

Controller Manual Revolution Freezer Controller



INDEX

SYMBOLS GLOSSARY.....	5
ABBREVIATIONS USED.....	5
INTRODUCTION	6
Risk – Sample Damage	6
Risk – Un-Authorized Sample Access.....	6
Operators and Restrictions.....	6
<i>Logged Out</i>	6
<i>Technician</i>	6
<i>Manager</i>	6
<i>Maintenance</i>	6
<i>Administrators</i>	6
Concepts.....	6
SCREENS.....	7
Home Screen	7
<i>Status Bar</i>	7
<i>Navigation Bar</i>	7
<i>Cycle Buttons</i>	8
<i>Live Status</i>	8
<i>Historical Trend</i>	8
<i>Motion Buttons</i>	8
<i>Dip Log</i>	9
Alarms Screen.....	10
<i>Slide to Reset Alarms</i>	10
Settings Screen.....	11
<i>Basic Settings</i>	11
<i>Advanced Settings</i>	11
<i>Save to SD Memory</i>	11
<i>Restore from SD Memory</i>	11
<i>Apply factory Defaults</i>	11
Status Screen	12
<i>Additional Live Status</i>	12
<i>Valves and Modes</i>	13
Location Learning.....	14
<i>Edit Learned Positions Screen</i>	14
INITIAL SETUP	15
Administrators Menu.....	15
User Administration	16
Usernames and Passwords	16
<i>Factory Default User Settings</i>	16
<i>Remove / Add User</i>	17
<i>Change Password</i>	17
<i>Export / Import User Settings</i>	18
<i>Tech Auto Log-In</i>	18
<i>Unsecured Access</i>	18
<i>RFID</i>	19
Carousel Positioning.....	20
<i>Pie Carousel</i>	20
<i>Rectangle Carousel</i>	20
<i>Quadrant Positioning</i>	21

HMI HW Config	22
Gateway Wifi	22
Gateway Ethernet.....	22
OPERATION.....	23
Automatic.....	23
LN2 Level Control – DP.....	23
LN2 Level Control – Temp. Sensors.....	23
Manual	23
Liquid Full	23
Radiance Temperature Control	23
FREEZER SETTINGS.....	24
Basic Settings	24
High Alarm LN2	24
Stop Fill LN2.....	24
Start Fill LN2.....	24
Low Alarm LN2.....	24
Pop-Up Dip Log Interval.....	24
Pop-Up Fill Log.....	24
High Temp Alarm.....	24
Low Temp Alarm.....	25
GBP Temp.....	25
Fog Clear Duration.....	25
Advanced Settings	25
DP System Settings.....	26
Level Measure Inhibit Time.....	26
Periodic Purge Duration.....	26
Periodic Purge Interval.....	26
Post-Fill Purge Duration.....	26
Temp Probe Level Protect - Enable/Disable.....	26
DP Level Control - Enable/Disable.....	27
Stabilization Response – Enable/Disable.....	27
Secondary Filter Time.....	27
LN2 Level Offset.....	27
Temperature & Sensor Settings	28
TempA Offset.....	28
TempB Offset.....	28
High Level Temp Offset.....	28
Low Level Temp Offset.....	28
Liquid Temp Setpoint.....	28
Valve & Protection Settings	29
Fill Valves Safety Timeout.....	29
GBP Valve Safety Timeout.....	29
Lid Lock.....	29
Overfill Temp Offset.....	29
Gas Bypass Temp Offset.....	29
Gas Bypass.....	29
Stop Fill Lockout.....	29
Radiance Settings.....	30
Radiance Enable.....	30
Radiance Max. Temp.....	30
Radiance Min. Temp.....	30
Motion Settings	31
Small Jog Size	31

Big Jog Angle.....	31
Level Check Absolute Ref.....	31
Quad A. Absolute Ref.....	31
ALARMS AND WARNINGS	32
Alarms	32
<i>Invalid Settings</i>	32
<i>Source Alarms</i>	32
<i>Valve Safety Timeout</i>	32
<i>Overfill Sensor Wet</i>	32
<i>DP System Fault</i>	32
<i>Low-Level Sensor Dry</i>	32
<i>Liquid Level too High</i>	32
<i>Liquid Level too Low</i>	32
<i>Top Temp - Over Temp</i>	32
<i>Top Temp - Under Temp</i>	32
<i>Sensor Fault - Overfill</i>	32
<i>Sensor Fault - Low-Level</i>	33
<i>Sensor Fault - Liquid Level</i>	33
<i>Sensor Fault - Top Temp</i>	33
<i>Sensor Fault - Gas Bypass</i>	33
<i>Sensor Fault - High-Level</i>	33
<i>Sensor Fault - Bottom Temp</i>	33
<i>Lid and Lock</i>	33
<i>Motion System Not Ready</i>	33
<i>Motor Stalled</i>	33
Warnings	33
<i>Logging Error</i>	33
<i>Logging Disabled</i>	33
<i>Manual Mode</i>	33
DATA	34
Filtering	34
<i>Primary</i>	34
<i>Secondary</i>	34
Logging	34
<i>uSD Memory</i>	34
Access	35
<i>uSD Memory</i>	35

SYMBOLS GLOSSARY

	<p>General Warning Sign</p>		<p>This Manual contains important instructions</p>
	<p>Electrical shock can kill. Do not attempt any service without first disconnecting the electrical power cord.</p>		<p>Do not dispose of the controller or its components with unsorted, non-recyclable residual waste</p>
		<p>Declares compliance with EU and UK Directives and Regulations. Declaration of Conformity is available upon request.</p>	

ABBREVIATIONS USED

LN2	Liquid Nitrogen
SD Memory	Secure Digital Memory
IoT	Internet of Things
SCADA	Supervisor Control and Data Acquisition
PLC	Programmable Logic Contrller
HMI	Human Machine Interface
UI	User Interface
GUI	Graphical User Interface
UPS	Un-Interruptible Power Supply
DP	Differential Pressure
GBP	Gas Bypass
uSD	Micro – Secure Digital

INTRODUCTION

IC Biomedical's line of cryogenic freezers (K-Series, Evolution, and Revolution), have an intelligent control system with a touch screen user interface. The Revolution M-Series adds motorized carousel motion to the base Revolution model. Operators must follow this manual carefully to avoid specific sample risks.

Risk – Sample Damage

Operators must ensure sample racks are properly secured in their carousel locations. Racks improperly secured are at risk of damage during motorized carousel motion. To prevent risk of sample damage during carousel motion, always secure racks fully in carousel location.

Risk – Un-Authorized Sample Access

Factory default user configuration is not secure. Initial setup of unique usernames and passwords is required for secure access. Without initial setup of usernames and passwords, all who have knowledge of default settings can access the freezer. See Also: Tech Auto Log-In.

Operators and Restrictions

User authentication and access is administered through the user interface of the freezer. Usernames and passwords can be configured from 4 possible user levels:

Logged Out

When logged out, sample access is not possible; most features are disabled. LN2 level and zone temperatures remain visible.

Technician

Technicians have sample access but are not able to retrieve log data or change settings of the freezer.

Manager

Managers have sample access; they also can retrieve log data.

Maintenance

Maintenance operators have all the privileges of managers plus the ability to change settings of the freezer.

Administrators

Administrators have full unrestricted access to samples, settings, and log data; they also can configure usernames and passwords under each available user level.

Concepts

The freezer contains a controller and user interface designed to automatically operate the freezer and provide intuitive secure access to users. LN2 level is measured and controlled using DP technology with temperature sensors backup. The freezer controller starts and stops LN2 fill cycles automatically. Access to samples is restricted through a locking lid. Authentication is required to access samples. Push button quadrant selection is enabled through motorized carousel motion. Factory default settings can be changed to optimize features for a particular application. Data and settings are logged for Operations history and Data analysis. Advanced integrations are possible with SCADA and IoT systems.

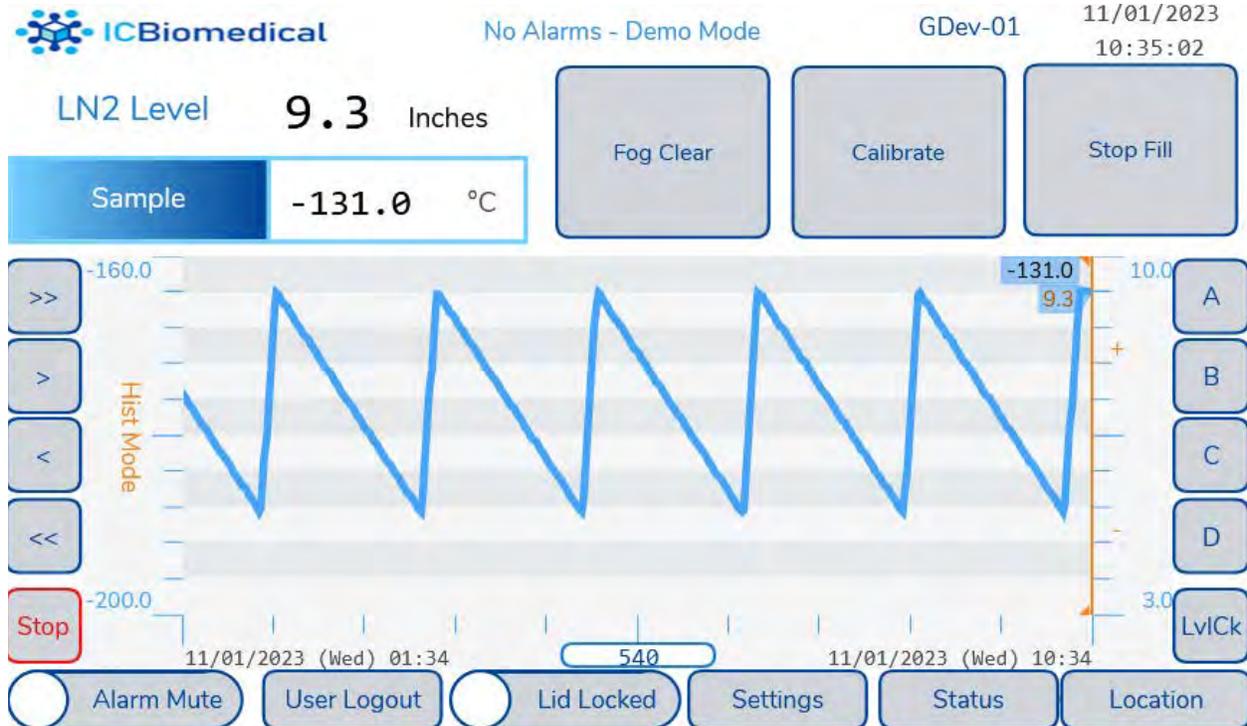
SCREENS

Screens of the user interface have status and navigation bars above and below main content.

