

SHOREdigital



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1 Introduction

In case of the Shore hardness test, an impression body with exactly defined geometry is pressed into the test material under stipulated conditions, and the penetration depth measured. The penetration depth depends on the modulus of elasticity and the visco-elastic properties of the material.

The shape of the impression body, the force applied on it and the duration of its application, provides the displayed Shore hardness numbers. Therefore only Shore hardness testers which comply with the relevant standards should be employed.

The maximum penetration depth in case of Shore A and Shore D is (2.5 ± 0.02) mm. 2.5 mm corresponds to 100 Shore scale divisions.

The force F applied on the penetration body indicates a linear curve in the range $0 \text{ mm} \leq h \leq 2,5 \text{ mm}$:

Shore A : $0.55 \text{ N} \leq F \leq 8.065 \text{ N}$

Shore D : $0 \text{ N} \leq F \leq 44.5 \text{ N}$

In case of the hardness test on plastics and rubber, small deviations of the test conditions from the nominal conditions can influence the precision considerably, unlike the hardness test on metals. These are e.g.

- Deviations from the nominal testing temperature
- Deviations from the nominal duration of action of the penetrating body (particularly in case of thermoplastics)
- Humidity

2 Fields of application

The digital Shore durometers enable the determination of the hardness of test specimens and components made from elastomers.

Shore A: Soft rubber, soft PVC, neoprene, silicone
Shore D: Ebonite, acrylic glass, polystyrol, stiff thermoplastics, hard plastic materials

2.1 Standardized measurement methods

2.1.1 Applicable standards

The digital Shore durometers correspond to the standards DIN 18898 DIN 7619-1(DIN 53505), DIN EN ISO 868 and ASTM d2240.

2.1.2 Recommended scale ranges

Recommended scale ranges In the VDI guidelines of the German Industrial Association VDI/VDE 2616 Sheet 2 and the indicated standards, it is recommended to employ only the following ranges:

Shore A : $10 \leq \text{Shore A} \leq 80$

Shore D : $30 \leq \text{Shore D} \leq 90$

Materials with Shore A hardness > 80 are to be tested effectively according to Shore D, and materials with Shore D hardness < 30 are to be tested according to Shore A.

2.1.3 Precision in practice

The set-adjusted hold time influences the result of the hardness measurement. If the hold time e.g. is shortened from the recommended 3s to 1s, higher hardness numbers are obtained. The difference can be 2 - 4 Shore units. On the other hand, a decrease of the hardness number is to be expected in case of an extension of the exposure duration from 3s to 15s. This effect is based exclusively on material properties.

In order to obtain comparable values, it is necessary to measure under similar conditions, e.g. with a hold time of 3 s and secured in the mount.

It is always appropriate to employ the average value from e.g. 5 individual measurements

2.1.4 Environmental conditions

The test should be carried out at $(23 \pm 2)^\circ\text{C}$. Measurements can also be carried out at other testing temperatures. However, these should then be indicated in the test report.

Also to be considered is the influence of the humidity content on the properties of many elastomers.

3 Operation

3.1 Equipment description

3.1.1 General view

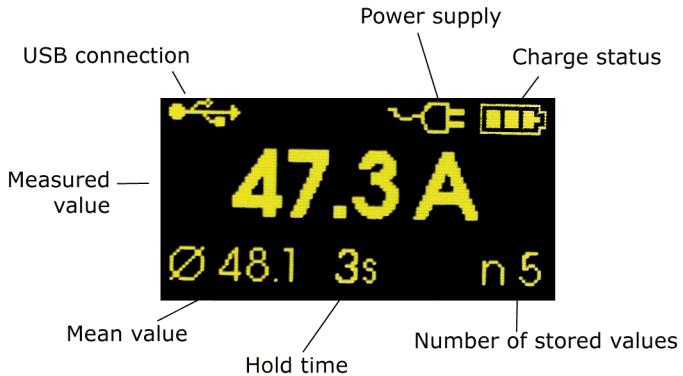


Illustration 1

- 1 – USB - Interface
- 2 – Display
- 3 – Keyboard
- 4 – 4 Mount fixing
- 5 - 5 Aluminum casing
- 6 - Placement surfaces

3.1.2 Display

After switching on, the main screen is displayed.



3.1.3 Power supply

The SHOREdigital has an operating time of approx. 8 hours. The charge status is displayed in the main window.

To charge the battery the Durometer can be connected via the USB interface either to the USB charging unit or to a PC (switched on).

