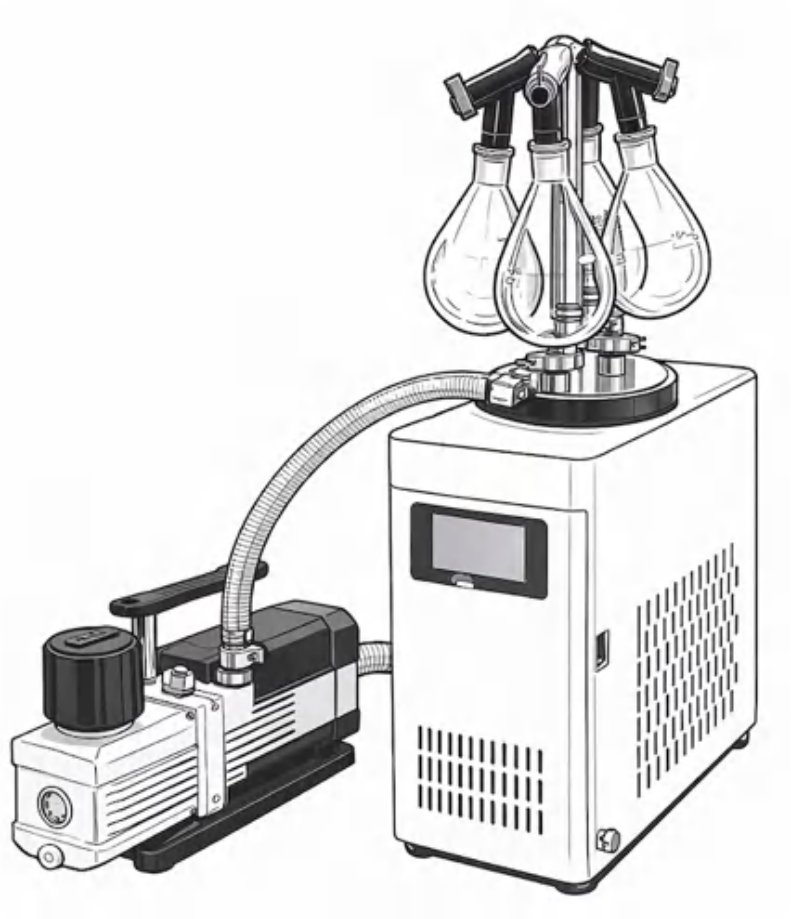
Mini Laboratory Freeze Dryer

User’s Instructions



Product Name: Mini Laboratory Freeze Dryer

Type: Manifold Type

Application: Small-batch laboratory freeze drying

Please read this manual carefully before use and keep it properly for future reference.

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Preface

Thank you for choosing our Mini Laboratory Freeze Dryer.

This equipment is designed for small-batch freeze-drying applications in laboratory environments. To ensure safe, stable, and effective operation, please read this manual carefully before installation, operation, and maintenance.

This manual applies to the current standard configuration of the **manifold-type Mini Laboratory Freeze Dryer**. If the equipment has been customized according to customer requirements, the actual configuration, accessories, and interface functions shall be subject to the contract, technical agreement, or accompanying documents.

Safety Instructions

Danger

1. This equipment shall only be operated by trained personnel.
2. The equipment must be connected to a properly grounded power supply.
3. Never plug in or unplug the power cord with wet hands.
4. Do not damage, modify, pull, bend excessively, or place heavy objects on the power cord.
5. The cold trap operates at low temperature. Avoid direct skin contact to prevent frostbite.
6. Samples must be completely pre-frozen before freeze drying. Residual liquid may cause foaming, sample blow-off, or vacuum instability.
7. Do not disassemble vacuum-related components while the system is running.

Warning

1. After transportation, the equipment should be placed properly and left standing for 6–8 hours before power-on.
2. The equipment shall be used indoors in a clean, dry, stable, and well-ventilated area.
3. Do not block the ventilation openings.
4. Before operation, check the power supply, vacuum pump, vacuum tubing, valves, and sealing parts.
5. The vacuum pump should be placed lower than the main unit to reduce the risk of oil backflow.
6. If abnormal smell, noise, temperature, or vacuum condition occurs, stop the equipment immediately for inspection.
7. Disconnect the power supply before cleaning or maintenance.

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1. Product Overview

This equipment is a **manifold-type Mini Laboratory Freeze Dryer**, intended for small-batch laboratory freeze-drying applications.

