

# HARTIP-3210

## PORTABLE HARDNESS TESTER



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# 1 Leeb Hardness Test (definition)

An impact body with a spherical test tip made of tungsten carbide is propelled against the sample surface by a spring force and then rebounds back. At a distance of 1mm from the sample surface, the impact and rebound velocities of the impact body are measured by the following method: when passing through the coil in its coil holder, a permanent magnet embedded in the impact body induces in the coil an electric voltage proportional to the velocity of the magnet. Leeb hardness (HL) is expressed by

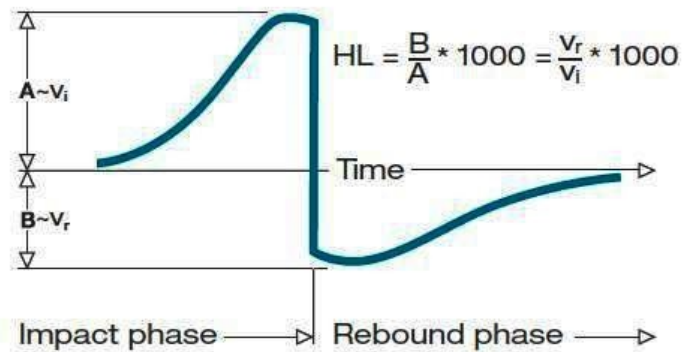
$$HL = \frac{V_r}{V_i} * 1000$$

Where HL = Leeb Hardness

$V_r$  = rebound velocity of the impact body

$V_i$  = impact velocity of the impact body

The output voltage of the coil when the impact body passes through the induction coil is illustrated in the following figure:



A Leeb's Hardness Tester measures the hardness of sample material in terms of Hardness Leeb (HL), which

can be readily converted into other Hardness units (Rockwell B and C, Vickers, Brinell and Shore D, etc.)

## Notation of Leeb's Hardness

When measuring the hardness of a sample material using the traditional static hardness testing method, a change of applied pressure will result in a change in the hardness reading. This will also happen during a Leeb's Hardness test when one changes the impact device. In hardness measurement of the same test sample with different impact devices, the Leeb's hardness values obtained will vary.

For example: 720HLD  $\neq$  720HLC

Because different converting curves are obtained from different impact devices, when converting hardness HL into another hardness values, the notation for the converted hardness value should include the impact device used.

For example:

Hardness HV converted from hardness HL using impact device D+15 should be written as 22, 8 HV LD+15.

Where: 22=Hardness value HL

8=Hardness value HV

L=Leeb's Method

D+15=Impact device

Hardness HRC converted from hardness L using impact device D should be written as 35, 9 HRCLD.

Where: 35=Hardness value HL

9=Hardness value HRC

L=Leeb's Method

D=Impact device

# 2 Specifications, Features and Applications

## 2.1 Introduction

HARTIP 3210 is a new generation of Leeb hardness tester with more advanced technology and features. The tester applies our new patent dual-coil sensor technology which makes the tester more accurate than old previous model. All impact device (probe) are no need to setup impact direction. HARTIP 3210 can work with both analogy impact device and wireless RF probe.

The measuring values can be downloaded to PC and printer by wireless or by cable.

The HARTIP 3210 also can be powered by USB power supply without battery via PC cable.

## 2.2 Specifications

Principle	Leeb hardness measurement
Accuracy	±0.3% @ HL=800
Repeatability	±2HL
Display resolution	1HL, 0.1HRC
Display	2.8" 320 x 240 TFT colour LCD - suitable under sunshine
Hardness scale	HL/HRC/HRB/HB/HV/HS/HRA/ $\sigma_b$
Measuring range	HL100-960 / HRC0.9-79.2 / HRB1.0-140 / HB1-1878 / HV1-1698 / HS0.5-1370 / HRA1.0-88.5 / $\sigma_b$ (rm) 1-6599N/mm <sup>2</sup>
Impact device	r/f wireless probe D / standard cable probe D DC/D+15/C/G/E/DL (Optional)
Materials and curves	11 common metal materials, 60 conversion curves
Memory	31 files, 100 data for each file, can be saved and re-readable
Statistics	Single group analysis -- mean, max., min., extreme deviation, standard deviation, and coefficient of kurtosis, coefficient of skewness, percent of pass, column diagram, normality distribution test and uniform distribution test Double group analysis -- significant difference test for mean value, standard deviation, percent of pass and distribution
Indicator	Upper limit / Lower limit / low battery / buzzer warning / date and time
Communication interface	USB / RS232 / Bluetooth / 2.4G wireless (Optional)
Continuous working time	>40 hours
Power supply	1.5V AA alkaline battery x 4 / 1.2V nickel-hydrogen rechargeable battery x 4 / 3.7V Li-ion rechargeable battery x 4 / USB power supply
Working environment	-10°C ~ + 45°C
Dimension	195x84x38mm
Weight	550g (battery not included)
Standard	Conforming to ASTM A956, DIN 50156, GB/T 17394-1998

## 2.3 Features

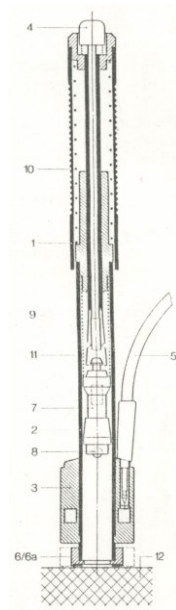
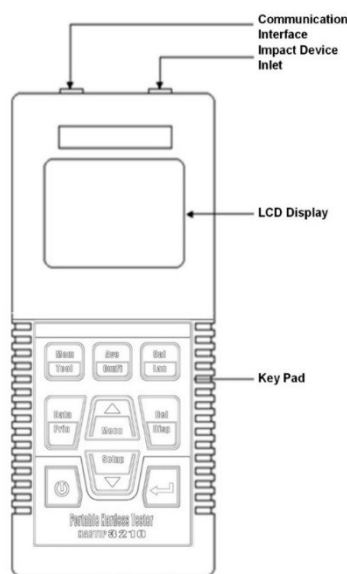
- ✓ Wireless digital / cable analogue compatible
- ✓ No need to setup different impact direction
- ✓ Higher accuracy with dual-coil technology
- ✓ TFT large color LCD with pixel 320 x 240
- ✓ Multi-color style – suitable under sunshine
- ✓ Multi display mode - statistics, bar graph, etc.
- ✓ Multi save mode for data
- ✓ Multi statistics calculation
- ✓ Print online and screen copy printout
- ✓ Sound reminder
- ✓ Real date and time
- ✓ Recalibration for unified or individual scale
- ✓ Operator, part no., procedure no. record

## 2.4 Applications

- ✓ Hardness tests on installed machines or steel structures: heavy and large work-pieces or permanently installed system parts.
- ✓ Rapid testing of multiple measuring areas for examination of hardness variations over larger regions.
- ✓ Hardness measurements for produced parts on production line.
- ✓ Identifying metallic material stored in warehouse.
- ✓ Ineffectiveness analysis of permanent parts, pressure -vessels, turbo generators, etc.

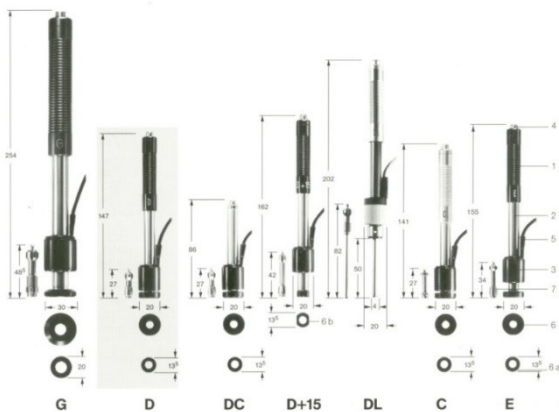
## 3 Hardness Tester Parts Names

### 3.1 Main Body



- 1 Loading tube
- 2 Guiding tube
- 3 Coil holder with coil
- 4 Release button
- 5 Connecting cable leading to the indicating device with coil plug
- 6 Large supporting ring
- 7 Impact body

### 3.2 Types of Impact Devices



#### 3.2.1 Special Features of Impact Devices

Type	Brief description	
D	Universal standard unit for majority of hardness testing assignments.	
DC	Extremely short impact device, other specs identical with type D.	
	Application:	<ul style="list-style-type: none"> <li>- highly confined spaces</li> <li>- holes and cylinders</li> <li>- internal measurements on assembled machines</li> </ul>
D+15	Slim front section	
	Application:	- Grooves and recessed surfaces.
DL	Extremely slim front section	
	Application:	<ul style="list-style-type: none"> <li>- extremely confined spaces</li> <li>- base of grooves</li> </ul>
C	Reduced impact energy (compared with type D).	
	Application:	<ul style="list-style-type: none"> <li>- surface hardened components, coatings</li> <li>- Minimum layer thickness: 0.2mm.</li> <li>- Thin walled or impact sensitive components (small measuring indentation).</li> </ul>

E	Synthetic diamond test tip (approx.5000 HV).	
	Application:	- extremely high hardness measurement such as high carbon steel up to 1200 HV
G	Increased impact energy(approx. 9 times that of type D)	
	Application:	- Brinell hardness range only - Heavy cast and forged parts with lower demands on surface finish.

### 3.2.2 Internal Structure of Impact Devices

Status: impact spring stressed

- 1 Loading tube
- 2 Guiding tube
- 3 Coil with holder
- 4 Release button
- 5 Connection cable (3-pole)
- 6 Large support ring
- 6a Small support ring
- 7 Impact body
- 8 Spherical test tip
- 9 Impact spring
- 10 Loading spring
- 11 Catch chuck
- 12 Material under test

Impact device model DC is not equipped with a loading tube; since it is loaded by means of a separate stick.

