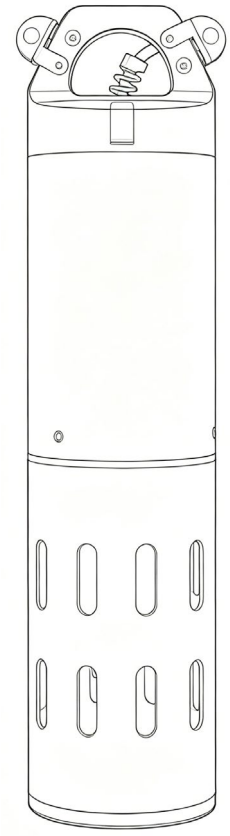
Multiparameter Water Quality Analyzer



S-MT191

User Manual

USER NOTICE

- Please read this instruction manual carefully before use and keep it for reference.
- Please follow the operating procedures and precautions in this manual.
- When you receive the instrument, please open the package carefully and check whether the instrument and accessories are damaged during transportation. If damage is found, please notify the manufacturer and dealer immediately and keep the packaging for return processing.
- When the instrument fails, please do not repair it by yourself, please contact the manufacturer's maintenance department directly.

CONTENTS

I. Instrument Introduction

1. host

The S-MT191 is an instrument used to monitor various water quality parameters. The S-MT191-6S main unit can accommodate up to 6 sensors , while the S-MT191-8S main unit can accommodate up to 8 sensors to acquire water quality parameter data. The sensors use electrochemical, optical, and physical detection principles to measure the corresponding parameters. The main unit uses dedicated interfaces: the S-MT191-6S has one optical sensor interface, one dissolved oxygen sensor interface, one conductivity sensor interface, and three electrochemical sensor interfaces ; the S - MT191-8S has two optical sensor interfaces, one dissolved oxygen sensor interface, one conductivity sensor interface, and four electrochemical sensor interfaces. The S -MT191 main unit can read sensor data, set sensor parameters, and perform calibration operations. It can also store data on the main unit, transmit it to a data acquisition platform, or directly transmit data to a PC or mobile phone according to user settings. Data communication can be achieved via wired or Bluetooth wireless transmission .

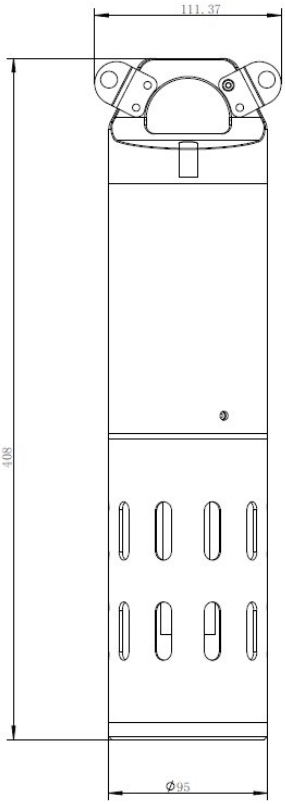


Figure 1-1 S-MT191 Main Unit

2. Technical parameters

Model	S-MT191-6S	S-MT191-8S
Sensor Interface	1* Optical sensor interface 1* Dissolved oxygen sensor interface 1* Conductivity sensor interface 3* Electrochemical sensor interface	2* Optical sensor interface 1* Dissolved oxygen sensor interface 1* Conductivity sensor interface 4* Electrochemical sensor interface
Communication methods	RS485 (Modbus RTU)	
Operating temperature	-5℃ - 60℃	
Power supply voltage	(9-26) V DC	
Protection level	IP68	
MTBF	≥1440h/time	
Power consumption	Normal operating power consumption: 1.5W; Sleep power consumption: 0.1W	
Material	Stainless steel/titanium alloy, POM	
Weight	2kg of POM material, 5kg of stainless steel material	
External dimensions	408mm × ϕ95mm	408mm × ϕ110mm

3. Main Features

- Digital miniature sensors can be combined arbitrarily;
- The cleaning brush automatically cleans itself, greatly reducing maintenance workload;
- Stainless steel or titanium alloy housings are available, with an IP 68 waterproof rating, suitable for various working conditions;
- RS485 signal output, standard Modbus protocol, easy to integrate and network.

