

HARDNESS TESTER ASTM RATED—PEN STYLE

USER'S MANUAL



EMHT40

Please read this manual carefully and thoroughly before using this product.

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INTRODUCTION

The EMHT40 is a pen-style instrument that uses the Leeb testing method to measure the hardness of any metal or surface for a wide variety of industrial purposes. The Leeb method is notable for its accuracy, wide measuring range and operating simplicity.

Typical applications for the EMHT40 include measuring the surface and coating hardness of installed machines and components, die molding surfaces and bearings. Up to 1250 test results can be stored in the EMHT40's memory and ported to a PC for display as an Excel table or graph.

Leeb hardness testing produces so-called Leeb hardness values for a target metal (the work piece). To measure hardness, the user cocks a spring-loaded, pen-shaped plunger and squeezes a trigger at one end of the instrument to fire the plunger (the impact device) against the work piece at the other end. A permanent magnet close to the work piece senses the impact and generates two voltages: one proportional to the plunger's impact velocity and the other proportional to the velocity with which the plunger rebounded from the work piece.

To determine the target's Leeb hardness value—a parameter designated HL—an algorithm within the EMHT40 divides the voltage representing the plunger's rebound velocity by the voltage representing its impact velocity and multiplies by 1000. The following formula is used for the computation:

$$HL=1000 \times (V_b/V_a)$$

where V_b is the voltage produced during the rebound of the impact device and V_a is the voltage produced during the impact of the impact device.

Leeb hardness values (HL) can be converted to values using other hardness units such as HV, HRC, HRB, HB and HS. The EMHT40 can also display readings using several of these hardness units. However, to maintain the accuracy of measurements all hardness values must describe not just the testing method but the type of impact device as well.

For example, a hardness value of 510 on the Leeb scale determined by using the "D" type tungsten-carbide impact device provided with the EMHT40 would be described as 510HLD.

KEY FEATURES

- Conforms to ASTM A 956
- Compact, easy to use and reliable
- Displays minimum, maximum and average values
- Wide measuring range, with display of hardness values in any of the following units: Leeb HL, Rockwell HRB and HRC, Vickers HV, Brinell HB and Shore HS
- Impact device works at any angle, even upside down
- 1250 reading internal memory and USB cable for interfacing to a PC

- 2-minute Auto Power Off
- 2-year limited warranty

WHAT'S IN THE PACKAGE

The EMHT40 comes in a hard plastic carrying case inside a cardboard box. Inside the case are:

- The pen-style EMHT40, incorporating a "D" type impact device.
- A standard hardness test block with a nominal hardness value of 777HLD.
- A cleaning brush and a conventional support ring in a Ziploc bag.
- An 110VAC adaptor with an output of 3.7VDC output available from a full-size USB jack.
- A cable with a full-size USB plug at one end and a mini-USB plug at the other. When used to connect the EMHT40 to a PC, the cable trickle-charges the Lithium-ion battery that powers the tester.
- A mini-disc containing 1) a program for displaying the contents of the EMHT40's memory on a PC, 2) drivers for Windows8 (64- and 32-bit), Windows7 (64- and 32-bit), Windows Vista (64- and 32-bit) and WindowsXP, and 3) installation and operating instructions for the program and drivers

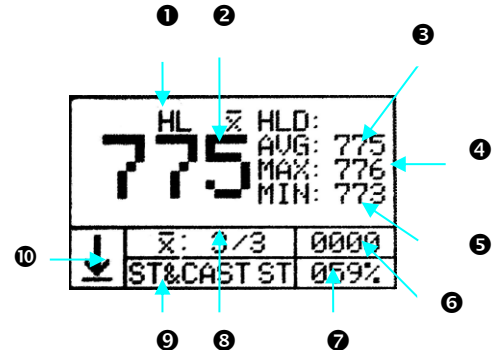
- This user's manual

PRODUCT OVERVIEW

The two following images show a typical EMHT40 display and the multiple functions provided by the three-button keypad on the bottom of the unit. Familiarize yourself with the position of all indications and the functions of the controls before moving on to the Setup Instructions and Operating Instructions.




