

pH/ORP Meter

Operation Manual

Instrument initial password: 0000

Instrument power supply: 220VAC

Wuxi Wohuan Instrument Technology Co., Ltd.

Brief operating instructions

This manual contains all the operation details of the instrument. The following brief operation instructions are used to help users learn to operate the instrument as soon as possible.

1. **Instrument installation: fix the instrument on the panel of the instrument cabinet or in the instrument box to prevent direct sunlight or water drenching, connect the power cable, and do not turn on the power first;**

2. **Electrode installation:** According to the site requirements, install the electrode in a flow type (used with stainless steel flow cell), a submerged type (with a submerged sheath, please do not directly immerse the electrode cable in the solution), pipeline type (Stainless steel or PVC mounting base), flange type (matching special flange), reactor installation (matching reactor jacket and installation kit) or other installation methods, please refer to pages P3-P4;

3. **Remove the plexiglass protective cap or rubber protective cap on the electrode head, and install the electrode;**

4. Connect the terminals of the electrodes to the terminal numbers on the back of the meter according to the marked numbers;

5. Turn on the power to start the measurement (two-point calibration is recommended before use).

Important Safety Information

Please read and observe the following:

- When the instrument uses 220VAC power supply as an option, there is a high voltage on the rear side of the instrument case, which may cause danger. Always disconnect line power before approaching this area of the meter.
- The wiring or repair should be done by a professional, and only the wiring and repair of the power-off instrument should be performed.
- In the event of a safety problem with the meter, immediately power down the meter to prevent any unintentional operation.

For example, the unsafe state may be when:

- 1) The instrument is obviously damaged;
- 2) The meter cannot operate normally or provide the specified measurement;
- 3) The instrument has been stored for a long time in an environment with a temperature over 50°C.

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1. Overview

The industrial pH/ORP meter (hereinafter referred to as the meter) is an online water quality monitor with a microprocessor. The meter is equipped with different types of pH (or ORP) electrodes, which are widely used in power plants, petrochemicals, metallurgical electronics, mining, paper making, biological fermentation processes, medicine, food and beverage, environmental protection water treatment and other industries. (pH) value or ORP (Oxidation Reduction Potential) value and temperature value for continuous monitoring and control. Such as power plant make-up water, saturated water, condensate water, general industrial water, domestic water and waste water.

The instrument adopts LCD display screen; intelligent menu operation; with current output, free setting of measurement range, high and low over-limit alarm prompt and two sets of relay control switches, adjustable hysteresis range; automatic or manual temperature compensation; various electrodes automatic calibration method.

According to user needs, we can provide pH (or ORP) electrodes with various installation processes such as [flow type] [submerged type] [pipe type] [flange type].

2. Structural features and working principle

2.1 Structural features:

The whole set of measurement system is mainly composed of two parts: meter (secondary meter) and pH (or ORP) electrode (primary meter). The pH (or ORP) electrode contacts the measured aqueous solution, and the meter displays the pH (or ORP) value and temperature value of the aqueous solution and working status.

2.2 Working principle

The instrument consists of signal measurement, calculation, display, network communication and panel instructions. The transmission impedance transformation of pH and temperature changes pH into a low resistance signal of 59.16mV/pH (25° C); NTC is transformed into a voltage signal.

The meter is matched with a pH (or ORP) electrode to monitor the pH (or ORP) value of the pH of the solution. The sensor is a battery composed of a pH (or ORP) glass electrode and a calomel (or Ag/AgCl) reference electrode. The Nernst equation yields a potential difference related to the pH of the solution: $E_x = E_o + S_pH$.

The potential difference is amplified by a preamplifier with high input impedance, and the thermal element sends a signal corresponding to the temperature value. After the two sets of signals are amplified, they are converted by A/D, and operated by a single-chip microprocessor through the I/O interface chip. is displayed prominently on the display.