4. sensors

The S-MT191 Multiparameter Water Quality Analyzer can monitor more than a dozen parameters online, including temperature, pH, ORP, conductivity, dissolved oxygen, turbidity, chlorophyll, blue-green algae, potassium ions, ammonium ions, nitrate ions, chloride ions, and fluoride ions.

01. Sub-Turbidity Sensor

Turbidity is an indirect measurement of the concentration of suspended solids in water. Turbidity sensors measure turbidity by emitting infrared light into the solution and measuring the scattering of light on particles in the water. Turbidity is both an important water quality indicator and a fundamental indicator for measuring environmental changes. Suspended solids in nature originate from a wide range of uncertain sources (e.g., silt, soil, sediment, algae, organic matter), but all particles affect light propagation and generate turbidity signals.

⊙ Sub-Turbidity Sensor technical specifications

Model	S-MT1910-TUR
Measurement Parameters	Turbidity (NTU), Temperature (℃)
Range	Turbidity : (0 ~ 100)NTU , (0 ~ 500) NTU , (0 ~ 2000) NTU , (0 ~ 4000) NTU Temperature: (0~50) ℃
Measurement Accuracy	Turbidity : ≤ ± 1 % of reading
Repeatability	Turbidity : ≤ 1% of reading
Resolution	Turbidity : 0.01 NTU
Cleaning System	Automatic cleaning brush (optional)
Power Supply Voltage	(9-36) Vitamin C , 1.1W
Communication Methods	RS485
Protection Level	IP68, underwater depth 60 meters
Temperature Range	(0 ~ 50)℃
External Dimensions	160 mm × ϕ 40 mm
Material	Stainless steel (316L), POM

02. Sub-Chlorophyll Sensor

The Sub-Chlorophyll Sensor can be excited by dual-wavelength or single-wavelength light sources and simultaneously measure chlorophyll and turbidity. The fluorescence produced by chlorophyll molecules under blue light irradiation can be used to calculate the chlorophyll concentration.

⊙ Sub-Chlorophyll sensor technical specifications

Model	S-MT1910-CHL	S-MT1910-CHL Pro
Measurement parameters	Chlorophyll a , temperature	Chlorophyll a , turbidity, temperature
Measurement methods	Chlorophyll a : Fluorescence method; Turbidity: Infrared scattering method	
Range	Chlorophyll a : (0 ~ 50/500) μ g/L Turbidity: (0 ~ 100/500/2000/4000) NTU Temperature: (0 ~ 60) ℃	
Accuracy	Chlorophyll a : ≤± 3% , Turbidity: ≤± 2%	
Repeatability	Chlorophyll a : ≤ 2% , Turbidity: ≤ 1%	
Resolution	Chlorophyll a : 0.01 μg /L , Turbidity: 0.01 NTU	
Detection limit	Chlorophyll a : 0.05 μg /L , Turbidity : 0.05 NTU	
Response time	≤ 10s	
Zero drift/quantity drift (24h)	≤±3 %FS	
Calibration cycle	6 months	
Temperature range	(0 ~ 60) ℃	

Model	S-MT1910-CHL	S-MT1910-CHL Pro
Protection level	IP68	
Cleaning method	Automatic cleaning with mechanical brushes	
Communication methods	RS485 (Modbus RTU) , maximum baud rate 115200bps	
Power supply / power consumption	(12/24)VDC / < 0.5 W (in non-cleaning mode)	
Material	Titanium alloy, stainless steel, POM	
Weight	0.5kg	
External dimensions	160mm × ϕ40mm	

03. Sub-Cyanobacteria Sensor

The Sub-Cyanobacteria Sensor is equipped with dual-wavelength or single-wavelength light sources for excitation, simultaneously measuring cyanobacteria and turbidity. The fluorescence produced by phycocyanin within the cyanobacteria under orange light can be used to calculate the cyanobacteria concentration.

