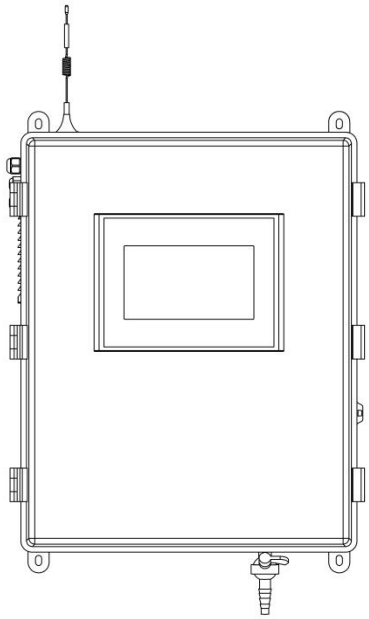
Multi-parameter water analyzer



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Preface

Thank you for purchasing our company's products. Please read this manual carefully before operating and using it correctly to avoid unnecessary losses caused by wrong 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.
- The content of this manual is strictly prohibited from reprinting or copying.

Version

U-SUP-MPP500-EN3

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

- Please read the operation manual carefully before putting into operation to avoid unnecessary losses due to wrong operation. Ensure the safe use of the product and it's control function, and understand the correct application methods.. 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	Multi-parameter water analyzer	1	
2	PE hose	1	6mm*2m
3	Y-type filter	1	25mm
4	Aviation connector	1	PC6-04
5	Teflon tape	1	
6	Expansion screws	4	8*40
7	Sandpaper	1	5000#
8	Spare sealing rings	3	
9	Quality inspection report	1	
10	User manual	1	
11	Certificate	1	
12	Packing list	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 Introduction

1.1 Introduction

The Multi-Parameter Online Water Quality Analyzer is a new generation of drinking water quality monitoring equipment independently developed and manufactured by our company. This equipment can be widely used for online water quality monitoring in urban or rural water treatment plants, water transmission pipelines, secondary water supply systems, user terminals, indoor swimming pools, large water purification equipment, and direct drinking water systems. It is an indispensable online analysis device in the fields of water plant production process control, water conservancy and water affairs management, and hygiene supervision.

The Multi-Parameter Online Water Quality Analyzer is available in both standard and custom versions. The standard version monitors parameters such as turbidity, residual chlorine/chlorine dioxide/ozone, pH,temperature, conductivity/TDS, and ORP. Meanwhile, the custom version allows for the deletion of parameters and customization of the instrument's appearance, logos, system names, and other items based on customer needs.

1.2 Features

- **Integration：** Integrated design, unified water inlet and outlet, centralized data display, wall-mounted installation to prevent flooding and ground moisture, does not occupy ground space, which is convenient for installation, operation and maintenance;
- **Multi-parameters：** Adopt integrated design to monitor four parameters of turbidity, residual chlorine dioxide, pH and temperature at the same time, and expand the conductivity/TDS, dissolved oxygen, ORP and other parameters;
- **High precision:** Long-term stable and accurate measurement in the order of tap water (0.1～1NTU) and purified water (0.001～0.1NTU);

- **High reliability:** Imported components are used for sensors and instrument components, which are optimized for online analysis of water quality with high reliability;
- **Low maintenance:** Support remote control functions such as automatic sewage discharge and remote adjustment, which can effectively reduce the frequency of on-site maintenance, low system operation and maintenance costs;
- **Self-protection:** The equipment supports built-in water ingress detection and automatic protection functions to effectively avoid accidental damage to the sensor, and built-in lightning protection devices to avoid lightning damage to the equipment;
- **Easy integration:** standard RS485 Modbus-RTU protocol and device wireless data transmission channel support on-site third-party device access;
- **Strong environmental adaptability:** optional temperature control heating antifreeze module, the equipment can be operated all year round outdoors in cold areas;
- **Highly customized:** The equipment can be customized with trademark, name, cabinet appearance, etc.

1.3 Technical parameters

Table 1 System Technical Specifications

Communication Output	RS485 Modbus RTU Communication Protocol + Wireless Data Interface
Power Supply	(220±22)VAC, (50±1)Hz
Power Consumption	≤30W
Inlet Water Flow	(0.03～0.06)m^3/h
Inlet Water Pressure	＜0.3MPa
Operating Temperature	（0~50）℃

Operating Humidity	≤95%RH (No Condensation)
Storage Temperature	(4~50) ℃
Cabinet Dimensions	500mm*400mm*200mm
Weight	Approximately 12kg
Display	Color Touch Screen

Table 2 Turbidity Performance Parameters

Measurement Method	90° Light Scattering Method			
Light Source	660nm Laser			
Measurement Range	(0~1)NTU	(0~20)NTU	(0~100)NTU	(0~2000)NTU
Accuracy	2% or ±0.02NTU, whichever is greater			10% or ±0.5NTU , whichever is greater
Resolution	0.0001NTU			0.001NTU
Detection Limit	0.005NTU			
Repeatability	≤1%			
Zero Drift	≤1.5%			
Indication Stability	≤1.5%			
Response Time	T_{90}≤120 s			
Recommended Maintenance Cycle	3~12 Months (Depending on Site Water Quality)			

Table 3 Residual Chlorine/Chlorine Dioxide (High Purity)/Ozone Performance Parameters

Measurement Range	(05)mg/L / (020)mg/L
Accuracy	±0.05mg/L or ±5%, whichever is greater (DPD Comparison Error ±10%)
Resolution	0.01mg/L
Detection Limit	0.05mg/L

Response Time	≤120 Seconds
Recommended Maintenance Cycle	1~3 Months or Weekly Calibration, 3~6 Months for Consumable Replacement

Table 4 pH/ORP (Optional) Performance Parameters

Measurement Method	sensor Method (Automatic Temperature Compensation)
Measurement Range	pH: (014)pH, ORP: (-2000~2000)mV
Accuracy	pH: ±0.1pH or ±2%, whichever is greater, ORP: ±20mV or ±2%, whichever is greater
Resolution	pH: 0.01pH, ORP: ±1mV
Repeatability	pH: ±0.1pH, ORP: ±10mV
Response Time	≤60 Seconds
Recommended Maintenance Cycle	1~3 Months

Table 5 Temperature Performance Parameters

Measurement Method	Thermistor Method
Measurement Range	(0~50)℃
Accuracy	±0.5℃
Resolution	0.1℃
Repeatability	≤0.5℃
Response Time	≤25 Seconds
Recommended Maintenance Cycle	12 Months

Table 6 Conductivity Performance Parameters

Measurement	Conductivity Cell Method

Method	(Automatic Temperature Compensation)
Measurement Range	（0~20000）uS/cm Pure water sensor: （0~20）uS/cm
Accuracy	± 0.8% F.S pure water sensor: 3% F.S
Resolution	0.01μS/cm
Repeatability	≤0.4%FS
Response Time	≤30 Seconds
Recommended Maintenance Cycle	3~6 Months

