Single/Dual Channel Universal Controller

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Preface

Thank you for purchasing universal controller. 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.
- Please use this product in accordance with its explosion-proof characteristics and comply with national and regional laws and regulations.

Version

U-SUP-MDC-P1/P2-EN2

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	Single/Dual Channel Universal Controller	1	
2	Manual	1	
3	Certificate	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.

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1 Introduction

1.1 Introduction

This product is an advanced, intelligent online multi-parameter controller capable of supporting up to two channels. The first channel's hybrid mode allows for the connection of either analog or digital sensors, while the second channel connects digital sensors. This controller can measure a variety of parameters including pH, ORP, conductivity, dissolved oxygen, turbidity, sludge concentration, residual chlorine, ammonia nitrogen, nitrate nitrogen, COD, BOD, oil in water, and more. Its continuous monitoring data can be transmitted to a DCS system via output transmission or communicated with a computer using the Modbus-RTU protocol via RS485 interface for remote monitoring and logging. It can also control cleaning systems or pumps. The controller offers an optional wireless transmission module,users can access real-time site conditions on mobile devices. This controller is widely used in various industries including thermal power, chemical fertilizers, metallurgy, environmental protection, pharmaceuticals, biochemistry, food, sewage, semiconductors, and tap water.

1.2 Features

- Versatile controller eliminates the need for multiple specialized controllers and automatically recognizes digital sensors for plug-and-play convenience.
- IP66 ingress protection, suitable for more complex working conditions.
- Dual-channel design allows connection of one or two sensors, reducing user costs and providing a cost-effective solution for adding a second sensor in the future.
- Optional wireless communication and mobile APP for real-time data viewing.
- Power ground and signal ground design enhances anti-interference capabilities.
- 4.3-inch full-view color screen, with quick switching between digital display and real-time curve modes, facilitates monitoring of data fluctuations.

- Optoelectronic isolation (0/4~20) mA transmission output with strong interference resistance, high precision output circuit design, achieves 0.1% accuracy, and complies with the NAMUR NE43 international technical standard.
- Features manual and automatic temperature compensation,the compensation curve including linear, pure water, acid, and alkali solution compensation, adaptable to more conditions.
- pH electrode health self-diagnostic alert function advises users on the electrode condition post-maintenance, helping to optimize maintenance actions.
- Current simulation function enhances the maintainability of the instrument.
- Optoelectronic isolated RS485 communication.
- Built-in large-capacity storage, allowing for reliable recording of up to 1,000,000 data entries.
- High and low alarm functions, hysteresis amount and hysteresis time are adjustable.
- Supports four languages: Chinese, English, Spanish, and Korean, offering more language options.
- Rack-mounted and wall-mounted installation methods available, providing flexible installation options.

1.3 Technical parameters

Table 1 Technical parameters

Analog sensor input	
Measured variables	pH / ORP / Antimony
Measuring ranges	pH/Antimony：(-2.00 ~ 16.00) pH ORP：(-2000 ~ 2000) mV
Input impedance	≥10^{12}Ω
Temperature types	NTC10K，Pt1000，Pt100
Temperature range	(-10~130)℃
Accuracy	pH：±0.02pH Antimony：±0.2pH

	ORP：±2mV NTC10K：(-10~60)℃, accuracy: ±0.3℃ (60~130)℃, accuracy: ±2℃ Pt1000 accuracy: ±0.3℃ Pt100 accuracy: ±0.3℃
Resolution	pH/Antimony：0.01pH； ORP：1mV
Repeatability	0.02pH
Temperature compensation	Compensation mode: Manual / Automatic Compensation curve: Linear, Acid, Base, Pure
Digital sensor input	
Measured variables	pH/ORP/Conductivity/Dissolved Oxygen/Turbidity/Sludge Concentration/Inductive Conductivity/Residual Chlorine/Ammonia nitrogen/Nitrate nitrogen/COD/BOD/Oil in water, etc.
Measuring ranges	pH: (0.00 ~ 14.00) pH ORP: (-2000 ~ 2000) mV Dissolved oxygen: (0～40) mg/L Saturation: (0～200)% Conductivity: (0～500) mS/cm Turbidity: (0～4000) NTU Sludge concentration: (0～120000) mg/L Inductive conductivity: (0～2000) mS/cm Residual chlorine: (0~100) mg/L Ammonia nitrogen: (0~1000) mg/L Nitrate nitrogen: (0~1000) mg/L COD: (0~1500) mg/L Note: Actual measurement ranges should refer to the technical data of the connected sensors.
Output	
Current output	Isolated, 2-channel (0/4~20) mA configurable to

	corresponding measurement ranges, load capacity 750Ω, output accuracy ±0.1%FS, compliant with NAMUR NE 43 standards.
Communication output	Isolated, RS485 interface, Modbus-RTU communication protocol.
Alarm output	3-channel SPST (2 alarms + 1 cleaning), NO/NC type, capacity 250VAC, 5A.
Alarm relay delay	0~9999 seconds, adjustable.
Wireless output (optional)	NB IoT or 4G
Electrical specifications	
Power supply	AC：(85~265)V，50/60Hz DC：(21.6~26.4) V
Power consumption	⩽28W
Cable entries	M20*1.5 cable gland
Cable specification	Spring terminals: suitable for AWG16~AWG24（0.2mm^2~1.5mm^2）cables； Plug-in terminals: suitable for AWG12~AWG28（1mm^2~2.5mm^2）cables；
Environment	
Operating environment	Temperature：(0 ~ 60)℃ Relative Humidity：10 %~85%（non-condensing）
Storage environment	Temperature：(-15~65)℃ Relative Humidity：5%~95%（non-condensing） Altitude：<2000m
Ingress protection	IP66
Flame Retardancy	UL94V-0

2 Structure and dimensions

Dimensions：151mm*144mm*118mm.

Weight：0.8kg

Material：PC+ABS

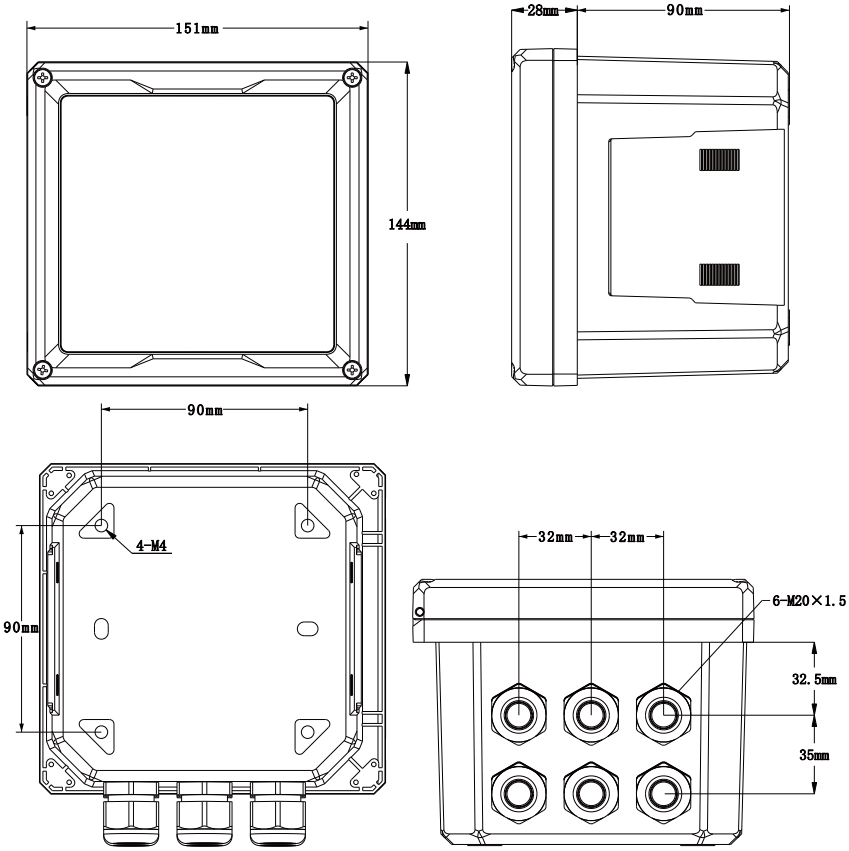


Fig.1 Product dimensions

3 Installation

3.1 Arrival inspection

After the product arrives, users should first check the packaging quality of the product, and the packaging box should be intact, undamaged, and clearly marked. If there is obvious damage to the packaging, the storage and transportation department should be contacted in a timely manner to investigate the problem and responsibility, and our company should be notified. If there are no damages or other issues with the packaging, the product can be unpacked and checked for completeness.

3.2 Installation conditions

Please read the instruction of installation location and method of instrument as described during installation.

Notes for installation

- The installation method of this product is panel mounting or wall mounting.
- Please install it indoors, avoiding wind, rain and direct sunlight.
- In order to prevent the internal temperature of this product from rising, please install it in a well-ventilated place.
- When installing this product, please do not tilt it to the left and right, try to install it horizontally (it can be tilted back <30 °).

The following places shall be avoided during the installation

- With ambient temperature over 60℃ degrees in operation.
- With humidity over 85% in operation.
- Nearby electromagnetic source.
- In strong mechanical vibration.
- With varying temperature and dew condensation.
- With oil smoke, steam, humidity, dust and corrosive gases.

3.3 Controller installation

3.3.1 Panel mounting

Installation steps：

(1) Cut an opening in the panel (opening size 138mm*138mm). Make sure the area around the panel cutout is clean and free of burrs.

(2) Place the controller into the panel cutout, ensuring a tight fit between the panel and the controller.

(3) Position two butterfly brackets on either side of the controller as shown in Fig.2.

(4) To secure the controller tightly in the opening, push both mounting brackets towards the backside of the panel.

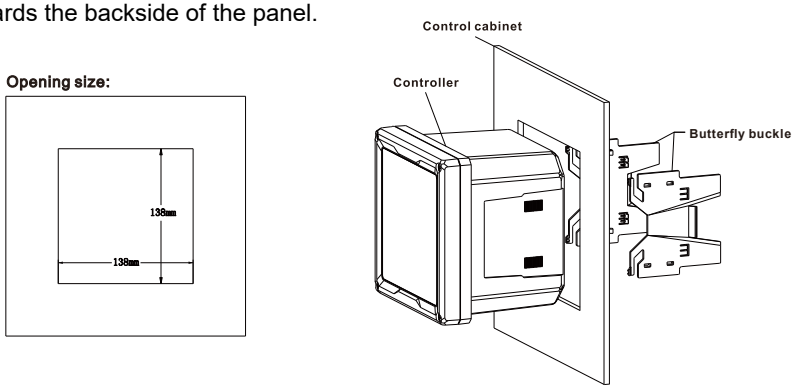


Fig.2 Panel cutout dimensions and installation method

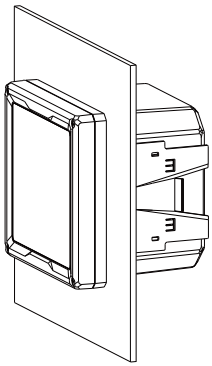


Fig.3 Panel mounting schematic

3.3.2 Wall mounting

Note: The maximum screw-in depth for the enclosure's mounting holes is 6mm. Do not exceed this limit.

Installation steps:

(1) Attach the mounting backplate to the enclosure. Do not exceed the maximum screw-in depth.

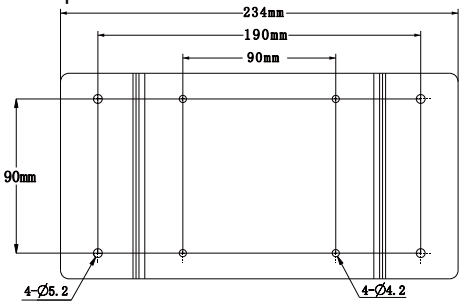


Fig.4 Dimensions of wall mounting plate

(2) Install the mounting plate along with the enclosure onto the wall.

(3) Use M4 self-tapping screws and M6 plastic heads to secure it to the wall.

(4) Ensure the controller is securely mounted in a horizontal position and that there is sufficient clearance around it for future maintenance and servicing.

(5) Adjust the orientation of the controller so that the cable gland faces downward.

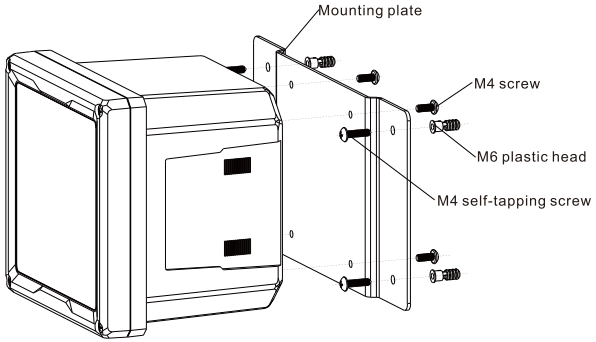


Fig.5 Wall mounting method

3.4 Sensor installation

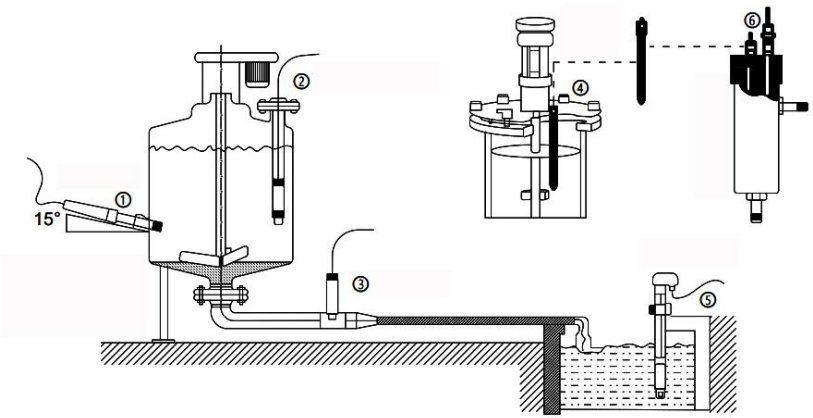


Fig.6 Schematic diagram of common installation method

①Side wall installation ②Flange mounted at the top ③Pipe installation
④Top installation ⑤Submersible installation ⑥Flow-through installation
The interface must be in 15°oblique angle, or it will affect the normal test and use of the electrode.We won't be responsible for any results due to this.

