

# Fluorescence Dissolved Oxygen Online Analyzer Operation Manual

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# Chapter 1 Product Overview

#### **1.1 Product Information**

#### 1.1.1 Dissolved Oxygen Sensor

The dissolved oxygen sensor measures the dissolved oxygen by the fluorescence method, and the emitted blue light is irradiated on the phosphor layer. The fluorescent substance is stimulated to emit red light, and the oxygen concentration is inversely proportional to the time when the fluorescent substance returns to the ground state. By using this method to measure the dissolved oxygen, it will not produce oxygen consumption, thus assuring data stability, reliable performance, no interference, and simple installation and calibration.

Specifications	Details	
Size	Diameter 55mm*Length 342mm	
Weight	1.85KG	
Main Matorial	SUS316L+PVC (Ordinary Version), Titanium Alloy (Seawater Version)	
	O-ring: Fluoro-rubber Cable: PVC	
Waterproof Rate	IP68/NEMA6P	
Measurement Range	0-20mg/L(0-20ppm), Temperature: 0-45°C	
Indication Resolution	Resolution: $\pm$ 3%, Temperature: $\pm$ 0.5°C	
Storage Temperature	-15~65°C	
Environment Temperature	0~45°C	
Pressure Range	≪0.3Mpa	
Calibration	Automatic air calibration,Sample calibration	
Cable Length	Standard 10-Meter Cable, Max Length: 100 Meters	
Warranty Period	1 Year	
External Dimension: _	RI	
	342.5	

Table 1 Sensor Technical Specifications



#### 1.1.2 Dissolved Oxygen Transmitter

The transmitter can be used to display data measured by the sensor, so the user can get the 4-20mA analog output by transmitter's interface configuration and calibration. And it can make relay control, digital communications, and other functions a reality.

The product is widely used in sewage plant, water plant, water station, surface water, farming, industry and other fields. The transmitter diagram is shown as figure 1.



Figure 1 Transmitter

(1) Relay, output and the signal

The transmitter is equipped with three configurable relay switches and two-way analog output.

(2) Sensor and the sensor module

The transmitter is a single-parameters one, can contain one sensor.

### ③ Transmitter shell

Transmitter shell is of IP65 protection class. For outdoor use, it's strongly recommended to take protective measures to prevent environmental damage.



Specification	Details	
Size	145*125*162mm L*W*H	
Weight	1.3KG	
Material of outside shell	lower casing: Aluminum with powder covering	
Waterial of outside siteli	cover: PA66+GF25+FR	
Waterproof Rate	IP65/NEMA4X	
Storage Temperature	-20 to 70°C	
Operation Temperature	-15 to 60°C	
Power Supply	AC: AC220V, 50HZ, 5W DC: DC24V	
	three-way analog output 4-20mA, response parameters and	
Output	corresponding scope can be programmed	
	Note: the maximum load is 500 ohms	
Polov	three-way relay can be set up, and response parameters and	
Nelay	response values can be programmed	
Display Output	128 * 64 dot matrix LCD with LED backlight, which can be	
Display Output	operated under the direct sunlight	
Digital Communication	MODBUS RS485 communication function, which can transmit	
Dipital communication	real-time measurements	
Warranty Period	1 year	

Table 2 Transmitter Specification

#### **1.2** Safety Information

Please read this manual completely before opening the package, installing or using. Otherwise it may cause personal injury to the operator, or cause damage to equipment.



### Warning labels

Please read all labels and signs on the instrument, and comply with the security label instructions, otherwise it may cause personal injury or equipment damage.

When this symbol appears in the instrument, please refer to the operation or safety information in the reference manual.



# Chapter 2 Installation

#### **2.1 Transmitter Installation**

You can install the transmitter in a variety of ways, please refer to the instructions of this manual for installation details.

### 2.1.1 Installation Components and Size

1) Figure 2 shows the transmitter installation components.



