Instruction Manual
Mobile digital Leeb Impact
Hardness Tester

SAUTER HMO

Version 1.4
01/2018
GB

PROFESSIONAL MEASURING

HMO-BA-e-1814

SAUTER HMO
Version 1.4 01/2018
Instruction Manual
Mobile digital Leeb Impact Hardness Tester

Thank you for buying this digital SAUTER Leeb impact hardness tester. We hope you are pleased with your high quality instrument and with its big functional range.

If you have any queries, wishes or helpful suggestions, do not hesitate to call our service number.

Summarize:

1   Introduction

1.1   Principle

The tester measuring principle is physically a rather simple one for this dynamic hardness tester.

An impact body with a hard metal test tip is propelled by a spring force against the surface of the test piece. Surface deformation takes place, when the impact body hits the test surface, which will result in a loss of kinetic energy.

This energy loss is calculated by velocity measurements, when the impact body is at a precise distance from the surface for both, the impact and rebound phase of the test.

The permanent magnet in the impact body generates an induction voltage in the single coil of the impact device. The voltage of the signal is proportional to the velocity of the impact body, and signal processing by the electronics provides the hardness reading for display and storage.
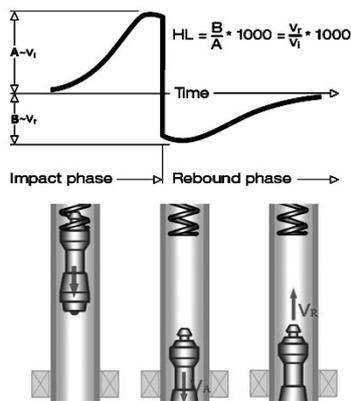

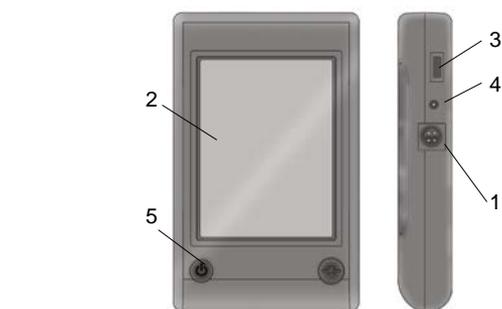$$HL = \frac{B}{A} * 1000 = \frac{V_r}{V_i} * 1000$$

Fig.1-1

1.2   Structure

1.2.1   Display Unit

1. Sensor jack 2. LCD screen 3. Mini USB jack

4. Charger jack 5.Power Button

Fig 1.2

1. Impact Body
2. Support Ring
3. Coil
4. Cable
5. Catch Chuck
6. Loading Tube
7. Release Button

Fig.1-3

Impact Device (type D)

The display unit can be connected to almost every type of Leeb impact device. It can identify them automatically.

D type (standard sensor) is shown in Fig.1-3,please see the others in appendix (chapter 5) for further description.

1.2.2 Display

The hardness tester has a big LCD with touchpad. (Fig. 1-4)
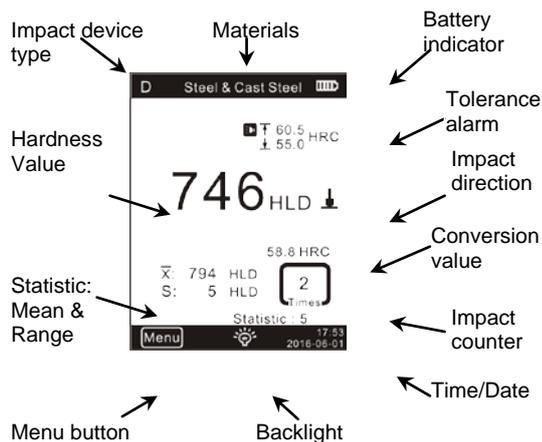

