

## KWS-630 Series Fluorescence Dissolved Oxygen Sensor Manual



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## 1.Introduction

The Kacise KWS-630 fluorescence dissolved oxygen sensor is designed for the aquaculture industry. It has the characteristics of stable online monitoring, and it has excellent characteristics compared with the traditional type sensor. It has no membrane, no need electrolyte, strong anti-interference, no need for frequent calibration, no consumption of oxygen, no flow rate limitation, automatic temperature and Gas pressure compensation, fast reaction speed, long service life and more economical and convenient, so the fluorescence dissolved oxygen sensor is the best choice for real-time dynamic monitoring of oxygen content in aquaculture.

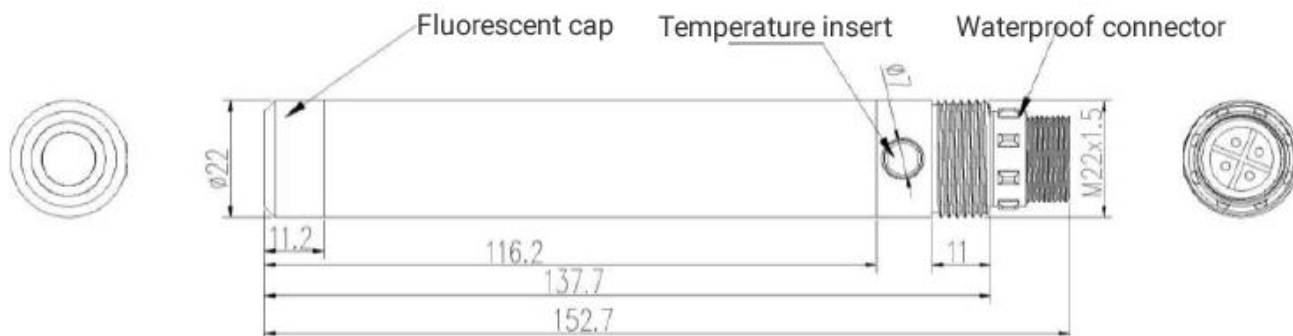
## 2.Feature

- Digital sensor, RS485 output, support MODBUS
- No electrolyte required, strong anti-interference, no need for frequent calibration; no oxygen consumption, no flow rate limit;
- Built-in temperature sensor, automatic temperature compensation;
- Tailor-made for the breeding market, with cost-effective performance

## 3.Technical Specifications

|                              |                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------|
| <b>Measurement principle</b> | Fluorescence method                                                                      |
| <b>Range</b>                 | 0-20mg/L or 0-200% saturation                                                            |
| <b>Accuracy</b>              | ±3%                                                                                      |
| <b>Casing material</b>       | 316L(KWS-630)<br>Titanium alloy(KWS-630T)                                                |
| <b>Maximum water depth</b>   | 30 meters                                                                                |
| <b>Response time</b>         | 60s                                                                                      |
| <b>Temperature range</b>     | 0-50℃                                                                                    |
| <b>Sensor interface</b>      | RS-485, MODBUS protocol                                                                  |
| <b>Power consumption</b>     | 0.1W (recommended power supply: DC9-24V, current>50mA)                                   |
| <b>Assembly</b>              | M22*1.5 (optional accessories can be converted to NPT3/4 thread), immersion installation |
| <b>Sensor dimensions</b>     | Φ22mm*152.7mm                                                                            |
| <b>Probe cable length</b>    | 10 meters (default), customizable                                                        |
| <b>Calibration</b>           | One or two-point calibration                                                             |
| <b>Fluorescent cap life</b>  | Guaranteed to use for one year (under normal use)                                        |

## 4. Dimensions



## 5. Installation and electrical connection

### 5.1 Installation

#### (1) Remove the protective cover

Before installation, please remove the rubber protective cap on the front of the dissolved oxygen sensor and keep it properly.

