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.

Table of Contents

1. Symbols

WARNING! Avoid injury

WARNING! Low temperature

Read owners manual before use.

Waste electrical and electronic equipment directive

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 recommended. 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 has no Radio Transmitter (Intentional Radiator) functions.
- 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

	CRF Series	HC Series	HCHE Series
Electrical	100-264V AC, 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		
Temperature	60 – 80 degrees F		
Relative Humidity	Less than 45%, non -condensing		

4. 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.

5. Operation Theory

5.1 Overview

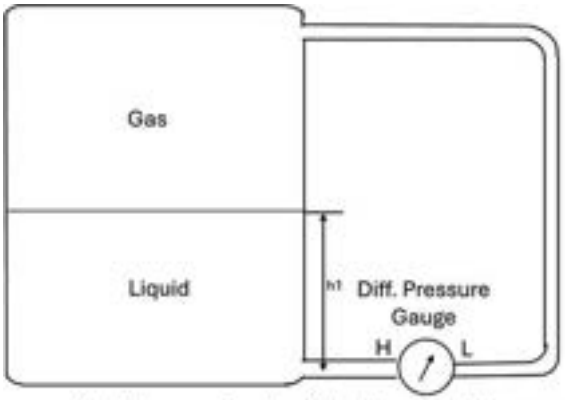
The controller is designed to maintain the liquid nitrogen level inside the tank within the low-level and high-level range defined. While doing this the controller monitors the temperature inside the tank with up to two PT100 probes. It provides logs to monitor temperature, level, and other notable events.

5.2 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.

For the redundant level measurement, a thermistor-based level is generated. A thermistor is a semiconductor in which the resistance is 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.



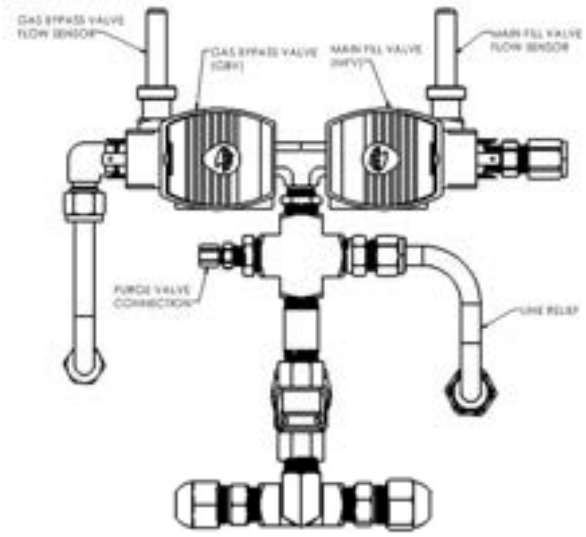
$$H = P_{Liquid} = \text{density of liquid x g x } h_1 + Pressure\ of\ gas$$

$$H - L = Differential\ Pressure$$

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

5.3 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. This valve actuates every night at 11:50 PM to ensure the DP line stays clear of any block-age.

5.4 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.

5.5 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.

Improper LN2 Supply Alarm
If the unit is not filled within the LN2 Supply Alarm Delay time the unit will display this alarm. To clear the alarm, connect a new supply cylinder and press the resume button or adjust the LN2 Supply Alarm Delay on the Alarm submenu.

GBP Sense Time Alarm
If the GBP sensor does not see LN2 within the time configured this alarm will occur and the unit will not fill. Either increase the GBP sense time on the alarm menu for your application, replace the LN2 supply cylinder with a full one, or ensure the GBP valve is plugged and press resume to continue.

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.

GBP Sensor Open
This error occurs when the GBP Sensor detects an 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 circuit the GBP Sensor plug for any reason.

Fill Sensor Open
This error occurs when the Fill Sensor detects an 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 circuit the Fill Sensor plug for any reason.

Fill Valve Stuck Alarm
This error occurs when the fill 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 fill valve seal. Caution: Excess LN2 will be present in the area. Ensure the room is safe to enter before resolving this error.

GBP Valve Stuck Alarm
This error occurs when the GBP valve sensor senses LN2 is 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 LN2 will be present in the area. Ensure the room is safe to enter before resolving this error.