If the Durometer is connected to a power source, the corresponding symbol is displayed in the main window. If the device is switched off while it is connected to a power source, the battery continues to charge and the corresponding symbols are indicated on the display. When the charging process has ended and the rechargeable battery is fully charged, the device switches off automatically and the display is blank.

3.2 Key functions

	Designation	Function
		Switching on/off of the device
	Function key FN key	<p>In the main window: Call menu</p> <p>In the menu: Display next menu item or return to the main window if the last menu item has been displayed.</p> <p>Other: Increase value.</p>
	CLR key	<p>In the main window: Deletion of the last measured value</p> <p>In the menu: Call menu item</p> <p>Other: Accept value and move insert mark to the right, or return to the main window if the insert mark is already completely to the right.</p>

3.3 Setting adjustments

3.3.1 Hold time / maximum value mode

In order to set-adjust the hold time, press the function key (FN) so often until "Adjust hold time" is indicated in the display. Then press the CLR key.

Now the currently set-adjusted hold time or "M" for the maximum value mode is displayed. With every press of the FN key, the hold time is increased by 1 second. If the maximum admissible hold time has been reached, "M" (maximum value mode) is displayed. If the FN key is

pressed another time, the minimum admissible hold time of 1 second is begun again.

If the required hold time is displayed (or "M" if a maximum value measurement is required), press the CLR key to accept the value and to return to the main window.

3.3.2 Time/date

In order to set the time and date, press the function key (FN) so often until "time / date" is indicated in the display. Then press the CLR key. Now the current time is displayed in the format "HH:MM".

With the FN key, you can increase the digit at the insert mark (digit is represented negated). When the maximum digit has been reached, it is begun again at 0.

Press the CLR key in order to move the insert mark to the next digit. If the insert mark is already completely to the right, the value is accepted with the next press of the CLR key.

Following the setting of the time, the date can be entered. The operation is implemented analogous to the time setting.

When the time and date entry has ended, the main window is displayed again.

3.3.3 Language

In order to set the language, press the function key (FN) so often until "Adjust language" is indicated in the display. Then press the CLR key.

The currently set language is displayed. With the FN key, the possible languages can be run through. Press the CLR key when the required language is displayed, in order to accept the setting and to return to the main window.

3.4 Data saving and deletion

Up to 100 measured values with date and time can be stored in the Durometer.

The number and the average value of the stored values are displayed in the main window in the lowest line.

As soon as there is a valid measured value present, it is stored automatically.

In order to delete the last stored value, you can do the following:

- a) Press the CLR key in the main window
- b) Press the function key (FN) so often until "Delete last" is indicated in the display and then press the CLR key.

In order to delete all values in the memory, press the function key (FN) so often until "Delete everything" is indicated in the display, and then press the CLR key.

3.5 Info window

The device-specific information is displayed in the information window. In the first line is the Shore type (Shore A or Shore D). The serial number is displayed in the second line. The version numbers of the firmware and the hardware follow after that. The total number of measurements carried out with this Durometer is indicated in the last line.

In order to display the information window, press the function key (FN) so often until "Information" is indicated in the display. Then press the CLR key.

If you wish to return to the main window, press the CLR key again.

4 Implementation of the measurements

4.1 Sample dimensions and measuring position

The specifications about the minimum sample dimensions vary somewhat in the standards and directives (DIN ISO 7619-1 §5).

A diameter of 30 mm and a sample thickness of 6 mm always suffice. In case of thinner material, up to 3 layers can also be laid on top of each other. However, no layer may be thinner than 2 mm in this case. If the hardness is in the upper range of the respective Shore scale, 4 mm thickness and smaller diameters also suffice under certain circumstances.

The separation distance of the measuring point from the sample edge should be 12 mm, the separation distance of the impressions from each other should be greater than 5 mm.

4.2 Measurement parameter settings

For an individual measurement, only the specification of the required hold time or the setting-adjustment to "Maximum value" are necessary. If an average value should be determined from a number of individual measurements, this is to be set as described in the chapter "Settings" before beginning the measurements.

The current settings are displayed in the lower status indicator line.

4.3 Measurement procedure/handling

Hold the Durometer vertically above the surface to be tested. Then press the Durometer without jerking onto the sample to be measured until the placement surfaces contacts the sample completely. The force with which the device is pressed onto the sample must be greater than the maximum test force. However, it must not be so great that the test specimen is pressed in by the placement surfaces.

The pressing force should be 12 - 13 N in case of Shore A, according to guideline VDI 2616/2, and 49.5 - 50.5 N in case of Shore D. These forces cannot of course be reproduced with manual measurements.

