OPERATION MANUAL

MICROBUL 1000-AT
Digital Auto Turret Micro Vickers Hardness Tester

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1 Introduction

1.1 Machine overview

First of all, thank you for choosing our products and viewing this manual.

The digital micro-Vickers hardness tester is suitable for testing metal structures, including tiny parts, thin plates, metal foils, wires, thin hardened layers and electroplated layers. It can also be used to test non-metallic materials such as glass, jewelry and ceramics that cannot be tested by the Rockwell test method and other relatively large test force tests. In particular, it can follow the structure of metals and test the internal hardness of materials such as induction hardening or carburization.

The digital display microhardness tester is a high-tech product of optomechanical integration. The hardness tester is novel in shape, has good reliability, operability and repeatability, and is an ideal product for testing microhardness.

The machine uses C language programming, high-magnification optical measurement system and optical dual-channel structure, new technologies such as optoelectronics and photocoupled sensing. Through key operation, the length of the measured indentation can be input on the key, the hardness value, the conversion scale, the test force, the test force holding time and the number of measurements can be displayed on the LCD screen.

The digital micro hardness tester can also be configured according to the special needs of users. It can take pictures of the measured indentation and the metallographic structure of the material, a visual screen measuring device and an automatic indentation measuring device. As well as the determination of Knoop hardness.

1.2 The principle of Vickers hardness and Knoop hardness

1.2.1 Vickers HV

The Vickers hardness test is to use a 136° regular diamond indenter to press into the surface of the object to be tested with a specified test force (F). After the specified time of maintaining the test force, the test force is removed, and the test piece is measured with a micrometer eyepiece The diagonal line of the indentation on the surface (d), calculate the average pressure (N/mm2) of the conical surface area of the indentation, which is the Vickers hardness value. (See Figure 1.1 for details).

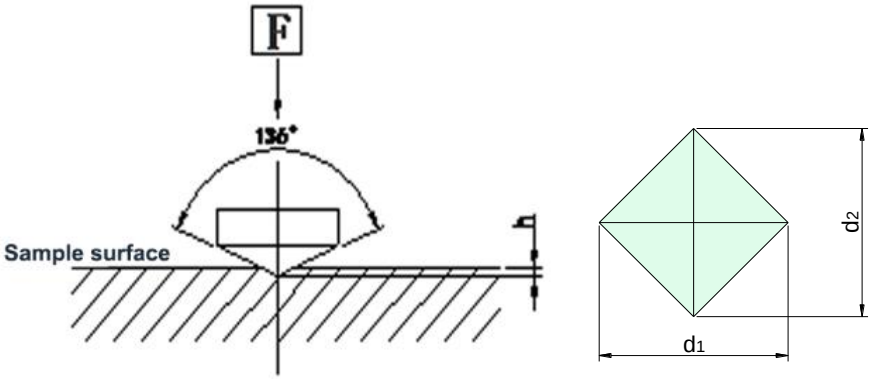


Figure 1.1 Principle of Vickers test

Vickers hardness calculation formula: $HV = 0.1891\frac{F}{d^2}$ **formula (1-1)**

HV—Vickers hardness

F --N

d--the average of the length of the two diagonal lines (d1, d2) of the indentation, mm

The relationship between HV indentation depth h and diagonal d: h=d/7 formula (1-2)

Note that when the test force is kgf:

$$HV = 1.854\frac{F}{d^2}$$ **(Formula 1-3)**

1.2.2 Knoop HK

The test principle of Knoop is the same as that of Vickers, except that its indenter is different from that of Vickers. Knoop is a pyramidal diamond indenter with a rhombus bottom. The indentation perpendicular to the surface of the test piece is a rhombus in appearance, and the ratio of the length of the two diagonal lines is approximately 7 to 1 (see Figure 1.2). Due to the geometric characteristics of the Knoop indenter, the diagonal measurement accuracy is higher when the test force is small. The depth of the indentation is very shallow, about 1/30 of the long diagonal. Due to this feature, the Knoop test is very suitable for testing the hardness of thin coatings, hardened surface layers, metal flakes, decarburized layers and hard and fragile metals.

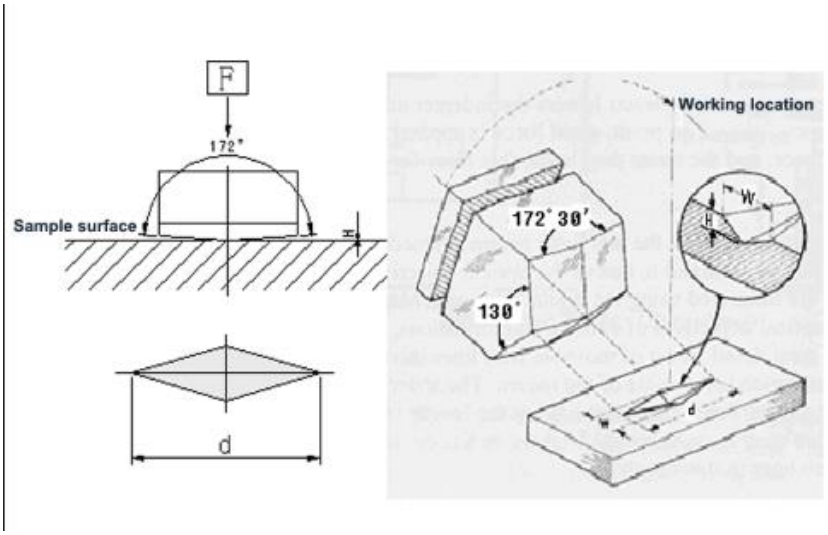


Figure 1.2 Principle of Knoop test

Knoop hardness calculation formula: $$HK = 1.4509\frac{F}{d^2}$$ **(Formula 1-4)**