Fig.1-4

1. <u>Impact device type:</u> it can be identified automatically or be setup.
2. <u>Materials:</u> The material of test piece.
3. <u>Battery indicator</u>
4. <u>Tolerance alarm</u>
5. <u>Conversion value</u>
   NOTE: When "---" is shown, it means the conversion is out of range.
6. <u>Impact direction</u>
7. <u>Hardness value</u>: Measured hardness value L (Leeb).
8. <u>Statistic values:</u> X: Mean value.   S: The range.
9. <u>Statistic times:</u> The impact times in a statistic data group
10. <u>Impact times counter</u>: Finished times of impacts
11. <u>Backlight:</u> Touch it tol turn on or off the backlight.
12. <u>Menu:</u> Touch it to enter the menu setup.
13. <u>Date / Time:</u> real time and date is displayed

1.3 Specifications

- HL Display Range: 　　　　　　0～999HLD
- Accuracy: 　　　　　　　　　　± 6 HL
- Displayer: 　　　　　　　　　　big LCD, backlight, touch screen
- Internal Data Storage: 　　　　500 measured value
- Resolution: 　　　　　　　　　1 (for HL, HV, HB, HSD, MPa); 0.1 (for HRC,HRB)
- Battery: 　　　　　　　　　　　Rechargeable Ni-MH battery
- Operating Temperature: 　　　　0°C~+50°C (32°F~122°F)

• Storage Temperature: -10°C~+60°C (14°F~140°F)
• Dimension: 130 x 87 x 28 mm
• Weight: 240g

1.4 Application Range

• Good for all metals, ideal for production level testing
• Best suited for on-site testing of heavy, big or already installed parts
• Handy for difficult to access or confined test locations
• Automatic compensation for impact direction
• Excellent for material selection and acceptance tests
• Easy to use and accurate on curved test surfaces (R > 10 mm)
• Metal production & processing, Automotive & transportation, Machinery & power plants, Petro-chemical, refineries, Aerospace & shipyard, Metal constructions, Testing services & laboratories

2 Test

2.1 Instrument preparation

Connecting

Use the signal cable to connect between display unit and sensor. (Fig. 2-1)

Charge the Battery

The tester should be charged before using it for the first time.

Turn on the power

Press⏻ to switch on the instrument.

Calibrate the Instrument

You should calibrate the tester using the test block for the first time.
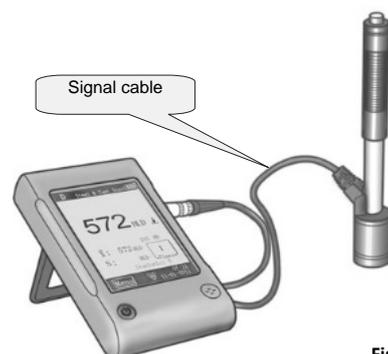(See 4.3 Calibration)

Signal cable

Fig 2-1

2.2 Specimen preparation

Inappropriate specimen will result in erroneous measurement results. Necessary processing and preparation should be carried out according to the original conditions of the specimen. For a preparation of specimen, following basic requirements should be fulfilled:
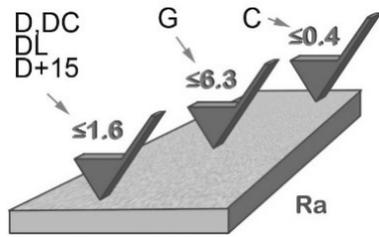
Fig.2-2

In the process of the test surface preparation, influences of cold and heat should be avoided on the specimen's surface.

Test surface should be flat with metallic luster, there may be no oxid layer and other kinds of impurities on it.

The roughness of test surface

The specimen must be of sufficient mass and rigidity. If insufficient, the displacement or move will be produced in the process of impact, it can cause large errors.

