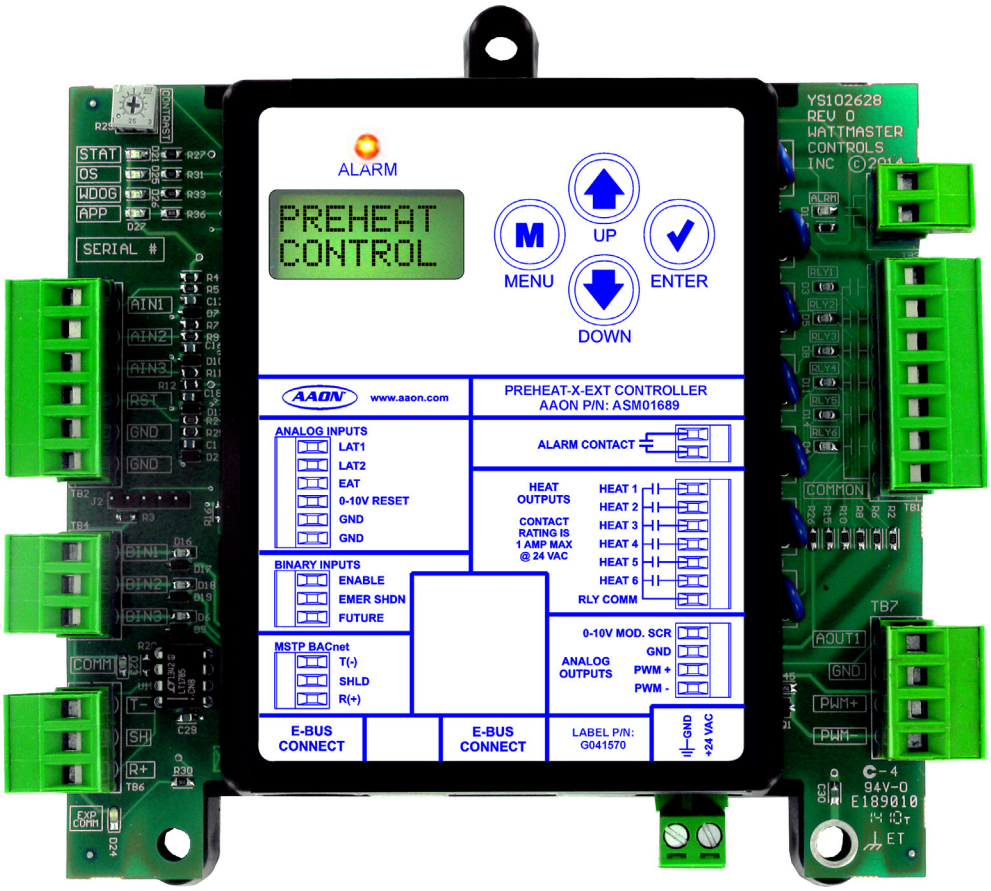
PREHEAT-X-EXT Module Technical Guide



PREHEAT-X-EXT REVISION LOG	
REVISION AND DATE	**CHANGE**
Rev. B, July 9, 2021	Updated part numbers, alarms and alarm history, and labels. Added Figure/Table content pages, and Fahrenheit/Celsius temperature conversion. Corrected cosmetic errors.
Rev. C, February 2, 2024	updated screens, updated LO LAT alarm, updated parts table, various cosmetic updates
Rev. D, December 6, 2024	Update setpoint screen temperature range changes

PREHEAT-X-EXT PARTS REFERENCE	
PART DESCRIPTION	**PART NUMBER**
PREHEAT-X-EXT Module	ASM01689
VCCX-IP Controller	ASM07424
VCCX2 Controller	ASM01698
VCB-X Controller	ASM01862
VCM-X E-BUS Controller	V07151
Duct Temperature Sensor	G051240 (6 in.), G051250 (12 in.)
Outdoor Air Temperature Sensor	G042230
E-BUS Cable Assembly E-BUS Power & Comm 1.5 ft., 3 ft., 10 ft., 25 ft., 50 ft., 75 ft., 100 ft., 150 ft., 250 ft., and 1,000 ft. spool	G029440 (1.5 ft.), G012870 (3 ft.), G029460 (10 ft.), G045270 (25 ft.), G029510 (50 ft.), G029530 (75 ft.), G029450 (100 ft.), G029470 (150 ft.), V36590 (250 ft.), G018870 (1,000 ft. spool)

www.aaon.com

All manuals are also available for download from www.aaon.com/controlsmanuals.

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Overview

The PREHEAT-X-EXT is designed to control fixed stages of Preheat and optional modulating Preheat to maintain a desired Preheat Leaving Air Temperature Setpoint. See **Figure 1**, **this page** for dimensions. See **Figure 2 and 3, pages 7 and 8** for wiring details.

The PREHEAT-X-EXT Module has a lower minimum Leaving Air Temperature Setpoint (0ºF). It should only be used with the approval of AAON.

NOTE: The PREHEAT-X-EXT contains no user-serviceable parts. Contact a qualified technician if your PREHEAT-X-EXT is not operating correctly.

Features

The PREHEAT-X-EXT has the following features:

- Can be operated in Stand-Alone Mode or in Communications Mode with the VCCX2 or other AAON unit controllers.
- Monitors the Preheater Leaving Air Temperature and Leaving Air Reset Signal and controls to maintain the setpoint.
- Has a lower minimum Leaving Air Temperature Setpoint (0ºF).
- Contains a 2 x 8 LCD character display and four buttons that allow for status display and setpoint changes.

