OPTISENS AAS 2000 Handbook

Dissolved Oxygen Sensor

KROHNE

1.1 Intended Use

The OPTISENS AAS 2000 sensors are used to measure the concentration of dissolved oxygen in water. They can be used in municipal and industrial waste water treatment facilities, water monitoring stations and other applications.

1.2 Safety instructions from the manufacturer

1.2.1 Copyright and data protection

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1.2.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation and operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.2.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of underneath icons.

1.2.5 Display conventions

The following symbols are used to help you navigate this documentation more easily:

DANGER!
This symbol designates safety advice on handling electricity.

WARNING!
These warning signs must be observed without fail. Even only partial disregarding such warnings can result in serious health damage, damage to the device itself or to parts of the operator's plant.

CAUTION!
These warnings must be observed without fail. Even only partial disregarding such warnings can lead to improper functioning of the device.

LEGAL NOTICE!
This symbol designates information on statutory directives and standards.

INFORMATION!
This symbol designates important information for the handling of the device.

- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.
  ➲ CONSEQUENCE
  This symbol designates all important consequences of the previous actions.

1.3 Safety instructions for the operator

WARNING!
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

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

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

INFORMATION!
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.
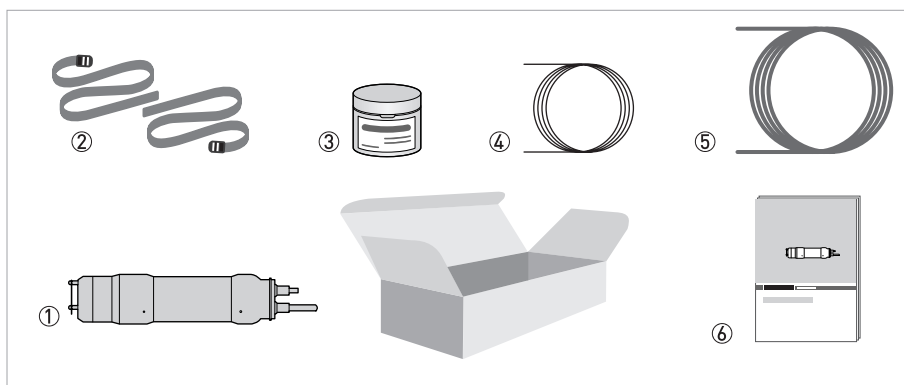
Figure 2-1: **Standard scope of delivery**

① AAS 2000 dissolved oxygen sensor
② 2 pcs of straps
③ Electrode cartridge AAS 2000 DO
④ 10 m / 33 ft signal cable
⑤ 10 m / 33 ft flush hose
⑥ Handbook

Optional accessories

- Protection plate AAS 2000 membrane
- MAA 2000 insertion holder, telescopic rod for OAS/AAS 2000 (incl. telescopic rod plus rod holder, handrail mounting bracket and sensor adapter)
- MAA 2000 side wall mounting for OAS/AAS 2000
- Signal cable extension for OPTISENS 2000 sensors, 10 m / 33 ft
- Signal cable extension for OPTISENS 2000 sensors, 30 m / 98 ft

Consumables/Spare parts available

- Electrode cartrige AAS 2000 DO

2.2 Device description

The sensor is designed to continuously measure dissolved oxygen levels in liquids. It is effective in saving energy costs associated with aeration systems in an activated sludge process. In addition, accurate measuring of dissolved oxygen allows for better control of nitrification/denitrification.

This manual details installation procedures and operational features of the sensor. Menu navigation and technical data for the MAC 080 converter can be found in the MAC 080 manual.

2.2.1 Design

The sensor is manufactured with 316SS (SS2343) stainless steel. Built-in flushing nozzles allow for the most accurate readings with little maintenance. The electronics is protected in the rugged casing, ensuring its reliability in very demanding environments.

The sensor has a fixed, shielded 10 m / 33 ft cable used for signal transmission between the sensor and the MAC 080 converter. The cable sheath is made of Hytrel and is highly resistant to aggressive materials and fluids.

2.3 Nameplates

> **ℹ** *INFORMATION!*
> *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.*

2.3.1 OPTISENS AAS 2000
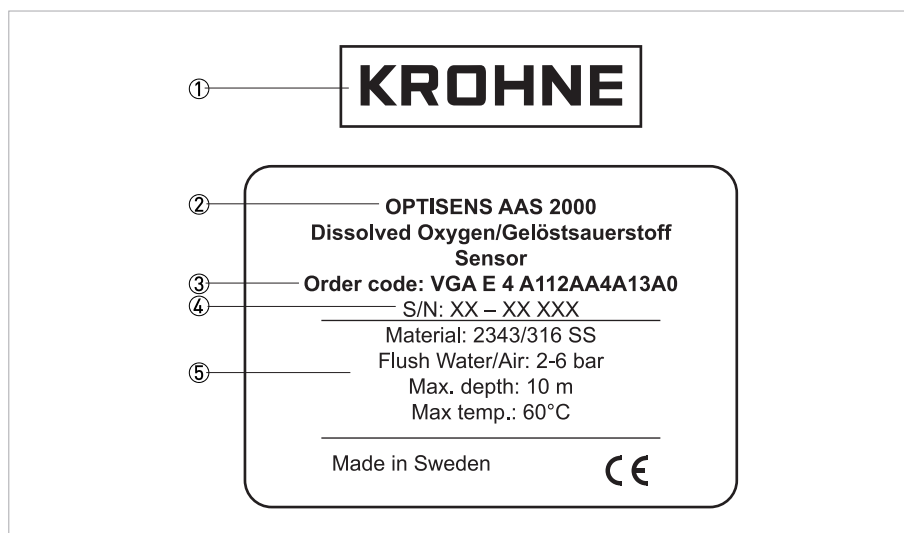
Figure 2-2: **Nameplate**
① Manufacturer
② Device type
③ Order code
④ Serial number
⑤ Sensor information

3.1 Notes on installation

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

i *INFORMATION!*
Check the packing list to check if you received completely all that you ordered.

i *INFORMATION!*
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.