HK—Knoop hardness

F --N

d--Indentation diagonal length, mm

The relationship between HK indentation depth h and diagonal d: h=d/30 (Formula 1-5)

Note when the test force is kgf:

$$HK = 14.229\frac{F}{d^2}$$ **(Formula 1-6)**

2 2 Main technical parameters

2.1 The main parameters of the machine

1) The number of test force levels:

There are 8 levels of test force: kgf unit is used on this machine, see Table 2.1

Table 2.1

Kgf	0.01	0.025	0.05	0.1	0.2	0.3	0.5	1
N	0.098	0.245	0.49	0.98	1.96	2.94	4.90	9.80

So the Vickers scale is: HV0.01, HV0.025, HV0.05, HV0.1, HV0.2, HV0.3, HV0.5, HV1

2) Hardness indication error:

The hardness measurement range of this machine: 5-3000HV, the accuracy meets or exceeds GB/T4340.2, see Table 2.2

Table 2.2

Hardness symbol	Maximum error Expressed as a percentage of the specified hardness value of the standard block												
	Hardness，HV												
	50	100	150	200	250	300	350	400	450	500	600	700	800
HV0.01													
HV0.025	8	10											
HV0.05	6	8	9	10									
HV0.1	5	6	7	8	8	9	10	10	11				
HV0.2		4		6		8		9		10	11	11	12
HV0.3		4		5		6		7		8	9	10	10
HV0.5		3		5		5		6		6	7	7	8
HV1		3		4		4		4		5	5	5	6

Note:
1. When the indentation diagonal is less than 0.020mm, the error value is not given in the table.
2. For the intermediate value, the maximum allowable error can be obtained by interpolation.
3. The value in the table is based on the maximum error of 0.001mm or 2% of the average value of the indentation diagonal, whichever is greater.

The content in the table is extracted from GB/T4340.2

3). Optical system: see table 2.3

Table 2.3

Objective lens	10×（observation）	40×（measurement）
Eyepiece	10×	
Total magnification	100×（observation）	400×（measurement）
Measurement resolution		0.03125μm
Halogen lamp brightness	20 levels adjustable	

When the machine has not been operated for more than 30 minutes, the halogen lamp will be turned off and press any key to wake it up.

4) Method of applying test force: automatic loading and unloading test force

5) Test force holding time: 5～60s (every 1 second is a unit)

6) Maximum height of test piece: 90mm

7) Distance from the center of the indenter to the outer wall: 120mm

8) Host weight: about 40Kg

9) Power supply: AC220V/50Hz

10) Overall dimensions: (length × width × height) (490×290×530) mm

11) XY platform

XY platform parameters are shown in Table 2.4

Table 2.4

Size	100×100mm
Stroke	25×25mm
Resolution	0.01mm

12) The difference between digital display manual turret and digital display automatic turret:
The observation-test-measurement position switch of the digital display manual turret micro-Vickers hardness tester is completed by the manual turret.
The observation-test-measurement position switch of the digital display automatic turret micro-Vickers hardness tester is completed by the automatic turret, which can also meet the manual operation and the inching turntable operation.

3 Installation and commissioning of the instrument

3.1 Working conditions of the hardness tester

a. Within the range of room temperature (23±5)℃;
b. Horizontal placement on a solid foundation;
c. In a vibration-free environment;
d. There is no corrosive medium around;
e. Indoor relative humidity is not more than 65%.

3.2 Unpacking and installation

The names of the components on the host are shown in Table 3.1

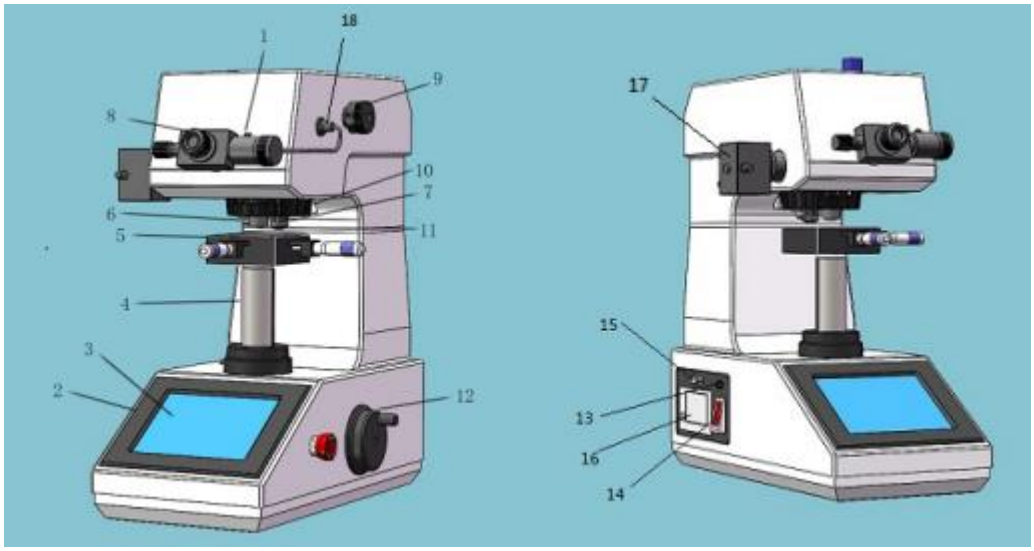


Figure 3.1 The appearance of the hardness tester host

Table 3.1 Name of each item

1.Measurement button	**2 Front cover**	**3.Touch Screen**	**4.Lifting screw**	**5. XY-stage**
6. Indenter	**7.10X Objective lens**	**8.Micrometer eyepiece**	**9. Load adjustment handwheel**	**10. Turret**
11.40X Objective lens	**12.Focusing hand wheel**	**13. Power switch**	**14. Power socket**	**15. RS232**
16. Printer	**17.Lighting box**	**18.Micrometer eyepiece connector**		

The installation and debugging steps are as follows:
a. Remove the outer packing box, take out the hardness tester host and accessory box (see Figure 3.1).
b. Place the hardness tester on the special workbench, take out the horizontal screw from the accessory box and screw it on the bottom of the main machine.
c. Remove the upper cover (12), unscrew the four screws and anti-vibration screws on the top of the machine

(Figure 3.2).

