NOVOTEST

NOVOTEST

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Operating manual

NOVOTEST

Magnetometer
NOVOTEST MF-1M

CONTENTS

Caution!
Please read this operating manual carefully before using the Magnetometer NOVOTEST MF-1M.

This operating manual (hereinafter referred to as OM) includes the information required to inform user about the performance and operating procedure of the product, magnetometer NOVOTEST MF-1M (hereinafter referred to as the device or magnetometer). 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, user 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 provides for the following:

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

The manufacturer 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 operating manual applies to all product modifications.

1 DESCRIPTION AND OPERATION OF THE DEVICE AND ITS COMPONENTS

1.1 Purpose

Magnetometer (teslameter) NOVOTEST MF-1M is designed to measure magnetic field strength (magnetic induction). The device is used in industrial and construction fields.

The magnetometer is designed to test the following parameters:

– checking of equipment for compliance with the required technical specifications;
– magnetic field measurement during testing of ferromagnetic products by the magnetic particle inspection;
– definition of residual magnetization;
– monitoring of permissible values of industrial interference;
– research and testing of magnetic field levels.

1.2 Specifications

A magnetometer is a portable device containing a circuit board with electronic components and a battery. The magnetic field transducer (Hall probe) is designed to measure the intensity of a constant magnetic field.

The main specifications of the device are shown in tab. 1.1.

Table 1.1 – The main characteristics of the device

Measurement range, G	±100 ±1000 ±2500
Measurement accuracy, G	±(1+0.05H) *where H – module of the numerical value of readings of the magnetometer expressed in Gauss*
Operating conditions: – ambient temperature for the electronic unit, ºC – ambient temperature for the probe, ºC – relative air humidity, % – air pressure, kPa	 from -10 to +40 from -20 to +40 up to 98 at +25 ºC from 84 to 106.7
Display resolution, G	0.1
Setting time, s, max	1
Dimensions: – electronic unit, mm – probe, mm	 120x75x36 Ø20x115
Weight: – electronic unit, kg, max – probe, kg, max	 0.25 0.08
Powering from two Ni-MH AA batteries (or alkali batteries)	1.2 (1.5) V
Operating time, h, min	20
Measurement units	G, mT, A/cm

1.3 Package

Electronic unit of magnetometer ..... 1 pc.
Hall probe ..... 1 pc.

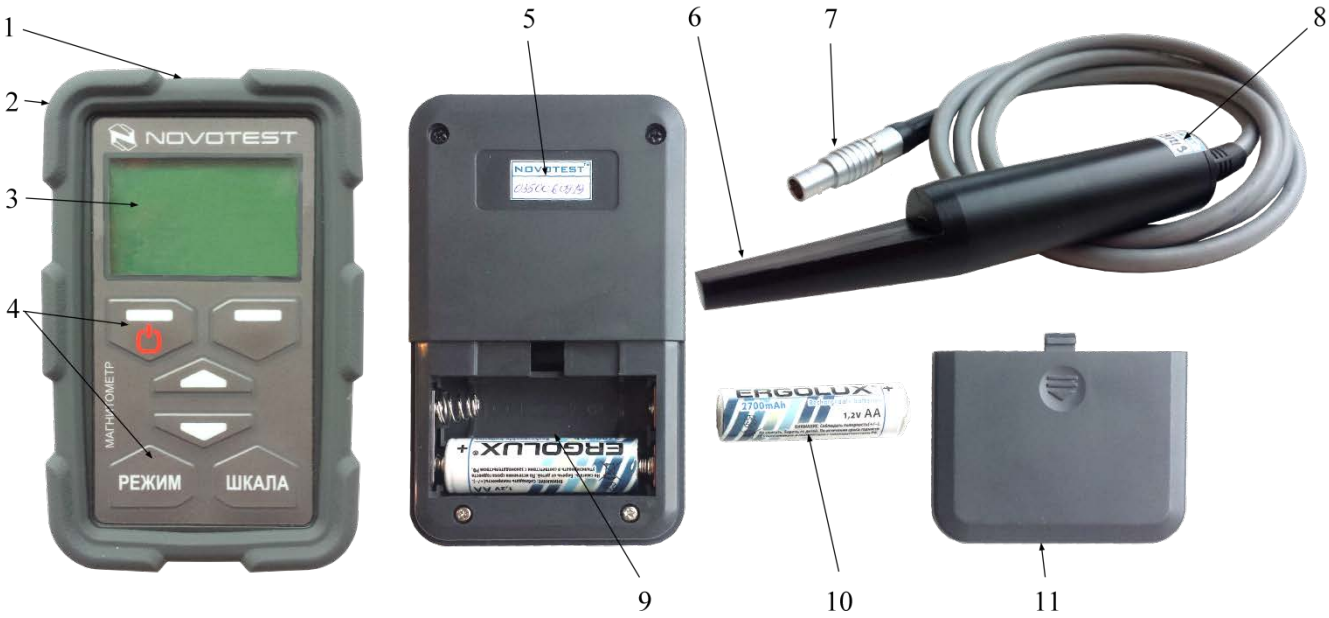
AA battery ..... 2 pc.
Protective silicone case ..... 1 pc.
Charger ..... 1 pc.
Operating manual RDC.OD.MF-1M.000 OM ..... 1 pc.
Transport packaging ..... 1 pc.

