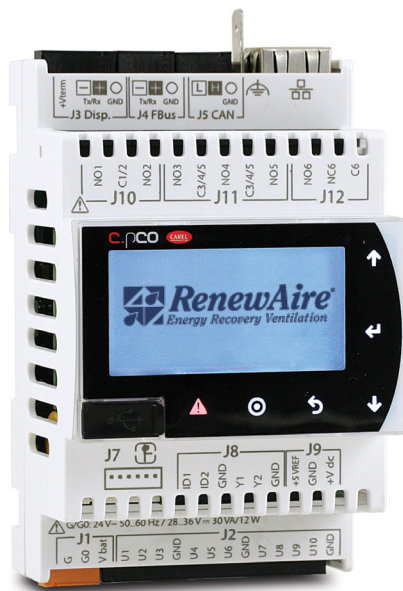


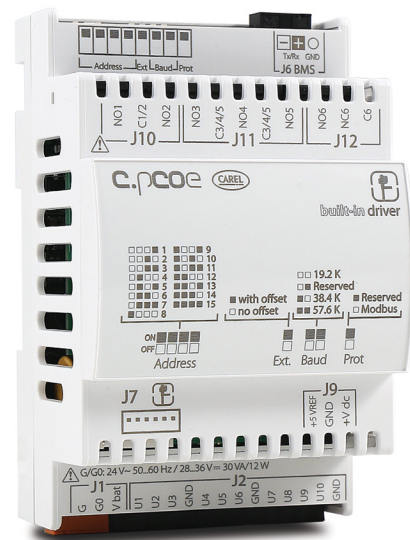
# DOAS INTEGRATED PROGRAMMABLE CONTROLS

## Installation, Operation and Maintenance Manual

FOR COMMERCIAL DN-SERIES



Carel c.pCO Mini

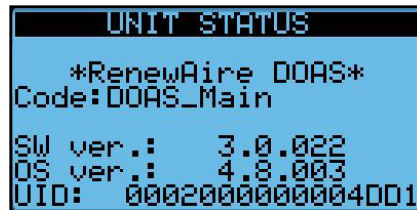


Carel c.pCOe Expansion Board

This manual applies to DN-Series DOAS units with controls version 3.xx.xx. For previous versions refer to the older manual. The version number can be seen on the splash screen when the unit power is cycled.



Newer units also have this version information in the *Unit Status* screens.



**⚠ WARNING**

**ARC FLASH AND ELECTRIC SHOCK HAZARD**

Microprocessor controllers as discussed in this manual are typically installed in a control panel where high voltages are present. Whenever accessing any controller, disconnect all electric power supplies, verify with a voltmeter that electric power is OFF and wear protective equipment per NFPA 70E when working within the electric enclosure. Failure to comply can cause serious injury or death.

The line side of the disconnect switch contains live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch and verify that power is off with a voltmeter. Refer to unit electrical schematic.

Follow all local codes.

**⚠ CAUTION**

**RISK OF ELECTRIC SHOCK OR EQUIPMENT DAMAGE**

Whenever electrical wiring is connected, disconnected or changed, the power supply to the DOAS and its controls must be disconnected. Lock and tag the disconnect switch or circuit breaker to prevent accidental reconnection of electric power.

**⚠ CAUTION**

**RISK OF COMPUTER SECURITY BREACH**

This controller is capable of being connected to a network. Any device that is connected to a network is susceptible to unauthorized access and hostile activities. It is the owner's responsibility to determine acceptable risks and to safeguard the security of the controller and all connected devices.

**IMPORTANT**

This controller is only for use in protected environments. It is not to be exposed to the weather or exposed to extremes in temperature.

**IMPORTANT**

Risk of degraded unit efficiency. Improper adjustment of unit setpoints may result in the DOAS operating inefficiently. Improper selection of Input Offsets may cause incorrect or inefficient operation of the DOAS.

**IMPORTANT**

Only persons who have been properly trained and authorized are to access the DOAS control panel and the controller. Changes to the controller settings are to be made only by trained and authorized personnel. All changes to the controller settings are to be documented in the Controller Maintenance Records section in this manual.

**IMPORTANT**

This control system is subject to periodic updates in firmware and the User Manual itself. Please contact RenewAire Support at [RenewAireSupport@RenewAire.com](mailto:RenewAireSupport@RenewAire.com) to determine if you have the most recent manual and firmware.

**READ AND SAVE THIS MANUAL/LIRE ET CONSERVER CE MANUEL**



**NOTE:** This page is to be completed by the installing contractor. The completed document is to be turned over to the owner after start up.

| NOTICE   |  |
|--|--|
| <p>This manual contains space for maintaining written records of settings and changes. See Section 15, Maintenance Records. At the time the DOAS is commissioned, a complete record (an operating parameter file) should be made of all settings, to include setpoints and offsets. Whenever changes are made to the controller data points, those changes should be recorded, along with the reason for the change.</p> <p>Information that is recorded is specific to just one DOAS or controller. If additional controllers are being documented, please make copies of these pages and identify each copy by its unit tag.</p> |  |

**UNIT INFORMATION**

Record information as shown below.

In the unlikely event that factory assistance is ever required, information located on the unit label will be needed.

Locate the RenewAire unit label found on the outside of the unit.

**NOTE:** This information is for purposes of identifying the unit-specific option data from the Configuration Code.

Configuration Code:

-  -          -

Serial Number:

SO #:



**NOTE:** When the DOAS is first connected to electric power, the unit is to be started only for purposes of testing correct wiring and to verify correct operation of the fans and dampers.

UNIT INFORMATION

|  |                      |                                   |                          |   |   |                      |  |                      |      |     |           |  |
|--|----------------------|-----------------------------------|--------------------------|---|---|----------------------|--|----------------------|------|-----|-----------|--|
| ETL LISTED<br>CONFORMS TO<br>UL STD 1812<br>UL STD 1812<br>CERTIFIED TO<br>CAN/CSA C22.2<br>No. 112<br>Intertek<br>4000519               |                      | <b>Energy Recovery Ventilator</b> |                          |   | Toll Free: 800-627-4499   |                      |  |                      |      |     |           |  |
|  |                      | <b>WARNING</b>                    |                          |   |   |                      |  | <b>AVERTISSEMENT</b> |      |     |           |  |
| Danger of electric shock. Always disconnect power source before servicing.<br>Not For Use In Cooking Area. Use Copper Supply Wires Only. |                      |                                   |                          |   | Danger de choc électrique. Toujours deconnecter la source d'alimentation avant les reparations.<br>Ne Pas Utiliser Dans Une Zone De Cuisson. Utiliser Des Fil D'Alimentation En Cuivre. |                      |  |                      |      |     |           |  |
| Motors Thermally Protected / Moteurs protégés thermiquement  |                      |                                   |                          |   |   | MOTOR/MOTEUR SPEC.   |  |                      |      |     |           |  |
| POWER SUPPLY TO UNIT / Alimentation d'énergie a l'unité  |                      |                                   |                          |   |   | MOTOR/MOTEUR SPEC.   |  |                      |      |     |           |  |
| Voltage  | Minimum Circuit Amps | Max Overcurrent Protection Device |                          | Voltage   | Qty & kW/HP   | FLA                  |  |                      |      |     |           |  |
| 575V   | 14.3                 | 15                                |                          | 575   | 2@5.0 HP  | 5.3                  |  |                      |      |     |           |  |
| 60 HZ 3-Phase Amp. Minimales de Circuit  |                      |                                   |                          | Dispositif de protection maximum contre les surintensites |   |                      |  |                      |      |     |           |  |
| Coil   | Type                 | Rows                              | FPI                      | Max Pressure (psi)  | Moters Protected by Variable Frequency Drives   |                      | Les moteurs protégés par la fréquence variable conduit |                      |      |     |           |  |
| Dehumidification   | -                    | -                                 | -                        | -   | Voltage   | Qty & kW/HP          | FLA  |                      |      |     |           |  |
| Re-heat  | -                    | -                                 | -                        | -   | 575   | 2@5.0 HP             | 6.1  |                      |      |     |           |  |
| Heat   | -                    | -                                 | -                        | -   | Qty & kW/CV   |                      | APC  |                      |      |     |           |  |
| Gas Heater/Chauffage A Gaz   |                      |                                   |                          |   |   |                      |  |                      |      |     |           |  |
| Option Code: DN-3-JRTBV138--G3VN2--L   |                      |                                   |                          |   |   |                      |  |                      |      |     |           |  |
| MODEL/MODELE: DN-3-JRT   |                      |                                   | Serial Number: L18 0020D |   |   | Voltage/Phase        |  |                      | Amps |     | Input MBH |  |
| SO#: 068519  |                      |                                   | JO#: 39377-0000          |   |   | 115V/1-Ph            |  | 2.4                  |      | 100 |           |  |
| Natural Gas  |                      |                                   |                          |   |   | Label No: 133987_000 |  |                      |      |     |           |  |

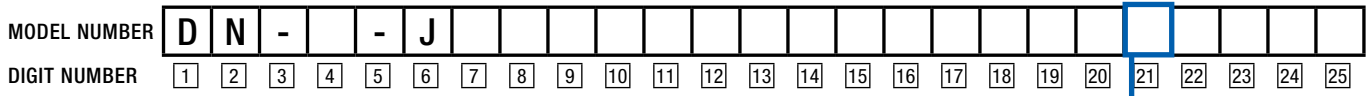
UNIT LABEL (TYPICAL)

| NOTICE  |  |
|---|--|
| <p>Whenever an operating parameter file is created in the controller internal memory, a backup file should be created on an external memory device and stored in some convenient place.</p> |  |



### CONFIGURATION CODE

Refer to Section 16, Reference in this manual for the full interpretation of the configuration code.



| Digits 1-5: | Model       |
|-------------|-------------|
| "DN-2-"     | = 1,650 CFM |
| "DN-3-"     | = 3,300 CFM |
| "DN-5-"     | = 4,950 CFM |

| Digit 21: | Unit Control Enhancements         |
|-----------|-----------------------------------|
| "2"       | = Premium Controls without BacNet |
| "4"       | = Premium Controls with BacNet    |

|  |           |  |           |
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NOTE: This unit has a microprocessor controller. It is commonly referred to as a “controller.”



NOTE: Many of these control features require the use of optional sensors. The unit configuration will determine the availability of some functions.

## 1.0 OVERVIEW

### 1.1 CONTROL SEQUENCE OVERVIEW

The RenewAire DOAS provides 100% outdoor air while saving energy by passing the Exhaust Air through the energy recovery core to exchange energy with the incoming air, with energy being passed to the incoming air in the winter, and energy being passed to the outgoing air in the summer. Pairing this with the factory-programmed DOAS controller provides an excellent turn-key solution with the following control options.

1. Turning the unit off and on based on
  - A digital input (smoke detector, occupancy sensor, etc)
  - The controller keypad
  - Schedule
  - A BMS system, if the feature is enabled
2. Isolation damper control
3. Supply and exhaust fan control
  - Variable speed fan control for variable speed and ECM fans (set as a percentage)
  - Variable speed fan control for variable speed fans as a CFM reading
  - Exhaust fan tracking
  - Fan control based on CO<sub>2</sub> or VOC levels (with optional sensor added)
  - Fan control based on duct pressure levels (with optional sensor added)
  - Single fan operation with digital input or BMS command
4. Supply and Exhaust Fan status via current sensors
5. Monitoring of these values
  - Outside Air (OA) Temperature
  - Outside Air (OA) Relative Humidity
  - Return Air (RA) Temperature
  - Return Air (RA) Relative Humidity
  - Supply Temperature (SA) before tempering
  - Exhaust Temperature (EA)
  - Supply Air CFM
  - Exhaust Air CFM
  - User-supplied CO<sub>2</sub> or VOC sensors
  - User-supplied Room or Duct Pressure sensors
6. Monitoring of pressure across filter for filter status
7. Bypass control for frost control/economizer control
8. Control for heating (additional Conditioned Air Temperature sensor required)
  - 0–10V Gas or electric
  - One- or two-stage heat pump
  - 10–0V Hot water valve control
  - Control based on Supply or Return Air
  - Setpoint can be reset off outdoor air temperature
9. Control for cooling (additional Conditioned Air Temperature sensor required)
  - 0–10V chiller water valve
  - One- or two-stage compressor/heat pump
  - Control based on Supply or RA
10. Dehumidification Control via cooling method
  - Reheat with optional hot gas reheat coil (requires coil leaving temp sensor)
  - Reheat with heat source (requires coil leaving temp sensor)
  - No reheat
  - Mode based on Outdoor or Return Air dew point

11. VRF Control Sequence
12. Dual Temp Coil (using BMS command for heat/cool signal)
13. Unoccupied operation with optional recirculation damper
14. Alarm alerts and logging

## 1.2 ENERGY RECOVERY BASICS

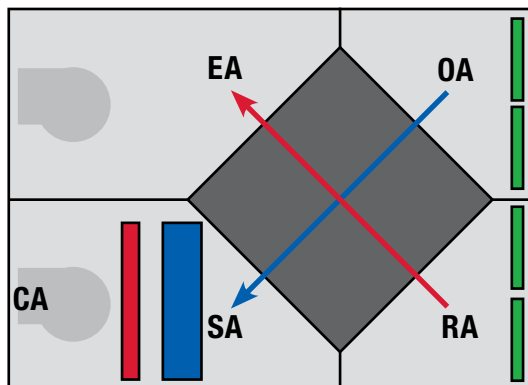
### IMPORTANT

It is important to understand and use the equipment airstream terminology as it is used in this manual. The airstreams are defined as:


- Outside Air (OA): Air taken from the external atmosphere and, therefore, not previously circulated through the system. Each DN unit has an OA air inlet, located on the end wall.
- Supply Air (SA): Air that is downstream of the enthalpic cores and is ready for conditioning.
- Conditioned Air (CA): Air that is supplied to an occupied space. Each DN unit has a CA outlet that may deliver either conditioned RA or SA. The CA outlet is optionally located on either the end wall or the floor.
- Return Air (RA): Air that is returned to a heating or cooling appliance from a conditioned space. When the DN unit operates in recirculation mode, RA is conditioned and returned to the occupied space in the form of CA. Each DN unit has an RA inlet, optionally located on either the floor or the end wall of the unit.
- Exhaust Air (EA): Air that is removed from a heating or cooling appliance and discharged. Each DN unit has an EA outlet with a damper. The EA outlet is on the back wall or top of the unit.

RenewAire energy recovery ventilators use static-plate, enthalpy-core heat exchangers that have no moving parts.

- During summer months, the hot and humid OA passes by the cooler, drier RA, lowering its temperature and humidity.
- During winter months, the cold and dry OA passes by the warmer, moister RA, raising its temperature and humidity.





 **NOTE:** If an optional internal heating device is selected the CA duct sensor may need to be installed at least three duct diameters away from the DOAS unit CA outlet.

### 1.3 TEMPERATURE SENSORS

There are four temperature sensors installed in each DOAS. These are NTC sensors that have a Carel curve. The curve characteristics can be found in the Reference section. They are located at:

- One at the inlet side of the EA Fan cone
- One at the inlet side of the SA Fan cone
- One at the entrance of the air intake to measure outdoor air (OA) temperature
- One at the entering RA duct of the unit

If a unit has heating and/or cooling, there is also a fifth CA sensor that is included but needs to be installed down the duct past the heating and cooling.

If the unit has a Hot Gas Reheat Coil, there will be a sixth Cooling Coil Leaving sensor right after the cooling coil.



FIGURE 1.3.0 DUCT TEMPERATURE SENSOR

### 1.4 COMBINATION TEMPERATURE AND HUMIDITY SENSORS

Humidity transducers are mounted in the OA and RA compartments and provide an output from 0–10VDC that is proportional to 0–100% Relative Humidity.



FIGURE 1.4.0 TEMPERATURE AND HUMIDITY SENSOR

1.5 SENSOR LOCATIONS

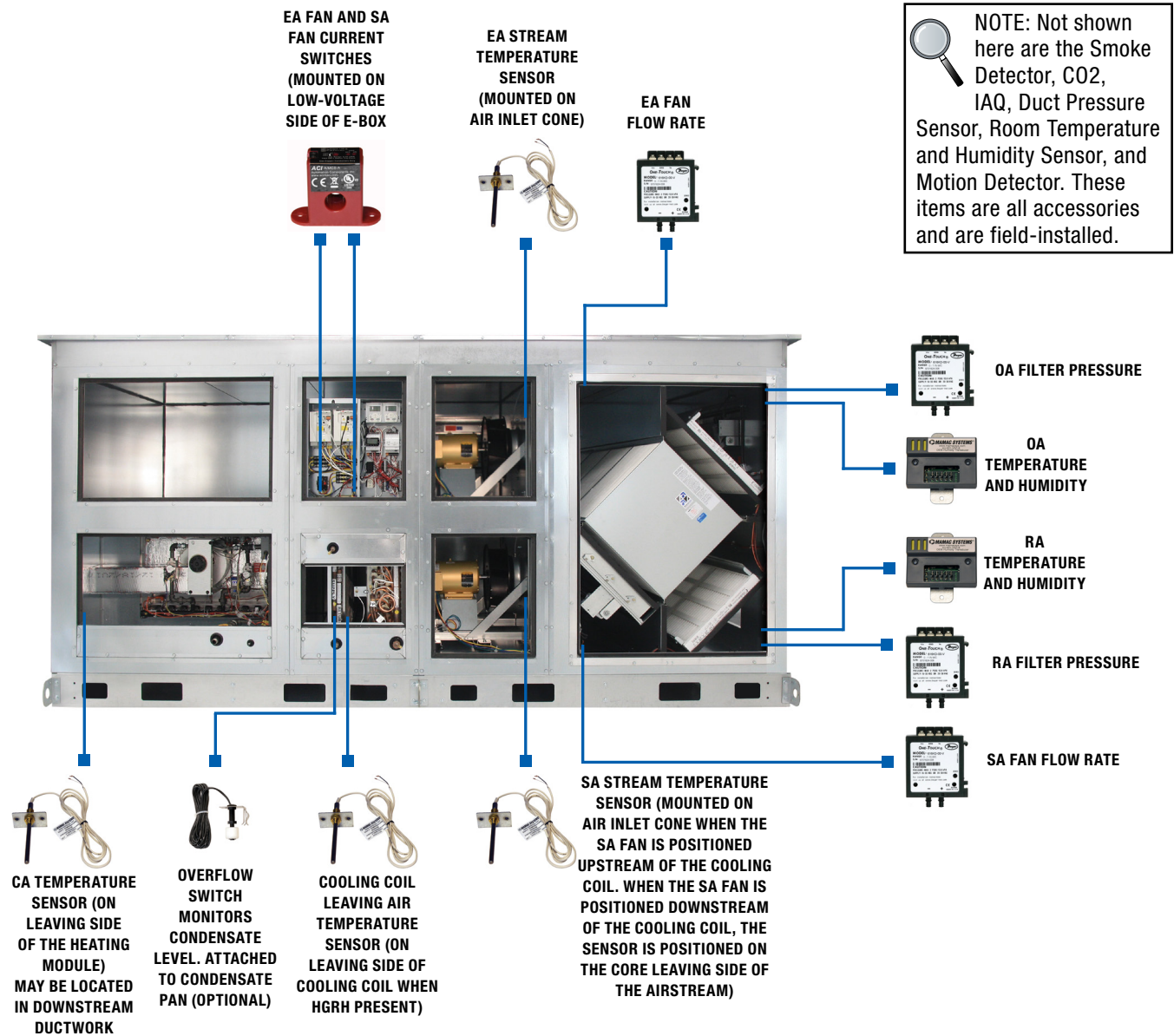
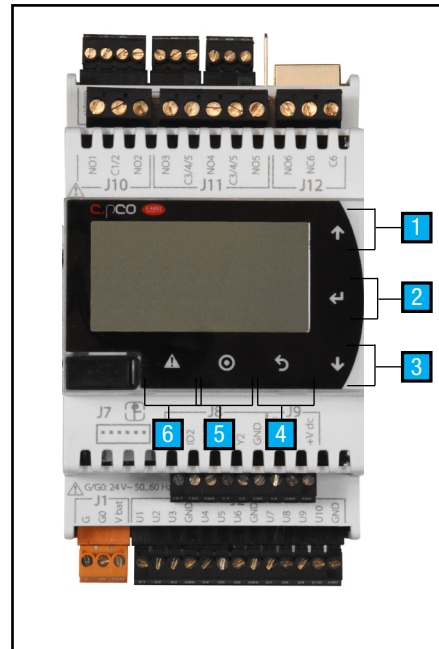


FIGURE 1.5.0 SENSOR LOCATIONS IN DN-SERIES UNITS

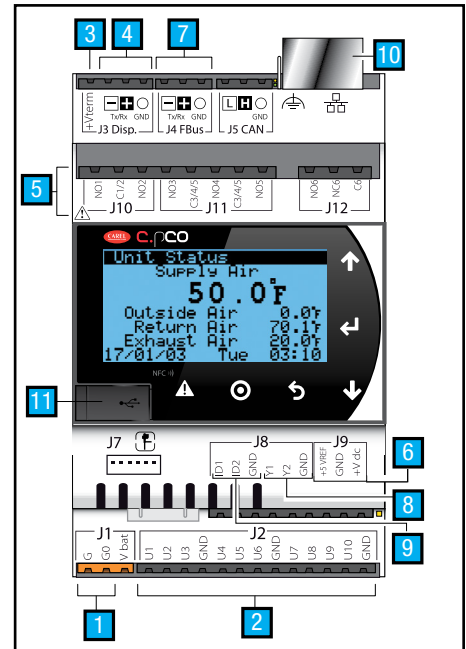
## 2.0 CONTROLLER OVERVIEW

The control utilizes the Carel c.pco (pronounced see-pee-ko) controller with the c.pcoe expansion module.



|   |                |
|---|----------------|
| 1 | Up Button      |
| 2 | Enter Button   |
| 3 | Down Button    |
| 4 | Escape Button  |
| 5 | Program Button |
| 6 | Alarm Button   |

FIGURE 2.0.0 C.PCO CONTROLLER BUTTONS



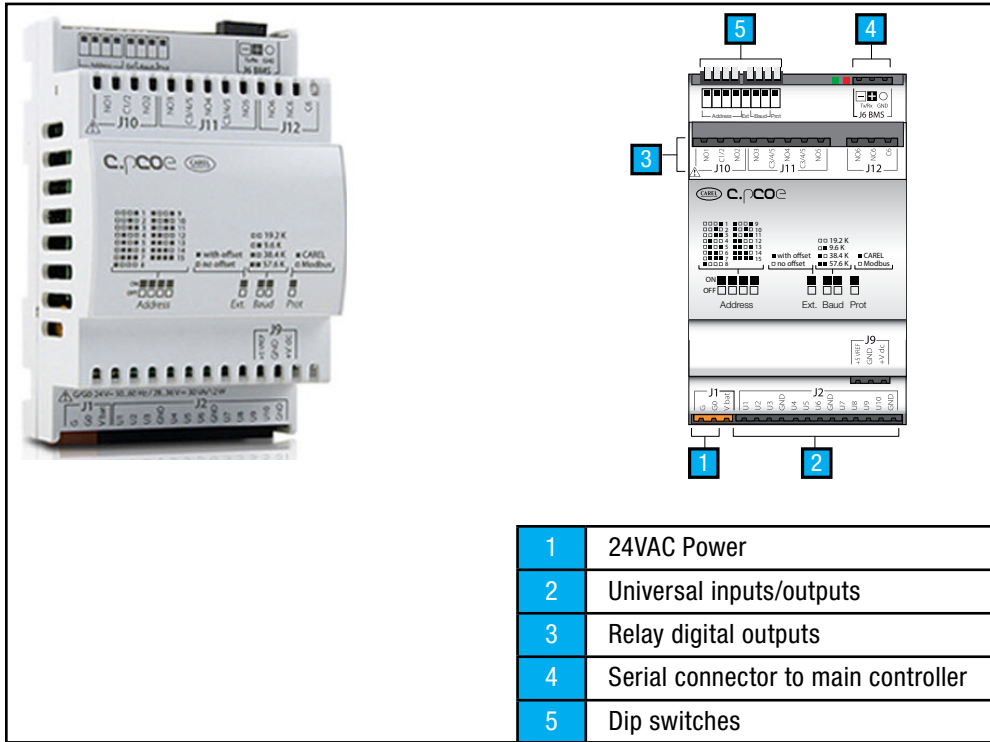
|    |                                     |
|----|-------------------------------------|
| 1  | 24VAC Power                         |
| 2  | Universal inputs/outputs            |
| 3  | Power for RUT remote display        |
| 4  | Remote display or BMS connection    |
| 5  | Relay digital outputs               |
| 6  | +5V power supply                    |
| 7  | FBUS connection to expansion module |
| 8  | Analog outputs                      |
| 9  | Digital inputs                      |
| 10 | Ethernet port                       |
| 11 | Micro USB port                      |

FIGURE 2.0.1 CONTROLLER EXTERNAL CONNECTIONS

The c.pCOe expansion module has multiple digital and analog inputs and outputs, serving as an extension of the controller. The expansion board provides:

- Heating and Cooling Control
- Monitor Airflow Rates, Temperatures, and Pressures

**NOTE:** Expansion module DIP switches are factory set to address 5, No Offset, 19.2K, and Modbus. These settings should not be changed.



**NOTE:** Dip switch positions (Left to Right) are always set as follows:  
 Forward  
 Backward  
 Forward  
 Backward  
 Forward  
 Forward  
 Forward  
 Forward

FIGURE 2.0.2 EXPANSION MODULE DETAIL

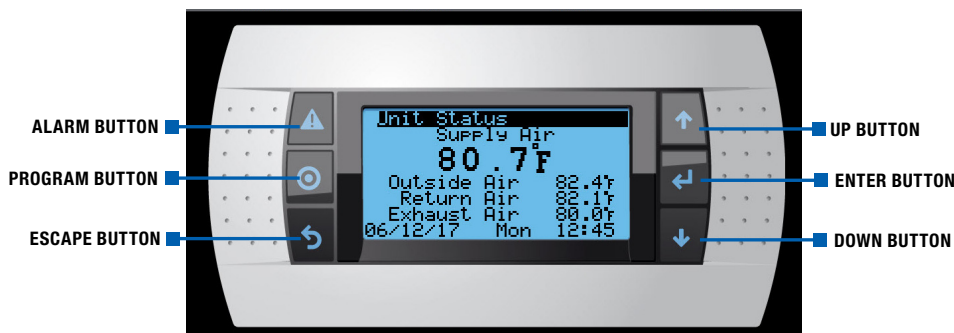


FIGURE 2.0.3 OPTIONAL REMOTE USER TERMINAL (RUT) BUTTON LOCATIONS



**NOTE:** When an alarm is first detected, the Alarm button will be flashing and an audible alarm will sound. After the alarm has been viewed, the light will remain on and the audible alarm will stop.



Pressing the PRG (program) button accesses the Service Menu or Login screen from any location in the user interface screens. The options that are available dynamically change depending on the configuration of the unit and the options installed on the unit.



The ESC button is used to go one level back from the screen the user is currently on. If the user is finished setting variables in a sub-menu, the ESC button takes them back to the previous menu. If the user is editing a variable and decides to not make a change, the ESC button takes them back to the top of that screen. Pressing the ESC button from the Main Menu takes the user back to the Main Status screen.



When on a screen with the cursor in the upper left-hand corner, the UP or DOWN hard buttons move the user from one screen to the next. While editing a variable, the UP or DOWN hard buttons allow the user to set the desired value of the variable. When viewing a view only variable, the UP or DOWN hard buttons scroll through the values available to the user.



When a menu or menu item has been highlighted, press the “ENTER” hard button to enter the highlighted selection. When a writable entry has been changed, press the hard button to enter the new value and then press it again to confirm the change.



Pressing the ALARM button displays any alarms that are currently active. There may be multiple screens of alarms. Pressing and holding the Alarm button for three seconds resets the alarms.

## 2.1 CONTROLLER ACCESS METHODS

The controller has a built-in display that can be used to set up the system and view the status of the system as well as address alarms. Two other options for accessing these are through the remote RUT and through the embedded web pages. All three methods use similar keys for the same purpose.

### 2.1.1 Using the Remote User Terminal (RUT)

The Remote User Terminal (RUT) allows you to plug into a controller and see the screens from that controller. RUTs are connected to the controller by means of a 10' cable and then used as hand-held devices. They can alternately be installed on a wall in some convenient location. The push buttons on the face of the RUT have the same functions as the push buttons on the controller.



FIGURE 2.1.0 OPTIONAL REMOTE USER TERMINAL (RUT)

The RUT (optional accessory, field-installed) plugs into the controller by means of a six wire cable with RJ12 jacks on each end. The six-wire cable is inserted in the RJ12 jack on the back of the RUT and the other end of the cable is inserted into the RJ12 adapter. The controller uses a pre-configured cable that plugs into the J3 jack on the controller and the other end is plugged into the RJ12 adapter. The cable looks similar to a standard phone cable but has a different pin out. The cable and coupler from the controller to the low voltage electrical box is included with the RUT.

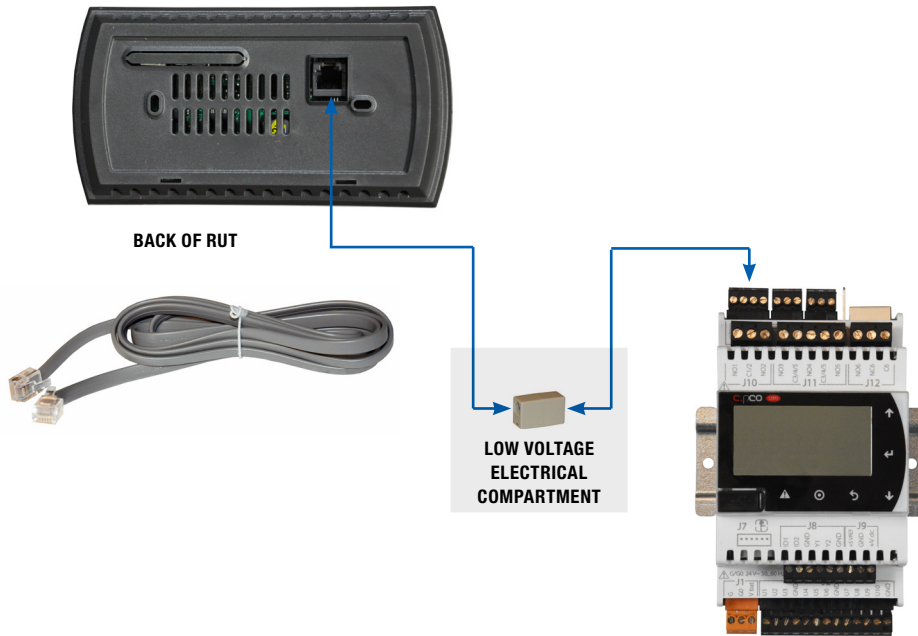


FIGURE 2.1.1 CONNECTING A RUT

**NOTE:** Common telephone wiring is 4 conductor and uses RJ11 terminals. It is different from the six-wire cable with RJ12 terminals needed for this accessory.

**NOTE:** If the controller was ordered for use with a serial BMS and an RUT is also desired, contact the factory for further information.

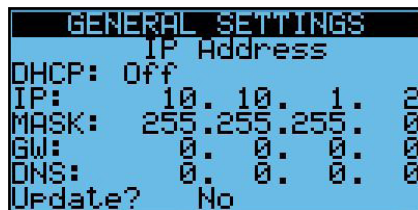
**NOTE:** For direct connection from RUT to J3 Terminal, use the following wiring:  
 Green & Black = +Vterm  
 Brown & Blue = GND  
 Red = Negative (-)  
 White = Positive (+)

2.1.2 Connecting Using Internal Web Pages

The controller has embedded web pages and when they are accessed, an interactive screen appears that allows the user to move through all the controller menus. The IP address of the controller is factory-set at 10.10.1.2. The subnet address (needed for setting up a LAN) is set at 255.255.255.0. These can be changed in the *General Settings* menu.

In order to connect to the controller with your pc you will need:

- An ethernet cable between the PC and the controller
- The PC connection must be on the same subnet as the controller. For example, if using the defaults, you would set the IP address of the PC connection to 10.10.1.xx where xx is not equal to 2, and the subnet to 255.255.255.0. (See directions for setting the PC IP address if you are not familiar with this.)



**NOTE:** The controller will only support private IP addresses which start with 192, 172, or 10.

- Using a browser such as Chrome, put the controller IP address into the address bar.



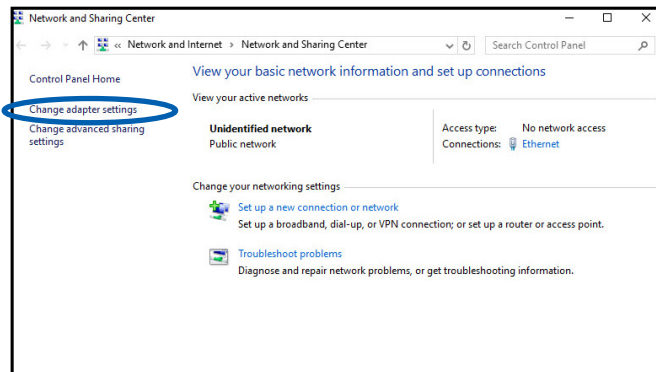


You should see this web page. To get to the menu screens, click on RUT on the Menu Bar.

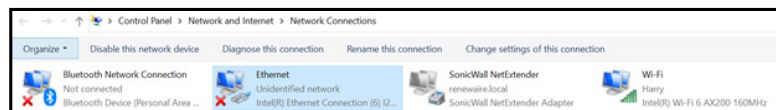


### 2.1.3 Setting the PC IP Address

For those that are not familiar with changing their PC adapter settings, go into Network Setting in the Control Panel and *Change Adapter Settings*.

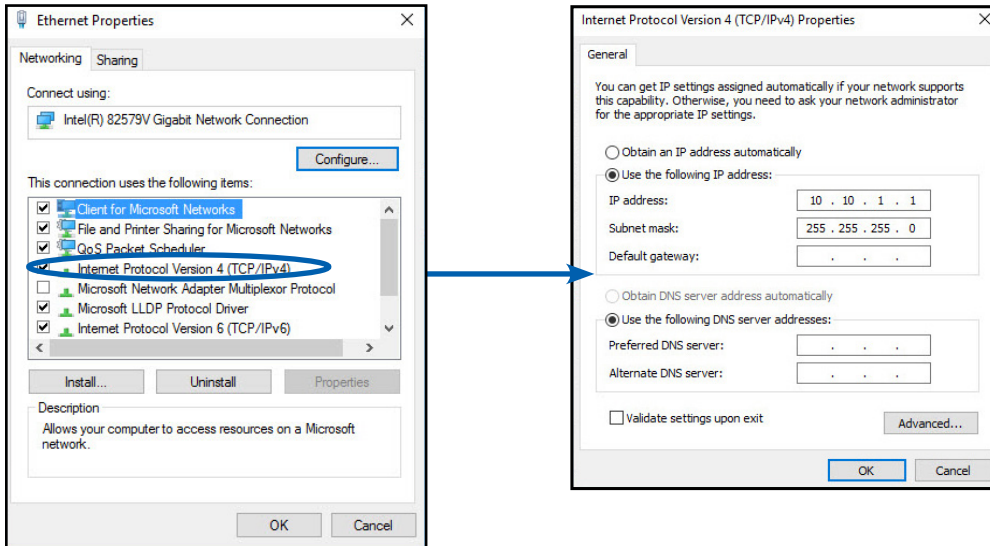


Choose the adapter you are using to connect to the controller.





Select Internet Protocol 4 and click on Properties.

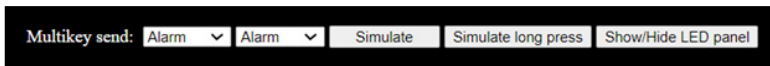


**NOTE:** When you are finished viewing the controller on your computer, remember to restore the original settings.

Enter the IP address you want to use. It should not be identical to the controller IP address. The last octet of the IP address should be different. Click OK.

### 2.1.4 Using the Multikey Function of the Web Pages

When you want to press multiple keys or press a key longer for a function you can use the keys below the Menu Screens to do this.



Two common uses are:

- Set the two keys to Alarm and Alarm and press *Simulate long press* to acknowledge alarms.
- Set the two keys to Alarm and Enter and press *Simulate long press* to get to system menus.

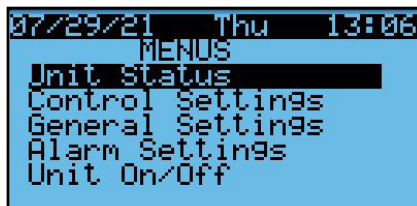
## 2.2 CONTROLLER MENU STRUCTURE

Any screen will have the name of the menu to which it belongs on the top line of the screen.

### 2.2.1 User Menu Structure

The user menu can be reached by pressing the ESC (back) button. The menus contain the following areas:

- *Unit Status*—Contains the status values of the sensors, fans, and heating and cooling, if applicable
- *Control Settings*—Contains the control settings for the fans and heating and cooling, if applicable
- *General Settings*—Contains the clock settings, Unit of Measures, IP Address, BMS settings, and the scheduler
- *Alarm Settings*—Contains the alarm settings
- *Unit On/Off*—Allows the user to turn the unit on and off via the keypad



2.2.2 Password Protected Menu Structure

The password protected menu can be reached but pressing the PROG button and entering the password. The menus contain the following areas:

- Back Up and Restore—Contains the screens to back up your settings or return to factory defaults
- Unit Configuration—Main Unit Configuration Settings that determine which screens show up in other areas
- I/O Configuration—Secondary configuration settings for functions
- I/O Calibration—Allows sensors to be adjusted for accuracy
- Sensor Overrides—Allows a sensor value to be temporarily overwritten for testing
- Test End Devices—Allows outputs to be manually manipulated for troubleshooting
- Advanced Service—Advanced Service Information and Settings



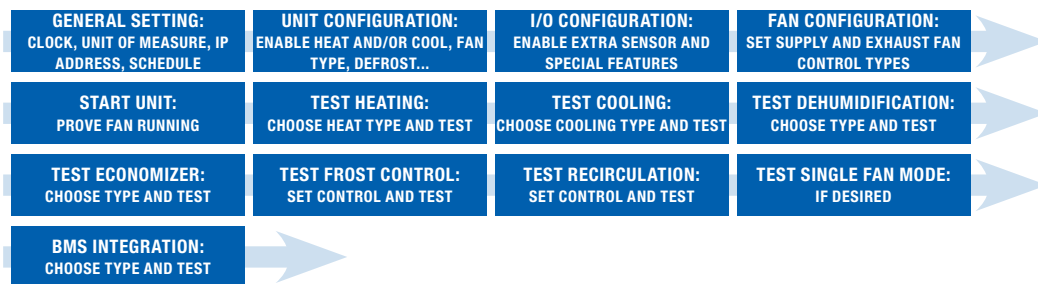
2.2.3 Password Entry

To access the password protected service screens, press the program (bullseye) button to get to the screen and enter the user password “1000.”



3.0 GENERAL FLOW FOR SETUP AND RUNNING UNIT

Depending upon features selected for the unit, the general flow for setup and running the unit is as follows:



## 4.0 UNIT CONFIGURATION

### 4.1 CONFIGURE GENERAL SETTING

There are several general settings that are need for correct operation of the controller.

#### 4.1.1 Setting the Time and Date

It is important to have the correct time and date for alarm time stamps and logging.

- Set Refresh to YES, It will turn back to NO after changing the display to the current controller time and date.
- Change the Time ad Date accordingly. (Day is automatically generated.)



#### 4.1.2 Setting the Unit of Measure

The controller supports the following settings:

- SI (bar, Celsius)
- USA (psi, Fahrenheit)
- UK (bar, Celsius)
- CAN (psi, Celsius)

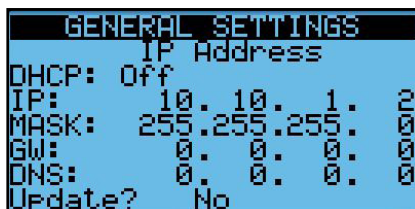
Set the Unit of Measure to the desired units for the display.



#### 4.1.3 Setting the IP Address of the Controller

The controller IP address may be used for the BMS, networking, or local access.

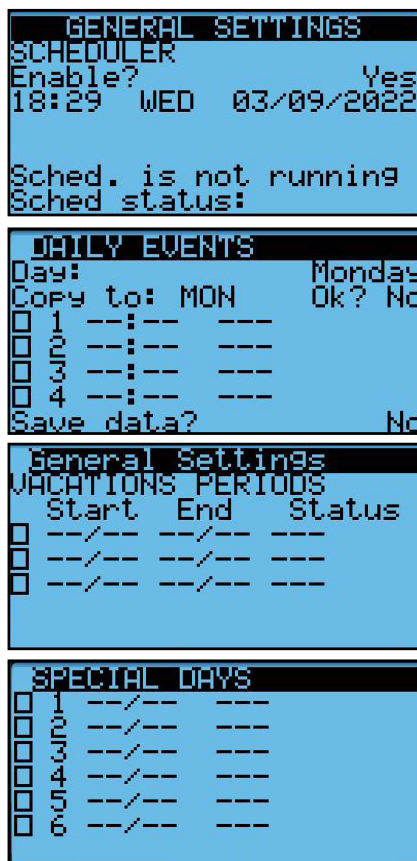
- Set the DHCP to OFF if using a static IP
- Set the IP address and Mask
- Set Update to YES
- Cycle power to the controller



#### 4.1.4 Scheduler

Enable the scheduler, if desired. If you enable the scheduler, it will have to be set for “ON” for the unit to run along with all other “ON” conditions.

- Enable the scheduler by setting to YES.
- Set the schedule for each day. You can use the copy feature to copy days. Save data after each.
- Set vacation periods.
- Set Special Days.



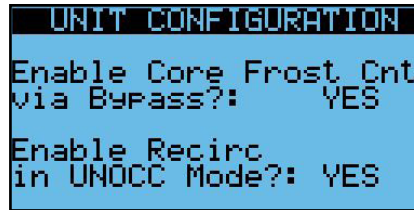
## 4.2 VERIFY UNIT CONFIGURATION

It is important to verify the configuration as the settings on these screens will also determine which screens show up in the user settings screens.

### 4.2.1 Main Unit Configuration

Depending upon how the unit was ordered, set the following settings:

- Enable Heat, if applicable.
- Enable Cooling, if applicable.
- Enable HGRH (Hot Gas Reheat), if coil present.
- Set heating and cooling types here, if desired. Or set them in the *Control Settings* later.
- Enable frost control, if desired.
- If recirculation dampers were ordered with unit, enable here.

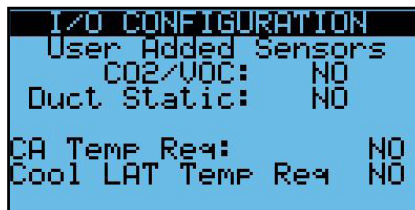


4.2.2 I/O Configuration

If using CO2/VOC or Duct Static Pressure to control the fans, enable the sensors here and adjust the scaling if needed. These are user supplied sensors. The CO2 or VOC sensors may also be used strictly for monitoring.

If either heating or cooling was enabled, the unit also requires a CA Temperature sensor in the discharge air duct. This may be included if heating or cooling was ordered with the unit but will have to be placed in the duct.

If the unit dehumidifies and requires reheat with Hot Gas Reheat or the heat source, a Coil Leaving Temperature Sensor is required. If a HGRH coil was ordered with the unit this sensor will be included.



4.2.3 Field-Installed Sensors and General Wiring

All sensors are wired to an intermediate terminal, as shown. The factory wiring connects to the controller itself. It is shown for troubleshooting purposes but should not be changed.

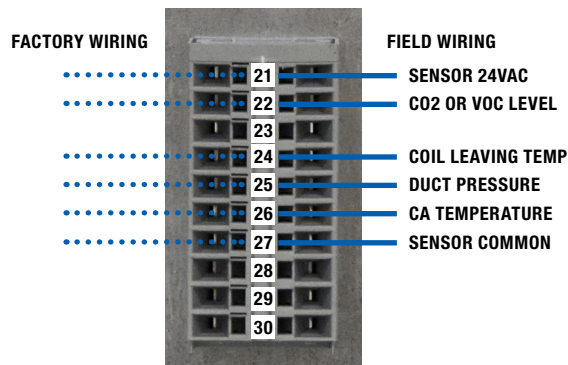


FIGURE 4.2.0 X3 TERMINALS

Field-installed control sensors and monitors are to be installed and wired in accordance with instructions shipped in the documentation package. Wire gauge must be in accordance with the following:

|                |      |      |      |      |      |       |
|----------------|------|------|------|------|------|-------|
| Wire Gauge     | #22  | #20  | #18  | #16  | #14  | #12   |
| Circuit Length | 100' | 150' | 250' | 400' | 700' | 1000' |

4.2.4 CO2/VOC Sensors

The DN control allows the use of either a CO2 sensor or a VOC sensor. The sensor may be physically attached to the system (Source = Hardware) or the value may be written from the BMS system (Source = from BMS).

The CO2 sensor is used as part of a demand control ventilation system to provide speed control of fans based on the level of CO2 in the space or duct. These sensors provide a 0–10VDC signal scaled as specified in the CO2/VOC scaling screen.

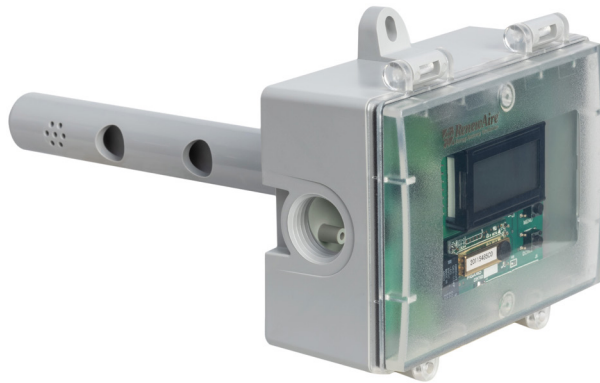
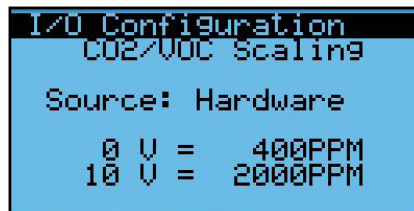


FIGURE 4.2.1 CO2 SENSOR (DUCT MOUNT, SIDE VIEW)

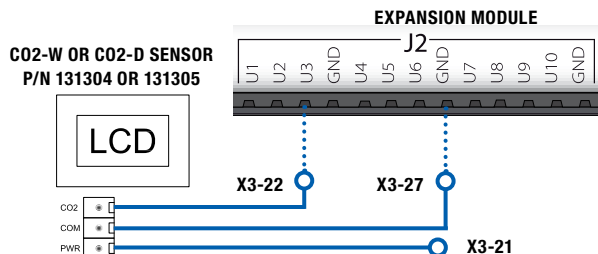


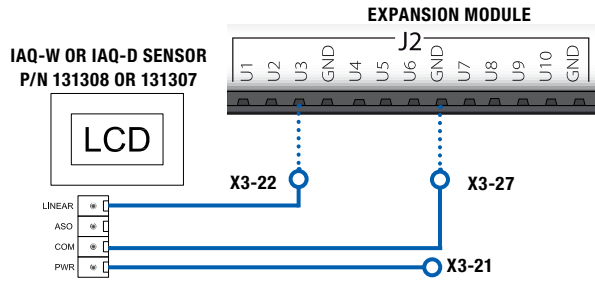
FIGURE 4.2.2 CO2 SENSOR (WALL MOUNT)

The Air Quality Monitor detects total VOCs (TVOC) in the supply airstream or the space. It uses a MEMs metal oxide semiconductor sensor to capture VOC emissions that are invisible to CO2 sensors. It is installed in the SA duct or the space. These sensors provide a 0–10VDC signal scaled as specified in the CO2/VOC scaling screen.



**NOTE:** When wiring sensor, do not wire directly to the expansion module; wire to the X3 terminal block, see Figure 4.2.0.





**NOTE:** When wiring sensor, do not wire directly to the expansion module; wire to the X3 terminal block, see Figure 4.2.0.

4.2.5 Differential Pressure Duct Sensor

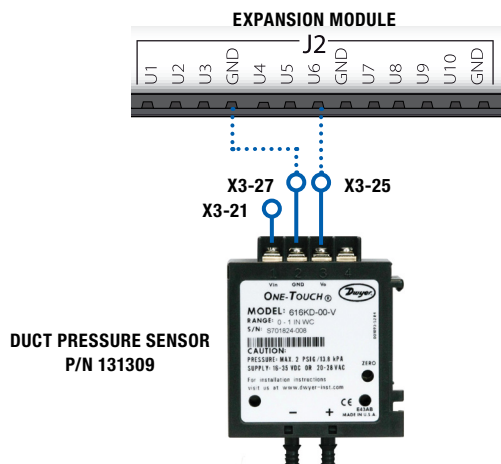
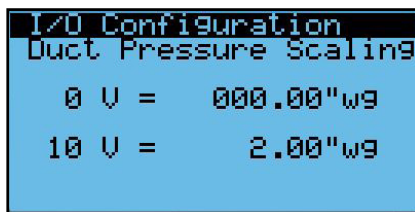
The pressure transmitter with a display screen (below right) is an optional accessory and would be installed in a duct to run the fan to meet a specific duct pressure. These sensors provide a 0–10VDC signal scaled as specified in the Duct Pressure scaling screen.



FIGURE 4.2.3 PRESSURE DIFFERENTIAL TRANSMITTER (TYP)



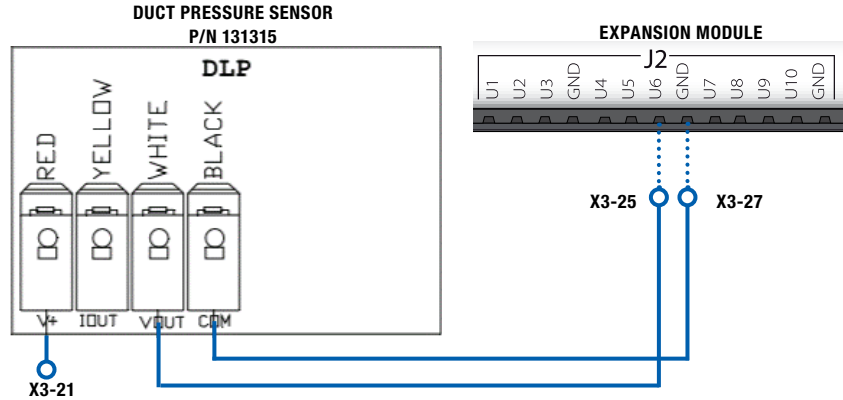
FIGURE 4.2.4 ELECTRICAL PRESSURE DIFFERENTIAL TRANSMITTER



**NOTE:** When wiring sensor, do not wire directly to the expansion module; wire to the X3 terminal block, see Figure 4.2.0.



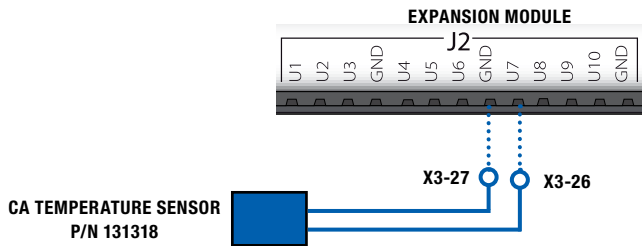
**NOTE:** When wiring sensor, do not wire directly to the expansion module; wire to the X3 terminal block, see Figure 4.2.0.



4.2.6 CA Temperature Sensor

The CA Temperature sensor is automatically enabled if the heating and/or cooling is enabled. If it is not connected, an alarm will occur. If your unit was ordered with heating and/or cooling, the supply temperature sensor should be included but may need to be installed down the duct to prevent cycling of heating or cooling. The sensor uses a special curve and cannot be swapped with standard T2 or T3 NTC sensors.

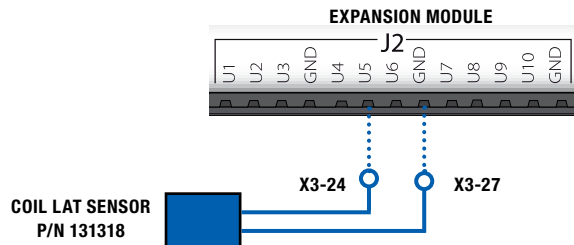
**NOTE:** When wiring sensor, do not wire directly to the expansion module; wire to the X3 terminal block, see Figure 4.2.0.



4.2.7 Coil Leaving Temperature Sensor

The Coil Leaving Temperature sensor is automatically enabled if the HGRH or heating reheat for dehumidification is enabled. If it is not connected, an alarm will occur. If your unit was ordered with a HGRH coil, the coil leaving temperature sensor should be. The sensor uses a special curve and cannot be swapped with standard T2 or T3 NTC sensors.

**NOTE:** When wiring sensor, do not wire directly to the expansion module; wire to the X3 terminal block, see Figure 4.2.0.



## 5.0 UNIT OPERATION AND FAN CONTROL

The primary purpose of the DN DOAS Unit is to provide 100% OA. The amount of air that it provides is based on the configuration of the supply and exhaust fans and whether the unit is running or not.

Fans are either controlled with variable speed drives or ECM motors.

### 5.1 SEQUENCE OF OPERATION FOR UNIT START

The unit will start when all of the following conditions are true:

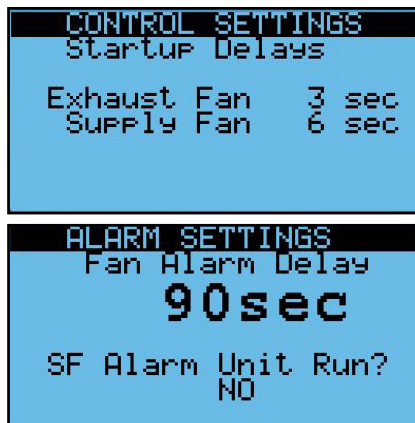
- There are no serious alarms.
- The Digital Input for start/stop (terminals 17 and 18) are closed.
- The unit is turned on at the keypad.
- The time is within the scheduler "ON" time, if scheduler enabled.
- The BMS has written the unit on signal, if BMS control is enabled.



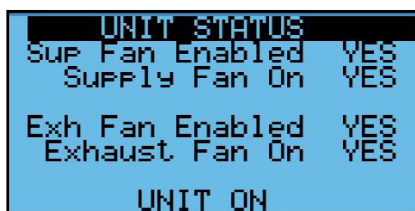
Upon starting, the isolation dampers will open. The end switches of these dampers will complete the Fan Enable signal to the ECM or VFD fans.