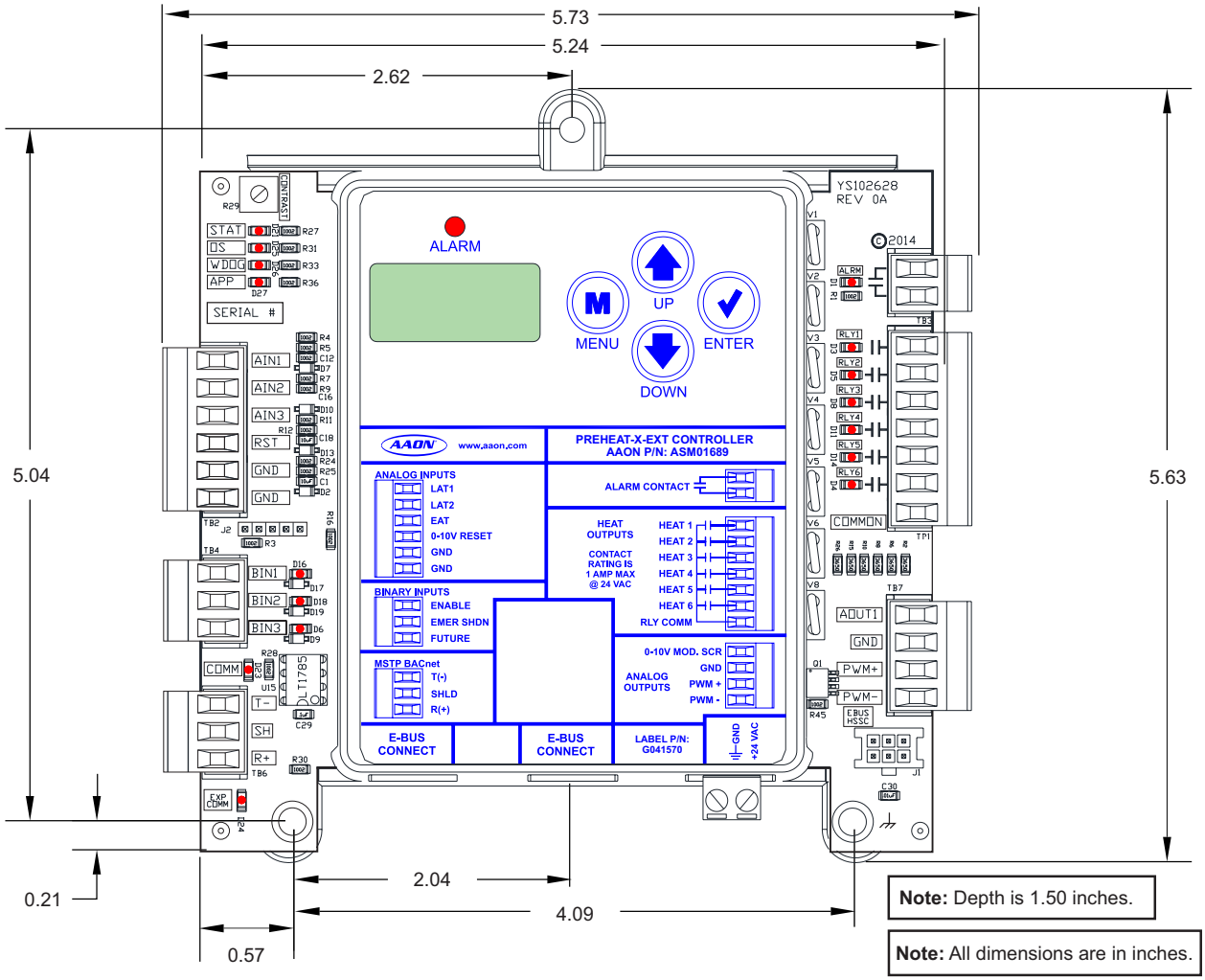


Figure 1: PREHEAT-X-EXT Dimensions

Important Wiring Considerations

Wiring

The modules must be connected to an 18-30 VAC power source of the proper size for the calculated VA load requirements. All transformer sizing should be based on the VA ratings listed in **Table 1, this page**.

Control Device	Voltage	VA Load	Operating Temperature	Humidity (Non-Condensing)
PREHEAT-X-EXT	18-30 VAC	18	-22°F to 158°F* -30ºC to 70ºC*	0-95% RH
	Inputs		Resistive Inputs require 10KΩ Type III Thermistor	
			24 VAC Inputs provide 4.7KΩ Load	
	Outputs		Relay Outputs: 1 amp maximum per output.	

Table 1: Electrical and Environmental Requirements

NOTE: If the temperature at the PREHEAT-X-EXT is below -4ºF (-20ºC), the display refresh rate could be less responsive.

WARNING: When using a single transformer to power more than one controller or expansion module, the correct polarity must always be maintained between the boards. Failure to observe correct polarity will result in damage to the AAON unit controller, PREHEAT-X-EXT, and any associated module.

Please carefully read and apply the following information when wiring the AAON unit controller, PREHEAT-X-EXT and any associated module.

1. All wiring is to be in accordance with local and national electrical codes and specifications.
2. All 24 VAC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the controller and connected devices.
3. Minimum wire size for 24 VAC wiring should be 18-gauge.
4. Minimum wire size for all sensors should be 24-gauge. Some sensors require two-conductor wire and some require three-or four-conductor wire.
5. Minimum wire size for 24 VAC thermostat wiring should be 22-gauge.
6. Be sure that all wiring connections are properly inserted and tightened into the terminal blocks. Do not allow wire strands to stick out and touch adjoining terminals which could potentially cause a short circuit.
7. When communication wiring is to be used to interconnect AAON unit controllers together or to connect to other communication devices, all wiring must be plenum-rated, minimum 18-gauge, two-conductor, twisted-pair with shield. AAON can supply communication wire that meets this specification and is color coded for the network or local loop. Please consult your AAON distributor for information. If desired, Belden #82760 or equivalent wire may also be used.
8. Before applying power to the AAON unit controller, PREHEAT-X-EXT, and any associated modules, be sure to recheck all wiring connections and terminations thoroughly.

Powering Up

When the controller and modules are first powered up, the POWER LED should light up and stay on continuously. If it does not light up, check to be sure that you have 24 VAC connected to the controller, that the wiring connections are tight, and that they are wired for the correct polarity. The 24 VAC power must be connected so that all ground wires remain common. If after making all these checks, the POWER LED does not light up, please contact AAON Controls Support for assistance.

Inputs

The PREHEAT-X-EXT can be operated in Stand-Alone Mode or in Communications Mode with the VCCX2 or other AAON unit controllers. For connection to the PREHEAT-X-EXT use an E-BUS cable connecting to the appropriate E-BUS ports. The Reset Input and Heat Enable are only used in Stand-Alone Mode. See **Figure 2**, **this page** for the Inputs Wiring Diagram.

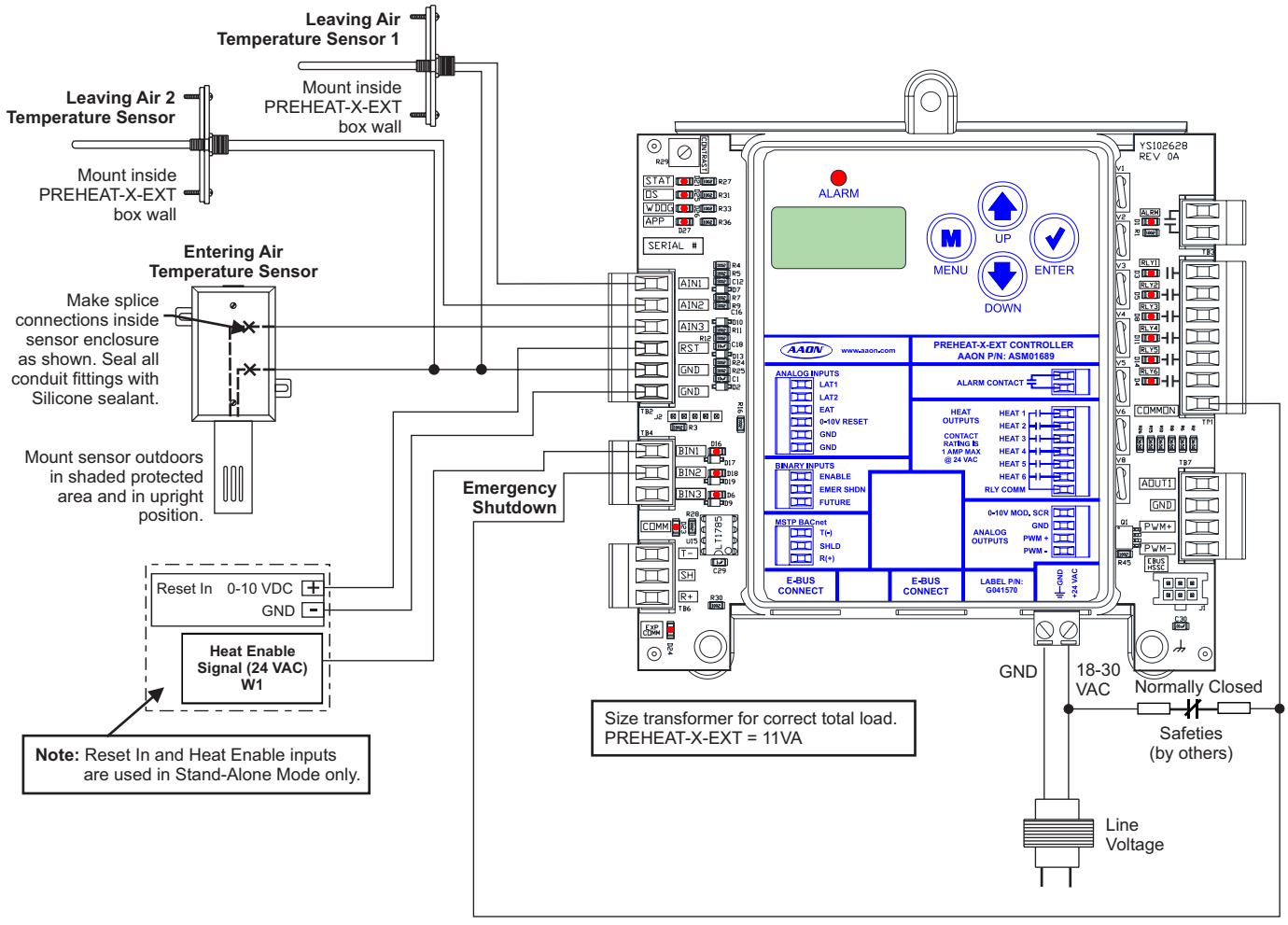


Figure 2: PREHEAT-X-EXT Inputs Wiring Diagram

Outputs Wiring

Outputs

The PREHEAT-X-EXT can be operated in Stand-Alone Mode or in Communications Mode with the VCCX2 or other AAON unit controllers. For connection to the PREHEAT-X-EXT, use an E-BUS cable connecting to the appropriate E-BUS ports. See **Figure 3**, **this page** for Outputs Wiring.

