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# **KHR500/P**

## **Rockwell Hardness Tester**

### **Instruction Manual**

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## 1 General description

KHR-500/500P can be used directly to measure Rockwell hardness and plastic Rockwell hardness, and it can change the value of Rockwell hardness into HB, HV, HLD, HK and  $\sigma_b$  value. Provided with many features such as high measuring precision, wide measuring range, automatic test force changing according the scales, automatic main test force loading/unloading, measuring results digitally display and automatic printing, communicating with external computer and etc., the tester is suitable for the hardness testing of carbon steel, alloy steel, cast iron, non ferrous metal, engineering plastic and etc.

The tester meets the following standard: ISO 6508-2, ASTM E18, and BS EN ISO6508-2.

## 2 Key performance parameters

- Preload: 98.1N (10kgf)
- Total test force: 588.4N(60kgf), 980.7N(100kgf), 1471N(150kgf),
- Scales: HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV
- Load cycle: 3~8s
- Load dwell duration: 2~50s
- Resolution : 0.1HR
- Display: High definition backlight LCD
- Operation: Menu selectable, Membrane keypad
- Auxiliary functions: Upper/lower limits setting& alarming,  
Data statistics, Avg., Max., Min., S, R,  
Scale conversion, HV, HB,  $\sigma_b$ ,  
Curved surface correcting automatically
- Data output: Print out, or output to PC through USB port
- Memory: Max 500 items of test results stored automatically
- Testing space: 200mm in vertical, 165mm in horizontal
- Dimensions: 550mm×200mm×720mm
- Net weight: 100kg
- Power supply: single phase, AC, 110V, 50~60Hz, 4A



The power supply can be reset to 220V. Please contact the supplier to reset it if the machine is used in the 220V region.

### 3 Basic configuration and structure

#### 3.1 Standard configuration

Host machine	1
Standard hardness block for A scale	1
Standard hardness block for B scale	1
Standard hardness block for C scale	1
1/16" ball indenter	1
120° cone diamond indenter	1
Mounting screws for indenter	2
Flat anvil	1
"V" shape anvil	1
Power supply wire	1
USB cable	1
Screwdriver	2
Dust cover	1
*** Inner Printer for KHR-500P ONLY	1

#### 3.2 Structure schematic diagram



- 1- screen and keyboard
- 2- indenter
- 3- anvil
- 4- leadscrew and protecting sleeve

- 5- handwheel
- 6- weights( in the tester)
- 7- switch and power panel
- 8- printer **KHR-500P only**

Figure 3.1

## 4 Installation and adjustment

- 4.1** Unpack the packing case, then remove the three M10 screws from the underside of the base. Lift the machine very carefully from the bottom. Remove the all accessories and the weights that are attached to the baseboard by the straps.
- 4.2** The machine should be mounted on a firm bench or table in a clean area, free from vibration or shock, recommended height 800mm. A hole must be provided in the top of the bench to provide working clearance for the leadscrew referring figure 4.1.
- 4.3** Place the tester on the prepared bench, turn the hand wheel in anti clockwise, low the anvil, remove the anti vibration pad; then place the level meter with the precision of 0.2mm/m on the anvil, adjust the levelling feet of tester to make the levelness 1mm/m, then lock the nuts.  
**Note: This is very important. The load changing will be affected if the levelness is not good.**

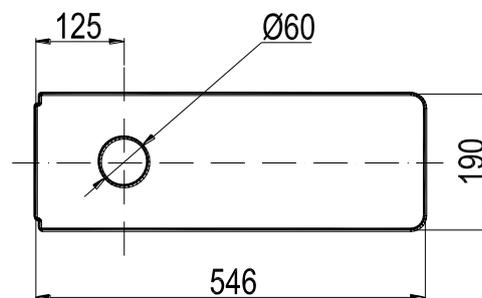


Figure 4.1

- 4.4** For installation, open the upper cover and back cover of tester, then remove all the packing materials and suspending weight at the V groove of the lever. Make sure the blade should be correctly placed in the V groove.
- 4.5** Reinstall the upper and back cover and connecting the power supply wire.

## 5 Operating methods

### 5.1 Testing preparation

Switch on the machine and then the tester will self check. The relative information such as type, series number, software version will be displayed on screen. Tester will come to main menu after self-checking; current test parameters will be displayed on screen, and the status at the last shutting off can be automatically stored. Figure 5.1.1 is a typical status of Rockwell testing parameter; showing the current scale, indenter type should be selected according to the current scale, test force, load dwell duration, as well as current time.

