RDO-406-S Online Fluorescence Method for Dissolved Oxygen

Sensor User Manual

Yantai Chemins Instrument Co.,Ltd

Hangzhou Chemins Sensing Technology Co., Ltd.

en.www.chemins-tech.com

Tel: +86 535-3463801/571-89870583

Add: No.96 Chushan Dong Road, Zhaoyuan City, Shandong Province
No 908, 17 Building, Singapore Science Park, Qiantang District, Hangzhou City, Zhejiang Province

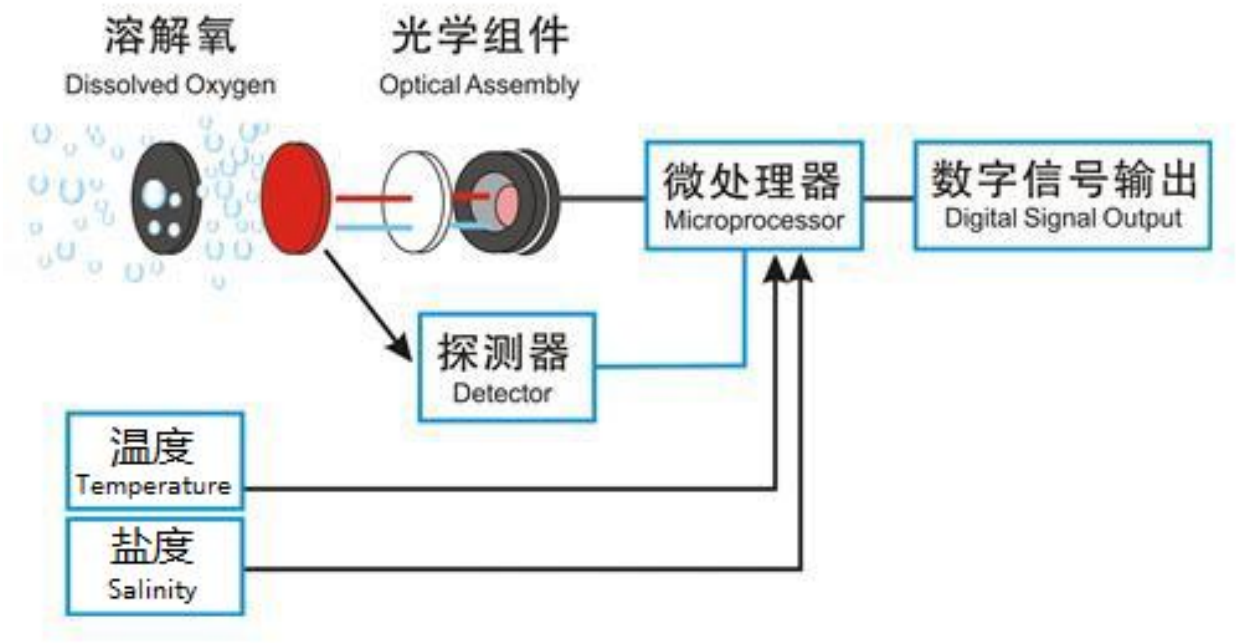
User Notes

- Please read this manual in detail before using it and save it for reference.
- Please abide by the operating procedures and matters needing attention in this manual.
- When receiving the instrument, please carefully open the package and check whether the instrument and accessories are damaged by shipping. If any damage is found, please inform the manufacturer and distributor immediately and keep the package for return for processing.
- When the instrument fails, please do not repair it on your own, please contact the maintenance department of the manufacturer directly.

Content

Ⅰ Operational Principle

The RDO-406 integrated online fluorescence dissolved oxygen sensor is designed based on the quenching principle of excitation fluorescence by specific substances in physics. When the excitation light is irradiated on the fluorescent material on the surface of the fluorescent film head, the fluorescent material is excited and emits fluorescence, and the extinction time of the fluorescence is affected by the concentration of oxygen molecules on the surface of the fluorescent film head. The phase difference between fluorescence and excitation light can be detected and compared with the internal calibration curve to calculate the concentration of oxygen molecules, and output the final value after temperature and salinity compensation.



