

---

# INSTALLATION INSTRUCTIONS & REPLACEMENT PARTS LIST

---

## DC3002 and DC3003 SOLID STATE LEAD/LAG CONTROLLER with DC FAN CONTROL



*Climate Control Solutions*

Bard Manufacturing Company, Inc.  
Bryan, Ohio 43506

*Since 1914...Moving ahead, just as planned.*

Manual No.: 2100-484E  
Supersedes: 2100-484D  
File: Vol. III Tab 19  
Date: 08-29-11

# CONTENTS

<b>Getting Other Information and Publications</b>	3	<b>Security (Locking) Feature</b>	
<b>DC3000 General Information</b>		Locking and Unlocking the DC3000	9
Shipping Damage	4	<b>Generator Run Feature</b>	
General	4	Standby Generator Disable Operation	9
Theory of Operation	4	<b>Backup DC Power Connection</b>	
Controller Certifications	4	Input Connections Available	9
<b>Specifications/Features for Basic Controller</b>		<b>DC Fan Control</b>	
DC3000 Basic Controller	5	Free Cooling & Emergency Ventilation	10
<b>Mounting the Controller</b>		Shelter Purge Control	10
Installation Instructions	5	<b>Controller Wiring</b>	
<b>Temperature Sensors</b>		Refer to Connection Diagram	10 & 11
Remote Indoor Sensor	5	<b>Alarm Wiring</b>	
Remote Outdoor Sensor	5	Wiring Alarm Relays	16
<b>Temperature Sensor Logic</b>		<b>2nd Stage Cooling Alarm</b>	
Using Multiple Sensors	5	Alarm Output is Available	16
<b>Controller Input/Output Specifications</b>		<b>Refrigerant Pressure Alarms</b>	
Main Controller Board	6	Connecting the Alarm Circuit	16
Internal Alarm Board	6	<b>Emergency Ventilation Sequence</b>	
<b>Low Voltage Field Wiring</b>		Using Economizers	
Circuitry in the DC3000	7	Two Operating Sequences	16
<b>Controller Grounding</b>		<b>Programming Instructions</b>	19
Earth ground	7	<b>Figures</b>	
<b>Controller Power-Up</b>		Figure 1 DC3002 Controller Connections for 2 Air	
Time Delay on Power-Up	7	Conditioners with Economizer	11
<b>Fire Suppression Circuit</b>		Figure 2 DC3002 Controller Connections for 2 Air	
Disabling the DC3000	7	Conditioners with No Economizer	12
<b>Staging Delay Periods</b>		Figure 3 DC3003 Controller Connections for 3 Air	
Stages 1 - 4	7	Conditioners with 3 Economizers	13
<b>Blower Operation</b>		Figure 4 DC3003 Controller Connections for 3 Air	
Various Blower Options	7	Conditioners with Economizers	
<b>Advance (Swap) Lead/Lag Unit Feature</b>		(No Economizer A/C #3)	14
Manual Switching of Units	7	Figure 5 DC3003 Controller Connections for 3 Air	
<b>Accelerate Timer Feature</b>		Conditioners with No Economizers	15
Testing the Timer Function	7	Figure 6 Alarm Board Connections for Normally Closed	
<b>Humidity Control Option</b>		"NC" Open-On-Alarm Strategy	17
Adding Optional Humidity Control	8	Figure 7 Alarm Board Connections for Normally	
<b>Sequence of Operation - Cooling (Air Conditioners)</b>		Open "NO" Close-On-Alarm Strategy	18
No Economizer	8	(Label) DC3000 Series	20
With Economizers	8	Figure 8 Parts List Description	21
<b>Sequence of Operation - Heating (Air Conditioners)</b>		<b>Tables</b>	
With Electric Heat	9	Table 1 Controller Connection Diagrams	10
		Table 2 Parts List	22

# Getting Other Information and Publications

---

These publications can help you install the air conditioner or heat pump. You can usually find these at your local library or purchase them directly from the publisher. Be sure to consult current edition of each standard.

Standard for the Installation ..... ANSI/NFPA 90A  
of Air Conditioning and  
Ventilating Systems

Standard for Warm Air Heating ..... ANSI/NFPA 90B  
and Air Conditioning Systems

## FOR MORE INFORMATION, CONTACT THESE PUBLISHERS:

**ACCA**     **Air Conditioning Contractors of America**  
1712 New Hampshire Avenue, NW  
Washington, DC 20009  
Telephone: (202) 483-9370  
Fax: (202) 234-4721

**ANSI**     **American National Standards Institute**  
11 West Street, 13th Floor  
New York, NY 10036  
Telephone: (212) 642-4900  
Fax: (212) 302-1286

**ASHRAE**   **American Society of Heating, Refrigerating,  
and Air Conditioning Engineers, Inc.**  
1791 Tullie Circle, N.E.  
Atlanta, GA 30329-2305  
Telephone: (404) 636-8400  
Fax: (404) 321-5478

**BARD**     **Bard Manufacturing Company, Inc.**  
1914 Randolph Drive  
Bryan, OH 43506  
Telephone: (419) 636-1194  
Fax: (419) 636-2640

# **\*\* IMPORTANT \*\***

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians. Please read entire manual before proceeding.

## **SHIPPING DAMAGE**

Upon receipt of equipment, the carton 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.

## **GENERAL**

**NOTE:** DC3000 is used throughout this Manual as a general reference to the controller system. There are two controller models, DC3002 for 2 HVAC units and DC3003 for 3 HVAC units, and these model numbers are referenced when specific features or characteristics apply only to either the DC3002 or the DC3003. Occasional reference is made to alarm board AB3002 or AB3003. AB3002 is the internal alarm board for the DC3002 controller, and AB3003 is the internal alarm board for the DC3003 controller.

These instructions explain the operation, installation and troubleshooting of the DC3000 controller.

All internal wiring is complete. Only attach low voltage field wiring to designated terminal strips.

The DC3000 is for use with units with or without economizers, and has a dehumidification control feature if an optional humidity controller is connected.

Each unit should be sized to handle the total load of the structure if 100% redundancy is required.

It is recommended that a five (5) minute compressor time delay relay be installed in each unit.

The DC3000 controllers are suitable for both 50 and 60 HZ operation, and are fully configurable such that they can be used in virtually any installation. See Controller Programmable Features and Default Settings.

## **THEORY OF OPERATION**

The DC3002 controller is used to control two wall mount air conditioners from one control system. It provides total redundancy for the structure and equal wear on both units. It can be used with units with or without economizers and it is recommended that both units be equipped alike.

The DC3003 controller is designed to control 3 air conditioners, and can be used for 2 if it is anticipated the third unit may be installed later.

**NOTE:** If this is done, see Note 1 on Alarm Board Connections (Figure 6 or 7) to prevent nuisance Power Loss Alarm indication for absent HVAC #3

When DC3003 is used for controlling three HVAC units, only units 1 or 2 operate in lead/lag sequence. HVAC #3 is always last to operate and functions only in the number 3 position. All three units are available to operate on-demand as required.

Alarm capability is standard on both models.

## **CONTROLLER CERTIFICATIONS**

The DC3000 main controller board, optional alarm boards, and remote sensors have undergone extensive testing for immunity and emissions. This system is FCC-compliant, in accordance with CE requirements, and meets the following standards:

EN50082-2 Standard for Immunity  
EN55011 Standard for Emissions

## SPECIFICATIONS/FEATURES FOR BASIC CONTROLLER

### DC3000 Basic Controller

- Input power: 18 to 32VAC, 60/50Hz, power is supplied from A/C #1 and/or A/C #2
- Isolation circuitry: no line or low voltage phasing required
- Backup power: connection for -24VDC or -48VDC (-20 to -56V) maintains microprocessor operation, front panel indication, and alarm relay operation during commercial power outages.
- Digital display: 4-character LCD
- Temperature display: F or C
- HVAC outputs: Form A (NO) relays (1A @ 24VAC)
- Cooling control stages: 2 for each A/C unit
- Heating Control stages: 1 for each A/C unit
- Dehumidification circuit: requires optional humidity controller as input signal.
- Operating temperature range: 0 to 120F (-18 to 49C)
- Storage temperature range: -20 to 140F (-29 to 60C)
- Temperature accuracy: +/- 1F from 60-85F (16-30C)  
+/- 1% outside 60-85F
- Lead/lag changeover time: 0 to 30 days
- Timing accuracy: +/- 1%
- Inter-stage time delay: 10 seconds between stages
- Inter-stage differential: 2F (1C) for all modes
- On-Off differential: 2F (1C) is standard, 4F (3C) when "excessive cycling" mode is enabled.
- Cooling set point range: 65 to 90F (18 to 32C)
- Comfort setting-Cooling 72F (22C), Heating 68F(20C), for 1 hour.
- Dead band (difference between cooling and heating set points): 2F to 20F (1C to 10C)
- Fire/smoke interface: standard NC circuit jumper, remove for connection to building system control, shuts down both A/C units immediately.
- Memory: EEPROM for set point and changeable parameters (maintains settings on power loss).
- Temperature sensors: 1 local is standard, will accept up to 2 optional 25-foot remote sensors, Bard part number 8612-023. One can be used for remote indoor sensor and one is dedicated for outdoor sensor for DC Fan free cooling operation, if desired.
- Controller Enclosure: 20-gauge pre-painted steel, 9.25"W x 13.50"H x 3.00"D, hinged cover, thirteen (13) .875" diameter electrical knockouts.
- LEDs for basic controller: Lead unit, Cooling stages 1 through 4, Heating Stages 1 through 4, Dehumidification operation. DC3003 has cooling stage and alarm LED's displayed internally for HVAC #3.
- Six (6) Push-button controls: On/Off switch-Change lead unit-Increase and Decrease set points-Program/Save-Comfort.

