# Steel Structure Analyzer NOVOTEST KRC-M2


**OPERATION MANUAL**

**2018**

## CONTENTS

# 1. Introduction

The following operation manual explains the preparation, setup, principles of operation, usage, and troubleshooting of the Steel Structure Analyzer NOVOTEST KRC-M2.

Please, read this instructions carefully for operate the Steel Structure Analyzer NOVOTEST KRC-M2 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

Steel Structure Analyzer NOVOTEST KRC-M2 is designed for non-destructive testing of chemical-thermal, thermal and thermomechanical treatments, evaluation of mechanical properties and residual stresses.

Steel structure analyzer is used to determination of mechanical properties, and measurement the hardness of metal products, as well as measurements of products from ferromagnetic alloys in the presence of correlations between the studied parameters. In addition, the device is used for testing the surface layer of ferromagnetic material for grading the metal in steel grades.

Steel Structure Analyzer NOVOTEST KRC-M2 has built in Li-Ion battery, so it is handy, easy to operate and can carry out tests

quickly without any difficulties. Also it can be used both in workshops and in field conditions without power electricity.

Using appropriate techniques, possible evaluation of residual life of steel structures.

The device is designed for operation in laboratories, workshop and field conditions at:

- ambient temperature -20 - +50 C°;
- relative humidity up to 80% at 35 C°;
- atmospheric pressure of 760 mm Hg (101,3kPa).

## 3. Specifications

3.1. The measuring range of the coercive force is 1,00 - 40,00 A/cm.

NOTE: Optionally measurement range of coercive force can be changed.

3.2. Measurement accuracy of the coercive force Hc at ambient temperature (20±5)°C does not exceed ±((0,025/Hc) + 0,03).
3.3. Power supply: +12V battery.
3.4. Measurement cycle - not more than 8 seconds.
3.5. Magnetization pulse amplitude - not less than 2,0 A.
3.6. Memory store include up to 2000 measurements.
3.7. Battery life - not less than 8 hours.
3.8. Power consumption (in the magnetization mode) is not more than 3.0 A.
3.9. Overall dimensions

| *Name* | *Overall dimensions, mm* |
|---|---|
| Information processing unit with battery | 170x120x38 |

| | |
|---|---|
| Probe | 170x120x170 |
| Charger | 130x58x32 |

3.5. Weight of the instrument and probes

| *Name* | *Weight, kg* |
|---|---|
| Information processing unit with battery | 0,6 |
| Probe | 1,6 |
| Charger | 0,35 |

## 4. Packing list

4.1. Information processing unit 1 pc
4.2. Probe 1 pc
4.3. Charger 1 pc
4.5. USB cable 1 pc
4.6. Operation manual 1 pc
4.7. Test block 2 pcs

## 5. Device design, operating principle, display and keys of the device

5.1. Device design
The design of the device includes an electronic unit and connectable probe. Socket of the probe is at the top of the information processing unit. The control buttons and display are located on the front panel.

5.2. Operating principle
5.2.1. The operating principle of the device is based on calculation of the coercive force through compensation measured current of residual magnetic induction in the closed magnetic circuit composed of the magnetic probe and standard sample or tested object.

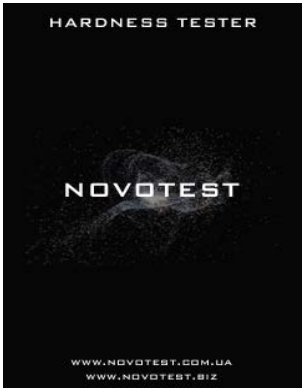
5.2.2. Cycle of measurements includes stages:
- magnetic preparation;
- compensation of residual magnetization;
- calculation of the coercive force;
- indication of the measurement result.

5.2.3. During magnetic preparation, the area of tested product which is between the pole pieces of the magnetic system of probe, are periodically magnetized up to saturation of current pulses with amplitude not less 2.0 A. Then is performed an automatic compensation of residual magnetization field. From the value of the magnetic field compensation current is automatically calculated value of the coercive force.

