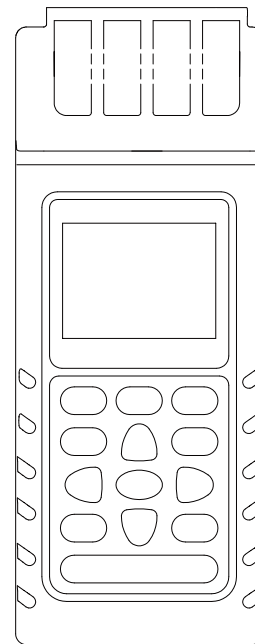


Leeb Hardness Tester



User's Manual



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User Instruction

Please read this instruction intently before your first utilization.

- 1> The warranty service should be paid for any malfunction beyond the warranty time.
- 2> Except the tester, "Special configurations" which are shaped sensor, lengthened wire, and specialized software should be paid for according to charging standards.
- 3> The warranty service is not available for any of those situations that includes:
disassembling the product by yourself; transportation damage; improperly keeping;
wrong operation and altering warranty card.
- 4> Operate it according to the manual, and please stop operating if there is any abnormality, and contact us as soon as possible.

**Professional casts quality and
good quality gets reputation**

Configurations

	NO.	Names	Quantity	Remark
Standard configuration	1	the tester	1pc	
	2	D-type impact device	1pc	
	3	standardized Leeb hardness block	1pc	
	4	nylon brush A	1pc	
	5	little back-up ring	1pc	
	6	USB data wire	1pc	
	7	manual	1pc	
	8	container	1pc	
	9	printing paper	1pc	
	10	disk	1pc	
Optional configuration	11	nylon brush B		for G-type impact device
	12	shaped impact device and back-up ring		refer to attached table 3 and 4
	13	data transmission instruments and analysis software disk	1pc	used on computer
	14	metal Leeb hardness testing means	1pc	GB/T 17394.1-2014

Chart 1

1. Summary

1.1 Product feature

- Test hardness according to leeb hardness testing principle. Available for many kinds of metal material;
- Switch between six intensity(HL, HRB, HRC, HB, HV, HS);
- USB port, transport datum handily and quickly;
- Large screen display 320*240 fro explicit, abundant readings;
- The screen with adjustable back-light is convenient for any background;
- Integrate the device into printer, printing paper can de done on site;
- Work life is no less than 160 hours with lithium batteries. Long life, environment protection, and functions of dormancy, auto-off for power save;
- With charging circuit, and distinct under-voltage and low power display;
- Support "steel" material, the HB value shows on screen directly without lookup manually when it's D/DC type impact testing on "Steel";
- Preset limited hardness alarm value for convenience of patch testing;
- Display in chinese, operations simple, handy;
- The max storage capacity is 800 sets of data one of which includes single reading, average value, impact direction, time, material and hardness unit;
- Software calibration function;
- Dimension: 206*80*36.5mm

1.2 Main application

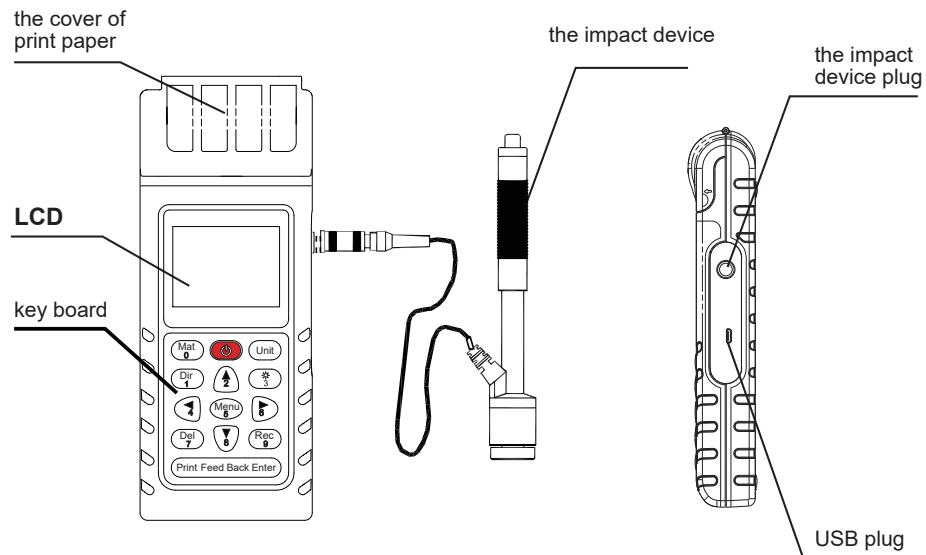
- Quick testing on many spots of heavy and thick work-pieces on a large-scale.
- Bearings and other parts
- Quality control of heat treated parts
- Hardness testing on lathe guide,automotive chassis
- Installed mechanical or permanent components
- Work-piececs with small space, like mold cavity
- Failure analysis of pressure vessel, steamer motor and its parts
- Request for standard original record of testing results
- Material differentiation of metallic warehouse.

