OPTISENS ORP 8590 Handbook

ORP sensor

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

KROHNE

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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 ORP 8590 sensor is the measurement of ORP value in water applications. The sensor is suitable for connection to the MAC 100 signal converter.

1.2 Safety instructions from the manufacturer

1.2.1 Copyright and data protection

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1.2.2 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.

1.2.3 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 Warnings and symbols used

Safety warnings are indicated by the following symbols.

DANGER!
This information 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.

1.3 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 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.

Figure 2-1: Standard scope of delivery

① Ordered sensor
② Documentation

Optional accessories

- SENSOFIT FLOW 1000 - flow through assembly
- SENSOFIT IMM 1000/2000 - immersion assembly
- SENSOFIT RET 1000/2000 - retractable assembly
- Cable pH/ORP-W US style sensor 4 pin connector to hanked 7.62 m 25ft / 10 m 33ft

Consumables/Spare parts available

- Various ORP solutions for sensor calibration
- Various cleaning solutions

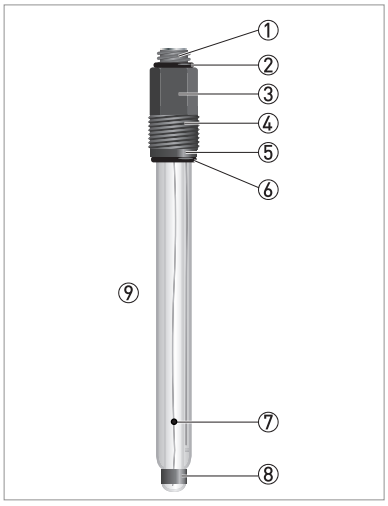
OPTISENS ORP 8590

- with 23 mm 0.91¨ length and attached cable 7.62 m 25 ft / 10 m 33 ft
- with 44 mm 1.75¨ length and attached cable 7.62 m 25 ft / 10 m 33 ft
- with 23 mm 0.91¨ length and 4-pin connector
- with 44 mm 1.75¨ length and 4-pin connector

INFORMATION!
For further Information contact your local sales office.

2.2 Device description

2.2.1 ORP sensor



① Thread for sensor cable connector
② O-Ring
③ Hexagonal nut
④ Thread
⑤ Washer
⑥ O-Ring
⑦ Diaphragm
⑧ Pt-Ring
⑨ OPTISENS ORP 8590

2.3 Nameplate

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.

The sensor type is specified on the labelling of the sensor package and on the sensor itself.

3.1 General notes on installation

INFORMATION!
Inspect the cartons 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

CAUTION!
Do not store the sensor tip dry. This will shorten lifetime considerably.
Always store the ORP sensor tip wet in a 3 molar KCl solution when not in use. Saltless water must be avoided since this would leak the KCl ions. The original packing in which the sensor tip was delivered contains a plastic tube with KCl solution and therefore is suitable for storage and transport (see following drawing).

- Since the ORP sensor is made out of glass it is very fragile. Avoid shocks of any kind.
- Do not touch or scratch the ORP sensitive glass tip of the sensor.
- Store the sensor in its original packaging in a dry, dust-free location. Keep it away from dirt. If necessary, clean it as described on page 23.

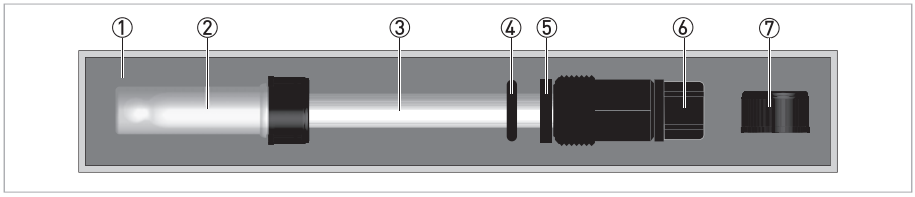


Figure 3-1: pH sensor in its original packaging

① Padding
② Plastic tube filled with 3 molar KCl solution
③ pH sensor
④ O-ring
⑤ Washer
⑥ Protective cap over electrical connector
⑦ Sealing cap without hole to seal plastic tube ② when sensor is in use