Figure 2 Installation Components

1- mounting plate	2- sealing ring of mounting plate
3- M5 nut	4- M5*100 bolt
5- M5*8 bolt	6- M5*40 bolt

② Figure 3 shows the transmitter installation size.





Figure 3 Installation Size

#### **2.1.2 Installation Steps**

- A. Installation Way of Clamp
  - Place the transmitter and the mounting plate on both sides of the clamp, and then use the mounting bolts and nuts to secure the transmitter and the mounting plate to the clamp, as shown in figure 4.
- B. Wall installation
  - Attach the transmitter with mounting bolts and nuts to the mounting plate, and then fixed the mounting plate on the mounting wall or board.
- C. Panel installation
  - Set the transmitter into the panel, and then fixed the transmitter with nuts and bolts on the panel, as shown in figure 5. Figure 6 shows the bottom view and the top view.

In the installation way of clamp, the diameter of clamp is 1 inch to 2.5 inches.





Figure 4 Installation Way of Clamp



Figure 5 Panel Installation







Figure 6 Bottom View, Top View

### **2.1.3 Wiring Installation**



Figure 7 is the preview of internal wiring of the transmitter. Table 3 is the wiring signal of the transmitter.



Figure 7 Preview of the Wiring

1- sensor interface	2- grounding
3- power supply interface	4- three-way relay
5- 4-20mA two-way interface	6- 485 communication interface

Table 3 Wiring Signal of the Transmitter.

### 2.1.4 Power Supply Wiring



The transmitter can use AC220V power supply. Please operate in strict accordance with the wiring instructions.

For the sake of safety and relevant electrical specification, there should be a local disconnect design, and it shall be suitable for all installation types. The connection mode of the power cord is shown as figure 8.



To ensure the safety in use, please be sure to be grounded.



Note: before any electrical connections, voltage protective layer must be pulled down. After all the connection, and before closing the shell of transmitter, the voltage protective layer should be back the place.

#### 2.1.5 Relay

The transmitter is equipped with three-way relay, and the main measurements or temperature response can be set up. Each relay can be configured individually for timing or alarming, moreover the relay switch and relay response values can also be set. Please be sure to disconnect the power supply, while wiring. The connection mode of the relay is shown as figure 9.





Figure 9 Relay Wiring

### 2.1.6 Analog Output

Output current should be configured, to use it rationally. The parameters configured included response parameters and corresponding measured value of 4mA and 20 mA.

### 2.2 Installation of Sensor

#### 2.2.1 Connection of Sensor

As shown in Figure 10, connect dissolved oxygen sensor with the transmitter.



Figure 10 Dissolved Oxygen Sensors

#### 2.2.2 Installation of Sensors



The specific installation steps are as follows:

- a. Install the 8 (mounting plate) on the railing by the pool with 1 (M8 U-shape clamp) at the sensor mounting position;
- b. Connect 9 (adapter) to 2 (DN40) PVC pipe by glue, pass the sensor cable through PVC pipe until the sensor screws into 9 (adapter), and do waterproof treatment;
- c. Fix 2 (DN40 tube) onto 8 (mounting plate) by 4 (DN42U-shape clamp).



Figure 11 Schematic Diagram on the Installation of Sensor

1-M8U-shape Clamp (DN60)	2- DN40 Pipe	
3- Hexagon Socket Screw M6*120	4-DN42U-shape Pipe Clip	
5- M8 Gasket (8*16*1)	6- M8 Gasket(8*24*2)	
7- M8 Spring Shim	8- Mounting Plate	
9-Adaptor(Thread to Straight-through)		

# Chapter 3 Product Interface and Operation



### **3.1 The User Interface**

The user interface is shown as figure 12.



Figure 12 The User Interface

1- screen	2- enter key
3-guide key	4- Esc key
5-menu key	

The user can operate through the panel, setting up and configuring input/output, screen and so on.

