



# **Digital Brinell, Rockwell, Vickers Hardness Tester NOVOTEST TB-BRV-D**



## **Operation manual**

**2018**



## **I. Major features:**

Digital Brinell, Rockwell, Vickers Hardness Tester NOVOTEST TB-BRV-D, with 8-inch touch screen for visual display and single-chip control system, can realize human-computer dialogue and automation operations. It features higher precision, simple operation, high sensitivity, user friendliness as well as stable value indication. It makes automatic operations come true such as the exertion and removal of test force, direct display of hardness number, etc.

Built-in printer, RS232 port and USB interface, making data exchange between a computer and the hardness tester available.

1. Adopting 8-inch touch screen for rich contents and convenient operations
2. Starting up for direct use without weights
3. Electronic loading and closed-loop control upon force value, leading to a high precision
4. Brinell, Rockwell and Vickers testing methods for hardness
5. Automatic hardness conversion
6. Optical system with high precision
7. Saving measured data into Excel document in USB drive for easy edit and preservation
8. RS232 port transferring test results to computer.

## **II. Application and scope**

Measuring the Brinell hardness, Vickers hardness and Rockwell hardness for ferrous metal, non-ferrous metal and hard alloy;

Wide application in measurement:

- a. Brinell hardness of casting, annealed steel, normalized steel, non-ferrous metal and mild alloy
- b. Rockwell hardness of quenching, tempering and other thermal-treatment materials
- c. Vickers hardness of Nitrided layer, ceramic, sheets, metal foil, electroplated layer and tiny parts

## **III. Introduction of technical parameters**

1. Power supply: AC220V±5%, 50~60Hz
2. Delay control: 0-90 seconds adjustable
3. Distance from the center of hardness penetrator to machine body: 160mm  
Maximum height of specimen: 150mm (Rockwell), 138 (Brinell, Vickers)
4. Dimensions (L × W × H): 550×230×750mm
5. Weight: 80kg
6. Test force:  
Rockwell: 60, 100, 150KGf (588, 980, 1471N)  
Brinell: 15.625, 31.25, 62.5, 125, 187.5Kg (153.2, 306.5, 612.9, 1226, 1839N)  
Vickers: 5, 10, 20, 30, 50, 100Kg (49.03, 98.07, 196.1, 294.2, 490.3, 980.7N)
7. Range of scale:  
Rockwell: HRA, HRB, HRC, HRD, HRF, HRG  
Brinell: HBW2.5/15.625 HBW2.5/31.25 HBW2.5/62.5 HBW5/62.5 HBW5/125



HBW2.5/187.5

Vickers: HV5, HV10, HV20, HV30, HV50, HV100

8. Test range:

Rockwell: 20-88HRA, 20-100HRB, 20-70HRA

Brinell: 5-650HBW

Vickers: 10-2900HV

9. Amplification: 100X, 50X, 25X

## **IV. Main structure (See Figure “Structure Diagram”)**

This machine is mainly comprised of machine body, electrical part, lifting part, loading and unloading part, sliding table, optical measuring part and so on.

With casting body, it has good rigidity and stability. Installing the loading and unloading part as well as electrical part internally, it is not only beautiful but also easy to clean.

The electrical part adopts a high-speed 32-bit microprocessor control system, 8-inch color touch screen, leading to fast arithmetic speed, huge information processing quantity, quick reaction as well as clear information.

The loading and unloading part of test force adopts stepper motor drive. The load cell transfers the hardness to the microprocessor control system, which adopts special algorithm and controls the stepper motor precisely. Therefore, the control precision of test force is improved a lot when compared with that of previous models.

According to actual needs of users, the test ruler has added new specifications of HV5, HV10, HV20 and HB15.625 for convenience.

It adopts a precision optical measurement system equipped with three objective lenses. Therefore, it can measure the hardness number with a wider range. Internal and external illumination are prepared for different indentations, making the indentations clearer and the measurement more correct.