3. Technical parameter

(1) Measuring range: pH: 0.01~14.00pH; ORP: -1999~+1999mV;

Temperature: -5~110.0°C;

(2) Resolution: pH: 0.01pH; ORP: 1mV;

(3) Basic error: pH: ± 0.1 pH; ORP: ± 3 mV; Temperature: ± 0.5 °C;

- (4) Automatic or manual temperature compensation range: $0\sim 110^{\circ}\text{C}$;
- (5) Stability: pH: $\leq 0.02\text{pH}/24\text{h}$; ORP: $\leq 2\text{mV}/24\text{h}$;
- (6) Signal output:
 $0\sim 10\text{mA}$ (load resistance $< 1.5\text{K}\Omega$); $4\sim 20\text{mA}$ (load resistance $< 750\Omega$);
Optional: $0\sim 5\text{V}$, $0\sim 10\text{V}$ (reservation required);
- (7) Two sets of relay control contacts: 3A 240VAC, 6A 28VDC or 120VAC;
- (8) Power supply: $230\text{VAC}\pm 10\%$, $60\pm 1\text{Hz}$, power $\leq 3\text{W}$;
 24VDC , power $\leq 1\text{W}$ (reservation required); 12VDC , power $\leq 1\text{W}$ (reservation required);
- (9) Dimensions: $96\times 96\times 130\text{mm}$;
- (10) Installation method: plate mounting (embedded); hole size: $91\times 91\text{mm}$;
- (11) Wall-mounted type: Waterproof wall-mounted box size: 300 (height) \times 200 (width) \times 167 (depth) mm;
- (12) Instrument weight: 0.6kg;
- (13) Working environment:
Ambient temperature: $-10\sim 60^{\circ}\text{C}$;
Relative humidity: not more than 90%;
Except for the earth's magnetic field, there is no strong magnetic field interference around.

4 Features

- ⊙ Intelligence: use a single-chip microprocessor to complete pH (or ORP) value measurement, temperature measurement and compensation;
- ⊙ Dual high-impedance preamplifier: high input impedance, anti-noise, strong anti-interference ability;
- ⊙ Three calibration methods: one-point calibration, two-point calibration and known concentration calibration;
- ⊙ Man-machine dialogue: menu operation structure, users can operate according to the prompts on the screen;
- ⊙ Multi-parameter display on the same screen: display pH (or ORP) value, temperature value and working status at the same time;
- ⊙ Output mode set by software: software selects $0\sim 10\text{mA}$ or $4\sim 20\text{mA}$ output;
- ⊙ The measurement range and the upper and lower alarm limits can be freely set; the upper and lower limit overrun alarm prompts;
- ⊙ Two sets of relay control switches, the hysteresis control range is adjustable;
- ⊙ Self-set password: The user can set or modify the password by himself, so as to prevent unrelated personnel from entering and causing misoperation;
- ⊙ After-sales service: provide technical support and after-sales service contact methods for users;

5 Installation and electrical connection

The instrument should be installed in a clean, dry, well-ventilated and vibration-free place. There should be a certain space around to facilitate the operation and maintenance of the instrument, and it should be as close as possible to the sampling point to facilitate electrical connection. The distance between the meter and the electrode should not be too far to facilitate the calibration operation.

pH/ORP

5.1 Instrument installation:

The instrument is suitable for embedded installation on the panel, the opening is shown in Diagram 1, and the opening size is 93×93mm. Insert the meter into the square hole and fix it with the provided bracket.