No.	Кеу	Function
2	Enter key	Enter the next menu or accept typed value
3	Guide key	Browse the menu, change the settings, and add or reduce digits
4	Esc key	Return to previous menu
5	Menu key	Go to the main menu

Table 4 Each Key's Function of Transmitter Panel

### 3.2 The Main Screen



When a sensor is connected to the transmitter, the screen shows measured data of the sensor, calibration, configuration and settings, time, warnings, errors and so on. The main screen is shown as figure 13.



Figure 13 The Main Screen Interface

1- The name of the instrument	2- the measured data of sensor	
6- temperature measured value/fault display/current loop output/relay/ (main screen switch, right and left)		
4- the unit of measured data		

#### 3.3 Control Set

"Device Info", "CAL OUT" and "SETUP" can be set in "Control Set". And in the "SETUP" we can check and set "Current 1/2", "Relay settings", "485 Address", "Contrast" and "Language".

#### **3.3.1 Device Information**

If you want to check the device information, press "up" "down" key to choose the "Device info", and then press the "enter" key. You can check the device information after seeing the screen showing "Device info".

#### 3.3.2 Current Output

1) Press the menu key, press "up" "down" guide key to select "Control Set" on the interface.

2) Then select "CAL OUT", and select the one of the two channels, by adjusting corresponding AD value of 4mA and 20mA to correct the current.(4 mA corresponds around 800 AD value, 20 mA corresponds around 4000 AD value.)



#### 3.3.3 Set-up



#### 3.3.3.1 Setting the current output 1/2

- 1. Press the menu key, and then press "up" "down" key to select "Control Set" in the interface;
- 2. Press "up" "down" guide key to select "Set-up " in the "Control Set ";
- 3. Press "up" "down" key to select "Current1/2", then press "enter " key;
- 4. Enter the interface entered is as following, then choose according to required;



- 5. Choose "Parameters" to enter;
- 6. Use "left" "right" guide key to select "Sensor " or "Temperature" to enter;
- 7. Press "up" "down" key to choose set output (4 mA or 20 mA), then enter;
- 8. Press "left', "right', "up', "down' key to choose needed value, then enter to complete the set-up.



And the program regards 4 mA the lowest, 20 mA the highest in their corresponding value range.

#### 3.3.3.2 Relay A/B/C

- 1. Press the menu key, then press "up' "down' key to select "Control Set' in the interface;
- 2. Press "up' "down' guide key to select "SETUP' in the "Control Set';
- 3. Press "up' "down' key to select "Relay A/B/C', then press "enter" key;

#### 1) Parameter

Press the "parameter' in the "Relay A/B/C' interface, and then select "Sensor' or "Temperature" to enter.



#### 2) To Set Function



Relay can be individually configured for timer or alarm function. Specific steps are as followings: Press the "Function' in the "Relay A/B/C' interface, then select "Warn' or "Time' to enter.

Function	
Warn / Time	

- Time: The function of relay's timing is, it works in a specific period of time, which is set as "Keeping", while in the rest of time, it's closed, and the time is a designed period. If you want the relay to work for 10s, closed for 50s, then you can set the "Keeping" as 1min.
- Warn: The relay's alarm works when it gets two measured values which are higher or lower than a specific threshold in a continuous interval, assigned by "on time delay", then it will be closed. And when the alarm ends, "the dead zone of threshold" happens: when measured value<high threshold value-high dead zone of threshold, "high threshold alarm" ends; while when measured value>low threshold value + low dead zone of threshold, "low high-threshold alarm" ends.

#### 3) To Set Corresponding Values

The response values have "low alarm', "high alarm", "low dead-band", "high dead-band", "off time delay " and "on time delay relay" when you choose the "Warn" in "Function". The response values have "Interval" and "Hold time" when you choose the "Time" in "Function".



#### 1 High Threshold Alarm

When the measured value goes high, the relay will set up corresponding higher limit value. When "alarm type" is set as "high threshold alarm", then the "high threshold value", "high dead zone of threshold", "on time delay" and "off time delay" should be set. The function of "high dead zone of threshold" is to end the alarming: for example, setting the "high threshold value" as 8, "high dead zone of threshold" as 0.2, so when the measured value is less than 7.8, then the alarm ends.

