CE

USER MANUAL

DLS3 CONTROL

LIQUID NITROGEN CONTROL SYSTEM

phasetwo®

www.phasetwoCCS.com

Introduction

This manual covers the use and maintenance for the DLS3 Control System installed on the phasetwo liquid nitrogen freezers. Please read all documentation before using this equipment and all personnel who use this equipment should be trained. In addition, an authorized distributor, service company, or technician should perform all service and maintenance on this equipment.

Failure to follow instructions in this manual may result in damage to equipment, poor or unexpected performance, or injury to personnel operating the equipment.

Material in this manual is for information purposes only. The contents and the product it describes are subject to change without notice. phasetwo makes no representations or warranties with respect to this manual. In no event shall phasetwo be held liable for any damages, direct or incidental arising out of, or related to the use of this manual.

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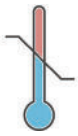
1. SYMBOLS GLOSSARY

This User Manual contains important warnings and safety warnings.

WARNING! Avoid injury



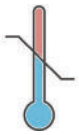
Temperature range at which the CCF Series can be exposed without risk.

Waste electrical and elrctronic equipment directive

Name and Address of manufacturer Date of manufacture

2. Safety

Please use proper handling procedures when working with Liquid Nitrogen (LN2). It is an extremely cold refrigerant and can cause serious injury if not handled properly. Also, the nitrogen gas can cause asphyxiation in a confined area, so be sure that all confined areas have adequate ventilation. In addition, for confined spaces, an Oxygen Monitoring System is recom-mended. For detailed information on the handling of cryogenic liquids, refer to the publication: P12 "Safe Handling of Cryogenic Liquids" available from the Compressed Gas Association Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202.



- This product is not intended for a life support function
- This product is intended to be used in laboratories, repositories, hospitals and smaller offices / clinics
- This product is an intentional radiator.
- This product is not intended for electromagnetic shielded rooms only
- This product is not a large permanently- installed product that is part of a system
- To avoid the risk of electric shock, this equipment should only be connected to a supply main with protective earth
- This product may be supplied with a SLA (Sealed Lead Acid) battery. Store the battery in a cool, dry area away from combustible material. Avoid overheating and overcharging. During normal battery installation, operation and maintenance, the user has no contact with the internal components of the battery or its internal hazardous chemicals.

3. Facility Requirements

Model	CRF Series	HC Series	HCHE Series
Electrical	18V DC, 3.9A, 47 to 63 HZ, 1.5 A Max @ 100VAC		
LN2 Supply	22-35 PSI (1.4 – 2.4 Bar) (CGA-295 Connection)		
Ventilation	Consult your Health and Human Safety Officer		
Oxygen Monitoring	Recommended in all installations		

4. Specifications

4.1. Connections

- Power: Cincon TRH70A180-11E03 VI
- Physical Connections: PHEONIX P/N 1757022
- RS485: RJ12
- Remote Alarm Contact:
- Logs & Firmware: USB Type A (Male)

4.2. Environmental - Indoor Use Only

Indoor Use Only

- Altitude: up to 2000m
- Operating temperature: 15 dec C to 27 deg C
- Relative Humidity: Non-condensing
- Mains Supply Voltage Fluctuations: EN 61000-3-3:2013+A1:2019
- Overvoltage Category: IEC 62368-1 Class 2

Dry Locations Only

- Ingress Protection: This equipment is not rated for ingress protection

4.3. Temperature Sensor

- Sensors: PT100 RTD (2-wire)
- Resolution: .1 degrees
- Accuracy: +/- .5 °C (Class A in accordance with DIN/IEC 60751)
- Resistance: 100 Ohm @ 0 °C

4.4. Level Sensor

- Sensors: Differential Pressure (Accuracy) & Thermistor
- DP Resolution: .1 in
- DP Accuracy: +/-0.5 in
- Thermistor Resolution: Discrete Points 1, 3, 5, 7, 13, & 34
- Thermistor Accuracy: +/-1”

> ***Note:*** *Thermistors must “warm-up” when the controller is off for extended periods and the unit already cold before reading accurately.*

5. Environmental Requirements

- Indoor Use Only
- Altitude: up to 2000m
- Operating Temperature: 15 deg C to 27 deg C
- Relative Humidity: Non-condensing
- Mains Supply Voltage Fluctuations: EN 61000-3-3:2013+A1:2019 Criterion A
- Overvoltage Category: IEC 62368-1 Class 2
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6.0 Installation and Setup

This section will review the basic receiving, installation, and startup procedures for phasetwo freezers. Always inspect the bill of lading for accuracy and external crate/packaging for damage before accepting the shipment.

6.1. Packaging Contents

Included with each freezer equipped with a DLS3 control

- Freezer with DLS3 control installed
- Transfer hose (6 ft – packaged in a cardboard box inside the crate)
- Liquid Nitrogen Measuring Stick (packaged in a cardboard box inside the crate)
- Power Adapter (packaged in a cardboard box inside the crate)
- IEC Power Cord (packaged in a cardboard box inside the crate)

6.2. Packaging Disassembly

Tools required: Electric impact or Drill with a PH-2 bit.

1: Unscrew sides at the top of the crate.

2: Unscrew and remove the side labeled “front” from the crate.

3: Remove top of the crate.

4: Unscrew and remove all other sides of the crate.

5: Using cutting pliers or shears, cut the metal banding attached to the bottom of the unit.

6: Unscrew and remove all blocks, or j hooks, underneath the unit.

7: Forklift unit off of the pallet, being careful to just raise it high enough to come off the pallet.

8: Remove and discard all protective packaging.

6.3. First Fill

Pre Fill Verifications:

1: If a third-party temperature probe is going to be installed. It is ideal to install it before filling the freezer. phasetwo’s freezers have thermistors installed in the center port of the freezer. If the location of the thermistors is not correct

your freezer will get a check DP Calibration Alarm every time a thermistor is triggered. Additionally, the thermistor cable can be damaged if it is bent while cold. It must be removed slowly allowing it to dethaw as it is removed. Contact phasetwo for a detailed instruction for installing third party probes.

2. Verify your LN2 supply pressure is below 35 psig. If your supply is higher contact phasetwo for advice before proceeding.

3. Verify an appropriate oxygen monitor is installed in the area.

4. Never leave the DLS3 control in the middle of a calibration. The DLS3 control assumes the operator is competent and does not exit calibration mode on its own. This can cause your dewar to not go into alarm or fill.

5. Moisture is the enemy of all atmospheric LN2 dewars. Removing the fill line cold can allow water to condense inside the fill line and work its way into the freezers DP circuit. Additionally, if you are unsure of the moisture content in your LN2 supply, do not use the automatic purge function. Instead, a manual purge should be completed once every 3 months. If these precautions are not followed an ice blockage can occur in the DP line causing an inaccurate DP level, MFV stuck open alarms, and Check DP Calibration Alarms.

Fill Instructions:

1. Place inventory control system in the freezer. If the freezer is a CRF6000 remove the lid. All other freezers can be filled with the lid closed on the first fill.

2. Turn on the freezer. It will automatically fill. It is normal for it to go into alarm. The alarms will be low level, T1 high, T2 high. The alarms can be muted via the mute button on the home screen. The first fill will take up to an hour and may require multiple supply cylinders.

3. While the freezer is filling determine the appropriate settings for the following parameters. Ensure the save button is pressed or the settings will not take. Fill related settings will not go in affect until the next fill cycle.

   LN2 Supply Alarm Delay: Maximum fill time after gas bypass completes. (Usually 120 minutes, located in the alarms submenu)

   GBP Sense Time: Maximum time for the gas bypass valve to be open before assuming no LN2 is available. (Usually 5 minutes for 22 psi LN2 cylinders, 15+ minutes for LN2 VJ piping systems, located in the alarms submenu)

   MFV Sense Time: Maximum time the fill line thermistor allows to not see liquid nitrogen temperatures. Note: This setting allows a user to just a longer than necessary LN2 supply alarm delay because it is a more proactive way of determine the supply is out of LN2. (Usually 10 minutes, located in the alarms submenu)

Start Fill: The level that the dewar starts filling *(Refer to table in DLS3 Manual for settings)*

Stop Fill: The level that the dewar stops filling *(Refer to table in DLS3 Manual for settings)*

T1 High: Select an appropriate maximum temperature your samples can be exposed to with a substantial safety factor. (Usually -150 °C, located in the temperature submenu)

T2 High: Enable T2 if desired. Select an appropriate maximum temperature your samples can be exposed to with a substantial safety factor. (Usually -150 °C, located in the temperature submenu)

4. After the fill is completed and all alarms are cleared, complete a DP Calibration following the steps in section 7.5.4.

5. If the unit is storing irreplaceable samples or embryos the following precautions are recommended.

   Written procedures should be maintained for monitoring and maintaining adequate liquid nitrogen levels and temperature.

   Monitoring process must ensure the liquid level is never below 10% or the established minimum level.

   Tanks should be filled at least weekly.

   IQ/OQ should be completed with a two fill cycle verification period. Contact phasetwo for IQ/OQ qualification documentation.

   Tank liquid levels, temperatures, and visual inspections for vacuum failure should be checked a minimum of 3 times a week.

   A spare tank and enough LN2 to fill it should be maintained at all times.

7. Operator Skills, Training & Knowledge

The personnel using the DLS3 Control and the phasetwo liquid nitrogen freezer should have a basic understanding of the safety procedures involved when working with LN2. In addition, the operating personnel should understand the messages and error conditions associated with the control system and should request support if questions arise.

Training and support are available through the distributor who sold the equipment, as well as through the manufacturer of the equipment.

8. Operation Theory

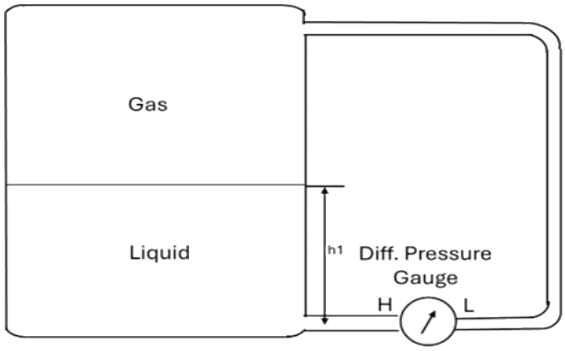
8.1. Overview

The controller is designed to maintain the liquid nitrogen level inside the tank within the low-level and high-level range defined. While doing this the controller monitors the temperature inside the tank on up to two PT100 probes. It provides logs to monitor temperature, level, and other notable events.

8.2. LN2 Level Measurement and Control

The DLS3 control system utilizes dual level detection technology. This technology is based on comparing a primary differential pressure (DP) level to a secondary thermistor-based level. This allows the control to be able to diagnose faulty DP values from scenarios like a DP line becoming frozen or an improper calibration. In the case of conflicting results, the unit will prompt you to calibrate the DP sensor. If the error is not cleared after calibration immediate service is required.

The DP level is the one displayed on the home screen. It is based on a principle that liquid head pressure is generated inside the tank and is proportional to the height of the fluid.



$$H = P_{Liquid} = \text{density of liquid x g x } h_1 + Pressure\ of\ gas$$

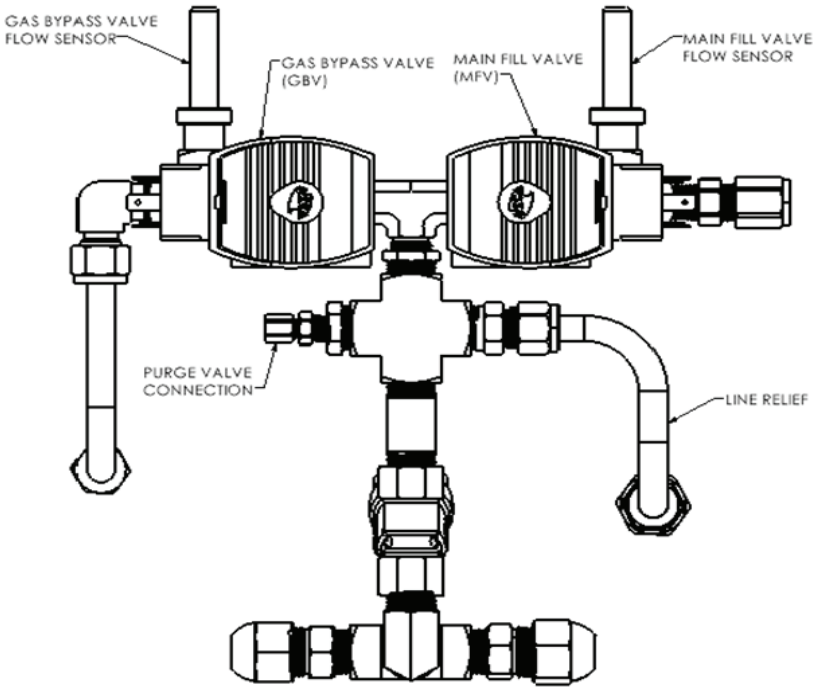
$$H - L = Differential\ Pressure$$

$$\boldsymbol{h_1 = \frac{Differential\ Pressure}{g\ x\ Density\ of\ liquid}}$$

For the redundant level measurement, a thermistor-based level is generated. A thermistor is a semiconductor in which the resistance is very dependent on the temperature it is sensing. When a thermistor is submerged in LN2 it changes resistance. If the height of the thermistor is known a corresponding level can be determined. Thermistor based measurements are very reliable but not as accurate as DP. The reliability of thermistors, and the location of our thermistors make them ideal for comparing against the DP.

Other manufacturers claim they have dual level sensing using RTD's. RTD's can not be used as thermistors for level determination. Our thermistors are tuned specifically for being sensitive to nitrogen temperatures and other proprietary circuitry allows our thermistors to definitively tell the difference between cold vapor and liquid state of nitrogen.

8.3. Plumbing Explanation and Purge Algorithm



A typical fill cycle starts by opening the Gas Bypass Valve. After the valve is open the Gas Bypass Flow Sensor will determine when LN2 is present. Once the GBP Flow Sensor sees LN2 it closes the GBP Valve and opens the Main Fill Valve. The Main Fill Valve flow sensor will then ensure liquid is flowing through the fill line. After each valve shuts the flow sensors will monitor for flow. If there is unintended flow it will attempt to clear the blockage. If that is not successful it will alert the end user of a stuck valve.