Impact devices should not be disassembled; otherwise misalignments in the spring system and the transmitter will occur.

## 4 Symbols and Illustrations

### 4.1 Meaning of Various Symbols

Symbol	Meaning
LD	Leeb hardness value obtained with impact device D
LDC	Leeb hardness value obtained with impact device DC
LG	Leeb hardness value obtained with impact device G
LC	Leeb hardness value obtained with impact device C
LD15	Leeb hardness value obtained with impact device D+15
LE	Leeb hardness value obtained with impact device E
LDL	Leeb hardness value obtained with impact device DL

Symbol	Meaning
HL	Leeb hardness value
HRC	Rockwell C hardness value
HRB	Rockwell B hardness value
HB	Brinell hardness value
HV	Vickers hardness value
HS	Shore hardness value
HRA	Rockwell A hardness value
SGM	Intensity of tension

### 4.2 Measurement and Conversion Table

Range for measurement and conversion:

PROBE D/DC				HLD: 100-960			
MATERIALS	HRC	HRB	HB	HV	HS	HRA	$\sigma_b(N/mm^2)$
STEEL/CAST STEEL	1-74.7	1.2-140	28-1027	45-1230	4.0-112	7-88.5	118-3315
ALLOY TOOL STEEL	0.9-78.7	*	15-1878	32-1698	5.5-128	*	79-6599
STAINLESS STEEL	3.7-62.4	8.3-101.7	85-655	36-802	6-131	*	108-1725
LAMELLAR IRON	21-59	24-100	35-570	90-698	6-83	*	*
NODULAR IRON	21-60	24-100	62-857	96-724	8-90	*	*
CAST ALUMINUM	1-48	24-85	19-445	22-193	3-64	*	129-2618
BRASS	1-53	1.5-99.6	32-477	29-495	5-65	32-76	258-4146
BRONZE	1-56	14-100	15-505	11-535	2-68	29-76	190-1860
WEOUGHT COPPER	1-54	14-100	39-569	38-590	6-73	*	*
FORGING STEEL	1-72	*	50-1060	48-1110	7-103	*	200-3750
ROLLING STEEL	1-72	*	82-1380	83-1440	14-117.8	*	310-4860

PROBE DL				DL: 100-980			
MATERIALS	HRC	HRB	HB	HV	HS	HRA	$\sigma_b(N/mm^2)$
STEEL/CAST STEEL	1-73	1.5-109.5	1-1026	1-1167	0.5-100	*	24-3517
ALLOY TOOL STEEL	2.4-79.2	*	5-1489	2.0-1556	1-122	*	38-5063
STAINLESS STEEL	*	*	*	*	*	*	*
LAMELLAR IRON	*	*	*	*	*	*	*
NODULAR IRON	13-78.4	38-110	50-1271	5-1160	1.5-102	*	*
CAST ALUMINUM	1-57	1.6-120	3-736	12-645	2.5-74	*	*
BRASS	*	*	*	*	*	*	*
BRONZE	*	*	*	*	*	*	*
WEOUGHT COPPER	*	*	*	*	*	*	*
FORGING STEEL	*	*	*	*	*	*	*
ROLLING STEEL	*	*	*	*	*	*	*

PROBE E				HLE: 100-960			
MATERIALS	HRC	HRB	HB	HV	HS	HRA	$\sigma_b(N/mm^2)$
STEEL/CAST STEEL	6.3-78.5	3-140	24-1144	24-1369	3.6-121	1-88	54-3800
ALLOY TOOL STEEL	10.5-83.2	*	8-1840	24-1659	10-1370	*	1-1460
STAINLESS STEEL	*	*	*	*	*	*	*
LAMELLAR IRON	*	*	*	*	*	*	*
NODULAR IRON	*	*	*	*	*	*	*
CAST ALUMINUM	*	*	*	*	*	*	*
BRASS	*	*	*	*	*	*	*
BRONZE	*	*	*	*	*	*	*
WEOUGHT COPPER	*	*	*	*	*	*	*
FORGING STEEL	*	*	*	*		*	*
ROLLING STEEL	1.4-81	*	98-1529	68-1541	16-124	*	262-5274

PROBE G				HLG: 100-900			
MATERIALS	HRC	HRB	HB	HV	HS	HRA	$\sigma_b(N/mm^2)$
STEEL/CAST STEEL	*	1-133	10-946	*	*	*	*



ALLOY TOOL STEEL	*	*	19-804	*	*	*	*
STAINLESS STEEL	*	*	10-844	*	*	*	*
LAMELLAR IRON	*	*	5-804	*	*	*	*
NODULAR IRON	*	*	5-998	*	*	*	*
CAST ALUMINUM	*	1-120	8-635	*	*	*	*
BRASS	*	*	*	*	*	*	*
BRONZE	*	*	*	*	*	*	*
WEOUGHT COPPER	*	*	*	*	*	*	*
FORGING STEEL	*	*	*	*	*	*	*
ROLLING STEEL	*	*	*	*	*	*	*

PROBE C				HLC: 100-960			
MATERIALS	HRC	HRB	HB	HV	HS	HRA	$\sigma_b(N/mm^2)$
STEEL/CAST STEEL	5-72.5	*	23-953	23-1125	5-111	*	*
ALLOY TOOL STEEL	4-77.2	*	*	43-1566	*	*	*
STAINLESS STEEL	*	*	*	*	*	*	*
LAMELLAR IRON	*	*	*	*	*	*	*
NODULAR IRON	*	*	*	*	*	*	*
CAST ALUMINUM	*	*	*	*	*	*	*
BRASS	*	*	*	*	*	*	*
BRONZE	*	*	*	*	*	*	*
WEOUGHT COPPER	*	*	*	*	*	*	*
FORGING STEEL	*	*	*	*	*	*	*
ROLLING STEEL	*	*	*	*	*	*	*

PROBE D+15				HLD+15: 100-960			
MATERIALS	HRC	HRB	HB	HV	HS	HRA	$\sigma_b(N/mm^2)$
STEEL/CAST STEEL	1-69.8	*	12-999	12-1221	2-112	*	*
ALLOY TOOL STEEL	1.3-78	*	*	2.0-1485	*	*	*
STAINLESS STEEL	*	*	*	*	*	*	*
LAMELLAR IRON	*	*	*	*	*	*	*
NODULAR IRON	*	*	*	*	*	*	*
CAST ALUMINUM	*	*	*	*	*	*	*
BRASS	*	*	*	*	*	*	*
BRONZE	*	*	*	*	*	*	*
WEOUGHT COPPER	*	*	*	*	*	*	*
FORGING STEEL	*	*	*	*	*	*	*
ROLLING STEEL	*	*	*	*	*	*	*

## 5 Preparation before Measuring

### 5.1 Requirements to the sample

Surface temperature of the sample should be lower than 120 °C.

The sample must feature a metallic smooth and ground surface, in order to eliminate erroneous measurements caused by coarse grinding or lathe scoring. Roughness of the finished surface should not exceed values shown in following table:

Types of impact devices	Max surface roughness of sample Ra
D/ DC, D+15,DL,E	2µm
G	7µm
C	0.4µm

## 5.2 Requirements related to sample weight

For samples weighing over 5 kg and of compact shape, no support is needed.

Samples weighing between 2-5 kg, and also for heavier samples with protruding parts or thin walls, should be placed on a solid support in such a manner that they do not bend or move by the impact force.

Samples weighing less than 2 kg should be firmly coupled with a stable support weighing over 5 kg.

For coupling purposes,

The coupling surface between the sample and base plate should be flat, plane parallel and ground.

A proper thin layer of coupling paste is to be applied to the contact surface of the sample.

The sample should be firmly pressed against the base plate surface by moving it with a circular motion.

The direction of impact should be perpendicular to the coupling surface.

For the coupling operation, the following prerequisites must be fulfilled:

Contact surface between the sample and the base plate must be flat, plane parallel and ground.

The direction of the test impact must be perpendicular to the coupled surface.

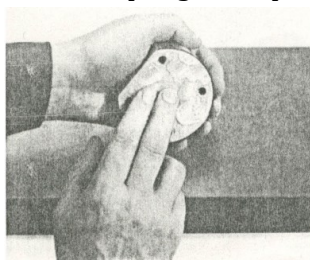
Minimum thickness of the sample for coupling under various impact devices are shown in following table:

Types of impact devices	Minimum thickness
D/DC,D+15,DL,E	3mm
G	10mm
C	1mm

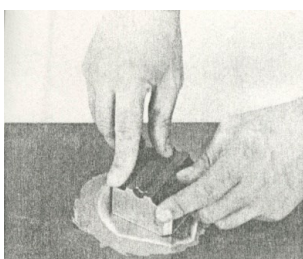
Proper Coupling:

Proper coupling requires a little experience. Insufficiently coupled samples produce large variation among measurements and abnormally low L-values while the operation is characterized by a rattling noise upon impact of the test tip.

Examples for coupling a test piece with a base plate:



Application of the coupling paste  
(As thin as possible).



Mutual rubbing of both parts while firmly  
press the sample against the base plate.



A particular advanced of coupling is the possibility of  
obtaining a very uniform, rigid connection between the  
sample and the support, totally eliminating stresses at  
the sample surface. The resulting variation in measured  
values is very low.

