Touch Screen Digital Rockwell Hardness Tester
Operation Manual

Precautions

1. **Read the Operation Manual:** Thoroughly review the operation manual before using the hardness tester. Familiarize yourself with the operating procedures and safety precautions to prevent damage to the tester and avoid accidents caused by improper use.
2. **Remove Packaging Materials:** Ensure all packaging straps and anti-shock tape are fully removed before operating the hardness tester.
3. **Power Requirements:** This unit requires a power supply of AC 110V/60Hz (U.S.) or AC 220V/50Hz (EU).
4. Electrical Components: Tampering with electrical components is strictly prohibited to prevent damage to the unit.
5. **Height Adjustment Wheel:** Do not rotate the height adjustment wheel during the dwell time between loading and unloading specimens.
6. **Manual Updates:** Haas reserves the right to modify or update the operator’ s and service manuals at any time without prior notice.

Contents

1. Introduction

Hardness is a critical property that determines a material's ability to resist deformation, wear, and abrasion, making it essential for assessing durability and strength. A hardness tester is an indispensable tool for accurately measuring this property, ensuring materials meet the performance and safety requirements of various applications. This property plays a crucial role in industries such as manufacturing, construction, and automotive, where accurately understanding this property is essential for selecting appropriate materials, ensuring quality standards, and optimizing processes like machining and heat treatment. Hardness testing also provides insights into related properties, such as tensile strength and brittleness, enabling engineers to predict how a material will behave under operational conditions. By using a hardness tester, manufacturers can maintain consistency in production, evaluate the effectiveness of surface treatments, and ensure components meet industry standards.

The Digital Rockwell Hardness Tester is equipped with a newly designed large display screen allowing for good reliability, and intuitive operation. Its main functions are as follows:

1. Capable of testing all Rockwell Scales
2. Plastic Rockwell scales (Optional)
3. Convert values between different scales
4. View and analyze test data
5. Wireless or wired printer capabilities for test data export

2. Technical Data

Rockwell Scales	HRA、HRB、HRC、HRD、HRE、HRF、HRG、HRH、HRK、 HRL、HRM、HRP、HRR、HRS、HRV
Preliminary Test Force	10Kgf(98.07N)　Permitted Error：±2.0%
Test Force	60Kgf(588.4N)、100Kgf(980.7N)、150Kgf(1471N) Permitted Error：±1.0%
Dwell Time	Adjustable 1-60s
Hardness Indication	5.2”　Touch Screen, Resolution:640x480
Resolution	0.1HR
Loading Control	Auto Loading/Dwell/Unloading
Hardness Conversion	HRC、HV、HBS、HBW、HK、HRA、HRD、HR15N、HR30N、 HR45N、HS、HRF、HR15T、HR30T、HR45T、HRB
Conversion Standards	ASTM、DIN
Language Option	Chinese, English, German, Portuguese, Turkish, Czech, Korean
Correction Range	-3.0HR to +3.0HR, Step 0.1HR
Data Memory	2000 Single Measuring Result, Curve Analysis, Results Reviewing And Analysis
Data Output	Optional Blue Tooth Mini Printer
Max. Height Of Specimen	175mm
Instrument Throat	165mm
Power supply	AC220V/50Hz;AC110V/60Hz
Dimension(LxWxH)	546x182x755mm
Packing Dimension	620x460x870mm
Gross/Net Weight	120Kg/90Kg
Execution Standard	GB/T230.2, JJS Z2245, EN-ISO6508, ASTME-18

3. Principle of Operation

The Rockwell hardness tester measures material hardness by determining the depth of indentation caused by an indenter under a specified load. Two loading scenarios are used, a minor load to establish a reference point, and a major load to penetrate the material. After removing the major load, the depth of the indentation is measured, and the hardness value is calculated. Different Rockwell scales (e.g., A, B, C) are used based on the material and load type. The test is quick, straightforward, and provides direct results, but may be less accurate for thin or irregularly surfaced materials.

$$HR = E - e$$

F0 = Preliminary minor load in kgf

F1 = Additional major load in kgf

F = Total load in kgf

e = Permanent indentation depth (in mm) caused by the major load, expressed in units of 0.002 mm

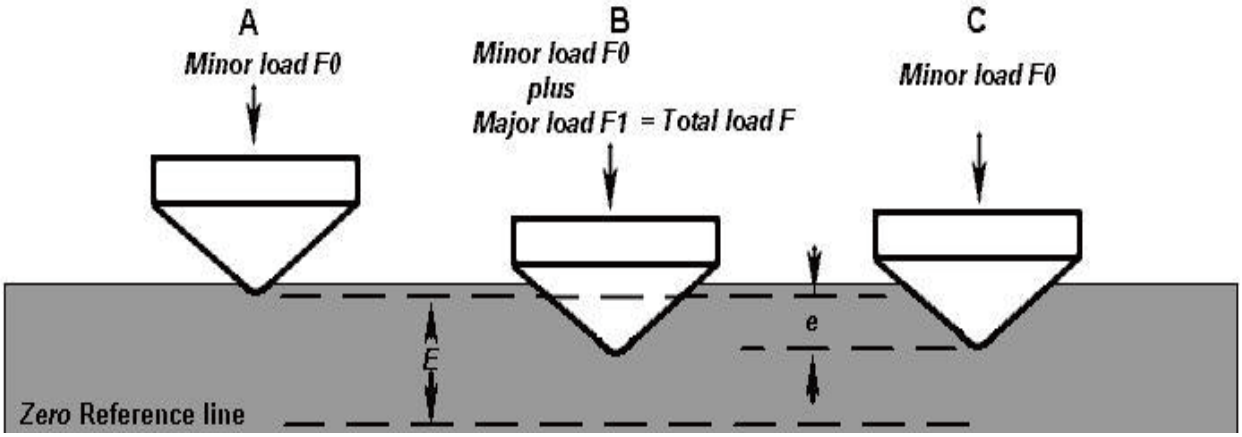
Example of e: HRC = 100 – (0.118mm / 0.002 mm)

HRC = 41

E = A constant depending on form of indenter: 100 units for diamond indenter, 130 units for steel ball indenter

HR = Rockwell hardness number

D = Diameter of steel ball



This table outlines various Rockwell hardness scales, specifying the indenter type, minor and major loads, total applied load, reference constant E, and the typical hardness range for each scale.

