



<b>Product Name</b>	GAOTek Pen type Leeb Hardness Tester
<b>Product SKU</b>	GAOTek-OET-135
<b>Product URL</b>	<a href="https://gaotek.com/product/gaotek-pen-type-leeb-hardness-tester/">https://gaotek.com/product/gaotek-pen-type-leeb-hardness-tester/</a>

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## 1. Principle of Leeb Hardness Testing Method

The impact body, which is equipped with tungsten carbide, impacts into the work piece and rebounds back. The rebound and impact velocities are measured at the 1mm point from the work piece in the following way: the integrated permanent magnet will produce directly proportional voltage with the impact velocity. The Leeb hardness values are calculated by the following formula:

$$HL=1000 \times (V_b / V_a)$$

In Which: HL: Leeb hardness values

$V_b$  : the voltage produced during the rebound of impact body  $V_a$ : the voltage produced during the impact of impact body

Figure 1 shows the voltage produced during the impact and rebound of impact body: voltage features of output signal

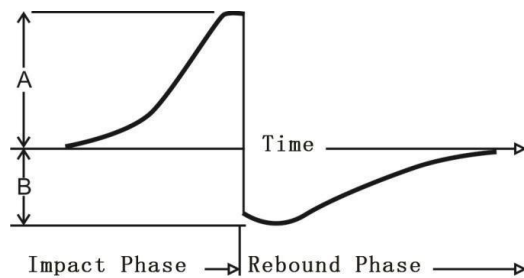


Figure 1.1

## 2. Instrument and Impact Device Diagram

### 2.1 Instrument Diagram

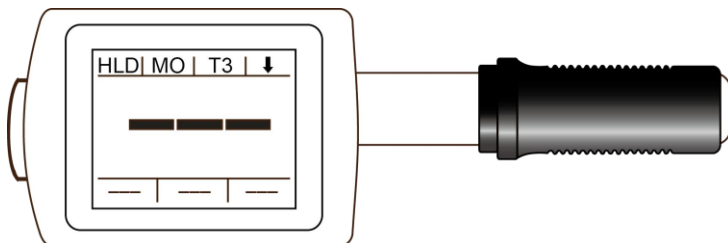


Figure 2.1





## 2.2 Standard Configuration

- ◆ Main Unit (With D type impact device)
- ◆ HLD Value Standard Test Block
- ◆ Data View Software
- ◆ USB Communication Cable
- ◆ Small Supporting Ring
- ◆ Cleaning Brush
- ◆ Operating Manual
- ◆ Instrument Case
- ◆ One AAA Battery

## 2.3 Optional Accessories

- ◆ Impact Device: DL Connector
- ◆ Standard Test Block
- ◆ Standard Supporting Ring
- ◆ Special Supporting Rings
- ◆ Small Supporting Ring





### 3. Functions and Applications

#### 3.1 Technical Specifications

**Measuring Method:** Leeb hardness testing method

**Hardness Scale:** HL, HB, HRB, HRC, HV, HS Strength ( $\sigma_b$ ). **Measuring Range:** HLD (200-960), HRC (19.8-68.5), HB (30-651), HV (80-976), HS (26.4-99.5), HRB (13.5-100),  $\sigma_b$  (375-2639).

**Impact Device:** D type impact device (Standard); Interchangeable DL

type impact device

**Accuracy:**  $\pm 6$ HLD (HLD=800), Repeatability 6HLD (HLD=800) **Measuring Direction:** Vertically downward, inclined downward, Level, inclined upward, vertically upward, 360 degrees by manual setting.

**Material:** Steel & Cast Steel, Stainless Steel, GC IRON, NC IRON, Cast Aluminum Alloy, Copper-Zinc Alloy, Copper-Tin Alloy, Brass, Forging Steel, Alloy Tool Steel

**Resolution:** 1HL, 1HV, 1HB, 0.1HRB, 0.1HRC, 0.1HS

**Display:** 1.77-inch color TFT LCD screen

**Memory:** 1000 groups (each group include 2-6 testing values and 1 average value)

**Communication Port:** USB 2.0 **Power:** 1 AAA Battery, 1.5V

**Working Temperature:**  $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$  **Size:** 149mm\*45mm

**Weight:** 110g (include battery)

**Battery:** 10g

**Standard:** GB/T 17394-1998, ASTM A956

#### 3.2 Applications

Installed machinery and permanent assembly parts Mould cavity

Heavy workpieces

Failure analysis of pressure vessel, turbine and other equipment's small test area

