Installation & Operation Manual

RAVEN-EYE®

Open Channel Non-Contact RADAR ATEX Flow Meter

V1.0, March 2015

FLOW-TRONIC nv

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1 Specifications

Specifications are subject to change without notice

RAVEN-EYE®			
Dimensions (W x L x D)	140 x 422 x 183 mm, without cable and mounting hardware		
Weight	3,85 kg, without cable and mounting hardware		
Enclosure	IP68 waterproof rating, polyurethane (PU), PU ESD-Dissipative paint		
Operating temperature	-20 to 50 °C		
Storage temperature	-30 to 60 °C		
Power requirements	Supplied by IFQ MONITOR for ATEX sensors via barrier box or RTQ-1000/RTQ-2000		
Interconnecting cable (disconnect at both sensor and logger ends)	Polyurethane, 8 mm diameter		
	IP68 < 1bar		
	Standard length: 10 m ; maximum length: 70 m		
Level measurement	Standard Range ultrasonic level sensor (range: 1,75 m) attached to the sensor using a mounting hardware Accuracy: 0,3% Temperature error: max. 0,04%/K		
	External 4-20 mA loop powered level sensor with correct electrical parameters to be connected to the IFQ MONITOR for or RTQ-1000/RTQ-2000.		
Communication	RS-485 with proprietary protocol for use with IFQ MONITOR for ATEX sensors or RTQ-1000/RTQ-2000		
Output	None		
Velocity measurement	Method: Radar		
	Range: ±0,15 m/s to ±9 m/s (bi-directional)		
	Frequency Range: 24.075 to 24.175 GHz, <100 mW (EIRP) max.		
	Accuracy: ±0.5% ±0.02 m/s (based on sensed surface velocity)		
Safety parameters	For model RAVEN-EYE-AZ1		
	Power Supply	RS485	
	Ui = 8,7 V	Ui = 8,7 V	Uo = 5,88 V
	Ii = 0,73 A	Li = 0,73 A	Lo = 0,24 A
	Pi = 1,6 W	Pi = 1,6 W	Po = 35,21 mW
	Ci = 10,6 µF	Ci = 0 µF	Co = 24,5 µF
	Li = 4,7 µH	Li = 0 µH	Lo = 30 µH
			Lo/Ro = 3,99 µH/Ohm
Approvals CE	2004/108/CE EMC Directive 2006/95/CE LVD Directive 1999/5/CE RTT Directive 2011/65/CE Rohs Directive		
ATEX Certification	ATEX Directive 94/9/EC - EN 80079-34 : 2011 EN60079-0 : 2012 + A11 : 2013 (CEI 60079-0 : 2011) EN60079-11 : 2012 (CEI 60079-11 : 2011) Marking :  II 2 G Ex ib IIB T4 Gb		

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Flow measurement	
Method	Based on continuity equation Q = V*A calculated by logger or flow monitor
Accuracy	± 5% of reading typical where flow is in a channel with uniform flow conditions and is not surcharged, ±1% full scale max.

2 General Information

2.1 Safety information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Safety Symbols And Warnings

Throughout this manual are safety warning and caution information boxes. Each warning and caution box will be identified by a large symbol indicating the type of information contained in the box. The symbols are explained below:

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary labels

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol, when noted on the product, indicated the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.

2.1.3 Confined space precautions

DANGER
Confined space entry. Training in pre-entry testing, ventilation, entry procedures, evacuation/rescue procedures and safety work practices is necessary before entering confined spaces.

Important Note: The following information is provided to guide users of RAVEN-EYE® Sensors on the dangers and risks associated with entry into confined spaces.

Definition of a confined space:

A confined space is any location or enclosure that presents or has the immediate potential to present one or more of the following conditions:

- An atmosphere with less than 19.5% or greater than 23.5% oxygen and/or more than 10 ppm Hydrogen Sulfide (H_2S).
- An atmosphere that may be flammable or explosive due to gases, vapors, mists, dusts or fibers.
- Toxic materials which upon contact or inhalation, could result in injury, impairment of health or death.

Confined spaces are not designed for human occupancy. They have restricted entry and contain known or potential hazards. Examples of confined spaces include manholes, stacks, pipes, vats, switch vaults, and other similar locations.

Standard safety procedures must always be followed prior to entry into confined spaces and/or locations where hazardous gases, vapors, mists, dusts or fibers may be present. Before entering any confined space check with your employer for procedures related to confined space entry.

2.1.4 R&TTE regulations

Use of this device is subject to the following conditions:

- There are no used serviceable items in this device.
- The user must install this device in accordance with the supplied installation instructions and must not modify the device in any manner whatsoever.
- Any service involving the transmitter must only be performed by FLOW-TRONIC S.A. or authorized trained personal.
- The user must ensure that no one is within 20 cm of the face of the radar transmitter when operating.

2.2 Product overview

The RAVEN-EYE® sensor measures the flow velocity in open channels using radar technology. The unit is designed to withstand submersion during surcharge conditions. Optional level sensors provide the IFQ MONITOR with the water level measurement during normal operation.

Figure 1: Product overview

1	RAVEN-EYE® ATEX Sensor	**3**	Mounting hardware (here: part of permanent sensor mount)
2	Sensor cable	**4**	Bubble level

2.3 Product identification

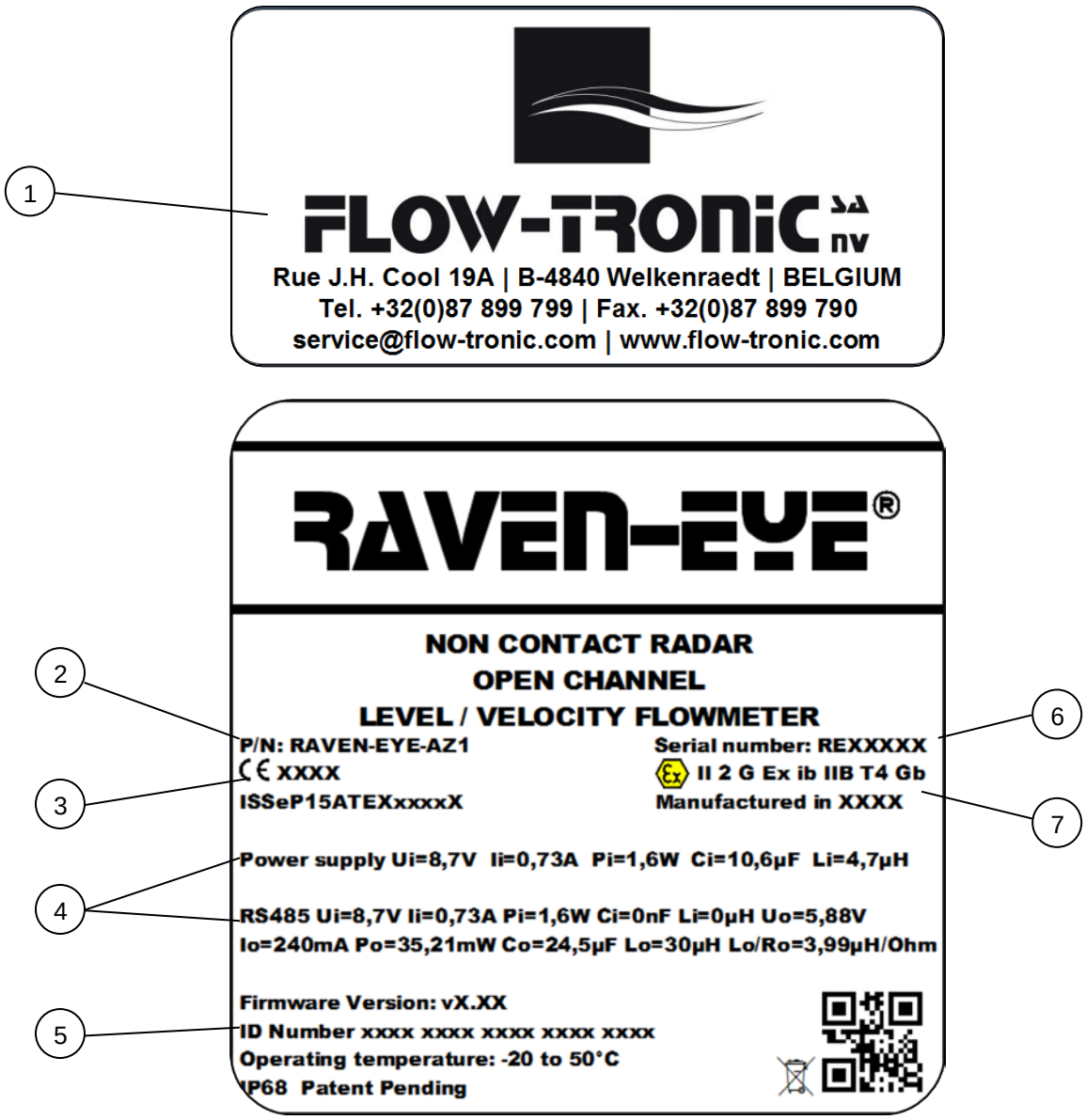


Figure 2: Identification label

1	Manufacturer's contact details	**5**	Identification number (ID)
2	Model	**6**	Serial number (S/N)
3	Certification number	**7**	Year of production
4	Electrical parameters		

RAVEN-EYE® flow sensors can be identified by means of 2 unique numbers, the serial number (S/N) oft the device and the identification number (ID Number):

- The ID number can be found on the identification label on the sensor (refer to Figure 2) or is shown by means of a pop-up window at every connection tot he computer using RTQ-Log.
- The serial number can be found on the identification label on the sensor (refer to Figure 2).

The identification label contains all necessary information for tracability, manufacturer's contact details, parameters and certification.

2.3.1 Theory of operation

The RAVEN-EYE® sensor is mounted above an open channel of water and measures the surface velocity. The depth from water is measured by an optional associated level sensor. The two measurements are used to calculate the flow rate using the continuity equation. The RAVEN-EYE® converts the surface velocity to average velocity by analyzing surface velocity distribution using a self-learning technology that doesn't require theoretical modules nor site calibration. Then the water level and pipe size is converted to the fluid area. Multiplication of fluid area by average velocity to obtain the flow rate.

Surface velocity measurement

The surface velocity of the water is measured using radar technology. A radar beam is transmitted from the sensor to the water surface at the center of the channel. A portion of the signal is reflected back at a slightly different frequency. The difference in frequency, known as the Doppler frequency, is directly proportional to the speed of the flow. Proprietary Patent Pending velocity measurement algorithms are then used to calculate the average speed of the flow stream.