### 5.3 Requirement on the surface-hardened layer of the sample

Surface-hardened steels, especially case-hardened steels, produce L-values which are too low when case-hardening depth is small because of their soft core. When measuring with impact devices D, DC, D+15, DL or E, depth of the hardened layer should be no less than 0.8 mm. When measuring with impact device C, the depth of the hardened layer should be no less than 0.2 mm.

Types of impact devices	Min. layer thickness for surface hardening
D/DC, D+15, DL, E	0.8mm
C	0.2mm
G	1.8mm

The test sample should not be magnetic.

For test sample of curving surface, where the radius of curvature R is less than 30mm, a small support ring should be applied.

Requirement on sample weight using various impact devices

Types of impact devices	Classification of samples		
	Heavy-weight	medium-weight	light-weight
D/DC, D+15, DL, E	>5kg	2 - 5kg	0.05 - 2kg
G	>15 kg	5 - 15kg	0.5 - 5kg
C	>1.5kg	0.5 - 1.5kg	0.02 - 0.5kg

When measuring hardness with HARTIP 3000, the following has to be noticed: Despite the low mass of the impact body and low impact energy, a relatively large impact force within short duration is generated when the impact body hits the measuring surface.

Types of impact devices	D/DC, D+15, DL, E	G	C
Max. impact force	900N	2500N	500N

No particular precautions are necessary for heavy-weight samples with compact shape.

Smaller and lighter samples or workpieces may yield or flex under this force, producing too-low L-values with excessively large variation. Even with big or heavy workpieces, it is possible for thin-wall regions or thinner protruding parts to yield upon impact. Depending on the frequency of the resilient yielding action, the measured L-value may be abnormally low or high. Under many situation, potential problems can be checked in the following manner:

- Medium-weight samples and also heavier samples with protruding parts or thin walls should be placed on a solid support in such a manner that they do not move or bend during the test impact.
- Light-weight samples should be rigidly "coupled" with a non-yielding support such as a heavy base plate. Clamping in a vice is of no value, since the samples become exposed to stress, and complete rigidity can never be attained. Consequently, measured L-values would be too small and show excessive variations.

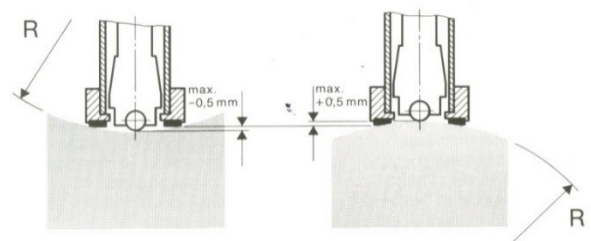
### 5.4 Samples with Curved Surfaces

Impact testers only work properly if the impact body has a certain position in the guiding tube at the moment of impact. In the normal position when testing flat and convex-cylindrical samples (such as round samples), the spherical test tip is located exactly at the end of the guiding tube.

However, when testing spherically or cylindrically shaped concave surfaces, the impact body remains further within the guide tube or protrudes further therefore. Thus, with such types of curved surfaces, it should be observed that the radius of curvature R is larger than the values indicated in the following Figure.

Curved surfaces should always be tested with the small support ring.

Impact device types D/DC, D+15, C and E  $R_{min}=30mm$   
Impact device type G  $R_{min}=50mm$



For impact devices D, DC, D+15, C and E, special support rings are available to accommodate smaller radii on convex or concave surface.

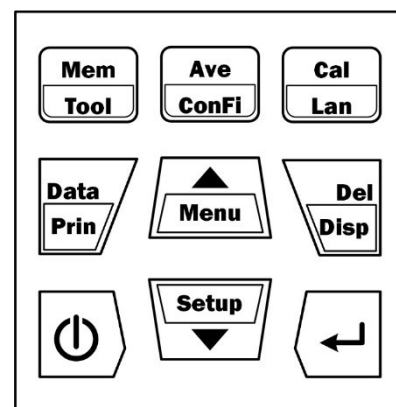
Types of impact devices	Support Ring	Radius for Curved Surface (mm)
D/DC, D+15,C,E	Standard support ring	>60
	Small support ring	60-30
C	Standard support ring	>100
	Small support ring	100-50

## 6 Operation

### 6.1 Function of Key and operation diagram

#### 6.1.1 Function of Key

Press the button shortly to execute the function in the first line: “Memory”, “Average”, “Calibration”, “Data” and “Delete”. Press the button and hold to execute the function in the second line: “Tools”, “Configuration”, “Language”, “Print” and “Display”.



Press it shortly to switch the tester on.  
Press and hold it to switch the tester off.



Press it shortly to enter memory menu (in measuring mode).  
Press and hold it to enter tool menu (in measuring mode).



Press it shortly to enter average menu (in measuring mode).  
Press and hold it to enter Customer menu (in measuring mode).



Press it shortly to enter calibration menu (in measuring mode).  
Press and hold it to enter language menu (in measuring mode).



Press it shortly to review stored data (in measuring mode).  
Press and hold it to print screen (in measuring mode).



Press it shortly to delete current data (in measuring mode).  
Press and hold it to change different display modes in turn (in measuring mode).



Press it shortly to enter menu (in measuring mode).  
Press it shortly to move the cursor up.  
Press and hold it to enter sample ID menu (in measuring mode).

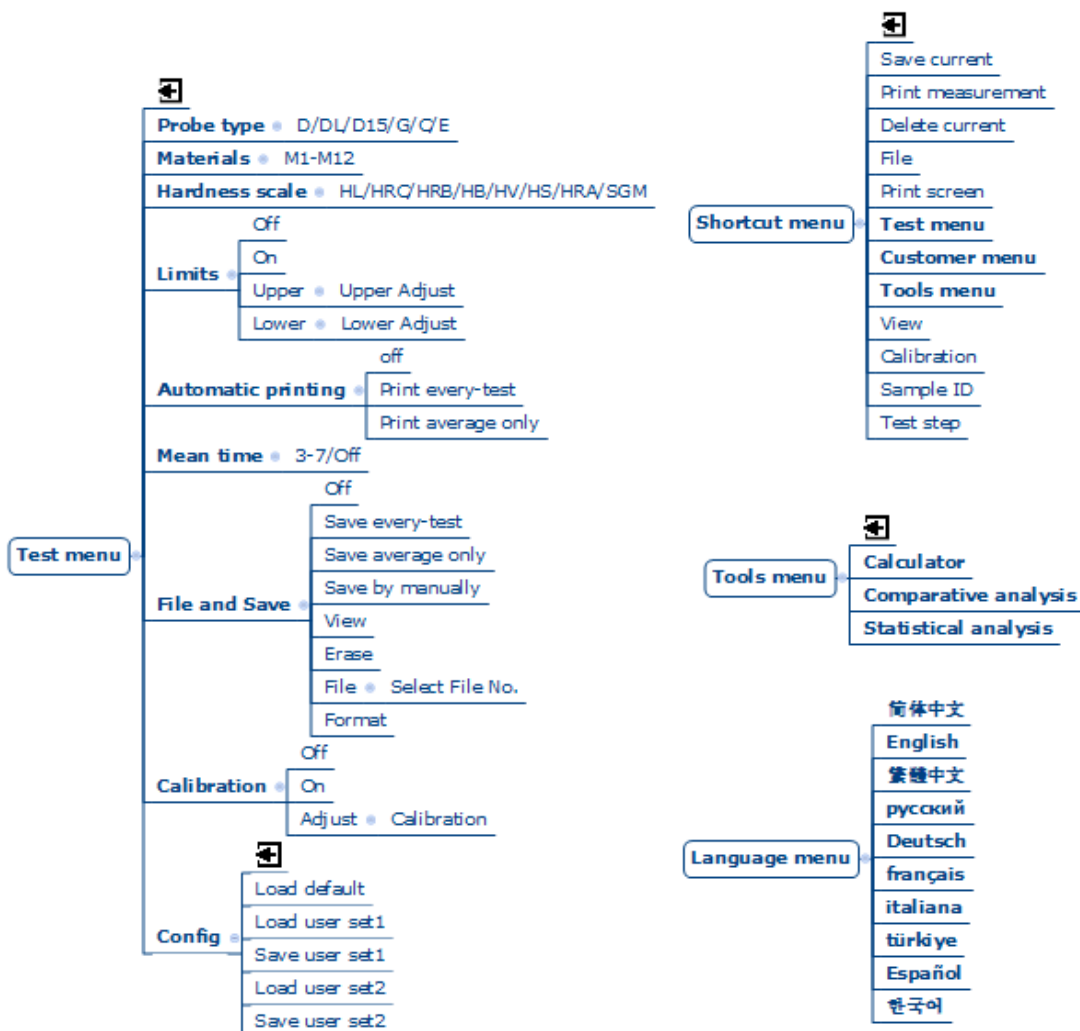
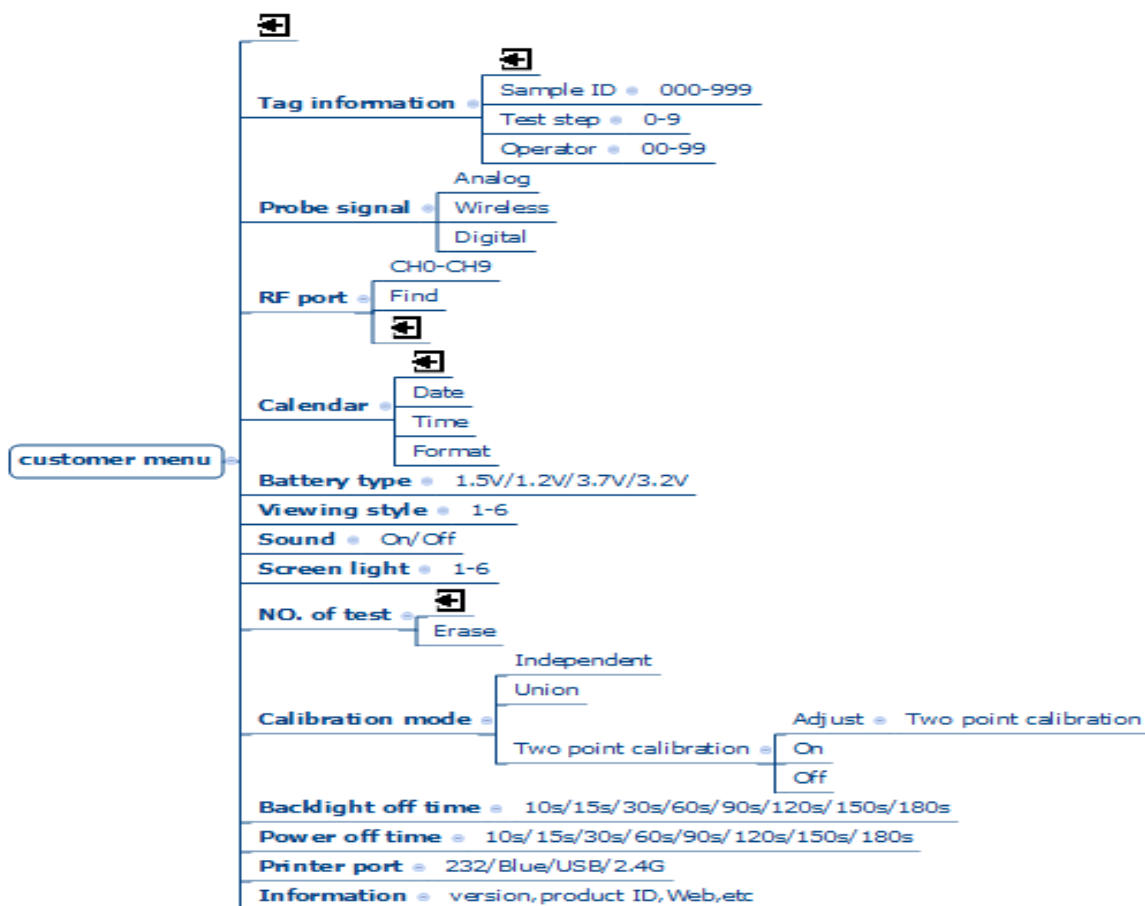


