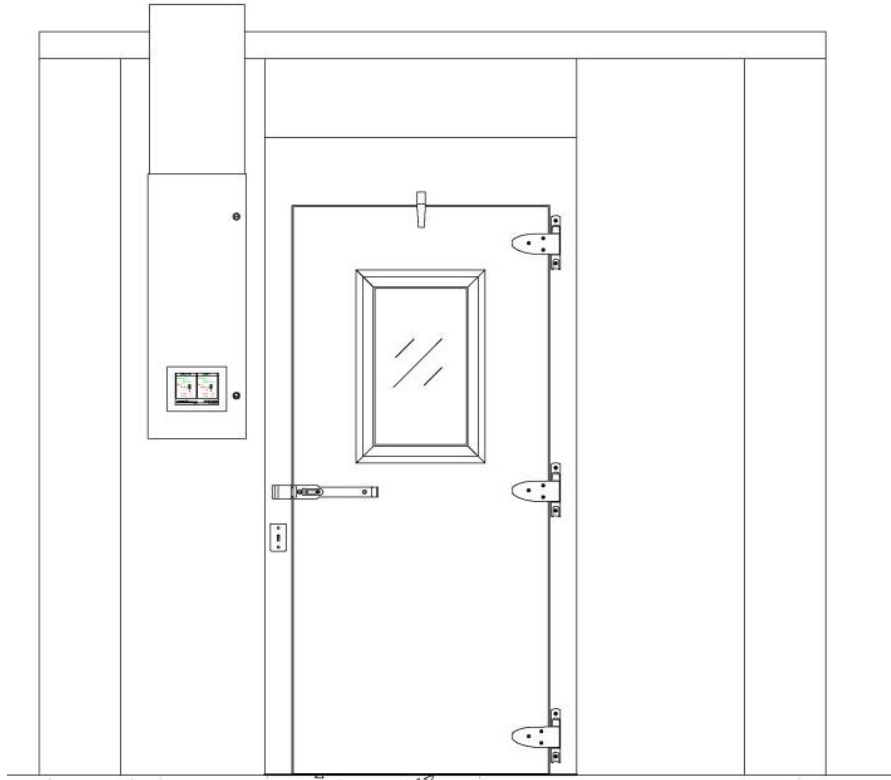




BIOCOLD
ENVIRONMENTS FOR LIFE

OPERATIONS & MAINTENANCE MANUAL



WEBSTER UNIVERSITY
INTERDISCIPLINARY SCIENCE BUILDING (ISB)
CONTROLLED ENVIRONMENT ROOM (CER)
+4°C WITH NON-CONDENSING HUMIDITY





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1. Introduction

BioCold Environmental rooms offer exceptional temperature and humidity control, as specified, for a wide range of applications. This manual is prepared for the walk-in environmental room installed at Webster University for the Interdisciplinary Science Building (ISB) in Webster Groves, Missouri. This manual contains information needed for proper operation of the BioCold environmental room. This chamber uses a BioCold Continuous Refrigeration system with hot gas bypass system with resistive heat, designed to accurately control room temperature at +4°C with ambient / non-condensing.

The control console also complies with the Americans with Disabilities Act (ADA). The BioLogic™ touchscreen allows system monitoring with a secure and dynamic interface at the screen or remotely.

This manual contains information needed for proper operation of the BioCold environmental rooms using the BioLogic™ touchscreen. For any questions or troubleshooting information not addressed in this manual, please contact the BioCold Environmental factory in Ellisville, Missouri (USA) at 636.349.0300 or service@biocold.com.

2. Principles of Operation

The BioCold refrigeration system operates as a “continuous proportional hot gas bypass system.” The compressor / condenser unit operates 100% of the time and does not cycle on/off or pump down even during a defrost cycle. BioCold takes the third refrigeration line (5/8” hot gas line) to the evaporator and introduces this through a side port manifold after the liquid expansion valve and before the distributor. The three refrigeration lines are introduced to the room through the ceiling and directly into the side of the air handler with only a few inches of exposed refrigeration lines. The liquid and hot gas solenoid valves are set on top the room, located near the ceiling stub out of the three refrigeration lines.

The BioCold control system includes a 7” color touchscreen user interface as well a programmable logic controller (PLC) with integrated process controls. The PLC is a modular system that includes a temperature process module, as well as dedicated logic modules for controlling chamber components. All operating parameter changes can be made via password-protected access at the color touchscreen interface, which also offers alarm history log and chamber trend data recording.

During normal operation, the 3/8” liquid line (cooling) solenoid valve (Sporlan Model XUP) and the 5/8” hot gas line (heating) solenoid valve (Sporlan Model XRM) cycle in order to control temperature in the evaporator coil. Both valves are normally closed and open when energized.

These valves are controlled by the microprocessor-based temperature controller with a 3/32 VDC output from a solid state relay inside the controller. This signal operates two (2) triac relays with one normally open for the liquid valve and the other normally closed for the hot gas valve. Thus, when one valve is open, the other is closed.

During normal operation, if there is a low temperature alarm event, the control signal is removed from both triac relays, causing both normally closed solenoid valves to close, the unit to pump down, and the compressor to shut off on low suction pressure control. When the remote interlock circuit is wired in series with the compressor contactor, both pump down and contactor coil interlock will occur during a low temperature alarm event. Also during a low limit alarm event in the cold rooms (default alarm temperature of +1°C), the alarm and compressor will cycle on / off, due to the fact that the room will begin to warm as soon as the compressor shuts off. When the room warms above the low limit alarm setpoint, the compressor will come back on, again dropping the temperature below the low alarm setpoint until the malfunction is diagnosed and remedied.

The control console is protected at all times. The unit is wired with a branch circuit using UL489 circuit breakers. Independent temperature safety limit controls are present for high and low temperature monitoring. Remote dry contacts also protect the mechanical equipment. Both an audible and visual alarm, and if applicable, personnel emergency alarm indicators are present as an additional safety feature; the alarm includes an adjustable delay and callback features.





3. Chamber Operations

The BioCold BioLogic™ Console is located on the walk-in exterior wall adjacent to the entry door. The console has a 7" color touchscreen and is connected to the component box mounted on top of each room via low voltage (24VDC) connections. This touchscreen has an "always on" display and high-precision touch accuracy for easy reference and adjustment.

All normal chamber operations are controlled at the BioLogic™ control panel, with temperature setpoint, current temperature reading, alarm setpoints, alarm history, temporary silence switch, and data logging / trend screen incorporated into the control panel. The component box houses the controls that operate the following: interior evaporator fans, lights, heaters, dehumidifier, and alarms.

NOTE: The component box contains equipment that operates on 115/230V, 1-phase or 3-phase power. This component box has a rotary disconnect and should only be opened by a trained professional.

3.1. Overview and Startup

Operation begins by applying power at the circuit breaker panel. After a few seconds of a self-test warm-up, the system will be ready to operate. The desired operating temperature is set or verified on the MAIN screen. The wide range rooms can be set to any temperature between +2°C and +40°C.

The startup procedure requires the user to have administrator privileges to modify the factory parameters like the setpoint. Details of each screen are provided in its corresponding section below.

