RIFTEK
Sensors & Instruments

LASER TRIANGULATION SENSORS

RF605 Series

User's manual

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Certified according to ISO 9001:2015

Contents

1. Safety precautions

- Use supply voltage and interfaces indicated in the sensor specifications.
- In connection/disconnection of cables, the sensor power must be switched off.
- Do not use sensors in locations close to powerful light sources.
- To obtain stable results, wait about 20 minutes after sensor activation to achieve uniform sensor warm-up.

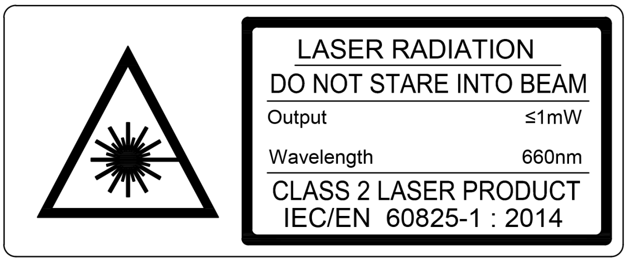
2. CE compliance

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

The sensors make use of a cw 660 nm wavelength semiconductor laser. Maximum output power is 1 mW. The sensors belong to the 2 laser safety class. The following 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 sensors are intended for non-contact measuring and checking of position, displacement, dimensions, surface profile, deformation, vibrations, sorting and sensing of technological objects as well as for measuring levels of liquid and bulk materials.

The series includes 4 sensors with the measurement range from 50 to 500 mm and the base distance from 25 to 105 mm. Custom-ordered configurations are possible with parameters different from those shown below.

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5. Basic technical data

RF605-	25/50	45/100	65/250	105/500
Base distance X, мм	25	45	65	105
Measurement range, mm	50	100	250	500
Linearity, %	±0.1 of the range			
Resolution, %	0.02 of the range			
Temperature drift	0.02% of the range/°C			
Max. sampling frequency, Hz	2000			
Light source	red semiconductor laser, 660 nm wavelength			
Output power, mW	≤0.95			
Laser safety class	2 (IEC60825-1)			
Output interface				
Digital	RS232 (max. 460.8 kbit/s) or RS485 (max. 460.8 kbit/s)			
Analog	4...20 mA (≤500 Ω load) or 0...10 V			
Synchronization input	2.4 – 5 V (CMOS, TTL)			
Logic output	programmable functions, NPN: 100 mA max; 40 V max			
Power supply, V	24 (9…36)			
Power consumption, W	1.5...2			
Environmental resistance				
Enclosure rating	IP67 (only for sensors with cable connector)			
Vibration	20g/10…1000Hz, 6 hours, for each of XYZ axes			
Shock	30 g/6 ms			
Operating ambient temperature, °C	-10…+60			
Permissible ambient light, lx	7000			
Relative humidity, %	35-85			
Storage temperature, °C	-20…+70			
Housing material	aluminum			
Weight (without cable), gram	60			

6. Example of item designation when ordering

RF605-X/D-SERIAL-ANALOG-IN-AL-CC(R)-M

Symbol	Description
X	Base distance (beginning of the range), mm.
D	Measurement range, mm.
SERIAL	Type of serial interface: RS232 - 232, or RS485 - 485.
ANALOG	Attribute showing the presence of 4…20 mA (I) or 0…10 V (U).
IN	Trigger input (input of synchronization) presence.
AL	Programmed signal, which has triple purpose. It can be used as 1. logical output (indication of the presence of an object in the working range); 2. line of mutual synchronization of two and more sensors; 3. line of hardware zero setting.
CC(R)	Cable gland - CG, or cable connector - CC (Binder 702, IP67). **Note**. R option – robot cable.
M	Cable length, m.

Example. RF605-105/500-232-I-IN-CG-3 – base distance 105 mm, measurement range 500 mm, RS232 serial port, 4…20 mA analog output, trigger input is available, cable gland, cable length 3 m.

7. Structure and operating principle

The operation of the sensors is based on the principle of optical triangulation (Figure 1).

Radiation of a semiconductor laser (1) is focused by a lens (2) onto an object (6). Radiation reflected by the object is collected by a lens (3) onto a linear CMOS array (4). Moving the object (6 – 6') causes the corresponding shift of the image. A signal processor (5) calculates the distance to the object from the position of the light spot on the array (4).

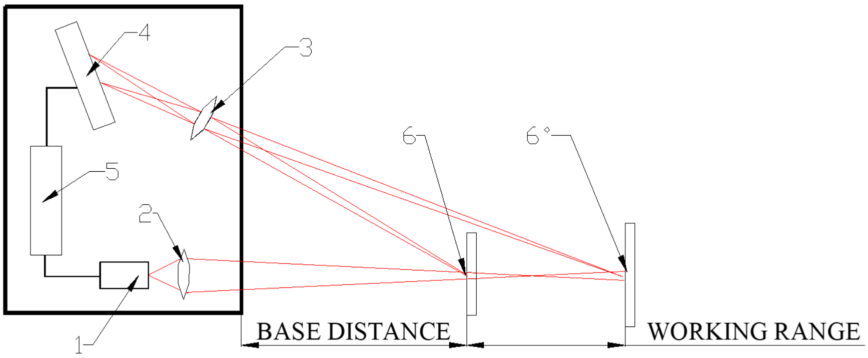


Figure 1

8. Dimensions and mounting

8.1. Overall and mounting dimensions

Overall and mounting dimensions of the sensor are shown in Figures 2 and 3. The sensor body is made of anodized aluminum. The output window is located on the front panel of the housing. For installation in equipment, the sensor housing has mounting holes.

Sensors are equipped with a cable gland or connector.

