



Sauter GmbH

Ziegelei 1
D-72336 Balingen
e-mail: info@kern-sohn.com

Phone : +49-[0]7433- 9933-0
Fax: +49-[0]7433-9933-149
Internet: www.sauter.eu

Instruction manual ultrasonic hardness tester

SAUTER HO

Version 2.0
03/2020
GB



PROFESSIONAL MEASURING

HO-BA-e-2020



SAUTER HO

V. 2.0 03/2020

Instruction manual ultrasonic hardness tester

Thank you for purchasing the digital ultrasonic hardness tester from SAUTER. We hope you will be very satisfied with the high quality of the hardness tester and its extensive functionality.

For any questions, wishes and suggestions we are at your disposal.

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1 Safety and liability

These operating instructions contain important information about safe handling and maintenance of your new device. Before using the appliance for the first time, please read these operating instructions completely and carefully. Please keep the manual in a safe place for future reference.

1.1 Safety Instructions

Your device is a high-precision instrument; it requires careful handling and must not be exposed to considerable vibrations. Risk of damage to internal components!

The indenter of the hardness tester is made of diamond and has absolute natural hardness. Risk of scratching and damage to valuable objects!

After the measurement, lift off the indenter for approx. 0.5s and then perform a new measurement. Otherwise there will be no resonance between the indenter and the test specimen in a short time.

After use, store the device in a transport case. Danger of damage!

The main unit and the sensor must not be disassembled. No liability is assumed for any damage resulting from this.

It is prohibited to use the device in an explosive environment. Fire and explosion hazard!

Battery: Only the battery supplied by the manufacturer may be used. The battery must not be disassembled. When inserting the battery, make sure that the polarity is correct.

Do not throw the battery into fire or heat sources, immerse it in water or expose it to water! If the battery is deformed, it must not be reused. Switch off the device before changing the battery. The battery must not be removed when the unit is switched on. The battery is installed before delivery and does not require any major changes.

Power supply unit: The power supply unit must be stored in a dry place. It must be protected against short circuits. Danger of damage! Do not touch with wet hands! Danger of electric shock!

We reserve the right to change the specification of the device as well as the software without prior notice.

2 Introduction

2.1 Description of the device

Many common measuring methods are currently used for hardness testing.

Such as Brinell, Rockwell, Vickers, Leeb and the like The test load as well as the rather large penetration depth in the Rockwell and Brinell method lead to

considerable damage to the surface of the test specimen. The Vickers method uses an optical measurement, but a problem-free and correct measurement requires extensive expertise. Furthermore, there is no possibility to test a test piece of greater weight or solid parts for hardness.

The ultrasonic hardness tester is based on the ultrasonic contact impedance method for performing comparable hardness tests on test specimens. The instrument ensures high precision and performance, is portable, easy to use and offers a non-destructive testing method.

2.2 Specification

Perfect accuracy: $\pm 3\%HV$, $\pm 3\%HB$, $\pm 1.5HR$

* Microscopic impression: it does not damage the specimen, the impression is only visible under a very powerful microscope

* fast Measurement : measurement results are readable within 2s, 60 times more power than tabletop units

* Large LCD display: direct display of measurement results, counter values, MAX and MIN values as well as average values and conversion factors

* Simple operation: the device is user-friendly after only a short training

* High performance: 2 years warranty

* Mass memory: up to 1000 measured value groups and up to 20 calibration sets can be stored

* Before calibration: 20 measurement value groups can be stored before calibration for recall to improve measurement performance

* Data output and printing: cable transfer via USB to computer and printer

2.3 Use

- * Hardness measurement of flange edge and flanks of gears, moulds, sheet metal, surface-hardened cutting edges as well as tooth grooves and conical parts
- * Hardness measurement of axles, thin-walled tubes and containers
- * Hardness measurement of wheels and rotor turbines
- * Hardness measurement of rotor blades
- * Hardness measurement of welded parts
- * Measurement of certain opening depths of incisions, radii of convex marks, irregular surfaces
- * Hardness measurement of majority of ferrous metals, non-ferrous metals and other alloyed steels in industrial production

2.4 Operating conditions

Operating temperature: -10~ 40°C

Storage temperature: -20~ +60°C

Relative working humidity: ≤85%.

During storage, avoid vibrations, aggressive environments and dust!

2.5 Scope of delivery for the standard version

- Display housing
- depending on version, corresponding probe
- Sensor cable
- (hardness comparison plate standard)
- Power supply unit USB
- Battery
- Screwdriver
- Transport case
- Operating instructions

