Remote system for oil pollution detection

Remote Optical Watcher

USER MANUAL

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NOTICES

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User manual number

ROW-UM-Eng-13-REVA-m6-c6

Software:

ROW Manager	**ROW configurator**	
Row Manager V.6.X.X.X	ROW Firmware 6	Row Configurator Version V.6.X.X.X

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Welcome to the ROW User Manual

This User Manual is a document describing the parameters and technical characteristics of the ROW system (hereafter – system or device) guaranteed by the manufacturer. This document will explain the principles behind the ROW's operation and guide you through how to operate the device.

This manual is divided into 6 Chapters:

1. Introduction

2. Unpacking and installation

3. Operation

4. Maintenance

5. Troubleshooting

6. Warranty

Please read this manual carefully before operating the instrument and pay special attention to the safety precautions in Chapter 1.3 and unpacking and installation instructions in Chapter 2. Please read both these sections before unpacking or attempting to operate the device. Please follow the instructions in this manual to ensure the proper operation of the device. Failure to follow these operating instructions properly may invalidate the product's warranty.

Contents

1. INTRODUCTION

This chapter includes principles of operation and safety precautions.

1.1. General description

Remote Optical Watcher (ROW) is autonomous non-contact sensor for detection of oil on water. Highly accurate and easy to maintain, the ROW finds oil spills early so you can respond before things get out of hand.

1.2. Safety precautions

This user manual describes the conditions for safe use of the device. We recommend that the personnel working with the device take a special briefing and safety training before operating the device, which emphasizes the hazards associated with its operation. Safety precautions list below ought to be strictly followed while operating with the device.

1. Installation and maintenance of the device should be carried out by qualified personnel. Technical servicing of the system should only be done by the manufacturer and its certified representatives.

2. The system is classified as a risk group 3 light emission hazard. During operation the LED radiates intense UV light. Precautions must be taken to avoid looking directly and at the reflected UV light. If the device is switched on, **do not look directly** into the UV light beam, and **avoid skin exposure**.

3. Operation of a device, which has been opened or is powered by an unsuitable or defective power supply cable and/or source is dangerous and could cause serious injury or death.

4. The wall outlet of the power supply must have a grounding (earth) contact. If an extension cord is used, make sure that the protector line is not interrupted.

5. Before the instrument is connected to the mains and switched on, check whether the required voltage corresponds to the line voltage.

6. Only trained service personnel should open the device, there are no user serviceable parts inside. Opening the instrument or dismantling parts of the instrument while the instrument is connected to the mains can cause some live components to be exposed. Connectors could also be live. Before any service, repair or change of parts, the instrument must be disconnected from all power supplies.

Service and repair work on an open live device should be avoided whenever possible. If such work is necessary, only qualified personnel aware of the hazards of this work should carry it out.

7. The device should be disconnected from the network for moving and servicing. This is to avoid false alarms and possible damage to the network.

8. Should the safe operation of the device be impaired, due to damage or other circumstances, the instrument must be made inoperative and secured against unintended operation. If a problem should occur with the device, switch off and take proper precautions to prevent further use of the device. The appropriate servicing personnel must then be informed.

LDI AS does not accept any liability for the consequences of irresponsible or inappropriate use or handling of the device.

1.3. Symbols used on instrument labelling

Caution! Consult enclosed documents.

Caution! To prevent electric shock do not remove instrument cover; no user serviceable parts inside. Refer servicing to qualified service personnel.

Caution! UV LED radiation. Avoid exposure to beam. Risk group 3 LED product inside.

The product complies with the requirements of the Electromagnetic Compatibility Directive as defined in 2014/30/EU.

The product complies with the requirements of the Electromagnetic Compatibility defined in EMC Regulations 2016 (Updated 7 November 2023) S.I. 2016 No 1091

The product complies with the requirements of the as defined in EN IEC 60079-0:2018, EN IEC 60079-0:2018/AC:2020, EN 60079-1:2014/AC:2018,   IEC 60079-0:2017 Ed.7, IEC 60079-1:2014 Ed.7, ATEX 2014/34/EU, IECEx 02, S.I. 2016 No. 1107

Earth/ Ground

1.4. Principles of operation

The ROW sensor is based on the fluorescence technique and works as a quick screening method of water surface. The principal merits of fluorescence techniques include the high sensitivity and selectivity of spectral distinction of single components within a complicated conglomerate of organic substances.

The system consists of a pulsed UV LED, receiving telescope, data control and processing electronics. A pulsed LED beam excites oil molecules in the monitored water area, and induces their fluorescence. The telescope collects the resulting returning signal for further processing. The received signal is immediately analyzed by the integrated analytical controller software. Data processing and result delivery are carried out in Real-Time mode. Schematic principle of work of the ROW is given in Figure 1.
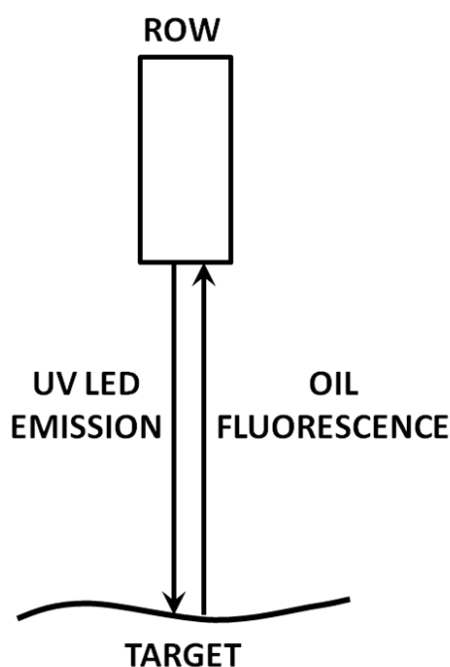
Figure 1. ROW - Principle of operation

The ROW sensor generates an ALARM when the level of detected pollution is higher than the preset threshold. The principle of detection of oil fluorescence is shown in Figure 2 below.

Y–axis – the level of a fluorescence signal, a. u.

The zone of a false alarm (the fluorescence from non-oil products)

The zone of a real alarm (the fluorescence from oil films)

The zone of a background or noise signal

X–axis - time
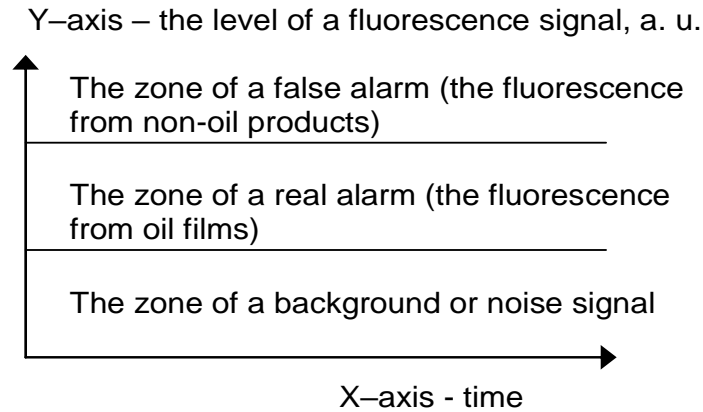
Figure 2. Oil Detection based on fluorescence strength

ALARM signals can be sent via wire or wireless communication systems (ROW system has RS-485 and current loop (4–20 mA) interfaces and "Relay contacts"). The ROW can be integrated in a sensor network and coupled with other devices.

1.5. Technical description

The ROW is enclosed in a sealed metal frame with an external cable for power supply and communication. The device is waterproof and designed to be installed in potentially explosive and flammable environments. The ROW working in real conditions is shown in Figure 3.

Figure 3. Typical picture of ROW working in real-life conditions (Freeport of Riga).

Three models of the ROW: aluminum, stainless steel and ATEX EXD.

1.5.1. Aluminum model (O23XXA)

Figures Figure 4 and Figure 5 indicate the main components of the aluminum ROW device.
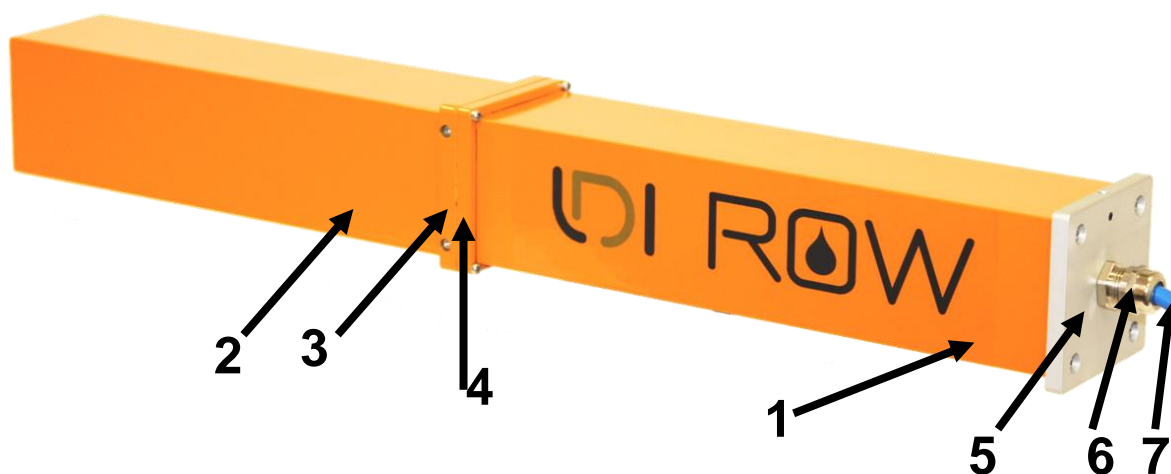
Figure 4. Elements of ROW Aluminum: 1- Main frame, 2 – Sunshield, 3,4 - Mounting plate with four fixing screw holes, 5 - End flange with four fixing screws, 6 - Main cable gland, 7 - Main cable
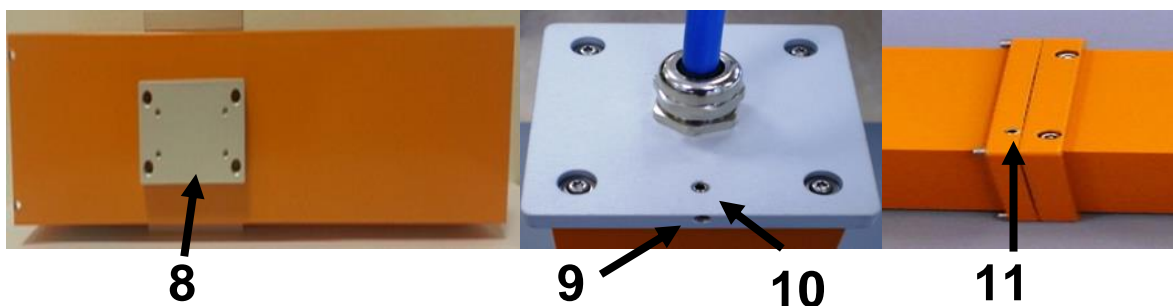
Figure 5. Elements of ROW (continued): 8 - Mounting plate with four fixing screws for external mechanical connection, 9 - Gas valve, 10 - Gas inlet, 11 - Gas outlet.

1.5.2. Stainless steel model (O23XXS)
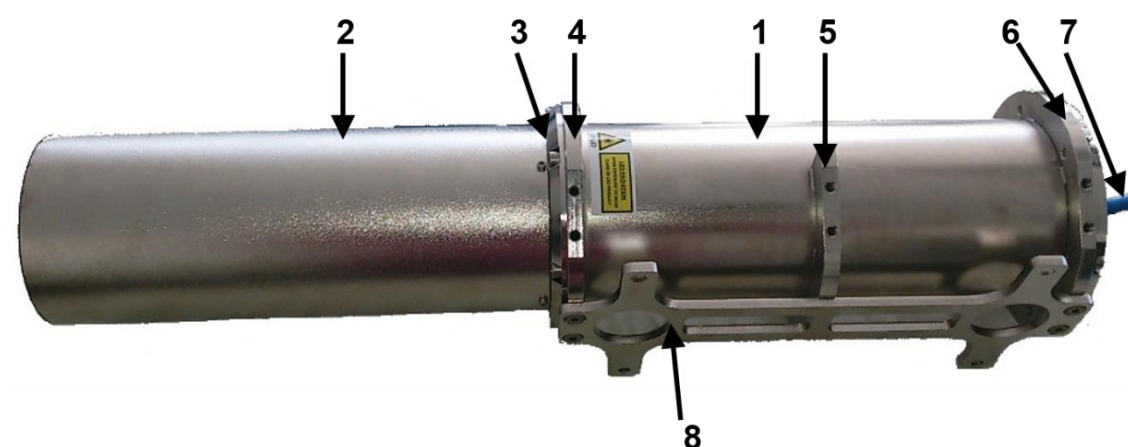
Figure 6. Elements of ROW Stainless Steel: 1 – Main frame, 2 – Sunshield, 3, 4, 5, 6 – Mounting flanges with fixing screw holes, 7 – Main cable with cable gland, 8 – Mounting plate with fixing holes for external mechanical connection.

1.5.3. ATEX/IECEx/UKEX Ex d model (O23XXE/O45XXE)

Figure 7. Elements of ROW Exd model: 1 – Main frame, 2 – Sunshield, 3, 4 – Mounting plates with fixing screw holes, 5 – Main cable with cable gland.

1.6. Technical specification

	Description	Parameters	
1.	**Operational**		
	Interfaces	All models	– Relay output – RS-485 – Current loop (4-20 mA)
	Sensitivity	From 1 micrometer of oil sheen	
	Sensing distance	O2311A	0.3 to 10 m above lower water level
		O2311S	0.3 to 8 m above lower water level
		O2301E	0.3 to 8 m above lower water level
		O2302E	0.3 to 8 m above lower water level
		O4500E	0.3 to 2m above water level
		O4501E	0.3 to 5m above water level
		O4502E	0.3 to 5m above water level
	Conditions of operation	Day and night	
	Mode of operation	Autonomous	
2.	**Technical**		
	Enclosure	O2311A	IP 68
		O2311S	IP 68, stainless steel 316L
		O2301E	
		O4500E	⟨Ex⟩ II 2 G Exd IIC T6 Gb -30C Ta ≤ +60C
		O4501E	IP68 stainless steel 316
		O4502E	
	Light source	O2311A	UVA pulsed LED (risk group 3)
		O2311S	UVA pulsed LED (risk group 3)
		O2301E	UVA pulsed LED (risk group 3)
		O2302E	UVA pulsed LED (risk group 3)
		O4500E	UVC pulsed LED (risk group 3)

		O4501E	UVC pulsed LED (risk group 3)
		O4502E	UVB pulsed LED (risk group 3)
	LED life	Min 5 years at highest sampling frequency	
	Output:	Relay Contacts	standard
		RS – 485	standard
		4-20 mA	standard
		RS-232	
		Ethernet/LAN	optional
		Wireless	optional
		Audio Alarm	optional
			optional
	Wireless Options:	Wi-Fi	
		GSM	Please discuss specific requirements with an LDI engineer
		Radio Link	
		Custom Solution	
	Communication	All wired or wireless communication systems	
3.	**General**		
	Power consumption	< 2 Watt	
	Power Options	+10...30 VDC or +12VDC **depends on ROW model** other options: 110/220 V AC 60/50Hz DC/AC Adapter, Solar power and battery power options	
	Dimensions (L (*L with sunshield) x W x H)	O2311A	310 (*590) X 83 X 80 mm
		O2311S	292 (*611) X 139 X 139 mm
		O2301E	360 (*677.5) X 132 X 132 mm
		O2302E	360 (*677.5) X 132 X 132 mm
		O4500E	360 (*677.5) X 132 X 132 mm
		O4501E	360 (*677.5) X 132 X 132 mm
		O4502E	360 (*677.5) X 132 X 132 mm
	Weight (* with sunshield)	O2311A	1.3 kg (*1.8 kg)
		O2311S	6.5 kg (*9.0 kg)

		O2301E	9.8 kg (*12.2 kg)
		O2302E	9.8 kg (*12.2 kg)
		O4500E	9.8 kg (*12.2 kg)
		O4501E	9.8 kg (*12.2 kg)
		O4502E	9.8 kg (*12.2 kg)
	Operating temperature	- 30°C to + 60°C	
	Base Station	Not required	
	Certifications	**CE** marked **UKCA** marked **IP68** for all models (protection against solid foreign objects IP6X 8h, 2kg/m3 of talcum powder, protection against water IPX8 is 7h with diving depth of 1500 mm) Conforms to US EPA Standards (**EPA/530 / UST-90/009**)	
	Warranty	2 years. Supported worldwide.	

Attention!

XX - submodels of devices:

Models O2301E and O2302E are designed for UVA LED and differ only by optical components set (emission filters, excitation filters, and dichroic window) (customized for specific oil product detection).

