CoolLinks™ HVAC Controller
Installation & Operations Manual 2021

This product manual describes the steps to install and operate the Marvair® CoolLinks™ HVAC controller. The information contained in this manual is to be used as a guide only. This manual does not supersede or circumvent any applicable national or local codes.

If you are installing the CoolLinks controller, first read Chapter 2 and scan the entire manual before starting work. The Marvair® air conditioners must be installed before the CoolLinks™ controller. For the installations instructions of the Marvair air conditioners, please contact Marvair. The latest versions of all literature, including the manuals can be downloaded from the Marvair website at www.marvair.com.

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Important Safety Information

1. Use Care when Lifting or Transporting the controller
2. Turn Electrical Power OFF at the breaker or fuse box BEFORE installing or working on the controller. LINE VOLTAGES ARE HAZARDOUS or LETHAL.
3. OBSERVE and COMPLY with ALL applicable ELECTRICAL AND BUILDING CODES and ORDINACES.
4. INSTALLATION and SERVICE should be performed ONLY by QUALIFIED and EXPERIENCED PEOPLE.
5. USE COMMON SENSE and **BE SAFETY CONSCIOUS.**

This is the safety alert symbol  . When you see this symbol in the manual, be alert to the potential for personnel injury or equipment damage. Understand the signal word DANGER, WARNING and CAUTION. These words are used to identify levels of the seriousness of the hazard.

⚠ **DANGER**	Failure to comply WILL result in death or severe personal injury or death.
⚠ **WARNING**	Failure to comply COULD result in death or severe personal injury or death.
⚠ **CAUTION**	Failure to comply COULD result in minor personal injury and/or property damage.

IMPORTANT is used to point out helpful suggestions that will result in an improved installation, reliability or operation.

Confidentiality:

Chapter 1 Materials Required for Installation

The following materials are provided in the CoolLinks™ HVAC controller package:

- CoolLinks™ PLC enclosure
- Inside temperature sensor with 40 ft. sensor cable
- Two, 50 ft. Cat5e Ethernet cables
- Smoke detector and hydrogen detector (optional)
- CoolLinks™ Installation and Operations Manual 2018 (this manual).

The following materials should be provided by the installer:

- Electrical conduit (3/4"), conduit fittings, mounting straps
- Mechanical installation hand tools (hammer drill, drill bits)
- Label maker & label tags

Chapter 2 CoolLinks™ OVERVIEW

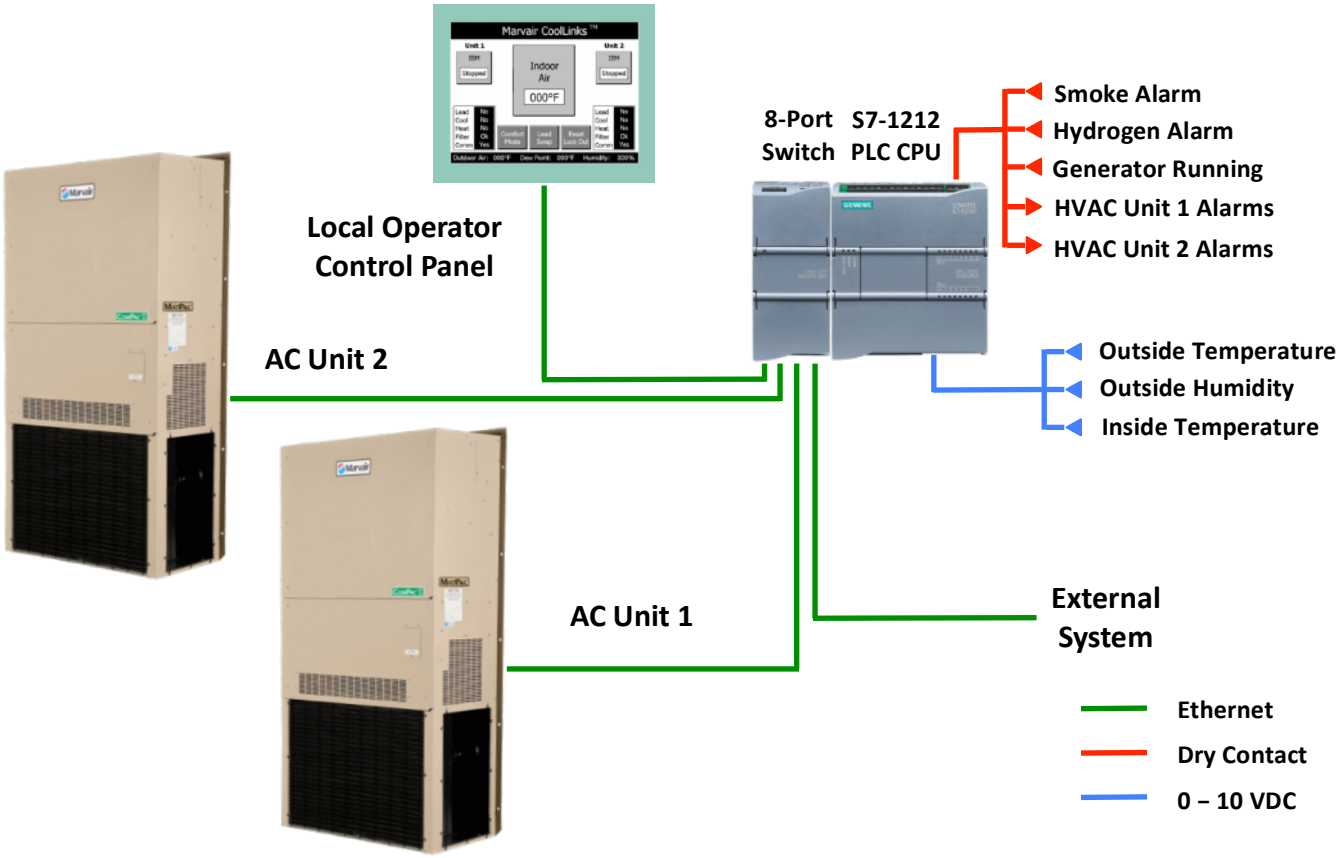
The PLC-based controller monitors internal and external shelter temperatures then sequences the operation of the Marvair DC Free Cooling (FC) HVAC units to provide either compressor (mechanical) or DC free-air cooling for the shelter equipment. The primary goal of the CoolLinks™ controller is to maximize the energy efficiency of the Marvair DC FC units while maintaining a consistent internal shelter temperature.

2.1 Equipment Architecture

Each telecommunications shelter is equipped with two externally mounted Marvair® DC FC air conditioners connected to the CoolLinks™ HVAC controller inside the shelter. An operator panel provides local set point control and alarm condition notification. Marvair units are specifically designed to cool telecommunications shelters where the high internal heat load requires year round cooling even when ambient temperatures are below 60°F. Although one unit can more than adequately cool the shelter space, a second unit is provided as a redundant backup and to allow lead/lag unit operation.

Each Marvair A/C unit operates on both AC and DC power. The compressor, electric heat (optional), and condenser fan motor all operate on AC power while the evaporator motor, DC free air economizer damper and the internal control board all operate on DC power. Since these key components are all powered from the 48 VDC plant (the same 48 VDC plant which supplies power to the shelter radios) this equipment always remains operational. Upon loss of AC power from the grid or the generator, use of the 48 VDC plant ensures that the units can provide emergency ventilation to the shelter until either grid or generator power is restored or the 48 VDC battery pack is exhausted.

When the outside air is cool and dry, the DC free air economizer damper opens and draws in filtered, outside air to cool the shelter. The 100% damper ensures that the volumetric flow of outside air brought into the shelter matches the rated airflow of the unit. The innovative design of the DC free air economizer assembly also allows inside air to exit the building (pressure relief) when the damper is in operation. The DC free air system not only provides temperature control and energy savings but also increased reliability through a decrease in the operating hours of the compressor and the condenser fan.



2.2 Control Sequence

The Marvair® CoolLinks™ controller sequences the operation of the two HVAC units to ensure the most energy-efficient conditioning of the shelter and the most balanced use of the equipment. The system determines the need to cool or heat the shelter based on an indoor temperature sensor and outside temperature/humidity sensor connected directly to the controller.

When cooling or heating is required, the controller runs the lead unit. The lead/lag unit operation rotates every 24 hours to ensure that each unit receives equal runtime and to extend the operating life of the units. If one of the units is unavailable, for example, scheduled maintenance, the system automatically selects the other unit. If the internal shelter temperature rises or falls above a certain threshold, the system runs both units.