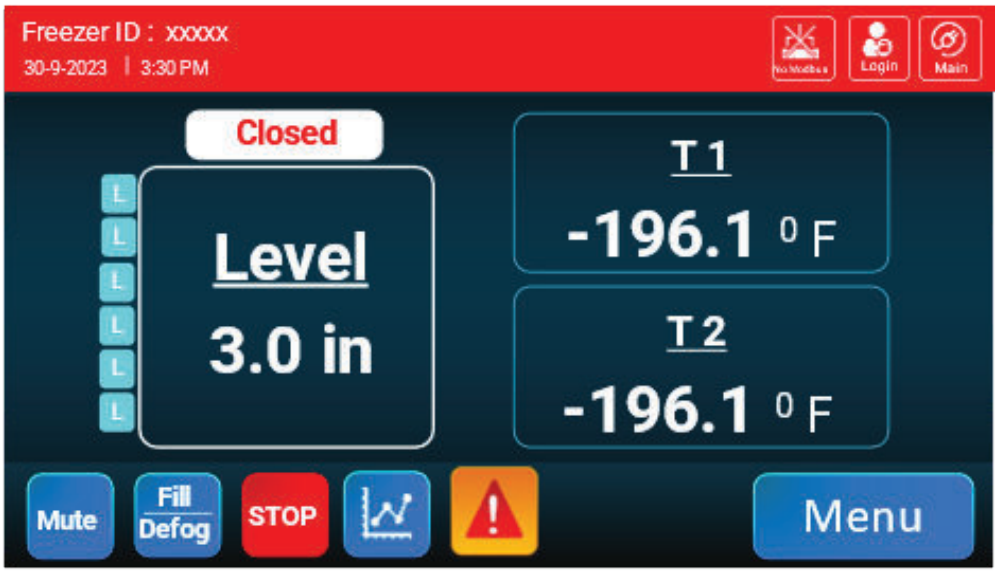
The plumbing also includes a DP purge circuit. The auto purge setting purges the DP line every night at 11:50PM with cold nitrogen gas. This setting should be set to manual unless you are certain there is no way moisture is in your LN2 supply. 22 PSI cylinders are not reliable sources of moisture free LN2.

8.4. Temperature Monitoring

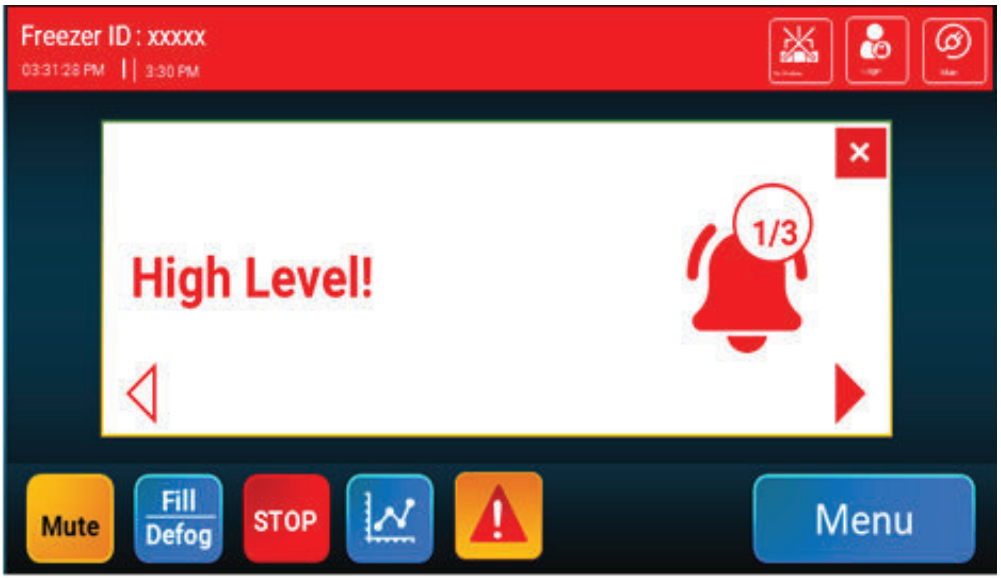
The temperature of the unit is monitored with two independent PT100 probes. The PT100 probes are set in the factory at the top box level. The second PT100 probe can be turned off if desired.

8.5. Alarm Conditions

The alarms are indicated on the main menu by a red bar across the top and a yellow caution symbol appearing next to the chart view button, see the below image for more info.



The specific alarms are displayed by pressing the caution icon and scrolling through the current alarms.



Below is a cumulative list of the possible alarms and an explanation of their meaning.

8.5.1. Improper LN2 Supply Alarm

If the unit is not filled within LN2 Supply Alarm Delay time this error occurs. To resolve verify the supply is not empty and the pressure is appropriate. If so, increase the parameter LN2 Alarm Delay Time in the alarm submenu.

8.5.2. Check DP Calibration Alarm:

The DLS3 control implements level measurement redundancy using discrete point thermistors. When thermistors change states from gas to liquid or liquid to gas the control compares the thermistor level to the current DP level. If there is a mismatch more than the defined threshold this alarm is given. Additionally, this alarm can be triggered when the control is off for long periods of time or when someone has moved the thermistor

arrays location while installing a 3rd party probe. Before installing 3rd party probes request the appropriate training/procedure from phasetwo or your distributor. To resolve this alarm verify the current DP level by measuring the level following the steps given in the calibration section of this manual. If the level is correct the thermistor array was likely moved during installation of a 3rd party probe. Contact phasetwo for resolution assistance. If the level is incorrect calibrate the unit following the instructions in the calibration section.

8.5.3. Thermistor Sensor Open

This error occurs when a thermistor is open circuit on the redundant level sensor. When this error is present the unit will not fill. To clear this error replace the thermistor array sensor and complete a power cycle of the control.

8.5.4. GBP Sensor Open

This error occurs when the GBP Sensor is open circuit. When this error is present the unit will not fill. To clear this error, ensure the GBP sensor is plugged in or replace the sensor and complete a power cycle of the control. Do not short the GBP Sensor plug for any reason.

8.5.5. Fill Sensor Open

This error occurs when the Fill Sensor is open circuit. When this error is present the unit will not fill. To clear this error, ensure the Fill Sensor is plugged in or replace the sensor and complete a power cycle of the control. Do not short the Fill Sensor plug for any reason.

8.5.6. Fill Valve Stuck Alarm

This error occurs when the fill valve thermistor is cold and the level increases over 2 inches without the unit in fill mode. Additionally, it can be triggered by two point calibrations and ice blockages. Caution: Excess nitrogen gas may be present in the area if this alarm is present. It is only cleared by turning the control on and off.

8.5.7. GBP Valve Stuck Alarm

This error occurs when the GBP valve sensor senses LN2 present and the unit is not filling. It indicates that the valve has debris on the seal and will pulse the valve open and closed to try and clear the debris. To clear this error, remove the debris trapped in the GPB valve seal. Caution: Excess nitrogen gas may be in the area.

8.5.8. Low Level Alarm

This error occurs when the liquid level is below the set low level in the level menu. To clear this error, fill the unit.

8.5.9. High Level Alarm

This error occurs when the liquid level is above the set high level in the level menu. To clear this error, increase the high level temporarily and determine what caused the unit to overfill. Additionally, this error can occur when an operator sets the stop fill to a lower level than the current level. When this alarm is present the unit will not defog or manual fill.

8.5.10. High Temperature Alarm

This error occurs when the temperature is above the set high temperature for each probe. To clear this error, determine the event that caused the high level and resolve it or increase the value of the high temperature in the temperature menu.

8.5.11. LN2 Usage Alarm

This error occurs when the LN2 usage increases by a factor of 2. If this error occurs, inspect the unit for ice buildup and symptoms of vacuum failures. If vacuum failure symptoms occur, make plans to take the unit out of service ASAP and contact phasetwo. If this error occurs along with a calibrate DP alarm, it could be the result of a leak in the DP system and may not be a vacuum failure.

It could be the result of a leak in the DP system or an ice blockage and may not be a vacuum failure.

8.5.12. Mains Power Failure Alarm

This error occurs when the AC power fails.

8.5.13. Battery Voltage Low Alarm

If the battery voltage goes below 11.2V this alarm is generated.

8.5.14. T1/T2 Temperature High Alarm

This error is generated when the high temperature threshold is crossed for either RTD.

8.5.15. T1/T2 Temperature Low Alarm

This error is generated when the high temperature threshold is crossed for either RTD.

8.5.16. T1/T2 Sensor Open Alarm

If either RTD becomes unplugged or open circuit for any reason, this alarm will occur.

8.5.17. DP Sensor Faulty

This error occurs when a hardware issue with the DP sensor occurs.

8.5.18. DP Sensor Open

If the DP sensors output voltage becomes continuously high or low this error occurs. To resolve this issue contact Phasetwo for a replacement main control module.

8.5.19. Thermistor Level Senor Faulty

If any thermistor measures open circuit this error will occur. To clear the error, replace the thermistor level sensor.

8.6. Logs

The unit records logs every 15 minutes when lid is closed or every minute when the lid is open. The logs are maintained for up to 30 years. To retrieve logs, plug in a usb cable to the back of the unit, see image below.

After plugging into the usb port the logs will show up on your laptop under a removeable storage device. Only the admin can log in to download the logs. The log data is stored in files labeled with their date.

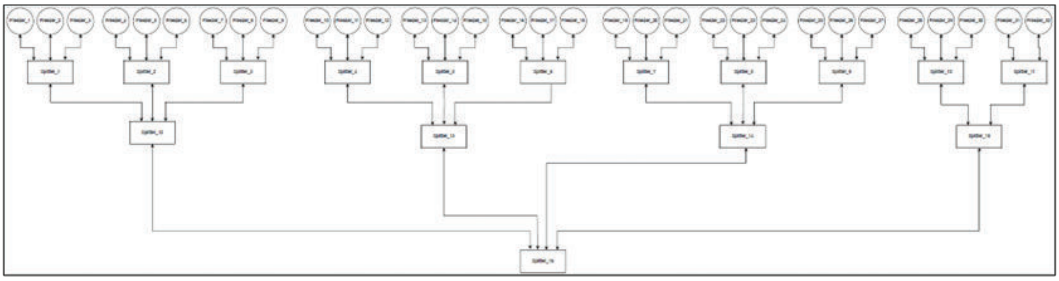
mm/dd/yr	Hrs:mins:secs	Type of log data	Code	Event/Fault description	Temperature 1	Temperature 2	Level

After downloading it onto the PC, open it in excel and apply filters to choose a particular log data for analysis.

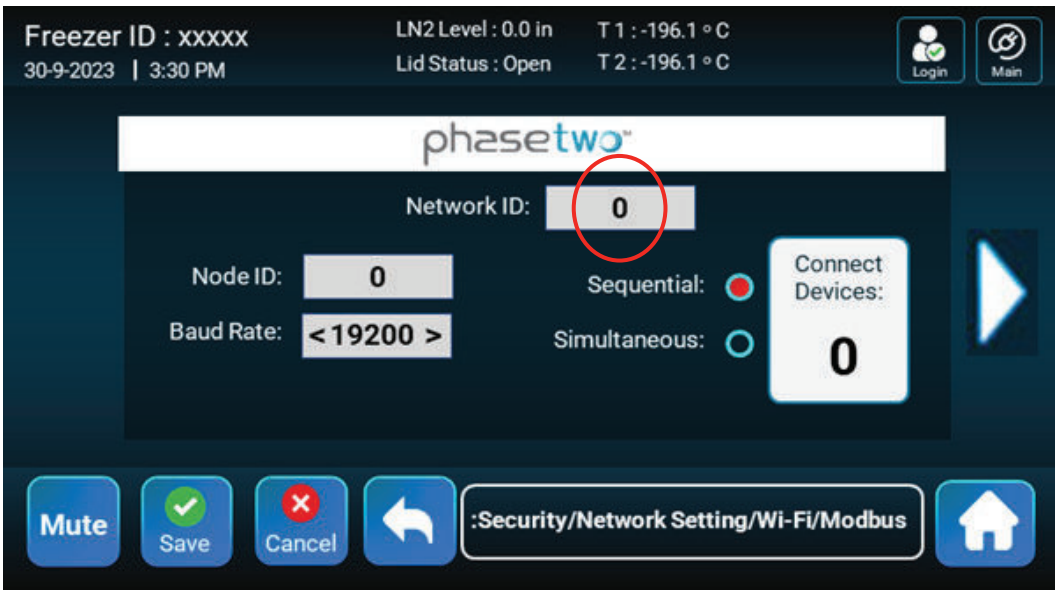
8.7. Communications

8.7.1. RS485 Networking

The control supports networking up to 32 tanks with no external controller. Before proceeding all units must be connected to the network via the RJ12 port on the rear of the unit, see below image. RJ12 splitters are required when connecting more than two units. The image below shows how the unit would be wired with a 3 way RS485 splitter. Splitters are available from phasetwo.

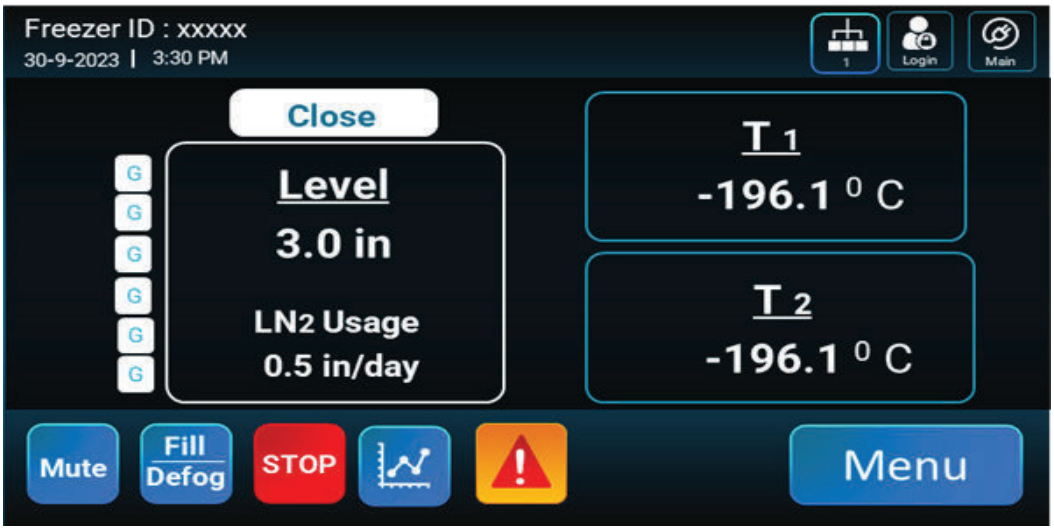


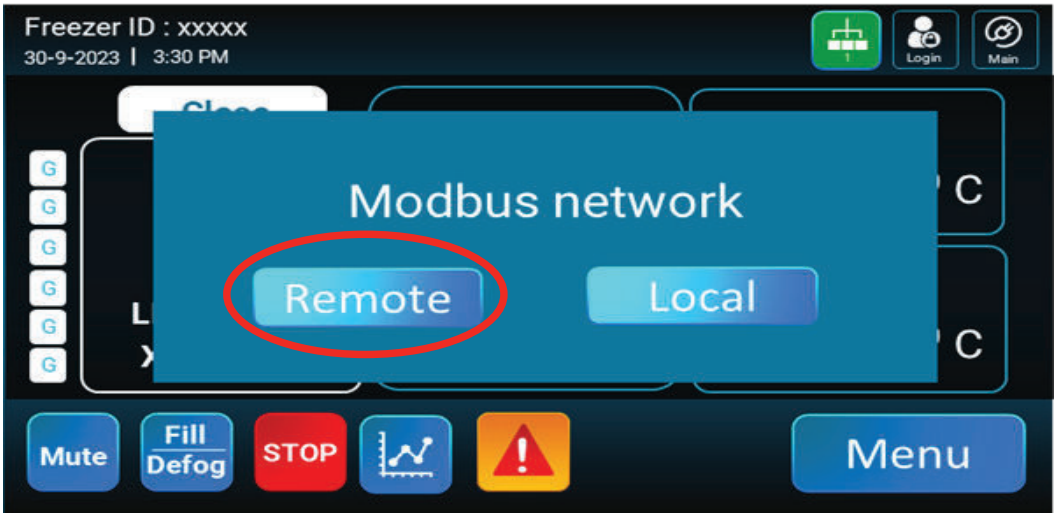
After wiring, start configuring the RS485 network by going to the control in which you want to be the master in the network and press menu -> security -> and finally freezer network. The master control is where you will check the status of the network and configure it.



