Dissolved oxygen sensors

Supmea

Headquarters

5th floor,Building 4,Singapore Hangzhou Science Technology Park,No. 6 street,
Hangzhou Economic Development Area,Hangzhou 310018,China

Singapore

2 Venture Drive #11-30 Vision Exchange Singapore

info@supmea.com
www.supmea.com
Supmea Automation Co.,Ltd.

Preface

Thank you for purchasing dissolved oxygen sensors for aquaculture controller. 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-7019-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	Dissolved Oxygen Sensors for Aquaculture	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. Product Overview

DO monitoring is the most critical water quality parameter in aquaculture. Our ODO series aquaculture optical dissolved oxygen sensor is specially designed for aquaculture applications. With embedded temperature sensor and robust RS485 digital signal output, the sensor can be seamlessly connected to our online controller. The sensor can be easily integrated into wireless sensor network and automation controls.

Features

Digital output, support RS485 / MODBUS.

No membrane, No electrolyte, No chemical interference, No frequent calibration required. No oxygen consumption, No flow dependent.

Specially designed for aquaculture application.

2. Structure Chart

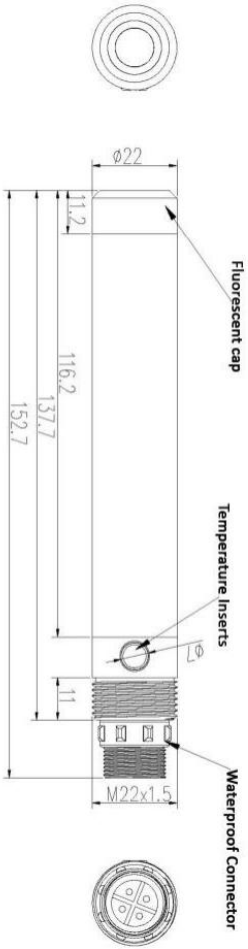

Fig. 1

3. Definition of Cable

Wire AWG-24 or AWG-26 shielding wire. OD=5.5mm

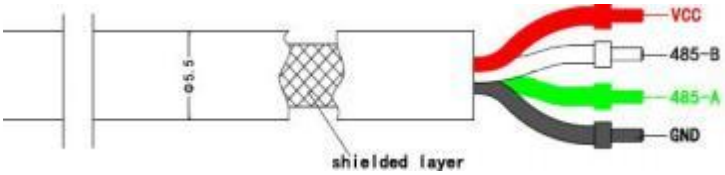

Fig. 2

Table 1

1. Red—Power (VCC)
2. White—485 Date_B (485_B)
3. Green—485 Date_A (485_A)
4. Black—Ground (GND)

4. Technical Parameters

Table 2

Name	Dissolved oxygen sensor
Principle	Fluorescence
Range	0-20mg/ L or 0-200 % saturation
Measurement Accuracy	±3%
Response Time	60s
Maximum Depth	30m
Temperature Range	0 ~ 50℃(non-freezing)
Temperature Accuracy	±0.5℃
Sensor Interfaces	RS-485, MODBUS protocol
Power Requirements	DC 9~24V, current <50mA
Construction	M22*1.5(optionally convertible to NPT3/4 thread), submersible installation
Sensor Size	Φ22mm*152.7mm
Probe Cable Length	10m (default), customizable
Calibration	One-point or two-points calibration
Body Materials	316L / Ti

Note

The above technical parameters are all data under laboratory standard liquid environment. Sensor life and maintenance calibration frequency are related to actual field conditions.

5. Installation

5.1. Configuration Table

Table 3

Standard Configuration	Number	Remarks
DO Sensor	1	
Wires and Cables	1	10m
Rubber Protection Cap	1	

5.2. Before Use

Take off the protect cap:
Please take off the protect cap of Optical dissolved oxygen sensor, before installation and keep them properly for future use. Meanwhile, tighten the protective cover.

5.3. Sensor Installation

(1) Wiring and Power Supply
① The female and male connector of sensor cable should be screwed tightly to avoid moisture incursio.
② Do not use the sensor cable to suspend the sensor! It is recommended to install a cable protection
sleeve to ensure that the cable is powered and watertight.
③ Make sure power supply voltage is correct before power on.
(2) Sensor Installation
① It is recommended to install the sensor vertically with electrodes facing down.
② Considering water level change, the sensor should be installed 30cm below water level. The sensor should not be installed no more than 2m below water surface for maintenance purpose.
③ The sensor must be securely installed to avoid damage caused by water flow and other things.

