JUMO ecoLine O-DO

Optical Sensor
for Dissolved Oxygen

B 202613.0
Operating Manual

JUMO

2013-11-21/00603743

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1.1 Safety information

General information

This manual contains information that must be observed in the interest of your own safety and to avoid damage to assets. This information is supported by symbols which are used in this manual as follows.

Please read this manual before commissioning the device. Keep the manual in a place accessible to all users at all times.

If difficulties occur during commissioning, please refrain from carrying out any manipulations that could jeopardize your warranty rights.

Warning signs

CAUTION!
This symbol in combination with the signal word indicates that **damage to assets or data loss** will occur if suitable precautions are not taken.

Note signs

NOTE!
This symbol refers to **important information** about the product or its handling or additional use.

1 Introduction

1.2 Features

The JUMO ecoLine O-DO is an optical sensor designed to measure dissolved oxygen in aqueous solutions. Its measuring method, accredited according to ASTM D888-05, is based on the principle of **luminescence quenching** and offers the following advantages:

- Low operating costs due to reduced maintenance work (no electrolyte changes)
- Greater calibration intervals due to low drift behavior
- No polarization voltage required
- High measuring accuracy, even for low concentrations
- Rapid response times
- No minimum inflow (no oxygen consumption)

The sensor features excellent interference immunity thanks to the integrated preamplifier and digital signal processing. The measured value for dissolved oxygen is automatically compensated with the temperature, air pressure, and salinity (salt content), and transferred without interference to the connected display unit and controller via a digital interface.

The membrane cap is easy to replace, meaning the sensor is very easy to maintain. The current calibration data is saved directly in the sensor electronics. As a result, the Plug and Play function of the system is enabled without the need for recalibration. The sensor also includes a log book containing the last ten successful calibrations in the form of a ring buffer.

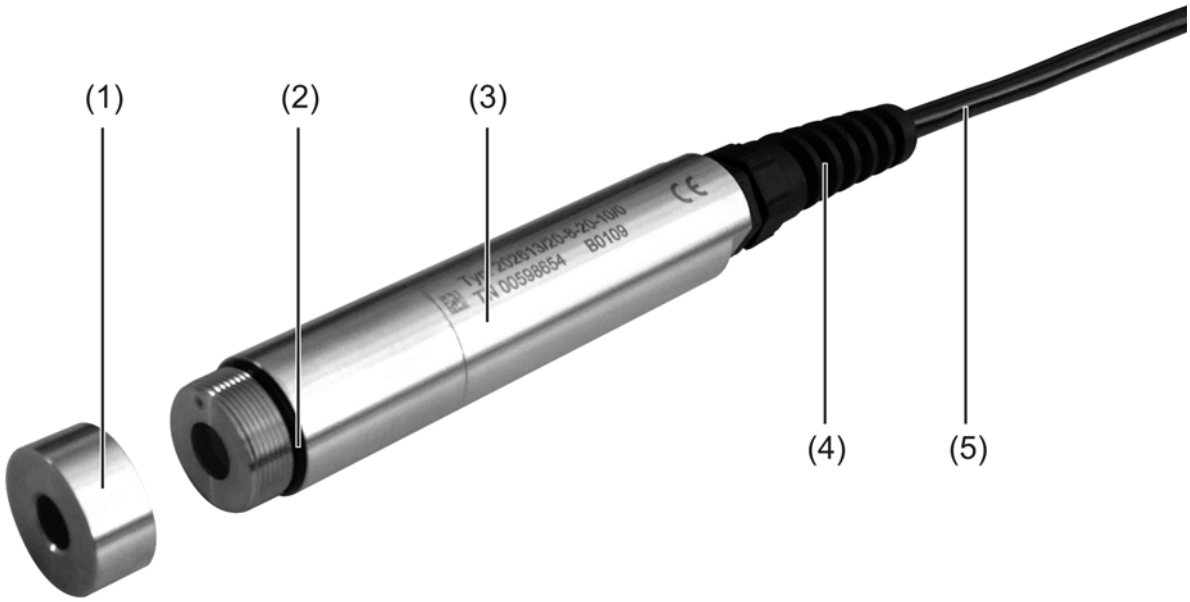
1.3 Areas of application

The compact and robust stainless steel sensor is particularly well suited to the following typical areas of application:

- Industrial and municipal sewage treatment plants
- Wastewater management (nitrification and de-nitrification)
- Surface water monitoring
- Fish farming, aquaculture
- Drinking water monitoring

1.4 Construction

The basic design of the optical sensor is as shown below:



(1) Stainless steel membrane cap with luminophore
(2) Membrane cap seal
(3) Sensor body with measurement electronics
(4) Cable bushing
(5) Securely connected connection cable

1.5 Function principle

A coloring agent (luminophore) is applied to the oxygen-permeable membrane cap. A green LED located in the sensor body irradiates the luminophore. By absorbing energy, it changes from its basic state to an excited state. Following a time delay, it returns to its basic state as it loses heat and emits the remaining energy as red light (referred to as florescent radiation), which is detected by a photo diode in the sensor body.

If the luminophore comes into contact with an oxygen module in the excited state, the energy transmission occurs directly onto the oxygen module without emission of the red light. The intensity of the florescent radiation reduces as the oxygen concentration increases. The operating life of the florescent radiation also reduces as the oxygen concentration increases. The measuring electronics modulate the exciter radiation. The oxygen concentration can be calculated precisely from the phase difference between the exciter and florescence radiation.

The measurement electronics of the sensor supply both the compensated oxygen concentration as well as the temperature value for the measurement medium, measured inside the sensor, to the connected transmitter/controller via the digital interface.

1.6 Factors influencing oxygen measurement

1.6.1 Influences on the measurement

The measurement of oxygen is influenced by the following factors:

- The temperature of the measurement medium
- The air pressure
- The salinity of the measurement medium

The degree of solubility of oxygen in water is dependent on the temperature, the salinity, and the air pressure. This dependency is stored in the sensor's measurement electronics in the form of functions. The sensor can therefore determine the oxygen concentration of the measurement medium, in order to digitally transmit the influencing factors above, in compensated form, to the transmitter/controller.

1.6.2 Influence of the air pressure on the calibration

With the most frequently used calibration method – end value calibration of the sensor in water vapor-saturated air – the air pressure must be taken into account.

For this purpose, the air pressure can, for example, be entered on the AQUIS 500 RS display unit / controller during initialization when operating the sensor. This value is transmitted to the sensor, where it is saved.

1.6.3 Salinity

The salinity refers to the concentration of dissolved salts (in % weight) in the medium.

The value for the salinity of the measurement medium is entered manually in the AQUIS 500 RS display unit / controller and transferred to the sensor.