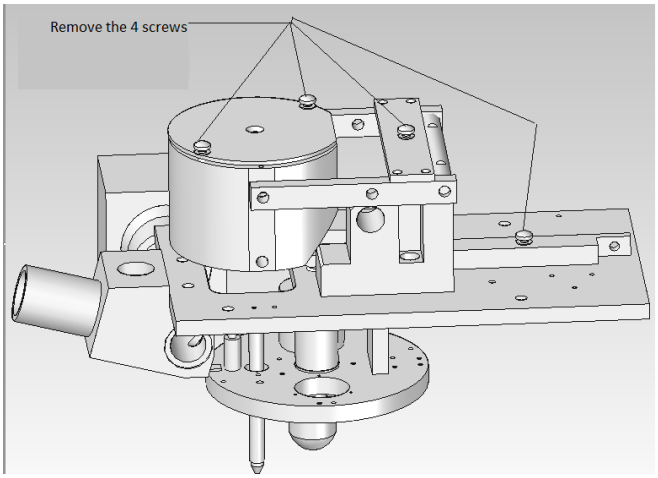


Figure 3.2 Location of 4 screws removed

d. Turn the test force selector（9） to the 1kgf position.

e. Take off the weight cover, remove the weight shaft and weight from the attachment box, and set the six weights from smallest to largest on the weight shaft. When installing, the weight shaft and weight should be wiped first, so that it cannot be stained with dirt.

f. Hold the top of the weight shaft, place it into the weight housing, and turn the weight shaft so that the cross pin is in a V-shaped slot

(figure 3.3). Align the hole in the end cover with the weight shaft so that the step fits inside the weight housing and can be rotated.

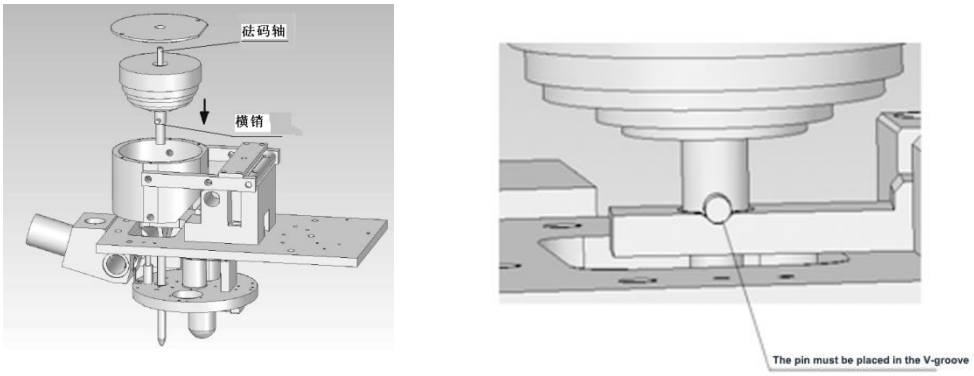


Figure 3.3 Weight shaft and weight placement

g. Turn the changing hand wheel (9) to make the weight shell flexible up and down in the positioning slot. Then close the upper cover (12).

h. Pull out the dust cover, take the micrometer eyepiece (8) out of the accessory box, insert it into the hole according to the installation direction (Figure 1), and insert it to the end.

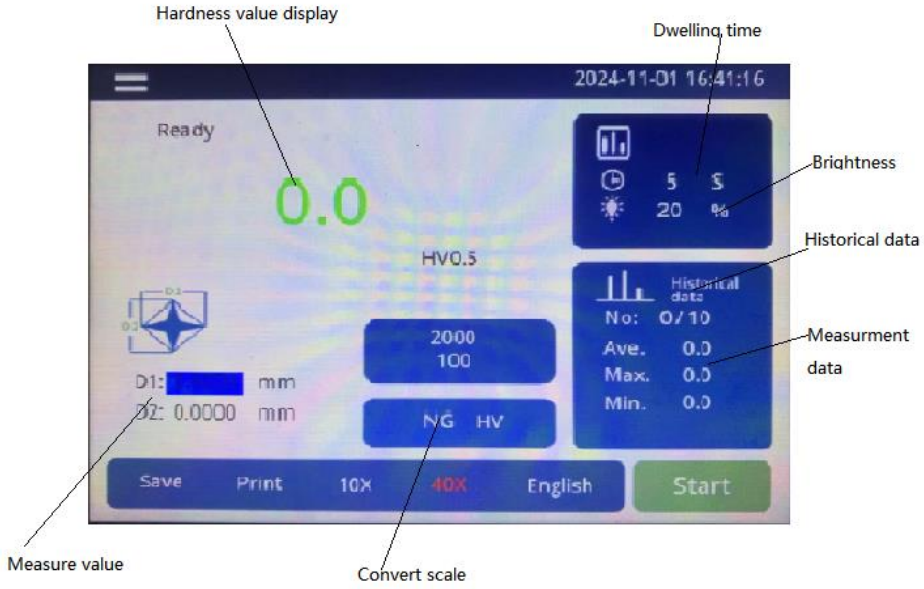
i. Take the cross-test bench (5) out of the accessory box, and wipe off the anti-rust oil on it. Insert its shaft into the hole of the lifting screw (4) and tighten the screw.

j. Take out the level meter from the accessory box and place it on the cross-test bench (5), adjust the screw to make it level (the blisters are in the center).

