AdaptAire

Digital Control System

User Manual

Rev. 7-22-04

Table of Contents

Overview

Applied Air's Digital Control System, AdaptAire, is designed to give the user the ultimate in heater performance and operational flexibility. Combined with the patent applied for airflow station used with recirculating heaters, AdaptAire provides flexibility, adaptability, and reliability in a user-friendly package. **Non-recirculating heaters, equipped with the AdaptAire system, do not have return air capabilities, and all functions related to recirculating heaters are not relevant.** Where a function is similar but different between recirculating and non-recirculating heaters, the function is explained separately.

AdaptAire accepts single or multiple heaters on the system network. Each heater is provided with a *local user interface*. The operating parameters for individual heaters may be input through the local interface. A PC may also be connected to the network. This allows the user to configure each heater separately, or all heaters can be configured simultaneously. A controls contractor can provide assistance in networking.

Operational modes include time scheduling, filter monitoring, and multiple damper control and temperature control schemes. All of these modes provide the maximum in heater operational flexibility.

The patent applied for airflow station imparts unparalleled adaptability into the operation of each heater. A daily self-calibration enables AdaptAire to detect the total air volume and the exact ratio of outside and return air entering the heater. Then AdaptAire daily fine-tunes the heater's operation based on these new parameters. Air volume can vary because of changes in static pressure conditions due to loading filters, VAV boxes, and building dynamics. These varying conditions influence the ventilation air provided by the heater, which in turn impacts the allowable *equivalent temperature rise* of the heater. Systems, which do not measure the outside air/return air ratio and recalibrate themselves accordingly, may cause the burner to shut off when it is need the most.

AdaptAire diagnostic capabilities insure swift response to abnormal heater conditions. A fault is generated anytime the operational parameters and actual heater operation are at odds. An indication of trouble is displayed at the local user interface and system PC in text format. In the Diagnostics section of this manual is a list of all faults and possible causes and solutions.

All of the features of the AdaptAire system are designed to provide the user with real time information. At any time the user can display all of the operational parameters, make changes, if necessary, and observe the various temperature, pressure, and damper readings. The system's diagnostic capabilities provide the user with up to the minute status reporting.

Controller Specifications

POWER REQUIREMENTS
24VAC ± 10%, 20VA

NETWORK COMMUNICATION
BACnet, Modbus, or N2 bus at 38.4K or 9600 baud. LonWorks using gateway.

LOCAL USER INTERFACE
BACview 2 line, 16 character display connected to controller via CAT5 cable and RJ45 connectors. BACview 4 line, 40 character display required for Modbus, or N2 bus. Either BACview can be located up to 1000' away from the controller.

MEMORY
512K bytes of flash memory and 512K bytes of non-volatile battery-backed RAM

REALTIME CLOCK
Battery-backed to keep time in event of power failure.

TEMPERATURE OPERATING RANGE
-20°F to 150°F, 10% to 95% RH non-condensing

INPUTS/OUTPUTS
10 Universal Inputs
- 0-5 VDC or 0-20 mA

6 Digital Outputs
- Relay contacts rated at 3A Resistive @ 24VAC
- Hand-Off-Auto switches
- LED indication

4 Analog Outputs
- 0 – 10 VDC or 0 – 20 mA
- LED indication

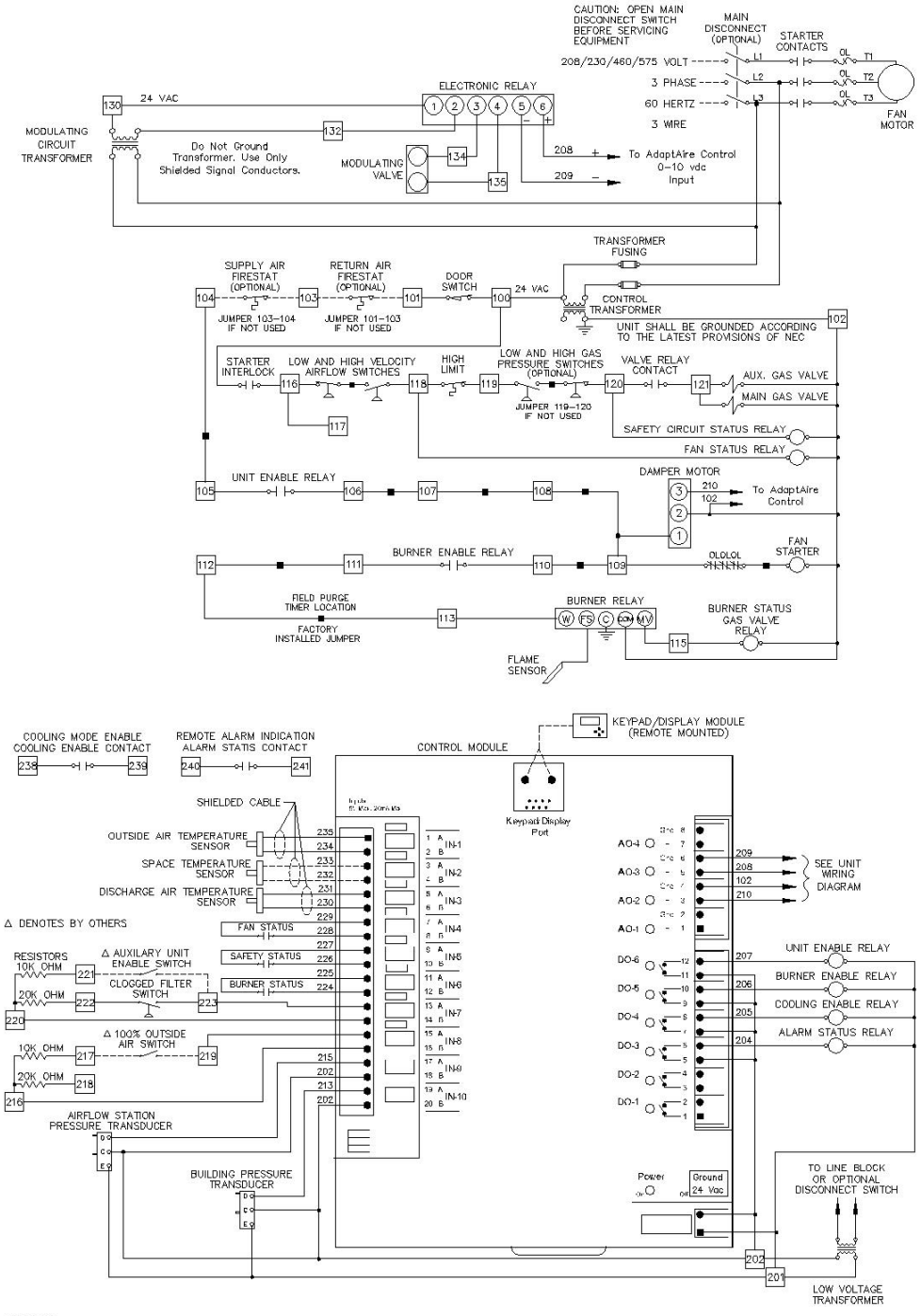
OUTPUT ASSIGNMENTS - ANALOG
AO1 Unassigned
AO2 RA or Mixing Damper Control
0 – 10VDC
AO3 Burner firing rate (to Maxitrol A200)
0 – 10 VDC
AO4 User Configured

OUTPUT ASSIGNMENTS - DIGITAL
DO1 Unassigned
DO2 Pilot to Main Flame Sensor Changeover Switch
DO3 Alarm
DO4 Cooling Enable
DO5 Burner Enable
DO6 Unit Enable

INPUT ASSIGNMENTS - UNIVERSAL
IN1 Outside Air sensor
IN2 Room Air sensor (no limit on distance from controller)
IN3 Discharge Air sensor
IN4 Fan Status
IN5 Safety Circuit Status
IN6 Burner Status
IN7 Multiplexed
A) Auxiliary Unit Enable
B) Clogged Filter
IN8 Multiplexed
A) 100% Outside Air Switch
B) Flame Failure from flame
IN9 Pressure Transducer for Building Pressure Control or User Configured
IN10 Pressure Transducer for Flow Station

Typical Wiring Schematic

RECIRCULATING CDF MODEL DIAGRAM



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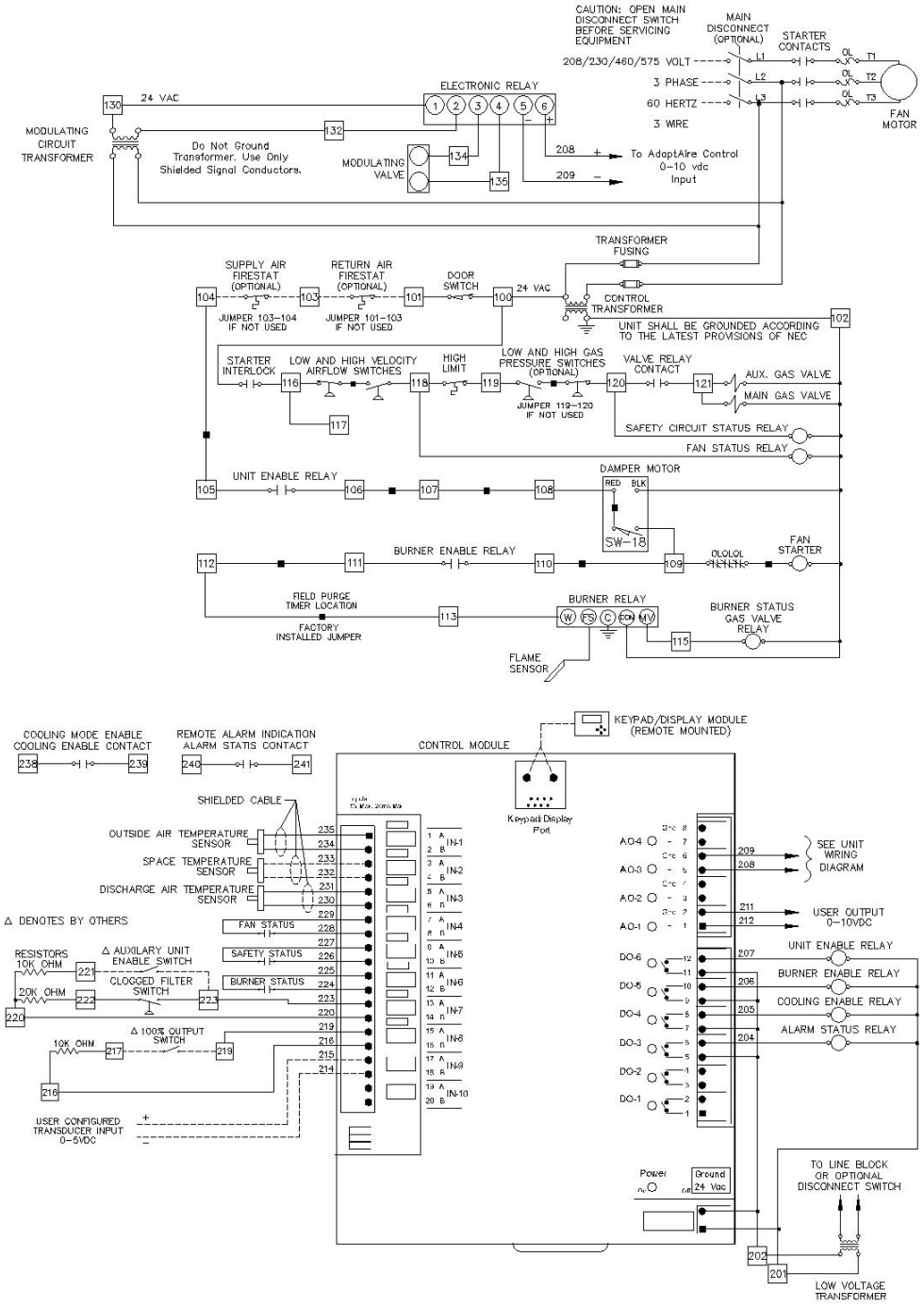
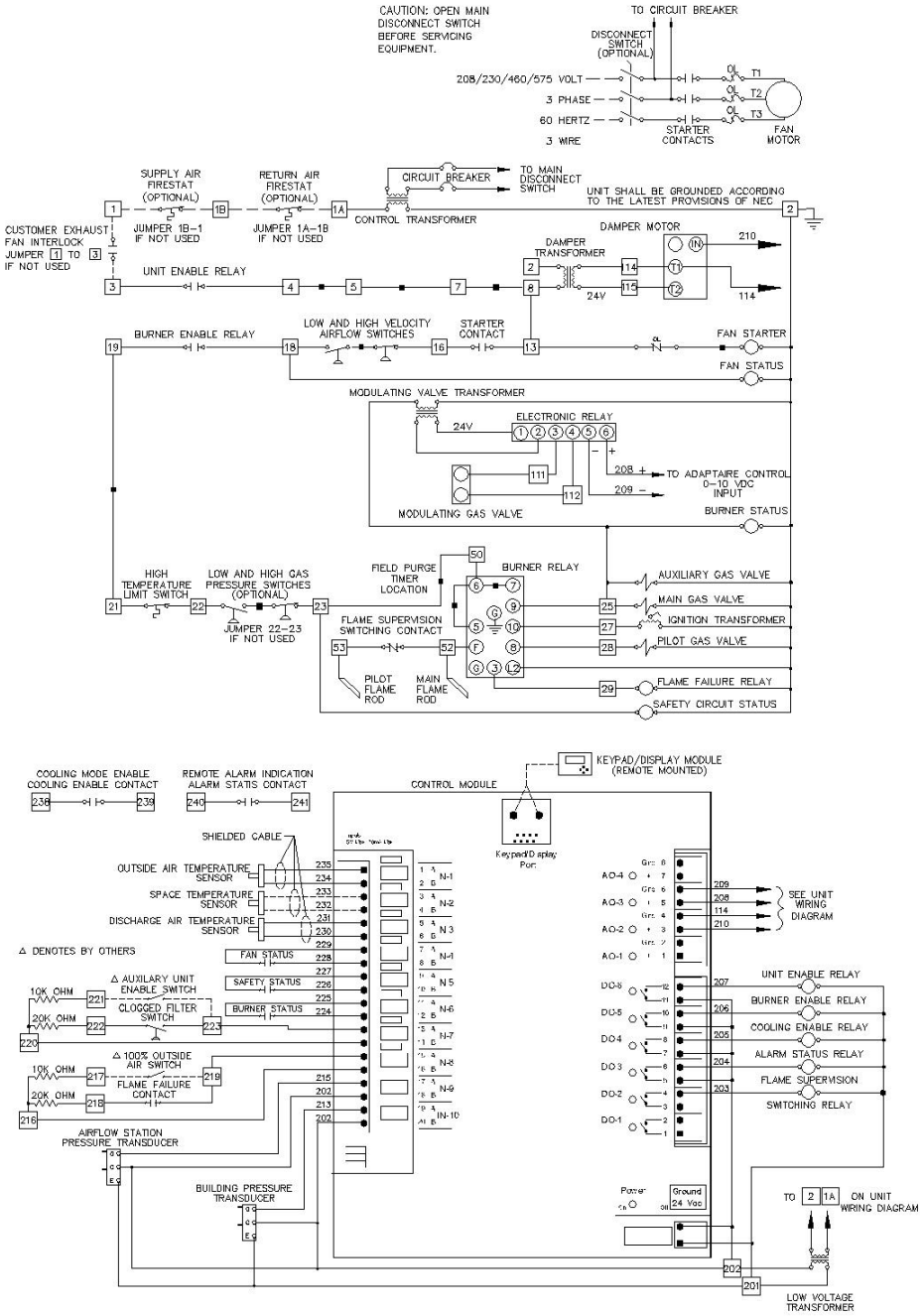
NON-RECIRCULATING CDF MODEL DIAGRAM



