KWS-450
Online Chlorophyll Sensor User Manual

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1. Working Principle

The chlorophyll sensor adopts advanced optical technology and an integrated design. It features highly efficient power management, a robust structure, and stable sensor performance. It requires minimal maintenance and infrequent calibration, making it suitable for long-term online monitoring. The sensor can be used in rivers, lakes, ponds, ocean surveys, aquaculture, drinking water sources, and for the research, investigation, and monitoring of algae and phytoplankton conditions.

2. Applications:

- Measurement range: 0–400.0 μg/L
- Resolution: 0.1 μg/L
- Operating temperature: 0–50° C; protection grade IP68, usable up to 20 m water depth
- Built-in temperature sensor
- Supports RS-485 communication, Modbus/RTU protocol, and optional 4–20 mA current output
- Convenient, fast, stable, and easy to maintain

3. Technical Performance and Specifications

1.Technical Parameters

Item	Specification	
Model	KWS-450	
Measurement Principle	Fluorescence Method	
Range & Resolution	0～400.0 ug/L	0.1 ug/L
Accuracy	±3% of reading, ±0.3°C, linearity: 0.999 R^2	
Response Time (T90)	<30 s	
Minimum Detection Limit	1 μg/L	
Calibration Method	Two-point calibration	
Cleaning Method	None	
Temperature Compensation	Automatic temperature compensation (Pt1000)	
Output	RS-485 (Modbus RTU), 4–20 mA (optional)	
Storage Temperature	-5 to 65°C	
Operating Conditions	0–50°C, <0.2 MPa	
Housing Material	316L stainless steel	
Installation Method	Submersible installation, 3/4 NPT thread	
Power Consumption	0.2 W @ 12V	
Power Supply	12–24 V DC	
Protection Rating	IP68	

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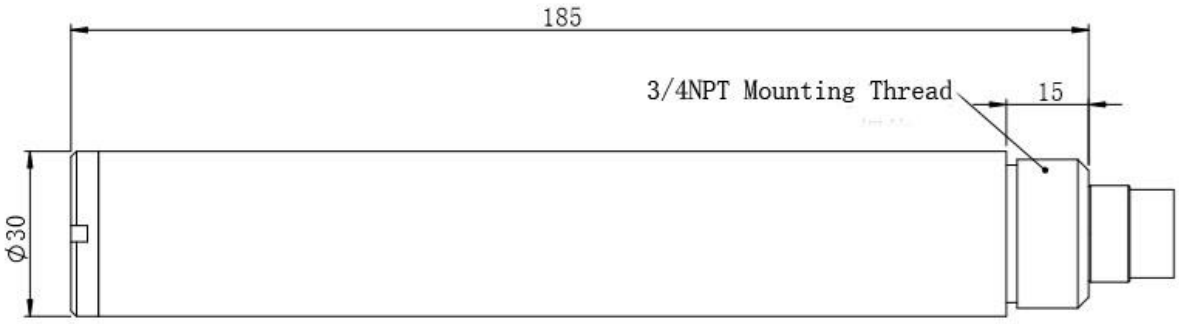
2.Dimension Diagram



Note: The sensor connector is an M16 5-pin male waterproof connector.

4. Installation and Electrical Connections

1.Installation

Installation distance requirements: keep at least 3 cm from the side wall and 10 cm from the bottom.

2.Electrical Connection

The cable is a 5-core shielded wire with the following wiring definitions:

- Red wire — Power supply (12–24 VDC)
- Black wire — Ground (GND)
- Blue wire — 485A
- White wire — 485B
- Yellow wire — Current output (optional; leave unconnected if not used)

Before powering on, carefully check the wiring sequence to avoid unnecessary damage caused by incorrect connections.

Wiring Notes:

Since the cable may be submerged in water (including seawater) or exposed to the air for extended periods, all connection points must be wate

5. Maintenance and Care

1. Maintenance Procedures and Methods

1.1 Maintenance Schedule

The cleanliness of the measurement window is crucial for maintaining accurate readings.rproofed. The user’s cable should also have sufficient corrosion resistance.

Maintenance Task	Recommended Frequency
Calibrate the sensor (if required by the relevant authority)	According to the maintenance schedule specified by the authority

1.2 Maintenance Methods

- Sensor surface: Rinse the outer surface of the sensor with tap water. If debris remains, wipe it gently with a damp soft cloth. For stubborn dirt, add a small amount of household detergent to the tap water for cleaning.
- Check the sensor cable: Ensure that the cable is not overly tight during operation. Excessive tension may cause internal wire breakage, resulting in sensor malfunction.
- Check the measurement window: Inspect the sensor’s optical window to ensure it is free from dirt or residue.

1.3 Precautions

The sensor contains sensitive optical and electronic components. Avoid subjecting the sensor to strong mechanical impacts. There are no user-serviceable parts inside the sensor.

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2.Sensor Calibration

The fluorescence intensity of the dye typically shows an inverse relationship with temperature, which should be taken into account during calibration.

a) Zero-point calibration: Use a brown beaker to collect an appropriate amount of distilled water. Place the sensor vertically in the solution, ensuring the front end is at least 10 cm above the bottom of the beaker. Wait 3–5 minutes for the readings to stabilize, then perform the zero-point calibration. Refer to the appendix for command details.

b) Slope calibration: Place the sensor in a standard solution, keeping the front end at least 10 cm above the bottom of the beaker. Wait 3–5 minutes for the readings to stabilize, then perform the slope calibration. Refer to the appendix for command details.

Temperature (°C)	μg/L CHl
30	145.2
28	148.2
26	151.2
24	154
22	158.8
20	164
18	172.8
16	181.6
14	186.4
12	190.2
10	196
8	200

The above table shows the correlation values between 1 mg/L Rhodamine B and chlorophyll-a at different temperatures.

