O₂ Lumitrode



6.1116.000

Sensor leaflet

8.0109.8015EN / v2 / 2023-09-04





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8.0109.8015EN / v2 / 2023-09-04 Technical Communication Metrohm AG CH-9100 Herisau

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O₂ Lumitrode

Overview

1 Overview

1.1 Product description

The O_2 Lumitrode is an optical sensor for measuring dissolved oxygen, i.e. the amount of dissolved oxygen molecules in an aqueous phase. The sensor works on the principle of luminescence quenching.

The O₂ Lumitrode can be connected to the following measuring instruments:

- 913 pH/DO Meter
- 914 pH/DO/Conductometer

1.2 Overview

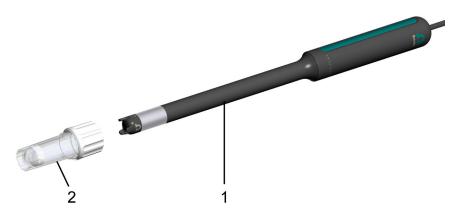


Figure 1 O₂ Lumitrode – Scope of delivery

1 O₂ Lumitrode

2 Calibration vessel

Overview

O₂ Lumitrode

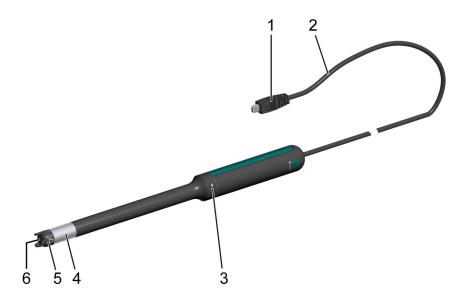


Figure 2 O₂ Lumitrode

- 1 Plug, mini-USB
- 3 Pressure compensation opening
- 5 O₂ cap, replaceable

- 2 Fixed cable, 1.2 m
- 4 Steel ring with temperature sensor
- **6** Sensor membrane

Calibration vessel

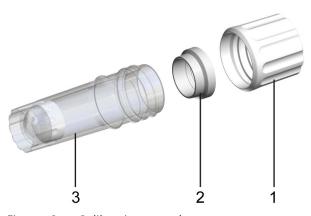


Figure 3 Calibration vessel

1 Screw cap

2 Clamping collar

3 Vessel with sponge

Functional description

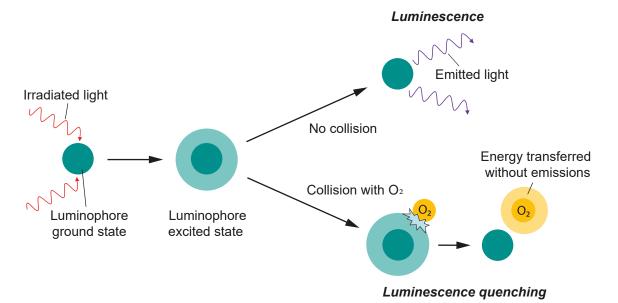
2 Functional description

The sensor works on the principle of luminescence quenching.

Luminescence

A luminophore is embedded in the sensor membrane in the O_2 Lumitrode. Irradiated light puts the luminophore into an excited state. When reverting to the ground state, the luminophore emits light in the NIR range.

The time period between excitation and reverting to the ground state (luminescence lifetime) causes a phase shift between irradiated and emitted light.



Luminescence quenching

If the aqueous phase contains dissolved oxygen, then oxygen molecules will collide with the luminophore. The collisions cause a transfer of energy from the luminophore to the oxygen molecules. The luminophore molecules thus revert to their ground state prematurely without radiation. The luminescence is guenched.

Influence on the phase shift

The luminescence lifetime of the luminophore molecules varies. The longer the luminescence lifetime, the greater the probability of a collision. Luminophore molecules with a long luminescence lifetime are therefore more frequently quenched. The average luminescence lifetime decreases. Accordingly, the phase shift between irradiated and emitted light is reduced.

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The more oxygen molecules collide with the luminophore, the shorter the average luminescence lifetime and the smaller the phase shift. The measured phase shift enables the calculation of the oxygen content (Stern-Volmer law).