Storing the sensor in the provided plastic tube

- Screw the sealing cap off the plastic tube. Keep it in the original packaging.
- If there is not enough KCl solution in the plastic tube, fill it up with 3 molar KCl solution.
- Insert the sensor tip through the hole in the storage cap (see drawing on page 12).
- Carefully push the O-ring delivered with the storage cap on the sensor so that the cap sits over the O-ring.
- Insert the sensor tip into the plastic tube until it is fully covered with KCl solution.
- Tighten the cap.
- Store the sensor in its original packaging.

3.3 Installation procedure

Because a new ORP sensor needs to be calibrated before it is installed into its final measuring location, it is important to follow the installation order:

1. Unpack the sensor.
2. Connect the sensor to the signal converter.
3. Calibrate the sensor.
4. Install the sensor into its final measuring location.

The required steps are explained in the following sections.

3.4 Pre-installation requirements

CAUTION!

- *Never touch or scratch the platinum measuring tip of the ORP sensor.*
- *Make sure that the glass tip is clean and dust-free. If necessary, clean the tip as described on page 23*

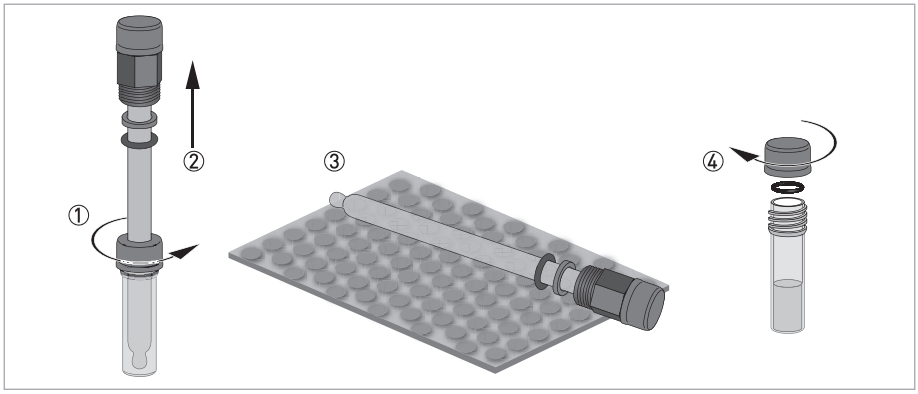


Figure 3-2: Handling the sensor

Unpacking the sensor

- Loosen the storage cap which is screwed or/and pushed on to the plastic tube ①.
- Gently pull the sensor out of the plastic tube ②.
- Lay the sensor on a soft mat/tissue ③.
- Screw or push the provided sealing cap on to the plastic tube, using O-ring as shown in the drawing ④. Keep the storage cap (the one with the hole in it) in the original packaging.

3.5 Electrical connection

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.

3.5.1 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.

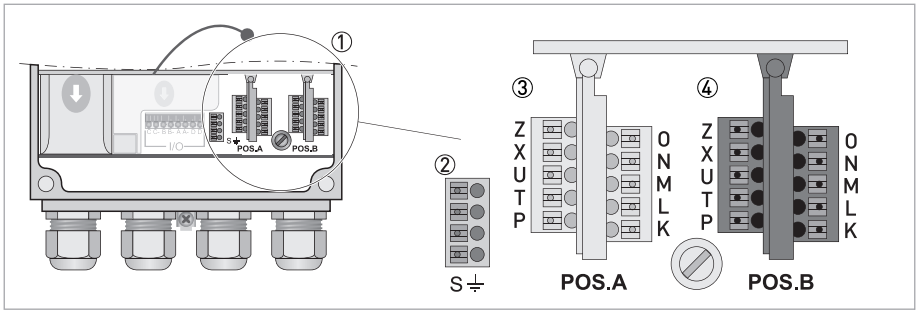


Figure 3-3: Sensor connection terminals on the signal converter dual channel version with terminal block A+B

① Sensor connection terminals
② Terminal block S (protective earth)
③ Terminal block A: terminals for sensor and temperature
④ Terminal block B: terminals for sensor and temperature

The ORP sensor is connected to the signal converter using a coax cable.