2 Structure and dimensions

2.1 Dimensions

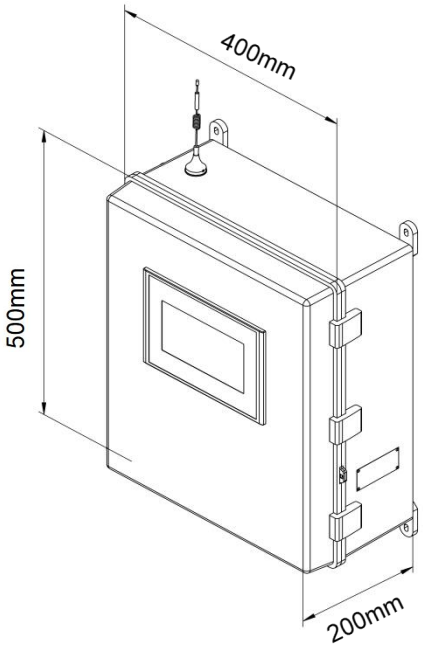


Fig.1 Product dimensions

2.2 Internal structure

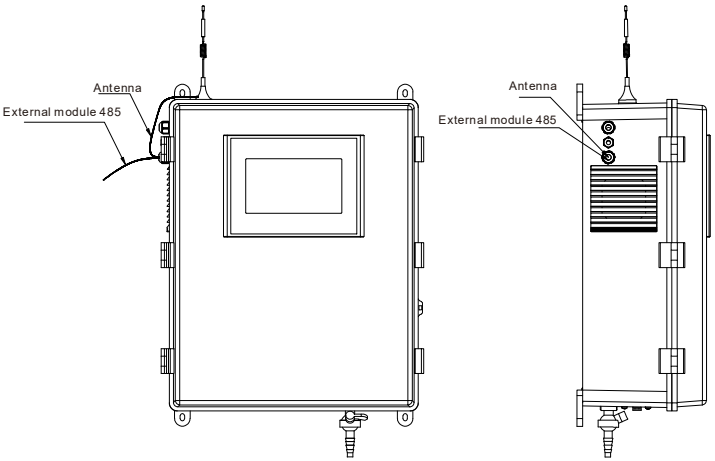


Fig.2

2.3 Internal structure

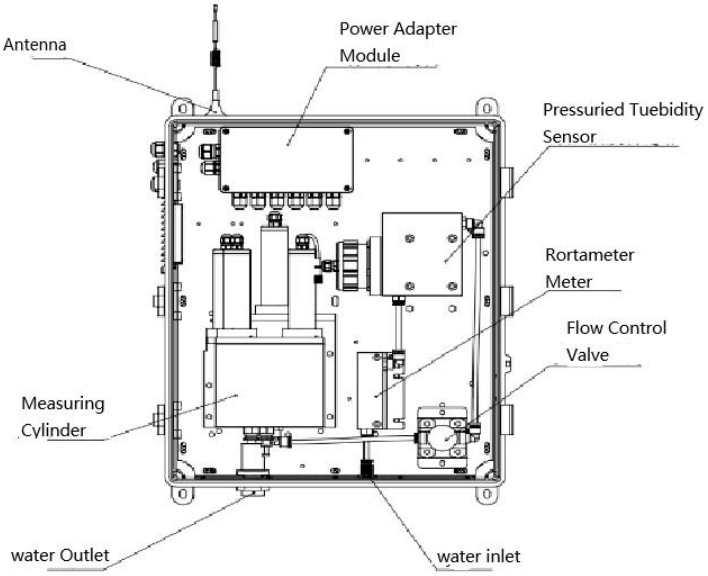


Fig.3

3 Installation

Before installation, please ensure to read the following instructions and reserve sufficient space to guarantee the correct installation of the product

3.1 Delivery Inspection

Upon receiving the product, users should first inspect the packaging quality. The packaging box should be intact with no damage, and the markings should be clear. If there is any obvious damage to the packaging, please contact the storage and transportation department promptly to investigate the issue and determine responsibility, and inform our company. If there are no issues such as packaging damage, you may open the box and take out the product to verify its completeness.

3.2 Installation Steps

3.2.1 Secure the Equipment

Mount the equipment vertically on a flat wall surface and secure it firmly.

⚠ Note: The equipment must be installed vertically to ensure the accuracy of sensor measurements and to prevent contamination or damage to the sensor.

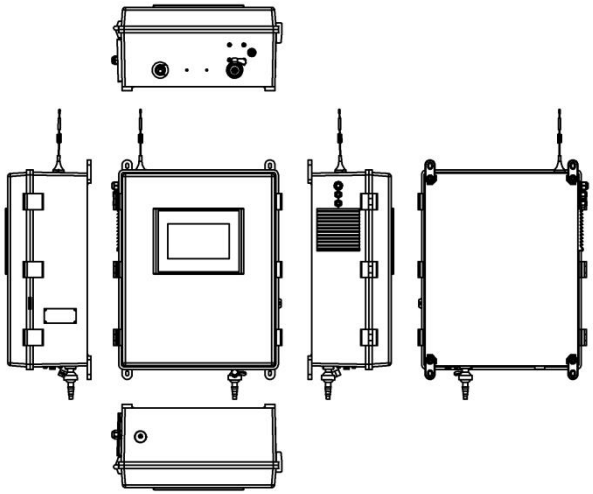


Fig.4 View of the equipment in all directions

3.2.2 Drainage Installation

Drainage relies on the natural gravity of the water to flow out, therefore, the drainage pipe should be as short, straight, and low as possible, with no arches or loops in the middle.

3.2.3 Water Inlet Installation

The inlet pipe of the equipment is connected using water pipes with outer diameters of either 6mm or 10mm as accessories, with a 4-point adapter employed to interface with a 4-point inlet pipe. An external valve is installed prior to the adapter for ease of equipment repair and maintenance.

After connecting, open the external water valve and allow the external water pipe to run for 10 minutes before directing the water into the equipment. This step is crucial to prevent dirt-laden water accumulated in the piping from entering the equipment. Adjust the internal needle valve to regulate the water flow, ensuring a continuous stream of water exits the overflow outlet of the flow cell.

Note: In environments with poor or unstable water quality, it is recommended that users install a pre-filter to prevent impurities from entering the equipment, which could block the internal water pathways and cause malfunctions.

3.2.4 sensor Installation

Remove the sensor protective cap and carefully insert the sensor into the corresponding installation hole in the flow cell.

Note: After installing the electrochemical sensor, it must be immediately supplied with water to keep the sensitive components of the electrochemical sensor moist (for residual chlorine/chlorine dioxide/ozone sensors, it is also necessary to maintain a continuous disinfectant in the water sample to prevent microbial growth from blocking the sensor's sensitive components).

3.2.5 Power Supply Installation

Connect the power cord to an AC220V power source.

3.3 Installation Diagram

Fig.5 Schematic diagram of equipment installation

3.4 Power-on and Operation

After completing the drainage, water inlet, and power supply installations, open the water valve, adjust the water inflow rate, connect the power cord, and turn on the internal air switch to power up the system.