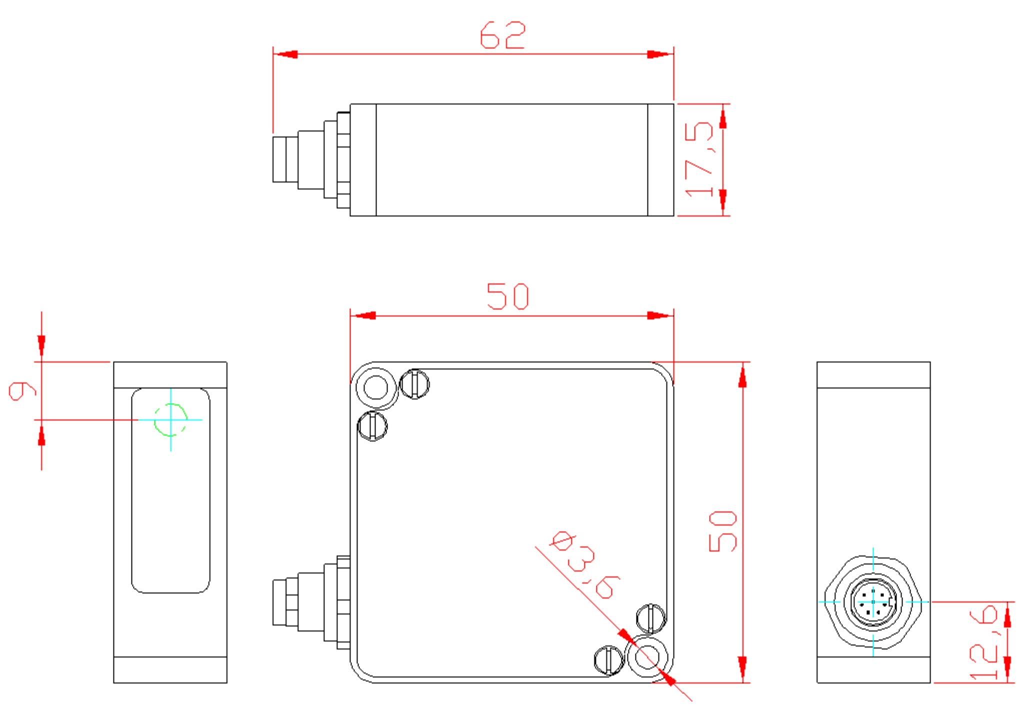


Figure 2. Sensor with connector

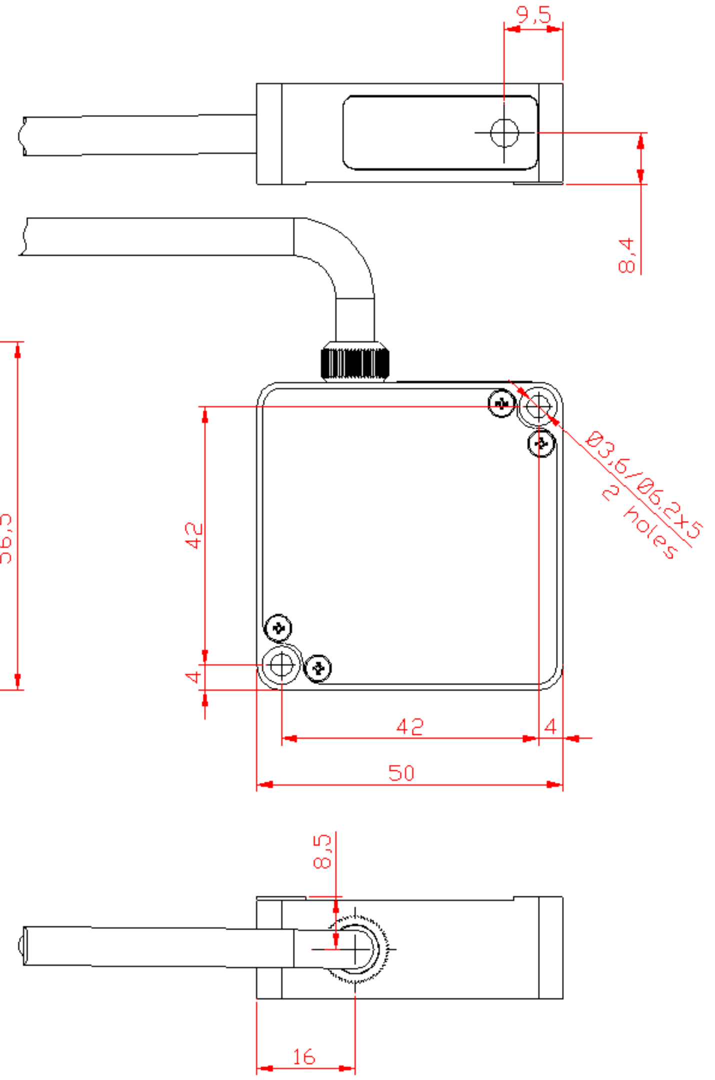


Figure 3. Sensor with cable gland

8.2. Overall demands for mounting

The sensor is positioned so that the object under control has to be placed within the working range of the sensor. In addition, no foreign objects should be allowed to stay on the path of the incident and reflected laser radiation.

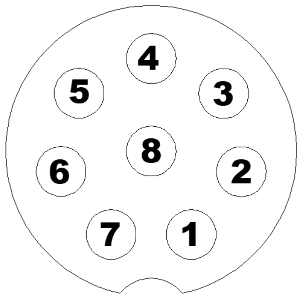
Where objects to be controlled have intricate shapes and textures, the incidence of mirror component of the reflected radiation to the receiving window should be minimized.

9. Connection

9.1. Designation of connector contacts

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

Binder 702 Series, #09-0427-80-08



Designation of contacts is given in the following table:

Model of the sensor	Pin number	Assignment
232-U/I-IN-AL	1 2 3 4 5 6 7 8	IN Gnd (power supply) TXD RXD Gnd (common for signals) AL U/I Power supply U+
485-U/I-IN-AL	1 2 3 4 5 6 7 8	IN Gnd (power supply) DATA+ DATA- Gnd (common for signals) AL U/I Power supply U+

9.2. Cables

Designation of cable wires is given in the table below:

Model of the sensor	Pin number		Assignment	Wire color
232-U/I-IN-AL	free lead free lead DB9 DB9 free lead free lead free lead DB9	- - 2 3 - - - 5	Power U+ Gnd (power supply) TXD RXD U/I IN AL Gnd (common for signals)	Red Brown Green Yellow Blue White Pink Grey
485-U/I-IN-AL	free leads		Power U+ Gnd (power supply) DATA+ DATA- U/I IN AL Gnd (common for signals)	Red Brown Green Yellow Blue White Pink Grey

10. Configuration parameters

The nature of the sensor operation depends on its configuration parameters (operation modes), which can be changed by sending commands via the serial port (RS232 or RS485). The basic parameters are given below.

