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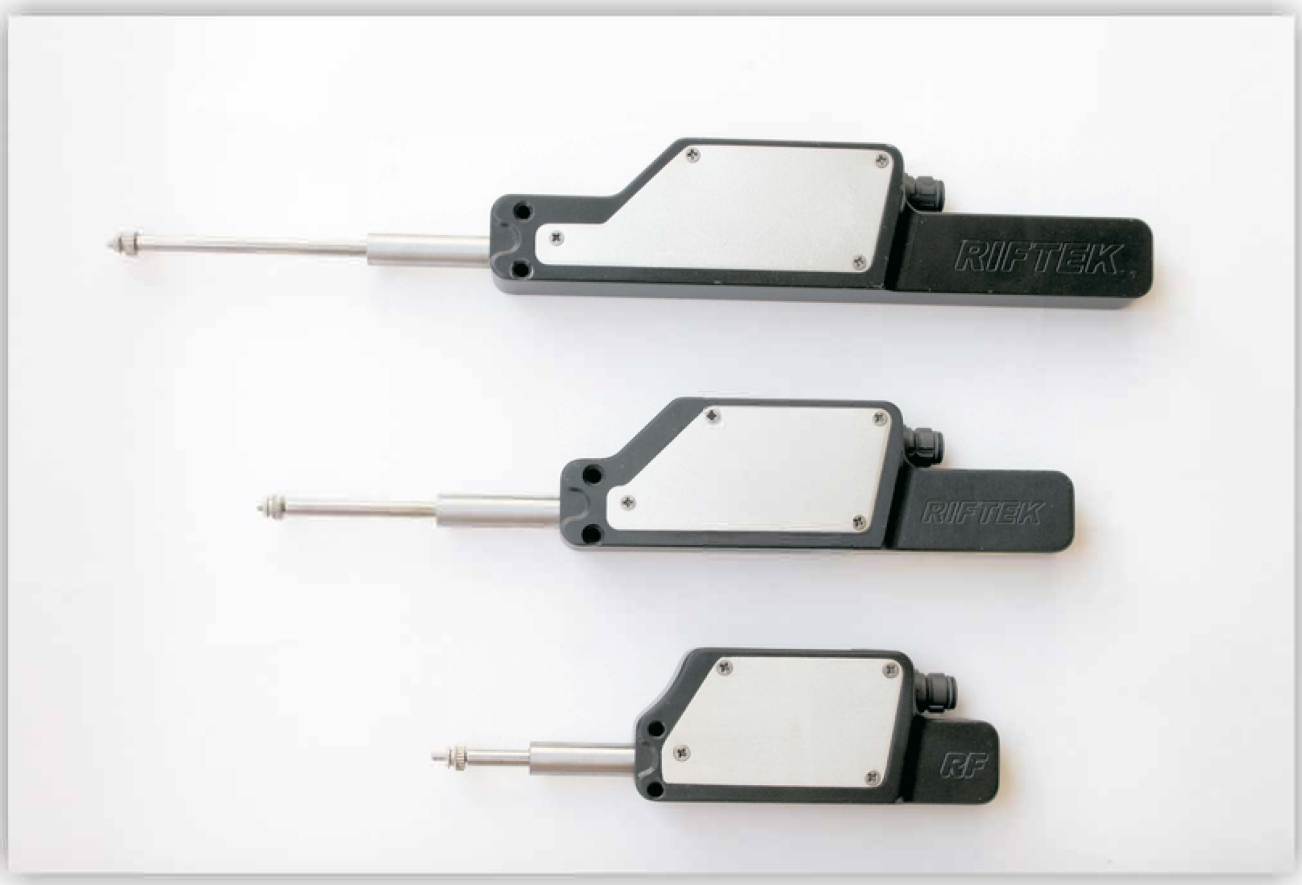
Sensors & Instruments



ABSOLUTE LINEAR ENCODERS

RF25x Series

User's manual

info@riftek.com
www.riftek.com

Certified according to ISO 9001:2008

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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.
- To obtain stable results, wait about 20 minutes after sensor activation to achieve uniform sensor warm-up.

2. Electromagnetic compatibility

The sensors have been developed for use in industry and meet the requirements of the following standards:

- EN 55022:2006 Information Technology Equipment. Radio disturbance characteristics. Limits and methods of measurement.
- EN 61000-6-2:2005 Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments.
- EN 61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use. EMC Requirements. General requirements.

3. General information

The sensors are intended for contact measuring and checking of position, displacement, dimensions, surface profile, deformation, sorting and sensing of technological objects.

The series includes sensors with the measurement range from 3 to 55 mm and the resolution up to 0,1 um. Custom-ordered configurations are possible with parameters different from those shown below.

4. Basic technical data

Model		RF251-3	RF251-25	RF256-15	RF256-35	RF256-55
Measurement range, mm		3	25	15	35	55
Accuracy (at T=20 ^{0}C), um		± 2				± 3
Resolution, um		0.1 or 0.5 or 1 or 5 or 10				
Output interface	digital	RS422	(RS485 and SSI or RS232) and (EncD5 or EncD10 – emulation of quadrature signals of incremental transducers)			
	analog	no	0…20 mA (<500 Om load) or 0…10 V			
Synchronization input		no		opto-isolated		
Logical outputs		no	two outputs, NPN: 100 mA max; 40 V max			
Indication		no		two-color LED (red/green)		
Power supply, V		12 (without analogue output) 15 (with analogue output)				
Power consumption, W		0,75				
Enclosure rating		IP57	IP50			
Operating temperature, °C		-40…+50	-10…+50			
Weight (without cable), g		110		110	150	180
Size, figure #		3	2	4	5	6

5. Example of item designation when ordering

RF25X-L-D-UART-EncDxAN-IN-LOUT-M

Symbol	Description
X	Model (1 or 6)
L	Measurement range, mm
D	Resolution, um
UART	Type of the serial interface (RS232, 232 or RS485 and SSI, 485)
EncDx	Period of quadrature signal, EncD5 – 5 um, EncD10 – 10 um
AN	Attribute showing the presence of Current Loop (I) or Voltage (U) output
IN	Trigger input (input of synchronization) (for RF256 sensors only)
LOUT	Attribute showing the presence of 2 logical outputs
M	Cable length, m

Note: when working in the EncD mode using the SSI, as well as analog outputs is impossible

Example: RF256-55-0.1-232-I-IN-CC-3, RF256 sensor; 55 mm measurement range; 0,1 um resolution; serial port – RS232; 4…20 mA analog output; IN – synchronization input presents; 3 m cable length.

6. Structure and operating principle

Operation of the sensors is based on the principle of photoelectric scanning of special scale, connected with a measurement tip of the sensor. Radiation of a LED 1 is collimated by a lens 2 and is directed on a scale 3. The image of area of the scale is examined by CMOS array 4 and is analyzed by signal processor which calculates position of the scale.

As compared with incremental sensors, absolute sensors have a number of advantages: the absolute position of the measurement tip is determined immediately after power is on and the necessity of search of the reference mark is excluded. Also excluded is the probability of accumulation or loss of count pulse signals in case of impacts, vibrations and reverse motion.

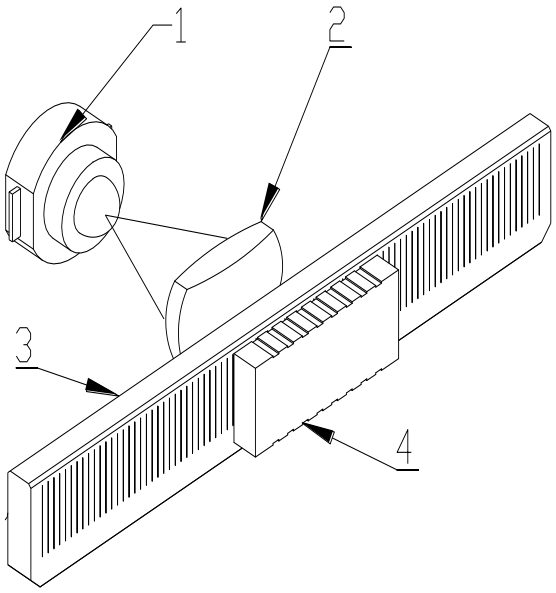


Figure 1

6

7. Dimensions and mounting

Overall and mounting dimensions of the sensors are shown in Figures 2…5. Sensor package is made of anodized aluminum.

