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HDT-RT Series

Motorized Digital Rockwell / Superficial Rockwell
Hardness Tester Operation Manual



Precautions

1. Prior to operation, thoroughly read the Operation Manual to fully learn the operating procedures and precautions of the hardness tester, so as to avoid equipment damage and safety incidents resulting from improper operation.
 2. During installation and commissioning of the hardness tester, carefully remove the cable ties and shockproof adhesive tapes.
 3. The equipment shall be powered by a single-phase three-core socket, and the protective ground terminal shall strictly meet the specified grounding requirements.
 4. It is prohibited to disassemble electrical components, switches and sockets of the hardness tester without authorization. Unauthorized disassembly may cause safety accidents.
 5. The printer attached to the device requires no power supply; printing is available upon connecting to the RS232 serial port. Never insert the power cord of the hardness tester into the printer-charging port.
 6. Do not rotate the load-changing handwheel during test force application, removal or dwell time.
 7. Our company continuously optimizes product quality and structural design. Minor discrepancies between the manual and actual hardness-tester structure are subject to change without prior notice.
- Thank you for your understanding.

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1. Introduction to Hardness Tester

- 1.1 Hardness is one of the key mechanical properties of materials. Hardness testing serves as an important method to evaluate the quality of metallic materials and components. Since the hardness of metals has a corresponding relationship with other mechanical properties, the values of strength, fatigue, creep, wear resistance and other mechanical properties of most metallic materials can be approximately derived by measuring hardness.
- 1.2 The digital Rockwell hardness tester adopts a novel large-screen display. It features high reliability, easy operability and clear visualization, and is a high-tech mechatronic product. Its main functions are listed below:
 - 1.2.1 Selection of Rockwell hardness scales
 - 1.2.2 Selection of Rockwell hardness scales for plastics (supplied against contract for special requirements)
 - 1.2.3 Conversion values between different hardness scales
 - 1.2.4 Printout of hardness test results

2. Technical Parameters

- 1) Model HDT-RT151: Only supports standard Rockwell hardness scales
- 2) Model HDT-RT152: Only supports superficial Rockwell hardness scales
- 3) Model HDT-RT153: Supports both standard Rockwell and superficial Rockwell hardness scales
- 2.1 Preliminary Test Force: Standard Rockwell: 98.07 N (10 kgf); Superficial Rockwell: 29.42 N (3 kgf) Tolerance: $\pm 2.0\%$
- 2.2 Total Test Force: Standard Rockwell: 588.4 N (60 kgf), 980.7 N (100 kgf), 1471 N (150 kgf); Superficial Rockwell: 147.1 N (15 kgf), 294.2 N (30 kgf), 441.3 N (45 kgf) Tolerance: $\pm 1.0\%$

2.3 Indenter Specifications

2.3.1 Diamond indenter for standard Rockwell test

2.3.2 Ø1.5875 mm ball indenter

2.4 Dwell Time: Adjustable from 2 s to 60 s

2.5 Maximum Allowable Height of Test Specimen: 230 mm

2.6 Distance from Indenter Center to Machine Body: 170 mm

2.7 Power Supply: AC 220 V $\pm$ 5%, 50~60 Hz

2.8 Overall Dimensions (Length $\times$ Width $\times$ Height): 475 $\times$ 200 $\times$ 700 (mm)

2.9 Net Weight of Hardness Tester: Approx. 70 kg

2.10 Permissible Error of Hardness Readings (Table 1)

2.11 Rockwell Hardness Test Scales, Indenters, Test Forces and Application Range (Table 2)

Table 1 Maximum Permissible Error of Hardness Tester Readings

Hardness Scale	Hardness Range	Max. Permissible Error
HRA	(20~75) HRA	± 2 HRA
	(>75~95) HRA	± 1.5 HRA
HRB	(10~45) HRB	± 4 HRB
	(>45~80) HRB	± 3 HRB
	(>80~100) HRB	± 2 HRB
HRC	(10~70) HRC	± 1.5 HRC
HRD	(40~70) HRD	± 2 HRD
	(>70~77) HRD	± 1.5 HRD
HRF	(60~90) HRF	± 2.5 HRF
	(>90~100) HRF	± 2 HRF
HRG	(30~50) HRG	± 6 HRG
	(>50~75) HRG	± 4.5 HRG
	(>75~94) HRG	± 3 HRG

