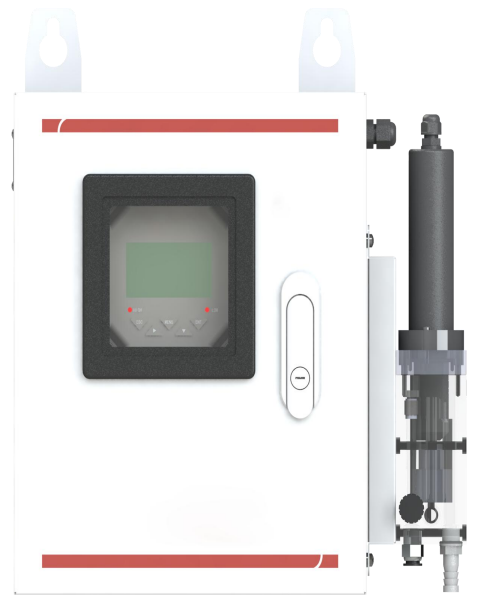
User's Manual

Residual Chlorine Analyzer

U-2LC-ACM-EN1



Preface

- Thank you for purchasing our product.
- This manual is about the product functions, wiring methods, setting methods, operating methods, troubleshooting methods, etc.
- Prior to operation, please read this manual thoroughly to ensure proper use and to prevent potential losses.
- After reading, please keep this manual in an accessible place for future reference during operation.

Note

- The contents of this manual are subject to change without notice due to real-time factors such as function upgrading.
- We strive to ensure the accuracy of the manual. Nevertheless, if you identify any errors or inaccuracies, please contact us.
    - Unauthorized reprinting or copying of this manual is strictly prohibited.

Version

U-2LC-ACM-EN1

Safety Precautions

For the safe operation of this product, please strictly follow the outlined safety precautions.

About this manual

- Please ensure the instrument operators have a careful reading of this manual.
- Prior to operation, please study this manual in detail to ensure a thorough comprehension of the device's functionality.
- This manual only describes the product's functions. The responsibility for the device ‘s suitability for any special or personalized purpose lies solely in the operator.

Precautions for product protection, safety, and modification

- For your safety and the normal operation of the product and its controlling systems, the guidelines and precautions specified in this manual are supposed to be fully observed. Operating the instrument in ways not specified in this manual may compromise its protective features. Our company shall not be liable for any malfunctions or accidents resulting from non-compliance with the precautions described.
- When equipping the product and its controlling systems with lightning protection or separate safety protection circuits, it needs to be implemented by other devices.
- If you need to replace components or fittings of the product, please use the model specified by the company.
- This product is not designed for applications in systems directly related to personal safety, such as nuclear power facilities, radioactive equipment, railway systems, aviation equipment, marine equipment, and medical equipment. If applied, it is the user's responsibility to implement additional equipment or systems to ensure personal safety.
- Do not modify this product.
- The following safety symbols are used in this manual:

Hazard: Failure to take appropriate precautions may result in serious

personal injury, product damage, or major property loss.

Warning: Pay special attention to critical information related to the product or specific sections of this user manual.

- Confirm whether the supply voltage is consistent with the rated voltage before operation.
- Do not use the instrument in a flammable and combustible or steam area.
- To prevent electric shock and operation errors, ensure proper grounding protection is in place.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at the correct electric level, shielded, with wires properly routed, and an SPD surge protector applied as needed.
- Some internal components may carry high voltage. To avoid the risk of electric shock, do not open the front square panel unless it is being handled by trained personnel or maintenance staff authorized by our company.
- To avoid electric shock, disconnect the power before performing any checks.
- Check the condition of the terminal screws regularly. If loose, please tighten them before use.
- Unauthorized disassembly, modification, or repair of the product is not allowed, as it may lead to malfunctions, electric shock, or fire hazards.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine, or other organic solvents, and avoid exposing the product to any liquids. If the product falls into the water, please cut off the power immediately to prevent leakage, electric shock, or fire hazards.
- Please check the grounding protection regularly. Do not operate the product if you think that the protection, such as grounding protection and fuses, is inadequate.

- 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; failure to do so may damage the product's protective devices.