1.7 Sampling rate

Optical oxygen sensors do not carry out any continuous measurements. The measuring procedures are activated by the connected display unit / controller and typically last approx. one second. To extend the operating life of the optical membrane, the measurement interval can be set to a value in the range 1 to 60 seconds in the AQUIS 500 RS display unit / controller (10 seconds in the delivery status).

2.1 Nameplate

Position

The nameplate is affixed on the front of the cardboard box in which the sensor is packaged.

Contents

The nameplate shows important information, including the following items, among others:

Description	Designation on the nameplate	Example
Device type	Type	202613/20-8-20-10/0
Fabrication number	F-Nr	007360540101326B0109
Part no.	TN	00598654

The information regarding the device type and part no. is also provided in a laser engraving on the sensor housing and the fabrication number is indicated on the connection cable sheath.

Device type

Compare the specifications on the nameplate with your order documents. The supplied device version can be identified using the order code in Chapter 2.2 "Order details", page 10.

Fabrication no. (F-Nr)

Among other things, the fabrication number indicates the production date (year/week) and the hardware version number.

Part no. (TN)

The part no. clearly identifies an article in the catalog. It is important for communication between the customer and the sales department.

Production date

Example: F-Nr = 0073605401013**26**B0109

The figures in question are in positions 12, 13, 14, and 15 (from the left).

The device was therefore produced in the 26th calendar week of 2013.

2 Identifying the device version

2.2 Order details

	(1)	**Basic type**
202613		JUMO ecoLine O-DO
		Optical oxygen sensor
	(2)	**Basic type extension**
20		Standard, 0 to 20 ppm
	(3)	**Version**
8		Standard with factory settings
	(4)	**Electrical connection**
20		Permanent cable
	(5)	**Length of permanent cable**
10		10 m
30		30 m
	(6)	**Extra codes**
0		None

	(1)		(2)		(3)		(4)		(5)		(6)
Order code		/		-		-		-		/	
Order example	202613	/	20	-	8	-	20	-	10	/	0

Important information:
The order code is not modular. When placing orders, if possible please select the items listed under **"Stock versions"** or **"Production versions“**. We must check the technical feasibility of and approve freely chosen combinations of individual code parts.

2.3 Scope of delivery

1 sensor with membrane cap in the version ordered
1 operating manual B 202613.0
1 calibration certificate

2.4 Accessories

(Delivery within 10 working days after receipt of order)

Fittings

Type	**Part no.**
Suspended fitting for type 202613/..., PVC, total length 1,360 mm	00601881
Immersion fitting for type 202613/..., PVC, total length 2,422 mm	00605469
Flow fitting for type 202613/..., PVC, angled seat	00601909

Maintenance set

Type	**Part no.**
Membrane cap with luminophore for type 202613/...	00601917

Suitable display unit with controller

Type	**Part no.**
JUMO AQUIS 500 RS, type 202569/...	See data sheet 202569

Accessories for AQUIS 500 RS

Type	**Part no.**
Support pillar with pedestal base, cantilever arm, and chain	00398163
Additional cross clamp for support pillar, required to attach the immersion fitting	00605468
Pipe-mounted kit for AQUIS 500 RS	00398162
Weather protection canopy for AQUIS 500 RS	00398161
Setup program for JUMO AQUIS 500 on CD-ROM	00483602
PC interface TTL/RS232 converter	00301315
PC interface with USB/TTL converter, adapter (socket), and adapter (pins)	00456352

2 Identifying the device version

3.1 Mounting site and ambient conditions

A suspended fitting or an immersion fitting (particularly suitable for aeration basins) from JUMO should preferably be used for mounting the sensor in a basin, a tank, or a container.

An insertion location representative for the typical oxygen concentration should be planned for the immersion operation.

Our own flow fittings should preferably be used for mounting the sensor in the supply line for the medium being measured or in the bypass.

A mounting site for the fitting should be selected that enables easy access for any subsequent calibration. It must be ensured that support pillars and fittings are mounted securely and in a way that subjects them to no more than low levels of vibration.

Electromagnetic fields, caused by equipment such as motors and transformers, should be avoided. The ambient temperature at the mounting site and the relative humidity must correspond to the technical data.

CAUTION!
Damage to the sensor membrane due to chemicals.
A damaged membrane can lead to incorrect measurement results.
The sensor membrane should be prevented from coming into contact with organic solvents, acids, and peroxides.

CAUTION!
Damage to the sensor membrane due to mechanical influences.
A damaged membrane can lead to incorrect measurement results.
The sensor membrane should be protected from mechanical loads, such as an abrasive particle stream in the measurement medium.

3 Mounting

3.2 Sensor fittings

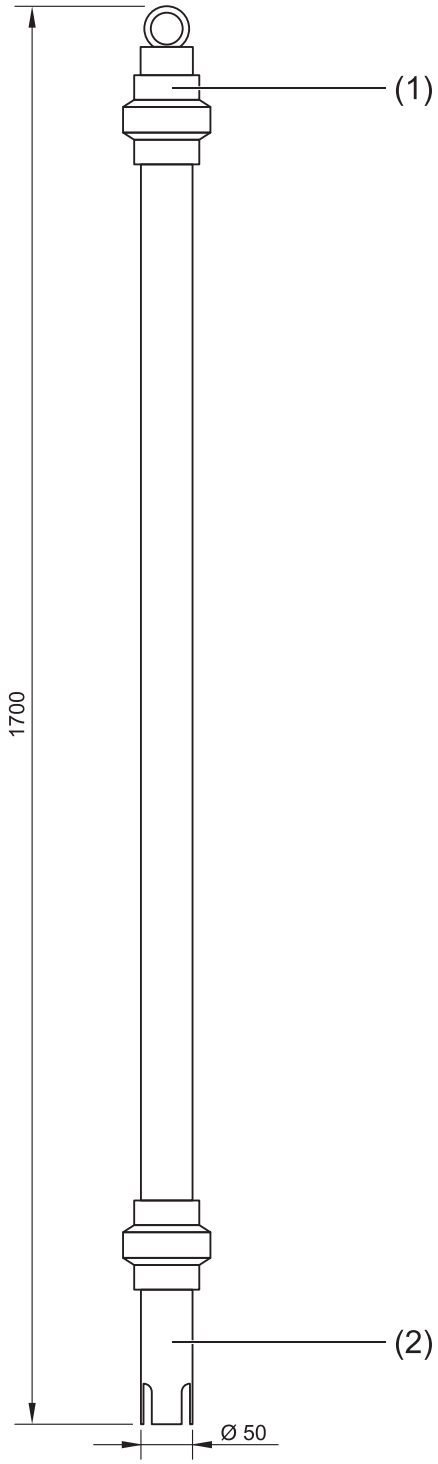
3.2.1 Suspended fitting

The suspended fitting holds the JUMO ecoLine O-DO oxygen sensor and is primarily used to take measurements from open basins. It can be positioned a considerable distance from the basin edge with the bracket suspended on a chain, for example. Different immersion depths are possible through the use of different immersion pipe lengths. Please note the following when planning your set-up:

- The fitting must be easily accessible to allow the sensor or the fitting itself to be maintained and cleaned regularly
- Do not allow the fitting (and thus also the sensor) to swing against and hit the basin edge
- When working with systems involving pressure and/or temperature, ensure that the fitting and sensor meet all relevant requirements
- The system designer must check that the materials in the fitting and sensor are suitable for the measurement (chemical compatibility, for instance)

Suspended fitting		
Materials	Flow body: Electrode holder:	PVC PVC
Admissible temperature	0 to 60 °C	
Pressure resistance	Up to 5 bar	
Total length	1,700 mm	
Part no.	00601881	

Suspended fitting



(1) Fastener with chain holder

(2) Sensor holder

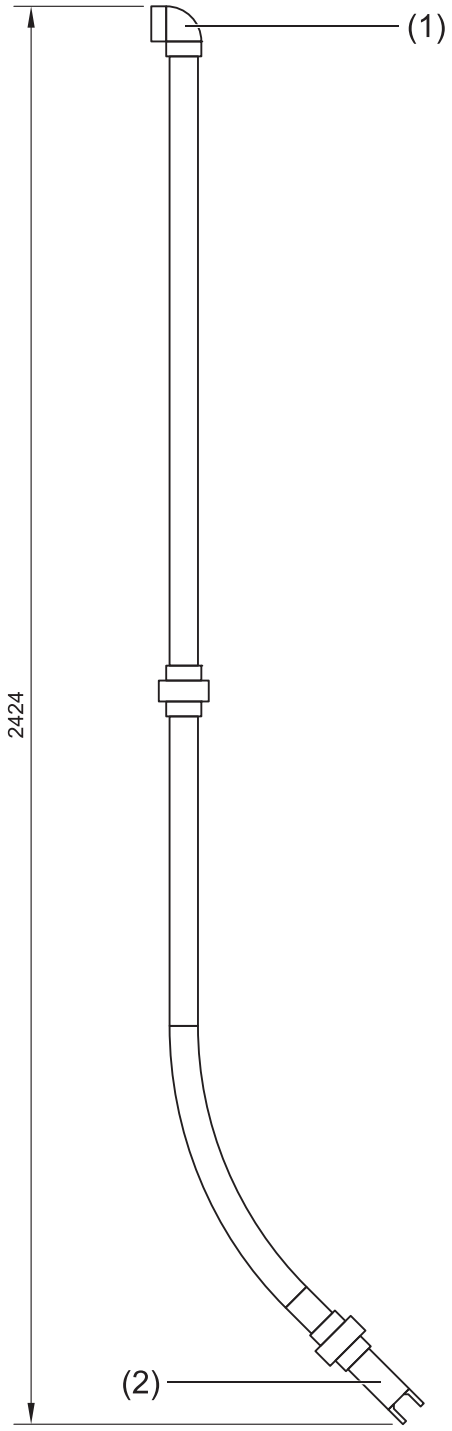
3.2.2 Immersion fitting

The immersion fitting holds the JUMO ecoLine O-DO oxygen sensor. It is curved at the bottom end and is primarily used for taking measurements from aeration basins. It protects the sensor and enables measurements at different immersion depths. The fitting is attached to a support pillar using a cross clamp. The following points should be taken into account during planning:

- The fitting must be easily accessible to allow the sensor or the fitting itself to be maintained and cleaned regularly
- Do not allow the fitting (and thus also the sensor) to swing against and hit the basin edge
- When working with systems involving pressure and/or temperature, ensure that the fitting and sensor meet all relevant requirements
- The system designer must check that the materials in the fitting and sensor are suitable for the measurement (chemical compatibility, for instance)

Immersion fitting		
Materials	Flow body: Electrode holder:	PVC PVC
Admissible temperature	0 to 60 °C	
Pressure resistance	Up to 5 bar	
Total length	2,424 mm	
Part no.	00605469	

Immersion fitting



(1) Angled fastener

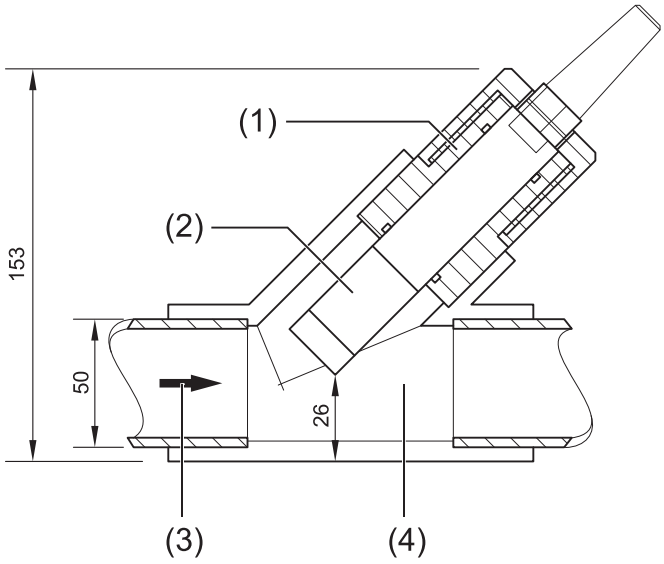
(2) Sensor holder

3.2.3 Flow fitting

The flow fitting holds the JUMO ecoLine O-DO oxygen sensor and is mounted directly in the supply line for the medium being measured or in the bypass. Its special design type ensures the correct inflow to the sensor, thus preventing incorrect measurements. Please note the following when planning your piping set-up:

- The fitting must be easily accessible to allow the sensor or the fitting itself to be maintained and cleaned regularly
- We recommend bypass measurements. It must be possible to remove the sensor through the use of shut-off valves
- When working with systems involving pressure and/or temperature, ensure that the fitting and sensor meet all relevant requirements
- The system designer must check that the materials in the fitting and sensor are suitable for the measurement (chemical compatibility, for instance)

PVC flow fitting, angled seat	
Material	PVC
Admissible temperature	0 to 60 °C
Pressure resistance	Up to 5 bar
Connection	Bonded socket joints
Process connection	T-piece DN 50, 45°
Part no.	00601909

