

RH-45AUTO (Superficial)
Modular Rockwell Hardness Tester

Operation Instructions

G & R Technology Inc.

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General Description

The RH-45AUTO (superficial) Modular Rockwell hardness testers are accurate advanced instruments distinguished by their friendly operation, high accuracy, repeatability, reliability, and versatility. They are used for testing the hardnesses of a variety of metals in different locations. They are automatic test machines built with precise force sensors, force monitoring electronics systems, and depth measurement systems. The RH-45AUTO are made up of a main unit and a set of frames. Each frame is specialized for holding a certain test specimen shape or size. By switching frames on the main unit, you can easily form specialized testers.

The RH-45AUTO can directly measure and produce 15N, 30N, 45N, 15T, 30T, and 45T readings, and can convert to HV and HB scales. The hardness tester has Bluetooth and USB capabilities for sending test results to a Bluetooth printer or PC.

CAUTION

1. The RH-45AUTO are automated testers. Do not touch any movable parts of the tester, such as the indenter, when the tester is operating or injury may occur.
2. Before beginning a test, ensure the indenter is placed in the position sleeve. Otherwise the displacement sensor will be damaged. The tester has a safety feature to detect if the indenter is missing. If so, the presshead will automatically move backwards, and “No Indenter” will FLASH on the display.

**NO
INDENTER**

3. The presshead and indenter cannot move forward more than 25mm. Any attempt to advance the presshead forward more than 25mm or retract the pressback backward before the starting position will turn off the motor. Use a smaller retaining frame or reposition the tester on the column stand if the test specimen is too small.

Safety and Liability

This instruction manual contains important information on safety, use and maintenance of the RH-45AUTO. Read through these instructions carefully before the first use of this tester. Keep these instructions in a safe place for future reference.

" General warranty terms and conditions of sale and delivery " Warranty and liability claims arising from personal injury and damage to property cannot be upheld if they are due to one or more of the following causes:

- Failure to use the tester in accordance with its designed use as described in this instruction.
- Incorrect performance check for operation and maintenance of the tester and its components.
- Failure to adhere to the sections of the instructions dealing with the performance check, operation and maintenance of the tester and its components.
- Unauthorized structural modifications to the tester and its components.
- Serious damage resulting from the effects of foreign bodies, accidents, vandalism and force majeure.

All information contained in these instructions is presented in good faith and believed to be correct. G & R Technology makes no warranties and excludes all liability as to the completeness and/ or accuracy of the information.

Safety instructions

The tester is not allowed to be operated by children or anyone under the influence of alcohol, drugs or pharmaceutical preparations. Anyone who is not familiar with these instructions must be supervised when using the tester.

1. Technical Specifications

Main unit specifications

	RH-150AUTO	RH-45AUTO
Preliminary Load Kg(N)	10 (98.07)	3 (29.42)
Total Test Force Kg(N)	60, 100, 150 (588.4, 980.7, 1471)	15, 30, 45 (147.1, 294.2, 441.3)
Test Scale	A, B, C	15N, 30N, 45N 15T, 30T, 45T
Test Load Control	Load Cell Based Feedback Loop System	
Test Cycle Type	Motorized (Auto Load, Test and Return)	
Standards Compliant	ASTM E18, ISO 6508, ASTM E140	
Resolution	0.1 HR	
Data Output	Bluetooth (to Printer), USB (to PC)	
Data Memory	1000 Test Results	
Battery	Rechargeable Li-ion Battery Work Time 6 hours Charge Time 2 hours	
Weight	2 Kg	
Dimensions	200mm X 110mm X 46mm	
Relevant Directives	EC Machinery Directive (98/37/EC) EC Electromagnetic Compatibility Directive (89/336/EEC)	

Test Specimen Ranges

On retaining frames:

Width	0-25 mm	25-50mm	50-75mm	75-100mm
Depth	50mm	50mm	50mm	50mm
Weight	0.15kg	0.2kg	0.3kg	0.4kg

On tube testing frame:

Thickness of Specimen Tube	Up to 20mm
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On column frame:

Width	0-250mm
Depth	130mm
Weight	17kg

2. Check Package

The RH-45AUTO is available in two different packages, each containing different frames and accessories. Upon purchase, please find the correct package list below and check if all listed accessories are included.

