CA5000

Liquid CO_2 Freezer Backup System

OPERATING INSTRUCTIONS MANUAL

HAMPSHIRE CONTROLS CORPORATION

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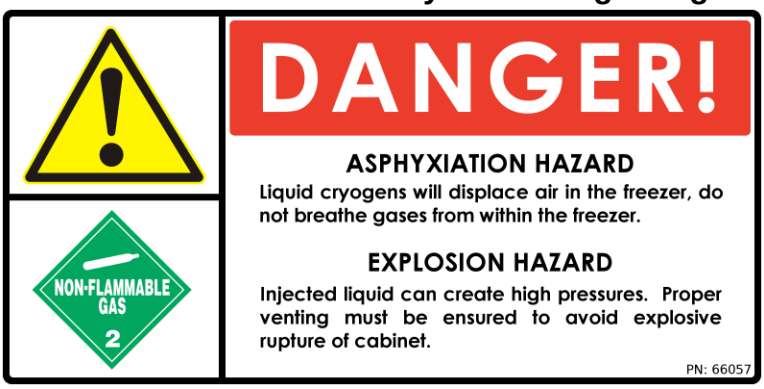
SAFETY WARNING

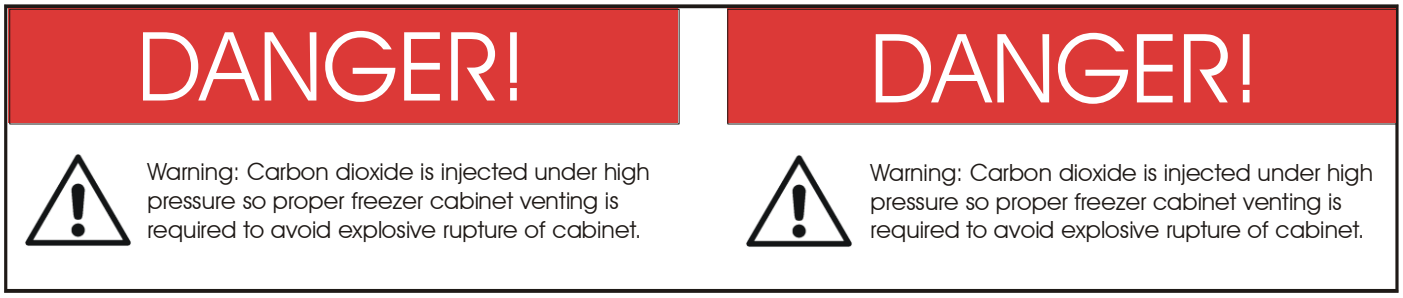
Please read this manual in its entirety before beginning installation.



Injected liquid CO_2 gas is under extremely high pressure, so proper system venting is required.

CO_2 gas suppresses oxygen levels so use care and appropriate ventilation in enclosed spaces to avoid suffocation.

A qualified service technician must be contacted for installation and periodic testing of the system as per manufacturer's instructions and applicable local and government regulations. The Backup System will not operate during a power failure if the system 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 only with a recommended Hampshire Controls replacement part. 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 use of this product.

All connections from the supply cylinder to the freezer require a minimum static pressure rating of 1500 psi.

Liquid CO_2 is extremely cold and will freeze unprotected skin. Always wear protective clothing and eyewear when working with liquid refrigerants.

O.S.H.A. regulations have been established for the safe handling, use and storage of high-pressure gas cylinders. Please consult a current edition of the O.S.H.A. regulations to ensure compliance with applicable safety requirements and lockout/tagout requirements.

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.

UNPACKING INFORMATION

The CA5000 is shipped in a single custom box. Please check the carton for the following:

- CA5000 Control – Alarm Display Module
- Battery-Valve-Module (BVM)
- BVM to CA5000 10' Control Cable
- Magnetic door interlock switch
- Flared nut for CO_2 fitting on BVM
- Thermocouple, 10' type T with plug to connect to CA5000
- Power Supply, 15V DC 1.2A
- 1/8" tube x 8 ft output tube /with connector nut installed

CUSTOMER SUPPLIED PARTS

Some parts and materials must be supplied by installer or a Gas Supply Company:

- **Siphon feed** CO2 tanks, 50 pounds or larger
- CGA320 adapter for tank
- Tubing, flexible or semi-flexible (copper) to connect CGA320 and Hampshire Controls supplied ¼" flare
- Freezer vent to release excess pressure, preferably from the top, of the cabinet

Model CA5000 Liquid CO_2 Backup System
Introduction

The Hampshire Controls Corporation CA5000 system is a unique combination of field proven, highly reliable Hampshire Controls alarm systems and a liquid CO_2 injection system, providing security for your products to ultra-low temperatures. It offers multiple 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 CO_2 is maintained at high pressure, ready to be injected into a freezer cabinet or system. When a malfunction occurs and the freezer warms above the user-defined setpoint, a controlled amount of liquid CO_2 is injected into the freezer. Since the boiling point of CO_2 is -78.5 °C, injected CO_2 boils and absorbs heat, protecting your product to temperatures as low as -70 °C.

