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NOVOTEST

Operating manual



(Electromagnetic-acoustic) EMA Thickness
Gauge NOVOTEST UT-3M-EMA

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**Caution!**

Please read this operating manual carefully before operating electromagnetic-acoustic (EMA) thickness gauge NOVOTEST UT-3M-EMA.

Operating manual (hereinafter referred to as OM) includes the information required to inform operator about the performance and operating procedure of the device – EMA Thickness Gauge NOVOTEST UT-3M-EMA (hereinafter referred to as the device or thickness gauge). The document contains the specification, description of the design and operating principle, as well as the information necessary for the right product operation. Before using the device, operator must read this manual, as the device must be operated by a person aware of the operating principle and design of the device.

The right and efficient operation of the device requires:

- measurement technique;
- conditions of measurement that meet the measurement technique;
- a trained operator who read this operating manual.

NOVOTEST reserves the right to make minor changes that do not impair the technical specification of the product. These changes may not be mentioned in this document.

The delivery set of the device includes the operation documents that are a part of this manual and the device registration certificate.

This OM applies to all product modifications.

1 DESCRIPTION AND OPERATION OF THE DEVICE AND ITS COMPONENTS

1.1 Intended use

Electromagnetic-acoustic (EMA) thickness gauge NOVOTEST UT-3M-EMA is intended for measuring the wall thickness of metal and alloy parts, walls of steel pipes, flat-rolled stock, rods, etc., without the use of couplant and preliminary surface preparation. EMA Thickness Gauge allows testing through a gap that might be air, rust, paint coating, fluid, plastic, salt deposits, etc.

The thickness gauge can be used in engineering, aerospace, metallurgy, in the mounting of metal structures, thermal power plants and nuclear power plants, field laboratories, and in the testing of vehicles.

1.2 Device specifications

Electromagnetic-acoustic (EMA) thickness gauge NOVOTEST UT-3M-EMA is a portable device enclosed in a shockproof casing with the chipboard, electronic components, and lithium-ion battery.

The product specifications are shown in the tab. 1.1.

Table 1.1 – Device specifications

Measurement range (depending on a transducer), mm	0.6 - 200
Permissible error, mm	$\pm (0.01h + 0.05)$ where: h – nominal thickness, mm
Ultrasound velocity range, m/s	100 - 9999
Resolution, mm	0.01
Measurement modes	Autocorrelation (ACF) Echo Echo-Echo (dual echo) Pique-Pique
Dimensions of the processing unit, max, mm	165x90x50
Power type	a built-in lithium-ion battery
Worktime without charging, min, h	8
Weight of the processing unit, max, kg	0.45
Display size	3.5 inches
Operating temperature range of the processing unit, °C	from -20 to +50
Air humidity, max	98 %, at 35 °C

1.3 Package

- The processing unit of EMA Thickness Gauge UT-3M-EMA 1 pc.
- EMA transducer As per order
- 2Lemo-2Lemo cable As per order
- USB cable..... 1 pc.
- Charger 1 pc.
- Packaging container 1 pc.
- Operating manual RDC.ED.UT-3M-EMA OM..... 1 pc.
- Registration certificate RDC.ED.UT-3M-EMA RS 1 pc.

* By a customer request, additional equipment or parts can be included in the package. The exact information on the scope of delivery is specified in the registration certificate of the device.

1.4 Device components

The device consists of a processing unit enclosed in a durable and lightweight aluminum case, and a transducer connected via sockets. The thickness gauge is controlled from the keyboard. Signals and readings, the status of the device and other information are presented on a contrast color LCD / TFT display.







The transducers are connected via coaxial cables, through the connectors that are located on the top panel of the housing. The device is powered by a lithium-ion battery. The mini-USB connector, located on the bottom of the case, is used to connect the device to a PC and to charge the battery. In fig. 1.1 shows the components of the device.



1 – casing; 2 – contrast color LCD/TFT display; 3 – keyboard; 4 – transducer connection sockets;
5 – mini-USB slot.

Figure 1.1 – Electromagnetic-acoustic (EMA) thickness gauge NOVOTEST UT-3M-EMA

The keyboard buttons and their functions:

-  – Turning on/off;
-  – “Back” button (returning to a previous section of the menu);
-  – Saving of a reading;
-  – Parameters menu;
-  – Navigation through the menu;
-  – Confirmation button.

1.5 Transducer

The thickness gauge is designed to function with EMA transducer (fix. 1.2). To prevent damaging, EMA transducer comes with a protective cap. The cap fitted on a transducer during the testing does not affect the measurement accuracy.



1 – 2Lemo-2Lemo cable; 2 – protective cap; 3 – EMA transducer.