- Sub-Cyanobacteria Sensor Technical Specifications

Model	S-MT1910-BGA	S-MT1910-BGA Pro
Measurement parameters	Algae density, temperature	Algae density, turbidity, temperature
Measurement methods	Algal density: fluorescence method; Turbidity: infrared scattering method	
Range	Algal density: (0 ~ 200000/2000000) Cells/mL Turbidity: (0 ~ 100/500/2000/4000) NTU Temperature: (0~60) ℃	
Accuracy	Algae density: ≤± 3% , Turbidity: ≤± 2%	
Repeatability	Algae density: ≤ 2% , Turbidity: ≤ 1%	
resolution	Algae density: 1 Cell / mL , Turbidity: 0.01 NTU	
Detection limit	Algae density: 200 Cells / mL , Turbidity: 0.05 NTU	
Response time	≤ 10s	
Zero drift/Quantity drift (24h)	≤± 3%FS	
Calibration cycle	6 months	
Temperature range	(0~60) ℃	
Protection level	IP68	
Cleaning method	Automatic cleaning with mechanical brushes	
Material	Titanium alloy, stainless steel, POM	
External dimensions	160mm × ϕ40mm	

04. Total Algae Sensor

The Sub-Total Algae Sensor is equipped with dual-wavelength or tri-wavelength light sources for excitation, simultaneously measuring chlorophyll, cyanobacteria, and turbidity. The fluorescence produced by chlorophyll molecules under blue light irradiation allows for calculation of chlorophyll concentration. Similarly, the fluorescence produced by phycocyanin within cyanobacteria under orange light irradiation allows for calculation of cyanobacteria concentration.

⊙ Sub-Total Algae Sensor Technical Specifications

Model	S-MT1910-BGA	S-MT1910-BGA Pro
Measurement parameters	Chlorophyll a , algal density, temperature	Chlorophyll a , algal density, Turbidity, temperature
Measurement methods	Chlorophyll a /algal density: fluorescence method; Turbidity: infrared scattering method	
Range	Chlorophyll a : (0 ~ 50/500) μ g/L Algal density: (0 ~ 200000/2000000) Cells/mL Turbidity: (0 ~ 100/500/2000/4000) NTU Temperature: (0 ~ 60) ℃	
Accuracy	Chlorophyll a /algae density: ≤± 3% , Turbidity: ≤± 2%	
Repeatability	Chlorophyll a /algae density: ≤ 2% , Turbidity: ≤ 1%	
resolution	Chlorophyll a : 0.01 μg /L , Algal density: 1 Cell / mL	
Turbidity: 0.01 NTU	Algae density: 200 Cells / mL , Turbidity: 0.05 NTU	
Detection limit	Chlorophyll a : 0.05 μg /L , Algal density: 200 Cells / mL	
Turbidity : 0.05 NTU	≤± 3%FS	
Response time	≤ 10s	
Zero drift/Quantity drift (24h)	≤±3 %FS	
Calibration cycle	6 months	
Temperature range	(0 ~ 60) ℃	
Protection level	IP68	
Cleaning method	Automatic cleaning with mechanical brushes	
Material	Titanium alloy, stainless steel, POM	
External dimensions	160mm × ϕ40mm	

05. Sub-Dissolved Oxygen Sensor

The Sub-Dissolved Oxygen Sensor is based on the principle of fluorescence quenching. It emits blue light of a specific wavelength onto a fluorescent material fixed on a glass plate, causing the material to fluoresce. The fluorescence lasts longest in the absence of oxygen, and its duration decreases when oxygen is present on the sensor membrane. To ensure measurement accuracy and stability, red light is emitted onto the fluorescent material

during the measurement cycle as a reference to determine the fluorescence duration.

The concentration of oxygen and the duration of fluorescence are inversely proportional, and this relationship can be quantitatively calculated using the Stern-Volmer equation. The relationship is as follows:

((Tzero/T) – 1) versus O 2 partial pressure

This is not a strictly straight line (especially at higher oxygen pressures), and the relevant data requires polynomial nonlinear regression analysis. This nonlinear characteristic does not change significantly over time and will not affect the sensor's measurement accuracy over a long period.

⊙ Sub-Dissolved Oxygen Sensor technical specifications

Model	S-MT191-DO
Measurement parameters	Dissolved Oxygen
Range	Dissolved oxygen: (0-20) mg/L or (0-200)%
Accuracy	±0.3mg/L
Repeatability	±0.3mg/L
Resolution	0.01 mg/L
Response time	≤6 0 s
Temperature range	(0 ~ 50)℃
Zero Drift (24h)	±0.3mg/L
Range drift (24h)	±0.3mg/L
Power consumption	0.55W (5V@110mA)

06. Sub-Conductivity Sensor

The Sub-Conductivity Sensor, mounted on the main unit, provides rapid temperature response and accurate temperature and conductivity data. The conductivity data can also be used to calculate salinity and TDS.