## MOUNTING THE CONTROLLER

Included in the controller carton is the controller and installation instructions.

The controller should be installed on a vertical wall approximately four (4) feet above the floor - away from drafts and outside doors or windows. Four (4) mounting holes are provided for mounting to the wall, and 7/8" holes for conduit connections are provided in both the base, sides and top of the controller.

## TEMPERATURE SENSORS

The standard (local) temperature sensor has 12" leads and comes installed from the factory.

The controller is designed to accept 1 additional remote indoor sensor, and connects to "Rem 1". The Bard part number for the optional sensor with 25-foot leads is 8612-023. This remote indoor sensor can be installed as required in the structure to address hot spots, barriers to airflow, etc. It can also be used as the local sensor

Outdoor sensor, same 8612-023 with 25-foot leads, is required for non-economizer installations when DC fan is to be used for free cooling. This sensor connects to the "Out" terminals.

It is recommended that the sensor lead wires be installed in conduit for protective purposes.

The highest reading of any connected indoor sensor will be used for high temperature alarm and the lowest reading sensor will be used for low temperature alarm.

**NOTE:** All sensors are polarity sensitive. The copper lead must connect to terminal CU, and the silver lead to AG.

Sensors are solid state, not RTD.  
Use only sensors supplied by Bard.

## TEMPERATURE SENSOR LOGIC

The standard local (**Loc**) sensor monitors the temperature at the controller location. If this is the only sensor connected, it will control the temperature read-out, the space (building) temperature, and also be used for Low and High Temperature alarm functions.

If one **REMOTE** sensor is installed and connected (**Rem 1**), the temperature read-out will display and the building will be controlled to an **average** of connected sensors. If there is more than 10F difference from the highest to the lowest connected sensor, the actual control will be governed by the hottest sensor for cooling and the coldest sensor for heating.

If two indoor temperature sensors are used, the average of the two sensors becomes the controller cooling and testing set point.

# CONTROLLER INPUT/OUTPUT SPECIFICATIONS

## DC3002/3003 CONTROLLER CONNECTIONS Located on Main Controller Board

<b>Unit #1</b>	C – 24VAC common R – 24VAC hot G – fan (Form A, NO) Y1 – 1 <sup>st</sup> -stage cool (Form A, NO) Y2 – 2 <sup>nd</sup> -stage cool (Form A, NO) W – heat (Form A, NO)
<b>Unit #2</b>	C – 24VAC common R – 24VAC hot G – fan (Form A, NO) Y1 – 1 <sup>st</sup> -stage cool (Form A, NO) Y2 – 2 <sup>nd</sup> -stage cool (Form A, NO) W – heat (Form A, NO)
<b>Unit #3</b> <b>(DC3003 only and located on Internal Alarm Board)</b>	C – 24VAC common R – 24VAC hot G – fan (Form A, NO) Y1 – 1 <sup>st</sup> -stage cool (Form A, NO) Y2 – 2 <sup>nd</sup> -stage cool (Form A, NO) W – heat (Form A, NO)
<b>F1-F2</b>	Fire/smoke interface Shipped with jumper installed (a)
<b>48Vdc</b>	Back-up power input -24Vdc or -48Vdc -20V to -56V range
<b>Local</b>	Main sensor, 12-inch leads CU – copper, AG – silver Polarity sensitive
<b>Rem 1</b>	Optional remote indoor sensor CU – copper, AG – silver Polarity sensitive
<b>Out</b>	Optional outdoor sensor (b) CU – copper, AG – silver Polarity sensitive
<b>Gen</b>	Generator interface G1-G2 Shipped with jumper installed (a)
<b>H1-H2</b>	Humidity controller input Requires optional controller Field installed

**NOTE:**  
*Sensors are solid state, not RTD.  
Use Bard sensors only.*

- (a) These connections require either jumper or Normally Closed (NC) relay contact at the Fire/Smoke and Generator interface for Controller to function.
- (b) Required connection if field installed DC Fan is to be used for free cooling and no economizers are installed in HVAC units.

**Note:** All alarm relays are dry contacts rated 1A @ 24VAC, 120VAC or 150VDC.

## DC3002/3003 CONTROLLER CONNECTIONS Located on Internal Alarm Board AB3002

<b>DC3002 Inputs</b>	
Lockout 1	2,3 – input from HVAC #1
Lockout 2	2, 3 – input from HVAC #2
Y Unit 1	signals when comp. #1 is active
Y Unit 2	signals when comp. #2 is active
<b>DC3002 Alarm Outputs</b>	
Smoke/Fire	Form C (SPDT)
Lockout 1	Form C (SPDT) Refrigerant alarm HVAC #1
Lockout 2	Form C (SPDT) Refrigerant alarm HVAC #2
Power Loss 1	Form C (SPDT) Power loss HVAC #1
Power Loss 2	Form C (SPDT) Power loss HVAC #2
Low Temp	Form C (SPDT) Low temperature alarm
High Temp 1	Form C (SPDT) High temperature alarm #1
High Temp 2	Form C (SPDT) High temperature alarm #2
Controller	Form C (SPDT) Controller failure alarm

<b>DC3002 Control Outputs</b>	
Econ 1	E, F - Form A (NO) See note (c)
Econ 2	E, F - Form A (NO) See note (c)
DC Fan	Form C (SPDT) Pilot relay for DC Fan control
2 <sup>nd</sup> Stage	Form C (SPDT) 2 <sup>nd</sup> -stage cooling alarm

- (c) Make these connections to terminals E & F in HVAC 1 and 2 respectively if desired to have economizers open for emergency ventilation at High Temp Alarm #2 setpoint condition.

<b>DC3003 Inputs</b>	
<b>Everything from DC3002 plus:</b>	
Lockout 3	2,3 – input from HVAC #3
<b>DC3003 Alarm Outputs (on AB3003 Internal Alarm Board)</b>	
<b>Everything from DC3002 plus:</b>	
Lockout 3	Form C (SPDT) Refrigerant alarm HVAC # 3
Power Loss 3	Form C (SPDT) Power loss HVAC #3
<b>DC3003 Control Outputs</b>	
Econ 3	E, F - Form A (NO) See note (c)

*Alarm relays can be wired for NO (close on alarm) or NC (open on alarm) strategy. Alarm relays can be used individually if there are enough available building alarm points, or can be arranged into smaller groups or even a single group so that all alarm capabilities can be utilized. When multiple alarms are grouped together and issued as a single alarm there will be no off-site indication of which specific problem may have occurred, only that one of the alarms in the group has been triggered. The individual alarm problem will be displayed on the LED display on face of the controller.*



## LOW VOLTAGE FIELD WIRING

The DC3000 is powered from the air conditioners that it is controlling, 24VAC (18-32V) low voltage only.

Circuitry in the DC3000 isolates the power supplies of all connected air conditioners so that no back feeds or phasing problems can occur. Additionally, if any air conditioner loses power, the DC3000 and the other air conditioner are unaffected and will continue to operate normally.

Connect the low voltage field wiring from each unit per the low voltage field wiring diagrams in Section on “Controller Wiring”.

## CONTROLLER GROUNDING

A reliable earth ground must be connected in addition to any grounding from conduit.

## CONTROLLER POWER-UP

Whenever power is first applied to the controller, there is a twenty (20) second time-delay prior to any function (other than display) becoming active. This time-delay is in effect if the controller On/Off button is used when 24VAC from air conditioners is present, and also if controller is in “ON” position and 24VAC from all connected air conditioners is removed and then restored.

## FIRE SUPPRESSION CIRCUIT

To disable the DC3000 and shut down both air conditioners, terminals F1 and F2 may be used. The F1 and F2 terminals must be jumpered together for normal operation. A normally closed (nc) set of dry contacts may be connected across the terminals and the factory jumper removed for use with a field-installed fire suppression system. The contacts must open if a fire is detected. See appropriate connection diagram - Figures 1, 2 or 3 for this connection. Contacts should be rated for pilot duty operation at 2 amp 24VAC minimum. Shielded wire (22-gauge minimum) must be used, and the shield must be grounded to the controller enclosure.

*IMPORTANT NOTE: Some Bard models employ an electronic blower control that has a 60-second blower off-delay. In order to have immediate shutdown of the blower motor, in addition to disabling the run function of the air conditioners will require a simple wiring modification at the blower control located in the electrical control panel of the air conditioners being controlled by the lead/lag controller. To eliminate the 60-second blower off-delay, disconnect and isolate the wire that is factory-connected to the “R” terminal on the electronic blower control, and then connect a jumper from the “G” terminal on the blower control to the “R” terminal on the blower control. The electronic blower control will now function as an on-off relay with no off-delay, and the blower motor will stop running immediately when the F1-F2 fire suppression circuit is activated (opened).*

## STAGING DELAY PERIODS

The following delays are built in for both cooling and heating:

**Stage 1** – 0 seconds for blower (if not already on as continuous)

10 seconds for cooling or heating output

**Stage 2** – 10 seconds after Stage 1 for blower

10 additional seconds for cooling or heating output

**Stage 3** – 10 seconds after Stage 2

**Stage 4** – 10 seconds after Stage 3

**Note:** For cooling Stages 1 and 2, the stage LED will blink for 10 seconds while the cooling output is delayed after that stage is called for. There is also a delay after the stage is satisfied, and after the LED stops blinking, the stage will turn off. There is a minimum 10-second delay between stages 2 & 3, and 3 & 4, but no delayed output when stage is turned on or off, and LED for those stages will not blink.

