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## 1. Introduction

The following operation manual explains the preparation, setup, principles of operation, usage, and troubleshooting of the hardness tester NOVOTEST T-UD2 and its versions T-U2, T-D2.

Please, read this instructions carefully for operate the hardness tester NOVOTEST T-UD2 functions quickly and effectively.

In doing this you will be able to take full advantage of the function range of the instrument. At the same time, you will also avoid errors and wrong operation which in turn would cause incorrect test results and thus could lead to injury and damage.

## 2. Appointment

The hardness tester NOVOTEST T-UD2 is handy, easy to operate and can carry out tests quickly without any difficulties.

Hardness tester NOVOTEST T-UD2 is mainly suitable:

- for measurement hardness of low and non-alloyed steels;
- for measurement hardness of high-alloyed steels;
- for measurement hardness of nonferrous metals.

## 3. Specifications

### 3.1. Calibration scales

Device has 20 calibration scales of hardness that conventionally divided into four scales and five materials for each:

	ST	AST	SST	CI	U1
HRC	<input checked="" type="checkbox"/>				
HB	<input checked="" type="checkbox"/>				
HV					
U1					

Each of the scales can be additionally calibrated by 1 or 2 points. Also, the unit measures in Leeb scale (with rebound probe) and Tensile strength, through the automatic recalculation from the Brinell scale.



### 3.2. The main characteristics of the device

Overall dimensions, mm	122x76x37
Powered by three NiMH batteries or AA batteries	each 1.2 V
Power supply current, not more than, mA	100
Time of continuous operation, not less than, h	20
Weight of electronic unit with batteries, not more than, g	250
Operating temperature range, ° C	from -20 to +40
Humidity, not more, %	from 30 to 80

### 3.3. Measurement range and limits of the basic permissible error

Hardness scale	Measurement range	Measurement error	
		U1	Leeb
Rockwell, HRC	From 20 to 70	±2	±2
Brinell, HB	from 90 to 150	±10	±10
Brinell, HB	from 150 to 650		±15
Vickers, HV	from 240 to 500	±15	±15
Vickers, HV	from 500 to 940		±20
Strength limit $\sigma$ (reference), MPa	from 370 to 1500	Is determined when markup	



### 3.4. Characteristics of probes

Probe Type	U1 (98 N)	U1 (50 N)	U1 (10 N)	Leeb
Overall dimensions, mm	Ø35x140	Ø35x140	Ø35x140	Ø20x145
Weight, g, not more than	250	250	250	130
Roughness of the measured surface, Ra	3.2	2.5	1.5	3.2
Radius of curvature of the measured surface, mm	5	5	5	10
Weight of the controlled product, not less than, kg	0.1*	0.1*	0.1*	5*
Thickness of the controlled product, not less than, mm	1.5*	1*	0.8*	10*
Load, kgf	10	5	1	-

\* and less when using recommendations for measuring the hardness of light and thin samples.

3.5. To save battery charge in the menu there is setting of device auto switch off.

## 4. Packing list

4.1. Information processing unit	1 pc.
4.2. Probes:	
UCI (10N)	___ pc.
UCI (50N)	___ pc.
UCI (98N)	___ pc.
Rebound (Leeb)	___ pc.
4.3. Charger	1 pc.
4.4. Batteries	2 pcs.
4.5. USB cable	1 pc.
4.6. Operation manual	1 pc.
4.7. Carrying case	1 pc.

## **5. Principle of operation**

### **5.1. Rebound method**

Rebound probe consists of an impact body and the capture. The impact body has a carbide tip and a permanent magnet for generating a voltage pulse; the impact device has a spring mechanism for loading and impelling the impact body, and an induction coil for detecting the magnet in the impact body. In the rebound hardness testing method, the speed variation caused by the impact of the impact body against the material surface is measured.

The impact energy is adjusted via the spring for the measurement. The impact body contained in the tube of the impact device is impelled against the test surface by means of the release button. In the course of this, the magnet of the impact body induces in the coil a voltage signal whose height is proportional to the impact phase speed. The impact causes a plastic deformation of the material and a permanent spherical indentation is produced in the surface. This plastic deformation leads to a loss of energy of the impact body and thus to a lower speed after the actual rebound phase.

