User Manual

Reverse Osmosis Control System

ROS-360

Shanghai ChiMay Technology Co., Limited

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User's Manual V1.1

Preface

Thank you for using ROS-360 series reverse osmosis control system produced by our company!

The RO reverse osmosis system monitoring platform is divided into single-stage RO system control, two-stage RO system control, two-stage RO+EDI, laboratory ultra-pure water system control.

Please read this manual carefully before installation. Correct sensor installation and parameter settings will maximize the performance and advantages of the product, providing you with a great user experience.

The ROS-360 is a precision process analysis and control integration system for reverse osmosis processes. It should be installed, operated, and maintained by trained personnel or those who understand and master the relevant professional knowledge.

If you encounter any difficulties during the installation or use of the ROS-360, please consult our after-sales service department in a timely manner.

After unpacking, please verify the complete list and the actual products you received. If there are any missing or damaged items, please contact our sales personnel immediately.

Manufacturer's solemn commitment:

1. If any quality problem occurs within one year from the date of purchase, you can get free repair or replacement.
2. No matter how you obtain this product, the manufacturer is committed to life-long technical service for the products sold 。
3. The damage caused by the following reasons is not included in the warranty scope：

   A. Damage caused by misconnecting high-voltage power supply or flooding;

   B. Damage caused by personal modification and misuse;

   C. Collateral loss caused by improper selection;

   D. Damage caused by exceeding the specified use conditions of the product;

   E. Property damage caused by improper force;

   F. Failure of storage and transportation caused by failure in accordance with the specified storage or transportation conditions (reference standard SJ/T10463-93);

   G. Consumable materials need to be purchased separately.

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1. Summarize

ROS-360 series reverse osmosis reverse osmosis control system adopts 7-inch color touch screen as the main operating platform, integrating PLC process control, water quality monitoring, pressure monitoring, parameter setting, flow monitoring and other functions, making RO process control more humane and lower cost.

The system integrates the running program of RO system, DI/DO control, water quality and flow detection and other detection functions 。

In order to meet the different process selection of users. Can be optional according to the single stage, double stage, conductivity /PH transmitter channel number. The following table describes the single-tier and dual-tier configurations

2. System Features

Man-machine interface: the use of 7 inch color touch screen, dynamic flow display, real-time multi-parameter monitoring display free switch ；

Conductivity monitoring: conductivity detection, source water, primary and secondary conductivity detection, with overlimit alarm and discharge drive ；

Desalting rate: can display the first desalting rate, the second desalting rate monitoring;

Human-computer interaction: real-time display of the current operating status of the system, alarm prompt, and modify various parameter Settings at any time ；

Automatic control: the control system has built-in measurement analysis and DI/DO, and embedded process running software to achieve high integration;

Consumable management: the pre-processing capacity and residual processing capacity of consumable can be forecast so that users can know the operation situation of consumable in time；

Flushing mode: boot flushing, full water flushing, running interval flushing, stand-by interval flushing, high/low pressure flushing mode, all flushing time can be set by oneself；

Integrated panel installation: all the detection modules are built in, so that the external distribution lines of the controller are few and the installation is simple and beautiful；

Electromagnetic compatibility: Good electromagnetic compatibility (EMC) design, easy to cope with the complex industrial electromagnetic environment；

Optional a variety of low-cost turbine flow sensors, impeller flow sensors (pulse output interface) : (display instantaneous flow and cumulative flow) :

Single stage system: can measure the source water flow, water flow;

Two-stage system: it can measure source water flow, primary water flow and secondary water flow;

Optional pressure transmitter measuring function (4-20MA interface):

Single stage system: Pre - and post - membrane pressure can be measured;

The two-stage system: primary pre-membrant pressure、primary post-membrant pressure, Secondary pre-membrane pressure、 Secondary post-membrane pressure;

RS485 remote transmission function: touch screen data can be remote transmission, communication port can be connected through GPRS/WIFI, mobile phones and computers on the data monitoring;

3. Main technical indicators

Electrical conductivity measurement	Electrode type	0.1 cm-1	1.0 cm-1	10.0 cm-1
	Source water conductance	----	(0～2000) μS/cm	(0～20.00) mS/cm
	TDS-1	(0～200) μS/cm	(0～2000) μS/cm	----
	TDS-2	(0～200) μS/cm	(0～2000) μS/cm	----
	Temperature Compensation	Automatic compensation based on 25℃, range (normal temperature electrode 0 ~ 50℃, high temperature electrode 0 ~ 120℃)		
	Accuracy	Supporting accuracy: ≤1.5 level		
Salt rejection rate	Accuracy Measuring range	(0-100) %		
The flow measurement (optional)	Measuring range	Determine the scope according to the pipe diameter; (Can display the accumulated flow, instantaneous flow)		
	Accuracy	According to the flow sensor used to determine;		
	Temperature Compensation	Automatic compensation based on 25℃, the range (normal temperature electrode 0 ~ 60℃, high temperature electrode 0 ~ 100℃)		
Pressure survey (Optional)	Measuring range	Can be set (such as 0 ~ 2.00mpa) to measure the pressure before and aft er the film		
	Accuracy	±0.01mA		
DI Signal input	Single suction	Low liquid level of the source water tank; First stage booster pump inlet low pressure detection; First stage booster pump outlet high pressure; High liquid level of primary water supply tank; Low liquid level of primar y water supply tank; Preprocessing signal (The status of all input points is: Closed valid)		
	Double step	Source water pressure low pressure; First stage booster pump inlet low p ressure; First stage booster pump outlet high pressure; High liquid level of primary water supply tank; Low liquid level of primar y water supply tank; Secondary booster pump outlet high pressure; Low liquid level of secondary water supply tank; High level preprocessing		

		signal of secondary production tank; (The status of all input points is: Closed valid)
DO relay Control the output	Single suction	Inlet valve; Source water pump; First stage high pressure pump; First stage flush valve; primary produced water conductivity overload discharge valve; Alarm output node; Manual water supply pump;
	Double step	Inlet valve; Source water pump; primary high pressure pump; primary flushing valve; Primary dosing pump; primary produced water conductivity overload discharge valve. Two-stage high pressure pump; Secondary flush valve; Superstandard discharge valve of secondary water producing conductivity; Alarm output node; Manual water supply pump;
	Load capacity	3A(AC 250V) or 3A(DC 30V)
Touch screen size	7 inch size	
External communication	RS485	Modbu3A(250V AC) or 3A(30V DC)s RTU protocol
Power Supply		DC24V (±2V) These include: touch screen, flow sensor, pressure transmitter
Working conditions		Temperature :(0 ~ 50)℃; Relative humidity: ≤85% (no condensation);
Storage Environment		Temperature :(-20 ~ 60) ℃; Relative humidity: ≤85% (no condensation
Installation Method	Touch Screen	Face plate open hole installation, Dimensions: 203*149*48mm (length * width * depth) Opening size: 190*136mm (l * W)

Note: If ac-220V power supply is required, it can be selected separately.