4 Panel function introduction

4.1 Panel function

Figure 4-1 shows the front panel of the touch screen micro hardness tester.



Pic 4-1

The date and time are displayed in the upper right corner of the screen: long press the time and date position, a modification dialog box will pop up, and the date and time can be modified.

Hardness display area: display the measured hardness value, display the test force (click the test force to switch between HV and HK) and the upper and lower limits of the test hardness.

Hardness conversion area: Click to enter the hardness conversion selection, and select the hardness scale to be converted. And display the converted hardness value.

Dwelling time: Click to enter to set the dwelling time, and the current dwelling time will be displayed during operation.

Light adjustment: adjust the brightness of the light, the (+) (-) on both sides of the value adjust the brightness of the light.

Measurement data: Set the number of measurements and display the average, maximum and minimum values of the measurement.

Measured value: display the diameter of the measured indentation and display the value.

Data query: query the saved historical data, click to enter, you can search and print the historical data.

Save: After the test data is completed, press the save button to save the current data in the historical data.

Print: After the test data is completed, press the print button to print the data.

10X: 10 times objective lens button, the objective lens is converted to 10 times, and the turret rotates to 10 times.

40X: 40 times objective lens button, the objective lens is converted to 40 times, and the brick tower rotates to 40 times.

Start: Start button. After pressing the start button, this button will display stop. After starting the experiment, press Stop to stop the experiment. After the load is reset, the brick tower will also reset.

4.2 Selection of test force

When you turn the test force conversion handwheel on the instrument to select a new test force, the test force value in the upper right corner of the main menu changes immediately. After selecting the test force, the new test force is loaded into the system. The system clears the previous test results, and the new test force test will start.

4.3 Energy-saving mode

The hardness tester will automatically enter the energy-saving mode after not using it for 10 minutes, and automatically turn off the light source. The user can press the up and down keys on the operating keyboard to wake up the energy-saving mode of the hardness tester, or rotate the right drum to wake up the hardness tester's light source for normal testing.

5 Use of Hardness Tester:

5.1 Operation and use of the hardness tester:

The working process of the hardness tester to measure the hardness is shown in Figure 5.1

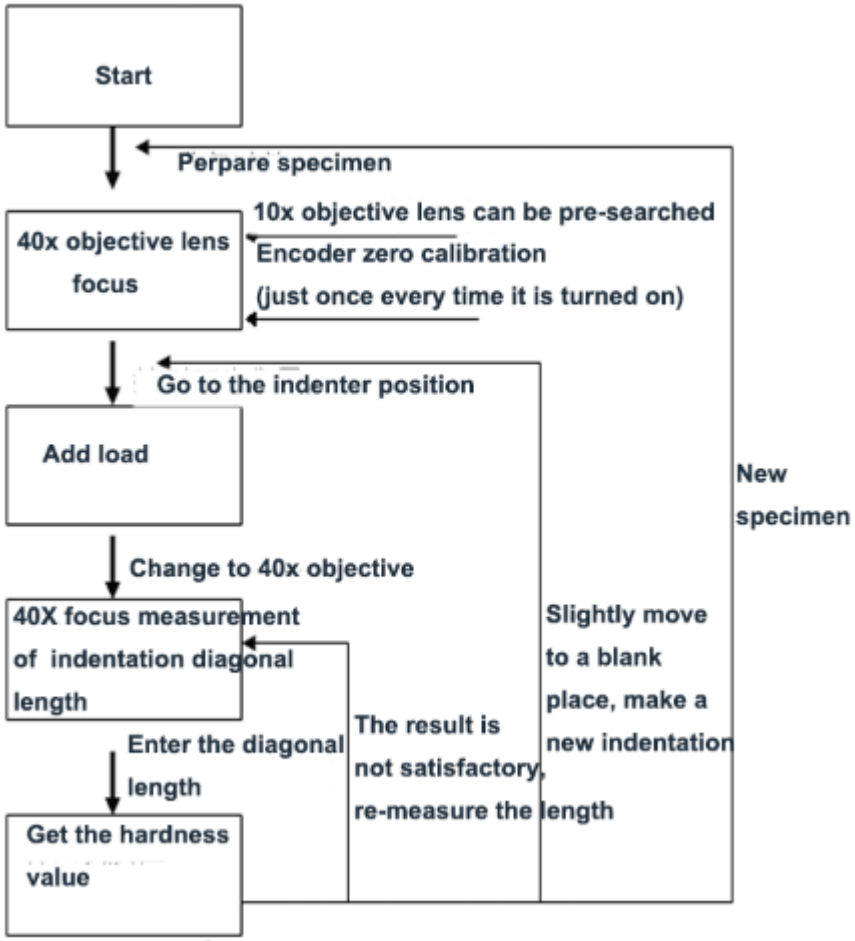


Figure 5.1 The measurement process of the Vickers hard hardness tester

The following specifically introduces the operation process of digital display manual turret models and digital display automatic turret models

5.1.1 Test process of digital display manual turret model:

1) Plug in the power supply and turn on the power switch. The interface appears on the screen, and the data can be modified at this time.

For example: selection of hardness scale (HV, HK), selection of hardness conversion, selection of dwell time, selection of light brightness and darkness, directly click on the place that needs to be modified to directly modify to meet the requirements.

2) Turn the change handwheel (9) to make the test force meet the selection requirements. The force value of the change handwheel (9) is consistent with the force value displayed on the screen. When turning the change handwheel (9), it should be done slowly and carefully. When the rotation reaches the maximum force of 1kgf, the rotation position has been reached, and it cannot continue to rotate forward, it should be rotated in the reverse direction; when the minimum force is 0.01kgf, it should also be rotated in the reverse direction.

3) 10s is the most commonly used test force retention time. You can also directly click on the 10S position to pop up a digital dialog box and directly enter the time that needs to be modified.

