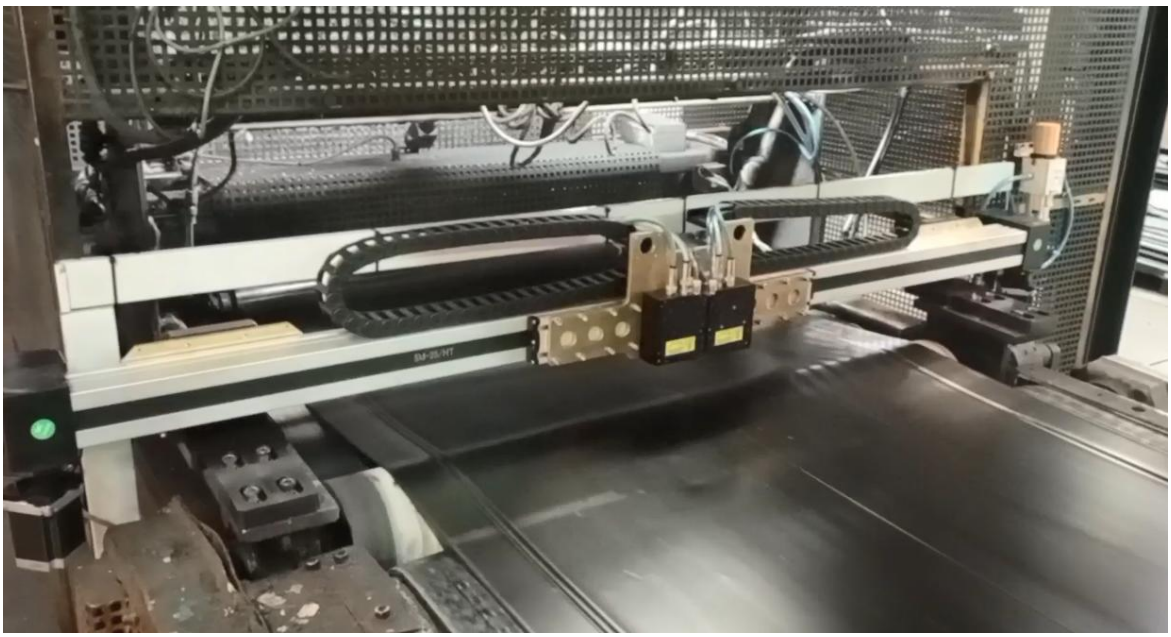
RIFTEK
Sensors & Instruments



THICKNESS MEASUREMENT SYSTEM

RF160.10 Series

User's manual

www.riftek.com
info@riftek.com

Contents

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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 indicating device must be grounded and connected to the grounding line through 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 is equipped with the laser sensors that belong to the 2 laser safety class according to IEC/EN 60825-1:2014.

The sensors make use of a semiconductor infrared laser with a wavelength of 808 nm. Maximum output power is 1 mW. The warning label is placed on the sensor body.

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

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

4. General information

The system is designed for non-contact measurement of the thickness of sheet materials during calendering, in this case rubber intended for the production of car tires. It is an autonomous software and hardware system, which includes laser sensors, a scanning module and a control and display device.

Main functions of the system:

- non-contact thickness measurement;
- tolerance control;
- logging results;
- digital and graphic display of results;
- storing results in a database;
- transfer of results to a remote computer (to the customer's database).

Technical characteristics of the system can be changed for a specific task.

5. Structure and operating principle

The system is placed above the calender roller (1) with the controlled material (2) and contains the support beam (3), on which two linear motion modules (4 and 4') with stepper motors (5 and 5') are installed. Each linear motion module carries the laser triangulation sensor (6 and 6'), which are mounted to automatically move along the calender.

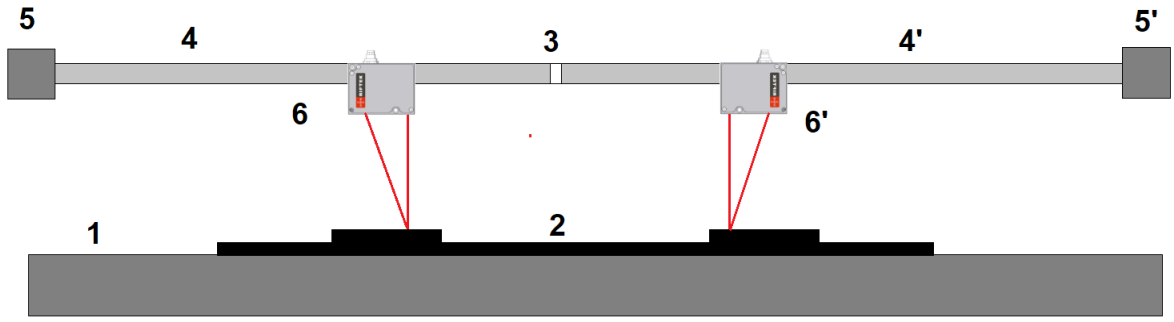


Figure 1 - Operating principle

Overall and mounting dimensions of the system are shown in Figure 2:

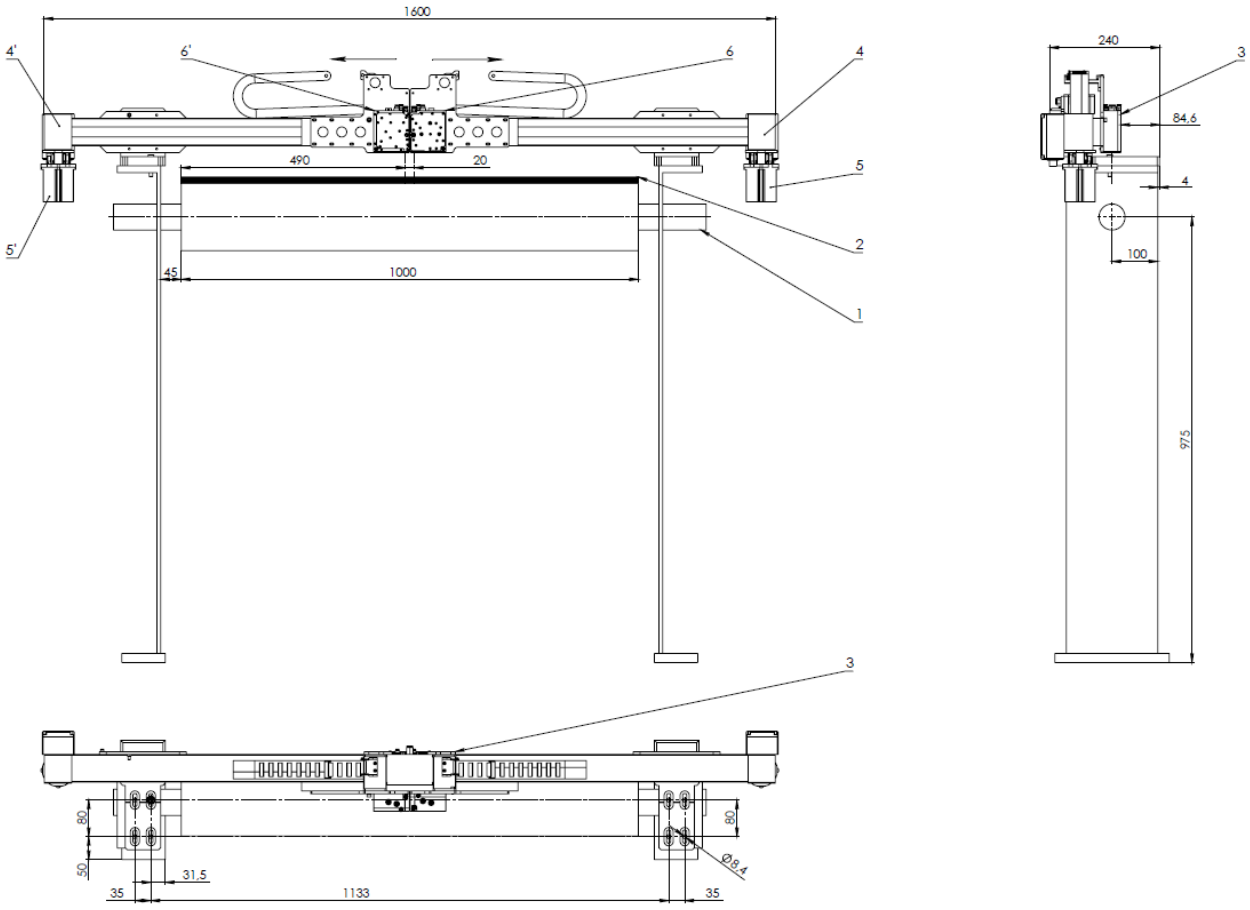


Figure 2 - Overall and mounting dimensions of the system

The system operates as follows.

The system is preliminarily and periodically calibrated. During the calibration process, laser sensors move along the roller (without material) and measure the distance to it. The obtained values, linked to the linear position of the sensors, are stored in the computer memory.

Sheet material thickness measurements are carried out as follows: depending on the requirements for the position of the control lines, the sensors are installed in the required positions along the roller. When moving material, sensors measure the distance to its surface, the resulting values are transmitted to the computer, where the thickness of the material is calculated as the difference between the distances to the material and the roller (calibration values).

5.1. Laser sensors

The system is equipped with laser triangulation sensors RF603-60/10 (base distance 60 mm, working range 10 mm), in a protective housing with air cooling and air protection of windows. A distinctive feature of the sensors is the use of an IR laser (808 nm) as a radiation source, which increases the stability of the sensors in water vapor conditions.

Laser triangulation sensors:
https://riftek.com/products/laser_triangulation_sensor/?change_lang=en

5.2. Control cabinet and panel computer

The control cabinet contains a power supply, motor drivers for linear motion systems, and an Ethernet switch.