The CA5000 is very simple to operate: plug in the unit, place the probe in the freezer chamber to be monitored, and the display will show the temperature of that location. Pushing combinations of three buttons allows the user to program all alarm set points, injection points and controls.

Optional features allow the unit to send temperature data to recording devices. Please contact Hampshire Controls for details of the many possibilities!

FEATURES

- An internal 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.
- Temperature can be maintained as low as -70 °C.
- Backup time of typically 8 hours on one standard cylinder of CO_2 at –60 °C setpoint.
- Independent user-programmable controls for system alarms and liquid CO_2 injection.
- Visible and audible indicators for system status.
- Multiple programmable delays are available to minimize nuisance or false alarms.
- Relay output is available for central alarm systems or automatic dialers.
- A door interlock switch prevents CO_2 injection while freezer is door is open.

SPECIFICATIONS

- Unit Ambient Operating Temperature: 0°C to +40°C
- Display Temperature Range: -200°C to +50°C
- Absolute Accuracy: +/- 2°C
- Display Resolution: 1°C
- Power Supply: 15 VDC (with included power adapter)
- Relay Output: SPDT NO/NC user-selectable dry contact, 30VDC/1A max. (non-inductive)
- Door Switch Input: User-selectable Normally Open or Normally Closed contact
- Backup Battery: 12VDC 12Ah Sealed lead-acid rechargeable
- Thermocouple: Hampshire Controls Precision ‘T’ type
- Factory Calibration: 1 Year

Model CA5000 Liquid CO_2 Backup System Installation

SENSOR PROBE

The probe supplied with the CA5000 is a highly accurate 'T' type thermocouple sensor. 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 of the unit, or if the probe is damaged it must be replaced.

NOTE: If the display shows a continuous reading of an unexpected value (for example, 1999), the probe has failed. Verify proper wiring and replace the probe as required.

Probe Installation

The probe may be used in air or in simulated product. 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 cabinet manufacturer and reseal the port.

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 some safety for the area being monitored without generating false or nuisance alarms. For example, locating the sensor probe on the bottom of a chest freezer will result in the alarm being sounded later than if it was located near the top. However, locating the sensor too close to the top of the chest freezer could result in the alarm being sounded due to lid openings. Choose a probe location that offers the safety desired for the enclosure contents.

CO2 TANK AND DELIVERY TUBE

Install the CO_2 output tube (1/8"x8' tubing) onto the BVM and into the freezer. The location should be near the CA5000 temperature probe and pointing away from it. The output and probe should be at the same height, near the back of the cabinet. Use care not to install the CO_2 delivery tube where it may be blocked by product. The cold CO_2 is heavier than air, so it will fill the freezer from the bottom up.

Install a siphon-type liquid CO_2 tank. Connect its output to the "Supply" fitting on the BVM. The supply fitting is 1/8" FNPT, an adapter for ¼" flared tubing is provided. Any high pressure tubing with .063" ID or larger can be used. Typically CO_2 leaks may be detected by ice, frost or condensation.

During a tank change, be certain to purge the delivery tubing of any high pressure gas after closing the empty CO_2 supply tank valve.

When setting the new tank, be sure to purge the system of any air in the delivery tubing after opening the CO_2 supply tank valve.

Purging is accomplished via manual valve control (purge) in Programming mode as described in this manual, page 9.

DOOR SAFETY SWITCH

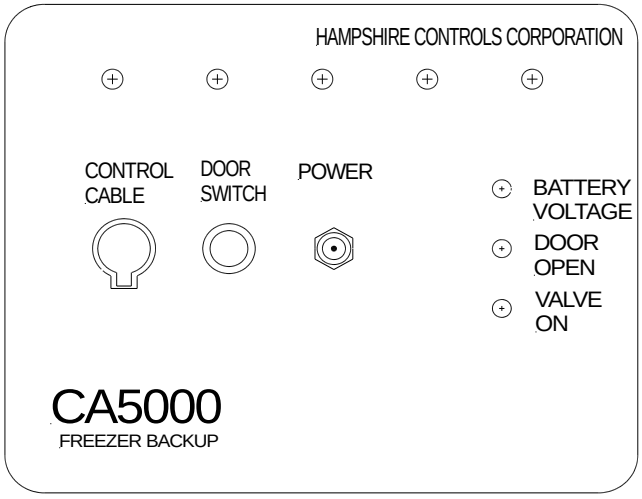
Install the supplied door switch so that it will activate upon opening the freezer or cabinet door. When installed and properly wired, it will interrupt the injection of CO_2 into the freezer. Verify this functionality by observing the visual indicator on the BVM as described below, confirm that the CO_2 injection halts when the red door-open LED indicator is illuminated.