3 Structure and function

3.1 Basic structure and functionality

Front and rear view of the ultrasonic hardness tester HO

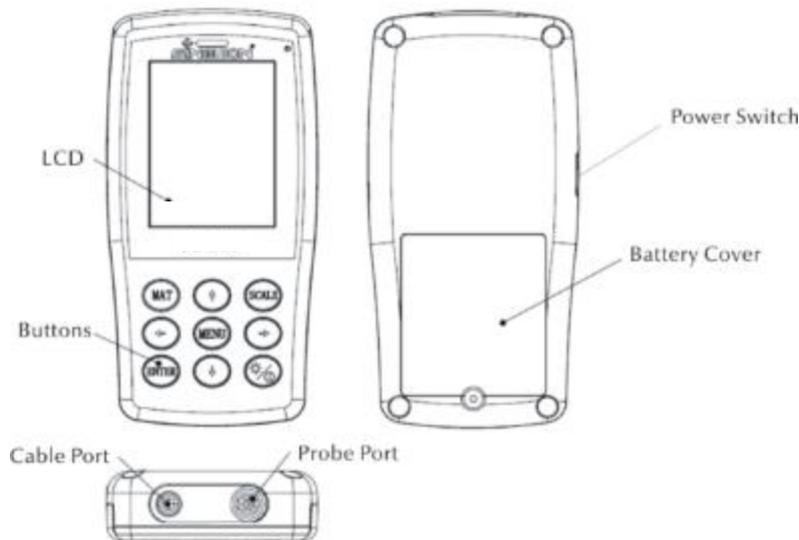


Fig. 1

The main unit is connected by means of an 8-pin data cable and an ultrasonic sensor (see fig. 1.1).

The function of the ultrasonic hardness tester is based on the ultrasonic contact impedance method as well as on the modulus of elasticity.

Formula for the quality of the ultrasonic measurement of the hardness tester EQ1:

$$\Delta f = f(E_{\text{eff}}, A); \quad HV = F/A$$

- Δf = Frequency shift
- A = Indentation area
- E_{eff} = Effective elastic modulus
- HV = Vickers hardness value
- F = Force applied in the hardness test

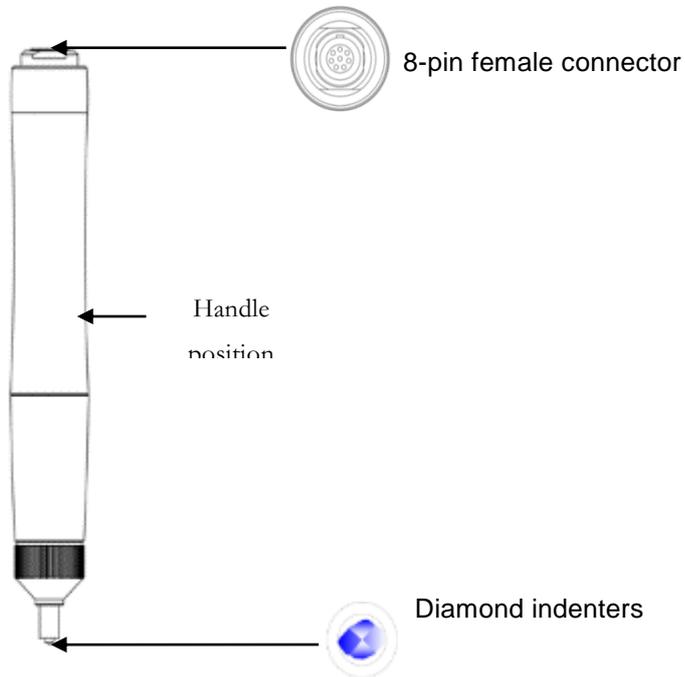
Hint:

As can be seen in EQ1, the change in frequency depends not only on the size of the contact area, but also on elastic modulus values of materials in the contact area. In order to take into account the differences in Young's modulus values, the instrument must be calibrated for different groups of materials.

After calibration, the ultrasonic contact impedance method can be applied to all materials that have corresponding elastic modulus values.

3.2 Ultrasonic sensor

3.2.1 Design of the manual sensor



3.2.2 Technical data of the manual sensor

Type of sensor	HO-A01	HO-A02	HO-A14
Available as	Accessories	Accessories	Accessories
Test force	10 N	20 N	100N
Diameter	22 mm	22 mm	22 mm
Length	154 mm	154 mm	154 mm
Diameter of the oscillating rod	2.4 mm	2.4 mm	2.4 mm
Surface roughness of the test specimen	Ra < 3.2 um	Ra < 5 um	Ra < 15 um
Minimum weight of test pieces	0,3 kg	0,3 kg	0,3 kg
Minimum thickness of test specimen	2mm	2mm	2mm

3.2.3 Indenter and impression

The ultrasonic penetrator is a diamond penetrator of 136 °. Below is an image of the impression in prism form on the test piece, the size of the impression varying according to the material of the test piece. The shape of the impression is the same as the Vickers method and would require a strong microscope for observation.

Fig. 3

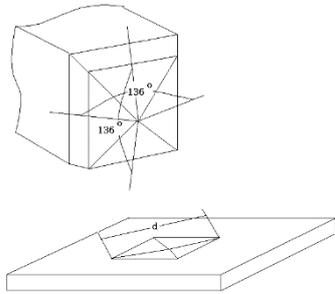
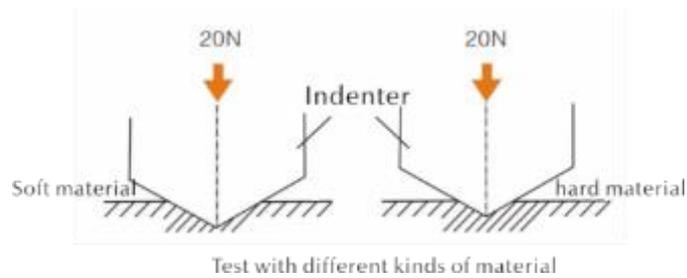


Fig. 4



The penetration depth (h) and the mean value of the diagonal length (d) of sensors of the ultrasonic hardness tester decrease together with the increase of the hardness value.