- a) Ensure control console and condensing unit have power and power disconnects are in ON position.
- b) Touch LOG ON button on welcome screen (Figure 1, left).
- c) Enter the appropriate USER NAME and PASSWORD in the LOG ON popup window.
- d) Touch MAIN button on the welcome screen.
- e) Set controller setpoint to desired operating temperature.

NOTE: If room is in alarm condition on initial startup, temporarily adjust alarm settings to mitigate an alarm condition. Alarm settings can be readjusted once room reaches normally operating temperatures.

3.2. BioLogic™ Screens and Windows

BioCold designs specialized screens for the control console that monitors and modifies changes in the CER. This section educates the user on the basic functions and / or operations of the screen and its corresponding windows that may pop-up during user options, configuration settings or alarms.

NOTE: The control console screens for your specific CER may vary slightly from those shown in this manual as each console is uniquely tailored for each room. This manual allows the user(s) to gain basic understanding to control the console and its settings.





3.2.1. Log On Window

The LOG ON window (Figure 1) will appear when the LOG ON button is selected. Each parameter has a predetermined security setting in which a user only with that security level or higher may modify that specific parameter. Details are provided in the corresponding Security section below.



Figure 1. Log On Window

3.2.2. Main Screen

The BioLogic™ MAIN operating screen (Figure 2) navigates to all the information needed for normal system monitoring, including temperature and humidity, as applicable, setpoints, current temperature and / or humidity reading(s), and high / low alarm setpoints. The MAIN button is available on each console screen. The temperature or humidity setpoint is changed directly from the MAIN screen or the TEMPERATURE TUNING screen.

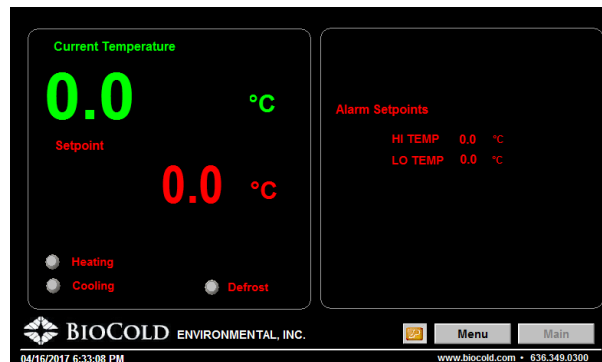


Figure 2. Main Screen

The MAIN screen also displays the status of various parameters, based on the specifications of the room. The status will show a green circle when that parameter is enabled or active. Examples of the various statuses available for display include, but are not limited to, (1) the heat being pumped in via resistive heater(s) or hot gas typically, (2) the cooling of the liquid valve(s), (3) the humidifier(s), (4) dehumidifier(s), (5) defrost, and / or (6) the specific system or zone in a multi-system or multi-zone chamber.

NOTE: When a loss of power to the control panel occurs, an error message may be seen. This is due to the RTD resetting itself; at initial power, the RTD reads a temperature of -270°C, which results in a failure / alarm. This is as-designed and allows the personnel to acknowledge the power incident and assess any other conditions as needed.

To adjust any parameters, users must first log on with the corresponding privileges (See Security, Section 3.3.).





Once logged on, the user may adjust temperature setpoints either by using the + / - buttons, or by using the popup keypad (Figure 3) to input the specific value. To access the popup keypad, first click on the setpoint digits (in Figure 2, this would be "0.0") to view the cursor, and then double-click to activate the popup keypad.

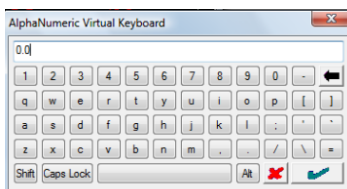


Figure 3. Alphanumeric Keyboard

3.2.3. Menu Screen

The BioLogic™ MENU operating screen (Figure 4) navigates to all the information needed for normal system monitoring, including temperature and humidity, as applicable, setpoints, current temperature and / or humidity reading(s), and high / low alarm setpoints. The MAIN button is available on each console screen. The temperature or humidity setpoint is changed directly from the MAIN screen. The screen contains buttons for each page needed for chamber operation. Based on the logon privileges, unavailable features will be grayed and non-selectable. The MAIN button is available on each console screen.

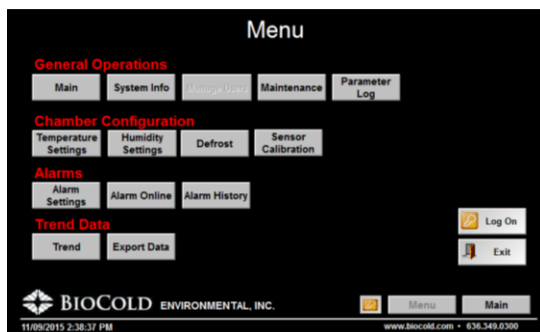


Figure 4. Menu Screen

The MENU screen is divided into four primary options and CER-dependent secondary options of control:

1. General Operations
 - a. Main
 - b. System Info
 - c. Factory (for BioCold or authorized use only)
 - d. Log On
 - e. Exit (user must be logged on)
2. Chamber Configurations (may include but are not limited to these options)
 - a. Temperature Settings
 - b. Defrost Settings (not applicable for warm rooms)
 - c. Humidity Settings
 - d. Redundancy Settings
 - e. Grow Lights
 - f. Sensor Calibration





- g. Parameter Log
- h. Ventilation
- 3. Alarms
 - a. Alarm Settings
 - b. Alarm Online
 - c. Alarm History
- 4. Trend Data
 - a. Trend
 - b. Export Data.

These screens and any corresponding windows not identified earlier are further detailed in its corresponding sections.

3.2.4. System Information (Startup) Screen

The BioLogic™ SYSTEM INFORMATION screen (Figure 5) is the central screen to navigate to other screens, if needed. The user can LOG ON via this screen or the MENU screen. The information on this startup screen cites factory information such as the version of the software and its corresponding project name.



Figure 5. System Information (Startup) Screen

3.2.5. Parameter Log Screen

The BioLogic™ PARAMETER LOG screen (Figure 6) is a table that is automatically generated to display changes made by a user to the settings of the control console. The timestamp, details of the change, new value, previous value, and user, respectively are captured in this table.

Figure 6. Parameter Log Screen





3.2.6. Maintenance Schedule Checklist Screen

BioCold Environmental highly recommends the upkeep and maintenance of the CER (see Section 3.5). The MAINTENANCE popup window (Figure 7a) provides a reminder for Facilities and/or the responsible team to ensure that the scheduled maintenance is performed. To remove this popup window, hit the Maintenance Reminder acknowledged button.



Figure 7a. Maintenance Schedule Checklist Screen

The MAINTENANCE screen (Figure 7b) will appear with maintenance information. The checklist includes:

1. Check the fan motor operations
2. Remove any obstructions from fan intake
3. Clean any dust accumulation from compressor / condensing unit
4. Verify the alarm settings and modify as needed
5. Clean the condenser coil, based on the hours of operation.

