



# Dissolved oxygen sensor Introduce Fluorescence method



**Type NO.: RD-DO-F-04**



## **1. Product Introduce**

Fluorescence dissolved oxygen sensor, no oxygen consumption, no flow rate limitation, no electrolyte, no maintenance and calibration, strong anti-interference ability, and excellent stability. Built-in temperature sensor, automatic temperature compensation. RS485 output, can be networked without a controller.

## **2. Product Features**

1. Digital sensor, RS485 output, support MODBUS
2. No membrane, no electrolyte, no interference, no frequent calibration
3. No oxygen consumption, no flow rate limitation
4. With super high cost performance

## **3. Product Principle**

Fluorescence dissolved oxygen sensor is based on the quenching principle of active fluorescence by specific substances in physics. The blue light emitted from a light-emitting diode (LED) irradiates the fluorescent material on the inner surface of the fluorescent cap. The fluorescent material on the inner surface is excited and emits red light. The phase difference between the red light and the blue light is detected and compared with the internal calibration value. Comparing to calculate the concentration of oxygen molecules, the final value is automatically compensated by temperature and air pressure.

## **4. Product application**

It can be widely used in the continuous monitoring of dissolved oxygen values in chemical fertilizer, river, metallurgy, environmental protection water treatment engineering, pharmaceutical, biochemical, food, aquaculture and tap water.

## **5. Product Parameter**

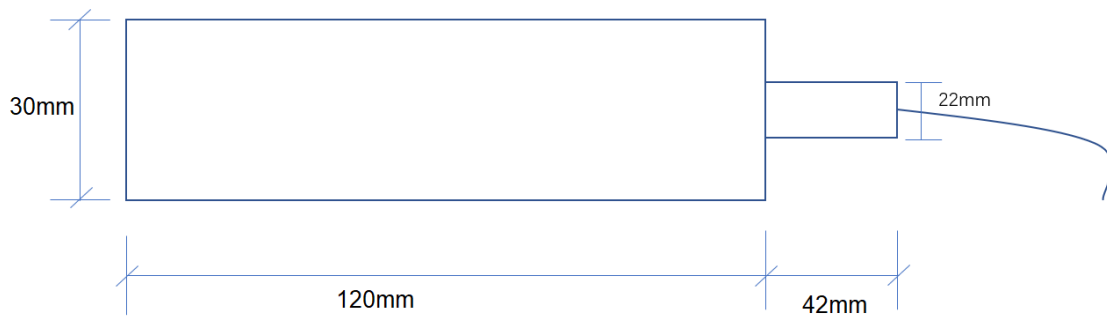
### 1. Technical Parameters

- Measuring range: 0~20mg/L or 0~200% saturation,0-50°C
- Resolution: 0.01 mg/L, 0.1 °C
- Measurement accuracy:  $\pm 0.3\%FS$ ,  $\pm 0.3^{\circ}C$



- Automatic temperature compensation: 0 ~ 50 ° C
- Output signal: RS485 (standard Modbus-RTU protocol, device default address: 01)
- Supply voltage: DC 12~24V, current <50mA
- Working environment: temperature 0 ~ 50 ° C;
- Power consumption: ≤0.5W
- Waterproof: IP68
- Operating pressure: 6bar
- Probe cable length:10 meters
- Fluorescent cap life: Guaranteed use for one year (under normal use)
- Shell material: Stainless steel

## 6. Product size



## 7. Wire connection diagram

1. Red wire-power supply (VCC)
2. Black wire --- ground wire (GND)
3. White or Yellow line---485 Data\_A (485\_A)
4. Green wire—485 Data B (485\_B)



**8. Air dissolved oxygen ratio table**

Temperature°C	DO mg/L	Temperature°C	DO mg/L	Temperature°C	DO mg/L
0	14.60	16	9.86	32	7.30
1	14.22	17	9.64	33	7.17
2	13.80	18	9.47	34	7.06
3	13.44	19	9.27	35	6.94
4	13.08	20	9.09	36	6.84
5	12.76	21	8.91	37	6.72
6	12.44	22	8.74	38	6.60
7	12.11	23	8.57	39	6.52
8	11.83	24	8.41	40	6.40
9	11.56	25	8.25	41	6.33
10	11.29	26	8.11	42	6.23
11	11.04	27	7.96	43	6.13
12	10.76	28	7.83	44	6.06
13	10.54	29	7.68	45	5.97
14	10.31	30	7.56	46	5.88
15	10.06	31	7.43	47	5.79

Note: The oxygen content of the air above is the value under standard atmospheric pressure, and it should be determined according to the local air pressure.