4) If the light source in the field of view is too dark or too bright, you can select the brightness of the (+) and (-) lights in the light adjustment zone.

5) Rotate the turret (10) so that the 40× objective lens (11) is in the forward position (the total magnification of the optical system is 400×, in the measurement state).

6) Place the standard test block or test piece on the cross test table (5), turn the rotary wheel (12) to raise the test table, when the test piece is about 1-2mm away from the lower end of the objective lens (11) (do not touch the objective lens) , And then observe with the eye cup near the micrometer eyepiece (8). A bright spot appears in the field of view of the micrometer eyepiece, indicating that the focusing plane is about to come. At this time, the test table should be slowly raised or lowered until the sample surface is clearly imaged in the eyepiece, and the focusing process is completed. Since the surface of the standard test block is very smooth, it is difficult for beginners to find the surface of the test piece. You can turn the test piece over (with the rough side facing up), and then turn it back after finding the surface of the test piece. To the test surface.

If you want to observe a larger field of view on the surface of the sample, you can turn the 10× objective lens (7) to the front position. At this time, the total magnification of the optical path system is 100× and it is in the observation state.

Note: When testing irregular samples, be careful to prevent the indenter from hitting the sample and damaging the indenter.

7) Turn the indenter (6) to the front position. You should feel that the turret (10) has been positioned. When rotating, you should proceed carefully and slowly to prevent impact from being too fast. At this time, the top of the indenter and the focused sample the distance between the planes is about 0.4 to 0.5 mm.

8) Press the "START" button, the test force is applied at this time (the motor starts), and the loading and unloading progress bar appears on the screen; when the progress bar is completed, the motor work end prompt beeps once, and d1:0 appears on the screen Waiting for measurement.

Warning: Do not move the test piece or rotate the turret when the motor is working. You must wait for the end of loading and unloading before moving, otherwise the instrument will be damaged.

9) Turn the 40× objective lens (11) to the front, then you can measure the diagonal length of the indentation in the micrometer eyepiece (8). If the indentation is not clear, you can slowly raise or lower the test table to make it Clear; if the two engraved lines in the micrometer eyepiece (8) are blurred, the eyecup on the micrometer eyepiece can be adjusted, which is determined by each person's vision.

11) Rotate the right drum and move the engraved line in the eyepiece to gradually move the two engraved lines closer together. When the inner side of the engraved line is infinitely connected

Near time (the inner side of the reticle is in a critical state with no optical gap, but the two reticles must not overlap). See Figure 5.3

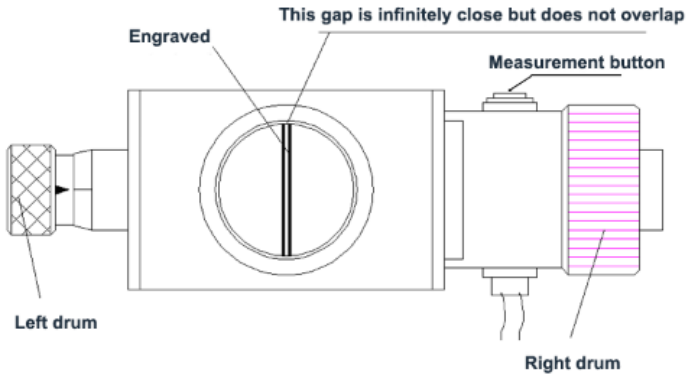


Figure 5.3 Measuring eyepiece

Long press the measurement button to clear the key, then the d1: value on the main screen is zero, which is the zero position in the term. Only then can the diagonal length of the indentation be measured in the eyepiece. (You must reset the zero position every time you turn on the machine)

12) Rotate the right drum wheel (20) to separate the marking lines, and then move the left drum wheel (16) to move the left marking line,

When the inner side of the left engraved line is tangent to the intersection of the left contour of the indentation, move the right engraved line to make the inner side tangent to the intersection of the indented contour, as shown in Figure 5.4.

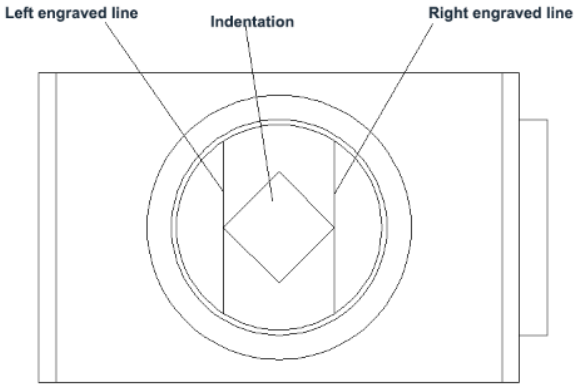


Figure 5.4 The measured indentation shows a long

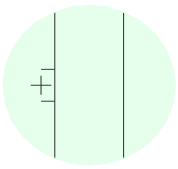
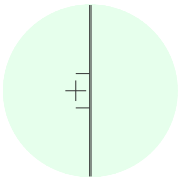
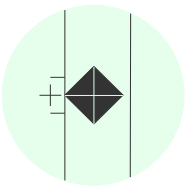
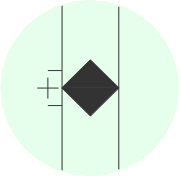
Press the measurement button (1) on the eyepiece, the measurement of the diagonal length d1 is completed; turn the eyepiece (9) 90°, above

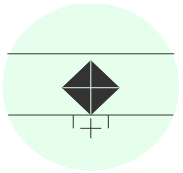
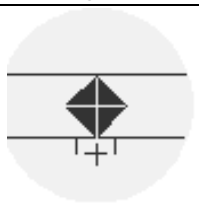
Measure the diagonal length d2 according to the method described above, press the measurement button (1), and the screen will display the value of this measurement and

The converted hardness value can be measured again by repeating the above procedure if it is considered that there is an error in the measurement.

