QE-7

Portable Ferrite Meter

Fast magnetic-induction measurement of ferrite-phase content in steels for laboratory, workshop and field inspection.

Measurement range	Display	Protection
0-100% ferrite	240 x 320 TFT	IP54 housing

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Preface
This manual introduces the device structure, working principle, technical specifications as well as information necessary for proper operation of the QE-7 ferrite meter (hereinafter referred to as the ferrite meter or device). Please, read carefully this manual before using the device.

1. General
1.1 Intended use
1.1.1 Field of application
The QE-7 ferrite meter is designed to measure the percentage of ferrite phase in steel samples. It can be used in laboratory, field and workshop conditions at enterprises of mechanical engineering, energy, radio electronics and other industries.

1.1.2 Operation conditions
The device is intended for use under the following environmental conditions:
- temperature range -20 °C … +55 °C
- relative air humidity up to 95% at a temperature of +35 °C

1.2 Delivery set
- Electronic unit - 1 pc.
- Magnetic induction probe - 1 pc.*
- Ferrite phase content control specimen - 1 pc.
- USB A – micro USB cable - 1 pc.
- Charger - 1 pc.
- Carrying bag - 1 pc.
- User manual - 1 copy
- Calibration certificate - 1 copy

* Number and type of probes are on customer's request.

1.3 Specifications
The main metrological and technical characteristics are given in Table 1.

Parameter	Magnetic induction probe
Measurement range	0 – 100 %
Limits of absolute measurement error	± (0.03 d + 1), where *d* is the percentage of the measured ferrite phase content)
Resolution in the measurement range of 5 … 100%:	0,1%
Display parameters	TFT, 240 × 320 dpi
Power supply	three Ni-Mh AA-type batteries
Rated supply voltage	4,5 V
Time of continuous operation from a fully charged new battery under normal climatic conditions	not less than 16 h
Dimensions of electronic unit	160 x 85 x 28 mm
Weight	0,5 kg

1.4. Principle and structure

1.4.1 Structure
The device comprises an electronic unit in impact-resistant housing with a rubber bumper and replaceable magnetic induction probes. The housing of the electronic unit is of IP54 class dust- and moisture-proof one.

At the top of the front panel of the electronic unit there is a color TFT display, which displays measurement results and service information necessary to control the device.

At the top of the front panel of the electronic unit there is a color TFT display, which displays measurement results and service information necessary to control the device. The display provides complete visual control of the measurement process using color indication.

Under the display there is a film keyboard for controlling the device. On the upper end wall of the electronic unit there is an ODU connector ("Lemo B0"-type) for connecting the probe, and a micro-USB connector to charge the built-in battery.

Note
It is not recommended to take measurements during charging because of possible increase in measurement error.

1.4.2 Principal

The operating principle of the ferrite meter is based on recording the electromotive force (EMF) arising in the winding of a differential-type magnetic induction probe when it is placed on a magnetic or non-magnetic base of the test object. The level of EMF depends on the size of the gap between the probe working part of and the base. In general, this dependence is a non-linear function.
The electronic unit provides EMF measurement on the signal and reference windings, linearization of the transfer characteristic of the measuring path, statistical processing and display of measurement results.

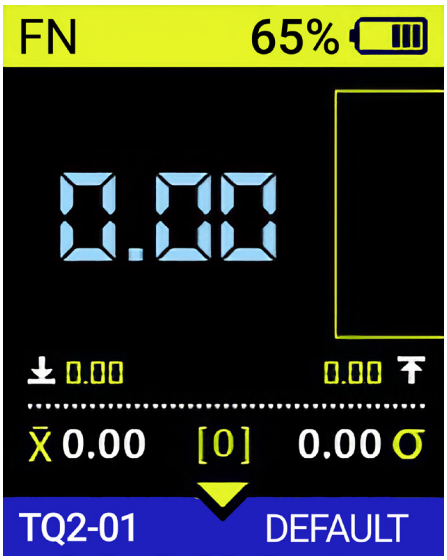
1.4.3 Operating modes

The ferrite meter has several operating modes:
- **DISCRETE** mode for measurement in a certain point
- **CONTINUOUS** mode for scanning the test object
- **SETUP** mode for setting up and selecting measurement parameters

1.4.4 Display

The information displayed on the screen is divided into three main blocks: block of results and parameters, top information line and bottom information line (see Figure 1).

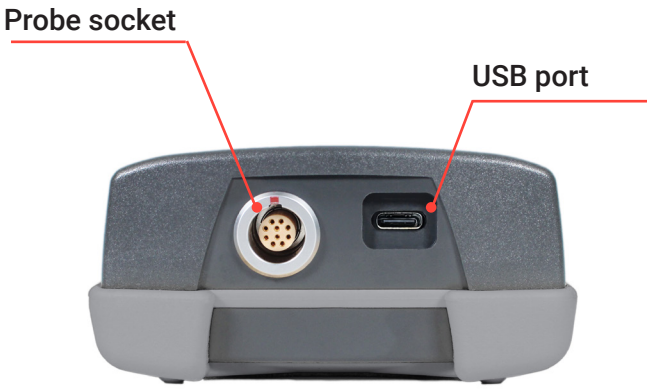
The top information line contains the following information:
- battery charge level (in all operating modes)
- units of measurement used (both in **DISCRETE** mode and **CONTINUOUS** mode)
- setup icon (in **SETUP** mode)



In all measurement modes, the bottom information line contains information on the type of connected probe and the current configuration name (see Figure 1).

