High-Capacity Stainless Steel Cryogenic Storage Systems

User Manual

To the User

To the User：

Thank you for choosing and using our product.

To ensure your safe, convenient operation and proper maintenance of this product, please read this manual carefully before use and keep it for future reference.

Our company shall not be held liable or responsible for any damage to the instrument resulting from the user's failure to follow the guidelines in this manual, or for any personal injury caused by failure to follow the safety instructions.

Note:
All models of this product are Class I electrical devices (AC power supply requires grounding), externally powered, and designed for continuous operation.

Table of Contents

Wide-Neck Stainless Steel Liquid Nitrogen Biological Storage Container 1

1.Instructions for Use and Precautions ..... - 1 -

1.1 General Knowledge ..... - 1 -

1.2 Properties of Liquid Nitrogen ..... - 1 -

1.3 Liquid Nitrogen Safety ..... - 1 -

1.4 Essential protective equipment ..... - 2 -

1.5 Usage Notes ..... - 2 -

2. Product Information ..... - 3 -

2.1 Product Overview ..... - 3 -

2.2 Main Structure and Features ..... - 4 -

2.3 Stainless Steel Large-Diameter Bioreactor Parameter Table ..... - 5 -

2.4 Piping System ..... - 6 -

2.5 Software Interface ..... - 8 -

2.6 Operating Environment ..... - 13 -

3. Installation and Initial Startup ..... - 13 -

3.1 Installation ..... - 13 -

3.2 Initial Startup ..... - 14 -

4. Operation ..... - 14 -

5. Preventive Maintenance ..... - 16 -

5.1 Maintenance Schedule ..... - 16 -

5.2 Preventive Examination Procedure ..... - 17 -

1.Instructions for Use and Precautions

1.1 General Knowledge

Liquid Nitrogen (LN2) is the refrigerant for this medical liquid nitrogen storage system. Understanding and adhering to specific safety practices is essential before handling LN2 and operating the Intelligent Stainless Steel Liquid Nitrogen Biological Container (hereafter referred to as the LN2 tank).

1.2 Properties of Liquid Nitrogen

Nitrogen is a colorless, odorless, and tasteless gas, constituting approximately 78% of Earth's atmosphere by volume. Collected and separated nitrogen can be liquefied.

Boiling point at 1 atmosphere	-195.8°C , -320.3°F , 77.4 K
Thermal Conductivity (Gaseous)	25.83 mW/(m·K)
Heat of Vaporization (Liquid)	198.38 kJ/kg
Density (Liquid) at 1 atm	1.782 Ibs/L , 807.4 g/L , 808.6kg/m3

1.3 Liquid Nitrogen Safety

Always strictly follow the operational guidelines from the manufacturer and supplier when transporting LN2 and operating the control system. Adhere to all safety precautions indicated on the LN2 storage tank and recommended by the manufacturer.

Warning：

Modifying this device without the manufacturer’s authorization is strictly prohibited!

Nitrogen is a potentially asphyxiating substance that can cause rapid suffocation without any warning signs! Store and use nitrogen in well-ventilated areas. Do not fill narrow, enclosed spaces with nitrogen. Never enter enclosed spaces that may contain nitrogen unless they have been thoroughly ventilated. If you accidentally inhale nitrogen, immediately move to fresh air. If you experience difficulty breathing, you may need supplemental oxygen; if you have stopped breathing, administer artificial respiration. Seek medical attention immediately!

Liquid nitrogen can cause severe frostbite to the eyes and skin. Do not touch pipes and valves that are frosted! Cold nitrogen vapor can also cause damage to the eyes and skin. If frostbite occurs, seek medical attention immediately and use lukewarm water—water that is close to body temperature—to gently warm the affected area.

It is prohibited to place liquid nitrogen into a sealed container without a safety valve. The expansion ratio of liquid nitrogen to gaseous nitrogen is 1:700 (meaning that 1 cubic meter of liquid nitrogen, when vaporized, can expand into 700 cubic meters of gas).

1.4 Essential protective equipment

Personnel must take all necessary precautions to prevent accidental contact of eyes and skin with LN2 and cold nitrogen gas. We recommend the following clothing and equipment for anyone handling LN2 or operating LN2 hoses, valves, and piping:

- Cryogenic gloves (loose-fitting)
- Full-face shield or chemical splash goggles
- Cryogenic apron
- Long-sleeved shirt and cuffless pants
- Closed-toe shoes (no sandals)

1.5 Usage Notes

1.5.1 Before use, inspect the product for any external defects. If found, report them to our company within 5 business days of receipt (contact info on back cover). Distributors/dealers should follow relevant terms in their agreements.
1.5.2 This container is primarily designed for stationary indoor storage of LN2 and frozen materials. It is not recommended for vehicular transport. If moved while containing LN2, avoid collisions, tilting, and severe vibrations.
1.5.3 When refilling LN2 indoors, ensure adequate ventilation to prevent oxygen deficiency.
1.5.4 New or thawed/warmed containers must be pre-cooled with a small amount of LN2 first. After reaching near thermal equilibrium (minimal boiling), fill to capacity. Use a pump or long-neck funnel, inserting the fill tube near the bottom. Leave space at the neck for nitrogen gas to escape. Avoid skin contact with LN2 to prevent frostbite.
1.5.5 For 2-3 hours after initially placing samples, periodically check the outer surface for condensation or frost. These signs indicate loss of vacuum, leading to rapid LN2 evaporation and tank failure. While rare (possibly due to improper handling/transport), this check is crucial to prevent sample loss.
1.5.6 The outer shell is under atmospheric pressure. Severe impact or pressure can cause dents, leading to product damage or failure.
1.5.7 This container is designed for LN2 storage only. Never store liquid oxygen.
1.5.8 The inner chamber operates at atmospheric pressure. Do not pressurize it or seal the neck opening.
1.5.9 The vacuum port seal is critical for maintaining vacuum integrity. Do not tamper with it, as damage will immediately degrade vacuum and render the tank unusable.
1.5.10 To check LN2 level, use the weighing method, a dipstick, or insert a solid wood/rod to measure frost height. Do not use hollow tubes, as LN2 may eject and cause injury. Handle samples gently.
1.5.11 For cleaning, use a neutral detergent, then rinse with warm water not exceeding 50°C (122°F). Dry the inner chamber thoroughly (preferably with warm air ≤50°C) and cool to ambient temperature before refilling with LN2.
1.5.12 Store the container in a cool, dry, well-ventilated area. During long-term storage, periodically check the LN2 level and the outer surface for condensation/frost.
1.5.13 Always lift and replace the lid vertically.
1.5.14 Due to the specialized technology involved, all repairs must be performed by our company. Return the container to us for inspection and servicing.

2. Product Information

2.1 Product Overview

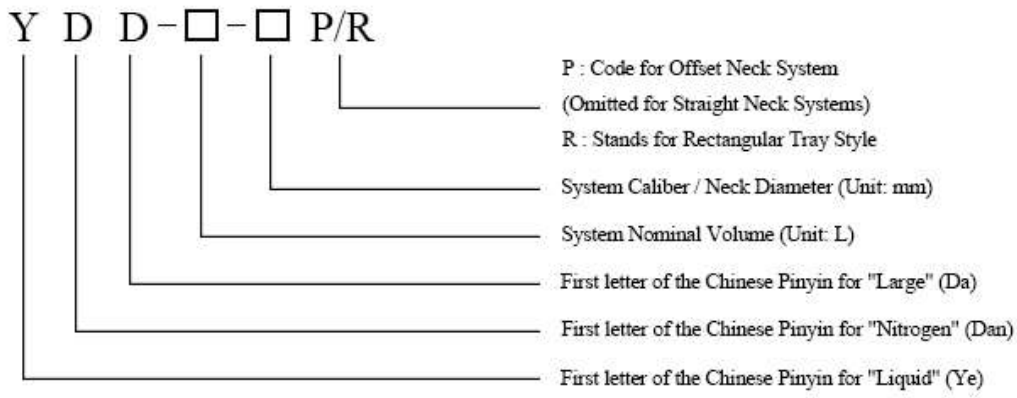
2.1.1 Product Name

Wide-Neck Stainless Steel Liquid Nitrogen Biological Storage Container

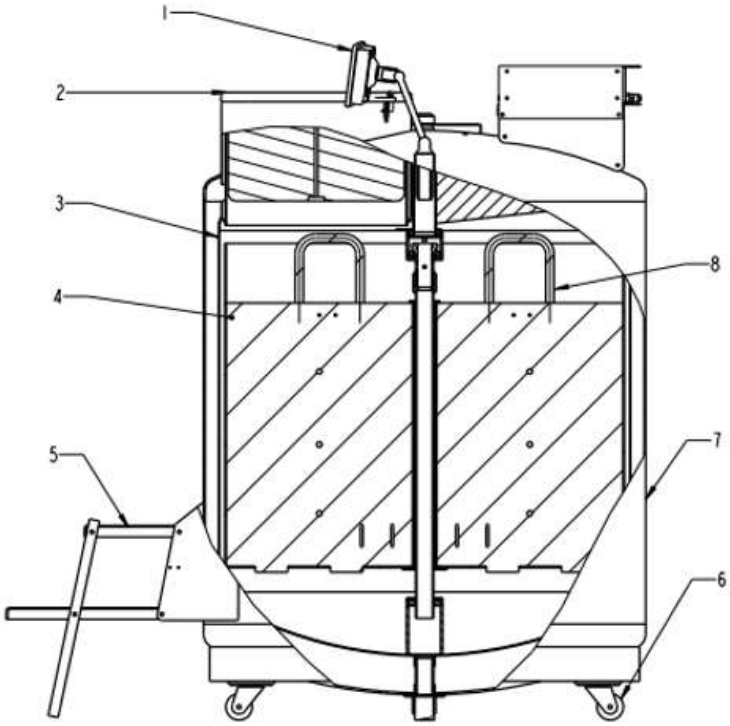
2.1.2 Product Models

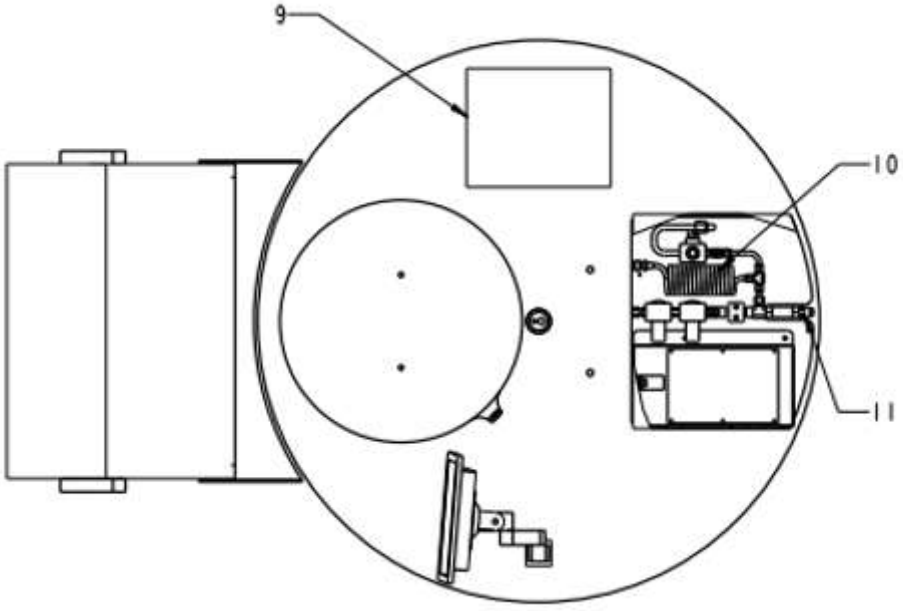
YDD-370-320P, YDD-460-320P, YDD-550-445P, YDD-800-445P, YDD-800-445R, YDD-850-460P, YDD-1000-520P, YDD-1000-635P, YDD-1800-635P

2.1.3 Model Nomenclature



2.2 Main Structure and Features





1.Liquid Nitrogen Intelligent Monitoring Management System	This control system adopts a customized PLC + touch screen control method, offering simple operation and reliable system performance.
2． Insulation Lid	The insulation lid is ergonomically designed to ensure safe and convenient use of the equipment.

3．Inner Vessel	Composed of an upper and lower closure and a middle cylindrical section, the inner vessel is manufactured using strict process procedures and advanced welding equipment, ensuring reliable welding and excellent structural integrity. The rotating tray within the vessel features a well-designed structure for smooth and easy rotation.
4．Rotating Tray	Equipped with 4 or 8 labeled compartments (depending on configuration), the tray allows users to visually distinguish between different cold storage items by region, preventing confusion during sample handling.
5．Foot Step Plate	Integrated step platform design ensures ease of use and minimal floor space occupation.
6．Casters	Three-inch swivel casters for easy mobility.
7．Outer Shell	Consists of an upper and lower closure and a middle cylindrical section. The connection between the inner and outer shells uses a specially designed low-conductivity support structure (including top and bottom supports). This maintains high strength while effectively reducing heat transfer from the exterior to the interior.
8．Rotating Tray Handle	The rotating tray employs a four-section structure. Using the handle allows quick positioning of target storage containers, making operation simple and efficient.
9．Workbench	A stainless steel workbench located near the device opening, used for temporarily storing and placing samples, accelerating sample retrieval speed.
10．Inlet Valve	The inlet valve uses a dual-coil design that automatically expels nitrogen gas from the exhaust pipe when liquid nitrogen is added, minimizing the impact of nitrogen flow on internal temperature.
11．Inlet Connector	Standard CGA295 gas connector with a ball valve seal, ensuring safe liquid nitrogen filling.

