

CA5000-N

Liquid Nitrogen Backup System



OPERATING INSTRUCTIONS MANUAL



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SAFETY WARNINGS

Please read this manual in its entirety before beginning installation.



Injected liquid nitrogen is under high pressure, so proper system venting is required.



Liquid nitrogen exhaust from an operating CA5000-N Liquid Nitrogen Freezer Backup System suppresses oxygen levels in enclosed spaces. To avoid asphyxiation, the facility must have appropriate ventilation, and N₂ and/or oxygen monitoring equipment should be installed in compliance with local, national, or regional regulations.



The CA5000-N Liquid Nitrogen Freezer Backup System must be installed, and periodically tested, according to Hampshire Controls' instructions, by a qualified refrigeration technician, or other qualified personnel, in compliance with local, national, or regional regulations. The CA5000-N Liquid Nitrogen Freezer Backup System will not operate during a power failure if it is not properly installed.



This product contains a sealed lead-acid rechargeable battery. Do not use if battery is damaged or leaking. Replace the battery with a Hampshire Controls' recommended battery only. Always recycle used batteries.



Do not modify or change system components. Using this equipment in a manner other than expressly intended may cause serious injury or death. Hampshire Controls shall not be liable for any incidental or consequential damages. The user assumes all risk and liability associated with the end use of this product.



Cylinders that supply liquid nitrogen must be used to provide proper CA5000-N Liquid Nitrogen Freezer Backup System operation. Do not use high pressure nitrogen gas cylinders. All connections from the liquid nitrogen supply cylinder to the freezer require a minimum working pressure rating of 150 psi.



Liquid nitrogen is extremely cold and will cause frostbite on unprotected skin. Always wear protective clothing and eyewear when working with liquid refrigerants. Liquid nitrogen must be handled safely by qualified personnel in compliance with local, national, or regional regulations.

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 O.S.H.A. regulations have been established for the safe handling, use, and storage of liquid nitrogen supply cylinders. Please consult a current edition of the O.S.H.A. regulations to ensure compliance with applicable safety requirements and lockout/tagout requirements. Liquid nitrogen supply cylinders must be handled safely by qualified personnel in compliance with local, national, or regional regulations.

 Empty the contents of the freezer and allow it to warm to ambient temperature prior to performing any work inside the enclosed space. Working in the chamber at its operating temperature may result in frostbite, or other physical harm.

 Place the CA5000-N Liquid Nitrogen Freezer Backup System Battery-Valve Module (BVM) in a secure, stable location 1) as close as possible to the ultra-low temperature (ULT) freezer inlet port to allow for maximum length of the CA5000 output tube within the freezer, and 2) where there is easy access to the POWER cord and CONTROL CABLE. Do not place the BVM in a location where there would be risk of the BVM falling or in a location where it would represent a tripping hazard.

 The CA5000-N Liquid Nitrogen Freezer Backup System has battery backup. Therefore, in the event of an emergency requiring the complete shutdown of the CA5000 system, both the POWER cord and the CONTROL CABLE must be disconnected, either on one end or the other. Place the CA5000-N Liquid Nitrogen Freezer Backup System BVM in a secure, stable location with easy access to the POWER cord and CONTROL CABLE connections.

 There are numerous interconnections between the CA5000-N Liquid Nitrogen Freezer Backup System Controller and BVM, the liquid nitrogen supply, the ULT freezer, and line power, including: the tubing from the liquid nitrogen supply to the BVM, the liquid nitrogen output tubing from the BVM to the ULT freezer, the CONTROL CABLE from the CA5000 Controller to the BVM, the DOOR SWITCH cable from the BVM to the ULT freezer door, the POWER cord from line power to the BVM, and the type T THERMOCOUPLE PROBE from the CA5000 Controller to the ULT freezer. Place the CA5000-N Liquid Nitrogen Freezer Backup System BVM in a secure, stable location as close as possible to the ULT freezer inlet port to minimize the distances of the interconnections. Organize and secure the interconnections in the safest possible configuration to minimize the risk of misidentifying the interconnections and to avoid tripping and/or equipment falling hazards.

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Unpacking Information

The CA5000-N Liquid Nitrogen (LN2) Backup System is shipped in a single custom box. Please check the carton for the following:

- ❑ **CA5000 Controller:** alarm display module
- ❑ **CA5000 Battery-Valve Module (BVM)**
- ❑ **Control Cable:** CA5000 Controller to CA5000 BVM
- ❑ **Door Switch:** magnetic door interlock switch
- ❑ **Door Switch Cable**
- ❑ **Type T Thermocouple Probe**
- ❑ **Power Adapter:** input: 100-240 VAC, 50-60 Hz, 1 A maximum; output: 15 VDC, 2.4 A, 36 W
- ❑ **LN2 Input Fitting:** 1/2" 45° flare nut LN2 input fitting on CA5000 BVM (**IN FROM TANK**)
- ❑ **LN2 Output Tubing:** 1/4" OD x 3/16" ID by 8' copper output tube with 1/4" 45° flare adapter for the CA5000 BVM (**OUTPUT TO FREEZER**).
- ❑ **Foam Insulation** for LN2 Output Tubing

Tools & Materials Required for Installation

- ❑ Liquid nitrogen supply, typically with a 1/2" 45° flare fitting
- ❑ Cryogenic-liquid rated tubing with 3/8" ID minimum, $\geq 6'$ length
- ❑ Tubing tools for bending the **LN2 Output Tubing** (1/4" OD x 3/16" ID by 8' copper)
- ❑ Crescent wrenches: 9/16" through 7/8"
- ❑ Drill with 3/32" bit, or double-sided tape, for door switch installation
- ❑ Foam, putty, or other insulating sealant to reseal **LN2 Output Tubing** and **Type T Thermocouple Probe** access ports on ULT freezer.
- ❑ ULT freezer vent to release excess pressure, preferable from the top of the cabinet.

Introduction

The Hampshire Controls Corporation CA5000-N system is a unique combination of field proven, highly reliable Hampshire Controls alarm systems and a liquid nitrogen (LN2) injection system, providing security for your products to ultra-low temperatures. It offers user-programmable control set points, alarm set points and alarm delay timers. Parameters are stored in non-volatile memory and are maintained even when power is lost.

The customer-supplied liquid nitrogen is maintained at ~22 psi pressure, ready to be injected into an ultra-low temperature (ULT) freezer cabinet or other ULT storage system. When a malfunction occurs and the freezer warms above the user-defined setpoint, an alarm will sound, and if the temperature continues to rise, a controlled amount of liquid nitrogen is injected into the freezer. Since the boiling point of nitrogen is -196 °C, the injected nitrogen boils and absorbs heat, protecting your product by maintaining the cabinet at temperatures as low as -175 °C.

The CA5000-N is simple to operate. Plug in the CA5000-N, place the temperature probe in the freezer chamber to be monitored, and the CA5000 will display the temperature at that location. Selecting combinations of the three CA5000 pushbuttons allows the user to program the alarm setpoints, LN2 injection setpoint, and other controls.