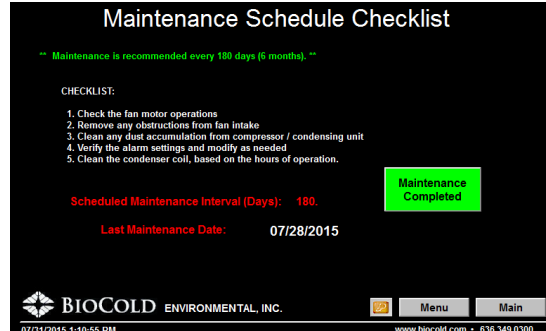


Figure 7b. Maintenance Schedule Checklist Screen

A scheduled interval of 180 days is recommended. This field is editable but a value no greater than 180 days is suggested to ensure that the equipment is checked and operates as specified by the requirements. Once this maintenance is completed, the authorized user will select the MAINTENANCE COMPLETED button and the “Last Maintenance Date” will show as that current day and the interval clock will reset.

3.2.7. Temperature Configuration (Settings) Screen

The BioLogic™ Control Panel incorporates a microprocessor-based Proportional, Integral, and Derivative (PID) controllers for both temperature and humidity (where applicable). These controllers use the PID bands to provide straight-line control.





The TEMPERATURE CONFIGURATION (settings) screen (Figure 8) includes all the parameters needed for temperature operation and adjustment. This single room operates under a single sensor.

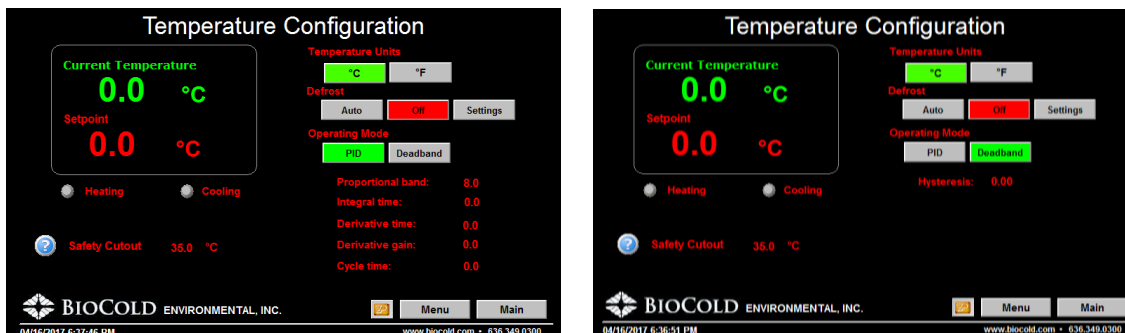


Figure 8. Temperature Configuration Screen with Deadband (left) and PID (right) Mode

The standard operating temperature of the room determines the available parameters on the screen. For example, a cold room or freezer will include the defrost setting. A stability, warm or wide range room may include Chamber Temperature Limits (i.e., cut-outs and cut-ins), which are set values to efficiently use as well as protect the equipment for the CER. More detail is provided in the Additional Information, Warning and Alarm Screen(s) section below.

3.2.7.1. Temperature Setpoint

To adjust the temperature setpoint, click on the temperature setpoint value, and use the popup keypad to adjust chamber temperature. Two operating modes are available: PID or Deadband or hysteresis control.

3.2.7.2. Temperature Units

The user has the option to select the units of temperature. Both the English unit of Fahrenheit and the metric unit of Centigrade (Celsius) are available. The numeric value of the temperature will be converted automatically based on the selected unit.

NOTE: When selecting a different temperature unit, the alarm may be triggered because the range of the alarm setting has not changed. An authorized user will need to adjust this value via the ALARM SETTINGS screen to disengage the alarm based on the selected unit for temperature.

3.2.7.3. Temperature Operation Modes

For normal operation, PID mode provides the tightest control. Each of the PID parameters may be individually adjusted using the Proportional Band, Integral, Derivative and Cycle Time parameters.

3.2.7.3.1. PID Mode

When in PID, five (5) control tuning parameters are calculated: Proportional Band, Integral Time, Derivative Time, Derivative Gain, and Cycle Time.

The default values for the temperature modes are:

1. Proportional Band: 2.0
2. Integral Time = 250.0





3. Derivative Time = 60.0
4. Derivative Gain = 1.0
5. Cycle Time = 15.0

- a) **Proportional Band:** This band is a percentage value or amount of change for the input parameter to generate a full change (0 to 100% or vice versa) in the output of the controller. The narrower the band, the smaller the area of the controller's proportioning action. This value is also referenced as the gain, which is the reciprocal of the proportional band. For example, a PB = 25 will have a change of 100% in the output when the parameter has changed by 25° from the setpoint. Trial-and-error settings may need to be tried to achieve the desired PB control.
- a. The desired PB results in a value very close to the setpoint. In the Figure 9 below, the temperature oscillations of the purple line mimics that with close to ideal tuning, with the red line as the setpoint.
 - b. If the result seen is more similar to the blue line with large over-and under-shooting values, then adjust the PB to one-half the current value.
 - c. The green line correction action would be to multiply the PB by 2x since no oscillations are detected.

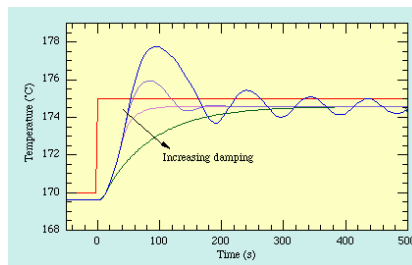
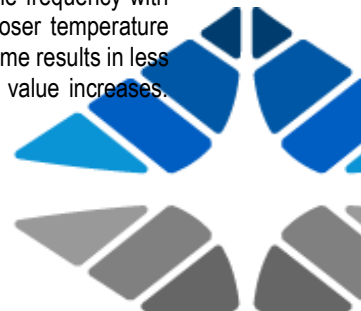


Figure 9. PID Oscillation Adjustments Graph

- b) **Integral Time:** This reset adjusts the proportional bandwidth to the setpoint; this function of time compensates for the offset from the setpoint. Excessive overshoot may indicate that this value is set too high; output oscillations indicate that the Integral value may be too low. Note that changes to this value require a corresponding change in the Derivative Time; these values are inversely proportional.
- c) **Derivative Time:** This value adjusts for the expected rate of the rise/fall of a system parameter like the temperature, and allows for an automatic modification of the proportional band to reduce the magnitude of the offshoot value. Excessive overshoot may indicate that this value is set too high as with the Integral Time. Note that changes to this value require a corresponding change in the Integral Time; these values are inversely proportional.
- d) **Derivative Gain:** The other derivative parameter is the derivative gain. The magnitude of the derivative error to the control action is the derivative gain. If the controller is determining a significant change, the derivative value creates a "slowing" action for the change requested by the controller. The default derivative gain is 1.0.
- e) **Cycle Time:** This time is also known as the duty cycle of the controller, which equates to the total length of time for the full on/off cycle. The unit for the cycle time is seconds and governs the frequency with which the controller monitors system conditions. A shorter cycle time will provide closer temperature control, with more frequent indexing of the refrigeration solenoid valves. Longer cycle time results in less frequent valve indexing with a gradual loss of straight line control as the cycle time value increases.





Controls are factory set with a cycle time of five (5) seconds, but this value may be adjusted to any non-zero value.

