
SERVICE INSTRUCTIONS WITH REPLACEMENT PARTS LIST

LV1000-100 CONTROLLER *Part of the Bard Free Cooling Unit System*

**NOTE: LV1000 Controller is required for operation when multiple
FUSION-TEC™ HR**AP wall-mount units are used.**



Bard Manufacturing Company, Inc.
Bryan, Ohio 43506
www.bardhvac.com

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GENERAL INFORMATION

Free Cooling Unit System

This Bard Free Cooling Unit system is composed of FUSION-TEC wall-mounted air conditioners matched with an LV1000 first on/next on controller. The wall mounts are specifically engineered for telecom/motor control center rooms.

NOTE: *The LV1000 controller and FUSION-TEC wall-mount units are designed specifically to work together. The LV1000 controller cannot run other Bard models or other brands of systems, nor can other controllers run the FUSION-TEC wall-mount units. They are a complete system, and must be used together.*

Controller

LV1000 controller and accessories included shown below.

LV1000 Series



LV1000 Series
Programmable Logic
Controller



TEC-EYE™ Hand-Held
Diagnostic Tool
Bard P/N 8301-059



Remote Temperature/
Humidity Sensor*
(with 35' shielded cable)
Bard P/N 8403-079



Communication
EMI Filters
Bard P/N 8301-055

* One remote temperature/humidity sensor and 35' of 5-wire shielded cable with drain are included with the LV1000 controller. Up to two additional remote temperature/humidity sensors can be purchased and installed. Temperature-only sensors (Bard P/N 8301-058) may be used instead of the additional temperature/humidity sensors, but will also need to be purchased separately. Temperature-only sensors require field-supplied 2-wire shielded cable with drain.

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians.

These instructions should be carefully read before beginning the installation. Note particularly any tags and/or labels attached to the equipment.

While these instructions are intended as a general recommended guide, they do not supersede any national and/or local codes in any way. Authorities having jurisdiction should be consulted before the installation is made. See **Additional Publications** for information on codes and standards.

Shipping Damage

Upon receipt of equipment, the cartons should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

Additional Publications

These publications can help when installing the air conditioner. They can usually be found at the local library or purchased directly from the publisher. Be sure to consult the current edition of each standard.

National Electrical Code.....ANSI/NFPA 70
Standard for the Installation of Air Conditioning
and Ventilating SystemsANSI/NFPA 90A

Standard for Warm Air Heating
and Air Conditioning SystemsANSI/NFPA 90B
Load Calculation for Residential Winter
and Summer Air Conditioning ACCA Manual J
Duct Design for Residential Winter and Summer
Air Conditioning and Equipment Selection
..... ACCA Manual D

For more information, contact these publishers:

Air Conditioning Contractors of America (ACCA)

1712 New Hampshire Ave. N.W.
Washington, DC 20009
Telephone: (202) 483-9370 Fax: (202) 234-4721

American National Standards Institute (ANSI)

11 West Street, 13th Floor
New York, NY 10036
Telephone: (212) 642-4900 Fax: (212) 302-1286

**American Society of Heating, Refrigeration and Air
Conditioning Engineers, Inc. (ASHRAE)**

1791 Tullie Circle, N.E.
Atlanta, GA 30329-2305
Telephone: (404) 636-8400 Fax: (404) 321-5478

National Fire Protection Association (NFPA)

Batterymarch Park
P. O. Box 9101
Quincy, MA 02269-9901
Telephone: (800) 344-3555 Fax: (617) 984-7057

ANSI Z535.5 Definitions:

DANGER: Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury. The signal word “DANGER” is to be limited to the most extreme situations. DANGER [signs] should not be used for property damage hazards unless personal injury risk appropriate to these levels is also involved.

WARNING: Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury. WARNING [signs] should not be used for property damage hazards unless personal injury risk appropriate to this level is also involved.

CAUTION: Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury. CAUTION [signs] without a safety alert symbol may be used to alert against unsafe practices that can result in property damage only.

NOTICE: [this header is] preferred to address practices not related to personal injury. The safety alert symbol shall not be used with this signal word. As an alternative to “NOTICE” the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.



Alarm Adjustment

Acknowledging/Clearing Alarms

Alarm conditions activate a red LED indicator that backlights the ALARM function key. As an option, an alarm condition may also be enunciated by an audible alarm signal. An alarm is acknowledged by pressing the ALARM key. This calls up alarm display screen(s) that provide a text message detailing the alarm condition(s). After an alarm condition is corrected, the alarm can be cleared by pressing the ALARM key for 3 seconds.

Sensor Failure Alarms

The controller is capable of determining if a sensor has failed. If the temperature or humidity measurement is outside the following ranges, the controller will consider the sensor as failed.

The sensor failure alarms are self clearing.

TABLE 1
Temperature and Humidity Sensors

Sensor	Range
Indoor Temperature 1	-41°F to 303°F
Indoor Temperature 2	-41°F to 303°F
Indoor Temperature 3	-41°F to 303°F
Indoor Humidity 1	0-100%
Indoor Humidity 2	0-100%
Indoor Humidity 3	0-100%

Temperature Alarms (Low Temp, High Temp, High Temp 2)

Low Temperature Alarm

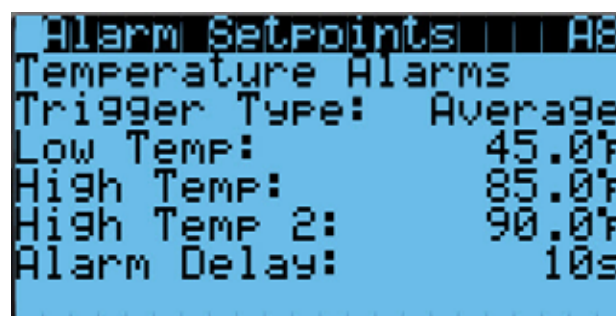
The LV will indicate an indoor low temperature alarm when any of the connected sensors that are enabled read a value below the low temperature limit of 45°F (factory default). This alarm **does not** use the average of the sensors if more than one space sensor is used.