RECIRCULATING DFOA and DFIA MODEL DIAGRAM



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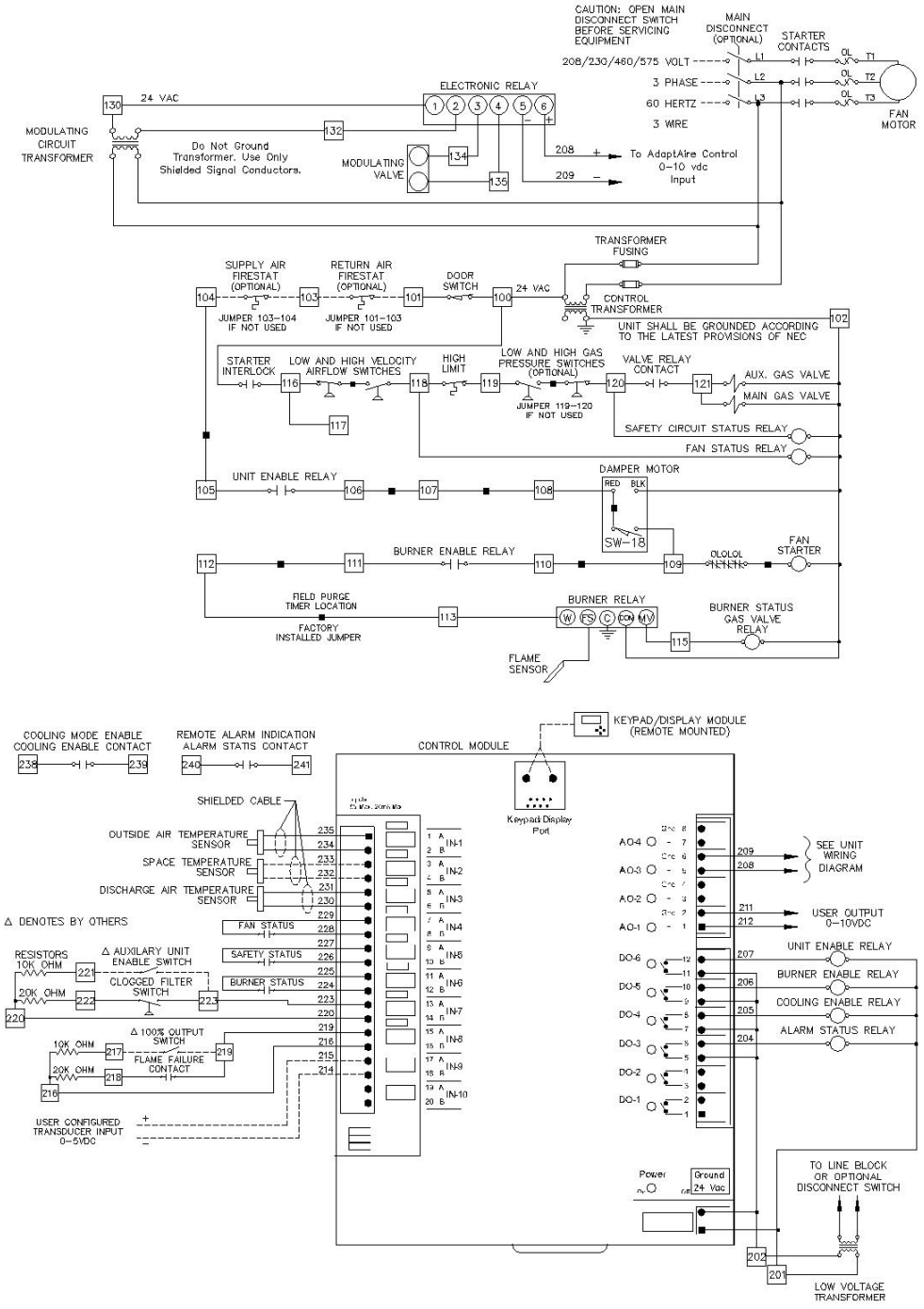


Networking

AdaptAire operates on BACnet network architecture at 38.4K or 9600 baud. BACnet, Modbus and N2 network systems do not require special communication interfacing. The AdaptAire system can be connected to most existing building automation systems using special controllers and network communication devices. See Appendix I for Device Parameters and Cache Setup information.

AdaptAire Default Settings

The following is a list of AdaptAire DDC controller defaults. These are the default operating parameters set at the factory prior to shipment.

ITEM	DEFAULT	RANGE	RELATED I/O
Unit Network Address	000 binary dips	000 – 255 binary dips	
Unit Operating Mode	OFF	OFF/MANUAL/AUTO	DO6
Time Clock Schedule	None	16 Normal/16 Holiday/8 Override schedules	DO6
Heating/Cooling Operating Mode	Heating	HEATING/COOLING	DO5
Damper Operating Mode	Manual	MANUAL/BUILDING PRESS/MIXED AIR TEMP	AO2
Fuel Selection	Natural Gas	NATURAL/PROPANE	AO3
Heating Night Setback	55°F	40°F - 80°F	DO5, DO6
Cooling Night Setback	100°F	75°F - 120°F	DO4, DO6
Room Temperature Setpoint	65°F	55°F - 90°F	AO2, DO6
Freezestat	45°F	35°F - 50°F	DO6
Outside Air Economizer Setpoint	65°F	40°F - 80°F	DO5
Minimum Discharge Temperature Setpoint	55°F	40°F - 130°F	AO3
Maximum Discharge Temperature Setpoint	100°F	55°F - 130°F	AO3
Mixed Air Temperature Setpoint	50°F	30°F - 90°F	AO2
Building Pressure Setpoint	0” W. C.	-0.05” - +0.05” W. C.	IN10, AO2
Manual Damper Position Setpoint	20% Outside Air	0% - 100%	AO2
Minimum Ventilation Setpoint	20% Outside Air	0% - 100%	AO2
User PID Select	Direct Acting	DIRECT/REVERSE	IN-9,AO1
High Input Value	0.00	-9999.99 – 9999.99	IN-9
Low Input Value	0.00	-9999.99 – 9999.99	IN-9
User Control Setpoint	0.00	-9999.99 – 9999.99	IN-9,AO1
Maximum User Setpoint	0.00	-9999.99 – 9999.99	IN-9,AO1
Minimum User Setpoint	0.00	-9999.99 – 9999.99	IN-9,AO1

Unit Operating Modes

There are three different modes which control the supply fan and unit operation: Off, Manual, and Auto. These operating modes are selected through the *UNIT MODES* menu tree of the local user interface or PC.

OFF MODE

Off Mode is the default heater operational mode. To place the unit in Off Mode scroll through the Unit Modes menu tree, locate the AUTO/OFF/MAN branch, and select OFF. This will place the unit in the OFF mode. The OFF mode prevents the fan and burner from starting. This mode will override the Time Clock and Night Setback functions. The Off mode prevents digital output DO1 from activating and keeps the heater from starting.

MANUAL MODE

Manual Mode allows the supply fan to turn on regardless of the Time Clock or Night Setback functions. To place the unit in Manual Mode scroll through the Unit Modes menu tree, locate the AUTO/OFF/MAN branch, and select MANUAL. This will place the unit in the MANUAL mode. This function activates digital output DO1.

AUTO MODE

Auto Mode has four different functions which control the supply fan and unit operation. They are a time clock function, heating and cooling night setbacks, and a signal from an external source to an auxiliary digital input. To place the unit in Auto Mode scroll through the Unit Modes menu tree, locate the AUTO/OFF/MAN branch, and select AUTO. This will place the unit in the AUTO mode. This activates the four Auto mode functions.

Scheduling Time Clock

The primary Auto Mode function is the Time Clock Schedule. The Time Clock function allows the user to schedule the operational times of the heater. There are three different schedules available: normal, holiday, and override. Each of these schedules can be programmed for up to nine separate On/Off events with any combination of days. The normal schedule sets the typical On/Off times for the heater. The holiday schedule sets the Off times for holidays and other shutdown periods. The override schedule sets the On times that will override the holiday schedule. This scheduling system allows the user to program a diverse array of On/Off operations. An example of a typical schedule would be to have the heater On Monday through Friday from 6:00 AM to 5:00 PM, except during the weeks of Thanksgiving and Christmas when the heaters will be Off. However they will run each weekday during the Thanksgiving shutdown from 8:00 AM until noon while a maintenance crew is in the building. AdaptAire has no preset operational schedule. To set the operational times of the heater scroll through the SCHEDULES menu tree, and locate the desired Normal, Holiday, or Override branch. Enter the days and times for the heater to operate. In the Normal or Override section these times should correspond to the desired "on" times for the heater's operation. In the Holiday section these times should correspond to the desired "off" times for the heater's operation.

See the CLOCK SET section of this manual for setting the time, date and Daylight Savings function.

Heating Night Setback

The Heating Night Setback function automatically cycles the heater "on" if the room temperature falls below the Heating Night Setback temperature setpoint, and the heater is

scheduled to be “off”. If the heater is scheduled to be “off” and the Heating Night Setback function turns the heater “on”, the heater will be cycled “off” once the room air temperature has risen 3° above the Heating Night Setback setpoint. This function toggles digital output DO1. The default for this setpoint is 55°F. To change the Heating Night Setback setpoint scroll through the SETPOINTS menu tree, locate the Heating Night Setback setpoint and enter a new temperature. The allowable temperature range is 40°F - 80°F.