(2) Low Threshold Alarm



When the measured value lowers down, the relay will set up corresponding lower limit value. When "alarm type" is set as "low threshold alarm", then the "low threshold value", "low dead zone of threshold", "on time delay" and "off time delay" should be set. The function of "low dead zone of threshold" is to end the alarming: for example, setting the "low warning point" as 2, "low high dead zone of threshold" as 0.2, so when the measured value is more than 2.2, then the alarm ends.

#### (3) Off Time Delay Relay

Set a time value, using it as the delay time from relay's closed to starting station.

(4) On Time Delay Relay

Set a time value, using it as the delay time from relay's starting to closed station.

#### **3.3.3.3 Communication Setting**

A. The transmitter is equipped with MODBUS RS485 communication function, please refer to this manual section 2.1.3 figure 7 to check the communication wiring. The transmitter is with RTU mode of communication, and the default baud rate is 9600, the specific MODBUS RTU table is shown in the following table.

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

B. The transmitter adopts the MODBUS standard protocol. The specific agreement content is as the following table shows.

Register Name	Register Address	Data Type	Length	Read /Write	Function Code
the value of Sensor	00	float	2	read	04
The temperature of Sensor	02	float	2	read	04

C. The device address is used as the communication setting, and specific steps are as followings: 1. Press the menu key, and then choose "Control Set" by pressing "up' "down" in the interface;



- 2. Press "up' "down" guide key to select "SETUP" in the "Control Set";
- 3. Press "up" "down" key in the "SETUP" menu to choose interface "485 address",

4. In the "Interface Address", press "left" "right" to change "bit" information, and press "up" "down" to change "value" information. 1-254 can be adjustable.

Interface Add	
00 <u>9</u>	(1~254)

#### 3.3.3.4 Contrast Level

- 1. Press the menu key, press "up" "down" key to choose "Control Set" in the interface;
- 2. Press "up" "down" key to choose "Contrast" in the "Control Set", then press "= >" to enter;
- 3. Press "up" "down" key to adjust contrast, and the range is 0-9. Setting interface is as shown.

CONT	RAST	
2	(0-9)	

#### **3.3.3.5** Language Settings

- 1. Press the menu key, press "up" "down" key to choose "Control Set" in the interface;
- 2. Press "up" "down" guide key to choose "Language" in the "Control Set";
- 3. Press "left" "right" to choose the needed language in the "Language", then press "= >" to enter. There are two language options, Chinese and English. Setting interface is as shown.

Language	
Chinese	English

#### **3.4 Parameters Setting**



The sensor can be configured with options such as slope, deviation, unit, altitude, salinity, response time, maintenance period, and default values. Use the configuration menu to set various parameters for the sensor.

The procedure is as follows:

- 1. Select "Menu", Press "Up", "Down" key to select "Probe Set".
- 2. Press "Up", "Down" key to select "Parameters" on the "Probe Set" interface, then press "Enter" to enter.
- 3. Select the desired adjustment parameters in the parameter settings interface, after entering the appropriate setting interface, use the guide keys to set the required value, and finally press the "Enter" key to complete the configuration. The options that can be configured and viewed are shown in the following table.

**Options for Sensor Configurations** 

Options	Description
Slope	The currently adjusted slope display (slope range should be between 0-1.5, the default value is 1.0, otherwise it requires to recalibrate)
Deviation	The deviation value defaults to 0.00mg/l
(Offset Value)	
Altitude	Default is sea level (Configurable)
(Pressure)	
Salinity	Enter the salinity value, unit is g / kg
Response Time	Set the response time of the signal, the default is 60 seconds
Measured Value	Real-time measured value of the sensor
Reset Default	Restore the sensor default settings

4. Table 5 shows the relationship between pressure and altitude.



Altitude(m)	Pressure(mm Hg)	Altitude(m)	Pressure(mm Hg)
-84	768	1066	669
0	760	1160	661
85	752	1254	654
170	745	1350	646
256	737	1447	638
343	730	1544	631
431	728	1643	623
519	714	1743	616
608	707	1843	608
698	699	1945	600
789	692	2047	593
880	684	2151	585
972	676	2256	578

Table 5 The Relationship Between Pressure and Altitude.