- Do not use the instrument if it is found damaged or deformed upon opening the package.
- Prevent dust, wire ends, iron fines, or other objects from entering the instrument during installation, as this may cause abnormal operation or failure.
- During operation, to modify the configuration, signal output, startup, stop, and operation safety shall be fully considered. Improper operation may lead to failure and even destruction of the instrument and control equipment.
- Each part of the instrument has a certain service life, which must be maintained and repaired regularly for long-term use.
- If the product comes to the end of its service life, it should be disposed of as industrial waste as a way of environmental protection.
- Disconnect the instrument when it is not in use.
- 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 terms beyond the scope of this product warranty.
- This company is not responsible for damage to the instrument, loss of parts, or unpredictable damage caused directly or indirectly by improper operation of the user.

No.	Items	Quantity	Note
1	Online Residual Chlorine Analyzer	1	
2	User Manual	1	
3	Test Certificate	1	

After opening the box, please confirm the scope of delivery before starting the operation. If you find that the model and quantity are incorrect or there is physical damage to the product's appearance, please contact us.

Contents

1 Overview

1.1 Introduction

The online residual chlorine analyzer is an intelligent online residual chlorine detection kit for water quality. Adopting high-quality imported components and a hypochlorous acid–selective permeable membrane head, the analyzer operates on the latest polarographic/amperometric technology. Combined with advanced manufacturing and quality control processes, the instrument ensures long-term stability, reliability, and measurement accuracy.

It is widely used for continuous monitoring and control of free chlorine in tap water plants, water distribution networks, swimming pools, cooling circulating water, and water treatment projects.

1.2 Measuring principle

The membrane-free residual chlorine sensor employs a three-electrode measurement system with two platinum electrodes and one silver chloride electrode. The built-in high-precision potentiostats enable its working electrode potential to be stable. In operation, disinfectant components such as hypochlorous acid undergo oxidation-reduction reactions at the working electrode, and the generated current follows Faraday's law, thereby measuring the disinfectant concentration.

1.3 Features

- Integrated design with unified inlet and outlet connections; wall-mounted installation protects against water flooding and ground moisture, saves floor space, and enables easy installation and maintenance.
- Electrochemical sensors with no reagent consumption and no pollutant discharge.
- Optically isolated (4~20) mA analog output with strong anti-interference capability.
- Optically isolated RS-485 communication.
- High and low alarm thresholds with adjustable hysteresis.
- The buzzer and LCD backlight can be switched on/off.

2 Technical Parameters

Table 1 Technical parameters

Measured variables	Residual chlorine
Measurement methods	Reagent-free, electrochemical, 3-electrode amperometric assay system
Working method	Continuous flow monitoring
Measuring range	(0~ 5) mg/L ; (0~ 20) mg/L
Detection limit	0.030 mg/L or lower
Accuracy	±3% of reading (DPD comparison error ±10% or ±0.05 mg/L, whichever is greater)
Repeatability	±3% of reading
Resolution	0.001 mg/L
Response time	T_{90} ≤ 90 seconds
Transmitter output	Isolated type, (4-20) mA, adjustable measurement range, 500Ω load capacity, output accuracy: ±0.2%FS
Communication	Isolated type, RS-485 output, Modbus-RTU
Alarm output	2-channel SPDT; normally open/closed type; capacity 250V AC, 3A
Power supply	220VAC
Power consumption	≤ 6.5 W
Inlet flow rate	≥ 400mL / min
Pressure resistance	≤ 0.5 MPa
Sample pH range	(4~9) pH
Operating temperature	(0~45) ℃
Calibration method	Single-point calibration, two-point calibration
Dimensions	321 mm (W) x 300 mm (H) x 200 mm (D)
Weight	7.5kg