### **5.2. UCI method**

The Vickers diamond is fixed to the tip of a round metal rod. This metal rod is excited, to its resonant frequency of approx. 78 kHz, into longitudinal oscillations. When the Vickers diamond contacts the sample surface, the resonant frequency will change. This change happens in relation to the size of the indent area from the Vickers diamond. The size, in turn, is a measure for the hardness of the tested material. Resonant frequencies can be measured very accurately. This is why the UCI method is suited to make the evaluation of Vickers indents, and thus of the complete test procedure, so much easier and quicker.

There are also two additional advantages:

- the measurement is made under load. (No impairment of the measurement due to elastic resilience);

- the hardness measurement is based on the area of the indent and not on the length of the indent diagonals.

The measurement is thus less affected by surface roughness; even gunmetal-finished surfaces can be measured.

Concerning the UCI method, the measurement value is also dependent on the Young's modulus of the material.

## **6. Preparations for operation**

### **6.1. Battery supply**

The hardness tester NOVOTEST T-UD2 is powered by batteries or accumulators. For this you need two AA 1.2 V:

- dry cells (AlMn) or rechargeable (Nickel-Cadmium or Nickel-Metalhydrid).

**NOTE!** The batteries must be fully charged before first use.

Using of batteries and accumulators.

Open the battery compartment. Insert the batteries, observing the correct polarity. Close the battery compartment.

Used or defective batteries are special refuse and must be disposed of according to the governing laws!

### **6.2. Connection of probes**

Socket for the probe is at the top of the information processing unit. Connect the probe cable to the NOVOTEST T-UD2 socket in accordance with the marks on the connector.

## 7. Basics of operation

### 7.1. Keys



Turn on/off; left soft key



Right soft key



Modes switch



Selection of hardness scale



Navigation key; increase



Navigation key; decrease

### 7.2. Selection of measurement method.

#### 7.2.1. Rebound method of measuring hardness is appropriate for:

- testing objects weighing more than 5 kg and a wall thickness more than 10 mm;
- massive products, products with a coarse-grained structure, forged and cast products;
- testing objects with minimal preparation of the surface.



7.2.2. UCI method of measuring hardness is appropriate for:

- testing objects with low mass and small wall thickness;
- testing objects with a glossy surface (with special requirements to the minimum size of the imprint);
- surfaces of the testing objects with hardened layers.

## **8. Operation**

8.1. Preparation of the test material.

The surface must be clean and free of oil, grease and dust.

The surface roughness of the material should meet the requirements of a specific probe (paragraph 3.8).

8.2. Features of the methods of measurement of metal hardness:

8.2.1. UCI method:

Distinct reading variations may especially occur with a mass lower than 0.1 kg and a specimen thickness of less than 1 mm if the test material is excited to resonance or sympathetic oscillations. Otherwise, such test materials must be fixed to a solid base, e.g. using a viscous paste. The same applies to the hardness test blocks.

8.2.2. Rebound method:

With smaller and less heavy test objects, the impact effect of the impact device may cause vibrations which could produce distorted measurement results.

- Test objects weighing less than 2 kg must in any case be fixed to the support using couplant so that there are no any vibrations.
- Test objects weighing between 2 kg and 5 kg must be placed on a large metal support (e.g. a table) in such a way that they are not moved or caused to vibrate by the impact.

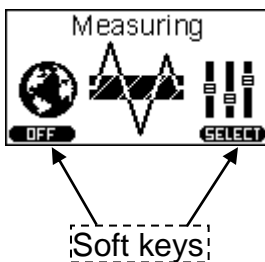


### 8.3. Device menu

After connecting the probe, hold **TURN ON** button  until logo appears on the display:






Then, you get to the main menu of the device:

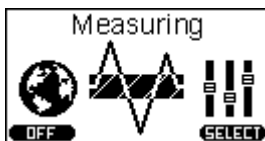


The menu consists of 6 sections:

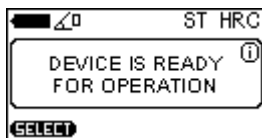
1. Measuring
2. Calibration
3. Archive
4. Settings
5. Memory card
6. Information

Scroll through the menu using the navigation keys  and , for entering press soft key **SELECT** using .

