
HARDNESS TESTER

HARTIP 1800

OPERATION MANUAL



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1. Forewords

1.1. History

The Leeb measuring method was first brought into measurement technology in 1978. It is defined as the quotient of an impact body's rebound velocity over its impact velocity, multiplied by 1000. Harder materials produce a higher rebound velocity than softer materials. For a specific group of material (e.g. steel, aluminum. etc.), Leeb hardness value represents a direct relationship to its hardness properties. For ordinary metal, conversion curves of hardness HL versus other standard static hardness (HB, HV, HRC, etc.) are available, enabling you to convert HL into other hardness values.

1.2. 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 velocity of the impact body are measured by the following method: A permanent magnet embedded in the impact body, when passing through the coil in its coil holder, induces in the coil an electric voltage proportional to the velocities of the magnet. Leeb hardness is expressed by the following formula:

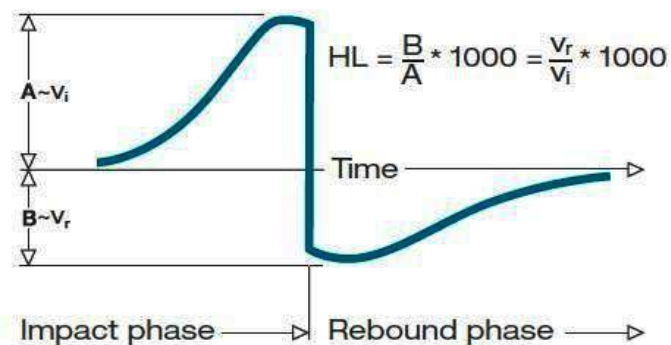
$$HL = \frac{V_r}{V_i} * 1000$$

Where: HL is Leeb Hardness

V_r is the rebound velocity of the impact body

V_i is the impact velocity of the impact body

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



Voltage characteristic of output signal

A Leeb's Hardness Tester measures the hardness of sample material in terms of Hardness Leeb (HL), which can be converted into other Hardness units (Rockwell B and C, Vicker, Brinell and Shore D).

1.3. 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≠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 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. Features and Applications

2.1. Introduction

This instrument is an advanced state-of-the-art palm sized metal hardness tester with many new features which are light weight, easy operation, integrated design, high contrast display, low operating temperature, auto compensating for impact direction and etc. It can be widely used for measuring hardness of almost all ferrous and non-ferrous metal materials for scale of Leeb hardness, Rockwell C, B &A, Brinell, Vickers, Shore and Strength.

HARTIP 1800 has a memory capacity of 400 blocks and 360000 data which can be downloaded to computer via USB or Bluetooth (Optional). The measuring value can be printed out from tester to micro-printer by USB or Bluetooth. All stored data can be recalled and read on the tester easily.

HARTIP1800 also has a very unique feature, which impact device can convert between D and DL simply by changing impact body. This two-in-one probe is equivalent to two individual probes. With this optional accessory, you can take measurement at very narrow surface such as slot bottom, gear tooth that probe D cannot match.

The 3.7V Li-ion rechargeable battery inside HARTIP 1800 can be charged via USB from PC or via individual battery charger from mains wall power. With data software for PC, customers can download measuring values from HARTIP 1800 to PC and make process such as save, delete, create testing report and export them to Excel.

2.2. Specifications

- ✧ Principle: Leeb hardness measurement
- ✧ Accuracy: $\pm 2HL$ (or $0.3\% @ HL=800$)
- ✧ Display: Digital with high contrast OLED
- ✧ Display mode: Normal/flip or upward/downward
- ✧ Hardness scale: HL / HRC / HRB / HB / HV / HS / HRA / σ_b
- ✧ Measuring range: HL200-960 / HRC19-70 / HRB13-109 / HB20-665 / HV80-940 / HS32-99.5 / HRA30-88
- ✧ Impact device: D / D-DL 2 in 1 (Optional)
- ✧ Materials: 10 common metal materials
- ✧ Memory: 400 blocks and 360000 data can be saved and re-readable
- ✧ Statistics: Average/Max/Min value can be calculated automatically
- ✧ Interface: USB/RS232 for data transferring, printing or charging battery, Bluetooth for data transferring and printing
- ✧ Recalibration: allowed by user
- ✧ Alarm: Up or down limit
- ✧ Indicator: Low battery
- ✧ Power supply: 3.7V Li-ion rechargeable battery
- ✧ Power on/off: Auto
- ✧ Operating environment: $-40^{\circ}\text{C} \sim +60^{\circ}\text{C}$

- ✧ Dimension (LxWxD): 148mm×44mm×22mm
- ✧ Net weight: 110g
- ✧ Standard: ASTM A956

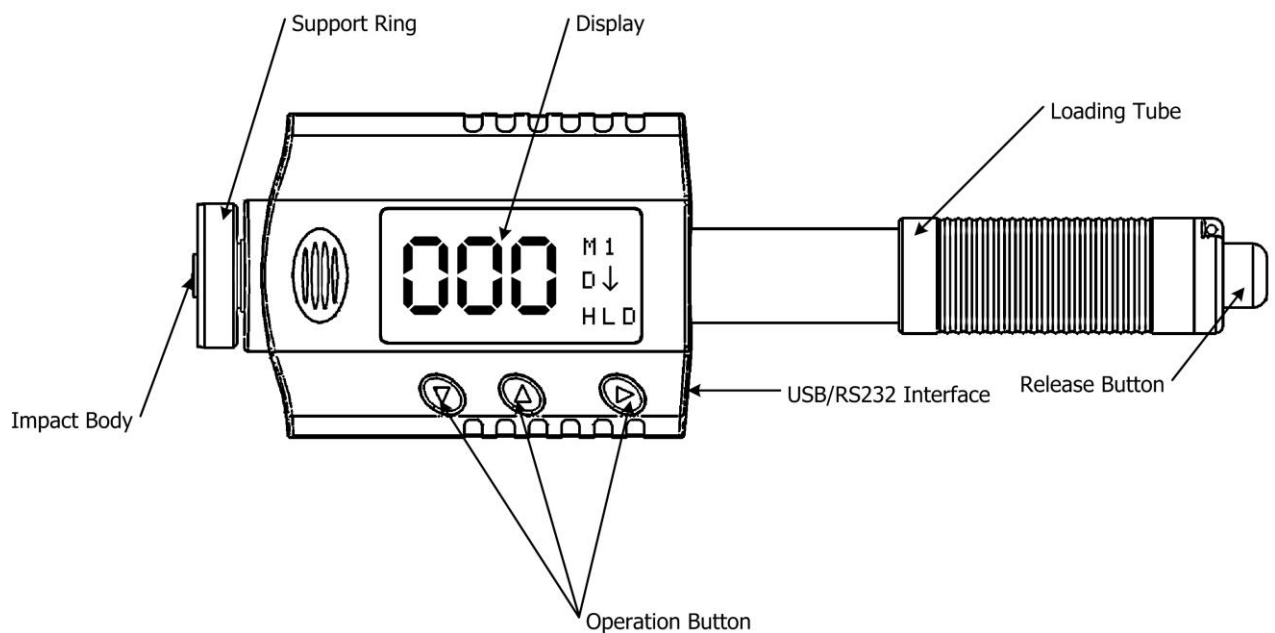
2.3. Key Features

- ✧ High accuracy: $\pm 0.3\%$
- ✧ Integrated design: combine probe and processor into one unit
- ✧ Two-in-one probe: D-DL convertible
- ✧ Wide operating environment: $-40\text{ }^{\circ}\text{C} \sim +60\text{ }^{\circ}\text{C}$
- ✧ Auto turn on & off
- ✧ High contrast OLED display: clearing at dark area
- ✧ Friendly display style: normal/flip or upward/downward
- ✧ Recalibration allowed by user

2.4. Applications

- ✧ Hardness tests on installed machines or steel structures: e.g. on heavy and large work-piece or on permanently installed system parts.
- ✧ Rapid testing of multiple measuring areas for examination of hardness variations over larger regions.
- ✧ Measuring hardness for produced parts at production line.
- ✧ Identifying metallic material stored in a warehouse.
- ✧ Ineffectiveness analysis of permanent parts, pressure -vessel, turbo generator.

3. Layout of instrument



4. Symbols and Illustrations

4.1. Symbols and Illustrations

| Symbols | Illustrations |
|---------------------------------|--|
| HLD | Leeb hardness value used with impact device D |
| LDL | Leeb hardness value used with impact device DL |
| HB | Brinell hardness value |
| HRB | Rockwell B hardness value |
| HRC | Rockwell C hardness value |
| HS | Shore hardness value |
| HV | Vickers hardness value |
| HRA | Rockwell A hardness value |
| σ_b (N/mm ²) | Strength value |

4.2. Measurement and Conversion Table

Range for measurement and conversion:

| IMPACT DEVICE D HLD: 170-960 | | | | | | | |
|-------------------------------|-----------|------------|---------|--------|-----------|-------|---------------------------------|
| MATERIALS | H R C | H R B | H B | H V | H S | HRA | σ_b (N/mm ²) |
| STEEL/CAST STEEL | 20.0-67.9 | 59.6-99.5 | 80-647 | 80-940 | 32.5-99.5 | 30-88 | 375-1710 |
| ALLOY TOOL STEEL | 20.5-67.1 | | | 80-898 | | | 1170-2639 |
| STAINLESS STEEL | 19.6-62.4 | 46.5-101.7 | 85-655 | 85-802 | | | 740-1725 |
| LAMELLAR IRON | 21-59 | 24-100 | 93-334 | 90-698 | | | |
| NODULAR IRON | 21-60 | 24-100 | 131-387 | 96-724 | | | |
| CAST ALUMINUM | | 24-85 | 30-159 | 22-193 | | | |
| BRASS | | 13.5-95.3 | 40-173 | | | | |
| BRONZE | | 14-100 | 60-290 | | | | |
| WROUGHT COPPER | | 14-100 | 45-315 | | | | |
| FORGING STEEL | | | 142-651 | | | | |
| IMPACT DEVICE DL LDL: 560-950 | | | | | | | |
| MATERIALS | H R C | H R B | H B | H V | H S | HRA | σ_b (N/mm ²) |
| STEEL/CAST STEEL | 20.6-68.2 | 37.0-99.9 | 81-646 | 80-950 | 30.6-96.8 | | |
| ALLOY TOOL STEEL | 20.5-67.1 | | | | | | |

5. Preparation before Measuring

5.1. Requirements for the sample

- 5.1.1. The surface temperature of sample should be less than 120 °C.
- 5.1.2. The samples must feature a metallic smooth, ground surface, in order to eliminate erroneous measurements brought about by coarse grinding or lathe scoring. The roughness of the finished surface should not exceed 2µm.