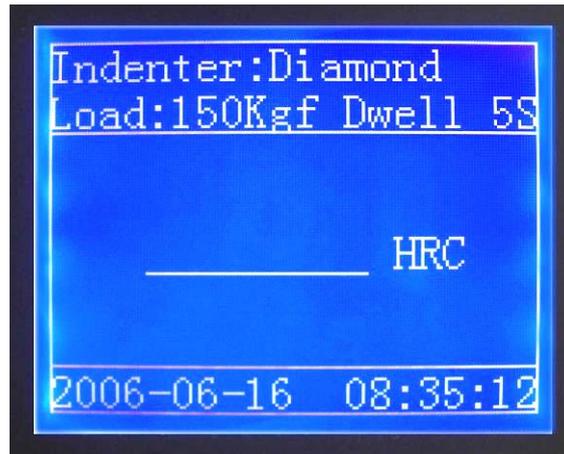


Figure 5.1.1

Pay more attention that the indenter selected must be mounted truly on the indenter base, therefore the indenter should be properly selected according to the prompt in case of the tester is used for the first time and indenter has not been installed ever. If the indenter has been provided, the checking for the conformity of indenter provided according the prompt on screen is necessary. When installing indenter, make sure the installing surface clean without foreign matters, and tightly fixed. The test force selection is automaticall according the scale, details as 5.2.1.

The test can be performed directly according to the procedure 5.3 if none of the parameters above is required to modify; following procedures should be observed if the modification is necessary.

## 5.2 Test parameters setting

Press “**Setup**” key, figure 5.2.1 will be showed on screen, the parameter setting is ready.

### 5.2.1 Scale selection

Press “**↕**” or “**↖**” key to move cursor to “1” in figure 5.2.1, press “**←**” key ,then the cursor move to “HRC” . Press “**↕**” or “**↖**” key at this time the optional 15 Rockwell scales HRC、HRA、HRB、HRD、HRE、HRF、HRG、HRH、HRK、HRL、HRM、HRP、HRR、HRS、HRV will be appear in sequence. When the desired scale appears as figure 5.2.2, press “**←**” to confirm. At this time test force will be changed automatically according the confirmed scale accompanying with beeping.

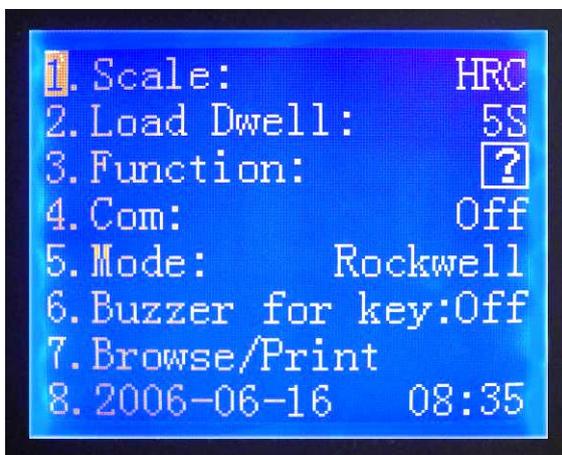


Figure 5.2.1

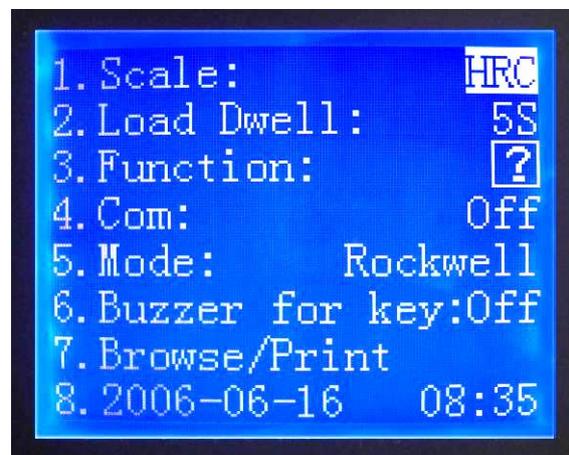


Figure 5.2.2

Press “**Setup**” key to return to figure 5.1.1; or press “**↕**” or “**↖**” key to reset the other parameters.

## 5.2.2 Load dwell setting

Load dwell refers to the duration of total test force (i.e. time of primary test force and main test force). For samples without continuous distortion with time after main test force has been loaded, the load dwell is normally set as 2~3s; for sample with continuous slowly distortion with time after main test force has been loaded, the dwell time is normally set as 6~8s; for sample with obvious distortion with time after main test force has been loaded, the holding time is normally set as 20~25s.