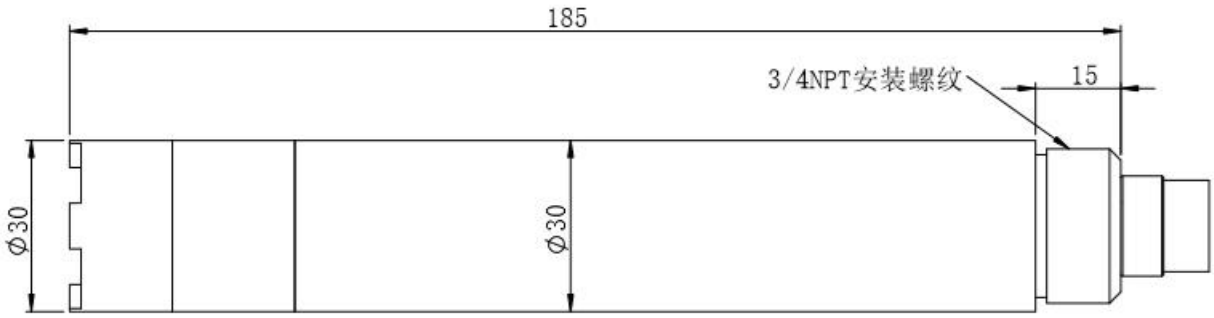
- No electrolyte required, no polarization
- No need to consume oxygen, not affected by flow rate
- Built-in temperature sensor, automatic temperature compensation
- Built-in salinity compensation, flexible parameter setting
- Not interfered by chemicals such as sulfides
- Small drift, fast response, more accurate measurement
- Longer service life and lower cost of use
- The fluorescent membrane head is easy to replace and easy to maintain
- RS-485 interface, Modbus/RTU protocol, 4-20mA current output
- Low power consumption and anti-jamming design

Ⅱ Technical performance and specifications

1. Technical parameter

model	RDO-406-S
Measurement principle	Fluorescence
Measuring range	0～20.00mg/L (0～200% saturation, 25℃)
Resolution	0.01mg/L，0.1℃
precision	±2%F.S.，±0.3℃
Temperature compensation	Automatic temperature compensation (Pt1000)
output method	RS-485(Modbus/RTU),4-20mA
working conditions	0～45℃、<0.2MPa
storage temperature	-5～65℃
Installation method	Immersion installation
cable length	5 meters, other lengths can be customized
Power consumption	0.2W@12V
power supply	12～24VDC
Protection class	IP68
calibration	Two point calibration
Fluorescent film head life	1 year (under normal use)
shell material	316L stainless steel

2. Dimensional drawing



Note: The sensor connector is m16-5 core waterproof connector male.

Ⅲ Installation and electrical connection

1. Install

The sensor should be immersed below the liquid level for fixed installation. When installing and using, avoid bumping or scratching the surface of the fluorescent membrane head, and the fluorescent membrane head should avoid being attached to the bottom of the water by sediments. The protective rubber cover should be removed during use.

2. Electrical connection

The cable is a 5-core shielded wire, and the wire sequence definition:

- Red wire—power wire (12～24VDC)
- Black wire - ground wire (GND)
- Blue wire - 485A
- Green Line - 485B
- Yellow wire - current output (if not used, can be left open)

Check the wiring sequence carefully before powering on to avoid wrong wiring

Wiring instructions: Considering that the cables are immersed in water (including seawater) or exposed to the air for a long time, all wiring points are required to be waterproofed, and the user cables should have certain anti-corrosion capabilities.

Ⅳ Maintenance

1. Maintenance schedule and methodology

1.1 Maintenance schedule

Unlike the electrochemical dissolved oxygen probe technology, the fluorescent dissolved oxygen membrane head does not consume oxygen and does not require frequent cleaning (except when used in viscous liquids).

Maintenance Tasks	Recommended Maintenance Frequency
Clean the sensor	Wash every 30 days
Check the sensor and fluorescent membrane head for damage	Check every 30 days
Replacing the fluorescent membrane head	Replace once a year
Calibrate the sensor (if required by the	According to the maintenance schedule required by

Note: The maintenance frequency in the above table is only a suggestion, please ask the maintenance personnel to clean the sensor according to the actual use of the sensor; however, the replacement frequency of the fluorescent membrane head is recommended to be once a year.

1.2 Maintenance method

a) Sensor outer surface: Rinse the outer surface of the sensor with clean water. If there is still dirt remaining, please wipe it with a damp soft cloth. For some stubborn dirt, you can add some household detergent to the water to clean it.
b) Surface of fluorescent membrane head: If there is dirt on the surface of fluorescent membrane head, please rinse with clean water or wipe gently with a soft cloth. When cleaning, pay attention to avoid scratching the measurement area and affect the measurement accuracy.

a) Inside of the fluorescent membrane head: Generally, no cleaning is required. If moisture or dust enters the interior of the fluorescent membrane head, the cleaning steps are as follows:
- Unscrew the fluorescent membrane head;
- Rinse the inner surface of the fluorescent membrane head and the sensor optical window with clean water;
- For oily dirt, it can be cleaned with household detergent;
- Gently wipe off moisture with a clean, lint-free cloth and allow to dry;
- Reinstall the fluorescent membrane head.

b) Check the cable of the sensor: the skin and root of the cable should not be damaged; the connection should not be submerged in water; the cable should not be taut when the sensor is installed normally, otherwise the internal wire of the cable will be easily broken, causing the sensor to not work normally.
c) Inspect the sensor housing for damage due to corrosion or other reasons.
d) Daily preservation of the fluorescent membrane head: When not in use, cover the rubber

protective cover with a wet sponge inside to keep the surface of the fluorescent membrane head in a wet state. If the surface of the measuring area of the fluorescent membrane head of the sensor is dry for a long time, measurement errors or data instability will occur, so it needs to be soaked in water for 48 hours before use.

