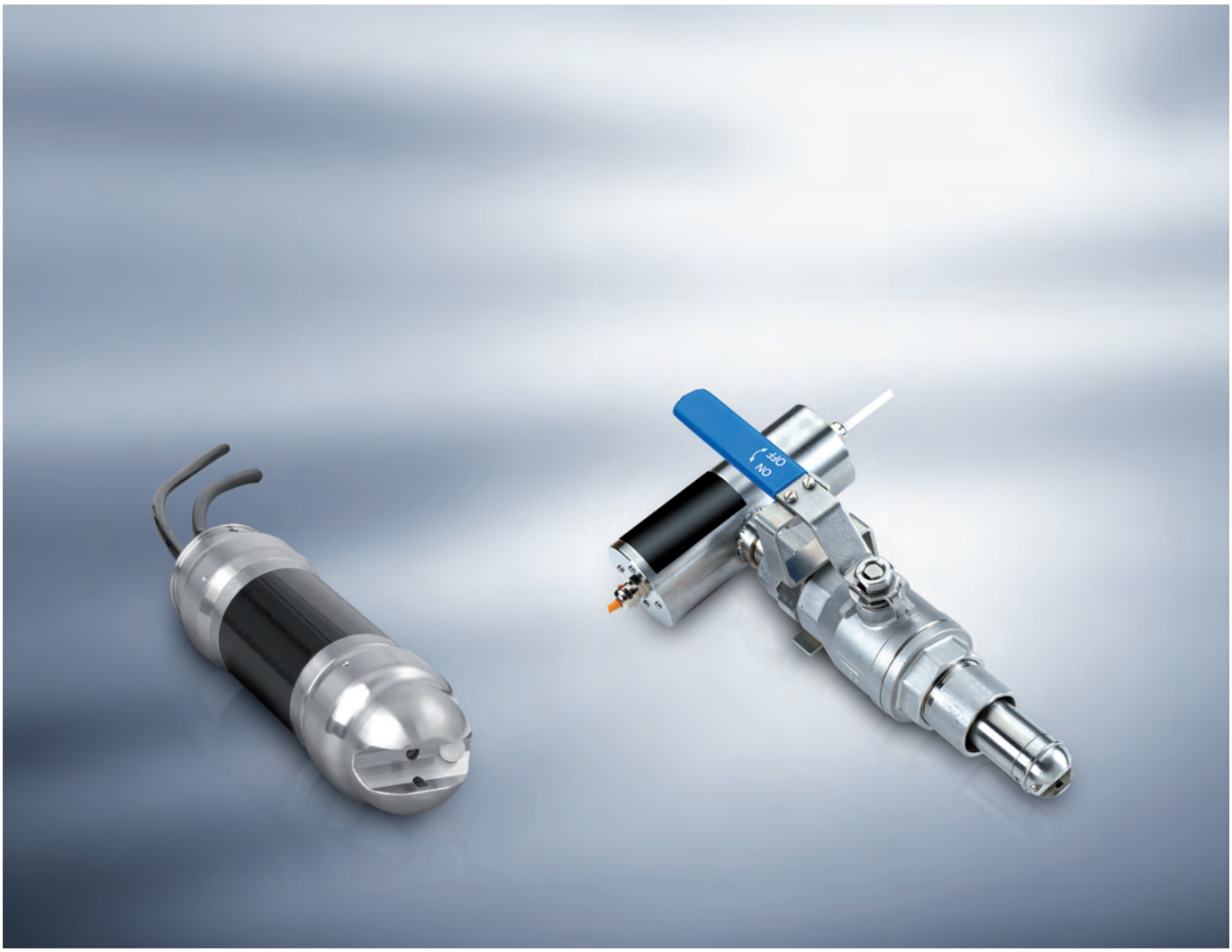


OPTISENS OAS 2000 Technical Datasheet

Suspended solids sensor

- Digital sensor of the OPTISENS 2000 series for use in waste water applications
- Wide measuring range, automatic spray cleaning, precise measurements
- Low maintenance costs with long service intervals

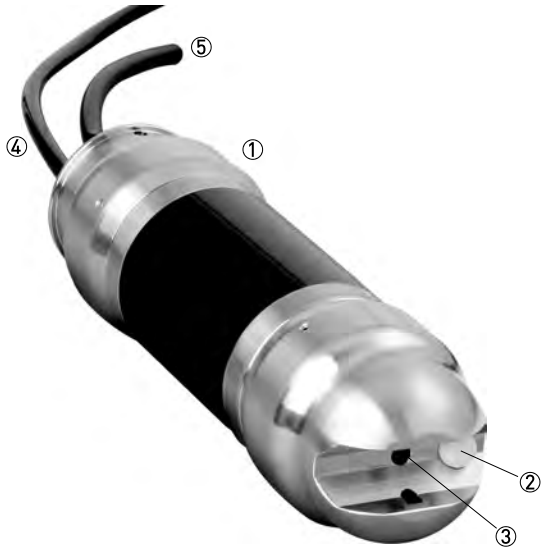
The documentation is only complete when used in combination with the relevant documentation for the converter.

KROHNE

1.1 Digital suspended solids sensor for waste water applications

As all the sensors of the OPTISENS 2000 series, the OAS 2000 suspended solids sensor is equipped with digital communication, a stainless steel body, integrated spray cleaning and flexible mounting options. These unique features perfectly enable the OAS 2000 sensors for use in municipal and industrial waste water treatment facilities.

The measuring principle using transmission of light allows precise measurements of suspended solids with an outstanding wide measuring range, independent of the sludge colour and with excellent long-term stability. Combined with the low maintenance costs, this allows extremely cost-effective operation of the OPTISENS 2000 sensors.



