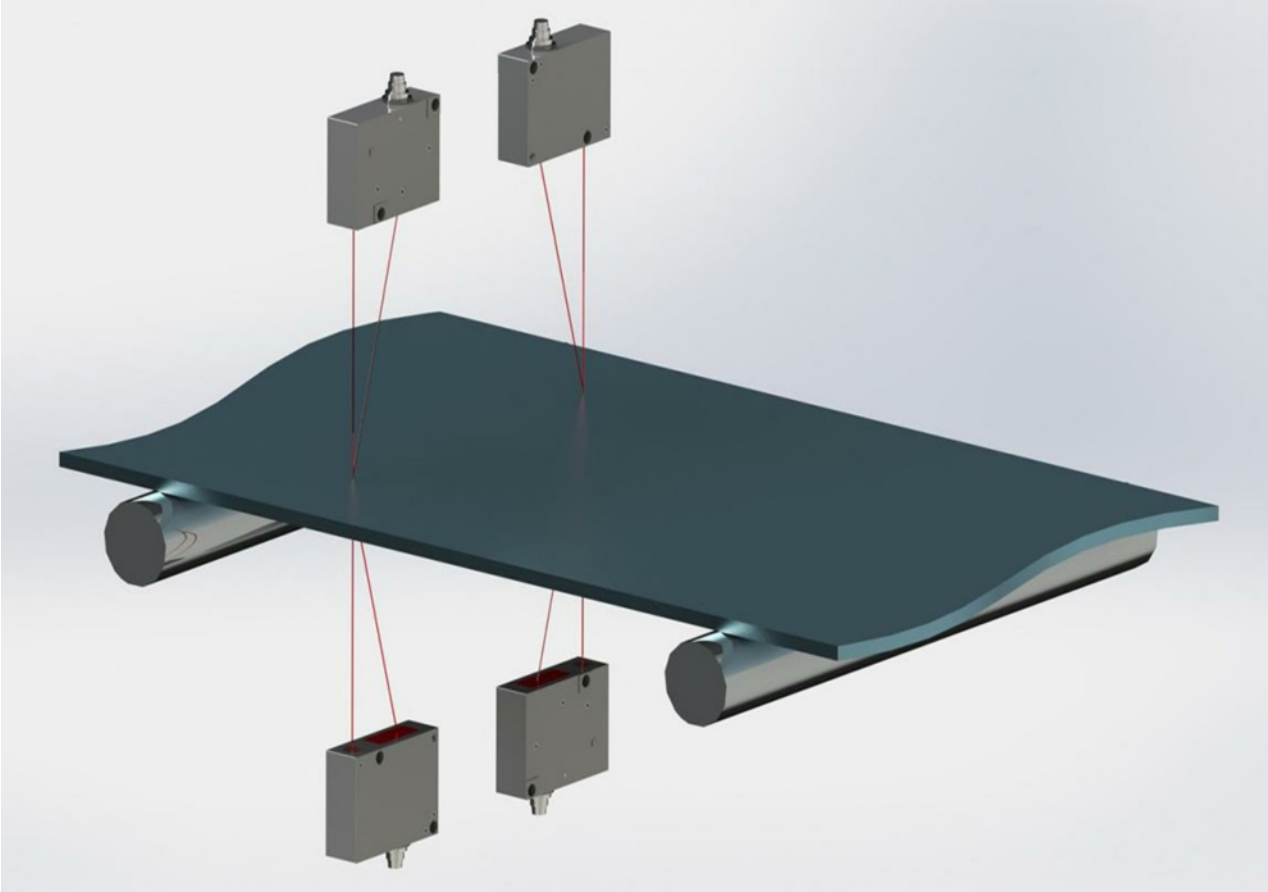
FDRF580 Series



Certified according to ISO 9001:2008

07.2019 | version 0001

Contents

1. Safety precautions

- Use supply voltage and interfaces indicated in the system specifications.
- In connection/disconnection of cables, the system power must be switched off.
- Do not use the system in locations close to powerful light sources.
- To obtain stable results, wait about 20 minutes after sensor activation to achieve uniform sensor warm-up.
- The indication device must be grounded and connected to the grounding bus by a separate branch.

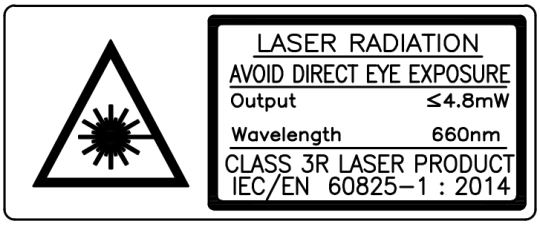
2. CE compliance

The system has been developed for use in industry and meets the requirements of the following Directives:

- EU directive 2014/30/EU. Electromagnetic compatibility (EMC).
- EU directive 2011/65/EU, "RoHS" category 9.

3. Laser safety

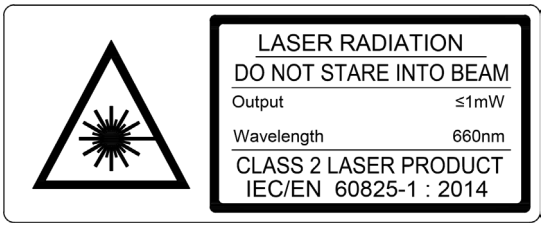
The system can contain laser sensors that belong to Class 3R or Class 2 according to IEC/EN 60825-1:2014. The maximum output power of Class 3R laser is 4.8 mW.
The following warning label is placed on the sensor body:



The following safety measures should be taken while operating the sensor:

- Do not target laser beam to humans.
- Avoid staring into the laser beam through optical instruments.
- Do not disassemble the laser sensor.
- Mount the sensor so that the laser beam does not fall onto a mirror surface.

The maximum output power of Class 2 laser is 1 mW. The following warning label is placed on the sensor body:



The following safety measures should be taken while operating the sensor:

- Do not target laser beam to humans.
- Do not disassemble the sensor.
- Avoid staring into the laser beam.

4. General information

The system is intended for non-contact measuring (when using laser sensors) of thickness of sheet materials such as tapes, boards, plates, and so on. It is a stand-alone software and hardware system that contains laser sensors (or contact encoders) and an indication device. System parameters can be changed for a specific task.

5. Structure and operating principle

The system can support an unlimited number of thickness control points. Each control point is one sensor mounted according to Scheme #1 (Figure 1, left) or two sensors mounted according to Scheme #2 (Figure 1, right).

According to Scheme #1 (one sensor for one point), the material thickness is a difference between the distance from the base surface on which the material is located, and the distance to the upper surface of the material measured by a sensor. The sensor position is calibrated relative to the base surface.

According to Scheme #2 (two sensors for one point), the material thickness is a difference of distances to the material surfaces measured by each of the sensors. The position of sensors is calibrated relative to each other.