Package 1: Column style stand package:

- RH-45AUTO measurement component
- Diamond indenter
- 1/16" ball indenter
- 20-35HRC test block
- 59-65HRC test block
- 60-90 HRBW test block
- Hex key
- 11.1V rechargeable battery
- 12.6V/1.2A battery charger
- Column style stand
- Fastening fixture
- 16mm Socket Wrench
- 60mm plane anvil
- 60mm V-type anvil
- Bluetooth printer and 8.4V/0.8A charger (optional)

Package 2: Retaining frames package:

- RH-45AUTO measurement component
- Diamond indenter
- 1/16" ball indenter
- 20-35HRC test block
- 59-65HRC test block
- 60-90 HRBW test block
- Hex key
- 11.1V rechargeable battery
- 12.6V/1.2A charger
- 0-25mm retaining frame
- 25-50mm retaining frame
- 50-75mm retaining frame
- 75-100mm retaining frame
- Tube-testing frame
- self-aligning flat anvil
- self-aligning V-type anvil
- 30mm flat anvil
- 30mm V-type anvil
- Plastic case
- Bluetooth printer and 8.4V/0.8A charger (optional)

3. Functional Description

Figures 1 and 2 illustrate the RH-45AUTO hardness tester.

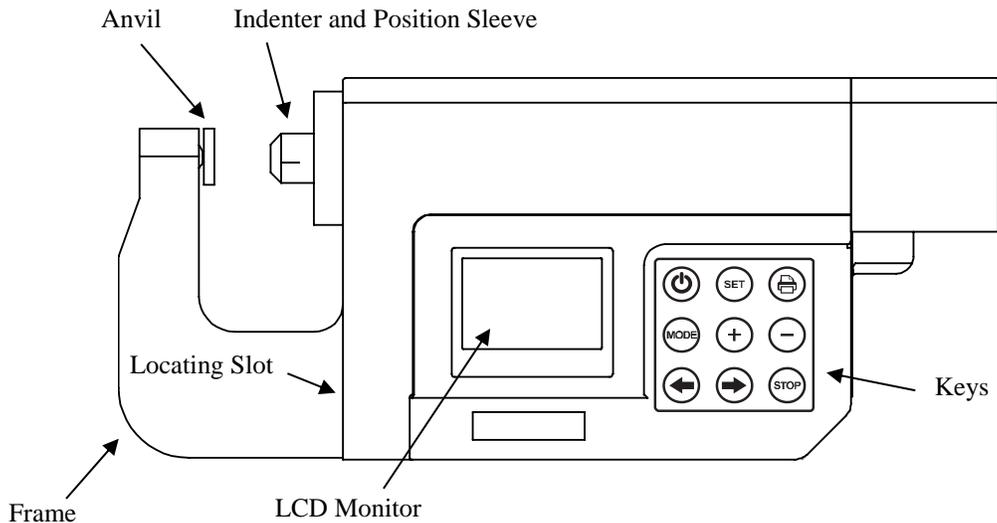


Fig. 1: Tester Front View

1. LCD Monitor: displays test results, operation descriptions, and prompts.
2. Keys
 -  key: power on/off. Note: the RH-45AUTO hardness tester has a power save function: it will automatically turn off if inactive for 5 minutes.
 - Function keys: SET, MODE, +, -: these keys are used for various operations as indicated on the LCD monitor.
 -  key: Bluetooth transmission - press this key to send data to the printer.
 -  key: begins test and moves indenter forward.
 -  key: moves indenter backward.
 - STOP key: stops indenter's movement.
3. Indenter and position sleeve: the indenter penetrates into the test specimen. The position sleeve holds the indenter and measures the penetration depth. The position sleeve and presshead both have marked lines. You need to line them up when inserting the position sleeve with indenter into the presshead hole. Then rotate the sleeve to lock it in the presshead.
4. USB connector: connects tester to an USB cable.
5. Charging port: for charging the battery
6. Anvil: holds the test specimens. Different types are available.
7. Locating slot: attaches frames with socket-head screws
8. Frame: holds the anvil. Different frames are available to accommodate different specimen sizes and shapes.