The low temperature alarm is self clearing.

To adjust the low temperature alarm setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A8)**.
5. Press ENTER key to scroll to **Low Temp** (see Figure 1).
6. Press UP or DOWN keys to adjust setpoint.

FIGURE 1
Adjusting Temperature Alarm Setpoints



High Temperature Alarm

The LV will indicate a high temperature alarm when any of the connected sensors that are enabled read a value above the high temperature limit of 85°F. This alarm **does not** use the average of the sensors if more than one space sensor is used.

The high temperature alarm is self clearing.

To adjust the high temperature alarm setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A8)**.
5. Press ENTER key to scroll to **High Temp** (see Figure 1).
6. Press UP or DOWN keys to adjust setpoint.

High Temperature 2 Alarm

The LV will indicate a high temperature 2 alarm when any of the connected sensors that are enabled read a value above the high temperature 2 limit of 90°F. This alarm **does not** use the average of the sensors like other functions do. In addition to the alarm being generated, this event will put the system into emergency vent mode. See **Emergency Vent** on page 11 for more information.

To adjust the high temperature 2 alarm setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A8)**.

5. Press ENTER key to scroll to **High Temp 2** (see Figure 1).
6. Press UP or DOWN keys to adjust setpoint.

The trigger type for the low temperature, high temperature and high temperature 2 alarms can be changed to reference either the displayed average or the lowest value (for low temperature alarm) and the highest value (for high temperature alarms). This only applies to multiple sensor installations. If only one sensor is used, this does not affect operation.

The default setting is **Average**.

To adjust the temperature alarms trigger type:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A8)**.
5. Press ENTER key to scroll to **Trigger Type** (see Figure 1).
6. Press UP or DOWN keys to change from **Average** to **Hi/Low**.

A delay of 10 seconds is applied to each alarm. This can be adjusted by:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A8)**.
5. Press ENTER key to scroll to **Alarm Delay** (see Figure 1).
6. Press UP or DOWN keys to adjust the delay.

Humidity Alarms (Low Hum, High Hum)

Low Humidity Alarm

The LV will indicate an indoor low humidity alarm when any of the connected sensors that are enabled read a value below the low humidity limit of 20% RH (factory default). This alarm **does not** use the average of the sensors if more than one space sensor is used.

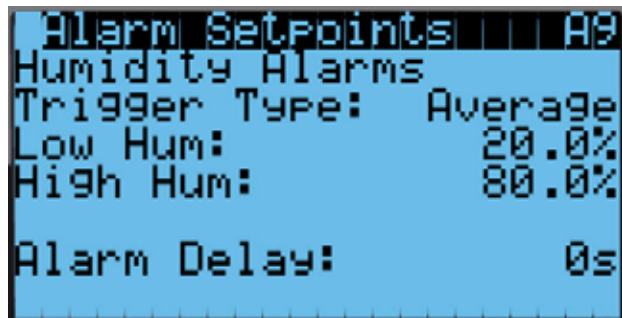
The low humidity alarm is self clearing.

To adjust the low humidity alarm setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.

4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A9)**.
5. Press ENTER key to scroll to **Low Hum** (see Figure 2).
6. Press UP or DOWN keys to adjust setpoint.

FIGURE 2
Adjusting Humidity Alarm Setpoints



High Humidity Alarm

The LV will indicate a high humidity alarm when any of the connected sensors that are enabled read a value above the high humidity limit of 80% RH. This alarm **does not** use the average of the sensors if more than one space sensor is used.

The high humidity alarm is self clearing.

To adjust the high humidity alarm setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A9)**.
5. Press ENTER key to scroll to **High Hum** (see Figure 2).
6. Press UP or DOWN keys to adjust setpoint.

The trigger type for the low humidity and high humidity alarms can be changed to reference either the displayed average or the lowest value (for low humidity alarm) and the highest value (for high humidity alarm). This only applies to multiple sensor installations. If only one sensor is used, this does not affect operation.

The default setting is **Average**.

To adjust the temperature alarms trigger type:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.

4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A9)**.
5. Press ENTER key to scroll to **Trigger Type** (see Figure 2).
6. Press UP or DOWN keys to change from **Average** to **Hi/Low**.

A delay is available to be applied to each humidity alarm (default is 0 seconds). This can be adjusted by:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Alarm Setpoints (A9)**.
5. Press ENTER key to scroll to **Alarm Delay** (see Figure 2).
6. Press UP or DOWN keys to adjust the delay.

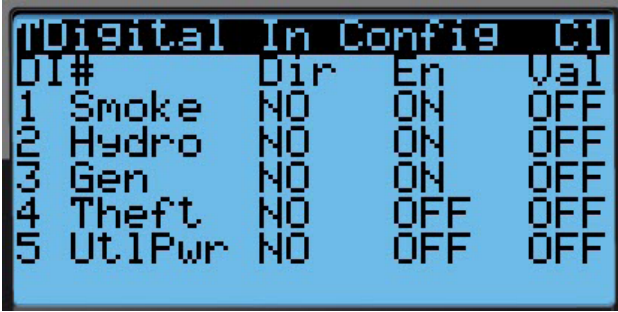
Smoke Alarm

The LV will indicate a smoke alarm when the smoke detector input is activated in the shelter. This input is enabled by default but comes from the factory with a jumper. To utilize this input, remove the jumper and connect the sensor in place of the jumper. The alarm will communicate this information to all of the wall units. The wall units will be disabled so that no operations occur. See smoke alarm installation instructions for specific wiring information. This alarm will automatically clear when the smoke detector no longer indicates smoke is present.