Figure 1

Arrows are used to select and change active parameters. Their actions are similar for different operating modes and are designed for intuitive learning, since their symbols correspond to the nature of their action.



2. Operation

2.1 Operating limitations
The device is intended for operation in the environmental conditions specified in paragraph 1.1.2.
2.2 Getting ready to work
2.2.1 Probe connection
Magnetic induction probes are used to determine the percentage of ferrite phase or ferrite number.
The probe should be connected to the electronic unit following the markings on the cable and connector.
The probe can be connected/ disconnected at any time regardless whether the electronic unit is turned on or not.

2.2.2 Turning the device on/ off
Connect the probe to the electronic unit of the device.

To turn on the ferrite meter, press and hold button.
When the device is turned on, it is automatically configured to work with the connected probe. During the setup it is advisable to use the spatial orientation of the probe which will be used during taking measurements.
When the automatic setup of the probe is finished, start the calibration procedure described in paragraph 2.3.7.

To turn off the ferrite meter, press and hold or wait until it automatically turns off after the time set in the energy saving parameters, if no buttons are pressed or no measurement is taken.

All the device settings are saved when it turned off or the battery is completely discharged.

2.3 Using the device
2.3.1 Taking measurements
The effect of temperature on measurement results should be taken into account. In order to obtain the best measurement accuracy, the device should be set up using a sample having the same temperature as the test object.

2.3.2 SETUP mode
The **SETUP** mode includes a list of parameters available for editing as well as adjustment and calibration procedures, and a configuration database.

The **SETUP** mode menu is shown in Figure 2.
The name of current configuration is displayed in the top information line.

The functions of the buttons in **SETUP** mode are given in Table 3.

Button	Function
	Navigate through menu items
	Enter the selected item settings
	Exit **SETUP** mode

Table 3

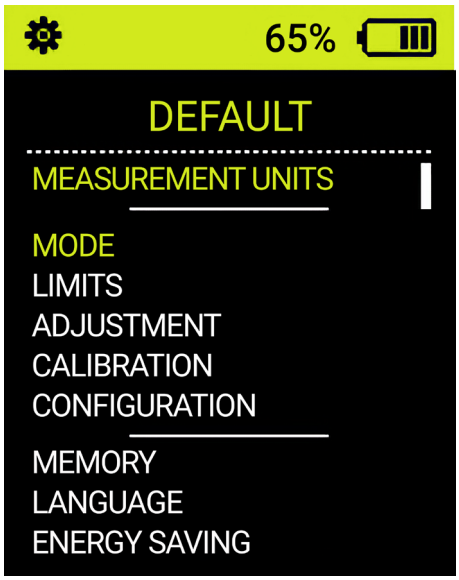


Figure 2

The menu items of **SETUP** mode, their corresponding functions and parameters are shown Table 4.

Menu item (parameter)	Parameter value	Description
Mode	discrete / continuous	Selection the measurement method
Units of measurement	% / FN	Selection of units of measurement
Limits	from 0 to 100 (%) from 0 to 120 (FN)	Setting the operation thresholds
Adjustment	-	Starting adjustment procedure using one control specimen
Calibration	-	Starting the calibration procedure using several control specimens
Configuration	From 1 to 10 (it is possible to create up to 10 configurations for each probe type)	Selection of existing configuration or creating new configuration
Language	English / Deutsch	Selection the interface language
Energy saving: • automatic shutdown time, minutes • standby time, s	0,5 / 1 / 2 / 3 / 4 /5 Never / 3 / 4 / 5 /10 / 15 / 30	Energy saving parameters
Turning off	-	Turning off the device

Table 4

Button	Function
	Changing the parameter value
	Navigate through menu items
	Exit with confirmation of the changes made
	Return the previous menu (all changes made will be saved)

Table 5

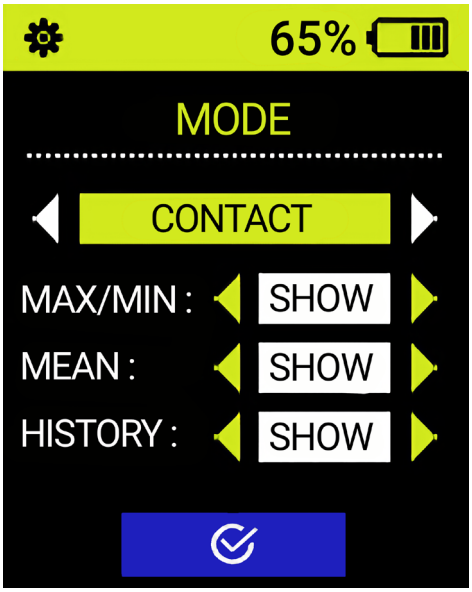


Figure 3

2.3.3 Mode

This menu item allows to select the measurement mode:

The **DISCRETE** mode is the main operating mode of the device providing obtaining measurement results in the selected units (percentage or ferrite number) over the entire range of measured values. Separate measurements are carried out each time the probe is placed on the test object. The measurement results are recorded and subjected to statistical processing (calculation of the arithmetic mean, minimum and maximum values).