Table 1 Maximum Permissible Error of Hardness Tester Readings

Hardness Scale	Hardness Range	Max. Permissible Error
HR15N	(70~94) HR15N	± 2 HRN
HR30N	(42~86) HR30N	
HR45N	(20~77) HR45N	
HR15T	(67~93) HR15T	± 3 HRT
HR30T	(29~82) HR30T	
HR45T	(10~72) HR45T	

3 Installation of Hardness Tester

3.1 Operating Conditions

3.1.1 Ambient temperature: 10°C ~ 30°C

3.1.2 Indoor relative humidity: $\leq 65\%$

3.1.3 Vibration-free environment without corrosive substances.

3.2 Unpacking and Installation

3.2.1 Cut off the packing straps, unscrew the screws on the bottom of the wooden crate, remove the outer case and take out the accessory box.

3.2.2 Use a spanner to unscrew the two M10 hexagon bolts under the base plate to separate the tester from the base plate. (Safety Warning)

3.2.3 Open the top cover of the machine and remove the internal foam filler.

3.2.4 Place the unpacked hardness tester horizontally on a firm workbench; the levelness error shall not exceed 1 mm/m. Drill a hole at the proper position on the workbench (Figure 1) to ensure normal operation of the lifting lead screw. The recommended workbench height is about 500 mm.

Table 2 Indenter, Test Force and Application Range for Hardness Scales

Scale	Indenter	Preliminary test force	Total test force	Application range
HRC	Diamond indenter	98.07N (10kgf)	1471N (150kgf)	Hardened steel, quenched and tempered steel, chilled cast iron
HRA			588.4N (60kgf)	Carbide, carbide steel, case hardened steel, hardened steel sheet
HRD			980.7N (100kgf)	Sheet steel, surface hardened steel
HRB	Ø1.5875mm carbide ball indenter	98.07N (10kgf)	980.7N (100kgf)	Mild steel, aluminum alloy, copper alloy, malleable iron, annealed steel
HRF			588.4N (60kgf)	Cast iron, aluminum, magnesium alloy, bearing alloy, annealed copper alloy, thin mild steel plate, etc.
HRG			1471N (150kgf)	Mild steel, aluminum alloy, copper alloy, malleable iron, annealed steel
HR15N	Diamond indenter	29.42N (3kgf)	147.1N (15kgf)	Cemented carbide, nitride steel, carburized steel, each heavy steel plate, etc
HR30N			294.2N (30kgf)	Surface hardened steel, carburized steel, knife, sheet steel, etc
HR45N			441.3N (45kgf)	Hardened steel, tempered steel, hard cast iron and parts edge, etc
HR15T	Ø1.5875mm carbide ball indenter	29.42N (3kgf)	147.1N (15kgf)	Annealed copper alloy, brass, bronze sheet, thin mild steel
HR30T			294.2N (30kgf)	Thin mild steel, aluminum alloy, copper alloy, brass bronze, malleable cast iron
HR45T			441.3N (45kgf)	Pearlitic iron, copper-nickel and zinc-nickel alloy sheets

