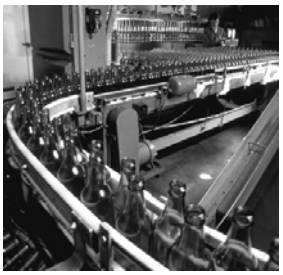
LISTEN.
THINK.
SOLVE.®

Allen-Bradley

FanMaster™ Energy Saving Package



INSTALLATION MANUAL

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at **http://www.rockwellautomation.com/literature**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.

Shock Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

Burn Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

Index

General Information

Who Should Use This Manual

Use this manual if you are responsible for installing and/or operating the Allen-Bradley® FanMaster™ Energy Saving Package. You must have a thorough understanding of installation and operation of HVAC units, Building Automation Systems (BAS) and electrical circuitry and components in order to successfully install this product.

Description of the Allen-Bradley FanMaster™ Energy Saving Package

The Allen-Bradley® FanMaster™ Energy Saving Package (referred to hereafter as FanMaster) is a data acquisition and control system that is integrated with existing mixed air, single path, constant volume air handler units (AHU) to help reduce energy and cooling and heating costs. FanMaster utilizes two air temperature sensors/transmitters, an outside air damper switch, a PLC with custom-configured application software and a configured PowerFlex® 400 AC drive to monitor the AHU air temperatures and control the supply and return (if present) air fan motor speed and outside air damper position (if used) to accomplish these savings.

A FanMaster evaluation unit is available for installation and is configured the same as the standard unit, but is not integrated with a drive. In addition to the controls listed above, the evaluation unit uses a fan current switch to monitor the “on” and “off” condition of the supply air fan to calculate potential fan energy and air cooling and heating cost reductions.

FanMaster is contained in either a NEMA/UL Type 1 (not available for evaluation units) or NEMA/UL Type 4 wall mount enclosure with an integrated, pre-configured PanelView™ Component C600 HMI terminal for ease of programming, operation and diagnostics. FanMaster also provides an interposing relay for interfacing to the existing BAS fan run signal and two additional relays for fan auxiliary running contacts.

What is Contained in this Manual

This manual provides installation and configuration information for the FanMaster product only. Refer to Reference Materials on page 1-2 for information on associated products.

To install and configure the FanMaster complete the instructions in each of the following chapters, sequentially:

- Chapter 2 - FanMaster Installation
- Chapter 3 - FanMaster Configuration and Start Up

Reference Materials

Rockwell Automation publications are available on the internet at www.rockwellautomation.com/literature.

The following manuals are recommended for additional information:

Title	Publication
PowerFlex 400 AC Drive Packages for Fan & Pump Applications Installation Manual	22C-IN002
PowerFlex 400 Adjustable Frequency AC Drive for Fan & Pump Applications User Manual	22C-UM001
Wiring and Grounding Guidelines for PWM AC Drives	DRIVES-IN001
PanelView Component HMI Terminals User Manual	2711C-UM001
MicroLogix 1100 Programmable Controllers User Manual	1763-UM001

For Allen-Bradley Drives Technical Support:

Title	Online at . . .
Allen-Bradley Drives Technical Support	**www.ab.com/support/abdrives**

FanMaster Installation

General Precautions

ATTENTION: Only qualified personnel familiar with Heating, Ventilating and Air Conditioning (HVAC) systems, adjustable frequency AC drives and associated instrumentation and machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this product or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

ATTENTION: FanMaster is a HVAC fan motor control device that when integrated with HVAC building automation systems and any other control devices does not provide limits for or protection against loss of freeze status, high temperature, high static, carbon dioxide/indoor air quality, smoke and fire, and/or flood control signals. All persons responsible for applying this equipment must satisfy themselves that the intended application of this equipment is acceptable.

ATTENTION: National Codes and Standards (NEC, VDE, BSI, etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

Installation Considerations

Consider and plan for the following when installing FanMaster for integration with an AHU:

- The existing BAS control supply fan start/stop signal. Two relays are provided for interfacing to the BAS fan start/stop signal. The relay installed in the FanMaster enclosure accommodates a 120V AC signal. A second relay is shipped loose and accommodates a 24V AC signal. If a signal other than 24V or 120V AC is used, you must purchase and install the appropriate relay separately. The Allen-Bradley 700-HK family of relays provides coil voltages from 6V AC…240V AC or 6V DC…48V DC. More information is provided on the Allen-Bradley web site at: http://www.ab.com/en/epub/catalogs/12768/229240/229266/229643/229701/tab3.html
- The existing BAS outside air damper position control signal (used with constant ventilation option only). FanMaster provides I/O connections for a 4…20 mA signal only. If the BAS control signal is 0…10V DC or 0…135 Ohms, a converter adapter must be purchased separately for both the input and output signals.

Installation Requirements

Power Source for FanMaster

120V AC, 10 Amp (min.) grounded service.

Tools Required for Installation

- Variable speed drill
- Sheet metal drill bits
- Various screwdrivers
- Various wrenches (open, socket and/or torque)
- Conduit cutting and bending tools (optional, for permanent installations)

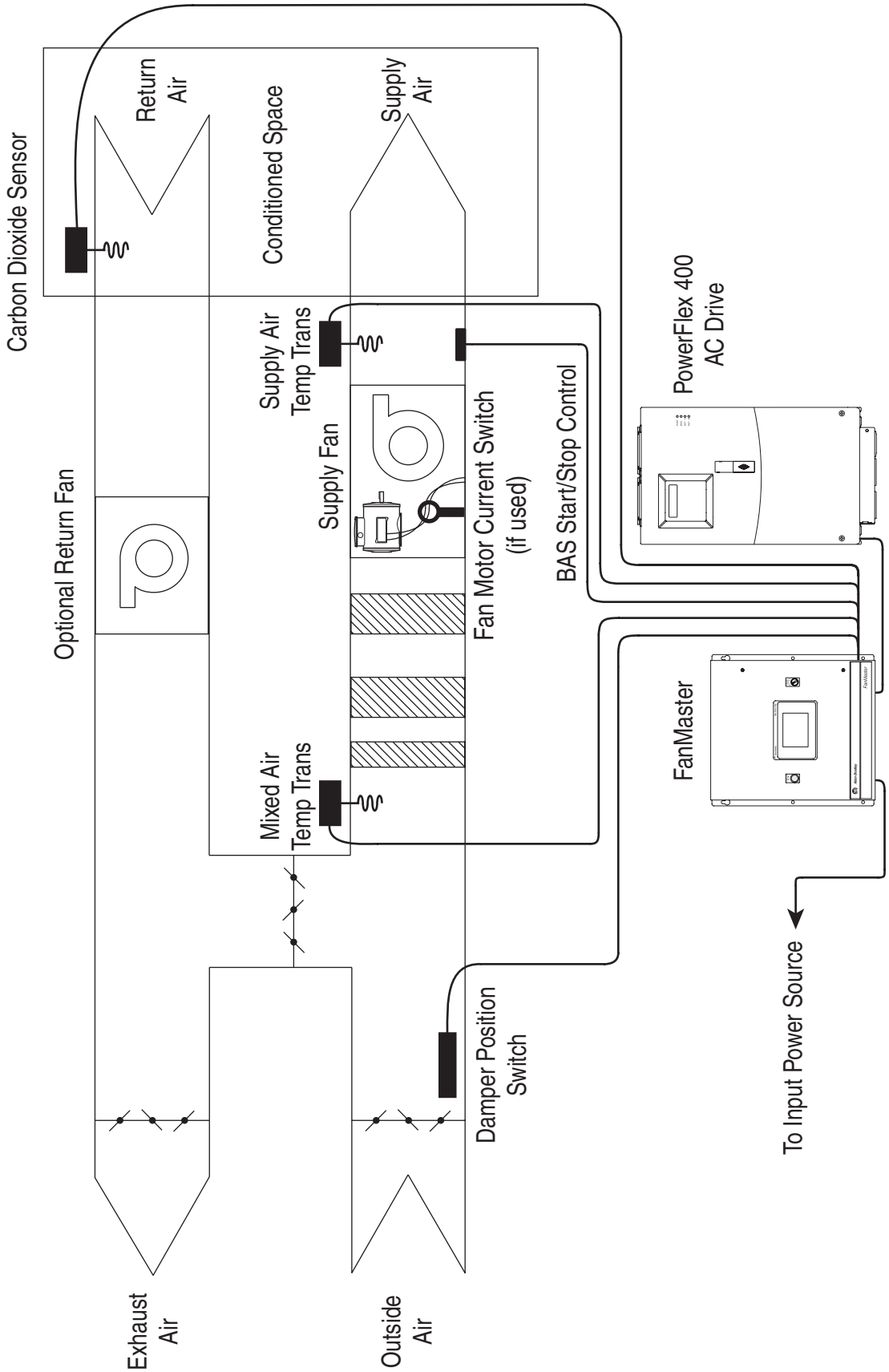
Wiring Specifications

Important: All power, I/O and signal wiring is customer supplied.

All wire to be Stranded, copper, 600V/105 °C (194 °F) insulation.

Terminal(s)	Description	Max. Wire Size	Min. Wire Size	Torque
L, N	Power	10 AWG	22 AWG	1.0 N•m (9.0 lb•in)
GND	Ground	6 AWG	16 AWG	2.3 N•m (20.4 lb•in)
–	I/O and Signal	12 AWG	22 AWG	0.6…0.8 N•m (4.5…7.1 lb•in)

Figure 2.1 Typical FanMaster and Drive Installation



Installation

Install the Instruments on the AHU

Refer to Figure 2.1 on page 2-3 the for guidance on instrument locations.

Important: Instrument cables must be no longer than 3200 m (10499 ft.) for 4…20 mA signals using a minimum of 20 AWG wire and 200 m (656 ft.) for digital signals using a minimum of 20 AWG wire.

1. Using the two screws and mounting flanges provided on the enclosure, mount the supply air temperature transmitter to the outside of the AHU sheet metal cover, in the middle of the supply air plenum. Placement must be after the heating and cooling exchangers.

   Important: Verify that the transmitter probe is installed in a position that does not cause contact with any internal equipment and that no internal equipment will be damaged while drilling the insertion and mounting holes.

2. Using the two screws and mounting flanges provided on the enclosure, mount the mixed air temperature transmitter to the outside of the AHU sheet metal cover, in the middle of the mixed air plenum. Placement should be in a position where the outside air and return air are equally mixed and the temperature reflects the average temperature entering the heating and cooling exchangers.

   Important: Verify that the transmitter probe is installed in a position that does not cause contact with any internal equipment and that no internal equipment will be damaged while drilling the insertion and mounting holes.

3. Using the two screws and mounting flanges provided on the enclosure, mount the carbon dioxide sensor in the return air plenum. Placement must be prior to the mixing of outside air with the return air.

   Important: The carbon dioxide sensor will not operate properly below 0° C (32° F).

   Important: Verify that the sensor probe is installed in a position that does not cause contact with any internal equipment and that no internal equipment will be damaged while drilling the insertion and mounting holes.

4. If your installation does not use constant ventilation, install the damper position indicator switch with the following considerations:

   – The damper position switch must be installed in a location that allows the switch to detect the damper position (e.g., on the damper actuator crank arm).

   – The damper position switch must be set to “closed” when the outside air damper is open 5 degrees beyond the normal minimum position for your installation.

5. If you are installing an evaluation unit only, clamp the current switch around any one of the supply fan motor leads.

Install the PowerFlex® 400 Drive (If Applicable)

If you are installing an evaluation unit, continue with Install the FanMaster Enclosure on page 2-6.

Important: If your are installing a Style A, NEMA/UL Type 3R, 4 and 12 PowerFlex 400 drive with a factory installed HOA switch and a speed potentiometer, you must place a jumper between terminal 35 on TB1 in the drive enclosure and terminal 8 on the drive signal terminal block. The Auto Start contact is not required on this drive.

Important: If you are installing a Style A, NEMA/UL Type 1 PowerFlex 400 drive, the optional inputs may be installed with the exception of the Hand/Auto, Auto Start and Speed Reference inputs.

Important: The FanMaster startup procedure will set all necessary drive parameters to the correct settings. Therefore, those sections of the drive installation and/or user manual which refer to setting or configuring parameters should be ignored during installation of the PowerFlex 400 drive.

For drive installation instructions, refer to the following publications:

- *PowerFlex 400 AC Drive Packages for Fan & Pump Applications Installation Manual*, publication 22C-IN002.
- *PowerFlex 400 AC Drive Packages for Fan & Pump Applications User Manual*, publication 22C-UM001.

For detailed information on how to properly wire and ground drives and determine maximum motor cable lengths, refer to:

- *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001.

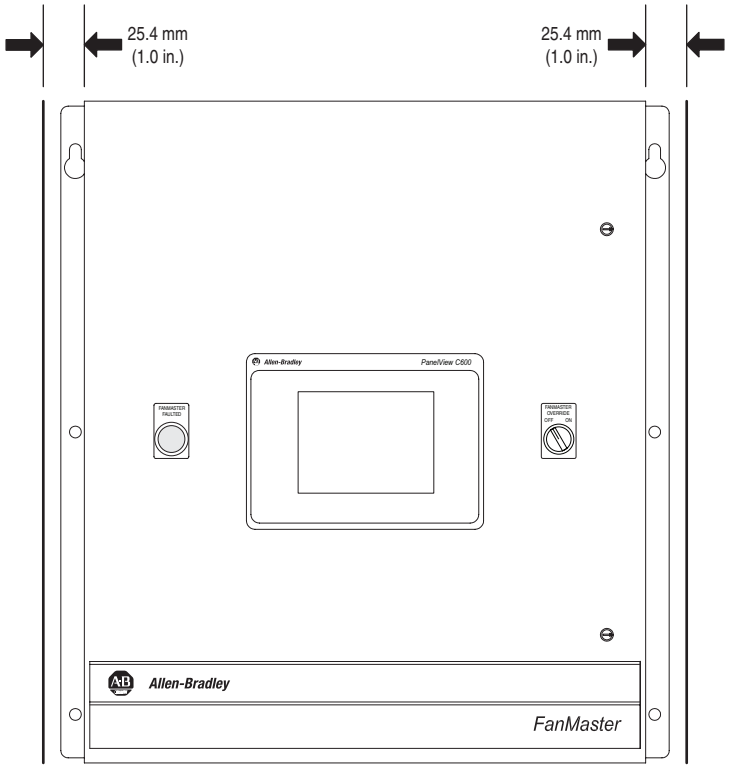
Install the FanMaster Enclosure

Environment

- The NEMA/UL Type 1 enclosure is rated for an operating temperature range of 0°…40°C (32°…104°F).
- The NEMA/UL Type 4 enclosure is rated for an operating temperature range of -23°…40°C (-10°…104°F).

Important: The NEMA/UL Type 1 enclosure must be mounted in a clean, dry location. Contaminants such as oils, corrosive vapors and abrasive debris must be kept out of the enclosure. These enclosures are intended for indoor use primarily to provide a degree of protection against contact with enclosed equipment. These enclosures offer no protection against airborne contaminants.

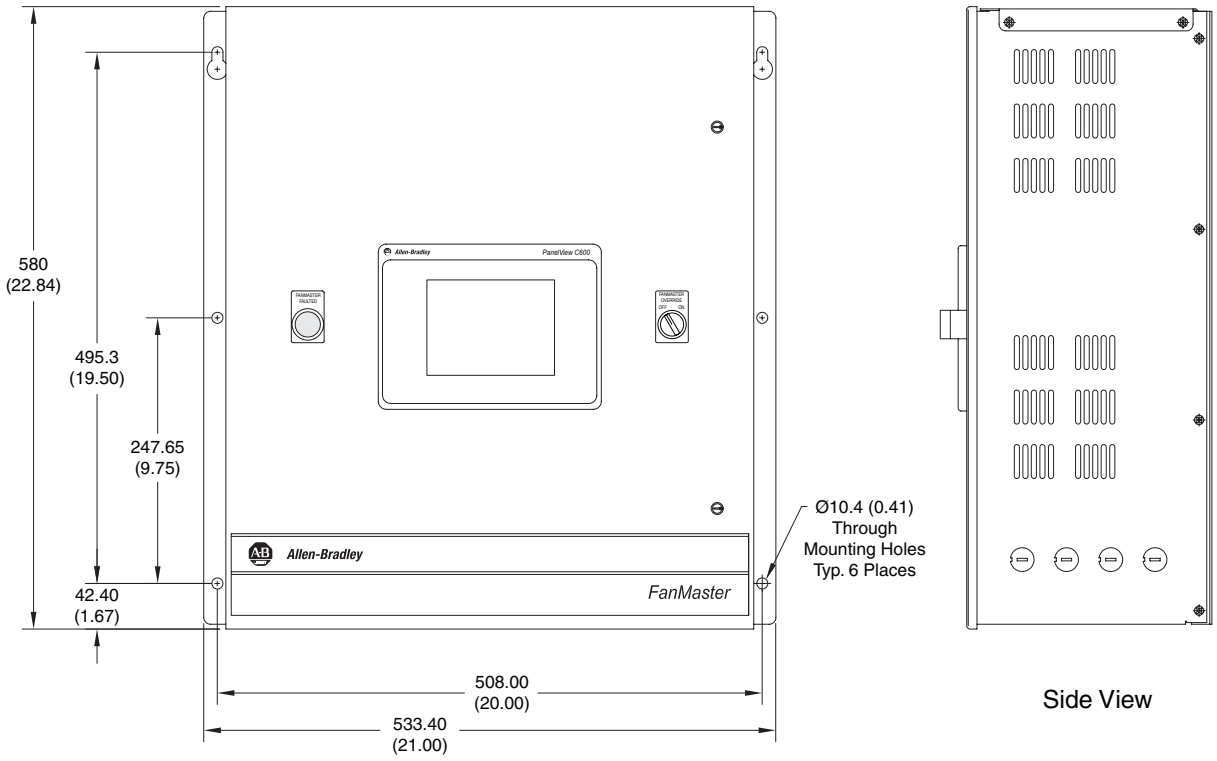
Figure 2.2 Enclosure Minimum Mounting Clearances



NEMA/UL Type 1 Enclosure Shown

Figure 2.3 NEMA/UL Type 1 FanMaster Enclosure Dimensions

Dimensions are in mm and (inches).



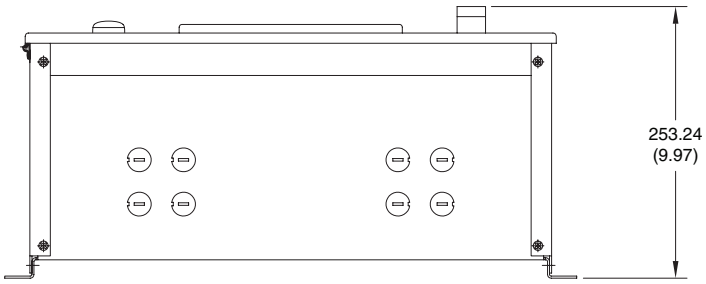
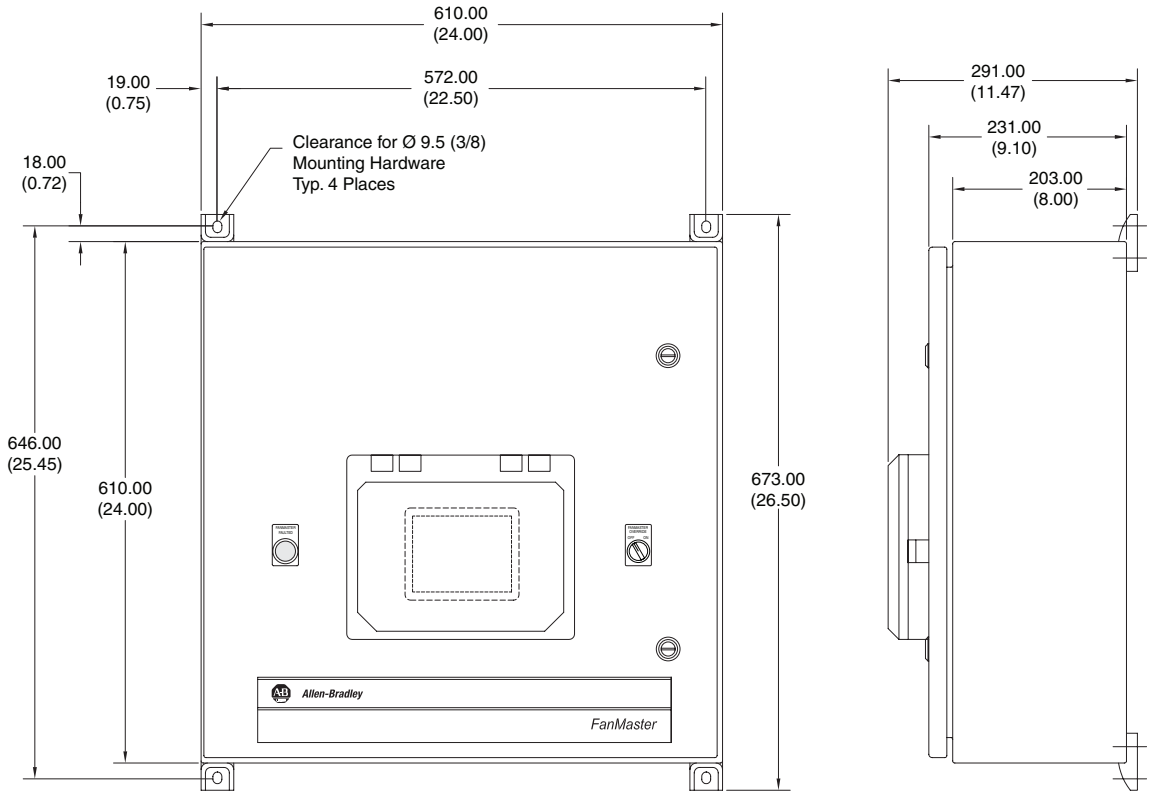


Figure 2.4 NEMA/UL Type 4 FanMaster Enclosure Dimensions

Dimensions are in mm and (inches).



Side View

Bottom View

FanMaster Enclosure Weights

Enclosure	Enclosure Only	Enclosure and Packaging
NEMA/UL Type 1	21.0 kg (46 lb)	26.3 kg (58 lb)
NEMA/UL Type 4	36.3 kg (80 lb)	41.7 kg (92 lb)

Lifting Instructions

The dimensions and weights provided above must be taken into consideration when lifting and mounting the enclosure. Use the proper equipment to safely lift and hold the weight of the enclosure while mounting.

ATTENTION: To guard against possible personal injury or equipment damage…

- Inspect all lifting hardware for proper attachment before lifting the enclosure.
- Do Not allow any part of the enclosure or lifting mechanism to make contact with electrically charged conductors or components.
- Do Not allow personnel or their limbs directly underneath the enclosure when it is being lifted and mounted.

Mounting Instructions

1. Verify the hole pattern on the panel to which the enclosure will be mounted. Refer to Figure 2.3 on page 2-7 or Figure 2.4 on page 2-8.
2. For NEMA/UL Type 1 enclosures, insert, but do not fully tighten, one bolt in one of the top holes in the panel. The bolt must be fully threaded into the panel before hanging the enclosure.
3. For NEMA/UL Type 1 enclosures, lift the enclosure and place onto the bolt installed in the panel.
4. Install the remaining bolts into the panel and fully tighten all bolts.

Wire the FanMaster

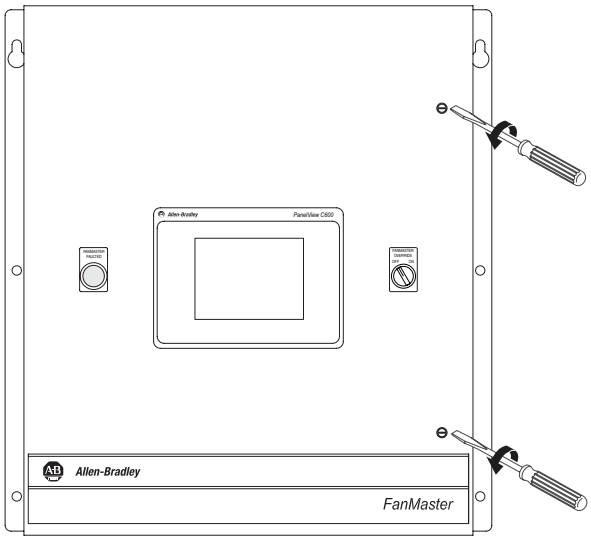
Refer to the FanMaster Diagrams contained in Appendix B for wiring and connection details.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with operation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

1. For permanent installations, determine where conduit will be routed and prepare the FanMaster enclosure for conduit connections.
   - For NEMA/UL Type 1 enclosures, remove the metal plugs in the pre-located openings in the enclosure for conduit connections.
   - For NEMA/UL Type 4 enclosures, drill the desired openings in the enclosure to accommodate conduit connections.

ATTENTION: Protect the contents of the enclosure from metal chips and other debris while removing the conduit opening plugs. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

2. Open the FanMaster enclosure and verify that circuit breaker 1 (CB1) is in the "off" position.



NEMA/UL Type 1 Enclosure Shown

3. Route the power wires through the appropriate conduit (if used) and connect to terminals L, N and G on terminal block 1 (TB1). Refer to Wiring Specifications on page 2-2 for power wire size.

Important: For each installed instrument, allow for the appropriate cable length necessary to reach the FanMaster I/O terminals in the enclosure. Refer to Wiring Specifications on page 2-2 for control wire size.

4. Wire the supply air temperature transmitter according to the manufacturer's instructions, route through the appropriate conduit (if used) and connect the control wires to terminals 100, 102, 123 and 124 on TB2 in the FanMaster enclosure.

5. Wire the mixed air temperature transmitter according to the manufacturer's instructions, route through the appropriate conduit (if used) and connect the control wires to terminals 100, 102, 125 and 126 on TB2 in the FanMaster enclosure.

6. Wire the CO_2 sensor according to the manufacturer's instructions, route through the appropriate conduit (if used) and connect the control wires to terminals 100, 102, 127 and 128 on TB2 in the FanMaster enclosure.

7. Wire the damper position indicator switch according to the manufacturer's instructions, route through the appropriate conduit (if used) and connect the control wires to terminals 100 and 105 on TB2 in the FanMaster enclosure.

8. If you are installing an evaluation unit, connect the control wires for the supply fan current switch to terminals 100 and 109 on TB2 in the FanMaster enclosure.

9. For FanMaster evaluation unit installations, continue with step 18 below. For installations with a drive, wire the RJ45 two-position terminal block adapter and terminating resistor (provided with the unit) to TB3 in the FanMaster enclosure and connect it to the PowerFlex 400 drive. Refer to the "RS485 Network Wiring" section of the *PowerFlex 400 AC Drive Packages for Fan & Pump Applications User Manual*, publication 22C-UM001… for detailed instructions.

   Important: The 120 Ohm terminating resistor must be connected to pins 4 and 5 of the RJ45 terminal block adapter on the return air drive or supply air drive, if a return air drive is not installed.

   Important: The communication cable maximum length should not exceed 500 m (1,640 ft.).

10. Connect the normally open contact (terminals R4 and R5) on the PowerFlex 400 drive used to indicate that the supply fan motor is running to terminals 135 and N on TB2 in the FanMaster enclosure.

11. Connect the existing BAS supply fan start/stop signal wires to terminals 159 and 160 on TB2 in the FanMaster enclosure.

    Important: A 120V AC relay (700-HK32A1) is installed (labeled CR4) in the FanMaster enclosure at the factory for the BAS supply fan start/stop signal. If your installation requires a relay for a 24V AC signal, you must remove the factory installed relay and install and wire the 24V AC (700-HK32A24) relay provided, or the appropriate relay for your installation.

12. Connect the contact output from terminals 119 and 120 on TB2 in the FanMaster enclosure to the existing damper controls in order to allow FanMaster to override the outside air damper controls.

The damper control override commands the damper to close periodically in order to reduce the amount of outside air provided to the AHU in order to further reduce costs associated with cooling and heating. This contact can be used to operate CR3 in the FanMaster enclosure or a customer supplied interposing relay or solenoid to close the damper when the output is turned on. Using the output to energize CR3 and wiring the existing damper control or power signals through the normally closed contacts on CR3 will close the damper when the output is on. Note: this output is not used if the constant ventilation option is used.

Important: The installer must determine and ensure the proper operation of this contact when used to force the damper closed.

13. (Optional - required when using the constant ventilation option rather than the default demand ventilation option.) If FanMaster will be used to control the outside air damper for constant ventilation control, connect the damper position control wires to terminals 14 and 15 on the PowerFlex 400 drive.

Important: Terminals 14 and 15 on the drive accept a 4…20 mA signal only. If the control signal is 0…10V DC or 0…135 Ohms, a converter adapter must be purchased separately and be installed for both the input and output signals.

14. (Optional - required when using the constant ventilation option rather than the default demand ventilation option.) If FanMaster will be used to override the BAS control of the outside air damper, connect the damper position command signal wires to terminals 100, 102, 218 and 219 on TB2 in the FanMaster enclosure.

Important: Terminals 100, 102, 218 and 219 on TB2 of the FanMaster unit accept a 4…20 mA signal only. If the control signal is 0…10V DC or 0…135 Ohms, a converter adapter must be purchased separately and be installed for both the input and output signals.

15. (Optional) If a dry contact output from FanMaster that closes on a high CO_2 level is required for connection to a BAS CO_2 alarm device, connect the signal wires from the CO_2 alarm annunciation device to terminals 117 and 118 on TB2 in the FanMaster enclosure.

16. (Optional) If a dry contact output from FanMaster that opens when FanMaster faults is required for connection to a BAS annunciation device, connect the signal wires from to the annunciation device to terminals 121 and 122 on TB2 in the FanMaster enclosure.

17. (Optional) If your AHU currently utilizes a flow switch or pressure sensor and requires a proof of flow dry contact output from FanMaster, connect the signal wires from the contact to terminals 100, 102, 218 and 219 on TB2 in the FanMaster enclosure.

18. Set CB1 to the “on” position.

19. Close the cover on the FanMaster enclosure.

20. Replace or close any drive or BAS control panel covers.

21. Complete the procedures in Chapter 3- FanMaster Configuration and Start Up.

Notes:

FanMaster Configuration and Start Up

This chapter contains the steps necessary to configure and start up FanMaster. Typical values are provided as defaults where applicable. The default values may not be valid for your installation and, if left unchanged, may affect the calculated energy savings results. Verify all values in Table 3.A on page 3-2 prior to completing the configuration procedures.

Using the PanelView C600 HMI Terminal

The PanelView C600 HMI terminal is a touch sensitive operator interface that is used to monitor and program the controller in the FanMaster via a pre-programmed HMI application. You can navigate the screens and edit values by touching a location on the display. For a description of each FanMaster screen, refer to Appendix C - FanMaster Screens and Field Descriptions.

For NEMA/UL Type 4 enclosures, loosen the two screws on the PanelView terminal cover in order to lift the cover and access the PanelView HMI terminal.

Important: Analog touch screens are intended for single presses at a time. If the touch screen is pressed in two locations at the same time, the presses are averaged as a single press in-between the two locations.

Gather and Record Data

Gather the following data in order to successfully configure and start up the FanMaster. Record the actual data for your installation in the table below and save the table for your records.