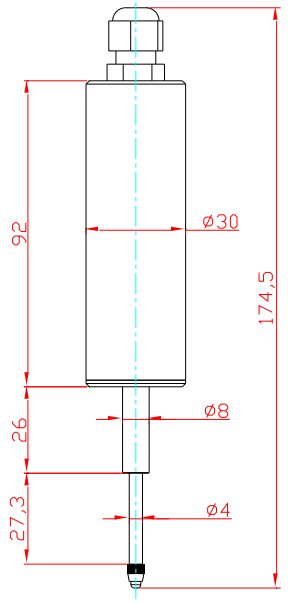


Figure 2

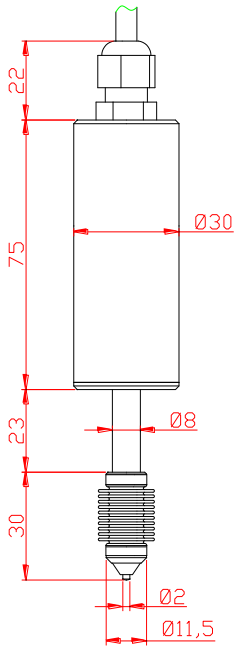


Figure 3

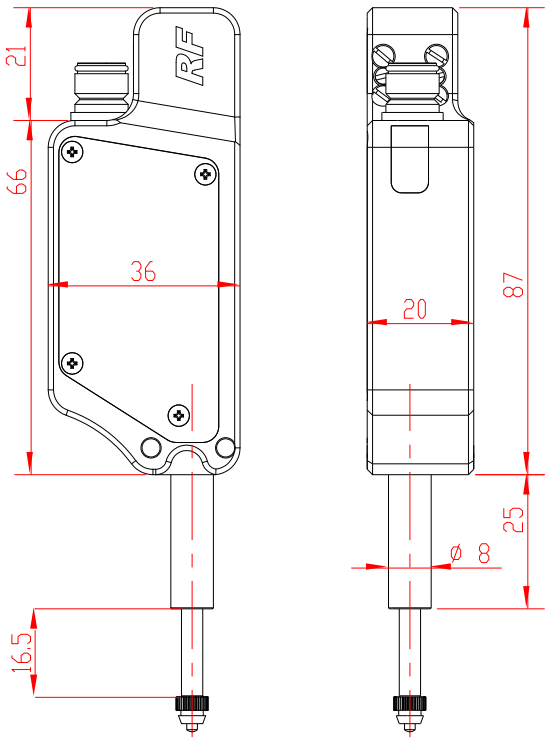


Figure 4

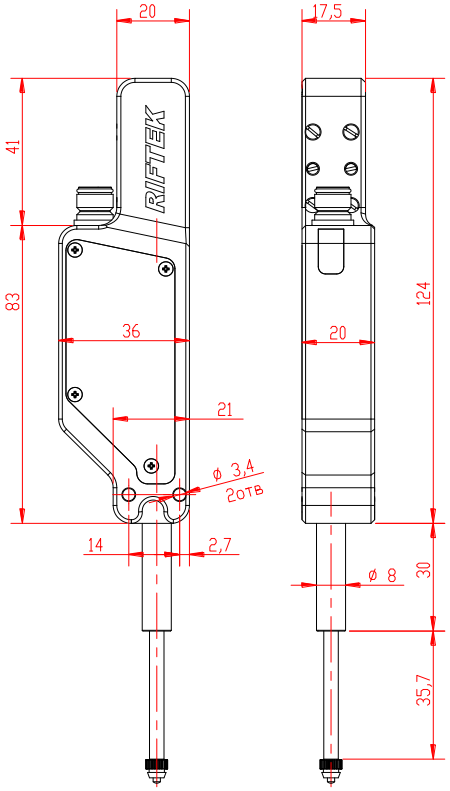


Figure 5

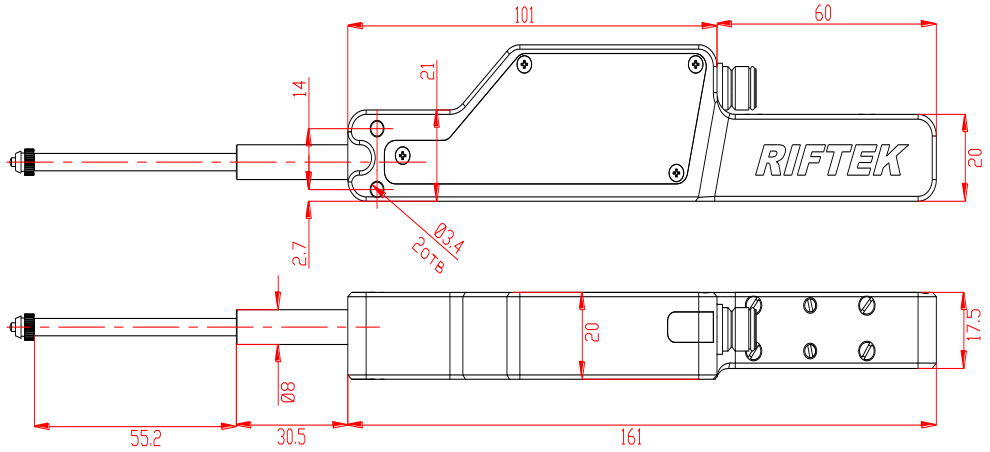


Figure 6

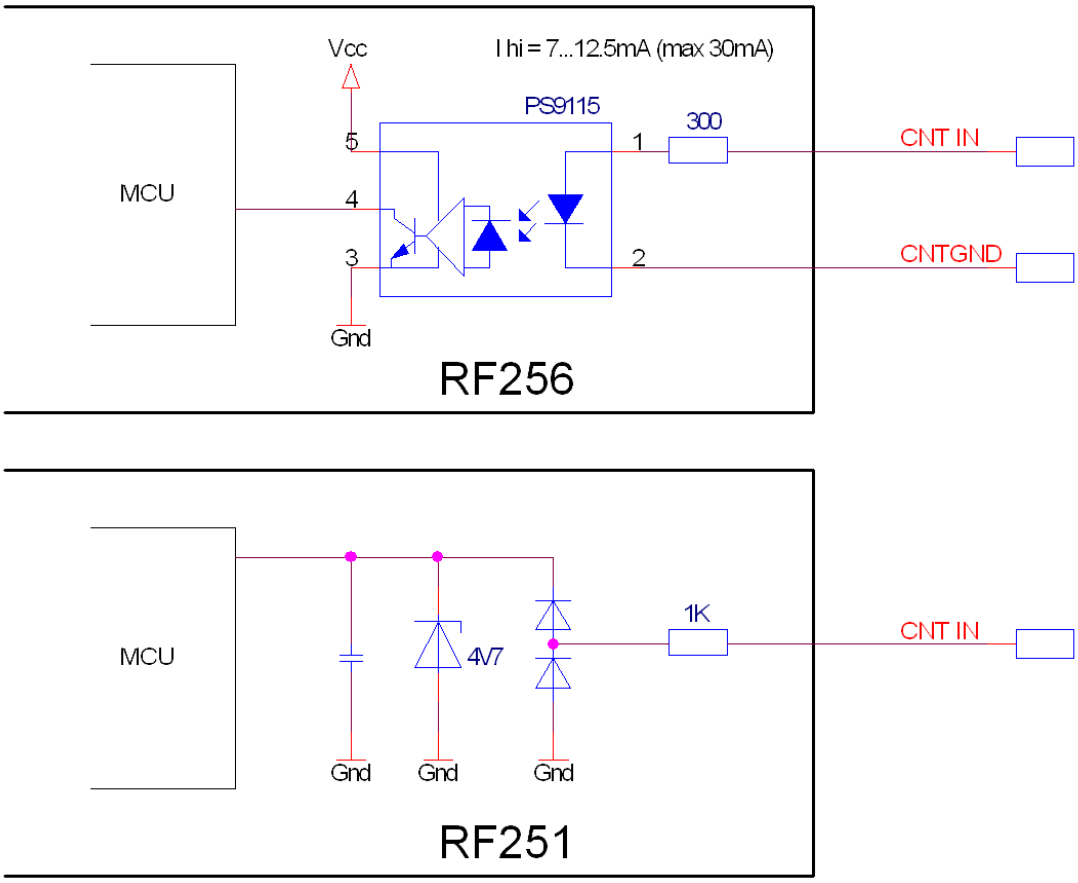
8. Connection

Model	Symbols	D-sub 9-pin (fem)	Wire color
232-U/I-IN	Power U+	-	Red
	Power U-	-	Brown
	TXD	2	Green
	RXD	3	Yellow
	IN	-	White
	Gnd (Common for the sygnals)	5	Grey
	U/I (UpLimitOC)	-	Blue
	AGND (LowLimitOC)	-	Pink
485-SSI-U/I-IN	Power U+	-	Red
	Power U-	-	Brown
	DATA+	8	Green
	DATA-	7	Yellow
	IN (Clock+)	-	White
	Gnd (Common for the sygnals) (Clock-)	5	Grey
	U/I (UpLimitOC)	-	Blue
	AGND (LowLimitOC)	-	Pink
RF25x-EncD	Power U+	-	Red
	Power U-	-	Brown
	EncB	-	Blue
	EncA	-	Pink
	Gnd	-	Grey
EncD-232- IN	Power U+	-	Red
	Power U-	-	Brown
	TXD	2	Green
	RXD	3	Yellow
	IN	-	White
	Gnd (Common for the sygnals)	5	Grey
	EncB	-	Blue
	EncA	-	Pink
EncD-485 -IN	Power U+	-	Red
	Power U-	-	Brown
	DATA+	8	Green
	DATA-	7	Yellow
	IN	-	White
	Gnd (Common for the sygnals)	5	Grey
	EncB	-	Blue
	EncA	-	Pink

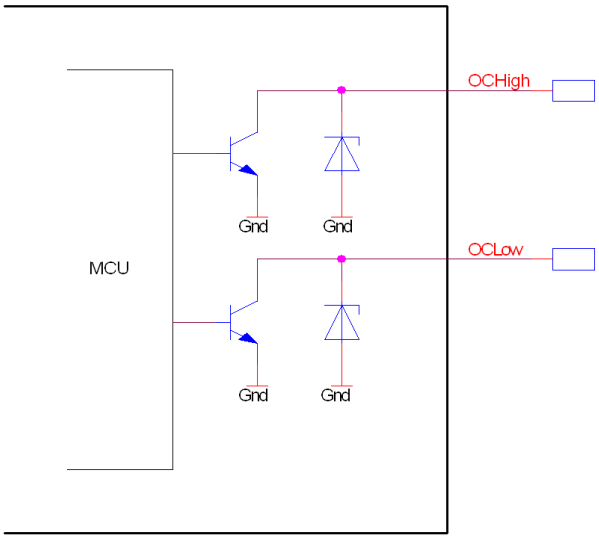
The manufacturer reserves the right to change the color code and the destination of connecting wires.