Cooling Night Setback

The Cooling Night Setback function automatically cycles the heater “on” if the room temperature rises above the Cooling Night Setback temperature setpoint and the heater is scheduled to be “off”. If the heater is scheduled to be “off” and the Cooling Night Setback function turns the heater “on”, the heater will be cycled off once the room air temperature has fallen 3° below the Cooling Night Setback setpoint. This function toggles digital output DO1. The default for this setpoint is 100°F. To change the Cooling Night Setback setpoint scroll through the SETPOINTS menu tree, locate the Cooling Night Setback setpoint and enter a new temperature. The allowable temperature range is 75°F - 125°F.

Auxiliary Unit Enable

The Auxiliary Unit Enable function overrides all other Auto Mode functions and automatically cycles the heater into operation. This function is activated whenever a 10,000Ω or 6,667Ω resistance is connected across Universal Input 7. See the Typical Wiring Schematic and Multiplexed Input sections of this manual for more information. This function can be used with a twist timer, toggle switch, door switch, exhaust fan interlock, or any other dry contact to override the time clock schedule.

Heating/Cooling Operating Modes

There are two different modes which control the heating and cooling operation: Heating and Cooling. These operating modes are selected through the *UNIT MODES* menu tree of the local user interface or PC.

HEATING MODE

Heating Mode allows the burner to operate as needed. When heating is required, digital output DO5 will be activated. To place the unit in Heating Mode scroll through the Unit Modes menu tree, locate the HTG/CLG/OFF branch, and select Heating. This will place the unit in the Heating mode.

General Burner Control

In the Heating Mode the burner will modulate to maintain a constant room temperature. To change the desired heating room temperature scroll through the SETPOINTS menu tree, locate the Heating Setpoint, and enter a new temperature. The allowable temperature range is 55°F - 90°F. The burner will modulate using a *PID* loop to maintain this temperature. Additionally, the control system modulates the burner to maintain the supply air temperature within a user defined operating window. This window defines the maximum and minimum discharge temperatures.

To change the desired minimum supply or discharge air temperature scroll through the SETPOINTS menu tree, locate the MIN DAT Setpoint, and enter a new temperature. This temperature must not be greater than the MAX DAT Setpoint. The allowable temperature range is 40°F - 90°F. This sets the lowest discharge air temperature which will leave the heater.

To change the desired maximum supply or discharge air temperature scroll through the SETPOINTS menu tree, locate the MAX DAT Setpoint, and enter a new temperature. This temperature must not be less than the MIN DAT Setpoint. The allowable temperature range is 55°F - 130°F. This sets the highest discharge air temperature which will leave the heater.

If the maximum and minimum discharge temperature setpoints are set for the same temperature, the supply air temperature will be the same as the setpoint regardless of the room temperature setpoint or actual room temperature.

Direct fired heaters deliver all of their products of combustion directly to the heated air space. For this reason it is extremely important that the proper ventilation rate be maintained to dilute these emissions. The AdaptAire system accurately measures the ratio of outside and return air, calculates the allowable *equivalent temperature rise* and automatically limits the burners firing rate. This insures the products of combustion, delivered to the space by the heater, are held at or below allowable OSHA thresholds. The outside air percentage is the driving parameter for this function. A greater percentage of outside air or dilution air enables the heater to generate a higher allowable equivalent temperature rise.

In order of lowest to greatest priority the burner modulation parameters are: room temperature, discharge or supply air temperature, and equivalent temperature rise.

There are three Energy Savings modes which could disable the burner.

Energy Savings Mode 1 Recirculating Heaters

Energy Savings Mode 1 will automatically disable the burner if the mixed air temperature is equal to or greater than the minimum discharge air temperature setpoint, and the room air temperature is 5°F above the room air temperature setpoint. When the burner is disabled, digital output DO5 is deactivated. This function is intended to restrain the room temperature from rising uncontrollably in buildings with internal heat gain. In certain conditions it may be necessary to readjust the minimum discharge air or room temperature setpoint upward or adjust the outside/return air ratio to provide a warmer supply air temperature.

Energy Savings Mode 1 Non-Recirculating Heaters

Energy Savings Mode 1 will automatically disable the burner if the outside air temperature is equal to or greater than the minimum discharge air temperature setpoint, and the room air temperature is 5°F above the room air temperature setpoint. When the burner is disabled, digital output DO5 is deactivated. This function is intended to restrain the room temperature from rising uncontrollably in buildings with internal heat gain. In certain conditions it may be necessary to readjust the minimum discharge air or room temperature setpoint upward or adjust the outside/return air ratio to provide a warmer supply air temperature.

Energy Savings Mode 2

Energy Savings Mode 2 will automatically disable the burner if the burner's minimum firing rate exceeds the allowable equivalent temperature rise. When the burner is disabled, digital output DO5 is deactivated. This condition is unlikely to occur unless the burner's minimum firing rate is misadjusted and set too high, or the inlet air opening is restricted.

Energy Savings Mode 3

Energy Savings Mode 3 will automatically disable the burner if the outside air temperature is above the Outside Air Economizer setpoint. When the burner is disabled, digital output DO5 is deactivated. This function is similar to an inlet duct thermostat. The burner will cycle back on if the supply air temperature drops 3°F below the Outside Air Economizer setpoint.

To change the desired outside air economizer temperature scroll through the SETPOINTS menu tree, locate the ECONOMIZER Setpoint, and enter a new temperature. The default for this setpoint is 65°F. The allowable temperature range is 40°F - 80°F.

COOLING MODE

Cooling Mode allows the cooling to operate as needed. When cooling is required, digital output DO4 will be activated. To place the unit in Cooling Mode scroll through the Unit Modes menu tree, locate the HTG/CLG/OFF branch, and select Cooling. This will place the unit in the Cooling mode. To change the desired cooling operational temperature scroll through the Setpoints menu tree, locate the Cooling Setpoint, and enter a new temperature. The allowable temperature range is 55°F - 90°F. The cooling will be disabled when the room temperature drops 3°F below the Cooling Setpoint.

Damper Control Modes

There are four different modes which control the heater damper operation: Manual, Mixed Air Temperature, Building Pressure, and 100% Outside Air. Except for the 100% Outside Air mode, these operating modes are selected through the menu tree of the local user interface or PC.

MANUAL MODE

Manual Mode is the default damper operational mode. This will set the outside air damper to a fixed position. To place the damper operation in Manual Mode scroll through the menu tree, locate the Damper Mode branch and select Manual Pos. Next, scroll through the menu tree, locate the Setpoints branch, select Man Vent SP, and enter the desired damper position. The allowable range is 0% to 100%. **Any setting below 20% will cause the burner to automatically cycle off.**

MIXED AIR TEMPERATURE MODE

The Mixed Air Temperature mode varies the percentages of outside air and return air to maintain a constant mixed air temperature. The AdaptAire controller computes the mixed air temperature using the outside air and return air temperatures and the ratio of their respective airflows. To place the damper operation in Mixed Air Temperature Mode scroll through the menu tree, locate the Damper Mode branch and select MA Temp Ctrl. Next, scroll through the menu tree, locate the Setpoints branch, select Mixed Air SP, and enter the desired temperature. The allowable range is 30°F - 80°F. **Anytime the outside air drops below 20% the burner will automatically cycle off. See Minimum Ventilation.**

BUILDING PRESSURE MODE

The Building Pressure mode varies the percentages of outside air and return air to maintain a constant pressure within the space. A pressure transducer compares the pressure outside the space to the pressure inside the space and transmits a corresponding signal to the AdaptAire controller. The controller compares this signal to the desired building pressure setpoint and uses a *PID* loop to modulate the outside air and return air dampers to maintain the specified building pressure. To place the damper operation in Building Pressure Mode scroll through the menu tree, locate the Damper Mode branch and select Bldg Prs Ctrl. Next, scroll through the menu tree, locate the Setpoints branch, select Bldg Prs SP, and enter the desired pressure. The allowable range is –0.05"wc to +0.05"wc. **Anytime the outside air drops below 20% the burner will automatically cycle off. See Minimum Ventilation.**

100% OUTSIDE AIR

The 100% Outside Air function automatically opens the outside air dampers and closes the return air dampers. This function is activated whenever a 10,000Ω or 6,667Ω resistance is connected across Universal Input 8. See the Typical Wiring Schematic and Multiplexed Input sections of this manual for more information. **The 100% Outside Air function overrides all other damper control functions.**

Minimum Ventilation

The Minimum Ventilation function defines the minimum outside air percentage and automatically prevents the dampers from modulating below this point. This function can be used in heating or cooling mode. **In the heating mode the AdaptAire controller will attempt to maintain a minimum of 20% outside air by overriding other damper controls as necessary. Anytime the outside air drops below 20% the burner will automatically cycle off.** To specify the Minimum Ventilation scroll through the menu tree, locate the Setpoints branch and select Min Vent, and enter the desired outside air percentage. The allowable range is 0% - 100% outside air.

Freezestat

The Freezestat function automatically cycles the heater off if the supply air temperature drops below the Freezestat setpoint for 3 continuous minutes. There is an initial 8 minute delay prior activation on recirculating heaters, and an initial 6 minute delay on non-recirculating heaters. The Freezestat function prevents digital output DO1 from activating and keeps the heater from starting. The default for this setpoint is 45°F. To change the Freezestat setpoint scroll through the menu tree, locate the Setpoints branch, select Freezestat SP, and enter a new temperature. The allowable temperature range is 35°F - 50°F.

Clogged Filter

An optional clogged filter switch is required for this function. The Clogged Filter function automatically notifies the user of a dirty filter condition. A Clogged Filter indication will appear on the local user interface. This function is activated whenever a 20,000Ω or 6,667Ω resistance is connected across Universal Input 7. See the Typical Wiring Schematic and Multiplexed Input sections of this manual for more information.

User Configured PID Control

This function is applicable to non-recirculating heaters only. The User Configured *PID* Control function allows the user to control an analog output, AO-1, based on a user defined analog input, IN-9, and setpoint. This function also allows the user to select the *PID* type (direct or reverse acting) and establish upper and lower control limits. Five keypad entries define the operational parameters. These parameters are: User Control Setpoint, Minimum User Setpoint, Maximum User Setpoint, Low User Input Value, and High User Input Value. The low and high input values describe the input transducer range. The control setpoint is the primary operational parameter while the minimum and maximum setpoints describe the extents of the desired operating range and provide secondary control as described below. The allowable range for all of these parameters is –9999.99 - +9999.99.

The analog input must be connected to IN-9. Terminal A on the IN-9 input is the positive terminal. Terminal B on the IN-9 input is the negative terminal. This input **must** be configured for either of two different types of input signals:

> 0-5Vdc: The output impedance must not exceed 10KΩ. The input impedance of the controller is 1MΩ.
>
> 0-20mA or 4-20mA: The input resistance on the "A" terminal is 250Ω. The "B" terminal supplies a voltage source to power the transducer. The "B" terminal is capable of supplying 18-24Vdc, but the total current of all "B" terminals must not exceed 200mA. If the voltage measured from the "B" terminal to Gnd is less than 18Vdc, an external power supply is required. See the wiring diagrams for recirculating model heaters for typical connections of transducers.
>
> **The IN-9 configuration jumpers on the controller must be set for the appropriate input signal. A thermistor or RTD must not be used.**

The analog output is AO-1 and is 0-10Vdc. Polarity is identified at AO-1 by "Gnd" and "+". A contact closure across IN-8 will drive the output to 100%.

DIRECT ACTING

The controller output AO-1 is modulated by a *PID* loop from 0% to 100% based on the User Control setpoint and the input signal to IN-9. As the input signal increases the output voltage increases. Additionally, a secondary control acts to override the *PID* loop to scale the output as follows.

If the input variable equals the User Control setpoint, the output will be determined by the *PID* loop. In this situation the override has no effect on the output value.

If the input variable is above the User Control setpoint, the output **could** increase from 0% to 100% as the input variable increases from the User Control setpoint to the Max User setpoint. In this situation the output value is the greater of the *PID* output or the override output.

If the input variable is below the User Control setpoint, the output **could** decrease from 100% to 0% as the input variable decreases from the User Control setpoint to the Min

User setpoint. In this situation the output value is the lesser of the *PID* output or the override output. See the following example.