Press “**↕**” or “**↖**” key to move cursor to “2” in figure 5.2.1, press “**←**” key, then the cursor move to “5S” as figure 5.2.3. Press “**↕**” or “**↖**” key at this time to select the dwell time range from 2s~50s, then press “**←**” to finish the setting.

Press “**Setup**” key to return to figure 5.1.1; or press “**↕**” or “**↖**” key to reset the other parameters.

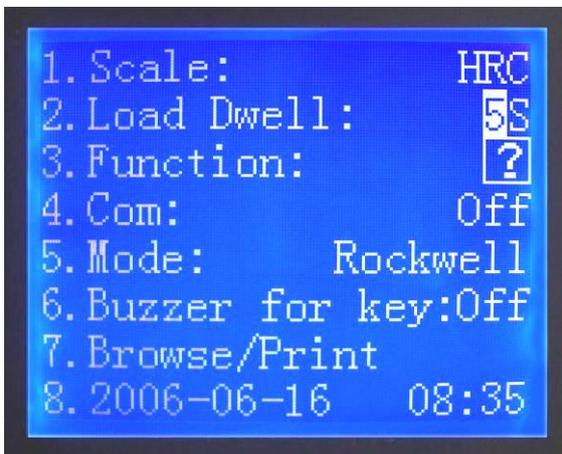


Figure 5.2.3

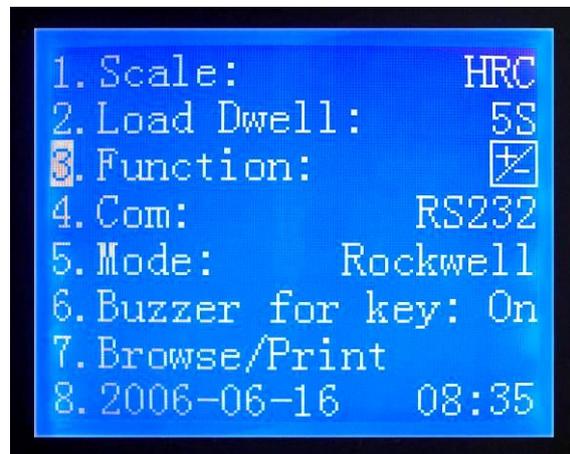


Figure 5.2.4

## 5.2.3 Auxiliary functions

The tester has four auxiliary functions, which can be used individually, multi selected or all selected. Press “**↕**” or “**↖**” key to move cursor to “3” in figure 5.2.1, press “**←**” key, then the cursor move to the position of “[?]” and change to “[☒]” as figure 5.2.4. Press “**↕**” or “**↖**” key at this time to select the desired auxiliary functions, then press “**←**” to conform and into next menu as 5.2.5~5.2.9. There four auxiliary functions marked as “[☒]”, “[Σ]”, “[⊞]”, “[∅]”, which represent limit setting, data statistics, scale conversion and curved surface correcting respectively.

### 5.2.3.1 Limit setting

Press “**↕**” or “**↖**” key to set the value of upper limit and the value of lower limit in the figure 5.2.5, then press “**←**” to confirm.

The upper limit and lower limit will be showed simultaneously with the displaying of measuring result each time after the function setting has been taken into effect. As figure 5.2.6, the testing

result is 59.9HRC, upper limit is reset as 62.0HRC, lower limit is 56.0HRC. If the result is beyond the limitation scope, warning on display, buzzing will send out at the same time.



Figure 5.2.5



Figure 5.2.6

### 5.2.3.2 Data statistics

The statistics for one group data is available; press “ $\Sigma$ ” or “ $\Phi$ ” key to determine the value of N (the applicable scope is 2~99) in figure 5.2.7; then press “ $\leftarrow$ ” to confirm.

The values of serial number n and N will be showed simultaneously with the displaying of measuring result each time after the function setting has been taken into effect. Refer to figure 5.2.6, 5 measurements will be performed totally, and the current measurement is the 2nd. In case of n=N, that is to say the last measurement had been completed, the tester will automatically calculate the average  $\bar{X}$ , standard deviation S, maximum (Max), minimum (Min) and the range R as figure 5.2.8 showing after the hand wheel had been unloaded by turning in anti direction.

Of which, the mean value, standard deviation and range can be calculated according to the following equation.



