## 1. 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.

## 2. BASIC TECHNICAL DATA AND PERFORMANCE CHARACTERISTICS

| RF605- | | 25/50 | 45/100 | 65/250 | 105/500 |
|---|---|---|---|---|---|
| Base distance, X, mm | | 25 | 45 | 65 | 105 |
| Working range, mm | | 50 | 100 | 250 | 500 |
| Linearity, % | | ±0.2 of the range | | | |
| Resolution, % | | 0.03 of the range | | | |
| Maximum sampling rate, kHz | | 2 | | | |
| Laser type | | Class 2, <1 mW, 660nm | | | |
| Output signal | digital | RS232 (kbit/s max) or RS485 (kbit/s max) | | | |
| | analog | 4…20 мА (≤500 Ω load) or 0…10 В | | | |
| Synchronization input | | 2,4 – 5 В (CMOS, TTL) | | | |
| Power Supply, V | | 24 (9…38) | | | |
| Alarm output | | NPN: 100 mA max; 40 V max | | | |
| Power consumption, W | | <1 | | | |
| Enclosure rating | | IP67 | | | |
| Operating temperature, °C | | -10…+60 | | | |
| Weight (without cable), g | | 70 | | | |

**Note:** All specifications apply for a diffusely reflecting white paper

**CE compliance.**

The sensors are designed for use in industry and are in compliance with the following standards:

- EN55022:2006 Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement:
- EN61000-6-2:2005 Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments
- EN61326-1:2006 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements

The sensors fulfil the specification of the EMC requirements, if the instructions in the manual are followed.

## 3. EXAMPLE OF ITEM DESIGNATION WHEN ORDERING

RF605-X/L-SERIAL-OUT-IN-AL-CC-M

| Symbol | Description |
|---|---|
| X | base distance (beginning of the range) in mm |
| L | operating range in mm |
| SERIAL | type of the serial interface (RS232 or RS485 or RS232&CAN) |
| OUT | attribute showing the presence of Current Loop (I) or U output<br>**Note:** only for the sensors with RS232 or RS485 |
| IN | trigger input (input of synchronization) |
| AL | This signal is of dual purpose. It can be used as:<br>1) logical output; ("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))<br>2) line of mutual synchronization for two and more sensors |
| CC | Cable gland – CG or socket + cable - CC (Binder 702, IP67, ) |
| M | Cable length in m |


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**For example**: RF605-65/250-232-I-CC-3 –base distance – 65 mm, range – 250 mm, serial port - RS232, 4…20 mA output available, socket + cable, 3 m.

## 4. STRUCTURE AND OPERATING PRICIPLE

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. A signal processor 5 calculates the distance to the object from the position of the light spot on the array 4.

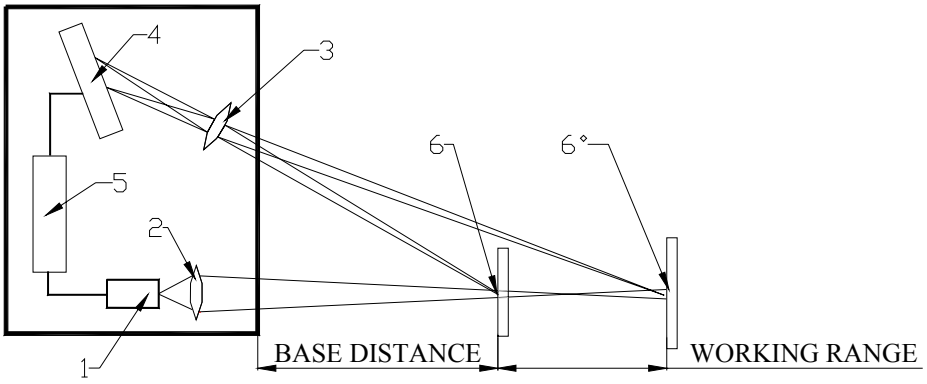


**Figure 1.**

## 5. OVERALL AND MOUNTING DIMENSIONS

**5.1.** Overall and mounting dimensions of the sensor are shown in Figure 2. Sensor package is made of anodized aluminum. The front panel of the package has output window. The package also contains mounting holes.