1.3 Application range

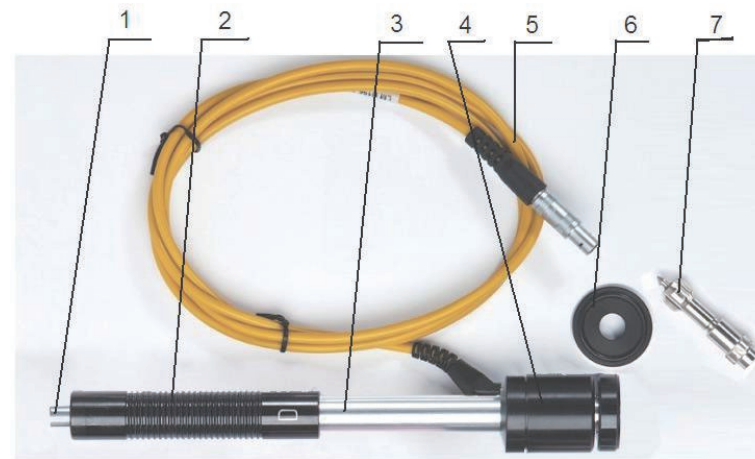
Refer to attached 1 and 2

2. Structural feature and working principle

2.1 The tester

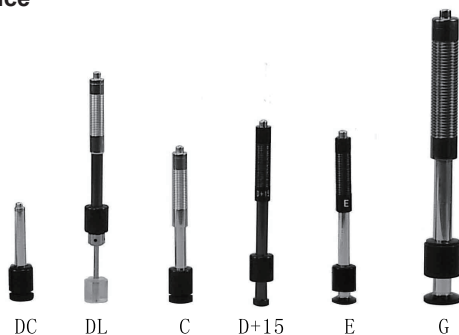


2.2 D-type impact device



1 Release button; 2 Load-adding sheath; 3 Conduit;
4 Coil components; 5 Wire; 6 Back-up ring; 7 Impact body

2.3 Shaped impact device



2.4 Working principle

Under the action of elastic force, the impact body with defined quality impact the surface of sample with a given speed, the hardness value is the ratio of between rebound velocity in where the head had 1mm distance with the surface of sample and impact velocity. Calculation formula as follows:

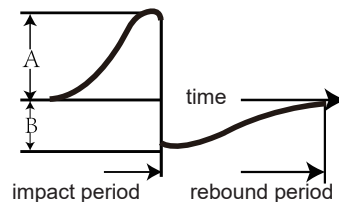
$HL = 1000 \cdot VB/VA$, In this formula,

HL is Leed hardness value,

VB is the rebound velocity of the impact body,

VA is the impact velocity.

The output signal refers to the demonstrating chart in right side:



3. Specifications

- Reading error and repeatability(chart 2)

NO.	Impact-device type	Hardness value for standard Leed hardness sample	Reading error	Reading repeatability
1	D	760 ± 30 HL D 530 ± 40 HL D	± 6 HLD ± 10 HLD	6 HLD 10 HLD
2	DC	760 ± 30 HL DC 530 ± 40 HL DC	± 6 HLDC ± 10 HLDC	6 HLD 10 HLD
3	DL	878 ± 30 HL DL 736 ± 40 HL DL	± 12 HL DL	12 HL DL
4	D+15	766 ± 30 HL D+15 544 ± 40 HL D+15	± 12 HLD+15	12 HLD+15
5	G	590 ± 40 HL G 500 ± 40 HL G	± 12 HL G	12 HL G
6	E	725 ± 30 HL E 508 ± 40 HL E	± 12 HLE	12 HLE
7	C	822 ± 30 HL C 590 ± 40 HL C	± 12 HLC	12 HLC

Chart 2

- Measuring range: 170~960 HLD
- Measuring direction: straight down/up, horizontal, tilted down/up
- Applicable materials: steel/cast steel, alloyed tool steel, stainless steel, gray cast iron, nodular cast iron, cast aluminum alloys, copper-zinc alloy(brass), copper-tin alloy(bronze), copper and forged steel.
- Unit: HL, HB, HRB, HRC, HRA, HC, HS
- Display: 320*240 TFT LCD
- Memory: 800pcs(impact time 32~1)
- Thermo printer, working quietly, print any numbers of paper to meet our needs;
- The broad of printing paper is (57±0.5)mm; the printing paper roll-diameter: 30mm
- Power: Built-in 3.7V 1800mAh lithium batteries
- Charging supply: 5V/500mA, charging time around 4 hours
- Working life: no less than 160 hours(no printing)
- Communicating port: USB1.1
- Working temperature: -20~+60°C without intense vibration, magnetic field, corrosive medium and heavy dust.
- Storage temperature: -30~+60°C, relative humidity ≤ 90%

4. Preparation and checking

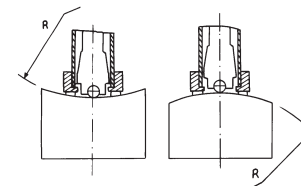
4.1 Preparation

For new product, please check the tester and accessories with the configuration list.

Contact us if there is any deficiency.