To change the smoke inputs:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Digital In Config (C1)**.
5. Press ENTER key to scroll to the variable in the table that intersects **Smoke** and **Dir** (see Figure 3).
6. Press UP or DOWN key to change direction.
7. Press ENTER key to save the value and move cursor to variable in the table that intersects **Smoke** and **En**.
8. Press UP or DOWN keys to change the value from **ON** to **OFF**.

FIGURE 3
Changing Input Values



DI#	Dir	En	Val
1	Smoke	NO	ON
2	Hydro	NO	ON
3	Gen	NO	ON
4	Theft	NO	OFF
5	UtlPwr	NO	OFF

Hydrogen Alarm

The LV will indicate a hydrogen alarm when the hydrogen detector indicates high levels of hydrogen inside the shelter. This input is enabled by default but comes with a factory-installed jumper. To utilize this input, remove the jumper and connect the sensor in place of the jumper. In addition to the alarm being generated, this event will put the system into emergency vent mode. See **Emergency Vent** on page 11 for more information. This alarm will automatically clear when the hydrogen detector no longer indicates hydrogen is present.

To change the smoke inputs:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Digital In Config (C1)**.
5. Press ENTER key to scroll to the variable in the table that intersects **Hydro** and **Dir** (see Figure 3).
6. Press UP or DOWN key to change direction.
7. Press ENTER key to save the value and move cursor to variable in the table that intersects **Hydro** and **En**.
9. Press UP or DOWN keys to change the value from **ON** to **OFF**.

Generator Alarm

The LV will indicate a generator run alarm when the generator run input indicates that the generator is running. This input is enabled by default but comes with a factory-installed jumper. To utilize this input, remove the jumper and connect the generator in place of the jumper.

To change the generator inputs:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.

3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Digital In Config (C1)**.
5. Press ENTER key to scroll to the variable in the table that intersects **Gen** and **Dir** (see Figure 3).
6. Press UP or DOWN key to change direction.
7. Press ENTER key to save the value and move cursor to variable in the table that intersects **Gen** and **En**.
8. Press UP or DOWN keys to change the value from **ON** to **OFF**.

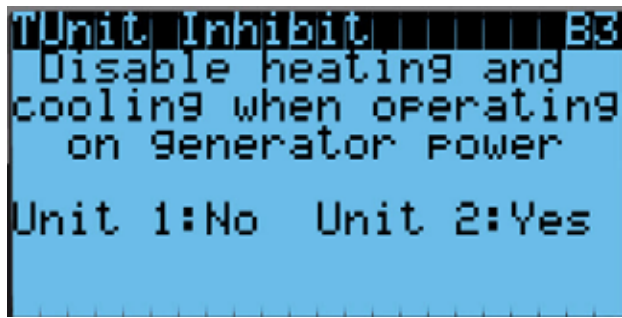
While the generator is running, the system will only allow selected units to run. This selection is customizable by the end user. This limitation is in place to match the unit power requirements to the shelter generator capacity.

The default for this setting is 1 unit is permitted to run if 1, 2, or 3 is selected for the number of units installed on the shelter. If the shelter is configured for 4 units, the default will be 2 units. If a different strategy is required, the end user can select which units by address are allowed to run when the generator run input is active.

To change which units run when the generator run input is active:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **Adv System Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Unit Inhibit (B3)**.
5. Press ENTER key to scroll to **Unit 1** (see Figure 4).
6. Press UP or DOWN key to change **Enabled on Gen** to **Disabled on Gen**.
7. Press ENTER key to save the value and move cursor to **Unit 2**.
8. Press UP or DOWN keys and ENTER key to change units to **Disabled on Gen** as needed.

FIGURE 4
Adjusting Units Running When Generator is Active



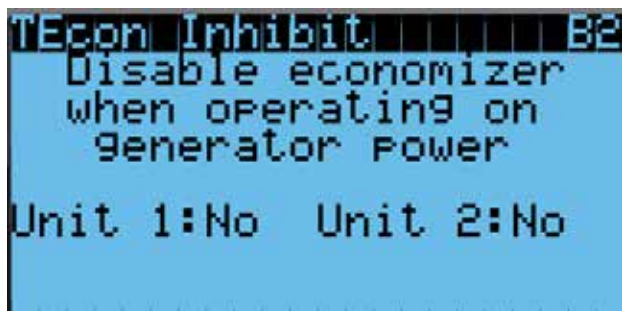
The system will also disable economizer operation of all wall units when the generator is running. This setting can be changed per wall unit by the end user to allow the economizer to operate if the exhaust of the generator is far enough away from the wall unit's fresh air intake.

To change which units can use the economizer when the generator run input is active:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **Adv System Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Econ Inhibit (B2)**.
5. Press ENTER key to scroll to **Unit 1** (see Figure 5).
6. Press UP or DOWN key to change **Enabled on Gen** to **Disabled on Gen**.
7. Press ENTER key to save the value and move cursor to **Unit 2**.
8. Press UP or DOWN keys and ENTER key to change units to **Disabled on Gen** as needed.

This alarm will clear and operation will return to normal when the generator run input no longer indicates the generator is running.

FIGURE 5
Adjusting Economizers Running When Generator is Active



Utility Power Loss Alarm

The LV will indicate a utility power loss alarm when the power loss input indicates that utility power to the shelter is not available. This can be accomplished in two ways. The first way is with units equipped with the inverter option; with these units, the wall unit controller will detect a power loss and communicate the event to the LV. The LV will then indicate a utility power loss alarm. The second way is with wall units that do not have the inverter option installed; with these units, 230v may be run into the LV enclosure and connected to the power loss relay. When 230v is not present at the power loss relay, the LV controller will indicate a utility power loss alarm. When the power loss alarm is no longer present from either the power loss relay in the LV or the wall units, the alarm will automatically clear.

To change the power loss inputs:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Digital In Config (C1)**.
5. Press ENTER key to scroll to the variable in the table that intersects **UtIPwr** and **Dir** (see Figure 3 on page 7).
6. Press UP or DOWN key to change direction.
7. Press ENTER key to save the value and move cursor to variable in the table that intersects **UtIPwr** and **En**.
8. Press UP or DOWN keys to change the value from **OFF** to **ON**.