4 Electrical connections

4.1 Terminal blocks

The following diagram illustrates the internal wiring of the controller. Please connect according to the wiring instructions.

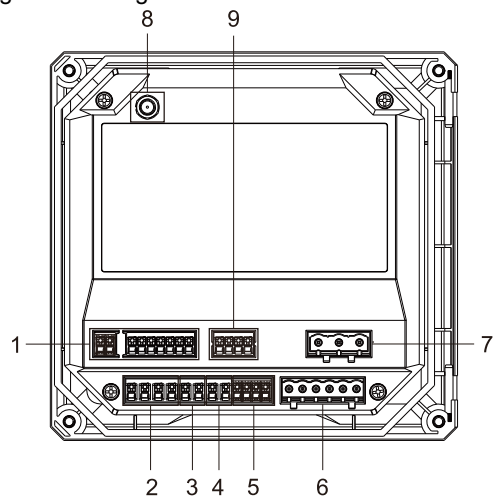


Fig.7 Internal wiring schematic

Table 2 Terminal definitions

No.	Definition	No.	Definition
①	Channel1 Analog sensor terminal	⑤	Channel 1 digital sensor terminal (cannot be used simultaneously with the analog sensor terminal for Channel 1)
②	2-channel (0/4~20) mA signal output terminal	⑥	Relay terminal
③	Communication module Terminal	⑦	AC or DC power terminal
④	Undefined	⑧	Wireless module antenna port (Optional)
		⑨	Channel 2 digital sensor terminal
①, ②, ③, ④, ⑤, ⑨are spring terminals； ⑥ and ⑦ are plug-in terminals.			

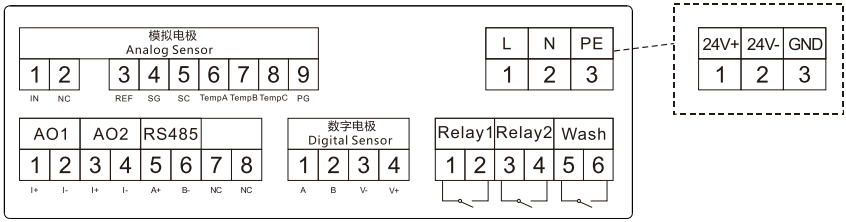


Fig.8 Terminal diagram for single channel

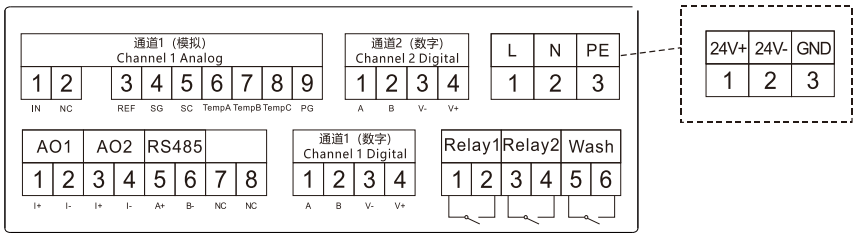


Fig.9 Terminal diagram for dual channel

4.2 Spring terminal connection

4.2.1 Safety tips

⚠Warning	
	Risk of fatal electric shock. Always disconnect the device's power before making any electrical connections.
	Risk of fatal electric shock. To maintain the enclosure's IP protection rating, use only conduit fittings and cable glands that are at least rated IP66 when connecting cables to the device.

4.2.2 Connection instructions

The signal port connection terminals use spring terminals, suitable for wires ranging from AWG16~AWG24 (0.2mm^2~1.5mm^2). The connection method is shown below.

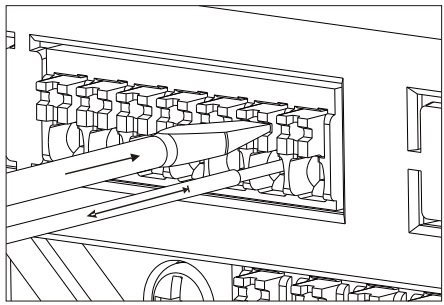


Fig.10 Spring terminal connection method

（1）Use a screwdriver to depress the wire clip (to open the terminal block).

（2）Insert the cable until it reaches the stop block.

（3）Remove the screwdriver (to close the terminal block).

Note: After connecting, ensure each cable end is securely fixed in place. If the cable end is not correctly installed to the stop block, the terminal cable end is especially prone to loosening.

4.3 Connecting to power

4.3.1 Safety tips

⚠Warning	
	Risk of fatal electric shock. Always disconnect the device's power before making any electrical connections.
	Risk of fatal electric shock. If this device is used outdoors or in potentially damp locations, it must be connected to its power source through a high-voltage protection device.
	Risk of fatal electric shock. Wiring applications for both (85-265) VAC and 24 VDC require a grounding (PE) wire. Due to electromagnetic interference, not connecting a well-grounded wire could result in fatal electric shock and poor device performance. Always connect a well-grounded wire to the controller terminal.
⚠ Danger	

	Risk of fatal electric shock. Do not connect an AC power source to the 24VDC model.

4.3.2 Wiring instructions

Note: Install the device in a location where it is convenient to turn off the device switch and operate it.

The controller is available in models with either (85~265)V AC or 24VDC power supply options. Please follow the relevant wiring instructions for the model you have purchased.

For controllers powered by 24V DC, the DC current must be stabilized within the specified 24VDC±10% voltage limits. The DC power source must also provide adequate surge and line transient protection.

Users must prepare a grounding cable (minimum 1.0mm^2), connect it to the power supply PE (GND), and ensure effective grounding.

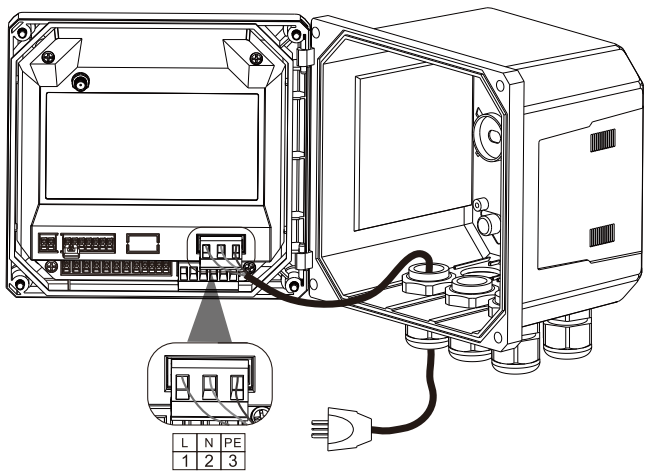


Fig.11 Power wiring schematic

4.4 Analog sensor wiring

4.4.1 Safety tips

⚠Warning	
	If the sensor lacks a solution grounding cable (SG) or shielded cable, terminals 4 and 5 must be shorted together using a jumper. Otherwise, measurement data may fluctuate significantly.

4.4.2 Wiring instruction

Note:

- If possible, use shielded cables and connect the shielding end to terminal 4 (SG) to enhance the device's anti-interference capabilities. If the cable has no shielding layer, then it is not necessary to make a connection.
- When the controller's power is not grounded, users can connect signal grounding terminal 9 (PG) to the earth.

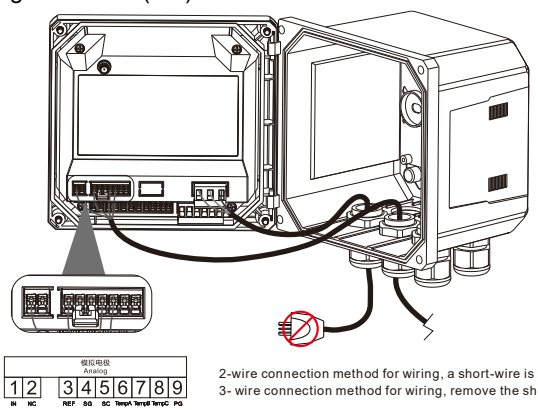
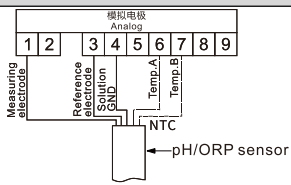
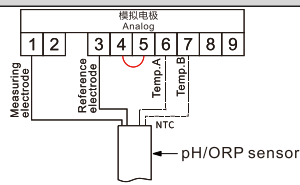


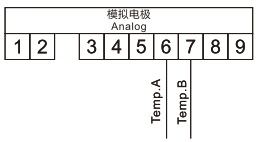
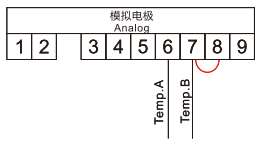
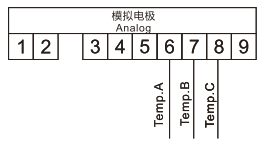
Fig.12 Analog sensor connection schematic

Table 3 Analog sensor wiring instructions

3-wire: Sensor with SG	2-wire: Sensor without SG
	

3-wire: Sensor with SG	2-wire: Sensor without SG
pH/ORP sensor with SG directly connects to terminal 4	pH/ORP sensor without SG need to short terminals 4 and 5 (the controller comes with a short-wire, or users can use a wire to connect them)

Table 4 Temperature electrode wiring

NTC TEMP.electrode	2-wire TEMP.electrode （Pt1000、Pt100）	2-wire TEMP.electrode （Pt1000、Pt100）
		
	2-wire TEMP.electrodes need to short terminals 7 and 8 (the controller comes with a short-wire, or users can use a wire to connect them)	

4.5 Digital sensor wiring

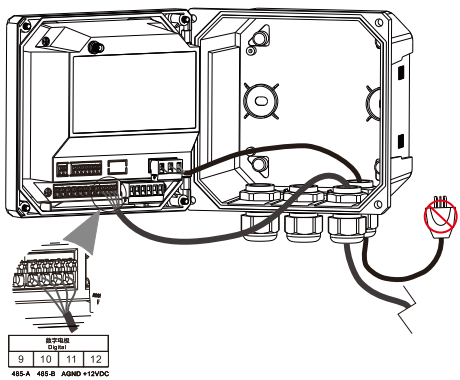


Fig.13 Digital sensor wiring schematic

When connecting a digital sensor to the controller for the first time, navigate to the "**Setup/Measure/CH1**" menu. Then, under "Input Signal," change "Analog Electrode" to "Digital Electrode" (the factory default is analog signal). The controller will automatically scan for devices. If a new device is detected, the controller will execute the installation process, requiring no further action from the

user. If the controller displays "Search Failed" or the main interface shows "Not Connected," it means the controller did not find the electrode or the electrode connection is incorrect. Please check the electrode wiring and re match, or enter the sensor type selection interface to manually select the model.

4.6 Analog output wiring

4.6.1 Safety tips

⚠Warning	
	There is a risk of fatal electric shock. Always disconnect the power source from the device before making any electrical connections.
	To maintain the IP protection level of the enclosure, use only conduit fittings and cable glands with an IP66 protection level or higher to connect the cables to the device.

4.6.2 Wiring instruction

The device is equipped with two independent analog outputs (AO1 and AO2). These outputs are commonly used for analog signals with a maximum load of 750Ω.

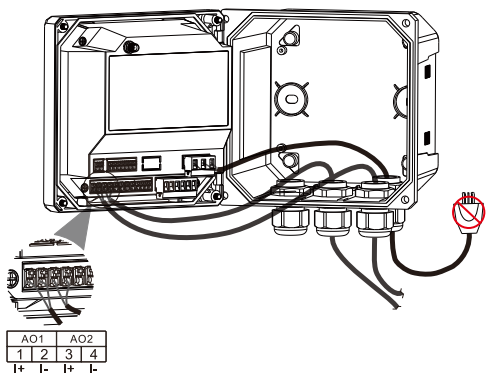


Fig.14 Analog output wiring schematic

4.7 Communication output wiring

4.7.1 Safety tips

⚠Warning	
	There is a risk of fatal electric shock. Always disconnect the power source from the device before making any electrical connections.
	To maintain the IP protection level of the enclosure, use only conduit fittings and cable glands with an IP66 protection level or higher to connect the cables to the device.

4.7.2 Wiring instruction

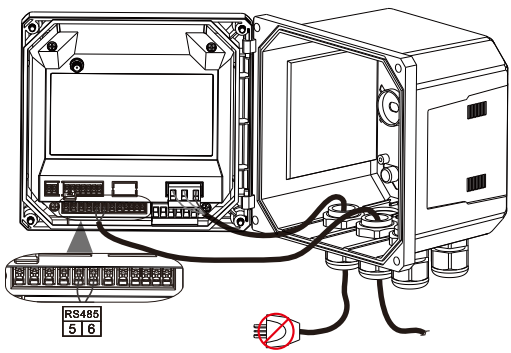


Fig.15 Communication output wiring schematic

4.8 Alarm and relay wiring

The controller is equipped with three unpowered, single-pole relays with a maximum resistive rating of 250VAC, 50/60Hz, 5A. For AC-powered controllers, the relay contacts have a maximum resistive rating of 250VAC, 5A, while for DC-powered controllers, the maximum resistive rating is 30VDC, 5A. The relays have no rated inductive load.

4.8.1 Safety tips

⚠Warning	
	Risk of fatal electric shock. Always disconnect the power source from the device before making any electrical connections.

	Risk of fire. The relay contacts are rated for 5A and are not fusible. Any external load connected to the relay must be equipped with a current-limiting device to restrict current to below 5A.
	Risk of fire. Do not bundle common relay connections or power connections inside the device on a daily basis.

