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# **BPX5501 Portable Hardness Tester**

## **USER'S MANUAL** V2.0

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# **CAUTION**

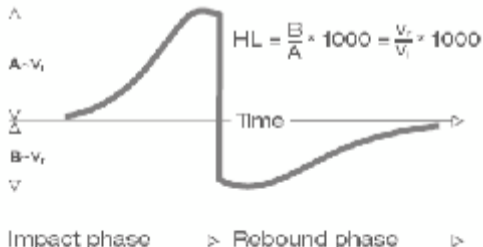
## **Please Carefully Read This First**

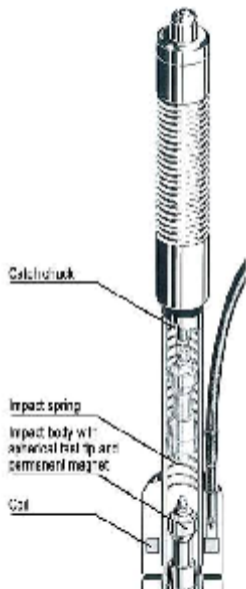
- 1. Users can only use the special battery and power adapter offered by our company in display unit, or may cause damage to products, battery leakage, even fire or explosion.**
- 2. Any components of the product cannot be submerged in water and exposed in the rain, which could cause a battery explosion, and display unit damage.**
- 3. To avoid electrical shock, do not open the cabinet.**
- 4. Even if the instrument is not used for a lone time, store it in a dry and cool place after fully charging it once per year. This is to maintain the battery functions.**

# 1. SUMMARIZE

## 1.1 Measuring Principle Scope

**BPX5501 Metal Hardness Tester** measuring principle is physically a rather simple, dynamic hardness test. An impact body with a hard metal test tip is propelled by spring force against the surface of the test piece. Surface deformation takes place when the impact body hits the test surface, which will result in loss of kinetic energy. This energy loss is calculated by velocity measurements when the impact body is at a precise distance from the surface for both the impact and rebound phase of the test. The permanent magnet in the impact body generates an induction voltage in the single coil of the impact device. The voltage of the signal is





proportional to the velocity of the impact body, and signal processing by the electronics provides the hardness reading for display and storage. Simply put, harder materials produce higher rebound velocity than those which are less hard (higher L value). **BPX5501 Metal Hardness Tester** is a direct hardness measurement within any particular material group (i.e. steel, aluminum, etc.) and can be used as a final test result without conversion. However, **BPX5501 Metal Hardness Tester** has established conversions to other hardness scales for the convenience of our customers. These conversions to other scales (HRC, HRB, HB, HV, HSD etc.) are programmed into the electronics, and can be shown directly on the display as the test result. All data is stored in the native L scale to prevent any possible errors with multiple conversions.

## 1.2 The Hardness Value "L"

This term, 1978 introduced by Doctor Dietmar Leeb into measuring technology, is the quotient for the impact body's rebound and impact velocity, multiplied by 1000. Harder materials produce higher rebound velocity than those which are less hard. With reference to a particular material group (e.g. steel, aluminum etc.) the L-value represents a direct hardness measurement and is used as such. Comparison curves with standard static hardness values have been established (Brinell, Vickers, Rockwell C, B) for the most prevalent materials, enabling the L values to be converted into the relevant values for these procedures.

With **BPX5501 Metal Hardness Tester**, such hardness values can be directly displayed in the hardness scales HRC, HRB, HB, HV, HSD and tensile strength (MPa).

## **1.3 Main Features:**

1.3.1 Highly accurate  $\pm 6$  HL

1.3.2 Automatic correction for impact direction

1.3.3 Large, easy to read display with backlight

1.3.4 User profiles for fast change of all settings

1.3.5 To operate with touch screen

1.3.6 Large memory with on-screen review of data

1.3.7 Converts to all common hardness scales (HV, HB, HRC, HRB, HSD) and tensile strength MPa.

1.3.8 Rechargeable Li-ion batteries

1.3.9 Conforms to the Standard ASTM A956-02

## 1.4 Application Range

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

## 1.5 Technical Information

### 1.5.1 Display Unit

- ✧ HL Display Range: 0~1000HLD
- ✧ Accuracy:  $\pm 6$  HL
- ✧ Unit Display: large LCD with adjustable contrast ,backlight, touch screen
- ✧ Unit Material: shock resistant ABS plastic
- ✧ Internal Data Storage: ~ 500 measured value
- ✧ Resolution: 1 HL; 1 HV; 1 HB; 0.1 HRC; 0.1 HRB; 1 HSD; 1 MPa
- ✧ Battery Type: rechargeable Li-Ion
- ✧ Operating Temperature: 0°C ~ +50°C (32°F ~ 122°F)
- ✧ Storage Temperature: -10°C ~ +60°C (14°F ~ 140°F)
- ✧ Humidity: 90 % max.
- ✧ Dimension: 135 x 83 x 24 mm (5.3 x 3.2 x 0.9 inches)
- ✧ Weight: 228g

## 1.5.2 Impact Unit

### Impact Unit D

Impact energy: 11 Nmm

Mass of the impact body: 5.5g

Test tip diameter: 3mm

Test tip material: tungsten carbide

Test tip hardness:  $\geq 1600\text{HV}$

Impact length: 147mm

Impact maximum diameter: 20mm

Impact weight: 75g



## **Impact Unit DC**

Impact energy: 11 Nmm

Mass of the impact body: 5.5g

Test tip diameter: 3mm

Test tip material: tungsten carbide

Test tip hardness:  $\geq 1600\text{HV}$

Impact length: 86mm

Impact maximum diameter: 20mm

Impact weight: 50g

## **Impact Unit D+15**

Impact energy: 11 Nmm

Mass of the impact body: 7.8g

Test tip diameter: 3mm

Test tip material: tungsten carbide

Test tip hardness:  $\geq 1600\text{HV}$

Impact length: 162mm

Impact maximum diameter: 20mm

Impact weight: 80g

## **Impact Unit DL**

Impact energy: 11 Nmm

Mass of the impact body: 7.3g

Test tip diameter: 2.78mm

Test tip material: tungsten carbide

Test tip hardness:  $\geq 1600\text{HV}$

Impact length: 202mm

Impact maximum diameter: 20mm

Impact weight: 100g

## **Impact Unit C**

Impact energy: 3 Nmm

Mass of the impact body: 3.0g

Test tip diameter: 3mm

Test tip material: tungsten carbide

Test tip hardness:  $\geq 1600\text{HV}$

Impact length: 141mm

Impact maximum diameter: 20mm

Impact weight: 75g

## **Impact Unit G**

Impact energy: 90 Nmm

Mass of the impact body: 20g

Test tip diameter: 5mm

Test tip material: tungsten carbide

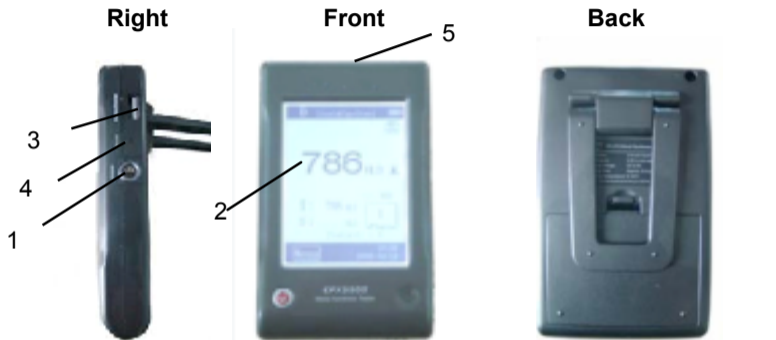
Test tip hardness:  $\geq 1600\text{HV}$

Impact length: 254mm

Impact maximum diameter: 30mm

Impact weight: 250g

## 1.6 Overview the Display Unit



**Fig 1.1**

**1. Sensor jack**

**4. Reset hole**

**2. LCD screen**

**5. IrDA window**

**3. Printer and charger jack**

## 2. CHECKING SUPPLIED ACCESSORIES

Make sure that the following accessories are supplied with your instrument. (Fig 2.1)



Fig 2.1

## 3. QUICK START GUIDE

### 3.1 Connect

To use the signal cable to connect between impact unit and sensor.