## 9. Installation method

1. Please pay attention that Never touch the fluorescent cap on the sensor head with nails or sharp objects.
2. When using it, please remove the rubber cover before use and put on the plastic protective cover.
3. When not using it, please put on the rubber cover again.
4. Please use clean water to rinse the fluorescent film or the matching brush.
5. It can be put into the water directly or install it by the mounting bracket

## 10. Data conversion method

### 1. Basic Modbus setting

Standard Modbus-RTU protocol, baud rate: 9600; check digit: none; data bit: 8;  
stop bit: 1

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

Communication protocol: MODBUS/RTU, check CRC16

Data is transmitted at large end (high bit first)

#### 1. Read data instruction frame

Definition	Address field	Function code	Register start address		Number of registers		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x03	Xx	Xx	Xx	Xx	Xx	Xx

#### 2. Read data response frame

Definition	Address field	Function code	Number of bytes	Response data	CRC	
Byte	0	1	2	3 ~ n	N+1	N + 2
Content	0x01	0x03	Xx	XX... XX	Xx	Xx

#### 3. Write data instruction frame

Definition	Address field	Function code	Register start address		Write data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	Xx	Xx	Xx	Xx	Xx	Xx

**4. Write data response frame**

Definition	Address field	Function code	Register start address		Write data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	Xx	Xx	Xx	Xx	Xx	Xx

**Note: CRC check code (low byte first)****3. Register address definition**

Register address	Name	Description	Number of registers	Access mode
44353 (0x1100)	Switch on and off	Start-up write data 1, shut-down write data 0. Power-on defaults to power-on status.	1 (2 bytes)	Write
40001 (0x0000)	Dissolved oxygen value + temperature	4 double-byte integers, which are dissolved oxygen value, decimal place of dissolved oxygen value, temperature value and decimal place of temperature value.	4 (8 bytes)	Read
40005 (0x0004)	Dissolved oxygen saturation (0 ~ 200%)	Two double-byte integers, which are saturation values and decimal places.	2 (4 bytes)	Read
40006 (0x0006)	Dissolved oxygen value + temperature	Two single-precision floating-point numbers, namely dissolved oxygen value and temperature value.	4 (8 bytes)	Read
4000B (0x000A)	Dissolved oxygen saturation (0 ~ 200%)	Single precision floating point number, saturation value.	2 (4 bytes)	Read
44097 (0x1000)	Zero calibration	Calibrate in anaerobic water, write data to 0, and automatically calculate calibration value; The read-out data is zero offset × 1000.	1 (2 bytes)	Write/read
44101 (0x1004)	Slope calibration	Calibrate in air saturated water, write data to 0, and automatically calculate calibration value; The readout data is a slope value × 1000.	1 (2 bytes)	Write/read
44105 (0x1008)	Enter zero calibration value	The written data is zero offset × 1000; The read-out data is zero offset × 1000.	1 (2 bytes)	Write/read
44106 (0x1009)	Input slope calibration value	The written data is slope value × 1000; The readout data is a slope value × 1000.	1 (2 bytes)	Write/read



44113 (0x1010)	Temperature calibration	Calibration in solution, the written data is the actual temperature value × 10; The readout data is the temperature calibration offset × 10.	1 (2 bytes)	Write/read
44129 (0x1020)	Salinity compensation	The read/write data is salinity value (PSU) × 10 for salinity compensation; The factory default is 0, without salinity compensation. The write value ranges from 0 to 500, corresponding to 0 to 50.0 PSU.	1 (2 bytes)	Write/read
48195 (0x2002)	Sensor address	The default is 6, and the write data range is 1 ~ 127.	1 (2 bytes)	Write/read
48225 (0x2020)	Reset sensor	The calibration value reverts to the default value, and the write data is 0. Note that the sensor needs to be calibrated again after reset before use.	1 (2 bytes)	Write
412388 (0x3064)	Atmospheric pressure (kPa)	The read/write data is an atmospheric pressure value (kPa) × 100 for calculating air saturated oxygen; Factory default setting. The written values range from 8000 to 13000, corresponding to 80.00 to 130.00 kPa.	1 (2 bytes)	Write/read

**4. Command example**

1. Obtain dissolved oxygen and temperature values

Function: Obtain the dissolved oxygen value and temperature of the probe: The dissolved oxygen value is the DO value after user calibration, the unit is mg/L, and the unit of temperature is Celsius.