Hardness Scale	Hardness Symbol	Indenter	Minor Load F0 (kgf)	Major Load F1 (kgf)	Total Load F (kgf)	Value of E	Typical HR Range
A	HRA	120° Diamond Cone	10.0	50.0	60.0	100	20-88
B	HRB	1/16” (1.5875 mm) Steel Ball	10.0	90.0	100.0	130	20-100
C	HRC	120° Diamond Cone	10.0	140.0	150.0	100	20-70
D	HRD	120° Diamond Cone	10.0	90.0	100.0	100	40-77
E	HRE	1/8” (3.175 mm) Steel Ball	10.0	90.0	100.0	130	70-100
F	HRF	1/16” (1.5875 mm) Steel Ball	10.0	50.0	60.0	130	60-100
G	HRG	1/16” (1.5875 mm) Steel Ball	10.0	140.0	150.0	130	40-94
H	HRH	1/8” (3.175 mm) Steel Ball	10.0	50.0	60.0	130	80-100
K	HRK	1/8” (3.175 mm) Steel Ball	10.0	140.0	150.0	130	40-100

Note: Unit only includes 120° Diamond Cone and 1/16" (1.5875mm) Steel Ball Indenter

4. Installation Steps

Operating Conditions

- Operating Temperature: 10-30°C / 50-86°F
- Relative Humidity: ⩽ 65%
- Minimal vibrations and dust in surrounding environment

Unpacking and Positioning

- Cut the crate belts, remove screws from the base and remove the crate cover.
- Unscrew the two (2) M10 bolts found on the bottom of the base to separate the hardness tester.
- It is recommended that the hardness tester be placed on a stable worktable within a horizontal deviation of 1mm/m. A level can be found along with the accessory kit provided.
- A hole will need to be drilled into the final location of the hardness tester. This hole will be used to allow the lead screw that controls the vertical position of the test anvil to have enough clearance for full range motions. Refer to Figure 3-1 for hole dimensions and positioning.
- Once fully positioned, open the Upper Cover (8) and the Back Cover (9) found in Figure 3-2.
- Untie fastening rubber tape on the Connecting Rod (22) and draw out the foam block under the Protecting Gasket (25) and lever (15). Connecting Rod and Protecting Gasket can be found in Figure 5-21. Lever can be found in Figure 3-3.

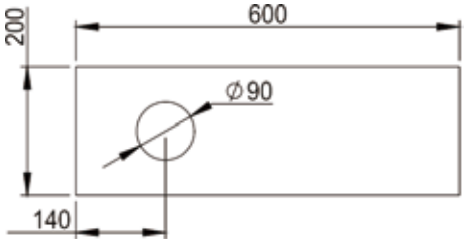


Fig 3-1

1. After installation, verify no debris or loose objects were left inside of the tester covers.
2. Fully review manual to have a complete understanding of the components to avoid incorrect use of the unit.

5. Components

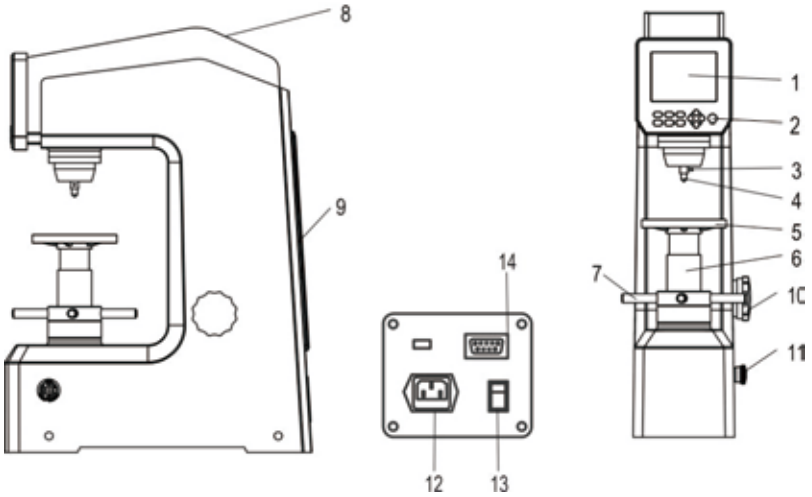
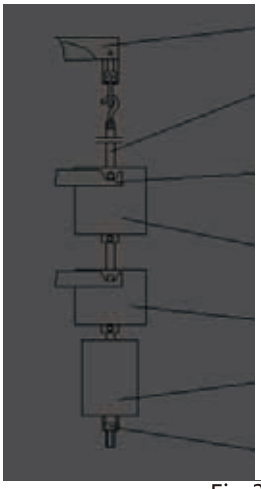


Fig 3-2

1. Touch Screen
2. Control Panel
3. Indenter Fastening Screw
4. Indenter
5. Anvil
6. Elevating Screw
7. Hand Wheel
8. Upper Cover
9. Back Cover
10. Force Knob
11. Emergency Stop
12. Power Socket
13. Power Switch
14. VGA Interface

6. Weights Installation

- During installation of weights, the tester should not be under any load.
- Thoroughly clean the A, B, and C weights found in the accessory kit prior to installing onto the hanging rod. Rotate the force knob to the 588 (60) setting, then take the Hanging Rod (16) from the Back Cover and insert the Hanging Rod through the A Weight. Once positioned, the M10 Nut should be tightened to fix the A weight into place and the Hanging Rod should be hooked to the ear of the lever. The B and C weights can then be placed on their respective Fork-Shaped Frames. The force knob should then be rotated and the weight should be visually inspected for a full cycle. The value on the force knob should correlate to the weights placed on the hanging rod. The weights should not make contact with the inside of the body.