For controllers powered by (85-265) VAC:

⚠Warning	
	Risk of electric shock. AC-powered controllers are designed to connect relays to AC power circuits.

Do not connect AC voltage exceeding 265V in the wiring compartment.

For controllers powered by 24VDC:

⚠Warning	
	Risk of electric shock. Controllers with an operating voltage of 24V are designed to connect relays to low-voltage circuits (e.g., voltage below 16V-RMS, 22.6V-PEAK, or peak 35VDC).

4.8.2 Wiring instruction

Relay terminals can accept AWG12~AWG28（1.0mm2~2.5mm2） wires (specific application depends on load conditions). Wires smaller than AWG28 are not recommended.

The relay is of SPST type; after activating an alarm or other statuses, the "Normally Open" (NO) and relay contacts will complete the circuit. The relay contacts will open the circuit when the alarm or other statuses are cleared, or when the controller's power is disconnected.

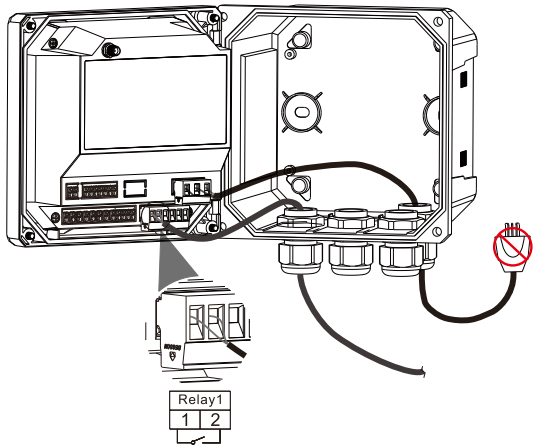


Fig.16 Relay wiring schematic

4.9 Wireless communication wiring (Optional)

4.9.1 Safety tips

⚠Warning	
	Risk of fatal electric shock. Always disconnect the power source from the device before making any electrical connections.
	Risk of lightning strike. When installing the controller outdoors, position the antenna where lightning protection is provided, or use a high-voltage shock protection device.
	Risk of fatal electric shock. To maintain the IP protection level of the enclosure, use only conduit fittings and cable glands with an IP66 protection level or higher to connect the cables to the device.

4.9.2 Wiring Instructions

Note: Do not place it inside a shielded cabinet.

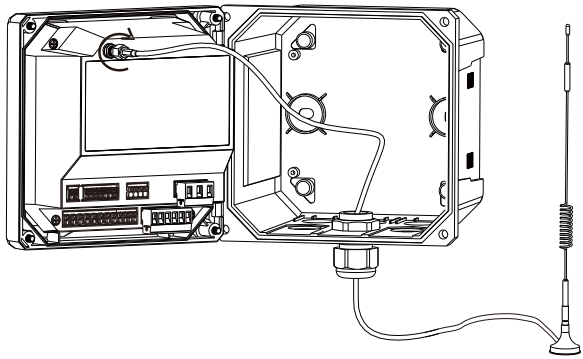


Fig.17 Wireless communication wiring schematic

- The antenna base comes with a magnetic suction feature, allowing it to adhere to metal devices.
- Position the antenna facing upwards to maximize the signal reception area.
- Since the antenna cable is relatively thin, for protection purposes, it is recommended to thread it through the same cable gland as other cables and secure it with a waterproof connector.

4.10 Cable gland installation

Note: Cable glands must be correctly installed to meet IP66 rating. Hydrate the O-rings before assembly.

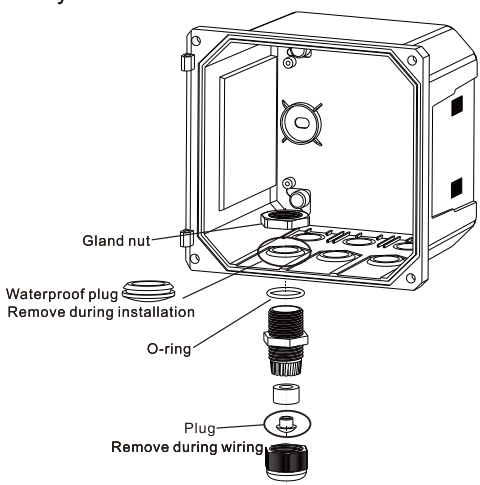


Fig.18 Cable gland installation

4.11 Post-Connection checks

Table 5 Post-Connection checks

Check Item	Result
Is the cable or instrument undamaged (visual inspection)?	☐
Does the cable meet the specifications?	☐
Is the cable completely free from external forces?	☐
Is the terminal allocation correct?	☐
Does the supply voltage match the voltage specified on the nameplate?	☐
Are all cable glands installed, tightly fastened, and sealed?	☐
Are all housings installed and tightly secured?	☐
After power-up, does the display show values?	☐

5 Operation

5.1 Startup

Once the controller is connected to the power circuit, it starts up as soon as the circuit is energized. After initialization, the controller will automatically scan for devices (factory setting is set to analog signals). If no sensor is detected, check if the sensor end is functioning properly. If you're connecting a digital sensor, go to **Setup/Measure/CH1/Inputs**, and change from analog signal to digital signal. The controller will then automatically search for the sensor.

5.2 Button display

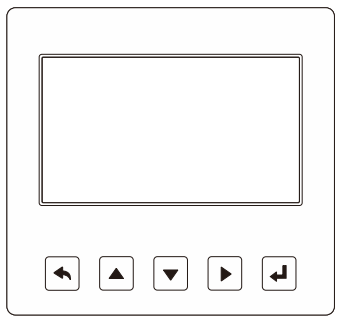
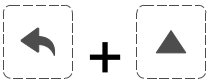
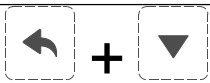


Fig.19 Button display

Table 6 Button definitions

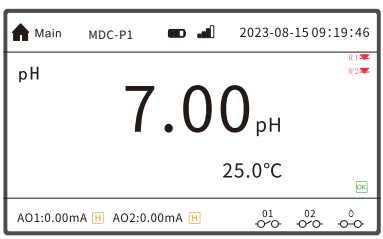
Icon	Button Name	Function Description
	Return	In "Main Measurement Interface," view related alarm status. In "Menu Interface," navigate back to the upper level between related layers.
	Up	In "Menu Interface," select relevant menu items. In settings, modify relevant values.
	Down	In "Menu Interface," select relevant menu items. In settings, modify relevant values.

Icon	Button Name	Function Description
	Right	Cycle through the digits of parameters. In "Measurement Interface," toggle display mode between numerical display and real-time curve.
	Enter	Hold down for 3 seconds under "Measurement Interface" to enter the main menu. In "Menu Interface," confirm changes.
	Return + Up	Press both simultaneously to initiate wireless communication (optional communication module).
	Return + Down	Press both simultaneously to search for digital electrodes.

5.3 Interface description

5.3.1 Main measurement interface

Single channel



Dual channels:

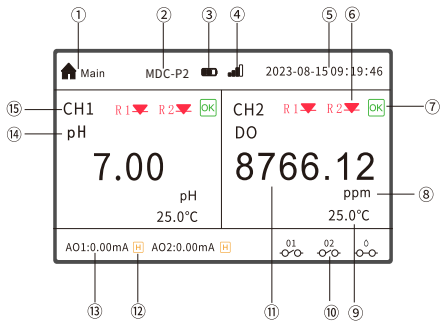
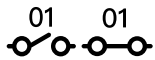
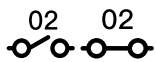


Fig.20 Main measurement interface

Table 7 Main measurement interface description

No.	Content	Icon	Explanation
1	Page Display Symbols		Icons change based on the current page; includes home, menu, settings, output,

No.	Content	Icon	Explanation
			calibration, and maintenance icons.
2	Controller Model	/	Displays the current controller model.
3	Mainboard Battery Level		Displays the level of the internal button battery.
4	Wireless Signal Strength		Shows the strength of the wireless transmission signal, the icon blinks during communication (optional wireless module).
5	System Time	/	/
6	Alarm	R1 R2	Shows high alarms for relays 01/02.
		R1 R2	Shows low alarms for relays 01/02.
7	Controller Status (Normal/Fault)	OK	If a performance fault occurs, "OK" disappears, a warning icon appears and you can view detailed issues in the Maintenance menu under Diagnostics-Logs-Fault Records. Under the state of "OK", alarms do not change the controller's status.
8	Measurement Units	/	Different units are displayed based on the measurement parameter, selectable manually.
9	Temperature Measurement Value	/	/

No.	Content	Icon	Explanation
10	Relay Status		Shows relay 01 is open or closed (normally open by default).
			Shows relay 02 is open or closed (normally open by default).
			Shows the cleaning relay is open or closed (normally open by default).
11	Main Measurement Value	/	/
12	Output Hold/Current Simulation		Output Hold: When this function is activated, the "Hold" icon will appear behind the current output value on the main display screen.
			Current Output Simulation: When activated, a "Simulation" icon will appear behind the current output value on the main display screen. Note: the simulation function cannot be used if the output is in 'Hold' mode.
13	Analog Output	AO1，AO2	Dual-channel outputs
14	Sensor Name	/	Displays the current sensor's name; if a digital signal input does not recognize the sensor, it shows "Not Connected".
15	Channel Name	/	Displays the channel number.

5.3.2 Curve interface

In the Main Measurement Interface, press the <> to switch to the curve display. The graph displays the measurement values for each active channel, making it convenient for monitoring measurement trends.

Single channel: **Dual channels:**

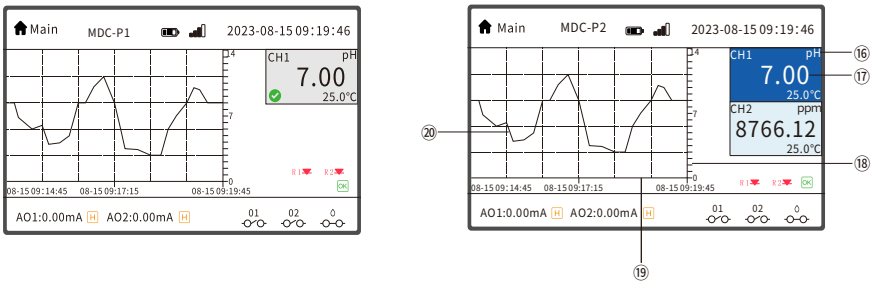


Fig.21 Curve interface

Table 8 Curve interface description

No.	Description
16	Measurement Parameter Name
17	Real-Time Measurement Data
18	Y-Axis: Auto-adjusts within the measurement range.
19	X-Axis: Time axis, adjusted by recording interval multiplied by 300.
20	Trend: Shows real-time measurement values; does not backtrack when switching interfaces.

5.3.3 Alarm information interface

In the Measurement Interface, press <> to view the alarm information.

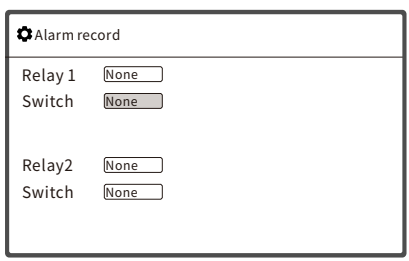


Fig.22 Alarm information interface

During alarms, the measurement interface displays a flashing red alarm box.

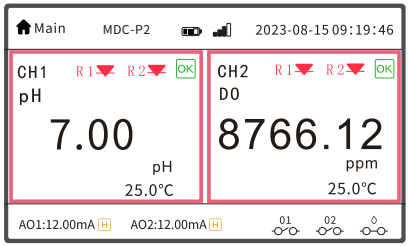


Fig.23 Alarm interface

5.3.4 Sensor not connected or disconnected

If the controller fails to recognize a digital sensor or if the digital sensor is disconnected, the parameter name on the main interface will display "Not Connected," and the measurement data will change to "----".

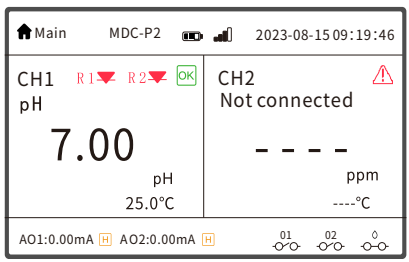


Fig.24 Sensor not connected or disconnected

5.3.5 Measurement dataover Limit

If the sensor measurement parameters exceed the upper or lower limits of the measurement range, the measurement data will display as "****".

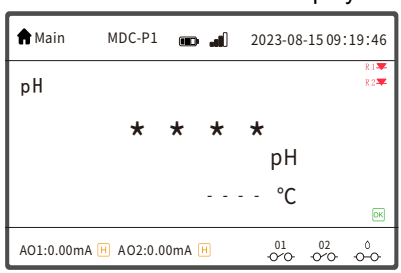


Fig.25 Measurement data out of range

5.3.6 Menu

Hold down <↵> for 3 seconds and enter the password (default password is "0000") to access the menu interface. The menu is as shown in the following figure.

