



RIFTEK
Sensors & Instruments



EDGE SENSORS

RF659 Series

User's manual

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1. Safety precautions

- Use supply voltage and interfaces indicated in the sensor specifications.
- In connection/disconnection of cables, the micrometer power must be switched off.
- Do not use micrometers in locations close to powerful light sources.
- Sensor windows should be kept clean. Do not clean the glass with abrasive and aggressive cleaning agents.
- If the windows are accidentally touched with fingers, they should be wiped immediately.

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2. CE compliance

The sensors have been developed for use in industry and meet 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

Continuous LED light source is installed in the sensor. Sensors belong to Class 1.

4. General information

The sensors are intended for non-contact measuring and monitoring the position of the edge (edges) of various objects, such as tapes, plates, substrates, etc.

5. Structure and operating principle

The sensor operation is based on the so-called ‘shadow’ principle, Fig.1. The sensor consists of controller and measuring head which consists of two modules – transmitter and receiver.

Transmitter module consists of LED (1) and lens (2). Receiver module includes a photo-detector array (3).

Radiation of the LED (1) is collimated by the lens (2) and directed to the photo-detector array (3). With an object placed in the collimated beam region, shadow image formed is scanned with the photo-detector array (3). Controller calculates the position of the edge of the object.

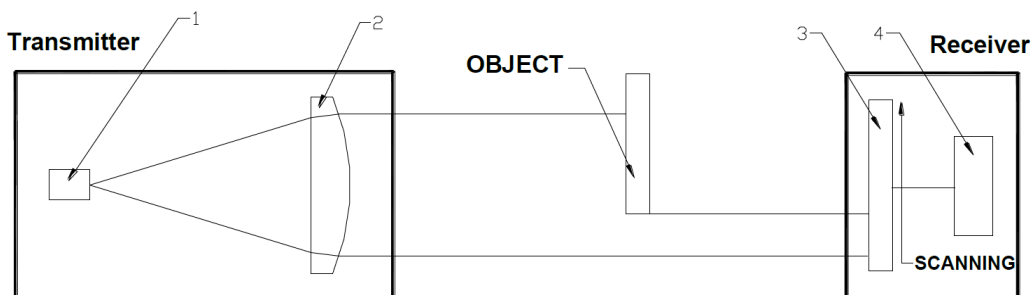
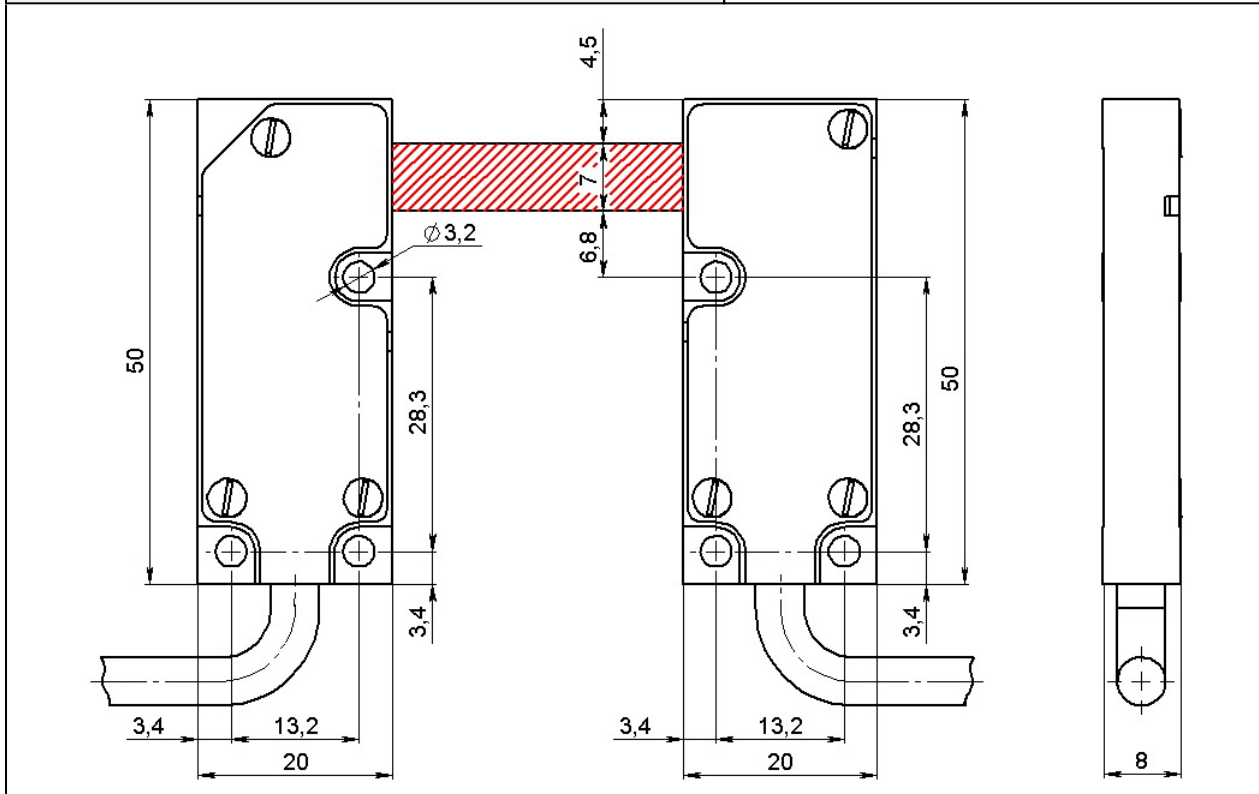