# Chapter 4 Calibration of Sensor



The dissolved oxygen sensor has been calibrated at the factory, and it can be calibrated by using automatic air calibration and sample calibration if there are needs to be automatic calibrated. It is recommended to use air automatic calibration. The specific steps are as follows:

#### 4.1 Automatic Air Calibration

- 1. Take out the dissolved oxygen sensor, and wipe it with a clean rag (soft texture and smooth surface).
- 2. Place the sensor in the air, and wait for the data on the instrument become stable (or about 10 minutes later) before starting calibration, meanwhile, avoid it from direct sunlight. Make sure all the settings of sensor are correct.
- 3. Enter the corresponding setup menu of the transmitter, and follow the steps "Menu"> "Probe Set"> "Calibration"> "Air Calibration".
- 4. After the value is stable, press "Confirm" to complete the calibration, if it's successful, a new correction slope will be shown, otherwise, it shows the original calibration slope. (Slope range should be between 0-1.5, otherwise, it should be recalibrated)

Notes on Calibration:

During calibration, ensure that the sensor is dry and that the probe is not exposed to direct sunlight. The saturation dissolved oxygen value at each temperature can refer to the annexed table.

#### **4.2 Solution Calibration**

- 1. Take out the dissolved oxygen sensor and wipe the sensor with a clean cloth (soft texture and smooth surface)
- 2. Put the sensor into the solution whose dissolved oxygen value is already known (this operation is required to be done in an anaerobic environment)
- 3. Enter the transmitter menu and follow the steps "Menu"> "Probe Set"> "Calibration"> "Solution Calibration". Then the screen shows the measured value and the standard value.
- 4. After the value is stable, input the standard value and press the input key to complete the calibration.
- 5. After the calibration is completed, take out the sensor and keep it dry, if the calibration fails, it may appear problems like too high or too low gain or unstable situation, the solution is to recalibrate in accordance with the procedure.

## Chapter 5 Maintenance

#### **5.1 Maintenance of Transmitter**



The maintenance of the transmitter is mainly to clean the transmitter, check the appearance and cable damage. The transmitter is an electronic device, and improper use of the environment may cause damage to the transmitter.

- 1. The environment above 60 °C in where the instrument is used will cause damage to the instrument.
- 2. False power or power fluctuations can cause damage to the instrument.
- 3. A collision or a drop can cause the damage of instrument.
- 4. Moisture, corrosion and air pollution can cause damage to the instrument.

Transmitter Cleaning: Ensure that the transmitter cover is closed tight and use a clean, wet cloth to wipe the outside of the transmitter.

Transmitter Inspection: regularly check the instrument working status to see if it is normal; regularly check the panel, terminals, switches, buttons, etc. If they are dirty, clean and sweep them.

Warning: Before maintenance, disconnect the power of the transmitter to ensure personal safety.

#### **5.2 Maintenance of Sensor**

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, and periodic calibration. You can also view the sensor's status during maintenance and inspection.

#### **5.2.1 Status of Sensor**

Follow the steps "Menu"> "Detection "> "Status" to view the main status of the sensor, data connection, temperature, maintenance cycle, red & blue light.