Figure 5.2.7



Figure 5.2.8

$$\bar{X} = \frac{1}{N} \sum X_i ,$$

$$S = \sqrt{\frac{1}{N-1} \sum (\bar{X} - X_i)^2}$$

$$R = \text{Max-Min}$$

Normally, the serial number will plus 1 after each measurement until the n is equal to N (i.e. all of the N measurements were finished), then begin with statistical calculation. In event of the current measurement required to be cancelled due to some reasons, press “↕” or “↘” key in the figure 5.2.6 when the “√” change to “×”, then unload (i.e. Lowdown the anvil). For this condition, n will not be added by 1, and the current measurement will not take part in the statistical calculation.

### 5.2.3.3 Scale conversion

The function can convert the measured Rockwell hardness value to other scales or strength. Such as changing the value of HRA scale into HBS, HBW, HV and HK value; changing the value of HRB scale into HB10, HB30, HV, HLD,  $\sigma_b$  and HK value; changing the value of HRC scale into HBS, HBW, HV, HLD,  $\sigma_b$  and HK value; changing the value of HRD scale into HV, HK, HB value; changing the value of HRE scale into HV, HK, HB value; changing the value of HRF scale into HV, HB value.

For instance, if we intend to convert the HRC value to HV value, press “↕” or “↘” key to move the cursor to “3. HRC—HV” in figure 5.2.9, and then press “←” to confirm.

The conversion value will be showed simultaneously with the displaying of measuring result each time after the function setting has been taken into effect. As figure 5.2.6, the hardness value measured is 59.9HRC, conversion value is 696HV. Each changing is performed within the applicable scope which changing is possible; “E” will be showed in case of the changing value beyond the scope.



Figure 5.2.9



Figure 5.2.10

### 5.2.3.4 Curved surface correcting

The testing results should be corrected if the surface of sample measured is the external surface of cylindrical part or spherical. Press “↕” or “↘” key to select cylindrical surface or spherical surface, then press “←” to confirm as figure 5.2.10.

After that, press “ $\uparrow$ ” or “ $\downarrow$ ” key to determine curvature radius or the diameter of sphere, and press “ $\leftarrow$ ” to conform finally.

The measuring result as well as correcting value will be given in the course of each measurement after the function setting has been taken into effect. Note: screen will display respectively testing value (the direct testing result without correcting) and correcting value. As figure 5.2.6, the measuring result is 59.9HRC and the correcting value is “+1.0” HRC.

**5.2.3.5** Press “**Setup**” key to return to figure 5.1.1; or press “ $\uparrow$ ” or “ $\downarrow$ ” key to reset the other parameters.

#### 5.2.4 Communication status setting

The tester is provided with series digital communication USB port (transmission rate 9600bps), which can be connected with external computer. After setting, test results of each time will be sent to external computer.

Press “ $\uparrow$ ” or “ $\downarrow$ ” key to move cursor to “4” in figure 5.2.1, press “ $\leftarrow$ ” key then the cursor move to “Off”. Press “ $\uparrow$ ” or “ $\downarrow$ ” key at this time, the optionals “Printer”、“USB”、“Off” will be appear in sequence. When the desired optional appears, press “ $\leftarrow$ ” to finish the selection.

Press “**Setup**” key to return to figure 5.1.1; or press “ $\uparrow$ ” or “ $\downarrow$ ” key to reset the other parameters.

#### 5.2.5 Buzzer for key

Press “ $\uparrow$ ” or “ $\downarrow$ ” key to move cursor to “6” in figure 5.2.1, press “ $\leftarrow$ ” key, then the cursor move to “Off”. Press “ $\uparrow$ ” or “ $\downarrow$ ” key to select the “On” or “Off” for the key buzzer, press “ $\leftarrow$ ” key to confirm finally.

Press “**Setup**” key to return to figure 5.1.1; or press “ $\uparrow$ ” or “ $\downarrow$ ” key to reset the other parameters.

#### 5.2.6 Browse through/print the track record

Press “ $\uparrow$ ” or “ $\downarrow$ ” key to move cursor to “7” in figure 5.2.1, then press “ $\leftarrow$ ” key. The latest 8 test results will display on the screen as figure 5.2.11. The serial number and time of the test are displaying simultaneity. There are 500 items of record in maximum. Press “ $\uparrow$ ” or “ $\downarrow$ ” key to scroll the items. The item of record which the cursor pointed can be printed by press “ $\leftarrow$ ” key.



Figure 5.2.11



Figure 5.2.12

Press “**Setup**” key to return to figure 5.1.1; or press “ $\uparrow$ ” or “ $\downarrow$ ” key to reset the other parameters.

