Fluorescence Dissolved Oxygen Sensor

Preface

Thank you for purchasing fluorescence dissolved oxygen sensor. Please read this manual carefully before operating and using it correctly to avoid unnecessary losses caused by false operation.

Note

- Modification of this manual's contents will not be notified as a result of some factors, such as function upgrading.
- We try our best to guarantee that the manual content is accurate, if you find something wrong or incorrect, please contact us.
- This product is forbidden to use in explosion-proof occasions.

Version

U-SUP-DO-7012-EN1

Safety Precautions

In order to use this product safely, be sure to follow the safety precautions described.

About this manual

- Please submit this manual to the operator for reading.
- Please read the operation manual carefully before applying the instrument. On the precondition of full understanding.
- This manual only describes the functions of the product. The company does not guarantee that the product will be suitable for a particular use by the user.

Precautions for protection, safety and modification of this product

- To ensure safe use of this product and the systems it controls, Please read carefully the operation manual and understand the correct application methods before putting into operation, to avoid unnecessary losses due to operation mistakes. If the instrument is operated in other ways not described in the manual, the protections that the instrument give may be destroyed, and the failures and accidents incurred due to violation of precautions shall not be borne by our company.
- When installing lightning protection devices for this product and its control system, or designing and installing separate safety protection circuits for this product and its control system, it needs to be implemented by other devices.
- If you need to replace parts of the product, please use the model specifications specified by the company.
- This product is not intended for use in systems that are directly related to personal safety.Such as nuclear power equipment, equipment using radioactivity, railway systems, aviation equipment, marine equipment, aviation equipment and medical equipment.If applied, it is the responsibility of the user to use additional equipment or systems to ensure personal safety.

- Do not modify this product.
- The following safety signs are used in this manual:

Hazard, if not taken with appropriate precautions, will result in serious personal injury, product damage or major property damage.

Warning:Pay special attention to the important information linked to product or particular part in the operation manual.

- Confirm if the supply voltage is in consistent with the rated voltage before operation.
- Don't use the instrument in a flammable and combustible or steam area.
- To prevent from electric shock, operation mistake, a good grounding protection must be made.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at is-electric level, shielded, wires shall be located rationally, SPD surge protector shall be applied properly.
- Some inner parts may carry high voltage. Do not open the square panel in the front except our company personnel or maintenance personnel acknowledged by our company, to avoid electric shock.
- Cut off electric powers before making any checks, to avoid electric shock.
- Check the condition of the terminal screws regularly. If it is loose, please tighten it before use.
- It is not allowed to disassemble, process, modify or repair the product without authorization, otherwise it may cause abnormal operation, electric shock or fire accident.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine or other organic solvents. Prevent all kinds of liquid from splashing on the product. If the product falls into the water, please cut off the power

immediately, otherwise there will be leakage, electric shock or even a fire accident.

- Please check the grounding protection status regularly. Do not operate if you think that the protection measures such as grounding protection and fuses are not perfect.
- Ventilation holes on the product housing must be kept clear to avoid malfunctions due to high temperatures, abnormal operation, shortened life and fire.
- Please strictly follow the instructions in this manual, otherwise the product's protective device may be damaged.

- Don’t use the instrument if it is found damaged or deformed at opening of package.
- Prevent dust, wire end, iron fines or other objects from entering the instrument during installation, otherwise, it will cause abnormal movement or failure.
- During operation, to modify configuration, signal output, startup, stop, operation safety shall be fully considered. Operation mistakes may lead to failure and even destruction of the instrument and controlled equipment.
- Each part of the instrument has a certain lifetime, which must be maintained and repaired on a regular basis for long-time use.
- The product shall be scrapped as industrial wastes, to prevent environment pollution.
- When not using this product, be sure to turn off the power switch.
- If you find smoke from the product, smell odor, abnormal noise, etc., please turn off the power switch immediately and contact the company in time.

Disclaimer

- The company does not make any guarantees for the terms outside the scope of this product warranty.
- This company is not responsible for damage to the instrument or loss of parts or unpredictable damage caused directly or indirectly by improper operation of the user.

No.	Name	Quantity	Note
1	Fluorescence Dissolved Oxygen Sensor	1	
2	Manual	1	
3	Certificate	1	

After opening the box, please confirm the package contents before starting the operation.If you find that the model and quantity are incorrect or there is physical damage in appearance, please contact us.

