Water Jacketed CO2 Incubator

NWCI-102

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Index

1. Safety Measures

- This manual contains important information on using this device. Operators must follow these instructions carefully.
- Keep this manual in a convenient place for users.
- The symbols described in this section will appear on the device and in this manual, aiming to ensure the safe and correct operation of the device and protect users or other individuals from potential harm.

1.1 Icons Explanation

	AC
	Grounding
	Power On
	Power Off
	Warning and Caution
	Caution: High Temperature

1.2 Safety Precaution Measures

- This equipment must not be placed outdoors. If it gets wet from rain, it may cause electric leakage and electric shock.
- This equipment should only be installed by qualified engineering or maintenance personnel. Installation by unqualified personnel may result in electric shock or fire.
- The equipment should be installed on a solid, level floor or platform. If the floor is not solid or the installation location is unsuitable, the equipment may tip over or fall, causing injury.
- Do not install this equipment in damp locations or places where it may be splashed with water. Otherwise, reduced insulation may cause electric leakage or electric shock.
- Do not install this equipment in places where flammable or volatile materials are stored. Otherwise, it may cause an explosion or fire.

- Do not install this equipment in places with acidic or corrosive gases. Otherwise, corrosion may cause electric leakage or electric shock.
- Use a power outlet with a grounding wire to prevent electric shock. If the power outlet is not grounded, a qualified engineer must install a grounding wire.
- Do not ground this equipment through gas, water pipes, telephone lines, or lightning rods. Incomplete grounding of these pipes and lines may cause electric shock.
- Use the dedicated power supply indicated on the equipment's nameplate. Using any other voltage or frequency not specified on the nameplate may cause electric shock or fire.
- If the container cannot be sealed, do not store volatile or flammable items in this equipment, as it may cause an explosion or fire.
- Do not insert metal objects such as nails or wires into any openings or gaps in this equipment, as accidental contact with moving parts may cause electric shock or injury.
- When storing toxic, harmful, or radioactive materials, use this equipment in a safe area. Improper use may pose health and environmental hazards.
- Before repairing or maintaining this equipment, be sure to turn off the power switch (if any) and disconnect the power supply to prevent electric shock or injury.
- Do not touch any electrical parts or switches such as power plugs with wet hands, as this may cause electric shock.
- Ensure that you do not inhale any drugs or suspended particles around the equipment during maintenance, as this may harm your health.
- Do not splash water directly on the equipment. Otherwise, it may cause an electric shock or short circuit.
- Do not place containers with water on the equipment. Otherwise, spilled liquid may cause electric leakage or electric shock.
- Do not drag, twist, or bind the power cord, and do not damage the power plug. Damaged power cords or plugs may cause fire or electric shock.
- Do not use power cords with loose plugs. Such power cords may cause fire or electric shock.
- Users must not disassemble, repair, or modify the equipment without authorization or guidance. Improper operation may cause fire or injury.
- If the equipment is not operating normally, unplug the power plug. Continuing to operate in an abnormal state may cause electric shock or fire.
- When unplugging the power plug from the socket, hold the power plug firmly and do not pull the power cord. Pulling the cord may cause electric shock or fire due to a short circuit.
- Before moving the equipment, unplug the power plug. Be sure not to damage the power cord, as a damaged power cord may cause electric shock or fire.
- When the equipment is not used for a long time, unplug the power plug. Otherwise, deterioration of the insulator may cause electric shock, leakage, or fire.
- If the equipment is left idle in an unsupervised area for a long time, ensure that children cannot approach the equipment, and that the door cannot be fully closed.
- Disposal of the equipment should be carried out by appropriate personnel. The door should be removed to prevent accidents such as suffocation.
- Do not place plastic packaging bags within the reach of children, as plastic bags may cause suffocation.

- After cleaning the dust off the power plug, insert the plug firmly into the socket. A dusty plug or improper connection may cause overheating or sparking.
- After a power outage or power cut, check the temperature, timer, and other settings when restarting the equipment. Otherwise, changes in settings may damage stored items.
- If the equipment has not been used for a long time after purchase, store it in a ventilated, dry environment. Otherwise, it may be damaged and not function properly when you use it again.
- When moving the equipment, prepare appropriate moving tools or qualified personnel, and ensure that the equipment does not tip over to prevent damage or injury.
- Ensure that there is sufficient width and height in the moving passage. If moving to the second floor or above, ensure that the elevator can accommodate the size of the equipment and ensure the safety of the equipment. Also, ensure there is enough space for installing the equipment and for personnel to use it.
- If the container cannot be sealed, do not store corrosive substances such as acids or alkalis in this equipment, as it may cause corrosion of internal components and electrical parts.

2. Introduction

Water Jacketed CO2 Incubator NWCI-102 is a microprocessor-controlled chamber employed in conventional science labs that deal with cell or tissue culture. The chamber is simple and advantageous to utilize and rely on heated water within the incubator's walls to maintain a consistent temperature inside the chamber. It gives the advantages of contamination control, flexible temperature consistency for even the most demanding incubation.

3. Features

- ✓ Round angular working chamber, thus easy to clean
- ✓ Safety protection system against overheating
- ✓ Superior quality stainless steel inner chamber with corrosion resistance
- ✓ Equipped with 5W UV germicidal lamp, inhibits contamination

4. Specifications

Model No.	NWCI-102
Volume	240L
Type	Water-Jacketed
Shelves	3
Control Mode	Intelligent control
Temperature range	+5 °C ~ 60 ºC
Temperature accuracy	± 0.3ºC
Temperature resolution	0.1ºC
CO2 Range	0-20%
Accuracy of CO2	0.001
Homogeneity of CO2	At 5% CO2, ±0.1ºC
CO2 Recovery	≤ concentration value x 1.2min
Humidification mode	Natural Evaporation
Dimension	600 × 550 × 750 mm

5. Applications

Common fields of application include tissue building, in vitro preparation, neuroscience, cancer research and other mammalian cell research to offer sterile conditions.

6. Instrument Introduction

6.1 Structural diagram

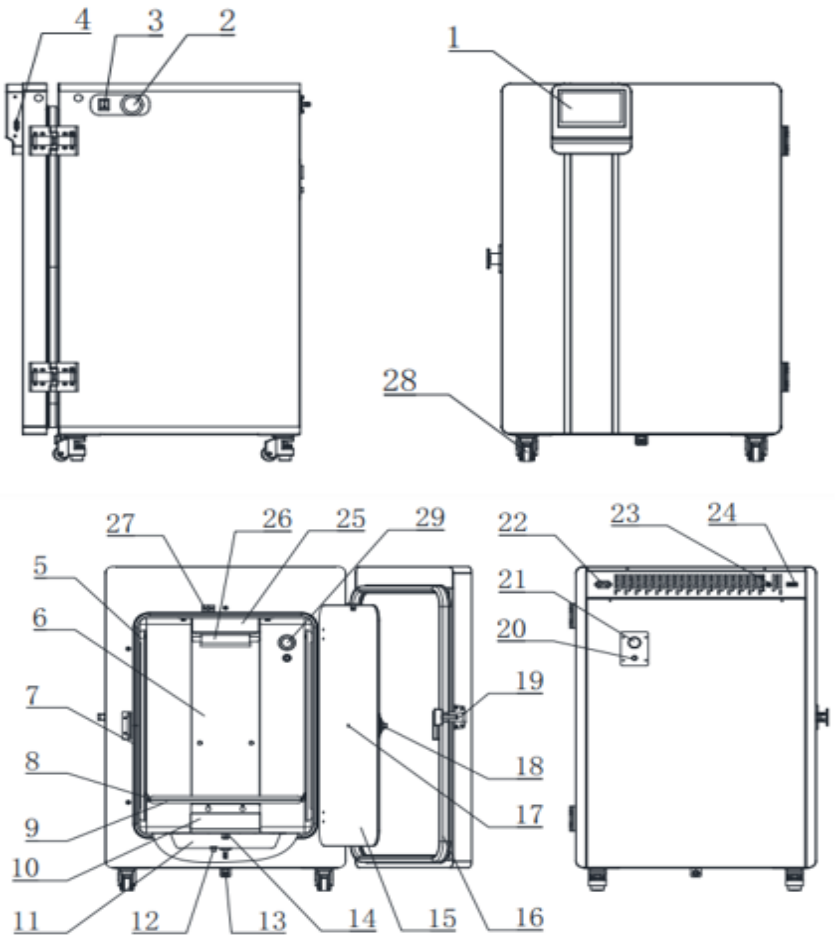


Figure-1

1) Touch Screen
2) Thermal Protection Switch
3) Power Switch
4) USB Port
5) Support Bracket
6) Rear Air Duct Panel
7) Glass Door Seal
8) Shelf Bracket
9) Shelf
10) Bottom Air Duct Panel
11) Water Tray
12) Liquid Level Switch
13) Outlet pipe
14) Water Tray Cover
15) Glass Door
16) Outer Door Seal
17) Concentration Sampling Port
18) Glass Doorknob
19) Door Lock
20) Equalizing Port
21) Test Channel
22) Power Cord Socket
23) Inflation Connector
24) 485 Communication Port
25) Air Duct Upper Plate
26) Filter
27) Door Magnetic Switch
28) Adjustable Caster
29) Silicone Plug

6.2 Concentration Sampling Port

In **Figure 1**, 17 is the sampling port, which can be used to detect the CO_2 concentration inside the box. Before measurement, first remove the silicone plug from the sampling port, insert the measurement tube through this port to the geometric center of the box, and then measure the concentration inside the box. Calibrate the concentration sensor based on the actual measured concentration.