Figure 1.2 – EMA transducer

The transducer of EMA Thickness Gauge includes the permanent magnet that entails specific requirements to the device operation:

1. If the device is moved near a sharp metal object, operator should exercise care as it might get magnetized to the transducer and harm operator.

Note – If the device is placed in proximity of a plastic magnet card, this might lead to the card failure.

2. If the transducer is placed on a loose and relatively lightweight sample, operator should hold it with hand.

3. If operator puts the device on a test object quickly and carelessly, it might bump against due to additional acceleration caused by the magnetic field. To save the service life of the transducer, it is recommended to place it on a test object smoothly and hold the device meanwhile.
4. It is recommended to put the device on the test object at a 60° angle. Once the transducer touches the test object, the transducer should be put upright.

1.6 Structure and functioning

The operating principle of the device is based on measuring the propagation time of an acoustic wave through the test object. The measured time is converted into thickness using the preset velocity of the ultrasonic wave propagation.

The acoustic wave is formed through electromagnetic-acoustic conversion directly on the surface of the test object, bypassing the contact medium between the transducer and the test object. Due to this conversion, the wave is not distorted in this medium.

The special data processing algorithm allows measuring the thickness of the test object correctly in the presence of interfering factors such as metal anisotropy, multiple reflectors, and external noise. The device eliminates the human factor, making thickness measurements fully automatic.

1.7 Operating modes

The device works in the following modes:

1. "MEASUREMENT":
 - "AUTO";
 - "MANUAL";
 - "B SCAN";
 - "CONTROL";
 - "CALIBRATION".
2. "ARCHIVE":
 - "PREVIEW" – preliminary viewing mode;
 - "VIEW" – viewing of the saved readings;
 - "LOAD MEAS." – the mode of measuring of the readings;
 - "DELETE" – removal of the selected measurements from the archive;
 - "DELETE ALL" – removal of all the saved measurements from the archive;
 - "EXIT".
3. "SETTINGS":
 - "LANGUAGE";
 - "BRIGHTNESS";
 - "COLOR SCHEME";
 - "SOUND";
 - "TYPE F";
 - "CLEAR. SD";
 - "TRANSDUCER";
 - "MATERIAL";
 - "SCALE";
 - "TIME";
 - "DATE".
4. "INFORMATION":
 - about the device.

1.8 Means of measurement, device, and accessories

The operability of the device is estimated using the reference samples. The measurement error of the device must be within the permissible error. If the permissible error is exceeded, the device must be calibrated according to c. 2.3.2.5.

Adjustment and setting of the device must be done by NOVOTEST.

1.9 Marking

The front panel of the device must show the designation of the device and the trademark of NOVOTEST.

The serial number is located on the back of the device.

1.10 Packaging

The processing unit and transducer are supplied in the packaging container excluding the damage when transporting.

To avoid mechanical damage of the cable and sockets of the device, disconnect the transducer from the device before placing it into the container.

2 INTENDED USE

2.1 Operating restrictions

The device must be operated away from dust and aggressive environments, and with consideration of features of the test objects in line with the agreed technical specifications, and the device must be used within its technical characteristics.

The magnetic of radio noise at the place of operation of the thickness gauge must not exceed the value that could impair the operation, i.e. it must not create the voltage at the amplifier input of the thickness gauge that is more than half of its maximum sensitivity.

If the magnetic field of radio noise is strong, the place of operation of the thickness gauge must be shielded from the external magnetic field.

The device must be used by a person who has read this operating manual.

If the device is carried to the place of operation at sub-zero temperature and placed in a room with a temperature above zero, it should be kept in a package for at least 6 hours to avoid the moisture buildup.

2.2 Preparation for the use

2.2.1 Visual inspection

Before an operation, the device must be checked visually, and its parts, processing unit, transducer, slots, and connection cable must be checked for damages.

2.2.2 Battery charging

To charge the battery, connect the power unit to the slot on the bottom edge of the device. The device can be operated during the charging.

The full battery charging takes up to 14 hours. When the device is being charged, it is prohibited to leave it unwatched. The device can be also charged by connecting it to a PC.

To avoid battery failure during long storage, the battery should be charged each 2 months, even when the device was not in operation.

2.2.3 Transducer connection

The transducer should be connected to the sockets in the top part of the device by a connection cable.



Caution!

To avoid failure of sockets and cables, follow the operating instructions for the use of connectors below!

The connector assembly of the device (fig. 2.1) consists of two parts: the device socket and the cable plug.