It operates based on a combination of a low-temperature cold trap and vacuum sublimation drying. With the help of an external vacuum pump, the system creates a low-pressure environment so that ice in a pre-frozen sample sublimates directly into vapor. The vapor is then captured and condensed as ice on the low-temperature surface of the cold trap, thereby removing moisture from the sample.

The current standard configuration is the **manifold type**, which is used only for the **drying stage**. It does not provide in-situ pre-freezing. Samples must be pre-frozen in external freezing equipment before being connected to this unit for freeze drying.

This equipment is suitable for:

- Laboratory research
- Small-batch sample freeze drying
- Parallel drying tests of multiple samples
- Process exploration and preliminary validation

This equipment is **not a GMP freeze dryer** and is not intended for sterile production, stoppering production, or automated manufacturing applications.

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2. Working Principle

Freeze drying is a process in which a wet sample is first frozen, and then the ice within the sample is removed by sublimation under vacuum conditions.

The freeze-drying process of this equipment mainly includes the following stages:

2.1 Sample Pre-freezing

The sample must first be completely frozen in an external refrigerator, low-temperature freezer, or ultra-low freezer. Only when the water in the sample has been completely converted into ice can it enter the freeze-drying stage.

2.2 Vacuum Generation

An external vacuum pump is used to reduce the system pressure so that ice can sublimate directly at low temperature.

2.3 Sublimation Drying

After the pre-frozen sample bottle is connected to the manifold valve and the corresponding valve is opened, the ice in the sample sublimates directly into water vapor under vacuum.

2.4 Cold Trap Capture

The cold trap plays a key role in condensation and vapor capture. During freeze drying, the moisture in the sample sublimates directly from solid ice to vapor under vacuum conditions. This vapor is rapidly captured by the low-temperature surface of the cold trap and re-condensed as ice, thereby removing moisture from the sample.

Main functions of the cold trap:

- Capturing sublimated water vapor and maintaining vacuum stability
- Preventing vapor from entering the vacuum pump and extending pump service life
- Providing a stable low-temperature condition to improve drying efficiency

Generally, the lower the cold trap temperature, the stronger its vapor capture capability.

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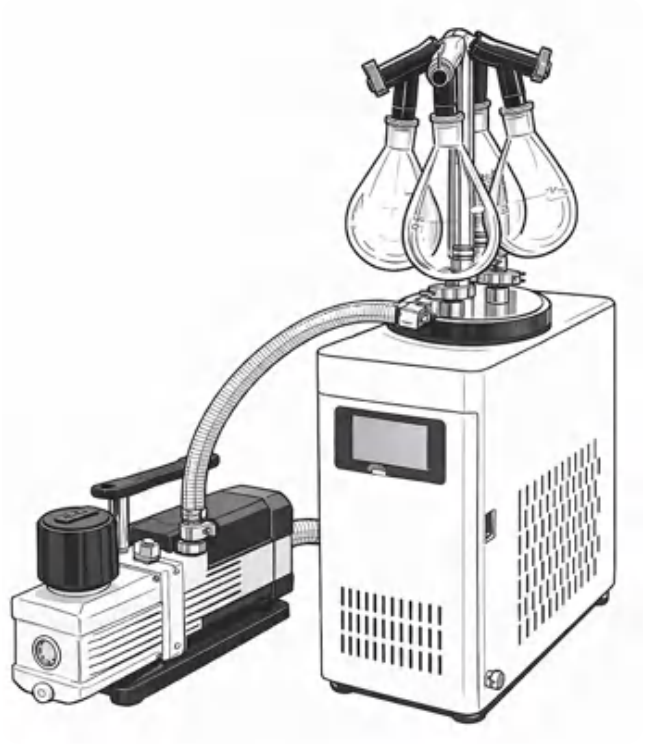
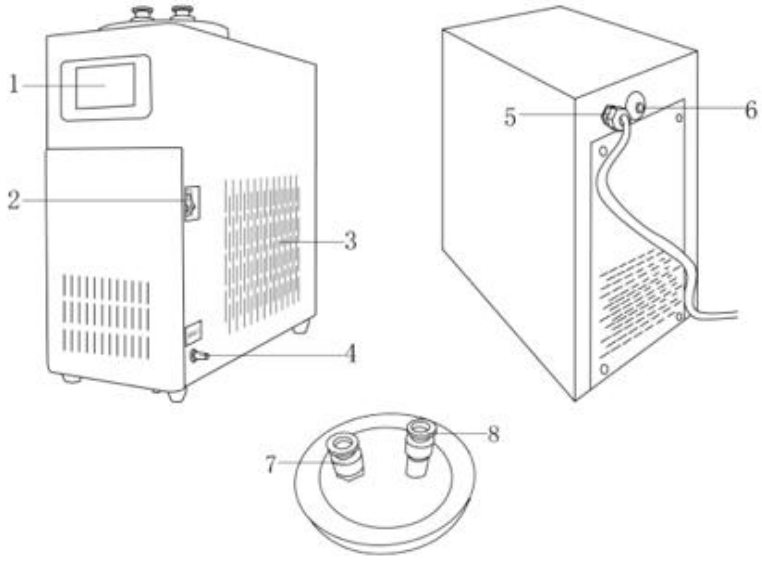
3. Equipment Structure