Pressure transmitter and flow sensor are optional components;

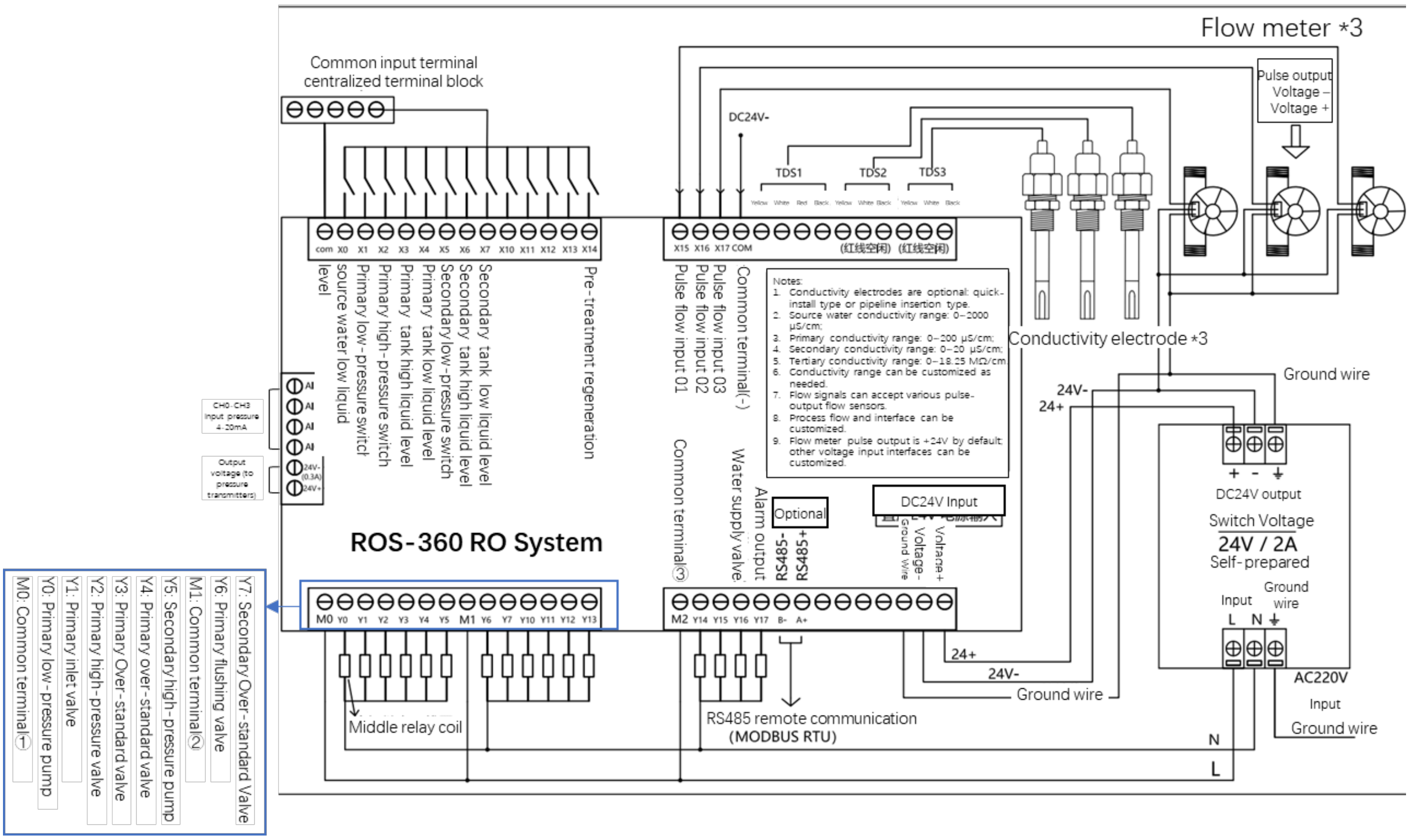
Single-stage standard: 7-inch touch screen all-in-one +2 ABS1.0 conductivity electrodes;

Single stage standard: 7-inch touch screen all-in-one +3 ABS1.0 conductivity electrodes;