9. Input-output schematic

9.1. Synchronization input



9.2. Logical outputs



10. Operation modes and configuration parameters

10.1. Operation modes.

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 two methods:

- by single requests (inquiries);
- by automatic data streaming.

Changing of the signal at analog output occurs in synchronism with the changing of the result transferred through the bit-serial interface. When RS485 or CAN or Ethernet interfaces are used, several sensors can be connected to the data collection device (network operation mode). .

10.2. Configuration parameters

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

10.2.1. Sampling mode

This parameter specifies one of the two result sampling options in the case where the sensor works in the data stream mode:

- Time Sampling;
- Trigger Sampling.

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

With *Trigger sampling* is selected, the sensor transmits the measurement result when external synchronization input (IN input of the sensor) is switched and taking the *division factor* set into account

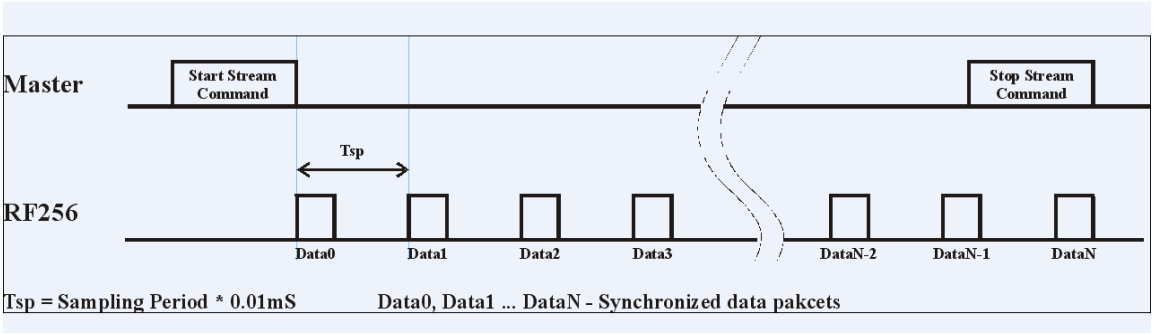
10.2.2. Sampling period

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.

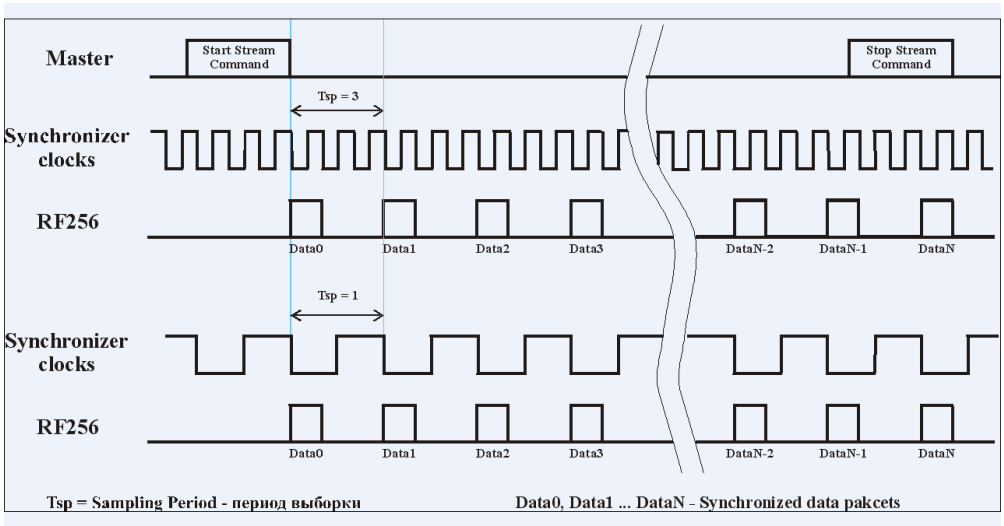
If the Trigger Sampling mode is selected, the ‘sampling period’ parameter determines the division factor for the external synchronization input. ***For example,*** for the parameter value equal to 100, data are transmitted through bit-serial interface when each 100^{th} synchronizing pulse arrives at 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 so built that measurements are taken at a maximum possible rate determined by the integration time period, the measurement results is sent to buffer and stored therein until a new result arrives. The above-mentioned parameters determine the method of the readout of the result form the buffer.

Note 2. If the bit-serial interface is used to receive the result, the time required for data transmission at selected data transmission rate should be taken into account in the case where small sampling period intervals are used. If the transmission time exceeds the sampling period, it is this time that will determine the data transmission



Data stream transfer with time synchronization



Data stream transfer with external synchronization

10.2.3. Line correction parameter

is intended for correction of encoder linearity (parameter changing can decrease encoder accuracy).

10.2.4. Zero position parameter

is intended for assign of sensor's Zero Point

10.2.5. 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.

Note. 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.

10.2.6. Analog output scaling

This parameter is intended for analog output calibration (parameter changing can decrease analog output accuracy).

10.2.7. Logical outputs thresholds

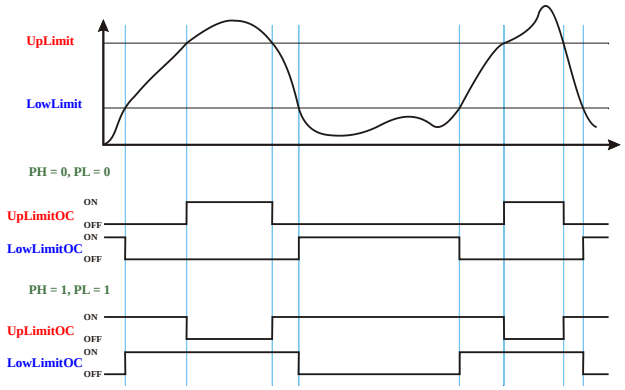
LowLimit sets the switching threshold for the logical output **LowLimitOC**. If the measured value is less than **LowLimit**, the output of **LowLimitOC** is set to active logical level, otherwise **LowLimitOC** is set to inactive logical level (polarity of the active and inactive logical levels is specified by the **Out Logic Polarity** parameter). The **UpLimit** parameter sets switching threshold for the logical output **UpLimitOC**. If the measured

value is higher than **UpLimit**, the **UpLimitOC** output is set to active logical level, otherwise **LowLimitOC** is set to inactive logical level (polarity of the active and inactive logical levels is specified by the **Out Logic Polarity** parameter).

10.2.8. Polarity og logical outputs

This sets polarity of the active and inactive states of the logical level outputs **LowLimitOC** and **UpLimitOC**.

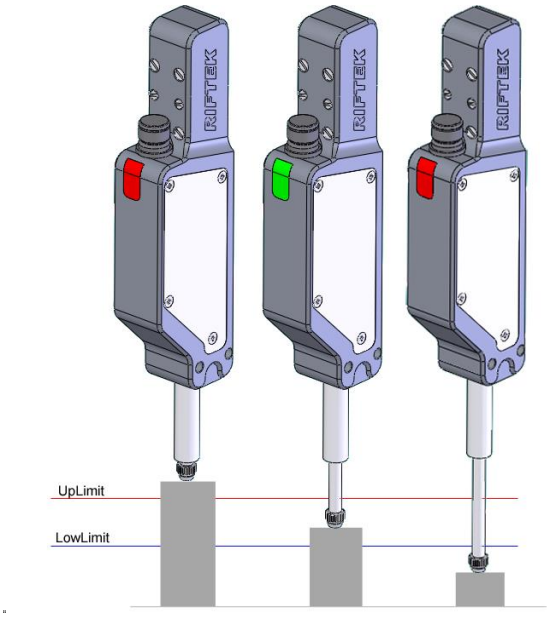
The Figure shows logical outputs switching diagrams depending on the state of polarity bits: **HP** – output polarity bit **UpLimitOC** and **LP** – output polarity bit **LowLimitOC**. The **ON** state – output transistor is open, the **OFF** state – output transistor is closed.