Contents

1. Specifications

Table 1 Technical Specifications of Dissolved Oxygen Sensor

Specifications	Details
Measurement Range	DO: 0~20mg/L or 0~200% saturability Temperature: 0-45℃ with automatic temperature compensation
Measurement Accuracy	DO: ±3% or ±0.3 mg/L of measured value,maximax criterion; Temperature: ±0.5℃
Repeatability	±0.3mg/L
Resolution	0.01mg/L
Pressure Range	≤0.3MPa
Materials	SUS316L (Ordinary Version), Titanium Alloy (Seawater Version) Up and down cover: PPS + glass fiber, Cable: PUR
Power Supply	9~28VDC
Communication Protocol	MODBUS RS485
Storage Temperature	-15~60℃
Operating Temperature	0~45℃ (not freeze)
Weight	1.4KG
Level of Protection	IP68/NEMA6P
Cable Length	Standard: 10 m, the maximum can be extended 100m

Note: The specifications of the product are subject to change without prior notice.

2. Product Overview

The dissolved oxygen sensor uses fluorescence to measure the dissolved oxygen. The sensor is covered with a layer of fluorescent material. When the blue light emitted by the sensor illuminates the fluorescent substance on the fluorescent cap, the fluorescent substance is excited to emit red light, and since the oxygen molecule can carry away the energy (quenching effect), the time and intensity of the excited red light and the concentration of the oxygen molecule become. In inverse proportion, the concentration of dissolved oxygen in water can be obtained by calculation.

This product is widely used in the DO online monitoring of the regulating tank, biochemical tank and effluent of sewage treatment plant.DO online monitoring in waterworks, surface water, water used in various industrial production processes, aquaculture and other industries. The sensor appearance is shown in Figure 1. The sensor size is shown in Figure 2.

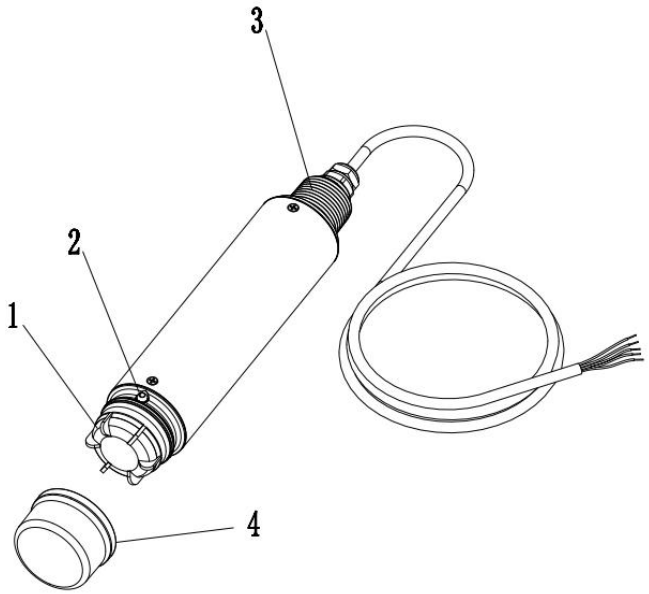


Fig. 1 Appearance Diagram of Dissolved Oxygen Sensor

Table 2

1- Fluorescent cap	2- Temperature Sensor
3- R1 thread	4- Protective cap

Note: When using the sensor, please pull out the sensor protective cap (Series No.4), Fluorescent cap (Series No.1) is the important part for the measurement function of this sensor. Do not spin down the fluorescent cap (Series No.1).

The following figure shows the size of the fluorescence dissolved oxygen sensor:

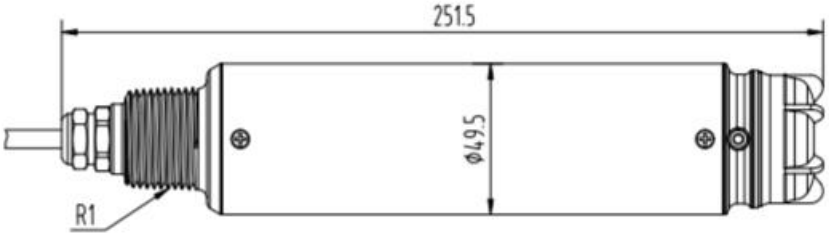


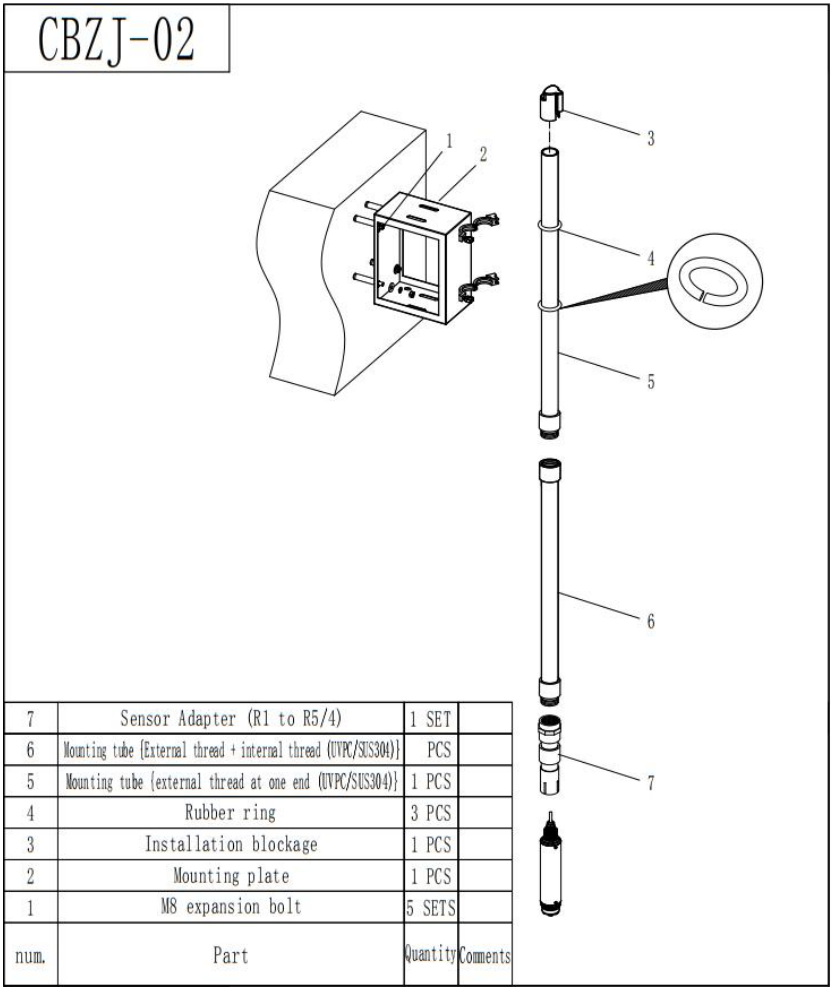
Fig. 2 Dimension Diagram of Dissolved Oxygen Sensor

3. Installation

3.1. Installation of Sensors

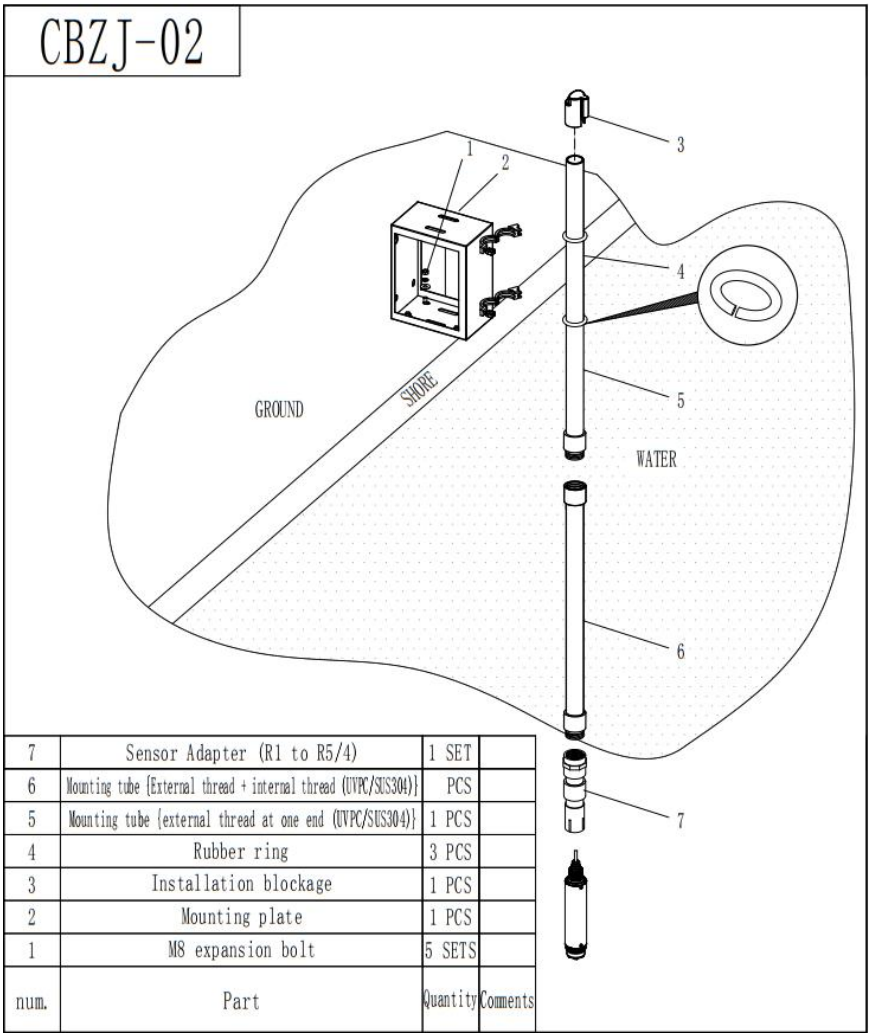
Note: The protective cap should be removed before use before measurement. Do not screw down the fluorescent cap.