Table

Certain hardness values according to different ultrasonic sensors (ultrasonic contact impedance method) including penetration depth (h, μm)

Vickers Hardness	HO-3M	HO-5M	HO-1K	HO-2K	HO-5K	HO-10K
800HV	4	5	7	10	15	22
600HV	4	5	8	11	18	25
300HV	6	8	11	16	25	35

4 Technical properties

4.1 Technical data

Measuring ranges:	HO-A03
HRC	20,3~68
HRB	41~100
HRA	37~85
AGM	80~1599
HB	76~618
Supported and displayed hardness scales	HRC, HV, HBS, HBW, HK, HRA, HRD, HR15N, HR30N, HR45N, HS, HRF, HR15T, HR30T, HR45T, HRB
Tensile strength	255~2180 N/mm ²
Battery:	
Voltage	4,2V
Capacity	4800mAh
Loading time	8h
Power supply unit:	
Entrance	220V/50Hz 110V/60Hz
Output	5V/1A
Menu languages	German, English, French, Italian, Spanish, Polish
Data memory	1000 measurement value groups, 20 calibration sets
Dimensions display unit	162x81x31mm
Weight display unit	0.5kg
Type	ASTM E140-18265 ; GB 18265 ; GB 2005/T 1172-1999

5 Safety instructions for handling

5.1 Preparation and control

5.1.1 Requirements concerning test pieces

Minimum thickness

The ultrasonic hardness tester uses a Vickers diamond indenter, so the Vickers hardness calculation formula is also used in the ultrasonic hardness tester. Thin layers or top coats of base material must have a minimum thickness (t).

1) The penetration depth of a diamond pyramid according to Vickers for specific hardness (in HV) and test load (in N) are given at EQ2:

$$h=0.062\sqrt{\frac{F}{HV}} \quad (5-1-1) \quad h : \text{mm, test load } F : \text{N}$$

Minimum thickness 10 times the penetration depth of the indenter used

$$t \geq 10h \quad (5-1-2)$$

From (5-1-1) und (5-1-2) results

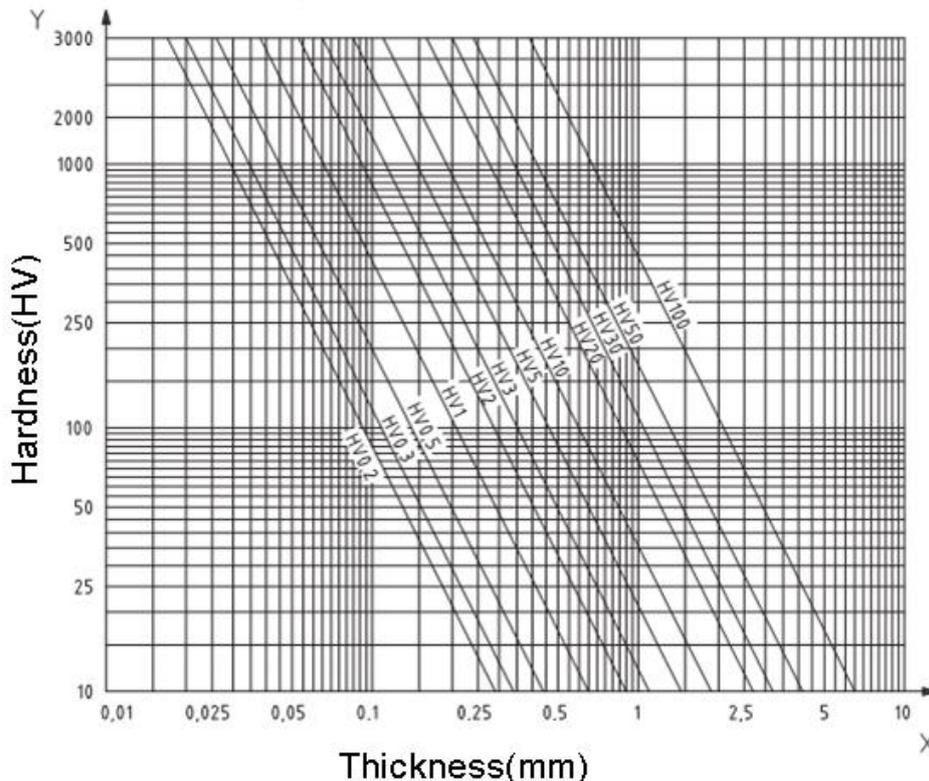
$$\text{Minimum thickness } t \approx 0,62\sqrt{\frac{F}{HV}} \quad (5-1-3) \quad t: \text{mm; Test load } F: \text{N}$$

Formula 5-1-3 gives the following minimum thickness values (Table No. 5-1-0)

Determined hardness value (HV) with two different sensors with required minimum thickness:

	HO-M	HO-1K	HO-2K	HO-5K	HO-10K
800HV	30um	69um	100um	150um	220um
600HV	49um	79um	110um	180um	250um
300HV	65um	112um	160um	250um	350um

Material thickness of the test object, test load and hardness value (HV 0.2 up to HV 100)



Important!

According to the ultrasonic contact impedance method (UCI method), the sensor must come into contact with the test piece, then it starts to oscillate and the hardness value is determined. The minimum thickness at the Vickers hardness value can therefore only be used for test pieces with large surfaces.