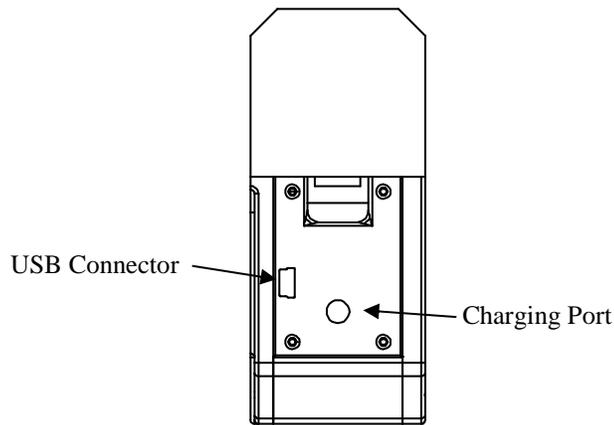


Figure 2: Tester Side View

Available Frames:

1. Retaining frames: the main unit and the retaining frames form a portable hardness tester. The retaining frames have different sizes: 0-25mm, 25-50mm, 50-75mm, and 75-100mm.
2. Tube testing frame: the main unit and the tube testing frame form a portable tube hardness tester.
3. The column frame: the main unit and the column frame form a stand hardness tester. There are a fastening fixture and an anvil on the stand. Attach the tester onto the fastening fixture. To change the height of the tester, unscrew the fastening fixture from the stand, remove it from its slot, and insert it into another slot. Place the test specimen on the anvil. Fine tune the height of the anvil by twisting it. The column stand can be placed in a vertical position or horizontal position.

4. Testing principle and procedure

Press the  key to power on the tester. Then, place the test specimen between the anvil and indenter. Then, press the  key once to move the indenter towards the test specimen. As the indenter is moving, you can press the STOP key to stop movement. Press the  key again to resume movement.

When the indenter pushes against the test specimen, the position sleeve will clamp the test specimen. Then, the indenter's tip will penetrate into the test specimen, creating an indentation.

The indenter will continue to move and apply a force on the test specimen. When the force reaches the preliminary test force F_0 , the indenter stops moving, wait for a specified dwell time. The tester then measures the indentation depth on the test specimen.

After waiting, the indenter will move again and further deepening the indentation.

When the applied force reaches the total test force F , the indenter stops moving and waits a specified dwell time.

After waiting, the indenter moves away from the test specimen, and decreases the force it applies on the test specimen. When the applied force decreases back to the preliminary test force F_0 , the indenter stops moving and waits for a specified dwell time. The tester then measures the larger indentation depth on the test specimen.

The tester analyzes both indentation depths to calculate the hardness of the specimen. The LCD displays the hardness reading. Finally, you can print the readings to a Bluetooth printer.

5. Pre-Treatment of the Test Piece

Preparation of the test piece surface prior to testing will help insure accuracy.

- a. The test should be carried out on a clean surface that is free from oxide scale, foreign matter, and especially lubricants.
- b. Preparation should be carried out in such a way that minimizes alteration of the surface hardness (for example, heat or cold-working).
- c. The thickness of the test piece should be no less than 0.08 in (2mm).
- d. The test piece should have a smooth even surface. The test surface should be polished so that a metallic luster appears. Measurement errors could result from the roughness of the test surface. The roughness (Ra) of the surface must be limited to $\leq 1.6 \mu\text{m}$.