Once the fan enable signal is complete, the fan command signal will be sent to the fan after the start up delay time. Each fan is paired with a current sensor. If within the alarm delay time, default 90s, the current sensor does not detect the fan running, the unit will shut down and an alarm will occur.

The setting *SF Alarm Unit Run?* setting tells whether the unit, and thus the exhaust fan, will continue to run if there is an alarm with the supply fan.



The Unit status is shown on the bottom of this screen. More than one of these statuses may be valid at one time



| UNIT STATUS CONDITIONS             |   |
|------------------------------------|---|
| STATUS SHOWN                       | MEANING   |
| Unit on                            | The unit is on and running.                                 |
| Unit switched off due to alarm     | The unit is off by a serious alarm.                         |
| Unit switched off by BMS           | The unit is off by command from the BMS.                    |
| Unit switched off by time band     | The unit is off by the scheduler.                           |
| Unit switched off by digital input | The unit is off due to contacts across 17 and 18 open.      |
| Unit switched off by local keypad  | The unit is off by the setting on the menu screen.          |
| Exhaust Fan Only Mode              | The unit is in single fan mode with exhaust fan running.    |
| Supply Fan Only Mode               | The unit is in single fan mode with supply fan running.     |
| Unoccupied Mode                    | The unit is set to unoccupied mode.                         |
| Cool Locked Out by BMS             | A BMS command has the cooling locked out.                   |
| Heat Locked Out by BMS             | A BMS command has the heating locked out.                   |
| Device Test                        | The system is in device test mode for more than an hour.    |
| Sens Ovrdr Active                  | The system has a sensor overwritten for more than 24 hours. |
| Frost Control Active               | The system is in frost control mode.                        |

5.1.1. Digital Input (ID1) Unit On/Off

The digital input across terminals 17 and 18 must be closed to turn the unit on. It can be jumpered if not used. Some of the uses are a remote switch, a smoke detector or a motion/occupancy sensor. The unit can also be supplied with an optional drain overflow switch that is wired into this input. Shown are the accessories are offered by RenewAire.

5.1.1.1 Optional Smoke Detector

Normally field-installed on the discharge duct, near the furnace.

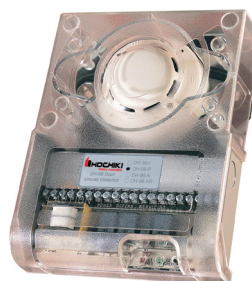


FIGURE 5.1.0 SMOKE DETECTOR

5.1.1.2 Optional Motion Sensor

Used for occupancy-based ventilation, hardwired to the low-voltage terminal strip.



FIGURE 5.1.1 MOTION SENSOR (CEILING MOUNT)



FIGURE 5.1.2 MOTION SENSOR (WALL MOUNT)

### 5.1.1.3 Optional Drain Overflow Switch

This is an optional accessory, ordered with the unit and factory-installed. The overflow switch monitors condensate levels in the condensate pan and if unacceptable levels are detected, it will cause the fans to switch OFF and the dampers will return to their Normally Closed positions. When the condensate level drops, the unit will return to normal operation.



FIGURE 5.1.3 OVERFLOW SWITCH

### 5.1.2 Dampers

Inside the DN DOAS unit, OA and RA airstreams are directed based on operating modes. There are three modes of operation: energy recovery, economizer/bypass, and recirculation.

In Energy Recovery Mode, OA and RA airflow is through the enthalpic cores. The isolation dampers are open and both fans are operating. The economizer face damper is open, and the bypass damper is closed, allowing OA to flow through the enthalpic cores only. Energy is recovered between the OA and RA airstreams.

Economizer/Bypass Mode, a standard feature, is activated when the OA enthalpy is less than the RA enthalpy and free cooling is desired. A portion or all of the OA passes through the bypass compartment. The isolation dampers are open and both fans are operating. The economizer face damper and bypass damper modulate to meter OA flow through the enthalpic cores and bypass compartment for no or limited energy recovery. Modulation of the face and bypass dampers allows the CA to maintain a desired air temperature without use of additional cooling. In full bypass mode, all OA flows through the bypass compartment with the economizer damper fully closed and the bypass damper fully open. RA continues to pass through the cores.

Recirculation Mode, an optional feature, is typically used during the Unoccupied Mode. OA does not enter the unit and RA airflow bypasses the enthalpic cores. The isolation dampers are closed and only the supply air fan is operating. The recirculation damper diverts RA through the bypass compartment and to the supply air fan. Additional heating or cooling can be added to the airstream before delivery back to the Occupied Space.

Refer to the unit IOM for more information on the dampers.

### 5.1.3 Fans

The fans may be driven by VFDs or may be ECM fans. The VFD fans get an enable signal and both types of fans get a 0–10VDC signal which is proportional to 0–100% fan command.

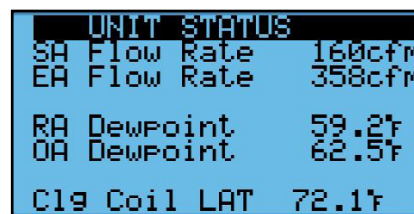
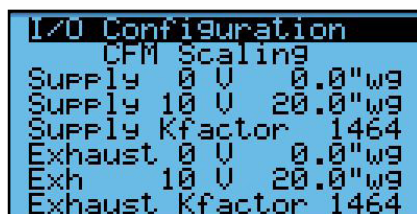
Factory VFD settings should not be changed. The settings are available in the *Reference* section of this manual.

### 5.1.4 Airflow Measurement

Two pressure transmitters that measure up to 20" w.g. are installed at the fan inlet cones and are used to measure pressure drop across the fan inlet rings. The scaling screen can be found in the *I/O Configuration*. The kfactor is factory set for the fans and should only be adjusted during test and balance. The supply and exhaust flow values can be read in the *Unit Status* screens.



FIGURE 5.1.4 PRESSURE DIFFERENTIAL TRANSMITTER (TYP)



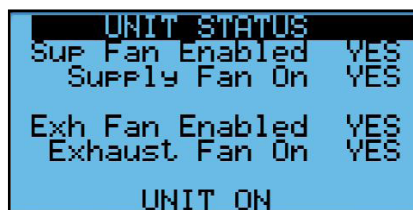
5.1.5 Current Sensors

Current sensors are installed on high voltage supply wires to sense current going to a fan motor. They are used to prove the ON/OFF state of fan motors.



FIGURE 5.1.5 CURRENT SWITCH

When the unit starts, this screen will show when the fans are enabled. There is a slight delay of a few seconds, and then the second line, supply (or exhaust) fan on shows the status of the current sensor.



The current sensors are factory adjusted and may need to be field-adjusted for the application. This will be evidenced by getting a supply fan alarm (AL10) or exhaust fan alarm (AL11). The instructions are in the Alarms and Troubleshooting section of this manual.

5.1.6 Filter Monitoring

There is a pressure transducer across the filters on the outdoor air and RA streams to monitor the filter status. The scaling is factory set in this screen.



NOTE: Current sensors are calibrated for reduced fan speed at time of shipment from the factory. Immediately after entering new operating parameters for the fans (done during the start up process), current sensors are to be re-calibrated for minimum current draw. The fan should be running at its minimum speed.

```

I/O Configuration
Filter Press Scaling
OA Flt 0 U= 0.0"wg
      10 U= 2.0"wg

RA Flt 0 U= 0.0"wg
      10 U= 2.0"wg

```

The alarm level can be set pressure can be set such that if the pressure reaches the alarm level, the unit will alarm but keep running.

```

ALARM SETTINGS
Filter Alarms

OA Level 1.0"wg
RA Level 1.0"wg
Alarm Delay 60 sec

```

You can also see the pressure in this screen so that if it gets close to the alarm level you can change it at your convenience.

```

UNIT STATUS
OA Humidity 25.0%
RA Humidity 22.3%
OA Enthalpy 21.8btu/lb
RA Enthalpy 21.3btu/lb
OA Filter 0.02"wg
RA Filter 0.05"wg
SA Temperature 68.7f

```

## 5.2 OPTIONS FOR SUPPLY FAN CONTROL

Units with a VFD or ECM for the supply fan can control the fan for constant speed, SA flow control, supply duct static pressure control, CO<sub>2</sub>/VOC control, or CO<sub>2</sub> Flow control. Available modes may depend on the sensors added.

### 5.2.1 Constant Fan Speed Option

The analog voltage command to the supply fan VFD or ECM can be set from the unit controller display or by the BMS. The adjustable range of 0% to 100% correspond to the minimum and maximum fan operating speed.

```

Control Settings
SUPPLY FAN CONTROL
Constant Speed

```

This supply fan operation mode can be used to field balance the SA flow rate.

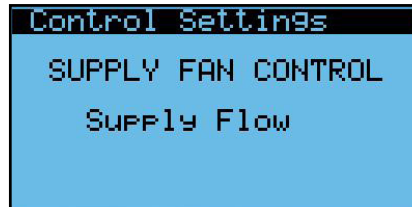
```

Control Settings
SUPPLY FAN
Constant Speed Setp
25 %

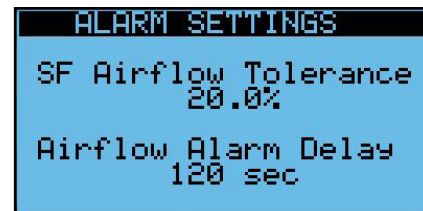
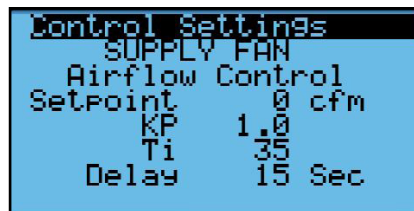
```

5.2.2 SA Flow Control Option

The controller will adjust the supply fan VFD or ECM command to maintain the SA flow rate at a setpoint.



The SA flow rate setpoint is entered and adjusted from the unit controller display or provided by the BMS. The minimum and maximum values for SA flow rate setpoint are unit dependent. An adjustable proportional and integral (PI) loop will compare the measured SA flow to the airflow rate setpoint and adjust the fan speed. If the measured SA flow rate varies from the desired airflow rate by more than 10% (adjustable) for more than 60 seconds (adjustable) a SA flow rate alarm will be set to true. This supply fan operation mode can be used to provide a constant SA flow rate as the unit filters become loaded.

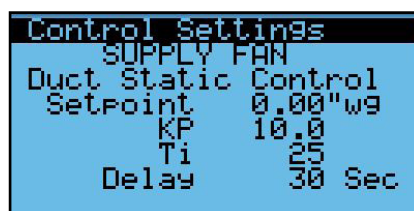


5.2.3 Supply Duct Static Pressure Control Option

The controller will adjust the supply fan VFD or ECM command to maintain the supply duct static pressure at a setpoint. This option requires a field-installed duct pressure transmitter and setup for the transmitter in the I/O configuration.



The SA duct static pressure setpoint is entered and adjusted from the unit controller display or provided by the BMS. The minimum and maximum values for SA duct static pressure setpoint are unit dependent. An adjustable PI loop will compare the measured SA duct static pressure to the static pressure setpoint and adjust the fan speed. If the measured static pressure varies from the desired static pressure by more than 0.05" w.g. (adjustable) for more than 60 seconds (adjustable) a SA static pressure alarm will be set to true. This supply fan operation mode can be used to provide a constant supply duct pressure for VAV systems.



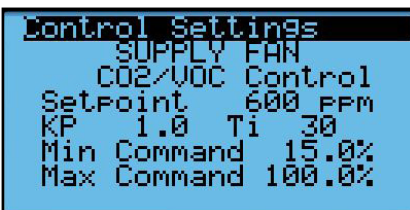


#### 5.2.4 CO2/VOC Control Option

The controller will adjust the supply fan VFD or ECM command to maintain the room or RA CO2/VOC level at a setpoint. This option requires a field-installed CO2 or VOC sensor or value from a BMS and setup for the sensor in the I/O configuration.

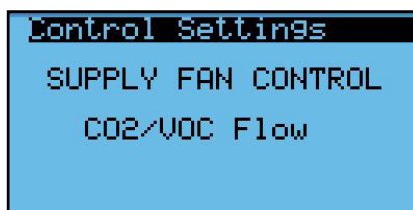


The CO2/VOC setpoint is entered and adjusted from the unit controller display or provided by the BMS. An adjustable PI loop will compare the measured CO2/VOC level to the CO2/VOC setpoint and adjust the fan speed. The minimum and maximum fan speed commands are adjustable. If the measured CO2/VOC level exceeds 1000 ppm (adjustable) for more than 60 seconds (adjustable) a CO2/VOC alarm will be set to true. This supply fan operation mode can be used to provide demand-controlled ventilation of a space. The minimum fan speed will provide the required minimum outdoor air when the CO2/VOC level is at or below the CO2/VOC setpoint.



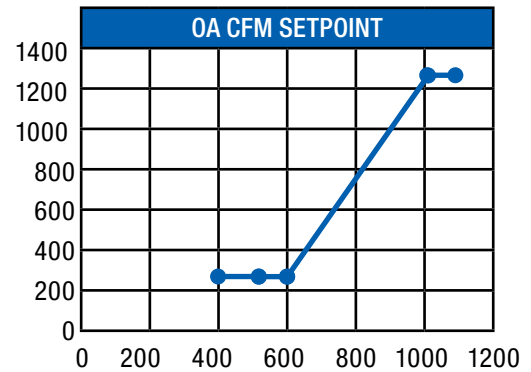
#### 5.2.5 CO2 Flow Control Option

The controller will adjust the supply fan VFD or ECM command based on the measured room or RA CO2 level.



The SA flow setpoint is derived from the user entered minimum and maximum CO2 levels and minimum and maximum desired airflow rates. When the CO2 level is at or below the minimum CO2 level the airflow setpoint is at the minimum and when the CO2 level is at or above the maximum CO2 level the airflow setpoint is at the maximum. Between the minimum and maximum CO2 levels the airflow setpoint is linearly scaled. If the measured CO2 level exceeds 1000 ppm (adjustable) for more than 60 seconds (adjustable) a CO2 alarm will be set to true. This supply fan operation mode can be used to provide demand-controlled ventilation of a space. The minimum fan speed will provide the required minimum outdoor air when the CO2 level is at or below the CO2 setpoint.

| Control Settings     |     |      |     |
|----------------------|-----|------|-----|
| SUPPLY FAN           |     |      |     |
| CO2/VOC Flow Control |     |      |     |
| CO2                  | MIN | MAX  |     |
| Flow                 | 500 | 1000 | PPM |
|                      | 294 | 589  | cfm |
|                      | KP  | 1.0  |     |
|                      | Ti  | 30   |     |



### 5.3 OPTIONS FOR EXHAUST FAN CONTROL

Units with a VFD or ECM for the exhaust fan can control the fan for fixed speed, EA flow control, supply fan command tracking control, supply fan flow rate tracking control, or return static pressure control.

#### 5.3.1 Constant Fan Speed Option

The analog voltage command to the exhaust fan VFD or ECM can be set from the unit controller display or by the BMS.

| Control Settings    |
|---------------------|
| EXHAUST FAN CONTROL |
| Constant Speed      |

The adjustable range of 0% to 100% correspond to the minimum and maximum fan operating speed. This exhaust fan operation mode can be used to field balance the EA flow rate.

| Control Settings    |
|---------------------|
| EXHAUST AIR         |
| Constant Speed Setp |
| 25%                 |

### 5.3.2 EA Flow Control Option

The controller will adjust the supply fan VFD or ECM command to maintain the EA flow rate at a setpoint.

```
Control Settings
EXHAUST FAN CONTROL
Exhaust Flow
```

The EA flow rate setpoint is entered and adjusted from the unit controller display or provided by the BMS. The minimum and maximum values for EA flow rate setpoint are unit dependent. An adjustable PI loop will compare the measured EA flow to the airflow rate setpoint and adjust the fan speed. If the measured EA flow rate varies from the desired airflow rate by more than 10% (adjustable) for more than 60 seconds (adjustable) an EA flow rate alarm will be set to true. This exhaust fan operation mode can be used to provide a constant EA flow rate as the unit filters become loaded.

```
Control Settings
EXHAUST AIR
Airflow Setpoint
    0 cfm
    KP 1.0
    Ti 15
    Delay 30 Sec
```

```
ALARM SETTINGS
EF Airflow Tolerance
    10.0%
Airflow Alarm Delay
    120 sec
```

### 5.3.3 Supply Fan Command Tracking Control Option

The controller will adjust the exhaust fan VFD or ECM command to track the supply fan VFD or ECM command.

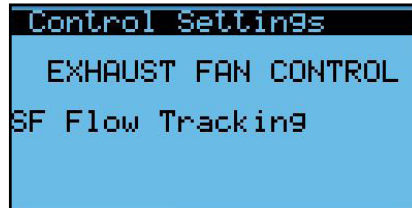
```
Control Settings
EXHAUST FAN CONTROL
SF Command Tracking
```

The minimum (50%) and maximum (200%) tracking rates are adjustable. This exhaust fan operation mode can be used to maintain proportional supply and exhaust fan commands as the supply fan modulates.

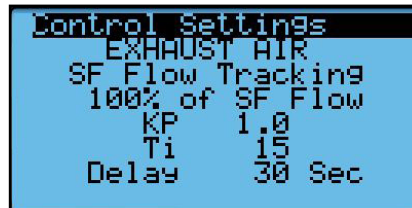
```
Control Settings
EXHAUST AIR
SF Command Tracking
    100%
```

5.3.4 Supply Fan Flow Tracking Control Option

The controller will adjust the exhaust fan VFD or ECM command to track the supply fan air flow rate.



The offset from the SA flow rate is adjustable from -25% to +25%. An adjustable PI loop will compare the measured EA flow to the airflow rate setpoint and adjust the fan speed. This exhaust fan operation mode can be used to maintain proportional supply and EA flows as the supply fan modulates and as the unit filters become loaded.

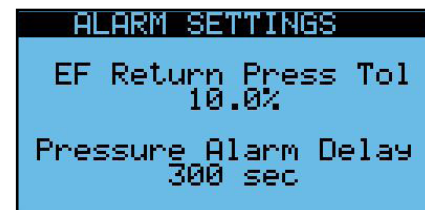


5.3.5 Return Static Pressure Control Option

The controller will adjust the exhaust fan VFD or ECM command to maintain the return duct static pressure at a setpoint. This mode cannot be used if the supply fan mode is duct static control.



The return duct static pressure measurement is typically a negative pressure value. The return duct static pressure setpoint is entered and adjusted from the unit controller display or provided by the BMS. The minimum and maximum values for the RA duct static pressure setpoint are unit dependent. An adjustable PI loop will compare the measured RA duct static pressure to the static pressure setpoint and adjust the exhaust fan speed. If the measured static pressure varies from the desired static pressure by more than 0.05 inches water gauge (adjustable) for more than 300 seconds (adjustable) a RA static pressure alarm will be set to true. This exhaust fan operation mode can be used to provide a constant return duct pressure for variable exhaust systems



## 6.0 TEMPERING CONTROL

The secondary purpose of the DN DOAS Unit is to provide 100% outdoor air that is dehumidified (using cooling) and/or tempered. Most of the DN DOAS units have some type of heating and/or cooling to provide this.

### 6.1 MODES OF OPERATION

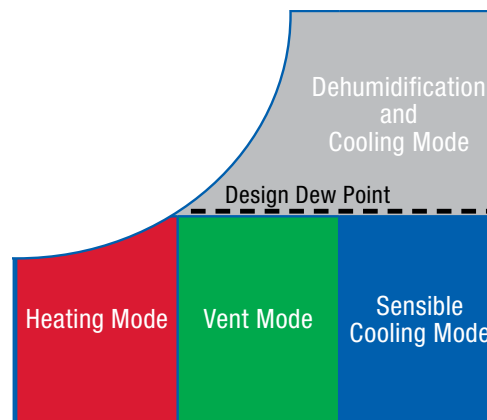
There are four modes of operation (if applicable):

- ♦ Dehumidification (and cooling) Mode—will run the cooling to maintain a dehumidification setpoint (around 50°F) and then reheat the air (to around 60°F), if feature is included
- ♦ Heating Mode—Will run the heating to maintain a heating setpoint
- ♦ Sensible Cooling Mode—Will run the cooling to maintain a cooling setpoint
- ♦ Ventilation Mode—Will only run the fans for ventilation

The mode during occupied operation will depend upon the following conditions. The mode is dependent upon whether the feature is enabled and the lockout dew point or outdoor air temperature for that feature.

See the following sections for more information on these modes. The mode is determined in this order:

1. Heating: Is the unit configured for heating?  
Is the outdoor air temperature lower than the heating lockout temperature?
2. Dehumidification: Is the unit configured for dehumidification? If so, is the unit in dehumidification mode?
3. Cooling: Is the unit configured for cooling?  
Is the outdoor air temperature higher than the cooling lockout temperature?
4. If it is in no other mode and the unit is on, it will be in Ventilation Mode.



In normal heating operation, the controller will prevent the heater from running when the Outdoor Air temperature is above the Lockout Above setpoint. This causes the DN unit to use energy recovery from the RA for heating instead of firing the heat module. The Lockout Above setpoint is assigned by the user, based on both ambient temperatures and experience with the building being heated. **RenewAire suggests an initial Lockout Above setting of 50°F.** If the OA air is at 50°F and the EA coming from the Occupied Space is at 72°F, the CA recovers enough heat energy from the EA that it will reach about 67.6°F without any supplementary heat from the heat module when the heat exchange core is at maximum efficiency. In every building, there is additional heat being generated by human activity, equipment and thermal gain from sunlight, etc. If there is very little additional heat being generated in the Occupied Space, the Lockout Above setting may have to be raised. If there is a great deal of heat being generated, the Lockout Above setting can actually be lowered further.

The Lockout Above function has a hysteresis band built into it to prevent short-cycling when the OA air is near the Lockout Above setpoint. In other words, if the Lockout Above setpoint is at 50°F, the gas heat module will be disabled whenever the OA air temperature is higher than 50°F. When the OA air temperature drops to 50°F, the controller will continue to lockout the heat module until the OA temperature drops an additional 1.8°F, the hysteresis band.

Lockout Below performs the same function as Lockout Above, but for cooling. The factory setpoint for Lockout Below is 70°F, meaning that if the Outdoor Air temperature is lower than 70°F, the cooling unit will be blocked from running. **RenewAire suggests an initial Lockout Below setting of 70°F.**

### 6.2 DEHUMIDIFICATION

The dehumidification is performed with the cooling. Therefore, the unit must have cooling enabled. It may also have HGRH enabled here, used for reheat during dehumidification.

```

Unit Configuration
Enable Heat:    YES
Enable Cool:   YES
Enable HGRH:   NO

CLG TYPE:On/Off
HTG TYPE:0 to 10 VDC
    
```

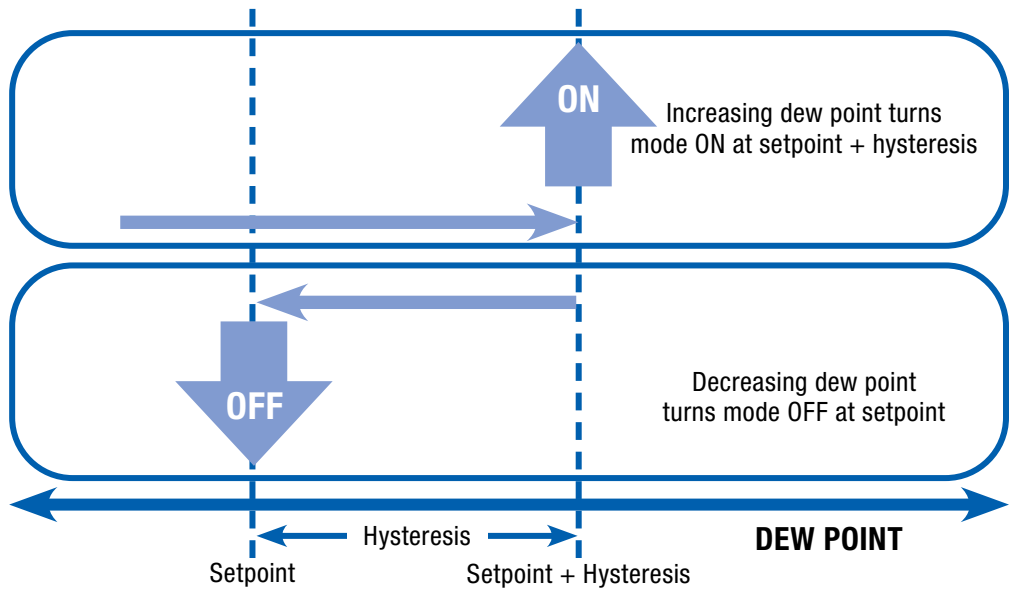
The setting for changeover is in *Control Settings*. Dehumidification mode will be on at the dehumidification setpoint + the hysteresis value set here. It will go out of dehumidification mode below the setpoint.

This screen will not show up if dehumidification is disabled in the prior screen.

```

CONTROL SETTINGS
Dehumid Mode On
Based on Return Air
Dewpoint:

On above SP + Hyst
60.0°F(SP) 1.7°F(hyst)
Off below SP
    
```



The status can be monitored in *Unit Status*.

```

UNIT STATUS
DewPoint
59.1°F
Dehum On Above 61.7°F
Dehum Off Below 60.0°F
Dehumid On NO
    
```

6.2.1 Dehumidification Types and Settings

There are four possibilities for dehumidification:


1. Cooling with Hot Gas Reheat. In this case the HGRH will be enabled in the above screen.
2. Cooling with Reheat performed by the heating source.
3. Cooling only. This mode could produce very cold air that might be uncomfortable if fed directly to an occupied space.
4. Disabled. In this case no dehumidification mode is available.

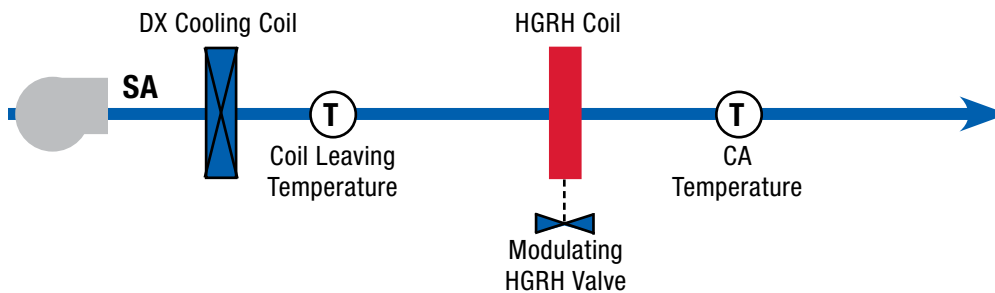
6.2.1.1 Dehumidification with Hot Gas Reheat

This dehumidification method requires DX cooling. It relies on an additional HGRH coil downstream of the cooling coil in which the hot refrigerant piping is in contact with the supply airstream. This allows a portion of the refrigerant cycle's normally rejected heat to be reclaimed as reheat.

When the return (or outdoor) air dew point exceeds the 55°F (adjustable) the dehumidification mode will be enabled. The air is cooled to a cooling coil leaving temperature setpoint, usually 55°F or below. Then it is reheated to a CA temperature setpoint, usually around 60°F. An adjustable PI loop will compare the measured air temperature to the air temperature setpoint and adjust the analog output to the valve.

If the unit was ordered with HGRH, the coil leaving temperature sensor was included.

 NOTE: For packaged DX units, the HGRH valve will open to 25% during compressor start up.



The settings for this method require that

- Cool and HGRH are enabled in the *Unit Configuration*.
- A setpoint for the coil leaving temperature and the CA temp are set.
- KP and Ti settings are adjusted for control of the HGRH valve, if necessary.
- The purge settings are adjusted, if necessary. These settings show a low % whereby if the valve is set to the low limit for the low limit time, which could cause oil to settle in the coil. Opening to a higher value for a period of time will allow the oil to return to the compressor it will be opened for the high override % for the override time.

```

UNIT CONFIGURATION
Enable Heat:    YES
Enable Cool:   YES
Enable HGRH:   YES

CLG TYPE:2 Stage
HTG TYPE:0 to 10 VDC
    
```

```

CONTROL SETTINGS
Dehumidification
Reheat performed with
HGRH:

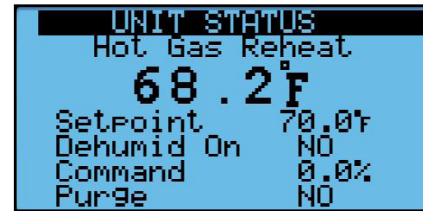
Cooling Coil LAT 50.0°F
CA Reheat SetP 64.4°F
    
```

```

CONTROL SETTINGS
HGRH Settings
KP      0.6
Ti      40
Low Continuous 10.0%
Low Time Limit  600s
High Override  50.0%
Override Time   60s
    
```



The status can be viewed in *Unit Status*.

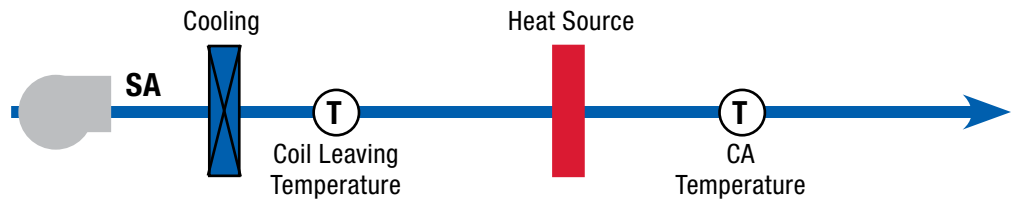


6.2.1.2 Dehumidification with Reheat from Heat Source

This dehumidification method uses any cooling source and heating source.

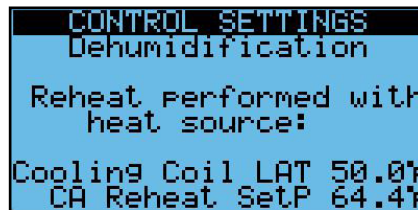
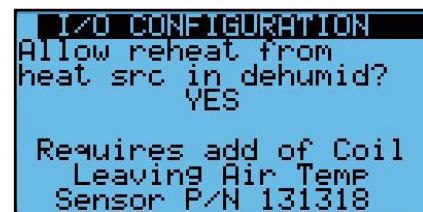
When the return (or outdoor, selectable) air dew point exceeds the 55°F (adjustable) the dehumidification mode will be enabled. The air is cooled to a cooling coil leaving temperature setpoint, usually 55°F or below. Then it is reheated to a CA temperature setpoint (or RA, based on setting for heating), usually around 60°F. An adjustable PI loop will compare the measured air temperature to the air temperature setpoint and adjust the analog output to the valve. The NO1 heating enable contact is engaged whenever the heating output is at 1% or higher.

To use this method you need to add a cooling coil leaving temperature sensor, P/N 131318, and install it after the cooling method. It should be wired as described in the *Verify Unit Configuration* section.

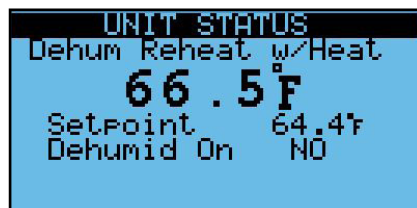


The settings for this method require that

- Cool and Heat are enabled in the *Unit Configuration*
- Set Allow heat src in dehumid to YES in *I/O Configuration*
- A setpoint for the coil leaving temperature and the CA temp are set



The status can be viewed in *Unit Status*.



6.2.1.3 Dehumidification with No Reheat

This dehumidification method uses any cooling source.

When the return (or outdoor) air dew point exceeds the 55°F (adjustable) the dehumidification mode will be enabled. The air is cooled to a CA temperature setpoint, usually around 50–55°F. If feeding the space directly, this could cause overcooling.



The settings for this method require that

- Cool is enabled in the *Unit Configuration*
- Set Allow heat src in dehumid to No in *I/O Configuration*
- A setpoint for the CA temp is set

```

Unit Configuration
Enable Heat:    YES
Enable Cool:   YES
Enable HGRH:   NO

CLG TYPE:On/Off
HTG TYPE:0 to 10 VDC
    
```

```

I/O CONFIGURATION
Allow reheat from
heat src in dehumid?
NO

Requires add of Coil
Leaving Air Temp
Sensor P/N 131318
    
```

```

CONTROL SETTINGS
Dehumidification

CA Temp SP
for Dehum:    50.0°F
    
```

The status can be viewed in *Unit Status*.

```

UNIT STATUS
Dewpoint
59.1°F
Dehum On Above 61.7°F
Dehum Off Below 60.0°F
Dehumid On NO
    
```

6.2.1.4 Dehumidification Disabled

The settings for this method require that

- Dehumidification Changeover Selection is set to “Dehum Disabled” in *I/O Configuration*. In this case the cooling will only be used to supply sensible cooling.

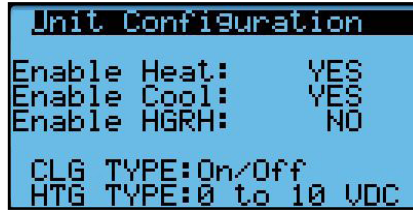
```

I/O CONFIGURATION
dehumidification
Changeover Selection
Dehum Disabled

Choose Outdoor Air for
applications w/19 amts
of Outdoor Air/changes
    
```

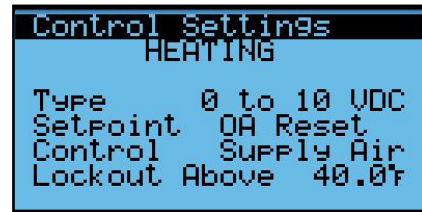
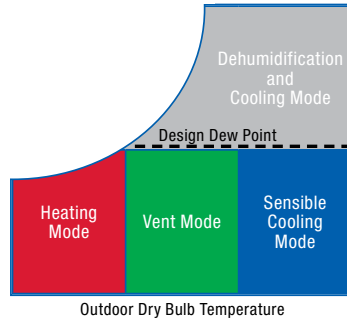
### 6.3 HEATING

The heating requires that heating be enabled in the *Unit Configuration*. The heating type can also be set here or in the *Control Settings*.



#### 6.3.1 Heating Mode

For any type of heating there is an outdoor air lockout temperature above which heating will not be allowed. Note that the default is low. This is to insure that at start up, you can start your fans without worrying if the tempering will also start. This value will need to be raised to an acceptable value.



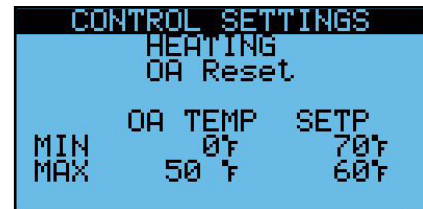
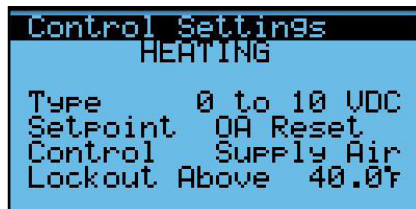
#### 6.3.2 Setpoint Type and Control Type

For each type of heating, you can choose a setpoint type and a control type. Setpoint types available:

- Adjust: If you choose this it will allow you to set a heating setpoint.
- OA Reset: You are prompted to set a reset schedule. In the screen shown, the setpoint will be 70°F if the outdoor air is 0°F or below, and 60°F if the outdoor air is 50°F and above. It will be linear between. For example, if the outdoor air is 25°F, the setpoint will be 65°F. This method is useful to avoid overheating the space or to avoid excess cycling in warmer temperatures.

Control types available:

- CA: Be sure to install your CA temperature sensor far enough down the duct to prevent over-cycling.
- RA: If you are only feeding one space this is a useful control method.

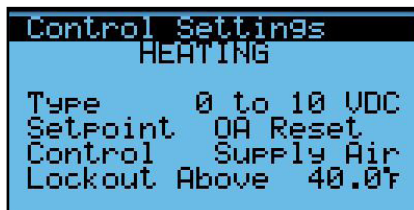


### 6.3.3 Heating Control Types

The following heating types are supported:

- 0–10VDC: Gas or Electric
- 10–0VDC: Hot Water Valve
- HP 1 Stage: with or without 0–10VDC aux heat—See *Combined Tempering*
- HP 2 Stage: with or without 0–10VDC aux heat—See *Combined Tempering*
- Dual Temp Coil: A coil that is used for both hot and cold water, depending upon season—See *Combined Tempering*
- VRF—See *Combined Tempering*
- VRF and Mod: VRF with 0–10VDC Aux Heat—See *Combined Tempering*

The heating type is either set in the Unit Configuration or at the top of this screen.



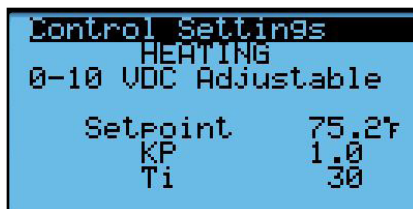
#### 6.3.3.1 0–10VDC Gas or Electric Heating

The mode is determined by the outdoor temperature and the heating lockout temperature settings.



This type of heating will modulate gas or electric heat using PI control. The KP and Ti can be adjusted to fine tune the control. The setpoint is also set here if set for Adjust. The NO1 heating enable contact is engaged whenever the heating output is at 1% or higher.

A unit-specific electrical schematic is found inside the access door to the core module.



The heating status can be monitored in the *Unit Status*. The screen shows:

- Heating Control Variable which will be:
  - as selected if in occupied operation
  - CA in dehumidification mode and heating is used for reheat
- Heating setpoint which will be:
  - Occupied heating setpoint if selected adjust and in occupied operation
  - Calculated OA reset heating setpoint if selected OA reset and in occupied operation
  - Unoccupied heating setpoint if unoccupied operation
  - Reheat setpoint if dehumidification mode and heating is used for reheat
- Whether heating enable 1 is ON

- Command (0–100%) to Heater, where 0 = 0VDC output and 100% = 10VDC output
- Heating Status

```

UNIT STATUS
0-10 V HEATING
 67.2°F
Setpoint 75.2°F
Output ON NO
Command 0.0%
LOCKOUT BY OA TEMP
    
```

The heating status values are shown. Multiple values may be true.

| MESSAGE               | MEANING  |
|-----------------------|--|
| Heat Locked Out by OA | The heating outdoor air lockout is higher than the OA temperature. |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).                     |
| Unocc Heat            | Unit is in unoccupied heating.                                     |
| Heat on for reheat    | Heat on for reheating in dehumidification mode.                    |
| Dehumid Mode          | Unit is in dehumidification mode.                                  |
| Unit OFF              | Unit is off.   |

6.3.3.2 10–0VDC Hot Water Valve

The mode is determined by the outdoor temperature and the heating lockout temperature settings.

```

Control Settings
HEATING
Type 0 to 10 VDC
Setpoint Adjust
Control Supply Air
Lockout Above 40.0°F
    
```



**NOTE:** The valve control can be set directly from the BMS if you change Valve control to BMS. In this case all Heating Control settings from the controller will be ignored.

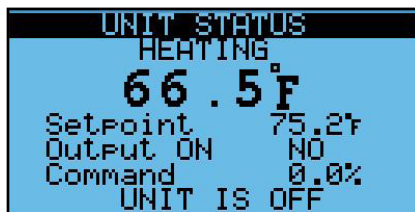
The hot water valve control is 10VDC for closed and 0VDC for open so that it fails open. This type of heating will modulate using PI control. The KP and Ti can be adjusted to fine tune the control. The setpoint is also set here if set for Adjust. The NO1 heating enable contact is engaged whenever the heating output is at 99% or lower.

```

Control Settings
HEATING
10-0 VDC - Adjustable
Setpoint 75.2°F
KP 1.0
Ti 30
Valve Control NORMAL
    
```

The heating status can be monitored in the *Unit Status*. The screen shows:

- Heating Control Variable which will be:
  - as selected if in occupied operation
  - CA in dehumidification mode and heating is used for reheat
- Heating setpoint which will be:
  - Occupied heating setpoint if selected adjust and in occupied operation
  - Calculated OA reset heating setpoint if selected OA reset and in occupied operation
  - Unoccupied heating setpoint if unoccupied operation
  - Reheat setpoint if dehumidification mode and heating is used for reheat
- Whether heating enable 1 is ON
- Command (0–100%) to Heater, where 0 = 10VDC output and 100% = 0VDC.
- Heating Status



The heating status values are shown. Multiple values may be true.

| MESSAGE               | MEANING   |
|-----------------------|---|
| Heat Locked Out by OA | The heating OA lockout is higher than the OA temperature. |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).            |
| Unocc Heat            | Unit is in unoccupied heating.                            |
| Heat on for reheat    | Heat on for reheating in dehumidification mode.           |
| Dehumid Mode          | Unit is in dehumidification mode.                         |
| Unit OFF              | Unit is off.  |

### 6.4 COOLING

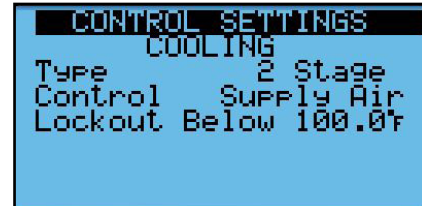
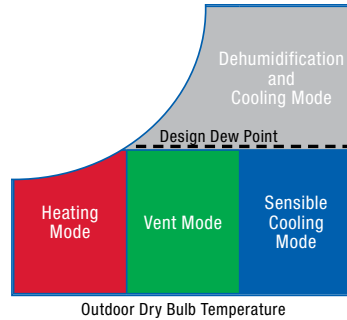
The cooling requires that cooling be enabled in the *Unit Configuration*. The cooling type can also be set here or in the *Control Settings*.





6.4.1 Cooling Mode

For any type of cooling there is an outdoor air lockout temperature below which cooling will not be allowed. Note that the default is high. This is to insure that at start up, you can start your fans without worrying if the tempering will also start. This value will need to be lowered to an acceptable value.



6.4.2 Cooling Control Type

For each type of cooling, you can choose a control type.

Control types available:

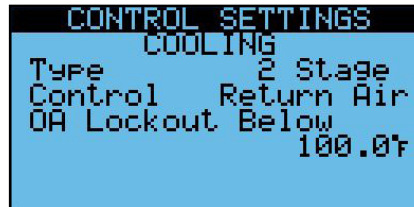
- CA: Be sure to install your CA temperature sensor far enough down the duct to prevent over-cycling
- RA: If you are only feeding one space this is a useful control method..

6.4.3 Cooling Types

The following cooling types are supported:

- On/Off: one-stage DX or heat pump—See *Combined Tempering* for heat pump operation
- 2 stage: two-stage DX or heat pump—See *Combined Tempering* for heat pump operation
- CW Mod: 0–10VDC signal to a chilled water valve, also used in Dual Temp Coil—See *Combined Tempering*.
- VRF—See *Combined Tempering*
- PDX: Packaged DX unit with variable speed compressor integrated.

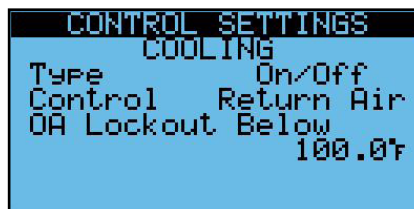
The cooling type is either set in the *Unit Configuration* or at the top of this screen.



6.4.3.1 On/Off: One Stage of Cooling

If this is a one-stage heat pump, see *Combined Tempering*.

The mode is determined by the outdoor temperature and the cooling lockout temperature settings.

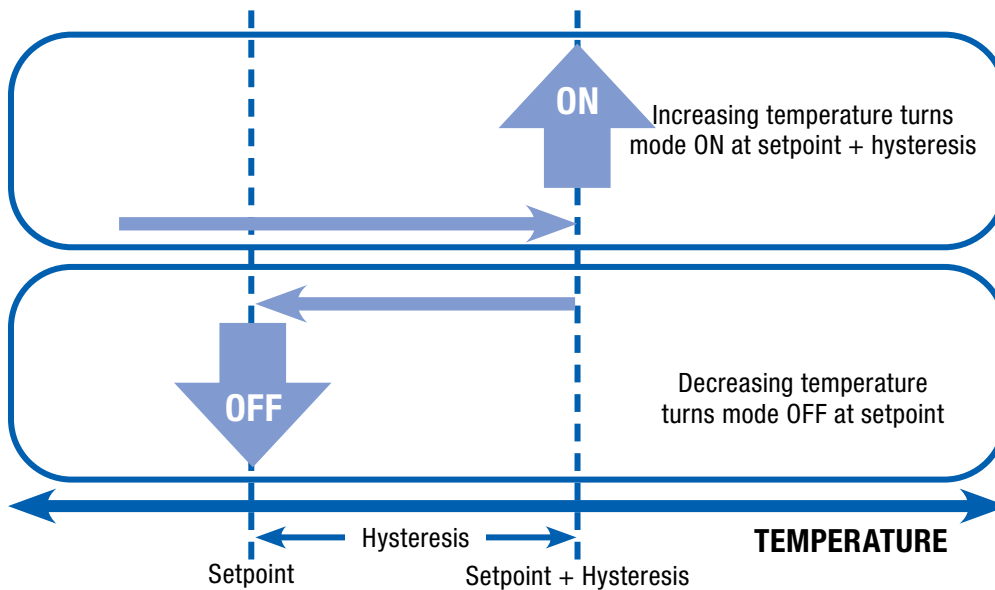




This type of cooling cycles one stage of cooling to maintain the cooling setpoint. You must set a hysteresis value whereby the stage will turn on at the setpoint + hysteresis and turn at setpoint. There is also a minimum on and off time to prevent over-cycling.

```

CONTROL SETTINGS
COOLING
Single Stage
Setpoint      66.2°F
Hysteresis    3.6°F
Min ON Time   300s
Min Off Time  300s
    
```



The cooling status can be monitored in the *Unit Status*. The screen shows:

- Cooling Control Variable which will be:
  - as selected if in occupied operation
  - Coil Leaving Temperature in dehumidification mode if reheat is used (heating or HGRH)
  - Supply temperature in dehumidification mode if reheat is not used
- Cooling setpoint which will be:
  - Occupied cooling setpoint if in occupied operation, not dehumidification
  - Unoccupied cooling setpoint if unoccupied operation
  - Coil Leaving Temperature setpoint if dehumidification mode and reheat is used
  - Dehumidification setpoint if dehumidification mode and reheat is not used
- Whether cooling enable 1 is ON
- Cooling Status

```

UNIT STATUS
COOLING
66.5°F
Setpoint      66.2°F
Output ON     NO
UNIT IS OFF
    
```

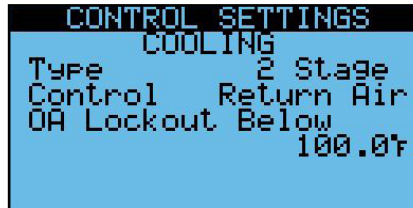
The cooling status values are shown. Multiple values may be true.

| MESSAGE               | MEANING   |
|-----------------------|---|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.  |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).  |
| Unocc Cool            | Unit is in unoccupied cooling.  |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode).<br>The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.   |
| Econ Only             | If cooling is not on.   |
| Econ Mode             | If in economizer mode.  |
| Unit OFF              | Unit is off.  |

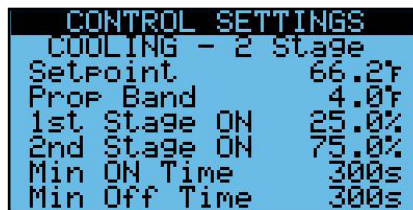
6.4.3.2 2-Stage: Two Stages of Cooling

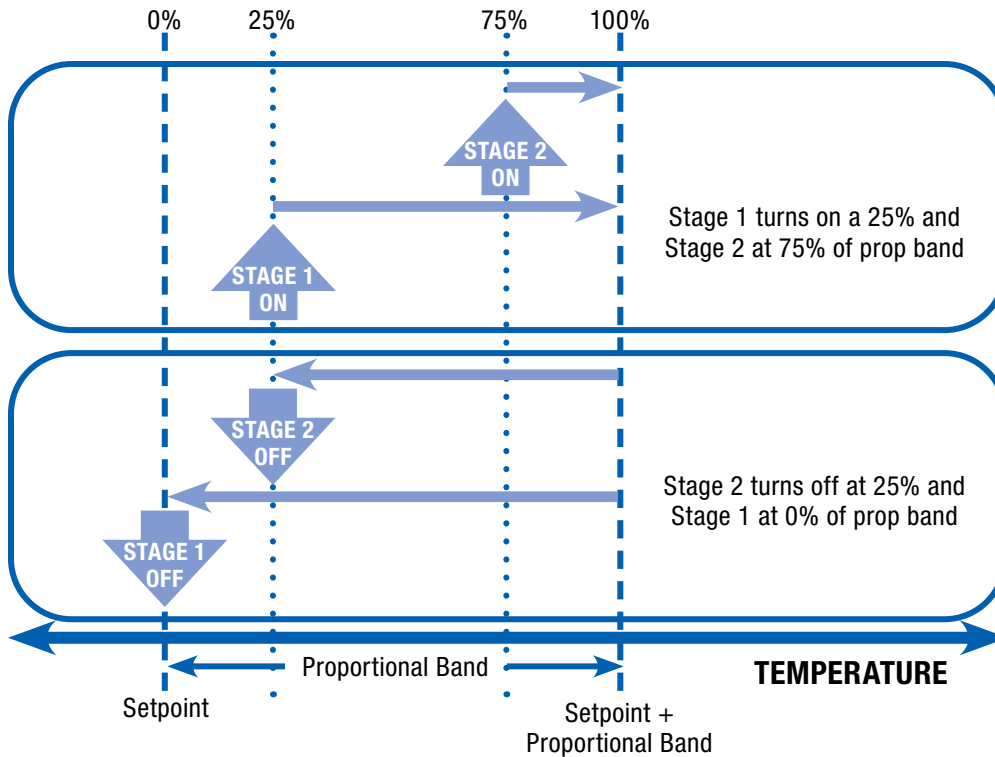
If this is a two-stage heat pump, see *Combined Tempering*.

The mode is determined by the outdoor temperature and the cooling lockout temperature settings.



This type of cooling turns cycles two stages of cooling to maintain the cooling setpoint. You must set a prop band value. This value represents 100%; the wider the prop band the slower the response. Then you specify the “on point” for stages one and two in percentages. Stage one will turn off at setpoint and stage two will turn off at the on point for stage one. There is also a minimum on and off time to prevent over-cycling.

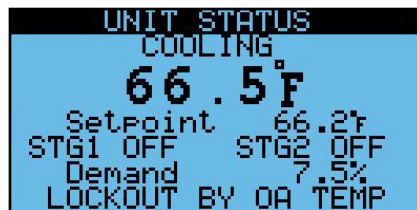




**Example:** In this case  $4^{\circ}\text{F} = 100\%$  which means that  $1^{\circ}\text{F} = 25\%$ , which makes our calculation easy. With the default settings, stage 1 turns on at  $66.2 + 1 = 63.2$ . Stage 2 turns on at  $66.2 + 3 = 65.2$ .

The cooling status can be monitored in the *Unit Status*. The screen shows:

- Cooling Control Variable which will be:
  - as selected if in occupied operation
  - Coil Leaving Temperature in dehumidification mode if reheat is used (heating or HGRH)
  - Supply temperature in dehumidification mode if reheat is not used
- Cooling setpoint which will be:
  - Occupied cooling setpoint if in occupied operation, not dehumidification
  - Unoccupied cooling setpoint if unoccupied operation
  - Coil Leaving Temperature setpoint if dehumidification mode and reheat is used
  - Dehumidification setpoint if dehumidification mode and reheat is not used
- Whether cooling enable 1 (stage 1) and cooling enable 2 (stage 2) are ON
- Cooling demand, expressed as a percentage of proportional band
- Cooling Status



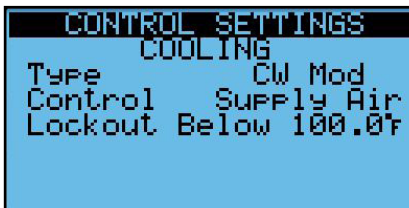
The cooling status values are shown. Multiple values may be true.

| MESSAGE               | MEANING  |
|-----------------------|--|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.                                       |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).   |
| Unocc Cool            | Unit is in unoccupied cooling.   |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode). The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.  |
| Econ Only             | If cooling is not on.  |
| Econ Mode             | If in economizer mode.   |
| Unit OFF              | Unit is off.   |

6.4.3.3 CW Mod: Chilled Water Modulating Coil

If this is a dual temp coil used for heating and cooling, see *Combined Tempering*.

The mode is determined by the outdoor temperature and the cooling lockout temperature settings.

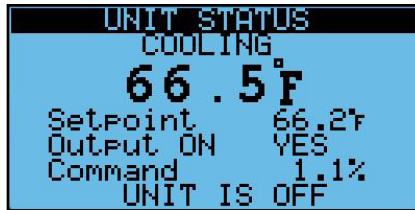


This type of cooling modulates a 0–10VDC chilled water valve using PI control. The KP and Ti can be adjusted to fine tune the control. The NO4 cooling enable contact is engaged whenever the cooling output is at 1% or higher.



The cooling status can be monitored in the *Unit Status*. The screen shows:

- Cooling Control Variable which will be:
  - as selected if in occupied operation
  - Coil Leaving Temperature in dehumidification mode if reheat is used (heating or HGRH)
  - Supply temperature in dehumidification mode if reheat is not used
- Cooling setpoint which will be:
  - Occupied cooling setpoint if in occupied operation, not dehumidification
  - Unoccupied cooling setpoint if unoccupied operation
  - Coil Leaving Temperature setpoint if dehumidification mode and reheat is used
  - Dehumidification setpoint if dehumidification mode and reheat is not used
- Cooling Status



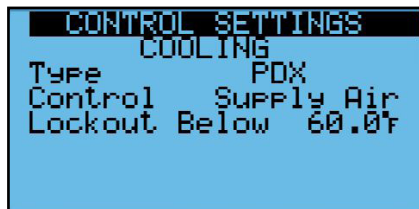
The cooling status values are shown. Multiple values may be true.

| MESSAGE               | MEANING  |
|-----------------------|--|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.                                       |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).   |
| Unocc Cool            | Unit is in unoccupied cooling.   |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode). The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.  |
| Econ Only             | If cooling is not on.  |
| Econ Mode             | If in economizer mode.   |
| Unit OFF              | Unit is off.   |

6.4.3.4 PDX: Packaged DX Unit with Variable Speed Compressor

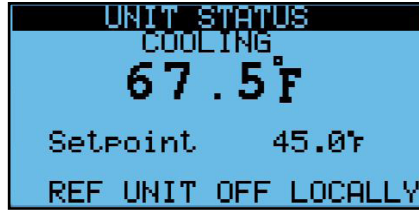
This type of cooling uses the integral packaged DX cooling with a variable speed compressor and possibly a second compressor, depending on cooling capacity. The KP and Ti can be adjusted to fine tune the control.