* By request of the customer, the package can be added by extra equipment or parts. The exact information about the scope of delivery is specified in the datasheet.

1.4 Composition

The magnetometer consists of the electronic unit and a Hall probe connected through a socket on the top part of the electronic unit (fig. 1.1).

The body of the device is made of a shockproof ABS plastic. The front panel of the electronic unit features a graphic display and control buttons. The graphic display shows the measured values of the magnetic field and the state of charge of the battery. The bottom part of the rear panel features a battery compartment.



1 – socket for the probe connection; 2 – protective silicone case; 3 – graphic display; 4 – keyboard; 5 – serial number of the device; 6 – Hall probe; 7 – the probe pin; 8 – serial number of the probe; 9 – battery compartment; 10 – AA battery; 11 – battery compartment cover.

Figure 1.1 – Magnetometer NOVOTEST MF-1M

Control buttons and their functions:

 – turning off and on;

– selection of measurement units;

– selection of measurement mode;

 – right functional button;

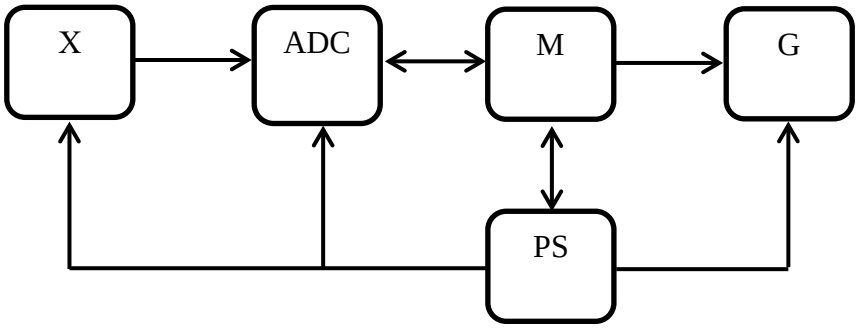
 – navigation up in the menu/increase of the input value;

 – navigation down in the menu/decrease of the input value.

1.5 Design and operation

The operating principle of a magnetometer is based on the physical Hall effect using the Hall linear elements (transducers) of PH type.

The structural scheme of the magnetometer is shown on the fig.1.2.



X – linear Hall element; ADC – analog-to-digital converter;
M – microprocessor controller; G – graphic display; PS – power source.