### 5.2.7 Time setting

Press “ $\uparrow$ ” or “ $\downarrow$ ” key to move cursor to “8” in figure 5.2.1, press “ $\leftarrow$ ” key, figure 5.2.12 appears. Press “ $\uparrow$ ” or “ $\downarrow$ ” key to move cursor to “1” in figure 5.2.12, then press “ $\leftarrow$ ” key, press “ $\uparrow$ ” or “ $\downarrow$ ” to select the year, and press “ $\leftarrow$ ” key to confirm. The month, also the date, hour, minute and second can be reset in the same way.

Press “**Setup**” key to return to figure 5.1.1; or press “ $\uparrow$ ” or “ $\downarrow$ ” key to reset the other parameters.

## 5.3 Testing

### 5.3.1 The preload loading

Place the sample to be tested on the anvil, and rotate the hand wheel in clockwise to uplift the anvil as figure 5.3.1, showing the anvil moving course. Rotate the hand wheel smoothly until the anvil in figure reaches the end position as figure 5.3.2. Buzzer warning will be given out, then the rotating should be stopped at right.

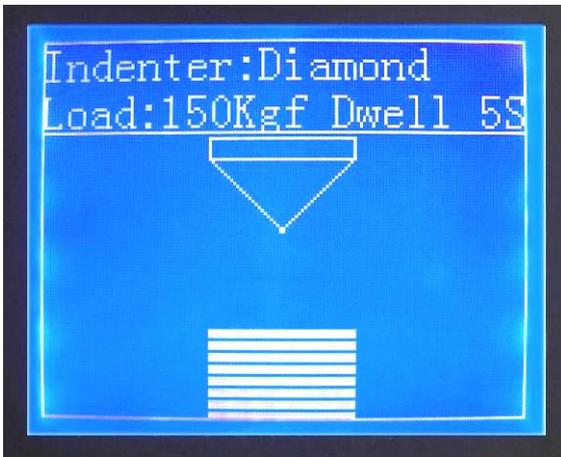


Figure 5.3.1

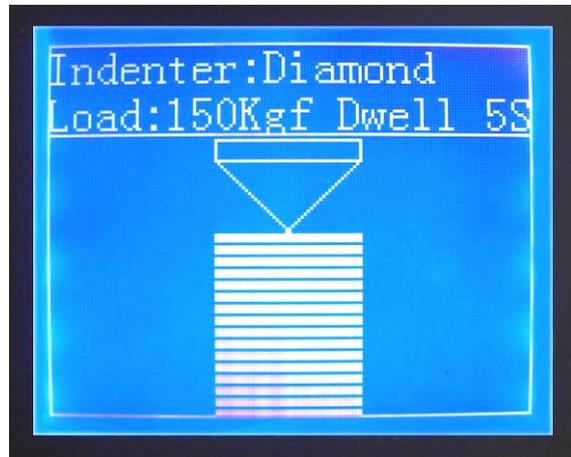


Figure 5.3.2

### 5.3.2 Automatic testing



Figure 5.3.3



Figure 5.3.4

After the primary test force loading, test will be performed automatically as follows: loading main test force, as figure 5.3.3; holding with dwell time counting down after loading, refer to figure 5.3.4. Finally, unloading is performed immediately when the dwell time has finished. Test results will be

showed on screen, refer to figure 5.2.6.

### **5.3.3 Unloading**

Rotate the hand wheel in anti-clockwise to lower the anvil, and the test force will be unloaded completely; the screen returns to figure 5.1.1, and all test parameters are stored for the next testing.

### **5.4 Shut down**

Remove the test force completely, and switch off the power supply. The power supply wires should be removed in case of idle for a long time.

## **6 Maintenance and attentions**

**6.1** When the hardness tester is to be carried about, the weights and the indenter must be removed. If it is to be transported for a long distance, the original packaging must be restored.

**6.2** When perform any adjusting and examining in the machine, the power supply must be cut off.

**6.3** When assemble and disassemble the indenter, much attention should be paid to ensure the tip avoid damage and contaminating, and the mounting surface should be clean without any foreign matters. The indenter should be removed to store carefully in case of idle for a long term; and rust protection measures are necessary.

**6.4** The surface of anvil and standard hardness block should be clean without contamination and scratch, scoring and bruising; coating rust protection oil is necessary when store.

**6.5** Dustproof and corrosive medium prevention should be considered in daily operating environment. Regular rust prevention measures should be adopted in moist area.

**6.6** The leadscrew of the anvil should be lubricated periodically. Apply a few drops of light machine oil, then run the leadscrew up and down a few times to distribute the oil. Remember not to drop too much oil.

**6.7** Please don't disassemble or adjust any fixed-constructional parts by yourself when abnormal phenomena present. You may have the servicing department of supplier to deal with it.