Refer to the *DN Series Packaged Refrigeration Supplement* for more information on this control.



The cooling status can be monitored in the *Unit Status*. The screen shows:

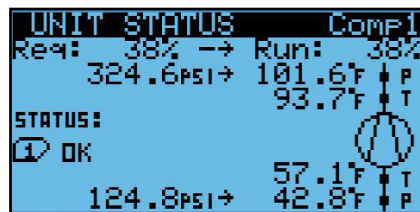
- Cooling Control Variable which will be:
  - as selected if in occupied operation
  - Coil Leaving Temperature in dehumidification mode if reheat is used (heating or HGRH)
  - Supply temperature in dehumidification mode if reheat is not used
- Cooling setpoint which will be:
  - Occupied cooling setpoint if in occupied operation, not dehumidification
  - Unoccupied cooling setpoint if unoccupied operation
  - Coil Leaving Temperature setpoint if dehumidification mode and reheat is used
  - Dehumidification setpoint if dehumidification mode and reheat is not used
- Whether cooling enable 1 is ON
- Command (0–100%) to valve, where 0 = 10VDC output and 100% = 0VDC
- Cooling Status



The cooling status values are shown. Multiple values may be true.

| MESSAGE                  | MEANING  |
|--------------------------|--|
| Cool Locked Out by OA    | The cooling OA lockout is lower than the OA temperature.                                       |
| Unocc Mode               | Unit is in unoccupied mode (BMS or scheduler).   |
| Unocc Cool               | Unit is in unoccupied cooling.   |
| Lockout Overlap          | The OA lockouts for heating and cooling overlap. (No vent mode). The heating takes preference. |
| Dehumid Mode             | Unit is in dehumidification mode.  |
| Econ Only                | If economizer is open less than 100%.  |
| Econ Mode                | If in economizer mode.   |
| Unit OFF                 | Unit is off.   |
| Ref Unit off Locally     | The refrigeration controller is turned off at the local keypad.                                |
| Serious Alarm Ref Unit   | The refrigeration unit is off due to a serious alarm.  |
| Stage 1 off due to timer | Stage 1 compressor is off for minimum off time.  |
| Stage 1 Start up         | Stage 1 compressor in start up; running at start up speed.                                     |
| Interstage delay         | Compressor off due to interstage delay.  |
| Stage 2 on due to timer  | Stage 2 compressor is on for minimum on time.  |
| Stage 2 off due to timer | Stage 2 compressor is off for minimum off time.  |
| Stage 1 shutdown         | Stage 1 compressor shutting down; running at minimum speed.                                    |
| Min Demand Timer         | Low demand for stage 1 compressor. After a while it will start to shutdown.                    |

Additional monitoring screens are available for packaged DX cooling circuit 1 with a variable speed compressor are shown here.



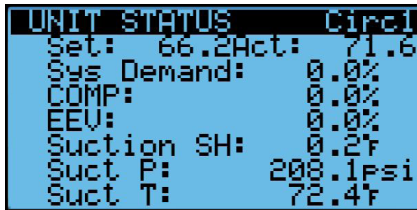
**Compressor 1 Status**

Required Compressor %, Actual Compressor running %  
 Discharge Pressure, Condenser Temperature  
 Discharge Temperature  
 Suction Temperature  
 Suction Pressure, Evaporator Temperature



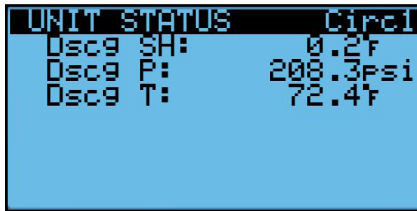
**Expansion Valve 1 Status**

Number of steps (0–480), percent open  
 Discharge superheat  
 Status: Closed, opening, etc  
 Protection: None, Low SH, LOP, MOP, HiCondTemp  
 Suction Superheat (Control point)

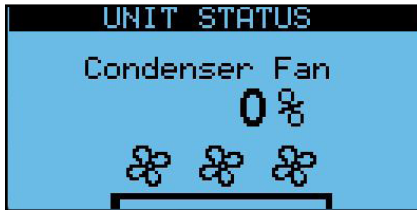


**Circuit 1 Status**

Clg Setpoint, Actual, System demand %  
Compressor 1 %  
Expansion Valve %  
Suction Superheat  
Suction Pressure  
Suction Temperature



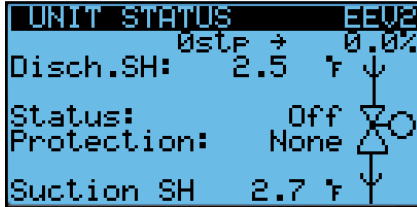
Discharge Superheat  
Discharge Pressure  
Discharge Temperature



**Condenser Fan**

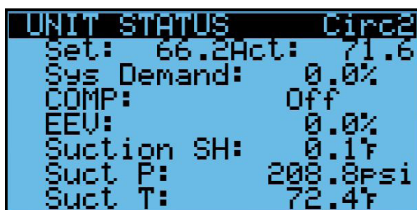
Percent running  
(This is a shared condenser fan signal set to both fans if two are used.)

Additional Screens if the packaged DX unit has a second circuit with an On/Off compressor are shown here.



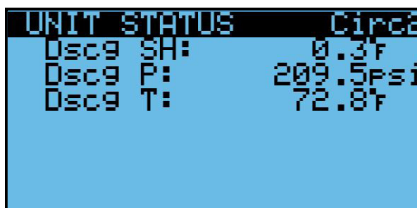
**Expansion Valve 2 Status**

Number of steps (0–480), percent open  
Discharge superheat  
Status: Closed, opening, etc  
Protection: None, Low SH, LOP, MOP, HiCondTemp  
Suction Superheat (Control point)



**Circuit 2 Status**

Clg Setpoint, Actual, System demand %  
Compressor 2 on/off status  
Expansion Valve %  
Suction Superheat  
Suction Pressure  
Suction Temperature



Discharge Superheat  
Discharge Pressure  
Discharge Temperature

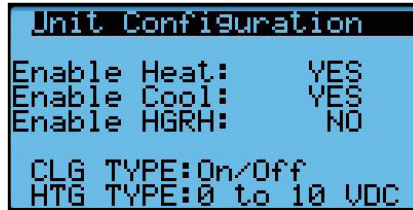


**6.5 COMBINED TEMPERING**

Combined Tempering are methods where the same control is used for heating and cooling. These types include:

- Single-stage heat pump with or without auxiliary heat
- Two-stage heat pump with or without auxiliary heat
- VRF with or without auxiliary heat
- Dual Temp water coil which supplies heating or cooling, depending upon season

These methods require that both heating and cooling be enabled in the *Unit Configuration*. The heating and cooling types can be set here or in the *Control Settings*.



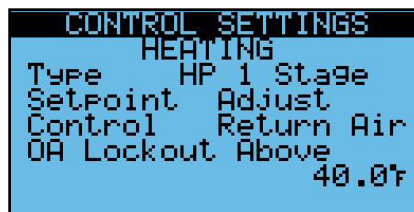
**6.5.1 Heat Pump 1-Stage: with or without 0–10VDC Aux Heat**

This type requires cooling type On/Off and heating type HP 1 Stage. These type settings are made here or in the *Control Settings*.



**6.5.1.1 Heat Pump 1-Stage Mode**

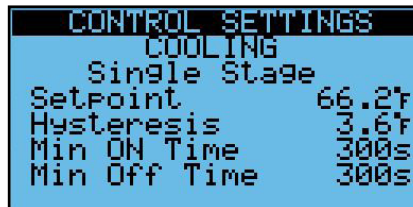
The mode is determined by the outdoor temperature and the heating and cooling lockout temperature settings.

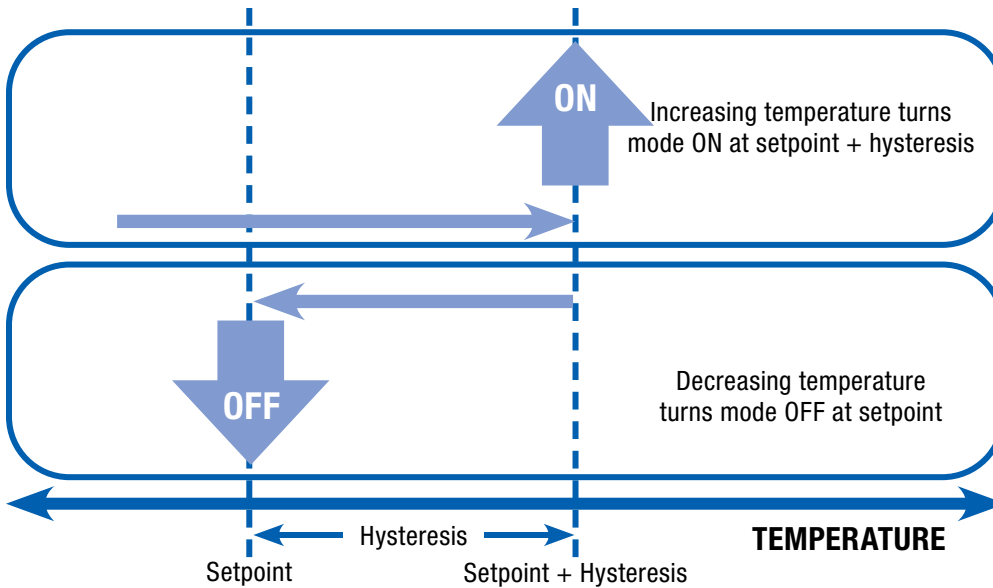


**6.5.1.2 Heat Pump 1-Stage Cooling Operation**

This type of cooling cycles one stage of cooling to maintain the cooling setpoint. You must set a hysteresis value whereby the stage will turn on at the setpoint + hysteresis and turn at setpoint. There is also a minimum on and off time to prevent over-cycling.

If in cooling mode, and the unit calls for cooling, it puts the tempering mode output used for a reversing valve, in the cool position and after a delay, will turn the compressor on and off to maintain the cooling setpoint.





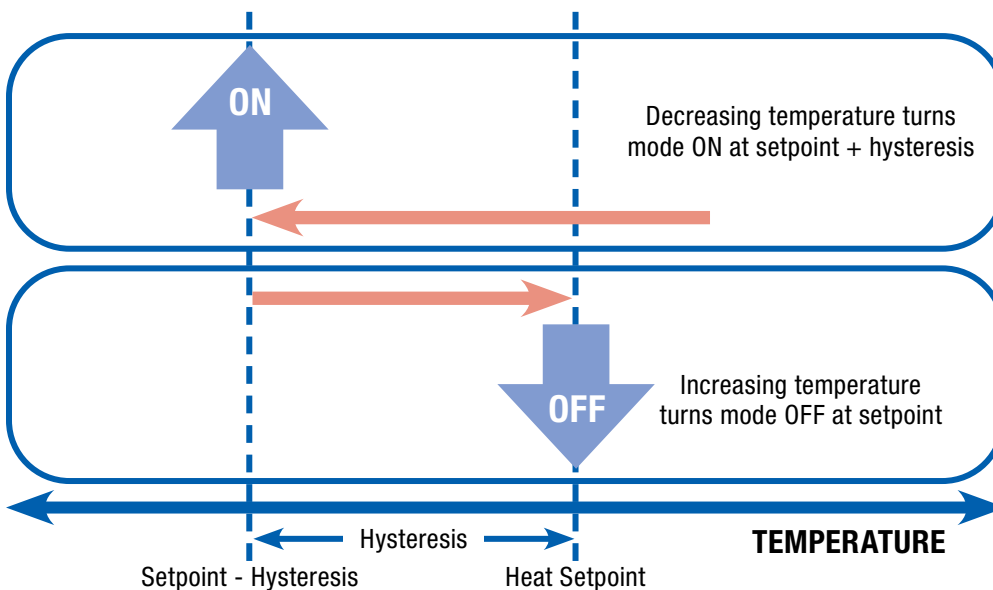
6.5.1.3 Heat Pump 1 Stage Heating Operation

This type of heating cycles one stage of compressor to maintain the heating setpoint while the reversing valve is in heat mode. There is also an option to use axillary heat when the OA is below a certain temperature. You must set a hysteresis value whereby the stage will turn on at the setpoint + hysteresis and turn at setpoint. There is also a minimum on and off time to prevent over-cycling.

If in heating mode, and the unit calls for heating, it puts the tempering mode output used for a reversing valve, in the heat position and after a delay, will turn the compressor on and off to maintain the heating setpoint.

```

CONTROL SETTINGS
HEATING
HP Single Stage Adj
Setpoint      75.2°F
Hysteresis    3.6°F
    
```



6.5.1.4 Heat Pump 1-Stage Auxiliary Heat

The unit allows you to use an 0–10VDC auxiliary heat source when the outdoor temperature is very cold. It will run a PI control to maintain the heat setpoint with the aux heat instead of the heat pump. If you have an auxiliary 0–10VDC heat source:

- Set the *Aux Heat Src?* To YES
- Set the outdoor temperature at which the unit will change from using the heat pump to aux heat.
- Adjust the KP and Ti for the PI loop, if necessary.

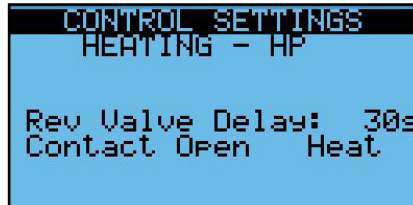


6.5.1.5 Heat Pump 1-Stage Reversing Valve

The reversing valve controls which direction the refrigerant flows. On change of mode (i.e. cool to heat), there will be a delay before the compressor turns on to allow the valve to come into position.

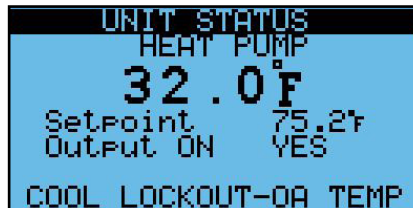
Reversing valve settings:

- Delay: This is the delay between the heating and cooling changeover where the compressor will not be turned on to allow the valve to get into position.
- Contact Open: Choose to have the contact open in heat or cool.



6.5.1.6 Heat Pump 1 Stage System Monitoring

The heat pump is monitored with heating and cooling screens as well as a reversing valve screen and if auxiliary heat is enabled, a screen showing its status.



The heat pump status values are shown. Multiple values may be true.

| MESSAGE               | MEANING  |
|-----------------------|--|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.                                       |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).   |
| Unocc Cool            | Unit is in unoccupied cooling.   |
| Unocc Heat            | Unit is in unoccupied heating.   |
| Heat Locked out by OA | The heating OA lockout is higher than the OA temperature.                                      |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode). The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.  |
| Econ Only             | If economizer is open less than 100%.  |
| Econ Mode             | If in economizer mode.   |
| Unit OFF              | Unit is off.   |
| Aux Heat Mode         | OA temp is cold enough that the auxiliary heat is used.  |
| IN HEAT MODE          | Valve is positioned for heat mode.   |
| IN COOL MODE          | Valve is positioned for cool mode.   |
| Valve Positioning     | Reversing valve is positioning. Not heat or cool is on during this time.                       |

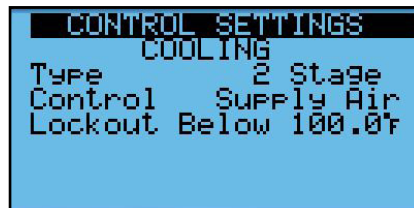
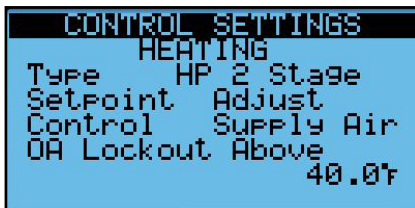
6.5.2 Heat Pump 2-Stage: with or without 0–10VDC Aux Heat

This type requires cooling type 2-stage and heating type HP 2-Stage. These type settings are made here or in the *Control Settings*.



6.5.2.1 Heat Pump 2-Stage Mode

The mode is determined by the outdoor temperature and the heating and cooling lockout temperature settings.

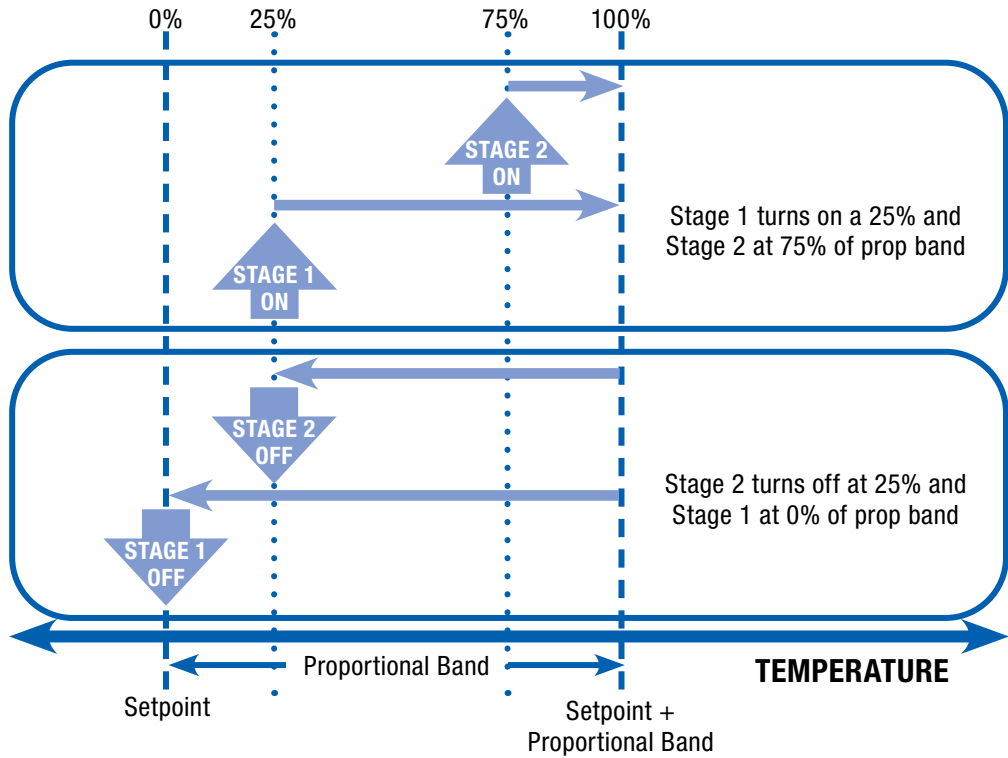


6.5.2.2 Heat Pump 2-Stage Cooling Operation

This type of cooling cycles two stages of cooling to maintain the cooling setpoint. You must set a prop band value. This value represents 100%; the wider the prop band the slower the response. Then you specify the “on point” for stages one and two in percentages. Stage one will turn off at setpoint and stage two will turn off at the on point for stage one. There is also a minimum on and off time to prevent over-cycling.

If in cooling mode, and the unit calls for cooling, it puts the tempering mode output used for a reversing valve, in the cool position and after a delay, will turn the compressor on and off to maintain the cooling setpoint.

| CONTROL SETTINGS  |        |
|-------------------|--------|
| COOLING - 2 Stage |        |
| Setpoint          | 66.2°F |
| Prop Band         | 4.0°F  |
| 1st Stage ON      | 25.0%  |
| 2nd Stage ON      | 75.0%  |
| Min ON Time       | 300s   |
| Min Off Time      | 300s   |

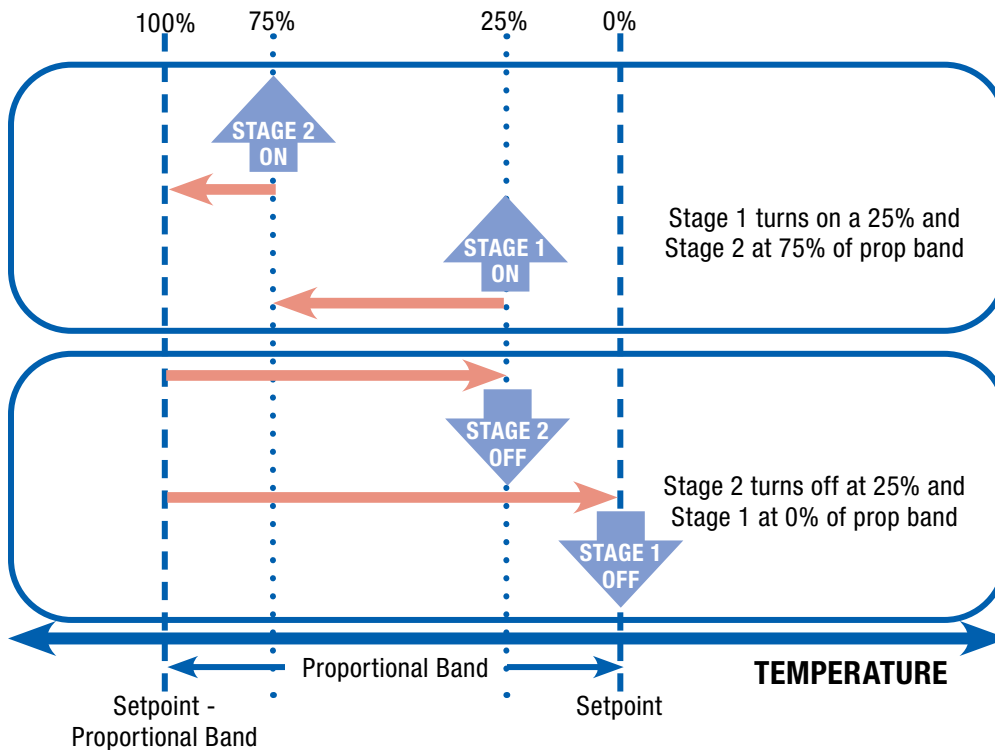


**Example:** In this case 4°F = 100% which means that 1°F = 25%, which makes our calculation easy. With the default settings, stage 1 turns on at 66.2 + 1 = 63.2. Stage 2 turns on at 66.2 + 3 = 65.2.

6.5.2.3 Heat Pump 2-Stage Heating Operation

This type of cooling cycles two stages of heating to maintain the heating setpoint. You must set a prop band value. This value represents 100%; the wider the prop band the slower the response. Then you specify the “on point” for stages one and two in percentages. Stage one will turn off at setpoint and stage two will turn off at the on point for stage one. There is also a minimum on and off time to prevent over-cycling.

If in heating mode, and the unit calls for heating, it puts the tempering mode output used for a reversing valve, in the heat position and after a delay, will turn the compressors on and off to maintain the heating setpoint.



**Example:** In this case  $4^{\circ}\text{F} = 100\%$  which means that  $1^{\circ}\text{F} = 25\%$ , which makes our calculation easy. With the default settings, stage 1 turns on at  $75.2 - 1 = 74.2$ . Stage 2 turns on at  $75.2 - 3 = 72.2$ .

6.5.2.4 Heat Pump 2-Stage Auxiliary Heat

The unit allows you to use a 0–10VDC auxiliary heat source when the outdoor temperature is very cold. It will run a PI control to maintain the heat setpoint with the aux heat instead of the heat pump. If you have an auxiliary 0–10VDC heat source:

- Set the *Aux Heat Src?* To YES
- Set the outdoor temperature at which the unit will change from using the heat pump to aux heat
- Adjust the KP and Ti for the PI loop, if necessary.

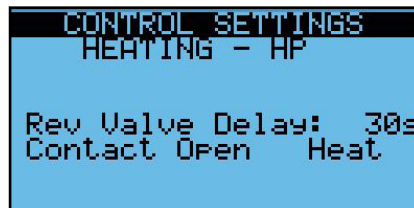


6.5.2.5 Heat Pump 2-Stage Reversing Valve

The reversing valve controls which direction the refrigerant flows. On change of mode (i.e. cool to heat), there will be a delay before the compressor turns on to allow the valve to come into position.

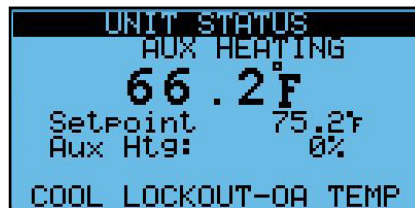
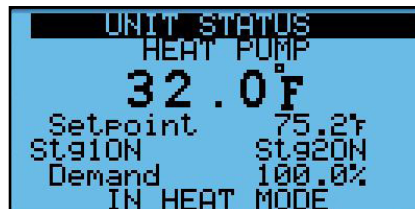
Reversing valve settings:

- Delay: This is the delay between the heating and cooling changeover where the compressor will not be turned on to allow the valve to get into position.
- Contact Open: Choose to have the contact open in heat or cool.



6.5.2.6 Heat Pump 2-Stage System Monitoring

The heat pump is monitored with heating and cooling screens as well as a reversing valve screen and if auxiliary heat is enabled, a screen showing its status.





The heat pump status values are shown. Multiple values may be true.

| MESSAGE               | MEANING  |
|-----------------------|--|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.                                       |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).   |
| Unocc Cool            | Unit is in unoccupied cooling.   |
| Unocc Heat            | Unit is in unoccupied heating.   |
| Heat Locked out by OA | The heating OA lockout is higher than the OA temperature.                                      |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode). The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.  |
| Econ Only             | If economizer is open less than 100%.  |
| Econ Mode             | If in economizer mode.   |
| Unit OFF              | Unit is off.   |
| Aux Heat Mode         | OA temp is cold enough that the auxiliary heat is used.  |
| IN HEAT MODE          | Valve is positioned for heat mode.   |
| IN COOL MODE          | Valve is positioned for cool mode.   |
| Valve Positioning     | Reversing valve is positioning. Not heat or cool is on during this time.                       |

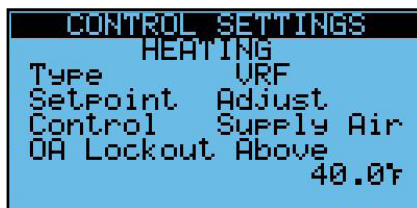
6.5.3 VRF: with or without Modulating Auxiliary Heat

This type requires cooling type VRF and heating type either VRF (no auxiliary heat) or VRF and Mod for units with 0–10VDC modulating auxiliary heat. These type settings are made here or in the *Control Settings*.



6.5.3.1 VRF Mode

The mode is determined by the outdoor temperature and the heating and cooling lockout temperature settings.

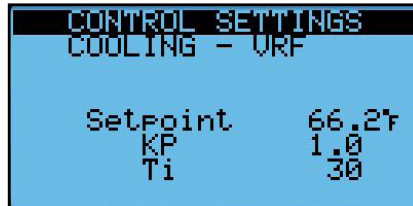


Based on whether the unit is in heating or cooling mode, the controller will set the tempering mode output in the correct position according to this setting. The minimum and maximum vales are also set here, as well as whether the cooling minimum demand coincides with the analog minimum or maximum.



6.5.3.2 VRF Cooling Operation

This type of cooling modulates a 0–10VDC output using PI control to maintain the cooling setpoint. The KP and Ti can be adjusted to fine tune the control. The NO4 cooling enable contact is engaged whenever the cooling demand is at 1% or higher.



6.5.3.3 VRF Heating Operation

This type of heating modulates a 0–10VDC output using PI control to maintain the heating setpoint. The KP and Ti can be adjusted to fine tune the control. The NO4 cooling enable contact is engaged whenever the heating demand is at 1% or higher.



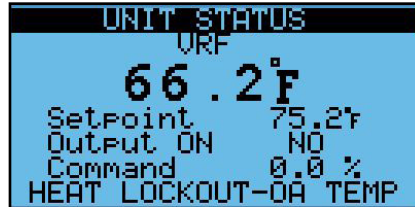
6.5.3.4 VRF Auxiliary Heat

If you selected VRF and Mod, the unit allows you to use an 0–10VDC auxiliary heat source when the outdoor temperature is very cold. The VRF Lowest OA setting at the bottom of this screen. The unit will switch to the auxiliary heat source below that temperature. The controller will run a PI control to maintain the heat setpoint with the aux heat instead of the heat pump. The NO1 heating enable contact is engaged whenever the heating demand is at 1% or higher in this mode.

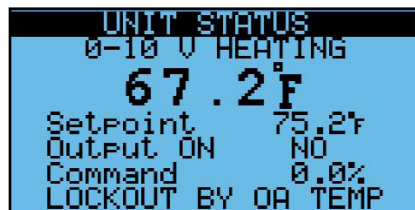


### 6.5.3.5 VRF Monitoring

This screen is available for monitoring the system in *Unit Status*.



This screen is also available if the control is set for VRF and Mod.



The VRF status values are shown. Multiple values may be true.

| MESSAGE               | MEANING   |
|-----------------------|---|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.  |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).  |
| Unocc Cool            | Unit is in unoccupied cooling.  |
| Unocc Heat            | Unit is in unoccupied heating.  |
| Heat Locked out by OA | The heating OA lockout is higher than the OA temperature.   |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode.)<br>The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.   |
| Econ Only             | If economizer is open less than 100%.   |
| Econ Mode             | If in economizer mode.  |
| Unit OFF              | Unit is off.  |
| Aux Heat Mode         | Auxiliary Heat is used.   |
| VRF On                | VRF is used (rather than aux heat).   |
| IN HEAT MODE          | Valve is positioned for heat mode.  |
| IN COOL MODE          | Valve is positioned for cool mode.  |

6.5.4 Dual Temperature Coil

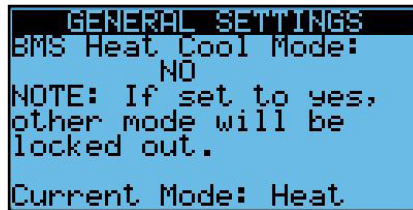
The dual temperature coil is a coil which provides heating in the winter and cooling in the summer by changing the temperature of the fluid in the coil. To do this, the coil needs to know what type of fluid (hot or cold) is being provided. It will lock out cooling in heat mode and vice versa. The only method for this is a BMS command. Therefore, the system must be equipped with a BMS system for this control.

The BACnet objects for this are:

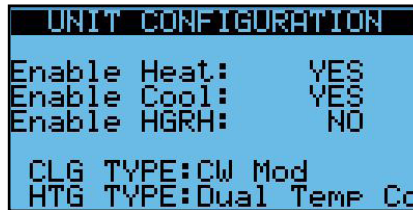
- BV 60 BMS\_SetHeatCool: 0 = No, 1 = Yes. This enables the control. This can also be set in the screen below.
- BV 61 BMS\_HeatCoolMode: 0 = Heat, 1 = Cool. This sets the type. The current setting can be seen in the screen below for troubleshooting.

The Modbus Registers for this are:

- Coil 4 BMS\_SetHeatCool: 0 = No, 1 = Yes. This enables the control. This can also be set in the screen below.
- Coil 5 BMS\_HeatCoolMode: 0 = Heat, 1 = Cool. This sets the type. The current setting can be seen in the screen below for troubleshooting.

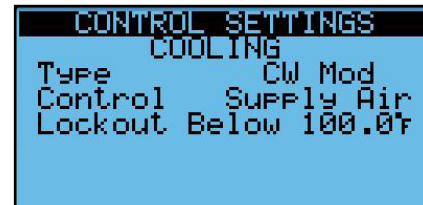
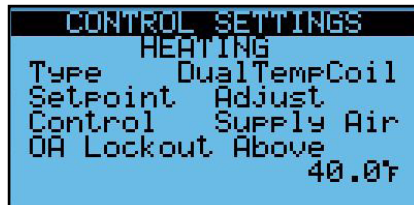


This type requires cooling type CW Mod and heating type DualTempCoil. These type settings are made here or in the *Control Settings*.



6.5.4.1 Dual Temperature Coil Mode

The mode is determined by the OA temperature and the heating and cooling lockout temperature settings as well as the BMS command. Both heating or cooling demand drive the same cooling command analog and cooling enable digital output.



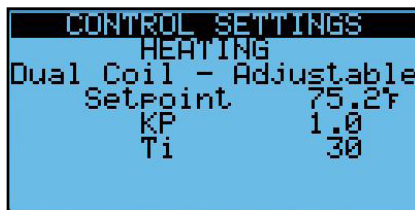
6.5.4.2 Dual Temperature Coil Cooling Operation


This type of cooling modulates a 0–10VDC cooling command output using PI control to maintain the cooling setpoint. The KP and Ti can be adjusted to fine tune the control. The NO4 cooling enable contact is engaged whenever the cooling demand is at 1% or higher.



6.5.4.3 Dual Temperature Coil Heating Operation

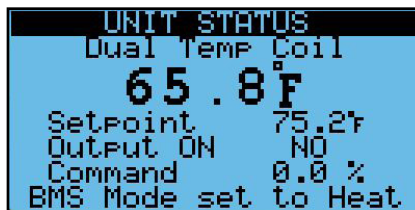
This type of heating modulates a 0–10VDC cooling command output using PI control to maintain the heating setpoint. The KP and Ti can be adjusted to fine tune the control. The NO4 cooling enable contact is engaged whenever the heating demand is at 1% or higher.



 NOTE: The valve control can be set directly from the BMS if you change Valve control to BMS.

6.5.4.4 Dual Temperature Coil System Monitoring

This screen is available for monitoring the system in *Unit Status*.



The Dual Temperature Coil status values are shown. Multiple values may be true.

| MESSAGE               | MEANING  |
|-----------------------|--|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.                                       |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).   |
| Unocc Cool            | Unit is in unoccupied cooling.   |
| Unocc Heat            | Unit is in unoccupied heating.   |
| Heat Locked out by OA | The heating OA lockout is higher than the OA temperature.                                      |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode.) The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.  |
| Econ Only             | If economizer is open less than 100%.  |
| Econ Mode             | If in economizer mode.   |
| Unit OFF              | Unit is off.   |
| Set BMS Heat/Cool!!   | In order to work properly, the BMS must be set to give a heat/cool command.                    |
| BMS Mode set to Heat  | BMS is setting the mode to heat. No cooling is allowed.  |
| BMS Mode set to Cool  | BMS is setting the mode to cool. No heating is allowed.  |
| IN HEAT MODE          | Valve is positioned for heat mode.   |
| IN COOL MODE          | Valve is positioned for cool mode.   |

**6.6 ECONOMIZER CONTROL (BYPASS/FREE COOLING)**

All DN DOAS units are equipped with a bypass damper which will make the incoming air bypass the enthalpic plate. In this case, when the unit is in cooling or dehumidification mode, if the OA is more favorable for cooling than the RA, the bypass damper will modulate to maintain the cooling setpoint. Only when the damper is wide open at 100% will the cooling be allowed to turn on.

The economizer settings are:

- Temperature
- Enthalpy
- Disabled



Economizer based on Temperature Sequence:

When the OA temperature is below the RA temperature less the hysteresis value, the economizer will modulate the face and bypass dampers using PI control to maintain the CA air temperature (or RA temperature, based on setting). The KP and Ti can be adjusted to fine tune the control.

The economizer will be locked out when:

- The OA temperature is less than the economizer adjustable low lockout.
- The RA temperature is below the adjustable low lockout
- Heating is enabled

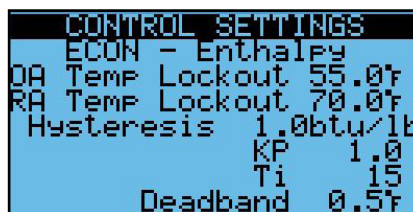


Economizer based on Enthalpy Sequence:

When the OA enthalpy is below the RA enthalpy less the hysteresis value, the economizer will modulate the face and bypass dampers using PI control to maintain the CA temperature (or RA temperature, based on setting). The KP and Ti can be adjusted to fine tune the control

The economizer will be locked out when:

- The OA temperature is less than the economizer adjustable low lockout.
- The RA temperature is below the adjustable low lockout
- Heating is enabled





## 7.0 UNOCCUPIED OPERATION

The DN DOAS unit can be ordered with an optional recirculation damper for unoccupied operation. The occupied/unoccupied signal can be set from the BMS or the scheduler.

During unoccupied operation, the unit allows the run the supply fan to run as set, and the heat or cool based on unoccupied setpoints for return air. This ensures that the temperatures do not go too far away from setpoint when the unit is unoccupied. To enable this feature, the unit must have recirculation dampers and the feature enabled here.

```

UNIT CONFIGURATION
Enable Core Frost Cntl
via Bypass?: YES

Enable Recirc
in UNOCC Mode?: YES
  
```

The settings for control are:

- Fan On: Continuous or Heat or Cool. If continuous, the fan will run all of the time at the low CFM in the next setting. If Heat or Cool, the fan will only run on a call for heat or cool.
- Flow Rate: The fan will run as specified to maintain this flow rate.
- Heating below: This is the unoccupied heating setpoint.
- Cooling above: This is the unoccupied cooling setpoint.

```

CONTROL SETTINGS
Recirc Settings
Fan On: Continuous
Flow Rate: 294 cfm
Heating below: 60.1F
Cooling above: 84.9F
Note: Heating must be
less than cooling
  
```

The unit can also be set to perform dehumidification, using the same dehumidification setpoints, in unoccupied mode if there is a humidity load in the space.

```

I/O CONFIGURATION
Allow Dehumidification
in unoccupied mode?
NO
  
```

To test unoccupied operation, you can use this screen which is located in the Sensor Overrides section.

```

SENSOR OVERRIDES
Test Unocc Mode

OFF
Status:
Occupied
  
```



**NOTE:** Unlike the sensors overrides, this value is kept on power cycle so make sure you go to set is back after the test.



## 8.0 SPECIAL FEATURES

These features are not common but are available in the DN DOAS controller.

### 8.1 FROST CONTROL

DN DOAS units utilize the bypass damper to bypass the core when it is very cold outside. This is usually used in northern states and Canada. The function is enabled in this screen.

```

UNIT CONFIGURATION
Enable Core Frost Cntl
Via Bypass?: YES
Enable Recirc
in UNOCC Mode?: YES

```

The frost control function is locked out if the OA temperature is above 5°F (adjustable). This is due to the fact that the core will typically not frost above 5°F if the RA humidity is not high enough to result in a saturated condition in the EA airstream. If they are exhausting restrooms with showers they may need to increase this value; if the RA is very dry they could decrease this value. Frost control actually is not enabled until the OA falls below the OA minus the hysteresis (1.1°F in this example) and is disabled when the OA temperature increases to 5°F.

If the OA is below 5°F the controller monitors the average EA temperature entering the exhaust fan. If the RA is very warm the EA will be warm even at colder OA temperatures and frost control is not required. The core has a “cold corner” in the exhaust (at the top in the DN as that RA experiences unconditioned OA over the entire core length) that could freeze before the rest of the exhaust portion of the core, thus the 35°F (adjustable) instead of 32°F for the default value. If the average exhaust temperature falls below 35°F a PI loop drives the modulating face/bypass damper to let a portion of the OA go around the core. Bypassing a portion of the OA will increase the EA temperature and the damper modulates to hold the EA at 35°F.

```

CONTROL SETTINGS
Frost Control Settings
Turn On When:
  OA Below      5.0°F
Hysteresis     1.1°F
Bypass EA Setpt: 35.1°F

```

The status can be viewed on this screen.

```

UNIT STATUS
FROST CONTROL
Active NO
EA Actual      73.7°F
EA Setpoint    35.1°F
Damper Command 0.0%
OA Actual      74.9°F
OA Low Limit   5.0°F

```

### 8.2 SINGLE FAN MODE

In some cases the application may require that only one fan run. The single fan mode is initiated by either closing the ID2 contact (terminals and 19) or a BMS command to BMSEFOnly variable. It is BV11 for BACnet and Coil 1 for Modbus, where 0 = No and 1 = Yes. The default is Exhaust Fan but it can be changed to Supply Fan here. If tracking the supply fan, also set a value for exhaust fan in single fan mode.

```

I/O CONFIGURATION
Single Fan Mode Select
Used with ID2 input
Choose fan:
    Exhaust Fan

If EF and tracking,
run EF at:    50%
  
```

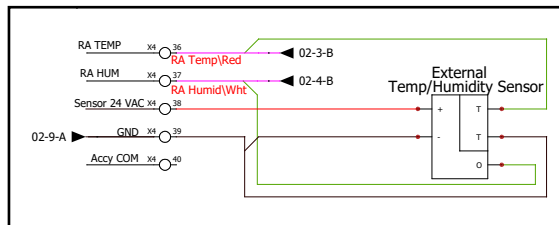
### 8.3 USE ROOM TEMP AND HUMIDITY RATHER THAN RETURN

The system allows you to use a room temperature and humidity sensor in place of the return air temperature and humidity sensor. One use for this is when you have unoccupied operation when the fans are off, you will be able to get a temperature indicative of the actual room temperature. This feature is useful when feeding a single zone. It requires the removal of the return sensors and replace them with the room sensor. The setting here will change the word “return” to “room” on the main screen to eliminate confusion.

```

I/O CONFIGURATION
ROOM SENSING
If using room sensor
instead of return, do
you want to change
the text on the main
screen?      NO
  
```

The Room Temperature and Humidity Sensor is P/N 102397 Wall Mount, RTH-W.



### 8.4 LIMIT SETPOINT RANGES FOR USERS

It is possible to set different limits for the heating and cooling occupied and unoccupied setpoints. The defaults are shown in these screens. This will limit the users in the front non-password protected screens from setting extreme setpoints.

```

I/O CONFIGURATION
Occ HTG Setpt Limit
LOW =    41°
HIGH =   118°

Unocc HTG Setpt Limit
LOW =    41°
HIGH =   118°
  
```

```

I/O CONFIGURATION
Occ CLG Setpt Limit
LOW =    41°
HIGH =   118°

Unocc CLG Setpt Limit
LOW =    41°
HIGH =   118°
  
```

### 8.5 USE HEATING OUTPUTS FOR STAGING

Normally the 1-stage and 2-stage heat pumps use the cooling outputs for the heat pump and the heating outputs for auxiliary heat. If for some reason the heater is actually a 1-stage or 2-stage heater, you can set this setting to “No” and the unit will use the heating outputs.

```

I/O CONFIGURATION
Heatpump Mode for
Heating

Use Cool Outs    YES
  
```

## 8.6 ADJUSTMENTS FOR TWO-STAGE COOLING

There are several special settings for the two-stage cooling.

- In cases where the condensing unit is tied to only the first compressor, set Only allow comp 2 is comp 1 in on: to YES. (Because of minimum off times it is normally possible that the second compressor turns back on before the first).
- Interstage delay: there is a delay between when the compressors are allowed to stage. It is defaulted to 180s.
- Normally the second compressor turns off at the same percentage that the first turned on and the first turns off at setpoint. If you set Specify Off Values: to YES, it will turn them off at the values specified.

```

I/O CONFIGURATION
Two Stage Comp Special
Only allow comp 2 if
comp 1 is on:      NO
Interstage Delay:
                  180s
  
```

```

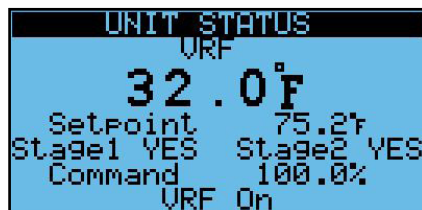
I/O CONFIGURATION
Two Stage Comp Special
Specify off values:
NO
Stage 1 off:      0%
Stage 2 off:      50%
(Not used if NO)
  
```

## 8.7 TWO-CIRCUIT VRF

If the unit is a VRF you are able to select that here.



You will then see this monitoring screen rather than the standard one.



The second stage will turn on when the demand is over 50% and turn back off when it falls below 49%.

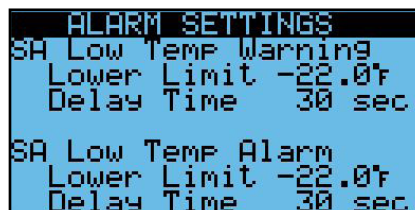
## 8.8 COLD WEATHER OPERATION

The DOAS unit has a built-in feature for detecting low temperatures to avoid dumping cold air into the space.

In versions 3.00.30 and higher, the low temperature allowed was decreased. Be sure to make sure these settings are appropriate for your application.

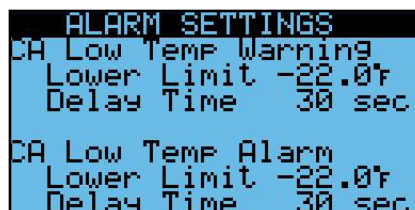
For systems that do not control a heater, the settings are shown in the following screen.

- If the SA Temperature falls below the low warning temperature for the delay time while the supply fan is running, the warning will sound but the unit will remain running.
- If the SA Temperature falls below the low alarm temperature for the delay time while the supply fan is running, the alarm will sound but the unit will shut down and require a manual reset to start again.



For systems that control heat, the settings are shown in the following screen.

- If the CA Temperature falls below the low warning temperature for the delay time while the supply fan is running, the warning will sound but the unit will remain running.
- If the CA Temperature falls below the low alarm temperature for the delay time while the supply fan is running, the alarm will sound but the unit will shut down and require a manual reset to start again.



## 8.9 SMOKE OR FREEZESTAT DEDICATED INPUT

This feature was added in version 03.01.07

It is possible to dedicate either digital input for a smoke and/or freezestat alarm which will shut down the unit and issue a manual reset alarm when engaged.

To use this feature, go to the I/O Configuration area and view this screen. The default for ID1 is DI On/Off and the default for ID2 is Single Fan Mode.

```

I/O CONFIGURATION
D19 Inputs Used For
ID1:DI On/Off
ID2:Sing Fan Mode
Must be different!
  
```

Change the input(s) to your desired alarms. Make sure you do not duplicate them. Shown is a sample but either input can be used for either alarm.

```

I/O CONFIGURATION
D19 Inputs Used For
ID1:Freezestat
ID2:Smoke Alarm
Must be different!
  
```

Once you do that, you will see either of these screens show up accordingly. Make sure you set the action for either *Open is ON* or *Open is Off*.

```

I/O CONFIGURATION
Smoke Alarm
Action
Open is OFF
  
```

```

I/O CONFIGURATION
Freezestat Alarm
Action
Open is OFF
  
```

You will also have the additional manual reset alarm(s) according to your selection:

- AL08: Smoke Alarm
- AL09: Freezestat Alarm

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## 9.0 VERIFYING I/O AND UNIT WIRING

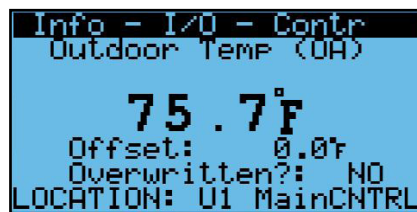
All of the I/O values should be verified and calibrated, if necessary.

### 9.1 VERIFYING ALL I/O THROUGH UNIT STATUS SCREENS

All of the individual I/O are able to be viewed in one place by pressing “ENTER” when on this screen, which is located toward the end of *Unit Status*.



There will be individual screens for each input and output. Several examples are shown.



### 9.2 CALIBRATING I/O

For a temperature sensor that may have run a long distance or a humidity sensor with a reading that may have drifted over time, a calibration may be necessary. There is a screen such as the one shown for each sensor and transducer. The current value at the top will reflect the change with the offset that is set in this screen.



### 9.3 GENERAL UNIT CONTROL WIRING

The following tables and diagrams show the general unit control wiring for the DN DOAS units. A unit-specific electrical schematic is found inside the access door to the core module.



## 9.3.1 Sensor Inputs

Sensors in Grey are optional, and field-installed.

| SENSOR                       | TYPE                              | SENSOR TERMINALS                  | INTERMEDIATE TERMINALS | CONTROLLER TERMINALS |           |
|------------------------------|-----------------------------------|-----------------------------------|------------------------|----------------------|-----------|
| OA Temperature               | Combined<br>CAREL NTC/0–<br>10VDC | Far Left (Red)                    | -                      | U1 (Main)            |           |
|                              |                                   | 2 (Black)                         | X4-39 GND              | GND TS2              |           |
| OA Humidity                  |                                   | 3 (Red)                           | X4-38                  | 24VAC TS1            |           |
|                              |                                   | 4 (Black)                         | X4-39 GND              | GND TS2              |           |
|                              |                                   | 5 (White)                         | -                      | U2 (Main)            |           |
| RA Temperature               |                                   | Combined<br>CAREL NTC/0–<br>10VDC | Far Left (Red)         | X4-36                | U3 (Main) |
|                              |                                   |                                   | 2 (Black)              | X4-39 GND            | GND TS2   |
| RA Humidity                  |                                   |                                   | 3 (Red)                | X4-38                | 24VAC TS1 |
|                              |                                   |                                   | 4 (Black)              | X4-39 GND            | GND TS2   |
|                              |                                   |                                   | 5 (White)              | X4-37                | U4 (Main) |
| SA Temperature               | CAREL NTC                         |                                   | (Red or White)         | -                    | U5 (Main) |
|                              |                                   | (Red or White)                    | -                      | GND (Main)           |           |
| EA Temperature               | CAREL NTC                         | (Red or White)                    | -                      | U6 (Main)            |           |
|                              |                                   | (Red or White)                    | -                      | GND (Main)           |           |
| OA Filter Pressure           | 0–10VDC                           | Vin (Red)                         | -                      | 24VAC TS1            |           |
|                              |                                   | GND (Black)                       | -                      | GND TS2              |           |
|                              |                                   | Vo (White)                        | -                      | U7 (Main)            |           |
| RA Filter Pressure           | 0–10VDC                           | Vin (Red)                         | -                      | 24VAC TS1            |           |
|                              |                                   | GND (Black)                       | -                      | GND TS2              |           |
|                              |                                   | Vo (White)                        | -                      | U8 (Main)            |           |
| OA Flow Rate Pressure        | 0–10VDC                           | Vin (Red)                         | -                      | 24VAC TS1            |           |
|                              |                                   | GND (Black)                       | -                      | GND TS2              |           |
|                              |                                   | Vo (White)                        | -                      | U1 (Exp)             |           |
| RA Flow Rate Pressure        | 0–10VDC                           | Vin (Red)                         | -                      | 24VAC TS1            |           |
|                              |                                   | GND (Black)                       | -                      | GND TS2              |           |
|                              |                                   | Vo (White)                        | -                      | U2 (Exp)             |           |
| CO2/VOC Level Sensor         | 0–10VDC                           |                                   | X3-21 (PWR)            |                      |           |
|                              |                                   |                                   | X3-27 (GND)            | GND TS2              |           |
|                              |                                   |                                   | X3-22                  | U3 (Exp)             |           |
| Coil Leaving Air Temp Sensor | CAREL NTC                         | (Red or White)                    | X3-24                  | U5 (Exp)             |           |
|                              |                                   | (Red or White)                    | X3-27 (GND)            | GND (Main)           |           |
| Duct Pressure Sensor         | 0–10VDC                           | Vin                               | X3-21 (PWR)            |                      |           |
|                              |                                   | GND                               | X3-27 (GND)            | GND TS2              |           |
|                              |                                   | Vo                                | X3-25                  | U6 (Exp)             |           |
| CA Temp Sensor               | CAREL NTC                         | (Red or White)                    | X3-26                  | U7 (Exp)             |           |
|                              |                                   | (Red or White)                    | X3-27 (GND)            | GND (Main)           |           |

## 9.3.2 Digital Inputs

Inputs in Grey are optional, and field-installed.

| INPUT                         | TYPE        | INPUT TERMINALS | INTERMEDIATE TERMINALS | CONTROLLER TERMINALS |
|-------------------------------|-------------|-----------------|------------------------|----------------------|
| Smoke Detector                | Dry Contact |                 | X2-15                  | C1/2**               |
|                               |             |                 | X2-16                  | 24VDC                |
| ID1 Unit Enable*              | Dry Contact |                 | X2-17                  | ID1                  |
|                               |             |                 | X2-18                  | GND                  |
| ID2 Single Fan Mode           | Dry Contact |                 | X2-19                  | ID2                  |
|                               |             |                 | X2-18                  | GND                  |
| SF Current Switch (SF Status) | Dry Contact | (Black)         | -                      | GND TS2              |
|                               |             | (Red)           | -                      | U9 (Main)            |
| EF Current Switch (EF Status) | Dry Contact | (Black)         | -                      | GND TS2              |
|                               |             | (Red)           | -                      | U10 (Main)           |

\*Overflow switch is wired into here if unit was ordered with one.

\*\* Smoke alarm will interrupt the enable signal to the fans. This will cause a fan alarm.

### 9.3.3 Digital Outputs

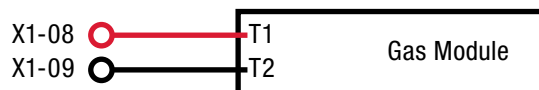
Outputs in Grey are optional, and field-installed. Heating and cooling may be factory-installed or field-installed, depending upon the unit.

| OUTPUT               | TYPE         | OUTPUT TERMINALS           | INTERMEDIATE TERMINALS | CONTROLLER TERMINALS |
|----------------------|--------------|----------------------------|------------------------|----------------------|
| SF Enable            | Dry Contact  | (See wiring diagram)       | X2-13                  | NO1 (Main)           |
|                      |              |                            | X2-14                  |                      |
| EF Enable            | Dry Contact  | (See wiring diagram)       | X2-11                  | NO2 (Main)           |
|                      |              |                            | X2-12                  |                      |
| Recirc Damper        | Dry Contact  | HOT                        | X2-07 (Red)            | NO3 (Main)           |
|                      |              | COM                        | X2-06 (Black)          | Accy COM             |
| OA Damper            | Dry Contact  | HOT                        | X2-03 (Red)            | NO4(Main)            |
|                      |              | COM                        | X2-02 (Black)          | Accy COM             |
| RA Damper            | Dry Contact  | HOT                        | X2-05 (Red)            | NO5 (Main)           |
|                      |              | COM                        | X2-04 (Black)          | Accy COM             |
| Serious Alarm Output | Dry Contact* |                            | -                      | NO6/NC6 (Main)       |
|                      |              |                            | -                      | C6 (Main)            |
| Heating Enable 1     | Dry Contact* | (See below for gas module) | X1-09                  | NO1 (EXP)            |
|                      |              |                            | X1-08                  | C1/2 (EXP)           |
| Heating Enable 2     | Dry Contact* |                            | X1-10                  | NO2 (EXP)            |
|                      |              |                            | X1-08                  | C1/2 (EXP)           |
| Tempering Mode       | Dry Contact* |                            | X4-32                  | NO3 (EXP)            |
|                      |              |                            | X4-35                  | C3/4/5               |
| Cooling Enable 1     | Dry Contact* |                            | X4-33                  | NO4(EXP)             |
|                      |              |                            | X4-35                  | C3/4/5               |
| Cooling Enable 2     | Dry Contact* |                            | X4-34                  | NO5 (EXP)            |
|                      |              |                            | X4-35                  | C3/4/5               |
| Any Alarm Output     | Dry Contact* |                            | -                      | NO6/NC6 (EXP)        |
|                      |              |                            | -                      | C6 (EXP)             |

\*There is an option to use 24VAC ACCY power if it is needed to drive a 24VAC relay. For example, to drive a cooling stage 1 relay, wire as follows:

- Accy 24VAC (X1-01) connected to EXP C3/4/5 (X4-35)
- EXP NO4 (X4-33) Cooling stage 1 connected to one side of the 24VAC relay coil.
- Accy COM (X4-40) connected to the other side of the 24VAC relay coil.