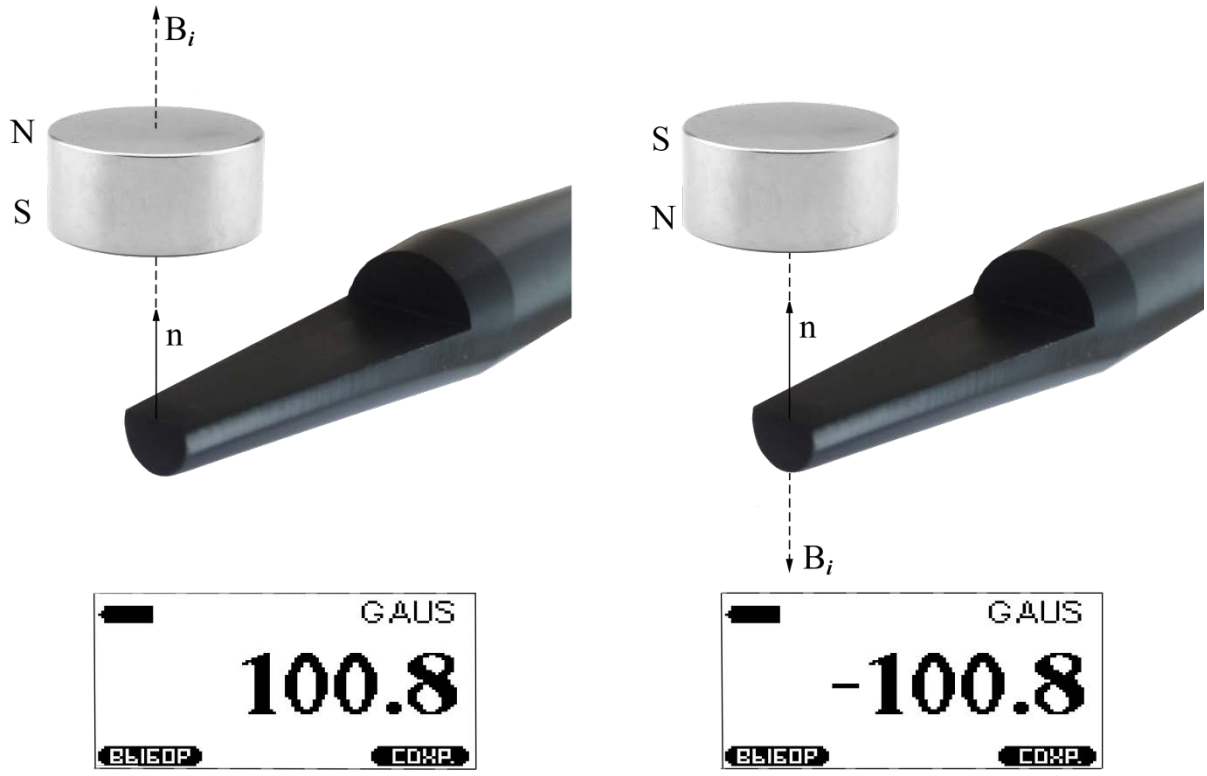
Figure 1.2 – Schematic stricture of magnetometer NOVOTEST MF-1M

The Hall element converts the magnitude of the magnetic field into a voltage which is fed to the input of analog-to-digital converter “ADC”. The synchronous analog-to-digital conversion of the signal leads to a cyclic sequence of digital codes, based on which the microprocessor controller “M” calculates the exact value of Hall electromotive force and converts it into measurement unit of induction or magnetic field strength and displays the reading in digital or graphic form on the graphic display “G”. The microprocessor controller “M” also monitors the status of the “PS” power system of the magnetometer.

1.6 Hall probe

The working surface of the probe features a hole with the Hall element. The sensitive area of the Hall element is arranged along the working surface of the magnetic field transducer.

The magnetometer readings correspond to the magnitude of the constant magnetic field induction vector component normal to the working surface of the magnetic field transducer B_i that is numerically equal to the scalar product of the magnetic field induction vector B and the unit normal vector n (fig. 1.3).



(a) (b)

Figure 1.3 – The readings depending on the passing of the magnetic induction vector through the Hall probe.

The positive reading of the magnetometer means that the normal component of the induction vector of a constant magnetic field at the measurement point goes outside the working surface of the magnetic field transducer. (fig. 1.3a).

A negative reading of the magnetometer means that the normal component of the induction vector of a constant magnetic field at the measurement point is within the working surface of the magnetic field transducer (fig. 1.3б).

1.7 Measurement instruments and accessories

The adjustment and setting of the device in case of detection of malfunctions should be performed by the manufacturer.

1.8 Labeling and sealing

The front panel of the device features the designation of the device with the trademark of the manufacturer.

The rear panel of the device features the factory number.

1.9 Packaging

The electronic unit and the converter are delivered in packaging containers that eliminate their damage during transportation.

To avoid damage to the cable and the connectors of the device, it is necessary to disconnect the converter from the device before placing it in the packaging container.

2 INTENDED USE

2.1 Operating restrictions

The device should be operated away from direct exposure to dust and aggressive environments with consideration of the parameters of the test objects under the agreed technical requirements and used within its specifications.

The device must be operated by a user who have read this operating manual.

After transporting the device to the place of operation at a negative ambient temperature and introducing it into a room with a positive temperature, the product must be kept in the package for at least 6 hours to avoid damage to the device due to moisture buildup.

2.2 Preparation for the use

2.2.1 Visual inspection

The device must be visually inspected and checked for damages of the processing unit, Hall probe, socket, and connecting cable.