(Fig 3.1)



## 3.2 Charge the Battery

You must Charge the battery (in display unit) before using the instrument for the first time.

## 3.3 Verifying the Instrument

The **BPX5501 Metal Hardness Tester** comes supplied with a calibrated test block. Check the unit against this test block when first powering on instrument for the day. Allowable tolerance is +/- 1 HRC point.

(See§4.2.5.1 Items)

## 4. OPERATING INSTRUCTIONS

### 4.1 Display Unit

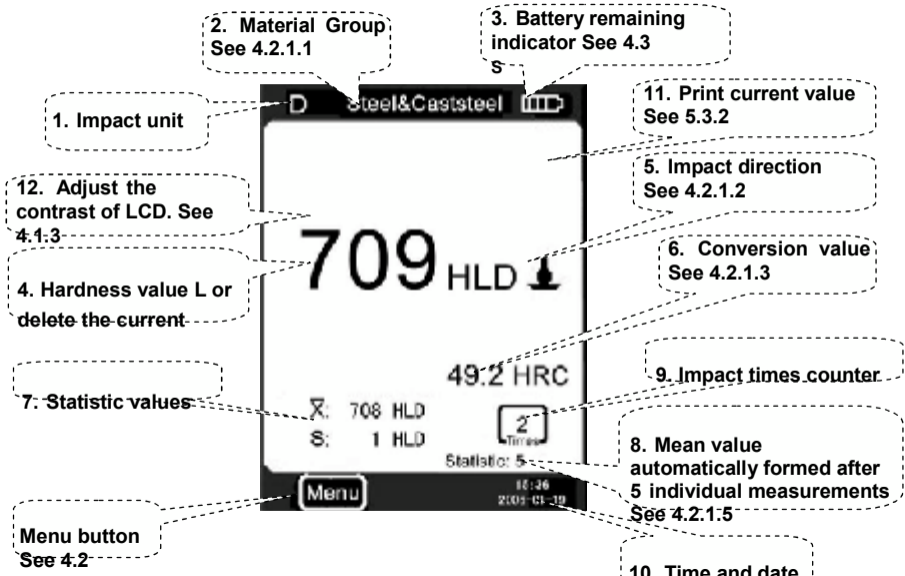
#### 4.1.1 Button

**POWER ON/OFF button**  : Press it to turn on the hardness tester; In any case, users can press this button again for one second to turn off the instrument.

**Note:**

1. When the instrument is charging, to monitor the charge state you can't turn off the instrument by press this button

#### 4.1.2 Measure Mode (Fig 4.1)



2. Material Group  
See 4.2.1.1

3. Battery remaining  
indicator See 4.3

1. Impact unit

11. Print current value  
See 5.3.2

12. Adjust the  
contrast of LCD. See  
4.1-3

5. Impact direction  
See 4.2.1.2

4. Hardness value L or  
delete the current

6. Conversion value  
See 4.2.1.3

7. Statistic values

9. Impact times counter

8. Mean value  
automatically formed after  
5 individual measurements  
See 4.2.1.5

Menu button  
See 4.2

10. Time and date

- 1. Impact unit type:** The impact unit type that connected to the display unit.
- 2. Material group:** The material group of the sample.
- 3. Battery remaining indicator:** indicate the remaining time of battery.
- 4. Hardness value L:** Measured hardness value L. (Users can click this area to delete current measuring date.)
- 5. Impact direction:** Display the impact direction.
- 6. Conversion value:** The conversion value of measured value “L”.

**Note:**

- 1. When “---” appear at this position, indicated the conversion is out of range.**
- 2. When no message at this position, Indicated that the “Conversion” have be set to “do not conversion” in this time.**

**7. Statistic values:**

$\bar{X}$ : Mean value.

S: The difference of maximum value and the minimum value

(Measured hardness value L).

**8. Statistic times value:** The impact times in a statistic data group

**9. Impact times counter:** Finished times of impact

**10. Time and date:** time and date of the system

**11.print current date:**print current date

**12. adjust the contrast of LCD**

### **4.1.3 Adjusting the LCD Contrast Manually**

Due to the use of different ambient temperatures and light conditions, it requires to adjust the contrast of LCD in order to making for observing and reading data.

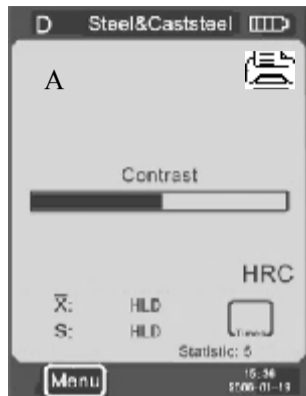
To click “A” area can open dialog box which adjusts the contrast of LCD.  
(Fig 4.2)

To click directly the following instruction of “Contrast Adjustment” can adjust the contrast of LCD on touch screen.

After the contrast adjustment to the appropriate state, users click "A" area to confirm the contrast and close this dialog box.

If there is no an operation in 3 seconds when open the dialog box which adjust the contrast of LCD, this dialog box will close automatically.

After adjusting contrast, the contrast will be restored to its original state if users will not click "A" area again to confirm the current operation.



**Fig 4.2**

#### **4.1.4 Select the type of Impact unit**

Click the icon “D” in the upper left corner of Fig 4.1 to change the type of impact device. This instrument has six options about the impact unit: D-type impact unit, G-type impact unit, DC-type impact unit, DL-type impact unit, D+15 type impact unit and C-type impact unit.

**Note:**

- 1. Make sure the correct type of impact unit has been selected, or the test value will be incorrect.**
- 2. This operation is only in the main interface to be valid**

## 4.2 Using the Menu

### BPX5501 Metal Hardness

**Tester** selects the Multistage menu mode, Fig 4.3

In measure mode, click **Menu** on the screen to display the menu. Fig 4.4

Fig 4.4

It contains six options:

**Testing Setup;**

**Printing Setup;**

Menu

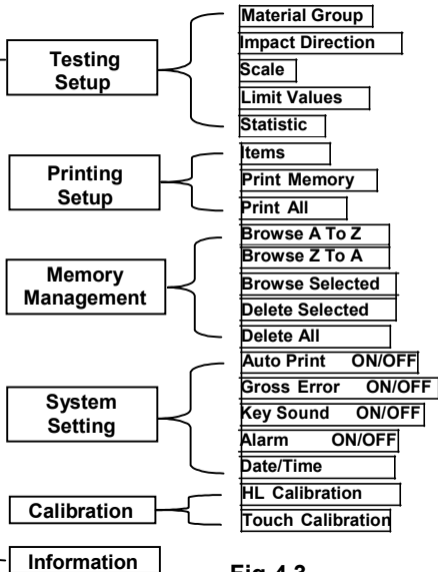
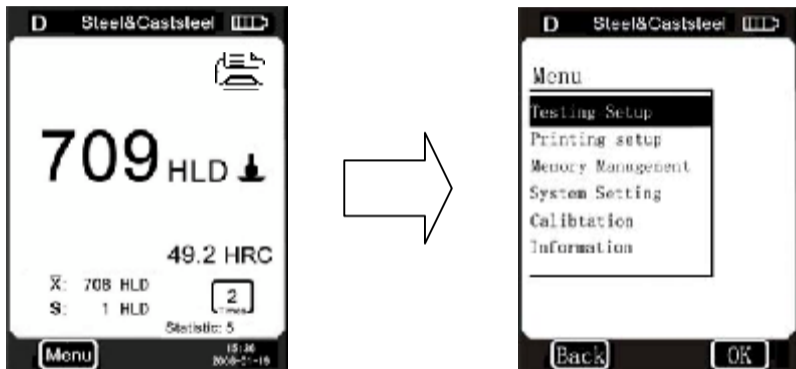