6.3 Test channel

As shown in **Figure 1**, 21 is the test channel, which has a silicone plug on the inside. This channel can be used for wiring or testing.

6.4 Water Tray

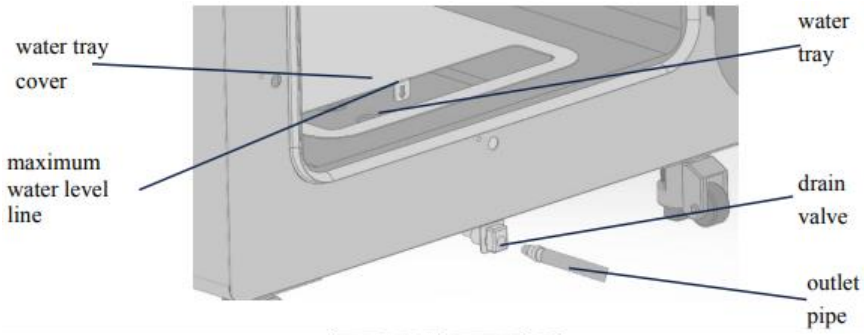


Figure-2

As shown in **Figure 2**, the sink is located at the bottom of the incubator, with a sink cover on top. Water is added to the sink through the hole at the front of the sink cover, ensuring that the water level does not exceed the mark on the sink cover. To drain the water, insert the drainpipe into the drain valve, and the water will flow out automatically. After draining, press the drain valve switch to remove the drainpipe.

7. Installation

7.1 Unboxing and Inspection

After opening the package, check the equipment. Inspect the incubator's appearance and all components for any damage or missing parts.

7.2 Installation environment requirements

The working environment for the instrument must meet the following requirements:

1) **Ambient temperature:** 18℃ - 30℃.
2) **Relative humidity:** ≤80%.
3) **Atmospheric pressure:** From 86kPa to 106kPa.
4) No strong vibrations or corrosive gases in the surroundings.
5) Avoid direct sunlight or other sources of heat and cold.
6) The placement surface should be sturdy and level.
7) Maintain a distance of at least 20cm between the equipment and the wall to facilitate heat dissipation and cleaning.
8) The equipment releases heat during continuous operation, which can change the indoor temperature. Additionally, opening and closing the door during operation may cause a small amount of CO_2 to leak into the room, so ensure good ventilation.

7.3 Handling

To prevent accidents and injuries during transportation, wear protective gear such as safety shoes and gloves. Before transporting, secure or remove any movable parts inside the equipment, such as shelves and shelf brackets, to prevent them from moving inside the equipment and damaging the inner door glass or other components. The stress points for lifting should be at the four corners of the equipment body, not on the outer door, to avoid deforming the outer door and affecting its sealing performance. Avoid strong vibrations during transportation, and do not overturn or collide with the equipment.

7.4 Installation

7.4.1 Installation of shelves and shelf brackets

Unfasten the shelf and shelf bracket and insert the shelf bracket into the hole of the shelf support as needed, symmetrically. There are front and rear limiters and guide rails on the back of the shelf. Insert the shelf guide rails from the front of the box into the shelf bracket, push the shelf backward, lift the front of the shelf after it hits the rear limiter, and continue to push it backward after passing the rear limiter until it hits the front limiter. When placing items, pull the shelf forward until it hits the rear limiter. After placing the items, push the shelf backward until it hits the front limiter.

7.4.2 Leveling the Equipment

The four casters at the bottom of the equipment can be adjusted individually to level the equipment. Rotate the ratchet to adjust the level. The casters are suitable for short-distance movement on flat surfaces. For long distances or uneven surfaces, use transport tools to avoid damaging the incubator.

7.4.3 Connecting the CO_2 Supply

Install the CO_2 pressure regulator on the CO_2 cylinder, ensuring there are no leaks at the connection. Use the provided rubber hose (inner diameter Φ8, pressure resistance 0.2MPa) to connect the output of the pressure regulator to the **"CO_2 Inlet"** on the back of the equipment, securing it with hose clamps. Before connecting the rubber hose, place the hose clamps on both ends of the hose. If connecting directly to a CO_2 supply line instead of a cylinder, ensure the gas source is stable with a pressure between 0.05MPa and 0.1MPa.

7.4.4 Power supply connection

⚠ **Warning:** The power socket must be reliably grounded to prevent electric shock!

Ensure there is a reliable power source near the equipment. The power supply must meet the equipment's requirements, and the power circuit should have a fuse or circuit breaker installed. After ensuring power safety, insert one end of the power cord into the socket on the back of the equipment, and then plug the other end into the power outlet.

7.4.5 RS485 Communication Port Connection

The incubator has an RS485 communication port on the back, supporting monitoring platforms, apps, and SMS alert functions (one of these can be selected). Connect one end of the communication cable to this port and the other end to the module. Ensure a reliable connection to avoid communication failures.

7.4.6 USB Port Connection

The control box on the side of the incubator's outer door has a USB port. After inserting a USB drive, you can export operation logs, historical data, and alarm records through the corresponding interface on the touchscreen.

Note: Remove any transportation protection devices and adhesive tapes from inside the chamber and the door.

8. Working Principle

A Water Jacketed CO_2 incubator is a device that provides stable temperature, stable CO_2 concentration, and high relative humidity for the in vitro culture of cells and tissues by simulating a similar growth environment for cells and tissues in the body within the incubator. It generates heat by heating the outer wall of the sealed chamber through electric heating elements and then uses heat conduction to heat the gas in the workspace. The temperature is then evenly distributed by the built-in fan. The temperature is controlled by a temperature control system consisting of a temperature sensor and a temperature controller, which maintains a constant temperature. The CO_2 concentration is controlled by a CO_2 concentration sensor and a gas supply system, while a water pan at the bottom of the incubator ensures high relative humidity.

9. Operations

9.1 Preparations before operation

Before starting the device, ensure the following:

1) Check if the seals on the inner and outer doors are intact and ensure good sealing after closing the doors.
2) Add an appropriate amount of sterile distilled water to the water tank at the bottom of the incubator chamber. Do not exceed the maximum indicated water level.
3) Adjust the shelf position according to the experimental requirements.
4) Check if the power supply and communication interfaces are reliably connected.
5) Check if the CO_2 gas line is reliably connected. Adjust the pressure-reducing valve to ensure the CO_2 cylinder pressure is not less than 5MPa. Then slowly adjust the pressure-reducing valve to set the CO_2 supply pressure to 0.05MPa - 0.1MPa, maintaining a stable CO_2 gas source.

⚠ **Attention:** To protect the cultured samples, users must clean or sterilize the workroom appropriately before operation.

9.2 Operating procedure

1) Turn on the device power switch.
2) Set the temperature and CO_2 concentration values on the touchscreen.
3) Click **"Run"** to start the device.
4) Once the temperature and CO_2 values stabilize, place the culture items on the shelves for incubation.
5) After incubation, remove the culture items.
6) Turn off the CO_2 gas source.
7) Turn off the power switch and unplug the power cord.
8) Connect the drainpipe to the front drain valve and drain the water from the tank.
9) Clean the incubator chamber, then keep the glass door and outer door open to allow the device to dry.

⚠ **Attention:** The number of samples placed on the shelf should not exceed 70% of the shelf area to avoid affecting the air circulation. Open the door as little as possible during the culture process to avoid parameter fluctuations and the introduction of contamination. CO_2 will overflow when opening and closing the door, so ensure good ventilation in the laboratory.

10. Software Operations

Attention:
Before using the equipment, carefully and thoroughly read the following specific operating instructions. Failure to do so may result in accidents due to operational errors.

10.1 Main Interface Introduction

Turn on the power switch, and after a few seconds, the main interface shown in **Figure 3** will appear.

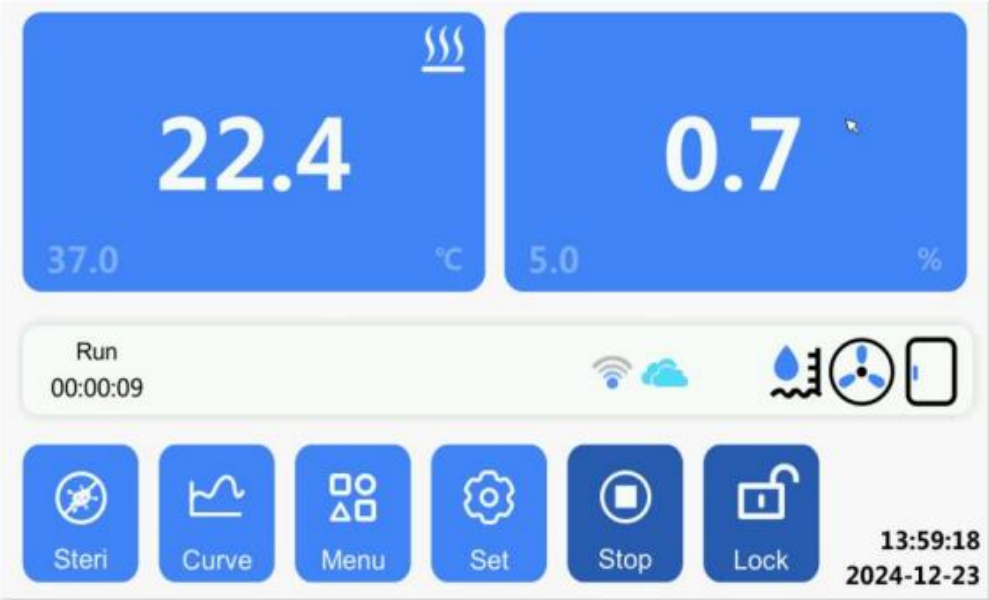
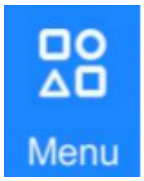


Figure-3 Main Interface

The explanation of the icons in the main interface can be found in **Table 1** below.

