



OPTISENS ADO 2000 Handbook

Amperometric dissolved oxygen sensor for water and wastewater industry

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

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1.1 Intended use

**CAUTION!**

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

**INFORMATION!**

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The intended use of OPTISENS ADO 2000 sensors is the measurement of dissolved oxygen in water applications. The sensor is suitable for connection to the MAC 100 signal converter.

1.2 Certifications

CE marking



The device fulfils the statutory requirements of the following EC directives:

- EMC Directive 2004/108/EC (valid until 2016/04/19) or
EMC Directive 2014/30/EU (valid from 2016/04/20)
- Low Voltage Directive 2006/95/EC (valid until 2016/04/19) or
Low Voltage Directive 2014/35/EU (valid from 2016/04/19)

The manufacturer certifies successful testing of the product by applying the CE marking.

1.3 Safety instructions from the manufacturer

1.3.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.3.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.3.3 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 or 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.

1.3.4 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 icons as shown below.

1.3.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



DANGER!

This warning refers to the immediate danger when working with electricity.



DANGER!

This warning refers to the immediate danger of burns caused by heat or hot surfaces.



DANGER!

This warning refers to the immediate danger when using this device in a hazardous atmosphere.



DANGER!

These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.



WARNING!

Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.



CAUTION!

Disregarding these instructions can result in damage to the device or to parts of the operator's plant.



INFORMATION!

These instructions contain important information for the handling of the device.



LEGAL NOTICE!

This note contains information on statutory directives and standards.



• **HANDLING**

This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➔ **RESULT**

This symbol refers to all important consequences of the previous actions.

1.4 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 packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**

Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**

Look at the device nameplate to ensure that the device is delivered according to your order.

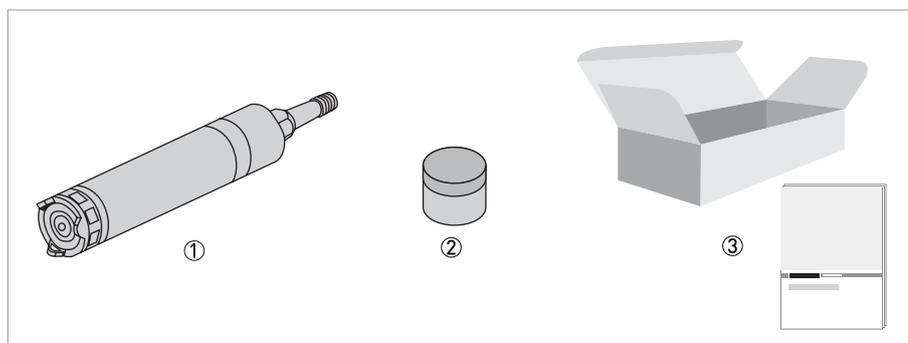


Figure 2-1: Standard scope of delivery

- ① Ordered sensor
- ② Electrode cartridge
- ③ Documentation

Optional accessories

- SENSOFIT IMM 2000 - Immersion assembly

Consumables/Spare parts available

- Electrode cartridge OPTISENS ADO 2000

**INFORMATION!**

For further information contact your local sales office.

2.2 Device description

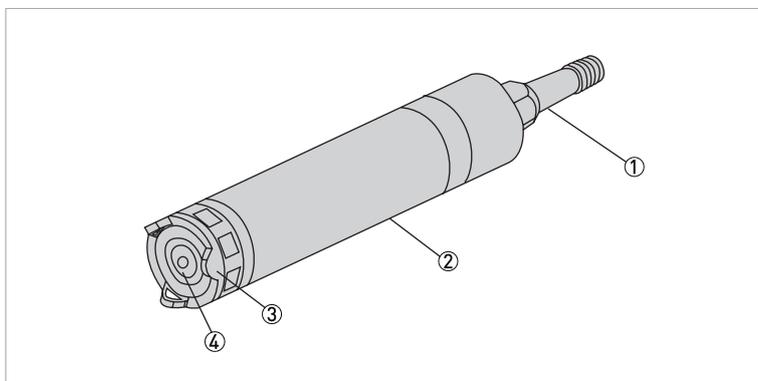


Figure 2-2: Device description

- ① Attached cable
- ② Stainless steel body
- ③ Protection basket
- ④ Electrode cartridge