① Stainless steel enclosure
② Spray nozzle for automatic cleaning system
③ NIR LED
④ Cable for digital connection to converter
⑤ Flush hose

Highlights

- Robust stainless steel enclosure
- Automatic spray cleaning
- Mounting option on a flexible telescopic rod
- Measuring principle using transmission of light
- Wide measuring range: 0...20000 mg/l (ppm)
- Independence of the measurement from the sludge colour
- Automatic temperature compensation
- Pre-calibrated in the factory for quick installation
- Digital communication with the MAC 080 multiparameter converter
- Up to four OPTISENS 2000 sensors can be connected to one MAC 080
- Two enclosure versions available: submersible and inline

Industries

- Municipal and industrial waste water treatment facilities

Applications

- Monitoring and control of suspended solids content (influent / primary clarifier, secondary clarifier, effluent from thickeners)
- Aeration basin / SBR / ditch / membrane: MLSS concentration (control of sludge age)
- Control of RAS (Return Activated Sludge) and WAS (Waste Activated Sludge)
- Sludge press / centrifuge: control of polymer dosage
- Influent: chemical reagent control

1.2 Options and versions

Modular concept and digital technology

A complete measuring system consists of:

- MAC 080 multiparameter converter
- One (or up to four) OPTISENS 2000 sensors
- Solenoid valve to control spray cleaning
- Assemblies for submersible or inline installation

Up to four sensors (for identical or different parameters) can be connected to the converter.

Due to digital communication the length of the sensor cable can be extended to max. 100 m / 328 ft without any signal losses. This provides more flexibility in terms of cabling and for the selection of the optimum measuring location, in particular with multisensor measuring points.

Automatic spray cleaning, special measuring principle

The OAS 2000 uses the transmitted light absorption principle. This unique method uses the ability of suspended solids to absorb and reflect light, in this case near infrared light (880 nm). This allows precise measurements of the suspended solids with an extraordinarily wide measuring range, independent of sludge colour.

The continuous checking of the high-efficiency NIR diode using the integrated reference detector means that zero calibration rarely needs to be carried out on the OAS 2000.

The specially-designed, robust stainless steel enclosure, together with the integrated automatic spray cleaning guarantees maximum measuring stability with low maintenance requirements and long service intervals.

Two versions for maximum flexibility

In waste water treatment facilities, measurements of the suspended solids are required at many different locations.

Besides measurements in aeration basins and channels, the suspended solids concentration often has to be measured directly in pump lines, e.g. in lines to digesters and driers.

To consider the different installation situations, the OAS 2000 is available in two versions:

- Submersible version for installations in basins and open channels
- Inline version for installations in pipelines

Assemblies and accessories (submersible version)

The fully-encapsulated OPTISENS 2000 sensor can be mounted on a special, flexible fibreglass telescopic rod, which can be extended to up to 4 m / 13 ft for submersion in basins. Furthermore the device can be mounted by using slide rails for installation on the side walls of channels or in other locations where there is limited installation space.

Besides quick installation and easy handling in term of maintenance (e.g. sensor cleaning) the telescopic rod mounting has an additional benefit: the stable, yet extremely flexible design of the telescopic rod and its bracket allows the sensor to be in constant motion due to the movement of the flowing water. This prevents ragging and contributes to the self-cleaning of the sensor.

You can find detailed information on these assemblies in the technical data sheet of the OPTISENS MAA 2000.

Assemblies and accessories (inline version)

The inline version of the OAS 2000 is designed for attachment to pipelines using a ½" ball valve.

The ball valve is installed using a butt weld end for a hole of 48.5 mm diameter (standard scope of delivery). A 1½" NPT nipple is available as an option.

For installations on existing assemblies, the OAS 2000 can also be supplied without the ball valve and nipple.

1.3 Combination of sensor / converter / mounting assembly

	MAC 080 converter	MAA 2000 telescopic rod	MAA 2000 slide rail
OAS 2000 submersible	x	x	x
OAS 2000 inline	x	N/A	N/A

1.4 Measuring principle

The sensor measures transmitted light through the liquid. The measuring principle is based on the suspended particles ability to absorb and reflect NIR (Near Infrared) light. The light source is a light emitting diode that pulses and emits monochromatic light with a wavelength of 880 nm. The detected measuring signal is inversely logarithmical proportional to the concentration of suspended solids. Signal treatment or linearisation is done within the converter.

In addition, the temperature is measured to be used for temperature compensation of the measured value. It can be read in the converter and used as secondary value when a sensor is configured to use both analog outputs.

The built-in temperature measurement is not a precision measurement, but shall be seen as an indication.

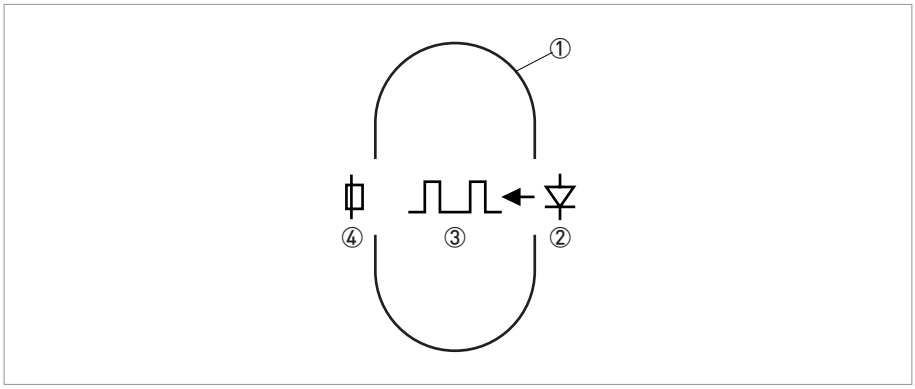


Figure 1-1: Cross-section of measuring gap

① Measuring gap
② Light source (NIR-LED)
③ Monochromatic light beam
④ Detector

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local representative.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).*

	Submersible version	Inline version

Measuring system

Measuring principle	Transmitted light absorption principle, pulsed NIR 880 nm, with reference measurement, temperature-compensated.	
	Reflection and absorption of light on suspended solids and sludge particles. The light passes the measured particles between the emitter and the detector in a straight line.	
Application range	Continuous measurement of suspended solids in waste water and sludge (e.g. in aeration basins).	Continuous measurement of suspended solids in pump lines for waste water and sludge (e.g. in pump lines for return sludge).
Measured value	Suspended solids concentration	