#### (2) Wiring and power supply

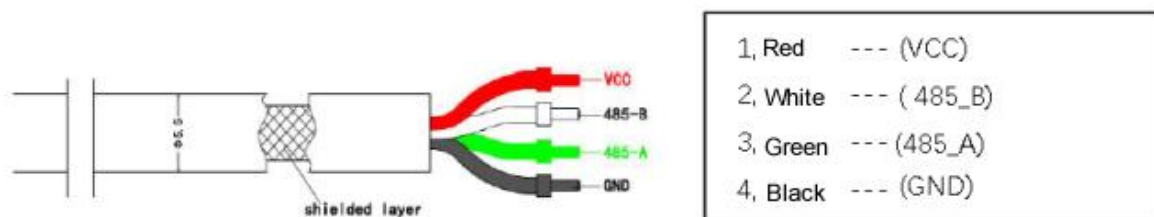
- ① The sensor watertight connector and the cable or mother connector must be tightly screwed to avoid water seepage;
- ② Do not use the sensor cable to hang the sensor! It is recommended to install a cable protective cover to ensure that the cable is well powered and watertight.
- ③ Before powering on, make sure that the power supply voltage and wiring sequence are accurate!

#### (3) Sensor installation

- ① Tail M22\*1.5 (optional accessories can be turned to NPT3/4 thread) fixed installation, shell clamp clamp installation; (Note: The sensor is recommended to be installed with the electrode facing downward);
- ② Considering the influence of water level, it is recommended to install it below 30cm from the lowest water level line (avoid long-term exposure to air for measurement);
- ③ The sensor needs to be fixedly installed to avoid probe collisions caused by water flow and other factors.

### 5.2 Electrical connections

wire AWG-24 或 AWG-26 shielding wire. OD=5.5mm



## 6. Calibration

### 6.1 Calibration method

The dissolved oxygen sensor supports 1-point (normally select 100% saturation point) or 2-point calibration with percentage/% (in units of 1, such as 0.96 for 96%) as the parameter. 1-point calibration mainly changes the K value, and 2-point calibration changes the K and B values.

### 6.2 Standard solution preparation

#### 1) Zero point standard solution

Prepare 1 beaker, take 200mL of distilled water and pour it into the cup, then add anhydrous sodium sulfite, stirring while adding until the anhydrous sodium sulfite is insoluble and solid crystals appear. The standard solution at this time is the zero point standard solution.

#### 2) 100% oxygen environment

Prepare 1 beaker, take 200mL of pure water (or distilled water) and pour it into the cup, and use a small aerator to fully expose the solution to air (10~15 minutes, the larger the solution, the longer the time required).

Note: If the conditions on site are limited, the sensor can also be cleaned and saturation point calibration can be performed in air (accuracy will be slightly deviated).

### 6.3 Manual calibration calculation of K and B example (taking 2-point calibration as an example)

First, restore the user calibration data to the default,  $K=1$ ,  $B=0$  (see the modbus document for details).

Clean the sensor and place it in a 100% oxygen environment (in air), read the dissolved oxygen value, wait for the data to stabilize, and the value is close to 1 (i.e. saturation 100%), for example 0.96, and record the value as Y. Wash the sensor again and place it in the zero point standard solution, immerse the front end of the sensor completely in the solution, read the dissolved oxygen value, wait for the data to stabilize and close to 0, for example 0.015, and record it as X.

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

Write the K and B values into the sensor. (See modbus document for details)

### 6.4 Required equipment and materials

Anhydrous sodium sulfite powder;

Deionized water or distilled water (such as Watsons distilled water);

Beaker, gloves, stirring rod, small aerator.

## 7. Maintenance schedule and methods

### 7.1 Maintenance cycle

Different from the electrochemical principle of dissolved oxygen probes, fluorescence dissolved oxygen probes do not consume oxygen, have no filling fluid, etc., and do not require frequent maintenance. Normal cleaning and user calibration are sufficient.

| Maintenance tasks                                    | Maintenance cycle (cleaning, calibration)                                                                                                 |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Cleaning the sensor                                  | Recommended every 2~3 weeks (extended for automatic cleaning brushes. Shortened for those without cleaning brushes and large biomass)     |
| Inspecting the sensor and fluorescent cap for damage | Check every 30 days                                                                                                                       |
| Replacing the fluorescent cap                        | Replace once a year                                                                                                                       |
| Calibrating the sensor                               | Recommended every 30 days for frequent use; before each use for occasional use; or adjust according to actual working conditions on site. |

Note: The maintenance frequency in the above table is only a suggestion. Please ask maintenance personnel to maintain the sensor according to the actual use of the sensor; however, it is recommended to replace the fluorescent cap once a year.