3.1.1. Quick Dismantling Pool Side Fixed Installation



num.	Part	Quantity	Comments
7	Sensor Adapter (R1 to R5/4)	1 SET	
6	Mounting tube {External thread + internal thread (UVPC/SUS304)}	PCS	
5	Mounting tube {external thread at one end (UVPC/SUS304)}	1 PCS	
4	Rubber ring	3 PCS	
3	Installation blockage	1 PCS	
2	Mounting plate	1 PCS	
1	M8 expansion bolt	5 SETS	

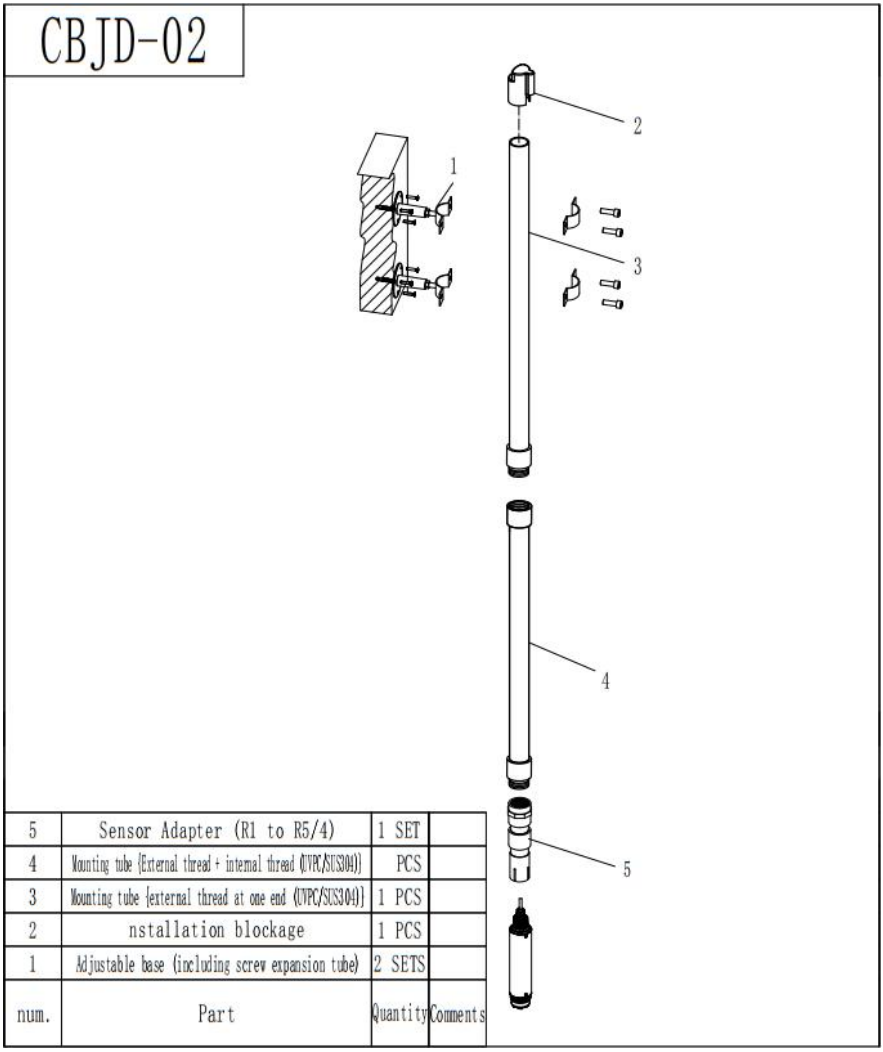
Fig. 3 Quick Dismantling Pool Side Installation Sketch Map (wall space)



num.	Part	Quantity	Comments
7	Sensor Adapter (R1 to R5/4)	1 SET	
6	Mounting tube {External thread + internal thread (UVPC/SUS304)}	PCS	
5	Mounting tube {external thread at one end (UVPC/SUS304)}	1 PCS	
4	Rubber ring	3 PCS	
3	Installation blockage	1 PCS	
2	Mounting plate	1 PCS	
1	M8 expansion bolt	5 SETS	

Fig. 4 Quick Dismantling Pool Side Installation Sketch Map (ground)