Assume the user wishes to control a chilled water valve using a temperature transducer. The control variable will be supply air temperature. As the supply air temperature increases, the chilled water valve should open to lower the temperature. The temperature transducer has a range of 50ºF - 85ºF. The user would like the supply air temperature to be 75ºF but does not want it to drop below 70ºF or go above 80ºF. The parameters entered on the keypad display will be:

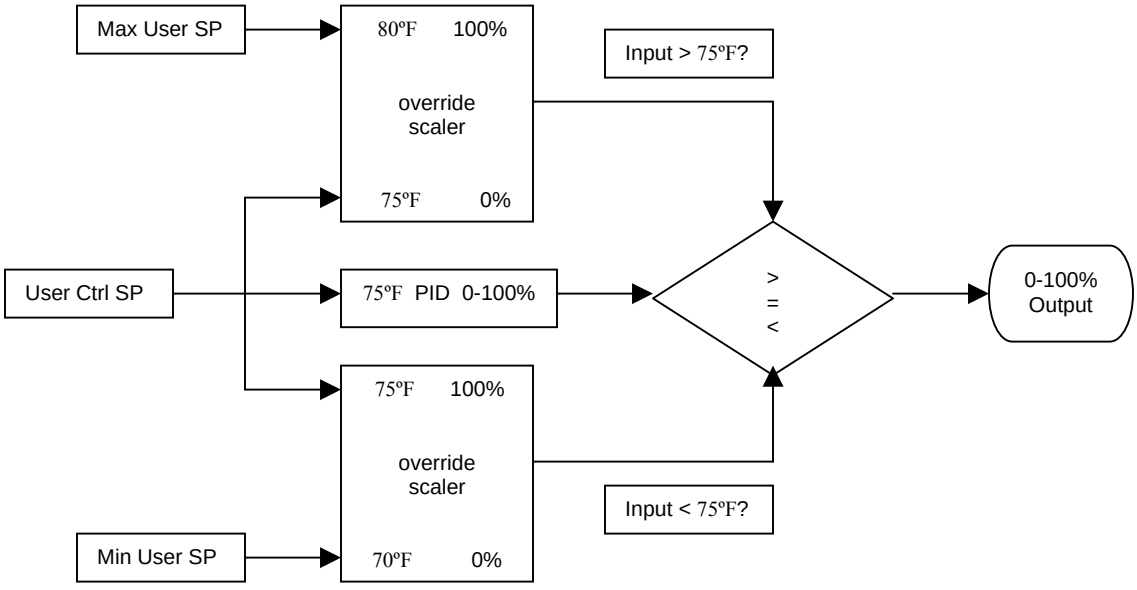
PID Select	Direct (as input increases output increases)
High Input Val	85ºF
Low Input Val	50ºF
User Ctrl SP	75ºF
Max User SP	80ºF
Min User SP	70ºF

The temperature transducer senses the supply air temperature and sends a corresponding signal to the AdaptAire controller. The controller compares this signal to the desired user control setpoint (75ºF) and uses the *PID* loop to modulate the output from 0-100% (0-10Vdc). The output is connected to the chilled water valve which opens or closes to maintain the specified supply air temperature.

If the supply air temperature is 75ºF, the output from the controller will be determined by the *PID* control sequence, and the override will have no effect on the output.

If the supply air temperature is more than 75ºF, the output from the controller will be determined by the *PID* control sequence or the override whichever is less.

If the supply air temperature is less than 75ºF, the output from the controller will be determined by the *PID* control sequence or the override whichever is more.



REVERSE ACTING

The controller output AO-1 is modulated by a *PID* loop from 0% to 100% based on the User Control setpoint and the input signal to IN-9. As the input signal increases the output voltage decreases. Additionally, a secondary control acts to override the *PID* loop to scale the output as follows.

If the input variable equals the User Control setpoint, the output will be determined by the *PID* loop. In this situation the override has no effect on the output value.

If the input variable is above the User Control setpoint, the output **could** decrease from 100% to 0% as the input variable increases from the User Control setpoint to the Max User setpoint. In this situation the output value is the lesser of the *PID* output or the override output.

If the input variable is below the User Control setpoint, the output **could** increase from 0% to 100% as the input variable decreases from the User Control setpoint to the Min User setpoint. In this situation the output value is the greater of the *PID* output or the override output. See the following example.

Assume the user wishes to control the fan speed using a variable frequency drive (VFD). The VFD input is 0-10Vdc. The control variable will be building pressure. As the building pressure increases, the fan speed should decrease. The building pressure transducer has a range of –0.1" to +0.1". The user would like the building pressure to be +0.03" but does not want it to drop below 0.0" or go above +0.05". The parameters entered on the keypad display will be:

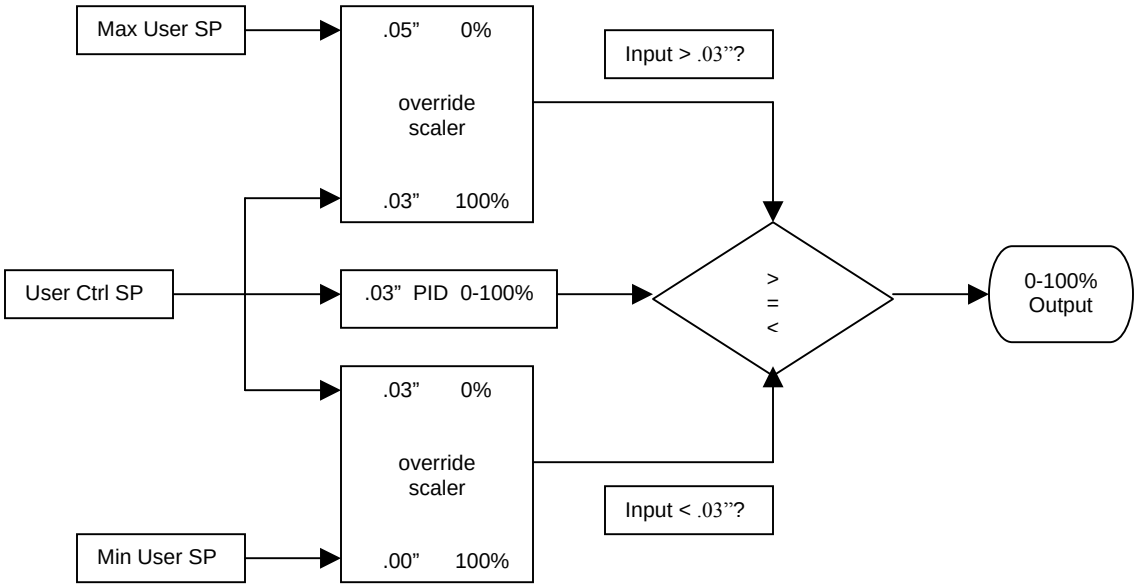
PID Select	Reverse (as input increases output decreases)
High Input Val	0.10
Low Input Val	-0.10
User Ctrl SP	0.03
Max User SP	0.05
Min User SP	0.00

The pressure transducer compares the pressure outside the space to the pressure inside the space and transmits a corresponding signal to the AdaptAire controller. The controller compares this signal to the desired user control setpoint (0.03") and uses the *PID* loop to modulate the output from 0-100% (0-10Vdc). The output is connected to the VFD which changes speed to maintain the specified building pressure.

If the building pressure is 0.03", the output from the controller will be determined by the *PID* control sequence, and the override will have no effect on the output.

If the building pressure is more than 0.03", the output from the controller will be determined by the *PID* control sequence or the override whichever is less.

If the building pressure is less than 0.03", the output from the controller will be determined by the *PID* control sequence or the override whichever is more.



Clock Set

The Clock Set function is used to set the current time and date as well as enabling Daylight Saving Time. To set the clock scroll through the menu tree, locate the Clockset branch, select Date, and enter a new date and time. Select DST to enable Daylight Saving Time. Daylight Saving Time is the default. If the unit is installed in the southern hemisphere, Sou Hem must be enabled. The default is **not** Sou Hem. For you convenience Daylight Saving Time has been preprogrammed for the next several years. To reset the starting and ending DST dates scroll through the DST menu tree, locate the desired year, and enter a new date.

Multiplexed Inputs

The I/O 6104 Automated Logic controller has 6 digital outputs, 10 universal inputs, and 4 analog outputs, thus, the name I/O 6104. Connecting two switching devices each to input 7 and to input 8 has expanded the functionality of this controller. These two switches effectively share their respective input. To allow the controller to identify which switch has closed, the switches are connected to the input through different size resistors. These resistors have values of 10K ohms and 20K ohms. When a single switch is closed, either the 10K or 20K resistor is connected to the input. When both switches are closed, the effective resistance at the input is 6,667 ohms. The controller is programmed to associate each different resistance with a specific function. For example a 20K ohm resistor is connected to input 7 when the optional clogged filter switch is closed. This tells the controller that the filters are clogged, and it notifies the user through the local user interface. See the Typical Wiring Schematic section of this manual for more information.

Resets

This section should assist the user in resetting alarms and cycle counters which have been displayed on the local user interface.

ALARM RS

Alarm RS is the alarm reset. To reset an alarm scroll through the menu tree, locate the Resets branch and select Alarm RS. Press the Enter key. The word OFF should flash. Now press the INC key and the word ON should flash on the display. Press the Enter key again and ON should stop flashing. Repeat this process so the word OFF is displayed and not flashing. The alarm has now been cleared and the Alarm RS function has been rearmed.

CALIBRATE

The Calibrate function forces the controller to recalibrate the return air flow station. The recalibration will occur immediately if the fan is running or at the next fan start. To recalibrate scroll through the menu tree, locate the Resets branch and select Calibrate. Press the Enter key. The word OFF should flash. Now press the INC key and the word ON should flash on the display. Press the Enter key again and ON should stop flashing. Repeat this process so the word OFF is displayed and not flashing. The calibration has now been initiated and the Calibration function has been rearmed.

FAN COUNT

Fan Count records each fan start. To reset a fan count scroll through the menu tree, locate the Resets branch and select Fan Count. Press the Enter key. The word OFF should flash. Now press the INC key and the word ON should flash on the display. Press the Enter key again and ON should stop flashing. Repeat this process so the word OFF is displayed and not flashing. The fan count has now been cleared and the Fan Count function has been rearmed.

HEATING COUNT

Heating Count records each burner start. To reset a heating count scroll through the menu tree, locate the Resets branch and select Heating Count. Press the Enter key. The word OFF should flash. Now press the INC key and the word ON should flash on the display. Press the Enter key again and ON should stop flashing. Repeat this process so the word OFF is displayed and not flashing. The heating count has now been cleared and the Heating Count function has been rearmed.

COOLING COUNT

Cooling Count records each cooling start. To reset a cooling count scroll through the menu tree, locate the Resets branch and select Cooling Count. Press the Enter key. The word OFF should flash. Now press the INC key and the word ON should flash on the display. Press the Enter key again and ON should stop flashing. Repeat this process so the word OFF is displayed and not flashing. The cooling count has now been cleared and the Cooling Count function has been rearmed.

Diagnostics – Critical Fault Codes

This section should assist the user in troubleshooting critical fault codes messages which have been displayed on the local user interface.

FAULT CODE: ***Unit off/Fan on***

PROBLEM: The controller has not activated DO6 to start the fan, but the fan status input, IN4, is receiving a signal that the fan is running.

SOLUTION: **If fan is running**

1. Is controller output LED for DO-6 lit?
    a. Yes. There is a problem with the controller program. Call factory.
    b. No. Continue.
2. Is controller output contact for DO-6 closed?
    a. Yes. Turn off the power to the controller and recheck. If contact is still closed the controller output is shorted. Replace the controller.
    b. No. Continue.
3. Is the unit enable relay energized?
    a. Yes. There is a short or jumper in the wiring. Determine cause and rectify.
    b. No. Continue.
4. Is motor starter energized?
    a. Yes. There is a short or jumper in the wiring. Determine cause and rectify.
    b. No. Continue.
5. Is the fan status relay energized?
    a. Yes. There is a short or jumper in the wiring. Determine cause and rectify.
    b. No. Continue.
6. Is the fan status relay's normally open contact, closed?
    a. Yes. Replace relay.
    b. No. Continue.
7. Is there continuity between both IN-4 terminals 7 and 8?
    a. Yes. There is a short in the wiring between these terminals. Determine cause and rectify.
    b. No. Replace controller.

SOLUTION: If fan is not running

1. Is the fan status relay's normally open contact, closed?
    a. Yes. Replace relay.
    b. No. Continue.
2. Is there approximately 5VDC at both IN-4 terminals 7 and 8?
    a. Yes. There is a short in the wiring between these terminals. Determine cause and rectify.
    b. No. Replace controller.

FAULT CODE: ***Unit on/Fan off***

PROBLEM: The controller has activated DO6 to start the fan, but the fan status input, IN4, is not receiving a signal that the fan is running.