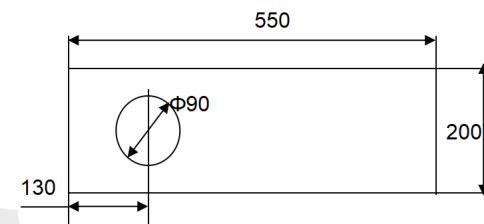


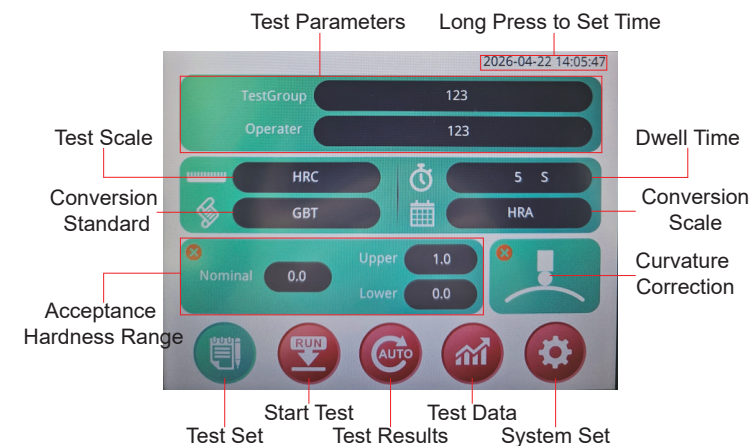
图1 硬度计安装开孔位置

4. Function Introduction

Note: This unit is an electronically loaded main unit without weights. It is ready for use once powered on! Turn on the power switch on the rear of the machine, and the operation interface will appear on the screen.

Main Unit Operation Interface:

4.1 Test Setting Interface



On the Test Setting interface, configure sample test information, test scale, hardness conversion standards and scales, and other relevant parameters.

For cylindrical samples, use a V-block and enable curved surface correction.

Set the standard value and tolerance of the workpiece to quickly screen qualified or unqualified products.

4.2 Test Start Interface



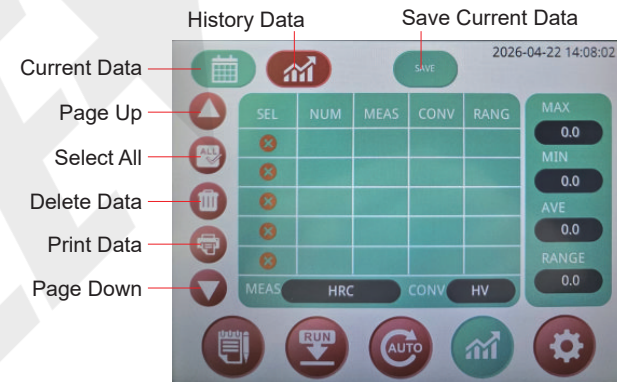
After selecting the corresponding test scale on the Test Settings interface, the test interface will automatically match the relevant test force and indenter. Please verify that the indenter in use is correct. Refer to Table 2 for details.

4.3 Result Display Interface



After the test is completed, the device will automatically jump to the result display interface, which shows the current hardness test value and converted hardness value, and automatically judges whether the result is qualified.

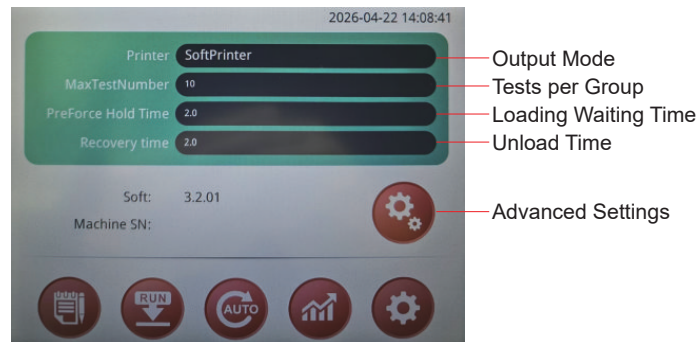
4.4 Data Statistics Interface



This interface displays all test data of the current group, including the maximum value, minimum value, average value and deviation range.

You can delete, print or export data. One group can contain up to 10 data points (the quantity can be set on the System Settings page).

4.5 System Settings Interface



You may select the output printer device on the System Settings interface:

- 1)"Data Receiver": Test results can be exported to PC software.
- 2)"Serial Printer": Test results can be printed via the connected printer.