The equipment mainly consists of the following parts:

1. Main unit
2. Touch screen

3. Refrigeration system
4. Cold trap chamber
5. Multi-port manifold valve assembly
6. Flask connection ports
7. Vacuum port
8. Drain outlet
9. Defrost system
0. Power switch
1. Protection fuse
2. External vacuum pump

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4. Product Features

1. Multi-port manifold design allows multiple samples to be freeze-dried simultaneously, improving laboratory efficiency.
2. Ultra-low temperature cold trap effectively captures sublimated vapor and improves system stability.
3. Compact structure and small footprint, suitable for laboratory use.
4. Simple and intuitive control interface for easy operation.
5. Suitable for small-batch and high-value sample drying in laboratories.
6. Compared with conventional tray-type laboratory freeze dryers, this unit has a simpler structure and lower operating cost.
7. The current standard configuration is the Flask-type manifold. Optional accessories may be confirmed according to the actual sample form and application scenario.

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5. Technical Parameters

The following is a general description of the standard machine. Specific data shall be subject to the equipment nameplate, contract, or technical confirmation documents.

Item	**Description**
Product Name	Mini Laboratory Freeze Dryer
Equipment Type	Manifold Type
Power Supply	AC220V / 50Hz
Control Method	Touch screen

Cold Trap Type	Vertical cold trap
Cold Trap Material	Stainless steel
Cooling Method	Air cooling
Drying Method	Manifold flask drying
Pre-freezing Function	No
Current Standard Configuration	Flask type manifold
Vacuum System	External vacuum pump
Defrost	Electric defrost if configured
Drainage	Drain outlet

If the customer has special requirements for sample type, bottle size, or interface type, accessories may be confirmed according to the actual application.

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6. Installation Requirements

6.1 Environmental Requirements

The equipment shall be installed in an environment meeting the following conditions:

1. Ambient temperature: 10°C to 28°C
2. Relative humidity: ≤70%
3. Well ventilated indoor area
4. No conductive dust, corrosive gas, explosive gas, or strong electromagnetic interference
5. Stable and solid working platform or floor

6.2 Installation Requirements

1. Open the package carefully and check the equipment and accessories according to the packing list.
2. Ensure reliable grounding.
3. Keep sufficient space between the equipment and surrounding walls or objects for heat dissipation, recommended not less than 500 mm.
4. The external vacuum pump should be placed lower than the main unit.
5. Connect the vacuum pump and the main unit with proper vacuum tubing and ensure good

sealing.
6. After installation, check that the power supply, vacuum connection, valve status, and drain status are correct.

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7. Operation Instructions

7.1 Preparation Before Use

1. Check whether the equipment appearance is in good condition.
2. Check the touch screen, power cord, vacuum tubing, valves, and vacuum pump.
3. Confirm that the vacuum pump has been properly filled with vacuum pump oil. Never run the pump without oil.
4. Confirm that the drain outlet is closed.
5. Confirm that the sample has been fully pre-frozen externally.
6. Confirm that the flask, valve ports, and sealing parts are clean and dry.

7.2 Sample Pre-freezing Requirements

This equipment **does not provide pre-freezing**. Samples must be pre-frozen externally.

Recommended requirements:

1. Samples should be loaded into suitable freeze-drying flasks.
2. The pre-freezing temperature should be lower than the sample eutectic point or glass transition temperature.
3. A pre-freezing temperature of not higher than -40°C is recommended.
4. Samples must be completely frozen without obvious residual liquid.
5. If possible, rotating pre-freezing or thin-layer freezing may help accelerate the subsequent drying process.

7.3 Start-up Procedure

1. Connect the equipment to a suitable power supply.
2. Turn on the main power switch.
3. Start the refrigeration function to pre-cool the cold trap.
4. Wait until the cold trap reaches a suitable low temperature before proceeding.