HVAC Fail Alarm

The LV will monitor the wall units and if any of the units communicate a high pressure or low pressure event, each event will be displayed individually on the LV. However, either of these alarms will open the alarm relay for HVAC failure. This output is connected to the NOC for remote notification. When all of these events are no longer present, the alarm relay output will close signaling there are no HVAC failure alarms.

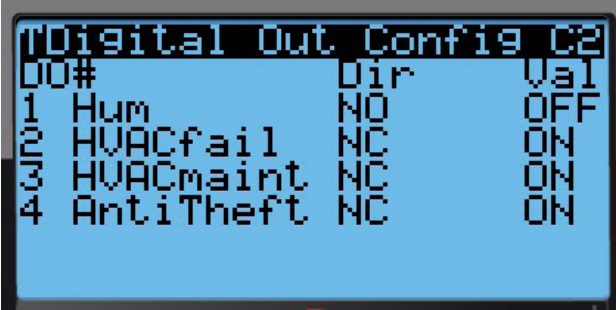
The LV will actuate a relay output when this alarm occurs. The output is set up to open when an alarm occurs by default. The direction of this alarm output can be changed if required.

To change the direction of the HVAC fail alarm output:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.

4. Press UP or DOWN keys to scroll to **Digital Out Config (C2)**.
5. Press ENTER key to scroll to the variable in the table that intersects **HVACfail** and **Dir** (see Figure 6).
6. Press UP or DOWN key to change direction.

FIGURE 6
Changing Output Values



DO#	Dir	Val
1 Hum	NO	OFF
2 HVACfail	NC	ON
3 HVACmaint	NC	ON
4 AntiTheft	NC	ON

HVAC Maintenance Alarm

The LV will monitor the wall units and if any of the units communicate a dirty filter event or a dirty condenser coil event, each of the alarms will be displayed individually on the LV. However, either of these alarms will trigger the alarm relay for maintenance to open, which is connected to the NOC for remote notification. When all of these events are no longer present, the alarm relay output will close signaling there are no HVAC maintenance alarms.

The LV will actuate a relay output when this alarm occurs. The output is set up to open when an alarm occurs by default. The direction of this alarm output can be changed if required.

To change the direction of the maintenance alarm output:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Digital Out Config (C2)**.
5. Press ENTER key to scroll to the variable in the table that intersects **HVACmaint** and **Dir** (see Figure 6).
6. Press UP or DOWN key to change direction.

Anti-Theft Alarm

The LV will indicate a theft alarm when the Bard Guard anti-theft controller (sold separately) indicates an alarm to the anti-theft input on the LV. This alarm will open an alarm relay output to the NOC for remote notification. When the input no longer indicates a theft,

the alarm will automatically clear and the alarm relay will return to its normal state.

To change the anti-theft alarm inputs:

1. Press MENU key to go to the Main Menu screen.
 2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
 3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.
 4. Press UP or DOWN keys to scroll to **Digital In Config (C1)**.
 5. Press ENTER key to scroll to the variable in the table that intersects **Theft** and **Dir** (see Figure 3 on page 7).
 6. Press UP or DOWN key to change direction.
 7. Press ENTER key to save the value and move cursor to variable in the table that intersects **Theft** and **En**.
 8. Press UP or DOWN key to change the value from **OFF** to **ON**.
4. Press UP or DOWN keys to scroll to **Digital Out Config (C2)**.
 5. Press ENTER key to scroll to the variable in the table that intersects **Hum** and **Dir** (see Figure 6).
 6. Press UP or DOWN key to change direction.

The LV is will actuate a relay output when this alarm occurs. The output is set up to open when an alarm occurs by default. The direction of this alarm output can be changed if required.

To change the direction of the anti-theft output:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Digital Out Config (C2)**.
5. Press ENTER key to scroll to the variable in the table that intersects **Hum** and **Dir** (see Figure 6).
6. Press UP or DOWN key to change direction.

Humidifier Output

The LV has the option to control a humidifier (sold separately) through a relay output. The output will close when a humidity call from the LV is active and open when the call is no longer present. The output can be configured to operate in reverse where the contacts will open when a humidity call is present and close when the call is no longer present.

To change the direction of the humidifier output:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **IO Config**; press ENTER key.

Temperature Control

Control Value Averaging

The system requires one temperature and humidity sensor (included with LV) to operate. It allows a **total** of three temperatures and three humidity sensors to be connected to the LV for better representation of what is happening in the shelter. When more than one sensor is used, the value is averaged and then used for temperature control operations and humidity control operations.

Comfort Mode

The LV has a feature that allows a temporary override of the temperature control settings. When “comfort mode” is activated, the system will control to 72°F. The system will stay in this mode for 60 minutes and is intended to provide a more comfortable space for a technician during a service call or scheduled maintenance.

Emergency Vent

When the high temperature alarm 2 or the hydrogen input indicate an alarm, the system will enter emergency vent mode. The LV will communicate to each wall unit that emergency vent mode is active. The wall units will then override the damper position to 100% open and turn the blower on. These two items will stay in this state until both the high temperature alarm 2 and the hydrogen detector are no longer in an alarm state.

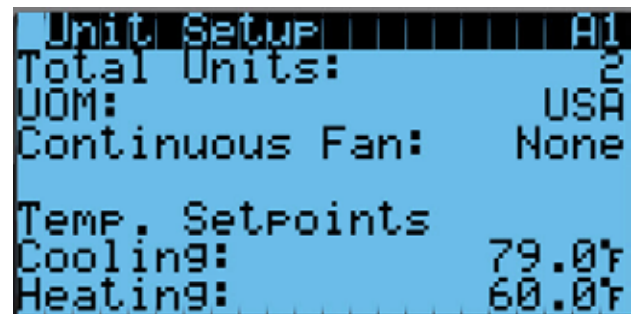
Cooling

When the wall units are connected to the LV, the economizer and compressor are commanded off and on by the LV. This allows the supervisory controller to consider the most effective and efficient order to bring cooling functions on using all of the available equipment installed on the shelter. At the same time, the LV will be able to match the load requirements of the shelter.