***Note**: The radar velocity sensor does not operate under surcharge conditions.*

Level measurement

The water level is measured using an ultrasonic pulse echo sensor. Two models are available, a standard range 1,75 m and a long range 5,75 m sensor. The sensors can be attached to the RAVEN-EYE® sensor body using specific mounting hardware. For both sensors a sound pulse is sent to the water surface and a portion of the signal is returned to the sensor. The transit time to the surface and back is used to calculate the distance from the water surface to the sensor. The pipe diameter and sensor offset are used to convert the distance to water depth.

External 4-20 mA level sensors from other manufacturers can be used to be connected to the UNI-TRANS or any other PLC or logger.

Flow calculations

The velocity and depth measurements are used with the channel shape and its dimensions to determine the flow rate. The flow rate is calculated from the continuity equation (1):

(1) Flow rate = Average velocity × Area

where

Flow rate	=	volume of liquid that passes the sensor per unit time (e.g. 300 litres per second)
Average velocity	=	average velocity of the liquid, calculated using surface velocity measurements and patent pending measurements algorithms
Area	=	cross-sectional area of the liquid in the channel, calculated using the channel dimensions and depth measurement.

3 Installation

3.1 Unpack the instrument

Before opening the shiping boxes, check them for any visible outside damage, and report the damages immediately.

Carefully unpack the RAVEN-EYE® and its accessories from the shipping carton and inspect for any visible damage. If an item is missing or damaged, please contact the manufacturer or local agent (refer to section 7 on page- 31 -)

List of standard delivered items:

1. RAVEN-EYE® Sensor
2. Cable at specified length
3. Installation & operation manual
4. USB communication cable (optional)
5. Standard range or long range level sensor (optional)
6. Permanent or one-time entry sensor mounting hardware (optional)
7. Mounting hardware for ultrasonic standard range or long range sensor (optional)

3.2 Precautions for hazardous location installations

DANGER
Explosion hazard. To ensure safety, the installation of instruments in hazardous locations must follow the specifications in the control drawings. Any modification to the instrumentation or to the installation may result in life threatening injury and/or damage to facilities.

The RAVEN-EYE® ATEX sensor (P/N: RAVEN-EYE-AZ1) is listed as intrinsically safe for Zone 1 hazardous locations. This means that the circuits within these sensors cannot produce a spark or thermal effect that could ignite a mixture of flammable or combustible gases when installed properly. It does not mean that these sensors are explosion proof. If proper safety precautions are not followed, or if the equipment is not installed properly, there might be potential for explosion. Be sure to review all safety precautions, installation and wiring practices throughout this manual before installing the RAVEN-EYE® ATEX sensor.

3.2.1 Intrinsically safe installation requirements

Installation of this equipment must satisfy local electrical code requirements using the hazardous location control drawings and is subject to final approval by the authority having jurisdiction. Install all associated apparatus, such as the intrinsically-safe barrier or controller in a non-hazardous location.

3.2.2 Hazardous location control drawings

DANGER
Explosion hazard. Never connect items to the sensor that are not specified on the control drawings. Do not connect or disconnect any equipment unless power has been switched off or the area is known to be non-hazardous.

Follow the control drawings provided (section 3.4.3 on page - 25 -and section 3.4.4 on page - 26 -) and all codes and regulations for connection to the sensor in the hazardous location.

3.3 Mechanical installation

3.3.1 Site location guidelines

For best accuracy, install the sensor where the flow is not turbulent. An ideal location is in a long, straight channel or pipe. Outfalls, vertical drops, baffles, curves or junctions cause the velocity profile to become distorted.

Where there are outfalls, vertical drops, baffles, curves or junctions, install the sensor upstream or downstream as shown in Figure 3 and Figure 4. For upstream locations, install the sensor at a distance that is at least five times the pipe diameter or maximum fluid level. For downstream locations, install the sensor at a distance that is at least ten times the pipe diameter or maximum fluid level.

If the location contains a junction and the flow in one pipe is much higher, install the sensor on the wall near the lower flow pipe.

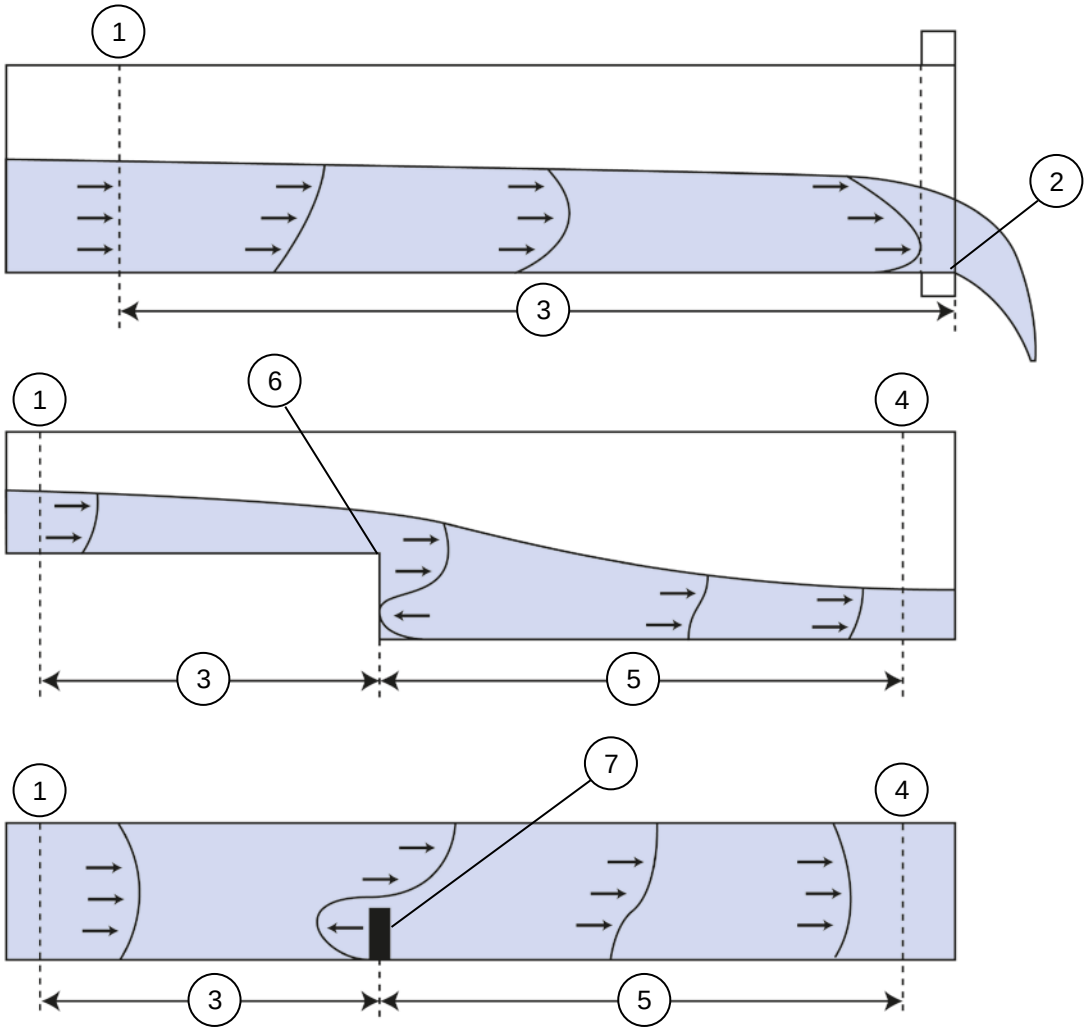


Figure 3: Sensor location near an outfall, vertical drop or baffle

1	Acceptable upstream sensor location	**5**	Distance downstream: 10 x pipe diameter
2	Outfall	**6**	Vertical drop
3	Distance upstream: 5 x maximum level	**7**	Baffle
4	Acceptable downstream sensor location		

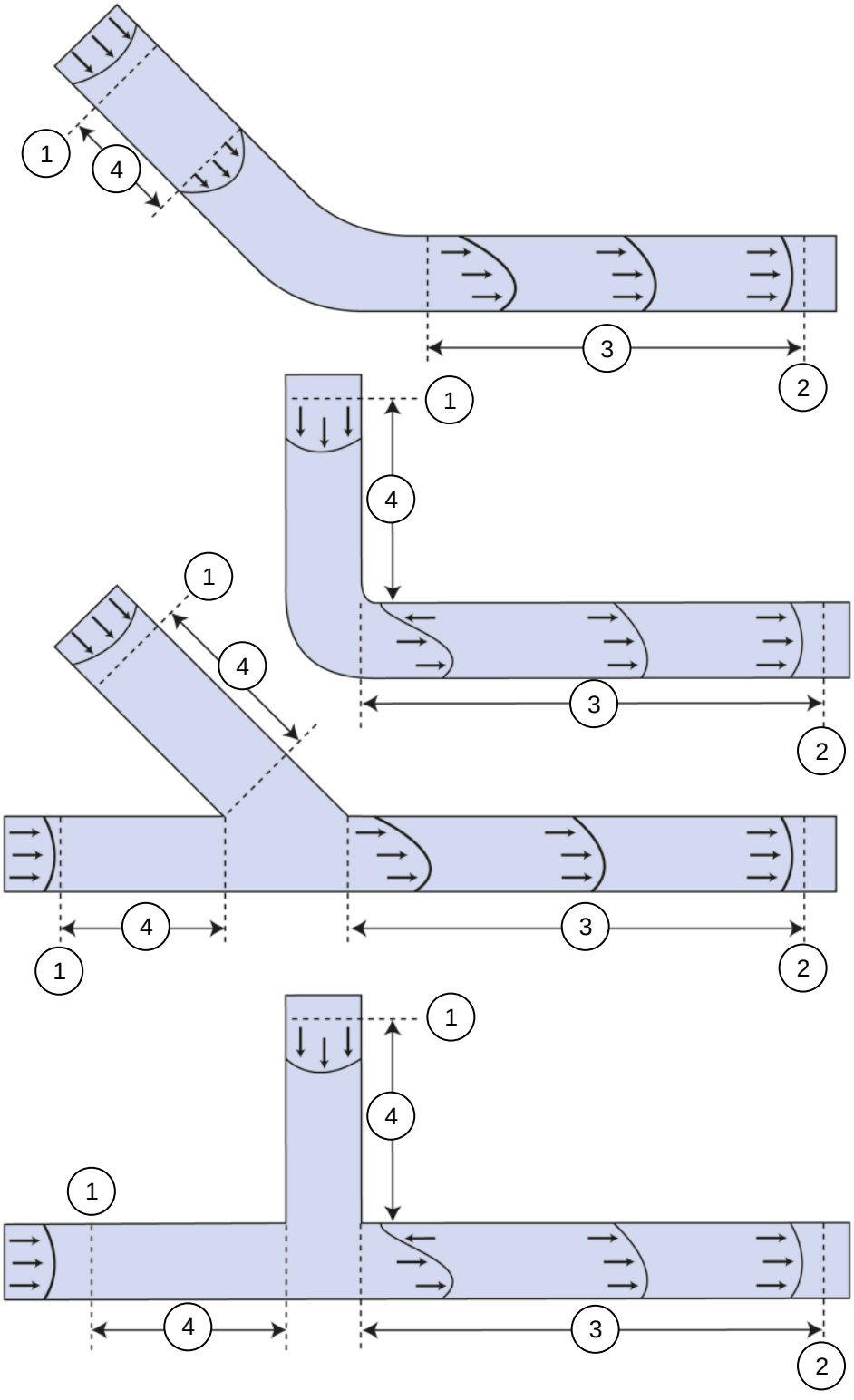


Figure 4: Sensor location near a curve, elbow or junction

1	Acceptable upstream sensor location	**3**	Distance downstream: 10 x pipe diameter
2	Acceptable downstream sensor location	**4**	Distance upstream: 5 x pipe diameter

3.3.2 Sensor installation

CAUTION
Potential hearing loss risk. Hearing protection required. The level transducer emits ultrasonic sound energy when powered. Ear protection must be worn when working within 1 meter of this device. Do not point the transducer output towards ears during installation, calibration and maintenance.

