

KWS-400 Optical Fiber Chlorophyll Sensor

Introduction

Kacise chlorophyll sensor, developed based on advanced fluorescent sensing technology, has the advantages of high sensitivity, high linearity, low noise and other indicators compared to the international mainstream similar products; especially the KWS-400B online self-cleaning chlorophyll sensor is integrated with an automatic cleaning brush, Integrated design, with solid structure, efficient power management, stable data performance, free from frequent maintenance and calibration; can be used online for a long time.

It can be widely used in the monitoring, investigation and research of algae and phytoplankton in rivers, lakes, ponds, marine surveys, aquaculture, drinking water sources and other scenes.

Feature

- Digital sensor, RS-485 output, support MODBUS.
- With automatic cleaning brush, prevent contamination, eliminate bubbles.
- Direct measurement is more convenient than traditional analysis method
- On-line continuous monitoring, real-time control water quality dynamics

Technical Specifications

Item	Fiber Chlorophyll Sensor	Self-Cleaning Chlorophyll Sensor
Model	KWS-400A	KWS-400B
Photo		
Principle	fluorescence principle	
Measuring Range	0~400ug/L or 0~100RFU	
Resolution	0.01 µg/L	
Protection Rate	IP68	
Max. pressure	6 bar	3 bar
Temperature Range	0 ~ 50℃	
Output	Support RS-485, MODBUS protocol	
Power Supply	DC12~24V, >500mA	
Working current	0.2W (when not brush); 0.6W (when brush)	
Installation	Input type, circulation type	Input type
Size	Φ22mm*175.5mm	Φ36mm*198.2mm
Cable Length	10 m, customizable	
Self-Cleaning System	NO	Yes
Calibration	0-point, one-point or two-point calibration	
Casing Material	Titanium	

Note:1. The above technical parameters are the data in the laboratory standard liquid environment;

2. The life of the sensor and the frequency of maintenance and calibration are related to the actual on-site working conditions.

Wiring

red - power supply (VCC)

white - 485 data _B (485_B)

green - 485 data _A (485_A)

black - ground (GND)

Installation

Wiring and power supply

1. Do not use the sensor cable to lift the sensor! It is recommended to install a cable protection cover to ensure that the cable is powered and watertight.

2. Make sure the wiring sequence and power supply voltage are correct before powering on!

Sensor installation

1. The sensor is recommended to be installed vertically with the electrode measurement light window facing down, and the sensor should be avoided from hitting the wall or other water conservancy facilities caused by water flow. If the water flow is strong, please fix the sensor;

2. Considering the influence of water level, the sensor should be installed 30cm below the lowest water level, and ensure that the measurement window is more than 10cm away from the bottom or obstacles;

3. The sensor is installed in a position where there are no air bubbles in the water, as far away as possible from the aeration port.

Calibration

Standard solution configuration

1. **Reagents required:** Rhodamine WT, 20% solution (CAS#37299-86-8)、deionized water

2. Configuration Method:

① Placement 200mg/L Rhodamine WT solution:

Take 0.5mL of Rhodamine WT,20% solution into 500mL volumetric flask, dissolve in deionized water to mark of 500 mL, which is 200mg/L Rhodamine WT stock solution.

② Placement 2mg/L Rhodamine WT solution:

Take 10mL of ① into a 1000 mL volumetric flask, dissolve in deionized water to mark of 1000mL, which is 2mg/L Rhodamine WT stock solution, can be used as a standard solution of chlorophyll.

③ Other concentration solution dilution methods:

$$\frac{\text{known solution concentration}}{\text{configure solution concentration}} = \frac{\text{configuration solution volume}}{\text{transferred solution volume}}$$

3. Attention:

Standard reagent stock solution must be stored in dark glass bottles at low temperature to prevent decomposition, the prepared solution is best used within 24 hours.

(4) Rhodamine WT solution- temperature - chlorophyll corresponding table

① Rhodamine WT solution of 2mg/L- temperature - chlorophyll corresponding table

Temp.	30	28	26	24	22	20	18	16
Chlorophyll(ug/L)	176.7	186.9	194.5	204.9	214.2	227.1	240.5	249.3

② Other concentrations of Rhodamine WT solution- temperature - chlorophyll congruent relationship, at the same temperature:

other concentrations of Rhodamine WT solution

2mg/L Rhodamine WT solution

= other concentrations of Rhodamine WT solution correspond to chlorophyll values

2mg/L Rhodamine WT solution correspond to chlorophyll values

For example, the corresponding chlorophyll value of 2mg/L Rhodamine WT solution at 20°C is 227.1µg/L, then the corresponding chlorophyll value of 1 mg/L of Rhodamine WT solution at 20°C is 113.55µg/L.