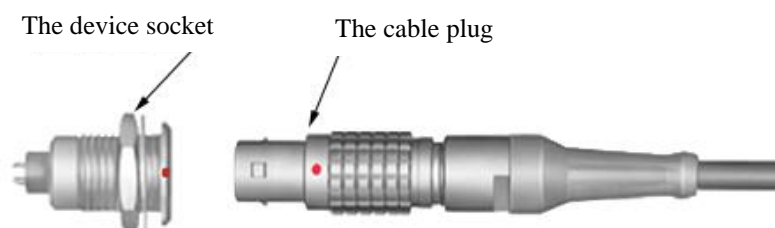


Figure 2.1 – Connectors used in the thickness gauge

Figure 2.2. shows the connection and disconnection of the connectors.


Caution!

Disconnecting the plug from the socket, hold it by the ribbed part and never pull the cable!

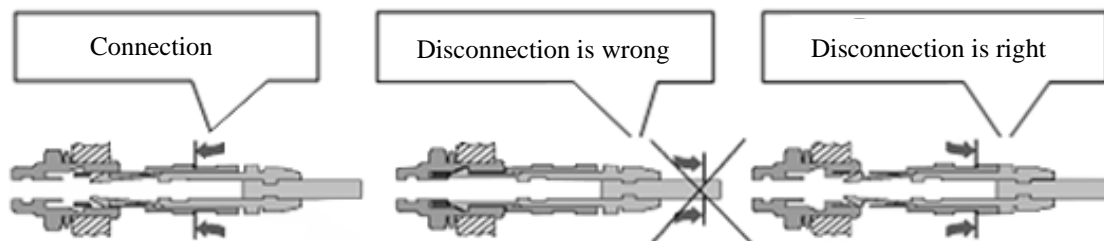


Figure 2.2 – Handling of the connectors

Note – The transducer should be connected when the device is off.

2.3 Operation

2.3.1 Turning on


Turn the device on by pressing “” on the control panel. When the device is on, the display will show the logo and the name of the device, version of firmware, and the serial number of the device (fig. 2.3).



Figure 2.3 – Display after turning the device on

After displaying this logo, the device will go to the main menu (fig. 2.4).






Figure 2.4 – Main menu

The main menu of the thickness gauge consists of four sections:

1. “MEASUREMENT” – entering the measurement mode;
2. “ARCHIVE” – displaying of all the saved measurement results;
3. “SETTINGS” – in this section, the following parameters can be set: language, brightness, color scheme, sound, type f., clear SD card, transducer, material, scale, time and date;
4. “INFORMATION” – displaying the information about manufacturer and the device.

2.3.2 “MEASUREMENT” mode

To enter the “MEASUREMENT” mode, choose the needed point using “” and “”, and confirm the selection by pressing “”.

In the MEASUREMENT mode, the display is split into two sections: main and informational (top part of the display) (fig. 2.5). The main section contains the working section of the mode, and the informational section features the battery charge, connection to PC, SD card connection, and the current time.

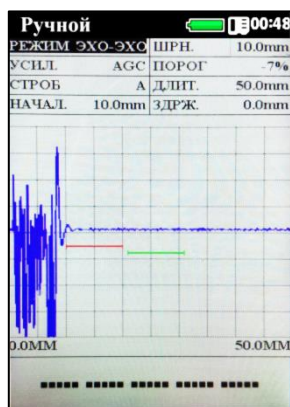















Figure 2.5 – Display of the thickness gauge

In “MEASUREMENT” mode, the thickness gauge can be operated in the following modes:

- “AUTO”;
- “MANUAL” mode;
- “B SCAN” mode;
- “CONTROL” mode;
- “CALIBRATION” mode.

To switch the operating mode of the thickness gauge, press “”, and select the needed mode by using “” and “”, press “” to confirm the selection. To navigate through the parameters, use “” and “”, and use “” and “” to change the value.

Operator can change the resolution of the selected parameter by pressing “”. The selected resolution is displayed by a special number (, , , ) next to the value being changed.

2.3.2.1 “AUTO” mode

In this mode, the device automatically analyses the measured signals, selects the measurement method, sets the parameters of the receive path, and displays the measured thickness value.

In the “AUTO” mode (fig. 2.6), the speed of ultrasound velocity in the test object must be set (the measurement of the velocity). The ultrasound velocity should be set through the calibration, or manually in the “SPEED” parameter (from 1000 to 9999 m/s).


Caution!

The device employs a transversal wave. The speed of propagation of transversal waves in steel is 3250 m/d.