Fig 4.3



## Memory Management; System Setting; Calibration and Information.



Measure mode

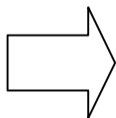
Menu mode

Fig 4.4

## 4.2.1 Testing Setup



Menu mode



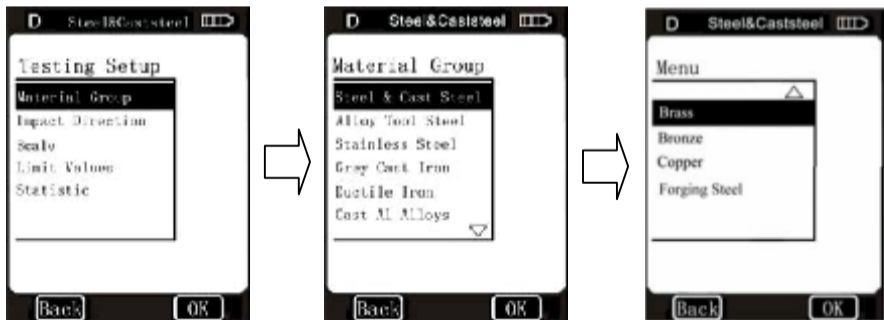
Testing setup menu

Fig 4.5

Click **Testing Setup** item on the menu mode to display the **Testing Setup** menu.

This menu item contain five selectable items: **Material Group**, **Impact Direction**, **Conversion**, **Limit Values** and **Statistic**.

#### 4.2.1.1 Material Group



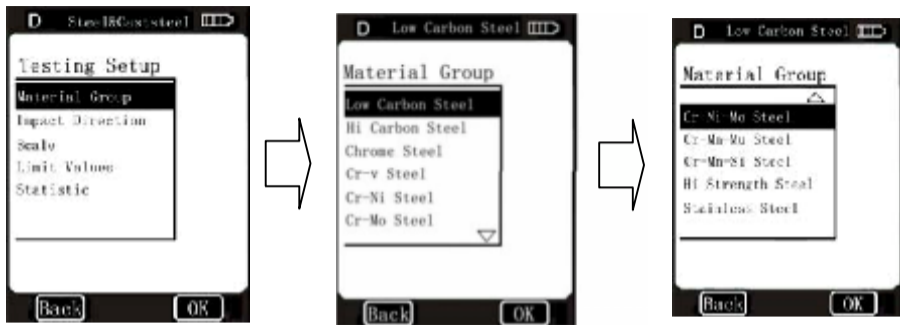


Fig 4.7

4.2.1.1.1 In measure mode, use touch pen to click the “**Material Group**” character to select the desired material.

When the type of impact unit is set to D (DC, DL or D+15) and “**Conversion**” is set to **hardness scale** (Fig 4.6), clicks on “**Material Group**” character continuously, the material changes according to

following sequence:

**Steel & Cast steel** → **Alloy Tool Steel** → **Stainless Steel** → **Grey Cast Iron** → **Ductile Iron** → **Cast Al Alloys** → **Brass** → **Bronze** → **Copper** → **Forging Steel** → **Steel & Cast steel** →...

When the type of impact unit is set to D (DC, DL or D+15) and “**Conversion**” is set to **MPa (tensile strength)** (Fig 4.7), clicks on “**Material Group**” character continuously, the material changes according to following sequence:

**Low Carbon Steel** → **Hi Carbon Steel** → **Chrome Steel** → **Cr-V Steel** → **Cr-Ni Steel** → **Cr-Mo Steel** → **Cr-Ni-Mo Steel** → **Cr-Mn-Mo Steel** → **Cr-Mn-Si Steel** → **Hi Strength Steel** → **Stainless Steel** → **Low Carbon Steel** →...

When the type of impact unit is set to G or C, clicks on “**Material Group**” character continuously, the material changes according to following sequence: **Steel & Cast steel** , **Alloy Tool Steel** , **Stainless Steel** ,

**Grey Cast Iron → Ductile Iron → Steel & Cast steel → ...**

**Note:**

- 1. When the type of impact unit is set to G, the conversion could only set to HV or HRB**
- 2. When the type of impact unit is set to C, the conversion could only set to HB, HRC, HV or HS**

**4.2.1.1.2** In **Material Group** menu, use touch pen to click the desired material item to select the material.

Click “△” or “▽” to page up or page down,  
Click **Back** to the upper menu.

**Note:**


- 1. It is necessary to select the material classification. When you did not know**

the material type, you must be reference the related material handbook.

2. When you change the material group, the Impact times counter will be set to “0”.

### 4.2.1.2 Impact Direction (Fig 4.8)

4.2.1.2.1 In measure mode, use touch pen to click the “**Impact Direction**” logo to select the desired impact direction.

Click on “**Impact Direction**” logo continuously, the impact direction changes according to following sequence: ...

4.2.1.2.2 In **Impact Direction** menu, click the desired impact direction logo to select the desired impact direction.



Testing Setup menu



Impact direction

Fig 4.8



## 4.2.1.3 Scale

**4.2.1.3.1** In measure mode, use touch pen to click the “**Scale**” character to select the desired hardness scale or tensile strength. Under selected the D-type impact unit, click on “**Scale**” character continuously, the scale changes according to following sequence:

**HB→HRB→HRC→HV→HSD→MPa→HB...**

HB	Brinell
HRB	Rockwell
HRC	Rockwell
HV	Vickers
MPa	Tensile strength



Fig 4.9

Under selected the G-type impact unit, click

on “**Scale**” character continuously, the conversion changes according to following sequence: **HB**→**HRB**→**HB**...

**4.2.1.3.2** In **Scale** menu, click desired hardness scale or tensile strength on the menu to select the hardness scale or tensile strength. When the type of impact unit is set to D, it's show in Fig 4.9, When the type of impact unit is set to G, it's show in Fig 4.10.



Fig 4.10

**Note:**

1. Since there are differences between the different hardness scale's valid range. Some test HL value can not be converted, at this time, the “---” will be show on the location where conversion value display.
2. When you set the conversion from hardness scale to tensile strength or

from tensile strength to hardness scale, you must be reset the material group.

3. Conversion value only supplies the general reference, which may result in some offset. Precisely conversion generally needs related comparative tests.

#### **4.2.1.4 Limit Values**

When the measured value “L” is out of the limit value range, the display unit will be alarm and send out a prompt.

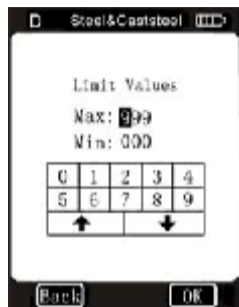
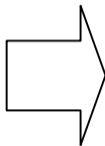
In **Testing Setup** menu, click **Limit Values** item to display the **Limit Values** setup menu. Fig 4.11

Set the limit values through click the screen keyboard.