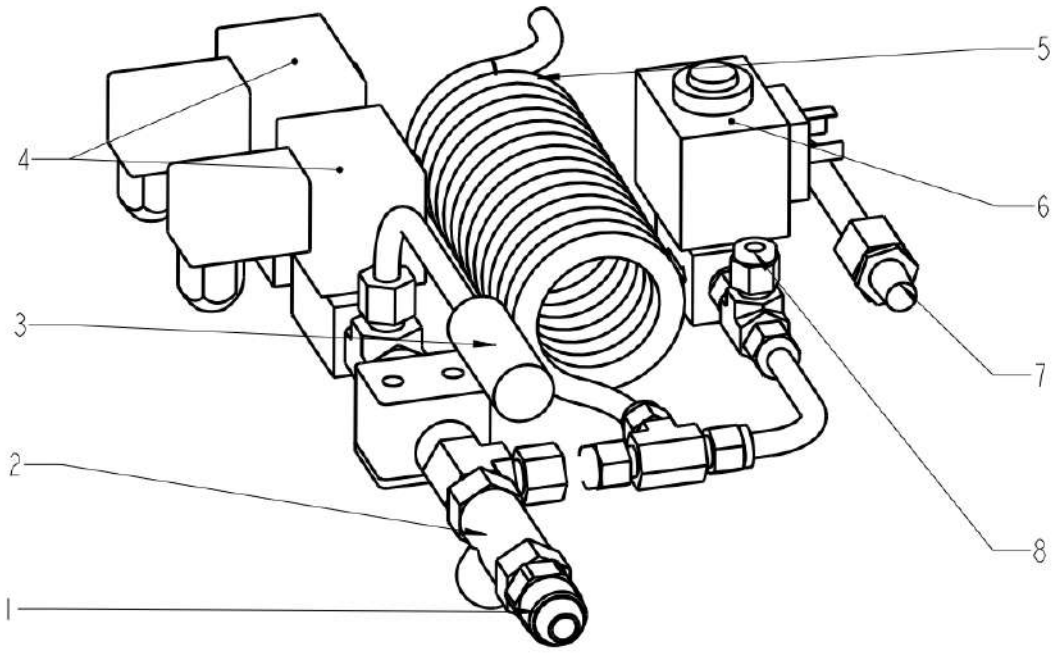
2.3 Stainless Steel Large-Diameter Bioreactor Parameter Table

Model	YDD-370-320P	YDD-460-320P	YDD-550-445P	YDD-800-445P
Maximum storage capacity				
1.2&2ml Storage Tube	16800	21000	28000	39200
10x10/9x9 Racks	12	12	24	24
5x5 Racks	8	8	16	16
Layers	12	15	10	14
Tank parameters				
Geometric volume(L)	370	460	588	800
LN volume(L)	55	55	125	133
Caliber(mm)	320	320	445	445

Effective height(mm)	708	914	590	840
Total height(mm)	1400	1600	1400	1650
OD(mm)	820	820	1090	1090
Empty weight (kg)	211.5	264	310	394.2
Full weight(kg)	513	638	790	1040

Model	YDD-800-445R	YDD-850-465P	YDD-1000-465P	YDD-1800-635R
Maximum storage capacity				
1.2&2ml Storage Tube	40600	42900	51000	95250
10x10/9x9 Racks	26	32	32	60
5x5 Racks	12	4	8	14
Layers	14	13	15	15
Tank parameters				
Geometric volume(L)	800	890	1031	1854
LN volume(L)	133	165	165	296
Caliber(mm)	445	465	465	635
Effective height(mm)	840	765	889	906
Total height(mm)	1650	1600	1700	1750
OD(mm)	1090	1190	1190	1565
Empty weight (kg)	394.2	400	495	805
Full weight(kg)	1040	1112	1319	2270

2.4 Piping System



1． Liquid Inlet Connector	The liquid inlet connector is a standard CGA295 connector.
2. Filter	Filters impurities from the LN2 supply line.

3. Safety Valve	125 PSI safety valve ensures line safety.
4. Dual Fill Solenoid Valves	Dual solenoid valve structure for fill safety.
5. Vaporizer Chamber (w/ DP Level Gauge)	Vaporizes LN2 to purge differential pressure level gauge lines, preventing clogging.
6. Hot Gas Exhaust Solenoid	Vents warm gas from the lines.
7. Muffler	Reduces noise during hot gas exhaust.
8. Exhaust Temp Sensor	Monitors temperature of LN2 in the line.

Electrical Component Specifications

Display	
Type	Android Touchscreen
Size	10 inch
Operation	Touch Control
Electronic Specs – Controller Only	
Input Voltage	24 V DC
Input Current (Max)	5 A
Input Current (Continuous)	1 A
Power Consumption (Max)	28 W
Power Consumption (Continuous)	6 W
Fill Valve Output Voltage	24 V DC
Short Circuit Protection	Current Limiting, Auto-Reset
Power Adapter Specs	
Input Voltage	110 – 230 V AC, Auto-Switching
Input Frequency	50 – 60 Hz
Output Voltage	24 V DC
Max Current Capacity	5 A
Input Current	0.73 A @ 110 V AC 0.35 A @ 230 V AC
Power Requirements – Controller + Adapter	
Input Voltage	110-230VAC/50-60Hz
Input Current (Max)	73A@110VAC
Input Current (Continuous)	35A@230VAC
Input Power (Max)	30 W
Input Power (Continuous)	8 W
Temperature Sensors	
Type	2-Wire Platinum RTD (Pt-100)
Quantity	3
Resistance	100 Ω at 0°C
Sensitivity	3.85 Ω / °C
Resolution	0.1°C

Accuracy - Single-Point Cal*	± 1.0°C
- Dual-Point Cal**	± 2.0°C
Range	- 200°C ~70°C
Level Sensors	
Type	Capacitive / Differential Pressure
Accuracy	± 10mmLN2
Resolution	1 mm
Range	75-983mm/0-625mm

2.5 Software Interface

2.5.1 Home Screen

Point A Temp: Top of tank temperature (°C).
Point B Temp: Bottom of tank temperature (°C).
LN2 Level: Liquid level height (mm).
LN2 Consumption: Daily consumption rate (mm/Day).
Fill: Manual fill button.
Defog: Manual defog button.
Mute: Buzzer on/off.

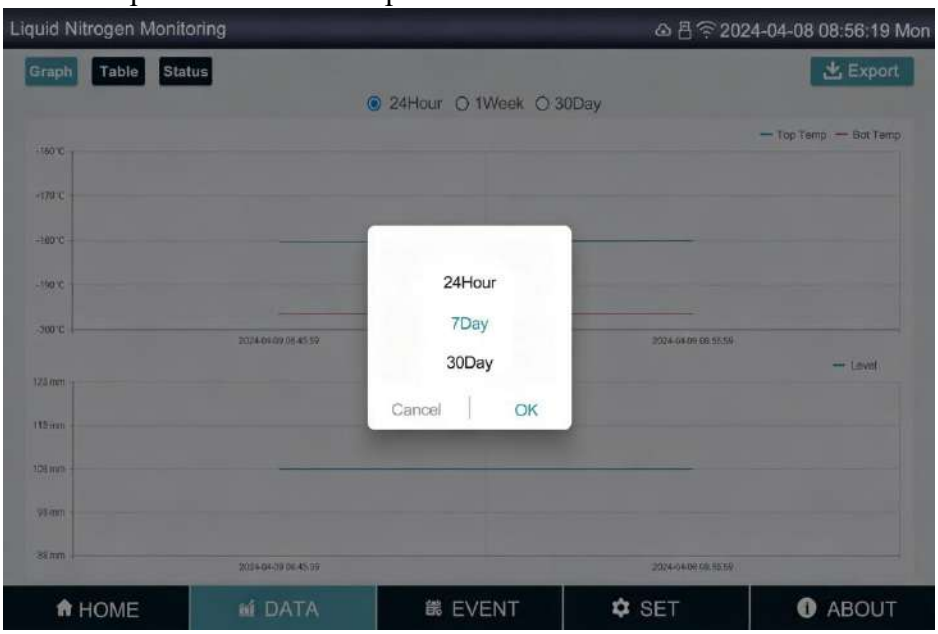
2.5.2 Data Screen

Shows trend graphs for Point A Temp (blue), Point B Temp (red), and LN2 Level (green) over time.

2.5.2.1 Tap "Table" for detailed data log.

2.5.2.2 Tap "Status" for component status.

2.5.2.3 Tap "Data" for data export.



2.5.3 Event Log

Shows log entries (name, start/end time). Export function same as 2.5.2.3.

2.5.4 System Settings

2.5.4.1 Parameter Settings

Auto Fill: Enable/disable automatic LN2 refill.

High Level Alarm: Alarm if level > set point.

Low Level Alarm: Alarm if level < set point.

Fill Timeout Alarm: Alarm if fill duration > setpoint.

Fill Start Level: (Auto-fill on) Begin fill when level < setpoint.

Fill Stop Level: (Auto-fill on) Stop fill when level ≥ setpoint.

Exhaust Temp: (See 2.4) Open hot gas valve if sensor temp > setpoint.

Exhaust Timeout: Alarm if exhaust duration > setpoint.

Scheduled Fill: Enable fixed-time refills.

Point A High Temp Alarm: Alarm if Temp A > setpoint.

Point A Low Temp Alarm: Alarm if Temp A < setpoint.

Point B High Temp Alarm: Alarm if Temp B > setpoint.

Point B Low Temp Alarm: Alarm if Temp B < setpoint.

Defog Duration: Default 30s for Defog button. Adjustable.

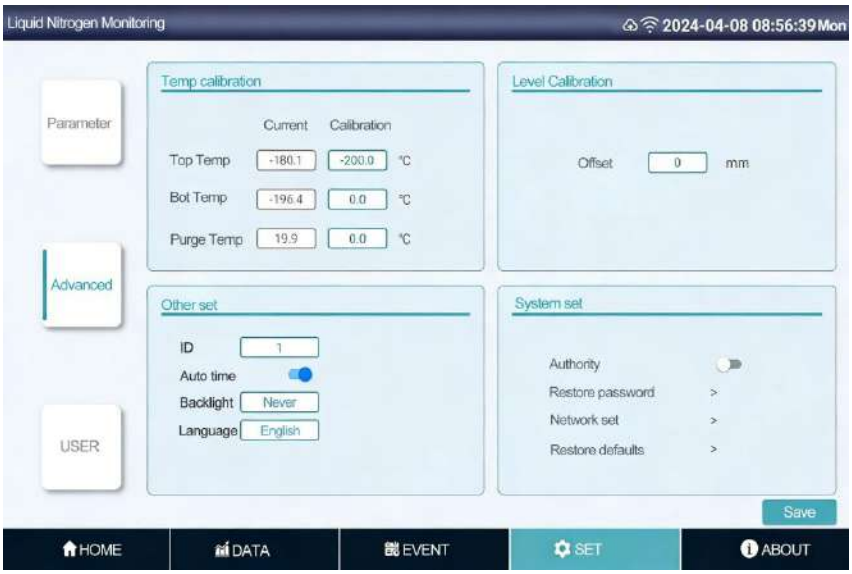
Auto Fill on Lid Close: Fill for cooling after closing lid (default 30s).

Mute Duration: Buzzer off time when Mute is activated.

Lid Open Timeout Alarm: Alarm if lid open > setpoint.

Vapor Phase Protect Temp: Stop fill if Temp A < setpoint.

2.5.4.2 Advanced Settings



Temp Calibration:Current Value: Sensor reading.

Calibration Value: Enter actual measured temperature.

Level Calibration:Level Offset = Actual Level - Displayed Level.

Other Settings:Device ID: Unit serial number.

Auto Date/Time: Network time sync (requires internet).

Sleep: Screen saver timeout.

Language: System language.

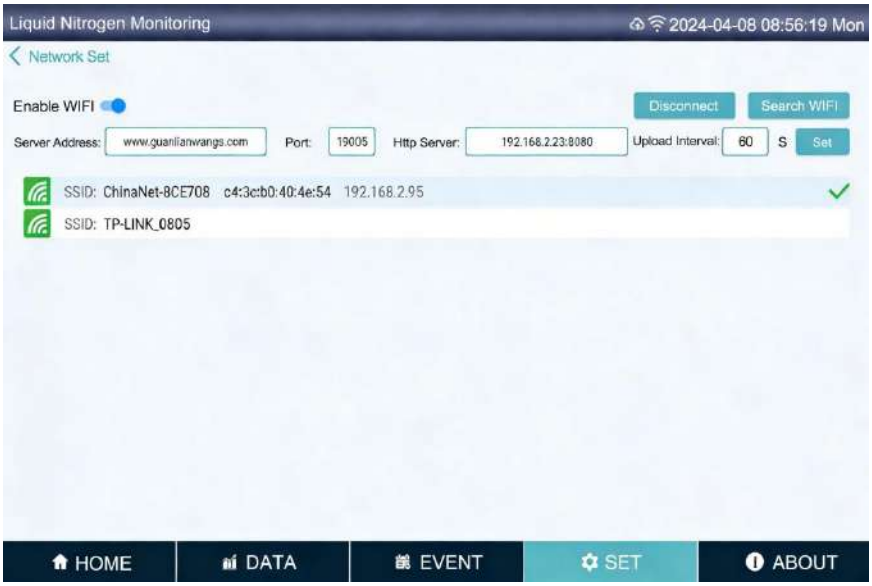
System Settings:Account Permissions: Enable/disable password protection.

Restore Default Passwords: Reset to factory passwords.

Network Setup: Connect to Wi-Fi.

Restore Factory Settings: Reset all settings.

2.5.4.3 Network Settings

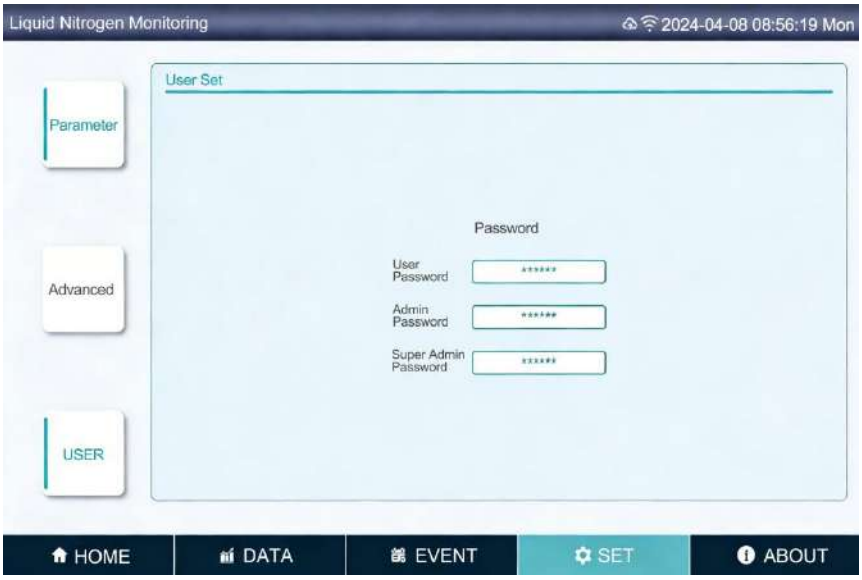


Enable Wi-Fi: Turn Wi-Fi on/off.

Disconnect Wi-Fi: Disconnect from current network.

Scan for Wi-Fi: Refresh available networks.

2.5.4.4 User Management



Operator Password: Basic access.

Admin Password: Administrator access.

Super Admin Password: Full system access.

Refer to Section 4.11 for permission levels.

2.6 Operating Environment

2.6.1 Ambient Temperature & Humidity

Designed for near-room temperature operation (-20°C to 50°C / -4°F to 122°F), with relative humidity <50%. While large temperature gradients exist, minor ambient changes have negligible impact on performance. High humidity can cause condensation/frost on the lid; keep dry or periodically wipe. Severe icing requires thawing (see Preventive Maintenance).