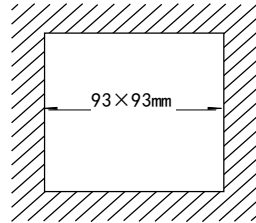


Diagram 1 Instrument installation hole size

5.2 Electrode installation:

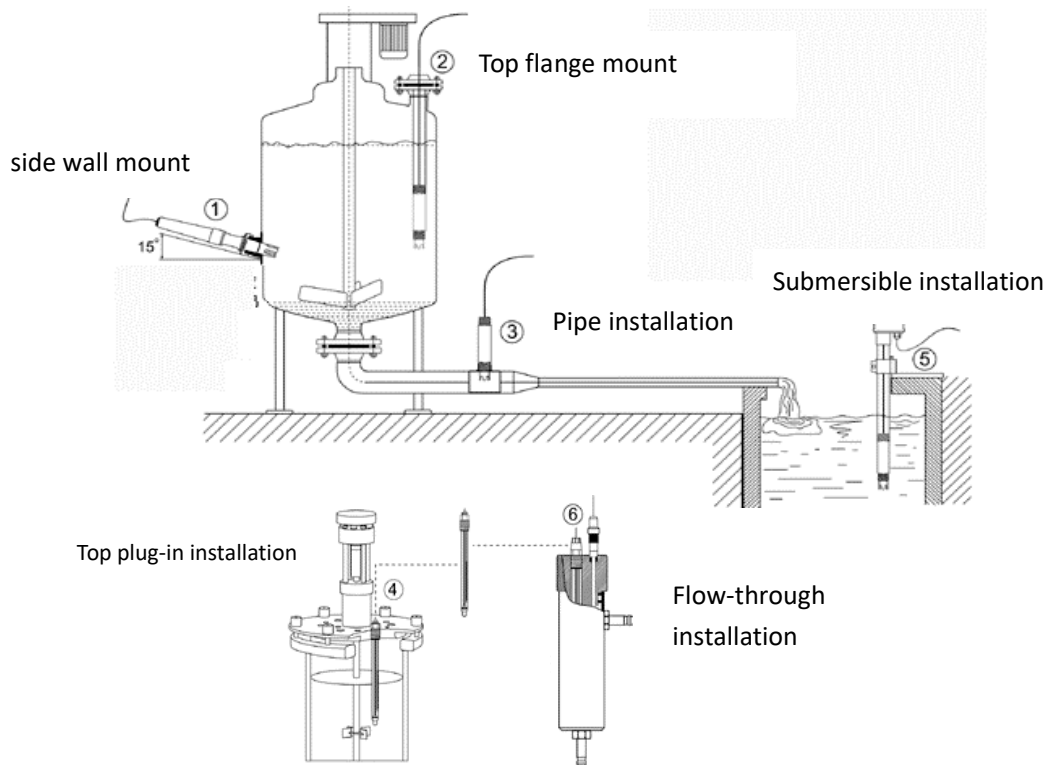


Diagram 2 Reference diagram of various installation methods

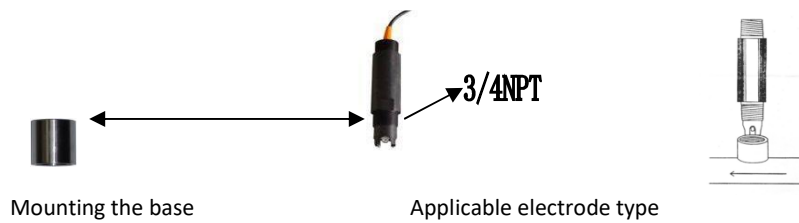
- ① Side wall installation: used for biological fermentation metal reactor, etc.



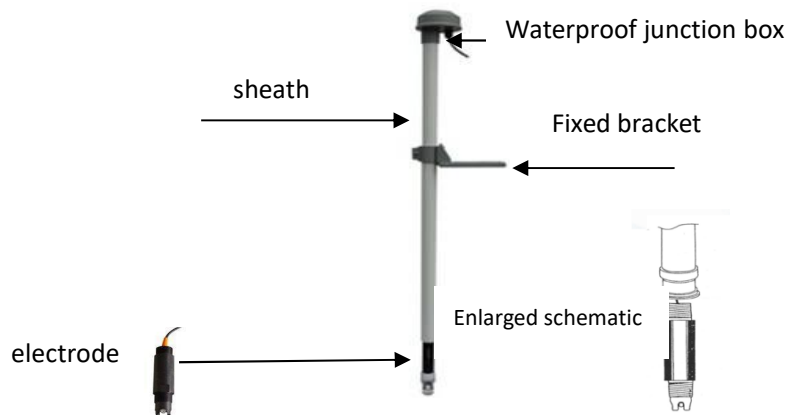
- ② Top flange mount



- ③ Pipeline installation: The installation point must allow the electrode to touch the water sample



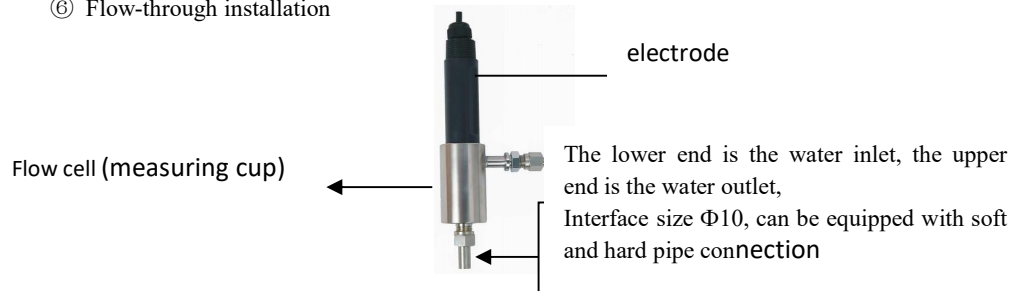
- ④ Top-insertion installation: directly insert the electrode into the small reactor
- ⑤ Submersible installation



pH/ORP

Important note: Pass the cable through the sheath, and connect the electrode tail thread with the inner thread of the sheath (use waterproof tape for waterproof treatment). If two sheaths are used, the connection between the two sheaths must be To prevent water from penetrating into the sheath to corrode the cable, fix the sheath on the fixing bracket, and cover the top of the sheath with a waterproof cap or black waterproof rubber cap to prevent rainwater from entering the sheath from the top.

