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**BOWERS METROLOGY GROUP****Testing Instruments**

Manual Portable Hardness Tester RANGEMASTER PLUS



Partners in Precision

10. TECHNICAL DATA

Hardness scale	Testing range	Resolution	Tolerance**
Vickers	35 - 1000	1	± 15
Brinell	100 - 500	1	± 15
Rockwell B	30 - 100	0.1	± 3
Rockwell C	20 - 70	0.1	± 2
Tensile strength	255 - 1999 N-mm ²	1	± 15
Shore scleroscope	24 - 97	1	± 2

** Average reading against calibrated hardness test block

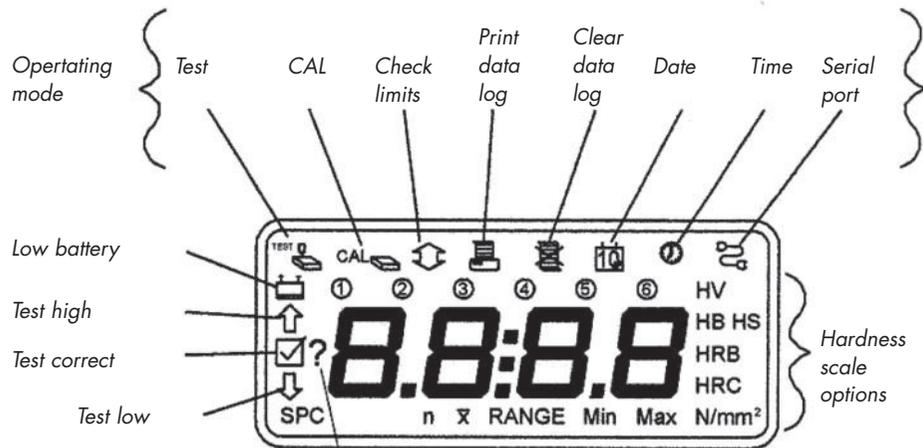
- Memory capacity 400 readings
- Output RS232 serial port
- Battery 9V PP3 (Alkaline)
- MAINS: AC-DC adaptor output 9VDC 100mA 0.9VA
fitted with mini DIN 8-pin plug.
- Weight (in case) 3Kg
- Operating temperatures -5°C to 35°C



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1. DISPLAY FEATURES



Query
When this icon appears it allows the option to be confirmed or cancelled. Press set to confirm.
Press cancel to exit without change.

1.1 CONTROL BUTTON FUNCTIONS

- | | |
|---------------|--|
| MODE | A. Step through the operating modes. |
| - | A. Cancel the previous reading.
B. Change check limits, date, time and calibration value. |
| + | A. Recall the previous reading.
B. Change check limits, date, time and calibration value. |
| SET/
RANGE | A. Select the hardness scale required.
B. Set the mode value or parameter in the memory. |

9. CARE OF INSTRUMENT

1. The Rangemaster is a precision instrument and should be treated as such so that it remains in good working order.
2. When the Rangemaster is not in use, it should be kept in the case provided.
3. The indenter and datum bush should always be kept clean to ensure correct results.
4. Oil or any other lubricant should never be applied to any part of the Rangemaster.

9.1. REPLACING THE DIAMOND INDENTOR

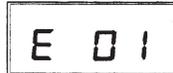
1. Depress the base and undo the datum bush locking screw.
2. Remove the datum bush using the adjuster key provided.
3. Place the adjuster key over the indenter and locate the two pins into the slots in the indenter.
4. Completely unscrew the indenter.
5. Screw the new indenter in until it is tight.
6. Refit the datum bush and refer to section 5 "Setting the datum bush".