## BLOWER OPERATION

The controller can be configured to have main HVAC blowers cycle on and off on demand; have all blowers run continuously (for DC3003, the blower is not “On” continuously for HVAC #3, but runs on demand only condition); or have the lead unit blower run continuously with the lag unit blower cycling on demand. Lead unit blower operating continuously is the default setting. There is also an option to have all blowers cycle on if one remote sensor is connected, and a temperature difference of more than 5F between any two sensors is observed. This helps to redistribute the heat load within the structure and should reduce compressor operating time.

When any of the stages are satisfied, the stage LED will blink for ten (10) seconds before the stage is actually turned off.

## ADVANCE (SWAP) LEAD/LAG UNIT FEATURE

Pressing the Advance button for one (1) second will cause the lead and lag units to change positions. This may be useful during service and maintenance procedures.

**Note:** DC3003 always operates HVAC #3 in last position: only HVAC #1 and #2 operate in lead/lag sequence.

## ACCELERATE TIMER FEATURE

Pressing the UP arrow button for five (5) seconds will activate an accelerate (speed-up) mode, causing the normal changeover time increments of days to be reduced to seconds. Example: 7 days becomes 7 seconds. When “ACC” displays, release button. Whichever LED is on, indicating lead unit will blink over for each second until the controller switches. This is a check for the timer functionality.

## HUMIDITY CONTROL OPTION

**Note:** *This function is not available if controller is configured for heat pump.*

The standard air conditioning system can be adapted to perform dehumidification control by addition of a simple humidity controller that closes-on-rise, and is connected to terminals H1 and H2 on the main controller board. Recommended Bard part number is 8403-038 (H600A 1014). See appropriate connection diagram - Figures 1, 2 or 3 for this connection.

The humidity control logic needs to be enabled in the program menu. Go to HuLE in the Programming Menu and change from No to Yes. This permits the following sequence of operation:

1. Temperature control always has priority over dehumidification. If there is any stage of cooling demand active, the dehumidification sequence is locked out.
2. If all stages of cooling are satisfied, and relative humidity is above the set point of humidity controller:
  - a. The green “Dehumid. Operation” light will come on, and the lag unit compressor and blower will operate until the set point of humidity controller is satisfied (or cancelled by a call for cooling).
  - b. If the space temperature drops to 67F, the electric heater of the lead unit will cycle to help maintain building temperature. It will cycle off at 69F.
  - c. If space temperature drops to 64F, the Stage 2 Heating light will come on and the lag unit compressor operating for dehumidification mode will cycle off until the building temperature rises above 65F from 1st stage heat and building load. The green “Dehumid. Operation” light stays on during this sequence, and when Stage 2 Heating light is Off, the compressor is On. The electric heater in lag unit is locked out in dehumidification mode.



## CAUTION

Humidity controller set point should be in 55-60% relative humidity area: Setting controller to lower settings will result in excessive operating time and operating costs for the electric reheat, and in extreme cases could cause evaporator (indoor) coil freeze-up if there are periods of light internal equipment (heat) loading.

## SEQUENCE OF OPERATION – COOLING AIR CONDITIONERS – (NO ECONOMIZER)

First stage cooling set point is the setting (SP) input into the controller. Factory default is 75F/24C. At Stage 1 cooling SP, the blower of the lead unit will come on (if not already operating because of continuous fan selection for lead unit). The DC fan will also operate at this time if controller is configured for free cooling using DC fan, and if outdoor temperature is 1F or more below (dFon) setting for DC fan operation 50, 55 or 60F (default is 55). DC fan is off at 1F above the (dFon) setting.

At Stage 2 cooling call (SP + 2F), the compressor for lead unit comes on.

At Stage 3 cooling call (SP + 4F), the blower for the lag unit comes on, followed 10 seconds later by the compressor for the lag unit.

## SEQUENCE OF OPERATION – COOLING AIR CONDITIONERS – (WITH ECONOMIZERS)

**Note:** *Economizer Logic Enabled must be switched from No to Yes in the Programming Menu.*

First stage cooling set point is the setting (SP) input into the controller. Factory default is 75F/24C. On a call for 1st Stage cooling, the blower will come on immediately (if not already on - See Blower Operation), and the Stage 1 LED will blink for 10 seconds before going solid, at which time the cooling output turns on. If the outdoor temperature and humidity conditions are below the set point of the economizer enthalpy control, the economizer will operate instead of the compressor. If outdoor conditions are not acceptable for free cooling, the compressor will automatically operate instead of the economizer.

Stage 2 cooling is 2F (1C) warmer than Stage 1. On a call for 2nd Stage cooling, the blower of the lag unit is turned on, and the Stage LED will blink for 10 seconds before going solid, at which time either the economizer or the compressor will turn on - based on enthalpy control setting and outdoor conditions.

Stage 3 cooling is 2F (1C) warmer than Stage 2. On a call for Stage 3 cooling, a signal is input into the lead unit economizer to cancel economizer and force lead unit compressor on. Stage 3 LED comes on solid with no blinking.

Stage 4 cooling is 2F (1C) warmer than Stage 3. If the lead unit compressor and lag unit economizer cooling capacity are not sufficient to hold the building temperature, and Stage 4 calls for cooling, a signal is input into the lag unit economizer to cancel economizer and force the lag unit compressor on. Stage 4 LED comes on solid with no blinking.

When any of the four (4) Stages are satisfied, the stage LED will blink for 10 seconds before the stage is actually turned off.

**DC3003 only:** Stage 5 cooling is 1F warmer than Stage 4. Stage 5 LED is located on the alarm board mounted inside the controller, and is marked Y1. There is also a Y2 LED, and Y1 and Y2 will cycle together.



## SEQUENCE OF OPERATION – HEATING (AIR CONDITIONERS W/ELECTRIC HEAT)

First stage heating set point is the dead band setting below first stage cooling set point (the SP entered into the program). The dead band is adjustable from 2-20F (1-10C), and the factory default is 10F (5C).

Second stage heating set point is 2F (1C) cooler than Stage 1.

**DC3003 only:** Stage 3 heat is the electric heater in HVAC #3.

## SECURITY (LOCKING) FEATURE

The DC3000 controller can be locked such that unauthorized persons cannot make any changes to temperature set points or any other selectable parameters of the controller system.

The ON/OFF and Comfort buttons remain fully active for their normal intent. The Advance/Change/Save button remains active for the Advance feature only, which allows the position of the lead and lag air conditioners to be swapped (reversed). The Program button remains partially active - allowing the review of temperature sensor(s) actual reading of temperature, and the current settings/choices that have been chosen. However, no changes can be made when the controller is locked, and if the change button is pressed when in the Program mode, the display will come up showing “Locd” instead of flashing the selectable choices for that parameter. The default (DEF) reset capability is also disabled when the controller is in locked mode.

Locking and Unlocking the DC3000 Controller:

1. Locking the controller requires using 3 buttons while the controller is in the normal operating (run) mode.
2. Press and hold the Advance/Change/Save button and the Up and Down arrow buttons simultaneously for 20 seconds until the display shows “Locd”.
3. To unlock the controller, press and hold the Advance/Change/Save button and the Up and Down arrow buttons simultaneously for 20 seconds until the display shows “uLoc”.

## GENERATOR RUN FEATURE

If desired, the DC3000 controller can be signaled from a standby generator system to lockout (disable operation) of the lag air conditioning system. This is sometimes mandated if the generator size is not sufficient to handle the building load (amperage) and that of all air conditioning systems.

A normally closed (NC) dry contact as part of generator controls is required. These contacts must open when the generator is started, and such action will signal the DC3000 controller to this condition and disable lag air conditioner run function.

On DC3003 with 3 HVAC's, only the “lag” A/C is locked out; the lead A/C and A/C #3 will still function.

A wire jumper is factory-installed across the G1 and G2 terminals on main controller board. To utilize the generator run feature, remove the jumper from G1 and G2, and connect the generator normally closed (NC, open-on-run) to the G1 and G2 terminals.

## BACKUP DC POWER CONNECTION

There are input connections available for -24VDC or -48VDC (-20 to -56V) backup power connection. Making this connection will maintain microprocessor operation, front panel display, LED signaling, and alarm relay operation during periods of commercial power outages and when no standby generator is available. This circuit is protected by a replaceable .5A (500mA) 250V fuse.

## IMPORTANT

*The shelter DC battery power must be connected to the controller and wired as shown in controller wiring diagrams in order to control the DC Fan ventilation package during periods when AC power is not available.*

*The backup DC power connection is polarity sensitive. If polarity is reversed, the controller will not function on backup power, no display and no alarm functions will be evident.*

## DC FAN CONTROL

The primary reason the DC3002 or DC3003 controller system would be used is for additionally controlling a DC Fan ventilation system installed in the shelter in addition to controlling either 2 or 3 HVAC units. The DC Fan package and intake system is independent of the HVAC systems, and is supplied by others.

A DC Fan pilot-duty control relay, Form C (SPDT) rated at 1A is incorporated into both DC3002 and DC3003 alarm boards for this purpose. DC Fan package must include the load control relay, or be otherwise field-supplied.