FEATURES

- ❑ Freezer cabinet temperature can be maintained as low as -175 °C. (Hampshire Controls recommends a -60 °C setpoint.)
- ❑ Backup times of 48 hours or more on one standard 180-L LN2 cylinder with a -60 °C setpoint.
- ❑ Typical backup LN2 consumption of < 4L LN2 per hour (25 cubic ft freezer, -60°C setpoint).
- ❑ Independent user-programmable controls for system alarms and liquid nitrogen injection.
- ❑ Visible and audible indicators for system status.
- ❑ Multiple programmable delays available to minimize nuisance or false alarms.
- ❑ Relay outputs included for central alarm systems or automatic dialers.
- ❑ A door interlock switch prevents LN2 injection while freezer door is open.
- ❑ An internal backup battery with integrated charger keeps the system running for at least 24 hours after a power outage.
- ❑ BAT indicator warns of a disconnected or low voltage backup battery condition.

SPECIFICATIONS

Table 1: CA5000-N LN2 Freezer Backup System Specifications

<i>CA5000-N Liquid LN2 Freezer Backup System</i>	
Backup Time (180-L LN2 cylinder)	>48 hours at -60 °C setpoint
Liquid Nitrogen (LN2) Supply Pressure	18 - 24 psi (20 °C)
Backup Temperature Setpoint Range	-150 °C to -40 °C
Type T Thermocouple Probe Range	-200 °C to +50 °C (factory calibration guaranteed for 1 year)
Accuracy	±2 °C
Resolution	1 °C
Freezer Door Switch Input (Interlock)	Door must be closed for LN2 injection
Output Relay (SPDT Contact)	Normally open (NO) or normally closed (NC), 30 VDC/1 A max (non-inductive)
Power Adapter	
Input (Fluctuation)	100-240 VAC (fluctuation not to exceed ±10% of nominal), 50-60 Hz, 1A max
Output	15 VDC, 2.4A, 36 W
Battery Backup	12 VDC, 12 Ah sealed, lead-acid rechargeable. Typically, >48 hours backup. Replace the battery with a Hampshire Controls' recommended battery only.
CA5000 Controller	5.0" (w) by 4.25" (h) by 1.75" (d), black Bakelite case, 1 lb.
CA5000 BVM	6.25" (w) by 5.0" (h) by 15.6" (d), painted steel case, 18 lbs.
Environmental Conditions	
Facilities	Intended for indoor (laboratory) use
Altitude	Up to 2,000 meters (6,600')
Temperature Range	0 °C to +40 °C
Maximum Relative Humidity	60% (0 °C to +40 °C)
Ventilation	Compliance with ANSI/ASSP Z9.5-2022 recommended.
Pollution Degree	POLLUTION DEGREE 2: only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected.

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Installation

NOTE: The CA5000-N LN2 Freezer Backup System must be installed according to Hampshire Controls' instructions, by a qualified refrigeration technician, or other qualified personnel, in compliance with local, national, or regional regulations. Maintaining the safety of ULT freezer while installing the CA5000-N LN2 Freezer Backup System, and when the installation is complete, is the responsibility of the installer.

NOTE: DO NOT USE AN IMPROPERLY RATED POWER ADAPTER. The CA5000-N LN2 Freezer Backup System POWER adapter is compatible with 100-240 VAC, 50-60 Hz, 1 A max input and outputs 15.0 VDC, 2.4 A, 36 W.

INTERCONNECTIONS

Table 2: CA5000-N LN2 Freezer Backup System Interconnections

CA5000 LABEL	FROM:	TO:	DESCRIPTION
THERMOCOUPLE	CA5000 Controller , 2-pin rectangular connector	ULT freezer	Type T thermocouple temperature probe, 10' lead, (p/n 48264)
OUT TO FREEZER	CA5000 BVM , 1/4" 45° flare fitting	ULT freezer	LN2 delivery tube, 1/4" OD copper tubing, 8' length, (p/n A84010-14)
IN FROM TANK	LN2 cylinder, typically 1/2" 45° flare fitting	CA5000 BVM , 1/2" 45° flare fitting	LN2 supply tube, cryogenic- liquid rated tube
DOOR SWITCH	ULT freezer door	CA5000 BVM , 3-pin circular connector	Door status monitor, 2-conductor cable, 10' lead, (p/n A84000-22)
CONTROL CABLE	CA5000 Controller , 6-pin circular connector	CA5000 BVM , 6-pin circular connector	Power from BVM to Controller , LN2 valve control from Controller to BVM , 6- conductor cable, 10' lead, (p/n A84000-06)
RELAY: SPDT CONTACT	CA5000 Controller	Facility alarm, auto dialer, <i>etc.</i>	Rating 30 VDC, 1 A (non-inductive)
POWER	Line power, 100-240 VAC, 50-60 Hz, 1 A max	CA5000 BVM , power jack, 15.0 VDC, 2.4 A, 36 W	Power adapter, international blades included, 5' cord, (p/n 29032)

SENSOR PROBE

The probe supplied with the CA5000-N is a highly accurate Type T thermocouple. It has excellent long-term stability and should not need recalibration in normal usage. However, if the probe is subjected to temperature extremes outside of the normal operating range for the unit, or if the probe is damaged it should be replaced.

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NOTE: If the CA5000 Freezer Backup display shows a continuous reading of an unreasonable value (for example, “1999”), then the probe has either failed or is disconnected. Verify proper connection, and replace the type T thermocouple probe, as required (see **Table 4. Replacement Parts**, p/n **48264, Type T Thermocouple Temperature Probe**).

Due to differences in probe locations within the ULT freezer and in probe calibrations, the temperature on the CA5000 Controller temperature display might not directly agree with the interior temperature display for the ULT freezer. If the two temperatures are within 5 °C of each other, then the CA5000-N LN2 Freezer Backup System will perform as expected. However, if the separation between the two temperatures is greater than 5 °C, then the CA5000-N LN2 Freezer Backup System Controller and the Type T Thermocouple Temperature Probe should be returned to Hampshire Controls for temperature recalibration.

Probe Installation

NOTE: The probe **MUST** be installed in freezer cabinet air and cannot be used in simulated product bottles. Insertion of the probe in simulated product bottles will delay the response time of the CA5000 Backup System and place freezer contents at risk.

When installing the sensor in a cabinet or enclosure (particularly freezers), use proper techniques to prevent room moisture from getting into the cabinet. Whenever possible, install the probe through an existing access or pass-thru port provided by the freezer manufacturer and reseal the port. The 1/4" OD copper tubing (OUT TO FREEZER) should normally go through this same port. If no port is available, consult the manufacturer of the freezer **BEFORE** drilling any holes into the freezer cabinet.

Inside the cabinet, route the probe wire so that it will not become snagged during loading, unloading, maintenance, or cleaning procedures.

Probe Location

Install the sensor probe in a location where it will respond to the average temperature of the space being monitored, and not to local conditions caused by routine door openings. The probe location should be optimized to provide an accurate temperature reading for the freezer cabinet without generating false or nuisance alarms. For example, locating the sensor probe on the bottom of a chest freezer will result in delayed alarms relative to locating the sensor probe near the top of the freezer. However, locating the sensor too close to the top of the chest freezer could result in frequent nuisance alarms caused by lid openings. Choose a probe location that offers the desired storage temperature safety for the freezer contents while keeping nuisance alarms at a tolerable level. Do not install the probe in a location where the sensor will be subject to frost buildup. Routinely inspect the probe tip to ensure that it is not embedded in frost buildup.