It is user-friendly owing to abundant interface means, built-in printer, RS232 serial port and USB interface.

## **V. Installation**

### **5.1 Installation Conditions**

1. The hardness tester must have a clean, dry working environment without any corrosive gas and electromagnetic interference.
2. The hardness tester must work without external mechanical vibration.
3. The experiment table (self-prepare) must be based on cement or metal with a certain rigidity or intensity to carry a hardness tester and its accessories. The tabletop is shown in Figure 5-0 (the dimension in the figure is only for reference), which has a  $\phi 70-80$ mm hole



accessible for lead screw. The levelness of the tabletop must be kept within 0.2/1000. There must be enough interval between hardness tester and surrounding walls for subsequent daily maintenance.

4. The power supply must be located within one meter of hardness tester. It must be stable in voltage and good in ground connection without any interference.

5. Work environment of workroom:  $23 \pm 5^{\circ}\text{C}$ .

6. Relative humidity of workroom:  $\leq 65\%$ .

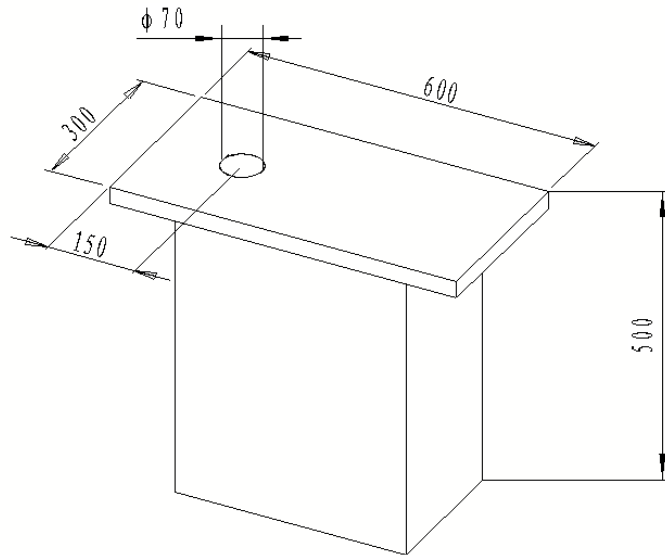


Figure 5-0 Diagram of testing bench

## 5.2 Unpacking

1. Unpacking tools: a. screwdrivers b. scissors

2. Steps:

a. Cut down packing strap by scissors and remove it.

b. Remove wood screw with screwdriver.

c. Uplift the box (do not break the main machine).

d. Tack out the information pack and check whether user manual (including packing list, certificate of quality) is ready.

e. Open the accessory case and check whether the parts in it is in line with the packing list.



- f. Take the dust cover away from the hardness tester.
  - g. Read installation instruction carefully.
3. Necessary tools for installation:

- Cross screwdriver (in the accessory case)
- Internal hexagonal wrench (in the accessory case)
- Clyburn spanner (prepared by users)

### 5.3 Installation Steps

1. Put the hardness tester in the stable, non-vibrating experiment table.
2. Install the four horizontal-adjusting screws (in the accessory box) into the four holes correspondingly in the bottom of the machine. The rear screws must be installed before the front screws.
3. Tear off the tape on the hardness penetrator carefully and pull out the end cape of the eyepiece.
4. Install the micrometer (in the accessory case) in the eyepiece. Please pull it to the bottom closely with the eyepiece; otherwise, the measurement precision will be influenced.
5. Put the leveling instrument on the testing bench; adjust the four horizontal-adjusting screws at the bottom of the hardness tester to center the spirit bubble in the leveling instrument.

## VI. Settings of parameter interface

Turn on the power and the switch, the interface will be shown as below:





In the main menu, the user can choose Rockwell, Vickers and Brinell according to the needs. The interface is also available to set time and date as well as the Rockwell hardness calibration, force value and micrometer.