(1) The surface condition of sample should be eligible in attached table 3:

- The temperature on the surface should below 120 °C ;
- Avoid causing testing error, the roughness on the surface should be as low as possible. On the tested surface must have metallic luster and be flat, smooth, and no greasy dirt;
- Request of sample weight: No back-up for the sample that is below 5kg weight; Back-up support for samples with overhanging part or thin-wall samples, in order not to cause sample's transformation, bend and movement. For middle size sample, put it over flat, solid surface completely reposefully;
- Curved sample: It's better that the tested face is plane. Small or shaped back-up ring is used for samples of which the radius of curvature is below 30mm(D, DC, D+15, C, E, DL type impact device) and below 50mm(G type impact device);



- The proper thickness is requested and the min thickness should be eligible in attached table 3;
- The hardened layer of samples should be eligible in attached table 3;
- Coupling: The light-duty sample must be coupled tightly with solid bearing part, the coupling surfaces with a little coupling agent should be flat, smooth, and are vertical with testing direction. For extensive sheet material, pole and curved samples, strengthen or support the tested spot on back for accurate testing value, in spite of its high weight and large thickness which can cause transformation and unstability;
- The sample's magnetism should be below 30 gauss;

(2) System setting: Refer to <<System setting>>


(3) Testing condition setting: Refer to <<Testing condition setting>>

4.2 Measuring method

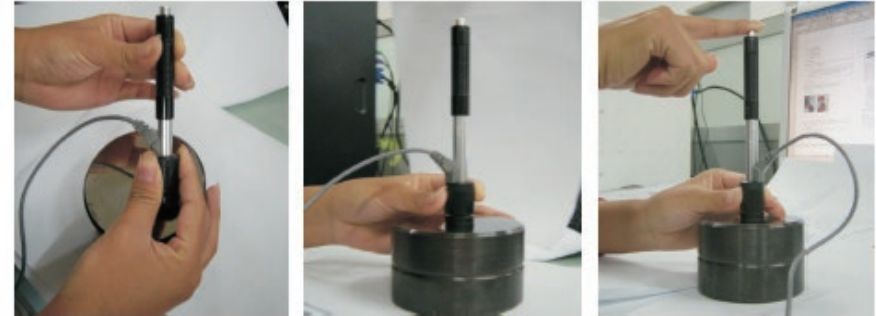
First, use random hardness test block for verification, the reading error and repeatability should be below the defined value in chart 2.

Attention: The hardness value of the random hardness test block is the arithmetic mean value of five readings, those readings comes from the calibrated Leeb hardness tester which test in straight down direction. Standardize it with calibration function if this mean value is out of limits.

(1) Activation

- Plug the impact device into the port on right side of it.
- Press  key to start to test.

(2) Loading



- Push the the ;oad-adding sheath down to lock the impact body; For DC type impact device, attach the loading rod on the tested face, plug the DC type impact device into the loading rod till stopped.

(3) Location

According to the chosen testing direction, press tightly the back-up ring on the sample's surface which is vertical with the impact direction.

(4) Testing

- Press the release button to test. The sample, the impact device and operator, all should be unmovable and jarless, and the force direction should go through the device's axis;
- Five times for each single spot. The difference value should not beyond $\pm 15HL$ of the mean value.
- The distance between any two indentation centers or any indentation center with the edge of sample should be eligible in chart 3;
- To special material, comparative trial is necessary for related conversion relation which is to converse accurately Leeb hardness value into different hardness value. The way is: utilize standardized Leeb hardness tester and related tester on one same sample. For every single hardness value, five tested value are needed homogeneously around over three hardened indentation spots, use the mean value of Leeb hardness value and related mean value to make comparative curve which at least need over three group datum.

Impact device type	Distance between any two indentation centers	Distance between indentation center and edge of sample
	no less than mm	no less than mm
D,DC	3	5
DL	3	5
D+15	3	5
G	4	8
E	3	5
C	2	4

Chart 3

(5) Tested value

- Leeb hardness testing value is a mean value of many valid tested value.
- The hardness value shows before the Leeb hardness unit HL, different value for different impact device.

5. Special tips

- Currently, this device only support D type impact device, please do not use others;
- In general, the current reading can not be saved if the impact time is not enough to set time;
- Can not set Hardness pattern (the cursor skips the Hardness setting signal) when Intensity pattern is already set;
- Not all materials are useful for all hardness patterns, it will converse into Leeb HL automatically if material is changed. So the first setting of testing conditions is to set Material, then Hardness pattern.
- Only is the function of transmission and auto transmission valid when the device connects with PC. The device will skip this option auto without connection;
- Numbers from one to nine correspond to respectively material, direction, up, back-light, left, menu, right, down, save keys.



6. Detailed operations instruction

6.1 Power on

Short press  key to turn it on.

Attention: The device will turn itself on when power supply is plugged in off condition.

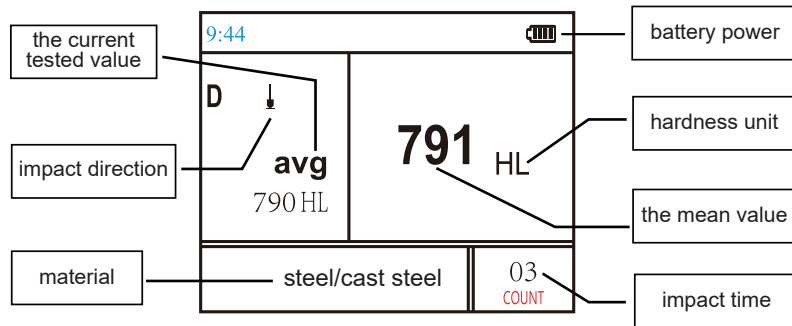
6.2 Power off

Long press  key two seconds to shut it down. Long press  key ten seconds to shut it down compulsorily.