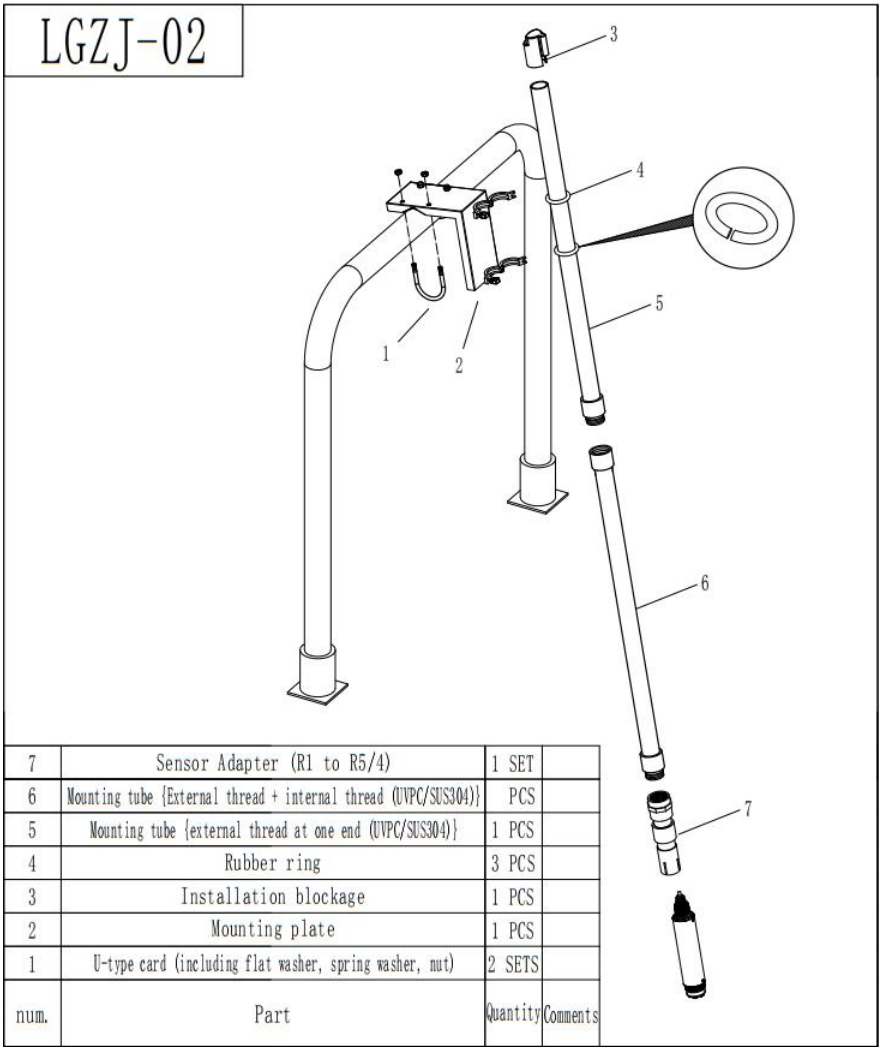
3.1.2. Classic pool side fixed installation



num.	Part	Quantity	Comments
5	Sensor Adapter (R1 to R5/4)	1 SET	
4	Mounting tube (External thread + internal thread (UVPC/SUS304))	PCS	
3	Mounting tube (external thread at one end (UVPC/SUS304))	1 PCS	
2	nstallation blockage	1 PCS	
1	Adjustable base (including screw expansion tube)	2 SETS	

Fig. 5 Classic Pool Side Fixed Installation Sketch Map

3.1.3. Railing Fixed Installation



num.	Part	Quantity	Comments
7	Sensor Adapter (R1 to R5/4)	1 SET	
6	Mounting tube {External thread + internal thread (UVPC/SUS304)}	PCS	
5	Mounting tube {external thread at one end (UVPC/SUS304)}	1 PCS	
4	Rubber ring	3 PCS	
3	Installation blockage	1 PCS	
2	Mounting plate	1 PCS	
1	U-type card (including flat washer, spring washer, nut)	2 SETS	

Fig. 6 Railing Fixed Installation Sketch Map

3.2. Connection of Sensor

The sensor should be correctly connected by the following definition of wire core:

Table 3

Serial No.	1	2	3	4	5
Sensor Cable	Brown	Black	Blue	White	Yellow + Green
Signal	+12VDC	AGND	RS485 A	RS485 B	Ground lead/PE

4. Interface and Operation

4.1. User Interface

The sensor is connected to the computer using RS485 to USB, and then use Mod bus Poll to connect.

Note: Modbus Poll software is a general software that can be downloaded online.

4.2. Parameter Setting

1、Click “Setup” on the menu bar, select “Read / Write Definition” and then set the parameters (The slave address for the first time is the slave label), then enter “30” for Quantity in the dialog box , click “OK”.