2.3 Nameplate

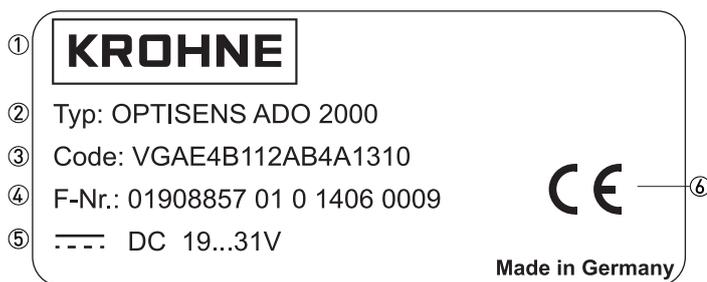


Figure 2-3: Example for a nameplate on the sensor body

- ① Manufacturer
- ② Device name
- ③ Order code
- ④ Serial number
- ⑤ Power supply data
- ⑥ CE marking



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order.

3.1 General notes on installation

**INFORMATION!**

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

**INFORMATION!**

Do a check of the packing list to make sure that you have all the elements given in the order.

**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 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 send back to the manufacturer.

3.3 Configuration of a measuring point

A complete measuring point consists of at least three parts:

- MAC 100 signal converter
- OPTISENS ADO 2000 sensor
- SENSOFIT IMM 2000 - Immersion assembly

3.4 Pre-installation requirements

**CAUTION!**

- Never touch or scratch the Teflon® membrane of the sensor.
- Make sure that the Teflon® membrane is clean and dust-free. If necessary, clean the membrane as described on page 27

**CAUTION!**

Do not turn the cable gland on the sensor this might cause a sensor leak and damage the electronics inside. While mounting or dismantling the sensor, the sensor cable must not be fixed or trapped as this might loosen the water tight gland connection from the sensor.

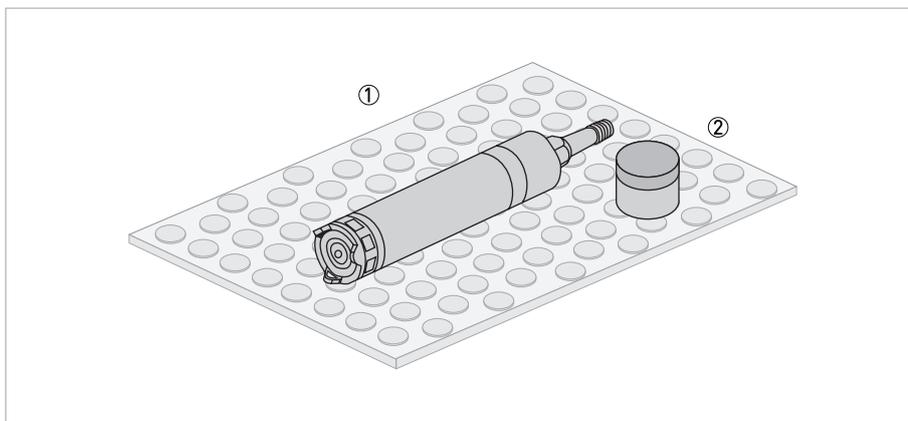


Figure 3-1: Unpacking the sensor

**Unpacking the sensor**

- Lay the sensor on a soft mat/tissue ①.
- Keep the electrode cartridge ② in the original packaging as long as it is not required.

3.5 Installation procedure

A new amperometric dissolved oxygen sensor needs to be calibrated before it is installed into its final measuring location. To install the device in the correct way, follow the order and the following sections and their instructions.

1. Mount the sensor into the immersion assembly. (For further information refer to the manual of the assembly)
2. Connect the sensor to the signal converter or directly to the control system.
3. Configure the measurement range. Calibrate the sensor.
4. Install the sensor into its final measuring location.

3.6 Safety instructions



DANGER!

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



DANGER!

All work on the electrical connections may only be carried out with the power disconnected.



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.

3.6.1 Connecting the sensor cable to the signal converter



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!



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order.