#### 9.3.3.1 Factory-Installed Gas Module Wiring—Digital



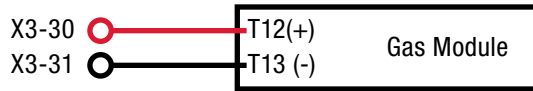
9.3.4 Analog Outputs

Outputs in Grey are optional, and field-installed. Heating and cooling may be factory-installed or field-installed, depending upon the unit.

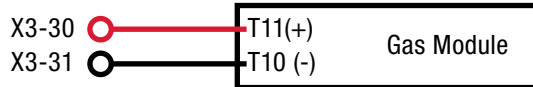
| OUTPUT          | TYPE    | OUTPUT TERMINALS           | INTERMEDIATE TERMINALS | CONTROLLER TERMINALS |
|-----------------|---------|----------------------------|------------------------|----------------------|
| SF Signal       | 0–10VDC |                            | 01-6-D                 | Y1 (Main)            |
|                 |         |                            | 01-2-D                 | GND                  |
| EF Signal       | 0–10VDC |                            | 01-4-D                 | Y2 (Main)            |
|                 |         |                            | 01-2-D                 | GND                  |
| Bypass Command  | 0–10VDC |                            | X3-23 (Black)          | U4 (EXP)             |
|                 |         |                            | X3-27                  | GND                  |
| HGRH Command    | 0–10VDC |                            | X3-28 (Red)            | U8 (EXP)             |
|                 |         |                            | X4-31                  | Sensor COM           |
| Cooling Command | 0–10VDC |                            | X3-29 (Black)          | U9 (EXP)             |
|                 |         |                            | X4-31                  | Sensor COM           |
| Heating Command | 0–10VDC | (See below for gas module) | X3-30 (White)          | U10 (EXP)            |
|                 |         |                            | X4-31                  | Sensor COM           |

9.3.4.1 Factory-Installed Gas Module Wiring—Analog

For gas modules with 10:1 turndown, see this diagram:



For gas modules with 5:1 turndown, see this diagram:



9.3.4.2 Wiring to Three-Wire Valves

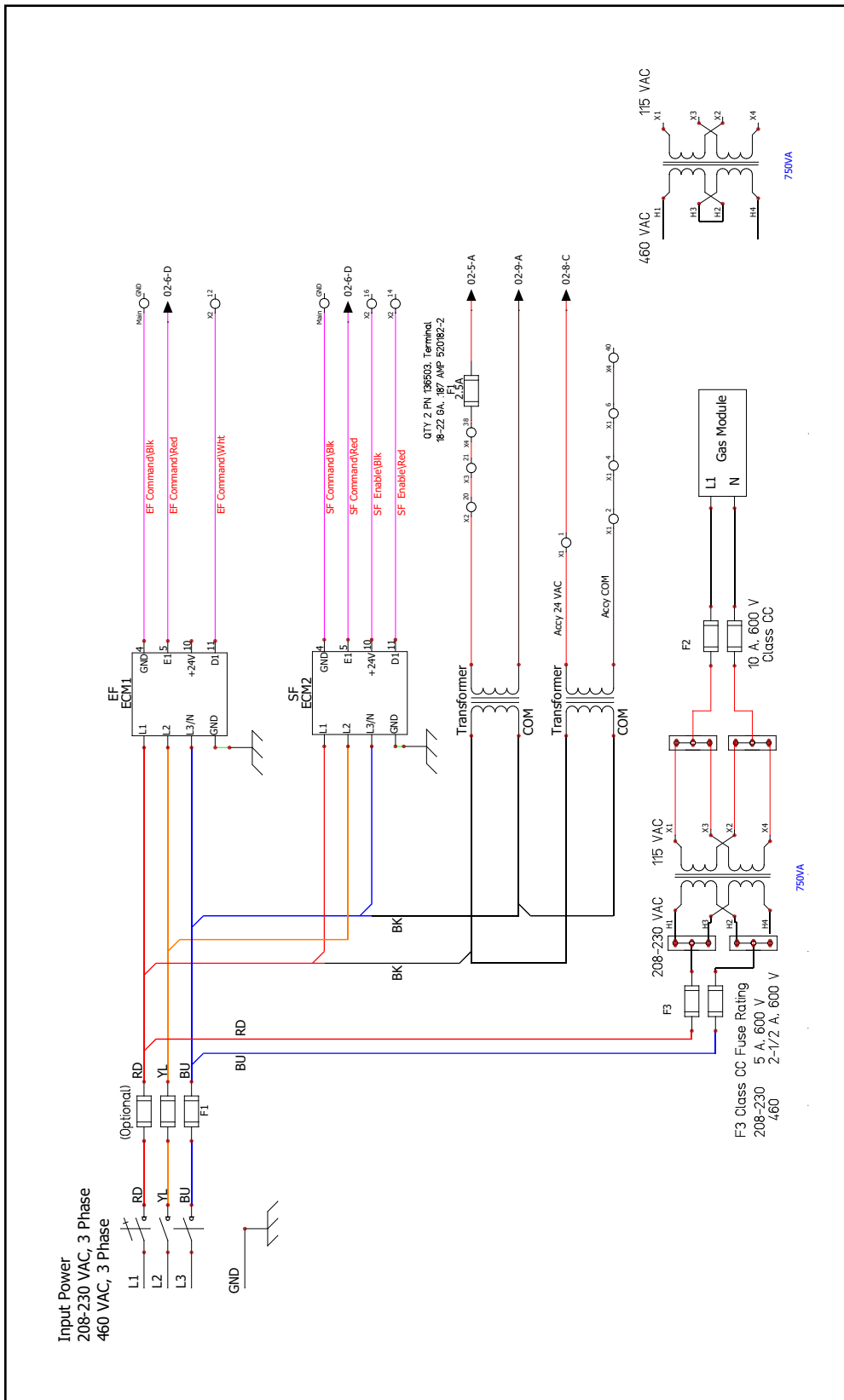
For Cooling or Dual Temp valves, use the following wiring:

- Sensor signal X3-29
- Common X4-31
- 24V Power to valve X3-21

For Heating valves, use the following wiring:

- Sensor signal X3-30
- Common X4-31
- 24V Power to valve X3-21

9.3.5 DN-2-RT, DN-3-RT Three Phase Power Wiring Schematic

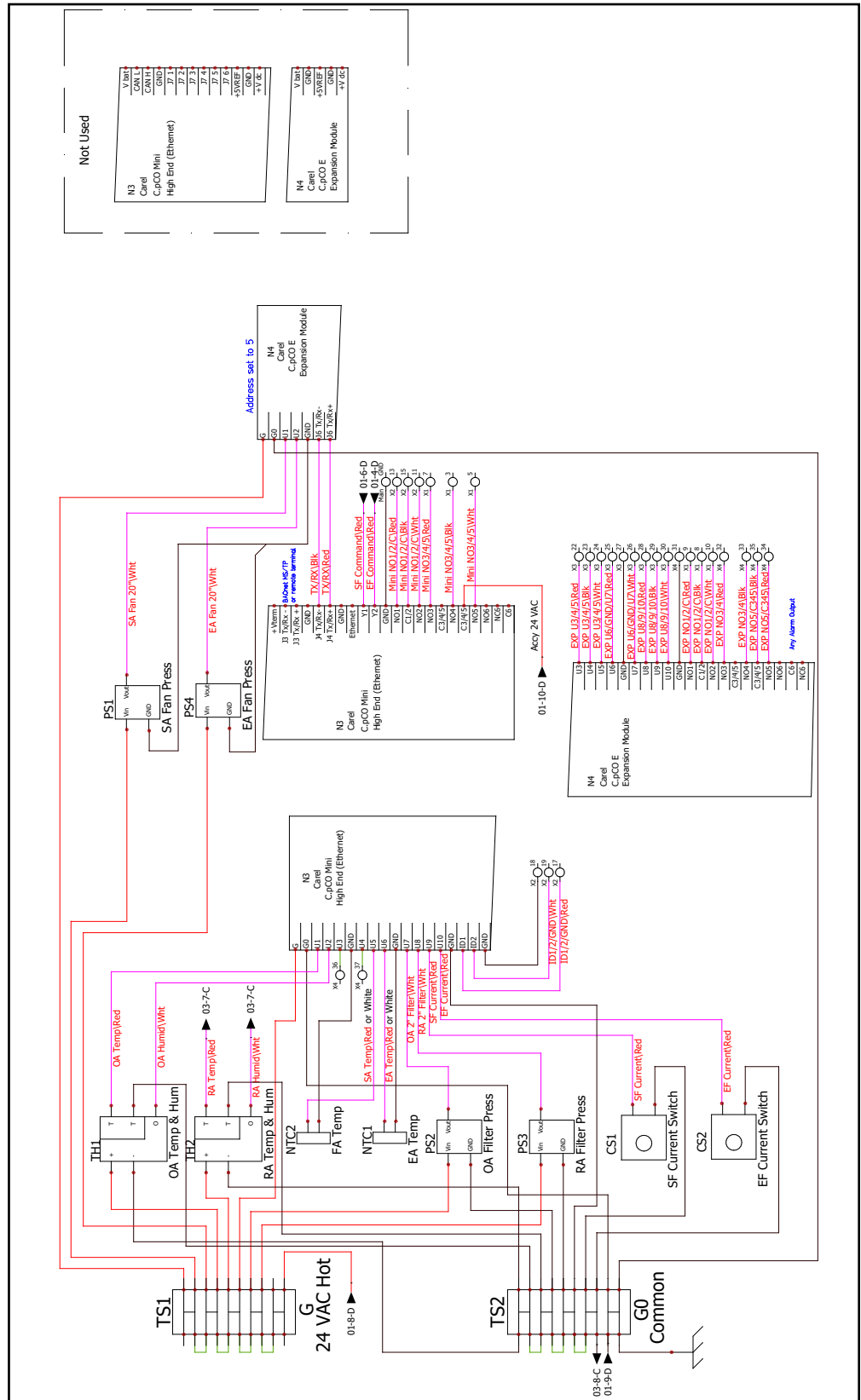


**NOTE:** This wiring schematic is TYPICAL of three phase, 208-230 and 460VAC input for models DN-2 and DN-3. This drawing is for a unit that includes gas heat and EC motors. A unit-specific electrical schematic is found inside the access door to the core module.

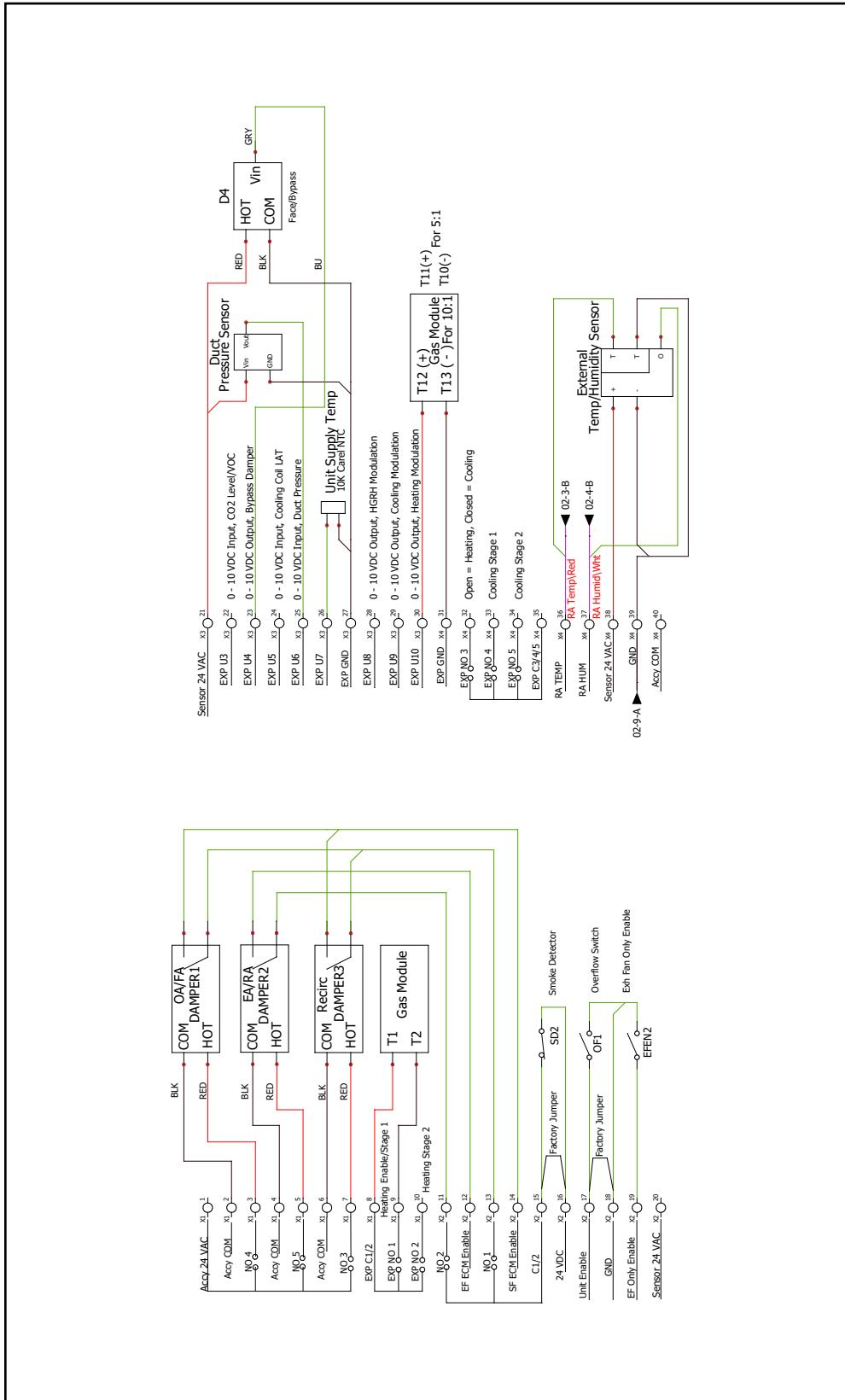


**NOTE:** This wiring schematic is TYPICAL control wiring for a three phase, 208-230 and 460VAC input for models DN-2, DN-3, and DN-5. This drawing is for a unit that includes gas heat and EC motors. A unit-specific electrical schematic is found inside the access door to the core module.

9.3.6 DN-2-RT, DN-3-RT, DN-5-RT Typical Control Wiring



9.3.7 Typical Field Wiring



**NOTE:** This wiring schematic is TYPICAL of three phase, 208-230 and 460VAC input for models DN-2, DN-3, and DN-5. This drawing is for a unit that includes gas heat and EC motors. A unit-specific electrical schematic is found inside the access door to the core module.



## 10.0 ALARMS AND TROUBLESHOOTING

If the problem is caused by an alarm, the first step in troubleshooting is to view the Alarm screens. Press the Alarm button on the face of the controller to see all current alarms and what function or component is causing the alarm. In some cases, the Alarm pre-set may need to be adjusted or an offset may need to be changed. Before making any changes to the controller programming, be certain to have an updated Backup file so that current settings can be easily restored, if needed. See the following *Alarms* section for these.

Problems with an air handler are sometimes strictly mechanical, in which a fan or damper or some other component simply stops working. Mechanical problems are easily traced to specific components by using the Test End Device feature in the service level. See the following *Test End Devices* section for this.

In other cases, problems may be caused by the air handler trying to overcome a pre-set or operating parameter that has been set by the user. In these cases, view the controller screens to trace the problem. See *Other Common Problems* section for these.

### 10.1 ALARMS

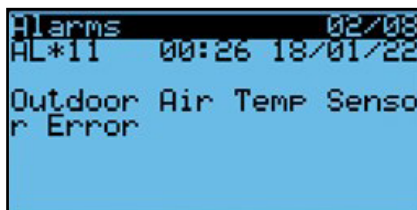
The alarms are viewed through the controller screen or through the BMS.

#### 10.1.1 Acknowledging Alarms

When an alarm occurs, you will hear a buzzer sound and the alarm light will flash. Press the alarm button to acknowledge the alarm and quiet the buzzer.

#### 10.1.2 Viewing Alarms and Alarm Log

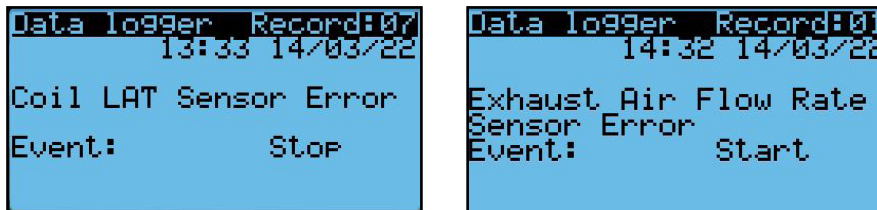
If there are active alarms the alarm button will be red. To view the active alarms, press the alarm button. Each alarm has an alarm number (AL\*11, in this case), a time stamp, and a message to show which alarm occurred.



Continue to press the button to cycle through all active alarms. At the end you will see this screen. Here you can press "ENTER" to see the past alarms.



An alarm log screen looks like this. If the event is Stop, it shows the time that the alarm went away. If the event is Start, it shows the time that the alarm first occurred. There may be up to 50 entries.



If no alarms are active, the screen will say No Alarms but you can still press “ENTER” to view the last 50 alarm occurrences.



### 10.1.3 Resetting Alarms

If you cycle through the alarms, you will see this screen. At this time, you can hold the alarm button down to reset the “User Reset” alarms. (The auto reset alarms reset themselves.)



### 10.1.4 Alarm Digital Outputs

The controller includes a digital output for remote indication of an alarm condition.

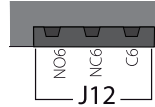
The first is AlarmOut.val and it closes the contact if there is an alarm that will shut down the unit. These include:

- Low Supply Temperature Alarm
- High Supply Temperature Alarm
- Loss of communication between the controller and the expansion module
- Exhaust Fan Alarm (Failure to start)
- Supply Fan Alarm (Failure to start) ONLY IF the *SF Alarm Unit Run?* is set to No. If yes, the unit will not shut down and the exhaust fan will be allowed to continue to run. All heating and cooling functions will be locked out, however.



The second is AnyAlarmOut.val and it closes the contact if there is any alarm including the ones in AlarmOut.val.

The physical connection for the first is made at the controller and the second is made at the expansion module. Both are terminated at the same terminal, J12, located in the upper right corner. There is both a normally open (NO6 to C6) and normally closed (NC6 to C6) option.



10.1.5 Specific Alarms and Their Meaning

The alarms are identified by number. They are grouped by type. Alarms 50–57, alarms 66–68, and alarms 100 and higher are specific to packaged DOAS units and are explained in the *DN Series Packaged Refrigeration Supplement*.

10.1.5.1 General Alarms

| NUMBER | NAME                | STATUS SHOWN | MEANING  |
|--------|---------------------|--------------|--|
| 0      | AI_retain           | User reset   | Error in the number of retain memory writings      |
| 1      | AI_Err_retain_write | User reset   | Error in retain memory writings                    |
| 2      | AI_Device_Test      | Auto reset   | Device Test is Running—Outputs Disabled!           |
| 3      | AI_BMS_Offline      | Auto reset   | Device offline alarm to BMS                        |
| 4      | OfflineAlrm_CPCOE_1 | Auto reset   | Device offline alarm CPCOE                         |
| 5      | CfgErrAlrm_CPCOE_1  | Auto reset   | Wrong configuration on device CPCOE                |
| 6      | OfflineDOAStoREF    | Auto reset   | Connection between DOAS and Ref Controller is lost |
| 7      | OfflineReftoInv     | Auto reset   | Inverter Offline                                   |
| 8      | AI_Smoke            | User Reset   | Smoke Alarm Input is engaged                       |
| 9      | AI_Freeze           | User Reset   | Freezestat Alarm Input is engaged                  |

**Alarm Number 0:** Error in the number of retain memory writings

This usually means indicates that the BMS is writing to a retained setpoint too often. Retained values are stored in a special memory so that they are kept on power loss. Failure to correct this could result in damage to the controller.

**Alarm Number 1:** Error in retain memory writings

This usually means indicates that the BMS is writing to a retained setpoint too often. Retained values are stored in a special memory so that they are kept on power loss. Failure to correct this could result in damage to the controller.

**Alarm Number 2:** Device Test is Running—Outputs Disabled!


This alarm occurs if someone had the unit in device test mode and the time limit has passed, usually an hour. Either cycle power to the unit or go into the Device Test section in the password protected menus and turn it off.

**Alarm Number 3:** Device offline alarm to BMS

This alarm occurs if the BMS is enabled, and it is offline.

**Alarm Number 4:** Device offline alarm CPCOE

This alarm occurs if the controller and expansion module have lost communication. For correct operation the dipswitches are set (left to right) Forward, backward, forward, backward,

 **NOTE:** The green LED indicates communication status on the BMS port. If there is communication on the BMS port (online) the green LED flashes, if there is no communication (offline) the LED stays on steady.

forward, forward, forward, forward. This coincides with an address of 5. Sometimes if they have been moved around it is necessary to set them all to OFF (forward), cycle power, and then set them as required, and then cycle power again.

- Check the wiring: FBUS on the controller to BMS on the expansion.
- Check that the dipswitches are positioned correctly

**Alarm Number 5:** Wrong configuration on device CPCOE

This alarm is an internal alarm. Contact TSS if this alarm occurs.

**Alarm Number 6:** Connection between DOAS and Ref Controller is lost

This alarm occurs on packaged refrigeration units and indicates that the communication between the refrigeration controller and the DOAS is lost. It is usually a wiring problem.

**Alarm Number 7:** Inverter Offline

This alarm occurs on packaged refrigeration units indicating the inverter for the variable speed compressor is offline. It usually indicates a power loss or a wiring issue.

**Alarm Number 8:** In Special Features, either ID1 or ID2 may be dedicated to a smoke alarm input. This alarm indicated that the alarm is engaged.

**Alarm Number 9:** In Special Features, either ID1 or ID2 may be dedicated to a freezestat alarm input. This alarm indicated that the alarm is engaged.

#### 10.1.5.2 Supply and Exhaust Alarms

| NUMBER | NAME          | STATUS SHOWN | MEANING           |
|--------|---------------|--------------|-------------------|
| 10     | AI_SupplyFan  | User reset   | Supply Fan Alarm  |
| 11     | AI_ExhaustFan | User reset   | Exhaust Fan Alarm |

**Alarm Number 10:** Supply Fan Alarm

This indicates that either the supply fan did not start, or that the current switch did not register the supply fan as running. Refer to the Supply or Exhaust Fan Alarm Troubleshooting section in the Test End Devices.

The delay for this alarm is set here. The setting is shared with the exhaust fan. Whether the unit shuts down if this alarm occurs is also set here.



**Alarm Number 11:** Exhaust Fan Alarm

This indicates that either the exhaust fan did not start, or that the current switch did not register the exhaust fan as running. Refer to the Supply or Exhaust Fan Alarm Troubleshooting section in the Test End Devices.

The delay for this alarm is set here. The setting is shared with the supply fan. This alarm will shut the unit down.



10.1.5.3 Airflow Condition Alarms

| NUMBER | NAME                     | STATUS SHOWN | MEANING                        |
|--------|--------------------------|--------------|--------------------------------|
| 12     | AI_SA_Airflow            | Auto reset   | Supply Airflow Alarm           |
| 13     | AI_EA_Airflow            | Auto reset   | Exhaust Airflow Alarm          |
| 14     | AI_SA_StaticPress        | Auto reset   | SA Static Pressure Level Alarm |
| 15     | AI_CO2                   | Auto reset   | CO2/VOC Level Alarm            |
| 16     | AI_SupAir_Low_Temp_Warn  | User reset   | Low SA Temp Warning            |
| 17     | AI_SupAir_Low_Temp_Alarm | User reset   | Low SA Temp Shutdown           |
| 18     | AI_SupAir_Hi_Temp_Warn   | User reset   | High SA Temp Warning           |
| 19     | AI_SupAir_Hi_Temp_Alarm  | User reset   | High SA Temp Shutdown          |
| 21     | AI_EA_StaticPress        | Auto reset   | EA Static Pressure Level Alarm |

**Alarm Number 12:** Supply Airflow Alarm

This alarm occurs when the supply is set to control on supply flow (CFM). It indicates that the flow measured is out of tolerance set here for more than the alarm delay set here.



This usually indicates that the unit is probably hunting and the KP (gain) for the PI control needs to be adjusted. Set the KP to 0.1 or 0.2 to start. If it responds too slow, you can increase it but these values are usually acceptable.



**Alarm Number 13:** Exhaust Airflow Alarm

This alarm occurs when the supply is set to control on exhaust flow (CFM). It indicates that the flow measured is out of tolerance set here for more than the alarm delay set here.



This usually indicates that the unit is probably hunting and the KP (gain) for the PI control needs to be adjusted. Set the KP to 0.1 or 0.2 to start. If it responds too slow, you can increase it but these values are usually acceptable.

```
Control Settings
EXHAUST AIR
Airflow Setpoint
      0 cfm
  KP      1.0
  Ti      15
  Delay   30 Sec
```

#### Alarm Number 14 and 21: Supply and Exhaust Air Static Pressure Level Alarms

These alarms occur when the supply fan is set to control on duct static pressure, or the exhaust fan is set to control on return static pressure. It indicates that the pressure measured is out of tolerance set here for more than the alarm delay set here.

```
ALARM SETTINGS
SF Duct Press Tol
      10.0%
Pressure Alarm Delay
      120 sec
```

```
ALARM SETTINGS
EF Return Press Tol
      10.0%
Pressure Alarm Delay
      300 sec
```

First make sure the pressure sensor is enabled in the *I/O configuration* and that there is a reading in the *Unit Status*. If you don't see this screen the sensor is not enabled. If the sensor is not reading correctly, check the wiring and calibration screen.

```
Unit Status
Duct Pressure
      0.00"wg
Setpoint  0.00"wg
```

If the sensor is reading correctly, this usually indicates that the unit is probably hunting and the KP (gain) for the PI control needs to be adjusted. Decrease the KP to slow the response Increase to get a faster response.

```
Control Settings
SUPPLY FAN
Duct Static Control
Setpoint  0.00"wg
  KP      10.0
  Ti      25
  Delay   30 Sec
```

```
Control Settings
Exhaust Fan
Return Static Control
Setpoint  0.050"wg
  KP      1.0   Ti  30
Min Command  15.0%
Max Command  100.0%
  Delay   30Sec
```

**Alarm Number 15: CO2/VOC Level Alarm**

This alarm occurs when the CO2/VO2 sensor is enabled, and the CO2/VOC level rises above the level set in this screen for more that the delay time.



First make sure the pressure sensor is reading correctly in the *Unit Status*. If the sensor is not reading correctly, check the range settings in *I/O Configuration*, the wiring, and the calibration screen.

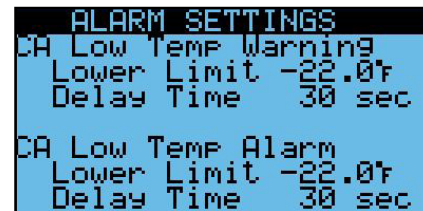
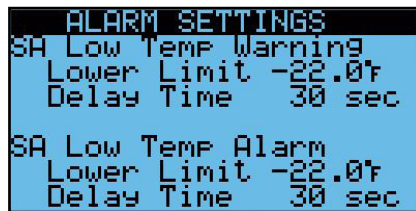


If the sensor is reading correctly, the CO2/VOC level is too high. You may have to adjust the fan control to keep it within limits.

**Alarm Numbers 16 and 17: Low SA Temp Warning and Low SA Temp Shutdown**

In units without heating, the alarm applies to the supply temperature (SA). In units with heating, this alarm applies to the unit supply temperature that is measured after the heating unit.

First, view the sensor value in *Unit Status*. If it seems OK, then check the alarm levels set here. (Only one will show, depending upon whether you have a Unit Supply Temp Sensor). The difference in the two is that the warning will just show as an alarm while the shutdown will shut down the unit. You can use the warning as a warning set at higher temperature for the purposes of warning. You can also just use one or the other by setting the limits of the one you do not want to use very low.



**Alarm Numbers 18 and 19: High SA Temp Warning and High SA Temp Shutdown**

This alarm only applies to units with cooling and applies to the CA Temperature.

First, view the sensor value in *Unit Status*. If it seems OK, then check the alarm levels set here. The difference in the two is that the warning will just show as an alarm while the shutdown will shut down the unit. You can use the warning as a warning set at lower temperature for the purposes of warning. You can also just use one or the other by setting the limits of the one you do not want to use very high.



```

ALARM SETTINGS
CA High Temp Warning
  Lower Limit 176.0°F
  Delay Time 500 sec

CA High Temp Alarm
  High Limit 176.0°F
  Delay Time 500 sec

```

#### 10.1.5.4 Sensor Alarms

| NUMBER | NAME                 | STATUS SHOWN | MEANING                             |
|--------|----------------------|--------------|-------------------------------------|
| 30     | AI_OA_Temp_Prpb      | Auto reset   | OA Temperature Sensor Error         |
| 31     | AI_OA_Hum_Prpb       | Auto reset   | OA Humidity Transducer Error        |
| 32     | AI_RA_Temp_Prpb      | Auto reset   | RA Temperature Sensor Error         |
| 33     | AI_RA_Hum_Prpb       | Auto reset   | RA Humidity Transducer Error        |
| 34     | AI_SA_Temp_Prpb      | Auto reset   | SA Temperature Sensor Error         |
| 35     | AI_EA_Temp_Prpb      | Auto reset   | EA Temperature Sensor Error         |
| 36     | AI_OA_Flt_Press_Prpb | Auto reset   | OA Filter Pressure Transducer Alarm |
| 37     | AI_RA_Flt_Press_Prpb | Auto reset   | RA Filter Pressure Transducer Alarm |
| 38     | AI_OA_Flow_Rate_Prpb | Auto reset   | OA Flow Rate Sensor Error           |
| 39     | AI_EA_Flow_Rate_Prpb | Auto reset   | EA Flow Rate Sensor Error           |
| 40     | AI_CO2_Level_Prpb    | Auto reset   | CO2/VOC Sensor Error                |
| 41     | AI_Duct_Press_Prpb   | Auto reset   | Duct Pressure Probe Error           |
| 42     | AI_Supply_Temp_Prpb  | Auto reset   | CA Temperature Sensor Error         |
| 43     | AI_Coil_LAT_Prpb     | Auto reset   | Coil LAT Sensor Error               |

#### Alarm Numbers 30–43: Sensor Alarms

These alarms occur when the controller detects that sensor is not reading in the expected range. Passive sensors such as temperature sensors show an error when the controller detects a short circuit or open circuit. Active sensors (0–10V) are in alarm when they value read is slightly above 10V.

To resolve the alarms, check the wiring to see if there is a loose wire or missing sensor.

## 10.1.5.5 Filter Alarms

| NUMBER | NAME            | STATUS SHOWN | MEANING                  |
|--------|-----------------|--------------|--------------------------|
| 60     | AI_OA_Flt_Press | Auto reset   | OA Filter Pressure Alarm |
| 61     | AI_RA_Flt_Press | Auto reset   | RA Filter Pressure Alarm |

**Alarm Numbers 60–61:** Filter Alarms

These alarms occur when the pressure exceeds the OA Level or the RA Level as set in the alarm settings.

For more information refer to Pressure Drop Tables in the *Reference* section.

```

ALARM SETTINGS
Filter Alarms
OA Level      1.0"w9
RA Level      1.0"w9
Alarm Delay   60 sec
  
```

To resolve the alarms, change the filter. If the alarm is still active, verify that the reading is as expected in the *Unit Status*. If not, check that someone has not changed the pressure transducer range in the *I/O Configuration*. Also check the offset or override for the sensors.

## 10.1.5.6 Maintenance Alarms

| NUMBER | NAME              | STATUS SHOWN | MEANING                               |
|--------|-------------------|--------------|---------------------------------------|
| 62     | AI_UnitLife_DOAS  | Auto reset   | DOAS Unit Service Threshold Reached   |
| 64     | AI_SupplyFanLife  | Auto reset   | Supply Fan Service Threshold Reached  |
| 65     | AI_ExhaustFanLife | Auto reset   | Exhaust Fan Service Threshold Reached |

**Alarm Numbers 62–65:** Maintenance Alarms

These alarms occur when the number of run hours reaches the thresholds set in the *Advanced Service*. A typical screen is shown here.

```

ADVANCED SERVICE
DOAS UNIT SERVICE INFO
Run Hours:      0
Svc Thr:        20000hr
STATUS:OK
Reset Svc Hrs:  NO
Starts:         0
Reset Starts:   NO
  
```

Refer to the *Advanced Service* for more information on these settings.

## 10.2 TEST END DEVICES

The *Test End Devices* allows you to manually control outputs for testing. The unit must be off for this feature to be enabled. An alarm will occur in one hour (default) if you forget to take the device out of test mode.

Once done. Make sure you cycle power to end test mode and put all values back to zero.



### 10.2.1 Supply or Exhaust Fan Alarm Troubleshooting

These alarms, 10 and 11, mean that either the fan did not start or that the current switch did not detect that the fan is running. To troubleshoot this:

- Turn the unit off through the keypad.
- In the password protected menus, go to the *Test End Devices* and enable. As shown, an alarm will sound if you leave the unit in device test mode for more than an hour (default).



- Open both dampers.



- Enable both fans.



- For the fan that has the alarm (supply or exhaust), command the fan to run at 35% or so. If you see the flow increase but don't see the feedback (current switch) to yes, then the problem is with the current switch. If you don't see the flow increase the fan did not start and the problem is either with the wiring or the VFD parameters. Check also that the smoke detector input (terminals 15 to 16) is closed and that the fan overload is not tripped.

```

TEST END DEVICES
SUPPLY FAN COMMAND
TEST VALUE:

      35%
Feedback:  ON
Flow:     15888

```

- If you think the problem is with the current switch, try adjusting the fan % up until you see the feedback go to YES. During this time, you should also see the flow to continue to increase. Once you see the feedback turn to yes you know the current switch needs adjustment. If it gets to 100% and you do not see it turn to yes, it may be wiring or a bad current switch. You can try to adjust it below.

#### Adjusting the Current Switch

With the dampers open and the fans enabled as described in the Test End Devices mode above, set the fan for which you want to calibrate to the minimum speed (%) at which you expect it to operate.

On the top of the sensor, there are an adjusting screw and two LED lights, one red and one blue. The adjusting screw will turn 15 turns. To set the sensor for any fixed-speed fan:

- Verify that the blue LED is on.
- Slowly adjust the potentiometer screw clockwise until the RED LED just turns on. This sets the trip point at the normal operating load current
- If the RED LED is on after initial power-up, slowly adjust the potentiometer counter-clockwise until the BLUE LED turns on and then slowly adjust the potentiometer clockwise until the RED LED just turns on.

### IMPORTANT

Cycle power to the unit after you are done testing. This will take the unit out of Device Test Mode and reset all of the test values to off or 0%.

## 10.3 OTHER COMMON PROBLEMS

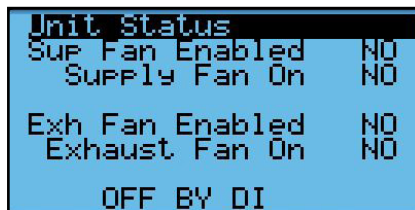
Listed are some other common problems you may encounter.

### 10.3.1 Unit Not On

If the unit will not run, go to this screen in *Unit Status* and the bottom line will tell you why.

Multiple items may be true. Possible messages and their meaning:

- Unit On: Unit is running
- Off by Alarm: A serious alarm is present; usually a fan alarm or supply temp alarm.
- Off by BMS: The BMS has set Enable BMS Control to yes and is not sending an On command.
- UNOCC by Sched: The scheduler is enabled and it indicates unoccupied.
- Off by DI: The terminals 17 and 18 need to be closed or jumped.
- Off by Keyboard: The menu screen *Unit On/Off* is set to off.
- Off by CO2 Level: the CO@ level is too low for the unit to run (special feature).
- Exhaust Fan Only Mode: The terminals 18 and 19 are closed indicating single fan mode. The setting for which fan will run is in *I/O Configuration*.
- Supply Fan Only Mode: The terminals 18 and 19 are closed indicating single fan mode. The setting for which fan will run is in *I/O Configuration*.
- Unoccupied Mode: Either the BMS or Scheduler is putting the unit in unoccupied mode.
- BMS Cool Lockout: This means that *BMS Heat/Cool Mode?* Is set to Yes in *General Settings* and the current mode is heat.
- BMS Heat Lockout: This means that *BMS Heat/Cool Mode?* Is set to Yes in *General Settings* and the current mode is cool.
- In Device Test: Mode in *Test End Devices* is enabled. Cycle power to get it out of this mode.
- Input Overwritten: There is a sensor that is overwritten in Sensor Overrides. This occurs after 24 hours as a reminder.



### 10.3.2 Sensor Reading #### or Has Extreme Value

This normally means that the sensor is not connected, or it has faulty wiring.

### 10.3.3 BMS Loss of Comm after Param Change or Restore

Most BMS setting changes require a power cycle. This applies to a parameter restore, which is basically the same thing.

### 10.3.4 Can Not See Device via IP Connection

If you are connected locally with a PC:

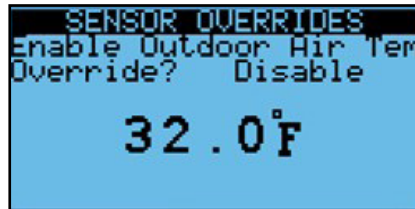
- Make sure your PC is on the same subnet but not the exact same IP address. The last octet has to differ.
- If you have just changed the IP address, make sure you said “update” on that screen and cycle power.
- Make sure the cable “snaps in” on both sides.
- Microsoft Edge browser does not work as well. Use Chrome, if possible.
- Make sure you don’t have anything in the USB connection in the front of the controller.

If you are connected remotely, check all of the above but also note that the connection has to be on the same subnet. An IP tunnel may also work.

## 10.4 TESTING FUNCTIONS IN GENERAL

When testing in general, the Sensor Overrides is a handy tool. These allow you to temporarily override a sensor to see if a function is working correctly. For example, if you want to test your cooling but it is cool outside, you can override your outdoor sensor to exceed the cool lockout temperature. This is handier than having to change all of your settings and then set them back.

To override a sensor, first set the value of the sensor and then enable. If you enable before setting the value, the value shown will be set right away. In this case, it will most likely turn on your heat.



If you leave a sensor overwritten, an alarm will occur after 24 hours. All overwritten values are lost on power cycle and the statuses go back to disabled.

## 10.5 RESTORE PARAMETERS (SETTING)

There are several levels of settings in the controller. Some are set by the factory, and some are set by users. These parameters include all configuration settings, fan settings, heat/cool settings, and BMS settings.

### 10.5.1 User Commissioning Settings (Service)

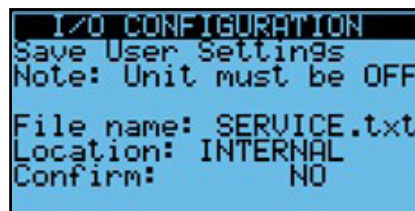
At the end of the I/O Configuration, the user is prompted to save their settings. It is probably best to save these values after setting all of the values in the Control Variables as well. This is password protected as every time you save the settings, the file will overwrite. The file name is "SERVICE.txt," and it will be saved to either the internal memory location, or the external USB drive that is attached in front.

To perform this operation, the unit must be OFF.

- Choose the location: internal or USB
- Set Confirm to YES



**NOTE:** RenewAire highly recommends that a USB thumb drive be installed in the USB port and a system backup (external) be made immediately after start up or commissioning.



If you choose USB and you get "Cannot access disk," there is something wrong with the connection or disk.



If you do the operation correctly, it will say “Operation Done.”

```

I/O CONFIGURATION
Save User Settings
Note: Unit must be OFF
File name: SERVICE.txt
Location: INTERNAL
Confirm: YES
Operation done
  
```

To restore user settings, the screen is in Backup and Restore. The steps are:

- Choose the location: internal or USB
- Set Confirm to Yes

You should see “Operation done.”

```

BACKUP & RESTORE
Restore User Settings
Note: Unit must be OFF
File name: SERVICE.txt
Location: INTERNAL
Confirm: NO
  
```

If the unit does not confirm that the operation was done, the controller may have been older and upgraded in the field. Older version saved factory parameters in EXPORT\_76. See the *General Save and Restore* for information on how to get those settings back into the controller.

### 10.5.2 Restore Factory Settings

This operation is used to go back to factory settings that were set in the factory while they tested the unit. These are somewhat specific settings but going back to these settings will require you to perform start up and commissioning again. To return to factory defaults:

- Choose internal
- Set Confirm to Yes

```

S BACKUP & RESTORE
Restore Factory
Note: Unit must be OFF
File name: FACTORY.txt
Location: INTERNAL
Confirm: NO
  
```

If the unit does not confirm that the operation was done, the controller may have been older and upgraded in the field. Older version saved factory parameters in EXPORT\_76. See the *General Save and Restore* for information on how to get those settings back into the controller.

### 10.5.3 General Save and Restore

There is a general save and restore function that allows you to save different versions of your parameters and save them under slightly different names.

Both saving and restoring use the same screen so care should be taken to make sure you have the screen set correctly so you do not lose all of your settings.

- Choose IMPORT (for restoring) or EXPORT (for saving)
- Choose memory type: INTERNAL or USB



- If the unit does not confirm that the operation was done, the controller may have been older and
- Choose File ID: EXPORT\_xx, where xx is any number from 00 to 99, If you are saving a set of parameters remember the number.
  - Set Confirm to Yes

```


S  BACKUP & RESTORE
Params Import/Export
Import/Export:
EXPORT
Memory type:
INTERNAL FLASH MEMORY
File ID:      EXPORT_00
Confirm:      NO
    
```

10.5.4 Code List for Save and Restore

Use these codes to troubleshoot the Save and Restore Feature.

| MESSAGE                                    | MEANING  |
|--|--|
| Operation Done                             | Save or Restore was successful.  |
| Cannot Access Disk                         | This usually happens when you choose USB and the USB is not inserted or detected. If inserted, the connector may be too short. |
| Cannot access file                         | This usually happens when you are importing and the file you are importing does not exist.                                     |
| Memory buffer is too small                 | You may have to erase some data from the drive or USB before you can perform the operation.                                    |
| Time parameters are not correct            | The clock needs to be set in <i>General Settings</i> .   |
| Module is currently busy—retry is required | Another operation was running. Retry.  |
| Log exporting failed                       | It is possible the connection was interrupted.   |
| Input parameter value is not valid         | The file may not be compatible with the program.   |

10.5.5 Return to Program Defaults

 NOTE: Do not use the other two lines unless directed to do so by TSS.

A more drastic approach may be needed to get internal settings out of the controller. Once done, you can restore a set of parameters by using any of the previously described methods. The process is called “Wipe Retain” for anyone familiar with the Carel controller. Most likely you will not use this operation unless you are directed to do so by RenewAire Technical Sales Support (TSS).

To perform this operation, choose YES on the top line Wipe retain mem.

```

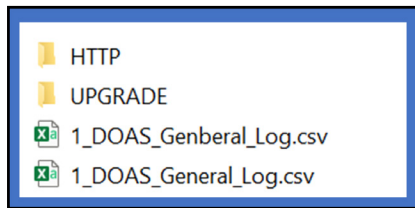
ADVANCED SERVICE
DEFAULT INSTALLATION
Wipe retain mem.: NO
Wipe NURAM mem.: NO
Wipe both mem.: NO
    
```

The unit will take a minute to get back. Then you can resume entering your parameters by any method.

## 11.0 ACCESSING FILES FROM AND PERFORMING UPDATES TO THE CONTROLLER

The controller has a total of about 92 MB of internal memory. There are several types of files that use the internal 92 MB of mass storage that are available on the controller.

- Logs—exported automatically in the root
- Alarm List—exported on demand
- Parameter sets —see *Restore Parameters (Settings)*
- Program and OS Upgrade packages—Reside in an UPGRADE folder
- Web pages—Reside in an HTTP folder
- User storage, such as documents



These files can be accessed through one of two methods:

- Connection via FTP through the Ethernet port
- Connection with a micro USB cable

It is also possible to export directly alarms, current log, and parameter sets to a USB drive that has either a micro USB connector or uses an adapter.

### 11.1 CONNECTIONS USING THE MICRO USB PORT

The controller has a built-in USB port where an external memory device such as a USB thumb drive can be plugged in. The external memory device may be used for backing up all settings and reported conditions such as Alarm History and presets. Backing-up is user-commanded and is done through the menu screens.

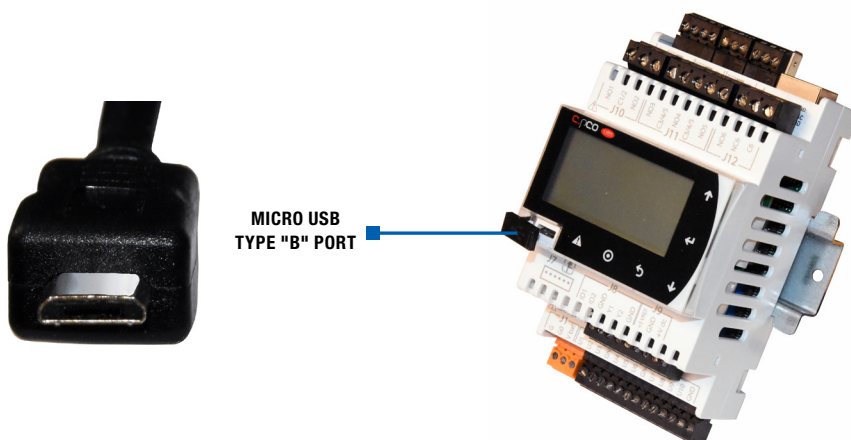
Note that the USB port is a Micro USB Type “B.” Thumb drives with a Micro USB Type B are difficult to find in some areas and it may be necessary to purchase an adapter to go from a more common Type A connector to the newer Micro Type B.

Make sure that the longer side of the USB connection is to the bottom of the controller. Do not force the connector in or you could damage the controller.

The controller requires that you use a cable or adapter with a longer end for the Micro USB side. One adapter we have found that works is the UGreen, purchased on Amazon.



**NOTE:** You cannot be connected by both methods at the same time. If you are viewing the web pages and then connect with USB, the web page will go blank until you disconnect.



### 11.2 ALARMS AND DATA LOGS

Two types of files that are exported on demand are logs and alarm lists. They can be exported to the internal memory or the USB drive.

The export of the logs will show “In Progress” while exporting. It may take a while depending upon the size.

```

S BACKUP & RESTORE
Alarm Export
Memory type:
INTERNAL FLASH MEMORY
File name:AL_EXPORT_00
Confirm: NO
    
```

```

BACKUP & RESTORE
LOG EXPORT
Memory type:
INTERNAL FLASH MEMORY
File name:
DOAS_General_Log.txt
Confirm: NO
In Process
    
```

#### 11.2.1 Example of Alarm Log

This is the file as opened in Excel. It includes a timestamp, alarm number, alarm name, and whether the event was the start of the alarm or the end (stop).

| TIME                      | ID | NAME                        | EVENT | VAR1 | VAR2 |
|---------------------------|----|-----------------------------|-------|------|------|
| 2022-01-28T16:11:22+00:00 | 39 | AI_EA_Flow_Rate_Prbl.Active | Start |      |      |
| 2022-01-28T16:11:22+00:00 | 38 | AI_OA_Flow_Rate_Prbl.Active | Start |      |      |
| 2022-01-28T16:11:21+00:00 | 42 | AI_Supply_Temp_Prbl.Active  | Start |      |      |
| 2022-01-27T17:48:22+00:00 | 39 | AI_EA_Flow_Rate_Prbl.Active | Start |      |      |
| 2022-01-27T17:48:22+00:00 | 38 | AI_OA_Flow_Rate_Prbl.Active | Start |      |      |
| 2022-01-27T17:48:20+00:00 | 42 | AI_Supply_Temp_Prbl.Active  | Start |      |      |
| 2022-01-27T15:48:02+00:00 | 39 | AI_EA_Flow_Rate_Prbl.Active | Start |      |      |
| 2022-01-27T15:48:02+00:00 | 38 | AI_OA_Flow_Rate_Prbl.Active | Start |      |      |

#### 11.2.2 Example of Data Log

This is the file as opened in Excel. It includes a timestamp and values of all of the factory preconfigured log values.

| TIME                 | EVENT | OA_Temp. Val | OA_Hum. Val | RA_Hum. Val | SA_Temp. Val | EA_Temp. Val | Cooling_C ommand. | Heating_C ommand. | RA_Temp. Val |
|----------------------|-------|--------------|-------------|-------------|--------------|--------------|-------------------|-------------------|--------------|
| 2022-02-06T00:00:03+ |       | 22.079       | 23.14       | 20.73       | 20.111       | 21.768       | 0                 | 0                 | 22.134       |
| 2022-02-06T00:00:08+ |       | 22.079       | 23.14       | 20.74       | 20.134       | 21.756       | 0                 | 0                 | 22.134       |
| 2022-02-06T00:00:13+ |       | 22.079       | 23.13       | 20.69       | 20.154       | 21.756       | 0                 | 0                 | 22.134       |
| 2022-02-06T00:00:18+ |       | 22.067       | 23.15       | 20.71       | 20.166       | 21.756       | 0                 | 0                 | 22.134       |
| 2022-02-06T00:00:23+ |       | 22.067       | 23.15       | 20.725      | 20.166       | 21.756       | 0                 | 0                 | 22.123       |
| 2022-02-06T00:00:28+ |       | 22.067       | 23.14       | 20.695      | 20.178       | 21.756       | 0                 | 0                 | 22.123       |
| 2022-02-06T00:00:33+ |       | 22.067       | 23.14       | 20.71       | 20.189       | 21.756       | 0                 | 0                 | 22.123       |
| 2022-02-06T00:00:38+ |       | 22.067       | 23.14       | 20.705      | 20.199       | 21.745       | 0                 | 0                 | 22.123       |
| 2022-02-06T00:00:43+ |       | 22.067       | 23.14       | 20.69       | 20.209       | 21.745       | 0                 | 0                 | 22.123       |
| 2022-02-06T00:00:48+ |       | 22.067       | 23.14       | 20.735      | 20.209       | 21.745       | 0                 | 0                 | 22.123       |

**NOTE:** There will be several log files on the internal drive. This is because the log is exported every night at midnight. The files are listed by day of week, where 1 = Monday. The file that starts with 9 is the file that is exported on demand.

|                           |           |
|---------------------------|-----------|
| HTTP                      |           |
| System Volume Information |           |
| UPGRADE                   |           |
| 1_DOAS_General_Log.csv    | 4,614,281 |
| 2_DOAS_General_Log.csv    | 4,614,281 |
| 3_DOAS_General_Log.csv    | 4,614,281 |
| 4_DOAS_General_Log.csv    | 2,067     |
| 5_DOAS_General_Log.csv    | 1,285,715 |
| 6_DOAS_General_Log.csv    | 4,614,281 |
| 7_DOAS_General_Log.csv    | 4,614,281 |

The variables that are logged are as listed here.

| VARIABLE            | VARIABLE          | VARIABLE                             |
|---------------------|-------------------|--------------------------------------|
| OA_Temp.Val         | Cooling_LAT.Val   | SuctPress_1.Val                      |
| OA_Hum.Val          | HGRH_Command.Val  | OA_Dewpoint                          |
| RA_Hum.Val          | Any_Alarm_Out.Val | RA_Dewpoint                          |
| SA_Temp.Val         | DscgTemp_2.Val    | RegCool                              |
| EA_Temp.Val         | DscgPress_2.Val   | GEN_RefrigerationStage               |
| Cooling_Command.Val | DscgPress_1.Val   | GEN_CompSpeedFeedback_PCT            |
| Heating_Command.Val | SuctTemp_2.Val    | GEN_DemandtoVarSpeedCompressor_1     |
| RA_Temp.Val         | SuctPress_2.Val   | EVD_VariableSpeed_EEV_PosPercent_Val |
| OA_Enthalpy         | SuctTemp_1.Val    |                                      |
| Bypass_Command.Val  | DscgTemp_1.Val    |                                      |

### 11.3 VIEWING PARAMETER FILES

You can view the parameter files that were created in *Restore Parameters (Settings)*. You can also share them between controllers. An excerpt of a file is shown below.

#Ver.1.0 cpCO Family Exported Configuration file

| #VARIABLE                           | DESCRIPTION | DATA TYPE DEFAULT VALUE |
|-------------------------------------|-------------|-------------------------|
| BACnet_Mapping                      | UINT        | 0                       |
| BMSMng.BACnetPort                   | UDINT       | 47808                   |
| BMSMng.BMS_Address_RS485            | UINT        | 4                       |
| BMSMng.BMS_BACnetDeviceInstance     | UDINT       | 5002                    |
| BMSMng.BMS_BACnetMSTP_MaxInfoFrames | UINT        | 20                      |
| BMSMng.BMS_BACnetMSTP_MaxMaster     | UINT        | 127                     |
| BMSMng.BMS_BACnet_CmdTimeout        | UINT        | 1500                    |
| BMSMng.BMS_BACnet_Timout            | UINT        | 3000                    |
| BMSMng.BMS_Baud_Msk                 | UINT        | 2                       |
| BMSMng.BMS_Baud_RS485               | UDINT       | 19200                   |
| BMSMng.BMS_Modbus_Timeout           | UINT        | 3000                    |
| BMSMng.BMS_Parity_MSK               | USINT       | 0                       |

### 11.4 PERFORMING UPDATES TO THE CONTROLLER

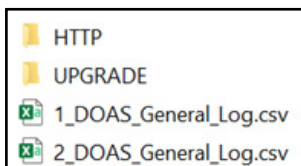
If directed by TSS, you may need to perform an upgrade to the controller program. A very similar process is also used to field-install BACnet licenses into the controller. Refer to the BMS Access for that process.