⑥ Flow-through installation



⑦ Other methods: If no suitable installation method is found above, please contact the manufacturer to order a special installation method.

5.3 Terminal wiring for the meter

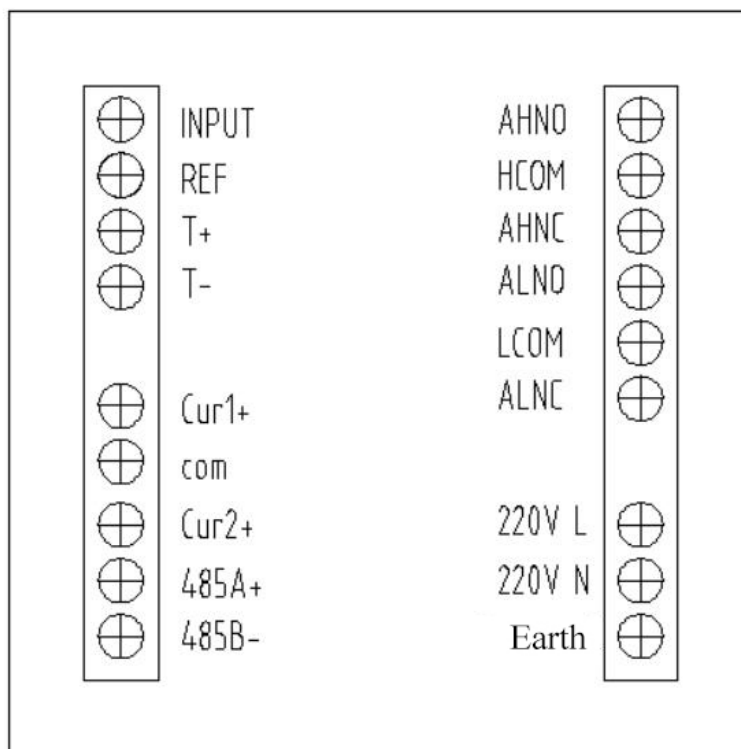


Diagram 3 Wiring diagram behind the instrument





Wiring Instructions:


1. Input: PH Electrode Measurement
2. REF: PH Electrode Reference
3. T + : temperature electrode
4. T- : temperature electrode
5. Cur1 + : PH current output signal +
6. com: current output signal (common terminal)
7. Cur2 + : temperature current output signal +
8. 485A + : RS-485 communication A
9. 485B-: RS-485 Communication B
10. AHNO: relay high alarm turns on
11. HCOM: relay high alarm common connection
12. AHNC: relay high alarm turns off
13. ALNO: relay low alarm turns on
14. LCOM relay low alarm common connection
15. ALNC relay low alarm turns off
16. 220V L: live wire/24V + (24VDC)
17. 220V N: neutral /24V + (24VDC)
18. Earth: Earth wire


5.4 Electrical connection:


The connection between the meter and the pH (or ORP) electrode: the power supply, output signal, relay alarm contact and the connection between the electrode and the meter are all at the rear of the meter, and the wiring is as shown in Figure 3. The length of the lead wire of the fixed electrode is usually 5-10 meters, and the terminal part has a labelled insert, which can be inserted into the terminal with the same number and symbol at the rear of the instrument and tightened.


6 Function key description

There are 6 touch buttons on the panel:  (left),  (right),  (up),  (down), For exit and confirmation, see cover.

 : Move the cursor to the left when entering data, or move the menu to the left;

 : Move the cursor to the right when entering data, or move the menu to the right;

 : Move up the menu or increase the value;

 : Move down the menu or decrease the value;

Esc: switch between the measurement screen and the menu screen or return to the previous menu, status or cancel the entered data in the menu screen;

Enter: The selection or confirmation of a menu item ends the input of data or confirmation of certain states.