For this mode, in addition to measurement result displaying on the screen, the display of additional information may be enabled. Select **SHOW** next to the required option:

- **MAX/MIN** – the minimum / maximum value during the measurement process
- **AVERAGE** – the arithmetic mean value and standard deviation
- **HISTORY** – the history of measurements taken

The **DISCRETE mode** menu is shown in Figure 3.

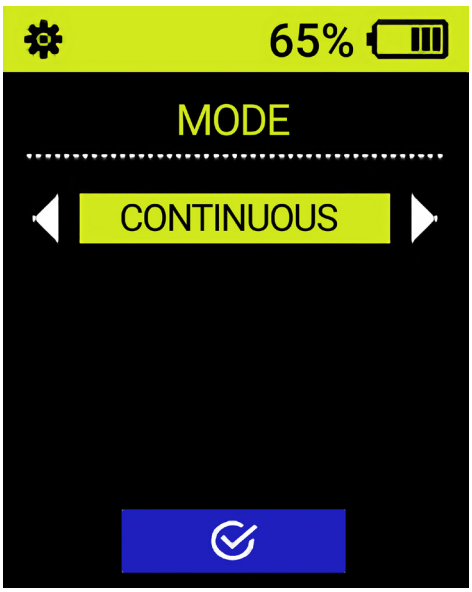


Figure 4

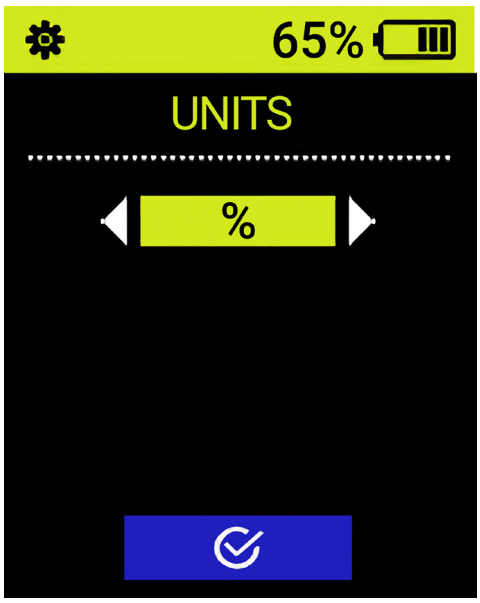


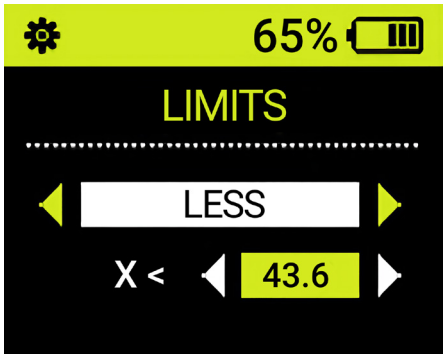
Figure 5

The **CONTINUOUS mode** (shown in Figure 4) displays the current value of the ferrite phase percentage or ferrite number in real time when scanning over the test object and ensures that the result is updated at least four times per second. This mode is intended for monitoring special areas of test object and for comprehensive testing of the device performance.

For this mode, in addition to the measurement result displaying on the screen, the display of minimum / maximum value may be enabled. Select SHOW option next to the **MAX/MIN** parameter.

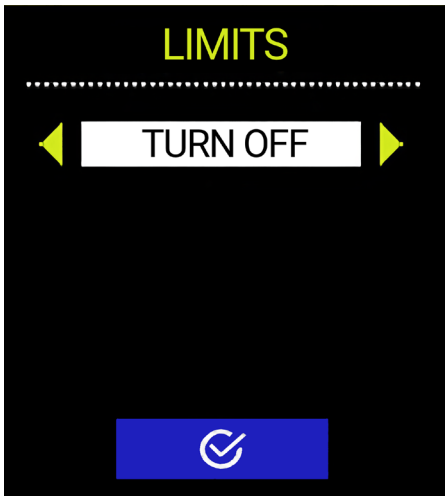
2.3.4 Measurement units
This menu item (shown in Figure 5) allows to select the units of measurement: percentage (%) or ferrite number (FN).

2.3.5 Limits
This menu item allows to set up the upper and the lower limits of operation threshold or specify the operation threshold range. Acceptable values range from 0 to 100%.



The **LIMITS** menu is shown in Figure 9.

