26.51.66

NON-FERROMAGNETIC MATERIALS' THICKNESS METER ИТ-1-01

Operation manual

ЮМГИ.401161.010 РЭ

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This operating manual (hereinafter referred to as the Manual) is intended for familiarizing with the Non-ferromagnetic materials' thickness meter ИТ-1-01 ЮМГИ.401161.010 (hereinafter referred to as the Meter) operation principle and its operating rules.

The Meter location is inside the heated buildings with air conditioning or partial air conditioning located at the altitude of up to 1,000 meters above the sea level.

The personnel permitted to operate the Meter shall be familiar with the present Manual, have appropriate skills in operation of technological processes' monitoring and adjustment instruments and admitted for works by the company's management.

List of reference regulatory documents is provided in Appendix A. List of measuring instruments, testing and auxiliary equipment is provided in Appendix B.

In the process of the Meters, manufacturing the production plant may introduce minor changes into the design. As a result, some component parts may slightly differ from ones described in the text of this Manual and depicted in Figures.

1 DESCRIPTION AND OPERATION

1.1 Function

The Meter is intended for measurement of non-ferromagnetic materials thickness, including produced glass bottles of various designs (except souvenir bottles) used in the industry for filling, storing and transporting alcoholic and non-alcoholic food liquids and produced glass containers for canned products' walls thickness.

The Meter is intended for operation at ambient temperatures from plus 10 °C to plus 35 °C and relative air humidity of up to 75 % at temperature of plus 30 °C .

The Meter is intended for operation from single-phase AC mains with voltage from 187 to 242 V, frequency of (50 ± 1) Hz, and having fixed protective earthing.

1.2 Specifications

1.2.1 Measurement ranges, absolute error limits depending on the measuring head type (flat or pin), on measured articles radius of curvature and on used induction coils meet requirements provided in Table 1.

Table 1 - Measurement ranges, radii of curvature and induction coils

Range No.	Thickness measurement range, mm	Minimum radius of curvature, mm min.	Induction coil	Absolute error limit
1	2	3	4	5
1	From 0.05 to 3.00	2.5 (or the plane)	Ball Ø 4 mm	± (0.02 + 0.012X)
2	From 0.05 to 8.00	3 (or the plane)	Hemisphere Ø 5 mm	± (0.02 + 0.012X)
3	From 3 to 12	5 (or the plane)	Hemisphere Ø 7 mm	± (0.2 + 0.015X)
4	From 0.05 to 2.00	1.5	Ball Ø 2 mm	± (0.2 + 0.012X)

Table 1 (continued)

1	2	3	4	5
5	From 0.050 to 0.999	Plane	Disc with ball	± (0.01 + 0.03X)

N o t e s
1 Ranges Nos. 1 - 4 are implemented with pin type head and range No. 5 is with flat head.
2 The induction coil resolution, mm:
0.001 for range No. 5;
0.01 for ranges Nos. 1, 2, 4;
0.1 for range No. 3.
3 X is measured value, mm.

1.2.2 The Meter weight – max. 2 kg.

1.2.3 Power consumption, max. 20 V A

1.2.4 Overall dimensions, max.:

- depth - 290 mm;

- width - 200 mm;

- height - 200 mm.

1.2.5 Operation mode type: intermittent. Maximum time of continuous operation is eight hours. At least one hour break.

1.2.6 Protection class rating from access to hazardous parts, ingress of foreign objects and ingress of water is IP 20 according to IEC 60529:2013. The Meter is protected against access by finger and ingress of foreign objects with diameter above 12.5 mm. The instrument is not protected against ingress of water.

1.2.7 Class of protection against electric shock I - products that have at least working insulation and an element for grounding. If the product has a wire for connecting to a power source, this wire must have a grounding core and a plug with a grounding contact. Under normal conditions, the electric circuits' insulation relative to body withstands testing voltage of (1,500 ± 50) V with frequency of (50 ± 1) Hz for one minute.

1.2.8 Mean time between failures is 1,500 hours.

1.2.9 Average service life is five years.

1.2.10 During storage, transportation, operation and disposal the Meters does not any harm to the human health and environment.

1.3 Article component parts

The Meter contains measurement unit, measuring heads and induction coils.

1.4 Design and functioning

1.4.1 General information

1.4.1.1 Figure 1 shows the appearance of the Meter complete set.

Designated in Figure 1 items are:

- 1 - measuring unit;

- 2 - pin type measuring head;

- 3 - completed with disc 12 flat measuring head to be installed instead of pin type measuring head during measurements in the range No. 5;

- 4 - completed with base 13 remote measuring head to be installed instead of pin type measuring head;

- 5 - display;

- 6 - fuse holder;

- 7 - «СЕТЬ» (MAINS) switch;

- 8 - keypad;

- 9 - USB port;

- 10 - mains connector;

- 11 - calibration service attachment;

- 14 - induction coil ((ball, hemisphere) symbol);

- 15 - reference sample ((2 mm, 4 mm, 6 mm) symbol);

- 16 - nameplate.

1.4.1.2 Measurement principle

The measurement principle consists in the following.

The measured material is placed above the measuring head so that the measured area touched its top. The induction coil is placed from above on this area so that it will be on the same axis with the measuring head.

The area thickness measurement is performed by measurement of the magnetic flux value passing via induction coil and via the

located at the head top Hall sensor. Signal from the Hall sensor is converted and output to the display in the form of material's thickness numeric value.

In case of the bottle (or container) wall thickness measurement, the bottle (container) external surface measured area is brought against the measuring head top and induction coil is placed inside the bottle (container) opposite to the measuring head top.