Press it shortly to move the cursor down.  
Press and hold it to enter Test step menu (in measuring mode).











































Press it shortly to confirm.  
Press it shortly to prompt shortcuts menu (in measuring mode).  
Press and hold it to exit and return to the Measure screen.



Operation Diagram









## 6.2 Symbols description

Probe		Analog probe
		Digital probe
		R/F wireless probe (disconnected)
		R/F wireless probe (battery runs out)
		R/F wireless probe (20% battery)
		R/F wireless probe (40% battery)
		R/F wireless probe (60% battery)
		R/F wireless probe (80% battery)
		R/F wireless probe (100% battery)
Battery for main unit		Battery runs out
		20% battery
		40% battery
		60% battery
		80% battery
		100% battery
Printing		Automatic printing enabled
Communication		Bluetooth paired
		Bluetooth unpaired
		RS232
		USB
		R/F 2.4G wireless
Calibration		Calibration enabled
Upper/Lower Limit		Upper/Lower Limit enabled
Tag information		Operator
		Sample ID-Test step
Mean time		Mean time
Starting window		Calibration enabled – only displayed during starting
		Main battery runs out – only displayed during starting
Shutting down windows		Shutting down– only displayed during automatic shutting down
User's operation		Entering window
		Exiting windows
		Saved successfully
		Save failed
		Deleted successfully
		Operation failed
		Invalid operation
		Operation succeed
		Working, please wait
		Optional function – need to be updated
File		Review
Data part	↑ or ▲	Beyond the upper limit
	↓ or ▼	Below the lower limit
	*	Gross error











### 6.3 Turn On/Off the Instrument

Press  shortly to turn on the instrument, then the tester will enter measuring mode. Press and hold  to turn off the tester.

### 6.4 Customer Menu

Press and hold  to enter Customer menu. Press   to select different items. Press  to enter. After adjustment, select “Exit”. Press  to return to Customer menu. Press and hold  to return to Measure screen.

### 6.5 Tag information

Press and hold  to enter Customer menu. Press   to select Tag information. Press  to enter. Press   to select “Sample ID”, “Test step”, “Operator” or “EXIT”. Press   to adjust numbers. After adjustment, press and hold  to save and return to Customer menu. Press  to exit.

Tag information

Probe signal

RF port

Calendar

Battery type

Viewing style

Sound

Screen light

No. of test

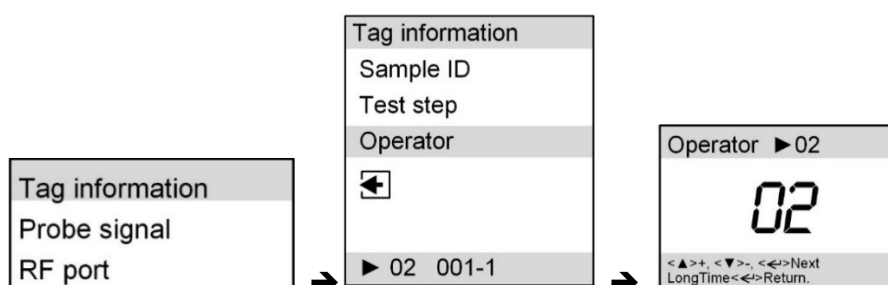
Calibration mode


Backlight off time


Power off time

Printer port









Information

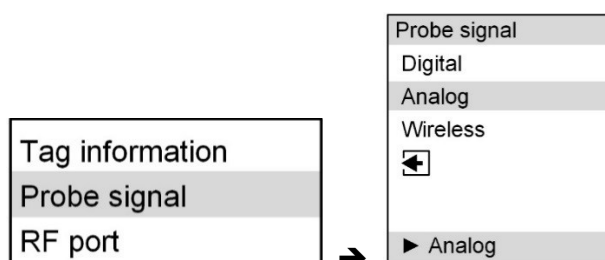


In Measure screen, you may also press and hold  to enter the “Sample ID” window.

In Measure screen, you may also press and hold  to enter the “Test step” window.

### 6.6 Probe signal

Press and hold  to enter Customer menu. Press   to select Probe signal. Press  to enter. Press   to select “Digital”, “Analog” or “Wireless”. Press  to save and return to Customer menu. Press  to exit.



Please select probe signal according to the actual probe type.

Note: to use 2.4G wireless channel to communicate with PC, disable wireless probe first.

Note: The wireless probes are susceptible to interference by various types of radio signals. Use wireless probes in environment with less electromagnetic. It is not recommended to use wireless probes in environment with strong electromagnetic field.

Note: The wireless probe has inside magnetic sensitive components. Do not use wireless probe in strong magnetic field.

## 6.7 RF port



Each tester and wireless probe have been set RF channel before leaving factory. In general, the users do not need to set up this parameter.


The instrument can be set up with multi wireless channels. For any wireless probe used by multi instruments simultaneously or under interference, change the wireless channel. Any wireless probe should be used in conjunction with one tester.

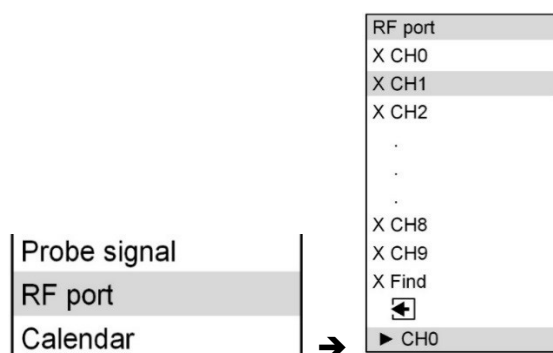
Change the channel in an environment free of electromagnetic interference (other products may have interaction with the instrument), and no other instrument of the same type (related instrument: HARTIP2200) is working.

Before changing the channel, wait until the wireless probe stops automatically (90 seconds). Do not re-start after the wireless probe shutting down.

Press and hold  to enter Customer menu. Press   to select RF port. Press  to enter.





Press   to select different channels. After selecting channel 0...9, displaying "Please wait" and flashing, then load the wireless probe to turn it on, "Exit" will display and flashes for short time and then

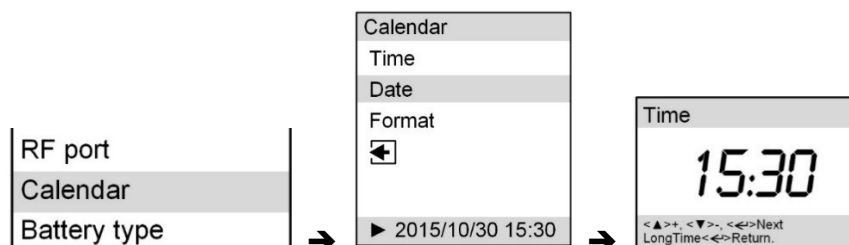
disappear, returning to Measure screen, and  displays on the measure windows, that means tester and wireless probe paired successfully.



## 6.8 Calendar

Press and hold  to enter Customer menu. Press   to select Calendar. Press  to enter.