When ordering the one channel version, only the interface "Pos.A" is populated. In the version with two channels the interfaces "Pos.A" and "Pos.B" are populated.

Wire	Terminal block Pos.A/B
OPTISENS ORP 8590 with double coax cable	
Inner coax shield (black)	N (ref.)
Coax core (transparent)	O (pH)
Pt100 (white)	P
Pt100 (red)	X

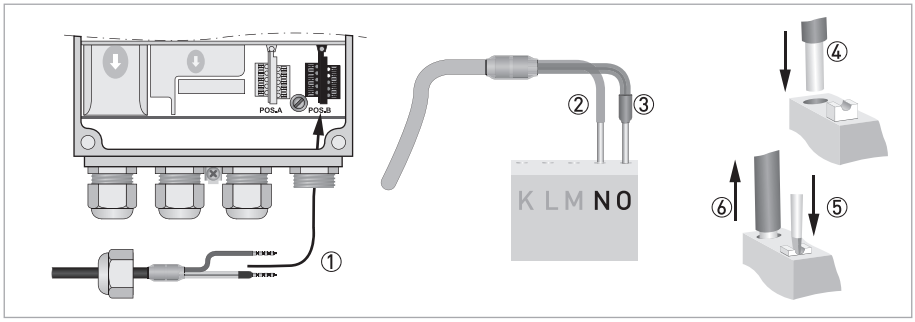


Figure 3-4: Connecting the sensor cable

The following instructions describe the connection of the different sensor cables.

Connecting the sensor cable to the signal converter

- Thread the sensor cable through the outer right cable gland ①.
- Push the coax shield ④ into terminal N ② and the coax core into terminal O ③.
- To remove a cable, press down the white clip ⑤ on the corresponding terminal and pull the cable out ⑥.

3.5.2 Connecting the cable to the sensor

CAUTION!
Moisture inside the sensor connector must be avoided! Moisture may cause a shortcut and deliver erratic readings!
If moisture has entered the connector, dry it with air (e.g. hair blower).

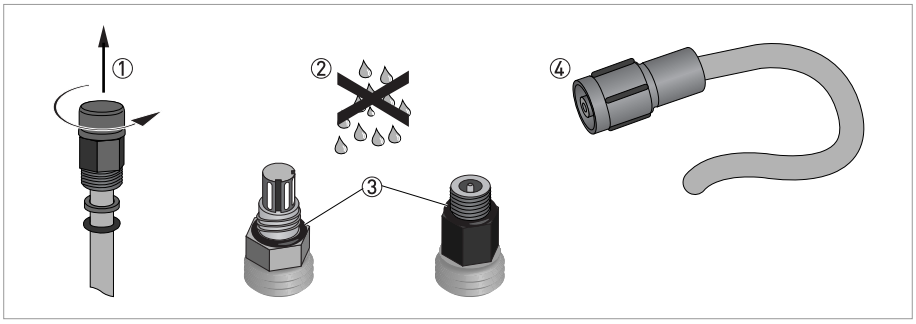


Figure 3-5: Connecting the cable to the sensor

Connecting the cable to the sensor

- Unscrew the protective cap from the sensor connector and keep it for future use ①.
- Ensure that both cable and sensor connector are absolutely dry ②.
- Make sure that the O-ring is positioned on the sensor connector ③.
- Screw the cable connector ④ on to the sensor and tighten it by hand.