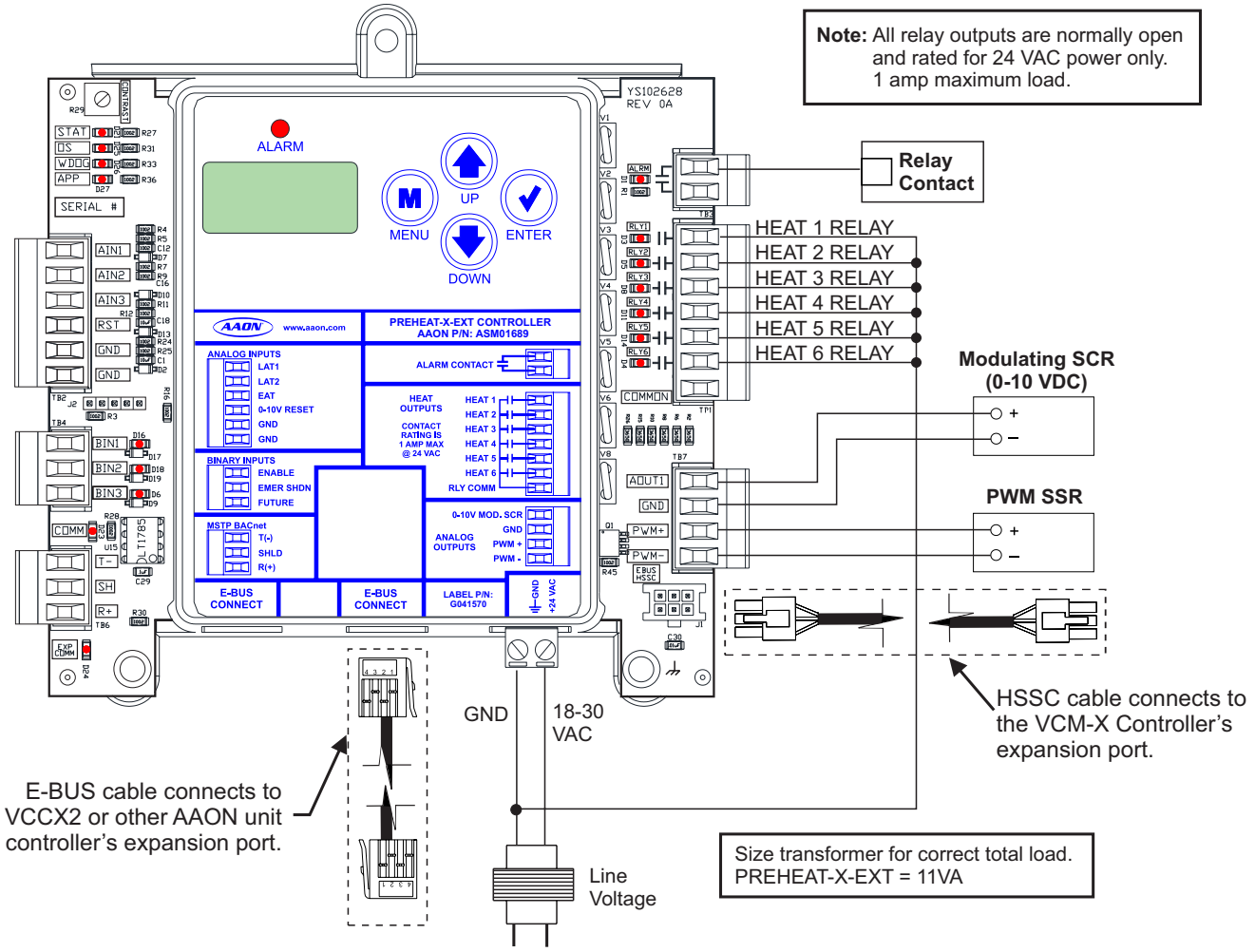


Figure 3: PREHEAT-X-EXT Outputs Wiring

I/O Map

See **Table 2, this page** to reference the inputs and outputs that are available on the PREHEAT-X-EXT.

Analog Inputs	
1	Leaving Air Temperature 1 (LAT1)
2	Leaving Air Temperature 2 (LAT2)
3	Entering Air Temperature Sensor
4	Reset In (0-10 VDC)
Binary Inputs	
1	Heat Enable
2	Emergency Shutdown
3	Future Use
Analog Outputs	
1	0-10 VDC Mod SCR
2	PWM SSR
Relays	
1	Alarm
2	Heat 1
3	Heat 2
4	Heat 3
5	Heat 4
6	Heat 5
7	Heat 6

Table 2: PREHEAT-X-EXT Inputs and Outputs

Analog Inputs

Leaving Air Temperature 1 (LAT1)

When enabled, the PREHEAT-X-EXT controls a Leaving Air Temperature (LAT) Setpoint. The PREHEAT-X-EXT can be configured to use only LAT1 for this purpose. Typically, the average of LAT1 and LAT2 is used.

Leaving Air Temperature 2 (LAT2)

When enabled, the PREHEAT-X-EXT controls a Leaving Air Temperature Setpoint. It can be configured to use only LAT2 for this purpose. Typically, the average of LAT1 and LAT2 is used.

Entering Air Temperature

When the Entering Air Temperature falls below the Entering Air Temperature Setpoint, preheat will be enabled.

NOTE: For AI1 through AI3, all temperature sensors must be Thermistor Type III Temperature Sensors, which provide 77.0ºF @ 10K ohms resistance.

Reset Input (0-10 VDC)

When the PREHEAT-X-EXT is used as a stand-alone module, the Leaving Air Temperature Setpoint can be reset by supplying a 0-10 VDC signal to the RST IN low voltage terminal block. This reset signal is optional and need only be used if you require resetting of the Discharge Air Temperature.

Binary Inputs

Heat Enable Contact (HEAT EN)

This input is only required when the PREHEAT-X-EXT is used in Stand-Alone Mode; it is not required when communicating with an AAON unit controller. The Heat Enable input is activated by a 24 VAC signal supplied from a building automation system to enable the PREHEAT-X-EXT. The module will not operate without 24 VAC being applied to this input terminal when used as a stand-alone module. When the Heat Enable Signal is lost or turned off, all stages deactivate immediately.

Emergency Shutdown Input

This wet contact (24 VAC) input is used to initiate shutdown of the HVAC unit when a normally closed Smoke Detector (by others), Firestat (by others), or other shutdown condition (by others) occurs and the contact is opened. The PREHEAT-X-EXT remains active and can initiate alarm relays.

Analog Outputs

0-10 VDC Modulating SCR

Depending on the type of Heat used, this output will supply a 0-10 VDC output signal for control of the modulating SCR Heat.

Pulse Width Modulating SSR

Depending on the type of Heat used, this output will supply a 12 V PWM Output Signal for control of the modulating SSR Heat.

Relay Outputs

Relay #1 - Alarm

This relay sends a signal when an alarm is enabled.

Relays #2 - 7

These relays are Fixed Stage Heat Outputs.

Operation Modes

Stand-Alone Mode

When used in Stand-Alone Mode, the PREHEAT-X-EXT will modulate SCR or SSR Heat and stage any additional fixed stages to maintain the Leaving Air Temperature Setpoint configured on the PREHEAT-X-EXT LCD display. The PREHEAT-X-EXT is activated by a 24 VAC signal to the HEAT EN Input.

Communications Mode

When the PREHEAT-X-EXT is connected and communicating with an AAON unit controller via a modular cable, the necessary information will be passed between the PREHEAT-X-EXT and the AAON unit controller to properly operate in the Heating Mode.

If the communication is interrupted between the PREHEAT-X-EXT and the AAON unit controller, both boards will show an alarm and the PREHEAT-X-EXT outputs will turn off. When communication is restored, the alarms will go away.

In this configuration, the Leaving Air Temperature Setpoints and the Preheat Enable Setpoints are set using the main AAON unit controller.

Preheat Enable

Stand-Alone Mode

Enabled when the Binary Input (BI1) is closed and the Entering Air Temperature is below setpoint.

E-BUS Communications Mode

Enabled by an E-BUS command when the Entering Air Temperature falls below the Preheat Setpoint.

BACnet Communications Mode

Enabled by BACnet® command or Binary Input (BI1), whichever occurs first.