NITROGEN SUPPLY AND DELIVERY TUBE

NOTE: USE TWO CRESCENT WRENCHES TO MAKE THE “IN FROM TANK” AND “OUT TO FREEZER” LN2 CONNECTIONS. When making the OUT TO FREEZER connection, use a 9/16" crescent wrench to fix the position of the 1/4" 45° flare nut on the CA5000 BVM and another 9/16" crescent wrench to tighten the 1/4" 45° flare connector on the LN2 Output Tubing (1/4" OD x 3/16" ID by 8' copper). When making the IN FROM TANK connection, use a 3/4" crescent wrench to fix the position of the 1/2" 45° flare nut on the CA5000 BVM and a 15/16" crescent wrench to tighten the 1/2" 45° flare connector on the cryogenic-liquid rated tube from LN2 supply. **The IN FROM TANK and OUT TO FREEZER tubing positions internal to the CA5000 BVM must remain fixed. Do not allow the torque on the mating connections external to the CA5000 BVM to rotate the tubing positions internal to the CA5000 BVM.**

Install the LN2 Output Tubing (1/4" OD x 3/16" ID by 8' copper) onto the CA5000 BVM connector labelled “OUT TO FREEZER” using the 1/4" 45° flare connector and route the tubing into

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the ULT freezer. The output from the LN2 delivery tube within the ULT freezer should be located near the CA5000 temperature probe, but the LN2 flow should be directed away from the temperature probe and away from the freezer door. **For clarity, the LN2 output flow must not directly impact the CA5000 type T thermocouple temperature probe.** The LN2 delivery tube output and CA5000 temperature probe should be at approximately the same height within the freezer cabinet and near the center point of the back of the cabinet (opposite of the freezer door). Use care to install the LN2 delivery tube where it will not be blocked by freezer contents. The cold LN2 is heavier than air, so it will fill the freezer from the bottom up. Insert the portion of the LN2 Output Tubing outside of the ULT freezer into the Foam Insulation and trim any excess Foam Insulation.

Connect an insulated, flexible cryogenic-liquid rated tube of at least 3/8" internal diameter (ID) to the LN2 cylinder or house LN2 supply, then purge the supply tubing of any contaminants by rapidly cracking open, and then closing, the LN2 supply valve. Finally, connect the LN2 tubing using the 1/2" 45° flare adapter on the CA5000 BVM.

NOTE: THE LN2 SUPPLY MUST NOT EMPLOY A FLOW-CHECK VALVE.

NOTE: CONFIRM THAT THE SUPPLY PRESSURE ON THE LN2 CYLINDER TANK GAUGE OR ON THE HOUSE LN2 SUPPLY GAUGE IS BETWEEN 18 AND 24 PSI.

NOTE: DO NOT REPLACE THE 1/2" 45° FLARE FITTING "IN FROM TANK" WITH ANOTHER TYPE OF FITTING. The 1/2" 45° flare fitting requires no Teflon tape or other thread sealant, which if applied improperly can result in the contamination, and probable partial or complete failure, of the CA5000 BVM LN2 injection valve.

During an LN2 cylinder change, be certain to purge the cryogenic-liquid rated delivery tubing of any contaminants after closing the empty LN2 cylinder valve. When installing the new LN2 cylinder, also be certain to purge the system of any air in the delivery tubing after opening the LN2 supply cylinder valve. Purging is accomplished via manual valve control **Pur (Purge)** as described in this manual (p. 19).

DOOR SAFETY SWITCH

Install the supplied CA5000 Door Switch so that it will activate upon the opening the freezer or cabinet door. When installed and properly wired, the CA5000 Door Switch will interrupt the injection of LN2 into the freezer. The CA5000 Door Switch interlock circuit is factory shipped to accept a closed contact (NC) for normal operation. Verify this functionality by observing the visual "OPEN DOOR" LED indicator on the CA5000 BVM as described below. Confirm that the LN2 injection halts when the red door-open LED indicator is illuminated.

BATTERY-VALVE MODULE (BVM)

The CA5000 BVM contains the backup battery, the backup battery charging and logic circuits, and the LN2 injection valve. On the front face of the CA5000 BVM, there is a 6-pin CONTROL CABLE connector for the CA5000 Controller, a 3-pin connector for the DOOR SWITCH interlock cable, and a POWER jack for the supplied power adapter. The rear panel of the CA5000 BVM has an IN FROM TANK connector for the LN2 cylinder or house supply and an OUT TO FREEZER connection for the LN2 Output Tubing.

BVM FRONT VIEW



BVM LEFT SIDE VIEW



Visual LED indicators display system status:

- ❑ **BATTERY VOLTAGE:** is a 2-color LED.
 - ❑ **Green** indicates that the battery and charger are operating normally.
 - ❑ **Flashing Red** indicates a low or discharged battery.
- ❑ **DOOR OPEN:** Red indicates that the door is open.
- ❑ **VALVE ON:** Yellow indicates that power is applied to the solenoid valve, and if an LN2 supply is connected, open, and not empty, then LN2 should be flowing into the ULT freezer.

DOOR SWITCH, RELAY CONTROL CABLE, POWER

Connect the DOOR SWITCH wiring to the CA5000 BVM and the CA5000 Controller output alarm RELAY to your facilities' systems as required. Connect the CONTROL CABLE to the CA5000 Controller and CA5000 BVM. Plug the CA5000 system AC adapter into a 100-240 VAC, 50-60 Hz

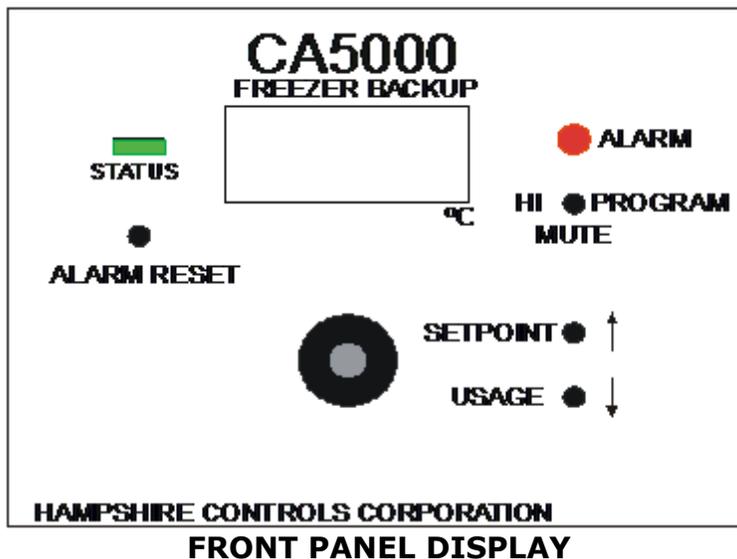
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outlet (international blades supplied) and into the POWER jack on the CA5000 BVM. If the temperature where the probe is located is within the CA5000 Controller's operating range (-200 to +50°C), then the CA5000 Controller display will show the current probe temperature.

OPERATIONAL CHECK

If the display is blank, verify power is supplied to the CA5000 BVM. If the CA5000 Controller STATUS LED is lit, then the CA5000 Controller has power. If not, then verify that the power adapter is plugged into the CA5000 BVM and into line power, and that the CONTROL CABLE between the CA5000 Controller and the CA5000 BVM is connected on both ends.

The STATUS LED indicator flashes every second. This indicates that the CA5000 is operating normally.