Home Screen

Live status and common controls are located on the Home screen.

Press “Inches” to change level units to “C.M”.
Press “LN2 Level” to open the Dip Log.



Status Bar

Status is displayed at the top of each screen.

Alarms Text - Active alarms and warnings text is displayed. Press to show the Alarms Screen.

Date and Time - Current date and time are displayed.

Navigation Bar

Navigation and common use buttons are located at the bottom of each screen.

Alarm Mute - Press or slide to mute the active alarm buzzer. It will re-sound after timeout if alarms not reset.

User Logout - Press to log-out the currently active user and return to the Home Screen. Logout will occur automatically after 5 minutes of inactivity.

Lid Lock - Press or slide to lock and un-lock the freezer lid. See also: Lid Lock Disable

Settings - Press to show the Settings Screen

Status - Press to show the vessels status screen

Location - Press to show the Location Learning Tools.

Cycle Buttons

Fog Clear – when pressed, a momentary fill begins with circulation fan running. After a configurable delay, the fill and circulation fan are automatically stopped. If fog remains too thick after the fog clear cycle, consider adjustments to the Fog Clear Duration setting.

Start Fill – when pressed, a fill begins. Gas bypass will precede the fill if not disabled in settings. If the automatic controller detects a stop fill condition, valves will close. The fill will stop without user interaction. (See also LN2 Level Control – DP and LN2 Level Control – Temp. Sensors)

Stop Fill – when pressed, a fill is ended, valves are closed. If the automatic controller detects a start fill condition, valves will open. The next fill will start without user interaction. (See also LN2 Level Control – DP and LN2 Level Control – Temp. Sensors)

Live Status

LN2 Level Inches – the current DP system measurement of LN2 level.

Sample – the current temperature sensor measurement at “Sample” location.

*Press “Sample” to edit text as desired.

Historical Trend

Live status variables trend on a graph of with a new sample captured each minute.

Hist Mode – press to switch between live and historical views of trend data.

+ / - - press to zoom, + zoom in, - zoom out

Cursor bar – slide when in historical mode to view data label at a particular time in history.

Motion Buttons

Big Jog Right (CW) – press to rotate carousel through a configurable angle.

Small Jog Right (CW) – press to rotate carousel through a configurable angle.

Small Jog Left (CCW) – press to rotate carousel through a configurable angle.

Big Jog Left (CCW) – press to rotate carousel through a configurable angle.

Stop – press to stop all motion.

A – press to rotate carousel to quadrant A location.

B – press to rotate carousel to quadrant B location.

C – press to rotate carousel to quadrant C location.

D – press to rotate carousel to quadrant D location.

LvlCk – press to rotate carousel to level check location.

**Revolution M600-R have rectangular carousel geometries and support 4 additional “quadrants”, E, F, G, and H.

Dip Log

Press "LN2 Level" to open the Dip Log



After entering a new entry for Dipped LN2, press "Confirm New Entry" to save permanently.



Alarms Screen

History, details and the reset button are located on the Alarms screen. Press the Alarms Text from any screen to show the Alarms screen. If an alarm is active, Slide to Reset Alarms will be visible.

Active Date	Active Time	AlarmMessage	AlarmStatus	AlarmType
		Invalid Settings	Status OK	Freezer Control System
		Lid and/or Lock	Status OK	Freezer Control System
		High Level Alarm	Status OK	Level Control System
		Low Level Temp Sensor Dry	Status OK	Level Control System
		Low Level Temp Faulty Sensor	Status OK	Faulty Sensor Detected
		Overfill at Liquid Temp	Status OK	Level Control System
		Overfill Temp Faulty Sensor	Status OK	Faulty Sensor Detected
		Top Temp Low Temp Alarm	Status OK	Freezer Control System
		Top Temp Faulty Sensor	Status OK	Faulty Sensor Detected
		Valve Safety Timeout	Status OK	Valves Control System
04/18/2023	15:26:16	Top Temp High Temp Alarm	Alarm	Freezer Control System
04/18/2023	15:20:12	Motion System Not Ready	Status OK	Freezer Control System

Alarm Mute

User Logout

Lid Locked

Settings

Home

Light OFF

Slide to Reset Alarms

Slide to Reset Alarms

Invisible when no alarm is active, slide to reset alarms. Maintenance privileges are required for Alarms Reset. See Also: Alarms and Warnings.

Settings Screen

Default values can be applied to settings; settings can also be saved to SD memory and restored from SD memory. This is done from the Settings Main screen. All Freezer Settings are categorized and accessible from submenus.



Basic Settings

Press to show the Basic screen.

Advanced Settings

Press to show the Advance Settings screen.

Save to SD Memory

Press to save currently active settings to “SETTING.CSV” on SD memory.

Restore from SD Memory

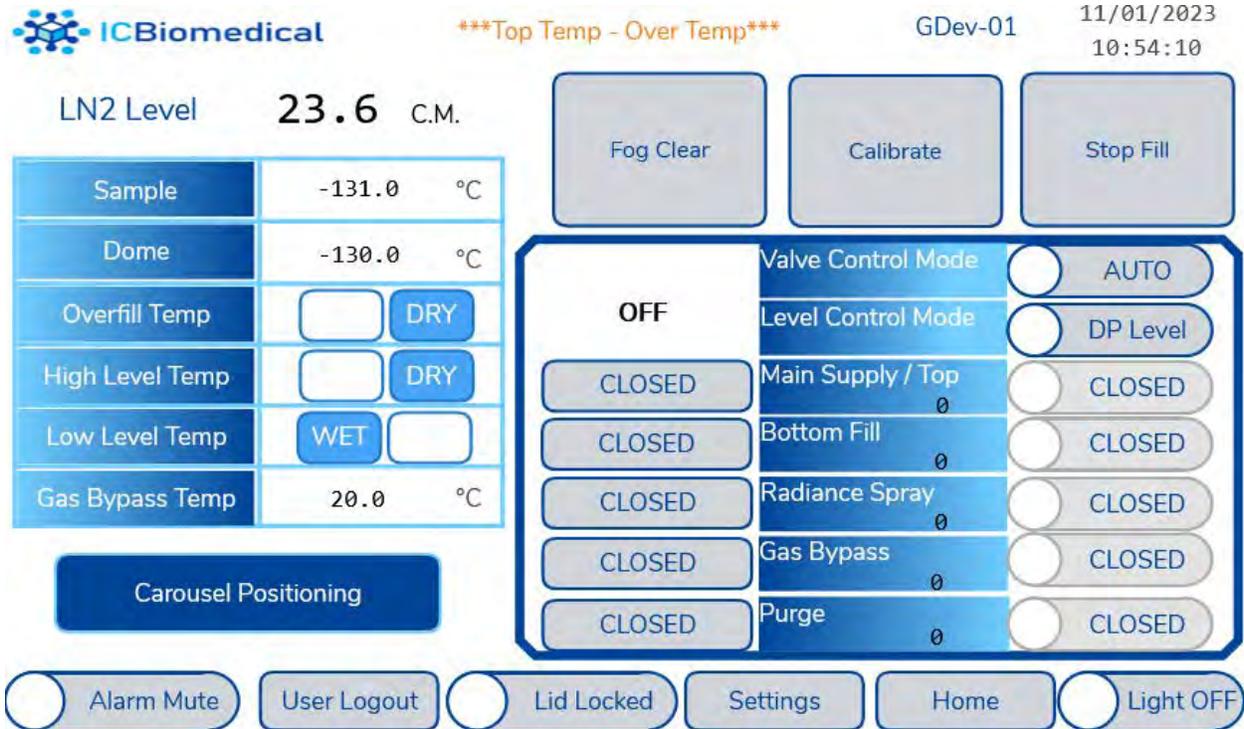
Press to restore active settings from “SETTING.CSV” on SD memory.

Apply factory Defaults

Press to apply factory default settings for configured freezer model.

Status Screen

Cycle Buttons and Live Status are common between the Home and Status screens. Additional status of sensors, valves, and modes of operations are only displayed on the Status screen.



ICBiomedical ***Top Temp - Over Temp*** GDev-01 11/01/2023 10:54:10

LN2 Level **23.6** C.M.

Sample	-131.0	°C
Dome	-130.0	°C
Overfill Temp	<input type="text"/>	DRY
High Level Temp	<input type="text"/>	DRY
Low Level Temp	WET	<input type="text"/>
Gas Bypass Temp	20.0	°C

Carousel Positioning

Fog Clear Calibrate Stop Fill

OFF

<input type="text" value="CLOSED"/>	Valve Control Mode	<input type="radio"/> AUTO
<input type="text" value="CLOSED"/>	Level Control Mode	<input type="radio"/> DP Level
<input type="text" value="CLOSED"/>	Main Supply / Top	<input type="radio"/> CLOSED
<input type="text" value="CLOSED"/>	Bottom Fill	<input type="radio"/> CLOSED
<input type="text" value="CLOSED"/>	Radiance Spray	<input type="radio"/> CLOSED
<input type="text" value="CLOSED"/>	Gas Bypass	<input type="radio"/> CLOSED
<input type="text" value="CLOSED"/>	Purge	<input type="radio"/> CLOSED

Alarm Mute User Logout Lid Locked Settings Home Light OFF

Carousel Positioning – press to show the Carousel Motion Reference screen.