10.1. Time limit for integration

The intensity of the reflected radiation depends on the characteristics of the surface of the controlled objects. Therefore, the laser output power and the time of integration of radiation incident onto the CMOS array are automatically adjusted to achieve maximum measurement accuracy.

The "Time limit for integration" parameter specifies the maximum allowable integration time. If the radiation intensity received by the sensor is so small that no reasonable result is obtained within the integration time equal to the limiting value, the sensor transmits a zero value.

Note 1. The measurement frequency depends on the integration time of the receiving array. Maximum frequency (2 kHz) is achieved for the integration time ≤106 µs (minimum possible integration time is 10 µs). As the integration time increases above 106 µs, the result updating time increases proportionally.

Note 2. Increasing this parameter expands the possibilities to control low-reflective (diffuse component) surfaces; at the same time, this reduces the frequency of measurements and increases the effects of exterior light (background) on the measurement accuracy. Factory setting of the limiting time of integration is 3200 µs.

Note 3. Decreasing this parameter increases the measurement frequency, but can decrease the measurement accuracy.

10.2. Sampling mode

This parameter specifies one of two result sampling options when the sensor is in data stream mode:

- Time Sampling.
- Trigger Sampling.

When selecting *Time Sampling*, the sensor automatically transmits the measurement result via the serial interface in accordance with the selected time interval (sampling period).

When selecting *Trigger sampling*, the sensor transmits the measurement result when switching the external synchronization input (IN input of the sensor) and taking into account the set *division factor*.

10.3. Sampling period

If the Time Sampling mode is selected, the 'sampling period' parameter determines the time interval in which the sensor will automatically transmit the measurement result. The time interval value is set in increments of 0.01 ms. ***For example,*** for the parameter value equal to 100, data are transmitted through bit-serial interface with a period of 0.01*100 = 1 ms.

If the Trigger Sampling mode is selected, the 'sampling period' parameter determines the division factor for the external synchronization input. ***For example,*** for the parameter value equal to 100, data are transmitted through bit-serial interface when each 100th synchronizing pulse arrives at IN input of the sensor.

Note 1. It should be noted that the 'sampling mode' and 'sampling period' parameters control only the transmission of data. The sensor operation algorithm is built in such a way that measurements are taken at the maximum possible rate determined by the integration time period, the measurement result is sent to the buffer and stored therein until a new result arrives. The above parameters determine how the result is read from the buffer.

Note 2. If the bit-serial interface is used to receive the result, the time required to transfer data at the selected data transmission rate should be taken into account when setting small intervals of the sampling period. If the transmission time exceeds the sampling period, then this time will determine the data transmission rate.

Note 3. It should be taken into account that the sensors differ in some variation of the parameters of the internal generator, which affects the accuracy of the Time Sampling period.

10.4. Point of zero

This parameter sets a zero point of the absolute coordinate system at any point within the working range. This point can be set by the corresponding command or by connecting the AL input to the ground line (this input must first be set to mode 3). When manufacturing the sensor, the base distance is set with some uncertainty, and, if necessary, it is possible to set the zero point more accurately.

10.5. Line AL operation mode

This line can operate in one of four modes defined by the configuration parameter value:

- mode 1: indication of run-out beyond the range ("0" – object is beyond the range (beyond the selected window in the range), "1" – object is within the range (within the selected window in the range);
- mode 2: mutual synchronization of two or more sensors;
- mode 3: hardware zero-set line;
- mode 4: hardware laser on/off.

In the *"Indication of run-out beyond the range"* mode, a logical "1" occurs on the AL line if an object under control is located within the working range of the sensor (within the selected window in the range), and a logical "0" occurs if the object is absent in the working range (within the selected window). For example, in this mode, this line can be used for controlling an actuator (relay) that is activated when the object is present (absent) within the selected range (Fig. 4.1).

The *"Mutual synchronization"* mode makes it possible to synchronize measurement times of two and more sensors. It is convenient to use this mode to control one object with several sensors, e.g., in the measurement of thickness. At the hardware level, the synchronization of the sensor is carried out by combining AL lines (Fig. 4.2).

Note. It should be taken into account that in the "Mutual synchronization" mode, the measurement frequency decreases in proportion to the number of synchronized sensors.

In the *"Hardware zero-set"* mode, connecting the AL input to the ground potential sets the origin of coordinates to the current point (Fig. 4.3).

In the *"Hardware laser on/off"* mode, connecting the AL input to the ground potential turns the laser on/off (Fig. 4.3).

Examples of using the AL line:

Out of the range indication	Mutual synchronization	Hardware zero-set/ Hardware laser ON/OFF

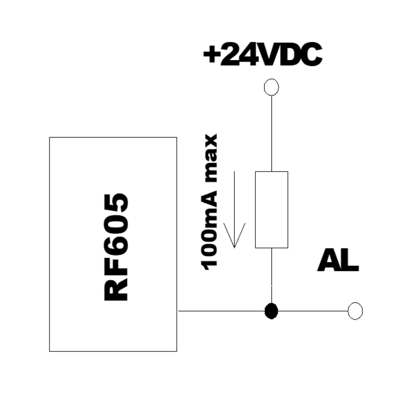
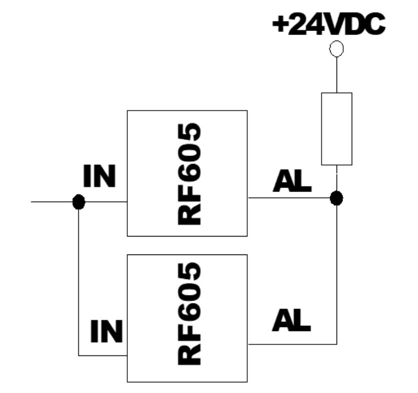
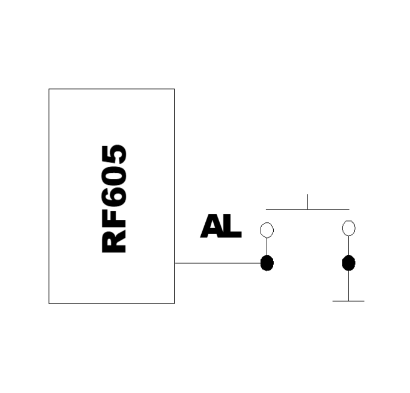

		

Figure 4.1	Figure 4.2	Figure 4.3

10.6. Time lock of the result

If the sensor does not detect an object, or if the authentic result cannot be obtained, a zero value is transferred. This parameter sets the time during which the last authentic result is transferred instead of a zero value. Discreteness of the time setting is 5 ms.