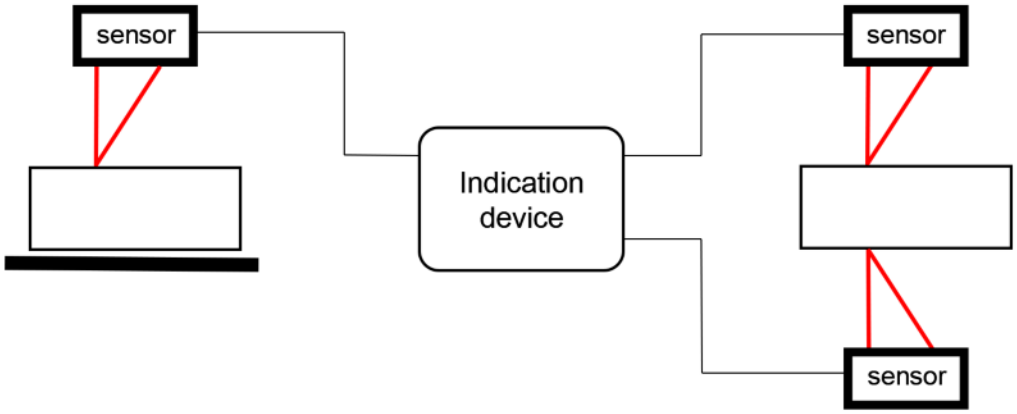


Figure 1. Scheme #1 with one sensor (left) and Scheme #2 with two sensors (right)

5.1. Laser sensors

The system can contains Laser triangulation sensors FDRF603 Series.
The User's manual for Laser triangulation sensors FDRF603 Series is available on request.

5.2. Contact encoders

The system can contains Absolute linear encoders FDRF65x Series.
The User's manual for Encoders is available on request.

5.3. Indication device

The indication device is intended to receive information from sensors, analyze and display the measurement results.

Laser sensors must be connected via the special connectors mounted on the housing of the indication device. The LCD display with the touch screen shows information. When the thickness value exceeds the tolerances, the operator will be notified by an audible alarm. The thickness value output is based on the analysis of values received from sensors and calculated for a given averaging time, and is repeated with periodicity equal to the averaging time.

Overall and mounting dimensions of the indication device:

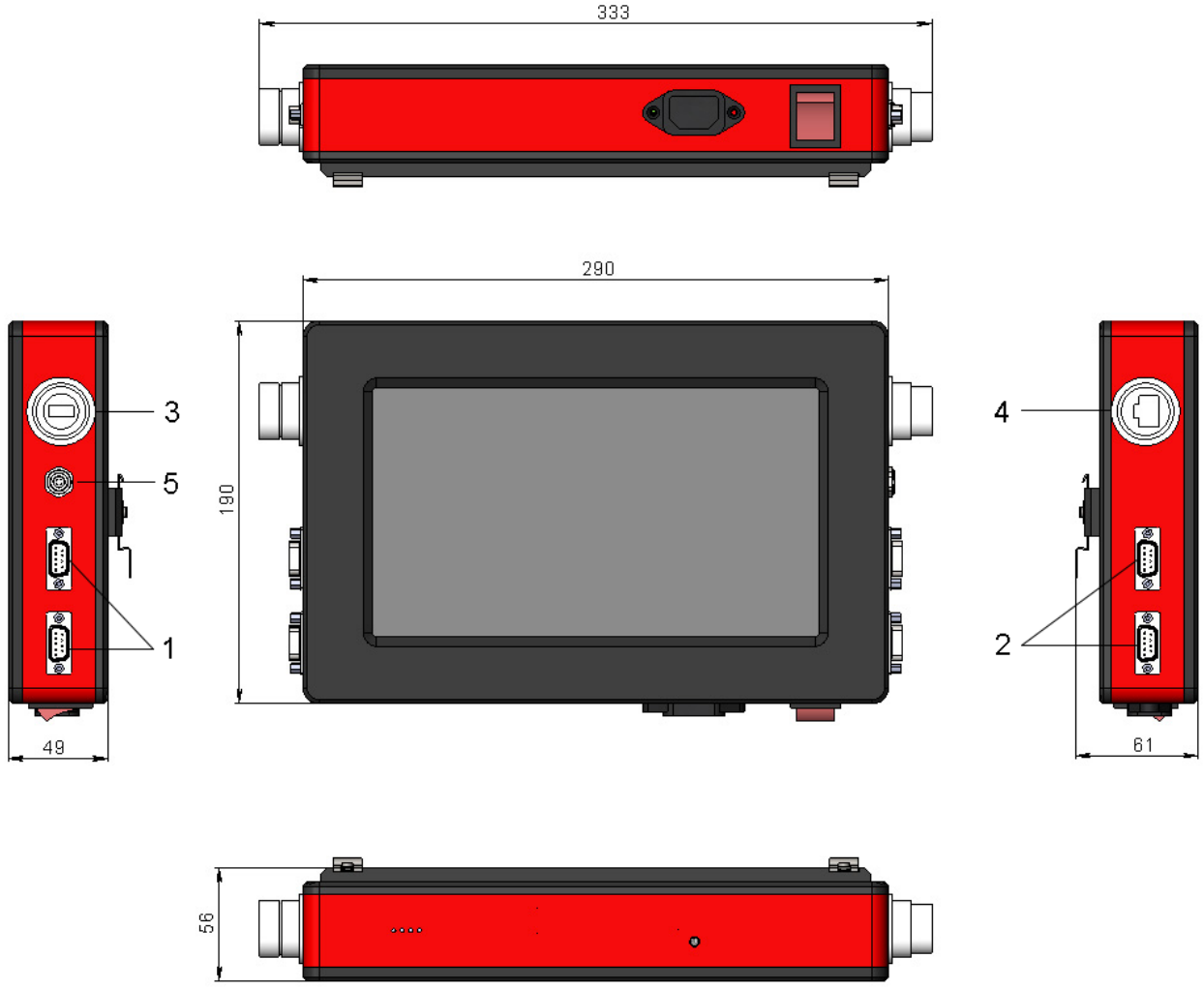


Figure 2. Overall and mounting dimensions of the indication device

Designations:
1 - DB9 connectors for connecting the sensors (Point 1);
2 - DB9 connectors for connecting the sensors (Point 2);
3 - USB;
4 - Ethernet;
5 - Encoder input and Logical output.

6. Basic technical data

Parameter		Value
Thickness measurement range, mm		by request
Thickness measurement accuracy, mm		±0.1% of the laser sensors measurement range or according to specification for encoders
Input interface, sensors connection		RS485
Output interface, result transfer		Ethernet
Logical output (OK/NOK)		Open collector
Encoder input		TTL
Software upgrade, data transfer		USB
Measurement speed, measurements/second		<9400
Power supply, V		220 (±10 %) for AC network with frequency of 50 (±1) Hz
Power consumption, W		10
Operating conditions	Ambient temperature, °C	+1..+35
	Relative humidity, %	65 (at 25°C)

Note: System parameters can be changed for a specific task.