Table 3.A Installation Data

Step	Data Required	Default Value	Actual
8	City climate profile (refer to City Climate Profiles on page A-3): Note: If an acceptable climate profile is not included in the list in Appendix A, you can use the User City Weather Data Setup screen (described on page C-14) to create and save a climate profile for your location.	Chicago	
9	Supply fan motor nameplate horsepower (HP) rating	10	
10	Supply fan motor nameplate full load amps (FLA) rating	12.2	
11	AHU CFM (If set to “0” in configuration, value will be auto calculated based on 2,000 CFM per 1 HP)	30,000	
13	Return fan motor nameplate horsepower (HP) rating (if installed)	5	
14	Return fan motor nameplate full load amps (FLA) rating (if installed)	6.1	
15	Electrical cost in dollars per kWh	0.0891	
16	Natural gas cost in dollars per MMBTU	8.50	
17	Supply fan motor efficiency rating	90%	
18	Supply fan to motor oversizing factor	100%	
19	Heating efficiency for your system	87%	
20	Outside air damper minimum open position	10%	
21	Coolant type used	Glycol or Water	
31	Is heating proportional (heat source level is varied) or two-state (heating is on or off)?	Heating Prop	
32	Is cooling proportional (cooling source level is varied) or two-state (cooling is on or off)?	Cooling Prop	
33	The system uses a pressure sensor (yes/no)?	No Pressure	
34	The system uses on-demand ventilation (CO_2 sensor is installed) or constant ventilation (Constant Vent.)?	Demand Vent.	
35	The system uses a CO_2 sensor (yes/no)?	CO2 (yes)	
37	The AHU has a heating system (yes/no)?	Yes / Mech Heat	
38	The AHU has a cooling system (yes/no)?	Yes / Mech Cool	
39	FanMaster will be allowed to override the BAS control of the outside air damper (yes/no)?	Yes / Damper Override	
40	If Econmizer option is used, the percentage per minute that the supply fan should ramp to 100% speed when the AHU is in economizer mode.	5%	
41	If a pressure sensor is used, the inWC value below which the supply fan speed should increase so pressure is maintained.	-0.010	
42	If a CO_2 sensor is installed, the CO_2 parts per million (ppm) at which outside air ventilation should occur.	700	
43	If a CO_2 sensor is installed, the CO_2 parts per million (ppm) at which a high CO_2 alarm will occur.	800	
51a	The difference in temperature between the mixed air and supply air at or below which the drive will run the supply fan at the minimum speed when cooling the conditioned space.	5	
51b	The difference in temperature between the mixed air and supply air at or above which the drive will run the supply fan at the maximum speed when cooling the conditioned space.	25	

Step	Data Required	Default Value	Actual
51c	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or below the minimum value when cooling the conditioned space.	50	
51d	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or above the maximum value when cooling the conditioned space.	100	
52a	The difference in temperature between the mixed air and supply air at or below which the drive will run the supply fan at the minimum speed when heating the conditioned space.	5	
52b	The difference in temperature between the mixed air and supply air at or above which the drive will run the supply fan at the maximum speed when heating the conditioned space.	50	
52c	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or below the minimum value when heating the conditioned space.	50	
52d	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or above the maximum value when heating the conditioned space.	100	
53a	The minimum supply air low temperature limit at which FanMaster will command the supply fan speed to run at the minimum speed.	45	
53b	The maximum supply air low temperature limit at which FanMaster will command the supply fan to run at the maximum speed.	50	
53c	The percentage of full speed that FanMaster will command the supply air fan to run when the supply air temperature has reached the minimum low limit.	100	
53d	The percentage of full speed that FanMaster will command the supply air fan to run when the supply air temperature has reached to maximum low limit.	50	
54a	The minimum supply air high temperature limit at which FanMaster will command the supply fan to run at the minimum speed.	145	
54b	The minimum supply air high temperature limit at which FanMaster will command the supply fan to run at the maximum speed.	155	
54c	The percentage of full speed that FanMaster will command the supply air fan to run when the supply air temperature has reached the minimum high limit.	50	
54d	The percentage of full speed that FanMaster will command the supply air fan to run when the supply air temperature has reached the maximum high limit.	100	

Configure the FanMaster

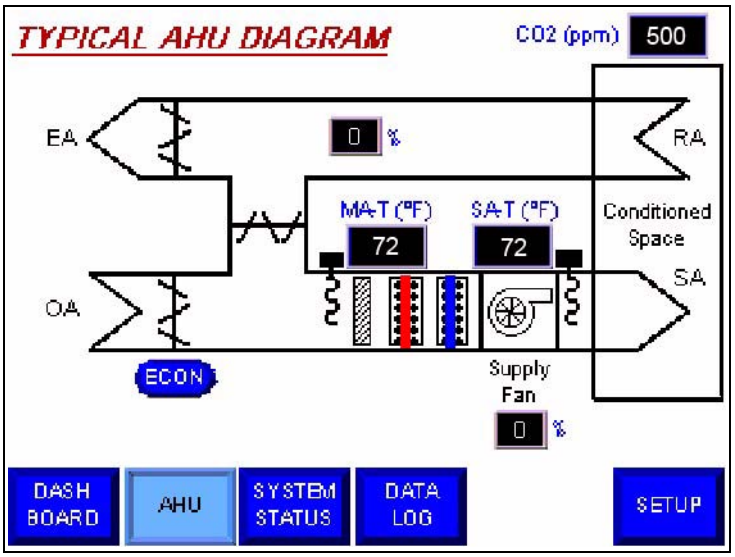
1. Apply power to the FanMaster and drive (if applicable). The PanelView HMI will boot up (this may take 2…3 minutes). When the Disclaimer screen displays, the unit is ready for configuration.

Evaluation Unit Install Only

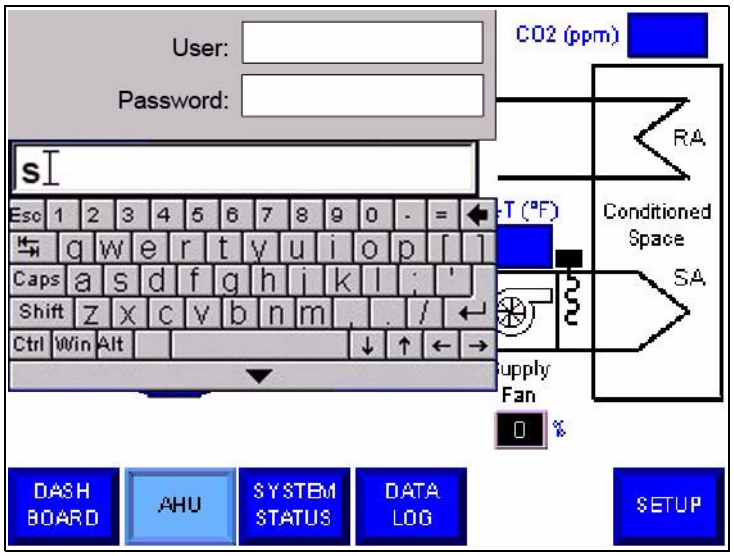
Permanent Install Only

2. Read the Disclaimer and press “OK”. The Dashboard screen displays.

3. Press “Next”. The Air Handler Unit Diagram screen displays.



4. Press “Setup”. You are prompted to enter a user name and password.

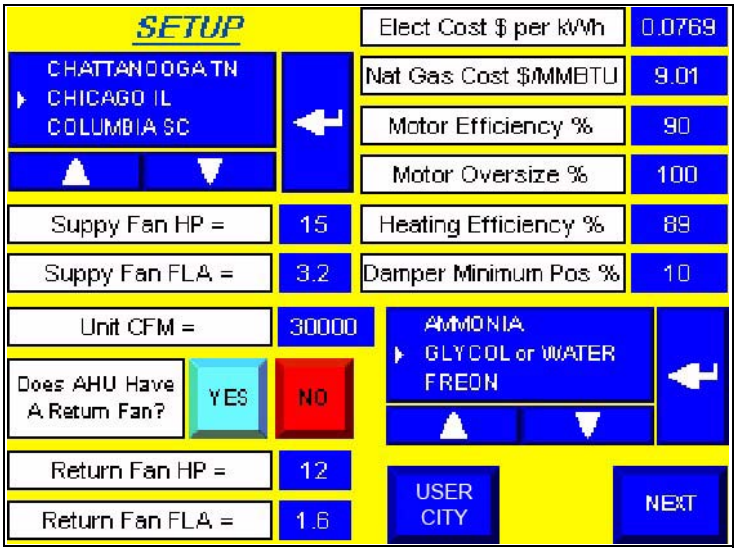


5. Press in the “User” field and, using the keypad, type “s”.

6. Press in the “Password” field and, using the keypad, type “258” and press “Enter” ( ).

   Note: If the PanelView is inactive for more than 15 minutes, you will be logged out and returned to a non-secured screen. When you press “Setup” again, you be required to log back into the setup screens.

7. The first Setup screen displays.



8. Select the city with the climate profile closest to the installation location (refer to City Climate Profiles on page A-3 for a list of city values). If an acceptable climate profile is not included in the list in Appendix A, press "User City" to access the User City Weather Data Setup screen (described on page C-14) where you can create and save a climate profile for your location. To select the climate profile you created, select "User City" from the city selection list. Press the up and down arrows ( ) below the list to scroll to and choose a city.

   Press Enter ( ) to apply your selection. The selected city will be highlighted.

9. Press the value to the right of the "Supply Fan HP" field and enter the supply fan motor rated horsepower.

   When a value field is pressed, a numeric keypad displays and the value is editable. Use the keypad to type the desired value and press Enter to accept the value. Press "Esc" to exit edit mode and cancel any edits.

10. Press the value to the right of the "Supply Fan FLA" field and enter the supply fan motor rated full load amps.

Note: At this point, any warning messages about an incorrect AHU unit CFM value may display and can be disregarded until all values for the supply and return fans have been entered.

11. Press the value to the right of the “Unit CFM” field and enter the air flow volume for the AHU. If you do not know the unit CFM, enter “0” in this field to allow FanMaster to provide a calculated value based on 2,000 CFM per 1 HP (e.g., a 15 HP Supply Fan = 30,000 CFM). An accurate value will display in this field only after all supply fan and return fan (if installed) values have been entered.

12. If a return fan is not installed, press “No” next to the “Does AHU Have A Return Fan?” field. If you pressed “No” for this step, continue with step 15 below.

13. If a return fan is installed, press the value to the right of the “Return Fan HP” field and enter the return fan motor rated horsepower.

14. If a return fan is installed, press the value to the right of the “Supply Fan FLA” field and enter the supply fan motor rated full load amps.

15. Press the value to the right of the “Elect Cost $ per kWh” field and enter the appropriate electricity cost in dollars per kilowatt hour.

16. Press the value to the right of the “Nat Gas Cost $/MMBTU” field and enter the appropriate natural gas cost in dollars per one million BTUs.

17. Press the value to the right of the “Motor Efficiency %” field and enter the percentage of supply fan motor efficiency. If not known, the default value can remain, however, may affect the calculated energy savings results.

18. Press the value to the right of the “Motor Oversize %” field and enter the percentage of the supply fan motor oversizing. This value is calculated as “Load HP / Motor HP * 100”. For example, if the supply fan motor HP matches the required fan HP, the default value of 100 can remain in this field. If the motor HP is 15 and the required fan HP is 10, enter 67 in this field (i.e., 10/15 * 100 = 66.66 or 66.7%).

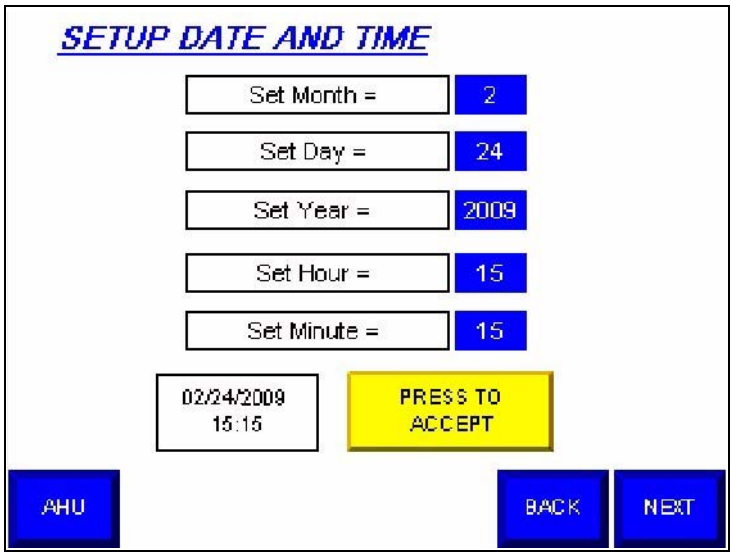
19. Press the value to the right of the “Heating Efficiency %” field and enter the percentage of heating efficiency. If not known, the default value can remain, however, may affect the calculated energy savings results.

20. Press the value to the right of the “Damper Minimum Pos %” field and enter the estimated outside air damper open position when not in economizer (free cooling) mode. This is the normal fresh air ventilation position. Ten percent is typical.

21. Select the coolant type used for the AHU. Press the up and down arrows ( ) below the list to scroll to and choose a type.

Press Enter () to apply your selection. The selected type will be highlighted.

22. Press “Next”. The Setup Date and Time screen displays.



23. Press the value next to the “Set Month” field and enter the current month (1-12).

24. Press the value next to the “Set Day” field and enter the current date.

25. Press the value next to the “Set Year” field and enter the current year (in the format ccyy).

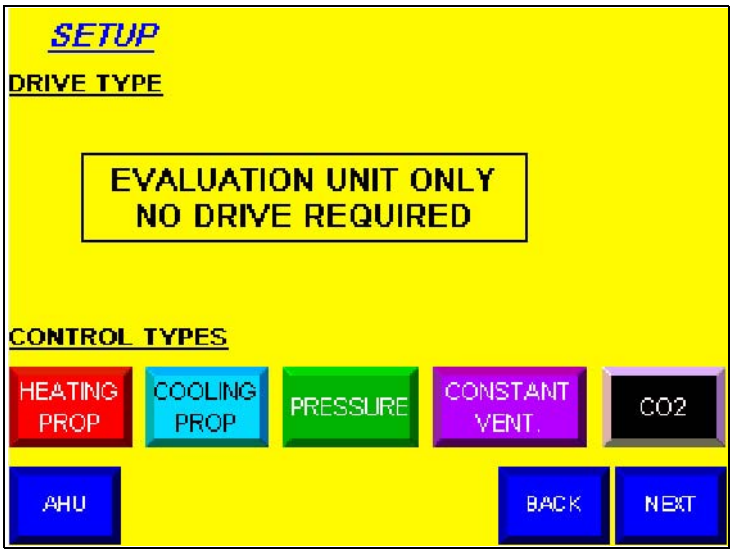
26. Press the value next to the “Set Hour” field and enter the current hour (military, 24 hour, format).

27. Press the value next to the “Set Minutes” field and enter the current minutes.

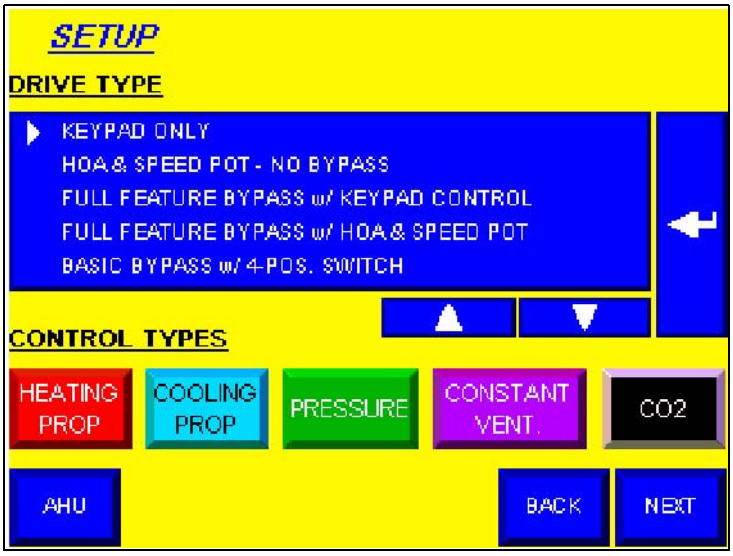
28. Press “Press To Accept” to set the current date and time.

29. Press “Next”. The second Setup screen displays.

Evaluation Unit Install Only



Permanent Install Only



30. If you have installed an evaluation unit, continue with step 31 below. If your installation contains a drive, select the Drive Type used for the AHU (see Table 3.B below). Press the up and down arrows ( ) below the list to scroll to and choose a type.

Press Enter ( ) to apply your selection. The selected type will be highlighted.

Table 3.B Drive Types

Selection:	Description:	Operation:
Keypad Only	Drive with an integral keypad with Hand-Off-Auto (HOA) mode, no HOA switch, no speed potentiometer (pot) and no bypass.	When the keypad is in "Auto", FanMaster controls the drive start/stop and speed commands. When the keypad is in "Hand", the keypad controls the drive start/stop and speed.
HOA & Speed Pot. No Bypass	Drive with an integral keypad, HOA switch, speed pot, and no bypass.	When HOA is in "Auto", FanMaster controls the fan start/stop and speed. When HOA is "Off" the fan is always off. When HOA is in" Hand" the Fan starts and the speed is controlled by the speed pot.
Full Feature Bypass w/ Keypad Control (NEMA/UL Type 1 only)	Drive with a full-feature bypass(1)(2) and integral keypad that allows Hand-Off-Auto (HOA) mode.	When HOA is in "Auto" and the Bypass Switch in "Drive", FanMaster controls the fan start/stop and speed. When HOA is in "Off" and the Bypass Switch in "Drive", the fan is always off. When HOA is in "Hand" and the Bypass Switch in "Drive", the keypad controls the fan start/stop and speed. When HOA is in "Auto" and the Bypass Switch in "Bypass", FanMaster controls the fan start/stop via the Bypass Contactor (line start). When HOA is in "Off" and the Bypass Switch in "Bypass", the fan is always off. When HOA is in "Hand" and the Bypass Switch in "Bypass", the fan line-starts immediately and continues to run via the Bypass Contactor.
Full Feature Bypass w/HOA & Speed Pot. (NEMA/UL Type 4 only)	Drive with a full-feature bypass(1)(2), integral keypad that allows Hand-Off-Auto (HOA) mode, and speed pot.	When HOA is in "Auto" and the Bypass Switch in "Drive", FanMaster controls the fan start/stop and speed. When HOA is in "Off" and the Bypass Switch in "Drive", the fan is always off. When HOA is in "Hand" and the Bypass Switch in "Drive", the fan starts and the speed is controlled by the speed pot. When HOA is in "Auto" and the Bypass Switch in "Bypass", FanMaster controls the fan start/stop via the Bypass Contactor (line start). When HOA is in "Off" and the Bypass Switch in "Bypass", the fan is always off. When HOA is in "Hand" and the Bypass Switch in "Bypass", the fan line-starts immediately and continues to run via the Bypass Contactor.
Basic Bypass w/4 Pos. Switch	Drive with a basic bypass(2)(3), and a four-position switch (determines the state of operation).	When the switch is in "Drive" and the keypad is in "Auto", FanMaster controls the drive start/stop and speed. When the switch is in "Drive" and the keypad is in "Hand", the keypad controls the drive start/stop and speed. When the switch is in "Bypass" the fan is line started and runs full speed via the Bypass Contactor.

(1) A full-feature bypass allows the motor to be manually transferred from drive output to the AC line, or from the AC line to the drive, while the motor is at zero (0) speed and a bypass control interface which provides status indication and allows for remote activation of the bypass circuit.

(2) Operation in Bypass mode is limited. FanMaster will not provide a proof of run signal, and CR1 and CR2 will not energize to provide "Fan Running" Aux Contacts. FanMaster control in Auto-Bypass mode is not available on the return air fan, if installed.

(3) A basic bypass allows the motor be manually transferred from the drive output to the AC line, or from the AC line to the drive and no remote or automatic bypass operation.

31. If the AHU uses a proportional heating system (heating source level is varied), continue with the next step. If the AHU uses a two-state (heating is on or off) heating system, press "Heating Prop" so that "Heating 2-State" displays.

32. If the AHU uses a proportional cooling system (cooling source level is varied), continue with the next step. If the AHU uses a two-state (cooling is on or off) cooling system, press "Cooling Prop" so that "Cooling 2-State" displays.

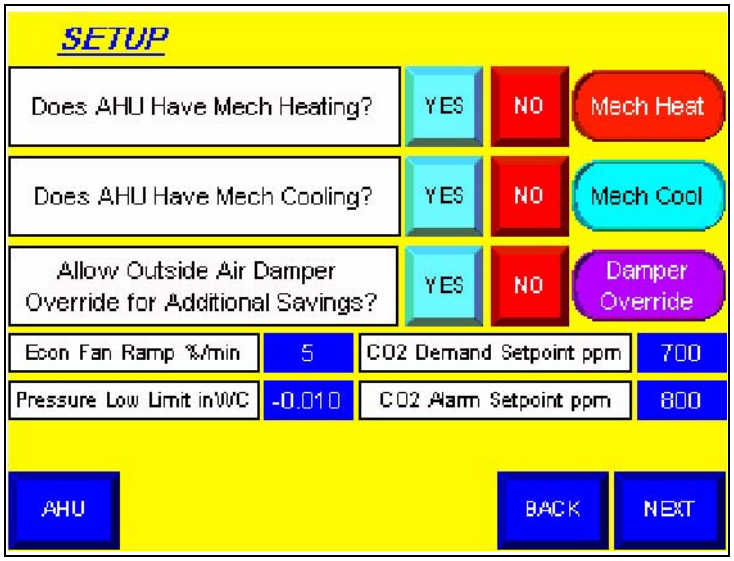
33. If a pressure sensor is not used, continue with the next step. If a pressure sensor is used, press "No Pressure" so that "Pressure" displays. (Note: A pressure sensor must be installed and configured as an analog input to FanMaster.)

34. If the AHU runs in demand ventilation mode (used in combination with a CO_2 sensor to provide on-demand ventilation to maintain the appropriate CO_2 level in the conditioned space), continue with the next step. If the AHU runs in constant ventilation mode, press “Demand Vent.” so that “Constant Vent.” displays (if a pressure sensor is installed, constant ventilation mode cannot be used).

Note: Demand ventilation reduces the cost associated with cooling and heating excessive outside air flows. Constant ventilation does not reduce the cost associated with cooling and heating outside air flows and is therefore only recommended for installations where the AHU must maintain a constant flow of outside air.

35. If a CO_2 sensor is installed, continue with the next step. If a CO_2 sensor is not installed, press “CO2” so that “No CO2” displays. Note: If you have selected “Demand Vent.” in the previous step, and “No CO2” in this step, “Demand Vent.” will be automatically changed to “Variable Vent.” (i.e., demand ventilation cannot be selected when a CO_2 sensor is not installed).

36. Press “Next”. The third Setup screen displays.



37. If the AHU does not have a heating system, press “No” next to “Does AHU Have Mech Heating?”. “Mech Heat” changes to display “No Mech Heat”.

38. If the AHU does not have a cooling system, press “No” next to “Does AHU Have Mech Cooling?”. “Mech Cool” changes to display “No Mech Cool”.

39. If the FanMaster will not be allowed to override the BAS control of the outside air damper, press “No” next to “Allow Outside Air Damper Override for Additional Savings?”. “Damper Override” changes to display “No Damper Override”.

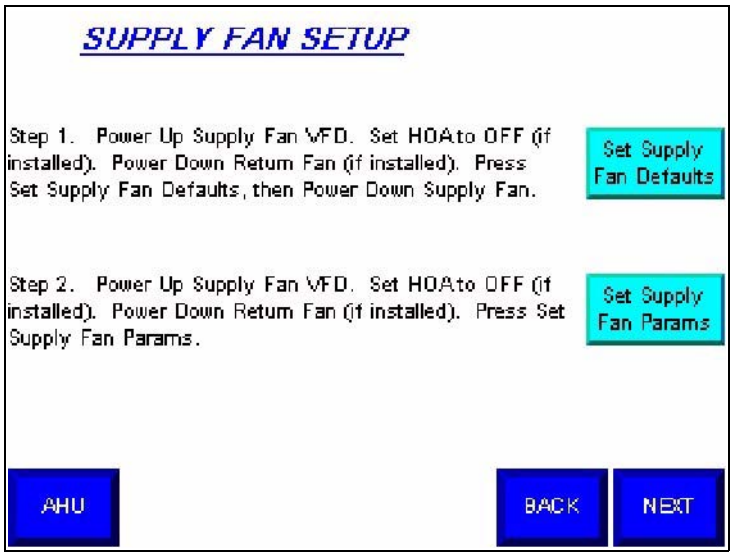
40. If the AHU provides an economizer mode, press the value next to “Econ Fan Ramp %/min” field and enter the percentage per minute that the supply fan should ramp to 100% speed when the AHU is placed in economizer mode.

41. If a pressure sensor is not used, continue with step 42. If a pressure sensor is used, press the value next to the “Pressure Low Limit inWC” field and enter the inWC value below which FanMaster will command the supply fan speed to increase in order to maintain the appropriate pressure level.

42. If a CO_2 sensor is installed, press the value next to the “CO2 Demand Setpoint ppm” field and enter the CO_2 parts per million (ppm) at which outside air ventilation should occur. In this case, 60 seconds after the value in this field has been exceeded, FanMaster will release override control (if enabled) of the outside air damper, allowing it to return to the normal position (open) and the supply fan to ramp to 100% speed until the CO_2 level is 50 ppm below the setpoint.

43. If a CO_2 sensor is installed, press the value next to the “CO2 Alarm Setpoint ppm” and enter the CO_2 parts per million (ppm) at which the an alarm will display on the PanelView screen, the fault indicator lamp on the front of the unit will turn on and the FanMaster Faulted signal will be set to “Faulted”, indicating that the high CO_2 level threshold has been exceeded. Refer to Chapter 4 - Troubleshooting for more information.

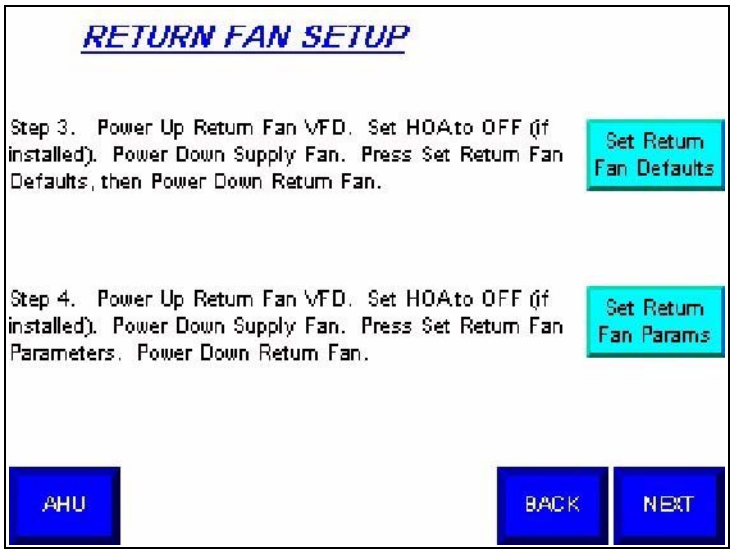
44. Press Next. The Supply Fan Setup screen displays.



45. Read and complete the tasks in steps 1 and 2 on this screen to set the supply fan parameters in the drive to the correct values.

Important: When removing power from the drive(s) as directed in the steps on this screen, verify that the drive is fully de-energized by waiting until the HIM module LED display is off.

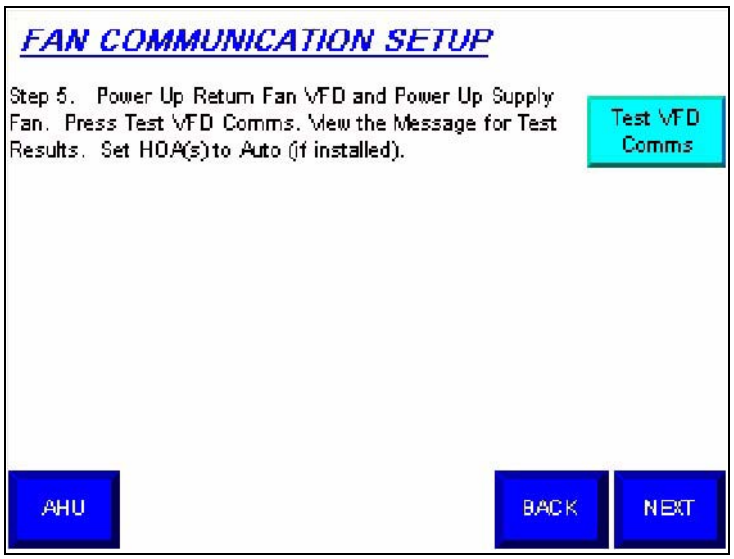
46. Press “Next”. If a return fan is not installed, the Fan Communication Setup screen displays - continue with step 49. For return fan setup, continue with step 47 below.



47. Read and complete the tasks in steps 3 and 4 on this screen to set the return fan parameters in the drive to the correct values.

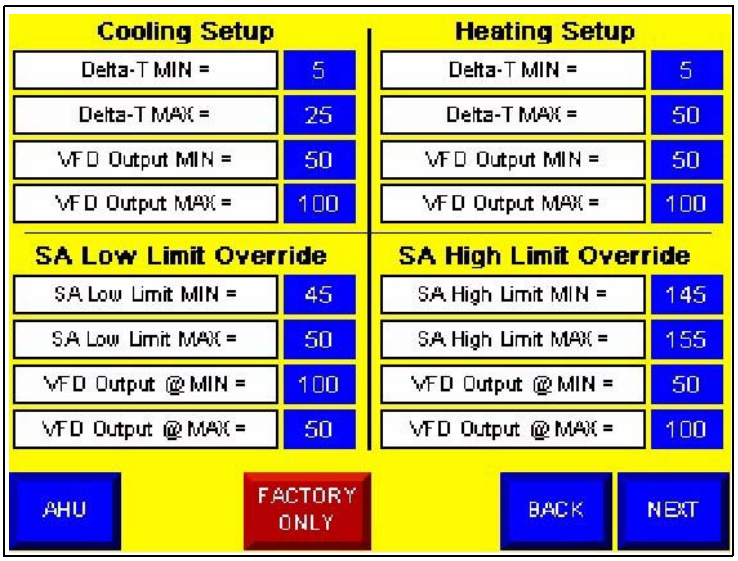
Important: When removing power from the drive(s) as directed in the steps on this screen, verify that the drive is fully de-energized by waiting until the HIM module LED display is off.

48. Press “Next”. The Fan Communication Setup screen displays.



49. Read and complete the tasks in step 5 (if a return fan is installed) or 3 (if a return fan is not installed) on this screen to test the communication link between the drive(s) and the fan(s). A message(s) displays to indicate if communications are working properly. Refer to Chapter 4 - Troubleshooting for more information if communications are not working properly.

50. Press "Next". The Cooling and Heating Setup screen displays.



Note: For supply fan speed:

- When in cooling mode, the supply fan speed will typically be set according to the ramp specified in Figure 3.1 or Figure 3.2 unless the supply air temperature enters the low limit override range (less than 50° F) in Figure 3.5. The final fan speed is the higher of the speeds set by the normal ramp (Figure 3.1 or Figure 3.2) or the low limit override ramp (Figure 3.5).
- When in heating mode, the supply fan speed will typically be set according to the ramp specified in Figure 3.3 or Figure 3.4 unless the supply air temperature enters the high limit override range (greater than 145° F) in Figure 3.6. The final fan speed is the higher of the speeds set by the normal ramp (Figure 3.3 or Figure 3.4) or the high limit override ramp (Figure 3.6).

51. Below "Cooling Setup", enter the following values:

Note: Refer to Figure 3.1 on page 3-17 and Figure 3.2 on page 3-17 for examples of cooling setup using default values.

a. Press the value next to "Delta-T Min" and enter the difference in temperature between the mixed air and supply air at or below which the drive will run the supply fan at the minimum speed (set in the corresponding "VFD Output Min" field) when cooling the conditioned space.

- For two-state cooling: When the difference in temperature rises above the value set in this field, the supply fan will be commanded to full speed (100% on).
- For proportional cooling: When the difference in temperature rises above the value set in this field, the supply fan will ramp up to a speed proportionate to the temperature difference.

b. Press the value next to "Delta-T Max" and enter the difference in temperature between the mixed air and supply air at or above which the drive will run the supply fan at the maximum speed (set in the corresponding "VFD Output Max" field) when cooling the conditioned space.

- For two-state cooling: The value set in this field has no affect on the fan motor speed and can be left set to the default value.
- For proportional cooling: When the difference in temperature is below the value in this field, the supply fan will be ramped to a speed proportionate to the temperature difference until the value in this field is reached. Once the temperature difference in this field is reached the fan speed will not exceed the value set in the corresponding "VFD Output Max" field (typically 100%).

c. Press the value next to "VFD Output Min" and enter the percentage of full speed that the drive will run the supply fan when the temperature difference is at or below the minimum value (set in the corresponding "Delta-T Min" field) when cooling the conditioned space.

d. Press the value next to "VFD Output Max" and enter the percentage of full speed that the drive will run the supply fan when the temperature difference is at or above the maximum value (set in the corresponding "Delta-T Max" field) when cooling the conditioned space.