3 Structure and Dimensions

3.1 External Dimensions

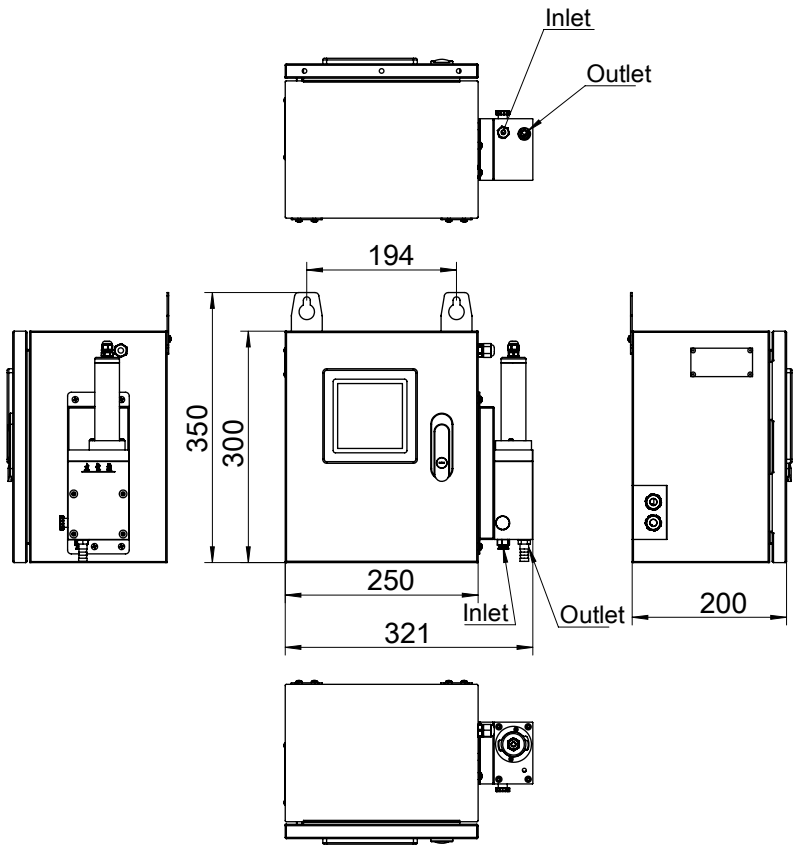


Fig.1 Dimensions (unit: mm)

3.2 Structure

The residual chlorine online analyzer is shown in Figure 2.

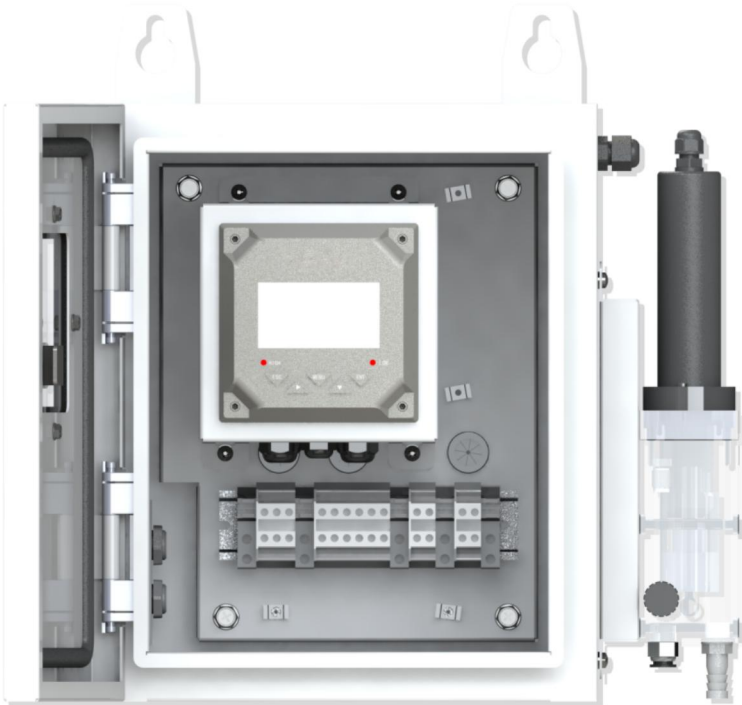


Fig.2 Internal structure diagram

4 Installation

4.1 Inspection upon Arrival

Upon acceptance, please carefully inspect the packaging quality. The packaging box should be intact and undamaged, with clear markings. If the packaging is visibly damaged, please promptly contact the storage and transportation department to clarify the problem and responsibility, and contact us at the same time. If the packaging is undamaged, proceed to unpack, take out the product, and check the packing list.

4.2 Installation Notes

Note	
	Do not install the instrument while water or electricity is on.
	The equipment must be installed horizontally; tilting will affect measurements and water flow.

4.3 Installation Steps

4.3.1 Fixed Equipment

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

Note: The equipment must be installed vertically; otherwise, it will affect the measurement accuracy or even damage the sensor.