CA5000-N Operating Mode Instructions

The CA5000-N Liquid Nitrogen Backup System can be set in one of two functional modes: **Operating Mode and Programming Mode**. In Operating Mode, the CA5000 Controller displays the Type T Thermocouple Probe temperature and provides alarms and outputs based upon user-specified settings. The pushbuttons serve the following functions in Operating Mode:

- ❑ The **ALARM RESET** clears the alarm and sets the current LN2 coolant usage (**CCO (Current LN2 Usage)**) and start time (**CSt (LN2 Started 'CSt' Minutes Ago)**) to 0 minutes.
- ❑ The **PROGRAM** button displays the **Hi (High Alarm Setting)** temperature at which a warning alarm is sounded. This button also mutes the beeper after an alarm for a preset time interval (**SIL (Alarm Silence or Mute Period)**). Each successive press of this button resets the mute timer. Additionally, this button accesses Programming Mode.
- ❑ The **SETPOINT** ↑ button displays the temperature setpoint (**SP (Setpoint)**) at which LN2 injection begins.
- ❑ The **USAGE** ↓ button displays the LN2 usage (**CCO (Current LN2 Usage)**) in minutes for the current LN2 injection event.

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The CA5000-N constantly compares the probe's temperature to the user-specified **Hi (High Alarm Setting)** temperature to determine out-of-range status. An out-of-range state is a temperature that is equal to, or warmer than, the user-defined **Hi (High Alarm Setting)**. The STATUS LED flashes green when the temperature is in-range. The CA5000-N will not alarm until the out-of-range state has continued for the specified **Ad (Alarm Delay Period)**. The **Ad (Alarm Delay Period)** prevents nuisance alarms such as those that might occur when opening the ULT freezer door when the probe is too close to the door.

When an alarm condition occurs, the beeper sounds, the ALARM LED flashes, and the STATUS LED blinks red. Pressing the **PROGRAM** button silences the beeper for the user-specified time (**SIL (Alarm Silence or Mute Period)**) and changes the alarm sound to short chirps. After the user programmed **SIL (Alarm Silence or Mute Period)** elapses, if the CA5000 is still in an alarm condition, the beeper will resume at full volume. The beeper also provides an audio tick whenever a CA5000 Controller button has been pressed.

When the probe temperature exceeds the **SP (Setpoint)** temperature and both the **Ad (Alarm Delay Period)** and the **rd (Relay Delay Period)** have expired, LN2 is injected into the freezer cabinet, and the ALARM LED changes to blinking amber/red. The amber/red blinking LED indication persists and does not clear until the unit **ALARM RESET** is pressed. The STATUS indicator that alternately blinks green/off for temperatures below the user defined **Hi (High Alarm Setting)**, and red/off for temperatures equal to or above the **Hi (High Alarm Setting)**, now blink green/amber for temperatures below the **Hi (High Alarm Setting)**, and red/amber for temperatures equal to or above the **Hi (High Alarm Setting)**. The blinking amber LEDs provide the user with a visual indicator that a ULT freezer temperature fault occurred and LN2 has been injected into the ULT freezer.

The **PROGRAM** button has the following functions:

- ❑ In Operating Mode, it displays the user defined **Hi (High Alarm Setting)**.
- ❑ When alarming, pressing the **PROGRAM** button mutes the beeper for the **SIL (Alarm Silence or Mute Period)**. Each successive **PROGRAM** button press resets the mute timer.
- ❑ Extended pressing of the **PROGRAM** button until "Hi" is displayed puts the CA5000 into Programming Mode and mutes the beeper.
- ❑ In Programming Mode, pressing the button cycles through the list of user parameters (see "**Detailed Description of Programming Parameters**" p. 15 - 20).

The **SETPOINT/↑** button has the following functions:

- ❑ In Operating Mode, pressing the button displays the LN2 injection control **SP (Setpoint)**.
- ❑ In Programming Mode, pressing the button increases the displayed parameter value.

The **USAGE/↓** button has the following functions:

- ❑ In Operating Mode, pressing the button displays the current LN2 usage in minutes (**CCO (Current LN2 Usage)**).
- ❑ In Programming Mode, pressing the button decreases the displayed parameter value.

Other Alarms

Should a problem arise with line power or the backup battery, a "**BAT**" indicator will be displayed on the CA5000 Controller, the ALARM LED will flash, and the beeper will sound. After confirming that the AC adapter is powered and is connected (try re-plugging both ends), contact Hampshire Controls for service or for a replacement battery. Replace the battery with a Hampshire Controls' recommended battery only.

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When the ULT freezer door has not been properly closed, after a fixed time of 15 minutes, the “dor” fault indication will be displayed on the CA5000 Controller, the red ALARM LED will flash, and the beeper will sound. Pressing the **MUTE** button will cause the beeper to sound short ‘chirps’, but the ALARM LED continues to flash, and the chirping remains audible, until the freezer door is closed.

CA5000-N Programming Mode Instructions

1. From Operating Mode, place the CA5000 in Programming Mode to access the desired parameters (see **Table 3. CA5000-N LN2 Freezer Backup System – All Parameters and Settings**, p. 21) as follows. While in Programming Mode, a small arrow is shown in the upper-left corner of the LCD display:
 - **Standard Alarm Parameters:** Press and hold the **PROGRAM** button until “Hi” is displayed.
 - **LN2 Control Parameters:** Press and hold the **SETPOINT**↑ and **PROGRAM** buttons simultaneously until “SP” is displayed.
 - **Timers and Manual Valve Controls:** Press and hold the **USAGE**↓ and **PROGRAM** buttons simultaneously until “SUS” is displayed.
2. The LCD display will show the first parameter that may be programmed (see the **Detailed Description of the Available Programming Parameters** on p. 15 - 20). The name of the parameter will flash briefly on the display followed by the current value of the parameter.
3. The flashing **STATUS** tricolor LED indicates the current state of the CA5000-N:
 - **Green** = Operating Mode, freezer temperature displayed.
 - **Amber** = Programming Mode
 - **Red** = Alarming. Freezer temperature above **Hi (High Alarm Setting)**.
4. To change the value of any parameter, press the **SETPOINT**↑ or **USAGE**↓ buttons. Pressing either button will change the parameter value by ±1.
5. Pressing and holding either the **SETPOINT**↑ or **USAGE**↓ button for a half-second will change the parameter value by ±10. It will continue to step by ±10 on subsequent button presses, provided that the next button press occurs within approximately 1 second.
6. Waiting more than 1 second before the next press of the **SETPOINT**↑ or **USAGE**↓ button will cause the step size to revert to ±1.
7. Once the CA5000-N is in Programming Mode, each time the **PROGRAM** button is pressed, the CA5000-N steps to the next parameter. As the CA5000-N steps to the next parameter, the value of the previous parameter is saved. Once the final parameter in the category (**Standard Alarm Parameters**, **Coolant Control Parameters**, or **Timers and Manual Valve Controls**) is reached, pressing the **PROGRAM** button again saves the final parameter value and causes the CA5000-N to exit Programming Mode and return to Operating Mode.
8. While in Programming Mode, if no buttons are pressed for approximately 30 seconds, then the CA5000-N will revert to Operating Mode.
9. The **ALARM RESET** button is a system reset which clears alarms, returns the CA5000-N to Operating Mode, and sets the **SUS (Suspend)**, **CCO (Current LN2 Usage)**, and **CSt (LN2 Started ‘Cst’ Minutes Ago)** timers to 0 minutes.