Please observe the following three aspects:

(1) Check the Water Level: The normal water level is when the water level monitoring sensor is submerged, and water continuously flows out of the overflow port of the flow cell. The display panel should indicate that the water inflow is normal.

(2) Check for Data on the Device: After powering on and filling with water for 5 minutes, the display panel should show the measurement phase with data displayed for multiple parameters. After the initial power-on for 2 hours, the sensor sensors will complete hydration and polarization, and the device will enter a stable operating state.

(3) Check Wireless Data Transmission: The network connection indicator light should be constantly on, and the display panel should show a connected status. Logging in to the website and WeChat should show the field data normally.

Note: Due to variations in water quality at different sites, it is generally necessary to recalibrate the chlorine/chlorine dioxide/ozone values at the site. Before calibrating the chlorine/chlorine dioxide/ozone values, the system must bepreheated with water and power for at least 2 hours. Calibration can only be performed after the chlorine/chlorine dioxide/ozone sensors have completed hydration and polarization. The calibration instrument used is a portable chlorine/chlorine dioxide analyzer using the DPD method.

Note: During field calibration, the chlorine/chlorine dioxide content in the water sample should not be less than 0.3mg/L (or the average chlorine content of the water sample), otherwise, there may be a large calibration error.

Note:During comparison and calibration, ensure water sample content is stable; use equipment's sampling port. Other locations may cause errors.

4 Operation

4.1 Display interface

The display screen of the multi parameter water quality analyzer is a touch screen, with a fully Chinese operating interface and guided system operation. This chapter takes eight parameters (turbidity, residual chlorine, temperature, pH, conductivity, ORP, dissolved oxygen, TDS) as examples to introduce the basic operation of the analyzer.

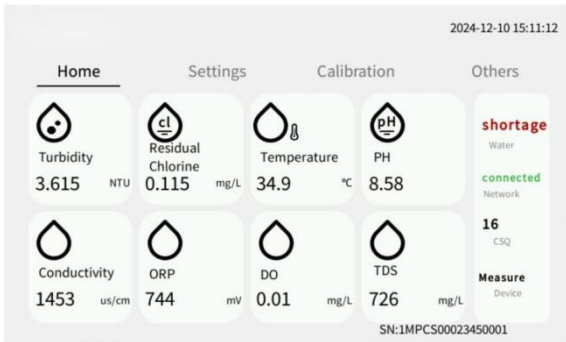


Fig.6 Displays the interface

4.2 Calibration menu

4.2.1 Turbidity Calibration

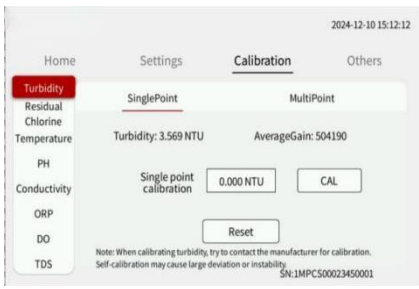
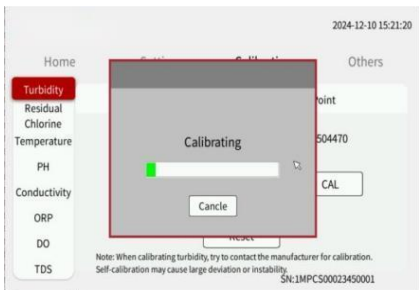
Turbidity calibration is divided into single-point calibration and multi-point calibration, which is divided into low-point calibration and high-point calibration.

(1) Turbidity Single Point Calibration

The turbidity single point calibration screen displays the current turbidity value and the average gain value. During calibration, it is necessary to wait until the turbidity gain value changes little and is relatively stable before calibration, otherwise the calibration effect will be unsatisfactory. Under the condition of normal water supply, please discharge the water for three times, with an interval of 180 seconds each time, until the dirt in the measuring cylinder is completely removed and the measured turbidity value tends to be stable, and then calibrate it. During calibration, when the hand-held equipment takes water, it is necessary to take water from the water intake below the equipment for measurement.

Table 7 shows the single point calibration operation when a haze value of 0.1 is measured by the handheld device.The turbidity single point calibration screen displays the current turbidity value and the average gain value. During calibration, it is necessary to wait until the turbidity gain value changes little and is relatively stable before calibration, otherwise the calibration effect will be unsatisfactory. Under the condition of normal water supply, please discharge the water for three times, with an interval of 180 seconds each time, until the dirt in the measuring cylinder is completely removed and the measured turbidity value tends to be stable, and then calibrate it. During calibration, when the hand-held equipment takes water, it is necessary to take water from the water intake below the equipment for measurement.

Table 7 Turbidity Single Point Calibration

Display	Operating instructions
	1. Enter the turbidity calibration page and click turbidity single-point calibration.
	2. Click to pop up the progress bar

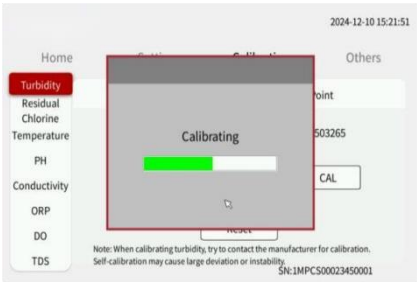
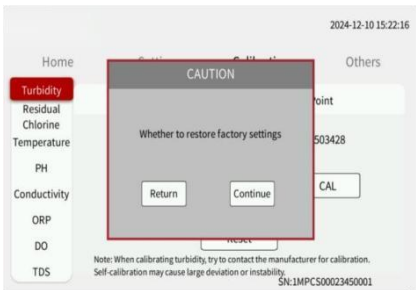
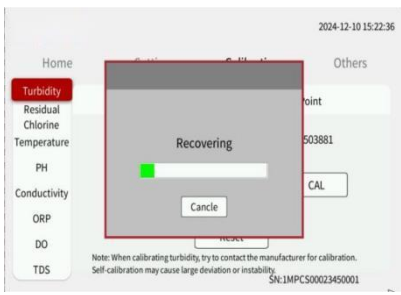
Display	Operating instructions
	3. The system continues to complete the calibration

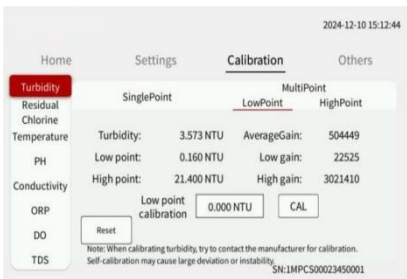
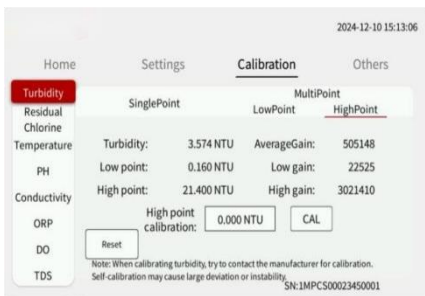
Table 8 Operation table for restoring factory calibration

Display	Operating instructions
	1. Click the "Restore Factory Settings" button on the calibration interface.
	2. Click the "Continue" button, at which point a progress bar will pop up.