Click **OK** confirm the limit values setup.



Testing setup menu



Limit values setup menu

Fig 4.11

Click **BACK** to cancel the limit values setup.

Click **↑↓** to select a desired bit.

#### 4.2.1.5 Statistic



**BPX5501 Metal Hardness Tester** has automatic statistic function. When the impact times are up to the **Statistic Times Value**, “ $\bar{X}$ ” value (the Mean value of measured hardness value L) and “S” value (the difference of Maximum value and the minimum value) are automatically formed and display on the screen.

In measure mode, use touch pen to click the “**Statistic**” character to display the **Statistic Times Value** setup menu; or in **Testing Setup** menu, click **Statistic** item to display the **Statistic Times Value** setup menu. Fig 4.12

Set the **Statistic Times Value** through click the screen, and then click **OK**.

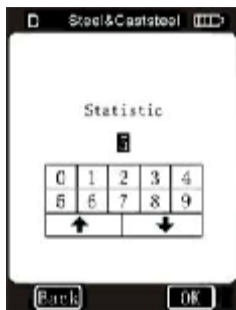
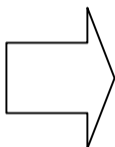
Click **OK** to confirm the **Statistic Times Value** entry.

Click **BACK** to cancel the **Statistic Times Value** entry.

Click   to select a desired bit.



Testing setup menu



Statistic times value setup menu

Fig 4.12

**Note:**

- 1. The statistic times value range is 1 ~ 99, when you set this value to “1”, the system has no Statistic process.**
- 2. When this value has be reset, the impact times’ counter will count from “0”.**

## 4.2.2 Printing Setup

When you have a micro-printer (optional), you can print out the measured values in many formats.

In menu mode, directly click **Printing Setup** on the menu mode to display the **Printing Setup** menu. Fig 4.13

There are three options in this menu: **Items**, **Print Memory** and **Print All**.

### 4.2.2.1 Items

A complete test result report form should include: measured values, conversion values, date, time, impact direction, statistic value, material, etc. you can choose the printing items in this menu. There are five options in this menu: **Date**, **Time**, **Direction**, **Mean Value** and **Material**.

Fig 4.13

In **Items** menu, click the desired item to display its **Function Switch**.  
Then click **“ON”** or **“OFF”** to confirm you choose.  
Click **BACK** or **“X”** to back to upper menu.



Menu mode



Print setup menu



Print setup menu



Function switch

Fig 4.13



## 4.2.2.2 Print Memory

You can print out the measured values and related items through this menu.

In **Printing Setup** menu, use touch pen to click **Print Memory** item to display the **Serial No. Range** menu. Fig 4.14



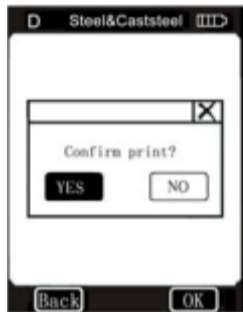
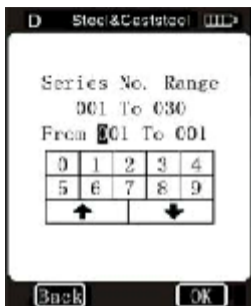
Set the printing range through click the screen keyboard (Click   to select a desired bit), and then click **OK** to display the confirm menu.

Fig 4.14, click “YES” to confirm printing, or click “NO” to cancel printing. Click **BACK** or “X” to cancel printing and back to upper menu.



Print setup menu



Confirm menu

Fig 4.14

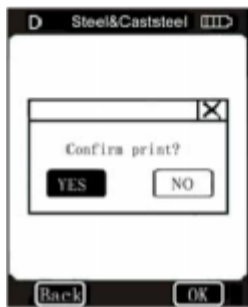
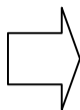
### 4.2.2.3 Print All

Use this menu you can print out all the measured data in memory.

In **Printing Setup** menu, use touch pen to click **Print All** item to display the confirm menu. Fig 4.15



Print Setup menu



Confirm menu

Fig 4.15

Use touch pen to click “YES” to confirm printing, or click “NO” to cancel printing.

Click **BACK** (or “X”) cancel printing and back to upper menu.

**Note:** BPX5501 Metal Hardness Tester can save about 500 data in memory, if you will print out all the memory data, you will spend a very long time

### 4.2.3 Memory Management

Through this menu, you can browse and delete the memory data, simultaneously also can print out the memory data.

In menu mode, directly click **Memory Management** item to display the **Memory Management** menu. Fig 4.16

There are five options in this menu: **Browse A To Z**, **Browse Z To A**, **Browse Selected**, **Delete Selected** and **Delete All**.



Menu mode



Memory management menu

D Steel&Caststeel III>

No.	HLD	DIR	MATERIAL	HRC
001	780	↓	Steel	57.9
002	782	↑	Steel	58.1
003	780	↑	Steel	57.9
004	786	↑	Steel	58.6
005	788	↑	Steel	58.8
006	768	↑	CWT.St.	56.5
007	765	↑	CWT.St.	56.1
008	764	↑	CWT.St.	56.0
009	765	↑	CWT.St.	56.1
010	761	↑	CWT.St.	55.6

Back OK

Browse A To Z

Fig 4.16

### 4.2.3.1 The Format of Memory Data

The data group (such as test result, conversion result, sample material and impact direction), automatically saved in memory after one individual measurement. The format of memory data is shown in Fig 4.17

After the data quantity that saved in the memory has been bigger than 800 groups, the Last group of data will store the 800th position and the first group of data will be erased. The second group of data will be moved into the 001st position, simultaneously the position of other group of data, will be moved into lower position.

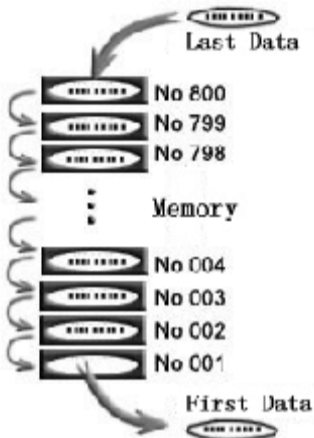






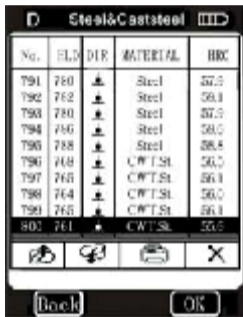
Fig 4.17

### 4.2.3.2 Data Browser Mode

This tester has provided three browser modes: **Browse A To Z**, **Browse Z To A** and **Browse Selected**.

In **Memory Management** menu, use touch pen to click the desired item, then click **OK** on the screen to display the relevant data browse menu, or directly click desired item in **Memory Management** menu to display the relevant data browse menu.


When you select **Browse A To Z** item, the menu is shown in Fig 4.16. In this menu, click  to page up, click  to page down, click  delete selected group of data, click  to print selected group of data, click **OK** to show the test time of selected group of data



No.	ELD	DIR	MATERIAL	HRC
791	760	▲	Steel	57.0
792	762	▲	Steel	58.1
793	770	▲	Steel	57.0
794	766	▲	Steel	58.0
795	788	▲	Steel	58.8
796	768	▲	CWTS	56.0
797	765	▲	CWTS	56.1
798	764	▲	CWTS	56.0
799	765	▲	CWTS	56.1
800	761	●	CWTS	55.5

Fig 4.18

When you select **Browse Z To A** item, the menu is shown in Fig 4.18

Click  or to page up.

Click  to page down.


Click  to delete selected group of data.