Table 1: Main Interface Icons

Icons	Name	Explanation
	Temperature	The small text in the lower left corner indicates the set temperature, while the large text in the middle shows the real-time temperature inside the box.
	CO_2 Concentration	The small text in the lower left corner indicates the set concentration, while the large text in the middle shows the real-time concentration inside the box.
	Fan	Displays the working status of the glass door.

	Glass Door	Displays the opening status of the glass door.
	Sterilization	Click this icon to enter the high-temperature and high-humidity sterilization interface.
	Curve	Click this icon to enter the curve interface.
	Menu	Click this icon to enter the menu interface.
	Settings	Click this icon to enter the settings interface to set the temperature and CO_2 concentration.
	Run/Stop	Click this icon to run/stop the program.
	Unlock/Lock	Click this icon to unlock/lock the keys.
	Heating	This icon lights up when the incubator is heating.
	CO_2 Filling	This icon lights up when CO_2 is being filled in the incubator.
09:13:50 2024-11-05	System Time Display	Displays the current time.

10.2 Operating Instructions

10.2.1 Temperature and CO_2 concentration settings

Click the **"Settings"** icon in the main interface to enter the settings interface shown in **Figure 4**. Click the box to set the value. After completing the setting, click the **"Return"** icon to return to the main interface.

Figure-4 Setting Interface

Set time: Set the running time value, setting range (0-9999h), a value of 0 means continuous operation.
Set temperature: Set the temperature value to be used, setting range (0-60℃).
Set CO_2: Set the CO_2 concentration value to be used, setting range (0-20%).

10.2.2 Curve

Click the **"Curve"** Graph icon in the main interface to enter the curve interface shown in **Figure 5**. The horizontal axis in the interface is the time axis, and the vertical axis is the temperature and concentration axis (both are displayed on the same axis). Click the area corresponding to the minimum and maximum values of the vertical axis to change the vertical axis value range. Unlike the historical curve in the historical data, the real-time curve is generated in real-time, so the curve cannot be operated (zoom in and out, move left and right, up and down).

Figure-5 Curve Interface

10.2.3 Sterilization

1) Click the **"Sterilization"** Graph icon in the main interface to enter the sterilization setting interface shown in **Figure 6.**
2) This product adopts high temperature and moist heat sterilization.
3) After carefully reading the **"Sterilization Instructions"** and completing the relevant operations, click the **"Start"** Graph icon, confirm the relevant operations, and enter the sterilization work interface. The sterilization process is divided into three stages: Heating, sterilization, and cooling. The current temperature and running time are displayed in real-time in the upper left corner of the interface. The entire operation process takes about 25 hours. Press **"Stop"** to terminate the sterilization program.
4) After sterilization is completed, enter the sterilization end interface shown in **Figure 7**, and press **"End"** to exit.
5) Opening the door or control failure during the sterilization process will cause the sterilization to be interrupted. After the interruption, click the **"Return"** Graph icon to exit. Since it is a 90℃ high temperature and high humidity sterilization, the door needs to be lowered to a safe temperature after the interruption to avoid burns.

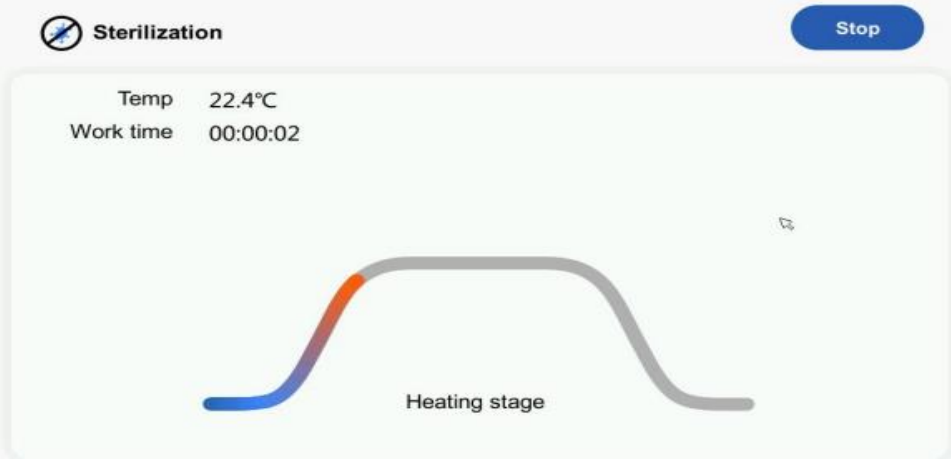


Figure-6 Sterilization operation interface

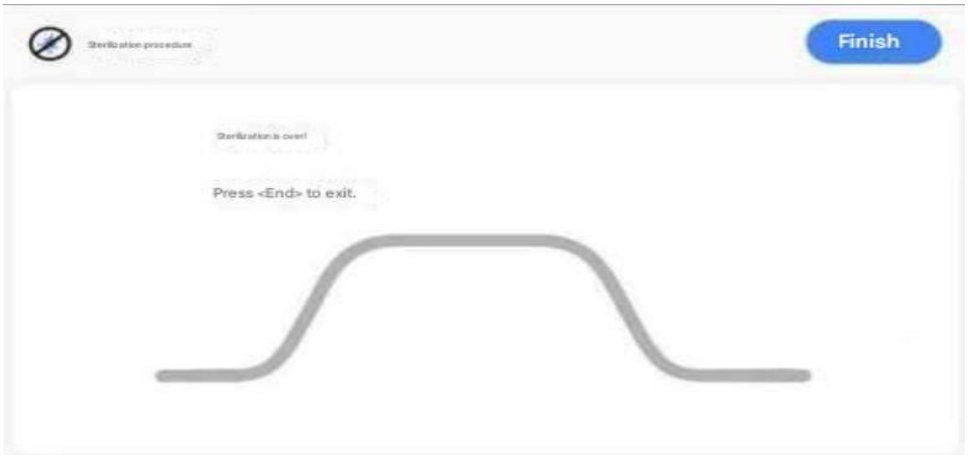


Figure-7 Sterilization end interface

10.2.4 Operation Log

Click the **"Menu"** icon in the main interface to enter the menu interface shown in **Figure 8.**

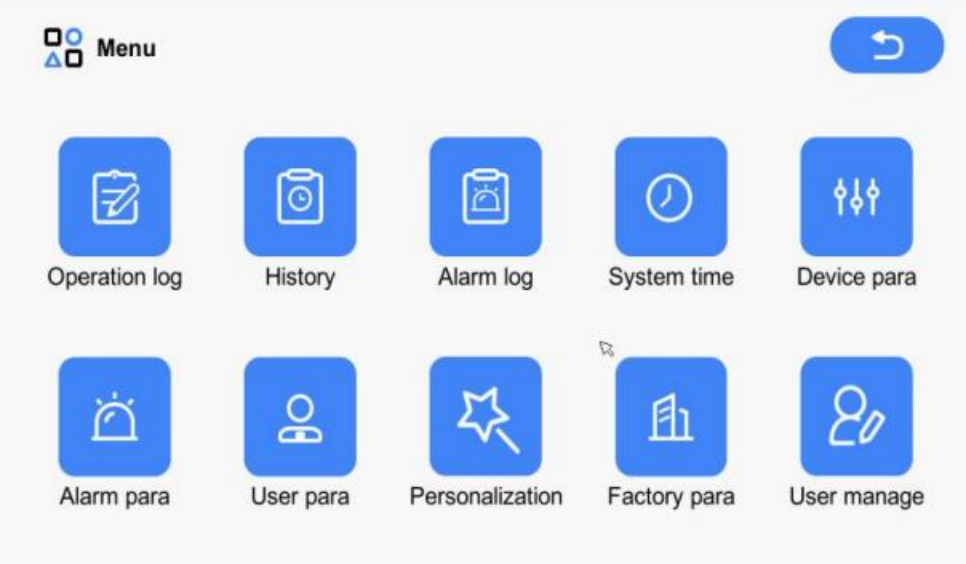


Figure-8 Menu Interface

In the **"Menu"** interface, click the **"Operation Log"** icon to enter the operation log interface shown in **Figure 9**. In the interface, you can view the user's operation content. After inserting the USB flash drive, click the **"Export"** icon to choose to export the operation log.