3.6 Calibrating the sensor

Before the sensor is installed, it has to be calibrated. Proceed as described on page 18. Then continue with the installation procedure.

3.7 Installing the sensor

3.7.1 General installation instructions

The sensor tip must always have full contact with the measuring medium.

The mounting position of the sensor should not deviate more than 75° from vertical position (sensor tip pointing downwards). Doing otherwise might cause internal air bubbles to float into the sensor glass tip. This would interrupt the electrical contact between the inner buffer solution and the glass surface.

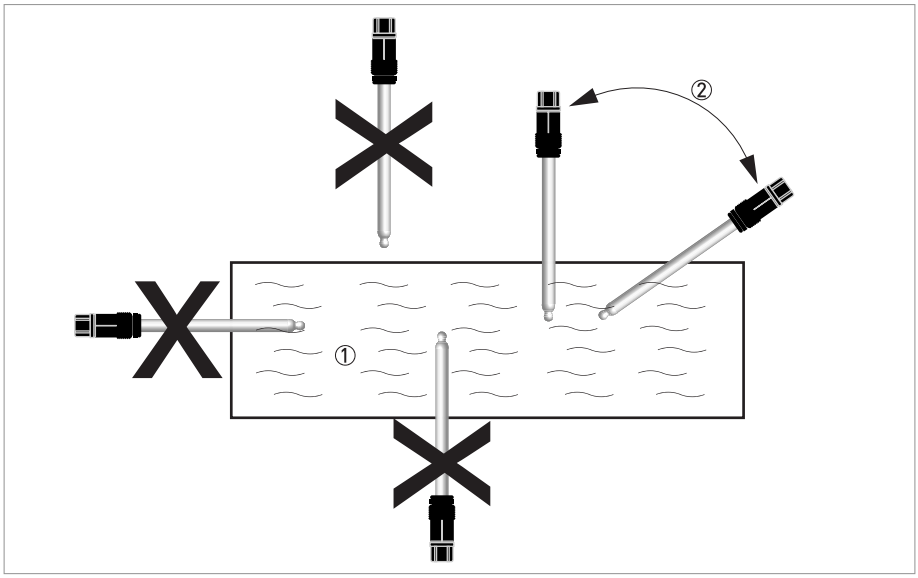


Figure 3-6: Installation requirements

① Measuring medium
② Maximum deviation of 75° from vertical position

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**	> ↵	A1 language		> ↵	For further information see function tables.
				A2 Tag			
				A3 hold function			
				A4 set clock			
				A5 reset errors			
				A6 analog outputs	> ↵ A6.1 measurement		
					A6.3 range		
					A6.4 time constant		
				A9...A11: calibration menus for process input A; existence of the single sub-menus depends on the hardware setting and the used sensor (e.g. if you use a pH sensor then only the menu A8 with the name "pH cal." appears); refer to sensor manual for further information.			
				A12...A16: calibration sub-menus for process input B, existence also depending on the hardware setting and the used sensor.			
		↓↑		↓↑	↓↑		↓↑
	> 2.5 s ↵	**B test**	> ↵	B1 Simulation Process Input A	> ↵ B1.1...B1.7: simulation menus for process input A; existence of the single sub-menus depends on the hardware setting and the used sensor, refer to sensor manual for further information.	> ↵	For further information see function tables.
				B2 Simulation Process Input B	B2.1...B2.7: simulation menus for process input B; existence of the single sub-menus depends on the hardware setting and the used sensor, refer to sensor manual for further information.		
		↓↑		↓↑	↓↑		↓↑