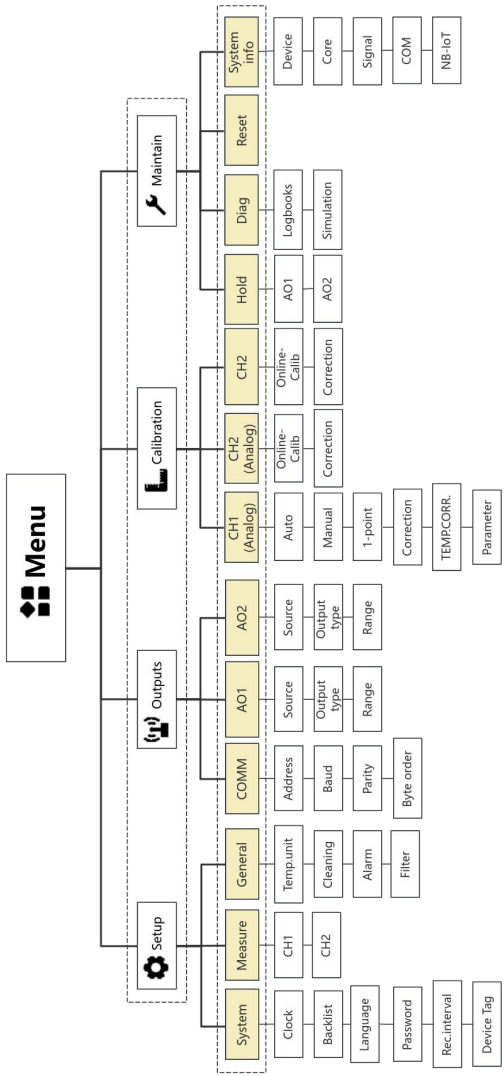


Fig.26 Menu tree

5.4 Operational instructions

5.4.1 Selection List

Some menus require choosing a parameter/data. In such cases, the controller will provide a list of options. Access the parameter selection interface by pressing <↵> and select the required parameter/data.

For example: Menu→Setup→Measure→CH1→Temp→TEMP.Sensor.

5.4.2 Numerical Values

(1) Values can be changed.

(2) The maximum and minimum limits of the variable are displayed at the bottom of the screen.

(3) Set the value within the specified range.

For example: Menu → Setups → Measure → CH1 → Filter time

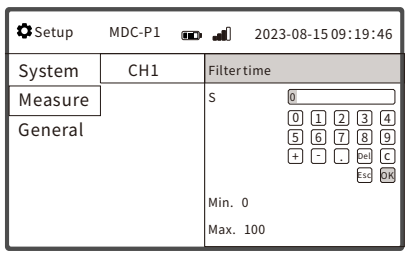


Fig.27 Setting values

5.4.3 Changes taking effect

If the controller prompts a "**Do you want to ave changes?**" dialog box, the following options are available. Selecting "**Yes**" will save the changes made, while selecting "**No**" will return you to continue with the settings.

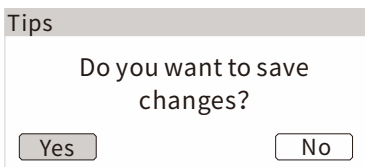


Fig.28 Save changes

After completing most menu settings, you'll need to go back to the secondary menu. At this point, the controller will prompt, "**Do you want to ave changes?**"

The changes will only take effect after pressing "**Yes**".

For some specific menu parameters, the changes will take immediate effect, such as **backlight status, backlight brightness, clock, inputs, sensor type, hold output, etc**. For these settings, the system will not prompt to save and will automatically save the changes.

5.5 Password

To access the controller's menu, a security password is required. The default password is "0000".

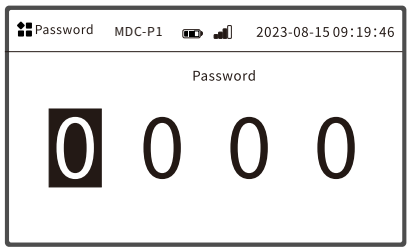


Fig.29 Enter password

Users can navigate to **Setup** → **Password** to customize and change the password. It is important to keep the updated password secure. In case of loss or forgetting the password, please contact our company for assistance.

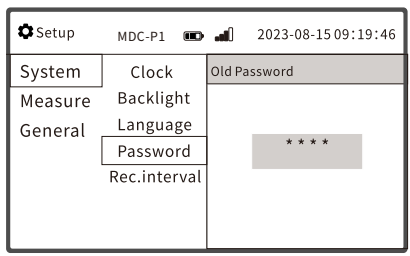


Fig.30 Password setting

5.6 System settings

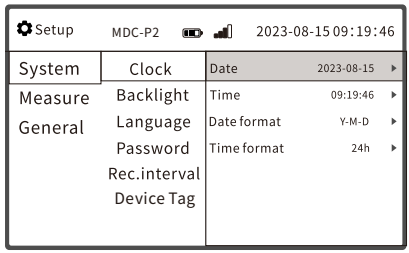


Fig.31 System settings menu

(1) Clock settings

If needed, adjust the time and format.

(2) Backlight settings

Adjust the screen backlight and brightness according to the working environment.

Settings include Auto/Always On/Off. If set to Auto, the backlight turns off after 30 seconds of no button activity and reactivates upon any button press. If set to On, the backlight does not turn off automatically.

Brightness adjustment is available in five levels: 1/2/3/4/5, where 5 is 100% brightness.

(3) Language settings

The default language for the controller is Chinese. English, Korean, and Spanish are also available.

(4) Password settings

Please refer to Chapter 5.5 "Security Password" for details.

(5) Recording interval

The default interval is 1 s. Real-time measurement curves and historical data are sampled or recorded based on this interval. The interval can be set to: 1s, 2s, 5s, 10s, 15s, 30s, 1min, 2min, 5min, 10min, 15min, 30min, 1h.

(6) Device Tag

Customize the device name.

5.7 Measure settings

For single-channel products, the channel cannot be turned off.

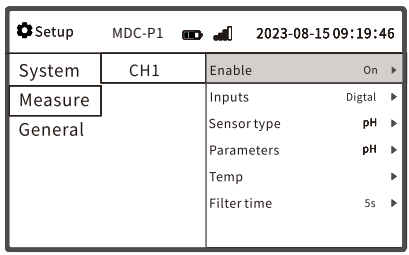


Fig.32 Measurement settings menu (single channel)

For dual-channel products, Channel 2 is enabled by default but can be disabled if necessary. When disabled, the measurement parameters for Channel 2 will not be displayed on the measurement screen.

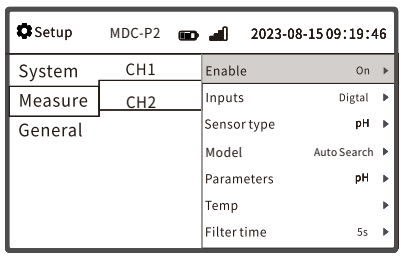


Fig.33 Measurement settings menu dual channel)

5.7.1 Inputs

Set to analog or digital sensor. The controller defaults to analog input; if a digital sensor is connected, switch from analog to digital. After making this change, the controller will automatically scan for sensor types. If no match is found, the controller will display "Search Failed". Please refer to Chapter 4.5 "Digital Sensor Wiring" for details.

Model Settings

5.7.2 Sensor type

For analog sensor, users can manually select between pH, ORP, or Sb; no need to choose for digital sensors.

5.7.3 Model Settings

After automatic searching, the digital electrode model will be displayed, and the model can also be selected manually based on prompts.

5.7.4 Parameters

Set the main parameters for sensor measurements. For pH/Sb, the parameters can be set to pH or mV; For ORP, the parameter can be set to mV.

(1) pH/Antimony

Parameters for pH/antimony electrodes can be set to either pH or mV.

(2) ORP

ORP electrode parameters can only be set to mV.

(3) DO

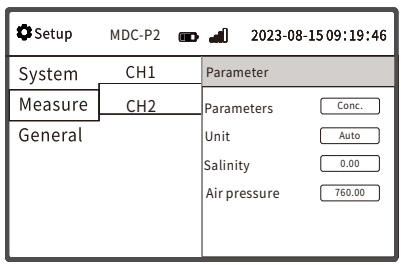


Fig.34 Dissolved oxygen parameter settings

Parameters: Concentration, Saturation.

Unit: Auto, μg/L, mg/L, ppm, ppb.

Salinity : Range from 0.00ppt to 40.00ppt, default at 0.00ppt.

Air Pressure: From 600Hg to 800mmHg, default at 760mmHg.

(4) Conductivity/Inductive Conductivity

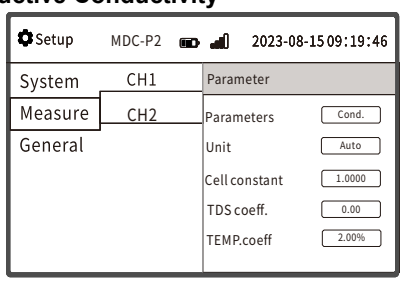


Fig.35 Conductivity/Inductive conductivity parameter settings

Parameters: Conductivity, Resistivity, Salinity, TDS.

Unit: Conductivity supports Auto, μS/cm, mS/cm, S/cm, μS/m, mS/m;

Resistivity supports Auto, MΩ·cm, kΩ·cm, Ω·cm, MΩ·m.

Salinity: Supports Auto, ppm, ppt, PSU, %.

TDS: Supports ppm, mg/L, ppt.

Cell Constant: Range from 0.0001 to 30.0000.

TDS coefficient: Range from 0.10 to 1.00 (1.00 to 7.00 for inductive conductivity).

TEMP compensation coefficient: From 0.00% to 10.00%, default at 2.00%.

(5) Turbidity

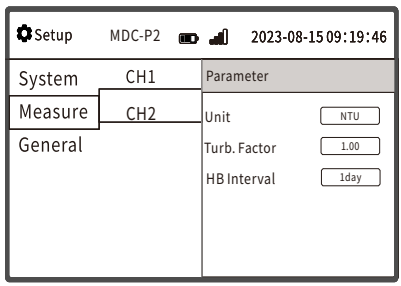


Fig.36 Turbidity parameter settings

Unit: NTU, FTU.

Turbidity factor: From 0.00 to 10.00.

HB Interval : 1min, 5min, 15min, 30min, 1h, 4h, 12h, 1 day, 3 days, 7 days.

(6) MLSS

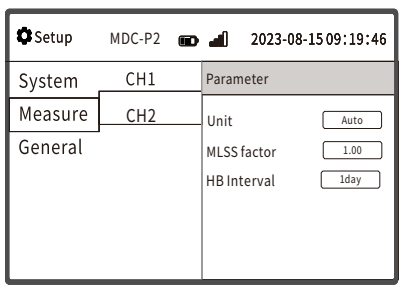


Fig.37 MLSS parameter settings

Unit: Auto, mg/L, ppm, g/L.

MLSS Factor: From 0.00 to 10.00.

HB Interval : 1min, 5min, 15min, 30min, 1h, 4h, 12h, 1 day, 3 days, 7 days.

(7) Residual Chlorine

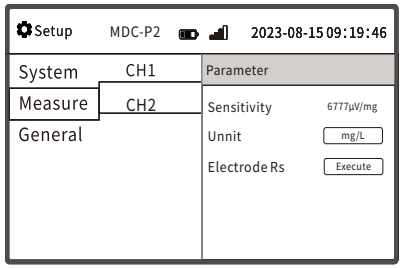


Fig.38 Chlorine parameter settings

Sensitivity: Displays current electrode sensitivity.

Measurement Units: mg/L.

Electrode reset: Allows resetting electrode parameters to factory settings.

(8) NH4-N / NO3-N

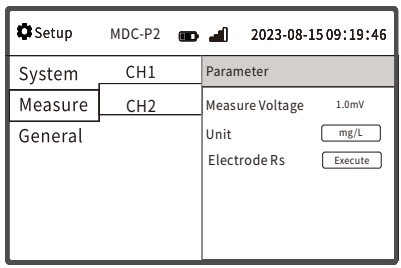


Fig.39 NH4-N / NO3-N parameter settings

Measurement Voltage: Displays current measurement voltage value.

Unit: NH4-N can be set to mg/L, ppm, pNO3N, mol/L;

NO3-N can be set to mg/L, ppm, pNH4N, mol/L.

Electrode reset: Allows resetting electrode parameters to factory settings.

(9) COD /BOD

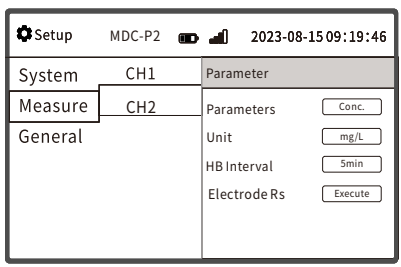


Fig.40 COD/BOD Parameter Settings Interface

Parameters: BOD、TOC、TSS、COD、PTU..

Unit: mg/L.

HB Interval : Options from 1 minute to 7 days.

Electrode reset: Allows resetting electrode parameters to factory settings.

(10) Oil in water

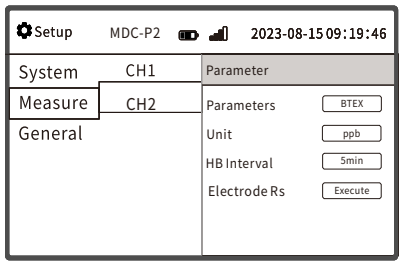


Fig.41 Oil in water Parameter Settings Interface

Parameters: BTEX。

Unit: Auto、ppb、ppm。

HB Interval : Options from 1 minute to 7 days.

Electrode reset: Allows resetting electrode parameters to factory settings.

5.7.5 Temperature

Set temperature compensation mode, temperature electrode type, and compensation curve type by clicking on the parameter box to select relevant parameters. Temperature compensation is for pH only. ORP generally does not have temperature compensation.

Compensation modes include Auto and Manual. In Auto, users can choose the type of temperature electrode and compensation curve; in Manual, users can only set the temperature, default is 25°C.

Temperature sensors supported: NTC10K, Pt1000, Pt100.

Compensation curve types: Linear, Pure , Acid, Base.

Linear: Use only when the sample has a good linear temperature coefficient; the default value is 0.1984mV/°C.

Pure: Compensates according to the ultra-pure water curve (corresponding to pH 7.0 at 25°C).

Acid: Compensates according to the sulfate curve (4.84mg/l corresponds to

pH 4.0 at 25°C).

Base: Compensates according to the ammonia/ammonium curve (0.272mg/l ammonia + 20µg/l ammonium corresponds to pH 9.0 at 25°C).

5.7.6 Filter time

In environments with significant electromagnetic interference, the filter time can be set 0s ~ 100s enhance measurement stability.