SOLUTION: If fan/motor is running

1. Is the BACview remote indicating an alarm?
    a. Yes. Check previous alarms and continue.
    b. No. Continue.
2. Is the motor starter's normally open auxiliary contact, closed?

a. No. Replace contact.
b. Yes. Continue.

3. Are the high and low velocity airflow switch contacts, closed?
    a. No. Are the belts on and is the fan motor.
        1) Yes. Contact factory. Do not adjust the switches setpoints.
        2) No. Determine cause and rectify.
    b. Yes. Continue.
4. Is the fan status relay energized?
    a. No. There is an open or break in the wiring. Determine cause and rectify.
    b. Yes. Continue.
5. Is the fan status relay's normally open auxiliary contact, closed?
    a. No. Replace relay.
    b. Yes. Continue.
6. Is there continuity between both IN-4 terminals 7 and 8?
    a. No. There is an open in the wiring between these terminals. Determine cause and rectify.
    b. Yes. Replace controller.

SOLUTION: If fan/motor is not running

1. Is the BACview remote indicating an alarm?
    a. Yes. Check previous alarms and continue.
    b. No. Continue.
2. Is controller output LED for DO-6 lit?
    a. No. There is a problem with the controller. Replace controller.
    b. Yes. Continue.
3. Is the unit enable relay energized?
    a. No. There is an open in the wiring between these terminals. Determine cause and rectify.
    b. Yes. Continue.
4. Is the unit enable relay's normally open contact, closed?
    a. No. Replace relay.
    b. Yes. Continue.
5. Is the motor overload relay tripped?
    a. Yes. Determine cause, rectify and reset.
    b. No. Continue.
6. Is the motor starter energized?
    a. No. There is an open or break in the wiring. Determine cause and rectify.
    b. Yes. Check motor and motor wiring.

*FAULT CODE: **Low Discharge Temperature***

PROBLEM: The controller has detected a low temperature at the fan outlet and has shut off the unit. See Freezestat section of this manual.

SOLUTION: If burner was operating prior to shutdown (check prior alarm log)

1. Is the outside air (OAt), room air (RoomT), or discharge air temperature (DAt), displayed on the BACview remote, reading 150°F or more?
    a. Yes. That sensor circuit or the sensor itself is shorted. Unplug the input jack from the AdaptAire controller. Did the display change to -40°F or less?

1) No. There is a short in the controller input. Replace the controller.
2) Yes. Disconnect the sensor wiring at the sensor. Connect an ohmmeter to the sensor. If it is shorted replace the sensor. At 70°F the resistance should be 10KΩ. See thermistor output curve for other temperatures. If it is not shorted, there is a short in the wiring between the sensor and the input plug. Determine cause and rectify. Refer to Appendix II for a typical 10KΩ thermistor output curve.

b. No. Continue.

2. Is the outside air (OAt), room air (RoomT), or discharge air temperature (DAt), displayed on the BACview remote, reading -40°F or less?
   a. Yes. That sensor circuit or the sensor itself is open. Jumper the input for the sensor. Did the display change to 150°F or more?
      1) No. There is an open in the controller input. Replace the controller.
      2) Yes. Disconnect the sensor wiring at the sensor. Connect an ohmmeter to the sensor. If it is open replace the sensor. At 70°F the resistance should be 10KΩ. See thermistor output curve for other temperatures. If it is not open, there is a break in the wiring between the sensor and the input plug. Determine cause and rectify.
   b. No. Continue
3. Reset the alarm. Check and note the DC voltage at AO-3. Set the Heating Setpoint for 90°F. Set the MAX DAT and MIN DAT Setpoints for 130°F. Did the Burner VDC, displayed on the BACview remote, increase??
   a. No. Unless the outside air temperature is extremely warm the Burner VDC should have increased to 7.5VDC or more. Close the manual main gas valve closest to the burner and measure the discharge air temperature. Is it less than 130°F?
      1) Yes. There is a problem with the controller program or controller itself. Contact the factory.
      2) No. The outside air temperature is too hot to determine the actual cause of the problem. Reset the alarm and recheck when the outside air temperature is much cooler.
   b. Yes. This signal is fed to the Maxitrol A200 signal conditioner. Disconnect the wires from terminals 5 and 6 on the A200 and measure the voltage on the wires. Is it the same as the voltage coming from the controller?
      1) No. There is an open in the wiring from the controller output. Correct wiring and reconnect the wires to the terminals on the A200. Be sure the wire from AO-3 terminal number 6 is connected to the A200's terminal number 5.
      2) Yes. Continue.
4. Is there 24VAC on the A200 terminals 1 and 2?
   a. No. Determine cause and rectify.
   b. Yes. Continue.
5. Is there twice the DC voltage on the A200 terminals 3 and 4 as there is on terminals 5 and 6?
   a. No. Replace the A200.
   b. Yes. Continue.

c. Yes. Continue.

6. Is the DC voltage on the Maxitrol modulating valve terminals the same as the DC voltage on the A200 terminals 3 and 4?
    a. No. There is a break in the wiring between the A200 and the modulating valve terminals. Determine cause and rectify.
    b. Yes. The electronics are working to this point. Continue.
7. Is there sufficient temperature rise for the amount of outside air that is being delivered to the space?
    a. No. Follow the instructions in this manual for placing the heater in Manual Pos. damper control. Adjust the Man. Vent setpoint to 20% outside air. Is there sufficient temperature rise for the amount of outside air that is being delivered to the space?
        1) No. Contact the factory.
        2) Yes. Continue.
    b. Yes. Continue.
8. Verify there is sufficient inlet gas pressure. Verify the modulating valve is properly adjusted. Verify the burner orifices are clear of obstruction. Contact the factory.

SOLUTION: If burner was not operating prior to shutdown (check prior alarm log)

1. Is there a prior alarm such as Safety Ckt., Airflow Sw., or Flame Failure?
    a. Yes. See the Diagnostic section for the previous alarm.
    b. No. Continue.
2. Is the room air (RoomT) or discharge air temperature (DAt), displayed on the BACview remote, reading 150°F or more?
    a. Yes. That sensor circuit or the sensor itself is shorted. Unplug the input jack from the AdaptAire controller. Did the display change to -40°F or less?
        1) No. There is a short in the controller input. Replace the controller.
        2) Yes. Disconnect the sensor wiring at the sensor. Connect an ohmmeter to the sensor. If it is shorted replace the sensor. At 70°F the resistance should be 10KΩ. See thermistor output curve for other temperatures. If it is not shorted, there is a short in the wiring between the sensor and the input plug. Determine cause and rectify. Refer to Appendix II for a typical 10KΩ thermistor output curve.
    b. No. Continue.
3. Is the discharge air temperature (DAt), displayed on the BACview remote, reading -40°F or less?
    a. Yes. The discharge air temperature sensor circuit or the sensor itself is open. Jumper the input for the sensor. Did the display change to 150°F or more?
        1) No. There is an open in the controller input. Replace the controller.
        2) Yes. Disconnect the discharge air temperature sensor wiring at the sensor. Connect an ohmmeter to the sensor. If it is open replace the sensor. At 70°F the resistance should be 10KΩ. See thermistor output curve for other temperatures. If it is not open, there is a break in the wiring between the sensor and the input plug. Determine cause and rectify.
    b. No. Continue

4. Reset the alarm. Check and note the DC voltage at AO-3. Set the Heating Setpoint for 90°F. Set the MAX DAT and MIN DAT Setpoints for 130°F. Did the Burner VDC, displayed on the BACview remote, increase??
    a. No. Unless the outside air temperature is extremely warm the Burner VDC should have increased to 7.5VDC or more. Close the manual main gas valve closest to the burner and measure the discharge air temperature. Is it less than 130°F?
        1) Yes. There is a problem with the controller program or controller itself. Contact the factory.
        2) No. The outside air temperature is too hot to determine the actual cause of the problem. Reset the alarm and recheck when the outside air temperature is much cooler.
    b. Yes. This signal is fed to the Maxitrol A200 signal conditioner. Disconnect the wires from terminals 5 and 6 on the A200 and measure the voltage on the wires. Is it the same as the voltage coming from the controller?
        1) No. There is an open in the wiring from the controller output. Correct wiring and reconnect the wires to the terminals on the A200. Be sure the wire from AO-3 terminal number 6 is connected to the A200's terminal number 5.
        2) Yes. Continue.
5. Is there 24VAC on the A200 terminals 1 and 2?
    a. No. Determine cause and rectify.
    b. Yes. Continue.
6. Is there twice the DC voltage on the A200 terminals 3 and 4 as there is on terminals 5 and 6?
    a. No. Replace the A200.
    b. Yes. Continue.
    c. Yes. Continue.
7. Is the DC voltage on the Maxitrol modulating valve terminals the same as the DC voltage on the A200 terminals 3 and 4?
    a. No. There is a break in the wiring between the A200 and the modulating valve terminals. Determine cause and rectify.
    b. Yes. The electronics are working to this point. Continue.
8. Is there sufficient temperature rise for the amount of outside air that is being delivered to the space?
    a. No. Follow the instructions in this manual for placing the heater in Manual Pos. damper control. Adjust the Man. Vent setpoint to 20% outside air. Is there sufficient temperature rise for the amount of outside air that is being delivered to the space?
        1) No. Contact the factory.
        2) Yes. Continue.
    b. Yes. Continue.
9. Verify there is sufficient inlet gas pressure. Verify the modulating valve is properly adjusted. Verify the burner orifices are clear of obstruction. Contact the factory.

FAULT CODE: ***Safety Circuit Open***

PROBLEM: The controller has detected a failure in the safety circuit.

SOLUTION: If fan is not running (check prior alarm log)

1. Is there a prior alarm such as Unit On/Fan Off or Airflow Sw?
    a. Yes. See the Diagnostic section for the previous alarm.
    b. No. Continue.
2. Set Unit Mode to Manual. Did fan start?
    a. No. See the Diagnostic section for Unit On/Fan Off.
    b. Yes. Continue.

SOLUTION: If fan is running (check prior alarm log)

1. Is the high temperature limit tripped?
    a. Yes. Determine cause and rectify.
    b. No. Continue.
2. Is the low gas pressure switch closed?
    a. No. Verify the inlet gas pressure is as specified on the gas piping diagram. **The low gas pressure switch setpoint should not be adjusted.** The inlet gas pressure must remain as specified when unit fires at full input. Correct gas pressure and reset switch. If the switch cannot be reset, replace it. See *Installation, Operation and Owners Manual* for more information.
    b. Yes. Continue.
3. Is the high gas pressure switch closed?
    a. No. Verify the firing rate pressure at full input is as specified on the unit rating plate. **The high gas pressure switch setpoint should not be adjusted.** The firing rate pressure must remain as specified when unit fires at full input. Correct gas pressure and reset switch. If the switch cannot be reset, replace it. See *Installation, Operation and Maintenance Manual* for more information.
    b. Yes. Continue.
4. Is the safety circuit relay energized?
    a. No. Check for loose wiring and rectify.
    b. Yes. Continue.
5. Is the safety circuit relay's normally open contact closed?
    a. No. Replace the relay.
    b. Yes. Continue.
8. Is there continuity across both IN-5 terminals 9 and 10?
    a. No. There is an open in the wiring between these terminals. Determine cause and rectify.
    b. Yes. Replace controller.

FAULT CODE: ***Burner Status***

PROBLEM: The controller has activated DO5 to start the burner, but the burner status input, IN6, is not receiving a signal that the burner is on.

SOLUTION: Inspect burner control circuit and burner

1. Is there a prior alarm such as Unit On/Fan Off, Airflow Sw., or Safety Circuit?
    a. Yes. See the Diagnostic section for the previous alarm.
    b. No. Continue.
2. Is the burner enable relay energized?
    a. No. There is an open in the 24VAC circuit. Determine cause and rectify.

b. Yes. Continue.

3. Is the burner enable relay's normally open contact closed?
    a. No. Replace relay.
    b. Yes. Continue.
4. Is there a pilot flame present?
    a. No. Refer to the *Installation, Operation and Maintenance Manual* for guidance in troubleshooting the flame relay or ignition module.
    b. Yes. Continue.
5. Is the flame relay or ignition module main valve terminal energized?
    a. No. Refer to the *Installation, Operation and Maintenance Manual* for guidance in troubleshooting the flame relay or ignition module.
    b. Yes. Continue.
6. Is the gas valve/burner status relay energized?
    a. No. There is an open in the main valve control circuit. Determine cause and rectify.
    b. Yes. Continue.
7. Is the gas valve/burner status relay's normally open contact closed?
    a. No. Replace relay.
    b. Yes. Continue.
8. Is there continuity across both IN-6 terminals 11 and 12?
    a. No. There is an open in the wiring between these terminals. Determine cause and rectify.
    b. Yes. Replace controller.