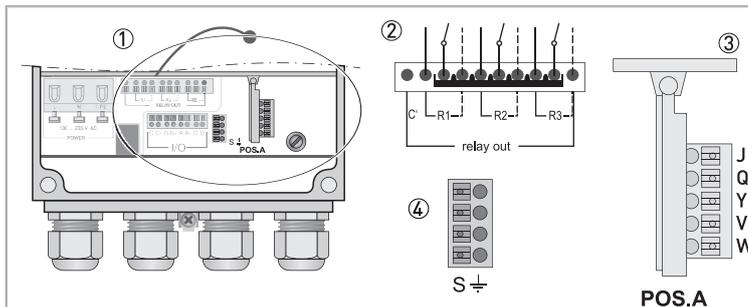


Figure 3-2: Sensor connection terminals on the signal converter

- ① Sensor connection terminal
- ② Relays
- ③ Terminal block A: terminals for sensors
- ④ Terminal block S (protective earth)

Wire	Terminal block Pos.A
Red	Q
Blue	W

Wire	R3 (Relay out)
Green	N.O.
Grey	Rx

Wire	Terminal S
Black	S

3.7 Sensor description

Keep the electrode cartridge in the original packaging as long as it is not required.

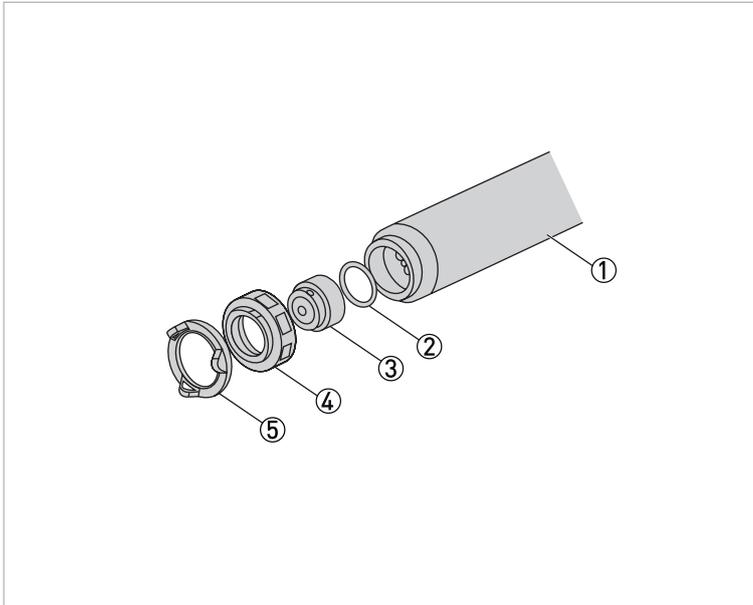


Figure 3-4: Parts of the sensor



- Unscrew the ring ④ with the protection basket ⑤ from the sensor ①.
- Take the electrode cartridge ③ out of the packaging and mount it on the sensor.
- Note the seal ②!
- Screw the ring ④ with the protection basket ⑤ onto the sensor.
- Wait for the sensor to run-in for about 2 hours.
- ➔ If the measurement is carried out in an area of low oxygen concentration, the run-in time may be considerably longer, since the excess oxygen in the electrolyte of the cell has to be used up first.



INFORMATION!

In the course of normal operation, a grayish-white deposit may form on the anode of the sensor module. This deposit does not affect the proper functioning of the measuring cell. Pressure fluctuations in the measured medium will affect the output signal!

Before the sensor is installed in the final measuring location, it has to be calibrated. For further information refer to *Calibration* on page 22.



INFORMATION!

Please wait at least 30 minutes after the sensor has been plugged in to have excess oxygen in the electrolyte be reduced at the cathode. The temperature has to be compensated. After this period start the calibration.

3.8 General installation instructions

The sensor tip must always have full contact with water.

The mounting position of the sensor should be 25°...75° from vertical position (sensor tip pointing downwards). Non-observance might cause air bubbles to stick to the sensor tip.

For optimal positioning use an immersion assembly as shown in the following image.

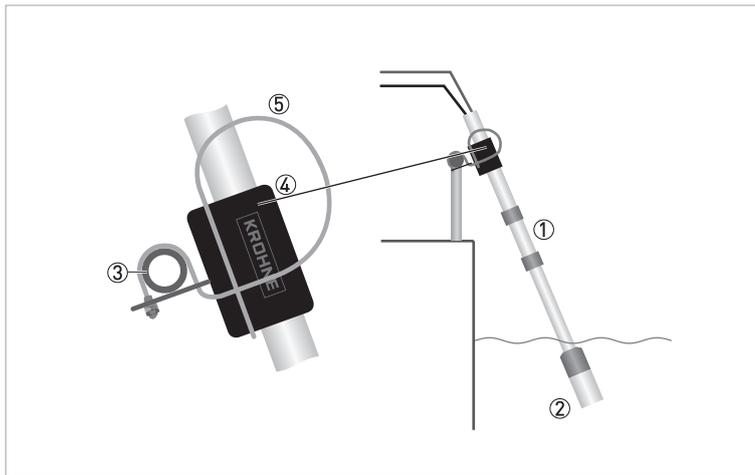


Figure 3-5: Optimal mounting position

- ① Immersion assembly
- ② Sensor holder
- ③ Handrail
- ④ Rod holder
- ⑤ Mounting bracket



INFORMATION!