Models O4500E, O4501E and O4502E are designed for UVC and/or UVB LEDs and differ only by optical components set (emission filters, excitation filters, and dichroic window) (customized for specific oil product detection).

1.7. Conformity to standards

1.7.1. Aluminum model (O23XXA/O45XXA)

Models: O23XXA: O2311A

$C\epsilon$ 1336

EVS-EN 61010-1, EVS-EN 61000-6-2, EVS-EN 61000-6-3, EN 61000-4 series, EN 61326

UK CA

EMC Regulation 2016 (Updated 7 November 2023) – S.I. 2016 No 1091

IP 68 EN 60529

1.7.2. Stainless steel (O23XXS/O45XXS)

Models: O23XXS: O2311S

O45XXS: O4500S/O4501S/O4502S

$C\epsilon$ 1336

EVS-EN 61010-1, EVS-EN 61000-6-2, EVS-EN 61000-6-3, EN 61000-4 series, EN 61326

UK CA

EMC Regulation 2016 (Updated 7 November 2023) – S.I. 2016 No 1091

IP 68 EN 60529

1.7.3. ATEX/IECEx/UKEX Ex d (O23XXE/O45XXE)

Models: O23XXE: O2301E/O2302E

O45XXE: O4500E/O4501E/04502E

CE 2460

EVS-EN 61010-1, EVS-EN 61000-6-2, EVS-EN 61000-6-3, EN 61000-4 series, EN 61326

UKCA 8501

EMC Regulation 2016 (Updated 7 November 2023) – S.I. 2016 No 1091

IP 68 EN 60529

Equipment is complying with designated standards:
EN IEC 60079-0:2018
EN 60079-1:2014

ATEX 2014/34/EU,
IECEx 02
SI 2016 No. 1107

	ATEX (Flameproof – DNV Presafe)
	⟨Ex⟩ II 2 G Ex db IIC T6 Gb
	(**Zone 1 and Zone 2**)
Zone	**IECEx (Flameproof – DNV Presafe)**
Ratings	Ex db IIC T6 Gb
	UKEX (Flameproof – DNV Presafe)
	⟨Ex⟩ II 2 G Ex db IIC T6 Gb
Notified Body	DNV Presafe
Number of certificates	Presafe 20 ATEX 61463X IECEx PRE 20.0044X DNV 23 UKEX61002X
Ambient temperature	-30˚C ≤ Ta ≤ +60˚C

2. UNPACKING AND INSTALLATION

This chapter gives detailed instructions on unpacking through installation. Read it carefully before operating the device for the first time.

2.1. Packing list

Number	Description	Quantity
1.	ROW system	1 (one)
2.	Cable with terminal block; up to 5m*	1 (one)
3.	RS-485 to USB Port**	1 (one) (optional)
4.	AC/DC converter**	1 (one) (optional)
5	Terminal block with D-sub connector for RS-485 and power jack	1 (one) (optional)
6.	Software stick memory	1 (one)
7.	ROW user manual	1 (one)
8.	Warranty registration form	1 (one)
9.	Customer acceptance form	1 (one)

_____

* – Each ROW comes with standard 5m cable. In case longer lengths are required this will be at additional charge. Please contact our team or your local dealer who will be able to provide a quote based on your situation.

** – Optional

2.2.   Unpacking

The ROW is delivered in a transport box provided by the manufacturer.

To unpack, open the transport box, extract the device and remove any packing and protective materials. Then check the contents of delivery in accordance with the enclosed list.

While unpacking, do not discard any packaging materials until all parts have been unpacked and checked according to the packing list to ensure all items are accounted for. If an item is missing, first check the packaging. If it still cannot be found, inform the sender and supplier immediately by giving as clear description of the missing item as possible using part numbers from this manual (also refer to delivery conditions).

Should there be any damaged or broken parts, repack them in their original packing, and immediately inform the sender and the supplier who will provide further instructions.

2.3. Sunshield assembling

The sunshield reduces the effect of strong ambient sunlight on the operation of the device. Please install the sunshield according to the diagram below.
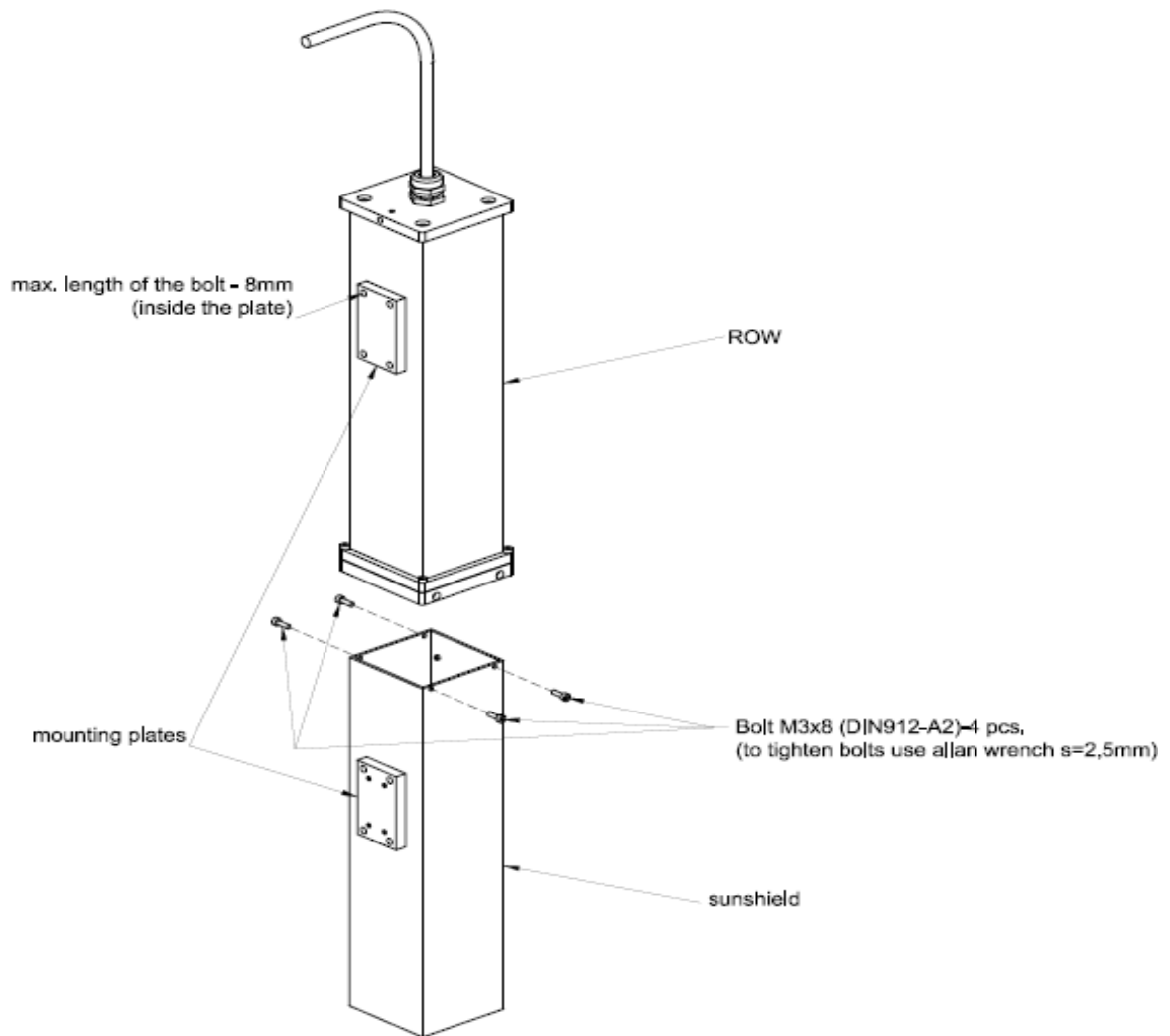
2.3.1. Aluminum model (O23XXA)

Figure 8. Assembly of ROW sensor (aluminum)

WARNING! Do not use longer mounting bolts than supplied by LDI! It may damage the device or cause a gas leak.
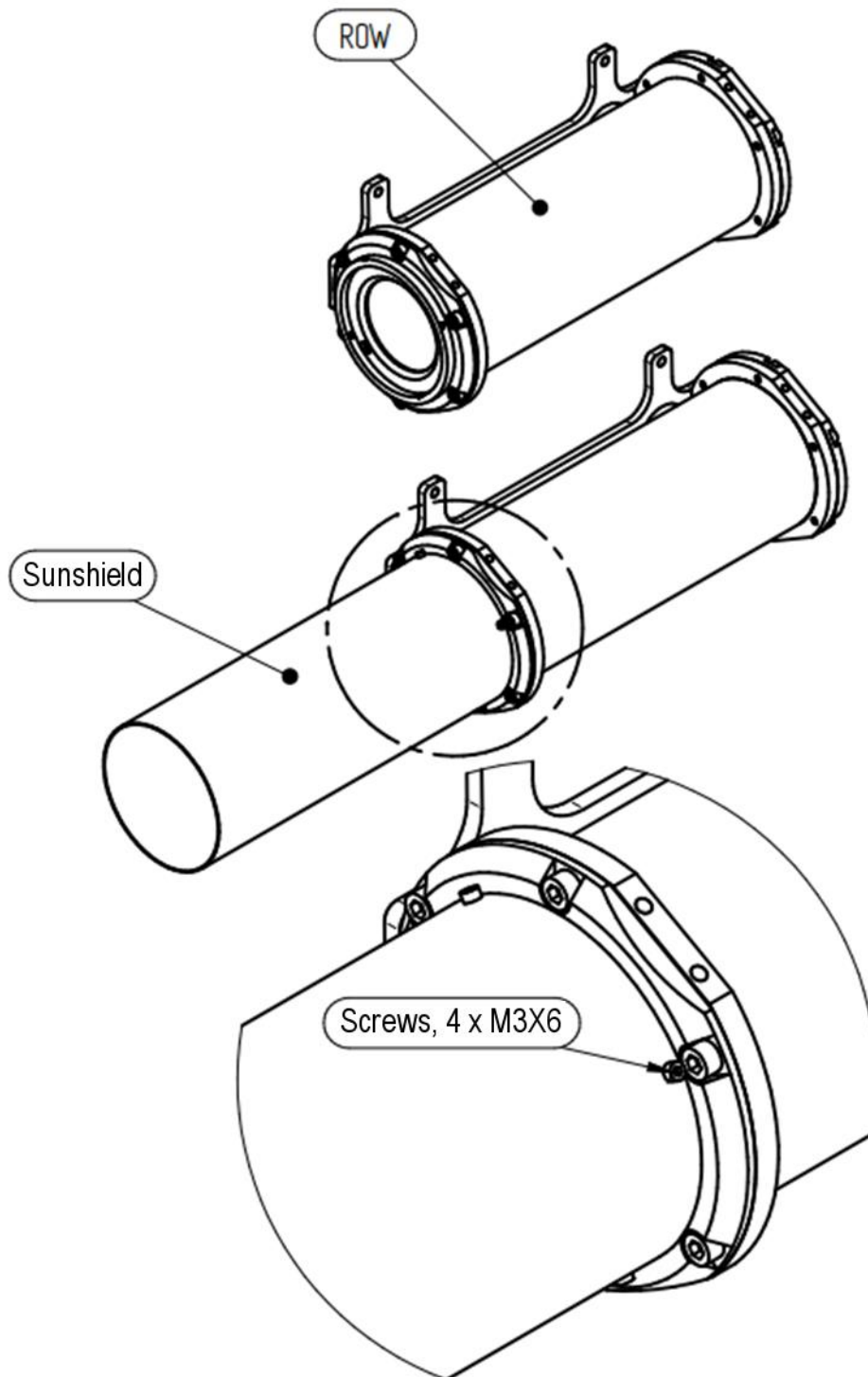
2.3.2. Stainless steel model (O23XXS)

Figure 9. Assembly of ROW (Stainless Steel)

2.3.3. ATEX/IECEx/UKEX Ex d model (O23XXE/ O45XXE)

- Attach the corner 4 to the housing using screws 6 and washers 8, 9.
- Attach the part 3 clamp fixator to the housing using screws 7.
- Attach the housing with the mounted corner 4 to the plate 2 using screws 6.
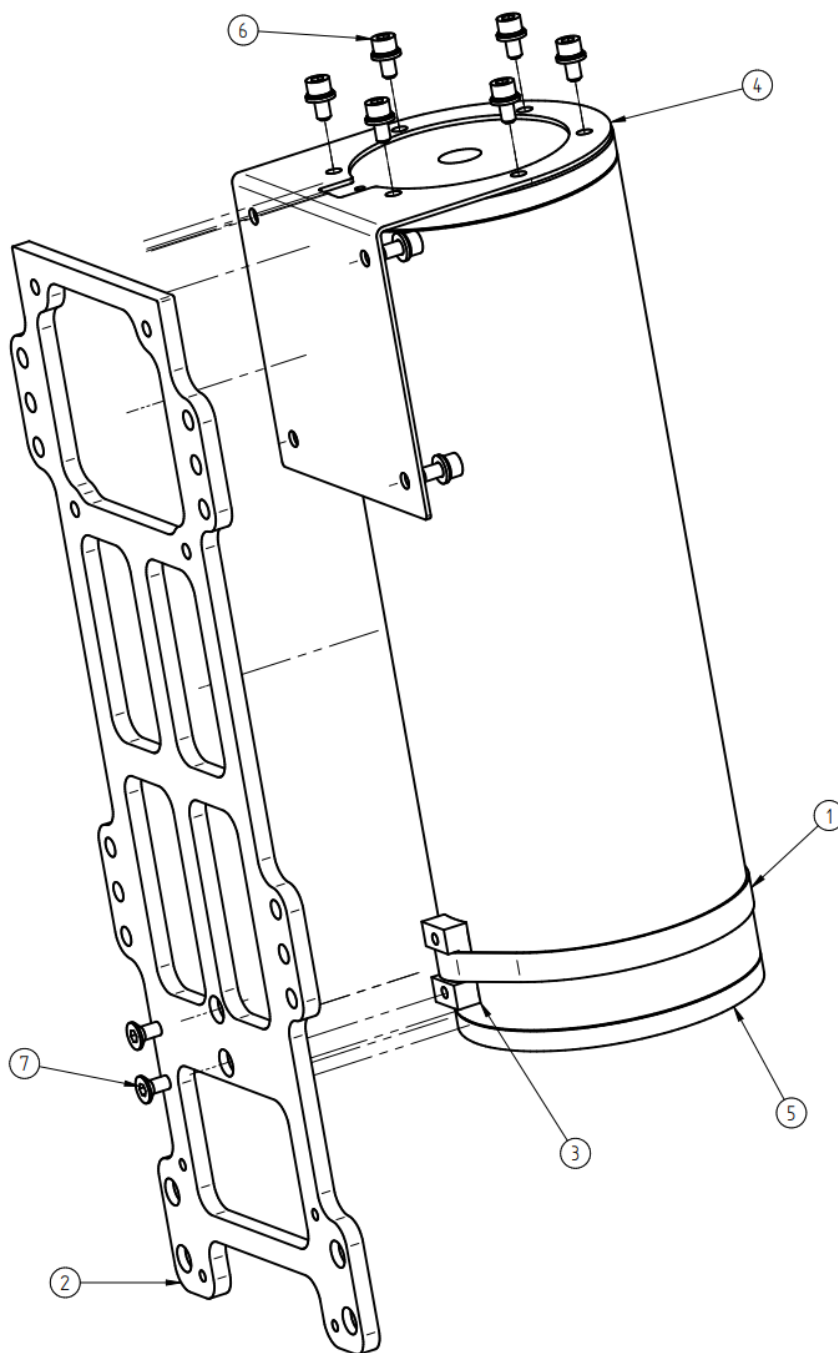- Fix the device with a clamp 1.