Figure 1

6. Basic technical data

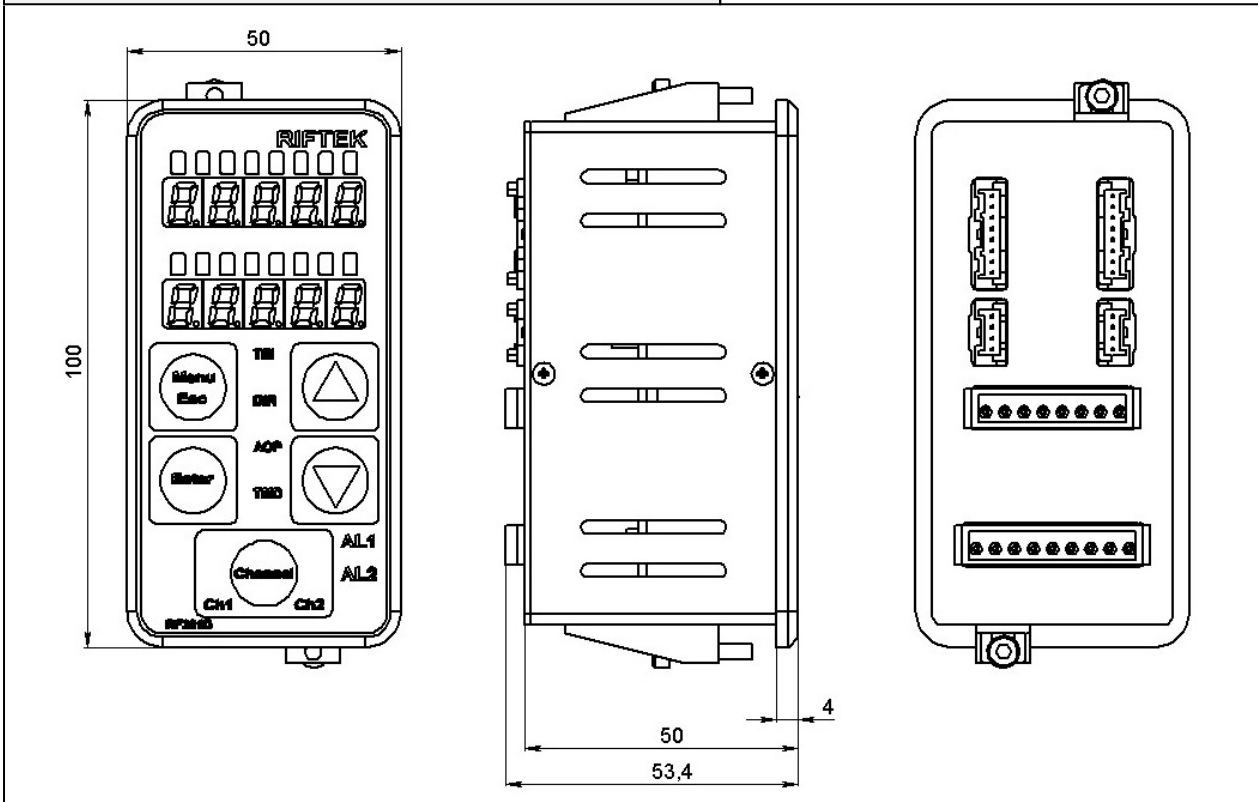
6.1. Measuring head

Type	RF659	
Distance between transmitter and receiver, mm	30	
Measurement range, mm	7	
Accuracy, μm	± 20	
Repeatability, μm	1	
Temperature dependence	0.1% range/C°	
Light source	LED	
Power supply, V	5	
Power consumption, W (transmitter/receiver)	0.5	
Environment resistance	Enclosure rating	IP40
	Vibration	20g/10...1000Hz, 6 hours, for each of XYZ axes
	Shock	30 g / 6 ms
	Operation temperature, °C	-10...+60
	Relative humidity, %	5-95
Housing/window material	aluminum / glass	
Weight with cable (cable length of 300 mm), gram	30 – transmitter, 30 – receiver	
Overall and mounting dimensions	see the figure	



6.2. Controller

Type	RF301D
Number of connected heads ("transmitter" - "receiver" pairs)	2
Cycle of result updating, Hz	1500
Digital indication	two five-digit displays
Resolution of digital indication, μm	1, 10
Digital output	RS485*
Analog outputs	two isolated channels, $\pm 5\text{V}$ (± 10), load $> 10\text{ k}\Omega$
Resolution of analog outputs, μm	2
Logic outputs	eight isolated channels of npn - open collector
Power supply, V	24
Power consumption, W	1.5
Housing material	aluminum
Weight, g	200
Overall and mounting dimensions	see the figure



* - RS485 is used to diagnose and configure the controller and measuring heads, as well as to update the software.

7. Connection

The back side of the controller contains connectors for measuring heads, 8-pin connector for power, analog outputs and RS485 interface, and 9-pin connector for logical outputs (Fig. 2).

Spring connector 1, numbering 'left to right'	Designation
1	+24V
2	GND
3	Isolated Analog Output 1
4	Isolated Analog Output 2
5	AGND
6	DATA+ (RS485)
7	DATA- (RS485)
8	GND

Spring connector 2, numbering 'left to right'	Designation
1	Isolated Alarm1 Channel 1
2	Isolated Alarm2 Channel 1
3	Isolated Threshold Low1
4	Isolated Threshold High1
5	Isolated Alarm1 Channel 2
6	Isolated Alarm2 Channel 2
7	Isolated Threshold Low2
8	Isolated Threshold High2
9	Isolated GND

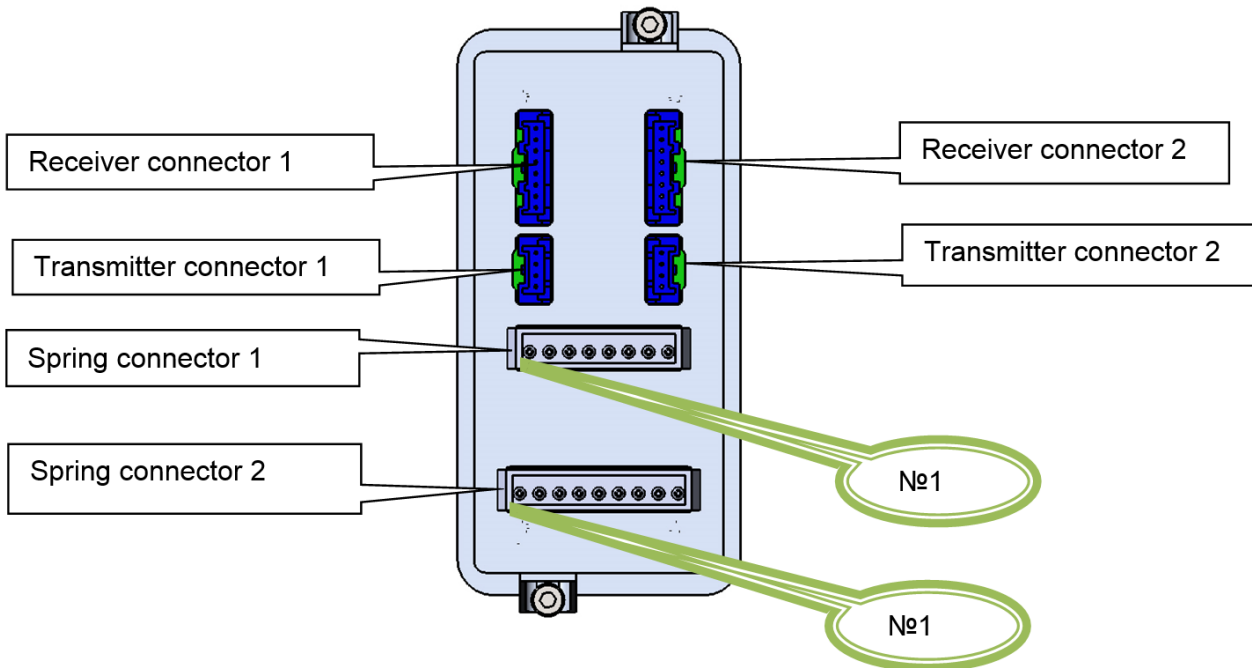


Figure 2

8. Operating procedure

Connect the measuring heads to the controller. Apply supply voltage to the controller. Values measured by channel 1 and channel 2 respectively are shown on digital indicators. LED indicators show the position of the object in the measurement area, i.e. lit areas and areas shaded by the object.

9. Working with parameters

Parameter control buttons and LED indicators are placed on the front panel of the controller, Fig. 3.

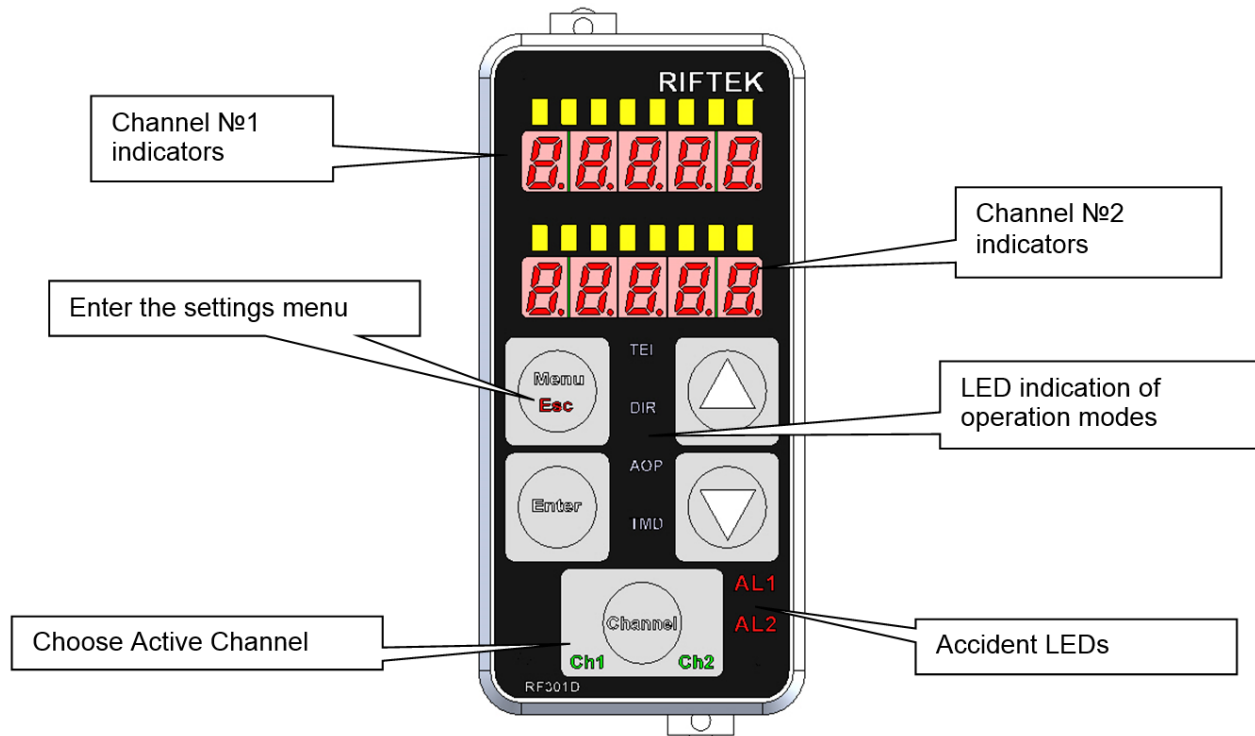


Figure 3

Parametrization is performed for each channel separately. Press the **Channel** button to select the channel. Selected channel is indicated by the corresponding LED.