For cooling requests, the system first examines the external shelter conditions to determine whether use of the DC Free-Air system is possible. If so, the economizer damper on the lead unit is opened and its position regulated by the controller to mix outside air with internal shelter air. If the internal temperature continues to rise, the DC Free-Air system is then enabled on the lag unit. Should the temperature continue to increase, the DC Free-Air cooling is disabled, both economizer dampers are closed, and mechanical cooling enabled on the lead unit. In the unlikely event that the temperature rises further, mechanical cooling is then activated on the lag unit. This control scheme allows CoolLinks™ to make as efficient use of the external air as possible to minimize HVAC power consumption.

The CoolLinks™ controller communicates with the HVAC units over Ethernet. If communications between the controller and one of the units fails, the HVAC unit will continue to run in stand-alone mode. Whenever communications are restored, the controller resumes control of the HVAC unit. An Ethernet connection is also provided for an SNMP interface through which a regional Network Operations Center (NOC) can receive alarms, monitor/change cooling/heating set points, and monitor HVAC unit operational parameters.

2.3 Set Point Control

The CoolLinks™ system compares the temperature from the indoor temperature sensor with the cooling and heating set points to determine the operation of the CoolLinks™ system. There are two groups of set points; cooling first/second stage set points, and heating first/second stage set points. The default values for these set points are:

Cooling first stage:	88**°**F
Cooling second stage differential:	5°F
Heating first stage:	50°F
Heating second stage differential:	2**°**F

In the event that the indoor temperature sensor fails, the system uses the mixed air temperature sensor value from the lead unit as the control temperature. If any of the set points are changed from the operator panel, the default values are restored after a period of one hour. The minimum set point for cooling or heating is 50°F and the maximum set point for cooling or heating is 90°F.

2.4 Cooling Set Point Control

Cooling First Stage:

The system will enable cooling whenever the indoor temperature is 1°F above the set point and disable cooling when the indoor temperature drops to 73°F. Note that although the cooling first and second stage set points can be temporarily changed from the operator panel, the disable set point is fixed at 73°F.

Cooling Second Stage:

The system will enable second-stage cooling whenever the indoor temperature is 1°F higher than the first-stage cooling set point plus the second stage cooling differential, and disable first and second-stage cooling when the indoor temperature drops to 73°F. The 5°F second-stage cooling differential allows the first-stage cooling time to operate fully and prevents short-cycling the second unit.

Cooling Example:

First-Stage Set Point:	88°F
Second-Stage Differential:	5°F
First-stage cooling start:	89°F (set point + 1°F)
First-stage cooling stop:	73°F
Second-stage cooling start:	94°F (set point + 1°F + 5°F)
Second-stage cooling stop:	73°F

Cooling Sequence:

Indoor Shelter Temperature	**Mechanical Cooling Operation**	**OR**	**DC Free-Air Cooling Operation**
89°F	DX Cooling Lead Unit		DC Free-Air Cooling Lead Unit
91°F	DX Cooling Lead Unit		DC Free-Air Cooling Lead & Lag
92°F	DX Cooling Lead Unit		DX Cooling Lead Unit
94°F	DX Cooling Lead & Lag Unit		DX Cooling Lead & Lag Unit
73°F	DX Cooling Off		DX & DC Free-Air Cooling Off

2.5 Heating Set Point Control

Heating First Stage:

The system will enable heating whenever the indoor temperature is 1°F below the set point and disable heating when the indoor temperature rises to 1°F above the set point. Note that if the cooling and heating temperature set points overlap, the system will only allow cooling to be active.

Heating Second Stage:

The system will enable second-stage heating whenever the indoor temperature is 1°F lower than the first-stage heating set point minus the second stage heating differential, and disable first and second-stage heating when the indoor temperature rises to 1°F above the first-stage set point. The 2°F second-stage heating differential allows the first-stage heating time to operate fully and prevents short-cycling the second unit.

Heating Example:

First-Stage Set Point:	50°F
Second-Stage Differential:	2°F
First-stage heating start:	49°F (set point - 1°F)
First-stage heating stop:	51°F (set point + 1°F)
Second-stage heating start:	47°F (set point - 1°F - 2°F)
Second-stage heating stop:	51°F (set point + 1°F)

Heating Sequence:

Indoor Shelter Temperature	**Mechanical Heating Operation**
49°F	Energize Heating Element Lead Unit
47°F	Energize Heating Element Lead & Lag Unit
51°F	De-Energize Heating Element(s)

2.6 DC Free-Air Cooling

When the calculated outside air dew point temperature is less than 65°F, the outside air temperature is less than 75°F, and the outside air relative humidity is less than 80%, mechanical cooling is disabled and outside air is introduced to cool the shelter. All three conditions must be satisfied before DC Free-Air cooling is enabled. In DC Free-Air cooling the damper is opened and its position regulated to mix outside air with internal shelter air. Every twenty-four hours, the damper is opened to 50% to verify the operation of damper motor, damper open switch, and damper actuator linkage.

2.7 Emergency Ventilation

If landline and generator power are lost, or both HVAC units are locked out for high or low pressure, the system selects Emergency Ventilation mode. Here, provided that the outside air is at a lower temperature than the inside air, the system will open the damper and run the Evaporator Blower Motor on each HVAC unit. The system again modulates the damper position to mix outside air with internal shelter air. Note that emergency ventilation will operate on both HVAC units and both will control the positions of their respective dampers independently.

2.8 Standalone Operation

If the control board in the HVAC unit is unable to communicate with the PLC in the CoolLinks™ system for a period of sixty seconds, the HVAC unit will select standalone mode. Here, the HVAC unit will run mechanical cooling and cool the shelter to a set point of 75°F. The mixed air sensor inside the HVAC unit functions as the shelter temperature sensor. When communications with the PLC is restored, the control board will automatically drop out of standalone mode and return to PLC-controlled operation.

2.9 System Interlocks

Smoke Detector (optional):

If the smoke sensor input to the CoolLinks™ system is active, the Compressor, Heater, and Evaporator Blower Motor on both HVAC units will be shut down and the damper will be fully closed. This is to halt the flow of air within the shelter.

Hydrogen Detector (optional):

If the hydrogen sensor input to the CoolLinks™ system is active, the damper(s) on units that are not currently mechanically cooling will be fully opened and the Evaporator Blower Motor(s) will be turned on. The intention here is to expel noxious gases and to introduce outside air into the shelter.

Generator Running (optional):

If the generator running input to the CoolLinks™ system is active, only one HVAC unit will be permitted to run mechanical cooling. As the generator is sized to run only one HVAC unit, this ensures that the generator load is not exceeded. Note also that when the generator is running, the HVAC will not operate in the DC Free-Air cooling mode. This prevents the wet stacking effect on the generator due to insufficient load.

Chapter 3 MECHANICAL INSTALLATION

3.1 Control Enclosure

The CoolLinks™ control enclosure can be mounted directly on the wall in any suitable location on the inside of the shelter; the enclosure does not have to be mounted on the same wall as the HVAC units. However, there are some physical constraints that should first be considered prior to mounting:

- Two, 50ft. Ethernet cables for connection to each of the HVAC units. The enclosure should be mounted to ensure that the distance from the electrical box inside each HVAC unit to the enclosure does not exceed 50ft. including all necessary conduit routing.
- One, 40ft. inside sensor communications cable is provided as part of the installation kit. Again, the distance between the enclosure and the sensor should not exceed the length of the communications cable, which must also be run in conduit.
- The operator touchscreen provides the main interface to the CoolLinks™ system and should be installed at height where a technician can comfortably operate the system while standing in front of the enclosure. Typically, this would be a height of 5ft. from the floor.
- The control enclosure has a depth of 8in. It is important to ensure that the enclosure does not extend into a walkway and does not impede access to other shelter equipment.

The control enclosure is mounted to the shelter wall with four screws through the back of the enclosure. To install the enclosure, first open the hinged door. Four mounting holes are visible on the rear of the enclosure. Screws should be installed in each hole and must be sufficient in length and size to support the 20lbs weight of the enclosure. If necessary, washers may be installed behind the heads of the screws.

Per shelter standards, all cables or wires entering or leaving the control enclosure must be installed in conduit, either fixed or flexible conduit. For this purpose conduit knockouts are provided on the top and both sides of the enclosure. Please refer to the ATT-TP-76300 for details of cable routing requirements.