15. Lever
16. Hanging Rod
17. Fork-Shaped Frame
18. Weights C
19. Weights B
20. Weights A
21. M10 Nut

Fig 3-3

7. Operation

Power On

Connect the power source, and place the power switch to the ON position. The main screen will display the operating page.

Fig 4-1 Power On Interface

Touch Screen Operation

- Single / Group Testing: Test modes can be set to either single or group modes. When placed in single test mode, the test number will equal “NG” and will display “Single” at the bottom left of the screen. When placed in group testing mode, the test number will equal “00” and will display “Average”.

Fig 4-2 Standard test Mode (Single)

Fig 4-3 Group test Mode

- Standard: Hardness conversions according to different standards
- Menu: Return to main menu
- Conversion: Select hardness conversion scales. Two conversion scales can be selected at a time.
- Printing: Print test data (Should be done before unloading)

8. Key Panel Operation

Fig 4-4 Control Panel

MENU — **Enter system setup**

CLR — **Clear value when testing load is relieved**

ESC — **Escape from main menu to measuring interface**

CVT — **Toggles through conversion scales / highlights conversion button**

PRT — **Printing: Print test data / highlights conversion button**

DISP — Display test results

ENTER — Enter to confirm modifications

— Direction button

— Direction button

9. System Setup

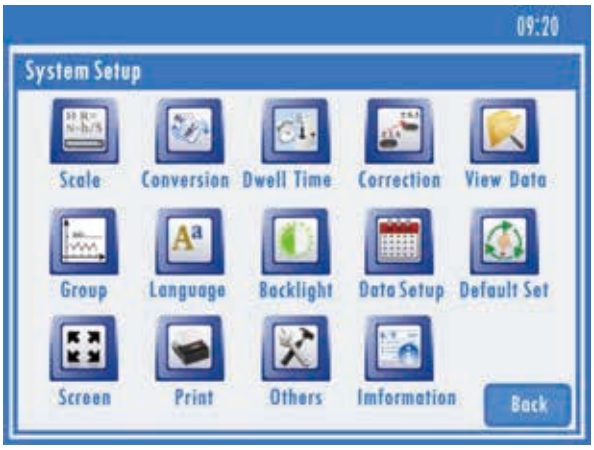


Fig 5-1 System Setup

- **Scale:** Select the scale button in the main menu and configure which hardness scale is to be used. The force knob and indenter selection will be vary depending on hardness scale chosen.
- **Conversion:** After selecting a hardness scale, the conversion scale works by automatically translating the measured Rockwell hardness (HR) value into equivalent values in other scales.
- **Conversion Standard:** In the same menu for conversions, two different hardness testing standards can be selected. The American Society for Testing Materials (ASTM) or Deutsches Institut für Normung (DIN) options can be selected based on required industry regulations for a specific application.

Notes:

- If the converted hardness is invalid, the display will show “NG”.
- When the conversion scale is updated, the system will update the saved scale to match the newly selected scale.

Fig 5-2 Hardness Scale

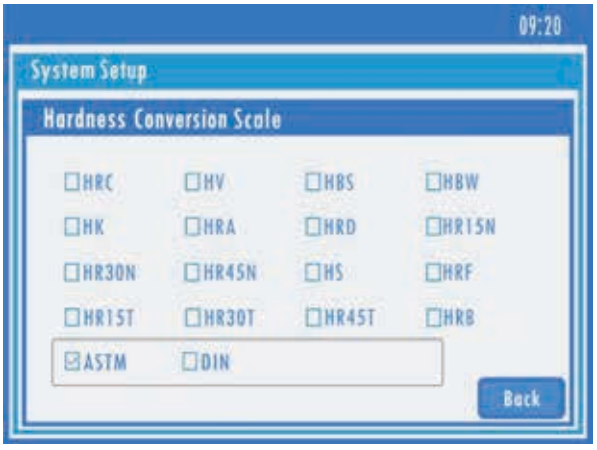


Fig 5-3 Hardness Conversion and Standard

- Dwell Time Setup: Adjust from 1-60s. Dwell time is important when testing materials due to their elastic recovery. By allowing the indenter to dwell in a material for a set time, this allows for plastic deformation to stabilize, ensuring more accurate readings. ASTM and DIN standards specify dwell times for various Rockwell scales to maintain uniformity in testing procedures.
- Language: Select the preferred language

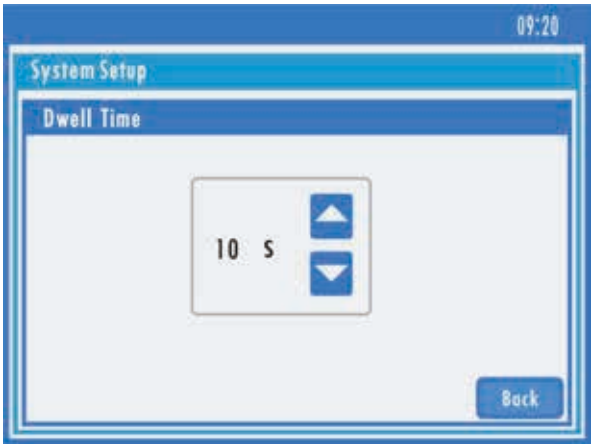


Fig 5-4 Dwell Time Setup

Fig 5-5 Language

- **Date Setup:** Click to modify year, month and date. Click enter to confirm system time update. (Figure 5-6)
- **Backlight Setup:** Click the backlight button in the main menu, adjust bar to desired brightness. (Figure 5-7)