3.2 Storage & Transport

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

3.3 Installing or changing the electrode

i *INFORMATION!*
The sensor is delivered with the electrode uninstalled. The electrode must be installed and calibrated before the sensor is submerged into water.

A plastic cap protects the electrode connection plug and the flushing nozzle in the sensor. Remove the plastic cap before installing the electrode. Retain the plastic cap as it may be used as protection later. Do not press on the top of the cap if the electrode is installed.
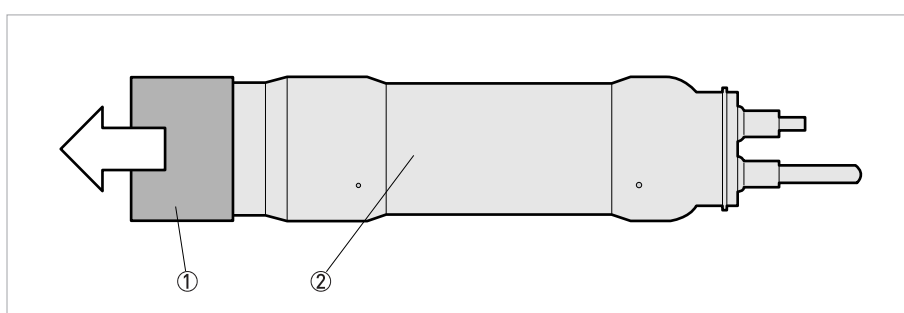
Figure 3-1: **Removal of plastic cap**
❶ Plastic cap
❷ Sensor
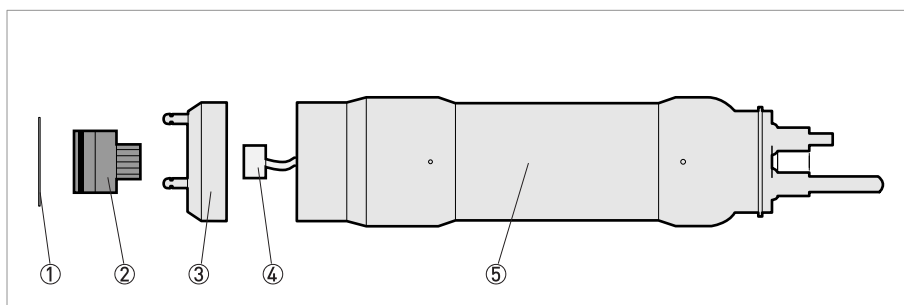
Figure 3-2: **Overview of the sensor**
❶ Protection plate
❷ Electrode
❸ Flushing head
❹ Cable connector
❺ Sensor housing

i *INFORMATION!*
The electrode can usually be assembled and disassembled without tools.

CAUTION!
Do not ever clamp onto the sensor housing or part of the cable when installing or removing the flushing head.
Do not touch the membrane of the electrode when mounting.
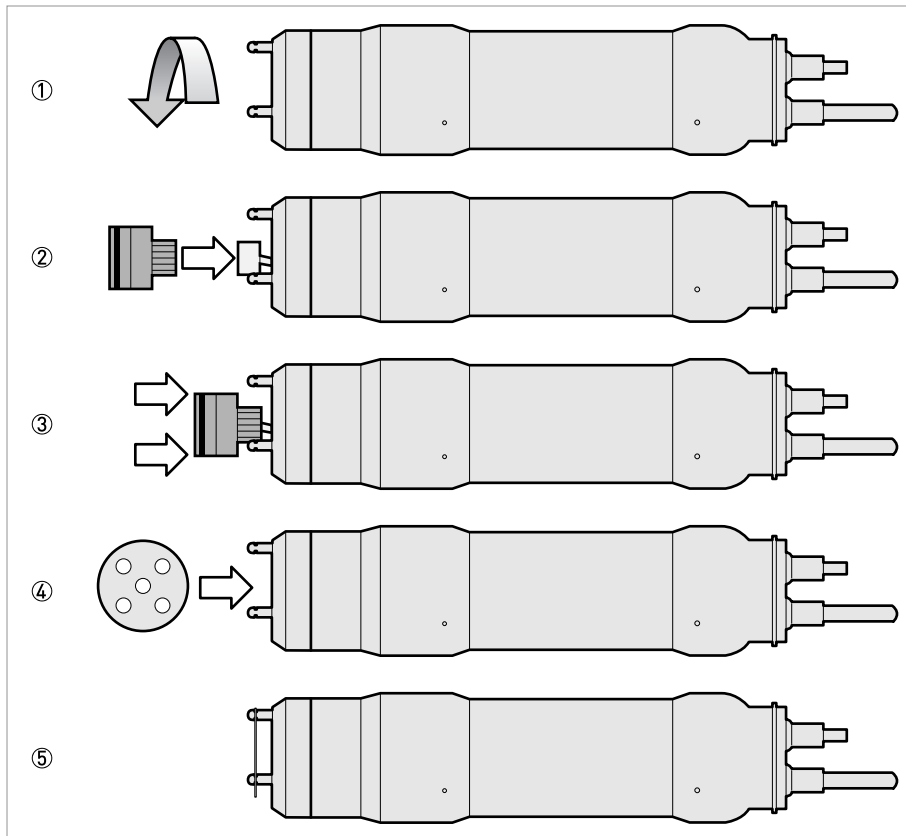
Figure 3-3: **Installing a new electrode**

Installing a new electrode (see figure above)

- Untighten the flushing head about one turn counterclockwise (if not already loose) to let the air out when the electrode is pushed in place ❶.

- Take the electrode out of the plastic container.

- Plug the electrode cable of the sensor into the connector on the electrode ❷.

- Install the new electrode into the flushing head ❸.

- Tighten the flushing head.

- Mount the protection plate, if needed ❹. See below for instructions on mounting the protection plate.