The Sub-Conductivity Sensor uses four graphite electrodes to measure the conductivity of a solution. Two electrodes measure the current, and the other two measure the voltage. The conductivity value is then calculated. Multiplying the conductivity value by an electrode constant (in 1/cm) converts it to a conductivity value in millisiemens per centimeter.

Temperature compensation

The S-MT191 sensors are equipped with internal temperature sensors. However, the temperature values measured by these sensors will not be recorded or displayed; they are used for sensor compensation, and the temperature values of these sensors are calibrated based on the temperature sensor on the conductivity sensor.

Figure 1-2 Bovine eye conductivity electrode

⊙ Sub-Conductivity Sensor technical specifications

Model	S-MT1910-BGA
Measurement parameters	Electrical conductivity, TDS , salinity, temperature
Electrode type	Four-electrode graphite electrode, thermistor
Range	Electrical conductivity: (0 ~ 200mS /cm)
Accuracy	≤±1%
Repeatability	≤1%
Response time	≤2 0 s
Resolution	Electrical conductivity: 0.01 μS/cm
Temperature range	(0 ~ 50)℃
Zero Drift (24h)	≤±1%FS
Range drift (24h)	≤±1%FS
Temperature accuracy	± 0.2 ℃
Temperature resolution	0.001 ℃
Power consumption	0.1W (5V@20mA)

07. Sub-pH/ORP Sensor

The S-MT191-pH Sensor is used to measure the acidity or alkalinity of water; the S-MT191 ORP sensor is used to measure the redox potential of water, which is a non-chemical component measurement. The measured potential is the combined reaction of all dissolved substances in the medium.

Figure 1-3 pH /ORP sensor

⊙ Sub-pH/ORP Sensor technical specifications

Model	S-MT191E-pH	S-MT191E-ORP
Measurement parameters	pH	ORP
Electrode	Glass electrode	Platinum electrode
Range	0 ~ 14	(-2000 ~ +2000) mV
Accuracy	≤±0.1pH	≤± 20 mV
Repeatability	≤±0.1pH	≤± 20 mV
Resolution	0.01 pH	0.1mV
Response time	≤1 0 s	≤1 0 s
Temperature range	(0 ~ 50)℃	
Drift	≤±0.1pH	≤± 20 mV

08. Sub-COD Sensor

The Sub-COD Sensor is an online water quality analyzer developed based on a brand-new transmission optical water quality analysis platform. It employs a highly stable ultraviolet/visible LED light source, combined with a multi-wavelength coaxial optical path design and multi-reference channel compensation technology, achieving long-term high-stability measurements. It can be widely used in wastewater monitoring, surface water monitoring, drinking water monitoring, and other applications.

⊙ Sub-COD Sensor technical specifications

Model	S-MT1910-COD-A	S-MT1910-COD-B	S-MT1910-COD-C
Measurement parameters	COD, UV254, turbidity, temperature	COD, UV254, turbidity, temperature, colorimetry	COD, UV254, turbidity, temperature, transparency
Measurement methods	UV/Vis absorption method		

Range	Optical path length (mm)	2	10	50
	COD (mg/L)	0-1500	0-300	0-60
	UV254 (Abs/m)	0-800	0-200	0-50
	Turbidity (NTU)	0-4000	0-1000	0-200
	Chromaticity (470nm)	0-25000	0-5000	0-1000
	Transparency (mm)	0-40	0-200	0-1000
	Temperature (℃)	0-60		
Accuracy	≤±5%			
Repeatability	≤3%			
Resolution	COD: 0.01 mg/L			
Response time	≤10S			
Calibration cycle	3 months			
Temperature range	(0~60)℃			
Protection level	IP68			
MTBF	≥1440h/time			
Communication methods	RS485 (Modbus RTU)			
Supply voltage/power consumption	(12/24) VDC/<0.6W (in non-cleaning mode)			
Material	Stainless steel			
External dimensions	183mm×ϕ35mm			

The S-MT1910-COD-D Sub-COD Sensor is an online water quality analyzer developed based on a brand-new transmission optical water quality analysis platform. It employs a highly stable ultraviolet/visible LED light source, combined with a multi-wavelength coaxial optical path design and multi-reference channel compensation technology, achieving long-term high-stability measurements. It can be widely used in wastewater monitoring, surface water monitoring, drinking water monitoring, and other applications.