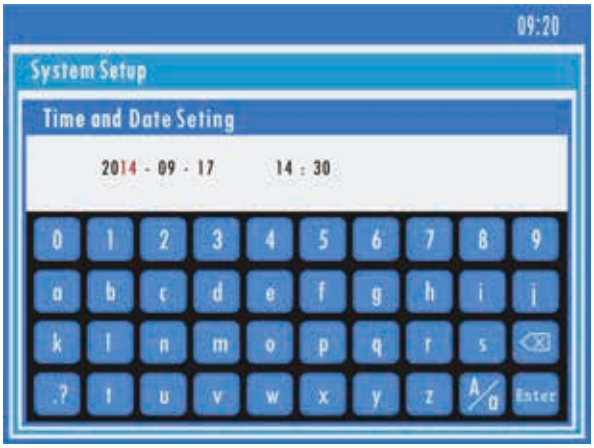


Fig 5-6 Time and Date Setup

Fig 5-7 Backlight Setup

- Screen Calibration: Calibrate the screen by pressing the black “+” icons till they turn green.
- Print Setup: Wirelessly print test data via Bluetooth connection, or by use of a VGA cable from the unit to a printer.
  - Toggle the hardness tester to begin searching for Bluetooth connection. Using the desired printing device, begin searching for the hardness tester in the Bluetooth selection menu and establish connection.
  - Once a connection is made, the screen will give the option to connect, or can go back to the print settings screen.
  - Data can then be printed in the test screen, or in the view data tab.
  - For detailed instructions about connecting to a PC, refer to the “Wireless Data Transmission Setup” section.

1. Make sure Bluetooth is powered on before connecting to the hardness tester.
2. The Bluetooth sensor range is about 3-10 feet (1-3 meters).
3. One-time connection is OK.
4. If the hardness tester is powered off, reconnect the Bluetooth device once the hardness tester has been restarted.
5. If the connection fails, retry the connection process again.

Fig 5-8 Screen Calibration

Fig 5-9 Searching for Devices

- **Wireless data transmission setup :**

Connect successfully with PC, setup as follows:

1) **XP System:** click start – program – accessory – communication and then HyperTerminal one by one. A new window will be displayed, select edit connection name and click OK.

2) **Above Win7 System:** for systems that do not have HyperTerminal, extra installation is needed. Users can download it from the internet. Double-click the function icon after the extraction. It will display a new connection "window-edit" name, select OK.

◆ It will pop out region setup when it is firstly used, users should set up as needed.

3) Choose the using com port (as the following Fig, port is COM3) baudrete [B/S] set up as 9600, others do not change, click OK after every setup.

4) After all the above has been finished, executive print operation data will transmit to PC.

- **Others Setup :** Click other setup, the submenu catalogue shown as 5-10. √ shows up, it is on state; √ does not show up, it is off state.

1) **【Click Sound】**: Switch on the system sound, if there aren't any other sounds, there is no other sound except for the test process

2) **【Click enable default name】**: This will display the name edit dialog box, then you can input the name and click Enter to confirm. The name consists of a set name and a number, see Fig 5-11, the saved name is Name01. If no changes are made, the default name consists of 16 digits, starts at 0 and increases.

a) When using set name of data, it will display as “name + digits”, such as “Name01”, the following would be “Name02”, etc.

b) When using default name, it will display as “0000000000000001”.

3) 【**The maximum number of tests**】This is only for average mode.

◆ **Remark:** this function is only available for group test mode, at most 10 test results, it will enter into next group when finished. Analyzed in test result line chart [data group].

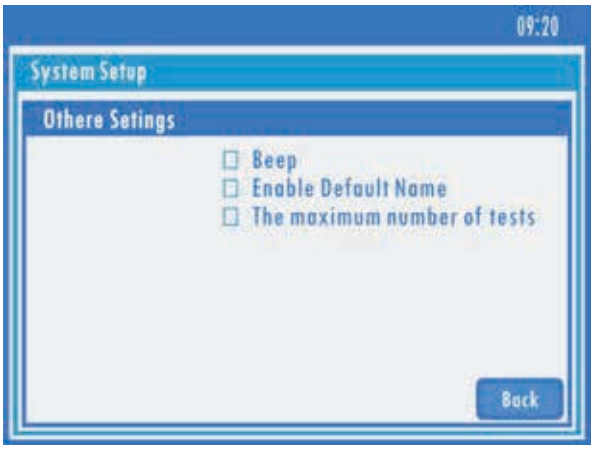


Fig 5-10 Others Settings

Fig 5-11 Edit Default Name

10. Test Preparation

- The test surface should be free of debris, rust, and cavities for the best results. The specimen should be completely flat against the diamond point / ball end of the indenter.
- The minimum thickness for a sample should be at least 10 times the indentation diameter to prevent edge effects and ensure accurate results. Thickness of sample should be 3-4 times the indentation depth for regular Rockwell scales such as HRC, HRB, and HRA. For superficial Rockwell scales, the sample should be at least 2 times the indentation depth in thickness.
- Sample should be fixed onto the testing anvil and should not be capable of moving while a load is being applied.
- If the sample has an irregular shape, a custom fixture should be used to position the testing surface perpendicular to the indenter.
- The V-shaped anvil should be used to position if sample being measured is circular.