Install the sensor in a light angle to avoid wrong measurement results due to a dirty sensor or trapped air on the sensor.

3.9 Installing or replacing the sensor

**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!

For further instructions on installation into SENSOFIT IMM 2000 refer to the relevant manual.



- Insert the sensor cable through the immersion assembly.
- Fasten the sensor using the 6 screws from the immersion assembly.
- Connect the wires to the MAC 100 signal converter. For further information refer to *Connecting the sensor cable to the signal converter* on page 14

For removing the sensor, repeat the steps above in reverse order.

After assembly into SENSOFIT IMM 2000 the sensor has to be calibrated. For further information refer to *Calibration with MAC 100 signal converter* on page 22

4.1 Menu mode structure



INFORMATION!

The following table just presents an overview. Additional levels are accessible from certain menus offering the possibility to change presets.

Measuring mode	Main menu	Submenu	Parameter	
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ←	A quick setup	> ← For further information see function tables. ↓↑	
		> ← A1 language		
		A2 Tag		
		A3 manual hold		
		A4 set clock		
		A5 reset errors		
		A6 analog outputs		> ← A6.1 measurement
		A6.2 conc. absolute		
		A6.3 range		
		A6.4 time constant		
A17 offset				
A19 product cal.				
↓↑	↓↑			

Measuring mode	Main menu	Submenu	Parameter														
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ←	B test	> B1 sim.process inp.A ←	> B1.1 temperature ←	For further information see function tables.												
						> B1.4 conc. absolute ←											
							> B1.6 concentration% ←										
								Simulation menus input A; existence of the single submenus depends on the selected hardware setting in C setup / C3 I / O. To start a simulation process refer to the MAC 100 manual.									
									> B3 simulation I/O ←								
										B3.6 simulation R3 To start a simulation process refer to the MAC 100 manual.							
											> B4 actual values ←						
												B4.1 operating hours					
													B4.2 process input A				
														Menus which show the corresponding actual reading; existence of the single submenus depends on the hardware setting and the used sensor.			
															> B5 logbooks ←		
																B5.1 status log	
																	B5.2 calibration log
B6.1 C number																	
	B6.2 process input A																
		B6.4 SW.REV. MS															
			B6.5 SW.REV. UIS														
				B6.6 Electronic Revision ER													
					↓↑												

Measuring mode	Main menu	Submenu	Parameter	
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ←	C setup	> C1 process input ← A	> Menus for the setup of the corresponding process input; existence of the single submenus depends on the hardware setting and the used sensor.
				C1.1 parameter
				C1.14 time constant
				C1.24 range 0%...100%
				C1.25 range
				C1.26 limitation
				C1.27 offset
				C1.29 product cal.
				C3 I/O
				C3.1 hardware
				C3.8 current R3
				C5 device
				C5.1 device info
				C5.2 display
				C5.3 1 meas.page
C5.4 2 meas.page				
C5.5 graphic page				
C5.6 special functions				
C5.7 units				
↓↑	↓↑	↓↑	↓↑	
D service: This menu is password protected and contains functions to be used by service personnel only.				

4.2 Calibration

**INFORMATION!**

Please wait at least 30 minutes till the sensor is active again and the oxygen in the electrolyte be reduced at the cathode. The temperature has to be compensated. After this period start the calibration.

4.2.1 Calibration with MAC 100 signal converter

For OPTISENS ADO 2000 only a 1-point calibration is needed. Calibration is mandatory at commissioning and when the electrode cartridge is changed.

**CAUTION!**

- *Never touch or scratch the Teflon[®] membrane of the sensor.*
- *Make sure that the Teflon[®] membrane is clean and dust-free. If necessary, clean the membrane as described on page 27*

To avoid alarms on the distributed control system (DCS) when temporarily removing the sensor (i.e. for maintenance), the signal converter has a hold function. This function "freezes" all outputs (i.e. the display and the current outputs) of the last measured value.