Click  to print selected group of data.

Click OK to show the test time of selected group of data.

When you select **Browse Selected** item, you can select serial No. range of that group of data stored in memory. This menu is shown in Fig 4.19.

In this menu, the input method is same as **Print Memory**, please refer to **4.2.2.2**. When the serial No. range input has finished, click OK to browse the selected group of data. Fig 4.20

Click  to page up.

Click  to page down.

Click  to delete selected group of data



Click  to print selected group of data.

Click OK to show the test time of selected group of data.

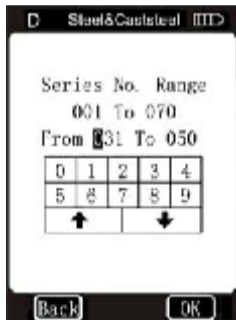
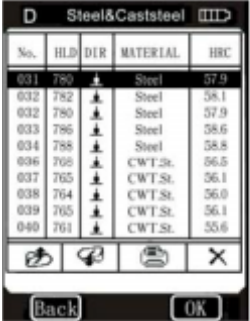


Fig 4.19



The screenshot shows a handheld device screen with the title "Steel&Caststeel". It displays a table with the following data:

No.	HLD	DIR	MATERIAL	HRC
031	780	↓	Steel	57.9
032	782	↑	Steel	58.1
032	780	↑	Steel	57.9
033	786	↑	Steel	58.6
034	788	↑	Steel	58.8
036	765	↑	CWT.St.	56.5
037	765	↑	CWT.St.	56.1
038	764	↑	CWT.St.	56.0
039	765	↑	CWT.St.	56.1
040	761	↑	CWT.St.	55.6

At the bottom of the screen are "Back" and "OK" buttons, and a row of four icons: a printer, a circular arrow, a printer with a checkmark, and an 'X'.

Fig 4.20

### 4.2.3.3 Delete Memory Data

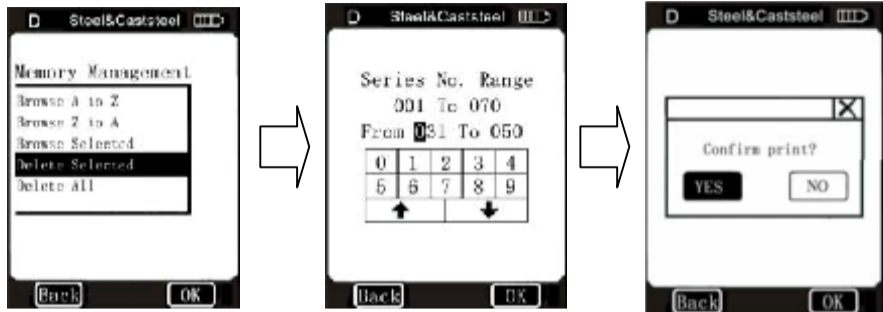
There are three ways to delete the memory data.

#### 4.2.3.3.1 Delete Memory Data in Data Browser Menu

Please refer to 4.2.3.2 .

#### 4.2.3.3.2 Delete Selected

In **Memory Management** menu, directly click **Delete Selected** item in **Memory Management** menu to display the serial No. range menu. Fig 4.21, In serial No. range menu, input you desired range that you want to delete, and then click **OK** on the screen to display a confirm menu. use touch pen to click “YES” or click **OK** to confirm delete, or select “NO” to cancel delete. Click **Back** or “**X**” to cancel delete and back to upper menu.



Memory management menu

Serial No. range menu

Confirm menu

Fig 4.21

**Note:** If the input range is out of the Serial No. range, then it will delete the actual data group in your input range and in memory data sequence number will arrange.

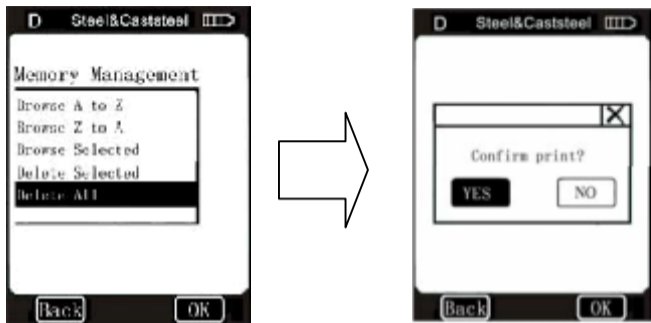


Fig 4.22

#### 4.2.3.3.3 Delete All

This operation will delete all data in memory.

In **Memory Management** menu, directly click **Delete All** item in **Memory Management** menu to display a confirm menu. Fig 4.22

Click "YES" (or click **OK**) to confirm delete.

Click “NO” to cancel delete.

Click **BACK** (or “X”) to cancel delete and back to upper menu.

## 4.2.4 System Setting

**System Setting** contains some system function switches; users can setup various switching functions according to their requirements, such as the adjustment of system calendar and clock.

In menu mode, directly click the **System Setting** option on the screen to display system setting menu, users can set for the corresponding switches or turn into the windows of setting system calendar and clock. Clicking **BACK**, users can turn back to the upper menu.

### 4.2.4.1 System Function Switch

Users can set four functions on the **system setting** menu: **Auto Print**;

## Gross Error; Key Sound; Alarm.

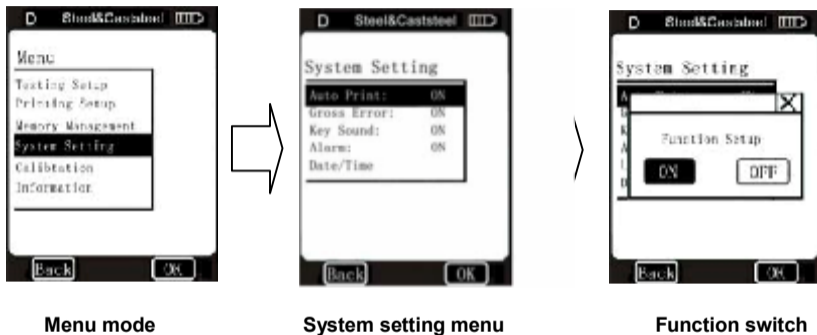




Fig 4.23

Users can open the function-setting window being selected by pressing button to choose relative operation options, and then click relative operation options to conduct function setting. See Fig 4.23.

Users can choose if turning on this function or not by using touch pen to click, they can confirm amendment by directly clicking **ON** and **OFF**.

Users can cancel operation by clicking **BACK** and  on screen.

When **Auto Print** is set as **ON**, printer will automatically print the data after the data measure finished.

When **Gross Error** is set as **ON**, gross errors will be shown out according to Grubbs criteria as the **Statistic Times Value** have been completed. See Fig 4.24. Users can click  to conduct deletion (Please refer to 4.2.3.3). When data has been deleted without supplementary point's measure, users can click **OK** to confirm the end of the measure,



No.	HLD	DIR	MATERIAL	HRC
001	836	↓	Steel	
002	834	↓	Steel	
003	835	↓	Steel	
004	837	↓	Steel	
005	835	↓	Steel	

$\bar{X} = 835$      $S = 2$

Back    OK

Fig 4.24

and be ready for the next measure. If supplementary point's measure is needed, users can click **BACK** to back to the **Measure Mode** window, and conduct supplement.

When **Key Sound** is set as **ON**, as users operate click effective icons on the touch screen, the buzzer will shortly beep once.

When **Alarm** is set as **ON**, as measured value is out of the limit values or gross errors appear, the buzzer will continuously beep twice.