Note: View the tables below to reference the minimum thickness of a specimen / mm based on their respective Rockwell Hardness Scale.

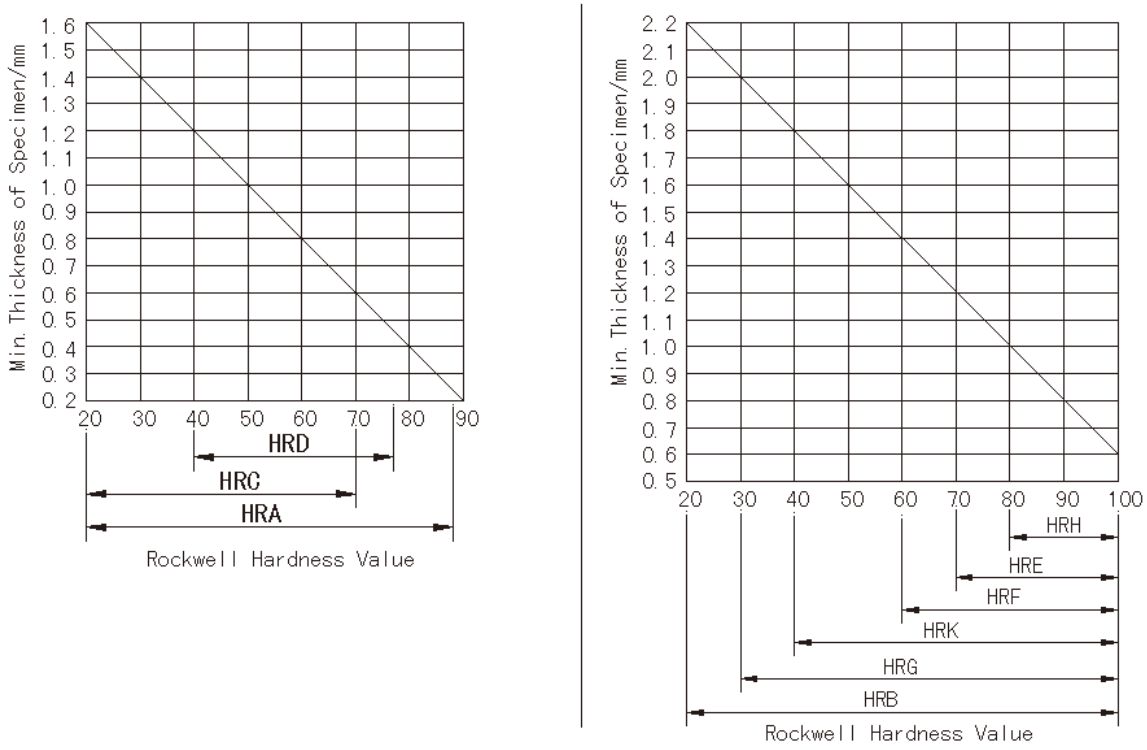


Fig 5-12 Min. thickness of specimen

11. Sample Test Steps

1. Set the Rockwell Scale

- Determine the appropriate Rockwell scale based on the material type and testing requirements.
- Select the scale on the digital testing screen.

2. Adjust Test Force and Indenter

- Refer to the recommendation displayed on the top left of the screen.
- Choose the correct indenter (diamond cone or steel ball).
- Set the appropriate test force based on the selected scale.

3. Configure Additional Settings

- If needed, select the required hardness conversions for other hardness scales.
- Increase the dwell time if the material or scale requires a longer load application.

4. Apply the Load

- Rotate the handwheel until the green bar on the screen reaches the required load level.
- Ensure the load is properly applied before proceeding.

5. Perform the Hardness Test

- Do not move the handwheel during the test.
- Allow the machine to apply the load and measure the indentation depth.
- Wait for the hardness result to appear on the screen.

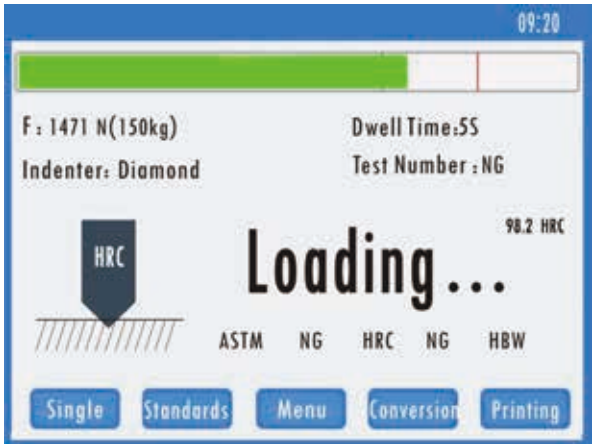


Fig 5-13 Loading

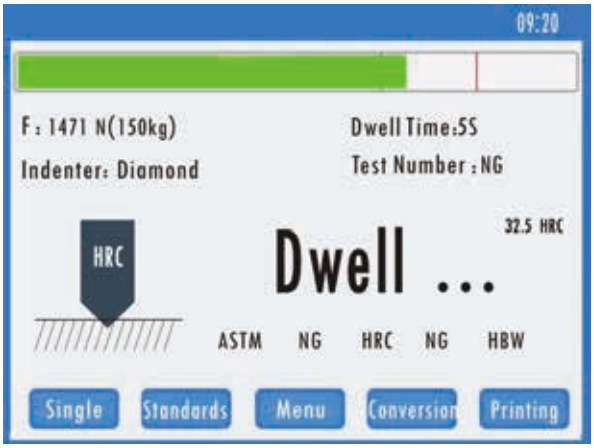


Fig 5-14 Dwell

5.3.5 The motor will start, initiating the automatic loading of the main test force. The dwell time of the total test is 5 seconds, the screen will begin counting backwards until the dwell time reaches 0 seconds (see Fig 5-15). The instrument will automatically unload the main test force; then it will keep the initial test force. When the buzzer sounds, the hardness value will be displayed on the screen, see Fig 5-16.