From the above it is clear that all sensors require a layer or surface coating up to 1 mm thick. For small specimens, if the thickness is less than 15 mm, the hardness value is changed by the resonance.

Most vibrations are elastic vibrations. There are measures to limit them: for this purpose, place the test specimen on a large part of metal, rubber and oil can dam the elastic waves. **It is recommended that the measured thickness is at least 2 to 3 mm. The dimensions of the test piece should be at least 5x5 mm.**

Roughness of the test piece surface

The applied test load (i.e. the selected UCI sensor) must be designed not only for the specific application, but also for surface quality and roughness of the fabric. For smooth and homogeneous surfaces a low test load can be applied, for surfaces of greater roughness and coarseness the highest possible test load should be applied. However, the surface must be free of impurities (oil, dust, etc.) and rust.

The surface roughness must not exceed 30% of the penetration depth (Ra # 0.33 h):

Sensor type	HO-1K	HO-2K	HO-5K	HO-10K	HO-M
Roughness of the test object	Ra < 2,5um	Ra < 5um	Ra < 10um	Ra < 15um	Ra < 2,0um

Weight of the test specimen and measuring method:

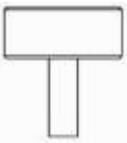
Weight	>300 g	100~300 g	10~100g
Auxiliary element	Direct testing	Support rings	Connector

Deep or curved specimens with a curved surface may be tested on both the convex and concave surfaces, provided that the radius of curvature of the specimen is designed for the particular sensor and for the sensor connection to ensure that the sensor is in a vertical position.

For test pieces with deep slit openings, the sensor should be equipped with a deep-hole

protective cover must be used.

Table:

			
Flat support ring	Small cylinder support ring	Large cylinder support ring	Deep hole Protective cover

5.2 Measurement

5.2.1 Preparation of the device

Connect the angular end of the 8-pin plug of the data cable to the 8-pin socket of the sensor, match it to the groove and insert it carefully. A "click" sound confirms correct installation (see Figure 5-2-1-1). Connect the other end of the 8-pin data cable to the 8-pin female connector on the main unit of the ultrasonic hardness tester. Align with

the groove and insert carefully. A "click" sound will confirm that the unit is correctly installed.

Switch on the power supply, then check whether the standard sensor is visible on the LCD display in the 2nd line. If so, the sensor is correctly connected (manual sensor is displayed as HO-A01 or HO-A02). If a red "error message" appears, the sensor is connected incorrectly.

Before formally measuring the test specimen, check whether the instrument is matched to a special hardness reference block to verify any permissible deviation and repeatability of the measurement number/measured value (in the vertical position, press the sensor against the hardness reference block 5 times. A mean value is given which can be compared with the number on the hardness comparison block). Check whether the deviation and repeatability have exceeded the standards. If this is the case, the user can perform the calibration himself.

The HO device supports hand-held and motorized sensors, available in the SAUTER range, as long as stock last . The sensor type must be set before measurement.