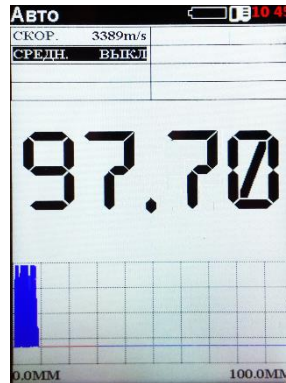


Figure 2.6 – “AUTO” mode

When testing materials with high attenuation, big objects, and using a big sounding range, the noise amplitude can be compared to the amplitude of the valid signal and the valid signal can be difficult to see with strong noise. For these cases, the device implements averaging that can be done by 2, 4, 8, 16, 32, 64 and 128 signals.

2.3.2.2 “MANUAL” mode

In the “MANUAL” mode, the measurement and testing are performed, and also setting of the device according to a specific task (fig. 2.7). All parameters for the settings of measurement are divided into categories (tab. 2.1) and depending on the selected category, operator can set different parameters.

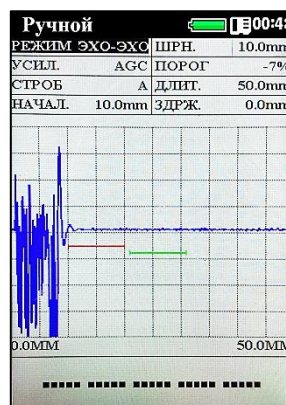


Figure 2.7 – “MANUAL” mode

Table 2.1 – Parameters of “MANUAL” mode

Categories	Parameters						
PIQUE-PIQUE	AMP.	START	WIDTH	THRESHOLD	DUR.	DELAY.	LEVEL
FRONT	AMP.	START	THRESHOLD	DUR.	DELAY.	AVG.	
ECHO	AMP.	START	WIDTH	THRESHOLD	DUR.	DELAY.	
ECHO-ECHO	AMP.	GATE A/ GATE B	START	WIDTH	THRES HOLD	DUR.	DELAY

Description of the parameters of the “MANUAL” mode:

- “AMP.”: amplification is adjusted automatically (AGC), or manually;
- “START”: the point of start of the selected gate (from 0 to the maximum measurement range);
- “WIDTH”: the width of the selected gate of the beam control. This value can vary from 0 to the maximum measurement range. The total of start and width of the gate cannot exceed the maximum measurement range;
- “THRESHOLD”: the threshold of the amplitude of processing of “THRESHOLD” echo signals. The range is from 0 to 100%;
- “DUR.”: duration of scanning;
- “DELAY”: this parameter sets the delay of the start of scanning against the monitoring pulse;
- “LEVEL”: turn on/turn off;
- “AVG.”: turn on / turn off, and set the quantity;
- “GATE A/GATE B”: a selection of the gate. It can be A or B.

2.3.2.3 “B SCAN” mode

“B SCAN” mode (fig. 2.8) is used for displaying of B-Scan that is the shape of the test object. This mode is used for detection of the corrosion damages, reduction, and lamination when scanning the test object and graphical B-scan.

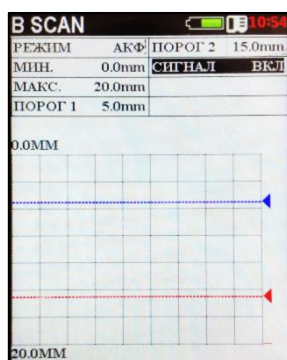


Figure 2.8 – “B SCAN” mode

All the settings of parameters of measurement in the “B SCAN” mode are divided into groups (tab. 2.2).

Table 2.2 – “B SCAN” parameters

Groups	Parameters				
AUTO	MIN.	MAX.	THRESHOLD 1	THRESHOLD 2	SIGNAL
ACF	MIN.	MAX.	THRESHOLD 1	THRESHOLD 2	SIGNAL
PIQUE-PIQUE	MIN.	MAX.	THRESHOLD 1	THRESHOLD 2	SIGNAL
FRONT	MIN.	MAX.	THRESHOLD 1	THRESHOLD 2	SIGNAL
ECHO	MIN.	MAX.	THRESHOLD 1	THRESHOLD 2	SIGNAL
ECHO-ECHO	MIN.	MAX.	THRESHOLD 1	THRESHOLD 2	SIGNAL

Description of the “B SCAN” settings:

- “MIN.”: the lowest value of the measurement range;
- “MAX.”: the highest value of the measurement range;
- “THRESHOLD 1” and “THRESHOLD 2”: minimum and maximum measurement threshold;
- “SIGNAL”: turning on/off of the sound signal.

2.3.2.4 “CONTROL” mode

This mode is used when it is necessary to examine the products by the exact thickness (minimum and maximum). When the measured thickness exceeds the set thresholds, signalization is triggered so the product can be rejected.