Figure 3.1 Example Proportional Cooling Setup

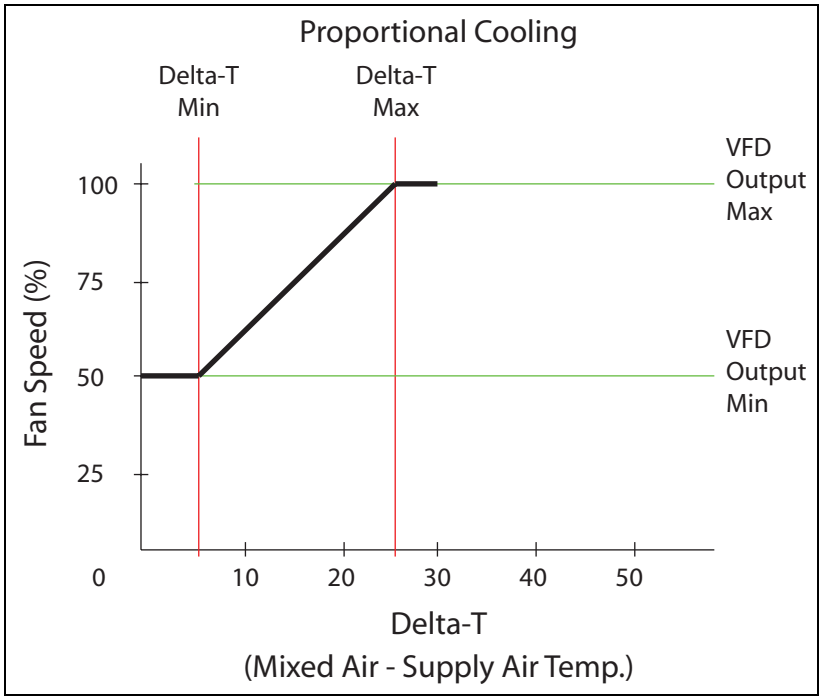
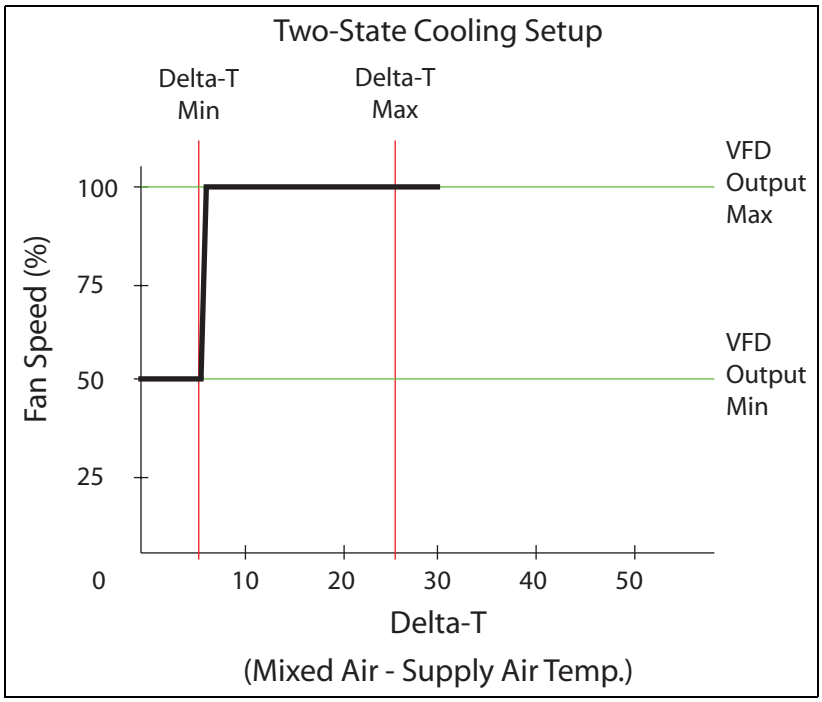


Figure 3.2 Example Two-State Cooling Setup



52. Below “Heating Setup”, enter the following values:

Note: Refer to Figure 3.3 on page 3-19 and Figure 3.4 on page 3-19 for examples of heating setup using default values.

a. Press the value next to "Delta-T Min" and enter the difference in temperature between the mixed air and supply air at or below which the drive will run the supply fan at the minimum speed (set in the corresponding "VFD Output Min" field) when heating the conditioned space.

- For two-state heating: When the difference in temperature rises above the value set in this field, the supply fan will be commanded to full speed (100% on).
- For proportional heating: When the difference in temperature rises above the value set in this field, the supply fan will ramp up to a speed proportionate to the temperature difference.

b. Press the value next to "Delta-T Max" and enter the difference in temperature between the mixed air and supply air at or above which the drive will run the supply fan at the maximum speed (set in the corresponding "VFD Output Max" field) when heating the conditioned space.

- For two-state heating: The value set in this field has no affect on the fan motor speed and can be left set to the default value.
- For proportional heating: When the difference in temperature is below the value in this field, the supply fan will be ramped to a speed proportionate to the temperature difference until the value in this field is reached. Once the temperature difference in this field is reached the fan speed will not exceed the value set in the corresponding "VFD Output Max" field (typically 100%).

c. Press the value next to "VFD Output Min" and enter the percentage of full speed that the drive will run the supply fan when the temperature difference is at or below the minimum value (set in the corresponding "Delta-T Min" field) when heating the conditioned space.

d. Press the value next to "VFD Output Max" and enter the percentage of full speed that the drive will run the supply fan when the temperature difference is at or above the maximum value (set in the corresponding "Delta-T Max" field) when heating the conditioned space.

Figure 3.3 Example Proportional Heating Setup

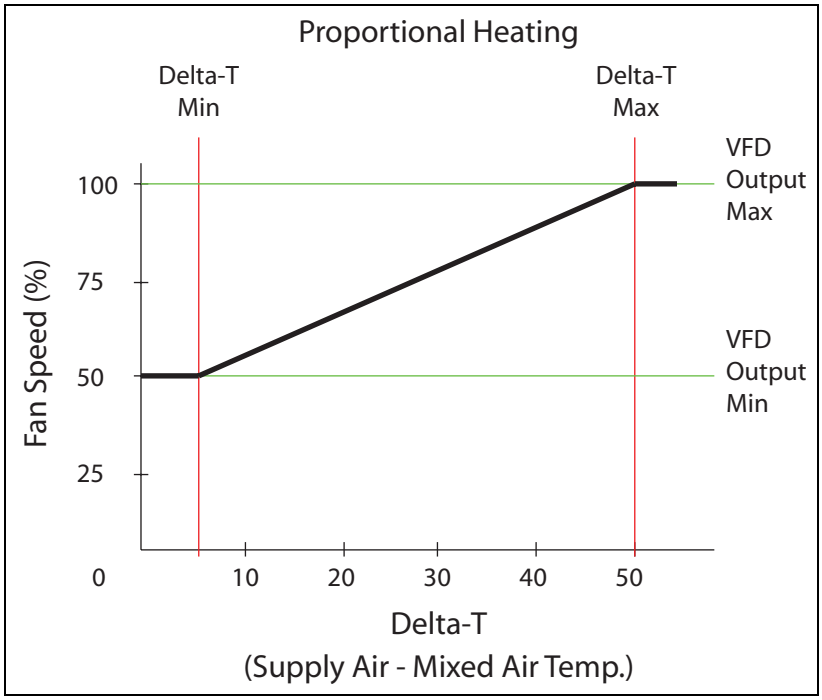
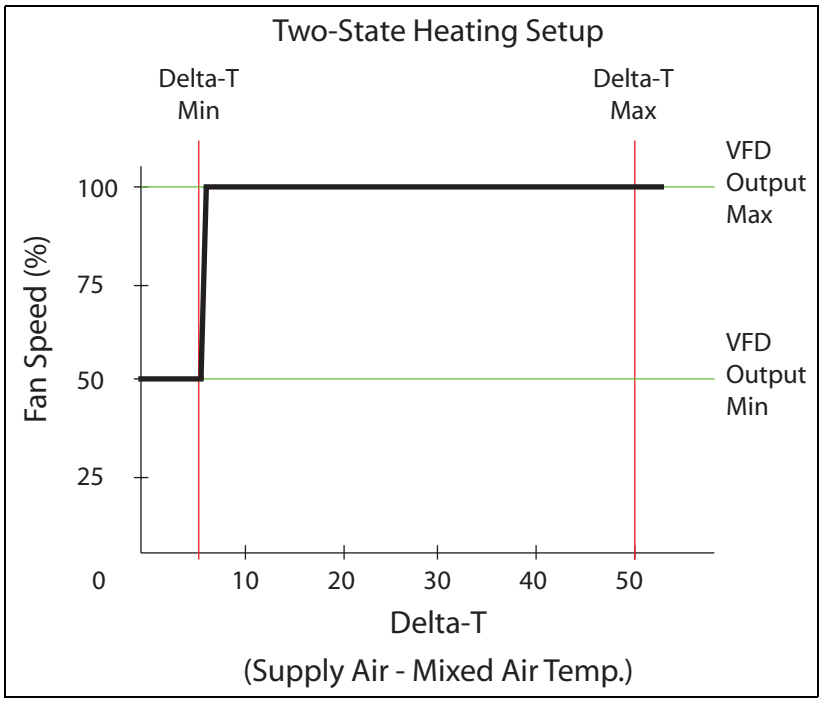


Figure 3.4 Example Two-State Heating Setup



53. The four fields below “SA Low Limit Override” are used to set a low supply air temperature range at which FanMaster will increase fan speed in an attempt to avoid freezing up the cooling system. Below “SA Low Limit Override”, enter the following values:

Note: Refer to Figure 3.5 on page 3-20 for an example of supply air low limit override setup using default values.

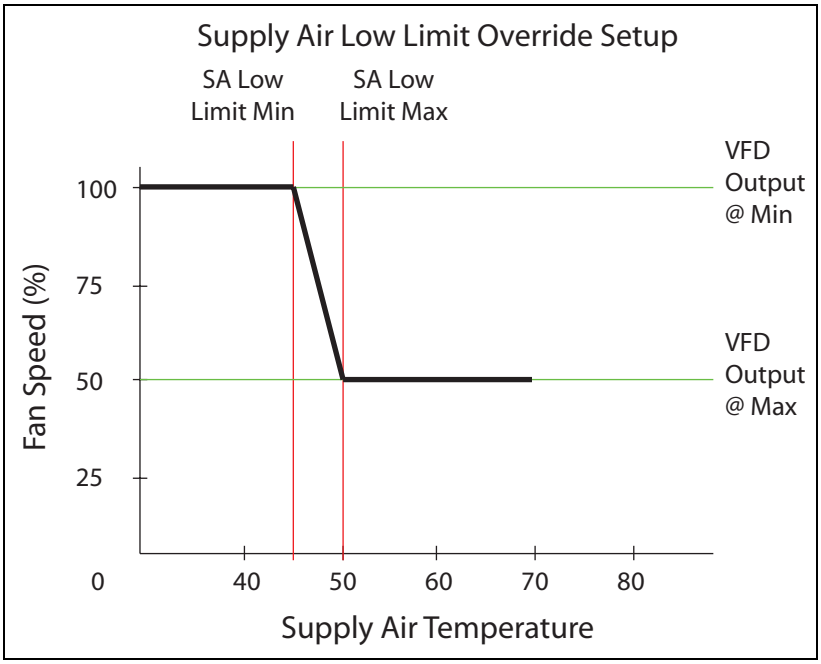
a. Press the value next to “SA Low Limit Min” and enter the minimum supply air low temperature limit at which FanMaster will command the supply fan speed to run at the value specified in the “VFD Output @ Min” field.

b. Press the value next to “SA Low Limit Max” and enter the maximum supply air low temperature limit at which FanMaster will command the supply fan to run at the value specified in the “VFD Output @ Max” field.

c. Press the value next to “VFD Output @ Min” and enter the percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA Low Limit Min” field is reached.

d. Press the value next to “VFD Output @ Max” and enter the percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA Low Limit Max” field is reached.

Figure 3.5 Example Supply Air Low Limit Override Setup



54. The four fields below “SA High Limit Override” are used to set a high supply air temperature range at which FanMaster will increase fan speed in an attempt to avoid overheating the heating system. Below “SA High Limit Override”, enter the following values:

Note: Refer to Figure 3.6 on page 3-21 for an example of supply air high limit override setup using default values.

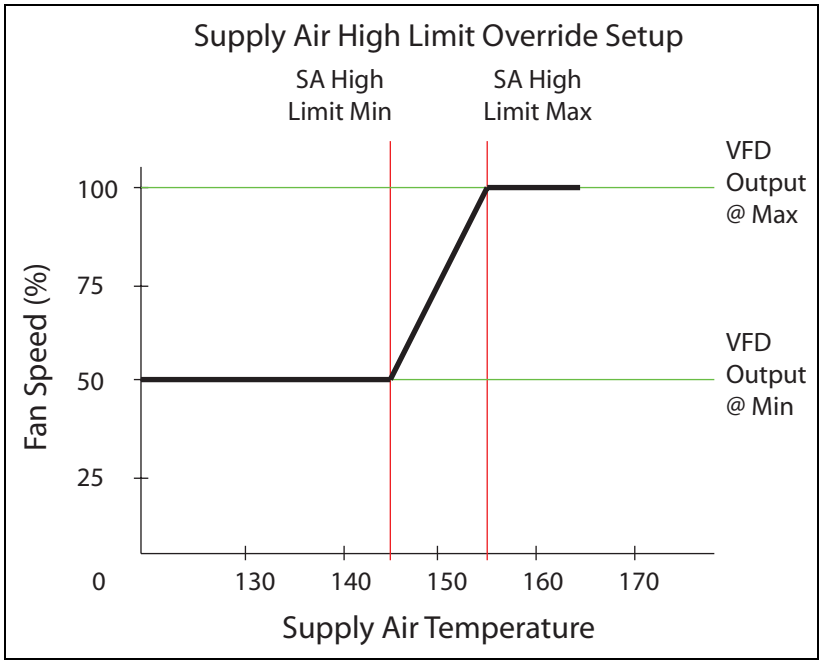
a. Press the value next to “SA High Limit Min” and enter the minimum supply air high temperature limit at which FanMaster will command the supply fan to run at the value specified in the “VFD Output @ Min” field.

b. Press the value next to “SA High Limit Max” and enter the maximum supply air high temperature limit at which FanMaster will command the supply fan to run at the value specified in “VFD Output @ Max” field.

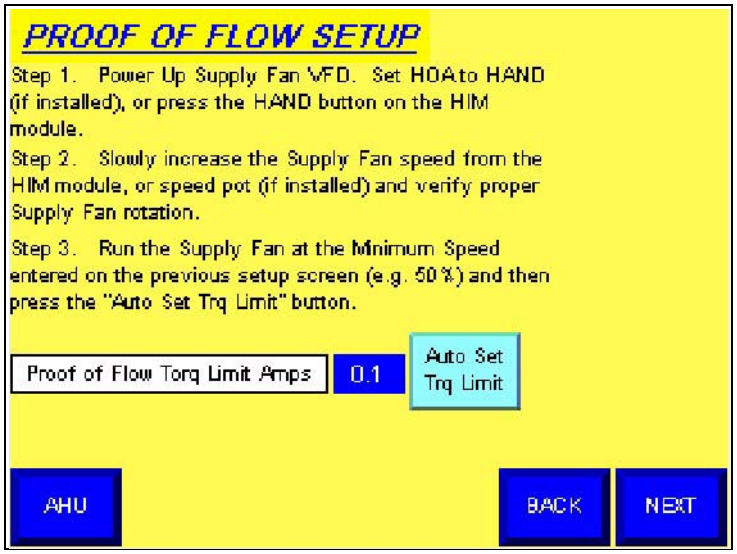
c. Press the value next to “VFD Output @ Min” and enter the percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA High Limit Min” field is reached.

d. Press the value next to “VFD Output @ Max” and enter the percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA High Limit Max” field is reached.

Figure 3.6 Example Supply Air High Limit Override Setup

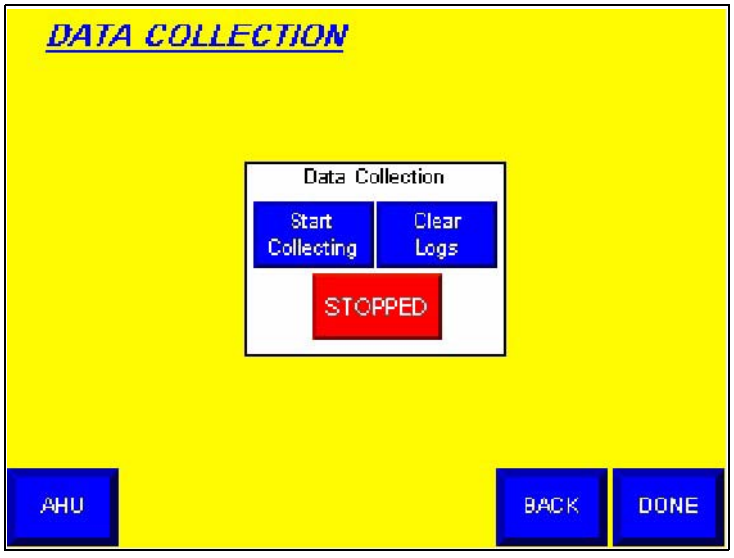


55. Press “Next”. If you have installed an evaluation unit, the Data Collection screen displays - continue with step 58 below. If a drive is installed, the Proof of Flow Setup screen displays - continue with step 56 below.



56. The existing proof of flow sensor (flow switch or pressure sensor) may not provide accurate proof of flow at a reduced fan speed. FanMaster will detect flow by monitoring the torque current required by the supply fan at the minimum speed. If the supply fan drive is not delivering 50% of this current threshold, the proof of flow output turns off. This screen allows the system to capture the 50% threshold by monitoring the current supplied to the motor at the minimum fan speed. Read and complete the tasks in steps 1…3 on this screen in order to set the torque current level at which the drive will run the supply fan at the minimum speed.

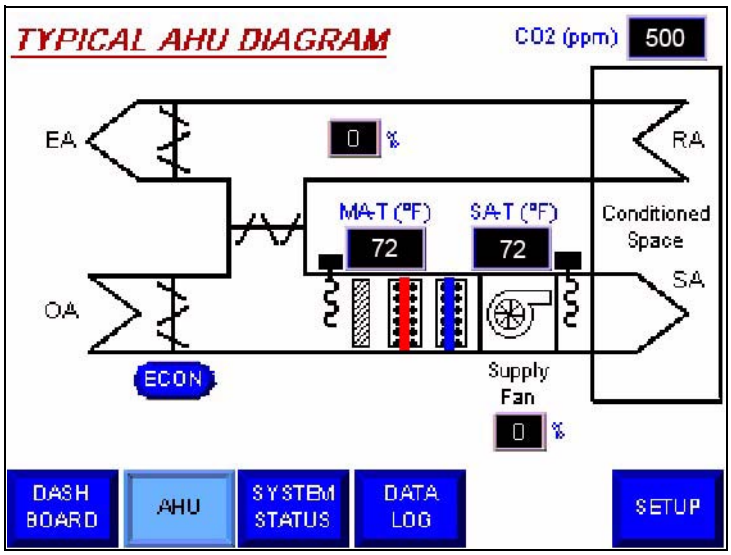
57. Press “Next”. The Data Collection screen displays.



58. In order to finalize the configuration, you will clear any data currently stored in the logs and then put FanMaster into service collecting new data. Press “Clear Logs”. A message displays to confirm that you want to delete the data stored in the log. Press “Yes”.

59. Press “Start Collecting”. “Stopped” will change to “Collecting”. FanMaster can run permanently and will collect and store up to five years of data. After five years, the oldest data will be overwritten by new data on a month-by-month basis.

60. Press “Done”. The Air Handler Unit Diagram screen displays.



61. Confirm that there are no error messages displayed on the screen. If any alarms or error messages display, refer to Chapter 4 - Troubleshooting for more information.

62. Verify that the temperature transmitters and CO_2 sensor readings are acceptable:

- Insert a calibrated thermometer into the air duct where the mixed air temperature transmitter is installed and compare the reading to the value displayed in the “MAT (°F)” field on the Air Handler Unit Diagram screen. The value in the “MAT (°F)” field should be within +/- 5% of the of the value on the thermometer.
- Insert a calibrated thermometer into the air duct where the supply air temperature transmitter is installed and compare the reading to the value displayed in the “SAT (°F)” field on the Air Handler Unit Diagram screen. The value in the “SAT (°F)” field should be within +/- 5% of the of the value on the thermometer.
- Insert a calibrated carbon dioxide sensor into the air duct where the CO_2 sensor is installed and compare the reading to the value displayed in the “CO2 (ppm)” field on the Air Handler Unit Diagram screen. The value in the “CO2 (ppm)” field should be within +/- 5% of the of the value on the sensor.

Note: When the AHU cooling and heating elements are off but the supply fan is running, the mixed air and supply air temperatures should typically be within a few degrees of each other, indicating proper calibration and operation.

Important: All instruments are calibrated at the factory. Follow the manufacturer’s recommended calibration practices in order to maintain the accuracy of the instruments.

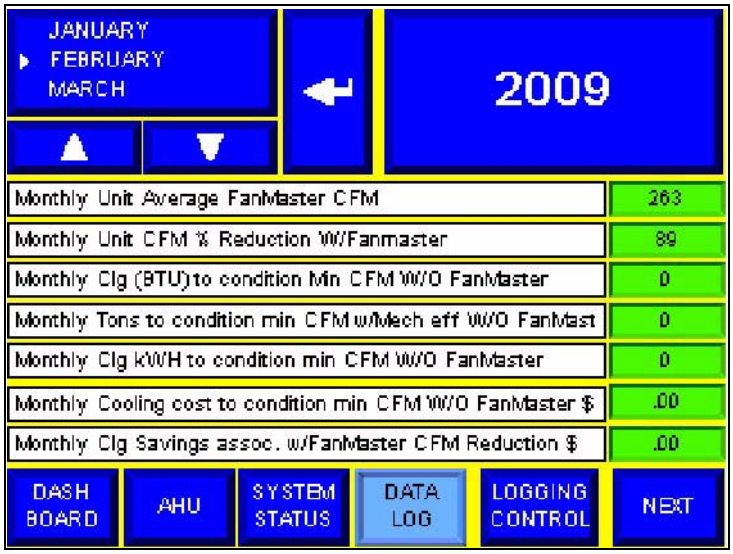
You have successfully installed and configured the Allen-Bradley® FanMaster™ Energy Saving Package.

If you want to	Refer to
View Detailed Data Log Information	page 3-25
Start and Stop Data Collection	page 3-26
Clear the Data Logs and Collect Data	page 3-27

View Detailed Data Log Information

You can view detailed historical energy saving data logged by the FanMaster.

1. On the Air Handler Unit Diagram screen, press “Data Log”. The first Data Log View screen displays.



2. To select a specific month for which you want to view data, press the up and down arrows (▲ ▼) below the list of months to scroll to and choose a month.

   Press Enter (↵) to apply your selection. The selected month will be highlighted.

   To select a year for which you want to view data, press the field displaying the year and enter the desired value.

   Press Enter (↵) to apply your selection.

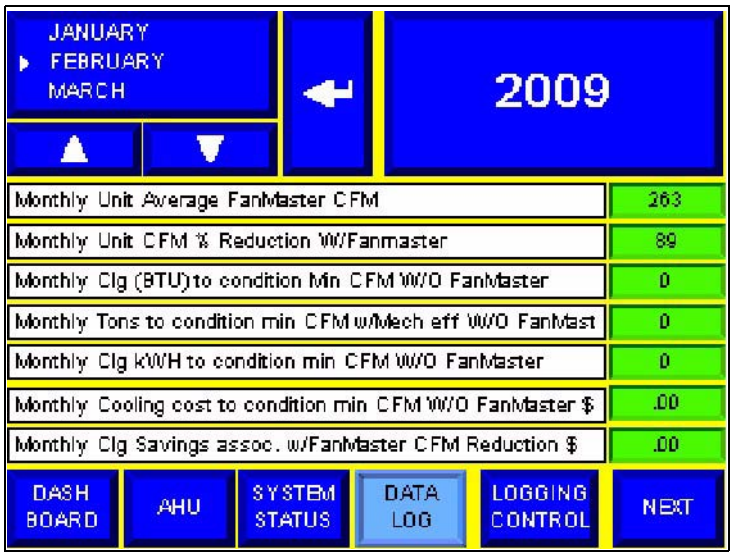
3. Press “Next” on this screen and subsequent screens to access the next Data Log screen and view all historical data for the selected time period. Refer to Appendix C - FanMaster Screens and Field Descriptions for a description of the fields contained on the Data Log screens.

Note: the month and data can be changed on each Data Log screen.)

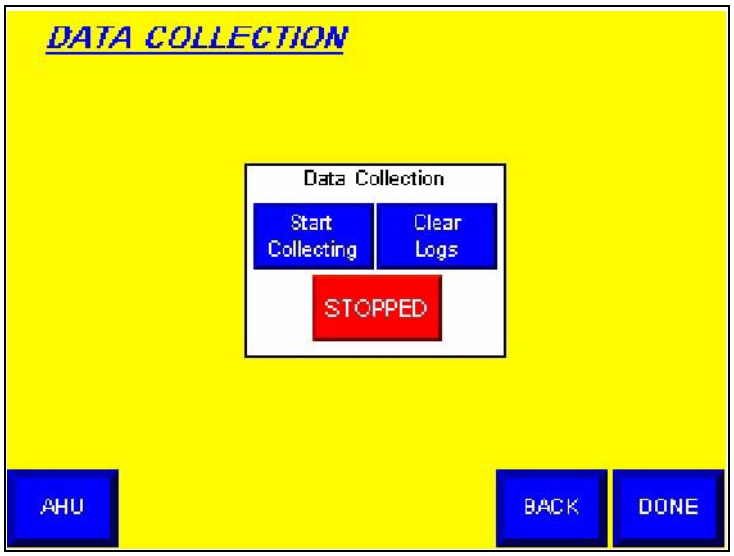
Start and Stop Data Collection

To start and stop collecting data:

1. On the Air Handler Unit Diagram screen, press “Data Log”. The first Data Log View screen displays.



2. Press “Logging Control”. The Data Collection screen displays.



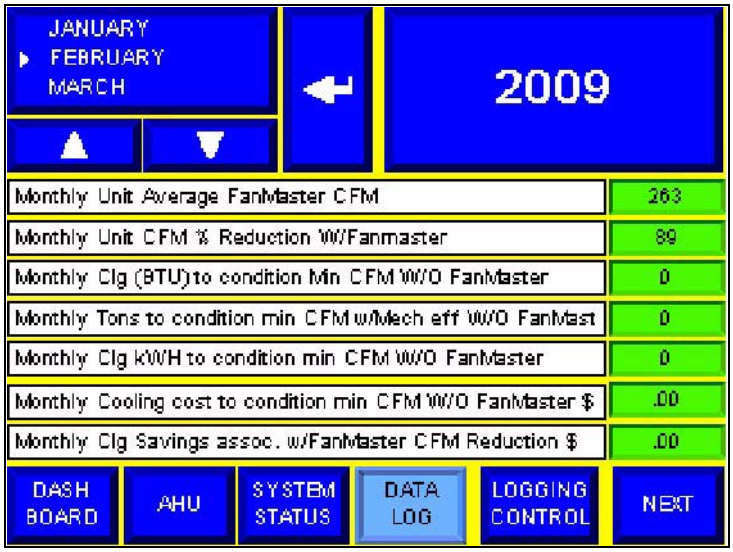
- To start collecting data, press “Start Collecting”. “Stopped” will change to display “Collecting”.
- To stop collecting data, press “Stop Collecting”. “Collecting” will change to display “Stopped”.

Clear the Data Logs and Collect Data

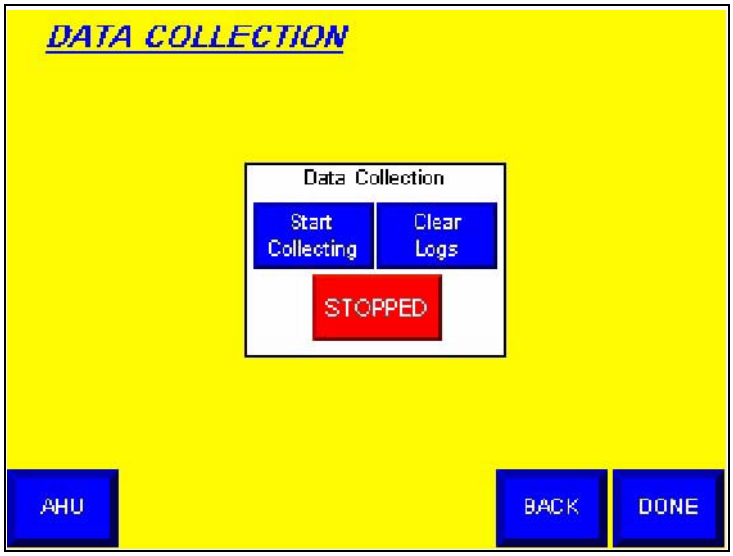
Important: Clearing the data logs will delete all historical energy savings data. This task should only be performed when you have completed the entire FanMaster configuration task and need to begin collecting new data.

To clear the logs and begin collecting data:

1. On the Air Handler Unit Diagram screen, press “Data Log”. The first Data Log View screen displays.



2. Press “Logging Control”. The Data Collection screen displays.



3. Press “Clear Logs”. A message displays to confirm that you want to delete the data stored in the log. Press “Yes”. All historical data will be cleared from the data logs.

Notes:

Troubleshooting

This chapter contains information on troubleshooting the FanMaster.

FanMaster Status

You can determine the operating status of the FanMaster in the following ways:

- Alarm indications. An alarm banner (example shown below) will display on the PanelView terminal to indicate a problem. Refer to FanMaster Alarms below for more information.

- Air Handler Unit Diagram screen on the PanelView terminal. This screen provides an overview of a typical AHU configuration and current FanMaster readings. If a value is out of range (OOR) or above a set limit, or a communication fault (Comm Fault) has occurred, in addition to the display of an alarm banner (described above), “OOR” or “Comm Fault” will display in place of the reading for the affected device. Refer to Air Handler Unit Diagram Screen on page C-3 for more information.
- FanMaster Faulted indicator light. This light, located on the front panel of the unit, will turn on when an error condition exists in the FanMaster and/or connected drive (if installed). The light will turn off when the error condition is cleared.
- FanMaster Faulted signal. An optional dry contact output that remains closed when the FanMaster is energized and is not faulted and opens when FanMaster is de-energized or is faulted. This output can be monitored by an external system for indication of proper FanMaster operation. Refer to Figure B.2 on page B-3.

FanMaster Alarms

An alarm banner displays on the PanelView terminal to indicate an alarm condition. The alarm banner displays on the screen until “Ack” (Acknowledge) is pressed. Clearing the alarm banner does not remove the alarm condition. Refer to the table below for a complete list of alarms and possible actions.