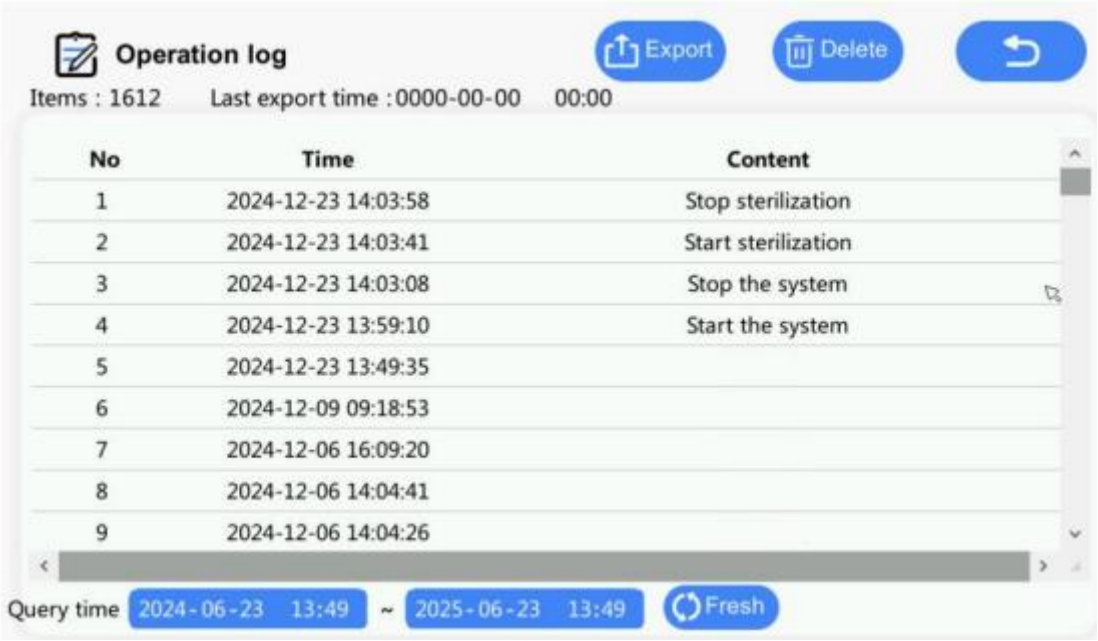


Figure-9 Operation Log Interface

10.2.5 Historical Data

In the **"Menu"** interface, click the **"Historical Data"** icon to enter the historical data interface shown in **Figure 10** and **Figure 11.** In the interface, you can view the temperature and concentration historical data. After inserting the USB flash drive, click the **"Export"** icon to export the historical data.

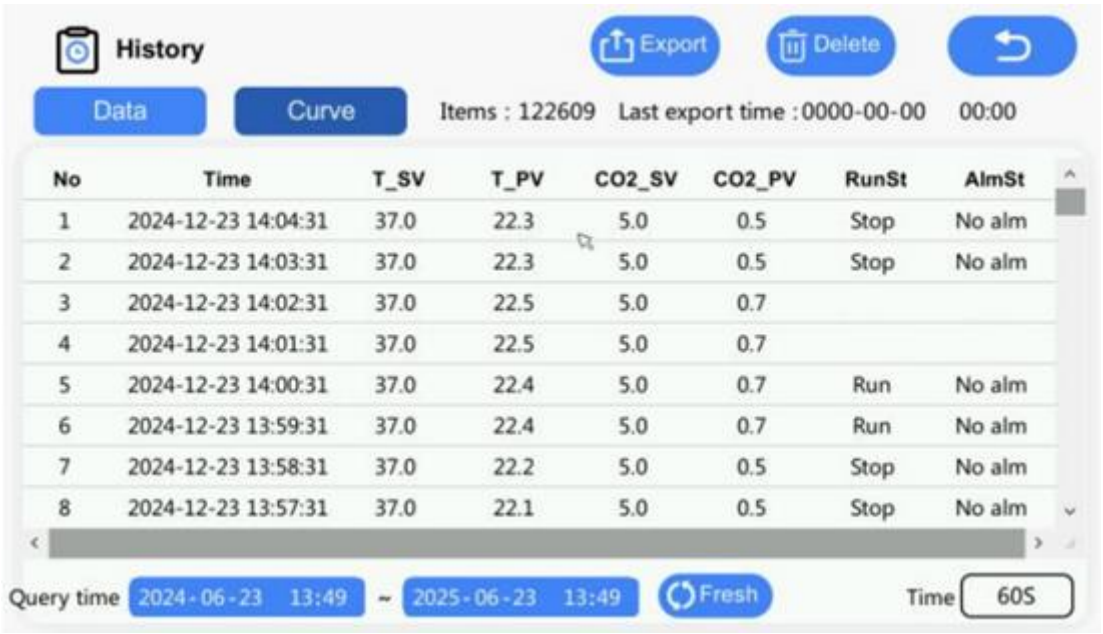


Figure-10 Historical data

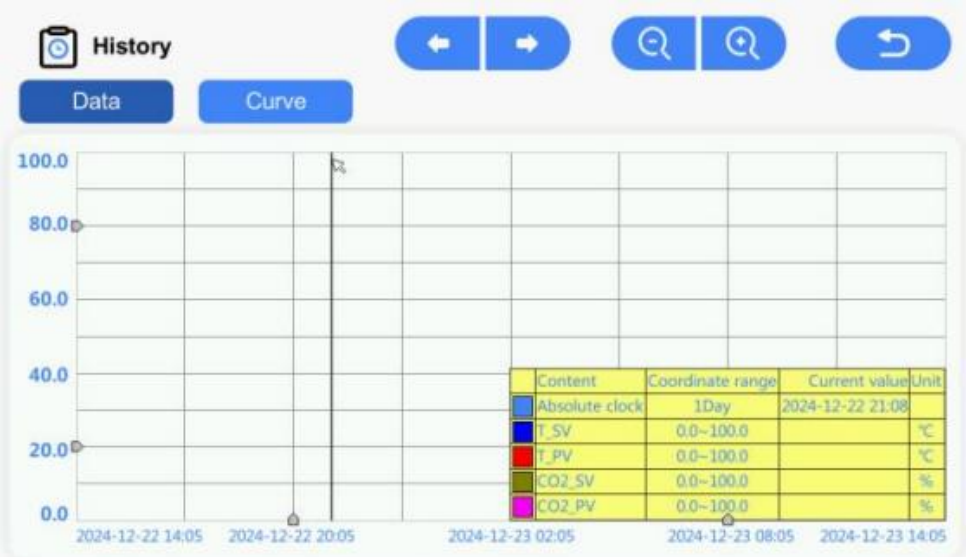


Figure-11 Historical Curve

Table 2: Parameter Description

Number	Content	Description
1	**[Export]** Button	When the USB is connected (and if user management permissions are enabled, the logged-in user must have "Export" permissions), you can click the data export button to pop up the data export confirmation dialog box; then click **"OK"** to export the data.
2	**[Delete]** Button	If user management permissions are enabled, the logged-in user must have **"Delete"** permissions to click and pop up the dialog box to confirm whether to delete historical data.
3	**[Curve]** Button	Click to enter the **[Historical Curve]** interface.
4	Time Setting Bar	Click the corresponding text box to set the start and end times of the historical data you want to view.
5	Data Recording Interval	Click to set the data recording interval.

10.2.6 Alarm Record

Click the **"Alarm Record"** icon in the **"Menu"** interface to enter the alarm record interface shown in **Figure 12.** The alarm content can be viewed in the interface. After inserting the USB flash drive, click the **"Export"** icon to export the alarm record.

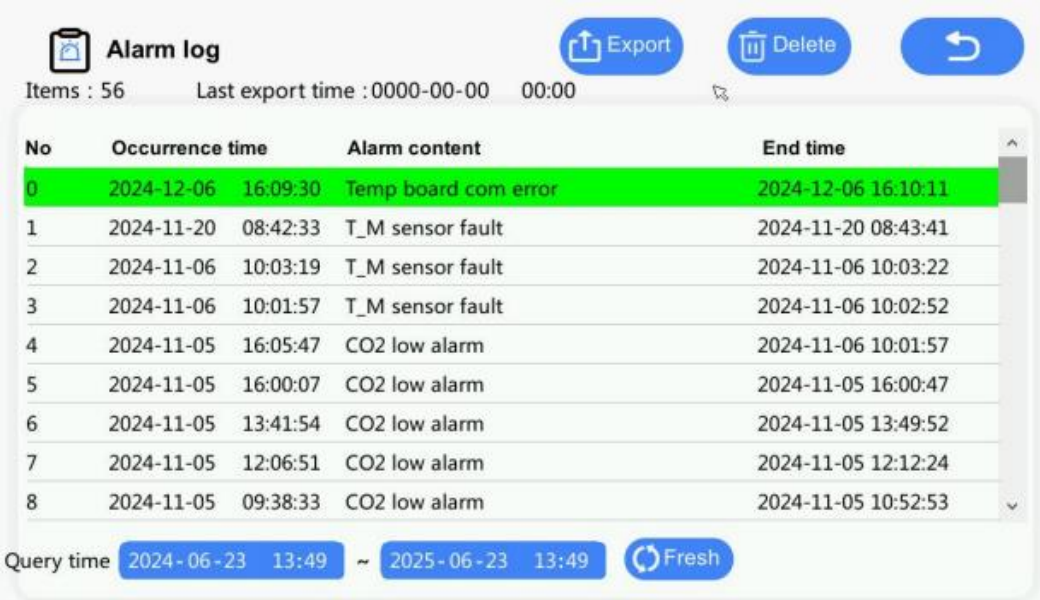


Figure-12 Alarm record interface

Table 3: Parameter description

Number	Content	Description
1	**[Export]** Button	When the USB is connected (and if user management permissions are enabled, the logged-in user must have "Export" permissions), you can click the data export button to pop up the data export confirmation dialog box; then click **"OK"** to export the data.
2	**[Delete]** Button	If user management permissions are enabled, the logged-in user must have **"Delete"** permissions to click and pop up the dialog box to confirm whether to delete alarm records.
3	**[Refresh]** Button	Click to refresh the alarm records.
4	Time Setting Bar	Click the corresponding text box to set the start and end times of the alarm records you want to view.