Figure 1 – Appearance

1.4.1.3 Functions of controls, switching components and indicators

On the upper panel's inclined front part, the following is located:

- display - presentation of current information;

- shown in Figure 2 keypad, containing:

1) "Menu" button;

2) "On" button;

3) "Enter" button;

4) "Esc" button;

5) "  ", "  ", "  ", "  ", "F1" and "F2" buttons.

Functions of the buttons are provided in the Table 2.

Table 2 - Functions of the keypad buttons

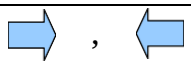
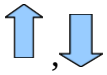
Button (buttons)	Function
	Movement of the cursor on the display along the items defined by the meter current menu
	In the main menu is movement of the cursor along the items on the display. In other menus is changing of the current value
«Menu»	Return to the previous menu
«Esc»	Canceling. In the «Измерение» (Measurement) menu is reset of minimum and maximum values
«Enter»	Entering the menu, data input
«F1»	Quick adjustment in the «Измерение» (Measurement) menu
«On»	The measurement results transfer to the computer (in the «Измерение» (Measurement) menu), saving of data to the internal flash-memory
«F2»	Sound alarm switching on/off in the «Измерение» (Measurement) menu

Figure 2 - Keypad

1.4.1.4 The Meter switching on

After the Meter switching on with the «СЕТЬ» (MAINS) switch, the display screen will show the startup screen (Fig. 3), the software loading and self-testing are taking place.

Figure 3 - Startup screen

In 30 seconds after switching on the «Измерение» (Measurement) menu will appear on the display screen (Fig. 5).

Figure 4 – Main menu

The main menu (Fig. 4) shows:

- Date (date, month, year);

- Time (hours, minutes);

- “buttons” (menu):

1) «Измерение» (Measurement);

2) «Калибровка» (Calibration);

3) «Программирование» (Programming);

4) «Заводские установки» (Factory settings);

5) «Настройки» (Settings);

6) «Помощь» (Help).

The Main menu response to the keypad buttons:

- « », « », « », « » - menu selection (choice is confirmed by the “button” color change from blue to green);

- “Enter” - entry into menu.

1.4.2 «Измерение» (Measurement) menu

1.4.2.1 General information on «Измерение» (Measurement) menu operating mode

Entry into the «Измерение» (Measurement) menu is performed from the Main menu using the « », « », « », « », «Enter» keypad buttons.

«Измерение» (Measurement) menu is shown in Figure 5.

Figure 5 - «Измерение» (Measurement) menu

This menu displays the following:

- 1 - measured value (thickness), mm;
- 2 - minimum thickness in series of performed measurements, mm;
- 3 - condition of sound alarm, on / off;
- 4 - type of used characteristics, initial / adjusted;
- 5 - “Коррекция” (Adjustment) “button” (submenu);
- 6 - minimum tolerance;
- 7 - minimum tolerance input “button” (submenu);
- 8 - maximum tolerance;
- 9 - maximum tolerance input “button” (submenu);
- 10 - used induction coil selection “button” (submenu);
- 11 - type of used induction coil;
- 12 - OAV factor, min / max;
- 13 - maximum thickness in series of performed measurements, mm.

The menu response to the keypad buttons:

- «⇧», «⇩» - change of the used induction coil type, if the “Индуктор” (Induction coil) “button” (submenu) is active on the display screen;
- «⇦», «⇨» - selection of “buttons” (submenus);

- “Enter” - entry into submenu;
- «Esc» - abortion of the series of measurements;
- «F1» - performance of the «Быстрая коррекция» (Quick adjustment) procedure;
- «F2» - sound alarm switching on/off;
- «On» - the measurement results transfer to the computer;
- «Menu» - return to the Main menu.

After entry to the «Измерение» (Measurement) menu, instead of measured value a number «XXXX» is displayed on the screen. A number «XXXX» is displayed in grey color. Approximately in three seconds after determination of current for the given characteristic the «XXXX» number color is changing to green.

If the «XXXX» number color is not changing to green or instead of «XXXX» a digital (numeric) value appears, than the «Быстрая коррекция» (Quick adjustment) procedure shall be performed.

The «Быстрая коррекция» (Quick adjustment) procedure is performed by pressing of the «F1» button on the keypad provided that the induction coil is removed from the measuring head.

If in three - four seconds after pressing of the «F1» button the «XXXX» number does not change into green color, and then the «F1» button shall be pressed again.

If the induction coil type is not changed in the process of operation, than it is recommended to perform the «Быстрая коррекция» (Quick adjustment) procedure once in an hour.

Measurements are performed automatically. Measurement results are displayed in the form of a number with two or three decimal digits. Number of decimal digits is set in the «Настройки» (Settings) menu.

In the process of the series of measurements, an obtained result is displayed. If measured value drifts beyond the tolerance, then digits change their color to red.

Measured in the series of measurements minimum and maximum values are recorded into the Meter’s memory.

The «On» button on the keypad enables data transfer to the computer. The series of measurements abortion is provided by pressing of the «Esc» button

on the keypad.

Return to the Main menu is enabled by pressing of the «Menu» button.

1.4.2.2 Adjustment

Adjustment (adjusting according to standard) of characteristic is performed in case of its deviation from the standard as a result of temperature, aging processes, magnetic fields and other factors influence on the Meter.

Necessity of adjustment shall be established after the reference specimen (standard) measurement if the measurement result is above or below value stated thereon for the admissible error value.