Figure 3 - Control cabinet

The industrial panel computer is designed to receive information from sensors, analyze and display measurement results.

Overall and mounting dimensions of the control cabinet and panel computer are shown in Figure 4.

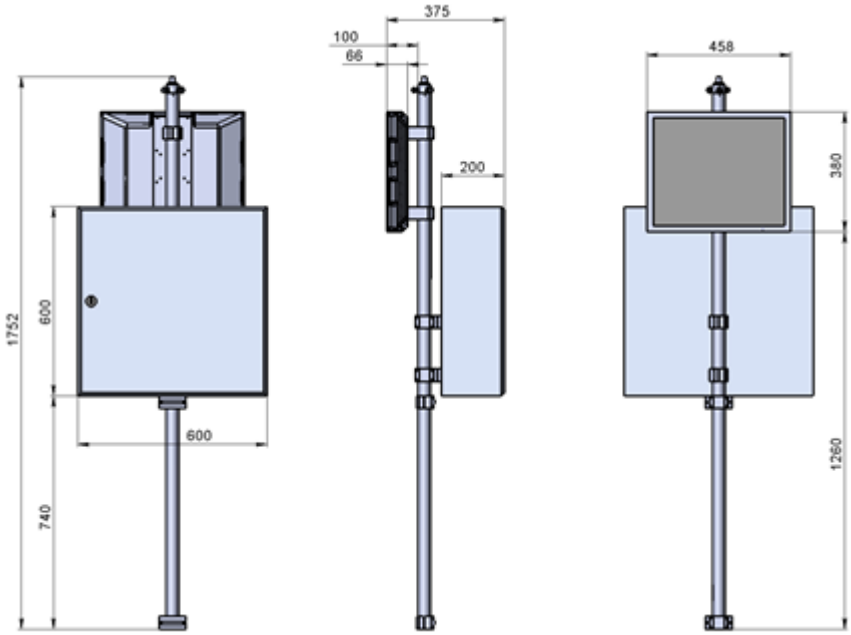


Figure 4 - Overall and mounting dimensions of the control cabinet and panel computer

Panel computer connectors:

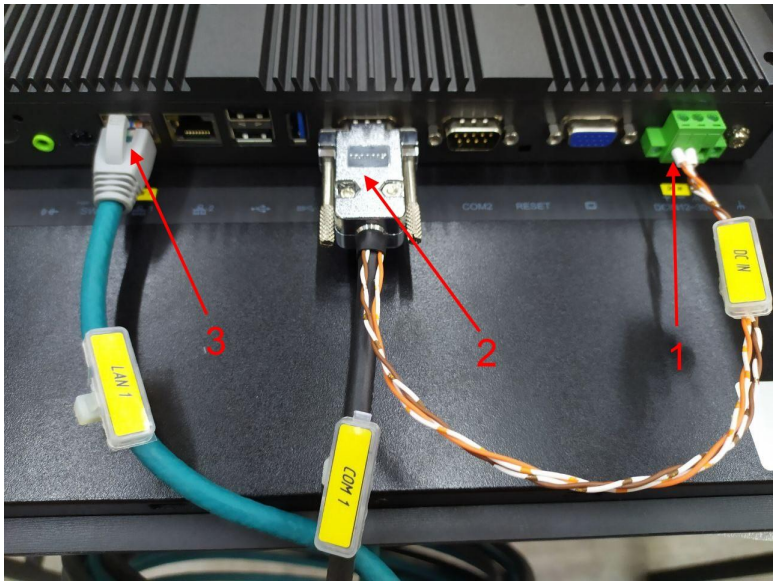


Figure 5 - Panel computer connectors

Designations:
1 – Display power cable.
2 – Data cable for connection to COM1 port.
3 – Ethernet cable.

6. Basic technical data

Parameter		Value
Thickness measurement range, mm		10 or customized
Measurement error, um		±20
Scanning range, mm		500x2 or customized
Input interface for sensors connection		Ethernet
Measuring rate, Hz		9400
Power supply, V		220 (±10 %) for AC network with frequency of 50 (±1) Hz
Power consumption, not more, W		500
Operating conditions	Ambient temperature, °C	+1...+35
	Relative humidity, %	65 (at 25°C)

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

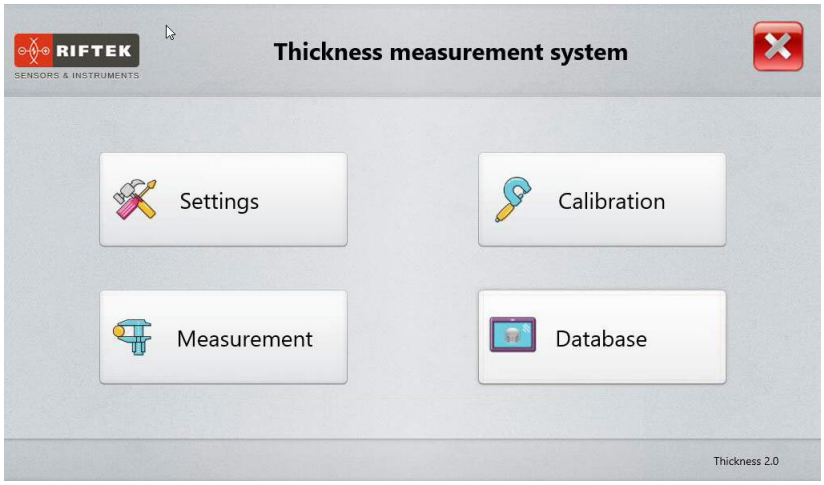
7. Example of item designation when ordering

RF160.10-T-W

Symbol	Description
T	Controlled thickness range, mm.
W	Cross scanning range, mm.

8. Service program

After powering on the panel computer, the main program window appears:

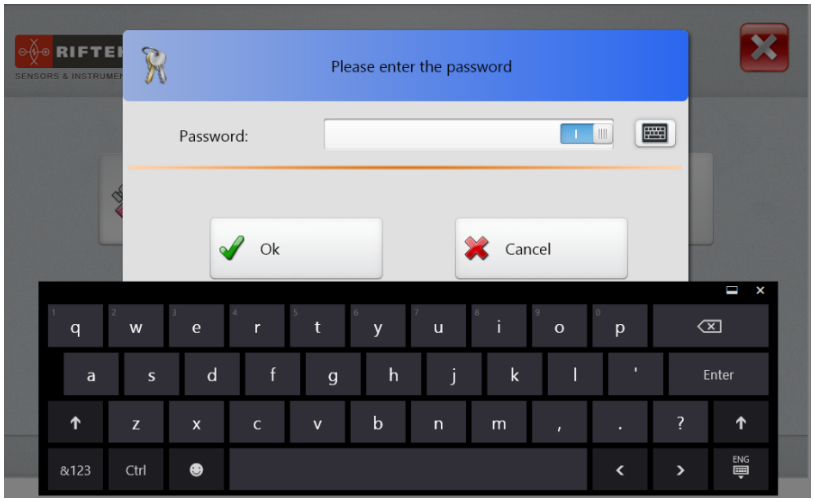


Buttons assignment:

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 ask for a password. When initially installed, the program accepts the following password: 1111. Enter the password and tap **Ok**.

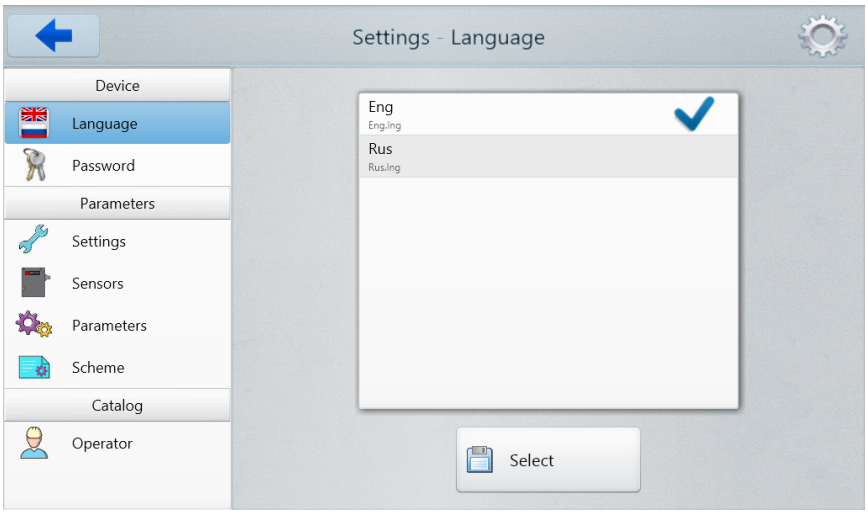


How to change the password, see par. 8.1.1.2.

8.1.1. Device settings

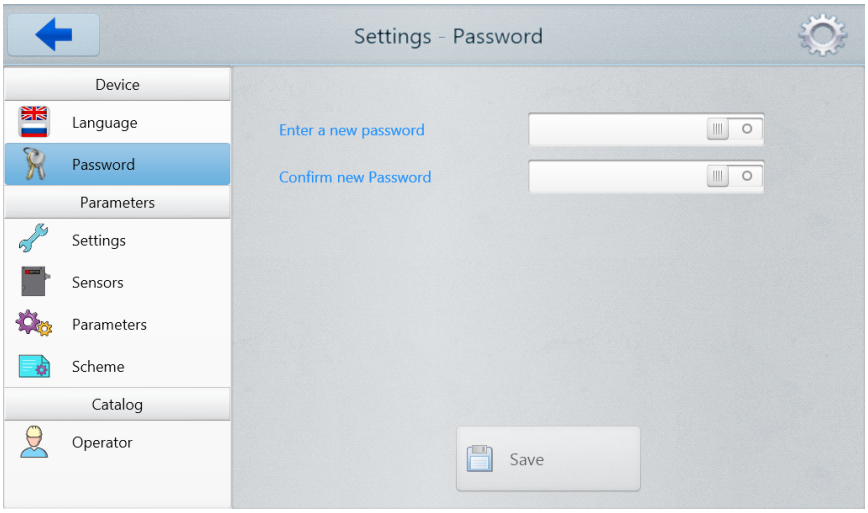
8.1.1.1. Language

To change the program language, tap **Language**, select the language support file, and tap **Select**.