3.2.7.3.2. Deadband Mode

When in Deadband mode, hysteresis determines the operations. The hysteresis is the value above / below the set point that the operating condition does not change. For example, if the hysteresis is 1.0 and the temperature setpoint is +4.0°C then the heating will turn off at +5.0°C and turn off at +3.0°C. The general idea is to have a more steady heating or cooling when the temperature outside a range of tolerance.

The default hysteresis value is 0.1.

Chamber Temperature Limits (i.e., cutouts and / or cutins) are set values to efficiently use as well as protect the equipment for the CER. More detail is provided in the Additional Information, Warning and Alarm Screen(s) section below.

3.2.8. Defrost Setting Screen

The defrost setting can be accessed via the MENU screen or the TEMPERATURE CONFIGURATION (Figure 10) screen. Defrost cycles are not typically needed on BioCold rooms operating at +4°C or above, and the defrost cycles will default to ON for freezer rooms. Details of this screen are provided in its corresponding section below.

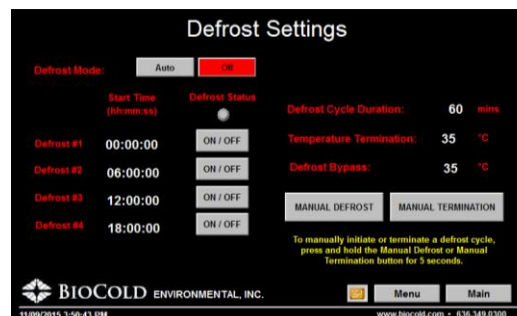
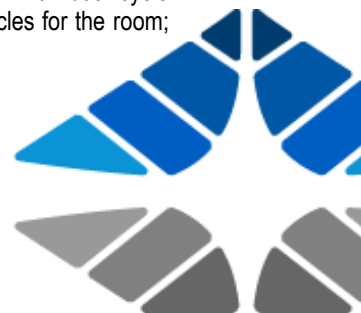


Figure 10. Defrost Setting Screen

In the event that regular defrost cycles do become necessary, the user sets this parameter by selecting the AUTO button for defrost on the Temperature Configuration Screen. The display allow the user to adjust the start times and duration of defrost cycles, up to four (4) cycles per day. The settings on the Defrost Settings screen will control defrost cycles when the Defrost Mode is set to AUTO, currently the button shows as OFF next to the corresponding start times. The defrost time clock is based on the touchscreen internal clock on the lower left corner.

This screen allows the authorized user to adjust the start times and duration of defrost cycles, up to four (4) cycles per day. Enter the start time using the military format for each cycle. For example, 2:15pm would equate to 14:15:00 value for the start time. The defrost cycles are individually enabled by selection the ON/OFF button next to the corresponding defrost start time. When the ON/OFF button is gray, that defrost cycle is disabled; when the button is green, the defrost cycle will trigger at the start time.

To enable the defrost cycles; select the Defrost Mode to AUTO in the DEFROST MODE field. Each individual cycle must be also enabled (i.e., set to ON (green)) to start the defrost cycle. To disable all the defrost cycles for the room; select the OFF button in the upper left for the DEFROST MODE field.





Note: The defrost time clock is based on the touchscreen internal clock on the lower left corner.

The room can be controlled manually for the defrost cycles. The MANUAL DEFROST button allows the room to start manually defrosting at that button request and will last based on the DEFROST CYCLE DURATION value entered. Alternately, if the system is currently in defrost mode, the MANUAL TERMINATION button allows the authorized user to instantly stop the current defrost cycle

3.2.9. Calibration Screens

The chamber is equipped with offset calibration capabilities for the temperature and humidity (as applicable) sensor(s), which can be accessed via the SENSOR CALIBRATION button on the MENU screen. Two calibration options are available to more accurately adjust to the room's present value temperature.

3.2.9.1. Calibration Mode

To calibrate chamber temperature on the CALIBRATION MODE screen (Figure 11), adjust the sensor calibration offset so that the system reading aligns with the standard instrument.

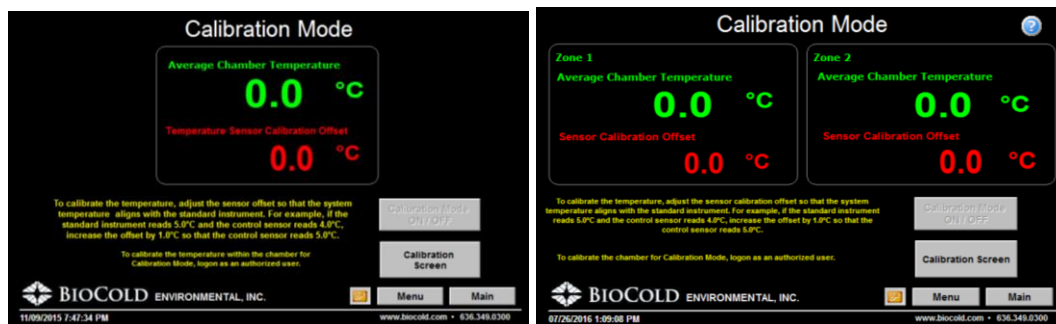


Figure 11. Sensor Calibration Mode Screen

Entering a negative value as the offset will subtract this value from the average sensor reading; a positive value for the sensor calibration offset will raise the sensor reading. This value is added to the current sensor reading prior to initially computing the average value.

The CALIBRATION MODE button allows the room to be calibrated by disabling all outputs from the PLC as well as the corresponding alarms. Only an authorized user can access this mode.

The CALIBRATION SCREEN button displays a new screen to allow adjustment to the average chamber parameters for mapping purposes.

3.2.9.2. Calibration with Uniformity Offset

The dimensions of a larger chamber can result in varying sensor readings. The sensor temperature is the averaged sensor calibration offset plus an initially averaged chamber parameter, given no uniformity temperature calibration offset.





The uniformity calibration offset is the value obtained during the room mapping process. The final averaged chamber temperature is the addition of the uniformity calibration offset with the average of both the sensor reading and the sensor calibration offset.

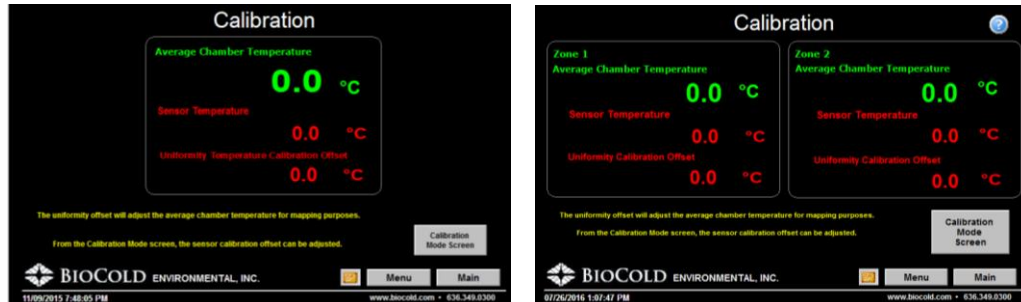


Figure 12. Calibration Screen

On the CALIBRATION SCREEN (Figure 12), entering a negative value as the offset will subtract this value from the average sensor reading; a positive value for the sensor calibration offset will raise the sensor reading. To enter a new value, double-tap on the sensor calibration offset value and use the popup on-screen keyboard to enter new values. This value is added to the current sensor reading prior to initially compute the average value.