4.3.2 Water Inlet Installation

Note	
	The inlet water pressure should be controlled within 0.5 MPa.
	The recommended flow rate is greater than 400 mL/min.
	The water inlet should always have water; an intermittent water supply is not allowed!

5 Electrical Connection

Note: The residual chlorine online analyzer operates at 220VAC. To ensure accurate measurements, please ensure that the ground wire is properly grounded.

5.1 Terminal Blocks

The terminal block diagram is shown in Figure 4.

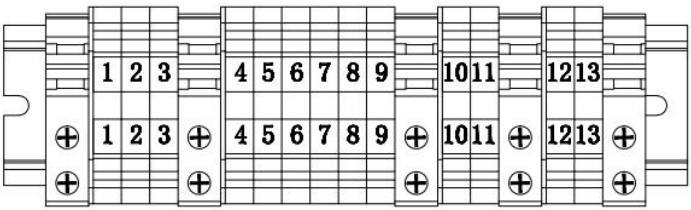


Fig.3 Internal wiring terminals

5.2 Terminal Definition

Table 2 Terminal Definition

No.	Meaning
1	L: AC 220 V power input-Line
2	NC: Not connected
3	N: AC 220 V power input-Neutral
4	HO: High-alarm relay — normally open (NO) contact
5	HC: High-alarm relay — normally closed (NC) contact
6	COM: Common terminal for high-alarm relay
7	LO: Low-alarm relay—normally open (NO) contact
8	LC: Low-alarm relay—normally closed (NC) contact
9	COM: Common terminal of low-alarm relay
10	485A: RS485 communication — A(+) terminal
11	485B: RS485 communication — B(-) terminal
12	I+: (4-20) mA output positive terminal
13	I-: (4-20) mA output negative terminal

6 Operation

6.1 Display and Operation Unit

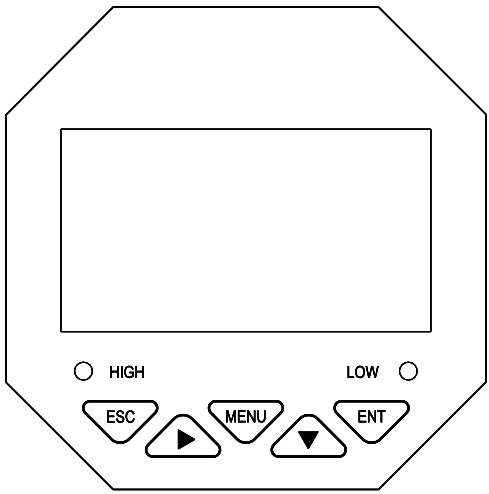


Fig.4 Display and Operation Unit

Table 3 Key Definition

Symbol	Key	Function Description
	ESC	In the "monitoring interface", view the relevant alarm status. Returning to the previous level from related interfaces under the "menu interface"
	Right	Cycle through to select and modify the parameter
	Menu	Access the menu under "monitoring interface" Exit the menu from "menu interface"
	Down	Select the relevant menu under the "menu interface" Modify relevant values in the “setting” interface.
	Confirm	Access submenus or confirm changes from the "menu interface"

6.2 Interface Description

6.2.1 Monitoring Interface

After powering on, the instrument will automatically match the sensor and then enter the monitoring interface. In the monitoring interface, press the [**Menu**] key to enter the password verification interface, enter the password to enter the main menu interface; press the [**ESC**] key to enter the alarm query interface to inquire the current alarm settings information. The monitoring interface is shown in Figure 6.

Note: If no instrument operation is performed within 3 minutes, the system will automatically redirect to the monitoring interface.

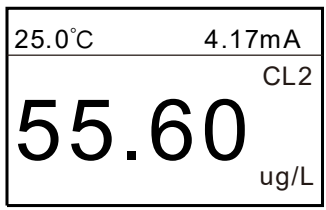


Fig.5 Monitoring interface

6.2.2 Alarm Query Interface

In the monitoring interface, press the [**ESC**] button to enter the alarm query interface, and the alarm setting information will be displayed, as shown in Figure 6.

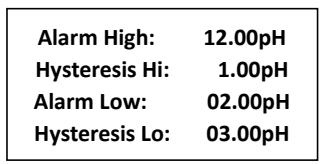


Fig.6 Alarm query interface

6.2.3 Password Verification Interface

On the monitoring interface, press the [**Menu**] button to enter the password verification interface, as shown in Figure 7.