“CONTROL” mode (fig. 2.9) allows operator to estimate the corrosion damage in the percentage of the reference thickness value.

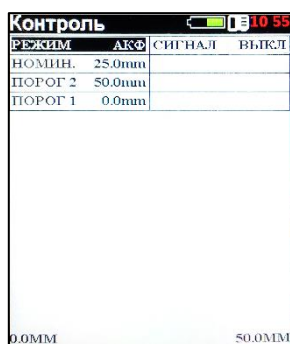


Figure 2.9 – “CONTROL” mode

All parameters of settings of the measurement in the “CONTROL” mode are divided into groups (tab. 2.3).

Table 2.3 – “CONTROL” mode parameters

Groups	Parameters			
AUTO	REF.	THRESHOLD 2	THRESHOLD 1	SIGNAL
ACF	REF.	THRESHOLD 2	THRESHOLD 1	SIGNAL
PIQUE-PIQUE	REF.	THRESHOLD 2	THRESHOLD 1	SIGNAL

FRONT	REF.	THRESHOLD 2	THRESHOLD 1	SIGNAL
ECHO	REF.	THRESHOLD 2	THRESHOLD 1	SIGNAL
ECHO-ECHO	REF.	THRESHOLD 2	THRESHOLD 1	SIGNAL

Description of settings of the “CONTROL” mode:

- “REF.”: reference thickness;
- “THRESHOLD 1” and “THRESHOLD 2”: minimum and maximum thresholds of the thickness measurement;
- “SIGNAL”: Turning on/off of the sound signal.

2.3.2.5 Calibration

To calibrate the device, place the EMA transducer on the test object. In “Calibration” mode, set “AVG.” that can be done by 2, 4, 8, 16, 32, 64 and 128 signals (the averaging can be deactivated if necessary), set the thickness of the reference sample “REFERENCE” and press “START CALIBRATION”.

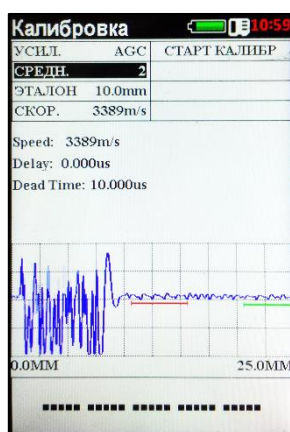




Figure 2.10 – “CALIBRATION” menu

Put the transducer into the air (away from the test object) according to the instruction on the display “PUT INTO THE AIR” (fig. 2.11), then confirm or reject the action by pressing “” or “.

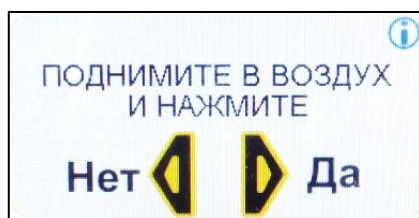




Figure 2.11 – “PUT INTO THE AIR”

The device will make a measurement and shows the new instruction on the display “PUT ON THE SAMPLE” (fig. 2.12), and then operator should confirm or reject the action by pressing the button “” or “.

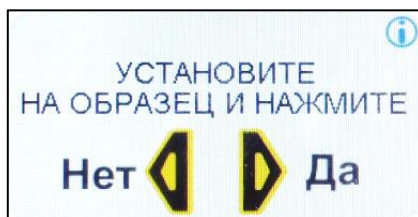


Figure 2.12 – “PUT ON THE SAMPLE”

The device will make a measurement and display the thickness of the reference sample. If the measured value is different from the reference sample and error is more than $\pm(0.01h + 0.05)$ mm, the device must be re-calibrated.

2.3.3 “SETTINGS” mode

When “SETTINGS” mode is selected (fig. 2.13), the device will go to the settings of the next parameters:

- “LANGUAGE”: setting the language of the device menu (English and Russian are available);
- “BRIGHTNESS”: change of the display brightness (10%, 20% ... 100%);
- “COLOR SCHEME”: selectin of the color scheme (01, 02);
- “SOUND”: Turning on/off (“ON”, “OFF”);
- “TYPE F.”: “Median” filter, “OFF”;
- “CLEAR. SD”: Clearing of SD card (switching “OFF” to “ON”), the SD card level is shown on the bottom part of the display;
- “TRANSDUCER”: the selection of the stored transducers;
- “MATERIAL”: aluminum, duralumin Д16Т, bronze, tungsten, iron, gold, brass, ЛС-59-1 brass, magnesium, manganese, copper, molybdenum, nickel, tin, lead, silver, steel 20ГЧДМ, ХН77ЕЮР steel, 40ХНМА steel, ХН70ВМТЮ steel, ХН35ВТ steel, Х15Н15ГC steel, CT3 steel, chromium, zinc, cast iron, 40x13 steel, user;
- “SCALE”: measurement units (mm, μ m);
- “TIME”: time setting (24h);
- “DATE”: setting the date, month, and year DATE/MONTH/YEAR.