Maintenance Schedule and Method

1. Maintenance Schedule

The cleanliness of the measurement window is very important to maintain accurate readings. It is recommended to clean the sensor light window before testing.

Maintenance Task	Recommended Maintenance Frequency	
	KWS-400A	KWS-400B
Clean the sensor	According to work condition	3~4 weeks is recommended
Calibrate the sensor	Once a month is recommended, or according to the work condition	

2. Maintenance Methods

(1) Sensor surface cleaning: Clean the outer surface of the sensor with tap water. If debris remains, wipe it with a damp soft cloth. For some stubborn dirt, you can add some household detergent to tap water to clean it;

(2) Outer surface of the measurement window: Clean the outer surface of the sensor with tap water. For

some stubborn dirt, you can use traditional cleaners and soft cloth to clean;

(3) Check the cable of the sensor: the cable should not be tight during normal operation, otherwise the internal wire of the cable will be easily broken, causing the sensor to not work normally;

(4) Check the cleaning brush: check whether the brush skin is in effective contact with the light window, whether it rotates normally, and whether it is loose; if it is severely worn and cannot scrape the window surface, it needs to be replaced, and if the rotating brush is loose, it needs to be tightened again;

(5) After 18 months of continuous use, the dynamic sealing device needs to be replaced.

The Matters Needing Attention

(1) The probe contains sensitive optical and electronic components. Make sure that the probe is not subject to severe mechanical impact. There are no user-maintainable parts inside the probe;

(2) There is a geared motor inside the self-cleaning chlorophyll sensor cleaning brush. Under no circumstances should external force be used to rotate the cleaning brush or hinder the cleaning brush from rotating. Larger external force factors will cause damage to the geared motor.

Communication 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
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	
7D 2D	CRC checksum	

Calculating CRC Checksum

- (1) Preset one 16-bit register as hexadecimal FFFF (i.e., all 1s) and call this register the CRC register.
- (2) Iso-oring the first 8-bit binary data (both the first byte of the communication information frame) with the lower 8 bits of the 16-bit CRC register and placing the result in the CRC register, leaving the upper 8 bits of data unchanged.
- (3) Shift the contents of the CRC register one bit to the right (toward the low side) to fill the highest bit with a 0, and check the shifted-out bit after the right shift.
- (4) If the shifted out bit is 0: repeat step 3 (shift right one bit again); if the shifted out bit is 1, CRC register and polynomial A001 (1010 0000 0000 0001) for the iso-or.
- (5) Repeat steps 3 and 4 until the right shift is made 8 times so that the entire 8-bit data is processed in its entirety.
- (6) Repeat steps 2 through 5 for the next byte of the communication information frame.
- (7) Exchange the high and low bytes of the 16-bit CRC register obtained after all bytes of this communication information frame have been calculated according to the above steps.
- (8) The final CRC register content is obtained as follows: CRC code.

Register Table

Start address	Command Description	Number of registers	Data format (hexadecimal)
0x1100H	User calibration K/B (read/write)	4	Total 8 bytes 00~03: K 04~07: B 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, see below for conversion method) To write k, for example, we need to convert k to 32-bit floating point and write it in (DCBA format)
0x1B00H	Brush power-on startup settings	1	2 bytes in total 00~01: 0x0000 does not start on power 0x0100 Power on and self-start
0x2600H	Chlorophyll value acquisition	4	8 bytes in total 00~03: Temperature value 04~07: Turbidity value The reading temperature value/water turbidity value is 4 bytes of data. (The low position is in the front, DCBA format, and this data needs to be converted to a change floating point number.)
0x3000H	Device address (read and write)	1	2 bytes in total 00~01: Device address The range can be set from 1~254 For example, the data obtained is 02 00 (If the low position is in the front, it means that the address is 2) Take address 15 as an example, then 0F 00 Write the corresponding address (low in front) When the current device address is unknown, user can use FF as a common device address to ask for the current
0x3100H	Brush startup (write only)	0	Send a write command with a write length of 0
0x3200H	Brush repeated start time setting (read and write)	1	2 bytes in total 00~01: Time Take the reading value 1E 00 (default) as an example, the actual value is 0x001E, that is, 30 minutes. For example, if you need to write for 60 minutes, convert it to 3C 00 for writing.