BATTERY - VALVE MODULE (BVM)

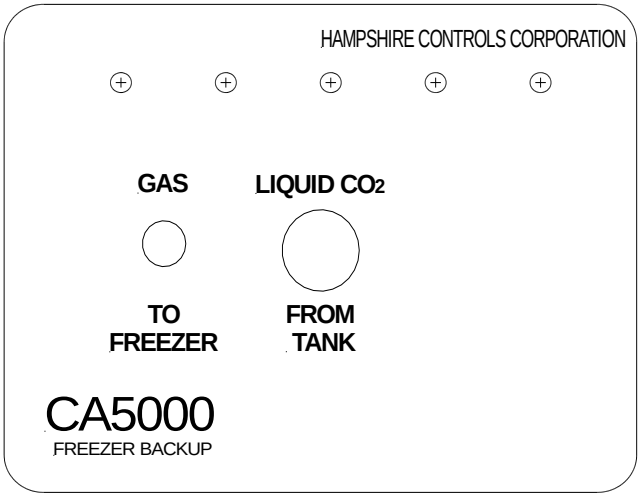
The BVM contains the backup battery, charging and logic circuits. On the front face are a 6-pin connector for the CA5000 Control Alarm Module, a 3-pin connector for the door switch interlock and a power jack for the supplied power supply. The rear panel has connections for a siphon-feed type liquid CO_2 tank, and the CO_2 discharge tube.

The CA5000 door switch interlock circuit is factory shipped to accept a closed contact (NC) for normal operation. It may be changed to Normally Open (NO) if desired by the small slide switch on the BVM circuit board (some disassembly required). Check that the “door open” led lights only when the door is open.

BVM FRONT VIEW



BVM REAR VIEW



Visual LED indicators display system status:

- BATTERY VOLTAGE: Green indicates the battery and charger are operating normally, flashing red indicates a low battery voltage or charging condition (if plugged into line power), or that there is no line power connected and the BVM and CA5000 Control Alarm Module are running on internal battery power.
- DOOR OPEN: When lit, red indicates that the door is open.
- VALVE ON: When lit, yellow indicates that power is applied to the solenoid valve and, if a non-empty CO_2 tank is connected and open, CO_2 should be flowing.

CA5000 CONTROL ALARM MODULE

Connect the CA5000 control cable to the Battery - Valve Module. Connect the door switch wiring and the output alarm relay to your system as required. DC power for the CA5000 system is provided via the POWER jack on the front panel of the BVM.

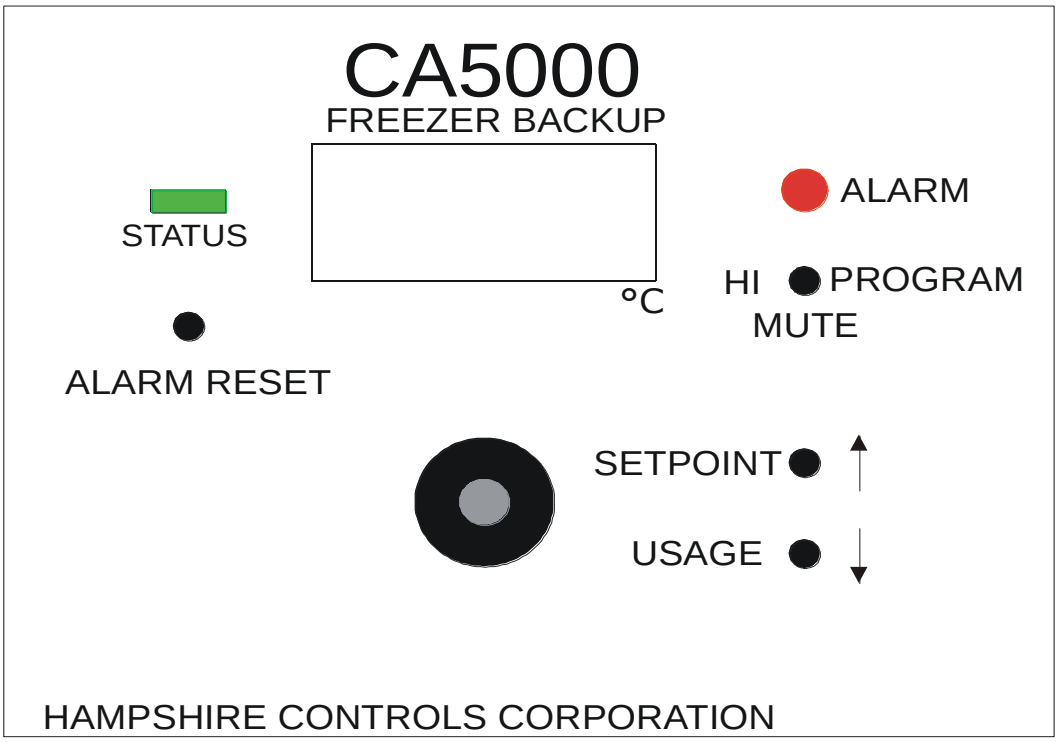
OPERATIONAL CHECK

Plug the CA5000 system power supply into a 110-120 VAC/60 Hz outlet. If the ambient air temperature is within the unit's operating range (-200 to +50°C), the display will show the current probe (air) temperature.

If the display is blank, verify power is supplied to the unit. If the STATUS LED is lit the CA5000 has power. If not, verify that the power supply is plugged into the BVM and into line power and the control cable between the CA5000 and the BVM is connected.

The STATUS LED indicator flashes every second, this indicates the unit is operating normally.

FRONT PANEL DISPLAY



CA5000 INSTRUCTIONS

OPERATING MODE

In Operating mode, the unit displays process temperature and provides alarms and outputs based on user-specified parameters.