5. Proper Operation of the Hardness Tester

5.1 Pre-Test Preparation

- 5.1.1 The surface of the test specimen shall be flat and smooth, free of contaminants, scale, pits and obvious machining marks. The supporting face of the specimen and the anvil shall be clean to ensure tight contact.
- 5.1.2 The minimum thickness of the specimen shall be more than 10 times the indentation depth. No visible deformation shall appear on the reverse side of the specimen after testing.
- 5.1.3 The specimen shall be stably placed on the anvil without shifting during force application, and the test force shall be applied perpendicularly to the specimen surface.

- 5.1.4 Select a suitable anvil according to the shape and dimensions of the specimen. For special-shaped workpieces, custom fixtures may be fabricated to ensure accurate hardness readings.

- 5.1.5 For cylindrical specimens, a V-block anvil must be used, and the test results shall be corrected with positive correction values. Refer to Table 4 for Rockwell hardness correction values for convex cylindrical surfaces.

5.2 Operating Procedure (Taking HRC high-level standard hardness block as an example)

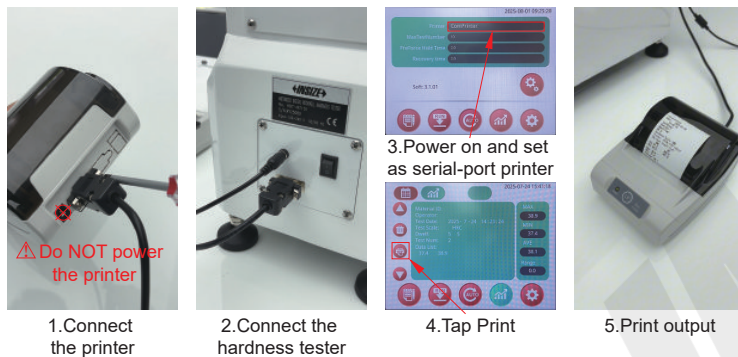
- 5.2.1 Take out the flat anvil and the HRC high-value standard hardness block from the accessory box, and wipe off oil contaminants on both surfaces.
- 5.2.2 Select HRC as the test scale on the setting page. Enter the test interface; the system will automatically configure the corresponding test force of 1471 N (150 kgf) and diamond indenter. Please verify that the installed indenter is the diamond cone indenter.
- 5.2.3 Turn the handwheel of the lead screw clockwise to raise the anvil slowly. Let the standard block contact the indenter gently without impact until the screen shows the "OK" indicator and the buzzer beeps. The preliminary test force has been applied, and the anvil will stop rising. (If the anvil rises too fast and exceeds the OK position, the buzzer will emit a continuous long beep to indicate an operational error. Lower the anvil and select a new test point.)
- 5.2.4 The motor will start and automatically apply the main test force, with a dwell time of 5 seconds. Once the countdown reaches zero, the motor will automatically remove the main test force while retaining the preliminary test force. When the buzzer sounds, read the hardness value displayed on the screen.
- 5.2.5 Turn the handwheel counterclockwise to lower the anvil, change the test point, and repeat the above steps.

5.2.6 At least five test points shall be measured on each specimen (the first reading shall be discarded). For mass inspection of bulk parts, the number of test points may be reduced appropriately.

5.2.7 Press the Print key to output data, and the operation is completed.

5.3 Printing Test Results

5.3.1 Take out the printer and its matching RS232 data cable. Use the RS232 data cable to connect the hardness tester to the printer. On the device, open the test-data interface, select the data to be printed, and tap the Print key to print. Both current test data and historical data can be printed.



Note:

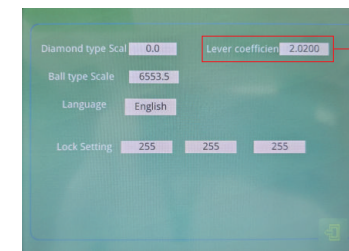
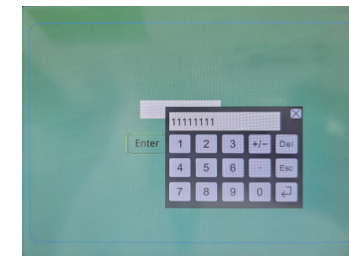
1. No interface configuration can be performed after the preliminary test force is applied. You must lower the lead screw counterclockwise before adjusting settings.
2. The printer can print when connected to the RS232 serial port and requires no power supply. Never insert the power cord of the hardness tester into the printer charging port.