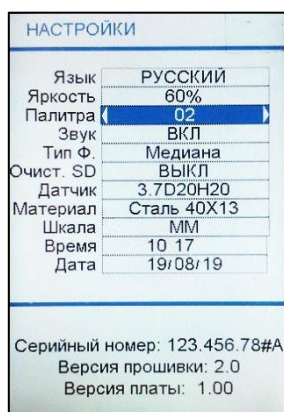










Figure 2.13 – “SETTINGS” mode

To navigate through «SETTINGS» menu, use “” and “” buttons, to select the parameter to be changed, press “”, and select the needed value by pressing “”, “”, “”, “” select the needed value that is confirmed by pressing “”.

2.3.4 “ARCHIVE” mode

This mode allows seeing all the saved measurement values and, if needed, download the selected file to continue working with the required settings (fig. 2.14).

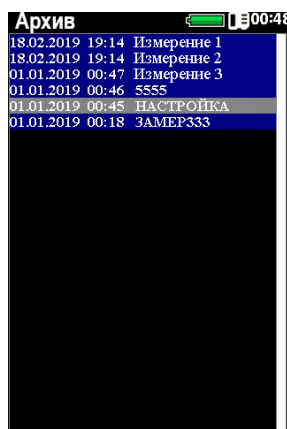





Figure 2.14 – “АРХИВ” mode

The saved measurement values are listed and sorted by the date of creation. To handle the saved files, select the saved file by using “” and “”, and press “”.

2.3.5 “INFORMATION” mode

In this mode, operator can view the product information: battery charge, voltage, consumed voltage, total operation time, measurement time, serial number, firmware version, and chipboard version (fig. 2.15).



Figure 2.15 – “INFORMATION” mode

2.3.6 Measurement

Before using the device, make sure that the battery is charged sufficiently. The green battery icon confirms that the battery is charged by 100%. If there is no charge or the charge is low (the red icon), the battery must be charged by a charger or by connecting the device to a PC.



1. Connect the EMA transducer to the device.
2. Turn the device on by pressing “”.
3. Select the operating mode of the thickness gauge by pressing “”, and set the needed parameters.
4. In needed, calibrate the device according to. 2.3.2.5.
5. Put EMA transducer on the teste object and achieve a stable value on the display (fig. 2.16).



Figure 2.16 – Measurement

6. To save the measurement value, press “”. Then, the name of measurement can be set with a virtual keyboard (fig. 2.17).

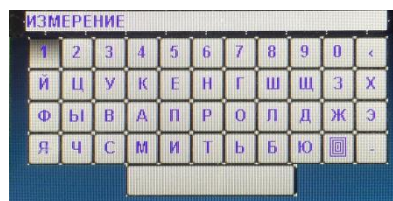








Figure 2.17 – The input of the measurement

Use “”, “”, “” and “” to navigate through the keyboard, select the needed symbol by pressing “”.

7. To turn the device off, enter the main menu and press “”.

3 MAINTENANCE OF THE DEVICE AND ITS COMPONENTS

3.1 Safety precautions

After commissioning of the device, it is recommended to inspect it periodically to check the following:

- operability;
- compliance with the operating requirements;
- battery charge level;
- absence of damage to the device components.

When using the charger connected to 220V at 50 Hz, operator should observe the regulations in “Safety procedure when operating consumer electronic units”.

If the device is not in operation for a long time, the batteries must be disconnected from a power supply and taken out from the device. Using this, the storage regulations of the battery must be observed.

The device can be used only by the persons instructed and certified by the II qualification category by safety engineering using the measuring devices.

3.2 Warranty

The above information about the warranty servicing applies to all the NOVOTEST products.

The manufacturer warrants the compliance of the device with the technical specifications with compliance with the terms of transportation, storage, and operation, and timely maintenance at least once a year.

3.2.1 Basic warranty

The device purchased from NOVOTEST or an authorized dealer is covered by the basic warranty – 3 years, subject to the timely maintenance at least once a year.

If any part of the device fails due to the defect of the material or a manufacturer, it shall be repaired or replaced by the manufacturer, or any authorized dealer of NOVOTEST, regardless of the transferring of the ownership right to a third party during the warranty period.

The warranty applies from the date of purchase of the device, normally, from the shipment date. If the device is purchased by an intermediate, the warranty period starts from the date of receipt of the device by an intermediate.