Attention: The device is in power-saved condition when it's charging, at this time, the device monitors the charging condition in real-time and can not print or paper skip.

6.3 Product description

On screen is the main display interface after power-on, as follows:



(1) Instruction about the main interface

Battery power: Left power

Impact direction: Current impact direction

Mean value: Current mean value

Hardness unit: Current hardness unit of reading

Tested value: Current single tested value

Material: Current set material

Impact time: It's the whole impact time in testing mode, it's the corresponding number of times in checking mode.

(2) Operation

Go through testing in main interface where shows the current tested value and average value, the impact time increase by 1 at the same time. The device sounds "beep", if the deviation is out of limit. The device sound "beep beep" when the impact time goes up to limit that is set.

- Press **[Rec]** key to save the current set of data only for once, and it is valid only when the impact time reach to established time. Press **[Del]** key to delete the last single reading, confirm it in interface as follows:

Delete it?

Yes

No

Press **▶▶** **◀◀** key to move cursor over "Yes", then short press **Enter** key to confirm.

Press **▶▶** **◀◀** key to move cursor over "No", then short press **Enter** key to cancel.

Press **Back** key to cancel operation despite the position of cursor.

- Press **Feed** key to make the printer paper skip;
- Press **Print** key to print the current datum, many times, it is valid only when the impact time is enough to established time;
- Press **▼** **▲** keys to check single tested value with different order;
- Press **☼** key to adjust LCD back-light;
- Press **Menu** key to enter the menu.

Shortcur setting keys:

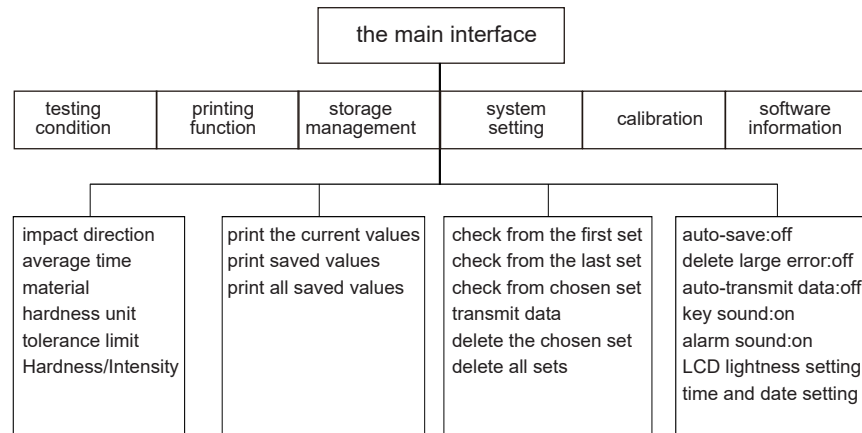
- Press **Dir** key to change the impact direction;
- Press **Unit** key to change the hardness unit. Press it to converse units periodically which is related the current material and impact device. It will be Leeb unit, if it is the Intensity pattern currently.

- Press **Mat** key to change material character. Press it to converse materials periodically. In hardness testing mode, press it ever time, the hardness unit will be conversed into Leeb unit. So set material first, then hardness unit.

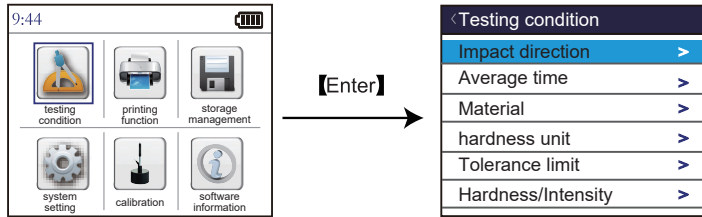
Attention: For special material, this conversion is a relative relation based on lots of tests of Leeb and others hardness. According to this relation, the device automatically converse Leeb hardness value into others hardness value.

6.4 Menu structure chart

The specifications and additional function can be set by operating Menu.



6.5 Testing condition setting



- In main interface, press [Menu] for the menu page, by [▼][▲][▶][◀] keys, choose condition setting, then press [Enter] for the page, press [▼][▲] keys to move cursor to choose the needed option, then press [Enter] key.

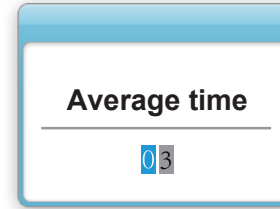
Attention: When the Intensity is chosen already, the hardness unit can not be chosen anymore, the cursor will skip this option.

• Impact direction setting



Press [▶][◀] keys to choose the needed direction, press [Enter] to confirm or [Back] key to cancel operation.