- The **ALARM RESET** button is a system reset which clears alarms and also sets the values of the current CO_2 usage and start times to zero.
- The **HI/MUTE/PROGRAM** button displays the Hi alarm temperature at which a warning alarm is sounded. This button also mutes the beeper after an alarm, for a preset time interval. Each successive press of this button resets the mute timer. Additionally, this button accesses Programming mode.
- The **SETPOINT/Up arrow** button displays the temperature setpoint at which CO_2 injection begins.
- The **USAGE/Down arrow** button displays the CO_2 usage for the current event.

OPERATING MODE (continued)

The CA5000 constantly compares the probe's temperature to the user specified values to determine out-of-range status. An out-of-range state is a temperature that is equal to, or warmer than, the user-defined limits. The STATUS LED flashes green when the temperature is in-range. The CA5000 will not alarm until the out-of-range state has continued for the specified "alarm delay" ("Ad") time. This user-defined alarm delay time will prevent nuisance alarms, for example when opening the freezer door for loading or unloading.

When an alarm condition does occur, the beeper sounds and the Alarm LED flashes and the Status LED blinks red/off. Pressing the **HI/MUTE/PROGRAM** button silences the beeper for the user-specified time, changing the sound to short chirps. After the user-programmable SILENCE parameter ("**SIL**") elapses and if the CA5000 is still in an alarm condition, the beeper will resume at full volume

When the probe temperature exceeds the **SP** "setpoint, injection" temperature CO_2 is injected into the system, the alarm LED changes to blink amber/red. The amber LED indication persists and does not clear when the alarm clears until the unit **ALARM RESET** is pressed. This provides the user a visual indicator that a fault occurred and CO_2 has been injected into the system.

The **HI/MUTE/PROGRAM** button has multiple functions:

- In Operating mode, it displays the user-defined **Hi** alarm setting.
- In Operating mode, pressing this button mutes the beeper after an alarm is sounded, for a preset time. Each successive button press also resets the mute timer.
- Pressing the button for two seconds places the CA5000 into Programming mode and mutes the beeper.
- In Programming mode, pressing the button cycles through the list of user parameters.

The **SETPOINT/Up arrow** button has a different function for each mode:

- In Operating mode, pressing the button displays the CO_2 injection control setpoint.
- In Programming mode, pressing the button increases the displayed parameter value.

The **USAGE/Down arrow** button has a different function for each mode:

- In Operating mode, pressing the button displays the current CO_2 usage.
- In Programming mode, pressing the button decreases the displayed parameter value.

A built in circuit monitors the status of the backup battery inside the Battery-Valve Module (BVM). Should a problem arise with the battery and the CA5000 is plugged into line power, the **"BAT"** indicator will illuminate on the display, the Alarm LED will flash and the beeper will sound. After checking that the ac power supply has power and is plugged into the BVM, contact Hampshire controls for service, or for a replacement battery.

The door switch interlock circuit monitors the status of the freezer door to ensure it is closed. When wired with a door switch as recommended and the door has not been properly closed, after a fixed time of 15 minutes the **"dor"** fault indication will be displayed, 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 remains flashing and the 'chirps' remain audible until the door is closed.

TABLE 1
Parameters and Settings

		Low Limit	High Limit	Factory Default	Unit	Resets?
Standard Alarm Parameters						
Hi	High Temperature Alarm *Note that this temperature cannot be set warmer than the "Set Point Injection" temperature in* **CO_2 Control Parameters** (below)	-200	50	-65	°C	No
Ad	Alarm Delay Period	0	30	5	Minutes	No
Rd	Relay Delay Period	0	30	10	Minutes	No
SIL	Silence Mute Period	5	120	20	Minutes	No
CO_2 Control Parameters						
SP	Set Point Injection temperature to initiate liquid CO_2 injection *Note that this temperature cannot be set colder than the High Temperature Alarm temperature in* **Standard Alarm Parameters** (above).	-60	40	-60	°C	No
On	On time for CO_2 valve	5	900	20	Seconds	No
OFF	Off time for CO_2 valve	10	900	40	Seconds	No
Timers and Manual Valve Control						
SUS	Suspends CO_2 injection	0	59	0	Minutes	Automatic
Pur	Activates CO_2 valve to purge delivery tube	0	1	0	-	Automatic
CCO	Reported Current CO_2 usage	-	-	-	Minutes	Automatic
CSt	Reported CO_2 Injection start timer	-	-	-	Minutes	Automatic
tCO	Reported Total CO_2 usage	-	-	-	Minutes	Manual

- To edit the Standard Parameters, press and hold the **HI/MUTE/PROGRAM** button.
- To edit the CO_2 Control Parameters, first press the **SETPOINT** button, and while holding it, also press and hold the **HI/MUTE/PROGRAM** button. The 3 control parameters are available.
- To access the Timers and Manual Valve Control, first press the **USAGE** button, and while holding it, also press and hold the **HI/MUTE/PROGRAM** button. The 3 reported timers, 1 control timer, and the valve control options are available.