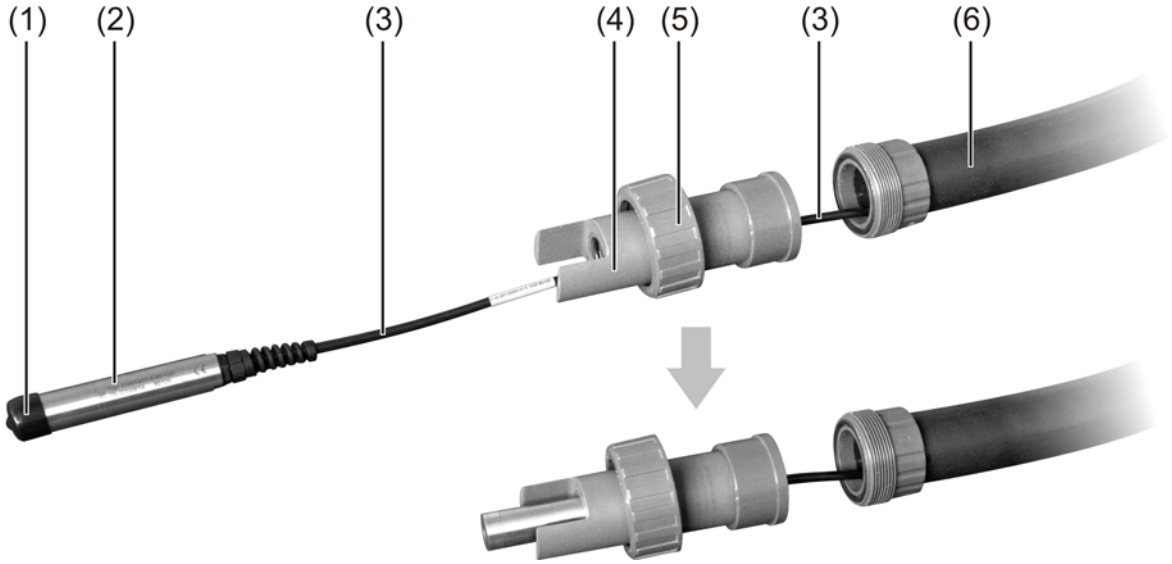


(1) Mounting adapter for sensor
(2) JUMO ecoLine O-DO sensor
(3) Flow direction
(4) T-piece, DN 50, 45, PVC

3.3 Insertion in fittings

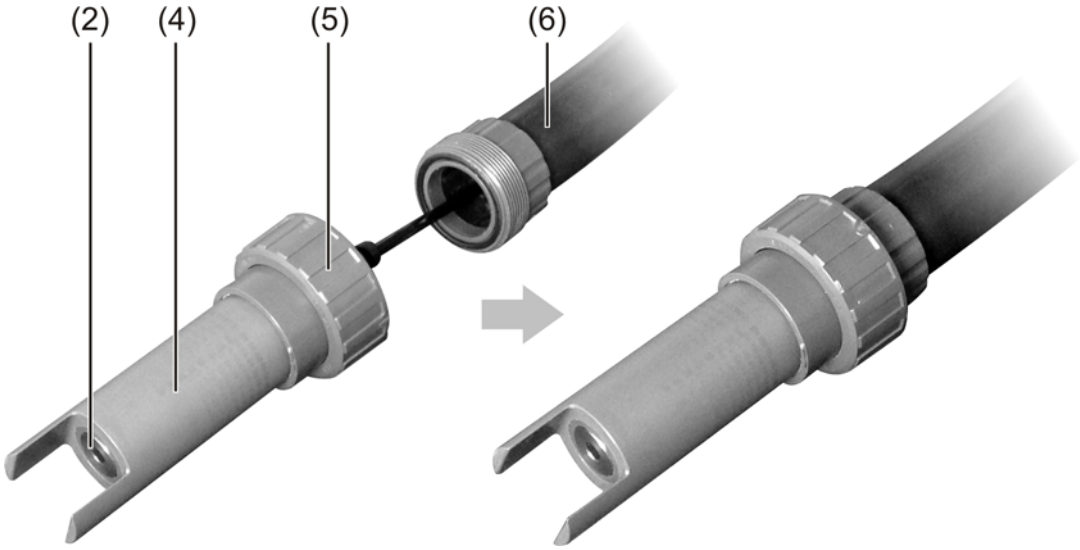
3.3.1 Insertion in the suspended or immersion fitting

The sensor is mounted on the relevant fitting as described below, using a **sensor holder**, which can be used both for the **suspended fitting** and for the **immersion fitting**:



Step	Activity
1	Guide the sensor cable (3) through the sensor holder (4) with union nut (5).
2	Insert the sensor cable into the fitting pipe (6) and completely feed through.
3	Remove the protective cap (1) on the sensor (2) and insert the sensor into the sensor holder.

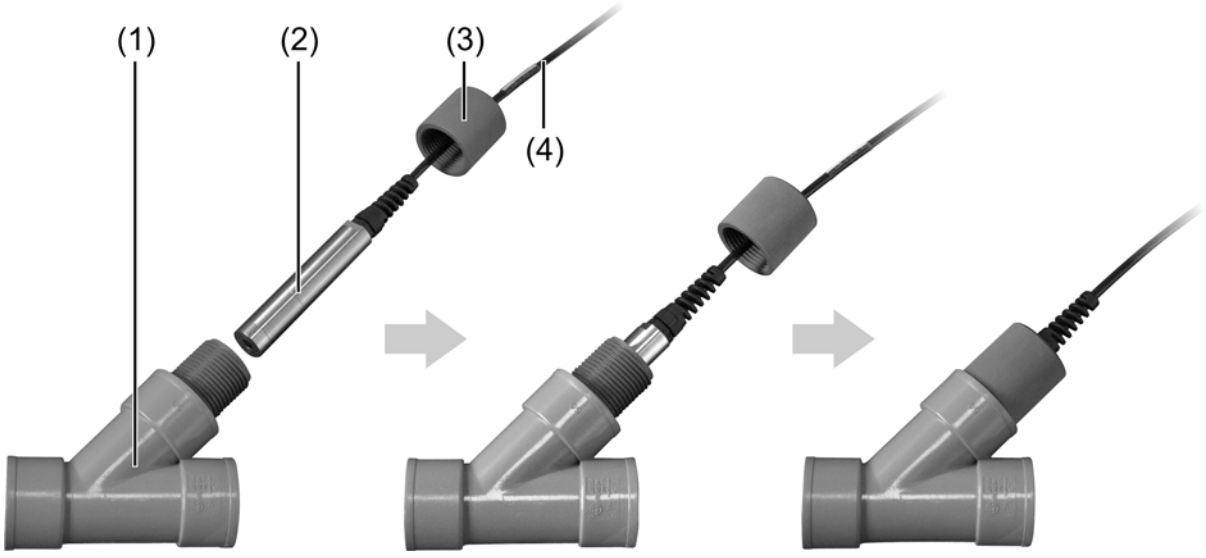
CAUTION!
Damage to the sensor membrane due to mechanical influences.
A damaged membrane can lead to incorrect measurement results.
When the sensor is inserted into the sensor holder, care should be taken to avoid mechanical load caused by pressing on the sensor membrane.