Leaving Air Sensor

The PREHEAT-X-EXT can be configured to use one of three sensor configurations for control.

- Leaving Air Sensor 1 only (LAT1)
- Leaving Air Sensor 2 only (LAT2)
- Average Leaving Air Temperature from LAT1 and LAT2

Leaving Air Setpoint

Stand-Alone

- Leaving Air Temperature Setpoint can be reset between the Leaving Air Temperature Setpoint and LAT Setpoint Reset Limit.
- The Reset Source is based on a 0-10 VDC input and range can be adjusted using the Leaving Air Temperature Setpoint Reset Source Low and Leaving Air Temperature Setpoint Reset Source High Setpoints.

E-BUS and BACnet Communications Mode

- A Leaving Air Temperature Setpoint will be sent to the controller.
- This value is stored in volatile memory and will be lost at reset.
- There are separate Leaving Air Temperature setpoints, depending on if the unit is in Heating, Vent, or Cool Mode.

Modulating Heat

- If configured, the Modulating Heat Output will be used as the first stage of heat.
- Analog Voltage Output can be adjusted between 0-10 VDC as needed to maintain the Leaving Air Setpoint.
- Controlled by an Internal PID Loop.

Heat Staging Up

The following conditions must be met before the first (next) stage of heat can be energized:

- Preheat Enable Signal/Command must be active.
- The Leaving Air Temperature must be below the Leaving Air Temperature Setpoint.
- If Mod Heat is configured, it must be at 100% for the Stage Up Delay.
- The Minimum Off Time must be met.
- The Stage Up Delay must be met (for second stage and above).

Heat Staging Down

The following conditions must be met before a stage of heat can be de-energized:

- Preheat Enable Signal/Command is deactivated or the Leaving Air Temperature must be above the Leaving Air Temperature Setpoint by the Leaving Air Temperature Deadband.
- If Modulating Heat is configured, it must be at 0% for the Stage Down Delay.
- The Minimum Run Time must be met.
- The Stage Down Time must be met.

Emergency Shutdown

The Emergency Shutdown Input must always be used and wired as a 24 VAC normally closed contact. If an Emergency Shutdown occurs, and that contact opens:

- All outputs will be immediately de-energized.
- An alarm will be generated.

High Leaving Air Temperature Alarm

If the Leaving Air Temperature is above the Leaving Air Temperature High Temp-erature Alarm Limit for more than the Alarm Delay, all heating outputs will be de-energized immediately.

- An alarm will be generated.
- A manual reset will be required.

Low Leaving Air Temperature Alarm

If the Leaving Air Temperature is below the Leaving Air Temperature Low Temperature Alarm Limit for more than two minutes, the heat will remain on but an alarm will be generated.

LCD Display Screen & Navigation Keys

The LCD display screens and buttons allow you to view status and alarms, and enable force modes. See **Figure 4, this page** and refer to **Table 3 and 4, this page** for descriptions.

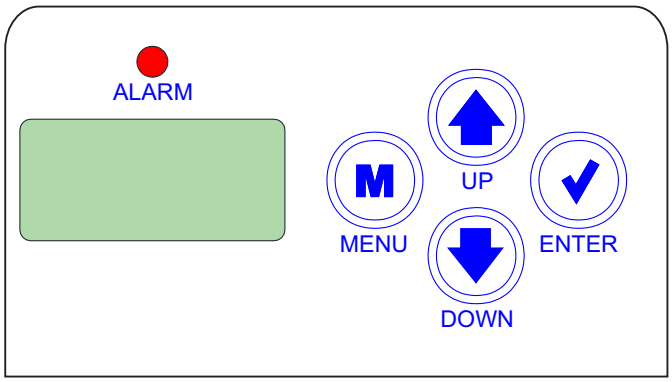


Figure 4: LCD Display and Navigation Keys

NAVIGATION KEY FUNCTIONS	
KEY	**FUNCTION**
MENU (M)	Use the **<MENU>** key to move through screens within Main Menu categories and return to the Main Menu while at other screens.
UP	Use this key to adjust setpoints and change configurations.
DOWN	Use this key to adjust setpoints and change configurations.
ENTER	Use the **<ENTER>** key to navigate through the Main Menu Screen categories.

Table 3: Navigation Key Functions

EDITING KEY FUNCTIONS	
KEY	**FUNCTION**
UP or DOWN	Use the **<UP>** or **<DOWN>** key to enter Edit Mode on a user-adjustable screen. Edit Mode is indicated by the underscore appearing on the screen. **NOTE:** Entering Edit Mode will also adjust the value up one (**<UP>** key) or down one (**<DOWN>** key), so you may have to readjust the value.
ENTER	Use the **<ENTER>** key to move through the digits in the screen when editing a numeric value. An extended press of the **<ENTER>** key saves your edits no matter the location of the editing cursor within the digits. Press the **<ENTER>** key to save a non-numeric value such as Hi Speed Network.
MENU (M)	The **<MENU>** key cancels editing when in Edit Mode. The screen you were editing will return to its original value and the underscore will disappear. A second press of the **<MENU>** key will return you to the Main Menu.

Table 4: Editing Key Functions

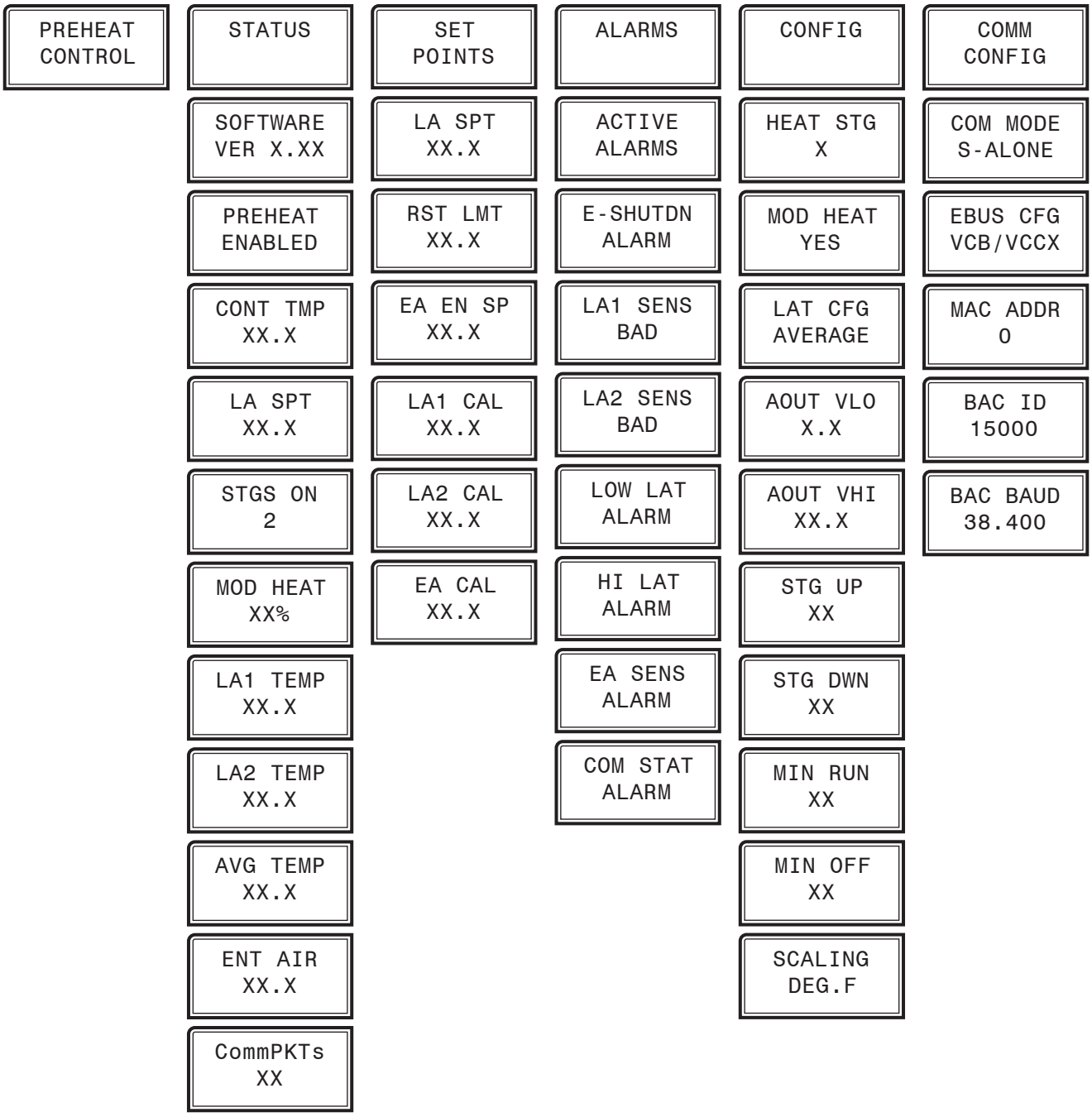


Figure 5: PREHEAT-X-EXT Main Screens Map

Main Screens

Refer to the following map when navigating through the LCD Main Screens. The first screen is an initialization screen. To scroll through the rest of the screens, press the **<MENU>** button.