Generally said: if the mass of the specimen is bigger than or equal to 5kg, tests can be carried out directly

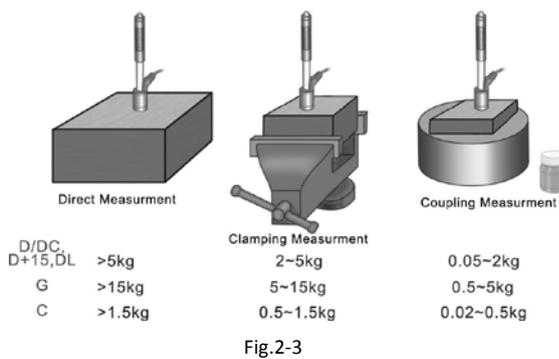| D/DC, D+15,DL	Direct Measurment	Clamping Measurment	Coupling Measurment
D/DC, D+15,DL	>5kg	2~5kg	0.05~2kg
G	>15kg	5~15kg	0.5~5kg
C	>1.5kg	0.5~1.5kg	0.02~0.5kg

Fig.2-3

Thickness of specimen

The thickness of specimen and thickness of homogeneous layer
(or surface hardening layer) should be thick enough.

If the test surface is not flat, the radius of test area should be larger than 30 mm (50 mm for type G). If this is not given, you will have to mount an appropriate support ring.
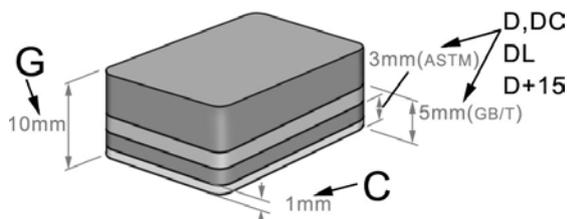The specimen should not be magnetic
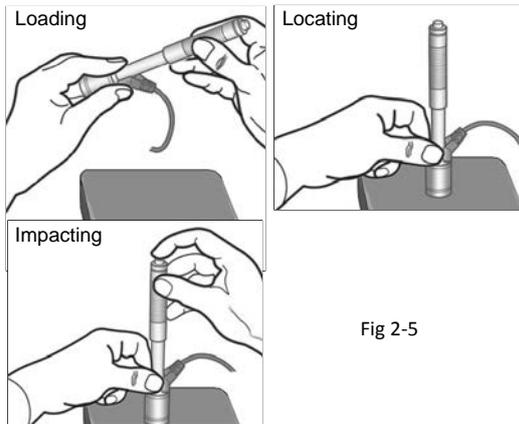

Fig.2-4

2.3 Testing procedure

Fig 2-5

Loading

Simply load the impact device by sliding the loading tube forward.

Locating

Then place and hold the impact device onto the surface of the specimen at the desired test point. Impact direction should be vertical to the surface of the specimen in a right angle.

Impacting (Measuring)

Trigger the impact by pressing the release button. The hardness value will be instantaneously displayed.

Reading the test result

Read out the test result from LCD at Fig. 1-4.

Annotation:

Generally,for each measurement location of a sample five tests have to be performed. The range (difference of maximum value and minimum value) values should be less than 15HL. The distance between any two impact point's should be ≥3 mm; the distance between an impact position and the edge of the sample should be ≥3 mm.

2.4 Browse

The tester can save hardness values, they can be browsed after testing. For this, enter the menus to select the browse mode, you wish to use (see **3.2.3** for details).
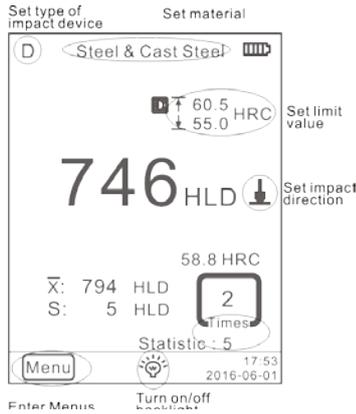

Fig 2-6

Fig 2-7

2.5 Print

Set type of impact device   Set material

(D) Steel & Cast Steel ▥

⊡ ↑ 60.5   HRC   Set limit value
   ↓ 55.0

746 HLD ⊕   Set impact direction

58.8 HRC

X̄: 794 HLD
S: 5 HLD   2
                 Times

Statistic : 5

(Menu)   ☼   17:53
                    2016-06-01

Enter Menus   Turn on/off backlight

The tester can be linked to a wireless printer to print a report.