The initial password is "0000". You can change your password via the password reset function. If you forget your password, please contact our company.

Fig.7 Password verification interface screenshot

6.2.4 Main Menu Interface

After entering the password, the main menu interface will be displayed.

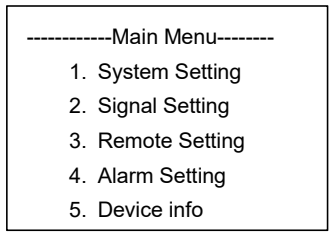


Fig.8 Main menu interface

System settings: language, buzzer, backlight settings, password change, and factory reset.

Signal setting: online calibration, signal correction, temperature calibration, electrode sensitivity, and electrode factory reset.

Remote setting: communication settings, current transmitter parameter settings.

Alarm setting: parameter settings for high alarm and low alarm.

Information query: query information for the current version.

6.3 Configuration Description

6.3.1 Signal Settings

（1）Online calibration

Residual chlorine signals require the use of a standard solution. The specific steps are as follows:

- Place the probe into the first point standard solution, input the standard value of the first standard solution, and click ENT. After the measured data stabilizes, click ENT to complete the first calibration.
- Remove the probe from the first standard solution, rinse it with clean water,

and dry the sensor;

- Place the probe into the second point standard solution, input the standard value of the second point standard solution, and click ENT. After the measured data stabilizes, click ENT to complete the second point calibration.

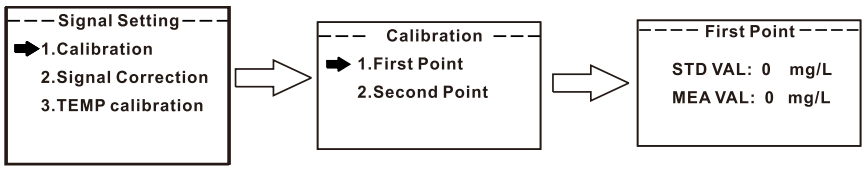


Fig.9 Online calibration of residual chlorine

（2）Signal Correction

The measured residual chlorine value can be corrected within ±15% of the measurement range.

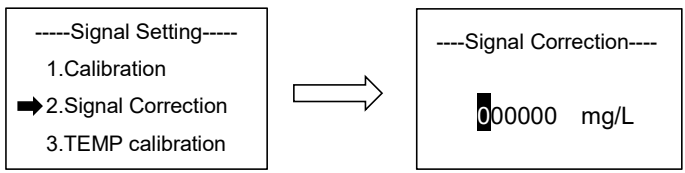


Fig.10 Residual chlorine signal correction

（3）Temperature Calibration

Enter the current standard temperature value to perform calibration.

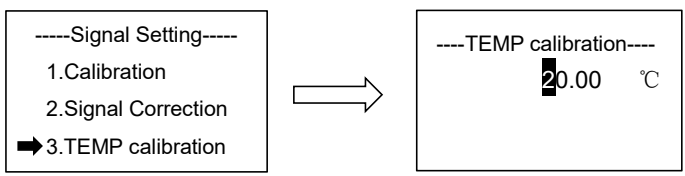


Fig.11 Temperature calibration

（4）Electrode Sensitivity

This displays the current measurement sensitivity of the residual chlorine electrode.

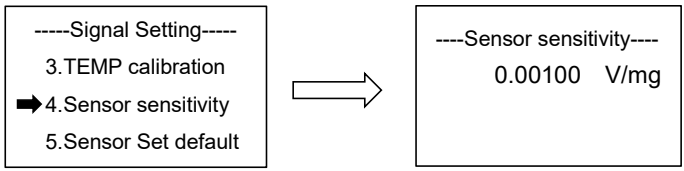


Fig.12 Display electrode sensitivity

（5）Restore electrodes to factory settings:

The electrodes have been restored to factory settings.

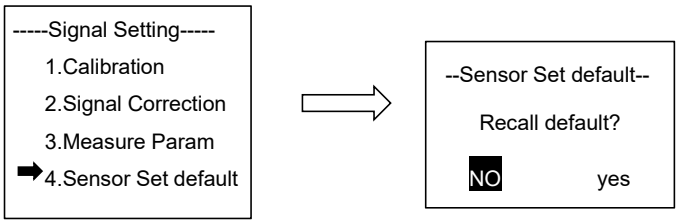


Fig.13 Electrode factory reset

6.3.2 Remote Settings

(1) Communication settings:

Configure the address, baud rate, and parity bit for 485 communication.