Design

Modular construction		
	A typical measuring system consists of: • MAC 080 multiparameter converter • 1 (or up to 4) OPTISENS 2000 sensors • Solenoid valves to control spray cleaning	
	Assemblies for submersion or side wall installation.	Ball valve assembly for inline installation.
Measuring range	0...20000 mg/l (ppm), min. 0...100 mg/l (depending on the sludge type)	0...5% suspended solids, min. 0...100 mg/l (depending on the sludge type)
Flushing	Flushing using clean water or compressed air.	
	Pressure: 6 bar / 87 psi	Pressure: 2 bar / 29 psi above process pressure, max. 10 bar / 145 psi
	Solenoid valve: available in 220 V and 117 V versions, up to 2 sensors can be operated on a single valve.	
	Flush hose: ¼" external diameter, PE, standard length: 10 m / 32.8 ft	

Measuring accuracy

Reference conditions	Medium: water	
	Temperature: +25°C / +77°F	
	Pressure: 1 barg / 14.5 psig	
Maximum measuring error	Typical ±2% of selected range, max. ±5% of selected range.	
	Temperature: ±0.5°C / 0.5°F	
Display resolution (in combination with MAC 080)	1 mg/l, extended mode: 0.1 mg/l	
	Temperature: 0.1°C / 0.1°F	
Calibration	Pre-calibrated in the factory, calibration on site: software-supported single or multipoint calibration using reference samples.	

Operating conditions

Temperature	Process temperature = ambient temperature	
	0…+60°C / 32…140°F	
Process pressure	Ambient	Max. 6 bar / 87 psi with automatic cleaning
		Max. 10 bar / 145 psi without automatic cleaning (special version)
Max. immersion depth	10 m / 32.8 ft	N/A
Protection category	IP68 (Nema 6)	

Installation conditions

AAS 2000 + MAA 2000 fibreglass telescopic rod for submersible installations	Installation on the handrail with up to 4 m length-adjustable, oscillating fibreglass assembly.	N/A
	Handrail mounting for: • Round handrails: d = 32...50 mm / 1.3…2" • Square cross-sections: 28...42 mm / 1.1…1.7"	
AAS 2000 + MAA 2000 slide rail mounting for side wall installations	Installation on side walls of channels and basins using slide rails for simple sensor removal.	N/A
OAS 2000 inline version	N/A	Pipe installation using a butt weld end for holes of 48.5 mm / 1.9" diameter (standard scope of delivery) or with an optional 1½" NPT nipple, on which a ball valve is installed to fit the sensor. Min. pipe diameter: 80 mm / 3.1".
Dimensions and weights	For detailed information see chapter "Dimensions and weights".	
Process connection	Open basins and channels	1½" ball valve for inline installation

Materials

Enclosure	316 SS
NIR diode	GAS diode, 880 nm wavelength, pulsed
Connection cable to converter	Insulation: Hytrel (5-pin M12 connector, fixed cable, shielded, 10 m / 32.8 ft)
Flush hose	PE

Approvals and certifications

CE sign	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.
Electromagnetic compatibility	Interference emission to EN 61000-6-4:2001; immunity to EN 61000-6-2:2001.
Low voltage directive	Safety requirements for electrical equipment for measurement, control and laboratory use in accordance with EN 61010-1:2001.

2.2 Dimensions and weight

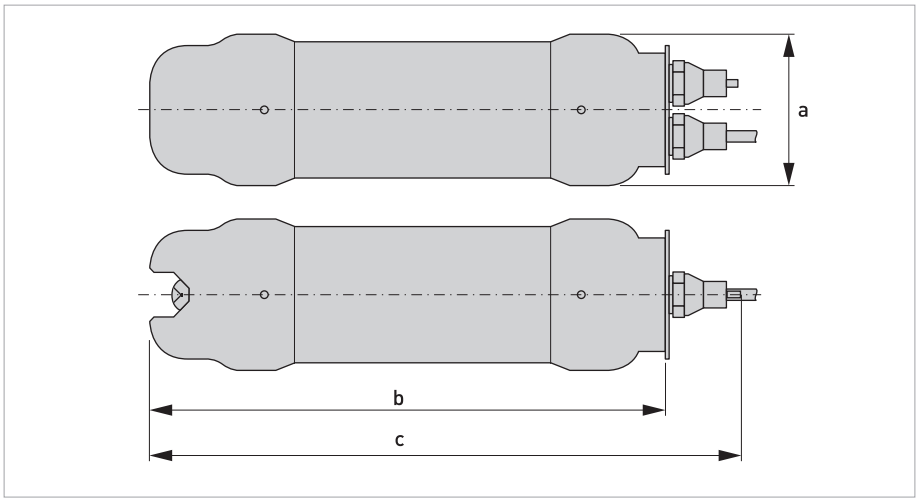


Figure 2-1: Submersible version

	Dimensions [mm]	Dimensions [inches]	Weight	
			[kg]	[lbs]
a	Ø66	Ø2.6	1.6	3.5
b	20	0.8		
c	227	8.9		
d	255	10.0		

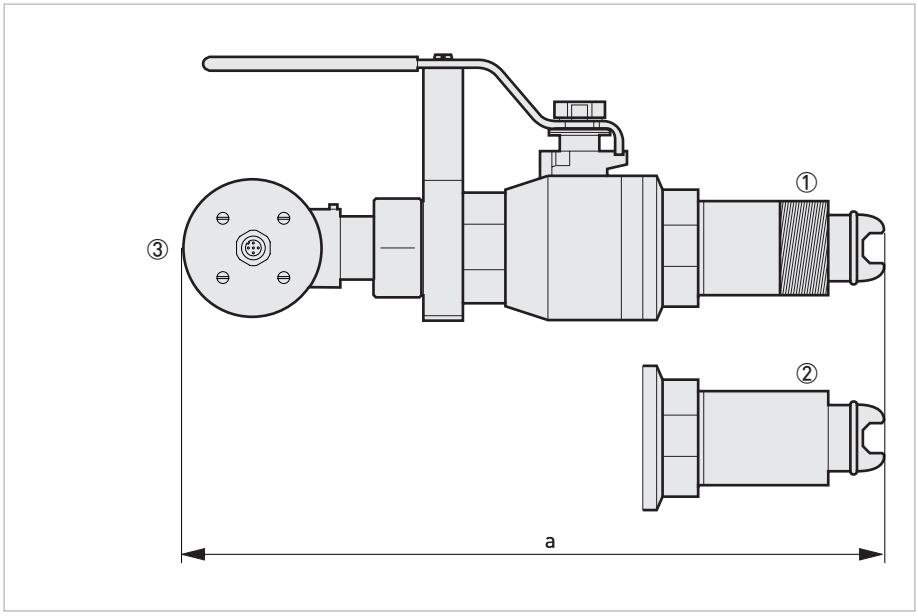


Figure 2-2: In-line version

① 1½" NPT
② Welding end
③ Min. 283 mm / 11.1" (de)installation spacing

	Dimension [mm]	Dimension [inches]	Weight	
			[kg]	[lbs]
a	368	14.5	4.6	10.1

3.1 Intended use

The sensors are used to measure suspended solids in water and wastewater treatment plants and other industrial applications. They are designed to be combined with the MAC 080 converter.