Additional Live Status

Sample Temp – temperature in degrees Celsius of sensor at the sample location. The sample temp location is physically located in the center column and the height can be adjusted. The name of this temperature location can be renamed by touching in the word Sample.

Dome Temp - temperature in degrees Celsius of sensor at the dome location. The name of this temperature location can be renamed by touching in the word Dome.

Overfill Temp – Wet / Dry status of sensor at overfill location. The overfill location should be physically above the high-level location.

High Level Temp – Wet / Dry status of sensor at high-level location. The high-level location should be physically above the low-level location.

Low Level Temp – Wet / Dry status of sensor at low-level location. The low-level location should be physically below the high-level location.

Gas Bypass Temp – temperature in degrees Celsius of sensor at the Gas Bypass location, sensing the temperature of exhaust gas at bypass valve.

Valves and Modes

Valve Control Mode – indicates current operating mode of valves controller. Auto mode for automatic control of valves to control LN2 level. Manual mode for maintenance and setup operations. Authenticated users can slide to switch between Manual and Auto modes.

Level Control Mode – indicates current operating mode of level controller. DP Level mode uses LN2 level measurements from the DP system along to maintain level between low and high setpoints. If a DP system alarm is active, Temp Sensor mode protections are enabled.

Valves Cycle Text – indicates current operating cycle of the valve controller (Off, Manual, Fog Clear, Gas Bypass, Fill, DP Purge)

Main Supply – indicates current status of the main supply valve and the number of seconds the valve has been open. When in manual mode, operators can slide to open / close the valve.

Bottom Fill – indicates current status of the Bottom Fill valve and the number of seconds the valve has been open. When in manual mode, operators can slide to open / close the valve.

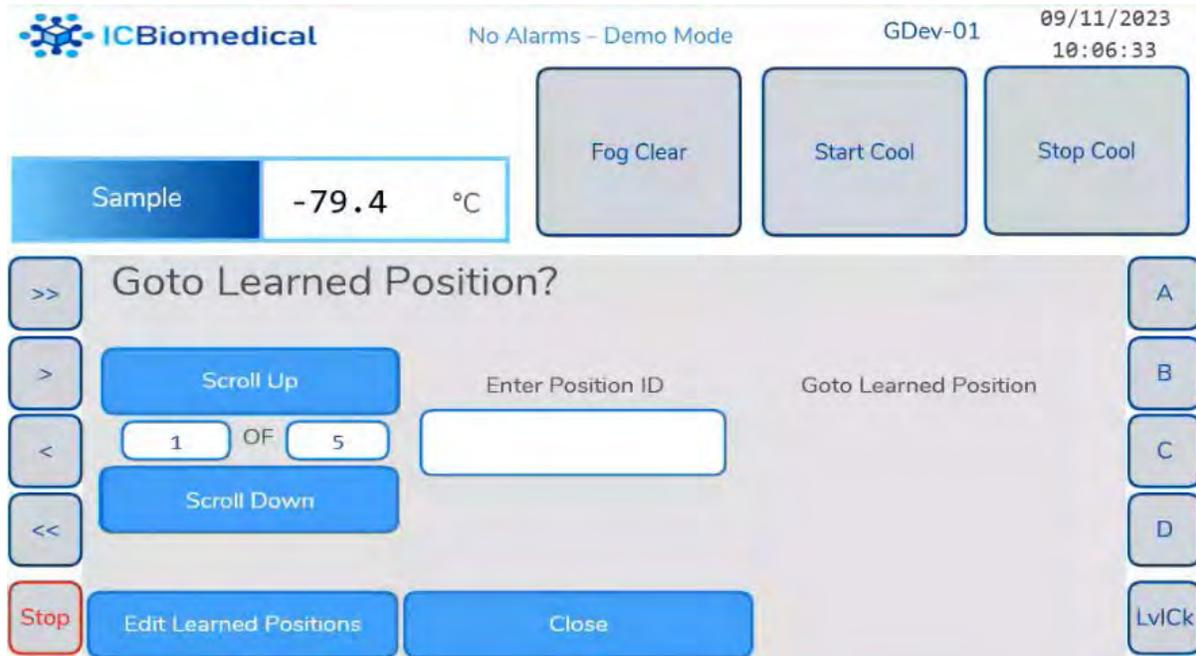
Radiance Spray – indicates current status of the Top Spray valve and the number of seconds the valve has been open. When in manual mode, operators can slide to open / close the valve.

Gas Bypass – indicates current status of the Gas Bypass valve and the number of seconds the valve has been open. When in manual mode, operators can slide to open / close the valve.

Purge – indicates current status of the Purge valve and the number of seconds the valve has been open. When in manual mode, operators can slide to open / close the valve.

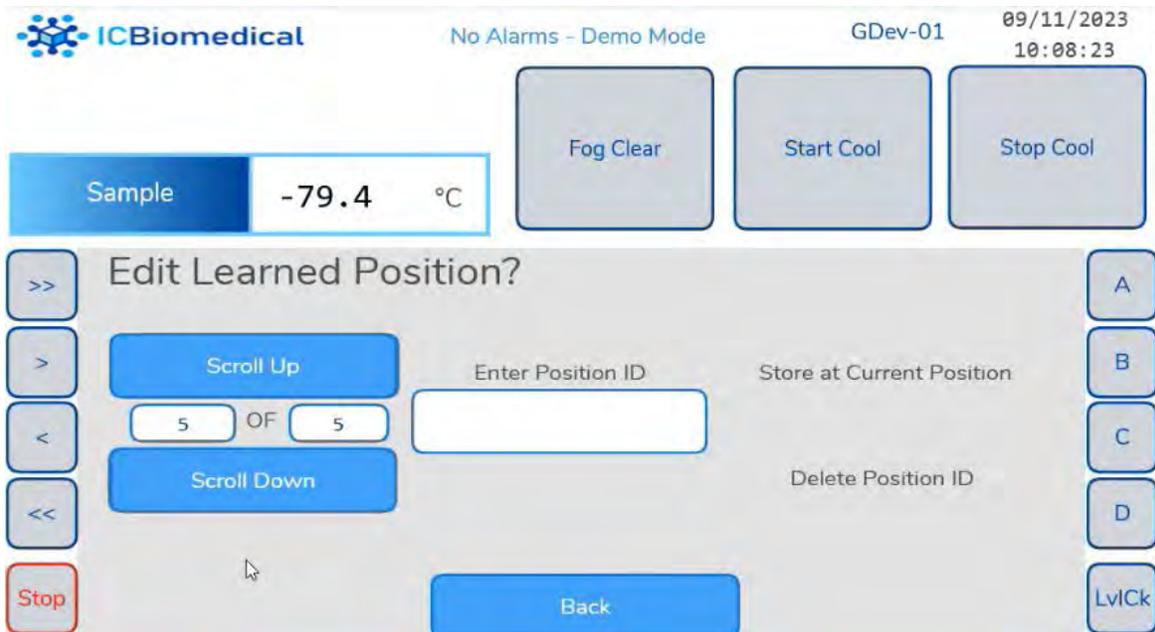
Location Learning

Allows for creating a location withing the carosel of a specific stored sample.



Edit Learned Positions Screen

This screen allows you to enter or delete a position ID of the stored sample and set the carosel quadrant location.



INITIAL SETUP

From a fully installed and powered on state, Administrators should perform initial setup of the freezer to ensure secure access. Accurate operation should be verified, and settings should be configured to meet application requirements. Motorized freezers require a re-reference operation following installation and subsequent power outages if position is incorrect.

Administrators Menu

Double-Tap on the Historical Trend of the Home Screen to show the Administrators Menu shown below. From this menu, User Administration, Logging, and Advanced Configuration features are accessible.

Admin Menu



User Administration

Users assigned to the Administrators group have privileges of User Administration. The User Administration menu facilitates Import, Export, Add, and Remove operations.

HMI - User Administration

PLC - User Access Enhancements

Current User Name: Admin
 Access User Name:
 Access User Password:

HMI - Tech Auto Login Credentials

User Name:
 Password:

Username and Passwords

Administrators have privileges to configure user authentication and access. At a minimum, default usernames should have their default passwords changed to unique passwords. All default usernames can be completely removed and new users created.

Factory Default User Settings

- | | | | |
|----|-----------------------------|------------------|-------------------|
| 1. | Administrators User Level – | 1 user "Admin" – | password = "pass" |
| 2. | Maintenance User Level – | 1 user "Maint" – | password = "pass" |
| 3. | Mangers User Level – | 1 user "Mngr" – | password = "pass" |
| 4. | Technicians User Level – | 1 user "Tech" – | password = "pass" |

Remove / Add User

Completely remove existing users and create new users.

When deleting, select the user group to which the user belongs. Then select username to be deleted. Press Delete.

When adding, select user group to which the user will belong. Then enter username and password. After confirming password, press Add.


Change Password

All users can change their own password from the user interface. From a logged-out state, pressing a locked button will open the Log-in screen. Use the Change Password button to make the change.



Export / Import User Settings

Export user settings to a USB memory and configure other freezers with identical access using import settings.

When exporting, a new file will be created on the USB memory. The new file will be password protected. Enter a password to protect the exported user settings file. Then press OK.

When importing, enter the password created during export. Then press OK.



Tech Auto Log-In

Member of the Technicians group, username “Tech”, password “pass” are credentials used for Auto Log-in by the user interface. Administrators should disable this feature by deleting the “Tech” username or changing the default password. If “Tech”/“pass” remains a configured user, Auto Log-in will occur.