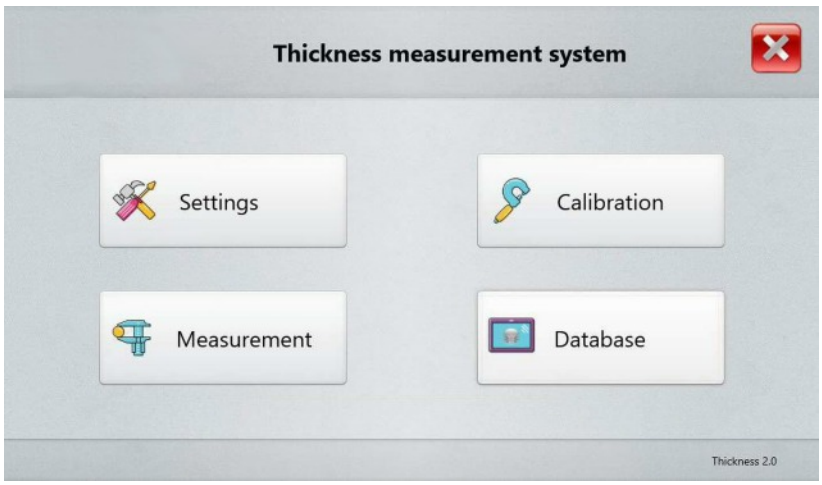
7. Example of item designation when ordering

FDRF580-N-N1-SERIAL-N3

Symbol	Description
N	Number of control points.
N1	Number of sensors in each control point (1 or 2).
SERIAL	Type of the sensor serial interface: RS485 - 485 or Ethernet - ET.
N3	Number of logic outputs.

8. Service program

When you switch on the indication device, the main program window appears:

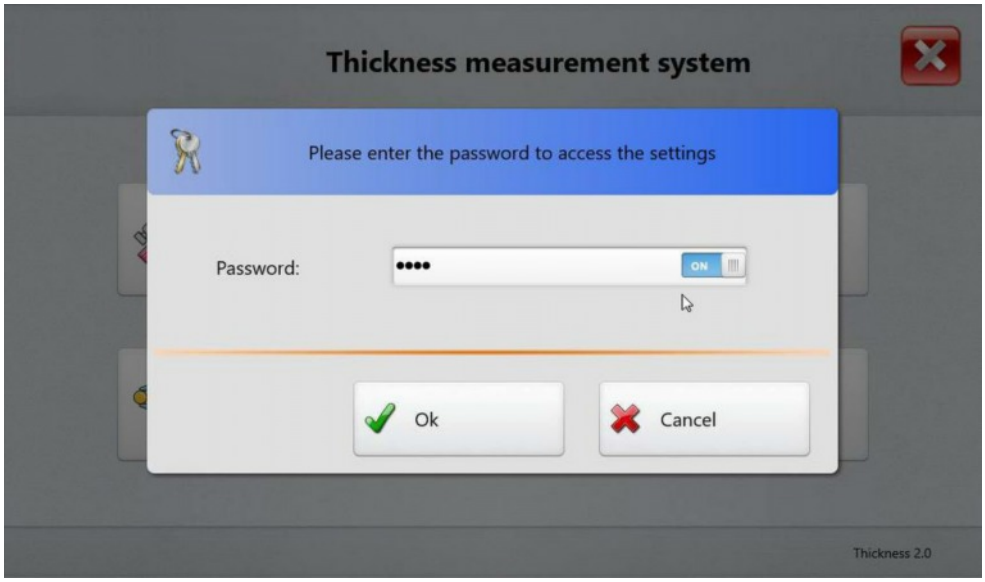


Buttons assignment:

Button	Assignment
Settings	Open the "Settings" window.
Measurement	Open the "Thickness measurement" window.
Calibration	Calibrate the system.
Database	Browse the database.

8.1. Settings

Before starting to work with the system, it is necessary to configure parameters. Tap the **Settings** button in the main window. The program will require a password. When initially installed, the program accepts the following password: 1111. Enter the password and tap **Ok**.

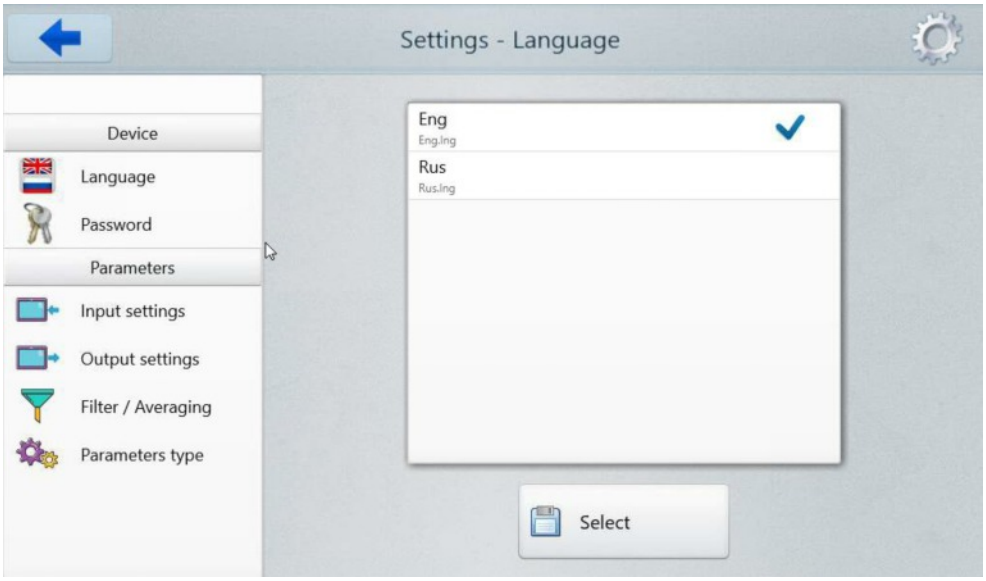


How to change the password, see Par. 8.1.1.2.