Figure 10 Assembly of ROW Ex d: Bracket installation: 1 – clamp; 2 - installation plate; 3 – clamp fixator; 4 - corner ; 5 – ROW body; 6 – screw M6x12 DIN 912 A4; 7 - screw M6x12 DIN7991 A4; 8 - Washer M6 DIN 125A A4; 9 - Washer M6 DIN 127 A4

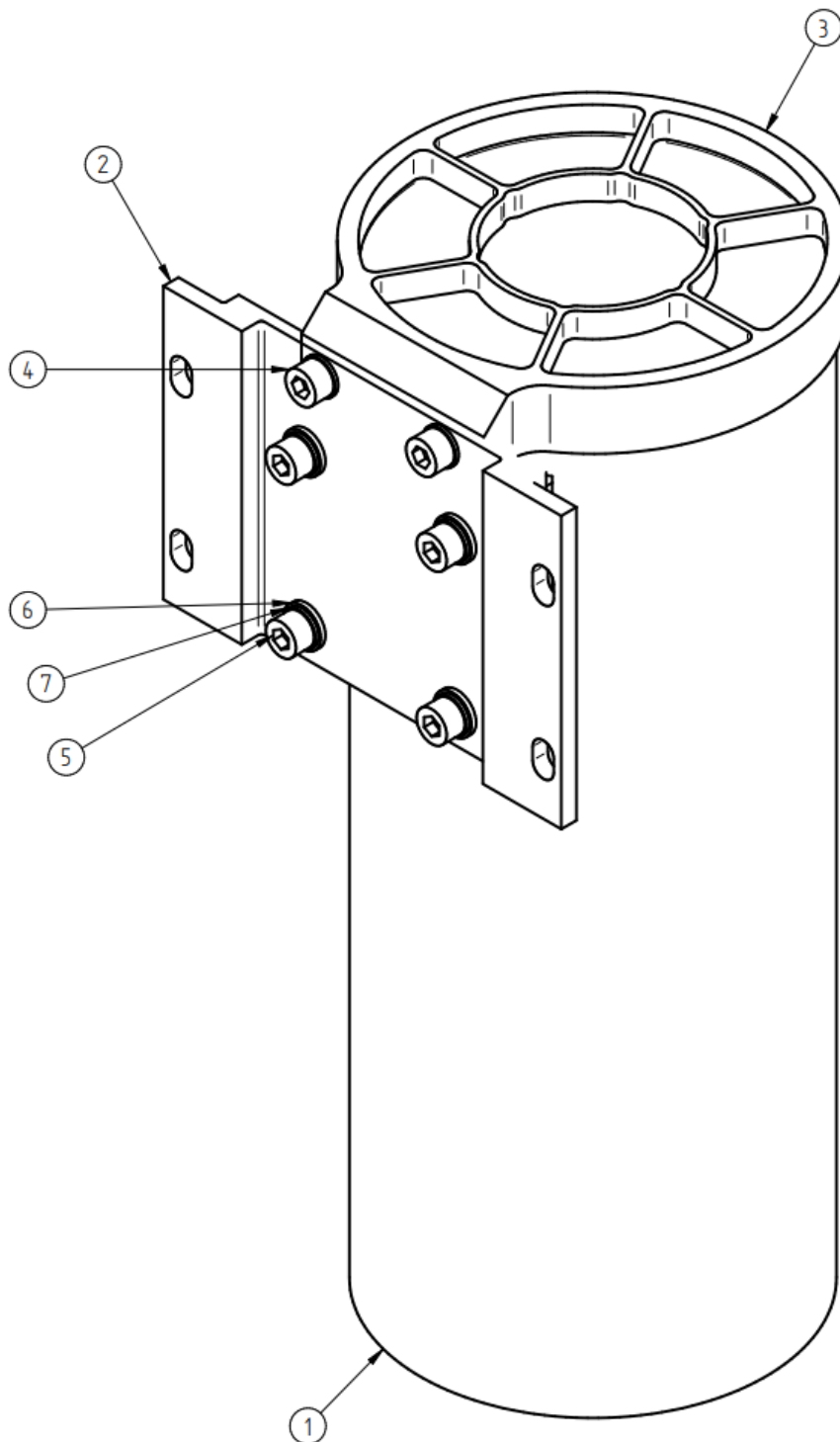- Attach the guard 3 and the plate 2 to the sunshield 1 using screws 4, 5 and washers 6, 7.

Figure 11 Assembly sunshield with guard: 1 – Sunshield; 2 – plate; 3 – window guard; 4 - Screw M6x12 DIN 912 A4; 5 - Screw M6x16 DIN 912 A4; 6 - Washer M6 DIN 125A A4, 7 - Washer M6 DIN 127 A4

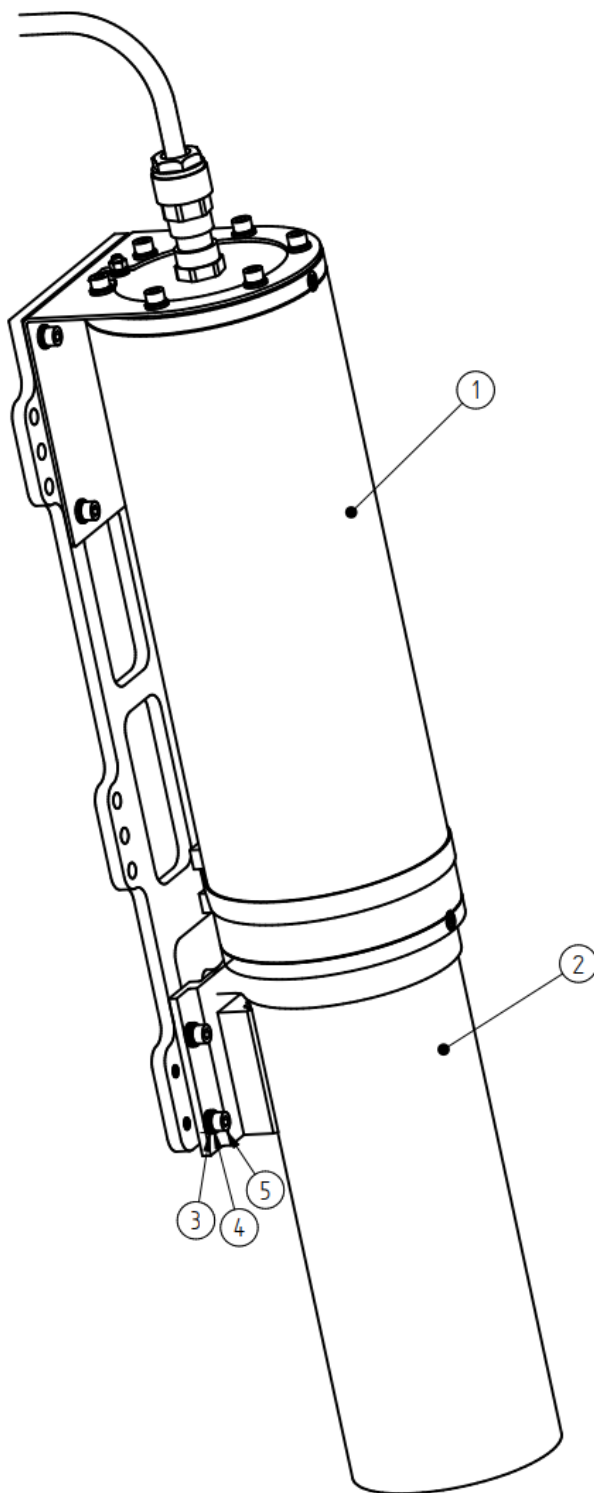• Attach the assembly 1 to the assembly 2 using screws 5 and washers 3, 4.

Figure 12 Final assembly of ROW Ex d/ ATEX/UKEX: 1 – ROW Ex d (Figure 10) and 2 – sunshield with window guard (Figure 11)

Attention! Flameproof and IP68 certified cable gland is a third party component and installed with cable in factory. The default length of the cable is 5 m.

2.3.3.1. Specific conditions of use

The special conditions of use are applied for ROW EX/ATEX models **as shown below:**

- The cable and cable gland certified for protection type 'd' with IP68 rating are initially installed by factory and delivered as complete unit.
- Opening the enclosure is permitted by authorized personnel only. The device must be disconnected from all electric circuits before opening the enclosure in an explosive atmosphere.
- When mounting the enclosure in a hazardous area, only cable glands certified for protection type 'd' with IP68 rating may be used and installed only by authorized personnel.
- Sunshield with window guard should be assembled to enclosure prior to use in a hazardous area.

Please refer to recommended mounting options in Chapter 2.4. Mechanical Installation.

NOTE: Due to the weight of enclosure, precautions must be taken to avoid damages to the equipment and the individual.

2.3.3.2. Specific conditions of use e.g. X-marking

The sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions of Use specified in the schedule to this certificate.

"X" - Equipment must only be placed in areas with low risk of mechanical danger (ref clause 26.4.2 in EN 60079-0:2018).

"X" - Flameproof joints dimensions specified in the drawings are different than the standard requirements. Min 7 threads must be engaged for all threaded flameproof joints

2.4. Mechanical installation

Instrument requirements - At least 8 bolts with 6 mm thread (not supplied) with required length and strength, and a key or a screwdriver for screwing into fixing holes in the mounting.

WARNING! Do not use longer mounting bolts! It may damage the device or cause a gas leak.

To ensure optimum performance the device should be installed in a vertically. There are 8 fixing holes (thread 6 mm) on the side face of the aluminum device (Figure 8). Fixing mechanics depend on the area to be monitored.

Please see the diagram below for suggested mounting options. Please discuss with LDI or your local distributor for a solution specific to your site.
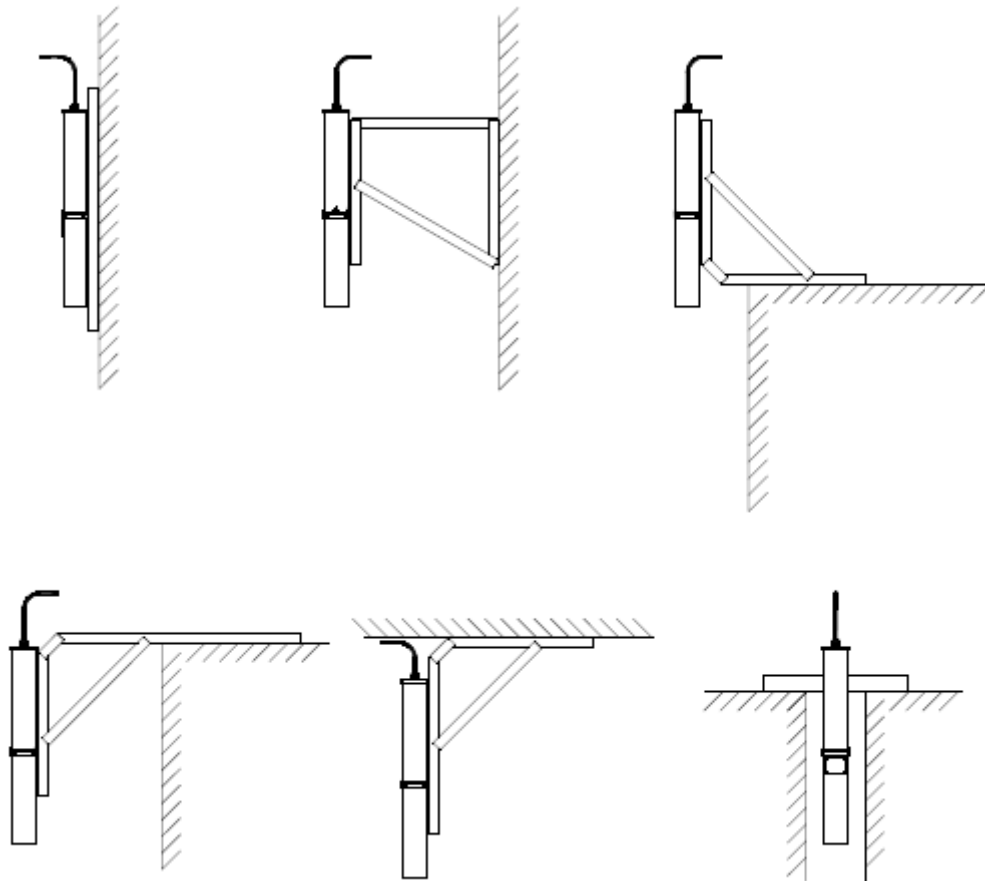

Figure 13. Recommended mounting options for the ROW sensor

2.5. Electrical connections
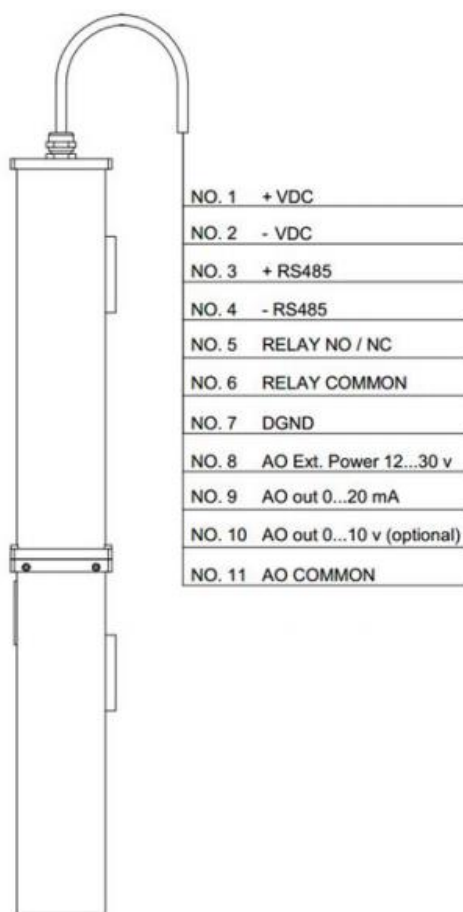
2.5.1. Wiring and specifications

NO. 1	+ VDC
NO. 2	- VDC
NO. 3	+ RS485
NO. 4	- RS485
NO. 5	RELAY NO / NC
NO. 6	RELAY COMMON
NO. 7	DGND
NO. 8	AO Ext. Power 12...30 v
NO. 9	AO out 0...20 mA
NO. 10	AO out 0...10 v (optional)
NO. 11	AO COMMON

Figure 14. Wiring specification of ROW Sensor cable

1. **+VDC** — Positive power supply (+10...30 VDC or +12VDC **depends on ROW model)**
2. **-VDC** — Negative power supply (Ground)
3. **+RS485** — RS-485 positive signal ("A")
4. **-RS485** — RS-485 negative signal ("B")
5. **Relay NO/NC** — Relay wire 1 (refer to sub-section 2.6.2.)
6. **Relay COMMON** — Relay wire 2 (refer to sub-section 2.6.2.)
7. **DGND** — RS-485 Common/Ground ("SC" or "G")
8. **AO Ext. Power** — External voltage supply for Analog Output (12...30V)
9. **AO out 0...20mA** — Current loop (Analog output, refer to sub-section 2.6.4.)
10. **AO out 0...10V** — Optional voltage output, not implemented in standard configuration
11. **AO Common** — Analog Output/Current loop Ground

2.5.2. Power supply

ROW can either be powered using a AC/DC converter provided with the unit, or by a third-party power supply that conforms to the requirements, by connecting "+" and "—" of the power input to wires 1 (+VDC) and 2 (-VDC) .

Power supply requirements:

- **O23XX series   10..30VDC, min 2W**
- **O45XX series   12VDC, min 2W**

Attention! Exceeding maximum permitted voltage levels (30V for O23XX, 12V for O45XX) will cause damage to the device, render it inoperable, and will void the warranty.

To facilitate powering the device with an adapter provided with the unit, a screw terminal with a jack is installed on the cable.

Attention! AC/DC adapter that is provided with ROW is for indoor use only!

The AC/DC power converter must be connected to a line supply with ground protector. **When using an extension lead ensure that the ground protector line is not interrupted.**

ROW can also be powered by a solar panel. For details on alternative power solutions, please contact your local distributor or Laser Diagnostic Instruments.

2.5.3. Analog output voltage and external supply

Analog Output tries to maintain required current by applying necessary voltage to the circuit. Voltage required to maintain necessary current can be obtained from the Ohm's law: I = V/R

By default, Analog Output is powered by internally generated 12V. Maximum voltage that is applied to the Analog Output in this case will be 9V. As a result, maximum wire + load resistance allowed will be 9V/20mA = 450 Ohm.

If total resistance is higher than that, it may be required to provide external power to Analog Output. In this case, the AO Ext. (wire #8) should be connected to an external voltage (max. 30V) and the "Use Internal Power" parameter in the ROW Configurator software should be unchecked. Maximum

wire + load resistance in this case will be defined by AO maximum voltage, which will be equal to

$V_{ext} - 3V$.

Attention! Do not attempt to supply Analog Output with more than 30V

2.5.4. Earthing (grounding) of ATEX/IECEx/UKEX Ex d model

Attention! ROW Ex d model must be earthed/ grounded to meet EMC immunity standards.

Earth the ROW Ex d using one of the supplied securing bolts and spring washers. Only earth at a single point to prevent earth loops.