3.2.10. Alarm Settings Screen

The BioLogic™ system provides alarm outputs if the room temperature. The high and lows of the parameters for this room are set in this screen (Figure 13) and are also displayed on the MAIN screen. Additional alarm parameters for delays and callbacks are also editable on this screen.

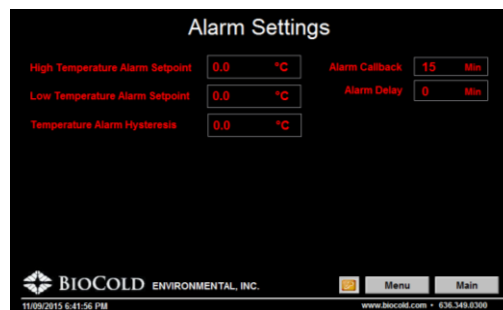
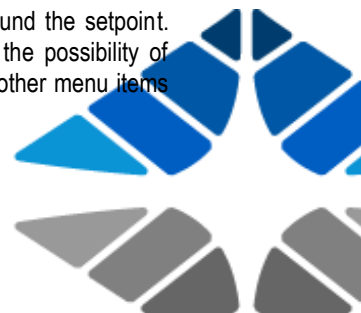


Figure 13. Alarm Settings Screen

3.2.10.1. High and Low Alarms

The high and low setpoints for the high and low alarms, respectively, can be set for the temperature as well as the humidity, if applicable. This value will trigger an alarm when the present value exceeds the high alarm setpoint or falls below the low alarm setpoint.

Upon operation near the desired setpoint the alarms can be set to the desired tolerance around the setpoint. BioCold recommends setting the alarms a minimum of 2.0°C from the setpoint to minimize the possibility of setting the alarms off when the door is left open for short periods of time. Do not change any other menu items





when setting the alarms. The operator with the appropriate security level may set these alarms based on site requirements and specifications.

3.2.10.2. High and Low Alarm Indicator

When an alarm event occurs, the audible alarm will sound and an alarm popup (Figure 14) will appear on the screen. To temporarily silence the audible alarm, press the ALARM SILENCE button. Use the ALARM DETAILS button to obtain the details of alarm and the alarm can also be silenced from this screen. This screen is also available on the MENU screen utilizing the ALARM ONLINE button for the status. See the below section for more details on the ALARM ONLINE screen.



Figure 14. Temperature Alarm Popup Windows

The audible alarm, i.e., buzzer, will continue until the alarm condition is remedied or the alarm is manually silenced by the operator. If the alarm is manually silenced, the alarm will re-sound based upon the Alarm Callback value if the chamber is still in alarm condition.

3.2.10.3. Callback and Delay Timers

There are various timers associated with the alarms. Typically, two types of timers are available: callback timer and delay timer.

The callback timer re-sounds the alarm after the Alarm Callback value has elapsed and the CER is still in the alarm condition. The callback timer will be reset if the alarm condition is remedied. This timer is used to silence the timer in order to contact an authorized user, facilities, and / or BioCold to investigate this alarm as needed.

The delay timer prevents the alarm from triggering and the buzzer from sounding until the Alarm Delay value has elapsed. The delay timer also delays any of the fail-safe triggers until this delay value has completed. This delay is useful when often opening or closing the door for extended periods of time or other circumstances where there are known and frequent external factors that may trigger an alarm otherwise

3.2.11. Alarm Online (Status) Screen

The ALARM ONLINE (Figure 15) screen cites the status of the current or past alarms within this chamber. When an alarm event occurs, the ALARM ONLINE screen provides details concerning the nature of the alarm and user responding to the alarm. The specific details are:

- a) the time the alarm occurred;
- b) the type of alarm (i.e., high temperature alarm);





- c) the time the alarm event cleared/normalized;
- d) the user who acknowledged the alarm condition.

Additional fields may be selected by the user using the COLUMN button.

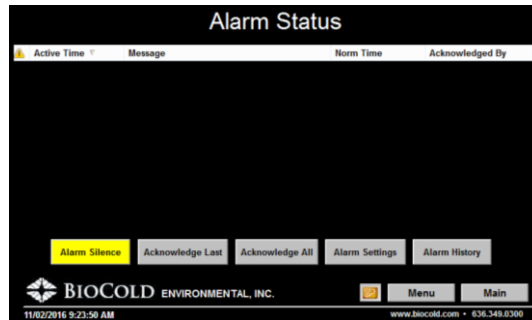


Figure 15. Alarm Online (Status) Screen

The ALARM SILENCE button is highlighted in yellow and appears on the ALARM ONLINE screen. This will silence the audible alarm until the failure can be diagnosed and repaired. If multiple alarms are triggered, then the latest individual or all the current alarms can be acknowledged by selecting the ACKNOWLEDGE LAST or ACKNOWLEDGE ALL button, respectively.

3.2.12. Alarm History Screen

The ALARM HISTORY screen (Figure 16) displays up to the last 100 alarm events with information showing:

- a) the time the alarm occurred;
- b) the type of alarm (i.e., high temperature alarm);
- c) the time the alarm event was acknowledged; and
- d) the time the alarm event cleared/normalized.

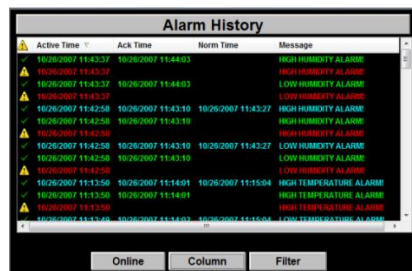


Figure 16. Alarm History Screen

Additional fields may be selected by the user using the COLUMN button on the ALARM HISTORY screen.





3.2.13. Trend Screen

The BioLogic™ HMI hard drive stores temperature and humidity trend data via the TREND screen (Figure 17) securely for a period of 365 days. Data can be accessed using the TREND button from the MENU screen.

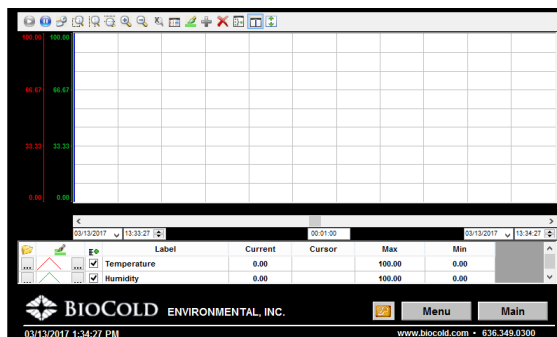


Figure 17. Trend Data Screen

The toolbar across the top of the Trend grid allows a single-button manipulation of the data within the grid. The options are from left to right:

Command/Tool	Description
Run	Sets the trend control to Run Mode (a.k.a. Online Mode). In this mode, the X-axis continues to scroll with the passage of time and the trends are updated with current tag values.
Stop	Sets the trend control to Stop Mode (a.k.a. Historical Mode). In this mode, the X-axis is stopped and the trends display only historical data. If decimation is enabled for one or more trends, the calculation and redrawing is done only in this mode.
Period	Opens a dialog which can be used to modify the X-axis scale main settings.
Window Zoom	Allows the user to click on the trend graph and drag the cursor to select the area that must be visible when the cursor is released. This option is disabled when the Multiple Section option (for the Y scale) is active.
Horizontal Zoom	Allows the user to click on two points in the trend graph, defining the horizontal scale that must be available.
Vertical Zoom	Allows the user to click on two points in the trend graph, defining the vertical scale that must be available. This option is disabled when the Multiple Section option (for the Y scale) is active.
Zoom In	Allows the user to zoom in (display half of the current X and Y scales) each time they click on the trend graph.
Zoom Out	Allows the user to zoom out each time they click on the trend graph.
Cancel Zoom	Cancels the current Window , Horizontal or Vertical Zoom and returns the trend graph to its original scale.
Legend Properties	Opens a dialog which can be used to modify the Legend main settings.
Pen Style	Opens a dialog which can be used to modify the pen style of the selected trend.
Add Pen	Opens a dialog which can be used to add a new trend to the trend control.
Remove Pen	Removes the selected trend from the trend control.
Multiple Sections	Switches the Y scale between Multiple Sections (a section for each trend) and Single Section (all trend share the same Y scale section).



<u>Command/Tool</u>	<u>Description</u>
Cursor	Switches the cursor (ruler) between visible and hidden.
Auto Scale	Changes the Y axis scale to fit all values from the trends that are currently being monitored.

3.2.14. Export Data Screen

From the MAIN menu, the EXPORT DATA button allows users to export the proprietary secure data stored on the HMI into a CSV file which can be easily viewed using spreadsheet software such as Microsoft Excel. This screen is called the EXPORT DATA screen (Figure 18).

Note: A mouse or stylus is recommended to enter information during this exporting of data exercise. To enter a new value without a mouse, double-tap on the desired field value and use the popup on-screen keyboard to enter new value.

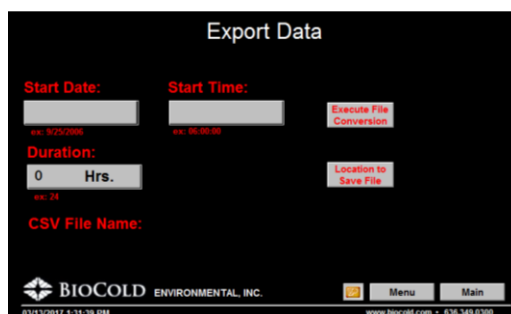


Figure 18. Export Data Screen

- To transfer the file to the USB device:
 - Unlock / unscrew and open the touchscreen enclosure.
 - Insert the memory stick in the USB port underneath the bezel of the touchscreen.
- From the EXPORT Data screen, enter a start date (mm/dd/yyyy), start time (hh:mm:ss), and duration (in hours) for the period to be downloaded.

For example, to download data for the week of July 1, 2016, enter a start date of 07/01/2016, start time of 00:00:00 and duration of 168 hours.

- Select the LOCATION TO SAVE FILE button to enter the desired file name of the document being generated and the path where the file will be saved

** The downloaded data has a default location in the folder \\storagecard\biocold\TrendHstCSV\ on the storage card (typically an SD card).

** The USB memory device displays as the "HardDisk" icon in the Windows Explorer window.

- Hit the EXECUTE FILE CONVERSION button to generate the file.





3.2.15. Fuji Limit Controller

The Fuji PXR4 limit temperature controller (Figure 19) provides alarm outputs if the room temperature exceeds the high or low temperature alarm settings as a safety cutout to shut down all or most heat-producing components to protect the control panel. When either alarm occurs, the appropriate HIGH or LOW alarm light will illuminate on the face of this controller and the remote alarm dry contacts will be activated. The range of this controller's alarm setpoints is wider than the range of the CER's alarm setpoints so the audible alarm would sound before the limit alarm would take effect.



Figure 19. Limit Controller

The upper right corner of limit controller indicates its function of °C, or as a temperature limit controller. As needed, a humidity limit controller may also be required and would be annotated with the %RH designation.

3.2.15.1. Display

The limit controller display is as follows:

- Upper right corner of controller indicates function: °C or %RH.
- PV (Process Value) = Indicates actual temperature/humidity level in chamber
- SV (Set Value) = Indicates temperature/humidity setpoint
- AL 1 AND AL 2 = Indicate alarm conditions (Unit is in alarm when lit).

The controller automatically returns to the default display screen after about one (1) minute of inactivity.

3.2.15.2. Clock

The clock on the limit controller can be adjusted as needed. On the face of the limit controller, push the ESC button once or twice to show the following:

>Stop
Set Param
Set Clock
Prg Name

- a. Push the down button to select "**Set Clock.**"





- b. Push the OK button once and then the up or down buttons as necessary to select the current day of the week.
- c. Push the right arrow key to the first time digit. (Use a 24 hour format.)
- d. Set the first digit by pushing the up or down buttons and then push the right button.
- e. Similarly, set the subsequent time digits and the date digits.
- f. When complete push the OK button

Push the ESC button and the date/time will be displayed.

3.2.15.3. Menu Selection

All control functions are available via the green SEL (select) button.

The three menus for the limit controller are accessed by pressing and holding the SEL button. While holding the SEL button, the menus will scroll automatically. Release the button at the menu desired; the up and down chevron or arrow buttons are to the right of the green SEL button, respectively. The submenus are adjusted using these buttons. Values are changed by tapping the SEL button until the value flashes then moving the value up or down using the arrow keys. Enter new values using the SEL button. After a period of approximately one minute, the control will revert to the default display.

- The first menu begins with the parameter "Stby"
- The second menu begins with the parameter "P"
- The third menu begins with the parameter "P-n1"

To change setpoint values, press the arrow button up or down, based upon the appropriate direction. No other adjustments will need to be made other than changing the alarm setpoints. The controllers can be "locked" by using the "LOC" function to prevent unauthorized tampering and are unlocked at the factory - consult the Fuji Microcontroller Manual for more details.

3.2.15.4. High and Low Alarms

The high and low alarms are factory preset at a safety setpoint temperature above ambient (+35°C for instance) and 1.0°C, respectively.

- **To change High Limit Alarm value:**
 - Press SEL button and hold down until you see "STby".
 - Press down arrow until you see "AL1"
 - Press SEL until lower number flashes.
 - Use arrow keys to create a new value for the high limit alarm
 - Press SEL to enter.
- **To change Low Limit Alarm value:**
 - Press SEL button and hold down until you see "STby".
 - Press down arrow until you see "AL2"
 - Press SEL until lower number flashes.
 - Use arrow keys to create a new value for the low limit alarm





- Press SEL to enter.

3.3. Adjusting the HMI Time and Date

The data collected is based upon the time and date located in the left side of the footer of most screens. If the date and time of the touchscreen need to be adjusted, then follow these instructions below. A USB mouse is recommended to make this adjustment and an admin user for the touchscreen is required.