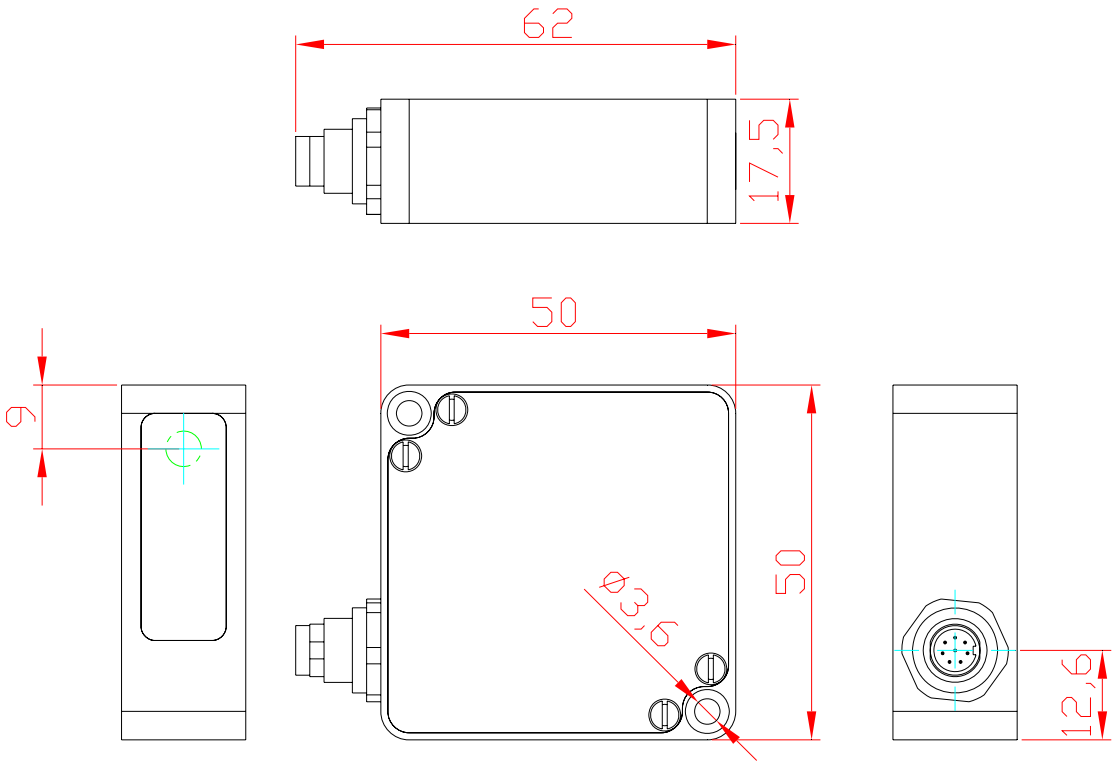


**Figure 2.**


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

## 6. CONNECTION

| Model | Symbols | D-sub 9-pin (fem) | Wire color |
|---|---|---|---|
| 232-U/I-IN-AL | Power U+ | - | Red |
| | Power U- | - | Brown |
| | TXD | 2 | Green |
| | RXD | 3 | Yellow |
| | U/I | - | Blue |
| | IN | - | White/Violet |
| | AL | - | Pink/Orange |
| | Gnd (Common for signals) | 5 | Grey/Black |
| 485-U/I-IN-AL | Power U+ | - | Red |
| | Power U- | - | Brown |
| | DATA+ | - | Green |
| | DATA- | - | Yellow |
| | U/I | - | Blue |
| | IN | - | White/Violet |
| | AL | - | Pink/Orange |
| | Gnd (Common for signals) | - | Grey/Black |

## 7. OPERATION MODES AND CONFIGURATION PARAMETERS.

**7.1**. Measurement data from sensors can be obtained through serial interface and/or on the analog output. Through the serial interface measurement data can be obtained by both single requests (inquiries) and by automatic data streaming (see Section 7, 'Description of serial interface'). When RS485 interface are used, several sensors can be connected to the data collection device through 'common bus' circuit (network operation mode).

**7.2.** The nature of operation of the sensor governs its configuration parameters (operation modes), which can be changed by transmission of commands through serial port. The basic parameters are as follows:

**Sampling period** — specifies the time interval (internal synchronization) or divider ratio of the trigger synchronization input for automatically refreshment of measurement results by the sensor. The value of the time interval is set in increments of 0.01 ms. If serial interface is used to receive the result and the time intervals set are small, the time required for data transmission at the selected data transfer rate should be taken into account. If the transfer time exceeds the sampling period, it wills this parameter, which will determine the data transfer rate.

**Sampling mode** — specifies the type of sampling

- Time Sampling or
- Trigger Sampling

With *sampling by time* selected, the sensor automatically transmits the measurement result via serial interface in accordance with selected time interval (sampling period).

With *sampling by external input* is selected, the sensor transmits the measurement result when external synchronization input is switched and taking *the division factor* set into account.


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**Range of the analog output** (beginning and end of the range of analog output). While working with the analog output, resolution can be increased by using the 'Window in the operating range' function which makes it possible to select a window of required size and position in the operating range of the sensor within which the whole range of analog output signal will be scaled.

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

**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 whole range of the analog output is automatically scaled onto the whole operating range of the sensor (sensitivity range).

**Logical output mode and mutual synchronization mode.**

*Logical output* can be used for

- 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)
- mutual synchronization of two or more sensors.

Selection of the mutual synchronization mode makes it possible to synchronize measurement times of two and more sensors. This mode is convenient to use for control of one object with several sensors, for example, when thickness is to be measured. On hardware level, sensor synchronization is carried out by combining AL lines.

**Time of lock of the result**. If the sensor does not find out object or if the authentic result cannot be received, zero value is transferred. The given parameter sets time during which is transferred the last authentic result instead of zero value

**Number of averaged values** specifies the number of source results to be averaged for deriving the output value. Source data are stored in a circular buffer, and new mean value is calculated each time the new result arrives; therefore, the output may regarded as a moving average.

The refreshment of the result through the analog output is also controlled by the two parameters described above.

**Time limit for integration.** Intensity of the reflected radiation depends on the surface quality of objects under control. Therefore, the time of integration of radiation incident onto the CMOS-array is automatically adjusted to achieve maximum measurement accuracy. This parameter specifies maximum allowable time of integration. If the radiation intensity received by the sensor is so small that no reasonable result is obtained within the time of integration equal to the limiting value, the sensor transmits a zero value. Increasing of this parameter expands the possibility of control of low-reflecting (diffuse component) surfaces; at the same time this leads to reduction of data refreshment rate and increases the effects of exterior light (background) on the measurement accuracy. Factory setting of the limiting time of integration is 1300 us.

**Level of laser output power.** By changing this parameter it is possible to switch the sensor to operation with minimum limiting time of integration (maximum operation speed) for particular surfaces.

**The point of zero** - sets a zero point of absolute system of coordinates in any point within the limits of a working range.