2.2.2 Installation of batteries

Install the batteries in the battery compartment by removing protective silicone case and opening the compartment cover by gently pressing and pulling down until the cover is completely detached. The batteries or battery are installed according to the polarity indicated on the device. Close the battery cover until it clicks into place and put on the protective silicone case. (fig. 2.1).

Figure 2.1 – Battery installation

2.2.3 Battery charging

Install the batteries in the battery compartment, having previously removed the protective silicone case and opened the compartment cover by gently pressing and pulling it down until the cover is completely detached. The batteries or a battery should be installed according to the polarity indicated on the device. Close the battery cover until it clicks and put a protective silicone case back on.

To charge the battery, user should to the following steps:

- Connect the battery to the charger terminals;
- Plug the charger back in.

The battery gets fully charged within 14 hours. The charger shall not be left unattended during the charge.

To avoid the battery failure during prolonged storage, the battery should be recharged with an interval of at least 2 months, even if it has not been used.

2.2.4 Hall probe connection

Connect the Hall probe via the connecting cable to the probe socket on the processing unit. Connect the connecting cable so that the red dot on the plug and the connector are aligned (fig. 2.2).

Figure 2.2 – The probe connection

Caution!
To prevent damage to the connectors and cables, follow the instructions for working with these connectors below.

The connectors used in the device (fig. 2.3) consist of two parts: the socket of the device and pin (plug) of the cable.

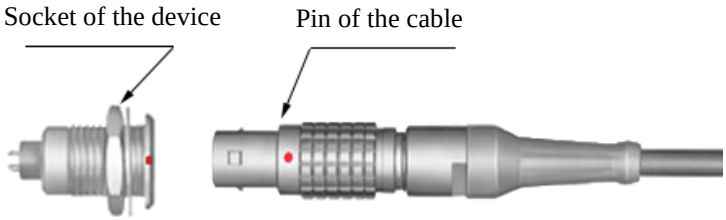


Figure 2.3 – Connectors of the device

The connection and disconnection between socket and pin are shown in fig. 2.4.

Caution!
Disconnecting the pin from the socket, hold it by the rubbed part of the body, do not pull the cable!

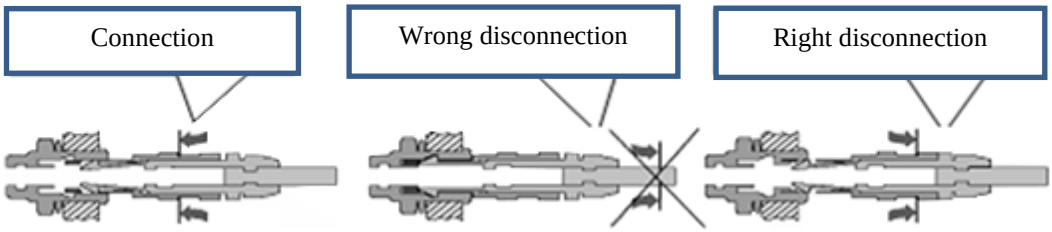


Figure 2.4 – Handling of connectors

Note – Connection and disconnection from the processing unit are allowed only with the magnetometer powered on.

2.3 Operation

2.3.1 Turning on

Turning on is performed by pressing "  " until a short screensaver appears on the graphic display (fig. 2.5).

Figure 2.5 – Screensaver after turning on

The device then goes to the main menu that can be navigated by quick pressing of "  " and "  ", selection of the section is made by pressing "  ".

2.3.2 "Measurement" section

When the "Measurement" section is selected (fig. 2.6), the device goes to the measurement depending on the chosen parameters (fig. 2.7).

Figure 2.6 – "Measurement" section

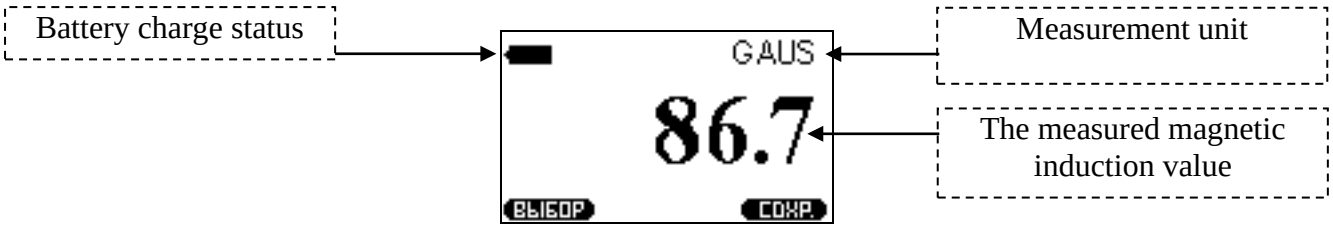


Figure 2.7 – Displaying of information during the operation

2.3.2.1 Selection of measurement units

Selection of measurement units is made by a quick pressing " 

". The device will offer the following measurement units (fig. 2.8):

– *Gauss;*
– *Millitesla;*
– *Ampere/cm;*
– *CODE.*

Note – The CODE scale is used for calibration by the manufacturer.