9.1. Settings menu

To enter the settings menu, you need to hold the **Menu** button pressed for 3 seconds.

9.2. Zero point

This parameter sets the measurement starting point within the measuring range. After Zero Point is set, the measurement result (in the digital display and analog output) is displayed as deviation from a zero point.

Press the **Channel** button and select the channel. The current channel number is highlighted by LED. Install the controlled object to the required position within the range.

Enter the settings menu, select "**Set.0**" using the arrows, and press the **Enter** button. Display 2 will show the current value. Select the current value of the parameter by pressing the **Up** arrow, or select '3.50 mm' (the middle of the range) by pressing the **Down** arrow. Then press **Enter** to confirm selection.

To exit the settings menu, press the **Esc** button. You will be prompted to exit without saving to FLASH by the "**CAnCEL**" message. To save parameters to FLASH, select "**SAUE**" and press **Enter**.

9.3. 'Technological elements ignoring' mode

Under technological elements to be understood objects in the test material, projecting with respect to its edge (pins, fasteners and so on), or slots, technological gaps and the like in the edge. Technological elements affect the correct measurement of the material edge position. The device has the ability to ignore the technological objects in the measurement process to ensure stable control of the main edge position.

Press the **Channel** button and select the channel. The current channel number is highlighted by LED.

Enter the menu, select "**tEl.x**" using the arrows, and press **Enter** to enter the submenu.

9.3.1. Detection threshold

Detection threshold sets a value, going beyond that is considered as the time of technological element detection. The parameter sets positive and negative thresholds simultaneously, i.e. if parameter is equal to 1.000 mm, all the values above 1 mm and below -1 mm trigger the 'Technological elements ignoring' mode.

Indication of parameter number – the leftmost LED lights up on the LED line. Display 1 shows the "**thrES**" message (Detection threshold), Display 2 shows the parameter value.

To edit the parameter, use the **Up** and **Down** buttons. To increase the parameter, press **Up**. To decrease the parameter, press **Down**. In order to go to the next parameter, press **Enter**.

9.3.2. Analog output retention time

Analog output status remains unchanged since the detection the of technological object and within the time specified by this parameter. The value of analog output corresponds to the last value before the operation mode begins.

Indication of parameter number – two leftmost LED light up on the LED line. Display 1 shows the "**AOrt**" message (Analog output retention time), Display 2 shows the parameter value.

To edit the parameter, use the **Up** and **Down** buttons. To increase the parameter, press **Up**. To decrease the parameter, press **Down**. In order to go to the next parameter, press **Enter**.

9.3.3. Lock range of the mode

At the end of analog output holding time, during the lock mode interval, the event of the going beyond threshold is not processed. Analog output level corresponds to the current measured value. This parameter is intended to allow the edge position adjustment of the material in the event of going beyond the threshold during time when the analog output was held.

Indication of parameter number – three leftmost LED light up on the LED line. Display 1 shows the "**LrAng**" message (Lock range of the mode), Display 2 shows the parameter value.

To edit the parameter, use the **Up** and **Down** buttons. To increase the parameter, press **Up**. To decrease the parameter, press **Down**. In order to go to the next parameter, press **Enter**.

9.3.4. Enabling/disabling the mode

Indication of parameter number – four leftmost LED light up on the LED line. Display 1 shows the "**StAtE**" message, Display 2 shows the parameter value. To edit the parameter, use the **Up** and **Down** buttons. To enable the mode, press **Up**. To disable the mode, press **Down**. In order to go to the main menu, press **Enter**.

When the mode is activated, the **"TEI"** LED lights up.

To exit the settings menu, press the **Esc** button. You will be prompted to exit without saving to FLASH by the **"CAnCEL"** message. To save parameters to FLASH, select **"SAUE"** and press **Enter**.

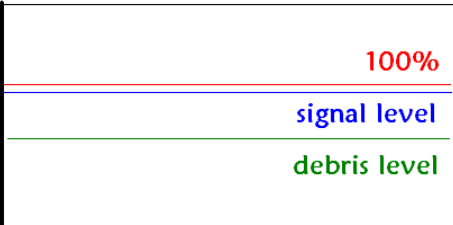
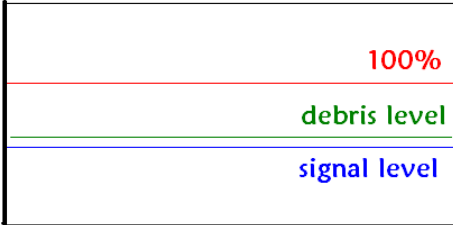
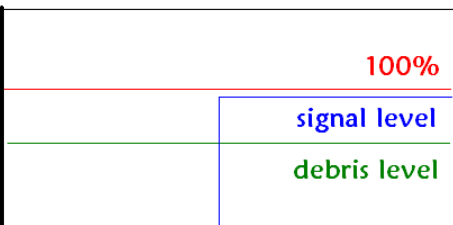
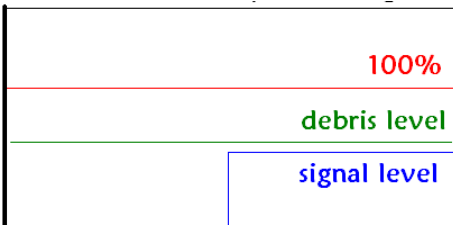
9.4. 'Debris' parameters

The **Debris** parameter is intended for setting the threshold value of the optical signal. If the values of the optical signal of the sensor are below the threshold, the display shows the **"AL2"** error message that signalizes of unacceptable contamination level.



ATTENTION!

When setting the **Debris** parameter, make sure that there are no objects within the control zone and the windows of the receiver and transmitter are clean.

Object is absent. Signal Level > Debris Level. No dirt. AL2=OFF	Object is absent. Signal Level < Debris Level. Window of measuring head is dirty. AL2=ON
	
Object is within the control zone. Signal Level > Debris Level. No dirt. AL2=OFF	Object is within the control zone. Signal Level < Debris Level. Window of measuring head is dirty. AL2=ON
	

Press the **Channel** button and select the channel. The current channel number is highlighted by LED.

Enter the menu, select **"dEbr.x"** using the arrows, and press the **Enter** button to enter the submenu.

9.4.1. Contamination level threshold

Indication of parameter number – the leftmost LED lights up on the LED line. Display 1 shows the **"thrES"** message, Display 2 shows the parameter value.

To edit the parameter, use the **Up** and **Down** buttons. To increase the parameter, press **Up**. To decrease the parameter, press **Down**. In order to go to the next parameter, press **Enter**.

9.4.2. 100% level of signal



ATTENTION!

Always install the current signal level as the level corresponding to 100%, in the following cases:

- when the system is turned on for the first time,
- when the length of the receiver or transmitter connecting wires were changed,
- when receiver and/or transmitter was reinstalled.

Indication of parameter number – two leftmost LED light up on the LED line.

To edit the parameter, use the **Up** and **Down** buttons. To set the current signal level as the parameter value, press **Up**. Display 1 shows the "**LECr.x**" message. To save the previous value, press **Down**. Display 1 shows the "**LEUP.x**" message. In order to go to the main menu, press **Enter**.