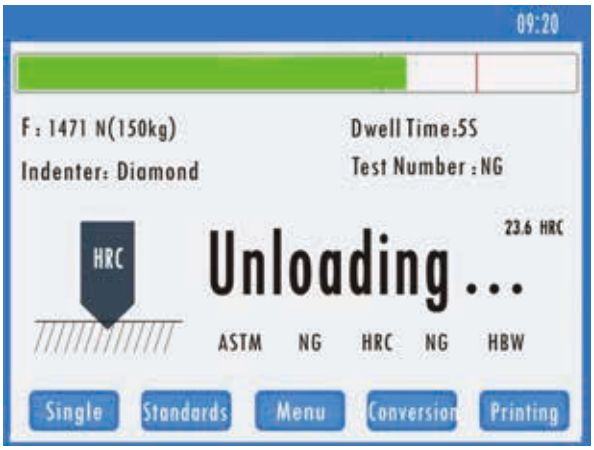


Fig 5-15 Unloading

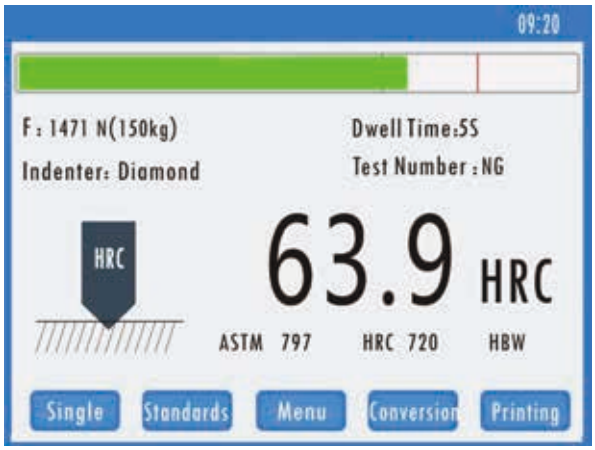


Fig 5-16 Hardness Result

5.3.6 Turn the Rotating Wheel anti-clockwise and lower down the Testing Table. And then change the testing points to be tested, repeat the operation described above, see Fig3-2.

5.3.7 The number of points tested should not be less than 5 (the first point is not included). The number of points tested may be reduced if the specimen is serial tested.

Warning: It is prohibited to adjust the handwheel during measurements to prevent damaging internal components and to provide the most accurate results. In the event of an emergency, utilize the emergency stop button found on the right side of the machine.

12. Viewing Data

- Each page on the data list displays 5 results as seen in **Figure 5-17**.
- Select the box to the left of the desired test and press **detail** to view data such as test results, test time, scale, and hardness conversions.
- Up to 10 sets of data points can be selected and graphed at a time. The graph will demonstrate the variations of each sample selected. The max and min values will be highlighted in red.
  - Ave: Mean Average Value
  - S: Standard Deviation; if "Err" is shown the means have exceeded the permitted error
  - %S: Percentage of Deviation; if "Err" is shown the means have exceeded the permitted error
  - %RE: Percentage of Repeatability
- Print:
  - Press the print icon or print button on the panel for list of individual or group results.

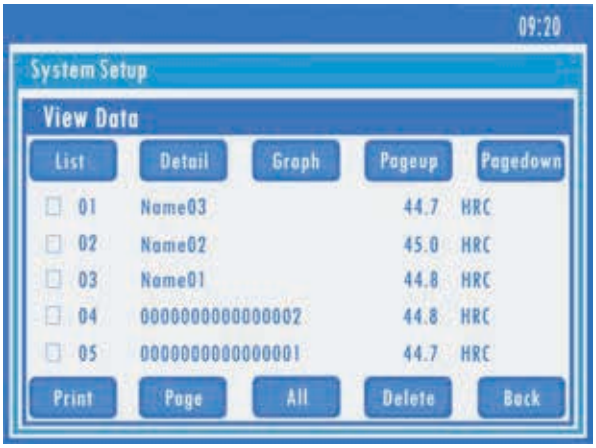


Fig 5-17 Data List

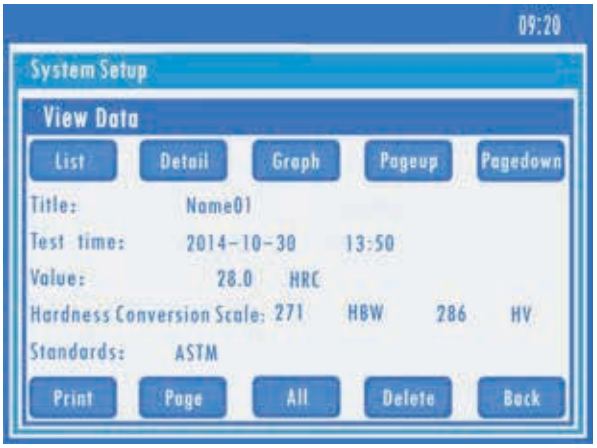


Fig 5-18 Particulars

13. Group Data

- In the main menu, group data can be seen by selecting the group data icon.
- The graph will demonstrate the selected scale in the Y-axis and test times in the X-axis.
- Print:
  - Press the print icon or print button on the panel for list of individual or group results.

Note: Data cannot be viewed if max tests set is not reached. If no data is stored in a set group, the system will output a "NO DATA" warning and return to the upper-layer interface.