Place the printer near the tester (within 2 meters), and turn its power on.

The test report is shown as Fig 2.7. The specific contents of the report can be setup in Items menu. (See 3.2.2)

3 Setup

The tester uses a touch pad, most of common settings can be arranged in the main interface directly. Some functions need to enter the menus to be set or operated.

3.1 Setting in main interface

The tester has been equipped with a touch pad, some common test parameters can be set on the main interface simply (Fig.3-1).

3.2 Setting in menus

Testing Setup	Material Group	System Setting	Custom Mate.
	Impact Direction		Auto Print ON/OFF
	Scale		Gross Error ON/OFF
	Limit Values		Key Sound ON/OFF
	Statistic		Alarm ON/OFF
	Workpiece		Language: EN
Printing Setup	Items		Date/Time
	Print Memory		Backlight Time
	Print All	Calibration	Test Calibration
Memory	Browse All		Touch Calibration
	Browse Selected	Information	
	Upload Data		
	Delete Selected		
	Delete All		

In main interface, touch Menu to enter the menus.
In menus:

touch "Δ" or "∇" to page up or page down
Touch **Back** in the upper menu, or return to main interface.
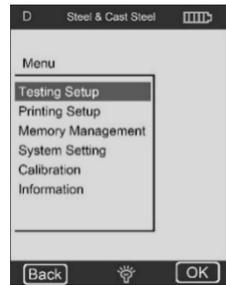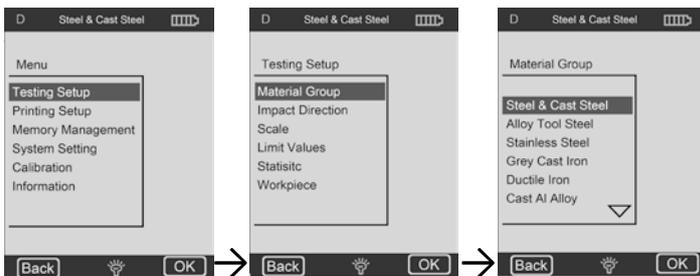

3.2.1 Testing Setup

Fig. 3-2

Material Group

Material Group is for selecting the materials you are going to test. It only determines the conversion to other hardness scales. If only Leeb hardness is needed, you may not care about it.

If the material is not listed in the menu, please refer to the material handbook to select a similar material type.
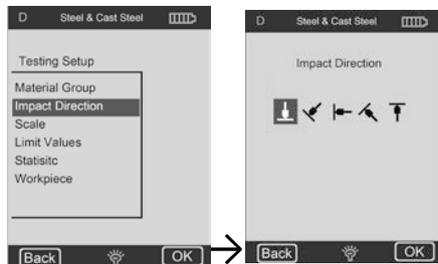
Impact Direction

Fig. 3-4

Scale
HB-Brinell hardness;
HRB- Rockwell scale B
HRC- Rockwell scale C;
HV- Vickers Hardness
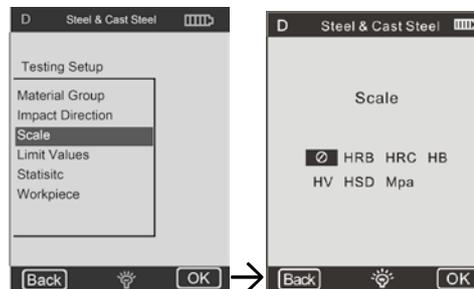**MPa**- Tensile strength.
⊘ Not conversion

Fig. 3-5

Annotation:
❶ Because there are different valid ranges between the different hardness scales, sometime the conversion cannot be performed, at this time, the symbol "---" will be displayed.

❷ The material group must be reset when you set to tensile strength (MPa).

❸ As we all know, the conversion is for reference only. To obtain precise conversions, you will have to do comparison tests.

Limit Values

The maximum limit and minimum limit of tolerance can be set. If once the hardness values measured are out of the range, the display unit will send out a prompt acoustic alarm.