Before adjustment the measuring head, induction coil and standards shall be thoroughly wiped with dry fibreless cloth.

Entry to the «Коррекция» (Adjustment) submenu is performed from the «Измерение» (Measurement) menu using the « ⇦», « ⇨», «Enter» buttons on the keypad.

The «Коррекция» (Adjustment) submenu is shown in Figure 6.

Figure 6 - The «Коррекция» (Adjustment) submenu

This submenu displays the following:

- the standard’s thickness numerical value entered manually from the keypad;
- «ESC» “button” - return to the «Измерение» (Measurement) menu (without saving);

- «Enter» “button”, by pressing of which the input value will be saved;

- description of the «  », «  », «  », «  » buttons functions.

After adjustment of the value press the «Enter» button on the keypad. After pressing of the «Enter» button return to the «Измерение» (Measurement) menu takes place (Fig. 5).

1.4.2.3 Input of the minimum and maximum tolerances

Entry to the «Доп. MIN» (Tolerance min.), «Доп. MAX» (Tolerance max.) submenu is performed from the «Измерение» (Measurement) menu using the «  », «  », «Enter» buttons on the keypad.

Input of values is performed in the same manner as described in 1.4.2.2.

1.4.2.4 Selection of induction coil

With each measuring head, a certain type of induction coil is used. Each induction coil has its own designation symbol displayed on screen. Correspondence of induction coils to the measuring heads is provided in Table 3.

Table 3 - Correspondence of induction coils to the measuring heads

Head type		Type of induction coil	Symbol	Note
1		2	3	4
Pin type measuring head		Hemisphere with diameter of 5 mm (with red end face)	Red	
		Hemisphere with diameter of 5 mm (with blue end face)	Blue	
		Hemisphere with diameter of 7 mm (with black end face)	Black	Optional
		Ball with diameter of 2 mm	Ball 2	Optional
		Ball with diameter of 4 mm	Ball 4	
Remote measuring head		Hemisphere with diameter of 5 mm (with green end face)	Green	
		Hemisphere with diameter of 5 mm (with yellow end face)	Yellow	
		Hemisphere with diameter of 7 mm (with white end face)	White	Optional
		Ball with diameter of 2 mm	Ball 2	Optional
		Ball with diameter of 4 mm	Ball 4	
Set of two pin type measuring heads	Head 1	Hemisphere with diameter of 5 mm (with red end face)	Red	
		Hemisphere with diameter of 5 mm (with blue end face)	Blue	
		Hemisphere with diameter of 7 mm (with black end face)	Black	Optional
		Ball with diameter of 2 mm	Ball 2	Optional
		Ball with diameter of 4 mm	Ball 4	
	Head 2	Hemisphere with diameter of 5 mm (with green end face)	Green	
		Hemisphere with diameter of 5 mm (with yellow end face)	Yellow	
		Hemisphere with diameter of 7 mm (with white end face)	White	Optional

Table 3 (continued)

1		2	3	4
Set of pin type and remote measuring heads	*Remote / pin type measuring head	Hemisphere with diameter of 5 mm (with red end face)	Red	
		Hemisphere with diameter of 5 mm (with blue end face)	Blue	
		Hemisphere with diameter of 7 mm (with black end face)	Black	Optional
		Ball with diameter of 2 mm	Ball 2	Optional
		Ball with diameter of 4 mm	Ball 4	
	*Remote / pin type measuring head	Hemisphere with diameter of 5 mm (with green end face)	Green	
		Hemisphere with diameter of 5 mm (with yellow end face)	Yellow	
		Hemisphere with diameter of 7 mm (with white end face)	White	Supplied on separate request
Flat measuring head		Disc with ball	Film	
* Selection of heads is made by the Customer				

Selection of the induction coil shall be made observing the following rules. First, to measure the films' thicknesses the flat measuring head and induction coil in the form of disc with ball ("film") are used.

Second, the thickness' "rejection" value shall be taken into account. For bottles of various designs (except souvenir bottles) used in the industry for filling, storing and transporting alcoholic and non-alcoholic food liquids, as "rejection" thickness, thickness of 1.22 mm and lower is taken, and (as a rule) "Ball 4", "Blue", "Red", "Green" or "Yellow" induction coils are used.

Third, two aspects are considered: measured objects' minimum radius of curvature and expected measurement range according to Table 1.

Example. In medical grade vials with radius of curvature of 1.5 mm the thickness can only be measured with the "Ball 2" induction coil, but only on such vials, which thickness value does not exceed 2 mm. Thus, at first, the expected measurement range and minimum spherical radii are determined, and then the induction coil is selected (according to Table 1).

1.4.2.5 Measurement method

The method principle consists in the following:

- entering into the «Измерение» (Measurement) menu and setting the measurement parameters;

- selecting the necessary induction coil;

- placing the examined material (for example, bottle) above the measuring head so that the measured area touched its top and installing the induction coil on this area from above (inside the bottle above the measuring head);

- performing necessary series of measurements (during the bottle wall thickness measurement the bottle is rotated around its rotation axis with its simultaneous movement from neck to bottom and back while taking readings).

1.4.3 «Заводские установки» (Factory settings) menu

1.4.3.1 «Заводские установки» (Factory settings) menu is intended for recovery of initial parameters (set by the manufacturer) in case of initial parameters deletion by the consumer.

1.4.3.2 Entry into the menu is performed from the Main menu using the « », « », « », « », «Enter» keypad buttons.

«Заводские установки» (Factory settings) menu is shown in Figure 7.

Enabling of the (menu) “buttons” is performed by corresponding keys «ESC» - cancelling, «Enter» - input.