There are three different methods to update a program, depending upon which way you connect to the controller. All three require that you have a file called “autorun.ap1,” given to you by TSS.

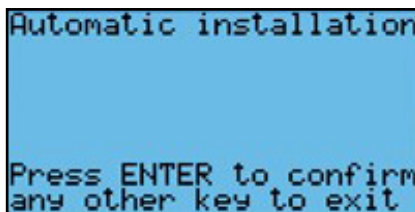
1. Connect via USB. This requires that you have a micro USB cable to go from your PC to the controller micro USB connection and can see the files in Windows Explorer.
2. Connect with a USB thumb drive to the micro USB connection.
3. Connect via Ethernet. This requires a PC and the ability to connect to the embedded web pages inside the controller.

#### 11.4.1 Upgrade Type: Connect via USB

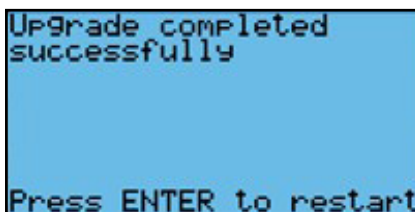
1. Save the parameters using the *General Save and Restore* method. Make sure you choose EXPORT! Remember the Export\_XX number you chose.
2. Carefully connect the micro USB cable to the front connection of the controller (long side to the bottom) and to your PC. Verify that you can see the files in Windows Explorer. It shows up as a USB drive. If you cannot see these files you will need to use another method.




3. Put the autorun.ap1 file in the folder called “UPGRADE.” You should not have other files in the root of that folder. You can have other folders in this folder, if needed.
4. You will be prompted to press “ENTER” to proceed.



5. Once it is done you will be prompted to press “ENTER” to restart the controller.



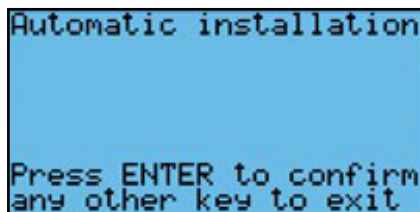
 NOTE: It is advised that you delete this file once you are done. Every upgrade file is named the same, regardless of version.

6. Restore the parameters using the *General Save and Restore* method. Make sure you choose IMPORT! Use the Export\_XX number you chose in step 1.
7. Cycle power.

#### 11.4.2 Upgrade Type: Connect with a USB Thumb Drive

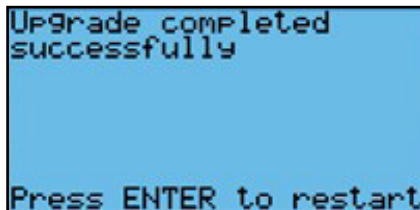
Connect with a USB thumb drive to the micro USB connection.

1. Save the parameters using the *General Save and Restore* method. Make sure you choose EXPORT! Remember the Export\_XX number you chose.
2. Put the autorun.ap1 file in a folder in the root of the thumb drive called "UPGRADE."
3. Carefully connect the micro USB drive to the front connection of the controller (long side to the bottom).
4. You will be prompted to press "ENTER" to proceed.



```
Automatic installation
Press ENTER to confirm
any other key to exit
```

5. Once it is done you will be prompted to press "ENTER" to restart the controller.



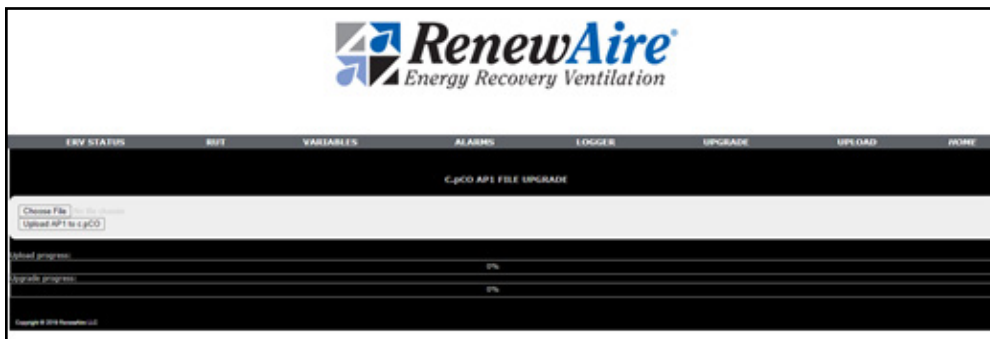
```
Upgrade completed
successfully
Press ENTER to restart
```

6. Restore the parameters using the *General Save and Restore* method. Make sure you choose IMPORT! Use the Export\_XX number you chose in step 1.
7. Cycle power.

#### 11.4.3 Upgrade Type: Connect via Ethernet

This requires a PC and the ability to connect to the embedded web pages inside the controller.

1. Save the parameters using the *General Save and Restore* method. Make sure you choose EXPORT! Remember the Export\_XX number you chose.
2. Go to the Upgrade Tab in the web pages.



3. Click on "Choose File" and locate the autorun.ap1 file on your PC that corresponds to the controller. Click "OPEN." You should now see that file name next to "Choose File."
4. Click "Upload AP1 to c.pco." You will see the file upload.
5. Once 100% on the upload, switch back to the RUT screen to see the upgrade taking place.
6. On the controller the program will see the file and require you to push "ENTER." You can see that on the front of the controller itself or on the RUT page of the web pages.
7. Restore the parameters using the *General Save and Restore* method. Make sure you choose IMPORT! Use the Export\_XX number you chose in step 1.
8. Cycle power.

## 12.0 GENERAL SYSTEM MONITORING

This section describes the general system monitoring. It is here only to provide a general sense of how to monitor the system. Specific screens and information appear depending upon the features you have selected. Refer to the documentation on the specific function for the information on specific monitoring screens.

The unit is monitored through *Unit Status*.

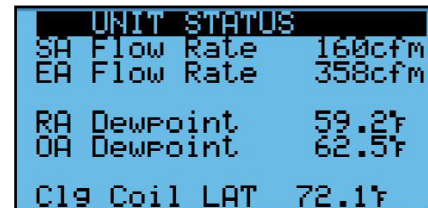
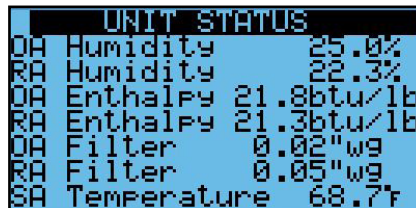
### 12.1 MAIN SCREEN

The main screen shows either the SA temperature coming off the core, or the CA temperature, depending upon whether the unit has tempering or not. It also shows the other four temperatures near the core.



### 12.2 OTHER STANDARD SCREENS

These screens also show standard values.

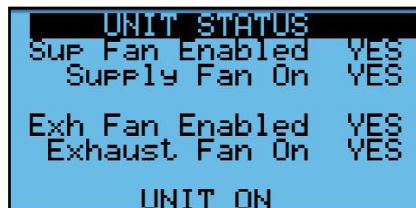


### 12.3 FAN AND UNIT STATUS SCREENS

The first screen is helpful on starting the unit. It shows whether the fan is being asked to turn on (enabled), and whether the current sensor is detecting that it has turned on.

It also shows the *Unit Status* conditions, described in the chart below.

The seconds screen shows the speed of the fans.





| UNIT STATUS CONDITIONS             |   |
|------------------------------------|---|
| STATUS SHOWN                       | MEANING   |
| Unit on                            | The unit is on and running.                                 |
| Unit switched off due to alarm     | The unit is off by a serious alarm.                         |
| Unit switched off by BMS           | The unit is off by command from the BMS.                    |
| Unit switched off by time band     | The unit is off by the scheduler.                           |
| Unit switched off by digital input | The unit is off due to contacts across 17 and 18 open.      |
| Unit switched off by local keypad  | The unit is off by the setting on the menu screen.          |
| Exhaust Fan Only Mode              | The unit is in single fan mode with exhaust fan running.    |
| Supply Fan Only Mode               | The unit is in single fan mode with supply fan running.     |
| Unoccupied Mode                    | The unit is set to unoccupied mode.                         |
| Cool Locked Out by BMS             | A BMS command has the cooling locked out.                   |
| Heat Locked Out by BMS             | A BMS command has the heating locked out.                   |
| Device Test                        | The system is in device test mode for more than an hour.    |
| Sens Ovrdr Active                  | The system has a sensor overwritten for more than 24 hours. |
| Frost Control Active               | The system is in frost control mode.                        |

The third screen shows:

- Whether the unit is enabled. (See *Unit Status Conditions* in the first screen to assess why the unit is not on).
- Whether the OA and RA dampers are open—they should be open if the unit is ON and in occupied mode, if applicable.
- The status of the bypass damper which is used for economizer and frost control, if the features are enabled.
- Whether the recirculation damper is present. This was set in *Unit Configuration*. This damper is optional, used for unoccupied operation.

| UNIT STATUS    |      |
|----------------|------|
| Unit Enabled   | YES  |
| OA Damper Open | YES  |
| RA Damper Open | YES  |
| Bypass Command | 0.0% |
| Recirc Enabled | NO   |

## 12.4 FIELD-INSTALLED SENSOR SCREENS

If the CO<sub>2</sub>/VOC and/or duct pressure sensors were enabled and installed, their value and setpoint are shown here.

| UNIT STATUS                |         |
|----------------------------|---------|
| CO <sub>2</sub> /VOC Level | 402 PPM |
| Alarm Level                | 1000PPM |

| Unit Status   |         |
|---------------|---------|
| Duct Pressure | 0.00"wg |
| Setpoint      | 0.00"wg |

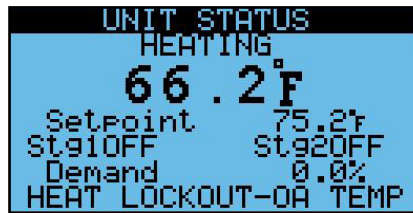
### 12.5 TEMPERING SCREENS

Depending upon whether dehumidification, heating, or cooling are enabled for the unit, and depending upon which type is used, the screens here will vary.

#### 12.5.1 Heating Screens

Each screen tells

- Heating type in use
- Control Variable (unit supply or return air)
- Current Setpoint (or OA reset value)
- Status of outputs for that heat type
- Heating Status



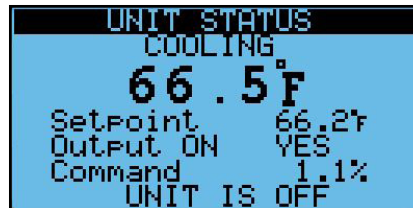
The heating status values are shown. Multiple values may be true.

| MESSAGE               | MEANING   |
|-----------------------|---|
| Heat Locked Out by OA | The heating OA lockout is higher than the OA temperature. |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).            |
| Unocc Heat            | Unit is in unoccupied heating.                            |
| Heat on for reheat    | Heat on for reheating in dehumidification mode.           |
| Dehumid Mode          | Unit is in dehumidification mode.                         |
| Unit OFF              | Unit is off.  |

#### 12.5.2 Cooling Screens

If in dehumidification, this screen will reflect the cooling used for dehumidification. Each screen tells:

- Control Variable (unit supply or return air for cooling, or coil LAT for dehumidification)
- Current Setpoint
- Status of outputs for that cooling type
- Cooling Status



The cooling status values are shown. Multiple values may be true.

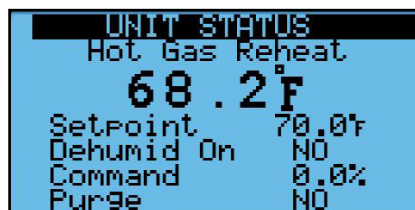
| MESSAGE               | MEANING   |
|-----------------------|---|
| Cool Locked Out by OA | The cooling OA lockout is lower than the OA temperature.  |
| Unocc Mode            | Unit is in unoccupied mode (BMS or scheduler).  |
| Unocc Cool            | Unit is in unoccupied cooling.  |
| Unocc Heat            | Unit is in unoccupied heating.  |
| Lockout Overlap       | The OA lockouts for heating and cooling overlap. (No vent mode).<br>The heating takes preference. |
| Dehumid Mode          | Unit is in dehumidification mode.   |
| Econ Only             | If economizer is open less than 100%.   |
| Econ Mode             | If in economizer mode.  |
| Unit OFF              | Unit is off.  |

Additional messages for packaged cooling:

| MESSAGE                  | MEANING   |
|--------------------------|---|
| Unit OFF                 | Unit is off.  |
| Ref Unit off Locally     | The refrigeration controller is turned off at the local keypad.             |
| Serious Alarm Ref Unit   | The refrigeration unit is off due to a serious alarm.                       |
| Stage 1 off due to timer | Stage 1 compressor is off for minimum off time.                             |
| Stage 1 Start up         | Stage 1 compressor in start up; running at start up speed.                  |
| Interstage delay         | Compressor off due to interstage delay.                                     |
| Stage 2 on due to timer  | Stage 2 compressor is on for minimum on time.                               |
| Stage 2 off due to timer | Stage 2 compressor is off for minimum off time.                             |
| Stage 1 shutdown         | Stage 1 compressor shutting down; running at minimum speed.                 |
| Min Demand Timer         | Low demand for stage 1 compressor. After a while it will start to shutdown. |

Screen showing dehumidification reheat information, HGRH or heat, including

- CA Temperature
- Reheat setpoint
- Whether dehumidification mode is "ON"
- Command for reheat or valve



| UNIT STATUS    |        |
|----------------|--------|
| Hot Gas Reheat |        |
| 68.2°F         |        |
| Setpoint       | 70.0°F |
| Dehumid On     | NO     |
| Command        | 0.0%   |
| Purge          | NO     |

Screen showing dehumidification information, if enabled, including

- Dew point (return air or outdoor air) used for determining mode
- Conditions for mode
- Whether dehumidification mode is “ON”

```

UNIT STATUS
Dewpoint
59.1°F
Dehum On Above 61.7°F
Dehum Off Below 60.0°F
Dehumid On NO
  
```

Screen showing economizer information, if enabled, including

- Cooling control value
- Cooling setpoint
- Whether economizer is active
- The economizer damper command
- Cooling status

```

UNIT STATUS
Economizer
68.3°F
Setpoint 66.2°F
Active NO
Command 0.0%
UNIT IS OFF
  
```

## 12.6 FROST CONTROL INFORMATION

This screen contains all frost control information.

```

UNIT STATUS
FROST CONTROL
Active NO
EA Actual 73.7°F
EA Setpoint 35.1°F
Damper Command 0.0%
OA Actual 74.9°F
OA Low Limit 5.0°F
  
```

## 12.7 ENTRY TO THE I/O INFORMATION SCREEN

This screen is described in *Verifying all I/O through Unit Status Screens*.

```

UNIT STATUS

Press ENTER for more
I/O Info
  
```

## 12.8 VERSION INFORMATION SCREEN

This screen contains:

- Type of application
- Version of program (SW) and operating system (OS)
- Unique controller identifier

```

UNIT STATUS
*RenewAire DOAS*
Code:DOAS_Main
SW ver.: 3.0.022
OS ver.: 4.8.003
UID: 0002000000004001
  
```

## 13.0 BMS ACCESS

The BMS settings are located in the *General Settings* after the scheduler. To get to that menu press the back button until it shows up.

### 13.1 SETTING CONTROL LEVEL

The first screen sets whether the unit will get an on/off command from the BMS. If you set this to Yes right away, the unit will not start until the BMS command is sent. Therefore, do not set this to Yes until you are ready to operate the unit.

Background: The unit will not turn on unless all of the following are true. As a result, any one can turn the unit off.

- There are no serious alarms.
- The Digital Input for start/stop (terminals 17 and 18) are closed.
- The unit is turned on at the keypad.
- The time is within the scheduler "ON" time, if scheduler enabled.
- The BMS has written the unit on signal, if BMS control is enabled.

```

GENERAL SETTINGS
Enable BMS Cntrl?
NO
This is for on/off
control and single
fan mode.
  
```

### 13.2 SETTING BMS TYPE

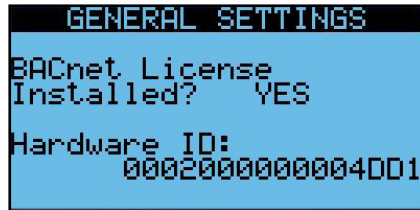
There are either three or five setting for BMS Type. The BACnet options will not show up unless a BACnet license has been installed.

- None
- BACnet MS/TP
- BACnet IP
- Modbus RTU
- Modbus IP

```

GENERAL SETTINGS
Protocol Type:
BACnet MS/TP
BMS Unit of Measure:
USA
  
```

The license status can be viewed in a later screen. Refer to *Adding a BACnet License* for more information.



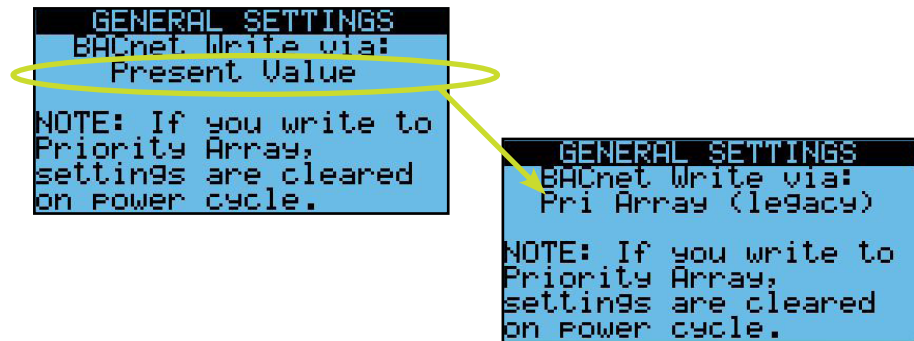
Once a protocol has been selected, additional BMS programming screens will appear. Change settings as needed. After the BMS protocol has been selected and protocol options have been selected, cycle power to the controller.

### 13.3 BACNET

RenewAire units are BTL listed by CAREL. They allow the BMS to write to the present value by default. This means that if the BMS writes to a setpoint that setpoint can be changed by the local HMI display. (Last one in wins). Priority array is not supported.

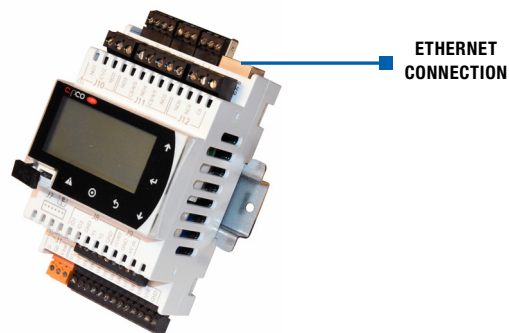
Setpoints, in general, are saved in EEPROM memory and maintained on power loss. These are referred to as RETAINED. For retained values, DO NOT write to these values constantly. Doing so will flag an alarm and can damage the controller. If you have a need to write to a value constantly, contact TSS to discuss options.

Older units wrote to the priority array. This was cumbersome to support. They also had limited mapping. If upgrading from an older version and you want to keep that mapping, change the setting below to "Pri Array legacy." The mapping is quite different and is supported in the older documentation. Also note that priority array setpoints were not kept on power loss.



#### 13.3.1 BACnet IP Connection

Connection of BACnet IP requires a physical cable connection to the RJ45 jack on the controller. Prior to making the wiring connections, the controller is to be tested to verify proper control of the DOAS unit under local control.



### 13.3.2 BACnet IP Settings

First, set the IP address of the controller in the same *General Settings* area.

- Set DHCP to Off if static.
- If Static, set the IP, mask, and gateway if required.
- *Set Update?* To Yes (power will need to be cycled. This can be done after all of the other settings.)

```

GENERAL SETTINGS
IP Address
DHCP: Off
IP: 10.10.1.2
MASK: 255.255.255.0
GW: 0.0.0.0
DNS: 0.0.0.0
Update? No
  
```

Next, set the BACnet Device ID. This screen allows you to set the ID digit by digit.

```

GENERAL SETTINGS
BACnet IP Settings
Device ID: 5002
Port: 47808
  
```

Last, set the BACnet port if different from the 47808 (BAC0). This screen allows you to set the BACnet Device ID scrolling up or down.

```

GENERAL SETTINGS
BACnet IP Settings
Device ID: 5002
Port: 47808
  
```

If you need to set the timing values, you can do that here.

```

GENERAL SETTINGS
BACnet IP Advanced
Timeout: 3000ms
Cmd Timeout: 1500ms
Error: 1
Error Status:
OFFLINE
  
```

### 13.3.3 BACnet MSTP Settings

First, set the BACnet Device ID. This screen allows you to set the ID digit by digit.

```

GENERAL SETTINGS
BACnet
Device ID: 0005002

ENTER A VALUE
0 - 4194302
  
```



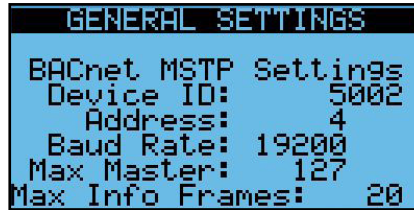
NOTE: The controller will only support private IP addresses which start with 192, 172, or 10.



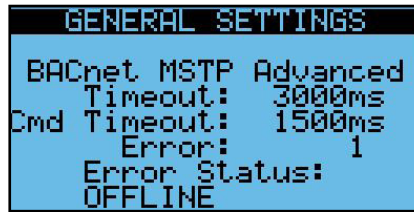
NOTE: Whenever the BMS type is changed, power to the controller must be cycled.



Next, set the BACnet MSTP Address, Baud rate, Max Master and Max Info frames as needed.



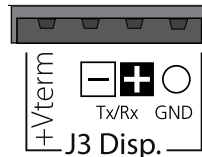
If you need to set the timing values, you can do that here.



13.3.4 BACnet MSTP Wiring

The BACnet MSTP network is wired into the four-pin connector named J3 Disp. In the upper left-hand corner of the controller. This is also used for a RUT display so the two cannot be used at the same time. For MSTP, use the plus (+) and minus (-), as well as the GND for reference if desired.

DO NOT use the +Vterm terminal. If you happen to plus a three-pin block in here and use the wrong three pins you might damage the port.



13.4 BACNET OBJECT LIST

| TYPE         | INSTANCE | VARIABLE NAME             | DESCRIPTION                       | VALUE RANGE | READ/WRITE (RET) |
|--------------|----------|---------------------------|-----------------------------------|-------------|------------------|
| Analog Input | 0        | OA_Temp.Val               | OA Temperature                    | F           | Read_NoWrite     |
| Analog Input | 1        | OA_Hum.Val                | OA Relative Humidity              | %           | Read_NoWrite     |
| Analog Input | 2        | RA_Temp.Val               | RA Temperature                    | F           | Read_NoWrite     |
| Analog Input | 3        | RA_Hum.Val                | RA Relative Humidity              | %           | Read_NoWrite     |
| Analog Input | 4        | EA_Temp.Val               | EA Temperature                    | F           | Read_NoWrite     |
| Analog Input | 5        | SA_Temp.Val               | SA Temperature (before tempering) | F           | Read_NoWrite     |
| Analog Input | 6        | OA_Flow_Rate.Val          | OA Flow Rate                      | CFM         | Read_NoWrite     |
| Analog Input | 7        | EA_Flow_Rate.Val          | EA Flow Rate                      | CFM         | Read_NoWrite     |
| Analog Input | 8        | Heating.HTG_SetP_Adjusted | Acting heating setpoint           | F           | Read_NoWrite     |
| Analog Input | 24       | RA_Flt_Press.Val          | RA Filter Pressure                | iwc         | Read_NoWrite     |
| Analog Input | 25       | OA_Flt_Press.Val          | OA Filter Pressure                | iwc         | Read_NoWrite     |

| TYPE         | INSTANCE | VARIABLE NAME                     | DESCRIPTION   | VALUE RANGE | READ/WRITE (RET)   |
|--------------|----------|-----------------------------------|---|-------------|--------------------|
| Analog Input | 26       | SF_Command.Val                    | Supply Fan Command (actual)                         | %           | Read_NoWrite       |
| Analog Input | 27       | EF_Command.Val                    | Exhaust Fan Command (actual)                        | %           | Read_NoWrite       |
| Analog Input | 28       | CO2_VOC_Level.Val                 | CO2 or VOC Level                                    | PPM         | Read_NoWrite       |
| Analog Input | 29       | Cooling_LAT.Val                   | Cooling Coil Leaving Air Temperature                | F           | Read_NoWrite       |
| Analog Input | 31       | Duct_Press.Val                    | Duct Pressure                                       | iwc         | Read_NoWrite       |
| Analog Input | 32       | CA_Temp.Val                       | CA Temperature (after tempering)                    | F           | Read_NoWrite       |
| Analog Input | 33       | Cooling_Command.Val               | Cooling Command                                     | %           | Read_NoWrite       |
| Analog Input | 34       | Heating_Command.Val               | Heating Command from Program                        | %           | Read_NoWrite       |
| Analog Input | 59       | Bypass_Command.Val                | Bypass Damper Command                               | %           | Read_NoWrite       |
| Analog Input | 62       | HGRH_Command.Val                  | HGRH Valve Command                                  | %           | Read_NoWrite       |
| Analog Value | 34       | HeatingCommand_BMS                | Heating Command from BMS                            | %           | Read_Writeable     |
| Analog Value | 35       | RA_Flt_AlarmHigh                  | RA Filter Alarm Level                               | iwc         | Read_Writeable (X) |
| Analog Value | 36       | OA_Flt_AlarmHigh                  | OA Filter Alarm Level                               | iwc         | Read_Writeable (X) |
| Analog Value | 37       | SF_ConstSpeedSetP.Val             | SF Const Speed Setpoint                             | %           | Read_Writeable (X) |
| Analog Value | 38       | SF_FlowControlSetP.Val            | SF Flow Control Setpoint                            | CFM         | Read_Writeable (X) |
| Analog Value | 39       | SF_DuctStaticSetP.Val             | SF Duct Static Pressure Setpoint                    | iwc         | Read_Writeable (X) |
| Analog Value | 41       | SF_CO2_VOCSetP.Val                | SF CO2 or VOC Setpoint                              | PPM         | Read_Writeable (X) |
| Analog Value | 43       | EF_ConstSpeedSetP.Val             | EF Constant Speed Setpoint                          | %           | Read_Writeable (X) |
| Analog Value | 44       | EF_FlowControlSetP.Val            | EF Flow Control Setpoint                            | CFM         | Read_Writeable (X) |
| Analog Value | 45       | EF_SF_TrackingSetP.Val            | EF SF Tracking Setpoint                             | %           | Read_Writeable (X) |
| Analog Value | 46       | EF_ReturnStaticSetP.Val           | EF Return Static Setpoint                           | iwc         | Read_Writeable (X) |
| Analog Value | 47       | CoolLockoutTemp                   | OA Cooling Lockout Temperature                      | F           | Read_Writeable (X) |
| Analog Value | 48       | HeatLockoutTemp                   | OA Heating Lockout Temperature                      | F           | Read_Writeable (X) |
| Analog Value | 50       | Econ_Temp_Diff                    | Economizer Temperature Differential                 | F           | Read_Writeable (X) |
| Analog Value | 51       | Economizer.Econ_Low_OA_Temp_Limit | Economizer Low OA Temp Limit                        | F           | Read_Writeable (X) |
| Analog Value | 52       | Economizer.Econ_Hysteresis        | Economizer Hysteresis                               | Btu/lb      | Read_Writeable (X) |
| Analog Value | 53       | BMS_CO2_VOC_Reading               | BMS CO2 or VOC Reading (in lieu of attached sensor) | PPM         | Read_Writeable     |

| TYPE         | INSTANCE | VARIABLE NAME                     | DESCRIPTION                                      | VALUE RANGE   | READ/WRITE (RET)   |
|--------------|----------|-----------------------------------|--|---------------|--------------------|
| Analog Value | 54       | HGRH_Coil_LAT_Setp.Val            | Coil LAT Setpoint for dehumidification           | F             | Read_Writeable (X) |
| Analog Value | 55       | Occ_HTG_Setp.Val                  | Occupied Heating Setpoint                        | F             | Read_Writeable (X) |
| Analog Value | 56       | Occ_CLG_Setp.Val                  | Occupied Cooling Setpoint                        | F             | Read_Writeable (X) |
| Analog Value | 57       | HGRH_Unit_LAT_Setp.Val            | Dehumidification Reheat Setpoint                 | F             | Read_Writeable (X) |
| Analog Value | 58       | Economizer.Econ_Low_RA_Temp_Limit | Economizer.Econ_Low_RA_Temp_Limit                | F             | Read_Writeable (X) |
| Analog Value | 59       | SF_CO2_VOCFlowMinCO2.Val          | SF Flow: MinCO2                                  | PPM           | Read_Writeable (X) |
| Analog Value | 60       | SF_CO2_VOCFlowMaxCO2.Val          | SF Flow: Max CO2                                 | PPM           | Read_Writeable (X) |
| Analog Value | 61       | SF_CO2_VOCFlowMinFlow.Val         | SF Flow: Min Flow                                | CFM           | Read_Writeable (X) |
| Analog Value | 62       | SF_CO2_VOCFlowMaxFlow.Val         | SF Flow: Max Flow                                | CFM           | Read_Writeable (X) |
| Analog Value | 64       | SF_UnoccFlowSetP.Val              | SF Unoccupied Flow Setpoint                      | CFM           | Read_Writeable (X) |
| Analog Value | 66       | Unocc_CLG_Setp.Val                | Unoccupied Cooling Setpoint                      | F             | Read_Writeable (X) |
| Analog Value | 71       | Unocc_HTG_Setp.Val                | Unoccupied Heating Setpoint                      | F             | Read_Writeable (X) |
| Analog Value | 73       | Dehumid_Changeover_SetP.Val       | Dehumidification Changeover Setpoint             | F (dew point) | Read_Writeable (X) |
| Analog Value | 77       | Defrost_OA_SetP.Val               | Frost control OA Setpoint Low Limit              | F             | Read_Writeable (X) |
| Analog Value | 78       | Defrost_OA_SetP.DBRight           | Frost control OA Setpoint Low Limit Differential | F             | Read_Writeable (X) |
| Analog Value | 79       | Defrost_EA_High_SetP.Val          | Frost control EA High Limit Setpoint             | F             | Read_Writeable (X) |
| Binary Input | 8        | OA_Damp.Val                       | OA Damper Command                                | Closed/Open   | Read_NoWrite       |
| Binary Input | 9        | RA_Damp.Val                       | RA Damper Command                                | Closed/Open   | Read_NoWrite       |
| Binary Input | 13       | Tempering_Mode.Val                | Tempering Mode                                   | Heat/Cool     | Read_NoWrite       |
| Binary Input | 14       | AlarmMng.AlmRes                   | Alarm Reset Status                               | No/Yes        | Read_NoWrite       |
| Binary Input | 15       | SF_Status.Val                     | SF Status from Current Sensor                    | Off/On        | Read_NoWrite       |
| Binary Input | 16       | EF_Status.Val                     | EF Status from Current Sensor                    | Off/On        | Read_NoWrite       |
| Binary Input | 17       | Alarm_Out.Val                     | Serious Alarm (Also a physical output)           | OK/Alarm      | Read_NoWrite       |
| Binary Input | 18       | Heating_Enable_1.Val              | Heating Stage 1                                  | Off/On        | Read_NoWrite       |
| Binary Input | 19       | Cooling_Stage_1.Val               | Cooling Stage 1                                  | Off/On        | Read_NoWrite       |
| Binary Input | 20       | Cooling_Stage_2.Val               | Cooling Stage 2                                  | Off/On        | Read_NoWrite       |

| TYPE         | INSTANCE | VARIABLE NAME               | DESCRIPTION                                  | VALUE RANGE | READ/WRITE (RET) |
|--------------|----------|-----------------------------|--|-------------|------------------|
| Binary Input | 21       | DOAS_UnitOn                 | DOAS Unit On Status                          | Off/On      | Read_NoWrite     |
| Binary Input | 22       | OfflineAlarm_CPCOE_1.Active | Offline Alarm expansion module               | OK/Alarm    | Read_NoWrite     |
| Binary Input | 23       | OfflineDOAStoREF.Active     | Offline DOAS to Refrigeration Controller     | OK/Alarm    | Read_NoWrite     |
| Binary Input | 24       | AI_SupplyFan.Active         | Supply Fan Start Alarm                       | OK/Alarm    | Read_NoWrite     |
| Binary Input | 25       | AI_ExhaustFan.Active        | Exhaust Fan Start Alarm                      | OK/Alarm    | Read_NoWrite     |
| Binary Input | 49       | Recirc_Damp.Val             | Recirculation Damper Command                 | Close/Open  | Read_NoWrite     |
| Binary Input | 57       | Heating_Enable_2.Val        | Heating Stage 2                              | Off/On      | Read_NoWrite     |
| Binary Input | 60       | Econ_Active                 | Economizer Active?                           | No/Yes      | Read_NoWrite     |
| Binary Input | 61       | DehumidMode_On              | Dehumidification Mode On?                    | No/Yes      | Read_NoWrite     |
| Binary Input | 67       | Unocc_Mode                  | Unoccupied Mode Status                       | Occ/Unocc   | Read_NoWrite     |
| Binary Input | 68       | Unocc_HTG                   | Unoccupied Heating Status                    | Off/On      | Read_NoWrite     |
| Binary Input | 69       | Unocc_CLG                   | Unoccupied Cooling Status                    | Off/On      | Read_NoWrite     |
| Binary Input | 70       | DefrostOn                   | Frost control On Status                      | Off/On      | Read_NoWrite     |
| Binary Input | 72       | Any_Alarm_Out.Val           | Any Alarm is True Status                     | OK/Alarm    | Read_NoWrite     |
| Binary Input | 499      | SeriousAlarm_RefUnit        | Alarm in Refrigeration Unit                  | OK/Alarm    | Read_NoWrite     |
| Binary Input | 500      | AI_retain.Active            | Too Many Writes to Retained Memory           | OK/Alarm    | Read_NoWrite     |
| Binary Input | 501      | AI_Err_retain_write.Active  | Too Many Writes to Retained Memory           | OK/Alarm    | Read_NoWrite     |
| Binary Input | 502      | AI_Device_Test.Active       | Unit Was Left In Device Test Mode            | OK/Alarm    | Read_NoWrite     |
| Binary Input | 503      | AI_BMS_Offline.Active       | BMS Is Offline                               | OK/Alarm    | Read_NoWrite     |
| Binary Input | 504      | OfflineAlarm_CPCOE_1.Active | Offline Alarm Expansion Module               | OK/Alarm    | Read_NoWrite     |
| Binary Input | 505      | CfgErrAlarm_CPCOE_1.Active  | Expansion Module Config Error                | OK/Alarm    | Read_NoWrite     |
| Binary Input | 506      | OfflineDOAStoREF.Active     | Offline DOAS to Refrigeration Controller     | OK/Alarm    | Read_NoWrite     |
| Binary Input | 507      | OfflineReftoInv.Active      | Offline Refrigeration Controller to Inverter | OK/Alarm    | Read_NoWrite     |
| Binary Input | 508      | AI_Smoke.Active             | Smoke Alarm Input Engaged                    | OK/Alarm    | Read_NoWrite     |
| Binary Input | 509      | AI_Freeze.Active            | Freezestat Alarm Input Engaged               | OK/Alarm    | Read_NoWrite     |
| Binary Input | 510      | AI_SupplyFan.Active         | Supply Fan Start Alarm                       | OK/Alarm    | Read_NoWrite     |
| Binary Input | 511      | AI_ExhaustFan.Active        | Exhaust Fan Start Alarm                      | OK/Alarm    | Read_NoWrite     |

| TYPE         | INSTANCE | VARIABLE NAME                   | DESCRIPTION   | VALUE RANGE | READ/WRITE (RET) |
|--------------|----------|---------------------------------|---|-------------|------------------|
| Binary Input | 512      | AI_SA_Airflow.Active            | Supply Airflow Out of Tolerance Alarm                 | OK/Alarm    | Read_NoWrite     |
| Binary Input | 513      | AI_EA_Airflow.Active            | Exhaust Airflow Out of Tolerance Alarm                | OK/Alarm    | Read_NoWrite     |
| Binary Input | 514      | AI_SA_StaticPress.Active        | SA Static Pressure Level Alarm                        | OK/Alarm    | Read_NoWrite     |
| Binary Input | 515      | AI_CO2.Active                   | CO2 Level Alarm                                       | OK/Alarm    | Read_NoWrite     |
| Binary Input | 516      | AI_SupAir_Low_Temp_Warn.Active  | Supply Air Low Temperature Warning                    | OK/Alarm    | Read_NoWrite     |
| Binary Input | 517      | AI_SupAir_Low_Temp_Alarm.Active | Supply Air Low Temperature Alarm                      | OK/Alarm    | Read_NoWrite     |
| Binary Input | 518      | AI_SupAir_Hi_Temp_Warn.Active   | Supply Air High Temperature Warning                   | OK/Alarm    | Read_NoWrite     |
| Binary Input | 519      | AI_SupAir_Hi_Temp_Alarm.Active  | Supply Air High Temperature Alarm                     | OK/Alarm    | Read_NoWrite     |
| Binary Input | 521      | AI_EA_StaticPress.Active        | EA Static Pressure Level Alarm                        | OK/Alarm    | Read_NoWrite     |
| Binary Input | 530      | AI_OA_Temp_Prb.Active           | OA Temperature Sensor Open or Short                   | OK/Alarm    | Read_NoWrite     |
| Binary Input | 531      | AI_OA_Hum_Prb.Active            | OA Relative Humidity Transmitter Out of Range         | OK/Alarm    | Read_NoWrite     |
| Binary Input | 532      | AI_RA_Temp_Prb.Active           | RA Temperature Sensor Open or Short                   | OK/Alarm    | Read_NoWrite     |
| Binary Input | 533      | AI_RA_Hum_Prb.Active            | RA Relative Humidity Transmitter Out of Range         | OK/Alarm    | Read_NoWrite     |
| Binary Input | 534      | AI_SA_Temp_Prb.Active           | SA Temperature Sensor Open or Short                   | OK/Alarm    | Read_NoWrite     |
| Binary Input | 535      | AI_EA_Temp_Prb.Active           | EA Temperature Sensor Open or Short                   | OK/Alarm    | Read_NoWrite     |
| Binary Input | 536      | AI_OA_Flt_Press_Prb.Active      | OA Filter Pressure Transmitter Out of Range           | OK/Alarm    | Read_NoWrite     |
| Binary Input | 537      | AI_RA_Flt_Press_Prb.Active      | RA Filter Pressure Transmitter Out of Range           | OK/Alarm    | Read_NoWrite     |
| Binary Input | 538      | AI_OA_Flow_Rate_Prb.Active      | OA Flow Rate Pressure Transmitter Out of Range        | OK/Alarm    | Read_NoWrite     |
| Binary Input | 539      | AI_EA_Flow_Rate_Prb.Active      | EA Flow Rate Pressure Transmitter Out of Range        | OK/Alarm    | Read_NoWrite     |
| Binary Input | 540      | AI_CO2_Level_Prb.Active         | CO2 Level Transmitter Out of Range                    | OK/Alarm    | Read_NoWrite     |
| Binary Input | 541      | AI_Duct_Press_Prb.Active        | Duct Pressure Transmitter Out of Range                | OK/Alarm    | Read_NoWrite     |
| Binary Input | 542      | AI_Supply_Temp_Prb.Active       | Conditioned Air (CA) Temperature Sensor Open or Short | OK/Alarm    | Read_NoWrite     |
| Binary Input | 543      | AI_Coil_LAT_Prb.Active          | Coil LAT Sensor Open or Short                         | OK/Alarm    | Read_NoWrite     |
| Binary Input | 560      | AI_OA_Flt_Press.Active          | OA Filter Needs Change                                | OK/Alarm    | Read_NoWrite     |
| Binary Input | 561      | AI_RA_Flt_Press.Active          | RA Filter Needs Change                                | OK/Alarm    | Read_NoWrite     |

| TYPE             | INSTANCE   | VARIABLE NAME            | DESCRIPTION                  | VALUE RANGE | READ/WRITE (RET)   |
|------------------|------------|--------------------------|------------------------------|-------------|--------------------|
| Binary Input     | 562        | AI_UnitLife_DOAS.Active  | Unit Service Request         | OK/Alarm    | Read_NoWrite       |
| Binary Input     | 564        | AI_SupplyFanLife.Active  | Supply Fan Service Request   | OK/Alarm    | Read_NoWrite       |
| Binary Input     | 565        | AI_ExhaustFanLife.Active | Exhaust Fan Service Request  | OK/Alarm    | Read_NoWrite       |
| Binary Value     | 10         | OnOffUnitMng.BmsOnOff    | BMS On/Off Command           | Off/On      | Read_Writeable     |
| Binary Value     | 11         | OnOffUnitMng.BmsEfOnly   | BMS Exhaust Fan Only Command | Off/On      | Read_Writeable     |
| Binary Value     | 12         | AlarmMng.AlrmResByBms    | Alarm Reset BMS Command      | OK/Reset    | Read_Writeable     |
| Binary Value     | 60         | BMS_SetHeatCool          | BMS Set Heat/Cool Capability | No/Allow    | Read_Writeable (X) |
| Binary Value     | 61         | BMS_HeatCoolMode         | BMS Heat/Cool Mode Setting   | Heat/Cool   | Read_Writeable (X) |
| Binary Value     | 63         | OnOffUnitMng.BmsUnocc    | BMS Unoccupied Command       | Occ/Unocc   | Read_Writeable     |
| Binary Value     | 74         | BMS_HW_Valve_Control     | BMS HW Valve Control         | No/Allow    | Read_Writeable     |
| Binary Value     | 75         | Heating_Enable_1.Val     | Heating Stage 1 BMS Enable   | Off/On      | Read_Writeable     |
| MultiState Input | 2          | SF_ControlType_BN        | SF_ControlType_BN            | See Notes   | Read_NoWrite       |
| MultiState Input | 3          | EF_ControlType_BN        | EF_ControlType_BN            | See 13.5    | Read_NoWrite       |
| MultiState Input | 4          | HTG_ControlType_BN       | HTG_ControlType_BN           | See 13.5    | Read_NoWrite       |
| MultiState Input | 5          | CLG_ControlType_BN       | CLG_ControlType_BN           | See 13.5    | Read_NoWrite       |
| MultiState Input | 6          | Heating_SetPtType_BN     | Heating_SetPtType_BN         | See 13.5    | Read_NoWrite       |
| Multistate Input | 7          | UnitStatus_BN            | UnitStatus_BN                | See 13.5    | Read_NoWrite       |
| Multistate Input | 8See Notes | Cooling_SetPtType_BN     | Cooling_SetPtType_BN         | See 13.5    | Read_NoWrite       |

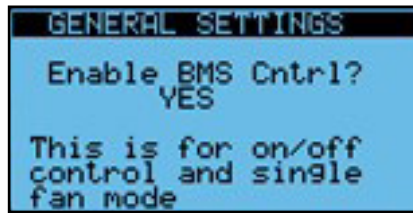
**13.5 BACNET APPLICATION NOTES**

13.5.1 Turning the Unit On and Off

If you plan to use the BMS to turn the unit on and off, make sure you have the control enabled through the keypad. Use Binary Value 10 “OnOffUnitMng.BmsOnOff.” The status can be read at “DOAS\_UnitOn” at Binary Input 21.

All of the following have to be true in order for the unit to be on:

- There are no serious alarms.
- The Digital Input for start/stop (terminals 17 and 18) are closed.
- The unit is turned on at the keypad.
- The time is within the scheduler “ON” time, if scheduler enabled.
- The BMS has written the unit on signal, if BMS control is enabled



| DOAS_UNITSTATUS_BN: MULTISTATE INPUT 2 |                      |   |
|--|----------------------|---|
| VALUE                                  | STATUS               | MEANING   |
| 1                                      | Constant Speed       | Value set as a percentage.  |
| 2                                      | Supply Air Flow      | Value set as flow (CFM).  |
| 3                                      | Duct Static Pressure | Value set to maintain a duct pressure. (Field-installed sensor required.)       |
| 4                                      | CO2/VOC              | Value set to maintain CO2 or VOC high limit. (Field-installed sensor required.) |
| 5                                      | CO2/VOC Flow         | Value set to vary CFM based on CO2 level. (Field-installed sensor required.)    |

| DOAS_UNITSTATUS_BN: MULTISTATE INPUT 3 |                             |   |
|--|-----------------------------|---|
| VALUE                                  | STATUS                      | MEANING   |
| 1                                      | Constant Speed              | Value set as a percentage.  |
| 2                                      | Exhaust Air Flow            | Value set as flow (CFM).  |
| 3                                      | SF Command Tracking         | Exhaust fan will run at a percentage of the SF percentage.                |
| 4                                      | SF Flow Tracking            | Exhaust fan will run at a CFM setpoint percentage of the SF CFM.          |
| 5                                      | Return Duct Static Pressure | Value set to maintain a duct pressure. (Field-installed sensor required.) |



| DOAS_UNITSTATUS_BN: MULTISTATE INPUT 4 |                     |  |
|--|---------------------|--|
| VALUE                                  | STATUS              | MEANING  |
| 1                                      | 0 to 10 VDC         | 0-10 VDC output for gas or electric heat (U10 exp). Digital output NO1 (exp) also active when over 0 volts.                                  |
| 2                                      | 10 to 0 VDC         | 10-0 VDC normally open output for hot water valve (U10 exp). Digital output NO1 (exp) also active when under 10 volts controlling.           |
| 3                                      | VRF                 | 0-10 VDC output for VRF (U9 exp). Digital output NO3 (exp) reflects heat/cool mode.  |
| 4                                      | Ht Pump 1 Stg       | Digital output NO4 (exp) for stage 1 heatpump. (Use NO1 (exp) if heater.)  |
| 5                                      | Ht Pump 2 Stg       | Digital output NO4 (exp) for stage 1 and NO5 (exp) for stage 2 heatpump. (Use NO1 (exp) and NO2 (exp) if heater.)                            |
| 6                                      | VRF & 0 to 10 V Mod | 0-10 VDC output for VRF (U9 exp). Digital output NO3(exp) reflects heat/cool mode. Additional 0-10 VDC output (U10 exp) for aux heat source. |
| 7                                      | dual temp coil      | 0-10 VDC output for valve (U9 exp). Digital output NO3 (exp) reflects heat/cool mode. BMS command tells whether heating or cooling.          |

| DOAS_UNITSTATUS_BN: MULTISTATE INPUT 5 |                       |  |
|--|-----------------------|--|
| VALUE                                  | STATUS                | MEANING  |
| 1                                      | 1 Stage               | Digital output NO4(exp) for one stage DX cooling.  |
| 2                                      | 2 Stage               | Digital output NO4(exp) and NO5(exp) for two-stage DX cooling.                                 |
| 3                                      | Cold Water Modulating | 0-10 VDC output for valve(U9 exp). Digital output NO4 (ex) will also engage when over 0 volts. |
| 4                                      | VRF                   | 0-10 VDC output (U9 exp). Digital output NO3(exp) reflects heat/cool mode.                     |
| 5                                      | PDX                   | Packaged DX cooling will communicate via Modbus to refrigeration controller.                   |

**DOAS\_UNITSTATUS\_BN: MULTISTATE INPUT 6**

| VALUE | STATUS                            | MEANING  |
|-------|-----------------------------------|--|
| 1     | Adjustable                        | Uses setpoint set on HMI or through Occ_CLG_Setp. Val (Analog Value 56).                       |
| 2     | Reset on OA Temperature           | Uses reset scheulde set on HMI.  |
| 3     | Trane Zone                        | Uses Trane Zone Sensor setpoint.   |
| 4     | Reset on Delta from Zone Setpoint | Resets the discharge (CA) temperature setpoint based on error from Trane Zone Sensor setpoint. |

**DOAS\_UNITSTATUS\_BN: MULTISTATE INPUT 7**

| VALUE | STATUS                                  | MEANING   |
|-------|---|---|
| 1     | Unit on                                 | The unit is on and running.                                 |
| 2     | Unit switched off due to alarm          | The unit is off by a serious alarm.                         |
| 3     | Unit switched off by BMS                | The unit is off by command from the BMS.                    |
| 4     | Unit switched off by time band          | The unit is off by the scheduler.                           |
| 5     | Unit switched off by digital input      | The unit is off due to contacts across 17 and 18 open.      |
| 6     | Unit switched off from the local keypad | The unit is off by the setting on the menu screen.          |
| 8     | Exhaust Fan Only Mode                   | The unit is in single fan mode with exhaust fan running.    |
| 9     | Supply Fan Only Mode                    | The unit is in single fan mode with supply fan running.     |
| 10    | Unoccupied Mode                         | The unit is set to unoccupied mode.                         |
| 11    | Cool Locked Out by BMS                  | A BMS command has the cooling locked out.                   |
| 12    | Heat Locked Out by BMS                  | A BMS command has the heating locked out.                   |
| 13    | Device Test                             | The system is in device test mode for more than an hour.    |
| 14    | Sens Ovrđ Active                        | The system has a sensor overwritten for more than 24 hours. |
| 15    | Off by CO2 Level                        | Off by CO2 Level.   |
| 16    | Frost Control On                        | Frost Control Mode Active.                                  |

| DOAS_UNITSTATUS_BN: MULTISTATE INPUT 8 |                                   |  |
|--|-----------------------------------|--|
| VALUE                                  | STATUS                            | MEANING  |
| 1                                      | Adjustable                        | Uses setpoint set on HMI or through Occ_CLG_Setp. Val (Analog Value 56).                       |
| 2                                      | Reset on RA Temperature           | Uses reset scheulde set on HMI.  |
| 3                                      | Trane Zone                        | Uses Trane Zone Sensor setpoint.   |
| 4                                      | Reset on Delta from Zone Setpoint | Resets the discharge (CA) temperature setpoint based on error from Trane Zone Sensor setpoint. |

### 13.5.2 Alarms

Individual alarms are mapped to Binary Inputs 500 and above. Two general alarms are available:

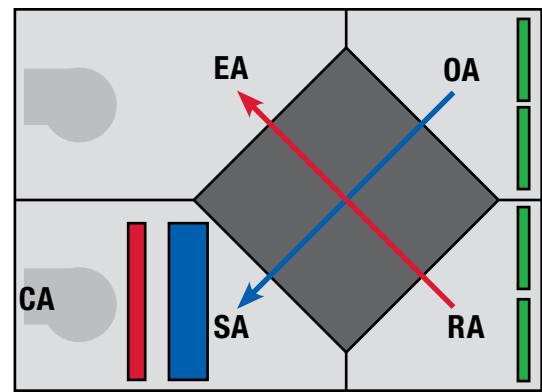
- Serious Alarm: Located at Binary Input 17, “Alarm\_Out.val” indicates whether there is a serious alarm that stops the unit.
- Any Alarm: Located at Binary Input 72, “Any\_Alarm\_Out.val” indicates whether there is any alarm present.

To reset the User Reset type alarms, set Binary Value 12 “AlarmMng.AlrmResByBMS” to true. The program will set it back to false. You can view the status change through Binary Input 14 “AlarmMng.AlrmRes.”

### 13.5.3 Temperature and Humidity Around the ERV

The following are available:

- Analog Input 0 “OA\_Temp.Val”
- Analog Input 1 “OA\_Hum.Val”
- Analog Input 2 “RA\_Temp.Val”
- Analog Input 3 “RA\_Hum.Val”
- Analog Input 4 “EA\_Temp.Val”
- Analog Input 5 “SA\_Temp.Val”

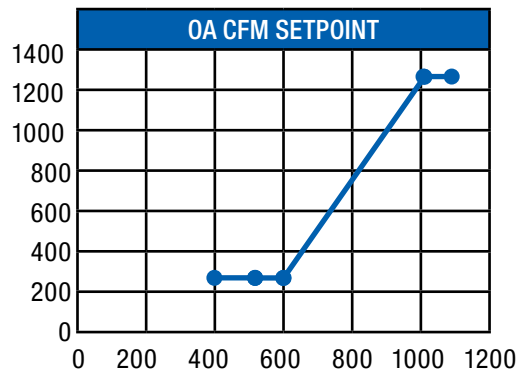


### 13.5.4 Fan Control

The supply fan control type method can be viewed at Multistate Input 2 “SF\_ControlType\_BN.” The valid values are 0 = Constant Speed, 1 = Supply Airflow, 2 = Duct Static Pressure, 3 = CO2/VOC, 4 = CO2/VOC Flow.

The corresponding settings are as follows:

- Constant Speed setpoint is Analog Value 37 “SF\_ConstantSpeedSetP.Val”
- Supply Airflow setpoint is Analog Value 38 “SF\_FlowControlSetP.Val”
- Duct Static setpoint is Analog Value 39 “SF\_DuctStaticSetP.Val”
- CO2/VOC setpoint is Analog Value 41 “SF\_CO2\_VOCSetP.Val”
- CO2/VOC Flow ramp set at Analog Values 59, 60, 61, and 62



The command to the fan is read at Analog Input 26 “SF\_Command.Val.” The feedback from the current sensor is read at Binary Input 15 “SF\_Status.Val.” The actual flow rate is viewed at Analog input 6 “OA\_Flow\_Rate.Val.”

The exhaust fan control type method can be viewed at Multistate Input 3 “EF\_ControlType\_BN.” The valid values are 1 = Constant Speed, 2 = Exhaust Airflow, 3 = SF Command Tracking, 3 = SF Flow Tracking, 4 = Return Static Pressure.

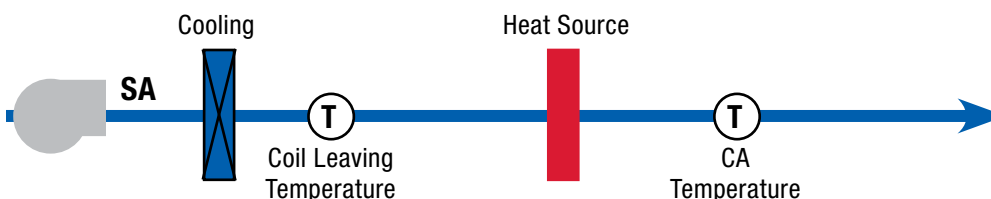
The corresponding settings are as follows:

- Constant Speed setpoint is Analog Value 43 “EF\_ConstantSpeedSetP.Val”
- Exhaust Airflow setpoint is Analog Value 44 “EF\_FlowControlSetP.Val”
- Exhaust Fan Tracking setpoint is Analog Value 45 “EF\_SF\_TrackingSetP.Val”
- Return Static setpoint is Analog Value 46 “EF\_ReturnStaticSetP.Val”

The command to the fan is read at Analog Input 27 “EF\_Command.Val.” The feedback from the current sensor is read at Binary Input 16 “EF\_Status.Val.” The actual flow rate is viewed at Analog input 7 “EA\_Flow\_Rate.Val.”