Measuring mode	Main menu		Submenu				Parameter	
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ↵	**B test**	> ↵	B3 simulation IO	> ↵	B3.1 - / current output A	> ↵	For further information see function tables.
						B3.2 - / current output B		
						B3.3 - / current output C		
						B3.4 - / control input D		
				B4 actual values		B4.1...B4.8: menus which show the corresponding actual reading; existence of the single sub-menus depends on the hardware setting and the used sensor; refer to sensor manual for further information.		
				B5 logbooks		B5.1 status log		
						B5.2 calibration log		
				B6 information		B6.1 C number		
						B6.2 process input A		
						B6.3 process input B		
						B6.4 SW.REV. MS		
						B6.5 SW.REV. UIS		
						B6 Electronic Revision ER		
		↓↑		↓↑		↓↑		↓↑
	> 2.5 s ↵	**C setup**	> ↵	C1 process input A	> ↵	C1.1...C1.18: menus for the setup of the corresponding process input; existence of the single sub-menus depends on the hardware setting and the used sensor; refer to sensor manual for further information.	> ↵	
				C2 process input B		C2.1...C2.17: menus for the setup of the corresponding process input; existence of the single sub-menus depends on the hardware setting and the used sensor; refer to sensor manual for further information.		
		↓↑		↓↑		↓↑		↓↑

Measuring mode	Main menu		Submenu				Parameter	
3 or 4 pages, scrolling with ↓ or ↑	> 2.5 s ↵	**C setup**	> ↵	C3 I/O	> ↵	C3.1 hardware	> ↵	For further information see function tables.
						C3.2 current output A		
						C3.3 current output B		
						C3.4 current output C		
				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

4.2.1 Calibrating ORP measurement

The potential of an ORP electrode is calibrated using a ORP buffer solution. In the course of that, the difference between the measured potential and the potential of the calibration solution is determined. This potential difference is printed on the buffer solution bottle and is defined as the voltage across the ORP electrode and a reference electrode. ORP sensors require no calibration, but you can perform a one-point calibration with an ORP buffer solution.

INFORMATION!
Remove the watering cap before starting the calibration.

CAUTION!
- *Never touch or scratch the platinum measuring tip of the ORP sensor.*
- *Make sure that the glass tip is clean and dust-free. If necessary, clean the tip as described on page 23*

CAUTION!
Moisture inside the sensor connector must be avoided! Moisture may cause a shortcut and deliver erratic readings!
If moisture has entered the connector, dry it with air (e.g. hair blower).

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. If you are in this mode and you want to initiate a calibration, you have to 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
• 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.
• Press ▼ or ▲ until the submenu **hold function** 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
• Press ▼ or ▲ to choose the option on
• Press ↵ to confirm the entered value.

- You have activated the 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 1a: 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
• Press **>** to enter the chosen menu.
You are on the first submenu level. In the upper line of the display "setup" and "c1" appears, beneath the submenu **process input A** is highlighted.
Press ▼ or ▲ to select **process input A** or **process input B** is highlighted. Choose process input A or B.
• Press **>** to enter the chosen menu.
• You are on the second submenu level. The submenu **ORP cal.** is highlighted.
• Press **>** to enter the chosen menu.

- You can start the calibration procedure now as described in "Step 2".

Step 1b: 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	
	• Press **>** to enter the chosen menu.	
		You are on the first submenu level. In the upper line of the display "quick setup" and "a" appears, beneath the submenu **language** is highlighted.
		Press ▼ or ▲ until the submenu **ORP calibration A** or **B** is highlighted.
		• Press **>** to enter the chosen menu.
		• You can start the calibration procedure now as described in "Step 2".

- You can start the calibration procedure now as described in "Step 2".

Step 2: preparing the calibration procedure

- If you re-calibrate an existing sensor, remove the sensor from its respective assembly and.
- If you calibrate a new sensor, make sure that the sensor is correctly connected to the signal converter.
- Check the sensor for damages, check the diaphragm for coating and rinse the sensor tip with tap water and gently swipe it with a soft tissue.
- Provide a suitable calibration solution.

After activating the hold function and the preparative measures, you can get access to the calibration procedure from the measuring mode in two different ways. Either you go via the main menu **setup** (step 3a) or via the main menu **quick setup** (step 3b).