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7 Detailed operating instructions

7.1 Power on: Check all the pipeline connections and electrical connections before use. After the power is turned on, the meter will display the left and right as shown in the diagram below. After a few seconds, the meter will enter the main measurement display as shown in the figure below.

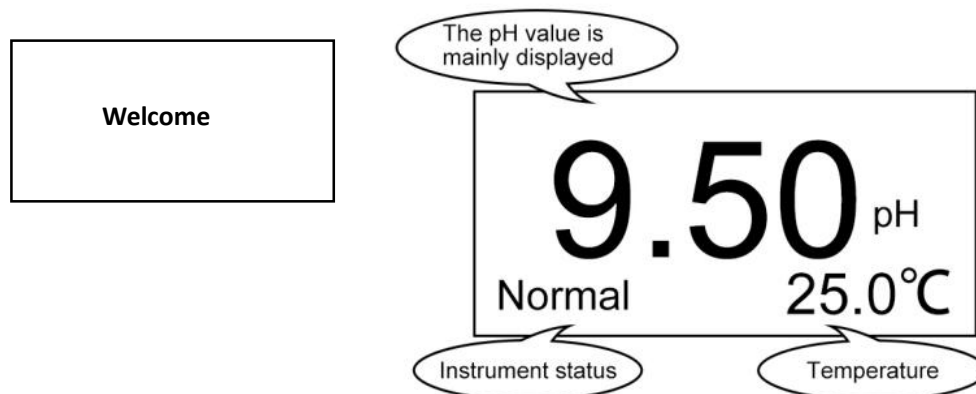
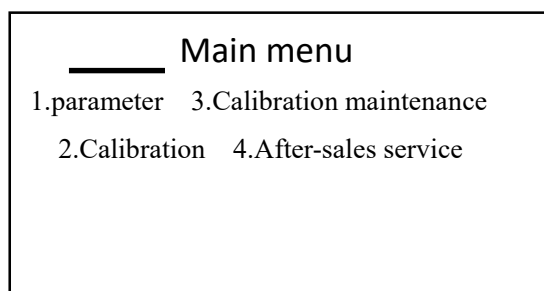


Diagram 4: The instrument is turned on and the main display of the instrument screen

Among them, the pH value is the main display, and the temperature and status are the secondary display.

The status prompt line displays the following information: 1. Normal 2. High limit alarm 3. Low limit alarm

7.2 Main menu: After pressing the "Exit" key in the main display state, enter the main menu:



7.3 Submenu: Set or modify the "parameters" according to the actual situation before measuring, otherwise measure according to the existing set value in the instrument. When the cursor is under the "parameter" menu, press the "confirm" key to enter the password, and then press "confirm" to enter multiple submenus. Before entering this menu, you need to enter the correct password (the initial password is 0000). After entering this menu, a flashing cursor will appear to indicate the current parameter item. After moving the cursor up and down according to the selected parameter, press the "Enter" key to enter the parameter item for setting or modification.

Important note: When entering a password or modifying numerical parameters, use the up and down keys to move and transform the numbers "0~9", "minus" and "dot", and the left and right keys to move the transformed position.

Backlight adjustment method: when the meter displays the fourth right, long press the "up" key, a grid background appears, then release the "up" key and then press the "up" or "down" key to adjust the backlight of the meter as required degree, until it is suitable.

Display: pH
PH zero 1 : 10
PH slop 1: 176
PH zero 2: 00.00

PH slope 2: -124
Compensation: 01.00
Alarm limit: 14.00PH
High latency: 00.00PH

PH slope 2: -124
Compensation: 01.00
Alarm limit: 14.00PH
High latency: 00.00PH

Minimum alarm: 00.00PH
Under-reported hysteresis :
00.00PH
I1 channel: PH
I1type: 4-20mA

I1 up limit: 14.00PH
I1 lower limit: 00.00PH
I2 channel: TEMP
I2 type: 4-20mA

I2 up limit: 100°C
I1 lower limit: 000°C
Temperature type: PT1000
Temperature mode: Actual

manual temperature: 25°C
PH conversion: NO
Conversion factor: 0.00
Backlight options: energy saving

Backlight time: 60S
Filter coefficient: 0.40
Table No: 1
Display mode: English

Baud: 9600
Parity check: no
Stop bit: 1
Product code: 1909346

7.4 Parameter description:

- 1) "Display Mode": You can select "pH" or "mV" (for ORP) measurement.
- 2) "Alarm High Limit", "Alarm Low Limit" and "Alarm Hysteresis": These three items are used to set the high and low alarm limits, the high alarm limit > the low alarm limit; and the hysteresis value of the control variable can be set . This function is used to control equipment such as metering pumps, solenoid valves, etc.
- 3) "Output current": This menu item is used to set the current output mode of the instrument, which can be set between "0-10mA" and "4-20mA", choose one.