Figure 7 - «Заводские установки» (Factory settings) menu

This menu displays the following:

- «ESC» “button” - return to the Main menu;

- «Enter» “button” - recovery of initial (factory set) parameters.

When pressing the «Enter» button on keypad, which is located on display and has green color, then recovery of parameters will take place. When pressing the «ESC» button on keypad, which is located on display and has red color, then return to the Main menu will take place.

1.4.4 «Настройки» (Settings) menu

1.4.4.1 Entry into the menu is performed from the Main menu using the « »,« », « », « », «Enter» keypad buttons.

«Настройки» (Settings) menu is shown in Figure 8.

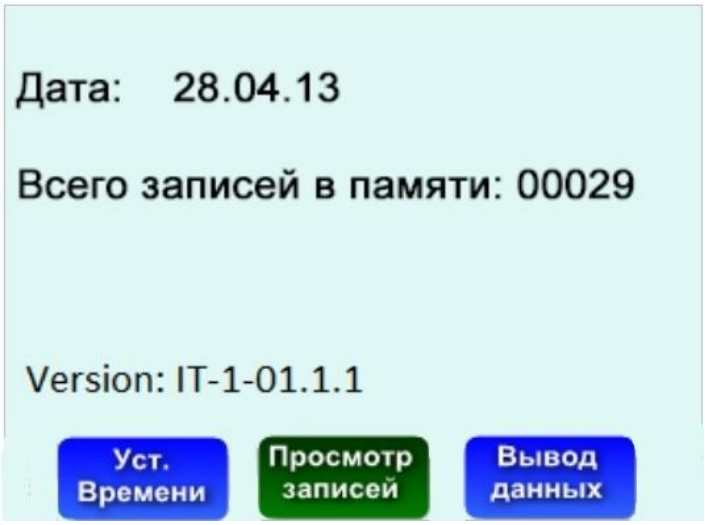


Figure 8 - «Настройки» (Settings) menu

This menu displays the following:

- Date (date, month, year);
- number of records in the memory;
- “buttons” (submenu):
    1) «Уст. времени» (time setting);
    2) «Просмотр записей» (view records);
    3) «Вывод данных» (data output).

The menu response to the keypad buttons:

- « », « » - selection of “buttons” (the selected “button” (submenu) changes its color from blue to green);

- “Enter” - entry into submenu;

- «Menu» - return to the Main menu.

1.4.4.2 «Уст. Времени» (time setting) submenu

Entry into the submenu is performed from the «Настройки» (Settings) menu using the « », « » and «Enter» keypad buttons.

«Уст. Времени» (time setting) submenu is shown in Figure 9.

Figure 9 - «Уст. Времени» (time setting) submenu.

This submenu displays the following:

- Date (date, month, year);

- Time (hours, minutes);

- «ESC» “button” - return to the «Настройки» (Settings) menu;

- “Enter” button - input of adjusted value.

Selection of date, month, year, hours and minutes is performed using the « », « » keypad buttons.

Changing of value is performed using the « », « » keypad buttons.

Input of adjusted value is performed using the

“Enter” keypad button.

Return to the «Настройки» (Settings) menu is performed using the «ESC» keypad button. Selection of “buttons” is made in the same manner as in 1.4.4.1.

1.4.4.3 «Просмотр записей» (view records) submenu

Entry into the submenu is performed from the «Настройки» (Settings) menu using the « ⇦ », « ⇨ », «Enter» keypad buttons.

«Просмотр записей» (view records) submenu is shown in Figure 10.

Figure 10 - «Просмотр записей» (view records) submenu

This submenu displays records (their content), as well as records viewing and deleting rules.

Each record contains the following:

- serial number;
- date, when the record was made;
- time, when the record was made;
- minimum and maximum measured thickness in the series of measurements.

Memory size is more than 5,000 records.

The submenu response to the keypad buttons:

- « ⇨ » - switching to the next hundreds of records;

- « » - switching to the previous hundreds of records;
- « » - switching to the next ten records;
- « » - switching to the previous ten records;
- «F1» - switching to the next thousands of records;
- «F2» - switching to the previous thousands of records;
- «On» - deletion of all records;
- «Menu» - return to the «Настройки» (Settings) menu.

1.4.4.4 «Вывод данных» (data output) submenu

Entry into the submenu is performed from the «Настройки» (Settings) menu using the « », « », «Enter» keypad buttons.

«Вывод данных» (data output) submenu is shown in Figure 11.

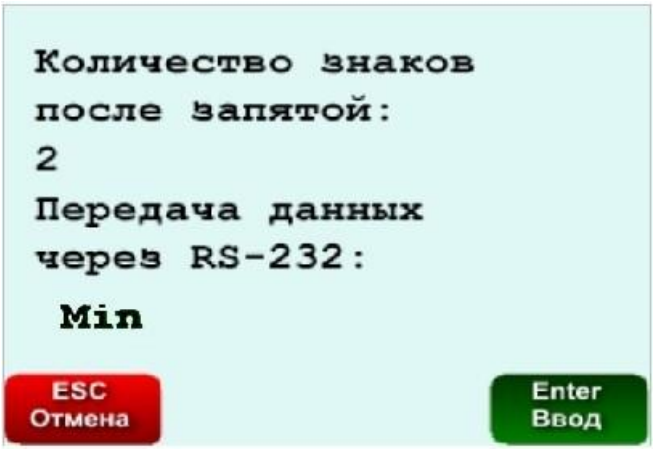


Figure 11 - The «Вывод данных» (data output) submenu

This submenu displays the following:

- in the upper sector - number of decimal digits in the measured thickness numeric value (two or three);
- in the lower sector - data transmission to the personal computer in the form of «min» or «max», or «min / max».
- «ESC» “button” - return to the «Настройки» (Settings) menu;
- “Enter” button - input of adjusted value.