3.2 Inside Temperature Sensor

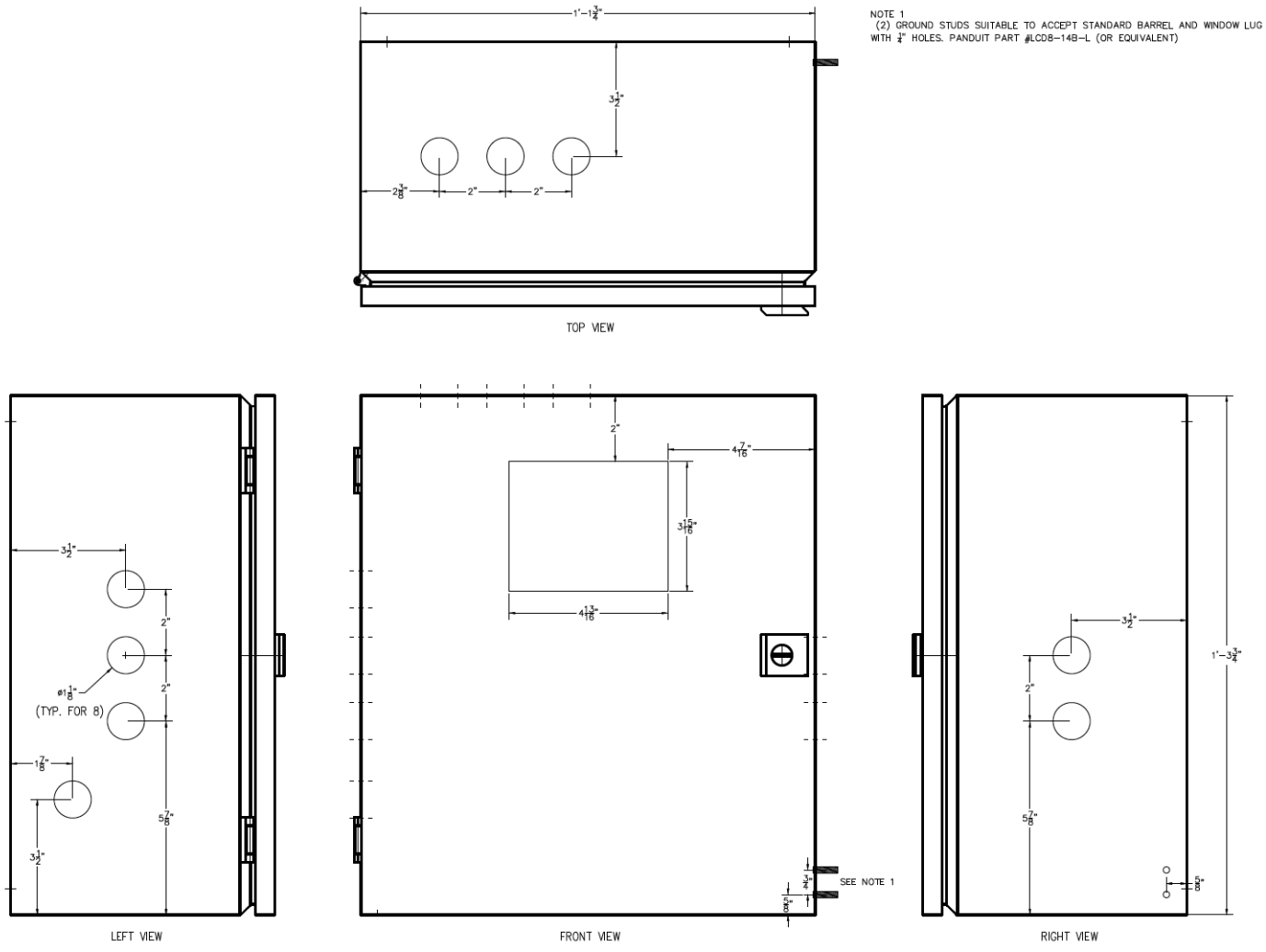
The inside temperature sensor measures the internal shelter temperature which is in turn is used by the CoolLinks™ controller to operate the cooling and heating functions of the DC FC units. The sensor mounts on a standard 4" x 2" Handy box and can be mounted anywhere within 40ft. of the controller (including conduit routing). The ideal location is on the wall midway between the two DC FC units at a height of 5ft. above the floor, provided that this location is not behind any equipment or a grounding bar. The sensor does need a nominal flow of air over the sensor element but should not be placed directly in front of the supply air or return air vents or adjacent to the shelter entry door. The sensor should also not be installed behind equipment racks or close to local heat sources such as rectifiers, radio cabinets, or battery chargers.

For detailed installation instructions, please refer to the bulletin *AT&T Indoor and Outdoor Sensor Installation rev.2 8/2014* on the Marvair AT&T web portal. To access this portal, go to www.marvair.com and scroll to the bottom of the Home page. Click on the AT&T icon. A user account is required to access the portal and new accounts can be requested from the same web portal.

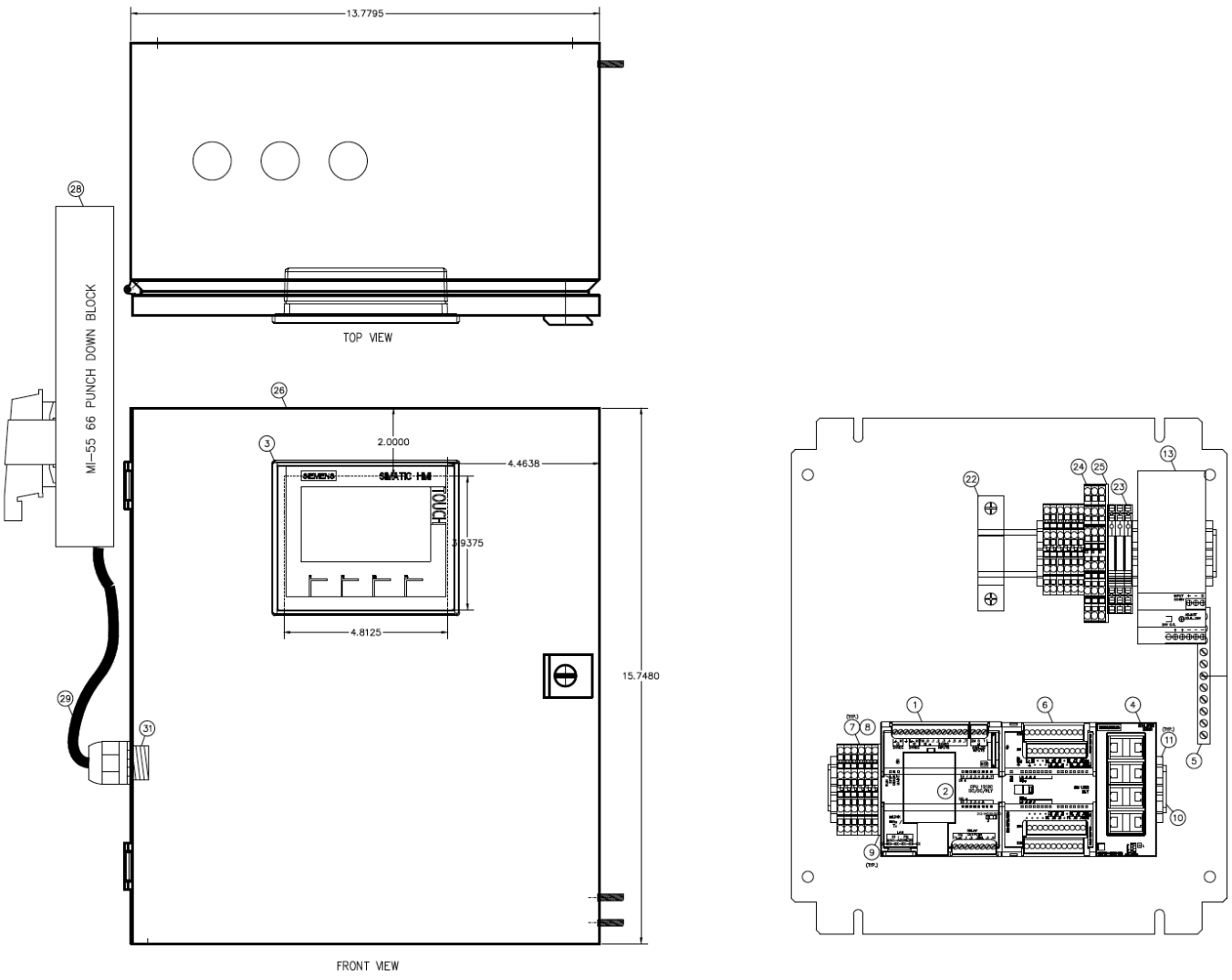
3.3 Outside Temperature & Humidity Sensor