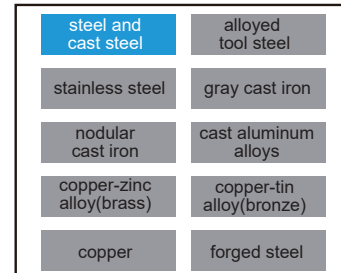
• Average time setting



Alter average time in the range of 1~32 times. Input the number by keys from 0 to 9 press [Enter] to confirm or [Back] to cancel.

• Material setting

To hardness, the applicable materials include: steel/cast steel, alloyed tool steel, stainless steel, gray cast iron, nodular cast iron, cast aluminum alloys, copper-zinc alloy(brass), copper-tin alloy(bronze), copper and forged steel.



Press [▼][▲][▶][◀] keys to move cursor to choose the needed material, then press [Enter] to confirm or [Back] to cancel.

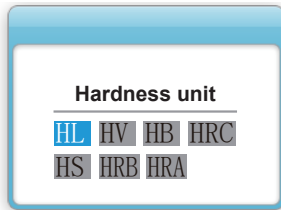
Attention:

- 1.The hardness unit converse into HL unit automatically after changing material setting.
2. Please set material, then hardness unit.

To intensit, there are mild steel, high carbon steel, chrome steel, chrome vanadium steel, chromium-nickel steel, chrome-molybdenum steel, Cr-Ni-Mo steel, chromansil, super-strength steel and stainless steel.

mild steel	high carbon steel
chrome steel	chrome vanadium steel
chromium-nickel steel	chrome-molybdenum steel
Cr-Ni-Mo steel	chromansil
super-strength steel	stainless steel

• Hardness unit setting



Press **【▼】****【▲】****【▶】****【◀】** keys to move cursor to choose the needed material, then press **【Enter】** to confirm or **【Back】** to cancel.

Attention:

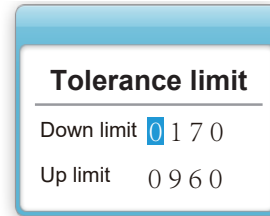
1. The hardness unit converse into HL unit automatically after changing material setting.
2. Please set material, then hardness unit.

Press **【▶】****【◀】** keys to move cursor to choose the needed hardness unit, then press **【Enter】** to confirm or **【Back】** to cancel.

Attention:

1. Only can the shown hardness units related to material and impact device be used.
2. Please set material, the hardness unit.
3. The hardness unit converse into HL unit automatically after material setting.

• Tolerance limit setting

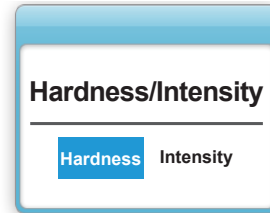


Input numbers by keys from 0 to 9, then press **【Enter】** to confirm or **【Back】** to cancel.

Attention:

1. Resetting will be reminded if the set value is out of measuring range.
2. Switch down limit into up limit auto if down limit is more than up limit.

• Hardness/Intensity setting



Attention:

The intensity testing function is only for D and DC type impact device, otherwise, it only can be HARDNESS.

6.6 The printing function

In main interface, press **[Menu]** key to the menu page, press **[▼] [▲] [▶] [◀]** keys to move cursor to choose the printing function, then press **[Enter]** to the printing page.

NO printing in charging condition.

◀Printing function	
print the current values	>
print saved values	>
print all saved values	>

Press **[▼] [▲]** keys to move cursor to choose the needed option, then press **[Enter]** to confirm.

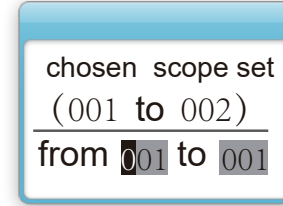
Attention:

1. Press **[Back]** key firmly stop printing after the current printing during printing process.
2. No printing in charging condition.
3. Opening the cover of printing paper is not allowed to avoid malfunction.
4. The printer can not print over 1 meter receipt to prevent printer movement from damaging.
5. Long-acting thermal printing paper is for datum that needs long-term storage. Normal thermal printing paper is for short term.
6. Keep the printing paper from high temperature or sunshine whether sealed or not.
7. Stop printing immediately as the printer is overheated, or blurred words. Waitfor cooling, then continue to work.

• The function of printing the current readings

By this function, the device can print name, number, time, date, the impact device type, the direction, mean times, material, single tested value, the average. If it is not off and no changes in testing conditions, then next the tester will only print the single tested value and the average.

• The function of printing the saved datum



First, choose the range. On screen shows the range of saved sets of data. Input the numbers by keys from 0 to 9. Press **[Enter]** to confirm or **[Back]** to cancel operation.

The printed content includes: the device's name, date, the impact device type, the direction, mean times, material, the No. of set, the average and the single tested value.

Attention:

1. The input number can not beyond the limits of number of the saved sets.
2. The number of beginning set can not beyond the number of the end.

- **The function of printing all saved datum**

print all saved datum in same form.

- **Paper skip(put paper in manually)**

In printer's normal working condition, press **【Feed】** key and RESUME key to for paper-skip, and keep press RESUME key all the time during this progress.

Attention: No paper-skip when it's charged.