- Perform a a new air-calibration. An air calibration must be performed whenever the electrode is changed.

➲   Installation of the electrode is completed.
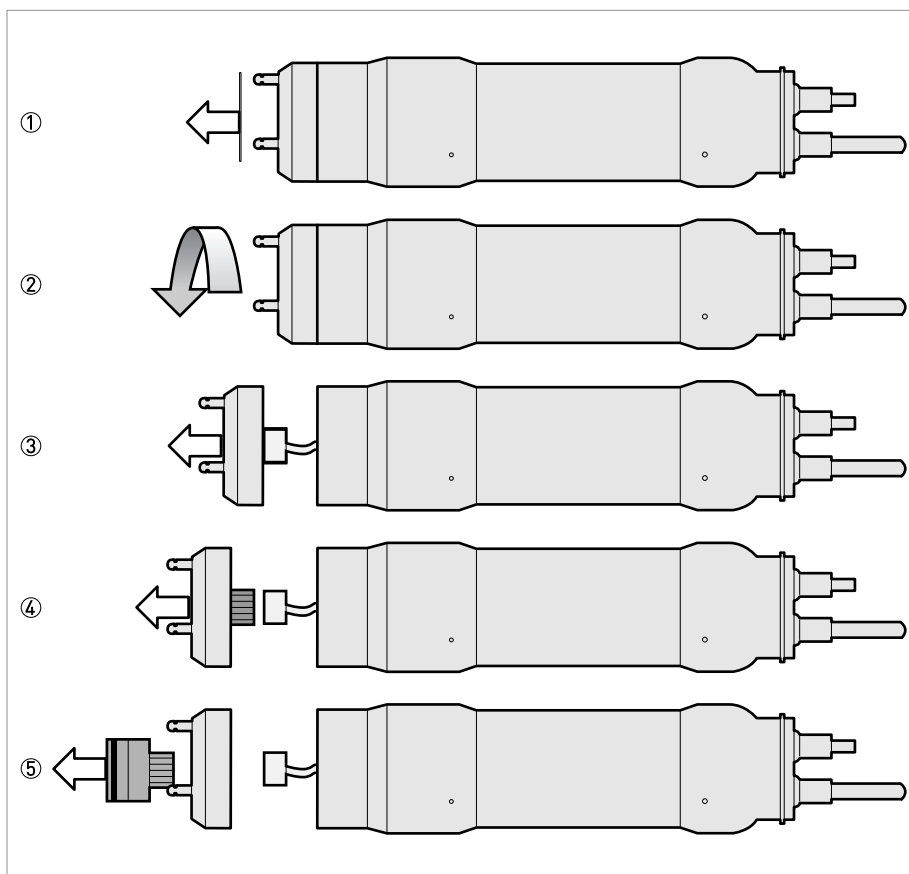
Figure 3-4: **Removing an old electrode**

CAUTION!
Make sure the electrode housing is dry before removing the flushing head. Water may come in to the housing when the flushing head is removed.

Removing an old electrode (see figure above)

- Make sure automatic flushing is disabled. This can be checked at the MAC 080 converter in the **Cleaning** menu of the AAS 2000 sensor (on page 22).

- If using the protection plate, pull it off before changing the electrode ❶.

- Loosen the flushing head by turning it counterclockwise ❷.

- Gently pull the flushing head out of the sensor housing ❸

- Unplug the electrode ❹.

- Remove the electrode from the flushing head by pressing firmly on the backside of the electrode near the cable connector ❺.

- Ensure that the O-ring that seals the flushing head is completely seated in the respective groove in the sensor body.

- If a new electrode is to be mounted, please follow the previous instructions ("Installing a new electrode").

- Screw the flushing head back onto the sensor. Do not screw it tight, otherwise the mounting of a new electrode (see previous instructions) will become more complicated.
- If a new electrode is not to be mounted, place the plastic cap over the electrode connection plug and the flushing nozzle in the sensor.

CAUTION!
Do not ever remove a flushing nozzle in order to mount the protection plate. The nozzles are fastened with a special locking jam.

Mounting the protection plate

- Remove the o-rings in the groove at the top of the three nozzles.
- Bend the plate slightly and press it down between the flushing nozzles.
- Ensure that the plate fits into the notches on the flushing nozzles. Correct the plate when it is mounted.

3.4 Mounting of the sensor

The sensor can be mounted in two ways:

- On a telescopic fiberglass rod placed in a mounting bracket that fastens to a handrail (on page 15).
- To an adjustable slide rail holder (on page 18)

Installation tips

- 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.

3.4.1 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.
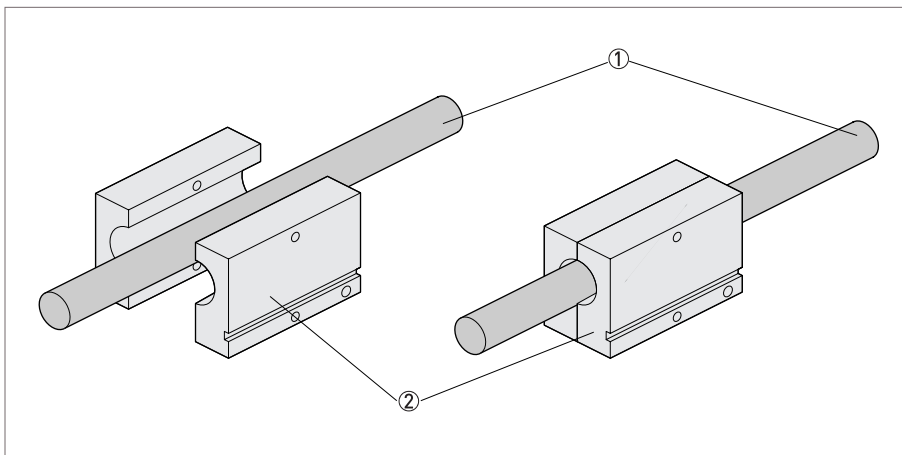
Figure 3-5: **Placing the rod holder around the rod**