The production line of bearings and other parts Distinguish the material of the metal material warehouse





## 4 Pre-Treatment of Workpiece

### 4.1 Workpiece Requirements

1. Surface roughness is an important requirement for the test piece, it should be smooth and no oil, or will cause measurement errors. The surface roughness of workpiece should be less than  $2\mu\text{m}$ .
2. Sample weight  $> 5\text{kg}$ , it can be tested directly without supporting. Sample weight is  $2\sim 5\text{kg}$ , with overhanging part or thin wall workpiece, it should be fixed and supported with object more than  $5\text{kg}$  weight to avoid deformation or moving. Sample weight  $< 2\text{kg}$ , it should be tight coupled with the supporting object of the weight more than  $5\text{kg}$ , and the surface of supporting body should be flat, smooth, and no excess couplet, the testing direction must be perpendicular to the coupling surface.
3. Other requirements of the sample: Sample weight  $\geq 0.1\text{kg}$ , Sample thickness  $\geq 5\text{mm}$ , Hardened-layer depth  $> 0.8\text{mm}$ .
4. While the supporting body being clamped , the impact direction should be perpendicular to the testing surface.
5. When sample is large area of plate, long rod, or curved workpiece, even fairly heavy and thick, it may still cause deformation and instability of the workpiece and cause incorrect test value. So, the back of the test position should be reinforced and supported.
6. The magnetism of the sample should be less than 30



## 4.2 Selection of Supporting Ring

When the curvature radius (R) of testing sample surface is smaller than 30mm and greater than 11mm, the small supporting ring should be used, or select our special supporting ring (Optional) to obtain the best test condition.

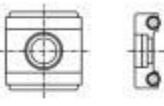
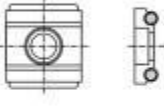
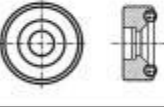


No	Code	Model	Diagram of Special Supporting Ring	Remark
1	03-03.7	Z10-15		Measure outside surface of cylinder R10~R15
2	03-03.8	Z14.5-30		Measure outside surface of cylinder R14.5~R30
3	03-03.9	Z25-50		Measure outside surface of cylinder R25~R50
4	03-03.10	HZ11-13		Measure inner surface of cylinder R11~R13
5	03-03.11	HZ12.5-17		Measure inner surface of cylinder R12.5~R17
6	03-03.12	HZ16.5-30		Measure inner surface of cylinder R16.5~R30
7	03-03.13	K10-15		Measure outside spherical surface SR10~SR15
8	03-03.14	K14.5-30		Measure outside spherical surface SR14.5~SR30
9	03-03.15	HK11-13		Measure inside spherical surface SR11~SR13
10	03-03.16	HK12.5-17		Measure outside spherical surface SR12.5~SR17
11	03-03.17	HK16.5-30		Measure outside spherical surface SR16.5~SR30
12	03-03.18	UN		Measure outside surface of cylinder, adjustable radius R10~∞

Table 4.1







## 5. Operation

### 5.1 Turn on the Instrument

Press power on button (D) to turn on the instrument, the screen displays the default interface, then powers on again to display the last parameters automatically.

### 5.2 Parameters Setting

#### 5.2.1 Material Setting

Press material setting button (B) to select the material, material Code No. from M0~M9:

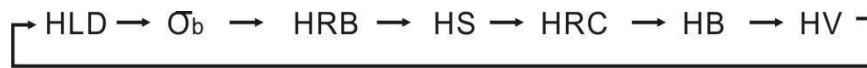
Material Code No.	Hardness	Tensile Strength
0	Steel and Cast Steel	Carbon Steel
1	Gray Cast IRON	Cr-Ni Steel
2	Nodular Cast IRON	Cr-Mo Steel
3	Cast Aluminum Alloy	Cr-V Steel
4	Brass	Cr-Mn-Si Steel
5	Bronze	High-Strength Steel
6	Copper	Stainless Steel
7	Stainless Steel	Cr-Ni-Mo Steel
8	Forging Steel	Chrome Steel
9	Alloy Tool Steel	