Correspondence between output current and measured pH value:

0~10mA output mode: $I = \{(D-DL)/(DH-DL)\} \times 10mA;$

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4~20mA output mode: $I=4mA + \{(D-DL)/(DH-DL)\} \times 16mA$.

Among them: I- output current value, D- current measured pH value, DH- user-set "output upper limit"; DL- user-set "output lower limit".

4) "Output upper limit" and "Output lower limit": These two items are used to set the measurement range of pH or ORP corresponding to the current output, output upper limit > output lower limit.

5) "Zero potential E0" and "Slope S": These two items are used to set the electrode zero potential and electrode slope respectively, mainly used to directly input its zero potential and slope when replacing a new electrode calibrated by the laboratory. The calibrated E0 and S of the electrode are also recorded in this "parameter" menu.

6) "Temperature mode" and "Artificial temperature": "Temperature mode" is divided into "measured" and "artificial", "Actual measurement" means that the temperature is actually measured by the temperature sensor; "artificial" means that the temperature is artificially set, and has nothing to do with the actual solution temperature. This function is mainly used to reduce a resistance box during analog debugging (for example, when the measurement is not affected by the temperature, the temperature can be set manually). "Artificial temperature" is used to set the size of the temperature value.

7) "pH conversion" and "conversion coefficient": This function is used for special occasions and generally does not work.

7.5 "Calibration": Since the zero potential of each pH electrode is not the same, the conversion coefficient of the electrode to the pH value of the solution (ie the slope S) can not accurately reach the theoretical value, and the zero potential and slope of the electrode will continue to change during use, resulting in aging.

It is necessary to periodically measure the standard buffer solution to obtain the actual zero potential E0 and slope S of the electrode, namely, perform "calibration". This instrument has three methods of one-point calibration, two-point calibration and known concentration calibration for users to choose.

Two-point calibration is recommended.

One-point calibration: The electrode is calibrated with a standard buffer solution, and only the zero potential of the electrode is calibrated. This method can be used to simplify operation when measurement accuracy is not required. Select a standard buffer solution with a pH value close to that of the water sample to be tested as the calibration solution. Before calibration, rinse the measuring cup more than 2 times. Then use a clean filter paper to gently dry the water droplets at the bottom of the electrode (do not wipe the electrode with filter paper, otherwise the electrode will be electrostatically charged, resulting in unstable readings). Pour the standard buffer solution into the measuring cup and insert the electrode. After selecting the standard

solution (see the left of the figure below), press the "OK" button to continue.

Please select standard solution			
9.18	6.86	4.00	pH

Calibration results
E ₀ =0.50 mV
To apply press OK, to cancel press to exit

After a few minutes, the calibration will be completed automatically (or manually press "Confirm"), and the reference value E0 of the calibration result will be displayed as shown in the right figure above (the data in the above figure is for reference only, not as the actual calibration data). Press "Enter" to save the data and then press "Exit". The user makes a judgment to see whether the measured standard solution is the same as the actual one. The specific value should be determined by the user according to the specific requirements of the measurement accuracy on site. The calibration results are automatically stored in "parameters", and "E0 and S values" can be queried. After the calibration is completed, the electrode is installed, and the water sample is connected to measure.

Two-point calibration (recommended): Select two of the three standard buffer solutions 4.00pH, 6.86pH, and 9.18pH to calibrate the electrode. Before calibration, the electrode can be activated in solution (preferably in pH electrode soaking solution) to ensure the stability and accuracy of calibration and monitoring values. The process of two-point calibration is similar to that of one-point calibration, except that the process of calibrating standard solution 1 and then calibrating standard solution 2 is completed. When calibrating at two points, first calibrate 6.86pH, and then calibrate 4.00pH or 9.18pH. Calibration results: glass material electrode $S \geq 0.90$ is qualified, metal antimony material electrode $S \geq 0.80$ is qualified.