**INFORMATION!**

As an indication that the manual hold function is active, the "warning sign" in the upper left corner of the display appears. Meanwhile the status messages show "checks in progress". For more details about how to select the manual hold function refer to the signal converter manual.

After starting-up the signal converter, the measuring screen appears. This is the standard screen which is displayed automatically in the normal operating mode. In this mode the calibration can be started. Activate the manual "hold function" in the first step.

Step 1: activating the hold function

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.
- Press **▼** or **▲** until the main menu **quick setup** is highlighted.

MAIN MENU	
> A quick setup B test C setup D service	
<ul style="list-style-type: none"> • Press > to enter the chosen menu. 	
You are on the first submenu level. In the upper line of the display "quick setup" and "A1" appears, beneath the submenu language is highlighted.	
<ul style="list-style-type: none"> • Press ▼ or ▲ until the submenu manual hold is highlighted. • Press > to enter the chosen menu. 	
You are on the second submenu level. In the upper line of the display "manual hold" appears, beneath the option off is highlighted.	
<ul style="list-style-type: none"> • Press ▼ or ▲ to choose the option "on". • Press ↵ to confirm the entered value. 	

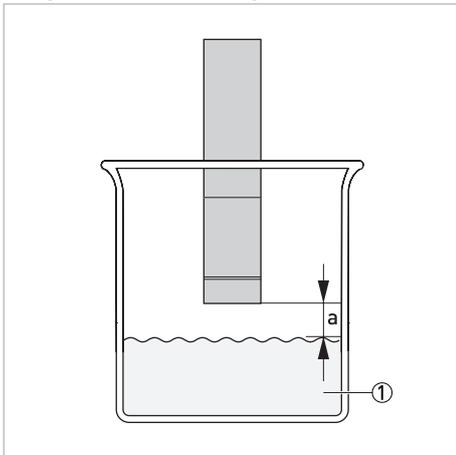


- You have activated the "manual hold" function. Go to the next step and prepare the calibration procedure. You have to return to the measuring mode.
- Press **↵** until you reach the measuring mode again.



Step 2: preparing the calibration procedure

- For re-calibration, remove the sensor from the process.
- If you calibrate a sensor, make sure that the sensor is correctly connected to the signal converter.
- Check the sensor for damages, check the Teflon[®] membrane for coating and rinse the sensor tip with tap water and gently swipe it with a soft tissue.
- Do not touch or scratch the membrane.

Step 3: calibration procedure**Figure 4-1: Calibration procedure**

Calibration in water-saturated air about 2 cm / 0.8" (a) above water

Position the sensor just above the surface of the water and wait for the sensor temperature-compensation time (about 20 minutes) to elapse. Avoid direct sunlight.



- For OPTISENS ADO 2000 only a 1-point calibration is needed. Use water vapour-saturated air.
- Just install the sensor inside a cup which has the same size as the sensor.
- Don't dip the sensor tip of the OPTISENS ADO 2000 into the water.
- Keep the sensor tip dry and in case of wetness, just try the Teflon[®] membrane with a clean, dry and soft cloth. Put the sensor inside the cup and lay a cloth over the sensor and cup to create a water vapour-saturated atmosphere. Please perform the calibration not in direct sunlight to avoid that the water temperature in the cup rises.

**INFORMATION!**

- If "calibration successful" is highlighted, press \leftarrow several times to save the calibration and to return to main menu level.
- If an error occurs during the calibration procedure, the display shows an error message.
- If the calibration was not successful please start again and follow the steps mentioned in this chapter.
- If the calibration was unsuccessful refer to *Troubleshooting* on page 26.

Step 4a: accessing the calibration menu via the main menu **setup**

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.
- Press **▼** or **▲** until the main menu **setup** is highlighted.

MAIN MENU	
A quick setup B test > C setup D service	
<ul style="list-style-type: none"> • Press > to enter the chosen menu. 	
You are on the first submenu level. In the upper line of the display "setup" and "C1" appear. Press ▼ or ▲ until the submenu process input A is highlighted.	
<ul style="list-style-type: none"> • Press > to enter the chosen menu. 	
You are on the second submenu level. In the upper line of the display "process input A" and "C1.1" appear. Press ▼ or ▲ until the submenu product cal. is highlighted.	
<ul style="list-style-type: none"> • Press > to enter the chosen menu. 	
Press ▼ or ▲ until calibration is highlighted.	
<ul style="list-style-type: none"> • Press > to start the calibration. 	
The actual concentration is displayed. Please wait till the value is stable.	
<ul style="list-style-type: none"> • Press > to proceed. 	
The calibration count down starts (approx. 900 seconds)	

Step 4b: accessing the calibration menu via the main menu **quick setup**

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.