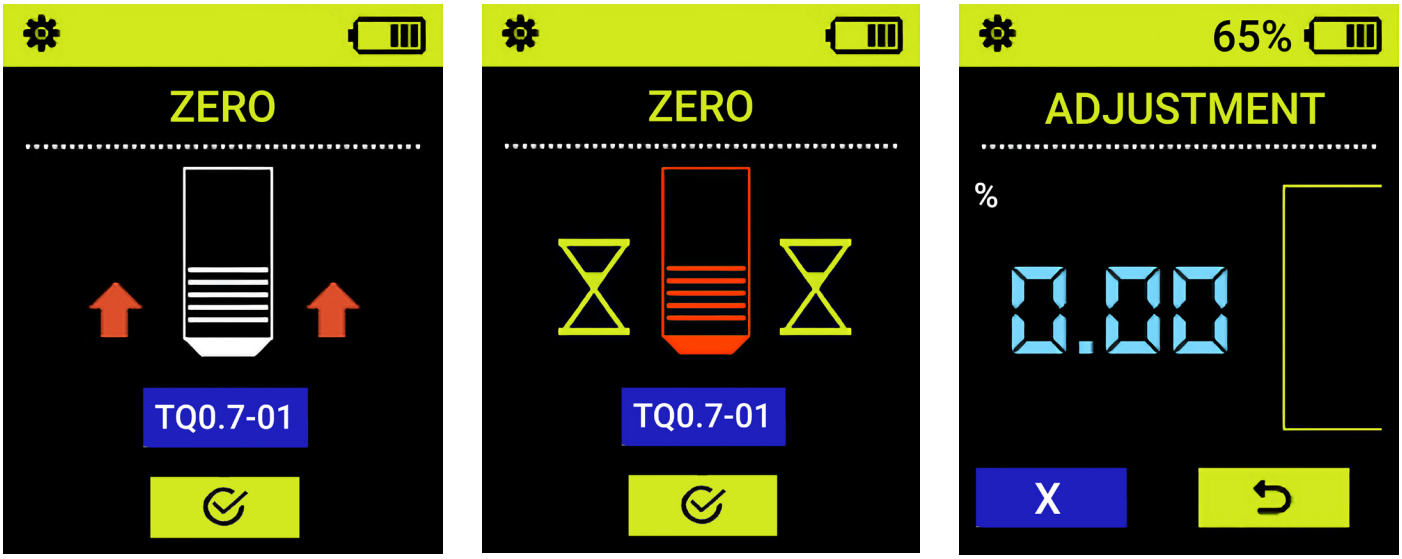
Figure 6



2.3.6 Adjustment

This menu item is intended to adapt the device to the connected probe and additional calibration setup.
The adjustment procedure allows to save only one point. Otherwise, the adjustment procedure is similar to the calibration procedure described in paragraph.
The **ADJUSTMENT** menu is shown in Figure 7.

Figure 7



ATTENTION:
WHEN RESETTING THE CALIBRATION RESULTS, THE ADJUSTMENT RESULT WILL ALSO BE RESET!

2.3.7 Calibration

This menu item is intended to perform device calibration using ferrite phase content control specimens included in the delivery set or using a representative area of the test object.

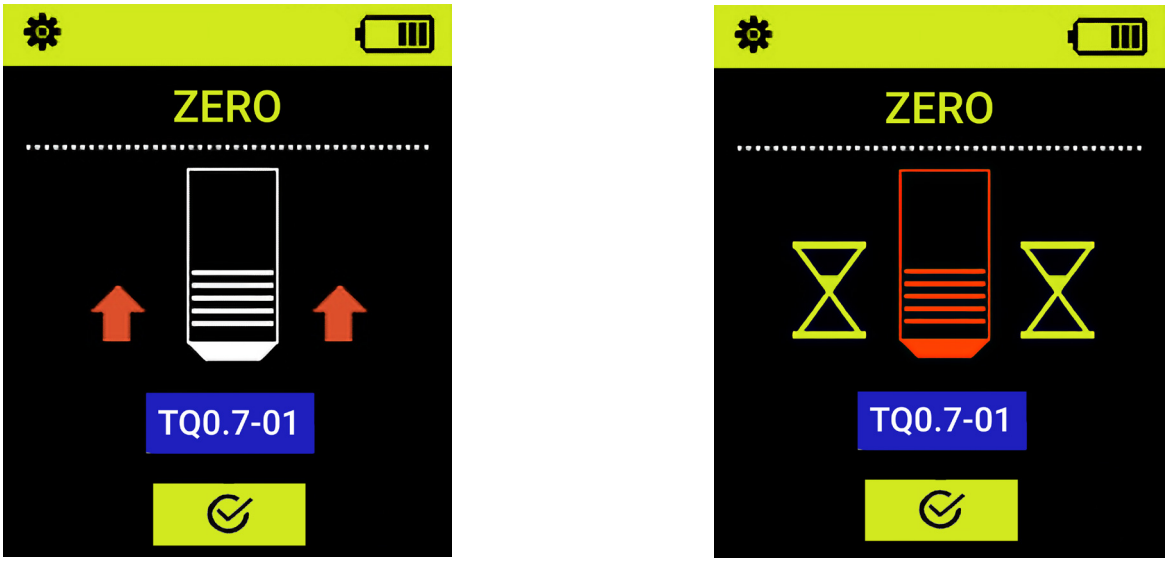
Calibration allows to reduce the effect of temperature and magnetic properties of base and coating materials on measurement results.
It is possible to utilize up to 30 ferrite phase content control specimens for the calibration procedure. The control specimens should be prepared before calibration.