10.7. Method of results averaging

This parameter defines one of two methods of averaging the measurement results implemented directly in the sensor:

- Averaging over a number of results
- Time averaging

When *"Averaging over the number of results"* is selected, a sliding average is calculated.

When *"Time averaging"* is selected, the results obtained are averaged over the specified time interval.

10.8. Number of averaged values/time of averaging

This parameter specifies the number of results to be averaged for deriving the output value or time of averaging.

The use of averaging makes it possible to reduce the output noise and increase the sensor resolution.

Averaging over the number of results does not affect the data update in the sensor output buffer.

In the case of time averaging, the data in the output buffer is updated at a rate equal to the averaging period.

Note. The maximum parameter value is 127.

10.9. Factory parameters

The sensors are supplied with the parameters shown in the table below:

Parameter	Value
Time limit for integration	3200 (3.2 ms)
Sampling mode	по времени
Sampling period	500 (5 ms)
Point of zero	Beginning of the range
Line AL operation mode	1

Time lock of the result	5 ms
Method of results averaging	Over the number of results
Number of averaged values	1

The parameters are stored in non-volatile memory of the sensor. Correct changing of the parameters is carried out using the parameterization program supplied with the sensor or the user program.

11. Description of RS232 and RS485 interfaces

11.1. RS232 port

The RS232 port provides a "point-to-point" connection and allows the sensor to be connected directly to RS232 port of a computer or controller.

11.2. RS485 port

In accordance with the accepted network protocol and hardware capabilities, the RS485 port makes it possible to connect the sensors to one data collection unit by a common bus circuit.

11.3. Modes of data transfer

There are two methods for obtaining measurement data:
- single requests (inquiries);
- automatic data streaming (stream).

11.4. Configuration parameters

11.4.1. Rate of data transfer through the serial port

This parameter defines the rate of data transmission via the bit-serial interface in increments of 2400 bit/s. For example, the parameter value equal to 4 gives the transmission rate of 2400*4 = 9600 bit/s.

Note. The maximum transmission rate for RS232/RS485 interface is 460.8 kbit/s.

11.4.2. Network address

This parameter defines the network address of the sensor equipped with RS485 interface.

Note. The network data communication protocol assumes the presence of one 'master' in the network, which can be a computer or other information gathering device, and from 1 to 127 'slaves' (RF605 Series sensors) that support this protocol.

Each 'slave' is assigned a unique network identification code – the device address. The device address is used to form requests or inquiries over the network. Each 'slave' receives inquiries containing its unique address as well as '0' address, which is broadcast and can be used to form group commands, for example, for simultaneous latching of values of all sensors and for working with only one sensor (with both RS232 port and RS485 port).

11.4.3. Factory parameters

Parameter	Value
Baud rate	9600 bit/s
Network address	1
Mode of data transfer	request

11.5. Interfacing protocol

11.5.1. Serial data transmission format

The data message has the following format:

1 start-bit	8 data bits	1 even parity bit	1 stop-bit

The even parity bit pads 8-bit data to even parity.

11.5.2. Communication session types

The communication protocol is formed by communication sessions that are initiated only by the ‘master’ (PC, controller). There are two kinds of sessions with the following structures:

1) “request”, [“message”] — [“answer”], square brackets include optional elements.
2) “request” — “data stream” — [“request”].

11.5.3. Request

“Request” (INC) is a two-byte message, which fully controls the communication session. The ‘request’ message is the only message in the session where the most significant bit is set to 0, therefore, it serves to synchronize the beginning of the session. In addition, it contains the device address (ADR), the request code (COD) and, optionally, the message [MSG].

"Request" format:

<table>
<tr><td colspan="2">Byte 0</td><td colspan="5">Byte 1</td><td>[Bites 2…N]</td></tr>
<tr><td colspan="2">INC0(7:0)</td><td colspan="5">INC1(7:0)</td><td>MSG</td></tr>
<tr><td>0</td><td>ADR(6:0)</td><td>1</td><td>0</td><td>0</td><td>0</td><td>COD(3:0)</td><td></td></tr>
</table>

11.5.4. Message

"Message’’ is the data burst that can be transmitted by a ‘master’ in the course of a session.

All messages with the "message" burst contain 1 in the most significant bit. The data in the message is transmitted in tetrads. When transmitting a byte, the low-order tetrad is transmitted first, then the high-order tetrad is transmitted. When transferring multi-byte values, the transfer starts from the low byte.

The following is the format of two “message” data bursts for transmitting the byte DAT(7:0):

<table>
<tr><td colspan="10">DAT(7:0)</td></tr>
<tr><td colspan="5">Byte 0</td><td colspan="5">Byte 1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>DAT(3:0)</td><td>1</td><td>0</td><td>0</td><td>0</td><td>DAT(7:4)</td></tr>
</table>

11.5.5. Answer

"Answer'' is the data burst that can be transmitted by a 'slave' in the course of a session.

All messages contain 1 in the most significant bit. The data in the message is transmitted in tetrads. When transmitting a byte, the low-order tetrad is transmitted first, then the high-order tetrad is transmitted. When transferring multi-byte values, the transfer starts from the low byte.

When 'answer' is transmitted, the message contains:

- SB-bit. It characterizes the update of the result. If SB is equal to "1", this means that the sensor has updated the measurement result in the buffer. If SB is equal to "0", then a non-updated result has been transmitted (see Note 1, p. 10.3). When transmitting parameters, the SB bit is equal to "0".
- Two additional bits of cyclic binary batch counter (CNT). Bit values in the batch counter are identical for all sendings of one batch. The value of the batch counter is incremented by the sending of each burst and is used for formation (assembly) of batches or bursts as well as for control of batch losses in receiving data streams.