The CA5000-N functions as a freezer temperature monitor, a ULT freezer coolant injection device, and an audio, visual, and output relay alarm system. The CA5000-N goes into alarm mode when the temperature sensed by the type T thermocouple probe exceeds the **Hi (High Alarm**

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Setting). Alarm system attributes are controlled by three additional **Standard Alarm Parameters:** **Ad (Alarm Delay Period)** – a delay (minutes) after the temperature first exceeds the **Hi (High Alarm Setting)** before the CA5000-N goes into alarm mode, **Rd (Relay Delay Period)** – an additional delay (minutes) after the temperature sensed by the type T thermocouple probe exceeds the **SP (Setpoint)** before the LN2 coolant injection valve and SPDT output relays are engaged, and **SIL (Alarm Silence or Mute Period)** – the time (minutes) for which the audio alarm is muted (chirping) when the **MUTE** button is pressed.

There are three **Coolant Control Parameters:** **SP (Setpoint)**, **On (On Time)**, and **OFF (Off Time)**. When the temperature sensed by the type T thermocouple rises above the **SP (Setpoint)**, the CA5000-N injects coolant for **On (On Time)** seconds, then waits **OFF (Off Time)** seconds before determining if more cooling is required to cause the temperature to fall below the **SP (Setpoint)**.

The LN2 coolant injection valve can be manually controlled by the **Timers and Manual Valve Control** parameters **SUS (Suspend)** - disengages the LN2 injection valve, and **Pur (Purge)** - engages the LN2 injection valve. CA5000-N firmware also monitors three timers: **CCO (Current LN2 Usage)** – time (minutes) the LN2 injection valve has been engaged since the **SP (Setpoint)** temperature was exceeded, **CSt (LN2 Started ‘CSt’ Minutes Ago)** – time (minutes) since the **SP (Setpoint)** temperature was exceeded and the LN2 injection valves was first engaged, and **tCO (Total LN2 Usage)** – the total time (minutes) the LN2 injection valve has been engaged since the LN2 coolant tank was first installed.

NOTE: In addition to clearing a CA5000-N temperature alarm condition, pressing the **ALARM RESET** button will also reset the **CSt (LN2 Started ‘CSt’ Minutes Ago)**, the **SUS (Suspend)**, and **CCO (Current LN2 Usage)** timers to 0 minutes. Previous data related to LN2 injection valve timing will be lost. Therefore, if this data is required for maintenance or engineering purposes, these values should be recorded **BEFORE** the **ALARM RESET** button is pressed. However, the **tCO (Total LN2 Usage)** timer continues to accumulate until it is manually reset to 0 minutes (typically upon the installation of a new LN2 coolant tank). The **tCO (Total LN2 Usage)** value can be reset to 0 minutes by following the **tCO (Total LN2 Usage)** programming instructions on p. 20.

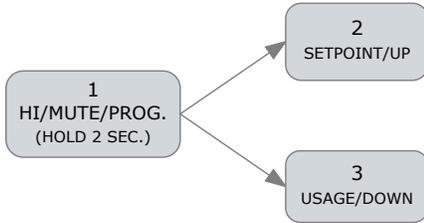
Detailed Description of the Available Programming Parameters

Standard Alarm Parameters

(Press and hold the PROGRAM button to activate)

Hi (High Alarm Setting)

In Operating Mode, the ALARM will activate if the CA5000 temperature probe indicates a temperature greater than or equal to the **Hi (High Alarm Setting)** °C. The **Hi (High Alarm Setting)** can be set between -200 °C and 50 °C. The CA5000-N **Hi (High Alarm Setting)** default setting is -70 °C.

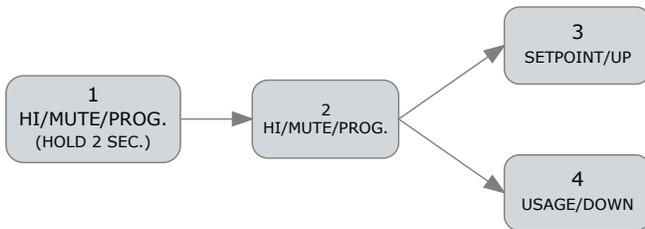


From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** button until the display reads “**Hi**”. Release the button, and the display will show the current **Hi (High Alarm Setting)**.
2. Press **SETPOINT/↑** to increase the **Hi (High Alarm Setting)** value.
3. Press **USAGE/↓** to lower the **Hi (High Alarm Setting)** value.

Ad (Alarm Delay Period)

If desired, the CA5000 will not provide an ALARM until the out-of-range state has continued for a specified time (**Ad (Alarm Delay Period)** minutes). The **Ad (Alarm Delay Period)** is used to prevent transient or nuisance alarms and may be set from 0 to 30 minutes. The CA5000 default **Ad (Alarm Delay Period)** is 5 minutes.



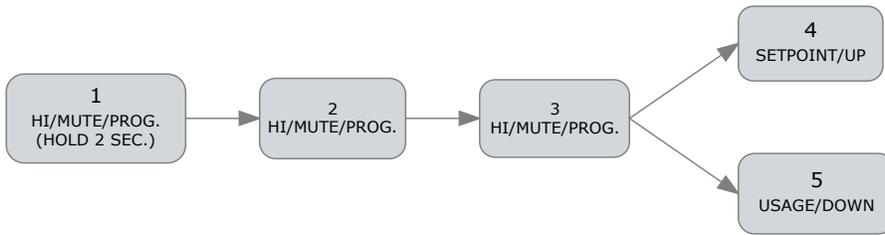
From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** button until the display reads “**Hi**”.
2. Press the **PROGRAM** button a second time, the display will read “**Ad**” momentarily, and then display the current **Ad (Alarm Delay Period)** value.
3. Press **SETPOINT/↑** to increase the **Ad (Alarm Delay Period)**.
4. Press **USAGE/↓** to decrease the **Ad (Alarm Delay Period)**.

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rd (Relay Delay Period)

The **rd (Relay Delay Period)** delays activation of both the CA5000 BVM LN2 injection valve and the CA5000 Controller output RELAY. The **rd (Relay Delay Period)** may be set from 0 to 30 minutes. The CA5000 default **rd (Relay Delay Period)** is 5 minutes.

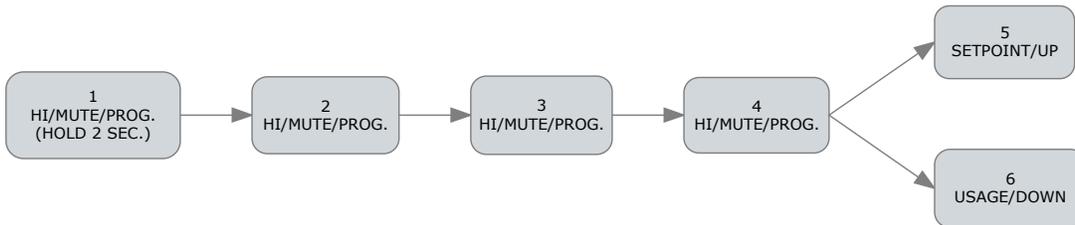


From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** button until the display reads “**Hi**”.
2. Press **PROGRAM** a second time.
3. Press **PROGRAM** a third time, the display will read “**rd**” momentarily, and then display the current **rd (Relay Delay Period)**.
4. Press **SETPOINT/↓** to increase the **rd (Relay Delay Period)**.
5. Press **USAGE/↓** to decrease the **rd (Relay Delay Period)**.