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.

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.

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.

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 failure. 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.

Initialization Alarm
During power on a health check occurs, if any sensor or COM device is found bad, this error will be generated.

Mains Power Failure Alarm
This error occurs when the AC power fails.

Battery Voltage Low Alarm
If the battery voltage goes below 11.2V this alarm is generated.

T1/T2 Temperature High Alarm
This error is generated when the high temperature threshold is crossed for either RTD.

T1/T2 Temperature Low Alarm
This error is generated when the high temperature threshold is crossed for either RTD.

T1/T2 Sensor Open Alarm
If either RTD becomes unplugged or an open circuit for any reason, this alarm will occur.

DP Sensor Faulty
If the DP level varies from the thermistor level by more than 1 inch, this alarm is generated. Clear this alarm by calibrating or determining the reason for the DP / thermistor variance.

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

Thermistor Level Senor Faulty
If any thermistor measures an open circuit this error will occur. To clear the error, replace the thermistor level sensor.

5.6 Logs
The unit records data every 15 minutes when lid is closed or every minute when the lid is open. The data 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.

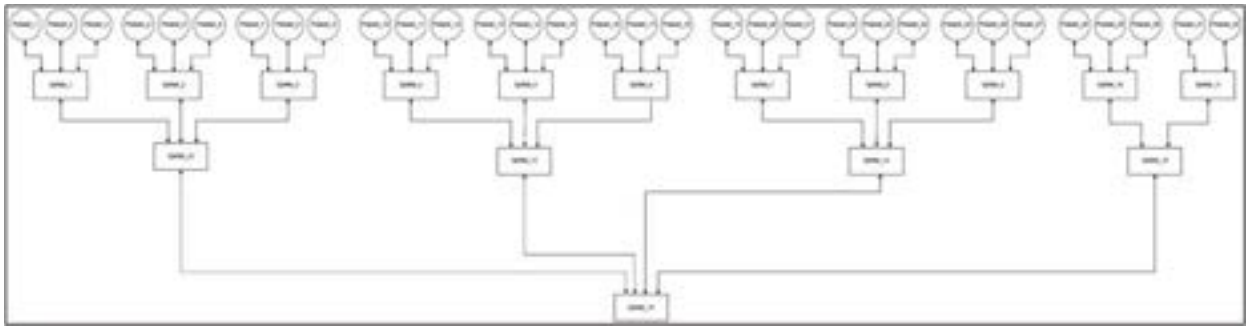
mm/dd/yr	Hrs:min:secs	Type of log data	Code	event / Fault description	Temperature1	Temperature2	Level

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

5.7 Communications

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 -> Freezer Network. 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. Once saved, 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 press 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 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, toggle the group slider to enable. 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.

Sintesy Cryolink S310

If user chooses to connect the Phasetwo unit with Sintesy networking, the MODBUS (RS485) port of the unit shall be connected to that of S310 Cryolink supplied by Sintesy.

Please contact your distributor or phasetwo for an interconnection cable between the unit and the S310.

phasetwo should be contacted for a special firmware update to configure the unit to work with Cryolink and for guidance in configuring the S310 Cryolink. The special firmware update will transfer the necessary settings and commands to Cryolink automatically for proper functioning.

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.

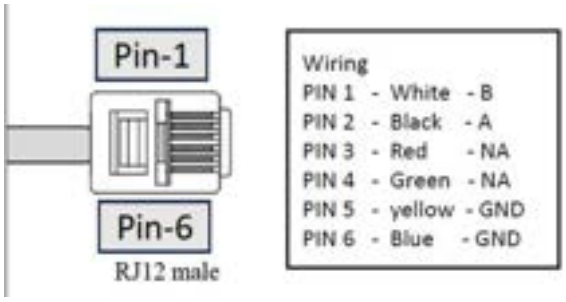
Alarms A1/A2		
Bit	**Meaning**	**Code**
0	Display initialization failed	0x00000001
1	EEPROM read write error	0x00000002
2	DP sensor faulty	0x00000004
3	Thermistor level sensor faulty	0x00000008
4	T1 is open	0x00000010
5	T2 is open	0x00000020
6	High level	0x00000040
7	Low level	0x00000080
8	No LN2 supply	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

See to the right image for a diagram of the RJ12 connector.