The submenu response to the keypad buttons:

- « », « » - changing of value (with upper sector selection);

- « », « » - changing of data transmission type (with lower sector selection);

- « », « » - enabling of «ESC» and «Enter» “buttons”;

- « », « » - selection of sectors;

- «ESC» - return to the «Настройки» (Settings) menu;

- “Enter” - input of adjusted value.

1.4.5 «Калибровка» (Calibration) menu

1.4.5.1 General information

Calibration is used when it is impossible to reduce the thickness measurement error by adjustment (1.4.2.2).

Calibration is performed using the reference specimens. As the reference specimens, the flat glass plates (three glass plates with different thicknesses for each induction coil) with the following thicknesses are used:

- from 0.4 to 4.3 mm for the “Ball Ø 4” induction coil (Table 1);

- from 0.4 to 6.3 mm for the “Hemisphere Ø 5 mm” induction coil (Table 1);

- from 2.8 to 10.5 mm for the “Hemisphere Ø 7 mm” induction coil (Table 1).

During calibration the reference specimens are installed in the ascending order of thicknesses indicated on them. Reference specimens are mounted onto installed on the measuring head service attachment.

1.4.5.2 Entry into the menu is performed from the Main menu using the « », « », « », « », «Enter» keypad buttons.

«Калибровка» (Calibration) menu is shown in Figure 12.

Figure 12 - «Калибровка» (Calibration) menu

This menu displays the following:

- 1 - measured thickness in hexadecimal code, mm;
- 2 - reference specimen thickness, mm;
- 3 - reference specimen (standard) current number (Point No....));
- 4 - current measurement number (five measurements (records) shall be performed);
- 5 - «Старт» (Start) “button” (submenu) - starting of the parameter calculation;
- 6 - «Запись» (Recording) “button” - recording of the reference specimen’s code;
- 7 - «Эталон» (Standard) “button” - input of the reference specimen thickness;
- 8 - «Индуктор» (Induction coil) “button” (submenu) - selection of used induction coil;
- 9 - type of used induction coil;
- 10 - message, which shows whether parameter with selected induction coil is calculated or not.

The menu response with the “buttons” enabling:

- «Старт» (start) - starting of the parameter calculation;
- «Запись» (recording) - recording of the measured value;
- «Эталон» (standard) - entry into the «Эталон» (Standard) submenu to input its thickness;
- «Индуктор» (induction coil) - selection of induction coil type.

The menu response to the keypad buttons:

- « ⇦ », « ⇨ » - selection (enabling) of the “buttons” (submenus);
- «Enter» - entry into submenu, enabled by the corresponding “button”;
- «Menu» - return to the Main menu.

1.4.5.3 Parameter calculation and recording

Parameter calculation and recording shall be performed by recording of the reference specimens’ thicknesses, following the algorithm:

a) before performance of calibration the induction coil is determined according to Table 1, with which the calibration procedure will be performed. For this, using the « ⇧ » and « ⇩» keys (field 8 in Fig. 12) the induction coil selection is performed, which will be indicated in the field 9 in Figure 12. At that, the field 3 in Figure 12 will have the following appearance: «Точка №00» (“Point No. 00”);

b) perform the «Эталон» (Standard) (field 7 in Fig. 12) “button” enabling and enter the «Эталон» (Standard) submenu by pressing the «Enter» key. The «Эталон» (standard) submenu is shown in Figure 13. After entry to the «Эталон» (Standard) submenu input of the reference specimens (glass plates) thickness shall be performed. The reference specimen’s actual thickness is indicated in marking.

c) the thickness input shall be performed using the « ⇦ », « ⇨», « ⇩ », « ⇧» and «Enter» keypad buttons according to the provided in submenu guidelines. The green colored «Enter» button, after which return to the «Калибровка» (Calibration) menu will take place, enables input and inputted value will be displayed in field 2 in Fig. 12. The red colored «ESC» “button” enables return to the «Калибровка» (Calibration) menu without saving of the inputted value;

Figure 13 - «Эталон» (standard) submenu

d) using the calibration service attachment (item 11 in Figure 1) place the selected reference specimen onto the Meter's head;

e) enable the «Запись» (recording) "button" (field 6 in Fig. 12) and lower the selected according to item a) induction coil onto the reference specimen. The field 1 in Figure 12 will display the specimen's thickness in hexadecimal code;

f) to record and save the measured value press the «Enter» key. After this the field 4 in Figure 12 will be incremented and will have the following appearance: «Запись №01» (Record No. 01);

N o t e - Repeat item f) 4 times until field 4 in Figure 12 will have the following appearance: «Запись №00» (Record No. 00). Repetitions shall be made in different points of the reference specimen.

g) after performance of all operations the reference specimen shall be changed and operations from b) to f) inclusive are performed. At that, the field 3 in Fig. 12 will have the following appearance: «Точка №01» (Point No. 01);

N o t e - Item g) shall be performed on three different reference specimens included into delivery package with increase in the specimens' thickness until field 3 in Fig. 12 will have the following appearance: «Точка №02» (Point No. 02). Last repetition of item g) with field 3 in Fig. 12 value of «Точка №03» (Point No. 03) shall be performed without the reference specimen installation and without using of the induction coil.