Step 3: calibration procedure

- After choosing the submenu **ORP** (step 1a) or **ORP calibration A or B** (step 1b) and step 2 in the previous steps, continue by pressing **>**.

➲ The currently measured value is shown on the display.

- Press ↵ to finally start the calibration procedure.
- Submerge the sensor tip into the ORP buffer solution.
- Wait until a steady value is displayed.
- Press ↵ to continue the calibration procedure.

➲ The message **ref. value ORP** and the value of the buffer solution are displayed on the screen.

- Enter the value of the buffer solution by pressing ▼ or ▲ and **>**. Press ↵ to confirm the setting.
- After 25 seconds the calibration step is completed.

➲ The message zero point is displayed on the screen.

- Press ↵ to confirm the setting.

➲ The message store cal. value is displayed on the screen. The signal converter asks if the new calibration values should be stored.

- Choose **yes** using ▼ or ▲ to store the calibration values. Choose **no** to discard the results.
- Press ↵ to confirm.

- If you want to return to the measuring mode, press ↵ several times until you reach this mode. Prior returning to the measuring display, you are asked if the configuration should be stored. Choose **yes** using ▼ or ▲ to store the new calibration values. Press ↵ to confirm.

INFORMATION!
If an error occurs during the calibration procedure, the display shows an error message. Possible causes for an error are:

Step 4: re-installing the sensor

- After the calibration procedure, rinse the sensor with tap water.
- Reinstall the sensor into its assembly, refer to *Installing the sensor* on page 15.

Step 5: switching back to measurement

- Deactivate the function **hold function** again.

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 calibtration 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.		
		You are on the first submenu level. In the upper line of the display "test" and "B1" appears, beneath the submenu **sim.process input A** is highlighted.	
		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 "B1" appears, beneath the submenu **status log** is highlighted.
			Press ▼ or ▲ until the submenu **calibration log** 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
The ORP sensor does not deliver a signal.	Mechanical damage of the platinum electrode, e.g. scratches.	Exchange sensor.
	Moisture inside the sensor connector.	Clean the connector (sensor/cable) with pure water and dry with air (e.g. hair blower).
The ORP sensor delivers a bad signal.	Coated/abraded platinum electrode.	Clean the platinum electrode by using aqua regia (this procedure uses hazardous chemicals and should only be performed by a qualified person), HCl concentrated/HNO3 concentrated (1/1).
The ORP electrode delivers an unstable signal.	The diaphragm in the reference half-cell does not provide good contact to the process medium due to drying up or coatings.	• Clean the diaphragm with hot soap or acid using a soft tissue (details on page 23). • Submerge sensor in water and increase the temperature to 50...60°C / 122...140°F. • Submerge sensor in 3 molar KCl solution at ambient temperature. The decrease in temperature will cause the reference half cell to suck in KCl solution through the diaphragm and regenerate the diaphragms functionality.

5.1 Maintenance

5.1.1 Cleaning

- Clean the platinum sensor surface with demineralised water.
- Slight dirt residues or dust: Rinse the sensor tip with demineralised water and clean it with a soft tissue.
- Oily and greasy coatings: Remove with a warm soap solution and rinse with demineralised water.
- Hardness deposits or metal hydroxide deposits: Soak the sensor tip including diaphragm in 10% citric acid or hypochloric acid for a couple of minutes and rinse the complete glass shaft of the sensor with demineralised water.
- Biological fouling: Soak the sensor tip including diaphragm in 10 % pepsin solution for minimum 3 hours and afterwards rinse the complete glass shaft of sensor with demineralised water.

5.1.2 Aging and re-calibration

During operation, but already during storage, ORP sensors age due to poisoning effects of the inner buffer system. Therefore it is important to re-calibrate the sensors in regular intervals as described on page 18.

When the sensor becomes too old to provide reliable measurements, the signal converter displays an error message after the calibration procedure. In this case, the sensor has to be exchanged.