6. Equipment Calibration Interface

If the measured results exceed the maximum permissible indication error, enter the advanced settings page from the system settings interface to correct the test values. The detailed procedure is as follows:

6.1 Multi-point Calibration

If readings deviate on multiple standard hardness blocks. Example: The measured value is 63.0 HRC for a 65.0 HRC hardness block; the measured value is 21.0 HRC for a 25.0 HRC hardness block.

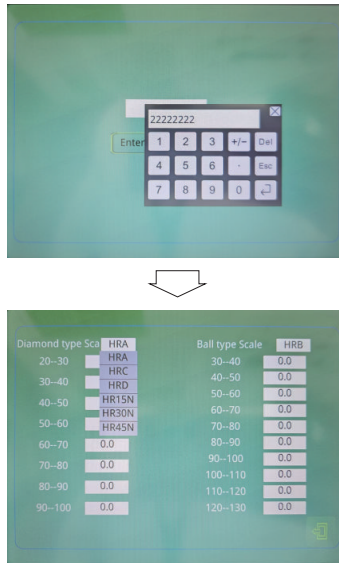


Adjust the lever coefficient in small increments of ± 0.1

Enter the program setting page and input the password: 11111111. Adjust the lever coefficient slowly in ± 0.1 increments based on the original value. (Note: Reducing the lever coefficient by 0.1 will increase readings by approximately 2 HRC at 60.0 HRC, and about 4 HRC at 20 HRC.) Exit the settings, then re-test the standard hardness blocks until the readings are accurate.

6.2 Single-point Calibration

If minor deviations still remain for an individual hardness block after the above adjustments. Example: For a 63.0 HRC hardness reference block, the measured value is 62.5 HRC.



Enter the program settings screen and enter the password "22222222". Select the HRC scale, then input a correction value of 0.5 for the [60-70] range (calculation: 63.0 - 62.5). Exit the settings to finish the single-point calibration of the hardness tester.

Note: Non-professional staff are prohibited from altering parameters arbitrarily, as this will compromise the measuring accuracy of the equipment. Please contact our after-sales service team and carry out calibration only under the guidance of our professional engineers.

7. Maintenance and Precautions for the Hardness Tester

7.1 Operators must follow the operating procedures and verify the instrument with reference blocks before and after tests. For infrequently used hardness testers, perform multiple hardness measurements on standard blocks after startup. Start testing specimens only after readings stabilize.

7.2 During the hardness test, do not turn the load-changing hand-wheel while applying, holding or removing the test force.

7.3 Only use the working surface of hardness blocks. The distance between two adjacent indentations, and from an indentation center to the block edge, shall be no less than 3 mm.

7.4 Unplug the power cord first before transportation. Keep the machine upright during moving.

7.5 Keep the tester clean and cover it with the dust cover after testing.

Apply anti-rust oil to hardness blocks and ball indenters after use to prevent corrosion.

7.6 Carry out periodic verification at least once a year to guarantee measurement accuracy.

7.7 Troubleshooting for Common Malfunctions

7.7.1 If the tester breaks down, contact the relevant service department for repair. Ordinary common faults can be fixed on your own (see Table 3).

Table 3 Common Faults & Troubleshooting

Problem	Possible Causes	Method of exclusion
Lifting screw stuck	The fit gap between the lifting screw is very small, and tiny threads or dirt may cause jamming	Take off the protective cover of the lifting screw, wipe the thread with a clean cloth, and then hold the knob handle with both hands to pull the lifting screw up and down (sandpaper is not allowed to rub the screw).
The deviation of hardness indication value is large.	1 Indenter damaged 2 Wrong choice of test force 3 The total test force or indenter is wrongly selected	1 Replace the diamond indenter or ball indenter. 2 Check the test scale selected in the setup interface. 3 Select the test force and indenter according to the requirements in Table 1.