For grounding use the conductor with minimum cross-sectional area of 0.75 mm2. Use stainless steel earth plate with surface area of at least 4 mm2 and M5 aperture. Figure 15 and Figure 16

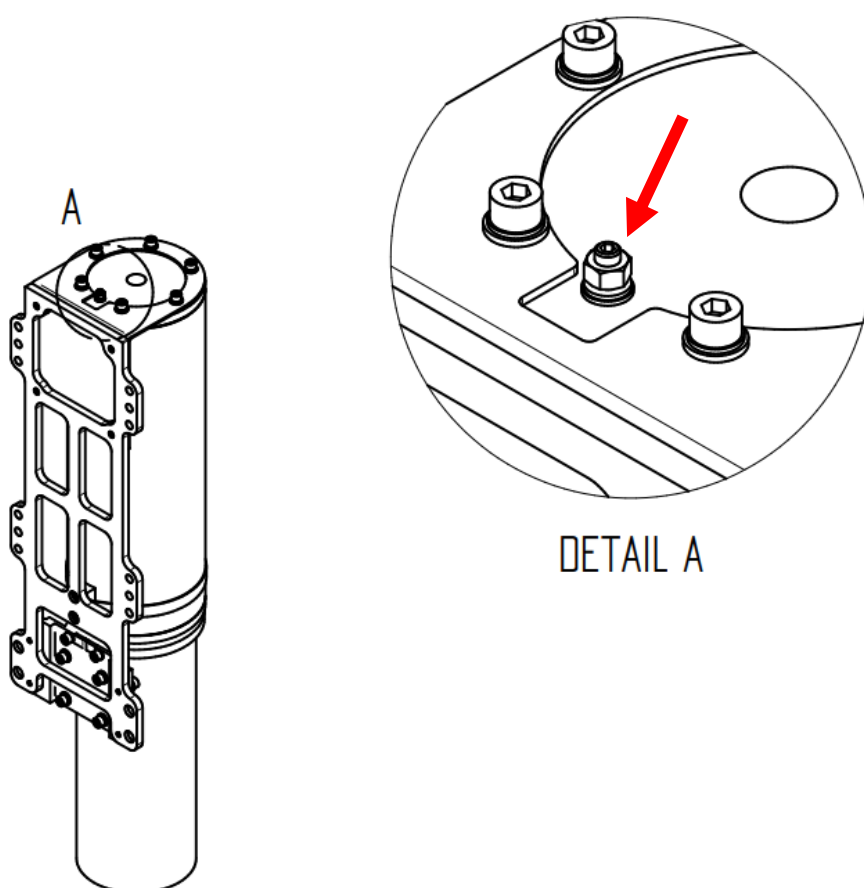show the grounding place and connection. The earth / grounding is labelled   .
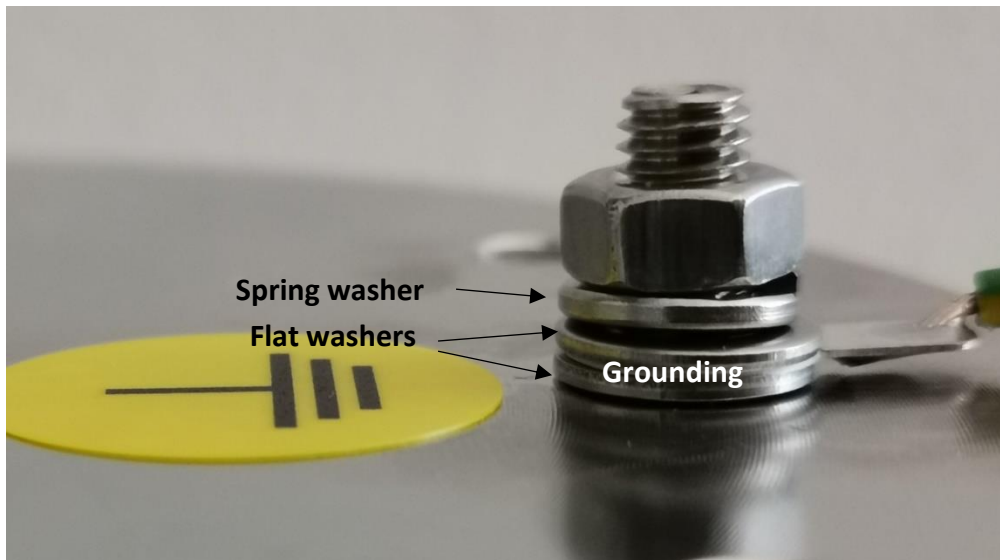

Figure 15 Earth (grounding)

Figure 16 Earth (grounding) connection

2.6. Connection options

2.6.1. Connection with PC

ROW can be connected to PC for run-time monitoring, data logging or configuration.

A PC should have Windows operational system (Windows 7/8/10), and a USB (recommended) or other serial data port for physical connection. The computer should have the ROW Configurator (for configuration and single unit monitoring) and/or ROW Manager (for single/multiple unit monitoring only) installed before use. Installation files are provided by LDI. For further details on the software, refer to chapter 3.

ROW uses RS-485 interface to connect to a PC. RS-485 to USB converter is supplied with ROW unit. Any other means of connecting an RS-485 bus to a computer can be used with ROW (includes, but not limited to RS-485 to Ethernet converters, radio modems, cellular modems, etc).

Attention! LDI does not take any responsibility for operation of any third-party equipment not agreed upon with LDI!

To connect the ROW device to a computer using an RS-485 to USB media converter provided by LDI, plug in the D-Sub connector of the cable terminal into the converter (make sure that ROW cable is connected to the terminal), then plug the converter in the USB port of your computer. If that is the first time the converter is being connected to the computer, please wait for a short time while the

device is being initialized and drivers are set up. For software configuration, refer to section 3.2 (ROW Configurator) and section 3.4 (ROW Manager).

Several units of ROW can be used on the same RS-485 bus or connected to the same computer port. In this case, every device should be assigned an address that is unique within the network. Device address can be assigned in Advanced Mode of ROW Configurator (refer to sub-section 3.2.11. of this manual).

Attention! Only change the device address if multiple devices are going to be used on the same bus. Always remember and/or record the address for every physical device. Unauthorized change of the device address may render the device inoperable!

In case of a long RS-485 transmission line where ROW serves as terminal device, it may be necessary to enable terminal resistor. This can be done by checking the "Turn On terminal device" in Advanced Mode (refer to sub-section 3.2.11. of this manual).

2.6.2. Connection with Relay network

ROW device includes a solid-state relay to indicate presence of an alarm. The relay can have two states (open loop and closed loop) and can be configured as normally-open or normally-closed.

The primary function of the relay is an indication of the oil alarm, therefore it is intended to transmit low-level signals to monitoring systems such as PLC controllers. Powering low-voltage, low-current devices, such as horns and hazard lights, is also possible as long as the voltage and current parameters do not exceed maximum ratings.

By default, the relay is set to work as normally-open (NO). However, it can be configured as normally-closed (NC) by checking *Alarm as open relay* parameter in ROW Configurator Advanced Mode.

Attention! Limitations:

- Max voltage: 60 V
- Max current: 500 mA

Connect Relay output with Relay network input according to scheme in Figure 14.

2.6.3. Connect with LAN network

To manage and monitor ROW over a Local Area Network, Internet or cellular network, the sensor may be connected to a media converter or a device server that would serve as a gateway from RS-485 to the computer network. *Planet ICS-100 media converter* is offered as an optional accessory and support is provided by LDI for its use with ROW sensor, but other device servers or cellular modems can be used. Contact LDI or your local distributor for further instructions.

Attention! LDI takes no responsibility and is not obliged to provide support for any third-party networking equipment not provided or recommended by LDI.

To connect to ROW over LAN network in ROW Manager or ROW Configurator provide an IP and port number of the device server to the corresponding field (refer to sub-section 3.2.5 for ROW Configurator or sub-section 3.4.3 for ROW Manager setup instructions). Device server should be accessible, and network routing options should be set up accordingly.

2.6.4. Connect with current loop (analog output)

ROW device includes a 4-20mA current loop interface, further referred as Analog Output.

The 4-20mA Current Loop is the industry standard that provides analog data transmission from sensors and other monitoring equipment, and which is easily integrated with various industrial control systems, such as SCADA systems, PLC controllers, etc.

The ROW's analog output is a flexible and highly configurable current loop interface. It can output data in analog (signal in range between adjustable thresholds) or discrete (alarm, no alarm, fault) form, in a range of either 0-20mA or 4-20mA.

The ROW Analog Output functions as **current source only.** Voltage for current loop can be supplied either by ROW itself (limited to 12V), or a dedicated wire in ROW cable, if higher voltage is desired. **Powering the ROW instrument from the loop is not possible!**

Attention! Limitations:

- ROW Analog Output can only function **as current source** (active device)!

- External power voltage range: 12...30V

- Max resistance of wires+load (int.power) 450 Ohm

Connect analog current loop output with current loop input of transmitter according to scheme provided in Figure 14.

3. OPERATION

This chapter describes how to operate your ROW Device. These instructions focus on the use of the ROW Configurator and ROW Manager software and configuring of sensor; please consult LDI or your local dealer for more detailed instructions on the direct use of the relay contacts.

Precaution! All electrical connections and software installations on the user's/installer's PC should be done before TURNING ON the instrument. For information on installation of the device, see Chapter 2.

To turn on the device, simply power it up (refer to sub-section 2.5.2 for voltage and power requirements), the device will start up automatically and begin to emit UV light. To check if that ROW sensor is working, a piece of white paper can be placed under the device. A flashing blue light spot should appear on the paper. The visible light spot may be weak, depending on the paper used and the model of ROW, it is recommended to obscure the paper from direct sunlight. If the light on the paper is still not visible, refer to section **Error! Reference source not found.** of Troubleshooting o r contact LDI for further instructions.

Attention! Do not stare into the optical opening of the device! Do not direct the device on people or animals! Use of UV-protective eyewear is recommended at all times when working with the device. ROW emits invisible and powerful beam of UV light that is extremely harmful for eyes.

3.1.   Alarm Generation

Based on the fluorescence levels and signal behaviour, the ROW will identify an oil spill and raise an alarm if the situation meets the criteria of an oil spill.

The following factors are important for identification of an oil spill, and are therefore required to be configured to efficiently utilise the device:

- **Signal thresholds**
    - o An alarm will only be generated when the signal is within thresholds (above Threshold Low and below Threshold High)
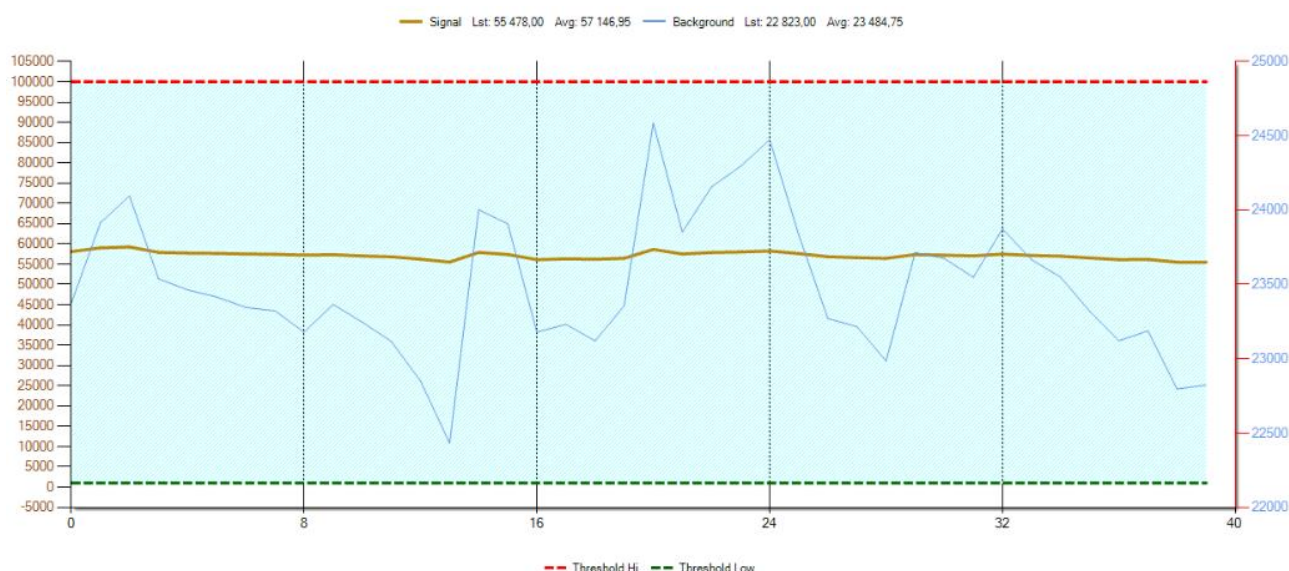
Figure 17. Signal between alarm thresholds

- o Signal level caused by an oil spill depends largely on the environmental factors of an installation site, such as distance to water, water cleanliness, presence of residual traces of oil product that are not considered a spill ("normal" level), etc.
- o Thresholds must be configured at the installation site, taking into account environmental factors and desired sensitivity. Please refer to the Section 3.3. for further details or contact LDI or your local distributor for assistance.

- **Background change**
  - o An alarm will only be generated when background level does not change significantly as the fluorescence level enters the thresholds (background change is less than defined in *Max change in Bkg* parameter).
  - o Oil products rarely cause strong sun reflection compared to water. Therefore, it is assumed that if the level of background signal changes significantly, there is a fluorescent object in the detection area other than an oil spill (such as paper, polystyrene, etc).
  - o By default, *Max change in Bkg* is set to 2. This value is considered optimal for most cases. If it is required to change this parameter (for instance, when detecting substances that have significant reflectivity), the value should be chosen in accordance with the expected oil product's reflectance.

- **Delay**
  - o An alarm will only be generated if the signal has stayed within the thresholds **for a certain time**, defined by the *External alarm (sec)* parameter.

o Default value for this parameter is 5 seconds. It is assumed that oil spills do not dissipate instantaneously, but rather stay in place for a significate time. Foreign objects with fluorescent characteristics similar to an oil spill, and insignificant spills or droplets of oil products are usually considered false alarms, and therefore their alarm triggering is not desired.

o For certain applications (identification of less significant spills, highly volatile substances, high current velocities) this parameter might require adjustment.

Once an oil spill has been identified by ROW, an alarm will be generated. These are following ways to check an alarm status of the device:

- **ROW Configurator** An alarm will be recorded in the log and displayed in the status window. Refer to the Section 3.2 for further details.

- **ROW Manager** An alarm will be recorded in the log and shown in the event list, the device will display "Alarm" in its status column. Depending on user settings, a notification window may appear showing the alarm, an e-mail notification can be sent, or an UDP status packet may be transmitted. Refer to the Section 3.4. for further details.

- **Relay output** Relay will change its state. Refer to the sub-section 2.6.2. for further details.

- **Analog Output** When working in <u>Alarm mode</u>, 20mA current will be maintained on the current loop. Refer to sub-section 3.3.5. for further details.

Attention! If ROW has started up while there is an oil spill in the detection area, the device will not raise an alarm until the current oil spill has been cleared!

3.2. ROW Configurator

The ROW Configurator software is designed for clients and service personnel to **perform initial setup of ROW devices**, either at an installation site or for demonstration purposes.

ROW Configurator can also be used for monitoring purposes, but its monitoring and notification functionality is limited, and it can only handle a single device at a time. ROW Manager is recommended for long-time monitoring and alarm handling of ROW sensor. Refer to section 3.4 for more information on ROW Manager.

3.2.1. Installing ROW configurator

The software can be installed from an LDI flash memory drive. In this case, please open the flash memory drive, and click Setup RowConfigurator6 v6.x.x.exe.

3.2.2. General description

Installation setup will create a ROW Configurator icon on your Desktop. Click on the icon to start the ROW Configurator.

Figure 18. Screenshot of the ROW Configurator window

To connect with ROW using the Configurator, a connection to computer over USB, serial port or TCP/IP network should be established. Following sub-sections describe connection methods in detail. For physical connection between ROW and the computer, refer to section 2.6.

3.2.3. FTDI connection type (USB)

This option may be used if ROW is connected to the computer with an RS-485 to USB adapter provided by LDI. Choose "**FTDI**" in the drop-down list of "**Connection Type**" box. Software should automatically detect the adapter if it is plugged in. Choose the adapter (*FT232R USB UART*) in the drop-down list of the "**Select FTDI device**" box (Figure 19).
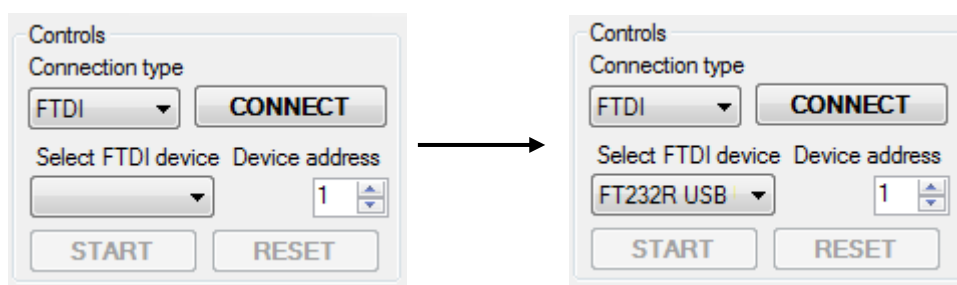
Figure 19. Selecting the RS-485 to USB adapter in ROW Configurator

3.2.4. COM connection type (serial port or serial converter)

This connection type may be used if ROW sensor is connected to the computer using a virtual or physical serial port (mainly RS-485 to USB or RS-485 to RS-232 media converters). Physical serial ports exist on some computers as a hardware RS-232 COM port. Virtual serial (or virtual COM) ports are created when a USB media converter is plugged in the computer USB port, and removed when the media converter is unplugged.