The outside temperature & humidity sensor measures the external shelter temperature and humidity to allow the CoolLinks™ controller to operate the DC Free-Air Cooling and, when necessary, Emergency Ventilation. The outside sensor is internal to the DC FC unit. The sensor and sensor cable are located on the underside of the electrical control box in the units. The free end of the sensor cable should be installed in the same conduit as the 48VDC feed to the DC FC units and terminated inside the CoolLinks™ controller. Although both DC FC units have an internal sensor, only the sensor in the DC FC unit designated as Unit #1 should be connected to the CoolLinks™ controller. The cable from the spare sensor should be installed in the same manner as the first sensor but tie-wrapped and labeled as spare inside the controller enclosure. In the event that the first sensor fails, connect the spare second sensor directly to the CoolLinks controller.

3.4 Mechanical Dimensions



CoolLinks™ Enclosure Dimensions



CoolLinks™ Enclosure Component Layout

Chapter 4 ELECTRICAL INSTALLATION

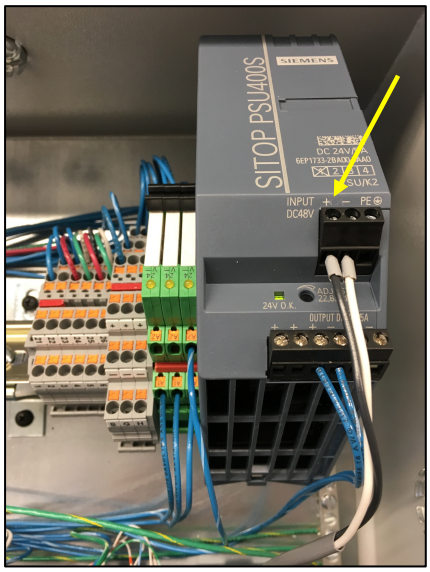
⚠ WARNING
ELECTRICAL SHOCK HAZARD

Failure to follow safety warnings exactly could result in serious injury, death, and/or property damage.
Turn off electric power at the service panel or fuse box BEFORE making any electrical connections and ensure a proper ground connection is made.

4.1 Control Power (48 VDC)

The CoolLinks™ controller requires a two-conductor, 5A, 48VDC feed from the shelter DC plant. This feed connects to the power converter inside the controller enclosure which steps the 48VDC down to 24VDC for the PLC and the sensor control power. Distances of up to 30 feet require 12AWG and distances greater than 30 feet must follow the NEC standard. The wire type must be per AT&T policy document *ATT-002-290-701, Cell Site DC Power Wiring Requirements*. Wire sizes 14AWG through 10AWG must use TelcoFlex®III or KS24194®L3 and sizes larger than 10AWG must use TelcoFlex®IV or KS24194®L4. All wire connections in the DC plant must use two-hole compression lugs sized for the wire gauge. The use of single-hole lugs is prohibited unless the DC plant cannot accommodate two-hole lugs.

After installing the cable between the DC plant and the controller, terminate the cable on the terminals inside the DC plant. Next, connect the cable to the + and – 48VDC terminals of the power converter inside the controller enclosure.

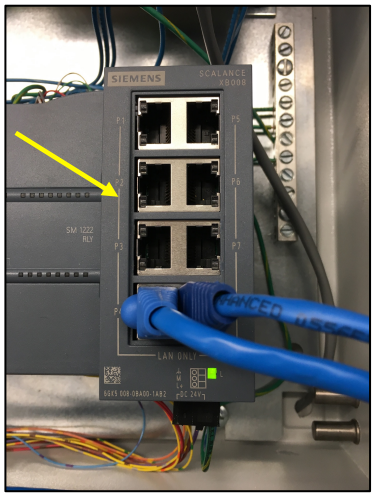


CoolLinks Power Converter 48VDC Connections

Install the 5A breaker in the DC plant with the breaker in the off position. The local market will supply the breaker since this is specific to the particular DC plant model and manufacturer. Prior to turning the breaker on, verify that the 48VDC polarity is correct. If so, turn on the breaker. The 24V OK light on the front of the power converter should now be on and the other modules inside the enclosure should power-up. If the DC plant polarity is correct and the power converter does not power-up, turn the breaker off then swap the wires on the power converter. Turn the breaker on and the unit should now power-up.

4.2 Ethernet Connections

The CoolLinks™ enclosure contains an eight-port Ethernet switch as shown below. All Ethernet devices in the system connect through this switch. The ports on the switch are not dedicated and any device can plug into any open port. The switch supports auto negotiation of transmission speeds as well as auto MDI/MDI-X crossover to allow either crossover or patch cable connections. Each port has a green LED that flashes on and off to indicate that a valid link is present and data is being received at the port. A solid green LED indicates that a valid link is present but no data at the port.



Eight-Port Ethernet Switch

Currently, there are five possible Ethernet connections in the system: Operator Panel, CoolLinks™ CPU, HVAC unit 1, HVAC unit 2, and the Olympus router. By convention, the operator panel and CPU plug into the bottom two ports (P4, P8) and the HVAC units into the top two ports (P1, P5). The Olympus router (if present) plugs into any remaining open port. The Ethernet cables from the CoolLinks™ controller to the HVAC units can be installed in the same low voltage conduit as the 48VDC feed to the DC FC units.

4.3 Configuration Options

Two types of controller configuration are available, the New Site Build (NSB) controller intended for new shelters and the End-of-Life (EOL) controller intended for field replacements of older controllers. Both controllers are functionally identical and the primary difference is the field connections for the RBS alarms. With the NSB controller, RBS alarms are available on the terminal blocks inside the enclosure. All NSB alarms are normally closed contacts. With the EOL controller, RBS alarms are available on a separate 66 block with a normally closed and normally open contact available for each alarm.

Two hard-wired options are available on the CoolLinks™ controller that affects the operation of the system. By default, both options are disabled. To enable either option, install the appropriate jumper wire. The two options are:

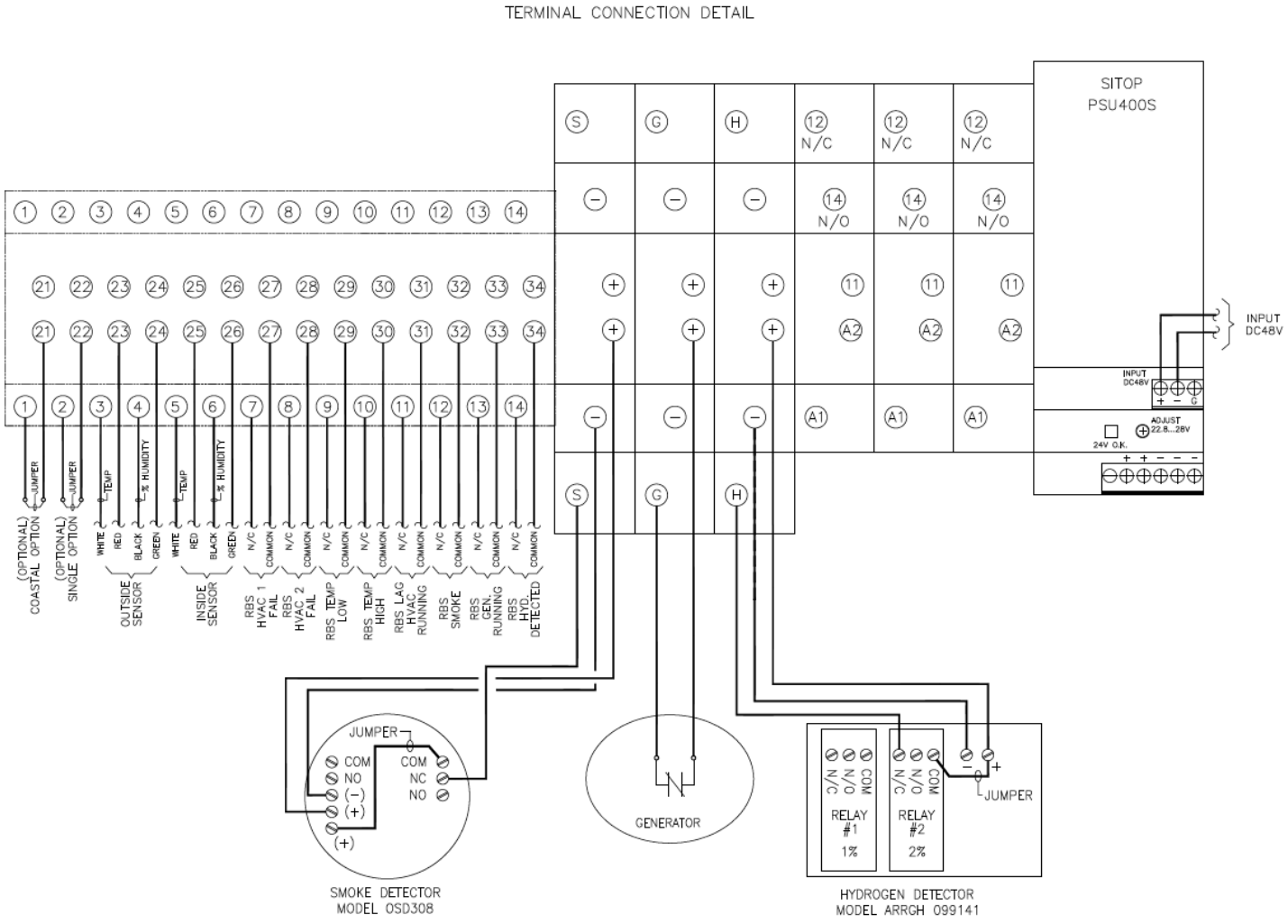
- Single Unit, which is intended for shelter or tenant improvement sites with only one HVAC unit. If installed, the lead/lag function is disabled, and communications fault alarms from unit 2 are suppressed.
- Coastal Unit, which is intended for shelters located adjacent to salt water, chemical, or dusty environments. If installed, the DC Free-Air system is disabled. This prevents the introduction of potentially corrosive air into the shelter and avoids filter contamination. The DC Free-Air damper will still operate in Emergency Ventilation.

After the controller type has been identified, follow the appropriate section to complete the wiring for the inside and outside sensors, the alarms to the shelter alarm block, and the hard-wired options.

4.4 New Site Build (NSB) Controller Field Connections

All of the field connections on the NSB controller terminate on the terminal blocks on the top right-hand side of the controller enclosure. These terminations fall into two types; two-tier terminals for the indoor sensor, outdoor sensor, HVAC alarms, configuration options, and three-tier terminals for the smoke, generator running, and hydrogen detectors.

Sensors, Options, Alarms, Detectors:



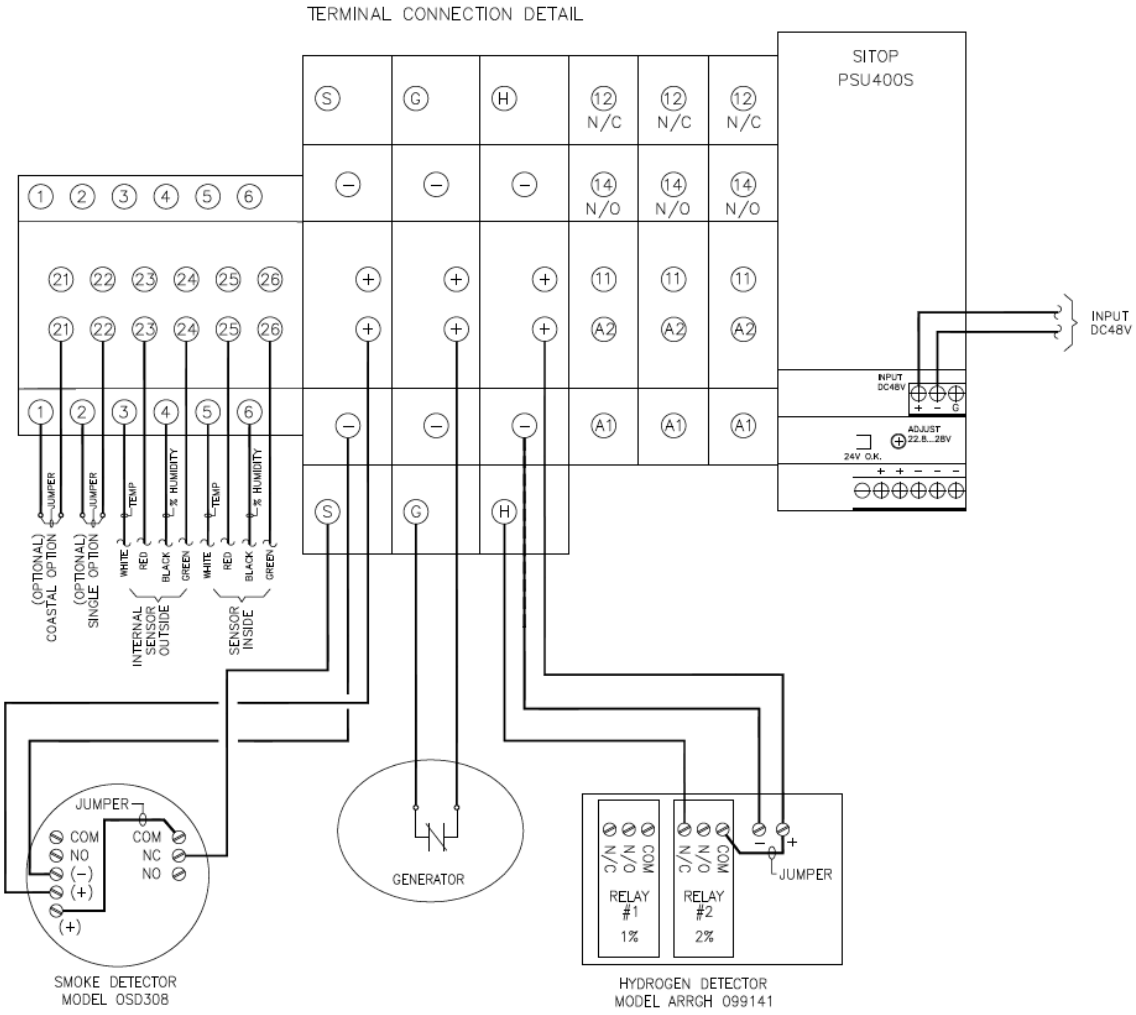
Notes:

1. If there is no smoke detector a jumper must be installed between S and + on the terminal block.
2. If the shelter is no input from the generator a jumper must be installed between G and + on the terminal block.
3. If the shelter is no hydrogen detector a jumper must be installed between H and + on the terminal block.

4.5 End of Life (EOL) Controller Field Connections

The EOL controller is similar to the NSB controller in that all field connections terminate on the terminal blocks on the top right-hand side of the controller enclosure. The primary difference is that HVAC alarms are now provided on a separate 66 punch-down block with normally open and normally closed dry contacts supplied for each alarm.