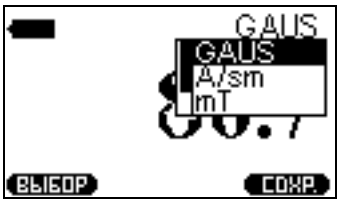


Figure 2.8 – Selection of measurement units

Select the needed measurement unit by "▲" and "▼" and press "●". The selected measurement unit is shown on the graphic display of the device.

After turning on, the magnetometer will measure in *Gauss*.

2.3.2.2 Measurement modes

To select the measurement mode, press "РЕЖИМ". The device will offer the following measurement modes (fig. 2.9):

– *Normal* – normal operation mode;
– *Graphical* – graphical mode.

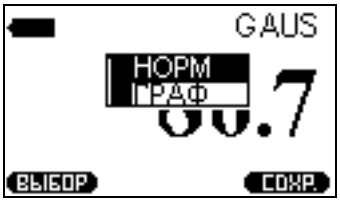


Figure 2.9 – Selection of measurement modes

In the "Normal" mode the device will display the current measurement value (fig. 2.10).

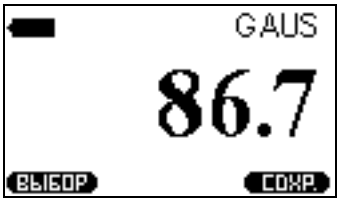


Figure 2.10 – Displaying of the reading in the "Normal" mode

In "Graphical" mode, the graphic display of the magnetometer will show the following information (fig. 2.11).

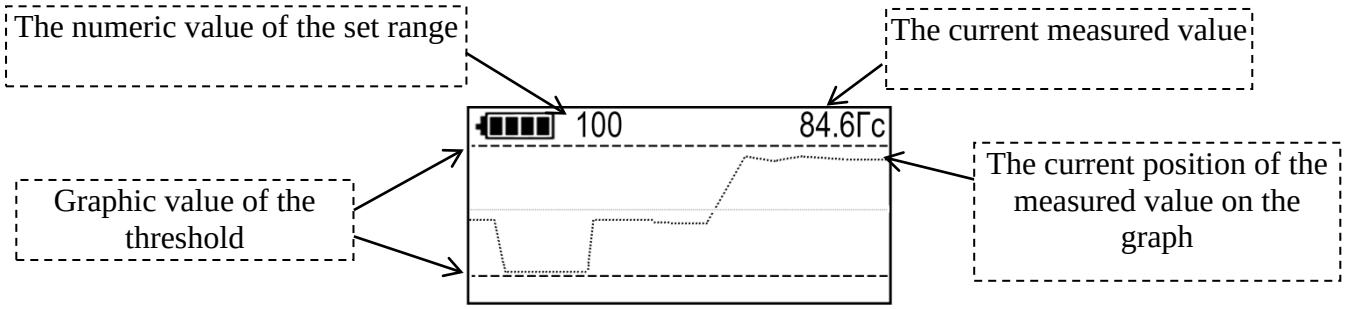


Figure 2.11 – The graphic scheme of the device operation

The threshold level and range are set in the “Settings” section. If the threshold of the measured value is exceeded, the sound signal is generated (the signal can be disabled in the “Settings” section).

2.3.3 Measurement

To measure the normal component of the induction vector of the constant magnetic field on the surface of a metal product or a permanent magnet, install the Hall probe with the working surface against the needed place of the test object (fig. 2.12).

Figure 2.12 – Measurement of the normal component of the induction vector of a constant magnetic field on the end and side surface of the test object

To measure the tangential (contacting) component of the induction vector of a constant magnetic field on the surface of a metal product or a permanent magnet, install the probe with the edge of the working place against the needed place of the test object (fig. 2.13).

Figure 2.13 – Measurement of the tangential component of the magnetic field induction vector on the end and side surfaces of the test object

The value of the measured value will be shown in the graphic display of the device (fig. 2.14).