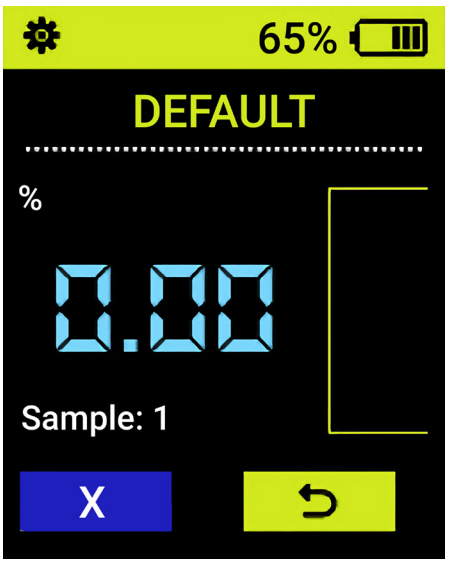
The surface of the control specimens should not show any traces of contamination.
To achieve the best measurement accuracy, the control specimen parameters (thickness, material grade, surface roughness, and curvature) must be identical to that of test object.

When entering the calibration menu, the probe will be automatically compensated.
To perform calibration, follow the instructions on the screen:

- enter the **CALIBRATION** menu. The name of the connected probe will be displayed on the screen
- lift the probe and press button to perform zeroing while holding probe in the air, see Figure 8 below.

Figure 8



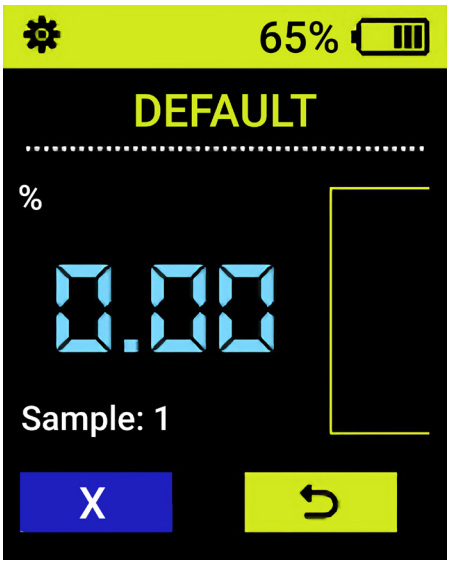


- proceed to calibration using control specimens (see Figure 9.)

At all stages of calibration using control specimens, and buttons are displayed on the screen. Use buttons to navigate.

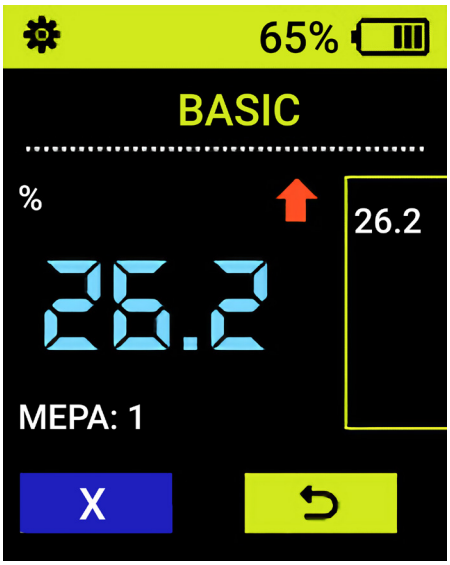
When button is selected and button is pressed, all measurement results will be reset. When button is selected and button is pressed, the current calibration result will be saved as the default value (set to default - reset calibration).

Figure 9



- choose a control specimen with required percentage of ferrite phase
- place the probe on the control specimen (see Figure 10.)

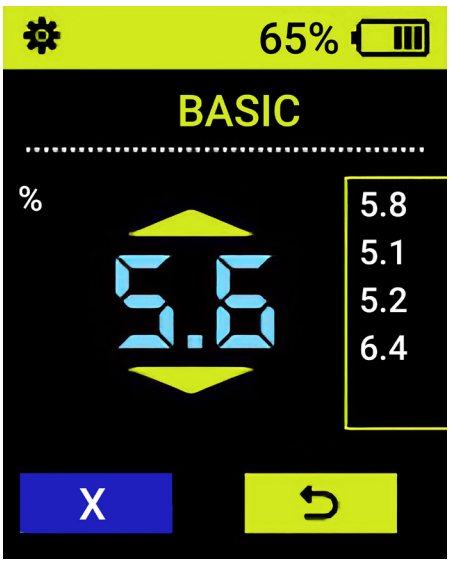
Figure 10



- the measurement result will be displayed on the screen. The red up arrow will appear in the right upper corner indicating that the probe needs to be removed from the specimen. The measurement result will be shown in the column on the right (see Figure 11.)
- remove the probe from the specimen
- the average value of ferrite phase percentage will be automatically calculated after each measurement
- measurement results will be displayed in the column on the right, the calculated average value will be shown in the center of the screen

NOTE
It is necessary to perform from 4 to 6 measurements to carry out the subsequent manual correction of the calculated average value.