Choose "**COM**" in the drop-down list of the "**Connection type**" box. This should detect all the available serial ports in your system. Then select the COM port associated with ROW serial adapter from the drop-down list in the "**Select COM port**" box. This list contains all the serial ports found on your PC and is refreshed every time "**COM**" connection type is selected (Figure 20).
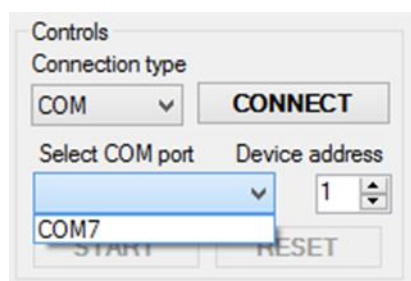
Figure 20. Selecting the COM port in ROW Configurator

If more than one COM port is present and you are not sure which one is associated with ROW, there are two ways of finding the correct one:

1. With the USB converter <u>unplugged</u>, open the COM port list and take a note which ports are in the list. Then plug in the converter, select COM connection type to refresh the list, and open the list again. The port that was not present before will be the correct one

2. Open the Windows Device Manager (press *Win+R*, type in *devmgmt.msc* and press *Enter*). Expand the **Ports (COM and LPT)** section. An RS-485 to USB converter will be shown as USB Serial Port. Mark the port name in brackets and select it in ROW Configurator.
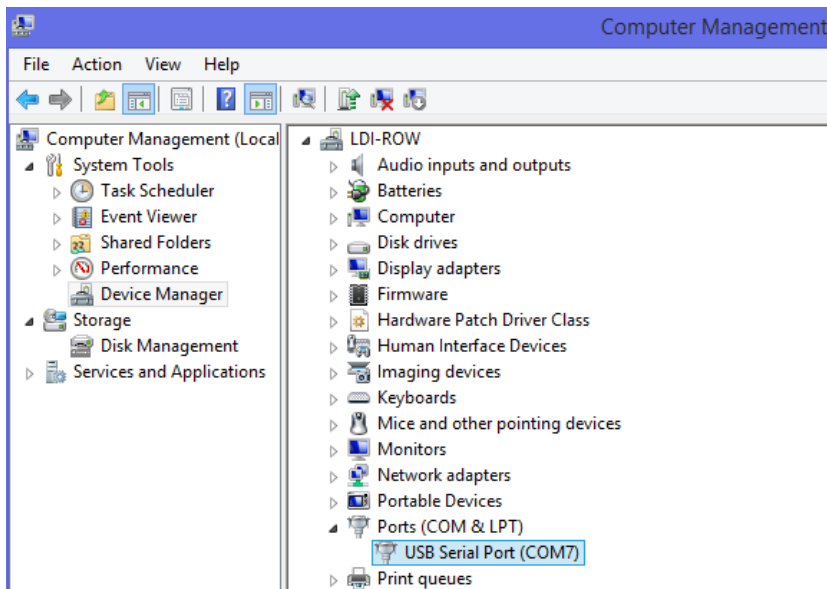
Figure 21. Windows Device Manager displaying RS-485 to USB converter as "USB Serial Port"

3.2.5. TCP connection type (TCP/IP over LAN or Internet)

This connection type can be used with any device servers that serve as a gateway from RS-485 to Ethernet, as well as RS-485-capable cellular modems. Please refer to sub-section 2.6.3 for further details.

Choose TCP under "Connection Type" box. Type in the IP address of the device server, and its port (for example, *192.168.0.100:23*).
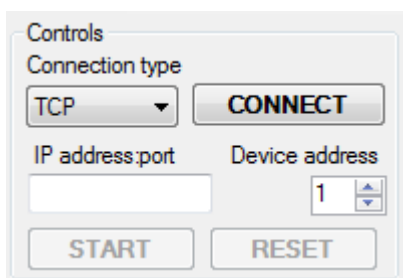
Figure 22. TCP connection to ROW

3.2.6. Connect to the device and read the device information

To establish connection, choose the connection type (see above), enter the device address (refer to sub-section 2.6.1 for more information on device addresses) and press Connect. If the connection has been successful, device state and technical information will be displayed in the Status area, and device parameter values will be written in the corresponding fields.
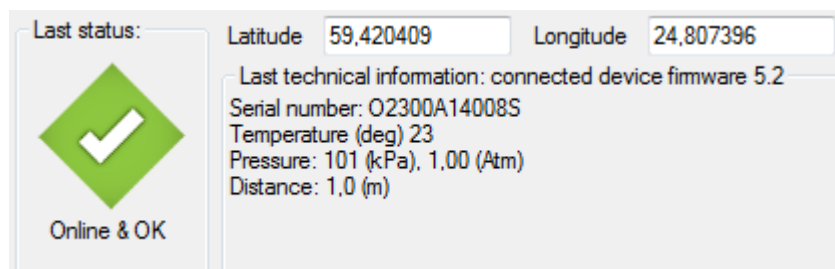
Figure 23. Device status area

The *Last status* pictogram will display one of the following device states:

- Online and OK (no oil spill)
- Alarm (oil spill detected, see section 3.1)
- Foreign object (fluorescent object not yet identified as oil spill)
- No connection with ROW
- Connecting to ROW, please wait

3.2.7. Device monitoring

To start monitoring the device, press "**START**" button. ROW Configurator will begin polling ROW sensor for data and display it on the graph. To stop monitoring, press **"STOP"** button.

The graph will display both signal and background in real time, as well as the current device state (see above).

Figure 24. ROW Configurator monitoring the device, no alarm
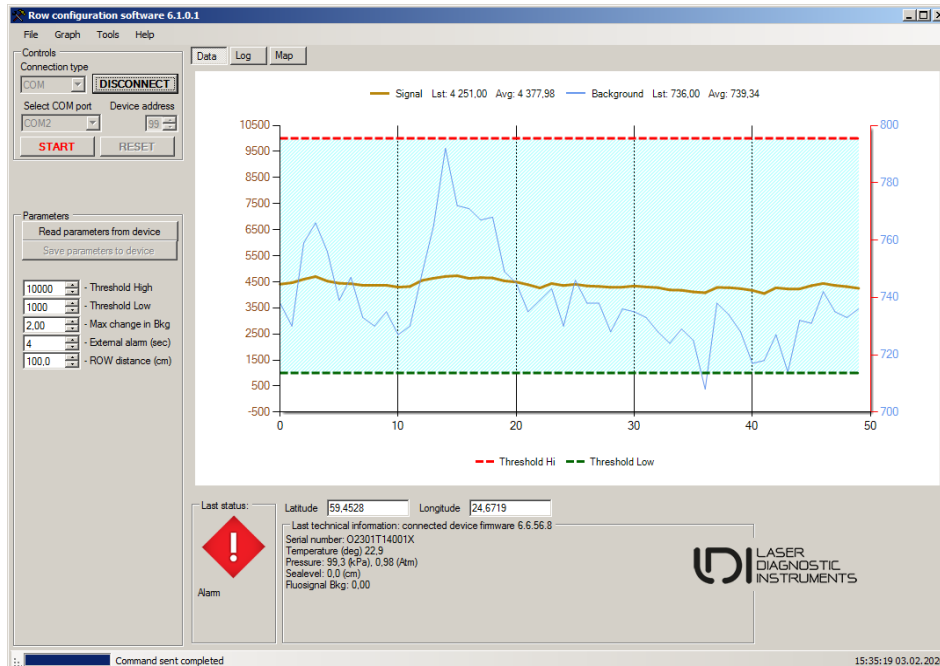
Figure 25. ROW Configurator monitoring the device, alarm

3.2.8. Device parameters

Apart from monitoring the device state, signal and background, ROW Configurator can also be used to adjust device parameters.

Following parameters can be changed by user:
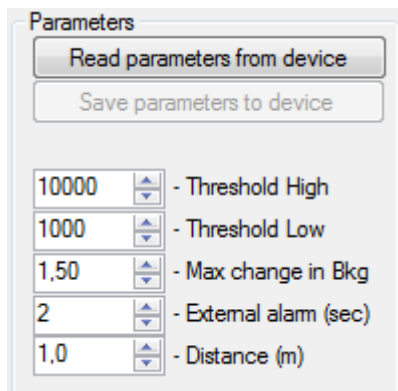
Threshold High – to set maximal level of ALARM

Threshold Low – to set minimal level of ALARM

Max change in Bkg – refer to Chapter 3.3.3

External alarm (sec) – to set the time delay of the alarm into accordance with the measurement conditions

Distance (m) – distance from ROW to object (water surface)

Figure 26. ROW parameters

For explanation of the parameters, please refer to section 3.1. It is recommended to contact LDI or your local distributor prior to adjusting the device.

To save new values of these parameters to the ROW, click the "**Save parameters to device**" button (this button is active after changing any parameters). To see the current configuration of the device, press "**Read parameters from device"**.

3.2.9. Logging

All the measurements and any software information are saved in log files. Click *File->Data Log->Open* to access the log file location.
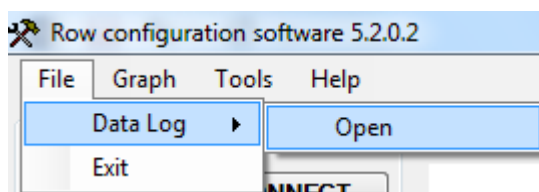
Figure 27. Accessing ROW Configurator log files
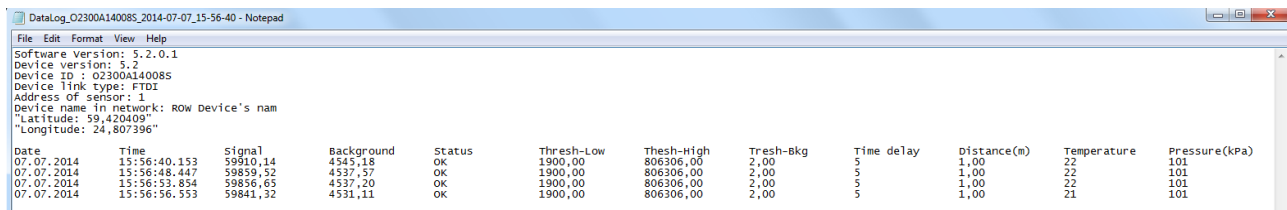
Files can be found at the following location:

<Current User>\Documents\RowConfigurator6\Logs\YYYY-MM

Where YYYY – year, and MM – month when the log has been started. Every YYYY-MM subfolder contains all the log files for that period of time.

Following log file types are generated by ROW Configurator:

- **Device Log (*DevLog_YYYY_MM_DD.html*)**
    - Logs all the operations and state changes of the device monitored by ROW Configurator.
- **Running Log (*RunLog_YYYY_MM_DD.html*)**
    - Logs technical information that concerns ROW Configurator operations.
- **Data Log (*DataLog_XXXXXX_YYYY_MM_DD.txt*)**
    - XXXXXX – Serial number of the device. Logs all the measurement information, including signal and background etc. Includes parameter header.

Figure 28. Data Log file opened in Notepad

3.2.10. Additional functionality of ROW Configurator

Graph tab
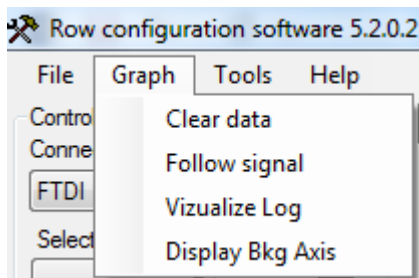
Figure 29. Graph tab.

Clear data – erases graph field

Follow signal – normalizes fluorescence signal on graph field

Visualize Log – opens selected log in graph field

Display Bkg Axis – creates secondary axis for background on the right size in normalized mode
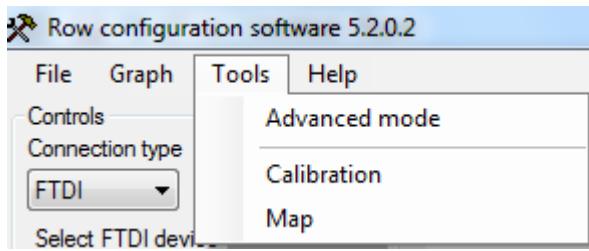
Tools tab

Figure 30. Tools tab

Advanced mode – opens advanced options using special passwords

Calibration – opens Calibration Wizard

Map – Shows the device on map

Help – shows software and manufacturer info

3.2.11. Advanced Mode

For setting up advanced parameters of ROW, such as device address, analog output parameters, and others, a special mode can be accessed. Advanced mode can be enabled by selecting *Tools -> Advanced Mode*. To prevent unauthorized access, a password is required to access the Advanced Mode. To get the password, please contact your distributor or Laser Diagnostic Instruments AS.

Attention! Only access the Advanced Mode and change the advanced parameters when it is necessary. Changing some of the advanced parameters may render the device inoperable. Keep a record of any changes made in the Advanced Mode!
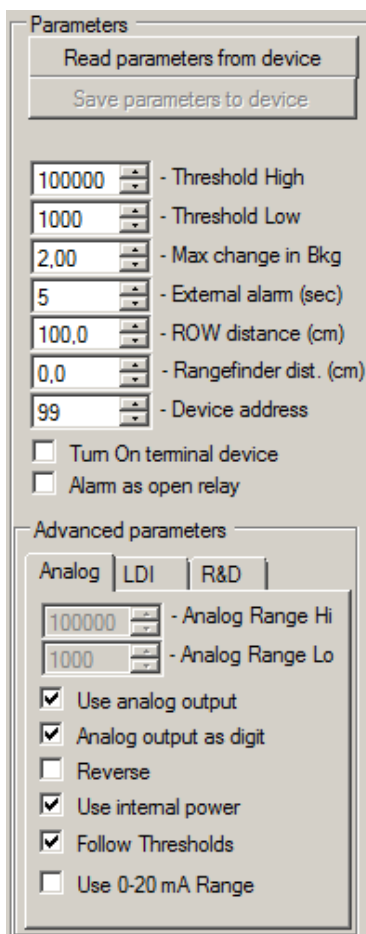
Figure 31 Advanced mode parameters

The following parameters are considered Advanced and are only accessible from Advanced Mode:

- **Rangefinder dist. (cm)**
  - Only relevant when using a Senix Rangefinder accessory. Please refer to the rangefinder manual
- **Device address**
  - Changes the device address, allowing the use multiple devices on the same network. **Refer to the subsection 2.6.1.**

Attention! Carefully read the subsection 2.6.1. before changing this setting!

- **Turn On terminal device**
  - Enables a terminal resistance for long RS-485 lines. Refer to subsection 2.6.1.
- **Alarm as open relay**
  - Toggles relay behaviour between NO and NC. Refer to subsection 2.6.2.
- **Advanced parameters – Analog tab**
  - Various current loop/analog output parameters. Refer to subsections 2.6.4. and 3.3.4.
- **Advanced parameters – LDI tab**
  - Not in scope of current manual. Please do not change.

3.3. ROW calibration and adjustment

3.3.1. Configuring alarm thresholds
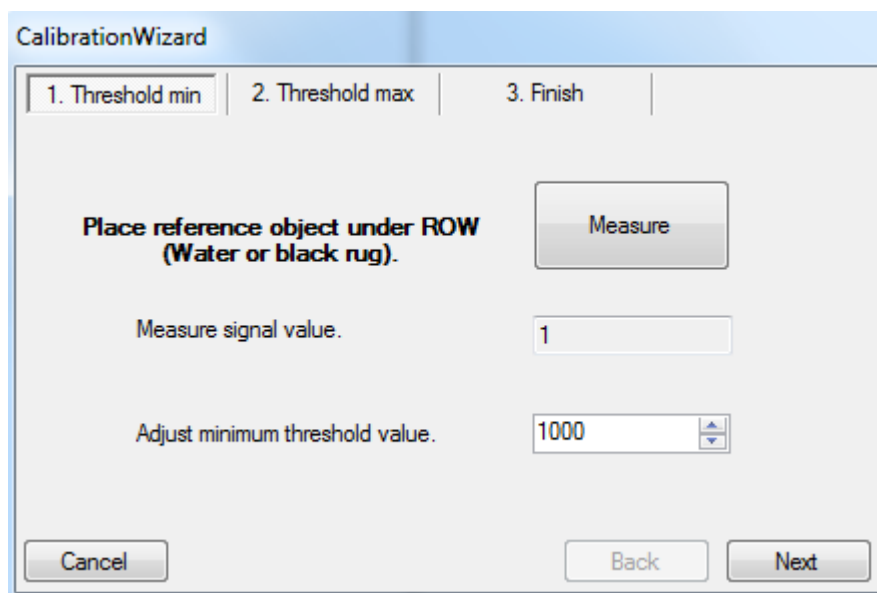
Set the value for *"threshold low"* higher than the fluorescence of the reference object (body of water, black rug) during measurements. This can be determined by looking at the "Signal" value when the ROW is positioned over the reference object. The *"threshold low"* value should also be lower than the fluorescence of the object (film of oil) that is being looked for. This can be determined by looking at the 'Signal' value when the ROW is positioned over the object being looked for.