PREHEAT
CONTROL

Press ✓ to scroll through PREHEAT-X-EXT Screens.

Press M to go to STATUS Screens.

STATUS

Press ✓ to scroll through STATUS Screens.

Press M to go to SETPOINTS Screens.

SET
POINTS

Press ✓ to scroll through SETPOINTS Screens.

Press M to go to ALARMS Screens.

ALARMS

Press ✓ to scroll through ALARMS Screens.

Press M to go to CONFIG Screens.

CONFIG

Press ✓ to scroll through CONFIG Screens.

Press M to go to COMM CONFIG Screens.

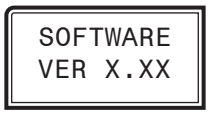
COMM
CONFIG

Press ✓ to scroll through COMM CONFIG Screens.

Status Screens

Refer to the following map when navigating through the Status Screens. From the STATUS Screen, press **<ENTER>** to scroll through the screens.

Status Screens shown below automatically if LCD display is left on the screen for 20 seconds.

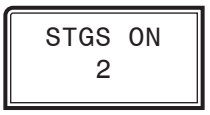


CURRENT SOFTWARE VERSION
Displays the current software version installed in the module.

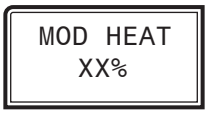
PREHEAT
Gives the Enabled status for the Preheat Mode. The PREHEAT-X-EXT can be enabled from one of the following: (1) Binary Input in Stand-Alone Mode, (2) E-BUS command from VCCX2 or other AAON unit controllers, or (3) BACnet point.

CONTROL TEMPERATURE
Displays the current controlling temperature. This could be one of the following based on configuration: (1) Leaving Air Sensor 1, (2) Leaving Air Sensor 2, or (3) the average of both.

LEAVING AIR TEMPERATURE SETPOINT
Displays the current Leaving Air Setpoint the module is trying to maintain. This value can come from the following based on configuration: (1) Internal Setpoints +/- Setpoint Reset Input, (2) E-BUS Input from VCCX2 or other AAON unit controllers or (3) BACnet point.



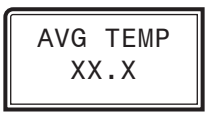
CURRENT NUMBER OF ACTIVE STAGES
Displays the number of heat stages currently energized. This includes the First Modulating Stage of Heat.



MODULATING HEATING OUTPUT
Displays the current Modulation Output Percentage of both the Analog and PWM outputs (they control together).

LEAVING AIR TEMPERATURE 1
Displays the Leaving Air Temperature 1 Sensor's current reading.

LEAVING AIR TEMPERATURE 2
Displays the Leaving Air Temperature 2 Sensor's current reading.



AVERAGE TEMPERATURE
Displays the current average temperature of both Leaving Air Temperature Sensors.

Status Screens

ENTERING AIR TEMPERATURE
Displays the current Entering Air Temperature Sensor reading.

COMMUNICATION PACKETS
Communication Packets are used to show the EBUS packets received from the main controller.

Setpoint Screens

Refer to the following map when navigating through the Setpoint Screens. From the SETPOINTS Screen, press **<ENTER>** to scroll through the screens and change setpoints. Use the **<UP>** and **<DOWN>** arrow keys to change your selections. Then press **<ENTER>** to save the new setpoint.

NOTE: When the PREHEAT-X-EXT is operating in Communications Mode, these setpoint screens will not appear on the LCD display because they are controlled by the main controller.

LEAVING AIR TEMPERATURE SETPOINT
Will display only in Stand-Alone Mode. This is the target temperature while the heating is enabled. If you are using the reset signal, this is the setpoint it will calculate to at zero volts.

Minimum	Default	Maximum
0ºF	70ºF	140ºF
-17.7ºC	21ºC	60ºC

RESET LIMIT SETPOINT
Will display and be used only in Stand-Alone Mode. If Remote Reset is being utilized, this will be the Leaving Air Setpoint when the Reset Voltage Input is at 10 VDC.

Minimum	Default	Maximum
0ºF	70ºF	140ºF
-17.7ºC	21ºC	60ºC

ENTERING AIR SETPOINT
This is the temperature at which Preheat is enabled. The Entering Air Enable Setpoint is set by the LCD display in Stand-Alone Mode and is set by the AAON unit controller in Communications Mode.

Minimum	Default	Maximum
-40ºF	55ºF	105ºF
-40ºC	12.7ºC	40ºC

LEAVING AIR SENSOR 1 CALIBRATION OFFSET
If the sensor is reading incorrectly, you can use this screen to enter an offset temperature to adjust the sensor's temperature.

Minimum	Default	Maximum
-100ºF	0ºF	100ºF
-55.5ºC	0ºC	55.5ºC

LEAVING AIR SENSOR 2 CALIBRATION OFFSET
If the sensor is reading incorrectly, you can use this screen to enter an offset temperature to adjust the sensor's temperature.

Minimum	Default	Maximum
-100ºF	0ºF	100ºF
-55.5ºC	0ºC	55.5ºC

ENTERING AIR SENSOR CALIBRATION OFFSET
If the sensor is reading incorrectly, you can use this screen to enter an offset temperature to adjust the sensor's temperature.

Minimum	Default	Maximum
-100ºF	0ºF	100ºF
-55.5ºC	0ºC	55.5ºC

Alarms Screen

Refer to the following map when viewing the ALARMS Screens. These screens will display automatically when alarms are present. For alarm troubleshooting, see **page 22**.

ALARMS

The alarms are as follows:

NO ALARMS: This will be shown if there are no current alarms.

E-SHUTDN: If 24 VAC is removed from the Emergency Shutdown Input, this alarm will activate and the controller will turn off all outputs. The alarm will be disabled when voltage has returned.

LA1 SENS: The first Leaving Air Temperature Sensor has been disconnected, shorted, open, or missing for more than 60 seconds. This alarm will be disabled when the sensor is working again.

LA2 SENS: The second Leaving Air Temperature Sensor has been disconnected, shorted, open, or missing for more than 60 seconds. This alarm will be disabled when the sensor is working again.

LOW LAT: This indicates a Leaving Air Temperature Cutoff alarm condition. If the Leaving Air Setpoint is less than 35ºF, the alarm will trigger then the Leaving Air Temperature is 10ºF cooler for two minutes.

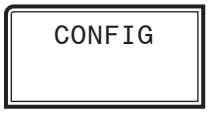
HI LAT: This indicates a Leaving Air Temperature Cutoff alarm condition which is activated if the controlling Leaving Air Temperature has risen above 120ºF. All outputs will stage off.

EA SENS: The Entering Air Temperature Sensor has been disconnected, open, shorted, or missing for more than 60 seconds. This alarm will be disabled when the sensor is working again.

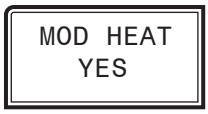
COM STAT: Communications have been lost with the main controller for more than 30 seconds. This alarm will disable when communications resume.

Configuration Screens

Refer to the following map when navigating through the Configuration Screens. From the CONFIG Screen, press **<ENTER>** to scroll through the screens and change setpoints. Use the **<UP>** and **<DOWN>** arrow keys to change your selections. Press **<ENTER>** to save any changes.



 # OF HEAT STAGES
Select the total number of Heat Stages including the Modulating Stage. Range is 0-6. Default is 0.



MODULATING HEAT
If either the Analog or PWM Modulating Heat Output is being used, this must be set to YES. Default is NO.