SIL (Alarm Silence or Mute Period)

The **SIL (Alarm Silence or Mute Period)** sets the number of minutes the beeper will chirp after the **MUTE** button is pressed during an alarm condition. If the alarm condition persists after the **SIL (Alarm Silence or Mute Period)** elapses, then the beeper will resume at full volume. The **SIL (Alarm Silence or Mute Period)** may be set from 5 to 120 minutes. The CA5000 default **SIL (Alarm Silence or Mute Period)** is 25 minutes.



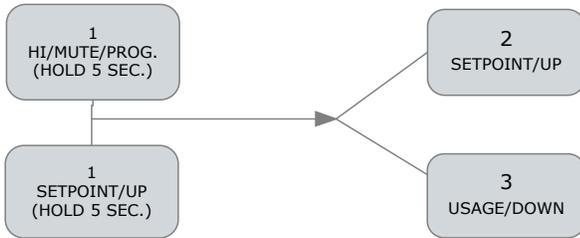
From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** button until the display reads “**Hi**”.
2. Press **PROGRAM** a second time.
3. Press **PROGRAM** a third time.
4. Press **PROGRAM** a fourth time, the display will read “**SIL**” momentarily, and then display the current **SIL (Alarm Silence or Mute Period)** value.
5. Press **SETPOINT/↑** to increase the **SIL (Alarm Silence or Mute Period)**.
6. Press **USAGE/↓** to decrease the **SIL (Alarm Silence or Mute Period)**.

LN2 Control Parameters

SP (Setpoint)

The **SP (Setpoint)** is the temperature (°C) at which LN2 will be injected into the ULT freezer or other target cabinet. The **SP (Setpoint)** range is from the **Hi (High Alarm Setting)** up to +40°C. Note that if the **SP (Setpoint)** is encountered, activation of the LN2 injection valve is delayed by the **rd (Relay Delay Period)**.

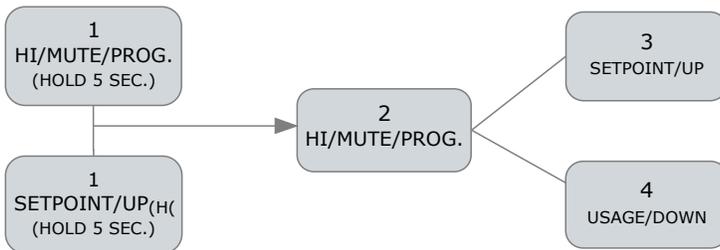


From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **SETPOINT**↑ buttons simultaneously until the display reads “**SP**”. Release the buttons, and the display will show the current **SP (Setpoint)**.
2. Press **SETPOINT**↑ to raise the LN2 injection **SP (Setpoint)** temperature.
3. Press **USAGE**↓ to lower the LN2 injection **SP (Setpoint)** temperature.
4. Press the **PROGRAM** again to adjust the LN2 injection **On (On Time)**.

On (On Time)

The **On (On Time)** is the LN2 injection time interval (seconds) into the ULT freezer or other target cabinet. The **On (On Time)** may be set from 5 to 900 seconds. The CA5000 default **On (On Time)** is 20 seconds.



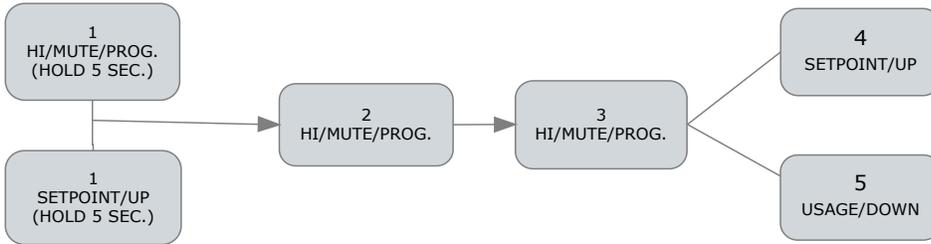
From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **SETPOINT**↑ buttons simultaneously until the display reads “**SP**”. Release the buttons.
2. Press **PROGRAM**, the display will read “**On**” momentarily, and then display the current **On (On Time)**.
3. Press **SETPOINT**↑ to increase the LN2 injection **On (On Time)**.
4. Press **USAGE**↓ to decrease the LN2 injection **On (On Time)**.

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OFF (Off Time)

The **OFF (Off Time)** is the time interval (seconds) between LN2 injections. The **OFF (Off Time)** may be set from 10 to 900 seconds. The CA5000 default **OFF (Off Time)** is 40 seconds.



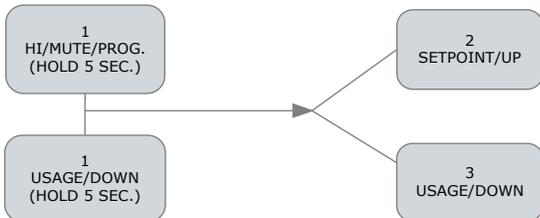
From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **SETPOINT** ↑ buttons simultaneously until the display reads “SP”. Release the buttons.
2. Press **PROGRAM**, the display will read “On” momentarily.
3. Press **PROGRAM** again, the display will read “Off” momentarily, and then display the current **OFF (Off Time)**.
4. Press **SETPOINT** / ↑ to increase the **OFF (Off Time)** LN2 injection interval.
5. Press **USAGE** / ↓ to decrease the **OFF (Off Time)** LN2 injection interval.

Timers and Manual Valve Control

SUS (Suspend)

The **SUS (Suspend)** stops LN2 injection for a specified time from 1 to 59 minutes. Both LN2 injection **SP (Setpoint)** and **Hi (High Alarm Setting)** are ignored during the **SUS (Suspend)** period. The STATUS LED continues to flash green/red as normal, and a fast, short blink of the ALARM LED indicates this suspended 'no-alarm' mode. When the **SUS (Suspend)** time expires, the CA5000 system returns to normal monitoring mode. The **SUS (Suspend)** timer is displayed while in this mode, and the current freezer probe temperature can be displayed at any time by pressing the **USAGE** / ↓ button. The timer is reset to zero by pressing the **ALARM RESET** button, or by manually setting the **SUS (Suspend)** time to 0 minutes.



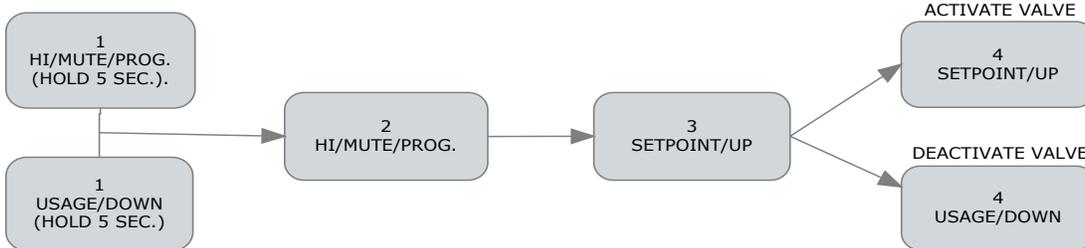
From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **USAGE** ↓ buttons simultaneously until the display reads “SUS”. Release the buttons, and the display will show the current **SUS (Suspend)** time.
2. Press **SETPOINT** / ↑ to increase the **SUS (Suspend)** time.
3. Press **USAGE** / ↓ to decrease the **SUS (Suspend)** time.