### 13.5.5 Tempering Control

The DN DOAS unit may provide heating and cooling/dehumidification if ordered as such. For heating and/or cooling, there will be a conditioned air temperature sensor which measured the air coming out of the unit as Analog Input 32 “CA\_Temp.Val.” For dehumidification with either hot gas reheat or reheat by a heat source, there will also be a coil leaving temperature sensor as Analog Input 29 “Cooling\_LAT.Val.”



### 13.5.5.1 Determining Tempering Mode

To determine the mode in which the unit is operating, the following values are considered:

- Analog Value 73 “Dehumid\_Chageover\_SetP.Val”
- Analog Value 48 “HeatLockoutTemp”
- Analog Value 47 “CoolLockoutTemp”

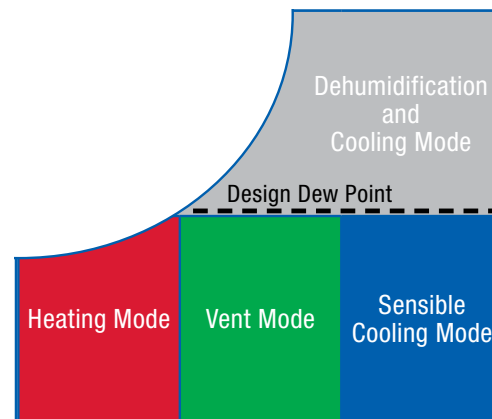
In addition, the BMS has the potential to use one more setting to determine whether the unit will lock out heating or cooling functions. This is required for the dual temp systems and may be useful for other situations. The Binary Value 60 “BMS\_SetHeatCool” must be true and then the mode is set through Binary Value 61 “BMS\_HeatCoolMode” where 0 =Heat and 1 = Cool. The BMS mode is shown for troubleshooting.

```

GENERAL SETTINGS
BMS Heat Cool Mode:
      NO
NOTE: If set to yes,
other mode will be
locked out.
Current Mode: Heat
  
```

See the following sections for more information on these modes. The mode is determined in this order:

1. Heating: Is the unit conFIGured for heating?  
Is the outdoor air temperature lower than the heating lockout temperature?
2. Dehumidification: Is the unit conFIGured for dehumidification? If so, is the unit in dehumidification mode?
3. Cooling: Is the unit conFIGured for cooling?  
Is the outdoor air temperature higher than the cooling lockout temperature?
4. If it in no other mode and the unit is on, it will be in Ventilation Mode.



The current Tempering Mode is viewed at Binary Input 13 “Tempering\_Mode.Val.” It is also an output used for VRF applications. The tempering mode will show heating when in heating or ventilation only mode, and cooling for cooling or dehumidification mode.

### 13.5.5.2 Heating Control

The heating control type is located at Multistate Input 4 “HTG\_ControlType\_BN.” The valid values are 1 = 0–10V, 2 = 10–0V, 3 = VRF, 4 = 1 stage, 5 = 2 stage, 6 = VRF+Mod, 7 = Dual Temp Coil. The setpoint is Analog Value 55 “Occ\_HTG\_SetP.Val” if adjustable setpoint is chosen. Otherwise the setpoint is based on an outdoor temperature schedule. The type is Multistate Input 6 “Heating\_SetPtType\_BN,” where 1 = Adjust and 2 = OA Reset. The acting setpoint is Analog Input 8 “HTG\_SetP\_Adjusted.”

The heating output statuses are the following:

- Binary Input 18 “Heating\_Enable\_1.Val” for stage one or modulating types where the demand is greater than 0
- Binary Input 57 “Heating\_Enable\_2.Val” for stage two
- Analog Input 34 “Heating\_Command.Val” shows a percentage for the 0–10V output.

It is also possible for the BMS to take over total control of the 10–0V hot water valve signal out to the controlled valve and heating output directly for special cases. All setpoints, etc. will be ignored in this case. To do this, set the heating setting “Valve Control” to BMS on the screen, or through Binary Value 74 “BMS\_HW\_Valve\_Control.”



Then control the valve through

- Analog Value 34 “HeatingCommand\_BMS” to set a value for the 0–10V output, where 0 is 0V and 100 is 10V.
- Binary Value 75 “Heating\_Enable\_1.Val” can also be controlled directly if needed.

### 13.5.5.3 Cooling Control

The cooling control type is located at Multistate Input 5 “CLG\_ControlType\_BN.” The valid values are 1 = 1 Stage, 2 = 2 Stage, 3 = Cold Water Modulating, 4 = VRF, 5 = PDX. The setpoint is Analog Value 56 “Occ\_CLG\_SetP.Val.”

The cooling output statuses are the following:

- Binary Input 19 “Cooling\_Enable\_1.Val” for stage one or modulating types where the demand is greater than 0
- Binary Input 20 “Cooling\_Enable\_2.Val” for stage two
- Analog Input 33 “Cooling\_Command.Val” shows a percentage for the 0–10V output.

### 13.5.5.4 Dehumidification Control

- If the cooling is currently being used for dehumidification, Binary Input 61 “DehumidificationMode\_ON” will be true.
- Analog Value 54 “HGRH\_Coil\_LAT\_Setp.Val” is the setpoint for dehumidification by cooling. The actual value is shown in Analog Input 29 “Cooling\_LAT.Val” is the temperature coming off the coil, if using reheat.
- The unit will reheat to Analog Value 57 “HGRH\_Unit\_LAT\_Setp.Val” if reheating.
- Analog Input 62 “HGRH\_Command.Val” will show the command for HGRH. If used.



#### 13.5.5.5 Economizer Control

The economizer will be enabled when there is a call for cooling and the outdoor is more favorable than the return air. In this case it will modulate the bypass damper to bypass the enthalpic core and thus limit or inhibit the exchange of energy. The mechanical cooling is not allowed until the bypass is open 100%. During this time the unit still uses 100% outdoor air.

Economizing is allowed when both of the following are below their limit:

- Analog Value 52 “Economizer.Econ\_Low\_OA\_Temp\_Limit”
- Analog Value 58 “Economizer.Econ\_Low\_RA\_Temp\_Limit”

The damper will modulate using PI Control set in the controller when the OA is less than the difference value specified as follows:

- If using the temperature economizer type, the value used is Analog Value 51 “Econ\_Temp\_Diff”
- If using the enthalpy economizer type, the value used is Analog Value 53 “Economizer.Econ\_Hysteresis”

You can view the status through Binary Input 60 “Econ\_Active” to see if the economizer is active. The bypass damper position is viewed at Analog Input 59 “Bypass\_Command.Val.”

#### 13.5.5.6 Unoccupied Control

If optional recirculation dampers are present, the unit will operate in unoccupied mode according to the following settings:

- Binary Value 63 “OnOffUnitMng.BMSUnocc” allows you to put the unit in unoccupied mode.
- The supply fan will either run continuous or on a call for heat or cooling as set in the controller. It will run at a speed set in Analog Value 64 “SF\_UnoccFlowSetP.Val.”
- It will maintain the Analog Value 66 “Unocc\_CLG\_SetP.Val” and Analog Value 71 “Unocc\_HTG\_SetP.Val.”
- The status of the recirculation damper is seen at Binary Input 49 “Recirc\_Damp.Val.”
- The unoccupied statuses can be viewed in Binary Input “67 “Unocc\_Mode,” Binary Input “68 “Unocc\_HTG,” and Binary Input “69 “Unocc\_CLG.”

#### 13.5.6 Frost Control

The frost control function utilizes the bypass to avoid frosting the enthalpic core. If bypass is enabled, when the OA is lower than Analog Value 77 “Defrost\_OA\_SetP.Val” minus Analog Value 78 “Defrost\_OA\_SetP.DBright,” and turns off again when the OA exceeds the AV77. The frost control status can be viewed at Binary Input 70 “DefrostOn.”

When frost control is on, the bypass damper will modulate to maintain a maximum Analog Value 79 “Defrost\_EA\_High\_SetP.Val.” The bypass damper position is viewed at Analog Input 59 “Bypass\_Command.Val.”

#### 13.5.7 Filter Monitoring

Filter pressures are read through Analog Input 24 “RA\_Flt\_Press.Val” and Analog Input 25 “OA\_Flt\_Press.Val.”

Filter alarm levels are set at Analog Value 35 “RA\_Flt\_AlarmHigh” and Analog Value 36 “OA\_Flt\_AlarmHigh.”

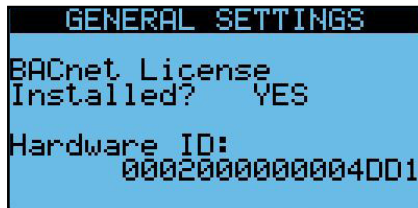
#### 13.5.8 Exhaust Fan Only Mode

If BMS control is enabled, the unit can also be put in exhaust fan only mode in occupied operation using Binary Value 74 “UnitOnOffMng.BMSEFOnly.”

## 13.6 ADDING A BACNET LICENSE

### 13.6.1 Obtaining a BACnet License

If your controller does not have a BACnet license, contact whoever provided the unit to obtain one. You will need the Hardware ID number on this screen when ordering. Be sure to copy it carefully or the license will not work.



The license will be delivered as a file with extension “.ap1.”

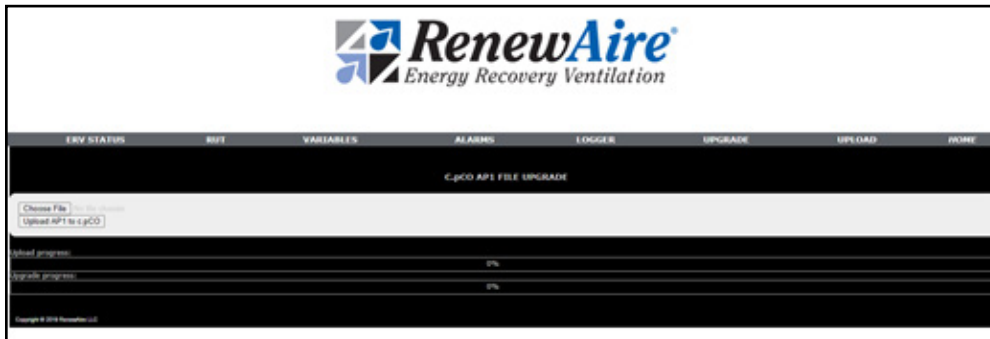
### 13.6.2 Installing the BACnet License via Web Page

#### Prerequisites

- Have ap1 BACnet upgrade file(s) located on your PC
- Ethernet connection from the PC to the controller and view the web page

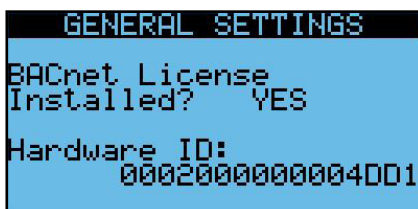
#### Steps

1. Go to the Upgrade Tab in the web pages.



2. Click on “Choose File” and locate the file on your PC that corresponds to the controller.  
HINT: The ending character in the UID of the controller should match the character of the ap1 file. Click “OPEN.”
3. You should now see that file name next to “Choose File.” Click “Upload AP1 to c.pco.” You will see the file upload.
4. On the controller the program will see the file and require you to push “ENTER.” You can see that on the front of the controller itself or on the RUT page of the web pages.
5. Once the upgrade is finished the controller will ask you to reboot.

You can then verify that the license is installed by going to the RUT page.



### 13.6.3 Installing the BACnet License via USB Drive

#### Prerequisites

- Micro USB Adapter
- USB Stick with the file in a folder in the root called “UPGRADE.” The file you received should be in that folder.

#### Steps

1. Carefully insert the micro USB end into the controller front under the door with the wide side to the bottom.
2. You should now see a prompt telling you press the enter key.
3. Once finished you will be prompted to press “ENTER” again.

You should now see the license is installed in the controller screen.

### 13.6.4 Installing the BACnet License via USB Connection

#### Prerequisites:

- PC
- Micro USB cable with the ability to plug in with a PC and have the controller appear as a USB drive in your Windows Explorer

#### Steps

1. Carefully insert the micro USB end into the controller front under the door with the wide side to the bottom.
2. You should see a folder called “UPGRADE” in the controller. Put the file in that folder.
3. You should now see a prompt telling you press the enter key.
4. Once finished you will be prompted to press “ENTER” again.

You should now see the license is installed in the controller screen.

## 13.7 MODBUS

The Modbus utilizes the standard registers and references them as an offset. For example, an offset of Input Register 0 is Register 30,001 and an offset for Holding Register 0 is register 40,001. All values are shown in decimal format. The implementation also uses Coils and Discrete Inputs in a similar manner.

### 13.7.1 Modbus TCP Connection



Connection of Modbus TCP requires a physical cable connection to the RJ45 jack on the controller. Prior to making the wiring connections, the controller is to be tested to verify proper control of the DOAS unit under local control.

FIGURE 13.2.0 ETHERNET CONNECTION

### 13.7.2 Modbus TCP Settings

First, set the IP address of the controller in the same *General Settings* area.

- Set DHCP to Off if static
- If Static, set the IP, mask, and gateway if required.
- *Set Update?* To Yes (Power will need to be cycled. This can be done after all of the other settings.)

```

GENERAL SETTINGS
IP Address
DHCP: Off
IP: 10.10.1.2
MASK: 255.255.255.0
GW: 0.0.0.0
DNS: 0.0.0.0
Update? No
  
```

Then set the timeout parameter, if needed.

```

GENERAL SETTINGS
Modbus IP Advanced
Timeout: 3000ms

Error Status:
Timed Out
  
```

### 13.7.3 Modbus RTU Settings

First, set the address, baud rate, stop bits and parity.

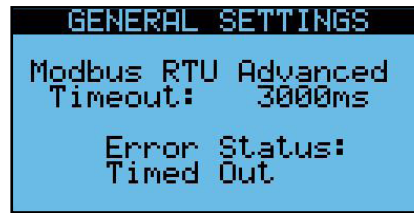
```

GENERAL SETTINGS
Modbus RTU Settings
Address: 4
Baud Rate: 19200
Stop Bits: 2
Parity: None
  
```



NOTE: The controller will only support private IP addresses which start with 192, 172, or 10.

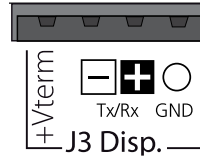
Then set the timeout parameter if needed.



#### 13.7.4 Modbus RTU Wiring

The Modbus RTU network is wired into the four-pin connector named J3 Disp. In the upper left-hand corner of the controller. This is also used for a RUT display so the two cannot be used at the same time. For Modbus RTU, use the plus (+) and minus (-), as well as the GND for reference if desired.

DO NOT use the +Vterm terminal. If you happen to plus a three-pin block in here and use the wrong three pins you might damage the port.



### 13.8 MODBUS REGISTER LIST

Modbus Registers with an offset of 0 have been duplicated at register 98 to accommodate Automated Logic Systems and other systems that cannot map 0.

| TYPE          | #  | VARIABLE                   | DESCRIPTION                              | RANGE       | READ/WRITE MODE (RET) |
|---------------|----|----------------------------|--|-------------|-----------------------|
| Coil          | 0  | OnOffUnitMng.BmsOnOff      | BMS On/Off Command                       | Off/On      | Read_Writeable        |
| Coil          | 1  | OnOffUnitMng.BmsEfOnly     | BMS Exhaust Fan Only Command             | Off/On      | Read_Writeable        |
| Coil          | 2  | AlarmMng.AlrmResByBms      | Alarm Reset BMS Command                  | OK/Reset    | Read_Writeable        |
| Coil          | 4  | BMS_SetHeatCool            | BMS Set Heat/Cool Capability             | No/Allow    | Read_Writeable (X)    |
| Coil          | 5  | BMS_HeatCoolMode           | BMS Heat/Cool Mode Setting               | Heat/Cool   | Read_Writeable (X)    |
| Coil          | 3  | OnOffUnitMng.BmsUnocc      | BMS Unoccupied Command                   | Occ/Unocc   | Read_Writeable        |
| Coil          | 6  | BMS_HW_Valve_Control       | BMS HW Valve Control                     | No/Allow    | Read_Writeable        |
| Coil          | 7  | Heating_Enable_1.Val       | Heating Stage 1 BMS Enable               | Off/On      | Read_Writeable        |
| Coil          | 98 | OnOffUnitMng.BmsOnOff      | BMS On/Off Command                       | Off/On      | Read_NoWrite          |
| DiscreteInput | 0  | OA_Damp.Val                | OA Damper Command                        | Closed/Open | Read_NoWrite          |
| DiscreteInput | 1  | RA_Damp.Val                | RA Damper Command                        | Closed/Open | Read_NoWrite          |
| DiscreteInput | 16 | Tempering_Mode.Val         | Tempering Mode                           | Heat/Cool   | Read_NoWrite          |
| DiscreteInput | 2  | AlarmMng.AlrmRes           | Alarm Reset Status                       | No/Yes      | Read_NoWrite          |
| DiscreteInput | 3  | SF_Status.Val              | SF Status from Current Sensor            | Off/On      | Read_NoWrite          |
| DiscreteInput | 4  | EF_Status.Val              | EF Status from Current Sensor            | Off/On      | Read_NoWrite          |
| DiscreteInput | 5  | Alarm_Out.Val              | Serious Alarm (Also a physical output)   | OK/Alarm    | Read_NoWrite          |
| DiscreteInput | 6  | Heating_Enable_1.Val       | Heating Stage 1                          | Off/On      | Read_NoWrite          |
| DiscreteInput | 7  | Cooling_Stage_1.Val        | Cooling Stage 1                          | Off/On      | Read_NoWrite          |
| DiscreteInput | 8  | Cooling_Stage_2.Val        | Cooling Stage 2                          | Off/On      | Read_NoWrite          |
| DiscreteInput | 9  | DOAS_UnitOn                | DOAS Unit On Status                      | Off/On      | Read_NoWrite          |
| DiscreteInput | 10 | OfflineAlrm_CPCOE_1.Active | Offline Alarm expansion module           | OK/Alarm    | Read_NoWrite          |
| DiscreteInput | 11 | OfflineDOAStoREF.Active    | Offline DOAS to Refrigeration Controller | OK/Alarm    | Read_NoWrite          |
| DiscreteInput | 21 | AI_SupplyFan.Active        | Supply Fan Start Alarm                   | OK/Alarm    | Read_NoWrite          |
| DiscreteInput | 22 | AI_ExhaustFan.Active       | Exhaust Fan Start Alarm                  | OK/Alarm    | Read_NoWrite          |
| DiscreteInput | 12 | Recirc_Damp.Val            | Recirculation Damper Command             | Close/Open  | Read_NoWrite          |
| DiscreteInput | 13 | Heating_Enable_2.Val       | Heating Stage 2                          | Off/On      | Read_NoWrite          |
| DiscreteInput | 14 | Econ_Active                | Economizer Active?                       | No/Yes      | Read_NoWrite          |
| DiscreteInput | 15 | DehumidMode_On             | Dehumidification Mode On?                | No/Yes      | Read_NoWrite          |

| TYPE            | #   | VARIABLE                          | DESCRIPTION   | RANGE       | READ/WRITE MODE (RET) |
|-----------------|-----|-----------------------------------|---|-------------|-----------------------|
| DiscreteInput   | 17  | Unocc_Mode                        | Unoccupied Mode Status                              | Occ/Unocc   | Read_NoWrite          |
| DiscreteInput   | 18  | Unocc_HTG                         | Unoccupied Heating Status                           | Off/On      | Read_NoWrite          |
| DiscreteInput   | 19  | Unocc_CLG                         | Unoccupied Cooling Status                           | Off/On      | Read_NoWrite          |
| DiscreteInput   | 23  | DefrostOn                         | Frost control On Status                             | Off/On      | Read_NoWrite          |
| DiscreteInput   | 20  | Any_Alarm_Out.Val                 | Any Alarm is True Status                            | OK/Alarm    | Read_NoWrite          |
| DiscreteInput   | 98  | OA_Damp.Val                       | OA Damper Command                                   | Closed/Open | Read_NoWrite          |
| DiscreteInput   | 100 | SeriousAlarm_RefUnit              | Alarm in Refrigeration Unit                         | OK/Alarm    | Read_NoWrite          |
| HoldingRegister | 44  | HeatingCommand_BMS                | Heating Command from BMS                            | %           | Read_Writeable        |
| HoldingRegister | 0   | RA_Fit_AlarmHigh                  | RA Filter Alarm Level                               | iwc         | Read_Writeable (X)    |
| HoldingRegister | 2   | OA_Fit_AlarmHigh                  | OA Filter Alarm Level                               | iwc         | Read_Writeable (X)    |
| HoldingRegister | 4   | SF_ConstSpeedSetP.Val             | SF Const Speed Setpoint                             | %           | Read_Writeable (X)    |
| HoldingRegister | 6   | SF_FlowControlSetP.Val            | SF Flow Control Setpoint                            | CFM         | Read_Writeable (X)    |
| HoldingRegister | 8   | SF_DuctStaticSetP.Val             | SF Duct Static Pressure Setpoint                    | iwc         | Read_Writeable (X)    |
| HoldingRegister | 12  | SF_CO2_VOCSetP.Val                | SF CO2 or VOC Setpoint                              | PPM         | Read_Writeable (X)    |
| HoldingRegister | 16  | EF_ConstSpeedSetP.Val             | EF Constant Speed Setpoint                          | %           | Read_Writeable (X)    |
| HoldingRegister | 18  | EF_FlowControlSetP.Val            | EF Flow Control Setpoint                            | CFM         | Read_Writeable (X)    |
| HoldingRegister | 20  | EF_SF_TrackingSetP.Val            | EF SF Tracking Setpoint                             | %           | Read_Writeable (X)    |
| HoldingRegister | 22  | EF_ReturnStaticSetP.Val           | EF Return Static Setpoint                           | iwc         | Read_Writeable (X)    |
| HoldingRegister | 24  | CoolLockoutTemp                   | OA Cooling Lockout Temperature                      | F           | Read_Writeable (X)    |
| HoldingRegister | 26  | HeatLockoutTemp                   | OA Heating Lockout Temperature                      | F           | Read_Writeable (X)    |
| HoldingRegister | 28  | Econ_Temp_Diff                    | Economizer Temperature Differential                 | F           | Read_Writeable (X)    |
| HoldingRegister | 30  | Economizer.Econ_Low_OA_Temp_Limit | Economizer Low OA Temp Limit                        | F           | Read_Writeable (X)    |
| HoldingRegister | 32  | Economizer.Econ_Hysteresis        | Economizer Hysteresis                               | Btu/lb      | Read_Writeable (X)    |
| HoldingRegister | 34  | BMS_CO2_VOC_Reading               | BMS CO2 or VOC Reading (in lieu of attached sensor) | PPM         | Read_Writeable        |
| HoldingRegister | 36  | HGRH_Coil_LAT_Setp.Val            | Coil LAT Setpoint for dehumidification              | F           | Read_Writeable (X)    |
| HoldingRegister | 38  | Occ_HTG_Setp.Val                  | Occupied Heating Setpoint                           | F           | Read_Writeable (X)    |
| HoldingRegister | 40  | Occ_CLG_Setp.Val                  | Occupied Cooling Setpoint                           | F           | Read_Writeable (X)    |
| HoldingRegister | 60  | HGRH_Unit_LAT_Setp.Val            | Dehumidification Reheat Setpoint                    | F           | Read_Writeable (X)    |
| HoldingRegister | 42  | Economizer.Econ_Low_RA_Temp_Limit | Economizer.Econ_Low_RA_Temp_Limit                   | F           | Read_Writeable (X)    |
| HoldingRegister | 52  | SF_CO2_VOCFlowMinCO2.Val          | SF Flow: MinCO2                                     | PPM         | Read_Writeable (X)    |



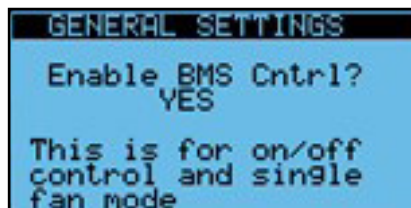
| TYPE            | #  | VARIABLE                    | DESCRIPTION                                      | RANGE         | READ/WRITE MODE (RET) |
|-----------------|----|-----------------------------|--|---------------|-----------------------|
| HoldingRegister | 54 | SF_C02_VOCFlowMaxC02.Val    | SF Flow: Max C02                                 | PPM           | Read_Writeable (X)    |
| HoldingRegister | 56 | SF_C02_VOCFlowMinFlow.Val   | SF Flow: Min Flow                                | CFM           | Read_Writeable (X)    |
| HoldingRegister | 58 | SF_C02_VOCFlowMaxFlow.Val   | SF Flow: Max Flow                                | CFM           | Read_Writeable (X)    |
| HoldingRegister | 46 | SF_UnoccFlowSetP.Val        | SF Unoccupied Flow Setpoint                      | CFM           | Read_Writeable (X)    |
| HoldingRegister | 48 | Unocc_CLG_Setp.Val          | Unoccupied Cooling Setpoint                      | F             | Read_Writeable (X)    |
| HoldingRegister | 50 | Unocc_HTG_Setp.Val          | Unoccupied Heating Setpoint                      | F             | Read_Writeable (X)    |
| HoldingRegister | 62 | Dehumid_Changeover_SetP.Val | Dehumidification Changeover Setpoint             | F (dew point) | Read_Writeable (X)    |
| HoldingRegister | 64 | Defrost_OA_SetP.Val         | Frost control OA Setpoint Low Limit              | F             | Read_Writeable (X)    |
| HoldingRegister | 66 | Defrost_OA_SetP.DBRight     | Frost control OA Setpoint Low Limit Differential | F             | Read_Writeable (X)    |
| HoldingRegister | 68 | Defrost_EA_High_SetP.Val    | Frost control EA High Limit Setpoint             | F             | Read_Writeable (X)    |
| HoldingRegister | 98 | RA_Flt_AlarmHigh            | RA Filter Alarm Level                            | iwc           | Read_Writeable (X)    |
| InputRegister   | 0  | OA_Temp.Val                 | OA Temperature                                   | F             | Read_NoWrite          |
| InputRegister   | 2  | OA_Hum.Val                  | OA Relative Humidity                             | %             | Read_NoWrite          |
| InputRegister   | 4  | RA_Temp.Val                 | RA Temperature                                   | F             | Read_NoWrite          |
| InputRegister   | 6  | RA_Hum.Val                  | RA Relative Humidity                             | %             | Read_NoWrite          |
| InputRegister   | 8  | EA_Temp.Val                 | EA Temperature                                   | F             | Read_NoWrite          |
| InputRegister   | 10 | SA_Temp.Val                 | SA Temperature (before tempering)                | F             | Read_NoWrite          |
| InputRegister   | 12 | OA_Flow_Rate.Val            | OA Flow Rate                                     | CFM           | Read_NoWrite          |
| InputRegister   | 14 | EA_Flow_Rate.Val            | EA Flow Rate                                     | CFM           | Read_NoWrite          |
| InputRegister   | 46 | Heating.HTG_SetP_Adjusted   | Acting heating setpoint                          | F             | Read_NoWrite          |
| InputRegister   | 16 | RA_Flt_Press.Val            | RA Filter Pressure                               | iwc           | Read_NoWrite          |
| InputRegister   | 18 | OA_Flt_Press.Val            | OA Filter Pressure                               | iwc           | Read_NoWrite          |
| InputRegister   | 20 | SF_Command.Val              | Supply Fan Command (actual)                      | %             | Read_NoWrite          |
| InputRegister   | 22 | EF_Command.Val              | Exhaust Fan Command (actual)                     | %             | Read_NoWrite          |
| InputRegister   | 24 | C02_VOC_Level.Val           | C02 or VOC Level                                 | PPM           | Read_NoWrite          |
| InputRegister   | 28 | Cooling_LAT.Val             | Cooling Coil Leaving Air Temperature             | F             | Read_NoWrite          |
| InputRegister   | 30 | Duct_Press.Val              | Duct Pressure                                    | iwc           | Read_NoWrite          |
| InputRegister   | 32 | CA_Temp.Val                 | CA Temperature (after tempering)                 | F             | Read_NoWrite          |
| InputRegister   | 34 | Cooling_Command.Val         | Cooling Command                                  | %             | Read_NoWrite          |

| TYPE          | #  | VARIABLE             | DESCRIPTION                  | RANGE       | READ/WRITE MODE (RET) |
|---------------|----|----------------------|------------------------------|-------------|-----------------------|
| InputRegister | 36 | Heating_Command.Val  | Heating Command from Program | %           | Read_NoWrite          |
| InputRegister | 38 | Bypass_Command.Val   | Bypass Damper Command        | %           | Read_NoWrite          |
| InputRegister | 40 | HGRH_Command.Val     | HGRH Valve Command           | %           | Read_NoWrite          |
| InputRegister | 98 | OA_Temp.Val          | OA Temperature               | F           | Read_NoWrite          |
| InputRegister | 42 | SF_ControlType_BN    | SF_ControlType_BN            | (See Notes) | Read_NoWrite          |
| InputRegister | 43 | EF_ControlType_BN    | EF_ControlType_BN            | (See Notes) | Read_NoWrite          |
| InputRegister | 44 | HTG_ControlType_BN   | HTG_ControlType_BN           | (See Notes) | Read_NoWrite          |
| InputRegister | 45 | CLG_ControlType_BN   | CLG_ControlType_BN           | (See Notes) | Read_NoWrite          |
| InputRegister | 48 | Heating_SetPtType_BN | Heating_SetPtType_BN         | (See Notes) | Read_NoWrite          |
| InputRegister | 50 | UnitStatus_BN        | UnitStatus_BN                | (See Notes) | Read_NoWrite          |

### 13.9 MODBUS APPLICATION NOTES

#### 13.9.1 Turning the Unit On and OFF

If you plan to use the BMS to turn the unit on and off, make sure you have the control enabled through the keypad. Use Modbus Coil "OnOffUnitMng.BmsOnOff" at Coil 0. The status can be read at "DOAS\_UnitOn" at Discrete Input 9.



All of the following have to be true in order for the unit to be on:

- There are no serious alarms.
- The Digital Input for start/stop (terminals 17 and 18) are closed.
- The unit is turned on at the keypad.
- The time is within the scheduler "ON" time, if scheduler enabled.
- The BMS has written the unit on signal, if BMS control is enabled.

| DOAS_UNITSTATUS_BN: INPUT REGISTER 50 |   |   |
|---------------------------------------|---|---|
| VALUE                                 | STATUS                                  | MEANING   |
| 1                                     | Unit on                                 | The unit is on and running.                                 |
| 2                                     | Unit switched off due to alarm          | The unit is off by a serious alarm.                         |
| 3                                     | Unit switched off by BMS                | The unit is off by command from the BMS.                    |
| 4                                     | Unit switched off by time band          | The unit is off by the scheduler.                           |
| 5                                     | Unit switched off by digital input      | The unit is off due to contacts across 17 and 18 open.      |
| 6                                     | Unit switched off from the local keypad | The unit is off by the setting on the menu screen.          |
| 8                                     | Exhaust Fan Only Mode                   | The unit is in single fan mode with exhaust fan running.    |
| 9                                     | Supply Fan Only Mode                    | The unit is in single fan mode with supply fan running.     |
| 10                                    | Unoccupied Mode                         | The unit is set to unoccupied mode.                         |
| 11                                    | Cool Locked Out by BMS                  | A BMS command has the cooling locked out.                   |
| 12                                    | Heat Locked Out by BMS                  | A BMS command has the heating locked out.                   |
| 13                                    | Device Test                             | The system is in device test mode for more than an hour.    |
| 14                                    | Sens Ovrdr Active                       | The system has a sensor overwritten for more than 24 hours. |
| 15                                    | Off by CO2 Level                        | Off by CO2 Level.   |
| 16                                    | Frost Control On                        | Frost Control Mode Active.                                  |

13.9.2 Alarms

Two general alarms are available:

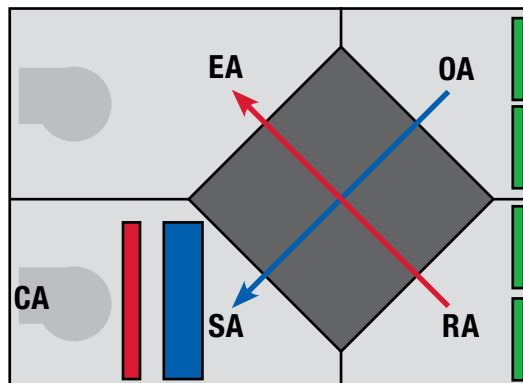
- Serious Alarm: Located at Discrete Input 5, “Alarm\_Out.val” indicates whether there is a serious alarm that stops the unit.
- Any Alarm: Located at Discrete Input 20, “Any\_Alarm\_Out.val” indicates whether there is any alarm present.

To reset the User Reset type alarms, set Coil 0 (or 98) “AlarmMng.AlrmResByBMS” to true. The program will set it back to false. You can view the status change through Discrete Input 2 “AlarmMng.AlrmRes.”

13.9.3 Temperature and Humidity Around the ERV

The following are available:

- Input Register 0 “OA\_Temp.Val”
- Input Register 2 “OA\_Hum.Val”
- Input Register 4 “RA\_Temp.Val”
- Input Register 6 “RA\_Hum.Val”
- Input Register 8 “EA\_Temp.Val”
- Input Register 10 “SA\_Temp.Val”

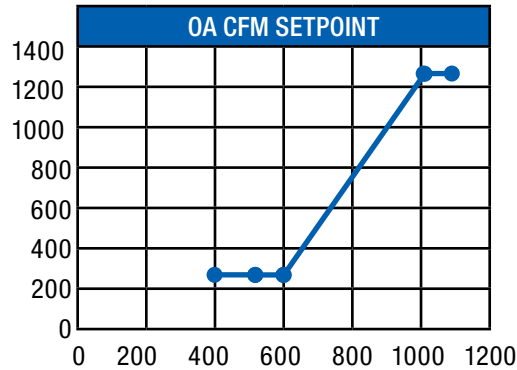


13.9.4 Fan Control

The supply fan control type method can be viewed at Input Register 42 “SF\_ControlType\_BN.” The valid values are 0 = Constant Speed, 1 = Supply Airflow, 2 = Duct Static Pressure, 3 = CO2/VOC, 4 = CO2/VOC Flow.

The corresponding settings are as follows:

- Constant Speed setpoint is Holding Register 4 “SF\_ConstantSpeedSetP.Val”
- Supply Airflow setpoint is Holding Register 6 “SF\_FlowControlSetP.Val”
- Duct Static setpoint is Holding Register 8 “SF\_DuctStaticSetP.Val”
- CO2/VOC setpoint is Holding Register 12 “SF\_CO2\_VOCSetP.Val”
- CO2/VOC Flow ramp set at Holding Registers 52, 54, 56, and 58.



The command to the fan is read at Input Register 20 “SF\_Command.Val.” The feedback from the current sensor is read at Discrete Input 3 “SF\_Status.Val.” The actual flow rate is viewed at Input Register 12 “OA\_Flow\_Rate.Val.”

The exhaust fan control type method can be viewed at Input Register 43 “EF\_ControlType\_BN.” The valid values are 1 = Constant Speed, 2 = Exhaust Airflow, 3 = SF Command Tracking, 3 = SF Flow Tracking, 4 = Return Static Pressure.

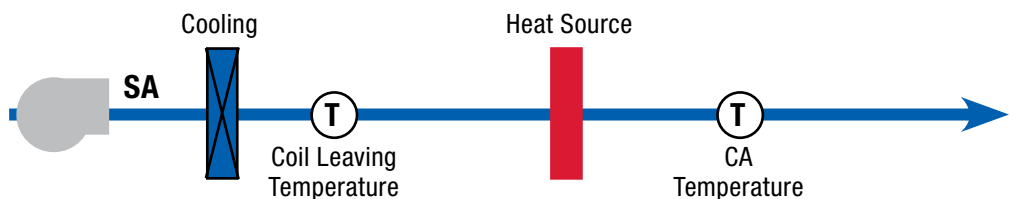
The corresponding settings are as follows:

- Constant Speed setpoint is Holding Register 16 “EF\_ConstantSpeedSetP.Val”
- Exhaust Airflow setpoint is Holding Register 18 “EF\_FlowControlSetP.Val”
- Exhaust Fan Tracking setpoint is Holding Register 20 “EF\_SF\_TrackingSetP.Val”
- Return Static setpoint Holding Register 22 “EF\_ReturnStaticSetP.Val”

The command to the fan is read at Input Register 22 “EF\_Command.Val.” The feedback from the current sensor is read at Discrete Input 4 “EF\_Status.Val.” The actual flow rate is viewed at Input Register 14 “EA\_Flow\_Rate.Val.”

13.9.5 Tempering Control

The DN DOAS unit may provide heating and cooling/dehumidification if ordered as such. For heating and/or cooling, there will be a conditioned air temperature sensor which measured the air coming out of the unit as Input Register 32 “CA\_Temp.Val.” For dehumidification with either hot gas reheat or reheat by a heat source, there will also be a coil leaving temperature sensor as Input Register 28 “Cooling\_LAT.Val.”



### 13.9.5.1 Determining Tempering Mode

To determine the mode in which the unit is operating, the following values are considered:

- Holding Register 62 “Dehumid\_Chageover\_SetP.Val”
- Holding Register 26 “HeatLockoutTemp”
- Holding Register 24 “CoolLockoutTemp”

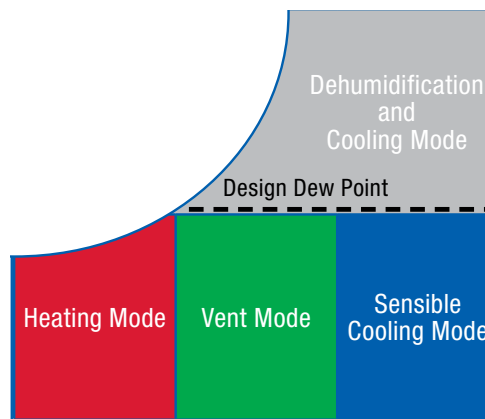
In addition, the BMS has the potential to use one more setting to determine whether the unit will lock out heating or cooling functions. This is required for the dual temp systems and may be useful for other situations. The Coil 4 “BMS\_SetHeatCool” must be true and then the mode is set through Coil 5 “BMS\_HeatCoolMode” where 0 =Heat and 1 = Cool. The BMS mode is shown for troubleshooting.

```

GENERAL SETTINGS
BMS Heat Cool Mode:
      NO
NOTE: If set to yes,
other mode will be
locked out.
Current Mode: Heat
  
```

See the following sections for more information on these modes. The mode is determined in this order:

1. Heating: Is the unit configured for heating?  
Is the outdoor air temperature lower than the heating lockout temperature?
2. Dehumidification: Is the unit configured for dehumidification? If so, is the unit in dehumidification mode?
3. Cooling: Is the unit configured for cooling?  
Is the outdoor air temperature higher than the cooling lockout temperature?
4. If it in no other mode and the unit is on, it will be in Ventilation Mode.



The current Tempering Mode is viewed at Discrete Input 16 “Tempering\_Mode.Val.” It is also an output used for VRF applications. The tempering mode will show heating when in heating or ventilation only mode, and cooling for cooling or dehumidification mode.

### 13.9.5.2 Heating Control

The heating control type is located at Input Register 44 “HTG\_ControlType\_BN.” The valid values are 1 = 0–10V, 2 = 10–0V, 3 = VRF, 4 = 1 stage, 5 = 2 stage, 6 = VRF+Mod, 7 = Dual Temp Coil. The setpoint is Holding Register 38 “Occ\_HTG\_SetP.Val” if adjustable setpoint is chosen. Otherwise the setpoint is based on an outdoor temperature schedule. The type is Input Register 48 “Heating\_SetPtType\_BN,” where 1 = Adjust and 2 = OA Reset. The acting setpoint is Input Register 46 “HTG\_SetP\_Adjusted.”

The heating output statuses are the following:

- Discrete Input 6 “Heating\_Enable\_1.Val” for stage one or modulating types where the demand is greater than 0
- Discrete Input 13 “Heating\_Enable\_2.Val” for stage two
- Input Register 36 “Heating\_Command.Val” shows a percentage for the 0–10V output.

It is also possible for the BMS to take over total control of the 10–0V hot water valve signal out to the controlled valve and heating output directly for special cases. All setpoints, etc. will be ignored in this case. To do this, set the heating setting “Valve Control” to BMS on the screen, or through Binary Value 74 “BMS\_HW\_Valve\_Control.”



Then control the valve through

- Holding Register 44 “HeatingCommand\_BMS” to set a value for the 0–10V output, where 0 is 0V and 100 is 10V.
- Coil 7 “Heating\_Enable\_1.Val” can also be controlled directly if needed.

#### 13.9.5.3 Cooling Control

The cooling control type is located at Input Register 45 “CLG\_ControlType\_BN.” The valid values are 1 = 1 Stage, 2 = 2 Stage, 3 = Cold Water Modulating, 4 = VRF, 5 = PDX. The setpoint is Holding Register 40 “Occ\_CLG\_SetP.Val.”

The cooling output statuses are the following:

- Discrete Input 7 “Cooling\_Enable\_1.Val” for stage one or modulating types where the demand is greater than 0
- Discrete Input 8 “Cooling\_Enable\_2.Val” for stage two
- Input Register 34 “Cooling\_Command.Val” shows a percentage for the 0–10V output.

#### 13.9.5.4 Dehumidification Control

- If the cooling is currently being used for dehumidification, Discrete Input 15 “DehumidificationMode\_ON” will be true.
- Holding Register 36 “HGRH\_Coil\_LAT\_Setp.Val” is the setpoint for dehumidification by cooling. The actual value is shown in Input Register 28 “Cooling\_LAT.Val” is the temperature coming off the coil, if using reheat.
- The unit will reheat to Holding Register 60 “HGRH\_Unit\_LAT\_Setp.Val” if reheating.
- Input Register 40 “HGRH\_Command.Val” will show the command for HGRH. If used.

#### 13.9.5.5 Economizer Control

The economizer will be enabled when there is a call for cooling and the outdoor is more favorable than the return air. In this case it will modulate the bypass damper to bypass the enthalpic core and thus limit or inhibit the exchange of energy. The mechanical cooling is not allowed until the bypass is open 100%. During this time the unit still uses 100% outdoor air.

Economizing is allowed when both of the following are below their limit:

- Holding Register 30 “Economizer.Econ\_Low\_OA\_Temp\_Limit”
- Holding Register 42 “Economizer.Econ\_Low\_RA\_Temp\_Limit”

The damper will modulate using PI Control set in the controller when the OA is less than the difference value specified as follows:

- If using the temperature economizer type, the value used is Holding Register 28 “Econ\_Temp\_Diff”
- If using the enthalpy economizer type, the value used is Holding Register 32 “Economizer.Econ\_Hysteresis”

You can view the status through Discrete Input 14 “Econ\_Active” to see if the economizer is active. The bypass damper position is viewed at Input Register 38 “Bypass\_Command.Val.”

#### 13.9.5.6 Unoccupied Control

If optional recirculation dampers are present, the unit will operate in unoccupied mode according to the following settings:

- Coil 3 “OnOffUnitMng.BMSUnocc” allows you to put the unit in unoccupied mode.
- The supply fan will either run continuous or on a call for heat or cooling as set in the controller. It will run at a speed set in Holding Register 46 “SF\_UnoccFlowSetP.Val.”
- It will maintain the Holding Register 48 “Unocc\_CLG\_SetP.Val” and Holding Register 50 “Unocc\_HTG\_SetP.Val.”
- The status of the recirculation damper is seen at Discrete Input 12 “Recirc\_Damp.Val.”
- The unoccupied statuses can be viewed in Discrete Input 17 “Unocc\_Mode,” Discrete Input 18 “Unocc\_HTG,” and Discrete Input 19 “Unocc\_CLG.”

#### 13.9.6 Frost Control

The frost control function utilizes the bypass to avoid frosting the enthalpic core. If bypass is enabled, when the OA is lower than Holding Register 64 “Defrost\_OA\_SetP.Val” minus Holding Register 66 “Defrost\_OA\_SetP.DBright,” and turns off again when the OA exceeds the HR66. The frost control status can be viewed at Discrete Input 23 “DefrostOn.”

When frost control is on, the bypass damper will modulate to maintain a maximum Holding Register 79 “Defrost\_EA\_High\_SetP.Val.” The bypass damper position is viewed at Input Register 59 “Bypass\_Command.Val.”

#### 13.9.7 Filter Monitoring

Filter pressures are read through Input Register 16 “RA\_Flt\_Press.Val” and Input Register 18 “OA\_Flt\_Press.Val.”

Filter alarm levels are set at Holding Register 0 (or 98) “RA\_Flt\_AlarmHigh” and Holding Register 2 “OA\_Flt\_AlarmHigh.”

#### 13.9.8 Exhaust Fan Only Mode

If BMS control is enabled, the unit can also be put in exhaust fan only mode in occupied operation using Coil 1 “UnitOnOffMng.BMSEFOnly.”



### 14.0 ADVANCED SERVICE

This area gives advanced service information, as described. These screens are used infrequently.

#### 14.1 RUN HOURS AND STARTS

For the DOAS unit as well as each fan and compressor, if applicable, there is a screen that shows the run hours as well as the number of starts. This screen also lets you specify a threshold for alarm to alert that service is required and the ability to reset those numbers once service is performed.

```

ADVANCED SERVICE
DOAS UNIT SERVICE INFO
Run Hours:      0
Svc Thr: 200000hr
STATUS:OK
Reset Svc Hrs: NO
Starts:        0
Reset Starts:  NO
    
```

```

ADVANCED SERVICE
SUPPLY FAN SUC INFO
Run Hours:      22
Svc Thr: 200000hr
STATUS:OK
Reset Svc Hrs: NO
Starts:        1
Reset Starts:  NO
    
```

#### 14.2 LAST POWER LOSS

This screen gives information on the last time the unit was powered down as well as the length of time the unit was powered down for troubleshooting.

```

ADVANCED SERVICE
LAST POWER LOSS
Current time:
16/03/22 22:16:29
PowerOff time:
16/03/22 17:21:57
Length last time off:
 0Days  0Hrs  1Min
    
```

#### 14.3 INTERNAL MEMORY WRITES

This screen gives information memory writes and the cycle speed of the applications. This would normally be used to give information to TSS, if requested.

```

ADVANCED SERVICE
Ret mem writes: 2526
Main task:
500ms 2.0Cycle/s
    
```

#### 14.4 ALARM INITIALIZATION

This screen will allow you to delete the alarm logs.

```

ADVANCED SERVICE
Alarm initialization
Delete alarm logs? NO
Clear AutoReset
counters? NO
Enable buzzer? YES
    
```

## 14.5 MEMORY WIPE

This screen will allow to wipe retained values (most setpoints) and/or NVRAM (clock and IP settings). You should only use this screen if directed to do so by TSS.

```
ADVANCED SERVICE
DEFAULT INSTALLATION

Wipe retain mem.: NO
Wipe NVRAM mem.: NO
Wipe both mem.: NO
```

## 14.6 COMMUNICATION TO EXPANSION MODULE

This screen allows you to see the status of the communication to the expansion module. TSS may request this information for troubleshooting.

```
S ADVANCED SERVICE

COMM TO EXP MOD
Dev Err: OK
Err Code: 0
Err ID: 0times
Poll ID: 441907times
```

## 15.0 MAINTENANCE RECORDS

### 15.1 UNIT START UP CONDITIONS

This page is to be used to record all settings on the controller at the time of unit start up.

**UNIT ID OR TAG:**

#### 15.1.1 Setpoints

| NAME OF SETPOINT | VALUE |
|------------------|-------|
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |
|                  |       |

#### 15.1.2 Offsets

| NAME OF OFFSET | VALUE |
|----------------|-------|
|                |       |
|                |       |
|                |       |
|                |       |
|                |       |

#### 15.1.3 IP Addresses

| NAME OF COMPONENT | IP ADDRESS |
|-------------------|------------|
| Controller        |            |

**15.2 CHANGES MADE TO UNIT AFTER START UP**

This page is to be used to record all user changes made to controller settings and indicate the reason for the change. In some cases, the reason for the change may be self-evident.

**UNIT ID OR TAG:**

15.2.1 Setpoints

| <b>NAME OF SETPOINT</b> | <b>NEW VALUE</b> |
|-------------------------|------------------|
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |
|                         |                  |

15.2.2 Offsets

| <b>NAME OF OFFSET</b> | <b>NEW VALUE</b> |
|-----------------------|------------------|
|                       |                  |
|                       |                  |
|                       |                  |
|                       |                  |
|                       |                  |

15.2.3 I/O Configuration Changes

**15.3 CONTROLLER UPDATES**

Anytime an updated controller program is provided by the factory and installed by the user, it should be recorded here:

| DATE |
|------|
|      |
|      |
|      |
|      |

**15.4 SETTINGS BACKUP FILE**

Use this space to record whether or not a backup has been performed to an external memory device (USB stick) and indicate where the USB stick is to be found.

Controller System Backup has been performed:  Yes

Type/ID of memory device:

Storage location of external memory device:

## 16.0 REFERENCE

### 16.1 TUNING PI CONTROL LOOPS

For any heating or cooling device that has a variable output and uses a variable control signal (including HGRH), the desired action is for the heating/cooling device to reach the setpoint quickly and smoothly. The controller monitors a selected temperature sensor and any variation from the setpoint is considered “Error.” The controller senses the Error and sends a control signal (call for heat or call for cooling) to the heating/cooling device. This control signal is referred to as a “command.” For most variable output hardware, the command will be an analog 0–10VDC signal.

This controller uses PI programming to control the response to Error. PI programming uses two different types of settings to control the command; KP and Ti

KP = proportional gain

- Responds directly to difference between setpoint and actual
- Larger KP values will cause a greater output response and eventually will oscillate.

Ti = integral band

- Responds to the accumulated difference between setpoint and actual
- Larger Ti values will cause a slower output response, very small values eventually will oscillate.

| CONTROL SETTINGS |        |
|------------------|--------|
| COOLING - FOX    |        |
| Setpoint         | 45.0°F |
| KP               | 7.0    |
| Ti               | 100    |

#### 16.1.1 Proportional Constant (KP)

The Proportional Constant (KP) determines the strength of the command for any given error.

**Example:** the setpoint in a heating system is 72°F. The actual temperature is 71°F so the Error is 10°F, which requires very little heat from the heater. The controller sees there is an error and immediately sends a call for heat that starts at 0.1% strength and ramps up as needed, but the rate of increase tapers off as the Error decreases. The rate of increase is proportional to the amount of Error. When the controller senses that the Error is decreasing, it will slow the rate of increase of the command.

- When the Error is small, the rate of increase of the command is slow.
- When the Error is large, the rate of increase is greater (the command responds proportionally to the amount of Error).

The factory default KP setting for most heating and cooling devices is 1, which produces a low and slow response. If the response is too slow, the KP setting can be increased so that the command will be stronger and faster.

**Example:** when the KP setting is 1 and Ti is set for 30 (the factory defaults) and there is a 1°F Error, it takes about 50 seconds for the command to change by 10%. If the KP setpoint is changed to 10, it takes about 5 seconds for the command to change by 10%. For most installations, the KP value will have to be increased to speed up changes in the command signal to an acceptable level. Setting the KP value too high will result in the heater/cooler overshooting the setpoint constantly.

- If the KP value is too low, the command will change too slowly and the setpoint may take too long to reach.
- If the KP value is too high, the command will change to 100% too quickly and the setpoint will be over-shot. This results in the heating/cooling device switching “ON” and “OFF” constantly.

### 16.1.2 Time Integral (Ti)

If the KP setting did not have some means of control, the resulting command signals would constantly over-shoot the setpoint. The Time Integral causes the controller to re-examine the amount of error at specific time intervals to see the amount of error remaining. Ti produces a damping effect on the KP value to reduce over-shooting the setpoint. Ti is an actual measure of time so that when the value is reduced, the frequency of sampling increases.

**Example:** the default Ti value is 30. If the value were changed to 15, sampling would occur twice as often. If the value were changed from 30 to 60, sampling would occur only half as often. If Ti were changed to 500, the result is that the sampling value would be insignificant and corrections to KP would not be happening.

- If the Ti value is set too low (meaning that sampling is occurring too often), the increase in the command signal will immediately begin to slow and keep getting slower because Ti is damping the KP value too much.
- If Ti is set too high (sampling is not occurring often enough), the Command signal will overshoot the setpoint in both a negative and positive direction, causing short-cycling of the heating device.

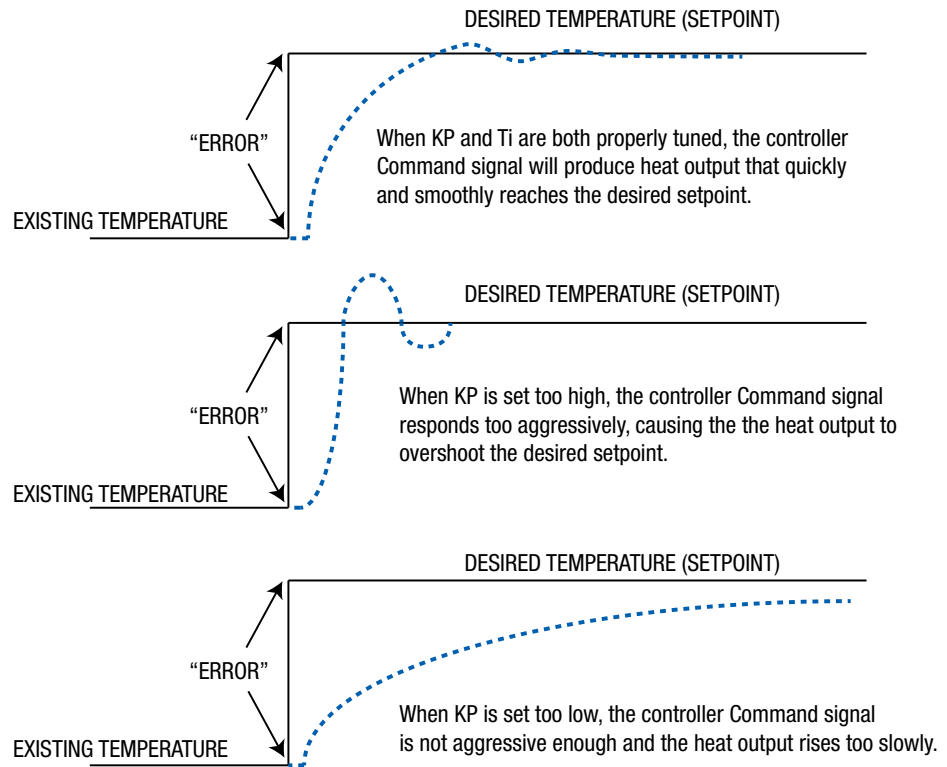


FIGURE 16.1.0 KP SETPOINT CHARTS

The process of adjusting KP and Ti to provide the most satisfactory controller output is known as tuning the controller. There are some sophisticated math equations that can be done to predict where the KP and Ti settings should be, but in the field, adjustment is normally done by a trial-and-error method. The KP setting is first adjusted and then the Ti setting is adjusted to manage the KP setting.