Step	Activity
1	Insert the sensor (2) into the sensor holder (4) as far as the stop.
2	Screw the sensor holder with the union nut (5) onto the fitting pipe (6) and tighten until handtight.

➥ The fitting can now be suspended or mounted at the operating location.

3.3.2 Insertion into the PVC flow fitting



Step	Activity
1	Unscrew the union nut (3) from the PVC flow fitting (1).
2	Guide the sensor cable (4) through the union nut on the fitting.

Step	Activity
3	Insert the sensor (2) into the fitting as far as the position shown in the middle image above.
4	Screw the union nut onto the fitting as far as the stop.

➥ The sensor is now located in the correct position inside the fitting.

3.4 Construction of a measuring point with support pillar

The support pillar with pedestal base, cantilever arm, chain, and weather protection canopy is designed for mounting on the edge of the basin. The JUMO ecoLine O-DO sensor is mounted in a suspended fitting or an immersion fitting as described previously. Thanks to the cantilever arm and the chain (suspended fitting) as well as the cross clamp (immersion fitting), a range of immersion depths and distances to the basin edge can be used. The weather protection canopy protects the display unit / controller from the effects of weather and atmospheric conditions. The pipe-mounted kit can be used to mount the display unit / controller to a pipe (Ø 30 to 50 mm). The following points should be taken into account during planning:

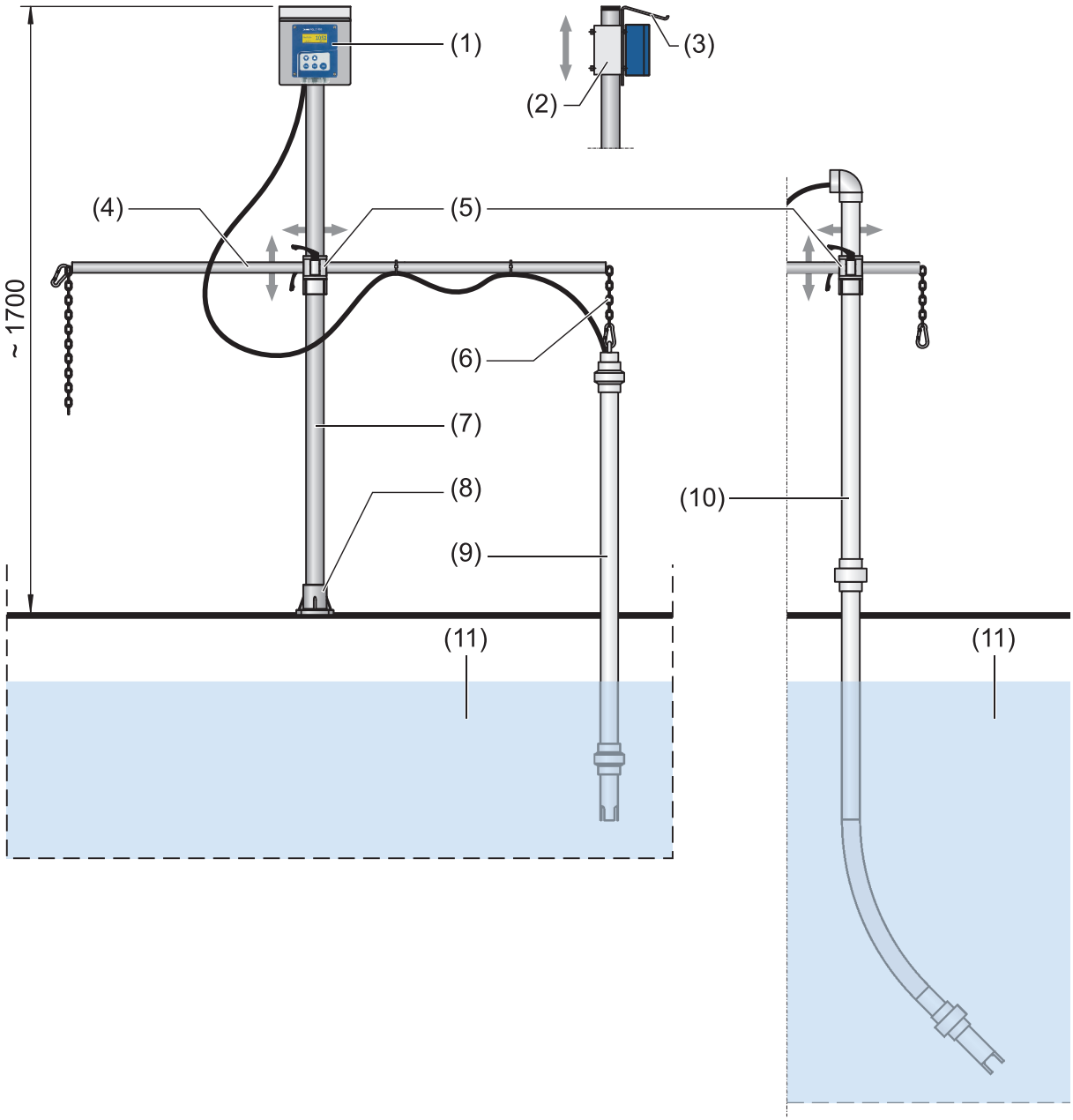
- The fitting must be easily accessible to allow the display unit / controller or the fitting itself to be maintained and cleaned regularly
- Do not allow the fitting (and thus also the sensor) to swing against and hit the basin edge.
- Avoid direct sunlight on the display unit / controller.
- The system designer must check that the materials in the fitting and sensor are suitable for the measurement (chemical compatibility, for instance).