### 6.1 Rockwell hardness operation:

Select Rockwell and enter the Rockwell operating interface:



Click the column of Tester's Serial Number and enter into the following interface:



The operator can click the column of Tester's Serial Number to input his own number and click the EN button to complete the input.

The same window will pop up when the column of the Upper-limit Value is clicked. Input the value of the upper limit and click the EN button.

The same window will pop up when the column of the Lower-limit Value is clicked. Input the value of the lower limit and click the EN button.

The same window will pop up when the column of Duration Time is clicked. Input the corresponding duration time and click the EN button.



Click the Scale column, select HRB and enter the window of Rockwell Scale as below:



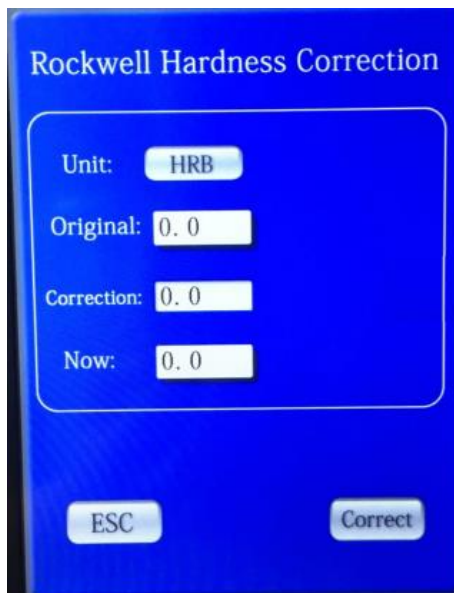
Select the desired scale, which will be displayed in the Scale column, and the interface will return to the Rockwell operation interface. Then the Rockwell experimental operation is available.

In the hardness test, the tester can click the Scale column in the window of Conversion Value if a conversion of scale is needed.

Testers can make the choice according to his own needs.

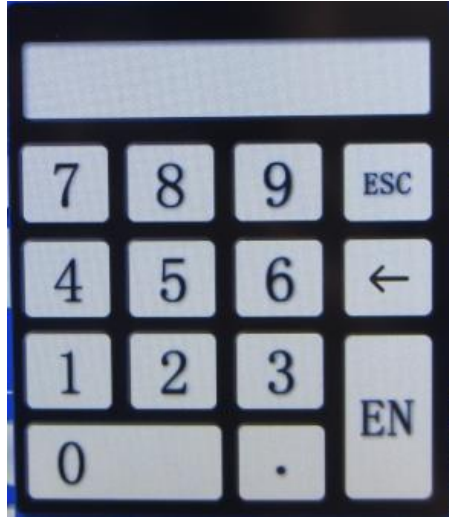
If the deviation between the measured hardness value and the reference block's hardness value is less than 3 degrees, a calibration can be made through Hardness Calibration as below:

Click the Hardness Calibration key and the following window will pop up:





Click the Calibration button and a data window will pop up:



Input the actual hardness value of the hardness reference block, press the Calibration key and the machine will take a automatic calibration. Then, exit the Calibration interface and test the hardness block. Another calibration will be necessary through the methods above if the measured hardness value is different from the value of the hardness block. If the measured hardness value is same as the standard value of the hardness block or there is only 1.5HR difference or less between the two value, the measured value will be qualified. If the deviation exceeds 3HR, the calibration shall be operated as below:

Enter Rockwell interface and select HRC scale; click the button of Rockwell Hardness Calibration after return to the main menu and then enter the interface of Rockwell Hardness Tester's Calibration as below:



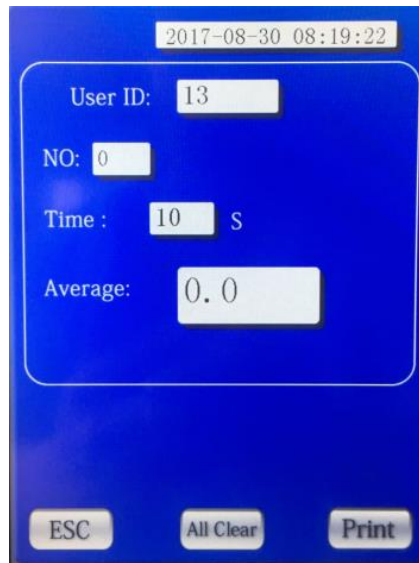
Enter the hardness value of reference block in the column of Hardness Input and press the Start





button, the machine will carry out the overall experiment automatically. When the column of Current Status shows no action after the test is completed, press the Calibration button for calibrating and then return to the main menu. Enter the Rockwell operation interface again for hardness test. If deviation between the measured hardness value and the reference block's still exceeds 1.5HR, repeat the operations above until the measured hardness value stays in the correct range. That is a complete calibration of HRC scale. If the measured value of other Rockwell scales exceeds the allowed range of the hardness block's hardness value, select the Hardness Calibration in the Rockwell interface for calibration, which can refer to the calibration methods of HRC scale.

Mean value: press the button of Mean Value and the window below will pop up:



The machine will display the test times and the mean value. Click the Print button to output the data in detail as well as the mean value.

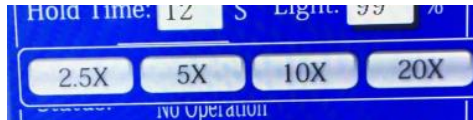
### 6.2 Brinell Hardness operation

Press the Brinell button and enter the Brinell menu as below:



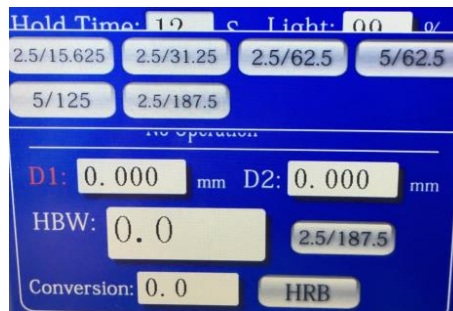


The operation of tester's serial number, the upper limit value, the lower limit value as well as the duration time is same as the Rockwell's. Objective magnification: according to the actual installation of the objective lens, click the 5X button as shown in the figure above and the following window will pop up.



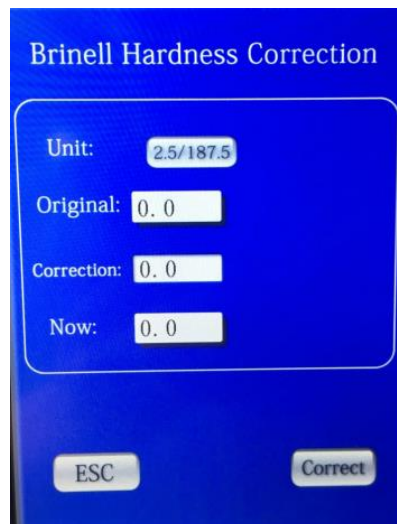
The operator shall select the objective magnification according to the actual installed objective lens.

Selection of Brinell scale: click the scale column—2.5/187.5—as shown in the figure and enter the window of Brinell scale selection as below:

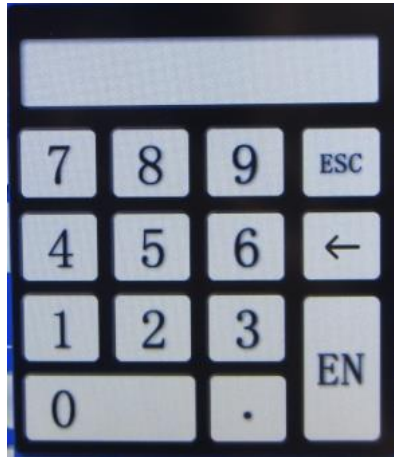


The operator can select corresponding scale accordingly and replace the hardness penetrator. The operator can use the reference block to test the machine. The machine must be calibrated if the measured hardness value exceeds the hardness block's value by 3%.