The DC Fan control can be configured to be used as follows:

1. For emergency ventilation only
2. For both free cooling and emergency ventilation
3. For free cooling only

The controller default setting is “Both”

When economizers are used in HVAC units 1 and 2 and Free Cooling is selected, the economizer controls make the decision when the DC Fan can be active as free cooling or not. The logic is as follows:

1. As long as at least one of the HVAC economizers is operating the DC Fan can operate
2. When outdoor conditions are not acceptable for free cooling using the economizers or when indoor load conditions as such that both economizers are forced off, the DC Fan is turned off. This is monitored by the Unit 1 and Unit 2 “Y” signals feeding from the HVAC 1 and 2 units to the DC3002 or DC3003 internal alarm boards. If both Unit 1 and 2 Y signals are present the DC Fan will not operate in Free Cooling mode.

When economizers are not used, and Free Cooling with the DC Fan is desired, and optional remote sensor Bard Part Number 8612-023 must be used.:

1. Sensor is connected to main controller board OUT terminals CU (copper wire) and AG (silver colored wire). The sensor is polarity sensitive and will not work correctly if connected in reverse.
2. The sensor must be located outside the shelter and should be in a junction box for physical protection.
3. It should be on the north side of the shelter if possible to keep from being influenced by the effects of the sun.
4. In the Program menu under “dFon” there are 3 choices for the DC Fan decision for free cooling or not: 50-55-60F. Factory default is 55F.
5. If set-point is 55F, the outdoor temperature must be 54F or colder for DC Fan to operate. Above 56F the DC Fan would be inhibited for Free Cooling.

For Emergency Ventilation using the DC Fan package, either “Emergency Ventilation Only” or “Both” must be selected in the Program menu. This means that if the shelter temperature rises to 1F above the High Temperature #2 set-point, the DC Fan control relay will be energized. The High Temperature #2 alarm relay also is energized at the same time. Default setting for High Temperature #2 is 90F.

**NOTE:** If economizers are installed, they can also be used for emergency ventilation. See Emergency Ventilation Sequence Using Economizers on page 16.

## DC FAN PURGE OPTION

The DC Fan can also be used for intermittent purge cycle if desired for purpose of controlling out-gassing from storage batteries or for any other reasons.

DC Fan purge duration is defined in minutes:

1. Shown as “Purg” in Programming Menu
2. Choices are No, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10-minutes
3. Default is set to No

DC Fan purge interval is defined in hours:

1. Shown as “Pint” in Programming Menu
2. Choices are 1, 2, 3, 4, 5, 6, 7, 8 up to 24-hours
3. Default is 1-hour
4. The “Pint” display is suppressed if Purg is set to No

**NOTE:** The purge interval starts at the end of the selected purge duration.

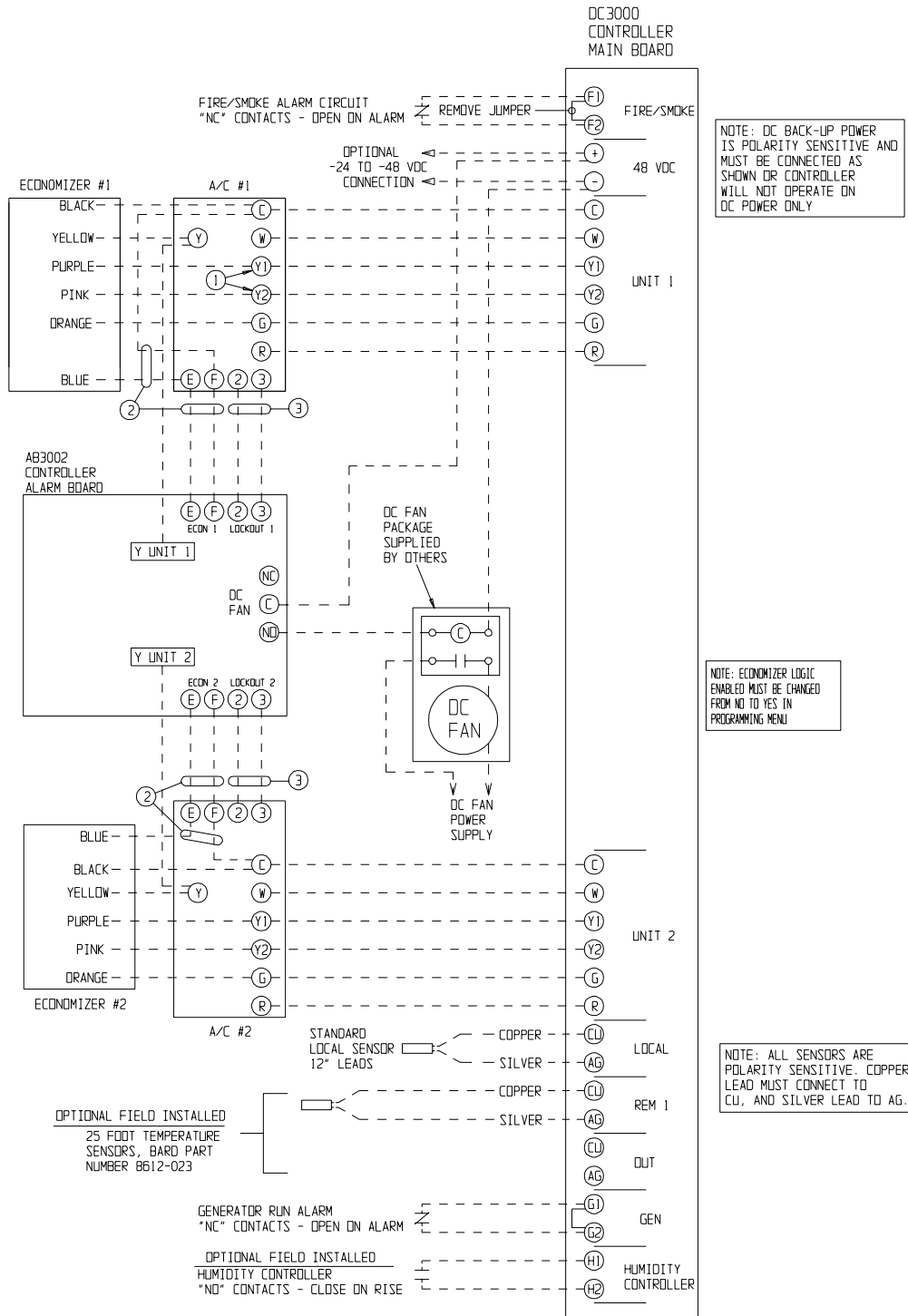
## CONTROLLER WIRING

The DC3002 can be used for controlling two (2) air conditioners with or without economizers. The DC3003 can be used for controlling three (3) air conditioners with or without economizers. Units with economizers will connect differently than units without economizers; therefore, it is important to use the correct connection diagram. See Table 1 for correct connection diagrams.

**TABLE 1**

Connection Diagram	Controller Model	No. of HVAC	Economizer Installed		
			HVAC #1	HVAC #2	HVAC #3
Figure 1	DC3002	2	Yes	Yes	---
Figure 2	DC3002	2	No	No	---
Figure 3	DC3003	2 or 3	Yes	Yes	Yes
Figure 4	DC3003	2 or 3	Yes	Yes	No
Figure 5	DC3003	2 or 3	No	No	No

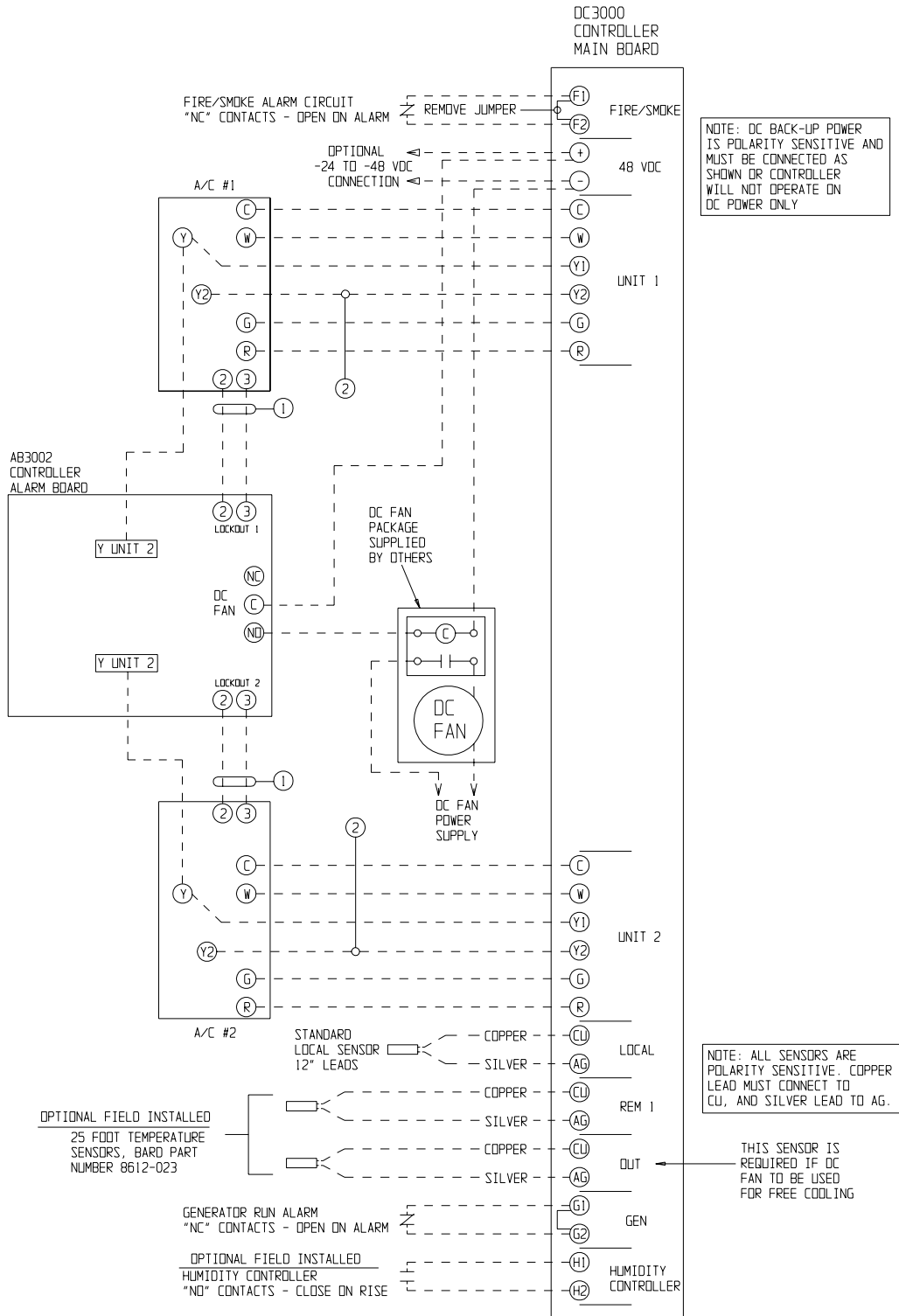
**FIGURE 1  
DC3002 CONNECTION DIAGRAM  
2 UNITS WITH ECONOMIZERS**