5.2. Requirements for the weight of the sample

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.

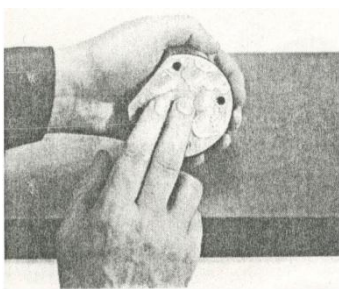
For coupling purposes,

- ✧ The coupling surface between the sample and base plate should be flat, plane parallel and ground.
- ✧ A thin proper layer of coupling paste is to be applied to the contact surface of the sample.
- ✧ The sample should be firmly pressed against the surface of the base plate 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:
- ✧ The contact surface of the sample and the surface of 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 (5mm).

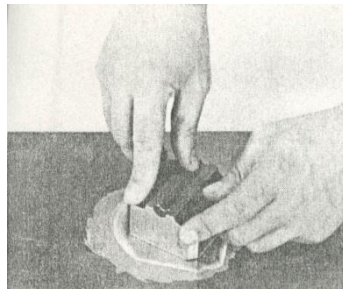
Proper Coupling:

Proper coupling requires a little experience. Insufficiently coupled samples produce large variations of individual measurements, L-values which are too low and the operation is characterized by a rattling noise upon impact of the test tip.

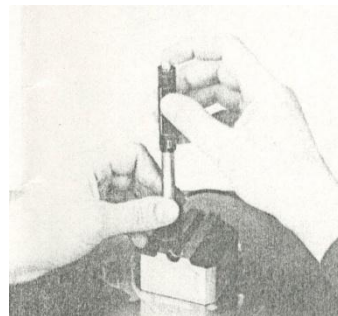
Example for coupling a test piece with a base plate:



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 for the surface hardened layer of the sample

Surface -hardened steels and 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 device D/DL the depth of the hardened layer should be no less than 0.8 mm.

5.4. Surface of the test sample should not be magnetic.

5.5. For test sample of curving surface with radius of curvature R less than 30mm, a small support ring should be used.

5.6. Supporting the Samples during Testing

| Type of impact device | Classification of samples | | |
|-----------------------|---------------------------|---------------|--------------|
| | heavy | medium-weight | light-weight |
| D/DL | more than 5 kg | 2 - 5 kg | 0.05 - 2 kg |

When measuring hardness with this tester, the following has to be noticed: Despite the low mass of the impact body and low impact energy, a relatively large impact force of short duration is generated when the impact body hits the measuring surface. The max. impact force of impact device D/DL is 900N.

For heavy samples of compact shape, no particular precautions are necessary.

Smaller and lighter samples or work pieces yield or flex under this force, producing L-values which are too small and of excessively large variation. Even with big or heavy work pieces 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 too small or too large. In many situations, potential problems can be checked in the following manner:

a) 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 flex during the test impact.

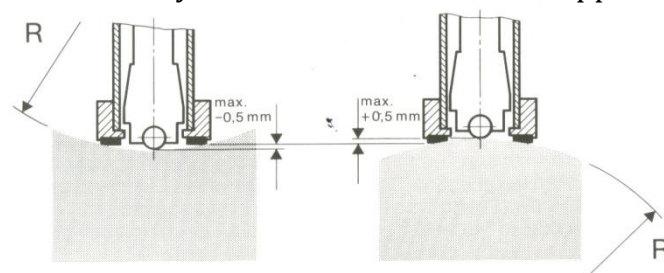
b) Light-weight samples should be rigidly "coupled" with a non-yielding support such as a heavy base plate. Clamping in a vice is of no value, since the samples become exposed to stress and because complete rigidity is never attained. As a rule, the measured L-values would be too small and show excessive variations.

5.7. Samples with Curved Surfaces

Impact testers only work properly, if the impact body has a certain position in the guide tube at the moment of impacting the test surface. In the normal position, automatically present when testing flat and convex-cylindrical samples (such as round samples), the spherical test tip is located exactly at the end of the guide 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 is to be observed that radii of curvature do not drop below the values indicated in the following Fig.

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



Impact device types D $R_{\min}=30\text{mm}$

For impact devices D, special support rings are available to accommodate smaller radii on convex or concave surface.

6. Operation

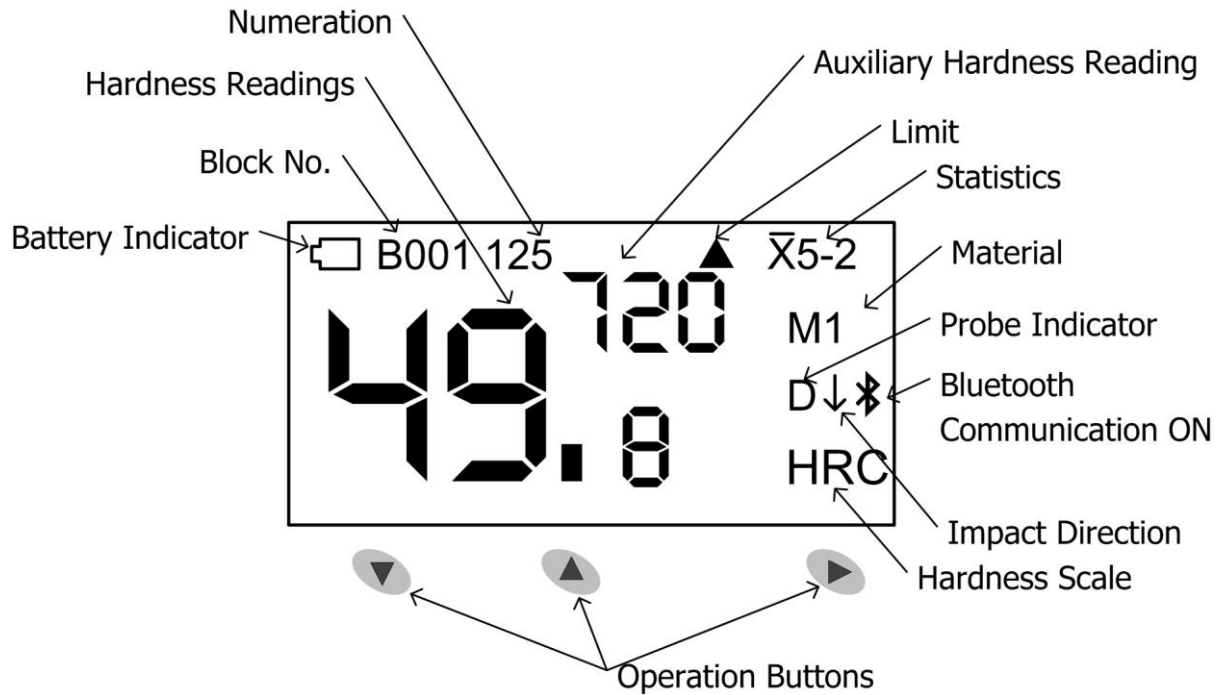


Figure 6-1 Display Description

6.1. Button description

- ▼: Downward button:
 - ✧ Move cursor downward or horizontal.
 - ✧ Shift single or duplex display mode.
 - ✧ Delete current reading after set up statistics.
- ▲: Upward button:
 - ✧ Move cursor upward.
 - ✧ Change value or digit circulative from 0 to 9.
 - ✧ Shift normal or upright display mode.
- : Confirmation button:
 - ✧ Enter main menu.
 - ✧ Confirm the selected item.