5.8 General settings

This menu allows users to configure the controller's temperature unit and relays. Of the three relays, two are designated as alarm relays and one as a cleaning relay. Settings can be adjusted according to user requirements.

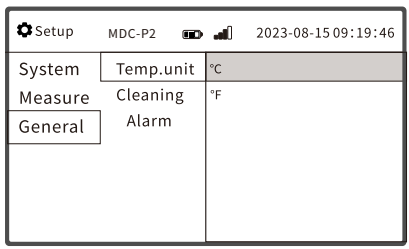


Fig.42 General settings menu

(1) Temperature unit

Options for Celsius (℃) or Fahrenheit (℉) are available, with ℃ being the default.

(2) Cleaning

- Manual enabling or disabling of the cleaning function is possible, and the indicator <⚙> on the measurement interface will provide appropriate cues.
- Cleaning duration can be set between 1 and 900 seconds.
- Cleaning intervals can be set between 1 second and 7 days.
- Several conditions can interrupt the cleaning feature: power loss or reboot of the controller; enabling of output-hold function; manual disabling by the user; or controller malfunctions.

⚠Warning	
⚠	Failing to cease cleaning operations during calibration or maintenance poses the risk of personnel injury due to exposure to media or cleaning

	solutions.

If a cleaning system is connected, it should be turned off before removing the sensor from the media.

If checking the cleaning function is necessary and the system cannot be turned off, appropriate safety measures, such as protective clothing, goggles, and gloves, must be taken.

(3) Alarm settings

The alarm settings can be configured for relay status, limit switch conditions, and delay functions.

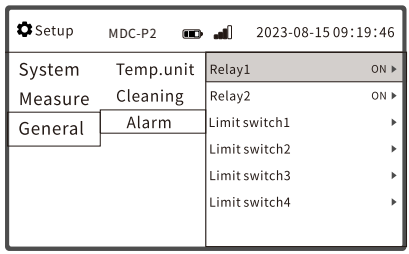


Fig.43 Alarm settings menu

- **Relay**

Relay can be turned on or off, and each relay can control up to four limit switches.

- **Alarm delay**

Alarm Delay only displays errors persisting beyond the set delay time, omitting brief or transitional errors. Delay time can be set between 0 and 9999 seconds.

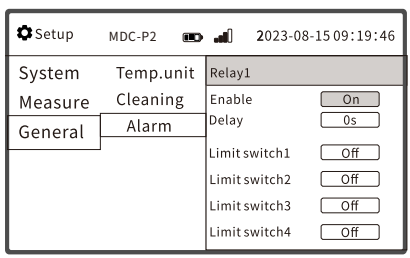


Fig.44 Alarm delay settings

- **Limit switches**

The function of the limit switch is to set the data source, alarm threshold, and hysteresis values.

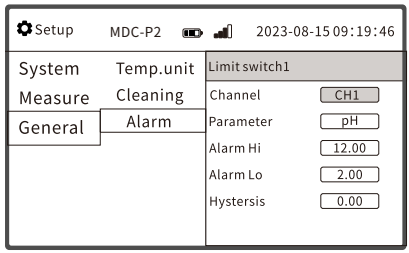
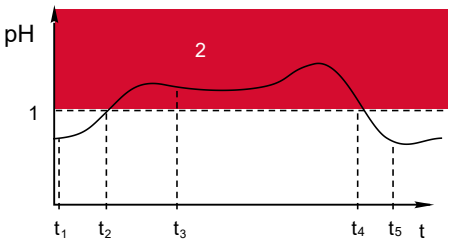


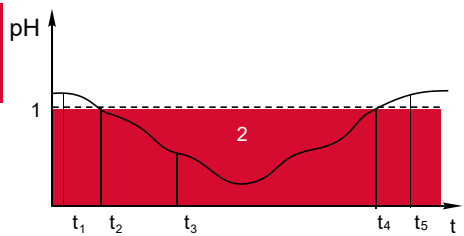
Fig.45 Limit switch settings

Parameter: Depend on the data source: pH, mV, temperature.

Alarm high/low : The range depends on the scale, for example, the pH alarm threshold can range from -2pH to 16pH



Exceeding high alarm value
(without hysteresis and delay)



Exceeding low alarm value
(without hysteresis and delay)

In the graph:

1. Alarm value 2. Alarm range

t_1, t_3, t_5, the relay remains inactive .t_2,t_4, the alarm is triggered.

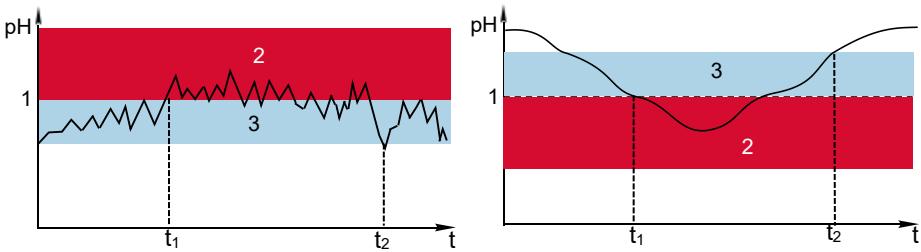
When the measured value (pH) increases and exceeds the set threshold, the relay activates (limit), especially if it surpasses the alarm delay time.

If the measured value decreases and falls below the close value, the relay triggers to close (limit minus hysteresis).

Hysteresis Value: This is added or subtracted from the set limit. The relay will only release when the measured value is entirely below or above the value after the hysteresis is applied. For instance, if a high set value is fixed at 100, and the measured value exceeds this, the relay is activated. If the hysteresis is 10, then the measured value must drop to 90 for the relay to release.

Values of (low alarm point + hysteresis) and (high alarm point - hysteresis) must be within the range.

Hysteresis Range: 0 to (high alarm value - low alarm value) / 2.



The graph on the left shows the hysteresis effect for a high alarm, while the one on the right illustrates the hysteresis effect for a low alarm.

In the graph:

1：High alarm value

2：Alarm range

3：Hysteresis range

t_1：Trigger the alarm；　　t_2：Clean the alarm.

- **Filter**

In environments with significant electromagnetic interference, the filter can be set 0 ~ 99 enhance measurement stability.

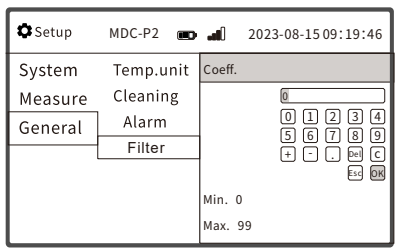


Fig.46 Filter setting

5.9 Output settings

Under this menu, settings related to RS485 communication and analog output can be adjusted.

5.9.1 Communication settings

Users can configure the RS485 communication address, baud rate, transmission

format, and byte order.

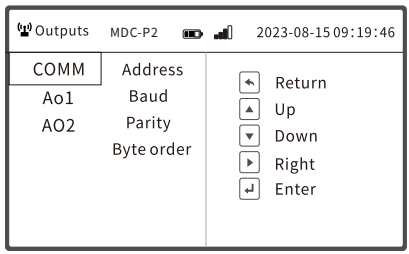


Fig.47 Communication settings

Address: Range from 1 to 247.

Baud: Options include 2400, 4800, 9600 (default), 19200, 57600, 115200.

Parity: The first digit represents the number of data bits, the second digit denotes parity, and the third digit indicates the stop bit.

Byte order: Choices are 1-0-3-2, 0-1-2-3, 2-3-0-1, and 3-2-0-1.

5.9.2 Analog output

Users can configure the signal source, output type, and range.

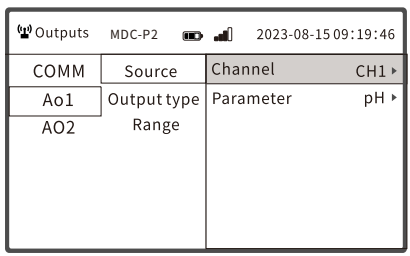


Fig.48 Analog output settings

Source: Users can select from input channels and sensor parameters. For instance, for pH, users can choose to output based on the pH parameter or the temperature parameter.

Output type: Either (4~20)mA or (0~20)mA. The current output complies with the NAMUR NE43 standard, with a linear range of 3.8mA to 20.5mA or (0~20.5)mA. If values exceed the range, the current value is capped at the upper or lower range limit and outputs a fault message (E100 or E101).

Range: Users can define the desired measurement range. By default, the controller is set to its maximum range.

6 Calibration

The calibration menu is automatically adjusted based on the type of electrode connected to the controller. Different electrodes have different calibration methods, and specific instructions provided with the electrode should be followed.

6.1 Analog pH calibration

For analog pH sensors, the controller offers automatic calibration, manual calibration, single-point calibration, signal correction, temperature correction, and it comes pre-stored with two buffer solution sets (GBT27501/NIST). Users can also manually input buffer solutions. Buffer solution pH values are measured at 25°C. If using automatic buffer solution recognition for calibration, one of the two buffer sets is needed (refer to Appendix B for buffer solutions and temperature relations). Before automatic calibration, select the correct buffer set: GBT27501 (4.00/6.86/9.18) or NIST (4.01/7.00/10.01).

With automatic temperature compensation, the temperature sensor must be immersed in the buffer solution to systematically temperature-compensate the sensor according to the Nernst equation.

In manual temperature compensation, calibration is adjusted according to the temperature set by the user, hence it’s best to match the buffer solution temperature with the set temperature to minimize calibration errors.

For precise calibration of pH electrodes, two-point calibration is recommended, where one of the pH values should be close to that of the sample water. For zero calibration, use a pH 7.00/pH 6.86 buffer solution (25°C); for calibrating the electrode slope, use a pH 4.01/pH 4.00 buffer solution (25°C) or a pH 10.01/pH 9.18 buffer solution (25°C).

6.1.1 Automatic calibration

- **Calibration settings**

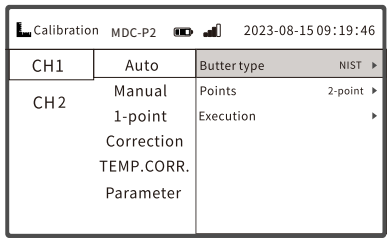


Fig.49 Automatic calibration settings Interface

1. In automatic calibration mode, select the standard solution group type (GBT/NIST) and confirm the buffer values at different temperatures.
2. Choose calibration method: 2-point or 3-point, typically 2-point is sufficient.
3. Execution.

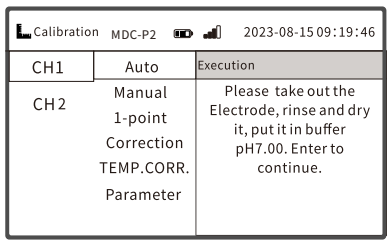


Fig.50 Perform calibration

- **Two-Point Calibration Steps**

1.After selecting "Execution", follow prompts to remove the electrode, rinse, dry, and place it into the pH 6.86 (pH 7.00) buffer solution, then press the "↵" key to start the first point of calibration.

2.The interface displays "In calibration and current calibration value"., and the analyzer automatically recognizes the standard solution from the selected buffer series.

3.Once readings stabilize, the analyzer will automatically judge (or allow manual confirmation) and proceed to the second point of calibration.

4.Following prompts, remove the electrode, rinse, dry, and place it into

buffer solution 2, then press the "↵" key to start the second point of calibration (Note: Buffer solution 2 is selected based on whether the measurement medium is acidic or basic).

5.Once readings stabilize, the analyzer automatically judges the calibration results.

Note:

During calibration, you can press "Return" at any time to exit without saving the current results.

If calibration is successful, it will prompt the electrode's health status, display the slope and zero point of this calibration. Pressing <↩> will prompt "Save ". Click "**Yes**" to record the calibration result in calibration parameters and calibration log; click "**No**" to reject this calibration.

Slope and zero point limit: If the slope value isn't within 80%-120% or the zero point drift isn't in the -1pH~1pH range, an error message will be displayed. Refer to Chapter 8 "Error Messages".

Sensor health prompt: Excellent sensor performance;sensor condition qualified， Need to schedule maintenance;Sensor condition bad， Suggestion maintenance.

- **Three-Point Calibration Steps**

Follow "Two-Point Calibration" steps, with the first point being neutral, and the subsequent two points recommended in an acid-to-base sequence.

6.1.2 Manual calibration

When standard buffer solutions (GBT/NIST) are not available for the desired calibration type, use this menu to manually enter other buffer values (kept at a constant temperature).

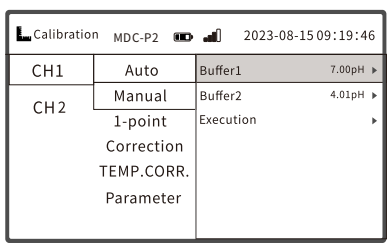


Fig.51 Manual calibration

- **Manual calibration steps**

1.After selecting "Execution", follow prompts to remove the electrode, rinse, dry, and place it into buffer solution 1 (current buffer solution measurement value displayed).

2.Once the value stabilizes, press the "↵" key to enter the second point of calibration.

3.Follow prompts to remove the electrode, rinse, dry, and place it into buffer solution 2.

4.Once the value stabilizes, press the "↵" key, and the analyzer displays the calibration results, judged as in "Automatic calibration".

6.1.3 1-oint calibration

⚠Warning	
	Perform this operation only when there is zero point drift.

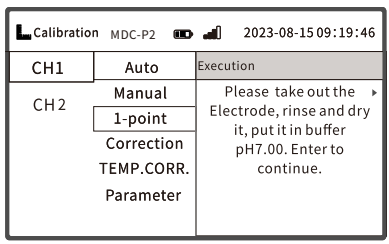


Fig.52 1-point calibration

Use a single buffer solution, known concentration solution, or direct sample water measurement (with values previously obtained in a lab) for single-point calibration. Each time, input the buffer solution value or sample water value. Upon completion, the zero point value is displayed.

6.1.4 Signal correction

Adjustments can be made for pH offset within a range of -2.00pH to 2.00pH.