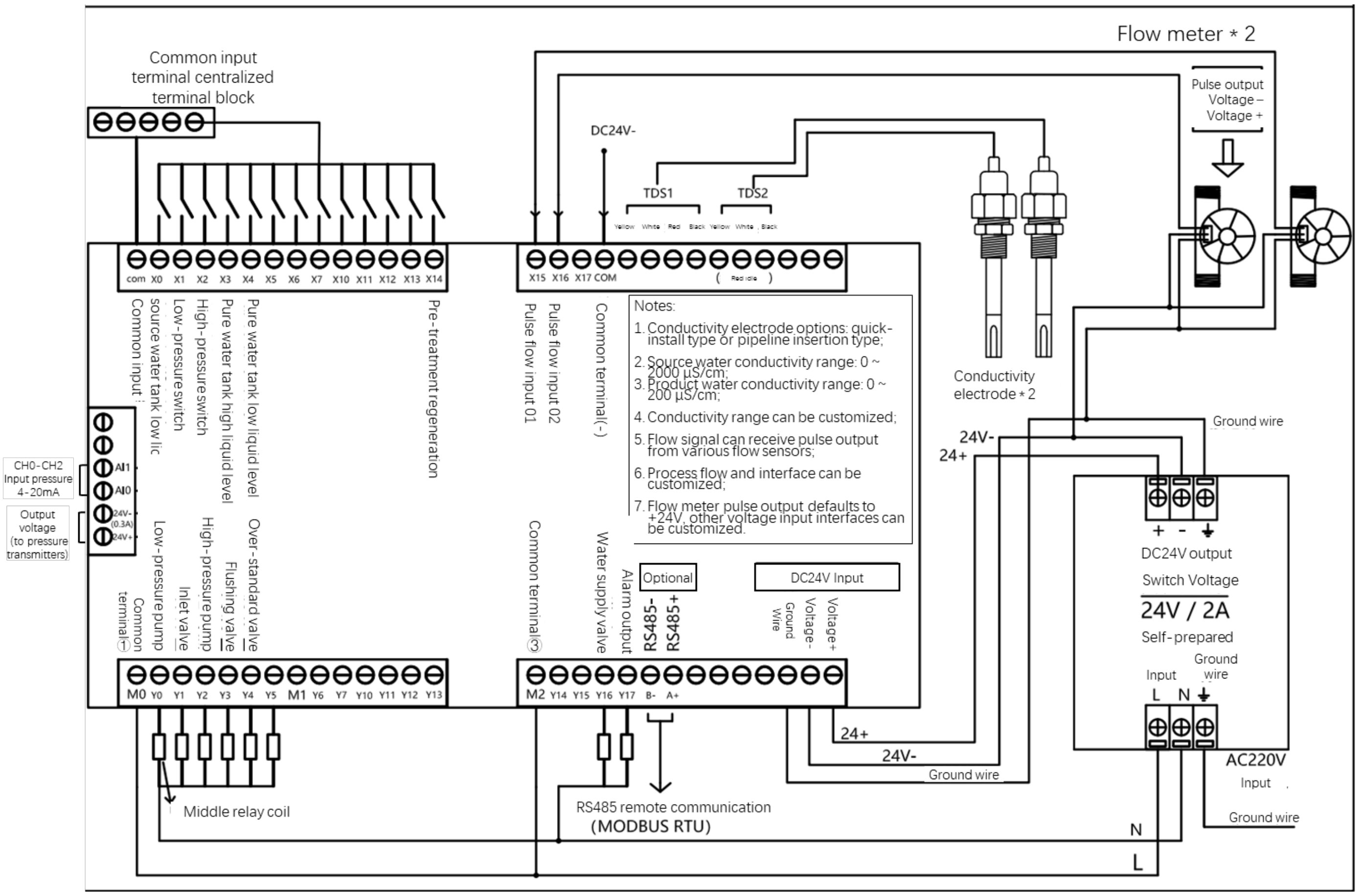
Relay output node: When driving large contactors, it is recommended to expand through intermediate relays or contactors for more permanent electrical reliability.

4. **Electrical wiring diagram**

Electrcal wiring diagram 1 (single stage)



Electrcal wiring diagram 2 (single stage)



5. Display interface description

Note: Due to periodic system upgrades, the display interface may differ slightly from the description herein. For any unresolved issues, please consult our technical personnel.

Boot screen, the system is starting up..

Single stage RO process control

Interface description -- single stage RO process control

a) Equipment status: real-time display of the current RO working mode (such as: startup flushing, system water supply, full water standby, etc.);

b) Execution time : the countdown time from the current RO mode to the next mode;

c) Displays the current working status of each component.Red: stop; Green: start) ；

d) 

The manual mode switch can be turned on only when the device is stopped, and then the manual debugging mode can be entered;

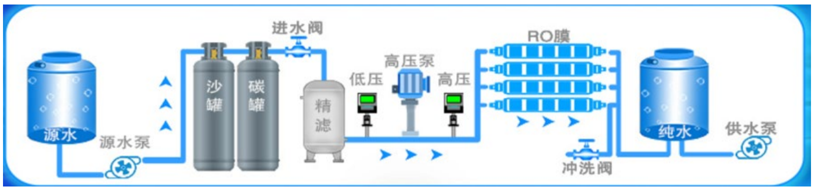
e) 

System switch button ；

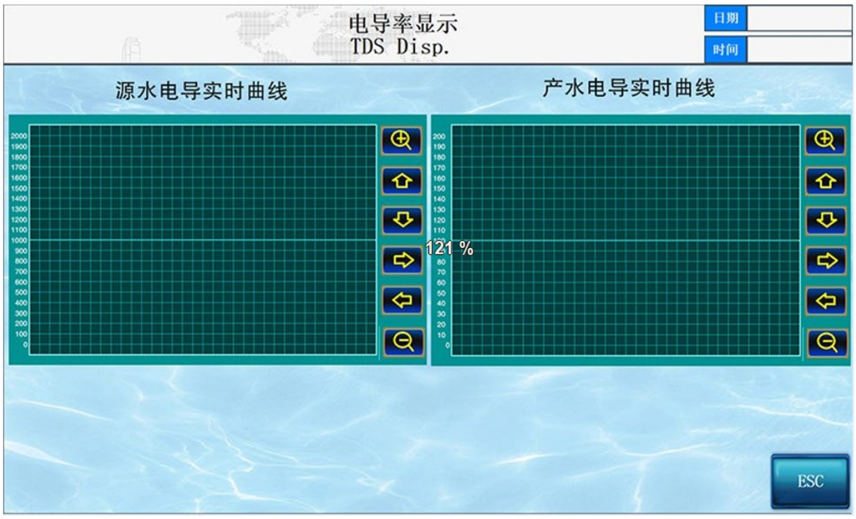
f) 

Supply pump manual button， The water supply pump can be manually opened only when the low liquid level switch of the pure water tank is switched on;

g) The flow chart interface displays the corresponding animation along with the running status of the device ；



h) Conductivity trend chart: the trend chart showing the current conductivity value can be enlarged or reduced to display the curve;



i) **Main menu -- System Settings ： password is required, default 111;**

j) **User parameter setting options:**

k) **Conductivity over limit alarm setting**

Electrode Type Settings: (Supported types: 0.01, 0.1, 1.0, 10.0cm-1;) System default/100; so the input value must be multiplied by 100;[0.01 electrode: input 1; 0.02 electrode: input 2; 0.1 electrode: input 10; 0.1 electrode: input 100; 10.0 electrode: input 1000;]Electrode Constant Settings: (Supported range: 0.000--9.999) System default/1000; so the input value must be multiplied by 1000; For example: If the electrode constant is 1.000, input 1000;