2.6.2 Atmospheric Pressure

Designed for operation at 57.2 kPa to 101 kPa (approx. 0.56 to 1.0 atm).

2.6.3 Heat Load

Uses LN2 as refrigerant (no mechanical cooling), resulting in negligible negative heat load.

3. Installation and Initial Startup

3.1 Installation

3.1.1 Verify LN2 supply source has sufficient LN2 and pressure is between 0.1-0.15 MPa (14.5-21.8 PSI).

3.1.2 Connect the LN2 supply line to the tank's fill port using a suitable cryogenic hose.

3.1.3 Open the supply valve briefly to check for leaks. Close valve after check.

3.1.4 Plug the unit's power cord into a properly grounded AC outlet with correct voltage.

Note: Do not power the controller or fill with LN2 yet. To prevent shock, ensure proper grounding. Upon later startup, alarms may sound initially (normal until sensors stabilize). Press "Mute" to silence buzzer for 30 min. The unit must be installed on a level surface.

3.2 Initial Startup

3.2.1 For initial fill, keep the lid OPEN or REMOVED. The warm tank will cause rapid LN2 boil-off; a sealed tank could be dangerous.

3.2.2 Confirm supply valve is open and pressure is 0.1-0.15 MPa.

3.2.3 Verify default parameter settings (refer to factory table provided with unit).

Reference Table for Parameter Settings of Vapour-Phase Liquid Nitrogen Tanks							
Model	YDD-370-320P	YDD-460-320P	YDD-550-445P	YDD-800-445P/R	YDD-850-460P	YDD-1000-520P	YDD-1800-635P
Fill Start Level	85mm	85mm	150mm	175mm	135mm	140mm	155mm
Fill Stop Level	155mm	155mm	230mm	240mm	210mm	245mm	245mm
Filling Timeout	50min	50min	50min	80min	80min	100min	100min
Venting Timeout	30min	30min	30min	40min	40min	40min	40min
High Level Alarm	190mm	190mm	270mm	270mm	270mm	300mm	300mm
Low Level Alarm	60mm	60mm	100mm	100mm	100mm	120mm	120mm
Point A High Temp Alarm	-150℃	-150℃	-150℃	-150℃	-150℃	-150℃	-150℃
Point A Low Temp Alarm	-195℃	-195℃	-195℃	-195℃	-195℃	-195℃	-195℃
Venting Temp.	0℃	0℃	0℃	0℃	0℃	0℃	0℃
Point B High Temp Alarm	-180℃	-180℃	-180℃	-180℃	-180℃	-180℃	-180℃
Point B Low Temp Alarm	-197℃	-197℃	-197℃	-197℃	-197℃	-197℃	-197℃
LN2 Consumption Alarm	40mm	40mm	40mm	40mm	40mm	40mm	40mm

3.2.4 Once confirmed, tap "Auto Fill" to begin filling.

Note 1: Initial fill will produce significant vapor and icing around the neck (normal).

Note 2: After first fill reaches set level, close the lid and let the tank stand for **48 hours** for pre-cooling. After pre-cooling, manually fill to the "Fill Stop" level before placing biological samples.

4. Operation

4.1 Auto-Fill Start

With "Auto Fill" enabled in Settings, filling starts automatically when the monitored level falls below the "Fill Start" setpoint.

4.2 Auto-Fill Stop

With "Auto Fill" enabled, filling stops automatically when the level reaches or exceeds the "Fill Stop" setpoint.

4.3 Line Purge Function (Differential Pressure Gauge only)

During auto-fill, vaporized nitrogen from the vaporizer chamber purges the gauge lines for a set duration to prevent ice blockage.

4.4 Hot Gas Exhaust Function

During auto-fill, the controller monitors the fill line temperature.

A. If temp ≥ "Exhaust Valve Open" setpoint, the hot gas valve opens to vent warm gas.

B. If temp < "Exhaust Valve Open" setpoint, the hot gas valve closes and the fill valve opens to supply LN2.

4.5 Manual Fill Function

Start: With Auto-Fill off, tap the "Fill" button on the Home screen.

Stop: Tap the "Fill" button again.

4.6 Defog Function

If excessive fog appears when lid is open, tap the "Defog" button. It runs for the pre-set duration.

4.7 High Temperature Alarm

Triggers if top temperature > setpoint for longer than the delay time. Buzzer sounds and alarm code flashes. Buzzer can be muted; code remains visible. Alarm clears when temperature ≤ setpoint.

4.8 High Level Alarm

Triggers if LN2 level > setpoint for longer than the delay time. Buzzer sounds and alarm code flashes. Buzzer can be muted. Alarm clears when level ≤ setpoint.

4.9 Low Level Alarm

Triggers if LN2 level < setpoint for longer than the delay time. Buzzer sounds and alarm code flashes. Buzzer can be muted. Alarm clears when level ≥ setpoint.

4.10 Lid Open Alarm

Triggers if lid is open > 5 minutes. Buzzer sounds and alarm code flashes. Buzzer can be muted. Alarm clears when lid is closed.

4.11 Password & Security

A multi-level security system controls access to settings. Contact authorized dealer or technical support if passwords are lost.

No.	Category			No password	Ordinary password	Management Password	Super Password	System Password
					111111	123456	654321	888888
1	Main Page		Fill Liquid		✔	✔	✔	✔
2			De -fogging	✔	✔	✔	✔	✔
3			Alarm Audio	✔	✔	✔	✔	✔
4	Data Management		Data export		✔	✔	✔	✔
5	Operation Log				✔	✔	✔	✔
6	Parameter settings	Fill Settings	Automatic Fill			✔	✔	✔
7			High-Level Alarm			✔	✔	✔
8			Low-Level Alarm			✔	✔	✔
9			Fill Over Time Alarm			✔	✔	✔
10			Fill Start			✔	✔	✔
11			Fill Stop			✔	✔	✔
12			Exhaust Temperature			✔	✔	✔
13			Exhaust timeout alarm			✔	✔	✔
14		Temperature Settings	A Point High-Temperature Alarm			✔	✔	✔
15			A Point Low-Temperature Alarm			✔	✔	✔
16			B Point High-Temperature Alarm			✔	✔	✔
17			B Point Low-Temperature Alarm			✔	✔	✔
18		Other Settings	De-fogging Duration			✔	✔	✔
19			Lid-Closed Auto-Fill			✔	✔	✔

No.	Category			No password	Ordinary password	Management Password	Super Password	System Password
					111111	123456	654321	888888
20			Mute Duration			✔	✔	✔
21			Lid Open Timeout			✔	✔	✔
22			Gas Phase Protection Temperature			✔	✔	✔
23	Advanced settings	Temperature Calibration	A Point Temperature Calibration			✔	✔	✔
24			B Point Temperature Calibration			✔	✔	✔
25			Bypass Temperature Calibration			✔	✔	✔
26		Liquid Level Calibration	Liquid Level Offset			✔	✔	✔
27			Factory Calibration				✔	✔
28		Other Settings	Device ID			✔	✔	✔
29			Auto Time and Date Synchronization			✔	✔	✔
30			Sleep Mode			✔	✔	✔
31		System Settings	Account Permissions				✔	✔
32			Restore Default Password				✔	✔
33			Network Settings				✔	✔
34			Restore Factory Defaults				✔	✔
35	User Management	Password Settings	Ordinary Password		✔			
36			Management Password			✔		
37			Super Password				✔	

4.12 Data & Alarm Log Export

Insert a USB drive into the rear USB port. Navigate to the "Data" or "Event Log" screen, select the desired date range and format, and export.

5. Preventive Maintenance

5.1 Maintenance Schedule

Task	Weekly	Monthly	Semi-Annual	Annual	Biannual
LN2 Level Check	✔				
LN2 Supply Check	✔				
Line Leak Check		✔			

High Temp Alarm Test			✔		
Level Alarm Tests			✔		
Lid Thawing			✔		
Foldable Step Check			✔		
Lid Hinge Check			✔		
In-Line Filter Replacement				✔	
Level Sensor Calibration				✔	
Temp Sensor Calibration				✔	
Solenoid Valve Replacement					✔
Safety Valve Replacement					✔

5.2 Preventive Examination Procedure

5.2.1 Level Check

The liquid-level detection system used in liquid-nitrogen biological containers is virtually maintenance-free. This provides operators with highly accurate and high-resolution indications, enabling them to know at all times the precise amount of liquid nitrogen remaining in the tank. Although highly reliable, it's still important to check the accuracy of the liquid-level detection system weekly. This helps prevent control-system failures from adversely affecting the temperature of the storage space inside the liquid-nitrogen tank.

Manually measure the amount of liquid nitrogen in the liquid nitrogen tank using the liquid nitrogen scale provided with each product. The measurement method is as follows:

1. Open or remove the lid of the liquid nitrogen tank to access the internal storage space.
2. Hold the liquid nitrogen scale vertically, with the 0 mm end facing downward.
3. Lower the liquid nitrogen gauge into the liquid level tank until it reaches the bottom of the liquid nitrogen container. Ensure that the liquid nitrogen gauge is vertical and touches the bottom of the liquid nitrogen biological container. You'll notice some liquid nitrogen boiling around the liquid nitrogen gauge.

4. Place the liquid nitrogen scale in liquid nitrogen for about 5 seconds.
5. Remove the liquid nitrogen scale from the liquid nitrogen and immediately swing it back and forth in the air. As the end of the liquid nitrogen scale enters the liquid nitrogen, a distinct frost line will form due to the condensation of moisture from the air.
6. Subtract 10 mm from the measured frost line, as this is due to boiling of liquid nitrogen around the level gauge when it is immersed in the liquid nitrogen. The resulting measurement represents the actual liquid nitrogen level inside the dewar.

5.2.2 Check whether the liquid nitrogen supply is sufficient.

Sufficient pressure and flow rate of the liquid nitrogen supply are critical to the operation of a liquid nitrogen storage system. Whether supplying from a large liquid nitrogen tank or a self-pressurizing liquid nitrogen container, it is essential to maintain a pressure of 0.1–0.15 MPa during the filling cycle and ensure that there is enough liquid nitrogen available to complete the filling process. Most alarms reported by liquid nitrogen storage systems are caused by insufficient liquid nitrogen supply.

Observe the pressure of the liquid nitrogen supply source. Ideally, the pressure should be 0.1–0.15 MPa.

Check the liquid nitrogen level in the liquid nitrogen supply source. Most large-capacity liquid nitrogen tanks are equipped with digital or analog methods for measuring the liquid nitrogen level.

Commonly, self-pressurizing liquid nitrogen containers typically use visual pressure gauges.

The minimum liquid nitrogen volume of the supply source should be sufficient to completely fill the several liquid nitrogen tanks it is currently filling.

If you confirm that the liquid nitrogen supply source is insufficient, please contact your gas supplier to replenish or replace the liquid nitrogen supply source.

5.2.3 Pipeline Leak Inspection

Leakage in pipe connections can lead to a series of problems, including but not limited to the following situations:

- Slow fill time
- Alarm
- High liquid nitrogen consumption
- The liquid level reading is inaccurate.
- The liquid nitrogen dosage reading is inaccurate.

Leaks in pipe connections are particularly common in liquid nitrogen supply systems, because various fittings and connectors are used when making pipe connections.

It’s always regularly loosened and tightened.

1. While the liquid nitrogen supply system is operating at normal working pressure, spray the leak detection fluid onto all transfer hose connections and liquid nitrogen tank line connections.
2. Allow the leak detection fluid to soak into each joint fitting for at least 30 seconds.
3. A large leak will become immediately apparent, forming large bubbles.
4. Small leaks take longer to become visible and will produce many tiny bubbles, eventually forming “foam.”
5. Most leaks can be repaired by tightening any loose fittings with a wrench of the appropriate size.
6. If the tightened joint fittings still have a leak, check whether there are cracks or wear on the fittings. If the fittings are damaged, replace them immediately.
7. If the connector fittings have been replaced, recheck for leaks.

5.2.4 High-Temperature Alarm Test

1. Set the tank opening temperature above the high-temperature alarm setpoint and maintain it above this value for longer than the high-temperature alarm delay time. Verify that the alarm is triggered. Under normal conditions, the buzzer will sound an alarm beep, and the alarm code will flash. After pressing the "Mute" button, the buzzer can be silenced, but the alarm code will remain displayed.
2. Ensure the tank opening temperature is less than or equal to the high-temperature alarm setpoint, and verify that the alarm has been cleared. At this point, there should be no alarm beep, and the alarm code should not be flashing.

5.2.5 Liquid Level Alarm Test

5.2.5.1 High-Level Alarm Test

When the detected liquid level exceeds the high-level alarm setpoint and remains above it for longer than the high-level alarm delay time, check whether the alarm is triggered. Under normal circumstances, the buzzer will sound an alarm beep, and the alarm code will flash. After pressing the "Mute" button, the buzzer can be silenced, but the alarm code cannot be turned off.

Ensure that the condition where the detected liquid level is less than or equal to the high-level alarm setpoint is met, and

verify whether the alarm has been cleared. At this point, there should be no alarm beep, and the alarm code should not flash.

5.2.5.2 Low-Level Alarm Test

When the detected liquid level exceeds the low-level alarm setpoint and remains above it for longer than the low-level alarm delay time, check whether an alarm is triggered. Under normal circumstances, the buzzer will sound an alarm beep, and the alarm code will flash. After pressing the “Mute” button, the buzzer can be silenced, but the alarm code cannot be turned off.

Set the liquid level detection to be ≤ the low-level alarm setpoint and verify whether the alarm is cleared. At this point, there should be no alarm beep, and the alarm code should not flash.

5.2.6 Thawing the lid

1. Open or remove the lid of the liquid nitrogen tank.
2. After opening the lid, it is recommended to cover the liquid nitrogen tank’s opening with an additional spare lid or another non-airtight method to prevent moisture from entering the storage space and minimize the impact on the temperature of the topmost container.
3. Let the lid sit at room temperature for about 30 minutes.
4. After thawing, carefully dry the lid, stopper, and gasket.
5. Check whether the lid is damaged; if necessary, replace the part.

5.2.7 Folding Table Inspection

If liquid nitrogen biological containers equipped with folding-step devices are used, their integrity should be checked every six months. Inspect the hinges for cracks and ensure that all connections are secure. Check whether the anti-slip strips on the steps are intact, and replace them if necessary. Make sure that the step-lock straps can securely hold the steps in their folded position. If the pivot bolts keep coming loose, consider tightening them again.

5.2.8 Replacement of In-line Filters

1.Close the liquid nitrogen supply valve and disconnect the liquid nitrogen transfer hose from the pipeline system.

2.Unscrew from the piping system and remove the liquid inlet fitting and the in-line filter.

3.Replace the filter inside the pipeline, and re -install the liquid inlet connector and the in-line filter onto the pipeline system. If necessary, you may use Teflon tape. Be sure to install the filter in the correct orientation, with the arrow pointing in the direction of liquid nitrogen flow.