The following is the format of two 'answer' data bursts for transmitting the byte DAT(7:0):

DAT(7:0)							
Byte 0				Byte 1			
1	SB	CNT(1:0)	DAT(3:0)	1	SB	CNT(1:0)	DAT(7:4)

11.5.6. Data stream

"Data stream" is an infinite sequence of data bursts or batches transmitted from 'slave' to 'master', which can be interrupted by a new request. When transmitting a 'data stream', one of the 'slaves' fully holds the data transfer channel, therefore, when the 'master' produces any new request sent to any address, the data streaming process is stopped. Also, there is a special request to stop the data stream.

11.5.7. Request codes and list of parameters

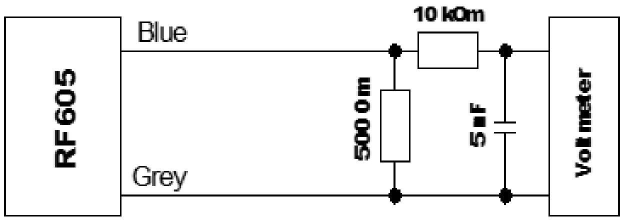
Request codes and a list of parameters are presented in Section 13.

12. Analog outputs

The change in the signal at the analog output occurs synchronously with the change in the result transmitted via the serial interface.

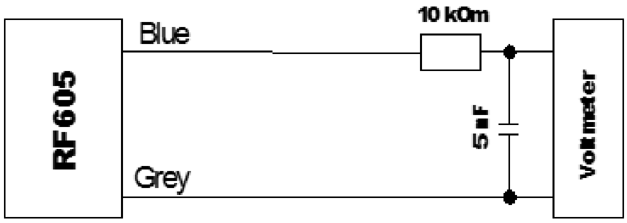
12.1. Current output 4…20 mA

The connection scheme is shown in the figure. The value of the load resistor must not exceed 500 ohms. To reduce noise, it is recommended to install an RC filter in front of the measuring instrument. The filter capacitor value is specified for the maximum sampling frequency of the sensor (2 kHz) and this value increases in proportion to the frequency reduction.



12.2. Voltage output 0...10 V

The connection scheme is shown in the figure. To reduce noise, it is recommended to install an RC filter in front of the measuring instrument. The filter capacitor value is specified for the maximum sampling frequency of the sensor (2 kHz) and this value increases in proportion to the frequency reduction.



12.3. Configuration parameters

12.3.1. Range of the analog output

While working with the analog output, the resolution can be increased by using the "Window in the operating range" function, which makes it possible to select a window of the required size and position in the working range of the sensor, within which the entire range of the analog output signal will be scaled.

Note. If the beginning of the range of the analog signal is set to a higher value than the end value of the range, this will change the direction of rise of the analog signal.

12.3.2. Analog output operation mode

When using "Window in the operating range" function, this mode defines the analog output operation mode.

Analog output can be:

- in the window mode or
- in the full mode.

"Window mode". The entire range of the analog output is scaled within the selected window. Outside the window, the analog output is "0".

"Full mode". The entire range of the analog output is scaled within the selected window (operating range). Outside the selected window, the entire range of the analog output is automatically scaled onto the entire operating range of the sensor (sensitivity range).

12.4. Factory parameters

Range of the analog output	Measuring range of the sensor
Analog output operation mode	Window

13. Request codes and list of parameters

13.1. Request codes

Request code	Description	Message (size in bytes)	Answer (size in bytes)
01h	Device identification	—	- device type (1) - firmware release (1) - serial number (2) - base distance (2) - range (2)
02h	Reading of parameter	- parameter code (1)	- parameter value (1)
03h	Writing of parameter	- parameter code (1) - parameter value (1)	—
04h	Storing current parameters to FLASH memory	- constant AAh (1)	- constant AAh (1)
04h	Recovery of parameter default values in FLASH memory	- constant 69h (1)	- constant 69h (1)
05h	Latching of current result	—	—
06h	Inquiring of result	—	- result (2)
07h	Inquiring of a stream of results	—	- stream of results (2)
08h	Stop data streaming	—	—

13.2. List of parameters

Parameter code	Name	Values
00h	Sensor ON	1 – laser is ON, measurements are taken (default state); 0 – laser is OFF, sensor in power save mode.
01h	Analog output ON	1/0 – analog output is ON/OFF; if a sensor has no analog output, this bit will remain in 0 despite all attempts of writing 1 into it.
02h	Averaging, sampling and AL output control	x,x,M,C,M1,M0,R,S – control byte, which determines the averaging mode – bit M, CAN interface mode - bit C, logical output mode - bit M1, analog output mode – bit R, and sampling mode - bit S. Bits x – not used. Bit M: 0 – quantity sampling mode (by default); 1 – time sampling mode. Bit C: 0 – request mode of CAN interface (by default); 1 – synchronization mode of CAN interface. Bit M1 and M0: 00 – out of the range indication (by default); 01 – mutual synchronization mode; 10 – hardware zero set mode; 11 – laser OFF/ON. Bit R: 0 – window mode (default); 1 – full range. Bit S: 0 – time sampling (default); 1 – trigger sampling.
03h	Network address	1…127 (default – 1)
04h	Rate of data transfer through serial port	1…192 (default – 4)

Parameter code	Name	Values
		Data transfer rate in increments of 2400 baud; e.g., 4 means the rate of 4*2400=9600 baud. NOTE: the maximum baud rate = 460800.
05h	**Reserved**	
06h	Number of averaged values	1…128 (default – 1)
07h	**Reserved**	
08h	Lower byte of the sampling period	1) 10…65535 (default – 500) Specifies the time interval in increments of 0.01 ms after which the sensor automatically transmits results on the data stream request (sampling priority = 0). 2) 1…65535 (default – 500) Specifies the division ratio for the sync input (sampling priority = 1).
09h	Higher byte of the sampling period	
0Ah	Lower byte of maximum integration time	2…65535 (default – 200) Specifies the limiting time of integration by the CMOS array in increments of 1 μs.
0Bh	Higher byte of maximum integration time	
0Ch	Lower byte for the beginning of analog output range	0…4000h (default – 0) Specifies the point within the range of the sensor at which the analog output reaches its minimum value.
0Dh	Higher byte for the beginning of analog output range	
0Eh	Lower byte for the end of analog output range	0…4000h (default – 0) Specifies the point within the range of the sensor at which the analog output reaches its maximum value.
0Fh	Higher byte for the end of analog output range	
10h	Time lock of result	0…255 Specifies the time interval in increments of 5 ms.
11…16h	**Reserved**	
17h	Lower zero point	0…4000h (default – 0) Specifies the beginning of the absolute coordinate system.
18h	Higher byte zero point	