### 8.3.1. Measuring



Selecting **Measuring**, you go to the measurement of hardness mode, depending on the probe at the top of the screen will display the angle of the probe (for rebound probe), or the state of the diamond indenter (for UCI probe).



Detailed description of the measurement of hardness, see paragraph 9.

### 8.3.2. Calibration



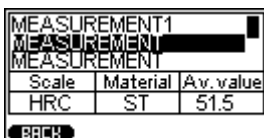
Selecting **Calibration**, you go to the table of calibrations where the scale conventionally divided into four hardness scales: Rockwell (HRC), Brinell (HB), Vickers (HV), User (U1). Each of the scales can be calibrated to 5 conventional materials: Steel (ST), Alloy Steel (AST), Stainless steel (SST), Cast Iron (CI), User material (U1).

Detailed description of the calibration process, see paragraph 11.

### 8.3.3. Archive





Selecting **Archive** you go to the list of saved measurements, which displays Measurement name, Scale, Material and Average Value.



The measurement list screen shows a table with three columns: Scale, Material, and Av. value. The first row contains 'MEASUREMENT1', a redacted name, and a redacted value. The second row contains 'MEASUREMENT', a redacted name, and a redacted value. The third row contains 'HRC', 'ST', and '51.5'. A 'BACK' button is located at the bottom left.

Scale	Material	Av. value
HRC	ST	51.5

You can store in memory up to 1024 measurements.

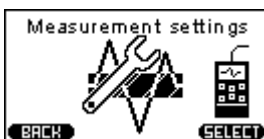
Scroll through the list using the navigation keys  and .

#### 8.3.4. Settings



Selecting **Settings** you go to the settings menu, there are 2:

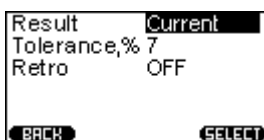
- **Measurement settings:**



- **Device settings:**



8.3.4.1. Measurement settings



By selecting **Measurement settings** you can configure the following settings:

*Result:* displaying measurement results can be **Current** (display instantaneous values of measurements) and **Average** (unit accumulates the series of measurements and display average value of hardness).

*Tolerance, %:* This parameter is used only for Smart mode. Set the % value adjusts the range of deviations of measurements to be included in the calculation of the average for the series in Smart mode. Detailed description of the Smart mode, see paragraph 10.3.

*Retro:* allows you to return to the measurement mode with saved last measurements after restarting of the device.

### 8.3.4.2. Device settings



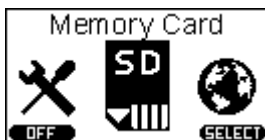
*Language:* selection language of the device menu (available English, Spanish, Russian).

*Brightness:* setting the brightness of the backlight.

*Sound:* there are 4 modes of device sound (Off, Key, Measurement, Key and Measurement)

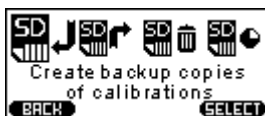
*Auto Off:* setting of the automatic shutdown device when it is not in use.

### 8.3.5. Memory Card



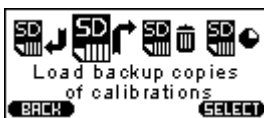
Selecting **Memory Card** you go to the menu of memory.

#### 8.3.5.1. Create backup copies of calibrations.



After calibration of the probe is recommended to create a backup copy of the calibration (usually the manufacturer makes the calibration of 1-2 scales, to check the probe). This is done in order to be able to resume adequate calibration after incorrect settings in the future.

#### 8.3.5.2. Load backup copies of calibrations.



After the initial save of calibrations you can always download it to the probe. This function is needed for the resumption of adequate calibration in case of wrong settings of the probe.

#### 8.3.5.3. Clear SD card



Clearing saved records in the archive, after clearing SD card the archive will be empty.

#### 8.3.5.4. Memory state



This menu displays the total, used and empty memory cells.

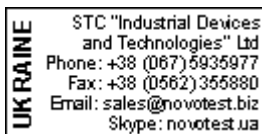
Memory state		
Total	Stored	Empty
1024	17	1007



**BACK**

### 8.3.6. Information



In this menu you can view information about the manufacturer and offices around the world.



Scroll through the list using the navigation keys  and  to see NOVOTEST dealers and general information about the device.