#### **4.2.4.2 Date / Time**

In **System Setting** menu, directly click **Date/Time** item to display the **Date/Time** setup menu. Fig 4.25

1. Users can choose to set contents (hour/minute/day/month/year) by clicking button on the screen.
2. Input data by clicking the numbers on the touch screen.
3. Users can successfully complete to setup by clicking **OK** on the



screen.

4. To cancel new setup by clicking **BACK** on the screen.

Sample: Steps of setting time of 10:50 am,  
Jan. 16, 2009 listed as follow:

1. Choose “hour” in **Date/Time** setup menu by clicking the number “1” then “0” on the screen.

2. Choose “minute” in **Date/Time** setup menu by clicking the number “5” and “0” on the screen.

3. Choose “day” in **Date/Time** setup menu by clicking the number “1” and “6” on the screen.

4. Choose “month” in **Date/Time** setup menu by clicking the number “0” and “1” on the screen.

5. Choose “year” in **Date/Time** setup menu by clicking the number “0”

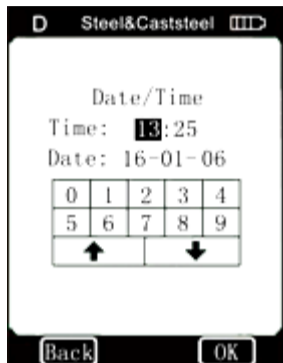


Fig 4.25

and “9” on the screen.

6. Click **OK** on the screen to confirm setting amendment; click **BACK** on the screen to cancel setting amendment.

## 4.2.5 Calibration

The **Calibration** contains the **HL Calibration** and **Touch Calibration**.

**HL Calibration** is used to calibrate the measured value (HL) of the hardness tester, so as to farthest decrease measuring error.

The **Touch Calibration** is used to calibrate the accuracy of the touch screen position, so as to provide correct fast operation of touch screen.

In **System setting** menu, select **Calibration** by clicking on the **Calibration** option to enter the **Calibration** screen. See Fig 4.26.

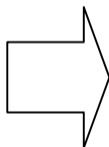
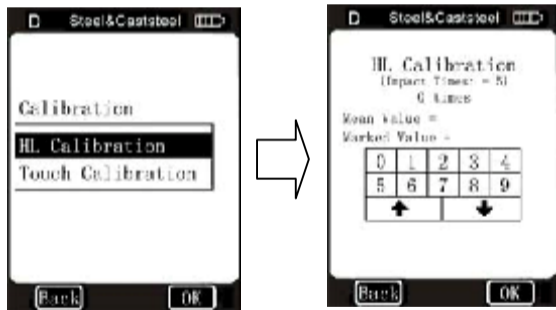


Fig 4.26

## 4.2.5.1 HL Calibration

In **Calibration** menu, click **OK** on the screen to display the **HL Calibration** menu, or directly click **HL Calibration** item in **Calibration** menu to display the **HL Calibration** menu. Fig 4.27



Calibration menu

HL Calibration menu

Fig 4.27

Carries on 5 effective impact tests on the test block, (when **Alarm** is set as ON(See§4.2.4.1 Items), and the number of impact times is less than 5, clicking OK will display an alarm prompt indicating there are operating errors), the measured values will display on the screen, (Users can delete the wrong data and measure again), Fig 4.28, then click **BACK** on the screen to back to **HL Calibration** menu, the Mean value automatically formed. Input the **HLD** value that marked on test block through click the screen keyboard and then click **OK** on the screen, The **HL calibration** finished.

No.	HLD	DIR	MATERIAL	ERC
001	838	↓	Steel	
002	834	↓	Steel	
003	835	↓	Steel	
004	837	↓	Steel	
005	836	↓	Steel	

Navigation icons: Home, Back, Print, Close

Summary:  $\bar{x} = 835$     $S = 2$

Buttons: Back, OK

Fig 4.28

**Note:**

1. When you use the D-type impact unit to calibrate the instrument, you must

set the type of impact unit to D at first, and when you use the G-type (DL-type, DC-type, C-type, D+15 type) impact unit to calibrate the instrument, you must set the type of impact unit to G(DL, DC, C or D+15) at first too (See§4.1.4 Items), or there is no point calibration, and the test value will be incorrect.

2. If it's the first time to use the hardness tester or has been so long since the last time, users should calibrate the machine by using Test Block.

The default impact direction is downwards. (See Appendix 1 in details)

## 4.2.5.2 Touch Calibration

The **Touch Calibration** is actually used to calibrate the consistency between touch screen sensor and LCD coordinates. If there is a deviation existing between the actual position of touch screen presses and the position of presses figures displayed by LCD, users should conduct Touch Calibration.

**BPX5501 Metal Hardness Tester** display

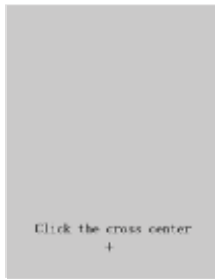


Fig 4.29

coordinates has been carefully calibrated when it's launched. Due to the difference of environmental conditions (especially notable changes in temperature and humidity), coordinates errors may arise during the process of use. It is normal for small errors that can be corrected well on this function.



**Step 1**



**Step 2**



**Step 3**

**Fig 4.30**

In **Calibration** menu, directly click **Touch Calibration** item in **Calibration** menu to display the **Touch Calibration** menu. See the Fig 4.30.

According to the prompt shown on the screen: Users can click the cross center by using touch pen under the steps of Fig 4.30. After completing the above three steps, a rectangular frame will be automatically displayed in the middle of the window, see Fig 4.31. Then users can click the core of rectangular frame by using touch pen, and system may automatically return to the window of the **Calibration**, and now, **Touch Calibration** has been completed.



Fig 4.31

If it can't be return to the window of **Calibration**, it means the operation was inefficient. users should re-click the core of rectangular frame



again (3 times at most); If it's still inefficient after 3 times, it will automatically return to the window shown as Fig 4.30(**Step 1**). Users should re-start all the steps of **Touch Calibration** till it's successfully done.

#### 4.2.6 Information

**Information** includes developers and version information of the software and the serial number

of the unit. Products manufactured in different periods, the software will be different because of version upgrade. Therefore in use, if users ask service engineer or agent for advice of technical

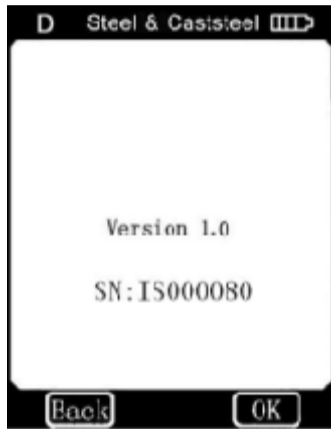


Fig 4.32

problems related to software, they may be required to provide such information.

In menu mode, users can directly click **Information** on the screen to get in the window of **Information**. See Fig 4.32.

**Note: Version number may be changed with software upgrade, which will not be re-notified.**

## 4.3 Charging

Users need to recharge batteries when batteries are used for the first time and exhaustion of electricity arises.

The capacity of battery will show as empty after exhausting use (3



Fig 4.33

columns as full), and show a word “Power Shortage!” Besides, the buzzer will beep once in two seconds to tell the user it’s time to charge. Firstly, users should insert the USB plugs of charger into the right USB jack of display unit, see Fig 4.33, and then connect the charger with AC socket (220V/50Hz) to start charging. Meanwhile, the screen of display unit will display “charging...”. See Fig 4.34.

When machine is at the turn-off model, charging machine will be automatically switched on, and the battery symbols will be shown consecutively. At the end of charging, users can see "charging complete" on the screen. If users press **ON/OFF** button at this time, the machine won't be turned off, because it is on a supervision mode.