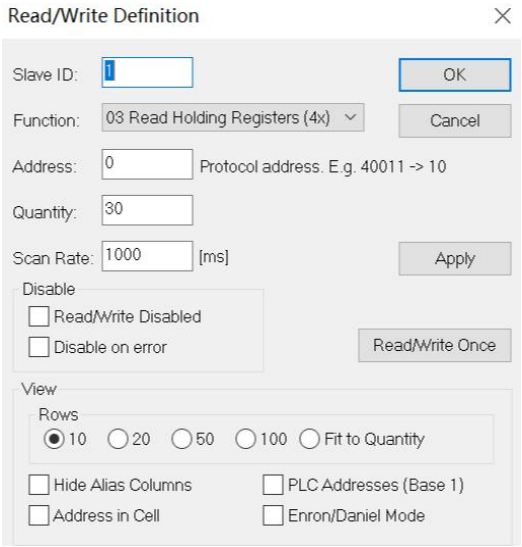


Fig. 7

Note: After the slave address is changed, the new address will be used for communication and the slave address for the next time connection is also the most recently changed address.

2、Click “Connection” on the menu bar, select the first line in the drop-down menu “Connection setup” (The baud rate for the first time is the slave label) and click “OK”.

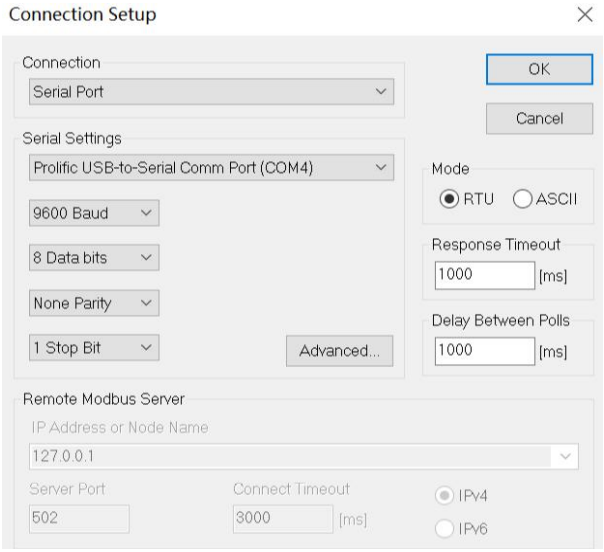


Fig. 8

Note: Port is set according to the Port number of the connection.

Note: If the sensor has been connected as described, and “Timeout Error” appears on the software “Display status”, it means that the connection is failed; remove and replace the USB port or check the USB to RS485 converter, repeat the above procedure until the sensor connection is successful.

5. Calibration of Sensor

The dissolved oxygen sensor has been calibrated at the factory and if you need to calibrate yourself, follow the steps below

The specific steps of automatic air calibration are as follows:

Dry the sensor, add a small amount of water (25~50mL) to the calibration kit and shake the bag for a few times. Then put the sensor into the calibration kit without touching the water and seal the calibration kit with your hand to make the sensor in a saturated air. The sensor should be away from light and high temperature and hard objects during calibration. The measured data is stable, Double-click the “06”, and a dialog box pops out. Enter “27” for Address in the dialog box, “16” for Value, then click “Send”.

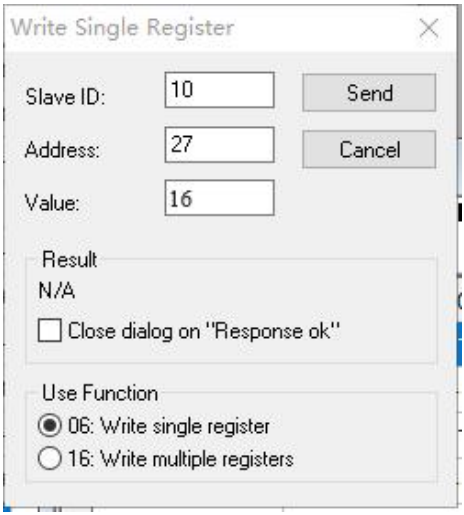


Fig. 9

Wait 20 seconds, change Value to “19” in the dialog box and click “Send”.

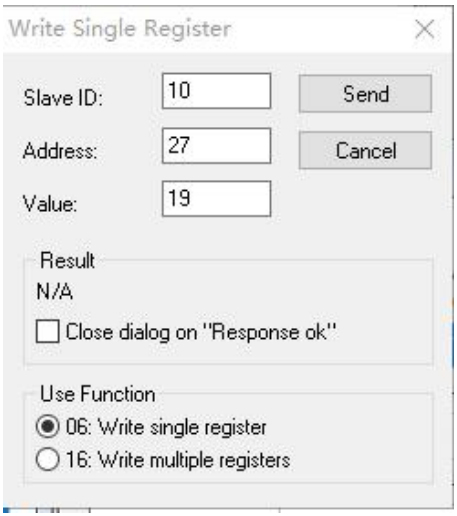


Fig. 10

The specific steps of zero-point calibration are as follows:

Dry the sensor and place it in the anaerobic water until the measured data is

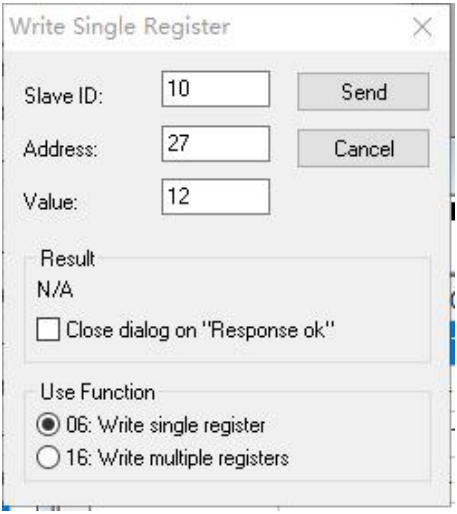


Fig. 11

Wait 20 seconds, change Value to “19” in the dialog box and click “Send”.

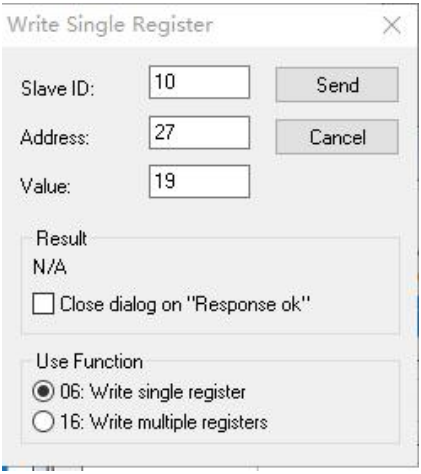


Fig. 12

Restore factory calibration

Dry the sensor and place it in the anaerobic water until the measured data is stable, Double-click the “06”, and a dialog box pops out. Enter “27” for Address in the dialog box, “35” for Value, then click “Send”. The recoverable slope is 1, and the deviation is 0.

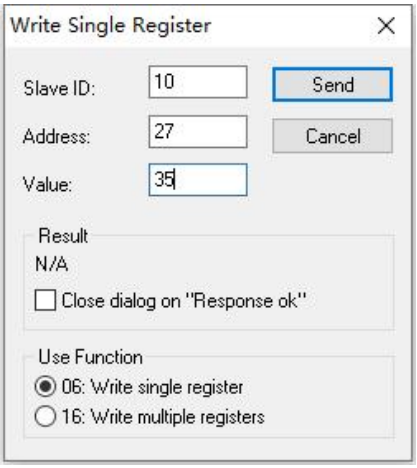


Fig. 13

6. Communication Protocol

The sensor is equipped with MODBUS RS485 communication function, please refer to this manual section 3.2 to check the communication wiring. The specific MODBUS RTU table is shown in the following table.

Table 4

MODBUS-RTU	
Baud Rate	4800/9600/19200/38400/57600
Data Bits	8 bit
Parity Check	no
Stop Bit	1bit

Table 5

Register Name	Address	Data Type	Register Number	Read/Write	Description
Dissolved Oxygen Value	0	Float	2	R (only read)	Unit: mg/L
Dissolved Oxygen Concentration	2	Float	2	R	
Temperature	4	Float	2	R	Unit: ℃
Calibration Slope	6	Float	2	W/R	Range: 0.5~1.5
Factor	46	Float	2	W/R	Range: 0.1~10
Deviation Value	8	Float	2	W/R	Range: -20~20
Salinity	10	Float	2	W/R	Unit: g/Kg
Manual Atmospheric Pressure	12	Float	2	W/R	Range: 200-1200 Unit: mmHg

Register Name	Address		Data Type	Register Number	Read/Write	Description
Baud Rate	16		Float	2	R	
Slave Address	18		Float	2	R	Range: 1~254
Response Time of Read	20		Float	2	R	Unit: s
Modify Baud Rate	16		Signed	1	W	0-4800 1-9600 2-19200 3-38400 4-57600
Modify Slave Address	17		Signed	1	W	Range: 1~254
Modify Response Time	30		Signed	1	W	2~60s (multiples of 2)
Atmospheric Pressure Compensation Model	160		Signed	1	W/R	0: Manual compensation 1: Automatic compensation
Automatic Atmospheric Pressure Compensation Value	162		Float	2	W/R	Range: 200-1200 Unit: mmHg
Air Calibration	Step 1	27	Signed	1	W	16
	Step 2	27	Signed	1	W	19
	It should be canceled if you don't want to calibrate after the execution of "Step 1".					
	Cancel	27	Signed	1	W	21
Zero-point Calibration	Step 1	27	Signed	1	W	12
	Step 2	27	Signed	1	W	19