To adjust the cooling setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Unit Setup (A1)**; press ENTER key.
5. Press ENTER key to scroll to **Cooling** (see Figure 7).
6. Press UP or DOWN keys to adjust value.
7. Press ENTER key to save.
8. Press the ESCAPE key several times to return to Main Menu screen.

FIGURE 7
Adjusting Setpoints



The LV monitors the space temperature and compares the value to the space cooling setpoint. The system will compare how far above or below the space temperature is when compared to the cooling setpoint. The LV will also consider how long the shelter temperature has been above or below the setpoint. Using these two considerations, the controller will generate a cooling demand. The cooling demand is a value between 0 and 100%. 0% represents no cooling demand and 100% representing full cooling demand.

The system will consider all of the available cooling stages and distribute the number of stages across the cooling demand range. As the demand rises, the system will stage on equipment every 2 minutes. As the demand lowers, the system will stage off equipment every 2 minutes.

The system will stage the equipment on in the order shown in Table 2 on page 12.

Unit Rotation

The system is also capable of rotating the order in which the units are brought on. This is done to distribute the equipment run time to each unit. This prevents one unit from providing all of the cooling for the shelter and shorting the lifespan of the wall unit.

The system is set to switch the unit rotation order every 7 days from the factory. This timeframe is adjustable. In addition to the time-based auto rotation, the system can be manually rotated on site for troubleshooting purposes.

The system has two different modes for staging unit operation: FIFO (First In/First Out) or FILO (First In/Last Out). With FIFO staging, the first unit on will be the first unit to turn off as demand decreases. In FILO staging, the first unit to turn on will be the last unit to turn off.

To view the lead unit and make adjustments to the unit rotation and staging:

1. Press MENU key to go to the Main Menu screen.

TABLE 2
Cooling Staging

1 Unit		
Order	Freecooling Available	Freecooling Not Available
1	Unit 1 Freecooling	Unit 1 Compressor Stage 1
2	Unit 1 Compressor Stage 1	Unit 1 Compressor Stage 2
3	Unit 1 Compressor Stage 2	--

2 Units		
Order	Freecooling Available	Freecooling Not Available
1	Unit 1 Freecooling	Unit 1 Compressor Stage 1
2	Unit 2 Freecooling	Unit 1 Compressor Stage 2
3	Unit 1 Compressor Stage 1	Unit 2 Compressor Stage 1
4	Unit 1 Compressor Stage 2	Unit 2 Compressor Stage 2
5	Unit 2 Compressor Stage 1	--
6	Unit 2 Compressor Stage 2	

3 Units		
Order	Freecooling Available	Freecooling Not Available
1	Unit 1 Freecooling	Unit 1 Compressor Stage 1
2	Unit 2 Freecooling	Unit 1 Compressor Stage 2
3	Unit 3 Freecooling	Unit 2 Compressor Stage 1
4	Unit 1 Compressor Stage 1	Unit 2 Compressor Stage 2
5	Unit 1 Compressor Stage 2	Unit 3 Compressor Stage 1
6	Unit 2 Compressor Stage 1	Unit 3 Compressor Stage 2
7	Unit 2 Compressor Stage 2	--
8	Unit 3 Compressor Stage 1	
9	Unit 3 Compressor Stage 2	

4 Units		
Order	Freecooling Available	Freecooling Not Available
1	Unit 1 Freecooling	Unit 1 Compressor Stage 1
2	Unit 2 Freecooling	Unit 1 Compressor Stage 2
3	Unit 3 Freecooling	Unit 2 Compressor Stage 1
4	Unit 4 Freecooling	Unit 2 Compressor Stage 2
5	Unit 1 Compressor Stage 1	Unit 3 Compressor Stage 1
6	Unit 1 Compressor Stage 2	Unit 3 Compressor Stage 2
7	Unit 2 Compressor Stage 1	Unit 4 Compressor Stage 1
8	Unit 2 Compressor Stage 2	Unit 4 Compressor Stage 2
9	Unit 3 Compressor Stage 1	--
10	Unit 3 Compressor Stage 2	
11	Unit 4 Compressor Stage 1	
12	Unit 4 Compressor Stage 2	

2. Press UP or DOWN keys and ENTER key to enter USER password 2000.
 3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
 4. Press UP or DOWN keys to scroll to **Unit Rotation (A2)**; press ENTER key.
 5. Press ENTER key to scroll to **Time Based** (see Figure 8).
 6. Press UP or DOWN key to change the value from **ON** to **OFF**.
 7. Press ENTER key to save the value and scroll to **Num. of Days**.
 8. Press UP or DOWN keys to change the value.
 9. Press ENTER key to save the value and scroll to **Manual Rotate**.
 10. Press UP or DOWN key to change the value from **OFF** to **ON**.
 11. Press ENTER key to save the value and scroll to **Staging Order**.
 12. Press UP or DOWN keys to change the value from **FIFO** to **FILO**.
 13. Press ENTER key to save.
 14. Press the ESCAPE key several times to return to Main Menu screen.
4. Press UP or DOWN keys to scroll to **Unit Setup (A1)**; press ENTER key.
 5. Press ENTER key to scroll to **Heating** (see Figure 7 on page 11).
 6. Press UP or DOWN keys to adjust value.
 7. Press ENTER key to save.
 8. Press the ESCAPE key several times to return to Main Menu screen.