Table 5.1



### 5.2.2 Hardness Scale Setting

Press scale setting button (A) to select the hardness scale and strength;



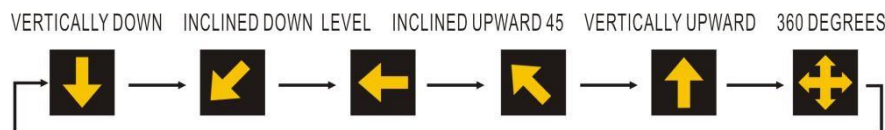
Note: when choosing DL probe in the storage interface, “HLD” displays as “HLDL”. Figure 5.2

### 5.2.3 Impact Times Setting

Press times button (C) to set the impact times from T1~T6, which will calculate the AVE value after the certain impacts.

### 5.2.4 Impact Direction Setting

Press direction button (D) to select impact direction. Figure 5.3



## 5.3 Measuring

### 5.3.1 Operating

Start measuring after finishing the parameters setting.

- ◆ Load the impact body: Pushing the loading-tube until contact is felt. Then allow it to slowly return to the starting position locking the impact body.
- ◆ Fixed position: Press the impact device support ring firmly on the surface of the sample.
- ◆ Release the impact body: Press the release button on the upside of the impact device to test. The sample and the impact device as well as the operator are all required to be stable now. And the direction of the force should be through the axis of the impact device.
- ◆ After testing, the screen displays as following, the tester will save testing results automatically, or it won't save testing results if the testing value is invalid. After several testing, the recent testing values will display in sequence at the bottom of the screen



## 5.4 Interface Description

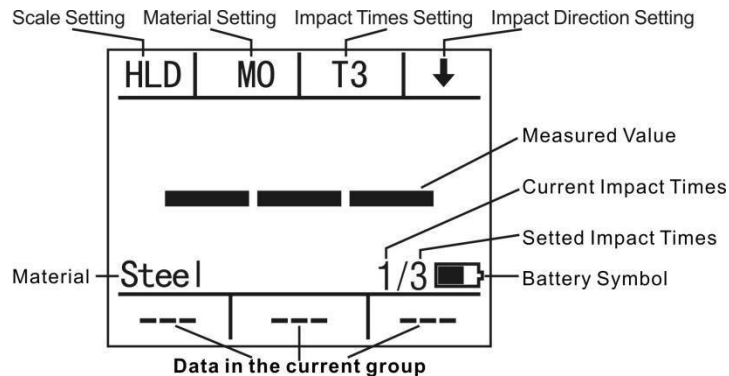


Figure 5.4

This instrument has total four main interfaces and one sub-interface (under the storage interface), long press the four buttons to switch to the corresponding four interface: default interface, calibration interface, storage interface, setting interface.

The A button corresponding to the default interface (booting interface): including scale (A), material (B), impact times (C), boot and impact direction (D).

The B button corresponding to the calibration interface: including calibration (A), increase (C) and decrease (D) calibration value. (To operate when mean value appears).

The C button corresponding to the storage interface: including save(A) (effective under the mean value), read (B), delete the current value(C), (D) the saved hardness values can be read and deleted when enter into the read interface.

Click B button to switch the sub-interface to read the stored values.

The D button corresponding to the setting interface: Language, impact device, bright adjustment and power off can be settled under this interface.



### 5.4.1 Default Interface

A→ Hardness scale switch button

B→ Material switch button

C→ Impact times selection button, calculating the mean value according to the selected times.

D→ Impact direction selection button

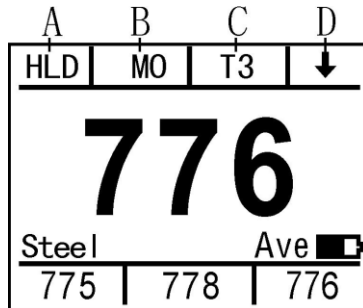


Figure 5.5

### 5.4.2 Calibration Interface (Factory Calibrated)

Measuring error can be usually caused by impact device abrasion after long time using. So, it is necessary to correct the error by calibration procedure to make the measurement accurate.

A→ Calibration button, can be operated only if the mean value effective.

C→ Increase button, can be operated only if the mean value effective.

D→ decrease button, can be operated only if the mean value effective.