6. Calibration

6.1. Calibration Solution Preparation

Preparation for zero oxygen environment: take 200mL distilled water and pour it into the prepared beaker, then add anhydrous sodium sulfite, add and stir at the same time, until anhydrous sodium sulfite is insoluble and solid crystallization occurs, then the standard solution can be regarded as close to 0 oxygen.

Preparation for 100% oxygen environment: Prepare 1 beaker, take 200mL purified water (or distilled water) and pour it into the cup, add to the air pump, and fully aerate the solution (at least 30 minutes).

Note: If the field conditions really do not allow, the sensor can be directly put into the air (calibration accuracy will be slightly deviated).

6.2. Calibration (take 2-point calibration as an example)

First restore the user calibration data to the default, K=1, B=0 (see modbus documentation).

Clean the sensor, place it in a 100 oxygen environment (in air), read the dissolved oxygen value, wait until the data stabilizes and the value approaches 1 (i.e. saturation 100), e.g. 0.96, and record the value as Y. Wash the sensor again into the zero calibration solution, let the front end of the sensor be completely submerged in the solution, read the dissolved oxygen value, wait for the data to stabilize and approach 0, e.g. 0.015, and record as X.

Calculate K and B values according to the following formula: K=(1-0)/(Y-X), B=-KX.

Write K, B values to the sensor. (see modbus documentation for details).

6.3. Appliances and Raw Materials Required

Anhydrous sodium sulfite powder.

Distilled water or deionized water (Watsons distilled Water).

Beakers, gloves, stirring rod, air pump.

7. Maintenance Schedule and Methods

7.1. Maintenance Cycle

Unlike traditional electrical chemical sensors, optical DO sensors require low maintenance. There are no need for frequent solution filling and calibrations.

Table 4

Maintenance Task	Maintenance Intervals (cleaning, calibration)
Cleaning Sensors	Cleaning every 30 days
Sensor and Sensor Cap Inspection	Check every 30 days
Sensor Cap Replacement	Replace once a year
Calibration	Frequent use is recommended every 30 days; occasional use is recommended before each use; or adjust yourself according to the actual working conditions on site.

Note:

The maintenance frequency in the above table is only a suggestion, please clean the sensor according to the actual use of the sensor by the maintenance personnel; however, the fluorescent cap replacement, recommends to replace it once a year.

7.2. Maintenance Methods

(1) Sensor maintenance

① Clean the sensor surface：Wash the outer surface of sensor with tap water, if there is still residue, using soft brush, for some stubborn dirt, household detergent can be added in tap water to clean.

② Fluorescent cap external surface cleaning：Remove the protective cover, flush the dirt on the light window of the sensor with clean water, and finally put the cover on;If you need to wipe it, please wipe it gently with a soft cloth and do not scratch it forcefully. Otherwise, once the fluorescent film is scratched or scratched, the sensor will not work properly.

③ Clean the cap inner surface: If water vapor or dust gets inside the fluorescent

cap, the cleaning steps are as follows:

Remove the fluorescent cap.

Rinse the inner surface of the fluorescent cap with tap water.

For dirt containing fat and oil, wash it in warm water with household detergent. Rinse the inner surface of the fluorescent cap with deionized water.

Gently dry all surfaces with a clean flannelless cloth and place in a dry place to allow water to completely evaporate.

④ Check the cable：inspect the sensor cable if there is damage.

⑤ Store the cap：Regular electrode maintenance requires cap to be stored in a protective cover with a damp sponge and checked and watered regularly, so as to keep the fluorescent film in a moist state for a long time. If the sensor fluorescent cap head is dry for a long time, the measurement results will drift, and it needs to be soaked in water for 48 hours before continuing to work.

(2) Notes

Protect the inner surface of the fluorescent cap from sun exposure. Do not touch the fluorescent film with your hands.

Avoid applying any mechanical stress (pressure, scratch, etc.) directly to the fluorescent film during use.

8. Frequently Asked Questions

Table 5 lists possible problems with ammonia nitrogen sensors and solutions. If your problem is not listed or the solution does not handle your problem, please contact us.

Table 5 List of Frequently Asked Questions

Failure Phenomena	Possible Causes	Solutions
Probe does not communicate or display measurement results.	Faulty connection of controller to cable	Reconnecting the controller and cables
	Cable failure	Please contact us
Measured value too high, too low or persistently unstable.	External surface of fluorescent cap adhered by foreign objects	Cleaning the outer surface of the fluorescent cap
	Damaged fluorescent cap	Replacing the fluorescent cap
	Fluorescent caps have exceeded their useful life	
	Probe internal hardware failure	Please contact us.
Temperature value beyond the measurable range or garbled readings	Faulty temperature sensor or probe	Please contact us.