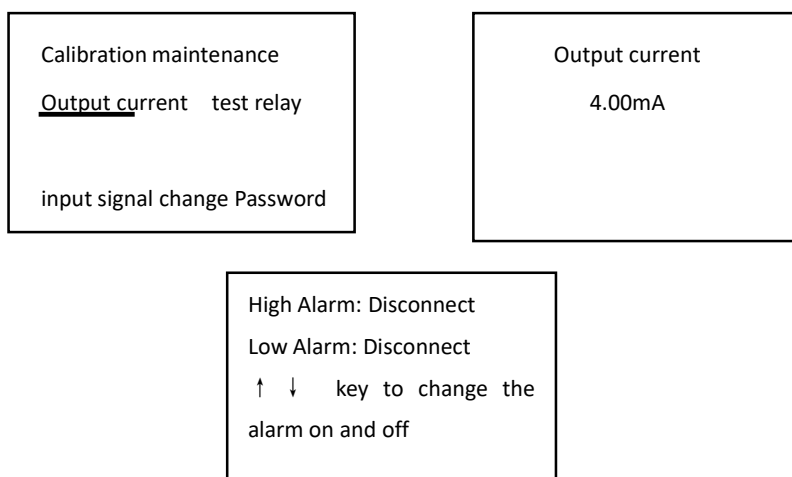
Known concentration calibration: calibrate after the known pH value is input.

About the configuration instructions of pH standard buffer solution: Please choose distilled water (generally drinking distilled water) for the water quality of standard buffer solution. Each bag of pH standard buffer solution can be configured with 250mL. When using it, you only need to pour out a small amount of capacity that can soak the pH electrode bulb. Others should be sealed and stored for future calibration.

8 Check Maintenance Menu

8.1 Output current check: This function is mainly used for the analog verification of the output current, allowing the user to check the accuracy of the output current of the meter within the full output range. Second, when it is connected to the collector or PLC, it can check whether the collector and PLC sampling are correct, so as to find Fault. When entering this submenu, a warning will appear, prompting you to ensure that the random change of the output current will not cause any harm before using this function. Press the "OK" key to continue, and enter the current output setting screen as shown in the figure below. The value displayed on the screen is the current output current. Use the up and down or left and right keys to change the current output current, and press the "OK" key to stop the change, or press the "OK" key to jump out of a box, and use the "UP, DOWN" button directly in the box. , Left, Right" key to input the current value to be calibrated. At this time, use an ammeter or a multimeter to measure the output current, which should be the same as the displayed value or within the error range.

Special reminder: When using this function, since the output current is arbitrarily set by the user, it may vary in the full range. It is necessary to confirm that the regulating controller or microcomputer connected to the output circuit will not produce control output with adverse consequences.



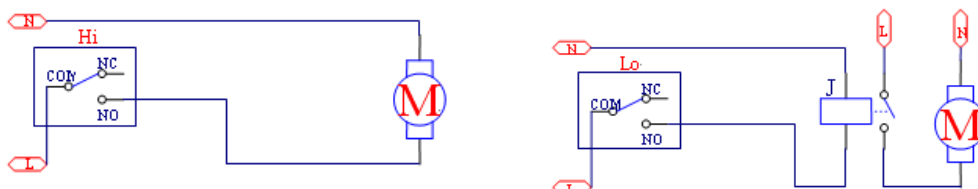
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8.2 Test Relay Calibration:

Entering this sub-menu displays as shown on the above page. This function is used to test the quality of the output of the alarm control relay. Press the up key to high alarm: disconnect or connect; press the down key to low alarm: disconnect or connect.

When the rated current of the control load is less than the current of the relay, it can be connected to the left of the figure below (the power supply cannot exceed 220V);

When the rated current of the control load is greater than that of the relay, an AC contactor needs to be connected, which can be connected to the right of the figure below.



8.3 Change Password:

After entering this submenu, first enter the "original password" (the initial password is 0000), then enter the "new password" and press "Confirm" to complete the modification of the user password. Up to five passwords can be set, please remember the password you set!

8.4 **Input signal verification:** This function is used when the manufacturer conducts simulation debugging.

8.5 **After-sale service:** This menu displays the contact information of the seller.

9 Daily Maintenance:

The instrument generally does not need routine maintenance. If there is a fault, you can contact our company and adjust it under the guidance of the company's technical staff (you can send it back to our company for help or verification).

Simple verification method: Set the parameter zero potential E0 to 0.0mV, the slope to 1.00, then short-circuit the terminals "9" and "10" of the meter, the meter should display 7.00 or within the error range; The 2K resistor is connected to the pins "11" and "12". The temperature of the meter should display about 27.5°C or within the error range. If the display is incorrect, the meter is faulty, and the manufacturer should be contacted for maintenance in time.