## 9. Hardness measurement

### 9.1. Using of the UCI method

The design of UCI Probe is shown in Figure 1a. Probe has a special removable collapsible nozzle with the puck (Figure 1b). The puck provides the convenience of positioning the probe relative to the testing object and a clip for the measurements



Figure 1a. UCI Probe U1

- 1 – Probe's body; 2 – Collapsible nozzle;  
3 – Puck; 4 – Place for fingers

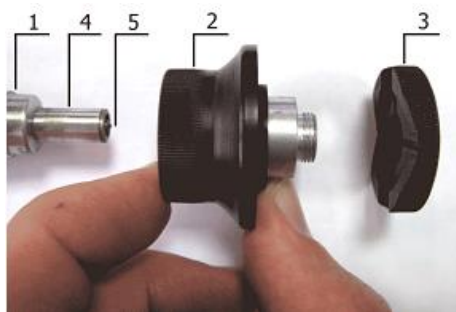


Figure 1b. Demounted nozzle

- 1 – Probe's body; 2 – Nozzle main part;  
3 – Puck; 4 – Protective tube;  
5 – Diamond.

One side of the puck is flat to using probe on flat surfaces. Another side has grooves for using a probe on cylindrical surfaces.

It is marked slots designed for ease of measurement of hardness on cylindrical products of various diameters. Probe with demounted nozzle is usually using to measure hardness in difficult places, such as narrow or deep groove.





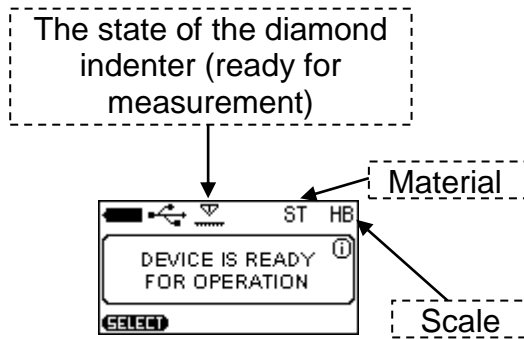


The probe may be removed from the nozzle is used for measuring the hardness in the narrow and hard to reach places.







Figure 2

Turn on the hardness tester pressing , and select the measurement mode by pressing . Detailed description of the modes, see paragraph 10.



Then select the scale and material hardness for which there is a proper calibration (How to calibrate device see paragraph 11). For select the

hardness scales press  and chose the scale by keys  and , then press  and chose the material.

During the measurement you can select other hardness scale. The displayed measurement reading will be converted according with the new hardness scale if it is calibrated.

**NOTE!** Calibration of UCI probe is carried out by the direct method, so the conversion is carried out on the basis of pre-calibration, and does not correspond to any standard.

Install the probe puck on the sample surface, keeping it in the tough skirt as shown in Figure 3a. By clicking on the skirt thrust both hands to bring the diamond tip of the probe perpendicularly to the sample surface to the touch (Figure 3b). Slowly (in about 0.5 seconds) by pressing with a force of (5 or 1 kg depending on probe type) thrust skirt, push the diamond tip into the metal surface, preventing swinging (Figure 3c). After the beep, remove the probe from the tested object.

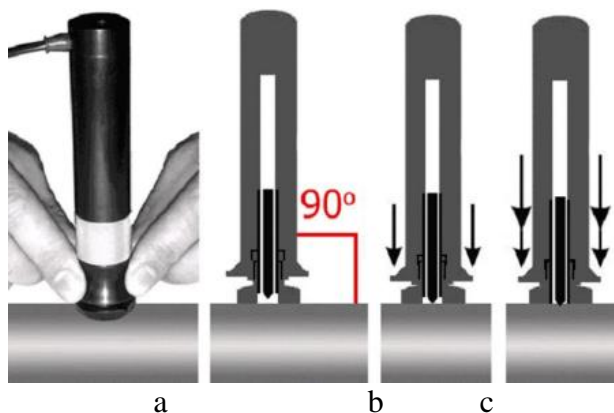
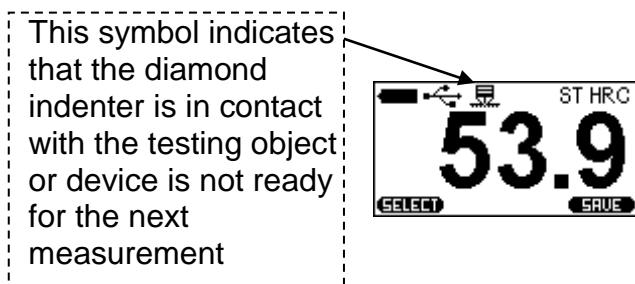