Delivery and packaging

3 Delivery and packaging

3.1 Delivery

Inspect the delivery immediately upon receipt:

- Check the delivery against the delivery note to ensure completeness.
- Check the product for damage.
- If the delivery is incomplete or damaged, contact your regional Metrohm representative.

3.2 Packaging

The product and accessories are supplied in protective special packaging. Keep this packaging to ensure safe transportation of the product. If a transport locking device is present, keep this as well for future reuse.

3.3 Unpacking the sensor

1 Unpacking and inspecting the sensor

Carefully remove the sensor and calibration vessel from the packaging.

2 Preparing the sensor

According to Chapter (see "Preparing the sensor", chapter 4, page 7).

Defective sensors must be sent back for warranty processing within 2 months (from the date of delivery).

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Storing the sensor

3.4 Storing the sensor

Always store the sensor in the calibration vessel within the specified temperature range.

1 Improper handling

Damage to or reduced service life of the O₂ cap.

- Avoid major mechanical strain on the sensor membrane.
- Do not touch the sensor membrane with your fingers, the sponge of the calibration vessel, brushes or similar.

Storing the sensor

1 Mounting the calibration vessel on the sensor

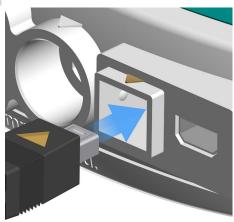
- Remove the screw cap from the calibration vessel.
- Place the screw cap of the calibration vessel on the sensor.
- Screw the calibration vessel onto the sensor. The sensor membrane must not touch the sponge.
- 2 Store the sensor within the specified temperature range. See *page* 17.

Preparing the sensor

4 Preparing the sensor

The sensor must be prepared before first use and after a long period of non-use.

1 Connecting the sensor



- Connect the plug of the sensor to the socket i of the measuring instrument. Observe the correct orientation (markings colored orange in the image).
- The measuring instrument detects the sensor after a few seconds. The sensor data is available in the sensor menu.

2 Calibrating the sensor

Carry out 2-point calibration with 0% and 100% air saturation. See (see "Calibrating the sensor", chapter 5.1, page 8).

1 Contaminated sensor

Impairment of the measuring behavior or falsification of the measuring results.

 The sensor surface and the sensor membrane must always be clean before measurement.

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Calibrating the sensor

5 Operation and control

5.1 Calibrating the sensor

The sensor must be calibrated before first use and after a long period of non-use with a 2-point calibration (0% and 100% air saturation).

For routine calibration, a 1-point calibration with 100% air saturation in the calibration vessel is usually sufficient.

Improper handling

Damage to the O₂ cap.

 Do not touch the sensor membrane with your fingers, the sponge of the calibration vessel, brushes or similar.

Contaminated sensor

Impairment of the measuring behavior or falsification of the measuring results.

 The sensor surface and the sensor membrane must always be clean before measurement.

2-point calibration

Prerequisite:

- The sensor is connected to the measuring instrument.
 - 1 Set the 2-point calibration 0%, 100% on the 91x meter:

 Menu ➤ Parameters DO ➤ Calibration param. ➤ Calibration points ➤ 0%, 100%

2 Calibration at 100% air saturation

- Detach the calibration vessel from the screw cap. Remove the calibration vessel and screw cap from the sensor.
- Remove the screw cap from the calibration vessel.
- Put some water on the sponge of the calibration vessel.
- Wait briefly so that the sponge can soak up the water.
- Pour off excess water.
- Place the screw cap of the calibration vessel on the sensor.
- Screw the calibration vessel onto the sensor. The sensor membrane must not touch the sponge.
- Wait at least 30 seconds to allow the air space to saturate with water vapor.

Operation and control

- Start calibration on the measuring instrument: press the CAL key.
- Follow the instructions of the instrument.
 If necessary, set the Temp. compens. and Air press. comp..