Set the *"threshold high"* value to a higher value than the maximum fluorescence of the object class (oil products) that is being looked for. This can be determined by placing oil under the sensor; the value should be set significantly higher than the oil reading, which can be seen as the "Signal" value given on the ROW configuration software screen. To increase the range of products that can be detected, this value can also simply be set to be 10% lower than the signal value from a highly fluorescing object like paper.

3.3.2. Calibration wizard

The calibration wizard helps user with threshold settings.
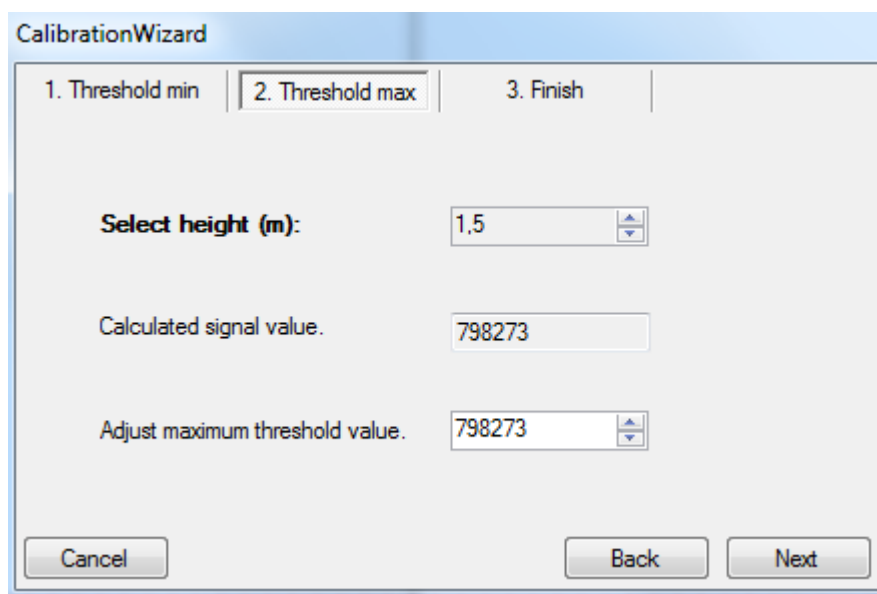
Open **Tools** menu and click **Calibration**.

Figure 32. Adjusting Threshold-Low

Position ROW over water surface (or black rug) and press **Measure**.

The ROW calibration wizard automatically calculates Low threshold. Click **Next** for next step.

Figure 33. Adjusting Threshold-High

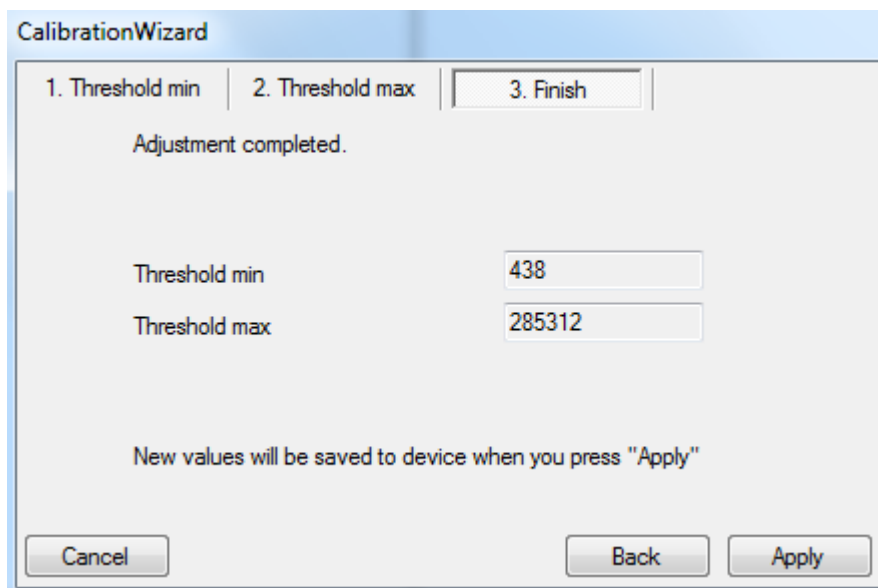Select distance to monitoring area. Click **Next**.

Figure 34. Finalizing calibration.

Calibration wizard asks user about new parameters. Press **Apply** for confirmation of new parameters. New parameters will be saved to the ROW's Controller.
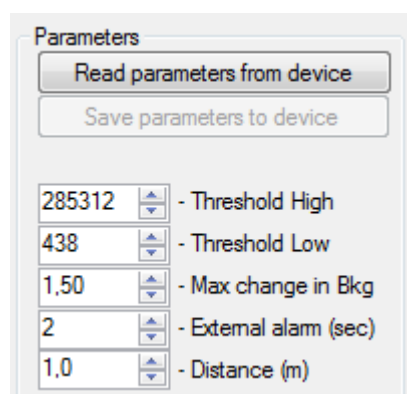

Figure 35. Calibrated parameters

3.3.3. Background settings

The ROW uses sophisticated technology to detect whether there is oil present or not. The device measures two parameters, Signal, S; and Background, B.

Arbitrary units are used for Signal Thresholds and relative units are used for Background Threshold.

Plastics, which are made from oil, will fluoresce in the same intensity range (have similar Signal values). However, many plastics reflect light more strongly than oil and surrounding materials. For plastics, the Background value will be more than double compared to the Background value for

water, for example. For actual oil spills, the Background will only slightly increase. Hence, if the Background has significantly changed, the ROW algorithm regards this as a false alarm and does not send an alarm alert (or trigger the Relay). In summary, the device will alarm if:

Signal is in alarm zone and $\frac{B_2}{B_1} < T_B$

Where:

B$_1$ is the Background value before the Signal has entered the threshold range

B$_2$ is the Background value after the Signal has entered the threshold range

T$_B$ is the maximum allowed change in background (Max change in Bkg)

Otherwise, the device will not alarm.

You can also set the "Max change in Bkg" parameter. For most presentations, the value 2.00 is fine for this and does not need to be changed.

See the troubleshooting steps in section 5.3 'Troubleshooting alarm thresholds' for more information.

3.3.4. Compensation for external factors

There is a special algorithm in place to compensate for long-term signal changes, such as water level rising/falling, water pollution and turbidity, seasonal dissolved organic matters (DOM) variations and other weather conditions. This algorithm can be enabled by setting the TAU parameter (in ROW Configurator Advanced Mode, LDI tab) to a non-zero value.

Function and purpose

The purpose of the background signal compensation is to accommodate for environmental changes that can affect detection capabilities of ROW.

While ROW can reliably indicate presence of an oil spill in static conditions by measuring the fluorescence strength level (usually referred to as "signal"), changing environment factors can affect the measurements, and as a result, detection capabilities. These factors include, but are not limited to, water level, precipitation, water clearance, presence of contaminants in water, etc. Certain parameters adjusted during the on-site device calibration (thresholds, distance) are meant to take

those factors into account in static conditions. However, these parameters may become inadequate whenever the environment conditions change.

Background signal compensation discards the slow signal changes, that are assumed to be caused by environmental factors and natural phenomena rather than an oil spill. Since oil spills usually cause fluorescence level to rise rapidly, signal change caused by a spill will still be detected, and an alarm will still be generated.

Operation

Setting TAU parameter to a non-zero value essentially makes ROW filter out constant component of the fluorescence signal level and any slow changes of the signal. This affects all the outputs, such as Analog Output, as well as data transmitted by RS-485 interface, displayed by both ROW Manager and ROW Configurator, and written into the log files. The actual value of the signal can still be determined by analyzing the log files, in the FluoBkg column.

The effect is that the absolute fluorescence strength, and its slow changes are no longer reflected or taken into account when making a decision on an alarm. Instead, only the quick changes of fluorescence level cause the signal to rise.

Whenever the indicated signal gets within the thresholds, this algorithm stops functioning until the signal has left the detection range. This ensures that any oil spill will be correctly detected for its whole duration.

Adjustment

The compensation is switched on whenever the TAU (Hrs) parameter (ROW Configurator in Advanced Mode, LDI tab) is set to a non-zero value. The value of TAU estimates how quickly the signal level can rise to be detected and can be treated as a time constant of a signal. Since oil spills cause signal level to increase to maximum in a short period of time, setting it to several hours will be sufficient to filter out any tidal activity during the day, or seasonal changes. For best performance, this value should be determined experimentally on site.

3.3.5. Configuration of Analog Output

When set up in Signal mode, Analog Output will provide a reading of the current signal value indicated by ROW. The signal will only be fitted into the Analog Output range (4-20mA by default) when it falls into the configurable interval, with extremes being displayed as 4mA or 20mA. This dependency between the signal and the Analog Output reading is the following:

- When the signal is lower than the Lower Limit of the configurable signal interval, Analog Output value will be set to 4mA.

- When the signal is higher than the configurable Higher Limit of the configurable signal interval, Analog Output value will be set to 20mA.

- When the signal is within the interval, it will be fitted according to the equation below.

$$I_{AO} = \frac{Signal - RangeLow}{RangeHi - RangeLow} \times 16\text{mA} + 4\text{mA}$$

Where Signal – current signal value measured by ROW, RangeLow – Lower limit of the signal interval, RangeHi – Higher limit of the signal interval.

To obtain signal value from analog output, a reverse procedure can be followed. If the Analog Output reading is either 4mA or 20mA, it means that the signal is below the Lower Limit or above the Higher Limit respectively. When the reading is in range of 4 to 20mA, signal value can be calculated with to the following equation:

$$Signal = \frac{I_{AO} - 4\text{mA}}{16\text{mA}} \times (RangeHi - RangeLow) + RangeLow$$

When set up in Alarm mode, Analog Output will provide 4mA in normal operation and 20mA when an alarm has been detected by ROW. This behavior can be reversed.

Analog Output Parameters

The ROW allows the user to modify following settings for Analog Output. All the settings are accessible by **ROW Configurator** software in Advanced Mode, on *Analog* tab of *Advanced Parameters*. Refer to sub-section 3.2.11.

If advanced mode is activated, the user can modify the analog parameters via the following window:
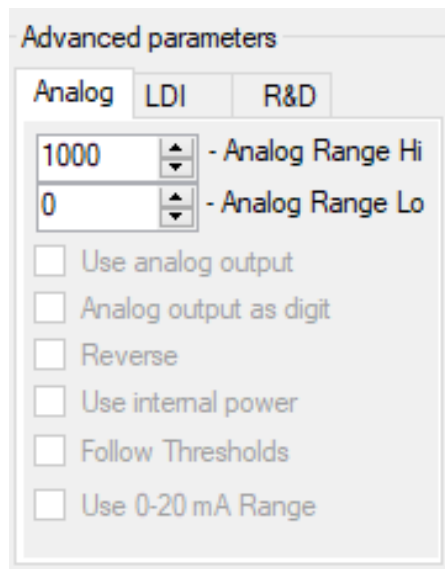
Figure 36. Analog Output parameters

- **Analog Range Hi** – defines the Higher limit of the Signal interval. By default equals Threshold High (see Follow Thresholds).

- **Analog Range Lo** – defines the Lower limit of the Signal interval. By default equals Threshold Low (see Follow Thresholds).

- **Use analog output** – enables or disables Analog Output. By default enabled.

- **Analog Output as digit** – when checked, Analog Output will be working in Alarm mode, otherwise it will be working in Signal mode. By default unchecked (Signal mode).

- **Reverse** – when checked, reverses the behavior of the Analog Output. By default unchecked.

- **Use internal power** – when checked, Analog Output will be powered internally by 12V. When unchecked, an external voltage should be provided to the *AO Ext. Power* wire. By default checked.

- **Follow Thresholds** – when checked, Analog Output signal interval will be equal to alarm thresholds (Threshold Low and Threshold High of Parameters). When unchecked, Analog Output signal interval can be set up independently by changing Analog Range Hi and Analog Range Lo parameters. By default, checked.

- **Use 0-20 mA Range** – when checked, uses 0mA as a lower end of the Analog Output range instead of 4mA. By default unchecked.

3.4. Row Manager

ROW Manager is a monitoring software for the ROW sensor. ROW Manager software will allow you to operate multiple devices simultaneously. It provides information about the status of the devices, including UDP broadcasts of state and measured signal, as well as allowing remote alerts to key personnel via email and SMS.

3.4.1. Installing ROW Manager

The software can be installed from an LDI flash memory drive. In this case, please open the flash memory drive, and click Setup RowManager v6.x.x.exe.

3.4.2. General description

The ROW Manager main window allows you to view the signal from each active ROW device in real time and enables you to view previous events using the log file.
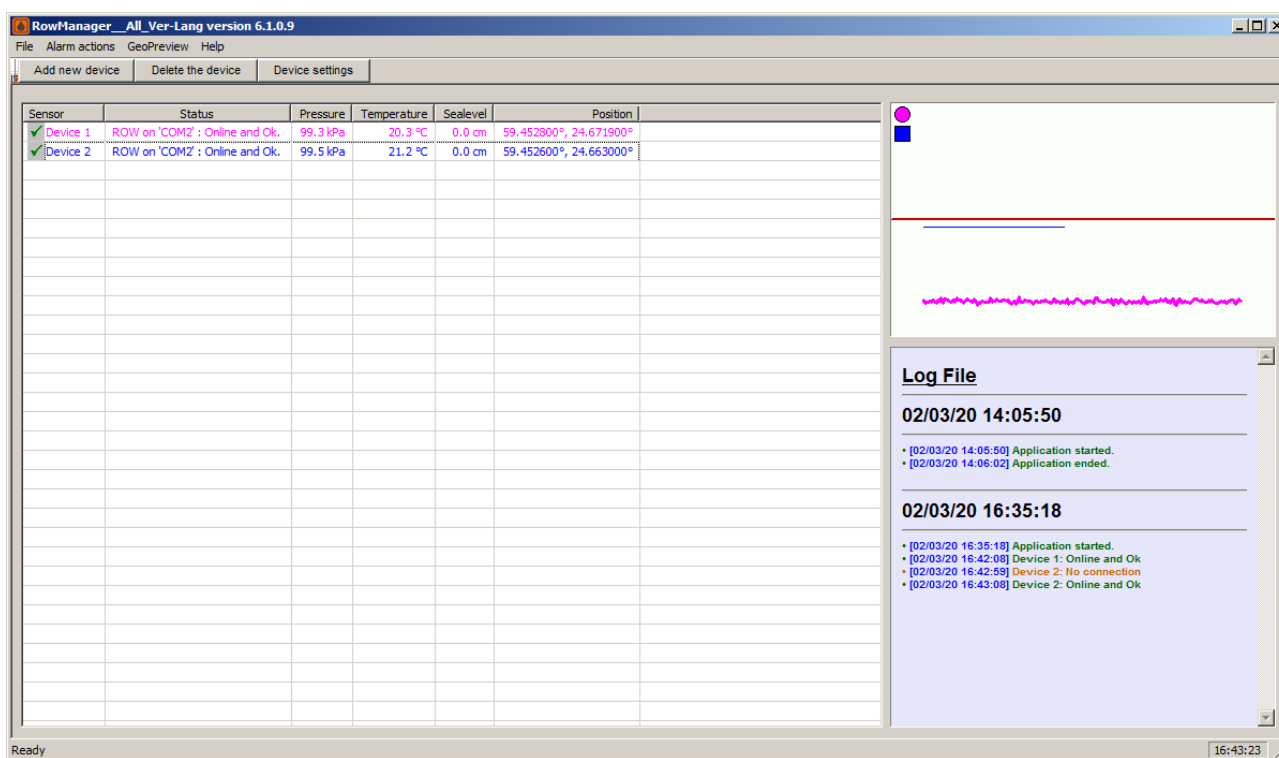
Figure 37. ROW Manager Main window

The main window contains following information:

- Device list with available information (name, status, technical info, location): on the left

- Normalized graph and threshold level: on the upper-right

- Event log which includes device events, state changes, software events: on the lower-right.

3.4.3. Start the device

Connect to required ROW devices.