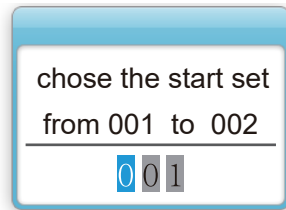
6.7 Storage management

In the main interface, press **【Menu】** key for the menu. Press **【▼】** **【▲】** **【▶】** **【◀】** keys to move cursor to choose Storage management, press **【Enter】** for options. Press **【▼】** **【▲】** keys to choose the needed function, then press **【Enter】** key. If there are no datum, then on screen shows "No Datum" and back auto.

Storage management	
Check from the first set	>
Check from the last set	>
Check from the chosen set	>
Transmit Data	>
Delete the chosen sets	>
Delete all sets	>

(1) Check from the first/last set

On screen shows the first or last set of data.



(2) Check from the chosen set

By this option, the page of choosing shows on screen. Input numbers by keys from 0 to 9.

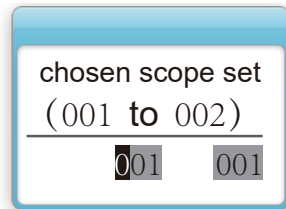
Press **【Enter】** to show the chosen set of data.

Press **【Back】** to cancel operation.

(3) Data transmission

Transmit the datum in text.(valid only when connect with PC)

(4) Delete the chosen sets



By this option, the page of choosing shows on screen.

Input numbers by keys from 0 to 9. Press **【Enter】** to delete or **【Back】** to cancel.

Attention:

1. The input number should less than the number of saved sets of data.
2. The number of beginning set should less than the number of last set.
3. The NO. will be rearranged after deleting.
4. When operating delete, special for small number, more than 30 seconds are needed to move latter datum forward, so do not turn it down in case data confusion.

(5) Delete all

Delete it?	
Yes	No

By this option, all sets of data will be removed.

(6) Confirm the deleting

In confirming page, press **▶** **◀** key to move cursor over "Yes" to delete datum or "No" to cancel the operation.

Despite the position of cursor, press **Back** key to cancel the operation.

(7) Data browsing

No.001	06/24	800HL
No.002	06/24	827HL
No.003	06/24	878HL
No.004	06/24	821HL
No.005	06/24	880HL
No.006	06/24	876HL
No.007	06/24	819HL
No.008	06/24	863HL
No.009	06/24	850HL
No.010	06/24	912HL

- In each page, there are ten sets of data at most, including the No., date and the average. Press **▼** **▲** keys to turn page. Press **Back** to return. Press **Enter** for the detail.
- Press **▼** **▲** to choose in pages. Press **Back** to return to the last page. Press **Enter** for the detail.

Record No.: No.001
 Date of survey: 16/06/24
 The probe model: D ↓
 Impact direction:
 Average time: 03
 Material: steel/cast steel
 Mean value: 792HL
 Single tested value: ↓

788 795 792

Press **▼** **▲** to turn page for the average, the testing conditions or the single tested value. Press **Back** to return to the last page.

6.8 System setting

In the main interface, press **Menu** to the menu. Press **▼** **▲** **▶** **◀** to move cursor over System setting. Press **Enter** for the page.

System setting		
Auto-save:	off	>
Delete large error:	off	>
Auto-transmit data:	off	>
Key sound:	on	>
Alarm sound:	on	>
LCD lightness setting		>
Date and time setting		>

Press **▼** **▲** to move cursor over the needed option.
 Press **▶** **◀** to alter the state or to enter the related setting page. Press **Back** to return.

For functions of AUTO-SAVE, AUTO-TYPE, DELETE LARGER ERROR, AUTO-TRANSMISSION, KEYS SOUND, ALARM SOUND, just choose on or off by **[▶]** **[◀]** keys.

Auto-save: in on state, save automatically the current set of data after testing and showing the average.

Auto-type: in on state, print automatically the current set of data after testing and showing the average.

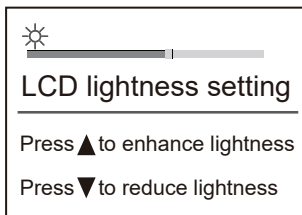
Delete larger error: in on state, delete large errors automatically based on 3σ law after the set mean times are done. Supplementary tests are needed if there are datum deleted.

Auto-transmission: in on state, transmit current set of data in text by USB port after testing and showing the average.

Keys sound: in on state, the device sound short "beep" when press one key.

Alarm sound: in on state, the device sound long "beep" when out of limits of tolerance or during deleting.

(1) LCD lightness setting



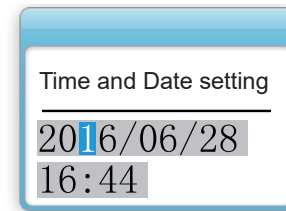
Press **[▼]** to increase the brightness

Press **[▲]** to decrease

Press **[Enter]** to confirm

Press **[Back]** to cancel.

6.9 Time and Date setting



The current time and date show on screen with form "year/month/day hour:minute".

Input numbers by keys from 0 to 9.

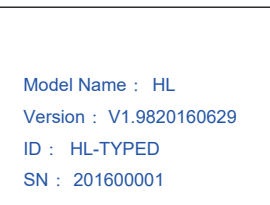
Press **[Enter]** to confirm the setting, or **[Back]** to cancel the operating.

6.9 Software information

In the main interface, press **[Menu]** to the menu page.