10.2.7 System time

In the **"Menu"** interface, click the **"System Time"** icon to enter the System Time interface shown in **Figure 13**, where you can modify the system time.

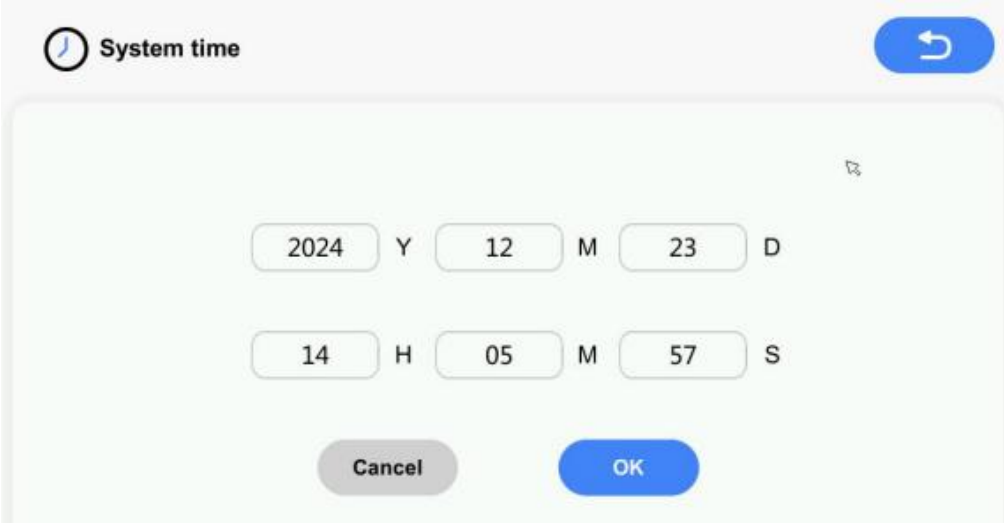


Figure-13 System time interface

10.2.8 Alarm Parameters

In the "**Menu**" interface, click the "**Alarm Parameters**" icon to enter the Alarm Parameters interface shown in **Figure 14**, and click the box to set the value in **Figure 15.**

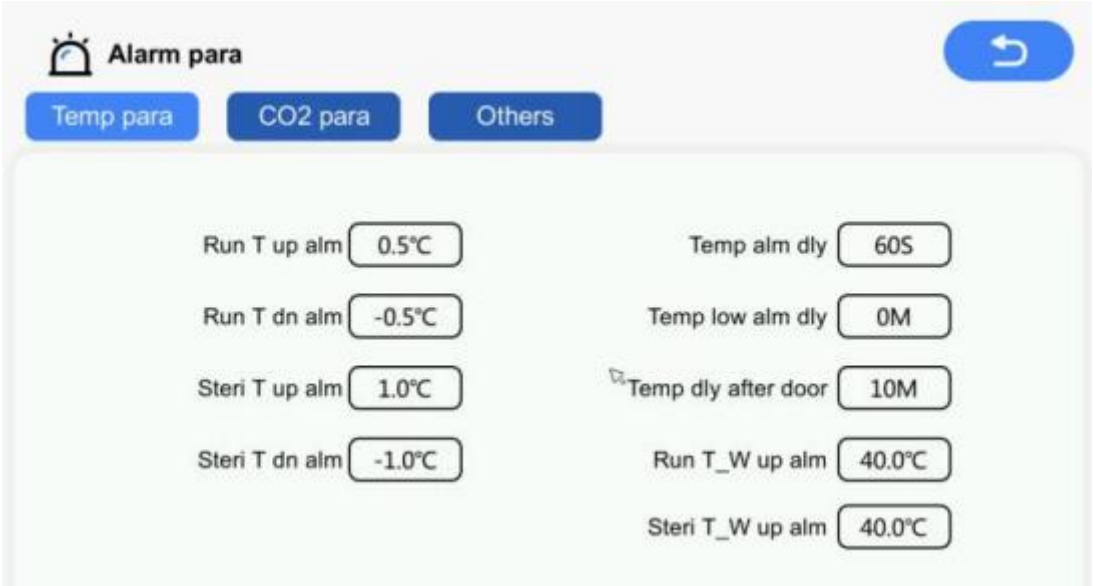


Figure-14

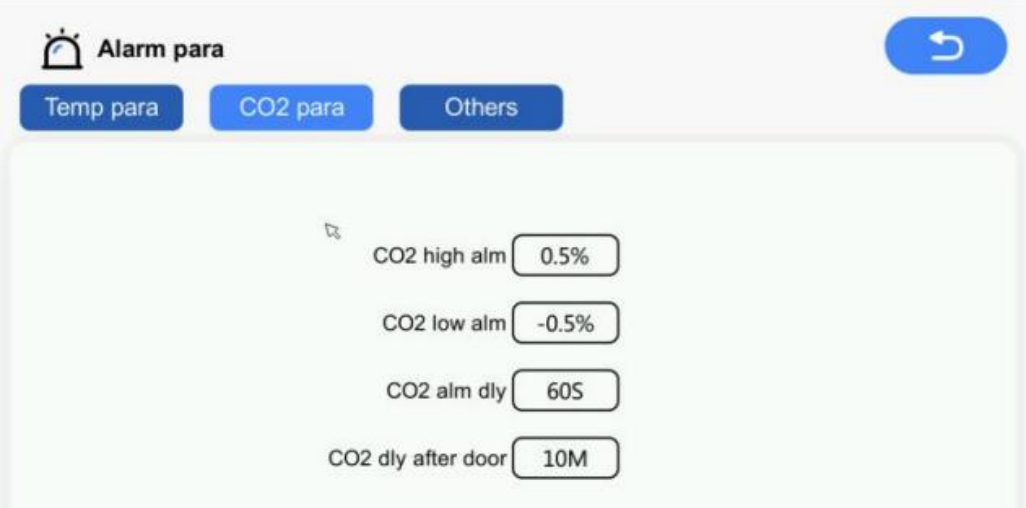


Figure-15 Alarm parameters interface

Table 4: Parameter description

Name	Function	(Setting Range) Initial value
Cultivation Stage Over-Temperature Alarm Deviation (ALH)	During operation, when the measured temperature inside the box > set temperature + ALH, and it lasts for the "temperature alarm delay" time, there will be an over-temperature alarm, the buzzer will sound, and the system will cut off the heating alarm relay.	(0.0 ~ 40.0℃) 0.5
Cultivation Stage Under-Temperature Alarm Deviation (ALL)	During operation, when the measured temperature inside the box < set temperature + ALL, and it lasts for the "temperature alarm delay" time, there will be an under-temperature alarm, and the buzzer will sound; if this parameter is 0, there is no under-temperature alarm function.	(-40.0 ~ 0.0℃) -0.5
Sterilization Stage Over-Temperature Alarm Deviation (ALH)	During high-temperature or humid-heat sterilization, when the measured temperature inside the box > set temperature + ALH, and it lasts for the "temperature alarm del ay" time, there will be an over-temperature alarm, the buzzer will sound, and the system will cut off the heating alarm relay.	(0.0 ~ 40.0℃) 1.0
Sterilization Stage Under-Temperature Alarm Deviation (ALL)	During high-temperature or humid-heat sterilization, when the measured temperature inside the box < set temperature + ALL, and it lasts for the "temperature alarm del ay" time, there	40.0 ~ 0.0℃) -1.0