5.2.4. The probe is a magnetic system which is closed with tested product. Null indicator of the magnetic field is a Hall sensor. There are coils at the probe, which are used for magnetization of tested objects and compensation the field of residual induction.
The device implements a compensation method of measurement. When you press the "Measure" key, begins the first sub-cycle of measurement (magnetization). Through coils is supplied magnetizing current. In the magnetic system is appears a field with magnetic intensity which enough for fullness magnetization of tested product. After magnetization, starts the second subcycle of measurement (compensation). The compensation circuit is a circuit with negative feedback, which is consist of null indicator of magnetic field (Hall sensor), measuring coil, amplifier and power source. The current, which flows through the coil of demagnetization, compensation the magnetic flux of the residual magnetization of tested product to zero, which is monitored with the null indicator of magnetic field. The value of current in coil of demagnetization, which is fixing, is proportionately to the coercive force of tested area of

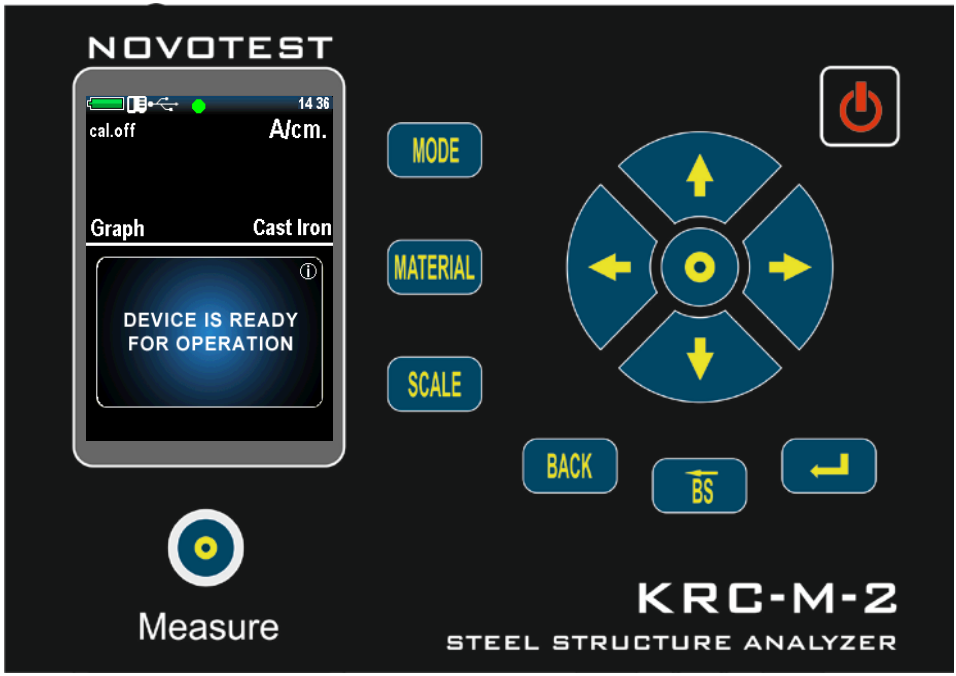
object. The informational parameter is a current in the compensation coil.

5.3. Display of the device
After switching on the device, briefly appears picture with logo on screen:




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


5.4. Keyboard of the device
5.4.1. The keyboard of the instrument is shown on the picture below:




5.4.2. Keys

 - Turn on/off key;

- Measure key;

- Modes switch;

- Materials switch;

- Scale switch;


, 
, 
, 
, 
- Navigation keys;

- Back key;

- Backspace key;


- Enter/Save key.

## 6. Operation

6.1. Preparation for operation
6.1.1. Operation with batteries

For switch on/off the unit press and hold the button  .

The level of the battery charging is shown on the left upper corner of the display as a small battery icon. The green battery color means the battery is fully charged. During discharging the battery icon segments disappear consecutively, from left to the right. One green segment or absence of segments means that the battery needs recharging.
For charging the battery of electronic unit:

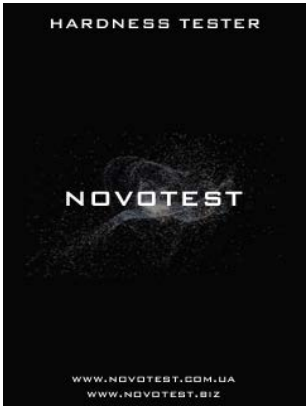
- disconnect the probe from the electronic unit;
- connect the charger's connector to the connector on the side panel of electronic unit;
- connect the charger to the mains power supply.

6.2. Preparation of the test material
The surface must be clean and free of oil, grease and dust, etc.

6.3. Connection of probe
Socket of the probe is at the top of the information processing unit. Connect the probe cable to the NOVOTEST KRC-M2 socket in accordance with the marks on the connector.