3.2.2 Extended warranty

There is a special program of extension of the basic warranty from 3 to 5 years. To take advantage of this program, user needs to pay the certificate with the purchasing. The terms and conditions of the extended warranty are specified in the certificate.

3.2.3 Warranty for repaired and replaced components

All branded parts of NOVOTEST installed during the warranty repair apply to the NOVOTEST warranty (up to the end of the warranty period).

The spare parts replaced during the warranty service, shall not be returned to the device owner.

3.2.4 Wearing parts

The parts wearing during the device operation are divided into two main categories. The first part includes the parts that need to be replaced or adjusted with frequency stipulated by the maintenance schedule of the device, and the second part includes the wearing parts, which frequency of replacement or adjustment depends on the conditions of the product operation.

3.2.4.1 The parts replaced during the maintenance

The parts listed above have limited service life and need replacement or adjustment with the periods stipulated by the schedule of the device maintenance. For these parts, the basic warranty applies before the first part replacement or adjustment. The warranty period for each part cannot exceed the limitations (by the time of operation of the device or working hours), specified in the conditions of the basic warranty.

- built-in batteries;
- gaskets, if they are removed due to accompanying adjustment;
- grease and operating liquids.

3.2.4.2 Wearing parts

The parts listed below that have limited service life or need to be replaced (adjusted) due to the damage. However, these parts are subject basic warranty of NOVOTEST during 12 months:

- transducers and their components;
- connection cables.

Note: The parts wearing due to friction (such as movable parts of measuring transducers, ultrasonic piezoelectric transducers, support arm etc.) are not covered by the basic NOVOTEST warranty, if these parts fail due to wear and tear during the device operation. However, if in the warranty period these parts fail due to defect of material or workmanship, they shall be repaired or replaced under the basic warranty.

3.2.5 Owner obligations

The operating manual and registration certificate of the device specifies the information about the proper operation and maintenance of the device.

Proper operation and maintenance of the device will help avoid costly repairs caused by incorrect operation, negligence or improper maintenance. Besides, following our recommendations will extend the service life of the device. Therefore, the device owner should:

- If any defect or fault is found, submit the device to NOVOTEST or the authorized dealer of NOVOTEST for a warranty repair as soon as possible. This can minimize the repair required for the device.
- Use only branded spare parts and couplants of NOVOTEST (with appropriate labels) during the device maintenance.

Note: The failure to perform the device maintenance in time under the maintenance schedule deprives of the right to warranty repair or replacement of the faulty parts.

- Use only branded spare parts and couplants of NOVOTEST (with appropriate labels).
- Make records of the device maintenance in the registration certificate and keep receipts and bills. If necessary, they will prove that the maintenance was made in time (according to periodicity specified in the registration certificate), using the recommended spare parts and couplants. This will help in making warranty claims to defects that might occur due to a deviation from the device maintenance schedule or the use of unauthorized parts or materials.
- Clean the casing of the device and probe according to recommendations of NOVOTEST.
- Fulfill the operation and storage requirements in line with NOVOTEST recommendations.

3.2.6 Warranty obligations

NOVOTEST warranty shall not apply if replacement or adjustment is caused by one of the following factors:

- Damages caused by negligent/incorrect operation of the device, natural disaster, water intrusion into device, probe, accessories, and parts of the device, accident or misuse of the device;
- Wear and tear;
- Non-observance of NOVOTEST recommendations regarding periodicity of the device maintenance;
- Non-observance of requirements to the device operation recommended by NOVOTEST;
- Changing of the configuration of the device or its components, intrusion into systems of the device, etc. without the approval of NOVOTEST;
- Refusal from repair of any damages found during the regular maintenance;
- Factors outside the scope of control of NOVOTEST, for example, air pollution, hurricanes, chips resulting from shocks, scratches, and use of unsuitable cleaning;
- Use of the repair methods not approved by NOVOTEST;
- Use of third-party spare parts and couplants of NOVOTEST.

All repairs covered by the NOVOTEST warranty shall be performed by the authorized service center of NOVOTEST.

3.2.7 Cases uncovered by warranty

The basic warranty of NOVOTEST and extended warranty of NOVOTEST shall not hold NOVOTEST accountable for any unexpected or indirect damage resulting from a defect covered by the above warranties. Such damage includes (but is not limited to the following):

- reimbursement for inconveniences, phone calls, posting and shipping expenses the device, loss of profit or damage to property;
- all warranties shall become void if the device is officially recognized unserviceable.