❶ Telescopic rod
❷ Rod holder
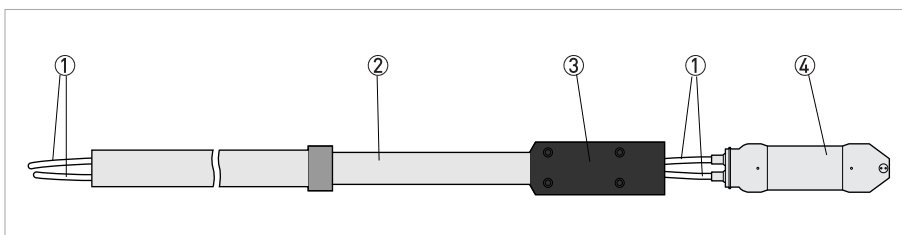
Figure 3-6: **Pulling the cable/hose through the rod**

❶ Cable/hose
❷ Telescopic rod
❸ Sensor holder
❹ Sensor
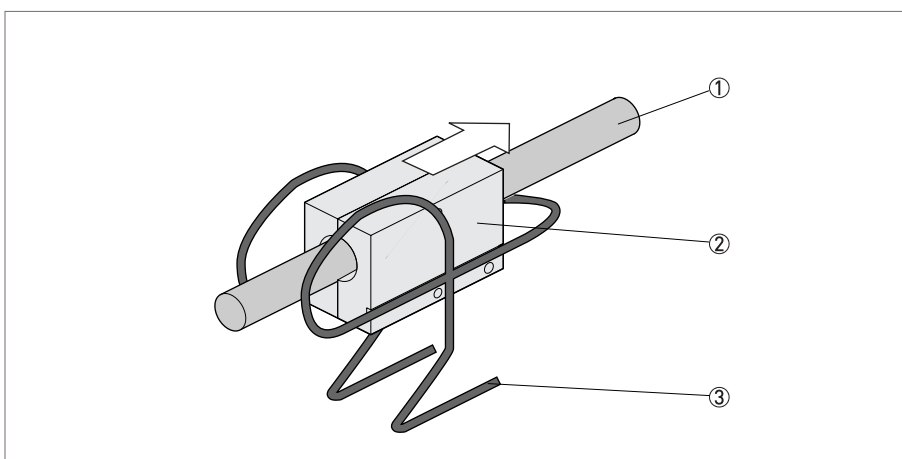
Figure 3-7: **Inserting the rod holder into the mounting bracket**

❶ Telescopic rod
❷ Rod holder
❸ Mounting bracket
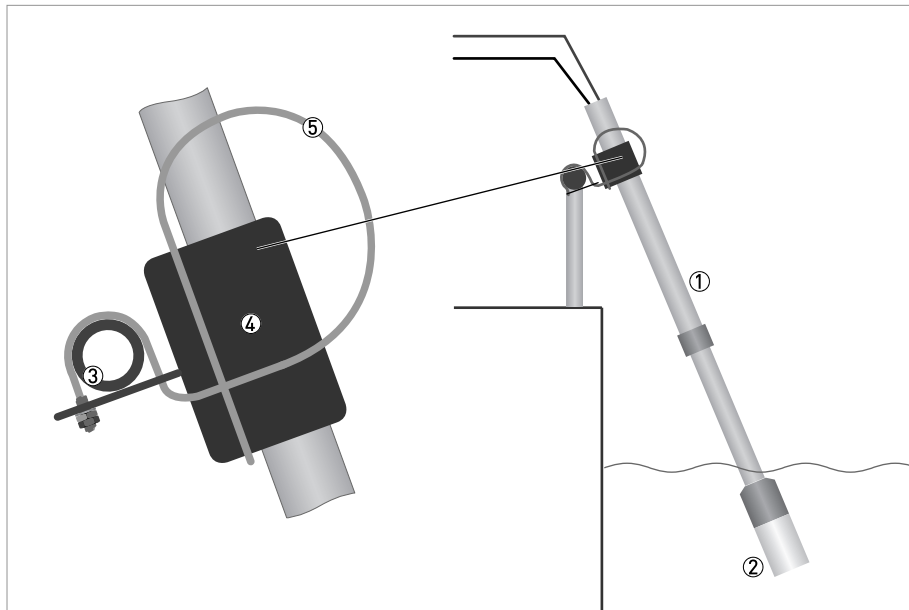
❶ Telescopic rod
❷ Sensor holder
❸ Handrail with mounting bracket attached
❹ Rod holder
❺ Mounting bracket

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

INFORMATION!
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.