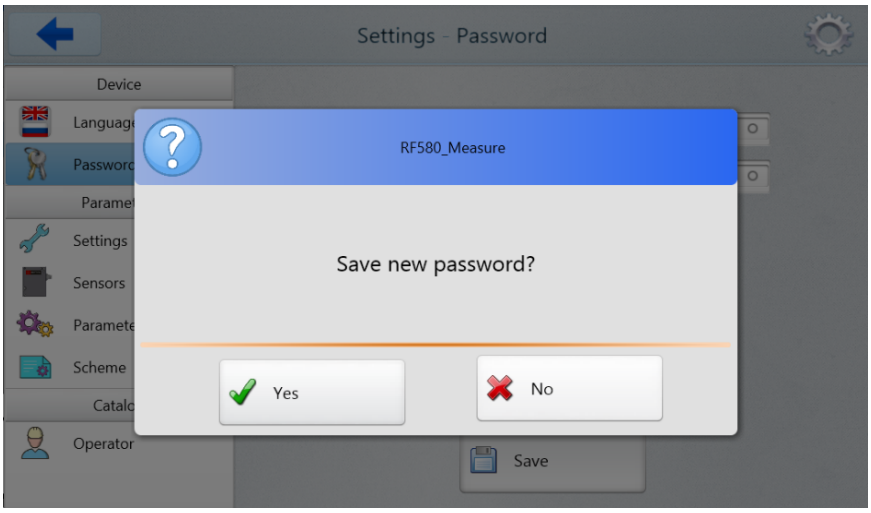


8.1.1.2. Password

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



The program will prompt you to confirm the action:

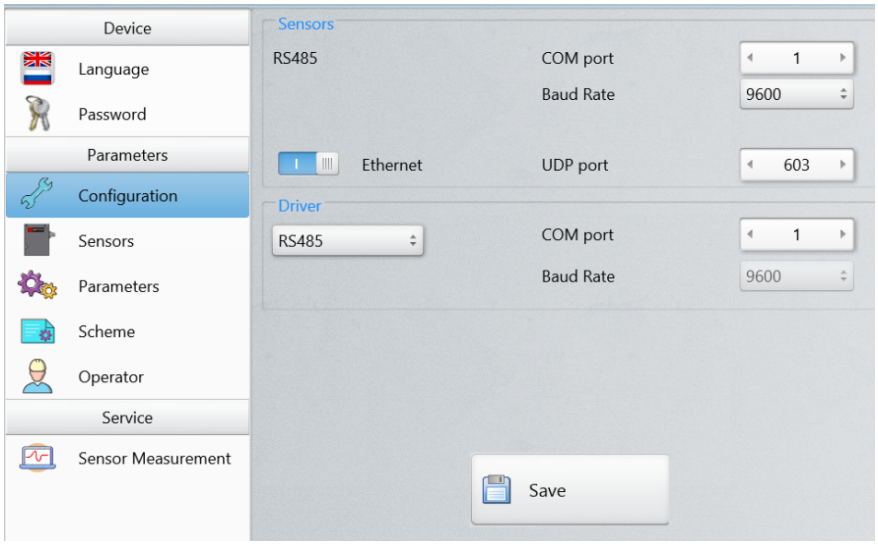


Tap **"Yes"** to save the new password, or tap **"No"** to cancel the action.

8.1.2. Parameters

8.1.2.1. Settings

The **Configuration** tab:



In the **Sensors** settings area, the user can specify:

- COM port for connecting sensors.
- Baud rate.
- If data is transmitted via Ethernet, select the UDP port (603 by default).

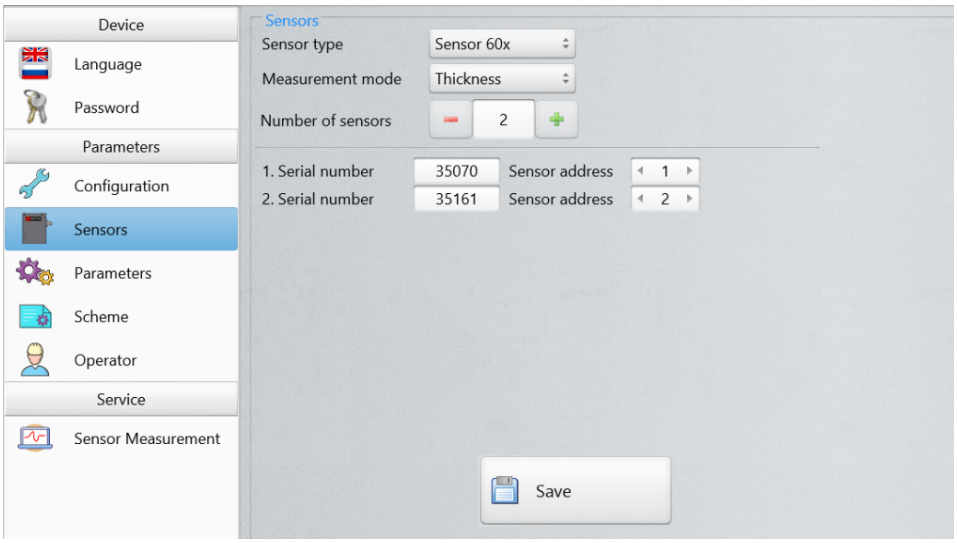
In the **Driver** settings area, the user can select:

- Motor driver connection interface RS485 or Ethernet and specify the connection port.

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

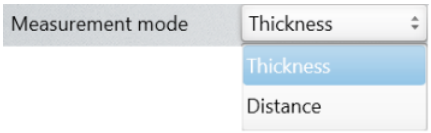
8.1.2.2. Sensors

The **Sensors** tab:



In the **Sensors** tab, the user can select the measurement mode, set the serial numbers of the sensors (when replacing) and their network addresses.

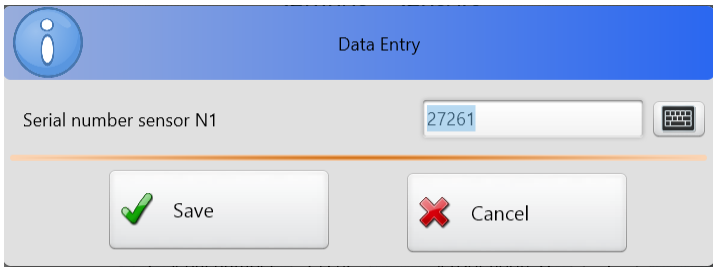
- To select the measurement mode, use the **Measurement mode** drop-down list.



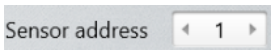
There are two measurement modes: **Thickness** and **Distance**.

For each sensor, it is necessary to enter the serial number and address.

A window for entering the serial number will appear when the cursor is placed in the **Serial number** field.



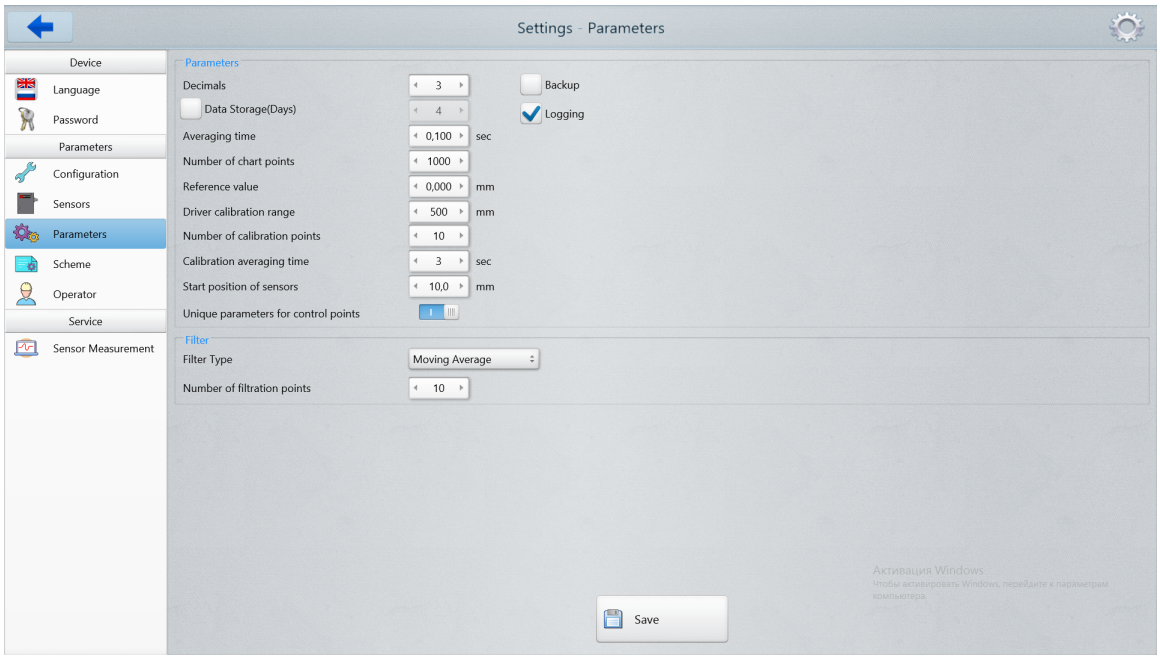
The sensor address is selected in the **Sensor address** field using the left / right arrows.