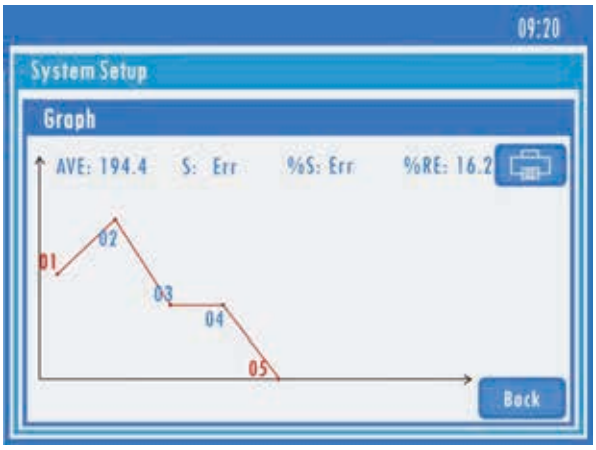


Fig 5-19 Single Test Review

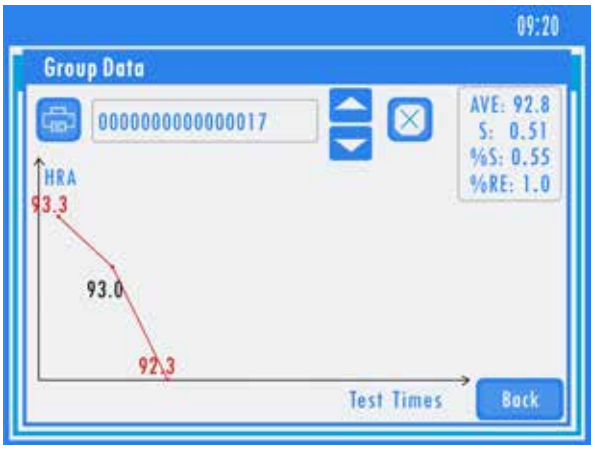


Fig 5-20 Group Data Review

14. Calibration Correction Methods

Unit is calibrated prior to leaving factory. If unit is found to be out of calibration, two methods can be found below. Method 1 and 2 should only be done by trained individuals.

Method 1:

• Select the **correction** icon in the main menu. Adjust the value in the positive or negative direction with the arrow keys. The adjusted value will depend on the actual test results when using the standard block. If the value is reading **too low**, the correction value is to be adjusted up. If the value is reading **too high**, the correction value is to be adjusted down.

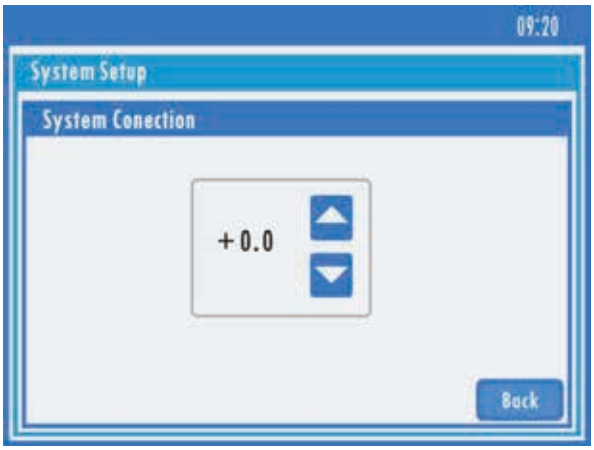
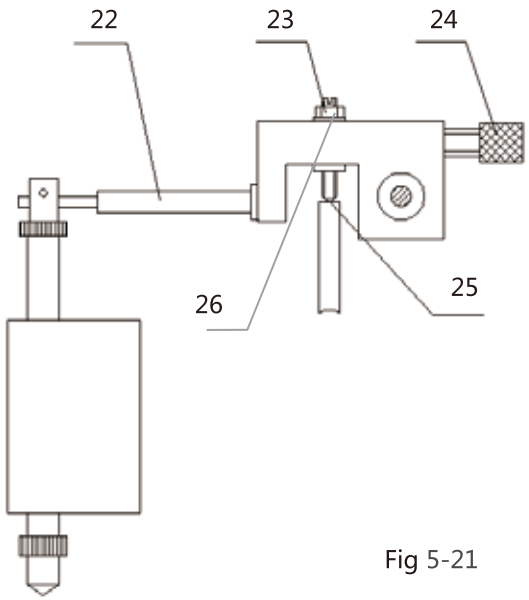


Fig 5-22 Correction Value

Method 2:

- Remove the upper cover and access the assembly as seen in Figure 5-21. Slightly loosen the nut (26) while simultaneously fixing the M4 screw rod (24) in place with a screw driver. Rotate the adjustment screw (24) in the clockwise direction, then re-tighten the nut (26). Retry the test using the standard as reference. If the value displayed is higher than the standard, rotate the screw in the opposite direction. If the value displayed is lower, continue rotating the adjustment screw in the clockwise direction



22. Connecting Rod
23. Screw Rod
24. Screw
25. Protecting Gasket
26. Nut

Fig 5-21

15. Factory Reset (Default Set)

- Default Set will completely reset all settings and data stored on the current unit. This should only be done if absolutely necessary. **Reset password: 88888888**

Fig 5-23 Ongoing Recovery

16. Maintenance Procedures

1. Daily Maintenance

- Clean the Indenter & Anvil – Wipe off dust, debris, and residues after each use.
- Check the Display & Controls – Ensure the digital screen and buttons are functioning properly.
- Verify the Test Area – Keep the testing surface free from dirt, oil, or damage.

2. Weekly Maintenance

- Inspect the Indenter – Look for wear, cracks, or deformation in the diamond or steel ball indenter.
- Check the Anvil Surface – Ensure it remains flat and undamaged for proper sample support.