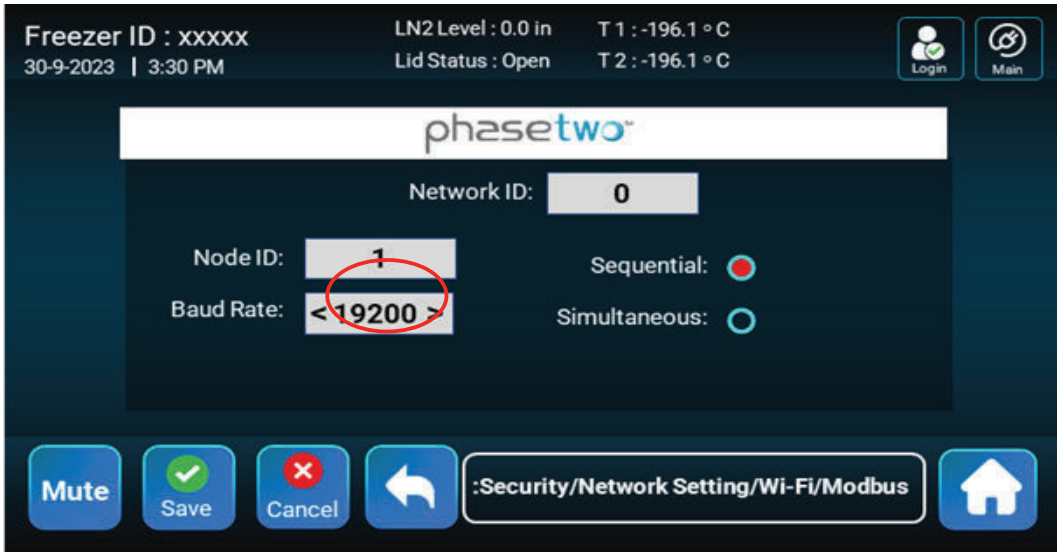
First create a network ID. This value can be up to 8 characters and must be only numbers and letters. No spaces are allowed. Next set the master unit node ID to 0 and press the save button. Note: The save button must always be pressed after making changes on any menu for them to remain. Now go back to the home screen by pressing the home button and pressing

the networking icon and selecting remote. If successful, the networking icon will be green and show a number which is the node ID underneath it.





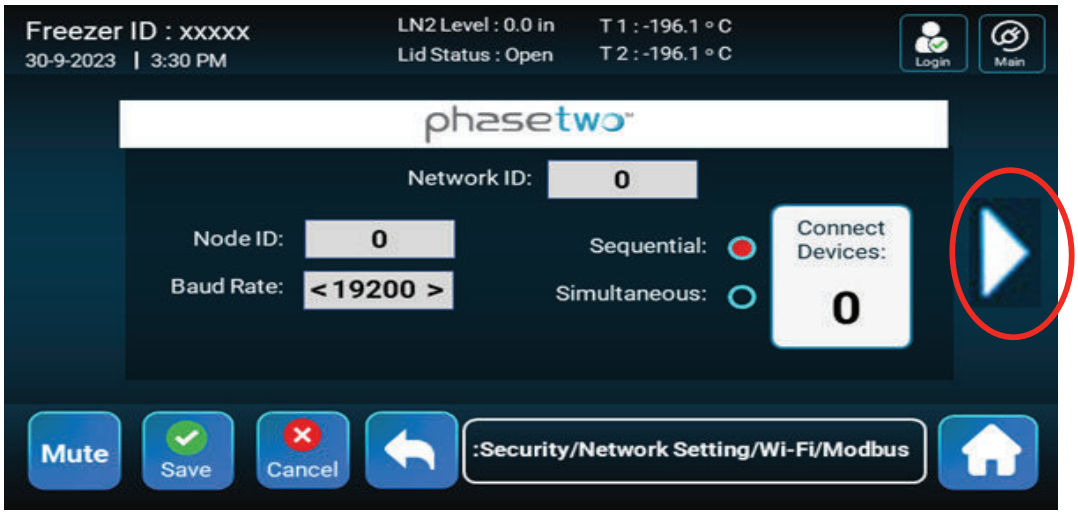
Now each unit controlled by the master must be configured. To do this go to menu -> Security -> Networking. Finally, type the previously defined network ID in, assign a node number to the unit, and hit save.



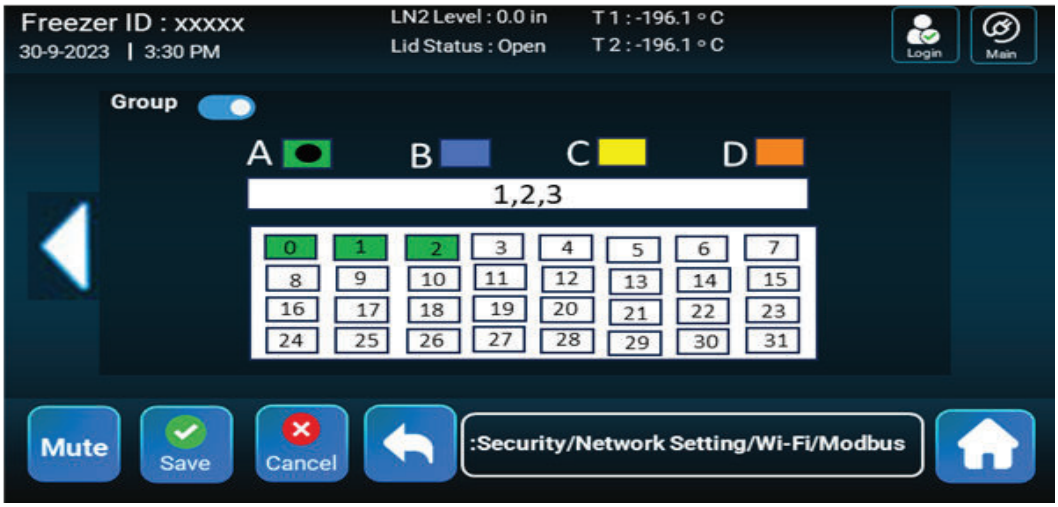
Note: Please ensure that each freezer is assigned a unique node ID (from 0 to 31). Also please ensure that there is 1 master. Duplication of IDs will result in malfunctioning of the network.

After completing go back to the main menu, select the network icon, and select remote. Complete this on each unit controlled by the master unit.

Upon completion, return to the master unit to finish configuring the network. Navigate to the networking screen on the master unit and select sequential fill or one fill all fill and select the arrow next to them.



On the following screen you can view the status of all nodes on the network. You can also configure groups which can be used for further control of the fill sequence. To enable subgrouping press the arrow on the right side of your screen. Then press on A, B, C, or D, and type the units you want grouped in the text field below separated by commas. No spaces are allowed. Up to four groups are supported.



In the case of sequential filling the Master will call for a fill. This can be done via a scheduled fill or allowing the unit to operate normally (scheduled fill disabled). Subsequently, each node will fill with the priority of group A first, then group B, and so on. In the case of simultaneous filling, the master will call for a fill. This can be done via a scheduled fill or allowing the unit to operate normally. Subsequently, each group will fill simultaneously in the order of group A, then group B, and so on.

Note: All scheduled fill settings will be ignored on non-master units.

If sequential fill is selected and if scheduled fill is disabled, the unit which initiates a fill request will be first asked to fill by the master unit, then the remaining units in that group will fill in a sequential manner. After the first group fills, the fill process continues with other groups as per priority assigned to groups as noted above.

Simultaneous fill is the same, with the difference being all units in that group from which a unit initiated a fill request will be filled followed by units belonging to other groups as per priority grouping.

It should be noted that if a unit loses connection from the network the text of the node box will become red in the master grouping page.

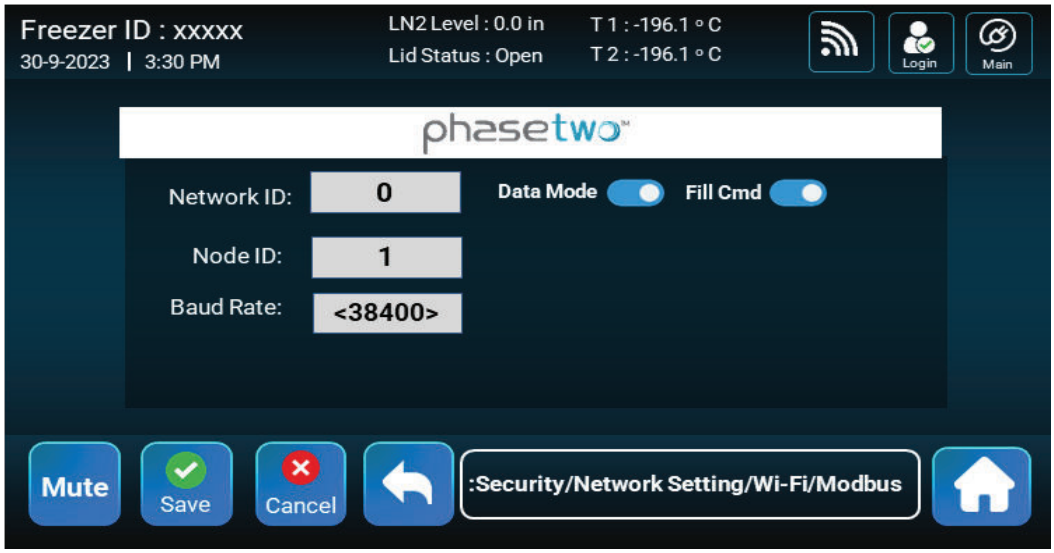
8.7.2. Sintesy Cryolink S310

The DLS3 supports integration with Sintesy via their cryolink S310. To connect the devices an adapter cord (P/N P2-2029895) is required.

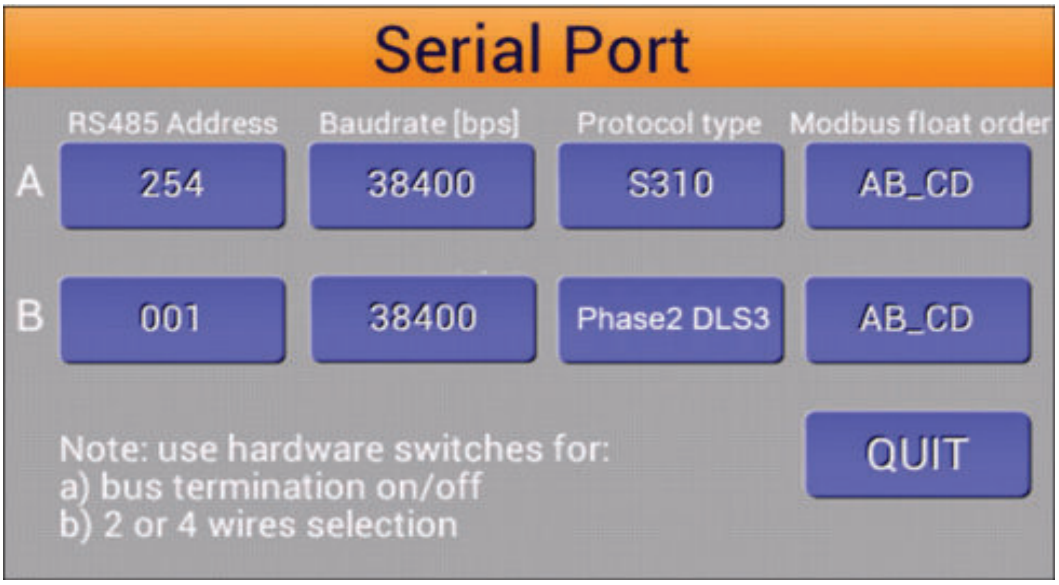
To configure the units complete the following steps.

1. Plug the adapter into the Sintesy 310 RJ45 port and the DLS3 RS485 RJ12 port.

2. Power on the DLS3 control and enter the freezer network menu and configure as shown below.



3. Power on the S310 enter the settings menu and configure as shown below.

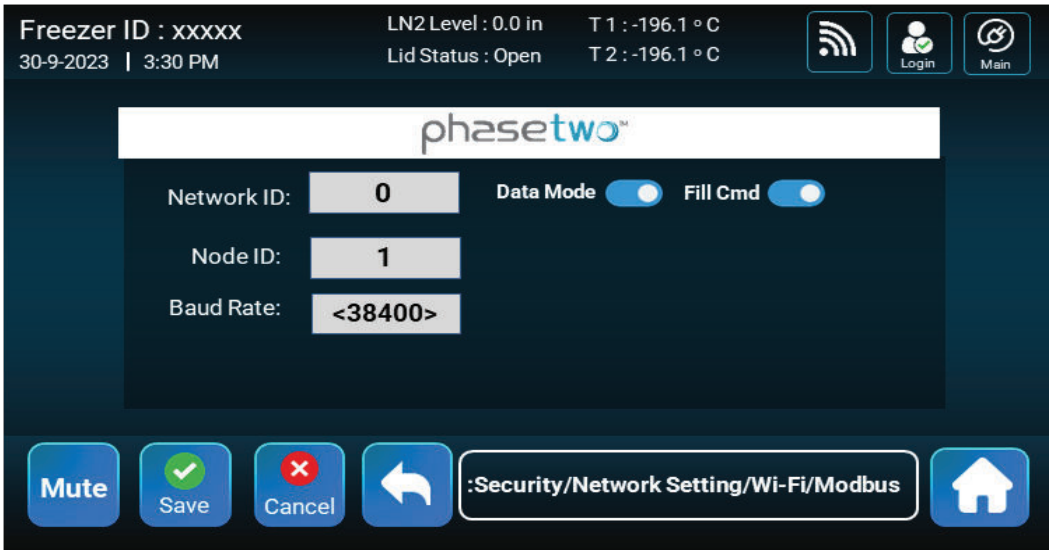


4. Ensure the internal DIP switches in the S310 are set to 2 wire and termination on.

5. Verify the two devices are communicating and match.

8.7.3. RS485 Data Mode

In some instances, integration to a third-party monitoring device is desired. The DLS3 supports this through remote alarm contacts and RS485 following the Modbus RTU protocol. To implement monitoring of the DLS3 control over RS485, go to menu -> settings -> freezer network and toggle on Data Mode. Note: Make sure the note ID is set to something other than 0. Otherwise, Data Mode will not be available to select. Do not put the unit in networking mode on the main screen.