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**The reserved parameters are used for the sensors setting. Change of these parameters can lead to infringement of sensor calibration.** Correct change of parameters is made with the help **of the installation program** supplied with the sensor**.**

## 8. DESCRIPTION OF SERIAL INTERFACE (RS232 or RS485)

**8.1.** The hardware port RS232 allows sensor to be connected directly to a computer.

**8.2.** In accordance with the protocol accepted and hardware capability, the RS485 port makes it possible to connect up to 127 sensors to one data collection unit by a common bus circuit.

**8.3.** Network data communications protocol assumes the presence of 'master' in the net, which can be a computer or other information-gathering device, and from 1 to 127 'slaves' (RF605 Series sensors) which support the protocol. Each 'slave' is assigned a unique network identification code – a device address. The address is used to form requests or inquiries all over the net. Each slave receive inquiries containing its unique address as well as '0' address which is broadcast-oriented and can be used for formation of generic 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).

**8.4.** Serial data transmission format:

1-start bit,8-data bits,1-odd bit,1-stop bit.

Odd bit is complementary to 8-data bits for oddness.

**8.5.** The communications protocol is formed by communication sessions, which are only initiated by the 'master'. There are two kinds of sessions:

1) 'inquiry',['message'] — ['answer'], square brackets include optional elements
2) 'inquiry' — 'data stream' — ['inquiry'].

'Inquiry' (INC) is a two-byte message, which fully controls communication session. The 'inquiry' message is the only one of all messages in a session where most significant bit is set at 0; therefore, it serves to synchronize the beginning of the session. In addition, it contains the device address (ADR), code of inquiry (COD) and, optional, the message (MSG).

The 'inquiry' format: INC0(7:0),INC1(7:0) = 0,ADR(6:0),1,0,0,0,COD(3:0), [MSG].

'Message' and 'answer' are data bursts that can be transmitted by 'master' or by 'slave' in the course of the session, respectively. 'Data stream' is an infinite sequence of data bursts or batches transmitted from 'slave' to 'master', which can be interrupted by a new inquiry. In transmission of 'data stream' one of the 'slaves' fully holds data transfer channel, therefore, when 'master' produces any new inquiry sent to any address, data streaming process is stopped. Also, there is a special inquiry to stop data streaming.

**8.6.** Message transfer.

All messages with a message burst contain 1 in the most significant digit. Data in a message are transferred in tetrads. When byte is transmitted, lower tetrad goes first, and then follows higher tetrad. When multi-byte values are transferred, the transmission begins with lower byte. The following is the format of two 'message' data bursts for transmission of byte DAT(7:0):

Dt0(7:0);Dt1(7:0) = 1,0,0,0,DAT(3:0);1,0,0,0,DAT(7:4).

**8.7**. Answer transfer (for the 01h…04h enquiry codes).

All messages with a message burst contain 1 in the most significant digit. Data in a message are transferred in tetrads. When byte is transmitted, lower tetrad goes first, and then follows higher tetrad. When multi-byte values are transferred, the transmission begins with lower byte.

When 'answer' is transmitted, the message contains three 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 batch counter is incremented by the sending of each burst and is used for formation (assembly) of


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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 transmission of byte DAT(7:0):

Dt0(7:0);Dt1(7:0) = 1,CNT(2:0),DAT(3:0);1,CNT(2:0),DAT(7:4).

**8.8.** Result transfer. An answer is formed as in 8.7.

**8.9.** Types of inquiries.

| Inquiry code | Description | Message (size in bytes) | Answer (size in bytes) |
|---|---|---|---|
| 01h | Device identification | — | –device type (1)<br>–modification (1)<br>–serial number (2)<br>–base distance (2)<br>–range (2) |
| 02h | Reading of parameter | - code of parameter (1) | - value of parameter (1) |
| 03h | Writing of parameter | - code of parameter (1)<br>- value of parameter (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 | — | — |

**8.10.** List of parameters

| Code of parame-ter | Name | Values |
|---|---|---|
| 00h | Sensor ON | 1 — laser is ON, measurements are taken (default state);<br>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 | Sampling and synchronization con-trol | x,x,x,x,x,M,R,S – control byte which determines logical output regime, bit M, analog output regime, bit R, and sampling regime, bit S;<br>bites x – do not use;<br>bit M:<br>0 – out of the range indication (by default):<br>1 – mutual synchronization regime.<br>bit R:<br>0 – window regime (default);<br>1 – full range.<br>bit S:<br>0 – time sampling (default)<br>1 – trigger sampling |
| 03h | Network address | 1…127 (default — 1) |
| 04h | Rate of data transfer through serial port | 1…192, (default — 4) specifies data transfer rate in increments of 2400 baud; e.g., 4 means the rate of 4×2400=9600baud. (**NOTE**: max baud rate = 460800) |
| 05h | Laser intensity level | 0…31 |
| 06h | Number of averaged values | 1…128, (default — 1) |
| 07h | | **Reserved** |
| 08h | Lower byte of the sampling period | 1) 10…65535, (default — 500) |


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| | | |
|---|---|---|
| 09h | Higher byte of the sampling period | the time interval in increments of 0.01 ms with which sensor automatically communicates of results on streaming inquiry (priority of sampling = 0);<br>2) 1…65535, (default — 500)<br>divider ratio of trigger input with which sensor automatically communicates of result on streaming inquiry (priority of sampling = 1) |
| 0Ah | Lower byte of maximum integration time | 2…65535, (default — 200) specifies the limiting time of integration by CMOS-array in increments of 1mks |
| 0Bh | Higher byte of maximum integration time | |
| 0Ch | Lower byte for the beginning of analog output range | 0…4000h, (default — 0) specifies a point within the absolute range of transducer where the analog output has a 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 — 4000h) ) specifies a point within the absolute range of transducer where the analog output has a maximum value |
| 0Fh | Higher byte for the end of analog output range | |
| 10h | Time lock of result | 0…255, specifies of time interval in increments of 5 mc |
| 11…16h | | **Reserved** |
| 17h | Lower zero point | 0…4000h, (default — 0) specifies beginning of absolute coordinate system. |
| 18h | Higher byte zero point | |

**8.11. NOTE**:

1) All values are given in binary form.