Press button "**Add new device**".
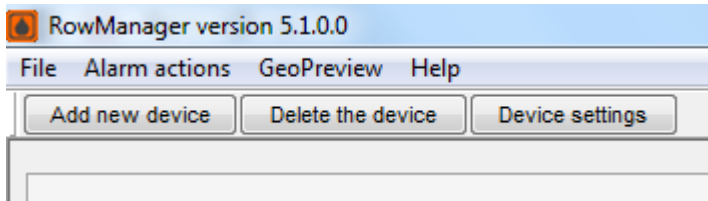
Figure 38. Device buttons

This will open the *Link Settings* window shown in the figure below. The name of the window contains the current name of the active ROW device.
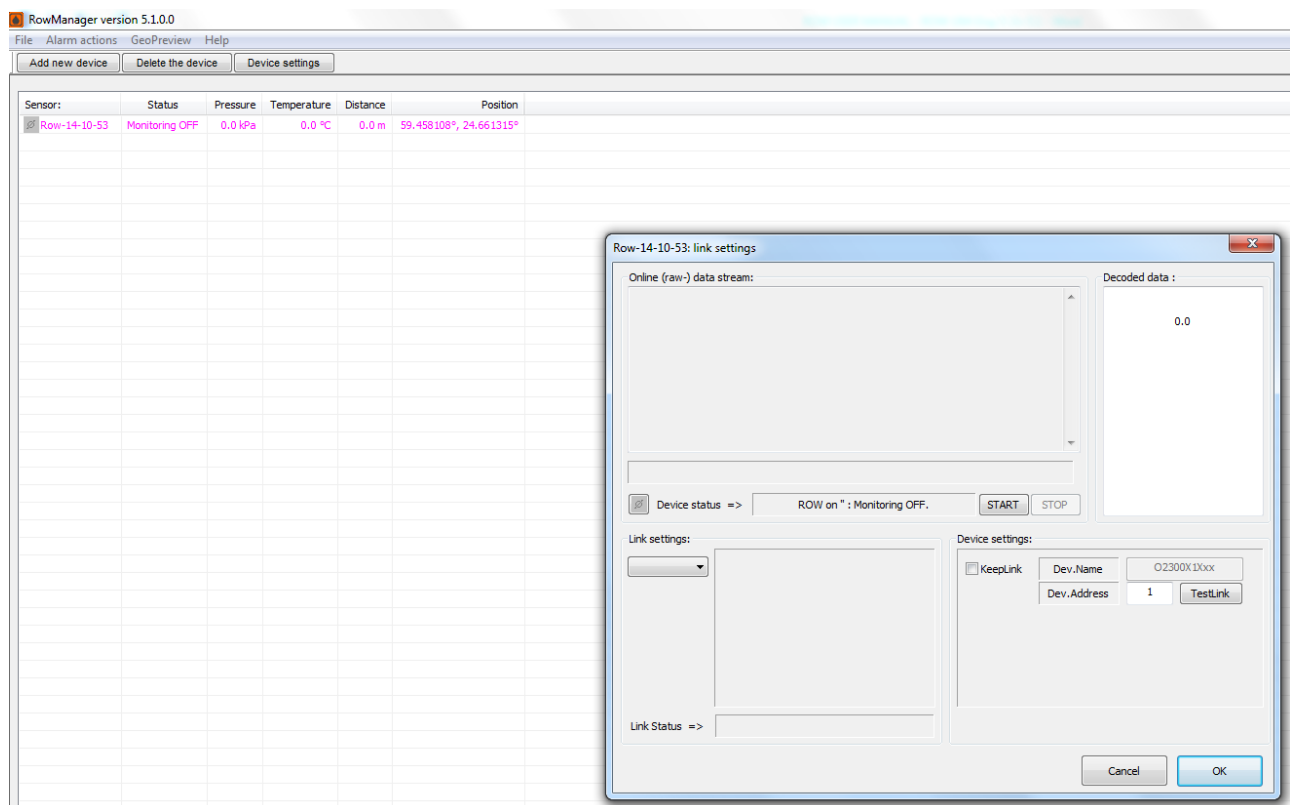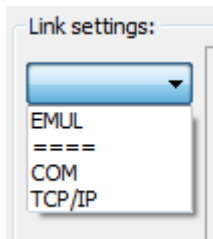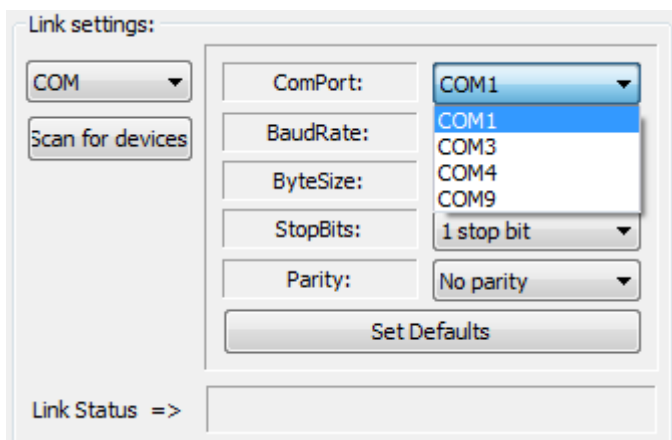

Figure 39. Device Link Settings

Next step – select the required type of connection using Link settings option from the list.

If only one COM port is in use, the software will automatically offer the user the COM port which is used by ROW; the instructions if more than one COM port is in use are below. All parameters of COM port will be activated automatically by the software, there should be no need to edit these settings (the settings shown are for demonstration purposes only).
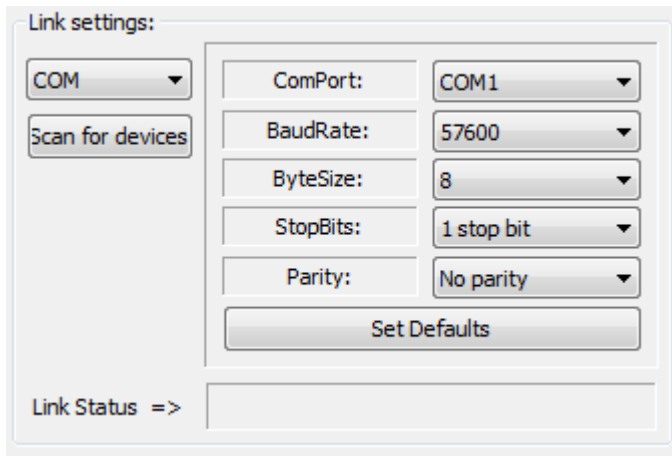
If there is more than one COM port listed, select the one that the ROW is connected to (how to find this out is described in Chapter 3.2.4.)

Select the right Device address (the device address can be set within the ROW Configuration).

Click **TestLink** button.

Control connection
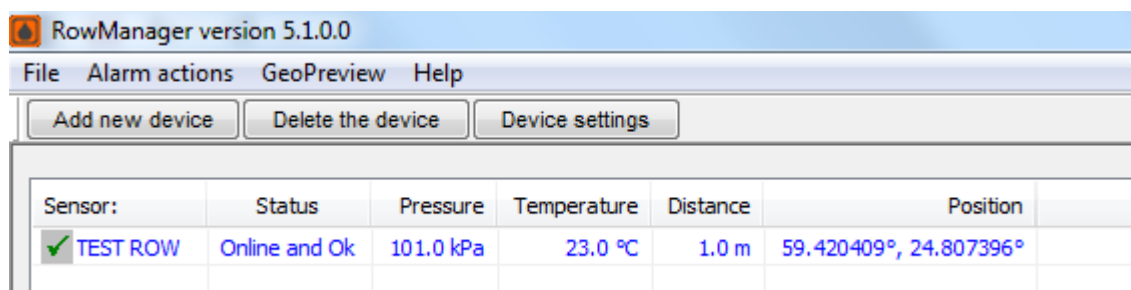

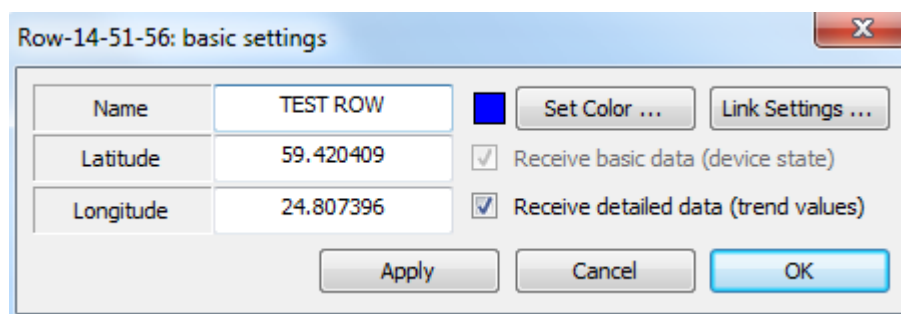Press the **START** button.

Press OK, and go back to the previous window.
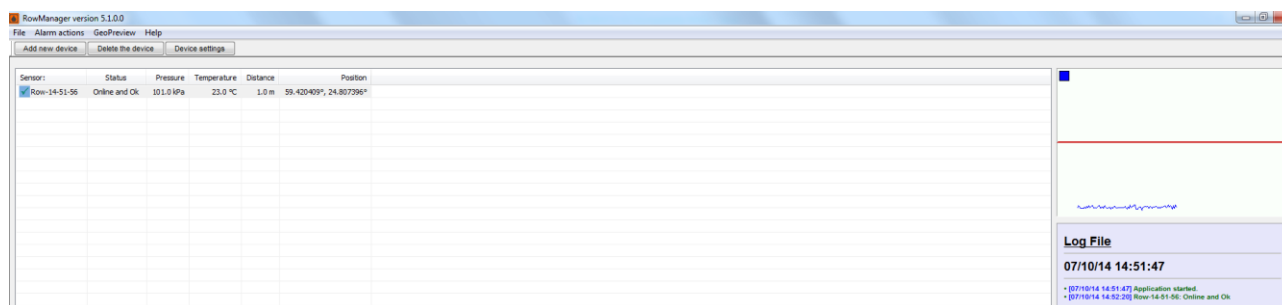
Click on the device and activate it. Press "Device settings" button.
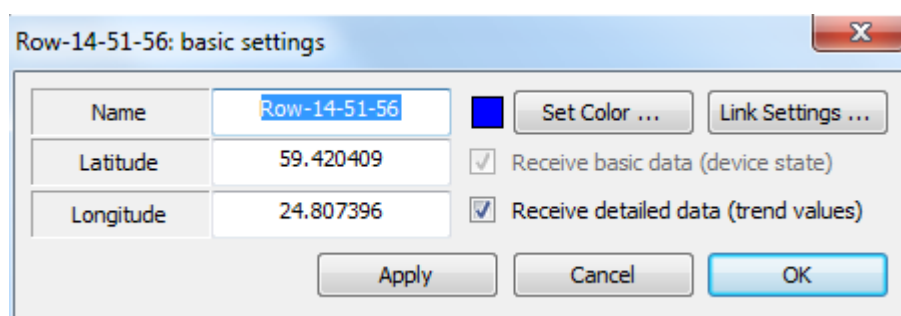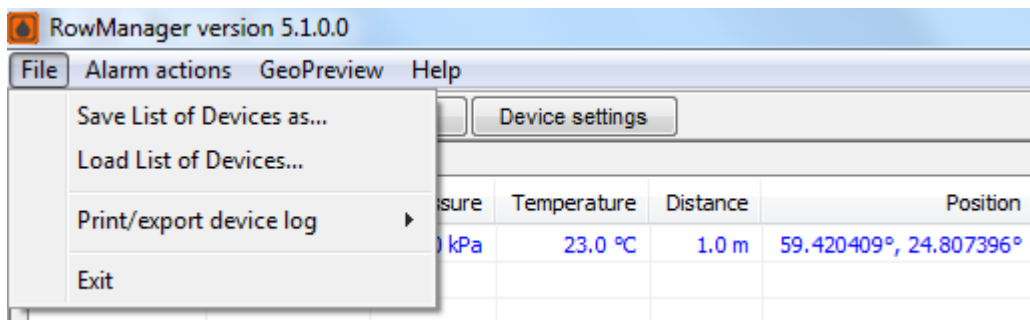

Change the default name of the ROW by using the field Name if required. We recommend changing this to the name of the location of the ROW. Press OK to go back to the Control Panel window.
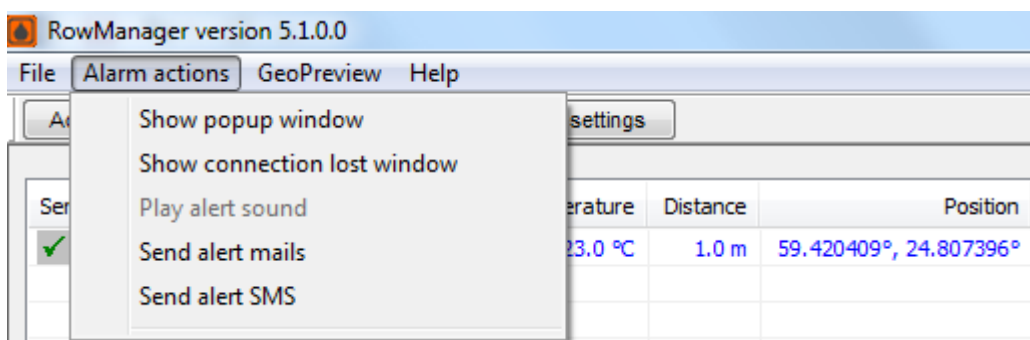
Row Manager main window options:

Group File

Save List of Devices as… - saves current ROW units set as *.ini file.

Load List of Devices… - opens in upper left field of main window needed ROW set from selected *.ini file

Print/export device log – opens selected log file in default browser with possibility of printing

Exit – exit with saving of current settings

Alarm actions

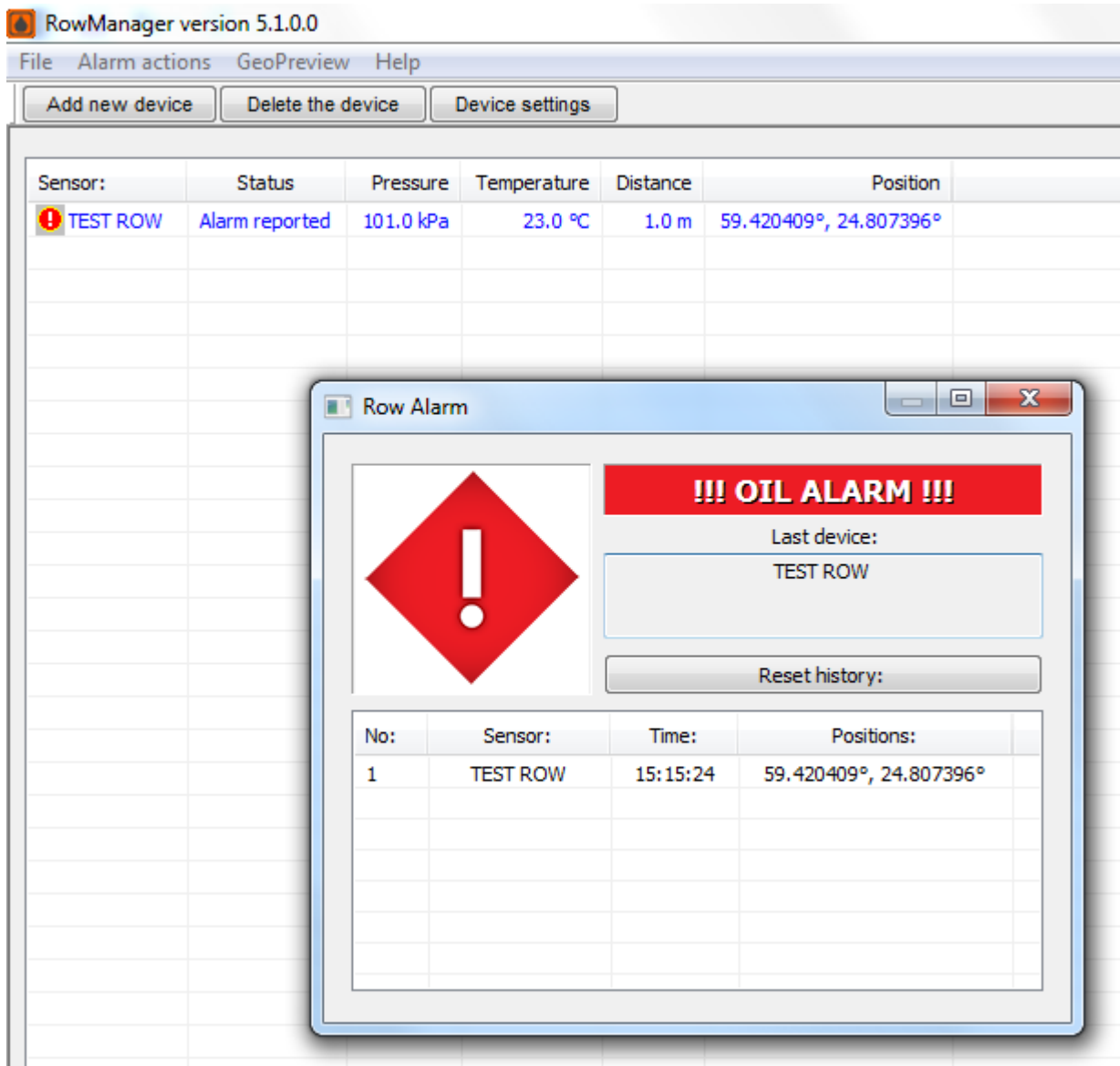User can set different options for alarm sending.