FAULT CODE: ***Burner Hand***

PROBLEM: The controller has not activated DO-5 to start the burner, but the burner status input, IN6, is receiving a signal that the burner is on.

SOLUTION: **Inspect burner control circuit.** ***This fault has the potential to be a very serious problem. Close the manual gas valves immediately if the fan is not running.***

1. Is the controller output DO-5 LED lit?
    a. Yes. Close manual gas valves. There is a problem with the controller program. Contact factory.
    b. No. Continue.
2. Are the main automatic gas shutoff valves energized?
    a. No. The main automatic gas shutoff valves are leaking. Turn off unit and close manual gas valves. Determine cause of valve failure and rectify.
    b. Yes. Continue.
3. Is the flame relay energized?
    a. No. There is a short in the wiring of the gas valves. Close manual gas valves. Determine cause of short and rectify.
    b. Yes. Continue.
4. Is the burner enable relay energized?

a. Yes. There is a short in the wiring of the flame relay. Close manual gas valves. Determine cause of short and rectify.
b. No. Continue.

5. Is the burner enable relay's normally open contact closed?
    a. Yes. Close manual gas valves. Replace the relay.
    b. No. Continue.
6. Unplug the input terminals from the input jack. Is there continuity between IN-6 terminals 11 and 12
    a. No. Close manual gas valves. There is a short in the wiring between the burner status relay and IN-6. Determine cause and rectify.
    b. Yes. Close manual gas valves. Replace the controller.

FAULT CODE: ***Flame Failure***

PROBLEM: **DFOA and DFIA Models Only.** The controller has received a signal from the flame relay at input, IN8, indicating a flame failure.

SOLUTION: **Investigate flame relay**

1. Is there a prior alarm such as Unit On/Fan Off, Airflow Sw., or Safety Circuit?
    a. Yes. See the Diagnostic section for the previous alarm.
    b. No. Continue.
2. See flame relay troubleshooting information in unit *Installation, Operation, and Maintenance Manual*.

Diagnostics – Non-Critical Fault Codes

This section should assist the user in troubleshooting non-critical fault codes messages which have been displayed on the local user interface.

FAULT CODE: ***Check Airflow Switches***

PROBLEM: The controller has activated DO6 to start the fan, and detected that the fan is running from a signal at the fan status input, IN4. Subsequently, the controller has detected a momentary opening of the fan status input, IN4. The momentary opening must occur within two seconds of the previous closure for this fault to occur.

SOLUTION: If high airflow switch is opening. Do not adjust the switch setpoints

1. Are all of the filters in place?
    a. No. Install filters and continue.
    b. Yes. Continue.
2. Does the external static pressure match that listed on the rating plate?
    a. No. Verify all associated ductwork is installed and continue.
    b. Yes. Continue.
3. Does the fan RPM match that listed on the Spec. Sheet?
    a. No. Correct to reduced fan speed and continue.
    b. Yes. Continue.
4. Are the airflow switches' sensing tubes obstructed?
    a. Yes. Clear and continue.
    b. No. Continue.
5. Contact factory.

SOLUTION: If low airflow switch is opening. Do not adjust the switch setpoints

1. Does low airflow switch open when the burner is off
    a. No. Disconnect both pressure sensing tubes from one of the airflow switches and measure the differential pressure by connecting the high sensing port of a manometer to one of the airflow sensing tubes and the low sensing port to the other. Is the differential pressure approximately the midpoint between the high and low airflow switch setpoints?
        1) No. Close the profile opening until the differential pressure is approximately the midpoint between the high and low airflow switch setpoints. Reconnect the sensing tubes, restart the burner, and verify the airflow switch remains closed when the burner is at the maximum rated input. Continue.
        2) Yes. Continue.
2. Are all of the filters dirty?
    a. Yes. Install clean filters and continue.
    b. No. Continue.
3. Does the external static pressure match that listed on the rating plate?
    a. No. Verify all associated ductwork is installed as designed, and there are no obstructions. Continue.
    b. Yes. Continue.
4. Does the fan RPM match that listed on the Spec. Sheet?
    a. No. Correct to increased fan speed and continue.
    b. Yes. Continue.
5. Are the airflow switches' sensing tubes obstructed?
    a. Yes. Clear and continue.
    b. No. Continue.
6. Contact factory.

FAULT CODE: ***Clogged Filter Switch***

PROBLEM: The filter air pressure switch has closed and connected a 20,000Ω or 6,667Ω resistance at controller input IN7. See the Typical Wiring Schematic, Multiplexed Input, and Clogged Filter sections of this manual for more information.

SOLUTION: If clogged filter switch is closing.

1. Are the filters dirty?
    a. Yes. Install clean filters and continue.
    b. No. Continue.
2. Are the airflow switch sensing tubes obstructed?
    a. Yes. Clear and continue.
    b. No. Continue.
3. Is the airflow switch setpoint properly adjusted?
    a. No. Adjust setpoint.
    b. Yes. Continue.
4. Are the wires connected to the air pressure switch's normally open contact?
    a. No. Rewire switch and continue.
    b. Yes. Continue.
5. Is the air pressure switch's normally open contact open?
    a. No. Disconnect the sensing tubes and recheck. Replace the switch if contacts do not open.

b. Yes. Continue.

6. Disconnect the wire from terminal 13 of IN7 Does this clear the alarm?
    a. Yes. There is short in the wiring. Determine cause and rectify.
    b. No. There is an internal short in the controller. Replace the controller.

FAULT CODE: ***Energy Save Mode 1***

PROBLEM: The controller has turned off DO5 because it determined the mixed air temperature is equal to or greater than the minimum discharge air temperature setpoint, and the room air temperature is 5°F above the room air temperature setpoint. See the Energy Savings Mode 1 section of this manual for more information.

SOLUTION: If setpoints are misadjusted

1. Is the mixed air temperature (MAt), displayed on the BACview remote, greater than or equal to the minimum discharge air temperature setpoint?
    a. Yes. Increase the MIN DAT setpoint. See Heating Mode – General Burner Control section of this manual for more information.
    b. No. Continue.
2. Is the room temperature more than 5°F above the room air temperature setpoint?
    a. Yes. Increase the Roomt SP setpoint. See Heating Mode – General Burner Control section of this manual for more information.
    b. No. Continue.

SOLUTION: If setpoints are not misadjusted

1. Is there a prior alarm such as Insufficient OA?
    a. Yes. See the Diagnostic section for the previous alarm.
    b. No. Continue.
2. Is the discharge air temperature (DAT), displayed on the BACview remote, reading 150°F or more?
    a. Yes. That sensor circuit or the sensor itself is shorted. Unplug the input jack from the AdaptAire controller. Did the display change to -40°F or less?
        1) No. There is a short in the controller input. Replace the controller.
        2) Yes. Disconnect the sensor wiring at the sensor. Connect an ohmmeter to the sensor. If it is shorted replace the sensor. At 70°F the resistance should be 10KΩ. See thermistor output curve for other temperatures. If it is not shorted, there is a short in the wiring between the sensor and the input plug. Determine cause and rectify. Refer to Appendix II for a typical 10KΩ thermistor output curve.
    b. No. Contact factory.

FAULT CODE: ***Energy Save Mode 2***

PROBLEM: The controller has turned off DO5 because it determined the burner's minimum firing rate exceeds the allowable equivalent temperature rise. See the Energy Savings Mode 2 section of this manual for more information.

SOLUTION: If OAT, RoomT or DAT are such that heat is required

1. Are the outside air hood filters or bird screen or any associated outside air ductwork obstructed?
    a. Yes. Clear obstruction or change filters.
    b. No. Continue.
2. Are the outside air and return air dampers and actuators working properly?
    a. Yes. Continue.
    b. No. Make necessary adjustments and force the unit to recalibrate. See Calibrate in the Resets Section of this manual.
3. Are the AdaptAire flow measuring station pitot tubes and pressure tubing clear?
    a. Yes. Continue.
    b. No. Clean and force the unit to recalibrate. See Calibrate in the Resets Section of this manual.
4. Do the dampers track with a change in the %OA setpoint? The dampers utilized on the heater are not linear with respect to airflow and openness, and as such, the proportion of outside air damper movement will not be exactly equal to the %OA setpoint. However, at 20% OA the dampers should be approximately ½" open.
    a. Yes. Continue.
    b. No. Check the damper motor and linkage connections. When 24VAC is powering the damper actuator and the control signal is 0VDC, the outside air damper should be close to a "rattle tight" position and the return air damper should be open. If the 24VAC power is removed, the actuator will draw the outside air damper tightly closed and the return air damper tightly open. When 24VAC is powering the damper actuator and the control signal is 10VDC, the outside air damper should be fully open and the return air damper should be closed.
        1)
    c. No. Contact factory.
5. Do the dampers track with a change in the %OA setpoint? The dampers utilized on the heater are not linear with respect to airflow and openness, and as such, the proportion of outside air damper movement will not be exactly equal to the %OA setpoint. However, at 20% OA the dampers should be approximately ½" open.
    a. Yes. Continue.
    b. No. Check the damper motor and linkage connections. When 24VAC is powering the damper actuator and the control signal is 0VDC, the outside air damper should be close to a "rattle tight" position and the return air damper should be open. If the 24VAC power is removed, the actuator will draw the outside air damper tightly closed and the return air damper tightly open. When 24VAC is powering the damper actuator and the control signal is 10VDC, the outside air damper should be fully open and the return air damper should be closed.
6. Is there approximately 24VAC at the COM and EXC terminals on the airflow station pressure transducer?
    a. Yes. Continue.
    b. No. Is there 120VAC on the primary side of the low voltage transformer and 24VAC volt at the transformer secondary?
        1) Yes. There is an open in the wiring between the transformer and the transducer. Locate the wiring problem and rectify.

2) No. If there is 120VAC on the primary and 0VAC on the secondary, replace the transformer. If there is 0VAC on the primary, there is an open in the wiring supplying power to the transformer. Locate the wiring problem and rectify.

7. Remove both of the plastic tubes from the airflow station pressure transducer and gently blow into the HIGH side port. Is there approximately 5VDC across the COM and OUT terminals of the pressure transducer?
    a. Yes. Continue.
    b. No. The pressure transducer is defective. Replace it.
8. Remove both of the plastic tubes from the airflow station pressure transducer and gently blow into the HIGH side port. Is there approximately 5VDC across the IN-9 terminals 17 and 18 terminals?
    a. Yes. There is a problem with the controller. Replace it.
    b. No. There is an open in the wiring between these pressure transducer and the AdaptAire controller terminals. Locate and rectify.

FAULT CODE: ***Energy Save Mode 3***

PROBLEM: The controller has turned off DO5 because it determined the inlet air temperature exceeds the Economizer setpoint. See the Energy Savings Mode 3 section of this manual for more information.

SOLUTION: If OAT, RoomT or DAT are such that heat is required

1. Is the outside air temperature (OAT), displayed on the BACview remote, reading 150°F or more?
    a. Yes. The outside air sensor circuit or the sensor itself is shorted. Unplug the input jack from the AdaptAire controller. Did the display change to -40°F or less?
        1) No. There is a short in the controller input. Replace the controller.
    b. Yes. Disconnect the sensor wiring at the sensor. Connect an ohmmeter to the sensor. If it is shorted replace the sensor. At 70°F the resistance should be 10KΩ. See thermistor output curve for other temperatures. If it is not shorted, there is a short in the wiring between the sensor and the input plug. Determine cause and rectify. Refer to Appendix II for a typical 10KΩ thermistor output curve.
2. Is the outside air sensor in the direct sunlight?
    a. Yes. Provide shade for the sensor so it is not affected by the direct sun.
    b. No. Contact factory.

SOLUTION: If setpoints are misadjusted

1. Is the Econmzr Setpoint set for 80°F?
    a. Yes. The outside air temperature is over 80°F and there should be no need for heat. If this is not the case, contact factory.
    b. No. Increase the ECONMZR SP setpoint. See Heating Mode – Energy Savings Mode 3 section of this manual for more information.

FAULT CODE: ***Insufficient OA***

PROBLEM: The controller has turned off DO5 because the percentage of outside air has dropped below 20% for more than five minutes, and the unit is in the Heating mode.