You can set the maximum and minimum limit by using a digital keyboard(Fig.3-6)

Touch ⬆or ⬇can move to other item or other digit.

Fig. 3-6

Statistic

The tester has got an automatic statistic function.

Here you can set the statistic times to calculate the mean value($\bar{x}$) and range value(S).

Note:

❶ The statistic times value range is 1 ~ 99, when "1" is set, the system has no statistic process.

❷ When some items (Material Group etc) were reset, it will count from 0.

Fig. 3-7

6) Workpiece

Organize the test piece into groups in order for query, printing or data processing.
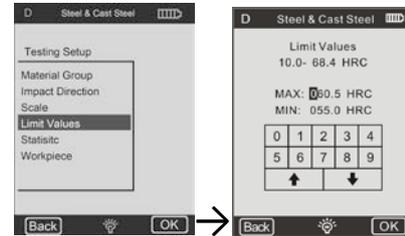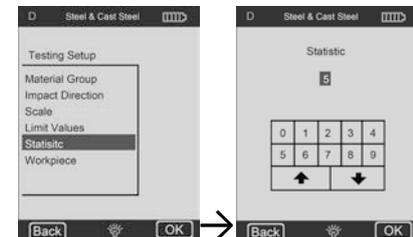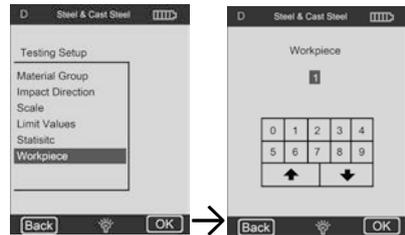
The range is 1-50, it can be saved.

Fig. 3-8

3.2.3 Printing Setup

Items To select item of test report printed.

Fig. 3-9

Fig. 3-10

Print Memory The range of data that you wish to print can be selected here.

Print All All measured data of the internnal memory can be printed.
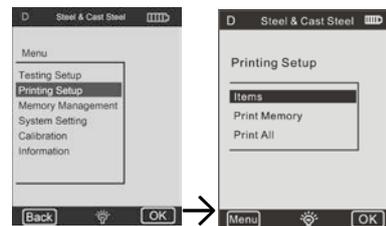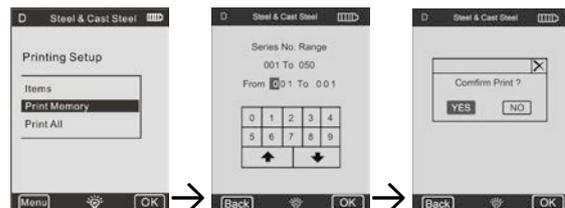

Fig. 3-11

3.2.4 Memory Management

You can browse and delete data in memory.
The test data saved in memory includes all test information. It can store up to 500 data. When it is full, the new data will squeeze the earliest data.

Therefore, it is recommended to save the data in time by other means(such as printing or uploading to PC) to prevent accidental loss of data.
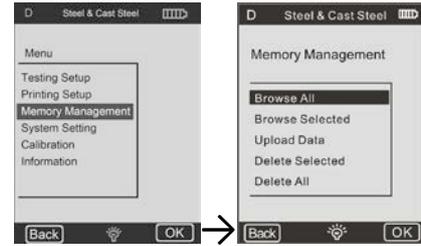

Fig. 3-12

Browse

This tester has provided three browser modes:
A To Z, Browse Z to A and **Browse Selected.**
Touch ⟲ or ⟳ to page up/down.
Touch ✕ to delete selected group of data.
Touch 🖶 to print selected group of data.
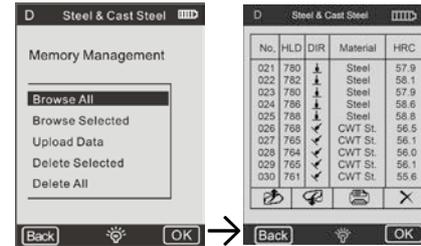Click OK to show the test time of selected group of data.