Note: The function of switch D/DL impact device is in the setting interface (5.9). The standard configuration D probe, calibration is needed after replacing to DL impact device.

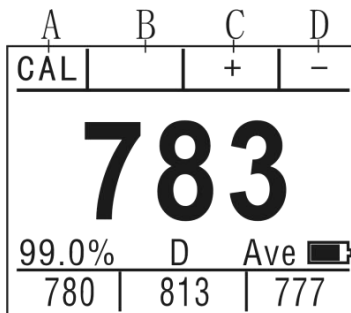


Figure 5.6





### 5.4.3 Storage Interface

A→ Save button, can be operated once after the mean value effective.

B→ Read the storage button, will switch to (5.8) read the storage sub-interface.

C→ Delete button, only the current value can be deleted. 6 testing results and 1 mean value each group can be stored. Press read button (B) to enter the reading mode, which displayed in cyan color (5.8)

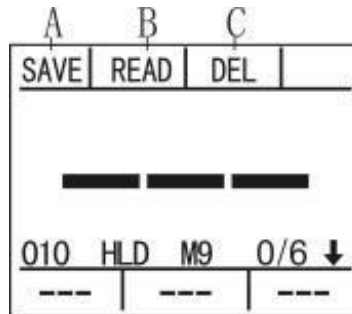


Figure 5.7

### 5.4.4 Sub-interface of Read the Storage

A→ Return to storage interface

B→ Delete the currently displayed stored value

C→ Browse the stored value upwardly

D→ Browse the stored value downwardly Main displays the mean value, and sub displays three stored values

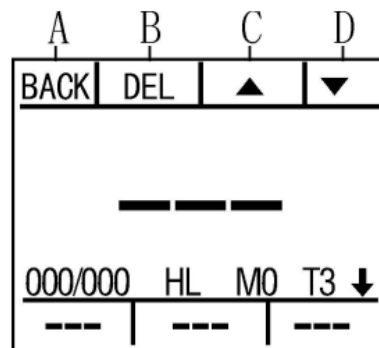


Figure 5.8



### 5.4.5 Setting and Shutdown Interface

A→ Language switch button: Simplified Chinese, Traditional Chinese,Japanese, English and Spanish.

B→ Impact device switch button, only DL probe is optional.

C→ Brightness control button, total three levels.

D→ Power off button

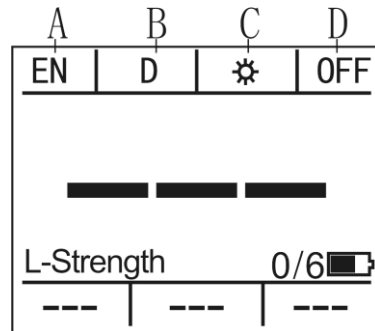


Figure 5.9

### 5.4.6 Storage Data Transmission

The data stored can be transferred from the instrument to a PC via communication software, for saving, statistic and analyzing the measurement. (See the help documentation in communication software for details)

## 6. Maintenance & Servicing

After a long time using it, please use the cleaning brush to clean the tube and impact body.

- ◆ Unscrew the support ring, take out the impact body.
- ◆ Spiral the nylon brush in counter-clock direction into the bottom of the tube and pull it out, repeating many times.
- ◆ Install the impact body and support ring.
- ◆ Release the impact body after testing every time.