4.Reconnect the liquid nitrogen transfer hose, open the liquid nitrogen supply valve, and check the connecting fittings for leaks.

Warning: Before replacing the filter, make sure the liquid nitrogen supply valve is closed and the pipeline assembly has been completely drained!

5.2.9 Level Sensor Calibration

1.Check the reading of the actual liquid level according to 5.2.1.

2.Check the reading displayed in the "Level" column on the main page.

3.Actual reading - Displayed reading = Level offset.

4.In "Settings" - "Advanced Settings" - "Level Offset," enter the level offset value.

5.2.10 Temperature Sensor Calibration

5.2.10.1 Single-point calibration

1.Prepare a small amount of liquid nitrogen-enough to completely immerse the end of the temperature sensor.

2. Place the temperature sensor into liquid nitrogen and observe the actual reading.

3. In “Settings” → “Advanced Settings” → “Temperature Calibration,” locate the “Calibration Value” column for each of the three temperature sensors—A, B, and C—and enter the actual temperature values there.

5.2.11 Replace the solenoid valve

All electromagnetic valves used in liquid nitrogen biological containers have been inspected and approved for low-temperature applications. To achieve optimal sealing performance in cryogenic environments, these electromagnetic valves are equipped with polytetrafluoroethylene (PTFE) seals. Over time, the normal thermal cycling experienced by these seals can cause them to harden and lose their ability to provide a complete seal, leading to permeation through the sealing

surfaces and increasing the system’s liquid nitrogen consumption. In extreme cases, this can result in overfilling and liquid nitrogen overflow. Additionally, the thermal cycling associated with normal operation can allow moisture to penetrate into the coil of the electromagnetic valve. Over time, this may cause corrosion of the connections and windings inside the coil, ultimately leading to failure. As a result, the electromagnetic valve will no longer function properly.

Note: Be sure to use the solenoid valves provided by our company for replacement. Using accessories not supplied by our company may cause the solenoid valve to malfunction and could even damage the controller system. Damage to the controller system resulting from the use of non-company accessories is not covered under the warranty terms.

Warning: Before replacing the solenoid valve, make sure the liquid nitrogen supply valve is closed and the pipeline assembly has been completely purged!

1.Remove the pipe cover to expose the piping system.

2.Insert a flathead screwdriver between the coil-retaining clip and the edge of the coil body to remove the coil-retaining clip Rotate the screwdriver, and the clip will slide off easily.

3.Disassemble and discard the coil assembly.

4.Use a wrench to loosen the hexagonal nut and remove the plunger housing. Remove the plunger housing and the plunger assembly components. Discard these components.

5.Remove any impurities that may have accumulated in the brass valve body.

6.Inspect the brass valve body S solenoid valve for any scratches or damage. If the sealing surface is in good condition, the Valve body can be reused. However if the sealing surface is already damaged, the pipeline will need to be disassembled and reassembled, and the entire valve body will have to be replaced (though this is not common).

7.Disassemble and reassemble a new valve using the above procedure.

8.Install the new embolization device, embolization shell, and coil assembly onto the old valve body.

9.Reassemble the valve using the new components in the reverse order.

10.Use a leak detection fluid to check and confirm that there are no leaks.

11.Open the nitrogen supply valve and press "Start Filling" to initiate a filling cycle. Once the filing cycle is complete, confirm that the liquid nitrogen flow has stopped when the filling cycle ends.

Note: If the brass valve body needs to be replaced, you' ll need to disassemble and reassemble the liquid nitrogen tank piping and replace the entire valve. Generally speaking, when disassembling and reassembling the piping, it s easier to start by removing the liquid inlet fitting if you' re replacing the liquid filing valve; conversely, if you' re replacing the gas bypass valve, it' s easier to start by removing the gas bypass silencer.

Note: When installing a brand-new valve, make sure its direction is correct.

5.2.12 Safety Valve Replacement

Warning: Before replacing the safety valve, make sure the liquid nitrogen supply valve is closed and the pipeline assembly has been completely drained!

1.Remove the pipe cover to expose the piping system.

2.Loosen the safety valve and remove it from the piping system. To prevent damage caused by entanglement, use a wrench to support the attached pipe.

3.Install the new safety valve; if necessary,use Teflon tape. Ensure that the pressure rating of the pressure relief valve is 125 PS (0.6bar).

Warning: Ensure that the safety valve' s rated pressure is 125 PSI (8.6 bar). Failure to install according to this specification could pose a safety hazard! Additionally, doing so will void the warranty!

Small Vapor-Phase Cryogenic Storage Systems

User Manual

Table of Contents

目录

Small Vapor-Phase Liquid Nitrogen Storage Container 1

1. Safety Precautions ..... - 2 -
    1.1 General Knowledge ..... - 2 -
    1.2 Properties of Liquid Nitrogen ..... - 2 -
    1.3 Liquid Nitrogen Safety ..... - 2 -
    1.4 Recommended Personal Protective Equipment ..... - 2 -
    1.5 Equipment Use ..... - 3 -
    1.6 First Aid Recommendations ..... - 3 -
2. Product Information ..... - 3 -
    2.1 Overview ..... - 3 -
    2.2 Main Structure and Features ..... - 4 -
    2.3 Medical LN2 Tank Model ..... - 4 -
    2.4 Piping System ..... - 5 -
    2.5 Controller Display Panel ..... - 5 -
    2.6 Controller Rear Panel / Physical Connections ..... - 10 -
    2.7 Specifications ..... - 11 -
    2.8 Operating Environment ..... - 12 -
3. Installation and Startup ..... - 12 -
    3.1 Installation ..... - 12 -
    3.2 Initial Fill Procedure ..... - 12 -
4. Operation ..... - 13 -
    4.1 Features and Functions ..... - 13 -
    4.2 Parameter Settings ..... - 19 -
    4.3 Advanced Settings ..... - 20 -
5. Preventive Maintenance ..... - 22 -
    5.1 Preventive Maintenance Schedule ..... - 22 -
    5.2 Preventive Maintenance Procedures ..... - 22 -
    5.3 Replacement of Parts and Accessories ..... - 26 -
6. Troubleshooting Quick-Reference Guide ..... - 26 -
7. Decommissioning ..... - 27 -
    7.1 Cleaning and Decontamination ..... - 27 -
    7.2 Product Disposal ..... - 27 -
8. Product Quality Warranty ..... - 27 -
9. Appendix ..... - 28 -

1. Safety Precautions

1.1 General Knowledge

Liquid Nitrogen (LN2) is the refrigerant for this medical liquid nitrogen storage system. Understanding and adhering to specific safety practices is essential before handling LN2 and operating the Intelligent Aluminum Alloy Liquid Nitrogen Biological Container (hereafter referred to as the LN2 tank).

1.2 Properties of Liquid Nitrogen

Nitrogen is a colorless, odorless, and tasteless gas, constituting approximately 78% of Earth's atmosphere by volume. Collected and separated nitrogen can be liquefied.

Property at 1 atm	Value
Boiling Point	-195.8°C , -320.3°F , 77.4 K
Thermal Conductivity (Gaseous)	25.83 mW/(m·K)
Heat of Vaporization (Liquid)	198.38 kJ/kg
Density (Liquid) at 1 atm	1.782 lbs/L , 807.4 g/L , 808.6 kg/m³

1.3 Liquid Nitrogen Safety

Always strictly follow the operational guidelines from the manufacturer and supplier when transporting LN2 and operating the control system. Adhere to all safety precautions indicated on the LN2 storage tank and recommended by the manufacturer.

WARNING

Unauthorized modification of this equipment is strictly prohibited!

Nitrogen is a potential asphyxiant and can cause rapid suffocation without warning! Store and use nitrogen in well-ventilated areas only. Do not fill with nitrogen in confined spaces. Do not enter enclosed spaces that may contain nitrogen unless adequately ventilated. If inhaled, move immediately to fresh air. If breathing is difficult, administer oxygen; if breathing has stopped, give artificial respiration. Seek immediate medical attention!

Liquid nitrogen can cause severe frostbite to eyes and skin. Do not touch frosted pipes or valves! Cold nitrogen vapor can injure eyes and skin. In case of frostbite, seek immediate medical **attention and warm the affected area with lukewarm water.**

Never place liquid nitrogen in a sealed container without a pressure relief valve. The expansion ratio from liquid to gaseous nitrogen is approximately 1:700 (i.e., 1 cubic meter of LN2 expands to about 700 cubic meters of gas).

The two most critical safety points when handling LN2 are adequate ventilation and protection for eyes and skin. While nitrogen is non-toxic, its danger lies in displacing oxygen from the breathing environment. Liquid nitrogen is more dangerous because a small amount of liquid evaporates into a large volume of gas. Therefore, LN2 equipment must be stored and operated in well-ventilated areas.

Personnel must take all necessary precautions to prevent accidental contact of eyes and skin with LN2 and cold nitrogen gas. We recommend the following clothing and equipment for anyone handling LN2 or operating LN2 hoses, valves, and piping

1.4 Recommended Personal Protective Equipment

- Cryogenic gloves (loose-fitting)
- Full-face shield or chemical splash goggles

- Cryogenic apron
- Long-sleeved shirt and cuffless pants
- Closed-toe shoes (no sandals)

1.5 Equipment Use

This equipment must be operated according to the manufacturer's and supplier's instructions. Safety labels are affixed to the outside of each LN2 tank. The unit must be stored in a well-ventilated area, protected from weather and heat sources. If using a self-pressurized LN2 dewar as a supply, refill it periodically to ensure proper operation. When replacing the supply dewar, follow this procedure:

1.Before replacement, allow all piping components to return to room temperature.
2.Close all valves associated with the supply dewar.
3.Briefly initiate a manual fill to relieve pressure within the piping assembly.
4.Disconnect the piping fitting on the supply hose.
5.Remove the empty dewar and replace it with a full one, pressurized to 22 – 35 psi (1.52 - 2.41 bar).
6.Connect the supply hose to the dewar's fitting.
7.Tighten the fitting on the dewar.

8.Open the liquid supply valve on the dewar.
9.Check for visible or audible leaks. Contact service personnel if needed.
10.Manually initiate a fill to confirm proper operation.

1.6 First Aid Recommendations

A Material Safety Data Sheet (MSDS/SDS) should be available wherever LN2 is stored and used, obtainable from the manufacturer or supplier. It describes symptoms of overexposure and first aid measures. A typical example: Symptoms like headache, drowsiness, dizziness, excitement, excess saliva, vomiting, or unconsciousness require moving the person to fresh air. If breathing stops, administer artificial respiration. Seek immediate medical help! Oxygen may be needed if breathing is difficult.

For frostbite from LN2 or cold gas, warm the affected area back to body temperature (37°C/98.6°F) as quickly as possible, then protect it from further injury or infection. Use warm water not exceeding 40°C (104°F). Do not rub the frostbitten area, before or after warming. For eye exposure, flush carefully with warm water for at least 15 minutes. For large body contact, remove clothing and use a warm shower. The victim should not drink alcohol or smoke. Seek medical attention immediately!

2. Product Information

This section provides an overview of the device and its components. Our company offers a series of LN2 storage systems with controllers to meet various low-temperature storage capacity needs. Each system is a handcrafted, double-walled, vacuum-insulated aluminum alloy dewar designed to maintain temperature and minimize LN2 evaporation.

This product is designed and manufactured per GB/T 5458-2012 standard. It features a level monitor with alarm functions for safe, reliable operation. Advanced high-vacuum multi-layer insulation and a carefully designed structure provide a large-diameter access port while maintaining low static evaporation rates, offering large storage capacity, low LN2 loss, ease of operation, aesthetic appearance, and long service life.

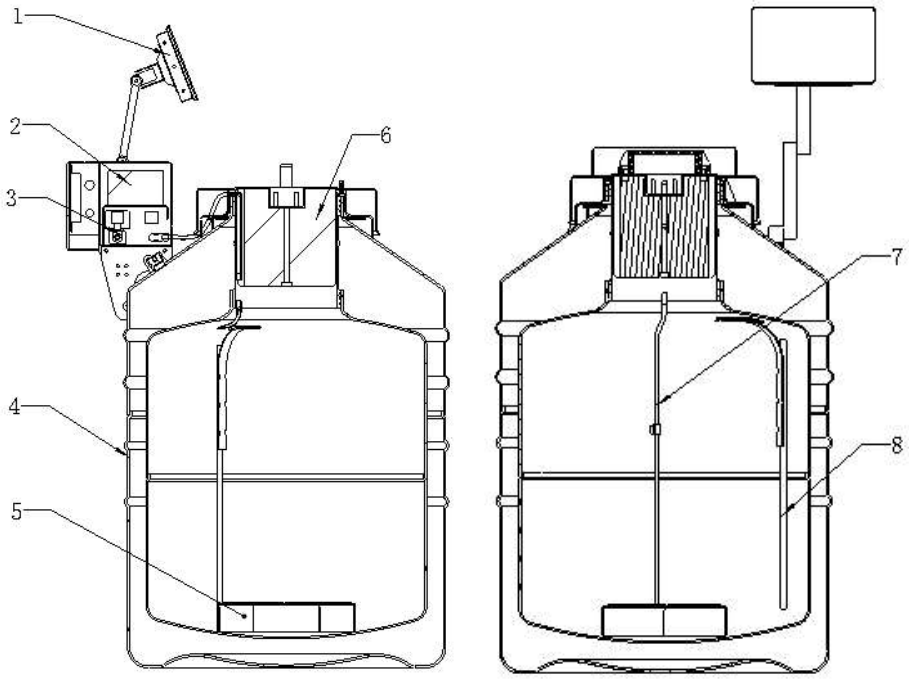
2.1 Overview

Product Name: Intelligent Aluminum Alloy Liquid Nitrogen Biological Storage Container

Product Model: Small Vapor-Phase LN2 Tank
Software: Intelligent LN2 Storage Monitoring and Management System

2.2 Main Structure and Features

1.Structure:
Primarily consists of refrigeration unit (LN2), tank body, battery, and electrical control system (see diagram below).
2.Diagram and Features:



1. Intelligent LN2 Monitoring/Control System	Custom PLC + touchscreen control for simple, stable, reliable operation.
2. Battery	Powers the control system during movement/transport or during AC power failure.
3. Fill Valve Assembly	Includes muffler. Ensures reliable filling, automatically purging nitrogen from lines to minimize temperature impact.
4. Outer Shell	Composed of upper and lower sections. Uses specially designed low-thermal-conductivity support structures to minimize solid heat transfer while ensuring strength.
5. Hexagonal Positioning Cassettes	Enable quick sample positioning and stable, reliable transport.
6. Plug	Reduces LN2 evaporation rate.
7. Fill Tube	For automatic LN2 replenishment.
8. Level Sensor Rod	Monitors internal LN2 level in real-time.