6.4. Device menu

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




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


The menu consists of 6 sections:

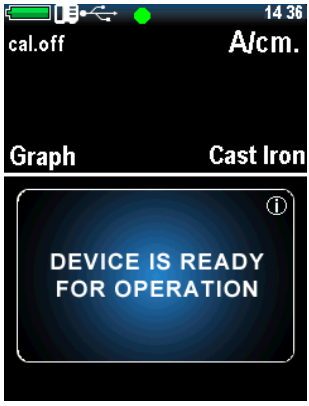
1. Measuring
2. Calibration
3. Archive
4. Settings
5. Memory card

6. Information

Move through the menu using the navigation keys  ,  ,  ,  , for entering press key  .

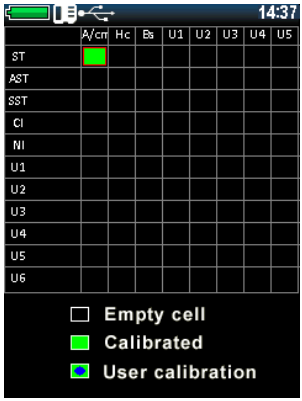
6.4.1. Measuring

Selecting **Measuring**, you go to the measurement mode, depending of selected scale of measurement.




6.4.2. Calibration

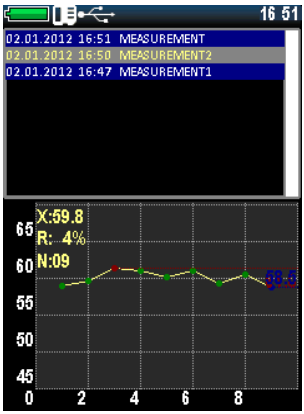
Selecting **Calibration**, you go to the table of calibrations where the scale conventionally divided into scales.




Detailed description of the calibration process.

6.4.3. Archive

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




You can store in memory up to 2 00 measurements.

Scroll through the list using the navigation keys  and  .

6.4.4. Settings

Selecting **Settings** you go to the settings menu for configure the following settings:


*Time:* time setting.

*Date:* date setting.

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

*Brightness:* setting the brightness of the display.

*Palette:* selection of menu themes (creation of color palette of menu makes with special software).

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

*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).

*Volume:* setting the volume of the device.

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

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

Navigate and select options using the navigation keys.

6.4.5. Memory Card

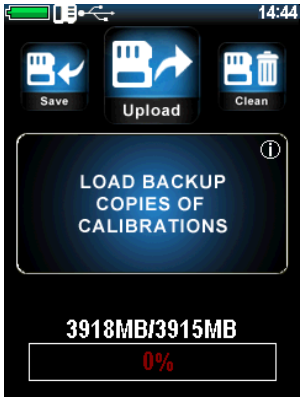
Selecting **Memory Card** you go to the menu of memory.

6.4.5.1. 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

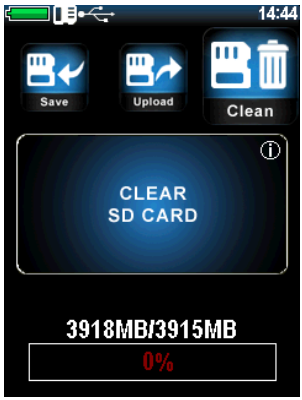
be able to resume adequate calibration after incorrect settings in the future.

6.4.5.2. 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.

6.4.5.3. Clear SD card




Clearing saved records in the archive and backup copies of calibrations: after clearing SD card the archive will be empty and backup copies of calibrations delete. To clean just stored archival records - transmit saved measurements to PC with special software. Thus backup calibrations will be unaffected.

At the bottom of the screen of this menu shown Memory state.

6.4.6. Information

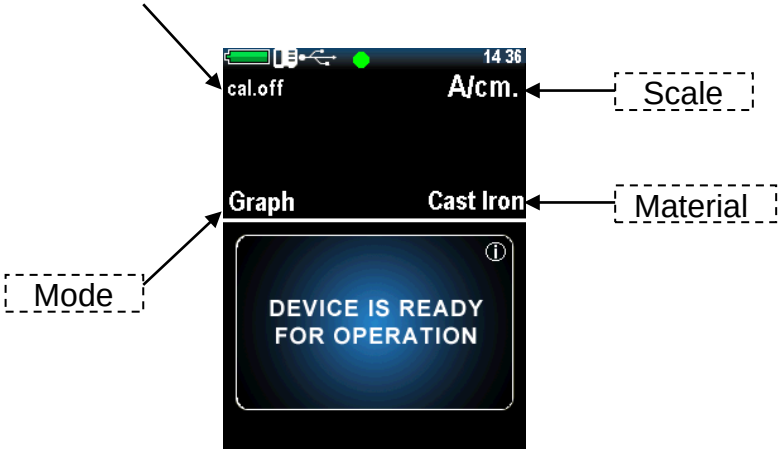
In this menu you can view information about the manufacturer and offices around the world.