13.3. Notes

- All values are given in binary form.
- Base distance and range are given in millimeters.
- The value of the result transmitted by a sensor (D) is so normalized that 4000h (16384) corresponds to a full range of the sensor (S in mm), therefore, the result in millimeters is obtained by the following formula:

$$X=D*S/4000h \text{ (mm)} \quad (1)$$

- On special request (05h), the current result can be latched in the output buffer where it will be stored unchanged up to the moment of arrival of request for data transfer. This request can be sent simultaneously to all sensors in the network in broadcast mode in order to synchronize data pickup from all sensors.
- When working with the parameters, it should be borne in mind that when the power is turned off the parameter values are stored in non-volatile FLASH memory of the sensor. When the power is on, the parameter values are read out to RAM of the sensor. In order to retain these changes for the next power-up state, a special command for saving current parameter values in the FLASH memory (04h) must be run.
- Parameters with the size of more than one byte should be saved starting from the high-order byte and finishing with the low-order byte.

13.4. Examples of communication sessions

1) Request "Device identification".

Condition: device address – 1, request code – 01h, device type – 61, firmware release – 88 (58h), serial number – 0402 (0192h), base distance – 80 mm (0050h), measurement range – 50 mm (0032h), packet number – 1.

The request format:

Byte 0		Byte 1					[Bytes 2…N]
INC0(7:0)		INC1(7:0)					MSG
0	ADR(6:0)	1	0	0	0	COD(3:0)	

Request from “Master":

Byte 0								Byte 1							
INC0(7:0)								INC1(7:0)							
0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1
01h								81h							

The following is the format of two ‘answer’ data bursts for transmission of byte DAT(7:0):

DAT(7:0)							
Byte 0				Byte 1			
1	0	CNT(1:0)	DAT(3:0)	1	0	CNT(1:0)	DAT(7:4)

Answer from “Slave”:

- Device type:

DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	0	0	0	1	1	0	0	1	0	1	1	0
91h								96h							

- Firmware release:

DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	1	0	0	0	1	0	0	1	0	1	0	1
98h								95h							

- Serial number:

DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	0	0	1	0	1	0	0	1	1	0	0	1
92h								96h							
DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0
91h								90h							

- Base distance:

DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	0	0	0	0	1	0	0	1	0	1	0	1
90h								95h							
DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
90h								90h							

- Measurement range:

DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	0	0	1	0	1	0	0	1	0	0	1	1
92h								93h							
DAT(7:0)															
Byte 0								Byte 1							
1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
90h								90h							

Note. Since packet number is "1", CNT is "1".

2) Request "Reading the parameter".

Condition: device address – 1, request code – 02h, parameter code – 05h, parameter value – 04h, packet number – 2.

Request (“Master”) – 01h;82h;

Message (“Master”) – 85h, 80h;

Answer (“Slave”) – A4h, A0h.

3) Request "Inquiring the result".

Condition: device address – 1, result – 02A5h, packet number – 3.

Request (“Master”) – 01h;86h;

Answer (“Slave”) – B5h, BAh, B2h, B0h.

Measured distance (mm) (for example, the range of the sensor = 50 mm):

X=677(02A5h)*50/16384 = 2.066 mm

4) Request "writing the sampling mode (trigger sampling)".

Condition: device address – 1, request code – 03h, parameter code – 02h, parameter value – 01h.

Request ("Master") – 01h, 83h;

Message ("Master") – 82h, 80h, 81h, 80h.

5) Request: "writing the division ratio"

Condition: division ratio – 1234=3039h, device address – 1, request code – 03h, parameter code – 09h (first or higher byte), parameter value – 30h.

Request ("Master") – 01h, 83h;

Message ("Master") – 89h, 80h, 80h, 83h.

For the lower byte: parameter code – 08h, parameter value – 39h.

Request ("Master") – 01h, 83h;

Message ("Master") – 88h, 80h, 89h, 83h.

14. Parameterization program

14.1. Function

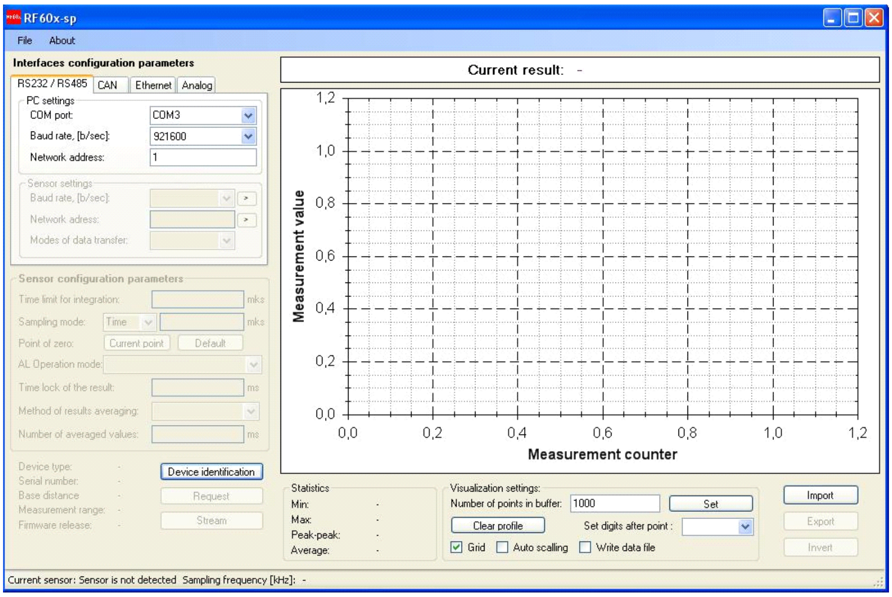
The **RF60X-SP** software is intended for:
1) Testing and demonstration of work of RF605 series sensors.
2) Setting of the sensor parameters.
3) Reception and gathering of the sensor data signals.
Download link:
https://riftek.com/upload/iblock/cb3/rf60x_sp.ZIP

14.2. Program setup

Start **RF60Xsetup.exe** and follow the instructions of the installation wizard.