Conductivity Alarm Mode: (0/1) 0: Low-limit alarm; 1: High-limit alarm

Low-limit Alarm Mode: When the measured value < alarm setting value, enter the alarm state; after the alarm, when the measured value > (alarm setting value + alarm return difference), the alarm is cleared;

High-limit Alarm Mode: When the measured value > alarm setting value, enter the alarm state; after the alarm, when the measured value > (alarm setting value - alarm return difference), the alarm is cleared;

Note: The alarm value and return difference cannot be equal to prevent oscillation. It is recommended to keep it between 5%-20%;

l) Flush time setting:

Note: When all parameters are set to 0, this function is skipped;

Start-up Preparation Time: Default 12 seconds; setting range: 00-999;

Start-up Flushing Time: Default 60 seconds; setting range: 00-999

Operation Flushing Time: Default 30 seconds; setting range: 00-999

Continuous Water Production X Minutes Flushing Time: Default 180 minutes, (execute operation flushing after continuous water production for X minutes);

Standby Flushing Time: Default 30 seconds;

Continuous Standby X Minutes Flushing: Default 240 minutes, (enter standby state when the pure water tank is full, execute standby flushing after continuous standby for X minutes);

Full Water Flushing: Default 30 minutes; (immediately flush when the pure water tank is full).

High/Low Pressure Flushing Mode: Red light: Turn off the high-pressure pump during flushing; Green light: Turn on the high-pressure pump during flushing;

Alarm Switch: Mute control of the buzzer after fault alarm;

m) 4-20mA Pressure Acquisition Settings

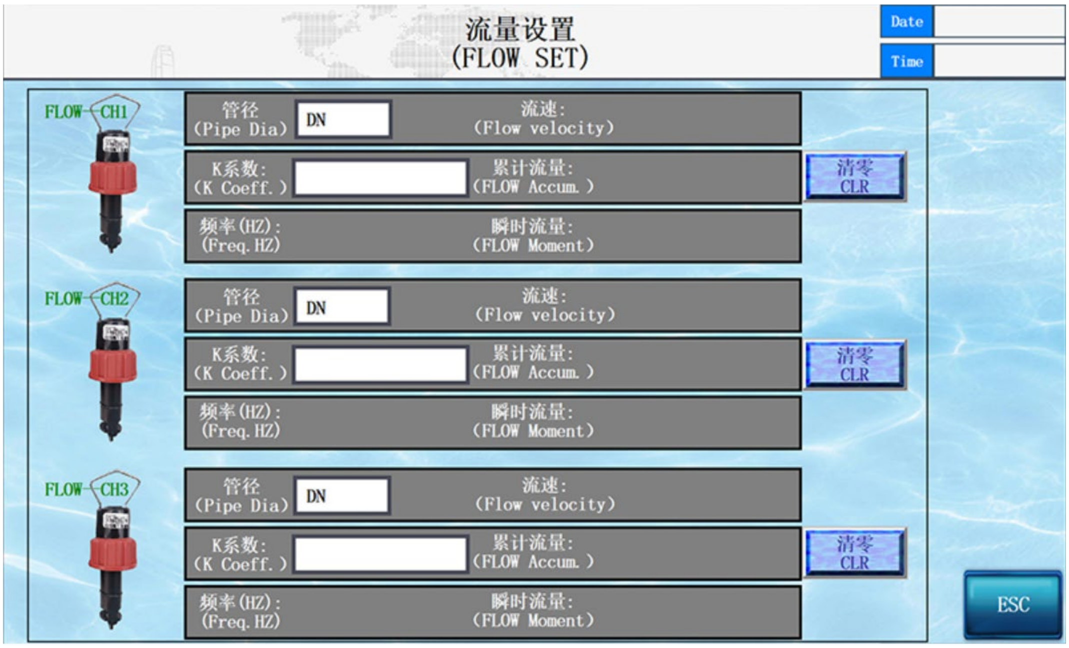
4mA_AD: Used to calibrate the AD value of 4mA. When inputting 4mA current, input the AD acquisition value below into this input box;

20mA_AD: Used to calibrate the AD value of 20mA. When inputting 20mA current, input the AD acquisition value below into this input box;

Acquisition Value: Displays the current analog input value of 4-20mA;

Range: Pressure range setting, unit is bar (kg);

n) System Parameter Setting (Only compatible with pulse output flow sensors, sensor voltage 24V, other voltages or flow sensors require custom hardware interface and software algorithm)



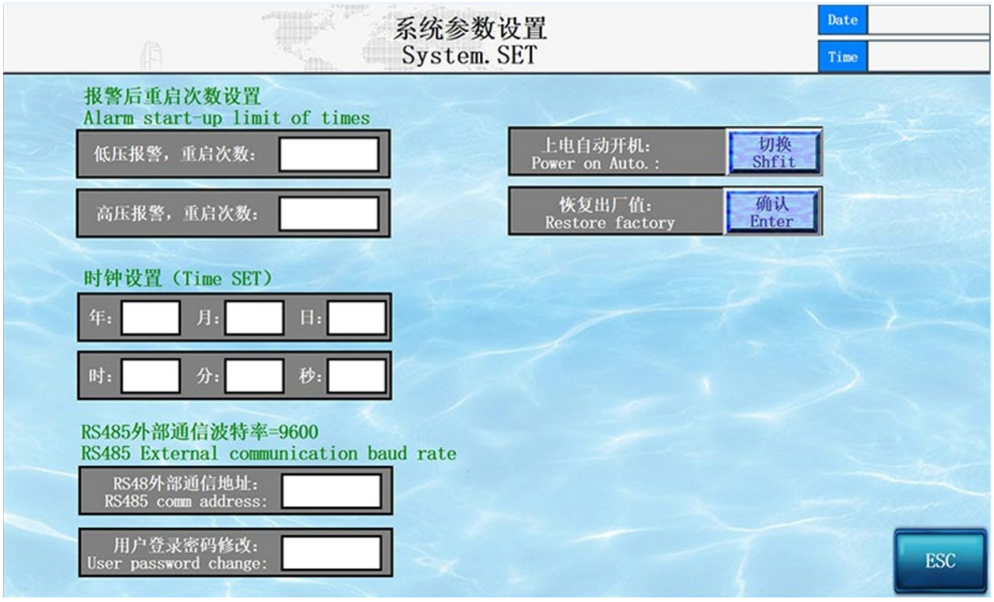
K Coefficient: Pulse flow sensor calibration coefficient, provided by the manufacturer; number of pulses corresponding to 1L of water;