Fig. 3-13

Fig. 3-14

Delete

You can do a bulk deletion or delete all data in memory.
Deleting a single data in browse is recommended.
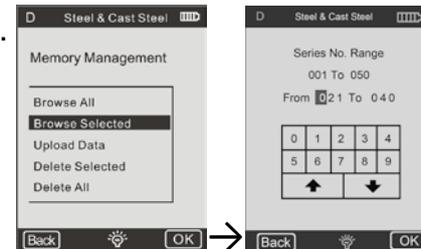
NOTE: If once the data is deleted, it will not be able to be recovered.
So be careful with the delete function.
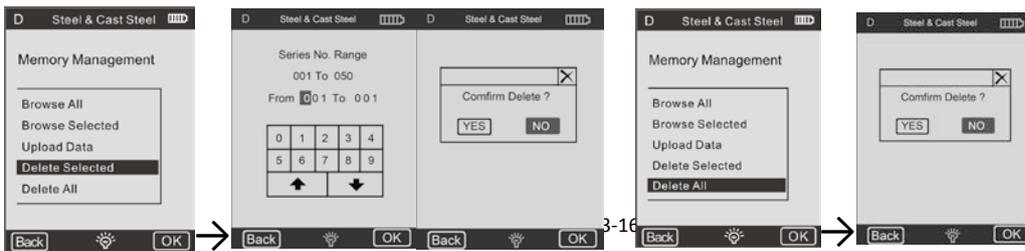

Fig. 3-15   Fig. 3-16

3) Upload Data

Data in memory can be loaded to PC.
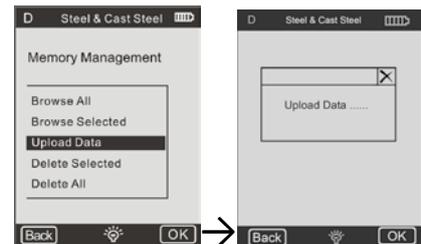Connect to PC, open the data acquisition software (Ehard).

Fig. 3-17

Enter **Upload Data**,
then you can receive or treat data on PC software side.

See manual of software for details.

3.2.5 System Setting

Custom Mate

You can customize your conversion tables, and select them in "Material A", "Material B" and "Material C".
You can select the scale and input the conversion table.(Fig.3-19)

Fig. 3-18

Auto Print

If Auto Print is set to "ON", when the test of a statistic group is finished, the tester will print the report automatically (the printer must be turned on).

Gross Error

When **Gross Error** is set to **ON**, gross errors will be shown out according to Grubbs criteria as the **Statistic Times Value** have been completed.
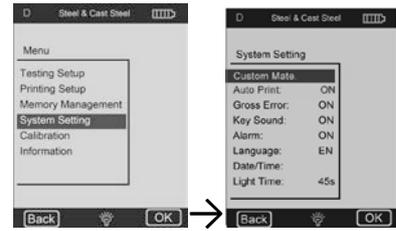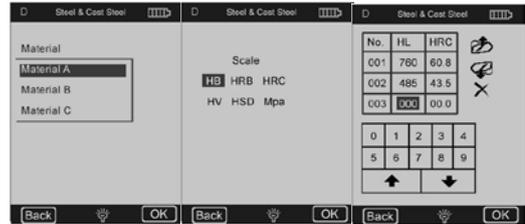

Fig. 3-19

4 Maintenance

4.1 Routine maintenance

General considerations

The impact device should avoid collision.Put it into the case after use. The impact body should be in release state when being stored.

The instrument may not be used close to strong magnetic fields. Any of the components may not get into contact withany kinds of oil or lubricant.

Clean the impact body

General every 1~2 thousands of times after test, the impact device tube and impact should be cleaned up.

Replacement impact ball

For long-term use, the impact ball may be worn, it should be replaced when test precisionseems to become affected.
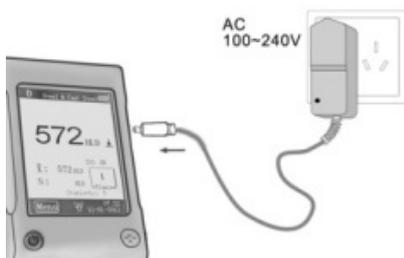
4.2 Charging

Fig. 4-2

4.3 Calibration

Test Calibration

Fig. 4-1

It is used to calibrate the tester, in order to reduce the error in future.