Register Name	Address		Data Type	Register Number	Read/Write	Description
	It should be canceled if you don't want to calibrate after the execution of "Step 1".					
	Cancel	27	Signed	1	W	21
Calibration Condition (Air or Zero-point)	401		Signed	1	R	0: default 1: calibrating 3: Calibration success 4: Calibration failure
Restore Default	27		Signed	1	W	33: Reset response time (2s)、salinity (0)、atmospheric pressure (760)
Restore Factory Calibration	27		Signed	1	W	35: Reset slope 1、deviation 0
Function Code	R:03 Write 06 as the reshaping data 06 Write 16 as the floating point data					

485 Analysis:

1 Read the Slope

Table 6

Register Name	Address	Data Type	Register Number	Read/Write	Description
Calibration Slope	6	Float	2	W/R	Range: 0.5-1.5

Send the command: 01 03 00 06 00 02 24 0A

The equipment return: 01 03 04 00 00 40 E0 CA 7B

Send command parsing:

01: device address 01

03: Function code 03 for reading register content

00 06: The starting register address read is 0006

00 02: Read 2 registers

24 0A: CRC16 check code

The device returns the analysis:

01: device address 01

03: Function code 03 for reading register content

04: The length of the returned data is 4 bytes

00 00 40 E0: The slope read is 7.00 (analyze 40 E0 00 00 using IEEE 754)

CA 7B: CRC16 check code

2 Modify Slave Address

Table 7

Register Name	Address	Data Type	Register Number	Read/Write	Description
Modify Slave Address	17	Signed	1	W	Range: 1-254

Send the command: 01 06 00 11 00 0F 99 CB

The equipment return: 01 06 00 11 00 0F 99 CB

Send command parsing:

01: device address 01

06: Function code 06 for writing register content

00 11: The register address of write data is 0017

00 0F: Write data content of 0015

99 CB: CRC16 check code

The device returns the analysis:

01: device address 01

06: Function code 06 for reading register content

00 11: The register address of the return write data is 0017

00 0F: Returns modified data content of 0017

99 CB: CRC16 check code

3 Set the Slope

Table 8

Register Name	Address	Data Type	Register Number	Read/Write	Description
Calibration Slope	6	Float	2	W/R	Range: 0.5-1.5

Send the command: 01 10 00 06 00 02 04 00 00 3F 80 63 D5

The equipment return: 01 10 00 06 00 02 A1 C9

Send command parsing:

01: device address 01

10: Function code 16 for writing register content

00 06: The starting register address write is 00 06

00 02: Write 2 registers

04: The length data is 4 bytes

00 00 3F 80: The slope write is 1.00 (analyze 3F 80 00 00 using IEEE 754)

63 D5: CRC16 check code

The device returns the analysis:

01: device address 01

10: Function code 16 for writing register content

00 06: The starting register address of the return write data is 00 06

00 02: Returns 2 registers

A1 C9: CRC16 check code

7. Maintenance

In order to obtain the best measurement results, it is very necessary to maintain the sensor regularly. Maintenance mainly includes cleaning, inspecting damage of the sensor. You can also view the sensor's status during maintenance and inspection.

7.1. Sensor Cleaning

It is recommended that the sensor should be cleaned at regular intervals (usually 3 months, depending on the site environment) to ensure the accuracy of the measurement.

Use water to clean the outer surface of the sensor. If there is still debris, wipe it with a damp soft cloth. Do not place the sensor in a direct sunlight or near radiation. In the entire life of the sensor, if the total sun exposure time reaches to one hour, it will cause the fluorescent cap aging and going wrong, and consequently leading to the wrong reading.

7.2. Inspection on the Damage of Sensor

According to the appearance of sensor to check if there is damage; if any damage is found, please contact after-sales service maintenance center in time for replacement to prevent malfunction of sensor caused by water from the damaged cap.

7.3. Preservation of Sensor

- When you are not using it, please cover the product's original protective cap to avoid direct sunlight or exposure. In order to protect the sensor from freezing, the DO probe should be stored in a place where it will not freeze.
- Keep the probe clean before storing it for a long time. Keep the equipment in a shipping box or a plastic container with electric shock protection. Avoid touching it with hand or other hard objects in case of scratching the fluorescent cap.
- It is forbidden that the fluorescent cap is exposed to direct sunlight or exposure.

7.4. Replacement of Fluorescent Cap

The sensor's measurement cap needs to be replaced when it’s damaged. In order to ensure the accuracy of the measurement, it is recommended to change it every year or it is necessary to be replaced when the cap is found severely damaged during the inspection.

Steps to replace the fluorescent cap: Unscrew the old cap from the sensor, and then screw the new cap on.