Select the address bit length, baud rate, and parity bits.

Selectable address range (1~254), baud rate (2400, 4800, 9600, 19200, 57600), and parity bits (no parity, odd parity, even parity).

ENT Save settings parameters

MENU Return to the monitoring interface

ESC Return to the remote transmission settings interface

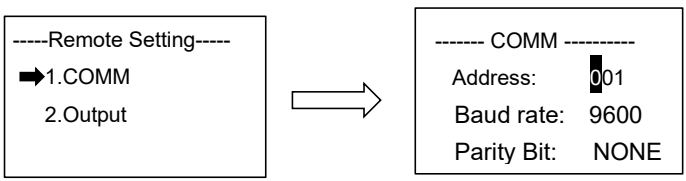


Fig.14 Communication settings interface

(2) Current transmission:

The values corresponding to 4mA and 20mA of the output can be set between (4-20)mA.

Select the data bit depth parameter.

Change data size

ENT Jump to 20mA parameter settings and save the settings.

MENU Return to the monitoring interface

ESC Return to 4mA parameter settings, return to the remote transmission settings interface.

Note: The unit xx and data size will be automatically switched depending on the selected sensor.

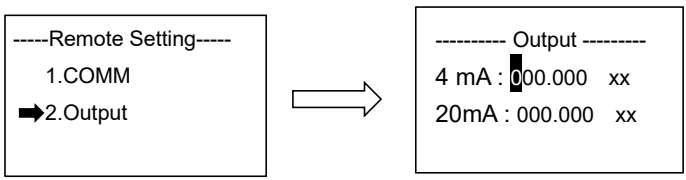


Fig.15 Current Transmitter

6.3.3 Alarm Settings

(1) High alarm value:

Set the alarm value and hysteresis of the high alarm relay. When (measured value>alarm value), the normally open contact of the high alarm relay is energized, and the normally closed contact is open. When (measured value<alarm value - hysteresis), the normally open contact of the high alarm relay is open and the normally closed contact is energized.

Select the data bit depth parameter.

Change data size

ENT Jump to hysteresis parameter settings and save the settings.

MENU Return to the monitoring interface

ESC Returns to alarm value parameter settings, returns to the alarm settings interface.

Note: The unit xx and data size will be automatically switched depending on the selected sensor.

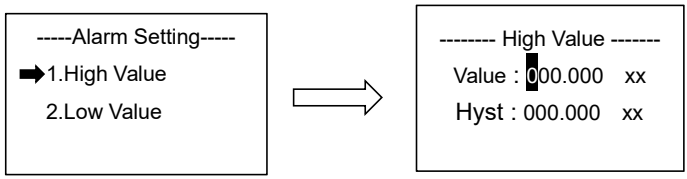


Fig.16 High alarm value setting

(2) Low alarm value:

Set the alarm value and hysteresis value of the low alarm relay. When (measured value < alarm value), the normally open contact of the low alarm relay is energized, and the normally closed contact is open. When (measured value > alarm value + hysteresis), the normally open contact of the low alarm relay is open and the normally closed contact is energized.

Select the setting parameter modification position.

Change data size

ENT Jump to hysteresis parameter settings and save the settings.

MENU Return to the monitoring interface

ESC Returns to alarm value parameter settings, returns to the alarm settings interface.

Note: The unit (xx) and data size will automatically switch depending on the selected sensor.

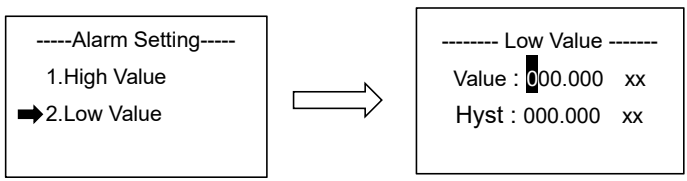


Fig.17 Low alarm value setting

6.3.4 Information Query Interface

Query the current version information.