Once the unit is configured, the below tables explain the mapping structure of the data.
Note: All available data is in Modbus RTU holding registers.

Register Mapping			
Address	**Register**	**Data**	**Value**
0	40001	Reserved	
1	40002	DP Level	Integer
2	40003	Reserved	
3	40004	Temperature 1 Value	Integer
4	40005	Temperature 2 Value	Integer
5	40006	Alarms: A1 / A2	0x0000 – 0xFFFF
6	40007	Alarms: A2 / A3	0x0000 – 0xFFFF
7	40008	Warning: W1 / W2	0x0000 – 0xFFFF
8	40009	Warning: W3 / W4	0x0000 – 0xFFFF
9	40010	Event: E1 / E2	0x0000 – 0xFFFF
10	40011	Event: E3 / E4	0x0000 – 0xFFFF

Notes: If the value is an integer divide it by 10. After dividing the result, if the result is greater than 32767 assume it is a negative value.

Alarms A1/A2		
Bit	**Meaning**	**Code**
0	Display initialization failed	0x00000001
1	EEPROM read write error	0x00000002
2	DP sensor faulty	0x00000004
3	Thermistor level sensor faulty	0x00000008
4	T1 is open	0x00000010
5	T2 is open	0x00000020
6	High level	0x00000040
7	Low level	0x00000080
8	No LN2 supply	0x00000100
9	LN2 short fill	0x00000200
10	LN2 improper fill	0x00000400
11	T1 high	0x00000800
12	T2 high	0x00001000
13	T1 low	0x00002000
14	T2 low	0x00004000
15	Lid open too long	0x00008000

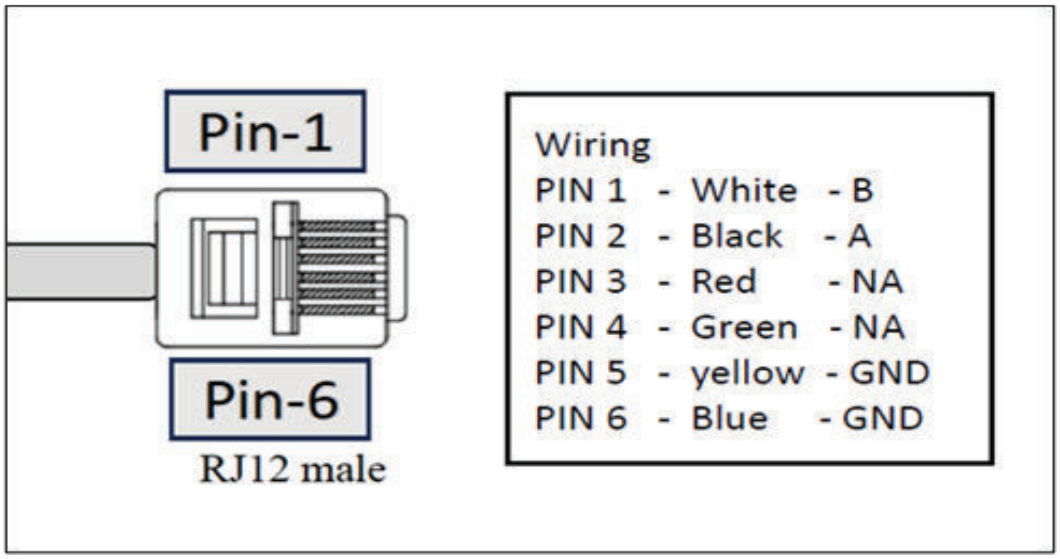
Alarms A3/A4		
Bit	**Meaning**	**Code**
0	(GBP) Gass bypass valve stuck open	0x00000001
1	(MFV) Main fill valve stuck open	0x00000002
2	(RFV) Redundant fill valve stuck open	0x00000004
3	5/2 Valve stuck open	0x00000008
4	GBP sensor open	0x00000010
5	MFV sensor open	0x00000020
6	Reserved	0x00000040
7	SD card failure	0x00000080
8	Wi-fi module failure	0x00000100
9	UI communication failure	0x00000200
10	Reserved	0x00000400
11	Reserved	0x00000800
12	T1 short	0x00001000
13	T2 short	0x00002000
14	Reserved	0x00004000
15	Reserved	0x00008000

Events A1/A2		
Bit	**Meaning**	**Code**
0	Start fill	0x00000001
1	Lid open	0x00000002
2	GBP opened	0x00000004
3	MFV opened	0x00000008
4	RFV opened	0x00000010
5	5/2 valve opened	0x00000020
6	Main power failed	0x00000040
7	USB connected	0x00000080
8	User logged in	0x00000100
9	User ID locked	0x00000200
10	Reset	0x00000400
11	Calibration processes started	0x00000800
12	DP calibration success	0x00001000
13	T1 calibration success	0x00002000
14	T2 calibration success	0x00004000
15	Reserved	0x00008000

Events A3/A4		
Bit	**Meaning**	**Code**
0	Reserved	0x00000001
1	Reserved	0x00000002
2	Reserved	0x00000004
3	Reserved	0x00000008
4	Firmware update	0x00000010
5	Not used	0x00000020
6	Not used	0x00000040
7	Not used	0x00000080
8	Not used	0x00000100
9	Not used	0x00000200
10	Not used	0x00000400
11	Not used	0x00000800
12	Not used	0x00001000
13	Not used	0x00002000
14	Not used	0x00004000
15	Not used	0x00008000

Warnings W1/W2		
Bit	**Meaning**	**Code**
0	High LN2 Consumption	0x00000001
1	Battery Not Connected	0x00000002
2	Battery Voltage Low	0x00000004
3	DP Cal Failed	0x00000008
4	RTD1 Cal Failed	0x00000010
5	RTD2 Cal Failed	0x00000020
6	LN2 Supply Reminder	0x00000040
7	Level Check Reminder	0x00000080
8	Schedule Fill	0x00000100
9	Maintenance Reminder	0x00000200
10	SD Card Access Error	0x00000400
11	Check DP Calibration	0x00000800
12	Failed to send email	0x00001000
13	Enter valid email id	0x00002000
14	Not used	0x00004000
15	Not used	0x00008000

See the below image for a pinout of the RJ12 connector.



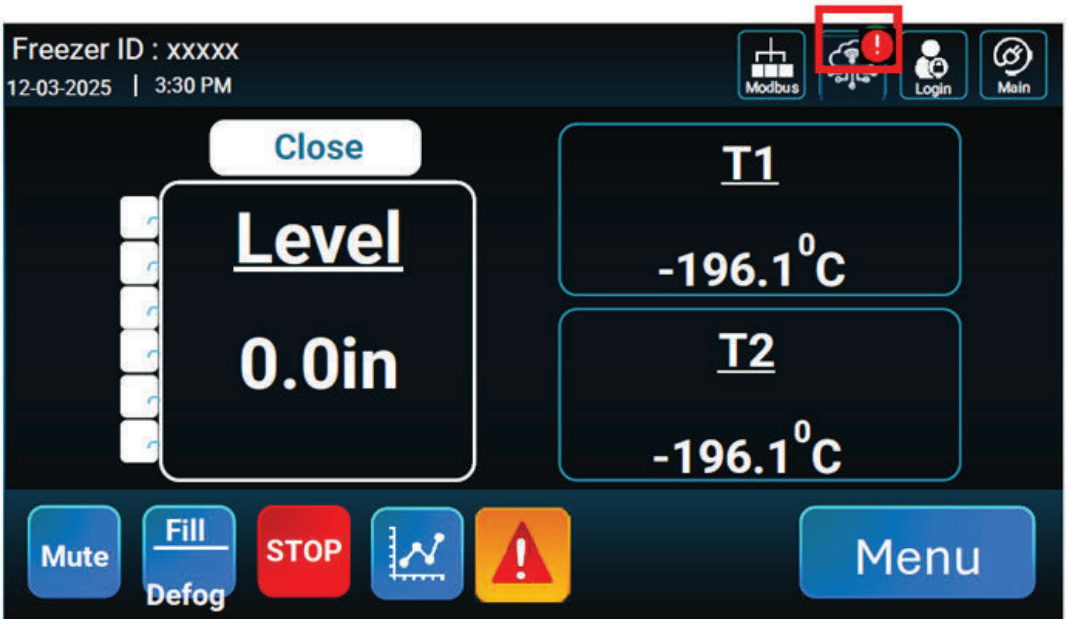
8.8. Firmware Update

8.8.1. Manual Firmware Update Process

Updating firmware on the DLS3 control can be completed by end users and takes about 30 minutes. Request the latest firmware update files and instructions from customerservice@phasetwoccs.com. The latest firmware versions at the time of this manual update is V1.27 for the main control and V1.21 for the GUI. It is recommended to check with phasetwo regarding firmware updates bi-annually.

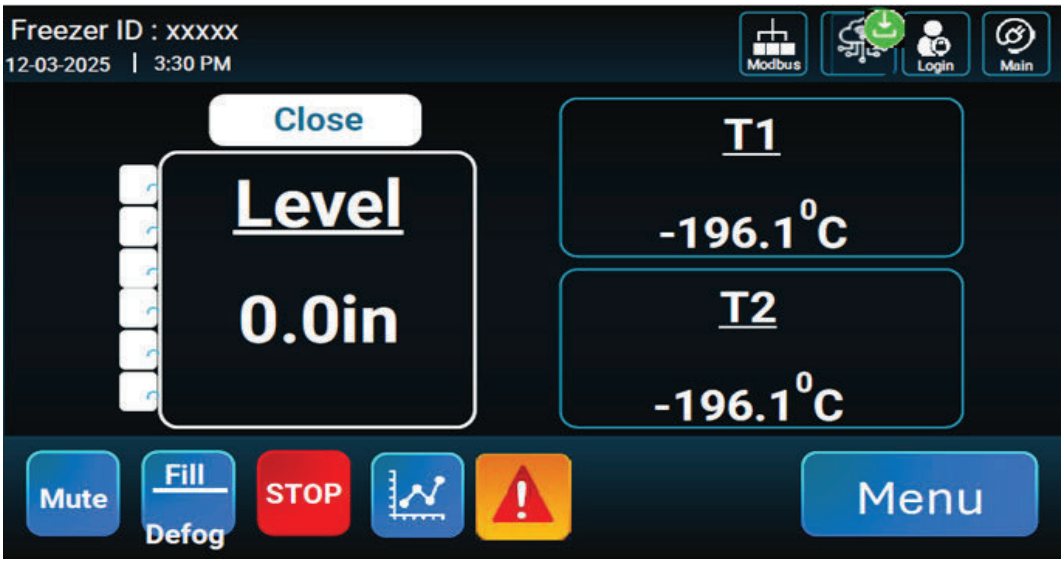
8.8.2. Cloud Based Firmware Update Process

All versions after V1.27 will support cloud based firmware updates. To enable cloud based updates the unit must be connected to our IOT server. See WIFI and IOT sections for instructions. When a new firmware update is available, the unit will indicate it on the home screen with the below symbol.

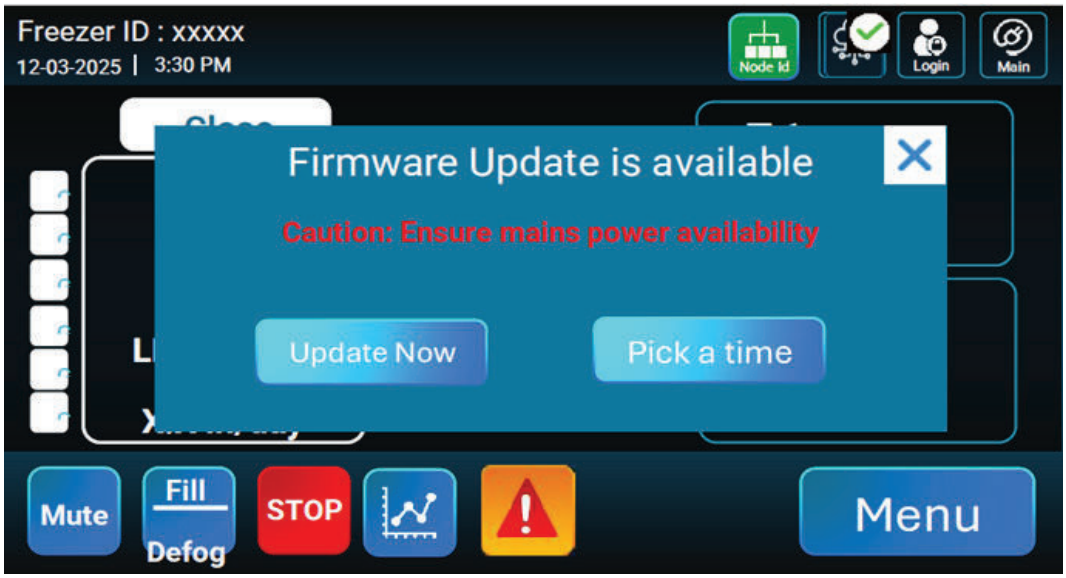


To download the new firmware, go to the main menu and hit the firmware download button. Once this button is selected, the firmware will download in the background. This will take up to 4 hours.

While the firmware is downloading the below symbol will be displayed on the home page.



Once the file is downloaded, the below pop will appear.

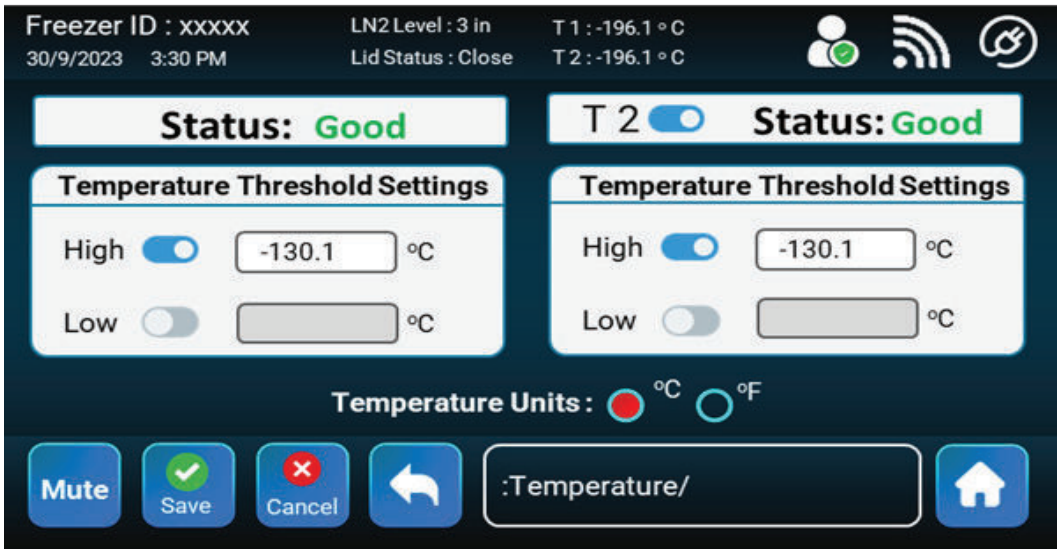


Select update now to complete the firmware update process. Select pick a time for the pop up to come back later to remind an update is downloaded and available. Main Control firmware updates and GUI firmware updates will be downloaded and installed separately. This feature will only be available when you are within 3 firmware versions from the one you are updating. Note: If there is both a main control firmware update and GUI update available, you may get a firmware mismatch alarm until both firmware updates are complete.