h) after recording of the reference specimens' values it is necessary to proceed with parameter calculation. For this, enable the «Старт» (start) "button" (field 5

in Figure 12 on the «Калибровка» (Calibration) menu and press the «Enter» key. On the display screen, a request will appear (Fig. 14):

Figure 14 - Request for parameter calculation

i) to start the parameter calculation press «Enter», or «Esc» - to cancel and return to «Калибровка» (Calibration) menu. After starting, the display will show the calculation process (Fig. 15). The calculation process takes place from 15 to 30 minutes;

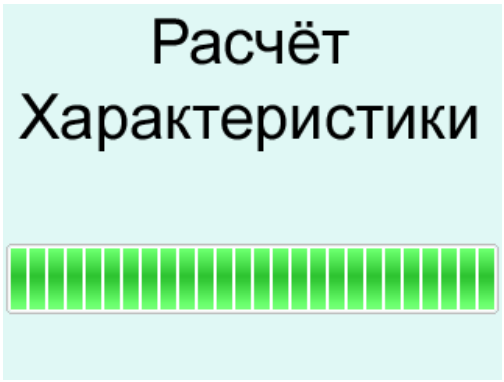


Figure 15 - Display of the calculation process

j) upon completion of the calculation process automatic return to the «Калибровка» (Calibration) menu takes place. At that, the field 10 in Figure 12 will have the following appearance: «Рассчитано» (Calculated).

Item 1.4.5.3 shall be repeated on all induction coils included into the delivery package.

1.4.6 «Помощь» (Help) menu

1.4.6.1 Entry into the menu is performed from the Main menu using the «⇦», «⇨» and «Enter» the keypad buttons.

1.4.6.2 «Помощь» (Help) menu is shown in Figure 16.

Figure 16 - «Помощь» (Help) menu

This menu provides the manufacturer's data.

1.4.7 «Программирование» (Programming) menu

This menu is intended for recoding of new parameters into the Meter and is accessible only for manufacturer's experts.

1.4.8 The measurement results transfer to the personal computer

The measurement results transfer to the personal computer (PC) is performed via the USB port or COM port (optional) of the Meter.

The measurement results transfer to the PC is only possibly with at least one parameter recorded into the Meter (for example, "Ball 4" or other).

For data collection to the PC a licensed software is required, which allows to process transferred from the Meter data.

N o t e - During PC and Meter connection it is necessary to perform adjustment for integrity of transmitted data. For adjustment, it is necessary to contact the developer of used software.

Necessary parameters for data transmission from the Meter to PC:

- Baud rate: 19,200 bit/s;

- data: 8 bits;

- parity: No;

- stop bits: 1;

- flow control: No.

1.5 Measuring instruments

Micrometer gauge of МЛ type - sheet plates with a dial for measuring the thickness of sheets and tapes. Accuracy class 1.

1.6 Marking

1.6.1 Marking of the Meter includes:

- the Meter description and designation;

- specifications designation;

- name of manufacturing plant and its trademark;

- rated supply voltage;

- rated current frequency;

- power consumption;

- “Made in Russia” information;

- serial number in accordance with the manufacturing plant numbering scheme;

- date of manufacture (month, year);

- symbol of State Register SI RF.

1.6.2 Consumption package (case) marking contains the following:

- the Meter description and designation;

- serial number in accordance with the manufacturing plant numbering scheme;

- date of manufacture (month, year).

1.6.3 Transportation packing marking contains the following:

- name of manufacturing plant and its legal address;
- handling signs: “Fragile. Handle With Care”, “Keep Dry”; “This Side Up”; “Stockpiling is limited to 60 kg”; “Temperature limit” ;
- packing net and gross weights;
- packing overall dimensions.

1.7 Packing

1.7.1 The Meter, measuring head with verification set and induction coils, power cord, service logbook, operation manual, copy of measuring instrument type approval certificate and other accessories are placed into bags from polyethylene film, manufactured by extrusion from high-pressure (low-density) polyethylene and compositions based on it containing pigments (dyes), stabilizers, sliding, antistatic and modifying additives and put into the case. The film is used in agriculture, in land reclamation and water management construction; as a packaging material in various sectors of the national economy; for the manufacture of consumer goods. Polyethylene film bags are closed using the Zip Lock or sealed.

1.7.2 Temporary anti-corrosion protection B3 - 10 (technical silica gel).

1.7.3 The case is placed into the corrugated cardboard box.

1.7.4 Each box is supplied with a packing list, which contains the following information:

- name of the manufacturing plant;
- the Meter description and designation;
- the Meter serial number;
- packer signature;
- certified by the seal signature of person in charge of acceptance (QCD).

1.7.5 Maximum packing gross weight is 4.5 kg.

2 INTENDED USE

2.1 Operating restrictions

2.1.1 Location is enclosed, heated and ventilated rooms.

2.1.2 Operation:

- under laboratory conditions;

- in rooms with air conditioning or partial air conditioning.

2.1.3 Ambient temperature is from plus 10 °C to plus 35 °C.

2.1.4 Relative air humidity is up to 75 % at temperature of plus 30 °C

2.1.5 Supply voltage is single-phase AC mains with voltage from 187 to 242 V, frequency of (50 ± 1) Hz having permanent protective earthing.

2.2 Safety Precautions

2.2.1 Workplace must meet the requirements of adopted at the customer's facility safety instruction for electric consumers with voltage of up to 1,000 V.

2.2.2 The personnel permitted to operate the Meter shall have the proper training, have studied this operation manual and admitted for works by the company's management.