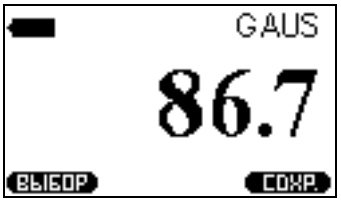


Figure 2.14 – Displaying of the measured values of a magnetic induction

2.3.4 Calibration

Caution!
Calibration shall be performed only by a highly qualified specialist using the magnets with a valid verification certificate, and only if required operationally!

When the “CALIBRATION” section is entered (fig. 2.15), the display will show the information as on the fig. 2.16.

Figure 2.15 – “Calibration” section

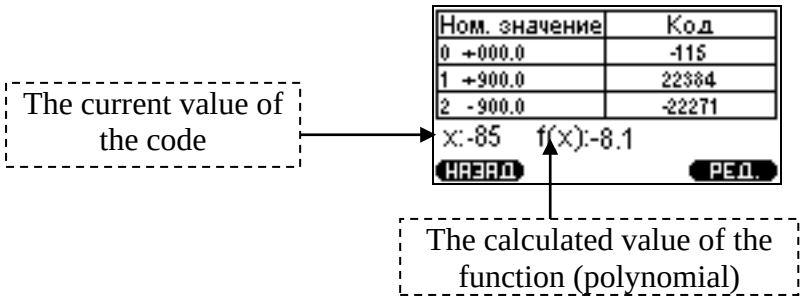


Figure 2.16 – “Calibration” section

A magnetometer shall be calibrated by four points: 0 G, + 999 G, -999 G, and 500 G with the magnetic inductometer SH1-1:

1. Calibrating by the first point, user must set the zero, for that the probe shall be put in a horizontal position away from sources of magnetic fields (fig. 2.17), and then set 0 G on in the «reference value» section of the display

Figure 2.17 – The probe position when zeroing

2. For a calibration by the second point, circuit the magnetometer with magnetic induction meter SH1-1 under the instruction manual of the magnetic inductometer.
3. Turn SH1-1 on and set the reference value of magnetic induction as +999 G. Set +999 G on the display of the magnetometer in the “reference value” cell.
4. Find the maximum code value at one of the points of the measured circuit and save the value in the probe memory by pressing the “edit” button.
5. For calibration by the third point, turn the probe by 180° and set -999 G in the “nominal value” cell of the magnetometer and perform operations described in c.4.
6. For calibration by the fourth point set the magnetic induction value as 500 G in SH1-1, and set 500 G in the “reference value” cell of a magnetometer and do the steps described in c.4.

2.3.5 “Archive” section

When the “Archive” mode is selected (fig. 2.18), the device goes to the list of the saved measurements. The device can store up to 256 measurements.

Figure 2.18 – “Archive” section

2.3.6 “Settings” section

When the “Setting” section is selected, the device goes to its settings (fig. 2.19).

Figure 2.19 – “Settings” section

2.3.6.2 The device settings

This menu features the setting of the following parameters (fig. 2.20):

- *Language:* selection of the language of the device (Russian, English, Spanish);
- *Brightness: change of the* display brightness (10. 20. …, 100%);
- *Contrast*: change of the display contrast (10. 20. …, 100%);
- *Auto turning off:* setting the automatic turnoff when the device is not in use (OFF, 1 minute, 5 minutes, 10 minutes, 30 the minutes).
- *Keyboard sound:* setting the sound signal when pressing keys (OFF, ON.);
- *Scale*: Selection of measurement units (Gauss, mT, A/cm, COD);
- *Range*: measurement of the magnetic induction is performed only within the set range (±1000 G);
- *A. scale*: (M1, M2, OFF);
- *Signal*: turning on and off of the sound signal (OFF, ON). If the measured value exceeds the threshold, the sound signal will be generated.
- *Level*: setting the measurement threshold of the magnetic induction.

Figure 2.20 – The device settings

2.3.7 Memory card

The device features the memory card for storage of the measurement values in the memory.

2.3.7.1 Calibration backup

Entering the “Memory card” section (fig. 2.21), the device goes to the memory menu (fig. 2.22).

Figure 2.21 – “Memory card” section

Figure 2.22 – Calibration backup

It is recommended to back up the calibration before calibrating the factory settings of the probe. This option allows for recovering the calibration after incorrect settings.

2.3.7.2 Downloading backups

The saved calibrations can be downloaded from the Hall probe memory. This function is needed to recover the right calibration in the event of incorrect settings of the probe. (fig. 2.23).