Materials for the measuring point components

Support pillar with pedestal base, cantilever arm, and chain		
	Material	**Part no.**
Support pillar	Stainless steel	00398163
Pedestal base	Diecast aluminium	
Cantilever arm	Stainless steel	
Chain	Stainless steel	

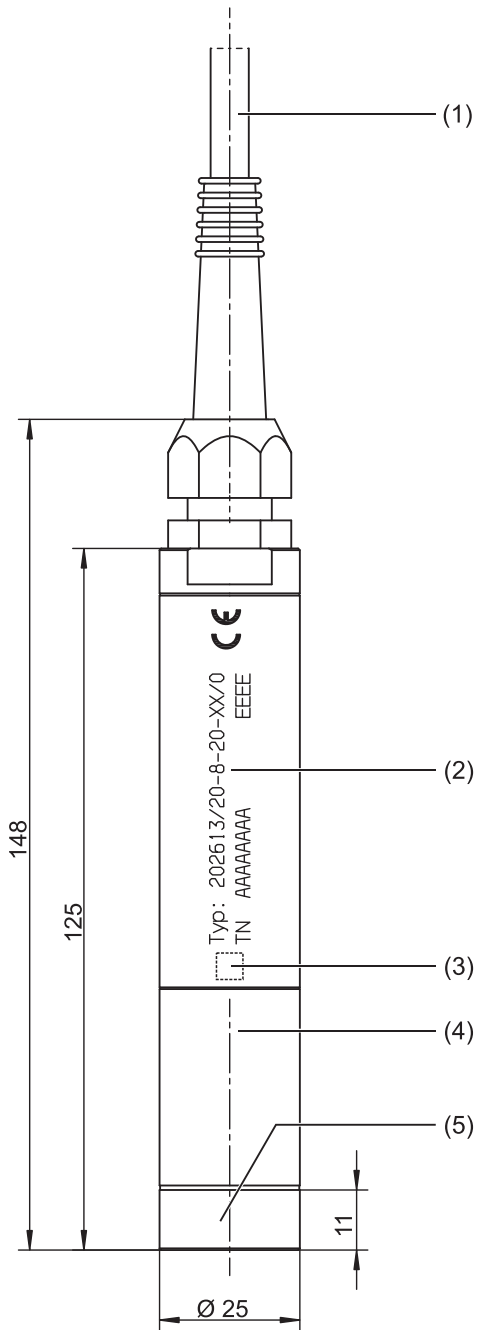
Pipe-mounted kit	Stainless steel	00398162
Weather protection canopy	Stainless steel	00398161
Suspended fitting	Chapter 3.2.1 "Suspended fitting", page 14	00601881
Immersion fitting	Chapter 3.2.2 "Immersion fitting", page 16	00605469
Cross clamp	Diecast aluminium	00605468

Measuring point set-up



(1) JUMO AQUIS 500 RS display unit / controller
(2) Pipe-mounted kit
(3) Weather protection canopy
(4) Adjustable cantilever arm
(5) Adjustable cross clamp
(6) Chain
(7) Support pillar
(8) Pedestal base
(9) Suspended fitting
(10) Immersion fitting
(11) Basin/tank/container

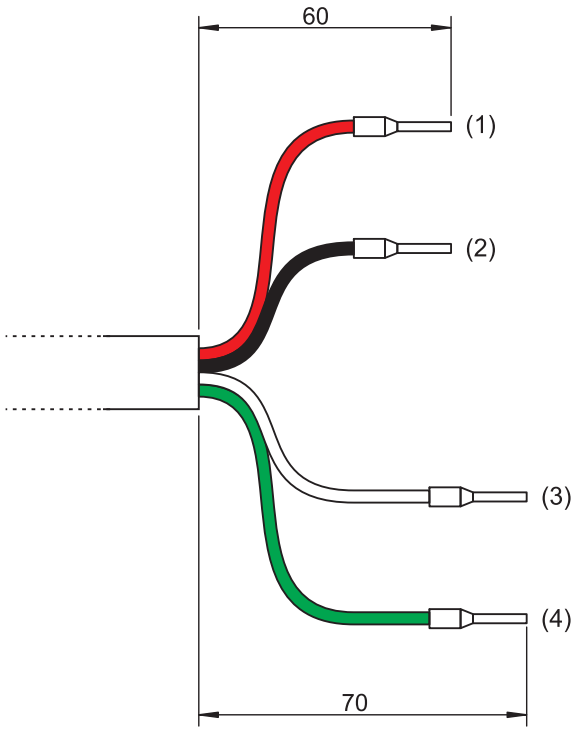
3.5 Sensor dimensions



(1) RS485 connection cable
(2) Laser engraving indicating sensor type and part no.
(3) QR code
(4) Sensor body with evaluation electronics
(5) Removable membrane cap with luminophore

4.1 Sensor connection cable

The sensor is equipped with a hardwired connection cable, available in a length of either 10 m or 30 m. The electrical connection with the display unit / controller is established without the need for soldering, via four lines with ferrules.



(1)Voltage supply + (red)
(2)Voltage supply - (black)
(3)RS485 + (white)
(4)RS485 - (green)

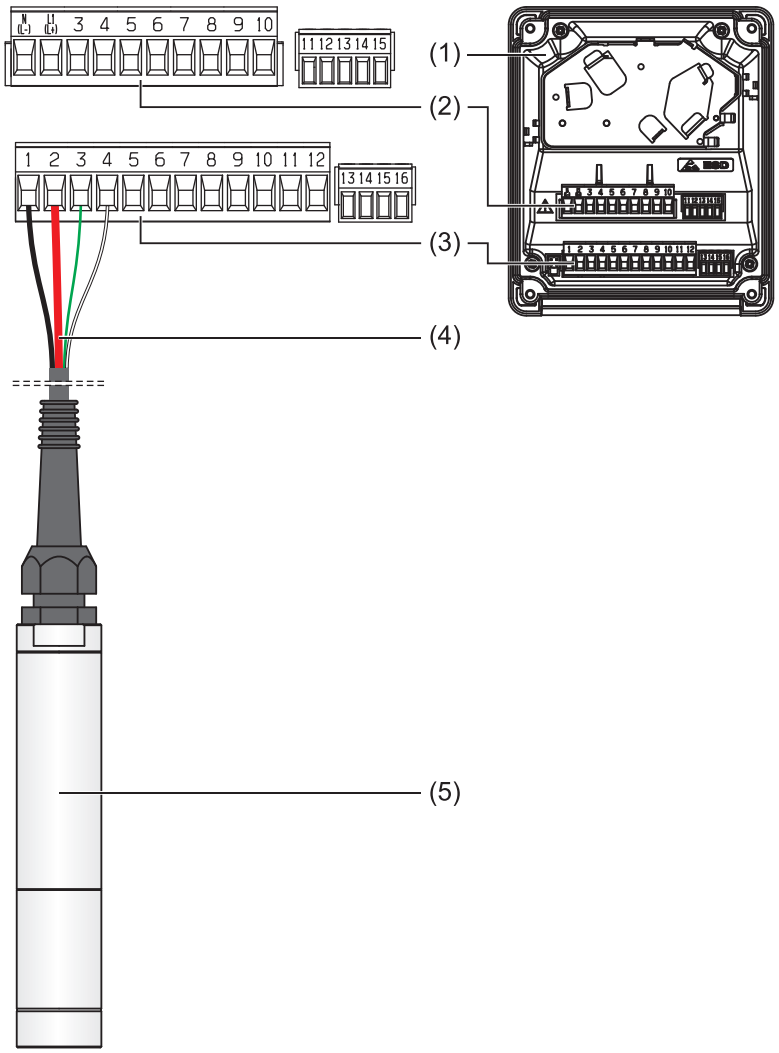
NOTE!
When the sensor is used in a JUMO suspended, immersion, or flow fitting, the electrical connection should only be made following insertion into the fitting, as the connection cable for the sensor is firmly attached to the sensor and must first be guided through parts of the fitting.