NOTE! To change parameters of the sensor use"RF25x-SP"setup software www.riftek.com/resource/files/rf25x-sp.zip.

11. Indication modes

The RF256 sensors are equipped with a LED display offering two indication modes: **Red** and **Green**. The display operation is directly connected with the values of the **LowLimit** and **UpLimit** parameters. The LED display is in the "green" indication mode if the measurement result lies in the range **LowLimit < Result < UpLimit**, i.e., the measurement result is not beyond the set limits. The LED display is in the "red" indication mode if the measurement result lies in the range **Result < LowLimit, or UpLimit < Result**, i.e., the measurement result is beyond any set limit.



12. Description of Serial interfaces

12.1. RS232 port.

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

12.2. RS485 port.

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.

12.3. Configuration parameters

12.3.1. Rate of data transfer through 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.

12.3.2. Net address.

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

Note. 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’ (RF603 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)/

12.4. Factory parameters table.

Parameter	Value
Baud rate	115200 bit/s
Net address	1

12.5. Interfacing protocol.

12.5.1. Serial data transmission format

Data message has the following format:

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

The oddness bit is a complement of the 8 data bits to evenness

12.5.2. Communication sessions types

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

1) “inquiry”, [“message”] — [“answer”], *square brackets include optional elements*

2) “inquiry” — “data stream” — [“inquiry”].

12.5.3. 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].

"Inquiry" format:

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

12.5.4. Message, MSG.

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

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

12.5.5. Answer

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

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 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)						
Byte 0			Byte 1			
1	CNT(2:0)	DAT(3:0)	1	CNT(2:0)	DAT(7:4)	

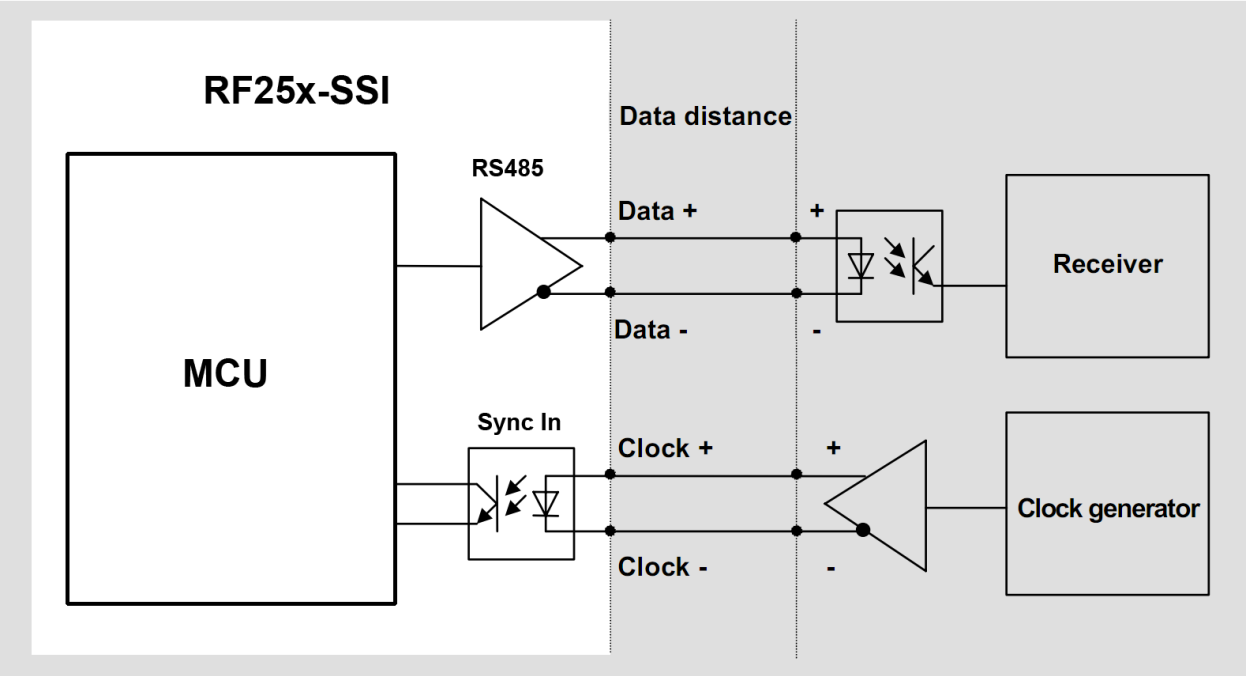
12.5.6. Data stream.

'Data stream' is an infinite sequence of data bursts or batches transmitted from 'slave' to 'master', which can be interrupted by a new 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.

12.6. Description of SSI interface

12.6.1. Sensor connection in the SSI interface mode

Sensor connection is shown in the Figure



In this mode, the sensor synchronization input is used as Clock signal input, and the RS485 interface lines are used for transmission of Data signal. The level of Clock and Data signals is 5V.

12.6.2. Enabling of the mode

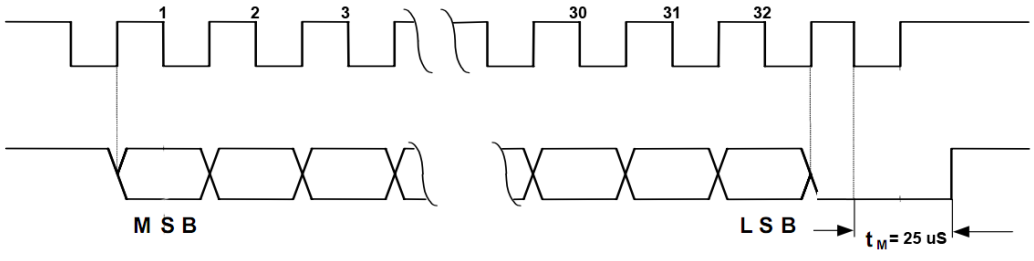
Enabling of the SSI mode is effected by setting SSI bit in the parameter "Check byte of sampling mode" (See Table 13.2).

When the SSI mode is enabled:

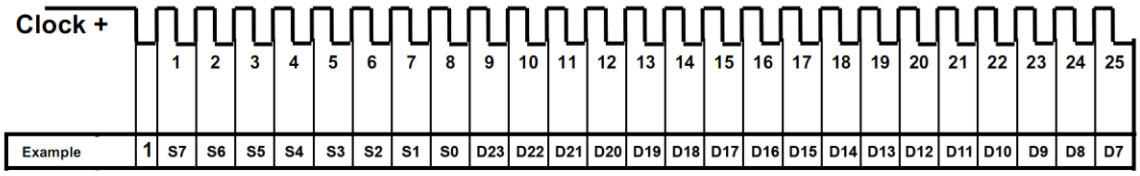
- if no clock pulses are present at the synchronization input, the sensor operates in the RS485 mode;
- if a clock signal is present, the sensor switches to the SSI mode. In this case, the sensor does not respond to requests of the RS485 interface. If sync signal is absent over an interval of more than 8 ms, the sensor switches to the RS485 mode.

12.6.3. Data format and transmission diagram

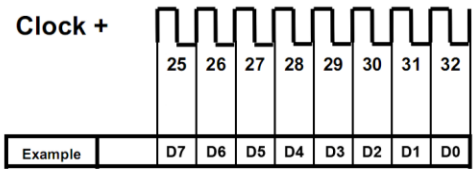
The transmission begins with most significant bits (MSB) and is triggered by the first falling edge. Bits are set by the rising edge and are read by the falling edge. A data packet consists of 32 bits. 8 upper bits are control bits (0xAC) and are used for checking correctness of the data. These are followed by 24 data bits. At the end of the packet transmission, the system holds the Data line at low level for 25 ms (the Clock line status is ignored).



Diagram



Continuation clock 26



S - special bits = 0xAC

D - data

The total number of data bits	-32
The number of data bits	-24
The number of security bit	- 8 (8 most significant bits 0xAC)
Clock pulse frequency	- up to 500kHz
Delay interval after sending of the package	- 25 ms

NOTE: The data (measurement result) are transmitted in tenths of a micron

12.6.4. Indicating lights in the SSI mode

When a clock signal is present in the Clock line, a green LED is lit to indicate that the sensor is in the SSI mode. If the clock signal is absent for more than 8 ms, the LED turns off and the sensor switches to the RS485 mode.

NOTE: It is important that the logic outputs should be disconnected (parameters LowLim and UpLim = 0).

12.7. Description of EncD interface

In the mode of EncD interface the sensor emulates output quadrature signals of incremental encoders, ie, square wave, shifted of 90^0 relative to each other and with a period of 5 to 10 micrometers.

12.7.1. Sensor connection in the SSI interface mode

In this mode, the logic outputs of the sensor are used as a quadrature outputs, see p.9.2.

12.7.2. Enabling of the mode

Enabling of the SSI mode is effected by setting EncD bit in the parameter "Status word" (See Table 13.2) of by Setup software.