8.1.1. Device settings

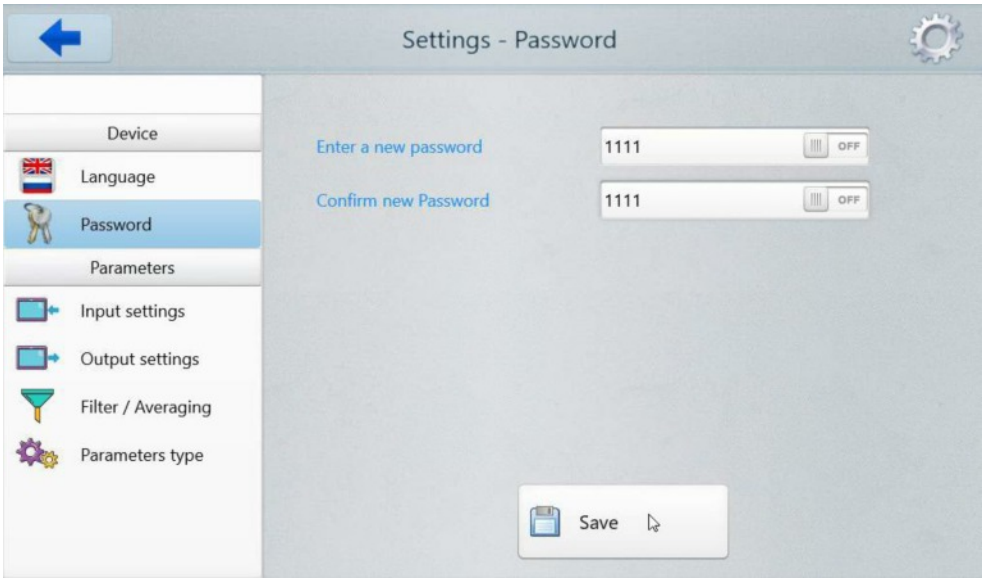
8.1.1.1. Language

In order to change the language of the program, tap **Language**, select the language support file, and tap **Select**.

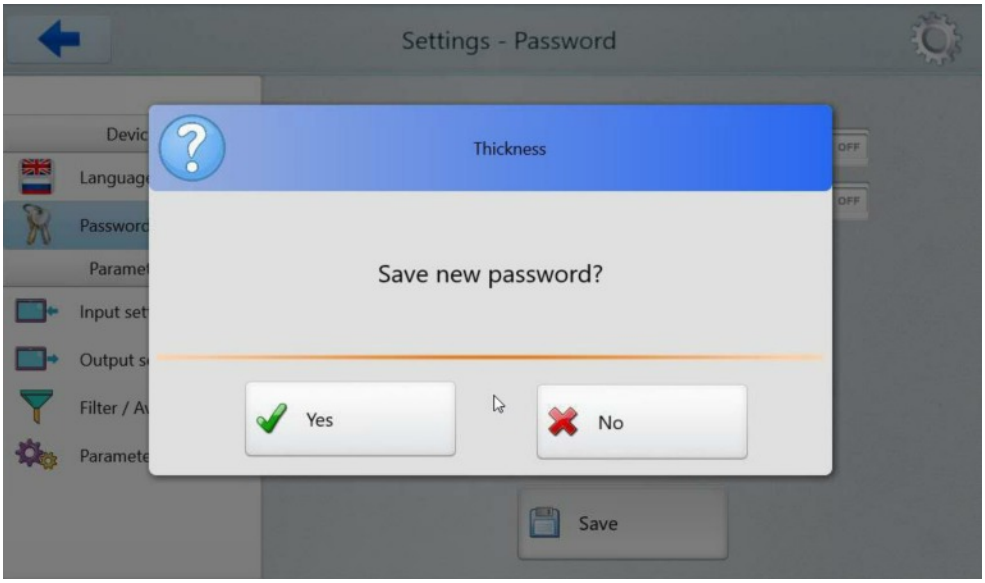


8.1.1.2. Password

To change the password, tap **Password**. Then enter a new password, confirm it and tap **Save**.



The program will prompt you to confirm the action:

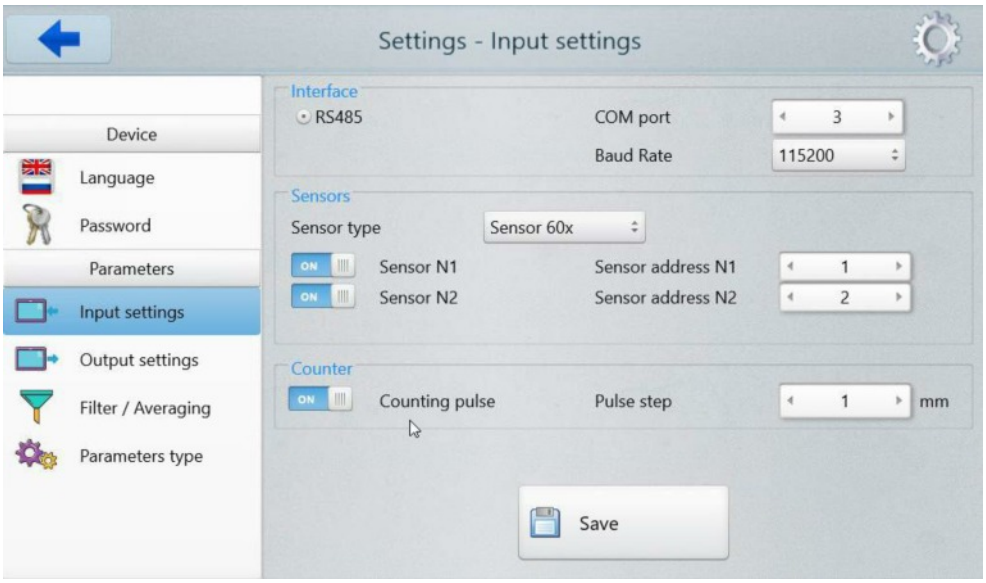


Select "Yes" to save a new password, or select "No" to cancel the action.

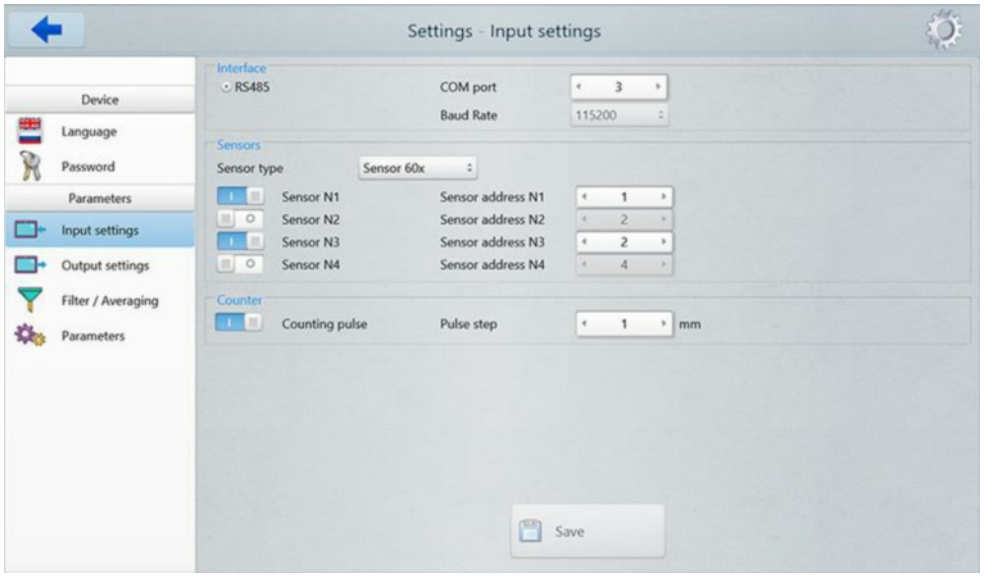
8.1.2. Parameters

8.1.2.1. Input settings

The **Input settings** tab for the one point measurement system:



The **Input settings** tab for the two points measurement system:



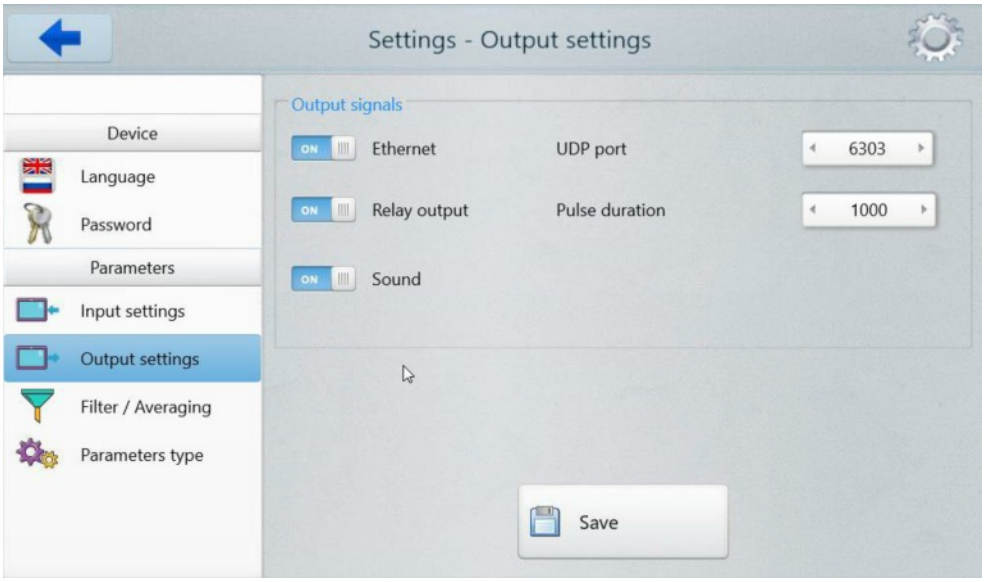
In the Interface settings area, the user can specify the COM port number and the baud rate.

In the Sensors settings area, the user can select the sensor type (60x or 65x), enable the sensors (ON / OFF buttons), and specify their network addresses.

In the Counter settings area, the user can enable the counter and specify the pulse step.
Note: In this case, the pulse means, for example, the pulses from the encoder that characterize the movement of the object under control. To save the changes, tap **Save**.

8.1.2.2. Output settings

The **Output settings** tab:



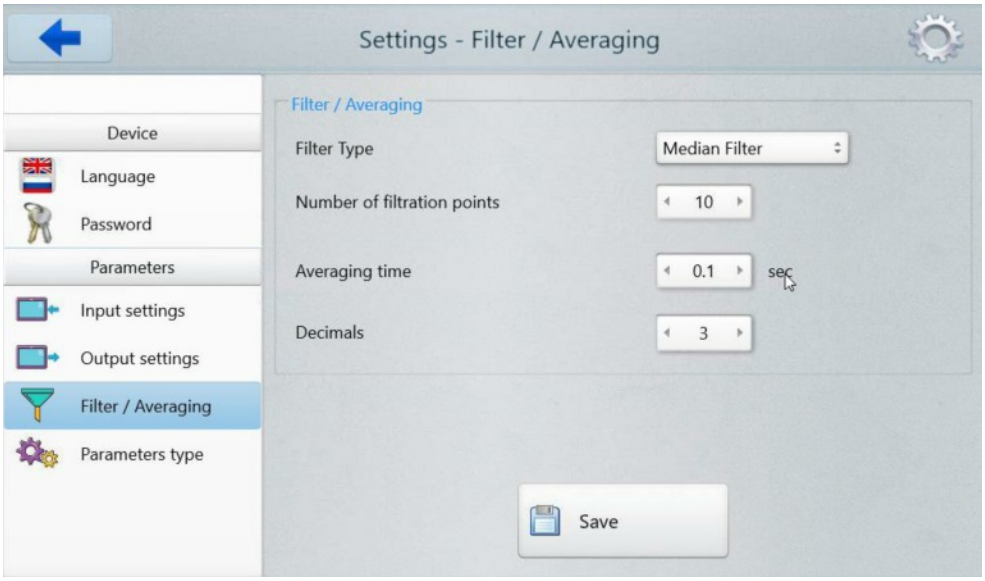
In the **Output settings** tab, the user can:

- enable the Ethernet interface;
- specify the UDP port;
- enable the relay output;
- enable an audible alarm ("Sound");
- specify the audible alarm duration ("Pulse duration").

To save the changes, tap **Save**.

8.1.2.3. Filter / Averaging

The **Filter / Averaging** tab:



Filtering is intended to lower the noise of the measurement signal which results in a better resolution. The description of parameters is given in the table below.

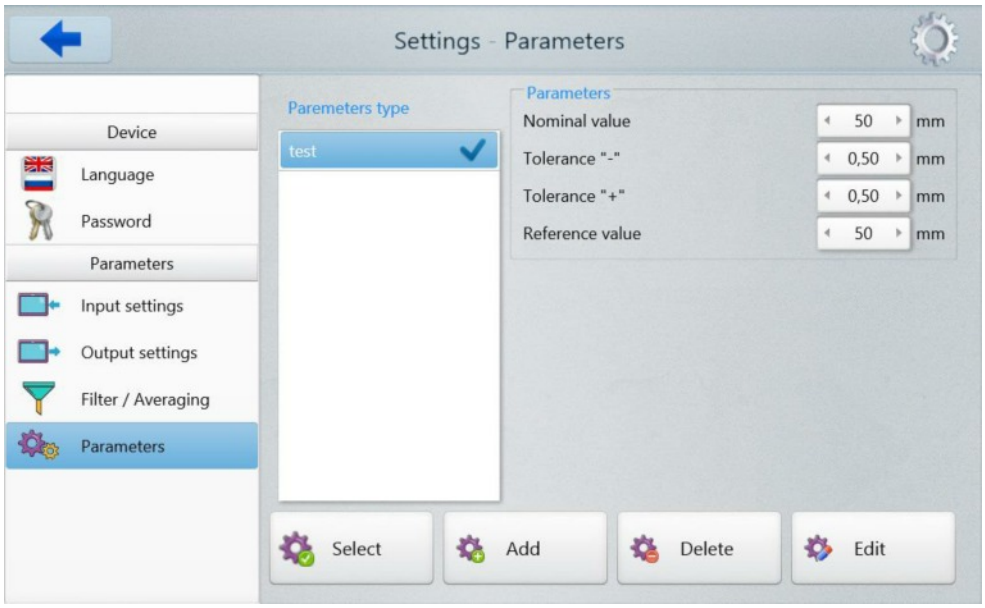
Parameter		Description
Filter type	No filtering	Without filtering.
	Moving Average	The selectable number of filtration points for successive measured values is used to calculate and issue the arithmetic average. Each new measured value is added, the first (oldest) measured value is removed from the averaging.
	Median Filter	The median is formed from a preselected number of filtration points for measurement values. The incoming measured values are also sorted again after each measurement. Afterwards, the average value is output as the median. If an even number is selected as a number of filtration points, the two average measurement values are added and divided by two.
Number of filtration points		This parameter is used to specify the number of measurement values to which the filter applies.
Averaging time		The time for which the measurement results will be output / saved (for example, every 0.1 s).
Decimals		The number of decimals for the measurement results.