Frequency: Real-time display of the pulse frequency value output by the current channel's flow sensor;

Instantaneous Flow: Instantaneous flow measured by the flow sensor of the corresponding channel;

Instantaneous Flow: Cumulative flow measured by the flow sensor of the corresponding channel; **can be cleared via a button, requires user password input.**

o) **System Parameter Settings**



Low Pressure Alarm, Restart Count: After a low pressure alarm occurs, the system delays for 1 minute to restart. After default 3 consecutive restarts, the system stops and waits for manual handling;

High Pressure Alarm, Restart Count: After a low pressure alarm occurs, the system delays for 1 minute to restart. After default 3 consecutive restarts, the system stops and waits for manual handling;

Clock Settings: Modify the system date and time;

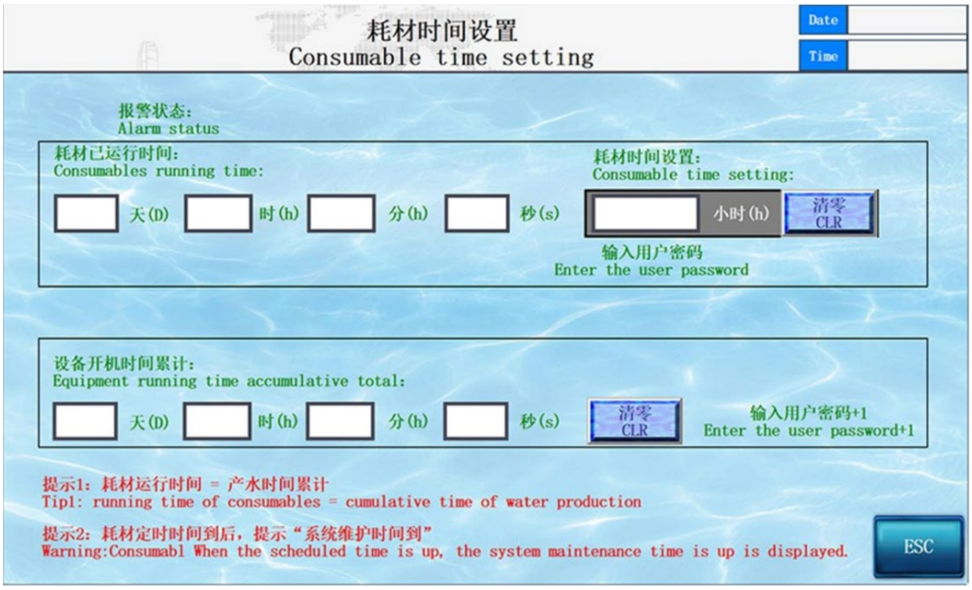
RS485 External Communication Address: Set the communication address of this machine during RS485 remote communication;

User Login Password Modification: Modify the login password for entering parameter settings; default password: 111

Power-on Automatic Start: Set the system to automatically start or manually start after power-on;

Restore Factory Settings: Restore to factory values, password = user login password;

p) Consumables time management



Consumable Operating Time: Displays the remaining time of the current consumable usage;

Consumable Time Settings: Set the operating time of the consumable to X hours; can be cleared by inputting the user login password;

Equipment cumulative start-up time: Displays the cumulative start-up time of the current equipment; can be cleared by inputting the user login password +1;

q) Port test

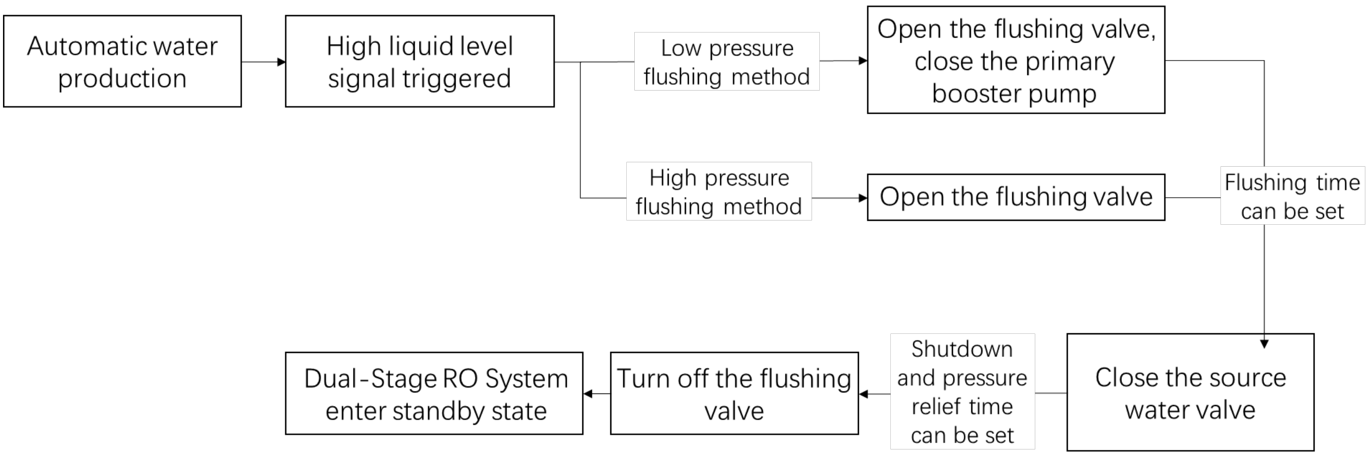
Input: Real-time display of the input signal status to observe the accuracy of external inputs;

Output: **In manual mode**, manually control the relay output, mainly used for equipment debugging;