6.2. Diagram of Operation

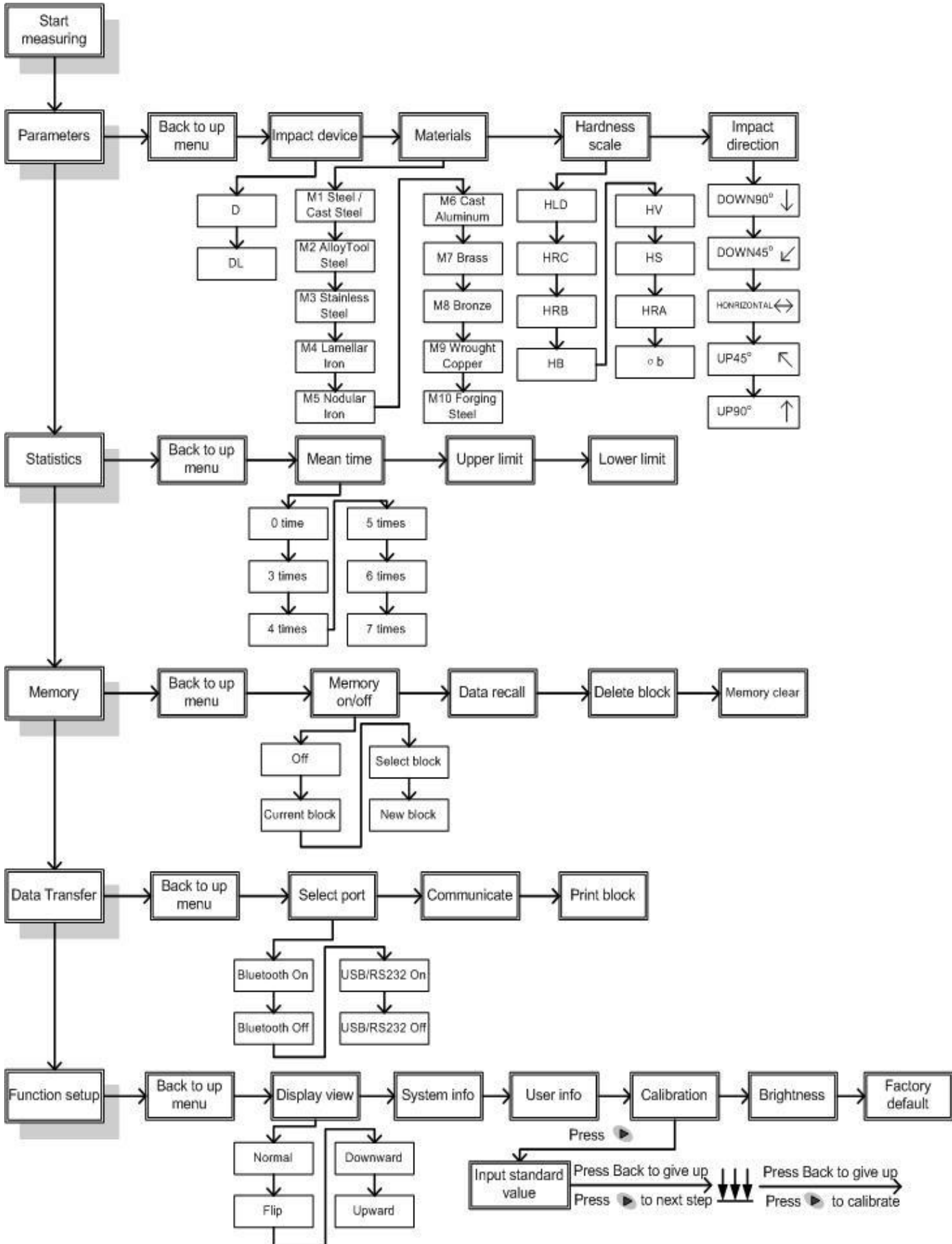


Figure 6-2 Diagram of Operation

6.3. Power on the instrument

HARTIP 1800 has the function of auto power on while taking measurement and auto power off after approx one minute of non-use.

To switch on the tester, push the loading tube toward tester until locking the impact body inside the probe. Then let the loading tube back to original position. The instrument will be powered on. The screen will show manufacturer's logo for one second and then enter the measuring mode, you can start measurement. At this moment, all parameters will be performed by factory default (new tester) or by last setting up before closed.



Figure 6-3 Measuring mode

If parameters have been set, begin measurement at once. If changing parameters is required, press the confirmation button ► on the keyboard to enter main menu.

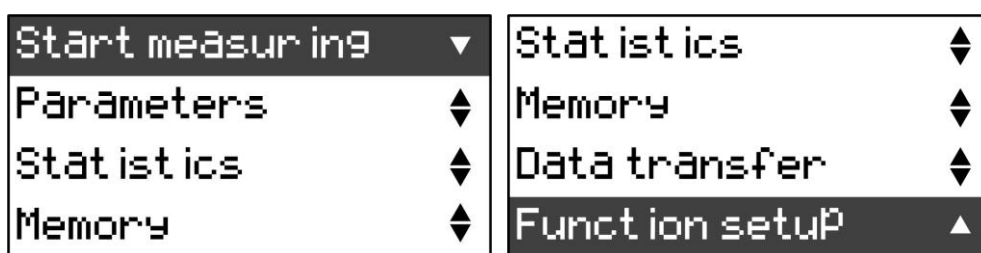


Figure 6-4 Main Menu

After entering main menu, press ▼ or ▲ button to move among the different options, press ► button to enter/confirm this option. Once the parameters setup is finished, they will be stored.

6.4. Parameters setup

In HARTIP1800, all parameters can be selected or changed from HARTIP1800 menu system by operator. By pressing the three buttons (▼, ▲, ►) on the face of tester, you can easily change the necessary parameters and activate the required functions by the logical, friendly menu system; even you do not need to read the instruction.

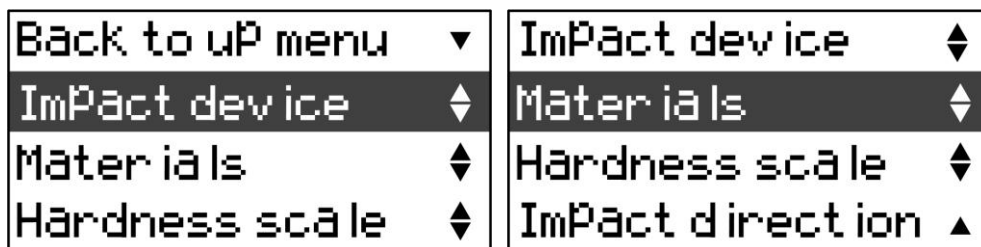


Figure 6-5 Parameters Menu

6.4.1. Function of button

- ▼: Downward button:
- ✧ Move cursor downward or horizontal.
- ✧ Shift single or duplex display mode.
- ✧ Delete current reading after set up statistics.
- ▲: Upward button:

- ✧ Move cursor upward.
- ✧ Change value or digit circulative from 0 to 9.
- ✧ Shift normal or upright display mode.
- ▶: Confirmation button:
- ✧ Enter main menu.
- ✧ Confirm the selected item.

6.4.2. Impact Device

HARTIP1800 is equipped with internal D probe. The impact device of HARTIP1800 can work as standard probe when using impact body D, it can also work as special probe DL when using impact body DL. Please set up Impact device to D while you are using probe D and set up Impact device to DL while you are using probe DL.

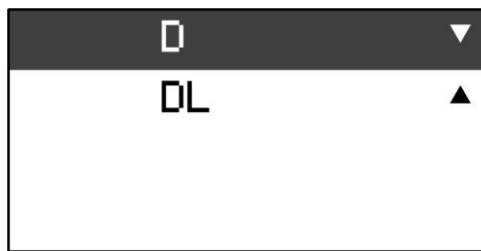


Figure 6-6 Impact Device Selection

After selecting impact device, "Successfully" will be displayed on the screen, then return to the Parameters menu.



Figure 6-7 Measuring mode with impact device D



Figure 6-8 Measuring mode with impact device DL

6.4.3. Materials selection

Material to be tested is prior to hardness scale. In another word, the material must be selected properly when you want to have any hardness scale except HLD.

Choose **Materials** from parameters menu and press ▶ button to enter sub-menu. 9 materials will be showed in following three screens. Press ▼ or ▲ button to move among the different materials. Then press ▶ button to confirm it and return to parameters menu.

| | |
|------------------------|--------------------|
| M1 Steel /Cast Steel ▼ | M4 Lamellar Iron ▲ |
| M2 Alloy Tool Steel ▲ | M5 Nodular Iron ▲ |
| M3 Stainless Steel ▲ | M6 Cast Aluminum ▲ |
| M4 Lamellar Iron ▲ | M7 Brass ▲ |

| |
|---------------------|
| M7 Brass ▲ |
| M8 Bronze ▲ |
| M9 Wrought Copper ▲ |
| M10 Forging Steel ▲ |

Figure 6-9 Materials Menu

6.4.4. Hardness scale conversion

Choose **Hardness scale** from parameters menu and press ► button to enter sub-menu. Press ▼ or ▲ button to choose different hardness scales, then press ► button to confirm the selection and return to parameters menu. Different hardness scales will show on the screen depending on different materials. The default hardness scale is Leeb hardness value (HLD).

| | |
|-------|-------|
| HLD ▼ | HRB ▲ |
| HRC ▲ | HB ▲ |
| HRB ▲ | HV ▲ |
| HB ▲ | HS ▲ |

| |
|-------|
| HV ▲ |
| HS ▲ |
| HRA ▲ |
| ob ▲ |

Figure 6-10 Hardness Scale

6.4.5. Impact Direction

Choose **Impact direction** from parameters menu and press ► button to enter sub-menu. Press ▼ or ▲ button to choose different impact directions. Then press ► button to confirm the selection and return to parameters menu. The default impact direction is downward.

| | |
|-------------------|-------------------|
| DOWN 90° ↓ ▼ | DOWN 45° ↙ ▲ |
| DOWN 45° ↙ ▲ | HORIZONTAL 0° ↔ ▲ |
| HORIZONTAL 0° ↔ ▲ | UP 45° ↖ ▲ |
| UP 45° ↖ ▲ | UP 90° ↑ ▲ |

Figure 6-11 Impact Direction

6.5. Statistics setup

Choose **Statistics** from main menu and press ► button to enter statistics menu. Press ▼ or ▲ button to choose the option to be set. Once the option is chosen, press ► button to confirm this selection.