Figure 3

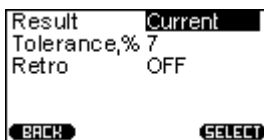
The display shows the value of hardness. The result of measurement is displayed on the display until the next measurement.




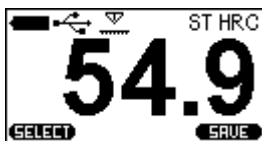
**WARNING! Not allowed a sharp click and scratching sample by indenter, this may lead to exceeding the allowable value of error and damage the diamond indenter.**




**NOTE!** The "exciter" in the probe is powered from the batteries. If the batteries are depleted you will get erratic test results.

You can get the value of the current measurement or the average for the series of measurements, depending on the settings in **Measurement settings** menu *Current* or *Average*:




After the measurement, you can save measurement (series of measurements) in the archive by pressing **SAVE** with key .

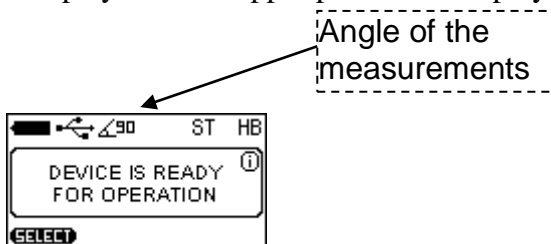


Move the cursor over the keyboard with keys  and  and selecting a symbol by pressing the . Then select **SAVE** by cursor. The record is stored in the archive.

## 9.2. Using of the Rebound (Leeb) method

Select scale and material with the existing calibration. Load the impact body using charging mechanism.

Press the buttons  and  to set the angle of the measurement. Fixed angle is displayed in the upper part of the display.



Position of the probe perpendicular to the ground plane corresponds to the angle  $0^\circ$ .

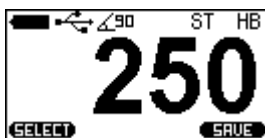
Place the rebound probe vertically onto the test surface and press it slightly against the surface. Charge the impact body by a charging mechanism pressing the probe enclosure until the clicks, as shown below:



Figure 4. Rebound probe

Press the release button on top of the impact device by finger of your free hand.

After pressing the shutter release button and the impact body hitting in the area of measurement sounds a beep and the display shows the value of measured hardness.



**WARNING!** The minimum distance between the imprints of measurements must be not less than 3 mm.

## 10. Measurement modes

To selecting the measurement mode go to the **Measurement** and press



. The device will offer you the following measurement modes:

- NORM – normal operation mode;
- STAT – statistics mode;
- SMART – mode of filter incorrect measurements;
- SYGNAL – the display signal mode (only for Leeb).

To select the measurement mode, press



### 10.1. Normal mode



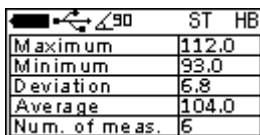
In normal mode, the device displays the current measurement value or average of series of measurements, depending on selected the Current or Average in Measurement settings menu:



## 10.2. Statistics mode

Statistics mode allows to monitoring the following parameters of measurement series:

- Maximum;
- Minimum;
- Deviation;
- Average;
- Number of measurements.



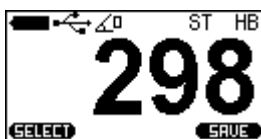
	90	ST	HB
Maximum	112.0		
Minimum	93.0		
Deviation	6.8		
Average	104.0		
Num. of meas.	6		

## 10.3. Smart mode

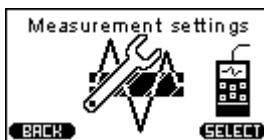


Smart mode allows the user to identify the general sequence of measurements. The device selects the first three series of measurements that do not exceed the specified tolerance. After that, the following measurements that exceed a given tolerance will be excluded from the series and will not be taken into account when calculating the average of the series.