14.3. Establishing a connection to the sensor

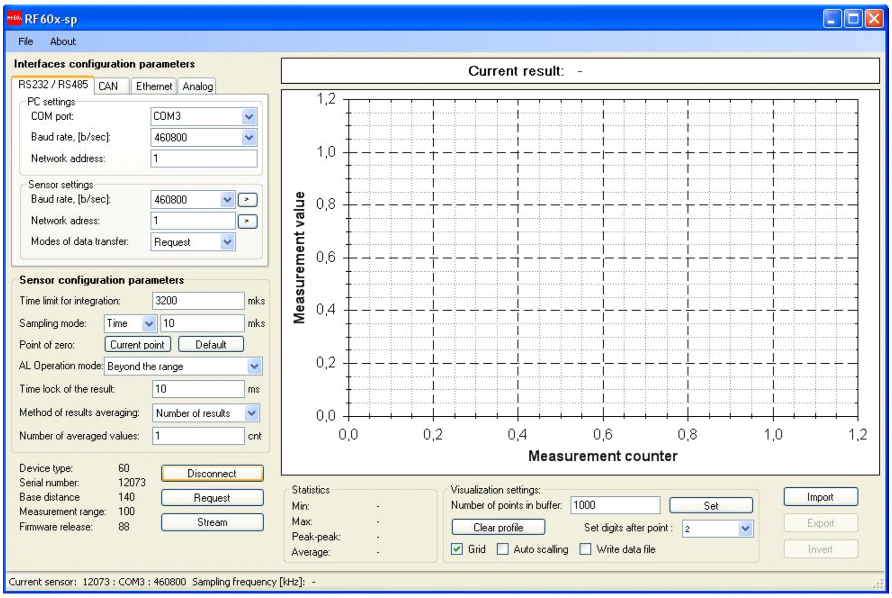
After starting the program, the main window appears:



To establish a connection, go to the **RS232/RS485** tab and do the following:

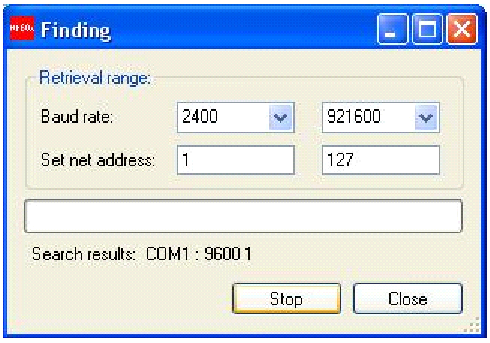
- Select the COM port to which the sensor is connected (virtual port if the sensor is connected via a USB adapter).
- Select the baud rate at which the sensor operates.
- Select the network address of the sensor, if necessary.
- Click the **Device identification** button.

If the specified parameters correspond to the parameters of the sensor interface, the program will identify the sensor, read and display its configuration parameters:



If the connection is not established, a prompt will appear asking to make an automatic search for the sensor:

Click **Yes** to start searching.



- In the **Baud rate** field, set the baud rate search range.
- In the **Net address** field, set the network address search range.
- Click the **Search** button

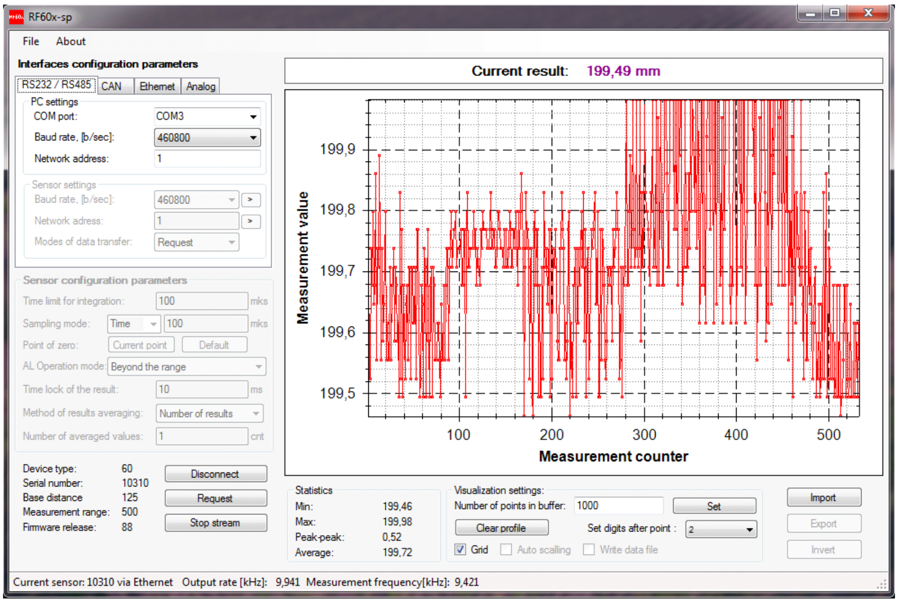
The program will perform an automatic search for the sensor by searching over possible baud rates, network addresses and COM ports.

14.4. Checking the sensor operability

Once the sensor is successfully identified, check its operability as follows:

- Place the object within the working range of the sensor.
- Click the **Request** button to obtain the result of one measurement in the **Current result** panel. The request type 06h is realized (see par. 13.1).
- Click the **Stream** button to switch the sensor to the data stream transmission mode. The request type 07h is realized (see par. 13.1).
- By moving the object, observe changes in the readings.
- The status bar at the bottom of the window displays the current data transmission rate and data update rate.

Clicking the **Stop stream** button stops the data transfer.