(2) Turbidity Multi Points Calibration

Turbidity multi-point calibration is divided into low point calibration and high point calibration, which is applicable to calibration when there is standard liquid on site. The current turbidity, average gain and current calibration table will be displayed on the interface, which is convenient for the user to check whether the calibration table is normal. The turbidity multi-point calibration operation is shown in Table 9.

Table 9 Turbidity Multi-point Calibration Operation

Display	Operating instructions
	1. Firstly, enter the standard solution value for the high point on the high point calibration page, and then click to start the calibration. After completing the high point calibration, clean the sensor to proceed with the low point calibration for turbidity.
	2. On the low point calibration page, enter the turbidity value of the low point standard solution, click to start the calibration, and complete the low point calibration for turbidity.

(3) Slope and offset (turbidity with pressure only in high range)

Displayed turbidity = Actual turbidity * Slope + Offset.

When performing single-point calibration for high-range pressure turbidity or medium-to-high-range turbidity, only the slope is modified. The slope and offset can also be manually adjusted according to site conditions. For more accurate calibration, a standard solution calibration method can be adopted to modify the slope and offset. The calibration slope and offset for high-range pressure turbidity or medium-to-high-range turbidity are shown in Fig.7.

Standard solution calibration requires manually calculating the slope and offset, and then entering the calculated values. The process is as follows:

Standard solution calibration requires two calibration solutions prepared in advance. The calibration solutions are generally recommended to cover the turbidity values that may be encountered during normal use. For example, if the sensor needs to measure water sources ranging from 2NTU to 50NTU during normal use, then the selected calibration solutions can be tap water with a turbidity of around 0.2NTU and a 100NTU standard solution. Theoretically, the closer the coverage range, the more accurate the measurements. In the following calibration example, A represents the actual value of calibration solution one, B represents the sensor measurement value of calibration solution one, C represents the actual value of calibration solution two, and D represents the sensor measurement value of calibration solution two. The calibration steps are as follows:

1) Clean the measurement cylinder and sensor.

2) Restore the factory settings and reset the calibration table.

3) After recording the actual value A of calibration solution one, introduce calibration solution one into the measurement cylinder until water overflows from the outlet. Wait for a few minutes until the turbidity value is basically stable, then record the displayed turbidity value as the sensor measurement value B of calibration solution one.

4) Drain calibration solution one and clean the measurement cylinder and sensor.

5) After recording the actual value C of calibration solution two, introduce calibration solution two into the measurement cylinder until water overflows from the outlet. Wait for a few minutes until the turbidity value is basically stable, then record the displayed turbidity value as the sensor measurement value D of calibration solution two.

6) Calculate the turbidity slope and turbidity offset using the formulas: Turbidity slope = (C-A) / (D-B), Turbidity offset = A - Turbidity slope * B.

7) Enter the calculated turbidity slope and turbidity offset into the edit box to complete the standard calibration.

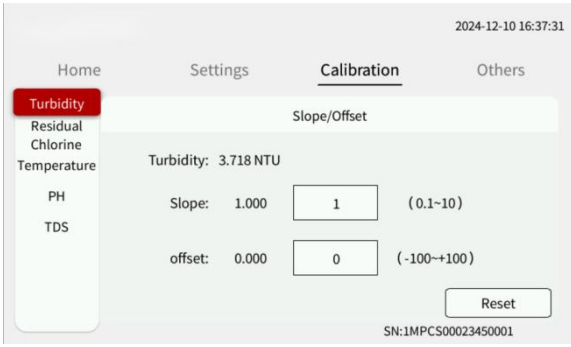


Fig.7 Calibration Diagram for Slope and offse

4.2.2 Residual Chlorine Calibration

Residual chlorine calibration is divided into high point calibration and zero point calibration.

(1) Residual Chlorine High Point Calibration

Precautions for high point calibration of residual chlorine:

1) Try to calibrate when the residual chlorine content in the water is high (it is recommended that the residual chlorine measured by the handheld device is greater than 0.3mg/L);

2) Calibrate when the residual chlorine content and flow rate are relatively stable;

3) When the sensor has just been maintained or the equipment has just been installed, it is recommended to conduct calibration after 2 hours of water and power supply.

Steps of residual chlorine high point calibration:

1) Open the sampling port below the equipment and drain water for 10 seconds;

2) take a water sample from a sampling port by use a handheld device for detection, and recording that value;

3) Repeat the step for 2 times, test for 3 times in total, and take the average value under the condition that the test values of the 3 times do not change much; if the change range is large, the possible reasons are as follows: ① the residual chlorine changes greatly, and test again after it is stable; ② there is an abnormal value, discard the test data, and take water again for testing;

4) Input the average value of the water sample measured by the handheld device into the high point edit box, and click calibration, as shown in Fig.8.

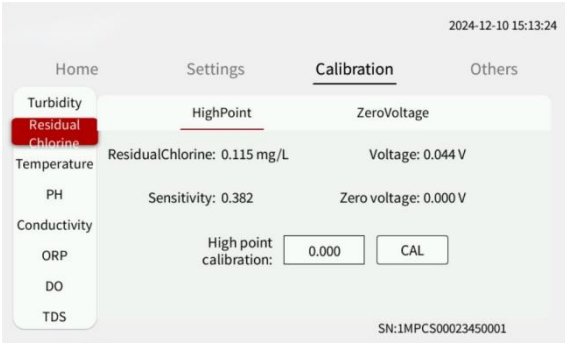


Fig.8 High Point Calibration Display

(2) Residual Chlorine Zero Point Calibration

Precautions for zero calibration of residual chlorine:

1) The zero point is relatively stable, and it is generally not necessary to conduct zero point calibration on site. If the zero point is adjusted incorrectly, the value will be abnormal. If it is necessary to adjust the zero point, please contact the after-sales personnel;

2) During zero calibration, clean the sensor with chlorine-free water, and then put the sensor into a chlorine-free water sample to wait for the voltage to be stable;

3) In the zero calibration interface, input the voltage of chlorine-free water measured by the sensor, and click Calibrate, as shown in Fig.9.

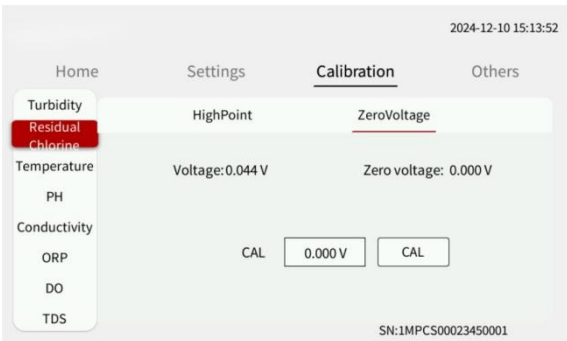


Fig.9 Display of Zero Calibration

(3) sensitivity

The meaning of sensitivity is the voltage corresponding to a disinfectant value of 1mg/L. For example, if the sensitivity is 0.2, it represents that when the disinfectant value is 1mg/L, the voltage increase of the sensor relative to the zero point is 0.2V (200mV).