WARNING
Explosion hazard. Installation of equipment into hazardous locations must be done so that no friction can be generated between the flow meter and any surrounding surfaces.

Mount the RAVEN-EYE® sensor above the open channel on the wall of the manhole.

For hazardous locations, a barrier must be installed outside of the hazardous area.

The RAVEN-EYE® sensor dimensions are shown in Figure 5 and Figure 6.

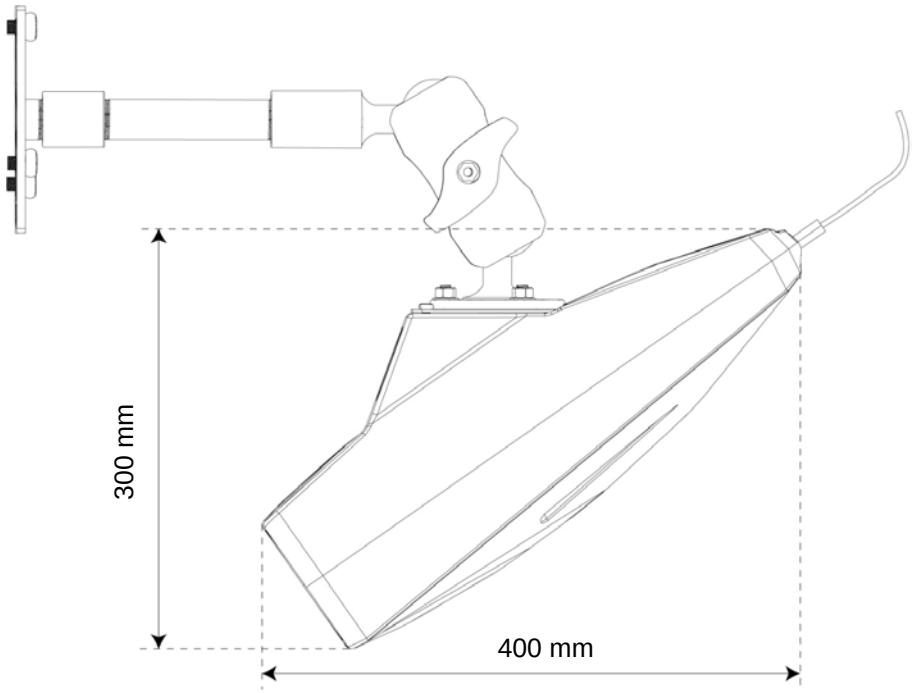


Figure 5: RAVEN-EYE® sensor dimensions side view as installed

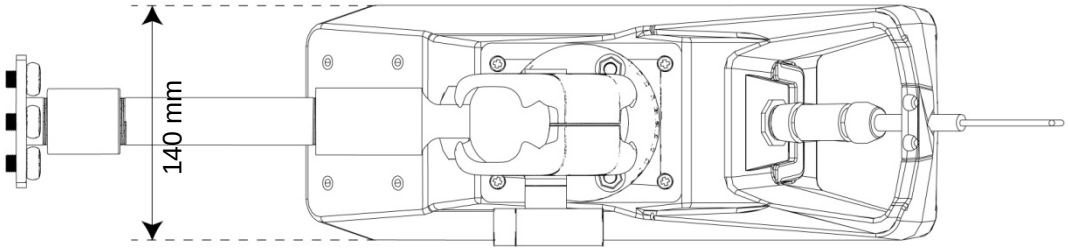


Figure 6: RAVEN-EYE® sensor dimensions top view as installed

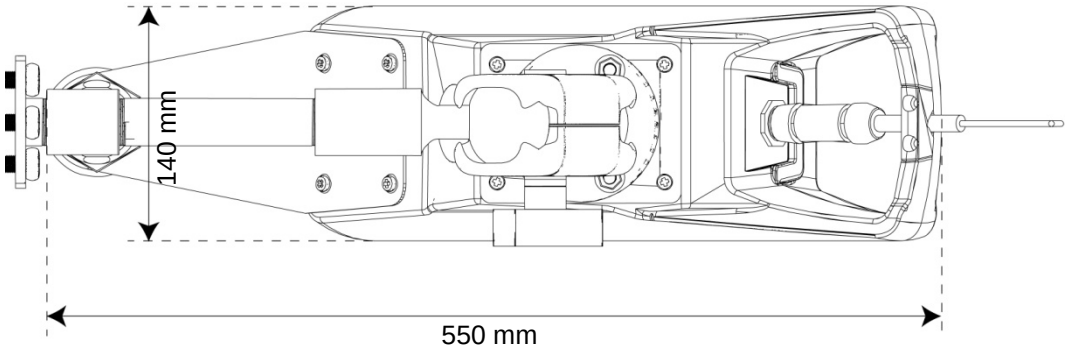


Figure 7: RAVEN-EYE® sensor dimensions top view with level sensor as installed

3.3.2.1 Install the mounting hardware on the wall

Sensor location guidelines

Review the following guidelines to find the best location for the sensor.

- Examine the upstream and downstream flow characteristics. Use a mirror if necessary. Install the sensor above the water where the flow is steady. Do not install the sensor where there are standing waves, pools or objects or materials that can disrupt the flow profile.
- If the upstream flow characteristics are acceptable, install the sensor on the upstream wall of the manhole with the sensor pointing upstream. This location will make sure that the measured flow is the same as the flow in the pipe and that the sensor cable points away from the wall.
- Install the sensor away from the sides of the pipe and in the very center of the flow where the fluid is at the maximum depth.
- Install the sensor in a location that is accessible for maintenance.

Prerequisites

- Permanent or one-time entry mounting hardware
- Material needed: Fixings, washers and screws from the correct size
- Tools needed: mirror, ruler or tape measure, marker, battery operated power drill, wrench.

Procedure

Complete the steps to install the mounting hardware on the wall of the manhole above the flow. Be sure to follow all codes and/or directives that are relevant to the location (refer to section 3.3.1 on page - 11 -).

1. Make a mark on the wall 400 mm above the crown of the pipe. The wall bracket will be installed centered on this mark.
2. Make sure that when the sensor is in position, the radar beam will not be blocked by the wall or channel. Refer to Figure 10 or Figure 12.
3. Position the wall mount bracket centered around this mark.
4. Attach the brackets to the wall using anchors and screws.
5. Connect the rest of the mounting hardware to the wall bracket.

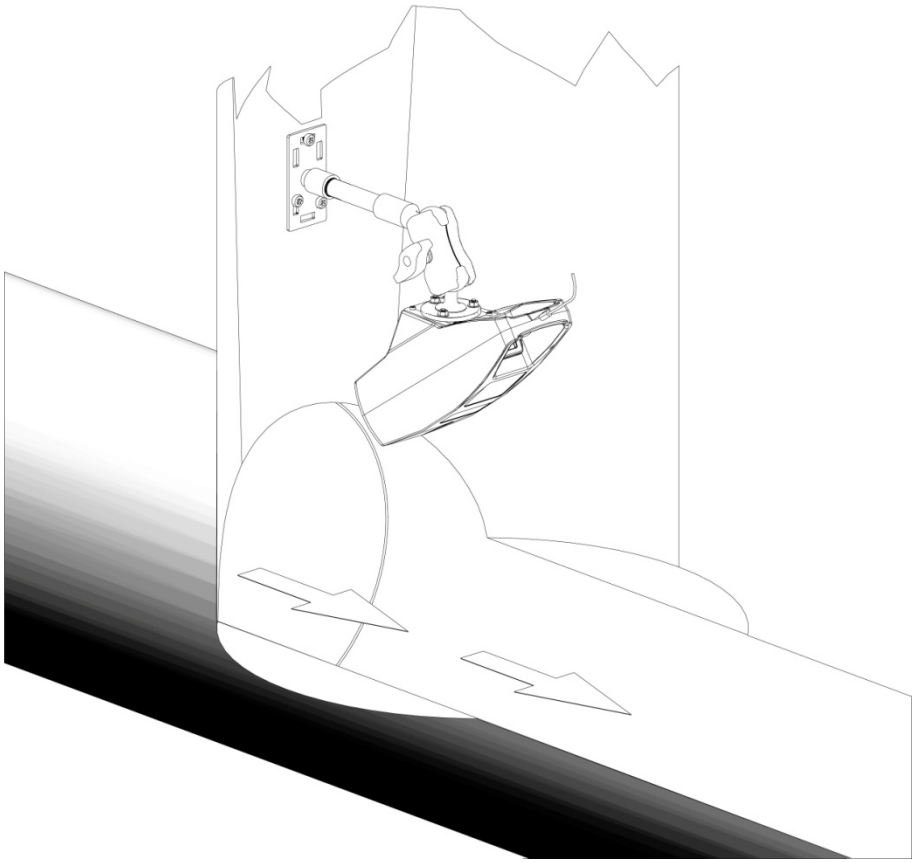


Figure 8: Wall installation

1	Distance from crown of pipe to wall bracket	

3.3.2.2 Attach the sensor to the mounting hardware

The sensor is equipped with 4 threads (M5) to be attached to the mounting hardware. Attach the rotative handle or the ball mount to the sensor. The sensor can be removed from the frame and installed without entering the manhole when installed with the one-time entry mounting hardware.