	will be an under-temperature alarm, the buzzer will sound; if this parameter is 0, there is no under-temperature alarm function.	
Temperature Alarm Delay	The alarm will only occur after the over-temperature, under-temperature, or water temperature over-temperature alarm has lasted for this time.	(0 ~ 9999 seconds) 60
Under-Temperature Alarm Delay	After the device starts running, if the current measured temperature inside the box < set temperature + ALL after running for this time, there will be an under-temperature alarm; if this parameter is 0, this function is disabled.	(0 ~ 999 minutes) 0
Temperature Alarm Detection Delay After Door Opening	After opening and then closing the door, the detection of over-temperature and under-temperature alarms will be delayed by this time	(0 ~ 999 minutes) 10
Cultivation Stage Water Temperature Over-Temperature Alarm Deviation (ALH)	During operation and when the water temperature function is enabled, if the measured water temperature > set water temperature + ALH, the system will cut off the heating relay.	(0.0 ~ 200.0℃) 5 0.0
Sterilization Stage Water Temperature Over-Temperature Alarm Deviation (ALH)	During high-temperature or humid-heat sterilization and when the water temperature function is enabled, if the measured water temperature > set water temperature + ALH, the system will cut off the heating relay.	(0.0 ~ 200.0℃) 60.0
Over-Concentration Alarm Deviation (ALH)	CO_2 over-concentration alarm, when the CO_2 measurement value > CO_2 set value + ALH, and it lasts for the "CO_2 alarm delay" time, there will be a CO_2 over-concentration alarm, and the buzzer will sound.	(0.0 ~ 20.0%) 0.5
Under-Concentration Alarm Deviation (ALL)	When the "CO_2 measurement value < CO_2 set value + ALL" starts detecting the CO_2 under-concentration alarm.	(-20.0 ~ 0.0%) -0.5
High-Concentration Alarm Delay	The CO_2 over-concentration alarm will only occur after it has lasted for this time.	(0 ~ 9999 seconds) 60
Door Opening Alarm Del ay	If the door is continuously open for more than this time during operation, there will be a door opening timeout alarm, and the buzzer will sound. **Note:** If this parameter is 0, there is no door control alarm.	(0 ~ 9999 seconds) 60

10.2.9 User Parameters

Click the **"User Parameters"** tab to enter the user parameters interface shown in **Figure 16**, **Figure 17**, and **Figure 18**. Click the boxes to set the values in the Figures.

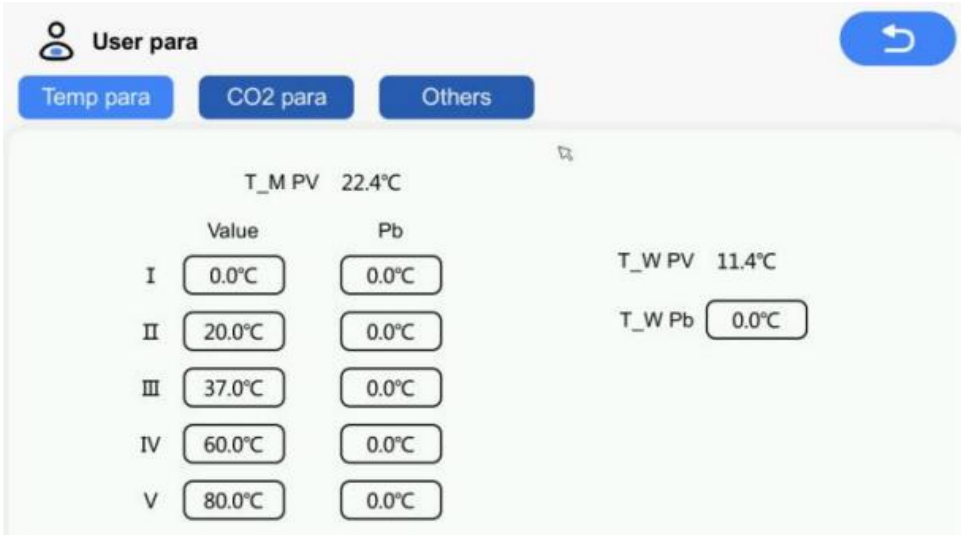


Figure-16 Temperature Parameters Interface

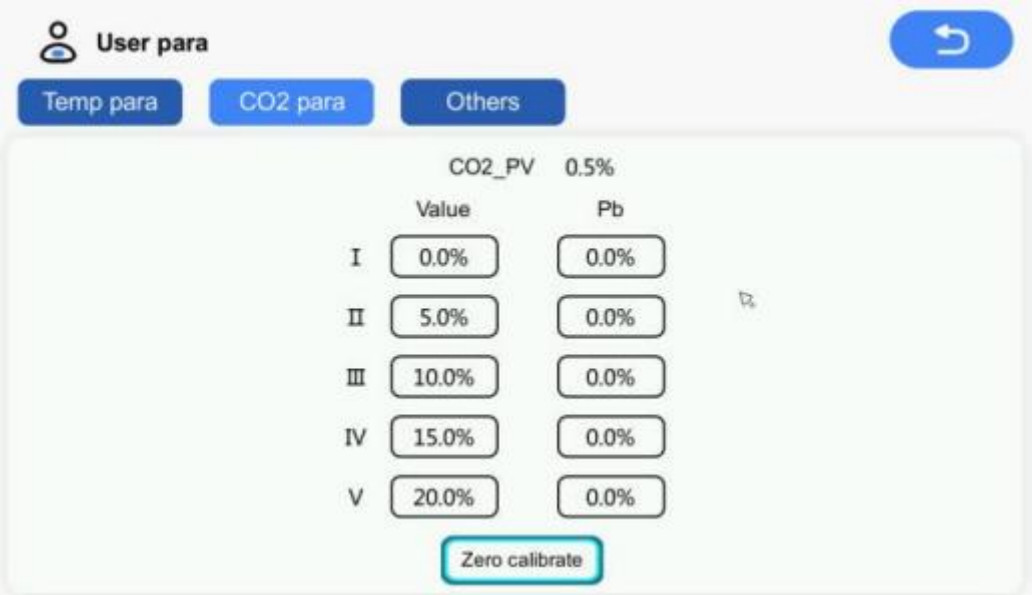


Figure-17 CO_2 parameters interface

Figure-18 Other parameters interface

Table 5: Parameters description

Name	Function	(Setting Range) Initial Value
Correction Point 1	The default value is 0.0℃, which is the first calibration point.	(-20.0℃ ~ Correction Point 2) 0.0
Correction Point 2	The default value is 20.0℃, which is the second calibration point.	(Correction Point 1 ~ Correction Point 3) 20.0
Correction Point 3	The default value is 37.0℃, which is the third calibration point.	(Correction Point 2 ~ Correction Point 4) 40.0
Correction Point 4	The default value is 60.0℃, which is the fourth calibration point.	(Correction Point 3 ~ Correction Point 5) 60.0
Correction Point 5	The default value is 80.0℃, which is the fifth calibration point.	(Correction Point 4 ~ 220.0℃) 80.0
Correction Deviation 1	The default value is -0.5℃, which is the thermometer value at the first correction point minus the system measurement value.	(-20.0 ~ 20.0℃) -0.5
Correction Deviation 2	In this example, input 0.3℃, which is the thermometer value at the second correction point minus the system measurement value.	(-20.0 ~ 20.0℃) 0.3

Correction Deviation 3	In this example, input 1.0℃, which is the thermometer value at the third correction point minus the system measurement value.	(-20.0 ~ 20.0℃) 1.0
Correction Deviation 4	In this example, input -0.5℃, which is the thermometer value at the fourth correction point minus the system measurement value.	(-20.0 ~ 20.0℃) -0.5
Correction Deviation 5	In this example, input -1.0℃, which is the thermometer value at the fifth correction point minus the system measurement value.	(-20.0 ~ 20.0℃) -1.
Water Temperature Deviation Correction	Correction value = Actual water temperature value - System measured water temperature value	(-40.0 ~ 40.0℃) 0.
Correction Points 1-5	The concentration correction method is similar to temperature.	0.0%
Correction Deviations 1~5		0.0 (-20.0 ~ 20.0%)
Sensor Zero Calibration	Click to perform zero calibration of the CO_2 sensor.	
Alarm Sound	Check whether the buzzer sounds during an alarm.	On
Door Detection Switch	Check whether to enable the door status detection function.	On
Timing Mode	Running Timing: Directly enters timing state from running state; Constant Temperature Timing: When the system is in running state, and when "main temperature set value - constant temperature timing deviation ≤ main temperature measurement value ≤ main temperature set value + constant temperature timing deviation", the system can enter timing state.	Running Timing
Constant Temperature Timing Deviation	When the temperature measurement value differs from the set value within this parameter, the system enters the timing state from the running state and starts timing.	(0 ~ 5.0℃) 0.5

Timing Unit	Select the timing unit for steps as hours or minutes.	Hours
End of Operation Prompt Time	The duration of the buzzer prompt is after the end of the operation.	(0 ~ 9999 seconds) 60

10.2.10 Personalization

Click the **"Personalization"** icon in the **"Menu"** interface.