4.2.3 Temperature Calibration

The temperature calibration is offset: displayed temperature = actual temperature + offset.

Enter the current temperature value during calibration, and the offset will change after calibration.

Signal type: NTC10K, NTC2.252K

Temperature signal: temperature resistance value

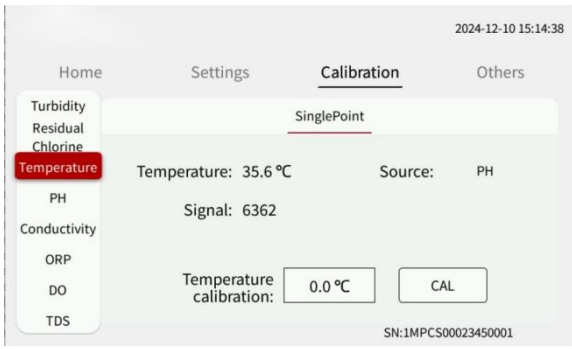
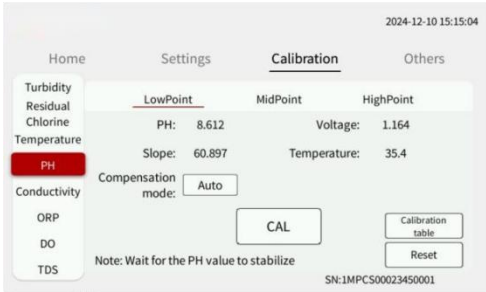
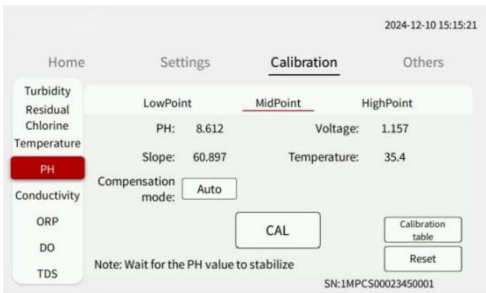
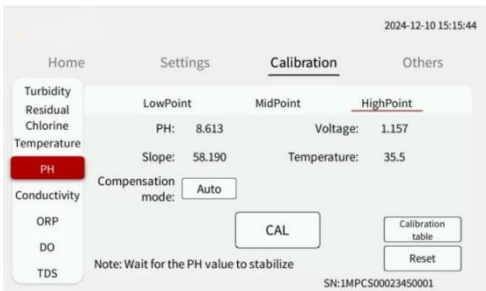


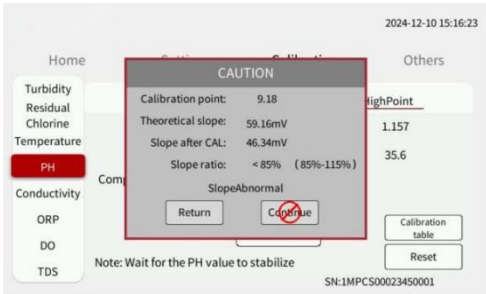
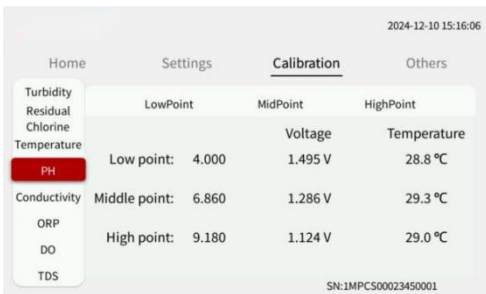
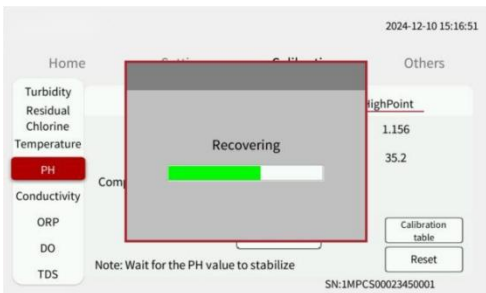
Fig.10 Temperature Calibration Display Diagram

4.2.4 pH calibration

There are three kinds of pH standard solutions. By default, the low point corresponds to 4.00, the midpoint corresponds to 6.86, and the high point corresponds to 9.18. Table 10 shows the calibration operation of the standard solution.

Table 10 Operation of pH standard solution calibration

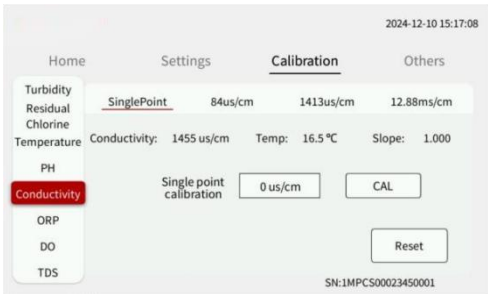
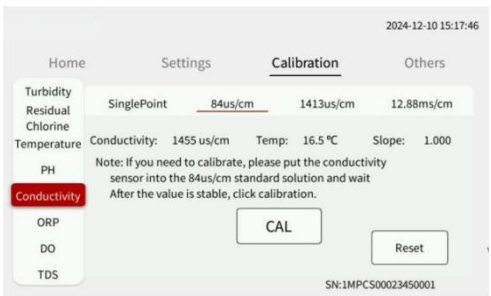
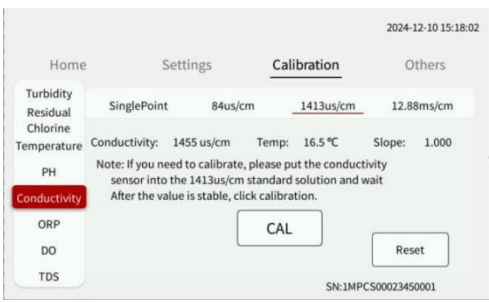
Display	Operating instructions
	1. Low Point Calibration for pH
	2. Mid-Point Calibration for pH
	3. High Point Calibration for pH

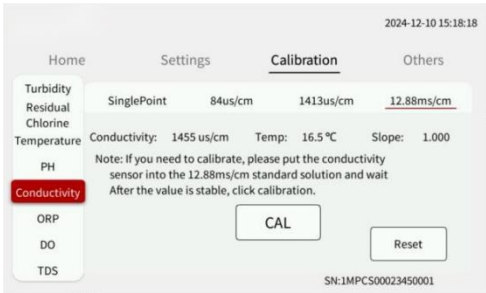
Display	Operating instructions
	4. During calibration, first rinse the pH probe and immerse it in the 6.86 standard solution. Enter the mid-point calibration interface for pH and wait for the pH voltage to stabilize before clicking the calibration button. Then, repeat the same steps for the calibration using the 9.18 and 4.00 standard solutions. During calibration, the slope validity will be verified. If the
	5. View the pH Calibration Table Page
	6. Restore factory settings.