3.2.8 Other warranties and consumer law

The basic warranty of NOVOTEST and extended warranty of NOVOTEST shall not harm the rights provided by the sale agreement that is executed with selling the device to the manufacturer or authorized dealer of NOVOTEST and the applicable law stipulating the requirements to sales and servicing of consumer goods.

3.3 Maintenance

The information about the maintenance applies to all NOVOTEST products.

The maintenance shall be performed during the device operation and is categorized into:

- preventive maintenance;
- regular maintenance.

Preventive maintenance shall be performed at least once in a quarter and includes visual inspection, cleaning, and greasing.

Regular maintenance shall be performed by NOVOTEST at least once a year and is mandatory to save the warranty of NOVOTEST.

It is very important to maintain the device during the entire operation period.

The list of steps performed during each maintenance will depend on the device model, year of production, and run to failure. By request, the authorized service center of NOVOTEST may provide the information about steps to be taken when servicing the device.

The records of regular maintenance of the device shall be made in the registration certificate of the device. The information about maintenance is very important; it can be needed to exercise the rights for warranty repair of the device. So, always make sure that the authorized service center of NOVOTEST puts a stamp in the right place under the record about the performed procedure.

If any failure in the device is found, it shall be submitted to NOVOTEST for maintenance. Table 3.3 lists the failures that operator can eliminate individually.

Table 3.1 – Possible failures and methods of elimination

Name of failure, signs, and additional evidence	Possible reason	Method of elimination
The device does not turn on	No power supply	Check the presence and condition of autonomous power supply
No measurement	The break in the electronic circuit	Find the break and cure it
Wrong measurement	The device is not calibrated or there is the influence of external factors	Re-calibrate the device and eliminate the external factors

4 RUNNING REPAIRS

By design and operating conditions, the device belongs to the devices that should be repaired by specialized companies or a manufacturer.

To submit the device to the service center (SC) for warranty service, the registration certificate of the device must be submitted. SC shall make a record in the registration certificate about the warranty service of the device and sends the copy to the manufacturer.

The device shall be submitted for warranty (after-warranty) repair or verification along with the registration certificate of the device. The accompanying documents shall state the contact details, phone number, and fax of the sender, and the method and address of delivery.

The warranty repair is performed upon the presence of the filled-in registration certificate.

5 STORAGE

The storage conditions of the device belong to category 1 according to GOST 15150 at the ambient temperature from +5 °C to +40 °C and relative humidity up to 80 % at the temperature of 25 °C. The temperature recommended for long-time storage is 10 °C – 30 °C.

During short-term storage and in the periods between applications, the device shall be stored in the intended packaging container. The place of storage should be free from vapors of aggressive media (acids, alkali) and direct sunlight. The device shall not be exposed to rapid shocks, falls or strong vibrations.

The devices shall be placed on storage racks or in palletized in the transportation container.

For long-term storage, the device must be preserved; the processing unit, transducer, and power unit should be placed into separate plastic bags and put in separate sections of the transportation case of the device.

6 TRANSPORTATION

The packed devices can be transported by any kind of carrier upon fulfilment of the following requirements:

- transportation is performed in the factory container;
- no direct moisture influence;
- the temperature does not go outside the range from -50 °C to +50 °C;
- humidity does not exceed 95 % at the temperature up to 35 °C;
- vibration is in the range 10 до 500 Hz and the amplitude up to 0.35 mm and acceleration up to 49 m/s²;
- shocks of peak acceleration of up to 98 m/s²;
- the devices in the vehicle are fastened to avoid falling and mutual bumps.

To avoid the moisture buildup inside the device after transportation from the sub-zero environment to a warm place, the device should be held in a container for 6 hours at room temperature.

7 DISPOSAL

The device does not contain dangerous or harmful substances that could harm a human health or environment and are not dangerous for life, public health and environment upon expiration of the service life. Due to this fact, device disposal can be done according to common waste disposal practices. Disposal shall be done by the type of components: plastic, metal, and fastening components.

The content of precious metals in the device components (electronic boards, connectors, etc.) is very low, so recycling is not expedient.

ANNEX A

The velocity of transversal wave propagation in materials

Table 1 – Velocity of transversal wave propagation in the materials

Material	The velocity of transversal waves, m/s
Aluminum	3100
Beryllium	8900
Bronze (phosphorous)	2330
Tungsten	2870
Iron	3200
Gold	1200
Cadmium	1500
Yellow metal	2120
Magnesium	3060
Manganese	3270
Copper	2260
Molybdenum	3350
Nylon	1100
Nickel	2960
Organic glass	1100
Tin	1670
Perspex	1110
Polystyrene	1120
Lead	700
Silver	1650
Steel	3250
Titanium	3100
Chrome	3975
Zinc	2440
Cast iron	2600