Calibration at 0% oxygen (with 6.2329.000 oxygen standard 0%)

- Remove the calibration vessel from the sensor.
- Tear open the sachet with oxygen standard 0% calibration solution.
- Immerse the sensor in the solution until it is over the metal ring.
- Swing the sensor briefly back and forth to remove adhering air bubbles.
- Start calibration on the measuring instrument: press the CAL key.
- Once the calibration has been completed, the instrument displays the results. If the measured values are within the defined limits, the instrument automatically adopts the calibration parameters. Otherwise the calibration is completed as a 1-point calibration. After a few seconds the main dialog appears.
- Rinse off the sensor with water.

The instrument is ready for measuring.

1-point calibration

Prerequisite:

- The sensor is connected to the measuring instrument.
- 1 Set the 1-point calibration 100% on the 91x meter:

 Menu ▶ Parameters DO ▶ Calibration param. ▶ Calibration

 points ▶ 100%

2 Calibration at 100% air saturation

- Detach the calibration vessel from the screw cap. Remove the calibration vessel and screw cap from the sensor.
- Remove the screw cap from the calibration vessel.
- Put some water on the sponge of the calibration vessel.
- Wait briefly so that the sponge can soak up the water.
- Pour off excess water.
- Place the screw cap of the calibration vessel on the sensor.
- Screw the calibration vessel onto the sensor. The sensor membrane must not touch the sponge.
- Wait at least 30 seconds to allow the air space to saturate with water vapor.
- Start calibration on the measuring instrument: press the CAL key.

Calibrating the sensor

Follow the instructions of the instrument.
 If necessary, set the Temp. compens. and Air press. comp.
 Once the calibration has been completed, the instrument displays the results and adopts them automatically.
 After a few seconds the main dialog appears.

The instrument is ready for measuring.

Maintenance

6 Maintenance

6.1 Replacing the O₂ cap

The measuring instrument displays the signal intensity with a status traffic light:

| Green | The signal intensity is in the correct range. |
|--------|--|
| Orange | The signal intensity is in the range of the lower limit value. A replacement of the O2 cap will soon be necessary. |
| Red | The signal intensity is below the lower limit value. Correct measuring can no longer be ensured. |
| | Replace the O₂ cap. Replacement set: 6.5623.000 |

Replacing the O₂ cap

- **1** Unscrew existing O₂ cap.
- Make sure that the sensor glass surface is clean and dry (see image). If necessary, rinse the sensor glass surface with deionized water and dry with a lint-free and non-scratching cloth.



- If necessary, enter the serial number of the new O₂ cap on the 91x meter: Menu ► Sensors ► Sensor list ► Serial no. cap
- 4 Screw on new O₂ cap.

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Cleaning the sensor

6.2 Cleaning the sensor

Improper cleaning

Damage to the sensor and the O₂ cap.

- Do not bring the sensor and sensor membrane into contact with any organic solvents.
- Never immerse the sensor in an ultrasonic bath.

Improper cleaning

Damage to or reduced service life of the O₂ cap.

- Avoid major mechanical strain on the sensor membrane.
- Do not touch the sensor membrane with your fingers, the sponge of the calibration vessel, brushes or similar.
- Do not clean the sensor membrane with abrasive cleaner.
- Do not rub the sensor membrane dry after rinsing.

Heavy contamination can have a negative effect on the measuring behavior or even falsify the measuring result. Always keep the sensor surface and sensor membrane clean.

Cleaning after each measurement

1 Rinse off the sensor with water after each measurement.

Periodic cleaning

- 1 Regularly check the **sensor** and the **sensor membrane** visually for contamination. Clean externally if necessary. Use water or a tenside solution as cleaning agent.
- If the **pressure compensation opening** is contaminated, remove the contamination from the opening. Use water or a tenside solution as cleaning agent.