Press   to select "Time", "Date" or "Format" to set time, date and date format. Press  to save and return to Customer menu. Press  to exit.











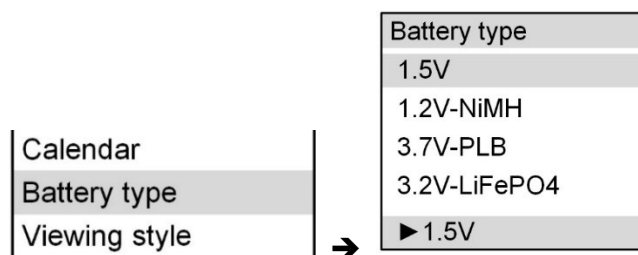


Note: Note: The calendar and the time is supplied by the internal battery. If the calendar time is missing after shutdown, check if the internal battery is normal.

## 6.9 Battery type

The instrument can use various types of batteries: 1.5V dry cell, 1.2V rechargeable battery and 3.7V lithium ion batteries. Choose proper battery type.

Press and hold  to enter Customer menu. Press   to select Battery type. Press  to enter. Press   to select different battery type. Press  to save and return to Customer menu. Press  to exit.











Note: to use 3.7V lithium-ion batteries, preferably to use that with charge-discharge protection. Charge the lithium battery in time. Do not keep the battery run out. Over-discharge of the lithium battery will reduce its lifetime. Charge the lithium battery every three months even it doesn't work, otherwise permanent damage will occur.

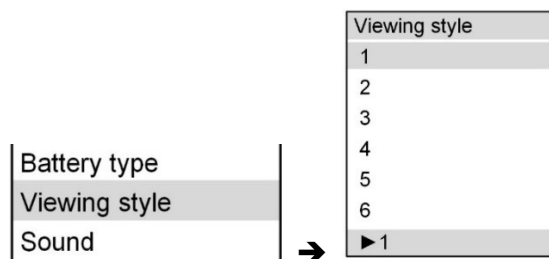
Note: to use 1.5V batteries, use that of leakage-free model. Any leakage of battery will cause corrosion of the instrument.

Note: the battery is fixed by spring. Strong vibration may cause momentary open circuit between the battery and spring, causing abnormal working of the instrument. The instrument should work in a stable environment.









Note: Do not use the battery mixed.

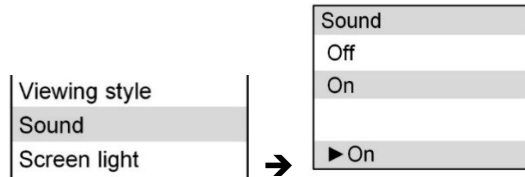
## 6.10 Viewing style

The instrument has various viewing styles. Press and hold  to enter Customer menu. Press   to select Viewing style. Press  to enter. Press   to select different style. Press  to save and return to Customer menu. Press  to exit.



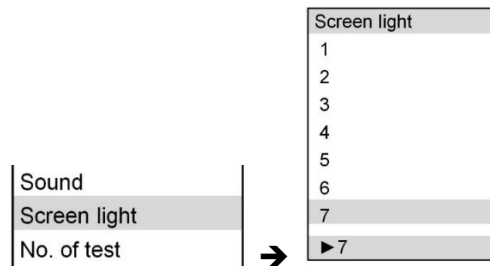
## 6.11 Sound

The instrument has sound prompt. Press and hold  to enter Customer menu. Press   to select Sound. Press  to enter. Press   to select "Off" or "On" to disable or enable the sound prompt. Press  to save and return to Customer menu. Press  to exit.



## 6.12 Screen light

Press and hold to enter Customer menu. Press to select Screen light. Press to enter. Press to select from 1 to 7 seven levels of brightness. Press to save and return to Customer menu. Press to exit.



Note: The brighter the brightness, the more the power consumption, and the shorter the battery life.

## 6.13 No. of test

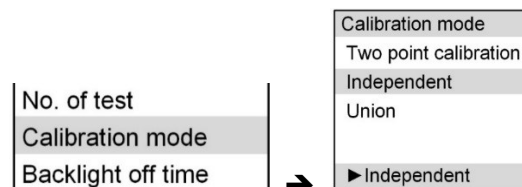
The statistics Measurement times. The user can maintain the probe based on the Measurement Number. Press and hold to enter Customer menu. Press to select No. of test. Press to enter. Press to select Erase to clear the numbers or view test numbers. Press to return to Customer menu. Press to exit.

The test number means the measurement times of the probe. After the measurement times of the probe exceeds the limit, conduct re-calibration, maintenance, repair and replacement of the probe.



## 6.14 Calibration mode

Press and hold to enter Customer menu. Press to select Calibration mode. Press to enter. Press to select two point calibration, Independent or Union mode. Press to return to Customer menu. Press to exit.



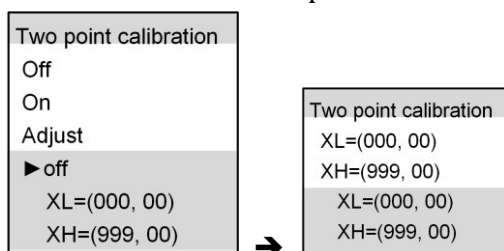
### 6.14.1 Single point calibration

The single point calibration contains two Calibration Modes -- Independent Calibration and Union Calibration. Union Calibration mode is a traditional calibration method. After calibration, all hardness scales will change following Leeb hardness.

In Independent Calibration mode, each hardness scale will be calibrated individually. Hardness of the other conversion will not change. This method applies only to certain special cases. When using this method, the relationship between the various hardness scales will change. Therefore, after calibration using this method, only the measurement with the specified hardness unit is valid, and the measurement with other scale is invalid.

### 6.14.2 Two point calibration

If the hardness of specimen is far different from the hardness of standard test block, two point calibration is preferred. Please use two hardness blocks to do the two point calibration. One is the high value block, another is the low value block. It would be better if the hardness of specimen is between the hardness of two blocks.







Two point calibration is available for HL scale. XL is for low value block, XH is for high value block. Input standard value of block in 000/999 position, input adjust value in 00 position. Adjust value = Standard value – Real value

For example, if low block is HL 510, high block is HL 780, the real reading on HL 510 is HL 505, on HL 780 is 790, then

XL= (510, 5)










XH= (780, -10)

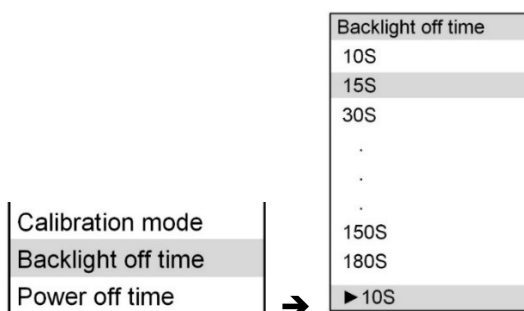
Press   to change number, press  to move to next item. When adjust value doesn't equal to 0,

the two point calibration effects, a symbol  will display at the top line of the screen.









Note: Before formal measuring using the instrument, check if the Calibration Mode is correct.

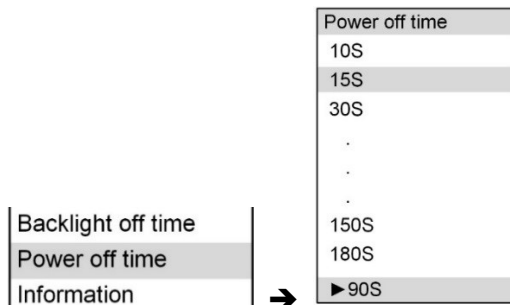
### 6.15 Backlight off time

Press and hold   to enter Customer menu. Press   to select Backlight off time. Press  to enter. Press   to “10s → 15s → 30s → 60s → 90s → 120s → 150s → 180s”. Press  to return to Customer menu. Press  to exit.











## 6.16 Power off time

Press and hold  to enter Customer menu. Press   to select Power off time. Press  to enter. Press   to select from “10s → 15s → 30s → 60s → 90s → 120s → 150s → 180s”. Press  to return to Customer menu. Press  to exit.



## 6.17 Printer Port

Press and hold  to enter Customer menu. Press   to select Printer port item. Press  to enter. Press   to select from “232→ Blue → USB → 2.4G”. Press  to return to Customer menu. Press  to exit.

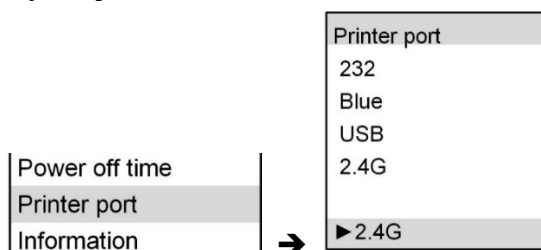
232: RS232

Blue: Bluetooth (pairing code: 1234, Bluetooth printer will search and pair with it automatically)

USB







2.4G: 2.4G R/F wireless

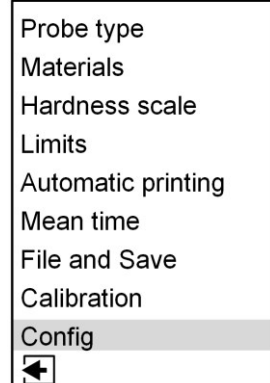
Please select suitable port according to your printer.