7.4 Pre-cooling and Pre-vacuum

For stable operation, the following preparation is recommended before connecting samples:

1. Start the refrigeration system and allow the cold trap to cool down sufficiently.
2. Start the vacuum system and pre-evacuate the equipment.
3. After the vacuum becomes relatively stable, connect the pre-frozen sample bottles.

Note:

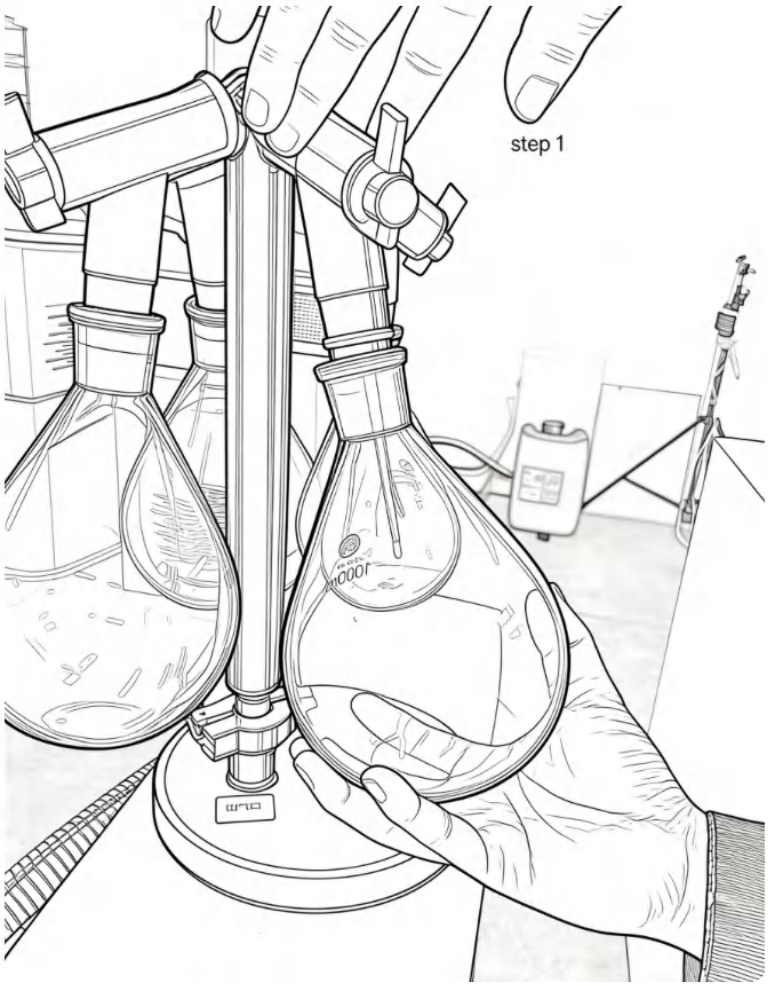
Pre-cooling and pre-vacuum before flask connection help reduce vapor shock, improve drying efficiency, and protect the vacuum system.