Unsecured Access

Two unsecured access modes are available for configuration by Administrators. Lid Lock Disable applies to all user levels and completely disables features related to the freezer’s lid lock and switch. By default, lid lock is enabled. Tech Auto Log-In provides a second unsecured access feature. If the “Tech” and “pass” user is left configured, automatic log-in will occur to allow sample access without explicit user log-in. Settings and all features restricted above technician level access remain secure.

RFID

Allows for a RFID tag to be used to access the controller instead of manually having to input username and password to access menus.

In the PLC – User Access Enhancements section of the screen you can enter the username and password for an already configured user level for a user RFID tag.

PLC - User Access Enhancements

Current User Name: Admin

Access User Name:

Access User Password:

Manage Access Enhancements

After username and password added have been entered, click on the Manage Access Enhancements button and if username and password is accepted an option will appear to swipe the new RFID tag.

PLC - User Access Enhancements

Current User Name: Mngr

Access User Name:

Access User Password:

Manage Access Enhancements

RFID UID:

Swipe the new RFID tag on the RFID reader and if accepted the RFID UID will change to read RFID UID Confirmed.

PLC - User Access Enhancements

Current User Name: Mngr

Access User Name:

Access User Password:

Manage Access Enhancements

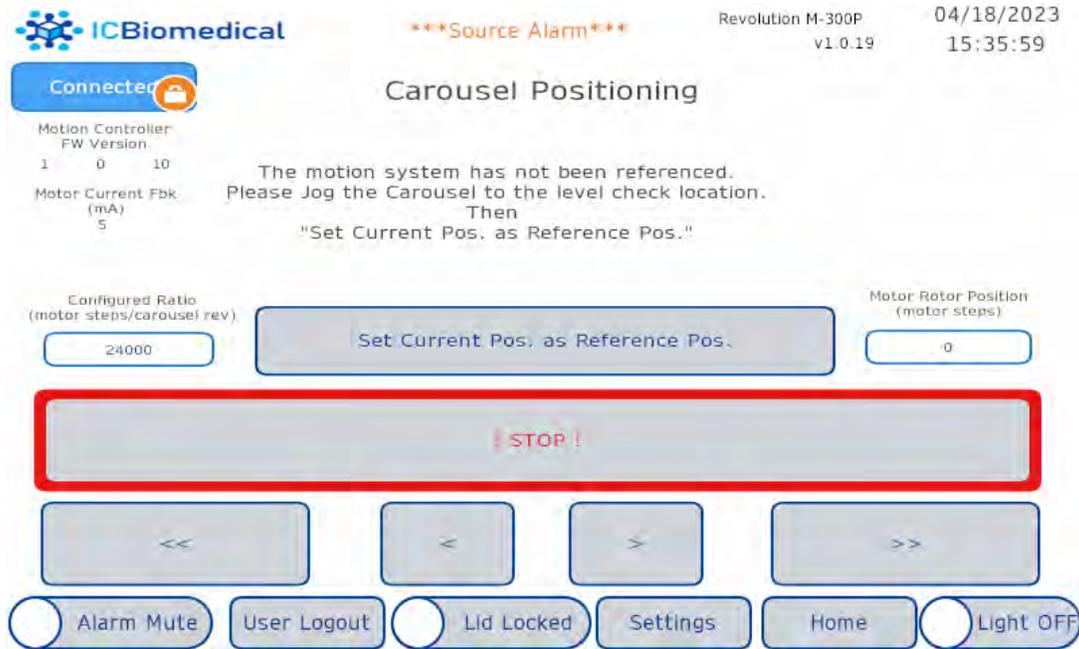
RFID UID:

Carousel Positioning

Following a loss of power, it is necessary to re-reference the motion system by jogging the carousel to the reference position and then pressing the reference button.

Pie Carousel

Pie shaped carousels use the level check position as the reference position.



ICBiomedical *****Source Alarm***** Revolution M-300P 04/18/2023
v1.0.19 15:35:59

Carousel Positioning

The motion system has not been referenced.
Please Jog the Carousel to the level check location.
Then
"Set Current Pos. as Reference Pos."

Configured Ratio (motor steps/carousel rev) 24000 Motor Rotor Position (motor steps) 0

Set Current Pos. as Reference Pos.

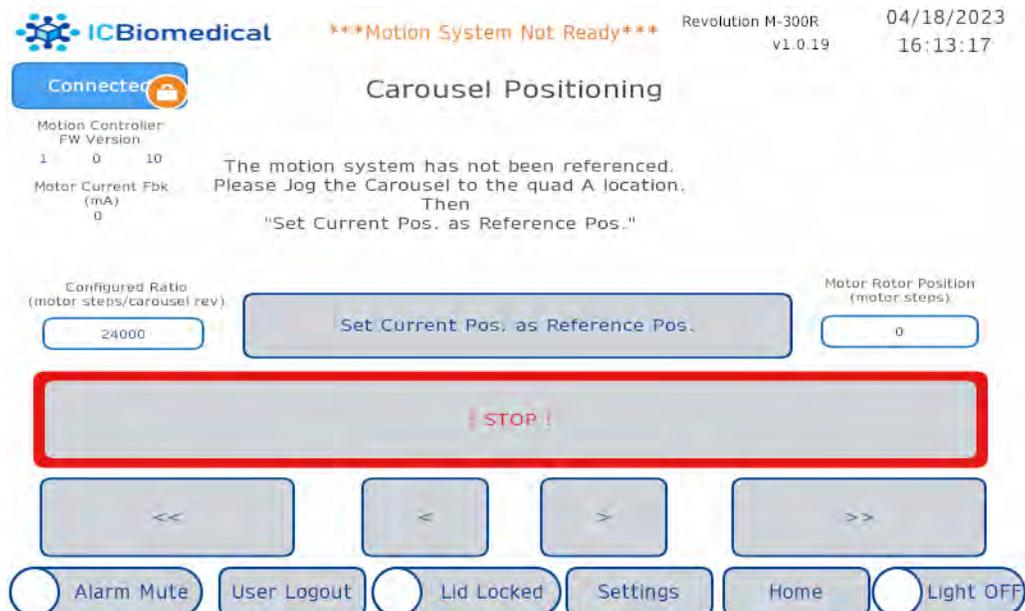
STOP !

<< < > >>

Alarm Mute User Logout Lid Locked Settings Home Light OFF

Rectangle Carousel

Rectangular carousels use the quadrant A position as the reference position.



ICBiomedical *****Motion System Not Ready***** Revolution M-300R 04/18/2023
v1.0.19 16:13:17

Carousel Positioning

The motion system has not been referenced.
Please Jog the Carousel to the quad A location.
Then
"Set Current Pos. as Reference Pos."

Configured Ratio (motor steps/carousel rev) 24000 Motor Rotor Position (motor steps) 0

Set Current Pos. as Reference Pos.

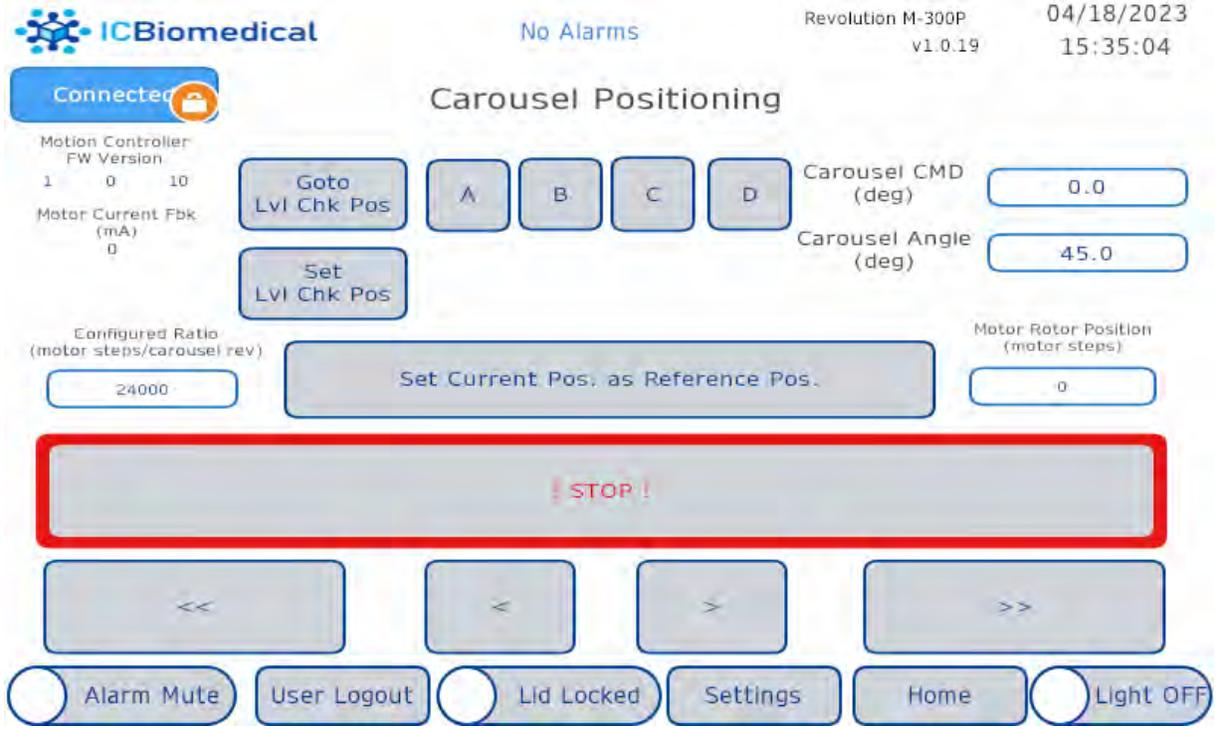
STOP !