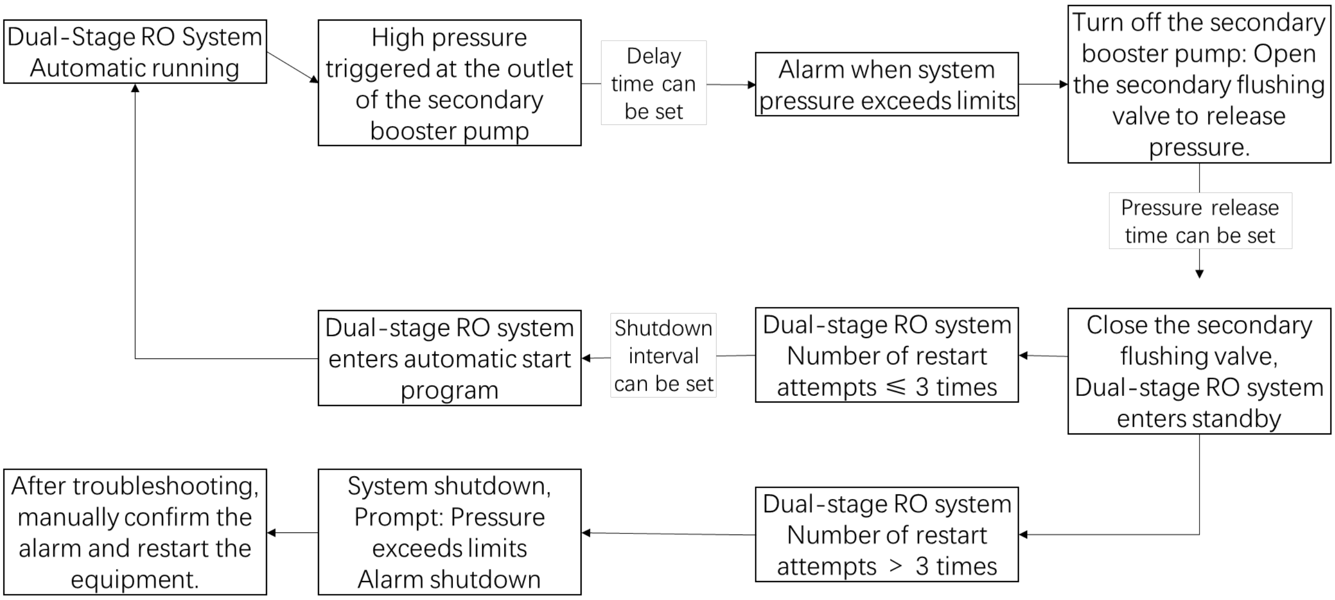
r) **Contact us** (The interface can be customized and the QR code can link to the company's website or online store)

6. Control process (conductivity exceeding standard valve also known as blowdown valve)

6.1. System shut-down process for full water state

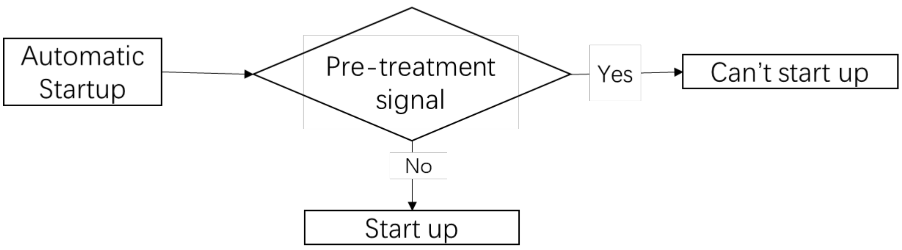


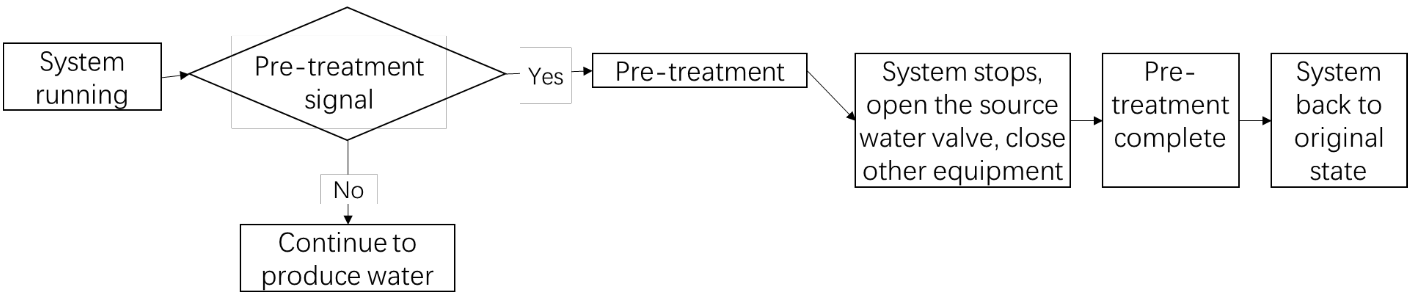
6.2. Pressure Protection Process for Dual-Stage RO System:



For dual-stage RO systems, the primary RO part and the secondary RO part are independent of each other. Their shutdown, operation, and alarm do not directly affect each other, increasing the overall system's operational stability.

6.3. Pre-treatment process:



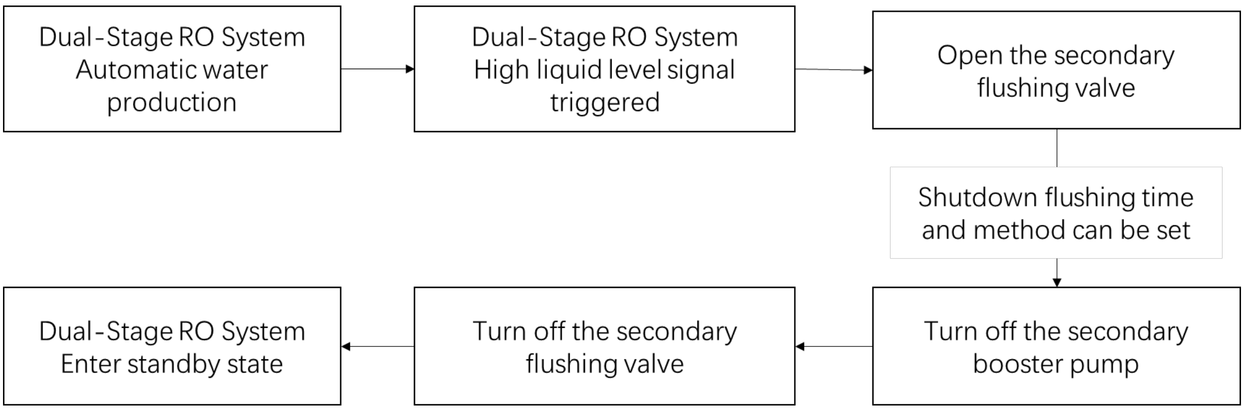


6.4. Product water conductivity/TDS over-limit handling process:

When the system is running normally, if the product water conductivity/TDS over-limit alarm is triggered, the over-limit valve opens to discharge the over-limit water, preventing it from entering the product water tank.