Display

- ① Hardness scale
- ② Measured value
- ③ Average value
- ④ Maximum value
- ⑤ Minimum value



- ⑥ Memory location
- ⑦ Remaining battery charge
- ⑧ Number of measurements used for averages
- ⑨ Material
- ⑩ Direction of impact

Keypad

- ①  On/Off/Save Setting
- ②  Select/Move/Delete
- ③  Select/Set/Change display style



SETUP INSTRUCTIONS

The “D” type impact device built into the EMHT40 will provide optimal results for work pieces with a surface roughness of 2 μ m.



A work piece should not be tested: 1) If its temperature is above 176°F (80°C); 2) It is within a strong magnetic field; or 3) It is less than 0.12 in. (3mm) thick or has a surface-hardened layer thinner than 0.03 in. (0.8mm).

Work pieces weighing more than 11 lb. (5kg) require no support.


Work pieces weighing between 4.4 and 11 lb. (2 and 5kg), as well as work pieces with protruding parts or thin walls, should be anchored to a solid support to prevent them from moving or flexing as a result of testing.

Work pieces weighing less than 4.4 lb. (2kg) should be tightly attached to a non-yielding support such as a heavy base plate.

Work pieces with a cylindrical or spherical inside or outside surface radius of less than 1.18 in. (30mm) require the use of the included support ring or a non-conventional support ring. The Appendix illustrates and describes several key parameters of 12 support rings in common use.

To power on the EMHT40, press the  button. The typical display shown in the Product Overview section will appear. **To power off the EMHT40**, press and hold the  button for at least 3 seconds.







NAVIGATING THE MENUS

Briefly pressing (but not holding) the  button opens the EMHT40's main menu screen of 10 items.

- 1. MEASUREMENT**
- 2. AVG. TIMES**
- 3. MAT. & SCALE**
- 4. TOLERANCE**
- 5. LOCATION**
- 6. MEMORY**
- 7. DATA OUTPUT**
- 8. CALIBRATION**
- 9. CONTRAST**




10. DEFAULT

Although it is not necessary to adjust the settings of all 10 items if you do not intend to store your measurements or port them to a PC, it is good practice to do so to understand the options available to you:

To select any item to view or change its setting, use the  and  buttons to move up or down and highlight its line. Then briefly press (but do not hold) the  button. In most cases, selecting a main menu item displays either: 1) a default value that can be adjusted by using the  and  buttons; or 2) a sub-menu of options that can be navigated using the same buttons. **To save any displayed setting** (whether you have changed it or not), briefly press the  button. Doing so resumes display of the main menu screen.





Hint: Try not to take too much time to make your menu selections. The EMHT40 has an Auto Power Off function that will automatically power off the unit during any 2-minute period during which no buttons are pressed.



1. Selecting **1. MEASUREMENT** displays the full measurement screen on the LCD.

2. Selecting **2. AVG. TIMES** displays the text **AVERAGE TIMES** over a number representing the number of readings used to calculate an average value. Choices range from 2 (the default) to 8. In most cases, choosing 3, 4 or 5 readings yields good results. Pressing the  button to save an "number of times" setting resumes display of the main memory screen.
3. Selecting **3. MAT. & SCALE** calls up two sub-menus in sequence. The first sub-menu lists nine options for the work piece material: **1. ST. & CAST STEEL, 2. CWT. STEEL, 3. STAINLESS ST., 4. G. CAST IRON, 5. N. CAST IRON, 6. CAST ALUMINUM, 7. BRASS, 8. BRONZES** and **9. COPPER**.
Pressing the  button to save a material setting opens up a second sub-menu of six hardness scale (unit) options: **1. HL, 2. HRC, 3. HRB, 4. HB, 5. HS** and **6. HV**.
Pressing the  button to save a hardness unit resumes display of the main memory screen.
4. Selecting **4. TOLERANCE** displays an upper and a lower limit for measured hardness values using the selected scale. Whenever a measurement is lower than the lower limit or higher than the upper limit, **L** or **H** will appear on the measurement display.


The first value available for viewing or changing is the upper hardness limit. The small “up” arrow (see following screen shot) will first appear below the “thousands” digit on the **UPPER** line. If the thousands digit is missing, that means the upper hardness limit is less than 1000.



TOLERANCE
LOWER. 100 HL
 ▲
UPPER. 900 HL



To change the thousands digit (including changing it from an invisible zero), press the  button as many times as necessary to reach the desired value. You can only *increase* the digit’s value by one per button press; to change the value from 6 to 5, for example, you must 1) press the  button three times to reach 9; 2) press it one more time to reach 0, and then 3) press the  button another five times to go from 0 to 5. When you have set the thousands digit to the desired value, press the  button to save the setting. Doing so shifts the “up” arrow to right to the “hundreds” digit of the

upper hardness limit. As with the thousands digit, you must press the  button as many times as necessary to reach the desired value of the hundreds digit. Then press the  button to save the hundreds digit setting and shift the arrow to the “tens” digit of the upper hardness limit.