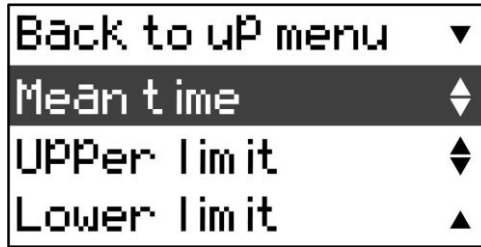
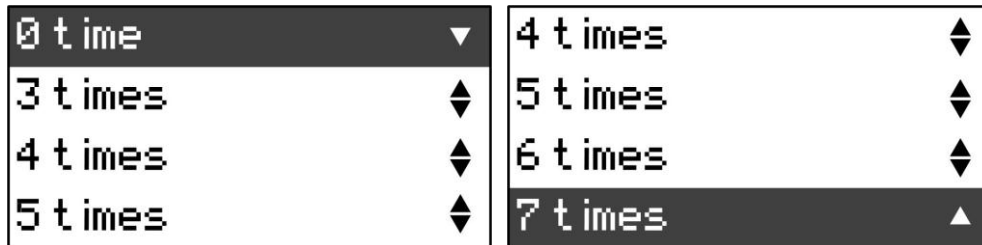


Figure 6-12 Statistics Menu

6.5.1. Mean time

Choose **Mean time** from statistics menu and press ► button to enter sub-menu. Then press ▼ or ▲ button to choose different mean times, then press ► button to confirm the selection and return to statistics Menu. The default mean time is 0 time.



6-13 Mean Time

After setting the mean time, statistics information will be showed on the measuring mode. When chosen display mode is different, the information showed on the measuring mode is also different slightly.

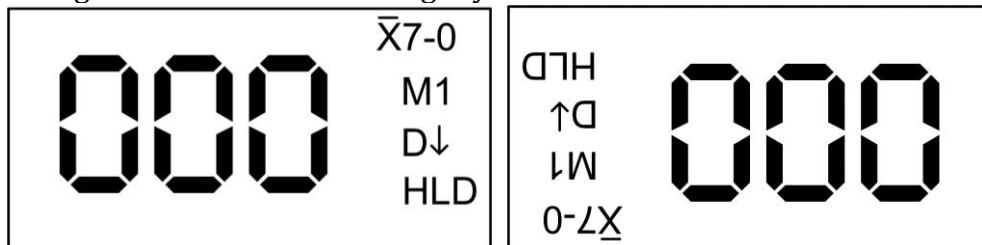


Figure 6-14 Horizontal Display

| NO. | HLD | ↑ | M1 |
|-----|-----|-----|-----|
| 01 | 565 | 10 | S |
| 02 | 563 | 295 | MAX |
| 03 | 564 | 563 | MIN |
| 04 | 566 | 564 | AVE |
| 05 | 564 | | |
| 06 | 565 | 295 | 07 |
| 07 | 567 | 565 | 06 |
| | | 564 | 05 |
| AVE | 564 | 995 | 04 |
| MIN | 563 | 495 | 03 |
| MAX | 567 | 563 | 02 |
| S | 01 | 565 | 01 |
| M1 | ↓ | HLD | NO. |

Figure 6-15 Upright Display

6.5.2.Delete measured values

After mean time is set, in order to avoid the error caused by abnormal values involving in calculation, you can delete the current values by following operation. Enter the upright display mode, then press ▼ key to delete current measuring value. All measured values from this time to NO 01 can be deleted one by one. If Memory is ON at this time, corresponding measured values in memory block will also be deleted.

6.5.3.Upper limit

Choose **Upper limit** from statistics menu and press ► button to enter sub-menu. Press ▼ or ▲ button to choose the value of upper limit alarm to be set and press ▼ button to move the cursor to choose the digit required being modified. Press ▲ button to modify the value at the chosen digit (0-9 cycle) and press ► button to confirm the selection and return to statistics menu. The default value of upper limit alarm is 999 (HLD) . When the users set the value of upper limit alarm, the ranges of hardness values corresponding to all hardness scales need be considered.

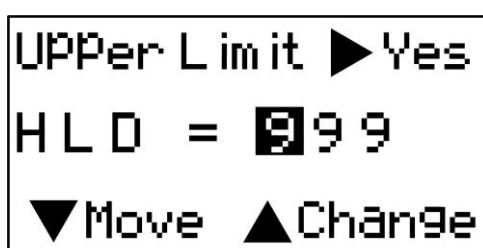


Figure 6-16 Upper Limit Alarm

6.5.4.Lower limit

Choose Lower limit from statistics menu and press ► button to enter sub-menu. Press ▼ or ▲ button to choose the value of lower limit alarm to be set and press ▼ button to move the cursor to choose the digit required being modified. Press ▲ button to modify the value at the chosen digit (0-9 cycle) and press ► button to confirm the selection and return to statistics menu. The default value of lower limit alarm is 150 (HLD).

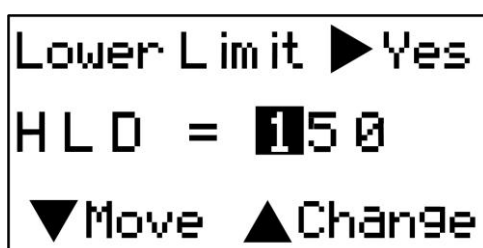


Figure 6-17 Lower Limit Alarm

6.6. Memory setup

Choose **Memory** from main menu and press ► button to enter memory menu. Press ▼ or ▲ button to choose the option to be set. Once the option is chosen, press ► button to confirm this option.

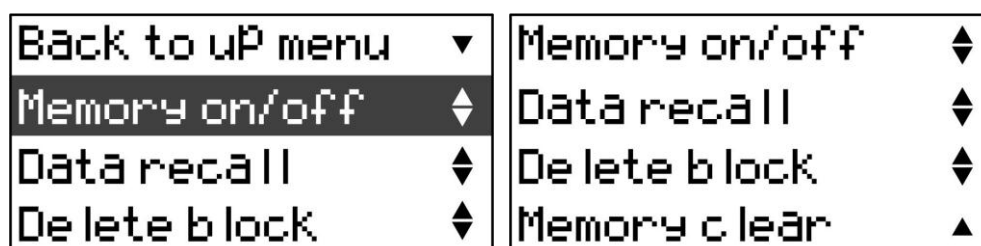


Figure 6-18 Memory Menu

6.6.1.Memory on/off

Choose **Memory on/off** from memory menu and press ► button to enter sub-menu. Press ▼ or ▲ button to choose the option to be set and press ► button to confirm the option.

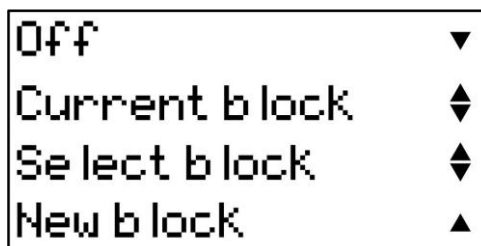


Figure 6-19 Memory on/off Menu

Off: If this option is chosen, the instrument will not store measured values. After the operation is successful, “Successfully” is showed on the screen of instrument. The screen will return to the Memory menu in 1 sec. The default value is Off.

Current block: If this option is chosen, the instrument will store the measured value into the current block. After the operation is successful, “Successfully” is showed on the screen of instrument. The screen will return to the Memory menu in 1 sec. The current block is storage block that is set by the user at the last time. If capacity of this storage block is full, a new block will be created automatically after this block. The default memory block is 001.

After Current block is set, current block No. and the measured value No. of this block will be showed on the top of measuring mode, e.g. “B001 001”, indicating the first block and the first measured value.

Select block: Press ► button to enter Select block window. On this window, the current block can be set as any block of existing blocks. Press ▼ button to move the cursor and choose the value of modified group No., cycling from hundreds, tens, units to return in turn. When the cursor is moved to the option of “Back”, by pressing ► button, the instrument returns the memory menu. Press ▲ button to modify the value at the chosen digit (0-9 cycle) . After setup is finished, press ► button to confirm the setup. After the operation is successful, “Successfully” is showed on the screen of instrument. The screen will return to the Memory menu in 1 sec. If group No. user chosen is beyond total group No., “Block not exist” will be showed on the screen of the instrument. The screen will return to the Select block Window in 1 sec.

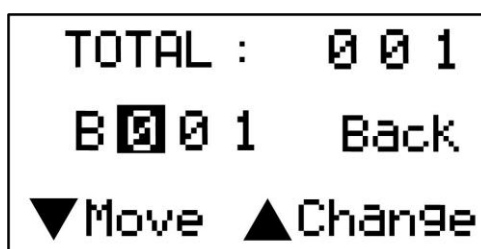


Figure 6-20 Select block Window

New block: If this option is chosen, one new block will be created as current block. After the operation is successful, “Successfully” is showed on the screen of instrument. The screen will return to the Memory menu in 1 sec. Total 400 blocks can be created in the instrument. 999 data can be stored in each block. When storage capacity of all blocks is full, “Out of storage” will be showed on the screen of instrument. At this time, the users can empty the memory or delete the memory blocks to release the storage space. Users can view the storage status through System info.

If the users do not make any modification, they can press ▼ and ▲ button simultaneously to return the Memory menu.