Calibration of Brinell hardness: click the Hardness Calibration button for the interface as below:

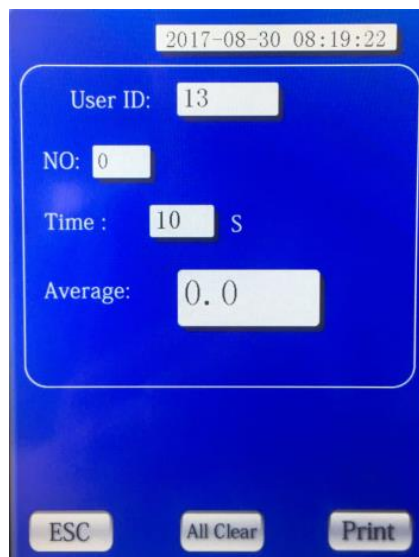


Click the Calibration button and enter the data window



Enter the actual hardness value of hardness reference block and press the Calibration button, the machine will calibrate itself automatically. After the calibration, exit the interface and test the hardness block. Another calibration will be necessary through the methods above if the measured hardness value is different from the hardness block's. If the measured hardness value is same as the standard value of the hardness block or there is 3% difference or less between the two value, the measured value will be qualified.

Mean value: press the button of Mean Value and enter the window as below:

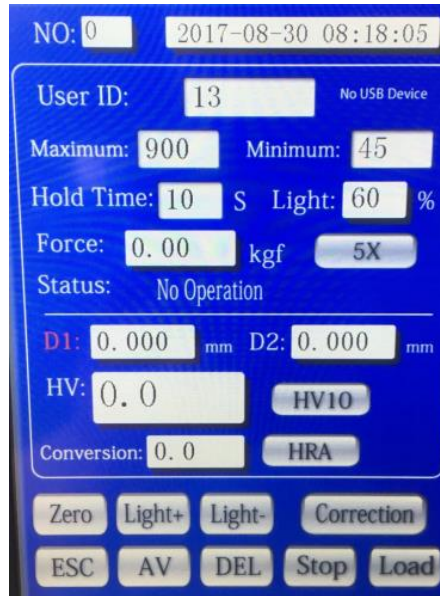


The machine will display the test times and the mean value. Click the Print button to output the data in detail as well as the mean value.



### 6.3 Vickers Hardness Operation

Click the Vickers button and enter the Vickers menu as below:

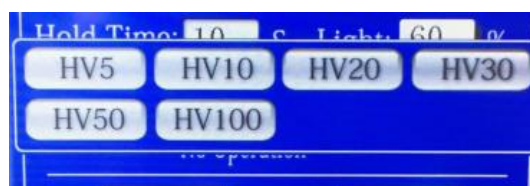


The operation of tester's serial number, the upper limit value, the lower limit value as well as the duration time is same as the Rockwell's. Objective magnification: according to the actual installation of the objective lens, click the 5X button as shown in the figure above and the following window will pop up.



The operator shall select the objective magnification according to the actual installed objective lens.

Selection of Vickers scale: click the HV5 as shown in the figure and enter the window of Vickers scale selection as below:

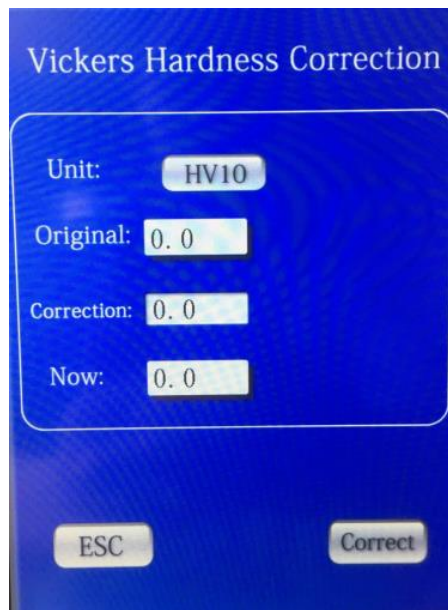


The operator can select corresponding scale accordingly.