7.5 Flask Connection

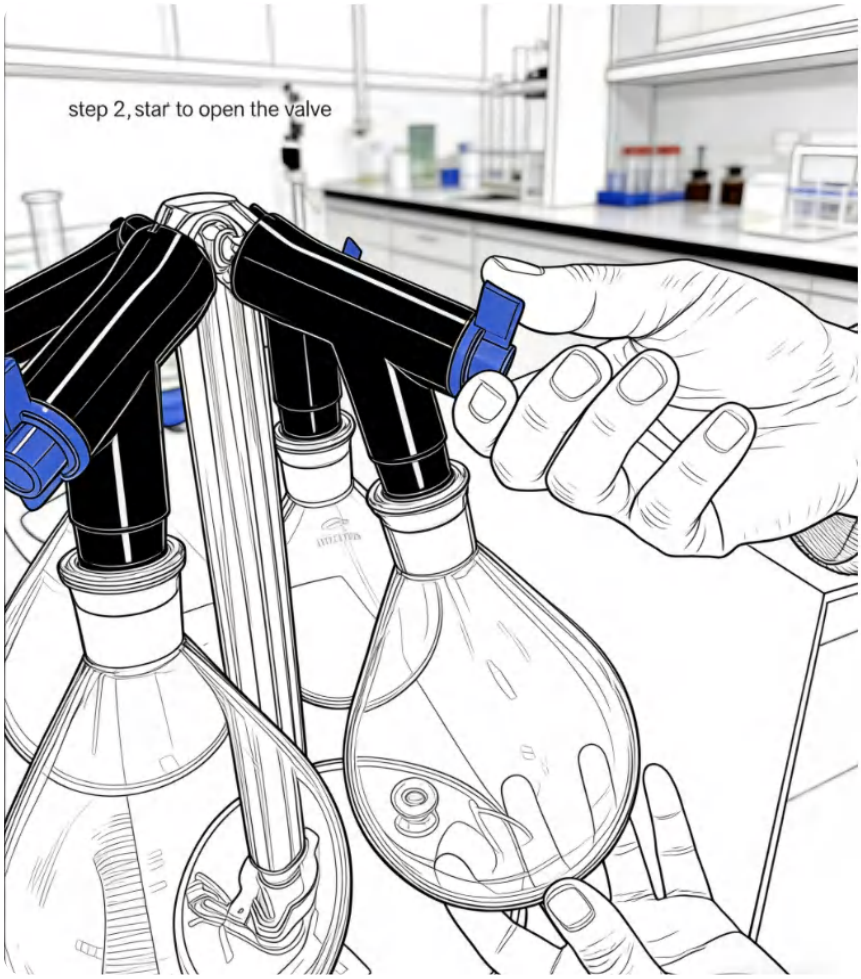
1. Remove the fully pre-frozen sample bottle from the external low-temperature environment.
2. Quickly connect the bottle to the manifold valve port.
3. Ensure that the bottle is properly connected and sealed.
4. Open the corresponding valve to connect the sample bottle to the vacuum system.

How to connect the frozen sample to the freeze dryer:

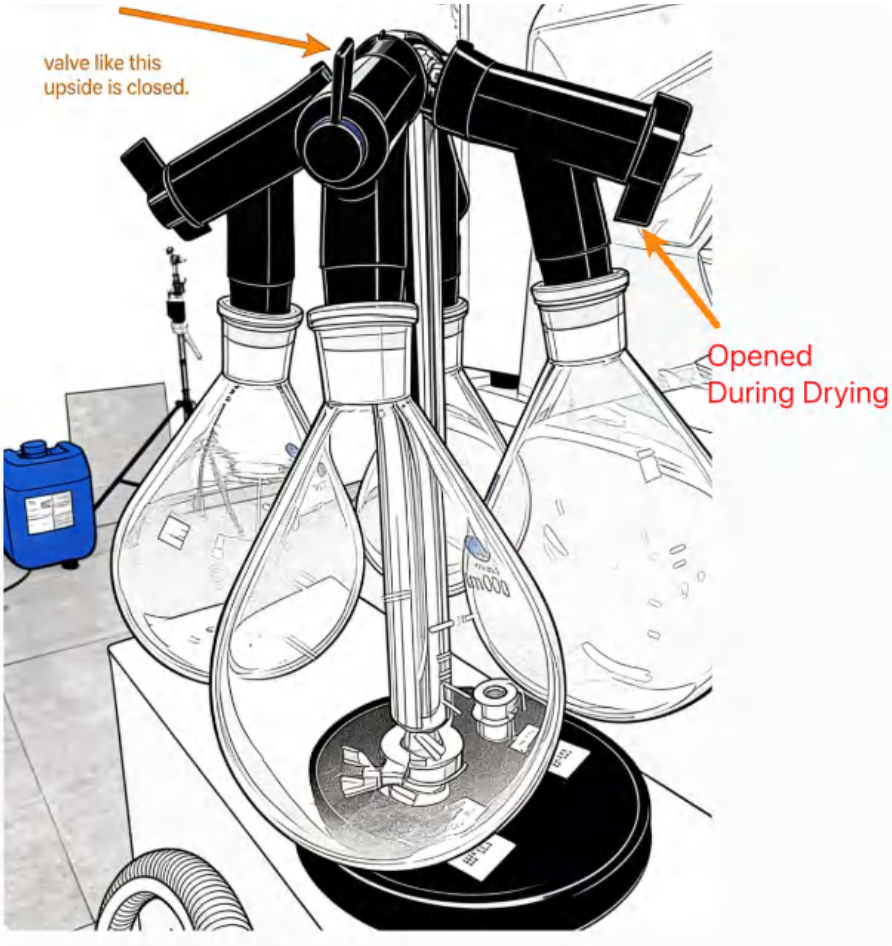
1. put the the frozen sample flask to freeze dryer’s valve.



2. Turn the valve to be opened.



3. here is the valves status for open or closed.