3.2 Notes on installation

Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Check the packing list to check if you received completely all that you ordered.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.3 Storage and transport

- Store the device in a dry, dust-free location.
- Avoid continuous direct sunlight.
- The original packing is designed to protect the equipment. It has to be used if the device is transported or sent back to the manufacturer.

3.4 Configuration of a measuring point

A complete measuring point consists of at least three parts:

- MAC 080 converter
- OPTISENS 2000 sensor (including cable)
- MAA 2000 sensor holder

If automatic flushing is installed, an optional solenoid valve is necessary as well.

Examples of typical measuring points are listed in the following sections.

3.5 Mounting of submersible version

The sensor can be mounted in two ways:

- On a telescopic fibreglass rod placed in a mounting bracket that fastens to a handrail (see next section).
- To an adjustable slide rail holder (see next section but one).

Installation tips

- When the sensor measures in a flume, it is important to find a place where the suspended solids concentration is representative.
- Make sure the flushing nozzle is downstream from the lenses pointing against the stream. This will avoid disturbances of the measurement by turbulence from the nozzle. At the same time it will produce a shield around the nozzle, due to a constant over pressure, preventing particles from getting in.
- Adjust the rod so that the sensor is at least 30 cm / 11.8" below the liquid surface or the lowest water level in decant applications to prevent the sensor from coming out of the liquid.
- In an aeration tank, ensure that the sensor is not directly above a diffuser head. It should be installed on the backside of the rolling diffuser effect.
- Flushing may not be required if the tank is well agitated. To verify the need for flushing, remove the sensor from the liquid after it has been in the liquid for several days.
- When installing in a clarifier, compressed air flushing is required due to no agitation of liquid and to remove oil and grease film on lens. This is especially applicable in primary clarifiers.
- When using the sensor for influent applications, always install the unit after the bar screen. If the bar screen spacing is larger than 6 mm / 0.24", then a baffle or diffuser plate should be installed in front of the sensor to prevent rags from catching on the sensor head. On influent applications, compressed air flushing is recommended due to the oil or grease in the liquid.

3.5.1 Mounting to MAA 2000 telescopic rod immersion holder

The mounting bracket of the telescopic rod is mounted to a handrail or a separate holder.
In case a handrail is not available, a mounting post with a vertical bar for sensor mounting can be purchased from the manufacturer.

