Dissolved Oxygen

OPERATING INSTRUCTIONS

SUP-D0-7016

2.2 Scope of Delivery

The shipment contains the following components:

- Sensor
- Operating Instructions
- Accessories (if applicable)

Keep the original packaging in case the device needs to be returned for maintenance or repairs.

2.3 Measurement Principle and Design

Stainless steel optical sensing cap

cap seal

Cable bushing

7 Technical Data

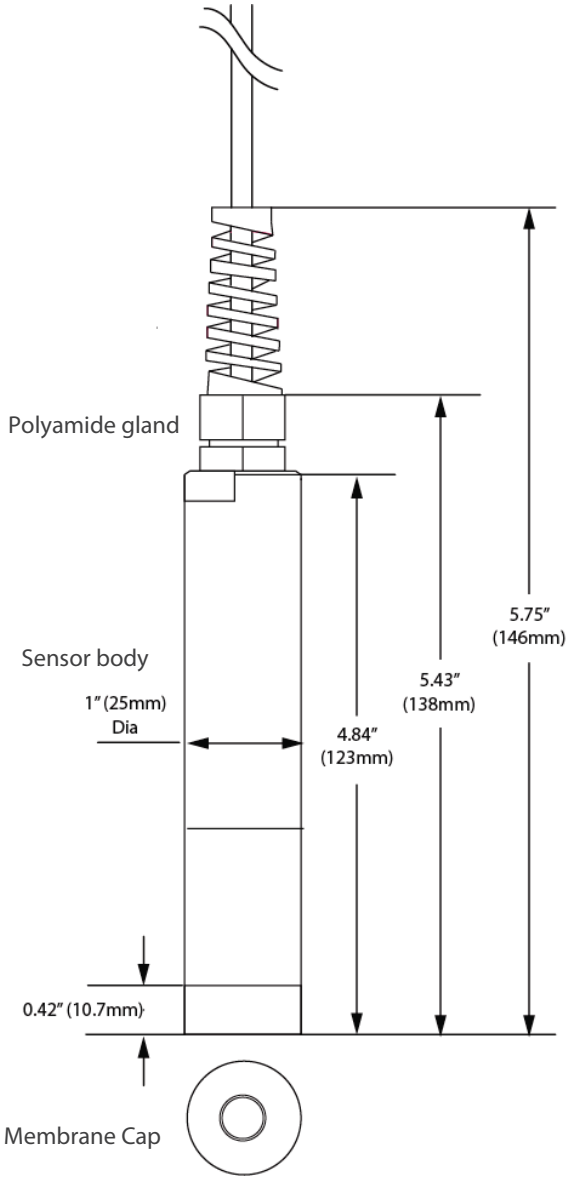
7.1 Technical Specifications

Measurement principle		Luminescence
Parameter		Dissolved Oxygen
Measurement range		0...20 mg/L 0...20 ppm 0...200 %
Measurement accuracy		± 0.1 mg/L ± 0.1 ppm ± 1 %
Resolution		0.01
Response time		90 % of the value in less than 60 seconds
Measurement interval		> 5 s
Inflow Velocity		no movement necessary
Temperature Compensation		Via NTC (compensation active for temperature lower than 0 °C)
Measurement range (temperature)		0...50 °C
Resolution (temperature)		0.01 °C
Accuracy (temperature)		0.5 °C
Membrane Cap		No cross-sensitivity with : pH 1 – 14 ; CO2, H2S, SO2 Cross-sensitivity to Organic solvents, such as acetone, toluene, chloroform or methylene chloride, Chlorine gas
Material		Standard Version in passivated Stainless steel 316L body, strainer and screw, For Seawater application Version in Titanium body, strainer and screw, Cable : polyurethane jacket Steam gland : Polyamide Patch with active material (black) – Membrane : Optical isolation silicon
Dimensions (L x Ø)		146 mm x 25 mm
Weight	stainless steel	~ 450 g
	titanium	~ 300 g
Interface		RS-485 (Modbus RTU)
Power consumption		1 W
Power supply		12 V (± 10 %)
Sensor cable		10 m(33ft)
Calibration/maintenance interval		2 years
Warranty		1 year

INSTALLATION

Max. pressure	5 bar
Protection type	IP68
Sample temperature	0...+50 °C
Ambient temperature	0...+50 °C
Storage temperature	-10...+60 °C

7.2 External Dimensions



Modbus RTU

Defaults: Address :10
Data: 8 bits, no parity, 2 stop bits
Baud Rate: 9600
Slave ID: 10
32 Bit Float

Parameters

Number	Parameter	Unit
1	Temperature	°C
2	Oxygen saturation	%
3	Oxygen concentration	mg/l
4	Oxygen concentration	ppm

Data types

Name	Register Count	Format
Uint16	1	Unsigned 16 bit integer. Value range: 0x0000 - 0xFFFF
Bits16	1	Register contains a bitmask, where every bit has a special meaning. This is most often used for parameter selection, where Bit 1 corresponds to the temperature and the following bits to parameter 1, 2, 3 and 4
Bits32	2	A bit vector using 32 bits, same as Bits16 but spanning two registers
Uint32	2	Unsigned 32 bit integer. Value range: 0x00000000 - 0xFFFFFFFF
Float	2	IEEE 754 32 bit floating point value
ASCII	1+	A sequence of ascii characters with two 8 bit characters stored in each 16 bit register
Date	8	A date in the form mmhhddMMYYYY, where mm is the minute, hh the hour, dd the day, MM the month and YYYY the year

All multi-register datatypes are stored in big-endian word order. That is the word with the most significant bits is stored at the lesser register address.