Enter Test Calibration. Select the type of impact device. Then choose a scale you want to calibrate in.

If HL is selected, you can enter calibration interface directly.

Fig. 4-3

If another scale is selected, the material type of the test piece used for a standard must be chosen.

Carry on 5 effective tests on the test block (when Alarm is set to ON, and the number of impact times is less than 5, touch OK and it will be displayed a prompt to show operating errors), the measured values will be displayed (you can delete the wrong data and return)
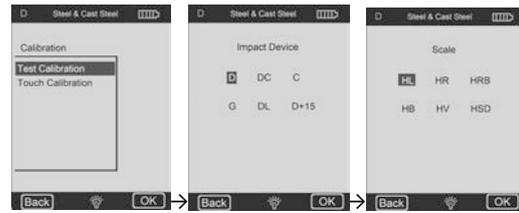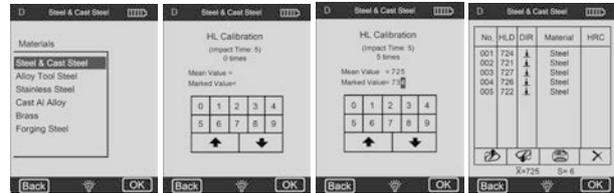
Touch Calibration

The **Touch Calibration** is actually used to calibrate the consistency between touch screen sensor and LCD coordinates.

If there is a deviation existing between the actual position of touch screen pressing contacts and the position of pressed figures displayed by LCD, users should conduct a Touch Calibration.

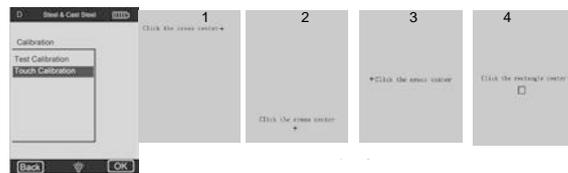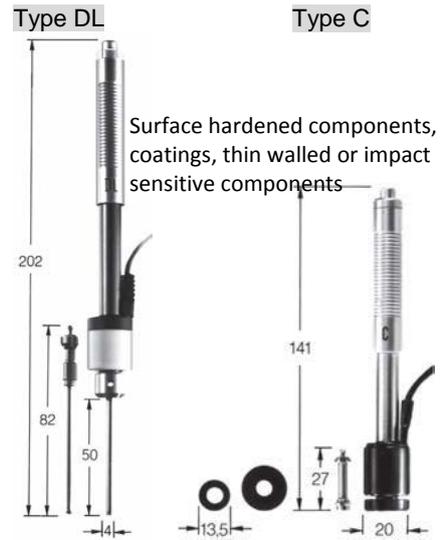Just click the center of cross line or a square frame according to the prompt shown.

Fig. 4-4

5   Appendix

A-1 Type of Impact Device

Type D

147

27

13,5   20

The basic type, it is suitable
for almost all applications.

Type DC

The shorted D, can measure
into the more narrow space.

86

27

13,5   20

Type DL

202

82

50

4

Type C

Surface hardened components,
coatings, thin walled or impact
sensitive components

141

27

13,5   20
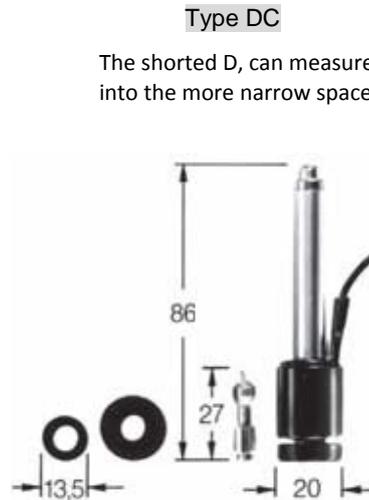
For in extremely confined
spaces or at the base of
grooves.