3.3.1. Via the Factory Screen

- 1) Login to the touchscreen as a “biocold” user from the MAIN or MENU screen.
- 2) Select the FACTORY button from the MENU screen
- 3) Double tap on the parameter to be changed.
 - a. Enter the time using the military format of 00:00:00 (hh:mm:ss)
 - b. Enter the date using the format of MM/DD/YYYY
- 4) Hit the corresponding button adjacent to the parameter to set value

3.3.2. Via Windows Desktop

- 1) Open the control panel door.
- 2) Plug the USB mouse into the USB port on the bottom side of the HMI unit.
- 3) Login to the touchscreen as an “admin” user from the MAIN or MENU screen.
- 4) Go to MENU screen (Figure 20)
- 5) Select the Logon button (gold key icon)
 - a) Enter valid username
 - b) Enter valid password
 - c) Hit “OK” button



Figure 20. Logging into Project

- 6) In the MENU screen, select the Exit button (to the right side of the screen) and confirm the command (Figure 21).





Figure 21. Logging Out of Project

- 7) The screen will now look similar to a Windows screen with a Remote Agent dialog window on the desktop.
- 8) Use the mouse to cursor to the lower part of the screen to view the Taskbar.
- 9) Double-click on the time in the Taskbar.
- 10) In the popup window, check the checkbox to “Automatically adjust clock for Daylight Savings.”
- 11) Make any necessary adjustments to the date, hour and/or minute value(s) (Figure 22).

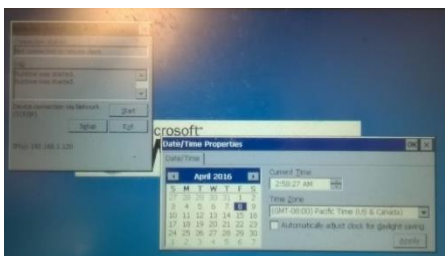


Figure 22. Adjusting Date and Time

- 12) Hit the “Apply” button.
- 13) On the Remote Agent window, hit the “Start” button.
If the program does not start within one (1) minute, cycle the power to the touchscreen.

3.4. Security

The BioCold BioLogic™ HMI interface incorporates logic designed to ensure that only authorized users can modify various parameters to ensure the chamber integrity. The MANAGE USERS screen (Figure 23) allows the administrator to manage the users for the room via the MENU screen. This screen option is unavailable until an admin or user of higher privilege is authenticated and the button will be selectable by the admin. The administrator has up to four (4) user account management options: create user, delete user, reset user password, and unblock a user.

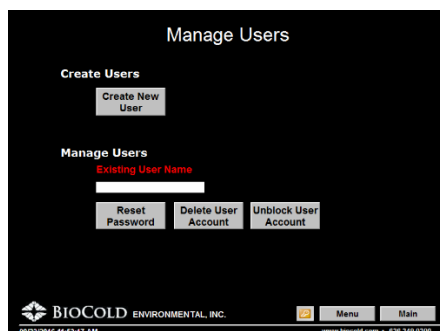


Figure 23. Manage Users Screen





3.4.1. User Accounts

The BioCold BioLogic™ HMI interface has three (3) levels of customer account access security during runtime: guest, user, and administrator. A fourth account is specifically set aside for the factory for development and runtime rights. Only the administrator can create and manage the users once the HMI is fielded.

Screen fonts will be a light grey when the current user logged in is not authorized to make changes to a button selection; conversely, the button font will be black with the appropriate access level. Editable values such as setpoints will show as a grey text field background when not accessible by that user level. A blue text field background on editable values indicates an authorized user is logged in.

A full group account matrix is provided below.

To create a new user account, log on with an administrator level username and password. The MENU screen will now show a MANAGE USER button in the top row. Click on that row to display the MANAGE USERS screen (Figure 24).

3.4.1.1. Guest Access Level

The GUEST account is the default access to the chamber operation and allows basic project control.

Without logging in, a user from the GUEST level can only view most chamber parameters as applicable via the MENU or system information screen:

- (MAIN, TEMPERATURE or HUMIDITY SETTING) temperature and humidity setpoints
- (MAIN, TEMPERATURE or HUMIDITY SETTING) current temperature and humidity readings
- (MAIN or ALARM SETTING) high and low alarms setpoints
- (SENSOR CALIBRATION) calibration values
- (MAIN or REDUNDANT) refrigeration system or controls status
- (ALL) alarm and notification / informational popup windows
- (ALARM HISTORY and ALARM ONLINE) current and past alarm information
- (SYSTEM INFO) startup or project information
- (PARAMETER LOG) changes to parameters by a user or PLC
- (MAINTENANCE) scheduled maintenance information.

Guests cannot modify any chamber settings but can silence an active alarm via its corresponding popup. Guests are able to manipulate the trend data to zoom in, zoom out, etc. because there is no modification to the actual values.

3.4.1.2. User Access Level

The USER level account has all the viewing rights as the GUEST account as well as can access most chamber functions. The user can edit the values or settings for the following parameters:

- (ALARM SETTING and TEMPERATURE / HUMIDITY SETTINGS) high and low setpoints and corresponding hysteresis, alarm delay, alarm callback
- (EXPORT DATA) reports for trend data
- (MAINTENANCE) maintenance duration and last timestamp
- (MENU) exiting or restarting the project server.





The USER has a minimum password size of five (5) characters with a minimum of one (1) alpha character and one (1) numeric character and no requirement for special characters. The password will expire after 180 days. This user will be logged off the project ten (10) minutes after the last user action. For security purposes, the account will be locked up after three (3) invalid attempts and will remain locked until unblocked by the administrator.

3.4.1.3. Administrator Access Level

The ADMINISTRATOR level account has all the viewing and editing rights as the USER account as well as can access most chamber functions.

- (MANAGE USERS) user access control
- (SENSOR CALIBRATION) sensor offsets

The chamber is shipped with one default administrator account:

Default Administrator Login: admin
Default Password: 63011 or 63011a

The ADMINISTRATOR has a minimum password size of six (6) characters with a minimum of one (1) alpha character and one (1) numeric character and no requirement for special characters. The password will expire after 180 days. This user will be logged off the project ten (10) minutes after the last user action. For security purposes, the account will be locked up after three (3) invalid attempts and will remain blocked until unblocked by the factory.

3.4.1.4. User Account Access Matrix

Permission	Group Account			
	Guest	User	Admin	Factory
VIEW	X	X	X	X
Current Temperature and Humidity Values	X	X	X	X
Temperature and Humidity Setpoints	X	X	X	X
Temperature and Humidity Calibration Offsets	X	X	X	X
Heating and Cooling Status	X	X	X	X
Humidification Equipment Status	X	X	X	X
Defrost Status (Cold Rooms and Freezers)	X	X	X	X
High and Low Alarm Setpoints	X	X	X	X
Alarm Hysteresis Values	X	X	X	X
Door Alarm Delay and Inhibit	X	X	X	X
Temperature and Humidity Operating Modes	X	X	X	X
Temperature Units	X	X	X	X
Temperature and Humidity PID and Deadband Parameters	X	X	X	X
Temperature Cutouts and Cutins	X	X	X	X
Alarm and Failure Popup Windows	X	X	X	X
Refrigeration System Status and Failure(s)	X	X	X	X
Alarm Silence	X	X	X	X
Informational Popup Windows	X	X	X	X
Alarm History	X	X	X	X
Current Alarm Online	X	X	X	X
Startup / System Information Screen	X	X	X	X
All Screens Except Manage Users Screen	X	X	X	X