12.7.3. Indicating lights in the EncD mode

The states of EncA and EncB outputs are displayed in green and red LEDs, respectively.

13. Inquiry codes and list of parameters

13.1. Inquiry codes table

Inquiry code	Description	Message (size in bytes)	Answer (size in bytes)

01h	Device identification	—	-device type (1) -modification (1) -serial number (2) -reserved (2) -range (2)
02h	Reading of parameter	- code of parameter (1)	- value of parameter (1)
03h	Writing of parameter	- code of parameter (1) - 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	—	—
0Ch	Assign of sensor's Zero Point.		-constant 0Ch (1)

13.2. List of parameters

Code of parameter	Name	Values
00h	Status word	1 — laser is ON, measurements are taken (default state); 0 — laser is OFF, sensor in power save mode x,x,x,x,x,EncD,Parity,Off – control byte, which determines sensor's mode , bites x – do not use; bit Off: 0 — sensor OFF and is in power save mode. 1 — sensor ON, measurement are taken (default state); bit Parity: 0 — parity control OFF; 1 — EVEN Parity ON (by default); bit EncD: 0 —EncD mode OFF (by default); 1 —EncD mode ON
01h	Sampling and synchronization control	x,x,x,x,x,SSI,x,S – control byte which determines sampling regime, bites x – do not use; bit SSI: 1 – interface SSI mode bit S: 0 — time sampling (default); 1 — trigger sampling;
02h	Network address	1…127 (default — 1)
03h	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)
04h…06h	Reserved	
07h	Lower byte of the coordinate system's "0"	1…167777215, (by default — 0) assigns "0" of the sensor's coordinate system
08h	Middle byte of the coordinate system's "0"	
09h	Higher byte of the coordinate system's "0"	
0Ah	Lower byte of the sampling period	1) 1…65535, (by default — 500) the time interval in increments of 0.01 ms with which sensor automatically communicates of results on streaming inquiry (priority of sampling = 0); 2) 1…65535, (by default — 500) divider ratio of trigger input with which sensor automatically communicates of result on streaming inquiry (priority of sampling = 1)
0Bh	Higher byte of the sampling period	
0Ch	Lower byte for the beginning of analog output range	0…65535 (by default – 0) specifies a point within the absolute range of transducer where the analog output has a minimum value (4 mA or 0V).
0Dh	Higher byte for the beginning of analog output range	

0Eh	Lower byte for the end of analog output range	0…65535 (by default – 4000h) specifies a point within the absolute range of transducer where the analog output has a maximum value (20 mA or 0V).
0Fh	Higher byte for the end of analog output range	
10h	Lower byte for the analog output scaling	1…65535, parameter of adjustment of analog output scaling
11h	Higher byte for the analog output scaling	
12h	Lower byte for **LowLimitOC** output switching	1…167777215, (by default — 0) assigns threshold of **LowLimitOC** output switching
13h	Middle byte for **LowLimitOC** output switching	
14h	Higher byte for **LowLimitOC** output switching	
15h	Lower byte for **UpLimitOC** output switching	1…167777215, (по умолчанию — 0) assigns threshold of **UpLimitOC** output switching
16h	Middle byte for **UpLimitOC** output switching	
17h	Higher byte for **UpLimitOC** output switching	
18h	Polarity of **LowLimitOC** and **UpLimitOC** logical outputs	x,x,x,x,x,x,PH,PL – control byte which specifies logical outputs polarity. PH –**UpLimitOC** output polarity, PL – **LowLimitOC** output polarity, bites x – do not use; bit PL: 0 — active logical level 0 (output n-p-n transistor is opened) (by default); 1 — active logical level 1 (output n-p-n transistor is closed); bit PH: 0 — active logical level 0 (output n-p-n transistor is opened) (by default); 1 — active logical level 1 (output n-p-n transistor is closed);

13.3. Notes

- All values are given in binary form.
- 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.
- 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.
- 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.

14. Setup program

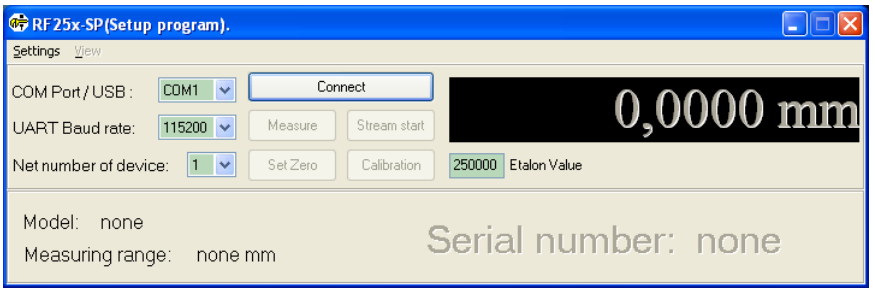
14.1. Function

The RF25X-SP software package (www.riftek.com/resource/files/rf25x-sp.zip) is intended for:

- testing and demonstration of operation of RF25X-series sensors;
- setting sensor parameters;
- reception and storage of data.

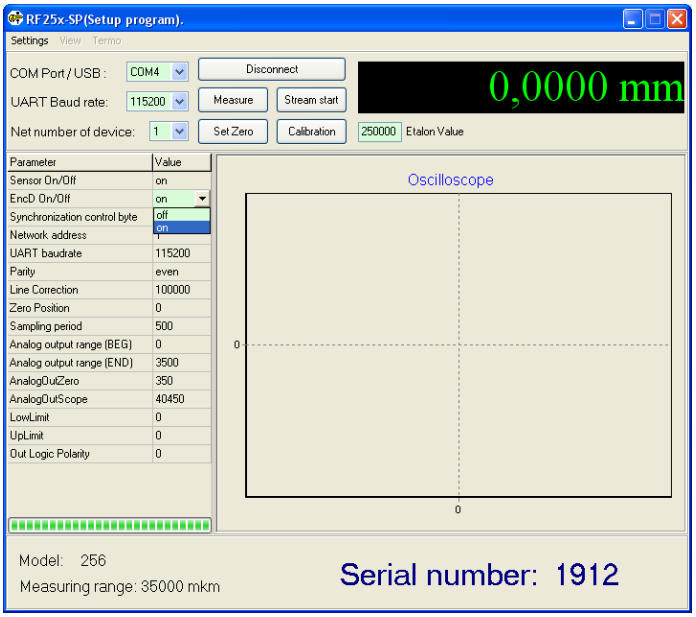
14.2. Sensor – PC connection establishment

Upon starting the program the working window appears:



- in the line **UART Baud rate** select sensor operation speed (factory setting – 115200 bit/s),
- in the line **COM Port/USB** select PC RS232 port number where sensor is connected or USB if sensor is connected to USB port through **FTDI** adapter.
- the line **Net number** of device defines sensor network address (factory setting for all sensors – "1")
- upon clicking the **Connect** button, RF25X-SP will attempt to establish communication with sensor with parameters selected as above. If it fails, a 'communication error' message is displayed.

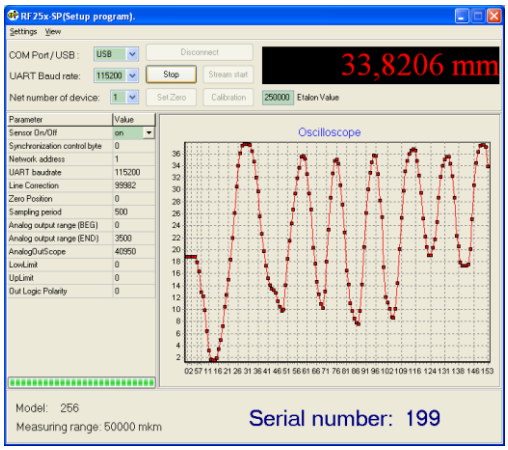
If communication is successfully established the window changes its form to the following and
in the line **Model** the sensor model is displayed;
in the line **Serial number**, a serial number of the sensor is displayed;
in the line **Measuring range**, the sensor working range is displayed:



14.3. Sensor performance checking

After communication has been successfully established it is possible to check sensor performance.

- 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. 13.1).



- 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. 13.1)
- By moving the measurement tip, observe changes of readings on the display and oscilloscope.
- Clicking of the **Stop/Stream stop** button deactivates the data transfer.

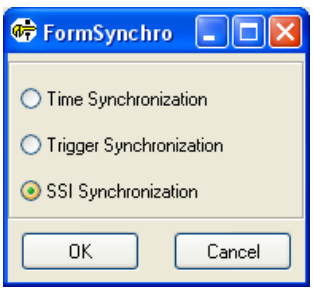
Note 1. Data coming from the sensor are accumulated and stored in a circular buffer with 10000 measurements storage capacity.
Note 2. By clicking left key of the mouse scale of the graphic can be changed, the right key is used to drag the graphic image within viewing region. By clicking the right key **Save to the file** menu is activated.

14.4. Setting and storing parameters of the sensor

The opening part of the RF25X-SP application (**Parameter – Value Table**) allows one to edit and enter the required parameters into both RAM and FLASH memory of the sensor.