Tools needed:

- Laptop computer to view the Heating screens and make adjustments to KP and Ti.
- A stopwatch or watch with a second hand to monitor times.
- Connect the laptop to the controller via ethernet.



### 16.1.3 Establish a KP Setting

Use the KP Adjustment Chart to track and log test trials of different controller settings. Make copies of the adjustment charts, as needed.

- Go to Main Menu > Unit Status > Heating. Note the temperature here.
- Go to Main Menu > Control Settings> Heating.
- Set the KP value at 5.
- Set the Ti value at 500. This will make the sampling frequency so low that it is essentially of no consequence and permits adjustment of KP without being affected by Ti.
- Set the setpoint for 20°F warmer than the current temperature as noted above. (Change the setpoint last because the controller will immediately respond to the setpoint change, using the KP and Ti settings that it currently has.)
- Click the “ENTER” button and then immediately go back to Main Menu > Unit Status > Heating.

View the Command and Temperature lines on the screen and enter the data at each time interval that was selected.

When the trial is complete, view the Command line on the chart to see how quickly it ramps up to 100%. If the Command percentage is rising too slowly, increase the KP value and run the trial again. The Command percentage should reach 100% (or very nearly) within 2–4 minutes.

Repeat the process, but move the heating setpoint 20°F lower than the current temperature and change the KP value to a larger value, possibly 10 or 15 larger than the previous trial.

Make data entries on the KP Adjustment Chart (following page) to help track changes to the KP settings. Select the most appropriate KP setting.

### 16.1.4 Establish a Ti Setting

- Leave the KP value as found above.
- Set the Ti value at the default value of 30. For each trial, increase the Ti setting.
- Follow the same process as described above. Repeat the trials until the smoothest response is found that does not cause over-shooting or oscillation of the heating command.

### 16.1.5 Verify the Combined KP and Ti Settings

When both KP and Ti have been set, run one final trial with the KP and Ti settings at their new values and record the results in the final chart. This ensures that the results are repeatable. Temperature and Command readings are obtained from Main Menu > Unit Status > Heating

For Elapsed Time, select a convenient amount of time to allow between readings (example: 30 seconds).

In the first column of each trial, fill in the starting data for the trial

DEVICES BEING ADJUSTED

|  |
|--|
|  |
|--|

KP Adjustment Trial 1

|                    |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| KP SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

KP Adjustment Trial 2

|                    |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| KP SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

KP Adjustment Trial 3

|                    |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| KP SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

KP Adjustment Trial 4

|                    |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| KP SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

FIGURE 16.1.1 KP ADJUSTMENT WORKSHEET

DEVICES BEING ADJUSTED

|  |
|--|
|  |
|--|

Ti Adjustment Trial 1

KP Setting for all Trials

|                    |                      |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Ti SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Ti Adjustment Trial 2

|                    |                      |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Ti SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Ti Adjustment Trial 3

|                    |                      |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Ti SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Ti Adjustment Trial 4

|                    |                      |                      |                      |                      |                      |                      |                      |                      |
|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Ti SETTING         | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| HEATING SETPOINT   | <input type="text"/> |                      |                      |                      |                      |                      |                      |                      |
| TEMPERATURE        | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| COMMAND PERCENTAGE | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ELAPSED TIME       | 0                    | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

FIGURE 16.1.2 TI ADJUSTMENT WORKSHEET

**16.2 FILTER PRESSURE DROP TABLES**

| 2" MERV 8 Clean Filter Pressure Drop (In. W.G.) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Airflow (CFM)                                   | 375  | 500  | 750  | 1000 | 1125 | 1500 | 1650 | 2000 | 2500 | 3000 | 3300 | 3500 | 4000 | 4500 | 4950 |
| DN-2  | 0.04 | 0.05 | 0.09 | 0.12 | 0.13 | 0.19 | 0.21 |      |      |      |      |      |      |      |      |
| DN-3  |      |      | 0.04 | 0.06 | 0.07 | 0.09 | 0.10 | 0.13 | 0.16 | 0.20 | 0.22 |      |      |      |      |
| DN-5  |      |      |      |      | 0.05 | 0.07 | 0.07 | 0.09 | 0.12 | 0.14 | 0.16 | 0.17 | 0.20 | 0.23 | 0.26 |

| 2" MERV 13 Clean Filter Pressure Drop (In. W.G.) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Airflow (CFM)                                    | 375  | 500  | 750  | 1000 | 1125 | 1500 | 1650 | 2000 | 2500 | 3000 | 3300 | 3500 | 4000 | 4500 | 4950 |
| DN-2   | 0.05 | 0.06 | 0.10 | 0.15 | 0.17 | 0.25 | 0.29 |      |      |      |      |      |      |      |      |
| DN-3   |      |      | 0.05 | 0.07 | 0.08 | 0.11 | 0.12 | 0.16 | 0.21 | 0.27 | 0.31 |      |      |      |      |
| DN-5   |      |      |      |      | 0.06 | 0.08 | 0.09 | 0.11 | 0.15 | 0.19 | 0.21 | 0.23 | 0.27 | 0.32 | 0.37 |

| 4" MERV 13 Clean Filter Pressure Drop (In. W.G.) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Airflow (CFM)                                    | 375  | 500  | 750  | 1000 | 1125 | 1500 | 1650 | 2000 | 2500 | 3000 | 3300 | 3500 | 4000 | 4500 | 4950 |
| DN-2   | 0.04 | 0.05 | 0.08 | 0.12 | 0.14 | 0.22 | 0.25 |      |      |      |      |      |      |      |      |
| DN-3   |      |      | 0.04 | 0.05 | 0.06 | 0.09 | 0.10 | 0.13 | 0.18 | 0.23 | 0.27 |      |      |      |      |
| DN-5   |      |      |      |      | 0.04 | 0.06 | 0.07 | 0.09 | 0.12 | 0.16 | 0.18 | 0.20 | 0.24 | 0.28 | 0.33 |

| 2" MERV 14 Clean Filter Pressure Drop (In. W.G.) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Airflow (CFM)                                    | 375  | 500  | 750  | 1000 | 1125 | 1500 | 1650 | 2000 | 2500 | 3000 | 3300 | 3500 | 4000 | 4500 | 4950 |
| DN-2   | 0.11 | 0.16 | 0.26 | 0.37 | 0.44 | 0.65 | 0.75 |      |      |      |      |      |      |      |      |
| DN-3   |      |      | 0.12 | 0.17 | 0.19 | 0.28 | 0.31 | 0.40 | 0.55 | 0.71 | 0.81 |      |      |      |      |
| DN-5   |      |      |      |      | 0.14 | 0.19 | 0.22 | 0.28 | 0.37 | 0.48 | 0.54 | 0.59 | 0.72 | 0.85 | 0.98 |

| 4" MERV 14 Clean Filter Pressure Drop (In. W.G.) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Airflow (CFM)                                    | 375  | 500  | 750  | 1000 | 1125 | 1500 | 1650 | 2000 | 2500 | 3000 | 3300 | 3500 | 4000 | 4500 | 4950 |
| DN-2   | 0.08 | 0.11 | 0.18 | 0.27 | 0.31 | 0.47 | 0.54 |      |      |      |      |      |      |      |      |
| DN-3   |      |      | 0.08 | 0.12 | 0.13 | 0.20 | 0.22 | 0.29 | 0.39 | 0.51 | 0.59 |      |      |      |      |
| DN-5   |      |      |      |      | 0.10 | 0.14 | 0.15 | 0.20 | 0.27 | 0.34 | 0.39 | 0.43 | 0.52 | 0.62 | 0.72 |

**16.3 TEMPERATURE SENSOR CURVE**

Only sensors with this Carel curve should be used with this system.

| °C    | °F    | KΩ     |
|-------|-------|--------|
| -50.0 | -58.0 | 329.20 |
| -49.0 | -56.2 | 310.70 |
| -48.0 | -54.4 | 293.30 |
| -47.0 | -52.6 | 277.00 |
| -46.0 | -46.0 | 261.80 |
| -45.0 | -49.0 | 247.50 |
| -44.0 | -47.2 | 234.10 |
| -43.0 | -45.4 | 221.60 |
| -42.0 | -43.6 | 209.80 |
| -41.0 | -41.8 | 198.70 |
| -40.0 | -40.0 | 188.40 |
| -39.0 | -38.2 | 178.30 |
| -38.0 | -36.4 | 168.90 |
| -37.0 | -34.6 | 160.10 |
| -36.0 | -32.8 | 151.80 |
| -35.0 | -31.0 | 144.00 |
| -34.0 | -29.2 | 136.60 |
| -33.0 | -27.4 | 129.70 |
| -32.0 | -25.6 | 123.20 |
| -31.0 | -23.8 | 117.10 |
| -30.0 | -22.0 | 111.30 |
| -29.0 | -20.2 | 105.70 |
| -28.0 | -18.4 | 100.40 |
| -27.0 | -16.6 | 95.47  |
| -26.0 | -14.8 | 90.80  |
| -25.0 | -13.0 | 86.39  |
| -24.0 | -11.2 | 82.22  |
| -23.0 | -9.4  | 78.29  |
| -22.0 | -7.6  | 74.58  |
| -21.0 | -5.8  | 71.07  |
| -20.0 | -4.0  | 67.74  |
| -19.0 | -2.2  | 64.54  |
| -18.0 | -0.4  | 61.52  |
| -17.0 | 1.4   | 58.66  |
| -16.0 | 3.2   | 55.93  |
| -15.0 | 5.0   | 53.39  |
| -14.0 | 6.8   | 50.96  |
| -13.0 | 8.6   | 48.65  |
| -12.0 | 10.4  | 46.48  |
| -11.0 | 12.2  | 44.41  |
| -10.0 | 14.0  | 42.25  |

| °C   | °F   | KΩ    |
|------|------|-------|
| -9.0 | 15.8 | 40.56 |
| -8.0 | 17.6 | 38.76 |
| -7.0 | 19.4 | 37.05 |
| -6.0 | 21.2 | 35.43 |
| -5.0 | 23.0 | 33.89 |
| -4.0 | 24.8 | 32.43 |
| -3.0 | 26.6 | 31.04 |
| -2.0 | 28.4 | 29.72 |
| -1.0 | 30.2 | 28.47 |
| 0.0  | 32.0 | 27.23 |
| 1.0  | 33.8 | 26.13 |
| 2.0  | 35.6 | 25.03 |
| 3.0  | 37.4 | 23.99 |
| 4.0  | 39.2 | 22.99 |
| 5.0  | 41.0 | 22.05 |
| 6.0  | 42.8 | 21.15 |
| 7.0  | 44.6 | 20.29 |
| 8.0  | 46.4 | 19.40 |
| 9.0  | 48.2 | 18.70 |
| 10.0 | 50.0 | 17.96 |
| 11.0 | 51.8 | 17.24 |
| 12.0 | 53.6 | 16.55 |
| 13.0 | 55.4 | 15.90 |
| 14.0 | 57.2 | 15.28 |
| 15.0 | 59.0 | 14.68 |
| 16.0 | 60.8 | 14.12 |
| 17.0 | 62.6 | 13.57 |
| 18.0 | 64.4 | 13.06 |
| 19.0 | 66.2 | 12.56 |
| 20.0 | 68.0 | 12.09 |
| 21.0 | 69.8 | 11.63 |
| 22.0 | 71.6 | 11.20 |
| 23.0 | 73.4 | 10.78 |
| 24.0 | 75.2 | 10.38 |
| 25.0 | 77.0 | 10.00 |
| 26.0 | 78.0 | 9.63  |
| 27.0 | 80.6 | 9.28  |
| 28.0 | 82.4 | 8.94  |
| 29.0 | 84.2 | 8.62  |
| 30.0 | 86.0 | 8.31  |
| 31.0 | 87.8 | 8.01  |

| °C   | °F    | KΩ   |
|------|-------|------|
| 32.0 | 89.6  | 7.72 |
| 33.0 | 91.4  | 7.45 |
| 34.0 | 93.2  | 7.19 |
| 35.0 | 95.0  | 6.94 |
| 36.0 | 96.8  | 6.69 |
| 37.0 | 98.6  | 6.46 |
| 38.0 | 100.4 | 6.24 |
| 39.0 | 102.2 | 6.03 |
| 40.0 | 104.0 | 5.82 |
| 41.0 | 105.8 | 5.63 |
| 42.0 | 107.6 | 5.43 |
| 43.0 | 109.4 | 5.25 |
| 44.0 | 111.2 | 5.08 |
| 45.0 | 113.0 | 4.91 |
| 46.0 | 114.8 | 4.74 |
| 47.0 | 116.6 | 4.59 |
| 48.0 | 118.4 | 4.44 |
| 49.0 | 120.2 | 4.30 |
| 50.0 | 122.0 | 4.16 |
| 51.0 | 123.8 | 4.02 |
| 52.0 | 125.6 | 3.90 |
| 53.0 | 127.4 | 3.77 |
| 54.0 | 129.2 | 3.65 |
| 55.0 | 131.0 | 3.53 |
| 56.0 | 132.8 | 3.42 |
| 57.0 | 134.6 | 3.31 |
| 58.0 | 136.4 | 3.21 |
| 59.0 | 138.2 | 3.11 |
| 60.0 | 140.0 | 3.02 |
| 61.0 | 141.8 | 2.92 |
| 62.0 | 143.6 | 2.83 |
| 63.0 | 145.4 | 2.75 |
| 64.0 | 147.2 | 2.66 |
| 65.0 | 149.0 | 2.58 |
| 66.0 | 150.8 | 2.51 |
| 67.0 | 152.6 | 2.43 |
| 68.0 | 154.4 | 2.36 |
| 69.0 | 156.2 | 2.29 |
| 70.0 | 158.0 | 2.22 |
| 71.0 | 159.8 | 2.16 |
| 72.0 | 161.6 | 2.10 |

| °C    | °F    | KΩ   |
|-------|-------|------|
| 73.0  | 163.4 | 2.04 |
| 74.0  | 165.2 | 1.98 |
| 75.0  | 167.0 | 1.92 |
| 76.0  | 168.8 | 1.87 |
| 77.0  | 170.6 | 1.81 |
| 78.0  | 172.4 | 1.76 |
| 79.0  | 174.2 | 1.71 |
| 80.0  | 176.0 | 1.66 |
| 81.0  | 177.8 | 1.62 |
| 82.0  | 179.6 | 1.57 |
| 83.0  | 181.4 | 1.53 |
| 84.0  | 183.2 | 1.49 |
| 85.0  | 185.0 | 1.45 |
| 86.0  | 186.8 | 1.41 |
| 87.0  | 188.6 | 1.37 |
| 88.0  | 190.4 | 1.33 |
| 89.0  | 192.2 | 1.30 |
| 90.0  | 194.0 | 1.26 |
| 91.0  | 195.8 | 1.23 |
| 92.0  | 197.6 | 1.20 |
| 93.0  | 199.4 | 1.16 |
| 94.0  | 201.2 | 1.13 |
| 95.0  | 203.0 | 1.10 |
| 96.0  | 204.8 | 1.08 |
| 97.0  | 206.6 | 1.05 |
| 98.0  | 208.4 | 1.02 |
| 99.0  | 210.2 | 0.99 |
| 100.0 | 212.0 | 0.97 |
| 101.0 | 213.8 | 0.94 |
| 102.0 | 215.6 | 0.92 |
| 103.0 | 217.4 | 0.90 |
| 104.0 | 219.2 | 0.87 |
| 105.0 | 221.0 | 0.85 |
| 106.0 | 222.8 | 0.83 |
| 107.0 | 224.6 | 0.81 |
| 108.0 | 226.4 | 0.79 |
| 109.0 | 228.2 | 0.77 |
| 110.0 | 230.0 | 0.75 |







|   |
|---|
| <b>kW for EC Motors (See Restrictions 1, 6, 7, &amp; 8)</b> |
| 1.35kW<br>2.70kW<br>3.70kW                                  |

|  |
|--|
| <b>Fan Horsepower for VFD (See Restrictions 2, 4, &amp; 5)</b> |
| 3 HP<br>5 HP   |

|  |
|--|
| <b>Vibration Isolation for VFD (See Restriction 3)</b> |
| Spring<br>Neoprene (Standard)                          |

|                                |
|--------------------------------|
| <b>GFCI Convenience Outlet</b> |
| Yes<br>No                      |

|                              |
|------------------------------|
| <b>Drain Overflow Switch</b> |
| Yes<br>No                    |

|   |
|---|
| <b>Paint</b>                            |
| None (Standard)<br>2500 Hour Salt Spray |

|                         |
|-------------------------|
| <b>Paint Color</b>      |
| White<br>Grey<br>Custom |

|  |
|--|
| <b>Outside Air Hood Moisture Eliminator (See Restriction 18)</b> |
| Yes<br>No  |

|                             |
|-----------------------------|
| <b>Recirculation Damper</b> |
| Yes<br>No                   |

|  |
|--|
| <b>Coil Tube Geometry (answered for each coil)</b>   |
| 3/8" 1.000" x 0.866"<br>3/8" 1.250" x 1.0825"<br>1/2" 1.250" x 1.0825"<br>5/8" 1.500" x 1.299"<br>5/8" 1.500" x 1.500"<br>1.0" 3.000" x 2.000" |

|   |
|---|
| <b>Coil Rows (answered for each coil)</b> |
| 1, 2, 3, 4, 5, 6                          |

|  |
|--|
| <b>Coil Fins Per Inch (answer for each coil)</b> |
| 6, 7, 8, 9, 10, 11, 12, 13, 14                   |

|  |
|--|
| <b>Coil Coating (answer for each coil)</b> |
| None<br>Electrofin UV                      |

|  |
|--|
| <b>Coil Position (answer for each coil) (See Restrictions 11, 12, 13, 14, 15, &amp; 28)</b>  |
| Position 1 (First in direction of Airflow after fan/core)<br>Position 2 (Second in direction of Airflow after fan/core)<br>Position 3 (Third in direction of Airflow after fan/core)<br>Position 4 (Condenser Coil only) |

|   |
|---|
| <b>Coil Mode (Water Coil Only) (See Restriction 16)</b>       |
| Cooling<br>Heating<br>Cooling & Heating (Seasonal Changeover) |

|   |
|---|
| <b>Coil Style (Evaporator Coil Only) (See Restriction 10)</b> |
| Standard<br>Interlaced 2 Circuits                             |

|  |
|--|
| <b>Element Material (Electric Heater)</b>  |
| 60-20-20 Ni-Cr-Fe with Nickel-Plate Terminal Pins (Standard)<br>80-20 Ni-Cr with Stainless Steel Terminal Pins (Corrosion Resistant) |

|                                    |
|------------------------------------|
| <b>Fuel Type (Gas Heat Module)</b> |
| Natural Gas (Standard)<br>Propane  |

|   |
|---|
| <b>Tube Material (Gas Heat Module)</b>                |
| 409 Stainless Steel (Standard)<br>304 Stainless Steel |

|   |
|---|
| <b>Elevation Range (Gas Heat Module)</b>  |
| 0-2000'<br>2001'-2999'<br>3000'-3999'<br>4000'-4999'<br>5000'-5999'<br>6000'-6999'<br>7000' and above |

|  |
|--|
| <b>Control Type (Gas Heat Module)</b>  |
| Modulating 5:1 (Natural Gas)/3:1 (Propane) (Standard)<br>Modulating 10:1 (Natural Gas)/6:1 (Propane) |

|  |
|--|
| <b>Gas Derated (Gas Heat Module) (See Restriction 9)</b> |
| Yes<br>No  |

|   |
|---|
| <b>Combustion Inlet Type (Gas Heat Module) (See Restriction 17)</b>   |
| Separated Combustion (Separate combustion air intake and flue exhaust)<br>Exhaust flue venting only (Combustion air intake via intake louver on unit) |

|   |
|---|
| <b>Compressor (See Restrictions 19 &amp; 20)</b>  |
| 1-Circuit: Qty. (1) Variable Speed<br>2-Circuit: Qty. (1) Variable Speed and Qty. (1) Fixed Speed |

|  |
|--|
| <b>Hot Gas Reheat (See Restrictions 19 &amp; 21)</b> |
| Yes, with Suction Line Accumulator<br>No             |

|   |
|---|
| <b>Valves (See Restrictions 19, 20, 22, &amp; 23)</b>   |
| 1-Circuit: Qty. (1) Electronic Expansion Valve<br>2-Circuit: Qty. (2) Electronic Expansion Valves |

|   |
|---|
| <b>Condensing Fan (see Restrictions 19, 24, 25, 26, &amp; 27)</b>       |
| EC Axial Fan: Qty. (1) or (2)<br>AC Axial Fan with VFD: Qty. (1) or (2) |

|  |
|--|
| <b>Condenser Coil Style (see Restriction 29)</b> |
| Standard<br>Face Split 2-Circuits                |

\*NOTE: Packaged Refrigeration components are dependent on operating conditions and are automatically selected.

|  |
|--|
| <b>Restrictions:</b>   |
| 1: Fan kW is only available with Fan Control Code "E".<br>2: Fan Horsepower is only available with Fan Control Code "V".<br>3: Vibration Isolation is only available with Fan Control Code "V".<br>4: Fan Horsepower "3" is only available in Model Code "DN-2".<br>5: Fan Horsepower "5" is only available in Model Codes "DN-3" & "DN-5".<br>6: 1.35kW is only available in Model Code "DN-2" & with Phase Code "1".<br>7: 2.70kW is only available in Phase Code "3" and Voltage Code "3" or "5".<br>8: 3.70kW is only available in Phase Code "3" and Voltage Code "4".<br>9: Gas derating question only applies for elevations above 2000'.<br>10: Interlaced 2 Circuits Coil Style is only available with Direct Expansion Coil or Heat Pump Coil.<br>11: If only one coil is selected, it must be placed in position 1.<br>12: Coil Position 2 only available when 2 or 3 supply air coils have been specified.<br>13: Coil Position 3 only available when 3 supply air coils have been specified.<br>14: For Cooling Codes "P" & "R", the Hot Gas Reheat Coil must be in the position directly following the cooling coil.<br>15: For Cooling Codes "D" & "R", the Direct Expansion coil must be placed in position 1. |

**Restrictions:**

- 16: One coil may be specified to act as both a hot water and chilled water coil. Only available when Cooling Code is C and Heating Code is H.
- 17: Combustion Inlet Type Separated Combustion only applies for Location Code "IN".
- 18: Outside Air Hood Moisture Eliminator only available in Location Code "RT".
- 19: Compressors, Hot Gas Reheat with Suction Line Accumulator, Valves, and Condensing Fans options are only available with Refrigerant Type Code "P".
- 20: 2-Circuit is only available with Model Codes "DN-3-" & "DN-5-", when 1-Circuit cannot meet the required capacity.
- 21: Hot Gas Reheat with Suction Line Accumulator is only available with Cooling Code "R"
- 22: Qty. (1) Electronic Expansion Valve only available with 1-Circuit.
- 23: Qty. (2) Electronic Expansion Valves only available with 2-Circuits.
- 24: Qty. (1) Condensing Fan is only available with Model Code "DN-2-".
- 25: Qty. (2) Condensing Fans are only available with Model Codes "DN-3-" & "DN-5-".
- 26: EC Axial Condensing Fans are only available with Voltage Codes "3", "4", & "5".
- 27: AC Axial Condensing Fans with VFD are only available with Voltage Code "8".
- 28: Coil Position 4 is only available with Refrigerant Type Code "P".
- 29: Face Split 2-Circuits Coil Style only available with Condenser Coil & 2-Circuits.

MODEL NUMBER

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | M | - | - | - | - | - | - | - | - | - | - | - | - | H | T | N | 1 | 1 | N | - | S | - | L | - |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

DIGIT NUMBER

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

|                    |                   |
|--------------------|-------------------|
| <b>Digits 1-2:</b> | Heater Type       |
| "HM"               | = Gas Heat Module |

|   |                       |
|---|-----------------------|
| <b>Digits 8-10:</b>   | Input Capacity in MBH |
| "050", "075", "100", "125", "150", "200", "250", "300", "350" |                       |

|                  |                          |
|------------------|--------------------------|
| <b>Digit 11:</b> | Fuel Type                |
| "N"              | = Natural Gas (Standard) |
| "P"              | = Propane                |

|                      |                                  |
|----------------------|----------------------------------|
| <b>Digits 12-13:</b> | Tube Material                    |
| "SS"                 | = 409 Stainless Steel (Standard) |
| "CS"                 | = 304 Stainless Steel            |

|                  |                     |
|------------------|---------------------|
| <b>Digit 14:</b> | Airflow Orientation |
| "H"              | = Horizontal        |

|                  |                    |
|------------------|--------------------|
| <b>Digit 15:</b> | Thermal Efficiency |
| "T"              | = 81%              |

|                  |                        |
|------------------|------------------------|
| <b>Digit 16:</b> | Elevation              |
| "S"              | = 0 - 2000' (Standard) |
| "2"              | = 2001' - 2999'        |
| "3"              | = 3000' - 3999'        |
| "4"              | = 4000' - 4999'        |
| "5"              | = 5000' - 5999'        |
| "6"              | = 6000' - 6999'        |
| "Y"              | = 7000' and above      |

|                  |                   |
|------------------|-------------------|
| <b>Digit 17:</b> | Disconnect Switch |
| "N"              | = None (Standard) |

|                  |                        |
|------------------|------------------------|
| <b>Digit 18:</b> | System/Inducer Voltage |
| "1"              | = 115V                 |

|                  |                |
|------------------|----------------|
| <b>Digit 19:</b> | Phase          |
| "1"              | = Single Phase |

|                  |              |
|------------------|--------------|
| <b>Digit 20:</b> | Power Fusing |
| "N"              | = None       |

|                  |                 |
|------------------|-----------------|
| <b>Digit 22:</b> | Control Voltage |
| "S"              | = 24VAC         |

|                  |  |
|------------------|--|
| <b>Digit 23:</b> | Control Type (see Restriction 1)                                 |
| "M"              | = Modulating 5:1 (Natural Gas)/3:1 without Thermostat            |
| "V"              | = Modulating 10:1 (Natural Gas)/6:1 (Propane) without Thermostat |

|                  |                   |
|------------------|-------------------|
| <b>Digit 24:</b> | Configuration     |
| "L"              | = Configuration L |

**\*NOTES:**

Digits 3-7, 21, & 25 are not used in this model.

All heaters come with standard features: Combustion Air Pressure Switch, Automatic Reset Fixed Temperature High Limit Switch, Manual Reset Flame Rollout Switch, and Direct Spark Ignition Control.

Descriptions of features and options are found in the installation and operation manual.

Several gas heat module options are limited to specific configurations of the DOAS unit in which the heater is installed.

|   |
|---|
| <b>Restrictions:</b>  |
| 1: Control Type Code "V" is not available with Input Capacity in MBH Codes "050", "075", "100", "125", & "150". |

MODEL NUMBER

|   |   |   |  |  |  |   |   |  |  |  |  |   |   |  |  |   |   |   |  |  |   |   |  |  |   |   |   |   |
|---|---|---|--|--|--|---|---|--|--|--|--|---|---|--|--|---|---|---|--|--|---|---|--|--|---|---|---|---|
| E | K | - |  |  |  | 1 | 6 |  |  |  |  | S | C |  |  | H | - | - |  |  | 3 | F |  |  | S | S | - | N |
|---|---|---|--|--|--|---|---|--|--|--|--|---|---|--|--|---|---|---|--|--|---|---|--|--|---|---|---|---|

DIGIT NUMBER

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

|                    |                                 |
|--------------------|---------------------------------|
| <b>Digits 1-2:</b> | Heater Type (See Restriction 1) |
| "EK"               | = Electric Heater               |

|                    |  |
|--------------------|--|
| <b>Digits 4-5:</b> | Width in Inches (See Restrictions 8 & 9) |
| "24", "30"         |  |

|                    |                  |
|--------------------|------------------|
| <b>Digits 6-7:</b> | Height in Inches |
| "16"               |                  |

|   |                                    |
|---|------------------------------------|
| <b>Digits 8-10:</b>   | Capacity in kW (See Restriction 2) |
| "005", "010", "015", "020", "025", "030", "040", "050", "060" |                                    |

|                  |           |
|------------------|-----------|
| <b>Digit 11:</b> | Mount     |
| "S"              | = Slip In |

|                  |               |
|------------------|---------------|
| <b>Digit 12:</b> | Element Style |
| "C"              | = Open Coil   |

|                  |  |
|------------------|--|
| <b>Digit 13:</b> | Element Material   |
| "C"              | = 60-20-20 Ni-Cr-Fe with Nickel Plate Terminal Pins (Standard) |
| "A"              | = 80-20 Ni-Cr with Stainless Steel Terminal Pins               |

|                  |                     |
|------------------|---------------------|
| <b>Digit 14:</b> | Airflow Orientation |
| "H"              | = Horizontal        |

|                  |   |
|------------------|---|
| <b>Digit 15:</b> | Control Box Offset (See Restrictions 6 & 7) |
| "D"              | = Left Hand (Standard)                      |
| "V"              | = Vertical                                  |

|                  |         |
|------------------|---------|
| <b>Digit 18:</b> | Voltage |
| "2"              | = 208V  |
| "3"              | = 240V  |
| "4"              | = 480V  |
| "8"              | = 600V  |

|                  |               |
|------------------|---------------|
| <b>Digit 19:</b> | Phase         |
| "3"              | = Three-Phase |

|                  |              |
|------------------|--------------|
| <b>Digit 20:</b> | Power Fusing |
| "F"              | = Fusing     |

|                  |                                |
|------------------|--------------------------------|
| <b>Digit 21:</b> | Stage (See Restrictions 4 & 5) |
| "1"              | = Single (Standard)            |
| "4"              | = 4-Stage                      |

|                  |                 |
|------------------|-----------------|
| <b>Digit 22:</b> | Control Voltage |
| "S"              | = 24VAC         |

|                  |                        |
|------------------|------------------------|
| <b>Digit 23:</b> | Control Type           |
| "S"              | = SCR (For BAS System) |

|                  |             |
|------------------|-------------|
| <b>Digit 25:</b> | Pilot Light |
| "N"              | = None      |

**\*NOTES:**

Digits 3, 16, 17 & 24 are not used in this model.

All heaters come with standard features: Disconnect Switch, Air Flow Switch (non-adjustable), Power Fusing, and Control Transformer.

Descriptions of features and options are found in the installation and operation manual.

Several intergrated electric heater options are limited to specific configurations of the DOAS unit in which the heater is installed. Please refer to the DOAS configuration to determine whether the below restrictions apply.

|  |
|--|
| <b>Restrictions:</b>   |
| 1: Heater density should be less than 30kW/ft <sup>2</sup> . $DENSITY = \frac{HEATER\ CAPACITY\ (kW)}{(W'' \times H'')} < 30$        |
| 2: Heater capacity kW entered as a whole number.   |
| 3: Formulas for calculating kW and temperature rise: $kW = \frac{CFM \times \Delta T}{3150}$ $\Delta T = \frac{kW \times 3150}{CFM}$ |
| 4: Stage Code "1" is only available when amperage is less than 96A.  |
| 5: Stage Code "4" is only available when amperage is greater than or equal to 96A.   |
| 6: Control Box Offset Code "D" is only available with Unit Model "DN-3-" and "DN-5-". Heat sinks on the left size of control box.    |
| 7: Control Box Offset Code "V" is only available with Unit Model "DN-2-". Heat sinks on the left side of control box.                |
| 8: Width Code "24" is only available with Model Code "DN-2-".  |
| 9: Width Code "30" is only available with Model Code "DN-3-" and "DN-5-".  |

Integrated Electric Heater  
Configuration Code Chart

### 16.5 VFD INFORMATION

The following information is for reference only. All of the VFD control is done by the RenewAire system and the settings are pre-set in the factory and should not be altered. Refer to the appropriate VFD section, following, according to the VFD provided with your unit.

#### 16.5.1 ABB VFD Information

This drive is used on ERV units with VFDs. ABB ACS320 VFDs are generally supplied in indoor units and ABB ACS355+N831 VFDs in rooftop units.



FIGURE 16.5.0 MODEL ACS320 SHOWN



FIGURE 16.5.1 VFD KEYPADS IN EBOX

#### 16.5.1.1 ABB VFD Parameters

VFD parameters are instructions that the Variable Frequency Drives follow. They are factory set and should not be changed unless you are instructed to do so by TSS.

To view the VFD's parameters from the keypad, press the "MENU" softkey. Press up/down arrows to highlight PARAMETERS, then select it by pressing the "ENTER" softkey.

#### 14.6.1.2 View All Parameters

VFD must be powered up to view the parameters.

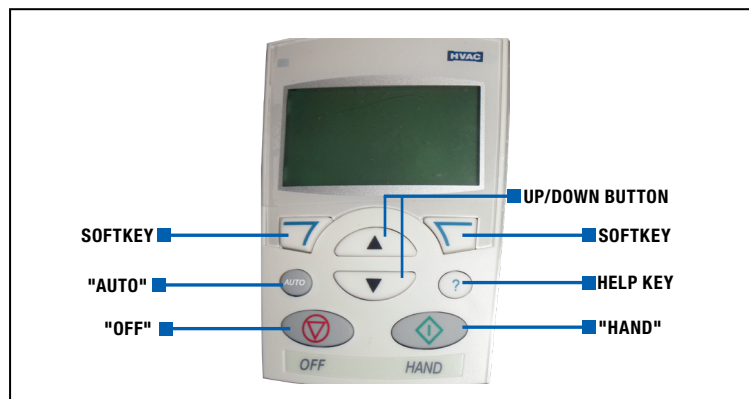


FIGURE 16.5.2 ABB KEYPAD BUTTONS

1. If “EXIT” is displayed above the left softkey, press softkey repeatedly until MENU appears above the right softkey.
2. Press the “MENU” softkey.
3. Use the “UP/DOWN” arrows to scroll the display until PARAMETERS is selected, then press the “ENTER” softkey.
4. You will see a numbered list of parameter “groups”—those numbers are the first two digits of the parameters in each group.
5. Press the “SEL” softkey to view all the parameters in each Group. Use the “UP/DOWN” buttons to scroll through the parameters. As each parameter is selected, its value will be displayed.

#### 16.5.1.3 Locking and Unlocking Parameters

VFDs are shipped locked to prevent accidental changes to parameter settings. If changes to factory parameter settings are desired, the VFD will need to be unlocked for editing the settings.

##### **To unlock all Parameters if Parameter 1602 reads LOCKED:**

1. Select Parameter 1603 PASS CODE: press “EDIT” softkey.
2. Use the “UP/DOWN” buttons to scroll to 358: press “SAVE” softkey (the entry will automatically revert back to 0); press “EXIT” softkey.
3. Scroll up to Parameter 1602 PARAMETER LOCK which reads LOCKED; press “EXIT” softkey.
4. Scroll to OPEN; press “SAVE” softkey; press “EXIT” softkey

Parameters are now unlocked. You can view and change them.

##### **To lock Parameters after changes are made if Parameter 1602 reads OPEN:**

1. Select Parameter 1603 PASS CODE: press “EXIT” softkey.
2. Use the “UP/DOWN” buttons to scroll to 358: press “SAVE” softkey (the entry will automatically revert back to 0); press “EXIT” softkey.
3. Scroll up to Parameter 1602 PARAMETER LOCK which reads OPEN; press “EXIT” softkey.
4. Scroll to LOCKED; press “SAVE” softkey; press “EXIT” softkey.

Parameters are now locked. You can view them but you cannot change them.

##### **Change VFD Parameters When Unlocked**

1. Select the parameter you want to edit. Press the “EXIT” softkey.
2. Use the “UP/DOWN” arrows to scroll through the available settings for that parameter.
3. Press the “SAVE” softkey to set the parameter to the selected value.

To return to RenewAire’s defaults, select parameter 9902 APPLIC MACRO and press “EDIT” softkey. Scroll down to USER 1 LOAD (Not USER 1 SAVE as this will overwrite the factory settings saved under USER 1 in the VFD base memory). Press the “SAVE” softkey.

Alternatively, to return to RenewAire’s defaults, select “PAR BACKUP” in the keypad menu; scroll to and select “DOWNLOAD FULL SET” (not UPLOAD TO PANEL as this will overwrite the factory settings saved in the keypad memory).

To return to ABB’s defaults, select parameter 9902 APPLIC MACRO and press EDIT softkey. Scroll up or down to select “HVAC DEFAULT.” Press the “SAVE” softkey. If HVAC DEFAULT was displayed without scrolling after pressing EDIT in parameter 9902, you will need to scroll up to another macro numbered 2 through 15 and press SAVE, then scroll back down to 1=HVAC DEFAULT and press “SAVE” again to get the settings to revert back to the original ABB defaults.



**NOTE:** VFD Manufacturer instructions list many other parameters.

Copies of the complete manufacturer’s instructions for the VFD are shipped with this unit, and are also available on-line at their respective manufacturer’s website.

ABB: [www.abb.com/drives](http://www.abb.com/drives)  
 SMV: [www.leeson.com](http://www.leeson.com)  
[www.lenze.com/en-us/products/inverters](http://www.lenze.com/en-us/products/inverters)  
 YASKAWA: [www.yaskawa.com/downloads](http://www.yaskawa.com/downloads)

To save an edited parameter set for possible restoration, select parameter 9902 APPLIC MACRO and press EDIT softkey. Scroll down to USER 2 SAVE (Not USER 1 SAVE as this will overwrite the factory settings saved under USER 1 in the VFD base memory). Press the “SAVE” softkey. This edited parameter set can now be reset using USER 2 LOAD.

The VFD should be relocked as described above after the desired parameter settings are entered to avoid further, accidental changes to parameter settings.

16.5.1.4 RenewAire ABB Parameter Settings

| PARAMETER | NAME/SELECTION                   | ABB ACS355+N831 OR ACS320 HVAC DEFAULT    | SETTINGS AS SHIPPED BY US                                   | COMMENTS   |
|-----------|----------------------------------|---|---|--|
| 1611      | PARAMETER VIEW                   | 2=SHORT VIEW ACS320<br>3=LONG VIEW ACS355 | 3=LONG VIEW   | Technician needs to set to LONG VIEW in order to edit some parameters in ACS320 VFDs             |
| 1103      | REF1 SEL                         | 1=AI1                                     | 1=AI1   | Leave at Default value for CC units  |
| 1104      | REF1 MIN                         | 0.0 Hz                                    | 15 Hz   | Added parameter for CC units   |
| 1105      | REF1 MAX                         | 60.0 Hz                                   | 60.0 HE, 90.0 LE units,<br>120.0 DN units                   | Added parameter for CC units   |
| 1301      | MINIMUM AI1                      | 20.0%                                     | 0%  | Added parameter for CC units   |
| 1302      | MAXIMUM AI1                      | 100.0%                                    | 100.0%  | Leave at Default value for CC units  |
| 1401      | RELAY OUTPUT 1                   | 1=READY                                   | 2=RUN   |  |
| 1601      | RUN ENABLE                       | 0=NOT SEL                                 | 1=DI1   | Added parameter for CC units   |
| 1608      | START ENABLE 1                   | 4=DI4                                     | 4=DI4   | Leave at Default value for CC units  |
| 2003*     | MAX CURRENT                      | 1.8*12N                                   | Typically 125% FLA for<br>>=1.15 SF Motor (*see exceptions) | CRITICAL PARAMETER. This provides motor protection!  |
| 2007      | MINIMUM FREQ                     | 0.0 Hz                                    | 15.0 Hz   |  |
| 2008      | MAXIMUM FREQ                     | 60.0 Hz                                   | 60.0 HE, 90.0 LE units,<br>120.0 DN units                   |  |
| 2101      | START FUNCTION                   | 1=AUTO                                    | 6=SCAN START  | ACS320 arrives with P2101 default at e6=SCAN START but ACS320 manual says default is 1=AUTO      |
| 2607      | SWITCHING FREQUENCY              | 2=ON (LOAD)                               | 1=ON  | Set to match ACS320 Default  |
| 3007**    | MOT LOAD CURVE                   | 100%                                      | Typically 98% for >=1.15 SF Motor (**see exceptions)        | CRITICAL PARAMETER. This provides motor protection!  |
| 3401      | SIGNAL 1 PARAM                   | 103=OUTPUT FREQUENCY                      | 101=SPEED AND DIR   | Changing P3401 will also change P3405 to RPM and P3407 to 30000 rpm listed in CHANGED PARAMETERS |
| 3418      | OUTPUT 3 DSP FORM                | 9=DIRECT                                  | 8=BAR METER   | Added parameter for CC units   |
| 3419      | OUTPUT 3 DSP UNIT                | 11=mA                                     | 4=%   | Added parameter for CC units   |
| 3421      | OUTPUT 3 MAX                     | 200%                                      | 100%  | Added parameter for CC units   |
| 9802      | COMMUNICATION PROTOCOL SELECTION | 5=BACnet                                  | 0=NOT SELECTED  | Set to match ACS320 Default  |

| PARAMETER   | NAME/SELECTION     | ABB ACS355+N831<br>OR ACS320 HVAC<br>DEFAULT | SETTINGS AS SHIPPED BY<br>US                                | COMMENTS  |
|-------------|--------------------|--|---|---|
| 9901        | LANGUAGE           | ENGLISH                                      | ENGLISH (AM)  |   |
| 9905        | MOTOR NOM VOLT     | Varies                                       | Equal to Motor Nameplate<br>Volts                           | When unit is marked 208–230V, set<br>this value at 208V.  |
| 9906        | MOTOR NOM CURR     | Varies                                       | Equal to Motor FLA (*per unit<br>nameplate, see exceptions) | When unit is marked 208–230V, set<br>this value at the FLA corresponding to<br>208V.  |
| 9908        | MOTOR NOM SPEED    | Varies                                       | Equal to motor nominal RPM.                                 | See separate document.  |
| 9909        | MOTOR NOM<br>POWER | Varies                                       | Equal to motor nameplate HP<br>(*see exceptions)            |   |
| 9902        | APPLIC MACRO       | 1=HVAC DEFAULT or<br>ABB STANDARD            | -1=USER S1 SAVE   | This will save the settings above that<br>can be restored by pressing SAVE<br>when “USER S1 LOAD” is selected in<br>parameter 9902. |
| CHANGED PAR |                    |  |   | CHECK PARAMETERS for mistakes   |
| PAR BACKUP  |                    |  |   | UPLOAD TO PANEL   |
| 1603        | PASS CODE          | 0  | 358   | Allows parameters to be locked.   |
| 1602        | PARAMETER LOCK     | 1=OPEN                                       | 0=LOCKED  |   |



16.5.1.5 Motor Specific VFD Parameter Settings

| ACS355—<br>RT VFD PN | ACS320—<br>IN VFD PN | VFD<br>PH | MOTOR<br>PN              | MOTOR<br>BRAND | PARAMETER #     |              |             |            |                     |                                    |
|----------------------|----------------------|-----------|--------------------------|----------------|-----------------|--------------|-------------|------------|---------------------|------------------------------------|
|                      |                      |           |                          |                | 9905<br>VOLTAGE | 9906*<br>FLA | 9908<br>RPM | 9909<br>HP | 2003*<br>MAX<br>FLA | 3007**<br>MOTOR<br>LOAD<br>CURVE % |
| 136483               | 136450               | 1         | 136350_001<br>106350_000 | Baldor         | 208             | 4.5          | 1760        | 1.5        | 5.6                 | 98                                 |
| 136484               | 136451               | 1         | 136351_001<br>106351_000 | Baldor         | 208             | 6.6          | 1755        | 2.0        | 8.2                 | 98                                 |
| 136485               | 136452               | 1         | 136352_002<br>106352_000 | Baldor         | 208             | 9.0          | 1760        | 3.0        | 11.2                | 98                                 |
| 136486               | 136471               | 3         | 140625_000               | Marathon       | 208             | 2.3          | 1725        | 0.8        | 2.9                 | 100                                |
| 136473               | NA                   | 3         | 135253_000               | S&P            | 208             | 2.2          | 1407        | 1.0        | 2.7                 | 100                                |
| 136487               | 136453               | 3         | 136350_001<br>106350_000 | Baldor         | 208             | 4.5          | 1760        | 1.5        | 5.6                 | 98                                 |
| 136488               | 136453               | 3         | 136351_001<br>106351_000 | Baldor         | 208             | 6.6          | 1755        | 2.0        | 8.2                 | 98                                 |
| 136489               | 136455               | 3         | 136352_002<br>106352_000 | Baldor         | 208             | 9.0          | 1760        | 3.0        | 11.2                | 98                                 |
| 136490               | 136456               | 3         | 136353_002<br>106353_000 | Baldor         | 208             | 13.9         | 1750        | 5.0        | 17.3                | 98                                 |
| 136491               | 136457               | 3         | 136354_002<br>106354_000 | Baldor         | 208             | 20.0         | 1770        | 7.5        | 25.0                | 98                                 |
| 136492               | 136458               | 3         | 136355_002<br>106355_000 | Baldor         | 208             | 25.4         | 1770        | 10.0       | 31.7                | 98                                 |
| 136490               | 136456               | 3         | 135543_002               | Dayton***      | 208             | 14.0         | 1760        | 5.0        | 17.5                | 98                                 |
| 136491               | 136457               | 3         | 134314_002               | Dayton***      | 208             | 20.5         | 1770        | 7.5        | 25.6                | 98                                 |
| 136492               | 136458               | 3         | 134316_001               | Baldor***      | 208             | 26.0         | 1770        | 10.0       | 32.5                | 98                                 |
| 136492               | 136458               | 3         | 106353_000               | Baldor         | 208             | 27.8*        | 1750        | 5x2        | 31.2*               | 98                                 |
| 136493               | 136472               | 3         | 140625_000               | Marathon       | 460             | 1.2          | 1725        | 0.8        | 1.4                 | 100                                |
| 136474               | NA                   | 3         | 135254_000               | S&P            | 460             | 1.2          | 1477        | 1.0        | 1.4                 | 100                                |
| 136494               | 136459               | 3         | 136350_001<br>106350_000 | Baldor         | 460             | 2.2          | 1760        | 1.5        | 2.7                 | 98                                 |
| 136494               | 136459               | 3         | 136351_001<br>106351_000 | Baldor         | 460             | 2.9          | 1755        | 2.0        | 3.6                 | 98                                 |
| 136496               | 136461               | 3         | 136352_002<br>106352_000 | Baldor         | 460             | 4.2          | 1760        | 3.0        | 5.2                 | 98                                 |
| 136497               | 136462               | 3         | 136353_002<br>106353_000 | Baldor         | 460             | 6.7          | 1750        | 5.0        | 8.3                 | 98                                 |
| 136498               | 136463               | 3         | 136354_002<br>106354_000 | Baldor         | 460             | 9.5          | 1770        | 7.5        | 11.8                | 98                                 |
| 136499               | 136464               | 3         | 136355_002<br>106355_000 | Baldor         | 460             | 12.0         | 1770        | 10.0       | 15.0                | 98                                 |
| 136497               | 136462               | 3         | 135543_002               | Dayton***      | 460             | 6.4          | 1760        | 5.0        | 7.9                 | 98                                 |
| 136498               | 136463               | 3         | 134314_002               | Dayton***      | 460             | 9.3          | 1770        | 7.5        | 11.5                | 98                                 |
| 136499               | 136464               | 3         | 134316_001               | Baldor***      | 460             | 12.5         | 1770        | 10.0       | 15.6                | 98                                 |
| 136499               | 136464               | 3         | 106353_000               | Baldor         | 460             | 13.4*        | 1750        | 5x2        | 15.0*               | 98                                 |

**\*Parameter 9906 motor nameplate FLA** round up to nearest 10th and Parameter 2003 125% motor nameplate FLA round down to nearest 10th. Parameter 2003 is typically set at 125% FLA for motors with  $\geq 1.15$  Service Factor (SF) or motors otherwise thermally protected regardless of SF and set at 115% FLA for motors with  $< 1.15$  SF and otherwise unprotected based on National Electric Code (NEC) Article 430.32.

DN-5 units have two 5 HP motors with a single 10 HP VFD per airstream. Parameter 2003 is  $2.25 \times$  motor FLA. Parameter 9906 is  $2 \times$  motor nameplate FLA, Parameter 9909 motor 1 nameplate HP plus motor 2 nameplate HP.

**\*\*Parameter 3007 Motor Load Curve %** is typically  $125\%/127\%=98\%$  for motors with  $\geq 1.15$  Service Factor (SF),  $115\%/127\%=90\%$  for motors with  $< 1.15$  SF, 100% (default setting) for otherwise thermally protected motors regardless of SF.

**\*\*\*Motor PN** shown is the Grainger Kit PN that can be seen in HE6X8X Job BOMs. Motor is supplied with the kit.

See RPART VFD Parameter Specifications for TECO and WEG-S motor parameter settings used in the past, located at U:\Procedures\Engineering Procedures\Procedures for Production\VFD – RPART Parameter Specifications\_JAN16.pdf

Select “CHANGED PAR” in the “Menu” to verify none of the parameters to be changed were missed and that the changed parameters were correctly altered from the VFD default settings.



**NOTE:** This wiring schematic is TYPICAL control wiring using ABB VFDs for a three phase, 208-230VAC and 460VAC input for models HE-2X, HE3X, HE-4X, HE-6X, and HE-8X. A unit-specific electrical schematic is found inside the access door to the core module.

16.5.1.6 ABB VFD Wiring to Controller

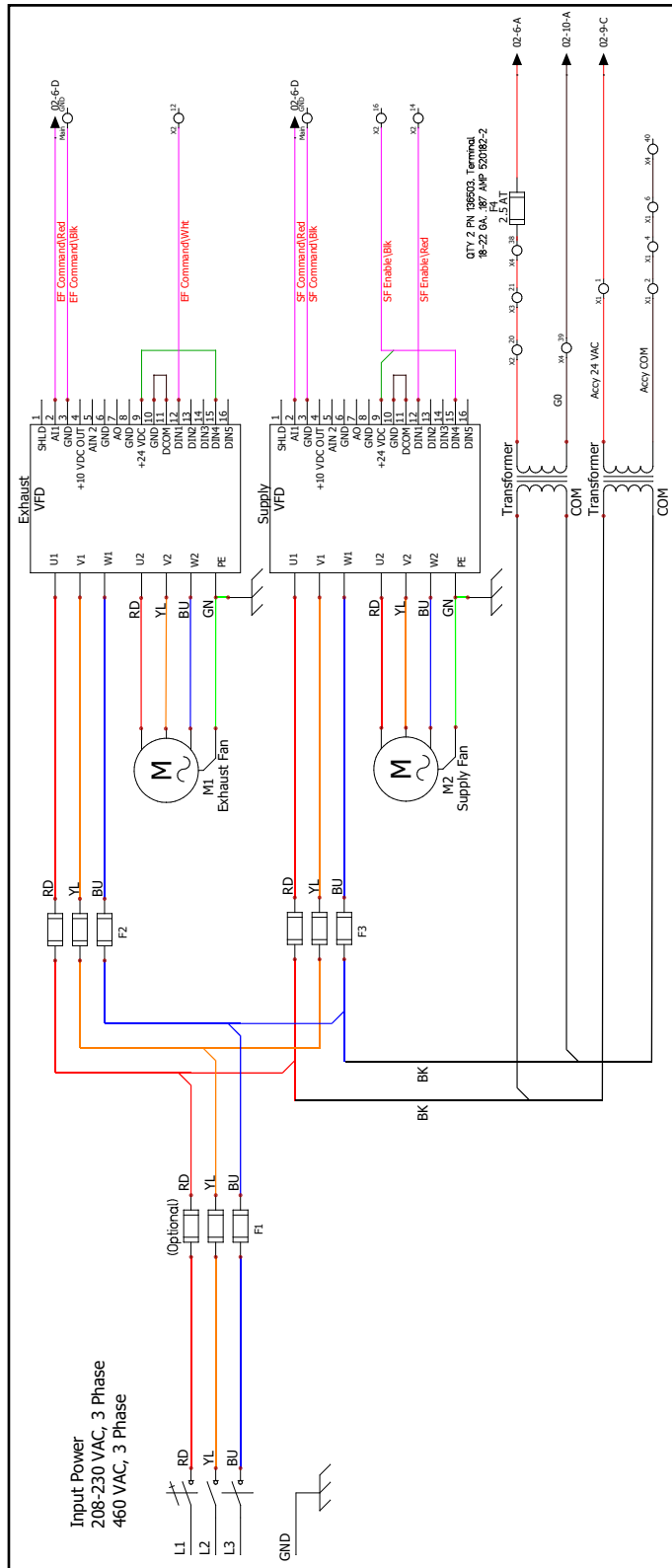


FIGURE 16.5.3 THREE PHASE ABB POWER WIRING SCHEMATIC

16.5.2 Lenze/Leesen SM Vector (SMV) VFD Information

The drive is the Lenze AC Tech/Leeson SM Vector (SMV) model.



FIGURE 16.5.4 SMV VFD SHOWN



FIGURE 16.5.5 VFD KEYPADS IN EBOX

16.5.2.1 SMV VFD Parameters

VFD parameters are instructions that the Variable Frequency Drives follow. They can be adjusted by using the keypads on the VFDs. Do not change these parameters from factory settings unless instructed to do so by TSS.