6. Basic Operations

Powering on the device

Press the  key to power on the tester. The LCD will display the main window, which will show the previous test reading:

MAX 62.7	MIN 62.7
AVE 62.7	HV 764.9
1 005	62.7 N45

Set Up a New Test

1. At the main window, press the SET key to start and set up a new test. You will now select the operating parameters. The LCD monitor will prompt for a number of test results in a test group:

AVE 04

2. Press the **+** or **-** keys repeatedly to change the number of test groups per reading. Then press the SET key to input that number and select a testing scale.
3. The LCD monitor will now prompt for a test scale. Press the  key repeatedly to cycle through N45, N30, N15, T45, T30, or T15. Each scale has a unique window shown below:

N45
45KG DIAMOND

N45
HV: ST
HB: ST

N30
30KG DIAMOND

N30
HV: ST
HB: ST

N15
15KG DIAMOND

N15
HV: ST
HB: ST

T45
45KG Ball

T45
HV: ST
HB: ST

T30
30KG Ball

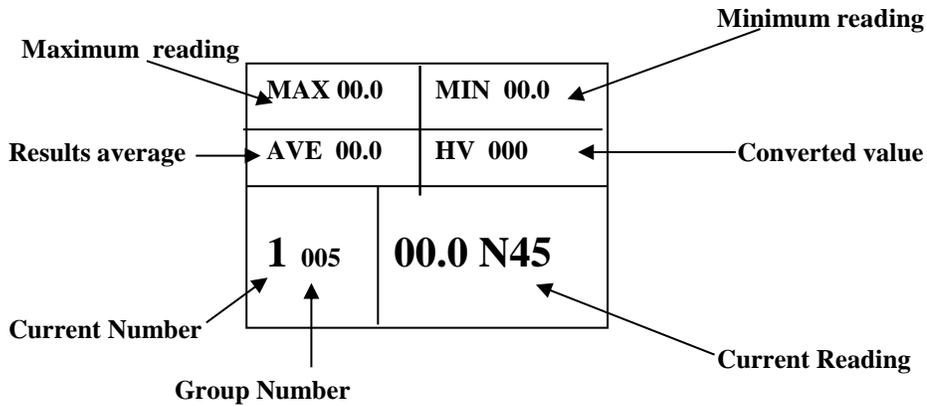
T30
HV: ST
HB: ST

T15
15KG Ball

T15
HV: ST
HB: ST

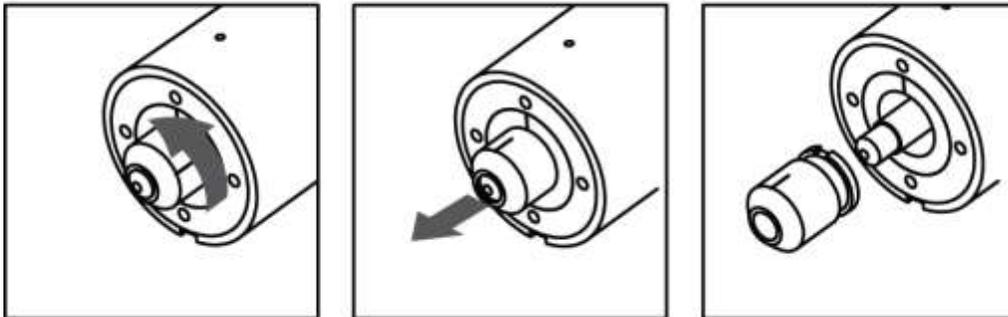
Abbreviation: ST----Steel

- Each scale's window prompts for test piece material for converting readings. Press the MODE key repeatedly to cycle through conversion values in Vickers (HV), Brinell (HB). The selected parameter will flash. Note: Only steel (ST) is currently supported for conversion.
- Press the SET key to return to the main window:

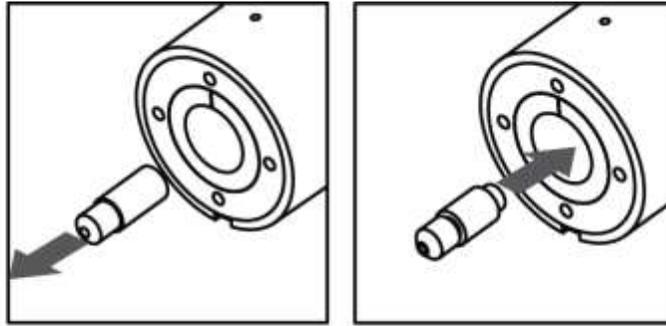


Testing Procedure

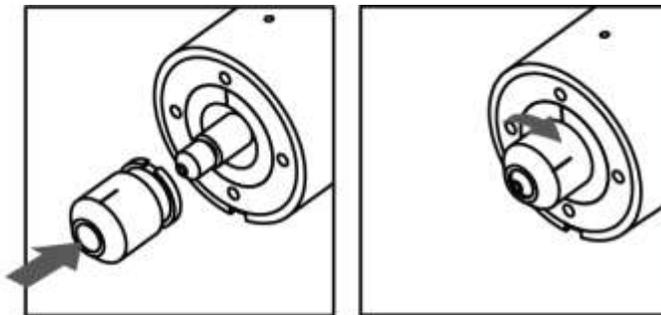
- As an example, we will perform an N45 test. Ensure the diamond indenter is placed in the tester. If not, twist the position sleeve until its notch lines up with the notch on the cylinder:



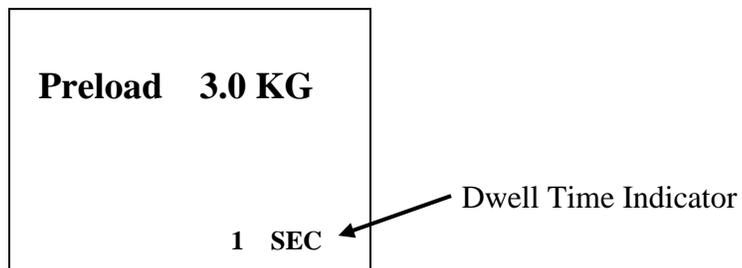
Then pull out the sleeve and replace the indenter with the correct one:



Reinsert the sleeve and twist to lock the sleeve:



2. Starting in the main window, place the test specimen between the indenter and anvil. Then, press the **←** key to move the indenter towards the test specimen. (While the indenter is moving, you can press the STOP key to stop the indenter, and then press the **←** key again to resume moving.)
3. The indenter will apply a preliminary test force on the test specimen, then stop moving for a specified dwell time. (The LCD monitor displays a timer for elapsed dwell time). The LCD monitor displays this screen:



4. After the dwell time elapses, the indenter automatically resumes moving and applies more force until the force reaches the load force. Then, the indenter stops

moving and pauses for a specified dwell time. The LCD monitor displays this screen:

Load 45.0 KG

1 SEC

5. After the pause, the indenter automatically moves backwards and decreases the force it applies on the test specimen until the force decreases back to the preliminary test force. Then the indenter stops moving and pauses for a specified dwell time. The LCD monitor displays this screen:

Unload 3.0 KG

1 SEC

6. After the pause, the indenter continues to move backwards away from the test specimen. You may remove the specimen. The LCD monitor displays this screen:

Unload 00.0 KG

Finally, the LCD monitor will display the test reading:

MAX 62.7	MIN 62.7	
AVE 62.7	HV 764.9	Converted Reading
1 005	62.7 N45	Test Reading

Note: Do not touch test specimen during testing, otherwise the test reading will be affected.

Search & Delete Test Readings

1. Search through readings in current test group

From the main window, press the **+** key to search and cycle through the test readings in the current group. If you want delete the currently displayed reading, press the **-** key. The reading will be deleted from memory and you will return to the main window. The LCD monitor now displays the previous test reading. If you want to return to the main window without deleting anything, press the SET key. The previous test reading will be displayed.

2. Delete current test result

From the main window, press the **-** key to delete current test result.

Transmit Data to Printer

1. First, power on the Bluetooth printer. Press the  key to start the transmit procedure. The tester will then attempt to pair with the printer, and the LCD window will flash "PAIR":

PRINTER PAIR

2. When both the tester and printer have been paired, the LCD window will display the current test group number. Press the **+** or **-** keys to cycle through and select the group number you wish to print.

**PRI
GROUP 04**

Press the  key again to transfer the selected data to the printer.