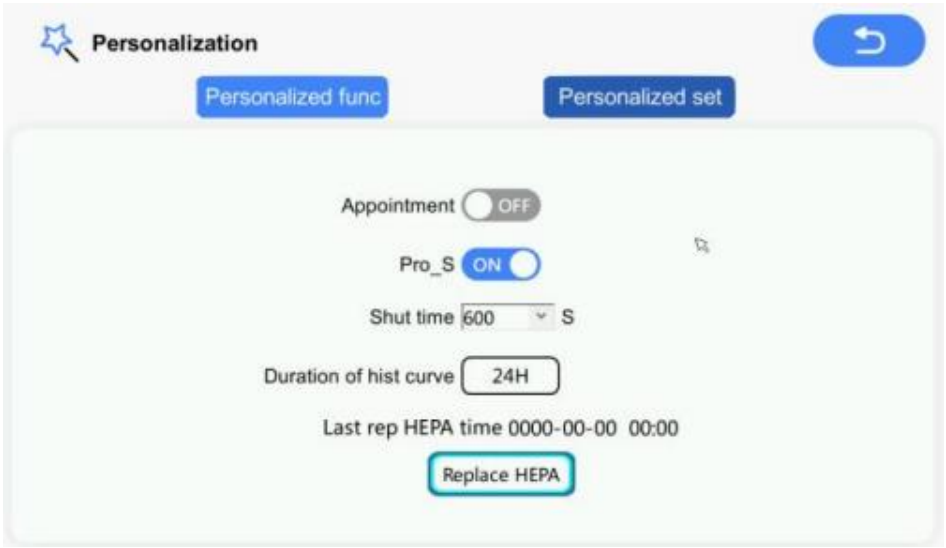


Figure-19 Personalization functions

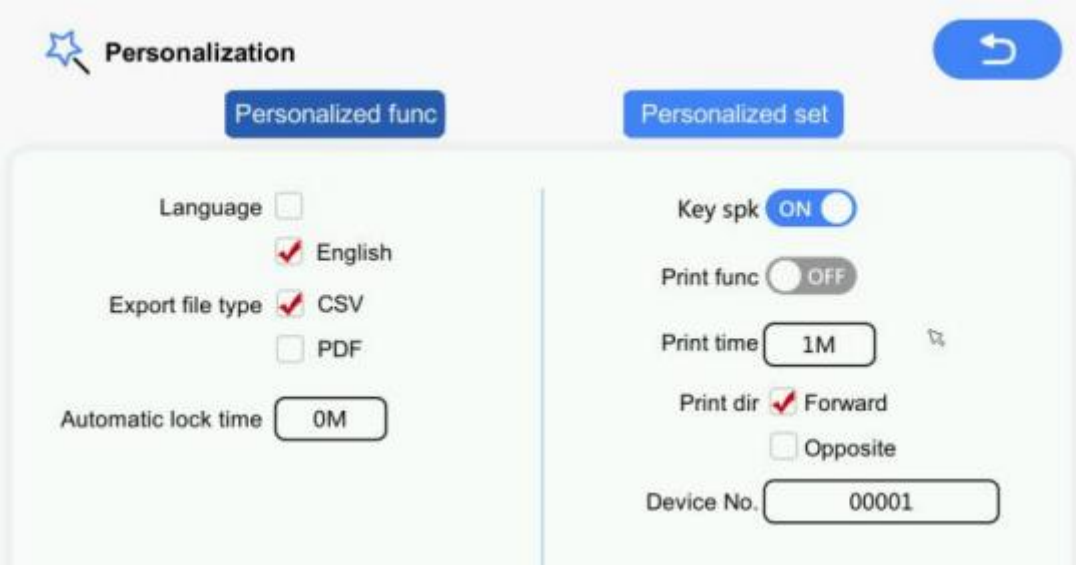


Figure-20 Personalization settings

Table 6: Parameters description

Name	Functions	(Setting Range) Initial
Reservation Function	Whether to enable the reservation function.	Off
Screensaver Function	Whether to enable the screensaver function.	Off
Backlight Off Time	When the screensaver function is enabled, if the touchscreen is not operated for this time, the touchscreen backlight will turn off.	600 seconds
Historical Curve X-Axis Duration	Duration of one screen of the historical curve	(1-150 hours) 24
Language Display	Display in English or other language	English
Export File Type	The type of export file, either CSV or PDF format.	CSV
Key Beep	Whether the buzzer sounds when the touchscreen is touched.	On
Printing Function	Off: The printing function is off. On: Printing function is on.	Off
Printing Interval	Print one measurement data at this interval. The first-time printing is enabled or whenever the date changes, print the header and current date.	(1-999 minutes) 1
Printing Direction	Direction of printing data.	Forward
Device Number	The number of this device.	00001

10.2.11 Users' management

Click the **"User Management"** icon on the **"Menu"** interface and enter the administrator's initial password **[0000]** to enter the user management interface. Select **"Administrator"** and click **"Edit"** to enter the administrator interface. It is recommended that the administrator reset a new password after entering the administrator interface for the first time and save the password to avoid being unable to enter.

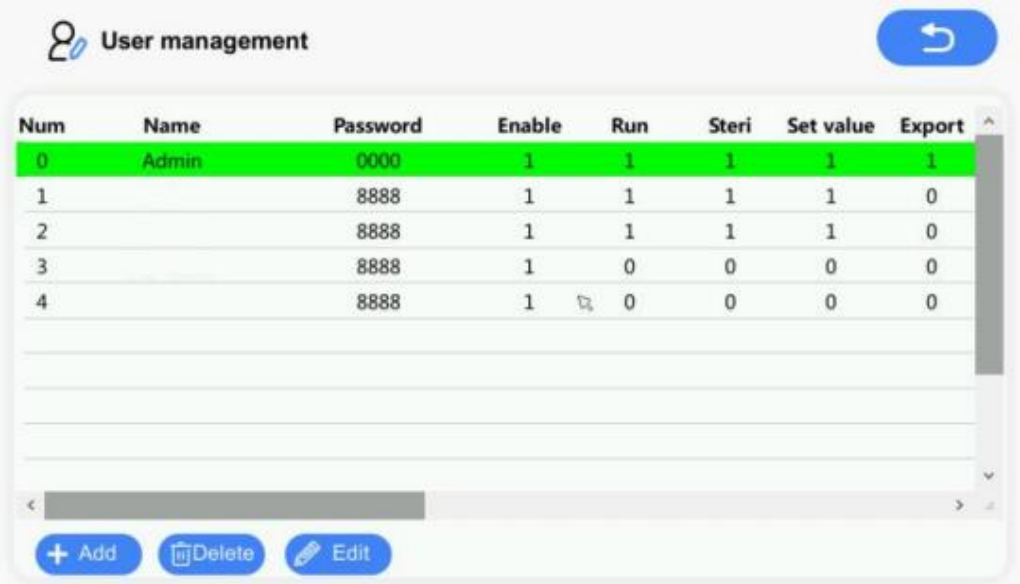


Figure-21 Account Permission Settings Interface

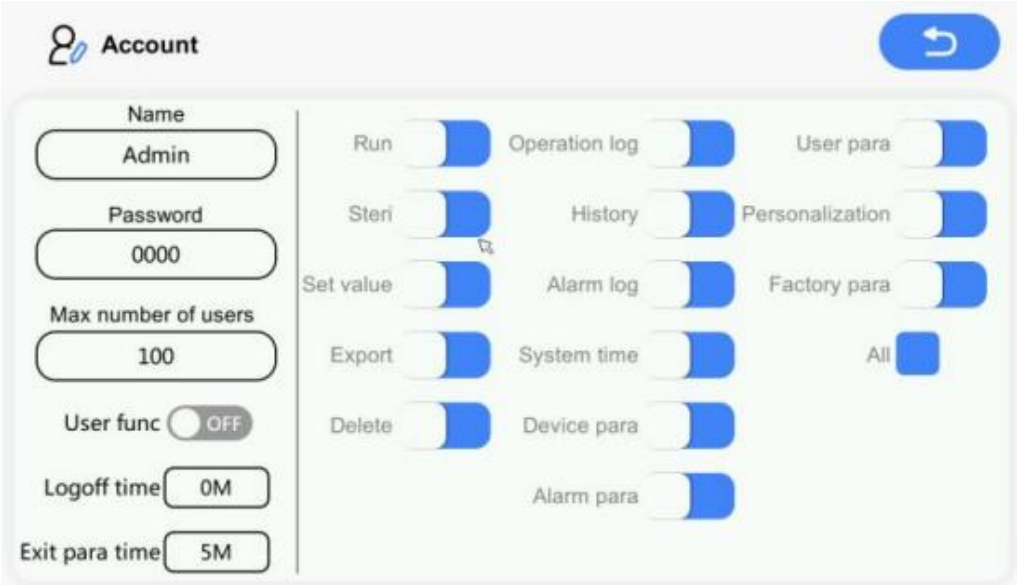


Figure-22 Account Creation Interface

1) **Administrator Account Interface Parameter Description:**
   Username: The administrator can modify the administrator's username.
   Password: The administrator can modify the administrator's password. The initial password is "**0000**".
   Maximum Number of Users: The number of users that the administrator can add.
   User Permission Management: The administrator can enable or disable the user management function.
   Auto Logout Time: After unlocking/user login, if the touchscreen is not touched for this period, it will lock/logout the user. **Note:** if set to 0, the user will not lock/auto logout. Setting range: (0-9999 minutes).

Exit Parameter Time: In non-monitoring interface status, if the touchscreen is not touched for this period, the system will exit the monitoring interface. **Note:** If set to 0, it will not automatically exit the monitoring interface. Setting range: (0-9999 minutes), default is 5 minutes.

After the administrator adds a user, the administrator can edit the user's permissions. The operation method is: the administrator selects the row where the created user is located, clicks **"Edit"** to enter the user permission setting interface, and selects several permissions for the user to use on the right side of the interface, as shown in the following **Figure 23**.