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Pur (Purge)

The **Pur (Purge)** control activates the LN2 injection valve. Use the **Pur (Purge)** to manually clear the LN2 delivery tube of high-pressure gas and air when changing LN2 tanks, for safety purposes, or maintenance purposes. **Pur (Purge)** can be set to 0 (LN2 valve off) or 1 (LN2 valve on). **Pur (Purge)** is only active while in Programming Mode, and upon exiting Programming Mode, the **Pur (Purge)** value always resets to 0 (LN2 valve off). The user must confirm the **YES** prompt by hitting the **SETPOINT/↑** button before the **Pur (Purge)** is set to 1 (LN2 valve on).

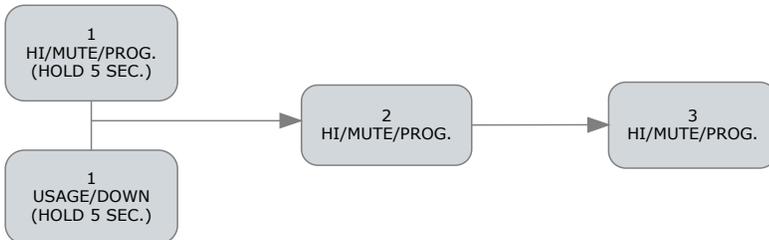


From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **USAGE** ↓ buttons simultaneously until the display reads “**SUS**”. Release the buttons.
2. Press **PROGRAM** and the display will read “**Pur**”.
3. Press **SETPOINT/↑** for a **YES** prompt to confirm the **Pur (Purge)** ‘LN2 valve on’ request.
4. Press **SETPOINT/↑** to activate the LN2 valve, and the CA5000 display will read “**1**”. Pressing the **USAGE/↓** button will set the displayed value to “**0**” and deactivate the LN2 valve.

CCO (Current LN2 Usage)

The **CCO (Current LN2 Usage)** reports the amount of time in minutes the LN2 valve has been open since the last **ALARM RESET**. The **CCO (Current LN2 Usage)** is reset to 0 minutes by pressing the **ALARM RESET** button.



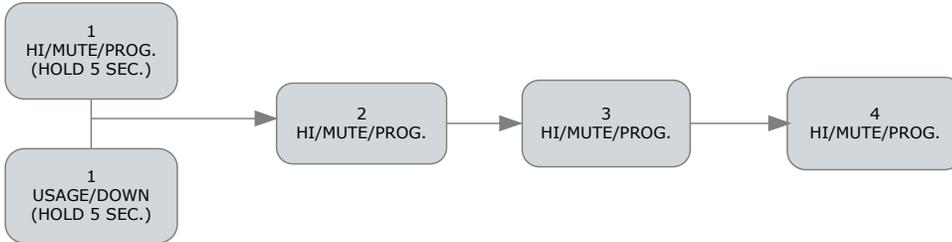
From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **USAGE** ↓ buttons simultaneously until the display reads “**SUS**”. Release the buttons.
2. Press **PROGRAM** and the display will read “**Pur**”.
3. Press **PROGRAM** again, the display will read “**CCO**” momentarily, and then the current **CCO (Current LN2 Usage)** time in minutes will be displayed.

CA5000-N Liquid Nitrogen Backup System Operating Instructions

CSt (LN2 Started 'CSt' Minutes Ago)

The **CSt (LN2 Started 'CSt' Minutes Ago)** reports the number of minutes since the start of the most recent LN2 injection into the ULT freezer or target cabinet. The **CSt (LN2 Started 'CSt' Minutes Ago)** value is reset to zero by pressing the **ALARM RESET** button.

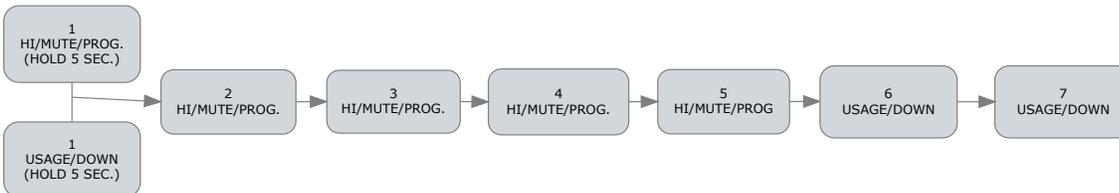


From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **USAGE** ↓ buttons simultaneously until the display reads “**SUS**”. Release the buttons.
2. Press **PROGRAM** and the display will read “**Pur**”.
3. Press **PROGRAM** again and the display will read “**CCO**”.
4. Press **PROGRAM** again, the display will read “**CSt**” momentarily, and then the current **CSt (LN2 Started 'CSt' Minutes Ago)** value will be displayed.

tCO (Total LN2 Usage)

The **tCO (Total LN2 Usage)** reports the total LN2 usage in minutes since the current LN2 tank was installed and the user or installer reset the **tCO (Total LN2 Usage)** value to 0 minutes. **tCO (Total LN2 Usage)** may only be reset to 0 minutes using the method described here.



From Operating Mode:

1. Place the system in Programming Mode by pressing and holding the **PROGRAM** and **USAGE** ↓ buttons simultaneously until the display reads “**SUS**”. Release the buttons.
2. Press **PROGRAM** and the display will read “**Pur**”.
3. Press **PROGRAM** a second time and the display will read “**CCO**”.
4. Press **PROGRAM** a third time and the display will read “**CSt**”.
5. Press **PROGRAM** a fourth time, the display will read “**tCO**” momentarily, and then display the current **tCO (Total LN2 Usage)** in minutes.
6. Press **USAGE** ↓ to display a **YES** prompt before resetting the **tCO (Total LN2 Usage)** to 0 minutes, if desired.
7. Press **USAGE** ↓ a second time to reset **tCO (Total LN2 Usage)** to 0 minutes.

All Parameters and Settings

Table 3: CA5000-N LN2 Freezer Backup System – All Parameters and Settings

		Low Limit	High Limit	Factory	Unit	Resets?
Standard Alarm Parameters				Default		
Hi	High Temperature Alarm Limit <i>Note that this temperature must be below the SP (Setpoint) injection temperature in Coolant Control Parameters (below).</i>	-200	50	-70	°C	No
Ad	Alarm Delay Period	0	30	5	Minutes	No
Rd	Relay Delay Period	0	30	5	Minutes	No
SIL	Silence Mute Period	5	120	25	Minutes	No
LN2 Control Parameters						
SP	Setpoint Temperature at which to initiate liquid nitrogen injection. <i>Note that this temperature cannot be set below (colder) than the Hi (High Alarm Setting) temperature in Standard Alarm Parameters (above).</i>	Hi	40	-65	°C	No
On	On Time for coolant valve	5	900	15	Seconds	No
OFF	Off Time for coolant valve	10	900	45	Seconds	No
Timers and Manual Valve Control						
SUS	Suspend Deactivates coolant injection valve.	0	59	0	Minutes	Automatic
Pur	Purge Activates coolant valve to purge delivery tube.	0	1	0	-	Automatic
CCO	Current LN2 Usage	-	-	-	Minutes	Automatic
CSt	LN2 Started 'CSt' Minutes Ago Coolant injection timer	-	-	-	Minutes	Automatic
tCO	Total LN2 Usage	-	-	-	Minutes	Manual

- ❑ To edit the **Standard Alarm Parameters**, press and hold the **PROGRAM** button until “Hi” is displayed.
- ❑ To edit the **LN2 Control Parameters**, first press the **SETPOINT**↑ button, and while holding it, also press and hold the **PROGRAM** button until “SP” is displayed.
- ❑ To access the **Timers and Manual Valve Control**, first press the **USAGE**↓ button, and while holding it, also press and hold the **PROGRAM** button until “SUS” is displayed.