2.2.3 The Meter shall only be connected to the 220 V, 50 Hz electric mains having permanent protective earthing.

2.3 Preparation of Article for use

2.3.1 Unpack the Meter. If the Meter was exposed to the negative temperatures, it is needed to be kept in the packing under normal conditions for at least 16 hours.

2.3.2 Check the completeness. Visually check the Meter and delivery

package. Make sure that there are no mechanical damages.

2.3.3 Position the measurement unit on flat, level surface.

2.3.4 Connect the power cord to the mains connector.

2.4 Using the Article

2.4.1 Power-on and testing instructions

Power-on and test run shall be performed after completion of items 2.4.2 and 2.4.3 of the present operation manual. Instead of the examined material (bottle) a reference specimen (standard) shall be used.

2.4.2 Preparation for measurement

2.4.2.1 The preparation shall be performed as follows:

- attach the measuring head to the measurement unit and select the induction coil using the information provided in the Table 1;

- connect the Meter to the electric mains 220 V, 50 Hz and switch it on by the «СЕТЬ» (MAINS) switch (switched on condition is confirmed by the switch button illumination). The display screen must show the startup screen. After the startup screen a «Измерение» (Measurement) menu must appear on the display screen;

- wait until the «XXXX» number will be shown in green color and continue operation.

IT IS PROHIBITED TO BRING THE INDUCTION COIL TO THE MEASURING HEAD UNTIL THE «XXXX» IS DISPLAYED IN GREEN COLOR!

N o t e - If the «XXXX» number is not displayed in green color, perform the «Быстрая коррекция» (Quick adjustment) procedure by pressing of the «F1» button on the keypad.

2.4.2.2 Display the selected induction coil on the display screen. To do this:

- using the «  », «  » keypad buttons enable the «Индуктор» (Induction coil) “button” and press «Enter» button on the keypad.

- using the «  », «  » keypad buttons select the necessary induction coil using the information provided in the Table 3;

- using the «  », «  » keypad buttons enable the «Доп. min» and «Доп. max» “buttons”, each time after enabling pressing the «Enter» button on keypad;

- using the «  », «  », «  », «  » keypad buttons set the minimum and maximum tolerances, each time after setting pressing the «Enter» button.

2.4.3 Measurement

2.4.3.1 Place the examined material (for example, bottle) above the measuring head so that the measured area touched its top and install the induction coil on this area from above (inside the bottle above the measuring head). The display screen must show amount of the measured value.

2.4.3.2 Perform series of measurements moving the material (during the bottle wall thickness measurement rotate the bottle around its rotation axis with its simultaneous movement from neck to bottom and back while taking readings).

N o t e - Measurements are performed automatically.

2.4.3.3 Press the «Esc» button on keypad when it is necessary to abort the series of measurements. Press the «On» button on keypad to transfer the measurement results to the computer.

N o t e - The Meter must be connected to the personal computer according to item 2.4.8.

2.4.3.4 After performance of the necessary series of measurements, repeat items 2.4.3.1, 2.4.3.2, and 2.4.3.3 with other materials (bottles).

2.4.3.5 Upon completion of works switch the Meter off using the «СЕТЬ» (MAINS) switch and disconnect it from the electric mains.

2.4.4 Adjustment

From the Main menu enter to the «Измерение» (Measurement) menu using the «  », «  », «  », «  » and «Enter» buttons on the keypad.

From the «Измерение» (Measurement) menu enter to the «Коррекция» (Adjustment) submenu using the «  », «  », «  », «  » and «Enter» buttons on the keypad.

To perform adjustment, proceed as follows:

- install the service attachment onto the measuring head;

- after measurement of the specimen's thickness with micrometer gauge install the reference specimen onto the attachment;

- install the attachment upper part (by rotation along the thread) so that the reference specimen touched the measuring head top;

- position the selected induction coil on the reference specimen;

- input the reference specimen's thickness numeric value using the «  », «  », «  », «  » and «Enter» keypad buttons.

N o t e - During adjustment and measurements with flat head ball in the disc shall be installed in the center of disc's crosshairs, by the disc and head's notches alignment into single imaginary line.

2.4.5 Recovery of initial parameters

From the Main menu enter to the «Заводские установки» (Factory settings) menu using the «  », «  », «  », «  » and «Enter» buttons on the keypad and enable the «Enter» "button" on display screen.

Press the «Enter» button on the keypad. Set by the manufacturing plant initial parameter shall be recovered.

2.4.6 Setting

From the Main menu enter to the «Настройки» (Settings) menu using the «  », «  », «  », «  » and «Enter» buttons on the keypad.

2.4.6.1 Time setting

From the «Настройки» (Settings) menu enter to the «Уст. времени» (Time setting) submenu using the « ⇦ », « ⇨ » and «Enter» buttons on the keypad.

Using the « ⇦», « ⇨ », « ⇩ », « ⇧ » buttons set date (day, month, year), time (hours, minutes), then enable the «Enter» “button” on display screen and the «Enter» button and then the «Menu» button on the keypad.

2.4.6.2 View records

From the «Настройки» (Settings) menu enter to the «Просмотр записей» (View records) submenu using the « ⇦ », « ⇨ » and «Enter» buttons on the keypad.

View records using the « ⇦», « ⇨», « ⇩», « ⇧ », «F1» and «F2» buttons by scrolling the “pages”.

To delete records press «On» button on the keypad.

CAUTION: ALL RECORDS WILL BE DELETED AT ONCE!

Upon completion of viewing press the «Menu» button on keypad.