Table 4.A FanMaster Alarms

Alarm	Description	Possible Action(s)
Supply Air Temperature Out Of Range	One of the following has occurred:	
	• The polarity of the device wiring is incorrect.	• Verify that the wiring is correct.
	• The supply air temperature is above or below the operating range (OOR) of the device.	• Check the transmitter probe and wiring for damage and replace if necessary. • Check for loose wiring at the transmitter or at terminal block 2 in the FanMaster unit. • If an OOR still exists, replace the transmitter.
Mixed Air Temperature Out Of Range	One of the following has occurred:	
	• The polarity of the device wiring is incorrect.	• Verify that the wiring is correct.
	• The mixed air temperature is above or below the operating range (OOR) of the device.	• Check the transmitter probe and wiring for damage and replace if necessary. • Check for loose wiring at the transmitter or at terminal block 2 in the FanMaster unit. • If an OOR still exists, replace the transmitter.
CO2 Level Out Of Range	One of the following has occurred:	
	• The polarity of the device wiring is incorrect.	• Verify that the wiring is correct.
	• The CO_2 level is above or below the operating range (OOR) of the device.	• Check the sensor probe and wiring for damage and replace if necessary. • Check for loose wiring at the sensor or at terminal block 2 in the FanMaster unit. • If an OOR still exists, replace the sensor.
Pressure Out Of Range	One of the following has occurred:	
	• The polarity of the device wiring is incorrect.	• Verify that the wiring is correct.
	• The pressure hose is crimped or blocked.	• Check for a damaged or block pressure hose.
	• The pressure level is above or below the operating range (OOR) of the device.	• Check the pressure sensor wiring for damage and replace if necessary. • Check for loose wiring at the sensor or at terminal block 2 in the FanMaster unit. • If an OOR still exists, replace the sensor.
Return Fan Comm Fault	One of the following has occurred:	
	• The polarity of the device wiring is incorrect.	• Verify that the wiring is correct.
	• A communication loss has occurred between the return air fan drive and the FanMaster.	• Verify that the drive is energized. • Check for a loose or damaged communication cable.
Return Fan Drive Fault	A return air fan drive fault has occurred.	• View the drive HIM display to identify the fault code and refer to the Troubleshooting section of the *PowerFlex 400 AC Drive for Fan & Pump Applications User Manual*, publication 22C-UM001…, for more information.
Supply Fan Comm Fault	One of the following has occurred:	
	• The polarity of the device wiring is incorrect.	• Verify that the wiring is correct.
	• A communication loss has occurred between the supply air fan drive and the FanMaster.	• Verify that the drive is energized. • Check for a loose or damaged communication cable.
Supply Fan Drive Fault	A supply air fan drive fault has occurred.	• View the drive HIM display to identify the fault code and refer to the Troubleshooting section of the *PowerFlex 400 AC Drive for Fan & Pump Applications User Manual*, publication 22C-UM001…, for more information.

Alarm	Description	Possible Action(s)
Supply Air Temperature High	One of the following has occurred:	
	• The supply air high temperature limit max. value may be incorrectly configured.	• Verify that the value in the “SA High Limit Max” field on the Cooling and Heating Setup Screen on page C-10 is set appropriately.
	• The supply air temperature is above the high limit setpoint as configured in the FanMaster.	• Verify that the fan drive is energized. • Verify that the fan is operational. • Verify that the damper actuator is operational. • Check the transmitter probe and wiring for damage and replace if necessary. • Verify the temperature using a calibrated thermometer. If the temperature is different that the value in the FanMaster, replace the supply air transmitter.
Supply Air Temperature Low	One of the following has occurred:	
	• The supply air low temperature limit min. may be incorrectly configured.	• Verify that the value in the “SA Low Limit Min” field on the Cooling and Heating Setup Screen on page C-10 is set appropriately.
	• The supply air temperature is below the low limit setpoint as configured in the FanMaster.	• Verify that the fan drive is energized. • Verify that the fan is operational. • Verify that the damper actuator is operational. • Check the transmitter probe and wiring for damage and replace if necessary. • Verify the temperature using a calibrated thermometer. If the temperature is different that the value in the FanMaster, replace the supply air transmitter.
Outside Air Damper Signal Out Of Range	One of the following has occurred:	
	• The polarity of the device wiring is incorrect.	• Verify that the wiring is correct.
	• The outside air damper signal is above or below the operating range (OOR) of the device.	• Check the damper position switch wiring for damage and replace if necessary. • Check for loose wiring at the device or at terminal block 2 in the FanMaster unit. • Check for loose or damaged wiring to the damper actuator. • Check the signal from the BAS to the damper actuator. • If an OOR still exists, replace the damper position switch.

Alarm	Description	Possible Action(s)
Mixed Air Temperature Low	One of the following has occurred:	
	• The mixed air low temperature limit min. may be incorrectly configured.	• Verify that the value in the “SA Low Limit Min” field on the Cooling and Heating Setup Screen on page C-10 is set appropriately.
	• The mixed air temperature is below the low limit setpoint as configured in the FanMaster.	• Verify that the fan drive is energized. • Verify that the fan is operational. • Verify that the damper actuator is operational. • Check the transmitter probe and wiring for damage and replace if necessary. • Verify the temperature using a calibrated thermometer. If the temperature is different than the value displayed in the FanMaster, replace the mixed air transmitter.
CO2 Level Above Setpoint	The CO_2 level is above the high level setpoint as configured in the FanMaster.	• Check the sensor probe and wiring for damage. • Check for loose wiring at the sensor or at terminal block 2 in the FanMaster unit. • Check the CO_2 level using another calibrated sensor. If the reading is different than the value displayed in the FanMaster, replace the CO_2 sensor.
Setup Values At Defaults / Perform Setup Per User Manual	The FanMaster configuration data has been cleared or lost and have been reset to the default values.	Complete the configuration and start up procedures. Refer to Configure the FanMaster on page 3-4.

Specifications

Category	Specification	
PowerFlex 400 AC Drive:		
Ratings:	**200…240V AC:** 2.2…22 kW 3…30 Hp 12…88 A	**400…480V AC:** 2.2…45 kW 3…60 Hp 4.8…77 A
FanMaster Energy Saving Package:		
Standards and Certifications	UL508A	
Ambient Temperature Limit for Enclosure Types	NEMA/UL Type 1 0°…40°C (32°…104°F) Intended for indoor use only.	NEMA/UL Type 4 -23°…40°C (-10°…104°F) Do not install in direct sunlight.
Input Power	120V AC, 10 Amp (min.) grounded service	
User Interface	PanelView Component C600 HMI Terminal	
Inputs and Outputs	Inputs: • Supply Air Temp. @ 4…20 mA = 0°…100°C (32°…212°F) • Mixed Air Temp. @ 4…20 mA = 0°…100°C (32°…212°F) • CO_2 @ 4…20 mA = 0…2000 ppm • Damper Position Switch (when not using constant vent. option) = DC contact closed when open > minimum (Economizer active) • BAS Start (full only) = 115V AC or 24V AC signal • Current Switch (evaluation unit only) = DC contact closed when fan running • Supply Fan Drive Running = Contact on drive closed when supply fan drive running • Supply Fan Drive Status and Speed Feedback (via Modbus RTU) • Return Fan Drive Status and Speed Feedback (via Modbus RTU, when installed) • Outside Air Damper Command from BAS (required only w/constant vent. option) @ 4…20 mA = 0…100% open command • Pressure (optional w/pressure override) @ 4…20 mA = -0.100…0.100 InWC building pressure to outside pressure difference Outputs: • High CO2 Alarm = Isolated contact closed • Supply Fan Proof of Flow = Isolated contact closed • FanMaster Not Faulted = Isolated contact closed • Damper Override (force outside air damper closed) - (used only when not using constant vent. option) = Isolated contact closed • Damper Command to Outside Air Damper - connect at supply fan drive analog output 1 terminals (required only w/constant vent.) @ 4…20 mA = 0…100% open command • Supply Fan Start/Stop and Speed Reference (via Modbus RTU) • Return Fan Start/Stop and Speed Reference (via Modbus RTU, when installed)	

Category	Specification
Instrumentation	Temperature Transmitter (2): 0°...100° C (32°F...212°F) Duct Insertion
	CO_2 Sensor: 0...2000 ppm, Duct Mount
	Damper Switch: • Type: Mechanical • Rating: 5 A, 120/250V AC • Operation: SPDT • Angle: N.O. makes 20 degrees above horizontal, breaks 15 degrees below horizontal • Operating Temp.: -30°...130°F (-34°...54°C) • Enclosure: UL 94V-0 flammability rating
Optional Instrumentation	Current Switch (provided w/evaluation unit only): • Type: AC/DC • Switch Voltage Max.: 30V AC/40V DC • Current Max.: 500 mA • Voltage on @ 24V DC , 150 mA: < 0.1V • Input Current Min.: 1.5 A • Input Current Max.: 200 A Recommended Modus T30 or M30 Differential Pressure Transmitter (customer supplied): • Supply Voltage: 11...32V DC • Power: 0.9 VA • Analog Output: 4...20 mA limited to approx. 3.85 mA at low end of span, approx. 25 mA at upper end • Overpressure: 8 x pressure range or 8" W.C. (1992.8 Pa), whichever is greater • Operating Temp.: 0°...45°C (32°...115°F) • Medium: Air or inert gases

City Climate Profiles

The values in this table are used to choose a city with the closest climate profile to the city in which the FanMaster product is installed. If an acceptable climate profile is not included in the list, you can use the User City Weather Data Setup screen (described on page C-14) where you can create and save a climate profile for your location.

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Albuquerque, NM	Jan.	0	-26715	0	-9072	0	-35787
	Feb.	0	-19829	0	-7600	0	-27429
	Mar.	8	-16804	0	-7978	8	-24782
	Apr.	153	-10202	0	-7097	153	-17299
	May	981	-5152	0	-4593	981	-9745
	Jun.	3651	-1383	8	-2567	3659	-3950
	Jul.	4323	-418	63	-443	4386	-861
	Aug.	3045	-738	100	-133	3145	-871
	Sep.	1273	-3131	10	-803	1283	-3934
	Oct.	192	-9876	0	-3636	192	-13512
	Nov.	0	-18802	0	-6953	0	-25755
	Dec.	0	-25262	0	-8747	0	-34009
	Annually	13626	-138312	181	-59622	13807	-197934
Anchorage, AL	Jan.	0	-40312	0	-9209	0	-49521
	Feb.	0	-35698	0	-8504	0	-44202
	Mar.	0	-32832	0	-7897	0	-40729
	Apr.	0	-24156	0	-4822	0	-28978
	May	0	-16239	0	-1532	0	-17771
	Jun.	1	-10131	0	-85	1	-10216
	Jul.	5	-7581	0	-2	5	-7583
	Aug.	4	-9127	1	-65	5	-9192
	Sep.	0	-15077	0	-703	0	-15780
	Oct.	0	-26605	0	-4289	0	-30894
	Nov.	0	-35543	0	-7981	0	-43524
	Dec.	0	-39680	0	-9012	0	-48692
	Annually	10	-292981	1	-54101	11	-347082
Arcata/Eureka, CA	Jan.	0	-17357	0	-647	0	-18004
	Feb.	0	-14848	0	-478	0	-15326
	Mar.	0	-15743	0	-218	0	-15961
	Apr.	0	-14269	0	-156	0	-14425
	May	2	-12793	1	-23	3	-12816
	Jun.	0	-10348	1	-2	1	-10350
	Jul.	1	-9289	10	0	11	-9289
	Aug.	0	-9183	20	0	20	-9183
	Sep.	15	-9695	12	-11	27	-9706
	Oct.	18	-12006	5	-32	23	-12038
	Nov.	0	-14767	1	-271	1	-15038
	Dec.	0	-17270	0	-621	0	-17891
	Annually	36	-157568	50	-2459	86	-160027

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Astoria/Clatsop, OR	Jan.	0	-20463	0	-1464	0	-21927
	Feb.	0	-17399	0	-918	0	-18317
	Mar.	0	-17546	0	-394	0	-17940
	Apr.	1	-14984	1	-116	2	-15100
	May	10	-12310	2	-9	12	-12319
	Jun.	32	-8888	8	0	40	-8888
	Jul.	43	-6787	30	0	73	-6787
	Aug.	60	-6522	79	0	139	-6522
	Sep.	85	-7772	31	-3	116	-7775
	Oct.	6	-11831	1	-49	7	-11880
	Nov.	0	-16642	0	-573	0	-17215
	Dec.	0	-20182	0	-1114	0	-21296
	Annually	237	-161326	152	-4640	389	-165966
Billings/Logan, MT	Jan.	0	-35206	0	-10723	0	-45929
	Feb.	0	-28774	0	-8911	0	-37685
	Mar.	1	-25506	0	-7540	1	-33046
	Apr.	52	-17189	0	-4679	52	-21868
	May	249	-10961	0	-1527	249	-12488
	Jun.	1159	-4934	22	-331	1181	-5265
	Jul.	2562	-2291	56	-133	2618	-2424
	Aug.	2146	-2878	5	-224	2151	-3102
	Sep.	585	-8284	0	-1245	585	-9529
	Oct.	67	-15408	0	-3790	67	-19198
	Nov.	0	-26526	0	-7826	0	-34352
	Dec.	0	-33234	0	-10213	0	-43447
	Annually	6821	-211191	83	-57142	6904	-268333
Birmingham, AL	Jan.	0	-20798	43	-3657	43	-24455
	Feb.	10	-15788	85	-2813	95	-18601
	Mar.	120	-11057	230	-1434	350	-12491
	Apr.	472	-6352	701	-400	1173	-6752
	May	1343	-2420	4093	-7	5436	-2427
	Jun.	3166	-474	9565	0	12731	-474
	Jul.	4553	-59	15457	0	20010	-59
	Aug.	4122	-118	14081	0	18203	-118
	Sep.	2072	-1398	7546	0	9618	-1398
	Oct.	413	-6452	1496	-139	1909	-6591
	Nov.	37	-11659	487	-1196	524	-12855
	Dec.	1	-18034	169	-2832	170	-20866
	Annually	16309	-94609	53953	-12478	70262	-107087

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Boise, ID	Jan.	0	-31824	0	-6962	0	-38786
	Feb.	0	-23965	0	-4834	0	-28799
	Mar.	1	-20136	0	-4168	1	-24304
	Apr.	77	-14121	0	-2971	77	-17092
	May	463	-9324	0	-1527	463	-10851
	Jun.	1744	-4423	4	-719	1748	-5142
	Jul.	3901	-2002	24	-323	3925	-2325
	Aug.	3303	-2341	14	-552	3317	-2893
	Sep.	1011	-6236	2	-1412	1013	-7648
	Oct.	89	-13052	0	-2792	89	-15844
	Nov.	0	-22928	0	-4349	0	-27277
	Dec.	0	-30545	0	-6652	0	-37197
	Annually	10589	-180897	44	-37261	10633	-218158
Boston/Logan, MA	Jan.	0	-31249	0	-7446	0	-38695
	Feb.	0	-27427	0	-6472	0	-33899
	Mar.	1	-24076	0	-4784	1	-28860
	Apr.	44	-15860	3	-2162	47	-18022
	May	225	-9039	187	-385	412	-9424
	Jun.	903	-3000	1672	-15	2575	-3015
	Jul.	1932	-696	4942	0	6874	-696
	Aug.	1414	-1044	4972	-1	6386	-1045
	Sep.	368	-4336	1767	-59	2135	-4395
	Oct.	24	-11393	201	-953	225	-12346
	Nov.	1	-18239	34	-2925	35	-21164
	Dec.	0	-27150	2	-5747	2	-32897
	Annually	4912	-173509	13780	-30949	18692	-204458
Brownsville, TX	Jan.	163	-8327	1993	-318	2156	-8645
	Feb.	278	-5540	2360	-208	2638	-5748
	Mar.	826	-2832	5352	-109	6178	-2941
	Apr.	1821	-955	9329	-10	11150	-965
	May	4135	-134	17299	0	21434	-134
	Jun.	6063	-15	21140	0	27203	-15
	Jul.	7020	0	22560	0	29580	0
	Aug.	6836	0	22732	0	29568	0
	Sep.	4838	-118	19347	0	24185	-118
	Oct.	2695	-968	11609	-8	14304	-976
	Nov.	1050	-3292	6782	-104	7832	-3396
	Dec.	361	-6771	3793	-328	4154	-7099
	Annually	36086	-28952	144296	-1085	180382	-30037

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Buffalo, NY	Jan.	0	-34995	0	-7782	0	-42777
	Feb.	0	-31417	0	-7029	0	-38446
	Mar.	1	-27152	0	-5385	1	-32537
	Apr.	38	-17761	1	-2556	39	-20317
	May	189	-9539	314	-536	503	-10075
	Jun.	601	-3503	1661	-19	2262	-3522
	Jul.	1309	-1345	3914	-1	5223	-1346
	Aug.	895	-1973	3639	-1	4534	-1974
	Sep.	215	-6217	1348	-62	1563	-6279
	Oct.	11	-14110	31	-918	42	-15028
	Nov.	0	-21413	1	-3112	1	-24525
	Dec.	0	-30742	0	-6165	0	-36907
	Annually	3259	-200167	10909	-33566	14168	-233733
Burlington, VT	Jan.	0	-39659	0	-9593	0	-49252
	Feb.	0	-35008	0	-8580	0	-43588
	Mar.	1	-29327	0	-6632	1	-35959
	Apr.	35	-18397	2	-3218	37	-21615
	May	230	-9746	204	-688	434	-10434
	Jun.	721	-4009	1263	-30	1984	-4039
	Jul.	1482	-1887	3349	0	4831	-1887
	Aug.	934	-2713	3083	-3	4017	-2716
	Sep.	153	-7629	861	-107	1014	-7736
	Oct.	5	-16097	26	-1496	31	-17593
	Nov.	0	-23556	0	-4292	0	-27848
	Dec.	0	-34427	0	-7875	0	-42302
	Annually	3561	-222455	8788	-42514	12349	-264969
Charleston, SC	Jan.	6	-16900	161	-2675	167	-19575
	Feb.	22	-13476	188	-2213	210	-15689
	Mar.	153	-9170	428	-1047	581	-10217
	Apr.	540	-4629	1285	-257	1825	-4886
	May	1610	-1478	5895	-5	7505	-1483
	Jun.	3307	-187	13484	0	16791	-187
	Jul.	5086	-11	20441	0	25527	-11
	Aug.	4159	-52	19473	0	23632	-52
	Sep.	2225	-544	12490	0	14715	-544
	Oct.	604	-4166	3915	-76	4519	-4242
	Nov.	107	-8918	1487	-803	1594	-9721
	Dec.	13	-14006	405	-1940	418	-15946
	Annually	17832	-73537	79652	-9016	97484	-82553

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Charleston/Kanawha, WV		0	-28261	1	-5899	1	-34160
		1	-23265	0	-5071	1	-28336
		55	-17889	4	-3495	59	-21384
		333	-10754	43	-1660	376	-12414
		711	-5647	1331	-207	2042	-5854
		1615	-1850	4705	-5	6320	-1855
		2591	-689	9651	0	12242	-689
		2078	-1015	8492	0	10570	-1015
		798	-3847	3597	-7	4395	-3854
		111	-10891	310	-573	421	-11464
		19	-16852	19	-2478	38	-19330
		0	-24620	2	-4729	2	-29349
		8312	-145580	28155	-24124	36467	-169704
Chattanooga/Lovell, TN	Jan.	0	-23863	2	-4304	2	-28167
	Feb.	2	-18721	15	-3439	17	-22160
	Mar.	55	-13761	50	-1818	105	-15579
	Apr.	390	-7777	310	-644	700	-8421
	May	954	-3382	2862	-18	3816	-3400
	Jun.	2711	-723	8284	0	10995	-723
	Jul.	4278	-140	14007	0	18285	-140
	Aug.	3519	-178	12861	0	16380	-178
	Sep.	1511	-1883	6701	-2	8212	-1885
	Oct.	214	-8109	976	-202	1190	-8311
	Nov.	12	-14224	182	-1495	194	-15719
	Dec.	0	-21113	36	-3424	36	-24537
	Annually	13646	-113874	46286	-15346	59932	-129220
Chicago/O'Hare, IL	Jan.	0	-36495	0	-8261	0	-44756
	Feb.	0	-30330	0	-6753	0	-37083
	Mar.	8	-24358	7	-4631	15	-28989
	Apr.	89	-15360	34	-2093	123	-17453
	May	442	-8373	614	-448	1056	-8821
	Jun.	1378	-2896	2628	-17	4006	-2913
	Jul.	2569	-1020	6443	-1	9012	-1021
	Aug.	1867	-1327	6566	-1	8433	-1328
	Sep.	615	-4926	2012	-72	2627	-4998
	Oct.	54	-12441	109	-907	163	-13348
	Nov.	0	-22009	7	-3563	7	-25572
	Dec.	0	-31040	5	-6394	5	-37434
	Annually	7022	-190575	18425	-33141	25447	-223716

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Columbia, SC	Jan.	8	-19541	107	-3442	115	-22983
	Feb.	30	-15148	92	-2775	122	-17923
	Mar.	214	-10900	212	-1464	426	-12364
	Apr.	776	-5836	631	-516	1407	-6352
	May	1878	-2282	3392	-30	5270	-2312
	Jun.	3617	-425	8934	-1	12551	-426
	Jul.	5173	-58	15025	0	20198	-58
	Aug.	4037	-119	15007	0	19044	-119
	Sep.	2267	-1225	8738	-1	11005	-1226
	Oct.	598	-6320	2027	-156	2625	-6476
	Nov.	94	-11299	752	-1102	846	-12401
	Dec.	11	-17610	209	-2701	220	-20311
	Annually	18703	-90763	55126	-12188	73829	-102951
Cut Bank, MT	Jan.	0	-38282	0	-9284	0	-47566
	Feb.	0	-32520	0	-7958	0	-40478
	Mar.	0	-29521	0	-7327	0	-36848
	Apr.	12	-20297	0	-5176	12	-25473
	May	74	-13861	0	-2465	74	-16326
	Jun.	301	-7745	2	-669	303	-8414
	Jul.	863	-4843	30	-299	893	-5142
	Aug.	857	-6076	0	-359	857	-6435
	Sep.	223	-11742	0	-1530	223	-13272
	Oct.	24	-18627	0	-3993	24	-22620
	Nov.	0	-29994	0	-7047	0	-37041
	Dec.	0	-36293	0	-8711	0	-45004
	Annually	2354	-249801	32	-54818	2386	-304619
Dayton/James M Cox, OH	Jan.	0	-33325	0	-7222	0	-40547
	Feb.	0	-27877	0	-6026	0	-33903
	Mar.	7	-21961	5	-3946	12	-25907
	Apr.	85	-13447	47	-1689	132	-15136
	May	496	-6592	1076	-279	1572	-6871
	Jun.	1497	-1924	3724	-10	5221	-1934
	Jul.	2568	-752	7269	-1	9837	-753
	Aug.	1880	-1254	6574	0	8454	-1254
	Sep.	672	-4566	2457	-39	3129	-4605
	Oct.	48	-12279	179	-836	227	-13115
	Nov.	1	-19800	16	-2915	17	-22715
	Dec.	0	-29213	0	-5646	0	-34859
	Annually	7254	-172990	21347	-28609	28601	-201599

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Denver/Stapleton, CO	Jan.	0	-30990	0	-11112	0	-42102
	Feb.	0	-25092	0	-9057	0	-34149
	Mar.	2	-22105	0	-8121	2	-30226
	Apr.	67	-15349	0	-5127	67	-20476
	May	309	-9330	0	-1786	309	-11116
	Jun.	1736	-3679	2	-588	1738	-4267
	Jul.	2842	-1579	28	-181	2870	-1760
	Aug.	1987	-2192	24	-158	2011	-2350
	Sep.	897	-6396	0	-1206	897	-7602
	Oct.	130	-14266	0	-4493	130	-18759
	Nov.	2	-23757	0	-8084	2	-31841
	Dec.	0	-29926	0	-10746	0	-40672
	Annually	7972	-184661	54	-60659	8026	-245320
Des Moines, IA	Jan.	0	-37967	0	-9010	0	-46977
	Feb.	0	-30779	0	-7051	0	-37830
	Mar.	18	-23823	1	-4816	19	-28639
	Apr.	138	-13686	31	-1971	169	-15657
	May	464	-6132	719	-354	1183	-6486
	Jun.	1840	-1570	3652	-1	5492	-1571
	Jul.	3344	-512	8056	0	11400	-512
	Aug.	2439	-1069	7038	0	9477	-1069
	Sep.	802	-4896	2301	-111	3103	-5007
	Oct.	78	-12807	115	-1272	193	-14079
	Nov.	0	-23551	2	-4321	2	-27872
	Dec.	0	-34325	0	-7553	0	-41878
	Annually	9123	-191117	21915	-36460	31038	-227577
Detroit City, MI	Jan.	0	-33946	0	-7212	0	-41158
	Feb.	0	-29829	0	-6564	0	-36393
	Mar.	2	-25028	0	-5079	2	-30107
	Apr.	74	-15567	23	-2637	97	-18204
	May	461	-7473	528	-597	989	-8070
	Jun.	1337	-2231	2181	-23	3518	-2254
	Jul.	2580	-683	4812	-4	7392	-687
	Aug.	1765	-1042	5127	-5	6892	-1047
	Sep.	536	-4476	1617	-59	2153	-4535
	Oct.	28	-12476	91	-775	119	-13251
	Nov.	0	-20525	3	-2989	3	-23514
	Dec.	0	-29683	0	-5855	0	-35538
	Annually	6783	-182959	14382	-31799	21165	-214758

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Dodge City (Awos), KS	Jan.	0	-31384	0	-8124	0	-39508
	Feb.	9	-24618	0	-6355	9	-30973
	Mar.	68	-20049	1	-4374	69	-24423
	Apr.	302	-12021	9	-1807	311	-13828
	May	730	-5944	379	-158	1109	-6102
	Jun.	3146	-1538	2138	-16	5284	-1554
	Jul.	5566	-394	3408	0	8974	-394
	Aug.	4491	-708	3479	-3	7970	-711
	Sep.	1899	-3826	991	-173	2890	-3999
	Oct.	402	-10667	41	-1581	443	-12248
	Nov.	19	-20865	0	-4564	19	-25429
	Dec.	0	-28854	0	-7407	0	-36261
	Annually	16632	-160868	10446	-34562	27078	-195430
Duluth, MN	Jan.	0	-47483	0	-11802	0	-59285
	Feb.	0	-39192	0	-9911	0	-49103
	Mar.	0	-34142	0	-8358	0	-42500
	Apr.	7	-22722	1	-5252	8	-27974
	May	105	-13396	25	-1945	130	-15341
	Jun.	276	-7223	447	-110	723	-7333
	Jul.	691	-4005	1509	0	2200	-4005
	Aug.	381	-5075	1414	-9	1795	-5084
	Sep.	72	-11259	361	-373	433	-11632
	Oct.	5	-19561	0	-2683	5	-22244
	Nov.	0	-31507	0	-7114	0	-38621
	Dec.	0	-43444	0	-10659	0	-54103
	Annually	1537	-279009	3757	-58216	5294	-337225
Ely/Elland Field, NV	Jan.	0	-35454	0	-11006	0	-46460
	Feb.	0	-28567	0	-8882	0	-37449
	Mar.	0	-26232	0	-8172	0	-34404
	Apr.	3	-19620	0	-7585	3	-27205
	May	87	-14073	0	-4960	87	-19033
	Jun.	1040	-7475	0	-3971	1040	-11446
	Jul.	2290	-4096	0	-2992	2290	-7088
	Aug.	1716	-5005	3	-3199	1719	-8204
	Sep.	501	-9960	0	-4356	501	-14316
	Oct.	34	-18552	0	-6759	34	-25311
	Nov.	0	-27195	0	-9054	0	-36249
	Dec.	0	-34180	0	-10970	0	-45150
	Annually	5671	-230409	3	-81906	5674	-312315

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El Paso, TX	Jan.	0	-19366	0	-5987	0	-25353
	Feb.	11	-13517	0	-5431	11	-18948
	Mar.	157	-10057	0	-6117	157	-16174
	Apr.	1021	-5208	0	-5165	1021	-10373
	May	3146	-1945	5	-3002	3151	-4947
	Jun.	7166	-397	229	-1152	7395	-1549
	Jul.	6743	-90	1300	-102	8043	-192
	Aug.	5197	-168	1597	-11	6794	-179
	Sep.	2998	-1359	645	-138	3643	-1497
	Oct.	939	-5618	30	-1307	969	-6925
	Nov.	43	-12787	0	-4336	43	-17123
	Dec.	1	-18596	0	-5940	1	-24536
	Annually	27422	-89108	3806	-38688	31228	-127796
Eugene/Mahlon Sweet Fld, OR	Jan.	0	-22633	0	-1598	0	-24231
	Feb.	0	-18455	0	-936	0	-19391
	Mar.	0	-17289	0	-382	0	-17671
	Apr.	7	-13990	4	-122	11	-14112
	May	119	-10753	48	-28	167	-10781
	Jun.	448	-6809	54	-2	502	-6811
	Jul.	1396	-4305	101	-4	1497	-4309
	Aug.	1268	-4281	46	-9	1314	-4290
	Sep.	623	-6527	26	-32	649	-6559
	Oct.	56	-11849	3	-121	59	-11970
	Nov.	0	-18054	0	-573	0	-18627
	Dec.	0	-22378	0	-1187	0	-23565
	Annually	3917	-157323	282	-4994	4199	-162317
Fort Worth NAS, TX	Jan.	12	-19197	18	-3297	30	-22494
	Feb.	68	-14314	50	-2230	118	-16544
	Mar.	258	-9573	409	-1218	667	-10791
	Apr.	710	-4115	1465	-292	2175	-4407
	May	2104	-1228	5393	-8	7497	-1236
	Jun.	5405	-121	9739	0	15144	-121
	Jul.	8177	-10	10193	0	18370	-10
	Aug.	7796	-17	9762	0	17558	-17
	Sep.	3768	-806	6570	-5	10338	-811
	Oct.	1080	-4030	1757	-121	2837	-4151
	Nov.	124	-10554	461	-1083	585	-11637
	Dec.	22	-16659	108	-2565	130	-19224
	Annually	29524	-80624	45925	-10819	75449	-91443

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Fresno, CA	Jan.	0	-17780	0	-457	0	-18237
	Feb.	5	-12218	3	-248	8	-12466
	Mar.	40	-10384	5	-225	45	-10609
	Apr.	644	-6528	4	-228	648	-6756
	May	2374	-3345	21	-140	2395	-3485
	Jun.	4963	-1210	75	-60	5038	-1270
	Jul.	7647	-370	377	-6	8024	-376
	Aug.	6319	-517	519	-3	6838	-520
	Sep.	3829	-1389	166	-10	3995	-1399
	Oct.	1216	-4860	13	-75	1229	-4935
	Nov.	25	-12086	3	-287	28	-12373
	Dec.	0	-18294	0	-643	0	-18937
	Annually	27062	-88981	1186	-2382	28248	-91363
Glasgow, MT	Jan.	0	-44699	0	-10949	0	-55648
	Feb.	0	-35866	0	-8600	0	-44466
	Mar.	0	-29736	0	-6836	0	-36572
	Apr.	52	-18371	0	-4254	52	-22625
	May	323	-10680	0	-1464	323	-12144
	Jun.	1051	-4839	72	-207	1123	-5046
	Jul.	2204	-2541	326	-77	2530	-2618
	Aug.	1972	-3419	32	-166	2004	-3585
	Sep.	424	-9757	0	-1101	424	-10858
	Oct.	43	-18007	0	-3320	43	-21327
	Nov.	0	-31487	0	-7465	0	-38952
	Dec.	0	-41556	0	-10240	0	-51796
	Annually	6069	-250958	430	-54679	6499	-305637
Hartford/Bradley, CT	Jan.	0	-33851	0	-8241	0	-42092
	Feb.	0	-28998	0	-7250	0	-36248
	Mar.	5	-24246	0	-5604	5	-29850
	Apr.	88	-14887	3	-2778	91	-17665
	May	429	-7707	294	-506	723	-8213
	Jun.	1178	-2852	2146	-14	3324	-2866
	Jul.	2371	-1135	5307	-2	7678	-1137
	Aug.	1687	-1737	4842	-1	6529	-1738
	Sep.	436	-5661	1639	-72	2075	-5733
	Oct.	32	-13372	198	-1273	230	-14645
	Nov.	2	-20224	29	-3580	31	-23804
	Dec.	0	-29860	0	-6770	0	-36630
	Annually	6228	-184530	14458	-36091	20686	-220621