The LV monitors the space temperature and compares the value to the space heating setpoint. The system will compare how far above or below the space temperature is when compared to the heating setpoint. The LV will also consider how long the shelter temperature has been above or below the setpoint. Using these two considerations, the controller will generate a heating demand. The heating demand is a value between 0 and 100%. 0% represents no heating demand and 100% representing full heating demand.

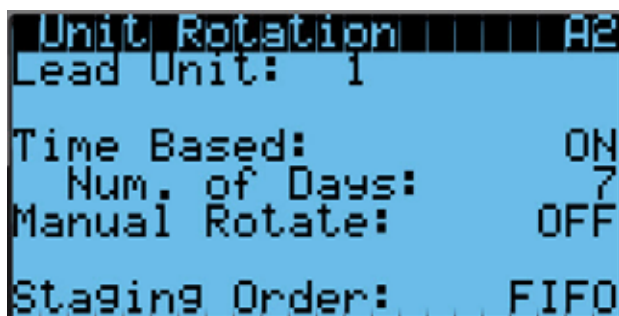
The system will consider all of the available heating stages and distribute the number of stages across the heating demand range. As the demand rises, the system will stage on equipment every 2 minutes. As the demand lowers, the system will stage off equipment every 2 minutes.

The system will stage the equipment on in the order shown in Table 3 on page 14.

The system is also capable of rotating the order in which the units are brought on. This is done to distribute the equipment run time to each unit. This prevents one unit from providing all of the heating for the shelter and shortening the lifespan of the wall unit.

See **Unit Rotation** on page 11 for information on unit rotation and staging.

FIGURE 8
Adjusting Unit Rotation Parameters



Heating

When the wall units are connected to the LV, the heat strips are commanded off and on by the LV. This allows the supervisory controller to match the required load of the shelter using all of the available equipment installed on the shelter.

To adjust the heating setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.

TABLE 3
Heating Staging

1 Unit	
Order	Heat Method
1	Unit 1 Heat Strip

2 Units	
Order	Heat Method
1	Unit 1 Heat Strip
2	Unit 2 Heat Strip

3 Units	
Order	Heat Method
1	Unit 1 Heat Strip
2	Unit 2 Heat Strip
3	Unit 3 Heat Strip

4 Units	
Order	Freecooling Available
1	Unit 1 Heat Strip
2	Unit 2 Heat Strip
3	Unit 3 Heat Strip
4	Unit 4 Heat Strip

Humidity Control

The LV will monitor the indoor humidity of the space and compare the value to the indoor humidity lower and upper setpoints.

Humidification

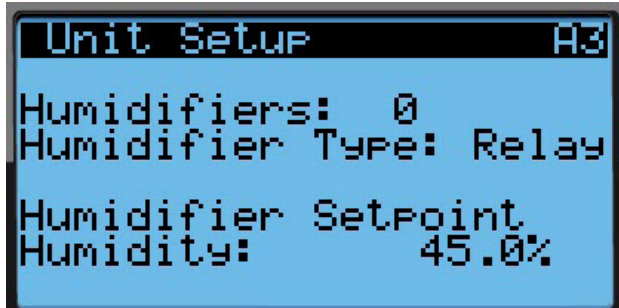
When the humidity is below the lower setpoint of 20% RH and a humidifier output is configured, the shelter will begin to humidify using the relay output to control a third party humidifier.

To change the number of humidifiers, type and setpoint:

1. Press MENU key to go to the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Unit Setup (A3)**; press ENTER key.
5. Press ENTER key to scroll to **Humidifiers** (see Figure 9).

6. Press UP or DOWN keys to adjust value.
7. Press ENTER key to scroll to **Humidifier Type**.
8. Press UP or DOWN keys to adjust value.
9. Press ENTER key to scroll to **Humidifier Setpoint Humidity**.
10. Press UP or DOWN keys to adjust value.
11. Press the ESCAPE key several times to return to Main Menu screen.

FIGURE 9
Adjusting Humidifiers Settings



Dehumidification

The system will take several actions to limit the indoor humidity level. At 70% RH, the economizer will be disabled to prevent outdoor air from being used to cool the shelter which may have a high moisture content. This mode will remain active until the shelter humidity level is below 60% RH. The system will switch from high sensible to standard mode when the indoor humidity is above 75% RH which will slow the blower down to remove more moisture. This mode will remain active until the shelter humidity level is below 65%. If the shelter reaches 80% RH, the system will switch the units into dehumidification mode. This mode will cool the shelter down to the heating setpoint and the compressor will turn off. Then the heat strip will activate and heat it back up to the cooling setpoint, then turn off. This will continue until the indoor humidity level is below 70% RH.

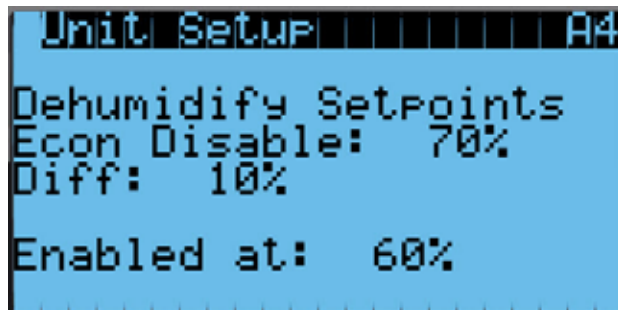
The economizer disable setpoint and differential (difference between disable setpoint and enable setpoint) are adjustable. The differential is limited to a minimum 10%.

To adjust the dehumidify economizer disable setpoint and differential:

1. Press MENU key to go to the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Unit Setup (A4)**; press ENTER key.

5. Press ENTER key to scroll to **Econ Disable** (see Figure 10).
6. Press UP or DOWN keys to adjust value.
7. Press ENTER key to scroll to **Diff.**
8. Press UP or DOWN keys to adjust value.
9. Press ENTER key to save.
10. Press the ESCAPE key several times to return to Main Menu screen.