SOLUTION: If heat is desired

1. Are the outside air hood filters or bird screen or any associated outside air ductwork obstructed?
    a. Yes. Clear obstruction or change filters.
    b. No. Continue.
2. Are the outside air and return air dampers and actuators working properly?
    a. Yes. Continue.
    b. No. Make necessary adjustments and force the unit to recalibrate. See Calibrate in the Resets Section of this manual.
3. Are the AdaptAire flow measuring station pitot tubes and pressure tubing clear?
    a. Yes. Continue.
    b. No. Clean and force the unit to recalibrate. See Calibrate in the Resets Section of this manual.
4. Do the dampers track with a change in the %OA setpoint? The dampers utilized on the heater are not linear with respect to airflow and openness, and as such, the proportion of outside air damper movement will not be exactly equal to the %OA setpoint. However, at 20% OA the dampers should be approximately ½" open.
    a. Yes. Continue.
    b. No. Check the damper motor and linkage connections. When 24VAC is powering the damper actuator and the control signal is 0VDC, the outside air damper should be close to a "rattle tight" position and the return air damper should be open. If the 24VAC power is removed, the actuator will draw the outside air damper tightly closed and the return air damper tightly open. When 24VAC is powering the damper actuator and the control signal is 10VDC, the outside air damper should be fully open and the return air damper should be closed.
5. Is there approximately 24VAC at the COM and EXC terminals on the airflow station pressure transducer?
    a. Yes. Continue.
    b. No. Is there 120VAC on the primary side of the low voltage transformer and 24VAC volt at the transformer secondary?
        1) Yes. There is an open in the wiring between the transformer and the transducer. Locate the wiring problem and rectify.
        2) No. If there is 120VAC on the primary and 0VAC on the secondary, replace the transformer. If there is 0VAC on the primary, there is an open in the wiring supplying power to the transformer. Locate the wiring problem and rectify.
6. Remove both of the plastic tubes from the airflow station pressure transducer and gently blow into the HIGH side port. Is there approximately 5VDC across the COM and OUT terminals of the pressure transducer?
    a. Yes. Continue.
    b. No. The pressure transducer is defective. Replace it.
7. Remove both of the plastic tubes from the airflow station pressure transducer and gently blow into the HIGH side port. Is there approximately 5VDC across the IN-9 terminals 17 and 18 terminals?
    a. Yes. There is a problem with the controller. Replace it.
    b. No. There is an open in the wiring between these pressure transducer and the AdaptAire controller terminals. Locate and rectify.

SOLUTION: If less outside air is desired

1. Is heat required?
    a. Yes. The AdaptAire control system must be in the Heating mode. In this mode the smallest allowable amount of outside air is 20%. Verify the system is in the Heating mode and the MIN VENT SP is set for 20%. See Heating/Cooling Mode and Minimum Ventilation Sections of this manual.
    b. No. Continue.
2. Is cooling or ventilation required?
    a. Yes. The AdaptAire control system must be in the Cooling mode. In this mode the smallest allowable amount of outside air is 0%. Verify the system is in the Cooling mode and the MIN VENT SP is set for the desired percent of outside air. See Heating/Cooling Mode and Minimum Ventilation Sections of this manual.
    b. No. Contact factory.

Glossary

Equivalent temperature rise – Simply stated this value is the actual temperature rise generated by the heater at any given time. More precisely stated, it is the quantity of outside air raised to the discharge air temperature, plus, the quantity of return air raised to the discharge air temperature. It is equivalent to the heat actually delivered to the space. The purpose for this in the burner control scheme is to limit the burner's firing rate, based on the percentage of outside air, and thus the carbon monoxide generated by the heater.

Expressed mathematically it is: $T_{eq} = \%OA\ (T_{da} - T_{oa}) + \%RA\ (T_{da} - T_{ra})$

Local User Interface – The BACview, two line by sixteen character display used to change setpoints and monitor the unit's operation.

PID Control or loop– Proportional, Integral, Derivative, a common control scheme used in modulating HVAC systems.

Menu Selection Tree

UNIT MODES

- Auto/Off/Man
  - Auto
  - Off
  - Man
- Htg/Clg
  - Heating
  - Cooling
- Damper Mode
  - MA Temp Ctrl
  - Bldg Prs Ctrl
  - Manual Pos
- Fuel Select
  - Natural Gas
  - Propane Gas
- Home
- Previous

SETPOINTS

- Roomt SP
  - °F range 55-90
  - Home
  - Previous
- Htg Setback SP
  - °F range 40-80
  - Home
  - Previous
- Clg Setback SP
  - °F range 75-130
  - Home
  - Previous
- Max DAt SP
  - °F range 55-130
  - Home
  - Previous
- Min DAt SP
  - °F range 40-130
  - Home
  - Previous

- Mixed Air SP
  - °F range 30-80
  - Home
  - Previous
- Bldg Prs SP
  - “WC range –0.05-+0.05

    - Home
    - Previous
- Man Vent SP
    - % range 0-100
    - Home
    - Previous
- Min Vent SP
    - % range 0-100
    - Home
    - Previous
- Econmzr SP
    - °F range 40-80
    - Home
    - Previous
- Freeze SP
    - °F range 35-80
    - Home
    - Previous
- Home
- Previous

STATUS MENU

- Roomt °F
- OAt °F
- DAt °F
- MAt °F
- MaxEQ °F
- ActEQ °F
- %OA %
- Bldg P "WC
- Dmprs VDC
- Burner VDC
- User In
- User Out %
- Fan Hrs
- Fan Cyc
- Htg Hrs
- Htg Cyc
- Clg Cyc
- Clg Hrs
- Home
- Previous

ALARM

- Alarm History
    - Critical
    - Non-Critical
    - Return-Normal

- Previous

RESETS

- Alarm RS
- Calibrate
- Fan Count
- Htg Count
- Clg Count
- Previous

SCHEDULES

- Normal
  - Schedule1 (typical 1 through 16)
    - Start hr:min
    - Stop hr:min
    - DAYS SUN, MON, TUE, WED, THU, FRI, SAT
    - Prev
    - Next
- Holiday
  - Holiday1 (typical 1 through 16)
    - MM:DD month:day
    - Start hr:min
    - Stop hr:min
    - Prev
    - Next
- Override
  - Override1 (typical 1 through 8)
    - MM:DD month:day
    - Start hr:min
    - Stop hr:min
    - Prev
    - Next

USER CONFIGURABLE IO

- PID Select
  - PID Type
    - Direct Acting
    - Reverse Acting
  - Home
  - Previous
- Hi Input Val
  - Home
  - Previous
- Lo Output Val
  - Home
  - Previous
- User Control SP
  - Home
  - Previous

- Max User SP
  - Home
  - Previous
- Min User SP
  - Home
  - Previous

CLOCKSET

- Date dd-mm-yy
- Time hh:mm:ss
- Prev
- DST
  - Enable
    - N no
    - Y yes
  - Sou Hem
    - N no
    - Y yes
  - 03Beg
    - Apr/06
  - 03End
    - Oct/26
  - 04Beg
    - Apr /04
  - 04End
    - Oct /31
  - 05Beg
    - Apr /03
  - 05End
    - Oct /30
  - 06Beg
    - Apr /02
  - 06End
    - Oct /29
  - 07Beg
    - Apr /01
  - 07End
    - Oct /28
  - 08Beg
    - Apr /06
  - 08End
    - Oct /26
  - 09Beg
    - Apr /05
  - 09End
    - Oct /25
    - Prev

Appendix I

Network Port Setup

Network Port Owner: BACnet (use B for BACnet, M for Modbus, or N for N2)
Network Port Type: EIA-485 (use 2 or 4)
Network communications set for 8 data bits, No parity, 1 stop bit

BACnet Device Parameters

Use default device object name?	Y	Device Name = see status screen
Use default device object ID?	Y	Device Name = see status screen
APDU Timeout	3000	(milliseconds)
Number of APDU retries	0	
Vendor Name	Automated Logic	
Vendor Identifier	24	

BACnet MS/TP Parameters

Station ID	set by module's rotary address switches – see status screen
Master node	Y
Max masters	127 (1-127, BACnet default = 127)
Max info frames	50 (BACnet default = 1. Should not be 0)

Modbus Device Parameters

Modbus address for this device is 1 Slave (use 0 for master)
The transmission mode is RTU (use A for ASCII)
Reverse order of high and low words for FLOAT data type: NO
Master response timeout 1 x 100ms (default = 100ms)

N2 Device Parameters

The slave address for this N2 device is 255 (use 1-255)

Cache Setup for Modbus and N2

The cache allows you to configure up to 200 points for Modbus or N2 communications. The protocol assigned to the I/O 6104's Network Port determines which cache parameters (Modbus or N2) will be used to process the cache point.

Type The BACnet object type of thie internal BACnet microblock that will send data to or receive data from an external device. Valid object types include:

- AI = BACnet Analog Input microblock
- AO = BACnet Analog Output microblock
- AV = BACnet Analog Value Parameter or Status microblock
- BI = BACnet Binary Input microblock
- BO = BACnet Binary Output microblock
- BV = BACnet Binary Value Parameter or Status microblock

ID The BACnet Object ID assigned to the BACnet microblock. This must be a decimal value in the range 1 to 999,999.

Description Optional text describing the cache point.

Action This determines how the cache line is processed. Valid actions depend on whether the module is configured as a Master or Slave device. Use '-' to disable the cache line.

Mod Fmt This describes the Modbus format for the object. Valid Modbus formats are:

UINT = 16 bit unsigned integer
SINT = 16 bit signed integer
FLOAT = 32 floating point number in two adjacent registers
BITn = where n = {0…15}, BIT0 being the least significant
DO = discrete output
DI = discrete input
ES = exception status
DEV = device type
COMERR = communication error

Mod Obj This is the data address on the Modbus device.

N2 Fmt The Network Point type. Valid Modbus formats are:

AI = Exposed as an Analog Input
BI = Exposed as an Binary Input
AO = Exposed as an Analog Output
BO = Exposed as an Binary Output
ADF = Exposed as an Analog Data Float
ADI = Exposed as an Analog Data Integer
BYT = Exposed as a Data Byte

N2 Obj The N2 Network Point address (1-255).