CA5000 PROGRAMMING MODE INSTRUCTIONS

To program the CA5000:

1. Press and hold the **HI/MUTE/PROGRAM** button for two seconds to bring the unit into Standard Programming mode. For the CO_2 Control Parameters, press and hold the **SETPOINT** and **PROGRAM** buttons to activate. For the Timers and Manual Valve Control, press and hold the **USAGE** and **PROGRAM** buttons to activate. While in programming mode, a small arrow is indicated in the upper-left corner of the LCD display.
2. The display will show the first parameter that may be programmed (see the Detailed Programming Parameter Descriptions beginning on page 10). The name of the parameter will flash, and then the current value of that parameter is displayed.
3. The flashing STATUS tricolor LED indicates the current status of the unit:
   - Green = Normal Display Mode
   - Amber = Programming Mode
   - Red = Temperature is out of range
4. To change the value of any parameter, press the **SETPOINT/Up arrow** or **USAGE/Down arrow** buttons. Pressing either button will change the parameter value by one count.
5. Pressing and holding either button for half a second will change the parameter value by 10 counts. It will continue to step by ten counts on subsequent button presses, as long as they occur within approximately one second.
6. Waiting more than one second before the next press of the **SETPOINT/Up arrow** or **USAGE/Down arrow** buttons will cause the step size to revert back to one.
7. Once the CA5000 is in Programming mode, each time the **HI/MUTE/PROGRAM** button is pressed, the unit steps to the next parameter. As the unit steps to the next parameter, the value of the previous parameter is saved. Once the final parameter is reached, pressing the **HI/MUTE/PROGRAM** button exits to Operating mode, storing the final parameter.
8. While in Programming mode, if no buttons are pressed for approximately 30 seconds, the CA5000 will revert back to Operating mode.
9. The **ALARM RESET** button is a system reset which clears alarms, returns the CA5000 to Operating mode, and also sets the values of the current CO_2 usage and start times to zero.

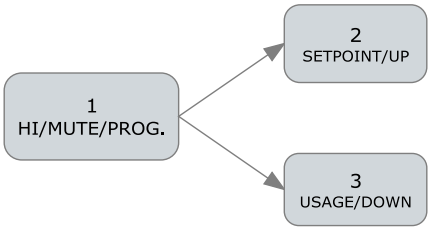
The **CA5000** functions as a monitoring and output device, and will provide an alarm at the value programmed into the standard parameter '**Hi**'. Three parameters perform the CO_2 control: Set Point **SP**, on seconds **On**, and OFF seconds **OFF**. When the temperature rises above the Set Point value, the unit injects CO_2 for "On seconds", then waits "Off seconds" before determining if more cooling is needed. Software monitors how many minutes elapse from the start of the CO_2 injection, how many minutes of "On" time (CO_2 usage) accumulate for this current event, and the total time that the CO_2 has been on, **tCO**, since the CO_2 tank was first started.

Important note : Resetting the CO_2 Alarm with **ALARM RESET** will also clear the CO_2 Start time counter **CSt,** the Suspend timer **SUS,** and Current Usage timer **CCO**. Previous data related to any CO_2 injection times is lost, so record these values first if this data may be required for Maintenance or Engineering purposes. However, the total CO_2 usage timer **tCO** keeps accumulating, until this value is reset manually to zero. This is accomplished by editing the value of the **tCO** parameter as follows: Press the **USAGE/Down arrow** button while in programming mode **tCO,** and a *YES* prompt is displayed for the user to confirm before resetting that value to zero. A press of the **Usage/Down arrow** button then sets the value to zero. See the detailed description of parameter **tCO** in the Available Programming Parameters section for additional information.

Standard Parameters (Press and hold the HI/PROGRAM/MUTE button to activate)

Hi (High Alarm Setting)

This is the high temperature alarm limit. In Operating mode, the alarm will activate if the probe reads a temperature equal to or above the high temperature limit. The high temperature limit cannot be set above the operating temperature range of the unit.

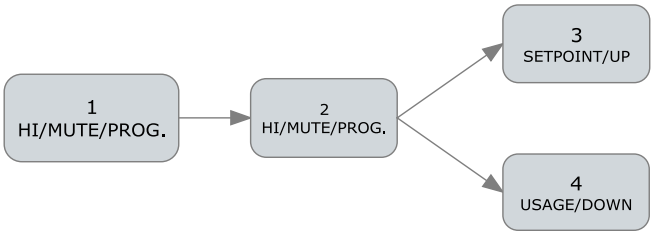


From operating mode:

1. Press & hold the HI/MUTE/PROGRAM button for two seconds to enter the Standard Programming mode. Release the button, the display will read **Hi** momentarily, and then its current value.
2. Press SETPOINT/UP ARROW to increase the value.
3. Press USAGE/DOWN ARROW to lower the 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. The alarm delay time may be used to prevent transient or nuisance alarms. This parameter may be set from 0 to 30 minutes.