**To view the parameters, the VFD must be powered up This can be verified by the LED display of the VFD.**

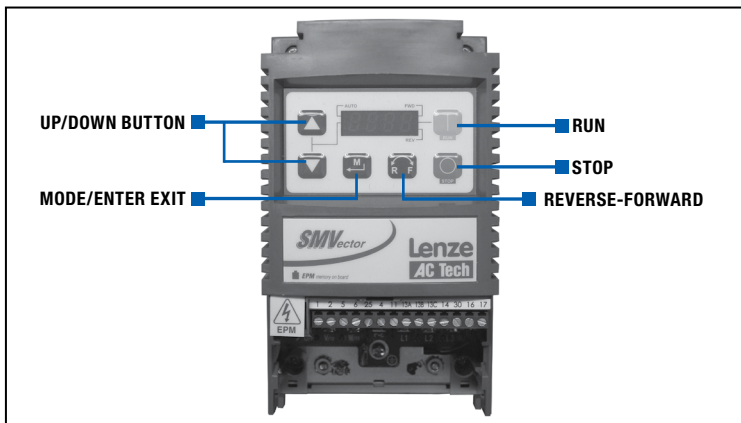


FIGURE 16.5.6 SMV KEYPAD BUTTONS

1. Push “MODE” button—PASS will flash onscreen followed by “0000.”
2. Push “MODE” button again to display P498.
3. Use “UP/DOWN” arrows to scroll through the parameters.
4. Press “MODE” button to display the parameter value.
5. Press “MODE” to exit—STOP will display.
6. To view other parameters start process over

**To change the parameters, IF PASS CODE is enabled (i.e. P194 is set to something other than “0”):**

1. Push “MODE” button—PASS will flash on screen followed by “0000.”
2. Press and hold “UP” Button to scroll to password 225.
3. Press “MODE”; P100 will be displayed.
4. Proceed to step 6, below.

**IF PASS CODE is NOT enabled (i.e. P194 is set to “0”):**

5. Press “MODE” button; the last-viewed parameter will be displayed.
6. Use “UP/DOWN” Button to scroll to parameter of interest.
7. Press “MODE” Button; parameter value will be displayed.
8. Use “UP/DOWN” Arrow button to change parameter value.
9. Press “MODE” button to save changed parameter value.
10. Press “MODE” button to exit; STOP will be displayed (in some cases the display will be different).

After parameter changes are complete, you must enter “225” and cycle power to lock changed parameters. Turn on the power to verify it is locked. Press “MODE” and PASS 0000 should be displayed if locked from making changes to parameters.

**To Reset VFD Parameters to Factory Settings using keypad:**

The VFD will need to be unlocked as described on page 11 to reset parameters to RenewAire factory or ABB defaults.

To return to RenewAire’s defaults, select parameter 9902 APPLIC MACRO and press “EDIT” softkey. Scroll down to USER 1 LOAD (Not USER 1 SAVE as this will overwrite the factory settings saved under USER 1 in the VFD base memory). Press the “SAVE” softkey.

Alternatively, to return to RenewAire’s defaults, select “PAR BACKUP” in the keypad menu; scroll to and select “DOWNLOAD FULL SET” (not UPLOAD TO PANEL as this will overwrite the factory settings saved in the keypad memory).

To return to ABB’s defaults, select parameter 9902 APPLIC MACRO and press EDIT softkey. Scroll up or down to select “HVAC DEFAULT.” Press the “SAVE” softkey. If HVAC DEFAULT was displayed without scrolling after pressing EDIT in parameter 9902, you will need to scroll up to another macro numbered 2 through 15 and press SAVE, then scroll back down to 1=HVAC DEFAULT and press “SAVE” again to get the settings to revert back to the original ABB defaults.

To save an edited parameter set for possible restoration, select parameter 9902 APPLIC MACRO and press EDIT softkey. Scroll down to USER 2 SAVE (Not USER 1 SAVE as this will overwrite the factory settings saved under USER 1 in the VFD base memory). Press the “SAVE” softkey. This edited parameter set can now be reset using USER 2 LOAD.

The VFD should be relocked as described above after the desired parameter settings are entered to avoid further, accidental changes to parameter settings.



**NOTE:** VFD Manufacturer instructions list many other parameters.

Copies of the complete manufacturer’s instructions for the VFD are shipped with this unit, and are also available on-line at their respective manufacturer’s website.

ABB: [www.abb.com/drives](http://www.abb.com/drives)  
 SMV: [www.leeson.com](http://www.leeson.com)  
[www.lenze.com/en-us/products/inverters](http://www.lenze.com/en-us/products/inverters)  
 YASKAWA: [www.yaskawa.com/downloads](http://www.yaskawa.com/downloads)

## 16.5.2.2 RenewAire SMV Parameter Settings

| PARAMETER | NAME                      | FACTORY SETTINGS   | COMMENTS   |
|-----------|---------------------------|--|--|
| P400      | Network Protocol          | 1  | 1 = Parameter changed on base VFD keypad to get Remote Keypad to display that is mounted in the ebox. Remote keypad not used on RD units.  |
| P100      | Start Control Source      | 1  | 1 = Start Control on VFD Terminal Strip on, terminals 1 and 4.   |
| P101      | Standard Reference Source | 1  | 1 = 0–10VDC speed reference.   |
| P102      | Minimum Frequency         | 15   | Determines the minimum operating speed (Hz) for the motor.   |
| P103      | Maximum Frequency         | 120.0  | Determines the maximum operating speed (Hz) for the motor.   |
| P108      | Motor Overload            | Set per Motor Table  | Critical Safety Parameter P108 = Motor FLA/VFD Output Rating X 100   |
| P160      | Speed at Minimum Signal   | 15   | When analog input is used to control VFD speed, sets VFD speed (Hz) when analog signal is 0%.  |
| P161      | Speed at Maximum Signal   | 120.0  | When analog input is used to control VFD speed, sets VFD speed (Hz) when analog signal is 100%.  |
| P165      | Base Voltage              | Set per Motor Table  | Must match motor nameplate voltage. Parameter P165 may not be adjustable.  |
| P194      | Password                  | Enter “225” and cycle power to lock VFD from parameter changes and display PASS 0000 | 0 = password disabled and VFD is unlocked. Must enter “225” to unlock and make changes to parameters if locked. PASS 0000 will show on screen when attempting parameter changes if locked. |

16.5.2.3 Motor Specific VFD Parameter Settings in RD Units

| SMV VFD PN       | 3PH MOTOR PN | MOTOR BRAND | HP | FLA | VFD OUTPUT AMPS | PARAMETER #    |         |
|------------------|--------------|-------------|----|-----|-----------------|----------------|---------|
|                  |              |             |    |     |                 | P108           | P165    |
|                  |              |             |    |     |                 | MOTOR OVERLOAD | VOLTAGE |
| 136506 wired 1PH | 136297_001   | Marathon    | 2  | 6.0 | 7.0             | 86             | 208     |
| 136506 wired 3PH | 136297_001   | Marathon    | 2  | 6.0 | 7.0             | 86             | 208     |
| 136508           | 136298_001   | Marathon    | 2  | 2.9 | 3.5             | 83             | 460     |
| 136509           | 136299_001   | Marathon    | 2  | 2.3 | 2.7             | 85             | 575     |
| 136511           | 136295_000   | Marathon    | 5  | 15  | 16.5            | 91             | 208     |
| 136512           | 136295_000   | Marathon    | 5  | 7.0 | 8.2             | 85             | 460     |
| 136513           | 136296_000   | Marathon    | 5  | 5.6 | 6.1             | 90             | 575     |

146.5.2.4 Motor Specific VFD Parameter Settings for Condenser Fans in DN w/Packaged Refrigeration

| SMV VFD PN | 3PH MOTOR PN | MOTOR BRAND | KW      | FLA | VFD OUTPUT AMPS | PARAMETER #    |         |
|------------|--------------|-------------|---------|-----|-----------------|----------------|---------|
|            |              |             |         |     |                 | P108           | P165    |
|            |              |             |         |     |                 | MOTOR OVERLOAD | VOLTAGE |
| *136513    | 136329_000   | Ziehl-Abegg | 2.8 kW  | 3.7 | 6.1             | 61             | 575     |
| **136466   | 136329_000   | Ziehl-Abegg | 2.8 x 2 | 7.4 | 9.0             | 82             | 575     |

\*DN-2 has single condenser fan controlled by single 5 hp/4 kW VFD.

\*\*DN-3 and DN-5 have two condenser fans controlled by a single 7.5 hp/5.5 kW VFD.

16.5.2.5 Motor Specific VFD Parameter Settings (continued) for 575V

| SMV VFD PN | 3PH MOTOR PN             | MOTOR BRAND | HP    | FLA  | VFD OUTPUT AMPS | PARAMETER #    |         |
|------------|--------------------------|-------------|-------|------|-----------------|----------------|---------|
|            |                          |             |       |      |                 | P108           | P165    |
|            |                          |             |       |      |                 | MOTOR OVERLOAD | VOLTAGE |
| 136509     | 136356_000<br>106356_000 | Baldor      | 1.5   | 1.8  | 2.7             | 67             | 575     |
| 136509     | 136357_000<br>106357_000 | Baldor      | 2     | 2.3  | 2.7             | 85             | 575     |
| 136465     | 136314_001<br>106314_000 | Baldor      | 3     | 3.3  | 3.9             | 85             | 575     |
| 136513     | 136315_001<br>106315_000 | Baldor      | 5     | 5.3  | 6.1             | 87             | 575     |
| 136466     | 136360_000<br>106360_000 | Baldor      | 7.5   | 7.6  | 9               | 85             | 575     |
| 136467     | 136361_000<br>106361_000 | Baldor      | 10    | 9.6  | 11              | 88             | 575     |
| 136467**   | 106315_000               | Baldor      | 5 x 2 | 10.6 | 11              | 96             | 575     |

\*\*DN-5 has two 5 HP motors per airstream with a single 10 HP VFD per airstream.

## 16.5.2.6 Motor Specific VFD Parameter Settings (continued) for 208–230V

| SMV VFD PN       | 3PH MOTOR PN             | MOTOR BRAND          | HP    | FLA  | VFD OUTPUT AMPS | PARAMETER #            |                 |
|------------------|--------------------------|----------------------|-------|------|-----------------|------------------------|-----------------|
|                  |                          |                      |       |      |                 | P108<br>MOTOR OVERLOAD | P165<br>VOLTAGE |
| 136820 wired 1PH | 140625_000               | Marathon             | 0.75  | 2.3  | 4.2             | 55                     | 208             |
| 136820 wired 1PH | 135253_000               | Soler & Palau        | 1.0   | 2.2  | 4.2             | 52                     | 208             |
| 136821 wired 1PH | 136350_001<br>106350_000 | Baldor               | 1.5   | 4.5  | 6               | 75                     | 208             |
| 136506 wired 1PH | 136351_001<br>106351_000 | Baldor               | 2     | 6.6  | 7               | 94                     | 208             |
| 136822 wired 1PH | 136352_002<br>106352_000 | Baldor               | 3     | 9    | 9.6             | 94                     | 208             |
|                  |                          |                      |       |      |                 |                        |                 |
| 136820 wired 3PH | 140625_000               | Marathon             | 0.75  | 2.3  | 4.2             | 55                     | 208             |
| 136820 wired 3PH | 135253_000               | Soler & Palau        | 1.0   | 2.2  | 4.2             | 52                     | 208             |
| 136821 wired 3PH | 136350_001<br>106350_000 | Baldor               | 1.5   | 4.5  | 6               | 75                     | 208             |
| 136506 wired 3PH | 136351_001<br>106351_000 | Baldor               | 2     | 6.6  | 7               | 94                     | 208             |
| 136822 wired 3PH | 136352_002<br>106352_000 | Baldor               | 3     | 9    | 9.6             | 94                     | 208             |
| 136511           | 135543_002               | Grainger<br>w/Dayton | 5     | 14   | 16.5            | 85                     | 208             |
| 136511           | 136353_002<br>106353_000 | Baldor               | 5     | 13.9 | 16.5            | 84                     | 208             |
| 136823           | 134314_002               | Grainger<br>w/Dayton | 7.5   | 20.5 | 23              | 89                     | 208             |
| 136823           | 136354_002<br>106354_000 | Baldor               | 7.5   | 20   | 23              | 87                     | 208             |
| 136824           | 134316_001               | Grainger<br>w/Dayton | 10    | 26   | 29              | 90                     | 208             |
| 136824           | 136355_002<br>106355_000 | Baldor               | 10    | 25.4 | 29              | 88                     | 208             |
| 136824           | 106353_000               | Baldor               | 5 x 2 | 27.8 | 29              | 96                     | 208             |



16.5.2.7 Motor Specific VFD Parameter Settings (continued) for 460V

| SMV VFD PN | 3PH MOTOR PN             | MOTOR BRAND       | HP    | FLA  | VFD OUTPUT AMPS | PARAMETER #            |                 |
|------------|--------------------------|-------------------|-------|------|-----------------|------------------------|-----------------|
|            |                          |                   |       |      |                 | P108<br>MOTOR OVERLOAD | P165<br>VOLTAGE |
| 136825     | 140625_000               | Marathon          | 0.75  | 1.15 | 2.1             | 55                     | 460             |
| 136825     | 135253_000               | Solar & Palau     | 1.0   | 1.13 | 2.1             | 54                     | 460             |
| 136508     | 136350_001<br>106350_000 | Baldor            | 1.5   | 2.2  | 3.5             | 63                     | 460             |
| 136508     | 136351_001<br>106351_000 | Baldor            | 2     | 2.9  | 3.5             | 63                     | 460             |
| 136826     | 136352_002<br>106352_000 | Baldor            | 3     | 4.2  | 4.8             | 88                     | 460             |
| 136512     | 135543_002               | Grainger w/Dayton | 5     | 6.33 | 8.2             | 77                     | 460             |
| 136512     | 136353_002<br>106353_000 | Baldor            | 5     | 6.7  | 8.2             | 82                     | 460             |
| 136827     | 134314_002               | Grainger w/Dayton | 7.5   | 9.25 | 11              | 84                     | 460             |
| 136827     | 136354_002<br>106354_000 | Baldor            | 7.5   | 9.5  | 11              | 86                     | 460             |
| 136828     | 134316_001               | Grainger w/Dayton | 10    | 12.5 | 14              | 89                     | 460             |
| 136828     | 136355_002<br>106355_000 | Baldor            | 10    | 12   | 14              | 86                     | 460             |
| 136828     | 106353_000               | Baldor            | 5 x 2 | 13.4 | 14              | 96                     | 460             |

**\*\*DN-5 has two 5 HP motors per airstream with a single 10 HP VFD per airstream.**

16.5.2.8 SMV VFD Wiring to Controller

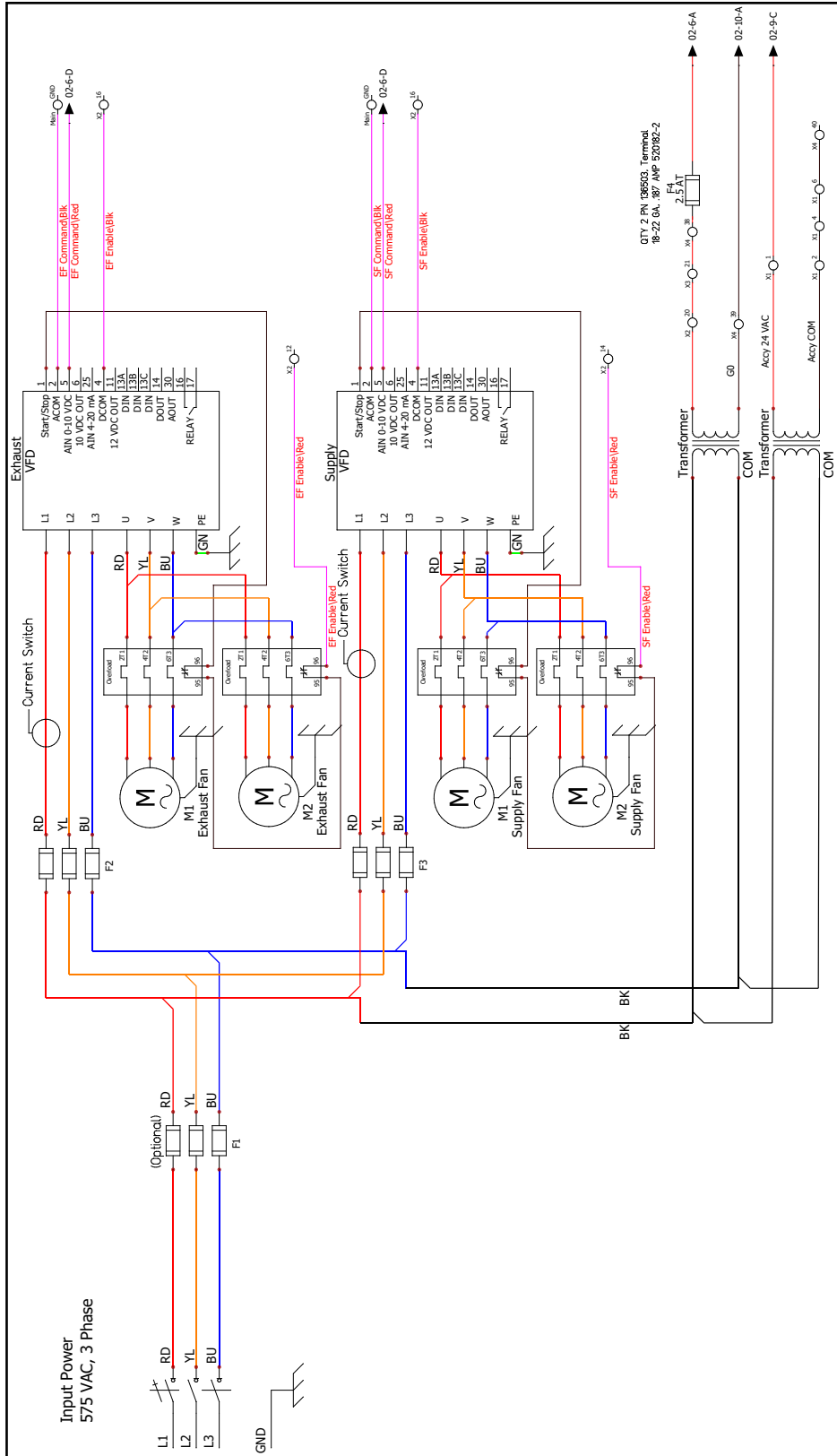


FIGURE 16.5.7 575V THREE PHASE SMV POWER WIRING SCHEMATIC

**NOTE:** This wiring schematic is TYPICAL control wiring using SMV VFDs for a three phase, 575VAC input for models HE-2X, HE3X, HE-4X, HE-6X, and HE-8X. A unit-specific electrical schematic is found inside the access door to the core module.

16.5.3 Yaskawa VFD Information

Yaskawa V1000 VFDs are supplied in indoor and rooftop units.



FIGURE 16.5.8 MODEL V1000 SHOWN

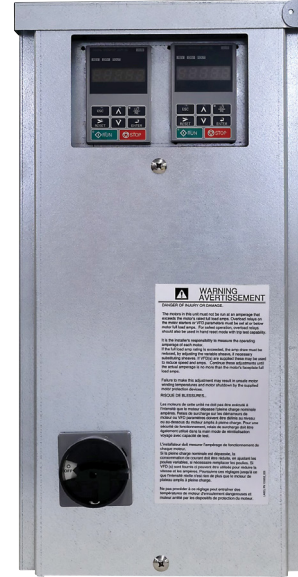


FIGURE 16.5.9 VFD KEYPADS IN EBOX

16.5.3.1 Yaskawa VFD Parameters

VFD parameters are instructions that the Variable Frequency Drives follow. They are factory set and should not be changed unless you are instructed to do so by TSS.

16.5.3.2 View All Parameters

VFD must be powered up to view the parameters.



FIGURE 16.5.10 YASKAWA KEYPAD BUTTONS

1. Press the “UP” arrow key until PAr is displayed and press the “ENTER” key to access the parameter settings. Parameters are categorized into groups by letter and number (Example: C3-02). The first parameter shown is A1-01.

2. To change the parameter number, each character in the parameter number will have to be adjusted. When accessing a parameter, the letter will be flashing. While the letter is flashing, press the “UP/DOWN” arrow key to change its value. Once the letter has been selected, press the “RIGHT” arrow key once to make the first number flash. Press the “UP/DOWN” arrow key to change the number's value. Repeat this process for all characters until the parameter number is displayed, then press the “ENTER” key.
3. The display will show the value of the selected parameter. If the motor is running, or if the VFD parameters are locked, the parameters can only be viewed and not changed.
4. Press the “ESC” button to go back to the parameter number adjustment screen and repeat steps 2–4 to view remaining desired parameters.

### 16.5.3.3 Locking and Unlocking Parameters

VFDs are shipped locked to prevent accidental changes to parameter settings. If changes to factory parameter settings are desired, the VFD will need to be unlocked for editing the settings.

#### **To unlock all Parameters:**

1. Press the “UP” arrow key until PAr is displayed. Press the “ENTER” key.
2. Change the parameter to A1-04. Press the “ENTER” key.
3. Change the value from a 0000 to 0358. Press the “ENTER” key.

All parameters should be visible/writable.

#### **To lock Parameters:**

1. Press the up-arrow key until PAr is displayed. Press the “ENTER” key.
2. Change the parameter to A1-04. Press and hold the “STOP” key, then press the “UP” arrow key to display parameter A1-05. Press the “ENTER” key.
3. Change the value from a 0000 to 0358. Press the “ENTER” key.
4. Change the parameter back to A1-04. Press the “ENTER” key.
5. The value should display 0000. Press the “ENTER” key to lock the VFD parameters.

All parameters should be visible/readable but cannot be adjusted.

#### **Changing VFD Parameters:**

To modify VFD parameters, the VFD must not be enabled and applying power to the motor. If the motor is running, press the “STOP” softkey or remove the enable from the controls.

1. Press the “UP” arrow key until PAr is displayed and press the “ENTER” key to access the parameter settings. Parameters are categorized into groups by letter and number (Example: C3-02). The first parameter shown is A1-01.
2. To change the parameter number, each character in the parameter number will have to be adjusted. When accessing a parameter, the letter will be flashing. While the letter is flashing, press the “UP/DOWN” arrow key to change its value. Once the letter has been selected, press the “RIGHT” arrow key once to make the first number flash. Press the “UP/DOWN” arrow key to change the number's value. Repeat this process for all characters until the parameter number is displayed, then press the “ENTER” key.
3. The display will show the default value of the selected parameter. Using the same process as step 2, change the values per the tables below. Once the desired value has been input, press the “ENTER” key. The word “END” will be displayed briefly to indicate the parameter has been changed. Then the parameter number that was just changed will be displayed again.
4. Repeat steps 2 and 3 to set remaining parameters.

**View only changed VFD parameters:**

Select “urFy” in the “Menu” to verify none of the parameters to be changed were missed and that the changed parameters were correctly altered from the VFD default settings.

1. Press the “DOWN” arrow button until “urFy” is displayed and press “ENTER” key.
2. Parameter B3-01 should be displayed. Press “ENTER” key to verify the setting.
3. Press “ENTER” key again to advance to the next parameter.
4. Repeat process until settings listed above have been verified.
5. If any parameters are not shown in the “urFy” list, set parameters per tables above.

16.5.3.4 RenewAire Yaskawa Parameter Settings

| PARAMETER | NAME/SELECTION                      | YASKAWA V1000<br>DEFAULT SETTINGS     | SETTINGS AS<br>SHIPPED BY US          | COMMENTS   |
|-----------|-------------------------------------|---------------------------------------|---------------------------------------|--|
| B1-01*    | Frequency Reference Selection 1     | 1: Terminals (Analog Input Terminals) | 1: Terminals (Analog Input Terminals) | Defines source of frequency command.   |
| B1-02     | Run Command Selection 1             | 1: Control Circuit Terminal           | 1: Control Circuit Terminal           | Defines source of run command.   |
| B1-03     | Stopping Method Selection           | 0: Ramp to Stop                       | 0: Ramp to Stop                       | VFD follows acceleration and deceleration times defined  |
| B3-01     | Speed Search Selection at Start     | 0: Disabled                           | 1: Enabled                            | VFD will attempt to detect a free-wheeling motor before applying output power.                               |
| B3-24     | Speed Search Method Selection       | 0: Current Detection Speed Search     | 1: Speed Estimation Speed Search      | Speed estimation method will be used.  |
| C1-01     | Acceleration Time 1                 | 10.0 s                                | 10.0 s                                | Time to accelerate from 0 speed to maximum frequency.  |
| C1-02     | Deceleration Time 1                 | 10.0 s                                | 10.0 s                                | Time to decelerate from maximum frequency to 0 speed.  |
| C6-02     | Carrier Frequency Selection         | 7: Swing PWM 1                        | 2: 5.0 kHz                            | Carrier frequency setting. If increased, may cause unintended derating of VFD output current capacity.       |
| D1-02     | Frequency Reference 2               | 0.00 Hz                               | 30.00 Hz                              | Low fixed frequency setting.   |
| D1-03     | Frequency Reference 3               | 0.00 Hz                               | 45.00 Hz                              | Medium fixed frequency setting.  |
| D1-04     | Frequency Reference 4               | 0.00 Hz                               | 60.00 Hz                              | High fixed frequency setting.  |
| D2-02     | Frequency Reference Lower Limit     | F: 60 Hz                              | HE and RPART—25.0%                    | Set per ERV type. Defines the minimum output frequency as a percentage of maximum frequency (E1-03 setting). |
|           |                                     |                                       | LE—16.7%                              |  |
|           |                                     |                                       | DN—12.5%                              |  |
| E1-03     | V/f Pattern Selection               | Varies                                | HE and RPART—F: 60 Hz                 | Set per ERV type. Defines the maximum output frequency via the V/f pattern selected.                         |
|           |                                     |                                       | LE—C: 90 Hz                           |  |
|           |                                     |                                       | DN—D: 120 Hz                          |  |
| E2-01     | Motor Rated Current                 | Varies                                | Motor Nameplate FLA                   | Set to the motor full load Amps output current rating on the nameplate.                                      |
| E2-04     | Number of Motor Poles               | E: Fault                              | Motor poles                           | "1800 rpm motor = 4 pole<br>1200 rpm motor = 6 pole"   |
| H1-01     | S1 Digital Input Function Selection | 40: Forward Run                       | 40: Forward Run                       | Sets digital input S1 to forward run enable when connected to the SC terminal.                               |
| H1-05     | S5 Digital Input Function Selection | 3: Multi-Step Speed Reference 1       | 3: Multi-Step Speed Reference 1       | Sets digital input S5 to Fixed Frequency Reference function 1 when connected to the SC terminal.             |

| PARAMETER | NAME/SELECTION                                   | YASKAWA V1000<br>DEFAULT SETTINGS | SETTINGS AS<br>SHIPPED BY US       | COMMENTS  |
|-----------|--|-----------------------------------|------------------------------------|---|
| H1-06     | S6 Digital Input Function Selection              | 4: Multi-Step Speed Reference 2   | 4: Multi-Step Speed Reference 2    | Sets digital input S6 to Fixed Frequency Reference function 2 when connected to the SC terminal.                                |
| H2-01     | Terminal MA, MB, and MC Function Setting (relay) | E: Fault                          | 0: During Run                      | Sets function of relay output to close contacts between MA and MC terminals.  |
| H3-01     | Analog Input A1 Signal Level Selection           | 0: 0–10 Vdc with Limit            | 0: 0–10 Vdc with Limit             | Sets the upper and lower limits of the analog input A1 range. Setting prevents frequency setpoint going negative when set to 0. |
| H3-02     | Analog Input A1 Function Selection               | 0: Frequency Bias                 | 0: Frequency Bias                  | The analog input A1 value will be added to the frequency reference.   |
| H3-03     | Terminal A1 Gain Setting                         | 100.0%                            | 100.0%                             | The analog input A1 value will be multiplied with the frequency reference   |
| H3-04     | Terminal A1 Bias Setting                         | 0.0%                              | 0.0%                               | Sets the analog input 1 Bias value to scale a 0–10 Vdc input signal.  |
| H3-09     | Analog Input A2 Signal Level Selection           | 2: 4–20 mA Current Input          | 2: 4–20 mA Current Input           | Sets the upper and lower limits of the analog input A2 range. Setting prevents frequency setpoint going negative when set to 0. |
| H3-10     | Analog Input A2 Function Selection               | 0: Frequency Bias                 | 0: Frequency Bias                  | The analog input A2 value will be added to the frequency reference.   |
| H3-11     | Terminal A2 Gain Setting                         | 100.0%                            | 100%                               | The analog input A2 value will be multiplied with the frequency reference   |
| H3-12     | Terminal A2 Bias Setting                         | 0.0%                              | -25.0%                             | Negative Symbol Required. Sets the analog input 2 Bias value to scale a 4–20 mA input signal.                                   |
| L1-02     | Motor Overload Protection Time                   | 1.0 Minutes                       | 0.2 Minutes                        | Sets the amount of time the VFD can output 120% VFD rated current before faulting.  |
| L2-01     | Momentary Power Loss Operation Selection         | 0: Disabled                       | 2: CPU Power Active                | Enables VFD to attempt to ride through momentary power loss.  |
| L3-02     | Stall Prevention Level During Acceleration       | Varies                            | Set based on VFD and Motor Current | "L3-02 = (Motor FLA / VFD FLA) X 1.25 CRITICAL PARAMETER. This provides motor protection!"                                      |
| L3-06     | Stall Prevention During Run                      | Varies                            | Set based on VFD and Motor Current | "L3-06 = (Motor FLA / VFD FLA) X 1.25 CRITICAL PARAMETER. This provides motor protection!"                                      |
| L5-01     | Number of Auto Restart Attempts                  | 0                                 | 10                                 | Number of automatic fault reset attempts.   |

**\*If no digital or analog signals will be used for the frequency setpoint, set B1-01 to function 0 to set frequency setpoint via keypad.**

16.5.3.5 208V Motor Specific VFD Parameter Settings

| # OF PH AND VOLTAGE | RA-YASKAWA VFD PN | YASKAWA MODEL #  | VFD FLA | 3PH MOTOR PN             | MOTOR HP | MOTOR BRAND          | PARAMETER #         |                  |                          |                        |
|---------------------|-------------------|------------------|---------|--------------------------|----------|----------------------|---------------------|------------------|--------------------------|------------------------|
|                     |                   |                  |         |                          |          |                      | E2-01               | E2-04            | L3-02                    | L3-06                  |
|                     |                   |                  |         |                          |          |                      | MOTOR RATED CURRENT | # OF MOTOR POLES | STALL LEVEL DURING ACCEL | STALL LEVEL DURING RUN |
| 1 PH 208V           | 136831            | CIMR-VUBA0006FAA | 6       | 140625_000               | 3/4      | Marathon             | 2.3                 | 4                | 48%                      | 48%                    |
| 1 PH 208V           | 136831            | CIMR-VUBA0006FAA | 6       | 135253_000               | 1        | Soler & Palau        | 2.2                 | 4                | 46%                      | 46%                    |
| 1 PH 208V           | 136831            | CIMR-VUBA0006FAA | 6       | 136350_001<br>106350_000 | 1.5      | Baldor               | 4.5                 | 4                | 94%                      | 94%                    |
| 1 PH 208V           | 136832            | CIMR-VUBA0010FAA | 9.6     | 136297_001               | 2        | Marathon             | 6                   | 4                | 78%                      | 78%                    |
| 1 PH 208V           | 136832            | CIMR-VUBA0010FAA | 9.6     | 136351_001<br>106351_000 | 2        | Baldor               | 6.6                 | 4                | 86%                      | 86%                    |
| 1 PH 208V           | 136832            | CIMR-VUBA0010FAA | 9.6     | 136352_002<br>106352_000 | 3        | Baldor               | 9                   | 4                | 117%                     | 117%                   |
| 3 PH 208V           | 136834            | CIMR-VU2A0004FAA | 3.5     | 140625_000               | 3/4      | Marathon             | 2.3                 | 4                | 82%                      | 82%                    |
| 3 PH 208V           | 136834            | CIMR-VU2A0006FAA | 6       | 135253_000               | 1        | Soler & Palau        | 2.2                 | 4                | 46%                      | 46%                    |
| 3 PH 208V           | 136835            | CIMR-VU2A0006FAA | 6       | 136350_001<br>106350_000 | 1.5      | Baldor               | 4.47                | 4                | 94%                      | 94%                    |
| 3 PH 208V           | 136836            | CIMR-VU2A0010FAA | 9.6     | 136297_001               | 2        | Marathon             | 6                   | 4                | 78%                      | 78%                    |
| 3 PH 208V           | 136836            | CIMR-VU2A0010FAA | 9.6     | 136351_001<br>106351_000 | 2        | Baldor               | 6.6                 | 4                | 86%                      | 86%                    |
| 3 PH 208V           | 136836            | CIMR-VU2A0010FAA | 9.6     | 136352_002<br>106352_000 | 3        | Baldor               | 8.48                | 4                | 117%                     | 117%                   |
| 3 PH 208V           | 136838            | CIMR-VU2A0020FAA | 19.6    | 136295_000               | 5        | Marathon             | 15                  | 6                | 96%                      | 96%                    |
| 3 PH 208V           | 136838            | CIMR-VU2A0020FAA | 19.6    | 135543_002               | 5        | Grainger w/ Dayton** | 14                  | 4                | 89%                      | 89%                    |
| 3 PH 208V           | 136838            | CIMR-VU2A0020FAA | 19.6    | 136353_002<br>106353_000 | 3        | Baldor               | 13.9                | 4                | 89%                      | 89%                    |
| 3 PH 208V           | 136839            | CIMR-VU2A0030FAA | 30      | 134314_002               | 7.5      | Grainger w/ Dayton** | 20.5                | 4                | 85%                      | 85%                    |
| 3 PH 208V           | 136839            | CIMR-VU2A0030FAA | 30      | 136354_002<br>106354_000 | 7.5      | Baldor               | 20                  | 4                | 83%                      | 83%                    |
| 3 PH 208V           | 136839            | CIMR-VU2A0030FAA | 30      | 134316_001               | 10       | Grainger w/ Dayton** | 26                  | 4                | 108%                     | 108%                   |
| 3 PH 208V           | 136839            | CIMR-VU2A0030FAA | 30      | 136355_002<br>106355_000 | 10       | Baldor               | 25.4                | 4                | 106%                     | 106%                   |
| 3 PH 208V           | 136839            | CIMR-VU2A0030FAA | 30      | 106353_000               | 5        | Baldor*              | 27.8*               | 4                | 116%*                    | 116%*                  |

\*DN-5 units have two 5 HP motors with a single 10 HP VFD per airstream. Parameter E2-01 is 2 x motor FLA. Parameter L3-02 is 1.25 x (2 x motor nameplate FLA) / VFD FLA, parameter L3-06 is 1.25 x (2 x motor nameplate FLA) / VFD FLA.

\*\*Motor PN shown is the Grainger Kit PN that can be seen in HE6X8X Job BOMs. Motor is supplied with the kit.

## 16.5.3.6 460V Motor Specific VFD Parameter Settings

| # OF PH AND VOLTAGE | RA-YASKAWA VFD PN | YASKAWA MODEL #  | VFD FLA | 3PH MOTOR PN             | MOTOR HP | MOTOR BRAND          | PARAMETER #         |                  |                          |                        |
|---------------------|-------------------|------------------|---------|--------------------------|----------|----------------------|---------------------|------------------|--------------------------|------------------------|
|                     |                   |                  |         |                          |          |                      | E2-01               | E2-04            | L3-02                    | L3-06                  |
|                     |                   |                  |         |                          |          |                      | MOTOR RATED CURRENT | # OF MOTOR POLES | STALL LEVEL DURING ACCEL | STALL LEVEL DURING RUN |
| 3 PH 460V           | 136840            | CIMR-VU4A0002FAA | 2.1     | 140625_000               | 3/4      | Marathon             | 1.15                | 4                | 68%                      | 68%                    |
| 3 PH 460V           | 136840            | CIMR-VU4A0002FAA | 2.1     | 135253_000               | 1        | Soler & Palau        | 1.13                | 4                | 67%                      | 67%                    |
| 3 PH 460V           | 136841            | CIMR-VU4A0004FAA | 4.1     | 136298_001               | 2        | Marathon             | 2.9                 | 4                | 88%                      | 88%                    |
| 3 PH 460V           | 136841            | CIMR-VU4A0004FAA | 4.1     | 136350_001<br>106350_000 | 1.5      | Baldor               | 2.2                 | 4                | 67%                      | 67%                    |
| 3 PH 460V           | 136841            | CIMR-VU4A0004FAA | 4.1     | 136351_001<br>106351_000 | 2        | Baldor               | 2.9                 | 4                | 88%                      | 88%                    |
| 3 PH 460V           | 136842            | CIMR-VU4A0005FAA | 5.4     | 136352_002<br>106352_000 | 3        | Baldor               | 4.2                 | 4                | 97%                      | 97%                    |
| 3 PH 460V           | 136843            | CIMR-VU4A0009FAA | 8.8     | 136295_000               | 5        | Marathon             | 7                   | 6                | 99%                      | 99%                    |
| 3 PH 460V           | 136843            | CIMR-VU4A0009FAA | 8.8     | 135543_002               | 5        | Grainger w/ Dayton** | 6.33                | 4                | 90%                      | 90%                    |
| 3 PH 460V           | 136843            | CIMR-VU4A0009FAA | 8.8     | 136353_002<br>106353_000 | 5        | Baldor               | 6.7                 | 4                | 95%                      | 95%                    |
| 3 PH 460V           | 136844            | CIMR-VU4A0011FAA | 11.1    | 134314_002               | 7.5      | Grainger w/ Dayton** | 9.25                | 4                | 104%                     | 104%                   |
| 3 PH 460V           | 136844            | CIMR-VU4A0011FAA | 11.1    | 136354_002<br>106354_000 | 7.5      | Baldor               | 9.5                 | 4                | 107%                     | 107%                   |
| 3 PH 460V           | 136845            | CIMR-VU4A0018FAA | 17.5    | 134316_001               | 10       | Grainger w/ Dayton** | 12.5                | 4                | 89%                      | 89%                    |
| 3 PH 460V           | 136845            | CIMR-VU4A0018FAA | 17.5    | 136355_002<br>106355_000 | 10       | Baldor               | 12                  | 4                | 86%                      | 86%                    |
| 3 PH 460V           | 136845            | CIMR-VU4A0018FAA | 17.5    | 106353_000               | 5        | Baldor*              | 13.4*               | 4                | 96%*                     | 96%*                   |

\*DN-5 units have two 5 HP motors with a single 10 HP VFD per airstream. Parameter E2-01 is 2 x motor FLA. Parameter L3-02 is 1.25 x (2 x motor nameplate FLA) / VFD FLA, parameter L3-06 is 1.25 x (2 x motor nameplate FLA) / VFD FLA.

\*\*Motor PN shown is the Grainger Kit PN that can be seen in HE6X8X Job BOMs. Motor is supplied with the kit.



### 16.5.3.7 To Reset VFD Parameters to Factory Settings using Keypad

The VFD will need to be unlocked as described on in section 3.3 to reset parameters to RenewAire factory or Yaskawa defaults.

#### To return to RenewAire's defaults, complete the following steps:

1. Press the "UP" arrow key until PAr is displayed. Press the "ENTER" key.
2. Change the parameter to A1-03. Press the "ENTER" key.
3. Change the value from a "0000" to "1110." Press the "ENTER" key.
4. The backup parameters should now overwrite any existing parameter settings.
5. The parameters should be verified using the "urFy" process outlined in section 3.3.

#### To return to Yaskawa's defaults, complete the following steps:

1. Press the "UP" arrow key until PAr is displayed. Press the "ENTER" key.
2. Change the parameter to A1-03. Press the "ENTER" key.
3. Change the value from a "0000" to "2220." Press the "ENTER" key.
4. The Yaskawa factory default parameters should now overwrite any existing parameter settings.
5. The parameters should be verified using the "urFy" process outlined in section 3.3.

#### To save an edited parameter set for possible restoration, complete the following steps:

1. Press the "UP" arrow key until PAr is displayed. Press the "ENTER" key.
2. Change the parameter to O2-03. Press the "ENTER" key.
3. Change the value from a "0" to "1." Press the "ENTER" key.
4. The parameters are now backed up to the VFDs internal memory.

There is no option to save the parameters in the remote-mounted keypad for Yaskawa V1000 VFDs.

The VFD should be relocked as described in section 3.3 after the desired parameter settings are entered to avoid further, accidental changes to parameter settings.



**NOTE:** VFD Manufacturer instructions list many other parameters.

Copies of the complete manufacturer's instructions for the VFD are shipped with this unit, and are also available on-line at their respective manufacturer's website.

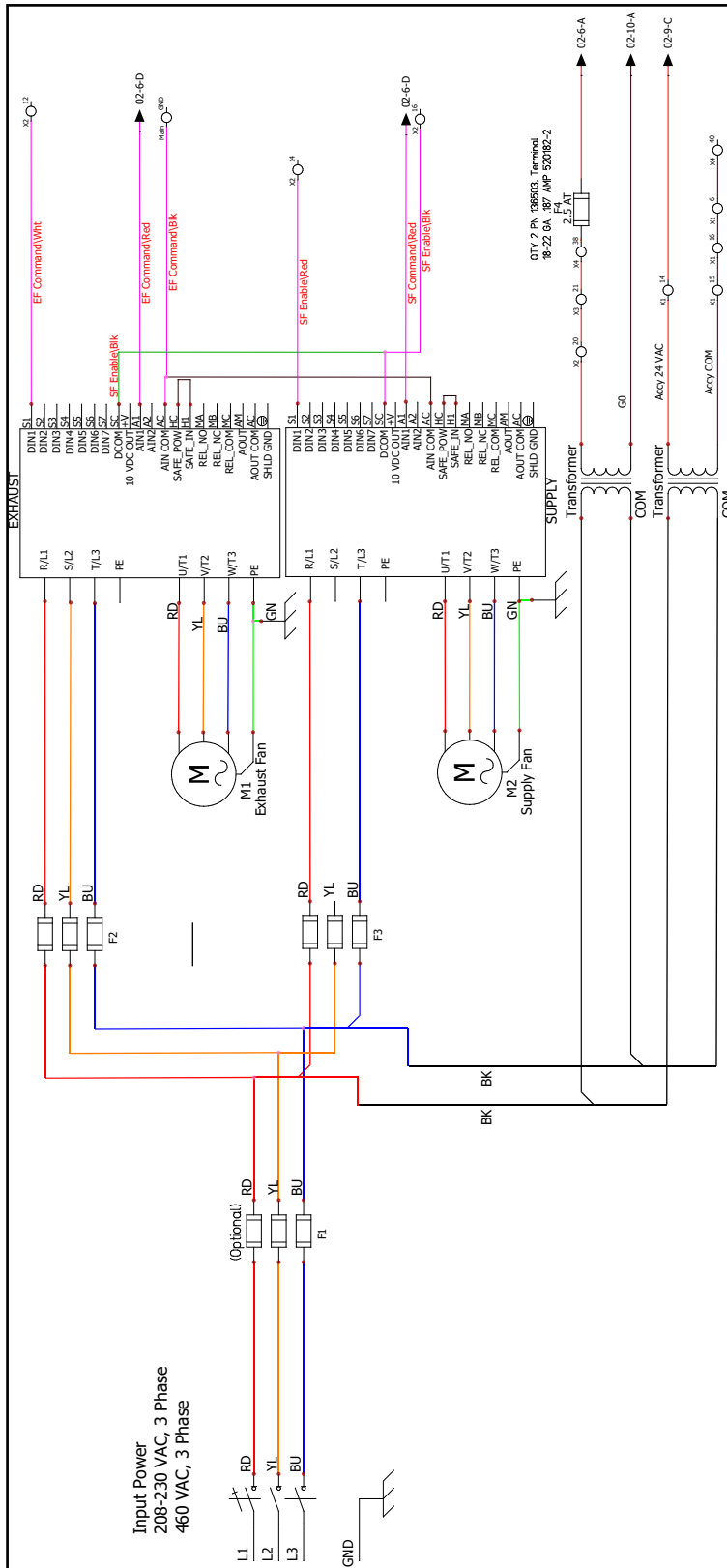
ABB: [www.abb.com/drives](http://www.abb.com/drives)

SMV: [www.leeson.com](http://www.leeson.com)

[www.lenze.com/en-us/products/inverters](http://www.lenze.com/en-us/products/inverters)

YASKAWA: [www.yaskawa.com/downloads](http://www.yaskawa.com/downloads)

16.5.3.8 Yaskawa VFD Wiring to Controller



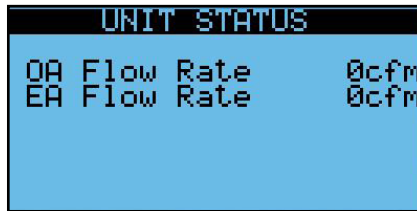
**NOTE:** This wiring schematic is TYPICAL of three phase, 208-230VAC and 460VAC input for models DN-2 and DN-3. This drawing is for a unit that includes gas heat and VFD motors. A unit-specific electrical schematic is found inside the access door to the core module.

FIGURE 16.5.11 THREE PHASE YASKAWA POWER WIRING SCHEMATIC

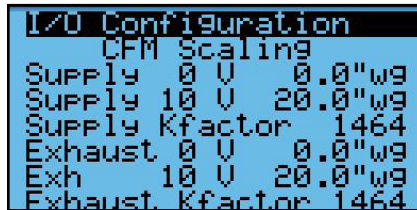
### 16.6 CFM SCALING

The DN controller provides a reading of CFM along with control options to control fans to maintain a specific flow. In order for these features to work correctly it may be required to scale this value.

To do this, you would require a manometer to read the actual flow value. Compare it to this screen in Unit Status.



If it reads off, you can adjust the kfactor on the following screen. Increasing that value will increase the reading. Decreasing the value will decrease the reading.



The factory set values are in this table.

| VOLTAGE     | HP/KW  | RENEWAIRE PN | VENDOR      | FAN SIZE         | UNIT       | K-FACTOR |
|-------------|--------|--------------|-------------|------------------|------------|----------|
| P1 200-277V | 1.35   | 136371       | Ziehl-Abegg | GR31C            | DN-2       | 1150     |
| P3 200-240V | 2.7    | 136372       | Ziehl-Abegg | GR35C            | DN-2, DN-3 | 1464     |
|             | 2.7 x2 | 136372       | Ziehl-Abegg | GR35C            | DN-5       | 2928     |
| P3 380-480V | 3.7    | 136373       | Ziehl-Abegg | GR31C            | DN-2, DN-3 | 1150     |
|             | 3.7 x2 | 136373       | Ziehl-Abegg | GR31C            | DN-5       | 2300     |
| P3 208-240V | 3      | 136352       | Baldor      | Punker 355 x 100 | DN-2       | 1562     |
|             | 5      | 136353       | Baldor      | Punker 355 x 100 | DN-3       | 1562     |
|             | 5 x2   | 136353       | Baldor      | Punker 355 x 100 | DN-5       | 3124     |
| P3 460V     | 3      | 136352       | Baldor      | Punker 355 x 100 | DN-2       | 1562     |
|             | 5      | 136353       | Baldor      | Punker 355 x 100 | DN-3       | 1562     |
|             | 5 x2   | 136353       | Baldor      | Punker 355 x 100 | DN-5       | 3124     |
| P3 575V     | 3      | 136314       | Baldor      | Punker 355 x 100 | DN-2       | 1562     |
|             | 5      | 136315       | Baldor      | Punker 355 x 100 | DN-3       | 1562     |
|             | 5 x2   | 136315       | Baldor      | Punker 355 x 100 | DN-5       | 3124     |

## 17.0 GLOSSARY

### **Analog Control Signal**

An analog signal is a varying-voltage output signal, typically between 0–10 volts. It is most often used to produce a specific amount of output from a variable-output device, such as a digital scroll compressor or a variable speed fan. 0 volts would represent an OFF condition and 10 volts would represent a demand for output at 100% of capacity.

### **BACnet**

Building Automation Control Network. BACnet is a communications protocol for building automation and control networks. It is just one of several different control systems that may be used as part of a BMS.

### **BACnet IP**

### **BACnet MSTP**

BACnet Master Slave Token Passing—this is one of the possible BACnet protocols that may be used.

### **BMS**

A building management system (BMS) is a control system that can be used to monitor and manage the mechanical, electrical and electromechanical services in a facility. Such services can include power, heating, ventilation, air-conditioning, physical access control, pumping stations, elevators and lights.

### **Cat-5 Cables**

Cat-5 cable, sometimes called Ethernet cable, is short for Category 5 cable, a current industry standard for network wiring. This type of cable is unshielded wire containing four pairs of 24-gauge twisted copper pairs, terminating in an RJ-45 jack. If a wire is certified as Cat-5 and not just a twisted pair wire, it will have this designation printed on the outside.

### **Controller**

Direct Digital Control is the automated control of a condition or process by a digital device (computer). The controller accepts digital or analog inputs from a variety of sensors and then follows all of its programmed instructions to produce action instructions to valves, actuators, fans, compressors and other HVAC components that can be adjusted. The Carel controller is a DDC controller.

### **Digital Control Signal**

A digital control signal is a fixed-voltage or amperage output signal, representing either an ON or OFF condition for the device it is connected to. It is typically used to activate a relay that controls operation of a device.

### **DIN Rail**

A DIN rail is a specially shaped metal strip which is used to mount relays, switches, terminals, etc. in industrial panels. The shape of the strip is such that these items can be pressed onto it and a spring clip on each device slips into the bend in the rail and the device is held firmly. The strip can be mounted with screws or bolts to a wall or panel. The controller and any expansion boards are typically mounted on a DIN rail in the Main Control Panel.

### **Economizer Bypass**

The Economizer Bypass provides energy conservation during operation of an ERV. It accomplishes this by sensing ambient conditions and it then allows the return air stream to move through an alternate duct, bypassing the ERV enthalpic core when the unit calls for cooling and the outdoor conditions are more favorable than the return air.

### **Ethernet**

Ethernet is the standard way to connect computers on a network over a wired connection. It provides a simple interface and is used for connecting multiple devices, such as computers, routers, and switches. When the Carel controller is incorporated into a BMS, the BMS computer and the Carel controller become an ethernet.

**IO Configuration**

Refers to the specific wiring terminals on the controller that are assigned for each Input or OutputIP

**IP Address**

A unique string of numbers separated by periods that identifies each computer using the Internet Protocol to communicate over a network

**Hot Gas Reheat (HGRH)**

Used in dehumidification, hot gas reheat relies on an additional coil downstream of the cooling coil in which the hot refrigerant piping is in contact with the supply air. This allows a portion of the refrigerant cycle's rejected heat to be reclaimed as reheat. The amount of refrigerant piped to the coil is modulated to maintain a supply temperature during dehumidification.

**Hysteresis**

The hysteresis is a value that is added to a setpoint for a specific control option to turn on, and then it turns off at setpoint. This helps prevent over cycling of the controlled device.

**I/O**

Refers to all of the inputs and outputs such as sensors and control to fans.

**Modbus**

Modbus is a serial communications protocol for use with programmable logic controllers (PLCs). It is a standard communication protocol, and it is now a commonly available means of connecting industrial electronic devices. Modbus enables communication among many devices connected to the same network, for example a system that measures temperature and humidity and communicates the results to a computer. Modbus is often used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition systems.

**Modbus RTU**—see Modbus, above.

**Modbus RTP**—see Modbus, above.

**NAND Memory**

NAND flash memory is a type of non-volatile storage technology that does not require power in order to retain data. The technology is used in common storage devices such as flash drives, solid-state drives and memory cards.

**NODE**

Any system or device connected to a network is also called a node. For example, if a network connects a file server, five computers, and two printers, there are eight nodes on the network. Each device on the network has a network address, such as a MAC address, which uniquely identifies each device.

**PI Control**

The output of PID controllers will change in response to a change in process variable or setpoint.

**RJ-45 jack**

RJ-45 is a standard type of connector for network cables. RJ-45 connectors are most commonly seen with ethernet cables and networks. RJ-45 connectors feature eight pins to which the wire strands of a cable interface electrically. Standard RJ-45 pinouts define the arrangement of the individual wires needed when attaching connectors to a cable. Several other kinds of connectors closely resemble RJ-45 and can be easily confused for each other.

**RUT**

Remote User Terminal. The RUT is the User Interface where a person can view current operating conditions or status, make changes to setpoints and otherwise control the operation of the air handler. The Carel RUT is an electronic device that has multiple push buttons and a viewing screen and is connected to the Carel Controller by means of a common telephone cable.

**Setpoint**

The desired value in a closed-loop feedback system, as in regulation of temperature or pressure.

**USB/USB Port**

Universal Serial Bus. There are different types of USB ports that are commonly used. Type “A” ports are almost always found on computers and are used to connect with other electronic devices. The Carel c.pCO Mini has a Micro USB type “B” that is used to connect to external memory devices or to a computer.

**USB Thumb Drive**

A very small, portable, solid-state hard drive that can be inserted into a USB port for storage and retrieval of data.

**UI**

User Interface—commonly called “UI.” A user interface is the means by which a person controls a hardware device or a software application. For the Carel Controller, the RUT (Remote User Terminal) is one possible User Interface.

**URL**

Uniform Resource Locator. Commonly referred to as a web address. It is a very specific address that identifies the location of a specific website or address on the internet.

**Wipe Retain**

Wipe/Retain is a user-commanded function in which all non-volatile memory in the Controller is erased and factory defaults are reinstalled.









## About RenewAire

For over 40 years, **RenewAire has been a pioneer in enhancing indoor air quality (IAQ)** in commercial and residential buildings of every size. This is achieved while maximizing sustainability through our fifth-generation, static-plate, enthalpic-core **Energy Recovery Ventilators (ERVs) that optimize energy efficiency**, lower capital costs via load reduction and decrease operational expenses by minimizing equipment needs, resulting in significant energy savings. Our ERVs are competitively priced, simple to install, easy to use and maintain and have a quick payback. They also enjoy the industry's best warranty with the lowest claims due to long-term reliability derived from innovative design practices, expert workmanship and **Quick Response Manufacturing (QRM)**.

As the pioneer of static-plate core technology in North America, RenewAire is the largest ERV producer in the USA. We're **committed to sustainable manufacturing** and lessening our environmental footprint, and to that end our Waunakee, WI plant is 100% powered by wind turbines. The facility is also one of the few buildings worldwide to be LEED® Gold and Green Globes certified, as well as having achieved ENERGY STAR Building status. In 2010, RenewAire joined the Soler & Palau (S&P) Ventilation Group in order to provide direct access to the latest in energy-efficient air-moving technologies. For more information, visit: [renewaire.com](https://renewaire.com)

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