8. FAULT DIAGNOSIS

Problems	Causes	Remedies
Inconsistent readings	1. Indentor chipped 2. Datum bush damaged 3. Datum bush loose 4. Surface finish	1. Replace with a new indentor 2. Replace with a new datum bush 3. Tighten the locking screw and reset the datum bush 4. Prepare surface (see "using tester by hand")
Low readings or no readings obtained	1. Indentor chipped 2. Indentor is not protruding through the hole in the datum bush	1. Replace with a new indentor 2. Reset the datum bush
Tester will not turn on	1. Flat battery	1. Replace the battery or use with a power supply unit
Tester difficult to calibrate	1. Broken indentor 2. Datum bush damaged 3. Well used calibration test block	1. Replace with a new indentor 2. Replace with a new datum bush 3. Purchase a new test block

8.1 COMMON ERROR MESSAGES

If an internal fault occurs, the Rangemaster may display an error number. If this occurs press cancel to clear the error message. The Rangemaster will reset and the fault should be cleared. If the error occurs repeatedly, note the error number and contact your dealer for assistance.



- E01: Calibration factor out of range =>2
- E02: Calibration factor out of range <=0.5
- E03: SPC series more than 99 readings

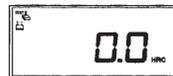


If either of these errors are displayed then the test block/component being tested has a hardness outside the selected hardness scale (see technical data) or the datum bush has been over/under adjusted (see adjustment).



8.2 LOW BATTERY

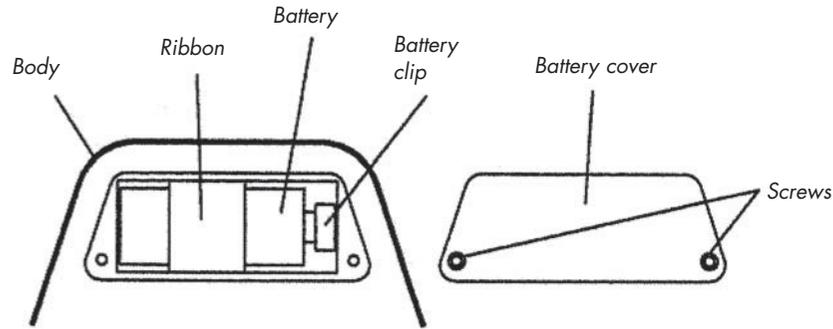
When the battery has reached the end of its life, the low battery icon will be displayed. The battery should be replaced as soon as possible to ensure accurate results. The Rangemaster uses one PP3 9V battery.



2. USING THE TESTER BY HAND

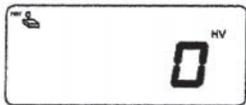
- When working on a bench or table ensure there is no "spring" otherwise low readings will result.
- The diamond indentor penetrates to a maximum of 0.127mm. Therefore the surface of the item to be tested must be smooth and free from toolmarks as these can result in false readings. A surface finish better than 0.4 µm (16") is recommended. The surface of castings or metals with scale should be prepared using fine emery cloth or similar. The size of the prepared area need only be large enough for the datum bush contact.
- Do not take more than one reading in the same place. Four to five readings should be taken on each test specimen to achieve a more accurate hardness value.
- The diamond is a 100° cone and rapid downward pressure can fracture the point.
- Always apply vertical pressure, a side slip will damage the diamond.
- Small circular parts should be held in a vee block when tested and large circular parts should not be allowed to roll when pressure is applied.
- Always test on the centre line of circular test pieces. "Off centre" tests will give incorrect readings and may result in damage to the diamond indentor.

3. GETTING STARTED AND SWITCHING ON



Installing the battery

1. Remove the cover retaining screws on the underside of the head.
2. Remove the battery cover and withdraw the battery clip.
3. Plug the clip onto the battery and check display reads as below.



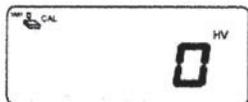
Initial Rangemaster display

4. Wrap the ribbon around the battery, place in battery compartment and replace battery cover and screws.

3.1 SWITCHING ON

Press the Set/Range button to switch on. The initial Rangemaster display will be active and the Rangemaster will be ready to take a test.