⊙ Sub-COD Sensor technical specifications

Model	S-MT1910-COD-D			
Measurement parameters	COD, Turbidity, Nitrate Nitrogen, Temperature			
Measurement methods	UV / Vis absorption method			
Range	Optical path length (mm)	2	10	50
	Nitrogen (mg/L)	0 - 300	0 - 50	0 - 10
	COD (mg/L)	0 -1500	0 -300	0 -60
	Turbidity (NTU)	0 -4000	0 -1000	0 -200
	Temperature (℃)	0 -60		
Accuracy	≤± 5 %			
Repeatability	≤ 3 %			
Resolution	Nitrogen and COD : 0.01 mg/L			
Response time	≤ 10S			
Calibration cycle	3 months			
Temperature range	(0 ~ 50)℃			
Protection level	IP68			
MTBF	≥1440h/time			
Communication methods	RS485 (Modbus RTU)			
Power supply voltage	(9-30)V DC			
Power consumption	< 0.6 W (in non-cleaning mode)			
External dimensions	180 mm × ϕ 35 mm			

09. Sub-Color Sensor

The Sub-Color Sensor is an online water quality analyzer developed based on the new LTS transmission optical water quality analysis platform. It employs a high-stability semi-conductor LED light source and combines an innovative multi-wavelength coaxial optical

path design with multi-reference channel compensation technology to achieve highly stable measurements. It can be widely used in wastewater monitoring, surface water monitoring, drinking water monitoring, and other applications.

- Sub-Color Sensor technical specifications

Model	S-MT1910-Color -390		S-MT1910-Color -470	
Measurement parameters	Color, turbidity, temperature			
Measurement methods	Colorimetry: Visible light absorption method Turbidity: Infrared absorption method			
Range	Optical path length (mm)	2	1 0	5 0
	Chromaticity (470nm)	0 -25000	0 -5000	0 -1000
	Chromaticity (390nm)	0 -5000	0 -1000	0 -200
	Turbidity (NTU)	0 -4000	0 -1000	0 -100
	Temperature (℃)	0 -60		
Accuracy	≤± 5 %			
Repeatability	≤ 3 %			
resolution	0.01° (colordegree)			
Response time	≤ 10S			
Calibration cycle	3 months			
Temperature range	(0 ~ 60)℃			
Protection level	IP68			
MTBF	≥1440h/time			
Communication methods	RS485 (Modbus RTU)			
Supply voltage/power consumption	(12/24) VDC < 0.6 W (in non-cleaning mode)			
Material	Stainless steel			
External dimensions	18 3mm × ϕ 35 mm			

10. Electrochemical Ion Selective Sensor (S-MT191E Series)

S-MT191 Electrochemical Ion Selective Sensors are used to measure the concentration of various ions in water, including Ammonia Nitrogen , Nitrate Nitrogen , Chloride ion , Potassium ion , and Fluoride ion.

⊙ Sub-Ion Sensor technical specifications

Measurement parameters	Ammonia Nitrogen	Nitrate Nitrogen	Chloride ion	Potassium ion	Fluoride ion	Calcium ion
Range	(0~1000) mg/L	(0~1000) mg/L	(0~20000) mg/L	(0~1000) mg/L	(0~1000) mg/L	(0~1000) mg/L
Accuracy	≤± 3%					
Repeatability	≤ 2%					
Resolution	0.01 mg/L					
Response time	≤ 60s					
Temperature range	(0~50)℃					
Drift	≤± 3%FS					

II. Operations

1. Main unit wiring

01. Integrated cable wiring

The cable is integrated with the main unit and cannot be detached. The cable length can be customized according to customer requirements. Specific wiring definitions are shown in the table below.

Cable color	Ash	Yellow	Blue	Black	Red	Brown
Wiring definition	485- A	485- B	485- COM	/	1 2/24 VDC	GND

02. Waterproof plug wiring

The waterproof plug cable is a custom-made cable, and the connector at the rear of the main unit can be wet-plugged. Specific wiring definitions are shown in the table below.

Connector serial number	1	2	3	4	5
Cable color	Blue	Brown	Red	Black	White
Wiring definition	485- B	GND	12/24 VDC	485-C OM	485- A

III. calibration

1. Basic Calibration Procedure

The S-MT191 sensors (except for temperature sensors) require periodic calibration to ensure measurement accuracy. The calibration procedure is basically the same, with only minor adjustments needed for some specific parameters.