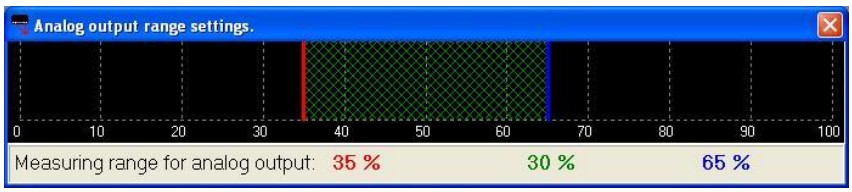
14.4.1. Parameters setting

- to switch **ON/OFF** the sensor, click the left mouse key twice in the **Value field** of the **Sensor On/Off parameter**;
- to set the **sampling mode** click the left mouse key in the **Value field** of **Synchronization Control Byte parameter**, thus calling out the priorities bites menu;
- to set SSI mode it is necessary to set **SSI Synchronization** flag in the line **Synchronization control byte**



- 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;
- to set **EncD** mode: write **on** into **EncD On/Off** parameter

- in the lines **Analog Range Begin** и **Analog Range End**, it is possible to set the analog output window boundaries in increments of 0,1% 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.

14.4.2. Parameters storing

- 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).
- Perform testing of the sensor operation with new parameters.
- 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.

15. RF25X-SDK library. Functions description.

Laser sensor is supplied together with SDK (www.riftek.com/resource/files/rf25x-sdk.zip).

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

- ✓ Definition file **RF25x.h**;
- ✓ **RF25x.lib** library for VC++/VS2003/VS2005/Borland C++;
- ✓ **RF25x.dll** executive library with a set of finished functions;
- ✓ Examples;

Note: the library RF25x is intended for OS Windows 98/Me/2000/XP

15.1. Connection to COM-port (RF25x_OpenPort)

The function **RF25x_OpenPort** opens COM-port with specified symbolic name, fills in the pointer to the device descriptor and returns the operation result:

```
BOOL  RF25x_OpenPort(
            LPCSTR      lpPort_Name,
            DWORD       dwSpeed,
            HANDLE *    lpHandle
);
```

Parameters:

lpPort_Name – name of COM-port (e.g., “COM1:”), full syntax for COM-port name specification see in MSDN, function CreateFile;

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

15.2. Disconnection from COM-port (RF25x_ClosePort)

The function RF65x_ClosePort closes COM-port and returns the operation result:

```
BOOL  RF25x_ClosePort(
            HANDLE              hHandle
);
```

Parameters:

hHandle – descriptor of the device obtained from function RF25x_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

15.3. Device identification (RF25x_HelloCmd)

The function **RF25x_HelloCmd** makes identification of RF25x according to net address and fills **RF25xHELLOANSWER** structure:

```
typedef struct _RF25x_HELLO_ANSWER_ {
        BYTE        bDeviceType;
        BYTE        bcDeviceModificaton;
        WORD        wDeviceSerial;
        WORD        wDeviceMaxDistance;
        WORD        wDeviceRange;
} RF25xHELLOANSWER, *LPRF25xHELLOANSWER;
```

Where:

bDeviceType – one byte value, which shows type of the device (for RF25x this value is equal 65) (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 RF25X sensor (type WORD);

wDeviceRange – two byte value, which contains the measurement range of RF25X sensor (tpe WORD).

```
BOOL RF25x_HelloCmd (
          HANDLE              hCOM,
          BYTE                     bAddress,
          LPRF25xHELLOANSWER  lprfHelloAnswer
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address;

lprfHelloAnswer - pointer to the RF25xHELLOANSWER structure.

Returned value:

If the device does not respond to identification request, the function returns FALSE, otherwise the function returns TRUE and fills variable RF25xHELLOANSWER structure

15.4. Reading of parameters (RF25x_ReadParameter)

The function **RF25x_ReadParameter** reads internal parameters of the RF25X sensor and returns the current value to the parameters address:

```
BOOL RF25x_ReadParameter (
        HANDLE              hCOM,
        BYTE                    bAddress,
        WORD                    wParameter,
        DWORD *             lpdwValue
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort, or CreateFile;

bAddress - device address;

wParameter - number of parameter, see Table 1.

Table 1

Parameter	Description
RF25x_PARAMETER_POWER_STATE	Power status of sensor
RF25x_PARAMETER_PRIORITY_AND_SYNC	Control of sampling and synchronization
RF25x_PARAMETER_NETWORK_ADDRESS	Network address
RF25x_PARAMETER_BAUDRATE	Data transmission rate through serial port
RF25x_PARAMETER_PIXEL_SIZE	Pixel size
RF25x_PARAMETER_DATUM_POINT	Coordinate system Zero
RF25x_PARAMETER_SAMPLING_PERIOD	Sampling period
RF25x_PARAMETER_BEGIN_ANALOG_RANGE	Beginning of analog output range
RF25x_PARAMETER_END_ANALOG_RANGE	End of analog output range

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*

15.5. Parameters saving (RF25x_WriteParameter)

The function **RF25x_WriteParameter** writes inside parameters of the RF25X sensor:

```
BOOL RF25x_WriteParameter (
        HANDLE              hCOM,
        BYTE                    bAddress,
        WORD                    wParameter,
        DWORD                   dwValue
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort либо CreateFile;

bAddress - address of thr device;

wParameter - number of parameter, see table 1;

dwValue - parameter value of RF25X.

Returned vale:

If the device does not respond to request to save all parameters, the function returns FALSE, otherwise, if record confirm is obtained from the sensor, the function returns TRUE

15.6. Saving current parameters in FLASH-memory (RF25x_FlushToFlash)

Function **RF25x_FlushToFlash** saves all parameters in the FLASH-memory of the RF25X sensor:

```
BOOL  RF25x_FlushToFlash(
            HANDLE      hCOM,
            BYTE        bAddress
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address.

Returned values:

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

15.7. Restoration of default parameters in FLASH-memory

The function **RF25x_RestoreFromFlash** restores all parameter values in the FLASH by default:

```
BOOL  RF25x_RestoreFromFlash(
                  HANDLE            hCOM,
                  BYTE              bAddress
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address.

Returned values:

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

15.8. Latching of the currend device (RF25x_LockResult)

The function **RF25x_LockResult** latches current measurement result till next calling of the function **RF25x_LockResult:**

```
BOOL   RF25x_LockResult(
              HANDLE              hCOM,
              BYTE                bAddress
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address.

Returned values:

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

15.9. Getting measuring result (RF25x_Measure)

The function **RF25x_Measure** reads current measurement value from the RF25X sensor in the values of 0,1 um:

```
BOOL   RF25x_Measure(
              HANDLE              hCOM,
              BYTE                bAddress,
              DWORD *             lpdwValue
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address.

lpdwValue - 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.

15.10. Starting measurement stream (RF25x_StartStream)

The function **RF25x_StartStream** switches RF25X sensor to the mode where continuous transmission of measurement results takes place:

```
BOOL   RF25x_StartStream(
              HANDLE              hCOM,
              BYTE                bAddress
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address.

Returned value:

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

15.11. Stopping measurement stream (RF25x_StopStream)

The function **RF25x_StopStream** switches the sensor from continuous measurement transmission mode to the “request-response” mode

```
BOOL   RF25x_StartStream(
              HANDLE              hCOM,
              BYTE                bAddress
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address.

Returned value:

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

15.12. Getting measurement result from the stream (RF25x_GetStreamMeasure)

The function RF25x_GetStreamMeasure reads data from the COM-port input buffer which are received from RF25X sensor after successful execution of the RF25X_StartStream function. The data arrive in the buffer at a rate specified in the RF25X sensor parameters. Since depth of the input buffer is limited to 1024 bytes, it is preferable to read data with periodicity equal to that specified in the RF25X sensor parameters. The parameter *lpusValue* is identical to the parameter *lpusValue* in the RF25x_Measure function.

```
BOOL   RF25x_GetStreamMeasure(
              HANDLE                  hCOM,
              DWORD *                 lpdwValue
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

lpdwValue - pointer to ULONG/DWORD, 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*

Note:

For stable work of **RF25x_GetStreamMeasure** function it is necessary to use it in the separate stream with the priority no less then THREAD_PRIORITY_NORMAL, otherwise there will be overflow of input buffer of the serial port and it can bring into unpredictable results

15.13. Setting of coordinate system zero (RF25x_SetDatumPoint)

The function **RF25x_SetDatumPoint** sets the beginning of coordinate system of the sensor:

```
BOOL   RF25x_SetDatumPoint (
            HANDLE              hCOM,
            BYTE                bAddress
);
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile;

bAddress - device address.

Returned value:

If device can't set zero, the function returns FALSE, otherwise the function returns TRUE

15.14. Transmission of user data (RF25x_CustomCmd)

The function **RF25x_CustomCmd** is used for transmission and/or reception of data from in RF25x sensor.