Procedure

1. Make sure that the cable is tightly connected to the sensor.
2. Locate the 4 threads on the sensor forseen to attach the ball mount or the rotative handle.
3. Attach the ball mount or the rotative handle to the sensor using a screwdriver and the 4 M5 screws delivered with the hardware.
4. Loosen the wing nut from the ball mount of the mounting hardware.
5. Insert the ball mount from the sensor and thighten the wing nut so that the sensor stays attached to the mounting hardware.

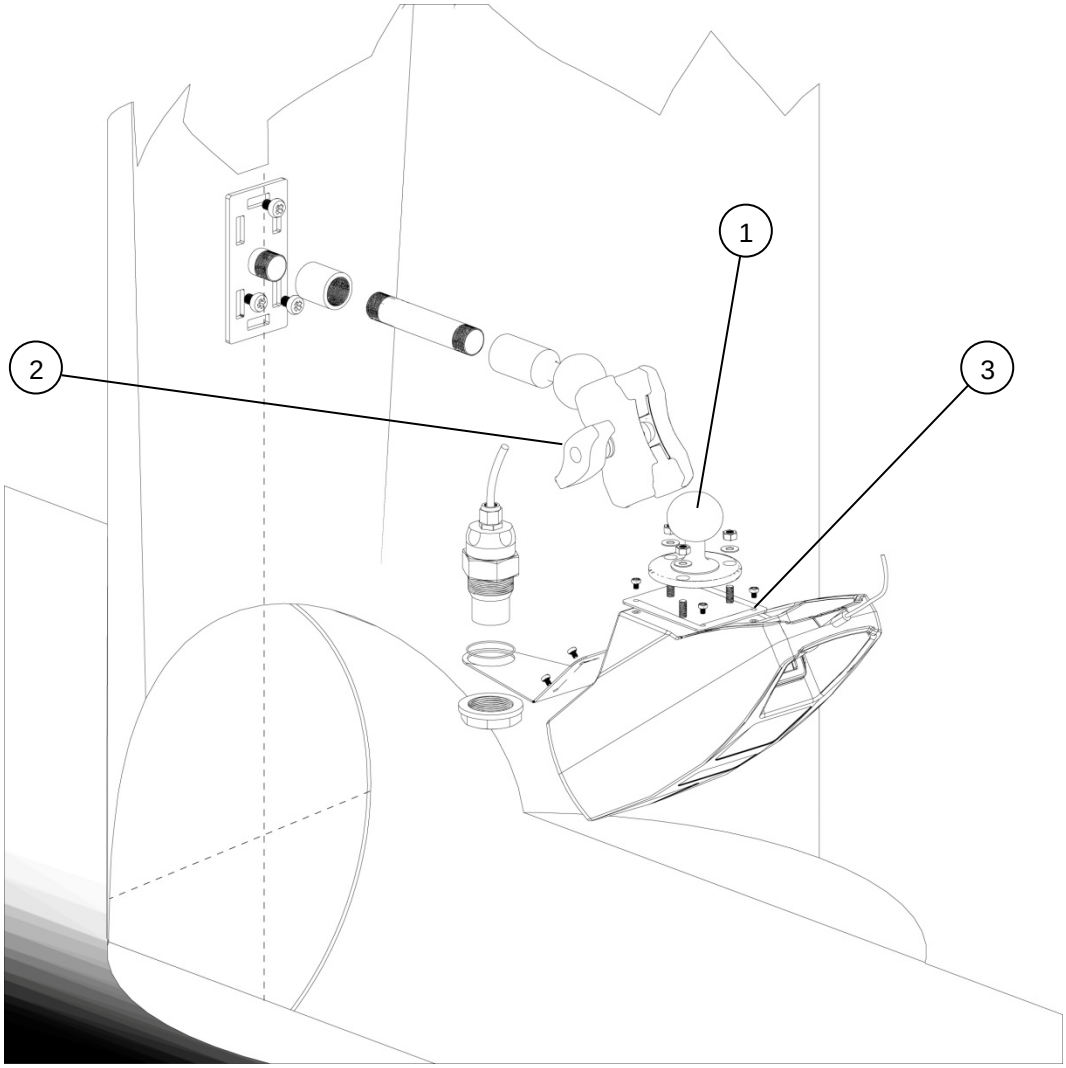


Figure 9: Assembling the mounting hardware

1	Ball mount	**3**	Threads for mounting hardware attachment
2	Wing nut		

3.3.2.3 Align the sensor vertically – RAVEN-EYE® without attached level sensor

The sensor must be aligned vertically to make sure that the sensor is above the flow and that the radar beam will not be blocked by the wall or pipe (Figure 10).

Procedure

1. Make an estimate of where a line that extends from the top of the radar lens perpendicular to where the lens will point (Figure 10).
2. Loosen the wing nut on the ball mount hardware and position the frame so that the radar beam will point below the crown of the pipe by at least 25 mm (Figure 10). It may be necessary to install the 200 mm or the 300 mm (optional) spacer to position the RAVEN-EYE® farther from the wall.
3. Tighten the wing nut and make sure that the radar beam is not blocked by the wall or pipe. If the beam is blocked, move the frame further away from the wall using the 200 mm or the 300 mm (optional) spacer or lower the frame.

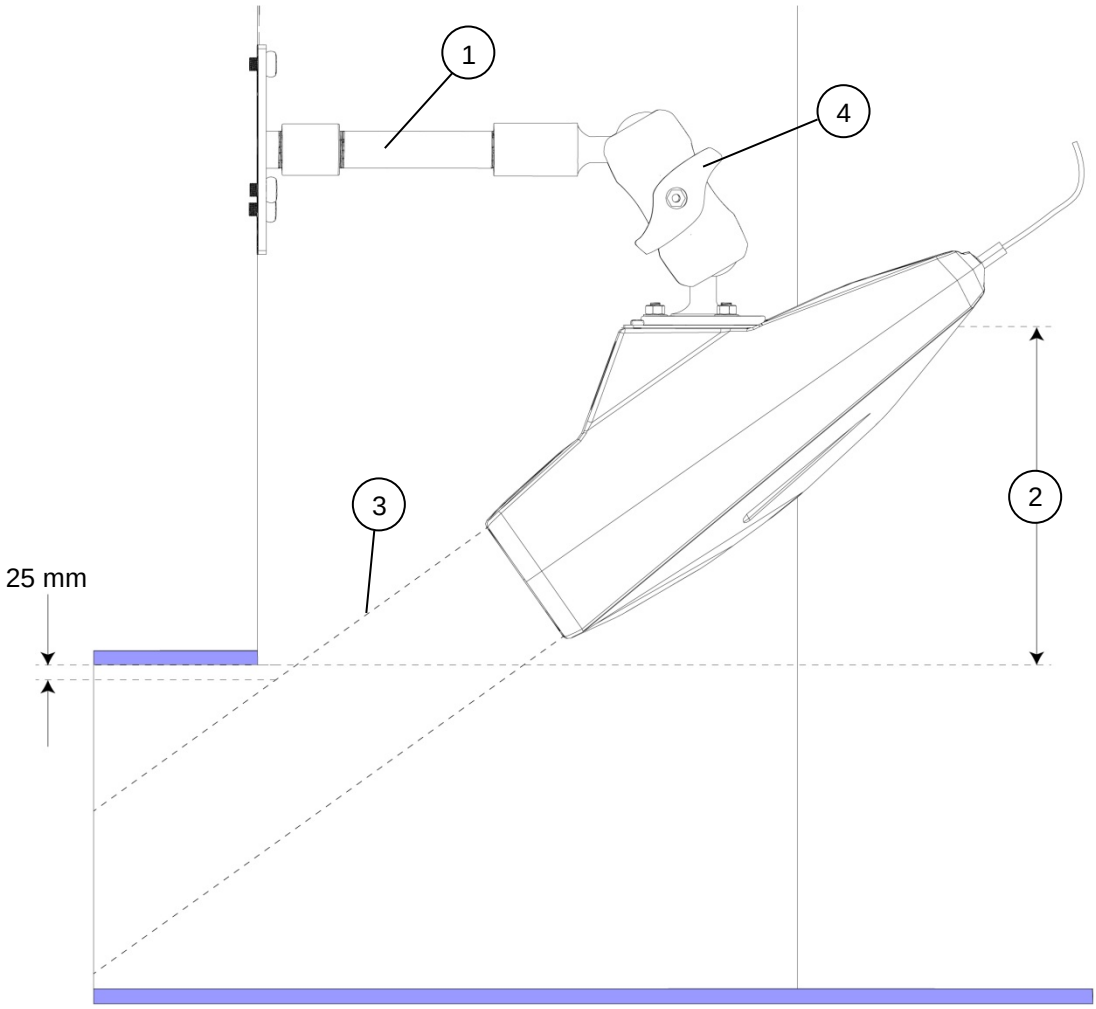


Figure 10: Vertical alignment of the RAVEN-EYE® sensor

1	Spacer	**3**	Line that extends from the top of the radar lens perpendicular to where the lens will point
2	Distance from crown of pipe to ball mount	**4**	Wing nut

3.3.2.4 Attach the level sensor (only for non-ATEX systems)

DANGER
Explosion hazard: Do not use ULS-02 (P/N: RAV-0002) nor ULS-06 (P/N: RAV-0006) sensors in combination with the RAVEN-EYE® ATEX sensor. Only use sensor that have the necessary approvals to enter the hazardous location.

Procedure

1. Locate the 4 threads to attach the level sensor.
2. Locate the level sensor support and the corresponding screws to attach the hardware.
3. Attach the level sensor support using a screwdriver and the corresponding screws.
4. Attach the level sensor to the level sensor support hardware using the delivered nut.