Single mode

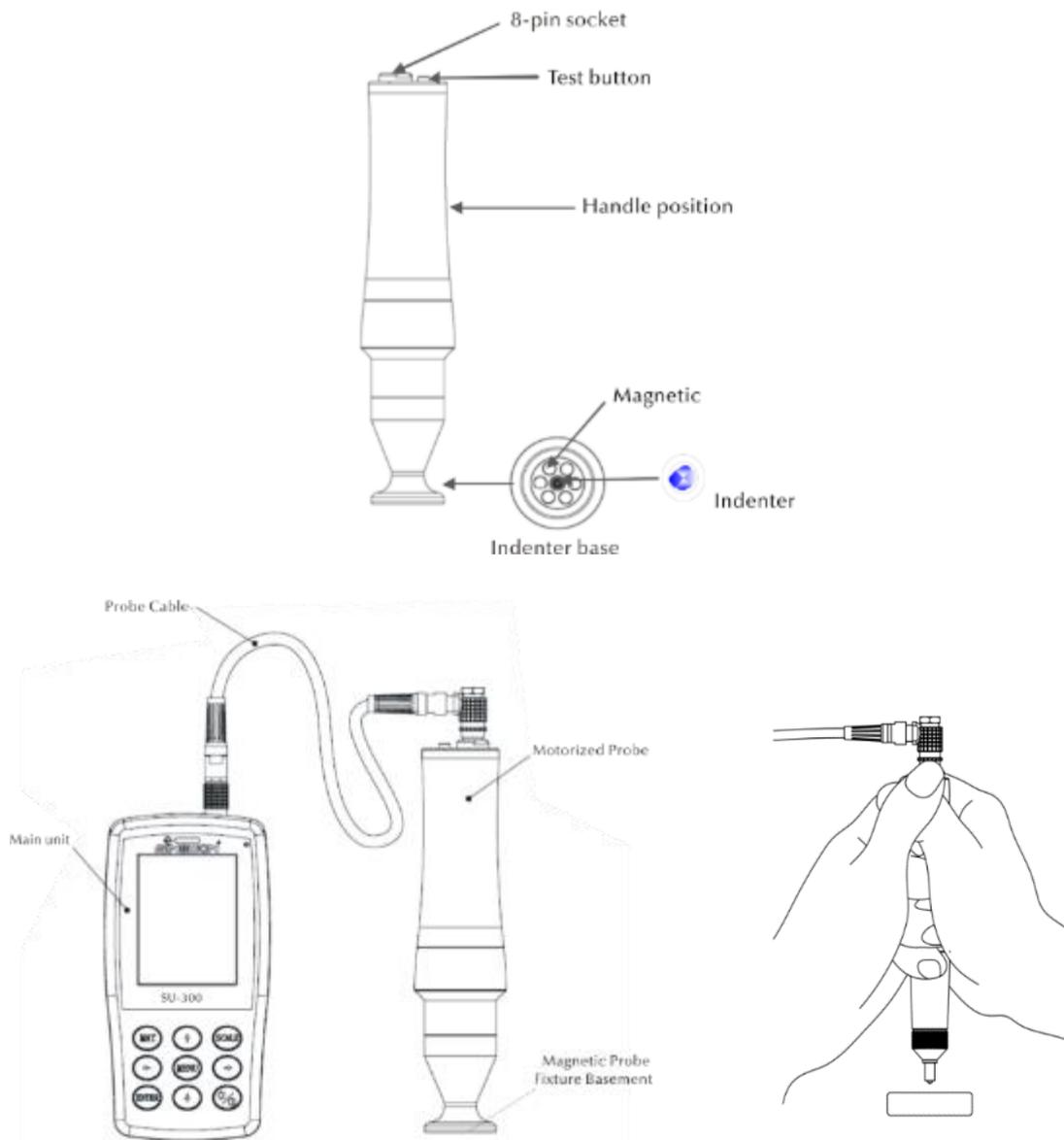


Group mode



Error mask

5.2.2 Measurement with a motorized sensor



Select [Menu]-[Select probe]-[Motorized probe]- Select [Motorized probe].

After correct connection, place the sensor vertically on the test sample, then press the red button on the top of the sensor. An AUTO test is performed. After 2s, the main unit triggers an acoustic signal, which means that the test load has expired. The LCD display shows a changed status message "Loading..." - "Test..." - "Unloading...". After discharging, the test results are shown on the display.

Group mode: After the acoustic signal, the display shows the message "Ready", which means that the 1st measurement has been completed. Then repeat the measurement about 4 times. After the 5th measurement, two acoustic signals are triggered by the main unit and the display shows the message "Complete" in the upper left corner, which means that 5 measurements have been performed in this group. For the display of the possible results, see section 5.2.2 (005-000 is the average value for the test group).

The result of the measurement is stored under [Memory settings]→ [Data overview], where all test results can be selected using the arrow keys [↑] and [↓].

Single test mode: After the acoustic signal, the display shows the message "Ready", which means that the first measurement has been completed. The test result is stored in [Memory Settings]→ [Data Overview], where all test results can be selected using the arrow keys [↑] and [↓].

Important! For non-magnetic test pieces, hold the sensor firmly to increase the measuring accuracy.

Sensor type	HO 3M	HO 5M	HO 8M	HO 10M
Selection	Optional			
Test force	3N	5N	8N	10N
Diameter	46mm			
Length	197,5mm			
Oscillating mandrel diameter	3.7mm			
Minimum weight of the test object	0,3kg			
minimum material thickness	2mm			

5.2.3 Measurement with a hand-held sensor

Select [Menu]-[Select probe]-[Manual probe]- Select [Manual probe].

Holding the central part of the sensor, hold the sensor **perpendicular** to the surface of the test piece, then press the sensor evenly against the test piece in a vertical position until its protective cover touches the surface of the test piece. Hold the sensor in this position for 2 seconds until an acoustic signal is triggered. The signal means that the sensor and the test sample are decoupled. The measured value is shown on the display.

Group mode: After the acoustic signal, the display shows the message "Ready", which means that the 1st measurement has been completed. Then repeat the measurement 4 times. After the 5th measurement, two acoustic signals are triggered by the main unit and the display shows the message "Complete" in the upper left corner, which means that 5 measurements have been performed in this group. For the results, see section 5.2.2 (005-000 is the average value for the test group).

The result of the measurement is stored under [Memory settings]→ [Data overview], where all test results can be selected using the arrow keys [↑] and [↓].

Single test mode: After the acoustic signal, the display shows the message "Ready", which means that the 1st measurement has been completed. The test result is stored in [Memory Settings] → [Data Summary], where all test results can be selected using the arrow keys [↑] and [↓].

In the event of incorrect operation, the display shows the message "Error", see section 5.2.2

If the measuring range is undershot or exceeded, the display shows the symbol "↓" or "↑".

5.2.4 reading of results

The ultrasonic hardness tester according to the UCI method supports the following hardness scales: HRC, HV, HBS, HBW, HK, HRA, HRD, HR15N, HR30N, HR45N, HS, HRF, HR15T, HR30T, HR45T, HRB.

The numerical hardness value is followed by the symbol of the measurement UCI, HV (UCI) in the Vickers method, with a numerical indication for the designation of the test load in kgf. Example: 446 HV(UCI) 10 = hardness UCI is 466 with a test load of 10 kgf. If numerical values are represented with the aid of another scale, they are stored analogously as 45 HRC(UCI) or 220 HBW (UCI) thanks to calibration.

6 Special precautions

Before changing the sensor, switch off the power supply to the main unit, then: hold the sensor perpendicular to the surface of the test sample during measurement.

If the device is not used for a longer period of time, it must be recharged before being used again.

To cancel the special programming of a measurement, press the [MENU] key. To restart the measurement, press [ENTER].