The specific measurement methods of indentation are listed below: please refer to Table 5.1

Table 5.1 Specific measurement methods of indentation

1. Observe the two engraved lines in the field of view from the eyepiece, and rotate the eyecup to make the engraved lines clear. Note: Rotating the eyecup may cause the indentation image to be blurred. After the two score lines are clear, turn the lifting wheel to make the indentation image clear, see Figure 5.5;	 Fig.5.5
2. Rotate the drums on both sides of the micrometer eyepiece to make the inner sides of the two engraved lines infinitely close, that is, when the light transmission between the inner sides of the two engraved lines is gradually in the critical state of light and no light, press the "measurement button" for 3 seconds, D1 on the main screen at this time: The value is zero, which is the zero position in the term. (The zero position must be re-calibrated each time the machine is turned on) See Figure 5.6;	 Fig.5.6
3. Rotate the two drum wheels of the micrometer eyepiece in the opposite direction. The two score lines are gradually separated. Turn the left drum wheel of the eyepiece so that the inner side of the left score line is tangent to the left edge of the indentation, as shown in Figure 5.7.	 Fig.5.7
4. Turn the right measuring drum to make the inner side of the right score line tangent to the right edge of the indentation, as shown in Figure 5.8, and press the measurement button(1) D1 on the eyepiece to complete the measurement.	 Fig.5.8

5. Rotate the micrometer eyepiece by 90° (note that the eyepiece tube should be tightly attached when rotating), and turn the drum so that the inner side of the lower score line is tangent to the edge under the indentation, as shown in Figure 5.9;	 Fig.5.9
6. Turn the measuring drum so that the inner side of the upper score line is tangent to the upper edge of the indentation, as shown in Figure 5.10, and press the measurement button (1) on the eyepiece D2 to complete the measurement. The instrument automatically calculates the hardness value and displays it, the number of tests is automatically increased by one, and one measurement is completed.	 Fig.5.10

5.1.1.1 Test process of digital display automatic turret model

When you use this machine, please always pay attention to the pressure head not to touch any objects during the rotation of the turret.

1). Boot

2). You can press to turn the turret to the position of the objective lens you want.

3). Place the test piece on the cross workbench, focus and find the focal plane.

When the focal plane is found, if the specimen is irregular, please turn the turret manually, and the indenter should not touch any objects before proceeding to step 4.

4). Press START, no matter where the indenter is, it will turn to the front and start the test, don't do any action at this time, wait for the test to complete,

5). After loading and unloading, the turret will automatically turn to the 40x objective lens. At this time, the hardness value can be obtained by diagonal measurement. The measurement method refers to the digital display manual turret model.

6 Maintenance and operation precautions of the hardness tester

6.1 Light source maintenance

When the bulb is broken, please replace it with a new one as follows:

1) Please cut off the power first to avoid electric shock;

2) Loosen screw 1 counterclockwise; see Figure 6.1

3) Push the back cover gently in the direction of arrow 1, and then turn it in the direction of arrow 2 to remove the back cover; see Figure 6.2.

4) Pull up the broken bulb and replace it with a new bulb; see Figure 6.3.

5) Wipe clean the surface of the new bulb with a soft cloth, and do not touch the surface of the bulb with your hands;

6) Push the back cover gently in the direction shown by arrow 1, and then turn in the direction of arrow 2 to close the back cover. See figure 6.4.

7) Turn on the power switch.

8) Observe the micrometer eyepiece, tighten and adjust the screw 1 clockwise to make the light in the field of view uniform. (If necessary, loosen and adjust the screw 2 up and down.) See Figure 6.5

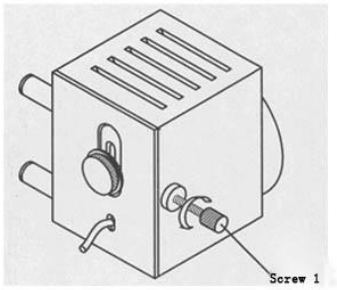


Figure 6.1 unscrew the screws

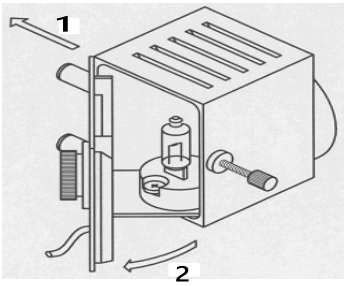


Figure 6.2 take off the back cover

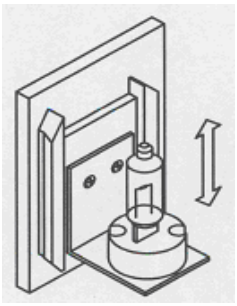


Figure 6.3 turn on the new light bulb

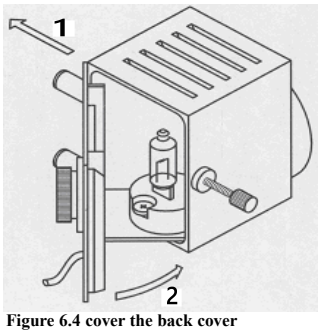


Figure 6.4 cover the back cover

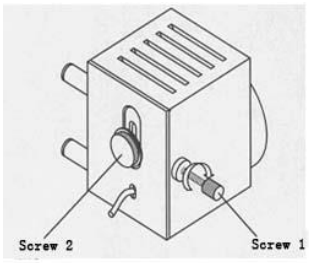


Figure 6.5 adjusting screw

6.2 Replacement of the fuse

When the machine fuse is broken, please replace it as follows:

1) Cut off the power, unplug the power cord from the socket, insert a flat-blade screwdriver into the middle of the connector according to the figure, and pry out the fuse socket.