9. Menu Guide

Select the menu button on the home screen and the below submenus are displayed.

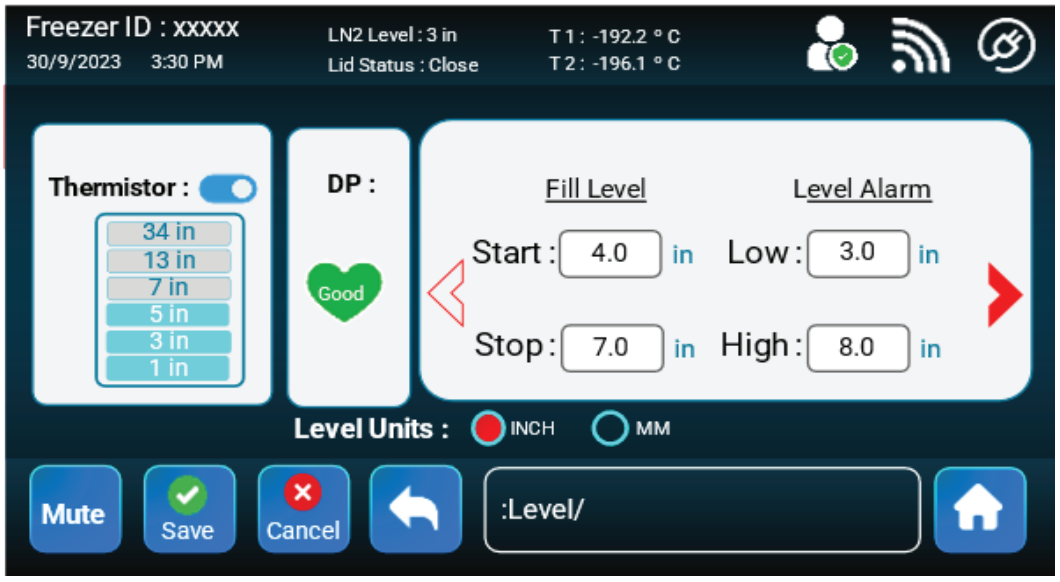
9.1. Temperature Submenu



T1 cannot be disabled. T2 can be disabled. The status of the RTD's is either good or open. Open could mean that no RTD is plugged in or that it has gone bad. To enable the low temp alarm, select the toggle next to low, click in the textbox area, and type a value. For any changes to be saved you must hit the save button before leaving the menu. All temperature alarms can be disabled. It is not recommended that the high temp alarm is ever disabled other than on a first fill.

Default Values	
T1 High Level Toggle	Enabled
T1 High Level Value	-170 C (HCHE & CRF), -150 C (HC)
T1 Low Level Toggle	Disabled
T1 Low Level Value	0 deg C
T2 Toggle	Enabled
T2 High Level Toggle	Enabled
T2 High Level Value	-170 C (HCHE & CRF), -150 C (HC)
T2 Low Level Toggle	Disabled
T2 Low Level Value	0 deg C

9.2. Level Submenu

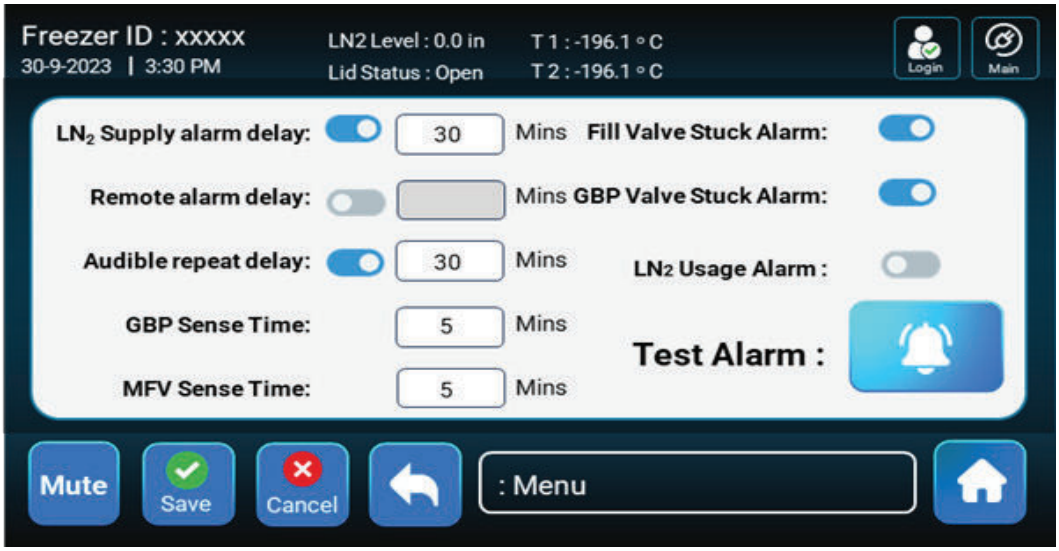


At first glance of the level menu, you get a quick status of the DP and which thermistors are submerged in LN2. As explained in the operation menu the thermistors are used as a redundant check on the DP. The height in each bar of the thermistor widget is the height the thermistor is in the unit. Selecting the toggle bar next to the thermistor widget title will remove the thermistor widget from the main menu.

If a change to the start fill and stop fill are desired simply click on the start fill or stop fill text box and type in the desired number. The unit has a valid range for each value and will prompt you if the value you selected is incompatible with the freezer. The Low level and high level alarm points are automatically adjusted 1” lower and higher than the value you typed. When changing values on the screen you must select save before leaving the menu for the new values to save.

Default Parameters					
	HCHE20	HCHE44/ 50 HCHE92/ 107	HC14	HC32	CRF6000
Therm. Widget Toggle	Enabled				
Start Fill Value	4.0 in	5.0 in	12.0 in	12.0 in	4.0 in
Stop Fil Value	7.0 in	8.0 in	20.0 in	20.0 in	7.0 in
Low Level Alarm Value	3.0 in	4.0 in	11.0 in	11.0 in	3.0 in
High Level Alarm Value	8.0 in	9.0 in	21.0 in	21.0 in	8.0 in
Level Units	Inch				

9.3. Alarm Submenu



The alarm submenu is used to configure all alarms excluding lid related alarms. Below is a detailed description of each option.

9.3.1. LN2 Supply Alarm Delay

If a fill cycle is not completed within this timer the control alerts the user with a Improper LN2 Supply Alarm. See the alarms section under operation for more detail.

9.3.2. Remote Alarm Delay

Remote alarm contacts are triggered for any alarm. When enabled the remote alarm contacts are delayed from closing for the specified period of time. When disabled the remote alarm contacts will not function.

9.3.3. Audible Repeat Delay

When disabled the audible alarm will not sound again until an alarm is removed or a new one is triggered. When enabled it allows the mute time to be adjusted. It is not recommended to disable the audible alarm repeat parameter.

9.3.4. GBP Sense Time

This parameter adjusts time the gas bypass LN2 sensor will wait for liquid nitrogen before triggering a Improper Fill Alarm, see the alarms section under operation theory for more detail. This value should be tailored to the installation to ensure no more LN2 is exhausted out the GBP line than necessary.

9.3.5. MFV Sense Time

This parameter adjusts time the main fill valve LN2 sensor will wait for liquid nitrogen after the gas bypass portion of the fill is completed. The default value will cover most installation cases.

9.3.6. Fill Valve Stuck Alarm

Toggle this off to turn off the fill valve stuck alarm.

9.3.7. GBP Valve Stuck Alarm

Toggle this off to turn off the GBP valve stuck alarm.

9.3.8. Test Alarm

This widget is used to test the audible alarm during maintenance. Press the widget button and confirm an audible alarm is heard.

9.3.9. Default Parameters

Default Values	
LN2 Supply Alarm Delay Toggle	Enabled
LN2 Supply Alarm Delay Value	30 min
Remote Alarm Delay Toggle	Enabled
Remote Alarm Delay Value	30 min
Audible Repeat Delay Toggle	Enabled
Audible Repeat Delay Value	30 min
GBP Sense Time	5 min
MFV Sense Time	5 min
Fill Valve Stuck Alarm	Enabled
GBP Value Stuck Alarm	Enabled

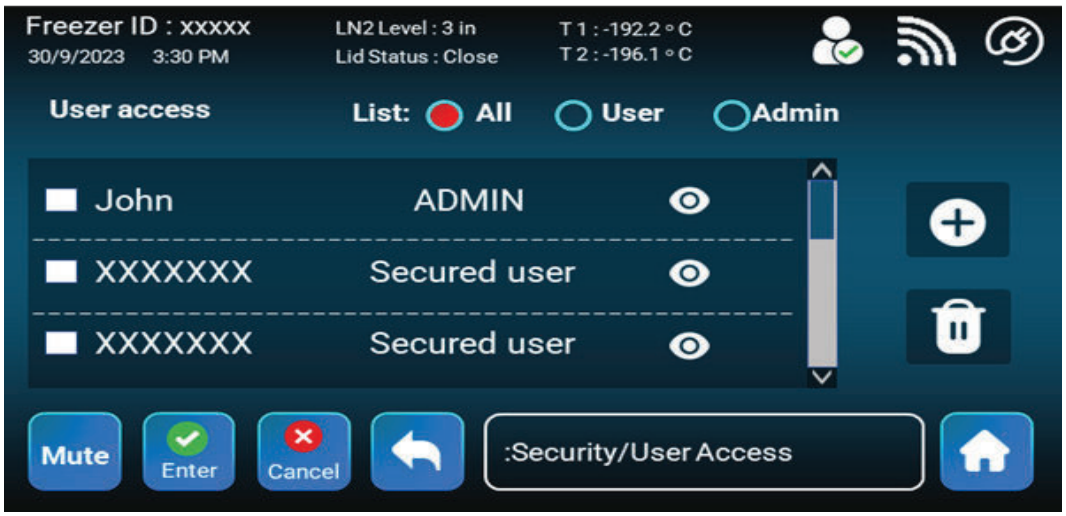
9.4. Security Submenu

9.4.1. Freezer ID

Select the text field under Freezer ID to change the freezer name displayed. The field does not accept spaces or special characters and is limited to 6 characters.

9.4.2. User Access

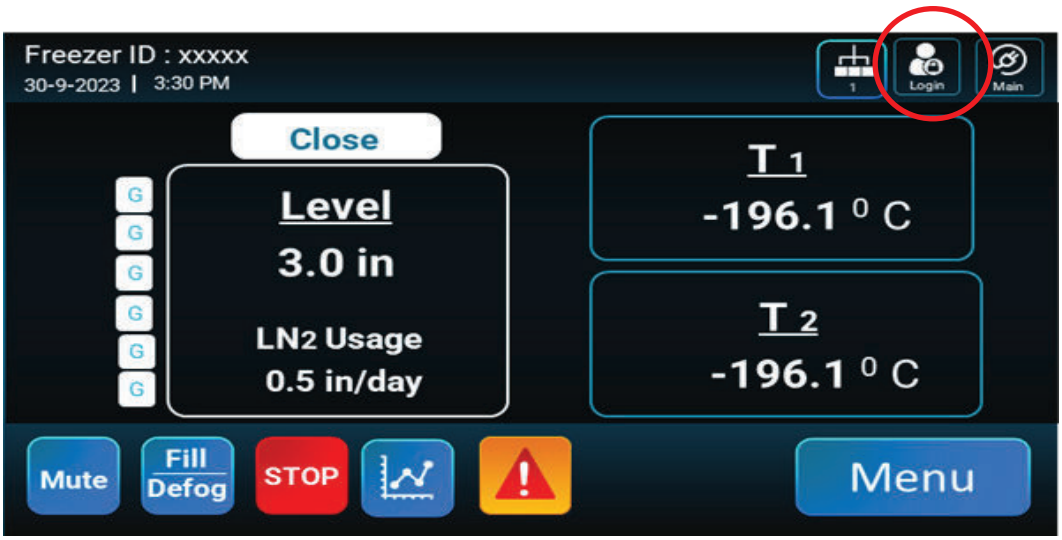
User access locks all submenus and manual fill if not logged in. User accounts can be created to keep track of who went in the freezer at what time. To turn on user access simply create an administrator profile in the user access menu.



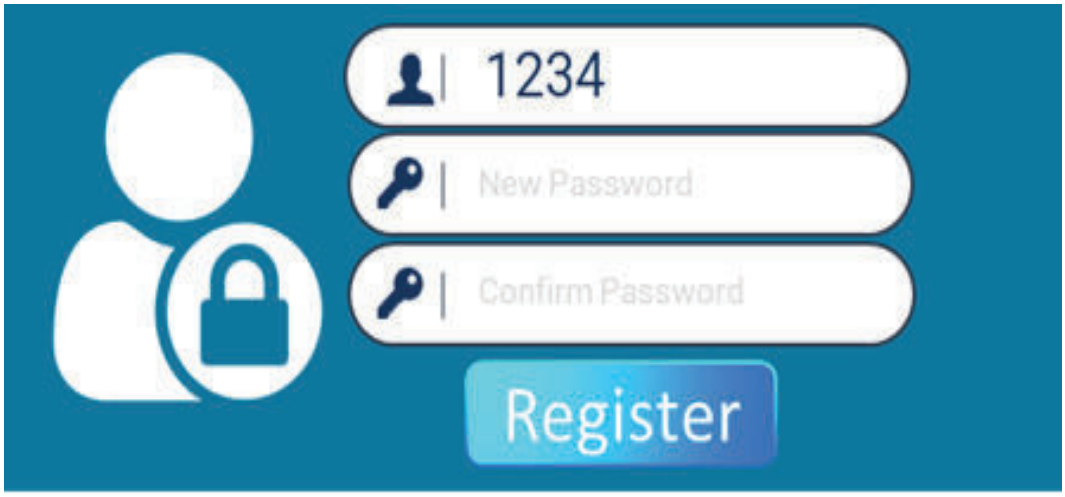
A total of 10 user accounts (2 admin users and 8 normal users) can be created in the database. Normal users can access all submenus and settings in menus except security submenu. Admin users have full access to all submenus including security submenu.

Only admin users can log in to download log data through USB pout or can upload and update firmware.