Figure 2.23 – Downloading the calibration backups

2.3.7.3 Memory card clearance

Selecting this section (fig. 2.24), the data stored in the archive of the device will be cleared. After clearing the SD card, the Archive will be empty.

Figure 2.24 – Menu of the memory card clearance

2.3.7.4 Memory state

When the “Memory state” section is selected (fig. 2.25), the table will appear showing the allowable number of saved measurements, the already saved measurements, and the measurements to be saved (fig. 2.26).

Figure 2.25 – The memory state menu

Figure 2.26 – Viewing of the memory stare

2.3.8 Information

In this menu section (fig. 2.27) user can view the information about the device, manufacturer and representative offices around the world. The “INFORMATION” mode also allows viewing the serial numbers of the device and the probe, the firmware version of the magnetometer and the number of measurements, for this the needed bookmark should be opened using the keys “  ” and “  ”.

Figure 2.27 – “Information” section

2.3.9 Turning off

The device turns off by a continuous pressing of “  ” button.

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;
- damage to the device components.

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

If the device is not in use for a long time, the batteries must be removed from the battery compartment.

The device can be used only by the persons instructed and certified by the II qualification category of safety engineering for the operation of measurement devices.

3.2 Verification

The verification is recommended to be done at least once a year.

The verification technique hereinafter referred to as verification, applies to the Magnetometer NOVOTEST MF-1M and stipulates the methods and accessories of primary and periodic verification.

The device shall be verified by the State metrology service or other authorized authorities and organizations with the right of verification.

Note – Verification of the device and the certificate of verification is executed only under customer order.

3.2.1 Preconditions for verification

Verifications can be performed in the following conditions:
– ambient temperature: +20 ±2°C;
– relative air humidity: 65 ±15%;
– air pressure: 100 ±8 kPa.

3.2.2 Steps and accessories of verification

During verification, user shall do the steps and use the accessories specified in table 3.1.

Table 3.1 – Steps and accessories of verification

Step of verification	Number of points	Verification accessories	Compulsoriness	
			after production and repairs	operation and storage
1. Visual inspection	3.2.3		Yes	Yes
2. Testing	3.2.4		Yes	Yes
3. Measurement error definition	3.2.5	Magnetic inductometer SH1-1	Yes	Yes
4. Documentation of verification	3.2.6		Yes	Yes

3.2.3 Visual inspection

The device shall be packaged in line with to c. 1.3 of RDC.OD.MF-1M.000.OM.

The user should visually check the processing unit, the connecting cable and the probe; the insulation and marking must be in normal condition and no damages shall be found. User should also check the connectors for cleanness and the absence of disconnected or loosely fixed components (it can be checked by a slight shaking the device), as well as tightness of fixing of the probe pin in the socket on the electronic unit.

3.2.4 Testing

The device shall be prepared for operation in line with c. 2.2 of RDC.OD.MF-1M.000.OM.

The control buttons of the device and switching of the measurement modes must be checked.

3.2.5 Measurement error definition

The permissible measurement error should be defined with magnetic inductometer SH1-1 by the following procedure:

1. Circuit the magnetometer and magnetic inductometer SH1-1 under the operating manual of the magnetic inductometer.
2. Turn on the magnetic inductometer SH1-1 and set the magnetic field to 1 mT, and the device display will show +1 mT; the reading may vary by not more than 0.5 %.
3. Reverse the current flow and the display of magnetometer will show the change of readings.
4. Measure the magnetic field during supply of magnetic strength by magnetic inductometer: 5 mT, 10 mT, 50 mT, 100 mT;
5. By the readings define relative measurement error of magnetic field strength in percent by the formula below:

$$\delta = \frac{мТл - мТл_Д}{мТл_Д} \cdot 100\% \quad (1)$$

Where mT ($мТл$) – the reading of magnetometer, mT;

$мТл_Д$ – the actual value of magnetic induction displayed by magnetic inductometer, mT.

The permissible measurement error shall not exceed ±0.1+0.05 H.

3.2.6 Documentation of verification

The verification of a device recognized as suitable for use is documented with a verification certificate of the approved form and its marking.

The negative verification is documented by a certificate of inoperability specifying the reason and eliminating the stamp of the previous verification.

3.3 Warranty obligations

The below-mentioned information of the warranty service applies to all the NOVOTEST products.

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

3.3.1 Basic warranty

The device purchased from NOVOTEST or an authorized dealer is covered by the basic 3-year warranty.