3.4.2 Mounting to MAA 2000 slide rail immersion holder
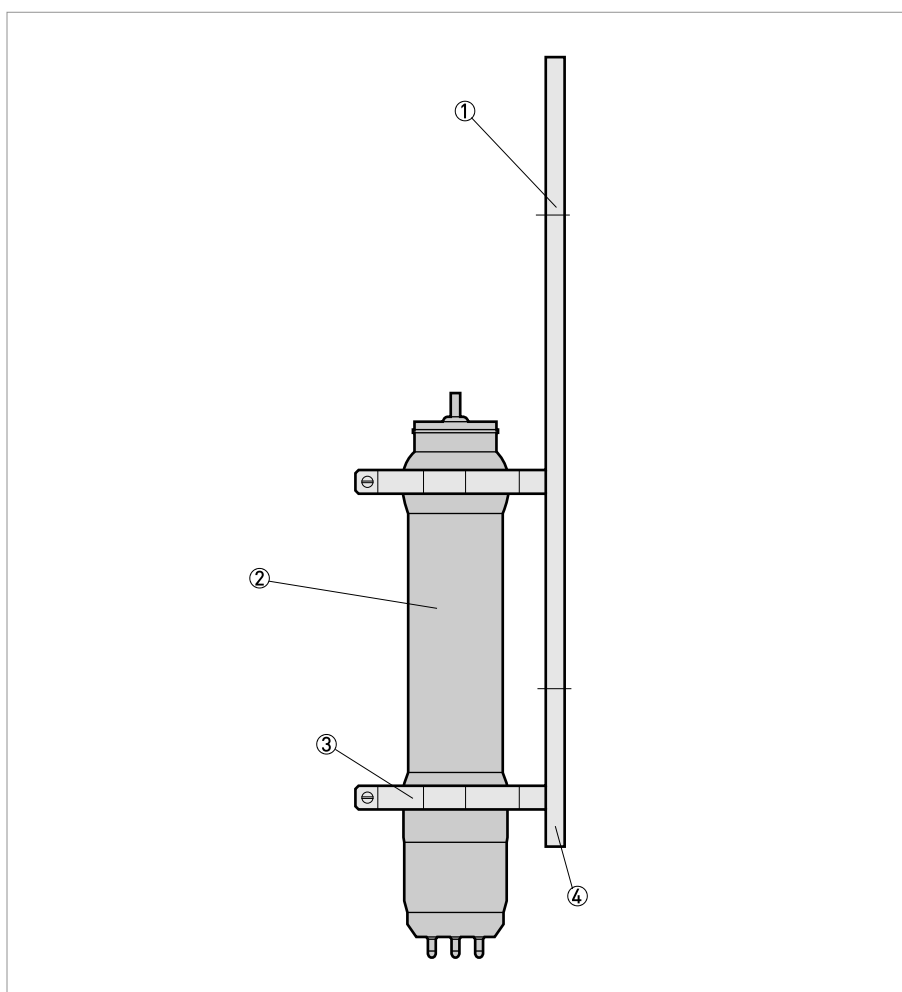
Figure 3-8: **Mounting to MAA 2000 slide rail immersion holder**

❶ Slide rail immersion holder
❷ Sensor
❸ 66 mm / 2.60" clamp
❹ Adjustable stop

CAUTION!
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.

3.5 Removing the sensor

CAUTION!
Opening the sensor housing will void all warranty! The sensor housing may not be opened except by service personnel.

CAUTION!
Do not use any sharp cleaning utensils (e.g. brush) on the membrane. The membrane should be cleaned with a soft cloth only!
The sensor housing and the telescopic rod may be cleaned with a soft brush or cloth, but not with a wire brush or other sharp tools.

Removing the sensor from telescopic rod installation

- Disconnect the sensor cable from the MAC 080 converter and the flushing hose from the solenoid valve.

- Open the clamp, and pull the rod out of the mounting bracket.

- Make sure all water inside the rod is drained.

- Open the black sensor adapter.

- Clean the sensor housing and rod with a soft brush or cloth. Do not use a wire brush or sharp tools!

- Flush the inside of the rod with clean water.

- Mount the protective cap (or a small plastic bag) on the sensor cable connector.

- Pull the cable and flushing hose out of the rod.

- Blow compressed air through the flushing hose to get rid of the water in the hose and the sensor.

- Place the plastic cap over electrode and flushing head to protect the membrane.

Removing the sensor from MAA 2000 slide rail assembly

- Disconnect the sensor cable from the MAC 080 converter and the flushing hose from the solenoid valve.
- Pull the sensor out of the slide rail and detach the two clamps.
- Clean the sensor housing with a soft brush or cloth. Do not use a wire brush or sharp tools!
- Mount the protective cap (or a small plastic bag) on the sensor cable connector.
- Blow compressed air through the flushing hose to get rid of the water in the hose and the sensor.
- Place the plastic cap over electrode and flushing head to protect the membrane.

4.1 Safety instructions

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

DANGER!
Observe the national regulations for electrical installations!

WARNING!
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.

INFORMATION!
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

INFORMATION!
Please refer to the MAC 080 manual for detailed information.

Connect the sensor to the MAC 080 converter using the connector on the end of the attached sensor cable. In the event that two sensors are to be connected to the same converter, use the optional junction box.

5.1 Sensor display

By simultaneously pressing ↓ and ↵ you alter between the converter main menu and the sensor information display for the selected sensor.
The sensor has two information displays. The first one, in addition to the measured value, shows the current temperature of the electrode, the setvalue for air and the "slope" of the electrode at the last air calibration. The second information display shows the date of the last calibration and the date the electrode was changed.

5.2 Menu

Use ↑ or ↓ to select the sensor in the main display. The menu for the selected sensor is accessed by pressing ↵ for five seconds. If the selected sensor is not active (the text **No transmitter** is shown) a warning is displayed that asks you to make another choice in order to show the sensor menu.

Menu "Settings"

Submenu	Description
Tag	Name of the sensor shown in the main display (10 characters).
I-Time	Integration time or dampening — can be set up to 999 seconds.
Decimals	1 or 2 for display and menu.
Analog	"None" , "Out1", "Out2", "Out3", "Out4", "Out1+2" or "Out3+4". Pick which analog output(s) are to be used with sensor
Second	"Temp" or "=Prim". If two analog outputs are chosen above, the first will always give the primary value according to the sensors selected scale. The second will either give the temperature scaled as stated below, or the same signal as the first channel. The temperature is additional information, not a precision measurement.
Temp 0-	Temperature scaling, value that will give max output on second channel.

Menu "Calibrate"

Submenu	Description
Airpres.mB	Specify within 10 mBar.
Calibrate	"No", "Zero" or "Air". Select what calibration to do.
Temp(info)	Shows actual temperature in the electrode.
Test(info)	Shows actual dissolved oxygen level.
Setvalue	Theoretical reading in air at current temperature and with the air pressure entered above. Shall be the same as **Test** immediately after the calibration.
Slope	Slope of the electrode at last air calibration. This value is an indication of the wearing of the electrode and it is normally over 80 for a well functioning electrode. However, an electrode may also function well at lower values. At values below 50 it is recommended to replace the electrode.
Calibrated	Date of last air calibration.
New electr.	Date when electrode was last changed. Push ↵ to edit the date, then ↵ again to store it.