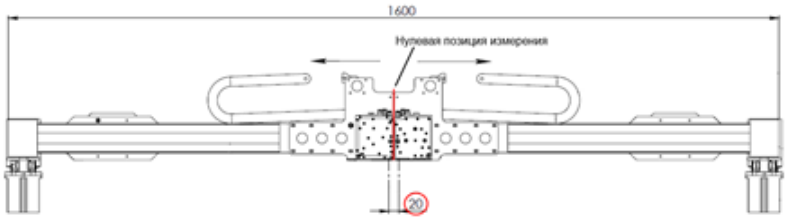
To save the changes, tap **Save**.

8.1.2.3. Parameters

The **Parameters** tab:



In the **Parameters** tab, the user can set general system parameters and filtering. The general parameters are described in the table below.

Parameter	Description
Decimals	The number of decimals for the measurement results.
Data Storage	The number of days during which the data is stored. If this checkbox is selected, the saved data will be stored in the database for the selected number of days, outdated data will be deleted automatically.
Backup	If this checkbox is selected, a backup copy of the database will be automatically created when you exit the program.
Logging	If this checkbox is selected, the main processes of the system operation will be recorded (logged) to the file.
Number of chart points	The number of measured points displayed on the graph.
Reference value	The reference value used when calibrating the system. For this system, since the thickness measurement is carried out from the surface of the roller, the reference value = 0.
Driver calibration range	The range over which the system is calibrated using the calender. The entered value is equal to the maximum material width divided by 2. That is, if the material width is 1000 mm, then the calibration range is 1000/2 = 500 mm (for each motion system).
Number of calibration points	The number of points over the entire calibration range for which calibration values are calculated and stored. That is, for a width of 500 mm, 10 calibration values will be calculated every 50 mm.
Calibration averaging time	The time during which the calibration point measurement results are accumulated and averaged.
Start position of sensors	In the initial position, each of the sensors is shifted at a distance of 10 mm from the system axis. The parameter value is equal to this distance. 
Unique parameters for control points	If this option is not selected, the tolerance values for all control points will be the same. Otherwise, tolerances are set for each point separately (see par. 8.1.2.4).

Filtering is used to reduce noise and achieve better resolution. Description of the parameters is given in the table below:

Parameter		Description
Filter type	No filtering	Without filtering.
	Moving Average	The number of filter points for the measured values. It is used to calculate the arithmetic mean. Each new measured value is added, the first measured value is removed from the averaging.
Number of filtration points		This parameter specifies the number of measurement values to which the filter applies.

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

8.1.2.4. Measurement scheme

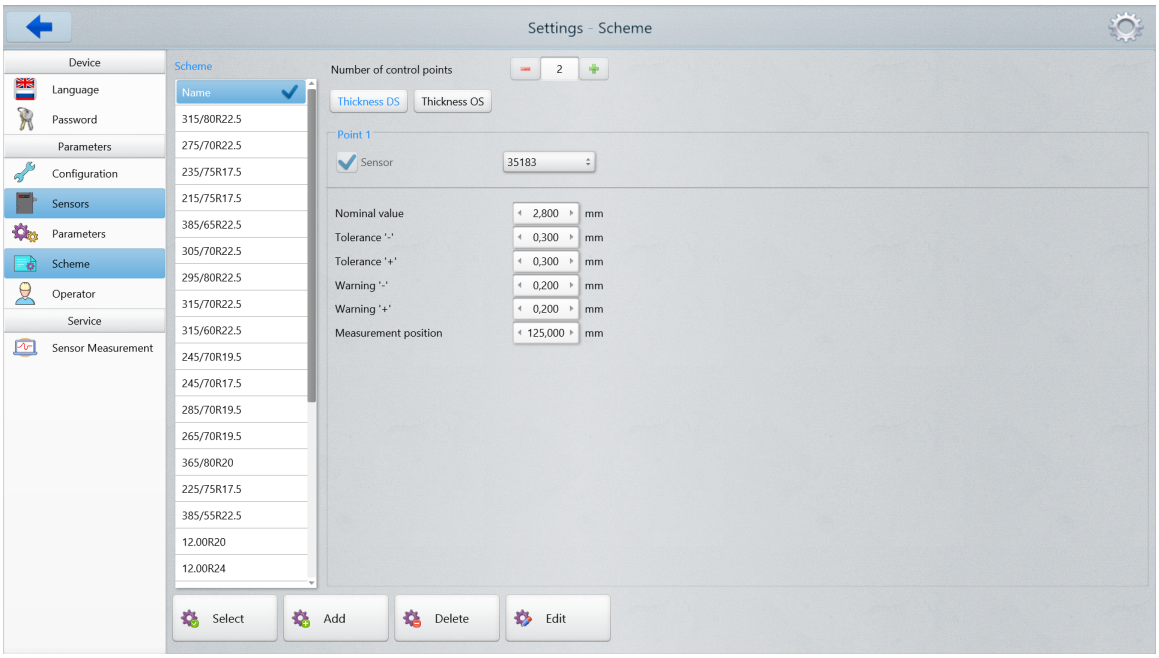
For each type of controlled material, you can create your own measurement scheme with a corresponding set of parameters for each of the two measurement points.

Scheme parameters:

- The name, for example, the size of the tire for the production of which this material is used.
- Nominal material thickness.
- Upper and lower tolerances.

- Upper and lower warning levels.
- The position of the sensor (control position) across the material, as the distance from the system axis to the control point on the material.

The **Scheme** tab:

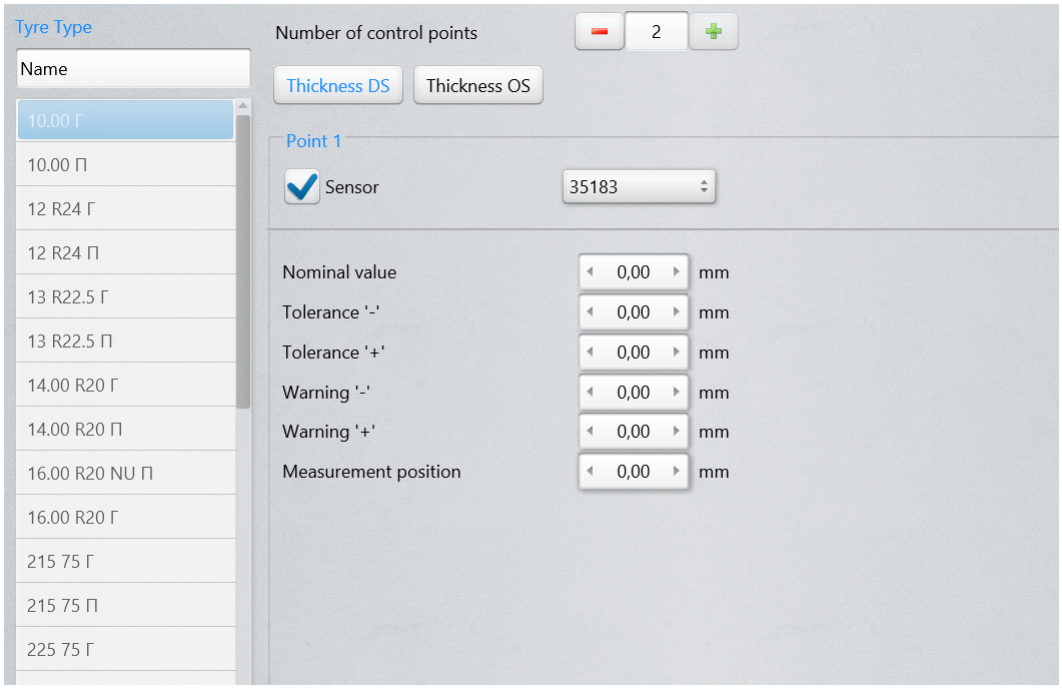


Buttons assignment:

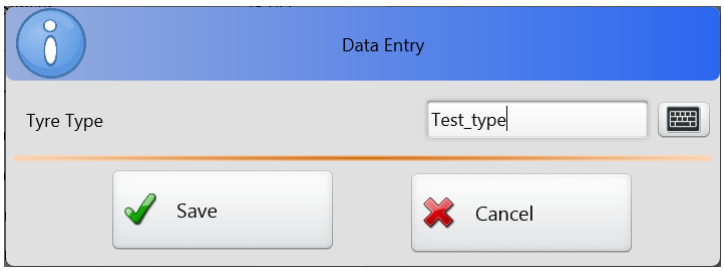
Button	Assignment
Thickness DS	Button for activating the parameters of the first sensor.
Thickness OS	Button for activating the parameters of the second sensor.
Select	Selecting a set of parameters. To select a set of parameters, you need to tap on it in the **Scheme** list and then tap the **Select** button.
Add	Adding a new set of parameters. To add a new set of parameters, you need to tap the **Add** button, specify the nominal thickness of the measured object (**Nominal value**), tolerances (**Tolerance '-'** and **Tolerance '+'**), warning levels **(Warning "+", Warning "-"**) and the measurement position.
Delete	Deleting a set of parameters. To delete a set of parameters, you need to tap on it in the **Scheme** list and then tap the **Delete** button.
Edit	Editing a set of parameters. To edit a set of parameters, you need to tap on it in the **Scheme** list and then tap the **Edit** button.

An example of adding the measurement scheme.