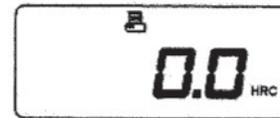
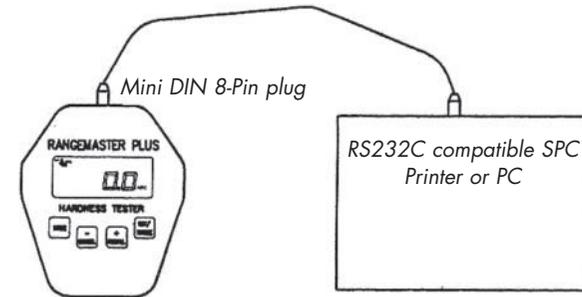
The Rangemaster switches off after two minutes if not used.



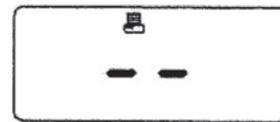
Note:
CAL appears after calibration

7.11 PRINT THE DATA LOG

The Rangemaster can be used with most RS232C compatible SPC and data collection systems.



1. Connect as per diagram.
2. Check serial port settings comply with printer or PC to be used.
3. Press Mode to display print icon.
4. Press Set/Range to start printing.
5. Display shows busy (-) whilst printing and reverts to 0 when printing is finished.



Note:
Do not plug into computer or printer without a battery fitted.

1. Press Mode button until clear log icon is displayed.
2. Press Set/Range and the query icon will appear.
3. Press Set/Range again and the log is cleared.
4. The busy icon is displayed until the log is cleared, the unit will revert to the date icon showing.

The data log will hold 400 test results. When the data log is full a message is displayed. Press cancel to clear the message, the data log must be cleared before anymore tests can be taken (see clearing the log).

7.10 SET THE SERIAL PORT

1. Press Mode to select the serial port icon.
2. Use the +/- and Set/Range buttons to select the appropriate settings.

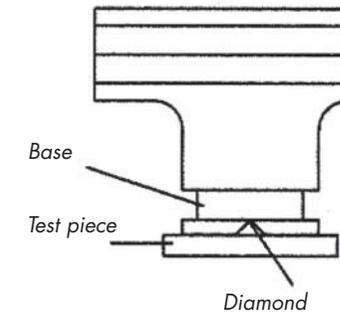
	Option 1	Baud rate 600, 1200, 2400, 4800, 9600
	Option 2	Data bits 7 or 8
	Option 3	Parity bit Odd (O), even (E), or none (N)
	Option 4	Stop bits 1 or 2
	Option 5	Handshaking None (-), software (S), or hardware (H)
	Option 6	Lines per page 10 - 99

4. TAKING A TEST ON THE TEST BLOCK

It is essential that all tests are taken on a firm base otherwise a low reading will result.



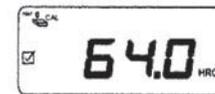
1. Stand comfortably with your arms directly over the tester. Take a firm hold of the hand grip and push down slowly until you feel the diamond touch the test block.



2. Continue the pressure until the diamond penetrates the surface of the test block and the Rangemaster reaches a physical stop. Excessive pressure is unnecessary.

3. Hold for two or three seconds as the bar counts down until a reading is displayed and then release. The reading will be held for five seconds on the display.

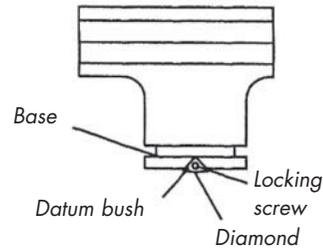
Note: Invalid if bar sequence is not completed.



4. Check the reading against the test block value, it should be within +/-2Rc. If the reading is out then the datum bush should be adjusted (see setting datum bush).