To save the changes, tap **Save**.

8.1.2.4. Parameters type

To work with the system, you need to select a set of parameters that will be used when you start the measurement process.

The **Parameters** tab for the one point measurement system:

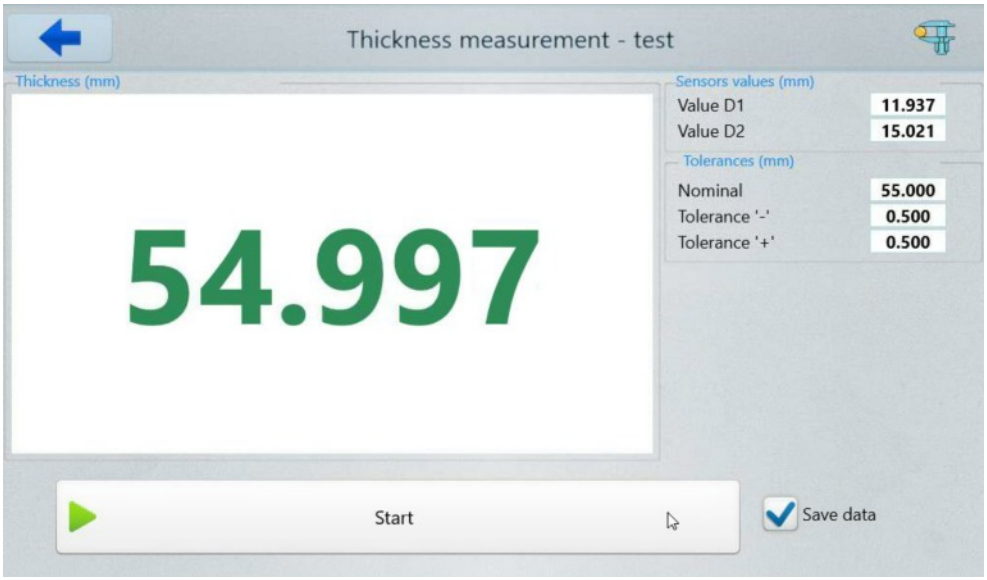


The **Parameters** tab for the two points measurement system:

- *Selecting a set of parameters*
  To select a set of parameters for using in the measurement process, tap it in the list of sets, and then tap the **Select** button.
- *Adding a new set of parameters*
  Tap the **Add** button, specify the nominal value, tolerances, and reference value.
- *Deleting a set of parameters*
  Tap it in the list of sets, and then tap the **Delete** button.
- *Editing a set of parameters*
  Tap it in the list of sets, and then tap the **Edit** button.

8.2. Measurement

Tap the **Measurement** button in the main window. The **Thickness measurement** window appears. The **Thickness measurement** window for the one point measurement system:

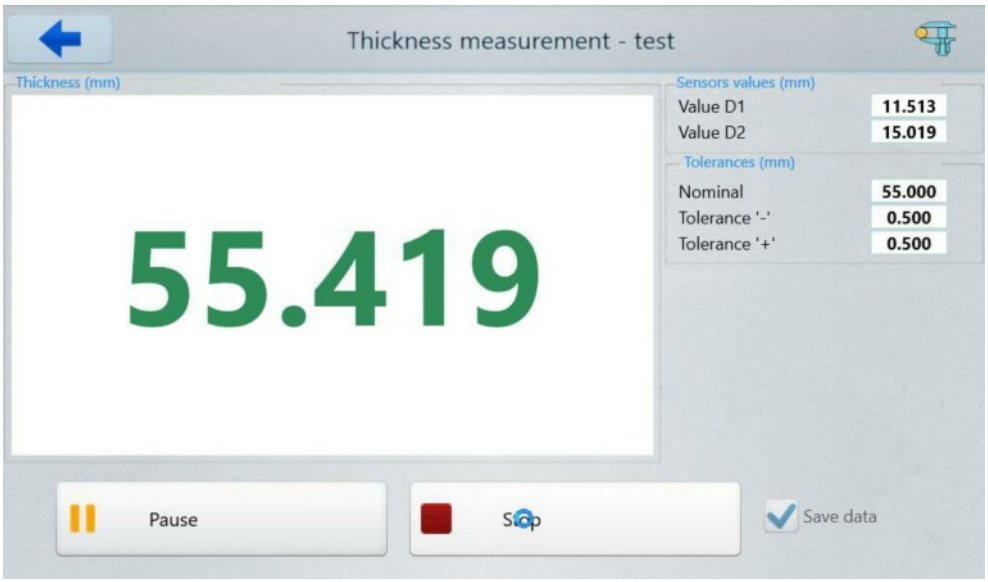


This window displays:

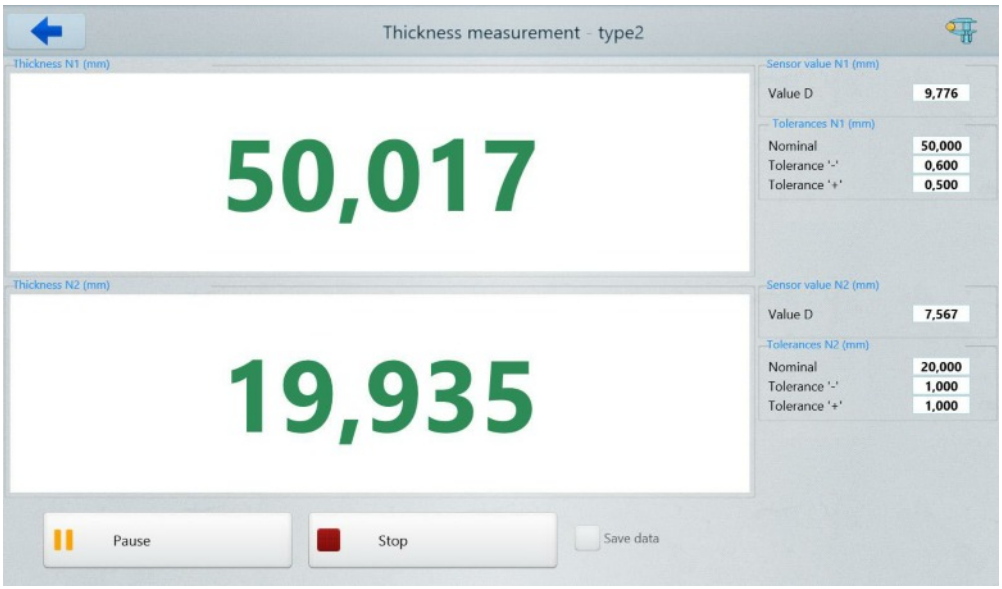
- name of the selected set of parameters (to the right of the window name);
- current thickness value (big green (or red) digits);
- values from the sensors (**Value D1 and Value D2**);

- nominal thickness value (**Nominal**);
- tolerances (**Tolerance '-'** and **Tolerance '+'**).