6.6.2. Data recall

Choose **Data recall** from Memory menu and press ► button to enter the block no. selection window. All blocks stored in the instrument are showed on the window; at most 9 block numbers are showed on each screen. “Change Page” is showed on upper left corner. Displayed content can be changed by pressing ▼ or ▲ button. When the page of block to be viewed is chosen, press ► button to change “Change Page” showed on upper left corner into “Back”. Press ▼ button to change the horizontal position of cursor and choose the block number to be viewed. Press ► button to enter the Data recall window. The window includes four-row three-column. The first row is used to show block number, total pages and No. of current page. Measured values are stored from the second row to the fourth row. Press ▼ or ▲ button to turn page forwards or backwards to view stored measured values. At the same time, press ▼ button and ▲ button to show measured value, hardness scale, material and impact direction alternately. Press the button once to switch the content once and allow cycling switch. On the Data recall window, press ► button to return the Block no. selection window. Press **Back** to return to the Memory menu. Also at the same time press ▼ button and ▲ button to return the Memory menu directly.

| | | | | | |
|------|-----|-----|------|----------|-----|
| Back | | | B091 | P001/002 | |
| 001 | 002 | 003 | 710 | 710 | 710 |
| 004 | 005 | 006 | 706 | 706 | 706 |
| 007 | 008 | 009 | 711 | 711 | 711 |

Figure 6-21 Data Recall

6.6.3. Delete block

Choose **Delete block** from Memory menu and press ► button to enter the block no. selection window. All blocks stored in the instrument are showed on the interface. At most 9 block numbers are showed on each screen. “Change Page” is showed on upper left corner. Displayed content can be changed by pressing ▼ or ▲ button. When the page of block to be deleted is chosen, press ► button to change “Change Page” showed on upper left corner into “Back”. Press ▼ button to change the vertical position of cursor and press ▲ button to change the horizontal position of cursor. Choose the block number to be deleted and press ► button. Confirmation screen will be showed on the instrument to remind if this block is deleted. Confirm to delete this block and press ► button to delete it. After the operation is successful, “Successfully” is showed on the instrument. Press ► button to return the Block no. selection window. Press **Back** to return to the Memory menu. Also at the same time press ▼ and ▲ button to return the Memory menu directly. After the block is deleted, all data of this block is lost. Therefore, be cautious to this operation. After deleting this block, its storage space can be set as current block for continuous service.

6.6.4. Memory clear

Choose **Memory clear** from Memory menu and press ► button, a confirmation screen will be showed on the instrument. Press ► button to confirm and empty the memory. While empty the memory, the instrument will give the prompt “Please wait”. After the memory is emptied, the instrument will give the prompt “Successfully”. Press ▼ button to return the Memory menu.

After the memory is emptied, all blocks and data stored in the instrument will lose. Therefore, be cautious to this operation.

6.7. Data Transfer

Choose **Data Transfer** from main menu and press ► button to enter Data Transfer menu.



Figure 6-22 Data Transfer

6.7.1. Select port

Choose **Select port** from **Data transfer** menu and press ► button to enter Select port menu.

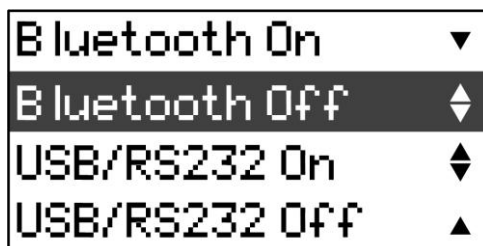


Figure 6-23 Selecting communication port

There are two ways for communicating with PC or printing, one is by Bluetooth, another is by USB/RS232. Press ▼ or ▲ button to select different options and then press ► button to confirm.



Figure 6-24 Communicating by USB/RS232



Figure 6-25 Communicating by Bluetooth

Via USB/RS232 or Bluetooth interface, testing values can be downloaded to PC or printed by micro-printer with our specified interface cable or via wireless connection. There are two ways to transfer data. One is “on line” transferring. The testing values will be transferred while taking measurement one by one. The other one is transferring from memory.

6.7.2. Transferring on line

Connecting HARTIP1800 to PC or micro-printer with our specified USB/RS232 cable or Bluetooth connection.

Start SADT software on PC or power on the micro-printer.

Taking measurement and the data will be downloaded to PC or be printed one by one.

Note: Please make sure the connection between PC and tester is successful. (See 11.3.1 Check Device)

6.7.3. Transferring from memory

Connecting HARTIP1800 to PC with accompanied cable or via Bluetooth.

Switch on HARTIP1800 and enter main menu.

Setting communication port from “Data transfer” → “Select port”.

Select “Data transfer” → “Communicate”, and “Transferring Press any key back” will be displayed which means the HARTIP1800 is under communication mode.

Please note all data transfer course must be under this mode. So please hold this mode while data transferring. Once you quit this mode, you cannot do any data transfer except normal measuring mode for transferring on line.

Start software on PC and operate the relative tool to download the data from memory.

Note: Please make sure the connection between PC and tester is successful. (See 11.3.1 Check Device

6.7.4. Print block

Choose **Print block** from **Data transfer** menu and press ► button to confirm. Then the instrument will enter print block interface. Please note before printing, you should select printing port first. (Please refer to 6.7.1).

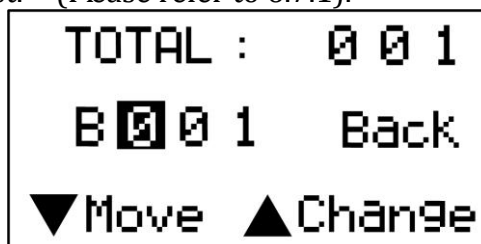


Figure 6-26 Printing block

Pressing button ▼, cursor will move between 0 0 1 and Back, the block no. can be changed from 0 to 9 by pressing ▲ button. After setting block no., press ► button to print the data stored in the selected block.

Moving cursor to Back and press ► button, the current operation will be given up.

Note: The setting of “select port” function is only valid for current operation. When tester is power off, the communication function will be turned off automatically. You should set it again if you need to communicate or print.

6.8. Function setup

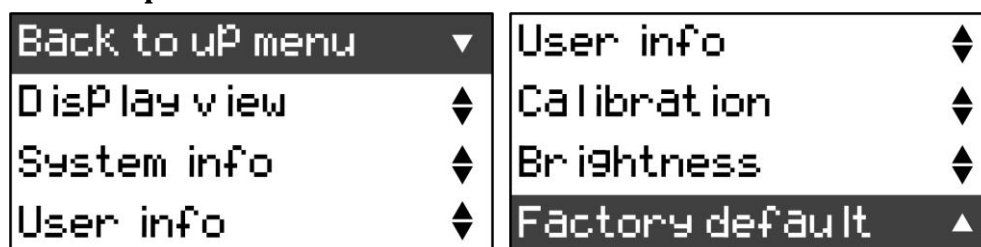


Figure 6-27 Function Setup

Choose **function setup** in main menu and press ► button to enter the function setup menu. Press ▼ or ▲ button to choose the option to be set. Once the option is chosen, press ► button to confirm this option.

6.8.1.Display mode



Figure 6-28 Display View Menu

HARTIP1800 is designed to display corresponding two values on the screen when you set up all other hardness scales except HLD. For example: when you select HRC as hardness scale, the screen can be set to display HRC value and also its correspondent HLD value.

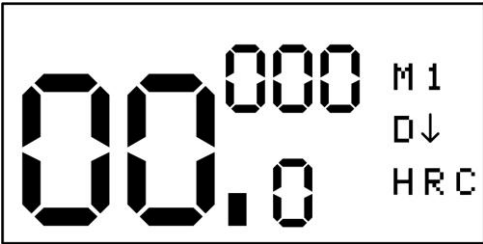


Figure 6-29 Duplex display

By pressing ▼ button you can shift display mode alternately between single display mode and duplex display mode.

Please note: the function will not be activated when only HLD is set up as hardness scale.

In order to meet the measurement of requiring different direction, HARTIP1800 is also designed to change display direction which function can be used for testing right-hand or objects with friendly viewing.

In HARTIP1800, there are four display directions can be selected. That is Normal/Flip or Downward/Upward.

6.8.2.Normal / flip

Normal display is just the default direction.

Flip is an opposite of normal display.

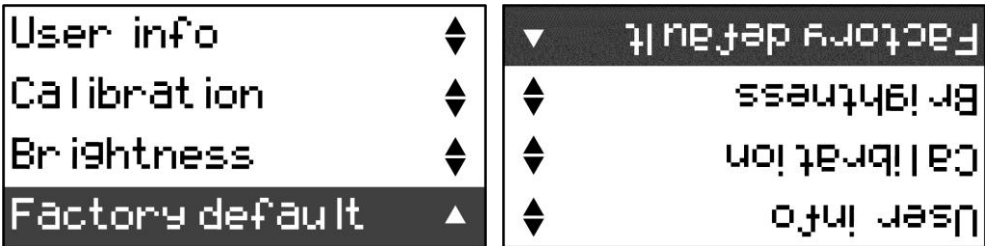


Figure 6-30 Normal / Flip View

6.8.3.Downward and Upward

Apart from Normal / Flip display view, HARTIP1800 also offers upright display view. With this view, HARTIP1800 can display as much as 12 hardness readings at the same time, also can display statics value during taking measurement.

| NO. | HLD | ↑ | ↓ |
|-----|-----|-----|-----|
| 01 | 565 | 10 | S |
| 02 | 563 | 295 | MAX |
| 03 | 564 | 563 | MIN |
| 04 | 566 | 564 | AVE |
| 05 | 564 | | |
| 06 | 565 | 295 | 07 |
| 07 | 567 | 565 | 06 |
| | | 564 | 05 |
| AVE | 564 | 995 | 40 |
| MIN | 563 | 495 | 03 |
| MAX | 567 | 563 | 02 |
| S | 01 | 565 | 01 |
| M1 | | HLD | NO. |

Figure 6-31 Downward / Upward View

6.8.4. Operation of display view

Press related buttons to enter main menu.

6.8.5. Select Function Setup and press ► button to enter its sub-menu.

Select Display view, press ► button to enter it.

Select the display view you wanted and then press ► button to confirm.

6.8.6. “Hot key” for shifting

In order to change display mode between normal and upright quickly, HARTIP1800 has a “hot key” ▲. At any time of measuring, pressing button ▲ can shift display mode between normal and upright alternately.

6.8.7. System info

Choose **System info** from the function menu and press ► button to enter the system info window. Machine serial number, battery capacity and storage capacity are showed on the screen. After viewing them, press ► button to return to the function menu.

```

Serial No.
XXXXXXXXXXXXXXXXXXXX
Battery      100%
Storage      %

```

Figure 6-32 System info

6.8.8. User info

Choose **User info** from the function menu and press ► button to enter the user info window. Ref. number, Part and operator information can be displayed on the screen. You can input these information via PC software. Please refer to 11.3.1 **Main Interface Introduction -> Modify operation information**. After viewing them, press ► button to return to the function menu.