Supported Modbus functions

These Modbus function codes are supported by the sensor:

Name	Code	Description / Use
Read multiple registers	0x03	Read the serial number, firmware version and of course measurement data
Write single register	0x06	Write a value in one register
Write multiple registers	0x10	Write data into a sequence of registers
Report slave ID	0x11	Get the sensor identification

Default Slave Address

The factory default setting of the slave address is 10 (0x0A).

Register description

The following table describes the Modbus register mapping:

Designation	R/W	Register	Data type	Description
Start measurement	W	1	Bits16	Start a measurement for a set of parameters. Value 31(0x1F)
Restore default calibration	W	2	Bits16	Restore the default calibration coefficients. Value 31(0x1F)
Reset standard of temporary calibration	W	76	Int16	Write 1 into this register to perform the reset
Temperature	R	83	Float	Current temperature measurement in °C
Oxygen saturation	R	85	Float	Measured oxygen saturation in %
Dissolved oxygen	R	87	Float	The concentration of dissolved oxygen in mg/l
Dissolved oxygen	R	89	Float	The concentration of dissolved oxygen in ppm
Modbus slave address	RW	163	Int16	Modbus slave address from 1 to 247
Measurement duration	R	164	Int16	Approximate time to obtain all measurements in ms
Averaging	RW	170	Int16	Averaging for all values except temperature. Values from 1 to 50 are allowed
Parity and Stop Bits	RW	188	Int16	0: Default: 2 stop bits (no parity) 1: Even parity and 1 stop bit 2: Odd parity and 1 stop bit
Temporary coefficients	W	332	Bits32	Each calibration coefficient (Offset, Scaling) has a corresponding bit in this two registers. Bit 1: Offset of temperature sensor Bit 2: Scaling of temperature sensor Bit 3: Offset of oxygen sensor Bit 4: Factory value Bit 5: Factory value Bit 6: Scaling of oxygen sensor
Temperature Offset	RW	512	Float	Write the temperature offset into this register during calibration
Temperature Scaling	RW	514	Float	Write the temperature scaling into this register during calibration
Oxygen Offset	RW	516	Float	Write the oxygen offset into this register during calibration
Oxygen Scaling	RW	522	Float	Write the oxygen scaling into this register during calibration
Operator Name of Temperature	W	638	ASCII[8]	Name of the operator who calibrated the temperature sensor (8 registers for 16 ascii characters)
Date of Temperature Calibration	W	646	Date	Write the current date at the end of the temperature calibration into this registers (see "Data types" section)
Operator of Oxygen Calibration	W	654	ASCII[8]	Name of the operator who calibrated the oxygen sensor (8 registers for 16 ascii characters)
Date of Oxygen Calibration	W	662	Date	Write the current date at the end of the oxygen calibration into this registers (see "Data types" section)
Sensor identifier	R	3328	ASCII[16]	Sensor identifier with serial number (16 registers with 32 characters)

Calibration

To calibrate the sensor using Modbus perform the following steps. During the whole time you must trigger measurements and read the results from the sensor.

1. Clear all bits (write 0x0000) for temporary coefficients in registers 332/333.
2. Write a value of 1 into register 76 in order to reset the temporary calibration.
3. Set the averaging in register 170 to 25.
4. **Offset calibration (optional):** Put the sensor for at least 5 minutes into sodium disulfite (during this period keep the sensor in motion all the time!) and wait until the readings have stabilized.
5. **Only when offset calibration is performed:** Write the target value of 0 as float value into registers 516/517 and then set Bit 3 in register 332 in order to use the temporary offset.
6. Put the probe into clean water for at least 10 minutes. Then remove it from the water and hold it into the air. Meanwhile frequently start and read the measurement.
7. Within two minutes after removing it from the water, write the target value of 100 (%) as float value into registers 522/523. Meanwhile frequently start and read the measurement.
8. Tell the sensor to use this temporary value by setting Bit 6 in register 332.
9. Verify the new calibration.
10. In order to apply the new calibration you must write a name into the registers beginning at address 654 and the current date into the registers beginning at address 662 in one single write multiple register request frame.
11. When you want to drop the calibration, write a value of 1 into register 76 in order to perform a reset of the temporary values.
12. Clear all bits for temporary coefficients in registers 332/333