2.3 Medical LN2 Tank Model

The following is a list of some of our LN2 storage system models. Our systems minimize LN2 evaporation while

maintaining a vapor storage temperature of -190°C, suitable for various sample storage applications.

Model	YDS-175-216L
LN2 Capacity (L)	175
Neck Inner Diameter (mm)	216
Static Evaporation Rate (L/day)	0.87
Number of Square Canisters	6
1.2ml & 2.0ml Vial Capacity (100-slot canister)	6000
Number of Rack Layers	10
Overall Height (mm)	1130
Required Doorway Width (mm)	678

2.4 Piping System

The piping system transports and regulates LN2 from the supply source to the tank via the fill line. It consists of three main circuits: Fill, Purge, and Gas Bypass.

2.5 Controller Display Panel

2.5.1 Home Screen

Display	10-inch LCD touchscreen
Point A Temp	Temperature at top of tank (°C)
Point B Temp	Temperature at bottom of tank (°C)
LN2 Level	Liquid level height (mm)
LN2 Consumption	Daily LN2 consumption rate (mm/Day)
Fill Button	Initiates/manually controls LN2 fill.
Defog Button	Activates defog function when lid is open.
Mute Button	Silences alarm buzzer.
Home Button	Returns to system home screen.

Data Mgmt Button	Views device operation data/trends.
Event Log Button	Views system operation and alarm logs.
Settings Button	Accesses parameter settings.
Info Button	Views device information.

2.5.2 Data Screen

This interface displays the trend curves for the temperature at Point A, the temperature at Point B, the liquid level, and time. Click “Table” to access the detailed data interface:

Click “Status” to enter the status interface for each sensor currently in use:

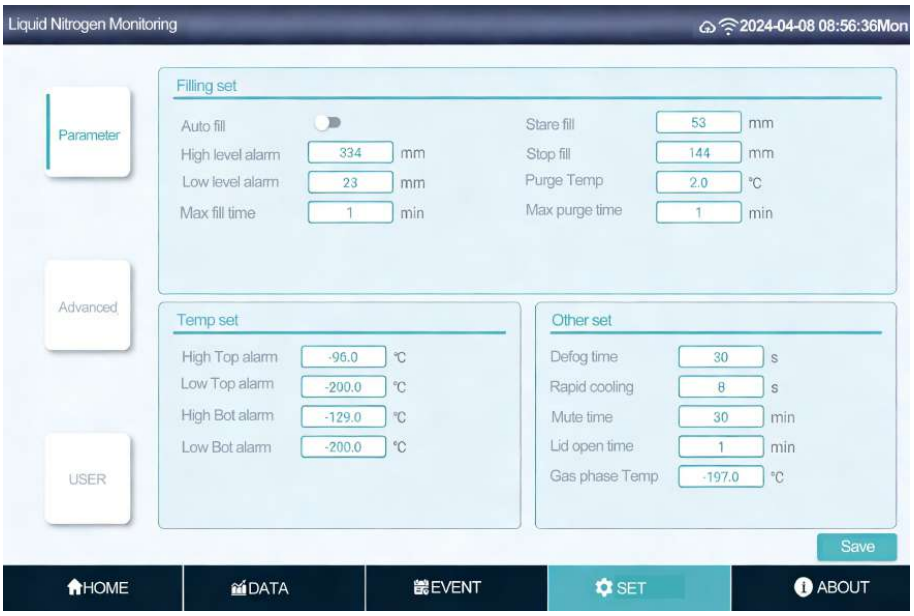
Click “Data Export” to enter the data export interface:

2.5.3 Event Log Screen

This interface displays the names of various alarms, as well as their start and end times. The search and export methods are the same as those described in 2.5.2.

2.5.4 System Settings Screen

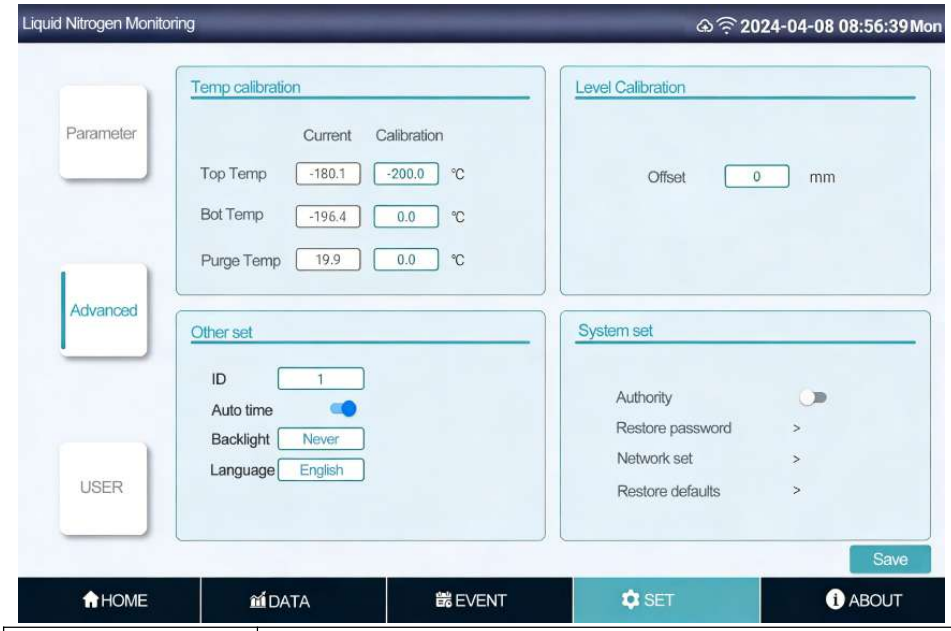
2.5.4.1 Parameter Settings



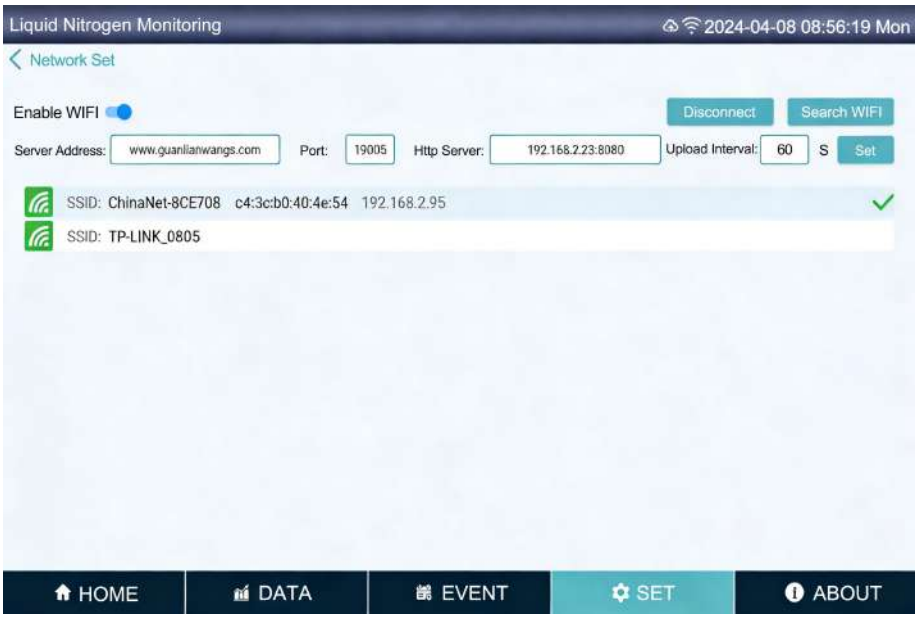
Auto Fill	Enable/disable automatic LN2 refill.
High Level Alarm	Alarm triggers if level > setpoint.
Low Level Alarm	Alarm triggers if level < setpoint.
Fill Timeout Alarm	Alarm if fill duration > setpoint.
Fill Start Level	(Auto-fill on) Begin fill when level < setpoint.
Fill Stop Level	(Auto-fill on) Stop fill when level ≥ setpoint.
Exhaust Temp	Open hot gas valve if sensor temp > setpoint.
Exhaust Timeout Alarm	Alarm if exhaust duration > setpoint.
Point A High Temp Alarm	Alarm if Temp A > setpoint.
Point A Low Temp Alarm	Alarm if Temp A < setpoint.
Point B High Temp Alarm	Alarm if Temp B > setpoint.
Point B Low Temp Alarm	Alarm if Temp B < setpoint.

Defog Duration	Default 30s for Defog button. Adjustable.
Mute Duration	Buzzer off time when Mute is activated.
Vapor Phase Protect Temp	Stop fill if Temp A < setpoint. Prevents overfilling in liquid phase mode (e.g., set to -197°C).
Auto Fill on Lid Close	(Function for large stainless steel tanks - refer to relevant manual)
Lid Open Timeout Alarm	(Function for large stainless steel tanks - refer to relevant manual)

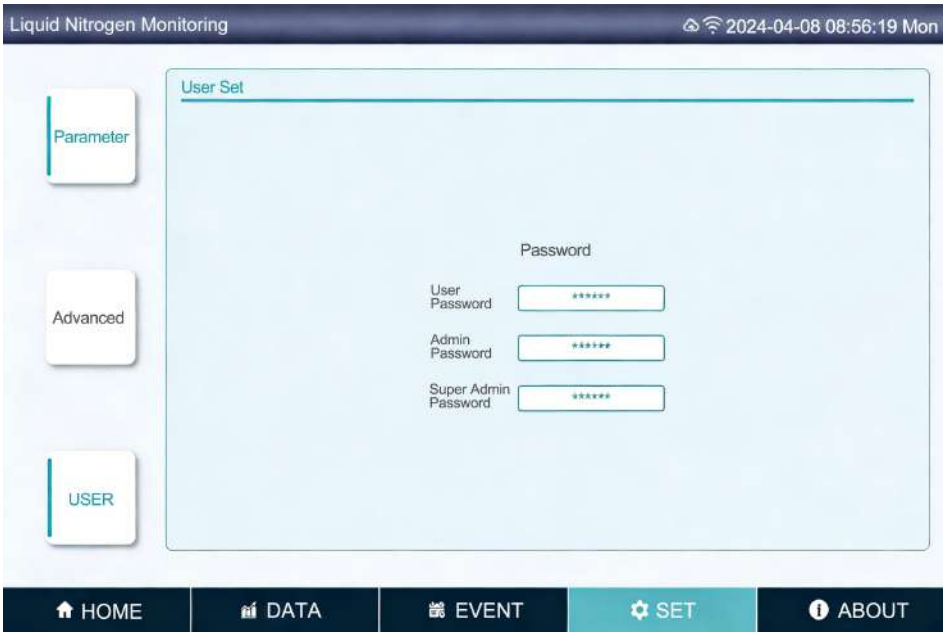
2.5.4.2 Advanced Settings



Temp Calibration	Columns: Sensor Current Temp, Calibration Value (enter offset).
Level Calibration	Level Offset = Actual Level - Displayed Level.
Other Settings	Auto-update time, adjust screen sleep timer, language selection.
System Settings	Account Permissions: Enable/disable password protection levels. Restore Default Passwords: Reset all passwords to factory default. Network Setup: Connect to Wi-Fi for remote functions. Restore Factory Settings: Reset all parameters to factory defaults.



2.5.4.3 User Management



2.6 Controller Rear Panel / Physical Connections

The controller's physical and electrical connections are located on the bottom or rear panel.

1	Temp A Port	Connects to Point A temperature probe.
2	Temp B Port	Connects to Point B temperature probe.
3	Serial Number Barcode	Controller serial number is below barcode.
4	24V Power Input	Main power connection.
5	Manual Fill Button	For manual LN2 fill (quick defog or emergency). Press and hold to open fill valve; release to close.
6	USB Port	For exporting controller log data.
7	Buzzer	For audible/visual alarm.
8	Harness Connector	12-pin harness connects to piping system, lid switch, and backup battery.

2.6.1 12-Pin Harness Connection

	Function	Desc	Wire Color	Wire	Length (mm)
1	Fill Valve	+	Brown	1	2000
2		—	Black	2	2000
3	Exhaust Valve	+	Brown	3	1900
4		—	Black	4	1900
5	Level Sensor	+	Brown	7	1200
6		—	Black	8	1200
7	Hot Gas Temp Sensor	+	Brown	9	1700
8		—	Black	10	1700
9	Lid Open Sensor	+	Brown	11	2500
10		—	Black	12	2500
11	Backup Battery	+	Brown	13	1200
12		—	Black	14	1200

Table 7: 12-Pin Harness Details

2.7 Specifications

Display	
Type	Android Touchscreen
Size	10 inch
Resolution	1024 x 600
Operation	Touch Control
Electronic Specs – Controller Only	
Input Voltage	24 V DC
Input Current (Max)	5 A
Input Current (Continuous)	1 A
Power Consumption (Max)	28 W
Power Consumption (Continuous)	6 W
Fill Valve Output Voltage	24 V DC
Short Circuit Protection	Current Limiting, Auto-Reset
Power Adapter Specs	
Input Voltage	110 – 230 V AC, Auto-Switching
Input Frequency	50 – 60 Hz
Output Voltage	24 V DC
Max Current Capacity	5 A
Input Current	0.73 A @ 110 V AC 0.35 A @ 230 V AC
Power Requirements – Controller + Adapter	
Input Voltage	110-230VAC/50-60Hz
Input Current (Max)	73A@110VAC
Input Current (Continuous)	35A@230VAC
Input Power (Max)	30 W
Input Power (Continuous)	8 W
Temperature Sensors	
Type	2-Wire Platinum RTD (Pt-100)
Quantity	3
Resistance	1000 Ω at 0°C
Sensitivity	3.85 Ω / °C
Temperature Monitoring	
Resolution	0.1°C
Accuracy - Single-Point Cal*	± 1.0°C
- Dual-Point Cal**	± 2.0°C
Range	- 200°C ~70°C

Level Monitoring	
Type	Capacitive / Differential Pressure
Accuracy	± 10mmLN2
Resolution	1 mm
Range	75-983mm/0-625mm

2.8 Operating Environment

2.8.1 Ambient Temperature & Relative Humidity

Designed for near-room temperature operation (18°C to 27°C / 64°F to 81°F), with relative humidity <50%. Minor ambient changes have negligible impact on performance. High humidity can cause condensation/frost on the lid; keep dry or periodically wipe. Severe icing requires thawing (see Preventive Maintenance).

2.8.2 Atmospheric Pressure

Designed for operation at 57.2 kPa to 101 kPa (approx. 0.56 to 1.0 atm).

2.8.3 Heat Load

Uses LN2 as refrigerant (no mechanical cooling), resulting in negligible negative heat load.

3. Installation and Startup

This section covers basic receiving, installation, and startup procedures. Inspect the packing slip and check for shipping damage before accepting the shipment.