Figure 11

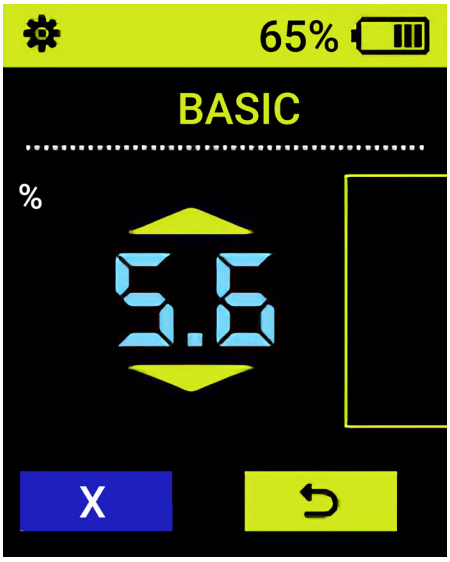


- after the fourth measurement, additional arrows will appear above and below the average value, indicating that its manual correction is available (see Figure 12.)

ATTENTION!
IF THE SEVENTH MEASUREMENT IS TAKEN, THE PREVIOUS SIX MEASUREMENT RESULTS WILL BE RESET!

Use ◀ ▶ buttons to set the value of ferrite phase percentage as close as possible to the actual one. The measurement results displayed in the column in the right will be reset (see Figure 13.)

Figure 12



- press button to save the correct result as a calibration point;
- press button to exit the **CALIBRATION** menu and return to **SETUP** mode.
- In order to add additional calibration points, choose control specimens with another percentage of ferrite phase and repeat the measurement procedure described above.

To delete previously saved measurements:

- press button if manual correction of the average value was not carried out
- start new measurements if manual correction of the average value was done

ATTENTION!
WHEN RESETTING THE CALIBRATION RESULTS, THE ADJUSTMENT RESULT WILL ALSO BE RESET!

Figure 13

2.3.8 Configuration

The device has a preset **BASIC** configuration by default. Separate configurations can be created for saving and further use of different sets of parameters or probe types or test objects.

The functions of the buttons active in this menu item are given in Table 6.
Use ◀ ▶ buttons to navigate.
The active button will turn yellow.

Button	Function
	Delete configuration
	Rename configuration
	Create new configuration
	Set configuration as active/ Select configuration

Table 6

To add new configuration or edit saved configuration:

- enter the **CONFIGURATION** menu
- use ◀ ▶ buttons to select button for creating new configuration. Select button for rename and save as new configuration
- use screen keyboard to type the configuration name, confirming each symbol by pressing button. The default name of the new configuration is “NEW 1”
- press button to save changes and exit.

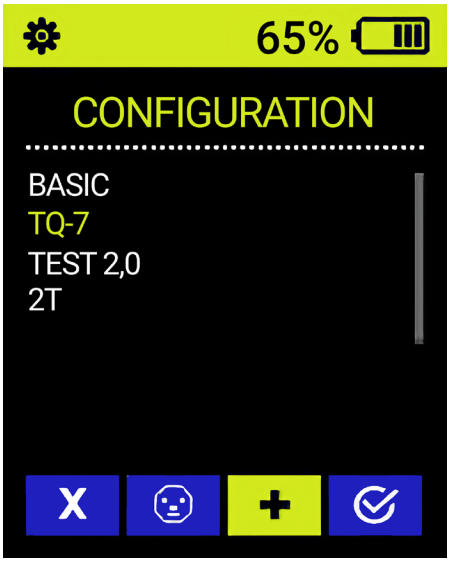


Figure 14

To delete configuration, select button and press button to confirm deleting or press button to cancel deleting.

2.4 Language
Selecting the device interface language:
- English
- Deutsch

The **LANGUAGE** menu is shown in Figure 15.

Figure 15

2.5 Energy saving
The **ENERGY SAVING** menu is shown in Figure 16.

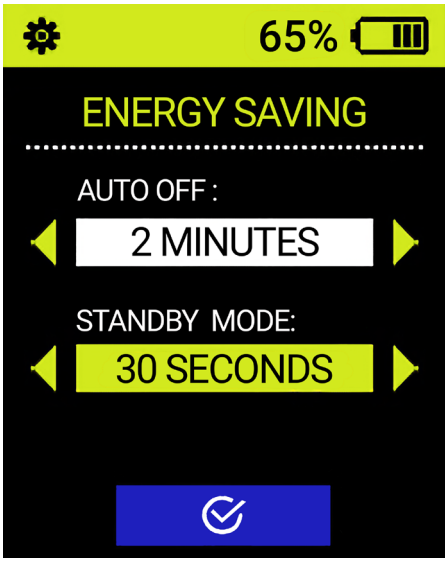


Figure 16

Menu item (parameter)	Parameter value	Description
Automatic shutdown time, minutes	0,5 / 1 / 2 / 3 / 4 /5	The period of time after which the device will turn off automatically, if no buttons are pressed or no measurement is taken during this period
Standby time, s	Never / 3 / 4 / 5 /10 / 15 / 30	The period of time after which the device will turn into standby mode (low power consumption, decreased screen brightness), if no buttons are pressed or no measurement is taken during this period

Table 7

The **DISCRETE** mode menu is shown in Figure 17.