Menu "Cleaning"

Submenu	Description
Press ↵ to go to the cleaning program	
Cleaner	"None", "Flush", or "Brush". Do not select "Brush" since this does not exist for this sensor (only for master).
Interval min	0...999 minutes, time between cleaning cycles (only for master)
Length sec	0...999 seconds, duration of flushing cycle (only for master)
Freeze sec	0...999 seconds, extra freeze time of output signal after a flushing cycle
Relay	"-", "1", "2", "Along 1", or "Along 2". Select relay to operate solenoid for flush cycle if this sensor is a master with its own relay, or relay used by master if this sensor is a slave. These are the same relays used for **Alarm relay** below.
Next time	The next scheduled cleaning time. Pushing ↵ on this line will set the time to current time and start a cleaning cycle. This could be used to test the "Flush" cycle (only for master).

Menu "Scale / Alarm"

Submenu	Description
Max	0...99.9 mg/l, equal to 20 mA output signal.
Min	0...99.9 mg/l, equal to 4 mA output signal.
Hi-Alarm	0...99.9 mg/l, the value zero inactivates the alarm.
Low-Alarm	0...99.9 mg/l, the value zero inactivates the alarm.
Alarm Relay	"-" "1", "2", or "1 and 2". Check that the relay is not being used for cleaning.

Menu "System"

Submenu		Description
Type		Type of sensor, read only
Serial		Serial number of the sensor, read only
SoftW		Software version of the sensor, read only
Temp		Sensor temperature, read only
MaxTemp		The highest temperature the sensor has been exposed to, read only
Info		Press ↵ to go to **Info** read only menu.
	MS0	SA value for zero sample.
	MS1	SA value for air sample.
	Cons 1	Calculated concentration at last air calibration.
	Ch1	Raw value for dissolved oxygen measurement.
	Ch2	Raw value for channel temperature measurement.
	Con	mg/l. This is what is displayed on main screen.
	Samp/s	Number of samples per second.
Service		Not accessible for users.

5.3 Calibration

Leave the instrument turned on for about 30 minutes prior to calibration so that the sensor and electronics can stabilize.

5.3.1 Zero calibration

The sensor is zero calibrated at the factory and does not often need to be zero calibrated. We do however recommend to do a new zero calibration when replacing the electrode since half the job is then already done.

Running a zero calibration

- Remove the electrode before performing a zero calibration (on page 12).
- Select the sensor to be calibrated in the menu by using ↑ or ↓.
- Press ↵ for approximately 5 seconds to enter the sensor menu.
- Select **Calibrate** and then press ↵.
- Select **Zero** by using ↑ or ↓ and then press ↵.
- Wait for the zero calibration to finish (usually takes about 20 seconds).
- ➲   A dialog box saying "Calibration done" will come up after successful calibration
- Press ↵ to return to the previous menu.
- ➲   The sensor is zero calibrated.
- Continue with air calibration (on page 25).

INFORMATION!
Detailed procedures for navigating the converter software can be found in the MAC 080 manual.

5.3.2 Air calibration

Please observe the following points while performing an air calibration:

- It is important to create a constant environment.
- The electrode cartridge must be dry with no water drops on the membrane.
- If rain and/or strong winds are present, the calibration procedure could be disturbed. In this case shield the equipment so that it is protected from the rain or wind.
- An open plastic bag over the sensor may slow the calibration time down, but is otherwise a good way to create constant conditions.

Performing an air calibration

- Fill a bucket halfway with water.
- Place the sensor about 30...45 cm/1...1.5 ft above the water surface to create a humid environment.
- Cover the bucket with a towel.
- Select the sensor to be calibrated in the menu by using ↑ or ↓.
- Press ↵ for approximately five seconds to enter the sensor menu.
- Select **Calibrate > Airpres.mB** and press ↵.
- Enter the current air pressure in mbar using ↑ or ↓ to change a digit and ↵ to move on to the next digit. It is sufficient to specify the pressure within 10 mbar (see table below for conversion from inHg to mbar).
- Select **Calibrate > Calibrate** and press Press ↵.
- Select **Air** using ↑ or ↓ (three choices can be made, "Air"/"No"/"Zero").
- Press ↵.
- Wait for the sensor to be calibrated. A successful calibration will take anywhere between 5...15 minutes for the sensor to stabilize.
- ⊃ A dialog box saying "Calibration done" will come up after successful calibration.
- Press ↵ to return to the previous menu.
- Select **Calibrate > Calibrated** and press Press ↵.
- Enter the date of the air calibration using ↑ or ↓ to change a digit and ↵ to move on to the next digit.
- Press ↵ to return to the previous menu.
- ⊃ The sensor is air calibrated.

The following appear in the calibration menu as read-only:

- **Temp (info)**: Displays the current temperature of the sensor.
- **Test (info)**: Displays the current measured dissolved oxygen value. Immediately after calibration and before the sensor is placed in the liquid, this value should closely resemble Setvalue. A reading outside of an acceptable range may indicate that the electrode needs to be replaced.
- **Setvalue**: Ideal value calculated using temperature and air pressure.

Air pressure conversion

It is important to enter the correct air pressure before doing an air calibration. Air pressure is measured in mbar (which is exactly the same as the SI-unit hPa).Below is a formula and a table to convert from inHG to mbar (and thus to hPa):

mbar = (inHg * 1000) ÷ 29.5

inHg	mbar
29.2	990
29.3	993
29.4	997
29.5	1000
29.6	1003
29.7	1007
29.8	1010
29.9	1014
30.0	1017
30.1	1020
30.2	1024
30.3	1027
30.4	1030

5.4 Scaling

The **Scale / Alarm** menu (see the OPTISENS MAC 080 manual) allows the user to set the high and low boundaries for a 4...20 mA output signal. In addition, this menu allows the user to set high and low alarm values to switch a relay when solids have reached critical points.