Show pop up window – will show pop window once alarm is on

Play alert sound – will play the alert sound

Send SMS alert – will turn on the SMS alert

Send alert mails – will turn on email alert

Geo Preview
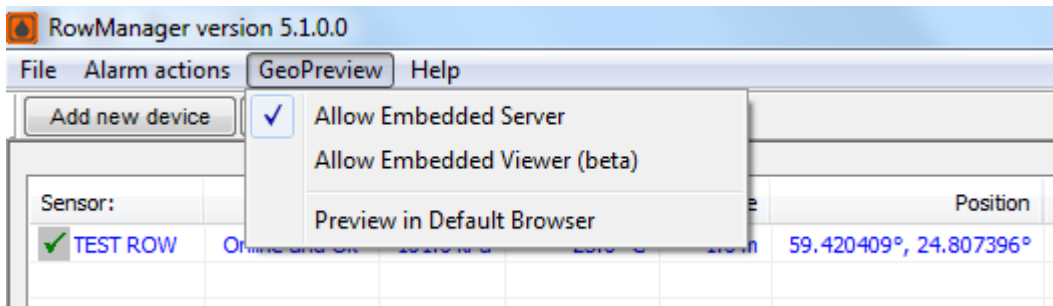
User can visualize ROW position on map. Internet connection is needed for this option.

Click "**Allow Embedded Viewer (beta)**".
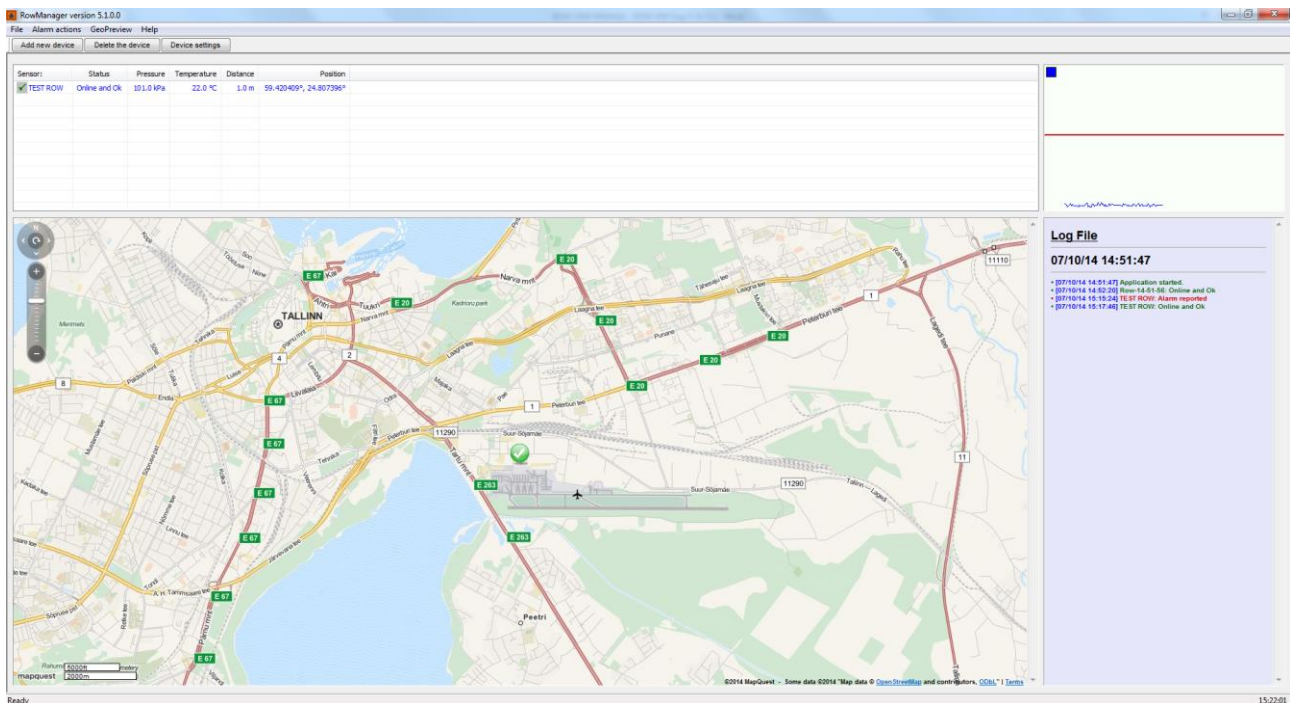
Help
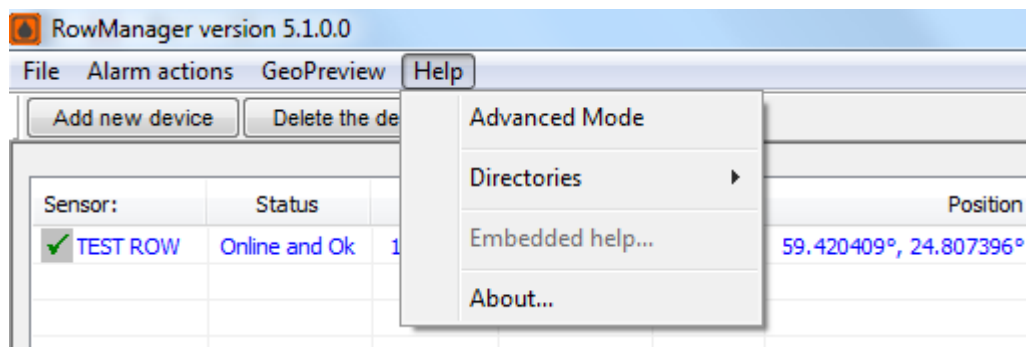
Directories – send directly to needed directories.
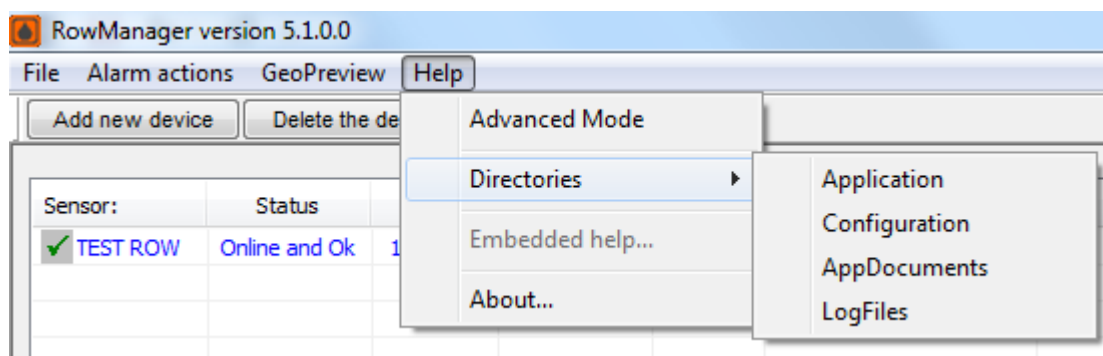
About… – shows common information Row Manager.

Advanced mode – allows you to see additional properties of your device which are not required for the normal operation of ROW sensors (connection type and address, real signal and thresholds).
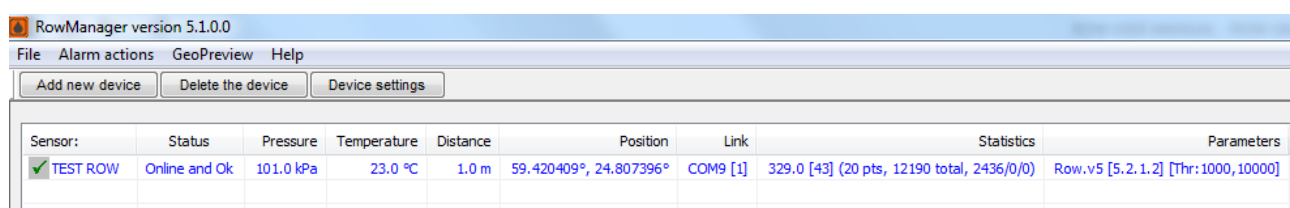
Right click on ROW device opens additional menu:
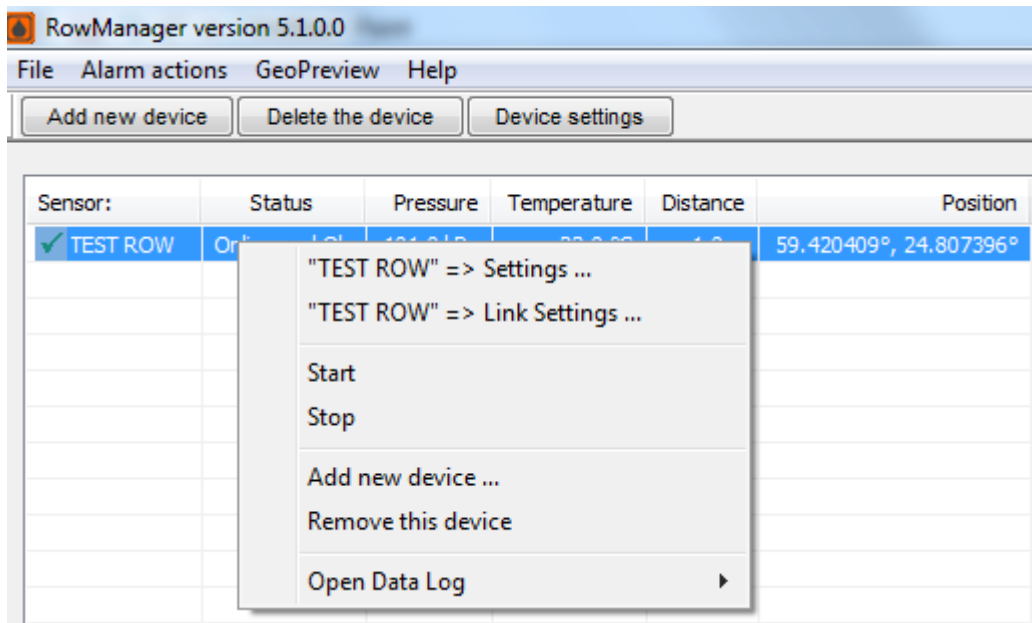
Settings… – opens first setting window for selected ROW device

Default location – opens link settings window

Default location – takes default geographic position of selected ROW device

Change Location – allows you to change the geographic position of selected ROW device

Get Status – shows the information window for the selected ROW device

Start – starts the data measurement for selected ROW device

Stop – stops the data measurement for selected ROW device

Fly to the device – shows geographic position of selected ROW device on map

Add new device… – adds a new ROW device in current list

Remove device(s) – removes selected ROW device(s) from current list

Open Data Log – opens .txt data log file

4. MAINTENANCE

4.1. Technical operation

Provided that the instructions in this manual are correctly followed, the system should require only minimal routine maintenance to ensure optimal performance.

In addition to the instructions given in Part 1.2 of this User Manual, this section emphasizes the importance of abiding by the following precautionary measures:

Avoid direct and diffused UV LED emission into the eyes. Protective glasses are required.

4.2. Optical/mechanical parts inspection

Inspection and maintenance of electrical installations is hazardous area have to be carried out according to the EN 60079-17 standard. Inspection of the sensor shall be carried out by suitably – trained personnel in accordance with applicable code of practice (for example, EN 60079-17)

Under normal working conditions, if properly installed and used, ROW Ex d does not need maintenance however, in order to grant and adequate and reliable functioning in time, it is suggested to regularly perform the following visual inspections:

- Inspection of the housing, of the connectors and/or cable glands, earthling / grounding of the electrical connections and of the connection cables to verify the presence of possible damages and corrosions.

Attention! ROW Ex d / ATEX /UKEX enclosure is manufactured from marine grade 316 stainless steel that makes the device corrosion resistant (low risk of corrosion). Screws, washers, nuts material is stainless steel.

- Inspection of optical window. The optical window can be cleaned, if necessary, by gently rubbing the outside of the lens with optical tissue and ethanol.
- Inspection of sunshield. The inside of the sun-shield should be cleaned as and when necessary (it needs only be cleaned if there is a noticeable build-up of dirt or other matter or if a noticeable drop in the signal level has occurred).

- Inspection of window guard (only for ROW Ex d). The window guard should be cleaned as and when necessary (it needs only be cleaned if there is a noticeable build-up of dirt or other matter or if a noticeable drop in the signal level has occurred).

Attention! Window guard is produced from anodized aluminum to protect against corrosion.

4.3. Adjustment of alarm level

Occasionally, it may be necessary to reconfigure the device due to a change in operational circumstances.

In order to adjust:

1. Connect the cable to 12 V power supply and PC USB port via RS485 to USB converter.

2. Use ROW configuration software to adjust the system parameters.

4.4. Gas pressure control

To minimize the impact of the moisture to the internal components of the device - the internal volume of the hermetically sealed housing of the system is purged with argon gas with a pressure of >1.0* atm. The system has an integrated pressure sensor inside from which the reading can be obtained as shown below.

Note: The gas pressure control is excluded for ATEX/IECEx/UKEX Ex d model (O23XXE/ O45XXE).

Order of gas pressure control:

1. Connect the cable to 12 V power supply and PC USB port.

2. Use ROW Configurator to read the value of gas pressure from the pressure sensor. The gas pressure is displayed in the "Technical information" box in the center bottom of the Configurator window.

5. TROUBLESHOOTING

This chapter helps to pinpoint and solves possible issues that may arise when operating the ROW device.

5.1. Troubleshooting ROW sensor

#	Issue	Possible Explanation	Possible Solution
1.	**No light visible on paper**	No power	Check if power supply is working Check if ROW wires 1 and 2 are connected to the power supply in correct polarity
		LED service life ended	Contact your distributor or LDI for service.
2.	**Fluorescent signal level too low**	Lens dirty	Clean the outside part of the output lens.
		Distance too high	Position ROW closer to water
		LED aged	Contact your distributor or LDI for service.
3.	**No connection with ROW device**		Restart PC software. Turn the device off; check connection cables; turn the device on. Check #1.

5.2. Troubleshooting of software

In case, right click is not working on MacBook running Windows 7.

Troubleshooting:

Option 1: Place two fingers on touchpad and click normally, this should invoke the right click in Windows.

Option 2: Try using an external mouse.

Option 3: Install latest touchpad drivers from manufacturer.

Option 4: Reinstall the latest Boot Camp drivers.

5.3. Troubleshooting alarm thresholds

No alarm with oil:

    1. Verify that Signal in alarm zone

    2. Verify that (B2/B1) is less than 'Max change in Bkg'. If not, increase 'Max change in Bkg'

Alarm from substance other than oil:

If signal is in the alarm zone, verify that (B2/B1) is more than 'Max change in Bkg'. If not, decrease 'Max change in Bkg'

6. WARRANTY

The warranty period is 24 months starting on the date of shipment. To activate the warranty, please return the signed warranty registration and customer acceptance forms to Laser Diagnostic Instruments AS. These forms should be received within 2 months from the shipment date.

The Warranty is from Laser Diagnostic Instruments AS and does not include traveling, expenses and labour hours at customer's location.

Warranty extends to the original purchaser only and is not transferable. Only users purchasing ROW products from authorized Laser Diagnostics Instruments AS (LDI) resellers or directly through LDI may obtain coverage under our limited warranties.

The Warranty covers all components with the exception of glassware breakage and consumable products. Brokerage and transport costs for the replacement parts replaced under the warranty are the client's responsibility. Laser Diagnostic Instruments AS will not be responsible for malfunctioning of the instrument if third party components are used in the instrument.

6.1. Warranty Registration Form

Purchase order no.:

Serial no:	
Date of purchase:	
Distributor:	
Company name:	
Address:	
Post code/ZIP	
City:	
Country:	
Contact person:	
Telephone number:	
Fax number:	
E-mail address:	
Company stamp:	
Name:	
Signature:	

The warranty registration form will only be valid when accompanied by the signed customer acceptance form.

Please return this form to:

Laser Diagnostic Instruments AS

49 Kopliranna street

Tallinn, Estonia

Date: _____

6.2. Customer Acceptance Form

Company name:

Address:

Post code/ZIP code:

City:

Country:

Date:

The undersigned authorized officer confirms that the performance of the instrument, as per the purchase order number as mentioned in the warranty registration form, is according to the specifications as submitted by the manufacturer.

☐ YES

☐ NO

Remarks:

_____
_____
_____
_____

Signature _____

Name _____