Please pay attention to the following points for sensor electrode maintenance:

- (1) When the flow-through structure is adopted, the flow rate of the incoming water sample should be kept as constant as possible.
- (2) When leaving the factory, the electrode head has a protective cap with electrode soaking liquid in it to keep the sensitive membrane moist. The protective cap should be removed before use and screwed on when not in use.
- (3) It is recommended to calibrate first and then install. When installing the measuring cell, do not collide with the glass bulb of the composite electrode to avoid damage.
- (4) When the site is not used without water for a long time, the electrode should be screwed on the protective cap in time, and the immersion solution with a concentration of 3.3m should be placed in the protective cap.
- (5) If there is dirt on the glass ball at the top of the electrode, it can be washed with 0.1N hydrochloric acid, and then activated by invading into 3.3mKCL solution, do not touch it with your hands. To ensure long-term correct measurement, the electrode must be cleaned, maintained and calibrated regularly. Antimony electrodes will be oxidized after being used for a period of time, and the electrode head will turn black. Fine sandpaper can be used to polish the electrode head to remove the oxidation ratio and ensure the sensitivity of the electrode measurement.
- (6) Keep the electrodes, cables and connectors clean and dry, free from moisture or water.
 - (7) If the electrode fails or is damaged, it must be replaced. It is recommended to replace one every year.

10 Completeness

Name	Qty
1) ORP meter electronic unit	1pc
2) ORP electrodes and connecting cables	1pc
3) Meter Mounting Bracket	2pcs
4) Electrode installation accessories (optional accessories)	1set
5) Instrument Operation Manual	1pc

Note: Please check the completeness of the purchased instrument before use.

For other series of analytical instruments of our company, please log in to our website to inquire.

Tips for using the instrument:

1. How to retrieve the forgotten password?

A: Enter the after-sales service menu, when you see the manufacturer's contact information, press the "left" and "right" keys at the same time, then you need to enter the password "54321", after entering, move the cursor to the bottom row of "password" to view the current Meter password.

2. How to correct the temperature error value (this method is only used for small errors, if the actual value differs greatly, it is necessary to check whether the instrument and electrode are working properly)?

A: Enter the after-sales service menu, when you see the manufacturer's contact information, press the "left" and "right" keys at the same time, then you need to enter the password "54321", after entering, move the cursor to "temperature calibration", the temperature value is too small Then input the error value directly, if the temperature value is too large, first input the negative sign and then input the error value.

3. How to correct the pH error value (this method is only used for small errors, if the actual value differs greatly, it is necessary to check whether the meter and electrode are working properly)?

Answer: Enter the after-sales service menu, when you see the manufacturer's contact information, press the "left" and "right" keys at the same time, then you need to enter the password "54321", after entering, move the cursor to "calibration", if the pH value is small, directly Enter the error value, if the pH value is too large, first enter the negative sign and then enter the error value.

PH/ORP Communication Protocol

Baud: 9600 Modbus-RTU

Data format: no parity bit 8 bits of data 1-bit stop bit

Default address: 1(1-99 adjustable)

Upper computer transfers the instruction:

Address	01H
Function Code	03H
Starting address 8 bits high	00H
Starting address 8 bits low	00H
data 8 bytes high	00H
data 8 bytes low	02H
CRC16 parity bit 8 bits low	C4H
CRC16 parity bit 8 bits high	0BH

Lower computer transfers the instruction:

Address	01H
Function Code	03H
Number of bytes in the data	04H
PH data 8 bits high	PH data total 2 bytes
PH data 8 bits low	
Temperature data 8 bits high	Temperature data is 2 bytes
Temperature data 8 bits low	
CRC16 parity bit 8 bits low	
CRC16 parity bit 8 bits high	

Calculation:

PH data is hexadecimal

Example:

Data sent by Lower Computer: 01030405780019BB 2C

The PH data for an instrument with an address of 01 is: 05H78H = 1400 = 14.00 PH

The temperature data is 0019 H = 25 = 25 ° C

The data sent by the lower computer: 010304019000227B FB

The PH data for an instrument with an address of 01 is 01H90H = 400 = 4.00 PH

The temperature is 0022 h34-34 ° C

That is: The final PH data is a double-byte hexadecimal number minus 100

The temperature data is a double-byte hexadecimal number