LEAVING AIR TEMPERATURE SENSOR CONFIGURATION
LAT1: Use Leaving Air Temperature Sensor 1 as the Controlling Temp.
LAT2: Use Leaving Air Temperature Sensor 2 as the Controlling Temp.
AVERAGE: Use the Average of LAT1 & LAT2 as the Controlling Temp.
Default is AVERAGE.

MINIMUM SCR VOLTAGE
This is the Low Voltage setting for the Analog Output. It sets the voltage level needed for 0%. Range is 0 -10. Default is 0

MAXIMUM SCR VOLTAGE
This is the High Voltage setting for the Analog Output. It sets the voltage level needed for 100%. Range is 0 -10. Default is 10.

STAGE UP DELAY
If configured for SCR modulation, this is the amount of time (in seconds) the controller must wait to activate an additional stage of heat if the Min Off Time is met. Range is 0 - 1200. Default is 180.

STAGE DOWN DELAY
If configured for SCR modulation, this is the amount of time (in seconds) the controller must wait to deactivate a stage of heat if the Min Run time is met. Range is 0 - 1200. Default is 180.

MINIMUM RUN TIME
This is the amount of time (in seconds) a stage of heat must remain on before it can be deactivated. Range is 0 - 1200. Default is 120.

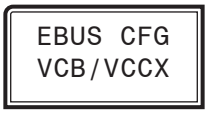
MINIMUM OFF TIME
This is the amount of time (in seconds) a stage of heat must remain off before it can be activated. Range is 0 - 1200. Default is 60.

TEMPERATURE SCALE
Fahrenheit (default) or Celsius.
This setting is used only in Stand-Alone Mode.

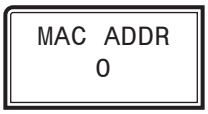
Communication Configuration Screens

From the COMM CONFIG Screen, press **<ENTER>** to scroll through the screens and change setpoints. Use the **<UP>** and **<DOWN>** arrow keys to change your selections. Press **<ENTER>** to save any changes.

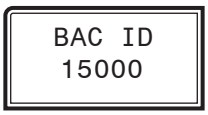
COMMUNICATIONS MODE
This setting configures the Communications Mode. The choices are (1) BACNET, (2) EBUS, or (3) S-ALONE (default).



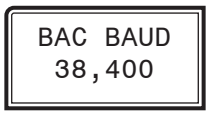
E-BUS CONFIGURATION
Select the controller that the PREHEAT-X-EXT is connected to.
NOTE: You must cycle power after changing to apply this setting.



BACnet® - CURRENT MAC ADDRESS
Valid range is 0 to 128. Default is 0.



BACnet® - CURRENT ID START
Range is 0 to 30000. Default is 15000.



BACnet® - CURRENT BAUD RATE
9600, 19200, 38400, 57600, 76800. Default is 38400.

General

The PREHEAT-X-EXT is equipped with LEDs that can be used to verify operation and perform troubleshooting. See **Figure 6, this page** for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

STATUS LEDs

POWER - This green LED will light up to indicate that 24 VAC power has been applied to the module.

Diagnostic LEDs

ALARM - This red LED located on the PREHEAT-X-EXT's cover above the LCD display will light up to indicate an alarm. The type of alarm(s) will be shown on the LCD display.

Communication LED

COMM - This yellow LED will light up and blink when communications are detected.

Relay LEDs

RLY 1-6 - These green LEDs will light up and stay lit as long as the Heat Relay(s) is active.

Binary Input LEDs

HEAT EN - This green LED will light up when Heat is enabled.

EMERGENCY SHUTDOWN - This green LED will light up when the Emergency Shutdown Input (BI2) has 24 VAC applied to it.

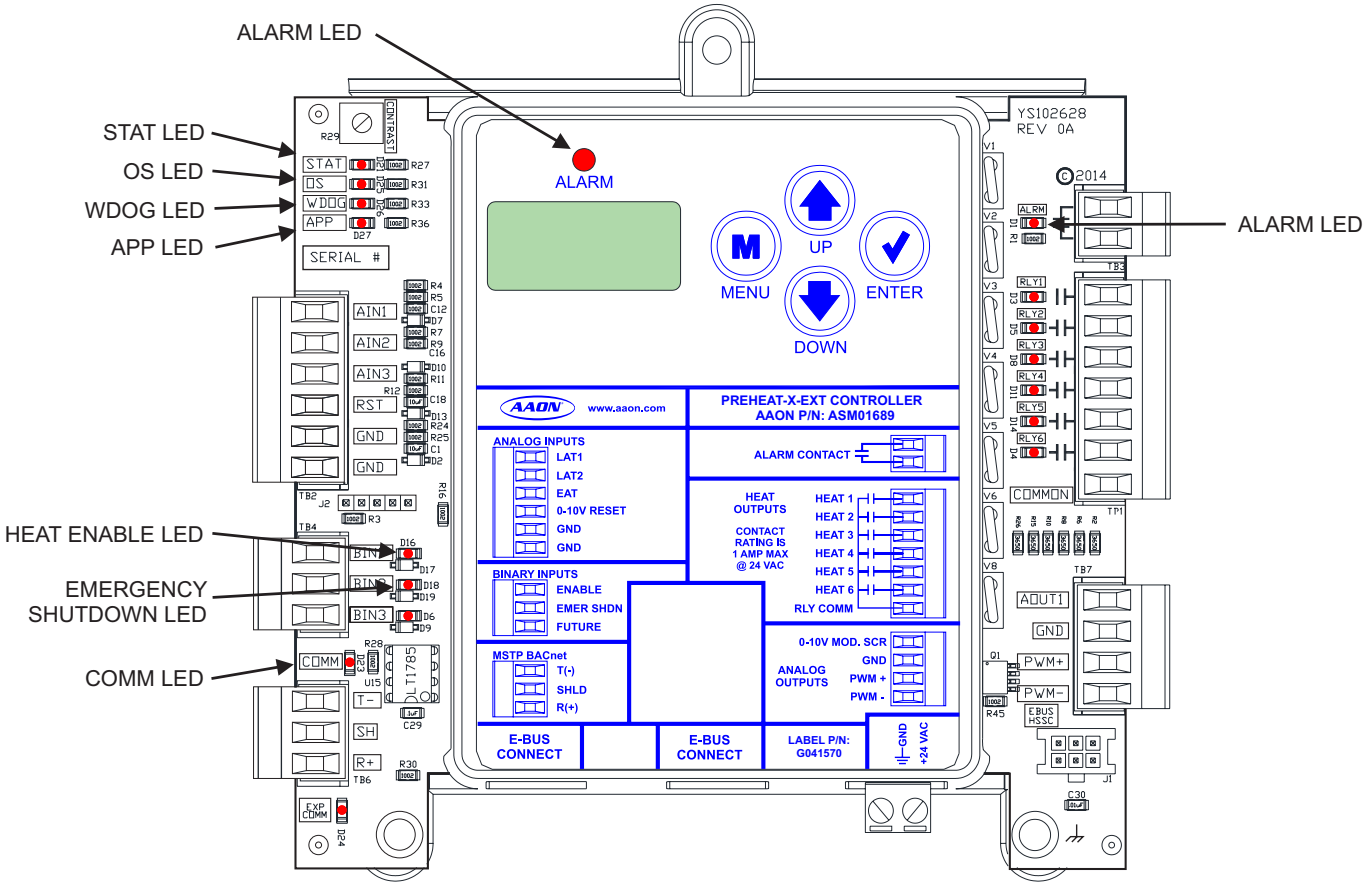


Figure 6: PREHEAT-X-EXT LED Locations and Descriptions

Alarms

Troubleshooting Alarms

Mechanical Failure:

- Check relay outputs on the PREHEAT-X-EXT for 24 VAC output.
- Verify output voltage (VOUT and GND) to SCR or PWM.
- Verify that the Leaving Air Temperature Sensor(s) is connected to AI1 and/or AI2 and GND on the PREHEAT-X-EXT.
- Verify that the Leaving Air Temperature Sensor probe(s) is mounted correctly.
- Remove AI1 and AI2 and GND wiring from the PREHEAT-X-EXT and take a resistance reading across the sensor (this may indicate open or failed wiring). See **Table 5, page 24**.