4.2.5 Conductivity Calibration

Conductivity calibration is divided into: single-point calibration, calibration with 84uS/cm standard solution, calibration with 1413uS/cm standard solution, and calibration with 12.88mS/cm standard solution, as shown in Table 11.

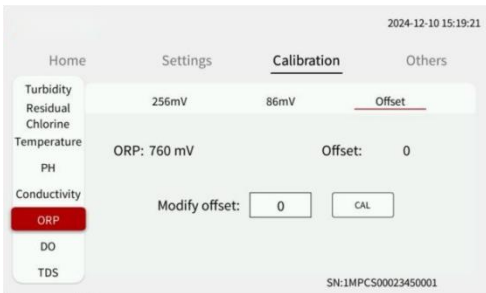
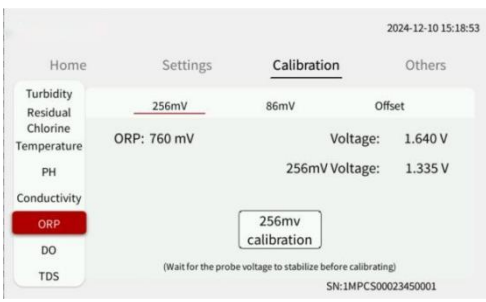
Table 11 Operation of conductivity calibration

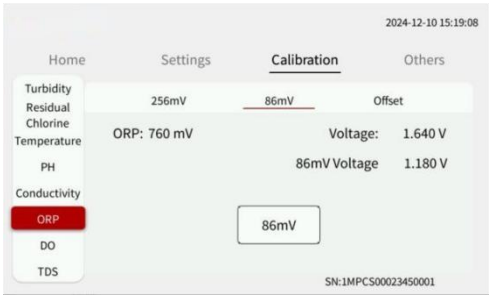
Display	Operating instructions
	1. Single-point conductivity calibration
	2. 84uS/cm Calibration using standard solution
	3. 1413uS/cm Calibration using standard solution

Display	Operating instructions
	4. 12.88mS/cm Calibration using standard solution

4.2.6 ORP Calibration

Table 12 Operation of ORP calibration

Display	Operating instructions
	1. ORP calibration is divided into two-point calibration using standard solutions of 256mV and 86mV. If there are no standard solutions available at the site, calibration can be performed by modifying the offset value, with the displayed ORP being equal to the actual ORP plus the offset.
	2. Enter the 256mV standard solution calibration interface. After rinsing and drying the sensor, immerse it in the newly prepared ORP 256mV standard solution. Wait for the sensor to stabilize, then click on the "256mV Calibration" button.

Display	Operating instructions
	3. Enter the 86 mV standard solution calibration interface, clean and dry the sensor, put it into the newly configured ORP86mV standard solution, and click 86 mV calibration after the sensor is stable.

4.2.7 TDS Calibration

Steps for TDS Calibration:

1) Open the sampling port at the bottom of the equipment and let the water flow continuously for 10 seconds.

2) Use a handheld device to collect a water sample from the sampling port for testing and record the value.

3) Repeat step 2 twice, performing a total of three tests. If the test values do not vary significantly among the three tests, take the average value. If there is a large variation, possible reasons include: ① Significant changes in the water sample, wait for it to stabilize before testing again; ② The presence of abnormal values. Discard the test data and collect water for testing again.

4) Enter the average value of the water sample measured by the handheld device into the edit box, and click on "Calibrate" as shown in Fig.11.

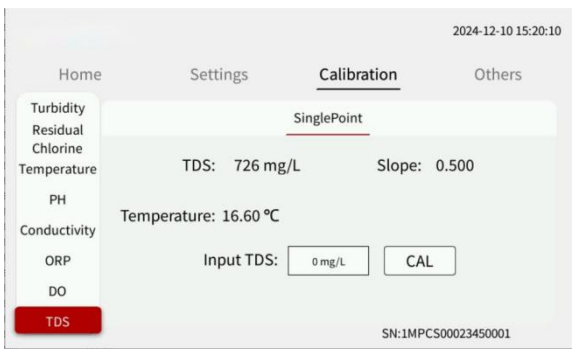
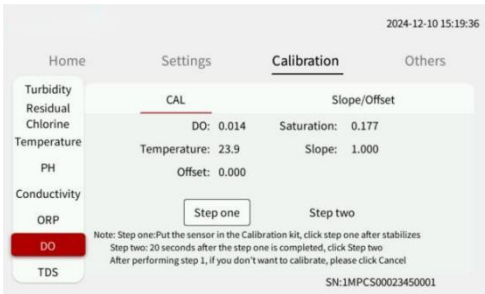
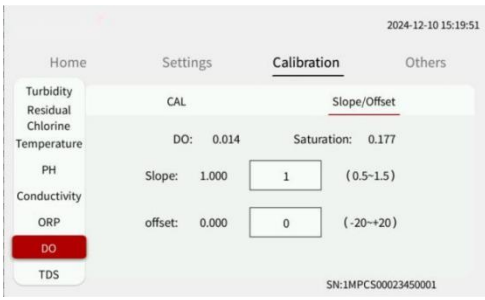


Fig.11 TDS Calibration diagram

4.3 Dissolved oxygen calibration

Table 13 Dissolved oxygen Calibration

Display	Operating instructions
	1. Dissolved oxygen calibration is divided into direct calibration of dissolved oxygen and calibration of slope and offset. The dissolved oxygen calibration process consists of two steps. In the first step, wipe the sensor clean and place it in the air. Once it stabilizes, click on "Calibration Step 1". At this point, a progress bar will pop up. After the progress bar completes, directly click on "Calibration Step 2" to complete the dissolved oxygen calibration.
	2. Directly modify the slope and offset calibration.

4.4 Modbus ID Setting

Modbus ID modification range (1-247), the default ID is 0x06, and the Modbus setting page is shown in Fig.12.

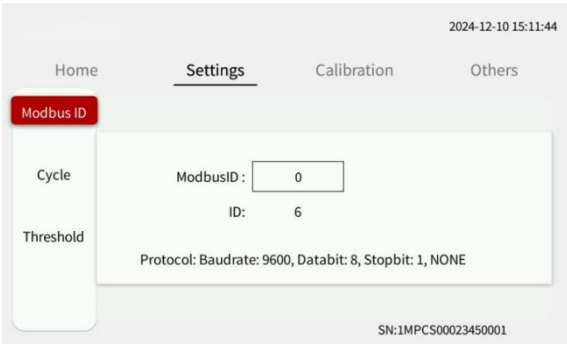


Fig.12 Modbus ID setting diagram

5 Maintenance and Servicing

The equipment should be maintained once every 1 to 3 months depending on the water quality and usage conditions at the site. Maintenance must be carried out with the power turned off, and the maintenance tasks are as follows.

5.1 Cleaning

Regularly clean dust and dirt inside and outside the equipment according to site conditions.The chlorine/chlorine dioxide/ozone flow-through tank and the turbidity measuring cylinder can be cleaned with a test tube brush and rinsed with clean water.