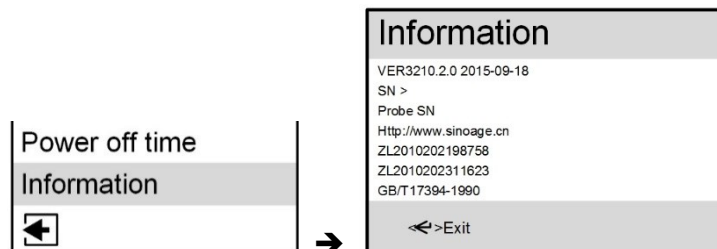


Note: Please set printer port as 232 or USB when printer is not in use, which will reduce power consumption.

## 6.18 Information

Press and hold  to enter Customer menu. Press   to select Information. Press  to view instrument information. Press  to return to Customer menu. Press  to exit.





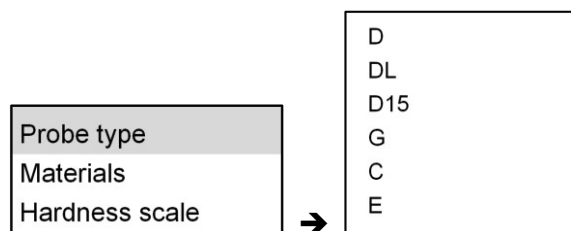
## 6.19 Parameters Setting

After starting, press to enter main menu. Press or to select the item. Press to enter the options. After adjustment, press to confirm and return to main menu, or press and hold to return to the Measure screen.

Note: Items following \* are options, which cannot be chosen in standard instruments.

## 6.20 Select Probe

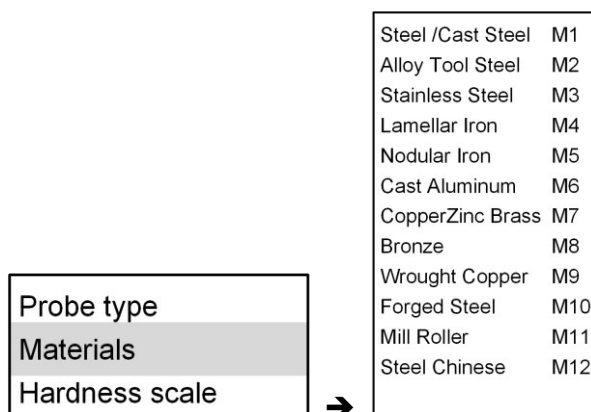
Press to enter main menu and press to select “Probe type” and press to enter probe type menu. You may select “D→DL→D15→G→C→E” probe. Press to confirm selection and go back to main menu, or press and hold to return to Measure screen.



Note: Please select D if you use DC probe.

## 6.21 Material Selection









Press to enter main Menu and press to select “Materials” and press to enter materials menu. There are 12 types of material, press to confirm selection and go back to main menu, or press and hold to return to Measure screen.

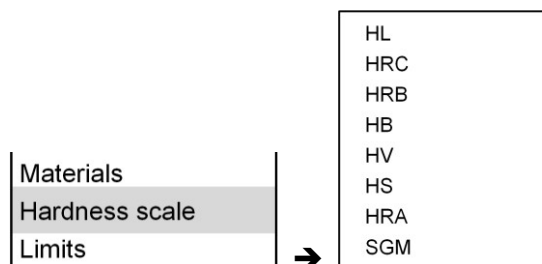


Note: M1, M10, M12 are all steel, and the difference between them: the conversion of M1 Hardness Unit follows the corresponding international standard; the conversion of M10 Hardness Unit follows the corresponding









state standard (forged steel); the conversion of M12 Hardness Unit follows the corresponding state standard (steel rolling). There are some numerical differences between the three standards. The user should select the proper one.

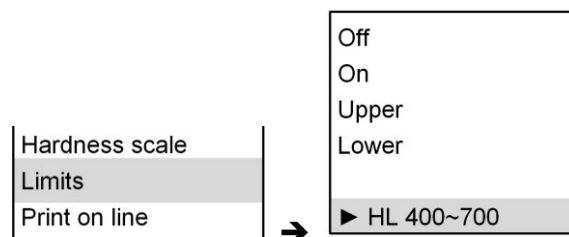
## 6.22 Hardness Scale


Press  to enter main Menu and press   to select “Hardness scale” and press  to enter Hardness scale menu. Press   to select different hardness scales, then press  to confirm selection and go back to main menu, or press and hold  to return to Measure screen.



## 6.23 Upper/Lower Limits

Press  to enter main Menu and press   to select “Limits” and press  to enter Limits menu. Press   to select different items, then press  to confirm selection and go back to main menu, or press and hold  to return to Measure screen.











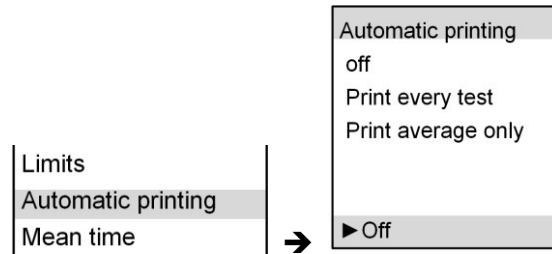
Select “On” to enable pre-set Upper/Lower Limit, and display “” in Measure screen. After enabling, the Voice Prompt is enabled by default. After overrun, prompt three sounds. If the measurement is above the Upper Limit, “△” displays next to the readings. If the measurement is under the Lower Limit, “▽” displays next to the readings. Select “Off” to disable Upper/Lower Limit prompt. Select “Upper” or “Lower” to adjust.

The Upper Limit must be higher than the Lower Limit, otherwise, the settings are invalid.

The settings of Upper/Lower Limit will impact the statistics of the qualified rate. Any value overrun is deemed as disqualified, otherwise, it is deemed as qualified.

## 6.24 Automatic Printing

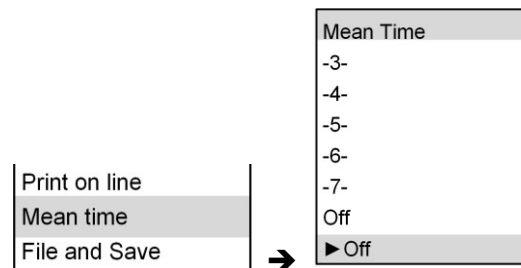
Press  to enter main Menu and press   to select “Automatic printing” and press  to enter print menu. Press   to select different items, then press  to confirm selection and go back to main menu, or press and hold  to return to Measure screen.



You may select “Off → Print every test → Print average only”. The port should match the printer. If the instrument is not equipped with a printer (or printer not enabled), select off, otherwise, the instrument will take time to search the printer, impacting the measure speed, and consuming the battery of the instrument.

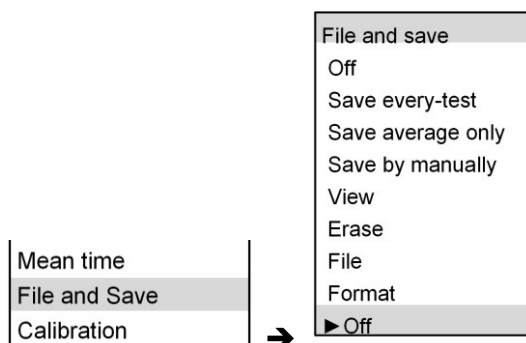
## 6.25 Mean Time

Press to enter main Menu and press to select “Mean time” and press to enter Mean time menu. Press to select different items, then press to confirm selection and go back to main menu, or press and hold to return to Measure screen.



## 6.26 File and Save

Press to enter main Menu and press to select “File and Save” and press to enter File and Save menu. Press to select different items, then press to confirm selection and go back to main menu, or press and hold to return to Measure screen.



Erase: To delete the data in current file.

File: To select different file (memory group)

Format: To delete all data in memory.

Save every-test: Save after each measurement.









Save average only: When mean time is enabled, save the average value instead of each reading.

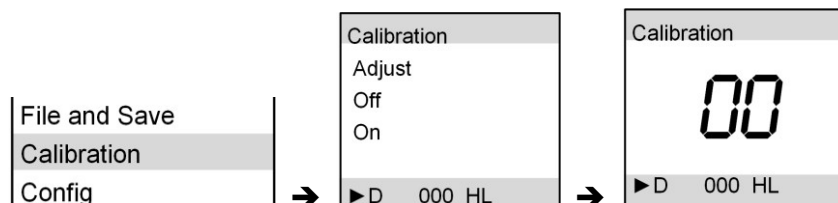
Save by manually: Press then select “Save current” to save the reading manually.

View: To review the stored data.

Stored data includes: measuring time, Operator No., Workpiece No., Step No., probe type, measured material, hardness scale, hardness reading, overrun status. The above data can be printed and uploaded to PC.


## 6.27 Calibration (Single point)


Press  to enter main Menu and press   to select “Calibration” and press  to enter Calibration. Press   to select different items. The user can adjust based on the value of standard block or standard hardness of measured materials. After adjustment then press  to save and go back to the menu, or press and hold  to return to Measure screen.



On: To enable the single point calibration.

Off: To disable the single point calibration.

Before calibration, please load factory default settings first (refer to 6.28 Config), then select calibration menu, then adjust value according to the accuracy, finally press  to accept changes. After Calibration is done, the

symbol  will display at the top line of the screen.









Note: before formal measuring using the instrument, check if the calibration is correct.

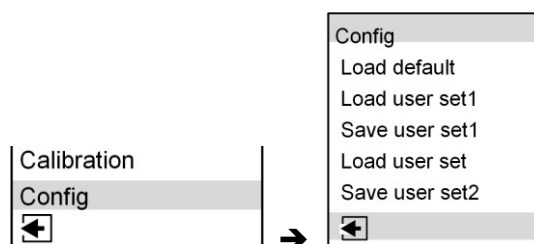
Note: if the calibration value is set to 0, the Calibration cannot be enabled.