The request frame and the reply frame of the Get Temperature and Dissolved Oxygen Value

(1) integer data command are described below by taking the temperature value of 22.52 and the dissolved oxygen value of 8.68 returned from the device address 0x01 as an example.

Definition	Address field	Function code	Start address		Number of registers		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x03	0x00	0x00	0x00	0x04	0x44	0x09



Request frame for command to obtain temperature and dissolved oxygen value

Definition	Address field	Function code	Number of bytes	Register value		CRC	
Byte	0	1	2	3 ~ 6	7 ~ 10	11	12
Content	0x01	0x03	0x08	8.68	22.52	0xCA	0x5A

Get the response frame of the temperature and dissolved oxygen value command

Dissolved oxygen value (3 ~ 6)				Temperature values (7-10)			
0x03	0x64	0x00	0x02	0x08	0xCC	0x00	0x02

Byte distribution of temperature value and dissolved oxygen value, where 0x0002 represents the number of decimal places

(2) Request frames and reply frames for single-precision floating-point commands

Definition	Address field	Function code	Start address		Number of registers		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x03	0x00	0x06	0x00	0x04	0x44	0x09

Request frame for command to obtain temperature and dissolved oxygen value

Definition	Address field	Function code	Number of bytes	Register value		CRC	
Byte	0	1	2	3 ~ 6	7 ~ 10	11	12
Content	0x01	0x03	0x08	8.68	22.52	0xC7	0xC8

Get the response frame of the temperature and dissolved oxygen value command

Remarks: temperature value, dissolved oxygen value: large-end storage mode, floating point number

Dissolved oxygen value (3 ~ 6)				Temperature values (7-10)			
0x41	0x0A	0xE1	0x48	0x41	0xB4	0x28	0xF6

Byte distribution of temperature value and dissolved oxygen value

(3) Get the sensor address

Function: Gets the MODBUS slave address of the current sensor. This command uses 0xFF as the fixed address field.

Take the returned address 0x03 as an example to explain the request frame and reply frame of the command of obtaining slave address.





Definition	Address field	Function code	Start address		Number of registers		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0xFF	0x03	0x20	0x02	0x00	0x01	0x3B	0xD4

Get the request frame of the slave address command

Definition	Address field	Function code	Number of bytes	Register value		CRC	
Byte	0	1	2	3	4	5	6
Content	0xFF	0x03	0x02	0x00	0x03	0xD1	0x91

Get the reply frame of the slave address command

**(4) Acquiring salinity values**

Function: Get the salinity value of the current probe, unit PSU, integer, minimum 0.1 PSU.

The request frame and the response frame of the Get Salinity Value command are described below using the return salinity value of 10.0 as an example.

Definition	Address field	Function code	Start address		Number of registers		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x03	0x10	0x20	0x00	0x01	0x25	0xD4

Request Frame for Get Salinity Value Command

Definition	Address field	Function code	Number of bytes	Register value		CRC	
Byte	0	1	2	3	4	5	6
Content	0x01	0x03	0x02	0x00	0x64	0xB9	0xAF

Response frame of get salinity value command

0x0064 indicates that the salinity value is 10.0 PSU

**(5) Acquire a calibration value of zero offset**

Function: Obtain zero offset calibration parameters.

The request frame and reply frame of the read zero offset calibration parameter value command are described below, using a value of-0. 997 as an example.