Periodic Maintenance

Hampshire Controls Corporation recommends the following monthly maintenance to ensure proper CA5000-N operation:

- ❑ Test the system to verify proper injection of LN2 into the ULT freezer or target cabinet. Use the **Pur (Purge)** command as described in the **Timers and Manual Valve Control** section (p. 19) of this manual.
- ❑ Inspect the type T thermocouple probe within the ULT freezer or target cabinet and confirm that there is no frost buildup on the tip of the probe.
- ❑ Test functionality of the DOOR SWITCH interlock circuit. Opening the ULT freezer door should cause the CA5000 BVM “DOOR OPEN” LED to illuminate and LN2 injection, if active, should cease.
- ❑ Test all external systems activated by the CA5000 Controller output RELAY.
- ❑ Confirm that all CA5000 visual indicators function and illuminate properly at the expected times.
- ❑ Confirm that there is sufficient liquid nitrogen remaining in the LN2 supply cylinder. A 180-L liquid nitrogen cylinder must be full or nearly full to provide the specified 48 hours of freezer backup time with a -60 °C setpoint.
- ❑ After 3 years (36 months) of use, replace the internal battery in the CA5000 BVM. Replace the battery with a Hampshire Controls’ recommended battery only (p/n **68112 CA5000 Battery, 12 V – 12 Ah, Lead Acid, Rechargeable**). Installation should be performed only by a qualified service technician. Recycle or dispose of the used battery properly.

Cleaning Instructions: Moisten a microfiber cloth with a mixture of 70% isopropyl alcohol and 30% water. Gently wipe the surfaces of the CA5000 Controller and CA5000 BVM. Clean the CA5000 Controller display screen, carefully wiping in one direction.

CA5000-N Liquid Nitrogen Backup System Operating Instructions

Replacement Parts

Table 4: CA5000-N LN2 Freezer Backup System Replacement Parts

All replacement parts are exclusively sold by, and must be ordered from, Hampshire Controls. Part replacement, and any repairs, must be performed only by a qualified service technician. Replace the battery with a Hampshire Controls' recommended battery only.

HAMPSHIRE CONTROLS PART # (P/N)	DESCRIPTION
F84010-01	CA5000-N Liquid Nitrogen Freezer Backup System
A84010-10	CA5000-N Liquid Nitrogen Freezer Backup System Battery-Valve Module (BVM)
F82040-230	CA5000 Freezer Backup Controller
48264	CA5000 Type T Thermocouple Temperature Probe, 10' Lead
A84010-14	CA5000-N Liquid Nitrogen Delivery Tube, 1/4" OD Copper Tubing, 8' Length
40052	CA5000 Door Switch
A84000-22	CA5000 Door Switch Cable, 2-Conductor, 10' Lead
A84000-06	CA5000 Control Cable, 6-Conductor Cable, 10' Lead
29032	Universal Power Supply, International Blades Included, 5' Cord Input: 100-240 VAC, 50-60 Hz, 1 A max Output: 15 VDC, 2.4A, 36 W
68112	CA5000 Battery, 12 V – 12 Ah, Lead-Acid, Rechargeable
68034	CA5000 Freezer Backup Controller Wall Mounting Bracket

Troubleshooting Guide

CA5000 Temperature Display Is Blank

- ❑ Verify power adapter is connected to line power and to the POWER connector on the Battery-Valve Module (BVM)
- ❑ Verify the CONTROL CABLE is installed between the CA5000 Controller and the CA5000 Battery-Valve Module (BVM).

CA5000 Temperature Display Reads '1999'

- ❑ If the display shows a continuous reading of **1999**, then the probe or associated wiring has failed. Confirm connections or replace the **Type T Thermocouple Temperature Probe (p/n 48264)** as necessary.

CA5000 Temperature Display Does Not Agree with ULT Freezer Temperature

- ❑ Due to differences in probe locations within the ULT freezer and in probe calibrations, the temperature on the CA5000 Freezer Backup Controller display might not directly agree with the interior temperature display for the ULT freezer. If the two temperatures are within 5 °C of each other, then the CA5000 Freezer Backup System will perform as expected. However, if the separation between the two temperatures is greater than 5 °C, then the **CA5000 Controller** and the **Type T Thermocouple Temperature Probe** should be returned to Hampshire Controls for temperature recalibration.
- ❑ If the temperature on the CA5000 Freezer Backup Controller display must be in direct agreement with the ULT freezer temperature display, and the temperatures are within 10 °C of each other, then a temperature offset can be added to the CA5000 Freezer Backup Controller temperature display. To add a temperature offset, press **USAGE/↓**, then add **SETPOINT/↑** and then **PROGRAM**. Release **USAGE/↓** and wait for "OFS" on the display. Adjust the displayed temperature offset using the **USAGE/↓** (down) and **SETPOINT/↑** (up) buttons. Press the **PROGRAM** button to return to the temperature display.

CA5000 Display Reads: 'xx' (numeric value)

- ❑ The **SUS (Suspend)** timer is active. To view the actual CA5000 freezer probe temperature, press the **USAGE/↓** button.
- ❑ To exit **SUS (Suspend)** mode, press **ALARM RESET**, or press and hold the **USAGE/↓** and **PROGRAM** buttons simultaneously, to adjust the **SUS (Suspend)** timer to 0 minutes.

Constant Alarm Condition

- ❑ Verify that the parameters are programmed correctly for your CA5000 installation and for the ULT freezer or target cabinet being monitored. See p. 15 - 20 for programming instructions.

CA5000 Locks Up or Does Not Respond

- ❑ Pressing **ALARM RESET** might resolve the issue.
- ❑ If not, disconnect, and then reconnect, the CONTROL CABLE from the CA5000 BVM to reboot the CA5000 Controller.

LIMITED WARRANTY

Hampshire Controls Corporation warrants each manufactured item against defects in material and workmanship, when used as recommended, for a period of one year from original purchase. Products believed to have such defects must be returned to the factory by prepaid transportation.

Hampshire Controls' obligation under this warranty is limited to the repair or replacement, at its option, of those items which upon examination prove to be defective. Such repair or replacement will be made without charge.

This warranty will be void if repairs or alterations are made or attempted without factory authorization; or if the item has been subject to misuse, negligence or accident.

Hampshire Controls Corporation assumes no liability for consequential damages of any kind. The purchaser, by acceptance of the product, assumes all liability of the consequence of its use or misuse.

Hampshire Controls Corporation makes no other warranty, whether expressed or implied, in connection with the sale or use of this product.



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