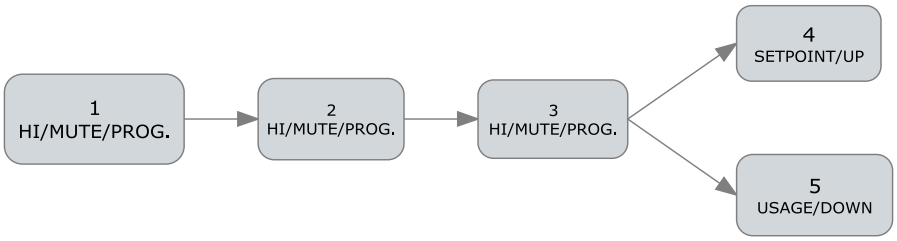


From operating mode:

1. Press & hold the HI/MUTE/PROGRAM button for two seconds to enter the Standard Programming mode.
2. Press HI/MUTE/PROGRAM button a second time, the display will read **Ad** momentarily, and then its current value.
3. Press SETPOINT/UP ARROW to increase the alarm delay.
4. Press USAGE/DOWN ARROW to decrease the alarm delay.

Standard Parameters (continued)

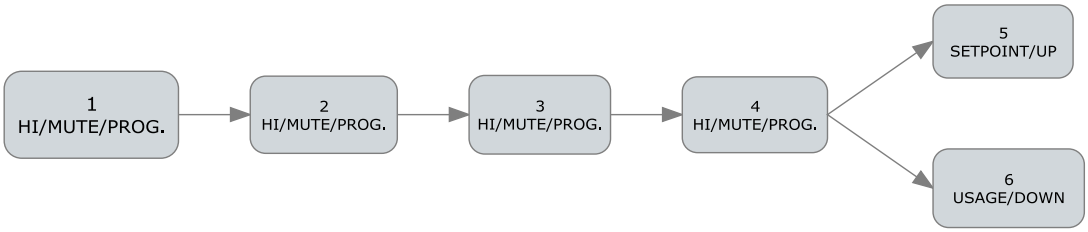
rd (Relay Delay Period)
This timer delays activation of the CA5000 output relay, as well as the injection of cryogen.
This parameter may be set from 0 to 30 minutes, default is 10.



From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM button for two seconds to enter the Standard Programming mode.
2. Press HI/MUTE/PROGRAM a second time.
3. Press HI/MUTE/PROGRAM a third time, the display will read **rd** momentarily, and then its current value.
4. Press SETPOINT/UP ARROW to increase the relay delay period.
5. Press USAGE/DOWN ARROW to decrease the relay delay period.

SIL (Alarm Silence, or Mute Period)
This parameter sets the number of minutes the beeper will “chirp” after the Mute button is pressed during an alarm condition. After the Silence Time elapses and the alarm condition still exists, the beeper will resume at full volume. This parameter may be set from 5 to 120 minutes.



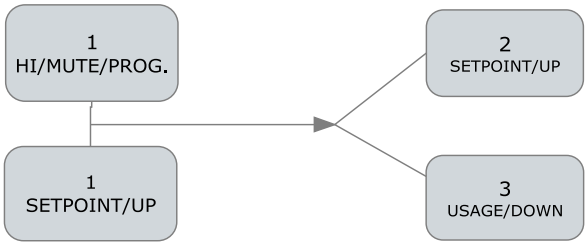
From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM button for two seconds to enter the Standard Programming mode.
2. Press HI/MUTE/PROGRAM a second time.
3. Press HI/MUTE/PROGRAM a third time.
4. Press HI/MUTE/PROGRAM a fourth time, the display will read **SIL** momentarily, and then its current value.
5. Press SETPOINT/UP ARROW to increase the number of minutes.
6. Press USAGE/DOWN ARROW to decrease the number of minutes.

CO_2 Control Parameters

Press and hold SETPOINT and PROGRAM buttons to activate

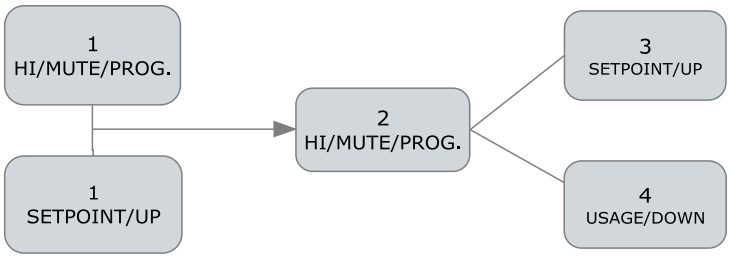
SP (Set Point)
This is the user-defined temperature set point at which CO_2 will be injected into the system. This parameter may be set from –60 to +40 °C and may be delayed by the rd parameter.



From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM and SETPOINT/UP ARROW buttons at the same time, the display will read **SP** momentarily, and then its current value.
2. Press SETPOINT/UP ARROW to raise the CO_2 injection temperature setting.
3. Press USAGE/DOWN ARROW to lower the CO_2 injection temperature setting.
4. Pressing the HI/MUTE/PROGRAM again will go to the ON parameter (next.)

On (On Time)
This is the user-defined time interval for CO_2 injection into the system. This parameter may be set from 5 to 900 seconds.