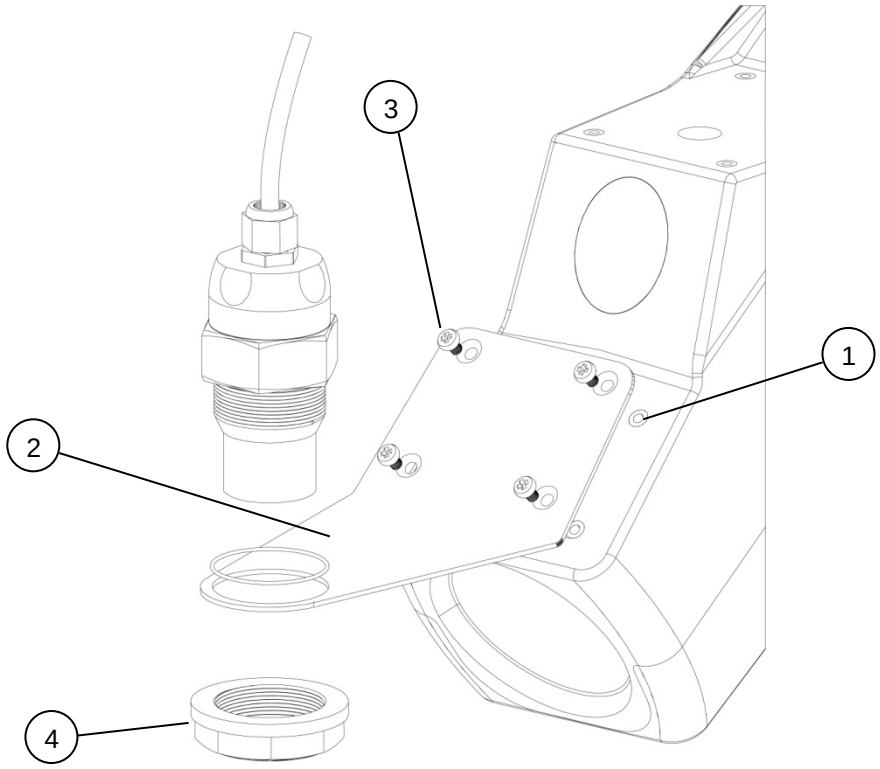


Figure 11: Level sensor attachment

1	Threads for level sensor support attachment	**3**	Screws to attach the level sensor support
2	Level sensor support	**4**	Nut for level sensor attachment

3.3.2.5 Align the sensor vertically – RAVEN-EYE® with attached level sensor

Prerequisites

- Attach the level sensor support to the RAVEN-EYE®.
- Tighten the level sensor to the level sensor support.

The sensor must be aligned vertically to make sure that the sensor is above the flow and that the radar beam will not be blocked by the wall or pipe (Figure 12).

Procedure

1. Make an estimate of where a line that extends from the top of the radar lens perpendicular to where the lens will point (Figure 12).
2. Loosen the wing nut on the ball mount hardware and position the frame so that the radar beam will point below the crown of the pipe by at least 25 mm (Figure 12). It may be necessary to install the 200 mm or the 300 mm (optional) spacer to position the RAVEN-EYE® further from the wall.
3. Tighten the wing nut and make sure that the radar beam is not blocked by the wall or pipe. If the beam is blocked, move the frame further away from the wall using the 200 mm or the 300 mm (optional) spacer or lower the frame.

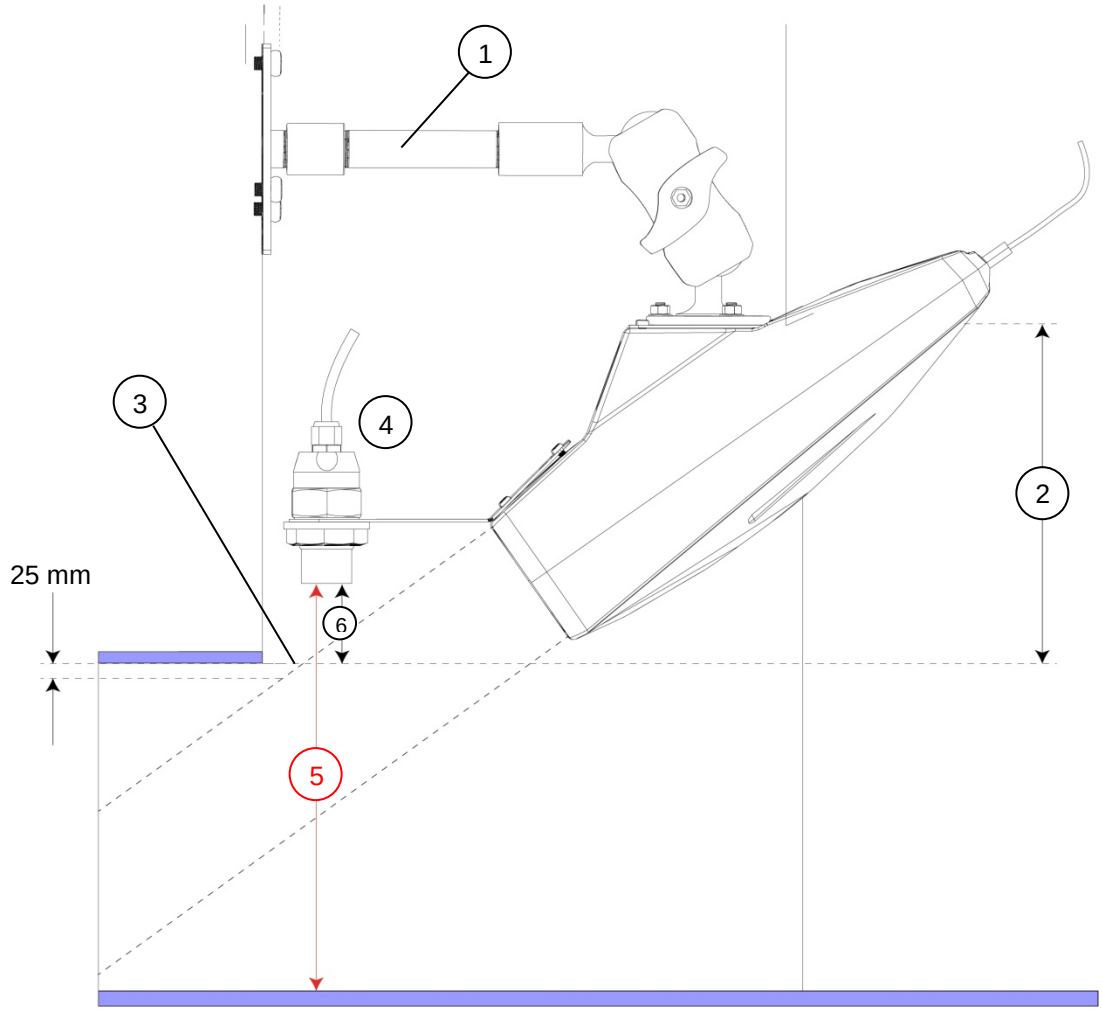


Figure 12: Vertical alignment of the RAVEN-EYE® sensor with attached level sensor

1	Spacer	**4**	Level sensor (ULS-02 or ULS-06)
2	Distance from crown of pipe to ball mount	**5**	Level sensor offset
3	Line that extends from the top of the radar lens perpendicular to where the lens will point	**6**	Distance from crown of pipe to tip of level sensor

3.3.2.6 Align the sensor horizontally

The sensor must be aligned horizontally to make sure that the sensor is centered over the flow. If the pipe is not levelled and has a slope of 2 degrees or more, align the sensor to be parallel with the surface of the water.

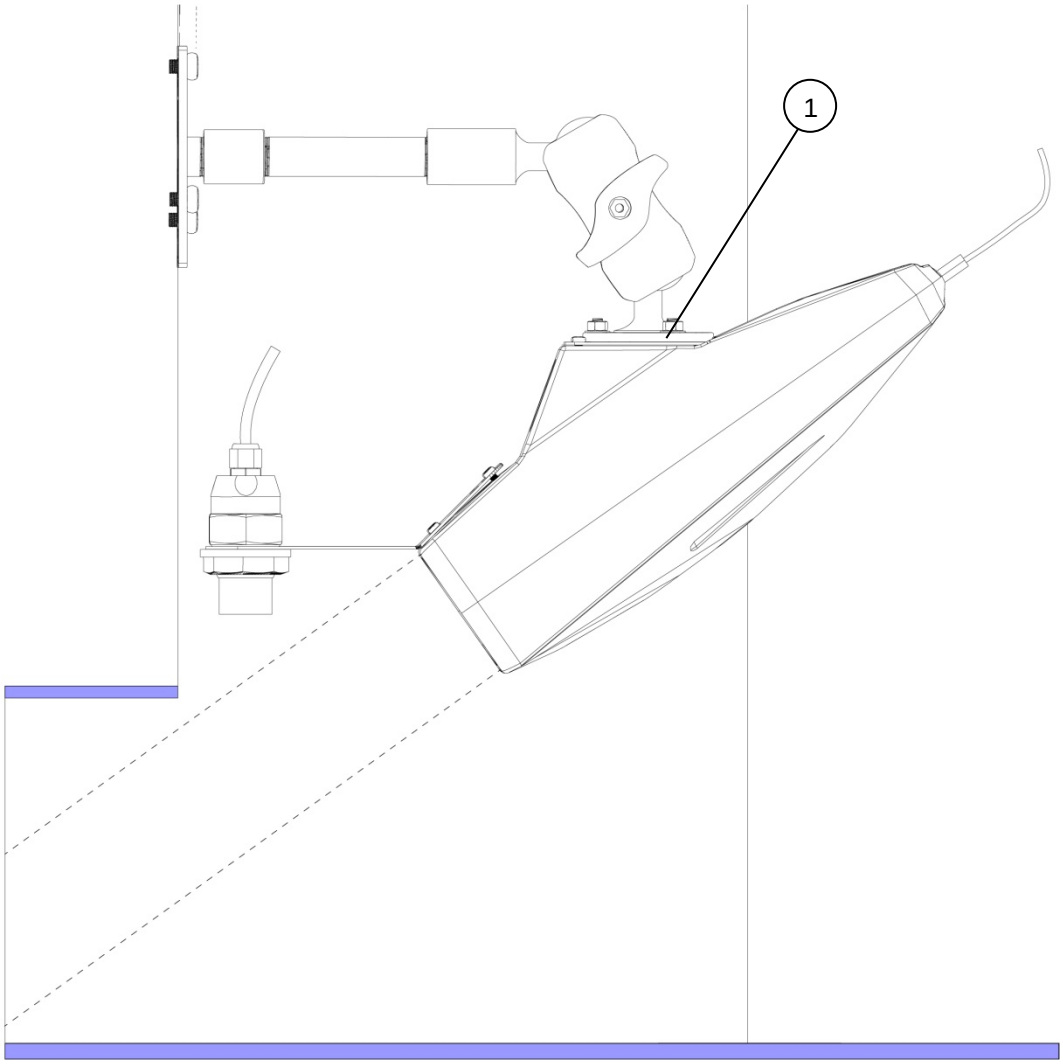


Figure 13: Horizontal alignment of the RAVEN-EYE® sensor

Procedure

1. Use a bubble level and position it on the horizontal platform of the RAVEN-EYE® (see point 1 on Figure 13).
2. Slightly loosen the wing nut and position the sensor so that the platform is positioned horizontally.
3. Tighten the wing nut and make sure the sensor is at the correct position.

3.3.2.7 Make a final alignment check

The correct vertical and horizontal alignment of the sensor is necessary for accurate measurements.

1. Check the vertical alignment (section 3.3.2.3 or section 3.3.2.5) and make adjustments if necessary.
2. Check the horizontal alignment (section 3.3.2.6) and make adjustments if necessary.
3. Repeat steps 1 and 2 until no further adjustments are necessary.