MAIN MENU	
> A quick setup B test C setup D service	
<ul style="list-style-type: none"> • Press > to enter the chosen menu. 	
You are on the first submenu level. In the upper line of the display "quick setup" and "A.1" appear. Press ▼ or ▲ until the submenu product cal. is highlighted.	
<ul style="list-style-type: none"> • Press > to enter the chosen menu. 	
Press ▼ or ▲ until calibration is highlighted.	
<ul style="list-style-type: none"> • Press > to start the calibration. 	
The actual concentration is displayed. Please wait till the value is stable.	
<ul style="list-style-type: none"> • Press > to proceed. 	
The calibration count down starts (approx. 900 seconds)	



Step 5: switching back to measurement

- Deactivate the function **manual hold** again.
- Install the sensor in the measuring location.

4.2.2 Calibration log



INFORMATION!

In order to show the history of the calibrations, the signal converter has a calibration logbook function. Up to 64 entries of the calibration history are stored including date and time.

Accessing the calibration log

- Press **>** for more than 2.5 seconds, then release the button. You are on the main menu level. In the upper line of the display "A" appears, beneath the main menu **quick setup** is highlighted.
- Press **▼** or **▲** until the main menu **test** is highlighted.

MAIN MENU A quick setup > B test C setup D service
Press > to enter the chosen menu.
Press ▼ or ▲ until the submenu logbooks is highlighted.
Press > to enter the chosen menu.
You are on the second submenu level. In the upper line of the display "logbooks" and "B5/B5.1" appears, beneath the submenu status log is highlighted.
Press ▼ or ▲ until the submenu calibration log and B5.2 is highlighted.
Press > to enter the chosen menu.



- You are on the data level and you see the calibration history. With the help of **▼** or **▲** you can scroll through the different entries.
- If you want to return to the measuring mode press **←** several times until you reach this mode.

4.3 Troubleshooting

Problem	Possible cause	Remedy
No values is displayed.	No power supply available or sensor cable not connected.	Check electrical connection.
No sensor reaction.	Deposits on the membrane	Clean the membrane and recalibrate the sensor.
	Membrane is damaged.	Replace electrode cartridge and recalibrate the sensor.
Indicated values are too low.	Deposits on the membrane.	Clean the membrane and recalibrate the sensor.
	Membrane is damaged.	Replace electrode cartridge and recalibrate the sensor.
	Low or no flow	Check flow (min. 5 cm/second / 1.97"/second)
Indicated value fluctuates.	Membrane is damaged.	Replace electrode cartridge and recalibrate the sensor.
When measuring in areas of low oxygen concentration: the indicated value is too high or the expected value is not reached or the value drops unexpectedly after calibration.	The run-in time was too short. The electrolyte in the cell still contains excess oxygen that is used up at the cathode during the run-in phase.	Extend the run-in time and recalibrate the sensor.
Instrument displays 18 mA (=service current ADO sensor) after calibration and does not change.	Calibration was unsuccessful.	Switch power to MAC 100 off and on.

5.1 Maintenance

5.1.1 Cleaning

- A greyish white deposit may form on the anode of the electrode cartridge. It does not affect the functioning of the measuring cell.
- Dirt deposits on the membrane may lead to erroneous results.
- To clean the membrane submerge the whole sensor in a bucket of tap water or in 1...5% hydrochloric acid solution (only for up to 10 minutes). Then rinse thoroughly with tap water and only use a soft tissue to carefully remove deposits from the membrane.
- The sensor housing may be cleaned by scrubbing it with a suitable brush. Make sure you do not touch or scratch the membrane!
- After the cleaning procedure thoroughly flush the sensor with water.

5.1.2 Recalibration

During operation, but already during storage, oxygen sensors age due to poisoning effects of the inner buffer system. Therefore it is important to recalibrate the sensors in regular intervals as described.

When the sensor becomes too old to provide reliable measurements, the electrode cartridge has to be replaced. Follow the procedure on page 16.