Scroll through the list using the navigation keys  and  .

## 6.5. Measurements

Turn on the device by pressing  , and select the measurement mode. For select the measurement mode press  and chose the mode that will be used by keys  and  then press  .

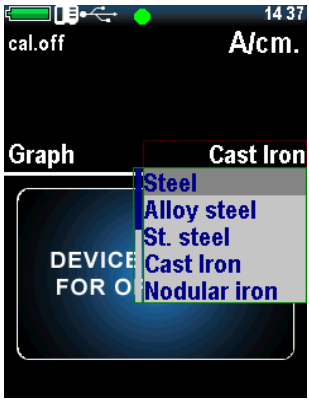
Presence of user calibration

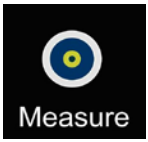



Then select the scale and material hardness for which there is a proper calibration.

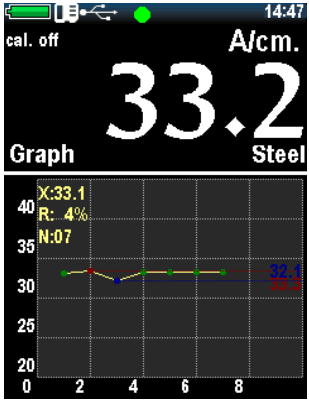
For select the scale press SCALE and chose the scale that will be used by keys and then press .

For select the material press MATERIAL and chose the material that will be used by keys and then press .

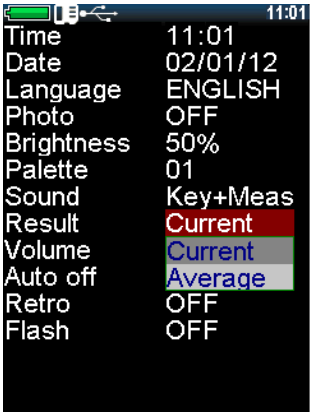



Put the probe on tested object. Measurement is performed by pressing the button 

on the front panel of electronic unit or by pressing the first (left) button on the handle of the probe. The measurement results are displayed on the display of the electronic unit, and also duplicated on display of the probe.
The measurement result is displayed until the next measurement.



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




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

Keyboard appears:


Move the cursor over the keyboard with navigation keys and select symbols by pressing  . Then press  for saving. The record is stored in the archive.

6.5.1. Measurements on calibration samples

The device has presetted calibration on standard samples of coercive force at one of user's scales.

For checking the measurement accuracy of the device, standard set includes two calibration samples:

1-st sample _____

2-nd sample _____

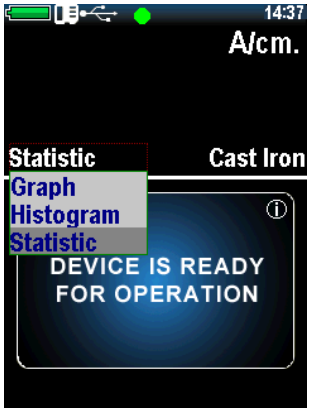
Put the probe on standard sample and press the button 

. The measurement results should match with coercive force value of the standard sample.

## 7. Measurement modes

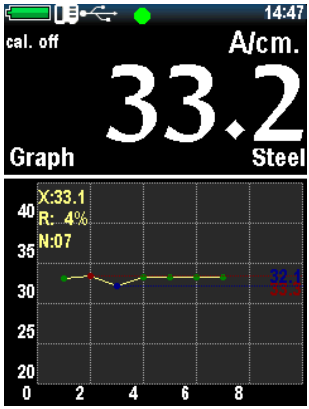
To selecting the measurement mode go to the **Measuring** and press 

. The device will offer you the following measurement modes:
- *Graph* – mode of the construction graph;
- *Histogram* – mode of the construction columnar bar chart;
- *Statistic* – statistics mode;

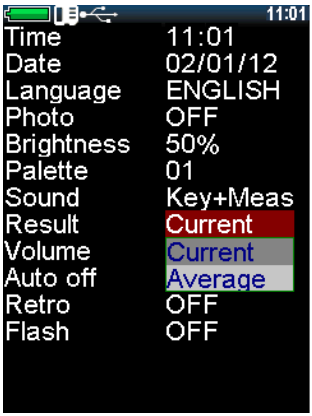



To select the measurement mode, press 
.