2) Base distance and range are given in millimeters.

3) 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:

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

4) On special inquiry (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 inquiry can be sent simultaneously to all sensors in the net in the broadcast mode in order to synchronize data pickup from all sensors.

5) When working with the parameters, it should be borne in mind that when power is OFF the parameter values are stored in nonvolatile FLASH-memory of the sensor. When 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.

6) 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

**8.12.** Examples of communication sessions:

1) Condition: request for device identification. Device address —1, inquiry code – 01h, device type —61h, modification —00h, serial number —0402 (0192h), base distance —80 mm (0050h), range —50 mm (0032h), burst number —1.

The ‘inquiry’ format:

INC0(7:0),INC1(7:0) = 0,ADR(6:0),1,0,0,0,COD(3:0), [MSG]. (SEE 7.5)

Inquiry (‘master’) — 01h;81h (INC0(7:0)=0,ADR=0000001,INC1(7:0)=1,0,0,0,COD=0001)

The following is the format of two ‘answer’ data bursts for transmission of byte DAT(7:0) (SEE 7.6):

Dt0(7:0);Dt1(7:0) = 1,CNT(2:0),DAT(3:0);1,CNT(2:0),DAT(7:4)

Answer (‘slave’) — 91h, 96h (device type), 90h, 90h (modification), 92h, 99h, 91h, 90h (serial number), 90h, 95h, 90h, 90h (base distance), 92h, 93h, 90h, 90h (range)


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(note: as bust number =1, then CNT=1)

2) Condition: request for reading of parameter. Device address —1, inquiry code – 02h; parameter code —05h, parameter value —04h, burst number —2.
Inquiry (‘master’) — 01h, 82h;
Message (‘master’) — 85h, 80h;
Answer (‘slave’) — A4h, A0h

3) Condition: request for result, device address —1, inquiry code – 06h, result value —02A5h, burst number —3.
Inquiry (‘master’) — 01h, 86h;
Answer (‘slave’) — B5h, BAh, B2h, B0h

The displacement (mm) is equal (for example, range of the sensor = 50 mm):

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

4) Condition: writing sampling regime (trigger sampling). Device address – 1, inquiry code – 03h, parameter code – 02h, parameter value – 01h.
Inquiry (‘master’) — 01h, 83h;
Message (‘master’) — 82h, 80h; 81h; 80h

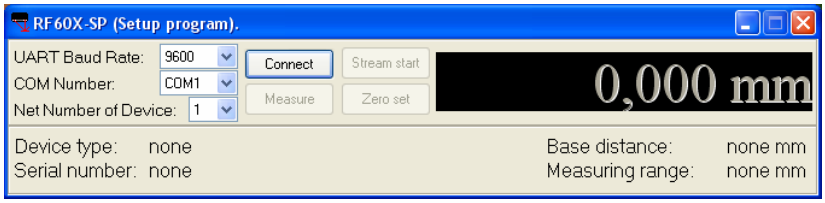
5) Condition: writing the divider ratio, for example, 12345=3039h. Device address – 1, inquiry code – 03h, parameter code – 09h (first of all, higher byte), parameter value – 30h
Inquiry (‘master’) — 01h, 83h;
Message (‘master’) — 89h, 80h; 80h; 83h
and, for lower byte, parameter code – 08h, parameter value – 39h:
Inquiry (‘master’) — 01h, 83h;
Message (‘master’) — 88h, 80h; 89h; 83h

## 9. SETUP PROGRAM

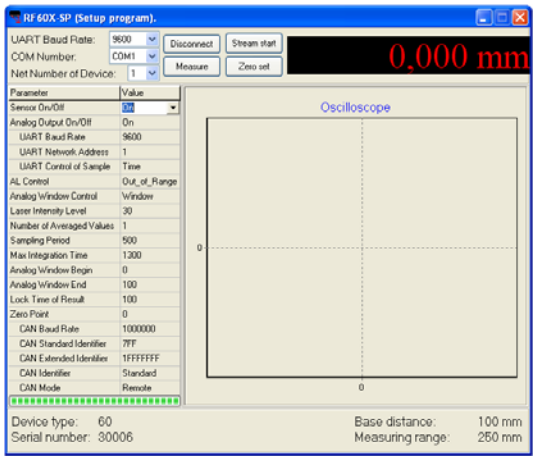
**9.1.** The "RF60X-SP" software package (www.riftek.com/resource/files/rf60x_sp.zip ) is intended for:

1) testing and demonstration of operation of RF605-series sensors;
2) setting sensor parameters;
3) reception and storage of data;

**9.2.** Upon starting the program the working window appears:




1. In the line “UART Baud rate” select sensor operation speed (factory setting – 9600 bit/s),
2. In the line “COM number” select PC RS232 port number where sensor is connected.
3. The line “Net number of device” defines sensor network address (factory setting for all sensors – "1")
4. Upon clicking the “Connect” button, RF60X-SP will attempt to establish communication with sensor with parameters selected as above. If it fails, a ‘communication error’ message is displayed.
5. If communication is successfully established the window changes its form to the following:




1) In the line "Device Type" the sensor model is displayed
2) In the line "Serial number", a serial number of the sensor is displayed
3) In the line "Base distance", base distance of the sensor is displayed
4) In the line "Measuring range", the sensor working range is displayed

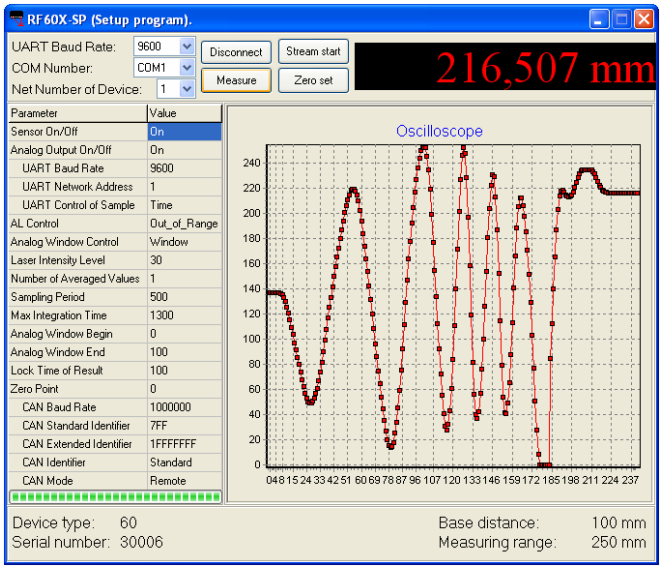
**9.3.** After communication has been successfully established, it is possible to check sensor performance. To do so

1) Place an object within the sensor operating range.

2) Pressing "Measure" button displays the results of measurement of object position on the indication panel and "Oscilloscope" panel. The "Oscilloscope" window shows graphic representation of the accumulated data. (X-axis – time (Time Sampling Mode) or number of the result (Trigger Sampling Mode), Y-axis – coordinates). The 06h request type is realized in this case (see par. 8.9)

3) Pressing "Stream start" button enables measurement mode with sampling by time in accordance with the selected Sampling Period parameter. The 07h request type is realized in this case (see par. 8.9).

4) By moving the object within the operating range, observe changes of readings on the display and oscilloscope.




5) Clicking of the "Stop"/"Stream stop" button deactivates the data transfer.

6) Data coming from the sensor are accumulated and stored in a circular buffer with 10000 measurements storage capacity.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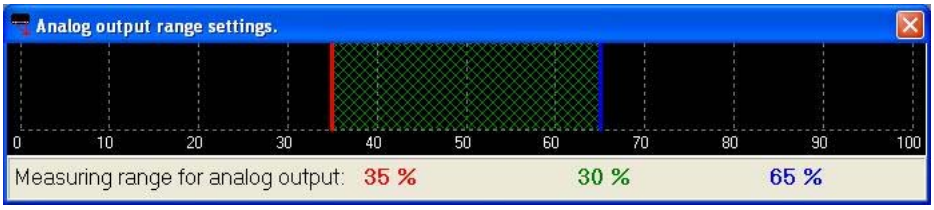
7) By clicking left key of the mouse scale of the graphic can be changed, the right key is used to drag the graphic image within viewing region. By clicking the right key "Save to the file" menu is activated.

**9.4. Setting parameters of the sensor**

The opening part of the "RF60X-SP" application ("Parameter – Value Table ") allows one to edit and enter the required parameters into both RAM and FLASH memory of the sensor.

- to switch ON/OFF the sensor, click the left mouse key twice in the 'Value' field of the 'Sensor On/Off' parameter;
- to enable/disable the analog output, click the left mouse key twice in the 'Value' field of the 'Analog Output On/Off' parameter;
- to set sampling mode ("UART Control of Sample"), press the key in the "Value" field and select the mode;
- to set the exchange speed, click the left mouse key in the 'Value" field of the 'UART Baud rate' line, thus calling out the list of permissible speeds;
- in the "UART Network Address" line set the net address of the sensor;
- in the line "AL Control" set AL output regime;
- in the 'Laser intensity level' line, the laser output power level can be selected (mW);
- in the 'Averaged values counter' line, select the number of measurements to be averaged directly in the sensor. Factory setting is "0";
- in the 'Sampling period' line, sampling period in 0.1 ms increments is selected;
- in the 'Max integration time' filed, it is possible to set the limiting integration time for the ruler (in microseconds);
- in the lines "Analog Range Begin" и "Analog Range End", it is possible to set the analog output window boundaries in increments of 1% of the working range. Call out the control toolbar by clicking twice in the 'Value' field:




Pressing the left mouse key activates red cursor which indicates the beginning of the scaling range, while pressing the right mouse key activates blue cursor indicating the end of the scaling range. To set up working window boundaries, press the respective button and, holding it in the pressed position, move the cursor within the sensor measurement region. Then, boundaries of the selected window will be displayed in the lower line in % (percentage) of the range.