3.1 Installation

Note: To prevent injury and damage, do NOT power the controller or fill with LN2 yet. Follow these guidelines after careful unpacking.

Note: The LN2 storage system must be installed on a level surface.

A. All connections between piping system components and the controller harness are safe voltage (DC24V).

B. Plug the power cord into a properly grounded AC outlet with correct voltage.

C. Plug the power cord into the controller's 24VDC input. The display will light up and begin startup.

D. To prevent shock, the unit must be connected to a properly grounded outlet.

E. Alarms may sound upon startup (normal).

F. Press the "Mute" button to silence the buzzer for 30 minutes. For installation, the buzzer can be disabled but must be reactivated afterward.

G. Before connecting the LN2 supply, remove the protective cap from the fill port. Ensure supply hoses are correctly connected and tightened.

Note: Recommended LN2 supply pressure: 0.1 MPa - 0.15 MPa (14.5 - 21.8 PSI).

3.2 Initial Fill Procedure

1.Begin the initial fill only after the system is correctly installed in its final location. Do not fill and then move the unit.

2.For the initial fill, OPEN or REMOVE the lid, as the warm tank causes rapid LN2 boil-off. If equipped with a lid switch, activate manual override (refer to lid switch section).

3.Confirm supply pressure is 0.1 MPa - 0.15 MPa and open the valve.

Item	65L	95L	115L	140L	175L
	Gas Phase	Liquid Phase	Gas Phase	Liquid Phase	Gas Phase
Fill Start (mm)	20	140	20	200	90

Fill Stop (mm)	90	180	90	240	90
Overfill Time (min)	40	40	40	40	40
Discharge Time (min)	30	30	30	30	30
High Level Alarm (mm)	100	190	100	250	100
Low Level Alarm (mm)	10	130	10	10	10
Point A Height (mm)	200	200	270	270	310
Point B Height (mm)	60	60	60	60	60
Δ High Temp. Alarm (°C)	-150	-150	-150	-150	-150
Δ Low Temp. Alarm (°C)	-195	-195	-195	-195	-195
Discharge Temp. (°C)	10	10	10	10	10
B Point High Temp. Alarm (°C)	-180	-180	-180	-180	-180
B Point Low Temp. Alarm (°C)	-197	-197	-197	-197	-197

Verify parameter settings are correct according to the reference table below (Table 9).

4.Once confirmed, tap "Auto Fill" to begin filling.

5.The initial fill takes much longer than subsequent fills due to the warm tank.

6.It is recommended to place empty storage components (racks, boxes, supports) inside during the initial fill. This pre-cools all components and helps the tank reach its "top box temperature" faster.

7.Some condensation and frost at the neck during initial fill is normal.

8.Once the controller shows a level reading, press "Stop Fill." Let the liquid stabilize, then insert the dipstick. Check if the measured level matches the controller display. Adjust the offset if needed. Press "Start Fill" to continue. When the maximum level is reached, wait 10 minutes for stabilization, check with the dipstick, and recalibrate if necessary.

9.After the controller level matches the physical level, close or replace the lid to let the tank stabilize and reach its rated temperature.

10It is recommended to place biological samples only after the "top box temperature" has stabilized at or below the tank's rated temperature for a few days. It is also advised to restart the controller 24 hours after initial installation to reset the LN2 consumption calculation.

4. Operation

This section details the controller's features and functions and demonstrates how to access and adjust various user settings.

All LN2 storage systems use LN2 as a refrigerant. At atmospheric pressure, LN2 temperature is -196°C. Depending on the model, LN2 resides inside or at the bottom of the storage space. Over time and with normal use, LN2 evaporates and the level decreases. To maintain the storage temperature, the LN2 level must be properly maintained. Therefore, the controller's primary function is to monitor and record temperature.

4.1 Features and Functions

The controller has a range of features for closely monitoring and controlling the internal environment of the LN2 storage system.

- LN2 Level Monitoring
- Automatic LN2 Level Control
- LN2 Usage Calculation
- Temperature Monitoring
- User-Defined Alarms
- Password/Security
- Communication Capability

- Lid Switch
- Hot Gas Bypass
- Backup Battery (Optional)

4.1.1 LN2 Level Monitoring

The LN2 level in the tank is measured using a capacitive sensor.

4.1.2 Automatic LN2 Level Control

The controller is equipped with a user-configurable LN2 level control system. Parameters can be adjusted electronically via the touchscreen or remotely.

The auto-fill function can also be disabled. Below are four user-defined level control parameters. See the Level Settings and Alarms section for adjustment instructions.

A. High Level Alarm: Triggers when the level reaches or exceeds the setpoint. Activates audible/visual alarm and remote alarm contact.

B. High Level Setpoint: The level at which the controller closes the fill valve and terminates filling (regardless of auto-fill status).

C. Low Level Setpoint: The level at which the controller initiates a fill cycle (regardless of auto-fill status).

D. Low Level Alarm: Triggers when the level is at or below the setpoint. Activates audible/visual alarm and remote alarm contact.

Note: Auto-fill control can be temporarily disabled by pressing "Stop Fill" for 30 minutes. It is also disabled during a Hot Gas Bypass Alarm or Fill Time Alarm and remains disabled until the alarm is cleared (by muting or restarting).

Overfill Protection: Prevents auto-fill if the level reading is 0 or suddenly drops to 0, guarding against overfilling when the controller cannot detect the level.

4.1.3 LN2 Usage

The controller calculates and displays the approximate evaporation rate of LN2 in the tank, shown in mm per day. The rate is calculated by measuring the time it takes for the level to drop by 12.7 mm (0.5 inches) and extrapolating that to a 24-hour period.

Example:

If the level drops from 6.0 inches to 5.5 inches in 12 hours, the displayed usage would be 1.0 inch/day.

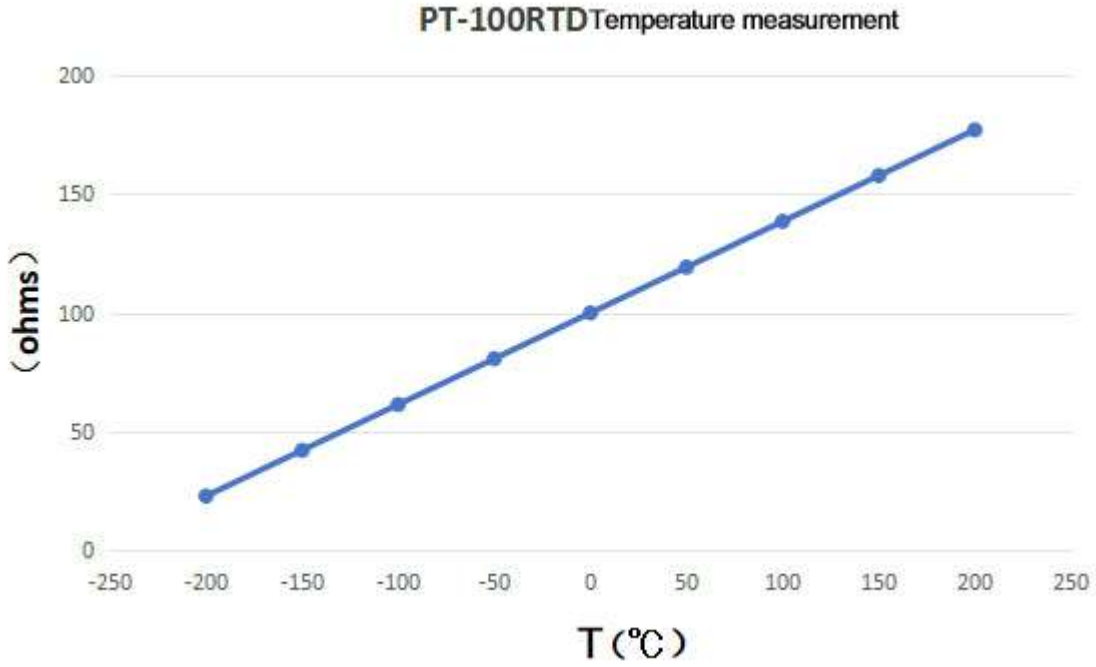
The calculation pauses during filling and resumes 15 minutes afterward to allow stabilization. Restarting the controller

or power resets the calculation.

Note: Several situations can temporarily exaggerate LN2 usage: a sudden level drop of 0.5 inches, prolonged lid opening, sample handling, filling from an empty supply, or moving the tank. While the usage is an accurate estimate over time, it can be skewed by such events.

4.1.4 Temperature Monitoring

The controller has two independent temperature measurement channels using 100-ohm Platinum RTDs (Pt-100). The resistance of the ultra-fine platinum wire changes linearly with temperature, making Pt-100 RTDs ideal for cryogenic measurement. The displayed reading is a running average of recent measurements, updated every second. The hot gas bypass sensor is also a Pt-100 RTD.



4.1.5 Alarms

The controller has 17 audible/visual alarms to alert users to potential issues with tank temperature, LN2 level, controller power, or LN2 supply. When triggered, the buzzer sounds, the alarm displays on the screen, and remote alarm contacts activate. To clear an alarm, correct the condition, then press "Mute" or restart the controller. If the condition persists, "Mute" only silences the buzzer for 30 minutes.

Note: Most controller alarms have a 1-minute delay to avoid false positives. * indicates alarms with no delay.

No.	Alarm Type	Description
1	High Temp. A*	Temperature A reading reaches or exceeds high temperature alarm setting.
2	High Temp. B*	Temperature B reading reaches or exceeds high temperature alarm setting.
3	Low Temp. A	Temperature A reading reaches or falls below low temperature alarm setting.
4	Low Temp. B	Temperature B reading reaches or falls below low temperature alarm setting.
5	High Level	Liquid level reaches or exceeds high liquid level alarm setting.

6	Low Level	Liquid level reaches or falls below low liquid level alarm setting.
7	Liquid Nitrogen Usage Alarm (can be enabled/disabled)	The liquid nitrogen usage exceeds the preset threshold. This alarm will not trigger any audible or visual alert on the device; it only records the event in the internal log during operation.
8	Liquid Nitrogen Usage Alarm (with audible/visual indicator)	When liquid nitrogen usage reaches 24 hours, an audible and visible alarm is triggered. The alarm duration is 5 minutes. Even if the controller has no audible or visible indication, the event code is still recorded in the log.
9	Fill Time	In the set maximum fill time period, filling is not completed. After the alarm is cleared, the automatic filling process will restart.
10	Bypass Time Alarm	The gas circuit bypass loop is delayed in closing after the filling process ends. Once filled, the bypass valve remains open for a certain time before closing automatically.
11	Temperature Probe A Failure Alarm*	Temperature A reading drops to zero (-273°C / -460°F / 0 K).
12	Temperature Probe B Failure Alarm*	Temperature B reading drops to zero (-273°C / -460°F / 0 K).
13	Bypass Temperature Sensor Failure Alarm*	Bypass temperature sensor reading drops to zero (-273°C / -460°F / 0 K).
14	Battery Low	Backup battery voltage has dropped below 21VDC.
15	Power Supply Disconnect (can be used with backup battery)	Controller power supply is interrupted. The system can operate on backup battery for up to 30 minutes.
16	Lid Open	The lid has been opened for longer than the set lid open alarm time.
17	Communication Lost	Controller has lost communication with the control panel or display module.

If any alarm occurs, contact our professional after-sales personnel or authorized dealer for handling.

4.1.6 Password and Security

The controller has a multi-level security system with four different security levels and up to ten assignable passwords, allowing control over who can change specific settings.

Example: A lab manager might give technicians a low-level password to view but not change settings, while a supervisor gets a high-level password for full access.

Password entry can be disabled in the password menu. See the Password and Security Settings section for details.

No.	Category		No password	Ordinary password	Management Password	Super Password	System Password
				111111	123456	654321	888888
1	Main Page	Fill Liquid		✔	✔	✔	✔
2		De -fogging	✔	✔	✔	✔	✔
3		Alarm Audio	✔	✔	✔	✔	✔
4	Data Management	Data export		✔	✔	✔	✔
5	Operation Log			✔	✔	✔	✔

No.	Category			No password	Ordinary password	Management Password	Super Password	System Password
					111111	123456	654321	888888
6	Parameter settings	Fill Settings	Automatic Fill			✔	✔	✔
7			High-Level Alarm			✔	✔	✔
8			Low-Level Alarm			✔	✔	✔
9			Fill Over Time Alarm			✔	✔	✔
10			Fill Start			✔	✔	✔
11			Fill Stop			✔	✔	✔
12			Exhaust Temperature			✔	✔	✔
13			Exhaust timeout alarm			✔	✔	✔
14		Temperature Settings	A Point High-Temperature Alarm			✔	✔	✔
15			A Point Low-Temperature Alarm			✔	✔	✔
16			B Point High-Temperature Alarm			✔	✔	✔
17			B Point Low-Temperature Alarm			✔	✔	✔
18		Other Settings	De-fogging Duration			✔	✔	✔
19			Lid-Closed Auto-Fill			✔	✔	✔
20			Mute Duration			✔	✔	✔
21			Lid Open Timeout			✔	✔	✔
22			Gas Phase Protection Temperature			✔	✔	✔
23	Advanced settings	Temperature Calibration	A Point Temperature Calibration			✔	✔	✔
24			B Point Temperature Calibration			✔	✔	✔
25			Bypass Temperature Calibration			✔	✔	✔
26		Liquid Level Calibration	Liquid Level Offset			✔	✔	✔
27			Factory Calibration				✔	✔
28		Other Settings	Device ID			✔	✔	✔
29			Auto Time and Date Synchronization			✔	✔	✔
30			Sleep Mode			✔	✔	✔

No.	Category			No password	Ordinary password	Management Password	Super Password	System Password
					111111	123456	654321	888888
31		System Settings	Account Permissions				✔	✔
32			Restore Default Password				✔	✔
33			Network Settings				✔	✔
34			Restore Factory Defaults				✔	✔
35	User Management	Password Settings	Ordinary Password		✔			
36			Management Password			✔		
37			Super Password				✔	

4.1.8 Event Log and Event Codes

The controller has built-in data logging that automatically stores timestamped key information (temperature, level, usage, alarms). Data is logged at user-defined intervals (default: 5 min). The non-volatile memory can store up to 30,000 events (~10 years at 5-hour intervals). The log can be easily downloaded via USB as a .CSV file. The log is crucial for diagnosing issues.

Note: The log is retained during power loss, restart, or firmware update but is cleared by a factory reset. When memory is full, the oldest events are overwritten.