5. SETTING THE DATUM BUSH

1. Check diamond is not damaged (use 10x magnification).
2. Clear calibration factor:
 - Select CAL mode
 - Press Set/Range button twice (icon 1 will be displayed).
 - Press Cancel button to clear calibration factor.
3. Take a test on the hardest test block.
4. Check test result against block value if test result differs by more than ± 2 HRC points, then adjust datum bush as follows.
5. If test result is below block value, undo locking screw and turn adjuster bush clockwise using adjuster key. Tighten locking screw* and take test again.
6. If test result is above block value, undo locking screw and turn adjuster bush anti-clockwise using adjuster key. Tighten locking screw* and take test again.
7. Repeat adjusting procedure until test result matches block value ± 2 HRC.
8. Change the scale and take a test on the softest block. The reading should be within ± 15 HV or ± 4 HRB. If the Rangemaster is correct, then calibrate. If the Rangemaster is incorrect, then contact your dealer.



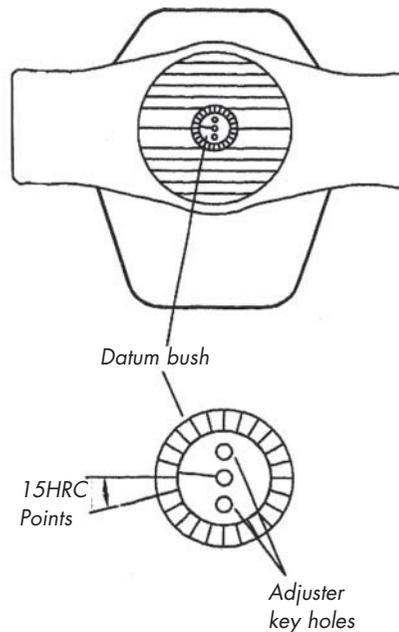
Note *:

Do not over-tighten locking screw.

As a guide to adjusting, if you move the adjuster bush the equivalent of 1 increment it will adjust the reading by approximately 15 HRC points.

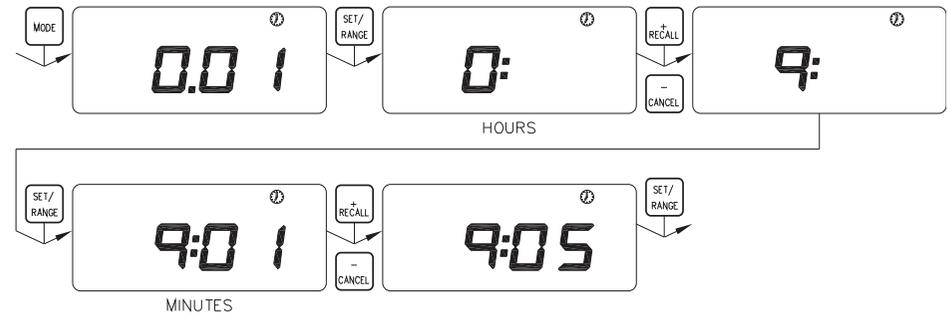
IMPORTANT:

1 increment = 15HRC point



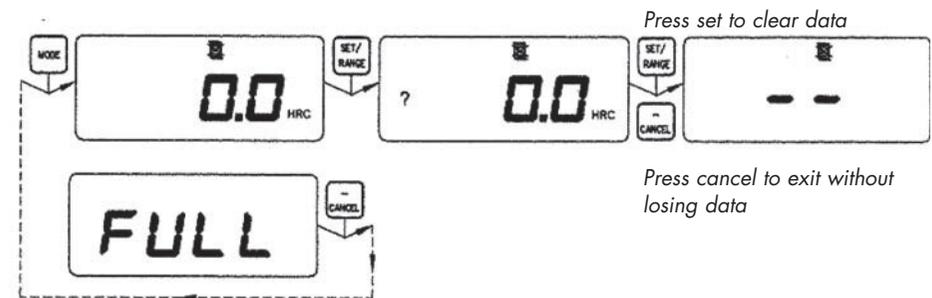
1. Press Mode button to select date icon.
2. Press Set and the date is shown on the left of the display.
3. Press +/- to alter the date and then press Set.
4. The month is now shown on the right side of the display.
5. Press +/- to alter the month and then press Set.
The date is now set.