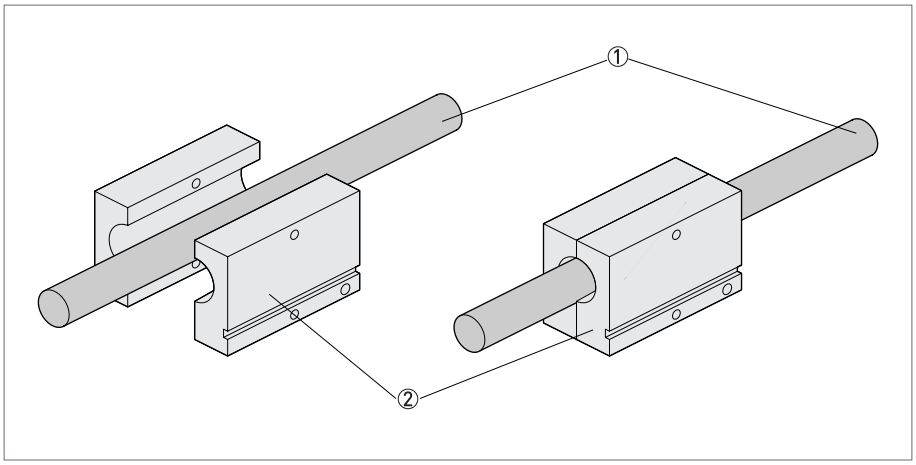


Figure 3-1: Placing the rod holder around the rod

① Telescopic rod
② Rod holder

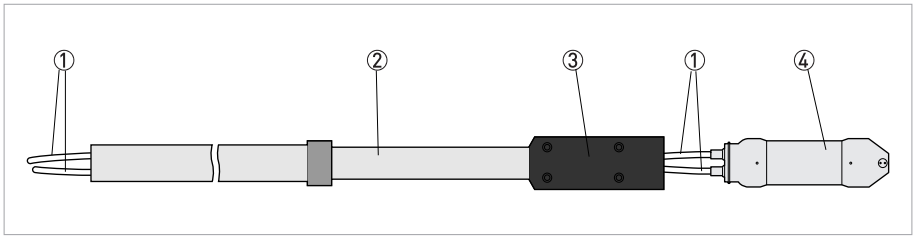


Figure 3-2: Pulling the cable/hose through the rod

① Cable/hose
② Telescopic rod
③ Sensor holder
④ Sensor

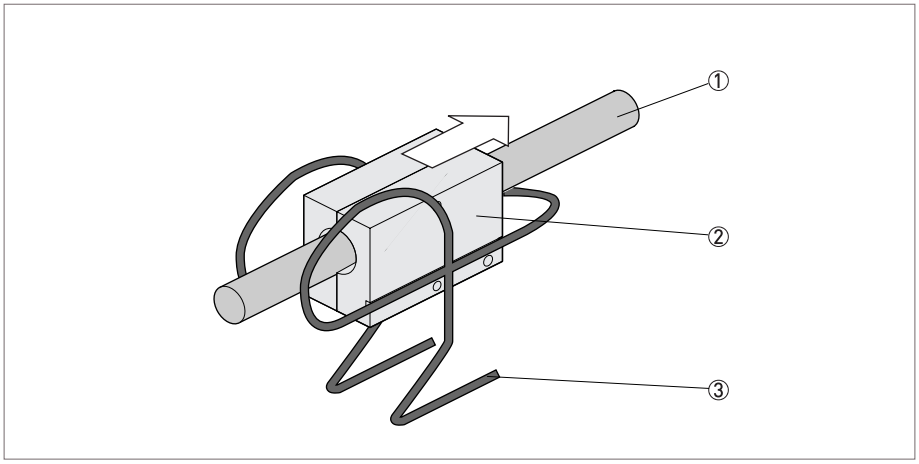
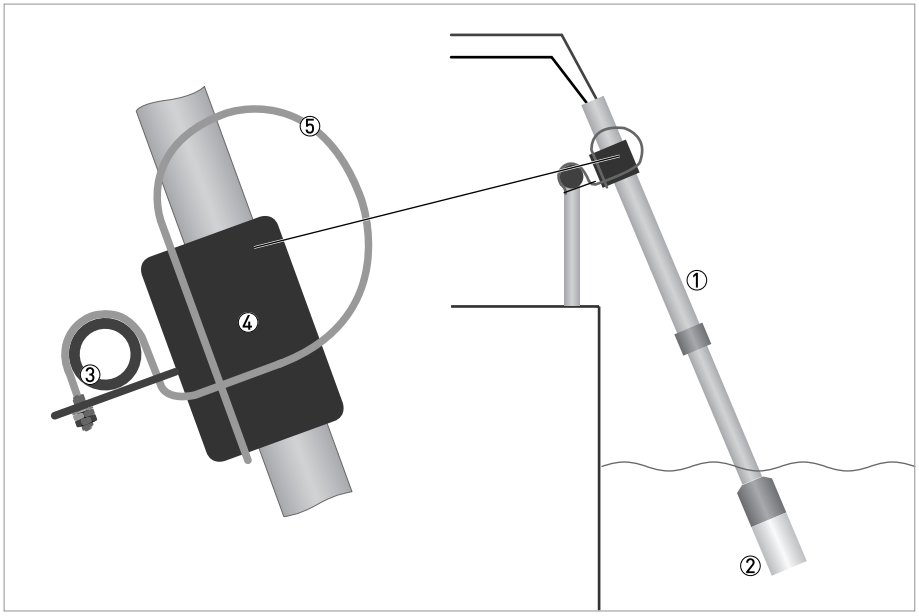


Figure 3-3: Inserting the rod holder into the mounting bracket

① Telescopic rod
② Rod holder
③ Mounting bracket



① Telescopic rod
② Sensor holder
③ Handrail with mounting bracket attached
④ Rod holder
⑤ Mounting bracket

Do not extend the rod sections beyond the black lines. This could lead to rod damage.

For best measurement, the rod shall be mounted in an angle (5...30° from vertical).

Mounting to telescopic rod immersion holder

- Mount the flexible mounting bracket on an existing handrail or on a separate holder, diameter 32...50 mm / 1.3...2.0" or square 28...42 mm / 1.1...1.7". The bent lip on the mounting plate shall be on top and faced toward the liquid or tank.
- Adjust the mounting bracket to the correct angle and tighten the nuts.

➲ The bracket shall be fixed to the rail and must not be able to rotate around it.

- Disassemble the rod holder and place it around the telescopic rod.
- Use the SS screws on the rod holder to tighten the rod holder to the rod.
- Pull the cable and hose through the sensor holder and rod.
- Connect the sensor to the rod with the two piece black PVC sensor holder.
- Tighten the adapter halves until snug, which will leave about 1.5 mm / 0.06" gap. The gap is required so the water can drain from the rod.
- Adjust the length of the telescopic rod as necessary by twisting the nuts while holding the rod. Do not extend the rod sections beyond the black lines. This could lead to rod damage.
- Insert the PVC rod holder with the telescopic rod into the mounting bracket. Make sure that the guide tracks of the rod holder are properly seated in the bracket.
- Fasten the safety-locking clamp.
- Check that the mounting bracket is safely fixed to the rail for the spring to work the way it is intended.

3.5.2 Mounting to MAA 2000 slide rail immersion holder

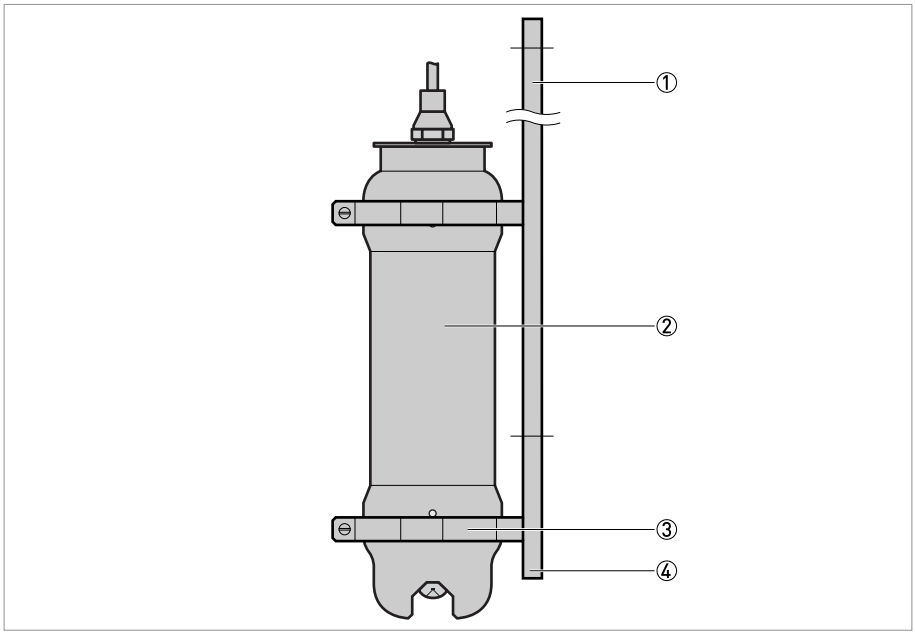


Figure 3-4: Mounting to MAA 2000 slide rail immersion holder

① Slide rail immersion holder
② Sensor
③ 66 mm / 2.60" clamp
④ Adjustable stop

In order to avoid large air bubbles which can affect the measurement please make sure that the slide rail immersion holder is mounted in a certain angle to the vertical position. The angle should be slightly off from vertical position (approx. 20°), but not more than 90°.