## 7.1. Graph mode

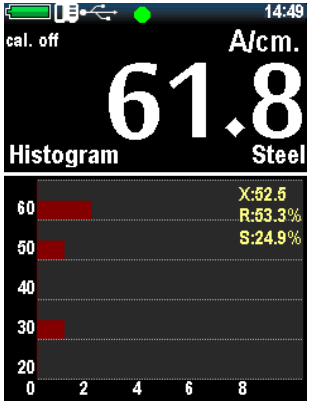



In graph mode, the device displays the current measurement value or average of series of measurements, depending on selected the Current or Average in Measurement settings menu:



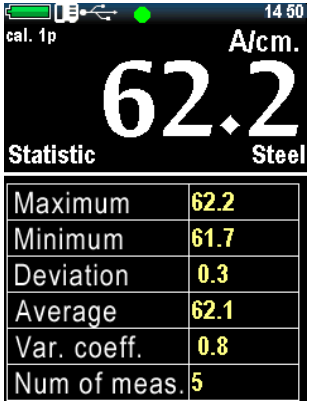
## 7.2. Histogram mode

The device builds histogram of series measurements.




## 7.3. Statistics mode

Statistics mode allows to monitoring the following parameters of measurement series: Maximum, Minimum, Deviation, Average, Number of measurements.

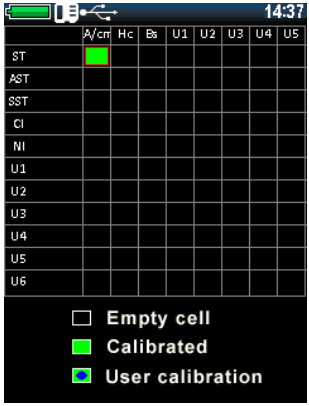


# 8. Calibration

8.1. Main calibration
To calibrate the probe you will need 3 samples of material with a known coercive force. Coercive force range should be wider than the coercive force of the materials which will be measured (The values should be the maximum or more, minimum or less and average).

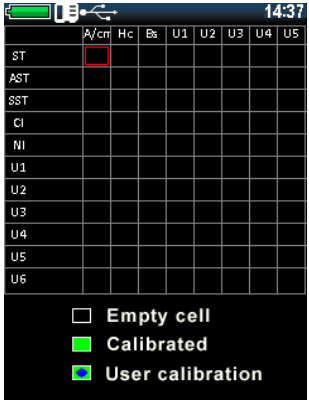
Select in the main menu **Calibration**:

The device goes to the table, each cell of the table corresponds to the certain scale of calibration for the certain material:

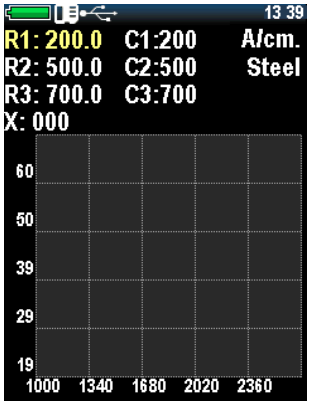



All calibrations of the device can be calibrated for any materials and any scales, and are divided in this way just for practicality.

Press the navigation keys to choice cell for calibration, for example **A/cm** for Steel:



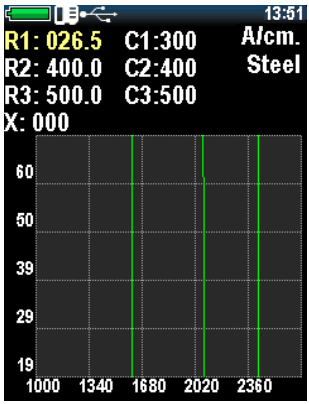

For select press  , the table appears:




The device, making the measurement, gets the nominal codes, the purpose of calibration - is to find the correlation between the nominal code and coercive force (construction of the relation function).