Aging effects ORP sensors:

- **Shift of zero point:** Compare the value with the sensor specified "Offset"-Value printed on the "user manual sensors" (scope of delivery). The zero point of the sensor should be near +/- 5 mV compared to "offset" value. In this case perform a one-point calibration. For more information refer to *Calibration* on page 18. Compare the calibration value with the reference value. If the calibration value deviate more than +/- 5 mV from the reference value, the sensor should be replaced by a new one.

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 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 neutralising, 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.*

5.4.2 Form (for copying) to accompany a returned device

Company:		Address:
Department:		Name:
Tel. no.:		Fax no.:Email address:
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:		

5.5 Disposal

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

6.1 Measuring principle

6.1.1 ORP measurement

The oxidation reduction potential, ORP in short, is the measurement for the concentration of oxidising and reducing agents in water. Its value is influenced both by pH and temperature. ORP is a sum parameter that gives no information on the concentration of a single substance in a mixture.

ORP measurements are used to monitor chemical reactions involving electron transfer. In drinking water treatment it can be found in ozone treatment and the removal of iron, manganese and nitrate as well as in disinfection steps. In swimming pools the German DIN 19643 requires ORP measurements as a hygiene parameter and decrees maximum and minimum values for fresh water, pool water, and salt water. In wastewater treatment ORP is measured in the denitrification process and in detoxication of industrial wastewater.

The ORP sensor consists of a measuring electrode of platinum or gold and a reference of e.g. Ag/AgCl. The potential of the measuring electrode changes with the concentration of reducing and oxidising agents and is measured against the reference. The measured values can be recalculated to fit literature values based on NHE (normal hydrogen electrode) as reference.

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 (Download Center).*

ORP sensor

OPTISENS	ORP 8590

Measuring system

Measuring principle	Potentiometric
Measuring range	-2000...+2000 mV

Design

Construction	CPVC Body mit Tuff Tip®
Shaft diameter	20 mm / 0.79"
Length	23 mm / 0.91" or 44 mm / 1.74"
Process connection	3/4" MNPT
Temperature sensor	Pt100
Sensor cap	4-pin connector or attached cable
Type of diaphragm	Ceramic

Measuring accuracy

Reference conditions	Medium: water
	Temperature: 20°C / 68°F
	Pressure: max. 1 bar / 14.5 psi (absolute)
Maximum measuring error	pH: 0.2% full scale
	Temperature: 1.0% full scale
Repeatability	0.2% full scale
Resolution	0.1 (or 0.01 in extended mode)
Long-term stability	24 hours: tested within accuracy definition
Temperature drift	Tested within accuracy definition
Cable length variation	Tested within accuracy definition

Operating conditions

Temperature range	0…+80°C / +23…+176°F
Max. operating pressure	6.9 barg / 100 psig at 60°C / 140°F
Minimum conductivity	>150 µS/cm

Installation conditions

Process connection	3/4" MNPT
Immersion assembly	SENSOFIT IMM 1000
Flow- through assembly	SENSOFIT FLOW 1000
Retractable assembly	SENSOFIT RET 1000/2000

Materials

Sensor shaft	CPVC
Measuring electrode	Platinum
Inner buffer	pH 7.0
Reference	Double junction
Diaphragm	Ceramic
Gasket	Viton®

Electrical connection

Connector	4-pin connector or attached cable
Cable	Only for 4-pin connector: Cable pH/ORP-W US style sensor 4-pin connector to hancked
Cable length	7.26 m / 25 ft; 10 m / 33 ft.