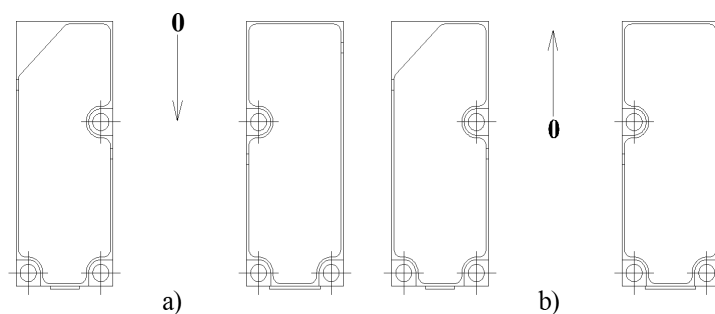
To exit the settings menu, press the **Esc** button. You will be prompted to exit without saving to FLASH by the "**CAnCEL**" message. To save parameters to FLASH, select "**SAUE**" and press **Enter**.

9.5. 'Count direction' parameter

Default count direction is conducted from top down (Fig. a). If necessary, the count direction can be changed.

Press the **Channel** button and select the channel. The current channel number is highlighted by LED.

Enter the menu, select "**dlr.x**" using the arrows, and press the **Enter** button in order to enter the submenu.



To edit the parameter, use the **Up** and **Down** buttons. To set the reverse count direction, press **Up**. Display 2 shows the "**UP**" message. To set the direct count direction, press **Down**. Display 2 shows the "**dn**" message. In order to go to the main menu, press **Enter**.

When you set the reverse count direction, the "**DIR**" LED lights up.

9.6. 'Analog output polarity and indication direction' parameter

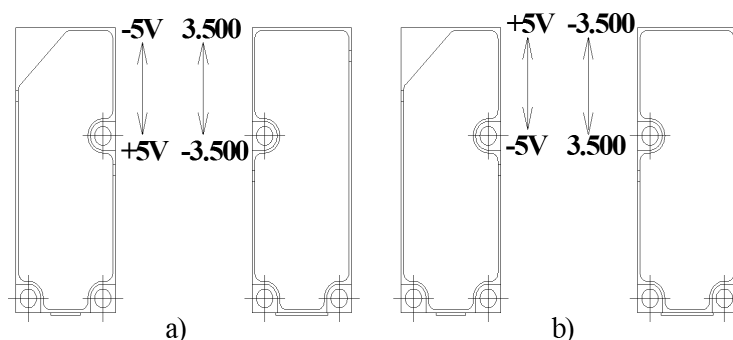
By default the analog output gives -5V with fully opened receiver (display shows 3.500), and +5V with fully closed receiver (display shows -3.500) (Fig. a) - negative polarity. If necessary, the polarity of the analog output can be changed (Fig. b).

Press the **Channel** button and select the channel. The current channel number is highlighted by LED.

Enter the menu, select "**AOP.x**" using the arrows, and press the **Enter** button in order to enter the submenu.

To edit the parameter, use the **Up** and **Down** buttons. To set the positive polarity of the analog output (Fig. b), press **Up**. Display 2 shows the "**POS**" message. To set the negative polarity of the analog output, press **Down**. Display 2 shows the "**nEg**" message. In order to go to the main menu, press **Enter**.

When you set the positive polarity of the analog output, the "**AOP**" LED lights up.



9.7. Logic output thresholds

The controller is equipped with logical outputs (two logical outputs for each channel). These logical outputs signalize about going beyond the upper and lower measurement thresholds.

Press the **Channel** button and select the channel. The current channel number is highlighted by LED.

Enter the menu, select "**LOut.x**" using the arrows, and press the **Enter** button in order to enter the submenu.

9.7.1. Lower threshold

The Threshold Low logical output is an isolated output of the open collector type (n-p-n). It is set to the active state when the measurement value is lower than the value of the lower limit parameter.

Indication of parameter number – the leftmost LED lights up on the LED line. Display 1 shows the "**LO.x**" message, Display 2 shows the parameter value.

To edit the parameter, use the **Up** and **Down** buttons. To increase the parameter, press **Up**. To decrease the parameter, press **Down**. In order to go to the next parameter, press **Enter**.

9.7.2. Upper threshold

The Threshold High logical output is an isolated output of the open collector type (n-p-n). It is set to the active state when the measurement value is higher than the value of the upper limit parameter.

Indication of parameter number – the leftmost LED lights up on the LED line. Display 1 shows the "**hI.x**" message, Display 2 shows the parameter value.

To edit the parameter, use the **Up** and **Down** buttons. To increase the parameter, press **Up**. To decrease the parameter, press **Down**. In order to go to the main menu, press **Enter**.

9.8. Resetting parameters

Parameters can be reset to factory values. In this case, all parameters of both channels will be reset.

Enter the menu, select "**dEFLt**" using the arrows, and press the **Enter** button in order to enter the submenu.

To edit the parameter, use the **Up** and **Down** buttons. To set the default values, press **Up**. Display 2 shows the "**LOAD**" message. To cancel the action, press **Down**. Display 2 shows the "**CAnCEL**" message. In order to go to the main menu, press **Enter**.

10. Analog outputs

The analog outputs are set up once by the manufacturer, but in some cases an adjustment may be required.

To enter the setting menu, it is necessary to do the following: when the controller is turned off, press the **Down** button, turn on the power, and, holding the **Down** button pressed, wait for the "**AOut.1**" and "**CLbr**" messages to appear.

- Connect the voltmeter to terminals AO1 and AGnd.

- Press the **Enter** button. Display 1 shows the "**AOLo.1**" message. Display 2 shows the parameter value.

- Use the arrow buttons to set the parameter value so that the voltage at the analog output AO1 is set to -5V.

- Press **Enter** to go to the next parameter.

- Display 1 shows the "**AOHi.1**" message. Display 2 shows the parameter value.

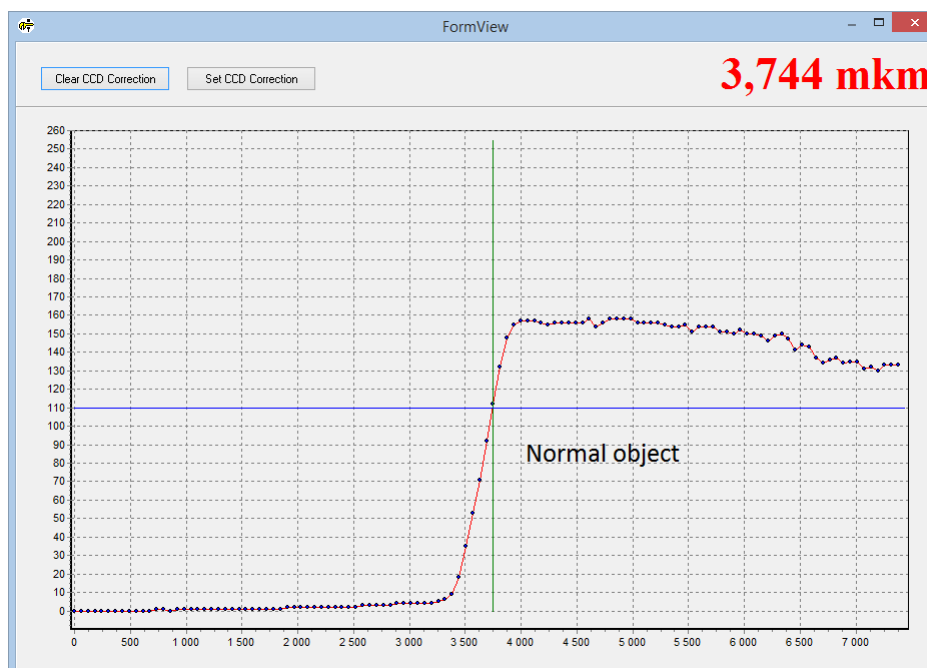
- Use the arrow buttons to set the parameter value so that the voltage at the analog output AO1 is set to 5V.
- Press **Enter** to go to the next parameter.
- Display 1 shows the "**AOLo.2**" message. Display 2 shows the parameter value.
- Connect the voltmeter to terminals AO2 and AGnd.
- Use the arrow buttons to set the parameter value so that the voltage at the analog output AO2 is set to -5V.
- Press **Enter** to go to the next parameter.
- Display 1 shows the "**AOHi.2**" message. Display 2 shows the parameter value.
- Use the arrow buttons to set the parameter value so that the voltage at the analog output AO2 is set to 5V.
- Press **Enter**.
- To save the changes, select "**SAUE**" using the arrow buttons.
- To exit without saving, select "**CAnCL**".
- Press **Enter** to exit the settings menu.