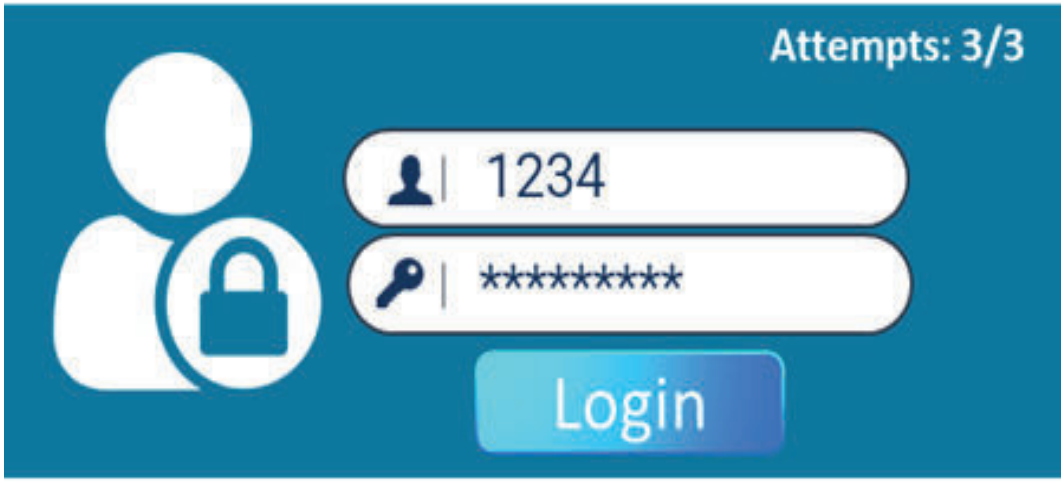
To create a user account, press the plus button, enter a user ID (these are case sensitive), and employee ID. If desired, you can go ahead and create all of the known users at this time. Next go back to the home screen and log in by pressing the login button shown below.



On the first login you create your password, see below.



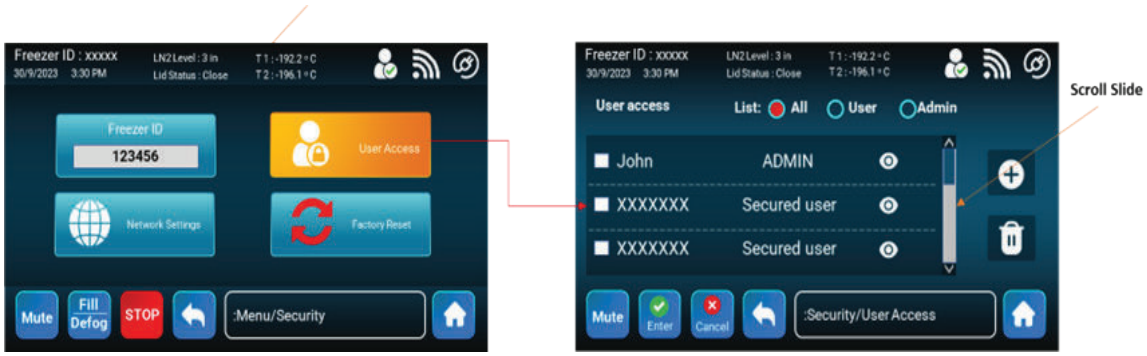
All usernames and passwords are case sensitive. After the first login, when hitting the login button, the user is prompted to enter their username and password, both are case sensitive.



Once logged in successfully you will see the below icon on the top of your screen.

To logout click on the user access icon and select log out. If you do not log out the control will automatically log you out after 3 minute if no touch screen activity is done

The Admin, after logging in, can remove or add user access by going to User access accounts page and deleting the user account.



9.4.3. Factory Reset

A factory reset returns all parameters, level, alarms, temperature settings. To complete a factory reset select the factory reset icon on the security submenu.

A delay of 5 seconds is implemented before a factory reset is done to ensure the user intentionally reset the settings.

Only the admin user can login to perform this operation.

9.4.4. Freezer Network

Please refer to the communications section.

9.4.5. Wi-Fi Setting

The DLS3 control includes built in Wi-Fi. To connect the control to the Wi-Fi proceed to the Wi-Fi menu and enter your SSID and password as shown below.
Note: *The SSID does not support the ‘ or . characters. Additionally, currently open networks are not supported.*

To connect to the network proceed to the home screen and hit the no internet icon. Then press connect Wi-Fi. At this point the Wi-Fi is connected but IOT is not configured. See IOT section to configure cloud data collection, text messages, and email alerts.

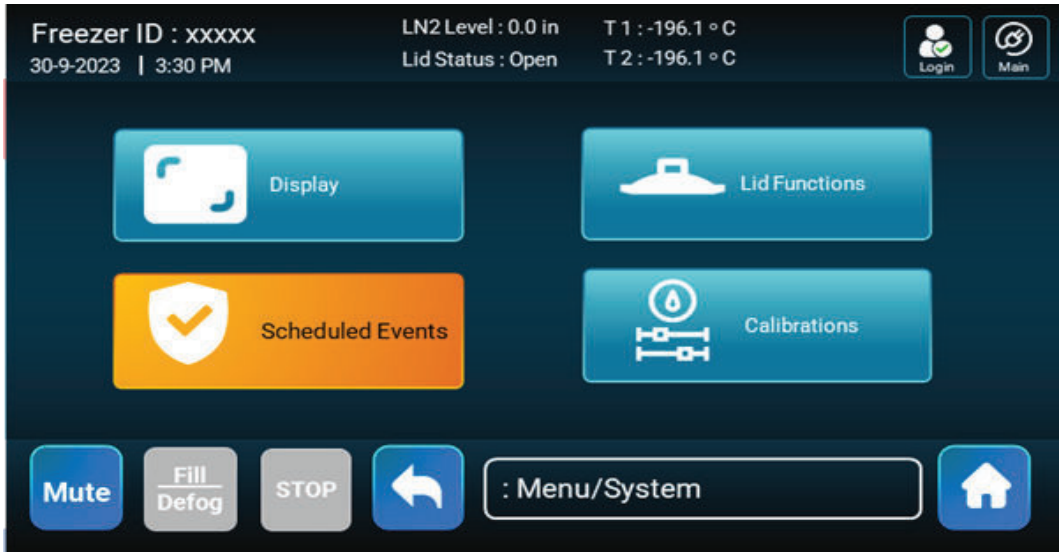
9.4.6. IOT

The DLS3 control supports IOT data collection, text alerts, and emails. These items are configured on the IOT menu.

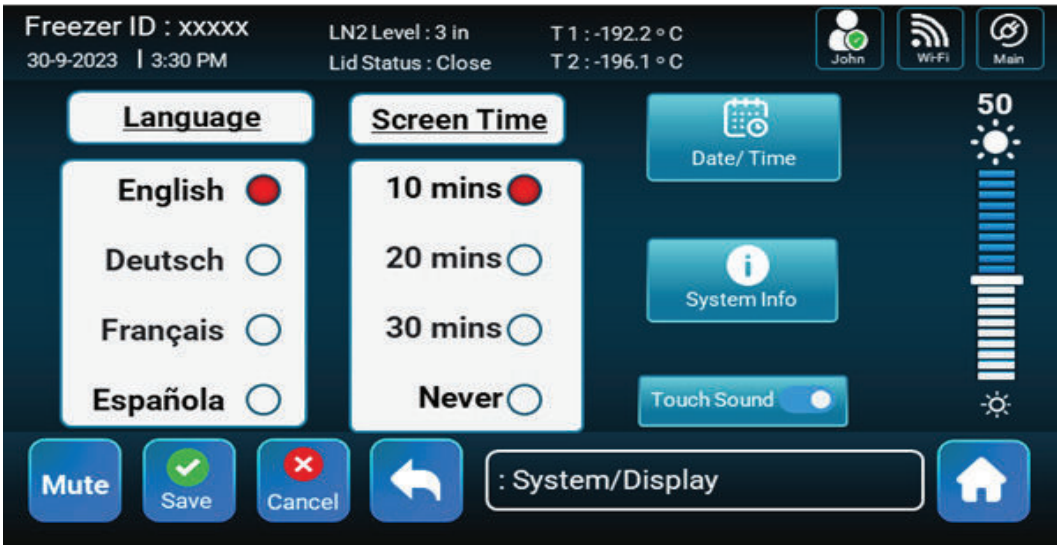
The device serial number and URL are configured in the factory. Do not change these values. If these fields are empty contact customer services for more assistance. Both the email ID and phone number must be entered for the units IOT alerts to function properly. The format for phone numbers is as follows: 1. The phone number shall have no dashes or spaces in it. 2. The phone number shall have +1 in front of it for US phone numbers, + country code for international numbers (no space between + and country code).

Once the appropriate email and phone number is entered select save, connect to the cloud by navigating to the home page and hitting the Wi-Fi Icon. Then hit connect to IOT. Return to the IOT menu and hit test IOT to ensure alerts are working properly. The first alerts can take up to 5 minutes to be received. Email alerts are often sent to your spam folder and will require your IT department to configure your SPAM filter to allow them through. Remote access to your tank can be completed by navigating to cloud.phasetwoccs.com and requesting a cloud account from customerservice@phasetwoccs.com. The units current status, last 3 months of logs, and additional emails and phone numbers can be obtained through our cloud.

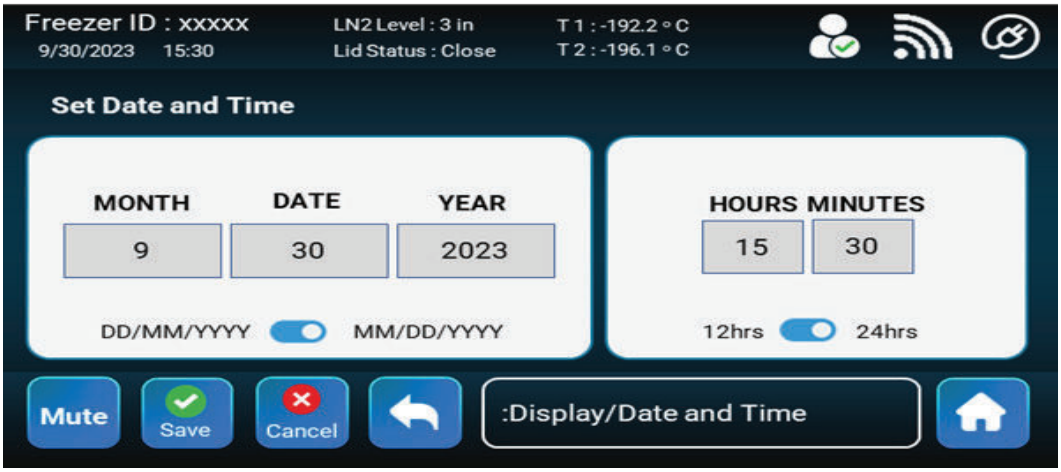
9.5. Settings Submenu



9.5.1. Display Submenu



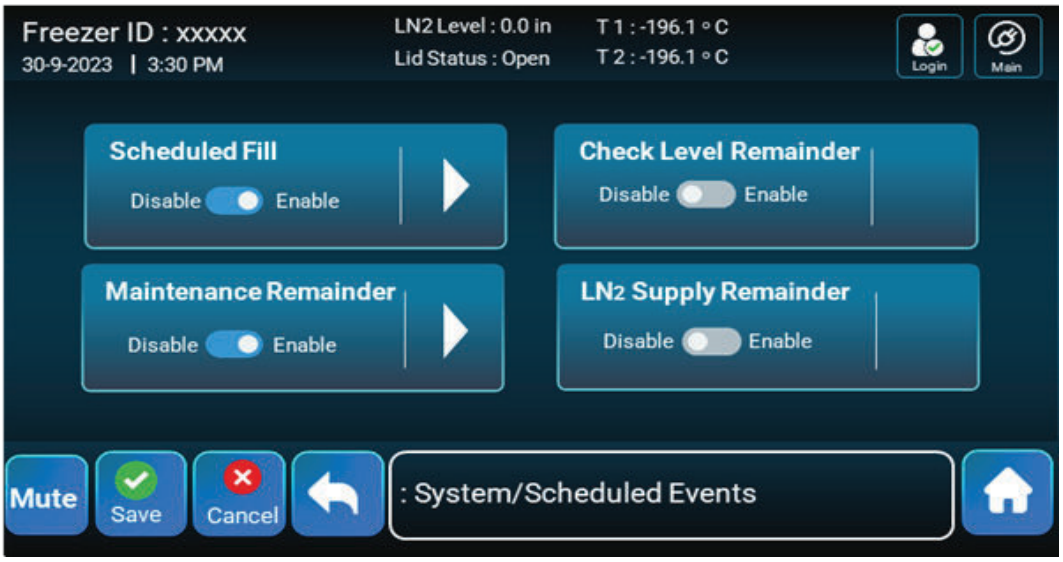
This submenu allows you to change the language, screen time, set the date and time, view system info, turn off touch sound, or increase decrease the brightness.



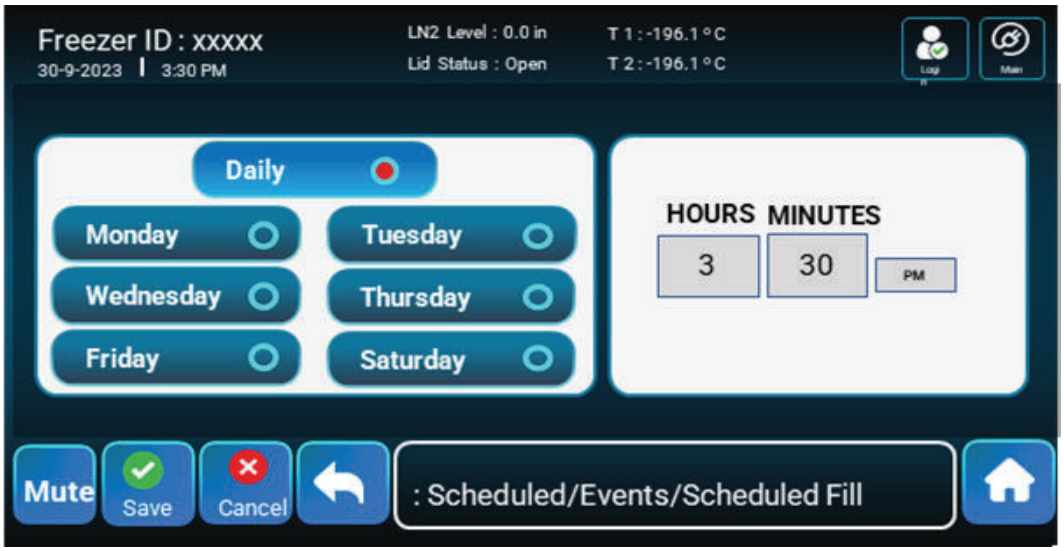
The date and time can be set on this screen with two formats for the date and two formats for the time.

On the system info menu, you can view hardware versions, software versions, and GUI versions. You can also manually type in your contact info for the customer site.