Definition	Address field	Function code	Start address		Number of registers		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x03	0x10	0x00	0x00	0x01	0x80	0xCA

Request frame for obtaining zero offset calibration parameter value



Definition	Address field	Function code	Number of bytes	Register value		CRC	
				3	4	5	6
Byte	0	1	2	3	4	5	6
Content	0x01	0x03	0x02	0xFC	0x1B	0xB9	0x4F

Return value: 0xFC1B, decimal-997

Corresponding to  $-997 * 1000 = -0.997$

Acknowledge frame for obtaining zero offset calibration parameter value

(6) Set slave address

Function: Set the MODBUS slave device address of the probe, and the address range is 1 ~ 247.

The request frame and the reply frame of the Slave ID setting command are explained by taking the old device address of the probe = 0x01 and the new device address = 0x19 as examples

Definition	Address field	Function code	Start address		Data		CRC	
			2	3	4	5	6	7
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x20	0x02	0x00	0x19	0xE2	0X00

Set slave address request frame instance

Definition	Address field	Function code	Start address		Data		CRC	
			2	3	4	5	6	7
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x20	0x02	0x00	0x19	0xE2	0X00

Setting slave address reply frame instance

(7) Write salinity compensation value

Function: Set the salinity compensation of the sensor.

The request frame and the response frame of the setting salinity value command are described below by taking the setting salinity value 10.0 as an example.

Definition	Address field	Function code	Start address		Data		CRC	
			2	3	4	5	6	7
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x20	0x00	0x64	0x8D	0X2B

Write an example of salinity parameter request frame



Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x20	0x00	0x64	0x8D	0x2B

An example of writing salinity parameter response frame

(8) Zero calibration

Function: Set the calibration value of dissolved oxygen zero point of the sensor; Ask the product to stand still in zero oxygen environment and send this command after the reading is stable.

Request frame and reply frame

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x00	0x00	0x00	0x8D	0x0A

Set Zero Calibration Command Request Frame Instance

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x00	0x00	0x00	0x8D	0x0A

Setting Zero Calibration Command Acknowledgement Frame Instance

(9) Enter zero calibration value

Function: The user enters the zero calibration value he wants to set

The request frame and reply frame of the Set Zero Offset Calibration Parameter Value command are described below, using a value of-0.997 as an example.

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x08	0xFC	0x1B	0x0D	0xC3

Input zero offset calibration value request frame instance

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x08	0xFC	0x1B	0x0D	0xC3

Input Zero Offset Calibration Response Frame Example



(10) Slope calibration

Function: Set the calibration value of dissolved oxygen slope of the sensor; Ask the product to stand still in saturated dissolved oxygen environment and send this command after the reading is stable. (If the requirement is not high, take out the product from the water and let it stand in the air for half an hour. Send this command after the reading is stable.)

Request frame and reply frame

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x04	0x00	0x00	0xCC	0xCB

Set slope calibration command request frame instance

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x04	0x00	0x00	0xCC	0xCB

Setting slope calibration command reply frame instance

(11) Enter the slope calibration value

Function: The user enters the slope calibration value he wants to set

The request frame and the reply frame of the Set Slope Calibration Value parameter value command are described below with a value of 0.997 as an example.

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x09	0x03	0xE5	0x9C	0x73

Input slope calibration value request frame instance

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x10	0x09	0x03	0xE5	0x9C	0x73

Input slope calibration response frame example



(12) Setting atmospheric pressure

Function: Set atmospheric pressure

The request frame and the reply frame of the setting atmospheric pressure value command are described below taking the atmospheric pressure value of 101.33 kPa (0x2795=10133) as an example.

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x30	0x64	0x27	0x95	0x1C	0x8A

**Set Atmospheric Pressure Value Request Frame Instance**

Definition	Address field	Function code	Start address		Data		CRC	
Byte	0	1	2	3	4	5	6	7
Content	0x01	0x06	0x30	0x64	0x27	0x95	0x1C	0x8A

**Setting Atmospheric Pressure Response Frame Instance**

**5. Error response**

If the sensor cannot execute the command of the upper computer correctly, it will return the following format information:

Definition	Address field	Function code	CODE	CRC	
Byte	0	1	2	3	4
Content	ADDR	COM + 80H	Xx	Xx	Xx

COM: Function code received

CODE: 01-Illegal function code

02-Illegal data address

03-Illegal data

**6. Notes**

In order to keep sure the high accuracy, when you receive the samples, please input your local air pressure and the water salinity if have. The product default is the standard atmospheric pressure and 0 salinity.