Troubleshooting

7 Troubleshooting

Measurement and calibration

| Problem | Cause | Remedy |
|--|---|--|
| No measuring signal. Display: —— | Wrong measuring channel switched on. | Switch on the corresponding measuring channel on the measuring instrument. |
| | The sensor is not connected. | Connect the sensor. |
| | The plug of the sensor is not properly plugged into the measuring instrument. | Check the connection to the measuring instrument. See (see "Preparing the sensor", chapter 4, page 7). |
| | O ₂ cap is missing. | Screw the O ₂ cap onto the sensor. |
| | Sensor membrane is leached out (photo-bleaching). | Replace the O₂ cap. |
| | O ₂ cap is defective. | Replace the O₂ cap. |
| | The sensor is defective. | Replace the sensor. |
| | The measuring input and/or the measuring channel is defective. | Send the measuring instrument to Metrohm Service for checks and, if necessary, repair. |
| Signal intensity reduced – the sensor status dis- play on the measuring | Sensor membrane is contaminated. | Clean the sensor membrane with water or tenside solution. |
| instrument is in the yellow or red range. | Sensor membrane is leached out (photo-bleaching). | Replace the O₂ cap. |
| Measured value is clearly wrong. | DO calibration is faulty. | Check/repeat calibration.Check the value for temperature compensation. |

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| Problem | Cause | Remedy |
|--|---|---|
| | | Check the value for atmospheric pressure compensation. |
| | Sensor membrane is contaminated. | Clean the sensor membrane with water or tenside solution. |
| | Sensor membrane is leached out (photo-bleaching). | Replace the O₂ cap. |
| | The sensor is defective. | Replace the sensor. |
| The measured value drift criterion is not ful- filled. | O ₂ cap is worn out. | Replace the O ₂ cap. |
| | Calibration: Error mes | sages |
| Problem | Cause | Remedy |
| 012-346 Signal too high | The measuring signal is above the limit value. | Reduce the LED intensity (%) setting on the 91x meter: Menu ➤ Sensors ➤ Sensor list ➤ LED intensity (%) |
| 012-347 Signal too low | The measuring signal is below the limit value. | Check the correct placement of the O₂ cap. If necessary, replace the O₂ cap. |
| 012-348 Signal not stable | The measuring signal is not stable. | For calibration at 100%: put some water on the sponge of the calibration vessel. Repeat the calibration. For calibration at 0%: check or replace oxygen standard 0%. Repeat the calibration. |

Recommended limit values:

upper limit: 60.00 °

Limit value dphi 100%: Lower limit: $15.00 \, ^{\circ}$, upper limit: $30.00 \, ^{\circ}$

Limit value dphi 0%: Lower limit: 40.00°,

Troubleshooting

| Problem | Cause | Remedy |
|------------------------------------|--|--|
| 912-106 Calibration limit value | The calibration data is outside of the specified limit values. | Check or replace oxygen standard 0%. Repeat the calibration. Check defined dphi limits in the sensor menu: Menu ➤ Sensors ➤ Sensor list Recommended limit values: Limit value dphi 100%: Lower limit: 15.00°, upper limit: 30.00° Limit value dphi 0%: Lower limit: 40.00°, upper limit: 60.00° |

Refer to the measuring instrument manual for further troubleshooting notes.

8 Disposal



This product is covered by European Directive, WEEE – Waste Electrical and Electronic Equipment.

The correct disposal of your old product will help to prevent negative effects on the environment and public health.

1 Disposing of the sensor

Put the sensor in electronic waste recycling.

More details about the disposal of your old product can be obtained from your local authorities, from waste disposal companies or from your local dealer.

Technical specifications

9 Technical specifications

9.1 Ambient conditions

Nominal function range 0 °C - +60 °C observe functional

range of measuring

instrument

Storage and transport +5 °C - +45 °C at max. 80% relative

humidity, non-condens-

ing

9.2 Dimensions

Measurements

Shaft diameter 12 mm

Maximum installation length 140 mm

9.3 Housing

Materials

Shaft material ASA acrylonitrile styrene

acrylate copolymer

stainless steel

9.4 Measurement specifications

pH range 2–12

Temperature range 0 °C to +60 °C Temperature sensor:

Pt100

Measuring range 0.0 - +500% air saturation

0.00 - +50.00 mg/L

Resolution 0.1 %

0.01 mg/L

Measuring accuracy

Range 0−8 mg/L ±0.1 mg/L Range 8−20 mg/L ±0.15 mg/L

Range 20–50 mg/L ±10 %

Minimum immersion depth 35 mm