2.4.6.3 Data output

From the «Настройки» (Settings) menu enter to the «Вывод данных» (Data output) submenu using the « ⇦ », « ⇨ » and «Enter» buttons on the keypad.

Select sectors (upper or lower) using the « ⇩ », « ⇧ » buttons.

Use the «⇦», «⇨» keypad buttons to change values (when the upper sector is selected) or to change the data transmission type (when the lower sector is selected).

Upon completion of adjustment, press the «Menu» button on keypad.

2.4.7 Calibration

2.4.7.1 General guidelines

Calibration shall be performed using the reference specimens included into the Meter delivery package. As the reference specimens, use the flat glass plates (by three glass plates with different thicknesses for each induction coil).

The reference specimens shall be installed onto mounted on the head service attachment

in the ascending order of thicknesses indicated on them.

Calibration shall be performed with ambient air temperature of (23 ± 5) °C and relative humidity from 50 % to 80 % at temperature of (23 ± 5) °C.

2.4.7.2 Calibration performance

Calibration shall be performed according to algorithm described in item 1.4.5.3. Upon completion of all operations press the «Menu» button to return to the Main menu.

2.4.8 The measurement results transfer to the personal computer

2.4.8.1 Connect PC to the electric mains and switch it on.

Connect the Meter's USB port (or COM port) to the PC input «  » using the USB (or RS-232) cable.

2.4.8.2 To set up the Meter for data transmission it is necessary to enter the «Настройки» (Settings) menu on the Meter and select «Вывод данных» (Data output) item. In the opened window, select «min», «max» or «min/max» mode.

2.4.8.3 Set the Meter to the «Измерение» (Measurement) mode and measure the thickness of necessary specimen with display of the minimum and maximum values on the screen.

2.4.8.4 After the measurement, press the «On» button. The measurement result will be transferred to the personal computer. On the personal computer the following information will be displayed in the used software:

- received data in the hexadecimal code (depending on the used software);

- received data in the ASCII format (ratio of «min» or «max», or «min/max») (depending on the used software).

3 MAINTENANCE

3.1 General guidelines

3.1.1 The personnel permitted to maintain the Meter shall have the proper training, briefed in the established order, have at least the second electrical safety qualification level, and admitted for work by the company's management.

3.1.2 The maintenance shall be performed at intervals specified in the Table 4, including after sustained interruption (over three months).

3.1.3 The maintenance shall be conducted under normal climatic conditions at ambient air temperatures from plus 15 °C to plus 35 °C and at the relative air humidity of up to 75 % at temperature of plus 30 °C.

3.2 Maintenance procedure

Maintenance shall be performed in the scope and sequence shown in Table 4. If necessary, the Meter shall be inspected according to item 2.4 of this OM.

Table 4 - The maintenance scope and sequence

Name of works	Maintenance method	Types of maintenance			
		Commissioning	Beginning of working shift	Once a month	Sustained interruption in operation
1	2	3	4	5	6
Wiping	Wiping of the Meter, induction coil, heads shall be performed with clean, dry, soft, lint free fabric	+	+	+	+

Table 4 (continued)

1	2	3	4	5	6
Power cord inspection	Inspection shall be performed: - by insulation resistance measurement with the megaohmmeter between the power cord current conducting circuits; - by the current conducting circuits resistance measurement with ohmmeter	+	*	+	+
Check of the blow fuses	Inspection shall be performed by the blow fuse resistance measurement with ohmmeter. The blow fuse part type shall be checked by the visual inspection	+	*	*	+
Performance of adjustment	Perform item 2.4.4	-	*	+	-
Calibration performance	Perform item 2.4.7	+	-	*	+
N o t e s 1 Symbol «+» means that maintenance is performed. 2 Symbol «-» means that maintenance is not performed. 3 Symbol «*» means that maintenance is performed when necessary.					

4 STORAGE

4.1 Packed in manufacturer’s transport packaging Meter shall be stored in enclosed storage facilities at ambient air temperature from minus 25 °C to plus 55 °C and relative humidity of up to 95 % at temperature of plus 35 °C .

4.2 Unpacked Meter shall be stored in enclosed heated storage facilities at ambient air temperatures from plus 5 °C to plus 40 °C and at the relative humidity of up to 75 % at temperature of plus 30 °C.

4.3 The storage facility must be located at the altitude of not more than 1,000 m above the sea level.

4.4 Maximum shelf life is one year.

4.5 In case of the Meter storage at the warehouse for more than six months, than during its withdrawal from storage and before using it is necessary to perform exceptional verification.

5 TRANSPORTATION

5.1 The Meter transportation in the manufacturer’s transport packaging can be performed by all means of enclosed transport, except for sea and unpressurized, and unheated aircraft compartments.

5.2 Maximum number of transshipments is two.

5.3 As to environment climatic aspects influence, packed in manufacturer’s transport packaging Meter transportation conditions are ambient air temperature from minus 25 °C to plus 55 °C and relative humidity of up to 95 % at temperature of plus 35 °C.

6 EXPANDED CRITERIA BY ELECTROMAGNETIC COMPATIBILITY

6.1 Is allowed compliance with the quality criterion of functioning according by nanosecond pulse interference with a reboot of the meter by the operator.

6.2 Is allowed to comply with the quality criterion of functioning according to the conductive interference, induced by radio frequency electromagnetic fields with a significant deterioration in the results of measurements of the thickness of the samples under study.

6.3 Compliance with the quality criterion of functioning according on the failures and interruption of the power supply voltage with the reboot of the meter by the operator.