4.1.9 Hot Gas Bypass

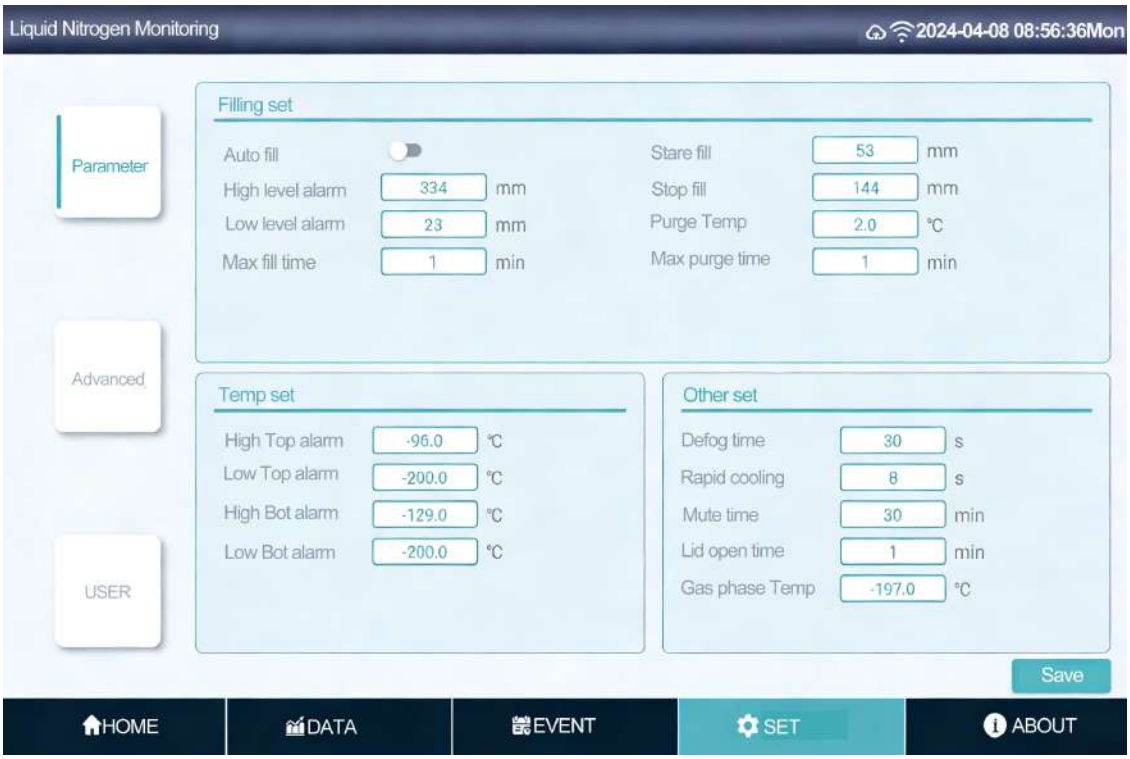
All controller-equipped products have a hot gas bypass function. It vents warm nitrogen from the supply line before initiating a fill cycle, preventing hot gas from entering the storage space. This helps maintain internal temperature uniformity and increases efficiency by reducing excessive evaporation during filling. It is especially beneficial for setups

with long supply lines.

The system includes:
1.Solenoid Valve (24VDC),
2.Temperature Sensor (Pt-100 RTD),
3.Muffler, and associated piping/electrical connections.

Before filling, the tank completes a bypass cycle. The bypass valve opens first, venting gas through the muffler. The controller monitors the pipe temperature. When LN2 begins to flow, the temperature drops. Once it reaches the user-set Bypass Temperature Setpoint (default: 10°C), the bypass valve closes, and the fill valve opens.
The Bypass Alarm Delay Time is the maximum allowed duration for the bypass cycle. If the temperature doesn't reach the setpoint within this time, the controller terminates the bypass, starts the fill, and triggers a Hot Gas Bypass Time Alarm. After that fill completes, auto-fill is disabled until the alarm is cleared. This often indicates an empty supply or low pressure but may also require increasing the Bypass Alarm Delay time. Default is 5 minutes.

4.2 Parameter Settings



4.2.1 Enable/Disable Auto-Fill Control

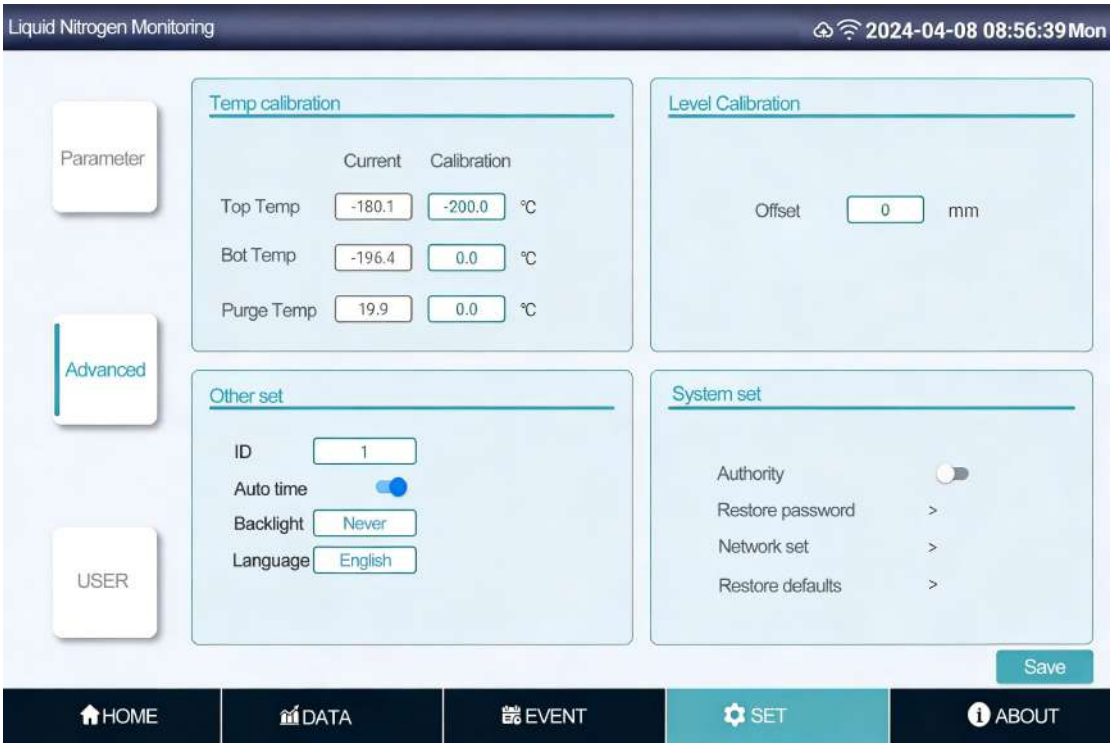
Can be set in the Advanced Settings menu. (Requires Security Level 3 or above).

4.2.2 Level Setpoints and Alarms

Auto-fill settings are adjusted in the Level menu. With auto-fill enabled, the controller starts a fill when the level is at or below the Low Level Setpoint and stops at the High Level Setpoint. Alarms trigger at the High/Low Level Alarm setpoints.
Note: There must be at least a 12.7 mm (0.5 inch) gap between each setpoint/alarm. Minimum Low Level Alarm is 10.2 mm (0.4 in), maximum High Level Alarm is 520.7 mm (20.5 in). (Requires Security Level 2 or above).

4.2.3 Level Offset Calibration

The level sensor signal is offset from the absolute bottom of the fluid column. This offset is factory-set. Do not adjust unless setting up a new tank (see Initial Fill) or instructed by authorized service. (Requires Security Level 3 or above).



4.3 Advanced Settings

4.3.1 Temperature Sensor Calibration

Describes how to calibrate the controller's temperature sensors. Two methods: Single-Point (reference: LN2) and Dual-Point (references: LN2 and Ice Water). Single-point is recommended unless regulations require dual-point. Dual-point is more accurate near room temperature but more complex.

All controllers are factory-calibrated to ±1.0°C. Recalibrate only if readings are suspect, after replacing a sensor/controller, or as part of preventive maintenance. For accuracy, set the correct LN2 saturation temperature for the tank's altitude.

WARNING: Always wear protective gloves and face shield when handling LN2.

4.3.1.1 Single-Point Calibration:

Requires enough LN2 to submerge the sensor tip.

4.3.1.2 Dual-Point Calibration:

Requires LN2 and a properly prepared ice-water bath (filtered water with crushed ice, rested for 5 min).

(Requires Security Level 2 or above).

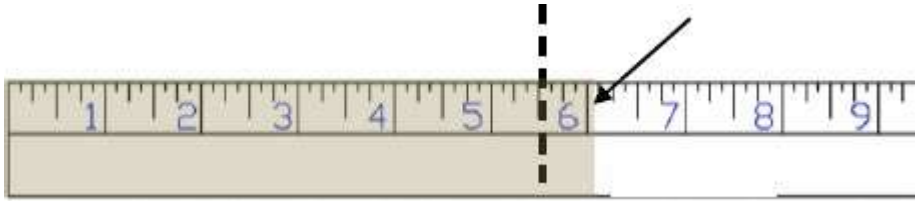
4.3.2 LN2 Level Calibration

Describes the level calibration procedure using the supplied cryogenic dipstick. Provides accuracy of ±13 mm (±0.5 in). Factory-calibrated; recalibrate if readings are suspect, after controller replacement, or for preventive maintenance.

WARNING: Always wear protective gloves and face shield when handling LN2.

4.3.2.1 Dipstick Procedure:

1. Open/remove lid.
2. Hold dipstick vertically, zero-end down.
3. Lower into LN2 until it touches bottom.
4. Hold for ~5 seconds.
5. Remove and swing in air. A distinct frost line forms.
6. Subtract 13 mm (0.5 in) from the frost line reading to account for boiling. This is the actual level.



4.3.2.2 LN2 Level Calibration:

Note: Cannot calibrate during a fill. Press "Stop Fill" and let lines vaporize for 10-15 min first. Calibration is most accurate at ~254 mm (10.0 in) and must be performed above 75 mm (3.0 in). (Requires Security Level 3 or above).

4.3.3 Hot Gas Bypass Sensor Calibration

Describes calibration for the hot gas bypass sensor. Single-point (LN2) or Dual-point (LN2 & ice water) methods. Factory-calibrated; recalibrate if readings are suspect, after sensor replacement, or for preventive maintenance. Set correct LN2 saturation temperature for altitude.

Single/Dual-point require enough LN2 to submerge the sensor. Dual-point also requires an ice-water bath.

(Requires Security Level 2 or above).

4.3.3.1 Bypass Sensor Removal:

WARNING: Close and disconnect all LN2 supplies before starting. Wear PPE.

1.Ensure LN2 supplies are off and disconnected.

2.Remove piping cover and rear panel.

3.Locate bypass sensor on piping.

4.Remove sensor using a 9/16" or small adjustable wrench. May need to temporarily disconnect wiring.

5.Perform calibration.

6.Reinstall with new PTFE tape, reconnect wires, reassemble covers, reconnect LN2 supply.

4.3.4.3 Language: Options: Simplified Chinese, English. (Req. Security Level 1+).

4.3.4.4 Max Fill Time: (In Advanced Fill menu). If a fill doesn't reach the High Level Setpoint within this time (30-240 min range), the controller stops the fill and triggers a Fill Time Alarm. Auto-fill is disabled until cleared. (Req. Security Level 3+).

4.3.4.5 Date & Time: Set in Advanced menu. Choose 12/24-hour format, date format (MM/DD/YYYY or DD/MM/YYYY). (Req. Security Level 2+).

4.3.4.5 Restore Defaults (Global Password): Resets all settings to factory defaults, resets calibrations, and changes the global password to 654321. Important: Download all data beforehand, as this erases stored logs. (Req. Security Level 2+).

Parameter	Default Setting
High Temperature Alarm	-150.0 °C
Low Temperature Alarm	-198.0 °C
High Level Alarm	150 mm
High Level Setpoint	520 mm
Low Level Setpoint	60 mm
Low Level Alarm	10 mm
Auto Fill	Enabled
Maximum Fill Time	60 minutes
Temperature Display Unit	°C
Hot Gas Bypass Menu	Enabled
Hot Gas Bypass Temperature Setpoint	0 °C
Hot Gas Bypass Alarm Delay Time	5 minutes

Event Log Interval	240 minutes
Global Password	654321

5. Preventive Maintenance

5.1 Preventive Maintenance Schedule

This section outlines the preventive maintenance required for optimal operation, performance, and longevity.

Note: At a minimum, follow the schedule below.

Maintenance Item	Weekly	Monthly	Semi-Annual	Annual	Biennial	Five-Yearly
Liquid Level Check	✓					
Check if liquid nitrogen supply is sufficient	✓					
Pipe and Tank Leak Inspection		✓				
High Temperature Alarm Test			✓			
Liquid Level Alarm Test			✓			
Thaw Dewar Lid			✓			
Replace Internal Filter				✓		
Full Function Test				✓		
Replace Solenoid Valve					✓	
Safety Valve					✓	
Thaw and Dehumidify Entire Dewar						✓

5.2 Preventive Maintenance Procedures

5.2.1 LN2 Level Check

The level detection system is nearly maintenance-free but should be checked weekly for accuracy to prevent temperature issues. Use the supplied dipstick per section 4.3.2.1. If the offset is ≥25 mm, calibrate per section 4.3.2.2.

5.2.2 Check LN2 Supply Source

Adequate LN2 supply pressure and volume are critical. Ensure pressure is 0.1-0.15 MPa during fill cycles and volume is sufficient to complete a fill. Many alarms are due to insufficient supply.

1. Observe supply pressure (should be 0.1-0.15 MPa). Use an additional gauge if supply gauge issuspected faulty.
2. Check LN2 volume in the supply (digital gauge on large tanks, visual gauge on dewars-beaware gauges can fail).
3. Minimum supply volume should be enough to completely fill all tanks it services.
4. Initiate a fill on one tank. The supply should maintain pressure throughout the cycle.
5. If supply is insufficient, contact your gas supplier for refill/replacement.

5.2.3 Pipe Leak Inspection

Pipe connections that leak can cause a series of problems, including but not limited to the following:

A. Slow fill time

B. False alarms

C. High liquid nitrogen consumption

D. Inaccurate liquid level readings

E. Inaccurate liquid nitrogen usage readings

Leaks in pipe connections are particularly common in liquid nitrogen refill systems, because when refilling with liquid

nitrogen, various connection fittings tend to become loose and require tightening.

To check for leaks in a properly operating system under normal working pressure:
1.Spray leak detection fluid onto all connection fittings and liquid nitrogen tank piping.
2.Allow the leak detection fluid to soak into each fitting for at least 30 seconds.
3.Large leaks will appear immediately, forming large bubbles.
4.Small leaks may take longer to show up; they will produce many small bubbles, creating "foam."
5.Most leaks can be repaired by tightening loose fittings with an appropriately sized wrench.
6.If tightening the fitting does not stop the leak, inspect the fitting for cracks or wear. Replace the fitting if damaged.
7.After replacing a fitting, recheck for leaks.