Repeat the above procedure for the tens and units digits of the upper hardness limit.




Note that when you press the  button to save the units digit of the upper hardness limit, the up arrow moves down, below the thousands digit of the **LOWER** line.




Repeat the procedure to set all four digits of the lower hardness limit. Note that when you press the  button to save the units digit of the lower hardness limit, the up arrow moves up to its initial position, below the thousands digit of the **UPPER** line. At that point, if you are satisfied with the settings of both hardness limits, press the  button to resume display of the main memory screen.

5. Selecting **5. LOCATION** calls up a display similar to the **TOLERANCE** screen, but with a 4-digit value below the text **SET LOCATION**. By alternating presses of the  button (to view or change the value of each digit) with presses of the  button (to save settings and select the next digit in turn), you can designate the number of the memory location to store your next saved measurement. When you are satisfied with the




memory location setting, press the  button to resume display of the main memory screen.




6. Selecting **6. MEMORY** calls up a screen with the text **OUTPUT** over three options: **1. SEQ. STORE**; **2. BATCH STORE** and **3. CLEAR MEMORY**. Use the  or  button to navigate to the desired option and then press the  button to select it.




Selecting **1. SEQ. STORE** calls up another screen with the text **SEQUENCE** over two options: **1. AUTO STORE** and **2. CLOSE STORE**. Use the  or  button to highlight the desired method of storing measurements (automatic or manual). Then press the  button to select it and resume display of the main memory screen.




Selecting **2. BATCH STORE** calls up another screen with the text **BATCH STORE** over two options: **BATCH 1. TO 12.** and **SELECT BATCH 1.** Use the  or  button to change the value on the lower line from the default value of 1 to any number from 1 to 12. Then press the  button. The display will show the text **PLEASE WAIT** as the EMHT40 assembles stored measurements into a batch with the assigned number. When

the batching process is finished, the unit will automatically resume display of the main memory screen.

Selecting **3. CLEAR MEMORY** calls up a display with the text **CLEAR ADDRESS** over two 4-digit values. By alternating presses of the  button (to view or change the value of each digit) with presses of the  button (to save settings and select the next digit in turn), you can designate the first and last numbers of a sequence of memory locations that you wish to erase. When you are satisfied with the memory location settings, press the  button. The EMHT40 will respond by showing the text **PLEASE WAIT** as the EMHT40 deletes the data in the specified memory location(s). When the deletion process is complete, the unit will automatically resume display of the main memory screen.




7. Selecting **7. DATA OUTPUT** calls up a screen with the text **OUTPUT** over two options: **1. SEQUENCE** and **2. BATCH**. Use the  and  button to navigate to the desired option and then press the  button to select it.




Selecting **1. SEQUENCE** calls up a screen with the text **SEQUENCE** over two lines: **START** and a 4-digit value, and **FINISH** and a 4-digit value. By alternating presses of the  button (to view or change the value of each digit) with presses of the  button (to save settings and select the next digit in turn), you can designate the number of the starting and ending memory locations to involve in batch data transfers to a PC. When you are satisfied with the memory location settings, press the  button to resume display of the main memory screen.

Selecting **2. BATCH STORE** calls up another screen with the text **BATCH OUT** over two options: **BATCH 1. TO 12.** and **SELECT BATCH 1.** Use the  or  button to change the value on the lower line from the default value of 1 to any number from 1 to 12, representing the number of the batch to be transferred to a PC. Then press the  button. The unit will automatically resume display of the main memory screen.



8. Selecting **8. CALIBRATION** calls up a screen with the text **CALIBRATION** over three lines: **CAL. RANGE, AVG. DATA** and **CAL. DATA**.

CALIBRATION
CAL. RANGE ±99
AVG. DATA 000
CAL. DATA -27

The small up arrow will initially be under the + or – sign to the left of **CAL. DATA**. By alternating presses of the  button (to change the plus sign to a minus sign, or vice-versa) with presses of the  button (to change the values of the two **CAL. DATA** digits), you can adjust the value of **CAL. DATA** until the **CAL. RANGE** and **AVG. DATA** values compensate for consistent measurement errors caused by normal wear of the impact device. When you are satisfied with the calibration adjustment, press the  button to resume display of the main memory screen.