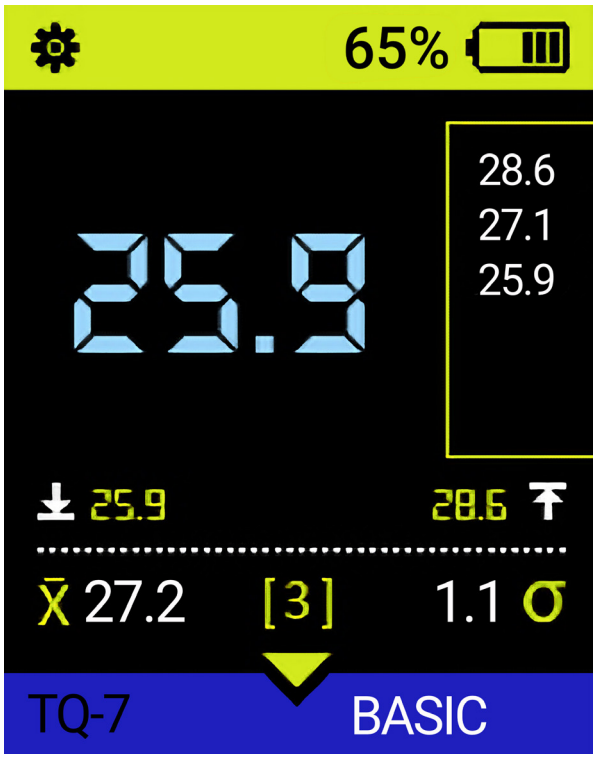
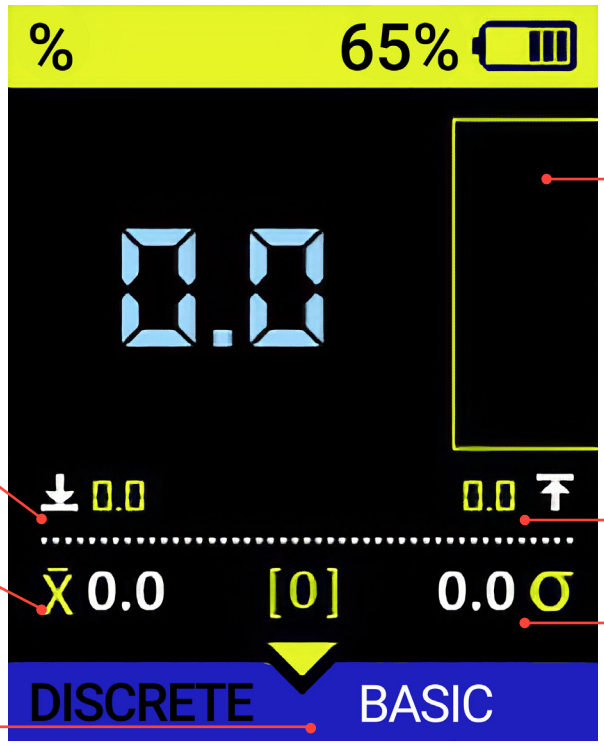


Figure 17

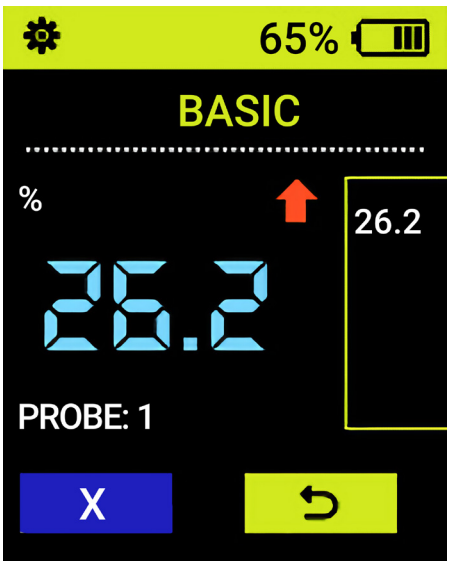


2.5.1 DISCRETE mode

In the **DISCRETE mode**, separate measurements are carried out each time the probe is placed on the test object.

To carry out the measurement:

- enter the **DISCRETE mode**
- bring the probe vertically to the test object surface
- place the probe on the test object surface and press firmly
- as the red up arrow appears, read the measurement result
- lift the probe, the red arrow should go out. When the **HISTORY** option is enabled, the measurement results will be displayed in a column on the right
- carry out next measurement if necessary



The **DISCRETE mode** menu in the process of taking measurements is shown in Figure 18.

Figure 18

2.5.2 CONTINUOUS mode

In the **CONTINUOUS mode**, measurements are carried out in real time when scanning over the test object.

The **CONTINUOUS mode** menu in the process of taking measurements is shown in Figure 19.The values of the parameters selected in the **MODE** menu item are displayed on the screen.