```
BOOL   RF25x_CustomCmd(
            HANDLE              hCOM,
            char *              pcInData,
            DWORD               dwInSize,
            char *              pcOutData,
            DWORD *             pdwOutSize
`
```

Parameters:

hCOM – descriptor of the device obtained from function RF25x_OpenPort or CreateFile

pcInData - pointer to data array which will be transmitted to RF25X 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.

pcOutData - pointer to data array where data received from RF25X 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

15.15. 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 **RF25x_Measure** while for FTDI USB devices it is **RF25x_FTDI_Measure**

15.15.1. USB connection through FTDI (RF25x_FTDI_OpenPort)

The function RF25x_FTDI_OpenPort opens connection through USB with determined symbol name, fills pointer on device descriptor and returns the result of operation:

```
BOOL  RF25x_FTDI_OpenPort(
            LPCSTR       lpPort_Name,
            DWORD        dwSpeed,
            FT_HANDLE *  lpftHandle
);
```

Parameters:

lpPort_Name – name of USB-device (for example “D2XX Recovery PID for XP”), full syntax you can find in **D2XX Programmers Guide**, function FT_W32_CreateFile with parameter FT_OPEN_BY_DESCRIPTION;

dwSpeed - working speed of USB-device. This parameter is identical of BaudRate field in the FTDCB structure, which is described in **D2XX Programmers Guide**;

lpftHandle - pointer of the device descriptor;

Returned value:

Idf connection is not opened, the function will return FALSE otherwise the function will return TRUE. More detail information about errors you can get by the function FT_W32_GetLastError, described in **D2XX Programmers Guide**

Note: To work with DLL library you can also use **LoadLibrary** function for library loading and **GetProcAddress** function to get pointer on the function.

15.16. Example

```
HANDLE            hRF25x      = INVALID_HANDLE_VALUE;
DWORD             dwValue;
DWORD             dwMeasured;
RF25xHELLOANSWER  hlans;

// Clear structure RF25xHELLOANSWER
memset(&hlans, 0x00, sizeof(RF25xHELLOANSWER));

// Open COM-порт
if (!RF25x_OpenPort("COM1:", CBR_115200, &hRF25x)
     return (FALSE);

// Interrogate device
if (RF25x_HelloCmd( hRF25x, 1, &hlans ))
{
      ////////////////////////////////////////////////
      //                                            //
      // After successful execution of RF60x_HelloCmd//
     // the structure hlans contains information    //
      // about RF25X sensor that responded to request//
      //
      //
      ////////////////////////////////////////////////