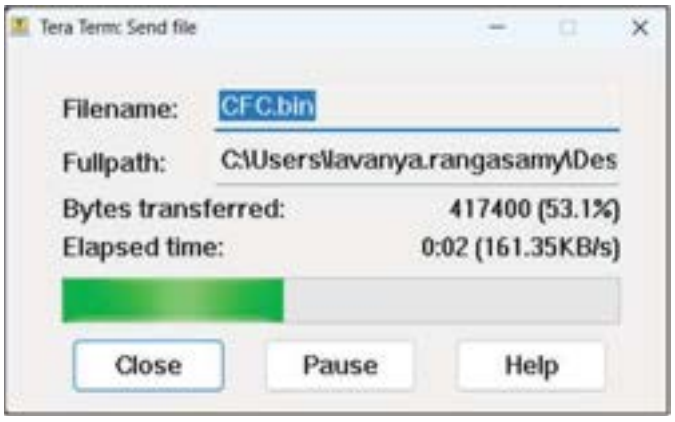


5.8 Firmware Update

Main Control Module Firmware Update
To complete a firmware update, first obtain the latest .bin file from your distributor. Then download Tera Term from Sourceforge.net. Connect the USB terminal on the back of the unit to the USB connector of your computer. If user access is being used, an admin account should be logged into before proceeding. After logging in, go to the Security Submenu and select Firmware Update.

Then press Start to allow uploading the new firmware. After firmware update is selected on the controller, open Tera Term and select the serial port.

Then go to File and select send file. Choose the Binary option and select the .bin file previously obtained from your distributor. If you do not choose the binary option, the firmware update will fail.



After downloading press Stop on the controller and disconnect the USB cable.
Note: Do not attempt to downgrade to a lower firmware version.
The control will then return to the home page and a pop-up message will display a firmware update is available.

Either configure an update time or select update now. Note: The 'pick a time' option cannot exceed more than one week. The unit will say "Firmware updating please do not disconnect from power". The unit will boot normally once the firmware update is complete.

Display Module Firmware Update

To complete a display firmware update, switch off the unit and disconnect the usb cable coming out of the display module that is plugged into the Main Control Module. With the unit remaining switched off, a usb drive will appear on your computer. Delete all files and replace them with the files provided. The files must be uncompressed, and the top-level folder must say THT and Font. Note: The file transfer process will take at least 10 minutes. Once complete, re-connect the display USB cable to the display port on the Main Control Module.

6. Menu Guide

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

6.1 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 it is defective. 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 the first fill.

Default Values	
T1 High Level Toggle	Enabled
T1 High Level Value	-130 deg C
T1 Low Level Toggle	Disabled
T1 Low Level Value	0 deg C
T2 Toggle	Enabled
T2 High Level Toggle	Enabled
T2 High Level Value	-130 deg C
T2 Low Level Toggle	Disabled
T2 Low Level Value	0 deg C

6.2 Level Submenu

At first glance of the level menu, you get a quick status view 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. The redundant level sensing algorithm will remain working in the background.