6.8.9. Calibration

After long time of use, the ball tip on impact body may worn which would lead inaccuracy. In order to compensate such error, the tester is designed to re-calibrate by user.

Before each calibration, it is recommended to restore the factory default first. (Please

refer to 6.8.11)

Choose **Calibration** from Function setup menu and press ► button to enter calibration setup.

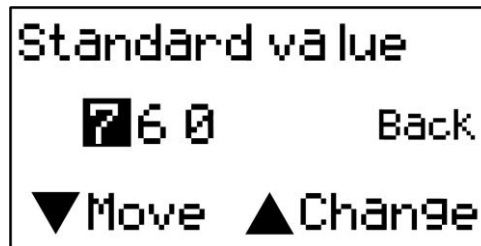
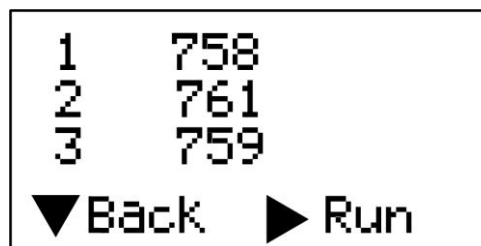


Figure 6-33 Calibration

Pressing button ▼, cursor will move between 7 6 0 and Back, the standard value can be changed from 0 to 9 by pressing ▲ button. After setting standard block value, press ► button to enter next step.

Moving cursor to Back and press ► button, the current operation will be given up.



You are asked to take 3 measurements on standard test block in total. After 3 measurements, press ► button to finish the calibration. You also can give up this calibration by pressing ▼ button.

Note: Calibration for impact device D and DL should be operated separately. Before calibration, you should choose impact device from parameters menu first, and then perform calibration for this impact device.

6.8.10. Brightness Adjustment

Choose **Brightness** from the function menu and press ► button to enter Brightness adjustment window.

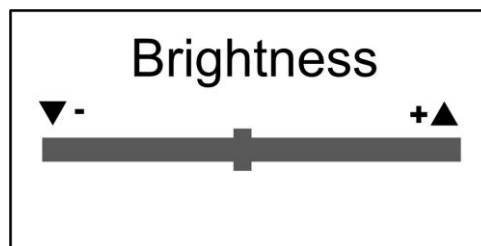


Figure 6-34 Brightness Adjustment

Press ▼ or ▲ button to adjust brightness, and then press ► button to return the function menu.

6.8.11. Factory default

Choose **Factory default** from the function menu and press ► button to enter factory default menu. The instrument will give the prompt "Factory default, Sure to set?" Press ▼ button to return the function menu and press ► button to confirm to restore factory settings. The instrument will give the prompt "Please wait", "Successfully". The screen will return to the Function menu in 1 sec.

Default setup:

Hardness scale: HLD
Impact direction: down 90°
Materials: M1
Mean time: 0 time
Upper limit alarm: 999 (HLD)
Lower limit alarm: 150 (HLD)
Memory: off
Display view: normal

7. Changing impact body

HARTIP1800 has a very unique feature, which impact device can convert between D and DL simply by changing impact body. This two-in-one probe is equivalent to two individual probes. With this optional accessory, you can take measurement at very narrow surface such as slot bottom, gear tooth that probe D cannot match.

Please refer to the following steps to change impact body.

Unscrew the support ring from the tester and let the impact body D out.

Insert the impact body DL into probe and screw the guide tube onto the probe.

Set impact device to DL from the tester's menu. Please refer to 6.4.2

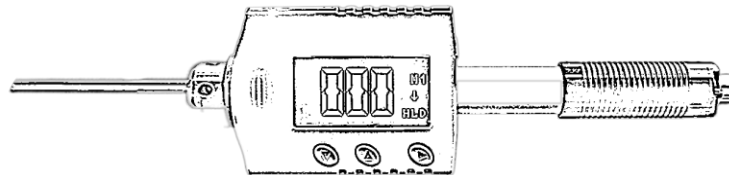


Figure 7-1 Hardness tester with DL probe

8. Take Measuring

8.1. Loading Spring

8.1.1. Hold the main body (the tester) with left hand while right hand is holding loading tube.
As figure 8-1

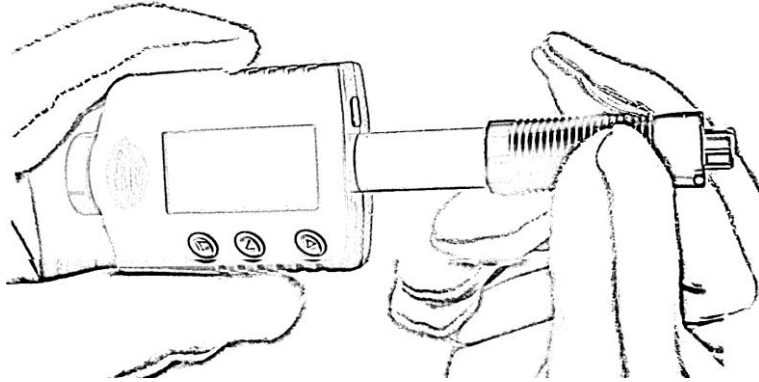


Figure 8-1

8.1.2. Push the loading tube with a little force against spring force toward tester until to lock the impact body.

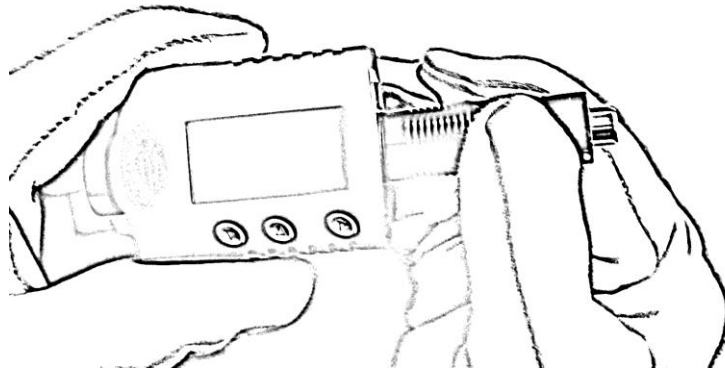


Figure 8-2

8.1.3. Loose the force and let the loading tube returns to the original position.

8.2. Take measurement

Place the tester against onto the surface of object to be measured by the support ring.
As figure 8-3.

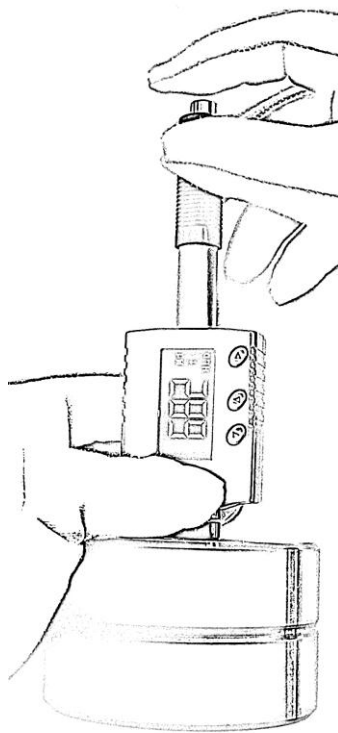


Figure 8-3

Please note: the proper way of holding is important for obtaining better readings.

Attention: the tester must be placed against object surface firmly and perpendicularly. A slight gap between support ring of tester and surface of object will lead inaccurate reading.

8.3. Release the testing force

After firmly placing the tester onto the surface of object with left hand, hold the loading tube with thumb and middle finger of right hand and press the release button with forefinger as figure 8-3.

The impact body inside probe will impact the surface of object with spring force. Then the hardness reading will be displayed on the screen.

Attention: when pressing the release button, please make sure not to press the release button only by single forefinger which may affect the testing accuracy.

9. Maintenance and Repair

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

9.1. Maintenance of the Impact Device

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

- Unscrew support ring and remove impact body from guide tube.

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

- Clean guide tube with the special brush provided.

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

9.2. Charging Battery

When a battery indicator displays that reminds you to charge the battery. However it is still possible to measure for some time. Please make sure to obtain additional or replacing battery from SADT. Otherwise it may cause the instrument to get un-accuracy value.

In order to avoid damage of battery due to over discharged, please charge the battery at least once every half year after long time of non-use.

Charging prompt

When electric quantity of battery is less than 10% of total quantity, an empty battery symbol will occur on upper left corner of measuring mode to remind the users of charging in time. Please note that the charging should be started when the instrument is powered off.



Figure 9-1 Low battery

Please connect the instrument with USB charger or PC and then power on the instrument. One half-empty battery symbol will occur on upper left corner of measuring mode to remind the users that the instrument is being charged. When the instrument is disconnected with the USB charger, the half empty battery symbol will not occur.



Figure 9-2 Charging

The low battery indicator will disappear after charging is finished.

Note: The instrument will enter screen saver mode without any operations during charging instead of turning off automatically. The instrument will return to measuring mode by pressing any key. Please make sure to keep the instrument in measuring mode during charging, otherwise it will stay in that screen instead of entering screen saver mode.