- ① Y1 AND Y2 MAY NOT BE ON TERMINAL BOARD, USE WIRE NUTS.
- ② CONNECT E AND F IF EMERGENCY VENTILATION ON HIGH TEMP #2 ALARM CONDITION IS DESIRED.
- ③ REFRIGERANT PRESSURE LOCKOUT ALARM - REQUIRES "J" CONTROL MODULE IN A/C UNITS.

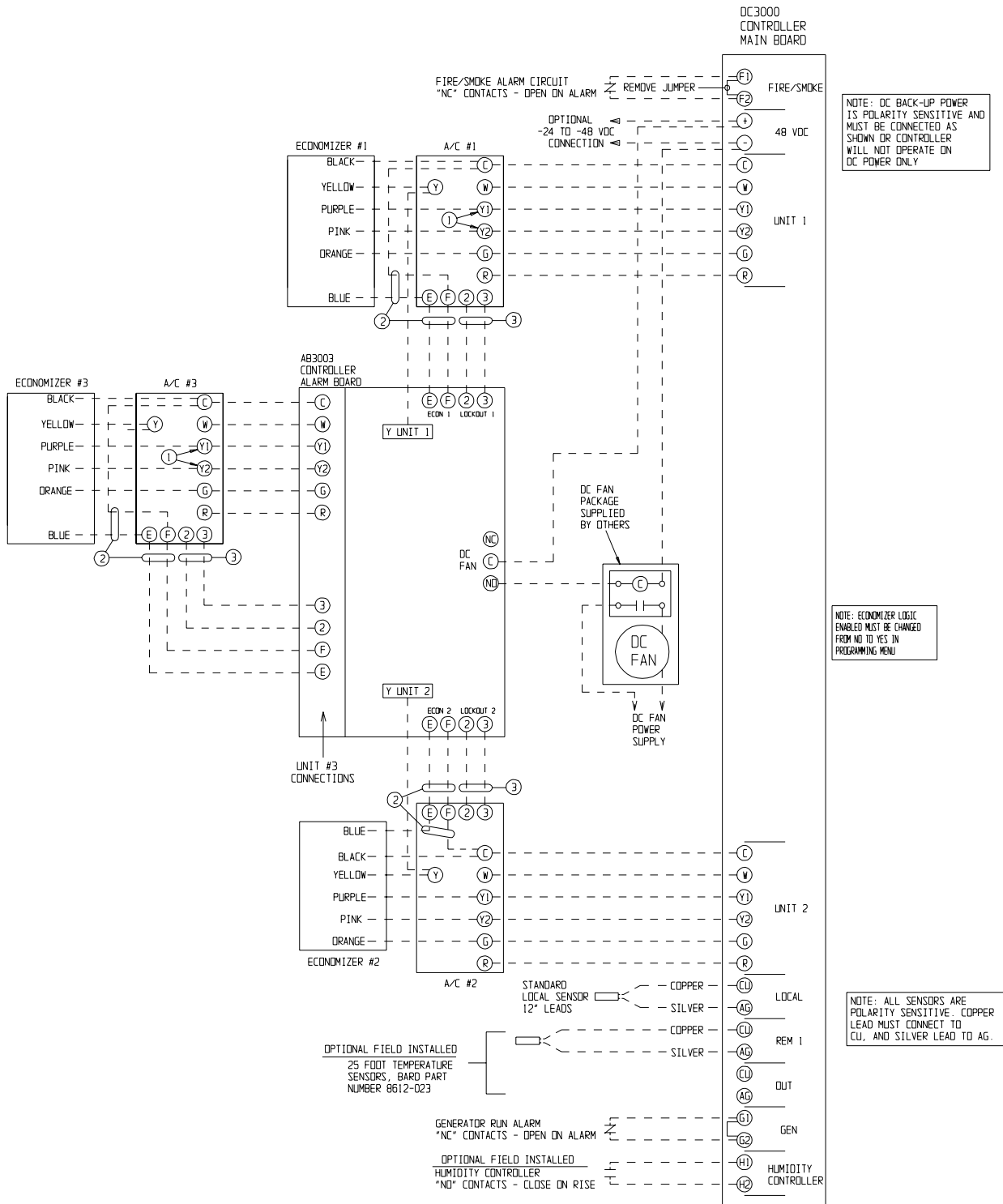
MIS-2291 A

**FIGURE 2  
DC3002 CONNECTION DIAGRAM  
2 UNITS NO ECONOMIZERS**



- ① REFRIGERANT PRESSURE LOCKOUT ALARM - REQUIRES "J" CONTROL MODULE IN A/C UNITS.
- ② CONNECTION REQUIRED FOR WAS 2-STAGE A/C UNITS ONLY.

**FIGURE 3  
DC3003 CONNECTION DIAGRAMS  
3 UNITS WITH ECONOMIZERS**



NOTE: DC BACK-UP POWER IS POLARITY SENSITIVE AND MUST BE CONNECTED AS SHOWN OR CONTROLLER WILL NOT OPERATE ON DC POWER ONLY

NOTE: ECONOMIZER LOGIC ENABLED MUST BE CHANGED FROM NO TO YES IN PROGRAMMING MENU

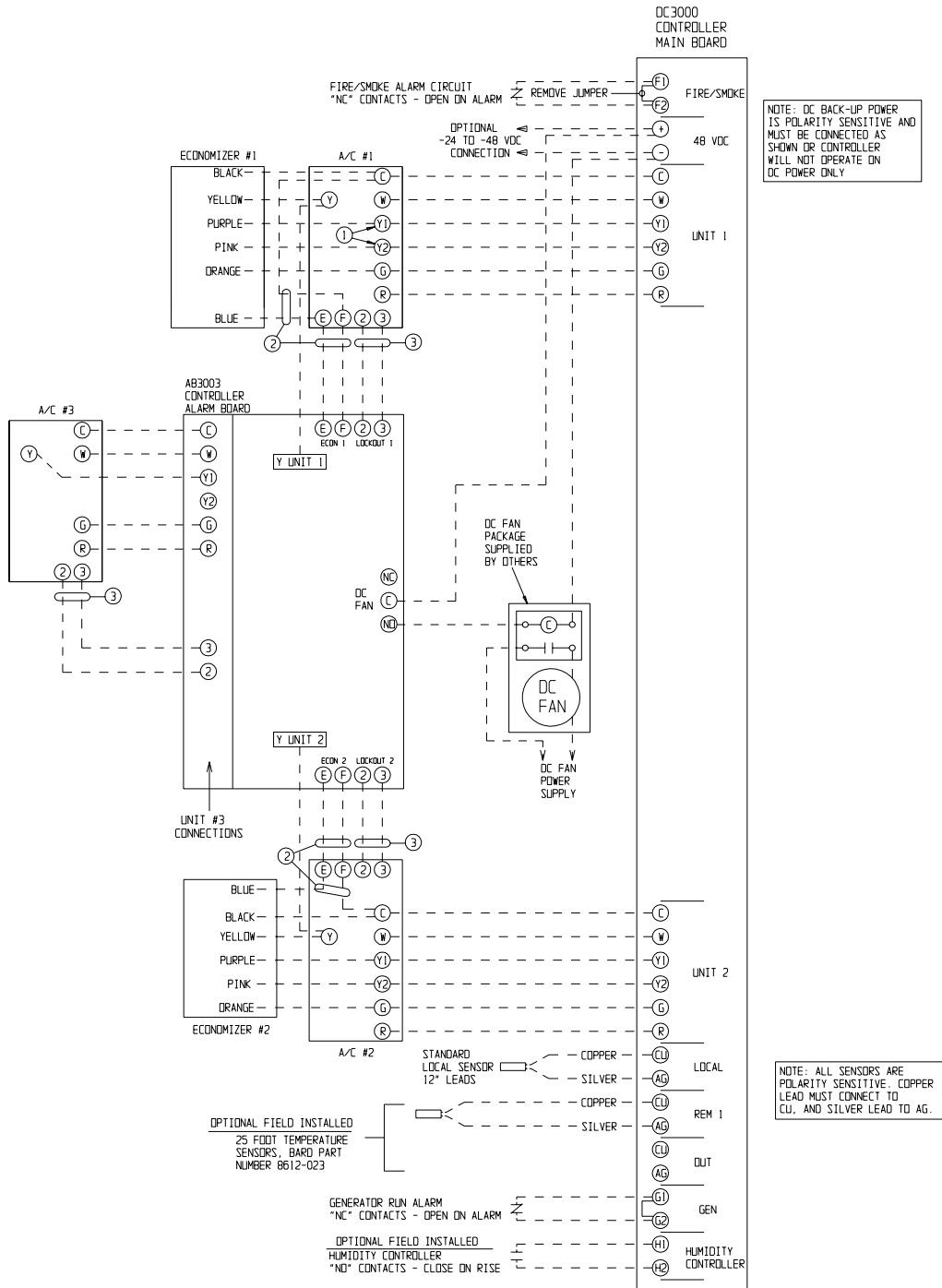
NOTE: ALL SENSORS ARE POLARITY SENSITIVE. COPPER LEAD MUST CONNECT TO CU, AND SILVER LEAD TO AG.