Leaving Air Temperature Failure:

- Verify that the Leaving Air Temperature sensor(s) is connected to the AI1 and/or AI2 and GND on the PREHEAT-X-EXT.
- Remove AI1 and AI2 and GND wiring from the PREHEAT-X-EXT and ohm out the sensor (this may indicate open or failed wiring). See **Table 5, page 24**.

Communications Loss:

- Check COMM LED on PREHEAT-X-EXT.
- Verify 24 VAC power to all interconnected controllers.
- Verify connection between the PREHEAT-X-EXT and associated controllers.
- In Communications Mode (connected with a modular cable), verify the PREHEAT-X-EXT configuration on the controller.

Mounting the Leaving Air Temperature Sensor

The Leaving Air Temperature Sensor should be located in the PREHEAT-X-EXT box's output location.

Locate the sensor in the center of the widest part of the PREHEAT-X-EXT box wall. Use the supplied template and a 5/16 inch drill to make a hole for the sensor.

Install the gasket over the probe and mount securely to the box wall using the supplied sheet metal screws. Be sure the gasket is compressed to provide an air tight seal.

For best accuracy, apply insulation on the outside of the box wall, over the sensor. This will help prevent thermal gradients from affecting the sensor.

WARNING: Make sure your Leaving Air Temperature Sensor(s) are mounted and wired according to these instructions prior to testing the unit or else the modulating valve will not control properly and may damage your equipment.

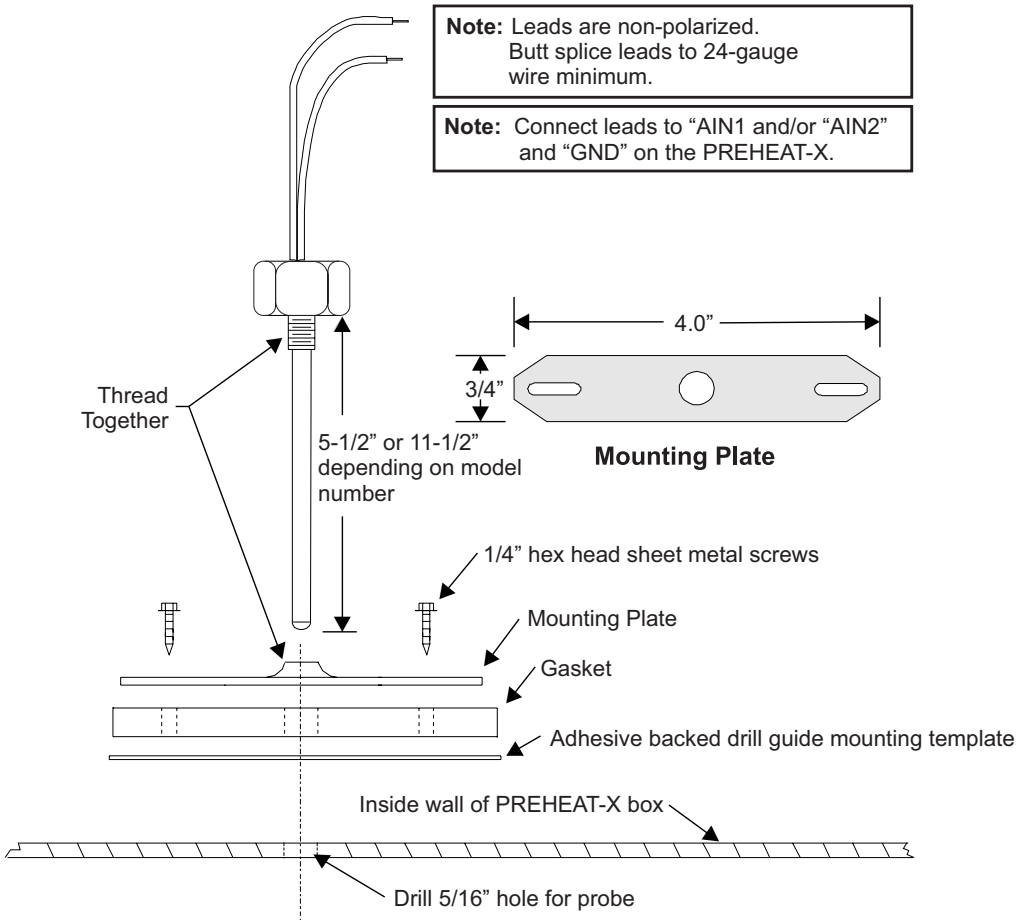


Figure 7: Leaving Air Temperature Sensor Installation

Sensor Testing

Leaving Air Temperature Sensor

If you suspect the Entering or Leaving Air Temperature Sensor is not reading correctly, make sure the wiring terminal connections are tight and that any wiring splices are properly connected. You can check the operation of the Leaving Air Temperature Sensor by measuring the resistance or voltage using a digital multimeter. Set the meter to DC Volts. Place the positive probe on the AI terminal and the negative probe on the GND terminal. Read the DC Volts and find that voltage in **Table 5, this page**.

Read the temperature corresponding with that voltage and determine if this is close to the actual temperature the sensor is exposed to. If the temperature from the chart is different by more than a few degrees, you probably have a defective or damaged sensor. You can also check the sensor resistance to determine correct operation.

Thermistor Sensor Testing Instructions

To read the resistance, set the meter to ohms. Unplug the sensor connector from the board and measure the resistance across the disconnected wires. This resistance should match the corresponding temperature from **Table 5, this page**.

Thermistor Sensor Testing Instructions

1. Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).
2. Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the "-" (minus) lead on GND terminal and the "+" (plus) lead on the sensor input terminal being investigated.

Temperature to Resistance/Voltage Chart							
Temp (°F)	Temp (°C)	Resistance (Ohms)	Voltage @ Input (VDC)	Temp (°F)	Temp (°C)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	-23.3	93333	2.98	**72**	22.2	11136	1.74
-5	-20.6	80531	2.94	**73**	22.8	10878	1.72
0	-17.8	69822	2.89	**74**	23.3	10625	1.70
5	-15	60552	2.83	**75**	23.9	10398	1.68
10	-12.2	52500	2.77	**76**	24.4	10158	1.66
15	-9.4	45902	2.71	**78**	25.6	9711	1.63
20	-6.6	40147	2.64	**80**	26.7	9302	1.59
25	-3.9	35165	2.57	**82**	27.8	8893	1.55
30	-1.1	30805	2.49	**84**	28.9	8514	1.52
35	1.7	27140	2.41	**86**	30	8153	1.48
40	4.4	23874	2.33	**88**	31.1	7805	1.45
45	7.2	21094	2.24	**90**	32.2	7472	1.41
50	10	18655	2.15	**95**	35	6716	1.33
52	11.1	17799	2.11	**100**	37.8	6047	1.24
54	12.2	16956	2.08	**105**	40.6	5453	1.16
56	13.3	16164	2.04	**110**	43.3	4923	1.09
58	14.4	15385	2.00	**115**	46.1	4449	1.02
60	15.6	14681	1.96	**120**	48.9	4030	.95
62	16.7	14014	1.93	**125**	51.7	3656	.88
64	17.8	13382	1.89	**130**	54.4	3317	.82
66	18.9	12758	1.85	**135**	57.2	3015	.76
68	20	12191	1.81	**140**	60	2743	.71
69	20.6	11906	1.79	**145**	62.7	2502	.66
70	21.1	11652	1.78	**150**	65.6	2288	.61
71	21.7	11379	1.76				

Note: If the voltage is above 3.3 VDC, the sensor or wiring is "open." If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.