5.2 Water leakage checks

Check individual pools, hoses, and joints for leaks, and replace or dispose of them if they are present.

5.3 Maintenance of Turbidity sensor

(1) Regularly check whether the inlet and outlet water are normal.

(2) Regularly clean the turbidity sensor.

(3) Regularly compare the measurement accuracy. If the measurement error exceeds the requirements, the sensor needs to be recalibrated.

5.4 Maintenance of Ampere Current sensors

The Ampere Current sensors include Chlorine/Chlorine Dioxide and Dissolved Oxygen sensors, which require periodic calibration. Supports one-button field comparison calibration. For Residual Chlorine/Chlorine Dioxide/Ozone, select recommended high-point calibration ≥0.3mg/L via device's gear button

Regular calibration of the DPD colorimetric method is recommended weekly, with a max interval of ≤30 days, ensuring stable pH and disinfectant content.

Cover the sensor with a protective cap when not in use and keep the sensor head moist.

Depending on the water quality and pollution situation, clean the sensor regularly and polish it with sandpaper (≥5000 mesh sandpaper) if necessary.

Polishing Steps for Membraneless Dual Platinum Ring sensor:

(1) Remove the sensor from the flow cell.

(2) Rinse the sensor with tap water.

(3) Wet the sandpaper with tap water, wrap the sandpaper around the two platinum ring sensors, and rotate and polish for at least 2 circles until the silver-white metallic gloss of the sensor is restored. Stop polishing at this point.

(4) After cleaning the polished area with tap water, reinstall the sensor back into the flow cell.

(5) Calibrate the sensor after allowing water to flow through for two hours.

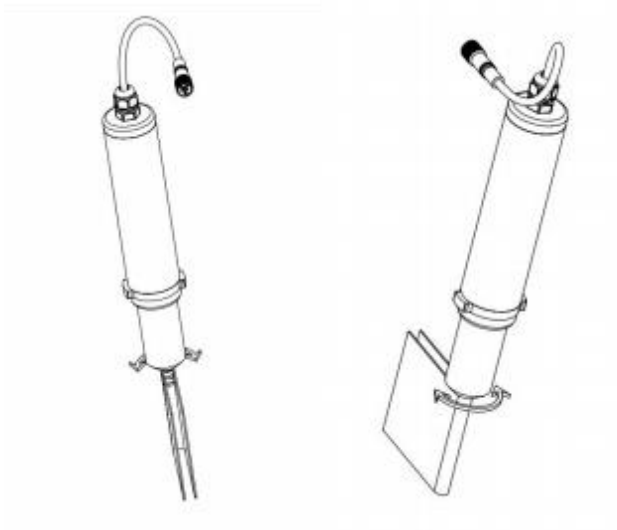


Fig.13 Polishing of Membraneless Dual Platinum Ring sensor

5.5 pH/ORP sensor Maintenance

The sensor requires regular cleaning and calibration. If there are deposits on the sensor surface, they can be cleaned with diluted hydrochloric acid and then rinsed with clear water. If there is a significant deviation in the pH/ORP value after calibration, the sensor should be replaced promptly and recalibrated. The sensor has a lifespan of 1 year, which may be shortened due to improper maintenance or excessively harsh site conditions.

For pH/ORP calibration: Please insert the sensor into the corresponding standard solution for calibration.

5.6 Conductivity sensor Maintenance

The sensor also requires regular cleaning and calibration. When cleaning with an alcohol-soaked cotton ball, be careful not to damage the platinum black on the sensor surface. If there is a significant deviation in the measured value, the sensor should be replaced promptly and recalibrated.

For conductivity calibration: Please insert the sensor into the standard solution for calibration.

5.7 Buffer Tank Maintenance

If there is excessive dirt inside the buffer tank, it should be cleaned promptly with a test tube brush or replaced as necessary.

5.8 Maintenance of Other Optional sensors

For the maintenance of other customized optional sensors, please consult our company separately.

6 Troubleshooting and Resolution

6.1 Common Troubleshooting

Common Faults of the Equipment and Troubleshooting Steps please refer to the following table for troubleshooting. If the issue cannot be resolved, please refer to the handling instructions for special situations below.

Table 14 Common Troubleshooting

Fault Phenomena	Possible Causes	Troubleshooting Methods
Abnormal Increase in Turbidity Value (Excluding Water Source Issues)	Improper installation causing water ingress and contamination of sensor light hole	Clean the glass of the sensor's light hole
	Contamination inside the flow cell	Clean the flow cell
Low Turbidity Value	Light source damage	Contact our company to replace the light source
	Internal contamination of the sensor	Clean the sensor
Inaccurate sensor Values	Inadequate maintenance	Perform sensor maintenance and recalibrate
	Damaged sensor	Replace the sensor and recalibrate
Network Communication Failure	Poor wireless signal at the site	Contact the carrier to increase signal coverage or change the installation location
	Outstanding balance	Contact our company to recharge the data plan
RS485 Communication Failure	Poorly connected signal cable	Disconnect power and reconnect the signal cable

6.2 Handling of abnormal turbidity values in special cases

(1) Inconsistency between laboratory equipment water samples and equipment water samples.Please go to the water outlet of the equipment to take water measurements.

(2) The front end of the sensor is covered with stains, and the displayed value of the device is much lower than the value measured by the DPD method. Please clean the front end of the sensor with clean water and polish it with sandpaper (sandpaper size>5000 mesh). The polishing steps can refer to the 6.4 ampere current maintenance section. After cleaning the polished part with tap water, install the sensor into the reflux pool and calibrate it after running normally for two hours. After this situation occurs, it is recommended to polish and calibrate the front end of the residual chlorine sensor every week. If it still cannot be resolved, please contact our company.

(3) When there is a large disparity between the water temperature at the site and the room temperature, it may result in the formation of water mist on the exterior of the measurement vessels used in laboratory equipment. This condition can interfere with the accuracy of measurements taken by the laboratory equipment. To address this issue, it is recommended to reduce the temperature difference between the water and the room before proceeding with measurements using the laboratory equipment.

6.3 Treatment of abnormal residual chlorine/chlorine dioxide values in special cases

(1) If the value measured by the DPD method is less than 0.05 and the device displays a value less than the value measured by the DPD method or a value of 0. Do not perform a calibration in this case because the DPD method is approaching the lower limit of measurement and the effect of the error will be significant.Increase the dosage rate and calibrate again when the DPD value is greater than 0.3mg/L.

(2) The sensor film head is covered with stains and the values shown by the device are much smaller than those measured by the DPD method.Please use a cotton swab to gently wipe the head of the sensor membrane, be careful not to wipe the membrane head too hard to break, and clean the

head of the sensor membrane with fresh water, then put the sensor back into the flow cell, and calibrate the sensor after two hours of normal operation.When this occurs it is recommended that the chlorine residual sensor membrane head be cleaned and calibrated weekly. If this does not solve the problem, please replace the membrane head and electrolyte.