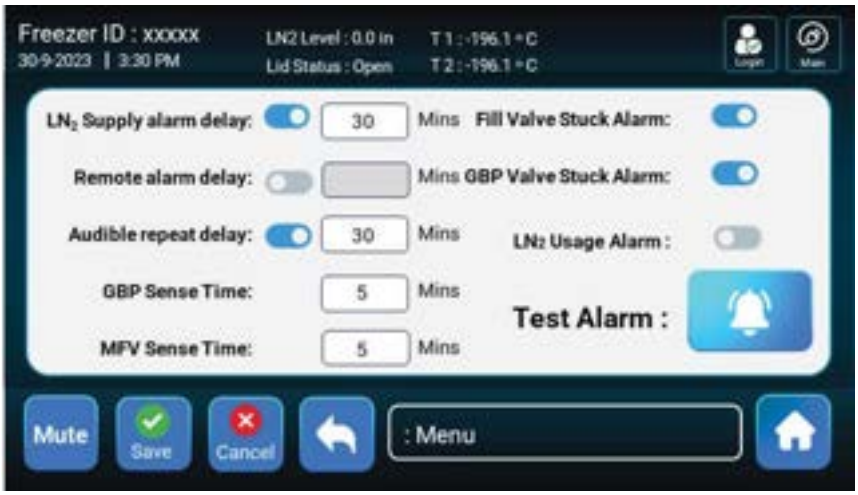
If a change to the Start Fill and Stop Fill are desired simply click on the Start Fill or Stop Fill text box and type in the desired number. The unit has a valid range for each value and will prompt you if the value you selected is incompatible with the freezer. The Low Level and High Level alarm points will automatically adjust 1" lower and higher than the value you typed. When changing values on the screen you must select Save before leaving the menu.

By selecting the arrow next to the alarm values more settings are displayed.

If turning the valve On & Off in a pulsed manner is required, adjust the Valve Open and Closed times accordingly here.

Default Parameters						
	HCHE20	HCHE44/50	HCHE92 /107	HC12	HC26	CRF6000
Therm. Widget Toggle	Enabled					
Start Fill Value	4.0 in	5.0 in		TBD	TBD	TBD
Stop Fil Value	7.0 in	8.0 in		TBD	TBD	TBD
Low Level Alarm Value	3.0 in	4.0 in		TBD	TBD	TBD
High Level Alarm Value	8.0 in	9.0 in		TBD	TBD	TBD
Level Units	Inch					
Valve Open Duration	0 Minutes					
Valve Close Duration	0 Minutes					

6.3 Alarm Submenu



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

LN2 Supply Alarm Delay
If a fill cycle is not completed within this timer the control alerts the user with an Improper LN2 Supply Alarm. See the Alarms Section under Operation for more detail.

Remote Alarm Delay
Remote alarm contacts are triggered for any alarm. When enabled the remote alarm contacts are delayed from closing for the specified time.

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.

GBP Sense Time
This parameter adjusts the amount of time the gas bypass LN2 sensor will wait for liquid nitrogen before triggering a GBP Sensor 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 through the GBP line than necessary.

MFV Sense Time
This parameter adjusts the 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.

Fill Valve Stuck Alarm
This alarm alerts the user when a fill valve is stuck open. In the case a fill valve is stuck open the unit should be serviced as soon as possible to ensure an overfill situation does not occur and/or a nitrogen gas asphyxiation risk is not created.

GBP Valve Stuck Alarm
This alarm alerts the user when a gas bypass valve is stuck open. In the case a GBP valve is stuck open the unit should be serviced as soon as possible to ensure a nitrogen gas asphyxiation risk is not created.

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

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 mins
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

6.4 Security Submenu

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.

User Access

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

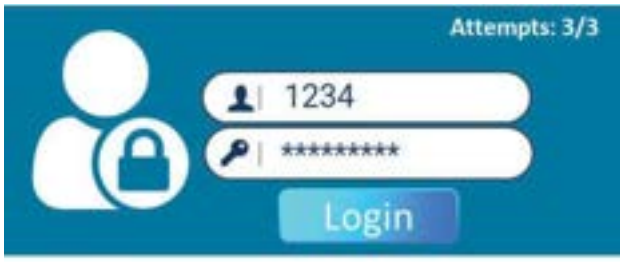
A total of 10 user accounts (2 Admin users and 8 Normal users) can be created in the database. Normal users can access all submenus and settings in menus except security submenu. Admin users have full access to all submenus including security submenu.

Only Admin users can log in to download log data through the USB port or 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 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 pressing 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 minutes if no touch screen activity is detected.

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

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.

Freezer Network
Please refer to the communications section.

Wi-Fi Setting
Under development.

IOT
Under development.