Filled with the color readings indicate that the device has fixed the general sequence and Smart mode is active.



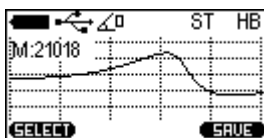
To set the tolerance of Smart Mode, go to **Measurement Settings**:



And set the percentage tolerance values from 1 to 10.



## 10.4. Signal mode



Mode is active only for Leeb probe and shows the voltage produced during the impact and rebound of impact body. **M** is the maximum value of the conditional code number which corresponds to the received signal.

## 11. Calibration



### Attention!

To be performed only by highly qualified personnel and only if required for the production process! It is not permissible to use hardness reference test blocks that have expired or whose surface has been used more than halfway (DSTU GOST 8.335).



CALIBRATION mode (fig. 2.16) and all operations in it are performed separately for UCI probe U1 and dynamic probe D1 and DIC. Moreover, the change of calibration curve takes place only in the scale in which calibration is performed.



Figure 2.16 - Calibration section

Graduating a hardness tester by the user is the process of matching (equalizing) the average hardness value of the hardness reference test block value by the hardness tester to its nominal value. Graduating the hardness tester by the user in HRC, HB, HV hardness scales, allows a temporary correction to the hardness tester calibration set by the manufacturer when the tester is released from production.

It is recommended that a hardness tester be calibrated by the user in the calibration interval in the following cases:

- If when the hardness tester is checked against a reference hardness test block its reading is stable, but differs from the nominal of the hardness test block;
- After long storage (more than 3 months);
- After intensive use;
- After major changes in operating conditions (temperature, humidity etc.)

One (one-point graduation), two (two-point graduation) or three (three-point graduation) hardness reference test blocks with maximum and minimum values on the hardness scale to be measured are required to calibrate the hardness tester.

*Example:*

*Three Rockwell hardness test blocks with values of  $(25 \pm 5)$  HRC,  $(45 \pm 5)$  HRC and  $(65 \pm 5)$  HRC are required for graduation on the full Rockwell scale.*

*If you are not using the full Rockwell scale range but only the 30-40 HRC range, then calibrate the hardness tester using two hardness test blocks of  $(25 \pm 5)$  HRC and  $(45 \pm 5)$  HRC.*

The user can calibrate the hardness scales: Rockwell (HRC), Brinell (HB), Vickers (HV) and custom (P1)

All adjustments of user scales are reversible - resetting each scale to the factory settings.

The following calibrations are set by the manufacturer:

- for dynamic probes D1 and D1C (fig. 2.17);
- for UCI probes U1 (fig. 2.18)

<input type="radio"/>	ST	AST	SST	CI	U1
HRC	<input checked="" type="checkbox"/>		<input type="checkbox"/>		
HB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HV	<input type="checkbox"/>		<input type="checkbox"/>		
U1					

**BACK**
**SELECT**

Figure 2.17 - Established calibration for dynamic probes D1 and D1C.

	ST	AST	SST	CI	U1
HRC	<input checked="" type="checkbox"/>				
HB	<input type="checkbox"/>				
HV	<input type="checkbox"/>				
U1					




**BACK**
**SELECT**





Figure 2.18 - Set calibration for UCI probe U1

Note - It is recommended to make a backup copy before carrying out the calibration, so that a proper calibration can be resumed in case of incorrect settings in the future (clause 2.3.7.1).

When user enter the calibration menu, a table appears as in fig. 2.17 (fig. 2.18), with each cell corresponding to a specific calibration scale for a specific material: steel (ST), aluminium (AL), stainless steel (SS), cast iron (CI) and custom material (P1).

Calibration cells can have three states:

-  – Calibration;
-  – Custom graduation (1, 2 or 3 points);
-  – Empty cell.

Use the «» and «» keys to select the cell to be calibrated and press the «» key to activate the calibration «menu» (figure 2.19): Edit, Delete, Cancel. Select the desired item and confirm by pressing the «»key again.

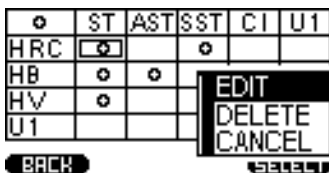






Figure 2.19 - Calibration menu

To start the calibration, select the number of calibration points (Fig. 2.20) by pressing the «» key and using the «» and «»,

keys to set the required number of calibration points - if there are three samples, select "3". To confirm press the key «  ».