After clicking the **Add** button, a window for entering data for a new scheme will appear on the screen:



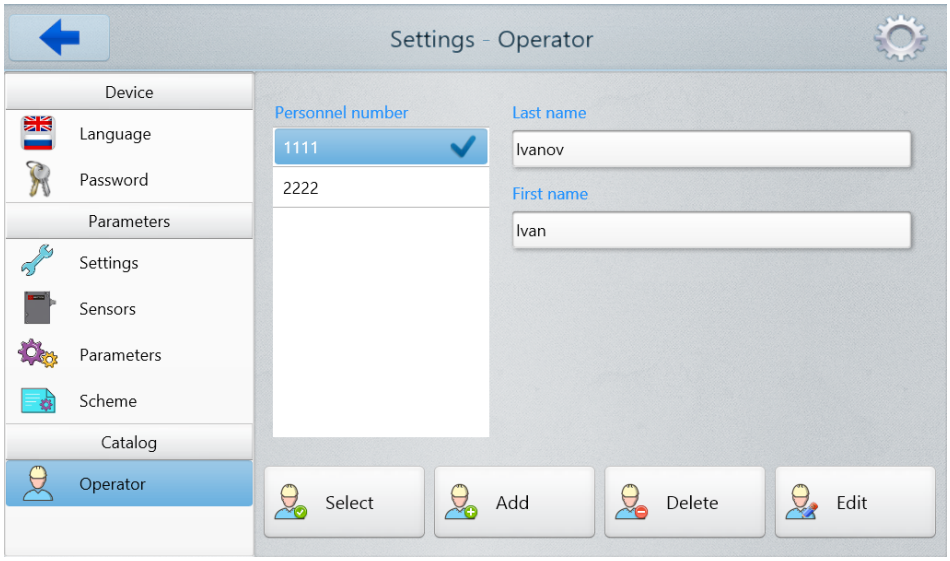
To change the value of a field, place the cursor on it and enter the value in the data entry window. For example, when changing the type name, the following window appears:



1. Enter the name (**Tire Type** field).
2. Sensor serial numbers are filled in automatically based on the settings (see par. 8.1.2.2).
3. Fill in the thickness nominal value (**Nominal value**), tolerances (**Tolerance '-'**, **Tolerance '+'**) and warning levels (**Warning '-'**, **Warning '+'**).
4. Set the measurement position (**Measurement position**).
5. In case unique values for measurement points are selected, enter the parameters for the second control point.
6. To save the changes, tap **Save**.

8.1.2.5. Operator

The **Operator** tab:



In this tab, the user can enter the operator's data. Subsequently, when saving the measurement results to the database, the data of the selected operator will be written to the database.

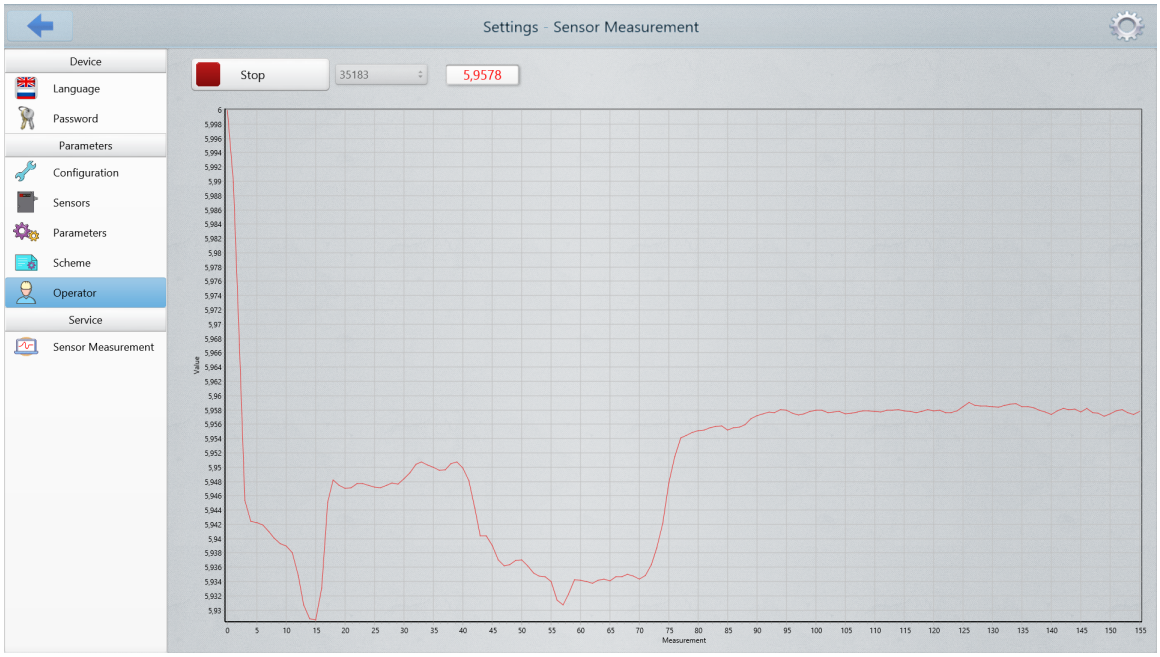
Buttons assignment:

Button	Assignment
Select	Selecting the current operator. To select the current operator, tap on the personnel number and then tap the **Select** button.
Add	Adding a new operator. To add a new operator, tap the **Add** button, specify the personnel number, last name and first name of the operator.
Delete	Deleting the operator. To delete the operator, tap on the personnel number and then tap the **Delete** button.
Edit	Editing the operator's data. To edit the operator's data, tap on the personnel number and then tap the **Edit** button.

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

8.1.2.6. Sensor readings

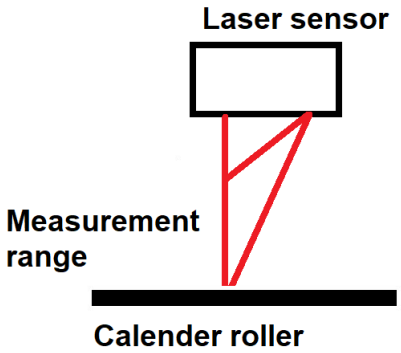
In this tab, the user can check the readings of each sensor at the selected measurement point. To do this: select the sensor number and tap the **Start** button:



8.2. Calibration

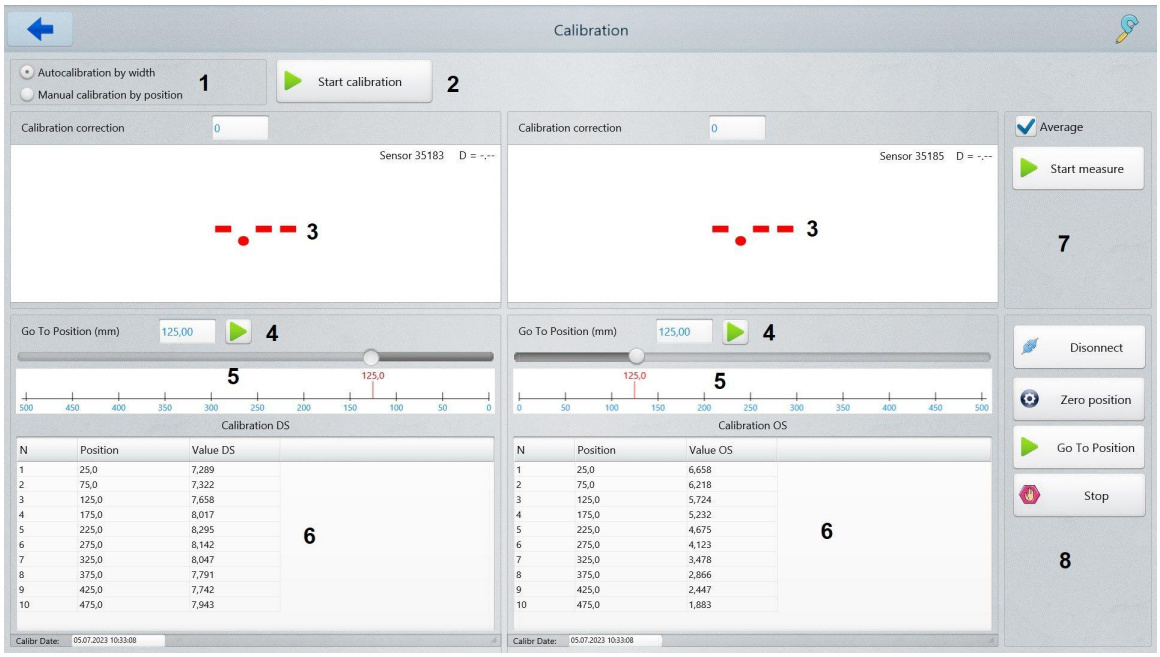
The thickness is controlled in a range not exceeding the operating range of the sensor(s). Calibration is carried out in the absence of material on the calender.

Calibration scheme:



Since the laser sensor is calibrated in its own coordinate system, and thickness measurements are made in relation to the base surface (calender roller) on which the object is located, it is necessary to link the coordinates of the sensors and the base surface.

The **Calibration** window:



This window displays:

1 – Calibration type selection.

2 – Calibration start.

3 – Calibration values at measurement points.

4 – Measurement position in the selected scheme for manual calibration.

5 – Current sensor position.

6 – Calibration table (the table shows the current calibration values that were saved during the last calibration).

7 – Sensor control panel.

Average – if this option is selected, the sensor values are averaged.

Start/Stop – start/stop measurements in the current position.

8 – Control panel for the motion system(s).

Connect/Disconnect – establishing a connection with the motor drivers of the motion system.

Zero position – move to zero position.