6.3 Dimensions

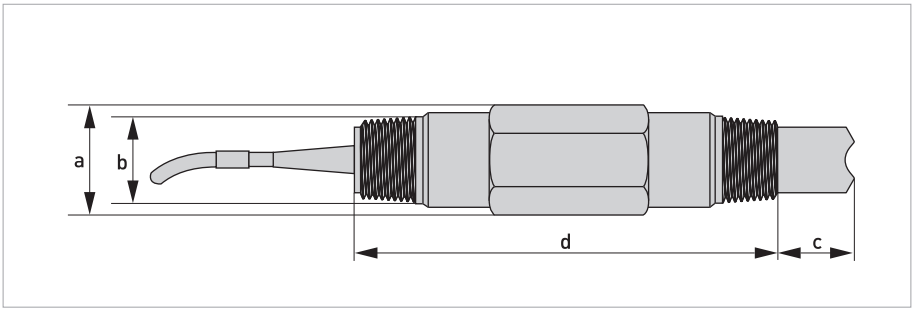


Figure 6-1: Dimensions OPTISENS ORP 8590

	Dimensions [mm]	Dimensions [inch]
a	28.57	1 1/8
b	3/4" MNPT thread	
c	23 / 44	0.91 / 1.74
d	171	6.73

7.1 ORP as a function of mV

The pH-value is the negative decadative logarithm of the hydrogen ion concentration, and it is directly related to the proportion of hydrogen ions H^+ to hydroxide ions OH^- in the media. The pH-sensor measures excess or deficit of the hydrogen ions and gives a proportional millivolt signal as output. The signal is 59.16 mV per 1 pH at 25°C / 77°F. In clean water there is a total balance between hydrogen ions and hydroxide ions, the output from the electrode is 0.0 mV and pH is 7. The millivolt signal is measured by the pH sensor and the corresponding pH value is calculated in the signal converter.

mV	pH	H^+ ions [mol/l]	OH^- ions [mol/l]	Example
414	0	1	0.00000000000001	
355	1	0.1	0.0000000000001	
296	2	0.01	0.000000000001	Coca Cola
237	3	0.001	0.00000000001	
177	4	0.0001	0.0000000001	Orange juice
118	5	0.00001	0.000000001	
59	6	0.000001	0.00000001	Milk
0	7	0.0000001	0.0000001	Clean water
-59	8	0.00000001	0.000001	Blood
-118	9	0.000000001	0.00001	
-177	10	0.0000000001	0.0001	
-237	11	0.00000000001	0.001	
-296	12	0.000000000001	0.01	
-355	13	0.0000000000001	0.1	
-414	14	0.00000000000001	1	Sulfa

7.2 ORP dependency

The output from a pH-electrode varies with the temperature in a predictable way. The size of the variation depends on both the temperature and the pH being measured.

°C	°F	pH	pH	pH	pH	pH	pH	pH	pH	pH	pH	pH	pH
5	41	2.30	3.24	4.18	5.12	6.06	7.00	8.06	9.12	10.18	11.24	12.30	13.36
15	59	2.15	3.12	4.09	5.06	6.03	7.00	8.03	9.06	10.09	11.12	12.15	13.18
25	77	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00
35	95	1.85	2.88	3.91	4.94	5.97	7.00	7.97	8.94	9.91	10.88	11.85	12.82
45	113	1.70	2.76	3.82	4.88	5.94	7.00	7.94	8.88	9.82	10.76	11.70	12.64
55	131	1.55	2.64	3.73	4.82	5.91	7.00	7.91	88.2	9.73	10.64	11.55	12.46
65	149	1.40	2.52	3.64	4.76	5.88	7.00	7.88	8.76	9.64	10.52	11.40	12.28
75	167	1.25	2.40	3.55	4.70	5.85	7.00	7.85	8.70	9.55	10.40	11.25	12.10
85	185	1.10	2.28	3.46	4.64	5.82	7.00	7.82	8.64	9.46	10.28	11.10	11.92
95	203	0.95	2.16	3.37	4.58	5.79	7.00	7.79	8.58	9.37	10.16	10.95	11.74

At pH 7 and 25°C / 77°F the temperature error is zero. If temperature or pH changes the temperature error is calculated using the following formula:

0.03 pH-difference / pH or 0.03 pH-difference / K

KROHNE product overview

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

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