Mounting to MAA 2000 slide rail immersion holder

- Mount the slide rail immersion holder to the side wall of the basin or open channel using the two predrilled holes. The adjustable stop should be on the bottom and the two sliding clamps above.
- Take the two sliding clamps off from the slide rail and mount them around the sensor housing. Make sure that the clamps are placed on the two elevated ends of the sensor housing (one on the upper part and one on the lower part, see figure above).
  The two guide tracks have to line-up in one straight line to each other.
- Slide the sensor with the two clamps into the slide rail. Make sure that the guide tracks of the two clamps are properly seated.
- Adjust the sensor position as necessary and fasten the adjustable stop.

3.6 Mounting of inline version

Be aware that the force may be strong when the sensor is mounted under pressure.

If the following instructions cannot be fulfilled in all parts, the sensor should not be mounted or dismounted under process pressure.

The inline sensor is mounted through a ball valve to make it possible to remove the sensor under pressure. Make sure there is at least 260 mm / 10.2" free space to remove the sensor from the valve. The sensor shall be mounted in a place where the process pressure is at least 1 bar. In horizontal pipes the sensor shall be mounted from the side or from below to avoid disturbance from air bubbles.

The sensor is designed to be mounted in a right angle to the process flow. The smallest process pipe diameter to mount the sensor is 80 mm / 3.1". The measure gap must be at least 5 mm / 0.2" from the pipe wall. If a sample outlet is used it must reach at least 20 mm / 0.8" into the pipe.

Place the sensor at a location where there is no risk for it to get damaged. When the OAS 2000 inline is used outdoors, it shall be mounted with a sun and rain protective hood.

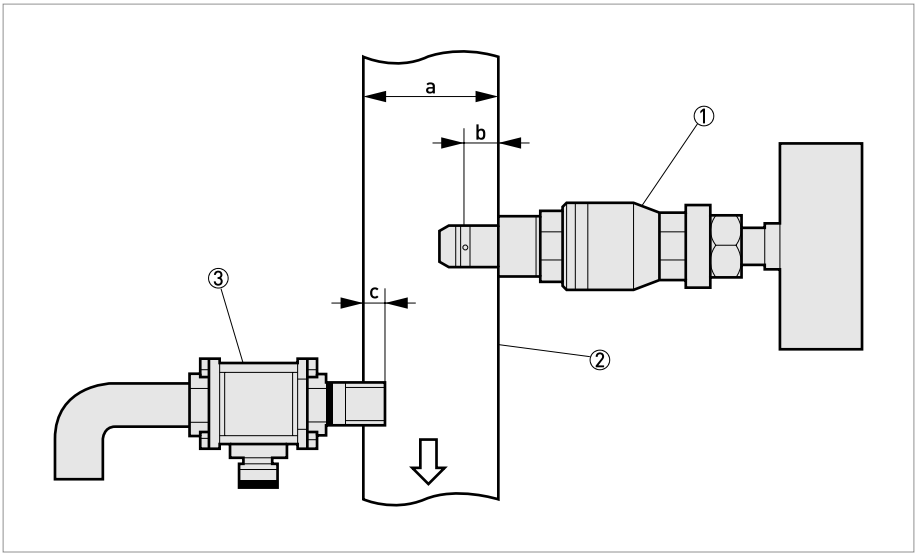


Figure 3-5: Mounting of sensor and sample outlet

① Inline sensor with ball valve
② Process pipe
③ Sample outlet

	Dimensions [mm]	Dimensions [inches]
a	min. 80 mm	min. 3.1"
b	min. 5 mm	min. 0.2"
c	min. 20 mm	min. 0.8"

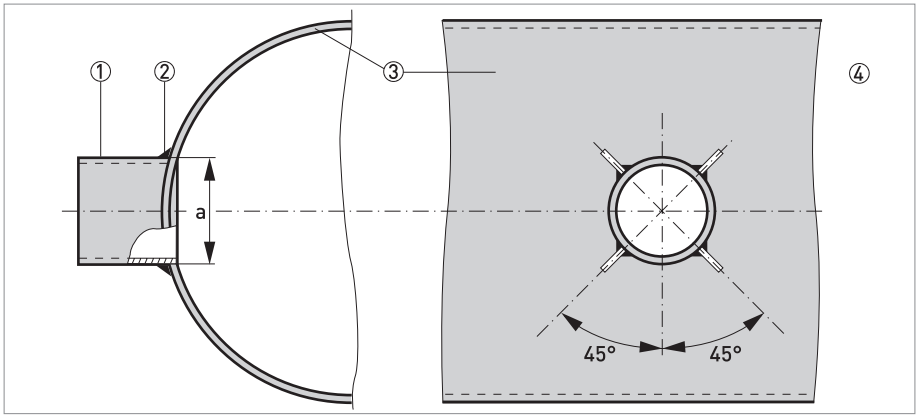


Figure 3-6: Mounting of weld end with strip iron

① Weld end
② Weld
③ Process pipe
④ Stabilizing weld

	Ø [mm]	Ø [inches]
a	48.5	1.91

Mounting the weld end (see previous figure)

- Open a Ø 48.5 mm / 1.91" hole in the process pipe.
- Cut the weld end to get the sensor head at least 5 mm / 0.2" from the pipe wall.
- Weld the weld end to the pipe.
- Stabilize the weld end using 3 mm / 0.1" strip iron according to the figure above.

Mounting the optional threaded nipple in a saddle

- Mount the saddle on the pipe according to the saddle manufacturer's instructions.
- Thread the nipple into the saddle.
- Use flaxen hair and joint paste. Be aware to get the correct distance from the pipe wall to the valve.