4 Electrical connection

4.2 Connection examples

4.2.1 Connection to the display unit with JUMO AQUIS 500 RS controller

NOTE!
The process of starting up the JUMO ecoLine O-DO sensor on the JUMO AQUIS 500 RS is described in detail in the operating manual B 202569.0.



(1) JUMO AQUIS 500 RS display unit / controller
(2) Terminal strip 1
(3) Terminal strip 2
(4) Sensor connection cable
(5) JUMO ecoLine O-DO (optical sensor for dissolved oxygen) with hardwired 4-conductor connection cable

Terminal assignment for the sensor connection cable on terminal strip 2		
Conductor color	Function	Terminal
Black	DC 5 V -	1
Red	DC 5 V +	2
Green	RS485 -	3
White	RS485 +	4

5.1 Initial startup

Once the sensor has been inserted into a fitting, the electrical connection has been established to a display unit, and the parameterization has been carried out on the display unit, the sensor is ready for initial startup.

NOTE!
The sensor will have been checked to ensure correct function and calibrated at the production plant, and it is delivered ready for operation. It is therefore not necessary to carry out calibration prior to initial startup.

The following points should be taken into account when carrying out initial startup on the sensor:

- Although it is not strictly required according to the measurement principle, a turbulent incoming flow is advisable to facilitate self-cleaning of the sensor.
- In order to ensure optimum, fault-free measurement, air bubbles under the sensor membrane should be avoided.
- During the initial startup of the sensor, following insertion into the measurement medium, you should wait until constant temperature has been reached (isothermal conditions).

NOTE!
Optical oxygen sensors do not carry out any continuous measurements. The measuring procedures are activated by the connected display unit / controller and typically last approx. one second. **To extend the operating life of the optical membrane**, the measurement interval can be set to a value in the range 1 to 60 seconds in the AQUIS 500 RS display unit / controller (10 seconds in the delivery status).

CAUTION!
Damage to the sensor membrane due to chemicals.
A damaged membrane can lead to incorrect measurement results.
The sensor membrane should be prevented from coming into contact with **organic solvents, acids, and peroxides**.

CAUTION!
Damage to the sensor membrane due to mechanical influences.
A damaged membrane can lead to incorrect measurement results.
The sensor membrane should be protected from mechanical loads, such as an **abrasive particle stream** in the measurement medium.

CAUTION!
Cross sensitivity of the sensor
The presence of chlorine can distort the measurement result (measured value displayed may be too high).
Check whether chlorine is present.

5.2 Calibration interval

The JUMO ecoLine O-DO is an optical sensor, for which a calibration frequency of at least once a year is recommended, depending on the operating conditions.

After the membrane cap is replaced, calibration should be carried out.

It is also advisable to regularly clean the sensor in a water-sulphite solution with a sulphite concentration of < 2 %, and to subsequently check the zero point (0 % saturation).

CAUTION!
Damage to the sensor membrane due to chemicals.
A damaged membrane can lead to incorrect measurement results.
The sensor membrane must not be in contact with the sulphite solution for longer than one hour.

If the zero point is moved, a complete two-point calibration must be carried out.

5.3 Calibration

In general terms, there are two calibration methods for the sensor, **end value calibration** and **two-point calibration**.

NOTE!
The process of calibrating the sensor with the JUMO AQUIS 500 RS display unit / controller is described in detail in the operating manual B 202569.0.

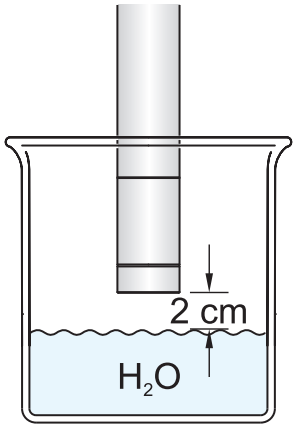
5.3.1 End value calibration

With end value calibration, the slope of the sensor is calibrated beyond the defined state of 100 % oxygen saturation. This state can in principle be achieved in two ways:

- By positioning the sensor in water vapor-saturated air (for example, directly over a water surface).
- By positioning the sensor in air-saturated water (air is directed through water until the water is saturated with it).

NOTE!
As the production of air-saturated water requires a high level of effort and is difficult to reproduce, the easier process of calibration in water vapor-saturated air is recommended for the operational calibration.

The illustration below shows the correct positioning of the sensor in water vapor-saturated air:



To achieve successful calibration, the following points must be taken into account:

- The sensor must be kept dry during the calibration process. Drops of water adhering to the sensor membrane could distort the measurement result.
- The air pressure and temperature must remain constant during the calibration.

5.3.2 Two-point calibration

With two-point calibration, the zero point and slope of the sensor are calibrated. This calibration method offers the greatest possible level of accuracy and is particularly recommended for measurements of small oxygen concentrations. It is carried out as follows:

- Sensor is immersed in a water-sulphite solution (sulphite concentration < 2 %) in order to determine the zero point (0 % saturation)

CAUTION!
Damage to the sensor membrane due to chemicals.
A damaged membrane can lead to incorrect measurement results.
The sensor membrane must not be in contact with the sulphite solution for longer than one hour.

- Washing and drying the sensor
- Sensor slope is determined by positioning in oxygen-saturated environment (100 % saturation) as described under Chapter 5.3.1 "End value calibration", page 29.