7.6 Freeze-drying Process

1. After connection, the sample starts sublimation drying under vacuum.
2. The generated vapor is captured by the cold trap.
3. During operation, observe the vacuum level, cold trap temperature, and overall running condition.
4. If a dried sample bottle needs to be removed during operation, close the corresponding valve first to isolate it from the system, then remove it.

7.7 End of Drying

1. Close all manifold valves after drying is completed.
2. Return the system to atmospheric pressure.
3. Stop the vacuum pump.
4. Stop the refrigeration system.
5. Remove the sample bottles and store the dried samples properly.
6. Perform defrost and drainage as required.

7.8 Shut-down Procedure

1. Confirm that all samples have been removed.
2. Stop the vacuum system.
3. Stop the refrigeration system.
4. Start the defrost function if required.
5. Drain the melted ice from the cold trap.
6. Clean the equipment surface and accessories.
7. Turn off the main power supply.

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8. Control System

The touch screen main interface usually includes the following functions:

- **Refrigeration / Refrige**
- **Vacuum**
- **Gauge**
- **Defrost**

8.1 Temperature Display

8.2 Vacuum Display

The system may display the current vacuum status. The actual unit and format depend on the software setting.

8.3 Basic Operation

1. After entering the main interface, check the current temperature and running status.
2. Press “Refrigeration” to start cooling.
3. Press “Vacuum” to start the vacuum pump.
4. Press “Gauge” to view or enable vacuum indication.
5. Press “Defrost” to start defrosting.

If the system has a parameter setting page, non-professional users shall not modify system parameters without authorization.

9. Maintenance

1. Check the oil level and oil condition of the vacuum pump regularly.
2. Replace vacuum pump oil after 200–500 hours of continuous operation, depending on actual use conditions.
3. Keep the equipment surface, manifold ports, valves, and sealing parts clean.
4. Defrost and drain the cold trap in time when excessive ice accumulates.
5. Do not start and stop the refrigeration system frequently. If restarting is necessary, wait at least 3 minutes after shutdown.
6. If the equipment is out of service for a long time, keep it clean and dry.
7. After use, check whether the drain outlet is closed properly.
8. Replace vacuum tubing in time if it becomes aged, hardened, or cracked.

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10. Troubleshooting

Symptom	Possible Cause	Solution
No power	Power not connected; fuse damaged; switch failure	Check power supply, fuse, and switch
Cold trap temperature drops slowly or remains too high	High ambient temperature; poor ventilation; refrigeration system fault	Improve ventilation; contact technical service if necessary
Vacuum cannot reach the required level	Leakage; loose connection; incorrect valve status; vacuum pump abnormal	Check sealing, tubing, valve status, and vacuum pump
Vacuum pump does not start	Power issue; motor fault; pump jammed	Check power supply and inspect the pump

Sample foaming or blow-off	Sample not fully pre-frozen; flask connected too quickly; excessive vacuum shock	Ensure complete pre-freezing and optimize connection procedure
Poor defrost performance	Excessive ice accumulation; insufficient defrost time	Extend defrost time and drain after complete melting

If the fault cannot be eliminated, stop operation and contact the manufacturer or service personnel.

11. Unpacking Inspection

After unpacking, please check the equipment and accessories according to the packing list and confirm the following:

1. Main unit appearance is intact
2. Touch screen is intact
3. Manifold valve assembly and interfaces are intact
4. Vacuum pump appearance is intact
5. Power cord, vacuum tubing, and accessories are complete
6. Accompanying documents are complete

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12. Packing List

The following is a standard configuration example. The actual packing list shall be subject to the one supplied with the equipment.

No.	**Item**	**Quantity**
1	Main unit	1 set
2	Manifold assembly	1 set
3	Freeze-drying flasks	Several

4	Vacuum pump	1 set
5	Vacuum tubing	1 pc
6	Power cord	1 pc
7	User’s instructions	1 copy
8	Certificate / warranty card	1 copy

13. Warranty Statement

1. The equipment is covered by the applicable warranty period from the date of shipment or sale.
2. During the warranty period, faults caused by manufacturing quality issues may be repaired according to the warranty policy.
3. The following cases are excluded from warranty coverage:

- Warranty period has expired
- Damage caused by improper operation
- Failure to use, maintain, or service the equipment according to this manual
- Damage caused by unauthorized disassembly, modification, or repair
- Damage caused by abnormal power supply, abnormal environment, or force majeure

For detailed warranty terms, please refer to the sales contract or warranty card.