7. System Operation

Shutdown Process for a Dual-Stage RO System When the Water Tank is Full:



Pre-power-on Check

Before powering on, check if the instrument power supply is normal. The default power supply is DC24V. Check if the wiring terminals of each instrument and the communica tion cables with the transmitter are correctly and firmly connected. After checking, pow er on the controller. After powering on, check if the controller display is normal.

Automatic operation

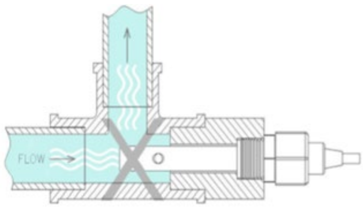
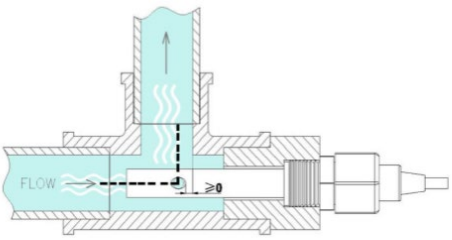
The system starts up in automatic/stop state by default. After logging in as a regular user, check if the operating parameters are normal and if the instrument data is correct. If using for the first time, log in as an engineering user (default password: 111) to check if the internal parameters of each instrument are correctly configured.

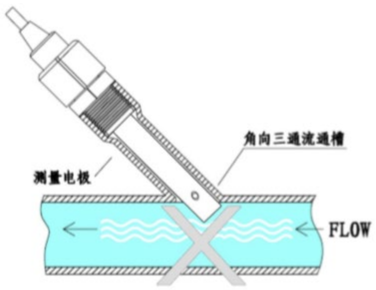
After checking the parameters, click the "ON/OFF" system on/off button on the RO process interface to switch the system to automatic operation state. At this time, the system will automatically open valves or pumps based on the product water tank level and alarm point detection without manual intervention.

Manual maintenance

The system is configured with manual control for user convenience. In case of equipment failure preventing automatic start or other special circumstances, this function can be used to open a specific valve or pump. In the system stop state, enter the manual debugging interface and turn on the manual debugging mode switch;

8. Sensor Dimensions and Installation

Incorrect Method: An air dead space forms in the upper part of the pipeline. Even though the conductivity cell's opening faces the FLOW, no fluid flows through the conductivity cell, making the measurement data useless and unstable.	
Correct Method: The waist hole of the conductivity cell is located in the fluid, allowing part of the fluid to flow through the conductivity cell and be continuously renewed, ensuring accurate measurements.	

Incorrect Method: When the conductivity cell is installed at an angle, the water flow cannot pass through the measurement waist hole. Air accumulates inside the conductivity cell, resulting in invalid and highly unstable measurements.	

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Correct Method:

Part of the FLOW passes through the waist hole of the conductivity cell and is continuously renewed, ensuring correct, stable, and accurate measurement data.

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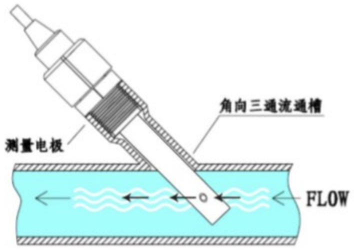

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Incorrect Method:

An air dead space forms in the upper part of the pipeline. Even though the conductivity cell's opening faces the FLOW, no fluid flows through the conductivity cell, making the measurement data useless and unstable.

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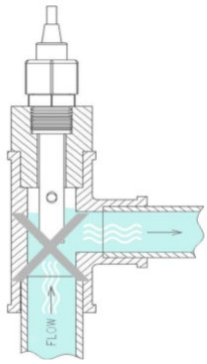

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Correct Method:

The waist hole of the conductivity cell is located in the fluid, allowing part of the fluid to flow through the conductivity cell and be continuously renewed, ensuring accurate measurements.

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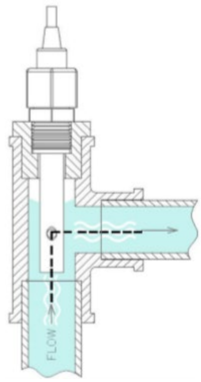

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Incorrect Method:

The water flow in the pipeline cannot ensure a full pipe. The downward flow creates air accumulation at higher points, making the conductivity cell constant an unknown variable. The data is invalid and unstable.

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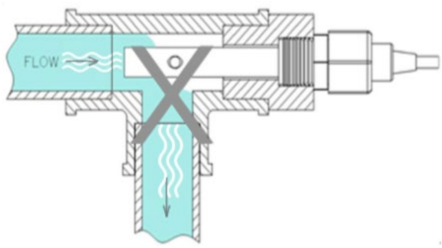

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8.1. Precautions

a) The conductivity cell should be installed in a closed-loop pipeline where the flow rate is stable and bubbles are unlikely to form, to avoid affecting the measurement.

b) For concentric tubular conductivity cells, whether installed horizontally, at an angle, or vertically, the front end should face the FLOW direction and extend into the flowing water.

c) The same applies to conductivity cells of other structural shapes.

d) The measurement signal is a weak conductive signal. The acquisition cable must not be connected to power or control lines. In the same set of connectors or terminals, it is prohibited to run or bundle the cable with power and control lines to avoid interference with measurements or damage to the instrument's measurement unit.

e) The cables of the conductivity cell are of a standard fixed length and are specialized cables. Do not arbitrarily extend or replace the cables.

f) During installation, keep the measuring part of the conductivity cell clean. Do not touch the inner surface with hands or unclean objects. Contact with oil, grease, or adhesive substances can result in inaccurate measurements for an extended period.

g) The conductivity cell is a precision measurement component, and its constant is determined by its geometric shape and fit. Do not alter the shape or size of the conductivity cell. Avoid cleaning or soaking it with strong acids, alkalis, or mechanical scraping, as these actions can change the cell constant and affect the measurement accuracy of the system.