6.5 Settings Submenu

Display Submenu

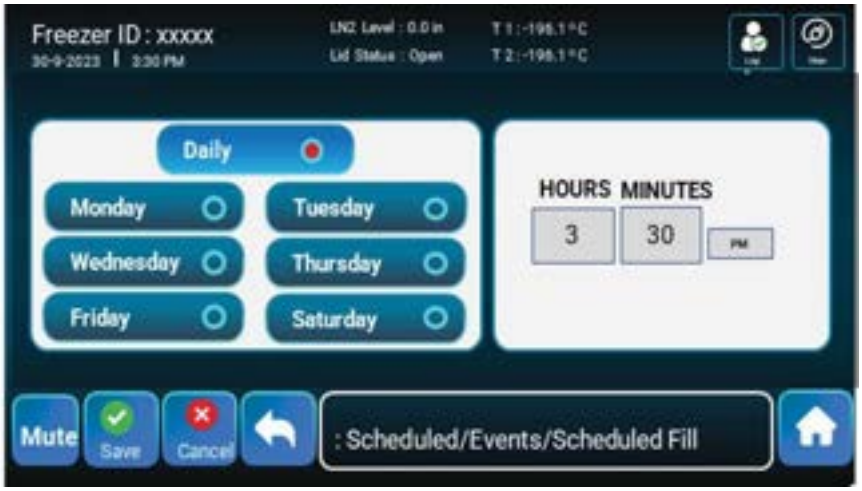
This submenu allows you to change the language, screen time, set the date and time, view system info, turn off touch sound, or increase decrease the brightness.

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

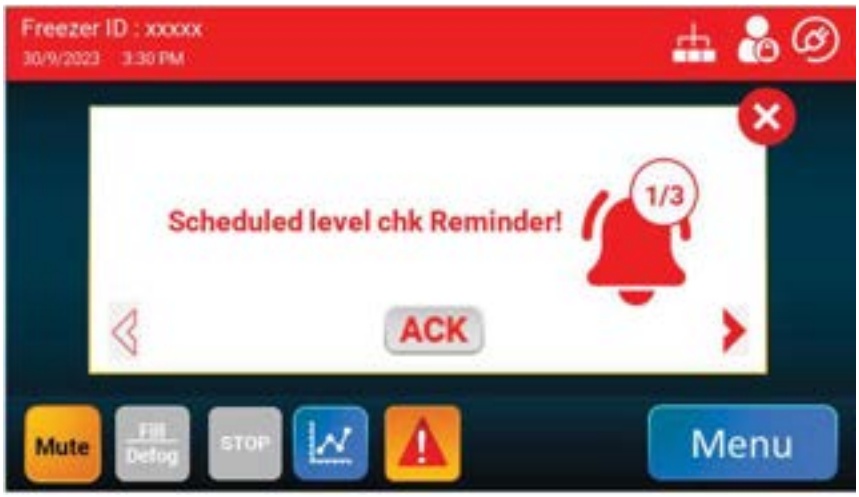
On the System Info menu, you can view hardware versions, software versions, and GUI versions. You can also manually type in your contact info for the customer site.

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 press Save.



A Scheduled Event Reminder is displayed as an alarm. The user simply presses ACK to clear the alarm and the unit logs that it was acknowledged in the log.

Lid Functions Submenu

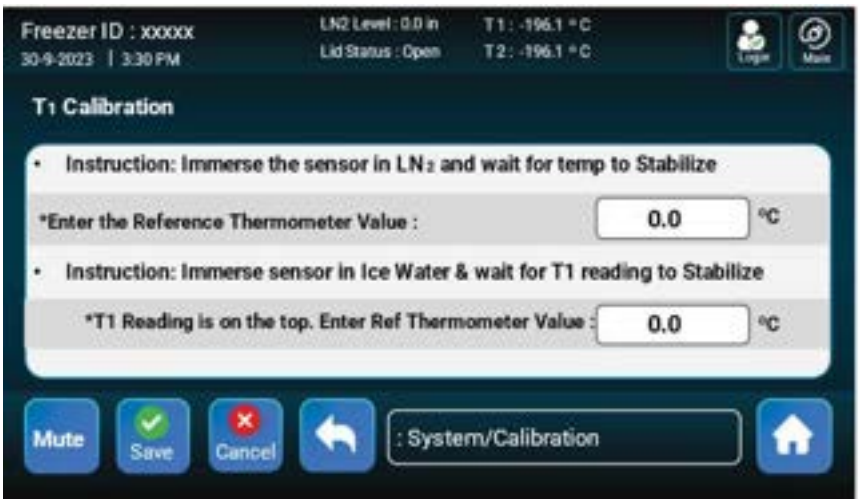
All functions and parameters related to the lid opening and closing are listed here. Toggle the lid switch on and off on this menu. The lid switch interlock is a place-holder for a solenoid lock, which is under development. Quick Chill is the time the unit opens the Fill valve after closing the lid. 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