Table 5: 0-3V Temperature Sensor - Voltage & Resistance for Type III Sensors

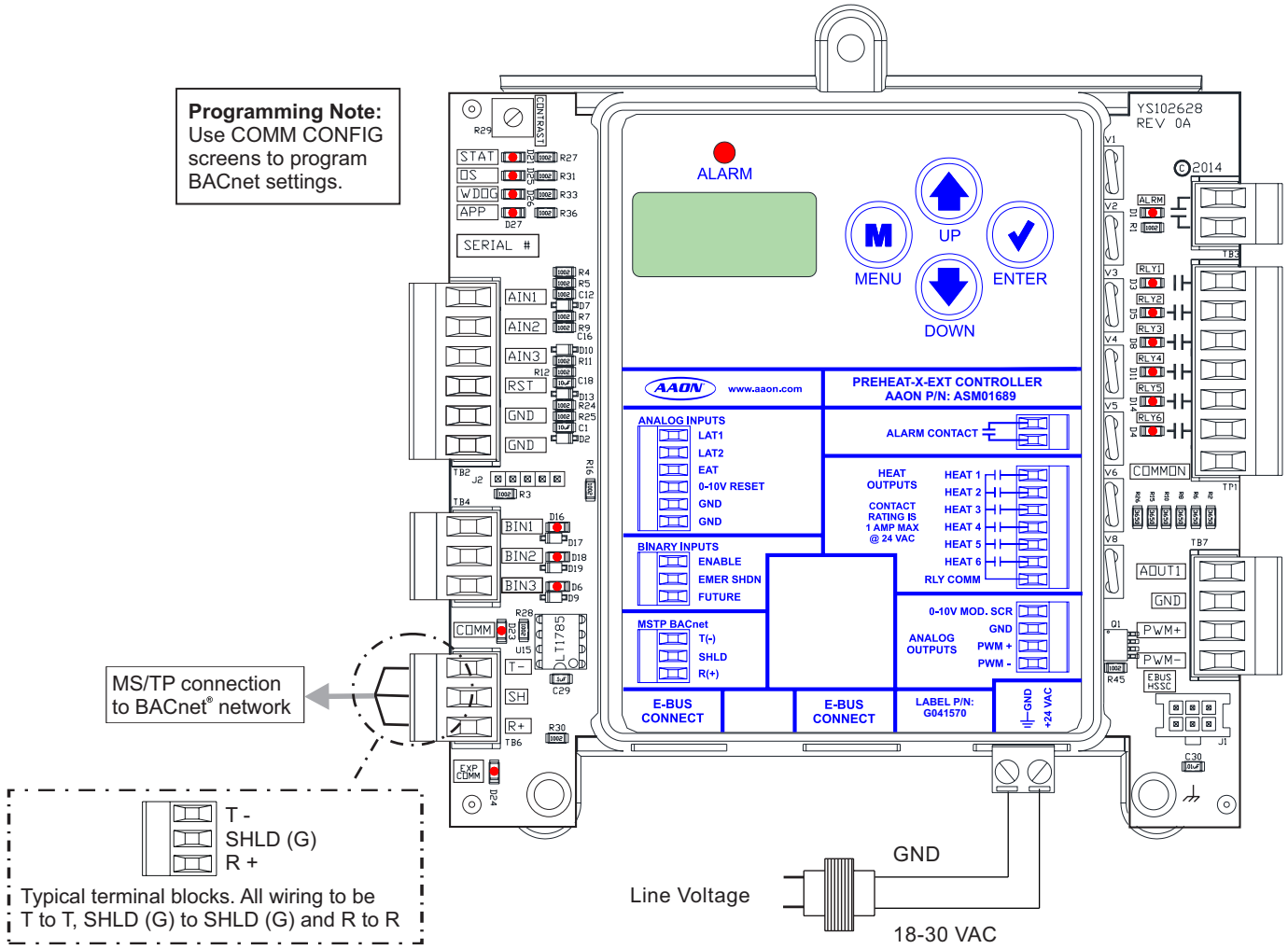


Figure 8: PREHEAT-X-EXT BACnet Connection to MS/TP Network

APPENDIX B: BACnet®

PREHEAT-X-EXT BACnet® Points

NOTE: These BACnet® points are only available if the unit is being used as a stand alone device. If connected to a VCCX2, refer to the *VCCX2 Technical Guide* for BACnet® points.

OBJECT	PARAMETER	DESCRIPTION	LIMITS	
AI: 1	Active Controlling Setpoint	The current Active Controlling Setpoint	Read Only	
AI: 2	Number of Heat Stages On	The current number of heat stages on	Read Only	
AI: 3	Modulating Output Position	The current Modulating Output Position	Read Only	
AI: 4	All Alarms Bit field	The current Alarm Status in a Bit field	Read Only, see alarm bits, page 27	
AI: 5	Entering Air Temperature	The current Entering Air Temperature	Read Only	
AI: 6	Leaving Air Temp Sensor 1	The current Leaving Air Sensor 1 Temperature	Read Only	
AI: 7	Leaving Air Temp Sensor 2	The current Leaving Air Sensor 2 Temperature	Read Only	
AI: 8	Leaving Air Average Temp	The current Average Leaving Air Temperature	Read Only	
AI: 9	Reset Input Percentage	The current Setpoint Reset Input Percentage	Read Only	
BI: 1	Enable Input Value	The current value of the Enable Binary Input	Read Only, 0 = Off, 1 = On	
BI: 2	Shutdown Input Value	The current value of the Emergency Shutdown Binary Input	Read Only, 0 = Off, 1 = On	
BI: 3	Preheat Enable Status	The current Enable status of the controller	Read Only, 0 = Off, 1 = On	
BI: 4	Alarm Relay Status	The current status of the Alarm Relay	Read Only, 0 = Off, 1 = On	
BI: 5	Heat 1 Relay Status	The current status of the Heat 1 Relay	Read Only, 0 = Off, 1 = On	
BI: 6	Heat 2 Relay Status	The current status of the Heat 2 Relay	Read Only, 0 = Off, 1 = On	
BI: 7	Heat 3 Relay Status	The current status of the Heat 3 Relay	Read Only, 0 = Off, 1 = On	
BI: 8	Heat 4 Relay Status	The current status of the Heat 4 Relay	Read Only, 0 = Off, 1 = On	
BI: 9	Heat 5 Relay Status	The current status of the Heat 5 Relay	Read Only, 0 = Off, 1 = On	
BI: 10	Heat 6 Relay Status	The current status of the Heat 6 Relay	Read Only, 0 = Off, 1 = On	
BI: 11	Emergency Shutdown Alarm	The current Emergency Shutdown Alarm status	Read Only, 0 = Off, 1 = On	
BI: 12	Leaving Air Sensor 1 Alarm	The current Leaving Air Sensor 1 Alarm status	Read Only, 0 = Off, 1 = On	
BI: 13	Leaving Air Sensor 2 Alarm	The current Leaving Air Sensor 2 Alarm status	Read Only, 0 = Off, 1 = On	
BI: 14	Low Leaving Air Temp Alarm	The current Low Leaving Air Temp Alarm status	Read Only, 0 = Off, 1 = On	
BI: 15	High Leaving Air Temp Alarm	The current High Leaving Air Temp Alarm status	Read Only, 0 = Off, 1 = On	
BI: 16	Entering Air Sensor Alarm	The current Entering Air Sensor Alarm status	Read Only, 0 = Off, 1 = On	
AV: 1	Remote Enable	Enables the Preheat from the BACnet® front end	Read / Write Volatile	
			0 = Disabled, 1 = Enabled	
AV: 2	Remote Leaving Air Setpoint	Controlling Leaving Air Setpoint from the BACnet® front end	Read/ Write Volatile	
			0ºF	140.0ºF
AV: 3	Remote Entering Air Setpoint	Entering Air Enable Setpoint from the BACnet® front end	Read / Write Volatile	
			-40.0ºF	105.0ºF

Table 6: PREHEAT-X-EXT BACnet® Points

PREHEAT-X-EXT BACnet® Property Identifier

BACNETPropertyIdentifier :
AllAlarmGroup1Bits ::= BIT STRING {
Reserved (0),
BadLeavingAir1 (1),
BadLeavingAir2 (2),
LowLeavingAir (3),
HighLeavingAir (4),
Reserved (5),
BadEnteringAir (6),
CommAlarm (7),
ShutDownAlarm (8)

PREHEAT-X-EXT Technical Guide

V97760 · Rev. D· 241206

AAON Controls Support:
Support.Controls@aaon.com

Controls Support Website:
www.aaon.com/aaon-controls-technical-support

AAON Factory Technical Support:
Technical.Support@aaon.com

Phone
866-918-1100
Monday through Friday, 7:00 AM to 5:00 PM Central Time

NOTE: Before calling Technical Support, please have the model and serial number of the unit available.

PARTS: For replacement parts, please contact your local AAON Representative.

Are you an AAON Rep?
You can visit My AAON to open new support tickets, communicate directly with our support teams, and track your support progress easily from one place!

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