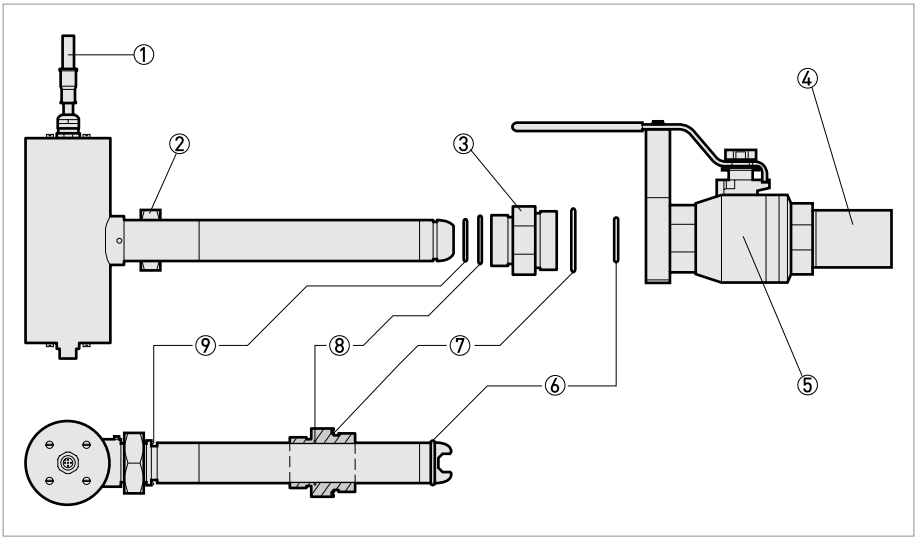


Figure 3-7: Mounting of sensor in ball valve

① Flush hose
② Sensor nut
③ Adapter
④ Weld end nipple or 1½" NPT threaded nipple
⑤ Ball valve
⑥ Lockring
⑦ O-ring 48 x 2 mm / 1.9 x 0.1"
⑧ O-ring 33.3 x 2.4 mm / 1.3 x 0.1"
⑨ O-ring 29 x 2.5 mm / 1.1 x 0.1"

Mounting the ball valve (see previous figure)

- Thread the valve end on the but weld end or nipple (use sealing tape or flaxen hair and joint paste).

Don not pull the valve end to the bottom. The valve handle plane shall have the same direction as the pipe. If the valve is turned the wrong way, the measuring gap will not be in line with the flow, resulting in faulty measurement.

The sensor is mounted in the valve using an adapter. The adapter serves two purposes:

1. A thread for the sensor nut to keep the sensor in place.
2. A stop for the lockring to prevent the sensor from coming loose when the sensor nut is loosened.

Be careful that the sensor is inserted straight. If the sensor is not straight, it can jam and so cause damages on the transmitter or valve.

If the transmitter is hard to mount and you suspect something that is stuck or the transmitter is not mounted straight, crank out and check that everything is OK.

The Sensor nut can release big forces. Do not ever loosen the nut without holding the sensor in place at the same time.

Mounting the sensor (see previous figure)

- Make sure that the o-rings in the adapter between the sensor and the valve and on the sensor below the sensor nut are in a faultless condition.
- Use silicon grease or soup to grease the o-rings before mounting the adapter.
- If the adapter is separated from the sensor, check and grease the o-ring inside the adapter. Then push the adapter over the sensor head having the smaller thread towards the sensor housing.
- Mount the lockring on the sensor head.
- Thread the adapter into the valve.

➲ The sensor is now fixed to the valve.

- When the adapter is tightened, open the valve.
- Push the sensor in place. If the process pressure is high, considerable force may be needed to push the sensor in place.
- Screw the sensor nut in place, but do not tighten it yet.
- Align the sensor in parallel with the process flow.
- Tighten the sensor nut.

➲ The sensor is mounted.

4.1 Safety instructions

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

Observe the national regulations for electrical installations!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Cable connections

The sensor is equipped with a fixed 10 m / 33 ft cable, which has a M12 connector attached. Connect the sensor to the converter using the M12 connector. In the event that two or more sensors should be connected to the same converter, use the optional junction box.

Power requirements:

- The sensor requires 24 VDC power, which is supplied from the converter via the sensor cable.
- The maximum current during operation is 45 mA.