11. Controller settings for working with transparent objects

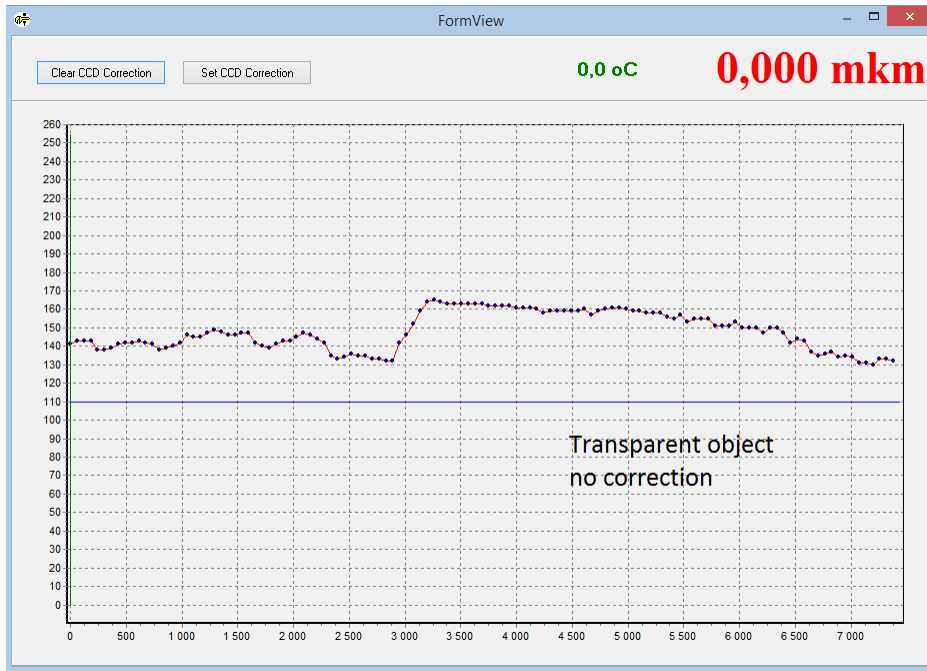
When working with transparent objects, it may be necessary to perform additional controller settings. This is due to the fact that the value of the threshold for finding the border of transparent objects depends on the degree of their transparency.

The screenshots below show the signals from the CMOS sensor for various objects and settings.

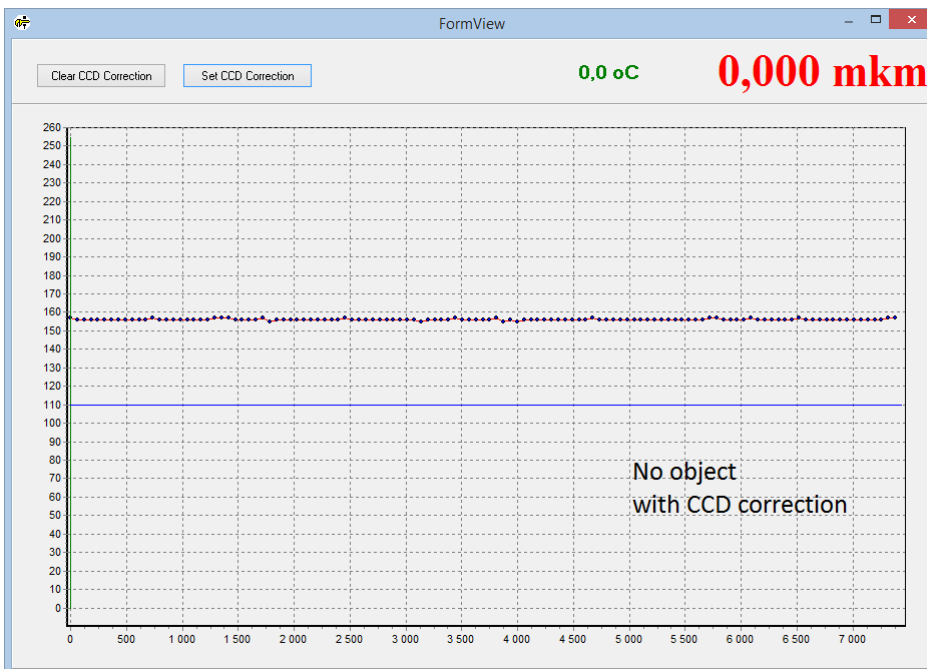
- Normal object.

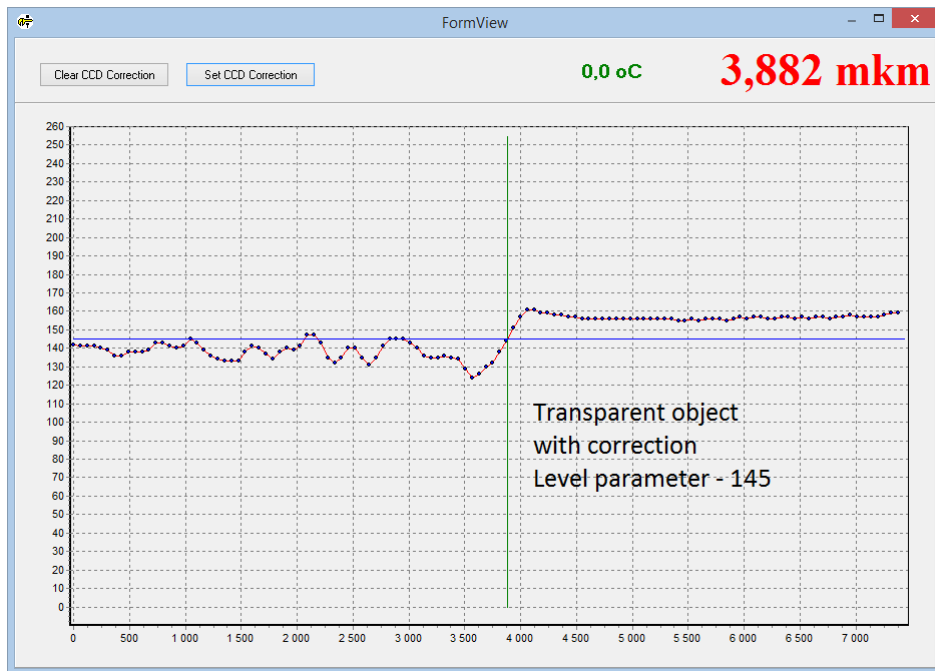


- Transparent object (without correction, the **Level** parameter is not set).



For correct operation, it is necessary to perform correction of the CMOS signal and set the parameter of the position detection threshold. The screenshots below show the following: the CMOS signal with correction, and the CMOS signal when measuring the position of the object with correction and with the **Level** parameter specified correctly.