2)Take out the fuse holder from the incoming wire connector. Take out the fuse and see if the filament inside is broken. If you cannot determine whether the fuse is broken, you can use an ohmmeter to check whether the filament is good

3) Replace with a new fuse and install it.

The fuse is installed in the fuse holder to protect the hardness tester from damage caused by the power supply voltage or internal short circuit. If there is any situation that causes the fuse to be repeatedly burned out, please contact the maintenance personnel immediately.

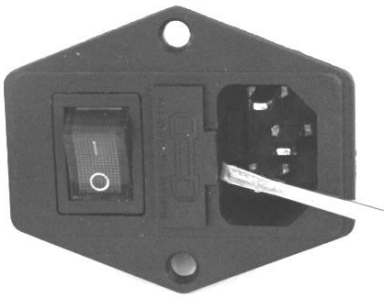


Fig. 6.6 Knock on the fuse holder

Fig. 6.7, Replace the fuse

6.3 Diamond indenter

1) The indenter (7) and the indenter shaft are very important parts of the instrument. Therefore, be very careful not to touch the indenter during operation.

2) In order to ensure the accuracy of the test, the indenter should be clean. When it is stained with oil or dust, you can use a degreasing sponge with alcohol (for industrial use) or ether, and carefully wipe clean at the top of the indenter.

3) If you want to replace the indenter, please do not disassemble it by yourself, please contact the maintenance person.

6.4 Micrometer eyepiece

1) Due to the parallax of each person, the scribe line in the field of view of the observation micrometer eyepiece may be blurred, so when the observer changes, the eyepiece on the eyepiece should be slightly rotated to make the scribe line in the observation field clear.
2) The micrometer eyepiece is inserted into the eyepiece tube. It should be inserted to the end without leaving a gap, otherwise it will affect the accuracy of the measurement. When measuring the diagonal of the indentation, the apex must be measured and then turned 90°. Measure another pair of vertices.
3) Zero point: the zero point must be re-calibrated each time the machine is turned on. See page 13.

6.5 Specimen

1) If you suspect that the hardness of the machine is inaccurate, you can use a standard hardness block to calibrate. When calibrating, the hardness block should face up, and the oil on the hardness block can be measured. Generally, the first test point is not counted, and the second point is valid.
2) The surface of the sample must be clean. If the surface is stained with grease and dirt, it will affect the accuracy of the measurement. When cleaning the sample, wipe it with alcohol or ether.
3) When the sample is a filament, a thin piece or a small piece, it can be clamped by the filament clamping table, the thin clamping table and the flat clamping table respectively, and placed on the cross-test table for testing; if the test piece is very small If it cannot be clamped, the test piece shall be inlaid and polished before the test.
4) To ensure the correctness of the test, the thickness of the sample must be guaranteed. Specimen according to national standards
The thickness must be no less than 8-10 times the depth of the indentation. So how to know that the test piece meets the specified requirements, here are several methods.
a) Direct observation method:
The test piece is tested in accordance with the specified requirements. After the test is over, observe whether the edge and back (support surface) of the test piece show signs of deformation. If there are traces, the result of the test is invalid.
It shows that the thickness of the test piece is too thin to meet the requirements of the test. At this time, there are two options. One is to redo the test piece, and some parts cannot be changed. The second is to choose a smaller test force, which can only be carried out within the specified requirements.
b) Formula calculation method:
The formula for calculating the thickness of the Vickers hardness test piece: h≈d/7.
c) Look-up table method: can look-up table 6.1

Table 6.1 Selection table of minimum thickness of sample and detection force

Min. thickness t/mm	Test force/N(Kgf)							
	0.049	0.9807	0.1471	0.1961	0.2452	0.4903	0.9807	1.9614
HV	HV0.005	HV0.01	HV0.015	HV0.02	HV0.025	HV0.05	HV0.1	HV0.2
50	0.019	0.028	0.034	0.039	0.043	0.062	0.087	0.123
100	0.013	0.020	0.024	0.028	0.0310	0.043	0.061	0.087
200	0.0097	0.014	0.017	0.020	0.022	0.031	0.043	0.062
300	0.008	0.011	0.014	0.016	0.018	0.025	0.036	0.050
400	0.0069	0.010	0.012	0.014	0.015	0.022	0.031	0.043
500	0.0062	0.0087	0.011	0.012	0.014	0.019	0.028	0.039
600	0.0056	0.008	0.010	0.011	0.013	0.018	0.025	0.036

700	0.0052	0.007	0.0090	0.010	0.012	0.016	0.023	0.033
800	0.0049	0.0069	0.0084	0.0097	0.011	0.015	0.022	0.031
900	0.0045	0.0064	0.0080	0.0091	0.010	0.014	0.021	0.029
1000	0.0043	0.006	0.0075	0.0086	0.009	0.0138	0.019	0.028
1200	0.0039	0.0056	0.0069	0.0079	0.0088	0.013	0.018	0.025
1400	0.0036	0.0052	0.0064	0.0073	0.082	0.012	0.016	0.023

Min. thickness t/mm	Test force/N(Kgf)							
	1.961	2.942	4.903	9.807	19.61	29.42	39.22	49.03
HV	HV0.2	HV0.3	HV0.5	HV1	HV2	HV3	HV4	HV5
50	0.12	0.15	0.19	0.27	0.38	0.47	0.54	0.61
100	0.086	0.13	0.14	0.19	0.28	0.33	0.39	0.43
200	0.062	0.075	0.097	0.14	0.19	0.24	0.27	0.31
300	0.050	0.062	0.080	0.11	0.16	0.19	0.22	0.25
400	0.043	0.053	0.069	0.10	0.14	0.17	0.20	0.22
500	0.039	0.048	0.062	0.09	0.12	0.15	0.17	0.19
600	0.036	0.043	0.057	0.08	0.11	0.14	0.16	0.18
700	0.033	0.040	0.052	0.073	0.10	0.13	0.15	0.16
800	0.031	0.038	0.049	0.069	0.097	0.12	0.14	0.15
900	0.029	0.036	0.046	0.065	0.095	0.11	0.13	0.14
1000	0.028	0.034	0.043	0.060	0.090	0.10	0.12	0.13
1200	0.025	0.031	0.040	0.056	0.079	0.095	0.11	0.12
1400	0.023	0.028	0.037	0.051	0.073	0.090	0.103	0.11