FIGURE 10
Adjusting Dehumidify Setpoints



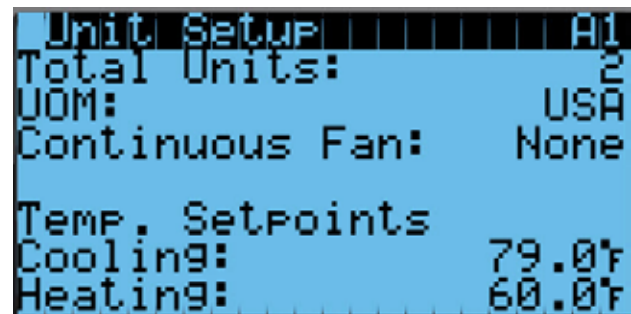
Fan Control

The LV has the option to change the continuous blower setting of the units connected to it. The options are All, Lead and None. If the option is set to All, then all of the units connected will run the blower continuously. If the option is set to Lead, only the unit in the lead position will run the blower continuously. If the option is set to None, then none of the units will run the blower continuously. When continuous blower doesn't apply to a unit, it will cycle the blower based on heating or cooling calls.

To adjust the continuous fan setting:

1. Press MENU key to go to the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Unit Setup (A1)**; press ENTER key.
5. Press ENTER key to scroll to **Continuous Fan** (see Figure 11).
6. Press UP or DOWN keys to adjust value.
7. Press ENTER key to save.
8. Press the ESCAPE key several times to return to Main Menu screen.

FIGURE 11
Adjusting Continuous Fan Setting



Hour Counting

The LV will keep track of the heating and cooling method run times for last hour. In addition to how long an item was on, it will also track how many times a method started.

ADDITIONAL INFORMATION

LV1000 Menus/Screens

Main Menu

Press the MENU key from any screen to return to the Main Menu. Press the UP or DOWN keys to scroll through the available menus. When the desired menu is highlighted, press the ENTER key to access that menu. Press the ESCAPE key or MENU key to return to the Status screen from the Main Menu.

Status Screen

The Status screen is the default start-up screen and also the return screen after 5 minutes of no activity. The screen can be accessed any time by pressing the ESCAPE key repeatedly. The LV1000 Status screen displays the current date, time, unit displayed, zone and unit status.

Quick Menu

The Quick Menu is available on the Status screen. Use UP or DOWN keys while on the Status screen to scroll between the three Quick Menu options; press ENTER key.

Data Log

The data log displays the record number, time of alarm event, date of alarm event, description of alarm event and whether the entry is the beginning or end of event. The data log will have as many screens as events occurred.

Info

Info displays wall unit status for each wall-mount unit connected to controller, last hour tracking (shelter), last hour tracking (for each wall-mount unit connected, last hour averages (zone temperatures, OA temperature and OA humidity) and additional LV1000 information.

Setpoints

Setpoints allows setting and enabling of comfort mode.

Menu Screens and Password Levels

- A** System Config: A1-A10 User
- B** Adv Sys Config: B1-B4 Technician
- C** I-O Config: C1-C18 Technician
- D** On/Off: User
- E** Alarm Logs: User
- F** Settings:
 - Date/Time: Technician
 - Language: User
 - Network Config: Technician
 - Serial Ports: Technician
 - Initialization

Clear Logs: User

System Default: Engineer

Restart: User

Parameter Config: Engineer

Alarm Export: User

- G** Logout: Used to log out of the current password level. Entering back into the menu requires password.

TABLE 4
LV1000 Passwords (Defaults)

User	2000
Technician	1313
Engineer	9254
Use UP or DOWN keys and ENTER key to enter password	

TABLE 5
LV1000 Status Messages

Message	Description
Ready	System is on and waiting for heat, cooling, etc.
Freecooling	System is actively economizing
Cooling	System is actively mechanical cooling
Heating	System is actively heating
Off by Alarm	System has major system fault preventing operation
Off by BMS	System has been turned off by network supervisor
Off by Keyboard	System has been turned off by local user
Manual Mode	A unit in the system has an active override
Comfort Mode	System is operating in comfort mode
Emergency Vent	System has active hydrogen alarm and is actively exhausting the air to outside
Emergency Cool	System has active hi temp 2 alarm and is calling for 100% cooling demand
Emergency Off	System has active smoke alarm and has commanded all units off

Additional Programming

Calibrating Sensors

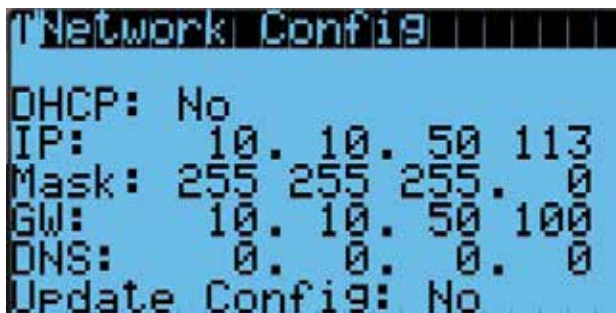
1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **I/O Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to sensor to be adjusted.
5. Press ENTER key to scroll to **Offset**.
6. Press UP or DOWN keys to add or subtract to the sensor offset value.
7. Press ENTER key to save.

IP Configuration

To set an LV IP address:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **Settings**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Network Config**; press ENTER key.
5. Press ENTER key to scroll to desired value to be changed (see Figure 12).
6. Press UP or DOWN keys to change selected value.
7. Press ENTER key to save and scroll to next value.
8. When finished, press ENTER key until cursor is on the Update Configure value; press ENTER key to update Network Configuration.
9. Press ESCAPE key several times to return to Main Menu screen.

FIGURE 12
IP Configuration



Changing to Celsius

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Unit Setup (A1)**.
5. Press ENTER key to scroll to **UOM**.
6. Press UP and DOWN keys to change value to **SI**.