8.2. Installation precautions

Notice: For applications in the food, beverage, and hygiene sectors, it is not recommended to use plastic conductivity cells coated with platinum black, as they do not meet the requirements for hygienic-grade conductivity cells.

Installation Precautions

The flow must be stopped to install or remove the sensor in the pipeline.

Turbulence and bubbles in the pipeline can cause unstable sensor measurements.

Excessive pressure in the pipeline can directly threaten the sensor's performance.

Conductivity electrodes of 0.1, 0.01, 1.0, or 10.0 may show significant measurement errors in ultrapure water.

The internal electrolyte of the sensor may diffuse slightly into the water, causing an increase in conductivity.

Water hammer effects and negative pressure in the pipeline can cause permanent damage to the sensor.

Collisions with particles and fiber entanglements in the water can easily cause permanent damage to the sensor.

9. Safety Precautions

When the equipment is in operation, it is strictly prohibited to perform maintenance on valves or pumps that are temporarily not running. The main power supply must be disconnected before troubleshooting or repairing the equipment.

If you need to switch between manual/automatic modes, you should stop the current operation. Do not perform any other operations during the program stopping process until the system has completely stopped. Otherwise, it may cause malfunctions and damage to the equipment. Only after the system has fully stopped should you switch between manual and automatic modes.

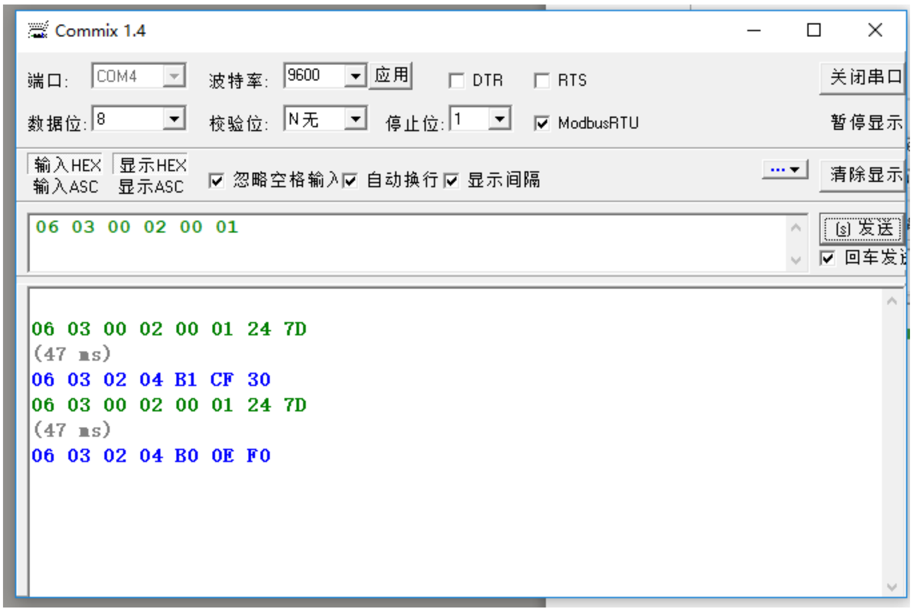
Parameters such as time in the parameter settings page must be changed before the system starts running. It is prohibited to change these parameters while the equipment is in operation.

When performing maintenance on the equipment, always disconnect the main power supply.

Note: RS-485 external communication: (Modbus RTU, communication format 9600, N,8,1)

Communication address: default 01; You can choose ----> System Parameter (default password 111) > Parameter Settings ----> External RS485 communication address Settings.

Baud rate: 9600 BPS (non-modifiable); Data format: 8 bits; Stop bit: 1 bit; Parity bit: None



Serial communication assistant test

RO Single stage RS485 communication protocol:

Address	Description	Numerial Type	Notes
00	The machine address	Hexadecimal unsigned integer	scope: 01-99
01	Baud Rate	Hexadecimal unsigned integer	scope: 2400--9600
02	Inlet conductivity value	Hexadecimal unsigned integer	Convert to base 2: for example
03	Effluent conductivity value (Divide by 100, default 2 decimal places)	Hexadecimal unsigned integer	0.00-600
04	Temperature value (Divide by 10, default 1 decimal place)	Hexadecimal unsigned integer	0.0--99.9
05	Electrical conductivity over limit alarm status	Hexadecimal unsigned integer	0: no alarm is reported. 1: alarm is reported
06	RO System working mode	Hexadecimal unsigned integer	

Address	Description	Numerial Type	Notes
	0: The system stops 1: RO film backwash 2: Water is being produced 3: Full water standby 4: fault shutdown 5: pretreatment regeneration 6: Maintenance alarm (RO membrane maintenance scheduled time, or ID regular maintenance time)		
07	Low pressure pump output status	Hexadecimal unsigned integer	0： Stop 1: Starts
08	Inlet valve output status	Hexadecimal unsigned integer	0： Stop 1: Starts
09	High pressure pump output status	Hexadecimal unsigned integer	0： Stop 1: Starts
10	Flush valve output status	Hexadecimal unsigned integer	0： Stop 1: Starts
11	Conductivity exceeds valve output state	Hexadecimal unsigned integer	0： Stop 1: Starts
12	Pure water tank high liquid level input state	Hexadecimal unsigned integer	0： No water 1: Full water is connected
13	Low liquid level input status of pure water tank	Hexadecimal unsigned integer	0：No water 1: Water is connected
14	High voltage switch input status	Hexadecimal unsigned integer	0: normal 1: alarm
15	Low voltage switch input status	Hexadecimal unsigned integer	0: normal 1: alarm
16	Liquid level input status of the source water tank	Hexadecimal unsigned integer	0: no water. 1: Connected to water
17	External control input status	Hexadecimal unsigned integer	0: Disconnect and manually control 1: Closed, automatically running
18	pretreatment regeneration input status	Hexadecimal unsigned integer	0: No signal is connected 1: The preprocessing signal is received

For other question, feel free to contact us.

Thank you for choosing ChiMay!

VCard **WhatsApp**