3.3.2.8 Measure the sensor offset

This section applies to ULS-02 and ULS-06 level sensors only. If you are using another type of level sensor, please refer to the instructions of the leveling device used.

The sensor offset is the distance from the tip of the level sensor to the bottom of the pipe or channel. This distance will be entered into the software and is necessary for accurate flow calculations.

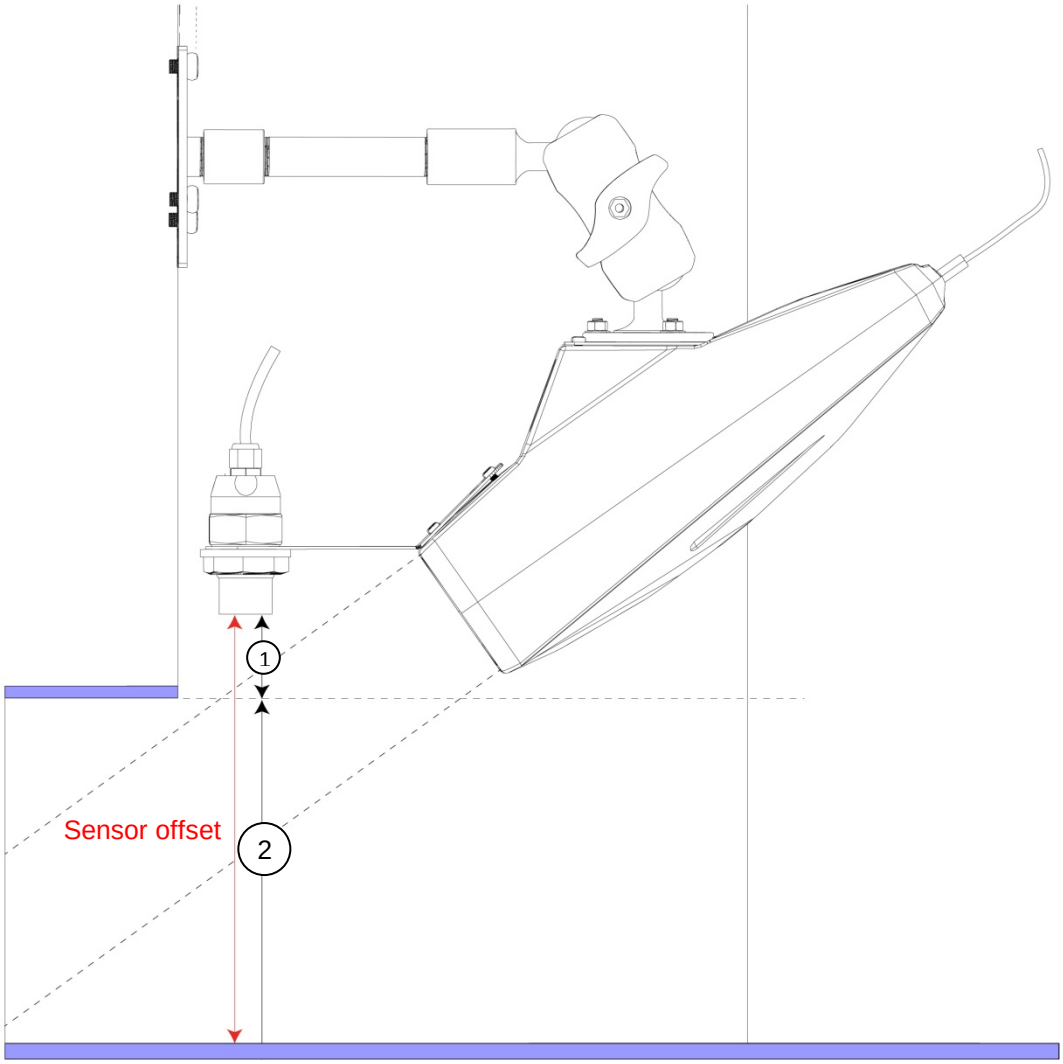


Figure 14: Sensor offset

1	Distance from crown of pipe to tip of level sensor	**2**	Pipe diameter

Prerequisites

- Rod
- Tape measure

Procedure

1. Put the rod in the bottom of the pipe or channel and align it vertically with the level sensor (Figure 14).
2. Make a mark on the rod to identify where the top of the sensor frame is.

3. Measure the distance from the bottom of the rod to the mark. This is the sensor offset.

Note: *If it is not practical to measure to the bottom of the pipe, measure the distance from the crown of the pipe to the top of the frame (Figure 14). Add this distance to the pipe diameter to get the sensor offset (sensor offset = pipe diameter + distance from crown of the pipe to top of frame).*

3.3.2.9 Sensor offset calculation

DANGER
Explosion hazard: Do not use ULS-02 (P/N: RAV-0002) nor ULS-06 (P/N: RAV-0006) sensors in combination with the RAVEN-EYE® ATEX sensor. Only use sensor that have the necessary approvals to enter the hazardous location.

The following rules apply to the ULS-02 or ULS-06 sensors in case they are used with a PLC or controller.

The following configurations apply to the ULS-02 (standard range) and ULS-06 (long range) level sensors.

How to setup a ULS-02 sensor?

Calculation: "Range min.." 4 mA : Sensor offset – 2.000
"Range max." 20 mA : Sensor offset - 250

Example: If the ULS-02 is installed at a distance of 1255 mm above the bottom of the channel, the values for the 4 mA and the 20 mA would be as follow:

"Range min." : 1.255 – 2.000 = -745 mm
"Range max." : 1.255 - 250 = 1.005 mm

How to setup a ULS-06 sensor?

Calculation: "Range min." 4 mA : Sensor offset – 6.000
"Range max." 20 mA : Sensor offset - 250

3.3.3 Measure the pipe diameter

The correct diameter of the pipe or channel is necessary for accurate flow calculations.

1. Measure the inside pipe diameter (I.D.) at three locations (Figure 15). Be sure that the measurements are accurate.
2. Calculate the average of the three measurements. Record this number for use during the software setup for the site.

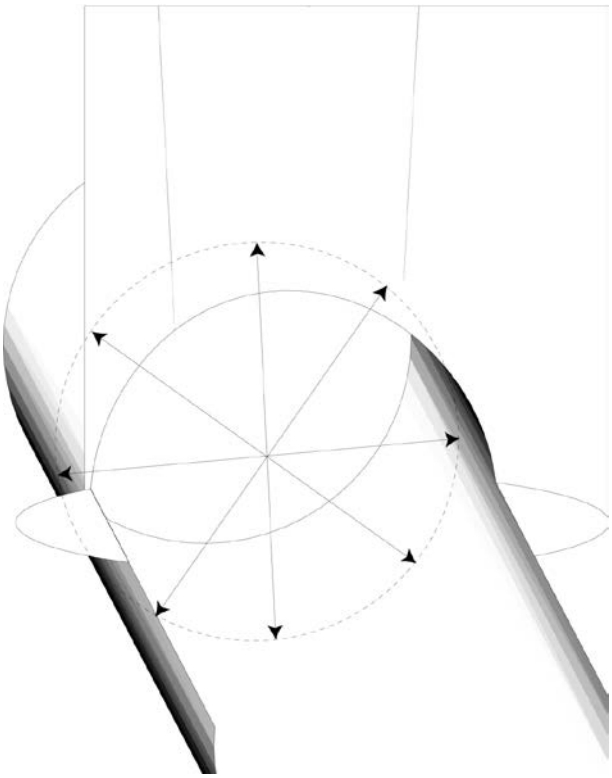


Figure 15: Pipe diameter measurement

3.4 Electrical connections

3.4.1 Wiring safety information

When making any wiring connections to the instrument, the following warnings and notes must be adhered to, as well as any warnings and notes found throughout the individual installation sections. For more safety information refer to section 2.1 on page - 5 -.

CAUTION
Always disconnect power to the instrument when making any electrical connections.

WARNING
Explosion hazard. Voltage connections to the barrier must be from the IFQ MONITOR with specific ATEX configuration supplying the barrier box with 6,9 VDC power source.

3.4.1.1 Electrostatic Discharge (ESD) considerations

Important Note: *To minimize hazards and ESD risks, maintenance procedures not requiring power to the analyzer should be performed with power disconnected.*

Delicate internal electronic components can be damaged by static electricity, resulting in degraded instrument performance or eventual failure.

The manufacturer recommends taking the following steps to prevent ESD damage to your instrument:

- Before touching any instrument electronic components (such as printed circuit cards and the components on them) discharge static electricity from your body. This can be accomplished by touching an earth-grounded metal surface such as the chassis of an instrument or a metal conduit or pipe.
- To reduce static build-up, avoid excessive movement. Transport static-sensitive components in anti-static containers or packaging.
- To discharge static electricity from your body and keep it discharged, wear a wrist strap connected by a wire to earth ground.
- Handle all static-sensitive components in a static-safe area. If possible, use anti-static floor and work bench pads.

3.4.2 Electrical installation in a hazardous location

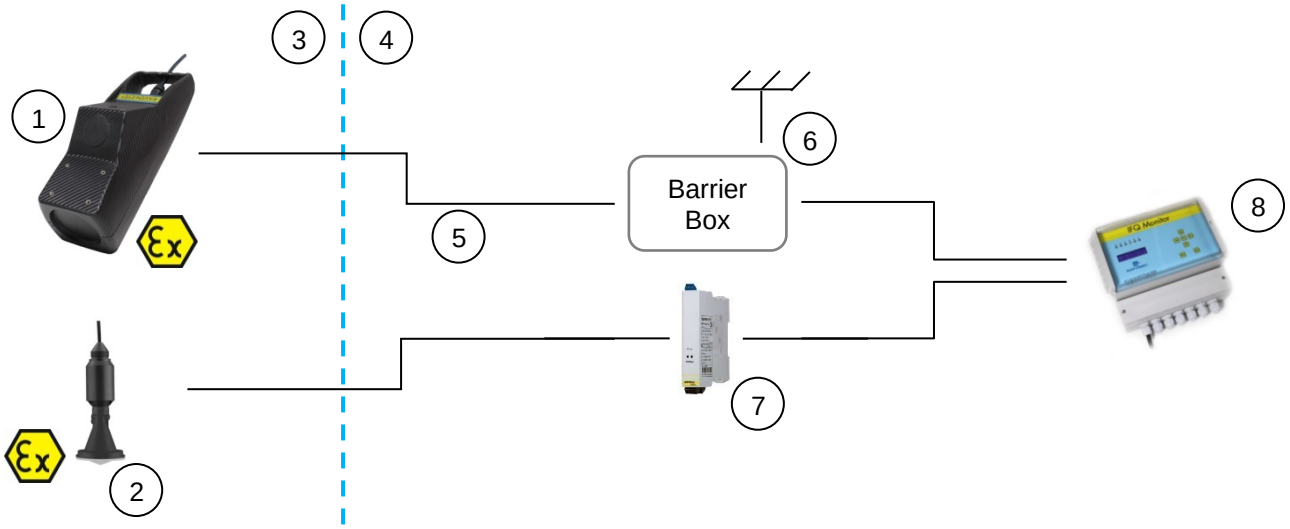
A barrier with appropriate entity parameters must be installed between the sensor and IFQ MONITOR for installation in hazardous locations.