9. Warranty Description

(1) The warranty period is 1 year.

(2) This quality assurance does not cover the following cases.

① Due to force majeure, natural disasters, social unrest, war (declared or undeclared), terrorism, the War or damage caused by any governmental compulsion.

② Damage caused by misuse, negligence, accident or improper application and installation.

③ Freight charges for shipping the goods back to our company.

④ Freight charges for expedited or express shipping of parts or products covered by the warranty.

⑤ Travel to perform warranty repairs locally.

(3) This warranty includes the entire contents of the warranty provided by our company with respect to its products.

① This warranty constitutes a final, complete and exclusive statement of the terms of the warranty, and no person or The agent is authorized to establish other warranties in the name of our company.

② The remedies of repair, replacement, or return of payment as described above are exceptional cases that do not violate this warranty, and the remedies of replacement or return of payment are for our products themselves. Based on strict liability or other legal theory, our company shall not be liable for any other damage caused by a defective product or by negligent operation, including any subsequent damage that is causally related to these conditions.

10. Communication Protocols

10.1. ModBus protocol information

●Protocol specifications

Name	Description
Communication Interface	RS485
Transport Mode	ModBus RTU
Port Settings	9600,N,8,1 (Default)
Device Address	0x01 (Default)

●Function code

Function Code	Description
0x03	Read register data, error return code 0x83
0x06	Write a single register, error return code 0x86
0x10	Write multiple registers, error return code 0x90

●Error code

Error Code	Description
0x01	Invalid instruction or current instruction unavailable, this feature is not supported.
0x02	The content of this address cannot be written with data.
0x03	The current input data is invalid and exceeds the input range.

●Query device address (standalone mode)

The device address is unknown. You can use address 0x00 to send the 03 command to query the device address.

●Broadcast instruction

When the host sends a device address of 0xff, it is a broadcast command, and the slave does not respond when receiving the broadcast command.

●Frame format

Read register data (0x03)

Inquiries：

Name	Device Address	Function Code	Start Address	Number of Registers	CRC
Data	Addr	0x03	M	N	CRC16
Byte Length	1	1	2	2	2

Reply frame:

Name	Device Address	Function Code	Return Bytes	Return Data	CRC
Data	Addr	0x03	N*2	Data	CRC16
ByteLength	1	1	1	N*2	2

Write a single register (0x06)

Inquiries：

Name	Device Address	Function Code	Start Address	Data Value	CRC
Data	Addr	0x06	M	Data	CRC16
Byte Length	1	1	2	2	2

Reply frame:

Name	Device Address	Function Code	Start Address	Data Value	CRC
Data	Addr	0x06	M	Data	CRC16
Byte Length	1	1	2	2	2

Write multiple registers (0x10)

Inquiries：

Name	Device Address	Function Code	Start Address	Data Quantity	Byte Count	Data Value	CRC
Data	Addr	0x10	M	N	N*2	Data	CRC16
Byte Length	1	1	2	2	1	N*2	2

Reply frame:

Name	Device Address	Function Code	Start Address	Byte Count	CRC
Data	Addr	0x10	M	Data	CRC16
Byte Length	1	1	2	2	2

10.2. Examples

●Read data

The starting register address is 0x0000, and the number of read registers is 2:

Device Address	Function Code	Start Address	Number of Registers	CRC
0x01	0x03	0x0000	0x0002	0xC40B

Data response: Read register data as 0x0001,0x0002:

Device Address	Function Code	Return Bytes	Return Data	CRC
0x01	0x03	0x04	0x0001,0x0002	0x2A32

If the current command is unavailable, return an error response:

Device Address	Function Code	Error Code	CRC
0x01	0x83	0x01	0x80F0

●Write data

Register address 0x0001, write data 0x0002:

Device Address	Function Code	Start Address	Data Value	CRC
0x01	0x06	0x0001	0x0002	0x59CB

Data response:

Device Address	Function Code	Start Address	Data Value	CRC
0x01	0x06	0x0001	0x0002	0x59CB

If the current register is not writable, return an error response:

Device Address	Function Code	Error Code	CRC
0x01	0x86	0x02	0xC3A1

●Continuously writing data

Write 2 consecutive register values from register address 0x0001, 0x0002, 0x0003:

Device Address	Function Code	Start Address	Data Quantity	Byte Count	Data Value	CRC
0x01	0x10	0x0001	0x0002	0x04	0x0002, 0x0003	0xD3 A2

Data response:

Device Address	Function Code	Start Address	Data Quantity	CRC
0x01	0x10	0x0001	0x0002	0x100 8

If the written data is invalid, return an error response:

Device Address	Function Code	Error Code	Check Code
0x01	0x90	0x03	0x0C01

●Address inquiry (single machine mode)

The device address is unknown. You can use the address 0x00 to send the 03 command:

Device Address	Function Code	Start Address	Number of Registers	CRC
0x00	0x03	0x0000	0x0002	0xC5DA

10.3. ModBus register information

●Register data

The following register data adopts big endian mode, with high byte first and floating-point number sequence 1234.