- in the 'lock time of result' line, select the time interval in increments of 5 ms after which the sensor generates the measurement result as the object comes into the working range and keeps the last measurement result on the display as the object goes out of the working range;
- in the 'Zero point' line, select the origin of coordinates in units of 0.1% of the range, or by pressing the 'Measure' button place the object in the required point of the working range and press the 'Zero set' key. Now, the origin of coordinates will correspond to the point selected by you;

1) By clicking the right key of the mouse on the left panel "Parameters save" menu is activated. Select 'Load' (to store one parameter) or 'Load All' (to store all parameters).
2) Perform testing of the sensor operation with new parameters.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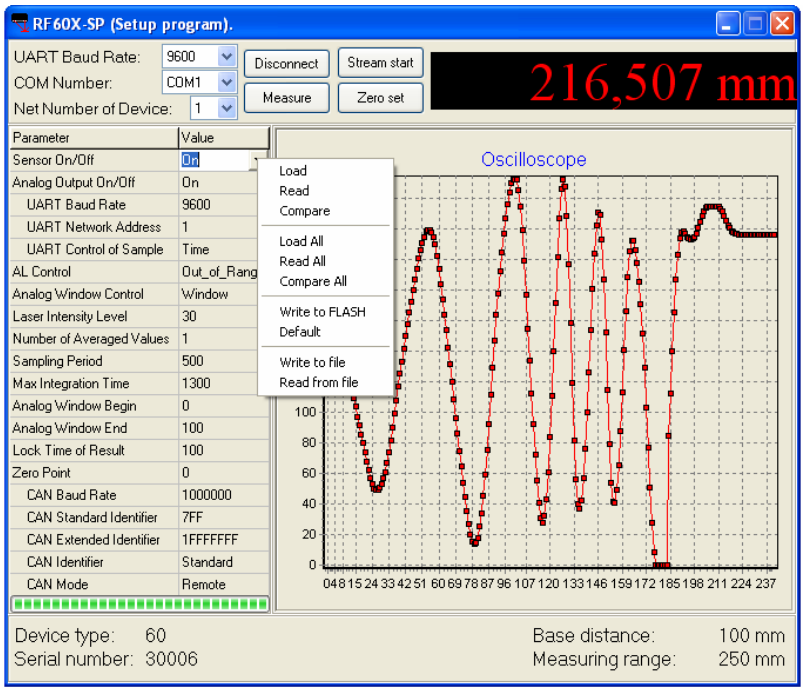
3) To store the new parameters in the sensor memory, click the "Write to FLASH" of "Parameters save" menu. The sensor will operate with these parameter settings in subsequent switched on.
4) To choose default sensor parameters, select "Default".
5) To save sensor parameters on the disk, select "Write to file".
6) To read sensor parameters from the disk, select "Read from file".




## 10. RF60X-SDK. FUNCTIONS DESCRIPTION

Laser sensor is supplied together with SDK (www.riftek.com/resource/files/rf60x-sdk_eng.zip) consisting of:

- dynamic library RF60x.dll,
- file for static linking of DLL to project RF60x.lib,
- definition file RF60x.h.

The SDK allows user to develop his own software products without going into details of the sensor communications protocol.

### 10.1. Connection to COM-port (RF60x_OpenPort)

```
BOOL RF60x_OpenPort(
        LPCSTR    lpPort_Name,
        DWORD         dwSpeed,
        HANDLE *  lpHandle
);
```

The function **RF60x_OpenPort** opens COM-port with specified symbolic name, fills in the pointer to the device descriptor and returns the operation result:

**Parameters:**

*lpPort_Name* – name of COM-port (e.g., “COM1:”), full syntax for COM-port name specification see in MSDN, function CreateFile;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*dwSpeed* - operation speed through COM-port. The parameter is identical to field BaudRate in DCB structure described in MSDN;
*lpHandle* - pointer to the device descriptor;

**Returned value:**
If COM-port fails to be opened and adjusted, the function will return FALSE, otherwise if COM-port was opened and adjusted successfully the function will return TRUE. More detailed information about returned errors can be obtained using API function GetLastError described in MSDN.

### 10.2. Disconnection from COM-port (RF60x_ClosePort).

The function **RF60x_ClosePort** closes COM-port and returns the operation result:

```
BOOL RF60x_ClosePort(
        HANDLE          hHandle
);
```

**Parameters:**
*hHandle* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

**Returned value:**
If COM-port fails to be closed, the function will return FALSE, otherwise if COM-port was closed successfully, the function will return TRUE.

### 10.3. Device identification (RF60x_HelloCmd).

The function **RF60x_HelloCmd** makes identification of RF60x according to net address and fills ***RF60xHELLOANSWER*** structure:

```
typedef struct _RF60x_HELLO_ANSWER_ {
    BYTE      bDeviceType;
    BYTE      bcDeviceModificaton;
    WORD      wDeviceSerial;
    WORD      wDeviceMaxDistance;
    WORD      wDeviceRange;
```

There:

`bDeviceType` – one byte value, which shows type of the device (for RF60x this value is equal 60) (type **BYTE**);
`bDeviceModificaton` – one byte value, which shows device modification (type **BYTE**);
`wDeviceSerial` – two byte value, which contains serial number of the device (type **WORD**);
`wDeviceMaxDistance` – two byte value, which contains the base distance of RF60X sensor (type **WORD**);
`wDeviceRange` – two byte value, which contains the measurement range of RF60X sensor (tpe **WORD**).


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```
BOOL RF60x_HelloCmd (
          HANDLE                hCOM,
          BYTE                  bAddress,
          LPRF60xHELLOANSWER    lprfHelloAnswer
);
```

**Parameters:**

*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

*bAddress* - device address;

*lprfHelloAnswer* - pointer to the RF60xHELLOANSWER structure.

**Returned value:**

If the device does not respond to identification request, the function returns FALSE, otherwise the function returns TRUE and fills variable **RF60xHELLOANSWER** structure.

### 10.4. Reading of parameters (RF60x_ReadParameter)

The function **RF60x_ReadParameter** reads internal parameters of the RF605 sensor and returns the current value to the parameters address:

```
BOOL RF60x_ReadParameter (
          HANDLE                hCOM,
          BYTE                  bAddress,
          WORD                  wParameter,
          DWORD *               lpdwValue
);
```

**Parameters:**

*hCOM* – descriptor of the device obtained from function RF60x_OpenPort, or CreateFile;

*bAddress* - address of the device;

*wParameter* - number of parameter, see Table 1,

Table 1

| Parameter | Description |
|---|---|
| RF60x_PARAMETER_POWER_STATE | Power status of sensor |
| RF60x_PARAMETER_ANALOG_OUT | Connection of analog output |
| RF60x_PARAMETER_SAMPLE_AND_SYNC | Control of sampling and synchronization |
| RF60x_PARAMETER_NETWORK_ADDRESS | Network address |
| RF60x_PARAMETER_BAUDRATE | Data transmission rate through serial port |
| RF60x_PARAMETER_LASER_BRIGHT | Laser brightness |
| RF60x_PARAMETER_AVERAGE_COUNT | Number of averaged values |
| RF60x_PARAMETER_SAMPLING_PERIOD | Sampling period |
| RF60x_PARAMETER_ACCUMULATION_TIME | Maximum accumulation time |
| RF60x_PARAMETER_BEGIN_ANALOG_RANGE | Beginning of analog output range |
| RF60x_PARAMETER_END_ANALOG_RANGE | End of analog output range |
| RF60x_PARAMETER_RESULT_DELAY_TIME | Result delay time |
| RF60x_PARAMETER_ZERO_POINT_VALUE | Zero point value |

*lpdwValue* - pointer to WORD-type variable where current parameter value will be saved.

**Returned value:**
If the device does not respond to parameter reading request, the function returns FALSE, otherwise the function returns TRUE and fills variable *lpdwValue*.

### 10.5. Saving current parameters in FLASH-memory (RF60x_FlushToFlash).

Function **RF60x_FlushToFlash** saves all parameters in the FLASH-memory of the RF605 sensor:

```
BOOL RF60x_FlushToFlash(
          HANDLE    hCOM,
          BYTE      bAddress
);
```

**Parameters:**
*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;
*bAddress* - address of the device.

**Returned value:**
If the device does not respond to request to save all parameters in the FLASH-memory, the function returns FALSE, otherwise, if record confirm is obtained from the sensor, the function returns TRUE.

### 10.6. Restoration of default parameters from FLASH-memory (RF60x_RestoreFromFlash).

The function **RF60x_RestoreFromFlash** restores all parameter values in the FLASH by default:

```
BOOL RF60x_RestoreFromFlash(
               HANDLE          hCOM,
               BYTE            bAddress
);
```

**Parameters:**
*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;
*bAddress* - address of the device.

**Returned value:**

If the device does not respond to request to restore all parameters in the FLASH-memory, the function returns FALSE, otherwise, if restore confirm is obtained from the sensor, the function returns TRUE.

### 10.7. Latching of the current result (RF60x_LockResult)

The function **RF60x_LockResult** restores all parameter values in the FLASH by default:

```
BOOL RF60x_LockResult(
          HANDLE          hCOM,
          BYTE            bAddress
);
```

**Parameters:**
*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

*bAddress* - address of the device.

**Returned value:**

If the device does not respond to result-latching request, the function returns FALSE, otherwise the function returns TRUE.

### 10.8. Getting measurement result (RF60x_Measure)

The function **RF60x_Measure** reads current measurement value from the RF605 sensor. The result value (D) transmitted by the sensor is normalized in such a way as the value of 4000h (16384) corresponds to full range of the sensor (S в мм), the result in mm is obtained by the following formula: X=D*S/4000h (mm) :

```
BOOL RF60x_Measure(
          HANDLE          hCOM,
          BYTE            bAddress,
          USHORT *        lpusValue
);
```

**Parameters:**

*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

*bAddress* - address of the device.

*lpusValue* - pointer to USHORT/WORD-type variable containing the result D.

**Returned value:**

If the device does not respond to result request, the function returns FALSE, otherwise, if the restore confirm is obtained from the sensor, the function returns TRUE.

### 10.9. Starting measurement stream (RF60X_StartStream)

The function **RF60x_StartStream** switches RF605 sensor to the mode where continuous transmission of measurement results takes place:

```
BOOL RF60x_StartStream(
          HANDLE          hCOM,
          BYTE            bAddress
);
```

**Parameters:**

*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

*bAddress* - address of the device.

**Returned value:**

If the device fails to be switched to continuous measurement transmission mode, the function returns FALSE, otherwise the function returns TRUE.

### 11.10. Stopping measurement stream (RF60x_StopStream)

The function **RF60x_StopStream** switches the sensor from continuous measurement transmission mode to the “request-response” mode:

```
BOOL RF60x_StartStream(
          HANDLE          hCOM,
          BYTE            bAddress
);
```


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**Parameters:**

*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

*bAddress* - address of the device.

**Returned value:**

If the device fails to be stopped in the continuous data transmission mode, the function returns FALSE, otherwise the function returns TRUE.

### 10.11. Getting measurement results from the stream (RF60X_GetStreamMeasure)

The function **RF60x_GetStreamMeasure** reads data from the COM-port input buffer which are received from RF605 sensor after successful execution of the RF60xX_StartStream function. The data arrive in the buffer at a rate specified in the RF605 sensor parameters. Since depth of the input buffer is limited to 1024 bytes, it is preferable to read data with periodicity uqual to that specified in the RF605 sensor parameters. The parameter *lpusValue* is identical to the parameter *lpus-Value* in the RF60x_Measure function.