3.4.3 Connection to an IFQ MONITOR

Important Note: The length of the cable between the barrier and the sensor cannot be longer than 70 meters.

Connect the cable from the RAVEN-EYE® sensor to the IFQ MONITOR for ATEX sensors:

1. Connect the cable from the RAVEN-EYE® ATEX sensor to the barrier box.
2. Connect the green/yellow cable from the barrier box to the ground.
3. Connect the cable from the barrier box to the IFQ MONITOR for ATEX sensors. For wire terminal connections to the monitor, refer to the user manual for the IFQ MONITOR. Make sure that the barrier that is connected to the RAVEN-EYE® sensor is connected to the RAVEN-EYE® terminal in the IFQ MONITOR for ATEX sensors.
4. Connect the cable from the ATEX certified level sensor to the corresponding barrier
5. Connect the cable from barrier of the level sensor to the IFQ MONITOR for ATEX sensors. For wire terminal connections to the monitor, refer to the user manual for the IFQ MONITOR. Make sure that the barrier that is connected to the ATEX certified level sensor is connected to the level sensor terminal in the IFQ MONITOR for ATEX sensors.



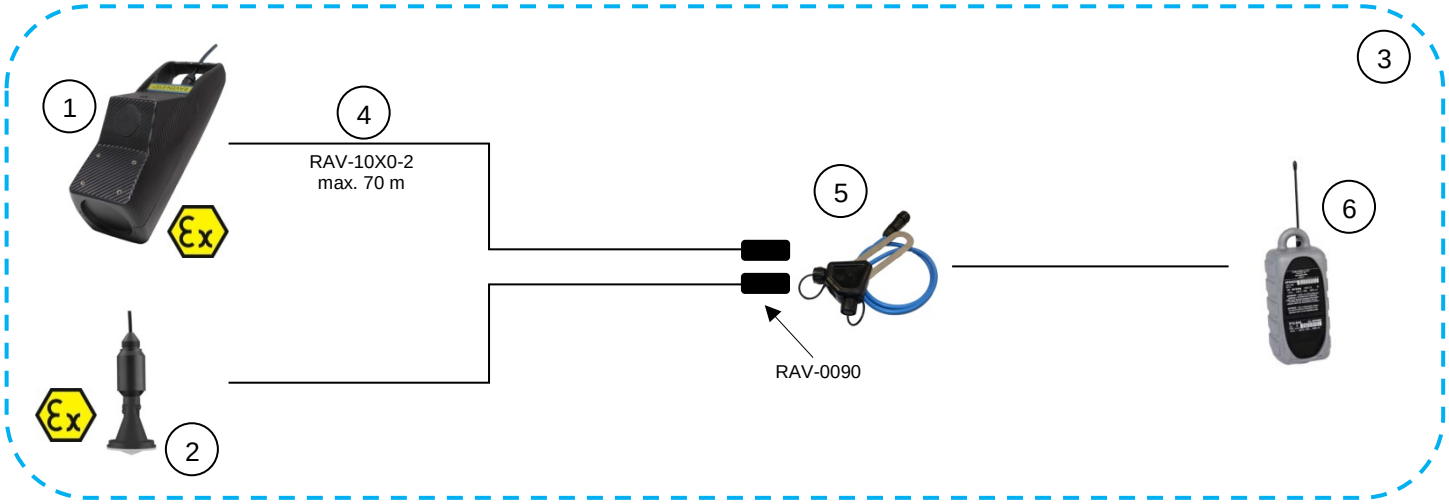
1	RAVEN-EYE® ATEX sensor	**5**	70 m maximum cable lentgh between barrier and RAVEN-EYE® ATEX sensor
2	ATEX certified level sensor with two wire 4-20 mA output	**6**	Barrier for RAVEN-EYE® ATEX sensor
3	Intrinsically-safe environment	**7**	Barrier for ATEX certified level sensor
4	Non-intrinsically-safe environment	**8**	IFQ MONITOR for ATEX sensors

3.4.4 Connection to a RTQ-2000

Important Note: The length of the cable between the splitter and the sensor cannot be longer than 70 meters.

Connect the cable from the RAVEN-EYE® sensor to the RTQ-2000 GPRS logger:

1. Connect the cable from the RAVEN-EYE® ATEX sensor to the "Y" cable splitter.
2. Connect the cable from the ATEX certified level sensor to the "Y" cable splitter.
3. Connect the cable from the "Y"cable splitter to the RTQ-2000 GPRS logger.



1	RAVEN-EYE® ATEX sensor	**4**	70 m maximum cable lentgh between splitter and RAVEN-EYE® ATEX sensor
2	ATEX certified level sensor with two wire 4-20 mA output	**5**	"Y" cable splitter
3	Intrinsically-safe environment	**6**	RTQ-2000 GPRS logger

4 Operation

Use the RAVEN-EYE® sensor in combination with one of the RTQ-2000 GPRS logger for portable applications or applications where no power source is present on site. The RAVEN-EYE® connects directly to the portable logger and the configuration of the sensor and the measuring site is made with the RTQ-Log configuration software or directly through our 123*Flow*.com web platform using a GPRS communication.

Use the RAVEN-EYE® sensor in combination with the IFQ MONITOR for ATEX sensors for stationary applications. The RAVEN-EYE® ATEX sensor connects directly to the IFQ MONITOR in combination with a barrier box and the basic configuration can be made using the programming keys on the device. The configuration of the sensor and the measuring site is made with the RTQ-Log configuration software.

4.1 Connect the RAVEN-EYE® to a computer

WARNING
Explosion hazard. Never connect directly a RAVEN-EYE® sensor previously installed in a hazardous location to the RAV-4001 or RAV-4003 communication module. A barrier box must always be connected between the RAVEN-EYE® sensor and the communication module.

In order to configure the RAVEN-EYE® flow sensor for a specific measuring site, connect the sensor to a computer where the RTQ-Log (version 2.906 or higher) configuration software is installed.

4.1.1 Configuration with RTQ-Log for IFQ MONITOR

Use the RAV-4001 communication cable to connect sensors equipped with open cables to a computer. The adaptor from the RAV-4001 diposes of 4 quick connect terminals. For RAVEN-EYE® ATEX sensors, only two of them are needed.

1. Disconnect power from the IFQ MONITOR
2. Connect the cables from the RAVEN-EYE® ATEX to the barrier box (refer to section 3.4.3 on page - 25 -)
3. Connect the black and white cables from the barrier box to the terminal of the RAV-4001.
4. Connect the red and green cables from the barrier box to the terminal of the IFQ MONITOR for ATEX sensors.
5. Turn on the power of the IFQ MONITOR for ATEX sensors.
6. Connect the USB connector from the RAV-4001 to the computer and lauch RTQ-Log.

Figure 16: RAV-4001 USB communication cable for open end cables

4.1.2 Configuration with RTQ-Log for RTQ-2000

DANGER
Explosion hazard. The use of the USB interface is not allowed in hazardous environment.

Pre-requisite:
Make sure that the latest version of the RTQ-Log software is installed on the computer. Contact Flow-Tronic S.A. or your local distributor for latest updates. Connect only one logger to the computer at a time.

The USB Interface is used for site set-up, configuration and for data retrieval through Laptop or PC. The RTQ-Log software must be installed on the computer to communicate with the logger. For more information on the RTQ-Log software, refer to “Installation & Operation Manual” of the RTQ-Log software.

1. To reach the USB connector on the logger, disconnect the antenna & the sensor cable
2. Remove the protective rubber
3. Engage a short key action with the magnet (ca. 1 sec.), in order to prepare the instrument for the deactivation. LED illuminates during the key action for more information please see the table of contents (refer to RTQ-2000 installation & operation manual).
4. Disconnect the battery pack by pressing on both push buttons on each side on the battery pack.
5. Connect the USB cable in order to configure the RTQ-2000 with the RTQ-Log software.

For further information about operation and use of a RAVEN-EYE with a RTQ-2000 GPRS logger, please refer to the RTQ-2000 installation & operation manual.

5 Maintenance

CAUTION
Radar RF Exposure Hazard. Although the RAVEN-EYE® microwave power level is very small (~15 mW) and is well below government stated exposure limits for uncontrolled environments, users of this product should follow proper safety protocols for the handling of devices with radar frequency transmitters. Avoid placing the head and other vital organ areas within the microwave beam (within 1 meter of the microwave aperture).

IMPORTANT NOTE:
Delicate Instrumentation. Handle with care to prevent damage to the microwave transmitter. Damaged transmitters can result in higher signal power levels, which can interfere with essential terrestrial microwave links.

5.1 Preventive maintenance

Monitor the inside pressure and humidity from the RAVEN-EYE® sensor, when the inside pressure varies below or above limits and the humidity raises above 75%, return the instrument to manufacturer for inspection and service.

Examine the RAVEN-EYE® sensor regularly to look for corrosion or damage.

Examine the RAVEN-EYE® sensor enclosure and make sure that no crackeling, swelling, blistering, pitting or loss of material has occurred on the upper and lower portions of the main PU enclosure. Also look for any discoloration or staining on the PU enclosure. If any of those or any other alteration occur, replace the RAVEN-EYE® as a complete unit and/or return it to FLOW-TRONIC S.A for repair (refer to section 7 on page - 31 -).

If the attached level sensor is used, examine the enclosure and the four M5 SS bolts. Inspect the cables and connectors for any damage or corrosion and tighten all connectors in the system.

The only parts of the RAVEN-EYE® system that can be replaced by the user is the cable and the mounting accessories. If the sensor becomes defective, it must be replaced as a complete unit and/or returned to FLOW-TRONIC S.A (refer to section 7 on page - 31 -).

Check the electrical connections

Examine the cable connectors on an annual basis for corrosion and tightness. If corrosion is found, clean and dry the connectors to make sure that no moisture is on the connector pins. If corrosion is severe, replace the cables.

5.2 Cleaning the instrument

Regular cleaning is not necessary because the sensor does not contact the flow unless a surcharge condition occurs. Examine the sensor after a surcharge to see if cleaning is necessary.