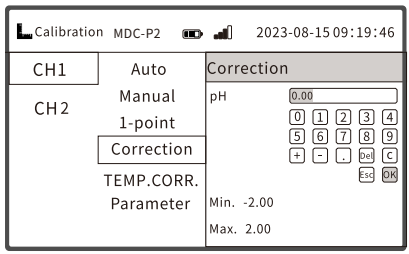


Fig.53 Signal correction

6.1.5 Temperature correction

This menu allows for adjustments of temperature offset within a range of -20.0°C to 20.0°C.

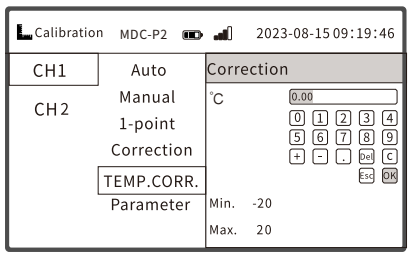


Fig.54 Temperature correction

6.1.6 Calibration parameters

Displays the slope and zero point data from the most recent successful calibration. If no calibration has been performed, it displays "None".

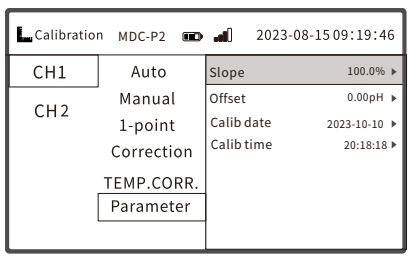


Fig.55 Calibration parameters

6.2 Analog antimony calibration

Change the sensor type to "Antimony Electrode", with calibration methods as

described in Section 6.1 "Analog pH Calibration".

6.3 Analog ORP calibration

For ORP analog sensors, the controller can provide 2-point calibration, 1-point calibration, signal correction, and temperature correction (if a temperature electrode is available). Industrial ORP electrodes generally require only single-point calibration to meet measurement needs.

The default ORP buffer solutions are 86mV and 256mV, but users can modify other standard solution values.

Configuration and values of ORP buffer solutions: Pour about 250ml of pH 4.00 standard buffer solution into a small beaker, add 10.2g of hydroquinone reagent and stir until saturated, creating a 256mV standard buffer solution. Pour about 250ml of pH 6.86 standard buffer solution into a small beaker, add 10.2g of hydroquinone reagent and stir until saturated, creating an 86mV standard buffer solution. ORP buffer solutions should not be used for long periods after preparation to avoid degradation and are generally used only on the day of preparation.

6.3.1 2-Point calibration

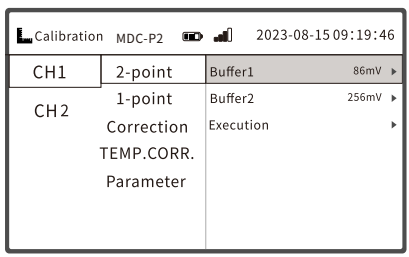


Fig.56 2-point calibration

- **Calibration steps**

  1.After selecting "Execution", follow prompts to remove the electrode, rinse, dry, and place it into buffer solution 1 (the interface will display the current buffer solution measurement value).

  2.After stabilization, press the "↵" key to proceed to the second point of calibration.

  3.As prompted, remove the electrode, rinse, dry, and place it into buffer

solution 2.

4.After stabilization, press the confirm button; the controller will display "In calibration", followed by the calibration results.

Note:

(1) During the calibration process, you can press "" at any time to exit the calibration.

(2) If the calibration is successful, the slope and zero point of this calibration will be displayed. Press the <> and a prompt will appear asking, "Save ". Clicking "Yes" will save the calibration results in both the Calibration Parameters and Calibration Log. Clicking "Back" will decline the current calibration results.

(3) If the calibration fails, a message "Failed, XXXX" will be displayed. This calibration result will not be saved. Press the <> to return to the calibration menu.

Slope and Zero Point Limits: If the slope value is not between 80% to 120% or the zero point drift is not within the range of -200mV to 200mV, an error message will be displayed. Refer to Chapter 8 "Error Messages and Troubleshooting"

6.3.2 2-point calibration

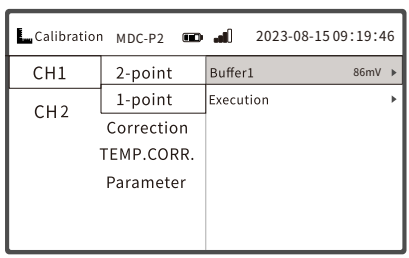


Fig.57 1-point calibration

Use a single buffer solution, a known concentration solution, or direct sample water measurement (where sample values have been previously obtained in the lab) for single-point calibration. Users need to enter the buffer solution value or sample water value each time. After calibration, the zero point value is displayed. "YES" saves parameters; "NO" does not record this calibration.

6.3.3 Signal correction

Allows for setting ORP offset within a range of -200mV to 200mV.

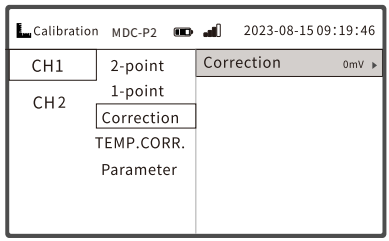


Fig.58 Signal srrection

6.3.4 Temperature correction

If the ORP electrode includes a temperature sensor, automatic temperature correction is possible, similar to Section 6.1.5 "pH Temperature Correction". Conventional ORP electrodes use manual temperature compensation without temperature correction functionality.

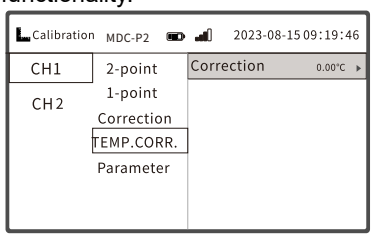


Fig.59 Temperature correction

6.3.5 Calibration parameters

Displays the slope and zero point data from the most recent successful calibration. If no calibration has been performed, it displays "None"

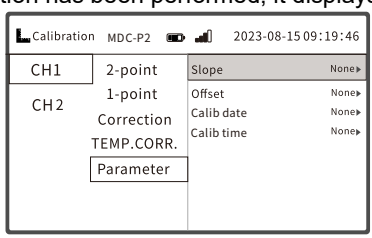


Fig.60 Calibration parameters

6.4 Digital pH sensor calibration

For digital pH sensors, the controller provides automatic calibration and signal correction, with pre-stored buffer solutions sets (GBT27501/NIST), using calibration methods as described in "Section 6.1 Analog pH Calibration".

6.5 Digital ORP sensor calibration

For digital ORP sensors, the controller provides two-point calibration and signal correction. Calibration methods are as described in "Section 7.3 Analog ORP Calibration".

6.6 Digital conductivity sensor calibration

Calibration methods vary with the type of sensor and include both 2-point and 1-point calibrations. Typically, a 1-point calibration is performed automatically by the device after the standard solution value is set. For inductive conductivity measurements, a 2-point calibration is used, with details provided in the sensor instruction manual.

1-point online calibration:

Enter the conductivity calibration interface, input the calibration liquid value to be calibrated (common standard solutions include 147.0 μS/cm, 1413 μS/cm, and 12.88 mS/cm; actual values may vary based on on-site standards), then initiate calibration, and place the connected electrode into the standard solution. Once the reading stabilizes, proceed with the calibration by pressing the "↵" key.

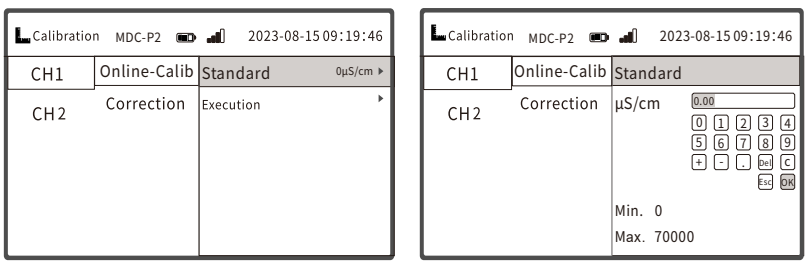


Fig.61 Setting the standard liquid value

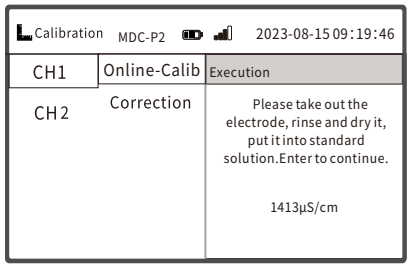


Fig.62 Executing calibration

2-point calibration: Zero Point and Solution Calibration (Inductive Conductivity)

Zero Point Calibration: Remove the electrode and expose it to air to calibrate the zero value, then click to perform the calibration.

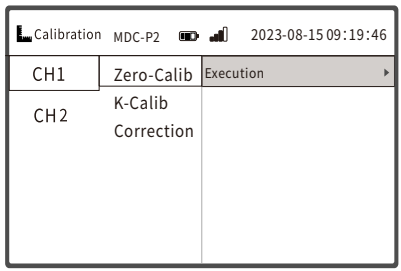


Fig.63 Zero calibration

Solution Calibration: Use standard solutions or laboratory-measured values of sample water for calibration.

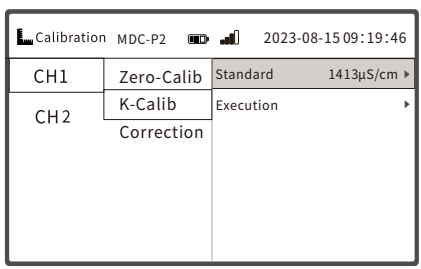


Fig.64 Solution calibration

Signal Correction: Allows setting of conductivity offset within ±15% of the measurement range.

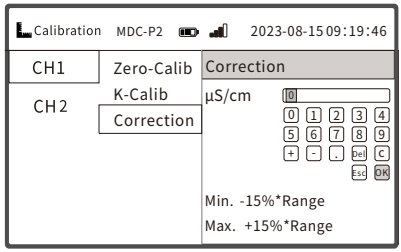


Fig.65 Conductivity signal correction

6.7 Digital DO sensor calibration

Online Calibration:

Options include zero-point and air calibration. Zero-point calibration can be performed in a sodium sulfite solution prepared with deionized water; air calibration can be performed in the air or in air-saturated water. After entering the calibration interface, wait for the measurement values to stabilize before completing the calibration by pressing the "↵" key.

Air Calibration:

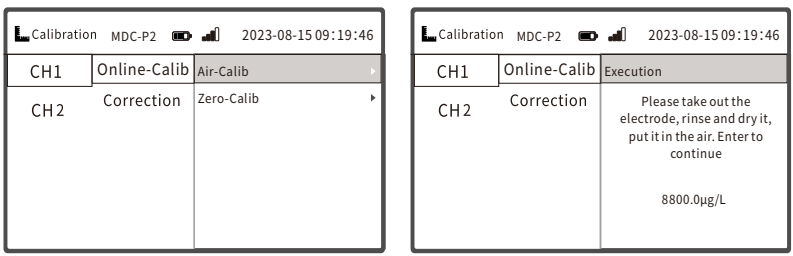


Fig.66 Air calibration

Zero calibration:

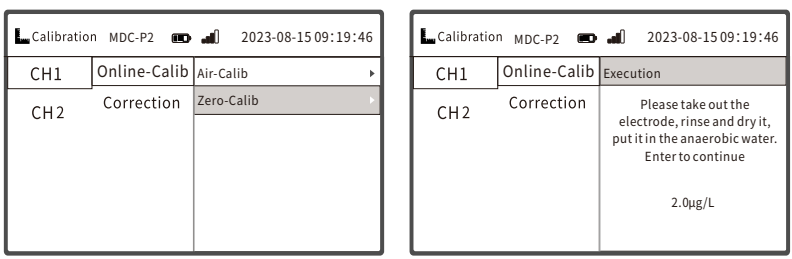


Fig.67 Zero point calibration

Signal Correction: Allows setting of dissolved oxygen offset within ±15% of the measurement range.

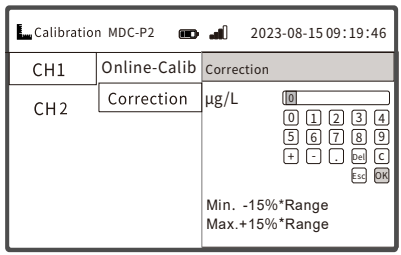


Fig.68 DO signal correction

6.8 Digital turbidity sensor calibration

Turbidity sensor calibration is typically a two-point process, requiring the use of standard solutions. The first point must be zero, and the second point can be set according to the actual standard solution used.

2-point calibration steps:

1.Go to the settings menu → measure→ channel 1/2 →Parameters, and set the turbidity factor to 1.00.

2.Enter the calibration interface and set the values for two standard solutions, typically with standard1 being pure water.

3.Initiate calibration, rinse the electrode thoroughly, dry, and place it into standard solution 1. Once the reading stabilizes, press the "↵" key. After being prompted to place it into standard solution 2, rinse and dry the electrode again, place it into standard solution 2, and after stabilization, press the "↵" key to complete the calibration.

4.At the end of calibration, the controller will display the results. If not passed, refer to " 8 Troubleshooting and resolution".

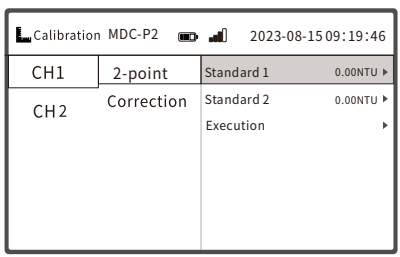


Fig.69 Turbidity calibration

Signal Correction: Allows setting of turbidity offset within ±15% of the measurement range.