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 on batteries and chargers is provided by the manufacturers of batteries and chargers, and therefore they are not covered by the NOVOTEST warranty. However, the authorized dealer of NOVOTEST will assist you in making warranty claims regarding batteries, batteries, and chargers.

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.

3.3.2 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 datasheet.

3.3.3 Warranty for repaired or replaced parts

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.

3.3.4 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.

3.3.4.1 The parts replaced during the maintenance

The parts listed above have a limited service life and need replacement or adjustment with the frequency stipulated by the device maintenance schedule of the. For these parts, the basic warranty applies before the first replacement or adjustment. The warranty period for each part shall not 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;
- oil and working fluids.

3.3.4.2 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 for 12 months:

- transducer and their components;
- connecting cables;
- parts and mechanisms exposed to mechanical impact during operation.

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.

3.3.5 Owner obligations

The operating manual and datasheet of the device state 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.
- Maintain the device in line with the instructions on operation and datasheet.

Note: The failure to perform the device maintenance in time under the maintenance schedule deprives user of the right to a 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 datasheet 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 case of the device and probe in line with recommendations of NOVOTEST.
- Observe the operation and storage requirements in line with NOVOTEST recommendations.

3.3.6 Warranty restrictions

NOVOTEST shall not be accountable if the repair or replacement is caused by one of the following factors (if no defect of workmanship exists):

- 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 on the regularity 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 the manufacturer;
- Use of batteries or other components of poor quality;
- Power line surge;
- Refusal from timely repair of damage identified during scheduled 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 technique 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.

3.3.7 Cases uncovered by warranty

The basic 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.

3.3.8 Warrants and consumer law

The basic 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 an authorized dealer of NOVOTEST and the applicable law stipulating the requirements to sales and servicing of consumer goods.

3.4 Maintenance

The information on the maintenance is valid for all the information of NOVOTEST.

The device maintenance is performed throughout its service life and is divided into the following types:

- preventive maintenance;
- scheduled maintenance.

The preventive maintenance is performed at least once every three months and includes external inspection, cleaning, and lubrication.

The scheduled maintenance is carried out by the manufacturer at least once a year and is a prerequisite to retain the manufacturer warranty.

It is very important to maintain the device in time during the entire operation period. In this case, it is necessary to follow the schedule in the table. 3.2 (focusing on the operating time of the device or the months of its operation, whichever happens first).

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 can provide information about steps to be taken when servicing the device.

The records of regular maintenance of the device shall be made in the datasheet 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.

Table 3.2 – The maintenance schedule of NOVOTEST

Device	Maintenance schedule of NOVOTEST
All models except for models specified below	The annual maintenance is carried out in one year or after 2000 hours of operation (whichever happens first)
Portable hardness testers (dynamic, ultrasonic, combined)	The annual maintenance is carried out in one year or after 2000 hours of operation (whichever happens first)

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

Table 3.3 – Possible failures and methods of elimination

Name of failure, signs, and additional evidence	Possible reason	Method of elimination
When a device turns on, the display shows no information and no sound signals	The batteries are discharged	Charge or replace batteries.
	Poor connection in the battery circuit	Clean the contacts in the battery compartment.
The readings remain unchanged	The cable disconnected from the magnetic field transducer	Find the disconnection place and eliminate if possible
	Magnetic field transducer is broken	Replace the magnetic field transducer

4 RUNNING REPAIRS

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

To submit the device to the service center (SC) for warranty service, the datasheet of the device must be submitted. SC shall make a record in the datasheet 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 datasheet 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 datasheet.

5 STORAGE

The storage conditions of the device meet the category 1 under 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 batteries shall be stored in the charged condition in a dry place. The term of storage of a fully charged and detached battery is the following:

- not more than 1 year at the temperature from 20 °C to 35 °C;
- not more than 3 months at the temperature from - 20 °C to 45 °C.

The recommended temperature during long-term storage is 10 °C – 30 °C.

The battery must be disposed upon the termination of a storage period.

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 electronic unit, transducer, and power unit should be put into plastic bags and placed in separate sections of the transportation case of the device.

6 TRANSPORTATION

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

- transportation is performed in the factory container;
- no direct exposure to moisture;
- the temperature in the range from -50 °C to +50 °C;
- humidity is less than 95 % at the temperature up to 35 °C;
- vibration is within the range from 10 to 500 Hz and the amplitude up to 0.35 mm and acceleration up to 49 m/s^2;
- shocks of peak acceleration of up to 98 m/s^2;
- 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.

NOTES