Procedure

1. Disconnect power to the logger or controller
2. Unplug the RAVEN-EYE® sensor connector from logger or controller.
3. Remove the sensor from the manhole.
4. Remove any debris from the bottom of the sensor. Clean the external surface of the sensor with mild soap and rinse with water.
5. Lower and position the sensor back in its initial position. Make sure that the cable points toward the center of the manhole.
6. Connect the RAVEN-EYE® sensor cable to the logger or controller following the installation & operation manual.

5.3 Cable replacement Procedure

Procedure

1. Disconnect power to the logger or controller
2. Unplug the RAVEN-EYE® sensor connector from the logger or controller.
3. Remove the sensor from the manhole.
4. Remove the cable clamp by removing the two screws on the sensor handle. Remove the cable.
5. Install the new cable. Make sure that the connector is aligned properly and that no debris or water gets into the connector.
6. Replace the cable clamp.
7. Lower and position the sensor back in its initial position. Make sure that the cable points toward the center of the manhole.
8. Connect the RAVEN-EYE® sensor cable to the logger or controller following the installation & operation manual.

6 Replacement Parts and Accessories

For replacement parts and accessories, please contact your direct representative or Flow-Tronic S.A.

7 Contact Information

7.1 For Belgium and Luxembourg

Flow-Tronic S.A.
Rue J.H. Cool 19a
B-4840 Welkenraedt
Belgium

Tel : +32 (0)87 899 799
Fax : +32 (0)87 899 790
Email: site@flow-tronic.com
www.flow-tronic.com

7.2 Outside Belgium and Luxembourg

Flow-Tronic maintains a large network of representatives and distributors. To locate a representative, send an email to info@flow-tronic.com or visit www.flow-tronic.com.

7.3 Technical Support

Technical and Customer Service Department personnel are eager to answer questions about our products and their use. In Belgium and Luxembourg, call +32 (0)87 899 799. Outside the Belgium and Luxembourg, contact your direct representative or send an email to service@flow-tronic.com.

7.4 Repair Service

Authorization must be obtained from Flow-Tronic before sending any items for repair.

Steps to follow to send the device to Flow-Tronic for repair:

1. Identify the serial number of the device.
2. Record the reason for return.
3. Make sure the equipment is free from foreign debris and is clean and dry before shipping.
4. Ship the item to:

   Flow-Tronic S.A.
   Rue J.H. Cool 19a
   B-4840 Welkenraedt
   BELGIUM

5. The item that has to be repaired gets an RMA (Return Material Authorization) number.
6. The price for repair is calculated and sent to the customer.
7. Repair is made after having received the authorization from the customer.

Appendix

App. 1 EC type examination certificate

ISSeP
Institut scientifique de service public
Métrologie environnementale
Recherche - Analyses
Essais - Expertises

Siège social
et site de Liège :
Rue du Chéra, 200
B-4000 Liège
Tél : +32(0)4.229.83.11
Fax : +32(0)4.252.46.65

Site de Colfontaine :
Zoning A. Schweitzer,
rue de la Platinerie
B-7340 Colfontaine
Tél : +32(0)65.61.08.11
Fax : +32(0)65.61.08.08

e-mail :
direction@issep.be
site web :
http://www.issep.be

(1) **EC TYPE EXAMINATION CERTIFICATE**

(2) **Equipment or protective system intended for use in potentially explosive atmospheres Directive 94/9/EC**

(3) EC type examination certificate number: **ISSeP15ATEX0019X**

(4) Equipment or protective system:
Non Contact Radar Flow Meter type RAVEN-EYE

(5) Applicant – Manufacturer – Authorized representative in the Community:
FLOW-TRONIC sa, nv

(6) Address: B- 4840 Welkenraedt
Rue J. H. Cool, 19a

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) ISSeP, notified body n^{r} 492 in accordance with article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in annex II to the Directive.

The examination and test results are recorded in confidential report n^{r}: 13013

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 60079-0 : 2012 + A11 : 2013 (IEC 60079-0 : 2011)
EN 60079-11 : 2012 (IEC 60079-11 : 2011)

(10) If the symbol "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC TYPE EXAMINATION CERTIFICATE relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 94/9/EC. Further requirements of this Directive may apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

(12) The marking of the equipment or protective system shall include the following indications:
Ex II 2 G Ex ib IIB T4 Gb

Colfontaine, the 08.04.2015

INSTITUT SCIENTIFIQUE DE
SERVICE PUBLIC
Zoning A. Schweitzer,
rue de la Platinerie
B-7340 COLFONTAINE (Wasmes)
Tél: ++ 32 65 610811 –
Fax: ++ 32 65 610808
e-mail : colfontaine@issep.be

M. LAMBERT,
Manager.

This certificate may only be reproduced in its entirety and without any change, schedule included

Wallonie

1/2

(13) **SCHEDULE**

(14) **EC TYPE EXAMINATION CERTIFICATE N^{R} ISSeP15ATEX0019X**

(15) Description of the equipment or protective system:
Non Contact Radar Flow Meter type RAVEN-EYE

Electrical parameters
Power Supply
Ui = 8.7 V, Ii = 0.73 A, Pi = 1.6 W, Ci = 10.6 µF , Li = 4.7 µH
RS485 (for each channel)
Ui = 8.7 V, Ii = 0.73 A, Pi = 1.6 W, Ci = 0 nF, Li = 0 µH
Uo = 5.88 V, Io = 240 mA, Po = 35.21 mW,
Co = 24.5µF, Lo = 30 µH, Lo/Ro = 3.99 µH/Ohm

Eventual prescriptions
Ta : - 20 °C to + 50°C

Routine tests : None

(16) Report n^{r}: 13013 of 27.03.2015
Composed in total of 32 pages, completed by the following descriptive documents:

- The instruction manual: « Raven-Eye Installation & Operation Manual »
- The drawings :

Number	Rev.	Dates	Pg	Description
FVDS_EX_D	EX_V4.3	16.06.2014	8	FVDSP Schematic
FVSupply_EX_D	EX_V4.3	16.06.2014	7	FVSupply Schematic
GUNN_Board	EX_V4.3	16.06.2014	5	GUNN Board Schematic
GUNN_Connect_EX_C	EX_V4.3	16.06.2014	2	GUNN Connect Schematic
FVDS_EX_D	EX_V4.3	16.06.2014	7	FVDSP Layout
FVSupply_EX_D	EX_V4.3	16.06.2014	5	FVSupply Layout
GUNN_Board_EX_D	EX_V4.3	16.06.2014	8	GUNN Board Layout
GUNN_Connect_EX_C	EX_V4.3	16.06.2014	5	GUNN Connect Layout
GUNN_Connect_EX_C	EX_V4.3	15.05.2014	3	GUNN Connect label
2-1225-000	-	14.05.2013	1	Boîtier radar
####	00	10.03.2015	1	Coque radar Flowtronic

- The datasheet of the paint M27.47 from Streicolor AG (2 pages).

(17) Special conditions for safe use:

Symbol X

The equipment enclosure has been submitted to an antistatic treatment. All precautions shall be taken in order to maintain this treatment even in the extreme using conditions.

(18) Essential Health and Safety Requirements: Covered by the Standards listed in (9)

App. 2 Flow-Tronic Customer Service Department Registration Form

Thank you for selecting Flow-Tronic flow instrumentation for your monitoring needs. Enclosed with your instrument you should find the operation manual(s) and accessories.

So that we may better serve your needs, please take a few minutes to complete this Customer Service Registration Form. Completion of this form will enable us to provide you with application information, software upgrades or product change notices.

Please fax (+32 (0)87 899 790) or e-mail (info@flow-tronic.com) this copy to Flow-Tronic.

If you have any questions or concerns regarding technical support, parts or service, please call Customer Service at +32 (0)87 899 799 or e-mail us at service@flow-tronic.com

Rue J.H. Cool 19a | B-4840 Welkenraedt | BELGIUM
Tel. : +32 (0)87 899 799 | Fax : +32 (0)87 899 790
E-mail : info@flow-tronic.com | www.flow-tronic.com

Customer Service Registration Form --- Customer Service Department
Flow-Tronic S.A.

Flow-Tronic Model _____ Serial Number _____

Company _____

Contact Name _____

Address _____

City _____ State _____Zip Code _____

Phone ( ) _____ Fax ( ) _____

E-Mail_____

Application Type _____

_____

Rue J.H. Cool 19a | B-4840 Welkenraedt | BELGIUM
Tel. : +32 (0)87 899 799 | Fax : +32 (0)87 899 790
E-mail : info@flow-tronic.com | www.flow-tronic.com

Warranty Statement

Manufacturer warrants all products of its manufacture to be free from defects in workmanship and material under normal use and service. This warranty extends for a period of twenty four (24) months after date of shipment, unless altered by mutual agreement between the purchaser and Flow-Tronic S.A. prior to the shipment of the product. If this product is believed to be defective, purchaser shall notify Flow-Tronic S.A. and will return the product to Flow-Tronic S.A., postage paid, within twenty four (24) months after date of shipment by Flow-Tronic S.A. If the purchaser believes the return of the product to be impractical, Flow-Tronic S.A. shall have the option, but will not be required, to inspect the product wherever located. In any event, if the purchaser requests Flow-Tronic S.A. visit their location, the purchaser agrees to pay the non-warranty expenses of travel, lodging and subsistence for the field service response. If the product is found by Flow-Tronic's inspection to be defective in workmanship or material, the defective part or parts will either be repaired or replaced, at Flow-Tronic's election, free of charge, and if necessary the product will be returned to purchaser, transportation prepaid to any point in Europe. If inspection by Flow-Tronic S.A. of such product does not disclose any defect of workmanship or material, Flow-Tronic's regular service repair charges will apply. Computing devices sold but not manufactured by Flow-Tronic S.A. are covered only by the original manufacturer's written warranty. Hence, this warranty statement does not apply.

The foregoing warranty is manufacturer's sole warranty, and all other warranties, express, implied or statutory, including any implied warranty of merchantability or fitness for a particular purpose, are negated and excluded. The foregoing warranty is in lieu of all other warranties, guarantees, representations, obligations or liabilities on the part of the manufacturer and Flow-Tronic S.A.

Purchaser's sole remedy and Flow-Tronic S.A.'s sole obligation for alleged product failure, whether under warranty claim or otherwise, shall be the aforestated obligation of manufacturer to repair or replace products returned within twelve months after date of original shipment.Flow-Tronic S.A. shall not be liable for, and the purchaser assumes and agrees to indemnify and save harmless Flow-Tronic S.A. in respect to, any loss or damage that may arise through the use by the purchaser of any of Flow-Tronic S.A.'s products.

FLOW-TRONIC nv

Rue J.H. Cool 19a | B-4840 Welkenraedt | Tel.: +32 (0)87 899 799 | Fax: +32 (0)87 899 790 | E-mail: info@flow-tronic.com | www.flow-tronic.com