7.8 SET THE TIME

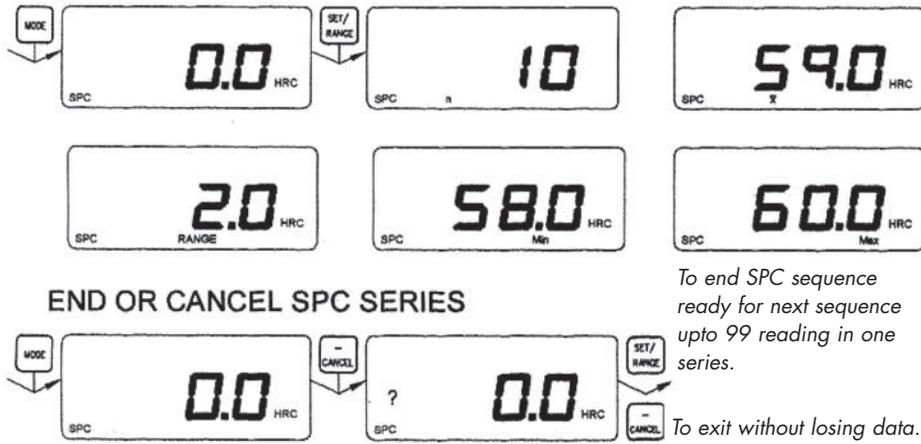


1. Press Mode button to select time icon.
2. Press Set and the hours are shown on the left of the display.
3. Press +/- to alter the hours and then press Set.
4. The minutes are now shown on the right side of the display.
5. Press +/- to alter the minutes and then press Set.
The time is now set.

7.9 CLEAR THE DATA LOG

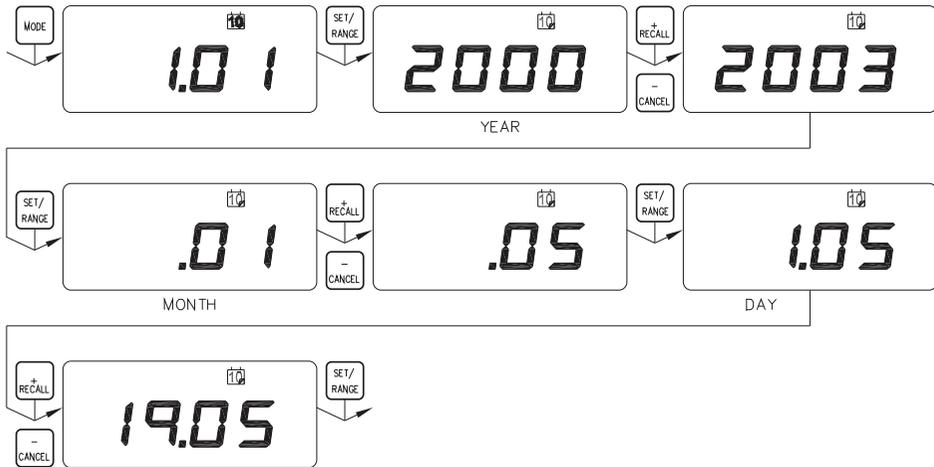


7.6. SPC FUNCTIONS



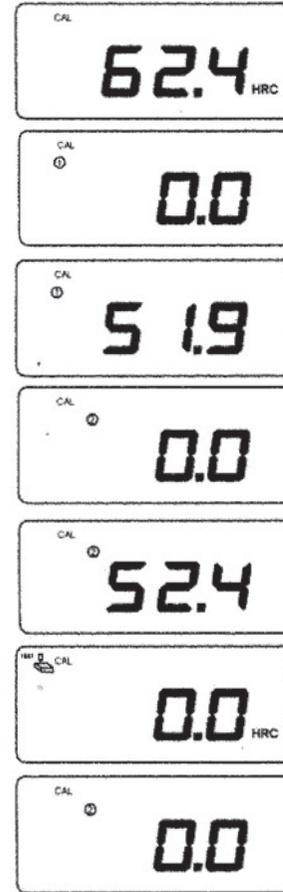
Note: The log is cleared automatically when the calibration, the range or the limits are changed.