```
BOOL RF60x_GetStreamMeasure(
        HANDLE              hCOM,
        USHORT *            lpusValue
);
```

**Parameters:**

*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

*lpusValue* - pointer to USHORT/WORD-type variable containing the result D.

**Returned value:**

If there are no data in the buffer, the function returns FALSE, otherwise the function returns TRUE and fills the value *lpusValue*.

### 10.12. Transmission of user data (RF60x_CustomCmd)

The function **RF60x_CustomCmd** is used for transmission and/or reception of data from in RF605 sensor parameters RF605.

```
BOOL RF60x_CustomCmd(
        HANDLE          hCOM,
        char *          pcInData,
        DWORD               dwInSize,
        char *          pcOutData,
        DWORD *         pdwOutSize
);
```

**Parameters:**

*hCOM* – descriptor of the device obtained from function RF60x_OpenPort or CreateFile;

*pcInData* - pointer to data array which will be transmitted to RF605 sensor. If no data need to be transmitted, *pcInData* must be NULL and *dwInSize* must be 0.

*dwInSize* - size of transmitted data. If no data need to be transmitted, this parameter must be 0.


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*pcOutData* - pointer to data array where data received from RF605 will be saved. If no data need to be received, *pcOutData* must be NULL.

*pdwOutSize* - pointer to the variable containing size of data to be received. If no data need to be received, this parameter must be NULL. After successful receipt of data, the amount of read bytes will be recorded to the variable where this parameter points to.

**Returned value:**

If transmission or reception of bytes fails, the function returns FALSE, otherwise the function returns TRUE.

### 10.13. Functions for operation of sensors connected to FTDI-based USB.

To work with FTDI-based USB devices, this library supports functions operating through D2XX library of FTDI. Performance of the functions is identical to that of the functions used for operation through serial port, the main difference being the presence of **FTDI_** prefix in the function name, for example: "getting result" function for serial port is **RF60x_Measure** while for FTDI USB devices it is **RF60x_FTDI_Measure**.

**12.14.** You can find examples of programs for LabView here:
www.riftek.com/resource/files/rf60x_labview_example.zip

**12.15.** You can find examples of programs for Visal Basic 6 here:
www.riftek.com/resource/files/rf60x-vb.zip


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**EXAMPLE 1**

```
HANDLE          hRF60x    = INVALID_HANDLE_VALUE;
DWORD                dwValue;
USHORT          usMeasured;
RF60XHELLOANSWER    hlans;

// Clear structure RF60xHELLOANSWER
memset(&hlans, 0x00, sizeof(RF60xHELLOANSWER));

// Open COM-port
if (!RF60X_OpenPort("COM2:", CBR_9600, &hRF60X)
     return (FALSE);

// Interrogate device
if (RF60X_HelloCmd( hRF60x, 1, &hlans ))
{
     ////////////////////////////////////////////////
     //                                            //
     // After successful execution of RF60x_HelloCmd//
     // the structure hlans contains information    //
     // about RF605 sensor that responded to request//
     //                                            //
     ////////////////////////////////////////////////

     //Read parameter: Laser brightness
     RF60x_ReadParameter(
                         hRF60x,
                         1,
                         RF60x_PARAMETER_LASER_BRIGHT,
                         &dwValue
                    );

     /*  dwValue contains laser brightness values  */

     //Obtain distance values from RF603 sensor
     RF60x_Measure( hRF60x, 1, &usMeasured );

     /* usMeasured contains measurement result */

}
RF60x_ClosePort( hRF60x );
```


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## EXAMPLE 2 (how to get a stream of result)

```
      HANDLE                    hRF60x             = INVALID_HANDLE_VALUE;
      USHORT                    usMeasured;
      RF60xHELLOANSWER          hlans;


      memset(&hlans, 0x00, sizeof(RF60xHELLOANSWER));

      RF60x_OpenPort("COM2:", CBR_9600, &hRF60x);


      if (RF60x_HelloCmd( hRF60x, 1, &hlans ))
      {
            printf("Dev modify\t: %d\r\nDev type\t: %d\r\nDev max dist\t:
            %d\r\nDev range\t: %d\r\nDev serial\t: %d\r\n",
                                    hlans.bDeviceModificaton,
                                    hlans.bDeviceType,
                                    hlans.wDeviceMaxDistance,
                                    hlans.wDeviceRange,
                                    hlans.wDeviceSerial
                                    );

            if (!RF60x_WriteParameter( hRF60x, 1,
RF60x_PARAMETER_SAMPLING_PERIOD, 500 ))
                  return (-1);

            if (!RF60x_StartStream(hRF60x, 1))
                  return (-1);

            RF60x_GetStreamMeasure(hRF60x, &usMeasured);
            printf("Measure    \t: %d\r\n", usMeasured);

            RF60x_GetStreamMeasure(hRF60x, &usMeasured);
            printf("Measure    \t: %d\r\n", usMeasured);

            RF60x_StopStream(hRF60x, 1);
      } else printf("rs232 error!\r\n");

      RF60x_ClosePort( hRF60x );
```

## EXAMPLE 3 (how to get a result with latching)

```
for (int i=0;i<100;i++)
{
      // Result latching
      RF60x_LockResult(hRF60x, 1);


      // Result receiving
      RF60x_Measure( hRF60x, 1, &usMeasured);

      printf("Measure-l   \t: %d\r\n", usMeasured);
}
```


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## 11. COMPLETE DELIVERY PACKAGE

The delivery package includes:

| | |
|---|---|
| RF605 Series sensor | 1 pc |
| Installation CD with RF60X-SP (executable module) and SDK | 1 pc |

## 12. WARRANTY POLICY

Warranty assurance for the sensor RF605 - 18 months from the date of putting in operation; warranty shelf-life - 12 months.

**Distributors**

| | | |
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