Press **[▼]** **[▲]** **[▶]** **[◀]** to move cursor over Software information.

Press **[Enter]** to enter the page.

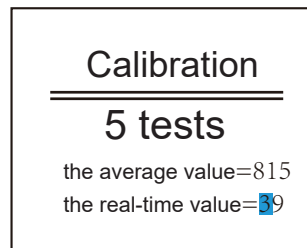
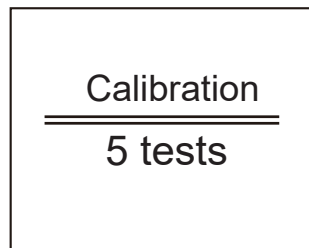


In this page shows related information of this product and inset software. The software's version number and the inset software identification number will be updated with software upgrading without prior notice.

6.10 Software calibration

Before first utilization or after a long while, please calibrate the tester and the impact device with random Leeb hardness block.

In the main interface, press **[Menu]** to the menu page, press **[▼] [▲] [▶] [◀]** to choose the calibration function for the page.



On screen shows the average after all tests. Input the real value by keys from 0 to 9.
Press **[Enter]** to confirm the setting.
Press **[Back]** to cancel it. The standard range is ± 15 .

6.11 Back-light

The device with back-light is convenient in dark circumstance. In on state, adjust the back-light by **[☼]** key.

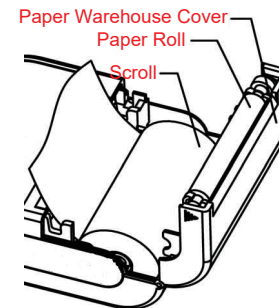
6.12 Auto-off

- The auto-off function for saving power
- Turn itself off without any tests or key operation in five minutes.
- On screen shows LOW-POWER signal when the power is low, then shut itself off.
- This function is unavailable when it's charged.

6.13 Printing

(1) Printing paper roll installation

- Squeeze the both sides of the cover slightly to open it;
- Put the paper roll in as shown in the figure. Pay attention on the paper's direction.
If it is installed in the opposite direction, the printer will not work.
- Pull a opportune length of paper roll as shown in figure out of the cabin.
- Straighten the paper roll and put the cover back.





(2) Attentions

The printing will need strong electric current. For safety, in any of the below situations, the printing can not be done:

1. When the power is low, the device would stop and show "Low power! No printing", but the others can be used normally.
2. When no paper in cabin, the device would stop and show " No paper". It will work after reloading the printing paper.
3. No printing when it's charged.

(3) The printer's specifications (please refer to the attached table 5)

6.14 Battery charging

In the tester installs rechargeable lithium batteries. The battery signal would flash when the power is low, and please charge it as soon as possible. Plug the USB wire, the rolling battery signal  shows on screen, after it's full, the signal  shows in motionless.

Attentions

- Do not open the cover during or after the process, and do not touch the movement of printer with hands or any parts of body in case of getting a burn.
- Do not throw the device into fire in case of explosion.

Malfunction analysis and troubleshooting

Problem description	Cause	Solution
Power-on is failed	The batteries is exhausted	Charge the batteries
Charging is failed	The batteries is unavailable	Return to factory for service
No readings are shown	The sensor's wire is failed	Change the wire

Maintenance

1. About the impact device

- Clean the conduit and the impact body of the impact device with nylon brush after 1000~2000 tests. First screw the back-up ring off, pick the impact body out, screw nylon brush inside conduit counterclockwise till the end, then pull it out. Repeat 5 times, then put the impact body and back-up ring on;

- Release the impact body after using;
- All kinds of lubricant are not allowed inside the impact device.

2. About the device

- Testing the standard Rockwell hardness block, all errors are more than 2HRC, the possible reason is the wear-out-failure of the head, changing it or the impact body should be considered;
- Please do not disassemble or adjust any fixture parts if there is any abnormal phenomenon.
Please send the filled-in warranty card to our maintenance department for after service.

3. About the batteries

No tests for a long time, please charge it fully, and charge it again every half a year in case of damage the batteries.

4. Storage condition, transportation and tips

- Store it in normal temperature and far away vibration, strong magnetic field,corrosive medium, humidity and dust;
- Transport it with original package in three-class highway.

Attached table 1

Material	Unit	Impact device					
		D/DC	D+15	C	G	E	DL
Steel/ Cast steel	HRC	17.9~68.5	19.3~67.9	20.0~69.5		22.4~70.7	20.6~68.2
	HRB	59.6~99.6			47.7~99.9		37.0~99.9
	HRA	59.1~85.8				61.7~88.0	
	HB	127~651	80~638	80~638	90~646	83.~663	81~646
	HV	83~976	80~937	80~996		84~1042	80~950
	HS	32.2~99.5	33.3~99.3	31.8~102.1		35.8~102.6	30.6~96.8
Forged steel	HB	143~650					
Alloyed Tool steel	HRC	20.4~67.1	19.8~68.2	20.7~68.2		22.6~70.2	
	HV	80~898	80~935	100~941		82~1009	
Stainless steel	HRB	46.5~101.7					
	HB	85~655					
	HV	85~802					
Gray Cast iron	HRC						
	HB	93~334			92~326		
	HV						
Nodular Cast iron	HRC						
	HB	131~387			127~364		
	HV						
Cast Aluminum Alloys	HB	19~164		23~210	32~168		
	HRB	23.8~84.6		22.7~85.0	23.8~85.5		
Copper-Zinc Alloys (Brass)	HB	40~173					
	HRB	13.5~95.3					
Copper-tin Alloys	HB	60~290					
Copper	HB	45~315					