- ① Y1 AND Y2 MAY NOT BE ON TERMINAL BOARD, USE WIRE NUTS.
- ② CONNECT E AND F IF EMERGENCY VENTILATION ON HIGH TEMP #2 ALARM CONDITION IS DESIRED.
- ③ REFRIGERANT PRESSURE LOCKOUT ALARM - REQUIRES "J" CONTROL MODULE IN A/C UNITS.

MIS-2294 A

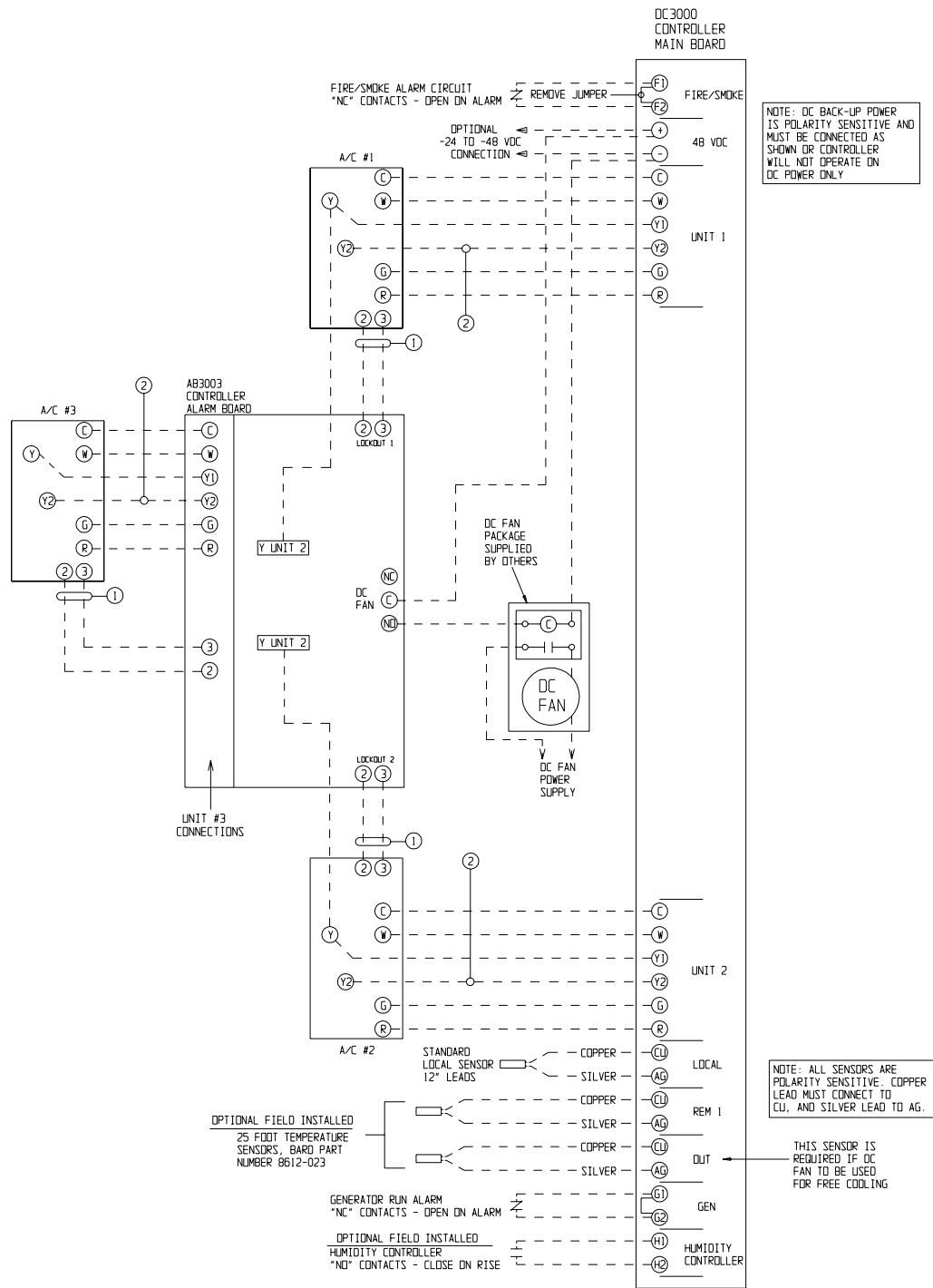


# FIGURE 4 DC3003 CONNECTION DIAGRAMS 3 UNITS WITH ECONOMIZERS (NO ECONOMIZER A/C #3)



- ① Y1 AND Y2 MAY NOT BE ON TERMINAL BOARD, USE WIRE NUTS.
- ② CONNECT E AND F IF EMERGENCY VENTILATION ON HIGH TEMP #2 ALARM CONDITION IS DESIRED.
- ③ REFRIGERANT PRESSURE LOCKOUT ALARM - REQUIRES "J" CONTROL MODULE IN A/C UNITS.

**FIGURE 5**  
**DC3003 CONNECTION DIAGRAMS**  
**3 UNITS WITH NO ECONOMIZERS**



- ① REFRIGERANT PRESSURE LOCKOUT ALARM - REQUIRES "J" CONTROL MODULE IN A/C UNITS.
- ② CONNECTION REQUIRED FOR WAS 2-STAGE A/C UNITS ONLY.

## ALARM WIRING

Alarm relays can be wired for NO (close on alarm) or NC (open on alarm) strategy.

Alarm relays can be used individually if there are enough available building alarm points, or can be arranged into smaller groups or even a single group so that all alarm capabilities can be utilized.

When multiple alarms are grouped together and issued as a single alarm, there will no off-site indication of which specific problem may have occurred, only that one of the alarms in the group has been triggered. The individual alarm problem will be shown on the LED display on the face of the controller.

**Note:** All alarm relays are Form C (SPDT) dry contacts rated 1A @ 24VAC, 120VAC or 150VDC.

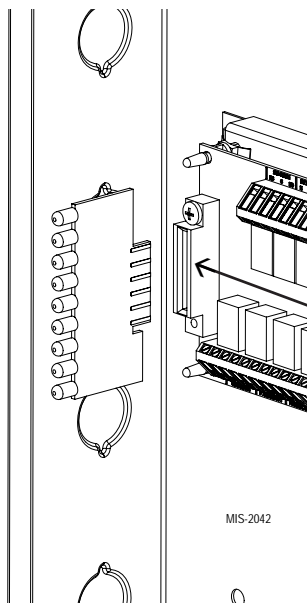
The Power Loss and Controller Alarm relays are all “reverse actuated”, which means they are continuously energized (the NO contact is closed) and switched to NC position upon alarm condition. Therefore, it is important to closely follow the alarm board connection diagrams that follow.

Any alarm feature that is not desired can simply be ignored (not connected).

*NOTE: The alarm LED display board is shipped uninstalled to protect it from possible damage during installation of the wiring to main controller board and/or the alarm board. It is polarity sensitive and is keyed so it can only be installed in correct position.*

**NOTE:** The LED display board can be replaced if needed independently of the alarm board. Bard part number is 8612-022.

### ALARM LED DISPLAY BOARD



## 2ND STAGE COOLING ALARM

This alarm output is available for use if desired. It is important to note that in some installations, due to A/C system sizing and internal heat load, that the secondary (lag) air conditioning unit may be called upon to assist the lead air conditioner some of the time. If this is the case, or possibly when additional heat load is added, using the 2nd stage cooling alarm will cause nuisance alarm conditions.

For installations where it is known that there is 100% redundancy (one air conditioning unit can handle 100% of the load 100% of the time) use of the 2nd Stage Cooling Alarm is a method to issue an alarm signal that the lead air conditioner is down (or not delivering full capacity) and that the lag air conditioner is now operating.

## REFRIGERANT PRESSURE ALARMS

Air conditioners with “J” control module are equipped with an alarm relay that is activated upon high or low refrigerant pressure lockout conditions. Connecting terminals 2 and 3 from the air conditioner 24V terminal block to the matching terminals 2 and 3 on the alarm board will allow these alarms to function.