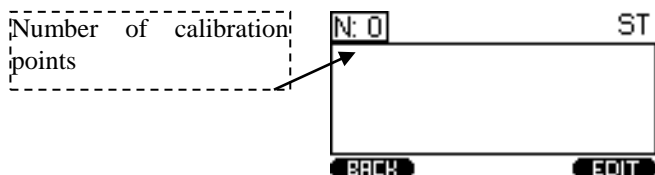
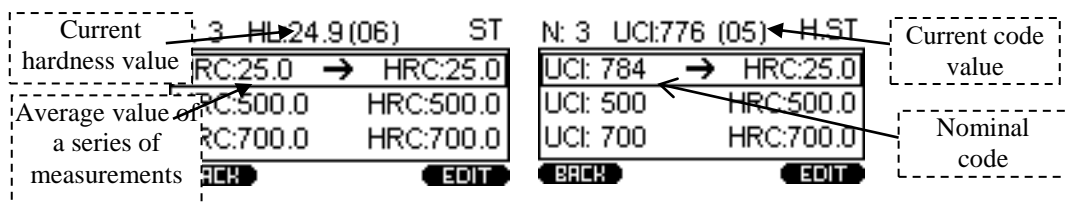


Figure 2.20 - Calibration menu


When calibrating for dynamic D1 probes and DIC the instrument, by making measurements, displays the average value of the series according to the current calibration (Fig. 2.21a). When calibrating for the UCI probe U1, the device receives nominal codes by making measurements, the purpose of calibration is to find the correlation between the code nominal and the hardness value of the material (fig. 2.21b).







a) Conducting calibrations for dynamic probes

b) carrying out calibration for UCI probes

Figure 2.21 - Conducting calibration for dynamic and ultrasonic probes

After setting the calibration points, press the button «  » to select the first calibration line and perform at least 5 measurements on the first sample.

After performing the measurements press the button «  », select the option «EDIT» and using the buttons «  » and «  » enter the nominal value of hardness of the sample (fig. 2.22). To enter the next value, use key «  ».

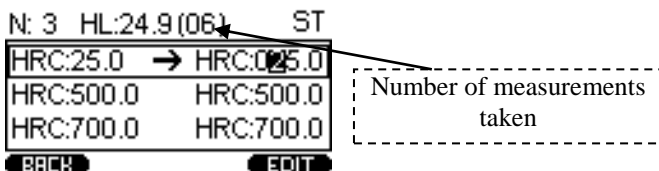




Figure 2.22 - Calibrating against the first sample

If the measurement reveals an obvious error, press the «  » key and select "DELETE", the last measurement will be deleted from the series.

To calibrate the second and third samples, press the «  ». key. The sequence of operations is the same as for the first calibration. When all the operations are completed, the instrument display will look like Fig. 2.23.

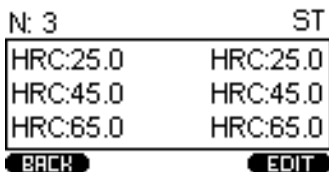


Figure 2.23 - Three-sample calibration

To save the calibration, press the «  » key and confirm by pressing the  ».

## **12. Technical maintenance, special conditions of operation**

12.1 On the whole, hardness testers do not require any special maintenance. However, for the purpose of hardness tester stable operation, regular maintenance is advisable.

### 12.2. Probe maintenance

Clean hardmetal ball and diamond pyramid from dust, mud and oil traces. Use soft cloth impregnated with alcohol solution.

Check the probe operation regularly by conducting hardness measurements on hardness reference blocks. Do not use reference test block with expired period between verifications (more than 2 years).

### 12.3. Information processing unit maintenance

To clean from any pollution, use soft dry cloth. Do not use the water, since the hardness tester is neither spray-proof nor water-proof due to the joints on its body.

Do not use any solvents, they can damage indication signs and writings on the front and back sides of the body.

### 12.4. Battery maintenance

The battery average life is not less than 3 years. The battery used in compliance with the "C" or "AA" international standard. It is done for the convenience of its replacement when it is required or sharp reduction of the continuous operation time (paragraph 3.6) independently of the country. Replacement is possible only by the battery with similar characteristics in compliance with the marking on it. From environmental protection point of view, the best thing is to use the battery.