Max	sets the 20 mA point output
Min	sets the 4 mA point output (may be negative for special applications)
Hi-Alarm	sets the high alarm set point; the value zero inactivates the alarm
Low-Alarm	sets the low alarm set point; the value zero inactivates the alarm

6.1 Cleaning

6.1.1 Cleaning the sensor

The sensor is equipped with built-in flushing nozzles. The nozzles are used to direct the cleaning medium (compressed air or water) via a flushing hose that is connected to the top of the sensor housing. A solenoid valve that is wired to a relay in the converter controls the air or liquid (see handbook OPTISENS MAC 080).
Compressed air is recommended for most applications.

Please observe the following:

- Flush as little as possible. Flushing wears the membrane of the electrode. Excessive flushing reduces the lifetime of the electrode.
- Try flushing shortly twice per day (720 minutes interval, 5 seconds length). If this doesn't keep the membrane clean, first reduce the interval, then increase the length.

⚠️ *CAUTION!*
Never flush if the electrode is not installed!
When the electrode is not installed, the plastic cap should be kept on the end of the sensor for protection.

⚠️ *CAUTION!*
The highest allowed flushing pressure is 6 bar / 87 psi. When using air, 2 bar / 29 psi is usually sufficient.

ℹ️ *INFORMATION!*
Pay attention to the requirements for protection against backflow, according to the EN 1717 standard for drinking water devices. If possible, use plant reuse water or effluent water for cleaning.
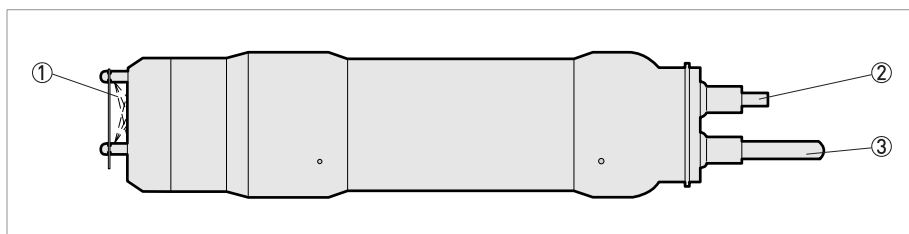

Figure 6-1: **Flushing system**
❶ Flushing
❷ Flushung tube
❸ Sensor cable

ℹ️ *INFORMATION!*
*In order to clean the sensor, flushing must be activated in the **Settings** menu in the MAC 080 converter*

There are two different ways of cleaning a sensor: The sensor can either be cleaned as a master or as a slave. Both options are described in the following instructions.

Cleaning the sensor as a master (sensor has its own relay)

- Select the sensor in the main menu by using ↑ or ↓.
- Press ↵ for approximately five seconds to enter the sensor menu.
- Use ↑ or ↓ to select **Cleaning** and press ↵.
- In the **Cleaning** submenu, select **Cleaner** and set it to **Flush**.
- Then specify the cleaning interval in minutes (**Interval min**) and the flush time in seconds (**Lenght sec**).
- Specify the relay to be used according to the wiring inside the MAC 080 converter. For example, if the solenoid is wired to relay #1, set **Relay** to **#1** for flushing.
- For sensors configured as masters, **Next time** displays the next time flush will be activated. Pushing ↵ will set it to current time and thus start cleaning.
- If needed, specify the extra freeze time in seconds (**Freeze sec**).

Cleaning the sensor as a slave (along with another sensor)

- Select the sensor in the main menu by using ↑ or ↓.
- Press ↵ for approximately five seconds to enter the sensor menu.
- Use ↑ or ↓ to select **Cleaning** and press ↵.
- The parameters **Cleaner**, **Interval min** and **Lenght sec** in the **Cleaning** submenu are set for the sensor being the master.
- Set **Relay** to **Along #1** or **Along #2** depending on what relay the master sensor uses.
- If needed, specify the extra freeze time in seconds (**Freeze sec**).

6.1.2 Cleaning the flushing nozzle

If the flushing nozzle becomes plugged, it can usually be cleaned by backflushing it with clean water.

Cleaning the flushing nozzle

- Before attempting to backflush, close the valve for the flush water source.
- Disconnect the sensor flushing hose from the solenoid valve.
- Place a 12 mm / 0.47" hose over the flush nozzle and carefully open the water valve.
- ➲ The pressure should clear the line of solids. If backflushing does not work initially, try cleaning the three flushing nozzles with a needle. Try backflushing the nozzles again as described above until clean water comes out at the solenoid valve end of the hose.

6.2 Spare parts availability

The manufacturer adheres to the basic principle that operational spare parts for each device or each important accessory part will be kept available for a period of 10 (ten) years after delivery of the last production run for that device.

Operational spare parts are defined as parts that are subject to faults in normal operation.

6.3 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, technical support and training.

INFORMATION!
For more precise information, please contact your local representative.

6.4 Support information form

Before calling the customer support, please collect the information in this form and have it at hand.

Company:		Name:	
Phone:		E-mail:	
Sensor type:		Position / tag:	
First go to the converter menu by pressing ↑ and ↵ simultaneously for five seconds. Then select **System** and press ↵. Write down the following information.			
Version:			
Serial:			
Box temp:			
Box heat:			
Leave the converter menu by pressing ↑ and ↵ simultaneously. Use ↑ and ↓ to select the sensor in the main display. Go to the sensor menu by pressing ↵ for five seconds. Then select **System** and press ↵. Write down the following information.			
Type:		SoftW:	
Serial:		Temp:	
Select **System > Info** and press ↵. Write down the following information.			
MS0:		MS1:	
Cons 1:		Ch1:	
Ch2:		Con:	
Samp/s:			
Leave the menu by pressing ↑ and ↵ simultaneously.			

6.5 Returning the device to the manufacturer

6.5.1 KROHNE representative

INFORMATION!
Please contact your local KROHNE representative prior to returning this device!