Reset to Factory Defaults

To reset the LV controller to factory default settings:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter ENGINEER password 9254.
3. Press UP or DOWN keys to scroll to **Settings**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Initialization**; press ENTER key.
5. Press UP or DOWN keys to scroll to the **Default Installation** screen; press ENTER key.
6. Press ENTER key to scroll to **Reset to Factory Defaults** (see Figure 13).
7. Press UP or DOWN key to value to **YES**; press ENTER key.
8. System will restart with default values.

FIGURE 13
Restoring Factory Default Settings

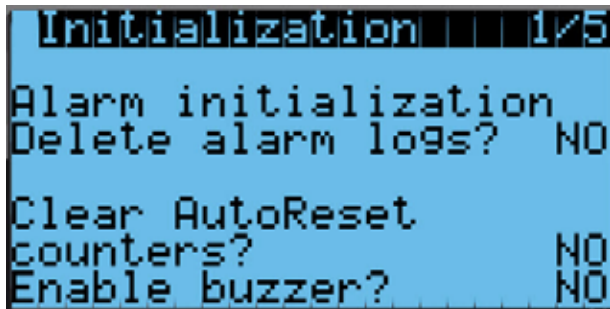


Clear Alarm Logs

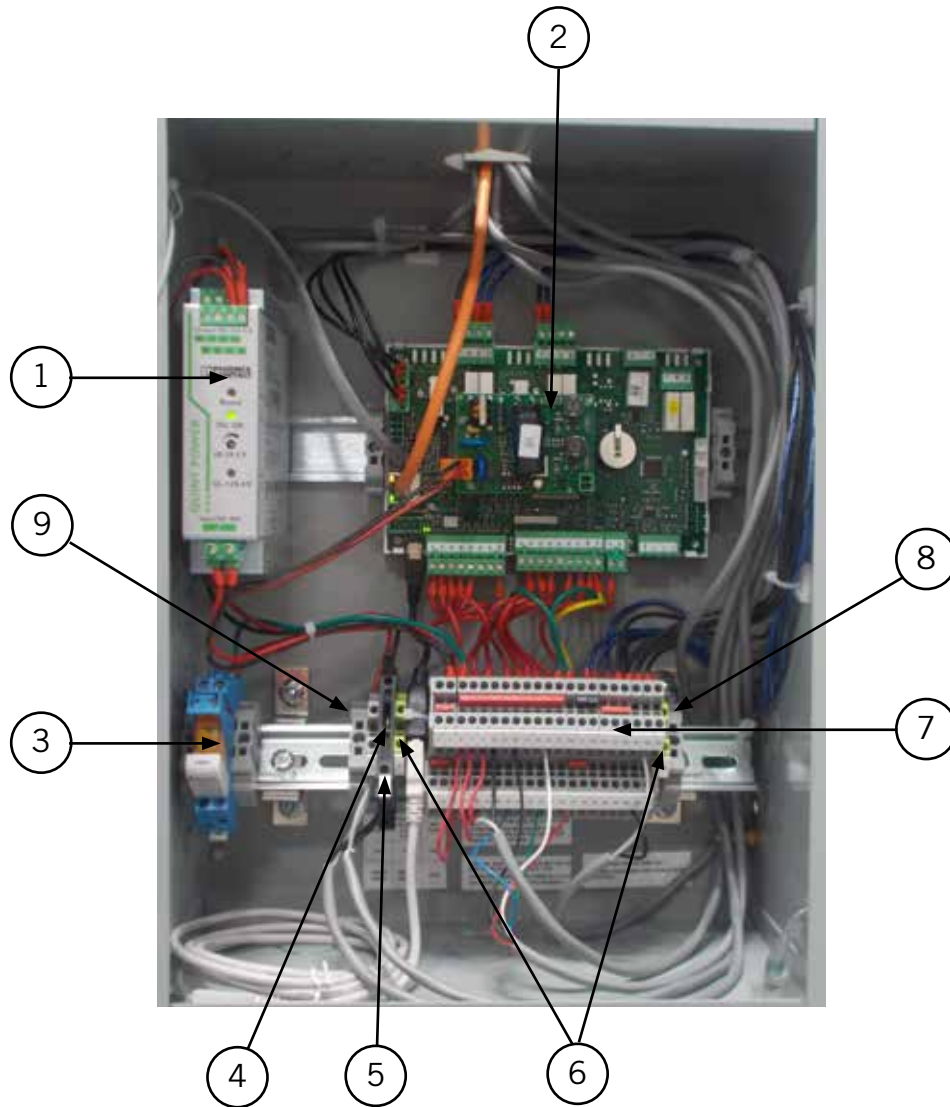
To clear the LV controller alarm logs:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Settings**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Initialization**; press ENTER key.
5. Press ENTER key to scroll to **Delete Alarm Logs?** (see Figure 14).
6. Press UP or DOWN key to value to **YES**; press ENTER key.
7. Press ESCAPE key several times to return to Main Menu screen.

FIGURE 14
Clearing LV1000 Alarm Logs



LV1000 REPLACEMENT PARTS



Dwg. No.	Part Number	Description	LV1000
1	8301-050	48VDC to 24VDC Converter 5 Amps	1
2	8301-076-001	Micro PC – Medium, programmed for LV1000	1
3	8201-154	24VDC Isolation Relay, DPDT	1
4	8614-059	1.0 Amp Fuse	1
5	8607-039	Fused Terminal Block	1
6	8607-052	Grounded Terminal Block	2
7	8607-057	Terminal Block	21
8	8611-144	End Clamp (for din rail)	4
NS	8301-053	Panel mounting display flush, pGDEvolution 132x64, black buttons with cable	1
NS	3020-010	35' Communication Cable	1
NS	8301-055	EMI Ferrite Filter	2
NS	8301-058	Remote Temperature Sensor ①	1
NS	8403-079	Remote Temperature/Humidity Sensor	1
NS	8301-059	TEC-EYE™ (Service Tool), 5 ft. telephone cable	1

NS – Not Shown ① Optional