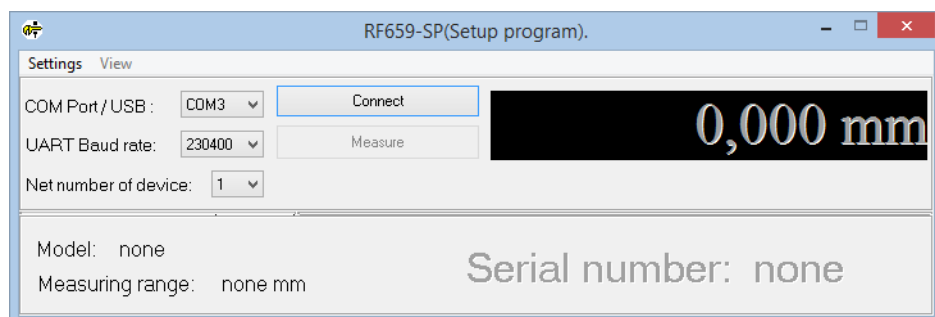




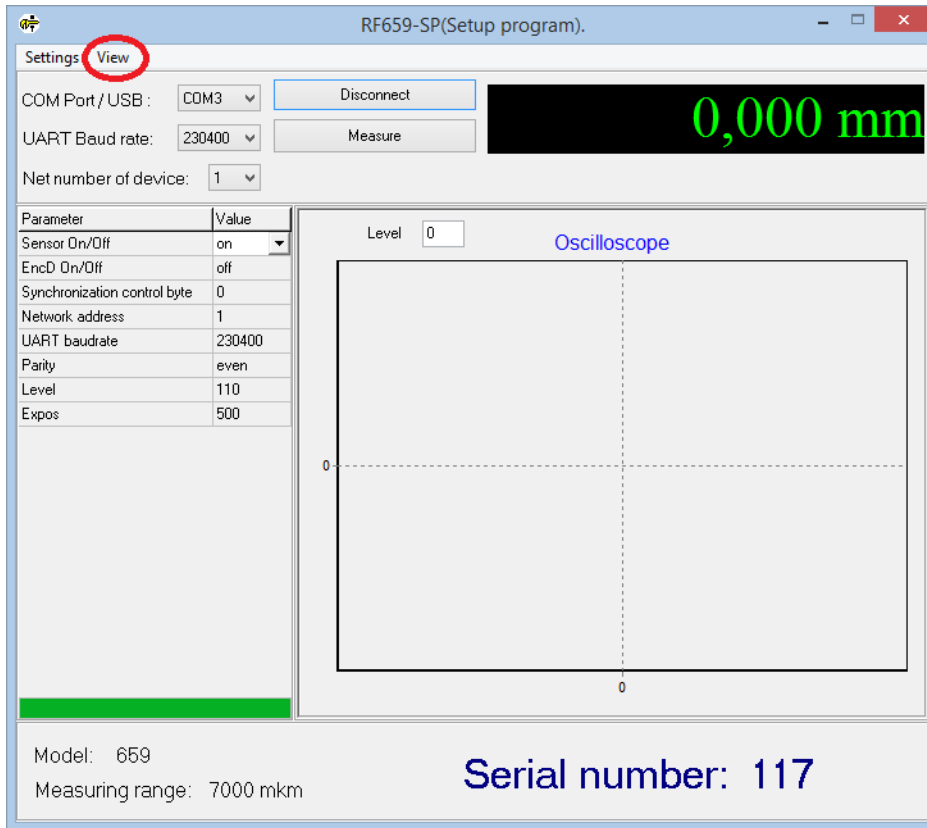
11.1. Setting algorithm

To configure the controller, you will need: the RS485 converter to connect the controller to a PC, and the RF659SP program.

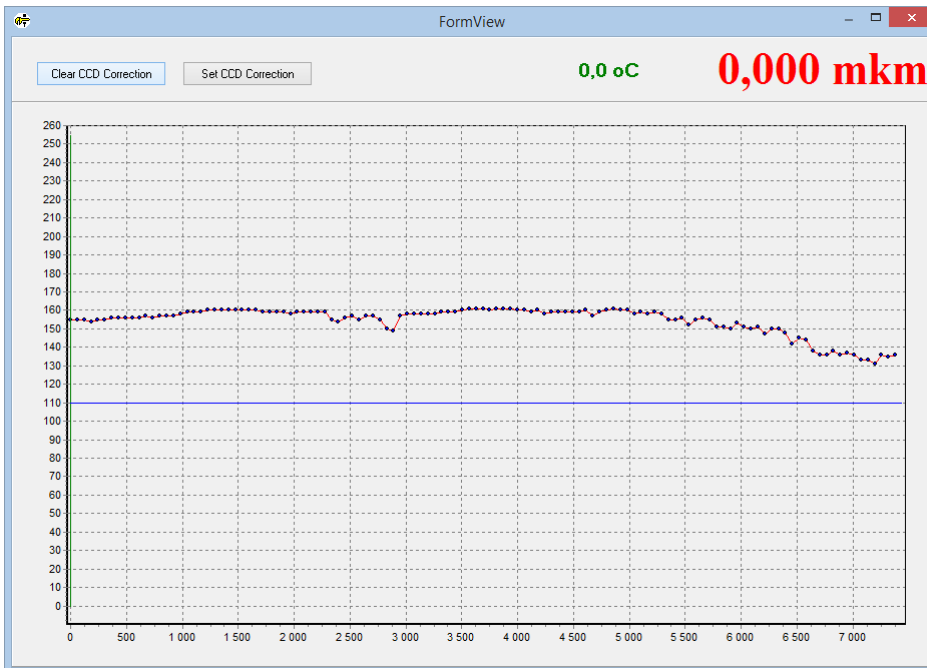
- Turn off the controller.
- Fix the measuring heads in the working position.
- Connect the measuring heads to the controller.
- Using terminals 6, 7 and 8 of the 8-pin connector (see par. 7) and the RS485 converter, connect the controller to the PC.
- Holding the **Enter** button pressed, feed power to the controller and wait for the "**rF659**" and "**tESt**" messages to appear.
- Run the RF659SP program.



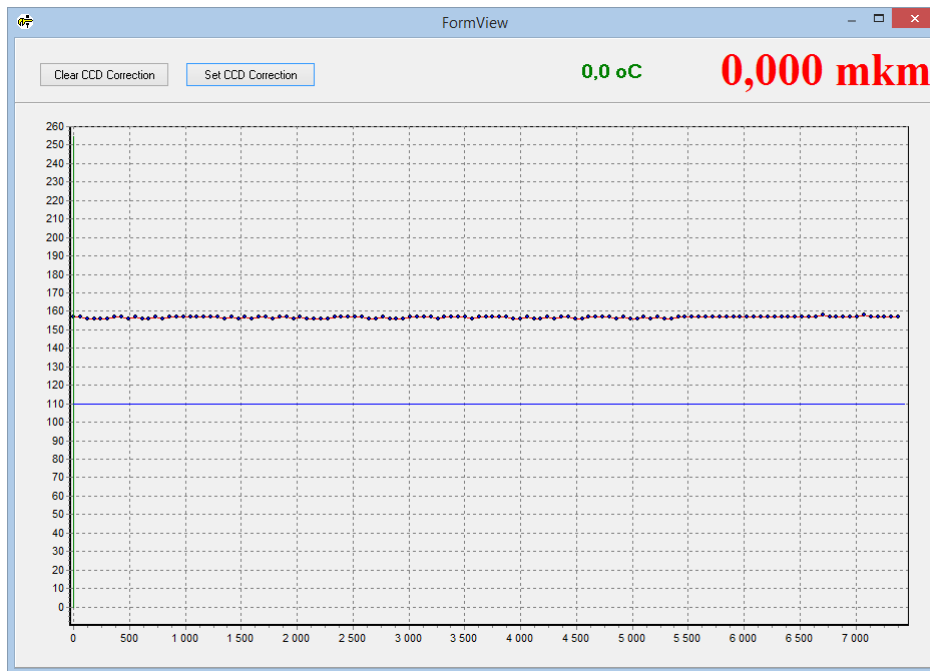
- Select the COM port, to which the RS485 converter is connected. Set the **Net number of device** parameter – 1. Click the **Connect** button.