Fig 4.34

**Note:** Please use the exclusive charger for the

display unit.

## 4.4 Backlight

The LED backlight of the LCD is used for poor light conditions. It can automatically open backlight when turn on the machine. If there is no measure, and no touch screen operation, machine will close backlight itself for saving power. It won't reboot until the status above happens. If the backlight is off, when users click touch screen or have measurement, then the backlight will light up again.

## 4.5 Reset

If the display unit isn't in order or halt during the use process, users can click the reset button by insert a slender rod into the **Reset** hole at the right side of display unit, and then the machine will restart.

## 4.6 Automatic Shutdown

Display unit will automatically shutdown in the following case in order to

save battery power. Display unit will store all the parameters automatically before turning-off.

1. If there is no measure, and no touch operation in 3 minutes, display unit will automatically switch off. And it will beep continuously in 10 seconds before shutdown.

2. When battery power is not enough, the display unit will display “power shortage”, and buzzer will beep once in one second, and the display unit will automatically switch off after 10 seconds.

## 5. DATA PRINTING

**BPX5501 Metal Hardness Tester** can be linked with exclusive micro printer, so printer can print out the measured values. Micro printer is an optional device. If necessary, please contact the dealer.

### 5.1 Printer Link

Switching off the power of the display unit, users can then insert the USB plugs of printer cable (optional) into the USB jack for printer at the right side of display unit, and insert the other side of cable into the



Fig 5.1

socket at the left side of printer, connecting the printer with display unit, see Fig 5.1. Users can now boot the printer by pressing **POWER** button on the printer, and turn on the display unit next. Other printer operations involving printer power connecting or power recharging is attached in printer user manual.

## 5.2 Infrared Printing

Put the display unit's infrared launch window at the level of printer's in infrared receive window, see Fig 5.2. At this time, users can use infrared print like serial print.



Fig 5.2

**Note: When using serial cable to print, users cannot put the hardness tester's infrared launch window at the Level of printer's infrared receive window; similarly, when using infrared print, users should pull down the serial cable. Otherwise, the printer will print unrecognizable code; even the paper will be non-stop output from printer.**

## **5.3 Test Report Format**

A complete test report is shown at Fig 5.3

```
-----  
Test Report  
-----  
Impact Unit Type: D  
Material : Steel&Caststeel  
1  808 HLD  ⬇  61.2 HRC  
Date: 31-07-06 Time: 18:21:27  
2  808 HLD  ⬇  61.2 HRC  
Date: 31-07-06 Time: 18:21:27  
3  805 HLD  ⬇  60.8 HRC  
Date: 31-07-06 Time: 18:21:27  
4  808 HLD  ⬇  61.2 HRC  
Date: 31-07-06 Time: 18:21:27  
5  805 HLD  ⬇  60.8 HRC  
Date: 31-07-06 Time: 18:21:27  
-----  
s = 3  HLD  00.4 HRC  
x̄ = 808 HLD  61.0 HRC  
Printed: 31-07-06  18:21:27  
-----
```

**Fig 5.3**



**Note:**

1. The specific contents of the report may be setup in Items menu. (See§4.2.2.1 Items)
2. The date and time printed are the print date and time.

## **5.4 Test Report Printing**

**BPX5501 Metal Hardness Tester** offers various typing ways. Users can flexibly choose the way of typing in the actual use.

### **5.4.1 Automatic Printing**


If **Auto Print** has been set to **ON**, printer can print automatically during the measure process. Display unit will sent out the data to printer after the completion of a group of test data. The printer will print the title of report

before the beginning of each group of data. When the **Statistic Times Values** is set as 1, the printer can't print automatically. When the **Statistic Times Values** is set as 2 to 99, the printer will print automatically by the statistic group.

## 5.4.2 Manual Printing


When **Auto Print** has been set to **OFF**, users can operate printer manually. And manual printing can be divided in two types.



1. **Statistic Times Values** is set as 1

After every time of impact, the uses can print out the measured value by clicking the  on the measure mode.

The printer will automatically print the information in the title part when printing starts.

2. **Statistic Times Values** is set as 2 to 99

When the impact times is up to users **Statistic Times Values**, click the  , the printer will print out all the measured values and statistics results in the group, and form a complete test report.


If users click the  before the impact times up to the **Statistic Times Values**, the printer will print out all the finished test values. When the impact times is up to users **Statistic Times Values**, users can click  again to print out the rest data and statistics results, by then, report printing completed.

### 5.4.3 Assemble Printing

Users may not print the report during the test; instead, they can print the measured values in **Printing Setup** menu. See§4.2.2.2 **Print Memory** and§4.2.2.3 **Print All**.

## 5.4.4 The Other Printing Ways

Users can print when browsing some data management pages (See 4.2.3.2 **Data Browser Mode**); Users can also execute printing in the window of statistic list (See 4.2.4.1).

When these printing ways are available,  will show on screen. Users can conduct operation according to relevant functions.

### **Note:**

- 1** **Statistic results in testing report would arise at the ending part of testing report only when automatic and manual printing ways of that the Statistic Times Values is set as 2 to 99.**
- 2.** **The dates and time in testing reports is the ones when the testing reports are being printed, not belong to the test dates and time.**
- 3.** **Thermal printing papers should be stored in an environment without high temperature and strong light. If it's necessary to storage, users should store their copies.**

## 6. HARDNESS TEST

### 6.1 Test Preparation

- 1) Make sure if the system connection is safe and reliable.
- 2) Press **ON/OFF** button to switch on the power, and check if it's need to charging. Inspect if every setting of display unit is correctly, particularly the materials and impact direction. The setting inconsistent with the actual condition may set up a great error.

### 6.2 Sample Preparation

Inappropriate sample will cause a great measurement error. Therefore, users should make the necessary handling and preparation under the original conditions of sample.

Preparation of the sample and the surface of test should be coincident with the following basic requirements:

- 1) During the process of sample surface preparation, users should avoid

the impacts of cold processing and thermal processing.

- 2) The sample surface is plane for better, the test surface should be with a metallic sheen, and not involve oxide layer or other stains.
- 3) Roughness of the test surface  $Ra \leq 1.6$
- 4) Sample must be of sufficient quality and rigidity. If it's lack of quality and rigidity, it may cause displacement or shaking in the process of testing impact, which can lead to large errors.

Sample quality  $\geq 5\text{kg}$  can be directly tested; if the sample quality is  $2\sim 5\text{kgs}$ , the sample should be taken in fixation test by means of appropriate clamping; if the sample quality is  $0.05\sim 2\text{kgs}$ , the sample should be conducted coupling before the test; if the sample quality  $< 0.05\text{kg}$ , this hardness tester is inappropriate to use.

Coupling method: Testing sample's back should be prepared to make a plane as a supporting surface with a smooth formation. Filling with a little coupling substance (Industry Vaseline can be used), users can

now press to the surface of the supporting object (The weight of supporting object should be more than 5 kg, and it can be replaced by test block) to stick into integration.

- 5) Samples should be thick enough and with sufficient surface absorption layered. If users use D-type impact device, the thickness of sample should not be less than 5mm, and surface absorption layer (surface-hardening layer) should not be less than 0.8mm. To accurately measure the hardness of the material, the best way is to remove the surface-hardening layer by processing.
- 6) When testing sample surface is not horizontal, the curvature radius of testing and nearby surface should be larger than 30mm. And appropriate supporting ring should be elected and installed.
- 7) A sample should not be with magnetic. The signal of the impact device would be seriously interfered in the work by the magnetic, which may cause inaccurate test results.

