting for the conversion is the "HRC" hardness scale.

5 Service and maintenance

5.1 Periodic maintenance

General Information

Impacts are to be avoided. After use, place the device back into the transport case. The rebound sensor must be stored in its triggered state. Avoid using the unit in a strong magnetic field. Protect all components from any contact with grease or oil.

Cleaning the rebound sensor

In principle, the tube and the housing of the rebound sensor must be cleaned every 1 to 2 thousand measurements

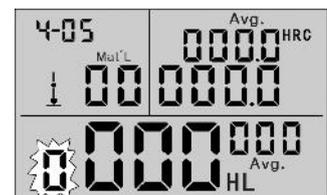
Procedure: turn the support ring, loosen and dismantle the rebounding body. Insert the nylon cleaning brush to clean the tube and tester body.

Replacing the impact ball

Continuous use may cause damage to the impact ball. It must be replaced as soon as the accuracy of the measurement appears to be impaired.

6 Calibration

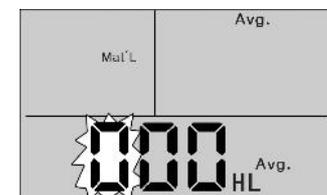
The calibration procedure is used to calibrate measured values (HLD, HRC, HRB, HB, HV and HSD) of the rebound sensor in order to exclude a measurement error as far as possible from the outset. The required scale shall be selected prior to calibration. To perform calibration for the HB range, the HB scale shall be selected with the key .



Keep the "Back/Prnt" button pressed for approx. 2s until the flashing value of the impact time is "0".

5 Perform measurements on test blocks to obtain an average value (this will help to exclude incorrect measurements during the procedure).

Keep the "Date/Time" button pressed for approx. 2s until the calibration mode is displayed.



Enter the default value for the test block.

Press the "DIR" "SCALE" buttons to change the values and then the "DEL" or "MAT" button to move to the following number.

Note:

If the calibration is performed in another scale HRC, HRB, HB, HV or HSD, the scale required for the measurement must be set first.

After step 3, keep the "Browse" button pressed and then press the "Date/Time" button.

Now the scale in which the calibration is carried out is displayed.

In another scale (HRC, HRB, HB, HV i HSD) in calibration mode, the input of standard values is done in a different way than when calibrating using the hardness tester LEEB (HL).

25.0HRC must be entered as "250" (HRB remains unaffected).

85HB must be entered as "085" (HV, HSD remain unaffected).

If the entered data is outside the range, no calibration is performed.

Clock setting

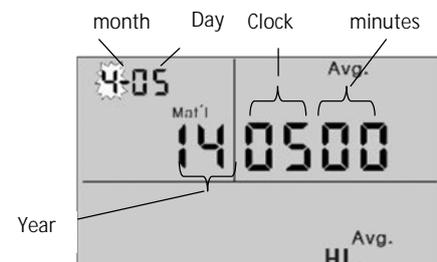
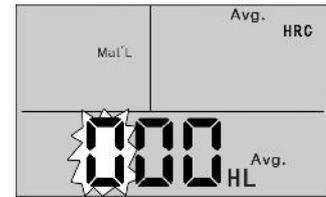
The hardness tester is equipped with an integrated real-time clock.

After changing the battery or always as required, the clock must be set again.

To do so, press the "Date/Time" button to select the setting mode.

Press the "DIR" "SCALE" buttons to change the values and then the "DEL" or "MAT" button to move to the following number.

Press the "Back/Print" button to confirm the setting and return to the measuring mode.



Reset

If the display does not function properly or gets stuck, a system reset must be carried out. To do this, remove and reinsert the batteries and then switch the unit on again.

7 Annexes

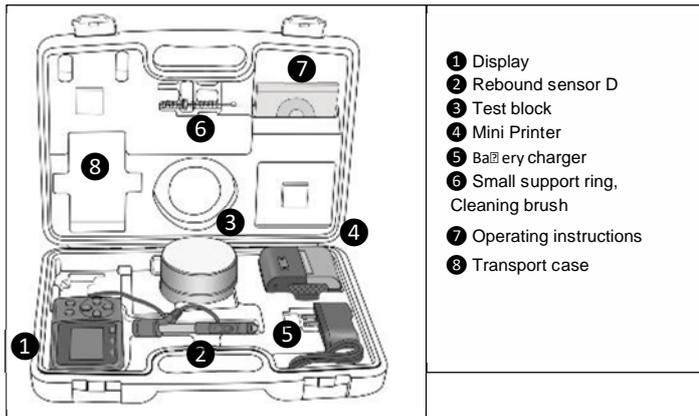
7.1 A-1 Conversion range

Material	AGM	HB	HRC	HRB	HSD	Tensile strength (MPa)
Steel & cast steel	81-955	81-654	20.0-68.4	38.4-99.5	32.5-99.5	375-2639
Alloyed tool steel	80-898		20.4-67.1			375-2639
Stainless steel	85-802	85-655	19.6-62.4	46.5-101.7		740-1725
Grey cast iron		63-336				
Ductile cast iron		140-387				
Aluminium casting alloy		19-164		23.8-84.6		
Brass		40-173		13.5-95.3		
Bronze		60-290				
Copper		45-315				
Forged steel	83-976	142-651	19.8-68.5	59.6-99.6	26.4-99.5	

7.2 A-2 Material Code

Hardness		Tensile strength	
Code	Material	Code	Material
01	Steel & cast steel	11	Low carbon steel
02	Alloyed tool steel	12	High carbon steel
03	Stainless steel	13	Chrome steel
04	Grey cast iron	14	Cr-V Steel
05	Ductile cast iron	15	Cr-Ni steel
06	Aluminium casting alloy	16	Cr-Mo steel
07	Cu-Zn alloy	17	Cr-Ni-Mo Steel I
08	Cu-Sn alloy	18	Cr-Mn-Mo steel
09	Copper	19	Cr-Mn-Si steel
10	Forged steel	20	High strength steel

7.3 A-3 Scope of Delivery



Note:

To view the CE declaration, please click on the following link:

<https://www.kern-sohn.com/shop/de/DOWNLOADS/>