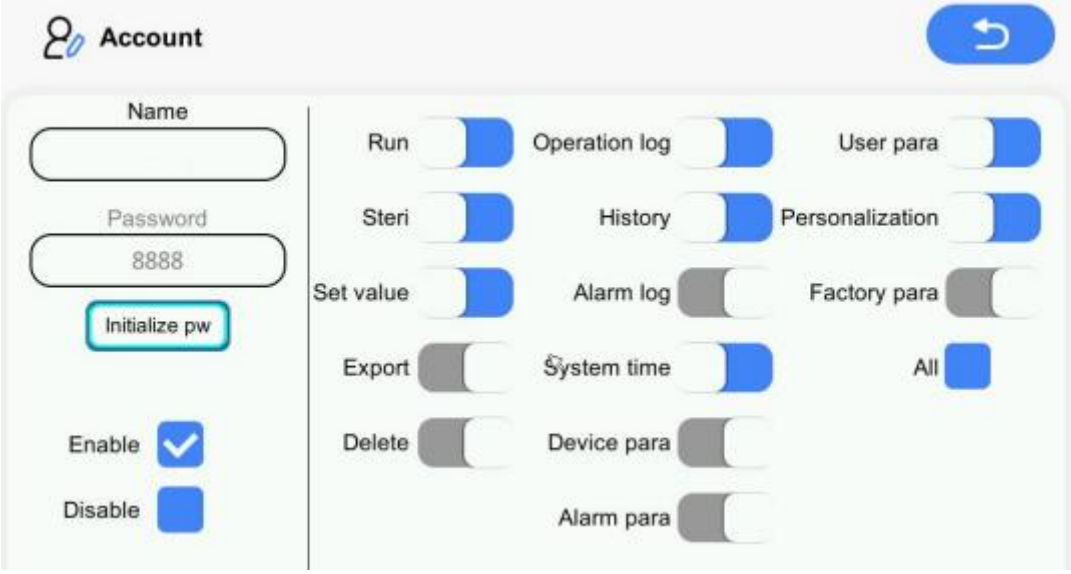


Figure-23 Account Permission Settings Interface

2) **Account Permission Settings Interface**

Username: The administrator can modify the username of the user.

Initialize Password: The administrator cannot modify the user's password directly. The initial password for the user is "**8888**". The administrator can reset the user's password to "**8888**".

Enable/Disable: The administrator can enable or disable the user. When enabled, the user can log in; when disabled, the user cannot log in.

After the administrator creates an account, the user can unlock the device by clicking the **"Unlock"** icon on the main interface (**Figure 3**). This will take them to the account login interface (**Figure 24**), where they can enter their username and password to operate the device.

Figure-24 User Log-in Interface

11. Maintenance

11.1 Cleaning

To reduce contamination and ensure good cell growth, regularly clean and disinfect the CO_2 incubator. Follow these steps and precautions:

1) **Wear Personal Protective Equipment (PPE):** Such as masks, gloves, and safety goggles.
2) **Prepare Cleaning and Disinfection Materials:** Use neutral detergents, distilled water, clean cloths, and disinfectants. Do not use chlorine-containing solvents on stainless steel surfaces.
3) **Transfer Samples:** Move all samples to a safe place.
4) **Turn Off the Device:** Switch off the power and unplug the device.
5) **Remove Detachable Parts:** Such as shelves, shelf brackets, supports, and water tank covers.
6) **Drain the Water Tank:** Insert the drainpipe into the drain valve, drain the water, and wipe away any residual water with a towel.
7) **Clean Surfaces:** Thoroughly remove dirt and residues from the chamber and detachable parts using a detergent, or spray disinfectant on these surfaces.
8) **Avoid Spraying Electrical Components:** Do not spray detergents or disinfectants directly on sensors, control panels, or displays to avoid damaging electrical parts.
9) **Rinse with Distilled Water:** Wipe off the detergent or disinfectant with a cloth and distilled water, repeating twice.
10) **Dry All Parts:** Use a dry cloth to wipe all cleaned parts.
11) **Reassemble Parts:** Ensure the device is completely dry before resuming normal operation.
12) **Sterilize:** Use the device's built-in high-temperature and high-humidity sterilization program for sterilization.

11.2 Removable parts

1) **Shelf support removal**
   Remove the shelf and shelf bracket, and then remove the butterfly nuts above and below the shelf to remove the shelf.
2) **Sink cover removal**

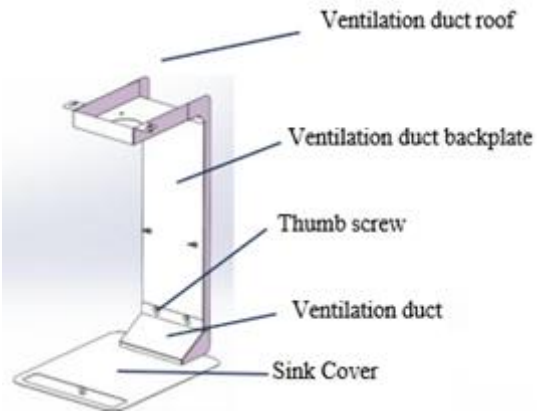


Figure-25 Air Outlet Assembly

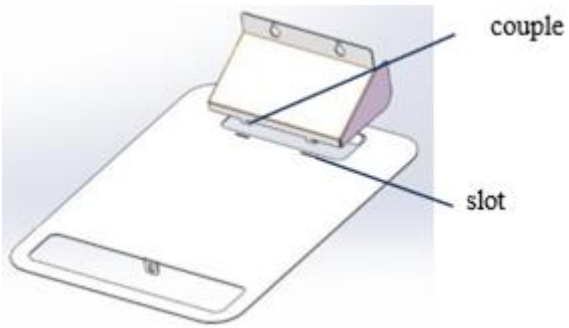


Figure-26 Sink Cover

Disassembly: As shown in **Figure 25**, loosen the two hand screws securing the air duct bottom plate (no need to remove them). Then, move the air duct bottom plate and water tank cover upwards. Align the irregular holes at the bottom of the air duct with the hand screws, then move forward to remove the air duct bottom plate and water tank cover.

Assembly: As shown in **Figure 26**, insert the hooks of the air duct bottom plate into the slots of the water tank cover. Then, push the air duct bottom plate to one side to complete the assembly of the air duct bottom plate and water tank cover. The air duct bottom plate has irregular holes, and the lower part of the air duct back plate has hand screws (in a loose state). Fit the irregular holes on the air duct bottom plate into the hand screws on the air duct back plate, then move down into place and tighten the hand screws.

11.3 Routine maintenance

During daily use of the equipment, daily maintenance of the equipment should be carried out to ensure the normal operation of the equipment. Daily maintenance should be carried out by the following requirements.

11.3.1 Daily Maintenance

Check the CO_2 gas source and supply pipeline daily to ensure normal supply.

11.3.2 Semi-Annual Maintenance

1) Inspect the seals on the inner and outer doors to ensure they are intact.
2) Check the regular control functions of the equipment.
3) Perform electrical safety checks.
4) Calibrate the temperature and CO_2 concentration measurements.

11.4 Filter replacement

The filter is fixed on the top plate of the air duct. Remove the 4 screws that fix the filter, take off the filter, and install a new filter. Whether to replace the filter depends on the actual situation. If the filter is found to be damaged or affects the product's performance, the filter needs to be replaced.

12. Troubleshooting

If the equipment malfunctions, refer to the table below to find the cause and solution.

Common Fault Analysis and Solutions

No.	Fault Phenomenon	Possible Cause	Solution
1	The display does not light up when powered	No power at the socket	Check and repair the power socket.
		Loose wiring in the equipment	Open the top cover and check the wiring.
		Damaged power switch	Replace the power switch.
		Blown fuse	Identify the cause and replace the fuse.
2	Temperature deviation alarm (too low/high)	The door magnetic switch malfunctioned.	The door switch is not connected or damaged, glass door is not closed tightly.
		Damaged controller	Replace the controller
		Heater not working	Check and replace the heater.
		Fan not turning or turning too slowly	Check and replace the fan
		The ambient temperature is too high	Lower the ambient temperature.
		Poor contact with Pt100	Check Pt100 wiring and replace it if necessary.
3	Heating failure	Damaged heater	Check the circuit and replace the heater.
		Damaged controller	Replace the controller.
4	CO_2 concentration not increasing/alarm	CO_2 source not turned on	Turn on the CO_2 source
		CO_2 pressure too high or too low	Adjust the pressure
		Faulty solenoid valve	Check and replace the solenoid valve
		Gas pipeline leak	Check and repair the pipeline
		Cabinet leak	Check the cabinet
		Faulty CO_2 sensor	Replace the sensor
5	CO_2 cabinet leakage	Damaged glass knob	Replace the knob
		Damaged inner door glass seal	Replace the seal
6	Independent over-temperature alarm	Faulty over-temperature switch	Replace the over-temperature switch

		Temperature control system failure	Switch off and check it.
7	Communication failure	Communication line interference or disconnection	Check if the communication line is loose
		Damaged communication hardware	Replace the hardware
8	The outer door cannot close	Damaged door lock	Replace the door lock
		Sagging outer door	Adjust the outer door hinge.

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