<< < > >>

Alarm Mute User Logout Lid Locked Settings Home Light OFF

Quadrant Positioning

After referencing successfully, the motion system is ready for carousel quadrant positioning.



ICBiomedical

No Alarms

Revolution M-300P v1.0.19

04/18/2023 15:35:04

Carousel Positioning

Connecter

Motion Controller FW Version: 1 0 10

Motor Current Fbk (mA): 0

Carousel CMD (deg): 0.0

Carousel Angle (deg): 45.0

Configured Ratio (motor steps/carousel rev): 24000

Motor Rotor Position (motor steps): 0

Set Current Pos. as Reference Pos.

STOP !

<< < > >>

Alarm Mute User Logout Lid Locked Settings Home Light OFF

HMI HW Config

Allows for controller configuration including Date/Time, Touch buzzer Enable/Disable, Screen brightness adjustment etc.

Gateway Wifi

Wifi settings

Wifi Current Status

Wifi IP Address of
Connected Freezer Gateway

10.10.2.202/24

Wifi Desired Change

Un-Check to Use Static IP

OR Enter a Static Wifi IP Address
for the Freezer Gateway

0.0.0.0/0

Apply Desired Changes

Disable Wifi

Alarm Mute
 User Logout
 Lid Locked
 Settings
 Home
 Light OFF

Gateway Ethernet

Ethernet settings

Current Status

IP Address of
Connected Freezer Gateway

10.10.10.33/24

Desired Change

Un-Check to Use Static IP

OR Enter a Static IP Address
for the Freezer Gateway

0.0.0.0/0

Alarm Mute
 User Logout
 Lid Locked
 Settings
 Home
 Light OFF

OPERATION

User's can perform manual operations at their discretion but, the freezer will automatically control LN2 level if left in its default configuration. Important operations are logged with time stamp and active user during the occurrence.

Automatic

Liquid LN2 level is measured by redundant systems and control can be performed using either system's measurement or use both systems with redundant protection.

LN2 Level Control – DP

Differential pressure (DP) is measured with a sensing tube. The measurement is filtered for smoothness then used to calculate an LN2 level. LN2 Level Offset must be accurately configured. DP level control is active by default. It can be disabled with the setting, DP Level Control Disable. When enabled, DP level control will:

Start Fill – when LN2 Level is less than or equal to the Start Fill LN2 setting.

Stop Fill – when LN2 Level is greater than or equal to the Stop Fill LN2 setting.

Alarm High – if LN2 Level is greater than or equal to the High Alarm LN2 setting.

Alarm Low – if LN2 Level is less than or equal to the Low Alarm LN2 setting.

Alarms for High and Low levels indicate a problem in the system that is affecting DP level measurement accuracy. When in DP level control and the low-level temperature sensor is located physically below the “Stop Fill” setpoint, a dry reading on the low-level sensor would indicate both a DP concern and need for immediate “Start Fill”. During an active fill, the overfill temperature sensor (assumed to be located physically above the “Stop Fill” setpoint) reading wet indicates both a DP concern and the need for immediate “Stop Fill”.

Level protections are enabled by default to activate the DP System Fault, perform the needed Stop/Start fill operation, and switch to LN2 Level Control – Temp. Sensors. See also Liquid Full.

LN2 Level Control – Temp. Sensors

By default, this mode is used to back-up LN2 Level Control – DP. This mode can be made the primary mode of level control with DP Level Control Disable. When disabled, DP system alarms are not monitored but, DP system measurements are logged and displayed normally. Whether primary or back-up, this mode being active uses detection of a dry low-level sensor to start a fill and this mode uses detection of a wet high-level sensor to stop a fill. Overfill protection applies to level control by temp sensors but can be disabled. See also Level Protection Disable.

Manual

When in manual mode, all automatic level controls are disabled. Each valve can be controlled individually from the user interface. This mode being active will generate a warning condition. While not recommended for normal operation, manual mode is useful in maintenance and setup scenarios.

Liquid Full

Level Protection Disable is a setting to allow for operation with DP level control not protected by Overfill and Low-level temperature sensors. The mode relies entirely on the DP level measurement system for LN2 level control. When an application requires liquid levels that would otherwise trigger the DP System Fault, Level Protection Disable can be set to permit DP control between the limits of Start Fill LN2 and Stop Fill LN2 ignoring the low-level dry and overfill wet conditions. See also LN2 Level Control – DP.

Radiance Temperature Control

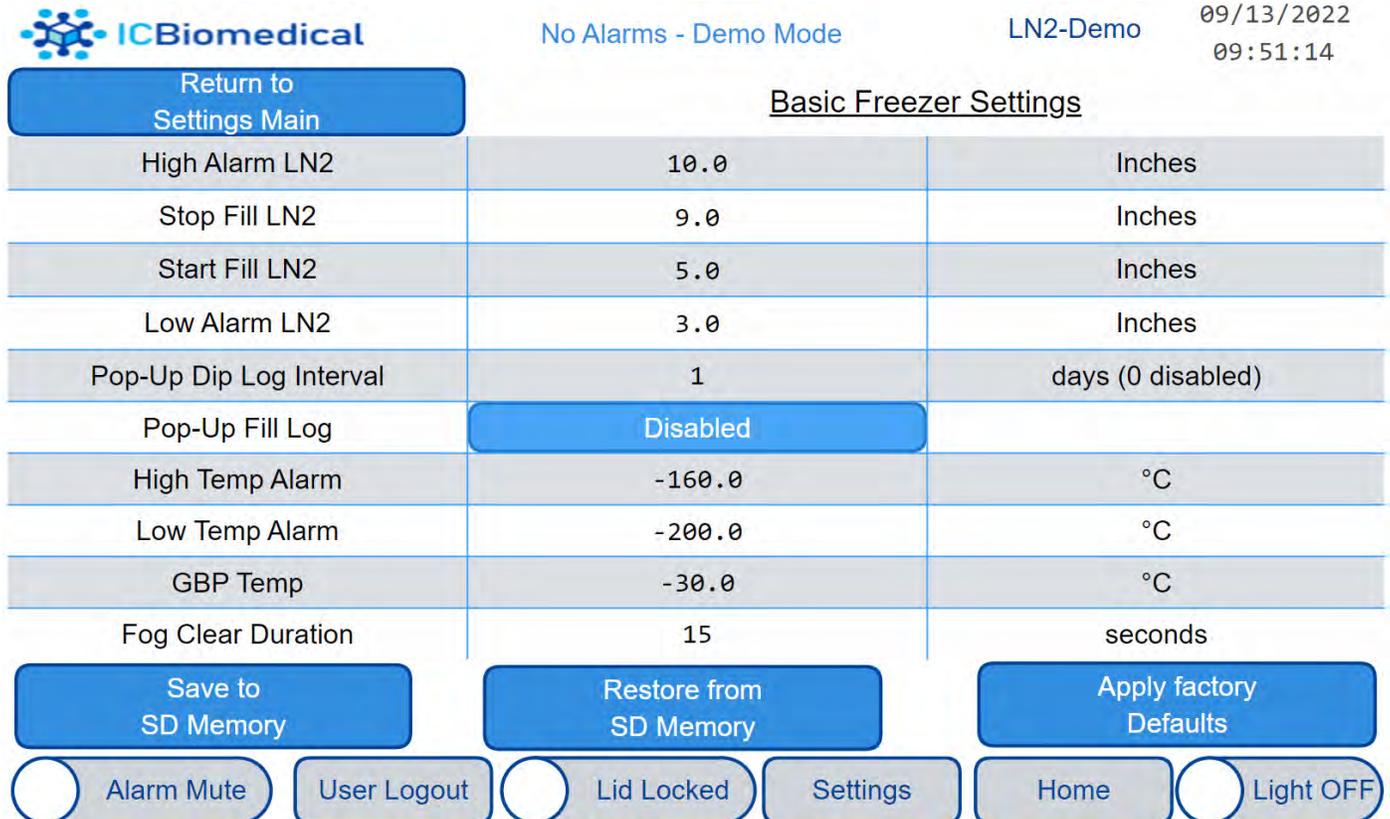
Radiance technology using LN2 vapor injection to maintain tank temperature between a maximum and minimum setpoint. When in radiance temperature control mode, LN2 level control is disabled.

FREEZER SETTINGS

Settings are saved on the controller. They can be adjusted from the user interface. Settings changed from the user interface, become active immediately and persist through a power outage. A portable copy of all settings is saved to SD memory of the freezer's controller. This copy is available for download from the PLC to a USB memory device. Active settings can also be restored from SD memory and be reset to factory defaults.

Basic Settings

Common settings related to temperature and levels.



Basic Freezer Settings		
High Alarm LN2	10.0	Inches
Stop Fill LN2	9.0	Inches
Start Fill LN2	5.0	Inches
Low Alarm LN2	3.0	Inches
Pop-Up Dip Log Interval	1	days (0 disabled)
Pop-Up Fill Log	Disabled	
High Temp Alarm	-160.0	°C
Low Temp Alarm	-200.0	°C
GBP Temp	-30.0	°C
Fog Clear Duration	15	seconds

High Alarm LN2

Liquid Nitrogen Level in inches at which to activate the Liquid Level too High alarm.

Stop Fill LN2

Liquid Nitrogen Level in inches at which to stop an active fill cycle.

Start Fill LN2

Liquid Nitrogen Level in inches at which to start a new fill cycle.

Low Alarm LN2

Liquid Nitrogen Level in inches at which to activate the Liquid Level too Low alarm.

Pop-Up Dip Log Interval

Liquid Nitrogen Level in inches at which to activate the Liquid Level too Low alarm.

Pop-Up Fill Log

Allows user to Enable/Disable the Pop-Up Fill Log

High Temp Alarm

Temperature in degrees Celsius at which the Top Temp - Over Temp alarm is triggered by the "Temp A" sensor.