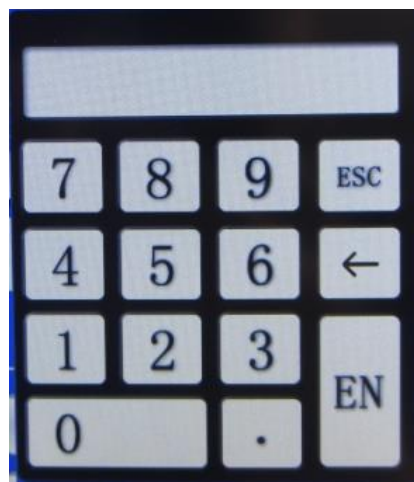


The operator can use the reference block to test the machine. The machine must be calibrated if the measured hardness value exceeds the hardness block's value by 3%.

Calibration of Vickers hardness: click the Hardness Calibration button for the interface as below:

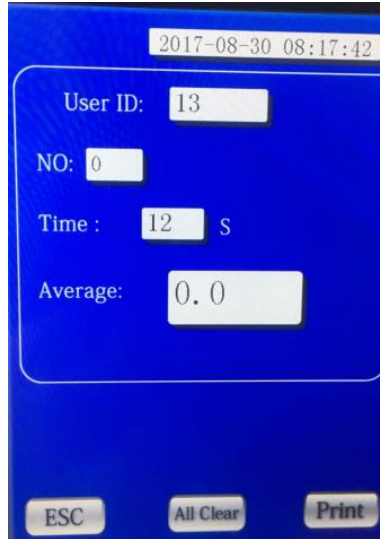


Click the Calibration button and enter the data window



Enter the actual hardness value of hardness reference block and press the Calibration button, the machine will calibrate itself automatically. After the calibration, exit the interface and test the hardness block. Another calibration will be necessary through the methods above if the measured hardness value is different from the hardness block's. If the measured hardness value is same as the standard value of the hardness block or the difference between the two value is within 3%, the measured value will be qualified.

Mean value: press the button of Mean Value and enter the window as below:



The machine will display the test times and the mean value. Click the Print button to output the data in detail as well as the mean value.

**Attentions: please keep the distance from the hardness penetrator to the surface of the subject for 0.5-1mm in the test. Remember that the hardness penetrator must not touch the surface and the distance between them must not exceed the range allowed.**

## VII. Measuring system

### 7.1 Micrometer

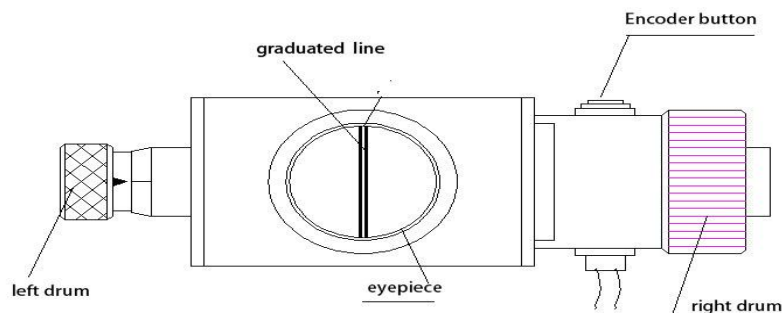


Figure 7-1 Micrometer



The micrometer shown in Figure 7-1 is a part of the hardness tester's optical system. It can help you observe the actual indentation and measure the diagonal length.

#### **7.1.1 Zero setting of micrometer**

1. Rotate the eyepiece until the two parallel black lines in it are very clear as **Figure 7-2**
2. Turn the left drum until the graduated line moves to the center of the eyepiece, and rotate the right drum; move the left side of the graduated line and make it tangent to the right of the other line as shown in **Figure 7-3**; then press the "CLEAR" key for zero setting.