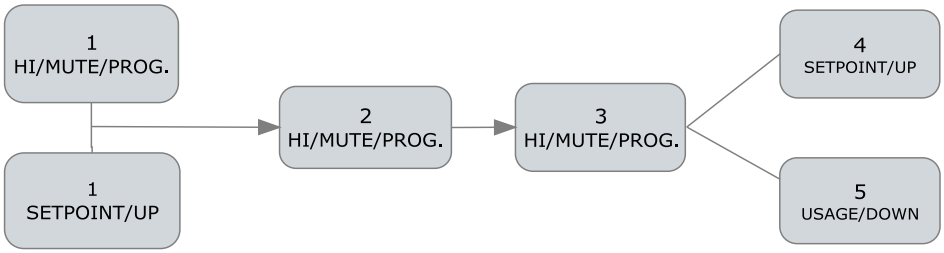


From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM and SETPOINT/UP ARROW buttons at the same time.
2. Press HI/MUTE/PROGRAM, the display will read **On** momentarily, and then its current value.
3. Press SETPOINT/UP ARROW to increase the CO_2 injection on time.
4. Press USAGE/DOWN ARROW to decrease the CO_2 injection on time.

CO_2 Control Parameters (continued)

OFF (Off Time)
This is the user-defined time interval between CO_2 injections. This parameter may be set from 10 to 900 seconds.

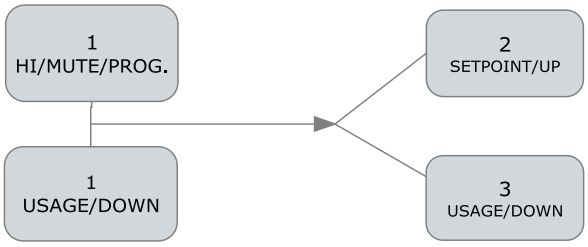


From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM and SETPOINT/UP ARROW buttons at the same time.
2. Press HI/MUTE/PROGRAM.
3. Press HI/MUTE/PROGRAM a second time, the display will read **Off** momentarily, and then its current value.
4. Press SETPOINT/UP ARROW to increase the off time.
5. Press USAGE/DOWN ARROW to decrease the off time.

Timers and Manual Valve Control (Press and hold USAGE and PROGRAM buttons to activate)

SUS (Suspend)
This parameter suspends the CO_2 injection for a specified time from 1 to 59 minutes, while both CO_2 injection and Hi Alarms are ignored and current process monitoring continues. The status light continues to flash green/red as normal, and the alarm LED provides a fast, short blink to indicate this special 'no-alarm' mode. When the **SUS** time expires, the system returns to normal monitoring and indication. The Suspend timer is displayed while in this mode, and the current process temperature may still be viewed by pressing the USAGE/Down arrow button. The timer is reset to zero by pressing the ALARM RESET button, or by manually setting it to zero.



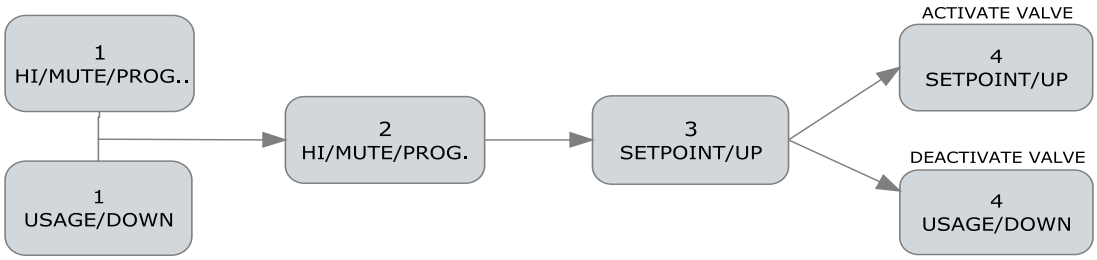
From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM and USAGE/DOWN ARROW buttons at the same time, the display will read **SUS** momentarily, and then its current value.
2. Press SETPOINT/UP ARROW to increase the suspend time.
3. Press USAGE/DOWN ARROW to decrease the suspend time.

Timers and Manual Valve Control (continued)

Pur (Purge)

This parameter is a manual control for activation of the CO_2 valve, used when the delivery tube must be purged for safety and/or maintenance purposes. Choices are 0 for valve off, 1 for valve on. It is only active while in programming mode, and upon exiting programming mode the value always resets to 0 (off). The user must confirm the displayed **YES** prompt before selecting 1 for valve on.

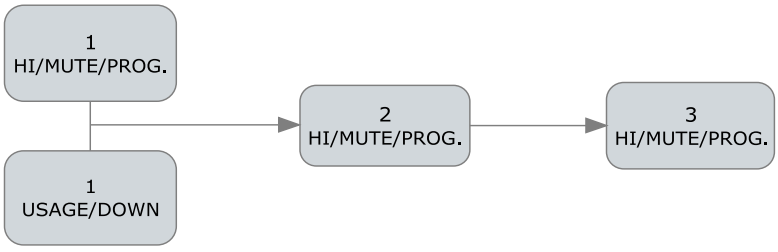


From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM and USAGE/DOWN ARROW buttons at the same time.
2. Press HI/MUTE/PROGRAM, the display will read **Pur**.
3. Press SETPOINT/UP ARROW for a **YES** prompt to confirm 'valve on' request.
4. Press SETPOINT/UP ARROW to activate the valve, the display will read **1**. Pressing the USAGE/DOWN ARROW button sets the displayed value to **0** to deactivate the valve.