Low Temp Alarm

Temperature in degrees Celsius at which the Top Temp – Under Temp alarm is triggered by the “Temp A” sensor.

GBP Temp

Temperature in degrees Celsius at which the gas bypass cycle will automatically complete and progress to the fill cycle. By default, a gas bypass cycle will precede each automatic fill cycle. Gas bypass can be disabled if desired by an Administrator with the Gas Bypass Disable setting.

Fog Clear Duration

Number of seconds before automatically ending the fog clear cycle.

Advanced Settings

No Alarms - Demo Mode

LN2-Demo

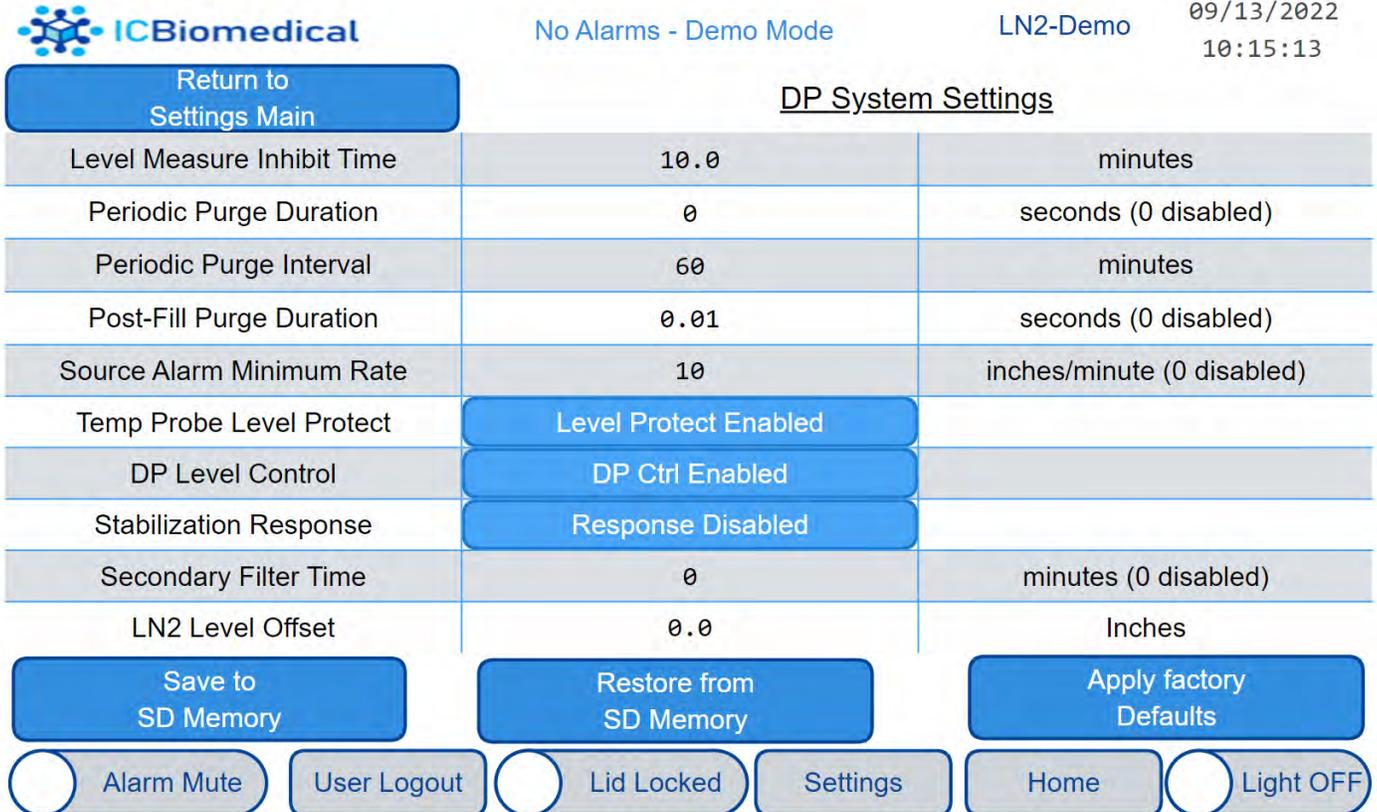
09/13/2022

10:02:40

[Return to
Settings Main](#)Settings Advanced[DP System
Settings](#)[Radiance
Settings](#)[Temperature & Sensor
Settings](#)[Motion
Settings](#)[Valve & Protection
Settings](#)[Redundant LN2
Measurements Calibration](#)[Save to
SD Memory](#)[Restore from
SD Memory](#)[Apply factory
Defaults](#) Alarm Mute[User Logout](#) Lid Locked[Settings](#)[Home](#) Light OFF

DP System Settings

Settings related to the DP level measuring system are found on this screen.



DP System Settings		
Level Measure Inhibit Time	10.0	minutes
Periodic Purge Duration	0	seconds (0 disabled)
Periodic Purge Interval	60	minutes
Post-Fill Purge Duration	0.01	seconds (0 disabled)
Source Alarm Minimum Rate	10	inches/minute (0 disabled)
Temp Probe Level Protect	Level Protect Enabled	
DP Level Control	DP Ctrl Enabled	
Stabilization Response	Response Disabled	
Secondary Filter Time	0	minutes (0 disabled)
LN2 Level Offset	0.0	Inches

Level Measure Inhibit Time

Time in minutes to hold LN2 level measurement at pre-purge value. DP system purge cycles occur periodically by default. This setting ignores new measurements during the period of transient pressure changes that follow a periodic purge.

Periodic Purge Duration

Time in seconds for purge valve to remain open during periodic maintenance purge cycle.

Periodic Purge Interval

Time in minutes between periodic maintenance purge cycles (purge cycle must not be disabled).

Post-Fill Purge Duration

Time in seconds for purge valve to remain open during “long” purge, only occurs immediately following a fill cycle.

Source Alarm Minimum Rate

Fill rate in inches/minute used to activate the Source Alarm. If sustained fill rates are held below this minimum rate for too long, the Source Alarm will activate.

Temp Probe Level Protect - Enable/Disable

Enable / Disable level protections. When disabled, the overfill sensor will not stop an active fill nor will the low-level sensor start a fill. When enabled, DP level control is protected by the overfill and low-level temp sensors. If the temp sensors indicated a DP level inaccuracy, the DP system alarms is activated.

DP Level Control - Enable/Disable

Enable / Disable DP based nitrogen level control. When disabled, the temperature sensors will be used for stop and start fill operations. When enabled, the DP level measurement and Start Fill Stop Fill setpoints are used. Also when enabled, the temperature sensors are used to protect the DP level control system.

Stabilization Response – Enable/Disable

Enable / Disable the advanced stabilization response for DP level measurement system. When enabled, an inhibit-purge-inhibit cycle is enforced at the end of fill cycles and the secondary filter time is temporarily set to 20 minutes following a fill cycle. This mode is only required when contamination of the DP system has occurred from ice or debris.

Secondary Filter Time

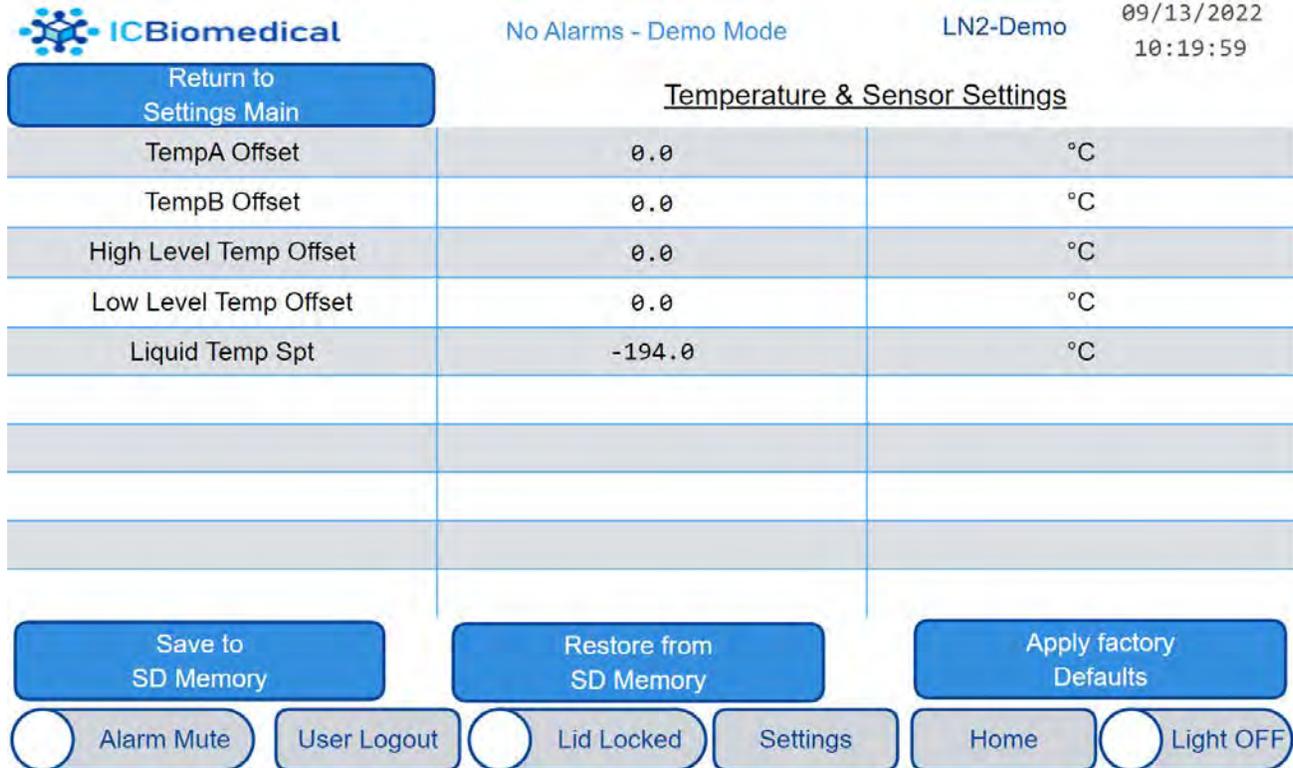
Time in minutes of the secondary filter. 0 will disable secondary filtering. 5 will cause the LN2 measurement to be smooth and roughly 5 minutes delayed compared actual level. 10 will cause the LN2 measurement to be smoother and roughly 10 minutes delayed.