5.1 Order code

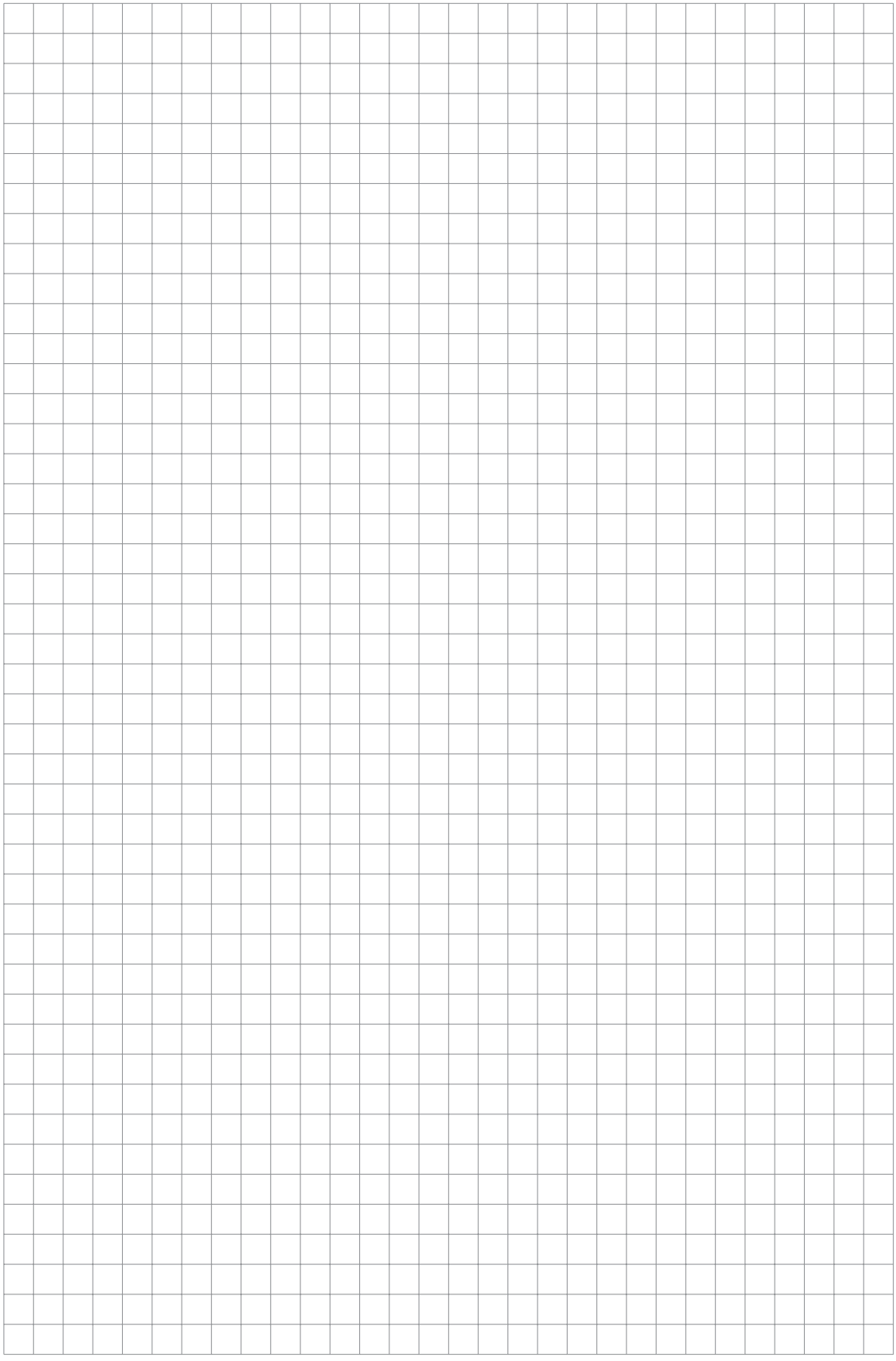
The characters of the order code highlighted in light grey describe the standard.

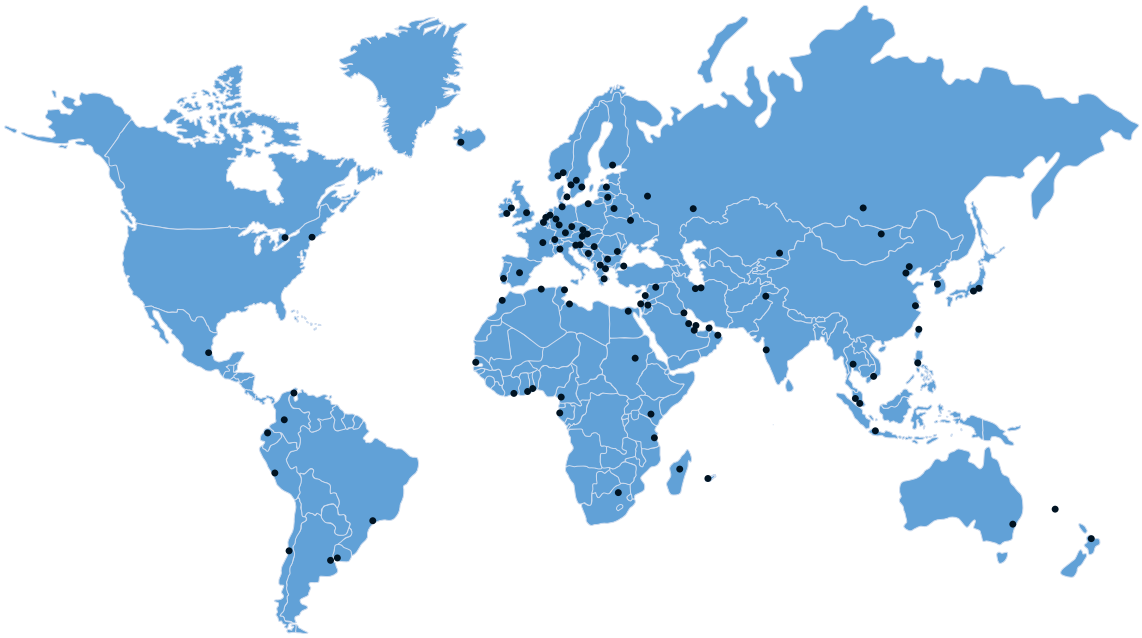
VGA R	4	Sensor										
		0	None									
		A	OPTISENS OAS 2000									
			Measuring range									
			0	None								
			1	0...20.000 mg/l (ppm), inline version								
			2	0...5 % inline version								
				Sensor features								
				0	None							
				1	Standard (submersible version)							
				A	Without retractable holder (inline version)							
				B	With retractable holder (inline version)							
					Process conditions							
					0	None						
					2	0...+60°C / +32...+140°F, 6 bar / 90 psi						
						Process connection						
						0	None					
						A	Adapter for MAA 2000, 1...4 m / 3.3...13.1 ft					
						B	1½" ball valve (inline version)					
							Sensor options					
							0	None				
							A	Spray nozzle				
								Sensor cable connection				
								0	None			
								4	Fixed cable			
									Cable			
									0	None		
									A	MAW 2000 fixed cable		
										Cable features		
										0	None	
										1	Standard	
											Cable length	
											0	None
											3	10 m / 33 ft
VGA R	4											Continued on next page

	Cable options		
	0	None	
	A	M12 connector for MAC 080 converter	
		Documentation	
		0	None
		1	English
		2	German
Carried over from previous page			Order code

5.2 Spare parts and accessories

Order number	Designation
XGA S 06010	OAS 2000 inline connection valve
XGA S 06020	OAS 2000 inline but weld end R 1½"
XGA S 06030	OAS 2000 inline 1/12" NPT nipple
XGA S 06040	Sealing kit for OAS 2000 inline version
XGA W 08010	Signal cable extension for OPTISENS 2000 sensor (10 m / 33 ft)
XGA W 08020	Signal cable extension for OPTISENS 2000 sensor (30 m / 98.4 ft)





KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Measuring systems for the oil and gas industry
- Measuring systems for sea-going tankers

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