Figure 19

3. Maintenance

Maintenance of the ferrite meter consists of cleaning the electronic unit from dust and dirt, charging the battery, repairing and verification.
For all issues regarding the use and repair of the device, please, contact the manufacturer.
The verification interval of the device is 1 year.

3.1 Prevention measures

Main prevention measures are listed in Table 8.

Inspection period	Prevention measures
Before each use	Check the electronic unit, cable, and probe for damage. Check connectors and plugs for dirt and foreign objects.
Before taking measurements	Check functionality of control and cable connections. Perform calibration
After each use	Clean the probe. Check the electronic unit, cable, and probe for damage.

Table 8

3.2 Battery

The battery of the device is designed to operate over a wide temperature range. At negative temperatures, the battery capacity decreases: at the lower value of the temperature range the capacity is approximately 15% lower than that at normal temperatures.

When the battery is completely discharged, the device turns off automatically.
The battery is equipped with built-in protection against overcharge, over discharge, excess current and temperature.
The battery life is intended for the entire warranty period of device operation.
Battery replacement is carried out only in service centers.

ATTENTION!
REPLACEMENT OF THE BATTERY BY THE USER INDEPENDENTLY RESULTS IN THE VOID OF THE DEVICE WARRANTY!

3.3 Battery charging

The battery can be charged from an external charger or from a personal computer.

ATTENTION!
TO AVOID DEVICE FAILURE, USE ONLY THE POWER ADAPTER INCLUDED IN THE DELIVERY SET!

To charge the battery, remove the cover from the battery pack and connect the power adapter to a 220/230 V power supply. The battery charging time depends on the discharge degree. Full charging time is 4-5 hours. Multiple recharging is allowed.

ATTENTION!
TO AVOID BATTERY FAILURE, DO NOT STORE THE DEVICE WITH DISCHARGED BATTERIES!

3.4 Troubleshooting

If a malfunction occurs, you should turn off and turn on the device. If the problem is not solved, you should use the recommendations given below.
Troubleshooting solutions for some problems are shown in Table 9.

Problem	Analysis	Solution
When turning on, the indicator blinks or the device turns off immediately	Low battery	Charge the battery
Large variation in readings when measuring at one point	The control conditions regarding the choice of location the probe are not observed	Locate the probe in accordance with paragraph 2.2.1
Measurement results exceed the error limits	Contamination inside the probe	Carefully disassemble the probe and clean it
There are no measurement results on the display	1. No contact in the probe connector 2. Broken connecting cable	1. Reconnect the probe 2. Repair broken cable

Table 9

If you encounter any other malfunctions in the operation of the device or have any questions about its use, please, contact representatives of the manufacturer.

4. Storage

The device must be stored in the carrying bag included in the delivery set.
The device should be stored on racks.
The arrangement of the devices in storage facilities must ensure their free movement and access to them.
The distance between walls, storage facility floor and the device must be at least 100 mm.
The distance between storage heaters and the device must be at least 0.5 m.
The storage facility should be free of conductive dust, admixtures of aggressive gases and vapors that cause corrosion of the device materials.

5. Transport

The device must be transported in the carrying bag included in the delivery set.
Transportation of packaged devices may be carried out over any distance by any type of transport without speed restrictions.

Packed devices must be secured in vehicles, and they must be protected from precipitation and splashing water, when using open vehicles
The placement and fastening of packaged devices in vehicles must ensure their stable position and exclude the possibility of hitting against each other, as well as against the walls of vehicles.
The transportation conditions of the device must comply with the requirements of the rules and regulations in force for each type of transport.
When transporting by air, the packed device should be placed in sealed and heated compartments.
After transportation at temperatures different from operating conditions, before operating the device, it must be kept in normal climatic conditions for at least two hours.

6. Warranty

6.1The warranty period for the device is 1 year from the date of sale (shipment).

6.2 The warranty period for the probes is 1 year from the date of shipment.

6.3 The manufacturer guarantees the compliance of the QE-7 ferrite meter with the requirements of document “QE-7 ferrite meter. Technical Specifications.

6.4 The manufacturer’s warranty does not apply to cables and consumables.
Parts subject to ordinary wear and tear: 30 days.

6.5 The manufacturer undertakes to repair the device free of charge during the warranty period, including replacing it as a whole, if during the warranty period the device fails or its characteristics are below the specifications given in this operation manual.

6.6 Warranties become void in the following cases:
- there are traces of mechanical damage, exposure to water or other active media on the electronic unit housing;
- the components of the electronic unit show signs of self-repair, disassembly, etc.
- the malfunction occurred due to a violation of the established rules for using the device, actions of third parties or force majeure circumstances.

7. Certificate of acceptance

QE-7 ferrite meter serial No _____,

is recognized as suitable for use as Ferrite phase content control specimen of _____ %/FN

Date of manufacture _____ _____ 202

Shipping date _____ _____ 202

Inspector _____

Stamp

Professional ferrite measurement support

Contact QMN Equipment for product configuration, calibration support, technical assistance and quotation requests.

Phone: 647-948-7714

Fax: 647-948-6667

Email: info@qmnequipment.com

Web: qmnequipment.com

Specifications and contents are subject to confirmation at the time of order.