## 12.5. Storage

12.5.1. Hardness tester shall be kept in the carry case, the probe and the battery shall be disconnected.

12.5.2. If hardness tester is kept in the carry case for than 14 days, the battery shall be taken out from its compartment in the information processing unit.

12.5.3. It is recommended to keep hardness testers in closed premises with the relative humidity not more than 80%, there shall be no mold, paints, acids, chemical agents and other chemicals, the evaporation of which may give a harmful effect. Sharp fluctuations of temperature and humidity which can result in dew formation are not allowed.

## 12.6. Transportation

12.6.1. Hardness tester transportation in the carry case shall be only in closed vehicles, where the possibility of mechanical damage or atmospheric precipitation is excluded.

12.6.2. The way packed in carry cases hardness testers are located inside the vehicle shall exclude.

## 12.7. Putting into operation after storage and transportation

12.7.1. After storage or transportation under the temperature lower than  $-5^{\circ}\text{C}$ , before starting hardness tester operation, it is necessary to keep it not longer than 1 hour under the temperature higher than  $+10^{\circ}\text{C}$  and not less than 2 hours under the temperature higher than  $0^{\circ}\text{C}$ .

12.7.2. Before operating hardness tester which was stored for more than 3 months and transported for more than 2 months, it is necessary to check such hardness tester on the reference hardness test blocks. If the measured AVEARGE value of the hardness tester does not correspond to the reference hardness test block NOMINAL value within the error limits, it is necessary to calibrate the hardness tester.

## 12.8. Special operation conditions

12.8.1. Increased dust content and humidity. Put the information processing unit of hardness tester into a transparent plastic bag. Tighten it at the level of connective cable a bit lower than the probe plug.

After the work under such conditions is finished, information processing unit shall taken out of the plastic bag and air it.

12.8.2. Frost ( $<0^{\circ}\text{C}$ ). Information processing unit is the most sensitive to low temperature part of hardness testers, especially LCD. If there is a possibility, keep hardness tester closer to your body and protect it with your coat or keep in the inside pocket, taking it out time from time for inputting the data into the archive.

### **13. Precautions and trouble shouting**

13.1. Treat the hardness tester with care. Any wrong treatment may result in the violation of the present Technical Reference and Operation Manual regulations and, thus, lead to the manufacturer hardness tester warranty cessation.

13.2. Always check the integrity of the cables, Information processing unit and probes. Provide immediate replacement of the damaged parts by the original ones. This job shall be performed by skilled personnel.

13.3. Do not expose the hardness tester to aggressive chemical medium.

13.4. Do not leave the hardness tester in the direct Sun.

13.5. Do not sink the hardness tester into any liquids. If the hardness tester gets wet, take the battery out and leave for 24 hours to get dry. If the hardness tester is used under the increased humidity or dust conditions, place the information processing unit into the plastic bag. After work period is over, it is mandatory to get the hardness tester dry.



## **14. Manufacturer's guarantee and service maintenance**

14.1. In case when hardness tester (information processing unit and probes), supplied by the Seller within one year since the delivery date used properly, appear defective, the Seller shall repair or replace them or supply new parts therefore and send them to the Buyer. The other parts of the device (battery, charger, bag) warranty does not cover. The Buyer must prepay any shipping charges, taxes, or duties associated with transportation of the product to the service location, and Seller pays return shipping and associated costs. In addition, the Buyer shall be responsible for insuring any product shipped or returned to an authorized service location, and the Buyer shall bear risk of loss during shipping to the service location, and Seller all risks during delivery to the Buyer. In order to exercise its rights the Buyer shall inform the Seller as soon as possible after the date when such defect appeared.

14.2. Prepare technically grounded reclamation document and send it together with the hardness tester to the guarantee service or to the manufacturer at the address:

*"NOVOTEST" Ltd*

*5, Spasskaya street, Novomoskovsk, 51200, Ukraine*

*Phone: +38-067-593-59-77*

*Fax: +38-056-935-87-44*

14.3. Post guarantee maintenance is conducted by the manufacturer service centre upon the Customer request.