Min. thickness t/mm	Test force/N(Kgf)					
	49.03	98.07	196.1	294.2	490.3	980.7
HV	HV5	HV10	HV20	HV30	HV50	HV100
50	0.62	0.87	1.23	1.50	1.94	2.75
100	0.43	0.61	0.86	1.06	1.37	1.95
200	031	0.43	0.62	0.75	0.97	1.4
300	0.25	0.36	0.50	0.62	0.80	1.2
400	0.22	0.31	0.43	0.53	0.69	1.0
500	0.19	0.28	0.39	0.48	0.61	0.86
600	0.18	0.25	0.36	0.44	0.56	0.80
700	0.16	0.23	0.32	0.40	0.51	0.74
800	0.15	0.22	0.31	0.38	0.49	0.69
900	0.14	0.21	0.29	0.36	0.46	0.64
1000	0.13	0.19	0.28	0.34	0.44	0.62
1200	0.12	0.18	0.25	0.31	0.40	0.56
1400	0.11	0.16	0.23	0.28	0.37	0.52

Please make the test piece according to the requirements stipulated in the national standard GB/T4340.

6.6 Selection of force and indentation size

When measuring Vickers hardness, as long as the condition of the test piece allows, try to use a large test force, and the measurement is relatively accurate. Generally, hard materials use a larger test force; soft materials use a smaller test force.

According to custom, it is most convenient to measure when the diagonal length of the indentation is about 50um, but the thickness of the material should also be considered.

Reference: Material thickness ≥1.5×diagonal length of indentation

For example: material thickness=0.1mm, the diagonal length of the indentation cannot be greater than 0.066mm.

Here it is satisfied: 0.1≥1.5×0.066.

6.7 Printer

There is a thermal printer on the body of the digital micro-hardness tester. The appearance and structure of the machine are shown in Figure 6-8.

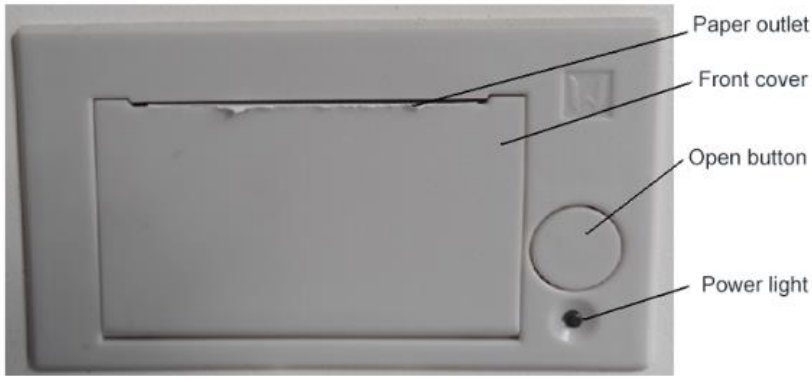


Figure 6-8 Printer appearance structure

When the power of the hardness tester is turned on, the power indicator will be lit.

When the out of paper indicator light flashes, the printing paper has been used up, please replace it.

Replace the printing paper

Thermal paper roll, paper width 44mm±0.5 mm

Inside the paper roll, the outer diameter is less than φ38 mm,

Paper thickness 0.065 mm, paper quality 53-64 g/m2

1) Open the front cover of the printer, as shown in Figure 6-9.

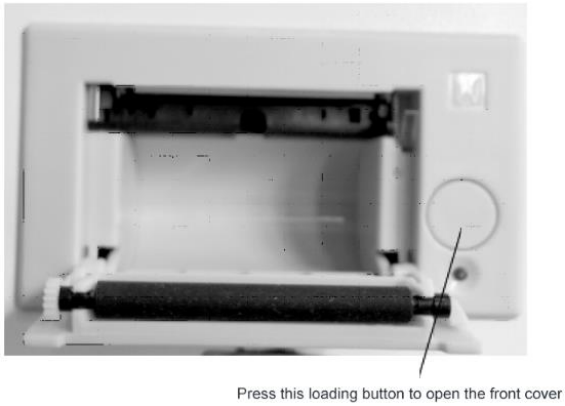


Figure 6-9 Open the front cover of the printer

2) Remove the paper roll from the printer. If there is already a paper roll on the printer, you can skip this step to step 4.

3) Put the new paper roll on the paper roll, and then press the paper roll into the guide slot of the printer.

4) Cut the paper end into the pattern shown in Figure 6-10.

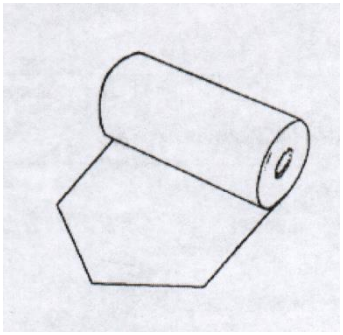


Figure 6-10 Paper end style

Figure 6-11 Put the paper and close the front cover

5)Pull the paper end from the paper outlet of the printer's front cover, and close the front cover. As shown in Figure 6-11, it can be used normally.

Note: If there is only paper output but no print record during printing, you may have loaded the printing paper upside down. You need to take out the paper roll and turn it around, and then reinstall it according to the above steps.