Tick the **Save data** box, if you want to save the measurement data to the database.
To start the measurement process, tap the **Start** button.
The one point measurement system:



The two points measurement system:

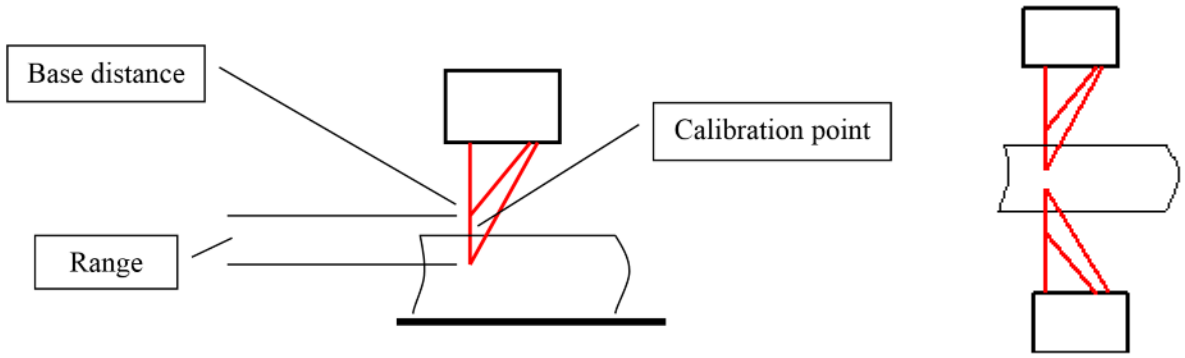


If needed, you can tap the **Stop** button to stop the measurement process, or tap **Pause** to pause the measurement process.

When the thickness value does not exceed the tolerances, it will be displayed in green color, otherwise - in red color.

8.3. Calibration

The thickness of materials is controlled within the working range of a sensor (sensors).



Scheme #1Scheme #2

To get the optimum results of the thickness control, a sensor should be mounted so that the controlled surface (surfaces) of the sample of nominal thickness was located in the middle of the working range of a sensor. Since a laser sensor is calibrated in its own coordinate system, and the thickness measurement is carried out relative to a base surface on which the controlled sample is located or according to two sensors, it is necessary to calibrate a sensor relative to a base surface (Scheme #1) or to calibrate the sensors according to each other (Scheme #2). The calibration must be done by using the sample of the known thickness.

Follow the steps below to perform the calibration procedure properly:

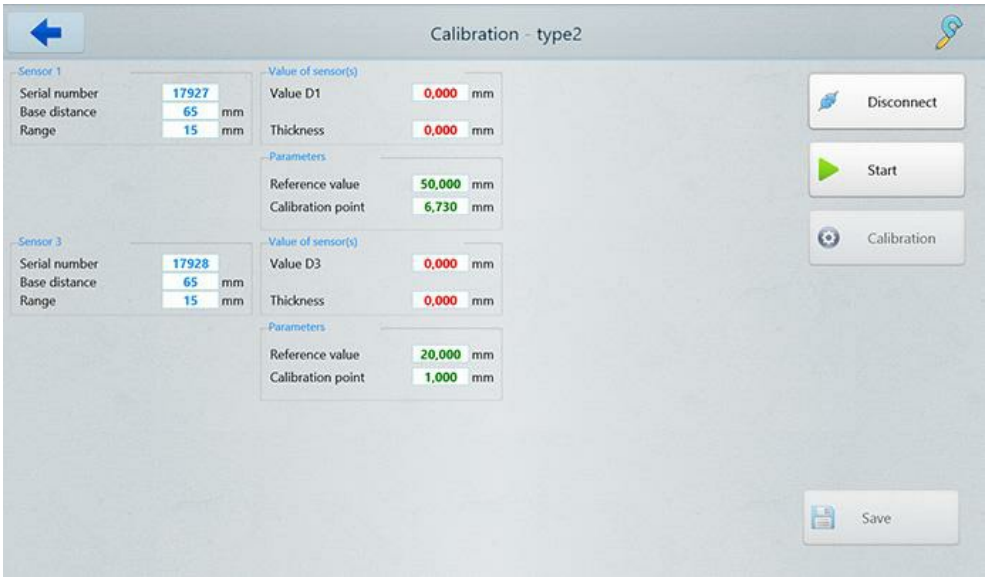
- Install the sample of the known thickness in the control area.
- Go to the **Settings** window. Tap **Parameters**, select a set of parameters, and make sure that the value in the **Reference value** field corresponds to the actual sample thickness value. If it doesn't, enter the actual sample thickness value into the **Reference value** field.
- Go back to the main menu and tap the **Calibration** button. The **Calibration** window appears. You will see a name of the selected set of parameters to the right of the window name.

The **Calibration** window for the one point measurement system:

The **Calibration** window for the two points measurement system:

· Tap the **Connect** button in order to connect to the sensors.
The one point measurement system:

The two points measurement system:



- Tap the **Start** button in order to start the measurement process. Parameters **Value D1**, **Value D2**, **Thickness** and **Calibration point** take values equal to the values of the sensor in the sensor coordinate system.

The one point measurement system:

The two points measurement system:

- Tap the **Calibration** button in order to start the calibration process. Parameters **Value D1**, **Value D2** and **Calibration point** are the values of a laser sensor in the sensor coordinate system. The **Thickness** parameter (sample thickness value) takes values equal to the values of a laser sensor in the coordinate system of a base surface, on which the sample is installed.

The one point measurement system:

The two points measurement system:

- If the **Thickness** value is equal to the **Reference value**, it means that the calibration procedure was done properly. Tap the **Save** button.