3. Frequently Asked Questions (FAQ)

Problem	Possible Cause	Solution
The operation interface cannot connect or does not display measurement results	Controller and cable connection error	Reconnect the controller and cable
	Cable failure	Please contact us
Measurement value too high, too low, or unstable	Sensor window contaminated or covered by debris	Clean the sensor window surface

6.Quality and Service

1. Quality Assurance

- The quality inspection department follows standardized testing procedures, equipped with advanced and comprehensive testing instruments and methods. Each product undergoes a 72-hour aging test and stability test, ensuring that no defective product leaves the factory.

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- If the defect rate of a batch of products reaches 2%, the buyer has the right to return the entire batch. All costs incurred shall be borne by the supplier. Inspection standards are based on the supplier's product specifications.
- The supplier guarantees both product quantity and timely delivery.

2. Accessories and Spare Parts

This product includes:

- sensor
- user manual
- certificate of conformity
- cable (5 meters)

3. After-Sales Service Commitment

The company provides a one-year warranty from the date of sale for this device. The warranty does not cover damage caused by improper use.If repair or adjustment is required, please return the product to us (shipping costs borne by the user). Ensure the product is well-packaged to prevent damage during transportation.The company will repair the instrument free of charge for any damage covered under warranty.

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Appendix – Data Communication

1. Data Format

The default data format for Modbus communication is:9600, n, 8, 1 (baud rate 9600 bps, 1 start bit, 8 data bits, no parity, 1 stop bit).

2. Frame Structure (xx represents one byte)

a) Read Data Command Frame

0B	03	xx xx	xx xx	xx xx
Address	Function	Starting Register	Number of Registers	CRC Checksum (low byte first)

b) Read Data Response Frame

0B	03	xx	xx……xx	xx xx
Address	Function	Byte Count	Response Data	CRC Checksum (low byte first)

c) Write Data Command Frame

0B	06	xx xx	xx xx	xx xx
Address	Function	Register Address	Data to Write	CRC Checksum (low byte first)

d) Write Data Response Frame (same as the Write Data Command Frame)

0B	06	xx xx	xx xx	xx xx
Address	Function	Register Address	Data to Write	CRC Checksum (low byte first)

3. Register Addresses

Register Address	Name	Description	Register Count	Access Mode
40001 (0x0000)	Measurement Value + Temperature	Four 2-byte integers representing: measurement value, measurement decimal places, temperature value, and temperature decimal places.	4 (8 bytes)	Read
44097 (0x1000)	Zero-point Calibration	Calibrate in distilled water; write data = 0. The readout data is the zero-offset value. (Calibration can also be performed in 0–100 μg/L standard solution; see slope calibration method.)	1 (2 bytes)	Read/Write
44101 (0x1004)	Slope Calibration	Based on the temperature relationship table in Section 4.2, calibrate in a known standard solution (1.0 mg/L Rhodamine B). Write data = actual concentration × 10; read data = slope × 1000.	1 (2 bytes)	Read/Write
44113 (0x1010)	Temperature Calibration	Calibrate in a solution; write data = actual temperature × 10; read data = temperature offset × 10.	1 (2 bytes)	Read/Write
48195 (0x2002)	Sensor Address	Default = 11; writable range: 1 – 255.	1 (2 bytes)	Read/Write
48196 (0x2003)	Baud Rate	Default = 9600. 0 = 9600, 1 = 19200.	1 (2 bytes)	Read/Write
48225 (0x2020)	Reset Sensor	Restores calibration values to default; write data = 0. Note: After resetting, recalibration is required before use.	1 (2 bytes)	Write

4.Command Example

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a) Measurement Command

Function: Retrieve the chlorophyll and temperature values measured by the sensor.

Chlorophyll unit: μg/L

Temperature unit: ℃

Request Frame:

0B 03 00 00 00 04 44 A3

Response Frame:

0B 03 08 01 02 00 01 00 B0 00 01 AB E4

Reading Example:

Chlorophyll Value	Temperature Value
01 02 00 01	00 B0 00 01

Example:

The chlorophyll value 01 02 represents the hexadecimal reading of the chlorophyll value, and 00 01 indicates that the value has one decimal place.

Converted to a decimal value: 25.8 μg/L.

The temperature value 00 B0 represents the hexadecimal temperature reading, and 00 01 indicates that the temperature value has one decimal place.

Converted to a decimal value: 17.6 ° C.

b) Calibration Command

Zero Point Calibration

Function: Sets the zero calibration value for the chlorophyll sensor. The zero calibration should be performed in distilled water.

Request Frame: 0B 06 10 00 00 00 8D A0

Response Frame: 0B 06 10 00 00 00 8D A0

Slope Calibration

According to the temperature correlation table in Section 4.2, calibration is performed in a known standard solution (1.0 mg/L Rhodamine B).

Input the chlorophyll concentration value (×10) corresponding to the calibration temperature.

Function: Sets the slope calibration value for the chlorophyll sensor.

The slope value is based on the actual standard solution value × 10.

Example (using 200 μg/L):

Request Frame: 0B 06 10 04 07 D0 CF CD

Response Frame: 0B 06 10 04 07 D0 CF CD

c) Setting Device ID Address

Function: Sets the MODBUS device address of the sensor.

Example: Change the sensor address from 11 to 01.

Request Frame: 0B 06 20 02 00 01 E2 A0

Response Frame: 0B 06 20 02 00 01 E2 A0

5. Error Response

If the sensor fails to execute a command correctly, it will return a response in the following format:

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Definition	Address	Function Code	CODE	CRC Check
Data	ADDR	COM + 80H	xx	CRC-16
Bytes	1	1	1	2

a) CODE:

01 – Function code error

03 – Data error

b) COM:

Received function code

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