5.2.4 High Temperature Alarm Test

1.Allow the dewar temperature to exceed the high temperature alarm setpoint, and wait longer than the high temperature alarm delay time. Check whether an alarm is triggered. Under normal conditions, the buzzer will sound continuously, and the alarm code will flash simultaneously. Press the “Silence” button to mute the buzzer (the alarm code will remain flashing).

2.Ensure the dewar temperature is ≤ the high temperature alarm setpoint. Check if the alarm is cleared. At this time, the buzzer should be silent, and the alarm code should stop flashing.

5.2.5 Liquid Level Alarm Test

If the liquid level inside the liquid nitrogen dewar exceeds or falls below user-defined thresholds, the controller will trigger a high-level or low-level alarm.

5.2.5.1 High-Level Alarm Test

1.Observe and record the current liquid level.

2.Check the current liquid level setting. The current liquid level should be between the high-level alarm setpoint and the low-level alarm setpoint. If not, refill the dewar to above the high-level alarm setpoint.

3.Adjust the liquid level offset value so that it is greater than the high-level alarm setpoint. For example, if the current high-level alarm setpoint is 10 inches, increase the offset by at least 1 inch. This will trick the controller into thinking the liquid level inside the dewar is higher than it actually is.

4.Observe the audible alarm. Note that the alarm delay time may be delayed by one minute. This delay is intentional to prevent false alarms.

5.After one minute, press the "Silence" button to confirm whether the audible alarm has been activated.

6.Reduce the offset value back to the original setpoint.

5.2.5.2 Low-Level Alarm Test

1.Observe and record the current liquid level.

2.Check the current liquid level setting. The current liquid level should be between the high-level alarm setpoint and the low-level alarm setpoint. If not, refill the dewar to above the low-level alarm setpoint.

3.Adjust the liquid level offset value so that it is less than the low-level alarm setpoint. For example, if the current low-level alarm setpoint is 5 inches, decrease the offset by at least 1 inch. This will trick the controller into thinking the liquid level inside the dewar is lower than it actually is.

4.If no audible alarm sounds after one minute, confirm whether the alarm has been activated.

Increase the offset value back to the original initial observation setpoint.

5.2.6 Dewar Lid Thawing Procedure

1.Open or remove the lid of the liquid nitrogen dewar.

2.After opening, it is recommended to use another spare lid or a non-airtight method to cover the dewar opening to minimize warm air entering the storage space and reduce the impact on the vacuum insulation.

3.Allow the dewar to sit in ambient temperature for approximately 30 minutes.

4.After cooling, carefully clean the lid, gasket, and sealing surface.

5.Inspect the lid for any damage; replace if necessary.

5.2.7 Replacement of Internal Pipe Filter

Warning: Before replacing the internal pipe filter, ensure the liquid nitrogen supply valve is closed and the piping assembly is fully depressurized.

1.Close the liquid nitrogen supply valve and disconnect the liquid nitrogen transfer hose from the three-way valve to isolate the system.

2.Turn off the system power and open the three-way valve to drain the internal filter.

3.Remove the old filter from the pipe line, then install the new filter in the same direction as the original. If needed, use a special tool to ensure the filter remains properly aligned with the flow direction indicated by the arrow on the housing.

4.Reconnect the liquid nitrogen transfer hose, open the liquid nitrogen supply valve, and check all connections for leaks.

5.2.8 Full Function Test

It is recommended to perform a full function test on the liquid nitrogen dewar every 12 months to ensure proper operation and detect potential issues before they become critical.

The test procedure can be written according to this manual, or you can directly use this manual to inspect the system’s functions.

5.2.9 Solenoid Valve Replacement

All solenoid valves used in the liquid nitrogen storage system have undergone testing and certification, suitable for cryogenic applications. To maintain performance in low-temperature environments, these solenoid valves are equipped with PTFE seals. Over time, the aging of these seals may reduce their ability to maintain a complete seal, leading to gradual leakage. In extreme cases, this could result in loss of liquid nitrogen vaporization. Normal thermal cycling may also cause moisture to penetrate into the solenoid valve's coil winding. With prolonged aging, this may lead to corrosion of electrical connections and wiring, potentially causing failure. This may result in the solenoid valve failing to operate normally.

Note: Only use the solenoid valve provided by our company for replacement. Using parts not supplied by our company may cause the solenoid valve to fail to work properly, potentially damaging the control system. Damage caused by using non-original components is not covered under warranty.

Solenoid Valve Replacement

Warning: Before replacing the solenoid valve, ensure the liquid nitrogen supply valve is closed and the piping assembly is fully depressurized.

1.Remove the pipe conduit cover to expose the internal piping system.

2.Insert a flat-head screwdriver between the wire coil fixed card and the wire body edge to remove the wire coil fixed card. Turn the screwdriver slightly; the card will pop out.

3.Remove and discard the wire coil assembly.

4.Use a new hex wrench to loosen and remove the hex nut, then detach the stem. Remove the valve seat and seal assembly. Discard these components.

5.Clean any possible debris from inside the yellow valve body.

6.Inspect the yellow valve body for wear or damage. If the sealing surface is in good condition, the valve body can be reused. If the sealing surface is damaged, the entire valve body must be replaced (do not reuse).

7.Install a new valve stem onto the new valve body.

8.Install the new valve seat and seal assembly onto the old valve body.

9.Reinstall the components in reverse order of disassembly.

10.Use leak detection fluid to check for leaks and confirm there are no leaks.

11.Open the liquid nitrogen supply valve and press “Start Fill” to initiate a fill cycle. After the fill cycle completes, confirm that the fill cycle has ended normally and the liquid nitrogen level is stable.

Note: If the yellow valve body needs replacement, it is recommended to replace the entire liquid nitrogen dewar and install a new valve (PN 1422461115). In general, when replacing the valve, it is easier to remove the three-way valve and start from the fill port. If replacing the gas bypass valve, it is easier to remove the valve from the gas bypass port.

Note: When installing a new valve, ensure its orientation is correct. The SMC yellow valve body has an "N" engraved on the edge; the "N" should face the inlet end.

5.2.10 Safety Valve Replacement

Warning: Before replacing the safety valve, ensure the liquid nitrogen supply valve is closed and the piping assembly is fully depressurized.

1.Remove the pipe conduit cover to expose the internal piping system.

2.Loosen the safety valve from the pipe system. To prevent thread damage, use a wrench to support the valve body.

3.Install the new safety valve (PN 1810032) securely. If needed, use a special tool to ensure proper alignment. Ensure the safety valve is rated for 125 PSI (8.6 bar).

Warning: Using a safety valve with a different pressure rating may lead to operational errors and could result in overpressure conditions. This will also void the warranty.

5.2.11 Thawing and Dehumidification of Entire Dewar

1.Disconnect the liquid nitrogen supply.

2.Turn off the controller power supply. If a backup battery is installed, disconnect it as well.

3.Open or remove the dewar lid.

4.Allow the liquid nitrogen to completely evaporate. Use a fan to blow air into the storage space to accelerate this process.

5.Once the storage space reaches room temperature, thoroughly clean and dry the interior of the dewar using a vacuum cleaner and towels to remove all moisture.

6. After removing all moisture from the storage space, purge the inlet piping system and annular line internallywith dry nitrogen gas to remove any residual contaminants. The compressed nitrogen gas can be connectedto the valve in the aluminum alloy tank or directly to the exhaust valve of the dewar. However, note that thiswill rapidly consume nitrogen gas from the aluminum alloy tank. Ensure the pressure does not exceed 125 psi(8.6 bar).

7. Connect the controller power supply and use a hose to connect the nitrogen gas cylinder or industrial-gradealuminum alloy tank valve to the gas bypass port on the side of the dewar. This allows the nitrogen gas toflow into the system.

8. Press "Start Fill" to allow the dewar to fill for 30 seconds.

9. Press“Stop Fill"

10. Press "Start Fill" again to refill the dewar for another 30 seconds.11. Repeat this cycle for 30 seconds each time until the inlet piping system and annular line are completely ceanand dry.

A Note: If necessary, perform individual purification of the liquid level sensor annular line. You may connectthe compressed nitrogen gas directly to the annular fitting on the dewar to purify it.

Warning: Before loosening the compression fittings and removing the annular line, ensure the liquid nitrogensupply valve is closed and the piping assembly has been fully depressurized.

1. Loosen and remove the 1/4-inch compression fitting from the exhaust valve and the annular fitting on thedewar.

2. Remove the 1/4-inch copper tube and purge it to clear any residual gas.

3. Connect the nitrogen gas supply directly to the 3/8-inch FPT (Female Pipe Thread) annular line connector.

4. Use nitrogen gas to purge the dewar's annular line, maintaining pressure at 125 psi (8.6 bar), until the internalpiping system is clean and completely dry.

Note: If moisture is not fully removed from the dewar and annular line, ice may form when refilling withliquid nitrogen. Ice buildup inside the dewar or on the annular line can interfere with normal operation of thedewar and affect the accuracy of the liquid level sensor system.Before refilling, ensure all moisture is completely removed!

5.3 Replacement of Parts and Accessories

Replacement Parts	
Part Number	**Description**
	Internal Pipe Filter - Stainless Steel Mesh
	Safety Valve - 0.86 MPa
	Low-Temperature Solenoid Valve - Fill andGas Bypass
	Exhaust Purge / 3-Way Solenoid Valve
	Gas Bypass Temperature Sensor - Pt-100 RTD
	Gas Bypass Muffler
	Temperature Probe - Length 1650 mm
	3-Way Temperature Sensor Fitting 660 mm
	3-Way Temperature Sensor Fitting 990 mm
	3-Way Temperature Sensor Fitting 1118 mm
	Power Supply - Input: 110-230 VAC; Output: 24 VDC (AC power cord not included)
	Power Output Cable - 110 VAC (North America)
	Power Output Cable - 230 VAC (Europe)
	Backup Battery Replacement - 24 VDC
	Controller
Accessories	
Part Number	**Description**
	Liquid Nitrogen Level Gauge - 1000 mm
	Fill Valve 3-Way - Connects Two Dewars toOne Liquid Nitrogen Supply Source
	Pressure Reducing Valve Outlet Adapter -3/8-inch NPT Outlet
	Liquid Nitrogen Transfer Hose - 1500 mm
	Liquid Nitrogen Transfer Hose - 2000 mm
	Liquid Nitrogen Transfer Hose Connector -Connects Two Transfer Hoses Together

6. Troubleshooting Quick-Reference Guide

Symptom	Possible Cause	Corrective Action	Reference Section
Tank won't fill	LN2 supply connected incorrectly	Check LN2 connections	Equipment Use
	LN2 supply empty or low pressure	Check LN2 supply	Check LN2 Supply
	Fill solenoid not opening	Check fill solenoid resistance / for debris	Replace Solenoid
	Current level at/above High Level Setpoint	Check current level & level settings	Level Settings
	Auto-fill disabled	Press "Start Fill" for manual fill; check auto-fill setting	Auto-Fill Settings
Slow fill / Long fill times	Insufficient LN2 supply	Check LN2 supply	Check LN2 Supply

	Clogged in-line filter	Clean or replace filter	Replace In-Line Filter
	Fill solenoid not fully opening	Check fill solenoid for debris	Replace Solenoid
	Leak in line or supply connection	Check for leaks	Line Leak Check
Incorrect temperature reading	Incorrect calibration / needs recalibration	Recalibrate temperature sensor	Temp Sensor Calibration
	Incorrect LN2 sat. temp for altitude	Check/adjust LN2 saturation temp	Appendix
	Faulty temperature probe	Check resistance; replace if needed	(Use Multimeter)
	Needs calibration	Perform level calibration	LN2 Level Calibration
Persistent Power Failure Alarm	Unstable AC voltage	Install UPS, backup battery, or high-quality surge protector	External Solution
High LN2 Usage	Placing/removing racks/samples		
	prolonged lid open	Usage will normalize as more data is accumulated.	
	Insufficient LN2 supply	Check LN2 supply.	Check LN2 Supply
Consistently high & increasing LN2 Usage	Possible vacuum failure	Contact authorized dealer or technical support.	

7. Decommissioning

7.1 Cleaning and Decontamination

The tank body is made of aluminum alloy. Use any cleaner/disinfectant that does not react with aluminum. Commonly, mild soap, household disinfectants, hydrogen peroxide, chlorine/water solutions, or denatured alcohol are acceptable. A general practice is washing with clean water, followed by spraying with medical alcohol and air drying, or using a 10% chlorine bleach/90% water solution. Ensure thorough drying before reuse.

7.2 Product Disposal

7.2.1 Small Vapor-Phase LN2 Tank:

Tanks that have stored biological samples must be decontaminated before disposal. Contact our company or refer to this manual for decontamination information.

7.2.2 Controller:

Local/national environmental regulations may prohibit disposal of electronic/electrical equipment like the controller with regular trash. Contact local authorities for disposal guidelines, or contact our company for information.

8. Product Quality Warranty

Our company's Small Vapor-Phase LN2 Tanks are warranted under normal use for one year from the date of receipt by the user. If manufacturing defects are confirmed, the following applies:

1. If, during initial LN2 fill, significant condensation or frost appears on the tank surface, we willrepair or replace the unit free of charge.

2. If initial testing shows the static LN2 holding time is below the standard specification, we willrepair or replace the unit free of charge.

3. Within one year, if a quality problem confirmed to be due to our manufacturing occurs, we willinspect or repair the product.

4. For repair or replacement, the complete container with all accessories, along with a copy of thematching product

certificate and purchase receipt, must be returned to our company.

The warranty is void under the following conditions:

1. User tampers with or damages the vacuum port seal.
2. Storage-type container is used for vehicular transport while filled with LN2 or samples, causingdamage.
3. Product is not used per instructions, e.g. using a storage container as a transport vessel,causing dents, neck scratches, internal pressure deformation/leaks, or inner chamber corrosion.4. User disassembles the equipment without authorization.
5. Damage caused by force majeure (earthquake, fire, flood, lightning, abnormal voltage, etc.).6. Invoice or warranty card is altered. (Warranty period starts from invoice date. Keep invoice andwarranty card.)
7. Damage due to improper user handling during transport, loading, management, or use.

For products beyond the warranty period, we will endeavor to repair them for a fee.

9. Appendix

Altitude (Meters)	LN2 Saturation Temperature (°C)
Sea Level -- 152	-195.8
152 -305	-196
305 – 457	-196.2
457 – 610	-196.4
610 – 915	-196.6
915 – 1220	-196.9
1220 – 1524	-197.2
1524 – 1829	-197.5
1829 – 2134	-197.8
2134 – 2439	-198.1
2439 – 2744	-198.4
2744 – 3049	-198.7

Table 16: LN2 Saturation Temperature vs. Altitude