LN2 Level Offset

Liquid Nitrogen offset in inches added to the measurement of LN2 level.

Temperature & Sensor Settings

Settings related to temperature sensors and alarms are found on this screen.



ICBiomedical No Alarms - Demo Mode LN2-Demo 09/13/2022 10:19:59

[Return to Settings Main](#)

Temperature & Sensor Settings

TempA Offset	0.0	°C
TempB Offset	0.0	°C
High Level Temp Offset	0.0	°C
Low Level Temp Offset	0.0	°C
Liquid Temp Spt	-194.0	°C

[Save to SD Memory](#)
[Restore from SD Memory](#)
[Apply factory Defaults](#)

Alarm Mute
 User Logout
 Lid Locked
 Settings
 Home
 Light OFF

TempA Offset

Offset in degrees Celsius added to the sensor measurement at location “Temp A/Sample”.

TempB Offset

Offset in degrees Celsius added to the sensor measurement at location “Temp B/Dome”.

High Level Temp Offset

Offset in degrees Celsius added to the sensor measurement at location “High-level”.

Low Level Temp Offset

Offset in degrees Celsius added to the sensor measurement at location “Low-level”.

Liquid Temp Setpoint

Temperature in degrees Celsius at which a temp sensor measurement is determined wet with LN2.

Valve & Protection Settings

Settings related to valves and protection are found on this screen.

Return to Settings Main		Valve & Protection Settings	
Fill Valves Safety Timeout	120		minutes
GBP Valve Safety Timeout	10		minutes
Lid Lock	Lid Lock Enabled		
Overfill Temp Offset	0.0		°C
Gas Bypass Temp Offset	0.0		°C
Gas Bypass	GasBypass Enabled		
Stop Fill Lockout	5		minutes

Save to SD Memory

Restore from SD Memory

Apply factory Defaults

Alarm Mute

User Logout

Lid Locked

Settings

Home

Light OFF

Fill Valves Safety Timeout

Number of minutes fill valves can remain open before safety timeout occurs. When a timeout occurs, the Valve Safety Timeout alarm will become active. Valves will be closed. Normal operation will not proceed without user interaction. Alarms must be reset, or Start Fill pressed, to return to normal operation.

GBP Valve Safety Timeout

Number of minutes gas bypass valve can remain open before safety timeout occurs. When a timeout occurs, the Valve Safety Timeout alarm will become active. The GBP will be closed. Normal operation will not proceed without Administrator interaction. Alarms must be reset to return to normal operation.

Lid Lock

Enable / Disable lid lock protection. When disabled, the lid lock is not used to control sample access. When enabled, lid locks automatically and requires authentication to unlock.

Overfill Temp Offset

Temperature offset in degrees Celsius added to the raw overfill sensor measurement.

Gas Bypass Temp Offset

Temperature offset in degrees Celsius added to the raw gas bypass sensor measurement.

Gas Bypass

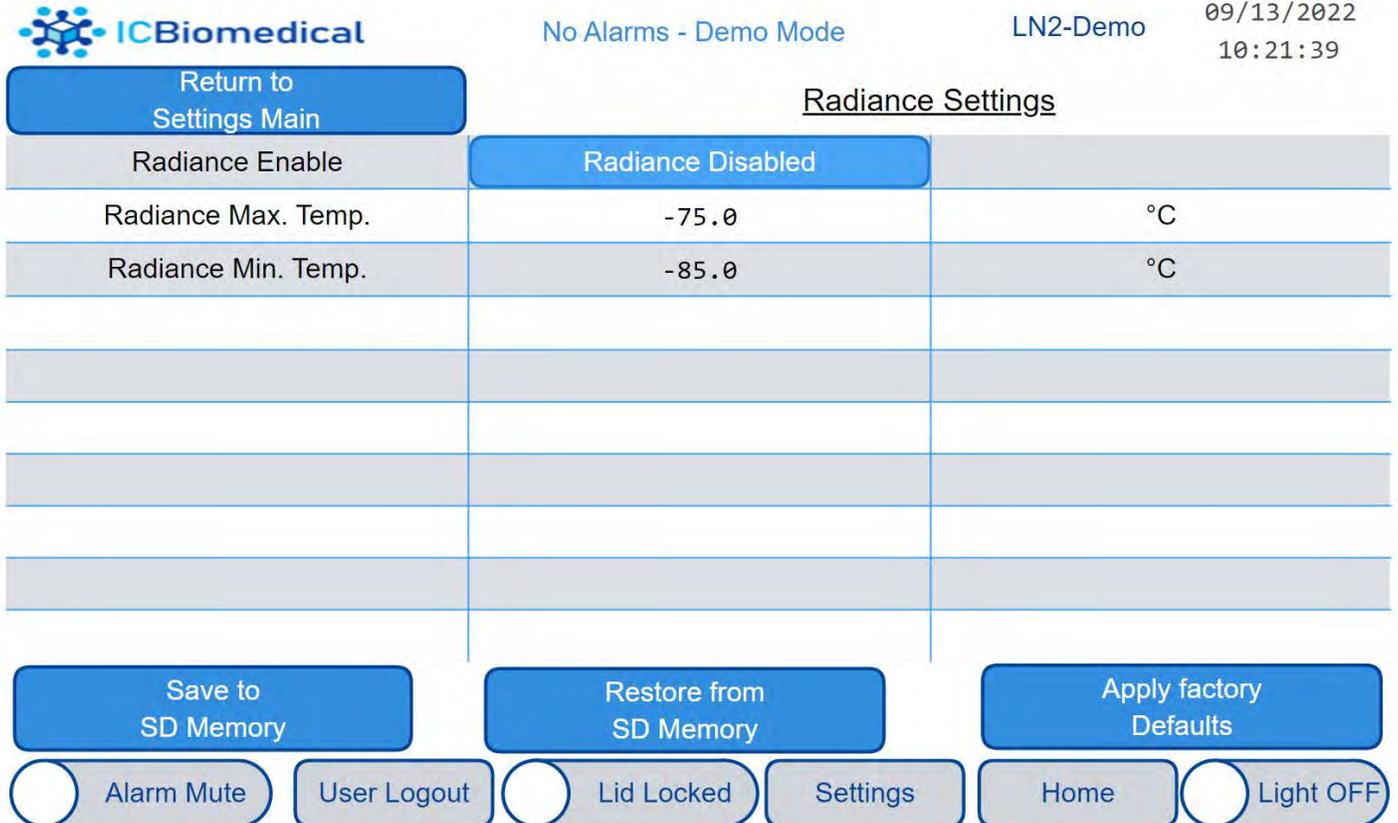
Enable / Disable gas bypass cycle preceding each fill cycle. When disabled, no gas bypass cycle will occur. When enabled, a gas-bypass cycle will precede each fill cycle.

Stop Fill Lockout

Time in minutes automatic fill cycles will be locked out, prevented from starting, after a Start Fill button press.

Radiance Settings

Settings related to the radiance temperature control feature are found on this screen.



ICBiomedical No Alarms - Demo Mode LN2-Demo 09/13/2022 10:21:39

Return to Settings Main Radiance Settings

Radiance Enable	Radiance Disabled	
Radiance Max. Temp.	-75.0	°C
Radiance Min. Temp.	-85.0	°C

Save to SD Memory Restore from SD Memory Apply factory Defaults

Alarm Mute User Logout Lid Locked Settings Home Light OFF

Radiance Enable

Enable / Disable of active temperature control using patented Radiance technology. Note: When in radiance temperature control mode, LN2 level control is disabled.

Radiance Max. Temp.

Set the maximum allowable temperature for the biological materials stored in the vessel.

Radiance Min. Temp.

Set the minimum allowable temperature for the biological materials stored in the vessel.

*Note: Max. and Min. temperature should be set no closer than 1°C

Motion Settings

Settings related to motorized carousel motion are located on this screen.


ICBiomedical
No Alarms - Demo Mode
LN2-Demo
09/13/2022
10:22:06

Return to
Settings Main

Motion Settings

Small Jog Size	5	carousel deg
Big Jog Size	90	carousel deg
Level Check Absolute Ref.	315.00	carousel deg @ Level Check
Quad. A Absolute Ref.	0.00	carousel deg @ Quadrant A

Save to
SD Memory

Restore from
SD Memory

Apply factory
Defaults

Alarm Mute

User Logout

Lid Locked

Settings

Home

Light OFF

Small Jog Size

Angle in degrees through which the carousel will rotate for “small jog”.

Big Jog Angle

Angle in degrees through which the carousel will rotate for “big jog”.

Level Check Absolute Ref.

Angle in carousel degrees, the location of the Level Check Position.

Quad A. Absolute Ref.

Angle in carousel degrees, the location of the Quadrant A Position.

ALARMS AND WARNINGS

Several conditions are monitored and when necessary, alarms and warnings are generated to alert users to conditions.

Alarms

An alarm buzzer will sound for all alarms. Any user can mute the alarm buzzer. After a timeout, the buzzer will sound once again unless alarms are reset. Administrators can reset alarms from the Alarms screen.

Invalid Settings

If a user configures a setting that conflicts with a related setting, the invalid settings alarms will become active. A “High Alarm LN2” setting that is below the “Stop Fill LN2” setting is one example of conflicting settings that will generate this alarm. “Purge interval” must also be greater than 2 times the “Level Measure Inhibit Time” to avoid this alarm.