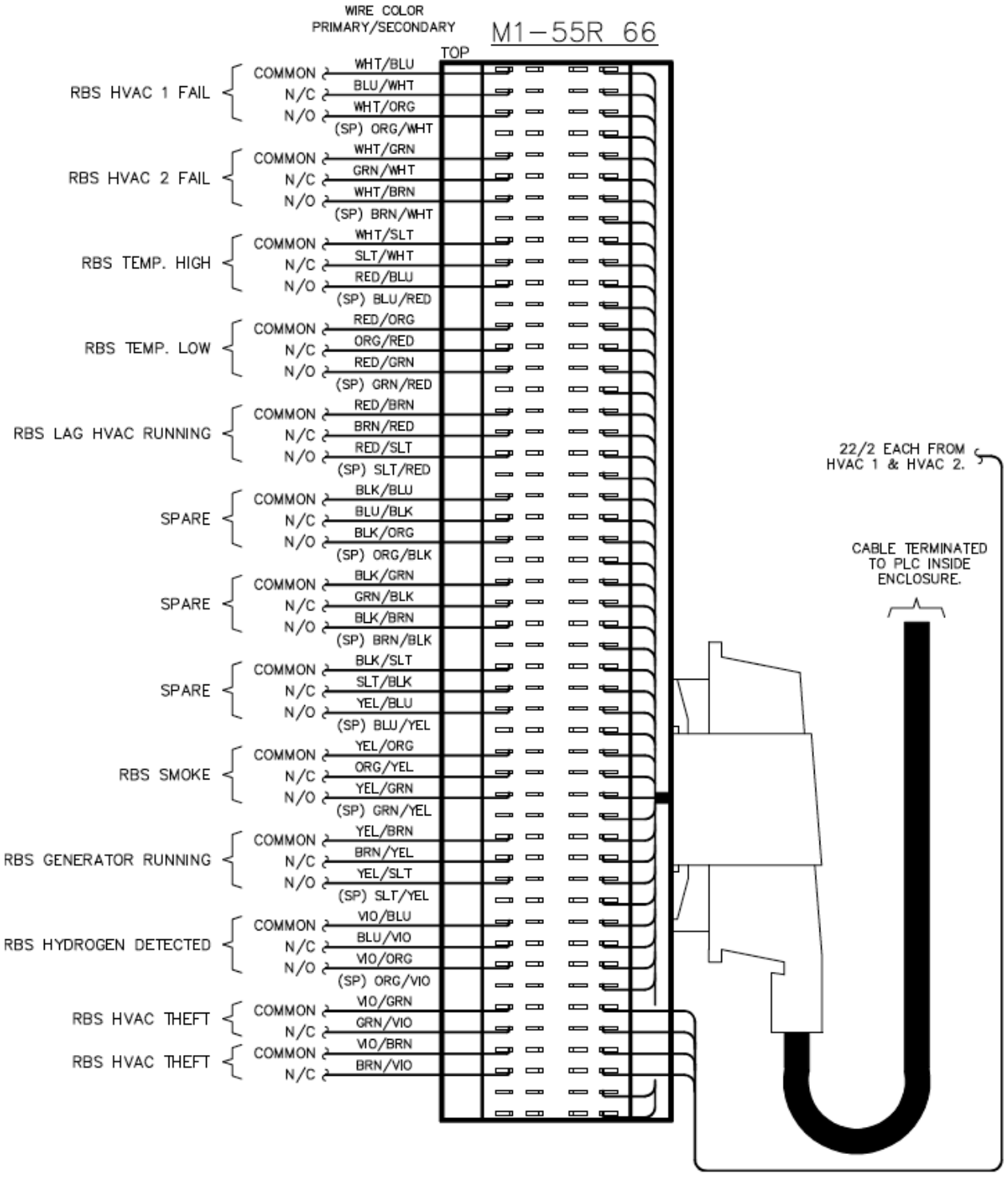
Sensors, Options, Detectors:



Notes:

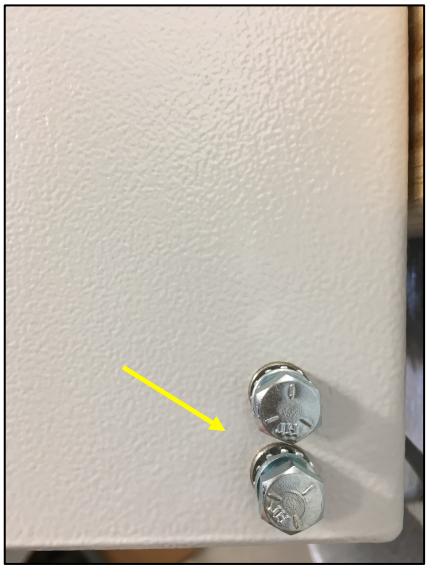
1. If there is no smoke detector a jumper must be installed between S and + on the terminal block.
2. If the shelter is no input from the generator a jumper must be installed between G and + on the terminal block.
3. If the shelter is no hydrogen detector a jumper must be installed between H and + on the terminal block.

Alarms:


WIRE COLOR
PRIMARY/SECONDARY
M1-55R 66
TOP
RBS HVAC 1 FAIL
COMMON WHT/BLU
N/C BLU/WHT
N/O WHT/ORG
(SP) ORG/WHT
RBS HVAC 2 FAIL
COMMON WHT/GRN
N/C GRN/WHT
N/O WHT/BRN
(SP) BRN/WHT
RBS TEMP. HIGH
COMMON WHT/SLT
N/C SLT/WHT
N/O RED/BLU
(SP) BLU/RED
RBS TEMP. LOW
COMMON RED/ORG
N/C ORG/RED
N/O RED/GRN
(SP) GRN/RED
RBS LAG HVAC RUNNING
COMMON RED/BRN
N/C BRN/RED
N/O RED/SLT
(SP) SLT/RED
SPARE
COMMON BLK/BLU
N/C BLU/BLK
N/O BLK/ORG
(SP) ORG/BLK
SPARE
COMMON BLK/GRN
N/C GRN/BLK
N/O BLK/BRN
(SP) BRN/BLK
SPARE
COMMON BLK/SLT
N/C SLT/BLK
N/O YEL/BLU
(SP) BLU/YEL
RBS SMOKE
COMMON YEL/ORG
N/C ORG/YEL
N/O YEL/GRN
(SP) GRN/YEL
RBS GENERATOR RUNNING
COMMON YEL/BRN
N/C BRN/YEL
N/O YEL/SLT
(SP) SLT/YEL
RBS HYDROGEN DETECTED
COMMON VIO/BLU
N/C BLU/VIO
N/O VIO/ORG
(SP) ORG/VIO
RBS HVAC THEFT
COMMON VIO/GRN
N/C GRN/VIO
RBS HVAC THEFT
COMMON VIO/BRN
N/C BRN/VIO
22/2 EACH FROM
HVAC 1 & HVAC 2.
CABLE TERMINATED
TO PLC INSIDE
ENCLOSURE.

4.6 Bonding

All of the electrical components within the CoolLinks™ controller enclosure are grounded to the grounding bar on the right-hand side of the back panel. This back panel is in turn grounded to the controller case. Two threaded inserts are provided on the outside of the enclosure to which the outside of this case should be grounded to the shelter halo with a green 6 AWG stranded wire using a two-hole compression lug on the case and a C-tap at the halo. The inserts are designed for a two-hole lug with 0.25-inch holes and a spacing of 0.75 inches. Please refer to ATT-TP-76300 for the specifics of the bonding requirements.



Bonding Lug Connections

4.7 External Cable Labels

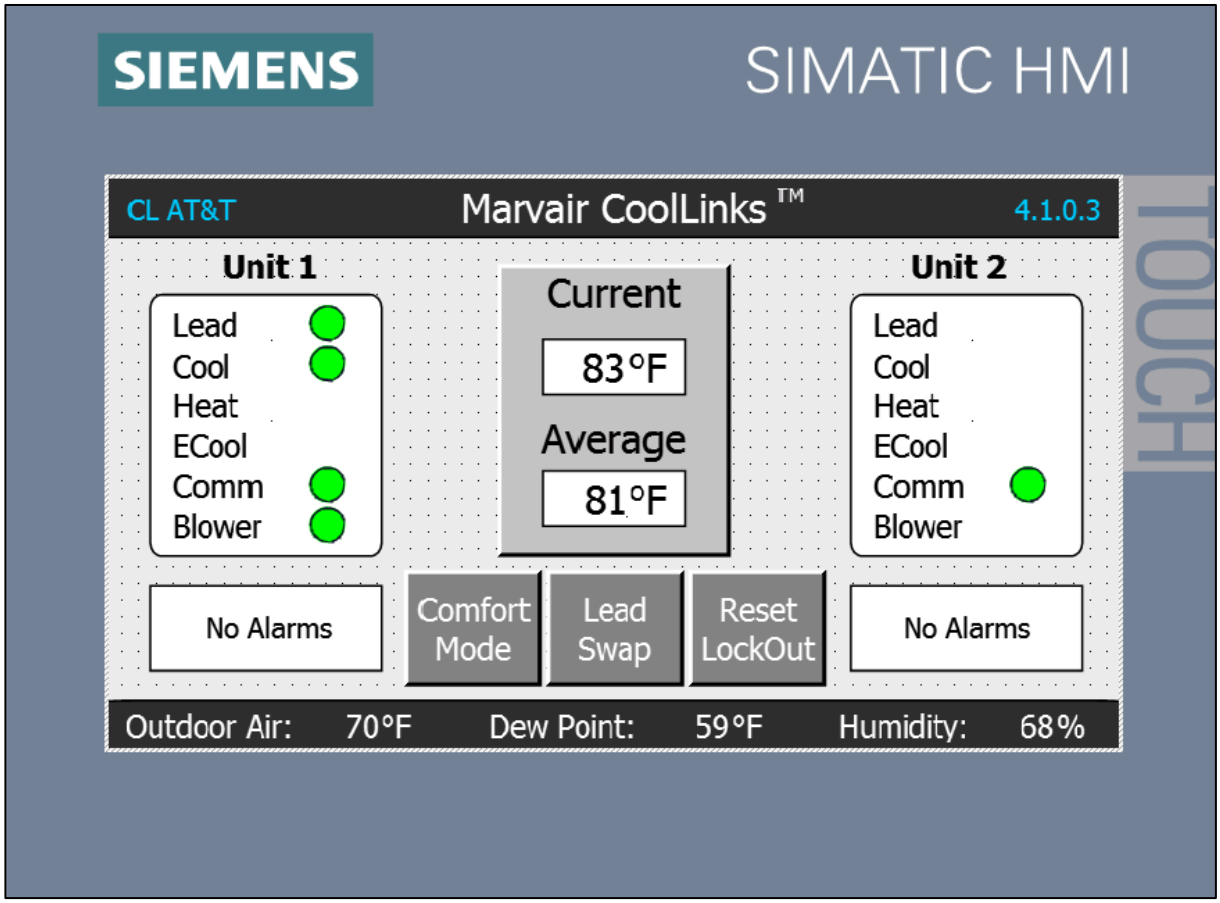
All cables that enter or exit the controller enclosure must be individually labeled. Please refer to ATT-TP-76300 for details of the labeling requirements. The table below identifies the type and purpose of each of the controller cables:

From	To	Description
DC Plant	Controller	48VDC Power Feed
Controller	HVAC Unit #1	Cat5e Ethernet Cable
Controller	HVAC Unit #2	Cat5e Ethernet Cable
Controller	Olympus Router	Cat5e Ethernet Cable (optional)
Inside Sensor	Controller	Sensor Power & Communications Cable
Outside Sensor #1	Controller	Sensor Power & Communications Cable
Outside Sensor #2	Controller	Sensor Power & Communications Cable (spare)

Chapter 5 OPERATOR INTERFACE

5.1 System Status

The main screen displays the status of the Marvair® CoolLinks™ system and the two Marvair® HVAC units. Standing inside the shelter facing the HVAC return air vents, unit 1 is the left-hand unit and unit 2 is the right-hand unit.



Main Status Screen

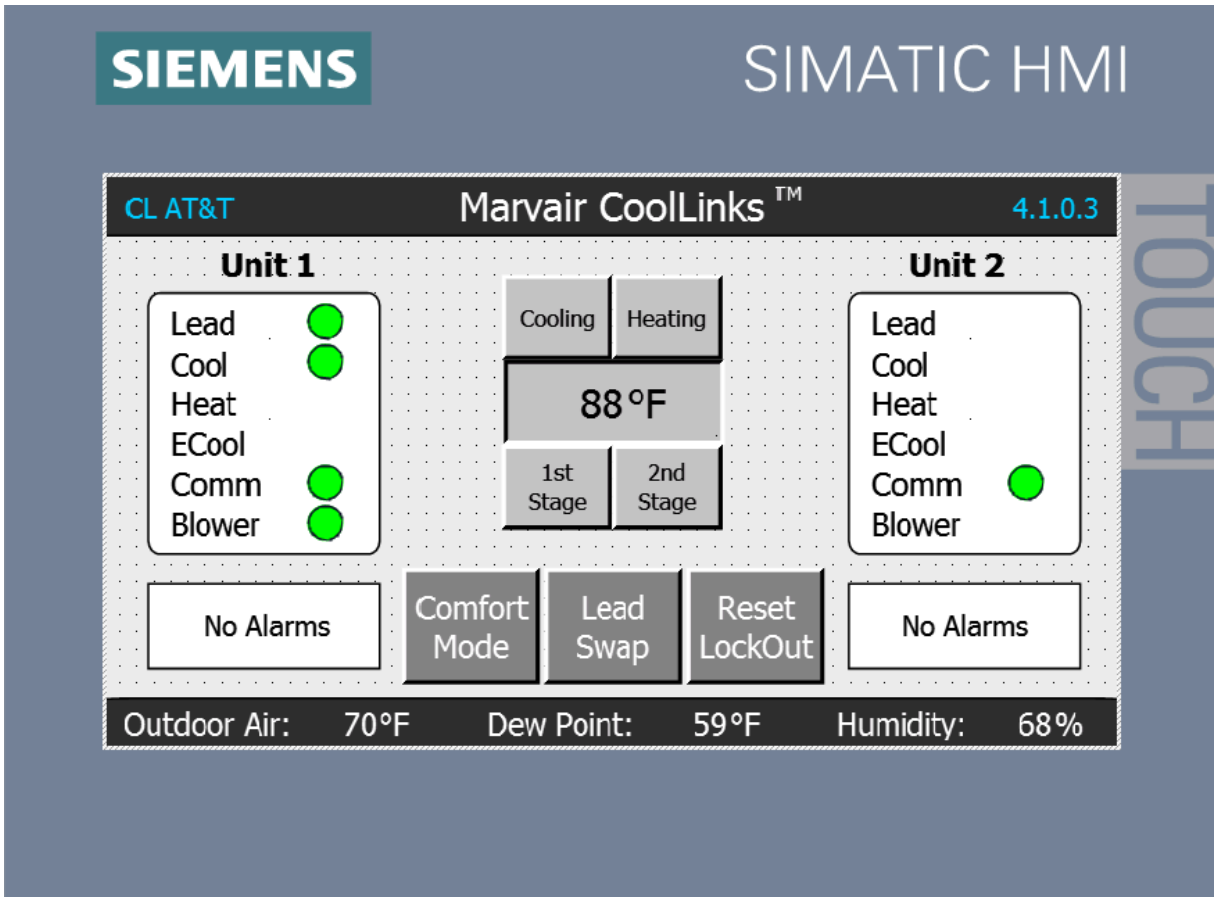
The fields on the status screen are as follows:

Current	Current indoor temperature. A flashing "###" indicates that the value from the sensor is bad and that either the sensor is faulty or not connected properly. In the case of a bad sensor value, the system uses the temperature from the internal mixed air sensor of the lead unit as the indoor temperature and disables DC Free-Air cooling.
Average	Average indoor temperature over the last 24 hours.
Unit Status Panel	Indicates the status of the HVAC unit as follows: • Lead Green: unit is lead unit • Cool Green: unit is cooling • Heat Green: unit is heating • ECool Green: DC Free-Air Cooling Active • Comm Green: PLC comm active, Red: PLC comm fault • Blower Green: evaporator blower running (IBM)

Lead Swap Push button	Swap the lead and lag unit. If the lag unit is in lockout or has a comm fault, the system will not swap. If the lead unit experiences a lockout or comm failure while cooling, the system will automatically swap to the lag unit.
Comfort Mode Push button	Drop the first-stage cooling set point from 88**°**F to 76**°**F to allow a service technician to work comfortably inside the shelter. After one hour the set point returns to its previous value. Pressing this push button if a smoke alarm is active will allow the HVAC units to run for ten minutes to cool the shelter and to reset the smoke detector high temperature interlock.
Reset Lockout Push button	Resets the lockout condition on whichever unit is in lockout. A call for cooling must be active before the lockout can be reset. Pressing this push button will also display the current software revision on the Indoor Air field for two seconds.
Outdoor Air	Outside air temperature (**°**F). A flashing "###" indicates that the value from the sensor is bad and that either the sensor is faulty or not connected properly. In the case of a bad sensor value the system disables DC Free-Air cooling and emergency ventilation.
Humidity	Outside air relative humidity (%). A flashing "###" indicates that the value from the sensor is bad and that either the sensor is faulty or not connected properly. In the case of a bad sensor value the system disables DC Free-Air cooling.
Dew Point	Dew point temperature (**°**F). When the calculated dew point is below 65**°**F, the outside air temperature is below 75**°**F, and the outside relative humidity is below 80%, then enable DC Free-Air cooling. A solid "###" indicates that one or both values from the outside sensor are bad.
Alarm Message	Active unit alarms are displayed in the alarm message window below the unit status panel. For multiple alarms the system scrolls through the active alarms displaying each alarm message for five seconds. Possible alarm messages are: • High Pressure Switch Alarm • Low Pressure Switch Alarm • High Pressure Switch Lockout • Low Pressure Switch Lockout • 1st High Indoor Temperature Alarm (> 95**°**F) • 2nd High Indoor Temperature Alarm (> 98**°**F) • Low Indoor Temperature Alarm (< 45**°**F) • Landline Power Alarm • Damper Alarm • Smoke Alarm • Generator Running • Hydrogen Alarm • Communications Alarm • Dirty Filter Alarm • No Alarms
CL AT&T x.x.x.x	Identifies the current software revision as x.x.x.x

5.2 Changing Set Points

Set points control the cooling and heating operation of the CoolLinks™ system. The minimum and maximum set points are 50°F and 90°F for both cooling and heating. To access these set points, simply touch the top or bottom of the Current/Average temperature display. This will then display the set point entry panel. If a new set point value is not entered within ten seconds, the display will revert back to the previous display.