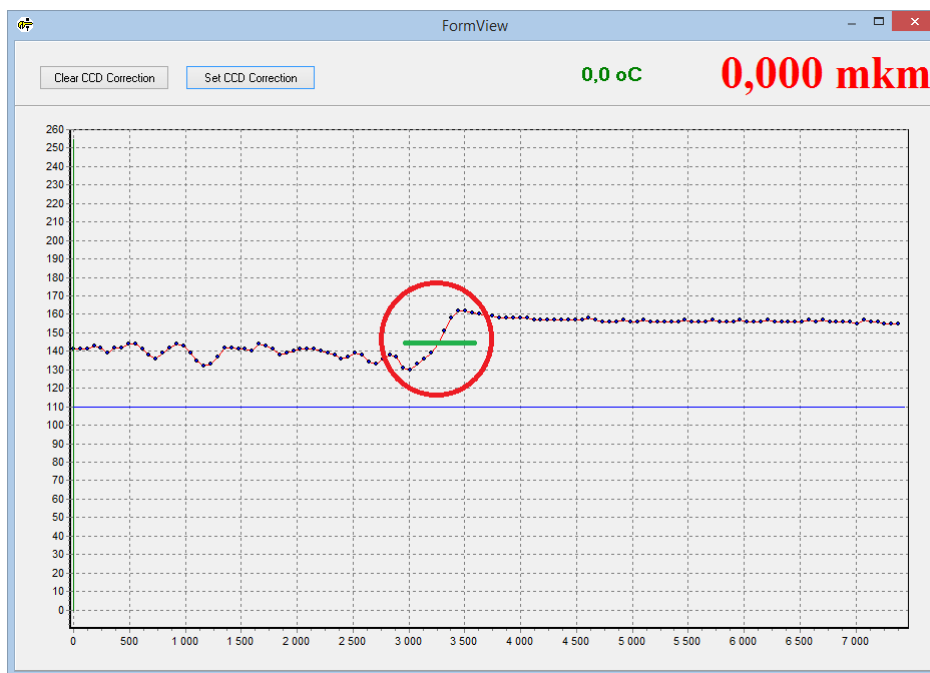
- Click **View** to enter the CMOS signal view mode. The **FormView** window appears.
- Make sure that there are no objects in the measurement area, and the windows of the receiver and transmitter are clean.



- Click the **Set CCD Correction** button.

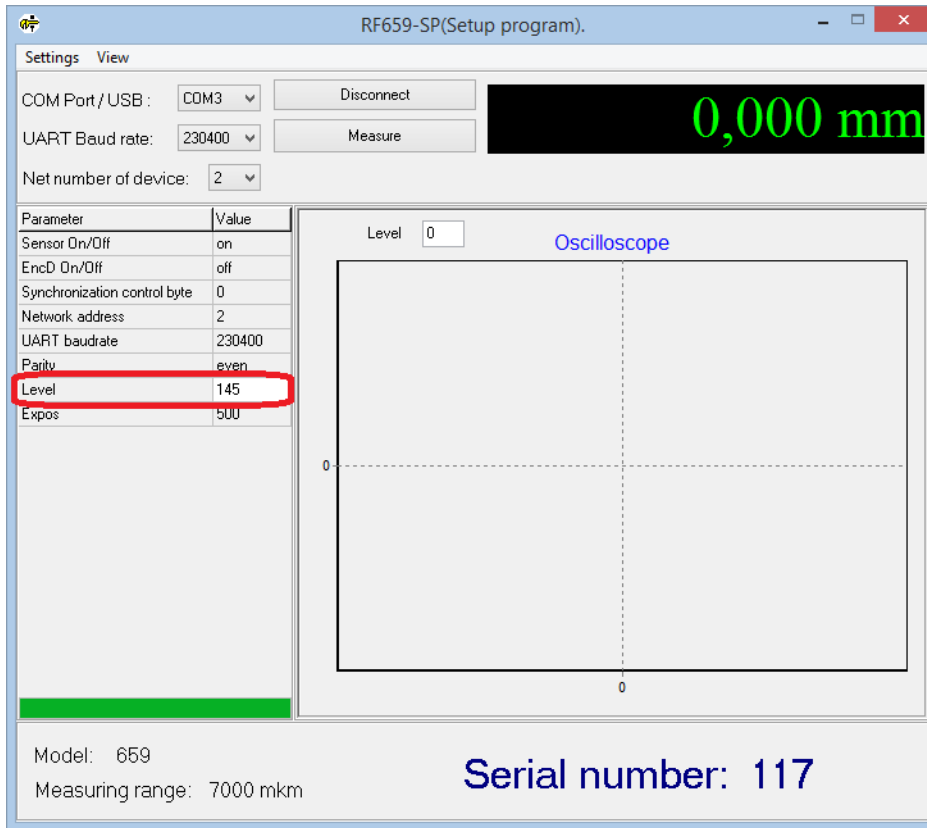


- Install a transparent object in the measurement area.
- Visually determine the level of the object position detection threshold.

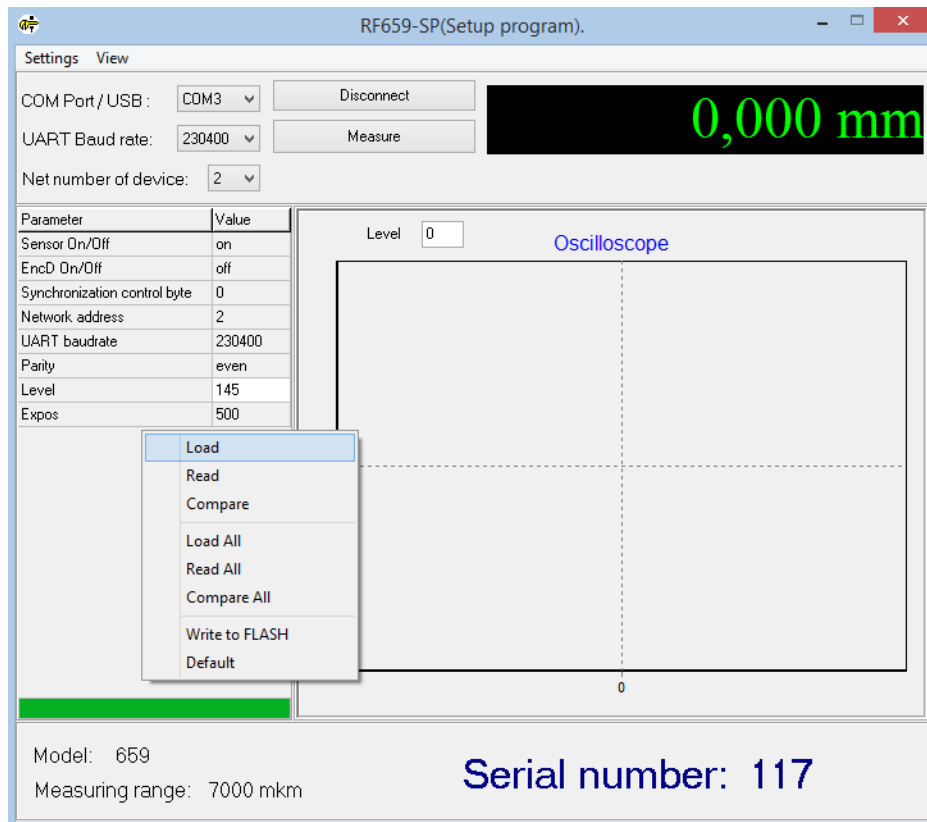


- Close the **FormView** window.
- Enter the value of the **Level** parameter corresponding to the level of the object position detection threshold.