3. Monthly Maintenance

- Perform a Calibration Check – Use standard test blocks to confirm the tester is producing accurate readings.
- Lubricate Moving Parts – Apply appropriate lubrication to mechanical components such as the handwheel and lead screw.

4. Annual or Periodic Maintenance

- Full Calibration & Certification – Conduct a full calibration using certified test blocks (recommended by ASTM, DIN, or manufacturer).
- Professional Servicing – Have a trained technician inspect and service the machine if required.

17. Troubleshooting

Problem	Possible Causes	Solutions
When tester is switched on, the screen does not turn on.	-Faulty power -Blown fuse	- Verify power cable is connect and not damaged -Replace Fuse
Touch screen / buttons are not functioning	-Software glitch -Measurement is being taken	-Restart unit -Lower anvil and restart measurement
Lead Screw is not moving	-Seized lead screw -Obstructions	-Apply a thin layer of lubricant to the lead screw -Verify there is no obstructions where the lead screw is being risen and lowered
Incorrect Readings	-Calibration is incorrect -Anvil and test surface is dirty -Indenter is damaged -Weights incorrectly installed -Incorrect test force	-Recalibrate using calibration block -Clean test surface and anvil for debris -Verify indenter is not damaged / in correctly mounted -Verify weights are mounted in the correct order per **Figure 3-3** -Verify the correct hardness scale / indenter / test force is set

18. Warranty

- Only an authorized Haas Factory Outlet distributor should service or repair a Haas machine that is protected by the original factory warranty. Servicing by any other party voids the warranty.

19. Storage / Transportation

- Unit should be kept in an area free of vibration, rust, and moisture to avoid damaging mechanical and electronic components. It is recommended to place unit back into original packaging.

Note: Manual can be updated without notice, latest updates can be found on www.haastooling.com

Table 1 (Hardness Value Corrections With Testing On Convex Cylindrical Surfaces)

Corrections to be Added to Rockwell B, F, and G Values Obtained on Convex Cylindrical Surfaces of Various Diameters

Table 1-1

Hardness Value(HR)	Diameters of Convex Cylindrical Surfaces (mm)						
	6	10	13	16	19	22	25
	Corrections to be Added to Rockwell B, F, and G Values (HR)						
20				4.5	4.0	3.5	3.0
30			5.0	4.5	3.5	3.0	2.5
40			4.5	4.0	3.0	2.5	2.5
50			4.0	3.5	3.0	2.5	2.0
60		5.0	3.5	3.0	2.5	2.0	2.0
70		4.0	3.0	2.5	2.0	2.0	1.5
80	5.0	3.5	2.5	2.0	1.5	1.5	1.5
90	4.0	3.0	2.0	1.5	1.5	1.5	1.0
100	3.5	2.5	1.5	1.5	1.0	1.0	0.5

Corrections to be Added to Rockwell A, C, and D Values Obtained on Convex Cylindrical Surfaces of Various Diameters

Table 1-2

Hardness Value (HR)	Diameters of Convex Cylindrical Surfaces (mm)								
	6	10	13	16	19	22	25	32	38
	Corrections to be Added to Rockwell A, C, and D Values (HR)								
20				2.5	2.0	1.5	1.5	1.0	1.0
25			3.0	2.5	2.0	1.5	1.0	1.0	1.0
30			2.5	2.0	1.5	1.5	1.0	1.0	0.5
35		3.0	2.0	1.5	1.5	1.0	1.0	0.5	0.5
40		2.5	2.0	1.5	1.0	1.0	1.0	0.5	0.5
45	3.0	2.0	1.5	1.0	1.0	1.0	0.5	0.5	0.5
50	2.5	2.0	1.5	1.0	1.0	0.5	0.5	0.5	0.5
55	2.0	1.5	1.0	1.0	0.5	0.5	0.5	0.5	0
60	1.5	1.0	1.0	0.5	0.5	0.5	0.5	0	0
65	1.5	1.0	1.0	0.5	0.5	0.5	0.5	0	0
70	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0	0
75	1.0	0.5	0.5	0.5	0.5	0.5	0	0	0
80	0.5	0.5	0.5	0.5	0.5	0	0	0	0
85	0.5	0.5	0.5	0	0	0	0	0	0
90	0.5	0	0	0	0	0	0	0	0

Table 2 (Allowable Repeatability and Error Table)

Rockwell Scales	Hardness Range	Max Error
HRA	(20 ~ 75)HRA	±2HRA
	(> 75 ~ 88)HRA	±1.5HRA
HRB	(20 ~ 45)HRB	±4HRB
	(> 45 ~ 80)HRB	±3HRB
	(> 80 ~ 100)HRB	±2HRB
HRC	(20 ~ 70)HRC	±1.5HRC
HRD	(40 ~ 70)HRD	±2HRD
	(> 70 ~ 77)HRD	±1.5HRD
	(> 90 ~ 100)HRE	±2HRE
HRF	(60 ~ 90)HRF	±3HRF
	(> 90 ~ 100)HRF	±2HRF
HRG	(30 ~ 50)HRG	±6HRG
	(> 50 ~ 75)HRG	±4.5HRG
	(> 75 ~ 94)HRG	±3HRG
HRH	(80 ~ 100)HRH	±2HRH
HRK	(40 ~ 60)HRK	±4HRK
	(> 60 ~ 80)HRK	±3HRK
	(> 80 ~ 100)HRK	±2HRK
HRE	(70 ~ 90)HRE	±2.5HRE
HRL	(100 ~ 120)HRL	±1.2HRL
HRM	(85 ~ 110)HRM	±1.5HRM
HRR	(114 ~ 125)HRR	±1.2HRR