Type D+15

162

42

21

20

13⁵

11
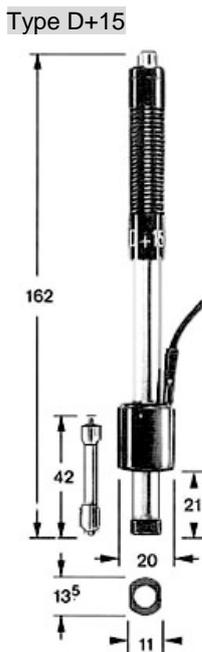
Particularly slim front section and
with measuring coil moved back.
Suit for hardness measurements is
in grooves and on recessed
surfaces.

Type G

Heavy castings and forgings
solid parts.

254

20

48,5

30

5.1 Scale Range

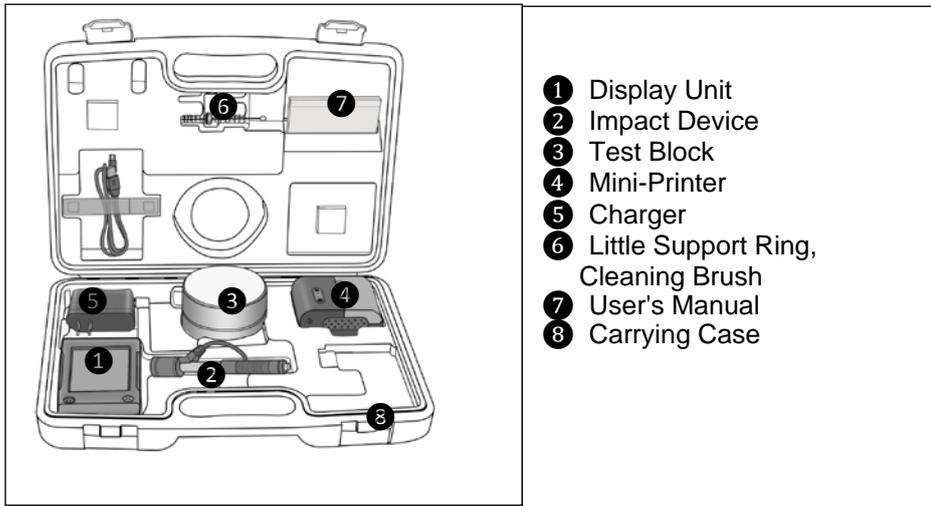| Type	Materials	HV	HB	HRC	HRB	HSD	Mpa
D,DC	Steel & Cast steel	81~955	81~654	20~68.4	38.4~99.5	32.5~99.5	375~639
	Alloy Tool Steel	80~898		20.4~67.1			375~2639
	Stainless Steel	85~802	85~655	19.6~62.4	46.5~101.7		740~1725
	Crey Cast Iron		63~336				
	Ductile Iron		140~387				
	Cast Al Alloy		19~164				
	Brass		40~173		23.8~84.6		
	Bronze		60~290		13.5~95.3		
	Copper		45~315				
	Forging Steel	83~976	142~651	19.8~68.5	59.6~99.6	26.4~99.5	

Steel	DL 560~950	C 350~960	D+15 481~850
HV	81~955	80~996	192~825
HB	81~654	80~683	188~654
HRC	20~68.4	20~69.5	20~64
HRB	38.4~99.5		
HSD	32.5~97.9	31.9~102	32.5~88.4

G	Steel	Grey Cast Iron	Ductile Iron
HLG	300~750	340~600	340~600
HB	90~646	92~326	127~364
HRB	47.7~99.9		

5.2 Packing List

1. Display Unit
2. Impact Device
3. Test Block
4. Mini-Printer
5. Charger
6. Little Support Ring, Cleaning Brush
7. User's Manual
8. Carrying Case

Annotation:

To have a look at the CE Declaration of Conformity, please click onto the following link: https://www.kern-sohn.com/shop/de/DOWNLOADS/