Attached table 2

NO.	Material	HLD	σ b(MPa)
1	mild steel	350~522	374~780
2	high carbon steel	500~710	737~1670
3	chrome steel	500~730	707~1829
4	Cr-V steel	500~750	704~1980
5	Cr-Ni steel	500~750	763~2007
6	Cr-Mo steel	500~738	721~1875
7	Cr-Ni-Mo steel	540~738	844~1933
8	Cr-Mn-Si steel	500~750	755~1993
9	SSST steel	630~800	1180~2652
10	SST steel	500~710	703~1676

Attached table 3

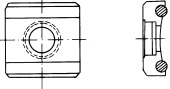




Shaped impact device	DC(D)/DL	D+15	C	G	E
impact energy	11mJ	11mJ	2.7mJ	90mJ	11mJ
impact body quality	5.5g/7.2g	7.8g	3.0g	20.0g	5.5g
bulb-head hardness	1600HV	1600HV	1600HV	1600HV	5000HV
bulb-head diameter	3mm	3mm	3mm	5mm	3mm
bulb-head material	tungsten carbide	tungsten carbide	tungsten carbide	tungsten carbide	adamas
impact device diameter	20mm	20mm	20mm	30mm	20mm
impact device length	86(147)/75mm	162mm	141mm	254mm	155mm
impact device quality	50g	80g	75g	250g	80g
sample max hardness	940HV	940HV	1000HV	650HV	1200HV
sample surface mean roughness	1.6 μ m	1.6 μ m	0.4 μ m	6.3 μ m	1.6 μ m
sample min quality testing directly stable support tight coupling	>5kg 2~5kg 0.05~2kg	>5kg 2~5kg 0.05~2kg	>1.5kg 0.5~1.5kg 0.02~0.5kg	>15kg 5~15kg 0.5~5kg	>5kg 2~5kg 0.05~2kg
sample min thickness tight coupling harden layer min depth	5mm ≥ 0.8 mm	5mm ≥ 0.8 mm	1mm ≥ 0.2 mm	10mm ≥ 1.2 mm	5mm ≥ 0.8 mm
bulb-head indentation dimension					
hardness 300HV indentation diameter indentation depth	0.54mm 24 μ m	0.54mm 24 μ m	0.38mm 12 μ m	1.03mm 53 μ m	0.54mm 24 μ m
hardness 600HV indentation diameter indentation depth	0.54mm 17 μ m	0.54mm 17 μ m	0.32mm 8 μ m	0.90mm 41 μ m	0.54mm 17 μ m
hardness 800HV indentation diameter indentation depth	0.35mm 10 μ m	0.35mm 10 μ m	0.35mm 7 μ m	---	0.35mm 10 μ m

the range of impact device application:

DC-type for hole or inner cylindrical surface;
DL-type for spindly narrow groove or hole;
D-type for regular testing;
D+15 for groove or sunken surface due to its smaller
contact area and lengthening;

C-type for hardened layer and samples with minor diameter and thinner wall
due to its smaller impact force which usually cause damage on surface;
G-type for larger thickness and more rough casting samples;
E-type for highest hardness materials.

Attached table 4

NO.	Model NO.	Shaped back-up ring sketch	remark
1	Z10-15		test outside cylindrical surfaceR10~R15
2	Z14.5-30		test outside cylindrical surfaceR14.5~R30
3	Z25-50		test outside cylindrical surfaceR25~R50
4	HZ11-13		test inner cylindrical surfaceR11~R13
5	HZ12.5-17		test inner cylindrical surfaceR12.5~R17
6	HZ16.5-30		test inner cylindrical surfaceR16.5~R30
7	K10-15		test outside sphere surfaceSR10~SR15
8	K14.5-30		test outside sphere surfaceSR14.5~SR30
9	HK11-13		test inner sphere surfaceSR11~SR13
10	HK12.5-17		test inner sphere surfaceSR12.5~SR17
11	HK16.5-30		test inner sphere surfaceSR16.5~SR30
12	UN		test outside cylindrical surface, adjustable radius R10~∞

Attached table 5 The printer's specifications

items		specifications
printing mode		thermal printing
printing points		384 dots/line
printing density		8 dots/mm
printing span		48mm
paper width		57±1mm
dimension		70*33.5*15mm
logic voltage		3.0~5.5V
heating voltage		3.3~85V
heating resistance		123Ω
max printing speed		85mm/s
feed accuracy		0.0625mm
overheat detection		thermal resistance
lack-paper detection		photoelectric detection
axial-load detection		none
working life span (25°C, constant energy)	pulse times	108 pluses
	resistance of mechanical wear	50km(printing density 12.5%)
working temperature		0~40 °C
working humidity(RH)		20%~80%
storage temperature		-25~70 °C
storage humidity(RH)		10%~90%