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Honolulu/Oahu, HI	Jan.	858	-548	5177	0	6035	-548
	Feb.	806	-447	4103	0	4909	-447
	Mar.	1133	-220	4010	0	5143	-220
	Apr.	1555	-79	4454	0	6009	-79
	May	2368	-31	6147	0	8515	-31
	Jun.	3158	-1	7444	0	10602	-1
	Jul.	3951	0	9668	0	13619	0
	Aug.	4630	0	10732	0	15362	0
	Sep.	4244	0	11130	0	15374	0
	Oct.	3470	-3	10431	0	13901	-3
	Nov.	2206	-55	8839	0	11045	-55
	Dec.	1237	-285	6506	0	7743	-285
	Annually	29616	-1669	88641	0	118257	-1669
Houston/Intercont, TX	Jan.	26	-14228	706	-1456	732	-15684
	Feb.	92	-10356	725	-912	817	-11268
	Mar.	251	-6478	2130	-365	2381	-6843
	Apr.	869	-2982	4451	-58	5320	-3040
	May	2680	-742	10243	0	12923	-742
	Jun.	4887	-87	17125	0	22012	-87
	Jul.	6385	-3	20851	0	27236	-3
	Aug.	6003	-17	20204	0	26207	-17
	Sep.	3663	-538	14461	0	18124	-538
	Oct.	1512	-3010	6207	-27	7719	-3037
	Nov.	369	-7280	3122	-386	3491	-7666
	Dec.	63	-12121	1348	-1086	1411	-13207
	Annually	26800	-57842	101573	-4290	128373	-62132
Indianapolis, IN	Jan.	0	-33487	0	-7045	0	-40532
	Feb.	0	-27507	0	-5604	0	-33111
	Mar.	11	-21140	10	-3467	21	-24607
	Apr.	94	-12627	86	-1283	180	-13910
	May	531	-5803	1480	-185	2011	-5988
	Jun.	1784	-1518	4998	-9	6782	-1527
	Jul.	2885	-579	10262	0	13147	-579
	Aug.	2117	-991	9399	0	11516	-991
	Sep.	821	-4218	3432	-29	4253	-4247
	Oct.	80	-11677	371	-717	451	-12394
	Nov.	0	-19631	51	-2709	51	-22340
	Dec.	0	-29291	2	-5397	2	-34688
	Annually	8323	-168469	30091	-26445	38414	-194914

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Jacksonville, FL	Jan.	58	-13135	566	-1382	624	-14517
	Feb.	114	-9841	628	-998	742	-10839
	Mar.	382	-6666	1327	-349	1709	-7015
	Apr.	903	-3654	2338	-64	3241	-3718
	May	2113	-1067	6947	0	9060	-1067
	Jun.	3757	-103	15810	0	19567	-103
	Jul.	5004	-7	21246	0	26250	-7
	Aug.	4394	-5	21623	0	26017	-5
	Sep.	2913	-203	17236	0	20149	-203
	Oct.	1007	-2702	7301	-8	8308	-2710
	Nov.	270	-6416	3198	-240	3468	-6656
	Dec.	77	-11560	936	-940	1013	-12500
	Annually	20992	-55359	99156	-3981	120148	-59340
Jackson/Thompson, MS	Jan.	6	-19004	212	-2552	218	-21556
	Feb.	36	-14144	271	-1777	307	-15921
	Mar.	223	-9650	815	-720	1038	-10370
	Apr.	641	-5164	1845	-126	2486	-5290
	May	1874	-1587	6415	-2	8289	-1589
	Jun.	3956	-291	13320	0	17276	-291
	Jul.	5135	-27	19800	0	24935	-27
	Aug.	4670	-91	18149	0	22819	-91
	Sep.	2681	-1132	10799	0	13480	-1132
	Oct.	718	-5648	3075	-96	3793	-5744
	Nov.	128	-10556	1273	-773	1401	-11329
	Dec.	18	-16319	573	-2041	591	-18360
	Annually	20086	-83613	76547	-8087	96633	-91700
Knoxville, TN	Jan.	0	-24897	0	-4515	0	-29412
	Feb.	2	-19477	0	-3696	2	-23173
	Mar.	31	-14467	42	-1985	73	-16452
	Apr.	259	-8315	276	-709	535	-9024
	May	747	-3784	2725	-34	3472	-3818
	Jun.	2182	-817	7998	0	10180	-817
	Jul.	3536	-183	13292	0	16828	-183
	Aug.	2964	-259	12348	0	15312	-259
	Sep.	1300	-2145	6044	-2	7344	-2147
	Oct.	164	-8598	747	-247	911	-8845
	Nov.	12	-14789	113	-1694	125	-16483
	Dec.	1	-22041	30	-3549	31	-25590
	Annually	11198	-119772	43615	-16431	54813	-136203

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Lander/Hunt, WY	Jan.	0	-39671	0	-12442	0	-52113
	Feb.	0	-31981	0	-10226	0	-42207
	Mar.	0	-26585	0	-9014	0	-35599
	Apr.	9	-18655	0	-6477	9	-25132
	May	108	-12275	0	-3243	108	-15518
	Jun.	1014	-5480	0	-1458	1014	-6938
	Jul.	2199	-2432	6	-697	2205	-3129
	Aug.	1638	-3050	3	-1317	1641	-4367
	Sep.	437	-8574	0	-2771	437	-11345
	Oct.	22	-17603	0	-5574	22	-23177
	Nov.	0	-29504	0	-9397	0	-38901
	Dec.	0	-37598	0	-11975	0	-49573
	Annually	5427	-233408	9	-74591	5436	-307999
Las Vegas/McCarran Intl., NV	Jan.	0	-18007	0	-5648	0	-23655
	Feb.	20	-12267	0	-4558	20	-16825
	Mar.	149	-9352	0	-4416	149	-13768
	Apr.	1155	-4364	0	-5006	1155	-9370
	May	3882	-1426	4	-3588	3886	-5014
	Jun.	9415	-149	12	-3072	9427	-3221
	Jul.	13095	-5	323	-1435	13418	-1440
	Aug.	11411	-11	548	-1370	11959	-1381
	Sep.	6179	-361	73	-1798	6252	-2159
	Oct.	1625	-3436	2	-3692	1627	-7128
	Nov.	54	-11050	0	-5384	54	-16434
	Dec.	0	-17715	0	-6263	0	-23978
	Annually	46985	-78143	962	-46230	47947	-124373
Little Rock AFB, AR	Jan.	1	-23575	15	-4020	16	-27595
	Feb.	10	-17964	34	-2887	44	-20851
	Mar.	98	-12556	238	-1483	336	-14039
	Apr.	433	-6188	972	-358	1405	-6546
	May	1339	-2452	4313	-8	5652	-2460
	Jun.	3802	-422	10725	0	14527	-422
	Jul.	5737	-92	15761	0	21498	-92
	Aug.	4937	-195	13382	0	18319	-195
	Sep.	2256	-1687	7176	-12	9432	-1699
	Oct.	538	-6492	1492	-209	2030	-6701
	Nov.	30	-13601	353	-1433	383	-15034
	Dec.	1	-20414	83	-2981	84	-23395
	Annually	19182	-105638	54544	-13391	73726	-119029

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Los Angeles Intl., CA	Jan.	40	-9412	0	-1007	40	-10419
	Feb.	39	-7888	2	-570	41	-8458
	Mar.	33	-8258	1	-275	34	-8533
	Apr.	77	-6317	8	-143	85	-6460
	May	34	-5015	45	-11	79	-5026
	Jun.	155	-2897	247	-9	402	-2906
	Jul.	157	-1405	1376	0	1533	-1405
	Aug.	274	-1066	2241	0	2515	-1066
	Sep.	369	-1319	1672	-6	2041	-1325
	Oct.	233	-2782	573	-190	806	-2972
	Nov.	128	-5895	34	-889	162	-6784
	Dec.	37	-8968	2	-1314	39	-10282
	Annually	1576	-61222	6201	-4414	7777	-65636
Louisville/Standiford Fld., KY	Jan.	0	-28587	1	-5872	1	-34459
	Feb.	0	-22833	1	-4721	1	-27554
	Mar.	34	-17076	23	-2868	57	-19944
	Apr.	232	-9650	136	-1028	368	-10678
	May	746	-4105	1972	-82	2718	-4187
	Jun.	2404	-906	6396	0	8800	-906
	Jul.	3951	-219	11754	-1	15705	-220
	Aug.	3172	-412	10403	0	13575	-412
	Sep.	1261	-2672	4624	-9	5885	-2681
	Oct.	146	-9245	640	-465	786	-9710
	Nov.	8	-16250	102	-2193	110	-18443
	Dec.	0	-24623	2	-4461	2	-29084
	Annually	11954	-136578	36054	-21700	48008	-158278
Macon/Lewis Wilson, GA	Jan.	3	-17932	89	-2789	92	-20721
	Feb.	17	-13559	174	-2130	191	-15689
	Mar.	196	-9370	449	-929	645	-10299
	Apr.	690	-5182	1093	-259	1783	-5441
	May	1971	-1729	4374	-3	6345	-1732
	Jun.	3891	-226	10866	0	14757	-226
	Jul.	5165	-14	17011	0	22176	-14
	Aug.	4440	-61	16921	0	21361	-61
	Sep.	2519	-919	10242	-2	12761	-921
	Oct.	670	-5353	2362	-116	3032	-5469
	Nov.	99	-9924	944	-887	1043	-10811
	Dec.	8	-15978	324	-2170	332	-18148
	Annually	19669	-80247	64849	-9285	84518	-89532

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Madison/Dane Co. Rgnl., WI	Jan.	0	-40253	0	-9496	0	-49749
	Feb.	0	-33417	0	-7781	0	-41198
	Mar.	4	-27305	0	-5545	4	-32850
	Apr.	66	-17089	7	-2643	73	-19732
	May	360	-8907	458	-557	818	-9464
	Jun.	1186	-3431	1989	-9	3175	-3440
	Jul.	2035	-1641	5134	0	7169	-1641
	Aug.	1308	-2568	4526	0	5834	-2568
	Sep.	367	-7208	1436	-121	1803	-7329
	Oct.	28	-15646	55	-1406	83	-17052
	Nov.	0	-25524	0	-4592	0	-30116
	Dec.	0	-36065	0	-7951	0	-44016
	Annually	5354	-219054	13605	-40101	18959	-259155
Medford/Jackson Co., OR	Jan.	0	-23915	0	-2256	0	-26171
	Feb.	1	-18710	0	-1627	1	-20337
	Mar.	2	-17328	0	-1141	2	-18469
	Apr.	96	-13265	0	-708	96	-13973
	May	517	-9349	5	-281	522	-9630
	Jun.	1481	-4975	11	-82	1492	-5057
	Jul.	3368	-2713	55	-30	3423	-2743
	Aug.	3093	-2877	16	-29	3109	-2906
	Sep.	1592	-5766	7	-136	1599	-5902
	Oct.	271	-12104	0	-368	271	-12472
	Nov.	0	-19671	0	-1121	0	-20792
	Dec.	0	-24223	0	-2009	0	-26232
	Annually	10421	-154896	94	-9788	10515	-164684
Memphis, TN	Jan.	0	-24174	6	-4300	6	-28474
	Feb.	2	-17733	13	-3026	15	-20759
	Mar.	66	-12522	128	-1594	194	-14116
	Apr.	446	-6322	488	-438	934	-6760
	May	1479	-2170	3000	-25	4479	-2195
	Jun.	4060	-281	8690	0	12750	-281
	Jul.	6013	-52	14939	0	20952	-52
	Aug.	4811	-181	12714	0	17525	-181
	Sep.	2197	-1745	6151	-8	8348	-1753
	Oct.	422	-6854	1146	-271	1568	-7125
	Nov.	26	-12916	274	-1529	300	-14445
	Dec.	2	-20417	75	-3341	77	-23758
	Annually	19524	-105367	47624	-14532	67148	-119899

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Miami, FL	Jan.	485	-3012	4580	-128	5065	-3140
	Feb.	553	-2243	3874	-95	4427	-2338
	Mar.	1097	-1202	5505	-33	6602	-1235
	Apr.	1858	-404	6201	-3	8059	-407
	May	3614	-29	12141	0	15755	-29
	Jun.	5010	-4	19272	0	24282	-4
	Jul.	6327	0	22281	0	28608	0
	Aug.	6218	0	23491	0	29709	0
	Sep.	5294	0	21763	0	27057	0
	Oct.	3375	-70	15064	0	18439	-70
	Nov.	1635	-611	9687	-2	11322	-613
	Dec.	676	-2133	5318	-86	5994	-2219
	Annually	36142	-9708	149177	-347	185319	-10055
Midland, TX	Jan.	6	-21257	0	-5455	6	-26712
	Feb.	71	-15442	0	-4118	71	-19560
	Mar.	333	-11200	7	-3885	340	-15085
	Apr.	1082	-5978	89	-2465	1171	-8443
	May	2834	-2299	645	-740	3479	-3039
	Jun.	4994	-409	2539	-72	7533	-481
	Jul.	5901	-75	3140	-1	9041	-76
	Aug.	5210	-155	3244	-3	8454	-158
	Sep.	2578	-1745	2197	-41	4775	-1786
	Oct.	872	-5895	385	-585	1257	-6480
	Nov.	104	-13114	23	-2821	127	-15935
	Dec.	13	-19333	0	-5162	13	-24495
	Annually	23998	-96902	12269	-25348	36267	-122250
Minneapolis-St. Paul, MN	Jan.	0	-43443	0	-10679	0	-54122
	Feb.	0	-35269	0	-8551	0	-43820
	Mar.	2	-28723	0	-6569	2	-35292
	Apr.	59	-16747	7	-3421	66	-20168
	May	361	-7820	282	-759	643	-8579
	Jun.	1241	-2598	2018	-15	3259	-2613
	Jul.	2359	-990	4311	0	6670	-990
	Aug.	1458	-1814	3961	0	5419	-1814
	Sep.	405	-6894	1109	-151	1514	-7045
	Oct.	31	-15260	36	-1750	67	-17010
	Nov.	0	-27768	0	-5890	0	-33658
	Dec.	0	-39425	0	-9379	0	-48804
	Annually	5916	-226751	11724	-47164	17640	-273915

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Minot AFB, ND	Jan.	0	-47985	0	-10752	0	-58737
	Feb.	0	-39107	0	-8702	0	-47809
	Mar.	0	-33482	0	-7158	0	-40640
	Apr.	68	-20601	0	-4085	68	-24686
	May	384	-11087	25	-1275	409	-12362
	Jun.	978	-4998	370	-104	1348	-5102
	Jul.	1752	-2762	912	-2	2664	-2764
	Aug.	1702	-4132	503	-59	2205	-4191
	Sep.	459	-10276	50	-703	509	-10979
	Oct.	28	-19609	0	-3169	28	-22778
	Nov.	0	-32723	0	-7184	0	-39907
	Dec.	0	-44654	0	-10155	0	-54809
	Annually	5371	-271416	1860	-53348	7231	-324764
Missoula/Bell Field, MT	Jan.	0	-36090	0	-8193	0	-44283
	Feb.	0	-29152	0	-6401	0	-35553
	Mar.	0	-25218	0	-5289	0	-30507
	Apr.	26	-17862	0	-3418	26	-21280
	May	169	-13000	0	-1277	169	-14277
	Jun.	698	-7544	15	-228	713	-7772
	Jul.	1869	-4586	20	-107	1889	-4693
	Aug.	1561	-5298	23	-167	1584	-5465
	Sep.	349	-10729	0	-632	349	-11361
	Oct.	10	-18794	0	-2647	10	-21441
	Nov.	0	-28534	0	-5516	0	-34050
	Dec.	0	-35711	0	-8075	0	-43786
	Annually	4682	-232518	58	-41950	4740	-274468
New Orleans/Intern., LA	Jan.	17	-13282	850	-1328	867	-14610
	Feb.	35	-9699	1022	-850	1057	-10549
	Mar.	230	-5927	2508	-318	2738	-6245
	Apr.	718	-2624	4455	-34	5173	-2658
	May	2413	-446	10621	0	13034	-446
	Jun.	4489	-40	18186	0	22675	-40
	Jul.	5511	-1	23582	0	29093	-1
	Aug.	5170	-5	22448	0	27618	-5
	Sep.	3423	-226	16147	0	19570	-226
	Oct.	1079	-2405	6308	-25	7387	-2430
	Nov.	255	-6281	3469	-274	3724	-6555
	Dec.	56	-11048	1644	-911	1700	-11959
	Annually	23396	-51984	111240	-3740	134636	-55724

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New York/John F. Kennedy, NY	Jan.	0	-28607	0	-6379	0	-34986
	Feb.	0	-25075	0	-5710	0	-30785
	Mar.	1	-21366	0	-4022	1	-25388
	Apr.	17	-13552	3	-1721	20	-15273
	May	172	-6969	397	-283	569	-7252
	Jun.	696	-1667	3314	-9	4010	-1676
	Jul.	2037	-247	9019	0	11056	-247
	Aug.	1710	-407	8930	-1	10640	-408
	Sep.	462	-2598	3684	-30	4146	-2628
	Oct.	17	-8814	613	-588	630	-9402
	Nov.	0	-16084	37	-2319	37	-18403
	Dec.	0	-24476	1	-4896	1	-29372
	Annually	5112	-149862	25998	-25958	31110	-175820
N. Platte/Lee Bird, NE	Jan.	0	-36955	0	-9734	0	-46689
	Feb.	0	-29699	0	-7778	0	-37477
	Mar.	16	-24886	0	-5880	16	-30766
	Apr.	165	-15899	0	-2791	165	-18690
	May	311	-8808	89	-470	400	-9278
	Jun.	1629	-3370	1156	-22	2785	-3392
	Jul.	3159	-1488	2582	0	5741	-1488
	Aug.	2447	-2163	2311	-2	4758	-2165
	Sep.	1018	-7201	321	-398	1339	-7599
	Oct.	171	-15805	2	-2483	173	-18288
	Nov.	1	-26539	0	-6369	1	-32908
	Dec.	0	-34757	0	-9265	0	-44022
	Annually	8917	-207570	6461	-45192	15378	-252762
Oklahoma City, OK	Jan.	0	-26047	0	-5751	0	-31798
	Feb.	18	-19757	0	-4020	18	-23777
	Mar.	85	-14346	48	-2314	133	-16660
	Apr.	298	-7643	382	-661	680	-8304
	May	981	-3045	2640	-27	3621	-3072
	Jun.	3267	-520	7680	0	10947	-520
	Jul.	6067	-65	9572	0	15639	-65
	Aug.	5437	-158	8804	0	14241	-158
	Sep.	2263	-2059	4726	-24	6989	-2083
	Oct.	466	-6958	628	-462	1094	-7420
	Nov.	26	-15404	84	-2203	110	-17607
	Dec.	0	-23259	5	-4566	5	-27825
	Annually	18908	-119261	34569	-20028	53477	-139289

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Pendleton, OR	Jan.	0	-28116	0	-4586	0	-32702
	Feb.	0	-22027	0	-3212	0	-25239
	Mar.	0	-18713	0	-2496	0	-21209
	Apr.	33	-13358	0	-1531	33	-14889
	May	300	-8943	0	-699	300	-9642
	Jun.	1150	-4427	1	-295	1151	-4722
	Jul.	3130	-2019	24	-211	3154	-2230
	Aug.	2491	-2273	6	-266	2497	-2539
	Sep.	774	-5687	0	-566	774	-6253
	Oct.	56	-12487	0	-1320	56	-13807
	Nov.	0	-21323	0	-2543	0	-23866
	Dec.	0	-27447	0	-4307	0	-31754
	Annually	7934	-166820	31	-22032	7965	-188852
Philadelphia, PA	Jan.	0	-29067	2	-6403	2	-35470
	Feb.	0	-24816	1	-5741	1	-30557
	Mar.	15	-20037	11	-3950	26	-23987
	Apr.	129	-11815	52	-1699	181	-13514
	May	595	-5311	1076	-256	1671	-5567
	Jun.	1796	-1307	4760	-5	6556	-1312
	Jul.	3391	-275	10044	0	13435	-275
	Aug.	2743	-451	8981	-1	11724	-452
	Sep.	883	-2691	3769	-30	4652	-2721
	Oct.	75	-9658	748	-516	823	-10174
	Nov.	6	-16427	121	-2364	127	-18791
	Dec.	0	-24977	10	-4946	10	-29923
	Annually	9633	-146832	29575	-25911	39208	-172743
Phoenix/Sky Harbor, AZ	Jan.	29	-10916	0	-2487	29	-13403
	Feb.	188	-7135	0	-2183	188	-9318
	Mar.	663	-5398	0	-2178	663	-7576
	Apr.	2881	-2107	0	-2514	2881	-4621
	May	6662	-408	6	-1862	6668	-2270
	Jun.	12880	-11	94	-1208	12974	-1219
	Jul.	15570	0	2687	-99	18257	-99
	Aug.	14471	0	3569	-34	18040	-34
	Sep.	9785	-27	1488	-131	11273	-158
	Oct.	3946	-1083	185	-823	4131	-1906
	Nov.	489	-5935	1	-2164	490	-8099
	Dec.	26	-10816	0	-2646	26	-13462
	Annually	67590	-43836	8030	-18329	75620	-62165

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Pierre, SD	Jan.	0	-40077	0	-9705	0	-49782
	Feb.	0	-32706	0	-7817	0	-40523
	Mar.	5	-27273	0	-5823	5	-33096
	Apr.	139	-16716	2	-3027	141	-19743
	May	480	-8591	121	-645	601	-9236
	Jun.	1764	-3181	1302	-20	3066	-3201
	Jul.	4031	-1249	2334	-4	6365	-1253
	Aug.	3240	-1828	1888	-22	5128	-1850
	Sep.	1157	-6763	315	-506	1472	-7269
	Oct.	124	-15008	0	-2366	124	-17374
	Nov.	1	-27631	0	-6214	1	-33845
	Dec.	0	-37214	0	-8942	0	-46156
	Annually	10941	-218237	5962	-45091	16903	-263328
Pittsburgh Intl., PA	Jan.	0	-32790	0	-7521	0	-40311
	Feb.	0	-27863	0	-6494	0	-34357
	Mar.	8	-22597	0	-4949	8	-27546
	Apr.	96	-14197	13	-2471	109	-16668
	May	375	-7543	425	-489	800	-8032
	Jun.	1045	-2721	2045	-12	3090	-2733
	Jul.	1893	-1149	4967	0	6860	-1149
	Aug.	1428	-1588	4276	-2	5704	-1590
	Sep.	426	-5046	1667	-43	2093	-5089
	Oct.	22	-13022	90	-980	112	-14002
	Nov.	0	-19907	2	-3249	2	-23156
	Dec.	0	-28763	0	-6119	0	-34882
	Annually	5293	-177186	13485	-32329	18778	-209515
Raleigh-Durham, NC	Jan.	0	-23211	28	-4599	28	-27810
	Feb.	7	-18752	20	-3939	27	-22691
	Mar.	81	-14234	87	-2405	168	-16639
	Apr.	378	-7825	319	-887	697	-8712
	May	920	-3685	2681	-45	3601	-3730
	Jun.	2386	-800	8122	0	10508	-800
	Jul.	3809	-189	14104	0	17913	-189
	Aug.	2966	-335	12632	0	15598	-335
	Sep.	1337	-1952	6597	-3	7934	-1955
	Oct.	238	-7938	1303	-257	1541	-8195
	Nov.	24	-13451	363	-1791	387	-15242
	Dec.	1	-20446	101	-3712	102	-24158
	Annually	12147	-112818	46357	-17638	58504	-130456

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Rapid City, SD	Jan.	0	-36153	0	-10186	0	-46339
	Feb.	0	-30123	0	-8484	0	-38607
	Mar.	4	-26366	0	-6855	4	-33221
	Apr.	98	-17680	0	-3753	98	-21433
	May	258	-10583	16	-881	274	-11464
	Jun.	1147	-4603	381	-64	1528	-4667
	Jul.	2745	-2029	617	-21	3362	-2050
	Aug.	2374	-2595	441	-78	2815	-2673
	Sep.	910	-7858	15	-981	925	-8839
	Oct.	126	-15681	0	-3367	126	-19048
	Nov.	0	-27200	0	-7238	0	-34438
	Dec.	0	-34565	0	-9660	0	-44225
	Annually	7662	-215436	1470	-51568	9132	-267004
Reno/Cannon Intl., NV	Jan.	0	-28658	0	-7356	0	-36014
	Feb.	0	-22173	0	-6191	0	-28364
	Mar.	1	-20252	0	-6041	1	-26293
	Apr.	65	-14751	0	-5544	65	-20295
	May	427	-9803	0	-3318	427	-13121
	Jun.	1672	-5076	0	-2109	1672	-7185
	Jul.	3602	-2852	2	-1076	3604	-3928
	Aug.	3072	-3603	3	-1141	3075	-4744
	Sep.	1305	-6976	0	-1987	1305	-8963
	Oct.	221	-13875	0	-3839	221	-17714
	Nov.	0	-21893	0	-5935	0	-27828
	Dec.	0	-27955	0	-7302	0	-35257
	Annually	10365	-177867	5	-51839	10370	-229706
Roanoke, VA	Jan.	0	-26597	1	-6277	1	-32874
	Feb.	1	-21844	0	-5396	1	-27240
	Mar.	39	-17129	5	-3674	44	-20803
	Apr.	236	-9929	55	-1693	291	-11622
	May	583	-4974	1135	-206	1718	-5180
	Jun.	1688	-1444	4329	-2	6017	-1446
	Jul.	2954	-474	8384	0	11338	-474
	Aug.	2355	-701	7467	0	9822	-701
	Sep.	854	-3258	3288	-18	4142	-3276
	Oct.	123	-10076	320	-719	443	-10795
	Nov.	9	-16207	55	-2750	64	-18957
	Dec.	0	-23789	4	-5220	4	-29009
	Annually	8842	-136422	25043	-25955	33885	-162377

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Rock Springs, WY	Jan.	0	-38878	0	-12011	0	-50889
	Feb.	0	-32049	0	-10003	0	-42052
	Mar.	0	-27773	0	-8678	0	-36451
	Apr.	0	-21424	0	-7430	0	-28854
	May	18	-14778	0	-4556	18	-19334
	Jun.	570	-7453	0	-3407	570	-10860
	Jul.	1309	-3779	2	-2266	1311	-6045
	Aug.	963	-4410	0	-2566	963	-6976
	Sep.	192	-9497	2	-3976	194	-13473
	Oct.	1	-19709	0	-7123	1	-26832
	Nov.	0	-30106	0	-9245	0	-39351
	Dec.	0	-35294	0	-11003	0	-46297
	Annually	3053	-245150	4	-82264	3057	-327414
Salt Lake City, UT	Jan.	0	-31976	0	-7688	0	-39664
	Feb.	0	-24957	0	-5591	0	-30548
	Mar.	0	-19993	0	-4140	0	-24133
	Apr.	64	-13566	0	-2690	64	-16256
	May	414	-8205	0	-1057	414	-9262
	Jun.	2444	-2968	3	-613	2447	-3581
	Jul.	4934	-749	75	-262	5009	-1011
	Aug.	3971	-1016	127	-379	4098	-1395
	Sep.	1253	-4750	7	-653	1260	-5403
	Oct.	108	-12698	0	-1829	108	-14527
	Nov.	0	-22090	0	-4436	0	-26526
	Dec.	0	-29725	0	-7017	0	-36742
	Annually	13188	-172693	212	-36355	13400	-209048
San Francisco, CA	Jan.	0	-15139	0	-331	0	-15470
	Feb.	0	-11619	1	-209	1	-11828
	Mar.	0	-11683	0	-131	0	-11814
	Apr.	40	-9939	0	-74	40	-10013
	May	88	-8718	0	-8	88	-8726
	Jun.	197	-6602	1	-4	198	-6606
	Jul.	133	-5803	2	-1	135	-5804
	Aug.	100	-5427	10	0	110	-5427
	Sep.	184	-5296	10	-7	194	-5303
	Oct.	138	-6928	7	-53	145	-6981
	Nov.	2	-10479	2	-226	4	-10705
	Dec.	0	-14586	0	-458	0	-15044
	Annually	882	-112219	33	-1502	915	-113721

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Scottsbluff, NE	Jan.	0	-35060	0	-10160	0	-45220
	Feb.	0	-28145	0	-8365	0	-36510
	Mar.	5	-24525	0	-6951	5	-31476
	Apr.	125	-16650	0	-4058	125	-20708
	May	403	-9693	3	-1048	406	-10741
	Jun.	1834	-3865	109	-157	1943	-4022
	Jul.	3239	-1861	342	-16	3581	-1877
	Aug.	2445	-2665	335	-18	2780	-2683
	Sep.	1052	-7797	22	-720	1074	-8517
	Oct.	154	-16399	0	-3683	154	-20082
	Nov.	1	-26130	0	-7308	1	-33438
	Dec.	0	-33441	0	-9804	0	-43245
	Annually	9258	-206231	811	-52288	10069	-258519
Seattle/Boeing Field, WA	Jan.	0	-21198	0	-2005	0	-23203
	Feb.	0	-17702	0	-1415	0	-19117
	Mar.	0	-16672	0	-831	0	-17503
	Apr.	13	-12788	0	-340	13	-13128
	May	100	-9146	3	-55	103	-9201
	Jun.	285	-5512	1	-5	286	-5517
	Jul.	709	-3256	42	-1	751	-3257
	Aug.	621	-3281	16	-1	637	-3282
	Sep.	198	-5722	5	-9	203	-5731
	Oct.	9	-11260	0	-65	9	-11325
	Nov.	0	-17364	0	-830	0	-18194
	Dec.	0	-21266	0	-1549	0	-22815
	Annually	1935	-145167	67	-7106	2002	-152273
Spokane, WA	Jan.	0	-32719	0	-6124	0	-38843
	Feb.	0	-26291	0	-4565	0	-30856
	Mar.	0	-23114	0	-3815	0	-26929
	Apr.	22	-16547	0	-2447	22	-18994
	May	197	-11480	0	-1067	197	-12547
	Jun.	686	-6383	0	-346	686	-6729
	Jul.	1979	-3480	12	-237	1991	-3717
	Aug.	1708	-3722	3	-275	1711	-3997
	Sep.	425	-8241	0	-683	425	-8924
	Oct.	19	-16338	0	-1936	19	-18274
	Nov.	0	-26082	0	-3595	0	-29677
	Dec.	0	-32396	0	-5890	0	-38286
	Annually	5036	-206793	15	-30980	5051	-237773

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Springfield, MO	Jan.	0	-29486	0	-6501	0	-35987
	Feb.	0	-23168	0	-4805	0	-27973
	Mar.	26	-17529	17	-2961	43	-20490
	Apr.	158	-10193	168	-894	326	-11087
	May	491	-4733	1908	-60	2399	-4793
	Jun.	2001	-1216	6637	0	8638	-1216
	Jul.	4050	-334	10922	0	14972	-334
	Aug.	3489	-609	8733	0	12222	-609
	Sep.	1290	-3492	3605	-30	4895	-3522
	Oct.	194	-9529	426	-703	620	-10232
	Nov.	6	-17751	33	-2666	39	-20417
	Dec.	0	-26072	1	-5169	1	-31241
	Annually	11705	-144112	32450	-23789	44155	-167901
St. Louis/Lambert, MO	Jan.	0	-30990	1	-6375	1	-37365
	Feb.	2	-24662	1	-4819	3	-29481
	Mar.	50	-18251	27	-2869	77	-21120
	Apr.	272	-9806	222	-961	494	-10767
	May	869	-3963	2098	-115	2967	-4078
	Jun.	2952	-766	6607	-1	9559	-767
	Jul.	5078	-165	12163	0	17241	-165
	Aug.	3977	-398	10615	0	14592	-398
	Sep.	1523	-2798	4291	-32	5814	-2830
	Oct.	202	-8948	710	-555	912	-9503
	Nov.	11	-17644	84	-2435	95	-20079
	Dec.	0	-27136	16	-4990	16	-32126
	Annually	14936	-145527	36835	-23152	51771	-168679
Syracuse/Hancock, NY	Jan.	0	-35809	0	-8190	0	-43999
	Feb.	0	-31729	0	-7346	0	-39075
	Mar.	10	-26961	0	-5595	10	-32556
	Apr.	56	-17021	9	-2614	65	-19635
	May	303	-9181	415	-449	718	-9630
	Jun.	815	-3781	1918	-11	2733	-3792
	Jul.	1642	-1733	4617	0	6259	-1733
	Aug.	1079	-2407	4498	0	5577	-2407
	Sep.	257	-6692	1371	-35	1628	-6727
	Oct.	19	-14595	65	-815	84	-15410
	Nov.	0	-21617	3	-2972	3	-24589
	Dec.	0	-31340	0	-6317	0	-37657
	Annually	4181	-202866	12896	-34344	17077	-237210