**Note: Set the value of micrometer to zero every time when the machine enters the Brinell or Vickers interface.**

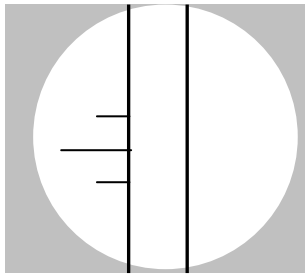
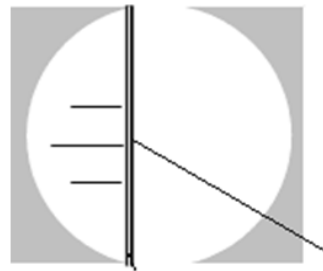


Figure 7-2



Two line are tangent

Figure 7-3

#### **7.1.2 Indentation Measurement**

1. Rotate the focus handwheel until the indentation is clear in the eyepiece
2. Rotate the micrometer to the horizontal state and make the graduated line coincide with the longitudinal diagonal of the indentation.
3. Rotate the left drum until the left graduated line in the eyepiece is tangent with the vertex angle in the left of the indentation.
4. Rotate the right drum to move the right graduated line of the eyepiece and make it tangent to the right vertex angle of the indentation. Press the "Encoder button", enter and save the length of the indentation's horizontal diagonal D1 as shown in **Figure 7-4**.
5. Rotate the micrometer clockwise by 90° that micrometer become vertical and make the graduated line coincide with the horizontal diagonal of the indentation.
6. Rotate the left drum until the upper graduated line of the eyepiece is tangent with the



upper end of the indentation.

7. Rotate the right drum to move the lower graduated line of the eyepiece and make it tangent to the lower end of the indentation. Press the "Encoder button", enter and save the length of the indentation's vertical diagonal  $D_2$  as shown in **Figure 7-5**.