The public part including registers marked with * must be supported, while other registers cannot be filled with 0.

Table 6

Name	Register	Function Code	Data Type	Access Type	Description
RS485 Slave Address	0x1100	0x03/0x06	short	W/R	1-254，default 1
RS485 Baud Rate	0x1101	0x03/0x06	short	W/R	1= 2400, 2= 9600 (default) , 3= 14400 4= 19200 5= 38400
Serial Port Configuration	0x1102	0x03/0x06	short	W/R	1= N81(default) 2 = N82 3 = E81, 4 = O81 N:No parity E:even parity check O:Odd Parity 8：Data bit 8 1：Stop position 1 2：Stop position 2

●Digital sensor

The continuous read operation of digital sensor registers 0x2000 to 0x2011 contains unsupported register functions in between, and writing 0 returns.

Register functions that are not supported except for the digital sensor registers 0x2000 to 0x2011 are returned in error code 0x01 format.

The decimal and unit occupy 2 bytes, with the high byte representing the decimal digits and the low byte representing the unit value. Please refer to the unit information.

Table 7

Name	Register Address	Function Code	Data Type	Access Type	Description
Data Version and Device Type	0x2000	0x03	short	R	High byte: data version, Low byte: device type Data version: 0x01 Device Type: 0x33
Dissolved oxygen value	0x2001	0x03	short	R	
Decimals and Units	0x2002	0x03	short	R	Decimal Places：2 Unit：mg/L
Temperature	0x2003	0x03/ 0x06	short	W/R	Range：-100~1100
Decimals and Units	0x2004	0x03/ 0x06	short	W/R	Decimal Places：1 Unit：℃
Dissolved oxygen saturation	0x2005	0x03 /0x06	short	W/R	Range：0-200
Decimals and Units	0x2006	0x03	short	R	Decimal Places：0 Unit：%
Salinity compensation	0x2007	0x03	short	W/R	0~4000 0.0ppt（default）
Decimals and units	0x2008	0x03	short	R	Decimal Places：2 Unit：ppt

Name	Register Address	Function Code	Data Type	Access Type	Description
Atmospheric pressure compensation	0x2009	0x03	short	W/R	760.0mmHg（default）
Decimals and units	0x200A	0x03		R	Decimal Places：1 Unit：mmHg
Temperature Mode	0x200C	0x03/ 0x06	short	W/R	1: Automatic (default) 2: Manual
Error code	0x200D	0x03	long	R	Refer to10.6 Error code
Calibration Status	0x200F	0x03	short	R	0: Not calibrated 1: Calibrated
Filter Coefficient	0x2011	0x03/ 0x06	short	W/R	0 ~ 9 0: No Filter
Restore Factory Settings	0x2020	0x06	short	W	0x01
Electrode calibration status	0x3000	0x03	short	R	0x0000: Successfully calibrated 0x0001: Calibration not yet completed 0x0002: Standard solution information not received or not available 0x0003: Signal instability or signal out of range 0x0004: Slope or bias exceeds allowable range
Electrode Calibration	0x3001	0x06	short	W	0x0001: Air calibration 0x0002: Zero point calibration
Exit calibration	0x3003	0x06	short	W	0x01 exits calibration state

10.4. Calibration process

Taking air calibration as an example:

Dissolved oxygen electrode register 0x3001 writes 0x0001 to enter the air calibration state of the sensor

Read the calibration status of the dissolved oxygen electrode register 0x3000 and check if the current calibration is complete

Entering the calibration state for more than 5 minutes without successful calibration, or register 0x3003 receiving an exit calibration instruction, the electrode exits the calibration state.

10.5. Error code

The Error code consists of 32 bits of data, each representing a type of fault.

Error code	Description
Bit0	Storage unit exception, write data failed
Bit1	Temperature sensor abnormal, out of range
Bit2	Abnormal sensor probe, out of range
Bti3	Not calibrated, check if the sensor has completed the calibration operation
Bit4-Bit31	reserve