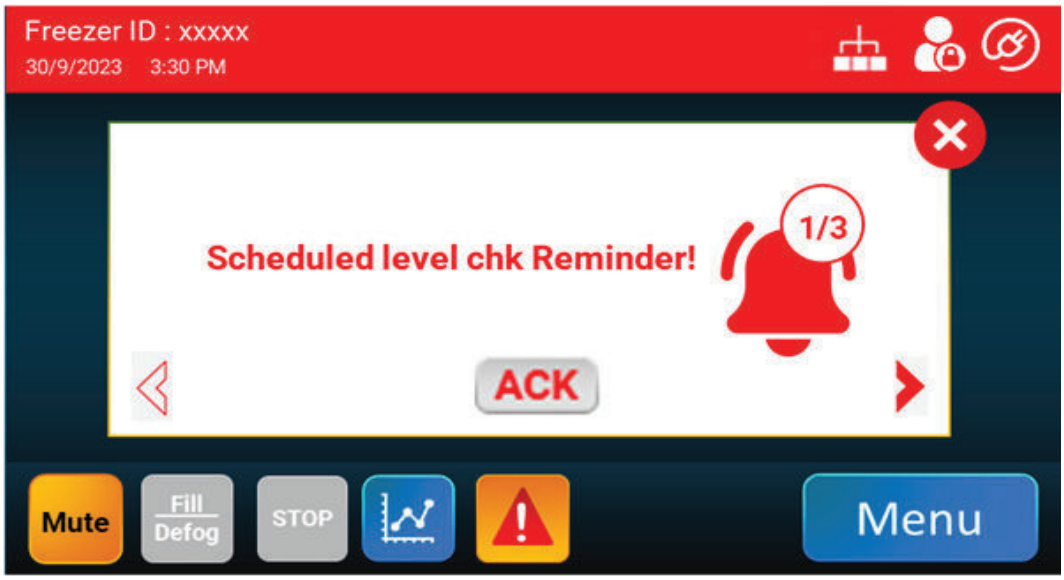
9.5.2. Scheduled Events Submenu



On this menu you can set up a scheduled fill, maintenance reminder, check level reminder, and LN2 supply reminder. To enable one simply toggle the switch to enable and click save. Then click the arrow next to it to configure further.

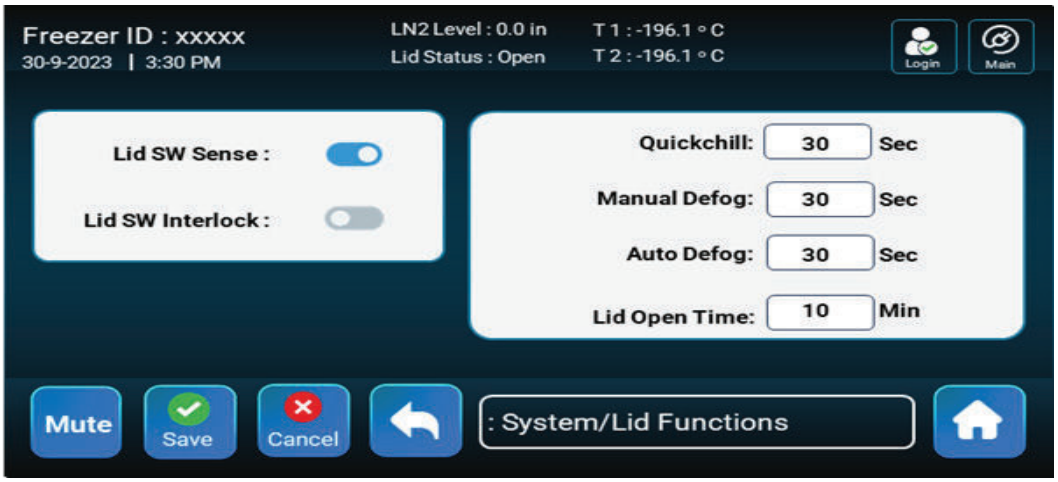


Select the date and time you want the event to occur and hit save.



A scheduled event reminder is displayed as alarm. The user simply hits ACK to clear the alarm and the unit logs that it was acknowledged in the log.

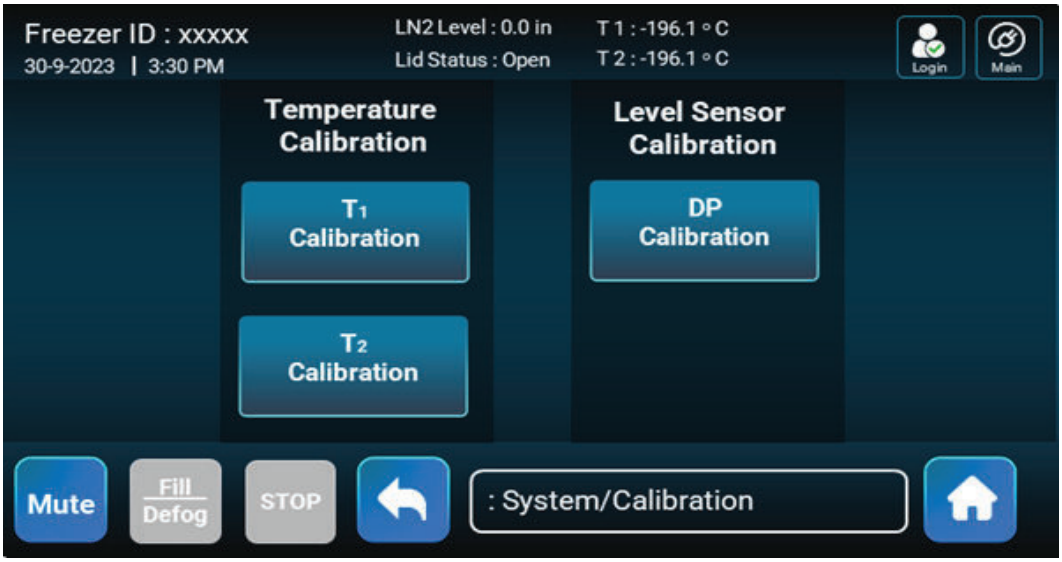
9.5.3. Lid Functions Submenu



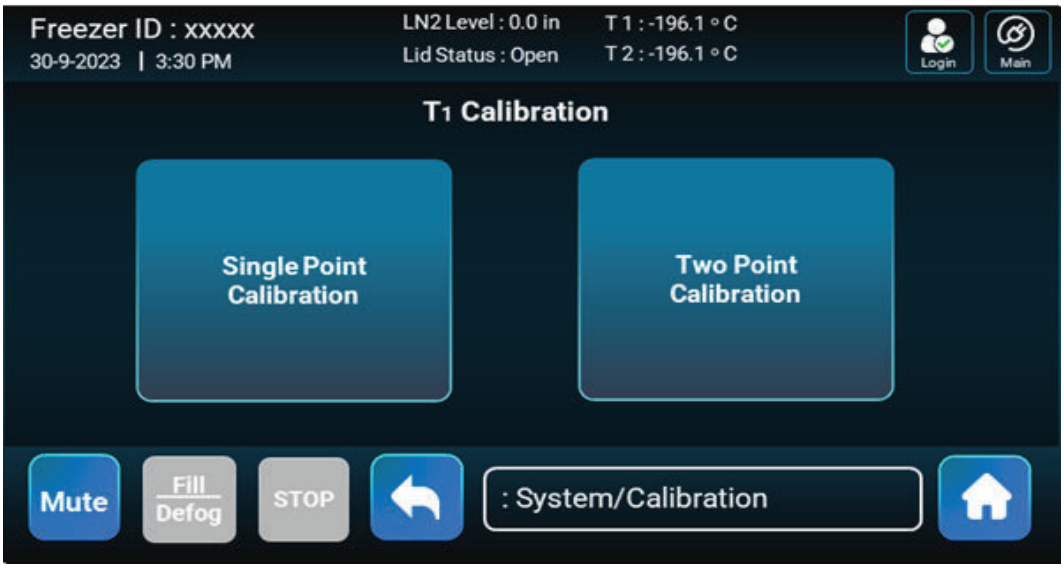
All functions and parameters related to the lid opening and closing are listed here. Toggle on and off the lid switch on this menu. The lid switch interlock is a placeholder for a solenoid lock which is under development. Quick chill is the time the unit opens the fill valve after closing the lid. defog is the time the unit opens the fill valve on a manual defog event. Auto defog is the time the unit opens the fill valve automatically after the lid is open. Lid open time is the time a lid can be kept open before an audible alarm occurs.

Default Values		
Setting	**Default Value**	**Acceptable Values**
Lid Switch Sense Toggle	Enabled	Enabled / Disabled
Lid Switch Interlock Toggle	Disabled	Enabled / Disabled
Quick chill Time	30 sec	0 to 300 sec
Manual Defog Time	30 sec	0 to 300 sec
Auto Defog Time	30 sec	0 to 300 sec
Lid Open Time	10 min	0 to 10 min

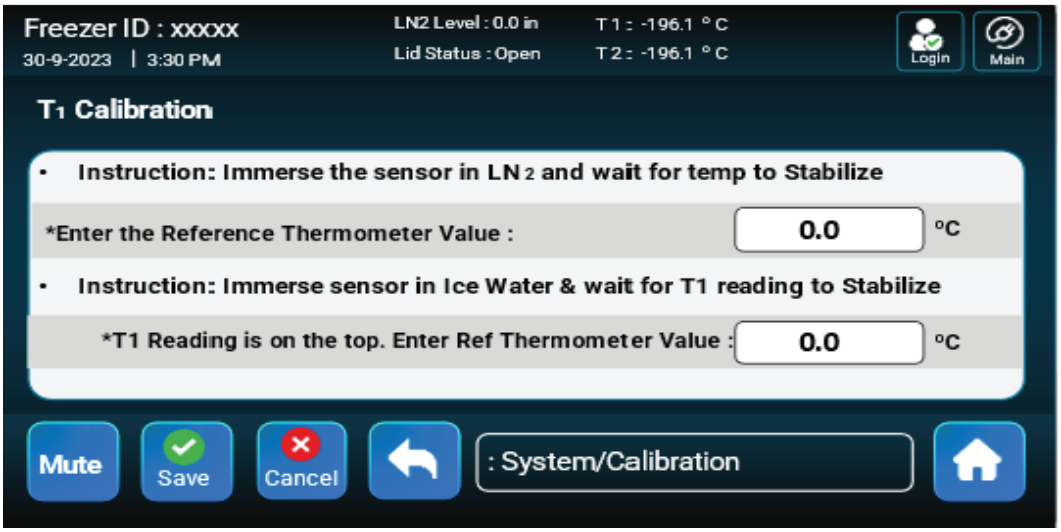
9.5.4. Calibrations Submenu



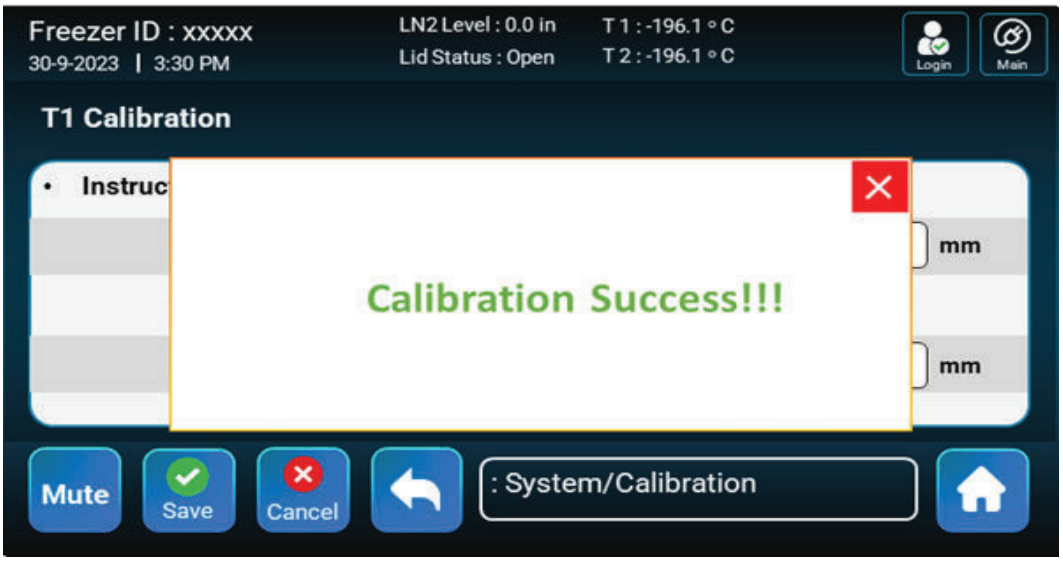
When selecting the calibration menu initially the unit displays all sensors that are available to calibrate. Below is a picture of the options available for the RTD probes T1 & T2.



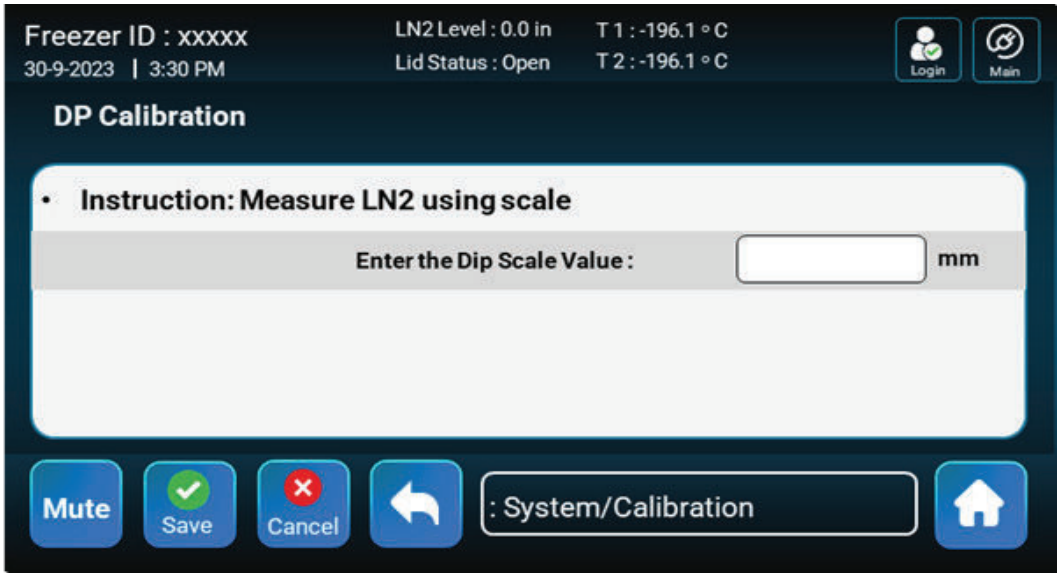
A single point calibration is less accurate than a two-point calibration. However, both are available. A single point calibration is similar in procedure to two-point calibrations. The manual will only cover two-point calibrations.



To complete a two-point calibration read the instructions and work from top to bottom on the screen. Step 1 is to immerse the sensor along with a calibrated probe in LN2 and wait for several minutes for it to stabilize. Enter the value measured on the calibrated probe in the top textbox. After completion of step 1, step 2 will be displayed to the user. For step two submerge the RTD probe in ice water along with the calibrated third-party probe. Wait several minutes for the reading to stabilize and enter the value measured on the calibrated third-party probe. Hit save when complete and the calibration will be evaluated to determine if the values are within an acceptable range.