To start the calibration, enter the real values of the coercive force samples by pressing  .

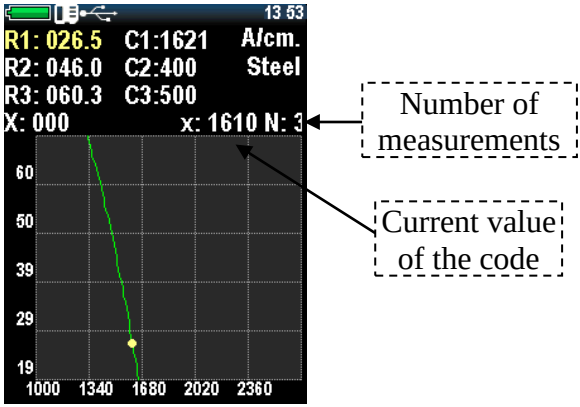
Use the navigation keys  and  for setting real values of hardness, to go to the next digit number, press  :




For ending setting of first value press again  , then the button  for adjusting the values of the next samples.

Then, move your selection on the hardness value according to the sample, and make at least 5 measurements. Make sure that the

value of **X** (current value of the code) would not varied by more than 3%.

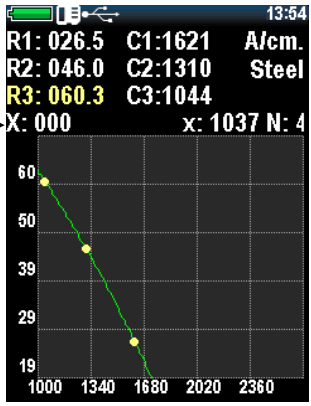



If you get an obvious error measurement, press 

and the last measurement will be removed from the series.

Go to the next nominal pressing  , and make the same procedure with other samples, you end up with:

The value for verification. Calculation of the average value of the code series.




To check the correctness of the got values, move the cursor to the **X:000** and take a few measurements on one of the sample.

For save, press BACK, window will appear:


Press **YES** by ↵. Calibration is saved. Select the appropriate material and scale, and device is ready for operation.

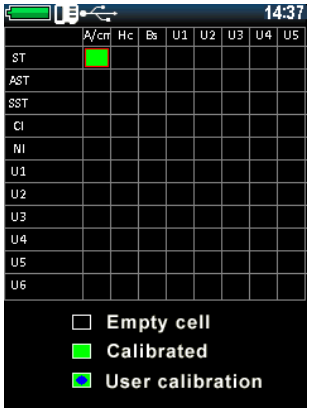
8.2. User (additional) calibration

Each of the saved main calibration may be further corrected. Additional calibration is recommended in the following cases:
- If the measurements of the device on the samples are constant, but differ from the nominal value of the standard samples;
- After extended storage (more than 3 months.);

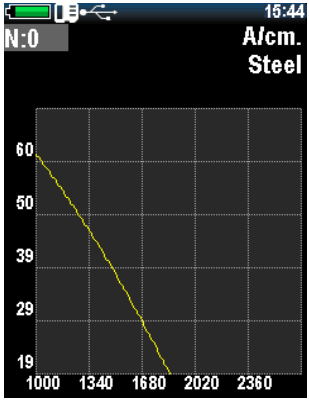
- After intensive operation;
- With a significant change in the operating conditions (temperature, humidity, etc.).

For the calibration of hardness scale needed one (single-point calibration) or two (two-point calibration) standard hardness tests samples with the maximum and minimum values for the controlled range of the hardness.

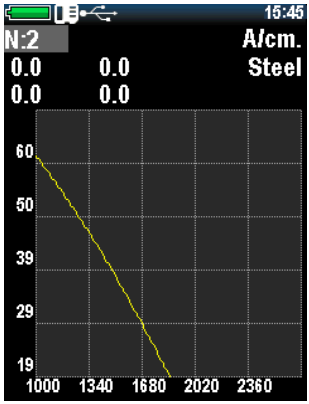
For example, we have two steel sample of known coercive force **A/cm**, and device shows a stable deviation for coercive force measurements on it. For making user two-point calibration select in main menu **Calibration**:



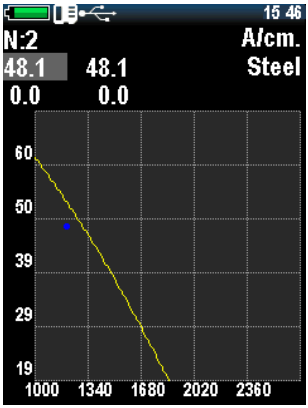

Press  and the screen appears:



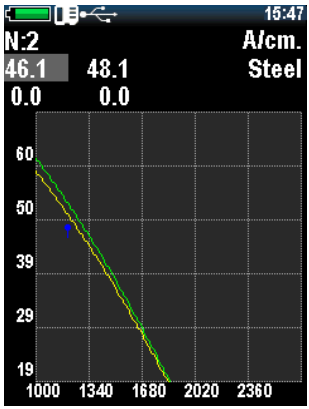

Press  for select the number of calibration points, as we have two sample - set 2 with pressing buttons  and  , then again  :



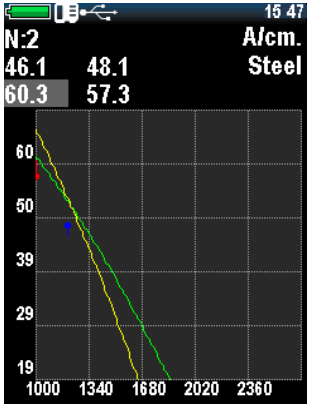
Move the cursor by pressing  to select the first row. Take about 5 measurements on the first sample, the instrument will display the average of the series in accordance with the current calibration. If you get an obvious error measurement, press  and the last measurement will be removed from the series. You will get:




Press  and by pressing  and  set the nominal value of the coercive force sample. To go to the next digit number, press  , for saving first value press  . After adjusting the value of the first sample you get:




Press  to adjust the second sample value, and perform the same operation. In the end, get:

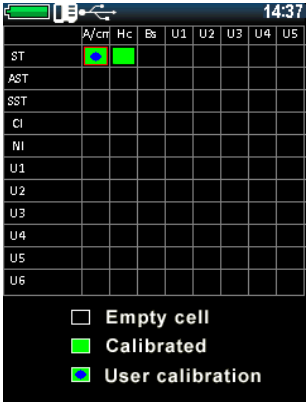



To save, press 

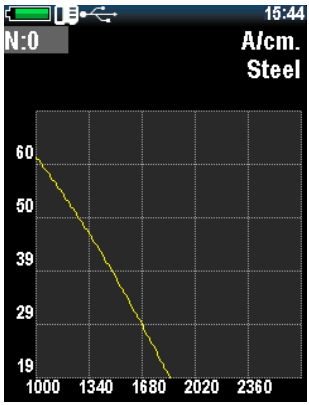
, window will appear:


Press **YES** by  . Calibration is saved. Select the appropriate material and scale, and device is ready for operation.

About the stored user calibration will symbolize the next state of the cell:




To delete user calibration, go to the user calibration mode and set to **0** for **N**:




## 9. Technical maintenance, special conditions of operation

9.1. For operation with the unit allowed persons who have been instructed and certified at the II qualification group on safety at work with electro-radio-measuring devices.

9.2. Troubleshooting and repairs are carried out exclusively by the manufacturer.

## 10. Storage and transportation

10.1. It is recommended to keep NOVOTEST KRC-M2 in closed premises with the relative humidity not more than 80% and temperature 25°C, there shall be no mold, paints, acids, chemical agents and other chemicals, the evaporation of which my give a harmful effect. Sharp fluctuations of temperature and humidity which can result in dew formation are not allowed.

10.2. NOVOTEST KRC-M2 transportation in the carry case shall be only in closed vehicles, where the possibility of mechanical damage or atmospheric precipitation is excluded.

10.3. After storage or transportation under the temperature lower than -5°C, before starting NOVOTEST KRC-M2 operation, it is necessary to keep it not longer than 6 hour under the temperature higher than +15°C and not less than 10 hours under the temperature higher than 0°C.

## 11. Manufacturer's guarantee and service maintenance

11.1. The manufacturer guarantees the normal operation of the device during:

- Electronic unit - 12 months from the date of sale,
- Converters - 6 months from the date of sale.

In case when NOVOTEST KRC-M2 (information processing unit and probe), 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, cables) 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.

11.2. Prepare technically grounded reclamation document and send it together with the NOVOTEST KRC-M2 to the guarantee service or to the manufacturer at the address: "NOVOTEST" Ltd., 51200. Ukraine, Novomoskovsk, Spasskaya str., 5, Phone: +38 067 593 59 77.

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

## NOTES