To obtain accurate results, rinse the calibration cup with water, then rinse with a small amount of the sensor calibration standard solution to be calibrated. Discard the rinsing calibration solution, and then refill the calibration cup with unused standard solution. Pour at least 600 mL of standard solution into the calibration cup, ensuring the sensor is submerged in water. Take care to avoid cross-contamination between different standard solutions.

Before adding or replacing the standard solution, the calibration cup and sensor must be cleaned and dried.

Figure 3-1 Calibration

For the basic calibration procedure of the software, please refer to the relevant instructions in “Sensor Calibration”.

2. Calibration Depth

Note : This calibration option is only available when your multi-parameter host is equipped with an integrated depth sensor. Ensure the depth sensor module is exposed to air and not submerged in any container.

In the sensor calibration menu, select depth. The default calibration is 1 point. Observe the signal value. Once it stabilizes, click “OK,” then click the calibration button below to complete the calibration operation. This will reset the sensor’s differential value to zero based on the current atmospheric pressure.

To achieve the best depth measurement performance, users should ensure that the

main unit is pointed in a consistent direction during measurement. During calibration, the main unit should be stationary and always in the same position.

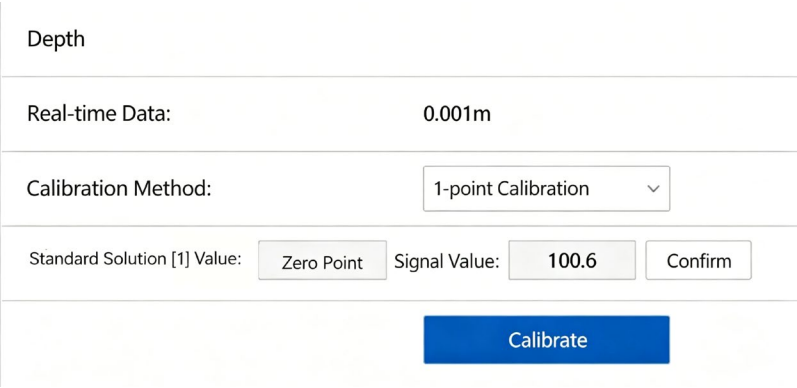


Figure 3-2 Depth Calibration

3. Calibrate conductivity

Before calibrating conductivity, the conductivity electrode needs to be cleaned. The calibration operation can be selected as conductivity, 2.5- degree compensated conductivity, or salinity.

First, pour the conductivity standard solution into the calibration cup. Select a suitable standard solution based on your monitoring environment. For stability reasons, we recommend using a standard solution with a conductivity greater than 1 mS/cm . After pouring the standard solution into the calibration cup, carefully immerse the multi-parameter instrument in the solution, ensuring the standard solution level is above the temperature sensor on the conductivity electrode. Gently rotate and/or move the main unit up and down to remove any air bubbles from the electrode. Before operating the software, ensure the electrode has been in the standard solution for 3-5 minutes to allow it to reach temperature equilibrium.

In the sensor calibration menu, you can choose from three calibration methods: conductivity - 25 , conductivity, and salinity. Calibrating any option will automatically calibrate the other two parameters. We recommend using the conductivity - 25 option. Enter the value of the standard solution you are using, and after the signal value stabilizes, click OK. Then click the calibration button below to complete the calibration operation.

- If the real-time data is unstable and fluctuates greatly, you can rotate and/or move the main unit up and down or reposition the main unit into the calibration cup to remove air bubbles attached to the electrodes.

4. Calibrate Dissolved Oxygen

Dissolved oxygen can be calibrated at one point or two points. One-point calibration

calibrates saturated oxygen. Two-point calibration calibrates both zero-point and saturated oxygen. The saturated oxygen standard solution can be prepared in two ways: “wet saturated air” or “air saturated water”.

Humidified saturated air: Place the sensor in a beaker and add water until the water level is about 5 mm below the dissolved oxygen sensor membrane surface, then stop. Allow it to stabilize for about 10 minutes before calibration.

500 mL of pure water to a beaker , use an air pump to inflate the water, then place the sensor in the water and observe the changes in the sensor value. After about 30 minutes , the data will stabilize, at which point calibration can be performed.