**between HLD V Conversion Table alue and HLDL Value**

HLD	300	304	306	308	310	314	316	318	322	324
HLDL	<b>560</b>	<b>562</b>	<b>564</b>	<b>566</b>	<b>568</b>	<b>570</b>	<b>572</b>	<b>574</b>	<b>576</b>	<b>578</b>
HLD	356	360	361	364	367	370	372	374	377	380
HLDL	<b>602</b>	<b>604</b>	<b>606</b>	<b>608</b>	<b>610</b>	<b>612</b>	<b>614</b>	<b>616</b>	<b>618</b>	<b>620</b>
HLD	410	413	415	418	420	423	425	429	431	433
HLDL	<b>644</b>	<b>646</b>	<b>648</b>	<b>650</b>	<b>652</b>	<b>654</b>	<b>656</b>	<b>658</b>	<b>660</b>	<b>662</b>
HLD	464	466	468	472	474	476	479	481	484	487
HLDL	<b>686</b>	<b>688</b>	<b>690</b>	<b>692</b>	<b>694</b>	<b>696</b>	<b>698</b>	<b>700</b>	<b>702</b>	<b>704</b>
HLD	518	521	524	527	530	532	534	537	540	544
HLDL	<b>728</b>	<b>730</b>	<b>732</b>	<b>734</b>	<b>736</b>	<b>738</b>	<b>740</b>	<b>742</b>	<b>744</b>	<b>746</b>
HLD	578	581	584	587	590	592	596	599	602	605
HLDL	<b>770</b>	<b>772</b>	<b>774</b>	<b>776</b>	<b>778</b>	<b>780</b>	<b>782</b>	<b>784</b>	<b>786</b>	<b>788</b>
HLD	644	647	650	654	657	660	664	667	670	674
HLDL	<b>812</b>	<b>814</b>	<b>816</b>	<b>818</b>	<b>820</b>	<b>822</b>	<b>824</b>	<b>826</b>	<b>828</b>	<b>830</b>
HLD	716	720	724	728	730	734	738	742	746	749
HLDL	<b>854</b>	<b>856</b>	<b>858</b>	<b>860</b>	<b>862</b>	<b>864</b>	<b>866</b>	<b>868</b>	<b>870</b>	<b>872</b>
HLD	793	797	800	804	808	812	815	819	823	826
HLDL	<b>896</b>	<b>898</b>	<b>900</b>	<b>902</b>	<b>904</b>	<b>906</b>	<b>908</b>	<b>910</b>	<b>912</b>	<b>914</b>
HLD	871	874	878	882	886	889	893			
HLDL	<b>938</b>	<b>940</b>	<b>942</b>	<b>944</b>	<b>946</b>	<b>948</b>	<b>950</b>			





328	330	334	336	338	340	344	346	348	352	354
<b>580</b>	<b>582</b>	<b>584</b>	<b>586</b>	<b>588</b>	<b>590</b>	<b>592</b>	<b>594</b>	<b>596</b>	<b>598</b>	<b>600</b>
383	386	387	390	392	395	398	400	403	405	408
<b>622</b>	<b>624</b>	<b>626</b>	<b>628</b>	<b>630</b>	<b>632</b>	<b>634</b>	<b>636</b>	<b>638</b>	<b>640</b>	<b>642</b>
436	438	440	444	446	448	451	453	456	458	461
<b>664</b>	<b>666</b>	<b>668</b>	<b>670</b>	<b>672</b>	<b>674</b>	<b>676</b>	<b>678</b>	<b>680</b>	<b>682</b>	<b>684</b>
490	492	495	497	500	502	505	508	510	513	516
<b>706</b>	<b>708</b>	<b>710</b>	<b>712</b>	<b>714</b>	<b>716</b>	<b>718</b>	<b>720</b>	<b>722</b>	<b>724</b>	<b>726</b>
546	548	551	554	557	560	563	566	569	572	574
<b>748</b>	<b>750</b>	<b>752</b>	<b>754</b>	<b>756</b>	<b>758</b>	<b>760</b>	<b>762</b>	<b>764</b>	<b>766</b>	<b>768</b>
608	611	614	617	620	624	627	630	634	637	640
<b>790</b>	<b>792</b>	<b>794</b>	<b>796</b>	<b>798</b>	<b>800</b>	<b>802</b>	<b>804</b>	<b>806</b>	<b>808</b>	<b>810</b>
678	681	684	688	691	695	698	702	706	709	712
<b>832</b>	<b>834</b>	<b>836</b>	<b>838</b>	<b>840</b>	<b>842</b>	<b>844</b>	<b>846</b>	<b>848</b>	<b>850</b>	<b>852</b>
752	756	760	764	768	771	774	778	782	786	789
<b>874</b>	<b>876</b>	<b>878</b>	<b>880</b>	<b>882</b>	<b>884</b>	<b>886</b>	<b>888</b>	<b>890</b>	<b>892</b>	<b>894</b>
830	834	837	841	845	849	852	856	860	864	867
<b>916</b>	<b>918</b>	<b>920</b>	<b>922</b>	<b>924</b>	<b>926</b>	<b>928</b>	<b>930</b>	<b>932</b>	<b>934</b>	<b>936</b>







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