     //Read parameter: Sampling parameter
     RF25x_ReadParameter(
                          hRF25x,
                          1,
                          RF25x_PARAMETER_SAMPLING_PERIOD
                    ,
                          &dwValue
                         );
      /* dwValue contains sampling period */
      //Get measurement from the sensor РФ25x
      RF25x_Measure( hRF25x, 1, &dwMeasured );
     /* dwMeasured contains the result */
}
RF25x_ClosePort( hRF25x );
```

16. Extras

16.1. PDA

PDA RF301 is used to work with sensors RF256 Series and provides autonomous work due to built-in accumulator. Overall sizes are shown on the picture 7. Digital display is on the front panel of PDA. In the picture you will find the following buttons: 1 – “reset”, 2 – “search”, 3 – ‘’shift”, 4 – “enter”. The charger connector is on the bottom panel. The slot for connection to the sensor is situated in the bottom of PDA.

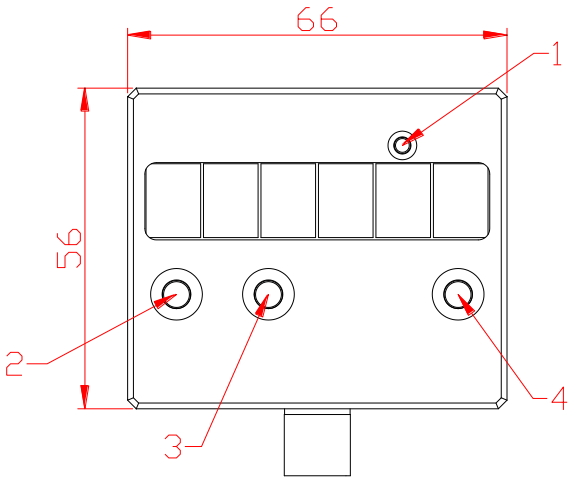


Figure 7

17. Complete delivery package

RF25X Series sensor	1 шт
CD with Software (RF25X-SP and SDK)	1 шт

18. Warranty policy

Warranty assurance for the sensor RF603 - 18 months from the date of putting in operation; warranty shelf-life - 12 months

19. Distributors

AUSTRALIA

Applied Measurement Australia Pty Ltd
RAILWAY INSTRUMENTS ONLY
Thornton Plaza, Unit 5,
27 Thornton Crescent, Mitcham
VIC 3132, Australia
Tel: +61 39874 5777
Fax: +61 39874 5888
sales@appliedmeasurement.com.au
www.appliedmeasurement.com.au

BELGIUM

Althen Sensors & Controls BV
Verrijn Stuartlaan 40, 2288 EL,
Rijswijk, Leidschendam
The Netherlands
Tel: +31 0 70 392 4421
Tel: +31 0 61 396 7830
Tel: +31 0 64 323 8393
sales@althen.nl
info@althen.nl
www.althensensors.com

BOSNIA AND HERZEGOVINA

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

BRAZIL

CAPI Controle e Automacao Ltda
Rua Itororo, 121, CEP 13466-240
Americana-SP, Brazil
Tel: +55 19 36047068
Fax: +55 19 34681791
capi@capicontrole.com.br
www.capicontrole.com.br

BULGARIA

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

CHILE

MOL INGENIERIA LTDA
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
Republica de Honduras 11936
Las Condes, Santiago de Chile
Tel: +56 9 59200362
hconcha@molingenieria.com
www.molingenieria.com

CHILE

Verne SpA
Apoquindo 2818, oficina 31
Las Condes, Santiago, Chile
Tel: +56 2 228858633
info@verne.cl
jsaavedra@verne.cl
www.verne.cl

CHINA

Beijing Haiwei Lutong Technology Co., Ltd
Yard 1, Tianxing Street, Fangshan
District, Beijing, China
Tel: +86 10 8366 1866
Fax: +86 10 8366 1866
info@haiwlt.com
www.haiwlt.com

CHINA

Chongqing Wolf Industrial Technology Co., Ltd
Room 2307 / 2308, Light of City
international business building,
No. 19 Jiangnan Avenue, Nan'an
District, Chongqing, China
Tel: 023 62832618
Fax: 023 62832113
info@wolf-hk.com
www.wolf-hk.com

CHINA

Beijing Gemston Mechanical & Electrical Equipment Co., Ltd
RAILWAY INSTRUMENTS ONLY
Room 613, Anfu Mansion, Fengtai
District, Beijing, China
Tel: +86 10 6765 0516
Fax: +86 10 6765 6966
Mobile: +86 137 1755 1423
dh0526@163.com
www.baoft.cn

CHINA

Xi'an Win-Success Automation Technology Co.,Ltd
Room 3-1-1039, Iduhui Building,
No.11 Tangyan South Road
High-Tech Zone, Xi'an
Shaanxi PRC, China
Tel: +86 29 81106280
Fax: +86 29 81106285
Mob: +86 133 19271405
info@maxsenor.com
www.maxsensor.com

CHINA

Micron-Metrology co., Ltd
No.2, Kecheng Rd., Industrial Park
District, Suzhou,
Jiangsu Province., China
Tel: 0512 65589760
Mob: +86 189 1806 9807
sales@micron-metrology.cn
www.micron-metrology.cn

CHINA

Zhenshangyou Technologies Co., Ltd
Rm 2205-2210, Zhongyou Hotel
1110 Nanshan Road, Nanshan
District 518054 Shenzhen, China
Tel: +86 755-26528100/8011/8012
Fax: +86 755-26528210/26435640
info@51sensors.com
www.51sensors.com

CROATIA

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

CZECH REPUBLIC

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

DENMARK

BLConsult
Ryssbalt 294
95 291 Kalix, Sweden
Tel: +46 70 663 19 25
info@blconsult.se
www.blconsult.se

ESTONIA

FoodLab OU
Haabersti linnaosa, Astangu tn 52
13519 Eesti, Tallinn, Estonia
Tel: +372 56 363110
foodlab.ee@gmail.com

FINLAND

Kvalitest Industrial AB
EXCEPT FOR RAILWAY INSTRUMENTS
Ekbacksvagen 28,
16869 Bromma, Sweden
Tel: +46 0 76 525 5000
sales@kvalitest.com
www.kvalitest.com
www.kvalitest.se

FINLAND

TERASPYORA-STEELWHEEL OY
RAILWAY INSTRUMENTS ONLY
Juvan teollisuuskatu 28
FI-02920 ESPOO, Finland
Tel: +358 400 422 900
Fax: +358 9 2511 5510
steelwheel@steelwheel.fi
www.teraspyora.fi

FRANCE

BLET Measurement Group S.A.S.
1 avenue du President Georges
Pompidou, 92500 Rueil
Malmaison, France
Tel: + 33 0 1 80 88 57 85
Fax: +33 0 1 80 88 57 93
technique@blet-mesure.fr
www.blet-mesure.fr

GERMANY

Disynet GmbH
Breyeller Str. 2, 41379
Brueggen, Germany
Tel: +49 2157 8799 0
Fax: +49 2157 8799 22
disynet@sensoren.de
www.sensoren.de

GERMANY

Finger GmbH & Co. KG
OPTICAL MICROMETERS ONLY
Sapelloh 172, 31606
Warmsen, Germany
Tel: +49 5767 96020
Fax: +49 5767 93004
finger@finger-kg.de
www.finger-kg.de

GERMANY

ALTHEN GmbH Meß- und Sensortechnik
Dieselstrasse 2, 65779
Kelkheim, Germany
Tel: +49 0 6195 7 00 60
info@althen.de
www.althensensors.com/de/

HUNGARY

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

INDIA

Influx Big Data Solutions Pvt Ltd
No:2, Krishvi, Ground Floor,
Old Airport Road, Domlur,
Bangalore - 560071, India
Tel: +91 73 37748490
Tel: +91 94 48492380
milan@influxtechnology.com
support_india@influxtechnology.com
www.influxtechnology.com

INDIA

Paragon Instrumentation Engineers Pvt. Ltd.
RAILWAY INSTRUMENTS ONLY
200, Station Road,
Roorkee, 247 667, India
Tel: +91 1332 272394
tanuj@paragoninstruments.com
www.paragoninstruments.com

INDONESIA

PT. DHAYA BASWARA SANIYASA
Botanic Junction Blok H-9 NO. 7
Mega Kebon Jeruk, Joglo
Jakarta,11640, Indonesia
Tel: +62 21 2932 5859
management@ptdbs.co.id

ISRAEL

Nisso Dekalo Import Export LTD
1 David Hamelech Street
Herzlia 46661 Israel
Tel: +972 99577888
Fax: +972 99568860
nissodekaloltd@outlook.com
www.fly-supply.net
www.aircraft-partsupply.com

ITALY

FAE s.r.l.
Via Tertulliano, 41
20137 Milano, Italy
Tel: +39 02 55187133
Fax: +39 02 55187399
fae@fae.it
www.fae.it

JAPAN

Tokyo Instruments, Inc.
6-18-14 Nishikasai, Edogawa-ku,
Tokyo, 134-0088 Japan
Tel: +81 3 3686 4711
Fax: +81 3 3686 0831
f_kuribayashi@tokyoinst.co.jp
www.tokyoinst.co.jp

LATVIA

FoodLab OU
Haabersti linnaosa, Astangu tn 52
13519 Eesti, Tallinn, Estonia
Tel: +372 56363110
foodlab.ee@gmail.com

LUXEMBOURG

Althen Sensors & Controls BV
Verrijn Stuartlaan 40, 2288 EL,
Rijswijk, Leidschendam
The Netherlands
Tel: +31 0 70 392 4421
Tel: +31 0 61 396 7830
Tel: +31 0 64 323 8393
sales@althen.nl
info@althen.nl
www.althensensors.com

MALAYSIA

OptoCom InstruVentures
H-49-2, Jalan 5, Cosmoplex
Industrial Park, Bandar Baru
Salak Tinggi, Sepang, Malaysia
Tel: 603 8706 6806
Fax: 603 8706 6809
optocom@tm.net.my
www.optocom.com.my

MONTENEGRO

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

NETHERLANDS

Althen Sensors & Controls BV
Verrijn Stuartlaan 40, 2288 EL,
Rijswijk, Leidschendam
The Netherlands
Tel: +31 0 70 392 4421
Tel: +31 0 61 396 7830
Tel: +31 0 64 323 8393
sales@althen.nl
info@althen.nl
www.althensensors.com

NORWAY

BLConsult
Ryssbalt 294,
95 291 Kalix, Sweden
Tel: +46 70 663 19 25
info@blconsult.se
www.blconsult.se

NORWAY

Salitec AS
PB 468, N-1327
Lysaker, Norway
Tel: +47 23 891015
Fax: +47 92101005
mail@salitec.no
www.salitec.no

PERU

Verne Peru S.A.C.
Las Codornices 104,
Surquillo, Lima, Peru
Tel/fax: +51 992436734
info@verne.cl
www.verne.cl

POLAND

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

POLAND

RIFTEK EUROPE sp. z o.o.
ul. Domaniewska 17/19, 02-672
Warsaw, Poland
info@riftek.com
www.riftek.com

PORTUGAL

Campal Inovacoes Ferroviarias Lda.
Lagoas Park, Edificio 7, 1° Piso
Sul, 2740-244 Porto Salvo, Oeiras,
Portugal
Tel: +351 21 584 4348
campal@campal.pt
www.campal.pt

SERBIA

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

SLOVAKIA

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

SLOVENIA

ASCO RAIL sp. z o.o.
EXCLUSIVE REPRESENTATIVE FOR RAILWAY EQUIPMENT
ul. Wielowiejska 53, 44-120
Pyskowice, Poland
Tel: +48 32 230 45 70
Fax: + 48 32 233 21 34
biuro@ascorail.pl
export@ascorail.pl
www.ascorail.pl

SOUTH KOREA

BS Holdings
B-201,Wonpogongwon 1ro,
59 Danwon-gu, Ansan-si,
Gyeonggi-do 15455, Republic of Korea
Tel: +82 31 411 5011
Fax: +82 31 411 5015
bsh5011@hanmail.net
www.lasersolution.co.kr

SOUTH KOREA

PROSEN. CO., LTD
M-1001, Songdo techno park IT center, 32, Songdogwahak-ro,
Yeonsu-gu, Incheon, 21984,
Republic of Korea
Tel: +82 32 811 3457
Fax: +82 32 232 7458
trade@prosen.co.kr
www.prosen.co.kr

SPAIN

IBERFLUID Instruments S.A.
C/ Botanica, 122, 08908
L'Hospitalet de Llobregat
Barcelona
Tel: +34 93 447 10 65
Fax: +34 93 334 05 24
myct@iberfluid.com
www.iberfluid.com

SWEDEN

BLConsult
Ryssbalt 294,
95 291 Kalix, Sweden
Tel: +46 70 663 19 25
info@blconsult.se
www.blconsult.se

SWEDEN

Kvalitest Industrial AB
EXCEPT FOR RAILWAY INSTRUMENTS
Ekbacksvagen 28,
16869 Bromma, Sweden
Tel: +46 0 76 525 5000
sales@kvalitest.com
www.kvalitest.com
www.kvalitest.se

SWITZERLAND

ID&T GmbH
Gewerbestrasse 12/a
8132 Egg (Zurich), Switzerland
Tel: + 41 44 994 92 32
Fax: + 41 44 994 92 34
info@idtlaser.com
www.idtlaser.com

THAILAND

Advantech Solution Co., Ltd.
20/170 Motorway Rd.,
Kwang Pravet, Khet Pravet,
Bangkok, Thailand 10250
Tel: +662 1848705
Fax: +662 1848708
sales@advantechsolution.com
www.advantechsolution.com

TURKEY

MAK Elektronik Malzeme Analiz ve Kalite Kontrol Cihazlari Dis Tic. Ltd. Sti.
Cenap Sahabettin Sokak, No:39,
34718 Kosuyolu - Kadikoy /
Istanbul - TURKEY
Tel: +90 216 402 10 34
Fax: +90 216 402 10 35
ulastac@metalografi.net
www.makelektronik.com.tr

TURKEY

TEKMA Muhendislik A.S.
Cevizli Mh. M. Kemal Cd.,
Hukukcular Towers,
A-Blok, No: 66-A/39
Kartal - Istanbul
Tel: +90 216 970 1318
Tel: +90 850 840 2334
info@tekma.eu
www.tekma.eu

UKRAINE

KODA
Frunze st. 22, 61002,
Harkov, Ukraine
Tel/Fax: +38 057 714 26 54
mail@koda.com.ua
www.koda.com.ua

UNITED KINGDOM, IRELAND

Althen UK
Northamptonshire
United Kingdom
Tel: +44 0 7823 921427
t.stoyles@althen.co.uk
www.althensensors.com
www.althencontrols.com

USA

Althen Sensors & Controls
2531 Bradley St., Oceanside, CA,
92056, USA
Tel: 858 633 3572
r.ream@althensensors.com

USA, CANADA, MEXICO

Acuity Products of Schmitt Industries, Inc.
2765 NW Nicolai Street
Portland, OR, 97210, USA
Tel: +1 503 227 7908
Fax: +1 503 223 1258
sales@acuitylaser.com
www.acuitylaser.com

USA, CANADA, MEXICO

International Electronic Machines Corporation
RAILWAY INSTRUMENTS ONLY
850 River Street, Troy,
New York, USA
Tel: +1 518 268-1636
Fax: +1 518 268-1639
marketing@iem.net
www.iem.net