## EMERGENCY VENTILATION SEQUENCE USING ECONOMIZERS

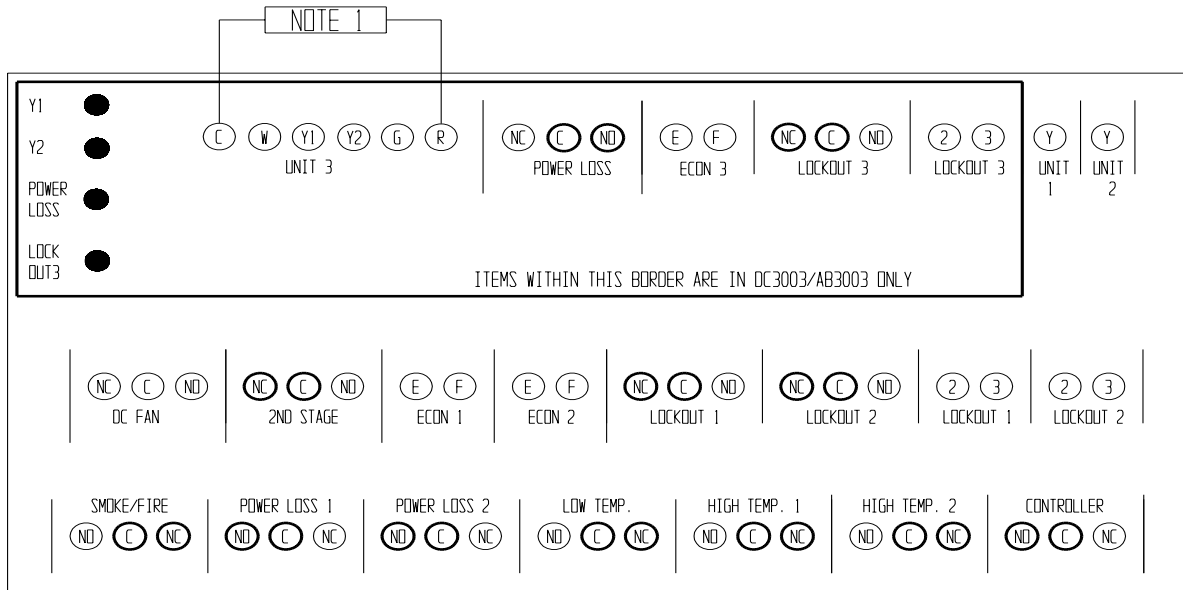
For units with economizers, there are two (2) emergency ventilation sequences designed into the controller. Both require the connection of terminals E and F from the air conditioner 24V terminal block to the matching terminals on the alarm board.

Sequence one requires a refrigerant pressure alarm, coupled with high temperature alarm condition No. 1 (HAL 1 set point). If both of these conditions occur, the economizer in the air conditioner that issued the refrigerant alarm will drive open to ventilate the building.

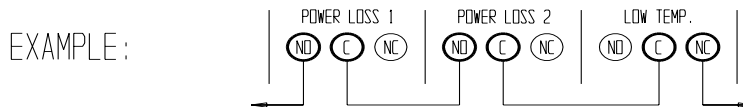
Sequence two (HAL 2 set point) is activated by high temperature alarm No. 2, and will initiate even without a refrigerant pressure alarm signal. Both economizers will be activated to provide emergency ventilation. This strategy help protect against building overheating if air conditioner(s) are inoperative for non-pressure related reasons (bad compressor, contactor, run capacitor, etc.).

*NOTE: The LED display board is polarized and will only fit in one direction as shown. It must be fully inserted in order for the controller to function properly.*

**FIGURE 6  
ALARM BOARD CONNECTIONS  
FOR NORMALLY CLOSED "NC" OPEN-ON-ALARM STRATEGY**



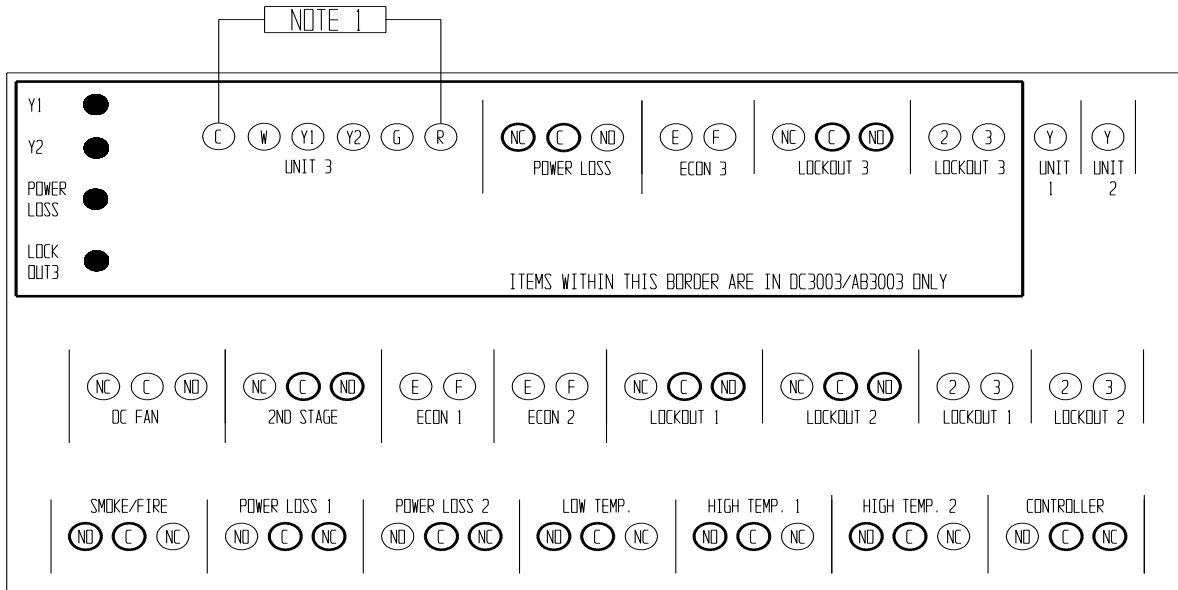
USE BOLDED ○ TERMINALS FOR DESIGNATED ALARMS AS DESIRED. SOME RELAYS ARE REVERSE ACTIVATED TO ACHIEVE "NC" OPEN-ON-ALARM SEQUENCE. EACH CAN BE USED INDIVIDUALLY IF THERE ARE ENOUGH BUILDING ALARM POINTS AVAILABLE OR CAN BE ARRANGED INTO SMALLER GROUPS OR EVEN A SINGLE GROUP SO THAT ALL ALARM CAPABILITIES CAN BE UTILIZED. FOR "NC" OPEN-ON-ALARM STRATEGY MULTIPLE ALARMS IN A GROUP ARE WIRED IN SERIES.



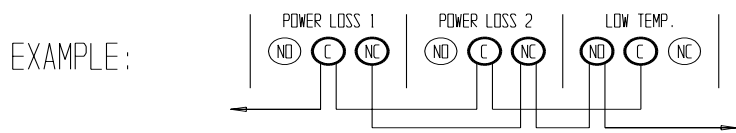
NOTE 1: IF ONLY 2 HVAC UNITS ARE USED BUT DC3003 CONTROLLER IS INSTALLED FOR POSSIBLE FUTURE EXPANSION, THEN TERMINALS (C) AND (R) FOR UNIT 3 MUST BE CONNECTED TO (C) AND (R) RESPECTIVELY FROM UNIT 1 TO PREVENT NUISANCE POWER LOSS ALARM SIGNAL FOR UNIT 3 FROM BEING ISSUED.

MIS-2289

**FIGURE 7  
ALARM BOARD CONNECTIONS  
FOR NORMALLY OPEN "NO" CLOSE-ON-ALARM STRATEGY**



USE BOLD **○** TERMINALS FOR DESIGNATED ALARMS AS DESIRED. SOME RELAYS ARE REVERSE ACTIVATED TO ACHIEVE "NO" CLOSE-ON-ALARM SEQUENCE. EACH CAN BE USED INDIVIDUALLY IF THERE ARE ENOUGH BUILDING ALARM POINTS AVAILABLE OR CAN BE ARRANGED INTO SMALLER GROUPS OR EVEN A SINGLE GROUP SO THAT ALL ALARM CAPABILITIES CAN BE UTILIZED. FOR "NO" CLOSE-ON-ALARM STRATEGY MULTIPLE ALARMS IN A GROUP ARE WIRED IN PARALLEL.



NOTE 1: IF ONLY 2 HVAC UNITS ARE USED BUT DC3003 CONTROLLER IS INSTALLED FOR POSSIBLE FUTURE EXPANSION, THEN TERMINALS **C** AND **R** FOR UNIT 3 MUST BE CONNECTED TO **C** AND **R** RESPECTIVELY FROM UNIT 1 TO PREVENT NUISANCE POWER LOSS ALARM SIGNAL FOR UNIT 3 FROM BEING ISSUED.



## PROGRAMMING INSTRUCTIONS

To swap lead and lag unit positions, press the ADVANCE button.

To enter the Program mode, press the PROGRAM button and release it when the message PROG appears on the display. When in Program mode, the DOWN and UP arrows are used to scroll through the programming steps.

**NOTE:** When using the UP and DOWN arrows, push for approximately 1 second until the alternating display goes blank, then release and display will alternate between the step function and setting.

A FLASHING display means that the function or choice is “SET”, and the display will alternate between the step function and setting.

To change the setting of any step, press the CHANGE button and the display will stop flashing, allowing change to the setting by using the DOWN or UP arrows. When desired setting is reached, press the SAVE button, and proceed as desired. When done with programming changes, press the PROGRAM button until display stops flashing and room temperature display is shown. If no buttons are pushed within thirty (30) seconds, the controller will automatically revert back to “RUN” mode.

To reset all controller settings to the factory default values, press the PROGRAM button for 10 seconds until display reads dEF.