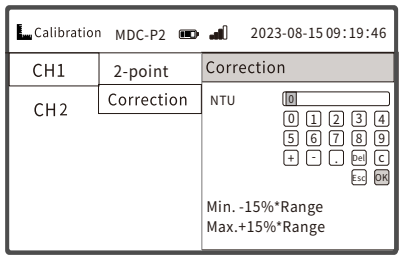


Fig.70 Turbidity signal correction

6.9 Digital MLSS sensor calibration

The calibration of sludge concentration sensors is a two-point process, requiring the use of standard solutions. The steps for calibration are as follows:

1.Access the settings menu → Measure →CH1/2 →Parameters, and set the MLSS factor to 1.00.

2.Enter the calibration interface and set the values for two standard solutions, typically with standard solution 1 being pure water.

3.Click to execute the calibration, rinse the electrode clean and dry it before placing it into standard solution 1. Wait until the readings stabilize and then press the "↵" key. When prompted to place the electrode into standard solution 2, rinse and dry the electrode again, then place it into standard solution 2. Wait for the readings to stabilize and then press the "↵" key button to complete the calibration.Chapter 8

4.Once the calibration is complete, the controller will display the calibration results. If the calibration fails, refer to "Fault Analysis and Troubleshooting".

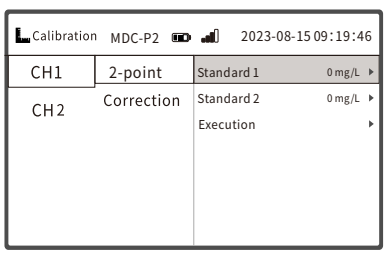


Fig.71 MLSS calibration

Signal Correction: Allows adjustment of the sludge concentration offset within ±15% of the measurement range.

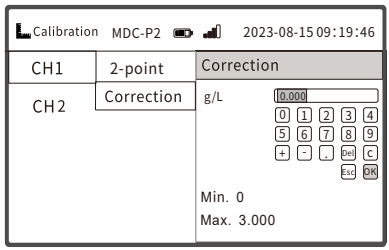


Fig.72 MLSS signal correction

6.10 Digital chlorine sensor calibration

After powering on for the first time or after a long power outage, allow the electrode to operate normally for 2 hours before calibration. On-site comparison calibration methods and laboratory calibration methods are available. It is recommended to use the on-site comparison calibration method during the use of the electrode, and the laboratory calibration method can be used in a laboratory environment.

Calibration includes zero-point calibration, slope calibration, and signal correction.

Zero point calibration: Enter the zero-point calibration menu. With the electrode powered and polarized, introduce chlorine-free tap water (can be circulated using a pump), execute the calibration, wait for the electrode measurement to stabilize, and then press the "↵" key to complete the calibration.

If calibration is successful, the controller will display the calibration results. If not, refer to " 8 Troubleshooting and resolution".

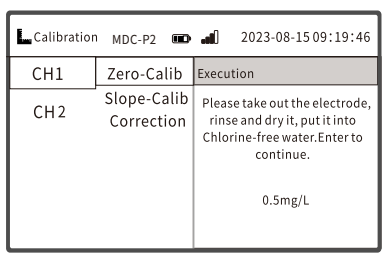


Fig.73 Zero point calibration

Slope calibration: Enter the slope calibration menu. When the measured display values linearly deviate from the actual values, perform slope calibration. Standard solutions can be prepared based on the on-site conditions, and the prepared solution values entered into the instrument. Alternatively, a DPD portable residual chlorine meter can be used to measure the sample water multiple times, and the average of these measurements entered as the standard value into the instrument. After executing the calibration, wait for the electrode measurements to stabilize, then press "↵" key to complete the calibration.

Once calibration is finished, the controller will display the calibration results. If the calibration is unsuccessful, refer to " 8 Troubleshooting and resolution".

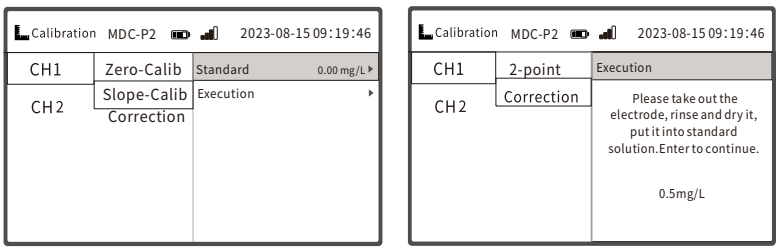


Fig.74 Slope calibration

Signal correction: Allows adjustment of the residual chlorine offset within ±15% of the measurement range.

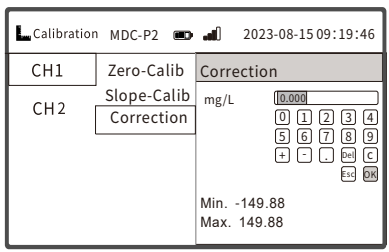


Fig.75 Chlorine signal correction

6.11 Digital COD/BOD sensor calibration

COD/BOD signal calibration supports single point calibration and two-point calibration. If the COD/BOD electrode supports measuring PTU, TSS, TOC and other parameters simultaneously, the corresponding parameters can be selected in the calibration parameter settings, and the calibration steps are the same as COD/BOD calibration.

- **1-point calibration**

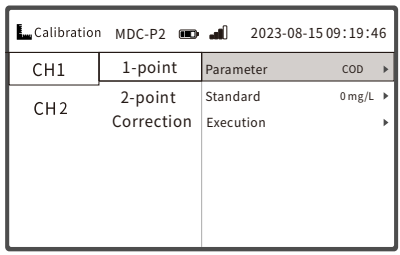


Fig.76 1-point calibration

The steps are as follows:

1. Enter the calibration menu, set the calibration parameters to COD, set the standard solution value.
2. Click to execute the calibration, remove the sensor, rinse it with deionized water, dry it, and place it into prepared standard solution. Wait until the measurement data stabilizes, then press the "↵" key to complete the calibration.
3. After calibration, the controller displays the results. If not passed, refer to " 8 Troubleshooting and resolution".

- **2-point calibration**

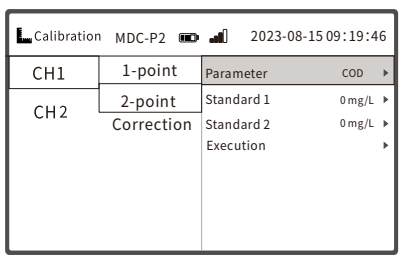


Fig.77 2-point calibration

The steps are as follows:

1. Enter the calibration menu, set the standard solution values from low to high concentration.
2. Click to execute the calibration, remove the sensor, rinse it with deionized water, dry it, and place it into prepared standard solution 1. Wait until the measurement data stabilizes, then press the "↵" key to proceed to the next step.
3. Remove the sensor, rinse and dry it again, place it into prepared standard solution 2, wait until the measurement data stabilizes, then press the "↵" key to complete the calibration.
4. After calibration, the controller displays the results. If not passed, refer to " 8 Troubleshooting and resolution".

6.12 Digital nitrate sensor calibration

Calibration of nitrate ion sensors can be done using either a two-point or three-point method, depending on the electrode's measurement range and the medium being tested. Standard solutions are required, and the steps are as follows:

1.Enter the calibration menu, choose between two-point or three-point calibration, set the standard solution values from low to high concentration.

2.Click to execute the calibration, remove the sensor, rinse it with deionized water, dry it, and place it into prepared standard solution 1. Wait until the measurement data stabilizes, then press the "↵" key to proceed to the next step.

3.Remove the sensor, rinse and dry it again, place it into prepared standard solution 2, wait until the measurement data stabilizes, then press the "↵" key to complete the calibration. If opting for a three-point calibration, proceed to step 4.

4.Remove the sensor, rinse and dry it, place it into prepared standard solution 3, wait until the measurement data stabilizes, then press the "↵" key to finish the calibration.

5.Once calibration is complete, the controller displays the results. If not

passed, refer to " 8 Troubleshooting and resolution".

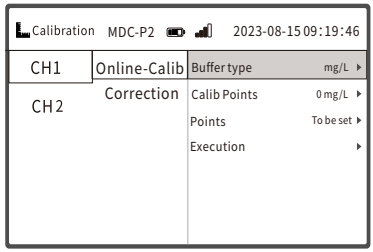


Fig.78 Nitrate calibration

6.13 Digital ammonium sensor calibration

The calibration steps for ammonium ion sensors are the same as those for nitrate ion sensors described in Section 6.12

6.14 Oil Sensor in Water sensor calibration

The calibration of oil signals in water supports single point calibration and two-point calibration.

●1-point calibration

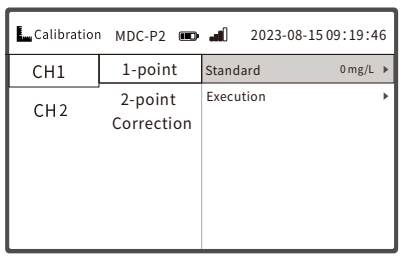


Fig.79 1-point calibration

The steps are as follows:

1. Enter the calibration menu,, set the standard solution value.
2. Click to execute the calibration, remove the sensor, rinse it with deionized water, dry it, and place it into prepared standard solution. Wait until the measurement data stabilizes, then press the "↵" key to complete the calibration.
3. After calibration, the controller displays the results. If not passed, refer to " 8 Troubleshooting and resolution".

- **2-point calibration**

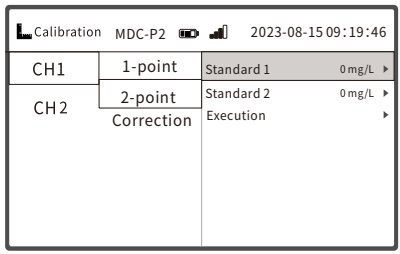


Fig.80 2-point calibration

The steps are as follows:

1. Enter the calibration menu, set the standard solution values from low to high concentration.
2. Click to execute the calibration, remove the sensor, rinse it with deionized water, dry it, and place it into prepared standard solution 1. Wait until the measurement data stabilizes, then press the "↵" key to proceed to the next step.
3. Remove the sensor, rinse and dry it again, place it into prepared standard solution 2, wait until the measurement data stabilizes, then press the "↵" key to complete the calibration.
4. After calibration, the controller displays the results. If not passed, refer to " 8 Troubleshooting and resolution".

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7 Maintain menu

The maintain menu offers Output Hold, Diagnostics, Reset, and System Information. When maintenance work is required on the analyzer, users can select the relevant function based on their needs.

7.1 Output hold

"Hold" is the process of setting the output to a known state during debugging. The output will be a fixed value or the last value. During calibration or other maintenance tasks, it's up to the user to decide whether to activate the hold function. Powering off and restarting won't affect the hold state.

Users can set the hold for both analog outputs of the analyzer. Before replacing the electrode or maintaining the instrument, activating this function will keep the output current constant. The controller can continue to display the measurement value in real-time, but the relay state cannot be modified, preventing inadvertent triggering of alarm chains. Once the hold output is activated, an "H" symbol will appear next to the respective analog output channel on the main interface. This interrupts all ongoing sensor cleaning programs. However, during hold mode, manual sensor cleaning can still be initiated (by toggling the cleaning settings on or off).

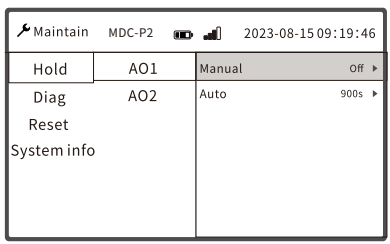

Fig.81 Output hold

There are two modes for Output Hold: Manual and Automatic.

In Automatic mode, you can set the release time for the hold. Once the set time is reached, the controller will automatically exit hold mode and return to normal output status. The range for setting the release time is 0s to 3600s, with a default setting of 900s. If you wish to cancel hold mode while in automatic hold mode, you can do so by turning on manual hold and then turning it off, thus canceling the

current controller's automatic hold status.

To activate automatic hold mode: Enter the automatic mode menu, set the release time, and press "OK". The controller will then immediately activate the hold function, ensuring that the output current remains unchanged.

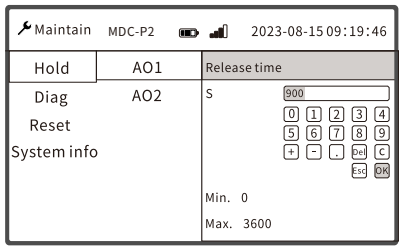

Fig.82 Setting the hold release time

7.2 Diagnostics

This section provides the option to view log events and current simulation functions. All logs are arranged in chronological order and contain event-related information.

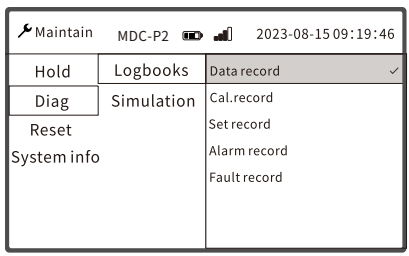

Fig.83 Diagnostics interface

7.2.1 Logbooks

Table 9 Log records

Log Type	Display	Max. Record Count	Delectable
Data record	All Measurement Data	500000	No
Cal. record	Calibration Events	100	Yes
Set record	Setting Events	100	Yes
Alarm record	Alarm Events	120	Yes

Log Type	Display	Max. Record Count	Delectable
Fault record	Fault Events	120	Yes

- **Data record**

Display Modes: List and curve.

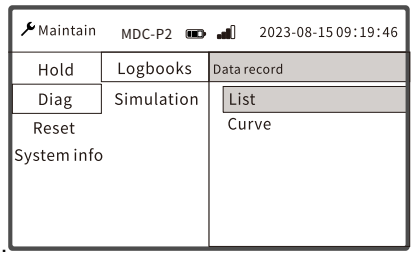

Fig.84 Data record

(1) List

Users can scroll through the list using the "Up" and "Down" keys. They can also search for data records by selecting a specific date and time, avoiding the need to scroll through all the information.