Please wait at least 30 minutes till the sensor is active again and the oxygen in the electrolyte be reduced at the cathode. The temperature has to be compensated. After this period start the calibration.



INFORMATION!

The life time expectation of the electrode cartridge depends heavily on the application.

5.2 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

5.3 Availability of services

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



INFORMATION!

For more precise information, please contact your local sales office.

5.4 Returning the device to the manufacturer

5.4.1 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 the personnel, the 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 neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that it is safe to handle and stating the product used.*

5.4.2 Form (for copying) to accompany a returned device



CAUTION!

To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no. and/or Email address:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	<input type="checkbox"/>	radioactive	
	<input type="checkbox"/>	water-hazardous	
	<input type="checkbox"/>	toxic	
	<input type="checkbox"/>	caustic	
	<input type="checkbox"/>	flammable	
	<input type="checkbox"/>	We checked that all cavities in the device are free from such substances.	
<input type="checkbox"/>	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:			

5.5 Disposal



CAUTION!

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

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:



According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.

The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

6.1 Measuring principle

The OPTISENS ADO 2000 is an amperometric dissolved oxygen sensor with a galvanic electrode cartridge consisting of membrane covered electrodes in an electrolyte solution.

Oxygen enters the electrode cartridge via the membrane. The essential potential to reduce oxygen at the silver cathode and oxidise lead at the lead anode is provided by the customised electrode/electrolyte system (galvanic cell). No external power supply and time consuming polarisation is needed. The resulting electrochemical current is measured as it depends on the concentration of oxygen.

The complete cartridge is easily replaceable without the need of exchanging the electrolyte solution.

6.2 Technical data



INFORMATION!

- *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 sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Design

Measuring principle	Amperometric
Measuring range	0...20 mg/l / 0...20 ppm dissolved oxygen
Sensor type	Installation with MAC 100 signal converter
Shaft diameter	40 mm / 1.57"

Operating conditions

Temperature range	0...+50°C / +32...+122°F
Pressure range	Max. 6 bar at 20°C / 87 psi at 68°F
Measuring accuracy	± 1% of end of range (20 mg/l)
Response time	t ₉₀ < 180 seconds (at 25°C / 77°F)
Flow rate	min. 5 cm/second / 1.97"/second

Installation conditions

Ingress protection	IP68
Weight	Approx. 0.7 kg / 1.54 lb

Materials

Sensor shaft	Stainless steel 1.4305
Sensor head and protective basket	PVC
Electrode cartridge	Teflon, PVC

Electrical connection

Cable	10 m / 32.8 ft or 15 m / 49 ft attached cable
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Approvals and certificates

CE	
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	EMC Directive 2004/108/EC (valid until 2016/04/19) or EMC Directive 2014/30/EU (valid from 2016/04/20)
Low voltage directive	Low Voltage Directive 2006/95/EC (valid until 2016/04/19) or Low Voltage Directive 2014/35/EU (valid from 2016/04/19)



INFORMATION!

For further information contact your local sales office.

6.3 Dimensions

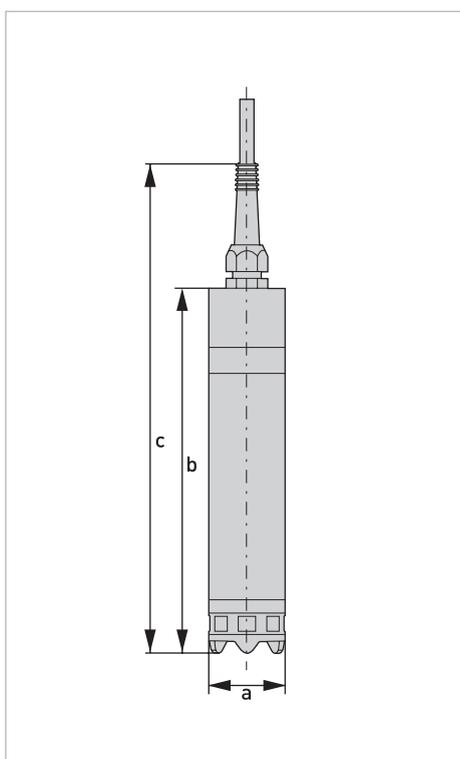


Figure 6-1: Dimensions

	Dimensions	
	[mm]	[inch]
a	40	1.57
b	193	7.6
c	258	10.16



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