City Name	Month/Period	Average Sensible Cooling Load *(BTU/CFM)*	Average Sensible Heating Load *(BTU/CFM)*	Average Latent Cooling Load *(BTU/CFM)*	Average Latent Heating Load *(BTU/CFM)*	Total Cooling Load *(BTU/CFM)*	Total Heating Load *(BTU/CFM)*
Tucumcari, NM	Jan.	1	-23573	0	-5395	1	-28968
	Feb.	9	-17834	0	-4311	9	-22145
	Mar.	79	-13810	0	-3751	79	-17561
	Apr.	420	-7994	0	-2393	420	-10387
	May	1424	-3588	13	-804	1437	-4392
	Jun.	4143	-823	197	-192	4340	-1015
	Jul.	5406	-179	622	-8	6028	-187
	Aug.	4317	-343	735	-7	5052	-350
	Sep.	1747	-2466	140	-100	1887	-2566
	Oct.	401	-7508	3	-1083	404	-8591
	Nov.	37	-14873	0	-3196	37	-18069
	Dec.	1	-22258	0	-4976	1	-27234
	Annually	17985	-115249	1710	-26216	19695	-141465
Washington/Dulles, VA	Jan.	0	-29184	0	-6320	0	-35504
	Feb.	0	-24362	1	-5473	1	-29835
	Mar.	35	-19564	8	-3712	43	-23276
	Apr.	193	-11550	86	-1570	279	-13120
	May	621	-5848	1477	-154	2098	-6002
	Jun.	1753	-1813	5298	-3	7051	-1816
	Jul.	3166	-664	10212	0	13378	-664
	Aug.	2537	-977	8851	0	11388	-977
	Sep.	987	-3635	3593	-9	4580	-3644
	Oct.	116	-11102	554	-622	670	-11724
	Nov.	12	-17528	78	-2571	90	-20099
	Dec.	0	-25635	9	-5105	9	-30740
	Annually	9420	-151862	30167	-25539	39587	-177401
Winslow, AZ	Jan.	0	-28253	0	-7682	0	-35935
	Feb.	0	-21140	0	-6532	0	-27672
	Mar.	10	-18020	0	-6606	10	-24626
	Apr.	175	-11367	0	-6547	175	-17914
	May	935	-6638	0	-4972	935	-11610
	Jun.	3707	-2445	3	-4115	3710	-6560
	Jul.	4313	-752	104	-886	4417	-1638
	Aug.	3276	-1473	132	-400	3408	-1873
	Sep.	1341	-3970	22	-1207	1363	-5177
	Oct.	236	-11010	0	-4011	236	-15021
	Nov.	2	-19541	0	-6354	2	-25895
	Dec.	0	-28031	0	-7982	0	-36013
	Annually	13995	-152640	261	-57294	14256	-209934

Notes:

FanMaster Diagrams

Drawing Index

Schematics (FanMaster w/Drive)

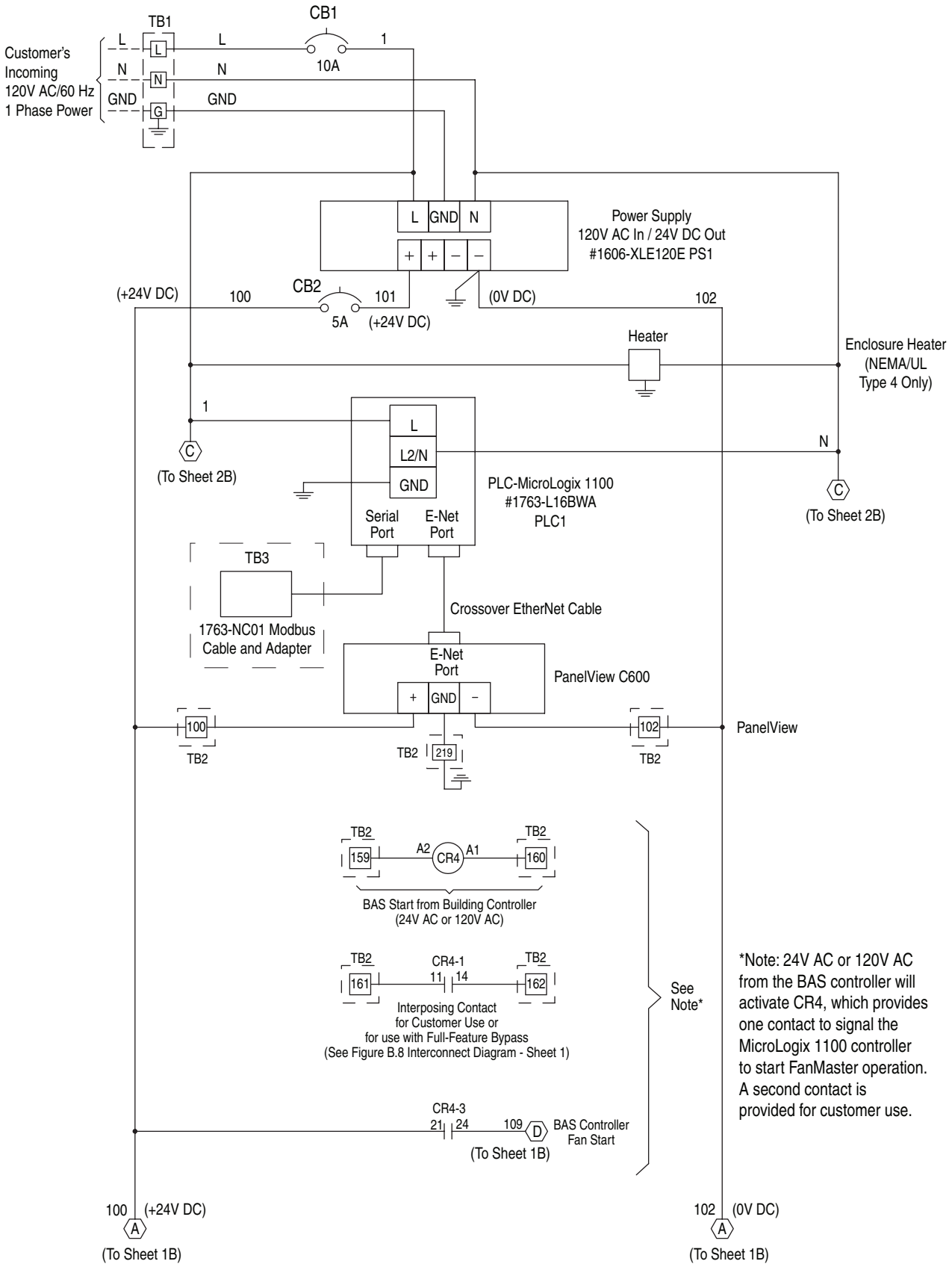
Schematics (FanMaster Evaluation Unit)

Inter-Connect

Wiring

Component Layout

Figure B.1 FanMaster (w/Drive) Schematic Diagram Sheet 1A



*Note: 24V AC or 120V AC from the BAS controller will activate CR4, which provides one contact to signal the MicroLogix 1100 controller to start FanMaster operation. A second contact is provided for customer use.

Figure B.2 FanMaster (w/Drive) Schematic Diagram Sheet 1B

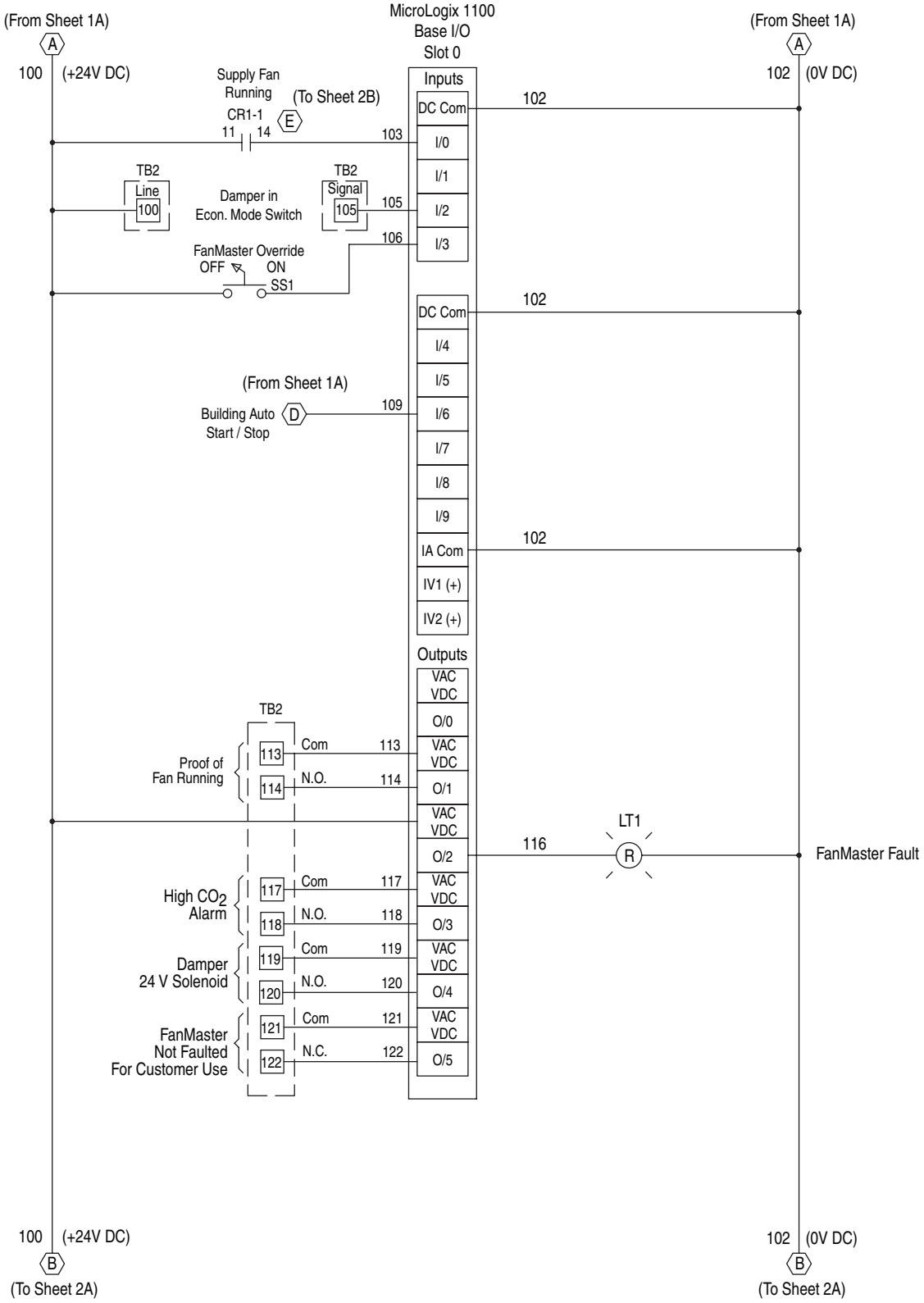


Figure B.3 FanMaster (w/Drive) Schematic Diagram Sheet 2A

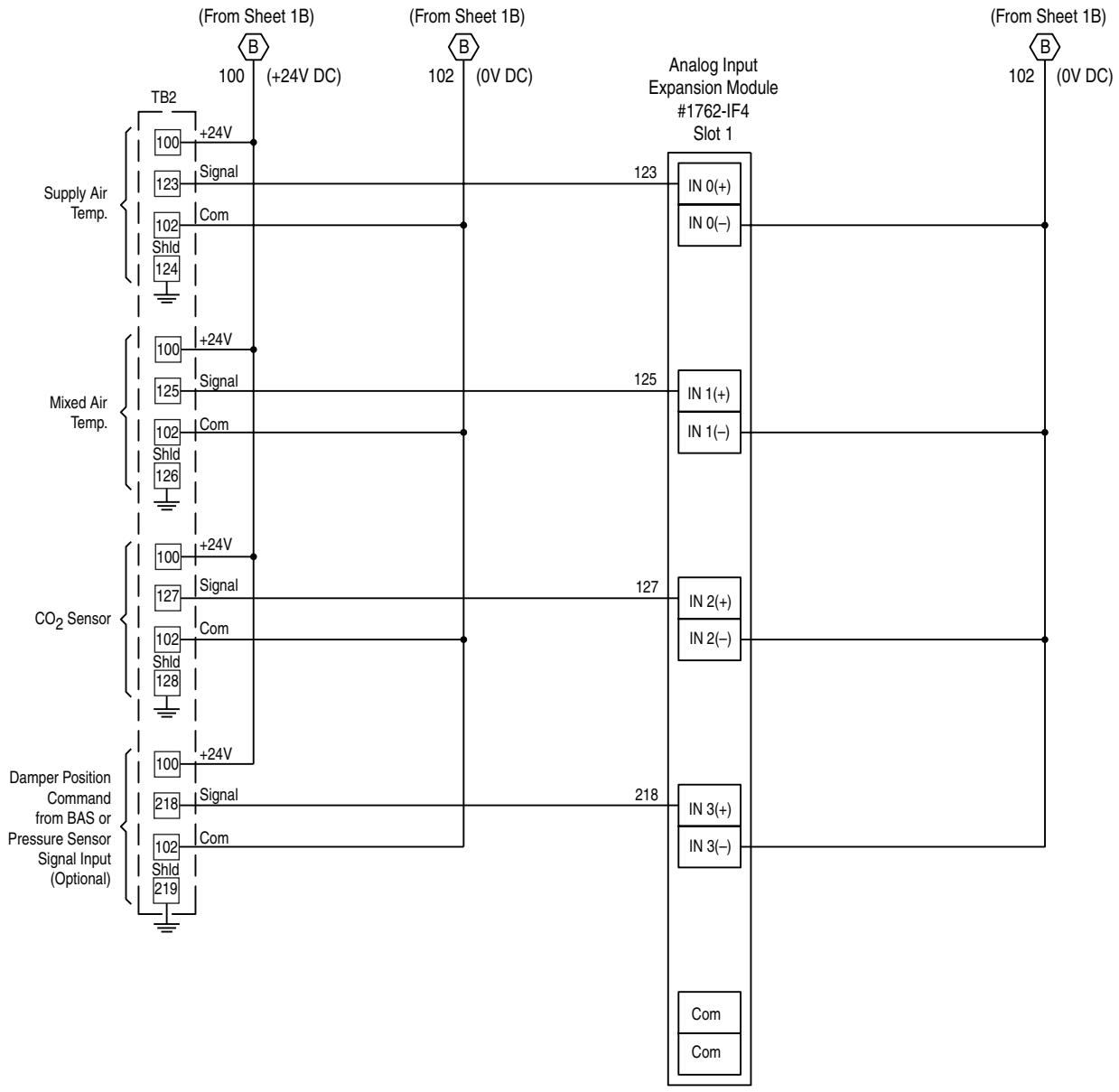


Figure B.4 FanMaster (w/Drive) Schematic Diagram Sheet 2B

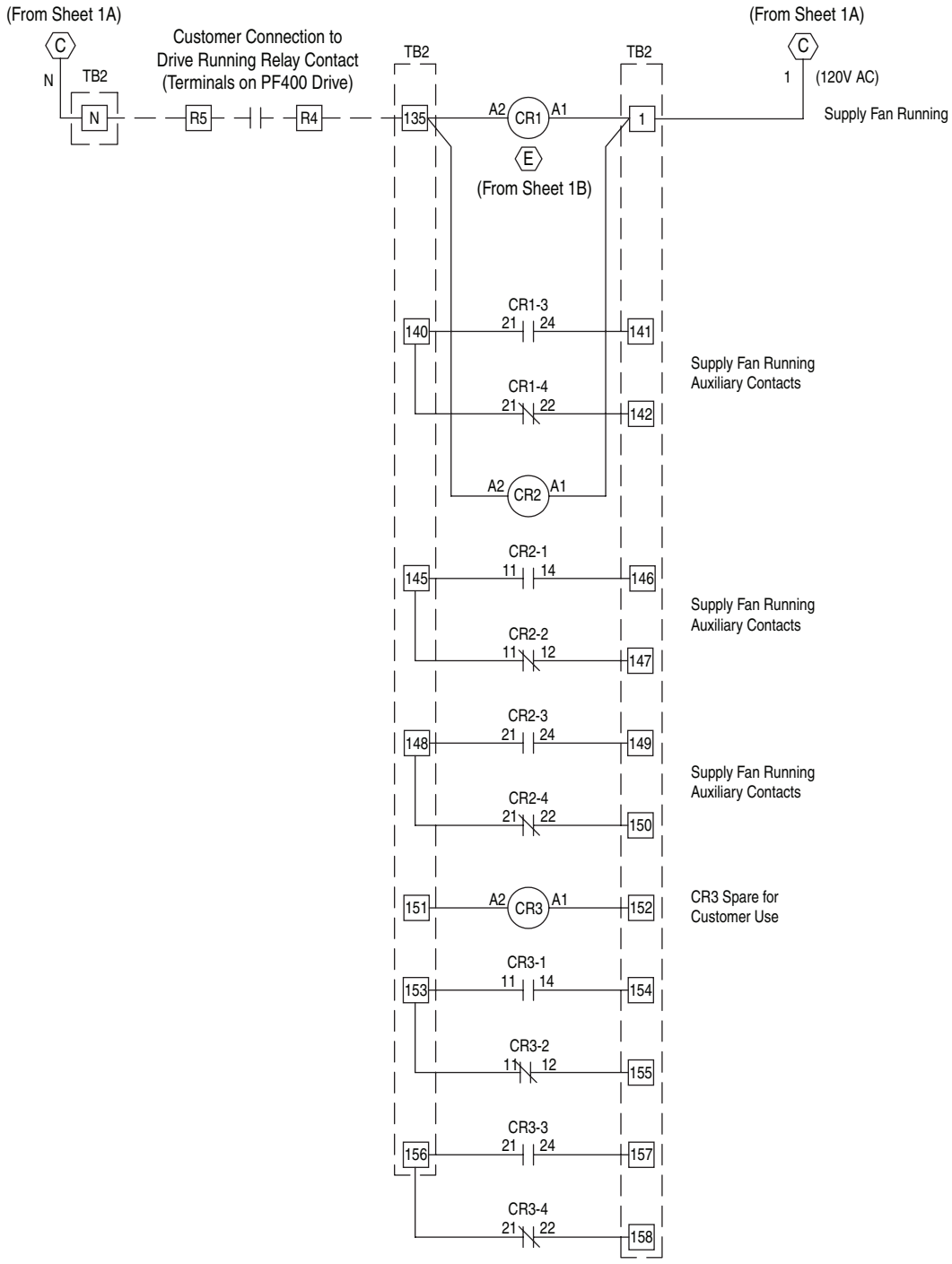


Figure B.5 FanMaster Evaluation Unit Schematic Diagram Sheet 1A

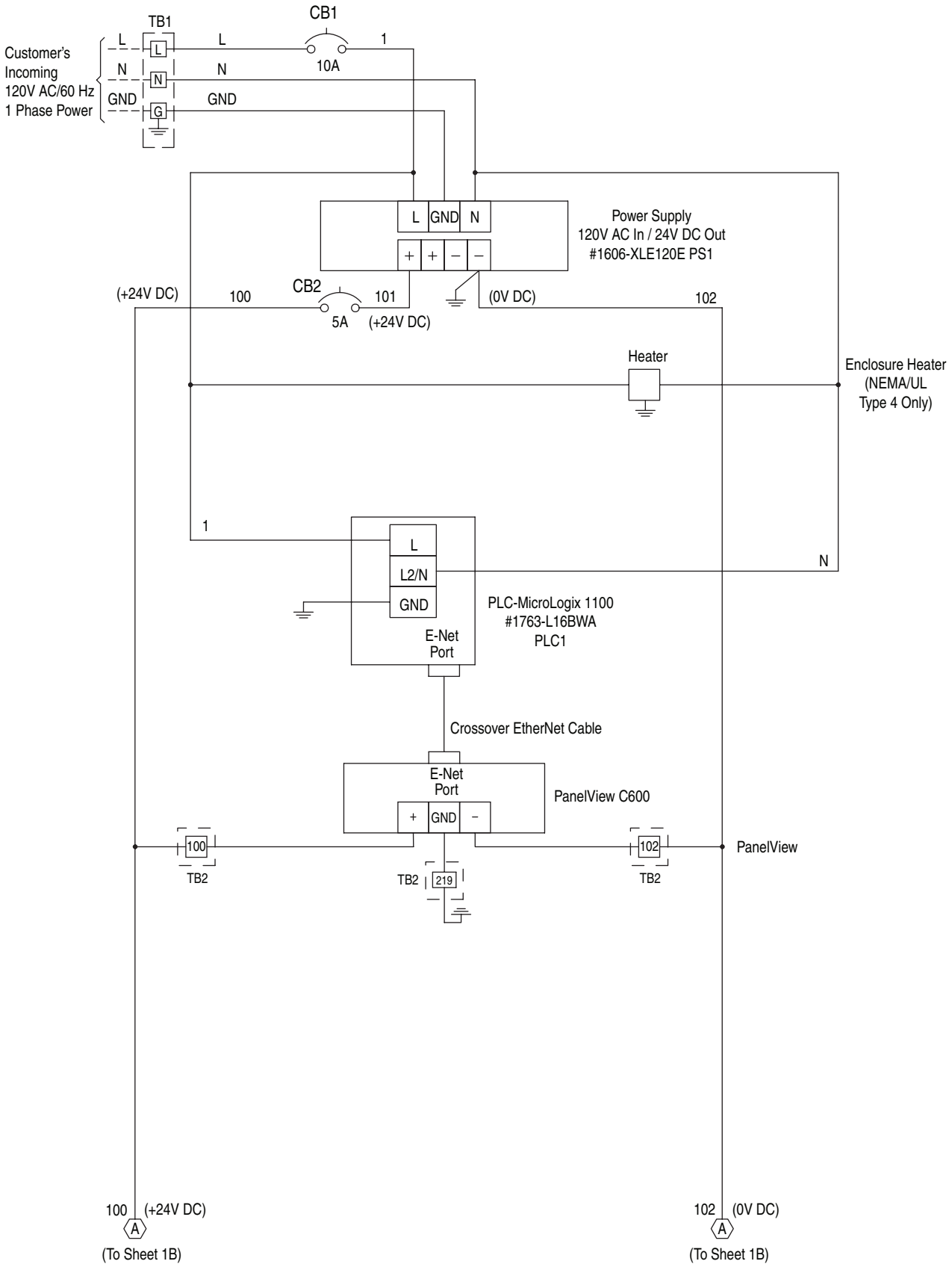


Figure B.6 FanMaster Evaluation Unit Schematic Diagram Sheet 1B

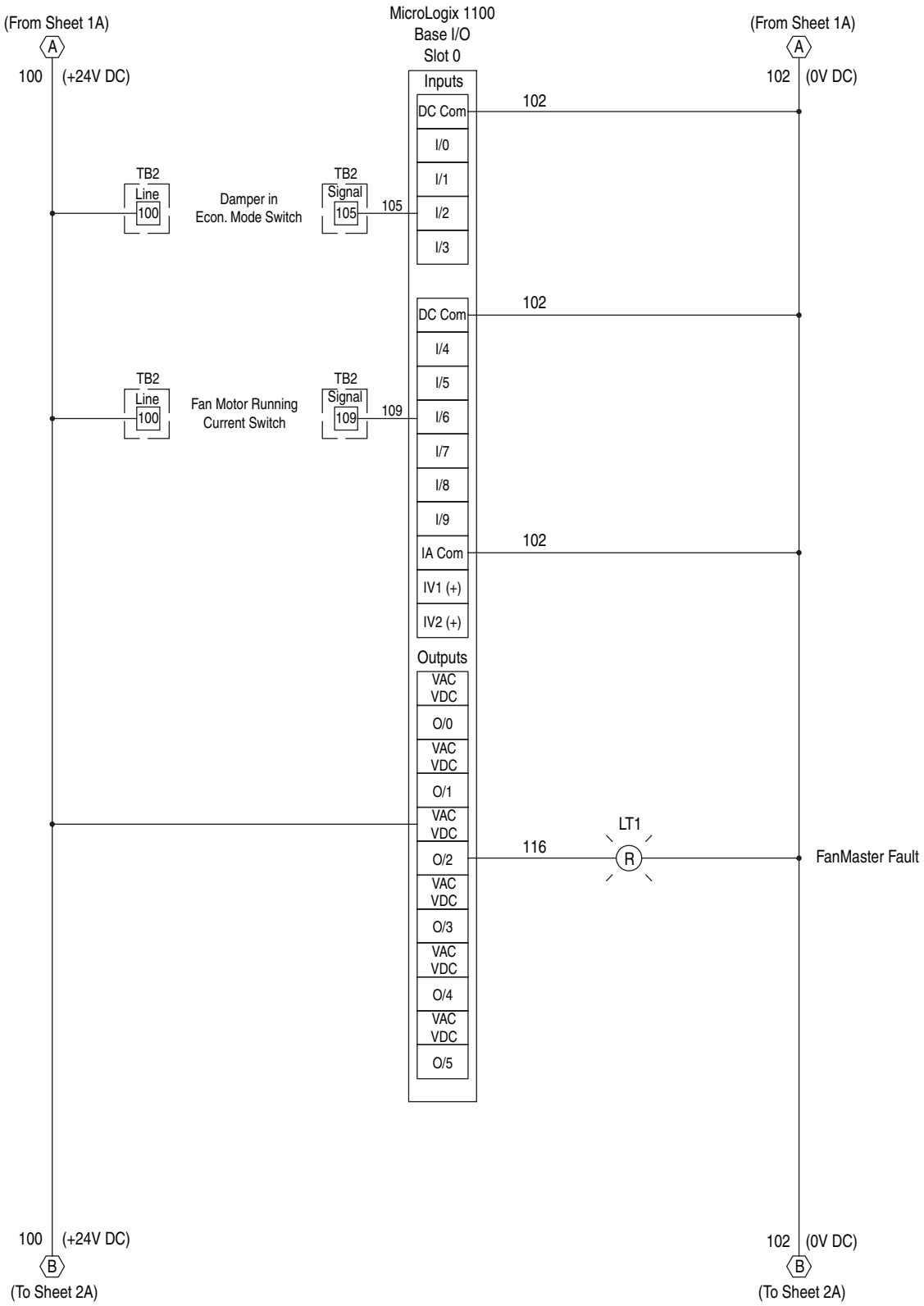


Figure B.7 FanMaster Evaluation Unit Schematic Diagram Sheet 2A

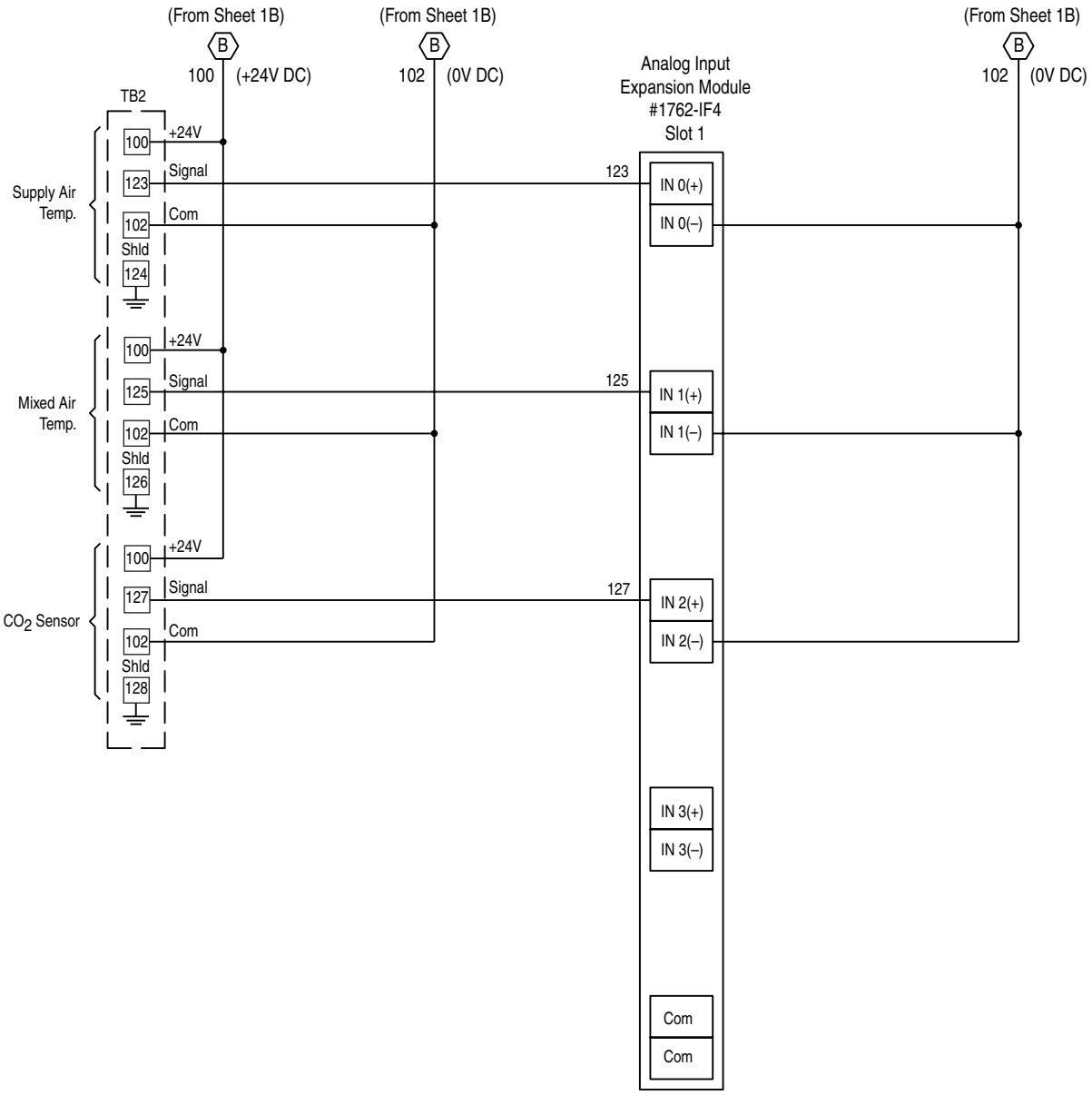
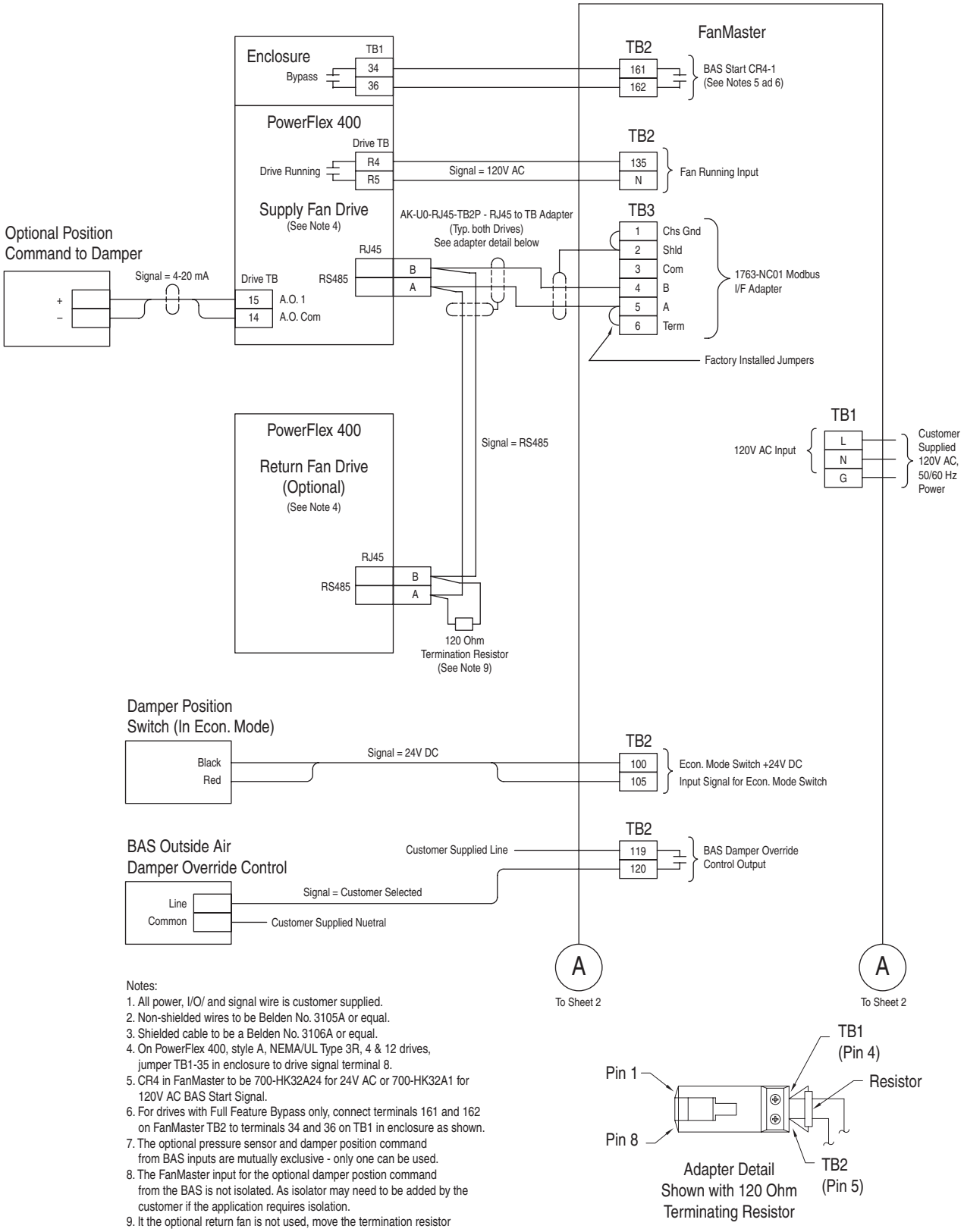


Figure B.8 Interconnect Diagram - Sheet 1



Notes:
1. All power, I/O/ and signal wire is customer supplied.
2. Non-shielded wires to be Belden No. 3105A or equal.
3. Shielded cable to be a Belden No. 3106A or equal.
4. On PowerFlex 400, style A, NEMA/UL Type 3R, 4 & 12 drives, jumper TB1-35 in enclosure to drive signal terminal 8.
5. CR4 in FanMaster to be 700-HK32A24 for 24V AC or 700-HK32A1 for 120V AC BAS Start Signal.
6. For drives with Full Feature Bypass only, connect terminals 161 and 162 on FanMaster TB2 to terminals 34 and 36 on TB1 in enclosure as shown.
7. The optional pressure sensor and damper position command from BAS inputs are mutually exclusive - only one can be used.
8. The FanMaster input for the optional damper postion command from the BAS is not isolated. As isolator may need to be added by the customer if the application requires isolation.
9. It the optional return fan is not used, move the termination resistor to the supply fan terminals A and B.