Permission	Group Account			
	Guest	User	Admin	Factory
Manage Users Screen			X	X
Log In or Exit Project			X	X
Parameter Log	X	X	X	X
Scheduled Maintenance Information	X	X	X	X
Trend Data	X	X	X	X
Export Data	X	X	X	X
Controller Status	X	X	X	X
SELECT / EDIT / MODIFY				
Temperature and Humidity Setpoints		X	X	X
Temperature and Humidity Calibration Offsets		X	X	X
High and Low Alarm Setpoints		X	X	X
Alarm Hysteresis Values		X	X	X
Temperature and Humidity Operating Modes		X	X	X
Temperature Units		X	X	X
Temperature and Humidity PID and Deadband Parameters		X	X	X
Temperature Cutouts and Cutins		X	X	X
Humidification Equipment / Heater Mode(s)		X	X	X
Alarm Silence	X	X	X	X
Redundant Refrigeration System Selection		X	X	X
Redundant Refrigeration System Failure Reset		X	X	X
Redundant Refrigeration System Switchover and Overlap		X	X	X
Redundant Recovery Delay		X	X	X
Scheduled Maintenance Information		X	X	X
Current Temperature and Humidity Values		X	X	X
Temperature and Humidity Setpoints		X	X	X
Defrost Settings (Coolers and Freezers)		X	X	X
Add or Delete Users			X	X
Calibration Mode for Testing Purposes			X	X
Change User Passwords			X	X
Door Alarm Delays and Inhibits		X	X	X
Log In or Exit Project			X	X

3.4.2. List User Accounts

A list of users can be displayed for the user with admin privileges and higher. To generate this list, login as an authorized user and then select the SHOW USERS button. The current users will display vertically next to the button.

3.4.3. Create New User Account

Click the CREATE USER button to display the NEW USER ACCOUNT window (Figure 24). On this screen, first enter the user name and password for the new user, then assign that user to a group, either user or admin. Click OK to establish the new login account.

Figure 24. New User Account Window





SECURITY TIPS:

1. To prevent unauthorized access, always log out after making changes to chamber parameters. To log out, press the LOG ON button from the Startup or Menu screens. The popup window will provide an option to LOG OFF.
2. For additional protection, all accounts have an automatic logout function. User level accounts will automatically log off after 5 minutes of inactivity; Administrator level accounts will log off after 15 minutes of inactivity.

3.4.4.Delete User Account

An authorized admin user may remove accounts that are no longer needed. First enter the user name in the Existing User Name field and then click the DELETE USER button. Click OK to remove that login account.

3.4.5.Unblock User Account

The user will be locked out after three (3) consecutive invalid login attempts within five (5) minutes. Any locked out user can be unlocked by an authorized user of a higher security level; e.g., the user-level account must be unlocked by an administrative user account. However, the counter does reset and more attempts are possible by waiting five (5) minutes after the second invalid attempt to reset this counter. In other words, as long as the final attempt is not executed until after waiting the configured amount of time, the user will not be locked out.

To unblock a user, insert the locked out username in the Existing User Name field and then select the Unblock User button. The user will then be unblocked and now has permission to access the data for users.

3.4.6.Reset User Password

An authorized user may also reset another lower-level user's account. First enter the user name in the Existing User Name field. Enter the first verification password and the popup stating the password mismatch will likely appear. Enter the second password verification and the notification window for mismatched passwords will disappear. Click the Reset Password button the new password will take effect for the login account. The password successfully changed window will also appear; hit OK to acknowledge the change.

3.5. Remote Monitoring and Control

BioLogic™ control systems are equipped for remote monitoring and control using a TCP/IP web thin client and/or secure viewing software. The touchscreen is the server for the application (i.e., the thick client). Any thin client machine will need to run the Web Thin Client to remotely view the chamber information. The Ethernet port on the touchscreen must be connected to the local area network (LAN) of the site. To identify the IP address of the server after LAN connection,

- 14) Open the control panel door.
- 15) Plug the USB mouse into the USB port on the bottom side of the HMI unit.
- 16) Login to the touchscreen as an "admin" user from the MAIN or MENU screen.
- 17) Go to MENU screen at the footer of the screen
- 18) Select the Logon button (gold key icon)
 - a) Enter valid username





- b) Enter valid password
 - c) Hit "OK" button
- 19) In the MENU screen, select the Exit button (to the right side of the screen) and confirm the command when prompted.
- 20) The screen will now look similar to a Windows screen with a Remote Agent dialog window on the desktop.
- 21) Use the mouse to cursor to the lower part of the screen to view the Taskbar.
- 22) Under the Hidden Icons triangle, locate the Remote Agent startup icon (Figure 25) and click on that icon.



Figure 25. Remote Agent Startup Icon

- 23) The Remote Agent popup window (Figure 26) will display with the IP address.

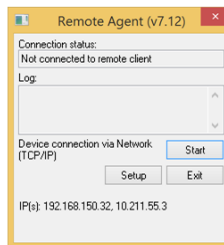


Figure 26. Remote Agent Popup Window

- 24) Download the Web Thin Client viewer from the following web address:
<https://www.dropbox.com/s/u7bxnor436wvo44/ThinClientSetup.exe?dl=0>
- 25) Open an Internet Explorer® browser window on the client machine and connect to the CER IP address using the following URL as an example with the identified IP address from Step 10 in its place. If a problem is encountered, then login to the IE program as an administrator.

<http://192.168.1.57/startup.html>

- 26) The login prompt will popup. Login with a valid username and password.

Note that only one web thin client license is available with each CER. Multiple licenses are available as an upgrade. With a single license, when more than one user attempts to access remotely, any secondary client will be denied access until the license is released.

4. Periodic Maintenance

BioCold environmental rooms are designed for long-term operation with minimal maintenance needs. BioCold recommends the following periodic maintenance schedule.

Regular Cleaning:





- ☐ Environmental room finishes may be cleaned on an as-needed basis with standard commercial detergents. Corrosive solvents may damage painted finish.

Monthly Maintenance:

- ☐ Visually inspect compressor/condensing unit to ensure fan intake is not obstructed.
- ☐ Visually inspect evaporator fan coil to ensure it is clear of ice.

Quarterly Maintenance:

- ☐ Clean compressor/condensing unit to remove dust accumulation and potential obstructions.

5. Regulatory Data Compliance

5.1. 21 CFR Part 11

Ensuring 21 CFR Part 11 compliance is fundamental to each BioCold project as electronic records are created, archived, and maintained within this control panel. The BioLogic design enables the client to retrieve and transmit the data through multiple media storage devices, via a secure network or externally. The applicable Predicate Control rules take precedence to ensure that the original automated data entries are stored properly.

BioCold understands that our compliance as the supplier or vendor of this project must be in accordance with your established processes. BioCold advises the authorized personnel or compliance department (i.e., the party liable for ownership of these records) to implement and adhere to established Procedural Requirements that includes but is not limited to formal training, accountability guidelines, and documentation control processes to maintain the integrity, confidentiality (as applicable), and authenticity of the automated electronic records generated. Ultimately, the record owner or end user has the responsibility to employ best practices for controls once the control panel is fielded.

The BioLogic offers its products and ongoing services through the life of the control panel.