Therefore the utilization of a mount is recommended for precise measurements in all standards.

During the application, the indicated value is updated continuously and corresponds to the position modification of the indenter, with reference to the placement surface. After expiry of the set-adjusted hold time, the hardness number can be read off. If the Durometer should display the maximum value, this is indicated after 2 seconds, at the latest.

5 Connection with the PC

In order to make a connection to the PC, the Durometer with the delivered USB cable must be connected to a USB interface of the PC. The SHOREdigital logs on to the PC as a serial interface. The interface is adjusted as follows:

Baud rate:	115200 Bd
Data bits	8
Stop bits:	1
Parity:	none
Flow control:	None
ASCII configuration	introduce I carriage return at the end

If the device is connected to this USB interface of the PC for the first time, it can be that the driver must be installed on the PC. The driver is available on the CD supplied.

5.1 Transmitting stored measured values

In order to transfer the stored measured values to the PC, press the function key (FN) so often until "Output everything" is indicated in the display. Then press the CLR key. The values are transferred to the PC automatically and can be received e.g. with hyper-terminal.

For every value a line is transmitted in the following format:

No;Www Mmm dd hh:mm:ss yyyy;Value\CR

where:

No	-	Number of measured value
Www	-	Weekday
Mmm	-	Month
dd	-	Day
hh	-	Hours
mm	-	Minutes
ss	-	Seconds
yyyy	-	Year
Wert	-	Shore number
\CR	-	Carriage return character

Example:

1;Fri Jul 16 13:22:04 2010;63.5

2;Fri Jul 16 13:25:51 2010;62.9

6 Care and maintenance

In order to ensure trouble-free measurements, the device should be handled carefully. In particular, the indenter is to be protected against damage.

To control the measurement accuracy, an annual control-check with the manufacturer is recommended. The penetration body is examined for scratches or other damage in this case. The characteristic plot of the loading equipment is measured using special test equipment.

7 Safeguarding and transport

For safeguarding and transporting the device, the original packing should be used.

8 Technical data

Dimensions	L=114mm h= 31 mm d = 70 mm
Weight	285 g
Interface	USB
Operating time	approx. 8 h
Charging time	approx. 2 h
Scale accuracy	0.1 Shore
Memory size	100 values

The precision of the force/path characteristic lies within the limits indicated in the standards. The dimensions of the indenter and support dimensions correspond to the indicated tolerances. The indenter consists of hard metal.

The digital Shore Durometers can be formally accepted according to DKD.

9 Scope of delivery

- Scope of delivery Shore Durometer (A or D implementation)
- USB cable
- USB charging unit
- Memory drive with USB driver and E-Handbook
- Storage box
- Operating manual

10 Accessories

A test mount is available for the digital Durometer. The mount not only facilitates the handling, it also ensures that the Durometer is always vertical and is applied with the correct force. The scattering of the measured values can be reduced by this (see notes on precision in practice)

An additional weight for Durometer Shore D. It is necessary to reach the press-on force

Test block set for Shore A (7 blocks) and Shore D (3 blocks), are available.

11 Information on waste disposal



This device includes batteries. Please do not dispose of in domestic waste. Dispose of this device at the end of its life cycle according to the applicable legal stipulations, and separate from domestic waste. Submit this product for waste disposal at an official turn-in center.

11.1 English

Consumers are legally required to dispose of batteries at suitable collection points, vending points or dispatch bays. The crossed-out wheeled bin means that batteries must not be disposed of in the household waste. Pb, Cd and Hg designate substances that exceed the legal limits.

11.2 French

La législation exige des consommateurs le dépôt des piles usagées dans un lieu de collecte approprié, un point de vente ou un entrepôt d'expédition. La poubelle barrée signifie qu'il est interdit de jeter les piles et les batteries avec les ordures ménagères. Pb, Cd et Hg désignent les substances dont les valeurs dépassent les limites légales.

11.3 Italian

Per legge, i consumatori sono obbligati a depositare le batterie esaurite presso i punti di raccolta, i punti di vendita o i magazzini di spedizioni. Il simbolo del contenitore dei rifiuti sbarrato indica che è vietato smaltire le batterie con i rifiuti domestici. Pb, Cd e Hg indicano le sostanze presenti con valori superiori alla norma.

11.4 Spanish

Los usuarios están obligados por ley a depositar las pilas viejas en un punto de recogida adecuado /punto de venta/centro de envío. El contenedor de basura tachado significa: la pilas no deben desecharse en la basura doméstica. Pb, Cd y Hg designan sustancias que se encuentran por encima de los valores establecidos por ley.



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