If the sensor or the main unit is connected with a data cable, proceed as described above, adjust to the groove and then insert carefully. Otherwise the inner pin of the plug connected to the data cable can be bent and damaged. One test consists of 5 measurements on an area of approx. 645 mm². If the material to be tested is judged to be non-homogeneous, several measurements are required in one test.

Due to the fact that the ultrasonic hardness tester is a precision instrument, special attention must be paid to its safe handling during measurement. No part of the ultrasonic hardness tester may be exposed to shock loads. The fact whether the handling is correct or not is decisive for the accuracy of the measurement. If handling is correct, use both hands to hold the sensor and apply a vertical load to the test piece. To avoid a change in pressure, it must be ensured that the hands do not slip or shake. To avoid scratching the test specimen by the sensor as well as the sensor itself, the sensor must be lifted vertically after each measurement.

Temperature: the temperature of the test specimen can be decisive for the results of the hardness measurement according to the UCI method. However, if the sensor is exposed to a higher temperature only for the duration of the measurement, measurements at a temperature higher than room temperature are possible without affecting the performance of the ultrasonic hardness tester.

7 Handling

7.1 Masks and buttons

7.1.1 Menu masks



The menu masks contain status display, model info, calibration data, test display, result list and info list for test results as shown in Fig. 6-3.

* Status display: model, buzzer, system time, battery.

* Sensor: Name of the calibration group; MP:10N stands for the motorized sensor with a test force of 10 N (motorized sensors are not supported). If a hand-held sensor is connected, it is automatically displayed.

* Test info: the test status "Load", "Test", "Unload", "Ready", "Complete" is displayed.

* Test standard: ASTM, DIN 18265, GB/T 1172.

* Test results: the hardness value is displayed

* Hardness conversion: results of the hardness conversion are displayed

* Test time: in group mode the test time angezeigt : 005-000 (it stands for average value based on 5 measurements)

* Statistics: MAX and MIN values and average values are displayed.

7.1.2 Control buttons

MAT:



- Start of the calibration process in the calibration mask; selection of the calibration group in the calibration mask; abbreviation for the calibration mask in the main mask

UP:



- Move up or increase

UNIT:



- Changing the measuring unit of the display unit

LEFT:



- Movement to the left, adjusting the display brightness - darker

MENU:



- Confirmation in the main mask and in the calibration mask; in other menu masks and serves to return to the previous mask

RIGHT:



- Movement to the right, adjusting the display brightness - brighter

ENTER:



- Start of the measurement in the main mask; serves as confirmation in other masks

DOWN:



- Movement downwards or lowering

SLEEP:



- Press and hold - Switch to sleep mode

7.2 Test settings

Press the [MENU] keys and select the [Test Setup] sub-category to display the Test Settings screen.

Hardness scale: Select the [Hardness scale] tab to select the desired hardness scale. Press [ENTER] to confirm.

The operator can show or hide usually applied hardness scales according to his wishes.

Test number: Select the [Measurement No.] tab and use the [←] and [↓] keys to shorten the test time or the [→] and [↑] keys to extend the test time, then press the [ENTER] key to confirm and the [MENU] key to exit the screen.

Fault Tolerance: Select the [Fault Tolerance] tab to set the permissible deviation in single mode, press the [↑] or [↓] key to select MAX/MIN, then press the [ENTER] key to enter the setting screen and set the MAX and MIN values. If the test result exceeds the permissible range, a red "failed" indicator will appear. Otherwise, the message "pass" appears. The above only applies to the single mode.

Batch mode: Select the [Batch Mode] tab and press ON to activate the single mode or OFF to activate the average mode, press [ENTER] to confirm.

When the average value is calculated, the largest and the smallest of the 5 measurements is eliminated, leaving 3 measurements. These three are added together and the result is divided by 3. The resulting value is the mean value

Test Time: Select the [Test Time] tab and use [←] [↓] [→] [↑] to set the desired test time, then press [ENTER] to confirm and [MENU] to exit the screen. The lower the value, the higher the speed. The general principle is to set a higher value for a high test load.

Conversion standard: 3 standards are applied:

- 1) ASTM E 140-2005;
- 2) DIN 18265;
- 3) AR/T1172-1999;

7.3 System settings

Press the [MENU] keys and select the [Settings] submenu to display the Test Settings screen.

Sound: Select the [Key Tone] tab and use the [↑] and [↓] keys to select the desired ON/OFF option, setting "OFF" will turn off any sound.

Battery Management: Select the [Battery Management] tab and select the desired ON/OFF option with the [↑] [↓] keys. With the ON option, if no operation is made within 5 minutes, the instrument will be automatically switched off (as during charging). If OFF is selected, the instrument will always remain in standby mode until the battery is discharged (the instrument must be switched off manually).

Backlight: use the [←] and [→] keys to set the desired light intensity.

Important! The light intensity can also be adjusted in other masks with the keys [←] [→].

Set the date and time: Select the [Date] tab and set the date and time with [↑] [↓] or [←] [→].

Language versions: Select the [Language] tab and choose the desired language version with [↑] [↓] (German, English, French, Italian, Spanish). Press the [MENU] key to cancel the operation.

Reset to the factory settings: Select the [Factory settings] tab and enter the password "888888". Press the [MENU] key to cancel the operation.