Figure B.9 Interconnect Diagram - Sheet 2

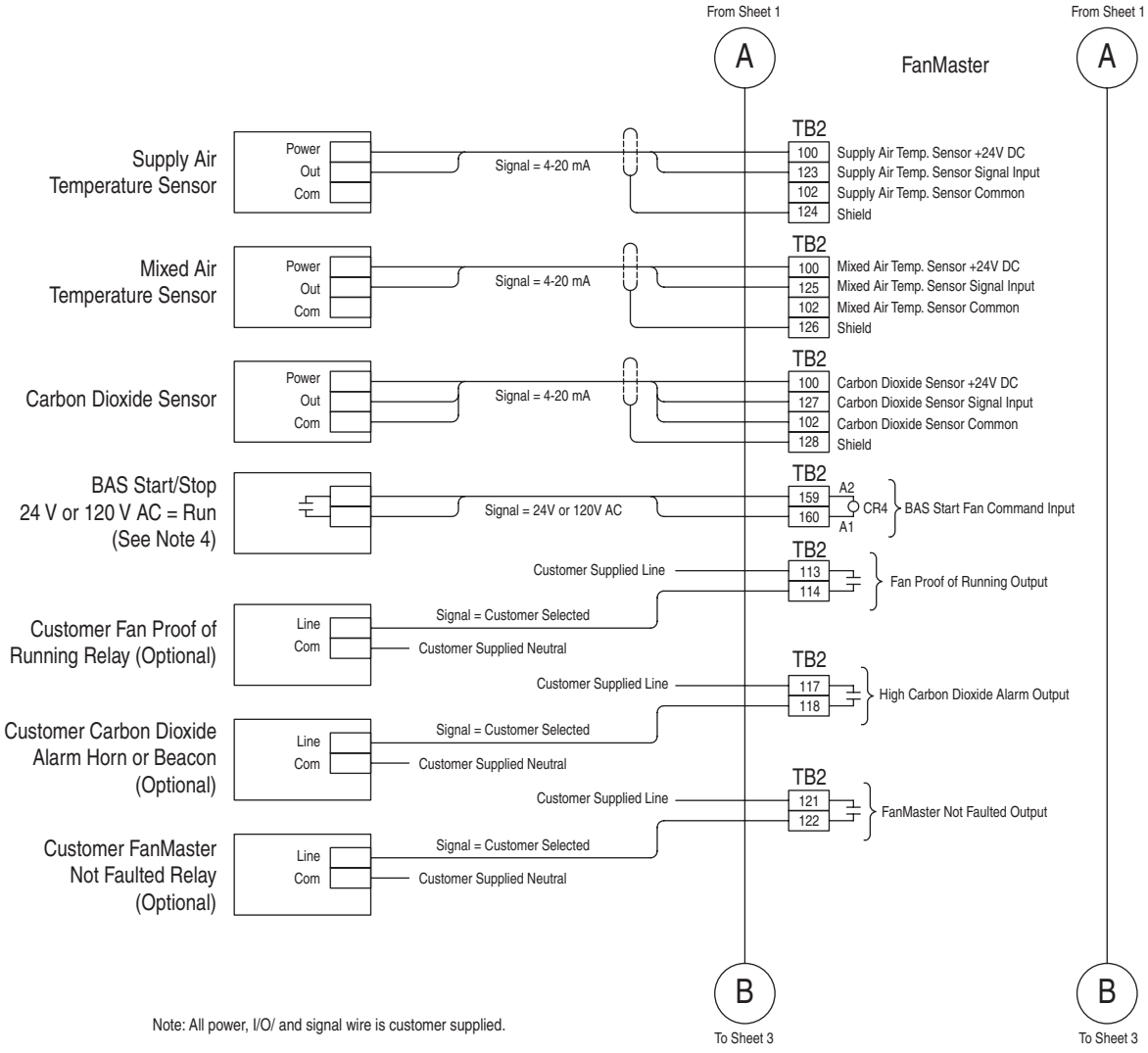
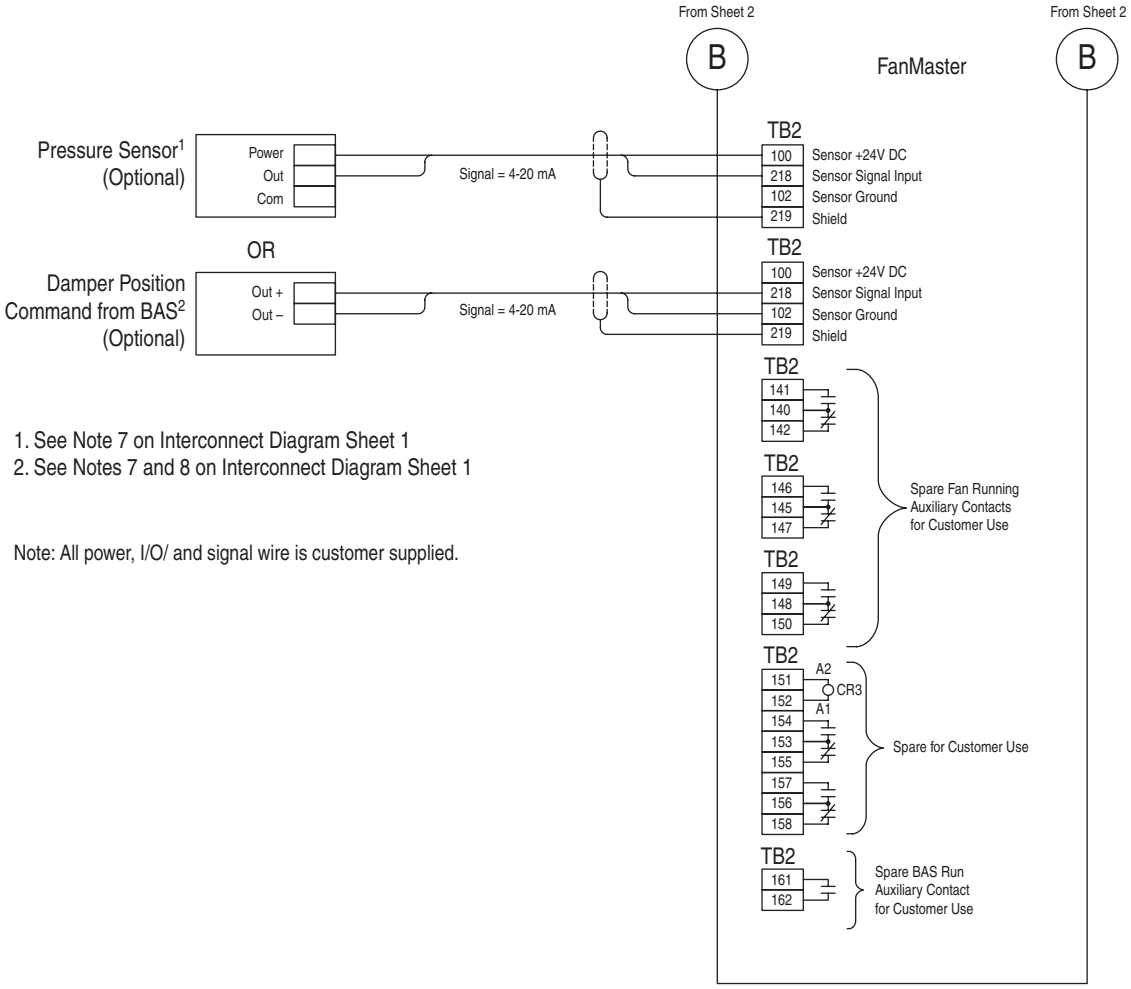


Figure B.10 Interconnect Diagram - Sheet 3



1. See Note 7 on Interconnect Diagram Sheet 1
2. See Notes 7 and 8 on Interconnect Diagram Sheet 1

Note: All power, I/O/ and signal wire is customer supplied.

Figure B.11 Wiring Diagram, FanMaster

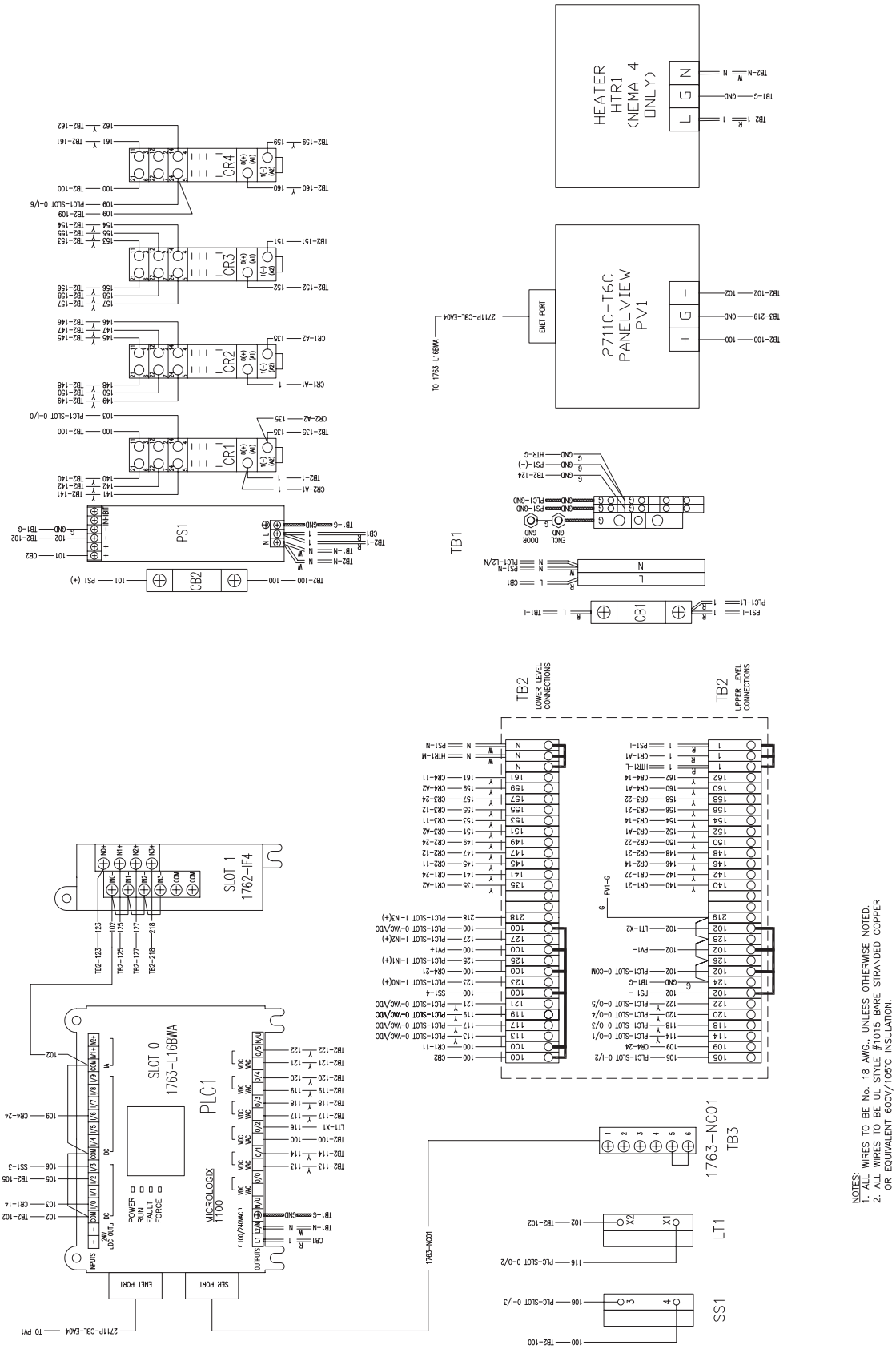
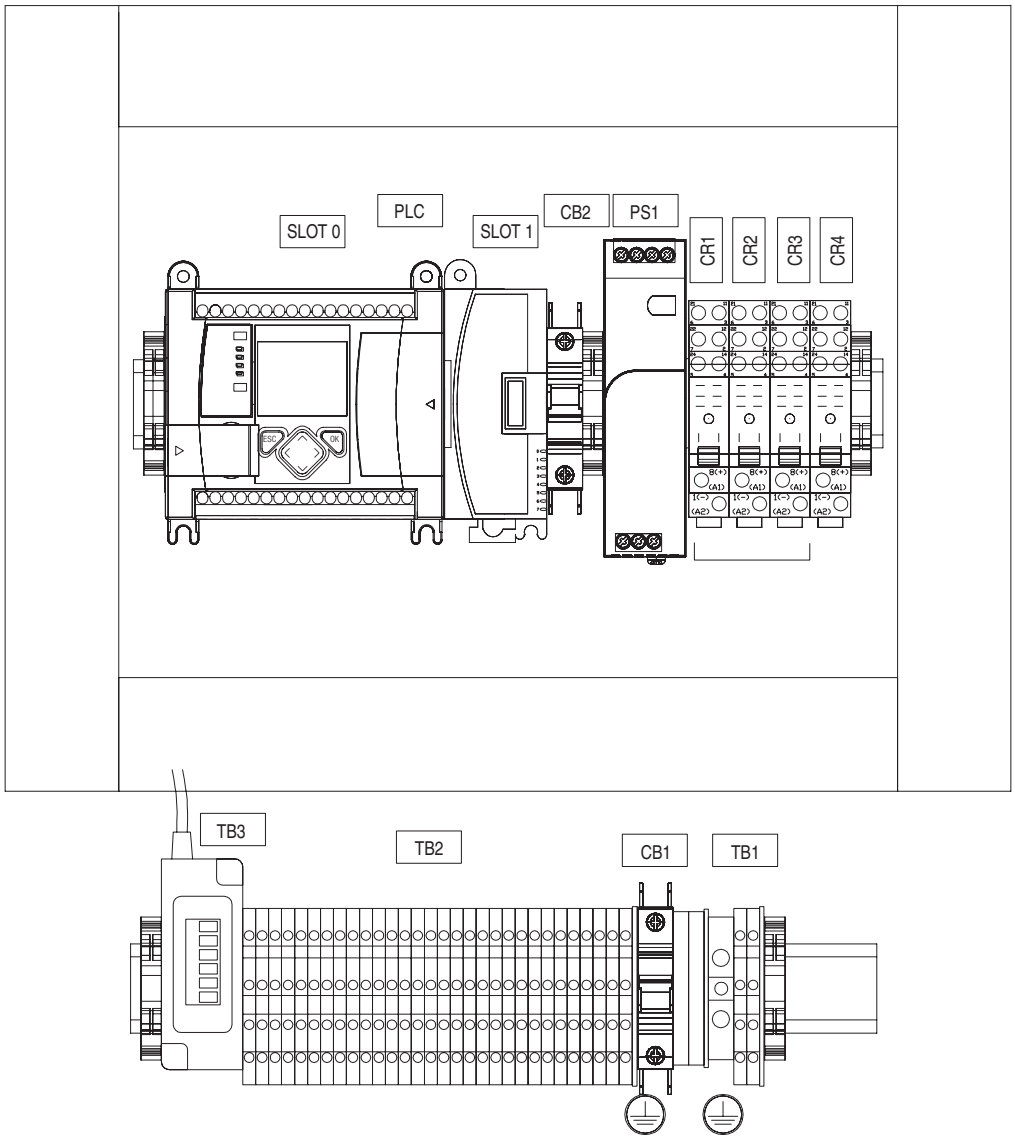
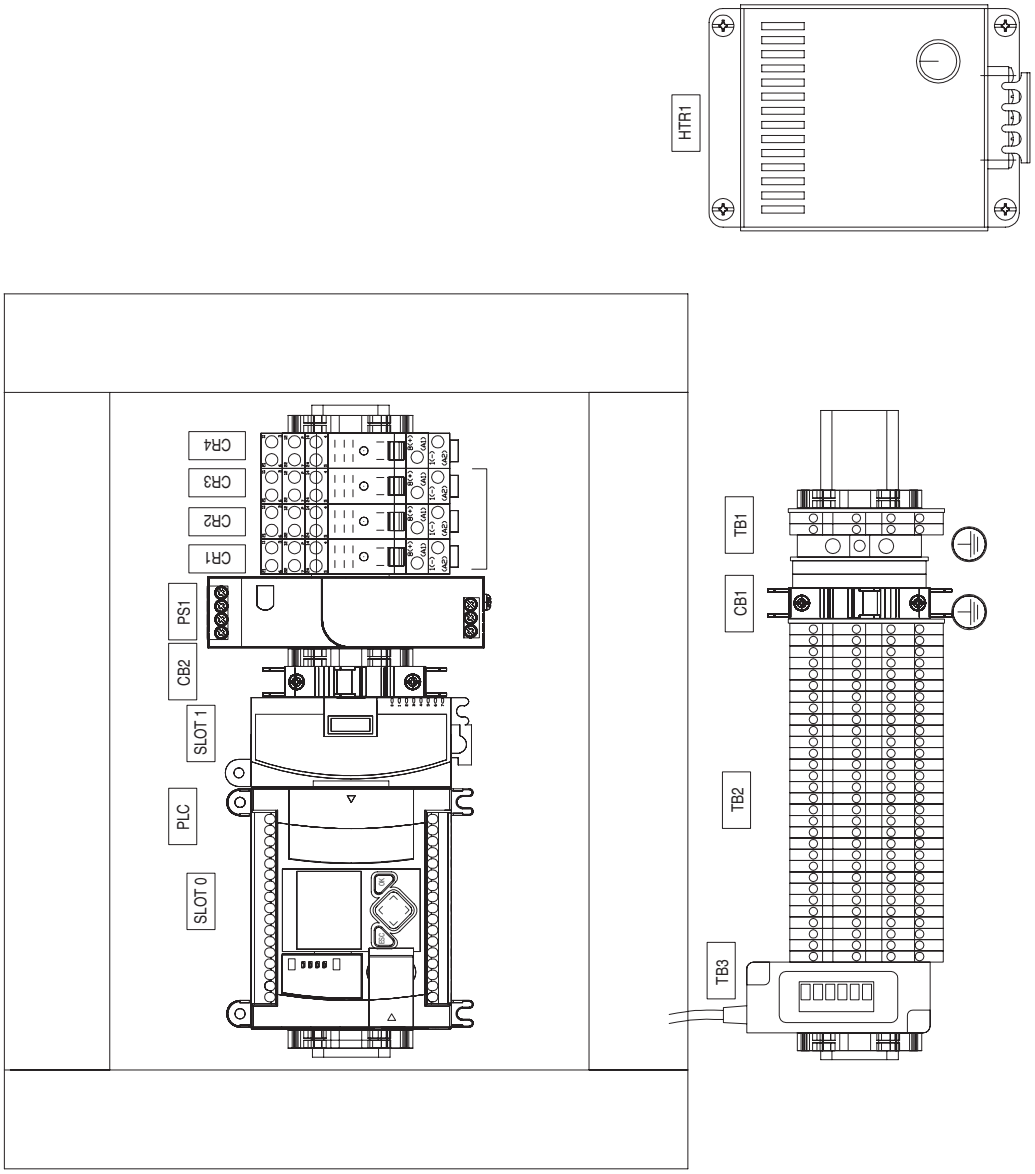


Figure B.12 FanMaster, NEMA/UL Type 1 Enclosure Layout



Label	Component
Slot 0	MicroLogix 1100 Programmable Controller
Slot 1	Analog Input Expansion Module
CB2	Circuit Breaker for controller and analog input module power
PS1	Power Supply 120V AC input / 24V DC output
CR1	Contact Relay for supply “fan running” signal
CR2	Auxiliary Contact Relay for supply “fan running” signal
CR3	Spare Contact Relay for customer use
CR4	Contact Relay for BAS Controller “start” signal
TB3	Modbus communication adapter
TB2	Primary I/O terminal block
CB1	Circuit Breaker for panel power
TB1	Power input terminal block

Figure B.13 FanMaster, NEMA/UL Type 4 Enclosure Layout



Label	Component
Slot 0	MicroLogix 1100 Programmable Controller
Slot 1	Analog Input Expansion Module
CB2	Circuit Breaker for controller and analog input module power
PS1	Power Supply 120V AC input / 24V DC output
CR1	Contact Relay for supply “fan running” signal
CR2	Auxiliary Contact Relay for supply “fan running” signal
CR3	Spare Contact Relay for customer use
CR4	Contact Relay for BAS Controller “start” signal
TB3	Modbus communication adapter
TB2	Primary I/O terminal block
CB1	Circuit Breaker for panel power
TB1	Power input terminal block
HTR1	Enclosure Heater

FanMaster Screens and Field Descriptions

This chapter contains a description of the information contained on each FanMaster screen. The screens are listed in order of appearance as you complete the configuration procedures.

DashBoard Screen

The Dash Board screen provides a quick view your energy savings.

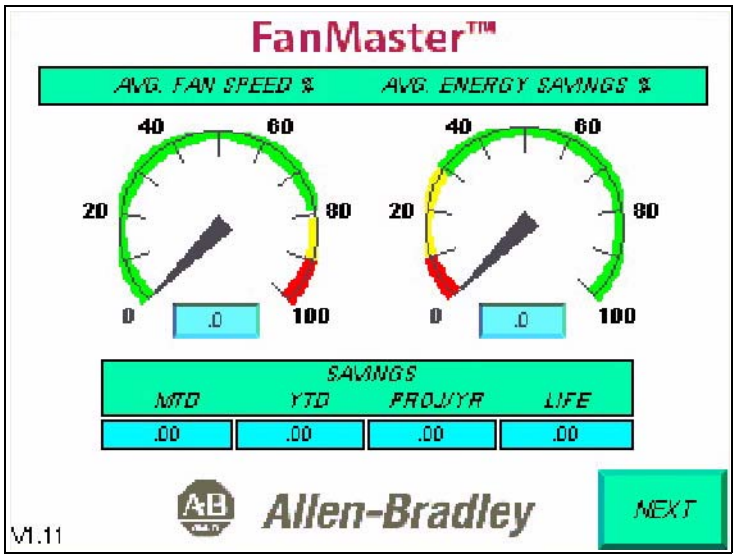


Table C.A Dash Board Screen Fields

Field Name	Description
Avg. Fan Speed %	Average percentage of full speed of the fan(s) speed since start up or the last time the logs were cleared.
Avg. Energy Savings %	Average energy (cost of fan electricity) savings since the start up or the last time the logs were cleared.
MTD (Savings)	Current month-to-date savings (including electrical, cool and heating costs, if applicable) since start up or the last time the logs were cleared.
YTD (Savings)	Current year-to-date savings (including electrical, cool and heating costs, if applicable) since start up or the last time the logs were cleared.
PROJ/YR (Savings)	Projected year-to-date savings (including electrical, cool and heating costs, if applicable) since start up or the last time the logs were cleared.
LIFE (Savings)	Total savings (including electrical, cool and heating costs, if applicable) since start up or the last time the logs were cleared.
Next	Press to view the Air Handler Unit Diagram Screen.

Air Handler Unit Diagram Screen

The Air Handler Unit Diagram screen provides an overview of a typical AHU configuration and current FanMaster readings.

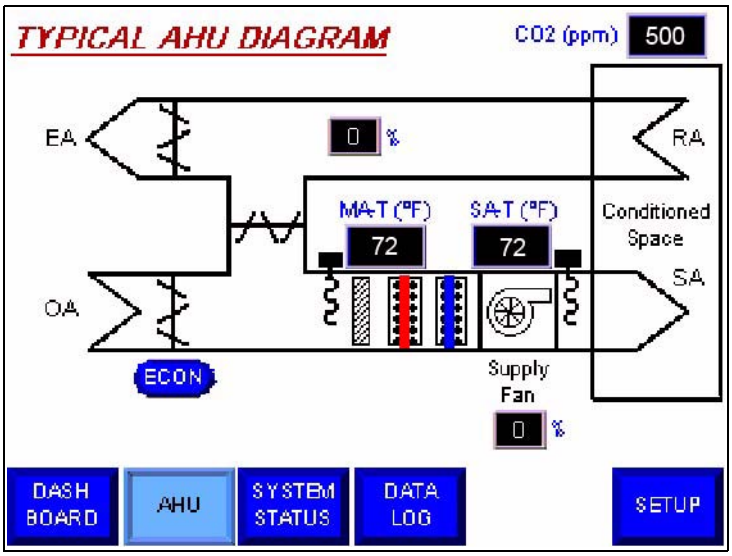


Table C.B Air Handler Unit Diagram Screen Fields

Field Name	Description
CO2 ppm	Current CO_2 level in parts per million (ppm).
Return Fan %	Current return fan percentage of full speed (if installed and configured).
MAT (°F)	Current mixed air temperature.
SAT (°F)	Current supply air temperature.
(ECON)	Damper status. “Econ” indicates that the AHU is in economizer mode. Min” indicates that the outside air damper is currently at the minimum open position. “xx%” indicates the percent open position (only displays if the constant ventilation option is used).
Supply Fan %	Current percentage of full speed of the supply fan.
Dash Board	Press to access the DashBoard Screen.
AHU	Screen you are currently viewing.
System Status	Press to view the System Status Screen.
Data Log	Press to view the first Data Log #1 Screen.
Setup	Press to view the first Setup Screen #1.

Setup Screen #1

The first Setup screen is used to enter data required to configure the FanMaster for your installation.

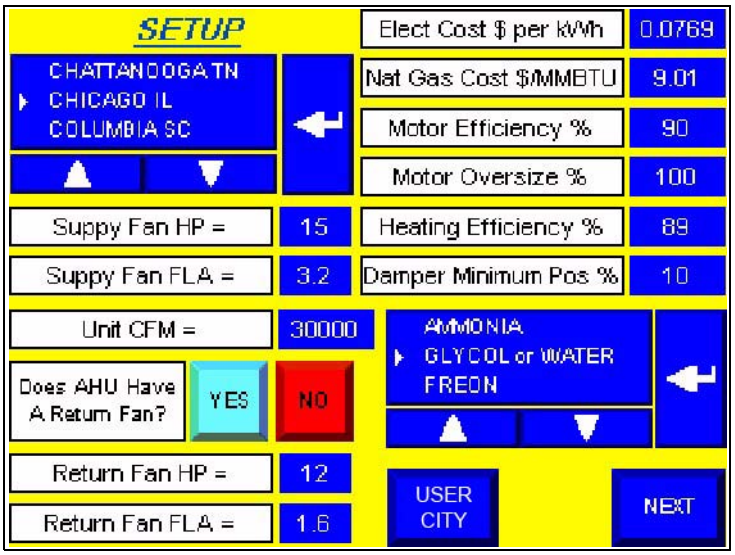


Table C.C Setup Screen #1 Fields

Field Name	Description
(City, State)	City and State location selection.
Supply Fan HP	Supply fan motor rated horsepower
Supply Fan FLA	Supply fan motor rated full load amps.
Unit CFM	AHU air flow volume.
Does AHU Have A Return Fan?	Return fan installed selection.
Return Fan HP	Return fan motor rated horsepower
Return Fan FLA	Return fan motor rated full load amps.
Elect Cost $ per kWh	Electricity cost in dollars per kilowatt hour.
Nat Gas Cost $/MMBTU	Natural gas cost in dollars per one million BTUs.
Motor Efficiency %	Percentage of supply fan motor efficiency.
Motor Oversize %	Percentage of motor oversizing.
Heating Efficiency %	Percentage of heating efficiency.
Damper Minimum Pos %	Outside air damper minimum open percentage.
(Coolant Type)	AHU coolant type.
User City	Press to view the User City Weather Data Setup Screen.
Next	Press to view the Setup Date and Time Screen.

Setup Date and Time Screen

The Setup Date and Time screen is used to enter the current date and time.

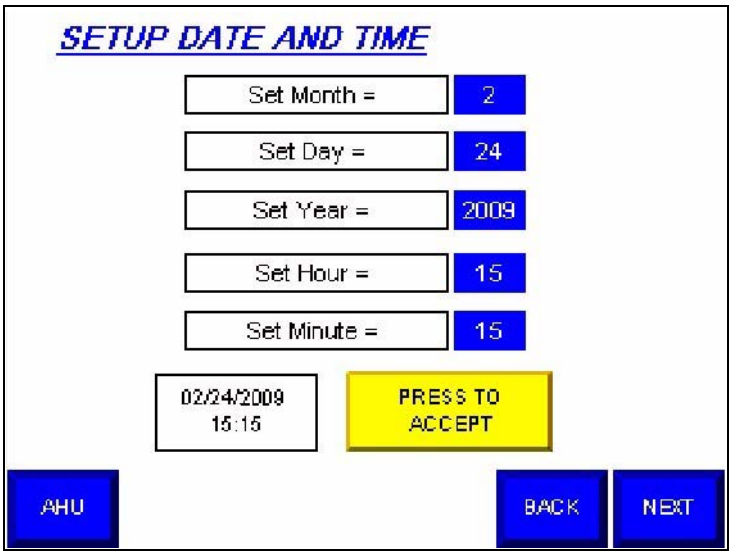


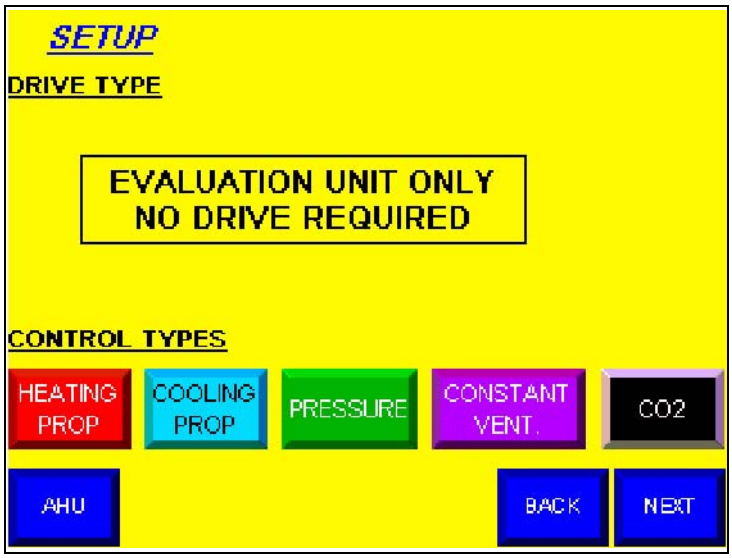
Table C.D Set Date and Time Screen Fields

Field Name	Description
Set Month	Current month (numeric).
Set Day	Current Day of the month.
Set Year	Current year.
Set Hour	Current hour (military format).
Set Minute	Current minute.
(date and time)	Displays the time entered i the time and date fields.
Press to Accept	Press to accept your entries and set the current date and time.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Setup Screen #1.
Next	Press to view the Setup Screen #2.