Source Alarms

If a fill valve is open for 10 minutes without measuring an increase in LN2 level, this alarm will activate. Pressing Start Fill button or reset of alarms is required to return to normal operation.

Valve Safety Timeout

If a fill valve or the gas bypass valves is open longer than the Fill Valves Safety Timeout or the GBP Valve Safety Timeout, this alarm will activate. Details of Fill vs Gas bypass timeout can be obtained on the Alarms Screen.

Overfill Sensor Wet

When the temperature sensor at the overfill location is determined to be wet with liquid nitrogen, this alarm will activate. See also Overfill Temp Offset and Liquid Temp Setpoint.

DP System Fault

When an error in the DP system has been detected, this alarm will sound. When in DP level control mode, a wet overfill sensor or a dry low-level sensor will trigger this alarm (only if not Level Protection Disable)

Low-Level Sensor Dry

When the temperature sensor at the low-level location is determined to be dry, this alarm will activate. See also Low Level Temp Offset and Liquid Temp Setpoint.

Liquid Level too High

When in DP level control mode and the measured level is above the High Alarm LN2 setpoint, this alarm will sound. See also LN2 Level Offset and DP Level Control Disable.

Liquid Level too Low

When in DP level control mode and the measured level is above the Low Alarm LN2 setpoint, this alarm will sound. See also LN2 Level Offset and DP Level Control Disable.

Top Temp - Over Temp

If the temperature measurement at the “TempA” location is above the High Temp Alarm setpoint, this alarm will sound. See also TempA Offset and TempA Label.

Top Temp – Under Temp

If the temperature measurement at the “TempA” location is below the Low Temp Alarm setpoint, this alarm will sound. *Low Temp Alarm setpoint is constant -200 degrees Celsius. See also TempA Offset and TempA Label.

Sensor Fault – Overfill

If the raw reading of the overfill temperature sensor is determined to be invalid, this alarm will activate. Short-circuit or open-circuit conditions will cause this error. When this error is active, overfill sensor readings will not be visible on any screen.

Sensor Fault – Low-Level

If the raw reading of the low-level temperature sensor is determined to be invalid, this alarm will activate. Short-circuit or open-circuit conditions will cause this error. When this error is active, low-level sensor readings will not be visible on any screen.

Sensor Fault – Liquid Level

If the raw reading of the DP sensor is determined to be invalid, this alarm will activate. Short-circuit or open-circuit conditions will cause this error. When this error is active, DP level measurements will not be visible on any screen.

Sensor Fault – Top Temp

If the raw reading of the “TempA” temperature sensor is determined to be invalid, this alarm will activate. Short-circuit or open-circuit conditions will cause this error. When this error is active, “TempA” sensor readings will not be visible on any screen.

Sensor Fault – Gas Bypass

If the raw reading of the gas bypass temperature sensor is determined to be invalid, this alarm will activate. Short-circuit or open-circuit conditions will cause this error. When this error is active, gas bypass sensor readings will not be visible on any screen.

Sensor Fault – High-Level

If the raw reading of the high-level temperature sensor is determined to be invalid, this alarm will activate. Short-circuit or open-circuit conditions will cause this error. When this error is active, high-level sensor readings will not be visible on any screen.

Sensor Fault – Bottom Temp

If the raw reading of the “TempB” temperature sensor is determined to be invalid, this alarm will activate. Short-circuit or open-circuit conditions will cause this error. When this error is active, “TempB” sensor readings will not be visible on any screen.

Lid and Lock

If the lid is locked open, this alarm will activate. If the lid is left open for too long, the alarm will activate. See also Lid Lock Disable.

Motion System Not Ready

If the motor controller is not communicating, fully operational at the correct version, and referenced for absolute position, this alarm will activate.

Motor Stalled

If the motor current during acceleration or during constant speed motion exceeds a statistical threshold overtime, this alarm will sound.

Warnings

Users are alerted to the presence of warning using the Alarms Text, just like alarms but, the buzzer will not sound. Normal operation of the freezer is permitted. When the condition causing the warning clears, the warning text will clear automatically. No reset is required for warnings.

Logging Error

If an error has occurred preventing successful data logging, this warning will be visible. The most likely cause would be a missing SD card in the freezer controller.

Logging Disabled

If logging is not enabled, this warning will be visible. Logging can be temporarily disabled. Every ten minutes, if the SD card is present, logging will be re-enabled.

Manual Mode

If in manual mode, see Valves and Modes, this warning will be visible.

DATA

Sensor data measuring temperatures, levels, and other states of the freezer system is analyzed and logged by the freezer's control system. A UPS protected PLC is the primary logging device. A uSD memory on the PLC is written with log data. The uSD also contains a portable settings back-up along with an operations log. As a back-up and not UPS protected, the HMI logs summary data to its local memory. DP Level measurements are filtered before use and reporting. All data can be exported to USB memory.

Filtering

Differential pressure is measured to calculate LN2 level. The raw pressure measurement is captured 10 times per second and can be noisy under certain conditions. Two stages of filtering are used to ensure level measurement accuracy and smoothness.

Primary

Six hundred level measurements are taken each minute. A primary filter always averages the previous minute of measurements to produce the measured LN2 level.

Secondary

Secondary filtering can be enabled using the Secondary Filter Time setting. When enabled, a 2nd order low-pass filter is applied to the LN2 further smoothing the measurement. Tip: if the Secondary Filter Time is set to 5 minutes, it will take roughly 5 minutes for the measured LN2 level to report the actual LN2 level.

Logging

Robust logging is handled by the PLC with data stored on the uSD card. Data can be exported to USB memory using the UI.

uSD Memory

Settings, Operations, and Full Cyclic data are logged to the uSD card of the PLC. Cyclic data is logged at 1-minute intervals and on change of alarms state. Operations are logged at occurrence with timestamp and active username. Settings are backed-up to uSD memory using Save to SD Memory.

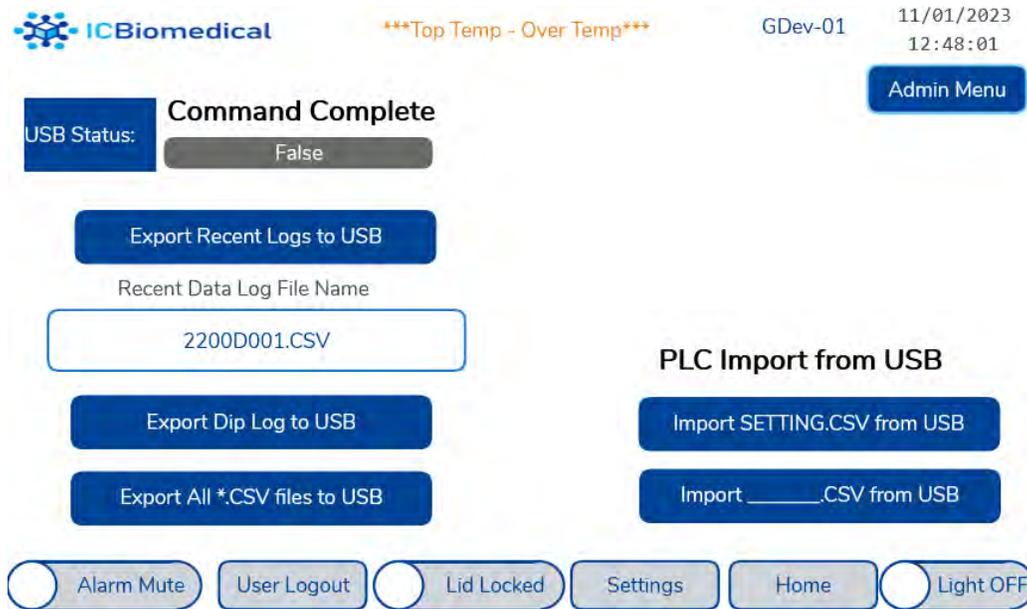
Access

Data files at the PLC and HMI can be copied to USB memory. uSD of the PLC is accessed via PLC USB port. Panel memory is accessed via HMI USB port. Administrator menus are accessed with a Double-Tap of the Historical Trend on the Home Screen.

uSD Memory

PLC USB

Export/Import of files on the uSD of the Freezer's PLC is possible from the PLC USB screen.



The screenshot shows the PLC USB interface. At the top left is the ICBiomedical logo. In the center, there is a status indicator: *****Top Temp - Over Temp*****. On the top right, the device ID is **GDev-01** and the date/time is **11/01/2023 12:48:01**. Below this is an **Admin Menu** button. The main section is titled **Command Complete**. Underneath, it shows **USB Status: False**. There are three export buttons: **Export Recent Logs to USB**, **Export Dip Log to USB**, and **Export All *.CSV files to USB**. A text input field for **Recent Data Log File Name** contains **2200D001.CSV**. To the right, under **PLC Import from USB**, there are two buttons: **Import SETTING.CSV from USB** and **Import _____.CSV from USB**. At the bottom, there is a row of navigation buttons: **Alarm Mute**, **User Logout**, **Lid Locked**, **Settings**, **Home**, and **Light OFF**.

PLC FTP

FTP download/upload of files on the uSD of the Freezer's PLC is possible when enable from the PLC FTP screen.



The screenshot shows the PLC FTP Server interface. At the top left is the ICBiomedical logo. In the center, there is a status indicator: *****Top Temp - Over Temp*****. On the top right, the device ID is **GDev-01** and the date/time is **11/01/2023 12:58:37**. Below this is an **Admin Menu** button. The main section is titled **PLC FTP Server**. Underneath, there are three buttons: **Start FTP**, **Running**, and **Stop FTP**. At the bottom, there is a row of navigation buttons: **Alarm Mute**, **User Logout**, **Lid Locked**, **Settings**, **Home**, and **Light OFF**.



Manufacturer
IC Biomedical, LLC



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