8. Then, the hardness value of the test is displayed.

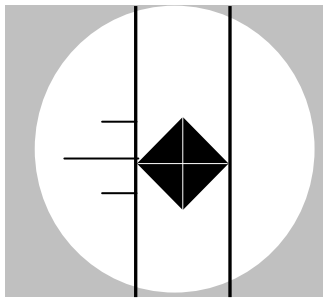


Figure 7-4

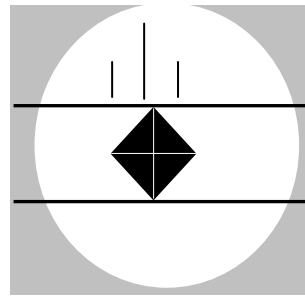
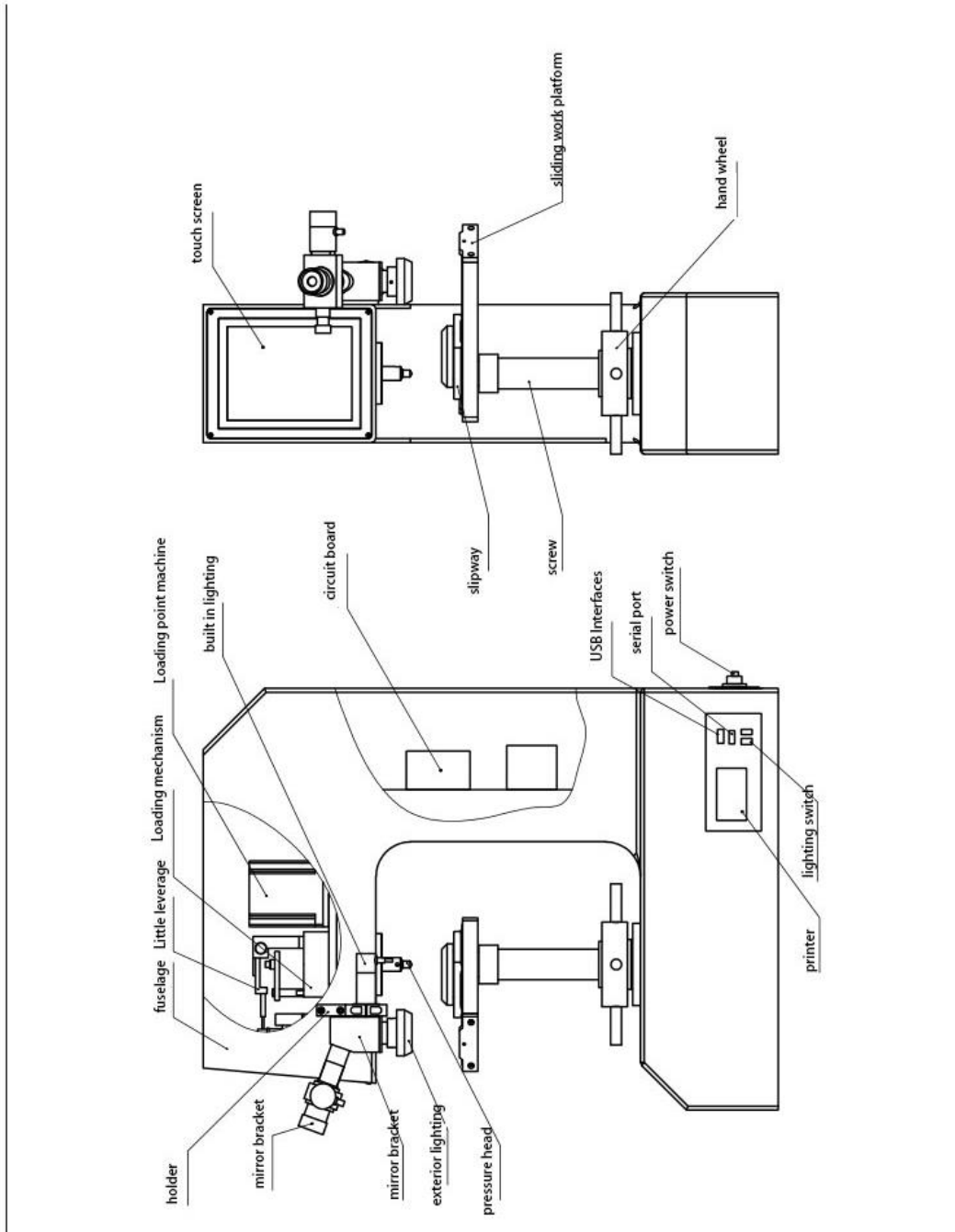


Figure 7-5





### VIII. Figures





## IX. Accessory case and parts

Parts in the accessory case of main machine

No.	Name (specification)	Quantity
1	Rockwell diamond hardness indenter	1 pc
2	Rockwell ball indenter: $\phi 1.5875\text{mm}$	1 pc
3	Large plain testing bench, middle plain testing bench, V-type testing bench	3 pcs
4	Rockwell hardness test block	5 pcs
5	Leveling instrument	1 pc
6	Horizontal adjusting screw	4 pcs
7	65mm screwdriver	1 pc
8	Power line	1 pc
9	RS232 communication line	1 pc
10	2A fuse	2 pcs
11	Dust cover	1 pc
12	Operating Manual (including Certificate of Quality, Calibration Certificates)	1 pc

Accessory caste of microscope

No.	Name (specification)	Quantity
1	Digital micrometer eyepiece	1 pc
2	Microscope base (including internal headlamp)	1 pc
3	Objective lens: 2.5X, 5X and 10X	1 pc for each
4	Sliding testing bench	1 set
5	External headlamp	1 pc
6	Vickers diamond hardness indenter	1 pc
7	Brinell ball indenter: $\phi 2.5\text{mm}$ , $\phi 5\text{mm}$	2 pcs
8	Vickers hardness test block (HV30)	1 pc
9	Brinell hardness test block (HBW/2.5/187.5)	1 pc