If the printer successfully receives the data, it will print the readings and the tester will return to the main window.

If the printer did not receive the data, the tester's LCD monitor will display:

**PLEASE CHECK
PRINTER STATUS**

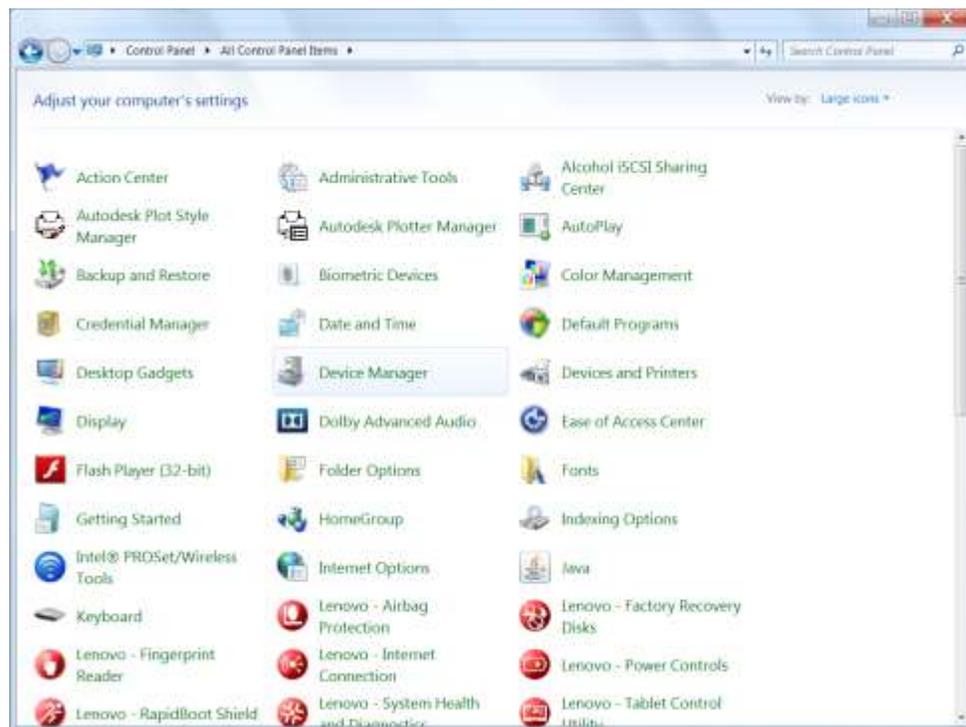
After 30 seconds, RH-45 hardness tester will return to main window. Check if the printer is powered on or operational and try transmitting again.

Transmit Data to Windows PC

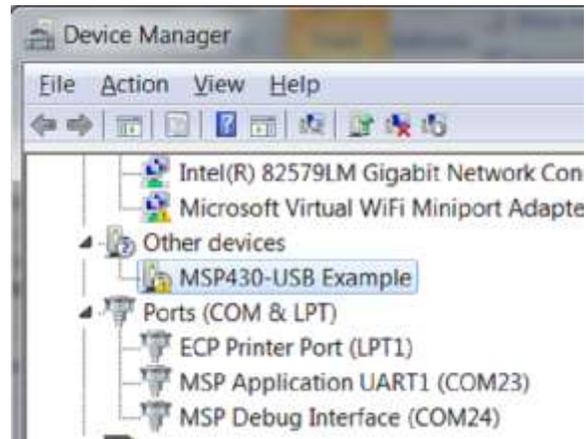
Initial PC Setup:

Download the Windows driver from the G & R Technology website.
Download and install the program Putty from
<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>

1. Insert USB cable into the tester's USB port.
2. Repeatedly press the MODE twice until the LCD window will display "USB TRANSFER"
3. A prompt on your Windows 7 Computer will appear, saying drivers are not installed
4. Enter your Windows 7 *control panel*. Make sure you are viewing by icons, not category. Run *device manager*.



5. Locate and expand “Other devices.” MSP430-USB Example should appear with a yellow exclamation mark.



6. Right click on this and select “Update Driver Software.”



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