In regard to DP calibration the control only offers an automatic two-point calibration. This feature is unique to the industry and allows for a simple user friendly precise calibration compared to other competitors.



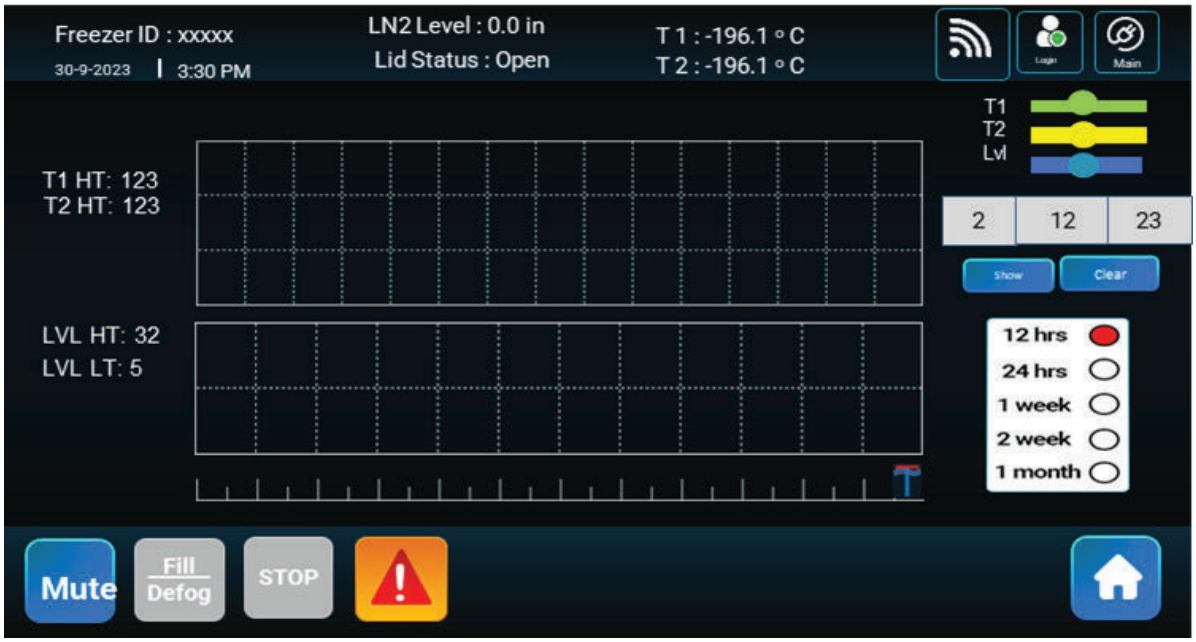
To complete a DP calibration simply measure the DP height as close as possible to the center of the tank using the manual dip stick provided with the tank. To do this dip the dipstick in the tank for 5 to 10 seconds, pull the stick out and wave it in the air. A distinct U frostline will occur. Read the level from the bottom of the U. If a clear U is not present the dip was not proper. Repeat the dip once the dip stick is at room temperature.

Do not calibrate below 6” of liquid nitrogen. Enter the measured value into the screen in the units shown and hit save. The unit will validate the calibration and display calibration success or failure. If using the dip stick tube location an additional amount shall be added to the measured value according to the below table.

Dip Stick Offsets for Dip Tube Location	
HCHE20	0.35 in
HCHE44/50	1.06 in
HCHE92/107	2.37 in
HC14	0.9 in (Measured from the top side of the bottom platform)
HC32	0.9 in (Measured from the top side of the bottom platform)
CRF6000	-1.6 in (Measured at top of rack support, note the value is intentionally negative)

9.6. Chart Submenu

The DLS3 control has live charting capability. To get to this menu hit the graph button from the home screen. Enter a specific date and hit show to see a specific date or select one of the pre defined options below.



The chart will display common/important events right above its x-axis. A key to those symbols is given below.

Graph Element	Events
Temperature Low	
RTD Sensor Open	
LID Open	
LID Close	
LID Open Too Long	
High Level Alarm	

Continued...

Graph Element	Events
Low Level Alarm	
Start Fill	
Stop Fill	
No Error	
Temperature High	

10. Validation

Some organizations require that equipment be validated periodically. If information is needed on the proper techniques to validate this equipment, please contact your supplier.

11. Preventative Maintenance

	Daily	Weekly	Monthly	Yearly	3 Years	5 Years	As Needed
Verify Temperature, LN2 Level, and Usage	X						
Verify LN2 Volume, and Pressure		X					
Inspect for Unusual Frost and Ice			X				
DP Calibration				X			X
RTD Calibration				X			X
DP Blowdown Valve						X	
ASCO Solenoid Valves						X	
Relief Valve Replacement							X
RTD Replacement						X	
Redundant Level Sensor Replacement						X	
Lid Switch							X
Battery Replacement					X		
Lid Gasket Replacement							X
Thaw, Decontaminate, and Dry Freezer							X

12. Troubleshooting

Symptom	Cause	Troubleshooting Steps
Freezer Not Filling / Slow Fill	• Low pressure in supply tank • Inadequate GBP Sense Time • Inadequate LN2 Supply Delay Time • Inadequate MFV Sense Time • Open GBP Sensor Alarm • Open MFV Sensor Alarm • Bad valve	1. Verify supply is proper (under 35 psi and adequate level. 2. Complete a fill and verify no alarms are present. If Improper fill is present, check GBP sense time and supply cylinder. If no LN2 supply is present, check supply cylinder and or increase LN2 Supply Delay Time. 3. Start a manual fill and listen for click noise from GBP valve. Check valve voltage to ensure it is 12VDC. 4. Contact customer support if issue is not resolved.
Check DP Calibration Alarm	• Inaccurate DP Calibration • Thermistor array moved during 3rd party temperature probe installation • Ice blockage in DP Line • Failed 3/2 valve	1. Dip the unit and verify the displayed DP level. Do not attempt calibrating the unit if you are not confident in your dip value. 2. Locate the center port and push the largest wire down until you feel significant resistance. This will relocate the thermistor array into the proper location. 3. Review logs or graphs for DP levels that don't make sense and or are erratic. 34" is a classic symptom of an ice blockage.

Symptom	Cause	Troubleshooting Steps
		4. Open lid and watch level during defog function. If level goes down during that time periodically and once it stops, proceeds to come back to initial level, an ice blockage is likely forming. 5. Remove the supply cylinder. If the level lower the DP valve has failed. 6. Check for lid freezing to unit during fill, leading to increased pressure. 7. Contact customer support if issue is not resolved.
Improper LN2 Supply Alarm	• Empty supply cylinder • Insufficient LN2 Supply Delay time programmed • Low pressure in supply tank	1. Verify the supply tank is full and pressure is between 15 and 35 psig. 2. Manual fill the unit and record the time for it to increase per the fill amount. Calculate fill time and adjust LN2 Supply Delay parameter in alarm menu. 3. Contact customer support if issue is not resolved.
No LN2 Supply Alarm	• The GBP thermistor sensor never sensed LN2 within the GBP sense time.	1. Increase GBP Sense time in al arm menus. Ensure it is adequate but safe. 2. Contact customer support if issue is not resolved.
Unit underfills	• Leak in DP Tubing • Out of calibration	1. Inspect DP tubing for leaks. 2. Contact customer support if issue is not resolved.

Symptom	Cause	Troubleshooting Steps
High Temp Alarm	• Unit is warmer than alarm temperature set in the temp menu. • Unit is out or low on LN2. • Vacuum failure.	1. Locate center port on HCHE's and ensure RTD probes are inserted 14" into port. If HC model is being investigated pull RTD's from rear tube and ensure they are inserted into the top box height. 2. If an HC model increase fill level to obtain a lower temperature. 3. Ensure there is liquid in tank. 4. Inspect tank for excessive frost and check usage compared to typical values. 5. Contact customer support if issue is not resolved.
Low Level Alarm	• Unit is in a low-level state, check supply cylinder • Ice Blockage in DP Line • Damaged 3/2 Valve	1. Measure LN2 in tank, fill tank if measurement is accurate. 2. If filling tank does not increase level an ice blockage is suspected. 3. Bypass 3/2 valve and hook tank DP fitting straight up to control DP port. If level increases and behaves normally 3/2 valve is damaged. 4. Contact customer support if issue is not resolved.
High Level Alarm	• User changed high level alarm lower than actual level	1. Measure LN2 in tank. Change stop fill level and wait for LN2 to boil off if accurate. Calibrate if not accurate.

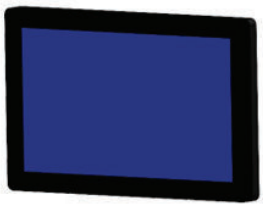
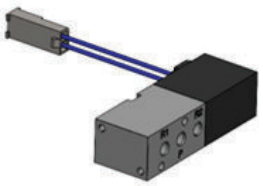
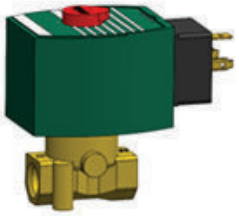
Symptom	Cause	Troubleshooting Steps
	• Check DP sensor against redundant level sensor to determine if something is wrong the DP • Ice Blockage in DP Line • Damaged 3/2 Valve	2. Compare thermistors against DP to determine if DP value makes sense. Calibrate if not ccurate. 3. Check level logs and determine if level behaves normally. Decreasing consistently except for during fills. If erratic, either the DP 4. Check for lid freezing to unit during fill, leading to increased pressure. 5. Contact customer support if issue is not resolved.
Excessive Frost & Ice	• Excessive filling time • Uncontrolled or excessive relative humidity • Vacuum Failure	1. Check unit usage. If above 1-2 in/day and the DP was not serviced or calibrated consider vacuum failure, move samples, and contact phasetwo. 2. Determine if ice is only present during or immediately following a fill. If so, this is normal. 3. First fills typically frost more due to cooling down of warm unit. 4. Watch an autofill cycle occur. If the fill takes longer than an hour consider shortening the distance between start fill and stop fill. 5. Contact customer support if issue is not resolved.

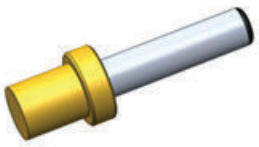
Symptom	Cause	Troubleshooting Steps
Fill Valve Stuck Alarm	• Fill valve has debris in valve seat • Ice Blockage in DP line • Damaged 3/2 valve • Pressure is excessive and the fill valve cannot shut	1. Download logs and or view the chart for the LN2 level over the last week. Determine if levels are normal or erratic. If they are not normal suspect a damaged 3/2 valve and or Ice Blockage in DP line. To determine which one remove the LN2 supply from the tank. If the level drops the DP valve is likely damaged. If not, a ice blockage in the DP line is likely. 2. Check LN2 supply pressure when not filling, during a fill, and following a fill. Ensure it does not exceed 35 psig. 3. Open lid and watch level during defog function. If level goes down during that time periodically and once it stops, proceeds to come back to initial level, an ice blockage is likely forming. 4. Check for lid freezing to unit during fill, leading to increased pressure. 5. Contact customer support if issue is not resolved.
GBP Valve Stuck Alarm	• GBP valve has debris in valve seat • Ice Blockage in DP line • Damaged 3/2 valve • Pressure is excessive and the fill valve cannot shut	1. Download logs and or view the chart for the LN2 level over the last week. Determine if levels are normal or erratic. If they are not normal suspect a damaged 3/2 valve and or Ice Blockage in DP line. 2. Contact customer support if issue is not resolved.

Symptom	Cause	Troubleshooting Steps
DP calibration process is stuck on calculating coefficients	• 3/2 valve tank and control lines are swapped potentially during valve servicing • 3/2 valve is bypassed from previous service	1. Remove rear cover and inspect DP valve connections, the top valve should be connected to the tanks annular line. If bypassed or swapped correct the issue. 2. Contact customer support if issue is not resolved.
Thermistor Sensor Faulty	• Thermistor array is not plugged in • One of the thermistors is damaged	1. Check for open thermistors on the level menu. If open the thermistor array needs to be replaced. Toggle off the thermistor array and contact customer service. 2. Remove rear cover and ensure the connector labeled level is plugged into the main control module. 3. Contact customer support if issue is not resolved.
Auto Defog and Quick chill is not functioning or behaving erratically	• Spacing between lid switch and magnet on lid hinge assembly is too wide. • Lid switch is unplugged. • Lid switch connector pins are unsecured • Thermistor array is unplugged • Bad thermistor array wire	1. Check that the lid switch magnet and switch is adhered to the lid and hinge respectively. Ensure their spacing is not excessive. 2. Remove the appropriate cover and check that the lid switch is plugged in. 3. Remove the appropriate cover and check that the level sensor is plugged in to the main control module. 4. Contact customer support if issue is not resolved.

Symptom	Cause	Troubleshooting Steps
LN2 Usage Alarm	• Calibration done recently • Possible vacuum failure	1. Inspect Freezer for excessive frost and ice. 2. Allow one fill cycle for reset of usage from calibration.

13. Replacement Parts

DLS3 Controller Accessories & Replacements		
Part Description	**Part #**	**Picture**
Mian Control Module	P2-2027355	
I/O Module	P2-2027356	
Display Module (w/display cables)	P2-2027357	
Purge Valve	P2-2027050	
Plumbing Assembly (HCHE series)	P2-2027358	
MFV Valve/GBP Valve (Single valve)	P2-2012980	

LN2 Flow Sensor	P2-2015598	
I/O Cable	P2-2027359	N/A
Redundant Level & RTD Assy (includes 1 redundant level assembly, and two RTD probes bundled together)	P2-2027359	N/A
Valve Cable	P2-2027470	N/A

14. Declaration of Conformity

Declaration of Conformity

Manufacturer: phasetwo, a Division of TOMCO2 Systems Company
SRN: US-MF-000035246
1110 Ridgeland Parkway, Ste. 110
Alpharetta, GA, 30004, USA

Products: DLS3 CONTROL

Applied harmonized standards and regulations:

Low Voltage Directive

IEC 61010-1:2010 +AMD1:2016	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
Report Reference: EFGX24100307-IE-01-L01	National Differences of CENELEC, Canada, Denmark, Japan, Switzerland, UK, & USA

Radio Equipment Directive

ETSI EN 300 328 V2.2.2	Compliance for 2.4 GHz ISM Band Devices

EMC Directive

Directive 2014/30/EU	Electromagnetic Compatibility of Equipment

EMC Test Standards

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use
ETSI EN 301 489-1 v2.2.3	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
ETSI EN 301 489-17 v3.2.4	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems

RoHS

Directive 2011/65/EU and Directive 2015/863	Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

We the Manufacturer hereby declare the above stated Products conform with the above stated Harmonized Standards and Regulations.

Year CE Mark first affixed: 2025

Zackery Waite — *phasetwo Designee*

03/17/2025 — *Date of Issue*

Form 4.2-5-2 Rev 2

15. Warranty

The DLS3 control is covered by a limited two (2) year warranty, effective date of invoice to the original purchaser.

Contact Us

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