2. Frequently questions

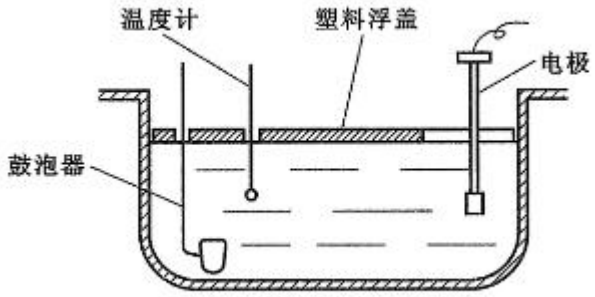
Wrong	Probable cause	Solution
The operating interface cannot connect or does not display the measurement results	Error connecting controller to cable	Reconnect the controller and cable
	Cable failure	Please contact us.
	The fluorescent cap is not tightened or damaged	Refit and tighten the fluorescent cap or replace the fluorescent cap.
The measured value is too high, too low, or the numerical value remains unstable.	The outer surface of the fluorescent cap is attached to the outer object	Clean the outer surface of the fluorescent film head and agitate the film head during measurement.
	The fluorescent film head is damaged	Replace the fluorescent cap
	The fluorescent membrane head has exceeded its service life	
Temperature measurement changes slowly	The temperature measurement area (stainless steel case) is adhered by foreign objects	Use a soft brush to gently remove the attachments

3. Calibration of sensors.

a) Zero calibration
Weighing 5 g of sodium sulfite by a balance, adding 95mL of water into a 250-mL measuring cylinder, pouring the water into a beaker, adding the sodium sulfite which has been weighed, stirring with a glass rod, dissolving, and obtaining a solution of 5% sodium sulfite, putting the sensor in a solution, And the zero point calibration is carried out after the three-minute numerical stability is stable. Refer to the Appendix to the instructions

b) Slope calibration
The sensor probe is placed in air saturated water and the slope is calibrated after 3 minutes of numerical stability. The instructions refer to the appendix.

c) Preparation of air saturated water: add 2/3 volume fresh distilled water to the constant temperature water bath to float the porous plastic sheet on the water surface (see figure as below). At the same time, the bubbler (air pump) is used to aerate the water continuously for more than 1 hour, stop aeration, and get air saturated water after 20 minutes or so. Put the sensor into the water and calibrate the slope after the numerical value is stable.



NOTE: As an alternative, slope calibration can also be performed in water-saturated air. Put the sensor into a calibration bottle with a small amount of water (the probe is 2-3mm above the water surface), make sure that the sensor membrane cap is kept wet but there is no water droplets, and calibrate the slope after 3 minutes for the value to stabilize.

4. Points for attention

- Avoid sun exposure to the inner surface of the fluorescent cap.
- Please don't touch the fluorescent film with your hands.
- Measuring and calibrating the surface of fluorescent film to avoid attaching bubbles.
- Avoid directly applying any mechanical stress (pressure, scratches, etc.) to the fluorescent film in use.

Ⅴ、Quality and service

1. Quality assurance

- The quality inspection department has a standard inspection procedure, with advanced and complete detection equipment and means, and according to the procedure inspection, the product is subjected to 72-hour aging experiment and stability experiment, so that a non-conforming product is not allowed to leave the factory.
- The consignee shall refund directly the product batches with a failure rate of 2%, and all expenses incurred shall be borne by the supplier. Consider the standard reference to the product description provided by the supplier.
- Ensure the quantity of goods and the speed of shipment.

2. Spare parts and spare parts

This product includes:

- 1 sensor
- 1 copy of the manual
- 1 certificate

3. After-sales service commitment

The company provides after-sales service for this machine within one year from the date of sale, but

does not include the damage caused by improper use. If you need to repair or adjust, please send it back, but the freight must be borne by yourself, and it is necessary to make sure that the packing is good to avoid damage in transit. We will repair the damage of the instrument free of charge.

Appendix data communication

1. Data format

The default data format for Modbus communication is: 9600, n, 8, 1 (baud rate 9600bps, 1 start bit, 8 data bits, no check, 1 stop bit).