Resetting to the factory defaults deletes the calibration information, inspection settings and system settings. This option should only be used in special cases.

7.4 Memory settings

Press the [MENU] keys and select the [Save Settings] submenu to display the Memory Settings screen.

Auto Save: Select the [Auto Save] section and select ON/OFF with the [↑] [↓] keys; with the ON option, measured data are automatically saved.

Result display: The [Display Results] tab can be accessed in two ways:

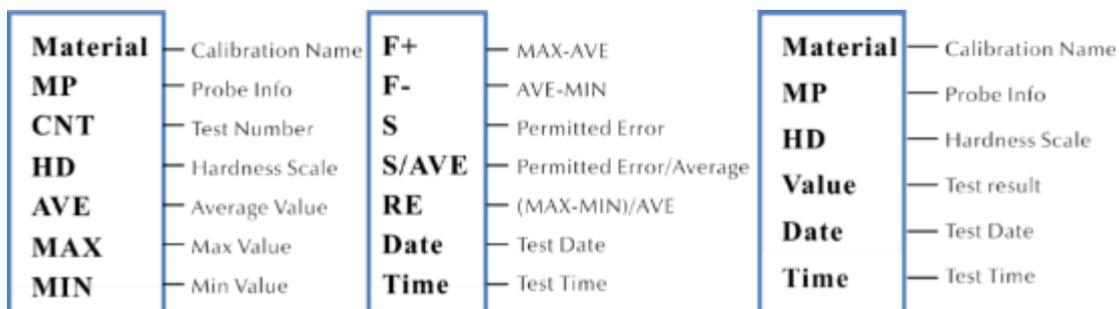
- in the main mask press the keys [↑] or [↓] ;
- Press the [MENU] key and select the [Save Settings] tab, then select the [View Results] tab.

The following procedure:

- 1) Change the individual measured values with the keys [↑] [↓].
- 2) Press the [MAT] key to search for a position.
- 3) Press the [ENTER] key to view detailed test results, 3 pages in total, from left to right. Use the [←] [→] keys to move between the pages.

Important! Sensor : "MP"= motorized sensor

"HP"= hand-held sensor



PC Connected: Select the [Connected] tab and use [↑] [↓] to switch the mode on or off. The test results are sent to the computer via the hyperterminals.

Partial deletion: Select the [Delete Parts] tab. To delete selected test results, press the [ENTER] key to select records to delete, then press the [UNIT] key to delete them.

Complete deletion: Select the [Delete All] tab and press [ENTER] to access the print screen; a dialog box will appear. Press [ENTER] to delete all the test results.

7.5 Print settings

Press the [MENU] keys and select the [Print Settings] submenu to display the screen for transmitting measured values.

Printing devices: Select the [Bluetooth/USB] tab and press [ENTER] to display the print screen and select the desired print option: Bluetooth or USB

Bluetooth settings: Select the [Bluetooth] tab to search for a wireless device, press [ENTER] to select the desired Bluetooth device, then select the confirmation and press again to establish a connection.

Print parts: Select the [Print Parts] tab to open the screen for printing selected results, and then press [ENTER] to select desired measurements for printing. Press the [UNIT] key to print data sets.

Print everything: Select the [Print All] tab and press [ENTER] to display the print screen, then select the "Send to print" option.

The print function is used to send test results to the computer by means of the hyper terminal.

7.6 Calibration

Press the [MENU] key and select [Calibration Option] to display the Memory Settings screen.

Perform calibration. Select the [Perform Calibration] tab and use the [↑] keys to select [↓], then press the [MAT] key to confirm (calibration must be performed before measurement). Then press the [↑] [↓] keys, select the calibration group and press the [UNIT] key to delete calibration sets.

Important! Press the [MAT] key in the main screen to open the calibration screen.

Reasons for carrying out the calibration:

- (a) If, when testing the test apparatus, the readings are found to be stable but deviate from the nominal values on hardness reference blocks
- b) After a long period of non-use (of more than 3 months)
- c) After intensive use (over 200,000 measurements with the ultrasonic sensor)
- d) In the event of a change in essential operating conditions (ambient temperature, humidity, etc.)

7.6.1 Calibration settings

Preparation for calibration

On the main screen, press the [MENU] key to enter the calibration setting screen, select the desired calibration option and then press the [ENTER] key to enter the screen. Then press [ENTER] to display the [Calibrate through] screen.

Editing the calibration name: Press the [↑] [↓] keys, select the "Material" option, the default name is "Calibration". Red marking indicates that the selection has already been made. Then press [ENTER] to display the editing screen and press [MAT] to confirm or [UNIT] to cancel.] Then press [ENTER] to return to the editing screen. The calibration name has been entered.

Entering Nominal values : as shown in Figure 7-9-3, press the [UNIT] key to select the desired scale. Then press the [↑] [↓] keys to select "Normal". Then enter the nominal value according to the hardness reference block.

The nominal value can be entered before or after calibration.

Procedure for Kalibrierung : After the above measures, press the [MAT] key to call up the test mask (es. The message "Please perform 5 measurements to determine the average value" is displayed...) . Make sure that the sensor touches the hardness reference plate vertically (for the motorized sensor, press the red button). In the case of the hand-held sensor, hold it firmly so that it touches the hardness reference block.