Non-Recirculating Cache Table for Modbus and N2

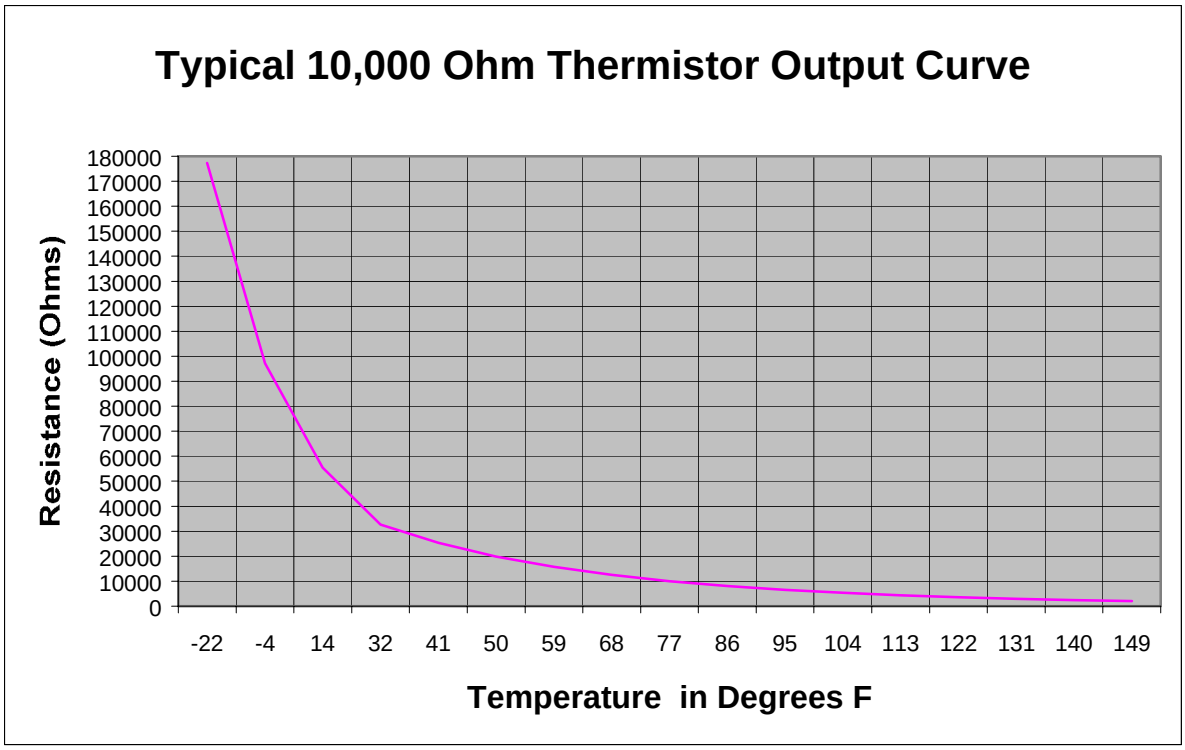
Non-Recirc Only	POINT TYPE	ID INSTANCE NUMBER	DESCRIPTION	ACTION	MOD FMT	MOD OBJ	N2 FMT	N2 OBJ
N	AI	13001	Space Temp	Expose to	FLOAT	30001	AI	4
N	AI	13002	OA Temp	Expose to	FLOAT	30003	AI	5
N	AI	13003	DA Temp	Expose to	FLOAT	30005	AI	6
N	AI	13006	User PID Input	Expose to	FLOAT	30038	AI	60
N	AO	14002	Gas Valve	Expose to	FLOAT	30013	AO	15
N	AO	14003	User Output	Expose to	FLOAT	30040	AO	61
N	AV	16001	Htg Nite SP	Expose to	UINT	40012	ADI	33
N	AV	16002	Unit Enable A/O/M	Expose to	UINT	40013	ADI	34
N	AV	16003	Freeze Stat SP	Expose to	UINT	40011	ADI	32
N	AV	16011	Fan Cycles	Expose to	UINT	30028	ADI	45
N	AV	16012	Fan Hours	Expose to	UINT	30029	ADI	46
N	AV	16019	Bnr Cycles	Expose to	UINT	30030	ADI	47
N	AV	16020	Bnr Hours	Expose to	UINT	30031	ADI	48
N	AV	16021	Inlet Duct SP	Expose to	UINT	40002	ADI	24
N	AV	16023	Heating SP	Expose to	UINT	40001	ADI	23
N	AV	16024	Gas % Open	Expose to	FLOAT	30015	ADF	37
N	AV	16025	Min DAT SP	Expose to	UINT	40004	ADI	26
N	AV	16027	Cooling Cycles	Expose to	UINT	30032	ADI	49
N	AV	16028	Cooling Hours	Expose to	UINT	30033	ADI	50
N	AV	16029	Cooling SP	Expose to	UINT	40005	ADI	27
N	AV	16030	Max DAT SP	Expose to	UINT	40008	ADI	29
N	AV	16031	Clg Nite SP	Expose to	UINT	40014	ADI	35
N	AV	16038	User Ctrl SP	Expose to	FLOAT	40017	ADF	62
N	AV	16040	Low User Range	Expose to	FLOAT	40019	ADF	63
N	AV	16041	Hi User Range	Expose to	FLOAT	40021	ADF	64
N	AV	16043	% User Output	Expose to	FLOAT	40023	ADF	65
N	AV	16044	Min User SP	Expose to	FLOAT	40025	ADF	66
N	AV	16045	Max User SP	Expose to	FLOAT	40027	ADF	67
N	BI	12001	Blower Status	Expose to	DI	10001	BI	1
N	BI	12002	Burner Status	Expose to	DI	10002	BI	2
N	BI	12003	Safety Limits	Expose to	DI	10003	BI	3
N	BO	11001	Unit Enable	Expose to	DI	10004	BO	9
N	BO	11002	Burner Enable	Expose to	DI	10006	BO	11
N	BO	11003	FSG Alarm Enable	Expose to	DI	10008	BO	13
N	BO	11004	Cooling Enable	Expose to	DI	10007	BO	12
N	BO	11005	Flame Rod Switch	Expose to	DI	10005	BO	10
N	BV	15001	Fan Cntr Clear	Expose to	DO	1	BO	16
N	BV	15002	Reset	Expose to	DO	7	BO	22
N	BV	15003	Fan Fault Status	Expose to	DI	10009	BI	52
N	BV	15004	Bnr Cntr Clear	Expose to	DO	2	BO	17
N	BV	15006	Cool Cntr Clear	Expose to	DO	3	BO	18
N	BV	15008	Aux On	Expose to	DI	10012	BI	55
N	BV	15009	Filter Dirty	Expose to	DI	10013	BI	56
N	BV	15011	FSG Alarm	Expose to	DI	10011	BI	54
N	BV	15013	H/C/ Mode Select	Expose to	DO	4	BO	19
N	BV	15016	Network Enable	Expose to	DO	8	BO	57
N	BV	15017	User PID Select	Expose to	DI	10014	BI	68

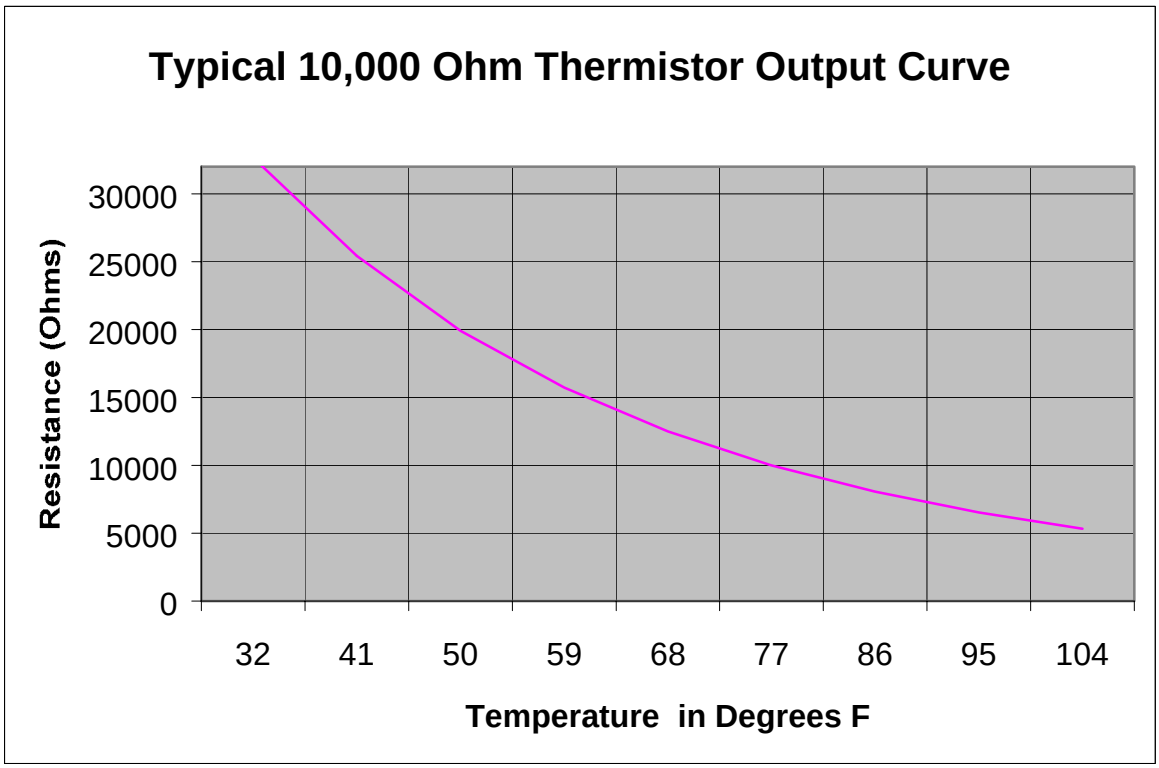
Recirculating Cache Table for Modbus and N2

Recirc Only	POINT TYPE	ID INSTANCE NUMBER	DESCRIPTION	ACTION	MOD FMT	MOD OBJ	N2 FMT	N2 OBJ
R	AI	13001	Space Temp	Expose to	FLOAT	30001	AI	4
R	AI	13002	OA Temp	Expose to	FLOAT	30003	AI	5
R	AI	13003	DA Temp	Expose to	FLOAT	30005	AI	6
R	AI	13004	Flow Stn Prs	Expose to	FLOAT	30007	AI	7
R	AI	13005	Bldg Prs x 100	Expose to	FLOAT	30009	AI	8
R	AO	14001	VDC Dampers	Expose to	FLOAT	30011	AO	14
R	AO	14002	Gas Valve	Expose to	FLOAT	30013	AO	15
R	AV	16001	Htg Nite SP	Expose to	UINT	40012	ADI	33
R	AV	16002	Unit Enable A/O/M	Expose to	UINT	40013	ADI	34
R	AV	16003	Freeze Stat SP	Expose to	UINT	40011	ADI	32
R	AV	16004	Flow Stn Avg Prs	Expose to	FLOAT	30021	ADF	40
R	AV	16005	Return Air %	Expose to	UINT	30023	ADI	41
R	AV	16006	Outside Air %	Expose to	UINT	30024	ADI	42
R	AV	16007	Act EQ Temp Rise	Expose to	FLOAT	30019	ADF	39
R	AV	16008	Max EQ Temp Rise	Expose to	FLOAT	30017	ADF	38
R	AV	16009	Max Disch Temp	Expose to	FLOAT	30027	ADF	44
R	AV	16010	Mixed Air Temp	Expose to	FLOAT	30025	ADF	43
R	AV	16011	Fan Cycles	Expose to	UINT	30028	ADI	45
R	AV	16012	Fan Hours	Expose to	UINT	30029	ADI	46
R	AV	16013	Mix Air Temp SP	Expose to	UINT	40010	ADI	31
R	AV	16014	Bldg Press SP	Expose to	FLOAT	40006	ADF	28
R	AV	16015	Manual Damper SP	Expose to	UINT	40009	ADI	30
R	AV	16016	Recirc Mode Select	Expose to	UINT	40015	ADI	36
R	AV	16019	Bnr Cycles	Expose to	UINT	30030	ADI	47
R	AV	16020	Bnr Hours	Expose to	UINT	30031	ADI	48
R	AV	16021	Inlet Duct SP	Expose to	UINT	40002	ADI	24
R	AV	16022	Min Vent SP	Expose to	UINT	40003	ADI	25
R	AV	16023	Heating SP	Expose to	UINT	40001	ADI	23
R	AV	16024	Gas % Open	Expose to	FLOAT	30015	ADF	37
R	AV	16025	Min DAT SP	Expose to	UINT	40004	ADI	26
R	AV	16027	Cooling Cycles	Expose to	UINT	30032	ADI	49
R	AV	16028	Cooling Hours	Expose to	UINT	30033	ADI	50
R	AV	16029	Cooling SP	Expose to	UINT	40005	ADI	27
R	AV	16030	Max DAT SP	Expose to	UINT	40008	ADI	29
R	AV	16031	Clg Nite SP	Expose to	UINT	40014	ADI	35
R	AV	16032	Bldg Press	Expose to	FLOAT	30034	ADF	51
R	AV	16033	Calb Time (secs)	Expose to	UINT	30036	ADI	58
R	AV	16034	Calb Time (mins)	Expose to	UINT	30037	ADI	59
R	BI	12001	Blower Status	Expose to	DI	10001	BI	1
R	BI	12002	Burner Status	Expose to	DI	10002	BI	2
R	BI	12003	Safety Limits	Expose to	DI	10003	BI	3
R	BO	11001	Unit Enable	Expose to	DI	10004	BO	9
R	BO	11002	Burner Enable	Expose to	DI	10006	BO	11
R	BO	11003	FSG Alarm Enable	Expose to	DI	10008	BO	13
R	BO	11004	Cooling Enable	Expose to	DI	10007	BO	12
R	BO	11005	Flame Rod Switch	Expose to	DI	10005	BO	10
R	BV	15001	Fan Cntr Clear	Expose to	DO	1	BO	16
R	BV	15002	Reset	Expose to	DO	7	BO	22
R	BV	15003	Fan Fault Status	Expose to	DI	10009	BI	52
R	BV	15004	Bnr Cntr Clear	Expose to	DO	2	BO	17
R	BV	15006	Cool Cntr Clear	Expose to	DO	3	BO	18
R	BV	15008	Aux On	Expose to	DI	10012	BI	55
R	BV	15009	Filter Dirty	Expose to	DI	10013	BI	56
R	BV	15010	All Vent	Expose to	DI	10010	BI	53
R	BV	15011	FSG Alarm	Expose to	DI	10011	BI	54
R	BV	15013	H/C/ Mode Select	Expose to	DO	4	BO	19
R	BV	15014	Fuel Select	Expose to	DO	5	BO	20
R	BV	15015	Force Calibrate	Expose to	DO	6	BO	21
R	BV	15016	Network Enable	Expose to	DO	8	BO	57

Appendix II

10KΩ Thermistor Output Curve





Appendix III

Airflow Station Layout