7.7 SET THE DATE



6. CALIBRATING THE RANGEMASTER

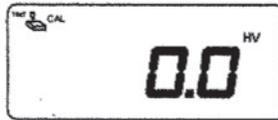
The calibration facility must only be used to make small adjustments to compensate for temperature, material characteristics, etc. Repeated use of calibration without setting the datum bush may result in incorrect results.



1. Carry out datum bush setting procedure.
2. Select CAL mode.
3. Enter test block value using +/- button and press Set/Range to accept the value.
4. The option 1 icon is now displayed and indicates first calibration test to be taken. Take test on test block in the usual way.
5. A percentage movement value is displayed for 5 seconds.
6. The option 2 icon is now displayed and indicates second calibration test to be taken on unused area of same block.
7. A percentage movement value is displayed for 5 seconds.
8. The calibration factor is then calculated and the reading returns to test mode with a zero reading if everything is correct.
9. If the option 2 icon remains then repeat test (from step 6 above).
10. Take a test on a softer block.
11. The reading on the softer block should be within +/-1.5HV or +/-4HRB. If the Rangemaster is correct then use as normal. If the gauge is incorrect then re-calibrate. If it still fails to calibrate then see fault finding section.

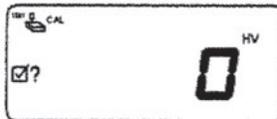
7. How do I

7.1 SELECT A HARDNESS SCALE



1. In test mode press the Set/Range button until the required scale is displayed.

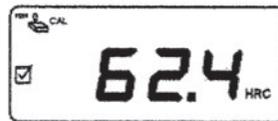
7.2 CANCEL A RESULT



In test mode:

1. Press the Cancel button.
2. The query icon will appear to confirm that the result should be cancelled.
3. Press the Set/Range button to cancel. Pressing any other button will abort the cancel function.

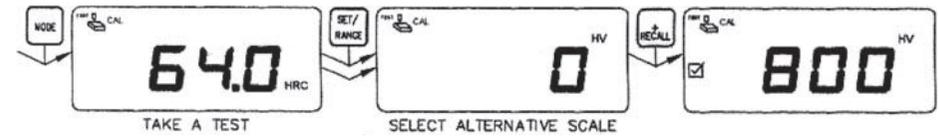
7.3. RECALL THE LAST RESULT



In test mode:

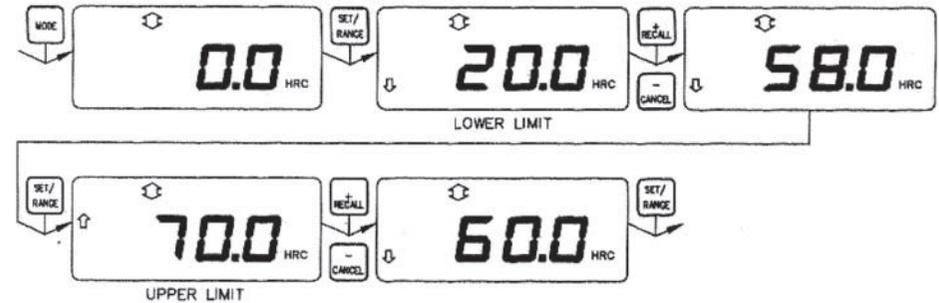
1. Press the Recall button and the last result will appear in the display for a few seconds before the display returns to test mode.

7.4 CONVERT TO A DIFFERENT SCALE



1. Take a test for example in HRC.
2. Press Set/Range to select the required scale, for example HV.
3. Press Recall button and the HRC result will be converted to HV.

7.5. SET THE CHECK LIMITS



1. Press Set/Range to select the hardness scale for which the limits are to be set.
2. Press Mode button until check limits icon is displayed.
3. Press Set/Range and the lower limit is displayed.
4. Press +/- button until required limit is reached and press Set/Range.
5. The upper limit is now displayed press +/-button until required limit is reached.
6. Press Set and the limits are entered and set.