Setup Screen #2

The second Setup screen is used to enter data required to configure the FanMaster for your installation. This screen is different for evaluation unit versus units installed with a drive. This configuration is completed at the factory.

Evaluation Unit Install Only



Permanent Install Only

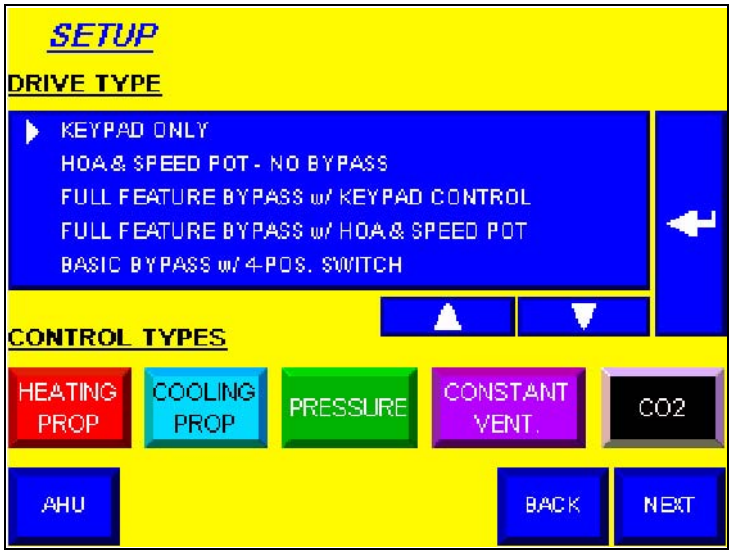


Table C.E Setup Screen #2 Fields

Field Name	Description
Drive Type	Type of drive installed. (No selections are available for evaluation units.)
Heating Prop	Proportional (Heating Prop) or two-state (Heating 2-State) heating system selection.
Cooling Prop	Proportional (Cooling Prop) or two-state (Cooling 2-State) cooling system selection.
Pressure	Conditioned space positive pressure (Pressure) or no positive pressure (No Pressure) selection.
Constant Vent	Constant ventilation (Constant Vent.) or no constant ventilation mode (No Const. Vent.) selection.

Field Name	Description
CO2	CO_2 sensor (CO2) or no CO_2 sensor (No CO2) installed selection.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Setup Date and Time Screen.
Next	Press to view the Setup Screen #3.

Setup Screen #3

The third Setup screen is used to enter data required to configure the FanMaster for your installation.

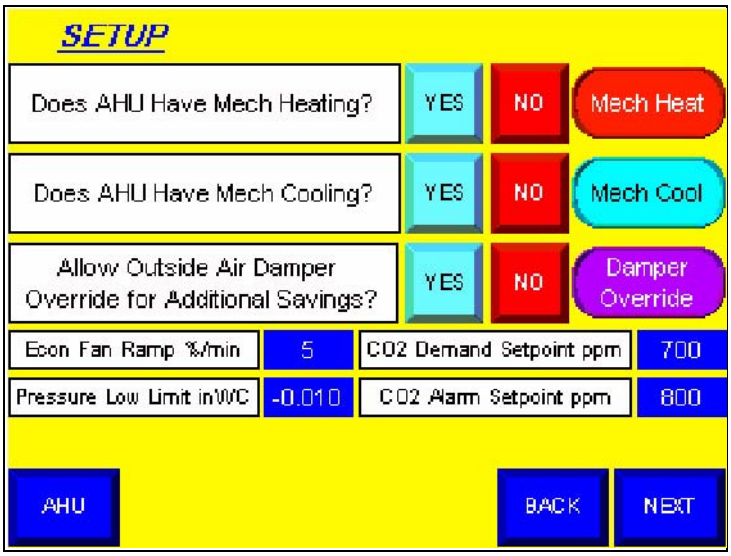


Table C.F Setup Screen #3 Fields

Field Name	Description
Does AHU Have Mech Heating?	Mechanical heating (Yes) or no mechanical heating (No) system installation selection.
Does AHU Have Mech Cooling?	Mechanical cooling (Yes) or no mechanical cooling (No) system installation selection.
Allow Outside Air Damper Override for Additional Savings?	FanMaster override of the BAS control (Yes) or no override of the BAS control (No) of the outside air damper selection.
Econ Fan Ramp %/min	Percentage per minute that the supply fan should ramp to 100% speed when the AHU is place in economizer mode.
Pressure Low Limit inWC	Inches in Water Column value below which FanMaster will command the Supply Fan speed to increase in order to maintain positive pressure in the conditioned space.
CO2 Demand Setpoint ppm	CO_2 parts per million (ppm) at which full fan speed and full outside air ventilation occurs until the CO_2 level is 50 ppm below the value set in this field.
CO2 Alarm Setpoint ppm	CO_2 parts per million (ppm) at which the an alarm will display on the PanelView screen, the fault indicator lamp on the front of the unit will turn on and the FanMaster Faulted signal will be set to “Faulted”, indicating that the high CO_2 level threshold has been exceeded.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Setup Screen #2.
Next	Press to view the Supply Fan Setup Screen.

Supply Fan Setup Screen

The Supply Fan Setup screen is used to set the supply fan parameters in the drive to the correct values.

Table C.G Supply Fan Setup Screen Fields

Field Name	Description
Step 1…Set Supply Fan Defaults	Used to set the supply fan to the default values.
Step 2…Set Supply Fan Params	Used to set the supply fan parameter values.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Setup Screen #3.
Next	Press to view the Return Fan Setup Screen or Fan Communication Setup Screen.

Return Fan Setup Screen

The Return Fan Setup screen is used to set the return fan parameters in the drive to the correct values.

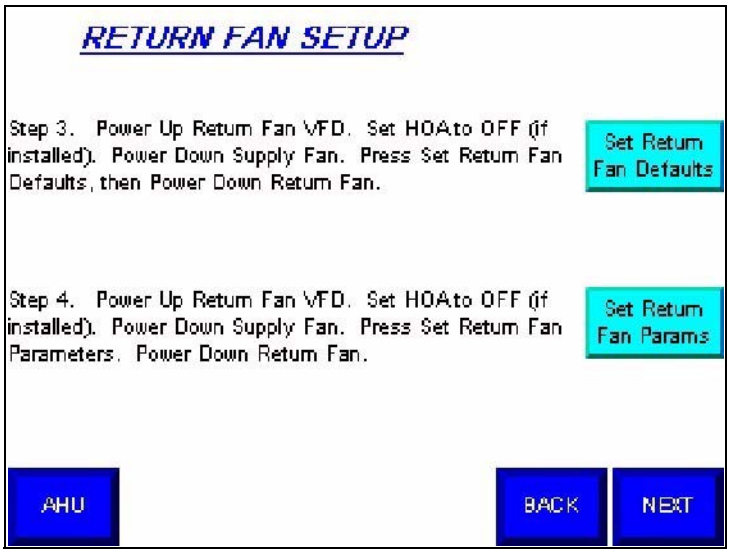


Table C.H Return Fan Setup Screen Fields

Field Name	Description
Step 3…Set Return Fan Defaults	Used to set the return fan to the default values.
Step 4…Set Return Fan Params	Used to set the return fan parameter values.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Supply Fan Setup Screen.
Next	Press to view the Fan Communication Setup Screen.

Fan Communication Setup Screen

The Fan Communication Setup screen is used to test the communication link between the supply and return (if installed) drive and fan.

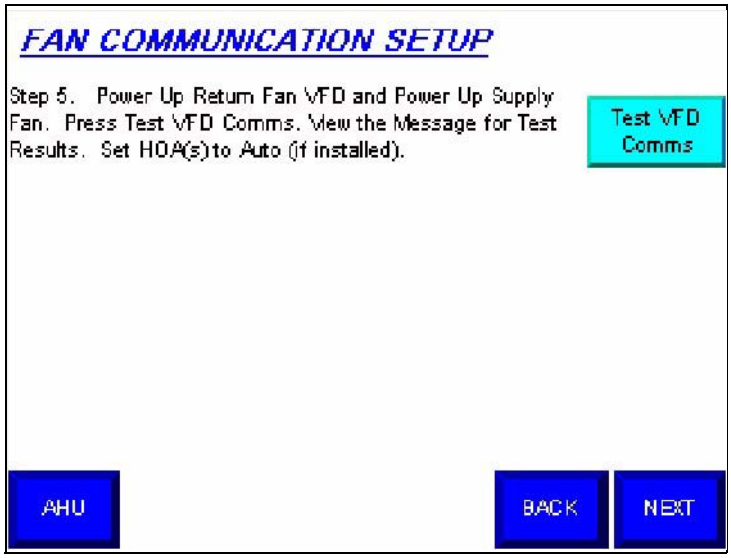


Table C.I Fan Communication Setup Screen Fields

Field Name	Description
Step 5 (or Step 3) …Test VFD Comms	Used to test the communication link between the drives and fans. Note: If a return fan is not installed, “Step 3” displays in place of “Step 5”.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Supply Fan Setup Screen or Return Fan Setup Screen.
Next	Press to view the Cooling and Heating Setup Screen.

Cooling and Heating Setup Screen

The Cooling and Heating Setup screen is used to set up cooling and heating limits and fan responses to those limits.

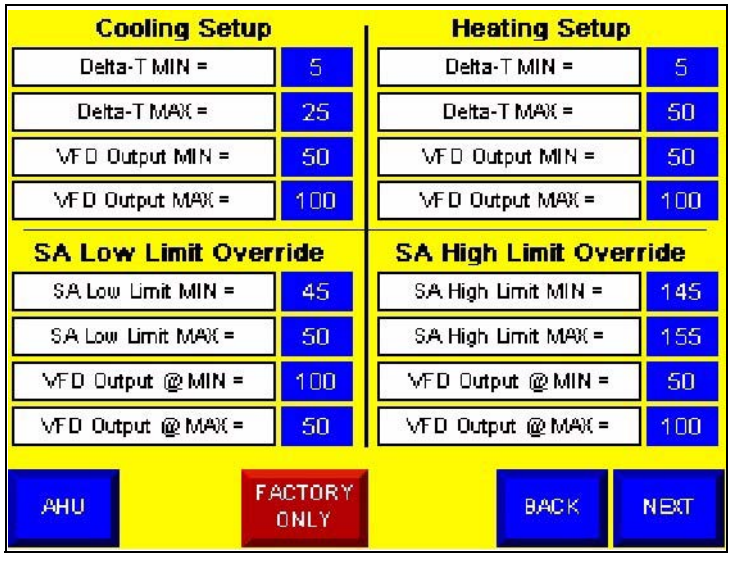


Table C.J Cooling and Heating Setup Screen Fields

Heading	Field Name	Description
Cooling Setup		
	Delta-T Min	The difference in temperature between the mixed air and supply air at and below which the drive will run the supply fan at the minimum speed when cooling the conditioned space.
	Delta-T Max	The difference in temperature between the mixed air and supply air at or above which the drive will run the supply fan at the maximum speed when cooling the conditioned space.
	VFD Output Min	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or below the minimum value (in “Delta-T Min” for Cooling) when cooling the conditioned space.
	VFD Output Max	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or above the maximum value (in “Delta-T Max” for Cooling) when cooling the conditioned space.
SA Low Limit Override		
	SA Low Limit Min	The minimum supply air low temperature limit at which FanMaster will command the supply fan speed to run at the value specified in the “VFD Output @ Min” field.
	SA Low Limit Max	The maximum supply air low temperature limit at which FanMaster will command the supply fan to run at the value specified in the “VFD Output @ Max” field.
	VFD Output @ Min	The percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA Low Limit Min” field is reached.
	VFD Output @ Max	The percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA Low Limit Max” field is reached.
Heating Setup		
	Delta-T Min	The difference in temperature between the mixed air and supply air at and below which the drive will run the supply fan at the minimum speed when heating the conditioned space.
	Delta-T Max	The difference in temperature between the mixed air and supply air at or above which the drive will run the supply fan at the maximum speed when heating the conditioned space.
	VFD Output Min	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or below the minimum value (in “Delta-T Min”) when heating the conditioned space.
	VFD Output Max	The percentage of full speed that the drive will run the supply fan when the temperature difference is at or above the maximum value (in “Delta-T Max”) when heating the conditioned space.
SA High Limit Override		
	SA High Limit Min	The minimum supply air high temperature limit at which FanMaster will command the supply fan to run at the value specified in the “VFD Output @ Min” field.
	SA High Limit Max	The maximum supply air high temperature limit at which FanMaster will command the supply fan to run at the value specified in “VFD Output @ Max” field.
	VFD Output @ Min	The percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA High Limit Min” field is reached.
	VFD Output @ Max	The percentage of full speed that FanMaster will command the supply air fan to run when the value in the “SA High Limit Max” field is reached.
	AHU	Press to view the Air Handler Unit Diagram Screen.
	Factory Only	(Secured access setup for factory use only.)
	Back	Press to view the Fan Communication Setup Screen.
	Next	Press to view the Proof of Flow Screen.

Proof of Flow Screen

The Proof of Flow screen is used to set the torque current level at which the drive will run the supply fan at the minimum speed. The existing proof of flow sensor (flow switch or pressure sensor) may not provide accurate proof of flow at a reduced fan speed. FanMaster will detect flow by monitoring the torque current required by the supply fan at the minimum speed. If the supply fan drive is not delivering 50% of this current threshold, the proof of flow output turns off. This screen allows the system to capture the 50% threshold by monitoring the current supplied to the motor at the minimum fan speed.

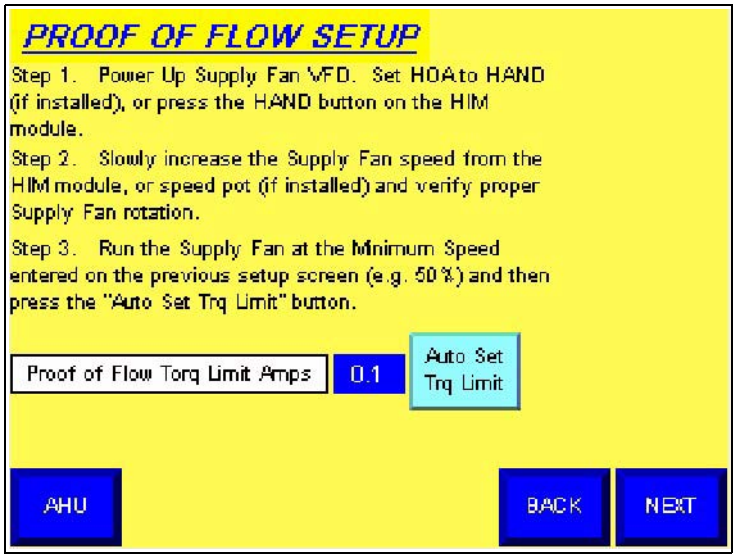


Table C.K Proof of Flow Screen Fields

Field Name	Description
Steps 1-3…Auto Set Torq Limit	Sets the minimum torque current level at which the drive will run the supply fan.
Proof of Flow Torq Limit Amps	The minimum torque current level required to run the supply fan motor.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Cooling and Heating Setup Screen.
Next	Press to view the Data Collection Screen.

Data Collection Screen

The Data Collection screen is used to start and stop data collection and/or clear the data logs.

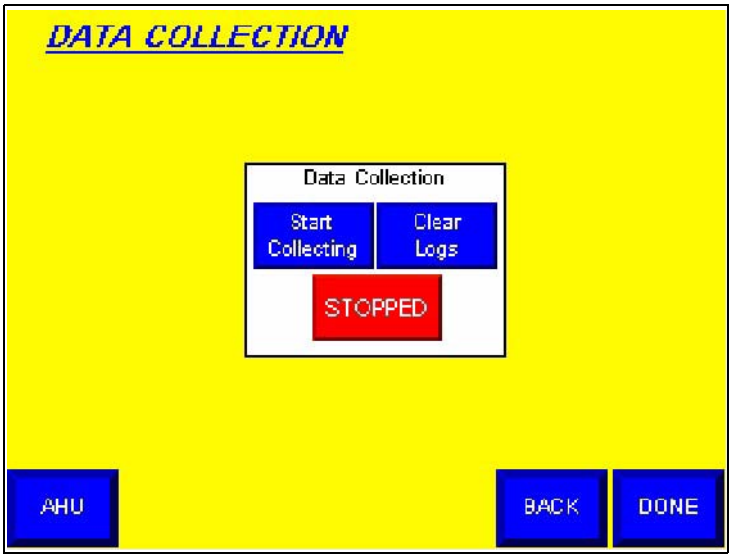


Table C.L Data Collection Screen Fields

Field Name	Description
Start/Stop Collecting	Starts or stops data logging. When “Start Collecting” is pressed, “Stopped” changes to “Collecting”. When “Stop Collecting” is pressed, “Collecting” changes to “Stopped”.
Clear Logs	Deletes all data currently stored in the data log.
AHU	Press to view the Air Handler Unit Diagram Screen.
Back	Press to view the Proof of Flow Screen. Note: “Back” does not display when this screen is accessed from the Data Log #1 Screen.
Done	Press to view the Air Handler Unit Diagram Screen. Note: “Done” does not display when this screen is accessed from the Data Log #1 Screen.
(Data Log)	Press to return to the Data Log #1 Screen. Note: “Data Log” does not display when this screen is accessed from the Proof of Flow Screen.

User City Weather Data Setup Screen

The User City Weather Data Setup screen is used to create and save a climate profile for use in the configuration of FanMaster when none of the existing city climate profiles in the setup adequately match the climate profile of the city in which the FanMaster unit is installed. You must enter the appropriate data in all fields on the screen for each month in the year in order to successfully create a climate profile. Once your climate profile is created, you can select "User City" in the city selection field on the first Setup screen to apply your profile. This screen can only be accessed from the first Setup screen during FanMaster configuration.

Note: A CD-ROM containing climate profiles for 800 cities worldwide can be ordered from the National Oceanic and Atmospheric Administration (NOAA) at this link: http://ols.nndc.noaa.gov/plolstore/plsql/olstore.prodspecific?prodnum=C00515-CDR-A0001

A list of the cities provided on the CD-ROM can also be viewed on the page accessed using the link above.

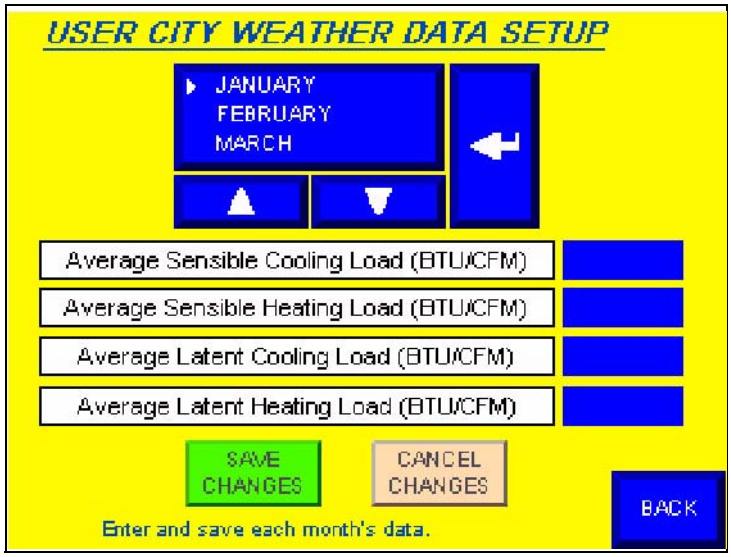


Table C.M User City Weather Data Setup Screen Fields

Field Name	Description
January, February, March …	Month selection. Choose the month for which you want to enter weather data.
Average Sensible Cooling Load (BTU/CFM)	The average sensible cooling load (in BTU/CFM) for the selected month.
Average Sensible Heating Load (BTU/CFM)	The average sensible heating load (in BTU/CFM) for the selected month.
Average Latent Cooling Load (BTU/CFM)	The average latent cooling load (in BTU/CFM) for the selected month.
Average Latent Heating Load (BTU/CFM)	The average latent heating load (in BTU/CFM) for the selected month.
Save Changes	Saves the values currently displayed in the fields for the selected month. Data must be entered and saved for each month of the year.
Cancel Changes	Cancels all changes made before the last save. The last saved data (if any) re-displays.
Back	Press to view the Setup Screen #1.

Data Log #1 Screen

The first Data Log screen is used to display detailed monthly energy and savings data collected by the FanMaster for up to five years running.

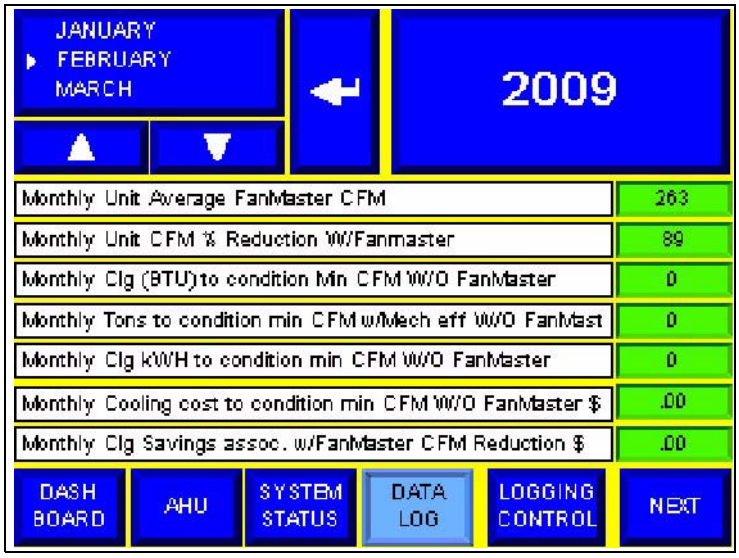


Table C.N Data Log #1 Screen Fields

Field Name	Description
January, February, March …	Month selection. Choose the month for which you want to view data.
(2009)	Year selection. Choose the year for which you want to view data.
Monthly Unit Average FanMaster CFM	Average volume of air (in thousands of CFM) provided by the AHU as calculated by FanMaster.
Monthly Unit CFM % Reduction w/FanMaster	Percentage less volume of air provided by the AHU using FanMaster.
Monthly Clg (BTU) to condition Min CFM w/o FanMast	Amount of cooling energy (in thousands of BTUs) needed to condition the minimum amount of air volume provided by the AHU without using FanMaster.
Monthly Tons to condition min CFM w/Mech eff w/o FanMaster	Amount of cooling energy in tons needed to condition the minimum amount of air volume provided by the AHU using the highest mechanical efficiency without using FanMaster.
Monthly Clg kWh to condition min CFM w/o FanMaster	Amount of cooling Kilowatts (in thousands) per hour to condition the minimum amount of air volume provided by the AHU without using FanMaster.
Monthly Cooling Cost to condition min CFM w/o FanMaster $	Cooling cost (in dollars) to condition the minimum amount of air volume provided by the AHU without using FanMaster.
Monthly Clg Savings assoc. w/FanMaster CFM reduction $	Amount of savings (in dollars) of cooling cost associated with the reduction in the amount of air volume provided by the AHU using FanMaster.
Dash Board	Press to view the DashBoard Screen.
AHU	Press to view the Air Handler Unit Diagram Screen.
System Status	Press to view the System Status Screen.
Data Log	Screen you are currently viewing.
Logging Control	Press to view the Data Collection Screen.
Next	Press to view the Data Log #2 Screen.

Data Log #2 Screen

The second Data Log screen is used to display additional detailed monthly energy and savings data collected by the FanMaster.

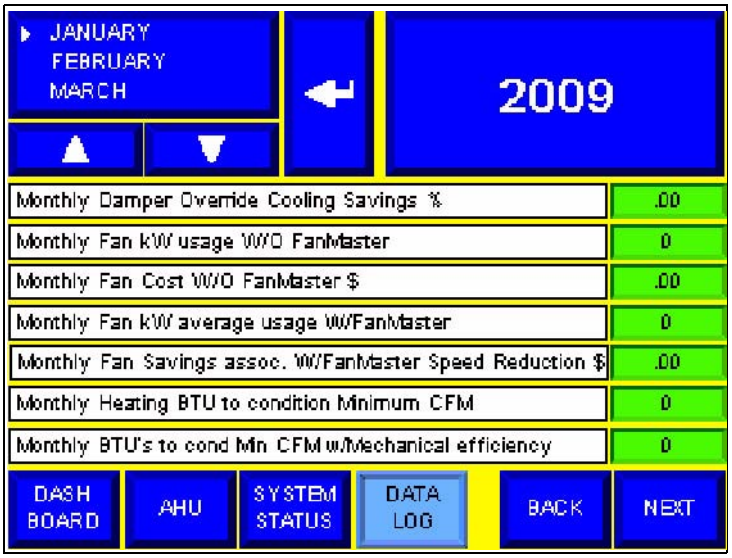


Table C.O Data Log #2 Screen Fields

Field Name	Description
January, February, March …	Month selection. Choose the month for which you want to view data.
(2009)	Year selection. Choose the year for which you want to view data.
Monthly Damper Override Cooling Savings %	Amount of savings (in dollars) of cooling cost associated with the control of the damper position using FanMaster.
Monthly Fan kW usage w/o FanMaster	Fan energy (in kilowatts) usage without using FanMaster.
Monthly Fan Cost w/o FanMaster $	Fan energy cost (in dollars) without using FanMaster.
Monthly Fan kW average usage w/FanMaster	Average fan energy (in kilowatts) usage using FanMaster.
Monthly Fan Savings assoc. w/FanMaster Speed Reduction $	Amount of savings (in dollars) associated with the fan energy usage reductions (lower fan speed) using FanMaster.
Monthly Heating BTU to condition Minimum CFM	Amount of heating energy (in thousands of BTUs) needed to condition the minimum amount of air volume provided by the AHU without using FanMaster.
Monthly BTUs to cond Min CFM w/Mechanical efficiency	Amount of heating energy (in thousands of BTUs) needed to condition the minimum amount of air volume provided by the AHU using the highest mechanical efficiency without using FanMaster.
Dash Board	Press to view the DashBoard Screen.
AHU	Press to view the Air Handler Unit Diagram Screen.
System Status	Press to view the System Status Screen.
Data Log	Screen you are currently viewing.
Back	Press to view the Data Log #1 Screen.
Next	Press to view the Data Log #3 Screen.

Data Log #3 Screen

The third Data Log screen is used to display additional detailed monthly energy and savings data collected by the FanMaster.

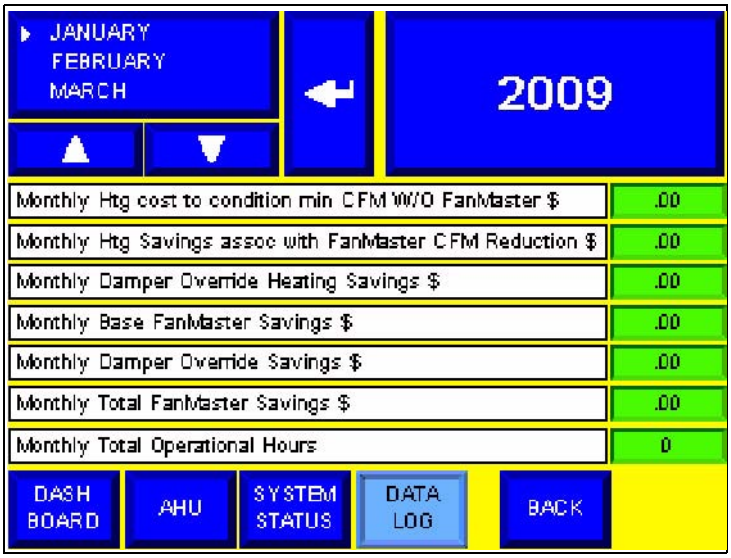


Table C.P Data Log #3 Screen Fields

Field Name	Description
January, February, March …	Month selection. Choose the month for which you want to view data.
(2009)	Year selection. Choose the year for which you want to view data.
Monthly Htg cost to condition min CFM w/o FanMaster $	Heating cost (in dollars) to condition the minimum amount of air volume provided by the AHU without using FanMaster.
Monthly Htg Savings assoc with FanMaster CFM Reduction $	Amount of savings (in dollars) of heating cost associated with the reduction in the amount of air volume provided by the AHU using FanMaster.
Monthly Damper Override Heating Savings $	Amount of savings (in dollars) of heating cost associated with the control of the outside air damper position FanMaster.
Monthly Base FanMaster Savings $	Amount of savings (in dollars) of fan energy usage and cooling and heating cost using FanMaster.
Monthly Damper Override Savings $	Amount of savings (in dollars) of cooling and heating cost associated with the control of the outside air damper position by FanMaster.
Monthly Total FanMaster Savings $	Total amount of savings (in dollars) of fan energy usage, cooling and heating cost including the control of the outside air damper position using FanMaster
Monthly Total Operational Hours	Total number of hours that the AHU has been operating this month.
Dash Board	Press to view the DashBoard Screen.
AHU	Press to view the Air Handler Unit Diagram Screen.
System Status	Press to view the System Status Screen.
Data Log	Screen you are currently viewing.
Back	Press to view the Data Log #2 Screen.

System Status Screen

The System Status screen is used to display additional detailed monthly energy and savings data collected by the FanMaster.

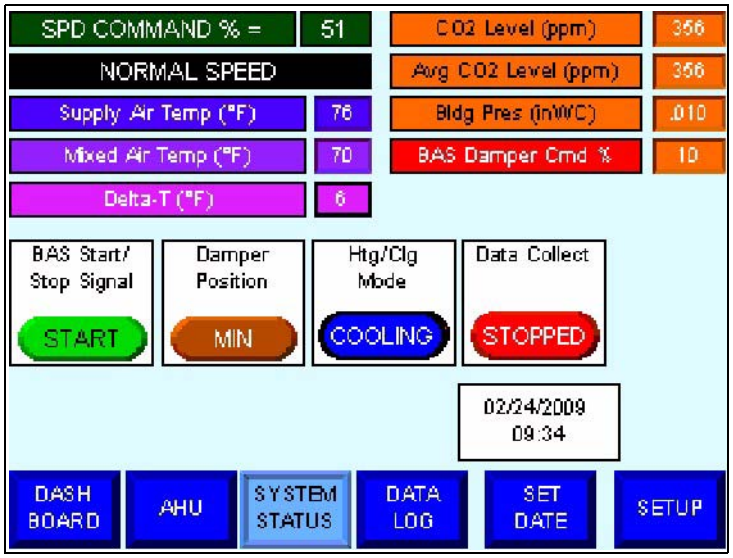


Table C.Q System Status Screen Fields

Field Name	Description
Spd Command %	Current percentage of supply fan motor full speed.
(Normal Speed)	Indicates that the supply fan motor is at “Minimum”, “Normal” or “Full” speed.
Supply Air Temp (°F)	Current supply air temperature.
Mixed Air Temp (°F)	Current mixed air temperature.
Delta-T (°F)	Current difference in air temperature between the mixed and supply air.
CO2 Level (ppm)	Current CO_2 level (if monitored).
Avg CO2 Level (ppm)	Current average monthly CO_2 level (if monitored).
Bldg Pres (InWc)	Current building air pressure (if monitored).
BAS Damper Cmd %	Current outside air damper percentage open as commanded by the BAS.
BAS Start / Stop Signal	Indicates whether the BAS is currently commanding the supply air fan to “Start” or “Stop”.
Damper Position	Indicates whether the outside air damper is currently in the “Min”, “Max” or “Econ” position.
Htg/Clg Mode	Indicates whether the AHU is currently in “Cooling”, “Heating” or “Sat” mode.
Data Collect	Indicates whether data collection is currently “Collecting” or “Stopped”.
(02/24/2009 09:34)	Current date and time.
Dash Board	Press to view the DashBoard Screen.
AHU	Press to view the Air Handler Unit Diagram Screen.
System Status	Screen you are currently viewing.
Data Log	Press to view the Data Log #1 Screen.
Set Date	Press to view the Setup Date and Time Screen.
Setup	press to view the Setup Screen #1.

U

V

W

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