2. Information frame format (xx stands for one byte)

a) Read data instruction frame

06	03	xx xx	xx xx	xx xx
Address	FC	Register start address	Number of registers	CRC check code (low bytes in front)

b) Read data response frame

06	03	xx	xx……xx	xx xx
Address	FC	Number of bytes	Response data	CRC check code (low bytes in front)

c) Write data instruction frame

06	06	xx xx	xx xx	xx xx
Address	FC	Register address	Read-in data	CRC check code (low bytes in front)

d) Data response frame

06	06	xx xx	xx xx	xx xx
Address	FC	Register address	Read-in data	CRC check code (low bytes before）

3. Register address

Register address	Name	Instruction	Number of registers	Access method
44353 (0x1100)	Switch machine	Boot write data 1, shut down write data 0. The power on defaults to the boot state.	1 (2 bytes)	write
40001 (0x0000)	Measured value+temperature	Four double-byte integers, measured, measured decimal, temperature decimal places, respectively, measured, decimal places.	4 (8 bytes)	read
40005 (0x0004)	Dissolved oxygen saturation (0-200%)	Two double-byte integers, saturation values and decimal places, respectively.	2（4 bytes）	read
44097 (0x1000)	Zero calibration	Calibrated in anoxic water, writing data 0; readout data zero offset.	1（2 bytes）	Write / read
44101 (0x1004)	Slope calibration	Calibrate in air-saturated water, write data to 0, read data to slope value × 1000.	1（2 bytes）	Write / read
44113 (0x1010)	temperature correction	In the solution, the written data is the actual temperature value × 10, and the readout data is the temperature calibration offset × 10.	1(2 bytes))	Write / read
44129 (0x1020)	Salinity compensation	The read / write data is salt value (PSU) × 10, which is used for salinity compensation, and the factory default is 0, no salinity compensation. Write values in the range of 0 to 500, corresponding to 0	1（2 bytes)	Write / read

		to 50.0 PSU.		
48195 (0x2002)	Sensor address	The default is 6, and the data range is 1-127.	1（2 bytes）	Write / read
48225 (0x2020)	Reset sensor	The calibration value restores the default value, and the write data is 0. Note that the sensor needs to be calibrated again after resetting.	1（2 bytes）	write

4. Command example

a) Boot instruction：
Function: let the probe emit light continuously and begin the measurement of dissolved oxygen value.
Request frame：06 06 11 00 00 01 4C 81
acknowledgement frame ：06 06 11 00 00 01 4C 81

b) Start measurement instruction：
Function: obtain the temperature and dissolved oxygen value of the measuring probe; the unit of temperature is degrees Celsius, and the unit of dissolved oxygen value is mg/L.
Request frame：06 03 00 00 00 04 45 BE
acknowledgement frame ：06 03 08 01 02 00 02 00 B0 00 01 D4 48
Reading example：

Dissolved oxygen value	temperature scale
01 02 00 02	00 B0 00 01

For example, the dissolved oxygen value 01 02 indicates the hexadecimal reading dissolved oxygen value, and 0002 indicates the dissolved oxygen value with 2 decimal points, which is converted to a decimal value of 2.58.
The temperature value 00B0 represents the hexadecimal reading temperature value, 0001 indicates the temperature value with 1 decimal point, converted to a decimal value of 17.6.

Calibration instruction：
Zero calibration
Function: set the calibration value of dissolved oxygen zero point of sensor；
Request frame：06 06 10 00 00 00 8C BD
acknowledgement frame ：06 06 10 00 00 00 8C BD
Slope calibration
Function: set the slope calibration value of dissolved oxygen for the sensor; here the slope

value is calibrated in air saturated water。

Request frame：06 06 10 04 00 00 CD 7C

acknowledgement frame ：06 06 10 04 00 00 CD 7C

d) Set the device ID address：

Function: set the MODBUS device address of the sensor；

Change the device address 06 to 01, with the following example

Request frame：06 06 20 02 00 01 E3 BD

acknowledgement frame ：06 06 20 02 00 01 E3 BD

e) Salinity compensation instruction:

Role: Set the sensor salinity compensation;

The water with a salinity of 35.0 PSU is measured and salinity compensation is added.

Examples are as follows:

Request frame: 06 06 10 20 01 5E 0D 1F

Reply Frame: 06 06 10 20 01 5E 0D 1F

5. Error response

If the sensor does not execute the upper computer command correctly, the following format information is returned：

Definition	Address	Function code	Code	CRC check
Data	ADDR	COM+80H	xx	CRC 16
Number of bytes	1	1	1	2

a) CODE：01 – Functional code error

03 – Data error

b) COM：Received function code