(3) The water samples at the site contained high levels of ammonia and nitrogen, and ammonia reacts with chlorine in many ways:

$NH_4^+ + HOCl \rightarrow NH_2Cl + H_2O + H^+$

$NH_2Cl + HOCl \rightarrow NHCl_2 + H_2O$

$NHCl_2 + HOCl \rightarrow NCl_3 + H_2O$

$2NH_4^+ + 3HOCl \rightarrow N_2 + 5H^+ + 3Cl^- + 3H_2O$

$NH_4^+ + 4HOCl \rightarrow NO_3^- + 6H^+ + 4Cl^- + H_2O$

The reaction may vary depending on the chlorine content, resulting in the formation of various chloramines. Experiments have shown that monochloramine can cause the free chlorine value of the DPD method to increase by 0.1 per 0.3 ml/L of monochloramine in a one minute reading, and that the residual chlorine sensor of the device cannot measure monochloramine.It is recommended that high purity chlorine dioxide be used for disinfection.

(4) On-site water samples contain more high-valent iron ions, high-valent iron ions have a strong oxidizing property, which will make the value of the DPD method high, in this case, using the DPD method to measure the value of the raw water can also be measured, and the sensor of the equipment can not measure iron ions.

Chlorine dioxide can oxidize iron ions to produce rust, increase the dosage of chlorine dioxide can oxidize part of the iron ions to produce free chlorine dioxide, the equipment can be detected but less than the value of the DPD method.

It takes several days for the residual chlorine to oxidize the high-valent ferric ions, and since most of the ferric ions are not oxidized, the values detected by the device will be much smaller than those measured by the DPD method.

(5) The water samples at the site contained a high level of nitrite ions, which were present in the same way as iron ions.

(6) On-site water samples contain more high-valent manganese ions, which have strong oxidizing property and will make the value of DPD method high, in this case, the value of raw water can be measured by DPD method, but the sensor of the equipment cannot measure manganese ions.

Chlorine dioxide can oxidize high-valent manganese ions. Increasing the dosage of chlorine dioxide can oxidize part of the high-valent manganese ions, thus generating free chlorine dioxide, which can be detected by the equipment, but the value is smaller than the value measured by DPD method.

The efficiency of residual chlorine in removing high-value manganese ions is low, most of the manganese ions are not oxidized, the equipment can read out the value but it will be much smaller than the value measured by DPD method.

7 Communication protocol

7.1 Physical interfaces

The field interface of the device is RS485 interface, baud rate 9600, data bit: 8, stop bit: 1, checksum: none, flow control: none.

7.2 Data protocols

Multi-parameter online water quality analyzer communication protocol using ModBus-RTU, the slave address default 0x06, read function code 0x03, write function code 0x10, register address table shown in the following table.

Table 15 Register Address

Sequence Number	Register Name	Register Address	Length	Byte quantity	Data Type	Operation	Description
1	Turbidity	1	2	4	UINT32	Read-only	Divide by 1000 ,unit is NTU
2	Residual Chlorine / Chlorine Dioxide / Ozone	3	2	4	UINT32	Read-only	Divide by 1000 ,unit is mg/L
3	Temperature	5	2	4	UINT32	Read-only	Divide by 1000 ,unit is ℃
4	pH	7	2	4	UINT32	Read-only	Divide by 1000 ,
5	Conductivity	9	2	4	UINT32	Read-only	Divide by 1000 ,nit is μS/cm
6	ORP	11	2	4	INT32	Read-only	Divide by

Sequence Number	Register Name	Register Address	Length	Byte quantity	Data Type	Operation	Description
							1000 ,nit is mv
7	Dissolved oxygen	13	2	4	UINT32	Read-only	Divide by 1000 ,unit is mg/L
8	TDS	17	2	4	UINT32	Read-only	Divide by 1000 ,unit is mg/L
9	Modbus ID	20	1	2	UINT16	Read-only	Modbus address, default 6
10	Turbidity	1101	2	4	FLOAT	Read-only	Unit is NTU
11	Residual Chlorine / Chlorine Dioxide / Ozone	1103	2	4	FLOAT	Read-only	Unit is mg/L
12	Temperature	1105	2	4	FLOAT	Read-only	Unit is ℃
13	pH	1107	2	4	FLOAT	Read-only	
14	Conductivity	1109	2	4	FLOAT	Read-only	Unit is uS/cm
15	ORP	1111	2	4	FLOAT	Read-only	Unit is mV
16	Dissolved oxygen	1113	2	4	FLOAT	Read-only	Unit is mg/L
17	TDS	1117	2	4	FLOAT	Read-only	Unit is mg/L

7.3 Examples of communications

（1）Example of UINT32 format

Master reads slave parameter values modbus command: (UINT32)：06 03 00 01 00 12 95 B0

Slave responds to host value modbus command (UINT32)：06 03 24 00 00 00 AF 00 00 01 54 00 00 48 44 00 00 1C 20 00 06 09 50 00 00 02 5F 00 00 21 3E 00 00 00 00 00 03 03 7C CC E9

Turbidity value：00 00 00 AF，converted to decimal 175，retaining three decimals to obtain a turbidity value of 0.175.

Residual chlorine value：00 00 01 54，converted to decimal 340, retaining three decimals to obtain a residual chlorine value of 0.34.

Temperature value：00 00 48 44，converted to decimal 18500，retaining three decimals to obtain a temperature value of 18.5.

pH value：00 00 1C 20，converted to decimal 7200，retaining three decimals to obtain a pH value of 7.2.

Conductivity value：00 06 09 50，converted to decimal 395600，retaining three decimals to obtain a conductivity value of 395.6.

ORP value：00 00 02 5F，converted to decimal 607，obtain an ORP alue of 607.

Dissolved oxygen value：00 00 21 3E，converted to decimal 8510，retaining three decimals to obtain a dissolved oxygen value of 8.51.

TDS value：00 03 03 7C，converted to decimal 197500，retaining three decimals to obtain a TDS value of 197.5.

（2）Example of FLOAT format

Master reads slave parameter values modbus command(FLOAT)：06 03 04 4D 00 12 55 57

Slave responds to host value modbus command (FLOAT)：06 03 24 3E 33 33 33 3E AE 14 7B 41 94 00 00 40 E6 66 66 43 C5 CC CD 44 17 C0 00 41 08 28 F6 00 00 00 00 43 45 80 00 36 1E

Turbidity value：3E 33 33 33，obtain a turbidity value of 0.175.

Residual chlorine value：3E AE 14 7B，obtain a residual chlorine value of 0.34.

Temperature value：41 94 00 00，obtain a emperature value of 18.5 .

pH value：40 E6 66 66，obtain a pH value of 7.2 .

Conductivity value：43 C5 CC CD，obtain a conductivity value of 395.6.

ORP value：44 17 C0 00，obtain a ORP value of 607 .

Dissolved oxygen value：41 08 28 F6，obtain a dissolved oxygen value of 8.51.

TDS value：43 45 80 00，obtain a TDS value of 197.5.

7.4 Air Interface

Please contact our technical support personnel for customization based on specific requirements.