### 7.2 Maintenance methods

#### (1) Sensor maintenance

- ① Cleaning the outer surface of the sensor: Use tap water to clean the outer surface of the sensor. If there are still debris left, wipe it with a damp soft cloth. For some stubborn dirt, you can add some household detergent to the tap water to clean it;
- ② Cleaning the outer surface of the fluorescent cap: Remove the protective cover at the front of the sensor (if any), rinse the dirt on the sensor light window with clean water, and finally put the protective cover on; if you need to wipe it, please wipe it gently with a soft cloth and do not scratch it hard, otherwise it will scratch or break the fluorescent film layer and the sensor will not work properly.
- ③ Cleaning the inner surface of the fluorescent cap: If water vapor or dust invades the inside of the fluorescent cap, the cleaning steps are as follows:
  - Remove the fluorescent cap and rinse the inner surface of the fluorescent cap with tap water;
  - For dirt containing fat and oil, use warm water with household detergent to clean it;
  - Rinse the inner surface of the fluorescent cap with deionized water;

Gently wipe all surfaces with a clean lint-free cloth and place it in a dry place to allow the water to evaporate completely.

- ④ Check the sensor body and cable: The cable should not be tight during normal operation, otherwise there is a risk of cable breakage, resulting in communication abnormalities; check whether the sensor housing is damaged due to corrosion or other reasons.
- ⑤ Daily storage of the fluorescent cap: When not in use, place it in a protective cover with a moist sponge and check and rehydrate it regularly to keep the fluorescent film moist for a long time. If the head of the sensor fluorescent cap is dry for a long time, the measurement results will drift. It needs to be soaked in water for 48 hours before continuing to work.

## (2) Precautions

Avoid the inner surface of the fluorescent cap from being exposed to sunlight. Please do not scratch the fluorescent film with your hands.

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

## 8. FAQ

The following table lists possible problems with dissolved oxygen sensors and their solutions. If your problem is not listed or the solution does not solve your problem, please contact us.

| Fault phenomenon                                                                         | Possible causes                                                      | Solution                                       |
|------------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------|
| The probe cannot communicate or does not display the measurement result                  | Error in connection between controller and cable                     | Reconnect the controller and cable             |
|                                                                                          | Cable failure                                                        | Contact us                                     |
| The measurement value is too high, too low or the value is continuously unstable         | Foreign objects attached to the outer surface of the fluorescent cap | Clean the outer surface of the fluorescent cap |
|                                                                                          | The fluorescent cap is damaged                                       | Replace the fluorescent cap                    |
|                                                                                          | The fluorescent cap has exceeded its service life                    | Contact us                                     |
|                                                                                          | Internal hardware failure of the probe                               |                                                |
| The temperature measurement value exceeds the measurable range or the reading is garbled | Temperature sensor or probe failure                                  | Contact us                                     |

## 9.Modbus Protocol

The RS485 communication protocol uses MODBUS communication protocol, and the sensors are used as slaves.

|                   |      |
|-------------------|------|
| Baud rate         | 9600 |
| Starting position | 1    |
| Data bits         | 8    |
| Stop bit          | 1    |
| Check digit       | N    |

Read and write data (standard MODBUS protocol).