When each state is normal, the display of each parameter is as follows:

Parameters	Status	Parameters	Status
Connection	ок	Temperature	ок
Data	ок	Red & Blue Light	ок

When the sensor status is not normal or the alarm is displayed, it might be the following circumstances:



#### 1. Loss of Sensor

Parameters	Status	Parameters	Status
Connection	LOSE	Temperature	
Data		Red & Blue Light	

#### 2. Main Value Outrange

Parameters	Status	Parameters	Status
Connection	ок	Temperature	ОК
Data	BEYO	Red & Blue Light	ОК

#### 3. Temperature Alarm

Parameters	Status	Parameters	Status
Connection	ок	Temperature	WARN
Data	ок	Red & Blue Light	ок

#### 4. Light

Parameters	Status	Parameters	Status
Connection	ок	Temperature	ОК
Data	ок	Red & Blue Light	WARN

#### 5. Maintenance Circle

Parameters	Status	Parameters	Status
Connection	ок	Temperature	ОК
Data	ок	Red & Blue Light	ок

### 5.2.2 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.

#### 5.2.3 Replacement of Measurement 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.

#### **5.2.4 Preservation of Sensor**

- A. 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.
- B. 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.
- C. It is forbidden that the fluorescent cap is exposed to direct sunlight or exposure.

# Chapter 6 Errors and Warning

If an error or warning occurs, the reading on the measurement screen will flash and "Fault" will be displayed at the bottom. The following are common mistakes and warnings:

1) Loss of Sensor

When the sensor is not connected to the transmitter or the connection between the probe and the transmitter is bad, there will be an alarm about the loss of probe, the screen will continue to flash and display "LOST", and it will display "Fault" word in its next line. When it happens, follow the steps below to scan the probe.

- 1. Press "Menu" to enter the main menu.
- 2. Press the navigation keys "Up"/ "Down" to select "Detection and Maintenance", and Press "Confirm" to enter "Setting".



3. Select the "Scan Probe" interface, and a prompt will ask you whether to continue. Select "Confirm" to complete the probe scan. The process is shown in the figure. If it's successful, it will display "Scan Completed! Success"; if it's failed, it will display "Scan Completed! Failed".

Detection	Probe Scan	
Scan probe	Please Confirm!	
Analog output Status	OK?	

#### 2) Temperature Outrange

A prompt that temperature is outrange will appear when the temperature of the measured solution exceeds the sensor's upper limit at which it can measure. The measurement screen will flash "+ + +", and the next line will display the word "Fault". In case of such warning, please contact technical support or after-sales service department.

#### 3) Measured Value Outrange

When the measured value exceeds the range, the screen will appear flashing "++ • ++" words, in its next line will display "Fault" word.

#### 4) ERR3 Alarm

When the ERR3 alarm occurs, it indicates the current loop is out of range, at this time, the reading on the screen will flash continuously and "ERR3" will be displayed below the reading. In case of such warning, please contact technical support or after-sales service department.

#### 5) Red & Blue Light Alarm

When the red & blue light alarm occurs, the number on the measurement screen will flash, you can go to the maintenance menu to view the red & blue light status by clicking "Menu"> "Detection "> "Status".

# Chapter 7 Problems and Solutions



Common Problems and Solutions:

Malfunction	Solutions	
Red & Blue Light Alarm	Check if the measuring cap is damaged, and replace it if it is.	
Overweight Alarm	Reboot the transmitter to check if it is still overweight and contact technical support if it still appears.	
Loss of Sensor	Check if the cable is plugged in and reconnect the cable; restart the transmitter or select the scan probe in the "Inspection / Maintenance Settings" and rescan the probe.	
Temperature Alarm	Return it to after-sales service department for maintenance.	

 Table 6: Saturated dissolved oxygen at various temperatures

Note: In case of other unsolvable problems, please contact our after-sales service or technical support department.



温度 (℃)	溶解氧(mg/L)	温度 (℃)	溶解氧(mg/L)
0	14.64	18	9.46
1	14.22	19	9.27
2	13.82	20	9.08
3	13.44	21	8.90
4	13.09	22	8.73
5	12, 74	23	8. 57
6	12.42	24	8.41
7	<b>12</b> . 11	25	8.25
8	11.81	26	8.11
9	11.53	27	7.96
10	11.26	28	7.82
11	11.01	29	7.69
12	10.77	30	7.56
13	10.53	31	7.43
14	10.30	32	7.30
15	10.08	33	7.18
16	9.86	34	7.07
17	9.66	35	6. 95