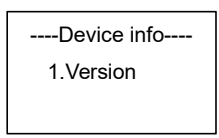


Fig.18 Version information query

7 Maintenance

7.1 Electrode Maintenance

Please note the following points in the electrode maintenance:

(1) Regular cleaning: wash out the contaminants adhering to the electrode.

(2) Keep the cable connector clean and dry.

(3) If the sensitivity is too low after long-term operation (sensitivity less than 0.05), perform a polishing procedure with sandpaper of ≥5000 in grit size.

Steps:

a. Remove the electrode from the flow cell.

b. Rinse the electrodes with tap water.

c. Moisten the sandpaper with tap water. Wrap the sandpaper around the two platinum rings and rotate the electrode for at least two full turns. Continue polishing until the rings are shiny with silvery metallic luster, as shown below.

d. After rinsing the polished electrode clean with tap water, re-insert it into the flow cell.

e. The electrode should be calibrated again after powering on in the water for 2 hours.

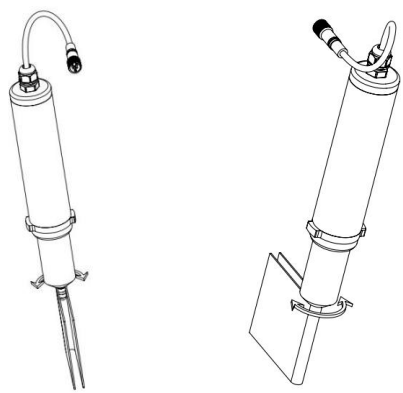


Fig.19 Maintenance diagram

7.2 On-site calibration

The calibration of the residual chlorine analyzer is recommended to be performed on-site at a high point; zero-point calibration is generally unnecessary. After high-point calibration, the instrument will recalculate the residual chlorine sensitivity, which can be used to judge the quality of the calibration. The instrument is generally calibrated before leaving the factory and can be put into direct use. For online monitoring of the measured medium, a certain and constant flow rate should be maintained, above 400 mL/min. If problems arise during actual use, the instrument's failure rate is generally low. The main issue is a change in the state of the residual chlorine electrode; therefore, it is necessary to check whether the residual chlorine electrode is in good condition. The residual chlorine electrode is not easily damaged; the main issues are whether the membrane head (membrane) is in good condition and whether the special filling solution inside the membrane head is depleted.

8 Fault Analysis and Troubleshooting

8.1 Troubleshooting

The online chlorine analyzer supports long-term operation with minimal maintenance. If you have troubles during operation, please try the following four solutions in the table. If the troubles are unresolved, please refer to 8.2 “Special cases and troubleshooting”.

Table 4 Troubleshooting

Troubles	Troubleshooting	Solutions
RS485 communication failure	The signal cable is not connected properly.	Power off the device and reconnect the signal cable
	Controller damage	Contact our company
The residual chlorine value remained unchanged. (Excluding water source issues)	Extended power-off time requiring re-polarization	Reserve sufficient water flow and power-on time for re-polarization.
	The residual chlorine electrode requires maintenance.	Clean the double platinum rings of the residual chlorine electrode, and polish if necessary.
	Residual chlorine electrode damage	Contact our company
Water leakage from the equipment leak	Excessive water pressure	Maintain the water pressure below 0.5 MPa
The controller has no display.	Power wiring is not connected properly.	Verify correct power wiring and ensure stable power supply.
The controller cannot be calibrated.	Electrode damage	Check if the standard solution was prepared correctly or if the electrode is damaged.
The screen displays “Sensor not connected.”	The sensor wiring is not connected properly.	Check if the sensor is disconnected.

8.2 Special Cases and Troubleshooting

(1) Low readings at very low chlorine concentrations

- **Special Conditions:** When the value measured by the DPD portable device is less than 0.05, while the device reading is lower than that or even zero:
- **Solution:** Do not perform calibration in this case, as the DPD portable tester is already near its detection limit, and measurement errors will be significant. Increase the dosing amount until the DPD reading exceeds 0.3 mg/L, then proceed with calibration.

(2) Fouled membrane head

- **Special Conditions:** When the electrode surface is fouled, the device reading is much lower than the DPD value.
- **Solution:** Clean the electrode. If the issue persists, polish the electrode with sandpaper of at least 8000 grit. Refer to Chapter 7 for the polishing procedure.