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 to accommodate a plethora of situations in the field. 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. Press Save when complete and the calibration will be evaluated to determine if the values are within an acceptable range.

Regarding DP calibration, the control only offers an automatic two-point calibration. This feature is unique to the industry and allows for simple, user-friendly and precise calibration compared to other manufacturers.

To complete a DP calibration simply measure the DP height as close as possible to the center of the tank with the manual dip stick provided with the tank. To manually measure liquid level, dip the dipstick in the tank for 5 to 10 seconds, pull the stick out and wave it in the air. A distinct frost line will occur. Subtract 0.5" from the frost line to account for liquid boiling during the measurement.

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

7. 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.

8. Preventative Maintenance

	Weekly	Monthly	Yearly	3 Years	5 Years	As Needed
Verify Temperature, LN2 Level, and Usage	X					
Verify LN2 Volume & 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

9. Troubleshooting

Symptom	Cause
Freezer Not Filling / Slow Fill	• Open GBP Sensor Alarm, check sensor and wiring. • Open MFV Sensor Alarm, check sensor and wiring. • Check that valve voltage is 12VDC • Low pressure in supply tank
Improper LN2 Supply Alarm	• Empty supply cylinder • Insufficient fill time programmed • Low pressure in supply tank
Unit underfills	• Leak in DP tubing or purge valve
High Temp Alarm	• Unit is warmer than alarm temperature set in the temp menu.
Low Level Alarm	• Unit is in a low-level state, check supply cylinder
High Level Alarm	• User changed high level alarm lower than actual level • Check DP sensor against redundant level sensor to determine if something is wrong the DP
Excessive Frost & Ice	• Possible vacuum failure
Fill Valve Stuck Alarm	• Fill valve has debris in its seal
GBP Valve Stuck Alarm	• GBP valve has debris in its seal
GBP Sense Time Alarm	• GBP sense time is too short for installation, see alarm submenu
MFV Sense Time Alarm	• MFV sense time is too short for installation, see alarm submenu
Thermistor Sensor Faulty	• Redundant level sensor is not plugged in • One of the sensors on the redundant level sensor is open, replace sensor.
GBP Sensor Open	• GBP sensor is not plugged in • GBP sensor wire is damaged • Plumbing wiring harness is faulty
MFV Sensor Open	• MFV sensor is not plugged in • MFV sensor wire is damaged • Plumbing wiring harness is faulty
Calibrate DP Alarm	• There is a mismatch between the thermistor array and DP sensor, troubleshoot DP value • DP line is frozen
LN2 Usage Alarm	• Possible vacuum failure, inspect freezer for ice and frost

10. Replacement Parts

DSL3 Controller Accessories & Replacements		
Main Control Module	P2-2027355	
IO 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	
Redundant Level & RTD Assy (includes 1 redundant level assembly, and two RTD probes bundled together)	P2-2027359	
I/O Cable	P2-2027470	

11. Declaration of Conformity

phasetwo, a division of TOMCO Systems, certifies that the item(s) described above have been manufactured in accordance with all applicable instructions and specifications. The required inspections and testing have been completed and the results indicate that the product is fully acceptable and in conformance with all internal requirements and specifications. Inspections are available by formal request of the Customer.

12. Warranty

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

Contact Us

United States : + 1 770.985.1313

Sales support/order placement : customerservice@phasewoccs.com

Technical Services : techservices@phasetwoccs.com

1110 Ridgeland Pkwy Suite 110 Alpharetta, GA 30004
770.985.1313
www.phasetwoccs.com