(2) Curve

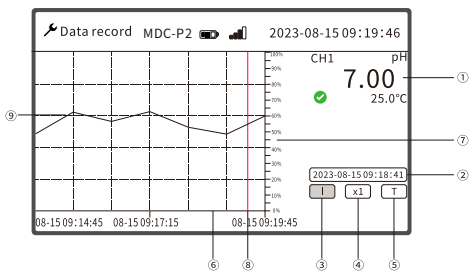

Fig.85 Data record Interface

Table 10 Explanation of data records

No.	Description
1	Measurement data, changes with the cursor.
2	Measurement time, changes with the cursor.
3	Cursor function, press the "Confirm" key to select.
4	Zoom function, after selecting "Confirm", adjust using the "Up" and "Down" keys. Zoom ratios: x1, x2, x4, x8.

No.	Description
5	Time selection, press "Confirm" to input a time to view.
6	X-axis: Time axis (record interval * 300, the record interval can be changed in system settings).
7	Y-axis: Displayed as a percentage of the range.
8	Data cursor axis, displayed after selecting the cursor function. Use the "Up" and "Down" keys to move the cursor and view data.
9	Data curve.

- **Logbooks**

Four types of logs can be queried, displayed, or deleted. Records can be viewed by scrolling through the list using the "Up" and "Down" keys. All records of a particular event type can be deleted.

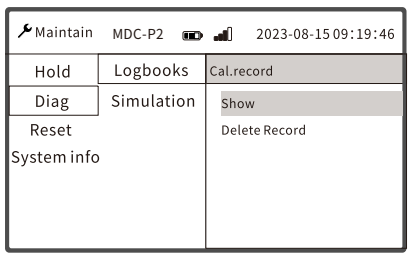

Fig.86 Logbooks Interface

7.2.2 Simulation

When testing, simulate the output current values of the two analog channels separately. This can be used to check whether the analyzer's output current is normal and consistent with the loop current.

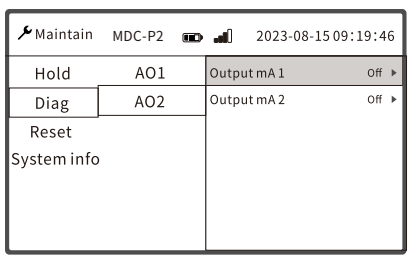

Fig.87 Simulation interface

To enable simulation: After entering the simulation function menu, input the

desired simulation current value and press "OK" to start the current simulation. <> will be displayed next to the simulated output channel on the main interface. Selecting "Off" will turn off the simulation. The simulation function is ineffective when in output maintenance mode.

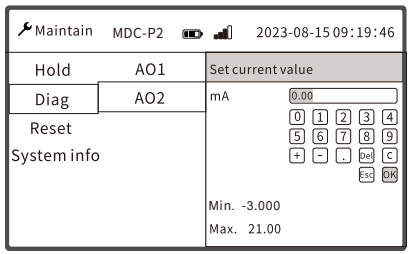

Fig.88 Output current setting

7.3 Reset

This operation will reset the controller parameters to their default values and erase all programmed values.

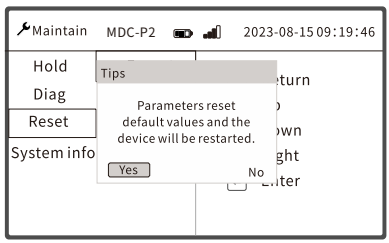

Fig.89 Factory reset

Default values:

(1) Restore all configuration data under the "Analog Output 1/2" interface.

(2) Restore all configuration data under the "Alarm Settings" interface.

(3) Restore all configuration data under the "Communication" interface.

7.4 System information

View device hardware, software information, NB-IoT communication status, and other related details.

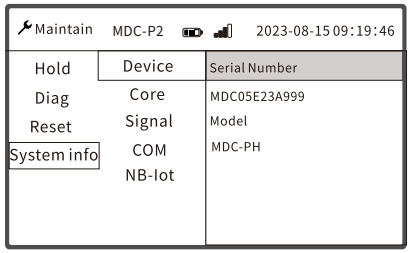

Fig.90 System information

8 Troubleshooting and resolution

8.1 Error codes

Table 11 Error Codes

Error Code	Error Content
100	Analog output 1 current exceeds lower range limit
101	Analog output 1 current exceeds upper range limit
102	Analog output 2 current exceeds lower range limit
103	Analog output 2 current exceeds upper range limit
201	Real-time clock time anomaly
202	Real-time clock battery voltage low
204	F-RAM access failed
205	External Flash access failed

8.2 Common troubleshooting

The table below lists potential problems with the instrument and their solutions. If your issue is not listed or the solution provided doesn't address your concern, please contact us.

Table 12 Troubleshooting and Resolution

Issues	Possible causes	Solutions
Measurement value (zero point) exceeded limit.	Buffer solution contaminated or expired.	Use a new buffer solution.
	Sensor aged.	Activate the sensor.
	Glass bulb contaminated.	Clean the sensor.
	Calibration procedure error.	Recalibrate.
Slope exceeded limit or slow response.	Buffer solution contaminated or expired.	Use a new buffer solution.
	Glass bulb contaminated.	Clean the sensor.
	Reference sensor blocked.	Clean the sensor.
	Sensor malfunction.	Check sensor operation.
	Sensor aged.	Activate the electrode.

Issues	Possible causes	Solutions
Reading out of range.	Controller malfunction.	Connect a pH signal generator in place of the probe to check the controller.
	Electrode failure.	Check sensor with buffer solution.
	Sensor connection incorrect.	Check sensor cable connections.
	Air bubbles inside the sensor glass bulb.	Remove the sensor, gently shake, and reinstall.
Reading unstable.	Controller malfunction.	Connect a pH signal generator in place of the probe to check the controller.
	Sensor or cable too close to high electromagnetic noise equipment.	Use shielded cables or stay away from high electromagnetic noise equipment.
	Solution not grounded.	Properly connect the sensor.
	Air bubbles inside the sensor glass bulb.	Remove the electrode, gently shake, and reinstall.
	External bubbles adhering to the bulb.	Remove and reinsert the electrode.
	Sample pipeline leaking, air entering the line.	Check pipeline sealing.
Slow drift.	Bulb contamination.	Clean the sensor.
	Reference electrode blocked.	Clean the sensor.
	sensor aged.	Activate the sensor.
No current output.	Output not configured.	Check the current output configuration
	Output port malfunction.	Check the output signal through menu : **Maintain/Diag/Simulation**
Sensor not recognized.	Sensor wiring incorrect.	Check the sensor wiring, ensure proper connection.
	Input signal setting error.	Confirm if the current sensor is analog or digital, check if the **Setup/Measure/Inputs** set correctly.

Issues	Possible causes	Solutions
	Digital sensor terminal box wiring error.	If a digital sensor is connected to a controller with a digital terminal box, user-provided terminal box, digital extension cable, or user-provided extension cable, please check if the wiring inside the terminal box or extension cable is correct.
Interface displays red border flashing.	Triggered alarm.	The set value is in an alarm state, refer to Section 5.6.3 "Alarm Settings".

9 Communication protocol

This product provides a standard RS485 serial communication interface and uses the standard Modbus-RTU communication protocol.

9.1 Real-time data

Reading operations use function codes 0x03/0x04.

Table 13 Addresses of measurement input registers

Register Address	Register Name		Number of Registers	Data Type	RS485 Access	Description
0x2004	Sensor access status		1	uint16_t	RO	0: Not accessed 1: Accessed
0x2005	Reserved (for alignment)		1	uint16_t	RO	
0x2006	Measurement Data 1	Measurement Type & Unit	1	uint16_t	RO	High byte: Represents the measurement parameter type (See Table 18) Low byte: Represents unit type (See Table 19)
0x2007		Reserved (for alignment)	1	uint16_t	RO	
0x2008		Measurement Value	2	float	RO	0x7FFFffff （+NAN） indicates an invalid value

Register Address	Register Name		Number of Registers	Data Type	RS485 Access	Description
0x200A		Upper Limit Value	2	float	RO	0x7FFFffff （+NAN） indicates an invalid value
0x200C		Lower Limit Value	2	float	RO	0x7FFFffff （+NAN） indicates an invalid value
0x200E		Reserved	2	float	RO	
0x2010		Reserved	2	float	RO	
0x2012		Reserved	2	float	RO	
0x2014 ~0x2022	Measurement Data 2, same as the description in "Measurement Data 1"					

9.2 Configuration data

9.2.1 RS485 communication

For read operations, function codes 0x03/0x04 are used. For write operations, function codes 0x06/0x10 are used.

Table 14 Addresses of RS485 registers

Register Address	Register Name	Number of Registers	Data Type	RS485 Access	Description
0x1100	Device Address	1	uint16_t	RW	[1, 247], default factory setting is 1
0x1101	Baud Rate	1	uint16_t	RW	Baud rate selection: 1:2400 9:4800 2:9600(Default) 4:19200 6:57600 7:115200

Register Address	Register Name	Number of Registers	Data Type	RS485 Access	Description
0x1102	Data Format	1	uint16_t	RW	Fixed 8-bit data: 1：No parity (1 stop bit) 2：No parity (2 stop bits) 3：Even parity (1 stop bit) 4：Odd parity (1 stop bit) Factory default: 1

9.2.2 Other configuration

For read operations, function codes 0x03/0x04 are used. For write operations, function codes 0x06/0x10 are used.

Table 15 Addresses of other configuration registers

Register Address	Register Name	Number of Registers	Data Type	RS485 Access	Description
System Clock					
0x4602	System Date	2	uint32_t	RW	BCD format, representing year, month, day sequentially. For example, 0x20230705 represents July 5th, 2023. Note: If time is set backward, data records between the old and new times will be lost.

Register Address	Register Name	Number of Registers	Data Type	RS485 Access	Description
0x4604	System Time	2	uint32_t	RW	BCD format, the top 3 bytes represent hour, minute, and second respectively. For example, 0x18400100 represents 18:40:01. Note: If time is set backward, data records between the old and new times will be lost.
RS485 Communication (Additional Configuration)					
0x4606	Byte Order for Transmission	1	uint16_t	RW	0:1-0-3-2 1:0-1-2-3 2:2-3-0-1 3:3-2-1-0 Factory default: 0

9.3 Measurement parameter types

Table 16 Measurement Parameter Types Table

Parameter type	Parameter name	Parameter type	Parameter name
0	None	0x0A	Turbidity
0x01	pH	0x0B	Sludge Concentration
0x02	ORP	0x0C	Residual Chlorine
0x03	Dissolved Oxygen Concentration	0x0E	COD (Chemical Oxygen Demand)
0x04	Dissolved Oxygen Saturation	0x0F	Ammonia Nitrogen
0x05	Salinity	0x10	Nitrate Nitrogen (NO_3 -N)
0x06	Atmospheric pressure	0x20	Water Hardness CaCO3
0x07	Conductivity	0x26	Temperature

Parameter type	Parameter name	Parameter type	Parameter name
0x08	Resistivity	0x2E	Concentration of conductive solution
0x09	TDS		

9.4 Unit Conversion Table

Table 17 Unit conversion table

Unit	ID	Unit	ID
0x00	℃	0x0B	%
0x01	℉	0x0E	MΩ*cm
0x02	mV	0x0F	mmHg
0x03	pH	0x10	NTU
0x04	uS/cm	0x1A	mol/L
0x05	mS/cm	0x1C	pX
0x06	ppm	0x23	S/cm
0x07	ppt (Part per thousand, salinity unit)	0x24	μS/m
0x08	mg/L	0x25	mS/m
0x09	g/L	0x2A	PSU
0x0A	ug/L	0x2B	ppb

9.5 Communication example

The data frame values below are in hexadecimal format, and the transmission byte order is "1-0-3-2".

Host (Computer) sends: 01 03 20 04 00 0A 8F CC

Device (Instrument) responds: 01 03 14 00 01 00 00 01 03 00 00 00 00 40 E0 00 00 41 80 00 00 C0 00 89 D5

Response command annotations:

01 indicates the device address

03 indicates the function code

14 indicates the response data content length of 20 bytes

0001 indicates the electrode access status as connected

0000 indicates a reserved field

0103 high byte indicates the parameter type as pH, low byte indicates the unit type as pH

0000 indicates a reserved field

00 00 40 E0 represents a measurement value of 7.0

00 00 41 80 represents an upper range value of 16.0

00 00 C0 00 represents a lower range value of -2.0

Appendix: pH calibration buffer solution

Table 18 GBT27501 buffer solution table

Temperature (℃)	pH4.00	pH6.86	pH9.18	Temperature (℃)	pH4.00	pH6.86	pH9.18
0	4.006	6.981	9.458	40	4.029	6.838	9.072
5	3.999	6.949	9.391	45	4.042	6.834	9.042
10	3.996	6.921	9.330	50	4.055	6.833	9.015
15	3.996	6.898	9.276	55	4.070	6.834	8.990
20	3.998	6.879	9.226	60	4.087	6.837	8.968
25	4.003	6.864	9.182	70	4.122	6.847	8.926
30	4.010	6.852	9.142	80	4.161	6.862	8.890
35	4.019	6.844	9.105	90	4.203	6.881	8.856

Table 19 NIST buffer solution table

Temperature (℃)	pH4.01	pH7.00	pH10.01	Temperature (℃)	pH4.01	pH7.00	pH10.01
0	4.01	7.12	10.32	40	4.03	6.97	9.89
5	4.01	7.09	10.25	45	4.04	6.97	9.86
10	4.00	7.06	10.18	50	4.06	6.97	9.83
15	4.00	7.04	10.12	55	4.08	6.97	9.81
20	4.00	7.02	10.06	60	4.10	6.98	9.79
25	4.01	7.00	10.01	70	4.12	6.99	9.76
30	4.01	6.99	9.97	80	4.16	7.00	9.74
35	4.02	6.98	9.93	90	4.20	7.02	9.73