9. Selecting **9. CONTRAST** calls up a screen with the text **CONTRAST** over a bar graph. Press the  button to increase the contrast, or the  button to decrease it. When you are satisfied with the contrast setting, press the  button to resume display of the main memory screen.
10. Selecting **10. DEFAULT** restores all settings to factory-default values.

OPERATING INSTRUCTIONS

To power on the EMHT40, press the  button. The typical display shown at left below will appear. To power off the EMHT40, press and hold the  button for at least 3 seconds.

Hint: Pressing the  button with the measurement screen on the LCD changes the display style from



to



Note that this alternate display style sacrifices details (at the bottom of the LCD) for a larger readout.

Before making a measurement, be sure the work piece complies with the weight, shape, thickness and temperature guidelines detailed in the Setup Instructions.

To make a measurement:

1. Remove the black plastic collar from the shaft of the impact device.
2. Cock the plunger by sliding the top half of the shaft down toward the LCD.
3. Place the black plastic end of the unit on a flat part of the work piece. If the work piece has a cylindrical or spherical inside or outside surface radius of less than 1.18 in. (30mm) use the included support ring or acquire or devise a non-conventional support ring as detailed in the Appendix.
4. Press the silver button at the end of the impact device shaft.
5. Read the measured hardness on the LCD.

INTERFACING WITH A PC

The EMHT40 comes with a mini-disc containing 1) a program for transferring the contents of the EMHT40's memory to a PC for display, 2) drivers for the Windows8 (64- and 32-bit), Windows7 (64- and 32-bit), Windows Vista (64- and 32-bit) and WindowsXP operating systems, and 3) installation and operating instructions for the program and drivers.

The disc contains several folders and files containing the instructions needed to install the drivers and to install and operate the program. Use the included USB cable to tether the EMHT40 to the PC via the mini-USB jack on the top of the instrument (above the LCD).

You may need to reassign the numbers of your PC's COM ports to enable the PC and the EMHT40 to communicate using the USB cable.

SPECIFICATIONS

Measurement Accuracy: $\pm 0.5\%$

Display Size, Type: 112×64 pixel LCD

Internal Memory Capacity: 1250 readings

Auto Power Off Trigger: 2 minutes of control button inactivity

Power Source: 3.7V rechargeable Li-ion-battery

Dimensions: 6.2 x 1.6 x 1 in. (158 x 41 x 26mm)

Weight: 4.2 oz. (120g)

OPERATING & MAINTENANCE TIPS

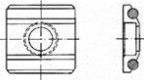


The EMHT40's battery should be kept charged and charged frequently to avoid damaging it. Using the AC adaptor, it takes about 4 hours to fully charge the battery from a completely discharged state. Trickle-charging the battery from a PC's USB port takes longer.

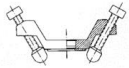
Over time, the tip of the impact body will abrade and reduce the EMHT40's measurement accuracy. Whenever measured values seem unusually large, calibrate the instrument by following the procedure described on pages 16 and 17.

APPENDIX: Non-conventional support rings

No.	Code	Type	Sketch	Remarks
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1	03-03.7	Z10-15		For cylindrical outside surfaces R10 to R15
2	03-03.8	Z14.5-30		For cylindrical outside surfaces R14.5 to R30
3	03-03.9	Z25-50		For cylindrical outside surfaces R25 to R50
4	03-03.10	HZ11-13		For cylindrical inside surfaces R11 to R13
5	03-03.11	HZ12.5-17		For cylindrical inside surfaces R12.5 to R17
6	03-03.12	HZ16.5-30		For cylindrical inside surfaces R16.5 to R30
7	03-03.13	K10-15		For spherical outside surfaces SR10 to SR15
8	03-03.14	K14.5-30		For spherical outside surfaces SR14.5 to SR30
9	03-03.15	HK11-13		For spherical inside surfaces SR11 to SR13
10	03-03.16	HK12.5-17		For spherical inside surfaces SR12.5 to SR17

11	03-03.17	HK16.5-30		For spherical inside surfaces SR16.5~SR30
12	03-03.18	----		For cylindrical outside surfaces with a radius adjustable from R10 to ∞