Set Point Entry Screen

From the set point control panel, alter the set points as follows:

Cooling First Stage:

Press the Cooling push button then press the 1st Stage push button. Both push buttons will turn dark gray with white text and the current cooling first-stage set point value will be displayed. Next, press the set point value to display the numeric entry screen and enter the new set point. The system will now enable cooling whenever the indoor temperature is 1°F above the set point and disable cooling when the indoor temperature drops to 73°F.

Cooling Second Stage:

Press the Cooling push button then press the 2nd Stage push button. Both push buttons will turn dark gray with white text and the current cooling second-stage set point value will be displayed. Next, press the set point value to display the numeric entry screen and enter the new differential value. The system will now enable second-stage cooling whenever the indoor temperature is 1°F higher than the first-stage cooling set point plus the second-stage cooling differential, and disable second-stage cooling when the indoor temperature drops to 73°F.

Heating First Stage:

Press the Heating push button then press the 1st Stage push button. Both push buttons will turn dark gray with white text and the current heating first-stage set point value will be displayed. Next, press the set point value to display the numeric entry screen and enter the new set point. The system will now enable heating whenever the indoor temperature is 1°F below the set point and disable heating when the indoor temperature rises to 1°F above the set point.

Heating Second Stage:

Press the Heating push button then press the 2nd Stage push button. Both push buttons will turn dark gray with white text and the current heating second-stage set point value will be displayed. Next, press the set point value to display the numeric entry screen and enter the new differential value. The system will now enable second-stage heating whenever the indoor temperature is 1°F lower than the first-stage heating set point minus the second-stage heating differential, and disable second-stage heating when the indoor temperature rises to 1°F above the first-stage set point.

Chapter 6 FUNCTIONAL TEST PROCEDURE

6.1 Pre-Test Checklist

The CoolLinks™ system can be functionally tested with the controls and features provided by the system and without the need for additional test equipment. Prior to performing any tests, verify the following:

- Ensure that all cables and wiring connections are properly installed from each HVAC unit to the CoolLinks™ controller and from the CoolLinks™ controller to the inside sensor, outside sensor, smoke detector, hydrogen detector, and generator control panel.
- Verify that the AC breakers in the shelter electrical distribution panel are in the ON position for both DC FC units.
- Verify that the DC breakers in the DC plant are in the ON position for both DC FC units.
- Switch the AC and DC breakers to the ON position on both DC FC units.
- Switch the DC breaker for the CoolLinks™ controller in the DC plant to the ON position.
- Wait for the operator panel to display the System Status Screen (approximately 30 seconds).
- Verify that there are no active alarms (it may take up to one minute for startup alarms to clear) and address any wiring or configuration issues at this time.
- Verify that the indoor air temperature, outdoor air temperature, and outside air relative humidity are consistent with the actual shelter conditions.

DO NOT use an open flame or lighter to heat either the inside or outside sensor. This can damage the sensitive sensing element in the sensor. Adjust the cooling and heating set points from the operator panel to force the system into heating or cooling in order to test system functions. In the case of emergency ventilation testing, a heat gun set on low heat and placed no closer than twelve inches from the sensor may be used to **SLOWLY** increase the indoor temperature.

6.2 Mechanical Cooling Test

- If conditions are not suitable for DC Free-Air cooling, set the first stage cooling set point to 1°F below the indoor air temperature. If conditions are suitable for DC Free-Air cooling, set the first stage cooling set point to 4°F below the indoor air temperature.
- The blower in the new lead unit will start and the lead unit will run in mechanical cooling mode.
- Allow the lead unit to run in mechanical cooling mode for at least one minute.
- Press the Lead Swap push button on the operator panel.
- The former lag unit will become the lead unit, the blower will start, and the unit will run in mechanical cooling mode. The blower on the lag unit will stop.
- Allow the lead unit to run in mechanical cooling mode.
- To run both units in mechanical cooling mode set the first stage cooling set point 10°F below the indoor air temperature. The lag unit will run in mechanical cooling mode. Note that although the blower will start, the anti-short cycle timer may still be active and the compressor may not start immediately.
- Mechanical cooling mode will stop when the indoor air temperature indoor temperature drops to 73°F.
- Restore the cooling first stage set point.

6.3 Electric Heat Test

- Set the first stage cooling set point to 90°F.
- Set the first stage heating set point to 1°F above the indoor air temperature.
- The blower in the lead unit will start and after ten seconds the new lead unit will run in heating mode.
- Allow the lead unit to run in heating mode for at least one minute.
- Press the Lead Swap push button on the operator panel.
- The former lag unit will become the lead unit, the blower will start, and after ten seconds the unit will run in heating mode. The blower on the lag unit will stop.

- Allow the lead unit to run in heating mode.
- Heating mode will stop when the indoor air temperature is 1°F above the first stage heating set point.
- Restore the cooling and heating first stage set points.

6.4 Emergency Ventilation & Damper Test

- Switch the AC breakers to the OFF position on both DC FC units.
- Leave the DC breakers in the ON position on both DC FC units.
- After approximately 30 seconds the Landline Power Alarm will be displayed in the unit status panel for each DC FC unit on the operator panel.
- Set the first stage cooling set point to 1°F below the indoor air temperature.
- If the indoor air temperature is greater than or equal to the outdoor air temperature, the system will activate Emergency Ventilation mode. Here, the indoor blowers on the lead and lag unit will run and the DC Free-Air dampers will open and modulate to mix outside air with internal shelter air.
- If the indoor air temperature is less than the outdoor air temperature, **SLOWLY** warm the indoor air temperature sensor until it is higher than the outside air temperature.
- Switch the DC FC unit AC breakers to the ON position and restore the first stage cooling set point.

6.5 Smoke Alarm Test

- Remove the signal wire (from smoke detector) or jumper wire (no smoke detector) from the three-tier terminal labeled S. This will simulate a smoke alarm.
- On both units, the indoor blower and compressor will stop and the DC Free-Air damper will close.
- Reinstall the signal or jumper wire.

6.6 Generator Running Test

- Set the first stage cooling set point to 6°F below the indoor air temperature to force both DC FC units into mechanical cooling. The indoor blower and the compressor on the lead and lag unit will both run.
- Remove the signal wire (from generator) or jumper wire (no generator input) from the three-tier terminal labeled G. This will simulate a generator running signal.
- The indoor blower and compressor on the lag unit will stop.
- Reinstall the signal or jumper wire.

6.7 Hydrogen Alarm Test

- Remove the signal wire (from hydrogen detector) or jumper wire (no hydrogen detector) from the three-tier terminal labeled H. This will simulate a hydrogen alarm.
- On both units, the indoor blower will run and the DC Free-Air damper will fully open. If mechanical cooling is active the compressor(s) will continue to run.
- Reinstall the signal or jumper wire.

6.8 Standalone Operation Test

- At the eight-port Ethernet switch, unplug the Cat5e cable from each of the DC FC units.
- After approximately 60 seconds the Communications Alarm will be displayed in the unit status panel for each DC FC unit on the operator panel. The indoor blowers on both units will now run.
- For each DC FC unit, when the mixed air temperature rises to 76°F, mechanical cooling will start and continue to run until the mixed air temperature drops to 74°F (the mixed air temperature sensor is internal to the DC FC unit and normally measures the return air temperature for the DC Free-Air system).
- Plug the Cat5e cable from each DC FC unit back into the eight-port Ethernet switch.
- After approximately 60 seconds the Communications Alarms will clear and the system will return to normal operation.

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