Note: During calibration, there is no need to modify the original signal value. The sensor will automatically calculate the calibration saturated oxygen value based on the temperature and the original signal value.

5. Calibrate pH

For pH calibration, we recommend using two-point calibration whenever possible to ensure better accuracy. Since the water in most of our environments has a pH between 7 and 10 , we suggest using a buffer solution with pH 6.86 and pH 9.18 , or a buffer solution with pH 7 and pH 10 .

Pour the correct amount of pH 7 buffer into the calibration cup and carefully immerse the sensor in the solution. Wait 3-5 minutes for the temperature to equalize before proceeding with the calibration.

Before calibrating the next buffer solution, first clean and dry the calibration cup, and then add the second buffer solution to the calibration cup.

Note: The actual pH value of a pH buffer solution will change with temperature. During calibration, pay attention to the current temperature and refer to the pH table of the buffer solution to set the standard solution value. For example, a pH 7 buffer solution is 7.00 at 25°C and 7.02 at 20°C .

Relationship between pH buffer solution and temperature

Temperature / ℃	pH=4.00	pH=6.86	pH=7.00	pH=9.18	pH=10.01
10	4.00	6.92	7.06	9.33	10.18
15	4.00	6.90	7.04	9.28	10.12
20	4.00	6.88	7.02	9.23	10.06
25	4.00	6.86	7.00	9.18	10.01
30	4.01	6.85	6.99	9.14	9.97
35	4.02	6.84	6.98	9.10	9.93
40	4.03	6.84	6.97	9.07	9.89
45	4.04	6.83	6.97	9.04	9.86
50	4.06	6.83	6.96	9.02	9.83

6. Turbidity Calibration

Turbidity sensors can be calibrated using one-point, two-point, or three-point methods. Before calibration, ensure that the sensor and calibration cup are clean and dry.

Taking two-point calibration as an example:

Pour 0 NTU standard solution (clean deionized water or distilled water) into the calibration cup . After stabilizing for 3-5 minutes , confirm the first calibration point.

Then wipe the sensor and calibration cup dry.

100 NTU of standard solution into the calibration cup . After stabilizing for 3-5 minutes , confirm the second calibration point. The second calibration point can be set according to the site conditions.

Three-point calibration

When the turbidity of the water sample varies widely, we can choose to perform three-point calibration on the turbidity sensor to obtain high accuracy over a large range. The procedure is the same as for two-point calibration: the first standard solution must be 0 NTU, the second point should be set to 20% of the range, and the third point should be set to the range value.

7. Calibration of total algae

Chlorophyll calibration typically employs a two-point calibration method. One standard solution must be pure water (0 μg/L), and the other standard solution is a water sample with a known chlorophyll concentration or a fluorescent equivalent. The water sample concentration is obtained through laboratory analysis; for the fluorescent equivalent, Rhodamine WT is recommended. In initial use, we can analyze the water sample concentration using laboratory methods and establish a proportional relationship between it and the Rhodamine WT concentration measured by the sensor. Subsequently, Rhodamine WT can be used to calibrate the sensor.

For specific calibration procedures, please refer to the calibration of turbidity sensors.

The calibration methods and procedures for cyanobacteria can be referenced from the calibration procedures for chlorophyll sensors.

Rhodamine WT Standard Solution – Preparation and Use

Warning: Please ensure you have read all safety guidelines and MSDS documents provided by the manufacturer before proceeding.

ug/L Rhodamine WT solution suitable for chlorophyll sensor calibration using the following steps :

- 1. Rhodamine WT is usually purchased in solution form, and the labeled concentration may vary. Our company purchases Rhodamine WT from the suppliers shown below, and we recommend that you purchase dyes with this product number whenever possible. This solution contains approximately 20 % Rhodamine WT (200 g/L).
- Keystone Aniline Corporation, 2501W. Fulton Street, Chicago, IL 60612 (Telephone: 312-666-2015) under the name KEYACID RHODAMINE WT (Part # 70301027). 20

%Rhodamine WT (200 g/L).