Note: Calibration is only a temporary way to ensure measurement accuracy. It is not recommended conduct calibration frequently to ensure accuracy of the instrument. For permanent calibration, please contact the manufacturer.

Note: Single Point Calibration is only significant for improved instrument measurement accuracy within a certain range, and will make instrument's measurement accuracy worse outside the range.

## 6.28 Configuration

Press  to enter main Menu and press   to select “Config” and press  to enter Config menu. Press   to select different items, then press  to confirm selection and go back to the menu, or press and hold  to return to Measure screen.







Load default: Restore factory default settings.







Save user set: User can save the set parameters, such as the impact device, materials, mean times, Upper/Lower Limit etc.

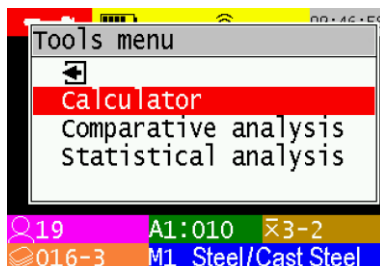
Load user set: Load the saved user settings.



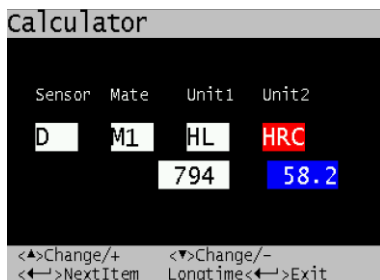
Exit() After setting, select “” and press  to return to Measure screen, or press and hold  to return to Measure screen.












## 6.29 Hardness Calculation Tools

This instrument has built-in analysis tools and a hardness calculator. Press and hold  to enter Tools menu. Press   to select and press  to confirm. Press and hold  to return to tools menu and press  to return to Measure screen.



## 6.30 Calculator



Press and hold  to enter Tools menu. Press   to select and press  to confirm. Press  to select the parameter: Sensor (Probe) → Mate (Material) → Unit1 (known hardness scale) → Unit2 (to be queried) → Known Hardness → Hardness to be queried in order. Press   to adjust. Press and hold   for fast adjustment and display of Hardness to be queried in time. Press and hold  to exit return to Tools screen. Press and hold  again to exit and return to Measure screen.

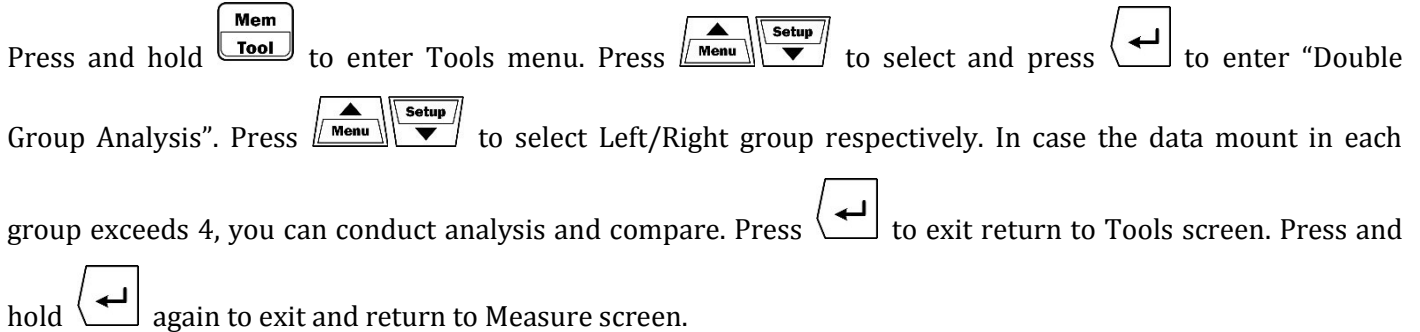
Note: for data entered outside the standard range, this calculator is still able to give relevant data, but only for reference.

## 6.31 Comparative analysis

Comparative analysis and calculation of two groups of data, to determine whether difference exists between the test sample, and which indicator has the difference.

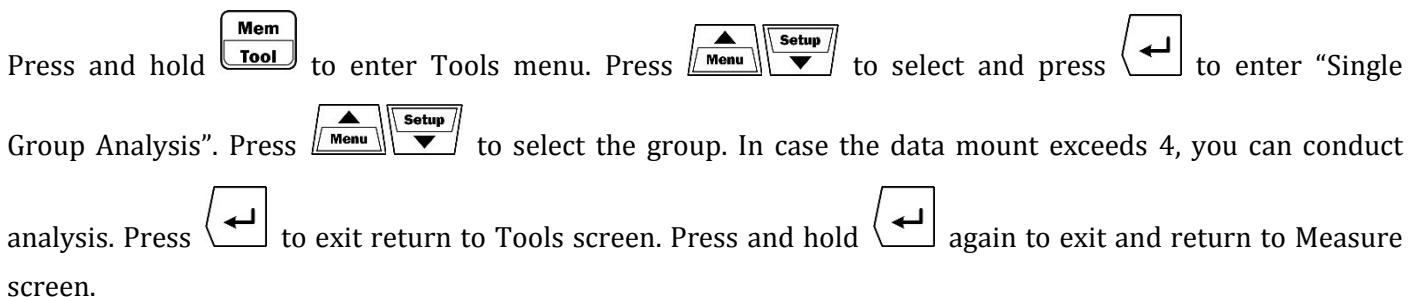
To perform comparative analysis, the data amount shall be 4 at least in each group, otherwise, displaying “The data amount is less than 4”.

For comparative analysis, the data type of the two groups shall be consistent for calculation, otherwise, displaying “Data in FILE are different types”. Consistent data type covers the sensor, materials and unit.



Distribution Diff.:Sig. (90%) (?): Distribution difference: Significant (90%)

For statistics analysis, the data type of the two groups shall be consistent for calculation, otherwise, displaying “Data in FILE are different types”. Consistent data type covers the sensor, materials and unit.



FILE A: Group A

NUM: Data amount in current group

D M1 HL: Probe, Materials, Hardness Unit

RAN (?): Range

AVE: Average value

STD (?): Standard Deviation

E95 (?): Mean 95% Confidence Intervals (Standard Deviation)

SKEW (?): Skewness

KUPT: Kurtosis

S95H (?): Standard Deviation, 95% Confidence Intervals Upper Limit, S95L: Standard Deviation 95% Confidence Intervals Lower Limit





Uniform-DIST.: Not refuse (95%) (?): Uniform distribution: Not refuse (95%)

Normal or Uniform: Not refuse (95%): normal distribution or uniform distribution: Not refuse (95%)

Normal-DIST.: Not refuse (95%): normal distribution: Not refuse (95%)



Neither Uniform nor Normal DIST: Neither normal distribution nor uniform distribution.

### 6.33 Shortcuts

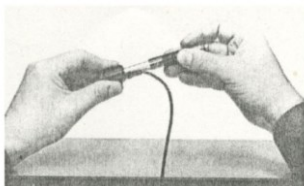
Press  in measuring mode, a group of shortcuts will prompt, press   to select then press  to confirm what you need rapidly.

### 6.34 Measuring Procedure

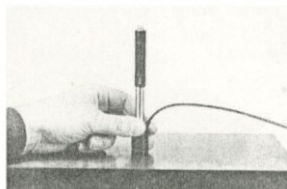
Turn on the tester

Press  shortly to turn on the instrument, then the tester will enter measuring mode Press and hold  to turn off the tester. Before turning on the tester, please make sure to put suitable batteries and connect probe well.

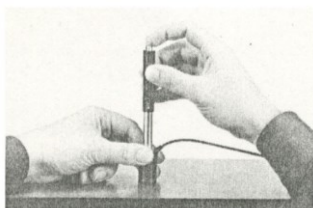
Measuring with cable probe



Loading: Press down the loading tube to lock the impact body inside the impact device.



Placing: Place and press the support ring beneath the impact device on the surface of work-piece under test. Distance between two test points should be no less than 3mm.



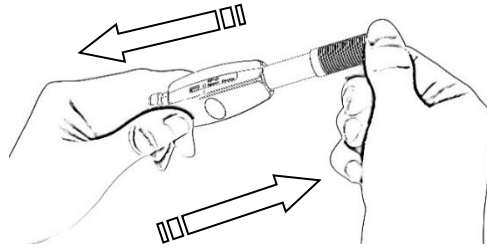
Starting: Press the button on top of the impact device to release the locked impact body to complete the measurement.

When one measurement is finished, the measured hardness value and related parameters will be shown on LCD.

During the testing process, the probe, work-piece and body must be stable.

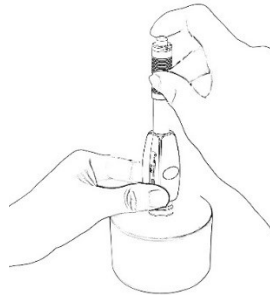
Measuring with wireless probe

Loading the wireless probe



Hold the impact device with left hand while push the loading tube with right hand toward to the end. Then loose the force and let the loading tube back to original position.

Release



Place the impact device against the object to be measured. Then press the release button on top of the impact device with finger of right hand. The measuring value will display on LCD.

When the tester is switched on, the tester will enter into measuring mode, and the wireless probe will start working after loading.