Procedure for the calibration of the hand-held sensor:

Hold the sensor and slowly lower it vertically onto the hardness comparison plate when the display shows 'Test - Ready'. If the sensor is pressed during testing when an acoustic signal is triggered, this means that the discharge process has been initiated. The sensor must then not be moved until the display shows the message 'Ready'. This means that the test process has been completed. The result is displayed under Average value. Then the measurement must be repeated 4 times at different points. As soon as two acoustic signals "di..." are heard, the display shows the message that the calibration has been completed.

Important! After 5 measurements have been performed, the results are not yet saved. Therefore, you should not press the [SCALE] key. This key is used to select the hardness scale. After pressing this key, the setting of the hardness scale and the calibration is deleted. It is therefore important to confirm the hardness scale before calibration.

Group settings when saving the calibration

If the values "Material" and "Normal" are entered before calibration, a dialog box "Is it ok about calibration? This is saved with the confirmation key.

If the nominal value was not entered before the calibration, it will be inserted automatically after 5 measurements, just like the average value. The display shows a dialog box "then input the normal to finish calibration". Then enter the nominal value according to the hardness reference block. If the mean value deviates slightly from the nominal value and does not exceed the permissible error range, the automatic nominal value can be used. Then press the [MAT] key to confirm.

After saving the calibration, this calibration is listed in the calibration option. The following calibration will be based on this calibration.

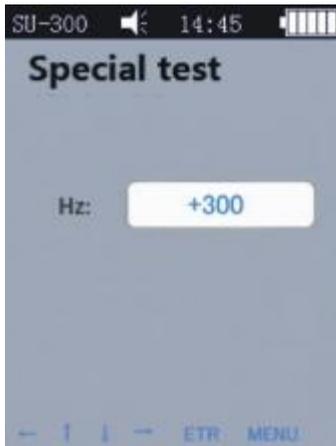
These measures must be carried out by a highly qualified technician and the measurement error must meet the requirements of DIN50159 when testing with the hardness reference block (for details see section 7.10).

Canceling Kalibrierung : To cancel calibration, press the [MAT] key. The "Exit Correction ? " window appears on the screen. First confirm the message and then press [ETR]. This cancels the calibration.

Remarks:

- In the calibration screen, first press the [MAT] key, then place the sensor vertically on the hardness comparison plate, and if there is no reaction, leave the sensor in place and press the [MAT] key again. Then perform 6 measurements.
- If the symbol ↑ appears on the display, it means that the hardness value exceeds the maximum value on the hardness scale. If the symbol ↓ appears on the display, it means that the hardness value is below the selected hardness scale.

7.6.2 Optional settings



In practical testing, some materials may exceed the hardness range. You can then adjust the compensation of the frequency (-1000 Hz ~ +1000 Hz) to perform the measurement. To make the adjustment, press the arrow keys, then press [ETR] to perform the machining.

After adjusting the frequency, the calibration mask must be called up again and a new calibration group created. Then the hardness value can be checked.

This calibration can only be used once (for certain materials).

7.7 Permissible deviation and repeatability

DIN50159 Permissible deviation and repeatability (%)				
Hardness scale	<250HV	250~500 HV	500~800 HV	>800HV
HV0.1	6	7	8	9
HV0.3	6	7	8	9
HV0.8	5	5	6	7
HV1	5	5	6	7
HV5	5	5	5	5
HV10	5	5	5	5

7.8 Battery

A rechargeable battery is mounted in the main unit (4.2 V, 4800 mAh). When the battery is empty, a symbol appears in the upper right corner to prompt you to charge the battery (). Connect the mains adapter to the socket on the unit and the plug to the 220 V mains. The full charging process takes 8 hours, but not less than 4 hours per charging process. When the charging process is complete, a symbol appears in the upper right-hand corner of the main screen to prompt you to disconnect the power supply ().

7.9 Data transmission

Download the CH340 driver (USB driver) to your computer. Connect the device to the computer with a data cable. Use the 4-pin female connector of the device and the computer host.

In the Win XP operating system, select Start -> program -> accessory -> communication -> hyper terminal, then create a new connection and assign a name to it. Select the port COM and set the parameter baud rate to 9600. No other settings need to be changed.

In the operating system win7 the option "hyper terminal" is not available. After installing such an option, please note that the parameter baud rate must be set to 9600. No other settings need to be changed.

A) Call up the screen Print settings - Print selected results / Print all results, then the data can be sent to the computer.

B) If the ONLINE mode is ON and the connection "hyper terminal" is established, each test result is immediately sent to the computer.

8 Maintenance

9.1 Before and after use, the head of the sensor shall be cleaned with a non-woven cloth lightly soaked in alcohol. After the measurements, clean the display unit and the surface of the sensor from dirt with a clean cloth.

9.2 After a longer period of non-use, the battery should be recharged.

9.3 If the instrument is not in use, the sensor must be provided with a protective cover. The diamond penetrator is hard and sharp and can easily be damaged by impact. The display unit and accessories must be stored in the transport case.

9 Warranty

10.1 The warranty for the display unit is 2 years and covers only qualitative defects. The accessories are excluded from the warranty protection. Please check the packing list of the unit.

10.2 If the unit needs to be repaired, please enclose a copy of the invoice with the unit.

10 Storage/Transport

The device must be stored in a place free from vibration, corrosion, moisture and dust. Standard temperature and humidity must be maintained. Before transporting the device, place it in the appropriate transport case to avoid possible damage

Note:

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

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