9.3. System reset

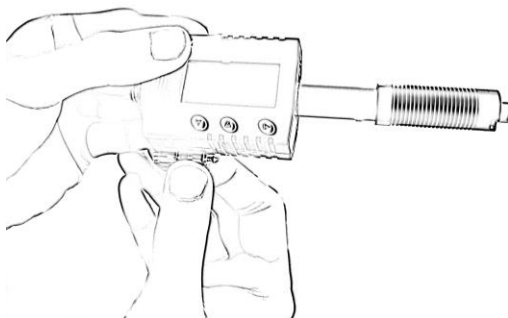
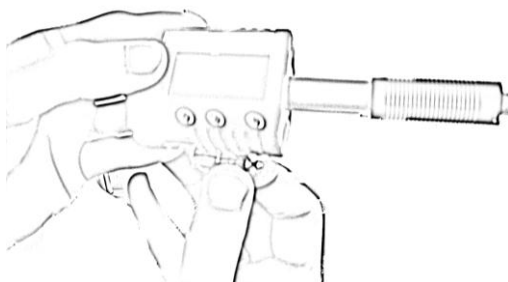
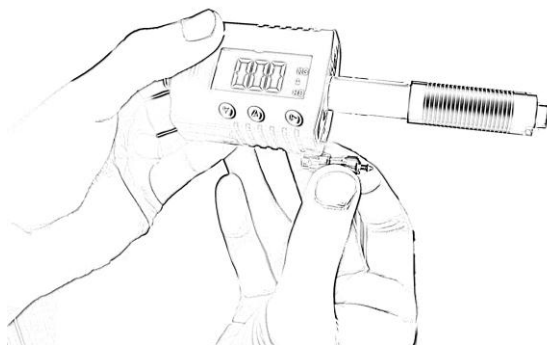
The instrument doesn't response possibly due to instable power voltage or others, the instrument can be reset when it does not response.

Take the impact body out of the instrument







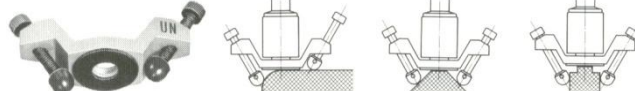

Place it at the bottom of the instrument and under the ▲ key

Move the impact body close to the instrument fore-and-aft to reset the system

Also substitute the magnet for the impact body.



10. Optional Accessories

| Support Rings for Impact Device D | | | |
|--|---|---------------|--|
| Part designation and dimensions: | | | Suitable for the following surfaces |
|  D6 | Φ 19.5×5.5mm | R≥60mm | plane cylindrical hollow-cylindrical spherical hollow-spherical |
|  D6a | Φ 13.5×5.5mm | R≥30mm | plane cylindrical hollow -cylindrical spherical hollow-spherical |
| Special Support Rings | | | |
|  | | | Cylindrical |
| Z 10-15 | 20×20×7.5mm | R 10mm-15mm | R<10mm not possible R≥30mm D6/D6a |
| Z 14.5-30 | 20×20×6.5mm | R 14.5mm-30mm | |
| Z 25-50 | 20×20×6.5mm | R 25mm-50mm | |
|  | | | hollow-cylindrical |
| HZ 11-13 | 20×18×5mm | R 11mm-13mm | R<11mm not possible R≥30mm D6a |
| HZ 12.5-17 | 20×20×5mm | R 12.5mm-17mm | |
| HZ 16.5-30 | 20×20×5mm | R 16.5mm-30mm | |
|  | | | spherical |
| K 10-15 | Φ 20×7.7mm | R 10mm-13mm | R<10mm not possible R≥30mm D6/D6a |
| K 14.5-30 | Φ 20×6.7mm | R 14.5mm-30mm | |
|  | | | hollow-spherical |
| HK 11-13 | Φ 17×5mm | R 11mm-13mm | R<11mm not possible R≥30mm D6a |
| HK 12.5-17 | Φ 18×5mm | R 12.5mm-17mm | |
| HK 16.5-30 | Φ 20×5mm | R 16.5mm-30mm | |
| UN | Φ 52×20×16mm | | |
|  | | | |
| Impact Body | | | |
| Impact body DL |  | | |

11. PC Software

11.1. Installation of hardware driver

As HARTIP 1800 is connected with the PC for the first time, the Windows operating system will prompt “found new hardware”. Then select the folder for the hardware driver manually.

Folder: (x: \ is the Drive Letter of the application CD)

x:\ cp2102\Drivers\CP210x USB Composite Device

x:\ cp2102\Drivers\CP210x USB to UART Bridge Controller

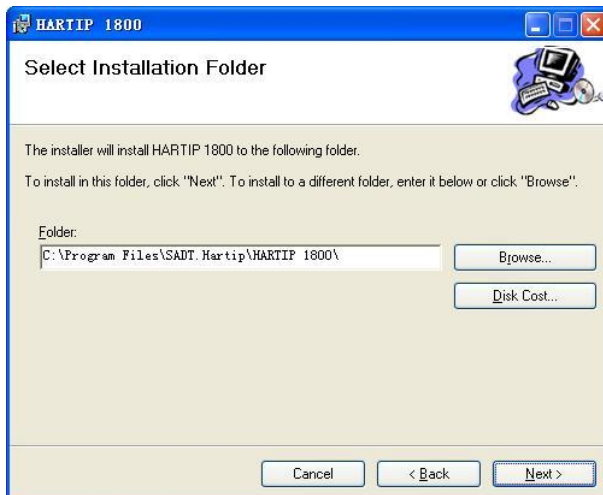
Install these two drivers.

11.2. Installation of Software

To start the HARTIP 1800 PC System Setup Wizard, double-click the file Setup.exe in the software folder.



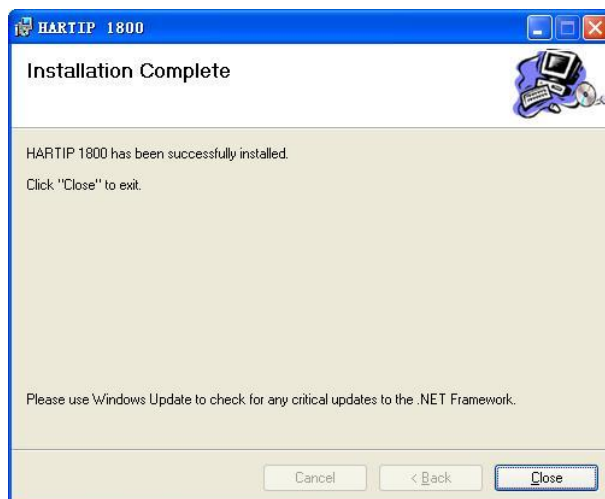
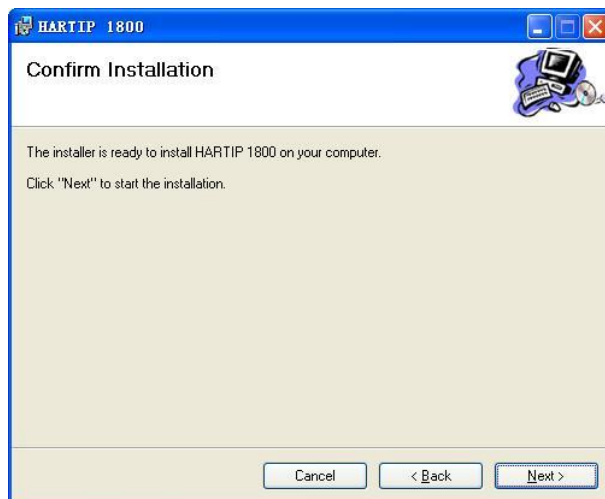
Click “Next” to continue.



The default installation folder is:

C:\Program Files\SADT.Hartip\HARTIP 1800\

Click “Next” to start the installation.



Note: If it is displaying that the ".Net Framework" is not installed during installation, install the file `dotnetfx.exe` in the CD.

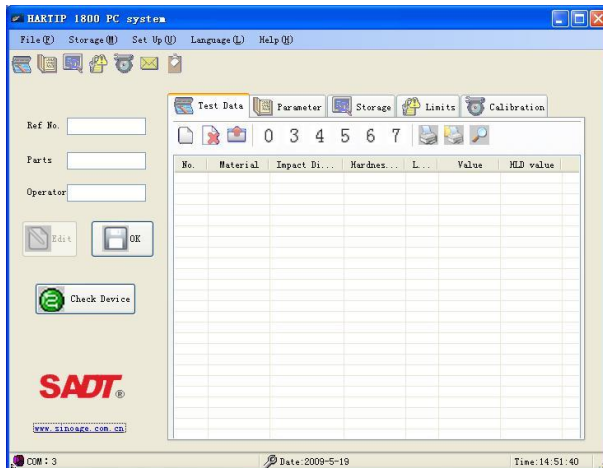
11.3. Operation of PC System Software

As the PC System software is started after successful installation of hardware drivers, if no equipment is connected with the port, the following dialog box pops up.



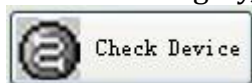
11.3.1. Main Interface Introduction

Main Interface

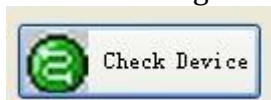


Check Device

You can press “Check Device” to connect with the tester manually if the connection fails. As the icon is grey, meaning the test equipment connection with HARTIP 1800 fails.



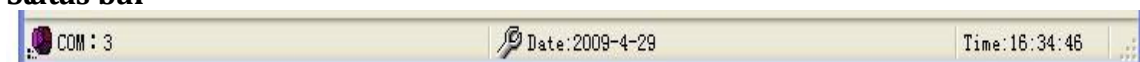
As the icon is green, meaning the test equipment connection succeeds.



For detailed operation of data transferring, please refer to 6.7 Data Transfer.

Note: Before pressing “Check Device”, please make sure to select right port from “Data transfer” first and then select “Communicate” from “Data transfer”.

Status bar



Display the port connection status, current date and time.

For normal connection, the port no. is displayed; for failed connection, displaying “Connection failed, please check the port.”

Modify operation information

For each group of measurement, the user may record the **Ref No.**, **Parts** and **Operator** in the group.