5.4 Maintenance

The following points should be taken into account during ongoing operation of the sensor:

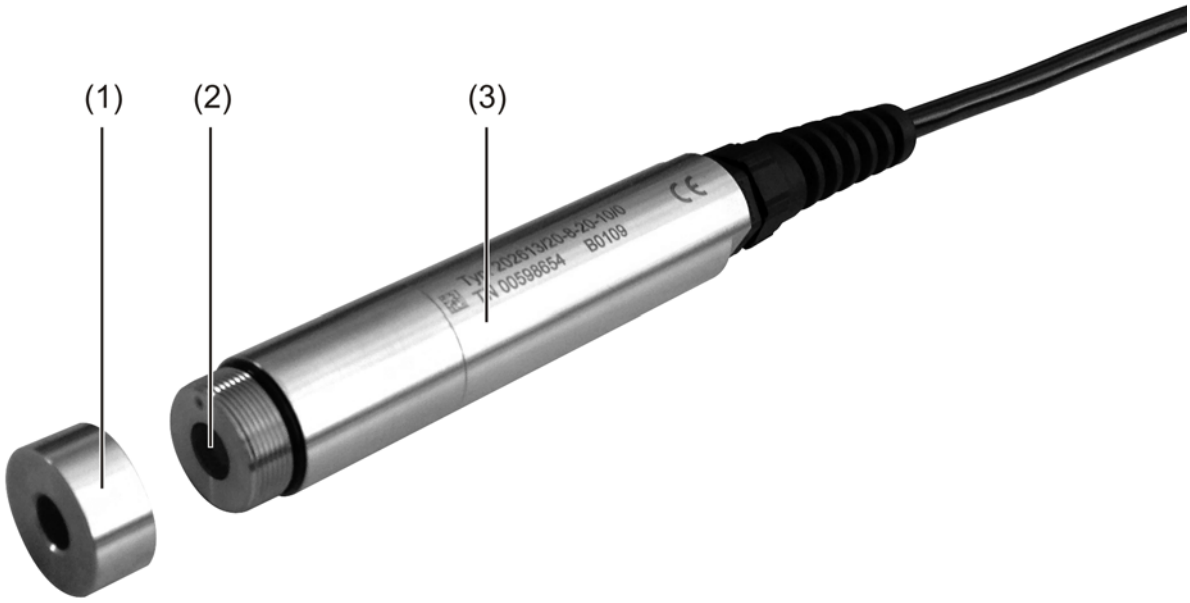
- The sensor must always be kept clean, particularly in the area around the optical membrane. The presence of a biofilm on the membrane cap can lead to measuring errors.
- A dirty membrane should be cleaned with warm, soapy water. A soft sponge should be used for cleaning (not an abrasive scouring sponge).
- If the sensor is put out of operation, it should be rinsed prior to being stored, and the protective cap should be fitted.

5.4.1 Changing the membrane cap

If it is necessary to move the measured value during operation (offset), the sensor should be cleaned and calibrated.

NOTE!
The process of calibrating the sensor with the JUMO AQUIS 500 RS display unit / controller is described in detail in the operating manual B 202569.0.

If cleaning and subsequent calibration cannot successfully be carried out, the unit consisting of membrane cap with luminophore must be replaced as described below.



Step	Activity
1	Unscrew the stainless steel membrane cap with luminophore (1) from the sensor body with measurement electronics (3). **When doing so, ensure that the optical window (2) of the sensor is not touched.**
2	Remove the replacement membrane (part no. 00601917) from the opaque protective film and screw onto the sensor body. **When screwing on, ensure that the optical window of the sensor is not touched.**
3	Recalibrate the sensor.

5.4.2 Storage

The following points should be taken into account when storing the sensor:

- It is important that the optical membrane retains humidity. The best way to ensure this is to store it in a protective box with an adsorber (such as a piece of cotton wool).
- If the membrane dries out, the sensor should be placed in a water bath or in an aqueous process medium to rehydrate (duration: approx. 12 hours).

CAUTION!
Reduction in the operating life of the sensor's optically active coating (luminescent coating) due to sunlight.
A damaged luminescent coating leads to incorrect measurement results, for example when using with a controller for incorrect dosing.
The sensor membrane, and with it the luminescent coating, should be protected from any unnecessary exposure to sunlight.

5 Startup and maintenance

6.1 Specifications

Measuring principle	Optical measurement according to the principle of luminescence quenching
Measurands	Dissolved oxygen Temperature
Measuring ranges	0.00 to 20.00 mg/l 0.00 to 20.00 ppm 0 to 200 % SAT
Resolution	0.01
Accuracy	±0.1 mg/l ±0.1 ppm ±1 % SAT
Response time	t_{90} < 60 s
Luminophore operating life (DO Disk)	Approx. 2 years depending on the sampling rate of the display unit and the process conditions
Temperature compensation	Via integrated NTC, in the range from 0 to +40 °C
Air pressure compensation	500 to 1100 hPa (entered on display unit / controller)
Salinity compensation	0 to 60 g/kg (entered on display unit / controller)
Max. sampling rate for measured values	1 Hz

6.2 Interfaces

Signal interface	RS485 interface with Modbus RTU protocol[1]

[1] Only in connection with suitable Modbus master devices, see chapter 6.6, "Display unit / controller".

6.3 Electrical data

Voltage supply	5 to 12 V
Current consumption	
Standby	25 µA
RS485 on average	4.4 mA (at 1 measurement/s)
Current pulse (starting current peak)	100 mA
Connection	4-conductor shielded cable, open conductor ends with ferrules
Electromagnetic compatibility	acc. to EN 61326-1
Interference emission	Class A
Interference immunity	Industrial requirements[1]

[1] Sensor is not protected against surge voltages.

6 Technical data

6.4 Ambient conditions

Inflow	An inflow is not required, but is useful and recommended to prevent a build-up of dirt
Admissible storage temperature	-10 to +60 °C
Admissible ambient temperature	-5 to +60 °C
Admissible process temperature	0 to +50 °C
Admissible process pressure	Max. 5 bar

6.5 Case

Dimensions	Ø 25 mm × 146 mm
Weight	827 g (sensor including 10 m cable) 1,984 g (sensor including 30 m cable)
Admissible cable length	Max. 30 m
Material	Sensor shaft and membrane cap: stainless steel 316L Cable bushing: polyamide Membrane: silicone
Precautionary measures when using the product	The membrane is susceptible to chemicals (organic solvents, acids, peroxides) and mechanical influences (impacts, abrasion, cracks)
Protection type	IP68

6.6 Display unit / controller

	The JUMO AQUIS 500 RS, type 202569/... is suitable for use as a display unit / controller, see data sheet 202569

JUMO GmbH & Co. KG

Street address:
Moritz-Juchheim-Straße 1
36039 Fulda, Germany
Delivery address:
Mackenrodtstraße 14
36039 Fulda, Germany
Postal address:
36035 Fulda, Germany
Phone: +49 661 6003-0
Fax: +49 661 6003-607
E-mail: mail@jumo.net
Internet: www.jumo.net

JUMO Instrument Co. Ltd.

JUMO House
Temple Bank, Riverway
Harlow - Essex CM20 2DY, UK
Phone: +44 1279 63 55 33
Fax: +44 1279 63 52 62
E-mail: sales@jumo.co.uk
Internet: www.jumo.co.uk

JUMO Process Control, Inc.

6733 Myers Road
East Syracuse, NY 13057, USA
Phone: 315-437-5866
1-800-554-5866
Fax: 315-437-5860
E-mail: info.us@jumo.net
Internet: www.jumousa.com