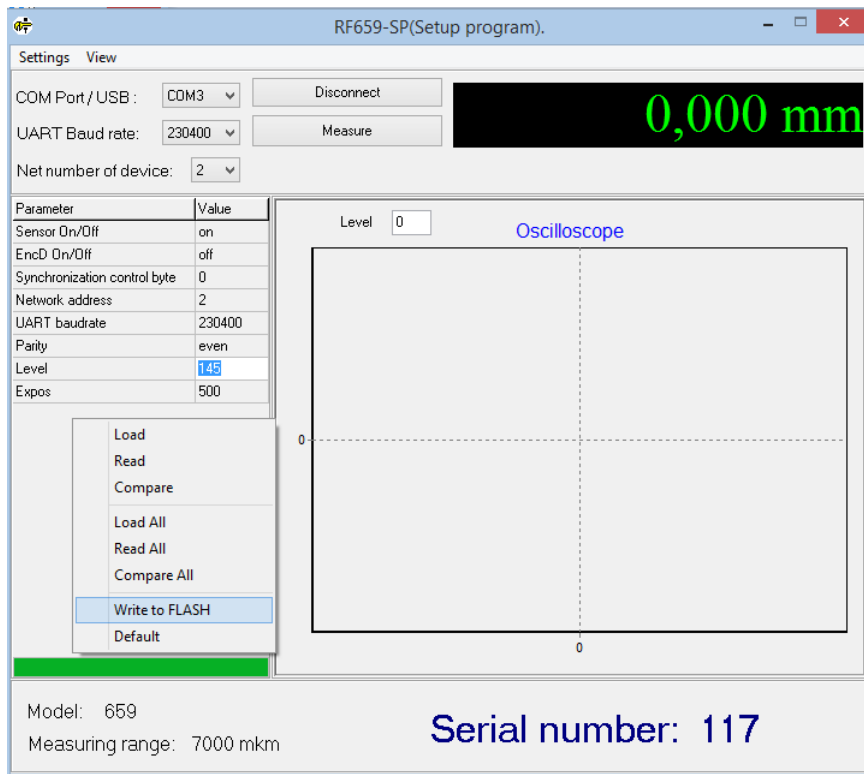
17



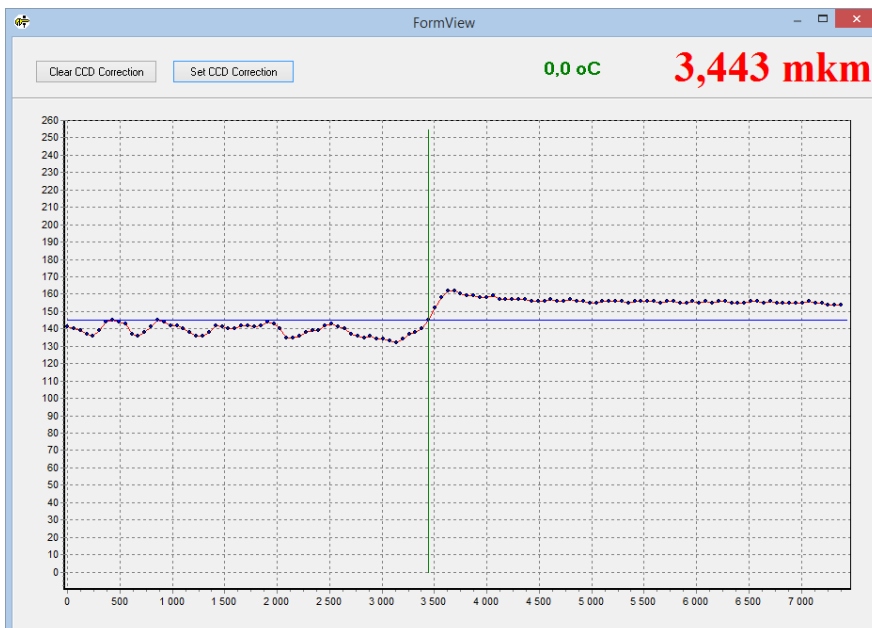
- Right-click in the parameters area and select **Load** to write the parameter to the RAM of the controller.



- Right-click in the parameters area and select **Write to FLASH** to write the parameter to the FLASH memory of the controller.



- Click **View** to open the window for browsing the CMOS signal. The **FormView** window appears. Make sure that the **Level** parameter is set correctly.



- Close the **FormView** window.
- Click the **Disconnect** button.
- Connect to the 2nd channel of the controller: select **Net number of device** – 2, and click the **Connect** button.
- Repeat the algorithm for the 2nd channel.
- Turn off the controller.
- Disconnect the RS485 converter from the controller.




ATTENTION!

In normal operation, the RS485 converter must be disconnected from the controller. Contacts 6, 7 and 8 of the 8-pin connector must be free.

12. LEDs and alarm outputs

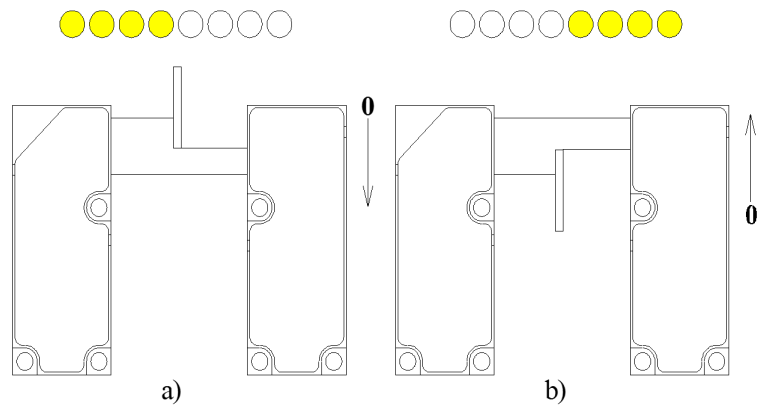
Status of outputs AL1 and AL2 is indicated by red LEDs on the front panel of the controller. The algorithm of the outputs work is described below.

ATTENTION!
 When the alarm output is triggered, the analog output of the corresponding channel is latched. The resumption of the analog output operation is performed after the alarm is turned off.

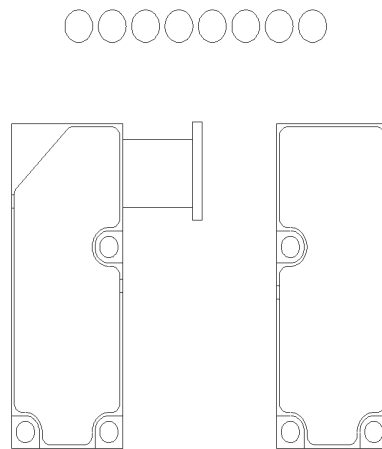
12.1. Output is off, LED is not lit

The position of the object in the measurement area corresponds to the state of **Measurement Direction** parameter,

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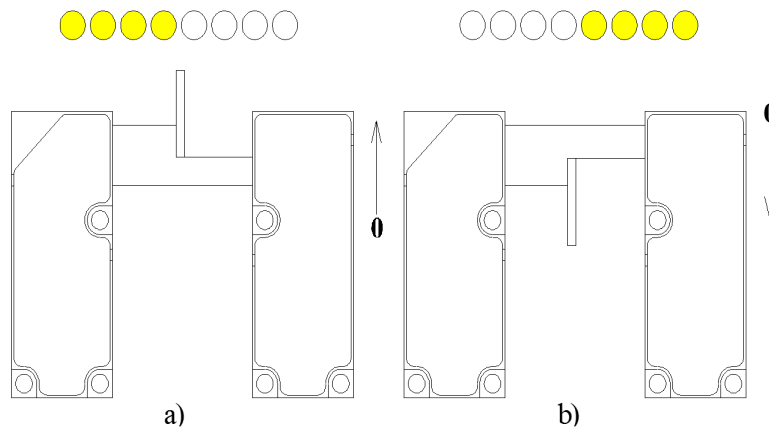


or the object covers the entire measurement area.

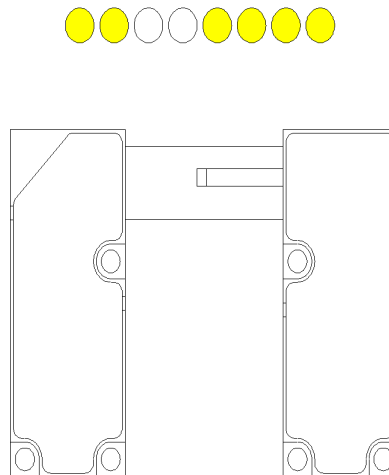


12.2. Output is on, LED is lit

The position of the object in the measurement area doesn't correspond to the state of **Count Direction** parameter,



or there is a complex object in the measurement area, forming more than one boundary light-shadow.



13. Warranty policy

Warranty assurance for Edge Sensors RF659 - 24 months from the date of putting in operation; warranty shelf-life - 12 months.

14. Revisions

Date	Revision	Description
05.04.2017	1.0.0	Starting document.
26.06.2018	2.0.0	The following sections were updated: - Basic technical data. - Connection. - Operating procedure. - Working with parameters. - LEDs and alarm outputs. The following sections were added: - Analog outputs. - Controller settings for working with transparent objects.