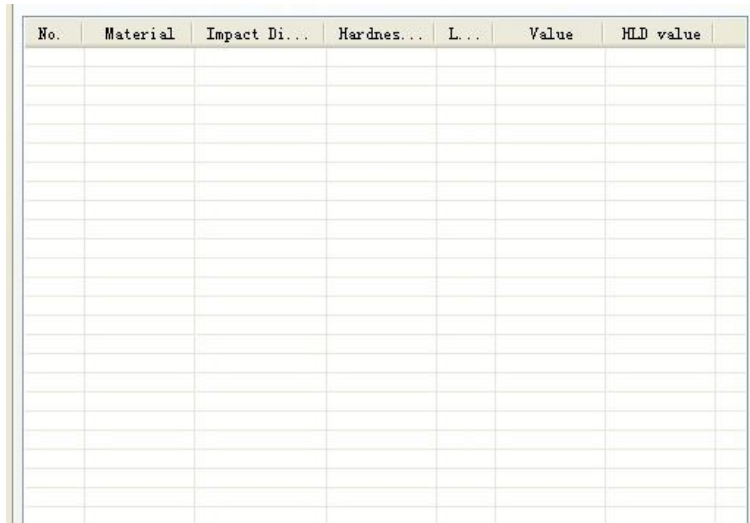
Select the group to be modified from the list, press the button "Edit" to active all input fields; enter the information; to save the data, press "OK". The operation information will be also saved in the HARTIP 1800.

Menus

File -> New

The items in the title

No., Materials, Impact Direction, Hardness Scale, Limit Alarm, Value, HLD value



| No. | Material | Impact Di... | Hardnes... | L... | Value | HLD value |
|-----|----------|--------------|------------|------|-------|-----------|
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Press the **Test Data** to clear the sheet.

File -> Open

Select a group of data from the list, and select the item **Export....** in the menu **File**, the current data may be exported to Text or CSV file format. Select the destination file format in the **File Type** filed.

File -> Save

As there is no test data, displaying



As **Ref No.** is not filled



As the **Parts** is not filled, displaying



As the **Operator** is not filled, displaying



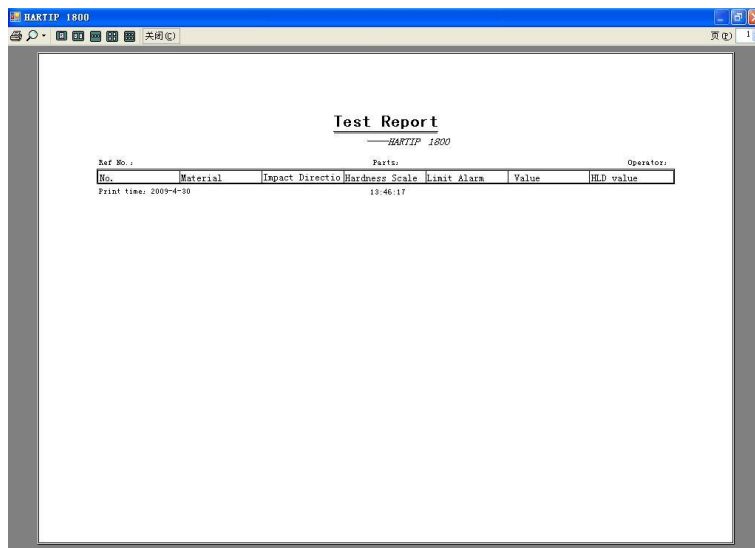
After the three items are filled, but "Fill" is not pressed, displaying



The **Save** dialog box to save the data.

Default filename: Name of operator_ current date

File -> Print Preview

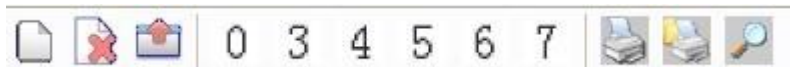


Switch to other screens



The icons correspond to “Test Data”, “Parameter”, “Storage”, “Limits”, “Calibration”, “Mail to us” and “About” in order from left to right.

Tools bar in Test Data screen



The icons correspond to “New Sheet”, “Delete One Row”, “Save Data”, “Mean time - 0 time”, “Mean time - 3 times”, “Mean time - 4 times”, “Mean time - 5 times”, “Mean time - 6 times”, “Mean time - 7 times”, “Print”, “Print Page Setting” and “Print Preview” in order from left to right.

“Parameter” screen

“Storage” screen

Storage status screen

Test Data

Parameter

Storage

Limits

Calibration

Storage state

Stored data

Delete block

Total number of used block is

Total number of not used block is

Available storage space

%

Read

Store Data screen

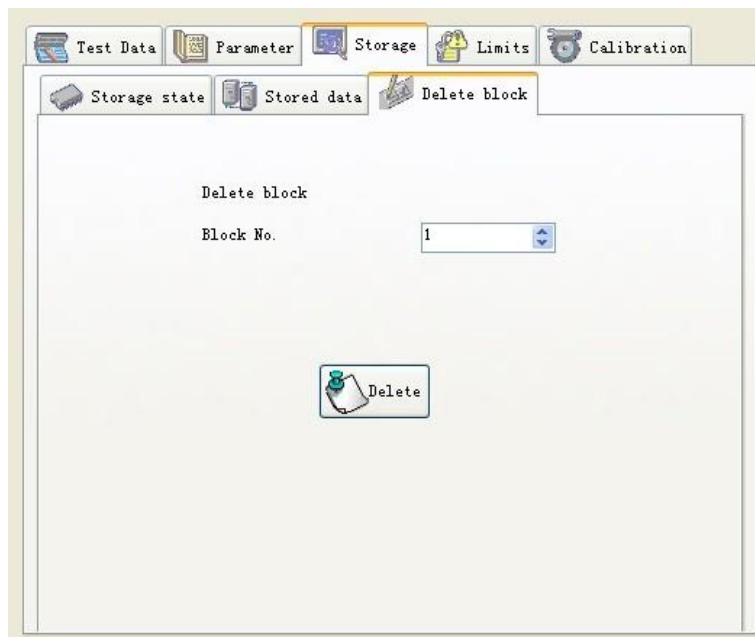
[illegible]

Tools bar:

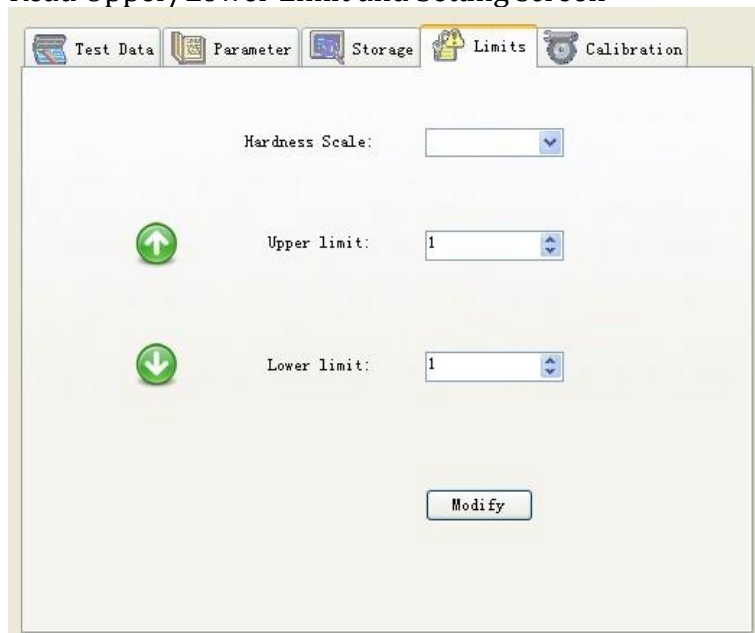


The icons correspond to “New Sheet”, “Read the Data in Chosen Group”, “Stop Reading”, “Save Stored Data”, “Print Stored Data”, “Print Page Setting” and “Print Preview” in order from left to right.

Delete block screen

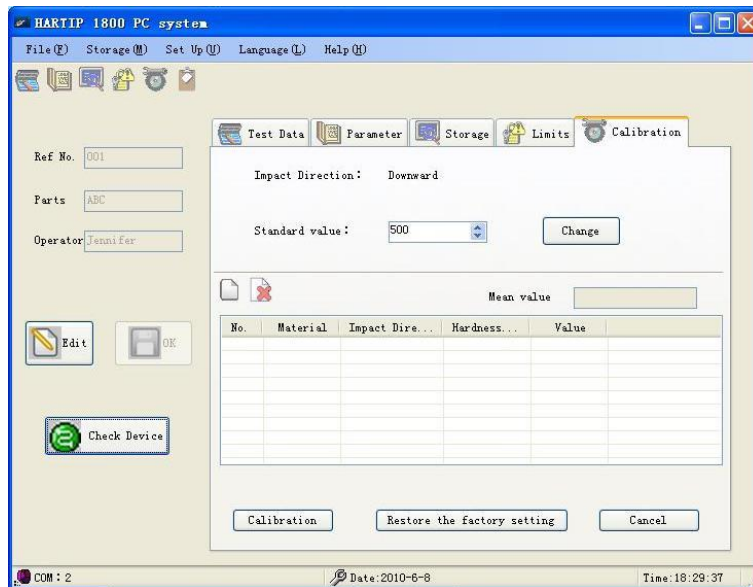


Read Upper/Lower Limit and Setting screen



Select the Hardness Scale drop-down menu to read the corresponding Limit Alarm value.

“Calibration” Screen



Setting the value of standard block for calibration

To modify the value of standard block, press “Change Reference Block Value”. The default value is “500”. The modified data is saved in the application and read as the application starts next time.

Calibration

To take measurement on the standard block for at least 3 times, and then click “Calibration” to finish calibration.

Restore the factory setting

To clear the calibration value, press “Restore the factory setting”.

Quit the PC system of HARTIP 1800.