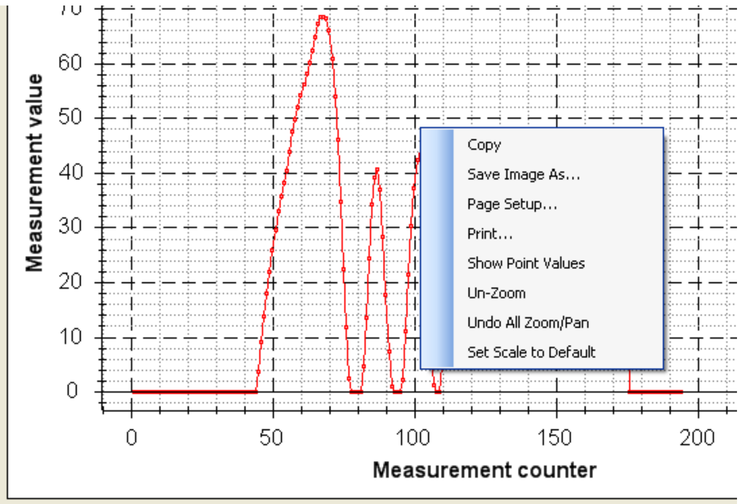
14.5. Display, gathering and viewing of data

The measurement results are displayed in digital form and in the form of oscillogram, and stored in the PC memory.

- The number of points displayed along the X coordinate can be set in the **Number of points in buffer** window.
- The method of scaling along the Y coordinate can be set using the **Auto scaling** function.
- Turning on/off the scaling grid is done using the **Grid** function.
- The number of displayed digits after the decimal point can be set in the **Set** window.
- To save the received data to a file, select **Write data file**.

Note. The number of points displayed on the graph depends on PC speed and becomes smaller in proportion to the data transmission rate. After the stream is stopped using the **Stop Stream** button, all received data will be displayed on the graph.

- To work with the image, right-click on the graph to open the menu:



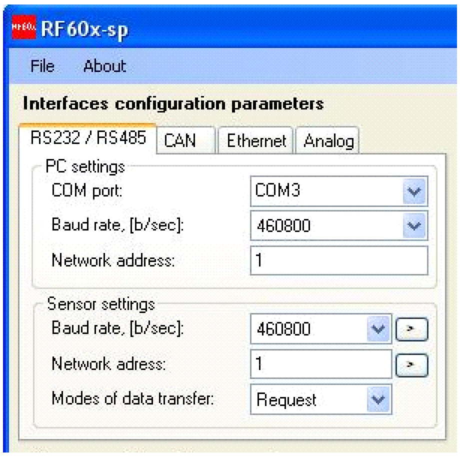
- To move the image, use the right mouse button.
- To zoom in/out the image, rotate the mouse wheel. The area to be zoomed in/out is selected by pressing the left mouse button.

- To save the data to a file, click the **Export** button. The program will offer to save the data in two possible formats: internal and Excel.
- To view previously saved data, click the **Import** button and select the file.

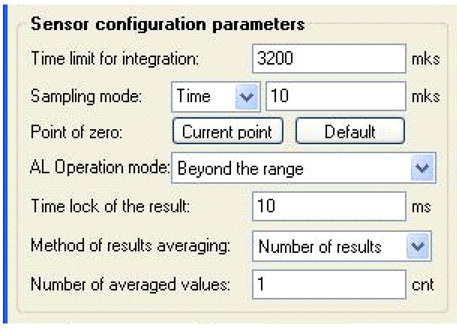
14.6. Setting and saving parameters of the sensor

14.6.1. Setting parameters

To configure the interface parameters, go to the **RS232/RS485** tab of the **Interfaces configuration parameters** panel:



Sensor parameters can be configured on the **Sensor configuration parameters** panel:

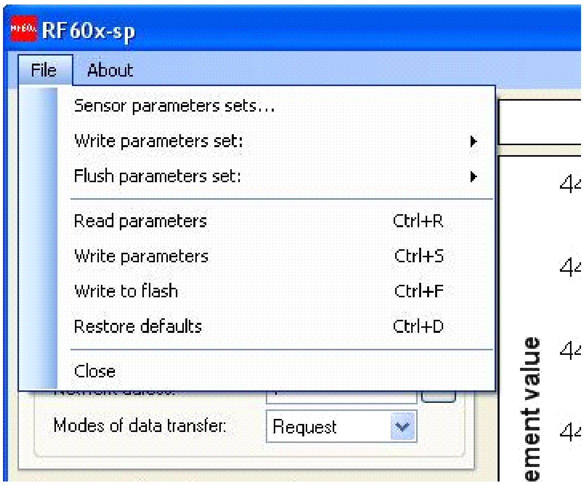


14.6.2. Saving parameters

- After setting one or several parameters as required, it is necessary to write them to the memory of the sensor. To do this, select **File > Write parameters**.

Note. Quick writing of RS232/RS485 interface parameters is carried out by a special button .

- Test the sensor operation with the new parameters.
- To save the new parameters to non-volatile memory of the sensor, select **File > Write to flash**. Now, with any subsequent activation of the sensor, it will work in the configuration you have selected.



14.6.3. Saving and writing a group of parameters

The sensor parameters can be saved to a file. To do this, select **File > Write parameters set**.

To call a group of parameters from a file, select **File > Sensor parameters sets…** and select the required file.

Note. These functions are useful if you need to write the same parameters to several sensors.

14.6.4. Recovery of default parameters

To restore default sensor settings, select **File > Restore defaults**.

15. RFDevice SDK

To work with laser sensors, we offer the RFDevice SDK library. This library allows users to develop their own software products without going into the details of the sensor communication protocol.

The RFDevice SDK library contains an API for working with all the company's products and includes:

- Documentation on classes and methods.
- Support for MSVC and BorlandC for Windows, Linux, Wrapper C#, Wrapper Delphi.
- Examples for C#, Delphi, LabView, MATLAB.

Download link:
https://riftek.com/upload/iblock/a1a/RFDevice_SDK.ZIP

16. Technical support

Technical assistance related to incorrect work of the sensors and to problems with the software is free. Requests for technical assistance should be sent to support@riftek.com.

17. Warranty policy

Warranty assurance for the Laser Triangulation Sensors RF605 – 24 months from the date of putting in operation; warranty shelf-life – 12 months.

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