- 2. Accurately measure 0.5 mL of Rhodamine WT solution and quantitatively transfer it to a 1000 mL volumetric flask . Fill the volumetric flask to the mark with pure water (distilled or deionized water) . After mixing thoroughly, this solution contains 100 mg of Rhodamine WT per 1000 mL of water . Transfer this solution to a glass bottle for future use.
- 3. Accurately measure 5.0 mL of the prepared solution into a 1000 mL volumetric flask, then fill the flask to the mark with pure water. Mix the solution thoroughly; the prepared solution concentration is 500 μg/L(the concentrate is diluted 200:1) . **Based on our experimental data analysis, we believe that the fluorescence signal of a 500 μg/L Rhodamine WT solution is essentially the same as that of a 100 μg/L chlorophyll a solution.** Therefore, during calibration, use this concentration of Rhodamine WT solution, and enter a standard value of 100 μg/L. Other concentrations should be prepared according to this ratio.
- 4. Concentrated standard solutions must be stored in dark glass bottles in a refrigerator to prevent decomposition. Diluted standard solutions prepared according to the above steps must be used within 24 hours of preparation. If Rhodamine WT standard solution is needed later, simply remove the concentrated dye solution, allow it to return to room temperature, and then dilute it. Concentrated solutions stored at low temperatures have better stability than diluted solutions stored at room temperature.
- 5. The preparation method for the standard solution of cyanobacteria is as described above. According to our experimental data analysis, the fluorescence signal of 100 μg/L Rhodamine WT is basically the same as that of 50 cells/μL cyanobacteria . Other concentrations should also be prepared according to this ratio.
- 6. The ratio of chlorophyll a and cyanobacteria to the fluorescence signal of Rhodamine WT varies in different regions. The ratio needs to be confirmed by laboratory analysis before the reagent is prepared according to the above method.

IV. Maintenance

1. Storage

Multi-parameter analyzers need to be properly stored when not in use. If the instrument is used regularly, it should be stored during its intervals; I call this short-term storage. If the instrument is not used for an extended period, such as during winter when it cannot be used, or under other circumstances, we call this long-term storage.

01. Short- term storage

For short-term storage, users should keep the sensor moist but not submerged in water, as this can cause sensor drift. Pour approximately 2 cm of water (deionized water, distilled water, tap water, or ambient water) into the bottom of the calibration cup, or place a damp sponge at the bottom of the calibration cup.

Unused host interfaces must be plugged. For external interfaces on the top of the host unit, the plugs provided with the shipment must be installed to prevent long-term exposure of the sockets and subsequent pin corrosion.

Note: Clean the host and sensors before storing.

02. Long- term preservation

Before storage, clean the main unit and sensors. Store the entire unit in a dark and dry place. The optical sensors (turbidity, total algae), dissolved oxygen sensor, and conductivity sensor do not require special treatment.

The main point of storing pH or ORP sensors is to protect the electrodes. Insert the tip of the electrode into the protective sleeve that came with the sensor when it was shipped, and fill the sleeve with pH 4 buffer solution.

2. Depth Sensor Maintenance

The depth sensor is located inside the main unit and communicates with the water through several small open holes. Users can use a syringe to inject water into these holes to clean the depth sensor. Water is injected into one hole and flows out from the others; this process is repeated until the water flowing out is clean.

Note: Do not use hard objects to clean the small holes, as this will damage the sensor surface and cause it to malfunction.

3. Optical Sensor Maintenance

The turbidity and total algae sensors require very little maintenance. Users should periodically check the front optical window and wipe it clean with a non-woven cloth or paper towel if necessary.

Note: Do not scratch the optical window with hard objects.

4. Conductivity Sensor Maintenance

Maintaining a conductivity sensor primarily requires cleaning the electrode sensing section. For the flat-head electrode, focus on cleaning the front end, wiping it clean with a non-woven cloth or paper towel until the four sensing dots are visible. For the bullseye electrode, focus on cleaning the central notch.

5. Dissolved Oxygen Sensor Maintenance

Dissolved oxygen sensors require fluorescent membrane caps. The typical lifespan of the membrane cap is 1-2 months . During use, the membrane cap should be replaced periodically; otherwise, measurement accuracy will be affected.

Users should check the sensor regularly and clean the membrane cap surface by wiping it with a non-woven cloth or paper towel.

6. pH sensor maintenance

The pH sensor consumes electrolyte in its electrodes during use. The electrode's lifespan depends on the operating environment, typically around one year. In practice, the electrode needs to be replaced periodically. During daily use, contaminants may accumulate on the electrode surface; users should clean the electrode surface with water and a paper towel. Avoid scratching with hard objects, as the glass bulb is fragile and requires care.

Replace pH electrode

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