6.5.2 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

CAUTION!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:
- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

CAUTION!
If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:
- *to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

6.5.3 Form (for copying) to accompany a returned device

Company:	Address:
Department:	Name:
Tel. no.:	Fax no.:
Manufacturer's order no. or serial no.:	
The device has been operated with the following medium:	

This medium is:	water-hazardous
	toxic
	caustic
	flammable
	We checked that all cavities in the device are free from such substances.
	We have flushed out and neutralized all cavities in the device.

We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.	
Date:	Signature:
Stamp:	

6.6 Disposal

CAUTION!
Disposal must be carried out in accordance with legislation applicable in your country.

7.1 Measuring principle

The electrode is a Clark type electrode with a membrane in FEP. The sensor consists of a gold cathode and silver anode. The Clark cell detects the oxygen though its reduction at the gold electrode. A membrane covers the two electrodes and blocks access of most species to the electrodes. Only dissolved gases such as oxygen can traverse the membrane, hence the reduction current responds to the oxygen concentration.
The electrode housing is made of PVC and is equipped with an O-ring sealing against the mounting. There is a connector on the electrode for the amplifier cable.
Active components included in the electrode are treated to maximize their life span.

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.

i   *INFORMATION!*
The build in temperature measurement is not a precision measurement, but shall be seen as an indication.

7.2 Technical data

Measuring system

Measuring principle	Amperometric measuring principle with a "Clark" electrode
Application range	Continuous measurement of dissolved oxygen in water (here especially in waste water applications), e.g. in aeration basins
Modular design	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
Measuring range	0…20 mg/l (ppm)
Measuring accuracy	±1% FS (full scale)

Operating conditions

Temperature range	0…+50°C / 32…122°F
Max. immersion depth	10 m / 32.8 ft
Calibration	Software-support zero point calibration and single point calibration by calibration measurement in air

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
	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.
Automatic spray cleaning	Flushing using clean water or compressed air;
	Pressure: 2...6 bar / 29…87 psi
	Solenoid valve: available in 220 V and 117 V versions; up to max. 2 sensors can be operated on a single valve
	Flush hose: ¼" external diameter; PE; standard length: 10 m / 32.8 ft
Process connection	Submersible version in open basins and channels

Materials

Enclosure	SIS2343 (316 SS)
"Clark" electrode	Design: replacable cartridge
	Cathode: gold
	Anode: silver
	Membrane: FEP Teflon (0.025 mm / 0.001")
Connection cable to converter	Insulation: Hytrel; 5-pin M 12 connector; fixed cable, shielded, 10 m / 32.8 ft long
Flush hose	PE

Approvals

Protection class	IP68 (Nema 6)
Approval symbol	CE
EMC (89/336/EEC)	Interference emission to EN 61000-6-4:2001; immunity to EN 61000-6-2:2001
Low voltage directive (89/336/EEC)	Safety requirements for electrical equipment for measurement, control, and laboratory use in accordance with EN 61010-1:2001

7.3 Dimensions and weight
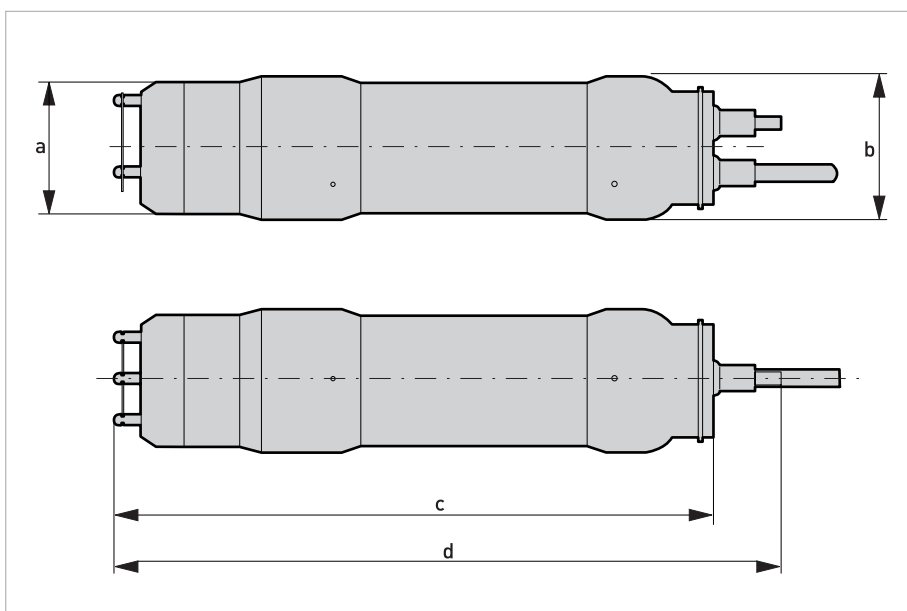
	Dimensions [mm]	Dimensions [inches]	Weight	
			[kg]	[lbs]
a	61	2.4	2.1	4.6
b	66	2.6		
c	275	10.5		
d	307	12.1		

8.1 Setup information form

This form can be used to document the setup of the sensor.

Sensor type	
Position / Tag	
In the **System** submenu of the sensor menu the following information can be collected:	
Serial	
SoftW	
In the **Settings** submenu of the sensor menu the following parameters can be set:	
I-time	
Decimals	
Analog	
Second	
In the **Cleaning** submenu of the sensor menu the following parameters can be set:	
Cleaner	
Cleaning interval	
Cleaning length	
Cleaning freeze	
Cleaning relay	
In the **Scale / Alarm** submenu of the sensor menu the following parameters can be set:	
Max	
Min	
High alarm	
Low alarm	
Alarm relay	
Leave the menu by pressing ↑ and ↵ simultaneously.	

KROHNE measuring technology - Product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Mass flowmeters
- Ultrasonic flowmeters
- Vortex flowmeters
- Flow controllers

- Level measuring instruments
- Temperature measuring instruments
- Pressure measuring instruments
- Analysis
- Oil and gas industry

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