CCO (Current CO_2 USAGE)

This parameter reports the current CO_2 usage amount in minutes and is reset to zero by pressing the ALARM RESET button.

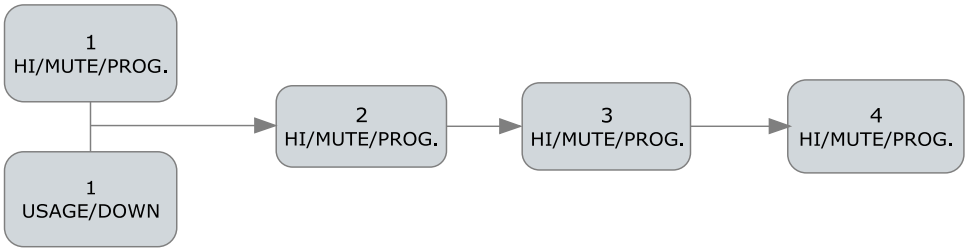


From Operating mode:

1. Press & hold the HI/MUTE/PROGRAM and USAGE/DOWN ARROW buttons at the same time.
2. Press HI/MUTE/PROGRAM.
3. Press HI/MUTE/PROGRAM again, the display will read **CCO** momentarily, and then its current value.

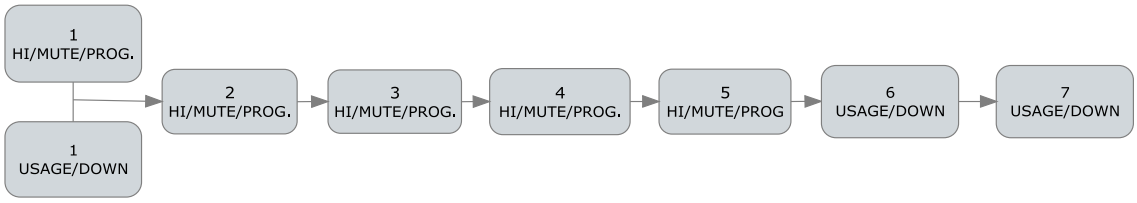
Timers and Manual Valve Control (continued)

CSt (CO_2 Started "CSt" minutes ago)
This parameter reports the number of minutes since the first CO_2 usage injection into the system and is reset to zero by pressing the ALARM RESET button.



From Operating mode:
1. Press & hold the HI/MUTE/PROGRAM and USAGE/DOWN ARROW buttons at the same time.
2. Press HI/MUTE/PROGRAM.
3. Press HI/MUTE/PROGRAM a second time.
4. Press HI/MUTE/PROGRAM again, the display will read **CSt** momentarily, and then its current value.

tCO (Total CO_2 USAGE)
This parameter reports the total minutes of CO_2 usage since the supply tank was installed and the user reset it back to zero. It may only be reset to zero by using the decrement (USAGE/down Arrow) button. Pressing the ALARM RESET button does NOT set this value to zero, unlike the **CCO** and **CSt** parameters.



From Operating mode:
1. Press & hold the HI/MUTE/PROGRAM and USAGE/DOWN ARROW buttons at the same time.
2. Press HI/MUTE/PROGRAM.
3. Press HI/MUTE/PROGRAM a second time.
4. Press HI/MUTE/PROGRAM a third time.
5. Press HI/MUTE/PROGRAM a fourth time, the display will read **tCO** momentarily, and then its current value.
6. Press USAGE/DOWN ARROW to display a **YES** prompt to confirm before resetting the value to zero, if desired.
7. Press USAGE/DOWN ARROW a second time to reset **tCO** to zero.

PERIODIC MAINTENANCE

Hampshire Controls Corporation recommends the following monthlyc maintenance to ensure proper system operation:

- Test the system to verify the control valve that supplies CO_2 operates properly. Use the **Pur** command as described in the Programming Parameters section of this manual.
- Test functionality of the door interlock switch circuit.
- Test all external systems controlled by the output relay.
- Observe all visual indicators function and are properly illuminated.
- Verify that an adequate supply of CO_2 is available for the system to operate.
- After 3 years of use, replace the internal battery in the BVM. Contact HCC for the correct replacement battery, and installation should be performed only by a qualified service technician. Recycle or dispose of the used battery properly.

TROUBLESHOOTING GUIDE

CA5000 Display is blank

- Verify Line power is connected.
- Verify interconnect cable is installed between the CA5000 and the Battery-Valve Module.

CA5000 Display reads incorrectly

- If the display shows a continuous reading of 1999, the probe or associated wiring has failed. Repair wiring or replace the probe as necessary.

Display reads: xx (numeric value)

- The Suspend timer is active. To view the actual process temperature press the **USAGE/Down arrow** button. To exit Suspend mode press **ALARM RESET** or press and hold the **USAGE/Down arrow** and **PROGRAM** buttons to adjust the timer to zero.

Constant Alarm Condition

- Verify the parameters are programmed correctly for your installation and process being monitored. See page 10 for Programming Mode Instructions.

Unit locks up or does not respond

- Remove line power by disconnecting the cable from the BVM to the display.

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 its products.