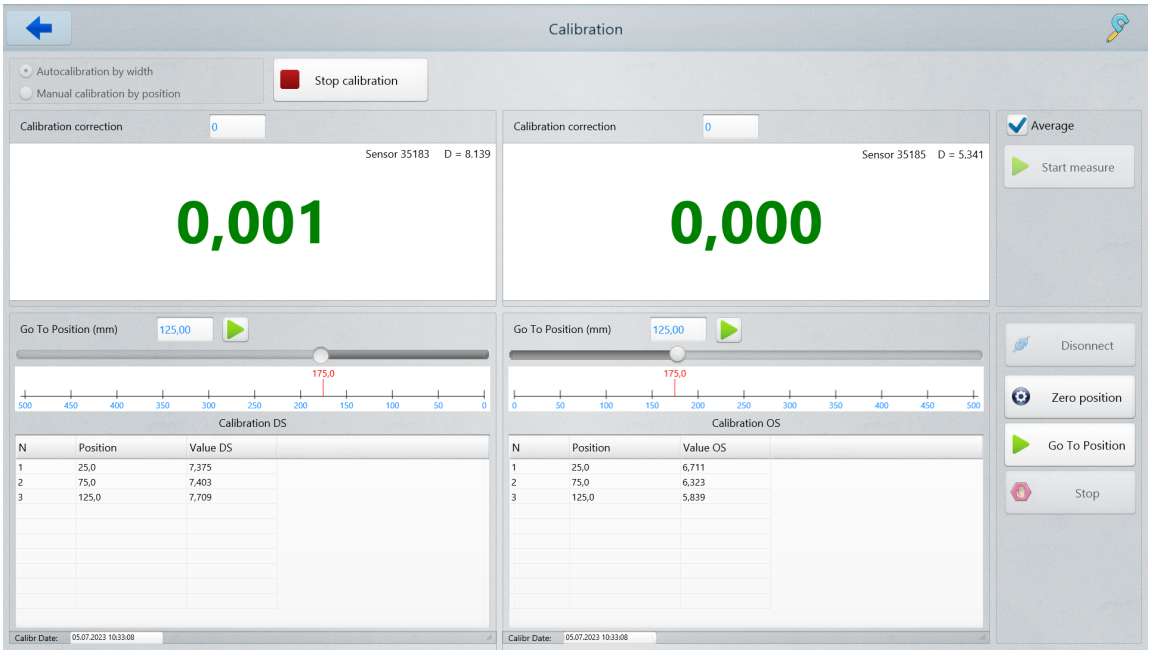
Go to position – move to the position selected in field 4.

Stop – emergency stop for motion systems.

8.2.1. Autocalibration by range

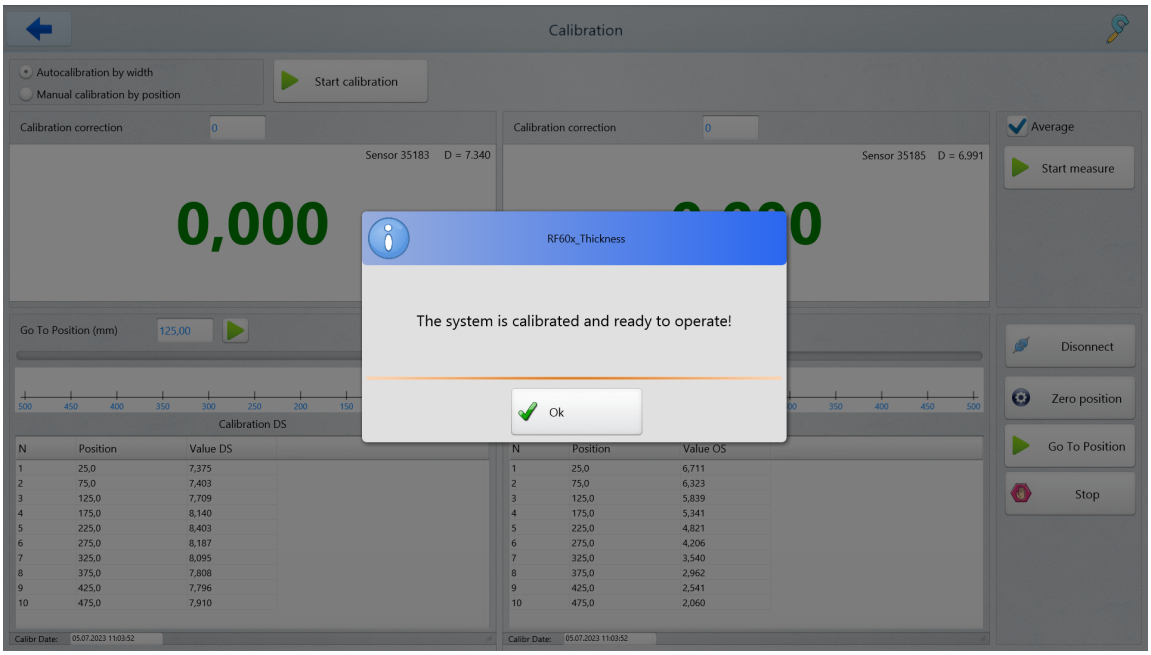
In this mode, calibration is performed automatically along the entire calender roller. For calibration you need:

- Select the calibration type.
- Tap the **Calibration** button.

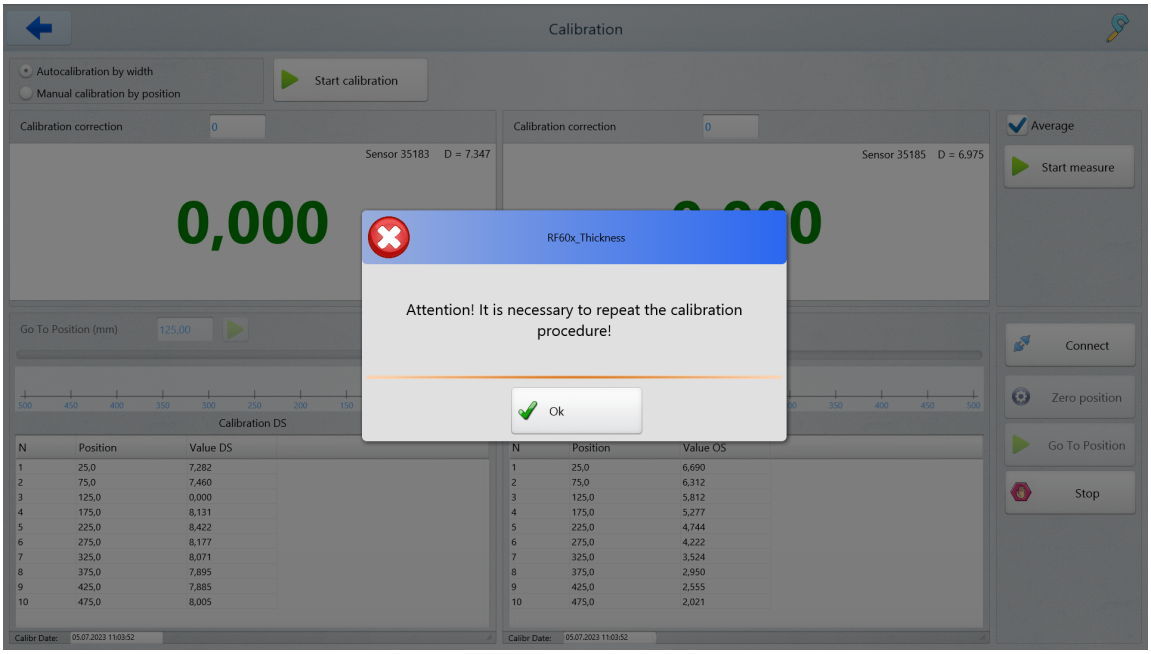


The system will begin calibrating along the entire length of the roller. During the calibration process, both sensors move sequentially to positions (10 default positions) evenly distributed along the roller and measure the distance to the roller. The measurement results are stored in the system memory and are used to calculate the thickness of the material.

If the calibration is successful, the following message will appear on the screen:



If the calibration was unsuccessful, the following message will appear on the screen:

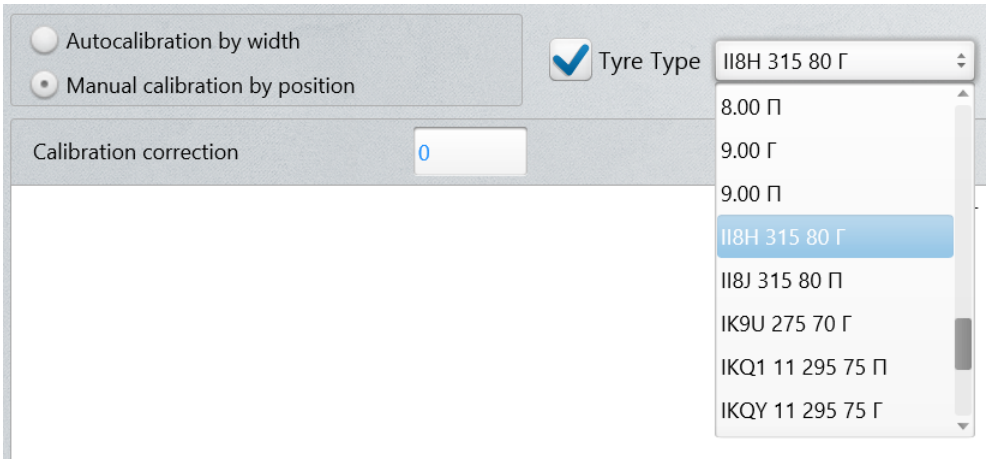


In this case, it is necessary to repeat the calibration until a positive result is obtained.