## 7 Maintenance and Repair

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*Do your best to avoid shock, heavy dust, damp, strong magnetic field, and oil stain.*

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### 7.1 Maintenance of Impact Devices

Impact devices do not require any particular care other than periodic cleaning of the impact body and the guiding tube after performing approximately 1000-2000 tests. During cleaning, the following procedures should be observed:

- Unscrew support ring and remove impact body from the guiding tube.

- Remove any dirt and metallic dust from the impact body and the spherical test tip.

- Clean the guiding tube with the special brush provided.

- Do not apply oil to any parts of the impact device.

### 7.2 Change Battery

One can change the batteries at any time. When AA alkaline batteries are used, please take the batteries out from battery compartment if the tester is not be used for a long time.

## 8 Introduction of PC software









Data communication software is designed for reading and processing the data of hardness tester. It can read the data from the memory of hardness tester, export the data to the computer and print the data from the computer printer.

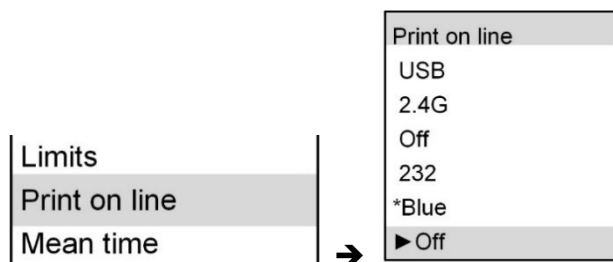
System requirement:

A PC with USB port

Windows 7 / Windows 8

## 8.1 Connect PC and hardness tester wirelessly

Insert USB dongle to PC, switch on the tester, then enable “Print on line” option. Press  to enter main Menu and press   to select “Print on line” and press  to enter Print on line menu. Press   to select current wireless connection 2.4G (Default) or Blue (Bluetooth, Optional), then press  to confirm selection and go back to main menu, or press and hold  to return to Measure screen. After “Print on line” is enabled, a printer with wireless indicator will display on the top line of the measuring window.



### 8.1.1 Driver installation

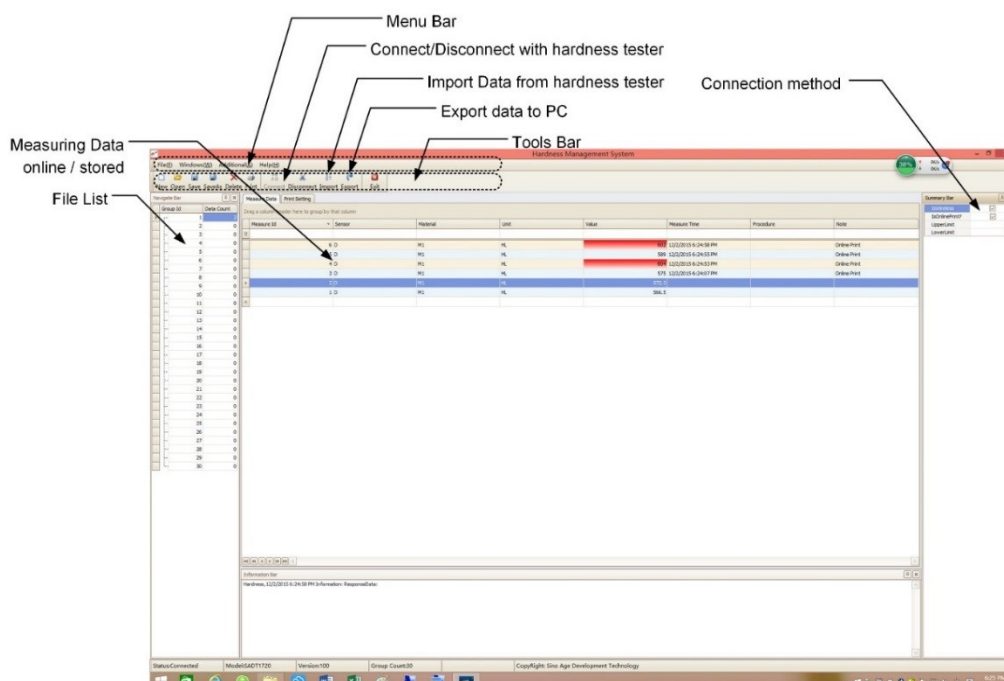
Computer will prompt "Found new hardware" while the hardness tester is connected to the computer first time, please install the driver located in X:\Drivers folder. (X: means CDROM drive letter).

### 8.1.2 Software Installation

Double click “setup.exe” to install the PC software. Please follow the installation wizard to finish it.

### 8.1.3 Start PC software

After the data communication software is installed, a shortcut will be created on the desktop automatically. Double click the shortcut to run the program.







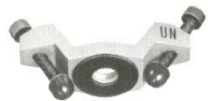
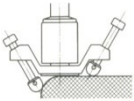
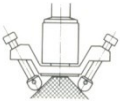
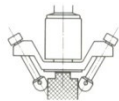


The main interface of the software is a standard windows form, containing the title bar, menu bar and toolbar.

**Please note:** After running the software, click the "Connect" from the toolbar to create connection between PC and tester. If it is connected by 2.4G/Bluetooth, please click "Is Wireless" option in the right Summary Bar first, then click "Connect" button to connect wireless connection. Bluetooth pairing code is 1234.

## 9 Optional Accessories

### Support Rings for Impact Device D

Part designation and dimensions:		Suitable for the following test surfaces	
D6	$\Phi 19.5 \times 5.5 \text{ mm}$	$R \geq 60 \text{ mm}$	plane cylindrical hollow-cylindrical spherical hollow-spherical
			
D6a	$\Phi 13.5 \times 5.5 \text{ mm}$	$R \geq 30 \text{ mm}$	plane cylindrical hollow -cylindrical spherical hollow-spherical
			
Z 10-15	$20 \times 20 \times 7.5 \text{ mm}$	$R 10 \text{ mm}-15 \text{ mm}$	cylindrical
Z 14.5-30	$20 \times 20 \times 6.5 \text{ mm}$	$R 14.5 \text{ mm}-30 \text{ mm}$	
Z 25-50	$20 \times 20 \times 6.5 \text{ mm}$	$R 25 \text{ mm}-50 \text{ mm}$	
		$R < 10 \text{ mm}$ not possible $R \geq 30 \text{ mm}$ D6/D6a	
HZ 11-13	$20 \times 18 \times 5 \text{ mm}$	$R 11 \text{ mm}-13 \text{ mm}$	hollow-cylindrical
HZ 12.5-17	$20 \times 20 \times 5 \text{ mm}$	$R 12.5 \text{ mm}-17 \text{ mm}$	
HZ 16.5-30	$20 \times 20 \times 5 \text{ mm}$	$R 16.5 \text{ mm}-30 \text{ mm}$	
		$R < 11 \text{ mm}$ not possible $R \geq 30 \text{ mm}$ D6a	
K 10-15	$\Phi 20 \times 7.7 \text{ mm}$	$R 10 \text{ mm}-13 \text{ mm}$	spherical
K 14.5-30	$\Phi 20 \times 6.7 \text{ mm}$	$R 14.5 \text{ mm}-30 \text{ mm}$	
		$R < 10 \text{ mm}$ not possible $R \geq 30 \text{ mm}$ D6/D6a	
HK 11-13	$\Phi 17 \times 5 \text{ mm}$	$R 11 \text{ mm}-13 \text{ mm}$	hollow-spherical
HK 12.5-17	$\Phi 18 \times 5 \text{ mm}$	$R 12.5 \text{ mm}-17 \text{ mm}$	
HK 16.5-30	$\Phi 20 \times 5 \text{ mm}$	$R 16.5 \text{ mm}-30 \text{ mm}$	
		$R < 11 \text{ mm}$ not possible $R \geq 30 \text{ mm}$ D6a	
UN	$\Phi 52 \times 20 \times 16 \text{ mm}$		
		  	

### 9.1 Micro printer

#### 9.1.1.1 Power on

Press the power switch (left button) and hold down for 3 seconds, then the power is on. The status indicator flashes.

#### *9.1.1.2 Power off*

Press the power switch (left button) and hold down for 3 seconds, then the power is off. The status indicator light turns off.

#### *9.1.1.3 Feeding Paper*

Press the paper feed button (right button), the printer start feeding paper. If release the button, then stop feeding paper.

#### *9.1.1.4 Self-test*

In the power-off state, press the paper feed button (right panel), do not release, and then power on. The printer will print self-test

#### *9.1.1.5 Working Status Indication*

Printer head overheating, lacking paper, roll cover open: work status indicator flashes, the flashing period is 4 seconds (bright for 2 seconds)

Communication Status Indicator: When the printer is in stand-by station, the working status indicator light period is 4 seconds (bright for 50 milliseconds).

#### *9.1.1.6 Power Status Indication*

In the printer working process, the remaining capacity is more than 50%, three-color power indicator, green light keep bright; when the battery power 50% ~ 30%, three-color power indicator, the yellow light keep bright; when the battery is less than 30%, three-color power indicator, the red light keep bright; When the battery power is too low to support normal printing, the printer will automatically shut down

In the process of charging, the charger-color indicator light shows red. When charging is completed, three-color indicator light turns green.

#### *9.1.1.7 Precautions*

Operate the printer correctly; avoid any damage to the printer;

If jams occur, be sure to power off and wait for 10 seconds until the head is cooled down. Then remove the paper jam;

Do not place this product in wet or dusty environments; no pressing, stack forbidden;

Only use qualified paper roll (with axis);

Do not use paper roll with the end adhesive to the axis, otherwise the printer cannot measure the paper roll end correctly, or cause.