# 7. TEST STEPS

## Performing of Hardness Test

**Easy to use** – simple operating elements allow for accurate measurements even by occasional users.

### 1) Loading

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



**Step 1**



### 2) Place

Then place and hold the impact device on the surface of the test piece at the desired test point.



### 3) Measure

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



**Step 3**

### 4) Read the test result

Modern electronics with power saving features provide for long operating life. The large LCD display always shows how **BPX5501 Metal Hardness Tester** is configured to test. Variable function touch screen allow for quick change of common test parameters, and the on screen hint line shows the other active control keys. No subjective measuring errors are possible, giving highly repeatable results. Internal self diagnostics with error messages assure reliable test results. Readings can be stored automatically in the internal memory or sent directly to a printer.

Repeating the above steps, users can carry out tests in more points.

**Note: Generally, each measurement location of sample is conducted for the five tests. The “S” value (difference of maximum value and the minimum value) values must be less than 15HL. The distance between any two impact positions should be  $\geq 3$  mm; the distance between impact position and the edge of the sample should be  $\geq 3$  mm.**

## 8. TROUBLESHOOTING

No.	Trouble	Reasons	Solutions
1	No response switched	Lack power	Recharge battery
2	Touch Screen no response	System halt	Reset
3	Touch Screen inaccurate	Parameters change	Touch Calibration (See 4.2.5.2)
4	Abnormally high results	Steel ball wearing	Replace the Steel ball
5	No test results	Sensor cables loose	Re-linking
6	Printer no response	Printer cable loose	Re-linking
<b>* Other trouble, please contact with agencies or distributor.</b>			

## **9. MAINTENANCE AND SERVICE**

### **9.1 Impact Device Maintenance**

After using 1000-2000 times, users should clean the catheter of impact device and impact body with nylon brush, and screw off the supporting ring before cleaning the catheter, and then take out the impact body, rotate the nylon brush into the tube in an anti-clockwise direction, and pull out when touching the bottom. So repeatedly, and then load up the impact body and supporting ring; Users should release the impact body after use. And the lubricant is banned.

### **9.2 Store the Report**

Because printing paper is thermal paper, it should be preserved to avoid the heat and direct light. If the print records are necessary to be kept in long-term preservation, please copy and preserve in time.

## 9.3 Normal Maintenance Procedures

In calibration of the hardness tester, if finding that error is larger than 12HLD, users must be renew the steel ball or impact body, because the reason may be that the steel ball or impact body is wore out to lead to failure in operation.

When the hardness tester arises other abnormal phenomena, users should not demolish or adjust any fixed assembly parts, instead, they should complete warranty cards, send them to maintenance department of professional maintenance by authorized organizations for maintenance. Machine staying in maintenance organizations generally do not last more than a week.

## 9.4 Service

In the following cases, **BPX5501 Metal Hardness Tester's** authorized agent


is not responsible for free maintenance of products, but maintenance

service is available.

- 1) Not according to brochures, fail to connect and protect the product, and lead it into failure or damage;
- 2) Beyond the warranty period;
- 3) Serial No. of product warranty card is inconsistent with the product itself;
- 4) Machinery parts are in disassembly or repaired by non-authorized agency or non-professional maintenance staff;
- 5) The parts are not in warranty (steel ball, sensors wires, frames, supporting ring components);
- 6) Unexpected factors or human actions have been resulted in damage of products, such as the use of non-exclusive charger, high temperature, influent water, mechanical destruction and crash etc.;
- 7) As customers make their way back to repair, products are damaged as a result of transportation and handling;
- 8) Irresistible force like earthquake and fire that cause product failures

# Appendix1. DAILY CHECKING

Test block is mainly used for calibrate the hardness tester. The error and the repeatability of the hardness tester should be in the scope defined by the following table.

Impact Device	Impact direction	Hardness of Test block (HL)	Error Allowed	Repeatability Allowed
D		750~830	$\pm 12\text{HLD}$	12HLD
		490~570	$\pm 12\text{HLD}$	12HLD

## Note:

### 1. $\text{Error} = \overline{\text{HLD}} - \text{HLD}$

$\overline{\text{HLD}}$  is the mean value of 5 Leeb hardness values measured on the test block.

HLD is the value that marked on test block.

### 2. $\text{Repeatability} = \text{HLD}_{\text{max}} - \text{HLD}_{\text{min}}$

$\text{HLD}_{\text{max}}$  is the maximum value in 5 Leeb hardness values that measured on the test block.  $\text{HLD}_{\text{min}}$  is the minimum value in 5 Leeb hardness value measured on the test

## **Appendix2. FACTORS AFFECTING THE ACCURACY**

Incorrect operation or improper testing conditions would have serious impact on testing accuracy. Following is several common factors affecting the accuracy of testing for the use of reference:

### **1) Roughness of Sample Surface**

When the impact body impact on the sample, a small pit would arise on the sample surface, so at the same time, should finish the surface of the sample. The less roughness, while the less consumption of impact energy. Accordingly, the roughness of sample testing points on the surface  $Ra \leq 1.6$ .

### **2) The Shape of Sample Surface**

Leeb testing principle demands the velocity of rebound and impact are on the same line. because the impact body is moving in a metal tube.



Even if the velocity of rebound and impact are not on the same line, it also can show hardness for sure, but the impact body would collide with tube wall when it rebounds, which will affect the velocity of rebound. Therefore, a greater error is on test accuracy. When the radius of curvature of the testing sample surface is smaller, the solution is the use of suitable variant supporting circle. If users require special supporting circle, we can contribute to design and process.

### **3) The Weight of the Sample**

If the sample weight must be larger than or equal to 5kg, and not easily sway. If the sample weight were less, the sample would need proper treatment (It is necessary to increase the supporting or mounting through coupling compress on larger weight testing stand), and the testing results can be achieved in accuracy. There should be a certain area at the testing points (the area required to meet a set of testing points) and no vibration or shaking. If the weight is not enough, users must be reduce

the jitter and sloshing by the methods of increasing supporting, coupling and compress. And supporting device should avoid shock.

#### **4) The Sample Stability**

Any effective tests need to minimize possible interference from outside; it's more important to dynamic measure such as Leeb hardness test.

Therefore, measuring only allowed in stable hardness testing system. If it's likely to lead to sample movement in the tests, users should fix it before testing.

## Appendix3. MEASUREING AND CONVERSION RANGE

<b>Materials</b>	<b>HV</b>	<b>HB</b>	<b>HRC</b>	<b>HRB</b>	<b>HSD</b>	<b>Tensile strength (MPa)</b>
<b>Steel &amp; cast steel</b>	<b>83-976</b>	<b>140-651</b>	<b>19.8-68.5</b>	<b>59.6-99.6</b>	<b>26.4-99.5</b>	<b>375-2639</b>
<b>Cold work tool steel</b>	<b>83-976</b>	<b>140-651</b>	<b>19.8-68.5</b>	<b>59.6-99.6</b>	<b>26.4-99.5</b>	<b>375-2639</b>
<b>Stainless steel</b>	<b>83-976</b>	<b>140-651</b>	<b>19.8-68.5</b>	<b>59.6-99.6</b>	<b>26.4-99.5</b>	<b>740-1725</b>
<b>Cast iron</b>		<b>140-387</b>				
<b>Cast aluminum alloys</b>		<b>30-159</b>				
<b>Copper/zinc alloys (brass)</b>		<b>40-173</b>		<b>13.5-95.3</b>		
<b>CuAl/CuSn alloys (bronze)</b>		<b>60-290</b>				
<b>Wrought copper alloys, low alloyed</b>		<b>45-315</b>				