(3) High ammonia content

When the water sample onsite contains a high concentration of ammonia nitrogen:

Ammonia reacts with chlorine in multiple ways:

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

$$NH_2Cl + HOCl \rightarrow NHCl_2 + H_2O$$

$$NHCl_2 + HOCl \rightarrow NCl_3 + H_2O$$

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

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

Different reactions may occur depending on the chlorine concentration, resulting in various chloramines.

Experiments show that monochloramine can cause the DPD method to overestimate free chlorine readings — for every 0.3 mg/L of monochloramine, the measured free chlorine increases by about 0.1 mg/L (within one minute of reading).

Since the digital residual chlorine sensor cannot detect monochloramine, it is recommended to use high-purity chlorine dioxide for disinfection in such cases.

(4) When the water sample contains a high concentration of ferric ions:

Ferric ions have strong oxidizing properties, which can lead the DPD method to produce higher readings. In such cases, the DPD method may still show a value even when measuring raw water, while the device electrode cannot detect ferric ions.

Chlorine dioxide can oxidize ferric ions into rust. When the dosage is increased, part of the ferrous ions are further oxidized, producing free chlorine dioxide that can be detected by the device. However, the detected value remains lower than that measured by the DPD method.

Residual chlorine oxidizes ferric ions very slowly, often taking several days; most ferric ions remain unoxidized, resulting in device readings much lower than DPD measurements.

(5) When the water sample contains a high concentration of nitrite ions:

The effect is similar to that of ferric ions described above.

(6) When the water sample contains a high concentration of manganic ions:

Manganic ions have strong oxidizing properties, causing the DPD method to give higher readings. In such cases, the DPD method may still show a value even when measuring raw water, while the device electrode cannot detect manganic ions.

Chlorine dioxide can oxidize manganic ions. A higher dosage of chlorine dioxide can oxidize part of them and generate free chlorine dioxide. Consequently, the device can detect a value, though still lower than that measured by the DPD method.

Residual chlorine has low efficiency in oxidizing manganic ions; most of them remain unoxidized, so the device may display a reading much lower than that obtained by the DPD method.

9 Warranty and After-Sales Service

Our company guarantees that any product quality issues arising during the warranty period will be covered under our unconditional "Three Guarantees" policy, which includes free repair, replacement, or return. All non-customized products are eligible for return or exchange within 7 days (excluding products damaged due to misuse). For customized products, the warranty terms specified in the contract shall apply.

Disclaimer

Product damage or failure is not covered under the warranty service, even during the warranty period:

(1) Product malfunctions caused by improper use by the customer.

(2) Product malfunctions resulting from unauthorized disassembly, repair, or modification by the customer.

Appendix A Communication Protocol

A.1 Physical Interface

This product provides a standard RS-485 serial communication interface and adopts the standard Modbus-RTU communication protocol.

A.2 Register Address

The communication data and register addresses are shown in Table 5.

Table 5 Register address

Address	Data types	Function code	Access	Description
0x1100	short	0x03/0x06	W/R	Slave address, 1 ~ 254
0x1101	short	0x03/0x06	W/R	Baud rate: 0=2400, 1=4800, 2=9600 (default) , 3=19200, 4=57600
0x1102	short	0x03/0x06	R	Parity bit: 0 = N81 (default) , 1 = O81, 2 = E81 N: No parity; E: Even parity; O: Odd parity 8: Data bits (8 bits)
0x2000	short	0x03	R	High byte: Data version; Low byte: Data type Data Version: 0x01 Device Type: 0x51
0x2002	float	0x03	R	Temperature value, unit: °C
0x2004	float	0x03	R	Residual chlorine value, unit: ug / L
0x2006	float	0x03	R	Meaningless, value is 0
0x2008	float	0x03	R	Meaningless, value is 0
0x2103	short	0x03	R	High alarm relay status

Address	Data types	Function code	Access	Description
				0: Disconnect 1: Engage
0x2104	short	0x03	R	Low alarm relay status 0: Disconnect 1: Engage

A.3 Communication Example

Query address 0x00 (single-player mode)

The device address is unknown. You can send the 03 command using the address 0x00.

Device address	Function code	Starting address	Number of registers	CRC
0x00	0x03	0x1100	0x0001	0x80E7

Data response: Device address is 0x01.

Device address	Function code	Return bytes	Returned data	CRC
0x01	0x03	0x02	0x0001	0x7984