8.2.2. Manual calibration by position

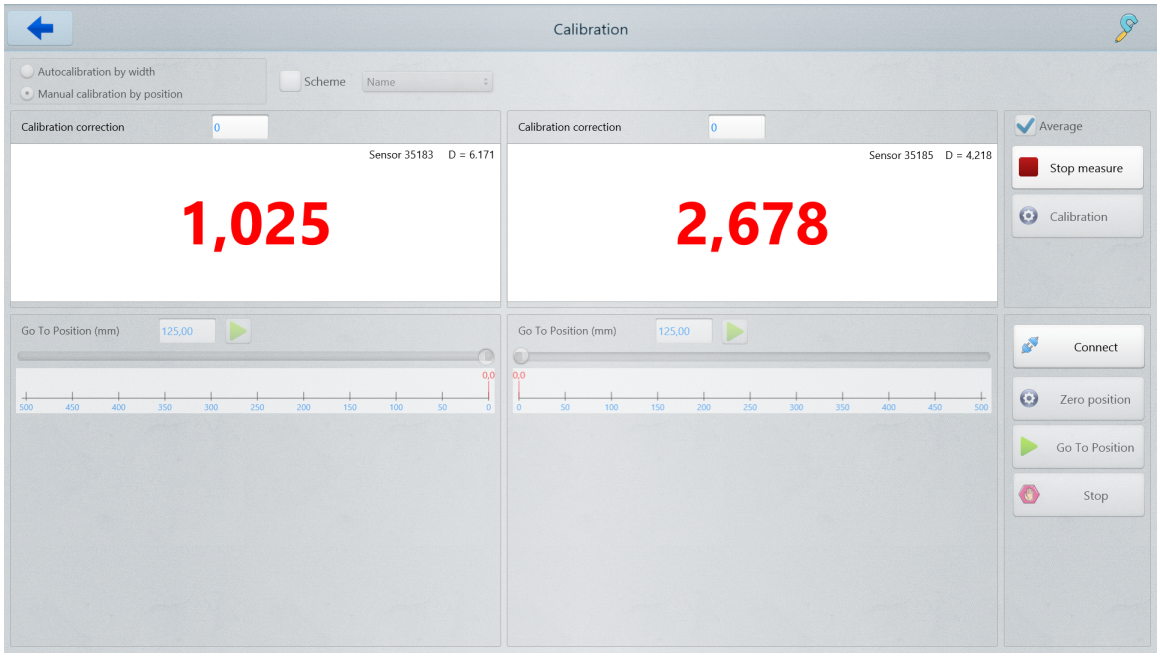
Manual calibration is performed only at specific linear positions of the laser sensors along the roller. To perform calibration it is necessary:

- Select the calibration type.
- Select the tire type (if necessary):

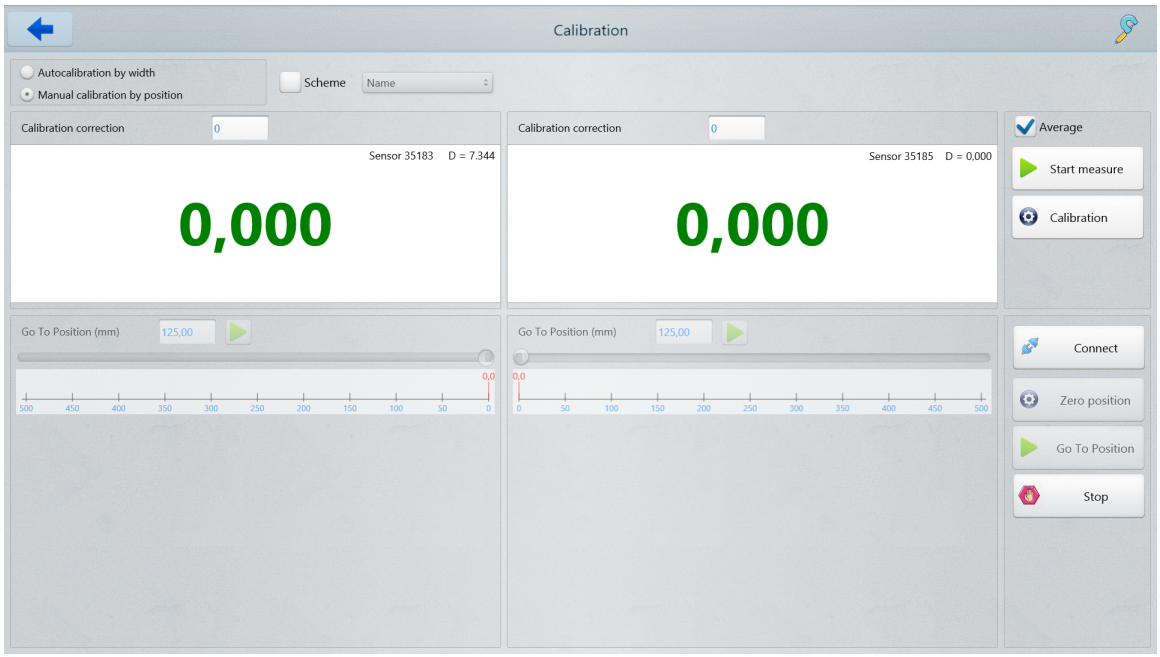


If a specific type of product is selected, the calibration position will be set automatically in accordance with the description of the measurement parameters for this type of material.

- Tap the **Connect** button.
- Tap the **Go to position** button to move the sensors to the calibration positions.
- Tap the **Start measurement** button to start the measurement process. The results of measuring the distance to the roller will appear.

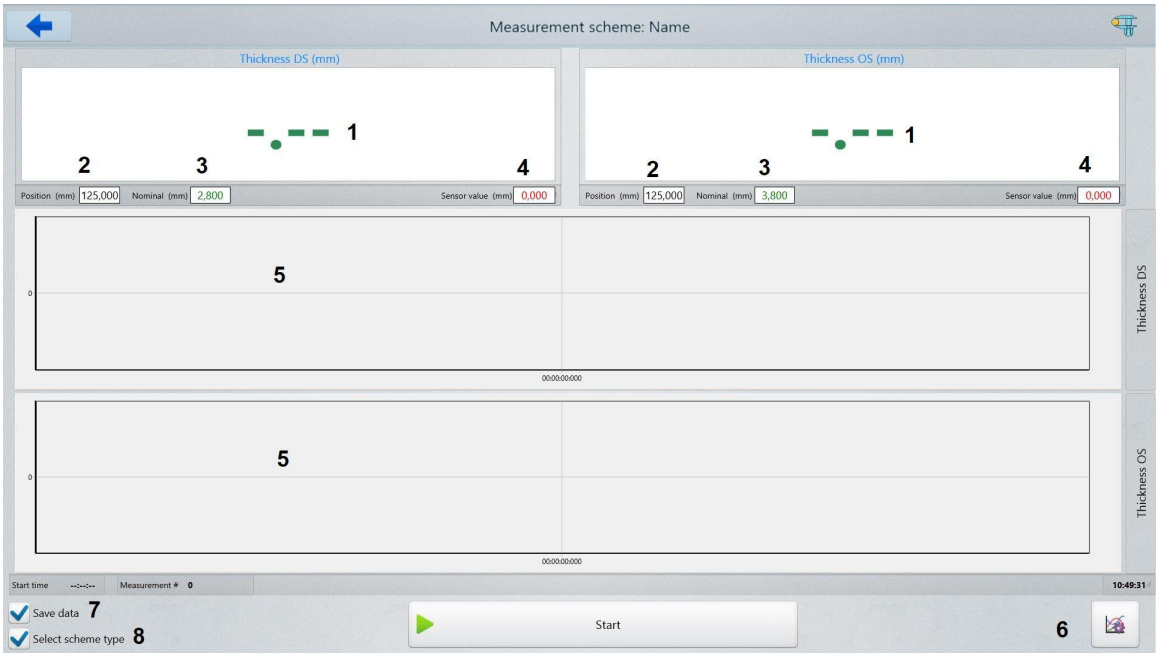


- To complete the calibration, tap the **Stop Measurement** button and then the **Calibration** button. The calibration data will be saved in the system memory. Screen view:

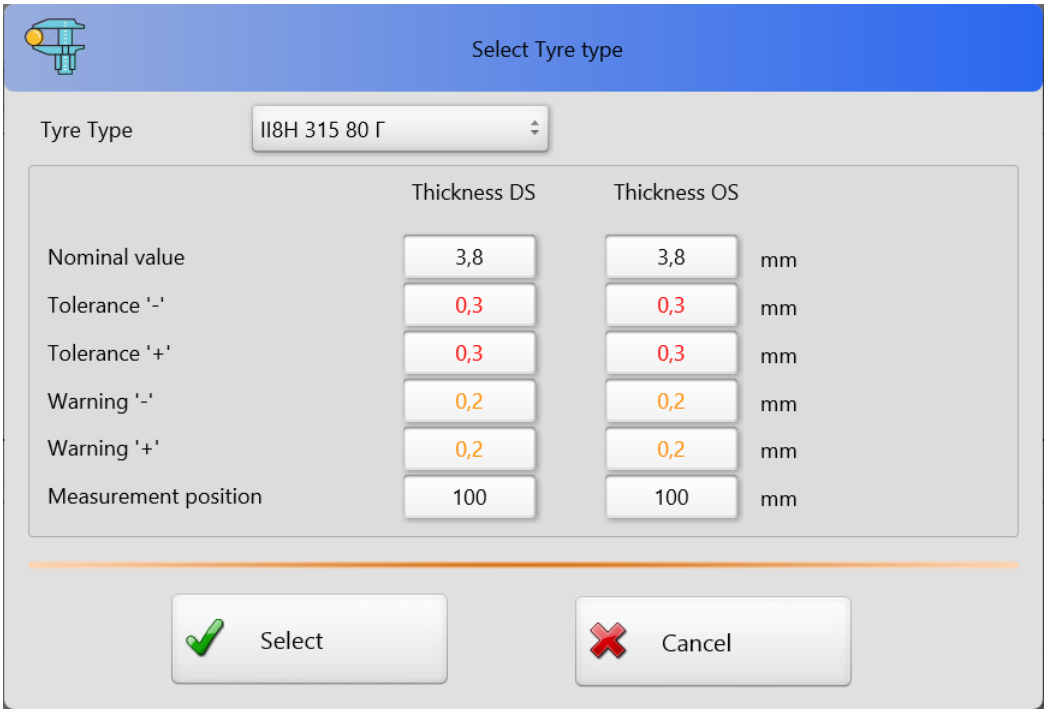


8.3. Measurement

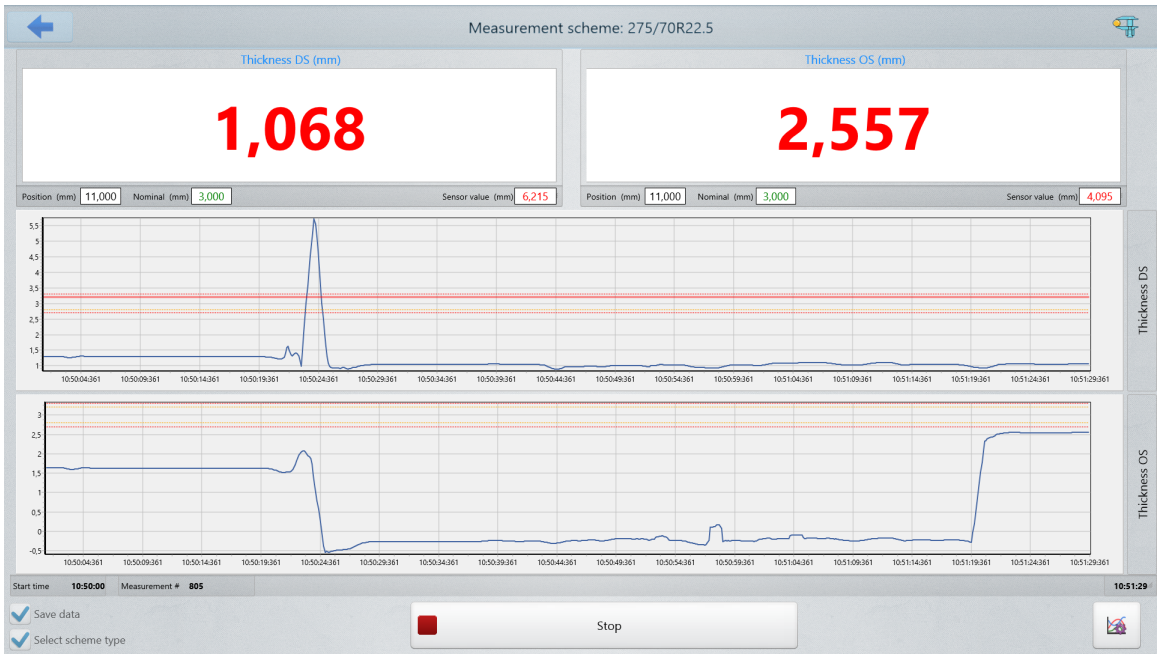
In the main menu, tap the **Measurement** button.
The **Measurement** window:



This window displays:
1 – Material thickness at measuring points DS and OS.
2 – Measuring position along the roller.
3 – Nominal material thickness.
4 – Sensor readings at measurement points.
5 – Graphic display of measurement results.
6 – Graph settings button.
7 – Selecting the option to save measurement results in the database.
8 – Selecting the **Tire type** option. If the choice is made, then when starting the measurement (**Start** button), the user will be asked to select the type of material for measurement and control. If the option is not selected, the default material type will be selected for measurement (see par. 8.1.2.4). Window for selecting the type of material (tire):

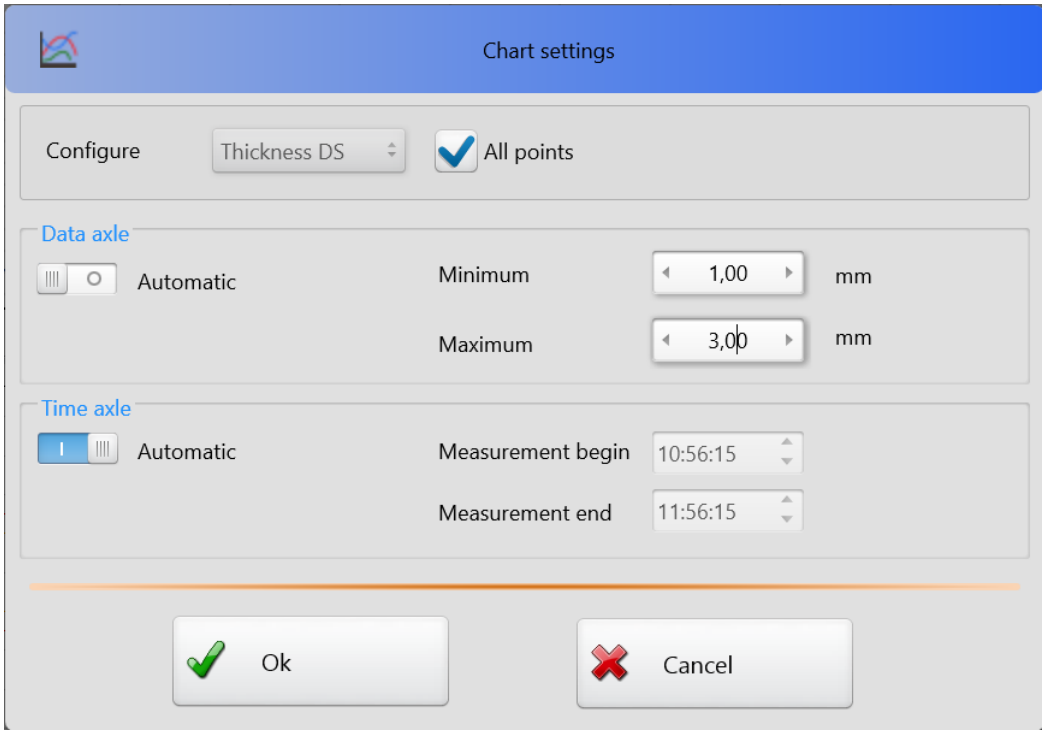


To start the measurement process, tap the **Start** button.
View of the **Measurement** window in operating mode:



The measured thickness value at the control point, which is within the set tolerances, is displayed in green, outside the limits - in red.

To switch to the mode of displaying results in graphical form, tap  .



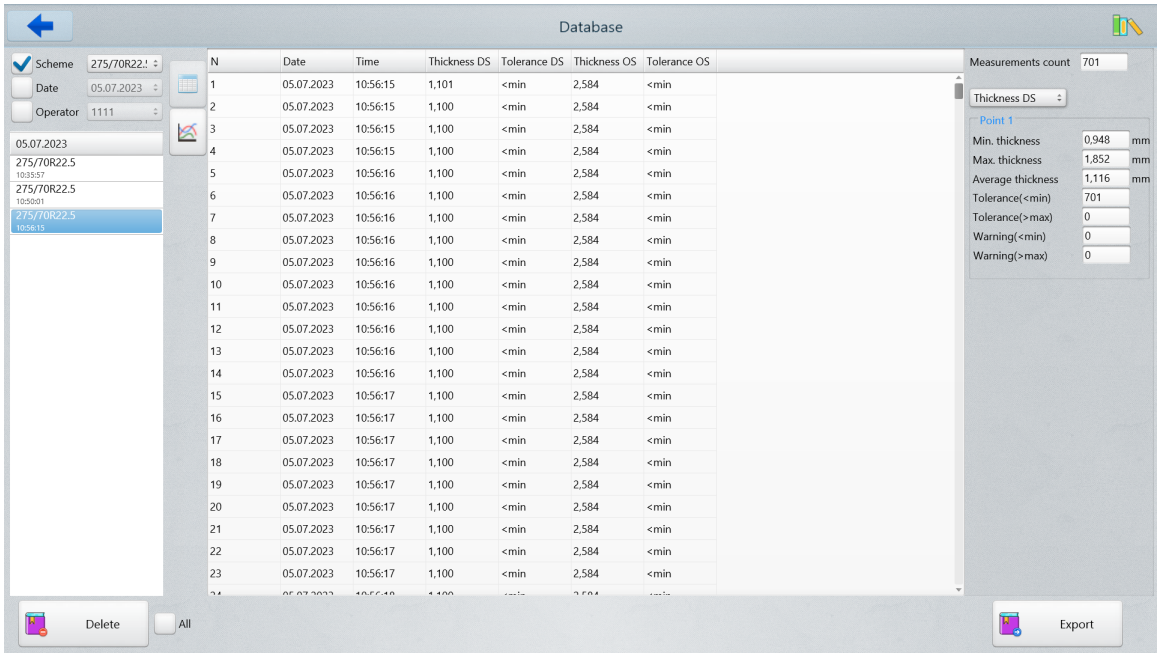
In the window that appears, you can configure the data or time axes to display data for all points or for each measurement point separately.

To interrupt the measurement process, tap the **Stop** button.

8.4. Database

During system operation, thickness values are saved to the database (provided that the **Save data** option is enabled - see par. 8.3).

To view the database, tap the **Database** button in the main menu of the program. The **Database** window will appear. Select a set of measurements to view from the list on the left side of the window.



Data can be presented in both tabular and graphical form.

To view the data in graphical form, tap . Screen view:

To view the data in tabular form, tap .

To work with the table, use a vertical scrollbar.

To delete a single measurement, tap on it in the table and then tap the **Delete** button.

To delete all measurements, select the **All** checkbox and then tap the **Delete** button.

Data can be exported to CSV and XLS formats - tap the **Export** button and select the required format.

9. Operating the system

Follow these steps:

- Connect the measuring system to the panel computer.
- Set system parameters (see par. 8.1.2).
- Calibrate the system (see par. 8.2).
- Start the measurement process (see par. 8.3).

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 directed to support@riftek.com.

11. Warranty policy

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

12. Revisions

Date	Revision	Description
31.01.2024	1.0.0	Starting document.

13. Distributors

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