***NOTE:** When the controller has the security locking feature enabled, no changes to any selectable features can be made, and the default reset feature is also locked out. All of the programmable features/settings can be reviewed using the Program button and Up or Down arrows, but any attempt to change settings using the Change button will result in display showing “Locd” indicating controller is locked. See section on Security (Locking) Feature.*

**See next page for Programmable Features, Default Settings and DC3000 front panel label layout.**



# DC3000 Series

*Solid State Lead/Lag Controller with DC Fan Control*

### Alarms

**Note:** On the DC3003 version the Lead/Lag Controller alarm light will "Flash" if Unit #3 has Power Loss or Refrig. Alarm. Open cover to observe Fault light that is on the alarm board located inside.

- Power Loss Sys. 1
- Power Loss Sys. 2
- Refrig. Alarm Sys. 1
- Refrig. Alarm Sys. 2
- Fire/Smoke Alarm
- Low Temp. Alarm
- High Temp. Alarm 1
- High Temp. Alarm 2
- Lead/Lag Controller Failure Alarm

1st Stage  2nd Stage  3rd Stage  4th Stage  Cooling

1st Stage  2nd Stage  3rd Stage  4th Stage  Heating

Digital Display

Lead Unit  Unit #1  Unit #2

Dehumid. Operation

On  
Off

↑

Program

↓

Advance Change Save

Comfort

### Programming Instructions

To swap lead and lag unit positions press the ADVANCE button.

To enter the Program mode, press the PROGRAM button and release it when the message PROG. appears on the display. When in Program mode the DOWN and UP arrows are used to scroll through the programming steps.

A FLASHING display means that the function or choice is "SET", and the display will alternate between the step function and setting.

To change the setting of any step press the CHANGE button and the display will stop flashing, allowing change to the setting by using the DOWN or UP arrows. When desired setting is reached press the SAVE button, and proceed as desired. When done with programming changes press the PROGRAM button until display stops flashing and room temperature display is shown. If no buttons are pushed within 30-seconds the controller will automatically revert back to "RUN" mode.

### Comfort Mode

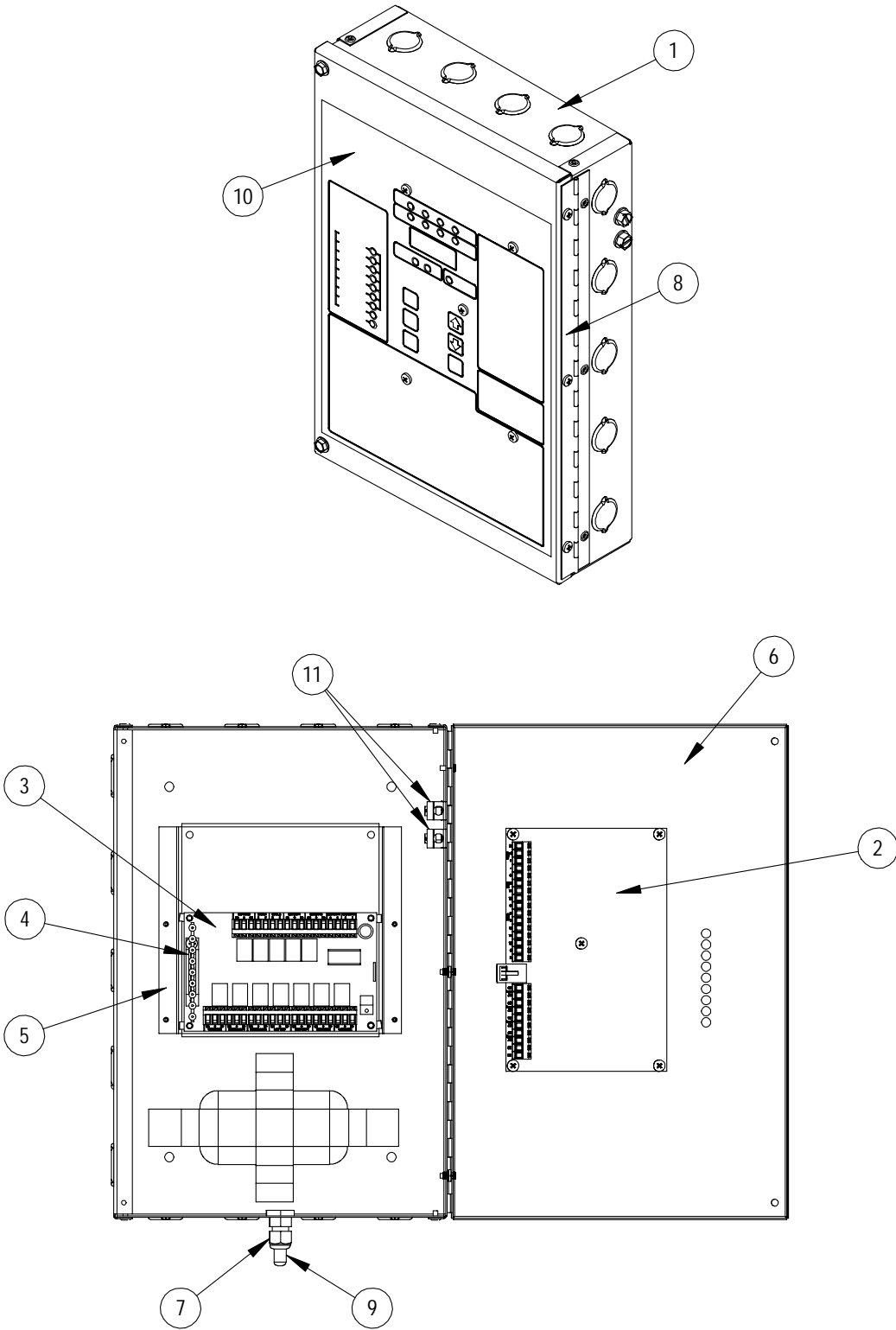
Press COMFORT button once to reset to 72°F/22°C Cooling and 68°F/20°C Heating for 1-hour. Display will flash 72 (or 22) during override period. Press 2nd time to cancel during override if desired, or will automatically revert after 1-hour.

### Programming Display Menu

*Refer to Installation Instructions for complete details.*

<p><b>SP</b> Cooling setpoint temperature <input type="checkbox"/> (65 to 90 deg. F or 18 to 32 deg. C, Default is 75F/24C)</p> <p><b>Loc</b> Temperature at local (main) Sensor</p> <p><b>r l</b> Temperature at Remote 1 sensor location*</p> <p><b>Out</b> Temperature at Outdoor sensor location*</p> <p><b>LLDC</b> Lead-lag-change-over time (1 to 30 days or 0 for disabled, Default is 7)</p> <p><b>cFAn</b> Continuous blower operation (None, Lead, Both, Default is lead)</p> <p><b>LoRL</b> Low temperature alarm setpoint (28 to 65 deg. F or -2 to 18 deg. C, Default is 50F/10C)</p> <p><b>HAL1</b> High temperature alarm level 1 setpoint (70 to 120 deg. F or 21 to 49 deg. C, Default is 85F/24C)</p> <p><b>HAL2</b> High temperature alarm level 2 setpoint (70 to 120 deg. F or 21 to 49 deg. C, Default is 90F/32C)</p> <p><b>dFAn</b> DC Fan Operation (Edcf "emergency vent only", Free "cooling", Both. Default is Both)</p> <p><small>* If installed. If sensors are not installed, no display is shown. See label inside cover for sensor logic.</small></p>	<p><b>dFon</b> Outdoor temperature setpoint for DC Fan <input type="checkbox"/> operation. Requires Outdoor Sensor (50-55-60F, Default is 55)</p> <p><b>db</b> Deadband between cooling and heating setpoint (2 to 20 deg. F or 1 to 11 deg. C, Default is 10F/5C)</p> <p><b>dEG</b> Degrees shown in F or C (F or C, Default is F)</p> <p><b>HuLE</b> Dehumidification Logic Enabled (Yes or No, Default is No)</p> <p><b>Cbds</b> System 1 &amp; 2 blowers run if delta T &gt; 5F between sensors (Yes or No, Default is Yes)</p> <p><b>QFde</b> 3 min. lead unit &amp; 4 min. lag unit off-delay enabled (Yes or No, Default is No)</p> <p><b>crun</b> Minimum 3 minute compressor run time enabled (Yes or No, Default is No)</p> <p><b>CHYS</b> Increase compressor Turn On/Turn Off differential with excessive compressor cycling (Yes or No, Default is Yes)</p> <p><b>Purg</b> DC fan Purge duration in minutes (No,1,2,3,4,5,6,7,8,9,10 Default is No)</p> <p><b>Pint</b> Interval between DC Fan Purge cycles in Hours (1,2,3,4,5,6,7,8,9,10 up to 24 Default is 1, Pint display is suppressed if Purg is No)</p> <hr/> <p><b>Locd</b> Controller is locked and no changes can be made. Consult building authority.</p>
---	--

**FIGURE 8**  
**PARTS LIST DESCRIPTION DIAGRAM**



SEXP-445 B

TABLE 2

<b>Parts List</b>				
<b>Dwg. No.</b>	<b>Part No.</b>	<b>Description</b>	<b>DC3002</b>	<b>DC3003</b>
1	127-343-4	Control Box	X	X
2	8612-037	Controller Board	X	X
3	8612-025	Alarm Board AB3002	X	
3	8612-026	Alarm Board AB3003		X
4	8612-022	Alarm Display		X
5	113-340-4	Support Bracket	X	X
6	152-385-4	Control Box Door	X	X
7	8611-099	LTF Fitting	X	X
8	5400-002	Hinge	X	X
9	8612-023	Sensor	X	X
10	7961-663	Label/Keypad	X	X