8.4. Database

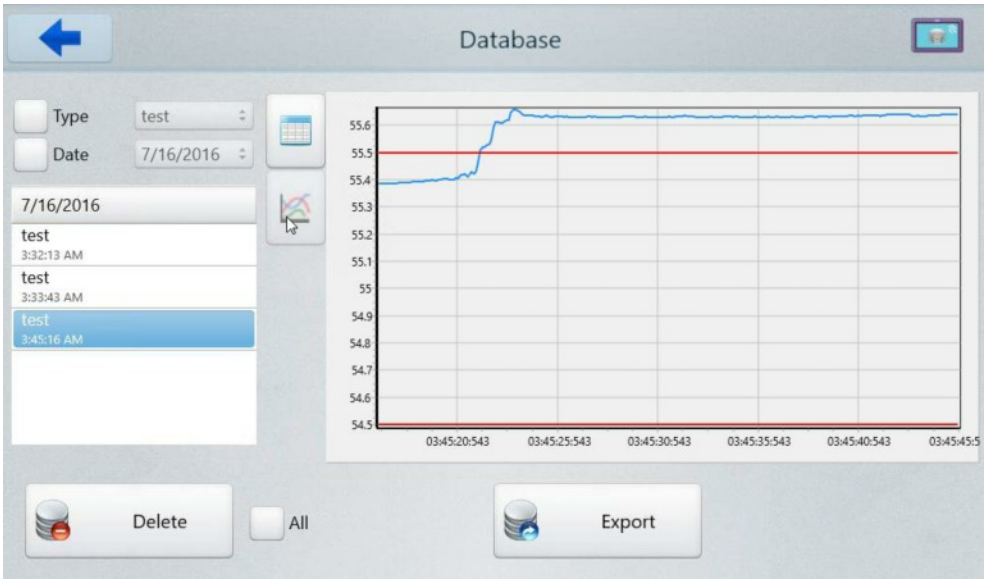
During the system operation, the thickness values are written to the database (if the **Save data** option is enabled, see Par. 8.2).

Tap the **Database** button in the main window. The **Database** window appears.

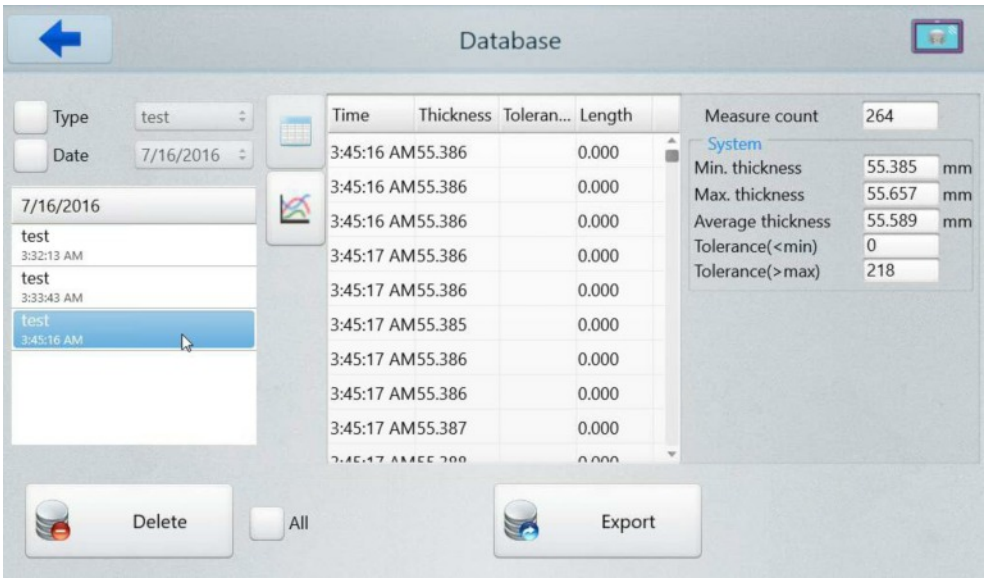
Select a set of measurements (you can find a list of sets to the left side of the window).

The data can be presented both in graphical form and in tabular form.

To browse the data in graphical form, tap  . On the screen:



To browse the data in tabular form, tap  . On the screen:



To work with the table, use a vertical scrollbar.
To delete a single measurement, tap it in the table and then tap the **Delete** button.
To delete all measurements, tick the **All** box, and tap the **Delete** button.
The data can be exported to CSV, XLS, and XML.
To export the data, tap the **Export** button, and select a format.

9. Operating the system

It is imperative to follow the steps below:

- Mount a sensor above the surface on which the controlled materials will move, (Scheme #1) or mount two sensors at apposite surfaces of material (Scheme #2). The sensor (sensors) should be mounted in accordance with its working range and the nominal thickness of the material (see Par. 8.3).
- Set parameters (see Par. 8.1.2).
- Start the measurement process (see Par. 8.2).
- Perform the calibration procedure (see Par. 8.3).

9.1. Ethernet interface

The Ethernet interface is used only to transmit the thickness value.

9.1.1. Factory parameters table

Parameter	Value
Destination IP address	192.168.1.200
Gateway IP address	192.168.1.1
Subnet mask	255.255.255.0

9.1.2. Data packet format

The sensor transmits the UDP packet to destination port 6303.
The packet consists of a header field (8 bytes) and a data field (4 bytes).
Data field:

- byte 0, byte 1 : beginning of the packet - [0x55,0xAA]
- byte 2, byte 3 : device serial number
- byte 4, byte 5 : packet number
- byte 6, byte 7 : data size - [4 bytes]
- byte 8, byte 9, byte 10, byte 11: measurement result

Example of data packet:

55h, AAh, 6Dh, 5Dh, 79h, 02h, 04h, 00h, 8Ah, C0h, 08h, 00h
55h, AAh - beginning of the packet
6Dh,5Dh - device serial number [s\n 23917]
79h, 02h - packet number [cnt = 633]
04h, 00h - data size [4 bytes]
8Ah, C0h, 08h, 00h - data [D = 0008C08Ah = 573578]
The result (in mm) is calculated by the following formula:
X=D/10000 = 573578/10000 = 57,3578 mm

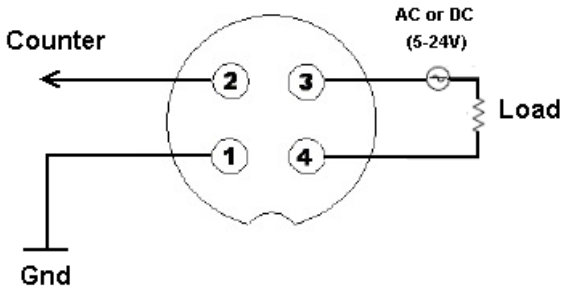
9.2. Encoder input and Logical output

The open collector is triggered when the thickness value exceeds the tolerance.

View from the side of connector contacts used in the device is shown below.

Binder on cable

pins 1,2 - Pulse input
pins 3,4 - Relay output



10. Technical support

Technical assistance related to incorrect work of the system and to problems with a service program is free. Requests for technical assistance should be addressed to Althen.

11. Warranty policy

Warranty assurance for the Thickness Measurement System FDRF580 Series - 24 months from the date of putting in operation; warranty shelf-life - 12 months.

12. Revisions

Date	Revision	Description
28.06.2017	1.0.0	Starting document.
07.06.2018	1.1.0	Updated: - description of the indication device (p. 5.3.) - description of the service program (p. 8.) - description of the open collector (p. 9.2.)

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The information provided herein is to the best of our knowledge true and accurate, it is provided for guidance only. All specifications are subject to change without prior notification.

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Althen stands for pioneering measurement and custom sensor solutions. In addition we offer services such as calibration, design & engineering, training and renting of measurement equipment.

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