The default address is 0x01, the address can be modified by register

### Reading data

Host call (hexadecimal)

01 03 00 00 00 01 84 0A

| Code  | Function Definition                   | Remarks                                      |
|-------|---------------------------------------|----------------------------------------------|
| 01    | Device Address                        |                                              |
| 03    | Function Code                         |                                              |
| 00 00 | Start Address                         | See register table for details               |
| 00 01 | Number of registers                   | Length of registers (2 bytes for 1 register) |
| 84 0A | CRC checksum, front low and back high |                                              |

Slave answer (hexadecimal)

01 03 02 00 xx xx xx xx

| Code  | Function Definition                   | Remarks                        |
|-------|---------------------------------------|--------------------------------|
| 01    | Device Address                        |                                |
| 03    | Function Code                         |                                |
| 02    | Number of bytes read                  |                                |
| XX XX | Data (front low and back high DCBA)   | See register table for details |
| XX XX | CRC checksum, front low and back high |                                |

### Writing data

Host call (hexadecimal)

01 10 1B 00 00 01 02 01 00 0C C1

| Code  | Function Definition                   | Remarks                        |
|-------|---------------------------------------|--------------------------------|
| 01    | Device Address                        |                                |
| 10    | Function Code                         |                                |
| 1B 00 | Register Address                      | See register table for details |
| 00 01 | Number of registers                   | Number of read registers       |
| 02    | Number of bytes                       | Number of read registersx2     |
| 01 00 | Data (front low and back high DCBA)   |                                |
| 0C C1 | CRC checksum, front low and back high |                                |

Slave answer (hexadecimal)

01 10 1B 00 00 01 07 2D

| Code  | Function Definition                       | Remarks                        |
|-------|-------------------------------------------|--------------------------------|
| 01    | Device Address                            |                                |
| 10    | Function Code                             |                                |
| 1B 00 | Register Address                          | See register table for details |
| 00 01 | Returns the number of registers written   |                                |
| 7D 2D | CRC checksum<br>(front low and back high) |                                |

## Register Table

| Start address | Command Description                                                                                                                                  | Number of registers | Data format (hexadecimal)                                                                                                                                                                                                                                                                    |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x1100H       | User calibration K/B (read/write)<br>Note: K and B need to be read and written at the same time, and separate reading and writing are not supported. | 4                   | 8 bytes in total<br>00~03: K<br>04~07: B<br>To read K for example, read out as 4 bytes of data (low bit in front, DCBA format, need to convert this data to floating point)<br>To write k, for example, we need to convert k to 32-bit floating point and write it in (DCBA format)          |
| 0x2700H       | Fluorescent cap parameters settings                                                                                                                  | 16                  | 32 bytes in total<br>00~03: L0<br>04~07: L1<br>08~11: L2<br>12~15: L3<br>16~19: TanZero<br>20~23: T0<br>24~27: T1<br>28~31: T2<br>DCBA format, this data needs to be converted to floating point numbers                                                                                     |
| 0x2600H       | Dissolved oxygen value acquisition                                                                                                                   | 6                   | 12 bytes in total<br>00~03: Temperature values<br>04~07: Dissolved oxygen percentage<br>08~011: Dissolved oxygen mg/L<br>Reads the temperature value / dissolved oxygen value as 4 bytes of data each (low bit first, DCBA format, this data needs to be converted to floating point number) |
| 0x3000H       | Device address                                                                                                                                       | 1                   | 2 bytes in total                                                                                                                                                                                                                                                                             |

|         |                                           |   |                                                                                                                                                                                                                                                                                                                                                             |
|---------|-------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | (read / write)                            |   | 00~01: Device address<br>Settable in the range 1 to 254<br>e.g. get data as 02 00 (low bit first means address is 2)<br>To write to address 15, for example, write 0F 00 (lower bit first) to the corresponding address<br>When the current device address is unknown, FF can be used as a generic device address to interrogate the current device address |
| 0x1500H | Setting salinity values<br>(read / write) | 2 | 4 bytes in total<br>00~03: Salinity value<br>Default is 0, unit ppt, DCBA format, this data needs to be converted to floating point number)                                                                                                                                                                                                                 |
| 0x2400H | Set air pressure value<br>(read / write)  | 2 | 4 bytes in total<br>00~03: Air pressure value<br>The default standard atmospheric pressure is 101.325, unit kpa, DCBA format, this data needs to be converted into a floating point number                                                                                                                                                                  |